Development of the Traffic Message Channel in RDS

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The article presents the current state of development of the Traffic Message Channel feature (TMC) of the Radio Data System. Standardization is necessary as regards both the technical characteristics of the system (data structures, message management protocols, interfaces, etc.) and the content of the traffic messages, in order to ensure compatibility of all TMC transmissions with all TMC receivers, regardless of their country of origin and/or utilization. Consideration is also given to the capacity of the RDS data channel, which implies the use of efficient coding methods and effects the complexity of the TMC receiver.

1. Introduction

During the past three years, broadcasters in all West European countries have either introduced RDS, or at least started test transmissions. In this same period, discussions have continued regarding the development and introduction of some new RDS features, among which is the Traffic Message Channel (TMC). This feature will permit the transmission of digitally-coded traffic messages which are derived from an agreed European message repertoire and which can be delivered in the language of the user. In effect, the RDS data channel could transmit a series of codes which extract pre-recorded message elements from a memory in the receiver and concatenates them to form a complete message for delivery via a speech synthesizer, printer, or other output device.

Following an initiative taken by the European Conference of Ministers of Transport (ECMT), the EBU has set up a group of RDS-TMC specialists which has been studying the possibilities for integrating the TMC feature into RDS. These studies have taken into account, among other factors, the restricted data capacity of the RDS system and the requirements of a number of broadcasters who wish to use RDS for non-programme related data services — services which could produce additional revenu for the broadcaster and thus help to finance the introduction of the RDS system. The present article summarises the report produced by the group of RDS-TMC technical experts working within the EBU, which concluded its study early in 1990.

2. Matters relating to the EBU

2.1. Transmission of traffic messages via RDS

2.1.1. Broadcast programme aspects

For broadcasters, the introduction of the TMC feature in VHF/FM services would appear to be an interesting objective, with a view to the complete elimination, in the long term, of the need to interrupt programmes with conventional traffic announcements. TMC offers a way of avoiding the overloading of programmes with such information. For the motoring listener, the TMC will have the advantage of delivering relevant traffic information in his own language. In general, therefore, the TMC is seen to be "a good thing".

The use of coded traffic messages evidently requires the creation and agreement of a standard message repertoire (in matching versions for each language) covering all likely requirements. The

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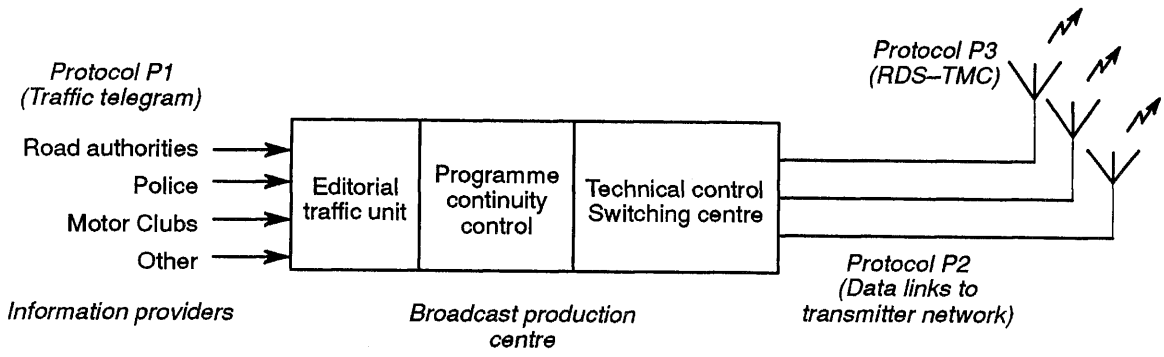

Fig. 1
Application of three different communications protocols for the broadcasting of spoken and coded traffic messages.

broadcasters, who have been issuing spoken traffic messages for many years, are of course well-placed to establish this repertoire, and in fact such a list has already been drawn up [1]. However, it appears to be necessary to restructure the repertoire to facilitate the management of messages at the receiving end.

TMC has also a number of disadvantages. Most importantly, it requires a complex — and still rather expensive — receiving device. This has to be used in addition to a car radio (which may, or may not, be equipped for conventional RDS decoding). Presently available RDS radios cannot be used for TMC, and they cannot be adapted for this purpose. Also, the ergonomic features of a TMC receiver, and the acceptability of its functions by the driver, have not yet been assessed.

After a standard for TMC has been agreed, perhaps in 1991 or 1992, it will take many years (5 to 10) until RDS-TMC receivers first reach the market. This means that conventional spoken broadcast traffic messages will have to be continued for many years; indeed, they will remain the major source of information of car drivers for the foreseeable future.

2.1.2. Technical integration of TMC in RDS

As shown in *Fig. 1*, the distribution of coded TMC traffic messages will have to be supported by a number of different communication protocols. In accordance with the proposals of the EUREKA research project CARMINAT, they are referred to here as P1, P2 and P3. The EBU technical expert group was however concerned only with the P3 broadcast protocol which is the one that permits TMC to be integrated into RDS, using group type 8A.

The main problem with the introduction of TMC in RDS is the transmission capacity that might be made available in RDS. It has become clear to the EBU experts that if the basic RDS features are fully implemented — that is, the programme-related features and automated tuning — these will require about 80 % of the data capacity in the RDS channel [2]. In other words, if TMC is the only other feature carried in the programme services where it is implemented, there will be capacity for the transmission of an average of only one TMC data group per second; this corresponds to only 37 useful data bits per second.

The other problem is the technology required for the TMC receiver. The anticipated complexity of the TMC device is close to that of a personal computer in spite of the fact that it could be fitted into a small box about the size of a car radio. Another question to be resolved is how the TMC receiver could be integrated into the car, or more particularly the in-car entertainment (ICE) environment.

Two solutions for the integration can be imagined:

a) The TMC device could be connected between the car radio and the loudspeakers. The disadvantage of this solution is that audio power amplifiers to drive the loudspeakers will be required in the TMC device. The advantage, however, is that a special interface standard for this type of connection would not be required.

b) The audio output (mono) from the speech synthesizer of the TMC device will require only a two-pin connection to the car radio. One additional control line could be used to command the volume override control which would exist already inside ARI and RDS radios. The loudspeakers would continue to be driven from the amplifiers in the car radio. The disadvantage is that existing car radios do not have these connections and therefore could not be used in conjunction with the new TMC device.

The TMC device will probably be too complex to permit its incorporation within a standard car radio case. It will also require its own RF tuner to permit the car radio listener a free choice of listening entertainment, without any obligation to tune to the particular programme service which carries the TMC information.

If TMC is to be provided via a separate receiver operating in parallel with a normal car radio, further standardization of the mechanical and electronic fittings in the car will also be necessary (see *Fig. 2*).

2.1.3. Implications for industry and users

Electronic equipment manufacturers have indicated that the problems discussed above could be resolved through a proper process of standardization of the TMC unit. Active promotion and recommendation of the standard would encourage mass manufacturing of compatible products. Bearing in mind that various degrees of complexity of a TMC receiver will be feasible, offering corresponding degrees of comfort in the use of the device, it appears likely that, in the long term, a TMC unit would not be more expensive than a medium or high-class car radio. Prototype TMC receivers are under construction and will be tested within the European research projects CARMINAT and DRIVE/RDS-ALERT [4]. These prototypes will of course be made in small quantities and will therefore be rather expensive.

From the listeners' point of view the TMC unit will have to interact with the car radio and ICE environment. TMC messages will be delivered in the user's own language via speech synthesis, and they should interrupt other audio signals only if the messages are urgent. If they are not urgent, they should be stored and delivered only when this is desired by the user. The messages should also be filtered according to criteria derived from the journey being undertaken. Ideally only relevant information should be output. To achieve this, some sort of interaction with future navigation aid devices, already under development for the car environment, will be required. Here too, a standard will be needed to define the manner in which this interaction should be achieved, although no detailed information has yet been made available.

2.2. RDS data capacity and conditions for reliable reception

To ensure that a message will be received reliably within RDS, it has to be repeated several times (say at least three times). Optimum reliability of TMC reception will be obtained if the message consists of only one RDS data group* (i.e. 37 useful data bits). The TMC coding rules require this to be achieved for at least 90 % of all messages to be broadcast. In exceptional cases, a two-group message will be acceptable. Longer messages, especially free-format text, shall be excluded for reasons of unreliable reception and to minimise the risk of overloading the RDS channel, bearing in mind the need for sufficient repetition of messages.

The overall message capacity of the RDS-TMC channel can be assessed as follows. If one TMC data group is transmitted per second, 3 600 data groups can be broadcast per hour. To guarantee reliable reception of one message, at least three groups (repetitions) will be required; hence a maximum of about 1 200 messages could be transmitted per hour. Messages must also be repeated to permit their acquisition by decoders which are newly switched on, and in practical circumstances the capacity will be considerably lower — by a factor of 5 to 10.

* In much of the TMC documentation an RDS "group" is referred to as a "sequence".

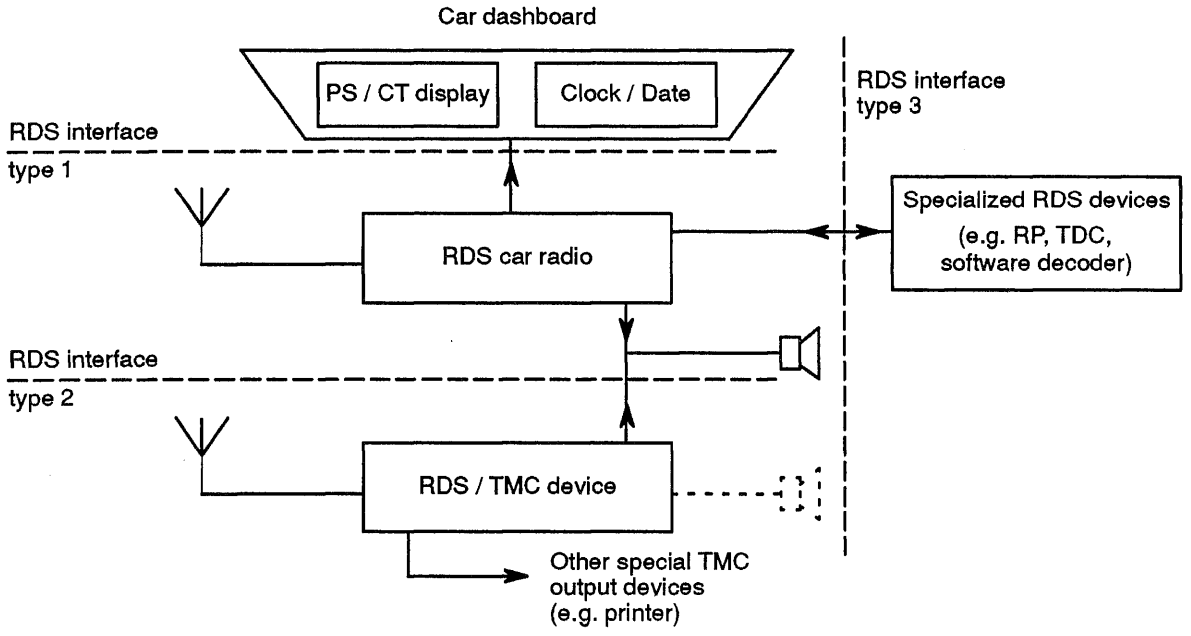

Fig. 2
RDS interface scenarios in the car-radio environment.

Although the capacity of the RDS broadcast channel is rather restricted, this does not mean that the TMC feature cannot be implemented. It does, however, mean that there is a constraint, and this in turn implies a need for a high degree of compression of the information to be transmitted. This can be achieved by the use of sophisticated coding techniques, so that 37 useful data bits will in most cases be sufficient to carry one TMC message.

The price to pay is the need for a sophisticated receiver, able to reconstruct the messages. In this context the receiver's location code repertoire, which contains codes representing place-names which may be significant to drivers (cities, towns, major road intersections, etc.), will probably have to be exchangeable in the form of a ROM cartridge. With present-day memory technology, and bearing in mind that 1 Mbyte of memory can carry just over 65 thousand location codes, it is probable that a single cartridge could contain only one location code set for a single country like the United Kingdom. For larger countries, like Germany, it is not yet clear whether one or two sets of location codes will be sufficient. If a CD-ROM were used, the location and message repertoire for a large part of Europe could be stored on a single disk.

3. EBU cooperation with the ECMT and the European Communities (DRIVE RDS-ALERT)

3.1. Processing of message codes

The overall development of the RDS-TMC system requires extensive collaboration between all interested parties, for example in respect of the message repertoire.

The elaboration of the repertoire is principally a matter of concern of the road-traffic experts rather than the technical system designers. Initially, the latter only need to know the maximum size of the message repertoire, and current indications are that the maximum number of message elements will be of the order of 2000.

However to permit TMC receivers to be built, the message repertoire needs to be standardized and, in defining this repertoire, account must be taken of the message handling and management methods — which are a matter for the technical experts.

3.2. Location codes

Work carried out within the ECMT, and later by the DRIVE/RDS-ALERT Consortium, indicates that for long-distance travelling a location code set would comprise codes for some 65 000 locations. The handling of these location codes is a matter of TMC system design. A number of requirements will have to be met. There should be a common international location set usable for long-distance travelling, and border areas of adjacent countries should also be included in the location sets of each country concerned. Again, to permit large-scale manufacture and to guarantee correct operation regardless of the country visited by the receiver, the codes need to be part of the RDS-TMC standard.

3.3. Future up-dating of message and location sets

Future up-dating of the RDS-TMC standard, and in particular the message and location repertoires, will require close collaboration between the broadcasters and the road-traffic authorities. The most representative organizations for these two groups, on a European scale, are the EBU and the ECMT, and ideally they should bear joint responsibility for the up-dating of the message and location repertoires.

4. Incorporation of the TMC feature in the RDS standard

The Radio Data System is the subject of a new CENELEC standard [3]. The EBU has retained the responsibility for enhancing the standard, in particular as regards newly-defined features such as TMC. The EBU is of course represented in CENELEC Technical Committee TC 107, which is responsible within that organization for RDS standardization.

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Acknowledgement

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