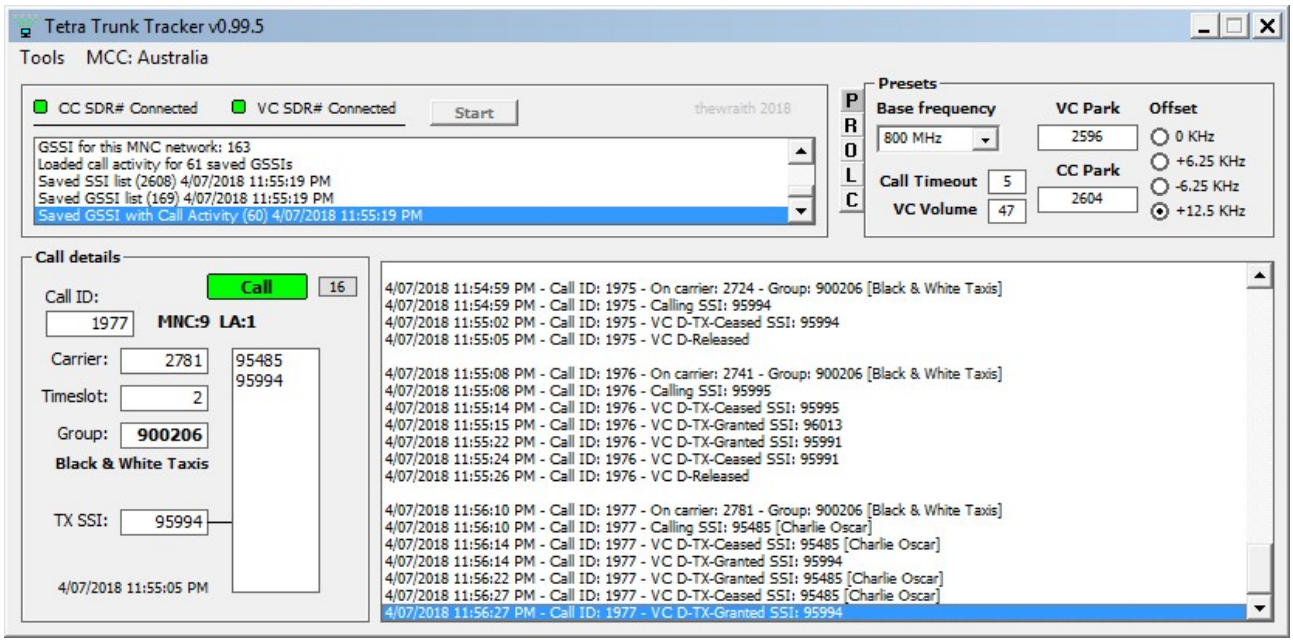
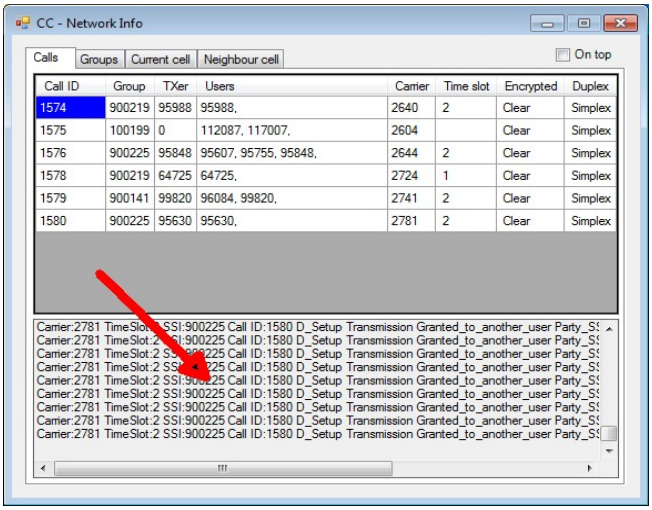
TETRA Trunk Tracker – Set-up and Usage

by thewraith2008 (6th March 2019)



Description:

TETRA Trunk Tracker reads DATA that is output from the SDR# plug-in TETRA Demodulator (by TSSDR) via the 'Network Info' calls log window.



It interprets this DATA to determine when a call is set-up, then instructs SDR# (VC) to move to the carrier (frequency) that the call will be on. It will also watch out for other PDUs to determine when a SSI starts or completes transmissions and when calls are complete (Released).

If the TETRA Demodulator does not work for you this program will do nothing to change that.

Tested on Windows 7 – Professional SP1 (32 bit, 64 bit), English.
Tested on Windows 10 – Home (v1709) (64 bit) see special notes
Tested on Windows 10 – Professional (64 bit) see special notes

Currently 2 modes exist:

Dual

- This requires 2 SDR# and 2 dongles with TETRA Demodulator and Net Remote plug-ins. Some features will work better in this mode (Priorities, SDS).

Single

- This requires only 1 SDR# and 1 dongle with TETRA Demodulator and Net Remote plug-ins. (Has limits)

CC = Control Control (this is a fixed frequency).
VC = Voice Channel (this varies frequency).
Carrier = Same as VC. Another name for any frequency in network. They are allocated a number.
Main Carrier = Same as CC
Base Frequency = Used to calculate frequency for a given carrier #.
If your TETRA signal are say 450MHz then you base frequency will be 400 MHz.

Please only use the release of TETRA Trunk Tracker with the supplied TETRA Demodulator (plug-in)

NOTE: Any TSSDR version released after 5th June 2018 will NOT work with TETRA Trunk Tracker.

Mixing different versions of TTT and plug-in WILL cause issues/crashes and affect some of the features.
I will NOT offer support to those who do.

The plug-in was not originally designed with trunk tracking in mind.
When using TTT with the plug-in, some of the information/features of the plug-in may not work as expected.

The TETRA Demodulator SDR# side panel will not always show correct GSSI/SSI values. Especially on VC.
Using GSSI blocking is not recommended. (e.g. Blocking threshold)
Using the plug-in logging is not recommended.
“Auto” checkbox is meant to be **unchecked.** TTT should switch this off automatically at start/reset.
Using the option in settings: “Call list – Alternative generation” is recommended to better show current calls in list (Network Info > Calls tab). This will work better with single and dual mode in different ways.

It should be noted that in the call list, private calls 'mode of operation' or 'Mode Op' (Simplex/Duplex) may not always be correctly identified for Duplex calls.
This is because multiple PDUs are required to correctly determine this and all the required PDUs may not be sent on one LA.

Multiple instances of TTT and TETRA Demodulator plug-in is not supported.

Features:

- A basic call recording (All or Selective call recording).
- Plot SDS location data (GPS) on map with DSDPlus LRRP (SDS Short/Long*)
- Display current call details with list of seen SSIs for that call. (SSI populate as they TX).
- GSSI holding - will only allow calls with selected GSSI to be heard.
- Call lockout based on GSSI. Can be unchecked in list to lockout GSSI.
- Call Priority. (Limited in Single mode)
  GSSI weighted 0-9, 9 is highest. If on active call and other call event occurs, if new call has higher priority then will switch to it.
- Collect/Save all seen GSSIs with Labels and Priority, By Network.
- Collect/Save seen SSIs with Labels and Last seen Date/Time, By Network.
- Set a call time-out. Returns to idle state if call does not see a release PDU after X time in seconds.
- Log call events to screen and file, if enabled.
- Log raw CC and VC PDU messages as seen by the 'TETRA Demodulator' plug-in, if enabled.
- Log GSSI daily call activity. (Single mode only plays calls that are on CC when this is selected)
- Set base frequency via UI.
- Set CC park carrier # via UI.
- Set VC park carrier # via UI.
- Suppress some PDUs. (unchecked is mainly for testing only)
- Suppress lockout messages.
- Sort SSI and GSSIs/Lockouts (by GSSI). This only occurs on start-up.
- Country Code label, defined via file (shown as menu item)
- Network label, defined via file (shown in tool tip where MNC,LA is in 'Call Details' panel)
- Location Area label, defined via file (shown in tool tip where MNC,LA is in 'Call Details' panel) Only shown when Network label used.
- Ignores Encrypted PDUs (with no reference to them)
- Set a seen GSSI priority via UI.
- Update a seen GSSI/SSI label via UI.
- Call active indicator.
- Restore SDR# windows to a defined position.
- Command line option for SDR# bandwidth adjustment.
- Hold delay after a recorded call. (To allow continued activity from same GSSI)
- Remote “On top” window that displays G/SSIs and there labels in larger font (+ a super size)
- Limited private call Simplex/Duplex[half] capability. (Can be disabled via command line)
- Auto setting Base frequency, Main carrier (CC) and Offset. (As of TTT v1.0.7)
- Remote window field colour presets (x7) and 1 for custom colour.
- System sounds for call states.
- CC(LA) switching. Manually switch to a different LA in network.
- Full duplex private calls. (As of TTT v1.0.13 and only in dual mode)

See “TTT_Features_and_Usage.pdf” for more details on these features and their use.

* Requires the new custom TETRA Demodulator plug-in that I compiled. (tetra_x86_2019-03-06)

Set-up: Prerequisites:

Your PC must be capable of running:

- 2 SDR# instances with TETRA Demodulator (Single mode only requires 1 SDR#)

SDR# (v1.0.0.1637+) (2 dongles or 1 for Single mode)
TETRA Demodulator plug-in (release 2019-February-19) - MUST be this mod (Supplied)
Net Remote plug-in (v1.2.6750 - Custom) - MUST be this mod (Supplied)
Virtual Audio Cable - optional for call recording (method #2).
TETRA trunk tracker with run-times. (This program).
1 or 2 SDR Dongles. If 2 then stable and same PPM value dongles is ideal.
If not same PPM then manual setting of PPM maybe required at each run time.

Installing: SDR#

It's assumed your installation of SDR# (with TETRA Demodulator) and dongles are already working.
If not, do this first. I can not help with this.

Make sure your using the TETRA Demodulator plug-in mode that came with TETRA Trunk Tracker.

Install SDR# plug-in 'Net Remote' Custom version. Copy “SDRSharp.NetRemote.dll” to your SDR# folder.
In SDR# folder is a file called “Plugins.xml”. Open it with notepad and add the following line before the TETRA Demodulator plug-in entry:

```
<add key="Net Remote" value="SDRSharp.NetRemote.NetRemotePlugin,SDRSharp.NetRemote"/>
```

This version will always save last state of 'Network' as disabled, there for will always start disabled avoiding port collisions between the two SDR# on start..

Must set port to 3383 (VC) and 3384 (CC). NOTE: This is done by TETRA Trunk Tracker now.

Install Virtual Audio Cable: optional for call recording (method #2)

Install Virtual Audio Cable or similar.
See the below section or "TTT_Features_and_Usage.pdf" for more details on configuring for recording.

Installing TETRA Trunk Tracker:

Unzip to free location. (Program must be able to write at location)

Copy and register runtime DLL (follow instructions for 32 or 64 bit Win OSes)

Check if "mswinsck.ocx" exists in one of the following locations below.

- **Windows\System32** for 32 bit OS
- **Windows\SysWOW64** for 64 bit OS

If file does not exist, copy file "mswinsck.ocx" (in vb-runtime folder) to one of these folders based on if your OS is **32/64 bit**.

To register DLL: (change if your paths are different)

Open CMD prompt "Run as Administrator" and type:

for 32 bit:

- regsvr32 c:\Windows\System32\mswinsck.ocx

for 64 bit:

- regsvr32 c:\Windows\SysWOW64\mswinsck.ocx

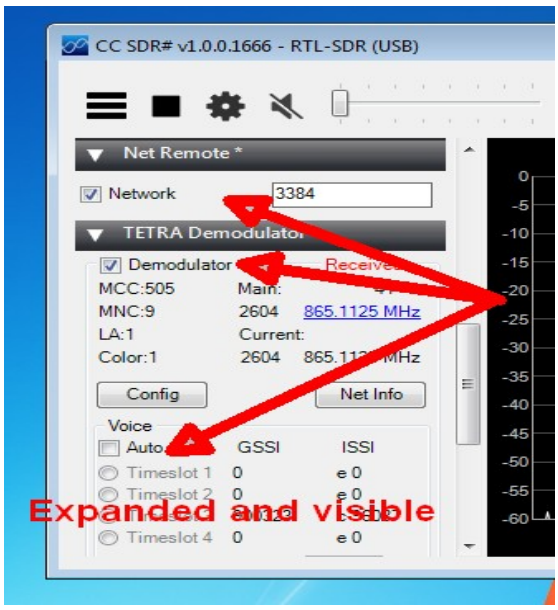
This program requires access to TCP 127.0.0.1 port 3383 and 3384 to communication with SDR#

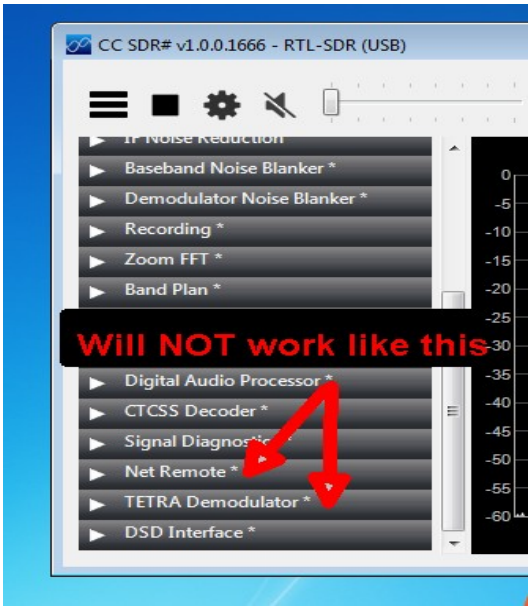
- either through Windows firewall or other installed firewall.

Configuration of SDR#

TETRA Trunk Tracker when started, attempts to pre-configure SDR#. But before that can happen, some items need to be manually set-up and left like this.

You must set the CC and VC SDR# side panel for TETRA Demodulator like in left image and not right image:





NOTE: SDR# will remember these positions on restarting SDR#.

Failure to do this means TETRA Trunk Tracker can't find the information it needs to operate and control the SDR#s.

The following section is split in two parts.
One for running dual mode and one for single mode of TETRA Trunk Tracker.
Please follow exactly to ensure that programs run as expected.

Of course this doesn't mean problems won't occur.

TETRA Trunk Tracker – Initial (Dual mode)

This mode is a bit easier to get running once the initial set-up is complete.

Windows 10 requirement: Run TETRA Trunk Tracker with elevated privileges "Run as Administrator"

NOTE: The initial run may not start everything. Restarting programs should start everything as expected.

Start SDR# 1

- Make sure 'Net Remote' is expanded in SDR# left panel and visible as shown above.
- Make sure 'TETRA Demodulator' is expanded in SDR# left panel and visible as shown above.

The two above states will be remembered by SDR# on restart.
Failure to do this means TETRA Trunk Tracker can't find the information it needs to operate.

Start SDR# 2

- Make sure 'Net Remote' is expanded in SDR# left panel and visible as shown above.
- Make sure 'TETRA Demodulator' is expanded in SDR# left panel and visible as shown above.

The two above states will be remembered by SDR# on restart.
Failure to do this means TETRA Trunk Tracker can't find the information it needs to operate.

Start TETRA Trunk Tracker

If 1st run:

- Select 'Base Frequency' from drop down list. (Auto as of v1.0.7)
- Input a CC Park Carrier #. (This must be the CC frequency to monitor.) (Auto as of v1.0.7)
- Input a VC Park Carrier #. (This must be a unused frequency.)
- Set your offset. (Auto as of v1.0.7)
  see "TTT_Features_and_Usage.pdf" for how to find your offset.
- Set 'VC Volume' to desired level. (default = 47 db)
- Configure "Checkbox Detection"
  Don't skip this or TETRA Trunk Tracker will not be able to pre-configure SDR# and you will need to configure SDR# yourself every time.

Click **Start**

After starting SDR# and TETRA Trunk Tracker the following should occur:

- 'Net Remote' 'Network' should now be enabled for CC, VC SDR#. And green indicator now seen.
- "SDR#" main and "Network Info" window names should now show CC or VC in front of them.
- CC, VC SDR# will be set to frequency as set in 'CC Park' and 'VC Park'
- CC, VC SDR# will be set to NFM and bandwidth of 25000
- CC, VC SDR# will be set to Volume to 25db (mute). VC SDR# will change to value in 'VC Volume' when call is active.
- CC, VC SDR# will start playback.
- The 'TETRA Demodulator' window 'Network Info' should open for CC and VC SDR# then minimise. (These need to be open).
- Should see in status log window "GSSI loaded for this MNC network: 0"
- Should see in event window "No MCC/MNC/LA seen"

Should now see the network MNC: and LA in "Call Details" panel and calls now start to be processed.

CC and VC "Network Info" Windows MUST be left open. (Minimised is OK, but not closed.)

TETRA Trunk Tracker – Running (Dual mode)(after initial set-up has been done)

- Start SDR# 1
- Start SDR# 2
- Start TETRA Trunk Tracker (then click **start**)

Windows 10 requirement: Run TETRA Trunk Tracker with elevated privileges "Run as Administrator"

TETRA Trunk Tracker – Initial (Single mode)

This mode is a bit easier to get running once the initial set-up is complete.

Windows 10 requirement: Run TETRA Trunk Tracker with elevated privileges "Run as Administrator"
- **Not sure if this is still required for single mode.**

NOTE: The initial run may not start everything. Restarting programs should start everything as expected.

Start SDR#

- Make sure 'Net Remote' is expanded in SDR# left panel and visible
- Make sure 'TETRA Demodulator' is expanded in SDR# left panel and visible

The two above will be remembered by SDR# on restart.
Failure to do this means TETRA Trunk Tracker can't find the information it needs to operate.

Start TETRA Trunk Tracker

If 1st run:

- Select 'Base Frequency' from drop down list. (Auto as of v1.0.7)
- Input a CC Park Carrier #. (This must be the CC frequency to monitor.) (Auto as of v1.0.7)
- Set your offset. (Auto as of v1.0.7)
  see "TTT_Features_and_Usage.pdf" for how to find your offset.
- Set 'VC Volume' to desired level. (default = 47 db)
- Configure "Checkbox Detection"
  Don't skip this or TETRA Trunk Tracker will not be able to pre-configure SDR# and you will need to configure SDR# yourself every time.

Click **Start**

After starting TETRA Trunk Tracker and SDR# the following should occur:

- 'Net Remote' 'Network' should now be enabled for SDR#. And green indicator now seen.
- SDR# will be set to frequency as set in 'CC Park'
- SDR# will be set to NFM and bandwidth of 25000
- SDR# will be set to Volume to 25db (mute). Will change to value in 'VC Volume' when call is active.
- SDR# will start playback.
- The 'TETRA Demodulator' window 'Network Info' should open for SDR# then minimise.
  (This needs to be open)
- Should see in top status log "GSSI loaded for this MNC network: 0"
- Should see in event window "No MCC/MNC/LA seen"

Should now see the network MNC: and LA in "Call Details" and calls now start to be processed.

"Network Info" Window MUST be left open. (Minimised is OK, but not closed.)

TETRA Trunk Tracker – Running (Single mode)

- Start SDR#
- Start TETRA Trunk Tracker (then click **start**)

Windows 10 requirement: Run TETRA Trunk Tracker with elevated privileges "Run as Administrator"
- **Not sure if this is still required for single mode.**

Shut-down

Close **TETRA Trunk Tracker**
Stop and close **CC SDR#**
Stop and close **VC SDR#**

Note: Do not shut-down the VC SDR# to quick after shutting down CC SDR#. If you do an error will occur.

"The configuration file has been changed by another program. (X:\sdrsharp-x86rev1666\SDRSharp.exe.Config)"

Configuring Checkbox Detection:

See “Checkbox_Detection_details.txt” for more details on why this is needed.

The default values are for Windows 7 Aero/Basic theme.

With SDR# and TETRA Trunk Tracker running:

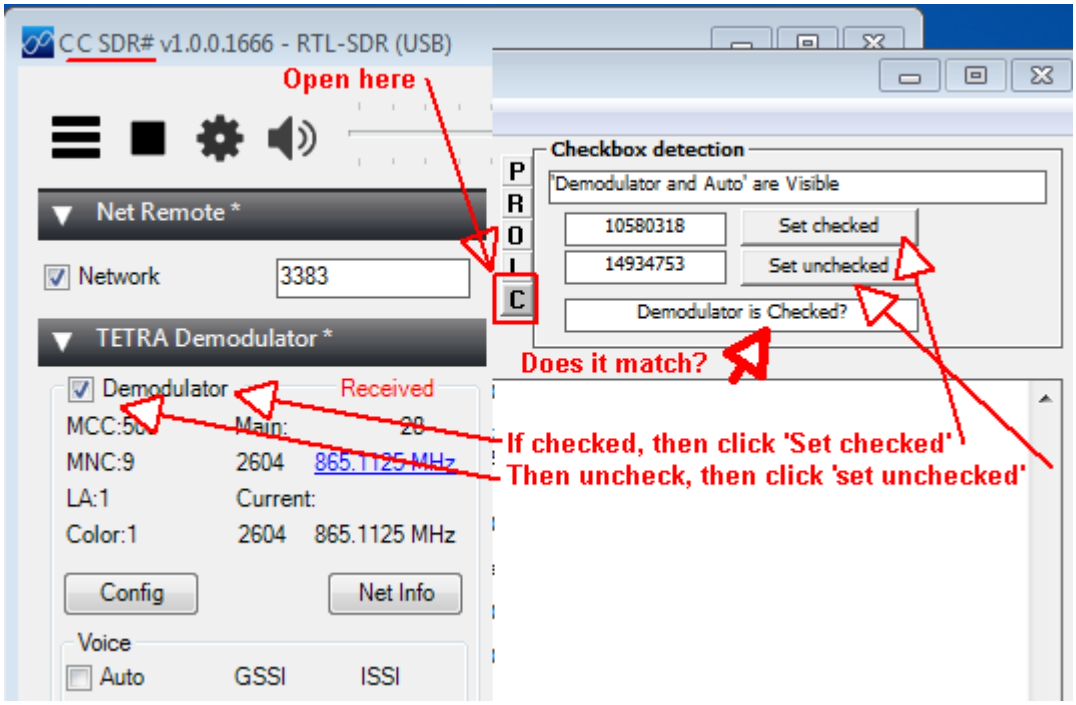
SDR#:
Make sure TETRA Demodulator panel is expanded and checkboxes visible with no other windows covering them.

- **We only need CC SDR# to calibrated too.**

TETRA Trunk Tracker:

- Click '**C**' in the option tabs.
- Should say “'Demodulator' and 'Auto' are Visible“ and buttons will be enabled. If not go back to “Configuration of SDR#” above.
- Whatever that state of 'Demodulator' checkbox. Click matching button 'Set ?'
- Change state of 'Demodulator' checkbox to opposite state of previous. Click matching button 'Set ?'
- Bottom line should indicate state of 'Demodulator' checkbox. Change checkbox state to validate with this line.

NOTE: When validating checkbox, move mouse off checkbox or it will give false reading.



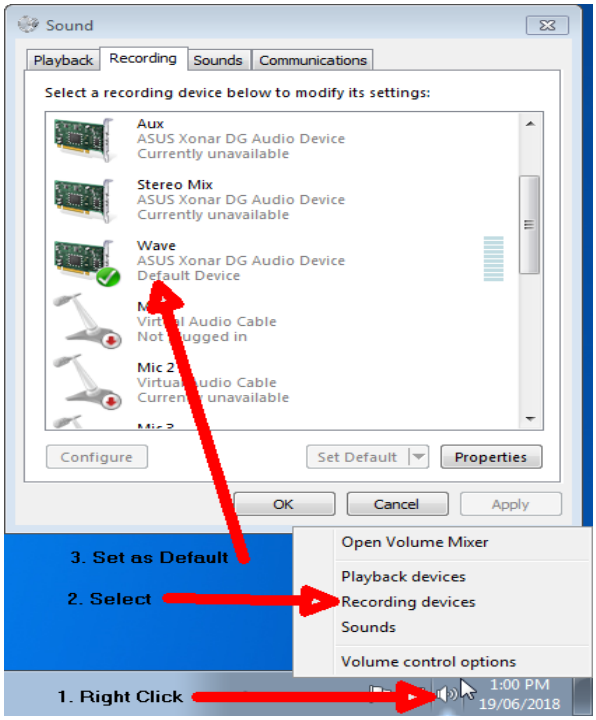
Configuring for Recording calls:

Two methods exist for recording. (see following sections)
Once selected method is chosen and set-up, select record mode in TETRA Trunk Tracker.

Filenames for recorded files will be:
Group calls: time_callid_gssi.wav
Private calls: time_callid_gssi[0]_issi[caller]_issi[caller].wav

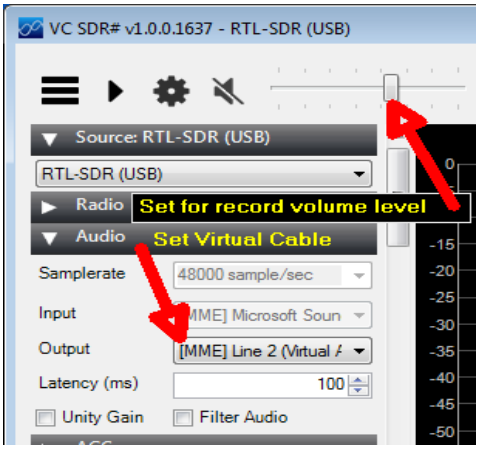
Recoding Audio set-up (Method #1)

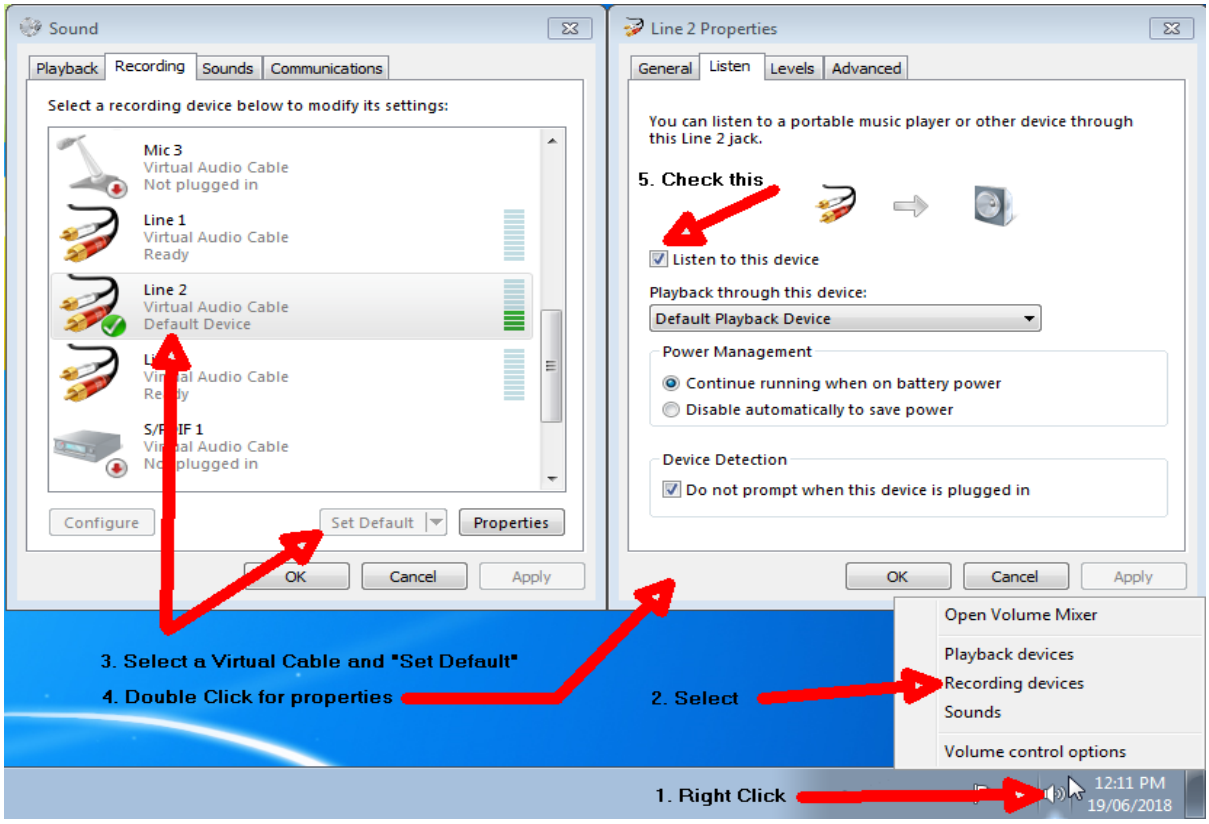
So long as WAVE is the default recording device, TETRA Trunk Tracker will record call.
NOTE: This method will also record any system sounds (Method 2 is better)



Recoding Audio set-up (Method #2)

You must have a Virtual Audio Cable Installed.
In SDR# set audio output device. Set volume in TETRA Trunk Track now, NOT in SDR# as shown.





#5 “Listen to this device” must be used to hear the calls when using a Virtual Audio Cable (e.g. Line 2). Disable it if you wish to do something else with PC. i.e. Playback calls. Calls will still be recorded when disabled.

BUG:
TETRA Demodulator locks up when changing “Listen to this device” from disabled to enabled. A workaround would be to disable “Demodulator” for both CC, VC then switch “Listen to this device”. Then enable “Demodulator” for CC, VC again.

Problems/issues/bugs/limitations

A quirk with calls can occur because a call does not sent the "D_Release" PDU at the end. The last PDU sent maybe the "D_TX_Granted" or "D_TX_Ceased" which causes TTT to reset the call watchdog timer which eventually times out after X amount of time. It's at this point, while waiting for this timer to time-out that the next call is set-up. The result is that this next call is missed.
I am not sure why some calls do not send the D_Release PDU.
I am not sure if it is a fault in the plug-in or it's just a quirk in the TETRA infrastructure.
TTT is not at fault here and does not contain a bug. It is working as expect in this regard.

NOTE: As of TTT v1.0.8 I have added some code (also in plug-in) to deal with the missing "D_Release" PDUs. It detects when a timeslot becomes unallocated and (the plug-in) outputs a message to TTT which will end call immediately with out delay.

Because of the auto updating of the current MCCH or “CC Park”. Manually setting “CC Park” field can be troublesome when all is running. When typing in the field, the auto code will update this field and overwrite what you are typing (about every 3 seconds).
As of v1.0.14, it is recommended to change the “CC Park” by using the CC(LA) switching feature.

Limitations:
As this program relies on other external components to function, i.e. SDR#, the TETRA Demodulator plug-in, Net remote plug-in. This program can/will probably break on new release of SDR# or the plug-ins.

Sorting of G/SSIs is only done on program start-up, and does delay start a little. Larger lists will take longer. (Should be better as of TTT v1.0.7)

Possible that large numbers of GSSI/SSI could eat too much RAM.
- Each GSSI entry is 42 bytes (1 million entries would be 42Mb
- Each SSI entry is 50 bytes (1 million entries would be 50Mb)

All ISSIs seen in private calls are stored under GSSI of 0.

Probably many more.

Bugs:

A very rare random WinSock error using Net Remote comms. While this occurs, code is in place to reset and continue on.

TETRA Demodulator locks up when changing “Listen to this device” (from method 2 call recording) from disabled to enabled. A workaround would be to disable “Demodulator” for both CC, VC then switch “Listen to this device”. Then enable “Demodulator” for CC, VC again.

A Invalid property value (Error 380) can rarely appear. This will crash TTT. Cause is unknown.
As of v1.0.13, added error trapping may help locate this issue.

Probably many more.

Special thanks to the creators of the following software:

SDRSharp (SDR#) by Youssef Touil

- https://airspy.com/

TETRA Demodulator (SDR# Plug-in) by TSSDR

- http://www.radioscanner.ru/forum/topic50051-30.html

Net Remote (SDR# Plug-in) by Al Brown

- https://eartoearoak.com/software/sdrsharp-net-remote
- https://github.com/EarToEarOak/SDRSharp-Net-Remote

DSDPlus (for LRRP)

- http://dsdplus.com

Necessary Disclaimer:

- **This program is "as is"**
- **This program is experimental. It most probably contains errors, bugs or whatever and that it may crash itself, SDR#, the plug-ins, windows or your car. You accept that you use it at your own risk.**
- **I make no promises to update it or support it.**
- **I'm under no obligation to implement anything.**
- **The creators of SDR# and the plug-ins TETRA Demodulator (by TSSDR) and Net Remote have the right to change there code as they see fit. Because of this, this program can and probably will break.**
- **Not reading read-me/set-up and usage files may cause you issues.**