

Hotspots

May 2024

Presented by Bill “Bucky” Buckwalter
WØSUN



HOTSPOTS and Digital Radio Here's Where The Fun Begins!



HOTSPOTS and Digital Radio

Multiple Radios and Multiple Modes



What is a Hotspot?

- Internet Gateway for Digital Communications with Amateur Radio
- Multi-mode Digital - D-Star, P25, DMR+, YSF and NXDN
- Big Three - D-Star, DMR, C4FM Fusion for Yaesu Radios
- What it's not.
- Digital Communications Only. Not FM Analog
- If you want FM Analog Communications get an Allstar Node.
 - Allstar SHARI Node or Node Ventures ClearNode



Two Types of Hotspots openSPOT 4 and Pi-STAR

openSPOT 
by SharkRF
The whole world in your pocket.



PI-STAR
Pi-Star Digital Voice Software



openSPOT 
by SharkRF

The whole world in your pocket.



openSPOT by SharkRF

<https://www.sharkrf.com/>

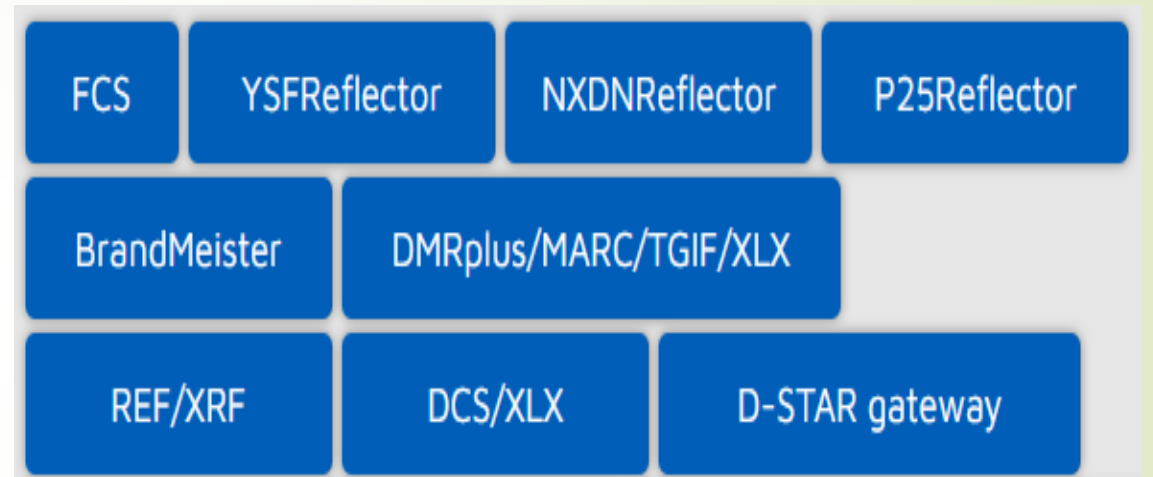
The screenshot displays the openSPOT 2 web interface. At the top, a blue navigation bar contains the logo 'openSPOT 2' and menu items: 'Status' (highlighted), 'Connectors', 'Modem', 'Settings', and 'Network'. The user 'openspot2' is logged in. On the left, there are buttons for 'Quick setup', 'User manual', and 'SharkRF Link'. The main content area is titled 'Status' and includes buttons for 'Fullscreen', 'Clear call log', and 'Export call log'. Below these are checkboxes for 'Limit call log lines' and 'Autoscroll'. A large grey box contains the text 'No call log entries.' Below this, system status is shown: 'Status: connected', 'Background conn. status: DAPNET | APRS', 'Active config profile: 2 (C4FMHome)', 'Active connector: YSFReflector', 'Modem mode: C4FM', 'Modem RX/TX frequency, power: 433.600000/433.600000 100%', and 'Server address: 75.70.63.143'. On the right, there are buttons for 'POCSAG/DAPNET', 'ID database lookup', and 'Upgrade'. At the bottom, a blue bar shows 'Profile: 2 (C4FMHome)', 'Connected', 'Advanced mode' (checked), and a 'Quick setup' button.

Cross Mode – OR - Direct

Choose Your Radio!



Choose Your Server!



SharkRF link -> No Radio Required



The screenshot displays the SharkRF Link application interface. At the top left is the SharkRF Link logo. To the right of the logo are three icons: an information icon (i), a settings gear icon, and a plus sign icon. Below these icons is a list of three tracked devices:

- openspot4**
Product: openSPOT4 Pro
UID: [redacted]
[Laptop icon] [Play icon] [Settings icon] [Close icon] [Device image]
- openspot4**
Product: openSPOT4 Pro
UID: [redacted]
[Laptop icon] [Play icon] [Settings icon] [Close icon] [Device image]
- openspot3-test**
Product: openSPOT3
[Device image]

At the bottom of the screenshot, there is a blue italicized text message:

*You don't need a transceiver!
Just use the SharkRF Link app.
(Pro version only)*

<https://www.pistar.uk/>

In 2014 Andy Taylor (MW0MWZ) wrote Pi-Star and integrated it with Raspbian which was the Operating System which ran on a Raspberry Pi.

The new Raspberry Pi Operating System is now called Raspberry Pi OS.

Raspberry Pi OS is based on the Linux Debian Operating System.

The Debian Linux OS versions have code words associated with each version named after characters in the Disney Pixar Movie "**ToyStory**"

The old unsupported version of Pi-Star was written for **Debian 8 (jesse)**

The most common version of Pi-Star is written for **Debian 10 (buster)**

December 2023 Andy produced a new version of Pi-Star that runs on **Debian 11 (bullseye)**

February 10, 2024 Andy released a Beta version of Pi-Star that runs on **Debian 12 (bookworm)**

Version	Codename	Debian release date	RPI OS release date
9	Stretch	June 2017	August 2017
10	Buster	July 2019	July 2019
11	Bullseye	August 2021	November 2021
12	Bookworm	Expected in 2023	-

The most common version of Pi-Star is written for **Debian 10 (buster)**
Pi-Star 4.1.8

December 2023 - Andy produced a new version of Pi-Star that runs on **Debian 11 (bullseye) Pi-Star 4.2.1**

February 10, 2024 - Andy released a Beta version of Pi-Star that runs on **Debian 12 (bookworm) Pi-Star 4.3.0**

Pi-Star Downloads

March 2024

Images available to Download

Pi-Star_NanoPi_V4.2.0_05-Feb-2024.zip
Pi-Star_OdroidXU4_V4.2.0_05-Feb-2024.zip
Pi-Star_OrangePiZero_V4.2.0_05-Feb-2024.zip
Pi-Star_RPi_V4.1.8_16-Feb-2024.zip
Pi-Star_RPi_V4.2.1_17-Feb-2024.zip

A very old common version of Pi-Star was ver. 3.4.17 Debian 8 (jessie)

Current Common version of **Pi-Star is ver. 4.1.8 - Debian 10 (buster)**

December 2023 Andy produced a new version of Pi-Star that runs on Debian 11 (bullseye)

Pi-Star ver. 4.2.1 runs on Debian 11 (bullseye)

Pi-Star Beta ver. 4.3.0 based on Current Debian 12 (bookworm) - <https://www.pistar.uk/beta/>

Pi-Star Digital Voice Dashboard for W0SUN

[Dashboard](#) | [Admin](#) | [Configuration](#)

Modes Enabled	
D-Star	DMR
YSF	P25
	NXDN
DMR XMode	POCSAG

Network Status	
D-Star Net	DMR Net
YSF Net	P25 Net
YSF2DMR	NXDN Net
YSF2NXDN	YSF2P25
DMR2NXDN	DMR2YSF

Radio Info	
Trx	Listening
Tx	434.100000 MHz
Rx	434.100000 MHz
FW	HS Hat:v1.4.6
TCXO	14.7456 MHz

DMR Repeater	
DMR ID	3135334
DMR CC	1
TS1	disabled
TS2	enabled
TG 310844/No Ref	
DMR Master	
BM United States ..	

YSF Network	
Room: US Colorado..	

Gateway Activity

Time (MDT)	Mode	Callsign	Target	Src	Dur(s)	Loss	BER
14:18:43 Apr 20th	DMR Slot 2	W0SUN	TG 310844	RF	0.4	0%	0.2%
13:31:57 Apr 20th	YSF	K0PRA	ALL at XLX720	Net	6.4	0%	0.0%
13:31:30 Apr 20th	YSF	AC0YV	ALL at XLX720	Net	21.6	0%	0.0%
13:25:29 Apr 20th	YSF	W0SUN	ALL at XLX720	Net	3.1	0%	0.0%
11:56:19 Apr 20th	YSF	KF5XK	ALL at XLX720	Net	5.2	0%	0.0%
11:43:43 Apr 20th	YSF	K00J	ALL at XLX720	Net	0.9	0%	0.0%
10:57:46 Apr 20th	YSF	N4S3W	ALL at XLX720	Net	0.2	0%	0.0%
10:57:29 Apr 20th	YSF	W0SUN	ALL	RF	16.4	0%	0.6%
10:47:02 Apr 20th	YSF	W0SUN	ALL	RF	3.0	0%	2.0%
08:55:00 Apr 20th	YSF	W8XAL	ALL at XLX720	Net	0.6	0%	0.0%
06:57:58 Apr 20th	YSF	AA0RX	ALL at XLX720	Net	3.6	0%	0.0%
06:54:31 Apr 20th	YSF	WA0SPM	ALL at XLX720	Net	0.2	0%	0.0%
06:54:30 Apr 20th	YSF	K0FTN	*****EAHN5 at K0FTN	Net	0.9	0%	0.0%
05:06:08 Apr 20th	DMR Slot 2	KA5GTM	TG 310844	Net	2.2	0%	0.0%
21:09:05 Apr 19th	YSF	KE0PCI	ALL at XLX720	Net	0.6	0%	0.0%
21:00:40 Apr 19th	YSF	AE0IN	*****EA9jI at AE0IN	Net	0.3	0%	0.0%
19:12:09 Apr 19th	DMR Slot 2	KB4SMK	TG 310844	Net	5.9	0%	0.0%
16:54:00 Apr 19th	YSF	AF90	ALL at XLX720	Net	10.0	0%	0.0%
16:04:45 Apr 19th	YSF	KE0WHY	ALL at XLX720	Net	0.8	0%	0.0%
15:24:12 Apr 19th	YSF	3164008	ALL at XLX720	Net	1.6	0%	0.0%

Local RF Activity

Time (MDT)	Mode	Callsign	Target	Src	Dur(s)	BER	RSSI
14:18:43 Apr 20th	DMR Slot 2	W0SUN	TG 310844	RF	0.4	0.2%	S9+44dB
10:57:29 Apr 20th	YSF	W0SUN	ALL	RF	16.4	0.6%	S9+39dB
10:47:02 Apr 20th	YSF	W0SUN	ALL	RF	3.0	2.0%	S9+41dB

WPSD – “W0CHP Pi-Star Dash”

A New Pi-Star Fork

Hostname: pi-tgff Pi-Star: 4.1.6 / Dashboard: 20240307

Pi-Star Digital Voice Dashboard for W0SUN

Dashboard | Admin | Configuration

Modes Enabled	
D-Star	DMR
M17	NXDN
P25	YSF
DMR X-Mode	YSF X-Mode
FM	POCSAG

Gateway Activity									
Time (MST)	Mode	Callsign	Target	Src	Dur(s)	Loss	BER		
07:56:45 Mar 8th	YSF	N7VDR (GPS)	DG-ID 0 at XLX303	Net	40.6	0%	0.0%		
07:55:43 Mar 8th	YSF	N1DZR (GPS)	DG-ID 0 at XLX303	Net	56.9	0%	0.0%		
07:52:31 Mar 8th	YSF	K7BAV (GPS)	DG-ID 0 at XLX303	Net	9.2	0%	0.0%		
07:49:22 Mar 8th	YSF	W7NEE (GPS)	DG-ID 0 at XLX303	Net	175.1	0%	0.0%		
07:46:39 Mar 8th	YSF	N7YGE (GPS)	DG-ID 0 at XLX303	Net	72.6	0%	0.0%		
07:22:59 Mar 8th	YSF	AC7VA (GPS)	DG-ID 0 at XLX303	Net	67.0	0%	0.0%		
14:56:06 Mar 7th	YSF	W0SUN (GPS)	DG-ID 0	RF	38.6	0%	0.5%		
14:11:09 Mar 7th	YSF	AB7I (GPS)	DG-ID 0 at XLX303	Net	34.0	0%	0.0%		
13:17:39 Mar 7th	YSF	N0CALL (GPS)	DG-ID 0 at XLX303	Net	12.2	0%	0.0%		

Local RF Activity							
Time (MST)	Mode	Callsign	Target	Src	Dur(s)	BER	RSSI
14:56:06 Mar 7th	YSF	W0SUN (GPS)	DG-ID 0	RF	38.6	0.5%	S9+46dB (-47 dBm)

Radio Info	
Trx	Listening
Tx	433.900000 MHz
Rx	433.900000 MHz
FW	HS_Hat:v1.5.2
TCXO	14.7456 MHz

YSF Network	
XLX303	

YSF2DMR	
DMR ID	313533429
YSF2DMR Master	
TGIF Network	

Pi-Star / Pi-Star Dashboard, © Andy Taylor (MW0MWZ) 2014-2024.
ircDDBGateway Dashboard by Hans-J. Barthen (DL5DI),
MMDVMdash developed by Kim Huebel (DG9VH),
Need help? Click here for the Facebook Group
or Click here to join the Support Forum
Get your copy of Pi-Star from here.

Hostname: pi-zum WPSD Ver: # 2ecda26a89

WPSD Digital Voice Dashboard for W0SUN

08:02:35, Mar 8 Profiles Live Caller Simple View SysInfo Admin

CPU Load	CPU Temp	Memory Usage	Disk Usage	Network Traffic
21%	88°F / 31°C	149.58 MB of 1.88 GB	1.78 GB of 14.44 GB	49.51 MiB ↓ / 13.78 MiB ↑

Radio Status	TX/RX Freq.	Radio Mode	Modem Port	Modem Speed	TCXO Freq.	Modem Firmware
IDLE	431.150 MHz	Simplex	/dev/ttyAMA0	115,200 bps	14.7456 MHz	ZUMspot:v1.5.2

Mode Status	
D-Star	DMR
YSF	P25
M17	NXDN
DMR X-Mode	YSF X-Mode
POCSAG	

Network Status	
D-Star Net	DMR Net
YSF Net	P25 Net
M17 Net	NXDN Net
DMR2NXDN	DMR2YSF
YSF2DMR	YSF2NXDN
YSF2P25	APRS Net
POCSAG Net	

YSF Status [Linked]	
XLX720 (YSF23160)	

Gateway Activity						
Time (MST)	Callsign	Country	Mode	Target	Src	Loss
18:19:33 Mar 7	N0AD	🇺🇸	YSF	DG-ID 0 at XLX720	Net	1.9 0%
17:25:03 Mar 7	W0SUN	🇺🇸	YSF	DG-ID 0 at XLX720	Net	161.3 0%
17:24:19 Mar 7	AE0NV	🇺🇸	YSF	DG-ID 0 at XLX720	Net	36.6 0%
17:21:43 Mar 7	W0CU	🇺🇸	YSF	DG-ID 0 at XLX720	Net	27.9 0%
16:56:43 Mar 7	W0SUN	🇺🇸	YSF	DG-ID 0	RF	0.5 0%
16:53:26 Mar 7	KA0BBQ	🇺🇸	YSF	DG-ID 0 at K0PRA	Net	13.8 0%

Local RF Activity						
Time (MST)	Callsign	Mode	Target	Dur(s)	BER	RSSI
16:56:43 Mar 7	W0SUN	YSF	DG-ID 0	0.5s (15 hrs ago)	---	S9+46dB (-47 dBm)

Get WPSD Help: [FAQs] • [User Manual] • [Facebook Group] • [Discord Server]
WPSD by W0CHP © 2020-2024 – WPSD Project Credits

WPSD – “WØCHP Pi-Star Dash”

A New Pi-Star Fork

- WPSD first released in 2020 – Was called “WØCHP Pi-Star Dash” by Chip, W0CHP.
- Starting in 2024 although based on Pi-Star, that name has been dropped.
- WPSD = WPSD Plausibly Stands for Divergence
- More code. Takes more resources. Needs a faster Raspberry Pi.
- Dashboard is very similar but there are more features.

WPSD – “WØCHP Pi-Star Dash”

https://w0chp.radio

Hostname: pi-zum
WPSD Ver. # 2ecda26a89

WPSD Digital Voice Dashboard for WØSUN

08:12:16, Mar 8

[Profiles](#)
[Live Caller](#)
[Simple View](#)
[SysInfo](#)
[Admin](#)

CPU Load	CPU Temp	Memory Usage	Disk Usage	Network Traffic
2%	90°F / 32°C	150.25 MB of 1.88 GB	1.78 GB of 14.44 GB	50.93 MiB ↓ / 17.03 MiB ↑

Radio Status	TX/RX Freq.	Radio Mode	Modem Port	Modem Speed	TCXO Freq.	Modem Firmware
IDLE	431.150 MHz	Simplex	/dev/ttyAMA0	115,200 bps	14.7456 MHz	ZUMspot:v1.5.2

Mode Status

D-Star	DMR
YSF	P25
M17	NXDN
DMR X-Mode	YSF X-Mode
POCSAG	

Current / Last Caller Details

Callsign	Country	Name	Location	Mode	Target	Src	Dur(s)
KFØNMA		Steven Swartz	Littleton, Colorado, USA	YSF	DG-ID 0 at XLX720	Net	0.9s (7 mins ago)

Caller Details:
 Hide Kerchunks:

Gateway Activity

Time (MST)	Callsign	Country	Mode	Target	Src	Dur(s)	Loss
08:05:30 Mar 8	KFØNMA		YSF	DG-ID 0 at XLX720	Net	0.9	0%
16:59:39 Mar 7	WØSUN		YSF	DG-ID 0 at XLX720	Net	0.9	0%
16:59:25 Mar 7	AEØNV		YSF	DG-ID 0 at XLX720	Net	6.3	0%
16:58:30 Mar 7	WØCU		YSF	DG-ID 0 at XLX720	Net	2.4	0%
16:56:43 Mar 7	WØSUN		YSF	DG-ID 0	RF	0.5	0%
16:53:26 Mar 7	KAØBBQ		YSF	DG-ID 0 at KØPRA	Net	13.8	0%
10:35:06 Mar 7	KDØHLP		YSF	DG-ID 0 at WØSUN	Net	3.0	0%
04:45:11 Mar 7	XLX720		YSF	DG-ID 0	Net	0.7	0%
03:25:52 Mar 7	WØSUN-Y		YSF	DG-ID 0	Net	0.6	0%

Local RF Activity

Time (MST)	Callsign	Mode	Target	Dur(s)	BER	RSSI
16:56:43 Mar 7	WØSUN	YSF	DG-ID 0	0.5s (15 hrs ago)	---	<div style="width: 100%; height: 10px; background-color: #007bff; position: relative;"> S9+46dB (-47 dBm) </div>

YSF Status [Linked]

XLX720
(YSF23160)

Network Status

D-Star Net	DMR Net
YSF Net	P25 Net
M17 Net	NXDN Net
DMR2NXDN	DMR2YSF
YSF2DMR	YSF2NXDN
YSF2P25	APRS Net
POCSAG Net	

WPSD – “WØCHP Pi-Star Dash”

WPSD Digital Voice Dashboard for W0SUN

23:57:10, Mar 11

[Profiles](#)
[Live Caller](#)
[Simple View](#)
[SysInfo](#)
[Admin](#)

CPU Load	CPU Temp	Memory Usage	Disk Usage	Network Traffic
28%	90°F / 32°C	148.55 MB of 1.88 GB	1.78 GB of 14.44 GB	90.43 MiB ↓ / 38.17 MiB ↑

Radio Status	TX/RX Freq.	Radio Mode	Modem Port	Modem Speed	TCXO Freq.	Modem Firmware
IDLE	431.150 MHz	Simplex	/dev/ttyAMA0	115,200 bps	14.7456 MHz	ZUMspot:v1.5.2

Mode Status	
D-Star	DMR
YSF	P25
M17	NXDN
DMR X-Mode	YSF X-Mode
POCSAG	

Current / Last Caller Details

Callsign	Country	Name	Location	Mode	Target	Src	Dur(s)
W0SUN		William D Buckwalter	Littleton, Colorado, USA	YSF	DG-ID 0 at W0SUN	Net	1.7s (29 mins ago)

Gateway Activity

Caller Details: Hide Kerchunks:

Time (MDT)	Callsign	Country	Mode	Target	Src	Dur(s)	Loss
23:28:27 Mar 11	W0SUN		YSF	DG-ID 0 at W0SUN	Net	1.7	0%
20:33:59 Mar 11	N0AD		YSF	DG-ID 0 at XLX720	Net	34.0	0%
20:31:36 Mar 11	K0PRA		YSF	DG-ID 0 at K0PRA	Net	76.9	0%
20:25:33 Mar 11	AC5S		YSF	DG-ID 0 at K0PRA	Net	27.9	0%
20:23:20 Mar 11	WD0CIV		YSF	DG-ID 0 at K0PRA	Net	30.9	0%
20:21:45 Mar 11	NA0MT		YSF	DG-ID 0 at XLX720	Net	56.3	0%
20:18:02 Mar 11	KY9X		YSF	DG-ID 0 at KY9X	Net	30.6	0%
20:16:12 Mar 11	N0KKV		YSF	DG-ID 0 at N0KKV	Net	46.7	0%

Network Status	
D-Star Net	DMR Net
YSF Net	P25 Net
M17 Net	NXDN Net
DMR2NXDN	DMR2YSF
YSF2DMR	YSF2NXDN
YSF2P25	APRS Net
POCSAG Net	

YSF Status [Linked]

Configuration and Navigation Demo

PI-STAR

Pi-Star Digital Voice Software

Yaesu System Fusion Configuration

Setting	Value
YSF Startup Host:	YSF23160 - XLX720 - K0PRAParkerCO ▾
UPPERCASE Hostfiles:	<input checked="" type="checkbox"/> Note: Update Required if changed
WiresX Passthrough:	<input checked="" type="checkbox"/>

Apply Changes

DMR Configuration

Setting	Value
DMR Master:	DMRGateway ▾
BrandMeister Master:	BM_3103_United_States ▾
BM Hotspot Security:
BrandMeister Network ESSID:	3135334 02 ▾
BrandMeister Network Enable:	<input type="checkbox"/>
BrandMeister Network:	Device Information Edit Device (BrandMeister Selfcare)
DMR+ Master:	DMR+ TDS02-DVSPH-A ▾

Configuration and Navigation Demo

PI-STAR

Pi-Star Digital Voice Software

Gateway Hardware Information

Hostname	Kernel	Platform	CPU Load	CPU Temp
pi-tgif	5.10.103-v7+	Raspberry Pi 2 Model B Rev 1.2	1.59 / 1.21 / 0.99	41.9°C / 107.4°F

Service Status

MMDVMHost	DMRGateway	YSFGateway	YSFParrot	P25Gateway	P25Parrot
DStarRepeater	ircDDBGateway	TimeServer	PiStar-Watchdog	PiStar-Remote	PiStar-Keeper

Modes Enabled

D-Star	DMR
M17	NYDN
P25	YSF
DMR XMode	YSF XMode
FM	POCSAG

Network Status

D-Star Net	DMR Net
M17 Net	NYDN Net

YSF Link Manager

Reflector	Link / Un-Link	Action
YSF23160 - XLX720 - K0PRAParkerCO	<input checked="" type="radio"/> Link <input type="radio"/> UnLink	Request Change

Gateway Activity

Time (MDT)	Mode	Callsign	Target	Src	Dur(s)	Loss	BER
17:14:35 Mar 12th	YSF	W0RMT (GPS)	DG-ID 0 at XLX720	Net	3.8	0%	0.0%
23:28:27 Mar 11th	YSF	W0SUN (GPS)	DG-ID 0 at W0SUN	Net	1.7	0%	0.0%

openSPOT Demo

<https://www.sharkrf.com/>

The screenshot displays the openSPOT-2 web interface. At the top, the logo "openSPOT-2" is visible in a blue header. The main content area features a "Quick setup" dialog box with a light gray background and a white border. The dialog has a title "Quick setup" and two buttons: "< Back" and "Cancel". Below the title, the text "C4FM/YSFReflector" is displayed. There are two input fields: "Server:" with the value "XLX720 (23160)" and "Callsign:" with the value "WOSUN". A blue "Connect" button is positioned below the input fields. In the background, the main interface shows a profile dropdown menu with "Profile: 2 (C4FMHome)" and a "Quick setup" button circled in red. The bottom right corner of the interface includes a checked "Advanced mode" checkbox.

A Little Bit About Raspberry Pi Hotspot Hardware



Compare Two Pi-Star Hotspots

ZUM Radio Elite 3.5

Raspberry Pi 4
Nextion Display
\$249.95



ZUM Radio Mini 1.3 OLED

Raspberry Pi Zero 2WH
OLED Display
\$174.95



A Little Bit About Raspberry Pi Hardware

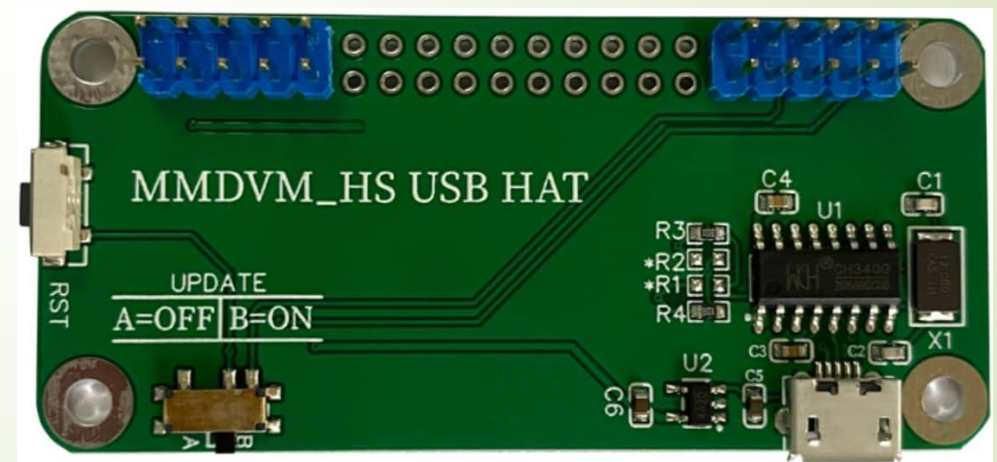
➤ Raspberry Pi Hotspot Typical Hardware

➤ Raspberry Pi Zero W

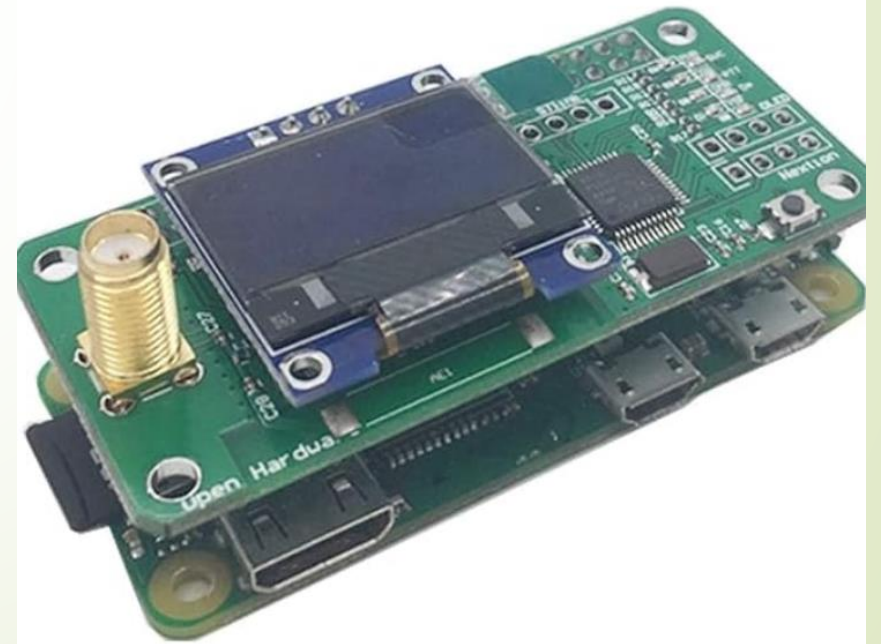
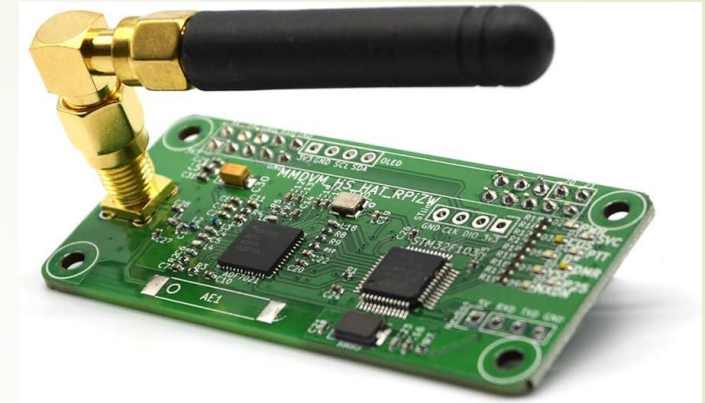
- MMDVM HAT - - **Multi Mode Digital Voice Modem**
- OLED DISPLAY
- SD Card
- Raspberry Pi Case - ie C4Labs or Jumbospot Case

➤ Raspberry Pi 3B+ or 4

- MMDVM HAT
- Nextion 2.4 or 3.5 inch Display
- SD Card
- Raspberry Pi Case



A Little Bit About Raspberry Pi Hardware

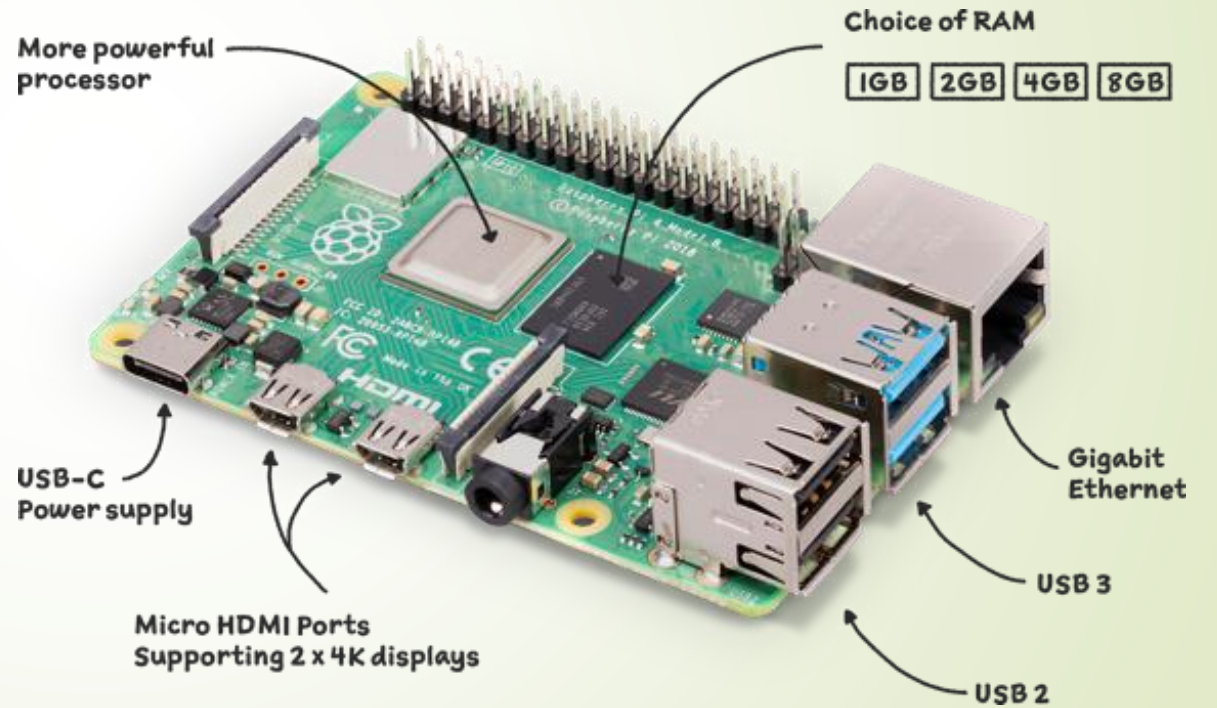


Raspberry Pi 3 and 4

Raspberry Pi 3 Model B+ - 2018



Raspberry Pi 4 - 2019



Raspberry Pi 3 and 4

Spec	Pi 3 Model B	Pi 3 Model B+	Pi 4 Model B
CPU type/Speed	ARM Cortex-A53 1.2 GHz	ARM Cortex-A53 1.4 GHz	ARM Cortex-A72 1.5 GHz
# of CPU Cores	4	4	4
RAM Size	1 GB LPDDR2	1 GB LPDDR2	1, 2, 4 GB LPDDR4
Integrated Wi-Fi	2.4GHz	2.4GHz and 5GHz	2.4GHz and 5GHz
Gigabit Ethernet	No	Over USB 2.0	Yes
Bluetooth	4.1 BLE	4.2 BLE	5.0 BLE
USB	4 x USB 2.0	4 x USB 2.0	2 x USB 3.0, 2 x USB 2.0
HDMI	1 x full size	1 x full size	2 x Micro, 4k video
Video Decode	H.264 (1080p30)	H.264 (1080p30)	H.265 (4kp60), H.264 (1080p30)
Video Encode	H.264 (1080p30)	H.264 (1080p30)	H.264 (1080p30)
OpenGL ES	1.1, 2.0 graphics	1.1, 2.0 graphics	1.1, 2.0, 3.0 graphics

A Little Bit About Raspberry Pi Hardware

Zero vs. Zero W vs. Zero 2 W



Zero

VS



Zero W

VS

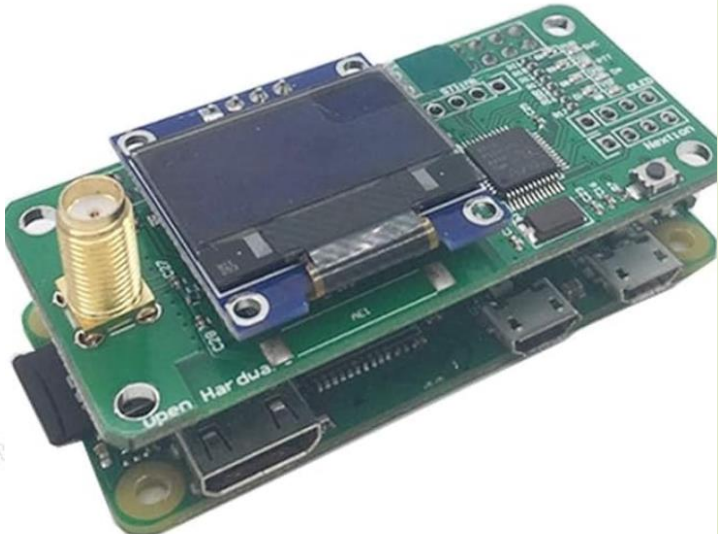
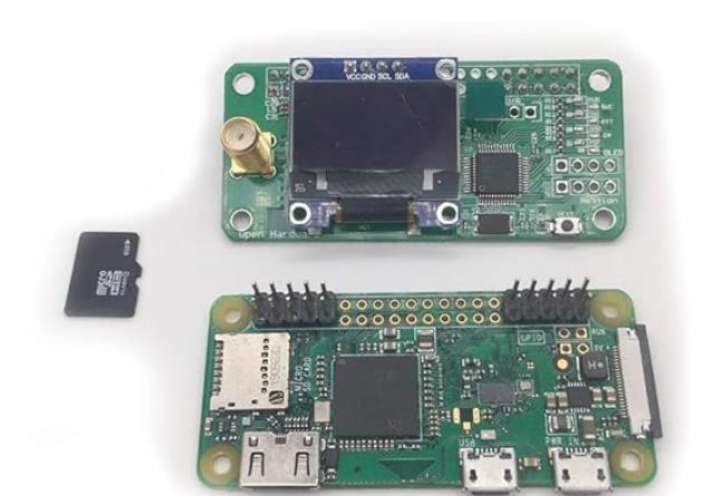


Zero 2 W

Raspberry Pi Zero vs. Zero W vs. Zero 2 W

Feature	Raspberry Pi Zero	Raspberry Pi Zero W	Raspberry Pi Zero 2 W
CPU	1 GHz Single-core	1 GHz Single-core	1 GHz Quad-core ARM Cortex-A53
RAM	512MB	512MB	512MB
Wireless Connectivity	None	Wi-Fi (802.11n), Bluetooth 4.0	Wi-Fi Dual-Band (2.4 GHz and 5 GHz), Bluetooth 5.0
HDMI Ports	Mini-HDMI	Mini-HDMI	Mini-HDMI
USB Ports	1 x micro-USB OTG	1 x micro-USB OTG	1 x micro-USB OTG, 1 x USB-C (Power)
GPIO Pins	40-pin GPIO header	40-pin GPIO header	40-pin GPIO header

Raspberry Pi Zero Hardware



Duplex Hotspots

- Duplex Hotspot with MMDVM Duplex Hat
- DMR Modulation takes advantage of Timeslot 1 and Timeslot 2
- Fusion or D-Star are not able to use Duplex functionality
- Stick to Simplex Hotspot with D-Star and Fusion



Let's Build a Hotspot

➤ Recommend Toshen's KE0FHS Pi-Star Guide

➤ "Playing With Pi-Star" -

➤ <https://amateurradionotes.com/pi-star.htm>

Gather Items:

- Pi-Star Software— You'll want to download the one for the Rpi - <https://www.pistar.uk/downloads/>
- WiFi (wpa_supplicant) Configuration File – WiFi Builder - https://www.pistar.uk/wifi_builder.php
- Blank microSD Card – Class 10/UHS-1 – **backup data first if needed**
- microSD to SD Card Adapter (Optional – depends on your PC)
- Raspberry Pi
- Raspberry Pi Power Supply of 2 amps or greater
- PC with SD Card or microSD Card reader/writer
- SD Card Imaging Tool
 - Balena - <https://etcher.balena.io/>

Download Pi-Star

<https://www.pistar.uk/downloads/>

PI-STAR

Pi-Star Digital Voice Software

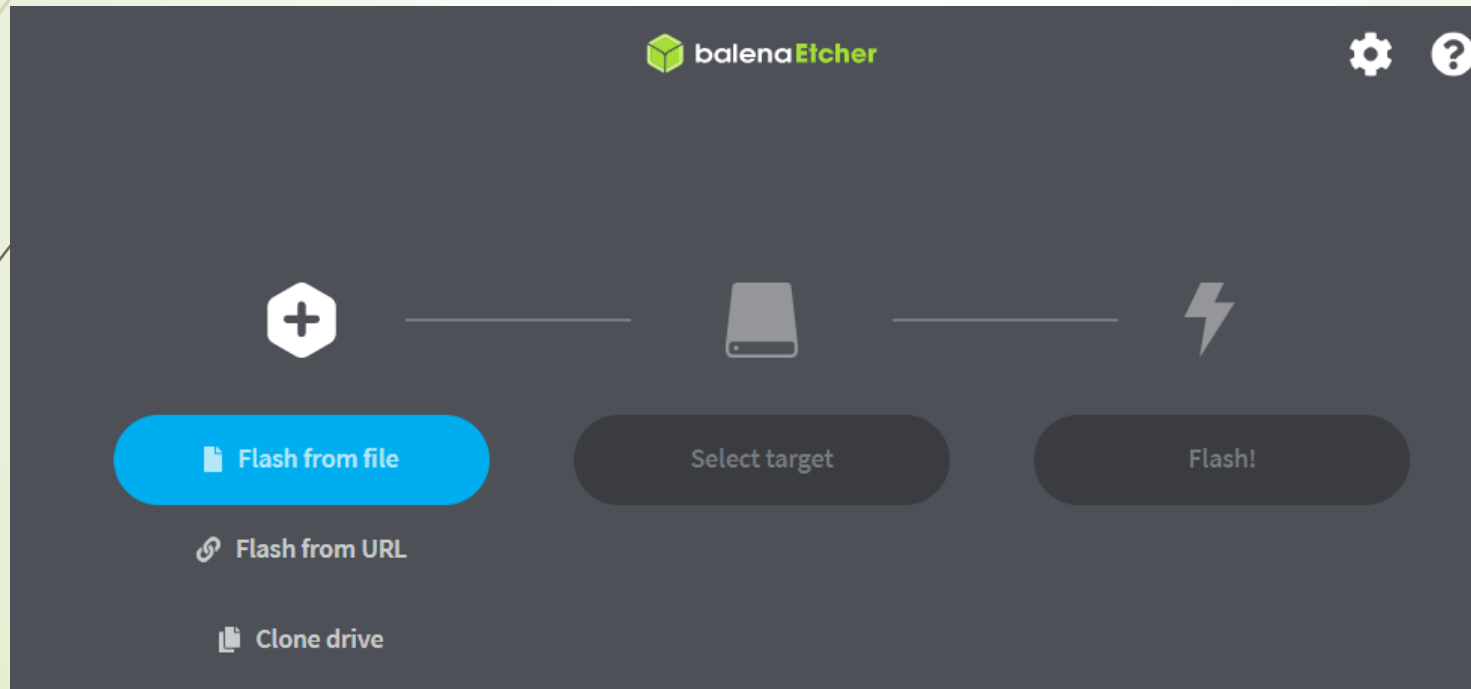
Pi-Star Downloads

Images available to Download

Pi-Star_NanoPi_V4.2.0_05-Feb-2024.zip
Pi-Star_OdroidXU4_V4.2.0_05-Feb-2024.zip
Pi-Star_OrangePiZero_V4.2.0_05-Feb-2024.zip
Pi-Star_RPi_V4.1.8_16-Feb-2024.zip
Pi-Star_RPi_V4.2.1_17-Feb-2024.zip

Imaging the SD Card

- Balena Etcher - <https://etcher.balena.io/>
- Use High Quality SD Card.



Use The Pi-Star WiFi Builder

- "wpa_supplicant.conf" Wi-Fi Configuration File
- Use Pi-Star WiFi Tool - https://www.pistar.uk/wifi_builder.php
- Download the file and copy onto the "Boot" volume of your Pi-Star SD card

Pi-Star WiFi Builder

This tool is used to create your "wpa_supplicant.conf" for use with Pi-Star. All you need to do is enter your SSID (this is the name of your Wireless Network) and the matching PSK (this is the Pre-Shared Key, or Password) for this network, when you hit "Submit" the generated config file will download to your computer.

If you require a config to connect to any available open network, leave the SSID and PSK lines empty, the generated config will allow your Pi to connect to any available open network.

All you need to do then, is drop this onto the "Boot" volume of your Pi-Star SD card - this will appear as you complete writing the SD Card.

Once the Pi-Star system boots up, it will add the config file for the WiFi and reboot.

WiFi Country Code:	US ▾
SSID:	<input type="text"/>
PSK:	<input type="text"/>
<input type="button" value="Submit"/>	



Boot up Pi-Star

Open your web browser and open the Pi-Star Interface:

- `http://pi-star/`
- `http://pi-star.local`

- Not working? Find the IP Address from your router
- Still not working. Use Angry IP Scanner - <https://angryip.org/>
- Scan your network for live devices with open port of 80



Login to Pi-Star Web Interface

- <http://pi-star.local>
- Login with
 - User ID - pi-star
 - Password - raspberry

Configure your Pi-Star Hotspot

Pi-Star:3.4.16 / Dashboard: 20180806

Pi-Star Digital Voice - Configuration

Dashboard | Admin | Expert | Power | Update | Backup/Restore | Factory Reset

Gateway Hardware Information

Hostname	Kernel	Platform	CPU Load	CPU Temp
pi-star	4.9.35-v7+	Pi 3 Model B (1GB) - Embest, CH	0.1 / 0.12 / 0.05	35.9°C / 96.6°F

Control Software

Setting	Value
Controller Software:	<input type="radio"/> DStarRepeater <input checked="" type="radio"/> MMDVMHost (DV-Mega Minimum Firmware 3.07 Required)
Controller Mode:	<input checked="" type="radio"/> Simplex Node <input type="radio"/> Duplex Repeater (or Half-Duplex on Hotspots)

Apply Changes

General Configuration

Setting	Value
Hostname:	pi-star Do not add suffixes such as .local
Node Callsign:	M1ABC
Radio Frequency:	438.800.000 MHz
Latitude:	50.00 degrees (positive value for North, negative for South)
Longitude:	-3.00 degrees (positive value for East, negative for West)
Town:	Town, LOC4TOR
Country:	Country
URL:	http://www.mw0mwz.co.uk/pi-star/ <input type="radio"/> Auto <input checked="" type="radio"/> Manual
Radio/Modem Type:	--
Node Type:	<input checked="" type="radio"/> Private <input type="radio"/> Public
System Time Zone:	Europe/London
Dashboard Language:	english_uk

Apply Changes

BER - Bit Error Rate

► What is the Bit Error Rate?

If your digital radio transmitter is not exactly on the same frequency of your hotspot, you can experience audio drop out and/or distorted audio. The alignment procedure to resolve this is cumbersome in the older version of Pi-Star.

It's so much easier in the later versions of Pi-Star

► Measuring the BER

Log into your MMDVM hot spot and select Dashboard from the top menu.

Key your transmitter for approximately 3 seconds on a not-so-busy reflector

Under 1.0% is acceptable but should be as close to 0.0% as possible.

BER – Bit Error Rate

Local RF Activity

Time (MST)	Mode	Callsign	Target	Src	Dur(s)	BER	RSSI
08:46:43 Mar 8th	YSF	W0SUN (GPS)	ALL	RF	2.6	5.0%	S9+46dB (-47 dBm)
08:46:10 Mar 8th	DMR TS2	W0SUN (GPS)	TG 310844	RF	2.2	1.3%	S9+43dB (-50 dBm)

Local RF Activity

Time (MST)	Mode	Callsign	Target	Src	Dur(s)	BER	RSSI
08:20:50 Mar 8th	YSF	KK7BVY (GPS)	DG-ID 0	RF	1.7	0.1%	S9+37dB (-56 dBm)
07:28:22 Mar 8th	YSF	K7PTL (GPS)	DG-ID 0	RF	5.0	0.3%	S9+37dB (-56 dBm)
06:42:23 Mar 8th	YSF	W6LDX (GPS)	DG-ID 0	RF	0.9	2.0%	S9+37dB (-56 dBm)
01:11:27 Mar 8th	YSF	CVVHUR	DG-ID 0	RF	0.2	0.0%	S9+37dB (-56 dBm)

BER on Old Pi-Star ver 3.17

Trial and Error

Modem



Modem	
Port	/dev/ttyAMA0
TXInvert	1
RXInvert	0
PTTInvert	0
TXDelay	100
RXOffset	0
TXOffset	0
DMRDelay	0
RXLevel	50
TXLevel	50
RXDCOffset	0
TXDCOffset	0



RXOffset

TXOffset

BER Calibration Tool on New Pi-Star ver 4.18

Pi-Star - Digital Voice Dashboard - Calibration Pi-Star: 4.1.6 / Dashboard: 20240307

Dashboard | Admin | Power | Backup/Restore | Configuration

Calibration Tool

<input type="button" value="Start"/> ● <input type="button" value="Stop"/>	D-Star	●	Base Freq.:	433900000 Hz				Current	Total
	DMR	●	Frequency:	433900000 Hz			Frames:		
	YSF	●	Offset:	-	0	+	Bits:		
	P25	●	Step:	25	50	100	Errors:		
	NXDN	●		<input type="button" value="Save Offset"/>			BER:		
							Seconds:	5 ▼	

Bit Error Rate (BER)

Seconds	BER
0	0.5
5	1.2
10	0.8
15	0.6
20	1.3
25	1.4
30	0.5



WOSUN Favorite Hotspots

- ▶ **openSPOT4 Pro from sharkRF - \$305.00 - <https://www.sharkrf.com/>**
- ▶ **ZUM Radio Elite 3.5 - \$250.00 - <https://www.hamradio.com/>**
- ▶ **TGIFSPOT 3.5 inch Nextion - \$368.00 - <https://www.tgifspot.com/>**
- ▶ **Assemble your own – be unique**

- ▶ **TGIF Junior Spot - \$179.00 –**
- ▶ **ZUM Radio Mini 1.3 OLED ZUMspot Kit - \$175.00 –**
- ▶ **Any Jumbospot or MMDVM Hotspot or Kit - \$108 to \$120 – Amazon or eBay**



Thank You!

WOSUN





Get A DMR ID

<https://www.radioid.net/register>



BlueDV and ZUMspot USB Stick



BlueDV for Windows

Menu Update About

FUSION FCS002 07 Link Unlink YSF FCS

By David PA7LIM Version 1.0.0.9572

SERIAL

DMR

DSTAR

FUSION

Frequency 433.900.000 Firmware ZUMspot-v1.4.16_ RX
DMR master Dest TG BER

CALL W0SUN

NAME WILLIAM

INFO 3135334

C4FM Status

TX RX

Lastheard	AMBE	BM lookup	APRS chat
Time	Call	Name	Mode
03:52 PM	N5YX	Grant	FUSION
03:52 PM	N5YX	Grant	FUSION
03:52 PM	N5YX	Grant	FUSION
03:53 PM	N5YX	Grant	FUSION
03:53 PM	N5YX	Grant	FUSION
03:53 PM	N5YX	Grant	FUSION
03:53 PM	N5YX	Grant	FUSION
04:40 PM	KC0JIM	James	FUSION
04:40 PM	KC0JIM	James	FUSION
04:40 PM	KC0JIM	James	FUSION
04:42 PM	W0SUN	William	FUSION
04:42 PM	W0SUN	William	FUSION

DMR Call Status Not Connected

DSTAR Call Status Not Linked

FUSION Call Status Linked to FCS002 07

Mute spk