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A silent revolution - RDS for FM radio



RDS Forum authors team

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*This book is dedicated to all colleagues within the EBU and the RDS Forum, who helped to make this RDS success story happen.
Thanks for the many opportunities we had to work with you.*

Dietmar Kopitz

About the co-ordinating author:

Dietmar Kopitz is one of the two founders of the RDS Forum and since 20 years its Chief Executive.

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Forward for the first ebook on RDS

Back in 1985 my boss, the Managing Director of BBC Radio, Richard Francis, sent for me and said that I was to take charge of the programme development and promotion of RDS. Not just for the UK, but through the European Broadcasting Union, for the whole of Europe.

“What is RDS?” I asked.

“It will be the most important development in radio since the invention of the transistor” was Richard’s reply and that started my love affair with the system which has revolutionised FM radio listening over the last 27 years.

In retrospect, I see now that the broadcasters who started down the RDS road all those years ago were creating a silent revolution in radio.

In cars in particular, if you are driving across your country and you wish to remain tuned to the same national station you will have to retune many times. This is due to the fact that overlapping coverage areas from the network of transmitters carrying the same programme have to broadcast on different frequencies to avoid interference.

With RDS you can find the station by name and the clever radio does the rest for you, and to avoid traffic hold ups you can receive travel news relevant to the local area through which you are driving.

All by courtesy of RDS.

Today, thanks to the enthusiastic take up by chip manufacturers, nearly every radio in Europe has the capability to decode the RDS data and take advantage of what is on offer. Not just radios but smart phones too have integrated RDS and so there are many 100 millions of radios out there which offer the useful features. These days it is not just automatic tuning and travel news but text messages about the programmes and information about the music being played.

It really has made FM radio so much better and easier to use. All over the world people are using it without being aware and yet there are few who understand how it works.

In this book, edited by Dietmar Kopitz, you will find an explanation of the whys and wherefores of the Radio Data System, set out in an easy to understand, non-technical way. You will see how the system developed and understand why the transition to digital radio is happening so slowly.

Modern radios don’t wear out and with a good RDS Radio there is little incentive to throw it away in favour of a DAB one, especially as few new cars offer the alternative of a DAB radio as standard. There is little to be gained by switching from FM except where radio stations are offering unique programming on DAB.

Governments are keen to shut down the FM broadcasts so that they can sell off access to that spectrum to meet their budget deficits. However the public, by not switching over to DAB, are making this option very difficult and I foresee that it will be at least another twenty years before more people are listening on digital than on FM. In the meantime RDS sails on into the sunset with clear enjoyable listening for everyone. Long may it continue.

Now switch off your radio for a while and sit back and enjoy this electronic publication which gives you the whole inside story of RDS, the Radio Data System, by one of the founding fathers, Dietmar Kopitz.

*Johnny Beerling, Chairman of the RDS Forum.
August 2013*

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In 1988 RDS was implemented on the BBC FM transmitter network. Johnny Beerling presented the innovation at the opening ceremony in London.



1990: The BBC's RDS crew on the road for an EBU meeting on RDS in Torino, Italy. From left to right: Mark Saunders, Bev Marks and Johnny Beerling.



RDS Forum 2012 at Glion/Montreux (Switzerland). From left to right: Dietmar Kopitz, Kent Adebarn, Johnny Beerling. Kent and his team had designed the first commercial RDS car radio, the Volvo SR-701, introduced into Volvo cars during 1987/8.

The RDS development history by Dietmar Kopitz

This Chapter gives a detailed overview about

- ▶ The RDS and RBDS standards
- ▶ the UECP specification and
- ▶ the RDS Guidelines.
- ▶ The current RDS standard is IEC 62106 ed.3 from 2013.
- ▶ The current RBDS US standard is NRSC-4-B from 2011.
- ▶ The RDS receiver measurement standard is IEC 62634 ed.2 from 2013.
- ▶ The Universal Encoder Communication Protocol UECP is published by the RDS Forum and the current version is 7.05 from 2010.
- ▶ The RDS Guidelines are also published by the RDS Forum and the current version is 5.1 from 2012.
- ▶ The RDS-TMC standards are ISO 14819 - all parts.



The EBU Specialists Group testing first RDS proposals at Bern/Interlaken (Switzerland) in 1980

HISTORICAL DEVELOPMENT

Early in the 1970s, many public broadcasters in Europe were beginning to ask themselves: what could be done with FM? It had been introduced in the 1950's and yet it was none too successful, despite continued investment in the transmission infrastructure. Many big broadcasters had, by the mid-1970s, completed their national FM networks with nominal service coverage around 95% of the population, or more. Nevertheless audience research and FM receiver sales continued to suggest that something was impeding the take-up of FM radio services by the public. However, in particular, the in-car entertainment sector had worked hard on improving receiver sensitivity which helped improve reception significantly. Some other factor must have been playing a role in this slow acceptance of FM services. Various research organisations were asked to look at this situation and reported mixed but highly constructive solutions.

In 1974 we had in Europe the following situation: the largest German car radio manufacturer Bosch/Blaupunkt had developed, in close collaboration with the research institute of the German public broadcasters (IRT), the ARI-system. ARI stands for "Autofahrer Rundfunk Information" which means "broadcast information for motorists" (note: The ARI system was

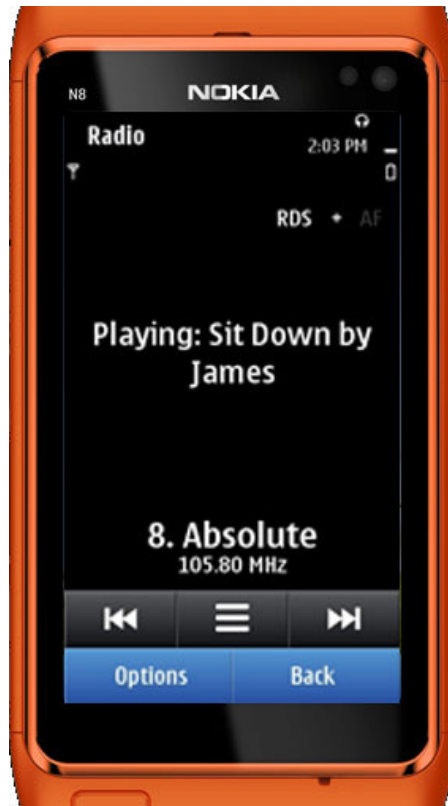
discontinued in Europe in the years 2004 - 2006). The system used the 57 kHz subcarrier with a 3.5 kHz injection level as a means to identify that the so marked programme carries from time to time announcements about road traffic. This subcarrier was then amplitude-modulated with 125 Hz, when the traffic announcement was broadcast, as a means of identifying that such an announcement is on air. In addition one out of six possible signals (between 23.75 Hz and 53.98 Hz) was used for area identification.

Bosch/Blaupunkt was hopeful at that time that this ingenious system would be adopted by the broadcasters all over Europe, which would have been an advantage from the receiver manufacturer's point of view because of the convenience of a more uniform market for the sales of car radios. To gain the broadcasters' support, the ARI system was submitted by the German public broadcasters to the European Broadcasting Union's Technical Committee, with the view to obtain then a recommendation from the EBU that this system should be generally used all over Western Europe.

The EBU is a European professional association of mostly public broadcasters, in Western Europe at that time, but it now also includes the broadcasters of Central and Eastern Europe. The EBU is in fact the authority to establish or harmonize operational broadcast practices in Europe. In doing so, there is full awareness in the EBU that it is not a standardisation organisation. Therefore, the EBU collaborates very closely with standardisation organisations like the ITU, CENELEC, IEC, ISO and ETSI to create the necessary standards, normally before any recommendation, relating to an operational practice for broadcasting, is issued.

RDS - What is it all about ? by Dietmar Kopitz

This Chapter gives a detailed overview about RDS and RBDS. It provides much of the necessary background that will help to better understand the details given in later chapters about RDS and its implementation options.



RadioText Plus is used in some recent devices that display for music items the title and the artist's name. The Nokia N8 smart phone was one of those.

OBJECTIVES TO BE ACHIEVED WITH RDS

The Radio Data System, RDS, offers broadcasters a flexible data-transmission channel accompanying VHF/FM sound broadcasts. Additionally, RDS offers the possibility for data service providers to introduce new data services if these are based on the concept of sending relatively “few” bits to many users. Thus, RDS can accommodate a wide range of possible implementation options.

Following a long period of systems development in the 1970s and early 1980s, and field trials in several European countries, RDS is now implemented in over 50 countries worldwide, in Europe, in some Asia Pacific region countries, South Africa, Latin America, the USA, Canada and Mexico (using RBDS).

SYSTEM CHARACTERISTICS

RDS development had started with a number of functional requirements to be fulfilled. These were:

The radio data signals must be compatible; they must not cause interference to the reception of sound programme signals on existing receivers or to the operation of receivers which use the ARI system.

The data signals must be capable of being reliably received within a coverage area as great as that of the monophonic main programme signal.

The usable data rate provided by the data channel should support the basic requirements of station and programme identification and provide scope for future developments.

The message format should be flexible to allow the message content to be tailored to meet the needs of individual broadcasters at any given time.

The system should be capable of being reliably received on low-cost receivers.

These requirements have significantly influenced the choice of the modulation parameters and the baseband coding characteristics.

The multiplex spectrum of a stereophonic FM broadcast signal comprises the small signal level RDS signal, centred around the 57 kHz subcarrier which is the third harmonic of the 19 kHz pilot-tone of the stereophonic modulation system. This choice of the subcarrier was critical for meeting the requirement to minimize data signal interference to the audio channels for existing receivers. The other parameter that is critical to achieve the same goal is the injection level of the data. The higher it is, the more rugged is the data service but under multipath conditions the interference to the audio channels will also increase. It was found in field trials that a minimum was ± 1 kHz and a reasonable operational choice was ± 2 kHz. At these levels there is usually virtually no interference from the data channel detectable during radio listening.

The use of the biphase coded data signal also helps compatibility with the audio programme signal because coherent

components at around 57 kHz were found to introduce data-modulated crosstalk in receivers that used a phase-locked loop (PLL) stereo decoder and which is the generally used demodulation technique used nowadays.

The bit rate of the RDS data stream is 1187.5 bits/s ($1187.5 = 57,000 / 48$) which, with biphase coding and the specified 100 % cosine roll-off filtering, gives an overall bandwidth for the data signal of approximately 5 kHz, centred on 57 kHz.

Choice of baseband coding

Multipath, in an FM system, produces distortion of the demodulated signal. The distortion components resulting from the relatively large amplitude sound programme signal components can easily swamp the data signal. When a vehicle moves along a road characterized by multipath interference, the quality of the received FM signal varies rapidly. At some moments, the demodulated audio programme is distorted; at others, it is completely broken up. The very important lesson learned from the 1980 and 1982 field trials in the Bern/Interlaken area was that reliable mobile reception is only possible when the radio data message stream is broken up into small independent entities, each of which can be received, decoded and applied independently of other parts of the data stream. This factor was crucial to the basic design of the RDS system and must be clearly understood for the design of new applications within RDS, such as those that can be carried within the ODA feature.

The RDS features in detail by Dietmar Kopitz

This Chapter describes the RDS features in a general manner.

AF	Alternative Frequencies list
CI	Country Identifier
CT	Clock Time and date
DI	Decoder Identification
ECC	Extended Country Code
EON	Enhanced Other Networks information
eRT	Enhanced RadioText
EWS	Emergency Warning System
IH	In House application
MS	Music Speech switch
ODA	Open Data Application
PI	Programme Identification
PIN	Programme Item Number
PS	Programme Service name
PTY	Programme TYpe
PTYN	Programme TYpe Name
RP	Radio Paging
RT	RadioText
RT+	RadioText Plus
TA	Traffic Announcement flag
TDC	Transparent Data Channels
TMC	Traffic Message Channel
TP	Traffic Programme flag

DESCRIPTION OF THE RDS FEATURES

Alternative Frequencies list (AF)

The list(s) of alternative frequencies give information on the various transmitters broadcasting the same programme in the same or adjacent reception areas, and enable receivers equipped with a memory to store the list(s), to reduce the time for switching to another transmitter. This facility is particularly useful in the case of car and portable radios.

Clock Time and date (CT)

Time and date codes shall use Coordinated Universal Time (UTC) and Modified Julian Day (MJD). Details of using these codes, which are intended to update a free running clock in a receiver, are explained in the RDS standard. If $MJD = 0$, the receiver shall not be updated. The listener, however, will not use this information directly and the conversion to local time and date will be made in the receiver's circuitry. CT is used as time stamp by various RDS applications and thus it must be accurate.

Decoder Identification (DI) and dynamic PTY Indicator (PTYI)

These bits indicate which possible operating modes are appropriate for use with the broadcast audio and to indicate if PTY codes are switched dynamically.

Extended Country Code (ECC)

RDS uses its own country codes. The first most significant bits of the PI code carry the RDS country code. The four bit coding structure only permits the definition of 15 different codes, 0x1 to 0xF. Since there are many more countries to be identified, some countries have to share the same code which does not permit unique identification. Hence, there is the need to use the Extended Country Code which is transmitted in Variant 0 of Block 3 in type 1A groups and together with the country identification in bits b_{15} to b_{12} of the PI code render a unique combination. The ECC consists of eight bits.

Enhanced Other Networks information (EON)

This feature can be used to update the information stored in a receiver about programme services other than the one received. Alternative frequencies, the PS name, Traffic Programme and Traffic Announcement identification as well as Programme Type and Programme Item Number information can be transmitted for each other service. The relation to the corresponding programme is established by means of the relevant Programme Identification. Linkage information, consisting of four data elements, provides the means by which several programme services may be treated by the receiver as a single service during times a common programme is carried. Linkage information also provides a mechanism to signal an extended set of related services.

Emergency Warning System (EWS)

The EWS feature is intended to provide for the coding of warning messages. These messages will be broadcast only in cases of emergency and will only be evaluated by special receivers.

Alternatively EWS may be implemented as an ODA.

In House application (IH)

This refers to data to be decoded only by the operator. Some examples noted are identification of transmission origin, remote switching of networks and paging of staff. The applications of coding may be decided by each operator itself.

The RDS Encoder Communication Protocol UECP by Dietmar Kopitz

This Chapter explains the need for a communication protocol to be used between broadcaster (studios) or data Service Provider and RDS encoders. The EBU has developed a specification for this protocol which is commonly called the UECP (Universal Encoder Communication Protocol). It is recommended to use it, especially when RDS is implemented within a network of several transmitters.

WHY DO RDS ENCODERS NEED A COMMUNICATION PROTOCOL?

Transmission operators who want to implement an RDS service need to install RDS encoders. They are normally installed at transmitter sites adjacent to the stereo encoder, which generates a 19 kHz signal that the RDS encoder uses to synchronise its output RDS data stream.

Two “types” of RDS can be provided: Static RDS services can be provided by an RDS encoder simply providing RDS information, such as a fixed AF list, from internal memory; whereas Dynamic RDS services, such as RadioText, require data input to an RDS encoder. Even Static RDS services may have to be changed from time to time, depending upon the network configuration and the type of radio programme on air.

Dynamic RDS is needed for a number of reasons. RDS data related to the radio programme content require a high degree of control from the on-air studio. In the case of a data service such as TMC, an operator specific implementation un-

der ODA, then a high degree of control is required from the Service Provider to supply the data to the RDS encoder, either to a single broadcast transmitter or to a network of broadcast transmitters.

Simple, but numerous different commands from the on-air studio or the Service Provider have to be sent via a suitable data link to the RDS encoder. For example, the on-air studio could change the status of the TA flag for a traffic announcement.

A number of proprietary update protocols were implemented on data links between source servers and the RDS encoders; several of them were encoder manufacturer specific. These protocols were used to send data messages from an RDS controller/management system (or simply an RDS encoder server) to the RDS encoders. Acknowledgements from the encoder were not essential and, instead, it was arranged to send repeats of each message in order to ensure their receipt. In this way a whole range of dynamic RDS features could be used by the broadcaster to enhance RDS performance for the listener.

WHY THE EBU DEVELOPED, WITH ENCODER MANUFACTURERS, THE UECP?

In the early nineties, the EBU studied a requirement that the various existing and implemented RDS encoder communication protocols should be harmonized. Such harmonization would then enable broadcasters to purchase RDS system

components (eg RDS encoders, RDS server computers and software) from a variety of sources. This would permit significant economies in network operation and it would offer the necessary high flexibility to implement, in successive stages, enhancements to already existing RDS implementations, specifically within transmitter networks. RDS system component manufacturers would then also be able to integrate their products with those from other manufacturers, enabling more complex systems to be produced than those that would otherwise have been impossible.

These proprietary update protocols had similar functional elements, however they differed significantly in their environmental models. The structure, functionality and addressing of their intended networks and the data structures within each RDS encoder are often quite different. Therefore the Universal Encoder Communication Protocol (UECP) specification, now very widely accepted, was based on *harmonized* environmental and encoder models.

The UECP is a layered communication protocol which is in line with on the commonly used OSI reference model (ISO Recommendation 7498). The UECP in its current version 7.05 (February 2010) has been updated by the RDS Forum since 1993.

The model and protocol also provides a template specification upon which new products may be based and most specifically it permits other existing encoder communication protocols to be enhanced. Thus many existing devices can be adapted to meet the present functionality required. The specification can now be freely obtained from the RDS Forum by downloading it from its website www.rds.org/uk.

Organizations and manufacturers that have contributed within the EBU and later within the RDS Forum to the elaboration of the UECP specification included: Aztec, Auditem, BBC, Deutsche Telekom, Ericsson (formerly Teli), IRT, Qbit, RE Technology, Rohde & Schwarz, TDF, Telefunken Sendertechnik and Teleray.

In the RDS Forum we have the following encoder manufacturers that all use the UECP version 7.05:

2wcom (Germany),

Auditem/Worldcast (France) and

Axel Technology (Italy).

UECP CONCEPT Addressing method

Communication to RDS encoders needs to be capable of many levels of addressing:

- ▶ To all encoders.
- ▶ To specific sets of encoders or to a particular device.

This may be accomplished by a suitable logical addressing method.

In defining an environmental model for the UECP, the following assumptions were made:

RDS signal monitoring, analysing and testing by Dietmar Kopitz

This chapter gives some practical advice about how to use a new product to look into the details of the RDS signal performance of any new or existing RDS receiver and analyse the content of the FM/RDS signals found on air.

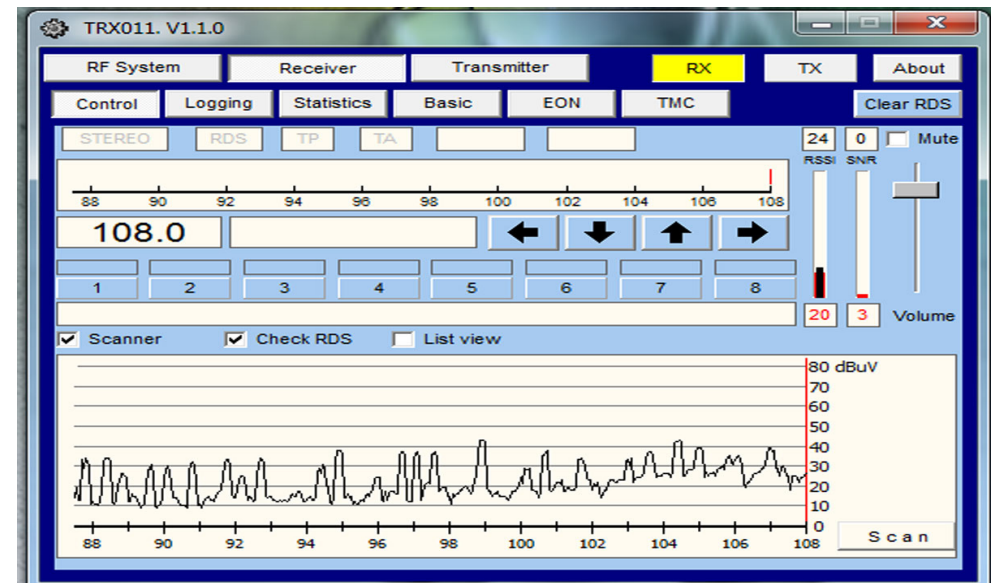


On screen we can see the band scan result. It only took a minute to get the complete picture about RDS on air

I think, everyone interested in RDS would like to know what RDS signals are really on air. Here is the solution. In June 2012 RDS Forum Member Catena (in the Netherlands) presented a new product, the TRX011 that I immediately perceived as a “wonder box”. The new product is relatively inexpensive and has the size of about a cigarette box. It is designed to be used with a Windows PC and it has to be connected to the PC via USB and no separate power supply for the box is needed. The software for analyzing and setting the transmitted RDS data is part of the package. Note specifically that you can transmit with this wonder box your own RDS data. It has implemented all RDS features (except one: eRT) including those that use the ODA, such as RDS-TMC and RT+. As eRT is an ODA, you can test it as well, but not display the text as a string of characters.

The wonder box was designed by Joop Beunders, who is one of those RDS design engineers that have the longest professional experience with RDS. Joop started his RDS development work in the late seventies with Philips in Eindhoven (Netherlands) building hardware for the Dutch RDS candidate system SPI. To enable his new TRX011 product to receive and transmit RDS data, he is using an integrated circuit designed some years ago by another RDS Forum Member, Silicon Labs in Texas. They brought this chip, Si 4721, to the market to permit small add-on products to be made for the many iPod and MP3 players available then. This was to permit these music players to transmit within a short range of a few meters distance the music and data (mainly titles and artist names) via FM/RDS to supply them to a free FM channel to which the car

radio could then be tuned (examples of such device suppliers are Belkin, Gear and many more). The IC can transmit any of the RDS data features so that, if the add-on device is well designed, such a short-range transmitter could signal via AFs an alternative free FM channel when the car is driven over a long distance. The information where such a free channel will be available would be obtained from a band-scan performed during the journey, carried out at frequent intervals by the receiver part of this IC.



The band scan result can also be displayed as a list showing the PI code and the PS name

RDS in the world of Automotive by Frits de Jong

In Chapter 1 we have seen that a replacement from the existing ARI system to a pan-European traffic information system (TP/TA) was an important issue for the car-industry to support RDS. The ARI system was limited to Germany, Austria, Switzerland and Luxemburg and no further plans existed to extend the system to other European countries. In addition the AF feature, which made it possible to follow a radio programme throughout a large geographical area or even an entire country without the need for manual re-tuning, created a lot of enthusiasm. RDS gave a huge contribution to driver safety which was the trigger for the car industry to design RDS radios in their new car models, first in the high-end cars, soon followed across the entire car products range.

BASIC AUTOMOTIVE REQUIREMENTS

In essence safe driving was the focus at the introduction of RDS car radios. Car radios capable to ensure undisturbed listening without the need of manual retuning of the radio programme. Traffic announcements could hardly be missed since TA was cross-linked over the entire network by EON. In other words the mental workload for the driver decreased significantly since RDS did all these things automatically.

PS - Programme service name

The PS is the most obvious visual identification of a radio programme. Ideally this name should stay on the display even if RDS synchronization is lost. The RDS sensitivity is generally 10dB lower than the FM sensitivity. In practice one can still listen to the radio programme, while RDS can no longer be received.

In order to ensure that the PS remains visible on the display even when RDS data is lost, the PS is memorized under the radio programme preset button.

AF Automatic program retune

An ideal RDS radio switches over inaudibly and in time to an alternative frequency (AF) with the best audio quality. Variations in sound should not occur. This is easier said than done!

A number of parameters are deterministic for the audio quality of the signal:

► Signal strength

The signal level is the most important parameter to select a new AF with a better audio quality.

► Distortion from Multipath

Multipath distortion occurs when RF signals reach the car antenna, both in a direct path from the transmitter and via reflections as known in mountainous areas. Signals from reflections arrive with a time delay, which causes an audible distortion.

To reduce the influence of multipath distortion, a system using multiple antenna's has been used: antenna diversity. In this system the tuner can switch to or even combine the signals from multiple antennas in order to reduce the multipath effect.

► Adjacent Channel

In areas with a high density of FM transmitters, a strong adjacent FM station may be present at a distance of +/- 100 kHz of the tuned radio programme. The effect has become less noticeable since the selectivity of car radios has been improved significantly over years.

Dynamic selectivity is almost a standard feature nowadays.

Nevertheless, when driving higher up in the mountains and near the borders, like the Black forest area in Germany or around large metropolitan regions like Paris, distortion of the audio may still frequently occur.

In principle the AF list of a radio programme is regularly validated on the above mentioned parameters. While listening, the tuner jumps shortly to an AF and measures the signal quality. During this short period the radio is muted. This short tuning action takes for modern well- designed tuners only 4-6 msec. Although this short update mute is almost inaudible for the listener, it is obvious that AF lists must be kept short in order to manage this AF list update process well.

As a result of this, a new AF will be available to switch to when the currently tuned frequency becomes weaker and

the audio quality is degrading. A golden rule after switching to a new AF is checking the PI code. It may happen that an AF from the list is valid in another part of the country or region while the AF at the current location belongs to a local transmitter with a different program. During the PI code check the radio will be muted. This mute period is audible, because it is defined by the RDS system and may take up to 200 msec under good conditions. Clever designed RDS radios will limit the audible PI checks to a minimum by making use of historical and statistical data.

Automotive requirements

The performance of this automatic re-tune system has been considered as a core feature by the car industry. Over the years millions of test kilometers were driven to develop and optimize algorithms to improve the system. At that time car radios were mostly single-tuner products. Undisturbed listening under difficult reception conditions at one hand and a clever AF list update mechanism in order to ensure reliable AF switching at the other hand were a major challenge. Both tasks had to be done by one tuner. Also compromises had to be made to keep this update process almost inaudible.

RDS test locations

We have seen which parameters are decisive for an optimal reception. A logical choice of areas to test the RDS performance on the road is where these conditions will be continuously available.

RDS-TMC: The Traffic Message Channel by Mark Saunders

Although RDS was primarily developed by Public-Service broadcasters as an aid to listeners in station selection and identification, RDS has also been widely and successfully used for commercial applications. The most implemented of these is Traffic Message Channel (TMC), where RDS transports densely coded information about driving conditions.

In the early 1990s, RDS became fitted as standard equipment in many new vehicles, especially in Western Europe, and a few years later Satellite-Navigation and route guidance systems started to become realistic consumer devices. Satellite-Navigation systems at their basic level are able to calculate the optimum route between two points, either the shortest route, or the quickest, but only become really useful if they take into account the traffic conditions between the points, and use that information in the route calculation process. Even without the aid of Satellite-Navigation, drivers themselves are able to pick the best route, or at least estimate how long their journey will take if fully appraised of accidents, roadworks, other factors, or simply sheer volume of traffic, that will affect their progress.

Spoken traffic information has for many years been the primary method of imparting information to drivers, but is extremely limited in the amount of information that can be conveyed by an announcer who typically will report ten or so incidents three or four times an hour during peak times, and even less frequently at other times. For drivers, spoken traffic information especially on national or large regional stations, is mostly irrelevant anyway.

The proven reliability of RDS to deliver information to vehicles became an obvious technology to use to deliver a better, more comprehensive and relevant traffic service to drivers.

ESSENTIAL ELEMENTS OF TRAFFIC INFORMATION

Traffic information, however communicated, needs to provide essential elements of information:

- ▶ what is being reported;
- ▶ where the problem is;
- ▶ what the effect is;
- ▶ who is being affected;
- ▶ how long the situation likely to last; and
- ▶ what can be done to avoid or ameliorate the situation.

To communicate this information would require a considerable bandwidth (more than the entire capacity of RDS) if transmitted as text (which would be fundamentally dangerous in a vehicle anyway), so instead the information is broadcast as a series of codes, which consume very little RDS bandwidth, and can be used directly by the in-vehicle systems. When presentation of messages is necessary, as codes rather than text are used, the service is language and unit independent, allowing the end-user his choice of presentation of the information.

TMC transmits the following core 'elements' in every message:

LOCATION: The point at which the problem has occurred, the beginning and end of the road stretch affected, a particular 'link' on the road network (for example an exit slip from a motorway), or an area.

EVENT: This is the part of the message which describes what is being reported; an accident, a road closure, road construction, traffic congestion, dangerous driving conditions, adverse weather conditions etc. Events broadly fall into one of two types – 'flow' which details the average speed of traffic on a road section, either explicitly with a km/h value, or comparatively using phrases such as 'slow traffic' or 'stationary traffic' or 'flowing freely' – or 'incident' which is the non-flow event messages, such as accidents, road construction etc. The incident messages can be split further into 'planned' and 'unplanned' incidents. Road Construction is an example of a planned incident, an accident however is unplanned.

Often, an incident causes a problem, with slow traffic flow be-

ing the result, so a message often contains both an 'incident' element and the resulting 'flow' element – an accident (incident) has caused traffic to move at only 20 km/h (flow).

DURATION: With some incidents, especially planned road construction, there is a specific scheduled time at which the incident is expected to have been cleared and conditions returned to normal, so a duration if known is also given or simply 'unknown' is sent.

Most traffic messages need just these three fundamental elements to adequately convey the information required, but TMC also allows several option details to be included when necessary. The most common example is to add specific time information for planned incidents. It is desired to notify in advance a road closure occurring over-night, so the start time of the closure (23:00 Thursday) until the re-opening (05:00 Friday) can be explicitly communicated too.

TMC IN DETAIL

TMC is the most-widely used example of an ODA (Open Data Application) within RDS. ODAs by design make use of one of the many specified 'un-used' RDS group types in a particular transmission, but by de facto, due to the fact that TMC slightly pre-dates the ODA concept, they always use type 8A groups to transmit the data. The necessary ODA type 3A group is of course also transmitted which gives the AID of RDS-TMC - CD46 - or an extension of TMC (as yet not realized anywhere) - CD47. The detail of both the information in the 8A groups and

3A group is given below.

Above was described the two core elements of a message, essentially Location and Event.

They differ is that a Location has geographical relevance, whereas largely an Event (or at least a core set) can occur anywhere. The principle adopted is that all TMC Service Providers use the same standardized 'Event List', but Location codes are determined locally.

The Future of FM radio with RDS by Dietmar Kopitz

During the past 20 years, the usage of RDS in FM radio receivers has tremendously increased.

Nevertheless, specifically among European public broadcasters, there is an attitude now that FM and RDS are “not alive and kicking” any longer. However, I think that in spite of their age FM radio, which is now over 60 years old and RDS, which is almost 30, in combination, both remain very attractive and totally mature radio broadcast technologies that cannot be easily replaced by digital radio. This is in Europe already confirmed by the fact that DAB had relative to FM/RDS radio, within the 20 years since it is available, only a very small market acceptance and this in spite of all the ongoing digital radio promotion.

When the RDS Forum came into being in 1993, it comprised mainly broadcasters and there were only a few major car radio manufacturers in the Forum. Nowadays it is the opposite; the Forum consists of mostly industry members and there are only a few broadcasters still active in developing RDS further. To get the best out of RDS, however both are needed. It is the well known “chicken and egg” relationship, which needs to be fully understood in the RDS context. We need more

broadcasters to join the RDS Forum and I shall now explain the benefits to them.

In the RDS Forum we have many experts, who can contribute to raising the awareness of the broadcasters about what RDS still has to offer. We are not talking about the basic RDS features that are used everywhere these days, but about the dynamic programme related RDS features, which are still much under-used.

Manufacturers in the RDS Forum are very quick to add more features to RDS radios, if these are needed in the market, but we can only develop this together with an alliance of broadcasters and manufacturers. Remember, we, in the RDS Forum, have the eggs, but we need the chicken !!!

The RDS Forum holds the view that the RDS technology is firmly established nowadays within the industry and for FM radio broadcasters it still has many attractions to offer, particularly in the mobile environment with Smart phones and Tablet devices.



This 91.3 screen was captured in October 2009 on radio BAYERN 1 in Munich:

- Upper line shows normal RadioText scrolling through the display
- Lower two lines show -RT+ tagged music info
 - > Music title on line 1
 - > Artist name on line 2

Since 2009 Apple implemented in its iPod nano models (5G, 6G, 7G) the RDS-RT+ feature for the display of broadcast Music titles and Artist names, a feature much used by broadcasters in Germany and the USA up to now.

This eBook was written by a team of RDS Forum members who are closely involved in the RDS development since more than two decades. Thus this book comprises an enormous amount of collective knowledge and information. It generally informs the reader about the possibilities seen now, within the RDS Forum, to use this well proven and much updated FM radio technology at its very best, well taking into account the transition to digital radio in Europe and the USA. This book gives an overview on the history of the RDS technology, describes generally the RDS system and all RDS features, explains the UECP and why it is needed, also explains how to monitor and generate RDS signals on air, RDS in the world of automotive applications, the fundamental principles of RDS-TMC, the possibility to extend RDS and makes a prediction of the future use of FM radio and RDS.

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