NATIONAL RADIO SYSTEMS COMMITTEE

2500 Wilson Boulevard
Arlington, VA 22201
(703) 907-7500
FAX (703) 907-7501

1771 N Street, NW
Washington, DC 20036
(202) 429-5346
FAX (202) 775-4981

RBDS versus RDS - What are the differences and how can receivers cope with both systems?

Scott Wright (Delco Electronics Corp.)

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I. Introduction

Since the introduction of the Radio Broadcast Data System (RBDS) standard in North America in 1993, much activity has surrounded the introduction of the system by both broadcasters and receiver manufacturers alike. One of the largest activities undertaken was the upgrade of the standard which took place over the past several years. This paper discusses the remaining differences between the North American RBDS standard and the European RDS standard. Recent changes[1] to both standards have resulted in greater harmonization of features, allowing the development of global broadcast equipment, consumer receivers, and data services.

The newly revised RDS and RBDS standards move forward into a new era for FM data services. All changes have been devised to be fully backwards compatible with the prior standards while offering a tremendous amount of growth. Figure 1 depicts the actual construction of the RBDS standard. The RDS standard is entirely contained within the RBDS standard with functional differences added within the appropriate sections of the text (modified) or within entirely new sections or annexes (new). This reflects the fact that the functional core of RBDS and RDS are identical. This can especially be seen by examining the RDS group allocations shown in Figure 2.

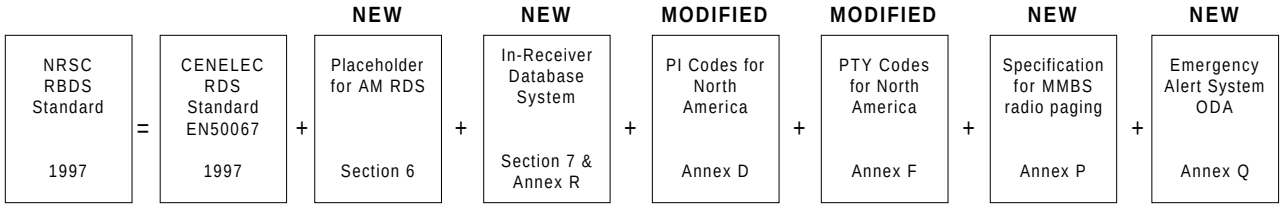

Figure 1 - RBDS Standard Functional Diagram

[1] At the time of writing both standards are in final ballot procedure. Final approval is expected early in 1998.

Group type	Description of Use
0 A	Basic tuning and switching information only
0 B	Basic tuning and switching information only
1A	Program Item Number and slow labeling codes only
1B	Program Item Number
2 A	Radiotext only
2 B	Radiotext only
3 A	Applications Identification for ODA only
3 B	Open Data Applications
4 A	Clock-time and date only
4 B	Open Data Applications
5 A	Transparent Data Channels (32 channels) or ODA
5 B	Transparent Data Channels (32 channels) or ODA
6 A	In House applications or ODA
6 B	In House applications or ODA
7 A	Radio Paging or ODA
7 B	Open Data Applications
8 A	Traffic Message Channel or ODA
8 B	Open Data Applications
9 A	Emergency Warning System or ODA
9 B	Open Data Applications
10 A	Program Type Name
10 B	Open Data Applications
11 A	Open Data Applications
11 B	Open Data Applications
12 A	Open Data Applications
12 B	Open Data Applications
13 A	Enhanced Radio Paging or ODA
13 B	Open Data Applications
14 A	Enhanced Other Networks information only
14 B	Enhanced Other Networks information only
15 A	Undefined[2]
15 B	Fast switching information only

Figure 2 RDS/RBDS Data Groups

[2] It should be noted that the Fast PS feature of RBDS is being phased out of use.

II. Summary of Differences

Recognition of the differences between RDS and RBDS is essential to all manufacturers. Depending upon the feature set of a particular receiver, some differences may be discounted, however; exercise caution when making such decisions. The differences between RDS and RBDS are now identified in the sense that it is indicated what is specific to RBDS (i.e. addition or deviation from RDS), or simply a harmonization measure:

1. **Program Type Definitions (PTY)** - Due to differing broadcast styles, the program type code definitions (i.e. Jazz, Rock, etc.) differ between RDS and RBDS.
2. **Program Identification Coding (PI)** - North American PI codes differ in functionality in three ranges. This affects alternate frequency switching and regionalization.
3. **"Dynamic" Program Service (PS) Name** - The RBDS Standard allows "non-distracting" changes to the PS, while the RDS Standard strictly forbids dynamic changes to the PS.
4. **Phase out of Fast Program Service (PS) feature** - Group 15A of RBDS was previously defined for use as a Fast PS feature. This usage is being discontinued.
5. **Mobile Broadcast Service (MBS) / Modified Mobile Broadcast Service (MMBS)** - MBS is the predecessor system to RDS in Europe. It is used as a commercial nationwide paging system in the United States. Since it shares the same modulation format as RDS, it may be time multiplexed with RDS.
6. **ID Logic Feature (IDL) / RDS Updates to In Receiver Database (IRDS)** - A licensed feature which allows the receiver to identify the call sign and format of non-RDS FM and AM broadcast stations via a built in database. This database may be updated via an Open Data Application (ODA).
7. **Emergency Alert System (EAS) Open Data Application** - An ODA has been developed to carry emergency information compatible with the U.S. Federal Communication Commissions (FCC) EAS protocol. This public ODA also offers increased consumer receiver functionality with emergency messaging.
8. **AMRDS** - The RBDS standard has a reserved section for an AM equivalent to RDS.

1. Program Type Definitions (Annex F) - To conform with differing broadcast styles, the PTY code definitions are different. These differences may be accounted for through the use of a look-up table within the receiver. This look-up table could be automatically actuated via ECC (see section III) or manually actuated (i.e. user or EEPROM switch). It should be noted that new program types have been added to both RDS and RBDS. Eureka DAB receivers deployed in North America should utilize the RBDS PTY codes. Figure 3 depicts the RDS and RBDS program type codes.

2. Program Identification (PI) Coding (Annex D) - In the U.S. PI codes are based on call letters rather than being assigned by any national authority as is done in throughout the rest of the world. A portion of the PI codes are reserved for network usage and also for assignment to stations in Canada and Mexico. During the upgrade to the RBDS standard, several mistakes were discovered in the non-call based PI codes which had to be corrected.

PTY Code	RDS Program type	RBDS Program type
0	No program type or undefined	No program type or undefined
1	News	News
2	Current Affairs	Information
3	Information	Sports
4	Sport	Talk
5	Education	Rock
6	Drama	Classic Rock
7	Culture	Adult Hits
8	Science	Soft Rock
9	Varied	Top 40
10	Pop Music	Country
11	Rock Music	Oldies
12	M.O.R. Music	Soft
13	Light classical	Nostalgia
14	Serious classical	Jazz
15	Other Music	Classical
16	Weather	Rhythm and Blues
17	Finance	Soft Rhythm and Blues
18	Children's programs	Language
19	Social Affairs	Religious Music
20	Religion	Religious Talk
21	Phone In	Personality
22	Travel	Public
23	Leisure	College
24	Jazz Music	Unassigned
25	Country Music	Unassigned
26	National Music	Unassigned
27	Oldies Music	Unassigned
28	Folk Music	Unassigned
29	Documentary	Weather
30	Alarm Test	Emergency Test
31	Alarm	Emergency

Figure 3 RDS/RBDS Program Types

The changes to the PI code assignment are summarized as follows:

- PI assignments below B000 will remain as is, allowing AF switching but no regionalization[3]. Call signs deriving PI codes "_0__", and "__00" are re-mapped into the "A" range of PI's.
- 3 Letter call signs - Modifications were made to the 3 letter call PI code assignment table.
- C000 - CFFF assigned to Canada. Allows AF switching, but no regionalization. PI codes C0xx, and Cx00 are excluded from use.
- F000 - FFFF assigned to Mexico. Allows AF switching, but no regionalization. PI codes F0xx , and Fx00 are excluded from use.
- B_01 - B_FF, D_01 - D_FF, E_01 - E_FF assigned for national networks in US, Canada, and Mexico. Regionalization[4] allowed. NRSC to provide assignments for all three countries. It should be noted that operation in this region is the same as it is for all RDS PI codes.

[3] No Regionalization - Variants based upon changes in the second nibble of the PI code should be ignored. Alternate frequency switching occurs only between exact PI codes.

[4] Regionalization - Consumer receivers should default to reject variants in the second nibble of the PI. If so desired, the receiver may be designed to allow the listener to accept or reject variants. Variant PI's may be accepted during a preset recall or PI search regardless of receiver setting.

The ECC code table was modified for these changes as well. The new PI assignments yield 3,584 possible non-regional PI's for Canada and Mexico, as well as 765 national network PI's for all three countries.

3. "Dynamic" Program Service Name (Section 3.1.5.1, 3.2.2) - During the update to the RDS standard a movement was made to specifically prohibit stations from dynamically changing the PS name. In some countries broadcasters have used the PS display as a text messaging feature similar to radiotext. Since the receiver can store and display only eight characters at a time a receiver might display a message totally unrelated to the program service (i.e. a receiver might display "and" during a preset recall on a station transmitting a PS sequence of "Radio-1", "Get up", "and", "dance!"). The design intent of PS is to provide a label for the receiver preset which is invariant, since receivers incorporating the alternate frequency (AF) feature will switch from one frequency to another in following a selected program. To combat unintended usage of the PS, the RDS standard adopted strict wording on the use of the PS feature. During adoption of the RBDS draft, considerable

debate about dynamic PS resulted in less stringent requirements for PS usage. Set makers should realize this difference although in actual practice system design should prepare for dynamic PS regardless of the intended country of usage. The excerpted text (section 3.2.2) of both standards follows:

RDS Standard - *The Programme Service name comprises eight characters, intended for static display on a receiver. It is the primary aid to listeners in programme service identification and selection. The use of PS to transmit text other than a single eight character name is not permitted (see also 3.1.5.1). Transmission of a PS name usually takes four type 0A groups, but to allow an instant display of the PS when a receiver pre-set is selected, the PS name is often stored for subsequent recall from memory when a programme service is selected. For this reason PS should generally be invariant. If a broadcaster wishes to transmit longer Programme Service names, programme-related information or any other text, then Radiotext provides this feature.*
A similar effect could be experienced with a dynamic text transmission of PTYN. As a result, dynamic PS and PTYN transmissions are expressly forbidden.

RBDS Standard - *The Program Service name comprises eight characters. It is the primary aid to listeners in program service identification and selection. The Program Service name is to be used only to identify the station or station program. This text may be changed as required by the station, but shall not be scrolled or flashed or altered in a manner that would be disturbing or distracting to the viewer (i.e. not more frequently than once per minute).*

4. Phase out of Fast Program Service (PS) feature (Section 3.1.5.20) - The prior version of the RBDS standard included a fast PS feature contained in group 15A. This usage is being phased out, however transmissions may still occur for several years. Newly designed equipment should not contain this feature, however receivers may still decode block 1 (PI), and block 2 (TP,PTY, TA, M/S, DI) data as this information will not change. Group 15A will remain undefined until at least after the phase out period has expired.

5. Mobile Broadcast Service (MBS) / Modified Mobile Broadcast Service (MMBS) (Annex P) -
The predecessor to RDS, MBS, still exists throughout North America. MBS is mainly used as a paging system through a network of

approximately 500 stations within the United States. The MBS system utilizes the same modulation technique as RDS, but employs a different data protocol. An MBS broadcast is identified through the offset word E. Receivers should be able to differentiate between RDS and MBS broadcasts by recognizing E offset words. By modifying the MBS data into a modulo-4 format, also known as modified MBS (MMBS), it is possible to time multiplex with RDS. Receivers may be designed to accommodate MMBS/RDS broadcasts by "flywheeling" synchronization through E offset words. At the time of this writing, no known MMBS broadcasts are occurring, however this may change in the future as RDS is deployed throughout the United States. Internal MBS/MMBS cross references can also be found throughout the RBDS standard as a reminder of particular system requirements and as a possible alternative to RDS. A public domain EAS protocol is also contained within the MMBS annex.

6. ID Logic Feature (IDL)/ In Receiver database updates via RDS (IRDS) ODA Protocol (Section 7, Annex R) - The ID logic feature is a licensed technology (PRS Corporation) that allows the incorporation of an in receiver database that contains format type and call letters for all AM and FM stations. When combined with RDS, IDL can provide similar data and features for non-RDS FM and all AM stations. The IRDS feature allows the database to be updated through a RDS ODA so that station information can be updated and maintained automatically.

7. Emergency Alert System (EAS) ODA Protocol (Annex Q) - Within the RBDS standard, the EAS ODA protocol is defined for use in the United States. This optional feature set is constructed around the Federal Communication Commission's (FCC) newly developed EAS system and is open for public use. RDS allows the silent re-transmission of emergency information. This has been combined with existing consumer oriented emergency features (i.e. PTY-31) to allow additional feature functionality to consumer receivers. The EAS ODA can also accommodate private emergency systems. The EAS ODA is identified by the application identification (AID) code "E911".

8. AM RDS (Section 6) - Section 6 of the RBDS standard currently serves as a "placeholder" for a future AM data system. The development of an AM data system is still supported by the RBDS subcommittee. Any such system must be compatible with the C-Quam AM Stereo system.

III. Related Issues

RDS Logo Usage (Section 5, Annex K) - The logo is a registered trademark of the National Association of Broadcasters (NAB) in the U.S. Before the logo can be used on any product, manufacturers will need to perform a self-certification test on their equipment and submit a self certification application to the Consumer Electronic Manufacturers Association (CEMA). The cost is $100 (US$) per year per manufacturer. Only equipment displaying the logo will require registration. Please note that consumer receivers must use the term "RDS' rather than "RBDS". Use RBDS only when referring to the actual standard.

Open Data Application (ODA) Registration (Annex L) - To provide easy registration for ODA application identification (AID) codes; a registration form based on US$ is available for use. It should be noted that AID codes are internationally recognized regardless of the issuing body.

Extended Country Codes (ECC) (Annex D, N) - The ECC codes allow receivers to identify the country that a broadcast is coming from. Since PI codes are limited in number, they must be repeated throughout the world. When the PI code is received in conjunction with the ECC, the exact country of origin can be identified. The updated ECC code table has been expanded to be international in scope. The ECC should be transmitted by all broadcasters, and it is recommended that it be a default automatic transmission in encoders. The ECC supports the development of global receivers which can automatically compensate for things such as:

- E blocks (MBS/MMBS)
- PI codes
- PTY Tables
- Tuning range and step
- FM De-emphasis

North American Common Feature Set - The most commonly utilized features in the United States are: PI, PS, PTY, PTYN, RT, TP, TA, CT, and AF. Probably the most startling revelation is the use of AF in the United States. Currently there are over 7000 FM stations licensed in the U.S. Also currently licensed are 2,695 translators[5]. A translator is a low power FM transmitter (10-250 Watts ERP) that is used to fill in coverage gaps within a stations primary service area or to extend the service area. A translator resides on a different frequency (alternate frequency) than the main transmitter. Additionally, many non-commercial stations (i.e. National Public Radio

[5] From Federal Communications Commission FM Engineering database, May 5, 1997.

in the U.S., the Canadian Broadcasting Corporation in Canada) and even some commercial stations broadcast identical programming over a number of full power stations. Thus, the AF feature of RDS does indeed have a place even in the United States. Future features in the U.S. could include:

- EAS ODA - Allows receivers to identify stations that provide emergency warning information.
- Enhanced Other Networks - For sharing of TA, PTY information for affiliated stations.
- Linkage Actuation - For linking syndicated programs.

Universal Encoder Communication Protocol (UECP) - The UECP offers a single communications protocol to interface with any broadcast encoder. Manufacturers should support the use of the UECP when making encoder upgrades to the new standard if at all possible. This will in turn support development of broadcast interfaces to such devices as:

- Music automation systems - Provide automatic update of artist and song title information via RT.
- Station Automation - Automatic switching for PTY, PTYN, and TA data.
- Commercial Automation - Provide listeners with ancillary information (via RT) concerning advertisers while the commercial is aired. This allows consumers more information (such as store hours, phone number, or location) while not requiring additional air time.
- EAS Interface - Provide automatic link to EAS encoders already installed in broadcast stations in the U.S.
- Clock Time Interface - Keep the station date/time accurate, and prevent transmission of CT unless an accurate time base is connected.

The development of fully automated dynamic RDS information will provide listeners with the most useful, timely, and interactive use of RDS possible.

Learn more via the internet - The following web sites can provide you with more information as well as timely updates:

- RDS Forum: www.rds.org.uk
- National Association of Broadcasters: www.nab.org/SciTech/standard.htm
- Consumer Electronics Manufacturers Association: www.cemacity.org/rds/

IV. Bibliography

[1] CENELEC (1997): Specification of the radio data system (RDS) for VHF/FM sound broadcasting. DRAFT prEN50067:1997 E. European Committee for Electrotechnical Standardization. Brussels Belgium.

[2] CENELEC (1992): Specifications of the radio data system; EN 50067. European Committee for Electrotechnical Standardization. Brussels Belgium.

[3] National Radio Systems Committee: United States RBDS Standard, January 8, 1993 - Specification of the radio broadcast data system (RBDS), Washington D.C.

[4] EIA/NAB National Radio Systems Committee RBDS Subcommittee: United States RBDS Standard, Draft 2.0, August 1997. - Specification of the radio broadcast data system (RBDS), Washington D.C.

[5] T. Beale, D. Kopitz: RDS in Europe, RBDS in the USA - What are the differences and how can receivers cope with both systems? - EBU Technical Review no.255 (Spring 1993).

[6] EBU (1997): RDS Universal Encoder Communication Protocol, UECP Version 5.1, European Broadcasting Union/ RDS Forum, 17A Ancienne Route, CH-1218 Geneva, Switzerland.