NRSC STANDARD

NATIONAL RADIO SYSTEMS COMMITTEE

NRSC-4-B
United States RBDS Standard
Specification of the radio broadcast data system (RBDS)
April, 2011

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FOREWORD

This Standard was produced by the Radio Broadcast Data System (RBDS) Subcommittee of the National Radio Systems Committee (NRSC). It reflects input from broadcasters, receiver manufacturers, users and potential users of radio data system services. This standard is based on the international RDS Standard IEC/CENELEC 62106 of which the technical specifications were initially developed within the European Broadcasting Union (EBU).

This Standard is nearly identical to IEC/CENELEC 62106 Edition 2.0, 2009-07. The NRSC-4-B document, unlike earlier versions, only includes those sections of the Standard which differ from the IEC version.

This Standard is a voluntary standard. Because its success is largely dependent on the radio listener's ability to use the same radio data system receiver in the same manner in any location, it is hoped that broadcasters and equipment manufacturers will comply with the spirit and the letter of this Standard.

The National Radio Systems Committee is jointly sponsored by the Consumer Electronics Association (CEA) and the National Association of Broadcasters (NAB). It serves as an industry-wide standards-setting body for technical aspects of terrestrial over-the-air radio broadcasting systems in the United States. At the time of the adoption of NRSC-4-B, the NRSC was chaired by Milford Smith of Greater Media, the RBDS Subcommittee was chaired by Barry Thomas of Lincoln Financial Media, and the RDS Usage Working Group (RUWG) was chaired by Steve Davis of Clear Channel Broadcasting.

CONTENTS

UNITED STATES RBDS STANDARD – SPECIFICATION OF THE RADIO BROADCAST DATA SYSTEM (RBDS)

1 SCOPE

This Standard is based upon IEC 62016 Edition 2.0, 2009-07. All provision of that IEC Standard, except for those in the Sections included herein, are incorporated into NRSC-4-B by reference. Except for Section 1 (SCOPE) and Section 2 (NORMATIVE REFERENCES), Sections which are included in the NRSC-4-B Standard replace their counterparts in the IEC 62106 Standard in their entirety.

2 NORMATIVE REFERENCES

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62106 Edition 2.0, 2009-07

ISO/IEC 10646, Information technology – Universal Multiple-Octet Coded Character Set (UCS)

ISO TS 14819 (all parts), Traffic and Traveler Information (TTI) – TTI Messages via Traffic Message Coding (TMC)

ITU-R Rec. BS.450-3, Transmission standards for FM sound broadcasting at VHF

ITU-R Rec. BS.643-2, System for automatic tuning and other applications in FM radio receivers for use with the pilot-tone system

ITU-T Rec. E.212, For the three digit Mobile Country Codes used in Annex M of this RDS specification refer to Complement to ITU-T Rec. E.212 (05/2004) published by ITU Geneva as Annex to ITU Operational Bulletin 897, dated 2007-12-01

ETSI EN 301 700, Digital Audio Broadcasting (DAB); VHF/FM Broadcasting: cross-referencing to simulcast DAB services by RDS-ODA 147

3 REPLACEMENT SECTIONS

The sections below replace their counterparts in the IEC 62106 Standard in their entirety. Note that all section, figure and table numbers referenced here are the same as the corresponding numbers in IEC 62106.

6.1.3 Group types

It was described above (see also Figure 9) that the first five bits of the second block of every group are allocated to a five-bit code which specifies the application of the group type and its version, as shown in Table 3.

Table 3. Group types

Group type	Group type code/version					Flagged in type 1A groups	Description
	A_3	A_2	A_1	A_0	B_0		
0 A	0	0	0	0	0		Basic tuning and switching information only (see 6.1.5.1)
0 B	0	0	0	0	1		Basic tuning and switching information only (see 6.1.5.1)
1A	0	0	0	1	0		Program Item Number and slow labeling codes only (see 6.1.5.2)
1B	0	0	0	1	1		Program Item Number (see 6.1.5.2)
2 A	0	0	1	0	0		RadioText only (see 6.1.5.3)
2 B	0	0	1	0	1		RadioText only (see 6.1.5.3)
3 A	0	0	1	1	0		Applications Identification for ODA only (see 6.1.5.4)
3 B	0	0	1	1	1		Open Data Applications (see 6.1.5.5)
4 A	0	1	0	0	0		Clock-time and date only (see 6.1.5.6)
4 B	0	1	0	0	1		Open Data Applications (see 6.1.5.7)
5 A	0	1	0	1	0		Transparent Data Channels (32 channels) or ODA (see 6.1.5.8)
5 B	0	1	0	1	1		Transparent Data Channels (32 channels) or ODA (see 6.1.5.8)
6 A	0	1	1	0	0		In House applications or ODA (see 6.1.5.9)
6 B	0	1	1	0	1		In House applications or ODA (see 6.1.5.9)
7 A	0	1	1	1	0	Y	Radio Paging or ODA (see 6.1.5.10 and Annex M)
7 B	0	1	1	1	1		Open Data Applications (see 6.1.5.11)
8 A	1	0	0	0	0		Traffic Message Channel or ODA (see 6.1.5.12)
8 B	1	0	0	0	1		Open Data Applications (see 6.1.5.12)
9 A	1	0	0	1	0	Y	Emergency Warning System or ODA (see 6.1.5.13)
9 B	1	0	0	1	1		Open Data Applications (see 6.1.5.13)
10 A	1	0	1	0	0		Program Type Name (see 6.1.5.14)
10 B	1	0	1	0	1		Open Data Applications (see 6.1.5.14)
11 A	1	0	1	1	0		Open Data Applications (see 6.1.5.15)
11 B	1	0	1	1	1		Open Data Applications (see 6.1.5.15)
12 A	1	1	0	0	0		Open Data Applications (see 6.1.5.16)
12 B	1	1	0	0	1		Open Data Applications (see 6.1.5.16)
13 A	1	1	0	1	0	Y	Enhanced Radio Paging or ODA (see 6.1.5.17 and Annex M)
13 B	1	1	0	1	1		Open Data Applications (see 6.1.5.18)
14 A	1	1	1	0	0		Enhanced Other Networks information only (see 6.1.5.19)
14 B	1	1	1	0	1		Enhanced Other Networks information only (see 6.1.5.19)
15 A	1	1	1	1	0		Open Data Applications (see 6.1.5.20)
15 B	1	1	1	1	1		Fast switching information only (see 6.1.5.21)

NOTE Mark “Y” indicates that group type 1A will be transmitted for the identification of the application using block 3 of group type 1A (except for an ODA, where the application identification is in group 3A instead).

NOTE: The use of Group 15A is not compatible with earlier RBDS receivers since recognition of this group was discouraged from 1998 to 2008 in anticipation of a reassignment of this Group's function.

The appropriate repetition rates for some of the main features are indicated in Table 4:

Table 4. Main feature repetition rates

Main Features	**Group types which contain this information**	**Appropriate repetition rate per sec.**
Program Identification (PI) code	all	11.4[a]
Program Type (PTY) code	all	11.4[a]
Traffic Program (TP) identification code	all	11.4[a]
Program Service (PS) name	0A, 0B	1
Alternative frequency (AF) code pairs	0A	4
Traffic announcement (TA) code	0A, 0B, 14B, 15B	4
Decoder identification (DI) code	0A, 0B, 15B	1
Music/speech (M/S) code	0A, 0B, 15B	4
RadioText (RT) message	2A, 2B	0.2[b]
Enhanced other networks information (EON)	14A	up to 2[c]

[a] Valid codes for this item will normally be transmitted with at least this repetition rate whenever the transmitter carries a normal broadcast program.

[b] A total of 16 type 2A groups are required to transmit a 64 character RadioText message and therefore to transmit this message in 5 seconds, 3.2 type 2A groups will be required per second.

[c] The maximum cycle time for the transmission of all data relating to all cross-referenced program services shall be less than 2 minutes.

A total of four type 0A groups are required to transmit the entire PS name and therefore four type 0A groups will be required per second. The repetition rate of the type 0A group may be reduced if more capacity is needed for other applications. But a minimum of two type 0A groups per second is necessary to ensure correct functioning of PS and AF features. However, with EON receivers search tuning is affected by the repetition rate of type 0 groups (TP/TA, see6.2.1.3). It must be noted that in this case transmission of the complete PS will take 2 seconds. However, under typical reception conditions the introduction of errors will cause the receiver to take 4 seconds or more to acquire the PS name for display.

The following mixture of groups (Table 5) is suitable to meet the repetition rates noted above.

Table 5. Group repetition rates

Group types	Features	Typical proportion of groups of this type transmitted
0A or 0B	PI, PS, PTY, TP, AF[a], TA, DI, M/S	40%
1A or 1B	PI, PTY, TP, PIN	10%
2A or 2B	PI, PTY, TP, RT	15%[b]
14A or 14B	PI, PTY, TP, EON	10%
Any other	Other applications	25%

[a] Type 0A group only

[b] Assuming that type 2A groups are used to transmit a 32-character RadioText message. A mixture of type 2A and 2B groups in any given message should be avoided (see6.1.5.3)

6.1.4.1 Use of Open Data Applications

Open Data Applications (ODA) are not explicitly specified in this standard. They are subject to a registration process and registered applications are listed in the EBU/RDS Forum - ODA Directory and on the RBDS Subcommittee web page of the NRSC, www.nrscstandards.org/RBDS/default.asp, (see Annex L), which references appropriate standards and normative specifications. These specifications may however be public (specification in the public domain, i.e. TMC, eRT, RT+ and ODA147 [see ETSI 301 700], see Annexes P and Q and Section 2) or privately owned (and not in the public domain). The terms public and private do not imply the degree of access to services provided by an application, for example a public domain service may well include encryption, as in TMC for example.

ODAs, whether public or private, must conform to all requirements of this, the RDS, or RBDS specification (as appropriate). Nothing in any ODA may require any aspect of a primary RDS feature to be changed or not to be transmitted in accordance with this specification. This is to ensure that the transmission of an ODA cannot adversely affect devices built in accordance with the RDS and RBDS specifications.

An ODA may use version A and/or version B groups, however it must not be designed to operate with a specific group type. An exception is TMC, which uses group type 8A. In any case, the specific group type used by the ODA in any particular transmission is signaled in the Applications Identification (AID) carried in type 3A groups (see6.1.5.4). Table 6 shows the version A and version B groups that may be allocated to ODA. Group types not shown in Table 6 are not available for ODA.

Table 6. ODA group availability signaled in type 3A groups

Group type	Application group type code	Availability for Open Data Applications
	00000	Special meaning: Not carried in associated group
3B	00111	Available unconditionally
4B	01001	Available unconditionally
5A	01010	Available when not used for TDC
5B	01011	Available when not used for TDC
6A	01100	Available when not used for IH
6B	01101	Available when not used for IH
7A	01110	Available when not used for RP
7B	01111	Available unconditionally
8A	10000	Available when not used for TMC
8B	10001	Available unconditionally
9A	10010	Available when not used for EWS
9B	10011	Available unconditionally
10B	10101	Available unconditionally
11A	10110	Available unconditionally
11B	10111	Available unconditionally
12A	11000	Available unconditionally
12B	11001	Available unconditionally
13A	11010	Available when not used for RP
13B	11011	Available unconditionally
15A	11110	Available unconditionally
	11111	Special meaning: Temporary data fault (Encoder status)

NOTE: The use of Group 15A is not compatible with earlier RBDS receivers since recognition of this group was discouraged from 1998 to 2008 in anticipation of a reassignment of this Group's function.

6.1.5.1 Type 0 groups: Basic tuning and switching information

The repetition rates of type 0 groups must be chosen in compliance with6.1.3.

Figure 12 shows the format of type 0A groups and Figure 13 the format of type 0B groups.

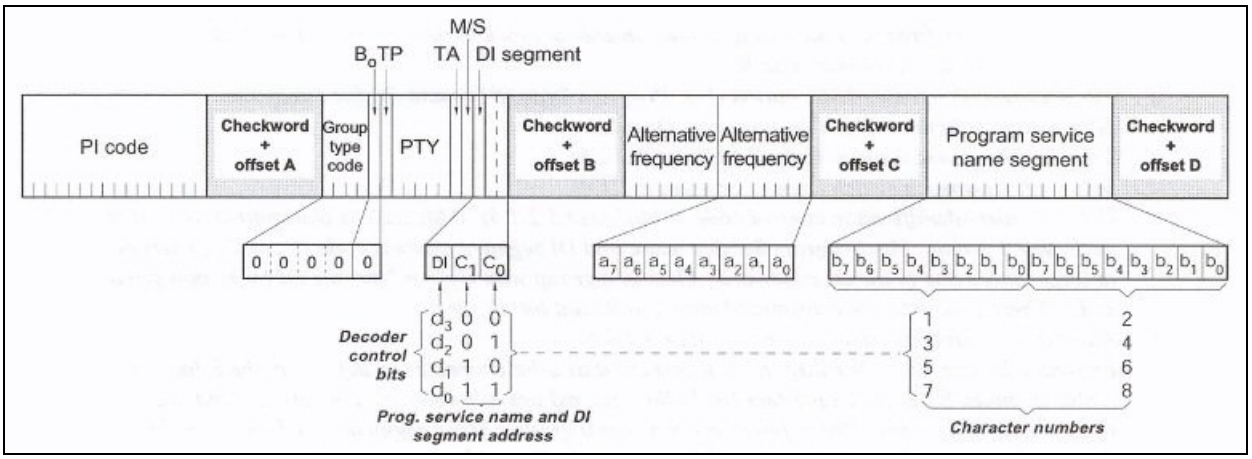

Figure 12. Basic tuning and switching information - Type 0A group

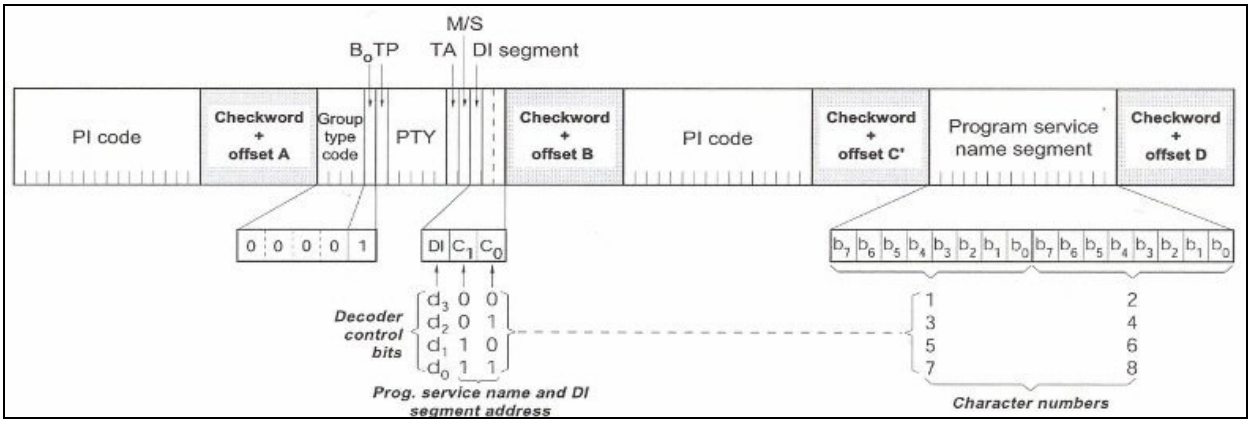

Figure 13. Basic tuning and switching information - Type 0B group

Type 0A groups are usually transmitted whenever alternative frequencies exist. Type 0B groups without any type 0A groups may be transmitted only when no alternative frequencies exist.

There are two methods (A and B) for transmission of alternative frequencies (see6.2.1.6.2).

The Program Service name comprises eight characters. It may be used to aid to listeners in program service identification and selection.

NOTE 1 Version B differs from version A only in the contents of block 3, the offset word in block 3, and, of course, the version code B_0

NOTE 2 For details of Program Identification (PI), Program Type (PTY) and Traffic Program (TP) code, see Figure 9,6.2.1 and Annexes D and F.

NOTE 3 TA = Traffic announcement code (1 bit) (see6.2.1.3).

NOTE 4 M/S = Music-speech switch code (1 bit) (see6.2.1.4).

NOTE 5 DI= Decoder-identification control code (4 bits) (see6.2.1.5). This code is transmitted as 1 bit in each type 0 group. The Program Service name and DI segment address code (C_1 and C_0) serves to locate these bits in the DI codeword. Thus in a group with C_1C_0 = "00" the DI bit in that group is d_3 . These code bits are transmitted most significant bit (d_3) first.

NOTE 6 Alternative frequency codes (2 x 8 bits) (see6.2.1.6).

NOTE 7 Program Service name (for display) is transmitted as 8-bit character as defined in the 8-bit code-tables in Annex E. Eight characters (including spaces) are allowed for each network and are transmitted as a 2-character segment in each type 0 group. These segments are located in the displayed name by the code bits C_1 and C_0 in block 2. The addresses of the characters increase from left to right in the display. The most significant bit (b_7) of each character is transmitted first.

6.1.5.3 Type 2 groups: RadioText

Figure 16 shows the format of type 2A groups and Figure 17 the format of type 2B groups.

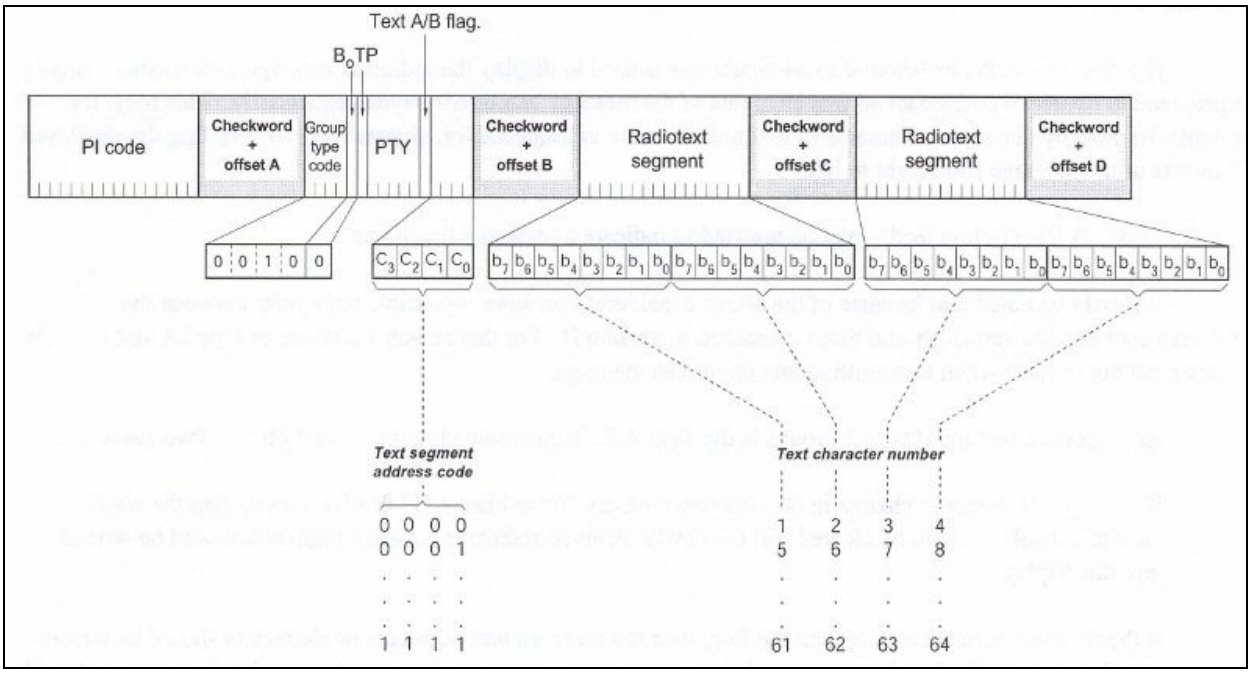

Figure 16. RadioText - Type 2A group

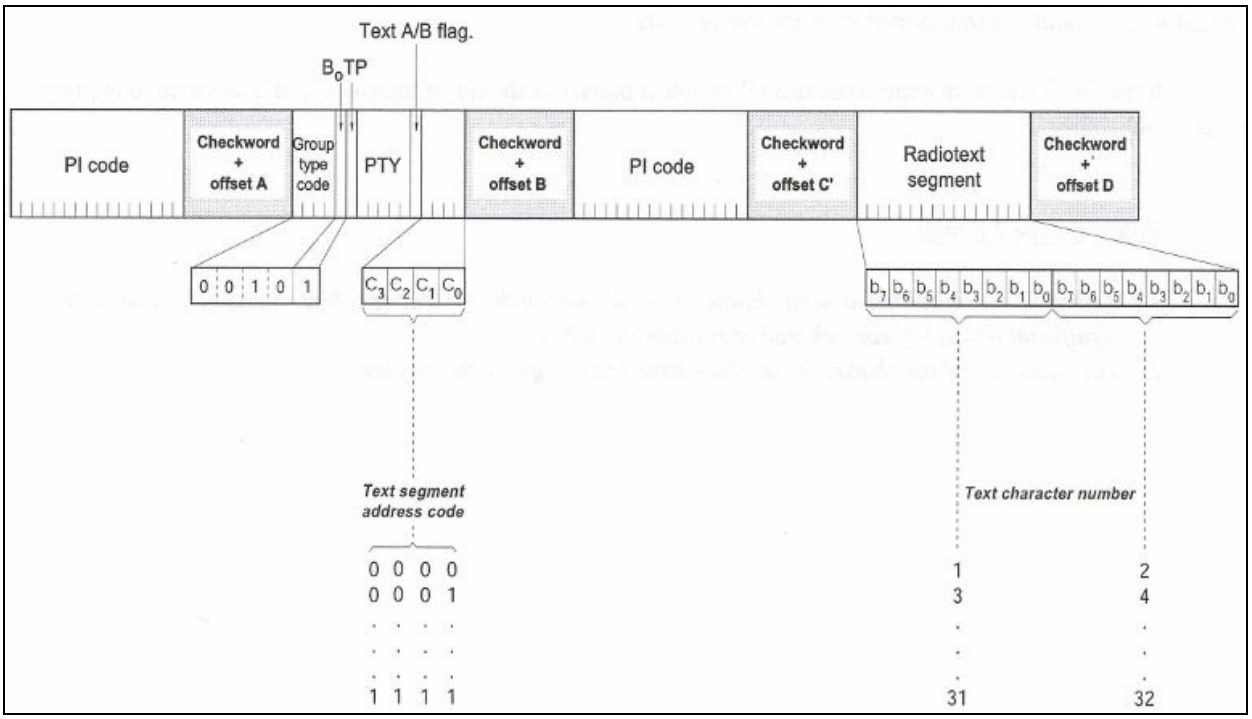

Figure 17. RadioText - Type 2B group

The 4-bit text segment address defines in the current text the position of the text segments contained in the third (version A only) and fourth blocks. Since each text segment in version 2A groups comprises four characters, messages of up to 64 characters in length can be sent using this version. In version 2B groups, each text segment comprises only two characters and therefore when using this version the maximum message length is 32 characters.

A new text must start with segment address “0000" and there must be no gaps up to the highest used segment address of the current message. The number of text segments is determined by the length of the message, and each message should be ended by the code 0x0D (Hex) - carriage return - if the current message requires less than 16 segment addresses.

If a display which has fewer than 64 characters is used to display the RadioText message then memory should be provided in the receiver/decoder so that elements of the message can be displayed sequentially. This may, for example, be done by displaying elements of text one at a time in sequence, or, alternatively by scrolling the displayed characters of the message from right to left.

Code 0x0A - line feed - may be inserted to indicate a preferred line break.

The following codes could be used with certain reservations noted.

Code 0x0B: end of headline. This marker may be placed anywhere within the first 32 character positions and indicates that the text up to that point is considered by the broadcaster to be the “headline” portion of the text. It is inserted by the broadcaster on the assumption that a 2 line, 16 character format has been adopted on the receiver. It may stand in place of a space character in the text string.

NOTE The use of the <0x0B> code is known to not be supported by at least one RDS IC vendor and hence is not supported in any products which use that vendor's ICs, including at least one major radio manufacturer. Use of this feature may cause the code to be displayed in unintended ways.

Code 0x1F: soft hyphen. This marker indicates the position(s) in long words where the author of the text would prefer a receiver to break a word between display lines if there is a need to do so. It has application only for multi-line non-scrolling displays.

NOTE The use of the <0x1F> code is known to not be supported by at least one RDS IC vendor and hence is not supported in any products which use that vendor's ICs, including at least one major radio manufacturer. Use of this feature may cause the code to be displayed in unintended ways.

A space shall be substituted by the receiver for any unrecognized symbol or control character.

It should be noted that because of the above considerations there is possible ambiguity between the addresses contained in version A and those contained in version B. For this reason a mixture of type 2A and type 2B groups must not be used when transmitting any one given message.

An important feature of type 2 groups is the Text A/B flag contained in the second block. Two cases occur:

- If the receiver detects a change in the flag (from binary "0" to binary "1" or vice-versa), then the whole RadioText display should be cleared and the newly received RadioText message segments should be written into the display;

- If the receiver detects no change in the flag, then the received text segments or characters should be written into the existing displayed message and those segments or characters for which no update is received should be left unchanged.

When this application is used to transmit a 32-character message, at least three type 2A groups or at least six type 2B groups should be transmitted in every two seconds.

It may be found from experience that all RadioText messages should be transmitted at least twice to improve reception reliability.

NOTE 1 RadioText is transmitted as 8-bit characters as defined in the 8-bit code-table E.1 in Annex E. The most significant bit (b_7) of each character is transmitted first.

NOTE 2 The addresses of the characters increase from left to right in the display.

6.1.5.6 Type 4A groups : Clock-time and date

The transmitted clock-time and date shall be accurately set to UTC plus local offset time. Otherwise CT shall not be transmitted.

Figure 20 shows the format of type 4A groups.

When this application is used, one type 4A group will be transmitted every minute.

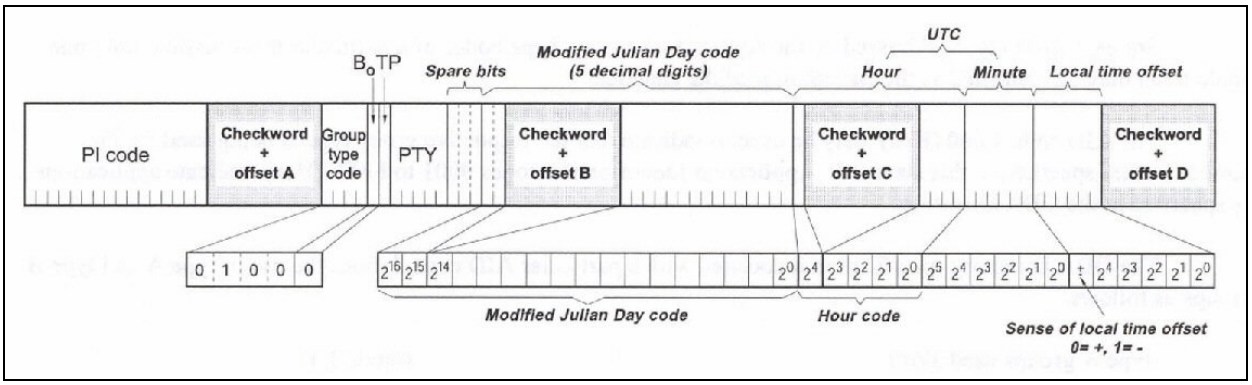

Figure 20. Clock-time and date transmission - Type 4A group

NOTE 1 The local time is composed of Coordinated Universal Time (UTC) plus local time offset.

NOTE 2 The local time offset is **expressed in multiples of half hours** within the range -15.5 h to +15.5 h and is coded as a six-bit binary number. "0" = positive offset (East of zero degree longitude), and "1" = negative offset (West of zero degrees longitude).

NOTE 3 The information relates to the epoch immediately following the start of the next group.

NOTE 4 The Clock time group is inserted so that the minute edge will occur within ± 0.1 seconds of the end of the Clock time group.

NOTE 5 Minutes are coded as a six-bit binary number in the range 0-59. The spare codes are not used.

NOTE 6 Hours are coded as five-bit binary number in the range 0-23. The spare codes are not used.

NOTE 7 The date is expressed in terms of Modified Julian Day and coded as a 17-bit binary number in the range 0-99999. Simple conversion formulas to month and day, or to week number and day of week are given in Annex G. Note that the Modified Julian Day date changes at UTC midnight, not at local midnight.

NOTE 8 Accurate CT based on UTC plus local time offset must be implemented on the transmission where TMC and/or Radio paging is implemented.

6.2.1.6.1 AF code tables

In the following code tables, each 8-bit binary code represents a carrier frequency, or it represents a special meaning as shown in Tables 10, 11 and 12.

Table 10. VHF code table

Number	Binary code	Carrier frequency
0	0000 0000	Not to be used
1	0000 0001	87.6 MHZ
2	0000 0010	87.7 MHZ
:	:	:
:	:	:
204	1100 1100	107.9 MHZ

Table 11. Special meanings code table

Number	Binary code	Special meaning
0	0000 0000	Not to be used
205	1100 1101	Filler code
206	1100 1110	Not assigned
:	:	:
223	1101 1111	Not assigned
224	1110 0000	No AF exists
225	1110 0001	1 AF follows
:	:	:
249	1111 1001	25 AFs follow
250	1111 1010	An LF/MF frequency follows
251	1111 1011	Not assigned
:	:	:
255	1111 1111	Not assigned

Table 12a. LF/MF code table - for ITU regions 1 and 3 (9 kHz spacing)

Number		Binary code	Carrier frequency
LF	1	0000 0001	153 kHz
	:	:	:
	:	:	:
	15	0000 1111	279 kHz
MF	16	0001 0000	531 kHz
	:	:	:
	:	:	:
	:	:	:
	:	:	:
	135	1000 0111	1602 kHz

Table 12b – MF code table – for ITU region 2 (10 kHz spacing)

Number		Binary code	Carrier frequency
MF	17	0001 0001	540 kHz
	:	:	:
	:	:	:
	:	:	:
	:	:	:
	133	1000 0101	1700 kHz

6.2.2 Coding and use of information for display

The code table E.1 for the displayed 8-bit text characters (basic character set) relating to the Program Service name, RadioText, Program Type Name and alphanumeric Radio Paging is given in Annex E.

As an alternative to RadioText RT with the *basic character set* an enhanced RadioText eRT with an *extended character set* given in Table E.2 may be used. The coding for eRT is detailed in Annex Q. It is an ODA.

The Program Service name comprises eight characters. It may be used to aid to listeners in program service identification and selection.

6.2.3 Coding of Clock Time and date (CT)

The transmitted clock-time and date shall be accurate; otherwise CT not be transmitted.

In order to avoid ambiguity when radio-data broadcasts from various sources are processed at one point (e.g. reception from multiple time zones), and to allow calculations of time intervals to be made independent of time zones and Daylight Saving Time discontinuities, the broadcast time and date codes will use Coordinated Universal Time (UTC) and Modified Julian Day (MJD). A coded local time-difference, expressed in multiples of half-hours is appended to the time and date codes.

Conversion between the Modified Julian Day date and UTC time codes and the various calendar systems (*e.g.*, year, month, day, or year, week number, day of week) can be accomplished quite simply by processing in the receiver decoder (see Annex G).

7.12 Program Service name (PS)

This is the label of the program service consisting of not more than eight alphanumeric characters coded in accordance with Table E.1, which is displayed by RDS receivers in order to inform the listener what program service is being broadcast by the station to which the receiver is tuned (see 6.1.5.1). An example for a name is "Radio 21." The Program Service name is not intended to be used for automatic search tuning.

D.2 PI structure

For land-based transmitters code assignments for bits b_{11} to b_0 should be decided by relevant authorities in each country individually.

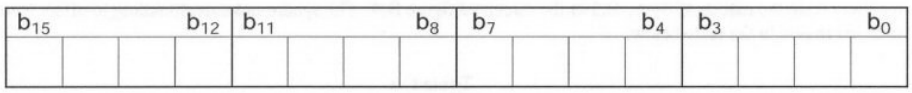

Figure D.1 – PI structure

Table D.1 – PI code structure

"Nibble 1"	Bits b_{15} to b_{12}	*Country code* Codes are indicated on the map of Figure D.3 and Table D.2
"Nibble 2"	Bits b_{11} to b_8	*Program in terms of area coverage* Codes are given in D.5 and D.6
"Nibbles 3 and 4"	Bits b_7 to b_0	*Program reference number* Codes are given in D.6

Codes shall be assigned in such a way that automatic search tuning to other transmitters radiating the same program can locate the same program identification code, *i.e.*, all 16 bits shall be identical. In cases where during a few program hours a network is split to radiate different programs, each of these programs shall carry a different program identification code, by using different coverage-area codes.

NOTE: Section D.7 and its subsections, given here, only appear in NRSC-4-B, and are appended to the sections in Annex D included in IEC 62106.

D.7 PI Coding for North America

PI codes in North America are issued and utilized differently than the rest of the world. In areas licensed by the U.S. Federal Communications Commission (except Guam), PI codes are calculated by the station's call letters.[1] Stations in Canada and Mexico use PI codes starting with 0xC and 0xF, respectively (except for certain CBC FM stations as indicated in Table D.7). This gives each station a unique PI code without the need for any outside coordination.

[1] Note: some broadcasters may elect to substitute 0x01 for the first nibble of the PI code to support RDS TMC traffic data transmission. See Section D.7.4 for additional information.

These PI codes do not make use of coverage area codes (Section D.4). Coverage area codes are only valid for the “B”, “D”, and “E” blocks of PI codes. Broadcasters and receiver manufacturers must make note of this subtle, yet significant, difference of the RBDS Standard.

As discussed in Footnote 1, an optional method for forming PI codes is given in Section D.7.4 which may be useful for broadcasters that are providing traffic information using RDS.

D.7.1 Call letter conversion method

NOTE: Call letters or slogan to be displayed by the receiver may be sent using the PS (program service) data.

1) Assign decimal values to last 3 letters of call letters using values from Table D.6:

Table D.6

LETTER	DECIMAL VALUE	LETTER	DECIMAL VALUE
A	0	N	13
B	1	O	14
C	2	P	15
D	3	Q	16
E	4	R	17
F	5	S	18
G	6	T	19
H	7	U	20
I	8	V	21
J	9	W	22
K	10	X	23
L	11	Y	24
M	12	Z	25

2) Calculate a weighted decimal value (**call it “<VAL>”**) for the last 3 letters of the call sign, according to each letter's position, and add together to obtain this decimal value (see exception for 3-letter call signs below).

Examples:

K <3rd letter position> <2nd letter position> <1st letter position>
W <3rd letter position> <2nd letter position> <1st letter position>

<3rd letter position value> x 676
\+ <2nd letter position value> x 26
\+ <1st letter position value>
decimal value for 3 letters = <VAL>

3) If station call sign begins with K, add <VAL> to (decimal) 4096 and convert the result to hexadecimal (HEX {<VAL> +4096}) to obtain four digit PI code. However, if call sign begins with W, add <VAL> to (decimal) 21672 and convert to hexadecimal (HEX {<VAL> +21672}) to obtain four digit PI code.

    IF K… HEX{<VAL> +4096} = FOUR DIGIT PI CODE
    IF W… HEX{<VAL> +21672} = FOUR DIGIT PI CODE

EXCEPTIONS TO ABOVE ASSIGNMENTS:

1) CALL LETTERS THAT MAP TO PI CODES = _ 0 _ _
   European receivers will treat a PI code that has a second nibble of zero as a local station (unique broadcast) and will not AF switch. If a station's call letters map to a PI code = _0_ _, the PI code assignment needs to be reassigned into the A _ _ _ group as follows:

   P1 0 P3 P4 → A P1 P3 P4

   Examples: 1045 →A145; 30F2 → A3F2; 80A1 → A8A1; etc.

2) CALL LETTERS THAT MAP TO PI CODES = _ _ 0 0
   If station's PI code ends with 00, the PI code will be reassigned into the A F _ _ group as follows:

   P1 P2 0 0 → A F P1 P2

   Examples: 1C00 → AF1C; 3200 → AF32; 8C00 → AF8C ; etc.

   NOTE: For 9 special cases—1000,2000,..,9000—a double mapping occurs utilizing exceptions 1 and 2:

   1000→A100→AFA1; 2000→A200→AFA2; ... ; 8000→A800→AFA8; 9000→A900→AFA9

3) TWO STATIONS CARRY THE IDENTICAL PROGRAMMING
   These stations will need to assign the same PI code for both stations. The radio will need an identical PI code match to switch to the alternate frequency. The call letters can still be displayed independently with the PS information.

   Example: If WYAY and WYAI have identical programming, either the mapping of WYAY (PI code = 4F78) or WYAI (PI code = 4F68) will need to be used.

4) 3-LETTER-ONLY CALL LETTERS
   For 3-letter call sign stations, a mapping of pre-assigned PI codes is shown in Table D.7, TABLE OF PI CODE POSSIBILITIES. The mapping of 3-letter-only call letters is reserved in PI codes ranging from 9950 to 9EFF.

5) NATIONALLY-LINKED RADIO STATIONS CARRYING DIFFERENT CALL LETTERS
   These stations will need to be assigned a PI code with a first nibble of B (B_01 to B_FF, D_01 to D_FF, E_01 to E_FF). NOTE: Nibble 2 can only be filled with 1 through F. If a 0 is used, some receivers may not switch to Alternate Frequencies.

Table D.7
TABLE OF PI CODE POSSIBILITIES

Note: some broadcasters may elect to substitute 0x01 for the first nibble of the PI code to support RDS TMC traffic data transmission. See Section D.7.4 for additional information.

Hex [0000-0FFF] RESERVED

CALL LETTERS (K)	<VAL> + 4096 (decimal)	FOUR DIGIT PI CODE (hex)
KAAA	0 + 4096 = 4096	HEX{4096} = 1000
KAAB	1 + 4096 = 4097	HEX{4097} = 1001
:	:	:
:	:	:
KZZY	17574 + 4096 = 21670	HEX{21670} = 54A6
KZZZ	17575 + 4096 = 21671	HEX{21671} = 54A7

CALL LETTERS (W)	<VAL> + 21672 (decimal)	FOUR DIGIT PI CODE (hex)
WAAA	0 + 21672 = 21672	HEX{21672} = 54A8
WAAB	1 + 21672 = 21673	HEX{21673} = 54A9
:	:	:
:	:	:
WZZY	17574 + 21672 = 39246	HEX{39246} = 994E
WZZZ	17575 + 21672 = 39247	HEX{39247} = 994F

CALL LETTERS MAPPING TO _ 0 _ _	FOUR DIGIT PI CODE (hex)
1000	A100
1001	A101
:	:
:	:
90FF	A9FF

CALL LETTERS MAPPING TO _ _ 0 0	FOUR DIGIT PI CODE (hex)
1000, A100	AFA1
1100	AF11
1200	AF12
:	:
:	:
1F00	AF1F
2000, A200	AFA2
2100	AF21
2200	AF22
:	:
:	:
AF00	AFAF

Table D.7 (continued)
TABLE OF PI CODE POSSIBILITIES

NATIONALLY/REGIONALLY-LINKED RADIO STATIONS CODE[a,b]	FOUR DIGIT PI CODE (hex)
NPR-1	B_01
CBC English – Radio One	B_02
CBC English – Radio Two	B_03
CBC French => Radio-Canada - Première Chaîne	B_04
CBC French => Radio-Canada - Espace Musique	B_05
CBC (reserved)	B_06
CBC (reserved)	B_07
CBC (reserved)	B_08
CBC (reserved)	B_09
NPR-2	B_0A
NPR-3	B_0B
NPR-4	B_0C
NPR-5	B_0D
NPR-6	B_0E
(not currently assigned)	B_0F
:	:
(not currently assigned)	B_FF
(not currently assigned)	D_01
(not currently assigned)	D_02
:	:
(not currently assigned)	D_FF
(not currently assigned)	E_01
(not currently assigned)	E_02
:	:
(not currently assigned)	E_FF

[a]In the United States, these codes will be allocated by the administrators of the NRSC. The second nibble of each four digit hex code shall be determined by the broadcaster using the rules for coverage area codes defined in Table D.3.

[b]The scheme outlined in this table will map all possible K___, W___, 3-LETTER-ONLY CALL LETTERS, CALL LETTERS MAPPING TO _0_ _, CALL LETTERS MAPPING TO __00, and NATIONALLY-LINKED RADIO STATIONS into a four digit hex PI code.

Table D.7 (continued)
TABLE OF PI CODE POSSIBILITIES

3-LETTER ONLY CALL SIGNS					
CALL	**FOUR DIGIT PI CODE (hex)**	**CALL**	**FOUR DIGIT PI CODE (hex)**	**CALL**	**FOUR DIGIT PI CODE (hex)**
KBW	99A5	KOY	9992	WHO	9978
KCY	99A6	KPQ	9993	WHP	999C
KDB	9990	KQV	9964	WIL	999D
KDF	99A7	KSD	9994	WIP	997A
KEX	9950	KSL	9965	WIS	99B3
KFH	9951	KUJ	9966	WJR	997B
KFI	9952	KUT	9995	WJW	99B4
KGA	9953	KVI	9967	WJZ	99B5
KGB	9991	KWG	9968	WKY	997C
KGO	9954	KXL	9996	WLS	997D
KGU	9955	KXO	9997	WLW	997E
KGW	9956	KYW	996B	WMC	999E
KGY	9957	WBT	9999	WMT	999F
KHQ	99AA	WBZ	996D	WOC	9981
KID	9958	WDZ	996E	WOI	99A0
KIT	9959	WEW	996F	WOL	9983
KJR	995A	WGH	999A	WOR	9984
KLO	995B	WGL	9971	WOW	99A1
KLZ	995C	WGN	9972	WRC	99B9
KMA	995D	WGR	9973	WRR	99A2
KMJ	995E	WGY	999B	WSB	99A3
KNX	995F	WHA	9975	WSM	99A4
KOA	9960	WHB	9976	WWJ	9988
KOB	99AB	WHK	9977	WWL	9989

D.7.2 Examples of assigning PI codes from Call letters

Example 1: call sign KGTB

G = 6 X 676 = 4056
T = 19 X 26 = 494
B=1 = 1
= 4551 (= <VAL>)

Since call sign begins with K: 4551 + 4096 = 8647 (STATION DECIMAL VALUE)
HEX [8647] = **21C7 = KGTB's PI code**

Example 2: call sign WKTI

K = 10 X 676 = 6760
T = 19 X 26 = 494
I = 8 = 8
= 7262 (= <VAL>)

Since call sign begins with W: 7262 + 21672 = 28934 (STATION DECIMAL VALUE)
HEX [28934] = **7106 = WKTI's PI code**

Example 3: Checking hex code

To check hex code:

4TH DIGIT X 4096
\+ 3RD DIGIT X 256
\+ 2ND DIGIT X 16
\+ 1ST DIGIT X 1
(should equal) STATION DECIMAL VALUE

For call sign KGTB:
PI code = 21C7, from STATION DECIMAL VALUE of 8647

2 X 4096
\+ 1 X 256
\+ 12 X 16
\+ 7 X 1
= 8647 = STATION DECIMAL VALUE

For call sign WKTI:
PI code = 7106, from STATION DECIMAL VALUE of 28934

7 X 4096
\+ 1 X 256
\+ 0 X 16
\+ 6 X 1
= 28934 = STATION DECIMAL VALUE

D.7.3 Application: Receiver functionality to PI code assignments

PI code usage for North America differs from that defined in IEC 62106. The RDS Standard accepts the usage of coverage area codes for all possible PI codes (see D.5 COVERAGE AREA CODES). Within North America coverage area codes are recognized only in the following PI code blocks:

- B_01 to B_FF
- D_01 to D_FF
- E_01 to E_FF

All other PI codes do not make use of coverage area codes and must be handed as such within the receiver.

Some European receivers store PI codes into presets in addition to storing frequencies into presets. This function is to recognize the broadcast first by program rather than frequency. Thus, if a preset is pushed and the PI code has changed, the European RDS receivers would not recognize the new PI code and go into a PI search.

EBU DOC TECH 3260 January 1990 Chapter 4 pg. 49 states:

> If however the PI code changes completely, the receiver should initiate a PI search for a frequency whose PI code exactly matches the PI code of the original tuned frequency. Failing an exact PI code match, the receiver should search for a PI code differing only in the regional element (bits 5-8) from the original PI code. If neither of these criterion are met, the receiver should remain on the original tuned frequency.

Therefore, in North America, since call letters are used to create the PI code, the receiver would have to do a PI search every time a station would change call letters or a preset is pushed in a new listening area having a station at the same frequency as the preset station. For PI codes < 0xB000, future receivers could check the AF list associated to a preset and if no AF's are acceptable, a PI search could be initiated. If no identical PI is found, the receiver should return to the original tuned frequency and accept the new PI code.

If a PI search is performed, the regional variant search (the second search to match PI codes differing only in bits 5-8) should be eliminated in a PI search if the tuned PI is below 0xB000, or within the ranges of 0xC000 to 0xCFFF, and 0xF000 to 0xFFFF.

If a feature similar to European regional variants is desired, a grouping in the B, D, and E blocks could be designated as follows:

> If NPR broadcasts break off national programming to go local for a period of time, it could be assigned a PI of B_01. NOTE: Cannot use 0 as the second nibble because current receivers will not search for AF's: therefore use 4-F for indication of a variant. If no AF's or identical PI's are found via the AF list or an identical PI search, the receiver could, while tuned to NPR station 1 (PI=B101), accept a variant NPR station 2 whose PI varies only in the second nibble (bits 5-8). Thus B201, B301, B401, . . . could be accepted.

PI codes starting with the B, D, and E nibbles yield 765 possibilities for "regional" programming. These PI codes will be shared by the United States, Canada, and Mexico. The problem here becomes that a "telephone book" needs to be kept; however, there should not be too many broadcasts that fit in this category and not many would be used.

D.7.4 Optional - modifying PI code for use with traffic information systems

Broadcasters who are transmitting traffic information using the TMC ODA may want to substitute 0x01 for the first nibble (bits b_{15} to b_{12} shown in Figure D.1) of the PI code. Doing so will make the TMC transmission compatible with a greater variety of traffic information receivers because many such receivers interpret a first nibble of 0x01 as an indication that the receiver is in North America, consistent with the Location Table definition contained in the TMC specification. Note, however, that this may also cause some receivers which use the PI code to determine the station call sign (by “back calculation”) to behave incorrectly.[2]

[2] See NRSC-G300, *RDS Usage Guideline* (expected publication date – Fall 2011), for additional information on the impact of the first nibble substitution discussed in this Section.

One method that a receiver can use to try and establish whether a 0x01 first nibble substitution has been made is to check for the presence of the TMC ODA in the RDS transmission as follows:

First nibble of PI code	TMC ODA data present	Receiver interpretation
0x01	No	PI code has been calculated using method described in NRSC-4, without a first nibble substitution. Note that approximately 16% of the radio stations in the Western half of the U.S. have a calculated first nibble of 0x01, and none of the stations in the Eastern half of the U.S. do.[3]
0x01	Yes	A first nibble substitution of 0x01 may have been done on the PI code, or, a station that has a calculated first nibble of 0x01 is transmitting TMC ODA information.
(any other value)	Yes or No	PI code has been calculated using method described in NRSC-4, without a first nibble substitution.

[3] Statistics from *RDS-TMC (ISO-14819-1) and PI Code Issue: Summary of the problem and the path to a solution*, presented to the NRSC RBDS Subcommittee on September 23, 2009.

NOTE: Section F.2 and its subsections, given here, only appear in NRSC-4-B, and are appended to the sections in Annex F included in IEC 62106.

F.2 Program Type (PTY) codes - (North America)

Table F.2 Program type codes, corresponding terms for display, and definitions (North America)

No.	PTY code	Program type	8-character display[a]	16-character display[a]	Definition
0	00000	No program type or undefined	None	None	
1	00001	News	News	News	News reports, either local or network in origin
2	00010	Information	Inform	Information	Programming that is intended to impart advice
3	00011	Sports	Sports	Sports	Sports reporting, commentary, and/or live event coverage, either local or network in origin
4	00100	Talk	Talk	Talk	Call-in and/or interview talk shows either local or national in origin
5	00101	Rock	Rock	Rock	Album cuts
6	00110	Classic Rock	Cls_Rock	Classic_Rock	Rock oriented oldies, often mixed with hit oldies, from a decade or more ago
7	00111	Adult Hits	Adlt_Hit	Adult_Hits	An up-tempo contemporary hits format with no hard rock and no rap
8	01000	Soft Rock	Soft_Rck	Soft_Rock	Album cuts with a generally soft tempo
9	01001	Top 40	Top_40	Top_ 40	Current hits, often encompassing a variety of rock styles
10	01010	Country	Country	Country	Country music, including contemporary and traditional styles
11	01011	Oldies	Oldies	Oldies	Popular music, usually rock, with 80% or greater non-current music
12	01100	Soft	Soft	Soft	A cross between adult hits and classical, primarily non-current soft-rock originals
13	01101	Nostalgia	Nostalga	Nostalgia	Big-band music
14	01110	Jazz	Jazz	Jazz	Mostly instrumental, includes both traditional jazz and more modern "smooth jazz"

No.	PTY code	Program type	8-character display[a]	16-character display[a]	Definition
15	01111	Classical	Classicl	Classical	Mostly instrumentals, usually orchestral or symphonic music
16	10000	Rhythm and Blues	R_&_B	Rhythm_and_Blues	A wide range of musical styles, often called "urban contemporary"
17	10001	Soft Rhythm and Blues	Soft_R&B	Soft_ R_&_B	Rhythm and blues with a generally soft tempo
18	10010	Foreign Language	Language	Foreign_Language	Any programming format in a language other than English
19	10011	Religious Music	Rel_Musc	Religious_Music	Music programming with religious lyrics
20	10100	Religious Talk	Rel_Talk	Religious_Talk	Call-in shows, interview programs, etc. with a religious theme
21	10101	Personality	Persnlty	Personality	A radio show where the on-air personality is the main attraction
22	10110	Public	Public	Public	Programming that is supported by listeners and/or corporate sponsors instead of advertising
23	10111	College	College	College	Programming produced by a college or university radio station
24	11000	Spanish Talk	Habl_Esp	Hablar_Espanol	Call-in shows, interview programs, etc. in the Spanish language
25	11001	Spanish Music	Musc_Esp	Musica _Espanol	Music programming in the Spanish language
26	11010	Hip-Hop	Hip hop	Hip hop	Popular music incorporating elements of rap, rhythm-and-blues, funk, and soul
27	11011	Unassigned			
28	11100	Unassigned			
29	11101	Weather	Weather	Weather	Weather forecasts or bulletins that are non-emergency in nature
30	11110	Emergency Test	Test	Emergency_Test	Broadcast when testing emergency broadcast equipment or receivers. Not intended for searching or dynamic switching for consumer receivers.. Receivers may, if desired, display “TEST” or “Emergency Test”

No.	PTY code	Program type	8-character display[a]	16-character display[a]	Definition
31	11111	Emergency	ALERT !	ALERT!_ALERT!	Emergency announcement made under exceptional circumstances to give warning of events causing danger of a general nature. Not to be used for searching - only used in a receiver for dynamic switching

[a]These terms are recommended for 8-character and 16-character radio displays, respectively.
Note: These definitions can differ slightly between various language versions.

NOTE: Annex L as given here only appear in NRSC-4-B, and is appended to the sections in Annex L included in IEC 62106.

ANNEX L Open data registration form

(informative)

Registration form (USA)

Every data application using the Open Data Applications (ODA) feature (see 6.1.4) must be transmitted together with an Application Identification (AID) number (see 6.1.5.4). The AID number, for each ODA ***in the United States***, is allocated by the RDS Registrations Office at the address shown in the following Registration Form. Forms must be completed fully (every question must be answered - the RDS Registrations Office will advise, if difficulty is experienced) and sent to the RDS Registrations Office, together with the nominal fee of US $495 (payable by credit card or check made payable to "National Association of Broadcasters"). Subject to satisfactory completion, an AID number will be allocated and a copy of the Form will be returned to the applicant. The allocations are coordinated with the RDS ODA registration office in Europe to avoid that the same allocation is made twice.

Transmissions carrying an AID *must* adhere fully to the details, specifications and references of the relevant registration. (Any subsequent updates, that do not *change* the fundamental requirements for the transmission of that ODA, may allow continued use of the same AID, but advice should be sought from the RDS Registrations Office.)

Details will be kept in the NRSC ODA Directory, which will be published, from time to time, and an up-to-date version of the Directory will be maintained on the NRSC Web site at www.nrsctandards.org/rbds,

Users of an AID must satisfy themselves as to the validity of using it and the accuracy of all related information and must accept all due consequence. The RDS Registrations Office is not liable for any incidental, special or consequential damages arising out of the use or inability to use an AID, whether in transmission or reception equipment.

Note: AID codes are Internationally allocated and recognized.

RDS Open Data Applications - Registration Form

This Form will be published in full, except last two answers, if specifically not permitted.

To:	RDS Registrations Office NAB Science and Technology Department 1771 N Street, N.W. Washington, DC 20036-2800 ***(completed form may be scanned and emailed to nrsc@nab.org)***	Application Date:

Question	Information	Comment
Applicants Name:		Title/Name of contact
Organization:		Company Name
Organization Address:		Street 1
		Street 2
		Town/City
		Area/County
		Postal Code
		Country
Application Name:		5 or 6 words, maximum
Application Description:	*Please use additional pages if desired*.	Give as much detail as possible.
Open Data mode: (see 6.1.5.4)		Choose one mode, only
ODA details, specifications and references:	**Tick, if publication not permitted** [ ] *Please attach additional pages.*	Give *all* details, proprietary documents and references.
Capacity requirement for both the ODA and AID groups:	**Tick, if publication not permitted** [ ] a) ..... ODA groups/second b) ..... type 3A groups/minute *Please use additional pages if desired.*	Indicate: ODA groups/second *and* type 3A groups/minute. Describe any constraints.

Data application designers need to consider a number of questions regarding their application and the RDS system interface, so that the RDS bearer is kept in conformity with best implementation practice. The following questions should be carefully considered (the RDS Registrations Office will advise, if difficulty is experienced) and the following Check List must be completed and attached to all applications.

RDS Open Data Applications - Check List

This Check List will not be published.

Question	***Considered***	***Notes***
Does the application behave correctly when not all RDS groups are received?	Tick, if considered [ ]	Necessary for mobile RDS applications
Does the application provide the means to identify the Service Provider?	Tick, if considered [ ]	
Does the application allow for future proofing, by upgrading?	Tick, if considered [ ]	
Does the application require sub-sets of associated applications?	Tick, if considered [ ]	Use of variant codes and/or other groups (e.g. clock-time)
Does the application include provision to reference other transmissions carrying the same service?	Tick, if considered [ ]	PI and AF
Does the application include an additional layer of error protection?	Tick, if considered [ ]	RDS already has considerable capability
Does the application include encryption?	Tick, if considered [ ]	
Does the application include data compression?	Tick, if considered [ ]	
Have you defined the capacity requirements for the application?	Tick, if considered [ ]	
Have you defined the capacity requirements for the AID under normal conditions?	Tick, if considered [ ]	
Is your application able to assume and lose the use of a group type?	Tick, if considered [ ]	
If so, have you defined the AID signaling when use of a channel is assumed?	Tick, if considered [ ]	
If so, have you defined the AID signaling when use of the channel ceases?	Tick, if considered [ ]	

Applicant represents and warrants that it is the owner of all rights in and to the application described herein, and that the application does not infringe any rights, whether common law, statutory, legal or equitable, of any third party.

Neither NAB, CEA, nor the NRSC shall be liable for disclosure of Confidential Information if made in response to an order of a court or authorized agency of government; provided that when possible notice shall first be given to the applicant/registrant so that a protective order, if desired, may be sought by that party.

Applicant hereby agrees to defend, indemnify and hold NAB, CEA, the NRSC and the officers, directors, employees, agents and assigns of any of them (hereinafter "the indemnified parties") harmless against any and all claims, liabilities, judgments, penalties, and taxes, civil and criminal, and all costs and expenses, including reasonable attorneys' fees, which may arise out of or are related to Applicant's representations, warranties, application and/or registration thereof or the actions or failure to act of the indemnified parties with regard to same.

The application/registration system in the United States shall be governed in accordance with the substantive law of the District of Columbia.

APPLICANT SIGNATURE	DATE
APPLICANT PRINTED NAME	

M.2.1.1.1 Group type 4A, clock-time and date (CT), is transmitted at the start of every minute.

NOTE The transmitted CT (see6.1.5.6 and6.2.3) must be accurate; otherwise the CT codes shall not be transmitted.

NRSC-4-B

NRSC Document Improvement Proposal

If in the review or use of this document a potential change appears needed for safety, health or technical reasons, please fill in the appropriate information below and email, mail or fax to:

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c/o Consumer Electronics Association
Technology & Standards Department
1919 S. Eads St.
Arlington, VA 22202
FAX: 703-907-4190
Email: standards@ce.org

DOCUMENT NO.	DOCUMENT TITLE:
SUBMITTER'S NAME: COMPANY:	TEL: FAX: EMAIL:
ADDRESS:	
URGENCY OF CHANGE: _____ Immediate _____ At next revision	
PROBLEM AREA (ATTACH ADDITIONAL SHEETS IF NECESSARY): a. Clause Number and/or Drawing: b. Recommended Changes: c. Reason/Rationale for Recommendation:	
ADDITIONAL REMARKS:	
SIGNATURE:	DATE:

FOR NRSC USE ONLY

Date forwarded to NAB S&T: _____
Responsible Committee: _____
Co-chairmen: _____
Date forwarded to co-chairmen: _____

NRSC-4-B

NRSC Document Improvement Proposal

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c/o Consumer Electronics Association
Technology & Standards Department
1919 S. Eads St.
Arlington, VA 22202
FAX: 703-907-4190
Email: standards@ce.org

DOCUMENT NO.	DOCUMENT TITLE:
SUBMITTER'S NAME: COMPANY:	TEL: FAX: EMAIL:
ADDRESS:	
URGENCY OF CHANGE: _____ Immediate _____ At next revision	
PROBLEM AREA (ATTACH ADDITIONAL SHEETS IF NECESSARY): a. Clause Number and/or Drawing: b. Recommended Changes: c. Reason/Rationale for Recommendation:	
ADDITIONAL REMARKS:	
SIGNATURE:	DATE:

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CEA
Consumer Electronics Association


NAB
NATIONAL ASSOCIATION OF BROADCASTERS