Radio Data System-Platform for traffic and travel information services

Claudiu Dan BARCA
The Romanian-American University, Bucharest

In the current National and European context where the public information is simultaneously spread on multiple channels and especially through mass-media channels, the text messaging services from public radio channels proved to be very useful and efficient for this purpose. Over the years, the use of a warning system like Radio Data System (RDS), at a global level shown, through text message or sound alarms is useful for the drivers to know the traffic, as well as for being aware of any emergency situations (fires, floods, earth-quakes). In this paper we present the characteristics of an RDS system with the Alert feature, as well as the study of radio covering of four from the Romanian National Radio News network's broadcasting points.
***Keyword**: RDS, RDS-TMC, Alert, radio coverage, emergency systems*

1 Introduction

The distribution systems of the analogic and digital radio signal are well known in nowadays, although the technical solutions are being generally landed as "classics". The frequency band used for a FM radio receptor is encountered in the range 87.5 – 108.0 MHz (also named "the CCIR Band") or in the range 67 – 72 MHz (also named "the OIRT Band"). In Europe, the "88 – 108" MHz band is used, all radio stations (local or national, public or private) deploying their activity in this band [1].

The data transmission system in radio channels of public broadcasting bands (RDS) is able to ensure the traffic information and to deliver them to users. The transmission of text messages regarding the description of events, status and location it is used. Information is transmitted through existing FM radio networks. This enables highly accurate, relevant and timely transmission of information, using the language chosen by the user and without interrupting normal services [2].

The RDS protocol allows the transmission of traffic messages like urgent messages, in cases of natural disasters [3,4,5].

The European Memorandum (MoU), published in his final form in 1997, presents the premises of the standard services and equipments of the data transmission System in radio channels in public bands and the specifications of the traffic channels for messages (Radio Data System, Traffic Message Channel- RDS-TMC) [6].

2. Depiction of the RDS-TMC System

- **Depiction "Alert"**

Within the Alert System, throw harmonization and interconnecting of the services, any user can employ the same receptor of any UE country and, also, can receive the same type of services, no matter the country he cross. Alert is a service which is based on the Alert-C broadcasting protocol and is free of charge for the user.

All the memorandum chapters acknowledge the right of introducing and establish services regarding the installation, distribution and maintaining equipments, taking into account the national statute, including the license, in accordance with the EU resolutions.

- **The attainment of the services platforms**

The parts that accept RDS-TMC and by default affiliate to the Memorandum are in

agree to create services platforms that include the public authorities, road infrastructures operators, information providers, broadcasters and broadcast network operators [7]. This platforms will ensure the base for the European coordination and will allow introducing the services operated by the corresponding parts. Also, they represents tools for performing and maintaining the services suitability, in accordance with the standard RDS-TMC, including the Alert functionality.

In 2003 was adopted the ISO 14819-1.2.3 standard, that defines the Alert-C protocol used by RDS-TMC [8,9,10].
The ISO 14819-1 standard defines the Alert-C protocol and the format of the data groups, necessary for transmitting RDS-TMC information:

- 3A group – information regarding the TMC application and it parameters
- 8A group – information regarding the services provider and traffic information.

The format of the 8A[8] data group is presented in **Fig. 1**.

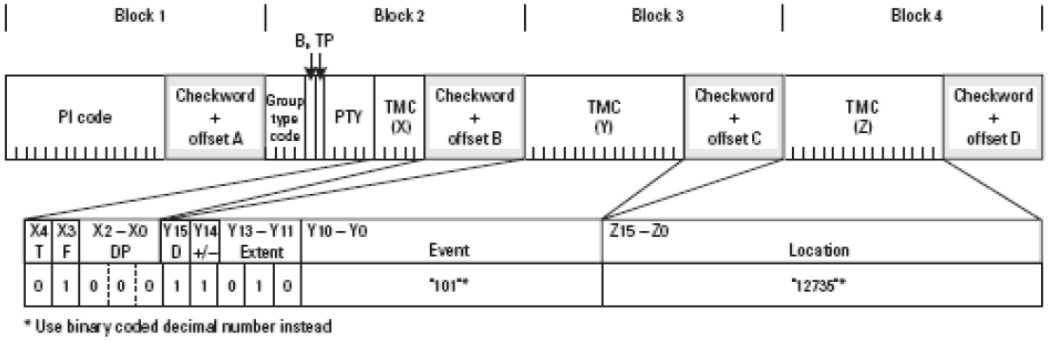

Fig. 1. The format of the 8A data group

The RDS-TMC posts contain coded information regarding the event, location, etc [9].

The format of the standard RDS-TMC post is presented in **Fig 2**.

- Event (11 bits): coding set by ISO 14819-2.
- Location (16 bits): location established by the national table of locations as depicted in ISO 14819-3.
- Direction (1 bit): direction +/- meaning toward street (predefined)
- Extent (3 bits) defines the next location.
- Duration (3 bits) – the estimated duration of the problem.

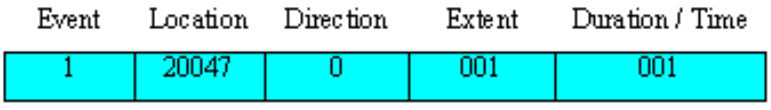

Fig. 2. The format of the standard RDS-TMC post

The message is coded when is transmitted, resulting in a coded message, previously defined. The TMC receptor/navigator decodes the initial message and it is provided to the user as text. One of the advantages of the coded message, above the text one, is that it can be presented to the user in the selected language.

- **The table of RDS-TMC Locations** [10]

The location is transmitted throw a 16 bits code. Each country must define a table of RDS-TMC locations, which is able to correlate the location code and the location itself. The following information will be provided: location, geographical coordinates, name of the location, etc.
The table of TMC locations is the starting point for the destination of the transmitted messages by the encoders of the radio stations. Specific codes that select locations from the events areas are transmitted.
Each country has a unique table of RDS-TMC locations, which needs to comprise all locations necessary for the TMC system to work properly. The maximum number of locations defined using a table is 65200.
The ISO 14819-3 standard requires that one country can assign maximum 4 tables of locations.
The ISO 14819-3 standard defines the mode in which the locations must be chosen and how the location table can be defined (made of 22 different tables). In the EU, there is a certification body format for the table of RDS-TMC locations, which checks the compliance with the standard, regarding the TMC table content for each country that desires the TMC system implementation. This certification body is TMC Forum.
After certification, the location table of the specific country is becoming public, in order for the navigator manufacturers to use in their navigation papers.
This process of certification is made when defining the TMC locations table and also when the later versions are elaborated.

At the physical level, there is a table named "header" and 22 tables that can make possible the locations descriptions.
Hereby are a few of the most important tables:

- table SUBTYPES – it contains the RDS areas subtypes (Area – A, Linear – L, Points –P)
- table LANGUAGES – information regarding the language
- table NAMES – the locations names
- table README – characters and other information regarding the local standard
- table ADMINISTRATIVE AREA
- table ROADS – roads table
- table SEGMENTS- the table that defines segments
- table PONTS – the table that defines points (P)
- table INTERSECTION – information about the intersections

Radio stations traditional are limited by two factors: the transmission power of a station on a certain frequency (normally limited to a radius of 150 km, but can be more or less depending on antenna height, relief, power emission) and the number of frequencies available that vary by state and country.
To achieve RDS-TMC services are required to implement broadcasting networks so as to allow their radio coverage of radio reception in good condition highway road (at least European corridors and subsequent national roads). The location of radiant systems is performed in accordance with radio coverage studies, best results give radio systems developed by one of the following strategies:

- choosing for each large area (hundreds of kilometers) of a major operator to ensure that the transmission of radio and RDS-TMC through multiple transmitters own it and having total

management of the network and messages sent

- harmonisation RDS-TMC services that can be provided by all local broadcasters by making working arrangements between them and RDS messaging center. Through this agreement they must ensure public services equivalent RDS.

An ideal solution would be to adopt an implementation techniques using services of only one radio operator, large-scale, it has the ability to cover the geographical areas as large as possible.
Another solution would be to create a directive antenna systems, which provides a radio field asymmetrically oriented areas of interest.

Directive antennas are the ones that mainly affects the radiation diagram to a certain direction of orientation. A directive antenna works focusing the signal on a certain direction with the others, and known as antenna "beam".
One of the great advantages of encapsulated antenna beam (typical installation method for broadcasting antennas) is that it is not affected by rain, snow, sand and electrostatic loads. Rain or storms charged electrostatically atmosphere resulting the increased noise band antennas vertical and horizontal. .As a special feature, asymmetrical antennas (generally made on the basis of multiple vibrating element) are totally immune to this type of noise (**Fig. 3**).

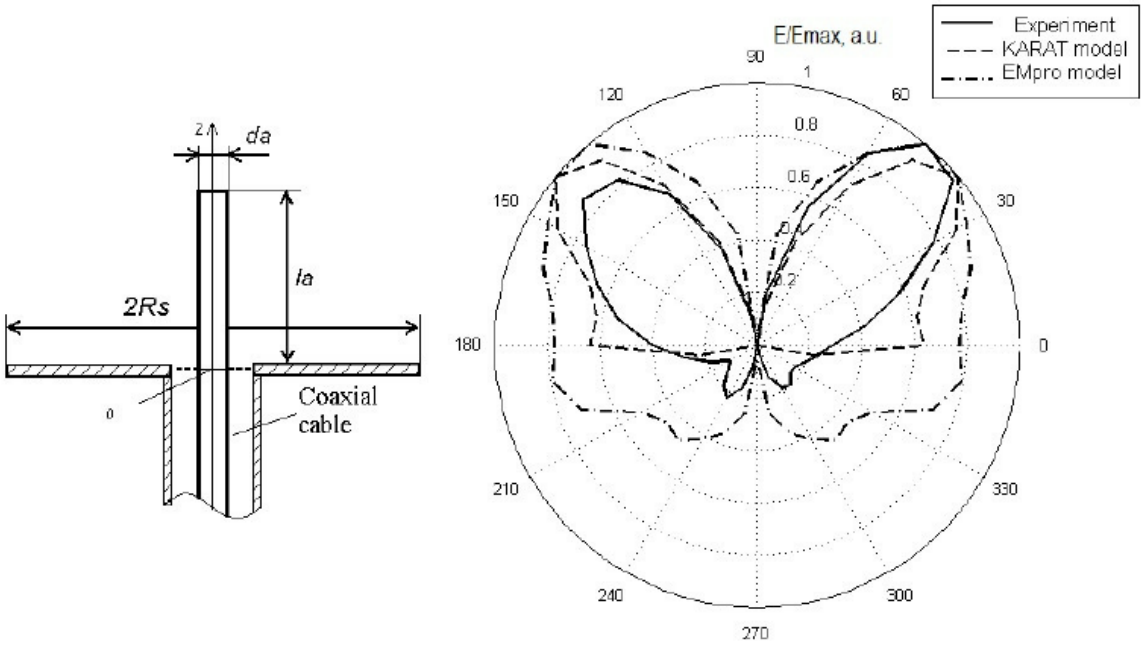

Fig. 3 Asymmetric dipole antenna radio and symmetric dipole antenna radio [11]

Another solution would be to create a passive repeaters placed along roads. These repeaters have the advantage that allow to re-route the signal characteristics influence without having on emission and radiation originating signal systems. Also, due to the transfer characteristics of the radio band, the systems allow the guidance of more frequent, corresponding to several public radio operators.

3. The structure of the broadcasting stations

The RDS message will be in the location where the broadcaster is located, which is basically RDS radio interface. Interconnection interface is provided for compatibility standards imposed by RDS radio standards.
RDS encoder output will connect to one of the entrances mixer / modulator FM broadcaster.

The interconnection scheme is shown in **Fig. 4**:

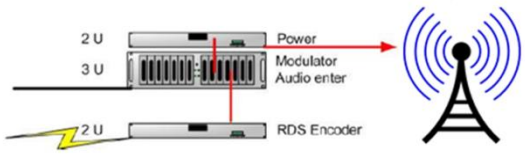

Fig. 4. The scheme interconnection stations broadcasting

In order to increase overall system reliability, encoder connects directly to data transmission networks, without need of intermediate equipment. Equipment used for radio equipment at each station fit entirely in RDS standards, the equipment have very good quality with very good reliability and excellent quality signal. These devices are integrated (virtually the entire local system is included in one physical equipment), standard and professional radio transmitter connects to any standard. From a physical perspective, they are modular rack .Thus is minimal installation effort and also local area connectivity is near. Physical connections are avoided for very long or terminating successive fields which could induce foreign radiant with undesirable effects on the local system. Connecting encoders RDS broadcasting systems involves their installation near transmitter module (whether the power amplifier is at the same location or not), as annexed to the way existing broadcast system. The connection is made directly through wiring and a sleeve locally standard, so that operations should not involve disconnection or disruption of local broadcasting.

In terms of the RDS-TMC system overall the technology aim is to achieve a wireless network with data transmission in the form of RDS to ensure radio coverage in all areas of interest, regardless of the strategy adopted or radio implementation territory.

For this purpose, the implementation of a national or local (but over wide areas) is necessary to undertake studies of radio coverage for each geographic area in part.

4. The coverage of the network broadcasters Romanian Radio Broadcasting Corporation

I used the software ICS Telecom and realized full coverage network of stations where RDS encoders were installed. (**Fig. 5-8**)

Locations of these stations are:

- **Costila**, 45.427161N, 25.48708E, Radio România Actualități 102.20MHz, 100kW;

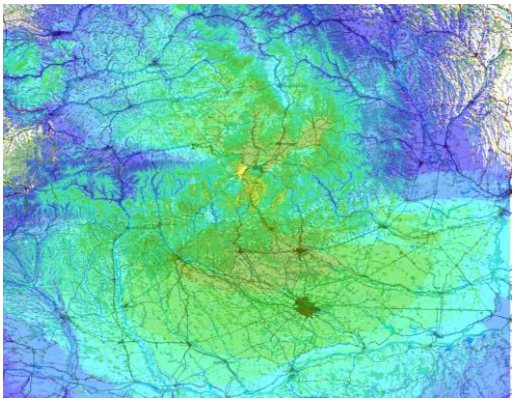

Fig. 5 Map representing the range of the transmitter from the network of Romania Actualitati installed at Costila (operating frequency = 102.2 MHz)

- **Herastrau**, 44°28'37" N / 26°03'00" E, Radio România Actualități 105.3 MHz, 10kW

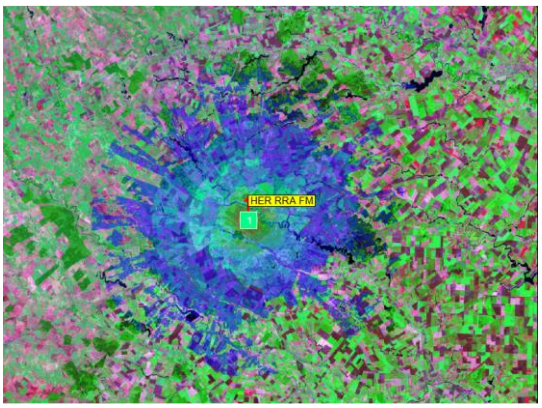

Fig. 6 Map representing the range of the transmitter from the network of Romania Actualitati installed at Herastrau (operating frequency = 105,3 Mhz)

- **Cozia**, 45°19'16"N / 24°19'46"E, Radio România Actualități 103.40 MHz, 10 kW;

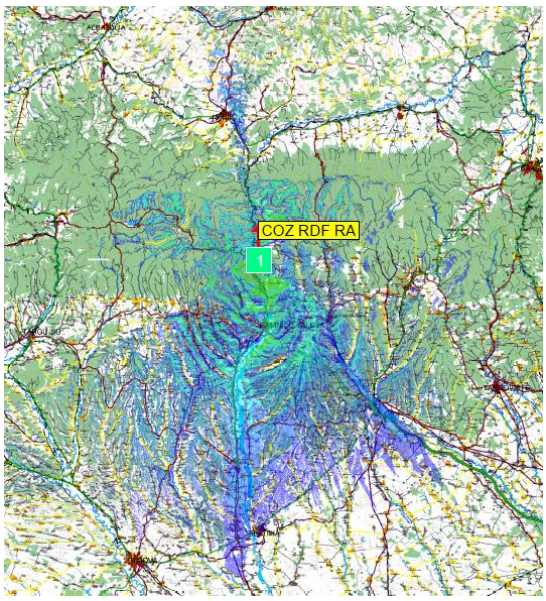

Fig. 7 Map representing the range of the transmitter from the network of Romania Actualitati installed at Cozia (operating frequency = 103,4 Mhz)

- **Vacareni**, 45°19'39" N / 28°10'36" E, 45.3277379N, 28.1768203E, Radio România Actualități 106.40 MHz,10 kW

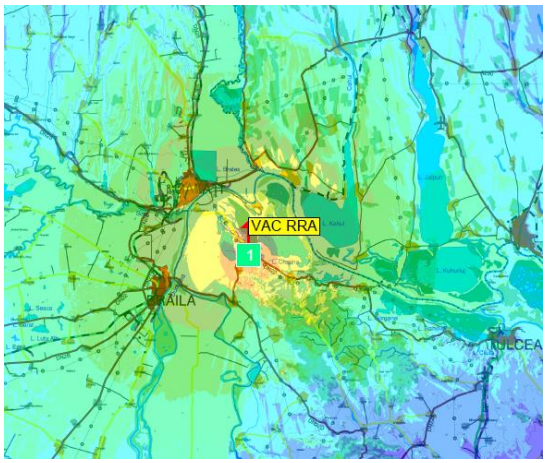

Fig. 8 Map representing the range of the transmitter from the network of Romania Actualitati installed at Văcăreni (operating frequency = 106,4 Mhz)

The study reveals that using maximum performance of the network of transmitters to this radio station obtained large areas of coverage so that it can achieve an early warning system RDS whose beneficiaries are drivers (System Alert) as and population exposed to risks the calamnitate (text and audio).

5. Conclusions

The RDS system is taking ground by its many possibilities of low implementation costs and various applications, known for its rapid development especially in the automobile traffic. On the other hand, because of its low implementation costs (despite the service's quality and efficiency) and its high increase in national radio network coverage, the system can be developed in future for other purposes too, such as emergency situations awareness. This system's main advantage is that it offers a reliable and secure information system without major maintenance and user expenses, the latter taking the entire benefit of it directly and transparently. Because of the almost inexistent user costs, the RDS based warning systems prove to be the most efficient and with the largest reach-out to its consumers

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Claudiu Dan BÂRCA graduated from Faculty of Computer Science for Business Management, Romanian American University in 2007, and holds a master degree in Economic Informatics since 2008 and a PhD in the field of Engineering Sciences since 2013. He is an assistant lecturer within the Faculty of Computer Science for Business Management having nine years of teaching experience. He also has good research and publishing activity: he was a member of the research teams of international and national projects. His core competences are in software programming and connected areas.