

GPRS Terminals for Reading Fiscal Registers

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Abstract—Data security in non-fiscal cash registers and non-fiscal printers is minimal. However, data security in fiscal cash registers and fiscal printers is also not satisfactory. This paper describes turnover control devices based on GPRS terminals for sending data from fiscal electronic cash registers and fiscal printers to the server of Tax Administration in order to prevent tax evasion, diversion of original goods from the distribution system and infiltration of counterfeited or original goods into the distribution system without payment of customs, tax and excise duties. The comparison with ordinary fiscal cash registers and non-fiscal cash registers is also provided.

Keywords—Turnover control, GPRS terminals, fiscal registers

I. INTRODUCTION

There are many reasons for turnover control from the point of view of many governments [1-10], starting from the obvious to very sophisticated ones, such as improved filling of the budget and increased tax collection, excise duty collection, custom duties collection, as well as efficiency of tax and trade inspectors. There is also a need for automatic accounting of tax duties and the prevention of: tax evasion, tax fraud, sale of excise goods without paid excise duties in regular distribution channels, the diversion of original goods from regular distribution channels, unfair competition and protection of consumers. The other important reasons are:

- registering data about transactions and turnover of articles (goods and services);
- analysis of data received from all taxpayers in order to identify taxpayers who evade registering of all transactions and turnover of articles;
- optimal utilization of human resources of tax inspectors and trade inspectors;
- more efficient implementation of tax laws;
- faster economic development;
- increased investments;
- prevention of misuse during registration of individual transactions and turnover of articles in non-fiscal and fiscal electronic cash registers, non-fiscal and fiscal printers.

The main reason for turnover control from the point of view of taxpayers is assistance to taxpayers during selling, business activities, order planning, etc. There are also possibilities of sending: data about summary turnover of articles and list of

sold articles to a server, computer or a mobile phone of a taxpayer. The article database can be also remotely updated (price adjusting, adding new articles, deleting of old articles, etc.). There is also a possibility of additional earnings of a taxpayer by refilling SIM cards of prepaid mobile phones, paying LOTO combinations, paying instant lottery, showing marketing messages on an additional display, etc.

Typical electronic devices for turnover control are:

- non-fiscal electronic cash register and non-fiscal printer (together hereinafter referred to as “non-fiscal register”);
- non-fiscal electronic cash register and non-fiscal printer with the external fiscal module;
- fiscal electronic cash register and fiscal printer (together hereinafter referred to as “fiscal register”);
- fiscal electronic cash register and fiscal printer with GPRS terminal sending data about turnover of articles (goods and services) performed at its location to Tax Administration Server (TAS) using existing GPRS network.

An electronic fiscal cash register (FR) is a standalone device with two displays and keyboard. A fiscal printer is connected to a personal computer (PC) or a point-of-sale system (POS) and usually has only one display (for buyer).

II. NON FISCAL REGISTERS

Data security and data authenticity in non-fiscal registers is minimal due to little or no responsibility of manufacturers, distributors, sellers and servicemen to government institutions, as well as their desire for bigger sales, i.e. profits, which causes the appearance of so-called “popular” cash registers in the market, which directly or indirectly allow many ways of misuse during turnover registration. In further text “unregistered” means an absence of an electronic track about some activity.

Particular reasons for introduction of fiscal registers, from the point of view of any government are prevention of unregistered misuses of non-fiscal registers, PC, POS systems and back-office servers, which can be activated without leaving a trace through a menu or a keyboard, without opening an enclosure, since they are secretly or even publicly supported in the original program, and which are almost impossible to be successfully controlled in practice, because

they have not been certified by competent government institutions prior putting into use. Typical forms of misuse by non-fiscal registers are:

- printing receipts in the training mode without keeping data on individual sold articles on the journal tape (if exists) or the journal memory (if exists), without summarizing and storing turnovers of articles in data memory or a hard disk, in order to mislead customers to believe that they have got real receipts;
- printing non-fiscal receipts (non-fiscal invoices, kitchen orders and bar orders) with individual names and prices of articles, in order to mislead customers to believe that they have got real receipts;
- printing duplicates of receipts, and giving them to other customers, typically receipts with single article on each of them, with apology for the lack of knowledge in cash register, in order to mislead customers to believe that they have got real receipts;
- non-printing, changing or clearing data about individual sold articles, that have already been written into the journal memory or a hard disk;
- changing the program in the program memory or a hard disk into a program allowing misuse;
- activation of additional programs for performing already listed misuses on PC or POS system instead of original programs or in parallel with original programs and many others.

III. NON FISCAL REGISTERS WITH EXTERNAL FISCAL MODULE

The addition of external fiscal modules for storing turnover of articles provides the following additional misuses in addition to the aforementioned misuses:

- storing already modified (counterfeited) turnover and transaction data due to forged program in the non-fiscal register and/or POS, which directly provides misuse;
- change of a program for interfacing with the external fiscal module into a program enabling misuse, since programs in non-fiscal register are not protected against change;
- destruction of ports for reading the external fiscal module, in order to prevent reading of years of data during audit;
- connection of the external fiscal module with cloned identification number and counterfeited content;
- displaying an interim sum prior to displaying the final sum to be paid, in order to mislead a customer to pay the interim sum, and after paying, cancelling of some or all sold articles, before storing to the external fiscal module.

Tax inspectors must read the external fiscal module due to the absence of automatic sending of data to TAS, which means that field work might be affected by corruption, laziness and the lack of knowledge. If tax inspector wants to verify the

receipt, he or she has to type all data from that receipt including the digital signature into PC, which is subject to typing errors, or use an OCR scanner, which is subject to OCR errors, or use a barcode scanner, which can't be printed on matrix printers, so they can't be controlled, which will increase their popularity for misuse.

Utilized digital signatures are not "collision resistant", so it can be identical for receipts with different turnovers, which is very simple done by changing a few letters or numbers in the header, which mask the change of turnover in the article area. Digital signatures are stored in the external fiscal module, while daily (Z) reports, state (X) reports, electronic journal and all other relevant data are stored in non-fiscal register or POS system, where they can be freely changed until digital signature becomes identical to changed data. Daily (Z) reports, state (X) reports, electronic journal and all other relevant data stored on a hard drive of POS or PC can be destroyed, with apology for the effect of viruses brought with pirated games by cashiers. Hard disk can be even formatted in order to prevent audit following the same apology.

Taxpayer must pay for the change of program in non-fiscal register or POS, in order to provide communication with the external fiscal module, which often cost as much as the external fiscal module. Besides this, it is hard to force existing manufacturers of non-fiscal registers and POS to change their software in order to communicate with the external fiscal module, since they might not employ anymore programmers who wrote low-level communication part of the program.

External fiscal modules must be certified for enormous number of existing non-fiscal registers and POS systems, which drastically increases their costs. Non-fiscal registers and POS systems that have been sold in lowest quantity will become suddenly more popular, since no external fiscal module manufacturer will be interested to pay for their certification, and they will not have external fiscal modules. External fiscal modules are not cheap, since their price is comparable to the price of fiscal registers, because 75% of main parts are the same (microprocessor, memory, communication, power supply, ports, cables, etc.). In other words, only printer mechanism, display and keyboard are missing. Addition of the expensive external fiscal module on existing non-fiscal registers and POS systems do not help the prevention of misuses, but instead provides the sense of false security, while increasing cost of audit and decreasing efficiency of tax inspectors:

IV. FISCAL REGISTERS

Typical data protection and data authenticity in fiscal registers are provided by the combination of mechanical devices and software means, defined by an appropriate law comprising:

- prevention of opening the fiscal register's enclosure and access to electronic components of the fiscal register by the service seal (usually made from a special material with the stamp of an authorized serviceman inserted into the screw);

- protection of the program memory against removal, change or clear by the program seal (a protective self-destroying sticker in case of attempted removal);
- protection of the fiscal memory against removal, change or clear by the fiscal seal (usually a protective self-destroying sticker in case of attempted removal), and coating with an epoxy hardening compound;
- storing summary turnovers of articles in the fiscal memory;
- printing data about individual sold articles on the journal tape, or storing in the journal memory;
- printing special marks (fiscal logo) on fiscal receipts, to distinguish them from non-fiscal receipts that might mislead the article buyer;
- printing special codes (digital signature) on fiscal receipts, to enable later checking of each issued receipt;
- protection against change or clear of all identification numbers, records' counters, the date and time of records, etc.

V. FISCAL REGISTERS WITH GPRS TERMINALS

The first author of this paper proposed and drafted the appropriate laws and rules stipulating the addition of GPRS terminal to fiscal registers (Fig. 1) in order to:

- send daily report data to TAS using FTP protocol;
- receive the acknowledge from TAS;
- read command from TAS with time and date (or period) as well as type of data it will send next time;
- try communication another 2 times on that day, or 3 time on the next day in case of an error.

This and improved solutions are already implemented in the following countries with the help of the first author:

- The Republic of Serbia (Law and rules in 2004, implementation in 2005);
- Republika Srpska (part of Bosnia and Herzegovina) (Law in 2007, rules and implementation in 2008);
- Federal Democratic Republic of Ethiopia (Law in 2008, pilot project in 2009, implementation in 2010);
- The Republic of Albania (Law and rules in 2009, implementation in 2010);
- The Federation of Bosnia and Herzegovina (part of Bosnia and Herzegovina) (Law and rules in 2010, implementation in 2010);
- The Republic of Slovenia (Law in 2011);
- The Republic of Tanzania (Law and rules in 2012).

The system with GPRS terminals (Fig 2) provides additional significant increase in tax compliance and tax collection due to audit planned by the expert software. The system implementation has almost zero cost (one FTP server plus one frame relay link) for tax administration, due to payment of communication costs by tax payers.

From tax payer's point of view, system implementation has almost zero cost due to subsidizing of turnover controllers by the government using tax credit, which can provide fast return due to increased tax collection.

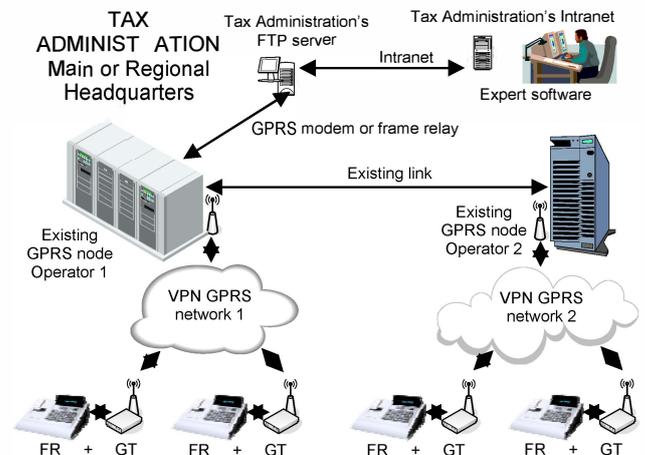


Figure 1. Fiscal registers (FR) with GPRS terminals (GT)



Figure 2. GPRS terminals

VI. MAJOR MISUSES

Most of the described forms of misuse in Table I cannot be detected without removing the service seal, opening the fiscal register, comparing the fiscal register with the certified model kept at the competent government institution and detailed inspection by experts, which causes additional expenses and requires additional time. However, some cases of misuse can be undetected even by experts, such as a replacement of electronic components (a microcontroller or a memory), in case the markings of the original and forged electronic components are identical, or differ in a small number of characters (in some cases only one), or are even removed. In addition to that, various complicated formats of electronic and printed data decelerate an audit or make it impossible.

Fiscal registers with GPRS terminals according to Table II decrease business-running expenses in comparison with utilization of fiscal registers or non-fiscal registers, when all costs are calculated, such as: accountant costs, purchasing cost, regular purchasing of journal tapes, change of already printed journal tapes with empty journal tapes many times per day for each fiscal register and stocking of printed journal tapes, as well as change of journal memory and fiscal memory every 5 years or less.

TABLE I. POSSIBILITY OF MISUSE

JM = Journal memory JT = Journal tape X = Yes - = Non important 0 = No	Type of an electronic device for turnover control							
	Fiscal register with GPRS terminal		Fiscal register		Non-fiscal register with the external fiscal module		Non-fiscal register	
	JM	JT	JM	JT	JM	JT	JM	JT
Not registering turnover (by cashier)	X		X		X		X	
Printing of misleading non-fiscal receipts	X		X		X		X	
Non-authorized change of the program	X		X		X		X	
Installation of additional programs	0		0		X		X	
Change and clear of data	0		0		X		X	
Fiscal memory access	X		X		X		0	
Journal memory access	X	0	X	0	X	0	X	0
Destruction of journal tape	0	X	0	X	0	X	0	X
Printing of counterfeited journal tape	0	X	0	X	0	X	0	X
Destruction of daily reports	-		X		X		X	
Printing of counterfeited daily reports on 2 nd printer	-		X		X		X	
Removal of the service seal	X		X		0		0	
Removal of the program seal	X		X		0		0	
Removal of the fiscal seal	X		X		0		0	

TABLE II. DEVICE PRICE AND EXPLOITATION COST DURING 10 YEARS

Device price and exploitation cost during 10 years Average price is provided in €	Type of an electronic device for turnover control							
	Fiscal register with GPRS terminal		Fiscal register		Non-fiscal register with the external fiscal module		Non-fiscal register	
	JM	JT	JM	JT	JM	JT	JM	JT
Device price (min)	300		200		300		200	
Device price (med)	400		300		400		300	
Device price (max)	700		600		700		600	
Fiscal memory change 2x / 10years	200		200		200		0	
Journal memory change 2x / 10years	200	0	200	0	200	0	200	0
Journal tape change (2 rolls each 0.2€/day)	0	1.000	0	1.000	0	1.000	0	1.000
GPRS transfer cost (5€/month)	600		0		0		0	
Equivalent accountant expenses (100€/month)	0 (accounting is a part of Expert Software)		12.000		12.000		12.000	
Total expenses (max)	1.700	2.500	13.000	13.800	13.100	13.900	12.800	13.600

VII. CONCLUSION

The official data of The Republic of Serbia show that the implementation of fiscal registers with external GPRS terminals has increased the relevant tax collection between 20% and 30% depending on a year, while grey economy spread has decreased by 30% [11]. The official data of Republika Srpska show that the implementation of fiscal cash registers with internal GPRS terminals has increased the relevant tax collection for 26% in 2008, 30% in 2009, which was bigger than predicted (20%).

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