

## **INFORMATION SYSTEM CREATION**

### **Experience of Uzbekistan Customs**

The Customs' information management system in the Republic of Uzbekistan is referred to the class of administrative type global systems. Big volumes of stored, transferred and processed information, as well as centralized information management are the typical characteristics of such system. Here, requirements to information accuracy, completeness and efficiency together with ensured high level of data security are critical for the system.

Unified Automated Information System (UAIS) of the State Customs Committee of the Republic of Uzbekistan (UZB SCC) was designed to implement the idea of the staged creation and development of a unified information space for the Customs Administration of the Republic of Uzbekistan. Here, simultaneous and efficient access by all Customs Administrations of any level to an integrated database, as well as opportunities for online receipt, amendment and analysis of required information would be ensured.

Key objectives in the establishment of UZB SCC's UAIS are the following:

- creation of an integrated multi-user database of UZB SCC's UAIS using modern technologies of Data Warehouse and Data Mart;
- development of a Web-based application software for the UAIS, which would cover all principle areas in the Customs activities at all levels (lower, middle and upper levels);
- development of data analysis and decision-making support facilities (DMSF) based on OLAP technologies (On-Line Analytical Processing for multivariate presentation and analysis of data);
- creation of a cluster server system for ensuring a required level of system reliability and survivorship;
- implementation of data replication technologies between servers of databases of UZB SCC Head Quarters and servers of Regional Customs Houses;
- integration of UZB SCC's UAIS with information systems of a number of ministries and agencies based on XML (Extensible Markup Language) standard;
- ensuring access to UZB SCC's information resources by stakeholder-ministries and agencies, as well as by legal entities and private individuals based in EDIFACT (Electronic Data Interchange for Administration, Commerce and Transport) standards;
- organization of storage of the UAIS's archival data based on LTO (Linear Tape Open) standard.

UZB SCC's UAIS is designed for automation of the following key functions of the Customs:

- maintenance, update and delivery of Regulatory and Reference Information (RRI) related to a specific industry to the Customs within the Unified System;
- informational control over office workflows and over implementation status of directions given by the Government and UZB SCC's management;
- maintenance and publication of quarterly and annual statistics on external trade;
- performance of efficient quarterly monitoring reviews of imports for the leadership of the Republic;
- maintenance of up-to-date statistical analytical data;

- maintenance of comparative (mirror-image) statistical data on foreign trade with counteragent-countries;
- analysis of customs tariff efficiency;
- information control over accuracy of declared customs value;
- maintenance of customs statistics on non-trade turnover;
- clearance of transport vehicle passports and maintenance of customs statistics on cleared motor vehicles of private individuals and legal entities;
- maintenance of specialized customs statistical data on standard reporting forms (forms 1n, T-6, f.1, f.3 and other);
- control over goods delivery according to internal transit procedure;
- centralized control over accuracy of charging and over complete collection of customs revenues in the public budget;
- control over clearance of liabilities on customs payments;
- control over actual provision and use of customs tariff preferences;
- control over availability and movement of seized goods;
- export customs-banking currency control;
- import customs-banking currency control;
- barter customs-banking currency control;
- maintenance of customs statistical data on customs rules offenders;
- ensuring remote access by operational subdivisions to information on participants of foreign economic activity and incompliant traders;
- customs clearance in non-trade turnover;
- customs clearance of goods;
- information for management of the UZB SCC's financial resources;
- information system for control over availability and movement of the Customs human resources;
- information for organization of external relation of UZB SCC;
- control over temporary importation and exportation of goods based on TIR Carnets;
- locating undelivered cars based on direct interaction between UZB SCC's Computer Center and Ministry of Transportation's Central Computer Center
- control over delivery of imported motor vehicles of private individuals;
- monitoring availability and movement of goods in bonded warehouses and customs warehouses;
- constant monitoring over user actions and performance analysis with regard to user application of the UAIS provided features;
- ensuring security and protection of the UAIS information; and
- other.

Starting from 1 October 2003, one of UZB SCC's UAIS subsystems, called "Unified Electronic Information System for External Trade Operations" (UEIS ETO), has started operation.

The UEIS ETO is a modern and international practices based system, which provides for informational interaction between all ministries and agencies of the Republic of Uzbekistan, which are responsible for registration and performance monitoring of foreign trade contracts.

The UEIS ETO is the Republic's first interagency information system, which is currently unique in Uzbekistan. The UEIS ETO's database consolidates and stores complete information about foreign trade operations, - starting from contract registration information, - received from all involved ministries and agencies. Currently, the UEIS ETO ensures the informational interaction between 6 ministries and agencies of the Republic of Uzbekistan. The system allows for increasing the number of participants at any stage of the system development.

The UEIS ETO is a multifunctional instrument of information transmission, exchange, processing and storage, which provides for distributed and remote access. The system supplies online to a user any analytical and reporting information about concluded contracts, contract registration, goods shipments, monetary transaction under the contracts and information about persons concluding the contracts.

When selecting and developing system and application software, a special attention was given to the issues of stability and safety of the system operations, and to its scalability.

The UEIS ETO software complex is implemented on IBM iSeries (AS/400) server.

Database Management System (DBMS) DB2 is used as data warehouse, and Lotus Domino is used as integrating software or "interlayer software". Program modules are implemented based on Java, LotusScript, JavaScript, @Formula and SQL.

The database can store any types of data, starting with ordinary text, digits, time and dating information, and ending with formatted text, graphical images, audio and video data and arbitrary data, which can be stored as attached objects in their native format.

Due to integration of hardware and software, iSeries also has DB2 64-bit relational database. Based on assessments by independent experts, the DB2 family is a most prevalent and popular database type in the world. Any iSeries system always contains a database. The database is built in hardware and in operational system, which allows for enhancing significantly its performance and ensures high reliability.

One of special features of iSeries is scalability, which can be implemented based on created Logical Partitions and integrated PC-servers (xSeries). Using this feature allows for allocation of various platforms (Windows, Linux, AIX, i5OS) on one Server, which would simplify significantly the integration of iSeries servers with any existing system, and the function of dynamical allocation of resources between platforms would allow for maximum efficient employment of all resources of the server.

In case when one of the member-countries uses only Windows-based software, the iSeries server will integrate a PC-server, which can operated such software with no problem, and converters will be created for dataflow from existing DB to the member-countries' unified database and vice-versa, which will not create stress for existing internal servers. All issues related to authorization and reporting would be addressed on an inward database.

The issue of DB reliability is addressed by internal duplication of units (starting with mirroring of hard disks and ending with duplication of data transmission buses), journaling and logging, and creation of a backup copy at tape library.

All applications, with no exception, operating at iSeries, are 64-bit applications.

When developing the system, the Domino and iSeries safety systems were used in full volume. To ensure a highest level of reliability and protection from data loss, the Domino object warehouse applies best algorithms of transaction journaling or logging.

Due to the existing requirement to ensure data security in the UEIS ETO and due to a stricter control established for login, the UEIS ETO has strengthened the authentication requirements and is using improved methods for authentication through application of electronic identification and encryption units.

To ensure a secure access to the system, a digital certificate is used, which is logged on individual token for each user of the system.

The principal purpose of token is to ensure authentication of a user when accessing protected resources and to ensure secure storage of passwords for login, encryption keys, digital certificates and any other secret information.

Currently, a USB token is provided to each registered user of the UEIS ETO.

The hardware and software platform of the iSeries server allowed for the creation within a short period of time of a system complying with international modern information technologies and has increased productivity of application software developers. Simplicity in use, high level of reliability of the software made possible within a relatively short amount of time to master and introduce the system into operation.

The soft and hardware platform selected for the development, allowed for trouble-free enhancement of the UEIS ETO and software upgrading on a staged basis without interruption of the UEIS ETO operation.

Based on requirements to the unified information space system, firstly requirements in the area of reliability and protection of the information, and considering that UZB SCC already has experience in the operation of IBM iSeries server systems, an optimal option for server platform would be application of IBM servers with iSeries advanced architecture.

When developing the software, the following can be used:

**For platform of demand assigned data exchange:**

- IBM WebSphere Application Server v6 – as an application server. IBM WebSphere is a leader in the area of application servers in J2EE specification, and many operational servers are supported by this product;
- IBM DB2 UDB v8 – Database Management System (DBMS) server, the most high-speed and fault-tolerant DBMS server in the world, also a leader in operational systems support;

**For platform of data exchange by subscription for sending attached files:**

- IBM Lotus Sametime 6.5.1 – message and mail processing system.
- IBM DB2 UDB v8 – DBMS server, the most high-speed and fault-tolerant DBMS server in the world, also a leader in operational systems support;

**For platform of data exchange by subscription for sending attached files and command:**

- IBM WebSphere Application Server v6 – as an application server. IBM WebSphere is a leader in the area of application servers in J2EE specification, and many operational servers are supported by this product;
- IBM DB2 UDB v8 – DBMS server, the most high-speed and fault-tolerant DBMS server in the world, also a leader in operational systems support;

- IBM WebSphere MQ – message queue server, the only message queue server for almost all servers in the world, which makes it absolutely platform-independent.

### **Organization of Informational Interaction between the UAIS Components**

UZB SCC's has a system of subdivisions, which is referred to the class of territorially distributed networks of national scale. Subdivisions of Regional Customs Houses (RCH) are territorially scattered and mostly located at a fairly long distance not only from a RCH, but also from locations with available public telecommunication network facilities.

Satellite communication technologies are used in the UAIS as a principal option for the development of a Data Transmission Network (DTN). While having comparable costs for lease of landline facilities and satellite communication channels, the satellite communication option allows to roll out the UAIS's DTN and to connect all subsystems to the UAIS within a very short period of time. Here, a required level of redundancy on existing DTN at the level of UZB SCC's provincial subdivisions and major customs posts can be accomplished, given that existing DTN is based on inter-switch trunk connections between digital ISDNs of telephone exchanges.

The satellite option allows to bypass the landline infrastructure and to establish direct connections between users and data processing centers through the server. When applying the satellite layer, providing for IP data transmission, the provision of improved services with a decreased time of network respond is ensured.

For implementation of global corporate networks via satellites, Time-Division Multiple Access (TDMA) technologies by VSAT are widely used. Wideband VSAT system with demand assigned bandwidth is a bidirectional system for corporate networks, which ensures higher efficiency and higher speeds of data transmission compared to other TDMA systems.

This technology combines wideband access and high-speed backward channel to satisfy requirements of applications using intensively the bandwidth by using IP data transmission via existing fixed communication Ku band satellites.

Dynamical allocation of carrying capacity together with Quality of Service (QoS) function and TCP acceleration make such a system more efficient and faster compared to other VSAT systems. Such combination of functions automatically increases speed of backward channel, ensuring a required carrying capacity. Given high speed of data transmission, the backward channel has capacity for speedy transmission even of large multimedia files.

VSAT station based DTN has a number of features, which can ensure efficient operation of the UAIS:

- Direct, – by single satellite bounce, – connection between network nodes;
- High channel efficiency (>95%);
- Regulated channel transmission speeds, allowing for the following:
  - To meet more precisely carrying capacity demanded by network node;
  - To provide communication channel to several nodes simultaneously;
  - To adapt to changing load environment.

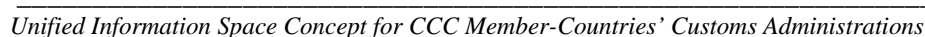
Such system decreases significantly costs and ensures substantially better characteristics of the system and better user services. By integration of the routing function with IP schemes with demand assignment bandwidth, the equipment costs can be decreased. Unlike fixed communication channels of landline networks, IP connections spring up and vanish based on

For building the UAIS's DTN, the option of satellite communication with use of carrier multiple access technology (TDMA/DAMA) was selected, which is capable to ensure an efficient operation of data and voice transmission application for the operational monitoring and control system.

The network nodes are built using modular hardware, which is the same both for the hub and for remote stations.

User channels operate at speed from 64 to 512 Kbit/sec. In general, the used technology and hardware allows for ensuring band on demand (BoD) up to 2 Mbit/sec, arranging networks with star, full mesh, hybrid and broadcast architecture, and ensures flexible adjustment of the network carrying capacity depending on radio signal propagation environment. Maximum number of stations in the network is more than 10.000.

The technology relies on multifrequency TDM/DAMA technology (more than 256 carriers) with aggregate speed from 32 Kbit/sec to 5 Mbit/sec. Data transmission interfaces used: Ethernet (IEEE-802.3), 10/100 BaseT (RJ-45). Voice transmission interfaces used: FXO/FXS (RJ-11)



## Network Management

Management of the satellite segment of the network is carried out on a centralized basis by specialized software. The network management center is organized based on a workstation located in the Control and Monitoring Center. The management system ensures the following:

- Registration of VSAT terminals in the network
- Network topology management
- Management and redundancy of carrying capacity for each terminal and for the network as a whole
- Monitoring of the network nodes performance and generation of messages about potential faults.

## Network Security Facilities

Security of the VSAT network against unauthorized access is ensured based on the following:

1. Elimination of unauthorized addition of a station to the network without prior registration of its unique parameters in the management system. Each station of the network is to be unambiguously identified in the network by the following parameters:
  - Station unique identifier
  - Station MAC address
  - Station IP address

At attempt of unauthorized addition of a station to the network with already existing parameters, both newly added and already existing, such station will be automatically disconnected with a notification to the network administrator.

2. Automatic compression and encryption of channel traffic using adapting encryption technologies.
3. Impossibility to listen and decrypt the traffic without prior registration in the network.

## Benefits of the Solution

**Flexibility.** Provides for building of a full mesh network with dynamical on-demand reallocation of carrying capacity of communication channels and with features for automatic reconfiguration and redundancy, which are unfeasible at a network based on fixed landline channels.

**Cost Efficiency.** General shared carrying capacity of the network is used on demand. There is no need for round-the-clock lease of fixed communication channels with excessive carrying capacity.

**Rapidity of Roll Out.** The whole network can be rolled out within a limited period of time, which can not be accomplished when using landline facilities.

The network consists of 82 customs post of the SCC, 15 remote stations of Regional Customs Houses and one central Hub (see Chart N001).

Due to the full mesh architecture of the network, each remote station has features for direct communication with the Hub and any other remote node of the network.

Ethernet is used as interface for these VSAT stations.

## Description of the Solution

To build the network, STM SOLANTE product line is used. SOLANTE platform is a satellite network based on DAMA technology, which ensures universal services for voice traffic and data traffic. SOLANTE supports full mesh architecture in combination with Demand Assignment Multiple Access for satellite connections. SOLANTE platform is optimized for use of satellite bandwidth assigned for the network with minimum costs on network operation servicing.

The Hub in the Monitoring and Control Center is equipped with a centralized network management system. The management system consists of two subsystems: Network Management System (NMS) and Network Control Terminal (NCT). NMS is built based on a workstation with installed management software by STM Company, where the software performs all network control and monitoring functions. It also manages the bandwidth allocation for all network nodes regardless of a used type of communication topology – star or hybrid. NCT allows NMS to transmit and receive messages to/from remote nodes through TDM/TDMA routed dedicated signaling channels. All remote nodes use these channels for responding to requests by NMS (performance status etc.) or to demands for allocation of the satellite resource.

Data transmission demands given to remote stations and to the Hub can be satisfied due to flexibility and modularity of Solante platform. Below described are 3 independent modules available in Solante line of products.

**SOLANTE™ VOICE** includes products for multichannel voice transmission both with outdoor and indoor options. Each module can serve up to 4 lines with various analog or digital interfaces. These modules can be cascaded to meet the requirement to specific number of interfaces on each remote node. Each module can be connected with regular telephone units, fax machines, dial-up modems and UATE. Connections are established on demand after analysis of a dialed number and discontinued after call completion.

**SOLANTE™ CONNECT** integrates in SOLANTE™ product line the combined SCPC – DAMA platform for data transmission. Each module can serve data transmission at speeds up to 2 Mb/sec and is mostly used for high-speed applications, such as trunk channels, video conferences, Intranet networks and many others. Connections are established on demand at occurrence of user traffic and discontinued in case of user inactivity. NMS controls the established data transmission channels on a centralized basis.

**SOLANTE™ ONLINE** ensures additional IP terminal port. This allows a service provider to offer voice services with additional feature of low cost data transmission using TDMA backward channel technology. SOLANTE™ ONLINE products can support the transmission speed of 40Kb/sec for applications not requiring high transmission speeds and requiring only voice transmission. Such applications can be banking networks, applications serving retail sales and other services, which are based on transaction processing. Additionally, this configuration can be superposed with a high-speed broadcasting channel based on DVB technology for ensuring operation of duplex broadband multimedia applications.

Considering requirements to data transmission speed, a solution based on SOLANTE CONNECT technology is used, which, as distinct from SOLANTE ONLINE, ensures data transmission at speeds from 32Kb/sec to 2Mb/sec within given network configuration. Solante Connect equipment can be configured to support symmetric and asymmetric data transmission between 2 remote stations (and in the same way between the Hub and remote station). Besides, Solante Connect uses satellite SCPC channels, which guarantee that full channel capacity will be available and allocated for a data transmitting channel.

**Demand Assigned Multiple Access (DAMA):** Based on VSAT stations Solante multimedia network technology applies the method of dynamic bandwidth allocation. At traffic occurrence, the channel is established based on carrying capacity allocation rules, which are established by



the control terminal. When the channel is not required any more, its released capacity will be turned back to the free satellite resources pool for consequent use by other nodes of the network.

**Simultaneous Full Mesh Communications:** Full mesh communication ensures not only the opportunity for employing several gateways, but also the opportunity for using appropriate diameter of antennas (depending on satellite characteristics), direct connection between remote nodes to ensure direct voice transmission and video conferences. Full meshing for voice and video conferences is important when it is necessary to minimize costs during communication between two remote notes. Here, the control terminal can establish and manage calls between several stations simultaneously.

**Dynamic Data Bandwidth Allocation:** Terminal can allocate a bandwidth between voice and data inside common COMF-TDMA channels. This means that full carrying capacity of the channel can be allocate for data, then reallocated temporarily for voice transmission for duration time of a telephone call, and afterwards again be reallocated to increase carrying capacity of the data transmission channel.

**Traffic Channel Transmission Efficiency:** STM Company has developed on specific features of implementation of high-quality satellite communications for dynamical data access with a very efficient use of satellite bandwidth. These features allow for decreasing costs of monthly lease of satellite transponders owing to delivery of convenient services for users. This technology by STM is called Connection Oriented Multi Frequency Time Division Multiple Access - COMF-TDMA.

**Scalability:** In today's environment, when used applications and data content, users' demands and their generated traffic are in the process of constant change, the opportunity for enhancing a network to meet increasing demands becomes the issue of special significance. Originating here from, there is the requirement for products modularity and for availability of features for nonstop adding of these products to the network. The STM solution allows for easy network expansion both in part of transmitting channels and in part of receiving channels. Moreover, when needed, supplementary functions can be added, such as voice, high-speed data transmission channels, DVB or additional carrying capacity of the network. None of other comparable products by other manufacturers has such high degree of modularity and flexibility as the solution by STM.

**Product Quality Through Experience:** Solante multimedia product platform uses the most advanced VSAT technology by STM Networks Company. Hardware is specially designed for operation in conditions of scarce electrical energy resources (for instance, using solar energy converters) and in conditions, when humidity and temperature control is unfeasible (hermetic outdoor modules).

## **Nodes Configuration**

### **Hub**

In addition to data transmission modules, which are common for all nodes, the Hub is equipped with Network Management System (NMS) and Network Control Terminal (NCT). NMS consists of a workstation connected to NCT. NCT is configured with general access control channels for transmission of controlling and managing messages. NMS ensures all functions required for the network initiation, network management, as well as operational and recording functions.

Before any 2 stations establish a connection between each other, all requests for bandwidth allocation will be processes by the management system on a centralized basis. Connections between remote stations are performed according routing tables, which are created by NMS.

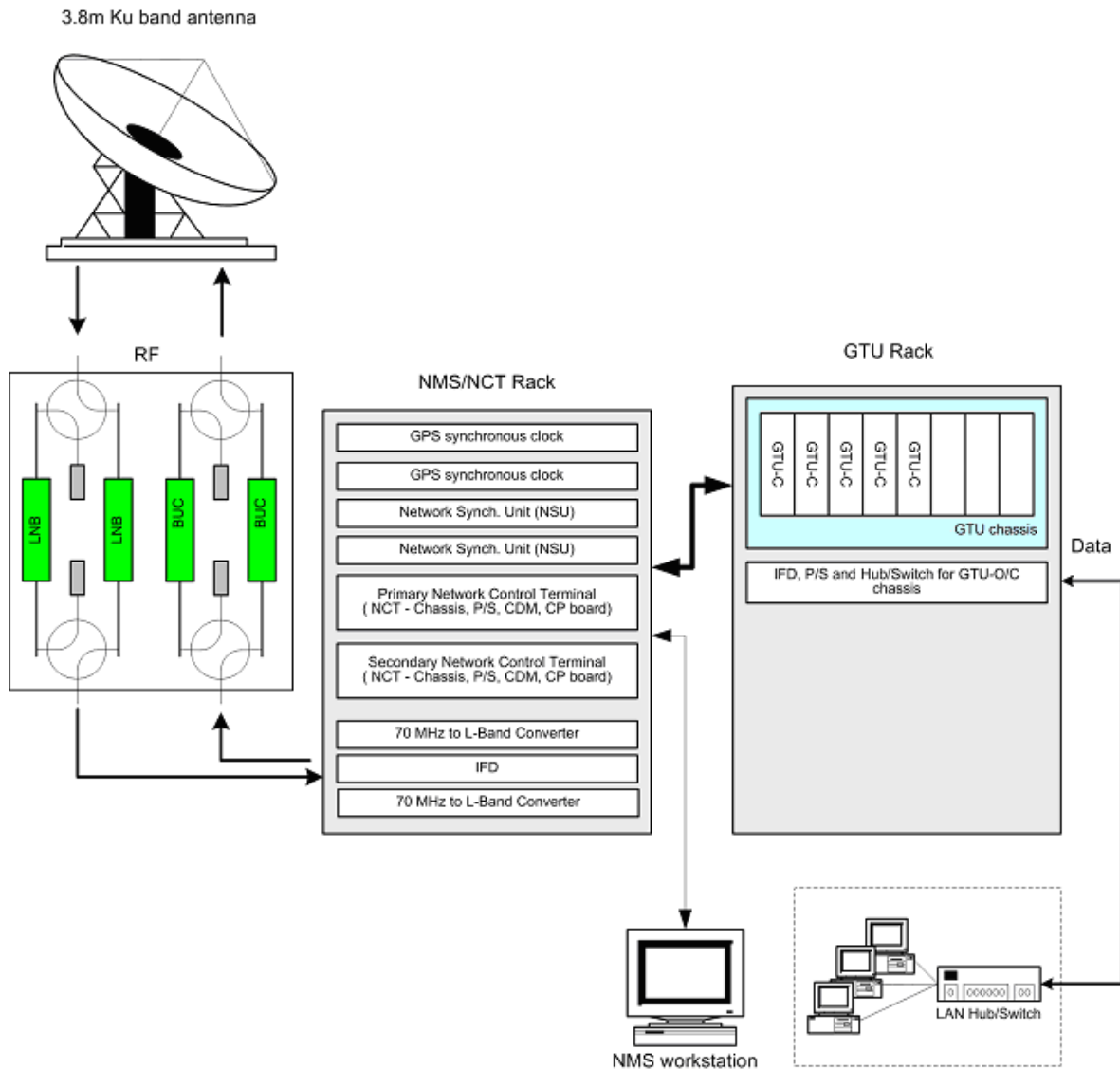
To meet the requirements of high level of fault-tolerance and survivorship of the project, NMS and NCT are backed-up by a fault-tolerant configuration. In case of fault of a primary NMS or NCT, a standby system, which functions in the mode of nonstop version tracking of the network

configuration (hot standby), is capable to start within less than 15 seconds, which guarantees a minimum time of disturbance in the network operation.

In addition to the above described, the Hub is equipped with the following equipment:

- One 3,8 Ku band antenna;
- One 8W Ku Band outdoor BUC and required units for band conversion;
- 5 SOLANTE CONNECT modules with one Ethernet interface each, connected to the primary network Control Terminal.

Picture below illustrates the Hub configuration:



Picture 1. Hub Configuration

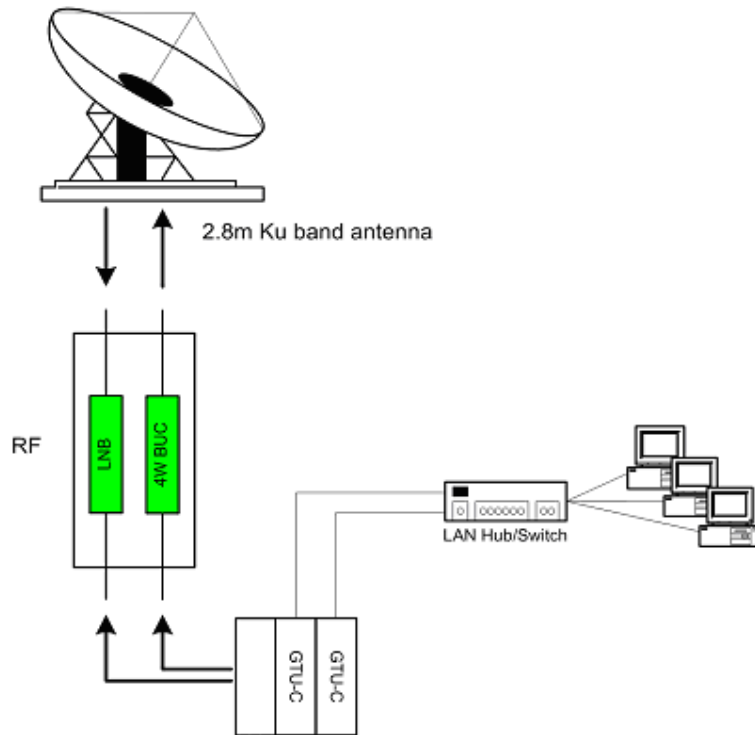
### Remote Station of Regional Customs House

Fourteen remote stations are fully identical and equipped with the following:

- One 2,4 Ku band antenna;
- One 4W outdoor BUC and required units for band conversion;

- 2 SOLANTE CONNECT modules with Ethernet interface each, connected to Regional Customs House network.

Picture below illustrates a remote station configuration:



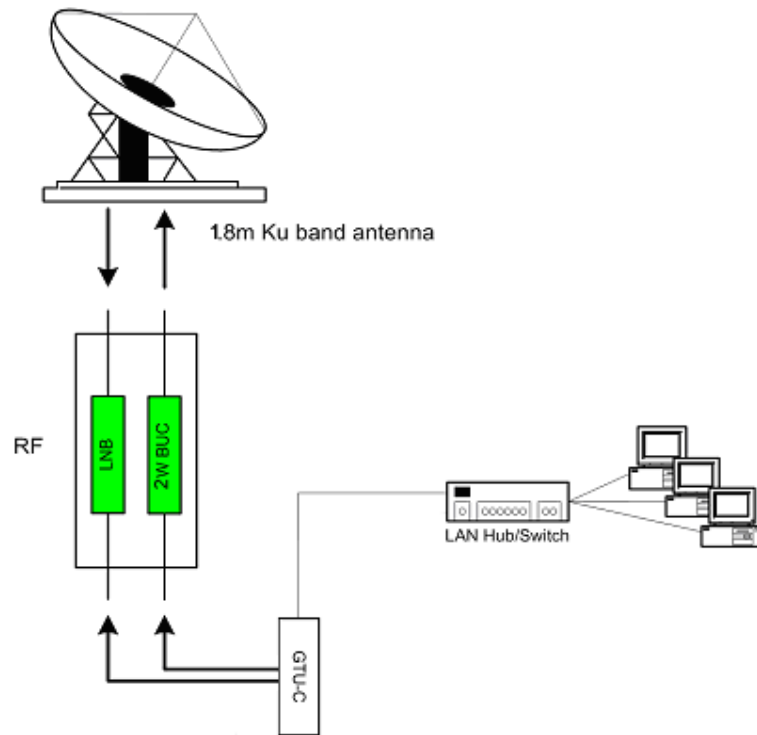
*Picture 2. Regional Customs House Remote Station Configuration*

### **Remote Station of Customs Post**

Structure of remote stations of Customs posts corresponds with the structure of Regional Customs House stations and contains the following:

- One 1,8 Ku band antenna;
- One 2W outdoor BUC and required units for band conversion;
- 1 SOLANTE CONNECT module with Ethernet interface connected to local network of Customs post.

Picture below illustrates Customs post remote station configuration:



*Picture 3. Customs Post Remote Station Configuration*