Digital Radio Operating Manual

Compiled by Steve Wright EI5DD

Introduction

Prior to 2017 there were two Yaesu Fusion Repeaters located in the Limerick area and one in the Donegal area. Despite this there was very little C4FM activity heard. There were approximately 32 operators registered on the DMR Registrations site. Presumably these were those using D-Star and a handful experimenting with DMR through their own personal Hotspot systems.

Following some experimentation, in 2017, experimentation with AOR 9000 Digital Voice modems sparked an interest in Digital Communications in Galway. Initially, the interest was in Fusion and many had purchased Yaesu equipment. Around the same time, there were good offers on Chinese DMR Radios and these were readily snapped up. The infamous "Code Plug" was an initial stumbling block but, with a little practice, more an more appeared on air. D-Star has very little interest in the West of Ireland but facilities are available for this Digital mode.

2018 saw the introduction of the Brandmeister Server in Ireland before the summer of that year. DMR numbers increase rapidly.

With the server in place, plans to put equipment on air were making progress. By the autumn of 2018, SIRN placed their first Multimode Digital Repeater on air, Galway and Mayo placed multimode Digital Gateways on air in the same year.

2019 saw two more Multi-Mode Repeaters on air in the Waterford area. Galway place three DMR Repeaters, and one Wires-X gateway on air. The Galway Analog Repeater EI2TBR had been substituted for Yaesu Fusion Equipment and the old EI7AKR Repeater was on the bench being converted to for D-Star use.

2020 sees the location of the Fusion Repeater and the Loughrea DMR Repeater being placed just outside of Loughrea Town. Three Multi-mode Gateways were placed on air from Roscommon, Kildare and Mullingar. Galway will have the D-Star repeater running from the middle of the City whilst waiting for a new location. A Multimode repeater has been procured an may be substituted for the Repeater located on the West Side of Galway City thereby freeing a DMR Repeater for an alternative location.

With a growing interest in the building of Multimode Digital Gateways for the 2 metre band it should be possible to fill in the gaps where there is no existing equipment in use. These devices are reasonably cheap to build and provide an excellent service.

It is now down to the users of the Digital Network to make it work. There is little point in going to the trouble to make the infrastructure available if there are no users.

Digital systems offer communications with operators all over the world just at the press of the PTT. If you wish to talk to any specific part of the world, there is a Talk Group there for it.

Galway have set up the facility to "Roam" between its four DMR repeaters so DMR communication is guaranteed for the majority of any journey throughout the county.

The Digital network is there for you to enjoy so please use it. If you hear a lone voice seeking a contact, please answer him/her. The more that we can get on air the better.

Take a little time to consider that all of this equipment does cost hard earned money and feel free to donate to your local service providers. It is not just monetary help required. Assistance to get equipment onto site and donation of parts is also much appreciated.

The bottom line is to enjoy the facilities available.



The BrandMeister Network

https://brandmeister.network/

What is BrandMeister

Brandmeister is a decentralized network active in 43 countries running 46 masters.
Every master has his own Master Server Manager. A list of all managers can be found at the URL above
We encourage the use of homebrew equipment.

Connect to the Brandmeister Dashboards for more information

BrandMeister Services

Official BrandMeister Dashboard—Shows Map of the Active Network
Repeaters
Hotpots
Master Servers
Hoseline (Online Talk Group Streaming)

Irish Brandmeister Server is located in Wateford Institute of Technology
Sysop John Ronan, EI7IG

It Hosts three Talk Groups

Ireland CALL TG 2722
Ireland Chat TG 2723
YSF Ireland TG 2724

DMR –MARC Worldwide Network

http://www.dmr-marc.net/

The network is an all-digital group of over 500 DMR-MARC repeaters in 75 countries with 62261 registered users. There are 4142 registered DMR repeaters world-wide in our database. we are all amateur radio operators many of whom are Motorola Solutions employees, Motorola Service Station employees, dealers, system installers and Motorola equipment aficionados.

Repeaters on our network are connected all the time. TRBO radios have great voice quality, great coverage, and extended battery life all in LESS THAN 1/3 the channel bandwidth of a traditional analog FM repeater with TWICE as many voice channels! Our mission is to offer you a reliable and scalable choice in connectivity: local, regional, national and international. Isn't it time you upgraded to digital radio's cutting edge?

Phoenix Network

https://www.opendmr.net/

OpenDMR.net operates PHOENIX, the largest amateur radio DMR network in the UK and DMR-DL, a large network in Germany. Additionally we provide robust, stable, high availability infrastructure and world wide Talk Group services to repeater keepers across Europe.

It is wholly owned, operated and managed by radio amateurs who are themselves UK repeater keepers. It is totally self-funded and there is no cost to any repeater to join the network and no financial contributions are requested. OpenDMR.net is totally without politics and will always remain so.

DMR Terminology

TDMA Time Division Multiple Access. DMR utilizes digital Time Division Multiple Access technology to divide a 12.5kHz channel into two alternating time slots (TS1 & TS2), with each carrying an individual conversation when operating in Repeater mode.

Channel – Is a specific Talk Group on a specific Timeslot of any repeater. channels can be assigned to different Zones. There are 16 channels available per Zone.

Radio Wide Feature – Setting this feature affects the radio as a whole.

Channel Wide Feature – Setting this feature ONLY affects the channel being programmed. A Channel **Wide Feature** does not affect operation of the radio as a whole.

Private Call – A call from an individual radio to another individual radio

Group Call – A call from an individual radio to a group of radios

All Call – A one-way call from an individual radio to every radio on the system. All Calls do not communicate across timeslots or frequencies within the system. All call is only used in a supervisory role where a supervisor needs to communicate with all users on a local system, rather than a particular group or individual.

Call ID

Private Call – range (1 – 16776415) This is the radio ID of the target radio. Every radio has a single Radio ID.
Group Call – range (1 – 16776415) This is the ID of the Group that the user wishes to subscribe to.
All Call – This has a fixed ID of 16777215 (i.e. 0xFFFFFF) This value is not editable. Seldom used in the Amateur context

Building a Code Plug

1. Apply for a DMR ID. You will need to enter this ID into the "**General Settings**" section of your Code plug.
2. Program a list of "**Contacts**" consisting of Talk Groups and Private Calls (other user ID's) you want to connect to.
3. Build a "**Channel**" list of repeaters, or simplex frequencies you are going to use including its transmit and receive frequency, Colour Code, Time Slot, and Contact.
4. Build a list of "**Zones**" or memory banks with sixteen (16) channels per Zone using the channels you just created.
5. Some DMR Radios require the programming of a group of "**Digital Receive Groups**" with the channels you have added to each **Zone**.
6. You will need to update each **channel** in a **Zone** with the **Digital Receive Group** you created for that **Zone**.

The Code plug Sections

1) Basic Information
2) General Setting
3) Menu Item
4) Buttons Definition
5) Text Message
6) Privacy Setting
7) Digit Emergency System
8) Digital Contacts
9) Digital RX Group Lists
10) Zone Information
11) Scan List
12) Channels Information
14) DTMF Signalling (not currently supported)

Frequency Range – Shows the working band of the radio. This parameter is set by the factory.
Last Programmed Date – Shows the last time data was saved, or "written", to the radio. The last time the radio was programmed.

Model Name – Shows the Model Name of the radio.
Serial Number – Shows the ESN (Electronic Serial Number) of the radio.
CPS Software Version – Shows the CPS software version being used on the PC.
Hardware Version – Shows the radio's Hardware Version.
MCU Version – Shows the radio's MCU (Microprocessor Control Unit) software version.
Unique Device ID – Shows the unique device ID of the MCU in the radio

General Setting

Radio Name – Sets an alias for the radio. On some radios when the radio powers up this alias shows up as the welcome text if the welcome image is not used. The user may enter up to a maximum of 16 characters. Valid characters are alphanumeric, spaces and special characters. This is a radio-wide feature.

Radio ID – Sets an individual ID that uniquely identifies the radio. This ID is used by other calling radios when addressing the radio, for instance, when making a private call or sending a text message. This is a radio-wide feature. ID Range: 1 – 16776415. This is your assigned DMR ID.

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Radio ID – Sets an individual ID that uniquely identifies the radio. This ID is used by other calling radios when addressing the radio, for instance, when making a private call or sending a text message. This is a radio-wide feature. ID Range: 1 – 16776415. This is your assigned DMR ID.

Monitor Type – (Analog Mode Only) Sets the Monitor mode to either Open Squelch or Silent. The user can access the Monitor feature by assigning a short or long programmable button press. This is a radio-wide feature.

Open Squelch – Radio unmutes regardless of whether there is any channel activity. If no activity is present, noise is heard through the speaker.

Silent – Radio unmutes only if there is channel activity.

VOX Sensitivity – VOX automatically transmits when the audio level is higher than the configured **VOX Gain Level**. Off:1 (low sensitivity) – 10 (high sensitivity)

TX Preamble Duration(ms) – (Digital Mode Only) Preamble is a string of bits added in front of a data message or control message (Text Messaging, Location Messaging, Registration, Radio Check, Private Call, etc…) before transmission. This preamble prolongs the message in order to reduce the chances of the message being missed by the receiving radio. The Transmit (TX) Preamble Duration sets the duration of the preamble. This duration needs to be increased as the number of scan members increases on the target radio. This value can be increased in all the transmitting radios if scanning radios are often missing data messages. However, a larger preamble occupies the channel longer. Therefore, increasing the Transmit preamble duration will increase the success rate of data received while other radios are scanning, but will decrease the amount of data that can be transmitted on the channel. This is a radio-wide feature.

RX Low Battery Interval(s) – The Receive (RX) Low Battery tone is an alert tone that sounds when the radio's l low battery threshold is reached while a call is being received, or while the radio is in idle mode. The RX Low Battery Interval sets the interval for the generation of this tone. This is a radio-wide feature.

PC Programming Password – Set the Programming password. If enabled, the right password will be required to be entered while reading from or writing to the radio.

Radio Program Password – When set you will need to enter this password into the radio before you can access the radio menu items. "00000000" disables the feature. This is a radio-wide feature.

Back Light Time(s) – Sets the default backlight duration time. This is a radio-wide feature.

Set Keypad Lock Time(s) - Sets the time to wait before locking the keypad. This is a radio wide feature.

Disable All LEDS - Turns off all LEDs during radio power up and while radio is in use. All LEDs are disabled including the backlight and power up LED, regardless of the backlight setting. This is a radio -wide feature.

Save Preamble – This feature enables or disables the battery saver preamble. The radio sends a preamble before each transmission to enhance the ability of receiving radios in battery saver mode to synchronize in preparation for transmissions; reducing the occurrence of late-entry. It is recommended that all radios in a system share the same setting for this field. This is a radio -wide feature.

Save Mode Receive – Enabling this feature causes an idle radio to automatically enter battery saver mode where it places certain radio functions on standby. After a certain duration or when there is any user button action, the radio returns to normal operation and checks the channel for incoming calls. If no calls are detected, it returns to battery saver mode.

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● While results vary across battery chemistry and user conditions, battery saver can deliver about a 10% improvement in battery life, but will also cause a delay in response time. When this feature is enabled, it is important to note that for the transmitting radios, there will be a slight delay in call setup (in the range of milliseconds) when pressing the PTT button. For the receiving radios, there may be an increase in late entry due to radios in battery saver mode having less opportunity to synchronize. This may cause the radios to miss the initial second of some audio transmissions in poor RF conditions. This, however, will not be experienced in good RF coverage. Although they are important to note, these delays are considered minor versus the improved battery life, therefore it is recommended to enable battery saver mode for all radios. This is a radio -wide feature.

Alert Tone

Disable All Tone – Checking this box will disable ALL tones radio wide. Leave un-checked for tones.

CH Free Indication Tone – This feature sounds an alert tone when a voice call ends. It also sounds when the voice call is interrupted on the current channel, for example, by interruptions caused by a third radio making an impolite call or sending an emergency alarm. However, this tone does not sound if the interruption is caused by a corrupted radio signal. Voice calls include Group Call, Private Call, All Call, and Emergency Call. A voice call ends when the user of the calling radio releases the Push-To-Talk (PTT) button, regardless of hang time. This feature alerts the receiving radio that the channel is available for him/her to respond producing a smoother flow of conversation.

This alert tone does not sound at the end of a Remote Monitor transmission, or during Priority Scan when the voice call ends while the radio is sampling the priority channel(s). This is a radio-wide feature.

Talk Permit Tone – This alert tone sounds after the PTT button is pressed and the radio is able to transmit on the channel. This is the prompt to begin speaking. This feature can be enabled for digital, analog, or both modes. This is a radio-wide feature.

Call Alert Tone Duration(s) - Configures the call alert tone sound duration for the radio decoding of the digital/MDC/QCII selective call alert. This is a radio-wide feature. If the

'Continue' option is selected, the call alert tone will continuously sound until the user cancels the call alert indication.

Scan Digital Hang Time(ms) – sets the time the radio will remain on a scan list member following the end of the channel activity. The hang time prevents the radio from resuming scanning until the conclusion of the response to the initial call. The timer starts at the end of the transmission and resets whenever a valid activity is detected on the channel during the hang time.

Scan Analog Hang Time – same as Scan Digital Hang Time above.

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Scan Analog Hang Time – same as Scan Digital Hang Time above.

Lone Worker.

Lone Worker Response Time(min) – This timer defines the time period after which the radio will sound Lone Worker alert. The Lone Worker must respond to this alert, by pressing any button, within the time period set for the Lone Worker Reminder Time, otherwise the radio will go into emergency operation. Once a button is pressed the timer is reset. This operating mode may be enabled/disabled by the user if a button has been programmed for Lone Worker, or on channel change. This timer can be set from 1 to 255 minutes in 1-minute steps.

Lone Worker Reminder Time(s) – This timer is used to set the time period for which the Lone Worker alert will sound. After this period the radio will go into the emergency mode of operation. This timer can be set from 0 to 255 seconds in 1-second steps.

Power on Password

Password and Lock Enable – checking this box enables the Power On Password function.

Power On Password – Enter a password to be used for power up. Up to 8 numeric characters are programmable.

Talkaround

Group Call Hang Time(ms) – Sets the duration the repeater reserves the channel after the end of a group call transmission. During this time, only members of the Group that the channel is reserved for can transmit. This produces smoother conversation. Maximum 7000 ms, Minimum 0 ms, Increment 500 ms.

Private Call Hang Time(ms) – Sets the duration the repeater reserves the channel after the end of a private call transmission. During this time, only the individuals involved in the call that the channel is reserved for can transmit. This produces smoother conversation. The user may want to set a longer hang time than the Group Call Hang Time as an individual tends to take a longer time to reply (talkback) in a Private Call. Maximum 7000 ms, Minimum 0 ms, Increment 500 ms.

Intro Screen

Intro Screen – Allows you to pick the intro screen displayed when the radio is powered on. The choices are:
Picture - Shows a default picture when powered on.
Char String: Displays up to two lines of (text) characters defined by setting Intro Screen Line 1 and **Intro Screen Line 2**. (up to 10 characters max on each line)

Menu Item

Menu Hang Time(s) – Sets the amount of time that the radio remains in the menu mode, after which the radio reverts back to the Home screen. If the duration is set to "Hang", the radio remains infinitely in this mode until the user exits the menu manually by pressing the back or home button. This is a radio-wide feature. Maximum 30 sec, Minimum 1 sec, Increment 1 sec.

Text Message – Allows the user to access the text message feature via the menu. The user has the ability to check the Inbox, edit Messages, Send Messages or Quick Text.

Contacts

Call Alert – Allows the user to initiate Call Alert via the menu. Call Alert allows the user to alert another user, requesting that they call back the user (call initiator) when they (recipient) become available. Call Alert can only be received when the channel is free.

Edit – Allows the user to edit the alphanumeric characters on the edit screen. The user has the ability to add a new entry to the Contacts list or edit an entry within the Contacts list.

Manual Dial – Allows the user to access the Manual Dial capability of the radio via the menu. Manual Dial allows the user to initiate a call (e.g. Private Call, Call Alert) or request (e.g. Remote Monitor, Radio Check, Radio Disable, Radio Enable) or send Text Messages by keying in the destination ID using the keypad. Manual dial may be used even if the destination ID is not listed in the Contacts.

Radio Check - Allows the user to initiate a Radio Check request from the menu. Radio check allows a user/ console operator to determine if a radio is active in a system without showing any indication to the radio's user.

Remote Monitor – Allows the user to initiate a Remote Monitor request to the target radio via the menu. Upon a successful request, the target radio's microphone and transmitter will be activated to be remotely monitored.

Program Key – Allows the user to enable or disable the Program Key menu in the radio. The Program Key feature allows the user to associate a call to the number buttons on the radio keypad (1-9 and 0).

- When the user long presses these buttons in the home screen, the associated call entry will be displayed. The supported call types are Group, Private, or All Call calls in Digital or Capacity Plus mode. This is a radio -wide feature.

Radio Enable - Allows the user to initiate the Radio Enable command to the target radio via the menu. Radio Enable is used to enable a target radio that is disabled (inhibited).

Radio Disable – Allows the user to initiate a Radio Disable command to the target radio via the menu. Upon a successful request, the target radio will disable all its user interfaces (e.g. all LED indicators including Backlight, alert tones, user inputs including PTT except for Volume/On/ Off knob on Portable and Power On/Off button on Mobile), ignore Emergency alarms and r received data to radio or external devices, mute received voice to radio or external device and disallow transmission of data or command from the radio or external device. This disables the radio if it is lost or stolen. However, the radio continues to monitor the air interface to enable it to receive the Radio Enable command.

Call Log

Missed – Allows the user to track the last ten incoming private calls that the user missed or failed to respond to. The user accesses the call log via the menu. This log also provides a quick way for the user to initiate a private call.

Answered – Allows the user to track the last ten incoming private calls that the user answered. The user accesses the call log via the menu. This log also provides a quick way for user to initiate a private call.

Outgoing Radio - This feature allows the user to track the last private call and call alert numbers that the user initiated and provides easy redial access. The maximum stored number is ten for both type of calls combined. The user accesses the call log via the menu. This log also provides a quick way for the user to initiate a private call.

Utilities

Talkaround – Allows the user to set the radio in Talkaround mode via the menu.

Tone or Alert – Allows the user to toggle all the tones and alerts on or off via the menu.

Power – Allows the user to adjust the radio's transmission power level via the menu.

Backlight – When enabled this feature can be toggled via the radio menu.

Intro Screen – Allows the user to switch the Introduction Screen between the picture screen and character screen upon radio power up, via the radio menu.

Keyboard Lock – Allows the user to toggle the keypad lock on or off via the menu.

LED Indicator – Allows the user to toggle the radio's LED indicator on or off via the menu.

Squelch - Allows the user to access the Squelch feature to select between Normal or Tight Squelch via the menu.

Password and Lock – Allows the user to enable or disable the Password Lock menu in the radio. When this f feature is enabled, the user has the ability to toggle the Password and Lock feature between on and off, or update the Password through the radio menu. This is a radio-wide feature.

VOX – Allows the user to toggle the VOX (Voice Activated Transmit) feature between on and off for the current channel via the menu. VOX enables the radio to automatically transmit whenever its microphone on the VOX-capable accessory detects voice. This is a channel-wide feature.

Display Mode – Allows setting the display mode, either CH (channel name) or MR (?) frequency display from the keypad. This is a radio-wide feature.

Program Radio – Allows programming the radio from the keypad. This is a radio-wide feature.

Scan

Scan – Allows the user to toggle Scan on or off via the menu for the current conventional channel personality. Scan allows the radio to search the scan list that is attached to the current channel/personality for an eligible channel/personality to receive or unmute. (note: you need a Scan List to activate scanning)

Edit List - Allows the user to edit the Scan List via the menu. The Edit List allows the user to perform certain actions on the scan list, e.g. view the scan list, change the scan member's priority level, add new scan members to the scan list or delete members from the scan list. Creating a new or deleting an existing scan list is not allowed on the radio.

Buttons Definitions

Long Press Duration(ms) – Sets the duration a button is required to be pressed (and held down), for it to be interpreted as a long press. This duration also controls the long press operation of the button assigned to the Emergency feature. This is a radio-wide feature.

- You can use this section to assign various functions to the two programmable buttons on the side of the radio. Button 1 is above the PTT switch and Button 2 is below the PTT switch. You can also assign t wo functions to each button. One function is activated by a short button press and the other is activated by a long button press, the duration being set by the previously explained **Long Press Duration** option.

One touch Access There are 6 rows that can be used to configure one touch access. Each row contains the parameters for a one touch access. Each row can then be assigned to a short or long programmable button press (One touch Access).

Number Key Quick Contact Access This column represents the keys from "0" to "9" on the numeric keypad.

Using these fields you can associate a contact with a numeric keypad button for quick **access.**

Text Message A user may enter up to 144 characters. Valid characters are alphanumeric, spaces and special characters. The user can then access those text messages by using the Quick Text option via the Text Message Menu feature.

Digit Emergency System

Associates any available digital emergency system to this channel for use during an emergency. Selecting the None option disables the user from transmitting an emergency call from this channel. This is a channel-wide feature.

Remote Monitor Duration - Sets the duration that the target radio can be remotely monitored. This is a radio -wide feature.

Tx Sync Wakeup TOT(ms) – (Digital Mode Only) This feature adjusts the value of the timer that begins immediately after a message is sent to wake up the repeater. The timer is stopped when the radio receives a repeater sync signal. If the timer expires before receiving a repeater sync signal, the radio sends another message to wake up the repeater

- The number of messages is determined by the TX Wakeup Message Limit, after which the repeater is assumed to be out of range. This is a radio-wide feature.

Tx Wakeup Message Limit – (Digital Mode Only) This feature sets the number of messages sent to wake up the repeater. Setting a higher number improves the success rate of waking up the repeater. This is a radio-wide feature.

Radio Disable Decode - Allows the radio to receive and process a Radio Disable command sent from another radio to remotely disable it. This feature helps to block usage of stolen or lost radios. This is a radio-wide feature.

Remote Monitor Decode – (Digital Mode Only) Allows the radio to receive and process Remote Monitor command sent from another radio. This command instructs the receiving radio to activate its microphone and transmitter for the duration specified in Remote Monitor Duration. A call is silently set up on this radio and its transmission controlled remotely without any indication given to the receiving radio user. This is a radio-wide feature.

Emergency Remote Monitor Decode – (Digital Mode Only) After an emergency alarm is initiated, this feature allows the radio to receive and process Remote Monitor commands sent from another radio for the duration specified in Remote Monitor Duration. This is an exceptional case of Remote Monitor Decode whereby the radio is able to decode Remote Monitor command even If the Remote Monitor Decode feature is disabled but only for the duration as specified in Remote Monitor Duration. This is a radio-wide feature

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System Name – This displays the name of the system.

Alarm Type – Specifies the behavior of the radio's alarm when the emergency button is pressed.

Regular - The radio transmits an alarm signal and provides audio and visual indication that it is in Emergency mode.

Silent - The radio transmits an alarm signal but gives no audio or visual indication that it is in Emergency mode. In addition, it will not unmute to any received audio.

Silent w/Voice - The radio transmits an alarm signal but gives no audio or visual indication that it is in Emergency mode. The radio then unmutes to qualified channel activity.

Alarm Mode – Specifies the behavior of the radio's alarm when the emergency button is pressed. This is a personality-wide feature.

Alarm Only - The radio sends an emergency alarm and exits the emergency mode. This alarm is a non-voice signal that triggers an alert indication on another radio.

Call Only - Once the "Emergency" button is pressed, no emergency alarm is sent but the user can make an emergency call by pressing the Push-To-Talk (PTT) button.

Alarm w/Call - Once the "Emergency" button is pressed, an emergency alarm is sent, after which an emergency call can be transmitted by pressing the Push-To-Talk (PTT) button.

Revert Channel – This is the channel used for digital emergency alarm or voice. Any single site digital channel may be set as the Revert Channel, including the channel indicated by the radio's channel selector.

Impolite Retries – An impolite transmission is a transmission that occurs even when there is activity on the current channel. The radio tries a number of impolite transmissions to get an acknowledgement and then goes on to try a number of polite transmissions. This feature sets the number of attempts to transmit an emergency alarm impolitely.

Revert Channel – This is the channel used for digital emergency alarm or voice. Any single site digital channel may be set as the Revert Channel, including the channel indicated by the radio's channel selector.

Impolite Retries – An impolite transmission is a transmission that occurs even when there is activity on the current channel. The radio tries a number of impolite transmissions to get an acknowledgement and then goes on to try a number of polite transmissions. This feature sets the number of attempts to transmit an emergency alarm impolitely.

Polite Retries – A polite transmission is a transmission that occurs only when the current channel is free of activity. The radio tries a number of impolite transmissions to get an acknowledgement before trying a number of polite transmissions. This feature sets the number of attempts to transmit an emergency alarm politely.

Hot Mic - When enabled, enabled the Emergency With Voice to Follow (Emergency Hot Mic) feature. The Hot Mic feature allows for the programming of the Hot Mic related features, i.e. Hot Mic Duration. An emergency alarm is sent and the microphone is activated for an emergency call. Voice is transmitted without the need to press the Push-To-Talk (PTT) button. This is a personality-wide feature.

Digital Contacts

Contact Name – Text field to describe the contact. Can be any text and will be used when programming the channels.

Call Type - Lists the types of calls available to the radio user.

Group Call - A call from an individual radio to a group of radios.

Private Call - A call from an individual radio to another individual radio.

All Call - A one-way call from an individual radio to every radio on that system. All Calls do not communicate across different timeslots or frequencies within the system. The ability to initiate an All Call is only programmed into radios that are used in supervisory roles.

- All other radios monitor All Call transmissions by default. This feature is very useful when a supervisor needs to communicate with all the users on a logical system, rather than just a particular group or individual.

Call ID - Sets an ID for a digital call member. This ID is used to identify and communicate with a target radio or group of radios (talk groups).

Group Call - This is the ID of the Group that the user wishes to subscribe to. range (1 – 16776415)

Private Call - This is the Radio ID of the target radio. range (1 – 16776415)

All Call - This has a fixed ID of 16777215 (this value is not editable).
All other radios monitor All Call transmissions by default. This feature is very useful when a supervisor needs to communicate with all the users on a logical system, rather than just a particular group or individual.

Call Receive Tone - This alert tone sounds on the receiving radio prior to unmuting during a Private Call, Group Call, or All System Call. This is to notify the user that the radio is unmuting. This feature is set on a per-call basis.

Band Width - Configures the analog channel spacing, digital channel default to 12.5KHz
Scan List - Associates a Scan List to this conventional channel. All the members on this list will be scanned during a scan operation. Any available Scan List can be selected. Selecting the None option disables scanning (including Auto Scan) on this channel. This is a channel-wide feature.
Squelch - Configures the analog channel tight or normal squelch (applicable to Analog mode only).
RX Ref Frequency - Configures the PLL Reference Frequency to use in receiving mode
TX Ref Frequency - Configures the PLL Reference Frequency to use in transmission mode
TOT(s) - The Time-Out Timer (TOT) is the duration that the radio can continuously transmit before a transmission is automatically terminated. This feature is used to ensure the channel is not monopolized by any one radio. The user may set smaller time-outs for busier channels. This is a channel-wide feature.
TOT Rekey Delay(s) - Sets the amount of time that the radio waits on a channel after the Time-Out Timer (TOT) expires (which stops the radio transmission) before allowing the user to transmit again. This is a channel-wide feature.
Power - Sets the radio's transmission power level for this channel. This feature can be toggled between high or low, via a short or long programmable button press (High/Low Power) or Power (Utilities Menu) feature. This is a channel-wide feature.
Channel Name - Configures the Channel alias
RX Frequency(MHz) – Sets a frequency (in MHz) on which the signal is received for the current channel. This is a channel-wide feature.
TX Frequency(MHz) - Sets a frequency (in MHz) on which a signal is transmitted for the current channel. This is a channel-wide feature.
Admit Criteria - Determines when voice or data is allowed to be transmitted on the channel. This is used to prevent a radio from transmitting on channels that are already being used. If the radio has different transmit and receive frequencies, only the receive frequency is monitored for activity. If no activity is found on the receive frequency, the radio allows the user to transmit on the transmit frequency even if it is being used. This is a channel-wide feature.
Always - The radio will always transmit when the Push-to-Talk (PTT) button is pressed. This option is also referred to as "Impolite" channel access.
Channel Free - The radio will check for an idle channel prior to allowing a transmission. This option is also referred to as "Polite to All" channel access.
Color Code - The radio will check if the specified Color Code is not in use prior to allowing transmission. This option is also referred to as "Polite to Own Digital System" channel access (for Digital channels only).
Auto Scan - Allows the radio to automatically begin scanning when the user selects the current conventional channel. When disabled, the user is still able to invoke the scan operation, via a short or long programmable button press (Scan On/Off) or Scan (Scan Menu) feature. This is a channel-wide feature.
Rx Only - When enabled, the base radio/repeater becomes a receiver only system. All the transmit parameters in all the channels are disabled.
Lone Worker - This feature enables the Lone Worker feature on a selected channel. When disabled, the user is still able to invoke the lone worker operation, via a short or long programmable button press (Lone Worker On/Off). This is a channel-wide feature.
VOX - This feature enables the VOX (Voice Operated Transmit) feature on a selected channel. VOX provides a convenient means of hands-free voice activated communication, removing the need to press the Push-to-Talk (PTT) button.
● This feature enables the radio to automatically assume the Push-to-Talk (PTT) button is pressed whenever its microphone on the VOX-capable accessory detects voice.
To avoid truncation at the beginning of the VOX call, Talk Permit tone (TPT) should be disabled. If TPT is enabled, the radio user shall use a trigger word to key-up the radio. This trigger word will not, in most cases, be transmitted. After uttering the trigger word, the radio user should begin speaking only after the TPT is heard. Channels may have their VOX feature toggled on/off via a short or long programmable button press (VOX On/Off) or VOX (Utilities Menu). This is a radio-wide feature.
Allow Talkaround - Ensures that the Receive parameters are used in place of the Transmit parameters when transmitting. This feature enables communication between radios in close proximity without the use of a repeater, and is, therefore, particularly useful when the radios are in close proximity and the repeater is out of range. This feature can be toggled between Repeater or Talkaround mode, via a short or long programmable button press (Repeater/Talkaround) or Talkaround (Utilities Menu) feature. This is a channel-wide feature.

Digital RX Group lists

Group List Name - Configures the RX Group List alias.
Available Contact - Displays all available Digital Groups that can be added to the RX Group's Members list.
Contact Member - Lists all Digital Groups which the radio is a member of (or subscribed to) on channels which the list is attached to. When the channel selected has this list attached, if the radio receives a group call that is addressed to any one of its subscribed groups, the radio will participate in that group call (i.e. it will unmute for incoming transmissions and talkback when the PTT is pressed).

Zone Information

Zone Name - Configures the Zone alias.
Available Channel - Displays all available Channels that can be added to the Zone.
Channel Member - Lists all Channels which were added to the Zone. The Max channel number of a Zone is 16.

Scan List

Scan List Name - Configures the Scan List alias.
Available Channel - Displays all available Channels that can be added to the Scan List.
Channel Member - Lists all Channels which were added to the Scan List. The Max channel number of a Scan List is 32.
Priority Channel 1 - Sets the Priority Channel 1 from the Scan List Channel Member. During scan, 50% of a radio's scans are on the Priority 1 member. If a Priority 2 member exists, scans for the Priority 1 member are reduced from 50% to 25%. Even after landing on a non-priority or Priority 2 member, the radio continues to periodically scan for transmission activity on a Priority 1 member. If the radio discovers activity on the Priority 1 member, it drops the current transmission, and unmutes to the Priority 1 member.
Tx Designated Channel - This feature defines the conventional channel/personality on which the radio will transmit if the user presses the Push-to-Talk (PTT) button while the radio is scanning. This paragraph is applicable to Conventional radios. If the Talkback option is disabled, this feature also defines the channel/personality where the radio will transmit if the user presses the PTT when the radio has stopped scanning to unmute to an eligible scan list member. Any channel can be selected as the TX Designated Channel. Alternatively, Selected or Last Active Channel may be chosen. This feature is disabled if the Talkback feature is enabled. When enabled, any scan member or Selected may be chosen as the TX Designated Channel in Conventional scanning (Conventional mode).
Selected – The channel indicated by the channel selector.
Channel1 – The “primary” priority channel.
Last Active Channel - The last channel where the radio in scan mode stopped and unmuted to receive audio.
Signaling Hold Time(ms) - Sets the amount of time that the radio waits on an analog scan list channel when a carrier signal of sufficient amplitude is detected on the channel. This pause allows the radio time to decode the analog system signaling data. If the decoded information is incorrect, the radio reverts to scan.
Priority Sample Time(ms) - Sets the duration that the radio waits, when in a call, before scanning the priority channels. If the call is taking place on a Priority 1 Channel, no scanning will take place. When scanning priority channels, the radio briefly mutes the current transmission. Increasing this interval improves the audio quality of the current transmission as fewer checks are done, but this also increases the chance of the radio missing priority channel activity.

Channel Information – Digital/Analog Data

Channel Mode - Configures the channel working in either digital or analog mode.

Digital Data

Private Call Confirmed - This feature sets Private Individual calls on the current digital channel as confirmed. By default, Private Individual calls are unconfirmed. This is a channel-wide feature.

Emergency Alarm Ack - Determines if the radio is allowed to acknowledge an emergency alarm. This is a channel-wide feature.

Data Call Confirmed – This feature enables individual packets in data calls (GPS, and Text Message) on the current digital channel or personality to be confirmed (i.e. acknowledged) on the current digital channel to be confirmed on the Data Link level. The transmitting radio resends data packets in the data call if the receiving radio does not respond with Data Link level acknowledgements or confirmations upon receiving the data packets. By default, data calls are unconfirmed. This is a channel-wide feature.

Compressed UDP Data Header – Sends the UDP data header in compressed format

Emergency System - Associates any available digital emergency system to this channel for use during an emergency. Selecting the None option disables the user from transmitting an emergency call from this channel. This is a channel-wide feature.

Channel Information – Digital Data

Contact Name – Defines the call that may be initiated on the channel by pressing the Push-to-Talk (PTT) button. However, if the channel is attached to a Group List with multiple Groups and there is an activity on one of the Groups, pressing PTT will initiate a talkback instead of a new call if it is within the hang time of the prior call. Selecting the None option prevents a call from being initiated on the channel. This is a channel-wide feature.

Group List – Associates any available RX Group list to the channel for reception. The user can listen to any Group in this list when there is any activity on it and talk back within the Group Call hang time. This is also known as a Group Scan. Selecting the None option disables the user from receiving any Group Calls on this channel, except when the **Call ID** is the same as the **Call ID** of the transmit member. The **Call ID** from the **Contact Name** is automatically added to the RX Group List on this channel by default. This allows the user to receive this call, even though this feature is set to None. This is a channel-wide feature.

Color Code – This feature allows a color code to be assigned to a given channel. Channels may have the same or different color codes. A repeater can only have one color code. A color code is used to identify a system. Different color codes are used to identify different systems. This feature enables a radio to roam between multiple systems by switching between channels with different color codes. The radio will be able to scan across channels with different color codes. Radios will ignore any channel activity not containing the matching color code for that system. Repeaters using the same frequency may be associated with different color codes. On shared channels, spectrum regulators may wish to assign different color codes to different licenses as part of their license agreement. This is a channel-wide feature.

Repeater Slot – DMR utilizes digital Time Division Multiple Access (TDMA) technology to divide a 12.5kHz channel into two alternating time slots, with each carrying an individual call when operating in Repeater mode. As a result, both the assigned frequency and the assigned time slot must be specified in order to completely describe a digital repeater channel. Radios or Groups that need to talk together must be assigned to the same frequency and time slot. This is a channel-wide feature.

Privacy – This feature allows privacy on selected digital channels. Privacy is a software-based scrambling solution that is not robust, and is only meant to prevent eavesdropping. The signaling and user identification portions of a transmission are not scrambled. Receiving radio(s) must have the same Basic Privacy Key (for Basic Privacy) or the same Key Value and Key ID (for Enhanced Privacy) as the transmitting radio in order to unscramble the privacy-enabled voice call or to receive the privacy-enabled data transmission. Illegal on Amateur Radio applications.

Privacy No. – Configures the Basic Privacy number to use.

Scanning

All DMR radios allow you to configure scanning of channels. Remember, you will only hear traffic on the frequency, time slot, and groups you have programmed on a channel. I typically scan both time slots on my local repeater and a simplex channel I use; you can also scan analog channels mixed with the digital channels. Scanning will decrease the battery life on your radio

Roaming

Roaming is not supported on all DMR radios. Check your owner's manual or manufacturer website to see if roaming is supported. In some radios it may be an additional cost option. Roaming is NOT scanning. Roaming is similar but different. Roaming is designed to have your radio automatically select the best channel if your current channel's Receive Signal Strength Indicator (RSSI) falls below a defined level as you move throughout the coverage area of a group of repeaters that carry the same Talk Groups on the same time slots. You should select channels that have the same time slot and receive groups configured; if you do not, roaming may not work correctly. Repeaters can be configured to transmit beacons at predefined intervals of inactivity so roamers will be on the correct channel. Without the repeater beacons, roaming will still work, but the radio will only change channels if it hears a repeater on the air. Roaming would be really great if all the DMR repeaters were on the same set of repeater pairs across the country, but it is too much to expect the Repeater Groups to work together for a unified re-banding of existing co-ordinations. It would also help if the different DMR networks could agree on which time slots were used by which Talk Groups.

Channel Information – Analog Data

CTCSS/DCS Dec - decodes the CTCSS tone sent by the Repeater or another radio to open the squelch
CTCSS/DCS Enc - encodes a CTCSS tone to open a repeater or other radio
QT Reverse - signals the squelch to close before the TX drops. Common to many commercial radios
Tx Signaling System - Choice of transmit signaling method e.g. CTCSS or DCS etc.
Rx Signaling System - Choice of method of squelch operation e.g. CTCSS or DCS etc.
Reverse Burst/Turn-off Code - Reverse burst or Squelch Tail Elimination ("STE") is a process that uses a change of the phase of the PL tone encoder for a short period of time after the user unkeys the PTT button. The term "reverse burst" is used to describe the deliberate phase change for a specific amount of time while the transmitter carrier stays on - about 150 to 200ms - with the phase of the PL encoder offset by from 120 to 180 degrees (180, naturally is a complete reversal). During the reverse burst time period the reverse phase stops the PL decode reed dead in its tracks - which slams the receiver squelch closed right now. By the time the Transmitter actually drops off the air the RX squelch is already closed - which results in no burst of squelch noise being heard.
Display PTT ID - allows the identification of the transmitting station to be displayed on the receiving radio
Decode 1 – Decode 8 - allows the user to see the PTT ID of the current transmission received. Will allow specific information to be received by the radio such as Radio Check, Selective Calling, Emergency etc.

Types of Call

Private Call - A Private Call is a means of directing a call to a specific callsign on the network using DMR I.D.

Group Call - A Group Call is a way of enabling groups to share a channel without distracting and disrupting one another.

All Call - All call is a one way call voice call and all users on a logical channel. This type of call is forbidden on the Brandmeister Network

DMR Talk Groups and Reflectors

Talk Groups - allow users to be separated from each other on each time slot without distracting or disrupting other users. Each radio will remain muted until the specific Talk Group assigned appears on frequency. Talk Groups can be created to cover areas such as, Worldwide, Regional, or Local. In short, a Talk Group is a simple way of organising or grouping radio traffic specific to the interest of a group of radio users. An example would be TG 2722 which is the Ireland Calling Talk Group which is an area where individuals wishing to establish contact with users in Ireland. TG 91 is the Worldwide Talk Group allowing calls from all over the world. Talk Groups become limited to a wide area and tie up many Repeaters in the process.

Static Talk Groups - These may be programmed into a Repeater or Gateway and are always connected. Should activity occur on a Static Talk Group, it will be relayed by the Repeater or Gateway.

Dynamic Talk Groups - These are inactive until a user initiates them by selecting them on the radio and keying the PTT. Whether on a Repeater or a Gateway, these will remain active for 15 Minutes and will drop unless reactivated by the user on keying their PTT.

Reflectors - A Reflector differs from a Talk Group as it allows different DMR networks to talk to each other with some form of uniformity. Access to a reflector is initiated via a Private Call to the Reflector, the user then carries on their conversation on that reflector using the Local Talk Group TG9 on Timeslot 2. **Note - it is not possible to use any Reflector on Time Slot 1.** To initiate a call to a reflector, select TG9 and key in the Reflector number and press the PTT. A voice message will come back with "connected to ….." To disconnect from a Reflector Key in 4000 and the voice message "disconnected" will result. After 20 minutes of inactivity the Reflector should automatically disconnect. Whilst the Reflector will auto disconnect, it is always **GOOD manners** to disconnect from a reflector when you have finished using it. It is via a reflector, that it is possible to access other Talk Groups, or Digital modes, such as D-Star and Fusion.

A List of Talk Groups and Reflectors may be found on the Internet. Another good reference point would include the Brandmeister Dashboard found at https://brandmeister.network/?page=talkgroups which is always up to date.

A List of Repeaters may be found at https://brandmeister.network/?page=repeaters

It is not possible to connect to a specific repeater as such but, provided the repeater has a specific Static Talk Group programmed into it, then it is possible to place a call into an area common to that Talk Group. Naturally it would be logical that all repeaters in Ireland would be monitoring TG 2722 which is the Irish calling Talk Group. By accessing TG 2722 on an individual Repeater, one would come out on TG 2722 on all repeaters on the network.

As things become busier, it would follow that, rather than hog all repeaters in the country, one would QSY to a chat channel such as TG 2723. Not vital at present! When contacting other countries, it is wise to QSY to a Chat Channel. In the case of the UK, TG 2350 is the UK Call Talk Group and there are chat channels on TG 2351, 2352, and 2353 which equate to Reflectors4401, 4402, 4403 respectively if you wish to follow that route.

A Brief DMR Programming Tutorial

You have Bought a Brand New Tytera MD-380 it has never been Programmed before

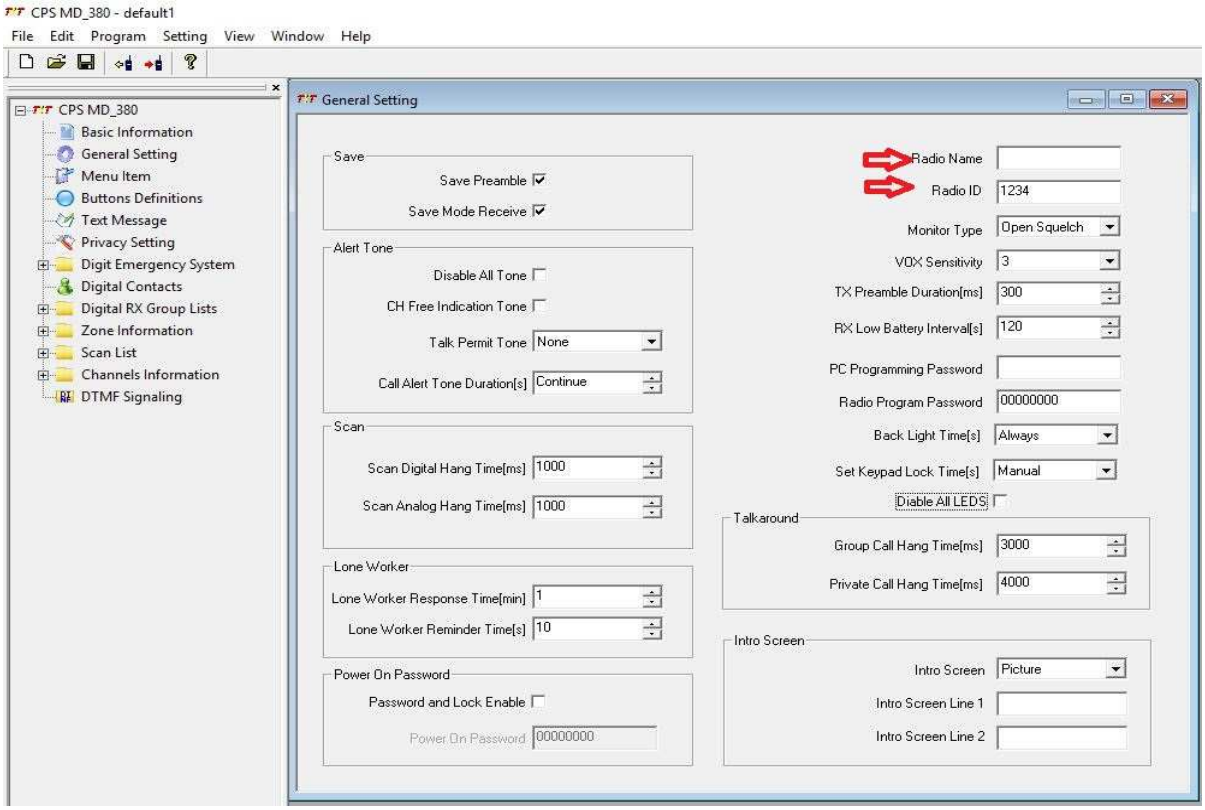
You have received your DMR ID from https://register.ham-digital.org/

Using the code plug program supplied with this Radio open it up and from the side menu Click on General Setting which will open up the General Setting box. See Below:

1) General Settings:

1) Add your Callsign to the Radio Name Box
2) Add Your DMR ID to the Radio ID box
3) If there is an Intro Screen Line 1 Box at the bottom of the Screen Place you Call here
4) If there is and Intro Screen Line 2 place your Name here.

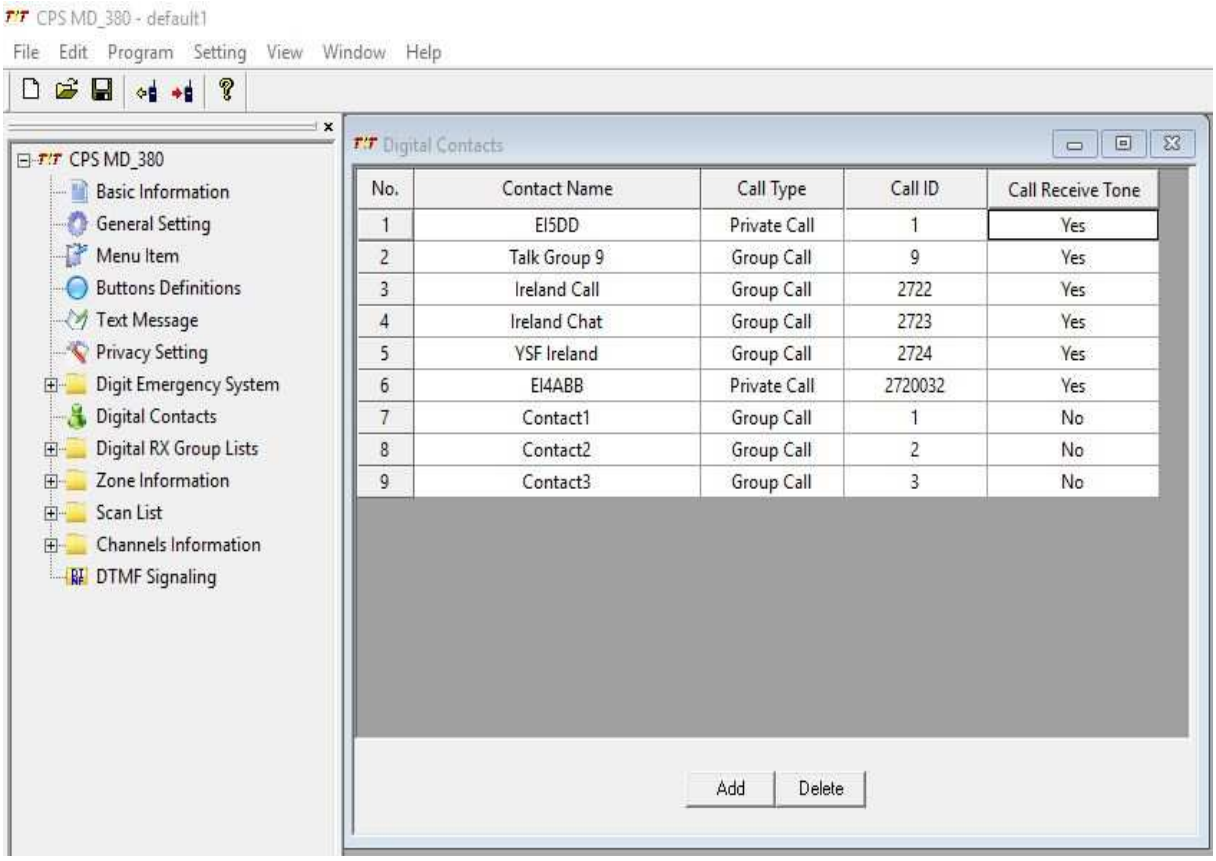
3 & 4 are really cosmetic and place the Call and Name on the Screen when the rig is turned on



2) Contacts: See illustration on next page

1) On the side menu, Click on “Digital Contacts”
   This will bring up the Digital contacts Screen and where the initial Programming begins
   The Digital Contacts Screen will appear.
2) Click on the Add Button for the number of contacts you wish to enter
3) Edit the first entry under contact name which will show as Contact 1 initially. Click on Contact 1 and rename it to EI5DD in this example
   Click on the Private Call box next to your entry and a pull down menu will appear
   A choice of three options will appear Private Call, Group Call, and All Call. Select Private Call for an individual’s Callsign

4) Add the DMR ID number matching that of the individual Call
5) Click in the Call receive Tone box and the option of Yes or No will appear Click YES
6) Talk Groups also need to be programmed in much the same way. These are also have unique IDs and have to be programmed as a “Group Call”. As shown by “Ireland Call”, “Ireland Chat” and “YSF Ireland”.



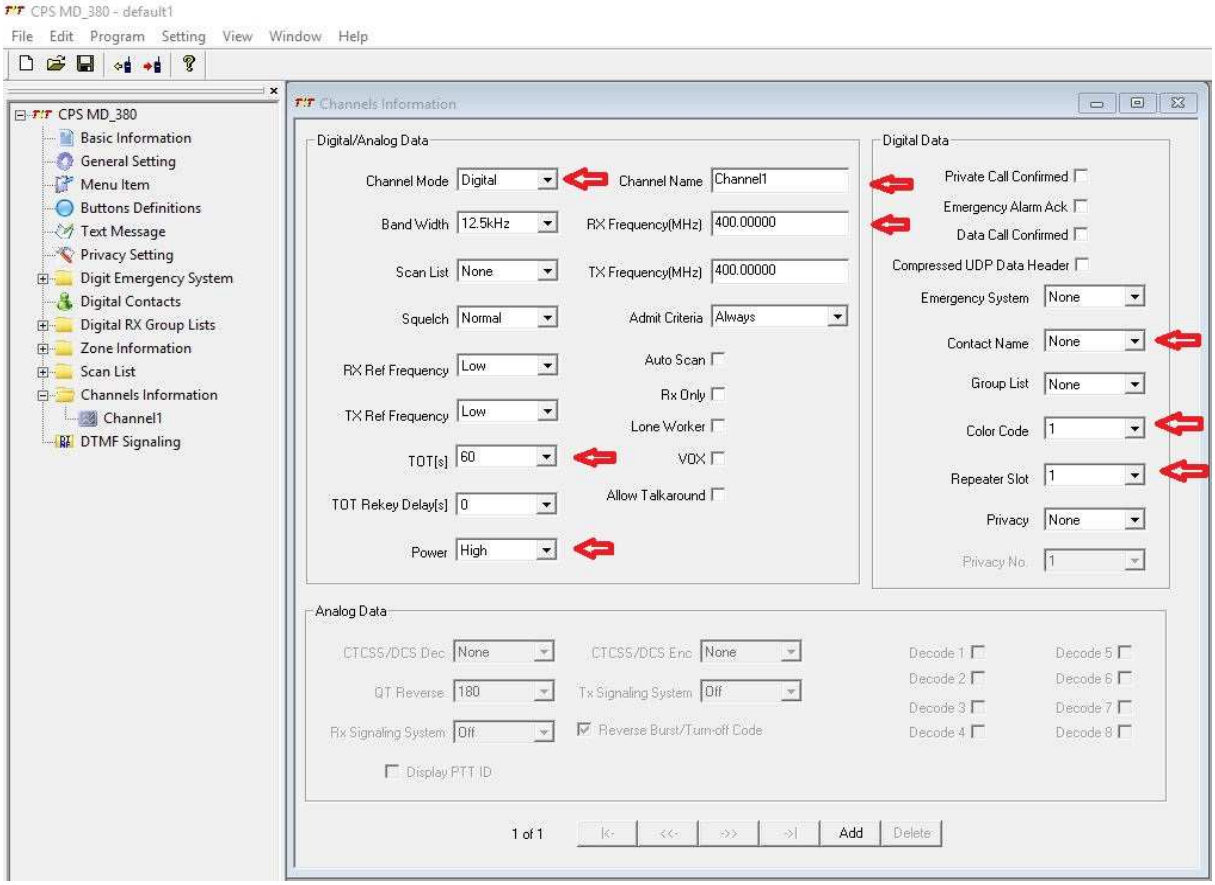
3) Program the Channels - See Diagram on Next Page

All of the positions with red arrows need to be filled in the following order

Channel Name - From our Example above this one can be named Ireland Calling Channel
Channel Mode - Generally defaults to Digital but, if not, the drop down menu will allow selection
Frequency - Your choice of Frequency for the RX and TX frequencies
Contact Name - Click on the down arrow and all of the contacts will display - choose the Ireland Calling Channel
Colour Code - This is can be any number 1 - 15 but generally set to 1 unless otherwise required
Repeater Slot - Can only be set to 1 or 2 - in our case we set this to 2
TOT (s) - Set to 180s for network operation. Most Network items time out after 3 mins
Power - Set to Low power if using a Hotspot but, set to High power if going through a repeater.

Best not to alter any of the other settings unless you have read more about them.

It is possible to program in Analog channels by selecting Analog in the Channel mode. The method is the same as for Digital Channels. CTCSS can tones can be added if the Analog mode is selected.



For use with a Hotspot e.g. DVMega or Shark Openspot:

If it is planned to use the Hand Held Radio with a hotspot or Local Repeater it is essential to program the TX and RX frequency to suit that of the device in question.

Zones

There are a maximum of 16 Zones selectable on the average Hand Held Radio. These can hold up to 16 channels. This equates to a total of 256 channels. This allows one to sort their channels into specific Groups held in each Zone.

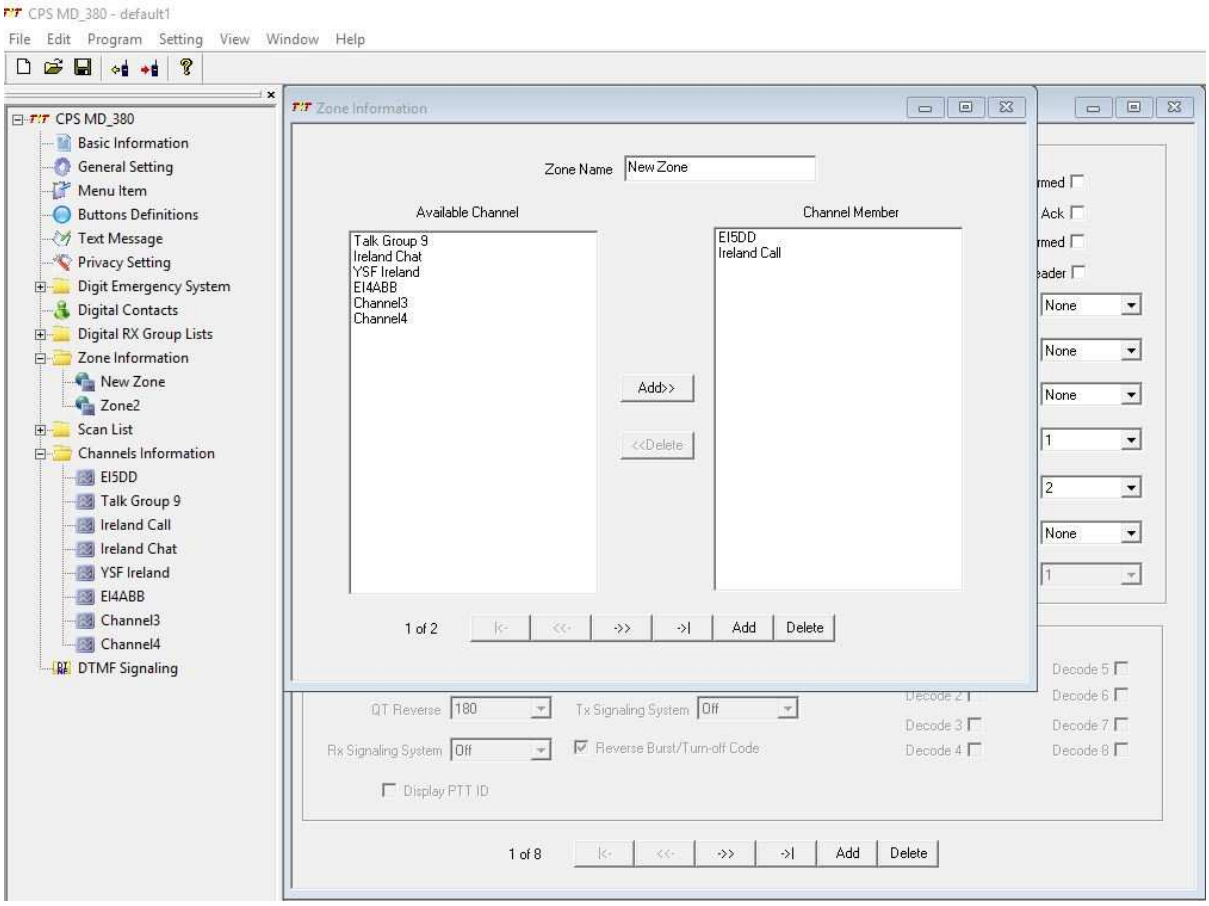
By "right clicking" the mouse on the Zone information, a small tab with "ADD" will appear click on “ADD” and this will add a New Zone into the list. Do it several times and there will be a few more Zones added.

Most of the Chinese Handheld Radios will only accommodate a Maximum of 16 Zones each containing a maximum of 16 Channels.

Right Click on Zone information and “ADD “will appear. Click on this and add the channel.

The Contents of a Zone may be anything from Just one contact up to a maximum of 16 contacts

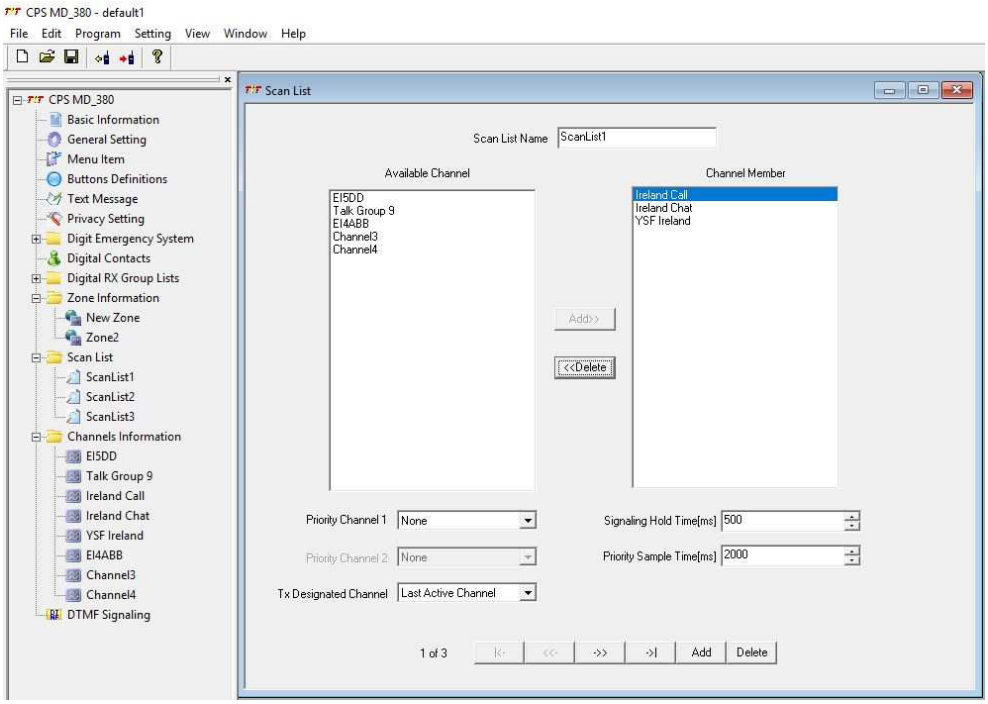
See the Zones Area on the Next Page



That completes the Basic Programming Steps. Save The program at this point in time!

The Scan List

The scan list is much like a Zone as it is set up in the same way.
To select the scan list Right Click on the “Scan List” folder Click Add and select the list

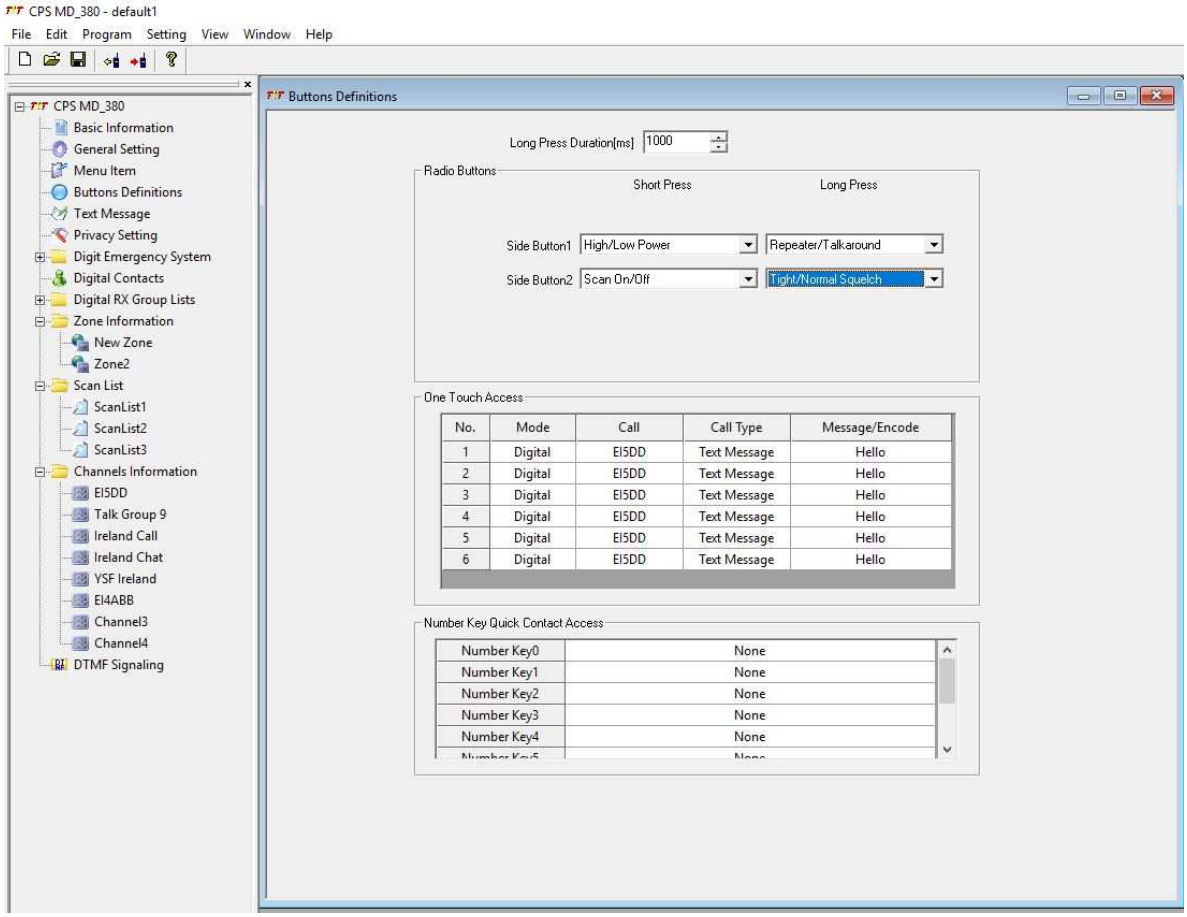


Rename the list from Scan List 1 to something Like Ireland Server in this case or a suitable name as dictated by your needs.

Highlight any thing in the left hand column and click the “Add” Button on the desired contact.

By utilising one of the Side Buttons on the Handheld, it is possible to scan or stop the scan.

Programming Side Buttons



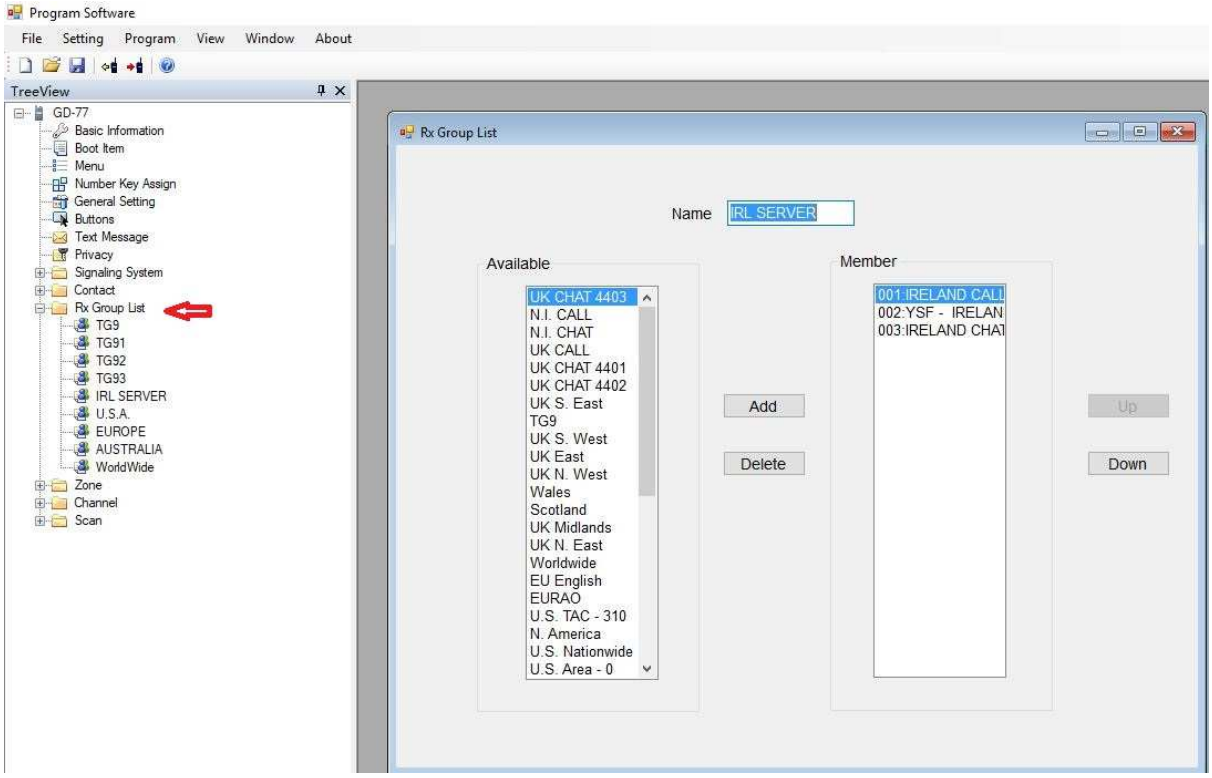
There are two side buttons on the side of most Chinese Handheld Radios. These are located on the side just bel ow the PTT.

The upper button can be programmed to toggle between High and Low Power using a short press and can be programmed for other functions by pressing for a longer time. These are just short cut buttons.

Repeater talk-around is possible by programming one of these keys. This is only used if the Repeater is not coming in too well and the station is closer to you. Can be useful!

The last item which is present on some other units, not on the Tytera MD -380, is the RX Group list. This is present on the GD-77 dual band 2m /70cm Handheld Radio. If you don’t put your calls into this list it won’t receive. They will be removing this requirement in the next few Firmware upgrades.

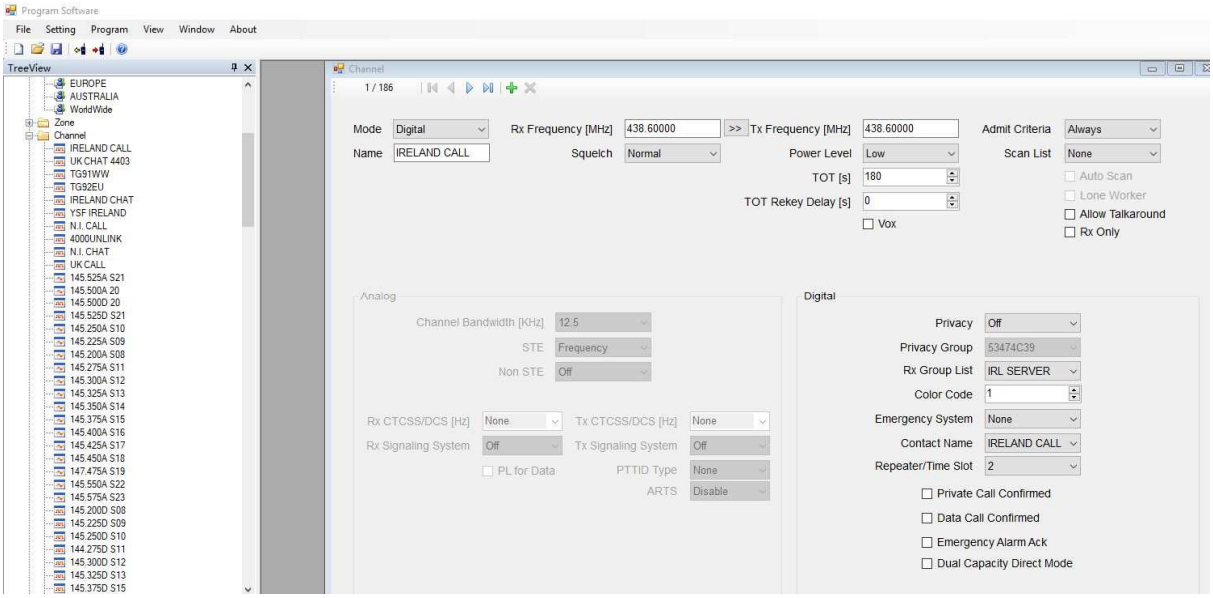
The Receive Group list according to the GD-77



The Group list is similar to the Zones List. One just has to select the calls in the left hand column and add them to the right hand column.

Give the RX Group list a suitable name—this example is Ireland Server as we have just dumped the Irish Talk Groups into this one.

As Seen in the Channels definition below for the GD-77, The name of the Channel, the Contact Name , and RX Group list are important. Without this information, The Rig will not transmit on the channels required



If **you have mastered this then you can program any DMR Radio**

Digital Repeaters

Digital Repeaters will reside in the allocation **439.000 - 440.000 with a - 9MHz split**. This means they will transmit on the 439 MHz area and receive in 430MHz.

Over time the DMR repeater network will increase. Many of the "Homebrew" Repeaters will be multimode operation. That is to say, DMR, Yaesu Fusion, and D-Star. Others will be mode specific.

At the time of writing the following Repeaters are on air:

EI7RHD - DMR Repeater Located a Letteragh, Co. Galway covering along the coastal road in the Westerly Direction, The Coast Road to Fanore on the opposite side of the Bay, Kinvara, Gort the Dublin Road, the Tuam Road and towards Oughterard. There are patchy spots well beyond these areas that would be suited to base operation. Operating on **O/P 439.450, I/P 430:450 and CC 1**.

EJ7IBD - **DMR Repeater** Located at the East End of Inishbofin Island covering the western coastline of Connemara. Operating on **O/P 439.475, I/P 430.475 and CC1**

EI7AKR - **DMR Repeater** Located near Abbeyknockmoy, Co. Galway. Has a very wide coverage of the county with spilling over into neighbouring counties. This Repeater will cover the majority of roads leading into Galway City. Operating on O**/P 438.425, I/P 430.825 and CC1**

EI7LRD - **DMR Repeater** Located near Kilnadeema Co. Galway. Covering the South East of Co. Galway with coverage into neighbouring counties. Operating on **O/P 439.450 , I/P 430.500 and CC1**

EI2KTD - **Fusion Repeater** Located near Kilnadeema, Co Galway with good coverage of Mid to East Galway. Operating on **O/P 145.625 I/P 145.025.**

EI7TBR - **D-Star Repeater** (to come online in 2020)

EI7DKD - Located on the Hill of Faughart, North of Dundalk with coverage as far as Drogheda. Operating on **O/P 439.5625 and I/P 430.5625 and CC1**

EI7CDD - Multi-mode Repeater Located at Carronadaverg between Dungarvan and Youghal, covering West Waterford and East Cork. DMR, D-Star and Fusion **O/P 439.650 MHz, I/P 430.650 MHz CC1**

EI7WCD - Multi-mode Repeater Located Tramore Co. Waterford covering East Waterford & Waterford City areas. DMR, D-Star and Yaesu Fusion **O/P 439.675 MHz, I/P 430.675 MHz CC1** also operational on Analog 103.5 Hz CTCSS Tones.

EI7MLD - Multi-mode Repeater Located on Mount Leinster. This repeater covers an area almost into Dublin and around the south midlands. Operating on **O/P 439.300, I/P 430.00 and CC1**

EI7FXD - DMR Repeater Located at Farmer's Cross Site overlooking Cork. Covers most of Cork **O/P 430.250 MHz, I/P 439.250 MHz**

EI2IPG - Fusion Repeater Located at Carndonagh Co. Donegal Operating on **O/P 145.71250 MHz, I/P 145.11250**

EI2JPG - Fusion Repeater Located at St John's Point Co. Donegal Operating on **O/P 145.750 MHz, I/P 145.150 MHz**

EI7WHR - Fusion Repeater Located at Woodcock Hill **O/P 434.725, I/P 433.175**

EI2TAG - Fusion Repeater to be located at Woodcock Hill the Callsign will change **O/P 145.725, I/P 145.125**

Digital Gateways

Gateways are a relatively easy solution to securing activity in any area. A Gateway may consist of a Transceiver such as a Motorola GM350, an MMDVM Modem board, and a Raspberry Pi running Pi-Star software. The Motorola GM 350 needs minor modification to ensure flat audio is output from the accessory socket. The audio to and from the Modem board is passed to the Motorola GM350 via the rear accessory socket. Using Pi-Star, it is possible to set up Static Talk Groups on DMR. It is also possible to run multimode adding Fusion, D-Star and P25.

Care has to be taken not to host really busy Reflectors on D-Star otherwise the whole unit will be taken over with one mode only. More to the point, and out of consideration towards other users, one should disconnect from the system once finished. Running a Gateway from the Home QTH is often more than adequate to provide a service to the area of a town or City like Galway.

The Galway Gateway has TG 2722, TG 2723, TG2724 and Northern Ireland Calling TG 2354 set as static TalkGroups. These are not busy and do provide the opportunity to monitor for activity from Ireland. No doubt, as activity increases the status will be revised. Dynamic Talk Groups may be operated through the Gateway. Reflectors may accessed via TG 9 Local.

EI2GCD - Located at Letteragh on the West side of the City. The Gateway is situated at the same site as the EI7RHD Repeater. Coverage on the Gateway will be similar to the Repeater EI7RHD. Being VHF, and located on **144.8500 MHz**, good coverage in the vicinity of Galway and surrounding areas is expected. This Gateway operates on Time Slot 2 only. DMR Static TG 2722, D-Star Reflector DCS049 I, YSF - YSF.IE

EI2SHD - A Wires-X Gateway located in Salthill, Galway operating on **144.8125 MHz.** The Gateway has a wide Coverage of Galway City and Surrounding areas withing a radius of 25 - 30 miles. The Gateway resides on CQ—UK although can be changed by pressing the "X" button on the Radio and selecting from the many international Nodes.

EI2DOD - Located at Derrynogue Co. Mayo. Operating on **144.8250 MHz.** Good wide coverage from Mayo and into the North Galway area. This Gateway operates o Time Slot 2 only. Both DMR and Fusion modes are in operation.

EI2BED - Located at Ballybride just outside of Roscommon Town and operating on **144.8625 MHz** and CC1. A Good wide coverage is possible to the East and North East with coverage as far as Ballinasloe to the South East. Both DMR and C4FM modes are operational with the possibility of D-Star as required. DMR Static TG 2722, D-Star DCS 049i, YSF - YSF.IE

EI2KTD - Located at Kildare Town and operating on **144.8325 MHz** and CC1. This promises to cover a wide area from Athlone almost into Dublin. DMR, D-Star and C4FM modes in operation.

EI7SND - Located in Mullingar and operating on **431.150 MHz**. DMR, D-Star and C4FM modes in operation. It has a wide coverage of the midlands with marginal coverage into Dublin.

EI2LRG - Located to the South East of Limerick Operating on **144.8375 MHz**

DMR Operation

DMR is a digital mode which uses TDMA technology. This allows for either two voice channels at the same time or one voice and one data channel. Slot 1 and Slot 2 are the respective audio channels available within a 12.5 KHz channel spacing. This is the equivalent of having two repeaters established on the same site.

The key to DMR operation is to program the radio with a Code Plug with a variety of popular Talk Groups. A short tutorial was included in an earlier section of this book. It is probably best to program individual Zones for specific target areas. A Logical approach will dictate the ease of operation.

This is my personal system of Zones for 70cm Repeaters and Hotspots.

Hotspot Local -	Contains all EI and UK Talk groups
Hotspot International -	Contains favourite International Talk Groups
EI7RHD Slot 1 -	Contains International and Chat Talk Groups used on the EI7RHD Repeater Slot 1 Also contains any Talk groups with other digital Modes bridged to it
EI7RHD Slot 2 -	Contains Cluster and Talk groups used on the EI7RHD Repeater Slot 2
EI7AKR Slot 1 -	Contains International and Chat Talk Groups used on the EI7AKR Repeater Slot 1 Also contains any Talk groups with other digital Modes bridged to it
EI7AKR Slot 2 -	Contains Cluster and Talk Groups used on the EI7AKR Repeater Slot 2

The above list is programmed in a similar fashion for all Repeaters not just those shown. It does involve a little time and effort but is worth it in the long run as it gives quick and easy selection of Channels especially for mobile operation. Program a little at a time and get them to work before adding more.

To operate a DMR Radio, select the Zone with the desired Channels programmed. Select the desired talk Group, and key once only to connect. If there is no activity on the channel place your call. If you wish to connect to another Talk Group, simply select the desired channel and repeat the action.

Talk Groups (TG) should be set to **TG 9** for **local repeater operation only** on Both Slot 1 and Slot 2

When operating through a repeater using TG9 Local, the repeater will retransmit the signal in just the same way as an Analog repeater does. **BUT**, once a Talk Group is accessed the Repeater acts like a Gateway. That is to say, the operator will be routing through the repeater to the destination Talk Group. TG9 must be set as a Group Call. It is only in this manner that TG9 will act as local operation through the Repeater. Galway does have the facility to use TG 19 in a similar manner.

Time Slot 1 is defined for International Operation and International Calling Talk Groups. Static Talk Group TG2723 and Static Talk Group TG 7 (Connacht Cluster) are established here. Short brief calls only with International Stations so as not to jam up the International Network. General QSOs and "rag chews" carried out here. Use TG2724 here also. D-Star and C4FM networks bridged onto DMR should be worked via Time Slot 1. Basically, any TG with another mode apart from DMR Bridged to it, whether Analog or digital goes on Time Slot 1

Time Slot 2 is for "Local and Semi-Local and Regional working" The Irish Call channel TG2722 is static along with TG8 (The Galway Digital Radio Group cluster) Please do not activate TG2723 on this Time Slot

Reflectors may be accessed on Time Slot 2 but they will be phased out by the end of 2021.

Bear in mind, that once connected to a Talk Group the Repeater effectively becomes a Gateway and will not repeat any station working that Talk Group. The use of Group Call TG 9 will facilitate local repeater operation.



PLEASE NOTE: It is necessary to leave a **3 second gap** between overs or calls to allow the network components to keep up with the multiple connections locally and around the world. Ignoring this advice will lead to the network components timing out.

A Repeater will disconnect from a Talk Group after 15 minutes but unfortunately this is not the case on a Gateway System.

If using a Gateway please guard against selecting an exceptionally busy talk group and then leaving it operating in that mode. Gateways do not disconnect automatically after 15 minutes so it is necessary to Key Talk Group 4000 to disconnect. You will no be thanked for walking away and leaving a busy Talk group active.

Static Talk Groups are those pre-programmed into a Repeater or Gateway and, should any activity appear on them, will be transmitted by the Repeater or Gateway.

Talk Groups Vs Reflectors

A Talk Group must be pre-programmed into the Radio and selected as a channel from the Radio.

A Reflector may be dialled directly from the H/H Keypad e.g. the Ireland Call Channel is Reflector Number 4780 but its Talk Group ID is 2722 which must be programmed into the Radio. The use of reflectors has been phased out more recently.

User Activated Talk Groups are not pre-programmed into the Repeater or Gateway, and are selected by the user.

TG9 is implemented on both Time Slots. Two independent QSO's can take place on the same repeater. If Time slot 2 may be busy so it is a simple matter to switch to TG9 on Time Slot 1. TG9 does not route through the server so your QSO is through the Local Repeater only and not throughout the network.

Roaming

Many of the Commercial Radios have the roaming facility which enables them to switch from a repeater of a lower signal strength to one with a stronger received signal strength.

The Galway Hytera Repeaters have the IP multisite connect facility enabling seamless roaming between repeaters provided that they all have a common Static Talk Group programmed. By Programming a roam list on your Radio it is possible to activate this whilst travelling over distance. The Roam list has to have a specific Talk Group programmed into a channel programmed for each repeater in the locality

Basically, if you are operating on TG 2722 on the Galway City Repeater and are heading towards Loughrea, your signal Strength will reduce to a level e.g. Strength 6 when this happens the radio will roam seek one of the repeaters pre-programmed into the Roam list with a higher signal strength. The Loughrea Repeater will, on this occasion have a higher signal strength an the radio will seamlessly switch to the Loughrea Repeater.
If all DMR Repeaters in the country had a static Talk Group TG 2722 programmed, it should be possible to roam, in a similar manner to the Cellular phone System, from one repeater to another across country.

A short note on the issue of Talk Groups.

There are currently three Talk Groups issued for National use as in TG 2722 (Ireland Call Channel), Talk Group 2723 (EI Chat Channel), and TG 2724 (A Chat Channel Linked to YSF Ireland C4FM) These are more than adequate for the current numbers of users. There are Cluster Channels available that may only be operated through Linked Repeaters. Galway Digital Radio Group Repeaters are all linked to their respective Clusters

Galway has now implemented the Provincial, on TG7 and the Galway Digital Radio Group Cluster, on TG8, on all of their Repeaters. These are Static Talk Groups and can be used in conjunction with Roaming

All Galway Repeaters in the Galway Network are "clustered" on TG 8.

Allocation of Talk Groups for "private user groups or clubs" is not in the Sprit of Amateur Radio. Special event Talk Groups maybe implemented as in Scout's Jamboree. Clusters are available for individual Repeater Groups such as the Galway Digital Radio Group and the Southern Ireland Repeater Group. All Repeaters in the respective repeater group are clustered together on TG 8. TG 8 in the Galway area will be the Galway digital Radio Group cluster, whereas, TG8 in the Southern Ireland Repeater Group will be clustered together in the South Eastern area.

C4FM

The C4FM digital mode is mistakenly referred to as "Yaesu Fusion" probably due to the fact that both C4FM and Analog operation is possible through the DRX-1 Repeater. Fusion is derived from the fact that both modes can be received automatically on the One Radio or Repeater without manual selection. One of the advantages is that a C4FM radio needs very little programming bar the Callsign entry on first use. The Radio can then operate through Repeaters and on Simplex channels in either the Digital C4FM or Analog Modes. It is only, when using the Wires-X mode, that the advantages of the system can be fully realised.

Yaesu C4FM Modes

The Four Operating Modes of System Fusion

V/D (Digital Narrow) – Voice + Digital or "V/D" mode

Voice FR (VW) Mode – Utilizes all available bandwidth for high-fidelity voice operation, providing the most crystal clear of voice communications.

Highspeed Data

Transfer data such as images or text messages at full rate with speeds up to 9600 Bits-per-second

Analog FM Mode

Maintains backwards compatibility with existing Analog FM Equipment, allowing a wide range of users to experiment with System Fusion Digital.

Capabilities such as Automatic Mode Select (AMS) On the DR-1X Repeater allow an even wider range of users to communicate, by running the repeater in "Fixed FM" mode on Transmit, and "Automatic Mode Select" on receive the repeater will automatically detect the incoming signal and convert it to an Analog FM Transmission. This mode allows digital users to communicate with existing Analog FM users without the need to switch their radios into FM Mode, allowing crystal clear Digital reception into the repeater that is converted into a conventional FM Signal.

Enhanced Communication Functions of System Fusion

Yaesu incorporated a suite of features within the System Fusion product line that are designed specifically for Amateur Radio Use. These features allow the operator to transmit High quality digital voice simultaneously along with Digital Data, and a High Rate (Data FR Mode) dedicated Digital Data mode that provides a method of transmitting Images, Text message and Telemetry Data at a high rate of speed.

What is WIRES X?

WIRES X (Wide-coverage Internet Repeater Enhancement System) is digital communication developed by Yaesu to further the interest of the Amateur Radio Communication. It uses a form of VOIP (Voice over IP) to connect Amateur Radio Station utilizing the Internet. It supports the new C4FM Digital Communication mode. C4FM digital signals are repeated without deterioration of audio and data communications and sent over the Internet to Amateur Radio Stations.

WIRES X uses local Node (station connected to the Internet via a PC) as access points which relay the communications of conventional Amateur Radio Stations.

An amateur Radio operator calls a local Node's radio which is connected to the Internet via a PC. The local Node radio relays the amateur's call to the Internet via the PC. The PC relays the amateur call to another Node's PC that is also connected to the Internet, then send sit to the Node radio. Then local Node radio then relays the call to the receiving amateur radio station.

A wires X-Gateway is a standalone access point enabling an operator to select the Wires-X mode by pressing

the “DX” button on the radio. A list of Nodes will appear and either touching the screen of the radio or by the push of a button makes it possible to connect to a node anywhere in the world. Such a node may be connected to many other nodes allowing a wider coverage in the area. This is similar to connection to D-Star Reflectors.

A Wires-X Gateway may be a standalone access point or an integral part of a repeater and will allow connection of local operators on the repeater with operators on a distant repeater, users of a node with many others connected or to output on a single node in another country.

WIRES-X also supports digital communications which can transmit and receive digitized data, e.g. text, image and audio on the same Global Network. The WIRES X Network extends the reach of an Amateur Station located in Ireland to an Amateur Station located withing range of a Wires-X node anywhere else in the worked. This can be accomplished by using just a hand held or base station radio connecting to a local Node then onto the distant Node then to the destination amateur radio station.

A Wires-X node is made up of a C4FM Radio, a HRi200 Wires-X Modem and a computer controlled. Sadly the Raspberry Pi has not been adapted at the time of writing. The system is then connected to the internet by Ethernet cable. More recent Firmware allows the C4FM Radio to act as both transceiver and modem with a connection to the Internet.

Some budget priced Yaesu C4FM radios may not have the facility of the DX button but will still be able to work through a Wires-X node if operated on the frequency of that Node. There will be no facility to change the Node or room to which the local node is connected. This applies to both operation on a Wires-X Gateway and through a Wires-X Repeater.

Receiving and Transmitting WIRES X

In order to listen or to receive a WIRES X signal, one has to find a Local Node or a WIRES X Repeater within the range of your transceiver.

Basically all WIRES X Nodes are Amateur Radio Stations that are voluntarily registered with Yaesu. The Amateur Radio Station information such as their location and operating mode is listed in Yaesu Website; https://yaesu.com/jp/en/wires-x/index.php. You can use the Yaesu list to search for nearby local Nodes, and other Nodes on the internet use by Amateurs that you want to communicate with.

Once you find that there is a WIRES Node in your area.

Now you are ready to connect to a Local Node to experience WIRES X.
Use the following procedure to set up your transceiver to receive and transmit on a Local Node.
Note: You do not need to set the transceiver to WIRES X mode to use the Local Node.
For the your particular radio…if you have a dual band;

1. Set the radio to use VFO A.
2. Enter the frequency of the WIRES X Node.
3. Set the mode to “DN”.

Use the key to change to the “DN” mode’.

Note: Pressing the key repeatedly cycles thru the transceivers modes, e.g. **FM > DN > VW > FM**

At this point you are ready to receive and transmit using the Local Node or WIRES X Repeater on the frequency that you found

Additional Uses for the "DX" Key on the Transceiver

The "**DX**"key is use to connect to a local Node in digital node, in addition to selecting the communication mode of the transceiver. This section will discussing the use of the "**DX**" key in the digital mode. You can use the "**DX**" key to connect to the Local Node.

NOTE: The "**DX**" key can also be used to determine if there is a Local Node on the current frequency.
When you press the "**DX**" key for over a second a flashing **X** symbol appears on the left of the frequency in the transceiver. The **X** symbol continues to flash until a node is found. When a local node is found, the **X** symbol is lit solid; the node and city name appears on the lower part of a transceiver's screen. If a node is not found within 5 minutes; the symbol disappears and the transceiver's screen returns to normal.

Now that the transceiver is in the WIRES X digital mode you can do the following;

1. **Search an accessible node or room from an internal list that you create on the transceiver**
2. **Specify the node or room by DTMF ID to connect to.**
3. **Specify the node or room by name to connect to**
4. **Selecting the most recently connected node or room**
5. **Enter the I.D. number of the Node to initiate a connection**

All Wires-X capable model of transceiver have the "**DX**" button and work in much the same way. It is best to consult the manual for each radio. Basically they wok in the same way. The FT1D and the FTM100 are not touch screen radios and so Wires-X operation is via ad therefore operate by push button for Wires-X node selection whereas the FTM400 and FT2D are touch screen radios and the node can be selected by simply touching the screen

Other features include:

Group Monitor (GM)

Digital Group Monitor automatically checks whether users within a communication group are in or out of range and displays information such as distance and orientation on the screen of the client radio for up to 24 Stations.
Each individual group can share Text and Picture messages between themselves, allowing intelligent control of how content is distributed amongst a large operating group.
Group Monitor is almost an invaluable feature when an operator or group of operators needs to track resources, such as in an emergency communication operation. Resources can easily be tracked and controlled, letting operators know when they are going to fall out of range and may need to return to the coverage area, or providing invaluable telemetry data for locating and tracking individual operators.

Snapshot Function (Picture Messaging)

By simply connecting the optional MH-85A11U Speaker Microphone with Camera, an operator can quickly take advantage of the high-speed data functions of any System Fusion C4FM radio and can easily transmit images to other C4FM users.
Transfer data such as images or text messages at full rate with speeds up to 9600 Bits-per-second
Image data which sent from a group member is displayed on the full-colour screen of the FTM-400DR or Monochromatic display of the FT2DR. This image data also retains a time record and the GPS location data of the snapshot. It is easy to navigate to that pictured location by using back track function. In addition, you can observe on the screen whether the transmitted data was successfully received by the member station. The snapshot image or received data is stored in a high capacity micro SD card, and you can recall and send that image data from the SD card anytime. The pictures and data files may be easily viewed and edited by using a personal computer by simply inserting the SD Card into any SD Card reader.

Smart Navigation Functions/Backtrack Function

The Smart/Real-time navigation function enables location checking at any time. In digital V/D mode, information such as position data is transmitted together with voice signals so the distance and direction to the other stations can be displayed in real-time while communicating with them.

The Backtrack Function enables navigation to a registered location at the touch of a button. When hiking or camping, simply register your starting point or campsite before departure, and the distance and orientation from the current location are displayed on the screen.

Text Messaging
Text messaging could not be simpler, with direct entry via T9 Text input or the On-Screen Keyboard (FTM-400), messages can be sent quickly to an individual operator or group of operators (GM Mode).

Alternatives to Wires-X

YSF and FCS are two independent systems that can be used with Yaesu equipment. A station on a given reflector system can only operate on that system unless it is bridged to another. YSF Ireland Room is linked to CQ-Ireland on Wires-X. They both react in the same way and the pressing of the "**DX**" button is used to access the list on available Nodes as with the Wires-X system.

Wires-X operation is only available on Yaesu Repeaters or through Wires-X Gateways.

YSF and FCS reflectors are found on Multi-mode Repeaters or Gateways using the Pi-Star operating system. They are also accessible using personal Hotspots.

A full list of YSF and FCS rooms may be found on the internet.

Yaesu's C4FM equipment is the easiest of the Digital modes to operate and there is plenty of activity. Try CQ-UK which will provide plenty of activity throughout the day. During the night the VK operators join CQ-UK making it a very active area.

America-Link is a location with a huge number of regional American Nodes connected. This is an area which will always produce a high level of activity.

In Japan the operation of Wires-X Gateways is far more popular than Repeater operation. A Good network of Gateways is obviously equally as workable as a Repeater Network.

DMR Bridge to CQ - IRELAND

DMR is Bridged to CQ-IRELAND Wires-X Room via TG 2724

D-Star Reflector is Bridged to CQ-IRELAND via Reflector XLX 353 E

Peanut Room YSF-IRE is bridged to CQ-IRELAND Wires-X Room.

Effectively four modes are Bridged together to CQ-IRELAND and it is possible to talk to an operator on any of these modes vis the Network Bridge.

Only the vary basic operation of the Yaesu Fusion system is mentioned here and it really is advisable to read the **m**anual (**RTFM**) to derive the best use out of the mode. There genuinely is more to Yaesu Fusion than meets the eye. Additional firmware upgrades have enabled the radio itself to become a standalone Wires-X node with out he need for the HRi200 Modem. A computer has to be connected via an expensive pair od accessory wires and the operation of the node is exactly the same as the use of the HRi200 modem.

Operating D-Star

It is essential to ensure that D-Star Registration is completed before trying to operate the D-Star Radio. It is worth taking care to ensure all is correct here. Probably the best way to register is via the ICOM UK website. The next task is to read the manual as most problems encountered are the result overlooking essential set up instructions.

Like the other Digital Modes, the operation via the Gateway system from Repeater to Repeater seems to be more popular than going through the local repeater.

To transmit in D-STAR and have other people hear you, you'll need to set four parameters: MYCALL, URCALL, RPT1, and RPT2. Of course, you'll also need to set the mode ("DV") and frequency, and if you're trying to talk through a repeater, the offset. At least there are no PL tones to worry about. (If you just want to receive for now, you can ignore MYCALL, URCALL, RPT1 and RPT2.)

MYCALL is your own call sign, eight characters maximum. You're allowed to add "/" and then other characters; The original intent was so that you could sign "/P", "/M", or "/7", but for D-STAR some people get creative, like "/Fred" for someone named Fred, or "/5100" for someone using an IC-5100.

URCALL can hold routing information or linking commands; to just use the local repeater, URCALL should be set to "CQCQCQ" most of the time unless directing to a specific call or location.

RPT1 should be set to the local repeater and module that you're trying to access. The Repeater you are talking to. (The setting doesn't matter for simplex.) See below for what I mean by a module.

RPT2 designates where you want your signal to be routed on your local repeater; normally RPT2 is set to the call sign of the local repeater, followed by "<space>G". (The Repeater or Gateway you want to appear on)

Don't get too worried about exactly what URCALL, RPT1, and RPT2 are for, because there is a simple web tool you can use that will tell you what to enter: The D-STAR Calculator. Just tell the calculator what you want to do, and it will tell you what to put in MYCALL, URCALL, RPT1 and RPT2. When using the calculator only change one thing at a time, and each time you change something the page will take several seconds to reload; be patient. Hints: always select "Local Repeater with Gateway" rather than "Local Repeater"; have a look at the Calculator's help page http://www.dstarinfo.com/calculator.aspx

The "module", "port", or "node" (all three words mean the same thing) of a D-STAR repeater refers to the band. ICOM makes modules for 2m (144 MHz), 70cm (440 MHz), and 25cm (1.2 GHz), and a repeater can have nodes for more than one band; some D-STAR repeaters have modules for all three bands.

"A" port or module is on 1.2 GHz,
"B" port is for 70cm
"C" port is for 2m.

So if you set RPT1 for "EI7RHD B", that would be the 70cm module / port / node of repeater EI7RHD (In the RPT2 setting "G" is often used, e.g. "EI7RHD G". In this case "G" doesn't refer to a module, but rather the gateway, which is a computer that connects the repeater to the internet.)

Set-Up

Enter My Call
My Station > Enter Callsign

Making a point to point call Simplex

` **Dial in a Simplex Frequency**
Set offset to none
Set mode to DV (probably was FM by default) (DV is the D-STAR Voice Modulation mode)
UR CALL CQCQCQ

Don't worry about the RPT1, RPT2, and UR call signs when working simplex.
Note RPT 1 and RPT 2 to do not matter on Simplex so these can be left blank

Basic Repeater Operation

Set frequency to the repeater's frequency
Set offset to the repeater's offset
Set mode to DV Sit back and listen.
You should hear any activity on the repeater

Programming a Repeater
Using the local repeater (no routing)

EI5DD wants to talk to other local ops using his local repeater EI7RHD, which is on 70 cm (node B).

MYCALL: EI5DD
URCALL: CQCQCQ
RPT1: EI7RHD B
RPT2: EI7RHD G

Call sign routing to a specific repeater and node

EI5DD is using his local repeater EI7RHD (the B module on 70 cm), and he wants to route his transmissions to the B module of the EI7MLD repeater on Mount Leinster.

MYCALL: EI5DD
URCALL: /EI7MLDB
RPT1: EI7RHD B
RPT2: EI7RHD G

If someone is already transmitting on the EI7MLD repeater node B when EI5DD starts transmitting, then EI5DD's transmission will be blocked on the remote repeater, and EI5DD's radio will display "RPT?EI7MLD" to notify him that his transmission didn't go through.

Call sign routing to the repeater and node last used by a specific Operator

EI5DD is on his local repeater EI7RHD, and his friend EI4ABB is on holidays; EI5DD wants to route his transmissions to whatever repeater his friendEI4ABB used most recently, in the hope of talking to his friend.

MYCALL: EI5DD
URCALL: EI4ABB
RPT1: EI7RHD B
RPT2: EI7RHD G

In this example it might look as though EI5DD is calling person-to-person, but it's repeater-to-repeater, and anyone listening to either repeater will hear the conversation.

When calling another repeater using call sign routing, one should announce what repeater and node one is calling from, for example "This is EI5DD calling CQ from repeater EI7RHD, node B, in Galway City, West Coast

of Ireland. CQCQCQ from EI5DD on repeater EI7RHD node B, CQ." Saying the repeater and node you're calling from out loud allows people on the other repeater to set up their radios manually if they can't use their "RX->CS" buttons for some reason.

(More on the **"RX->CS"** button later.) **

Be patient and wait at least a couple minutes, so that an operator on the other repeater can stop what he or she is doing and program the radio to route his or her transmissions to your repeater and node.

It is important to note that it's easy to cause unintentional interference with call sign routing, because you won't hear transmissions from people using the other repeater unless they set up their radios to talk to you. If you're routing your transmissions to another repeater, either to call CQ or to call a specific ham, you might be interrupting a QSO or a net, so keep your transmission short and don't call more than once or twice. But don't be afraid to do it, because meeting new people on the air is what ham radio is all about!

If you use call sign routing to talk to someone on another repeater, be sure to change URCALL back to "CQCQCQ" immediately after you've finished. If you forget, your transmissions for your next QSO with someone on the local repeater will be inadvertently routed to the other repeater you were routing to earlier!

By the way, when D-STAR users outside the Ireland are looking for a QSO then they are more likely to call CQ, similar to the way it's done on SSB, rather than announce that they are "monitoring".

** *Every ICOM D-STAR radio has an "**RX->CS**" button. The **"RX->CS"** button gives you an easy way to automatically set URCALL, RPT1, and RPT2 to route your transmissions to the repeater and node that the previous caller, or any one of the last several callers, called from. Read your radio's manual to discover exactly how to use **"RX->CS".***

DPlus Linking

Call sign transmission routing works well, but there are a couple disadvantages: there is no easy way to link more than two repeaters, and a caller routing his or her transmissions to another repeater has no idea whether the other repeater is busy or not.

Software called DPlus, which can be installed on the gateway computer that connects a D-STAR repeater to the internet. DPlus adds several functions, most importantly the ability to link a repeater to another repeater, or to a D-STAR reflector. With DPlus-style linking, a lasting link to another repeater or a reflector can be set up. Anything said on any linked repeater will automatically be routed to every other linked repeater, with no special radio configuration required.

A D-STAR reflector is a computer connected to the internet that runs special software. The nice thing about reflectors is that lots of repeaters can be connected to one reflector. For instance, reflector 14C "fourteen-Charlie" is the popular reflector for D-STAR repeaters on the West Coast of the US and Canada; link your local repeater to reflector 14C, and half the D-STAR users from San Diego to Vancouver will hear you when you transmit. And then there is Reflector 1C, the "D-STAR Mega Reflector", used world-wide. That reflector is always busy with operators from all over the world.

There is a list of reflectors here http://www.dstarinfo.com/reflectors.aspx

DPlus Linking to Another Repeater

EI5DD wants to link his local repeater EI7RHD to the 70cm "B" module of repeater EI7MLD.

MYCALL: EI5DD
URCALL: EI7MLDL
RPT1: EI7RHD B
RPT2: EI7RHD G

After setting up the radio, the operator should key the microphone for about one second to transmit the command. If the command succeeds, the repeater will play a recording saying, "remote system linked". After linking, the operator should immediately change URCALL back to CQCQCQ

Most D-STAR users outside Japan use DPlus linking rather than call sign routing. So why mention call sign routing? Every D-STAR radio owner should know how to use call sign routing, because that was the original intent of the designers of D-STAR. It works well and knowing how to use it will allow you to talk to the thousands of D-STAR users who prefer connecting that way.

DPlus Linking to a Reflector

EI5DD wants to link his local repeater to Reflector 14C, to which many other West Coast repeaters are already linked.

MYCALL: EI5DD
URCALL: REF014CL
RPT1: EI7RHD B
RPT2: EI7RHD G

After setting up the radio, the operator should key the microphone for about one second to transmit the command. If the command succeeds, the repeater will play a recording saying, "remote system linked". After linking, the operator should immediately change URCALL back to CQCQCQ.

There are a couple other useful tools available to users of DPlus-equipped repeaters: Echo Testing and the information message. An echo test is a good way to find out how you sound on the local repeater; when you key up a few seconds of your audio are recorded, and then the recording is played back. The Information message tells the linking status of the repeater. See the examples for more information.

Please Note, Unlinking is very important – If you link to a Repeater, or Gateway, it is always good operating protocol to leave it as you find it. If you have linked to a busy Reflector like REF 001 C, please Unlink when you have finished. By not doing so, you will leave almost continuous activity transmitting through the Repeater or Gateway unnecessarily putting the system under stress and ultimately overheating. Repeaters or Gateways are generally left linked to a national or local reflector. In our Case DCS 049 i

Unlinking

EI5DD wants to unlink his local repeater EI7RHD from the reflector or other repeater that it's currently linked to.

MYCALL: EI5DD
URCALL: <space><space><space><space><space><space><space>U
RPT1: EI7RHD
RPT2: EI7RHD G

After setting up the radio, the operator should key the microphone for about one second to transmit the command. If the command succeeds, the repeater will play a recording saying, "remote system unlinked". After unlinking, the operator should immediately change URCALL back to CQCQCQ.

Echo Test

EI5DD wants to hear how he sounds on his local D-STAR repeater, EI7RHD.

MYCALL: EI5DD
URCALL: EI7RHD E
RPT1: EI7RHD B
RPT2: EI7RHD G

After setting up the radio, EI5DD keys up the radio and announces an echo test: "This is EI5DD performing an echo test, hello test test test". The repeater records the audio and then plays it back. After an echo test, URCALL should be changed back to CQCQCQ.

Information Message

EI5DD wants to discover whether his local repeater EI7RHD is currently linked.

MYCALL: EI5DD
URCALL: EI7RHD I
RPT1: EI7RHD B
RPT2: EI7RHD G

After setting up the radio, EI5DD keys up the radio for about one second (no need to speak into the microphone). If the repeater is linked, he will hear the message "remote system linked", and a text message should scroll across the screen announcing what the repeater is linked to. After asking for the information message, URCALL should be changed back to CQCQCQ.

The Most Recent D-Star radios have a facility to select **U** for Unlink, **I** for Information, and **E** for Echotest.

Please do not use Echotest unless absolutely necessary as there are plenty of operators to answer your calls. Echotest is more often used when setting up levels on gateways and Repeaters and unless you love the sound of your own voice it is not necessary.

D-Star Reflector systems include REF DCS, XRF and XLS

REF
The first reflectors where the REF reflectors. To convey the DStar information the software used to run a REF reflector uses a network protocol called DPlus to communicate with the repeaters. The DPlus protocol requires you to be registered into the US-Trust system. To connect your repeater to a REF reflector you'll issue a command REFxxxaL on your radio, replacing xxx with the wanted number and a with the wanted module.

XRF

The second type of reflectors that came up were the XRF reflectors. The software used to run the XRF reflector uses another network protocol called DExtra. To connect your repeater to an XRF reflector you'll issue a command XRFxxxaL on your radio, replacing xxx with the wanted number and a with the wanted module.

DCS

The DCS reflectors arrived later and originated in Germany. It is/was a centralized system ran by German Operators. If you wanted to run a reflector you had to give admin rights to some German Operators who would install the software for you on your server. Quite awkward. Ok focus back. The DCS reflectors also come with their own network protocol. The protocol here is simply called DCS. Recently the operators in charge of the DCS decided to drop the system, but some fellow ops decided to take it over. To connect your repeater to a DCS reflector you'll issue a command DCSxxxaL on your radio, replacing xxx with the wanted number and a with the wanted module.

XLX

Having gone through all three historical reflectors, you are probably thinking XLX is a reflector that speaks XLX protocol" …Continue reading!

The software used to run the XLX reflectors speaks all three previous protocols REF, XRF, DCS and, in addition, its own protocol which is only used to interconnect reflectors together. As a side note, XLX reflectors are very versatile and can also be accessed through DMR and Fusion with full audio transcoding.

What is D-Star

Advanced Multi-Band Excitation (AMBE) is the technology that is used in D-STAR to compress the voice for transmission. AMBE is implemented in the AMBE-2000 or AMBE-2020 chips which are found within every D-STAR radio. The AMBE-2000™ Vocoder Chip, which is manufactured by Digital Voice Systems, Inc. (DVSI), implements DVSI's patented and award winning AMBE® Voice Compression Algorithm. The field-proven success of this technology has resulted in its recognition as the standard for voice quality in communication systems around the globe. Satellite systems such as ACeS, AMSC/TMI, ICO, Inmarsat, Iridium, Optus and Thuraya use this technology because of its superior voice quality at low bit rates.

How D-STAR Works

D-STAR is digital modulation
Voice is converted from analog to digital for transmission
Data is combined with digitised voice for transmission at 4800 bps
2400 bits for Voice 1200 bits for voice Forward Error Correction
1200 bits for Data
Callsign is sent with each transmission

What can D-STAR Do?

Transmit or receive voice and 1200 baud data simultaneously on 2m, 440 and 1.2 GHz (no TNCrequired)
128 Kb data transmission on 1.2 GHz with Internet connectivity (Ethernet bridge to Internet with IP address)
D-PRS (digital APRS) automatic position reporting simultaneous with voice with GPS
Flexible repeater linking with Gateway and Internet connection
Reflectors act as conference bridge for linking multiple repeaters

Enhancing D-Star Functions with the RS-MS1A Android App

By using data in place of voice frames, the ID-5100A and ID-51A PLUS transfers data 3.5 times faster (3480 bps) than in the conventional DV mode (with voice). Pictures taken by an Android™ device can also be quickly transmitted in the DV Fast Data mode

Text Messaging
Share Pictures
D-STAR Stations and Repeater Sites Mapping
Repeater List Viewer – highlights repeaters in an area according to current GPS position
D-PRS converts the D-STAR GPS information to APRS™ compatible strings and presents it to the APRS-IS (APRS Internet Server) and other APRS™ client/

DR Functions and Remote Settings using the RS-MS1A

You can set the transceiver's "FROM" and "TO" fields and change some of the transceiver's function settings from your Android™ device. When used with the optional Bluetooth™ headset, VS-3, you can wirelessly control the ID-5100A from a remote place

D-Star for Emergency Communications

Voice and data communications in one radio (no TNC required Operates over wide areas with Internet repeater linking (ad-hoc nets)
Serves local area through local repeater
Same capabilities on simplex
Expanded capabilities with no infrastructure required
Live D-PRS allows live position updates at HQ
Transmission of near Live Pictures

D-Rats

D-RATS is a full function data communications tool for D-STAR and more…and it's FREE
Written by Dan Smith, KK7DS
Utilises D-STAR low-speed data mode (~1200 baud)
PC connects directly to D-STAR radio (No TNC required)
Windows, Linux and Mac versions available
Can be used without radio over Internet or with DV Dongle
Provides chat, messaging, email, forms, file transfer (unattended), mapping (maps included)
Ideal for use on Emergency Communication Operations

DVStick30

Since the digital ham radio systems borrow technology from commercial systems, the codec definitions have been adopted. Although there are free open source codecs available, these free codecs are not compatible with commercial systems because they use different protocols. Every digital radio for D-Star, DMR, P25, C4FM, NXDN etc contains such a codec chip as a component of the radio. All radios need such a codec chip to transform the Digital Data into Analog and vice versa. This is exactly what the DVMEGA DVstick-30 does.

The DVStick30 retails for approximately €95.00 and provides an excellent opportunity to sample D-Star without spending a fortune on D-Star radios. It is possible to access REF, DCS, XRF and XLS reflectors. The benefit of such a 'radio less' application in ham radio is the possibility to stay in touch with the friends at home when traveling without a radio, or where no suitable digital repeaters are nearby. The requirements for the Internet data rate are, thanks to the capable codec chip, quite low, usually an ISDN line with 64 kbps is enough.

In Conclusion

D-Star has always got bad press as it is only possible to operate from ICOM Radios. Not strictly true as Kenwood also produce and expensive handheld. With the introduction of MMDVM Pi-Star systems it is easy enough to manufacture a Gateway or Repeater. Some Analog repeaters have been successfully converted for D-Star use.

Indeed, D-Star Registration can be a little difficult, but going direct to the ICOM UK website and submitting requested information will have the registration fully completed within 24 hours.

Take time to read the basic manual and you will be on the air quickly. There is a considerably larger manual which supplies plenty of information to cover the more advanced features of D-star.

Some Say:

D-STAR is a proprietary standard. **Incorrect** – D-Star, like most all the rest of these technologies, is an open standard. Like all the other digital technologies, they all use a proprietary Codec
D-STAR is a fad that will go away **Incorrect** – It has lasted the test of time and, whilst other modes have become popular, D-star has not suffered any losses. In fact, many have taken an interest in D-Star as a result of trying other Digital Modes.
D-STAR requires the Internet. **Incorrect** – It is possible to link Repeater systems via a 23cms Link. One can adopt a standalone network using D-Star's own linking system.
Only one vendor supports D-STAR. **Incorrect** – Kenwood supplies a D-Star Handheld. There are numerous systems allowing the manufacture of D-Star compatible Repeaters or Gateways.
D-STAR radios are too expensive. **Incorrect** – Compare to any other specialist type of Radio and the prices are comparable e.g. the Yaesu FT3D is the same price as an ICOM ID-51E Plus2 handheld.
Note the DVStick 30 gives a cheap way to discover the wonders of D-Star.
D-STAR is too complicated. **Incorrect** – If one takes the time to read the manual all will be revealed and understood. Sadly most operators seem to have a phobia for reading manuals

Glossary of D-Star Terms

AMBE – This is the chip that encodes it. (3600 bits per second data stream) made by Digital Voice Systems Incorporated (Its proprietary) and about $20

Busy Lockout – It is a function that has the rig check to see if a frequency is busy. If it is, then helps prevent you from doubling with another Operator.

Call Sign Routing – A method to send a voice 'Envelope' to another user by sending it to the gateway system to find out where that last call sign was heard and spiting it out there, or if not found where that call sign is registered at.

D-STAR - (Digital Smart Technologies for Amateur Radio) is a digital voice and data protocol specification developed as the result of research by the Japan Amateur Radio League to investigate digital technologies for amateur radio. While there are other digital on-air technologies being used by amateurs that have come from other services, D-Star is one of the first on-air and packet-based standards to be widely deployed and sold by a major radio manufacturer that is designed specifically for amateur service use.

DV – Digital Voice mode: basically, your transmitting voice and Data at the same time.

DVADAPTOR – A Device plugged into the Antenna line of an HF rig to add D-Star capabilities to another rig (Typically HF on 6-10 meters)

DVAP – A device plugged into a USB port on a computer to allow another D-Star rig (typically an HT) to use the computer to connect to the D-Star Gateway network.

DV-Dongle – A device plugged into a USB port allowing an operator to talk to other DPlus enabled gateway repeaters though a computer with a broadband connection.

Falling off the cliff – A term used to describe when someone has moved out far enough that no single can be received / sent. (This is like the FM Analog term of 'Falling into the static' because of the abrupt nature that this has, hence the term 'Falling off the Cliff.')

Gateway 2.0 – The software on the repeater's Gateway system that makes it all possible. It runs on Linux, and CentOS is the Linux distribution that it recommends.

Linking – Creates a link from one repeater node to another repeater node or Reflector allowing for everyone on the node (who is registered on a gateway) to communicate with the other target.

My Call – One of the 'Magic 4 Fields' normally the operator using the rig.

Memory Bank/group – A method of organizing memory entries.

Node – Often used to refer to a node or module of a Repeater stack e.g. EI5DD Node C (144.850)

Node Routing – Sends a 'Voice envelope' to a node on either the same repeater or another node on another repeater.

One Touch Reply – A function of a D-Star rig to be able to quickly answer a call sign route, or a Node route, by pressing a button putting the caller's call sign into your "Your Call" field. This way you can 'call sign route back to them.

R2D2 – A term used to describe 'Noise' in a D-Star communication. "I got a bunch of R2D2 on that" meaning that some of the signal made it through but not all of it, thus it creates a lot of robot-like noise when that happens. It also happens when doubling, and if enough power to trip the repeater but not enough to get a full signal into it.

RPT* - Shown on a rig when the gateway confirms transmission. Different models tend to show different things.

RPT1 – Normally the repeater node your calling in from (EI5DD C) for example. (It's what repeater node you're talking into)

RPT2 – Normally that repeaters Gateway, usually the call sign with a G in the 8th position.

Slash Field – The field following the call sign field that contains 4 spaces to put letters or numbers after my call. (Ex: EI5DD /800H) normally this is where you put your rig's model number. Dongles use /DNGL and DVAP use /DVAP automatically.

Text Insert – A 20-character field that you turn on and when you key down, your 'my call' then Slash field, then what ever is in the Text Insert that you have selected. Normally it is, "Name, Location, Country" i.e., Galway City. This way all who look at the screen when you key down, have that information. Sometimes it is used for stating who net control is, or for special events.

UR Call – the most volatile field, used to direct what you want to do.

D-Star is, undoubtedly, the most complex of the modes and the full manual for D-Star Handhelds and Mobile transceivers is normally about 300 pages.

There is a plentiful supply of reference material on the internet to assist with getting the station set up for D-Star.

The Nifty Guide to D-Star operation is a book devoted to the set-up of D-Star and operating procedures and it is also possible to purchase a dedicated Nifty guide for the Operation of a specific D-Star Radio which is a more pocket sized version of the 300 page manual.

Some Do's and Don'ts with any form of Digital Radio

There are a large number of Band Police in this world and sooner or later you will fall foul of them. Even in Ireland believe it or not.

1) Listen before Transmit.

2) Count to number 5 in the head before pushing the PTT with a reply to a contact. This allows components of the Network to reset. This is particularly relevant to anything to do with Fusion Repeaters in Ireland. They are connected to the DMR network via a Bridge network which allows Fusion and DMR operators to talk to each other on the Fusion Network. When the station drops carrier even on the repeater count to 5 before reply. This allows the system to Reset its timers, allows the latency to catch up and prevents a long roll around occurring on the Network. Sudden drop outs are generally down to not observing this rule.

3) Set Time out Timers for 3 minutes maximum. Most items on the network Time Out after 3 minutes. Be conscious of this. You may lose your contact if you time out.

4) Where possible avoid using a Parrot to repeat your own voice back to you. There are plenty there to give you a signal report if you ask. Parrots waste network time!

5) Do Not Call **CQ** this is **NOT** worldwide DX. It is easier to talk to somebody in Australia than to talk to somebody in Galway! A Call such as "EI0XXX is listening on the Ireland Calling Channel for any call. Do this a couple of times and you will get a response. Do Not say "Breaker for a copy" otherwise you may never get a contact.

6) Do not appear on channel and say this is EI0XXX listening as most will **not** want to spoil your pleasure and will let you continue to listen.

7) If you have contacted on a calling Channel, QSY to another Chat Channel, before somebody moans at you. Particularly common in the UK. UK Call >> UK Chat 1 or UK Chat 2 etc. Generally not enough activity to justify this but manners maketh man!

8) Whilst digital does include your call sign on the transmission it is still good practice to announce your callsign and that of the person you are working - there are no changes in our licence conditions yet.

9) Do >>**NOT**<< Key up with a Blank Transmission on a Repeater of Gateway more than once without speaking. You will be blocked from the Server for at least an hour. This is a built in protection on all Brandmeister systems.

10) Support activity on your local Gateways or Repeaters these are installed for the benefit of all of the Amateur Radio Fraternity. All activity is welcomed and rewarding.

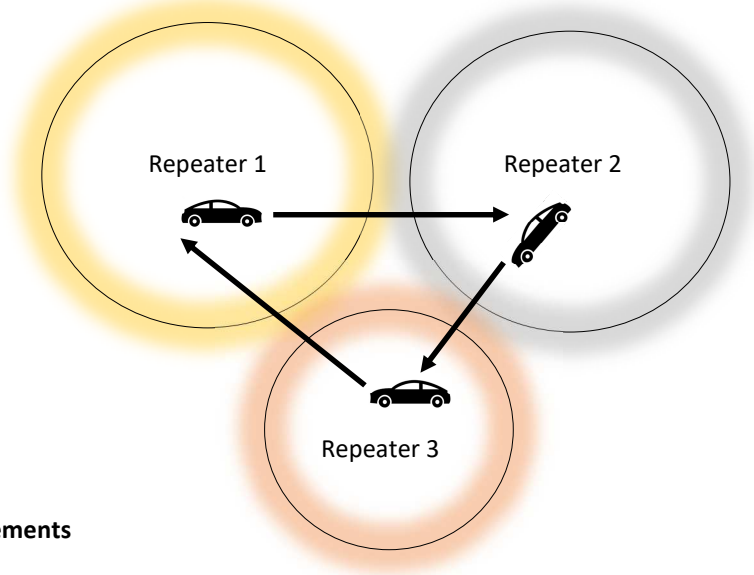
11) Above all be courteous to other users. Remember you were new to Digital once upon a time and many would have assisted and encouraged you into this aspect of the Hobby.

12) The use of **Private Call** is >>**NOT**<< encouraged on the Brandmeister Network. SMS messaging is, however, not a problem.

Roaming on The Galway DMR Repeater Network

Roaming is possible when a radio is set to automatically move between Repeaters depending on which receives the strongest signal. In a roaming system it is necessary to set the RSS threshold which is the minimum signal strength that he radio will consider strong enough before it starts searching for a stronger signal. The RSSI needs to be programmed into the radio.

Consider a radio moving between three repeater coverage areas. As the radio moves from Repeater 1 the signal strength slowly reduces and reach a point where the signal from Repeater 1 reduces below the pre-programmed RRSI threshold. At this point the radio will search through a list of Repeaters programmed into a ***Roam List*** to see if they have a stronger signal at that location. The ***Roam List*** is simply a list of all Repeaters that the radio could use. If one Repeater in the Roam List does have a stronger signal the radio will switch to using that repeater automatically so as the user moves closer to Repeater 2 the radio will switch to Repeater 2 and as the Radio moves closer to Repeater 2 the RSSI level will increase and the radio will stop searching for other repeaters. If the radio starts to move towards Repeater 3, the signal will fall below the RSSSI level and the radio will start searching for a stronger signal. It should detect Repeater 3 and switch to that channel. Once the RSSI is strong enough the radio should stop searching for a stronger repeater and remain with Repeater 3 until the signal, once again, falls below the RSSI threshold.



Requirements

Repeaters have to be able to connect to each other and relay the same audio at the same time on at least one Talk Group. On Hytera and Motorola systems this is called IPMulti-site Connect. This works well in commercial systems dedicated to only a few users but in Amateur radio this can be more difficult. On amateur radio Repeaters, many talk groups are used and are linked differently. Some Talk Groups are linked to all other repeaters all over the country, whilst others are linked to repeaters within a specific area and some are user activated. Area specific Talk Groups can be programmed in such a way that the radio will only roam on Repeaters that have that Talk Group.

Issues

The major problem is that somebody may be operating on another talk group on a Repeater when you roam onto it. This is where roaming would fail in amateur radio. The conversation would have to be terminated or manually set the radio to use another Repeater. A second issue is with user activated Talk Groups. User activated Talk Groups will only become activated on a specific repeater only when you have manually transmitted onto that Talk Group. If you activate the talk group on one repeater and then roam into the coverage of another repeater, the talk group will not be activated on the second repeater.

Ensure that the desired Static Talk Groups are programmed onto each repeater in the network and this will work. The only time there maybe problems is if another operator is occupying the Repeater and using a different Talk Group.

Irish Talk Groups

Talk Group Number	Talk Group Name	Description	Reflector
2722	Irish Call Channel	EI National Calling	4780
2723	Ireland Chat Channel	Casual Chat	
2724	YSF Ireland to Wires-X	Link to IE-YSF	
27240	SIRN	Link to SIRN Repeaters	

UK Talk Groups

Talk Group Number	Talk Group Name	Description	Reflector
2350	UK Calling	UK National Calling	4400
2351	UK Chat 1	UK Chat Channel 1	4401
2352	UK Chat 2	UK Chat Channel 2	4402
2353	UK Chat 3	UK Chat Channel 3	4403
23510	UK S. East	UK S. East Chat	4411
23500	UK S. West	UK S. West Chat	4410
23590	UK East	UK East Chat	4419
23580	UK Midlands	UK Midlands Chat	4418
23562	UK M62 Corridor	On Repeaters near M62	——
23560	UK N. East	UK N. East Chat	4416
23520	UK N. West	UK N. West Chat	4412
2355	GM Calling	GM Calling Channel	4405
23550	GM Chat	GM Chat Channel	4415
2357	GW Calling	GW Calling Channel	4407
23570	GW Chat	GW Chat Channel	4417
23522	BM UK Hub		4420
23526	Allstar Link		4426

AREN Talkgroups

Talk Group	Description
2729	AREN Logistics
27230	AREN Logistics
27291	AREN Tactical

Northern Ireland Talk Groups

Talk Group	Description
23254	Northern Ireland Calling Channel
23540	Northern Ireland Chat Channel

Cluster Talk Groups link all repeaters in a specific area. This means that all of the Galway Repeaters will be on this group. This will facilitate Local Operation and will also facilitate Roaming between the four Repeaters allowing a seamless QSO whilst travelling throughout the Galway coverage area.

Clusters have recently been integrated into the Galway System. If outside of the Galway Network, use the Talk Group assigned to the area cluster and this will allow access to the respective cluster in the area. As there are only 19 + registered DMR users, we may eventually see an increase in activity on the local Clusters.

Using TG 7 or TG8 through South Eastern Repeaters will route through their local network only.

Talk Group	Description
7	Provincial Cluster Slot 1
8	Can be used for regional clusters on Slot 2
9	For local Repeat only
27250	Connacht (Cluster TG7 - Slot 1)
27251	Leinster (Cluster TG7 - Slot 1)
27252	Munster (Cluster TG7 - Slot 1)
27253	Ulster (Cluster TG7 - Slot 1)
27254	SIRN (Cluster TG8 - Slot 2)
27255	Galway Digital Radio Group (Cluster TG8 - Slot 2)
272907	JOTA IRL (Slot 1)

Talk Group Programming Scratch pad

Channel #	Contact Name	Call Type	Call ID	Call Receive Tone
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				

Hytera