RDS

AT FULL BLAST

A quick guide for setting-up your RDS content to perform well on current receivers

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Introduction

Let’s look at the RDS features of modern FM receivers and how radio stations actually exploit these features. You can also understand this article as a brief guide to setting up your RDS (Radio Data System) or as a list of minimum requirements for modern FM broadcast equipment.

First of all, let's think about the scope and form of information provided in the RDS. Is this information always complete enough for the listener to orientate themselves in the current broadcast and in the program schedule? Are the display capabilities of today's receivers fully utilized? The answers are not always favorable. In the past, a large number of radios managed to get information on the display about the currently playing song, the current program or other dynamic texts. Unfortunately, not much progress has been made since then. In many cases, radio gives the impression of being outdated, compared to modern means of communication.

Paradoxically, radio websites tend to be information-rich. We can see what is currently playing, who is hosting, what program is running, what program will follow, studio contacts, but we also find an overview of events or a summary of events organized by the radio. So the most difficult task has been completed - compiling and publishing the information. Why significant part of this information is not included in the RDS? The listener can "find everything on the web", but the listener must be attracted to the receiver in particular. Modern receivers with large graphic displays can display information, but someone must first provide it to them in a suitable form.

Marking up text information with RT+

The function called Radiotext Plus (RT+) will be mentioned many times in this article, so it is probably not surprising that we will start with its description. As known, the Radiotext function in RDS is reserved for transmission of the texts. The RT+ does not transmit any text, it only extends the possibilities of the Radiotext - it indicates the position in Radiotext where a text of a certain type (class) is located. In total, a maximum of two sections of Radiotext can be marked in this way.

To get a more concrete idea, if information about the currently playing song is transmitted in Radiotext, the RT+ tells the receiver which part of the text is the name of the artist and which part is the name of the song. A total of 63 classes are defined, including the long (full-length) name of the radio station, the studio phone number, news and events, web addresses, advertising messages, information about the broadcast program, etc.

RT+ is not a new feature, it is here since 2007 and more significant support in receivers started to appear around 2011. Since the multifunctional devices and receivers with graphic display arrived last years, the RT+ feature has become important. Its absence in RDS data can be considered as a significant failing. The RT+ feature is still overlooked or underused, see [1]. In some cases, it may be enough to just turn on this feature with a few clicks! Let's face it: Radio stations that do not yet broadcast RT+ are visually becoming out of fashion.

A radio station broadcasting only Radiotext.

A radio station broadcasting Radiotext and RT+.

Why is the RT+ function so important? Let's summarize some of its advantages:

- The radio receiver gets not only the text itself, but also information about what the text is related to and what it describes
- The station is visually more attractive at first glance and may even be preferred by the receiver itself when searching for stations
- RT+ allows to show the text even on receivers that do not display Radiotext

- Texts of different types remain stored in the receiver's memory and are displayed even when they are not currently being broadcast
- A large set of different texts can be broadcast in sequence and clarity is still maintained
- Visual consistency with other modern electronic communication services
- Easier use of text information, e.g. direct search of a song, dialing a phone number, etc.
- Full compatibility – Radiotext is still readable without any problems even on receivers that do not support RT+

Implementing the RT+ is relatively easy matter with today's tools. In many cases, it is not even necessary to change RDS encoders. The first step is to abandon 20-year-old software... Then, completely new horizons will open up in terms of loading, planning, processing and rotating texts. "Tagging" all broadcast texts can be a matter of moments.

When we mean texts, we mean not only the currently playing song *(item.artist and item.title)*, but also the description of the broadcast program *(programme.now)*, next show *(programme.next)*, phone number *(phone.studio)*, internet address *(info.url)*, events (*info.event)*, and last but not least, commercial messages *(info.advertisement)*.

Tags can be inserted into the text manually (for example into a text file with station slogans) or automatically in several different ways: based on a match with one of the templates, by fixed assignment to a specific text source or by assignment to a specific XML/JSON element from the text source.

Example of manual insertion:

```
Call our free hotline <phone.studio>800 123 456</phone.studio>
```

Example of a template:

```
%PREFIX%<item.artist/> - <item.title/>%SUFFIX%
```

The RDS encoder control software encodes the RT+ information into a format supported by the encoder. Any elements in brackets <...> are removed from the text, so they will no longer be included in the final Radiotext and the RT+ data is received by the receiver simultaneously with the Radiotext using ODA data groups.

Only one Radiotext can be transmitted at a time, so a loop is used for different texts. The texts are switched (if possible) in a fixed time rhythm, for example after 30 seconds. You can go even further and create a main loop containing secondary loops. For example, information about the song being played can be alternated with one of the station's slogans, and further according to the broadcaster's imagination. When using RT+, texts do not disappear from the receiver (or rather, they should not disappear), the receiver remembers the last received text for each type (class).

Long Program Service name (Long PS)

The Long PS function allows you to send a station name in UTF-8 encoding up to 32 bytes long. This means that the old station name limitation of a maximum length of 8 characters is finally lifted. Theoretically, any characters from the Unicode table can also be sent, including various symbols, icons, etc.

The function is relatively new; it appeared in the specification known as "RDS2". However, it is transmitted within the "old" RDS, in groups of type 15A. Thanks to this, it is relatively easy to implement. Up to a quarter of currently manufactured receivers should support the Long PS function.

The function is not a replacement, but only a supplement to the traditional 8-character PS. Its use is suitable for stations that have special characters in their name or whose name is longer than 8 characters. In other cases, the Long PS function is unnecessary.

Dynamic PS

Many years back, when receivers could only display an 8-character station name (PS), a special method was introduced to display longer texts by splitting the text into sections that were sequentially broadcast on the radio display. The Dynamic PS was born. The Dynamic PS arose to compensate poor display possibilities of old receivers and there is no longer any reason for its existence.

First of all, it is necessary to understand that the PS is part of the radio station brand, similar to a logo or jingles. For example, if you activate the automatic station search function on your receiver, then in the resulting list, in addition to the usual names, you will come across for this: "VYTRCIIO" or this: "R-izMo a". Yes, these are stations that broadcast Dynamic PS. Will the listener recognize their favorite radio station in them? Dynamic PS only works with perfect reception and only if there is sufficient time allocated to receive the station, which is really not the case when the receiver is searching the entire band. In addition, there are an increasing number of receivers that filter Dynamic PS and do not display it at all when listening.

Another problem is the inconsistency of the display across different radio stations. Many current receivers display PS and Radiotext on two different lines. The listener usually does not know what the PS is or what the Radiotext is. He wonders why some stations display the texts "up there" and other stations "under the station name". Not to mention the fact that sometimes even people directly from the radio are not completely clear about it :) Sometimes it is even the intention of the broadcaster - to provide two types of information at once, one in Radiotext and the other in Dynamic PS. It is unnecessary, because the RT+ solves this completely.

To summarize, the PS should be absolutely static. You should completely disable the Dynamic/Scrolling PS in your RDS encoder. The name of the radio station, which does

not fit into 8 characters, or information that should reflect the current content being broadcast, can be provided using services designed for this: the Long PS or the RT+.

Character set for text services

Even in 2024, all texts in RDS around the world are subordinated to a single 8-bit character set that is perhaps 50 years old. The only exception is the already mentioned Long PS function, which is based on UTF-8 encoding. Unfortunately, extending the UTF-8 encoding to other text services (like eRT) is still in the realm of dreams, due to completely lacking support in receivers. The following table shows all the characters that are available in RDS:

0x	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0		0	@	P	`	p	á	â	ª	º	Á	Â	Ã	ã
1	!	1	A	Q	a	q	à	ä	α	¹	À	Ä	Å	å
2	"	2	B	R	b	r	é	ê	©	²	É	Ê	Æ	æ
3	#	3	C	S	c	s	è	ë	‰	³	È	Ë	Œ	œ
4	¤	4	D	T	d	t	í	î	Ğ	±	Í	Î	ŷ	ŵ
5	%	5	E	U	e	u	ì	ï	ě	İ	Ì	Ï	Ý	ý
6	&	6	F	V	f	v	ó	ô	ň	ń	Ó	Ô	Õ	õ
7	'	7	G	W	g	w	ò	ö	ő	ű	Ò	Ö	Ø	ø
8	(	8	H	X	h	x	ú	û	π	µ	Ú	Û	Þ	þ
9	)	9	I	Y	i	y	ù	ü	₢/€	¿	Ù	Ü	Ŋ	ŋ
A	*	:	J	Z	j	z	Ñ	ñ	£	÷	Ř	ř	Ŕ	ŕ
B	+	;	K	[	k	{	Ç	ç	$	°	Č	č	Ć	ć
C	,	<	L	\	l	|	Ş	ş	←	¼	Š	š	Ś	ś
D	-	=	M	]	m	}	ß	ğ	↑	½	Ž	ž	Ź	ź
E	.	>	N	^	n	~	¡	ı	→	¾	Đ	đ	Ŧ	ŧ
F	/	?	O	_	o		Ĳ	ĳ	↓	§	Ŀ	ŀ	ð	

Basic set | Extended set

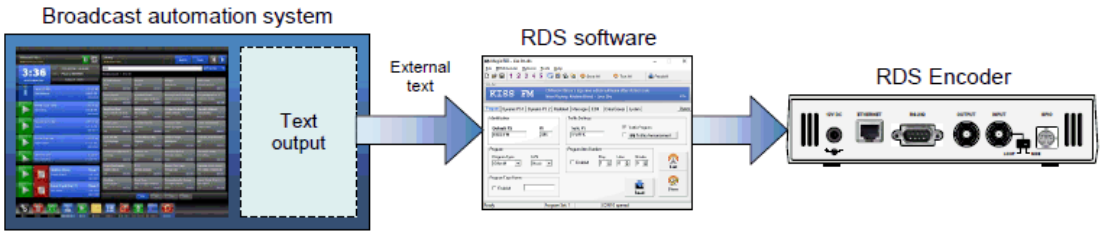
For all languages for which it is applicable, the broadcaster should include the characters from the ‘Extended set’ region in all text messages. An exception can only be made for the program name (PS) and it can therefore continue to be broadcast using the ‘Basic set’ characters only, as the PS is part of the brand and any misrepresentation on old receivers may not be permissible. In addition, for modern receivers, the full station name can be broadcast in parallel in the form of Long PS or in RT+ under the *stationname* tag.

Source texts are usually encoded in UTF-8, in worse case in ANSI (8-bit Windows character set). Other outdated character sets are probably no longer used at all. Conversion to the RDS character set must be ensured, either in the control software or in the RDS encoder itself. The problem can only be with outdated software or encoder, or in the case where the conversion is carried out via a third character set. But all this is a thing of the past and replacing it with today's solution does not represent any significant obstacle.

Another topic should be mentioned in relation to the character set: It is generally not recommended to write texts only in capital letters, and RDS is of course no exception. Such text has lower readability. In Internet discussions, writing in capital letters is considered rude. For song titles, we can recommend a conversion to the so-called 'Title Case', where all initial letters are capitalized and the rest of the word is written in lowercase. In addition to the fact that it looks quite good, it also hides some errors in the song naming.

Connection to the broadcast automation system

In order to be able to send text data about the currently playing song, or other information related to the station's program content, it is necessary to establish connection between the broadcast automation system and the RDS encoder(s). Although in many cases there is a possibility to send data from the broadcast automation system directly to the RDS encoder, in general such a solution must be considered as unsatisfactory, see [2]. The preferred solution uses specialized control software for RDS encoders as a middleware between the broadcast automation system and the RDS encoders:



Broadcast automation systems usually contain only basic support for RDS encoders. In most cases, Radiotext with the currently playing song can be sent to a selected serial port or TCP connection. The number of supported encoders is usually limited and any advanced features may be missing. We typically require additional functions and options:

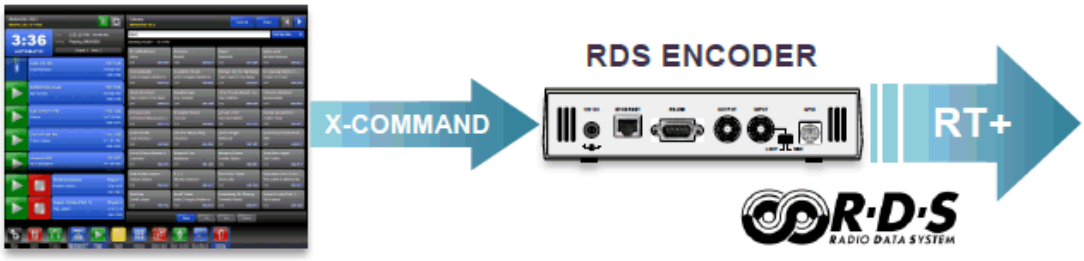
- Automatic text modifying and filtering based on specified keywords
- Inclusion of text information from various sources, such as program trailers, slogans, news and other messages
- Tagging of all information using RT+
- Control of other RDS services (PTY, TA, PI) according to the daily schedule or occurrence of keywords

- One common access point for the entire network of RDS encoders
- Joint operation of RDS encoders of different manufacturers and types
- Monitoring of the network status, etc.

For these and other reasons, it makes sense to operate "broadcast software" for RDS content in addition to the broadcast system for audio content. There is also an economic aspect at play - when using central software for operating RDS encoders, these devices can be implemented in a simpler way, for example in terms of the number of communication ports or individual support of network services.

Radiotext and RT+ in single command

In case the broadcast automation system sends texts to the RDS encoder directly (without additional software acting as a middleware), an ASCII communication protocol extension called X-Command was developed, based on a simplified XML language structure. One of the main goals was to enable RT+ transmission without the original application having to support it. It also replaces outdated commands for inserting RT+ information, which had to be encoded in advance and sent separately.



All necessary processing, optimization and encoding of RT+ is now provided directly by the RDS encoder, as well as conversion from UTF-8 encoding. As an example, we can give the following single-line command, based on which the RDS encoder sends a new Radiotext including RT+ tags for the artist name and song title:

```
XCMD=<rds><item><dest>3</dest><text><artist>Daft Punk</artist> - <title>One More Time</title></text></item></rds>
```

As can be seen from the structure of the command, to implement it, it is enough to define a template for text output, for example:

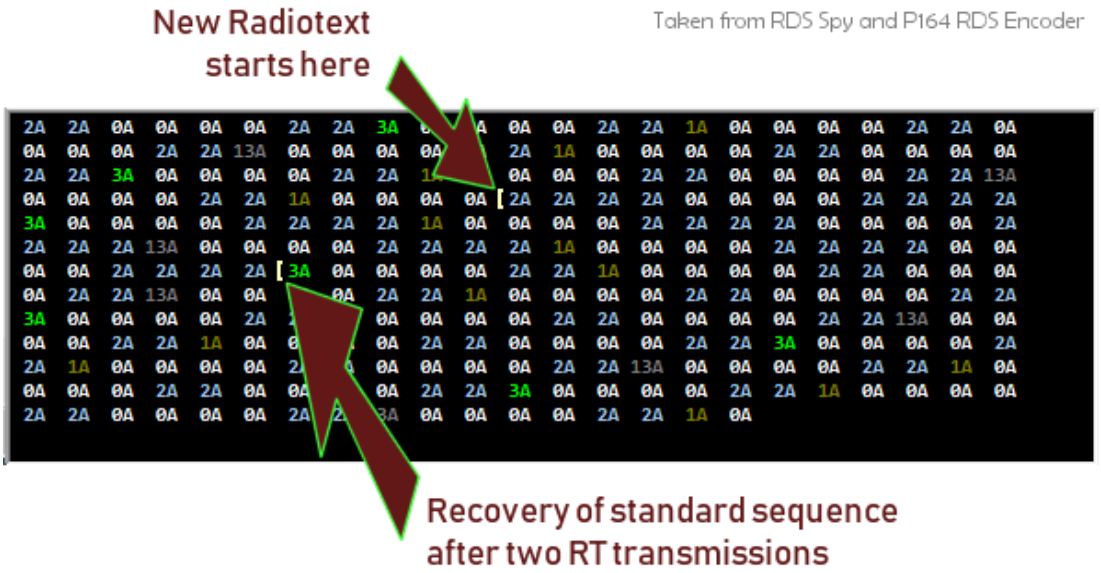
```
XCMD=<rds><item><dest>3</dest><text><artist>%artist</artist> - <title>%title</title></text></item></rds>
```

The exact format of the template depends on the specific broadcast automation software. In any case, the command is terminated with a CR (Carriage Return, 0x0D) character like any other ASCII command.

Radiotext display delay

Before the text information is displayed to the listener on the LCD, it must go through several phases, each of which adds a certain delay. The software must detect the existence of new text, send it to the RDS encoder, the encoder must process the information and then send it to the receiver. Although it may seem that sending a short text to the receivers is a matter of a moment, the fact is that this is where the largest part of the delay occurs. This is due to the relatively low transmission speed of the RDS system, which is further significantly degraded due to the need to reserve some capacity for services other than Radiotext.

The typical delay in displaying new text on the receiver is therefore around 5 seconds. This is assuming perfect reception and in the absence of data-intensive services such as EON or TMC – then it is more likely to take double or triple this time. The good news is that there is a way to shorten the total delay by about a third.



The method is based on dynamic sequence of RDS groups and requires support in the RDS encoder. With this method, a higher transmission capacity is temporarily reserved for Radiotext immediately after its change. In the case of Radiotext, these are type 2A groups. The new text is therefore displayed on the receivers faster, and then it is sufficient to transmit it at the usual rate of 2A groups.

Extended Country Code

The first digit of PI (Program Identification code) is commonly used to distinguish the country from which the station is broadcasting. Since one digit does not allow distinguishing all the countries of the world, each specific digit is shared by several countries. It may seem that this does not matter. This is not entirely true.

Today's receivers, especially car radios, contain an extensive database of information and graphics for many radio stations. In order for this database to be used correctly,

the country identification must be unambiguous and independent of the receiver's settings. The RDS function ECC (Extended Country Code) is used for this. It is single-byte information and its assignment can be found in Internet resources or in the RDS encoder's control software.

If the RDS encoder does not support the ECC function directly, it can be encoded manually and sent as a user-defined group of type 1A: `0x00__ 0x0000`, or such as `1000 00__ 0000`, where the __ is the ECC byte in hexadecimal representation. The frequency of transmission is sufficient once every five seconds.

Conclusion

It is in the common interest of all radio stations to assure listeners that the radio receiver can still be perceived as a modern device. However, in order to do this, it is necessary, in addition to sound reproduction, to also take into account the visual impression when using the receiver.

Hopefully, the information presented in this article will help a little. We offer a solution to all radio stations that decide to adapt their RDS to current needs.

[1] Radio World. *Broadcasters Need to Do Better With Visual Displays*, 2024.
[2] NAB Digital Dashboard. *Best Practices Report*, 2023.