Getting Started Motorola Tetra portables & mobile radios – DMO mode

author: Wilko PA1WBU
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Introduction

This Getting Started (GS) is intended as *a guideline* for the programming and use of Motorola Tetra (Terrestrial Trunked Radio) radios, with settings as used within the 'coverage area' of the former[1] Arnhem Tetra DMO repeater PI1ANH in the Netherlands. Of course, the concepts are also useful for other DMO repeaters.

PI1ANH was a Direct Mode Operation (DMO) Tetra repeater. That is why this GS deals exclusively with DMO parameters. Trunked Mode Operation (TMO) is not discussed . In addition to the programming, there are hints around the use included. [2]

The 'screenshots' in this GS are mostly based on a code plug for a Motorola MTP850; for other types of radios it will look (slightly/quite) different. It should not be surprising that the newer the radio is or the firmware running on the radio, the more possibilities are typically available.

The settings as proposed ensure that the radio programming has sufficient unity, and with-it communication should be *possible.* As with most digital communications, there are a lot of options and settings. This also gives you more than enough opportunities to choose settings that prevent it from working.

General

When working with the Motorola CPS programming software it will quickly become clear that there is *a lot of flexibility* in the radios. And all that flexibility can be configured at the smallest detail level. It is also clear that Tetra was originally designed for mission critical communication, primarily for professional users from the Emergency Service Organizations (ESO) world. Later, Tetra became more and more established for other professional uses, think chemical factories, public transport etc., Professional users in general almost always use Trunked Mode Operation (TMO). The TMO functionality is much more extensive than Direct Mode Operation (DMO). The CPS programming software offers both TMO and DMO programming. Unfortunately, it is not always clear whether a parameter applies only to TMO or (also) to DMO or only to DMO. This makes for a fascinating puzzle at times.

A word or two on encryption..

Important to know is that there is radio firmware with different encryption capabilities, both for TEA (Tetra Air Encryption) and for end-to-end encryption (E2EE). Be sensible and stick to firmware that has neither TEA nor end-to-end encryption. Firmware files without encryption

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1 PI1ANH is these days a TMO repeater. This DMO GS is maintained for reference.
2 In the meantime PI1ANH is now operational as a Tetra TMO node. The old PI1ANH DMO hardware is periodically QRV as a TMO-DMO gateway.

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have names with CLEAR, NonE2E. Radios can be made suitable for amateur use by loading CLEAR firmware onto them.

TEA1 firmware in principle should not be an objection, TEA2 is *exclusive* for use by government departments (police etc.). **Possession of TEA2 radios is in many countries prohibited by law.** Tetra radio's in the hands of hams are known to have led to "interesting" discussions with law enforcement (especially in the UK and Germany). Don't make it even more interesting by running around with TEA firmware.. You have been warned.

By the way, there is no sensible reason whatsoever for us as radio amateurs to own TETRA radios with encryption. After all, as a radio amateur, we are not allowed to use encryption anyway.

Commercial users are allowed to use encryption, of course using the TEA1 variant, and not TEA2. The only reason to use TEA1 in your Tetra radio is if you use a commercial network, for example the Dutch Entropia network, in addition to the radio amateur frequency spectrum. For more info on encryption and secured use please refer to:

https://tcca.info/fm_file/turkey2009murgatroyd-pdf/

Lab / depot mode CPS

The CPS programming software exists in a standard and a depot version (also called lab version). Lab/depot has many more possibilities and is intended for use by service organizations.

In depot/lab mode, for example, calibration values can also be changed, the frequency range extend to the 70cm amateur band, RF power class to be extended on MTP850, GPS function enabled, etc. **But beware: mistakes when using depot mode can go very wrong.**... *Read*: can permanently disable the radio. Be warned. Ask or check first…

For those who still want or need to work with lab mode: **always** make a backup of the complete flash memory of the working radio prior to adjusting settings. A backup is made in lab mode, with the Flash Report feature. The Report Type should be set to Entire Flash, as seen in the following screenshot. Creating a backup takes a while, depending on the radio type, backup files of around 80MBytes are common.
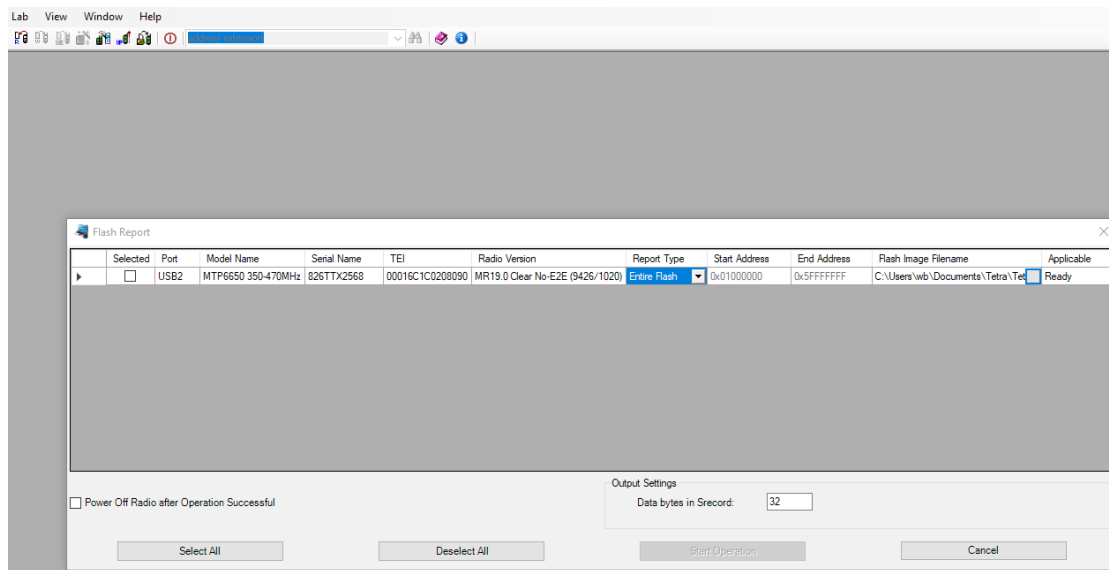
Don'ts...

There are a number of things that can be done on the radio or in CPS that are _really_ better left untried. That is, unless it's fun for you to spend days trying to revive a bricked radio. There is a real chance that the radio is not salvageable and can enter the e-waste recycling !

The list below does not pretend to be complete..

- Don't use lab/depot mode CPS. Really, it's usually not necessary.
- Don't perform firmware upgrades. Consider if a firmware upgrade is really necessary. Amateur use is quite different from use in a large Tetra network. _If it works, leave it alone._
- Never use the "Erase radio" function in CPS. This feature erases the complete flash memory of the radio, so including the firmware and the boot loader. The radio is **dead** after that. Radio repair requires special cables, special boot code etc. It is certainly **not** a given that there is a way to obtain the necessary bits..
- Never use the erase function on the radio itself, by dialing **00## The end effect is the same as "Erase radio" run from CPS...

Supplies

For programming a Motorola Tetra set is necessary:

- Obviously you neeed a Motorola MTH800, MTP850/MTP850s/MTP830/CEP400, or MTM800 Tetra radio. Of course, other Motorola Tetra radios can also be used, like MTM800E, MTM5000, MTP3000, MTP5000 or MTP6000 series. The settings must then be taken from this GS and programmed accordingly. Depending on the radio model and the firmware installed, CPS might show you slightly different screens/settings. That said, it should not be too difficult.
- The use of Tetra equipment from other vendors like for example Sepura, Nokia, Cleartone, or EADS is obviously also possible. You will have to adapt the

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programming of those radios based on what is described in this GS. And: no, the author does not have non-Motorola radios, so cannot help you.

- Programming is done with the Motorola Customer Programming Software (CPS), running under Microsoft Windows. You will have to obtain this CPS from Motorola or find it on the internet.
- With CPS 7.4 , one OM has had a lot of problems after installing the depot DLL files. After much research it came to light that Windows 10 64bit blocked these depot DLL files. After the block was lifted, CPS worked without any problems. See the photo below for the method to remove the block. (blokkering = block).
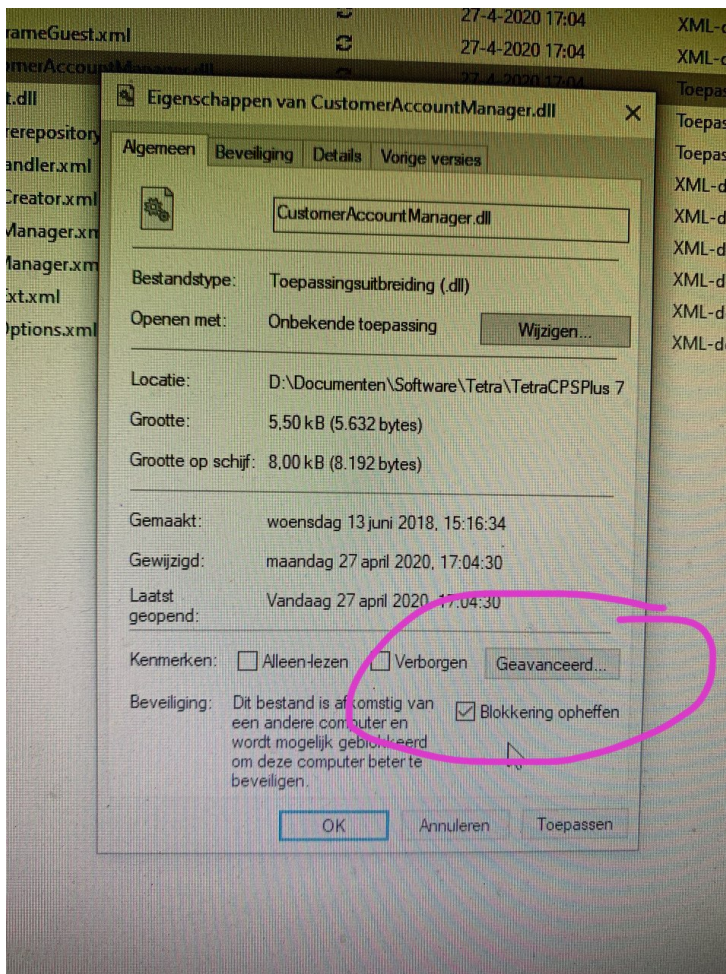
- CPS needs a Release PacKage (RPK) that corresponds to the firmware as installed on the radio Without the right RPK, CPS won't work, not even for reading the code plug from the radio. For RPK's you will have to search the Internet.
- Newer radio models usually (and that makes perfect sense) need a recent CPS version and recent firmware RPKs.
- In general: do not upgrade radio's if there is no really good reason to do so. Upgrades are known to have turned perfectly fine radio's into e-waste. Again.. you have been warned!

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- In some cases, a newer CPS version is required to perform a firmware update on a radio. That's just clumsy, but there is no other way. Example: The most recent version firmware for the MTP860, MR5.14.10 can not be loaded onto the radio with CPS 6.0.2. MR5.14.9 and older are, however, can be loaded onto the radion by CPS 6.0.2. Hence the advice to use CPS 7.x. There is generally no longer any reason to use CPS 6.x (unless your radio runs some ancient firmware, which is not impossible when it is obtained as surplus).

- A CCS7 ID number (commonly known as a DMR ID, although that does not cover the load, CCS7 is also used for D-Star, and now also for Tetra) for use as Tetra ISSI. To keep it simple, I use the name CCS7. We use a CCS7 within the Arnhem Tetra community because the CCS7 ID is unique worldwide. That's handy for Tetra, too. For amateurs who already have a DMR ID, the ID can simply be reused for Tetra.

  A CCS7 request can be made via https://radioid.net/#!

- In the Netherlands, a maximum of **one**, seven-digit, CCS7 number is issued per OM/YL. There are only a limited number of CCS7 available, to avoid scarcity, the restriction has been set.

  Now, some amateurs have more than one Tetra radio. Sometimes even a lot more than one.. It is still necessary to give a unique ISSI in each of your radios. This is necessary for use with Tetra TMO (Trunked Mode Operation). In Arnhem we derive these ISSI numbers from the official CCS7 number. All Dutch CCS7 start with 204, the number 204 is the Dutch MCC (mobile country code).

  Approach followed: -
  we remove the number 204, and on the right, we add a serial number which is unique for each radio of the relevant amateur.

  Example: CCS7 of the author is 2046204. The first radio gets 2046204 as ISSI. The 2nd radio gets 62041, the 3rd radio 62042 and so on. This gives enough ISSIs, even for a Tetra pack rat aka 'radio collector'.

  Remark: do not use **6** digit ISSI. ISSI with 6 digits are reserved for use by Tetra repeaters.

  Remark: should a link between Tetra **TMO** and DMR (e.g. Brandmeister) ever become reality, this will need to be looked at more closely. TMO requires a unique ISSI for every radio that is active within the network. Duplicate ISSI on the same TMO node cause havoc for the radio's involved. So, even if you only use DMO keep the ISSI unique, you might find yourself on a TMO network later.

- For programming an MTH800, an MTP850, a CEP400, a MTP830s or an MTP850S radio, one of the USB programming cables shown below are highly recommended.

The part# of the black cable is SKN63111B, price at the various Chinese suppliers and eBay is around EUR 20 including shipping.

A cheaper solution, which works just as well, is an original Motorola cable, part# AAKN4015A. Originally used for cell phones, it also works on Motorola Tetra radios. They are available from eBay, I got mine from a US-based eBay shop called `cellularwholesalesinc`, for less than EUR 10 including shipping.

- For MTP3000 and MTP6000 radios, you can use the desk charger, which has a mini-USB connector. A standard USB cable is all that is needed to be able to program the radio. Very convenient. There are also dedicated USB programming cables available for these radios.
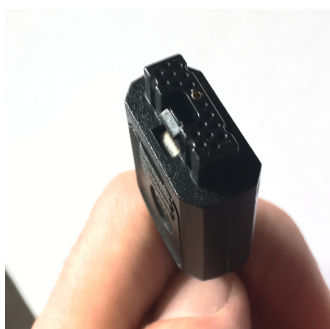
- For MTM800E and MTM5400 mobile radios, the microphone connection is typically used, with a special USB cable. See below.

- Programming an old MTM800 (monochrome LCD) mobile radio requires some creative tinkering with cables to connect a COM port of the PC to the serial interface that sits on the accessory/programming connector on the back of the MTM800. Original Motorola cable can of course also be used, but is costly.

For the creative radio amateur:
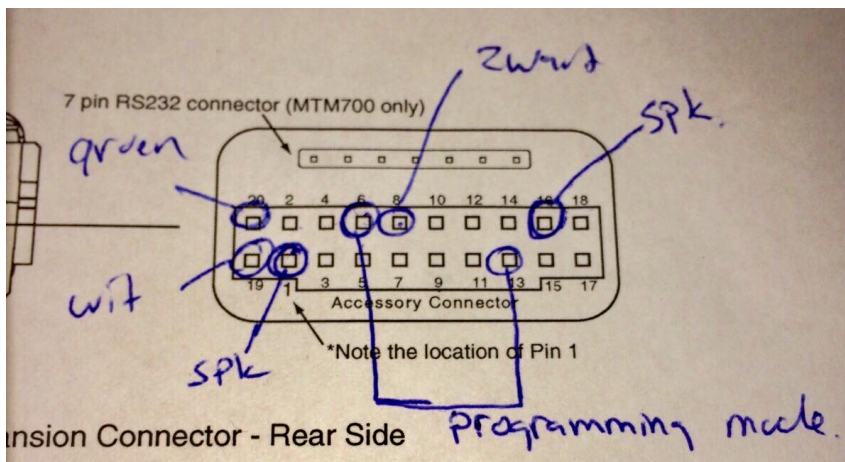
Green and white are the serial data connections (receive/transmit). Black is ground. The pins labeled SPK are for the speaker. The indicated colors for the data connections correspond to a Prolific USB serial dongle as found on eBay. The pins marked "programming mode" must be connected via a switch to select programming mode. It is also possible to enable programming mode from the keypad: hold down digit keys 1 and 9 and subsequently turn on the mobile radio.

Please note that the signals on the serial connection of the MTM800 are TTL level so 0-5V (or 0-3.3V, depends on who you want to believe on the Internet). My own MTM800 worked without fail using an RS-232C converter that delivers signals on the MTM800 side TTL 0-5V. I usually use an older PC that still has a *real* COM port, so does not require an USB-serial converter. The RTS-CTS requirement as mentioned

below has been addressed by a simple wire in the DB9 plug that is inserted into the COM port.

CPS requires CTS-RTS and DTR-DTS. If those signals are not present or are not 'faked' by a USB driver in the right way, THEN CPS will *never* detect the MTM800. Many USB serial dongles only have Receive and Transmit data signals. Modem / flow control such as RTS-CTS and DTR-DTS are not present.

All in all, certainly not all serial USB dongles work with CPS. For example, my favorite Silicon Labs CP2102 USB serial dongles didn't seem to be talking to CPS. *Some* USB serial dongles are faking RTS-CTS vs DTR-DTS with enough persuasion to convince CPS to detect the MTM800.

What has proven to "just work" are FTDI USB-serial chips. I have in the meantime given up on Prolific: There are more useful and pleasant things to spend your time on than obnoxious drivers & hardware.

The following section might still be of interest to people using older cables with Prolific USB-serial chips. I decided life is too short to keep mucking around with those. Good luck..

Unfortunately, there seems to be an abundance of 'fake' Prolific USB serial chips in circulation, which are, especially on Windows 10, not recognised by the standard driver. Windows 7 doesn't have the problem in my experience, but that may depend on the USB dongle. Your mileage may vary. A lot.

Problems can be identified using Windows Device manager as seen below:
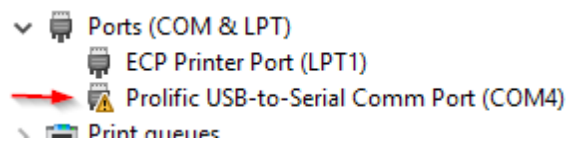
Note the yellow triangle with-! in it.

If it's wrong, then under the Tab General you will find something like the one below
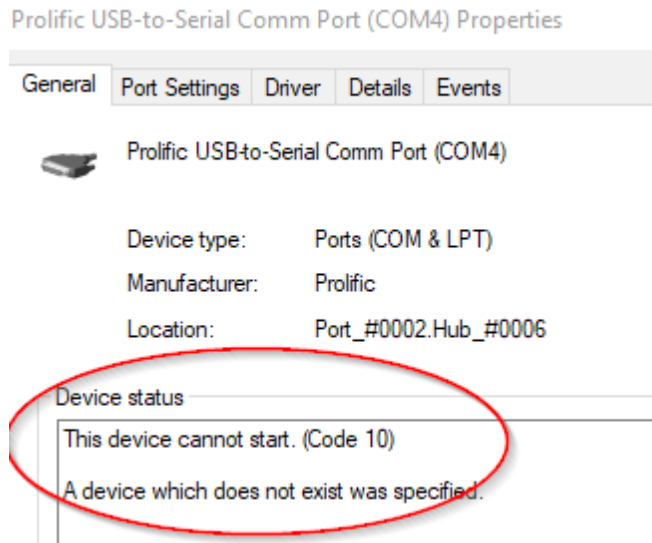
The solution is then to install an **old/older** driver for the Prolific chip. You can find them in all kinds on the Internet.

After installation of that (old old?) driver, that driver still needs to be made active.

That's what Windows Device Manager does.

First: don't believe that "The best driver is already installed"
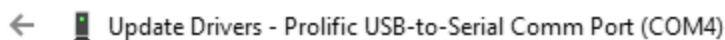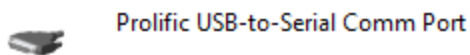
Select Update driver and then the option indicated with the red arrow.

Update Drivers - Prolific USB-to-Serial Comm Port (COM4)

Browse for drivers on your computer

Search for drivers in this location:

C:\Users\wkb\Documents

Browse...

☑ Include subfolders

→ Let me pick from a list of available drivers on my computer
This list will show available drivers compatible with the device, and all drivers in the same category as the device.

Then select the newly installed "od old" Prolific driver:

Update Drivers - Prolific USB-to-Serial Comm Port (COM4)

Select the device driver you want to install for this hardware.

Select the manufacturer and model of your hardware device and then click Next. If you have a disk that contains the driver you want to install, click Have Disk.

☑ Show compatible hardware

Model
Prolific USB-to-Serial Comm Port Version: 3.3.2.105 [10/27/2008]
Prolific USB-to-Serial Comm Port Version: 3.8.25.0 [7/12/2018]

If this is all done successfully, the error message will be gone, and CPS will be able to use the serial port:
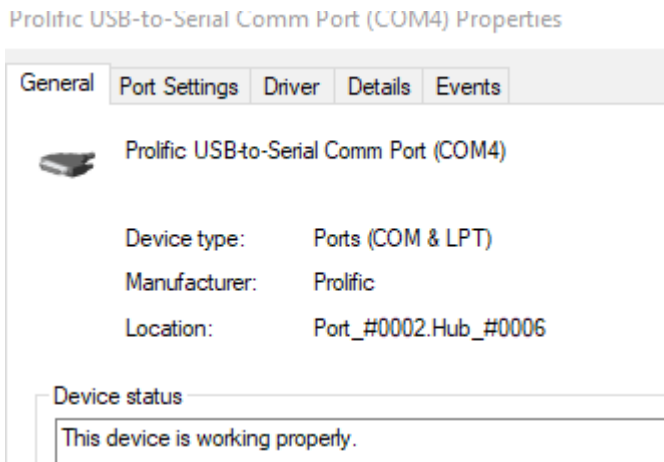
Only... Windows has the handy habit of reinstalling the latest driver without asking for permission to do so (because it knows the *best driver* after all..?) once the USB serial dongle is reconnected to the PC. Windows Update also gets in the way here. In short: if it doesn't work, the above driver trick should be repeated.

Sometimes you're lucky, sometimes you're not. If you're not lucky, it's extremely irritating and time consuming. As stated before: the author has given up on Prolific.

Install RPKs (partially optional)

Depending on which version of firmware is currently in the radio, you *may* need to install additional RPK (release packages). RPK is Motorola speak for "firmware packages". CPS requires the RPK of the firmware which is currently loaded on the radio.

If the relevant RPK is missing, a code plug cannot be read from the radio and no new code plug can be created or programmed into the radio. CPS reports it in cases an additional RPK is required to read/program the radio. So, until you have the required RPK loaded in CPS using the functions under "Release Packet" menu you are stuck.

Activate programming mode

- Ensure you have a well-charged battery. Loosing power during programming is seriously bad news..
- Putting radios in programming mode is done as follows:
  o Turn off radio
      o Connect program cable between radio and PC
      o Start up CPS
      o In order, push keys <1> and <9> and hold them down.
      o Power on by holding the <red Power on> button until the display starts flashing with a fairly cryptic content. It's going to take a while. How the display actually looks is radio model dependend.
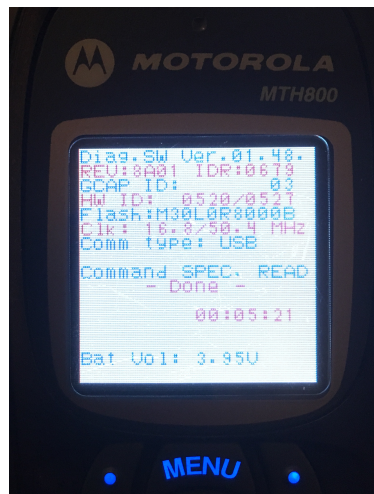
- o CPS now automatically shows the radio in the Radios pane
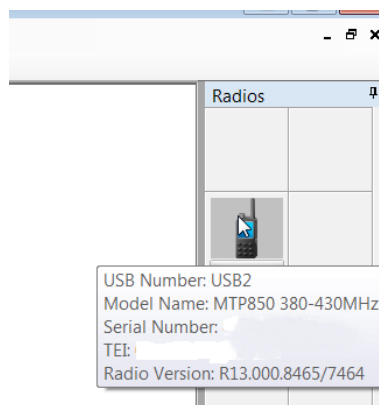
- Putting an MTM800E (with color display) into programming mode is done in the same way as a for a portable radio.
- Put MTM800 (monochrome display) mobile radios in programming mode as follows:
  - o Turn off mobile radio
  - o Connect cable between mobile radio and PC
  - o Determine which serial port is used (and fix the driver problem if necessary, see earlier)
  - o Start up CPS.
  - o Set the hardware switch to programming mode
  - o Turn on mobile radio by pressing the volume knob
- MTM5400 radios when powered up in normal mode switch to programming mode when they detect a programming cable on their microphone connector. Really neat. The 1-9-powerup method also works.

  For the old MTM800 nothing seems to be happening now. No LEDs on, no display, just NOTHING. That's Motorola's way of showing that programming mode is active (...) OR that the mobile radio is simply not in programming mode. Or something. In short: very convenient. Specialists measure the current that the radio draws after switching on. Programming mode corresponds to about 270mA.

o CPS subsequently needs a scan to detect the radio:
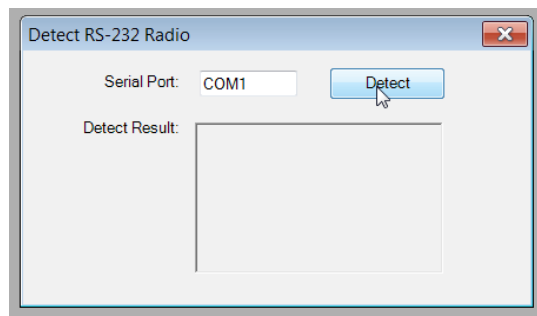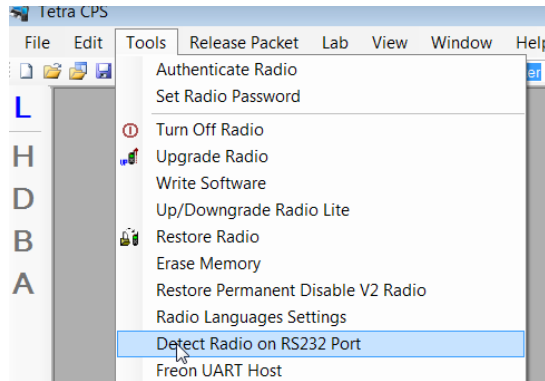
If no radio has been found after the Detect, it is time for some (...)
elementary troubleshooting:
- Data cable connected properly?
- Correct COM port entered in CPS?
- Cable itself is good? Tx Data from the mobile phone does to Rx Data from the PC/USB dongle?
- In case of a USB cable: correct driver?
- Put programming switch into programming mode?
- Is the radio powered on at all?
- The power supply is switched on?
- <etc.>

Good luck..

Back up the existing settings/code plug

Right-click the icon in the Radio pane and select *Read Radio:*

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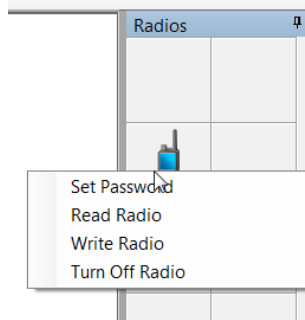
After some time, the code plug is read from the radio and CPS displays the settings. BEFORE you make any changes: make a backup via *File* >Save. In this way, if something goes wrong, the old, working setup can always be restored. **Don't skip this. And do remember where you stored that file.**

CPS may be protesting by reporting that the radio contains a code plug of a firmware version for which the relevant RPK has not been installed. Installed RPKs can be checked and imported through the Release packet manager:
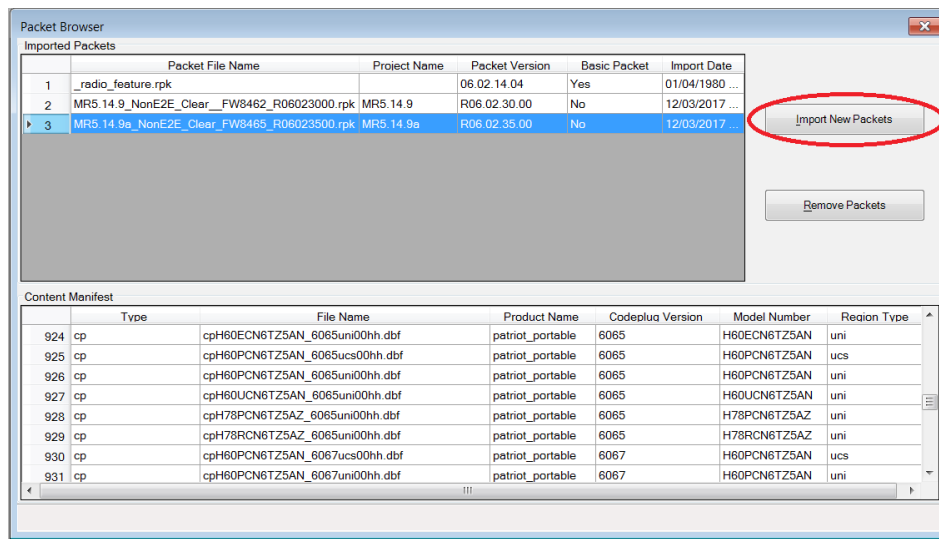
General tip: that something will go wrong at least once is almost a given. You Have Been Warned. **Make backups** of the code plugs. Also keep the older versions. Then you can gradually return to a working radio. (Really.... this approach has been used by the author of this GS several times).

Should something go wrong and it seems hopeless: just ask for help. It can go from bad to worse, to the point that the radio is completely 'dead'. How to solve such a thing is no subject for this GS. So, don't experiment endlessly yourself in these kinds of cases. Ask.

<u>**Also do not use the CPS Erase radio function.**</u> This feature does not only erase the code plug from the radio but also the actual firmware. Getting that firmware back in is difficult at best, requires special cables, boot images etc. **It could also mean the end of the radio.**

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Basic settings

Several things need to be set up to ensure that this is worked together as well as possible:

- The user's ISSI must be set. The ISSI is a unique number per Tetra user. 'Reuse' of the CCS7 ID as known in DMR land for the Tetra ISSI ensures that the ISSI remains unique worldwide. Should there ever be a link between Tetra and DMR, this point is important.

  So: don't take my CCS7 from the screenshots please☺

  See also the previous section on ISSIs if you have more than one Tetra radio.

- In order for the radio to be usable with DMO repeaters, the Feature flag DMO repeater must be enabled. The Feature flag DMO Repeater Mode is for use of the radio itself as a DMO repeater. Possibly somewhat confusing. Not every radio can operate as a DMO repeater, the example below comes from an MTP850 that *can*.

  Side note: an MTM800 and MTM800e cannot act as DMO repeaters. Both can *make use* of a DMO repeater. The MTM800 FuG can act as a DMO repeater, the reason being that an MTM800 FuG is in reality a MTM5400. Confusing isn't it?

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	Field Name	Field Value	Set Default
17	Home Mode Display	☑	
18	DMO Gateway	☑	
19	One-Touch Feature	☑	
20	My Favorites	☑	
21	Speed Dialing	☑	
22	GPS	☑	
23	Flip Display	☑	
24	Energy Economy	☑	
25	TNP1 Support	☑	
26	Selected Network Enabled	☑	
27	Address Book Restrictions	☐	
28	Talkgroup Dialing by Index	☑	
29	WAP	☐	
30	Direct Mode (DMO) Semi-Duplex Private Call	☑	
31	Packet Data Page Enable	☐	
32	Multislot Packet Data	☐	
33	DMO Repeater	☑	
34	DMO Repeater Mode	☑	
35	Clear LA Blacklist on Talkgroup Change	☑	
36	Remote Programming	☑	
37	BSI SIM Support	☐	
38	Congested Cells	☐	
39	Call-Out	☐	

- The DMO Address Extension setting must set up the Mobile Country Code (MCC) and Mobile Network Code (MNC).

  MCC 204 is the official, standardized, country code for the Netherlands. The MNC we have chosen is a poetic freedom based on the seventy-three known to all of us hams. This makes 204/7373 the agreed standard for Dutch radio amateurs. These settings are important in order for ISSI call sign translations to be correctly performed at the other station(!). It also works perfectly fine without a contact list, but that aside.

- The DMO Reservation Time determines (roughly) how long a radio "holds the channel". During that period, another radio cannot transmit. This is indicated in the display and with beep signals.

The standard value of 5 seconds has been found to be *annoyingly long*. The advice is to go to 1 second. CPS also allows a value of 0 but the CPS help text advises not to do so. So, 1 is the best choice.

- The DMO Talk groups must be programmed. Of course, to a certain extent, this is a matter of taste. At the minimum, the correct frequency and group number (GSSI) must be programmed into a talk group before you can use the Arnhem PI1ANH DMO repeater.

  In the Talk group list, the QRG of PI1ANH is recorded and the use GSSI (ID) 1000. GSSI 1000 is the agreed standard for DMO in the Netherlands.

  Check what your repeater/region/country uses. For example Germany uses different MNC/MCC as well as GSSI. Get these settings wrong and things will (silently) refuse to work..

  Remark: the PI1ANH **DMO** repeater does not use a split. Tetra uses TDMA (Time Division Multiple Access) on a single 25kHz wide channel. Within that 25kHz is therefore both the traffic *to* the repeater and the traffic *from* the repeater.

  Remark: In the screenshot below the column `Communication Type` is set to `Repeater`. Given that we (in Arnhem that is) are now also using DMO-TMO gateways it is recommended to set the `Communication Type` to `Gateway & Repeater`.

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	Name	ID	Status	DMO Folders List	Communication Type	Gateway Selection	Gateway Address	Frequency Channel	Receive Call to DMO Partnership Networks	Network MCC	Network MNC
1	PI1ANH	1000	Programmed	1:Repeaters	Repeater	None		430.67500	User Defined	204	7373
2	PI1KAN	1000	Programmed	1:Repeaters	Repeater	None		431.00000	User Defined	204	7373
3	PI1RKW	1000	Programmed	1:Repeaters	Repeater	None		430.95000	User Defined	204	7373
4		0	Not Programmed	1:Repeaters	Direct	None		390.00000	User Defined	0	0
5		1000	Not Programmed	1:Repeaters	Direct	None		390.00000	User Defined	0	0
6		1000	Not Programmed	1:Repeaters	Direct	None		390.00000	User Defined	0	0
7		1000	Not Programmed	1:Repeaters	Direct	None		390.00000	User Defined	0	0
8		1000	Not Programmed	1:Repeaters	Direct	None		390.00000	User Defined	0	0
9		1000	Not Programmed	1:Repeaters	Direct	None		390.00000	User Defined	0	0
10	430.0000	1000	Programmed	2:Zendamateurs	Direct	None		430.00000	User Defined	204	7373
11	430.0125	1000	Programmed	2:Zendamateurs	Direct	None		430.01250	User Defined	204	7373
12	433.2500	1000	Programmed	2:Zendamateurs	Direct	None		433.25000	User Defined	204	7373
13	433.5000	1000	Programmed	2:Zendamateurs	Direct	None		433.50000	User Defined	204	7373
14	433.5500	1000	Programmed	2:Zendamateurs	Direct	None		433.55000	User Defined	204	7373
15	433.6000	1000	Programmed	2:Zendamateurs	Direct	None		433.60000	User Defined	204	7373
16	433.6500	1000	Programmed	2:Zendamateurs	Direct	None		433.65000	User Defined	204	7373
17	433.7000	1000	Programmed	2:Zendamateurs	Direct	None		433.70000	User Defined	204	7373
18	433.7500	1000	Programmed	2:Zendamateurs	Direct	None		433.75000	User Defined	204	7373
19	433.8000	1000	Programmed	2:Zendamateurs	Direct	None		433.80000	User Defined	204	7373
20	433.8500	1000	Programmed	2:Zendamateurs	Direct	None		433.85000	User Defined	204	7373
21	435.0000	1000	Programmed	2:Zendamateurs	Direct	None		435.00000	User Defined	204	7373
22	435.2500	1000	Programmed	2:Zendamateurs	Direct	None		435.25000	User Defined	204	7373
23	435.5000	1000	Programmed	2:Zendamateurs	Direct	None		435.50000	User Defined	204	7373
24	435.5500	1000	Programmed	2:Zendamateurs	Direct	None		435.55000	User Defined	204	7373

In the DMO list, the maximum transmission times (roughly comparable to a 'strangler' on a classic analog repeater) can be set. 300 seconds is the maximum, the default is lower. Choose the maximum. Or set it to 0 (zero), that disables timeouts altogether. Note that this setting is in your own radio, it is *not* the repeater that enforces it. The radio gives a beep at the expiry of the Warning timer.

	Name	Status	Transmission Timeout Timer, sec	Transmission Timeout Warning Timer, sec	Number of Talkgroups in the Range	Receive Only
1	Repeaters	☑	300	240	9	☐
2	Zendamateurs	☑	300	240	16	☐
3	Rza / LPD	☑	300	240	70	☐
4	Rza Amersft	☑	300	240	9	☐
5		☐	0	0	0	☐
6		☐	0	0	0	☐
7		☐	0	0	0	☐
8		☐	0	0	0	☐
9		☐	0	0	0	☐
10		☐	0	0	0	☐
11		☐	0	0	0	☐
12		☐	0	0	0	☐
13		☐	0	0	0	☐
14		☐	0	0	0	☐
15		☐	0	0	0	☐
16		☐	0	0	0	☐

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Contact list (optional; but very handy)

Filling the Contact list ensures that when connecting to a known station, the CCS7 of that other station is automatically translated into a call sign and that call sign appears on the radio's display. "Known" here means that the ISSI and the call of the remote station are stored in the Contact list of the radio.

If an unknown ISSI is received, a long set of numbers will be displayed instead of a call sign.

Please note that, of course, the opposite station must *also* be programmed correctly to make the translation work. That *includes* the setting for the DMO Address Extension, which is often forgotten as it turns out. The ISSIs of the other stations must be entered under the heading *Private* in the *Contact Book > Contact List:*

Language

The Motorola radios support a variety of languages, up to Mongolian and Chinese. It is practical to program the preferred language to be the Default:

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In order to select a language other than the default language from the *Setup* menu, the language choice option in the menu must be enabled:
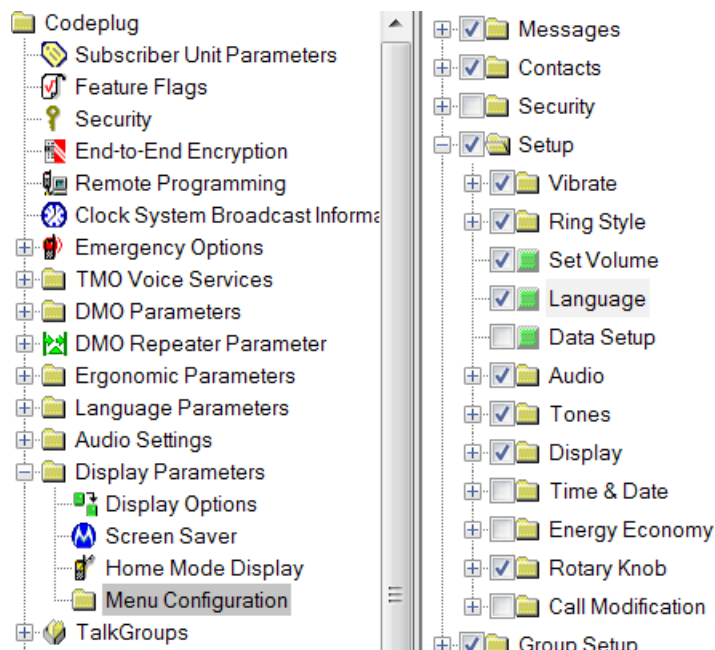
GPS settings (optional)

The radios are equipped with GPS receivers as standard. The MTM800[E] and MTM5400 mobile rdios *can* be equipped with GPS. In these radios, GPS is a separate hardware module, which unfortunately is not always installed. CPS makes it possible to set the conditions under which the radio sends a position report to a central/control room. In Arnhem, PI1ANH will play the role of GPS destination, possibly in due course with a link to APRS (aprs.fi).

The location messages are sent by the radios to the ISSI of PI1ANH:

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Remark: a repeater ISSI is only 6 digits for the repeater, this instead of 7 digits for ordinary users.

In the future, an overview might be made available of the locations of the Tetra users, such as APRS. Also, a coverage overview of the PI1ANH can be derived from the location reports. At the time of writing (early 2020) e.g. GPS logging/forwarding is not yet operational. The parameters in the radio programming can of course already be prepared. The (ETSI standard) LIP is used, not the Motorola-proprietary LRRP.

Remark: please set the Current GPS Cycle to 2, so underline the screenshot below shows.

The following settings should be made *assuming that you do indeed want to share your location*:

Below is the setting of the destination ISSI (PI1ANH):

Under *GPS LIP Triggers* you can find a very comprehensive list of parameters that determine the conditions under which the radio sends a location report. How you program this is largely your own taste. Keep in mind that when you send frequent reports, the battery will drain faster.

Here's an example:

In order to manually send a GPS position report, it is practical to assign that function to a function key. In this example, the Function Key1 was chosen. That's the button on the side, *above* the PTT button of the portable radio:

Status messages (optional)

Tetra provides for the transmission of status messages (via SDS, roughly like SMS within mobile telephony). These status messages consist of a number that is translated into a text by the receiving Tetra radio. Of course, transmitting and receiving radio must use the same text for a given number to avoid a Babylonian confusion of speech.

The following status messages have been provisionally recorded by the Arnhem Tetra users for the first experiments:

	Name	ID	Status
▶1	At scene	32768	☑
2	En route	32769	☑
3	Available	32770	☑
4	73	32771	☑
5	SOS	32772	☑
6	Food	32773	☑
7	Low Battery	32774	☑
8	QRT	32775	☑
9	QSY	32776	☑
10	Beer!	32777	☑
11		36875	☐
12		36876	☐
13		36877	☐
14		36878	☐
15		36879	☐
16		36880	☐
17		36881	☐
18		32768	☐
19		32768	☐
20		32768	☐
21		61439	☐

Emergency options (optional)

The radios are equipped with the possibility to signal an emergency via a priority call. Although this is more useful for a professional TMO network, such as the Dutch C2000 / UK Airwave networks, it *also* works in DMO and *also* using a DMO repeater.

After pressing the orange button on the radio, an alarm goes off on all listening radios, a red alarm screen appears on the display etc. In short, it certainly draws your attention ☺

Settings via:

RSSI low notifications (optional)

The radios can be set to alert the user with a beep in case of (too) low signal reception. When using a *repeater,* this can be useful. It can also be very irritating over time. Just try to it to see if you like it. This, too, is primarily useful for the emergency services (TMO) world, where a warning of poor coverage can literally be a matter of life or death.

Display parameters & screensaver (optional)

There are all kinds of setting possibilities for the radio display such as larger font size, contrast, backlight intensity etc. It is also possible to load a screensaver picture in GIF format on the radios.

Import your own screensaver GIF image on the portable radio:

First get the GIF file with *Load* into CPS (size depends on the type of radio. For example, for an MTP850 or MTH800, 130x130 pixels), then subsequently *Import* the GIF to make it ready for programming:
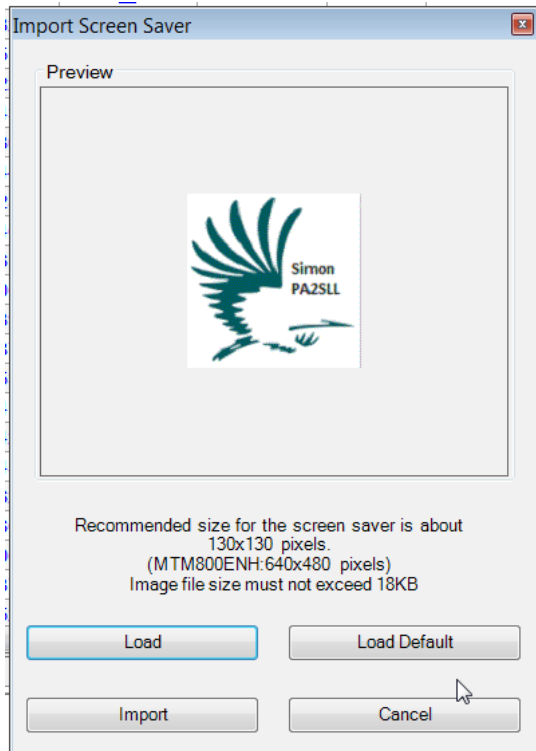
Customize configuration menu (optional)

It is possible to adapt the menu of the radio to the detail level to your own wishes. Menu items that are not desired/needed can be omitted at your discretion. That can be very useful.

Example, below are e.g. Crypto, Security (PIN code), Recent calls and Shortcuts left out of the menu:

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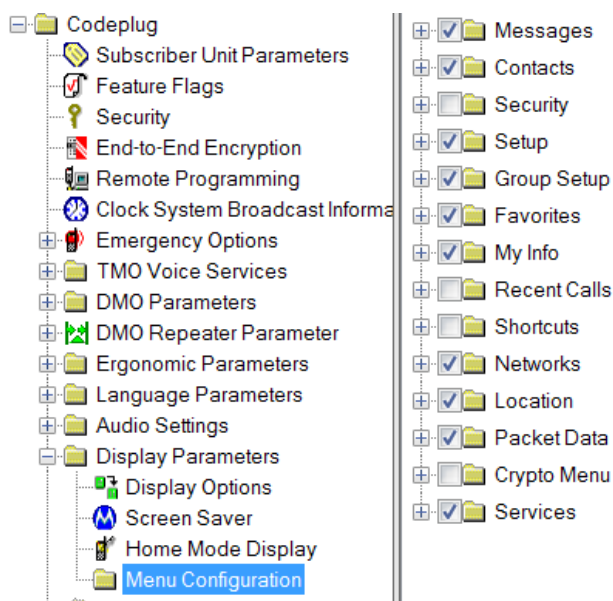
Programming

If the code plug is ready, it can be programmed into the radio. This is done by a right-click on the icon in the Radio pane, followed by *Write radio.*

After some time, the background color changes from orange to green and the programming is ready. Use *Turn off radio* to turn off the radio and then turn it back on. **Remark**: With the mobile radios, do not forget to switch off the programming switch in case your programming cable has one!

If all went well then, the radio now works with the new settings. If not: customize and reprogram. Experience shows that this usually needs to be repeated a few times before everything is to your satisfaction.

Tip: Save the code plug also on the PC. *Read radio* allows you to read the code plug from a radio, *but that requires that the radio must still function normally.* That is usually the case, but it **can** also go wrong (own experience). A known-good code plug on disk is particularly useful to have under all circumstances.
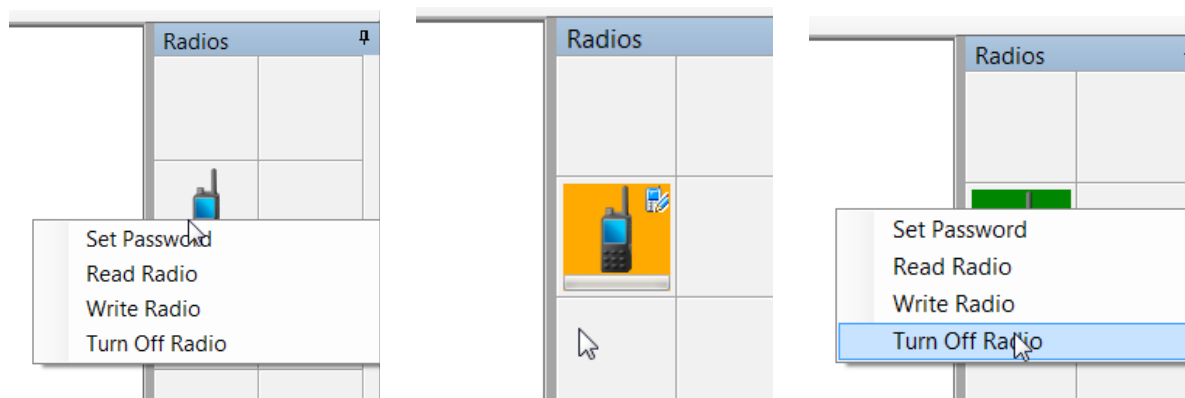
Signal strength indication

In the standard display there is not too much information (to put it in mildly) about the signal strength of the received signal. As a radio amateur, we obviously care more than (say) a police officer. For a police officer the rule is simple "if my radio works then it is fine".

Fortunately for us radio amateurs, the portable radios and some mobile radios can be put into a *Test* mode by means of a magic key combination. That is *provided* that Test function is enabled in the code plug. Most features are intended for TMO, but the limited DMO info is also very useful.

The magic key combination is for an MTH800, an MTP850, MTP6000 or an MTM800E (colour LCD):

      * # <Menu key> <Right navigation button>
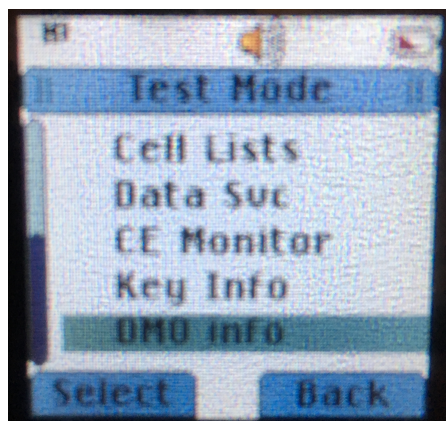
For the MTM800 (i.e. for the non-E version which has a monochrome LCD) the combination is:

<Arrow right> 1 <Menu> 2 <Menu> 3
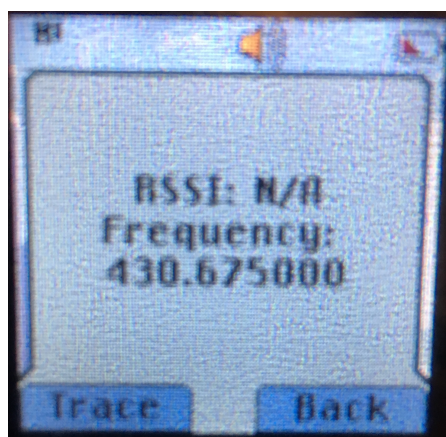
For the CEP400/MTP830/MTP8x0ex and newer radios without keypad the combination is:

<Arrow Left> <Arrow right> <Arrow Left> <Menu>

Once successfully entered, the following information is shown on the display :

Select DMO info, now the display shows the following:

The RSSI is the Received Signal Strength Indicator (nice word for S-meter). N/A, or not available, indicates that no signal was received at the time the photo was taken. As soon as the signal is received, a number is displayed. Obviously for DMO there must be an active QSO on the repeater for the radio to display an RSSI value.

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Also very useful: the frequency of the talk group is displayed. In the standard display you see only the programmed talk group name, not its frequency. The photo shows the QRG of PI1ANH.

Learn more

Information about "Amateur Tetra" can be found at:

- The documentation on the website of the STTA Foundation can be found at https://www.pi4tta.nl/tetra-ham-documents/
  - The Dutch radio amateur Telegram group "Tetra NL / 204"
  - The Telegram group "HamTETRA international"
  - The German-language Telegram group "HAM-TETRA"
  - The website https://hamtetra.network
  - PE2KMV's website, in particular https://www.pe2kmv.nl/wp/category/tetra/ and https://www.pe2kmv.nl/wp/projecten/motorola-tetra-programmer/
  - If it really doesn't want to work: send an email to Wilko PA1WBU@Veron.nl