

DDE CLIENT

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ABSTRACT

DDE CLIENT is software that is suitable for fully real time automatic control of hardware in the satellite laboratory. This software controls hardware, which handle communication with satellites on low elliptical orbits. This makes communication much easier. The controlled hardware is the IF-100 aerial rotor and the transceivers YAESU FT-736, 840 and 847.

By using this software we eliminate the necessity to hand-operate the setting up of peripheral devices on the ground station. A possibility for remote control of PTT is included. Input data are taken from TrakSat [1] or WiSP [2] tracking software with the help of DDE link.

1 ANALYSES

Creating of this software was inspired by the already existing DDE CLIENT [3] for the WiSP program. Unfortunately, this software didn't support the hardware available in the satellite communication laboratory in the VUT, UREL department.

Primarily, I had to establish connection with the WiSP program and obtain so the input data needed for controlling the hardware. These are the data concerning azimuth and aerial rotor elevation as well as the frequency of transmission. Secondly, the obtained data were analyzed and transmitted to the hardware.

That is why it was necessary to create drivers for communication with aerial rotor and transceivers. I use for the communication serial and parallel ports of personal computer. These phases of development were completed successfully, and the program is used for managing the hardware in the satellite communication laboratory since the year 2000.

However, using this program I found out, that the data obtained from the WiSP program is not accurate enough. That is why it is more convenient to make use of the TrakSat software which also contains the DDE link. The TrakSat software provided me more complex data about the satellite that is just flying over. This software is still being improved. I made slight modifications of the DDE program and this program is now able to manage the hardware in the laboratory on the basis of the input data obtained from both the WiSP and TrakSat software.

Some other significant functions of the DDE CLIENT are:

- the possibility to switch into hand control position of single periphery,
- the choice of the peripherals that are managed manually,
- the review of current settings and status of particular peripherals (feed back for user),
- quick switch of transceiver drivers without the necessity to restart the computer or software,
- the possibility to scheme the following steps – the correction of the pre-set operations in a given date and time,
- the possibility to launch the PTT transmission through the driver of the transceiver, data pin 0 of the parallel port or through RTS/DTR pin of the serial port.

2 PRESENT STATE

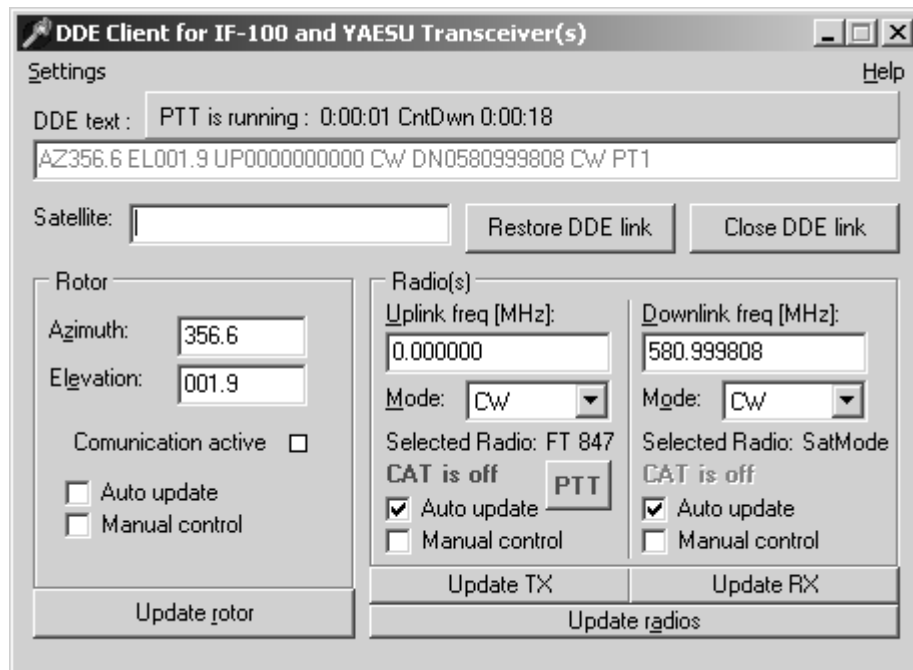


Fig. 1: *The DDE Client main window*

The figure No. 1 views the main window of the DDE Client on the end of the flight of the satellite. The transmission is activated and the “WatchDog” is running as well. Both software and documentation are written in English language which is more convenient in case of a remote access to the satellite communication laboratory.

3 AERIAL ROTATOR

When controlling the aerial rotator, a standard parallel port of personal computer and a specific data format, not included in the program documentation, are used. In order to explore this data format I used the program [8] and [9]. Program [8] is a rotor driver written for

MS-DOS operating system. It is resident program, which is arranged for sending the commands to the aerial rotor.

The data format of commands was analyzed when a link between two personal computers was established. One computer was sending the data, while the other served as a logic analyzer that sampled the data obtained from the parallel port. Thanks to this process I obtained a complete set of numbers for data serving azimuth and the elevation supported by aerial rotor.

The analyzed time sequence proved that:

- Aerial rotor communication is activated by setting \$08 bit for 1 value.
- bit \$02 is a clock pulse. A deeper examination proved that the aerial rotor reacts rising edge of the clock pulse and reads the value of the bit \$01.
- I obtained a complete table for control of aerial rotor.
- After a closer examination of the obtained data I derived the values to find out the parameter sent to the LPT port. These are:

$$b_{az} = trunc\left(\frac{angle.256}{360}\right) \quad (1)$$

The formula (1) is valid for the angles ranging $-180-180^\circ$, with the exception of $-180, -90, -45, 90$ and 180° , when you have to set the values gained from the analyzer.

$$b_{el} = trunc\left(\frac{angle.256}{180}\right) \quad (2)$$

The formula (2) is valid for the angles ranging $0-180^\circ$, with the exception of $45, 90$ and 135° .

With the help of the above-mentioned formulas and with the communication protocol I created a driver suitable for controlling the aerial rotor, which runs smoothly.

The aerial rotor driver requires setting the basic data. There is a dialog box in the program that serves for this purpose. The data that you have to set up are:

- Parallel port base address.
- An offset concerning azimuth and elevation in relation with the geographical position and basic placement of the rotor.
- The point of a minimal deviation concerning azimuth and elevation, which will cause that rotor is set in motion.
- The minimum elevation, needed to so that the rotor is tracking the incoming satellite.
- You can choose the delay between single communication bits in relation to the length of a cable.

4 TRANSCEIVERS

I enclosed documentation [11] to the transceivers containing the description of the communication process and the Computer Aided Transceiver (CAT) function.

Every type of transceiver contains different parameters. That is why I created an abstract basic object driver. This basic driver provides common functions for all derived drivers. With the help of object programming technology it is possible to switch the drivers quickly while the program is running. In addition, this set of drivers can easily be extended, if need to be.

The parameters in communication between the PC and the transceiver:

- The data are transmitted on the serial port; the transmission speed is 4800 bps or more.
- All the commands sent to the transceiver are made of 5 data bytes and the interval between them is 200 ms at the most.
- The last byte of these five is, in fact, the leading one. The other four are arguments of the command.
- The codes and values of the supported commands used in the program are mentioned in the transceiver user documentation [11].
- 5 specific bytes are used for conclude the communication. When the program is ended, the communication must be finished as well.

The particular drivers are protected from errors in setting the frequency mode.

The above-mentioned types of transceivers have the same algorithm for transforming frequency into 4 bytes. The accuracy of the setting is ± 5 Hz. However, the program requires a precise frequency parameter in Hz items for this transformation.

While using the drivers, it was found out that when the PTT command is sent by CAT, the microphone input, which is responsible for tuning downlink frequency, is out of order. For this reason, I enriched the program of the PTT switching with the data pin 0 of the parallel port or with RTS/DTR pin of the serial port. This PTT switch selection can be carried out in the transceiver setting dialog box. The quick switch of this function is possible when the program is running.

5 COMPATIBILITY

The program is compatible with operating systems Microsoft Windows 9x, Me, 2000, NT and XP. It may happen that that some applications impair the DDE link between DDE CLIENT and tracking software. In such cases we have to resume the link with the help of the Restore DDE link button, available in the program's main menu.

Considering the type of operations carried out in the satellite communication laboratory, I suppose that only the applications concerned with controlling the ground station will be running and no other ones. DDE CLIENT is fully compatible with all that applications. DDE CLIENT stable for a long period tested for several months.

6 CONCLUSION

This program is a useful and effective tool that makes good use of the above-mentioned hardware. Its abilities and newly added functions gave way to a perfect automatic collection of the telemetry of satellite Phase 3D. There is the possibility to switch into manual control if running an experiment or if a quick intervention is required.

At present is possible to fully control laboratory using Internet, due to combination of software TrakSat and DDE Client.



REFERENCES

- [1] MILLS, S. Program TrakSat. AMSAT, 2000
- [2] JACKSON, Ch. Program WiSP. AMSAT, 1998
- [3] MEDEROS, F. Program WiSP DDE Client.
- [4] RAIDA, Z.-DOLEŽAL, P. Objektově orientované programování v PASCALU. Skripta ÚREL FEI VUT Brno, 1997
- [5] CANTÚ, M. DELPHI 4. GRADA 1999
- [6] KAINKA, B.-BERNDT, H. Využití rozhraní PC pod Windows. HEL 2000
- [7] PETZOLD, Ch. Programování ve Windows. Computer Press 1999
- [8] GUELZOW, P. Program DB2OS, AMSAT 1991
- [9] RICHTER, R. Program Rotor-test, AMSAT 1993
- [10] BORLAND, Prostředí Borland Pascal 7.0, Borland International, Inc. 1992
- [11] YAESU, Uživatelská dokumentace k transceiverům FT-736, FT-840 a FT-847
- [12] Teixeira, S.-Pacheco, X. Borland Delphi – průvodce vývojáře II-IV, Unis publishing, 1998
- [13] BORLAND, Vývojové prostředí Borland Delphi 4, Borland International, Inc., 1998