

The RDS service (Radio Data System)	2
RDS features	2
Alternate Frequency (AF/EON)	2
Traffic Announcement / Traffic Program Indication (TA/TP).....	2
TMC - Traffic Information via Traffic Message Channel.....	2
Station name, Program Type, Radio Text (PS/PTY/PTYN/RT).....	2
Specific user data forwarding (TDC).....	2
Radio Paging (RP) - Paging via RDS.....	2
EWS - Emergency Warning System	2
Position of the RDS signal in the modulation spectrum	3
RDS groups	3
Group Format	4
Error Correction and Synchronization.....	4
RDS information for indication	5
Program Service Name (PS) / Scrolling Program Service Name (SPS).....	5
Program Type Name (PTYN)	5
Radio Text (RT).....	5
Clock Time and Date (CT).....	5
RDS control information	6
Program Identification and Extended Country Code (PI und ECC).....	6
Program Type (PTY).....	6
Traffic Program Identification (TP).....	6
Traffic Announcement Identification (TA)	6
Music/Speech Switch (M/S).....	6
Decoder Identification (DI) and Dynamic PTY Indicator (PTYI).....	7
Alternative Frequencies (AF)	7
Program Item Number (PIN).....	8
Group Sequence (GS).....	8
Special RDS information	9
Enhanced Other Networks Information (EON).....	9
Transparent Data Channel (TDC).....	9
In House Applications (IH)	9
Radio Paging (RP).....	10
Emergency Warning System (EWS).....	10
Traffic Message Channel (TMC).....	10
Free Format Groups.....	10

The RDS service (Radio Data System)

The Radio Data System (RDS) is an add-on data service, used by many 87.5 to 108 MHz FM radio stations. The purpose of RDS is to increase the system functionality.

RDS is a stable system and will probably not be replaced by DAB (Digital Audio Broadcasting). At least not, as long as there are active analog FM radio stations.

RDS features

Alternate Frequency (AF/EON)

Avoids that e.g. car drivers have to manually change the frequency while driving. If the chosen signal turns weak, the RDS tuner automatically switches to an alternative frequency. This works by a list of alternative frequencies, which is transmitted via RDS. The tuner automatically switches to the strongest station. To avoid user inconvenience, the tuner is muted during fast automatic switching.

EON makes it possible to transmit information about other stations. This could be used by a station, which does not offer street traffic program content. If an alternative station with street traffic program content is available, the tuner automatically switches to this station during a street traffic program broadcast.

Traffic Announcement / Traffic Program Indication (TA/TP)

Can be used to mark a station that offers traffic information (TP) and to indicate if there is ongoing traffic information. An RDS tuner can be set to only unmute audio if there is ongoing traffic information (TA).

TMC - Traffic Information via Traffic Message Channel

Can be used to forward special traffic information. This could be information about traffic jams, which are used by navigation systems for optimized routing.

Station name, Program Type, Radio Text (PS/PTY/PTYN/RT)

RDS tuners can display the station name (PS) instead of the frequency or display program related information (PTY/PTYN). Radio text makes it possible to broadcast longer text blocks like the song title and the artist of the current song.

Specific user data forwarding (TDC)

Can be used to forward any transparent data via RDS.

Radio Paging (RP) - Paging via RDS

RDS offers pager capability. Specific pagers can receive individual messages via RP.

EWS - Emergency Warning System

RDS offers an Emergency Warning System. Special EWS receivers can be alerted in the case of emergencies or disasters. This means fast and also cost-efficient warning for the population when dangers like tsunami-flood waves, industry accidents with hazardous emissions etc. arise.

Position of the RDS signal in the modulation spectrum

The lower 15 kHz contain the monophonic audio signal. The stereophonic audio signal is placed between 23 and 53 kHz. The RDS data is contained in sidebands at 57 kHz. The RDS technology enables data rates of about 1187 bit/s. Figure 1 shows the signals in the frequency domain.

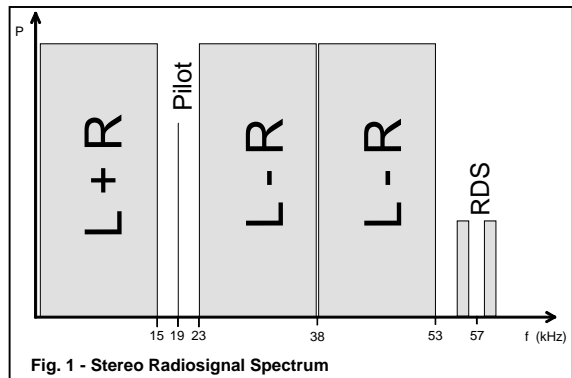


Fig. 1 - Stereo Radiosignal Spectrum

RDS groups

RDS data is formatted in groups. There are 16 groups, divided into type A and type B.

These groups contain different data like PTY or EON data.

A group is formatted as follows:

It contains 104 bits and is divided into 4 blocks.

A block contains 26 bits and is divided into the „Information Word“ and the „Check word“ with the „Offset“.

The „Information Word“ contains 16 bits and carries data.

The „Check word“ with the „Offset“ is for error correction and synchronization.

Figure 2 shows the coding structure.

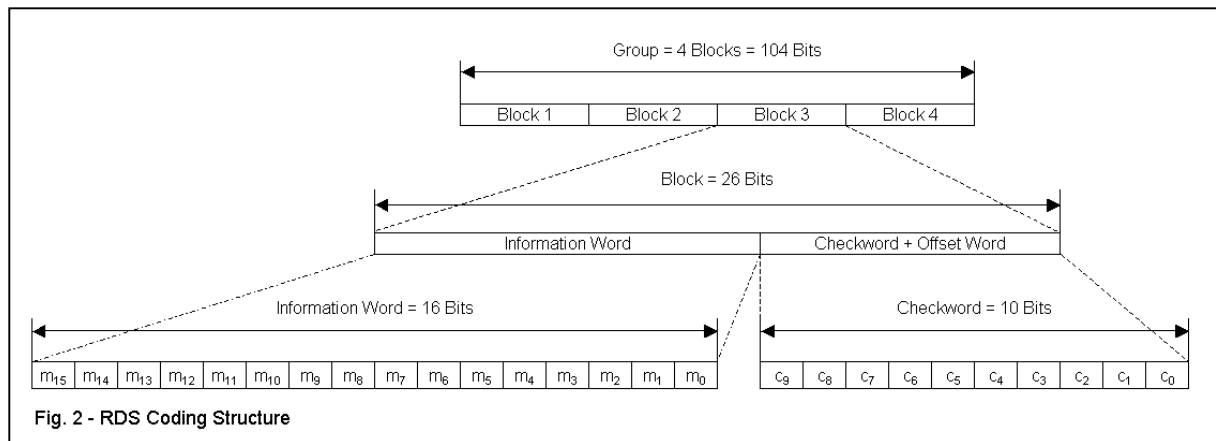


Fig. 2 - RDS Coding Structure

Group Format

The groups are formatted as follows:

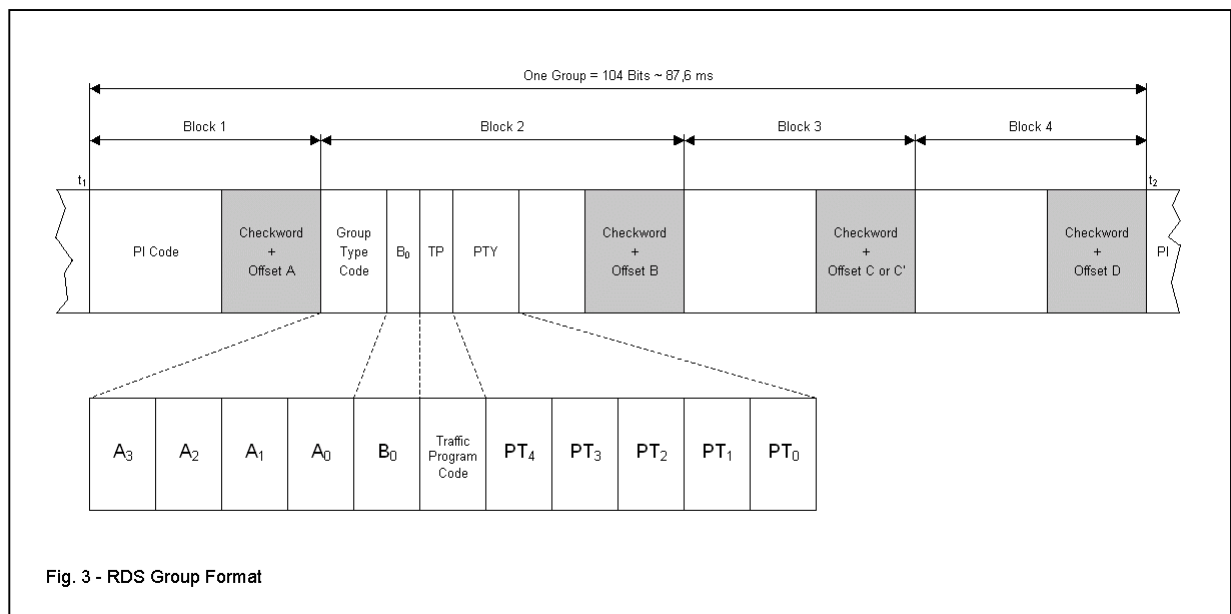
Block 1 of each group contains the PI code of the station.

Block 2 contains the following data:

- Group Type Code (identifies the present transmitted group)
- Version Flag (identifies the group as type A or type B)
- TP Flag
- PTY
- 5 group individual bits

Block 3 and 4 contain group specific data.

Figure 3 shows the group format.



There are "A" and "B" groups. Different to A groups, B groups always contain the PI code in the 3rd Block. If a radio station e.g. has no alternative frequencies, it can send the group "0B" instead of "0A". This means that the PI code is transmitted again for better synchronization instead of transmitting alternative frequencies.

Error Correction and Synchronization

The last 10 bits of a block are used for error correction and synchronization. The synchronization works by using predefined offset words.

The error correction works by using an algorithm which:

- Detects all 1 or 2 bit errors within a block.
- Detects all burst errors if the span is below 11 bits.

RDS information for indication

Program Service Name (PS) / Scrolling Program Service Name (SPS)

The Program Service Name contains max. 8 alphanumeric characters. It can be used to inform the user about the station ID. The PS is usually displayed by every RDS enabled tuner.

As an addition to the static PS it is possible to use a dynamic PS (scrolling PS). Scrolling PS means that also texts like song title and artist or longer station names can be displayed on non-radio text enabled receivers.

The Program Service Name is transmitted in the groups 0A and 0B.

Note: According to the RDS standard, the PS has to be a static display and must not contain other text than an 8 digit name. So please check if scrolling PS is allowed in your country before you start to use it.

Program Type Name (PTYN)

The PTYN can be used for detailed description of the PTY by 8 digits.

Example: If the PTY is "4" (Sport) a PTYN like "Cycling" could be transmitted.

The PTYN is intended for displaying additional information only and cannot be used for automatic station tuning like the PTY.

The PTYN is optional and not obligatory.

The Program Type Name is transmitted in the group 10A.

Radio Text (RT)

Radio Text offers another opportunity to transmit alphanumeric digits. RT offers to transmit long text messages of 64 digits. Additionally RT offers to transmit chain messages.

Radio Text is transmitted in the groups 2A and 2B.

Clock Time and Date (CT)

RDS has the capability to transmit the present time and date. RDS tuners can display the transmitted time and date or synchronize the internal clock to it. The Universal Time Coordinated (UTC) format and Modified Julian Day (MJD) format is used to avoid ambiguity e.g. if a tuner receives signals from different time zones. Local time shifts can be defined in steps of 30 minutes.

Note: Radio stations should ensure to always transmit accurate time and date. Faulty time and date information could have a negative effect on users (e.g. wrong time of a car clock or clock radio). Critical is also the change between normal and daylight savings time. If accurate time and date information could not be ensured, it is better to turn off the CT transmitting. So clocks with an alternative internal reference still work properly.

The CT is transmitted in the group 4A.

RDS control information

Program Identification and Extended Country Code (PI und ECC)

The Program Identification Code is used for the identification of the transmitted content. Every program has a specific PI code. It enables the RDS tuner to distinguish between different countries and areas with the same program. As the PI code is not capable of covering the large number of participating countries, the Extended Country Code can be used additionally.

The PI code is not to be displayed directly, but for internal differentiation of all other programs. An important function of the PI is the automatic search for alternative frequencies. The tuner can search for a frequency with the same program in the case of a weak signal reception. The PI codes are issued by national broadcasting regulating authorities.

The PI code is transmitted in every RDS group.

The Extended Country Code is transmitted in the group 1A.

Program Type (PTY)

The Program Type is an identification number and should be transmitted by every program. The number assigns one of the 31 categories to the program. Possible categories are e.g. Sport, News or Pop-Music.

A tuner can use the PTY to receive specific program types only. Additionally the code can be used for station searching.

The PTY code is transmitted in every RDS group.

Traffic Program Identification (TP)

The Traffic Program Identification Flag is used to identify stations that offer traffic program. The flag is set if the station automatically sets the TA flag on traffic announcements. The TP can be used for automatic station searching.

The Traffic Program Identification Flag is transmitted in every group.

The flags TP and TA have the following functions:

TP	TA	Function
0	0	Program offers no traffic program
0	1	Traffic program is offered via an EON referenced program
1	0	Traffic program itself offers traffic program and eventually via EON
1	1	Ongoing traffic announcement on present program

Traffic Announcement Identification (TA)

The Traffic Announcement Identification Flag is used to indicate an ongoing traffic announcement.

A tuner can use the TA as follows:

- Auto-switch to FM tuner if another audio source is selected (CD, cassette etc.)
- Automatic audio volume increase
- Auto-switch to prior audio source at the end of a traffic announcement

The Traffic Announcement Flag is transmitted in the groups 0A, 0B and 15B.

Music/Speech Switch (M/S)

The Music/Speech switch is used to identify if music or speech program is transmitted. The signal supports tuner with two individual volume modes – one for music, the other for speech. This enables the user to configure the settings according to individual requirements.

The Music/Speech switch is transmitted in the groups 0A, 0B and 15B.

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

The Decoder Identification identifies different operating modes. This enables controlling of individual decoders. Additionally it indicates if static or dynamic PTY codes are transmitted.

The following modes are possible:

- Mono or Stereo
- Artificial Head, No Artificial Head
- Compressed, Not Compressed
- Static PTY Codes, Dynamic PTY Codes

The decoder information is transmitted in the groups 0A, 0B and 15B.

Alternative Frequencies (AF)

Alternative frequency lists are used for sending frequencies that transmit the same program.

The RDS tuner starts to tune to one of the alternative frequencies if the current frequency delivers a weak signal.

There are two types of AF methods.

Method A:

The number of frequencies is transmitted prior to the alternative frequencies itself. If repeaters are used, the list also contains the transmitting frequency itself. A list can contain up to 25 frequencies.

The table shows an example: (AF = Alternative Frequency)

#5	AF1
AF2	AF3
AF4	AF5

Method B:

Used if the list contains more than 25 frequencies or if it is necessary to display the frequencies, which temporary transmit regional different content. In method B the number of frequencies is transmitted prior the transmitting frequency itself. 12 frequency pairs, containing the transmitting and an alternative frequency, follow.

These pairs are usually in ascending order, but should be in descending order if the list contains alternative frequencies that temporary transmit different programs. One list can contain up to 12 frequencies.

The table shows an example: (SF = Station frequency, AF = Alternative Frequency)

#7	SF
SF	AF1
SF	AF2
AF3	SF

Notes:

The AF method used is not stated explicitly, but can be identified by the frequent repetition of the tuning frequency.

AF is transmitted in group 0A.

Program Item Number (PIN)

Identifies the scheduled broadcasting time of a specific program. It enables an RDS receiver to work on specified programs only. This function can be used to plan recordings on scheduled broadcasts.

The PIN is transmitted in the groups 1A and 1B.

Group Sequence (GS)

Specifies which groups are sent by an RDS Encoder. Only groups, which are listed in the group sequence will be transmitted.

The groups 4A, 14B and 15B are an exception. These are transmitted automatically if data arises and must not be entered in the group sequence. If radio paging is used, group 1A is also transmitted automatically at a rate of 1 per second.

12 groups are transmitted per second. Therefore the group sequence specifies the repetition rate of specific groups in a specific time. Groups are transmitted if corresponding data arises only; otherwise they are skipped in the group sequence.

Example: Group Sequence 0A, 2A, 0A, 2A, 6A, 0A, 2A, 0A, 2A, 6A, 3A, 0A

If all groups are filled with data, the repetition rate for group 0A is 5 per second, for 2A it is 4 per second, for 6A it is 2 per second and for 3A it is about 1 per second.

If group 2A is not filled with data, because there is Radio Text, group 2A is skipped. So instead of the above group sequence, the sequence is 0A, 0A, 6A, 0A, 0A, 6A, 3A, 0A.

Additionally an Extended Group Sequence (EGS) can be used instead of the usual group sequence. Then replacement groups can be defined for unfilled groups.

Example: Extended Group sequence 0A, 9A, 2A (**4A, 8A**), 0A, 6A

If all groups are filled with data, the transmitted sequence is 0A, 9A, 2A, 0A, 6A.

If group 2A is not filled with data, the group sequence is 0A, 9A, 4A, 0A, 6A.

If also group 4A is not filled with data, the group sequence is 0A, 9A, 8A, 0A, 6A.

Special RDS information

Enhanced Other Networks Information (EON)

The EON Feature has been developed to support large broadcast networks with several different programs. The Enhanced Other Networks Information enables the transmitting of information about other programs, additionally to the normal RDS data.

The EON data consists of a collection of optional RDS properties of other RDS programs. These are referenced by the PI codes.

RDS receivers can setup a database of other programs and use it for user convenience.

Example: If a station does not offer traffic program, RDS tuners can use the traffic program of other stations. To do this, the tuner temporarily switches to the other station during traffic announcements.

The following content can be transmitted via EON:

EON-PI

Identifies the other program and assigns the related properties.

EON-PS

The PS of the other program can be transmitted via EON.

EON-PTY

The PTY of the other program can be transmitted via EON.

EON-TP

The TP Flag of the other program can be transmitted via EON. This makes it possible to identify if the other station offers traffic program.

EON-TA

The TA Flag of the other program can be transmitted via EON. This makes it possible to detect an ongoing traffic announcement on the other program. The flag can be used to automatically switch to the other program during the traffic announcement.

EON-AF

As on the active station, alternative frequency lists of the other EON referenced program can be transmitted. Equal to the normal AF lists, there are two types of group formats (A & B). These have to be declared explicitly.

EON Data is transmitted in the groups 14A and 14B. Group 14B is used for indicating a change of the TA flag status of a referenced station only.

Transparent Data Channel (TDC)

Used to forward any transparent data. The provider itself can define the data. The TDC can be used to address up to 32 different applications. RDS receivers can use the TDC output for an external application (serial data) or for controlling a pixel graphic display.

Special receivers are necessary to use the TDC data. Normal RDS receivers ignore the TDC data.

Possible applications are:

To control a billboard display by serial data, received by a special RDS receiver.

To install an information system and address special tuner, which display or react on the data.

The Transparent Data Channel is transmitted in the groups 5A and 5B.

In House Applications (IH)

Can be used by the provider to transmit any data for internal purposes. Usual customer tuner should ignore these data. Can be used e.g. for remote switching

The In House Applications are transmitted in the groups 6A and 6B.

Radio Paging (RP)

The Radio Paging Feature has been developed to provide a pager service via RDS data. The user needs a special pager receiver with a specific subscriber code.

There are two Radio Paging Protocols – the Radio Paging and the Enhanced Paging Protocol

The protocols offer the following functions:

Radio Paging:

Supports several message types incl. international pager calls.

It is possible to use several services simultaneously to transmit the pager calls.

Supports a battery saving mode

Enhanced Paging Protocol:

Supports multiple providers and wide area services.

Improved battery saving.

Implementation of international radio paging support

Compatible to the RBDS standard

Enhanced addressing capacity for larger paging networks

Message titles

Additional message types

Radio Paging is transmitted in group 7A.

Emergency Warning System (EWS)

Enables the transmitting of emergency warnings. These warnings are transmitted during emergencies only. A warning activates special EWS receivers that automatically turn on and switch to a predefined emergency station.

EWS Messages are transmitted in variant 7 of group 1A and 9A.

Traffic Message Channel (TMC)

Used for the distribution of traffic and travel data via RDS. The messages are language coded and can be received by relevant users only. Even if a user travels through several countries, the messages are always displayed in the language of the user. Special receiver can filter these messages and use them for optimized travel routing.

So RDS-TMC is for supporting traveling users, by helping them to travel save and efficient between departure and destination.

TMC is mainly used in combination with navigation systems. These can use the information about e.g. traffic jams to optimize the traveling route.

The TMC processing is done with the Alert-C protocol.

RDS-TMC data is transmitted in group 8A.

Free Format Groups

The groups 3A, 10A, 11A, 12A, and 13A can be defined as required by means of the Free Format Groups. So these can be filled with binary user data.

The groups can be filled as follows:

The last 5 bits of block B and each 16 bits of block C and D can be defined by the user. The other bits are fixed and cannot be changed.

This means the PI code, the Group Type Code, the Version Code, the TP Flag and the PTY are not user definable, but the remaining 37 bits can be user defined.

Although the groups can be filled with user data, it is important to note that the RDS receiver can identify these as groups. So these groups are processed as normal groups and should contain valid data only.

The Free Format Groups are transmitted in the corresponding group.