METHODS OF IDENTIFICATION OF ALARM SIGNALS, USED IN DETECTION SYSTEMS IN THE RUSSIAN FEDERATION

REPORT by

Director General of "Techsin" LLC

Ph.D. Vladimir S. Pertsev

Magic Maggiore: Technical Reachback Workshop

March 28-30, 2017, Ispra, Italia

SYSTEM OF AUTOMATED CONTROL OF TRANSPORT (SACTR)

One of the most important directions of fight against terrorism, including, nuclear and radiological terrorism, is development of the preventive measures focused on detection of illegal transportations of NM, RM and other dangerous substances and materials by different types of transport.

The comprehensive system of automated operating, continuous and objective control of transportation of NM, RM and other dangerous substances and materials and the products that contain them (SACTR) is developed for implementation of these measures in Russia.

SACTR includes a complex of the control equipment, service personnel and employees of special forces, set of organizational measures and means of program technical supply which functioning is carried out in unified legal and information space and is directed to counteraction to illicit trafficking of nuclear and radioactive materials and other dangerous substances and materials, to fight against acts of terrorism using different types of weapons of mass destruction.

THE GENERAL SACTR ARCHITECTURE WITH REGARD TO MONITORING OF NUCLEAR MATERIALS AND RADIOACTIVE MATERIALS

Subjects of monitoring – the radioisotope sources (RS), the nuclear materials (NM), radioactive waste

Land ways
(commercial, private, military transportations)

- Automobile transport, railway transport, including subway
- pedestrian boundary checkpoints
- luggage terminals
- cargo terminals

Sea ways
(commercial, private, military ports)

- passenger terminals
- ports of shipment of containers
- ports without containers shipments,
- ports for small sea vessels
- coastline

Air ways
(commercial, private, military airports)

- commercial passengers traffic
- commercial cargo traffic
- non-commercial traffic

Postal services
(state and private)

- Interoffice mail
- International mail

Primary objectives

Detecting of the objects of control:
- In cities
- At public events
- In places of freight handling
- At checkpoints

Reporting

about the elicited facts at:
- Air transportation
- Navy transportations
- Land transportation

TECHNICAL MEANS

Stationary

For control of:
- people
- vehicles
- railway cars and load platforms

Portable

- spectrometry
- radiometry
- dosimetry

Radiography

Active and passive control with gamma, neutron, X-Ray and terahertz radiation

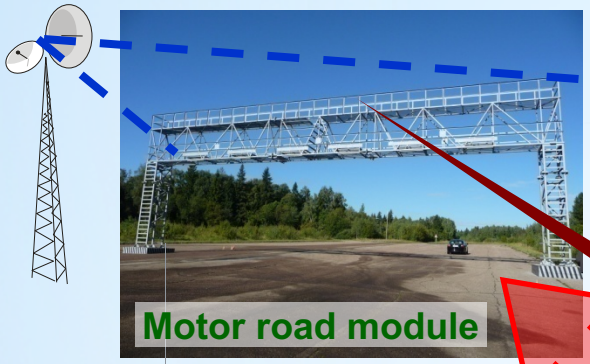
Identification and tracking of vehicles and cargos

- Radiofrequency identification

THE GENERAL STRUCTUR AND FUNCTIONAL DIAGRAM OF THE SACTR

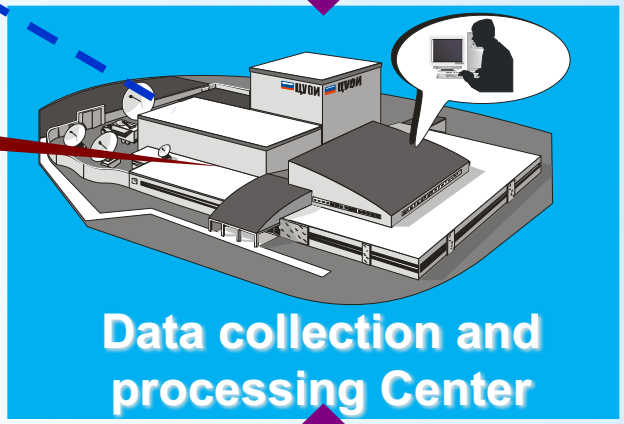
GICNT

ТЕХСИН



GLONASS

Operational control center



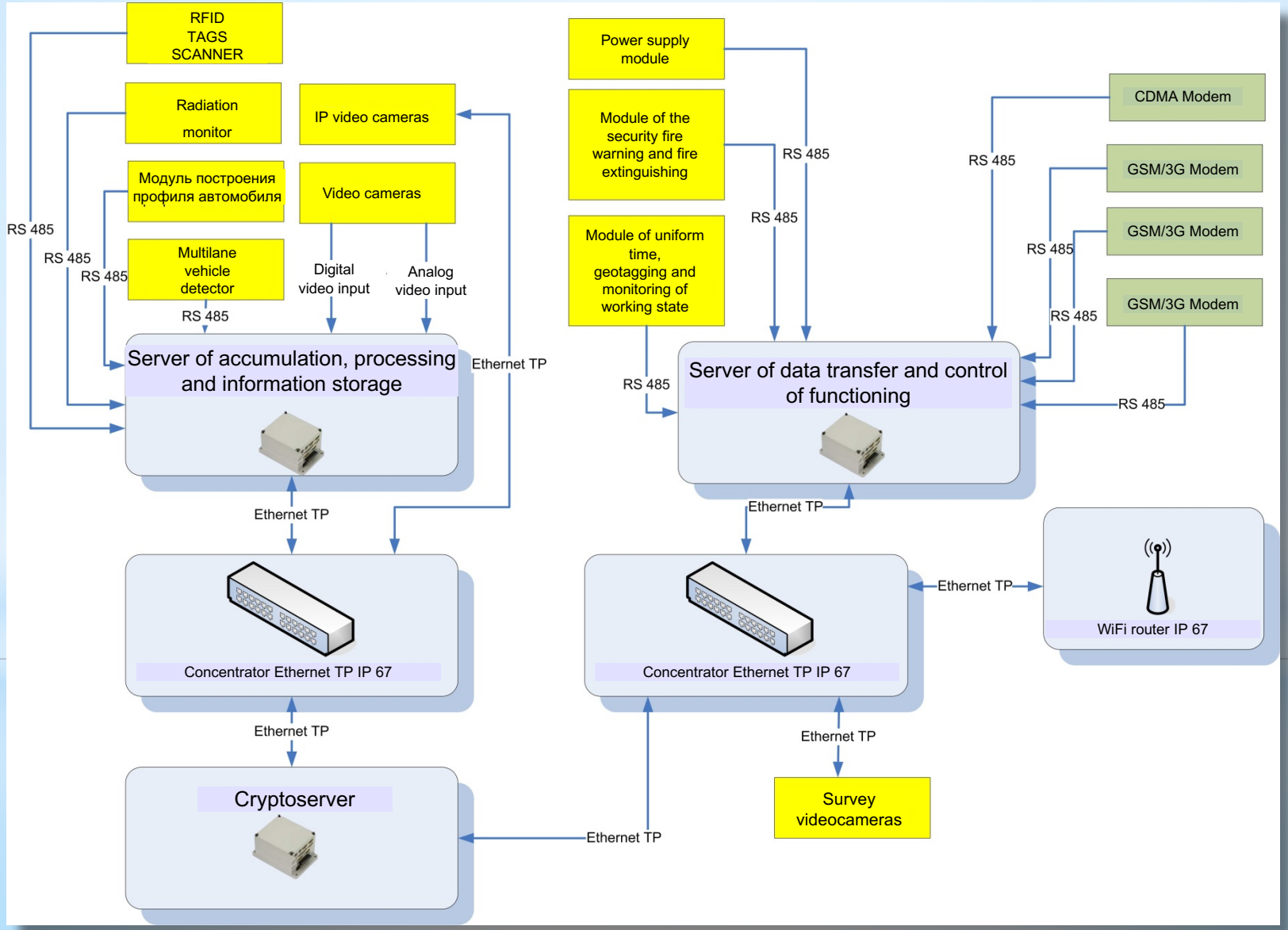
- radio channel for data transmission

- response on the detection of ionizing radiation source

THE MAIN METHODS OF LOWERING OF INSTRUMENT AND METHODICAL ERRORS OF RADIATION MONITORS APPLIED IN SACTR FOR REDUCTION OF NUMBER OF FALSE ALARMS

№	Reason of false alarm signal	The measures applied in SACTR for reduction of quantity of false alarm signals
1	Change of distribution of pulse counting from detectors. Level of false alarms significantly increases and has constant character	reliable lightshield (for scintillators), steady against moisture, temperature
		reliable junction of photoelectric multiplier and plastic steady against vibrations, moisture, temperature
		refusal of system of maintenance of temperature in monitors, use of the electronics working in the expanded temperature range
		refusal of mechanical adjusting elements (potentiometers, etc.)
2	Influence of the external influencing factors (Electromagnetic interference, temperature, moisture, vibrations). As a rule, false alarms have impulse character	use of vibration-proof constructive solutions of the monitor and detector blocks
		use of the constructive decisions minimizing formation of condensate on working surfaces of critical nodes (detectors, power supply units, the controller);
		use of circuit and constructive designs of reduction of EMI, use of powerful inlet supply line filters
		use of all-weather monitor sensors of presence
3	Methodical errors. As a rule, false alarms have the impulse character coming from a mismatch of procedures of monitoring and model of operation of the monitor.	two modes of model of operation of the monitor are used – with the sensor of presence and without it
		verification regime of procedures of measurement (together with video cameras, RFID, vehicle registration plates, etc.)

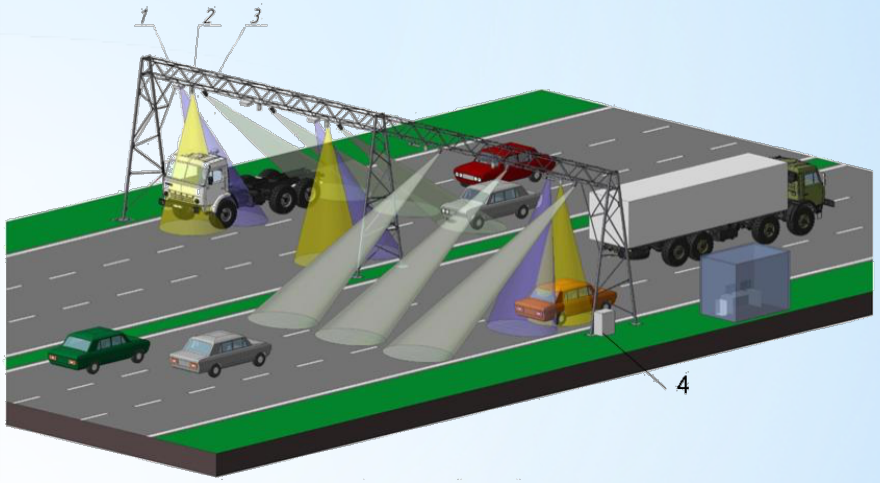
STRUCTURAL DIAGRAM OF THE ARCH TYPE SACTR UNIT



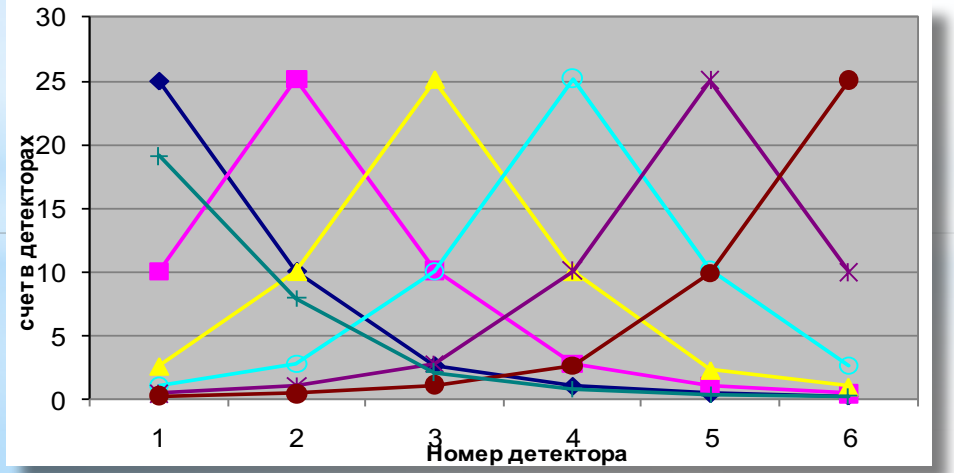
TECHNOLOGIES OF THE SACTR RADIATION AND RADIO-FREQUENCY MONITORING WITHOUT SPEED LIMITATION AND TRAFFIC CONDITIONS OF VEHICLES IN CASE OF THEIR MULTILANE MOVEMENT

HORIZONTAL CONFIGURATION OF DETECTORS

RADIOFREQUENCY IDENTIFICATION

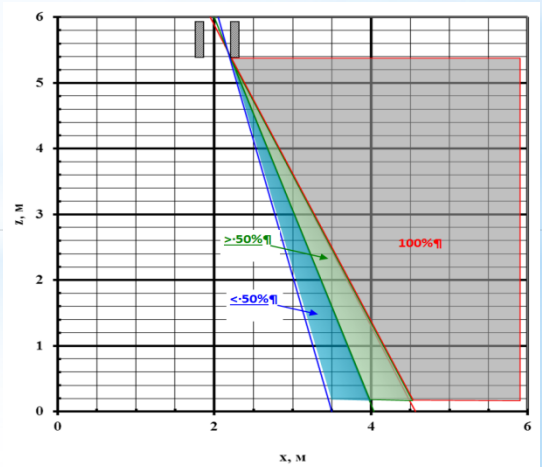


ALGORITHMIC COLLIMATION OF DETECTORS



10 multiple exceeding of the useful signal on a monitoring lane is provided

PHYSICAL COLLIMATION OF DETECTORS



Formation of monitoring from 75% to 125% of band width is provided

THE BASIC SITUATIONS IDENTIFIED BY SACTR THROUGH THE COMPLEX ANALYSIS OF THE SIGNALS COMING FROM ITS FUNCTIONAL SUBSYSTEMS

№	Event type	Event category	Tag issued for shipment	Registration № matches	Transportation according to the schedule	departure from a schedule	Lost tag	Tag associated with a vehicle	No tag in database	No tags detected	Radiation monitor alarm
1	Legal shipping of NM and/or RM	N			+	+		+			+
2	Illegal shipping of NM and/or RM with with the lost (stolen) RFID tag of the “green channel”	A					+			+	+
3	Illegal shipping of NM and/or RM without RFID tag	A									+
4	Legal shipping of NM and/or RM with departure from a schedule	I	+	+		+				+	+
5	Legal shipping of NM and/or RM with RFID tag swapping	A	+		+			+			+
6	Legal shipping of NM and/or RM with departure from a schedule and RFID tag swapping	A	+			+				+	+
7	Illegal shipping of NM and/or RM with actual RFID tag	A	+	+				+		+	+
8	Illegal shipping of NM and/or RM with stolen RFID tag	A								+	+

NB!: **1. «+» the signs which are present at the message on the registered event or revealed in processing;**
2. Event category: N – «Normal», I – «Important», A – «Alarm».

INFORMATION REPRESENTATION SAMPLE ABOUT RESULTS OF MONITORING ON A AUTOMATED WORKSTATION IN A COMMAND CENTER AND INFORMATION PROCESSING IN SACTR

THANK YOU FOR YOUR ATTENTION!

Techsin, LLC
http://www.tehsin.ru
Phone: +7(495)926-19-86
+7(910)422-56-47
e-mail: tehsin@tehsin.ru
boss@tehsin.ru