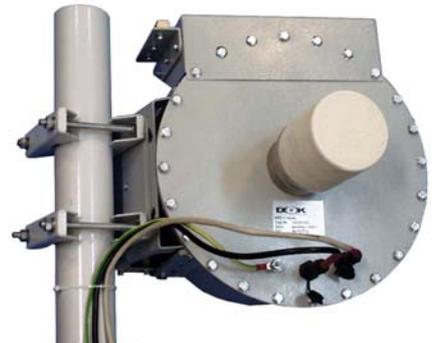


City-A

Fast Ethernet MM-wave Radio of Point-to-multipoint Topology

- **200 Mbps total Capacity**
- **Non-collision operation**
- **Fast Ethernet interface**
- **Secure communication**
- **Carrier Class QoS (Quality of Service)**

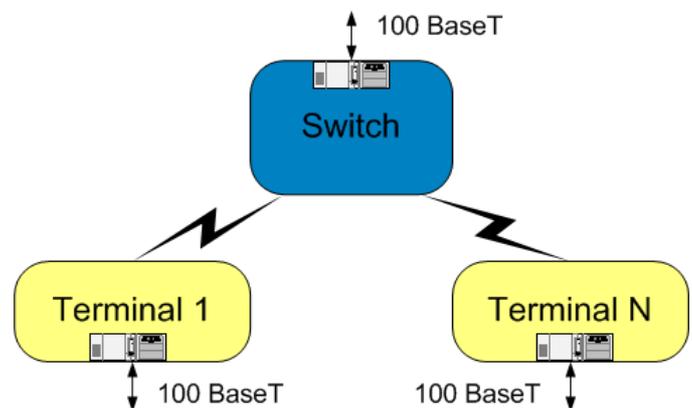


City-A was designed to construct wideband IP-networks in urban areas. City-A is operating in 40.5-43.5 GHz band, allocated in EU for broadband communications.

How it works

City-A set consists of Switch and Terminals. The Switch is deployed on height dominating building. Terminals are deployed on line-of-sight positions within Switch service area. One terminal can serve a bunch of offices, apartments, houses etc.

City-A operates like a Fast Ethernet Router. IP-packets, incoming to Terminal, are forwarding to Switch or, via Switch, to Terminal front-end. IP-packets, incoming to Switch, are forwarding to Terminal of destination.



Interfaces

Both Switch and Terminals have Fast Ethernet interfaces. They can be connected to any network equipment directly.

Capacity

Downstream channel (Switch to Terminals) capacity is 100 Mbps. Total upstream channel capacity (Terminals to Switch) is 100 Mbps as well. There are no collisions in City-A system. The losses for system management in downstream are less than 0.5%, in upstream – less than 10%. So, the real City-A capacity is about 200 Mbps independently on any external circumstances.

Non-collision operation is provided by the following:

1. Downstream and upstream are operating in different frequency bands. Downstream capacity does not depend on the upstream channel load and vice versa.
2. Terminal dishes have very small beamwidth (0.7° to 2°). The data transmitting from one Terminal does not affect on the data receiving by other Terminals.
3. To eliminate collision at Switch receiver, all Terminals transmits in TDMA mode, one after another, according to instructions issued by Switch. Period and duration for any Terminal is assigned during the system configuration or automatically.

Secure communications

Is provided by 2 factors:

1. It is very difficult to find 40.5-43.5 GHz equipment on the market for spy data trapping.
2. Due to very small Terminal beamwidth (only 2 times more than in laser free optical systems) the data interception, even having appropriate equipment, is as difficult as in optical systems.

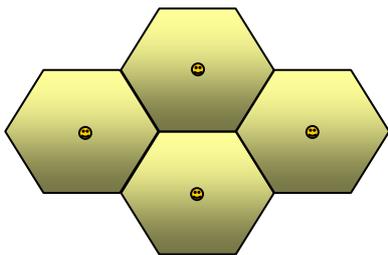
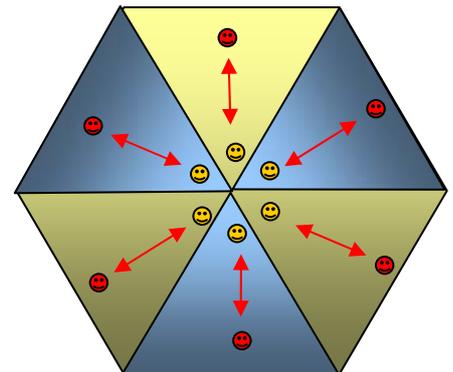
QoS

City-A was designed to provide a necessary quality in IP-phone communications. Downstream delay is less than 1 ms. Upstream delay is 0.5 .. 1 ms per operating Terminal.

Complex network topology

An Operator can deploy a number of City-A systems on the same territory.

City-A Switch is completed by 30, 45, 60 or 90° sector antenna. Accordingly, the operator can deploy 4, 6, 8, or 12 Switches in the same point (to eliminate interference, different polarizations are used in adjacent sectors). So the total network capacity can be increased up to 1.2 Gbps, full duplex.



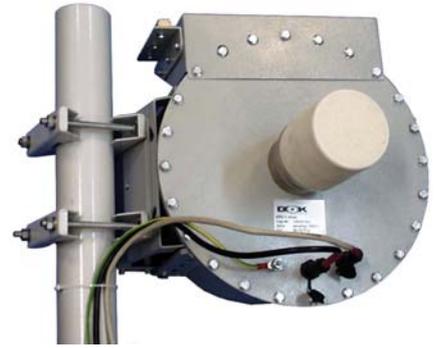
To connect more terminals or cover wider area, several cells can be deployed.

City-A components

City-A is designed based on 2 key components: Switch and Terminal.

The Switch consists of ODU and IDU. The ODU is a transceiver with sector antenna. IDU is built on the base of computer and installed in the office. ODU and IDU are connected with «twisted pair» cable.

The Switch IDU can be connected to Internet router, Billing&Authorization system etc.

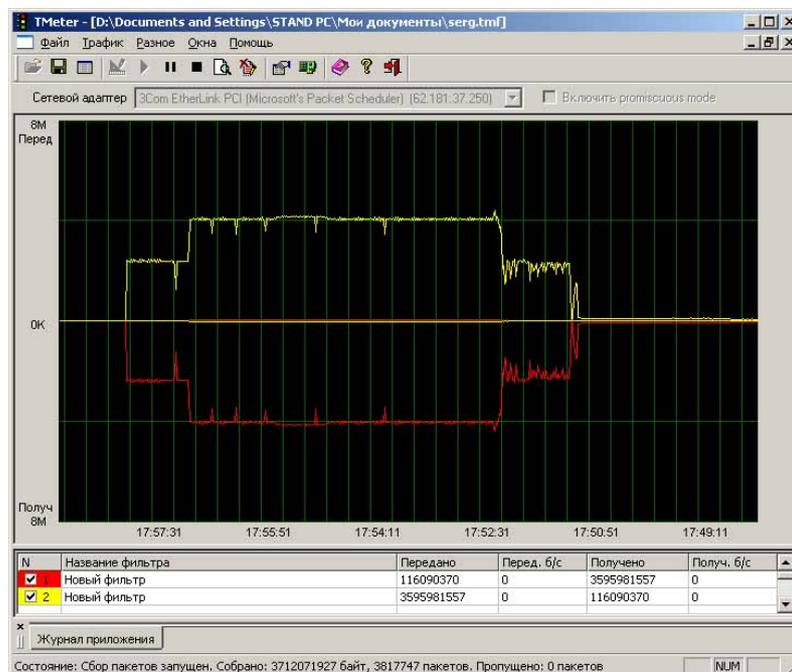


The Terminal is also consists of ODU and IDU, connected to each other by «twisted pair» cable. Terminal IDU is connected directly to LAN.



Capacity examples

The best way to demonstrate the system capacity – to transmit a file from the LAN, connected to one Terminal, to the LAN, connected to other terminal of City-A system. Here you can find how 2 movie files 700 MB each were transmitted. Upstream channel was split among both Terminals in equal parts (50 Mbps). Source and destination computers were run under WinXP, QoS was not off.



Phone communications in City-A

For phone communication, operator can use VoIP technology. Operator can also transmit E1 streams encapsulated in IP. It was demonstrated in actual tests that more than 20 non-compressed and more than 160 compressed E1 streams can be transmitted in City-A.

Software

Embedded software is operated under Linux both in Switch and Terminal IDUs. It provides:

- TDMA mode in data transmission from Terminals
- Terminal transmitter's dynamic power control to equalize a signal, received on Switch
- Automatic registration of Terminal, switched on
- Automatic stop of polling the Terminal, switched off

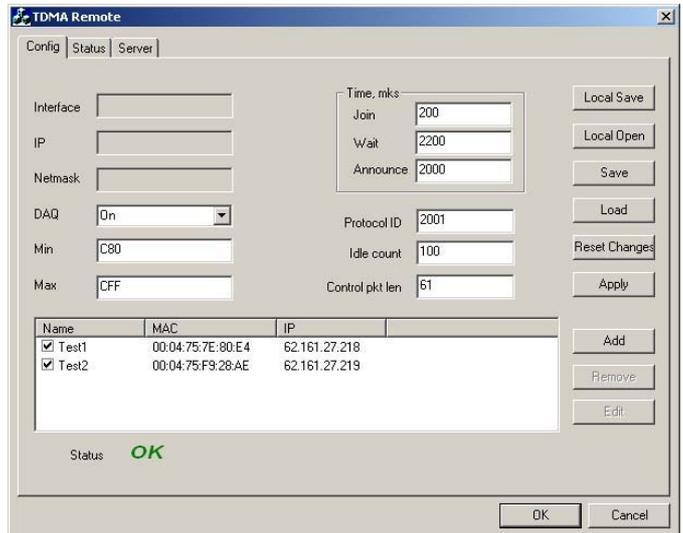
Monitoring and control are executing under TDMARemote software operating on any Windows-computer, having network access to the Switch. It provides:

Set up parameters of upstream channel TDMA

Set up parameters of Terminal transmitter's dynamic power control

Authorize Terminals

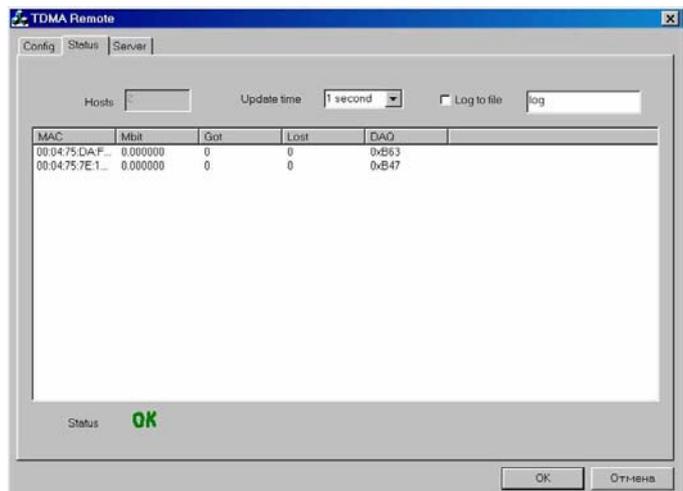
Disconnect Terminals



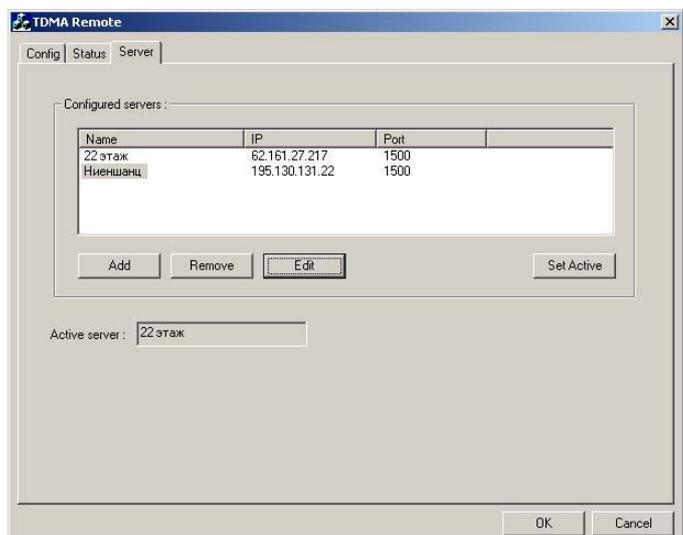
Monitor the Switch and Terminals

Logging the system to the file

Turn the Test mode to check the upstream and downstream channels quality



Monitor different City-A systems



City-A datasheets

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System assembling and setup

Operator can deploy and set up the system on his own. He need to:

- fix Switch and Terminals ODU on vertical pipes, connect them to power source and to IDU
- direct Terminal antennas on the Switch transmitter
- assign IP-addresses to Switch and Terminal front-end interfaces
- create a Terminal list and configure TDMA parameters using TDMARemote software
- test upstream and downstream channels quality using TDMARemote

Specification

<i>Frequency range</i>	<i>40.5-43.5 GHz</i>	<i>Sectors in the cell</i>	<i>4, 6, 8, or 12</i>
<i>Frequency band</i>	<i>500 MHz per channel, 1.5 GHz duplex separation</i>	<i>Terminal antenna diameter</i>	<i>30, 45, or 60 cm</i>
<i>Downstream capacity</i>	<i>100 Mbps</i>	<i>Cell radius (90° sector, 5 mmph rain rate)</i>	
<i>Upstream capacity</i>	<i>100 Mbps</i>	<i>30 cm Terminal antenna</i>	<i>1.9 km</i>
<i>Operation mode</i>	<i>Full Duplex</i>	<i>60 cm Terminal antenna</i>	<i>3.1 km</i>
<i>Maximum number of Terminals</i>	<i>unrestricted</i>	<i>Environment</i>	<i>-45 °C to +50 °C</i>
<i>Maximum number of Terminals in VoIP</i>	<i>150</i>	<i>ODU Power</i>	<i>54 VDC, 2 A</i>
<i>The Switch sector width</i>	<i>90, 60, 45, or 30°</i>		