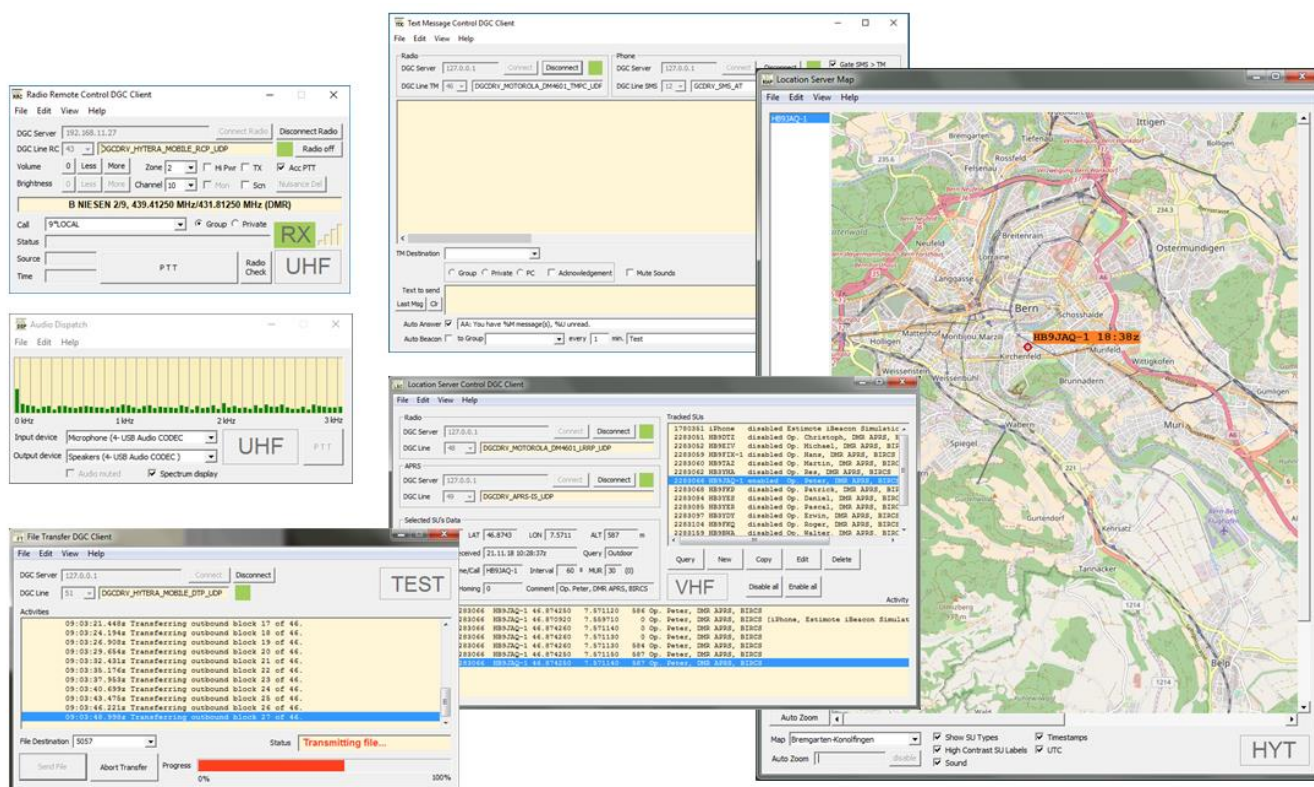


Radio Control System

Getting the Special Features of Modern Digital Radio Systems to Work



General

BIRCS is an easy to operate suite of PC programs designed as a modular concept. With its functions the software provides a means to use the special features of modern digital radio communication equipment:

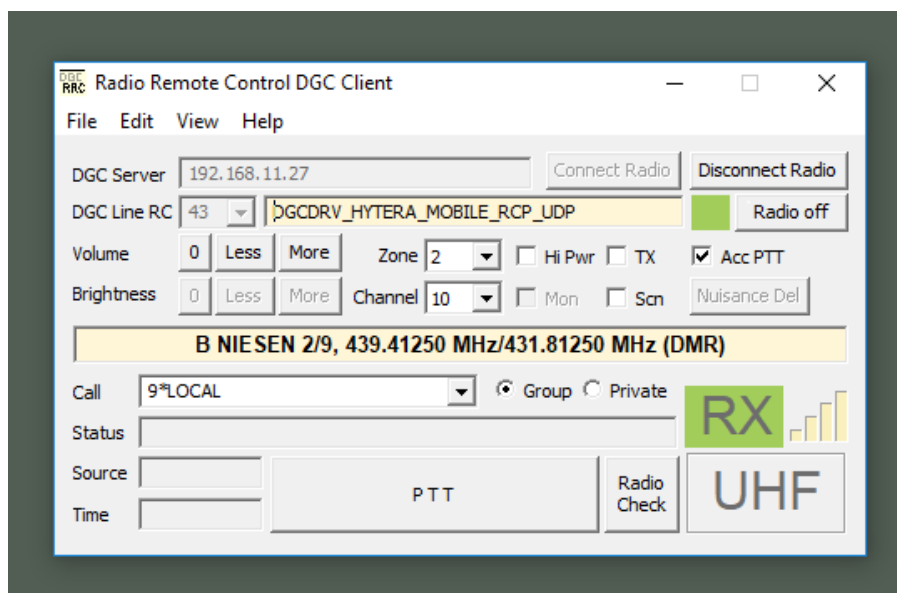
- *Radio Remote Controlling*
- *Streaming of Radio Audio from/to the PC Network (Voice Dispatching/Voice Recording)*
- *Transmission and Reception of Short Text Messages (with optional Mailbox and Alarm Handling System), SMS Gateway*
- *Location Services with Map Display (Indoor/Outdoor)*
- *Telemetry Services*
- *File Transfer*

The **BIRCS** suite of programs is executable under Microsoft Windows operating systems (Windows Vista or later). During the development of the software care has been taken to ensure that the system remains Internet independent. There is no utilization of third party online Internet components so the programs are also best suited for emergency services and similar organizations.

For the time being **BIRCS** supports Motorola (MOTOTRBO™ series) and Hytera branded professional two-way radios. The modular concept of **BIRCS** is layer based. Therefore the system is able to adopt different radio hardware simply by replacing some device drivers without the need to modify the application layers of the software. Other radio brands/models may be supported in the future. **BIRCS** consists of the program units described in the following sections.

Radio Remote Controlling

Radio Remote Control (RRC) is a program to control the functions of a PC connected radio (usually at the base station) locally or over the network. Due to its multiuser abilities it allows the setup of several dispatcher workstations accessing one single radio.

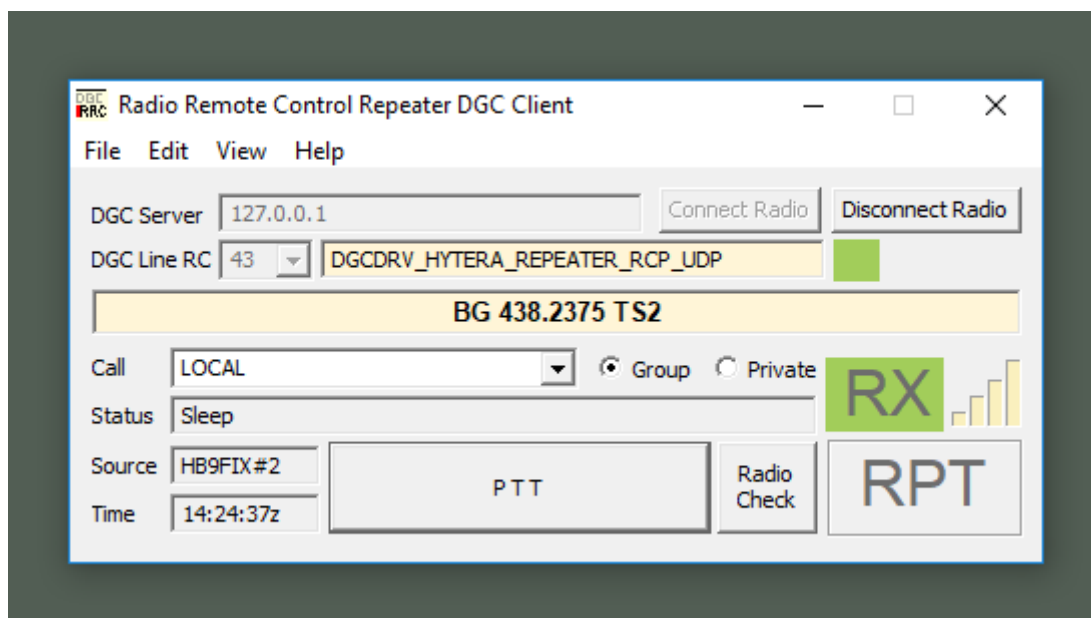


The following functionality is available in RRC:

- Connect/disconnect to/from the radio
- Display of version information (firmware and options)
- Volume setting
- Display brightness setting
- Zone selection
- Channel selection within the selected zone and display of the channel parameters
- Power level setting (high/low)
- Transmit/receive switching (PTT)
- Activation/deactivation of the monitor function
- Activation/deactivation of the scan function
- Nuisance deletion (while scanning)
- Radio Check
- Display and selection of contacts/talkgroups
- Radio power-off

Additional functions can be implemented if they are supported by the radio.

For direct repeater access BIRCS offers a specialized application RRC/R (Radio Remote Control /Repeater). In radio nets using repeaters the use of mobile radios as dispatcher stations is obsolete with RRC/R because a LAN/WAN connection between the dispatcher PC and the repeater replaces those radios (available for Hytera systems only).

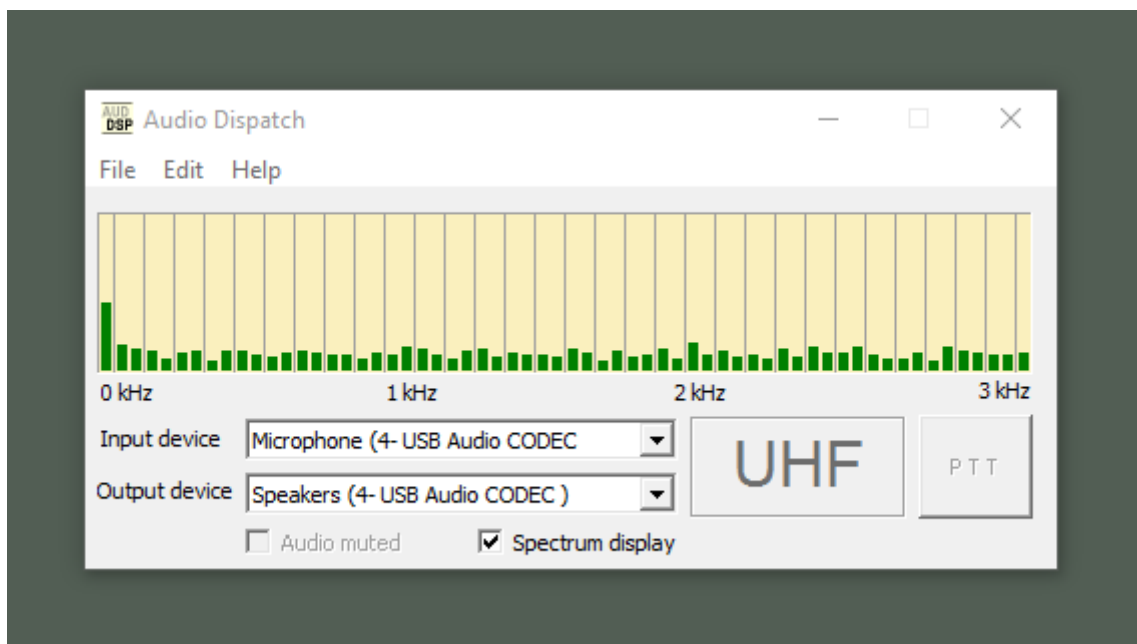


Audio Streaming from/to the PC Network

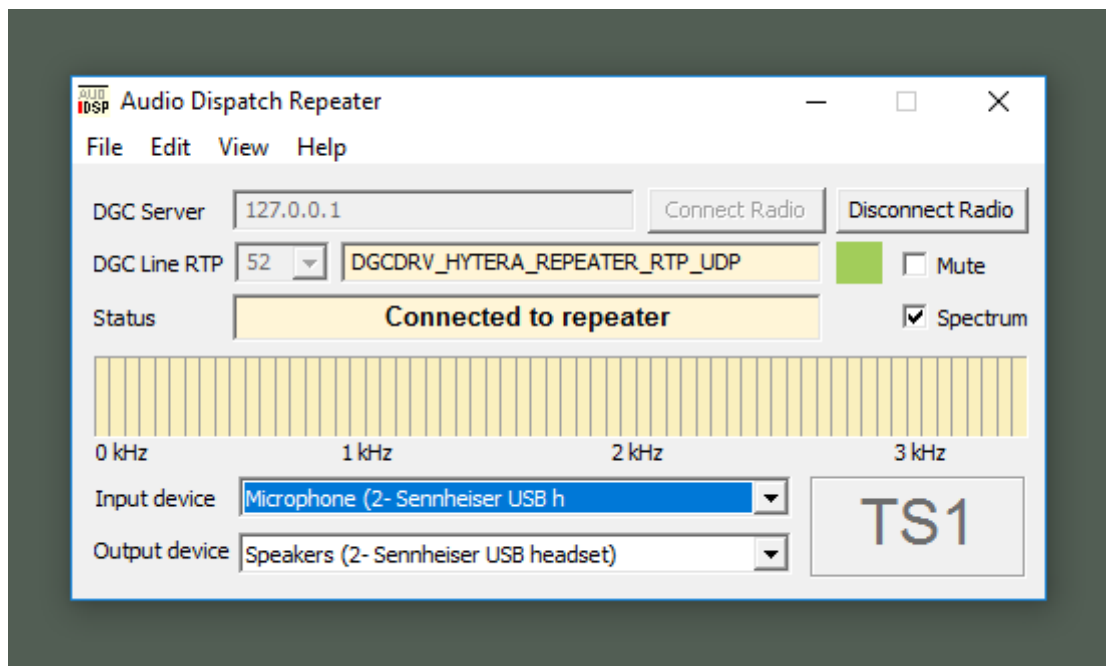
Audio Dispatch (AD) streams the audio received by the radio into the network. It also converts an audio stream from the network into transmit audio for the radio when transmitting. For AD to work a

soundcard interface connected to the PC and to the radio is required. Receive and transmit audio streams are visualized using colors in a bar graph spectrum display (0 to 3 kHz). By using AD every PC in the network is able to access the radio connected to the radio server PC for reception and transmission without any additional peripherals except the microphone and speakers of the PC. AD also maintains a network interface to RRC for transmit/receive switching. Depending on the network configuration AD is able to play the audio of other participants in the network so a dispatcher not only hears traffic received by the radio but also transmit audio coming from the other dispatcher workstations. AD can be configured to record the complete audio stream (inbound and outbound) into a .wav file, a function required by law in certain applications. As an additional feature AD can be used for local intercom purposes between dispatcher workstations over the network if configured accordingly. In conjunction with selective call messaging (described later) AD can mute the audio stream from the network on user request and enable it again automatically on reception of a suitable (configurable) selective call code from the radio. So a dispatcher will only hear traffic directed to him and nothing else.

AD is intended to run on the radio server PC and simultaneously on any number of dispatcher workstations.

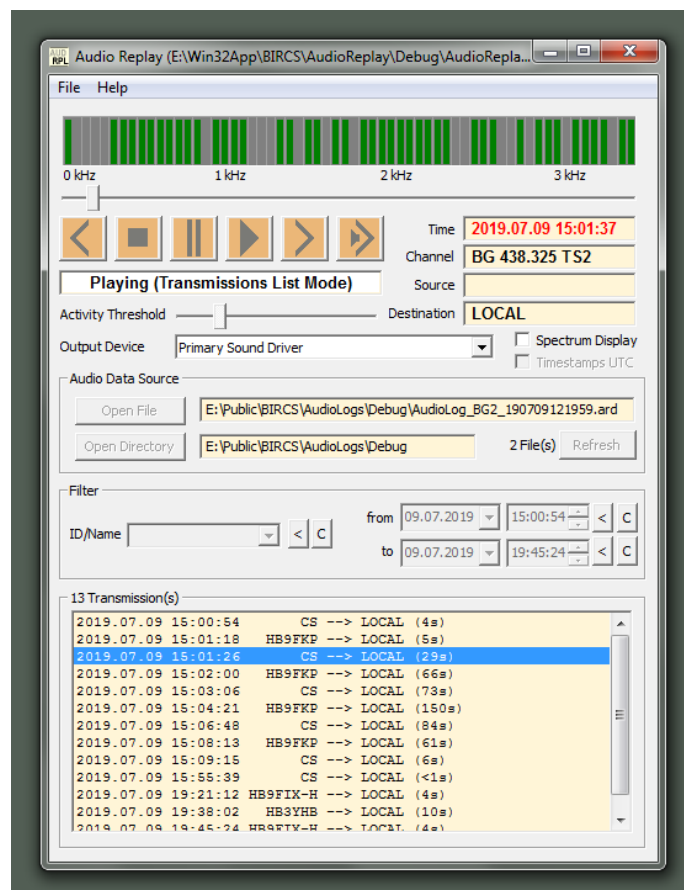


Similar to RRC and RRC/R there is a program variant AD/R intended for direct repeater access. With AD/R audio streams between a dispatcher PC and a repeater are transmitted or received using a LAN/WAN network connection without any radio (available for Hytera systems only).



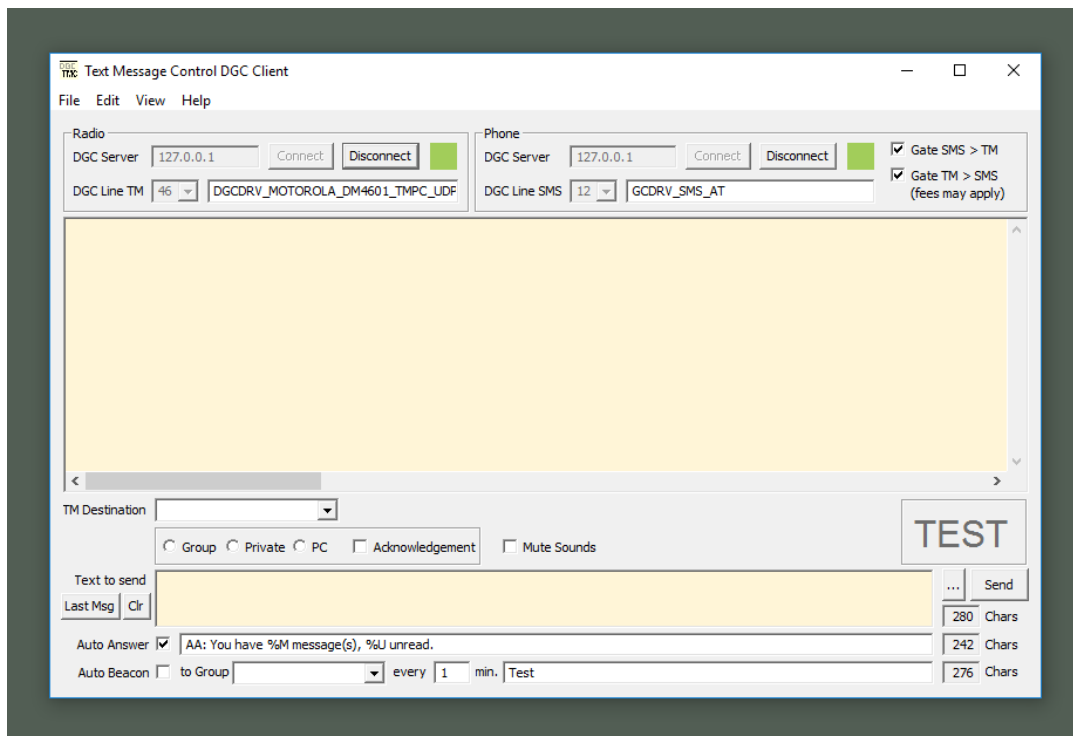
Voice Recording

The programs AD and AD/R can be configured to record voice traffic. For later analysis a program AudioReplay (AR) exists offering flexible filtering to quickly find and replay any transmission made by the participants of the radio network.



Text Messages

Text Message Control (TMC) is the text messaging module in the program suite. It can send and receive short text messages from the PC to other communication participants in the radio network. The messages can be addressed to private, group or PC contacts. TMC incorporates a network interface for third party applications in order to send and receive short text messages as well as a Short Message Service (SMS) gateway function between the radio network and a cell phone network. An SMS from a cell phone can be sent to any radio user in range of the control station and radio text messages can be sent as SMS to any cell phones in the mobile network.

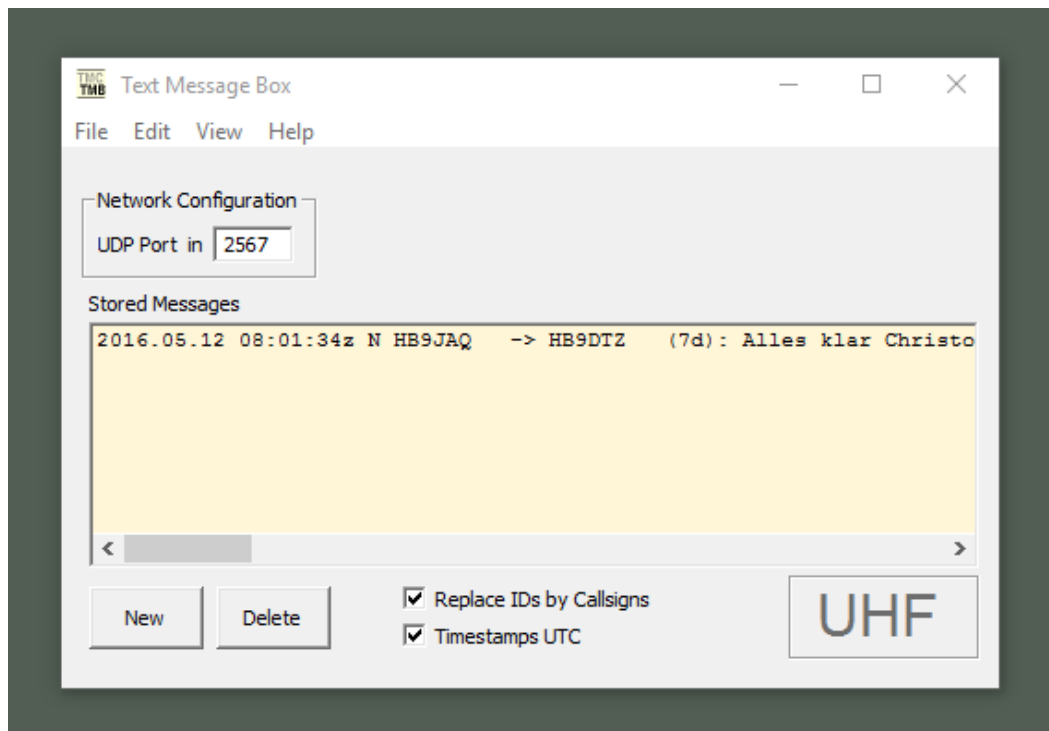


TMC offers the following functions:

- Connect/disconnect to/from the radio
- Reception of short text and alert messages
- Acoustical signaling upon message reception (mutable)
- Transmission of short text messages
- Address selection/entry
- Selection of the destination station type (private, group, PC)
- Reception acknowledge request (not for group destination)
- Retransmission of the last sent message
- Automatic answer (AA) in cases where the control station temporarily is unattended
- Regular transmission of beacon/bulletins text messages (with selectable time interval)
- SMS Gateway function
- Logging of all sent and received text messages with timestamp (local time or UTC)

Text Message Box

Text Message Box (TMB) is a mailbox system for short text messages. TMB is intended to run on a control station where it is available to the radios in the field. The program offers a command interface to the field radio user who is enabled to control/query TMB over the air. Field radios can put messages for other radios into the mailbox system and the radios addressed can read these messages at a later point in time whenever they are ready to do so. TMB works in conjunction with the program TextMessageCtrl (TMC). Message reception and transmission is handled by TMC while the command messages are processed by TMB. TMB implements the Mailbox Radio Command Interface (MRCI) available to the field radio user.



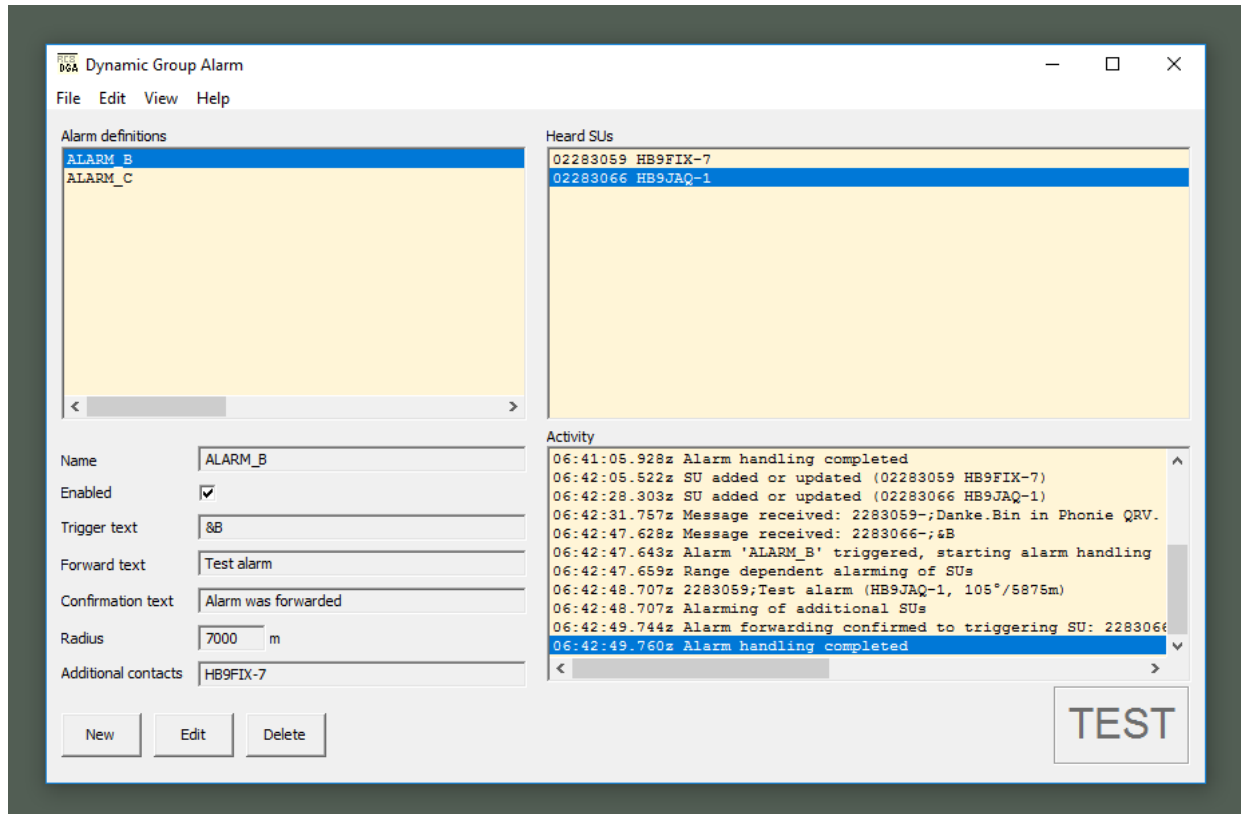
TMB offers the following functions:

- Processing and answering of command text messages received by TMC over the air
- Storing message content for other radios persistently (mailbox)
- Message read-out triggered by field radios
- Handling of number-of-available-messages queries (per user)
- Deletion of stored messages on user request
- Manual message entry (intended for use by the control station administrator)
- Logging of operations

Dynamic Group Alarm

Dynamic Group Alarm (DGA) is a software program handling and forwarding alarm messages. DGA is intended to run on a control station where it is available to the radios (subscriber units or SUs) in the field. Field radios can trigger alarms by transmission of predefined text messages to the control

station. The control station will then forward the alarms to other SUs or PC based stations in the vicinity of the triggering SU specifying location information (direction and distance to the station in distress). DGA works in conjunction with the programs LocationServerCtrl (LSC) and TextMessageCtrl (TMC). Message reception and transmission is handled by TMC while LSC provides location information of the SUs in the radio net.

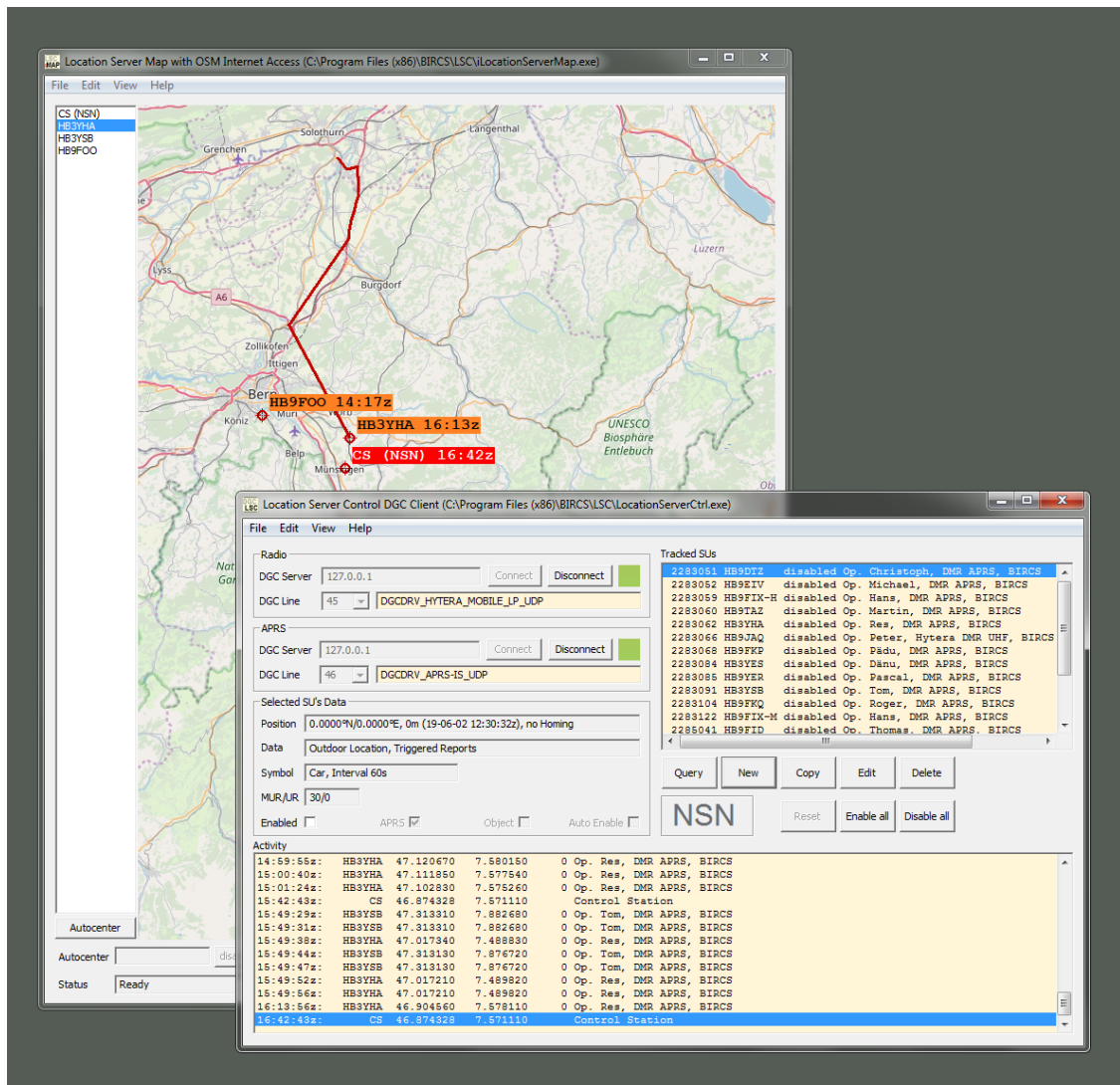


DGA offers the following functions:

- Definition of alarm events
- Maintaining a list of SUs (location data received from LSC)
- Reception of alarm messages with forwarding to other SUs (alarm handling)
- Logging of operations

Location Service

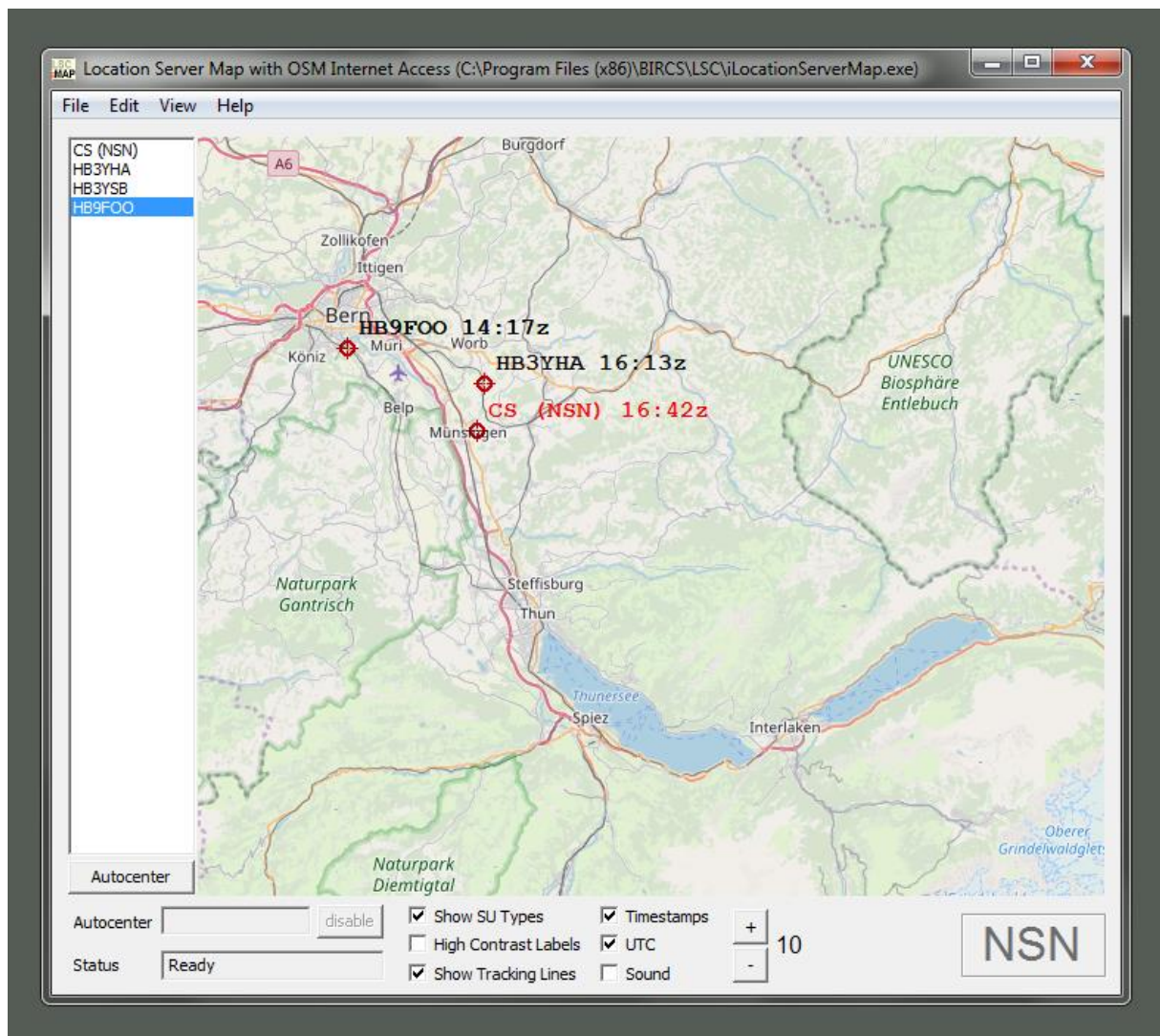
Location Server Control (LSC) requests, displays and further processes location data coming from subscriber units (SUs) in the field and in range of a control station. Up to 128 SUs to track are held in a pool where they can be parametrized individually. There is a network interface to the program module TMC by which an SU even is able to configure its parameters itself using configuration text messages.



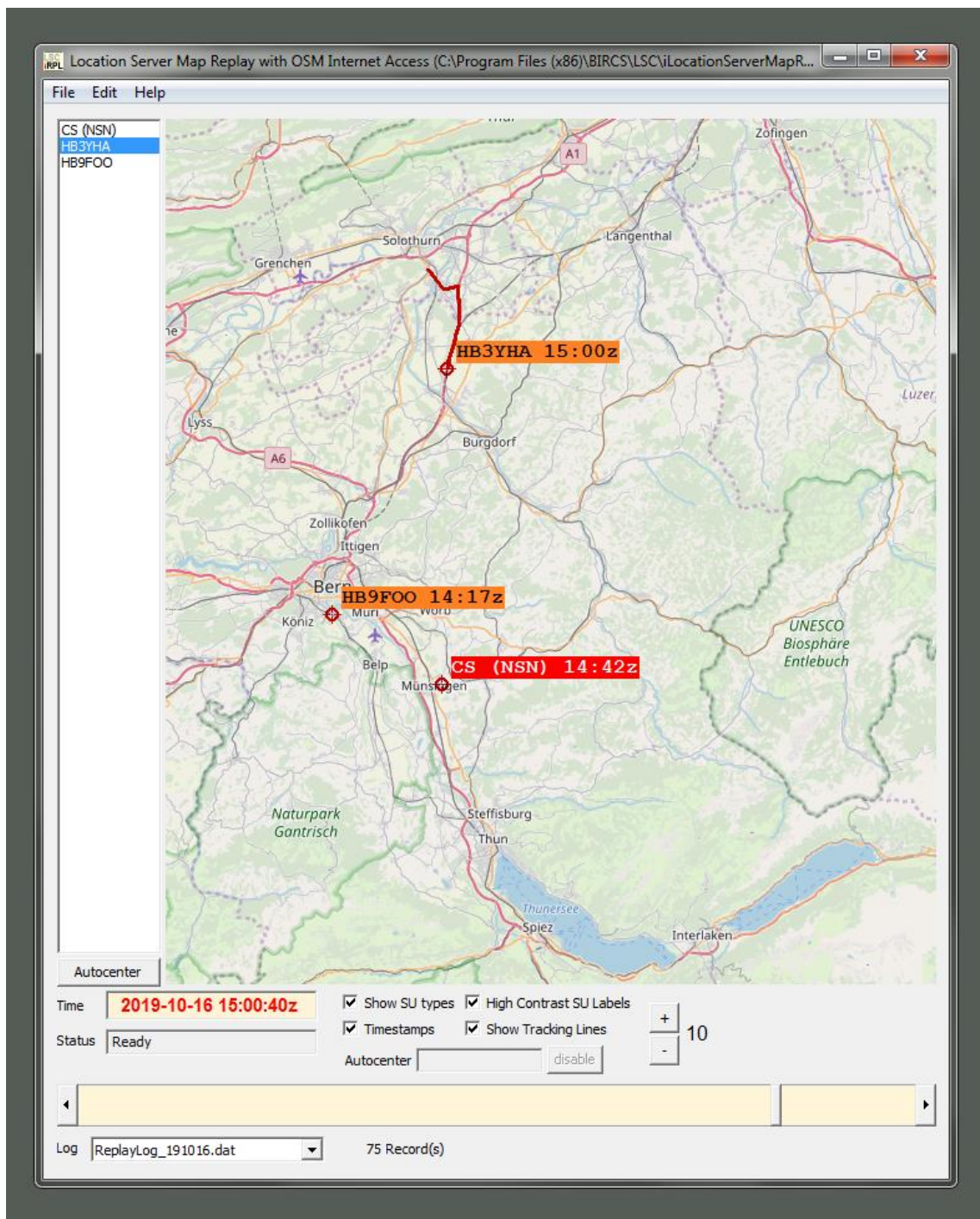
LSC maintains logs of all location traffic. This data can be visualized and replayed anytime during one year from the time it was recorded. Location Server Map (LSM) serves as a real time mapping module working with individual locally stored (offline) raster bitmap maps for displaying the SU's location.

The following functions of LSC/LSM are available:

- Connect/disconnect to/from the radio
- Connect/disconnect of an additional data service for further processing of the location data acquired (optional)
- Management and configuration of the field radios to be tracked
- Regular transmission of location requests directed to the field radios to be tracked (using individual time intervals)
- Outdoor (satellite based), Indoor (Bluetooth/iBeacon based) or mixed
- Display of known positions in a map
- Zoomable OpenStreetMap (OSM) map data is downloaded from the Internet automatically. Once downloaded, the map tiles are stored on the PC for offline use, so an Internet independent operation is possible.
- Logging of all location data received for further investigation

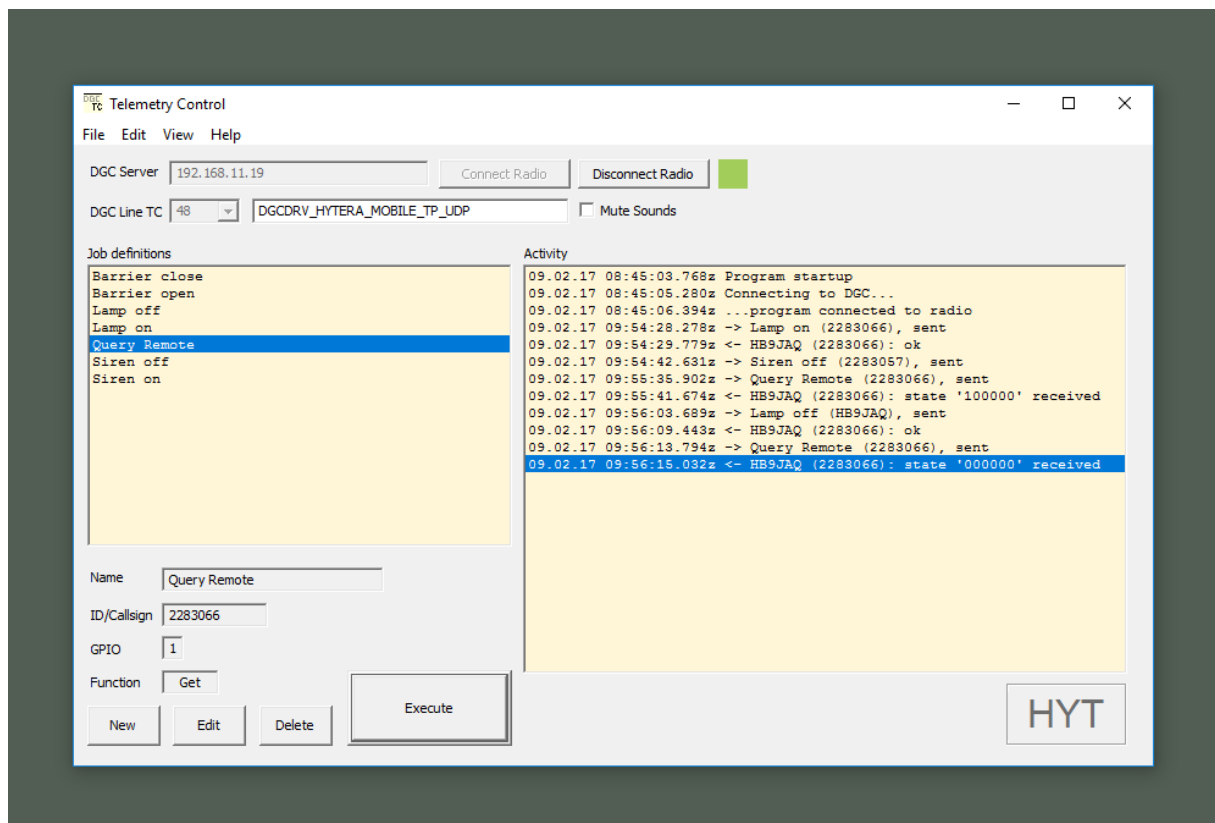


Since LSC logs location data received by the SUs in the field as day logs the map display of any point in time can be traced whenever it is necessary using the program Location Server Map Replay (LSM Replay). Location data is archived for a maximum of one year but can be deleted anytime if desired.



Telemetry Service

Telemetry Control (TC) is a software program able to control/query general purpose digital input/output (GPIO) signals on remote radios. TC is intended to run on a control station. The control station can set, clear or pulse the GPIO signal levels of the destination radios or trigger a state transmission. Spontaneous transmissions of field radios due to a GPIO signal level change occurring (if programmed within the remote radio accordingly) can also be handled.



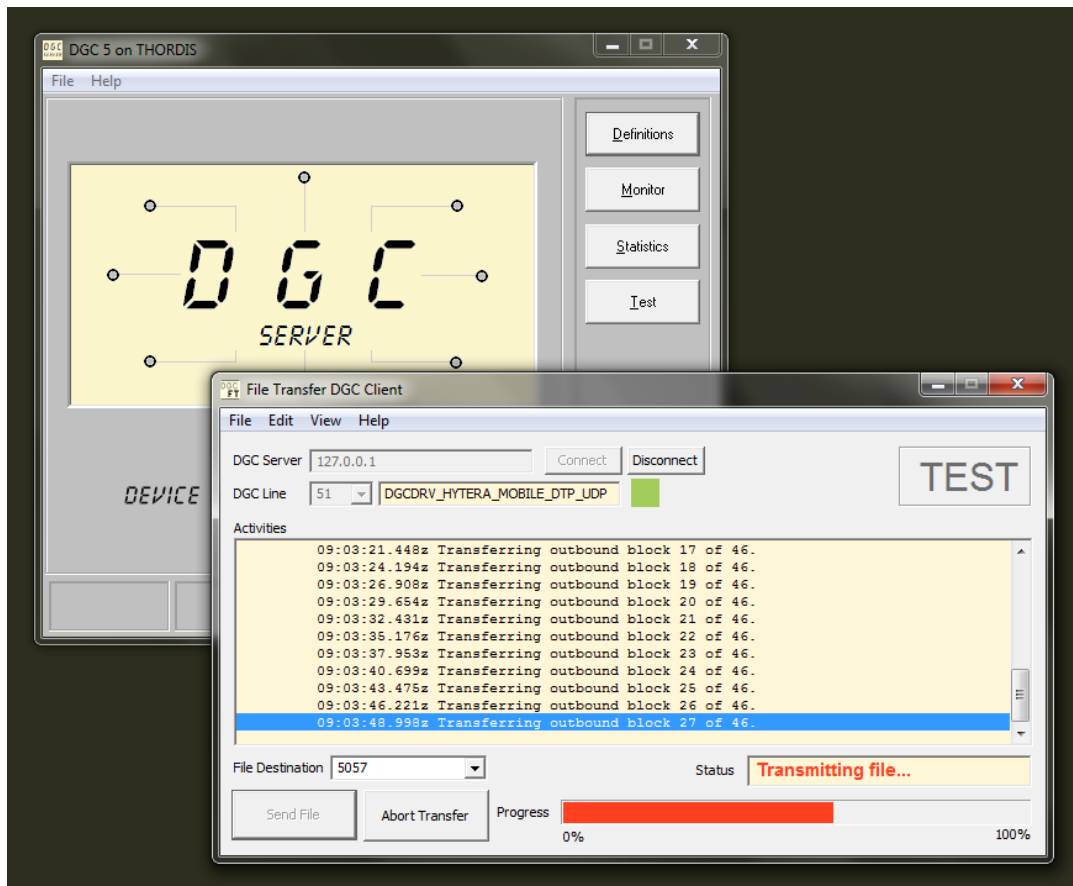
TC offers the following functions:

- Definition of telemetry jobs
- Controlling remote GPIO signals
- Sense (query) remote GPIO signals
- Logging of operations

TC is also able to act as a telemetry server for third party applications using UDP datagrams over the TCP/IP network.

File Transfer

The program module File Transfer (FT) enables the user to send and receive data files between two PCs over a radio link. Transfers are triggered manually by the user or by third party applications through copying a file into a special port directory.

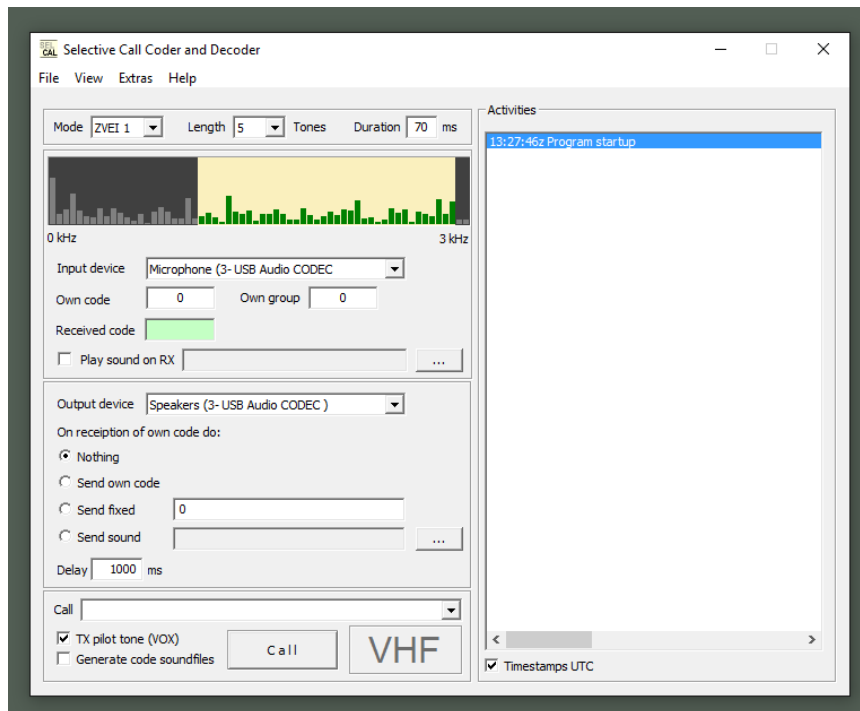


Receiving and Transmitting Selective Calls, Audio Messaging

SelCallCodec (SCC) is a 5 to 7-tone encoder/decoder program suited to work with audio coming from or sent to a radio. It works in conjunction with a soundcard interface connected to the PC and the radio. While SCC can be used as a self-contained software application it also integrates smoothly with the **BIRCS** suite of programs. While SCC acts as a server program other programs can use its services as clients locally or over the network.

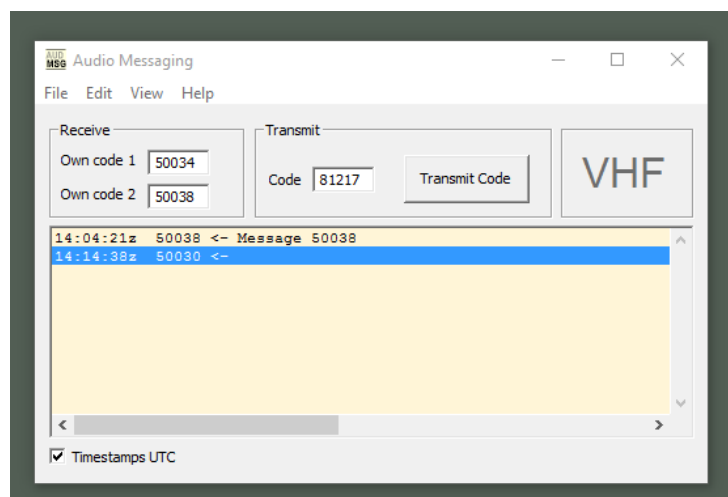
The following functions are supported:

- Selectable operation mode (selective call type/family)
- Decoding of signaling codes with selectable reaction
- Encoding of signaling codes
- Creation of sound files based on selective calls
- Monitoring/logging of events
- CAT controlling support for TX/RX switching
- Processing of signaling commands and control commands
- Network interface for remote control



SCC supports selective call families ZVEI 1, ZVEI 2, DZVEI, CCIR and EEA. Decoded calls are broadcasted over the network and can be processed by other applications.

AudioMessaging (AM) serves as a client to SelCallCodec (SCC). While the latter is intended to run on the radio server as a service-providing application AM will run on a dispatcher workstation. There it co-operates with the program Audio Dispatch (AD). As a network audio stream to audio converter at a dispatcher's workplace AD can be muted to shield the dispatcher from the nuisance of undesired communications. If Audio Messaging receives selective calls from SelCallCodec and one of two specifiable codes is matched AM instructs Audio Dispatch to unmute so the dispatcher will be able to hear a voice call directed to him. AM is also able to transmit codes entered through the dispatcher's keyboard over the air using SelCallCodec running on the radio server. For more expressiveness a text message equivalent can be assigned to incoming codes which is displayed in the activities window upon reception of that code.



DGC

The program modules of **BIRCS** don't communicate directly with the underlying radio hardware but use a middleware program DGC (Device Gateway Communicator) instead. Using specific radio device drivers DGC isolates the application programs from the communication details pertaining to the radios by creating a standardized interface towards the application software layer. This enables the application programs to remain in service unchanged even if the radio hardware is replaced by a new generation of devices only by exchanging a driver. DGC can communicate with the devices connected to it using serial (RS-232, real or virtual) or Ethernet interfaces. Any communication protocol imaginable can be implemented within a specific radio device driver. Such device drivers not only can be used to control physical devices, they also can be used to implement additional application specific data processing services if necessary.

