RADIOWORLD

RDS

BASICS AND
BEST PRACTICES

RDS: Let's Start With the Basics

In 2018, even industry veterans need to break out of RDS habits of 15 to 20 years ago

By **Alan Jurison**

In an age when over-the-air broadcast radio is competing against so many new-entrant audio delivery platforms, RDS has become an essential part of FM broadcasting in the United States and Canada. In this Radio World eBook, we explore what it is and why you need it. We offer practical information you'll need as a broadcast engineer or station manager to make sure your station remains competitive in the digital dashboard.

INTRODUCTION

What is RDS? Radio Data System is a worldwide standard of transmitting data through FM radio. The most widely adopted use of RDS is for station-related metadata that is helpful to listeners of a station to identify with both the station and its content. The most popular implementation is for title and artist information of the current song.

Radio Broadcast Data System (RBDS) is a slight variant of this standard fine-tuned to North America. For the purposes of this eBook, we will collectively will refer to both RDS and RBDS as RDS.

FM radio stations encode RDS as a 57 kHz subcarrier, often referred to an SCA. This is in turn decoded on supported receivers for use generally on a display for the listener.

What started out as a niche feature on a handful of FM radio receivers in the late 1990s and early 2000s has turned mainstream in this decade. In the United States, a lot of radio listening occurs in automobiles. The auto industry has embraced new display technologies. Gone are the old single-line basic LED displays, and now new large multi-colored LCD displays are commonplace in most automobiles. This is not a new trend; the process started over a decade ago. We started seeing vehicles with these displays in the mid-2000s, and slowly in the early to mid-2010s they appeared in more and more vehicles. In 2018 it's hard to find a new or recently made vehicle at any price level that does not offer one of these displays.

Auto makers have placed the displays in what is known as the "center stack" or console area of the dashboard where the radio traditionally lived. The systems that drive these displays often perform traditional functions, such as climate control and AM and FM radio broadcasting. But these systems have evolved into "entertainment" or "infotainment" systems. No longer is AM/FM the only entertainment in the car.

These systems can stream audio, either natively or via a tethered phone. They support other sources of audio, such as satellite radio, and a lot of the designs have embedded applications like iHeartRadio and Pandora.

Your listeners want to know more about the current song that's playing or other content. You need to do more.

Simply put, the traditional AM/FM radio is still there but now competing with many other sources of content and entertainment.

Even before automotive apps entered the market, car manufacturers were looking for things to put on this display. A common and easy for them to do was to add RDS support when tuned to FM broadcast. It's a worldwide standard, it's an open standard and it's easy for them to implement.

That is the good news: Virtually every vehicle sold in the United States has this capability.

However, not all FM broadcast stations have enabled RDS. And not all RDS implementations are the same. Our industry really needs to focus on implementing RDS — and not just getting a basic encoder, installing it quickly with static information and walking away. For FM radio to remain competitive to all these new audio sources available in the car, broadcasters must get serious and

make sure their RDS implementations are of high quality, offer dynamic information, and that their transmissions are operating with peak performance.

The RDS standards and specifications are lengthy and can be hard to digest. Let's consider what you really need to know.

THE BUILDING BLOCKS

First, you need an RDS encoder. See Doug Irwin's discussion of things you need to know about this device, how to select one and install it.

Once the RDS encoder is added to the air chain, pay close attention to the output of the RDS subcarrier. You want to aim for a minimum of 5 percent injection. However, if your station is prone to a lot of multipath, operates at low power (e.g., an LPFM or translator) or is trying to serve an audience at the edge of coverage contours with the best RDS performance, consider 6 percent. Doug covers this topic quite nicely later.

But don't stop there! Many stations buy an encoder, install it, put their static station name, callsign or slogan up and call it a day. That is no longer competitive in the new digital dashboard. Your listeners want to know more about the current song that's playing or other content. You need to do more.

Second, to provide the best RDS experience, you want the data being sent to the RDS encoder to be dynamic. This generally requires you to arrange from some sort of connectivity between the RDS encoder and your automation system or metadata middleware system. There are a variety of ways to provide that link. The older methods generally were via RS-232 serial; however, if you're starting fresh, it is strongly recommended you work out a plan for IP connectivity between these systems.

Note, security is important here. Make sure this information is over private circuits or VPN. Do not run RDS data unencrypted over the Internet. Do not place an RDS encoder directly on the Internet. Your station will be compromised without these protections. See NRSC-G300-B Section 4.6 for more related to RDS encoder security.

Third, provide dynamic content to the RDS encoder. Metadata management is a large topic of its own. See the article by Stu Buck from Xperi/Arctic Palm for an introduction to this topic.

Some automation systems can address RDS encoders directly. However, these days, since this information needs to go to a variety of different outputs — FM RDS encoders, HD Radio Program Service Data (PSD), streaming audio platforms, NextRadio (FM on smartphone), billboards, and other destinations — many broadcasters have moved to middleware software and hardware providers to manage these inputs and outputs. Stu explores this in his article.

RadioText in a 2014 Jeep Grand Cherokee.

FINE TUNING YOUR RDS IMPLEMENTATION

With the infrastructure in place, it's time to fine-tune your RDS implementation to provide the best user experience across a variety of receivers.

Just remember: You may have observed RDS on a handful of receivers out there, but there are literally hundreds of implementations. Radio stations need to cater to all of them. Don't focus so much on making the radio *you* own look the best. Don't focus just on the program director's car radio. Don't focus on your experience of RDS in the previous decade. You need to account for everything, and that's where best practices come to play.

RadioText (RT) — This by far is now the most important RDS-related field. This is a text string, up to 64 characters in length. You can combine the station name, title and artist information in this string, and rotate it with other station branding or promotional messages. Most of the large displays prefer RadioText and display it in a more prominent way than any other RDS field. Our industry needs to focus on this field. I called for this in 2010 when I started noticing these displays being included in more automobiles. Now they are commonplace.

In addition to making sure your station transmits RadioText and has relevant and dynamic information in the RT field at all time for these receivers, make sure you prioritize its transmission in your RDS encoder. More on how to do that below.

PS and PS Scrolling — This was the industry's introduction to RDS here in the United States. Automotive companies started implementing RDS on the older single-line LED displays, and they didn't have a lot of room. Auto radios implemented PS, which was originally meant to be a static station naming field. It is only eight characters in length.

In North America, broadcasters found that if they changed the PS every few seconds, many automotive receivers sold in the 2000–2008 timeframe would update the text in the dash as well.

PS evolved into PS scrolling, where a long string of station name, song title, artist and branding information was cut up into eight-character blocks and sent over a period of time with a delay between each block. Many industry veterans think of RDS under this lens even today. There was almost an arms race of who could scroll the PS text faster amongst broadcasters.

While PS scrolling was very important when RDS was adopted, it's less so today. Many vehicles that showed

Early RDS Designs - PS Scrolling

General Motors Early RDS designs from 2000-2010

PS was prominent in early designs

Chrysler Early RDS designs from 2000-2010

PS also prominent in early designs

PS was prominent, so broadcasters employed PS scrolling.

only the PS are at the end of their usable lifespans, are off the road or have had their radios replaced with aftermarket options. Stations only doing PS scrolling, or stations that optimized for PS scrolling over a decade ago, should retool and start focusing on RadioText (RT).

Another important factor: The National Highway Traffic Safety Administration released guidelines to the automotive industry to reduce driver distraction. Auto manufacturers are now disabling or dampening the amount of scrolling that was taking place. Many of the original PS scrolling designs on the RDS transmission side from the early 2000s are no longer compatible with these new implementations.

Eventually, PS scrolling may become a thing of the past, but again it's important to consider the entire field of RDS receivers out there. In North America, PS scrolling is still commonplace and still will be for a while longer; but it is recommended that you set the minimum PS text change block for the "scrolling" to 4 seconds. In addition to helping with the NHTSA guidelines, it helps PS scrolling perform better in multipath conditions.

As a result of PS and PS scrolling becoming less important, broadcasters with existing RDS systems should reconfigure them to scroll PS less, no faster than every 4 seconds, and include the PS groups less in their transmission. More about that below.

Program Type (PTY) — PTY provides a list of about 30 radio formats to pick from, and displays on many new automotive receivers.

Here is one area of difference between the international RDS standard and North American RBDS. The definitions of which number translates to what format name vary.

For instance, PTY=10 in the RDS standard means Pop music, but in the RBDS North American standard PTY=10 means Country. So it's important to use the correct list. In North America, the most appropriate PTY for "pop," CHR/Top 40 stations is PTY=9 (Top 40). Find a list of RDS/RBDS program types here.

RadioText+ (RT+) — Many broadcasters are not familiar with RT+. We should start learning and adapting and adding it to our transmissions. Automotive manufacturers are starting to respond with receivers to decode it.

RT+ tagging is a way to define the meaning of the text contained in the 64-character RadioText described earlier. With RT+, now the station name, title, artist and other information can be broken up into different fields and used by the receiver to help improve the display of the information.

Implementation of RT+ began almost a decade ago, focused mainly on portable FM receivers that adopted it. This allowed RDS and FM radio to provide the same look and feel as recorded content on these devices. Perhaps the most widely known unit was the Apple iPod fifth-generation Nano series, introduced in 2009. This continued through their seventh edition of the product; the entire line was discontinued in 2017. Other models such as the Microsoft Zune were short-lived.

The implementation of RT+ on these devices was pretty good. There is still an ample supply of them on the resale market (think eBay), I recommend picking one up to help test your station(s). RT+ allowed FM radio to have an "MP3 player feel" and provide current title, artist and album information to the listener on these devices. But alas, as technology moves on, the dedicated "MP3" portable music player largely has left the marketplace. That functionality now is built directly into our phones and automotive infotainment systems.

The aftermarket automotive receiver market has continued to support RT+ in its designs. Because of the loss of the Apple Nano, broadcasters for the most part have thought of RT+ as not being adopted as well as expected by RDS receivers.

However, that is changing.

In factory installed automotive radios, BMW started supporting RT+ in 2012 and continues to do so in many current models. Recently, Toyota introduced RT+ in some of its models in 2018.

RT+ as deployed in a 2018 Toyota Camry. Images show the home and audio screens.

The accompanying images show a 2018 Camry with RT+ support. I think this breathes new life into RT+, so broadcasters should look at implementing it. Most of the middleware metadata solutions can help you implement it.

RT+ gives automotive manufacturers a way to take the RadioText provided by RT and parse the station name, title, artist, album and other information, and present it in a more organized and consistent fashion. This is yet another way to keep traditional analog FM radio relevant and provide the same "look and feel" as some of the other new digital audio entertainment offerings in the dash. Are you aware of other automotive companies supporting RT+? We'd love to hear about it; my email address is at the end of this article.

OPTIMIZING TRANSMISSION OF RDS INFORMATION: GROUP SEQUENCE

Now that you have a primer of the most important RDS-related fields, it's important to understand how they are transmitted by the RDS encoder. A lot of engineers skip over this part, don't be one of those people!

Since RDS has a relatively low bitrate by today's technology standards (1,187 bits per second), it's critical for you to manage that bandwidth effectively. There's a finite amount of bandwidth available; how can you best balance the transmission of this information to the entire receiver population out there?

Each RDS encoder comes out of the factory with a default sequence of these RDS features. Many of the defaults were established back in the days when PS scrolling and display was so dominant. This sequence varied from RDS encoder model to model, manufacturer to manufacturer — even firmware to firmware on the same model. It's important for you to do some research. If you have any doubts, it's best to reach out to your RDS encoder manufacturer for support.

The NRSC has done significant research in this area, shared in Table 6 of NRSC-G300-B, shown in the accom-

panying chart on page 8.

To cater to the widest variety of receivers, yet with an emphasis on new large screen automotive displays, the NRSC guides you to spend 75 percent of your RDS bandwidth on the RadioText (RT). This recommendation is not new, the NRSC issued this guidance in 2012. Not only is this the most widely used field in recent automotive designs, it also takes the longest to transmit, since it can be up to 64 characters in length. Increasing the RT send rate in your group sequence will allow the text to display on the radio much faster, and also helps on the fringe of coverage or when multipath is encountered.

There are literally hundreds of RDS receiver implementations out there. Radio stations need to cater to all of them.

Today, out of the box, most default RDS encoder settings still spend more of their bandwidth on the Program Service (PS) and scrolling. Because of the increasing importance of RT over PS, it is recommended you doublecheck your existing RDS encoders to make sure they match the guidelines in Table 6. Similarly, if you have a new RDS encoder you are installing, consult Table 6 to optimize the RT transmissions.

These suggestions work well for the majority of radio stations in North America. However, there are some specialized RDS applications beyond what we've discussed. Stations running RDS-based traffic services such as RDS Traffic Message Channel (RDS-TMC) must dedicate a lot of bandwidth to those services. These stations should use Table 7 in the document. Also, some stations use RDS to transmit emergency alerts to a special subset of receiver positions at schools, hospitals and homes. Contact the

Enhancing The In-Vehicle Receiver Display

by **Stu Buck**, Arctic Palm

RDS allows broadcasters to add small amounts of data to the transmission that is displayed on FM Receivers.

In today's world listeners have more listening options than ever. Apple Car Play, Pandora, Spotify, and Pod Casts to name a few. In this environment, how does radio maintain its place in the market and in the car's center stack?

As always, the number one feature of any station is content. Live, Local, and immediate coverage of the local marketplace providing listeners with information and entertainment relevant to them. How better to keep listeners tuned in than to enhance their listening experience with metadata about the song that is playing, the show and host, local weather, Emergency Alerts and other content specific to the area?

What better way than to include metadata in the FM broadcast with an RDS encoder? The RDS feature allows us to add small amounts of data to the FM transmission that is displayed on FM Receivers. RDS encoders are simple to add and some FM Transmitters include an RDS encoder ready to go.

The question is how do we get metadata to the encoder? While most automation systems and satellite services provide a metadata feed, the information is not in a form that can go directly to the encoder, so we need a middleware application such as Arctic Palm's Center Stage Live to capture the metadata, filter, format and feed the metadata to the encoder in a format it can understand.

Who of us has not heard a song on the radio and tried to remember the title or the artist? By adding RDS to your broadcast, a simple glance at the receiver and we know. While this is great for music, even music stations have non-music segments where additional information can add to the listener experience. This may include items such as the station's slogan, program/host information, local weather, Emergency Alerts or even commercial messages. Again, this requires middleware like Center Stage Live to enter and schedule the content.

There are two message formats sent to the encoder. The PS, which is the Program Service Name and is a static 8-character message containing the station's Call Letter, Frequency or Street Name. The second message is the RT or Radio Text field which is a 64-character message containing the metadata. While some newer receivers display both the PS and RT, older receivers and even some newer models will only display the PS and may require the listener to press an info "I" or display "D" button to see the Radio text. Even if the receiver displays metadata for satellite stations or other sources, the FM station may not, and in some cases pressing the info button will be turned off while the car is in motion. This difference in how receivers handled metadata resulted in the controversial DPS or Dynamic PS display where the encoder formats the 64-character radio text into 8-character segments and transmits it as the PS. When introduced, for the first-time thousands of listeners were introduced to RDS with the response "I Love That".

With products like Center Stage Live, we have a lot of power to post RDS messages as well as HD Radio and The Artist Experience, Web Sites and services like TagStation/Nextradio, TuneIn, Streaming services as well as other devices and services. With this power, we as broadcasters along with the OEM's, need to balance providing listeners with the information they want while not being a distraction.

For Broadcasters, ensuring our informational, promotional and commercial message is clear and concise. For OEM's, ensure metadata, regardless of the source is easy to access and view.

ADVERTORIAL

manufacturer of your alerting system or your RDS-TMC (traffic) provider for support before adjusting the group sequence in the RDS encoder, as it could affect the transmission of these vital services.

PROGRAM IDENTIFICATION (PI) CODES

Not yet discussed but important is the Program Identification (PI) code. Every station has to have a unique PI code. Duplicates should never occur, except in cases of time-aligned, 100 percent simulcasts. This is a thing that often gets overlooked with RDS. A station staff will buy an RDS encoder, take it out of the box and install it in the airchain, set the station name and walk away. Without setting the PI code, you are using the default code from the manufacturer (often F000).

For many, this seems like not a big issue. But another station in the same geographical market may get an RDS encoder and installs it. If they make the same mistake, you have two stations in the same general area with the same PI code. Some automotive receivers will switch back and forth to any frequency they find with the same PI code. This is meant for Alternate Frequency (AF) switching between signals. As the signal get weak on Station 1, the radio can automatically tune to Station 2. How the receiver determines if it is OK to switch frequencies is if the PI code matches.

So, you want to make sure that all your stations are transmitting a unique PI code.

PI Code Resources:

In the United States, PI codes are assigned to full-powered FM stations by the NRSC-4-B calculation method, via callsign; see NRSC-4-B Section D.7.1. FM translator licensees should see http://picodes.nrscstandards.org. Also see NRSC-G300 Section 5.1 for more about PI code usage. (Note: Most consumer-facing receivers do not back-calculate the callsign from the PI code; and the NRSC discourages new designs from doing such. New radios should focus on RT+ StationName.Short. See NRSC-G300-B Section 5.1 for more information.) Note, too, that in Canada and Mexico, PI codes are assigned by a regulatory body.

FOR MORE INFORMATION

After reading this eBook, if you want to dig into more details I highly recommend reviewing the National Radio Systems Committee NRSC-G300-B RDS Usage Guideline document.

It is a thorough document and covers this topic in

Table 6: Recommended RadioText (RT) send rates for stations with no significant ODA use
Note: these settings may interfere with any special ODA groups being transmitting such as leased traffic or other data. When transmitting ODA data, it is best to consult with the station's corporate engineering staff or the company that is leasing the data to ensure there is no interference with these services.

Encoder Type(s)	Recommended Setting	0A PS (%)	2A RT (%)	3A (%)	RT+ ODA (%)
Inovonics 711 / Audemat FMB1, FMB10 †	RT_RATE=1	45	50	1	4
Inovonics 712, 713 †	DRTS=9	63	32	1	4
Inovonics 720, 730 *	DRTS=9	24	71	1	4
Audemat (Worldcast) FMB-50, FMB-80 †† / Burk RDS Master † / BW Broadcast RDS3 †† / Kvarta RDS1000 ††	GS=0A,2A,2A,2A	24	71	1	4
Pira32 ††	GRPSEQ=0222	24	71	1	4
DEVA SmartGen Mini, 4.1, 5.0††	SQC=2A, 2A, 2A, 0A, 2A, 2A, 2A, 0A, 2A, 2A, 2A, 0A, 2A, 2A, 2A, 0A, 11A, 2A, 2A, 0A, 2A, 2A, 2A, 0A, 2A, 2A, 2A, 0A, 2A, 2A, 2A, 0A, 2A, 2A, 2A, 0A, 11A, 2A, 2A, 0A, 2A, 2A, 2A, 0A, 2A, 2A, 2A, 0A, 2A, 2A, 2A, 0A, 2A, 2A, 2A, 0A, 11A, 2A, 2A, 0A, 3A	25	69	1	5
2wcom C02, C04 †††	2A, 2A, 2A, 0A, 2A, 2A, 2A, 0A, 2A, 2A, 2A, 0A, 2A, 2A, 2A, 0A, 11A, 2A, 2A, 0A, 2A, 2A, 2A, 0A, 2A, 2A, 2A, 0A, 2A, 2A, 2A, 0A, 11A, 2A, 2A, 0A, 2A, 2A, 2A, 0A, 2A, 2A, 2A, 0A, 2A, 2A, 2A, 0A, 2A, 2A, 2A, 0A, 11A, 2A, 2A, 0A, 3A	25	69	1	5

† Many legacy encoders do not support integrated RT+ from the manufacturer, but 3rd party hardware or software solutions exist to enable these features.
* Requires firmware upgrade of 2.6 or higher to achieve desired group sequence.
†† May require firmware or software upgrade to enable integrated RT+ features.
††† Requires ARCOS configuration software. Encoder -> Dataset -> General -> Group Sequence. GS= string, not required. Replace 11A with desired RT+ ODA location. Encoder needs RT+ AiD configured and 3A and RT+ ODA specifically shown in Group Sequence and AUTO_RTPLUS enabled to use integrated RT+ transmission feature.

Table 6 reference on Group Sequence from NRSC-G300-B

depth, with contributions from dozens of broadcast engineers. It has gone through several revisions and improvements since it was adopted in 2012 and updated in 2014. Also note that a new NRSC-G300-C update will be up for an adoption vote at the April 2018 NRSC meeting. Assuming it is adopted, look for it in late April or May.

I recommend NRSC-G300 as the document is more approachable and practical for daily use. If you want to research more about the inner workings and details of the RBDS standard, also review NRSC-4-B. Note, it was last updated in April 2011. The G300 guideline document has some more updated content.

Alan Jurison is a senior operations engineer for iHeartMedia's Engineering and Systems Integration Group. He was a major contributor to the NRSC-G300 documents, and chairs the NRSC RDS Usage Working Group (RUWG). He has authored a series of RDS-related articles for Radio World available at radioworld.com/rds. *He holds several SBE certifications including CPBE, CBNE, AMD and DRB. His opinions are not necessarily those of iHeartMedia, the NRSC, or Radio World. Email him at* ajurison@storm.net. ∎

Why Do I Need a Middleware Application?

Metadata differs from system to system, making it difficult to send from automation directly to the encoder

Stu Buck is founder of Arctic Palm.

When asked what Arctic Palm does, we reply: "When you look at the radio and it tells you the name of the song that is playing — that's what we do." The only response we have ever gotten is "I love that!"

We utilize the Radio Data Service functionality to insert text into the FM transmission. This content is available from most automation systems and satellite services that output some form of "now playing" information. We also capture content from web services such as Content Depot's MetaPub and program websites providing metadata for the current song or a playlist log of the day's events.

Display from a GM Silverado.

We insert the metadata in the FM broadcast using an RDS encoder. There are a number of those on the market; and some FM transmitters have built-in encoders.

With metadata and an RDS encoder, we are ready to insert text into the FM broadcast. Sounds simple, but how do we get the text from the source to the encoder?

Metadata differs in content and format from system to system, and most RDS encoders accept text commands, but these also differ for each manufacturer. This makes it difficult to send information from the automation system directly to the encoder.

To accommodate these differences, we require a middleware application to capture, filter and format the metadata and send it to the encoder as well as other devices and services. Some automation vendors have their own applications; and there are several commercial applications on the market, such as our own award-winning Center Stage Live with CSRDS.
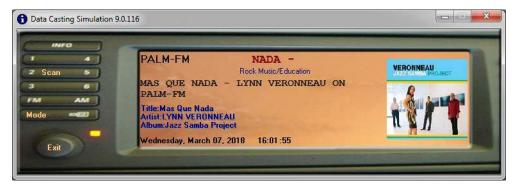
TIPS

The first step is to establish communication between the source and the middleware application. The connection to an automation system may be IP, a disk file or a serial connection. Satellite services usually link via a serial port, while others may be available from an internet service or an internal application on the local network.

In a closed system, where the source and RDS encoder are on the same network, the middleware may be installed on the on-air computer. However, if metadata is coming from or going to other devices and services, the middleware may be installed on another computer to keep the on-air computer isolated. In this case the network can be configured to give the middleware one-way access to the on-air computer output and still access the outside world.

Metadata may include events other than music or com-

Display from Center Stage Live Simulator.

mercials, so the middleware must filter out events such as voice tracks, jingles and PSAs. Music and commercial events are parsed and the individual fields examined to filter characters that may not display properly or are re-formatted for a better display. For example the artist name may arrive as SMITH,BOB while we want to display *Bob Smith*. While commercial events may be included in the display they are normally sent to streaming services for commercial substitution.

We are now ready to send the text to the encoder, which is via a serial or IP connection. For our purposes,

> *To accommodate these differences, we require a middleware application to capture, filter and format the metadata and send it to the encoder as well as other devices and services.*

we will limit this discussion to four commands: the Program Service Name (PS), Radio Text (RT), Dynamic PS (DPS) and Radio Text Plus (RT+).

The Program Service Name (PS), is an eight-character static field that contains the station call letters, frequency or street name. The Radio Text field (RT) is a 64-character with the artist and title, program name, local weather or other information.

Unfortunately, some older receiver designs only display the PS and either do not display RT or require the listener to press an "Info" button. Even if the receiver displays now-playing information for a SirusXM station, it will revert to the PS for FM stations.

This brings us to the controversial Dynamic PS (DPS), which is a process where the encoder breaks the 64-character RT message into eight-character segments and

sends it as the PS. While in violation of some standards, this process was introduced in the early 2000s and for the first time listeners responded to RDS with "I love that." On occasion, an engineer will call about RDS not working and we tell them how to turn on DPS and get a "It's working now."

Today's receivers have better displays, which may eventually eliminate the need for DPS; but for now, DPS is still popular. When using DPS, set it to block mode showing eight characters at a time and set to the recommended scroll speed of 4 seconds.

The last item is RT+ that sends a special command to RT+ enabled receivers. The can extract the artist and song title from the RT field and, when connected to the Internet, the listener can purchase and download the song.

WHAT TO LOOK FOR

In addition to RDS encoders, middleware can provide a process for scheduling informational, promotional or commercial messages by station, date, time of day and day of week with an option to link the message to an on-air event. This is very important for talk stations to provide dynamic content; but note that music stations often have 30 percent or more of the day in non-music segments. This time can be used to promote the station, program, weather, contest or other events.

Middleware application can also switch between input sources and post metadata to other devices and services such as HD Radio, streaming services, websites and services such as Tag Station/Next Radio.

As broadcasters, we need to balance the listener experience while minimizing driver distraction. As such we should limit message rotations, keep messages short and easy to read.
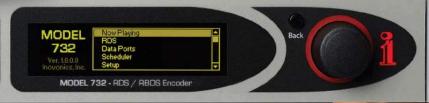
Displaying program information on the receiver is a hit with listeners and a good way to keep listeners tuned in. It keeps radio competitive in the digital dash. It may even be a source of revenue. But we will keep that for another day. ∎
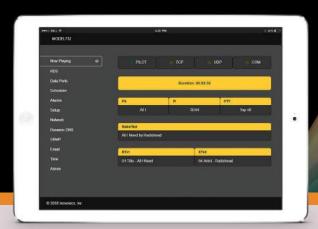
OK Now Let's Plug It All Together

With the basics in mind, let's move on to implementing the transmission of RDS

by **Doug Irwin**

Now that we've learned how useful and necessary RDS is in this day and age, let's move on to implementing its transmission. As one would expect it's quite easy — and the first thing to do is to purchase an actual RDS generator.

FEATURES TO LOOK FOR

As one would expect, there are various manufacturers of RDS generators. Most have some variation of a similar feature set. Important features include:

- *Sync input.* The RDS generator is going to have no problem generating a signal right at 57 kHz, but if you want it synchronized with your pilot frequency, drive this port with an output from your stereo generator.

- *MPX loop-through.* This presents an easy means to add RDS to your present baseband signal; more on this below.

- *Front-panel and/or RS-232 access.* Sure, nowadays most configuration is via an IP connection. Sometimes it's just as easy to use the front panel or a simple serial connection.

- *IP connectivity.* If you intend to have middleware "talk" to your RDS generator, you need this feature.

- *Web-based User interface.* Again, sometimes it's nice to not have to use a network connection. But more often this is the best way to configure the unit, and the only way to do it as you sit in your office or at home.

Manufacturers to research in your quest to add RDS include Inovonics, Audemat/Worldcast, 2Wcom, Burk, BW Broadcast, DEVA, PIRA, Kvarta and Jump2Go. Consult Table 6 in Alan Jurison's article for specific model numbers.

Note too that audio processors from the likes of Wheatstone, Orban and Telos Alliance feature RDS capabilities. The Omnia.11, for example, has its own internal generator

that supports a static display; the Orban 8700i internal generator supports dynamic RDS; and the Wheatstone AirAura X4 has "full RDS capabilities" according to its literature.

SCA/RDS INPUT PORTS

Modern exciters have the means to generate their own RDS carriers, which might make sense in certain cases. Even so, they'll have connectors on the back for these subsidiary signals. These ports might be labeled as "RDS" or "SCA" but in reality they do the same thing: The signal connected to that port is added to the sum total of signals making up the baseband. Note, if you are using an external RDS generator, you will want to make sure the internal RDS generators of a new exciter or processor are turned off. That could turn into a real mess!

Certain features are common to most professional RDS generators.

The amount of signal needed can vary by manufacturer but it will be related to the sensitivity of the composite input: Whereas 3.5 volts peak-to-peak for 100 percent modulation is a typical sensitivity for the composite input (meaning the sum total of L+R, the pilot and L–R), 3.5 volts peak-to-peak will typically generate 10 percent modulation for RDS or SCA inputs.

The ports are nearly always BNC type, so the cable used with likely be RG-58 or some variant. It's a good idea to use a double-shielded type to diminish the possibility of other noise somehow getting in to the baseband through that cable.

You'll also want to be sure that the RDS generator and your exciter are at the same ground potential if you are connecting an unbalanced inputs to an unbalanced output, otherwise you could introduce power-line related noise to your FM signal.

OLDER EXCITERS

In many cases, you may be stuck with an older exciter (perhaps for a backup transmitter) that has only one port for "SCA." If you are already transmitting an SCA using that port, you have a minor problem: how to physically inject the RDS signal in to your baseband.

Broadcast Devices has a solution: The CMP-300 has three balanced or unbalanced inputs (switchable) that mix the composite, subcarriers and/or RDS signals. The unit has a three-output distribution amplifier so that the mixed signals can be distributed to up to three exciters or STLs, and each output is capable of driving a 50 ohm load as far away as 100 feet from the unit. The front panel has provision for level control of inputs and outputs.

Some RDS generators also have a "loop-through" port so that you can have the RDS added to your baseband signal; you simply take the feed that has been going to the exciter, connect it to the RDS generator loop-through port and then take the output port and connect that to the exciter. A sum amp inside the RDS generator does the real work. (Note, though, that now you have one more device that could cause an interruption of the air chain.)

If you happen to be using a composite STL transmitter at your studio location, it may have a provision for adding "SCA" or RDS as well. Just make sure if you do use this port that the overall modulation of the radio link doesn't become excessive.

Another simple way to get around the lack of SCA ports on an older exciter is by using available SCA "sum" ports that are on modern audio processors. Orban's 8700i, the Omnia.11 and Wheatstone's AirAura X4 all provide a means, via BNC connectors on the rear panel, to add RDS signals (via ports labeled as "SCA").

SETTING THE PI CODE

Every station needs a *unique* PI code; duplicates should never occur (except in cases of time-aligned 100 percent simulcasts). If you don't set this in advance, you run the risk of having it match one (or more) stations in your market that also neglected to change their default. Why is this important? Some automotive receivers will switch back and forth between frequencies that are using the same code. (This feature is used in Europe, but for the most part, not in the U.S.) Not to belabor the obvious, but this is something you *don't* want to happen.

In the United States, PI codes are assigned by NRSC-4-B calculation method for full-powered FM stations via their callsign; see NRSC-4-B Section D.7.1. For FM translators use http://picodes.nrscstandards.org.

NRSC-G300 section 5.1 has more information about PI code usage.

One way to get around lack of SCA ports on an older exciter is to use available SCA "sum" ports on modern audio processors. This is the rear of a Wheatstone AirAura X4.

SETTING RDS INJECTION LEVEL

Once you are ready to inject the RDS signal into your FM baseband, naturally you'll want to know how much injection you need so that receivers can consistently pick up the information you are sending. The amount of injection affects the overall modulation level, so some compromise must be reached.

Referring to the FCC's rules: According to 73.1570 (b) (2) total modulation must not exceed 100 percent on "peaks of frequent reoccurrence" as referenced to 75 kHz of deviation, but stations "providing subsidiary communications services using subcarriers" may increase their overall modulation level by 0.5 percent for each 1 percent of subcarrier injection. In no event should the overall modulation exceed 110 percent (82.5 kHz peak deviation).

My experience is that 5 percent injection for RDS is adequate for the job, although in some situations such as stations that have a lot of multipath, low-power LPFM and translators, or stations that are trying to cover an audience at the edge of their service contours, 6 percent is recommended. There are several monitors that will allow you to set and monitor the RDS injection easily, including the Belar RDS-1, the Inovonics INOmini 633 and the DEVA DB4004, which allows the user to read the actual RDS injection level and includes a Bit Error Rate (BER) reading.

NO EXTERNAL RDS MONITOR

You may find yourself in a position that you have to include RDS but there's no current budget to purchase an external monitor. The task then is measuring your injection level.

Modern exciters, such as those made by Nautel and others, will allow you to look at the overall baseband with built-in spectrum analysis. In so doing, it's a relatively easy matter to compare your SCA injection to your pilot injection. (Naturally you need to know your pilot injection then — but this is a more common feature on modulation monitors.) If your pilot injection is 9 percent, for example, by setting the RDS injection 6 dB below it, you'll achieve 4.5 percent modulation.

That method is handy for work during the day, of

The PD Wants to See Artist and Song Title

How to get artist/title/station taglines onto the radio display before your PD explodes

By **Alex Hartman**

The author is a partner in Optimized Media Group.

You've been tasked with a mission. The new transmitter has an RDS encoder inside it. The PD wants to see artist and title information on his radio.

Getting a Nautel (or any) transmitter to talk to your automation systems metadata export can often be done by simply sending text data as "TEXT=" or "PS=", but a lot of automation systems send the data so often that it can overwhelm the front end of the RDS encoder in the transmitter.

If you are doing this, make sure to set the export to only be sent once per cart change, or as infrequently as you can. For example, if you can send the data at the beginning of every spot fired, that will work well, but on some automation systems, the options are a window from 0 to 20 seconds or so. In this case, set the time to the maximum possible.

Even with this, it is frequently more elegant (especially if you're dealing with HD Radio and need PAD as well) to use a middleware product, such as Arctic Palm's Center Stage suite.

So now we have our tools. Automation export, middleware and an encoder in the transmitter. With our three required components, we have our mission: Get artist/title/station taglines onto the radio display before the PD explodes.

FIRST THINGS FIRST

To start, you need to get your automation system to export song title / artist out as either an XML or text file, or directly via IP into our Arctic Palm PC. Your automation vendor can help you with this step as each system is unique in this step.

Next, we need to set up the proper items in Arctic Palm, such as its input formats. Center Stage is preset with many automation systems it natively knows how to use. There is also a "custom" format that the support folks at Arctic Palm can help you set up for your specific

instance. Center Stage is a cleverly written program in that instead of "looking for data" all the time, it goes based on a time field, either by milliseconds, seconds or minutes:seconds format depending on your automation system export.

Using this method, your RDS data can never really be "stale" as it takes the time the current song is from your automation, and displays it for that amount of time! If new data is not submitted within a few seconds of that songs length, it sends the static station slogan message.

Once Arctic Palm is set up to take the data in, it needs to be sent somewhere, like your new shiny transmitter!
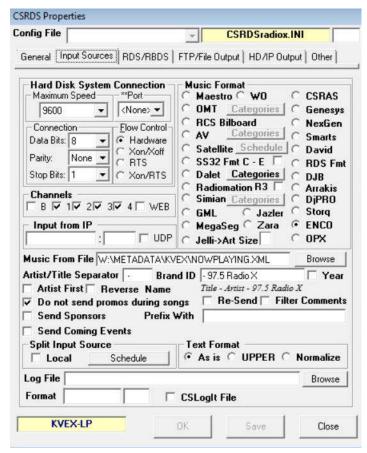

Fig. 1: CSRDS Input Settings

This part does take a few steps, and it's not difficult, but both support departments can help you out in their respective settings. But here's a hint, you want to do the transmitter *first*! You will be tempted to set up the rest of the output tabs in Center Stage, but stop here and set up the encoder next. We will come back and get to the outputs.

On your Nautel transmitter, via the AUI, navigate to the Menu, and Presets. Select Load, and load the preset you either have on air, or load the one you'd like to edit to enable RBDS/RDS onto. Navigate over to the RDS tab, and select Enable. You should now be presented with a bunch of gibberish options talking about hex codes, phase, data source, etc. On the data source drop down, ASCII over IP is the one we want. Next, set your injection level to your desired level. I personally find that anything over 5 percent seems to be a waste if you're in a relatively flat terrain. Then set the phase. This is the oddball secret nobody seems to understand unless they're RDS experts. Most leave it set to zero, you should measure the combination of the pilot and 57kHz and adjust the RDS phase to be in quadrature with the pilot. For more information refer to NRSC-G300-B Section 4.2 "a properly synced RDS encoder will utilize a subcarrier signal that is in quadrature with the 19 kHz pilot; this will slightly reduce the modulation peaks of the subcarrier without reducing their actual levels, pro-viding for more room for the main channel modulation". This also can help to minimize interference between the RDS signal and the 19kHz stereo pilot, thus can have an

impact on effective range of each.

Now we're on to your PI code. Don't fear. First timers in RBDS/RDS always ask "what's the PI code? Isn't it always 3.14?". Well, not this PI code. This is a hexadecimal representation of your call letters. How do you figure out that KSTP is 4185, or WTMJ is 8815? Of course, someone made a calculator! (PI, Calculator, get it?) You can find that calculator here.

Once you have your PI code, enter the hexadecimal number into the PI code field on the AUI, set your PTY and other options, but leave PS NAME and PTYN BLANK! Keep that PI code handy, we'll need it in the next step.

ALMOST THERE

Save your settings and activate your preset. Now we're ready for some RDS injection! Almost … On to Center Stage!

❱ *Continued from page* **13**

course. But what if your exciter doesn't have native spectrum analysis? After all, that feature has really only become commonplace over the last 10 years or so. You can also adjust your RDS injection simply by looking at the overall modulation, using a plain old mod monitor, but the station will need to be silent to do so. (That pretty much means an overnight for most of us.)

To carry this out, you would do the following:

1. *Disconnect the composite feed and any other SCAs from the exciter input.* Clearly at this point your mod monitor should read zero modulation.
2. *Connect your RDS signal to the exciter.* If your mod monitor has "scale" settings (i.e., –10, –20 dB, etc.), then set it for –10 dB. Set the injection level to read 5 percent overall.
3. *Reconnect composite and other SCA signals.* You'll find your RDS is pretty much "buried" now in the overall modulation reading.

Without a separate RDS monitor you'll be "flying blind," but clearly an automobile or other receiver that displays RDS will be of use here. Having a car radio to monitor RDS, if not ideal, will put you in the same shape as a vast majority of your listeners. Drive around to the edge of coverage, or the most important areas you are trying to serve and see how things perform.

Echoing Alan Jurison: Get to know the RDS charac-teristics of the car radio you are using, and study the results from other stations, in order to see how your station compares. The key is to manage your RDS encoder to be compatible with as many receivers out there. We think the suggestions in this eBook and the NRSC guidelines will help you get there.

Doug Irwin, CPBE AMD DRB, is vice president of engineering at iHeartMedia in Los Angeles and a technical advisor to Radio World. His Trends in Technology columns will appear here regularly.

Share your comments on this topic or about our ebooks to radioworld@nbmedia.com. *Thanks for reading!* ■

With Center Stage properties open, we now need to set the output in the RDS tab. There is a preset in here for Nautel transmitters already and it does work. Select it on the right side and slide down onto the lower right settings under Encoder. For the IP address, enter the IP address you assigned to your Nautel transmitter. The next box to the right of the IP is the port number, for any Nautel RDS enabled transmitter, this port is *7005*. Make sure the "UDP" checkbox is *UNCHECKED*. Now enter the PI code into the next field below the IP address and set up the rest of your encoder settings here. Typically, I leave most of them blank, only setting DI, MS, RT, and RT Rate (set to 1). Any duplicate settings in Center Stage *AND* AUI, the AUI will always win the settings war. Make sure to not duplicate settings nor put in different values between the AUI and Center Stage.

Fig. 2: CSRDS RDS settings for embedded Nautel RDS encoder

Just a few more things. Step down below our encoder settings now and check "Use Dynamic PS" and enter your station slogan in the textbox below (or the static message you want sent during breaks). Yes, purists are fuming now. I'm going to be lynched. Dynamic PS breaks specification, and Center Stage will remind you of that when you save your settings. But everyone wants it, so the guys at Arctic Palm have obliged the U.S. market by putting this in here, and the settings below the textbox containing your station slogan, DPSM= and DPSS, set the marching resend rate and character stepping rate. "Normal" and "3" respectively seem to do well.

Click Save, click "Yes" to the pop-up reminding you that you're breaking spec by using DPS, and then select Close, click Yes again to the nagging pop-up again about DPS, and click Start to start sending the RBDS/RDS data to your transmitter!

Did we finish before the PD exploded? ■