NRSC REPORT

NATIONAL RADIO SYSTEMS COMMITTEE

NRSC-R300
Program Associated Data (PAD) Field Length Study
November 2011

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FOREWORD

An increasing number of radio receivers are displaying Program Associated Data (PAD), also called Program Service Data (PSD). This NRSC Report is intended to help broadcasters and receiver designers plan best use of precious resources, namely limited over-the-air data bandwidth, receiver display space, and consumer focus. Sometimes these limited resources prevent the full length of a text string from being displayed.

In this context, the following questions are frequently asked: “How long is the Artist name? The Title? The Album?” Knowing this information can help inform the design of radios and the prudent use of bandwidth. To that end, this Report describes the numerical analysis of an extensive database of program content text strings which helps to answer these questions. Over 149,000 program items were considered. The resulting Artist, Title and Album string lengths are summarized below in histograms and Cumulative Distribution Functions (CDFs).

The information contained in this NRSC Report is the work of the RDS Usage Working Group (RUWG), a subgroup of the Radio Broadcast Data System (RBDS) Subcommittee of the NRSC. At the time of first adoption of this Guideline, the RUWG was chaired by Steve Davis, Clear Channel Radio, and the RBDS Subcommittee was chaired by Barry Thomas, Lincoln Financial Media. The NRSC chairman at the time of adoption of NRSC-G300 was Milford Smith, Greater Media, Inc.

The NRSC is jointly sponsored by the Consumer Electronics Association and the National Association of Broadcasters. It serves as an industry-wide standards-setting body for technical aspects of terrestrial over-the-air radio broadcasting systems in the United States.

ACKNOWLEDGEMENT

The NRSC gratefully acknowledges the contribution of Clear Channel, who provided the extensive program database for this study.

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PROGRAM ASSOCIATED DATA (PAD) FIELD LENGTH STUDY

1 SCOPE

This NRSC Report presents the results of a numerical analysis on Program Associated Data (PAD), specifically on the number of characters needed to display song title, artist and album title fields.

2 INFORMATIVE REFERENCES

The following references contain information that may be useful to those reading this NRSC Report. At the time of publication the editions indicated were valid.

[1] NRSC-4-A United States RBDS Standard – Specification of the Radio Broadcast Data System, National Radio Systems Committee, April 2005
[2] IEC 62106, Specification of the Radio Data System (RDS) for VHF/FM sound broadcasting in the frequency range from 87.5 MHz to 108.0 MHz, International Electrotechnical Commission (IEC), Edition 2.0, 2009-07
[3] NRSC-G200 Harmonization of RDS and IBOC Program Service Data (PSD) Guideline, National Radio Systems Committee, September, 2007
[4] Coding of RadioText Plus information (RT+), RBDS TS – Annex P, RBDS Forum TS 2008, R08_008_3

2.1 Symbols and abbreviations

In this Report the following abbreviations are used:

CDF	Cumulative distribution function
CSV	Comma-separated values
DCC	Displayable character count
PAD	Program associated data
RDS	Radio Data System (IEC Standard)
RBDS	Radio Broadcast Data System (NRSC Standard)
RT	RadioText feature of the RBDS standard
RT+	RadioText-plus open data application of the RBDS standard
RUWG	RDS Usage Working Group of the NRSC's RBDS Subcommittee

2.2 Definitions

In this Report the following definitions are used:

Cover, Coverage The degree to which a particular character count fully presents (covers) the set of strings in the Demonstration Database.

Displayable Character Count The total string length that is visible on a display. This includes the physical display character count, plus the count of characters displayed by time multiplex techniques such as scrolling or paging through.

Scrolling A technique used to display a longer text string than there are characters in the physical display. In scrolling, the display characters appear to move to the left, by repeatedly blanking the left-most position, moving the remaining characters to the left by one position, and adding an additional character from the string to the right-most position. This process continues until the string has been presented, up to the device's DCC.

Paging	A technique used to display a longer text string than there are characters in the physical display. In paging, the display shows an initial portion of the string. After a brief timeout period or a button press, the display is blanked and replaced with the next part of the string. This process is repeated until the string has been presented, up to the device's DCC.
Demonstration Database	The database of Artist, Title, and Album strings provided to the NRSC by Clear Channel for analysis in this report.
Truncate	The process of cutting off a string at the n^{th} character without editorial consideration of the result.
Abbreviate	The process of reducing a string length to *n* characters using editorial control to maintain the meaning of the information as completely and readably as is practicable. Abbreviation often includes the elimination of unnecessary or less important words or information as well as the shortening of individual words by removing characters.

3 BACKGROUND

In 2011, the RDS Usage Working Group, which is a subgroup of the RBDS Subcommittee of the National Radio Systems Committee, was granted access to Clear Channel's extensive database of artist name ("Artist"), song title ("Title") and album name ("Album") fields. This database (the "Demonstration Database") was used for study and analysis into the lengths of these fields. The results may be interesting to broadcasters who store and transmit this information, and to receiver makers who plan on displaying it.

4 METHODOLOGY

This study used the following methodology. The steps are not complicated and are documented here to aid in interpreting the graphs.

4.1 Starting Point

The Demonstration Database was provided to the NRSC by Clear Channel Radio. It consists of a file containing PAD information on 149,065 songs, in comma-separated values (CSV) format. This file included Artist and Title information for each song, plus Album information for about 25% of the songs, comprising about 660,000 words of text.

4.2 File Size Reduction and Import to Excel

The original file was split into five blocks to reduce the individual file size below 64K records each. Then each file was imported into Excel and saved in XLS format.

4.3 Conversion Check

A visual scan was conducted on each file block, looking for obvious issues resulting from the file conversion process. Two categories of issues were found: artifacts of the original database (misspelled names, extraneous punctuation marks, etc.); and artifacts of the conversions from CSV to Excel XLS.

In the case of the former (database artifacts), no changes were made, as these are representative of the real-world Demonstration Database. Very few of these were found, and the statistical results would not be substantively improved by retouching such occasional flaws.

In the case of the latter (file conversion artifacts), it was sometimes necessary to compare to the original CSV file to correct the XLS file. Fortunately there were also relatively few of these issues, considering the size of the database.[1]

It should be noted that while the outright errors were few, there were some unexpected findings in the text. For example, many Album fields in the database contain a concatenation of the actual album name, plus a year. For example, the string "Against The Wind, 1980" is found in an Album field; Bob Seger and The Silver Bullet Band's album is named "Against the Wind" and Clear Channel chose to append the name with a comma and the date of the album ", 1980". Because the year information is part of the design of the Demonstration Database, the Album field was not modified prior to calculating string lengths in the first pass, although further analysis is presented in later sections. All in all, about 60% of the Album fields included a year in this format (", 1980").

4.4 Remove Duplicates

Next, duplicates of the Artist, Title and Album fields were removed. For example, the first 33 songs had the Artist name, ".38 Special". For the histogram calculation, this should be considered as one 11-char name. The goal is to evaluate a population of unique Artist, Title, and Album strings. Ultimately, this analysis produces "existence" histograms (unweighted), not "playtime" histograms (weighted by frequency of broadcast).

An alternative way of looking at the distribution of Artist, Title, and Album string lengths is from the listener's perspective. In this alternative approach, each string in the Demonstration Database would be treated as unique. This would mean that the 33 instances of ".38 Special" contribute 33 times to the histogram. This would give more weight to bands which release more songs. However, this doesn't consider the relative popularity of these songs.

A fully weighted version of this analysis would also include a weighting for the amount of total airplay each song has gotten. This information, if available, would unnecessarily complicate the analysis. Therefore, this approach was not used.

4.5 Calculate String Lengths

For each of the five file blocks, the lengths of each unique Artist, Title and Album string was calculated using the Excel len() formula.

4.6 Calculate File Block Histograms

Each of the three lists of string lengths in each file block was used to create a unique histogram, using bins representing each possible string length [0,1,…100] and the Excel Data Analysis Toolpak "Histogram" tool.

[1] For the visual scan only a relatively short time was allotted per page of records, only a second or two. A meticulous check of each field, cross-checking with online sources where necessary, would require a great deal of additional time and was considered outside the scope of this study.

4.7 Combine Histogram Data

In a summary file, the histograms for the three fields in each of the five file blocks were combined back into three full-database histograms, one representing the Artist information for the original 149,065 records; one representing the Title information; and one representing the Album information.

4.8 Generate CDFs

Also in the summary file, the histogram data was used to build cumulative distribution function (CDF) curves.

5 RESULTS

5.1 Artist String Length Frequency Histogram and CDF

Figure 1 ("Artist Frequency") shows the frequency of occurrence—on the Y-axis—of Artist strings of length [bin], where [bin] is a variable which runs from 0 to 100 and is shown along the X-axis. For example, there is a peak at [bin]=13 characters, of 2343 songs with that length Artist string.

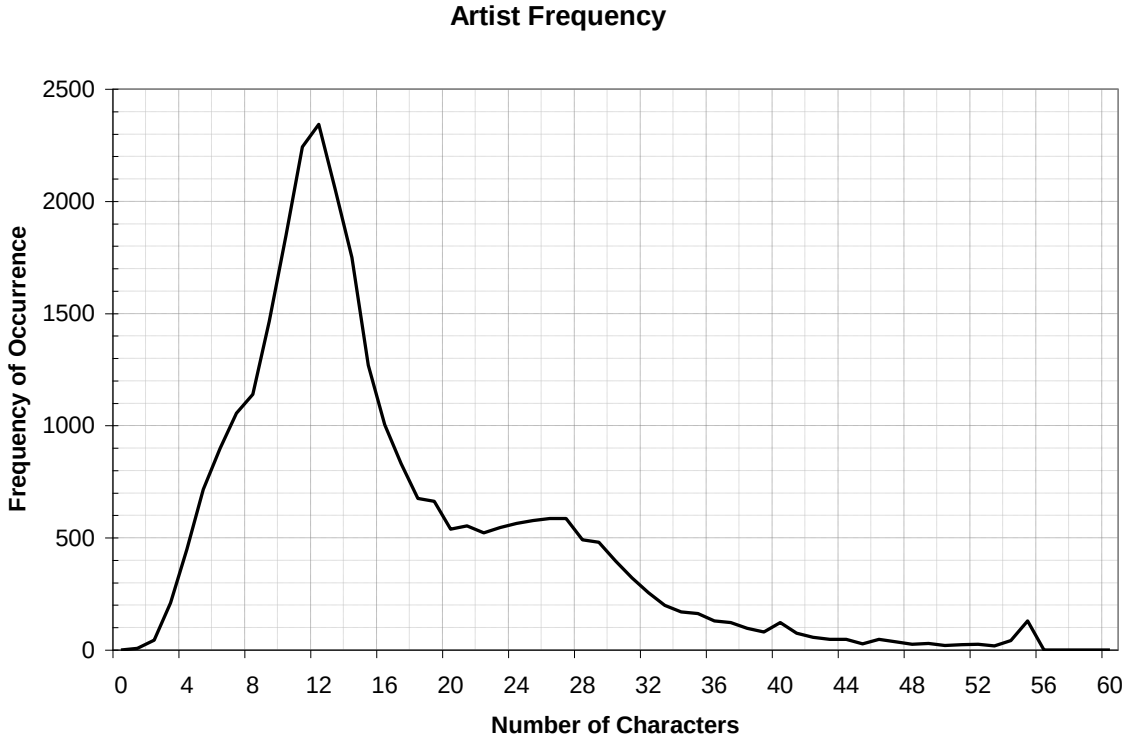

Figure 1. Artist Field – frequency of occurrence of number of characters in Artist strings

The same data are shown in Figure 2 below, in cumulative distribution function (CDF) format. In this format, the number of songs with Artist string length at or below the X-axis value can be read off the Y-axis. For example, approximately 96% of songs have Artist string length that fit into 36 characters. The same data are shown in Figure 3, but in a closer view of the knee of the CDF between about 24 and 60 characters.

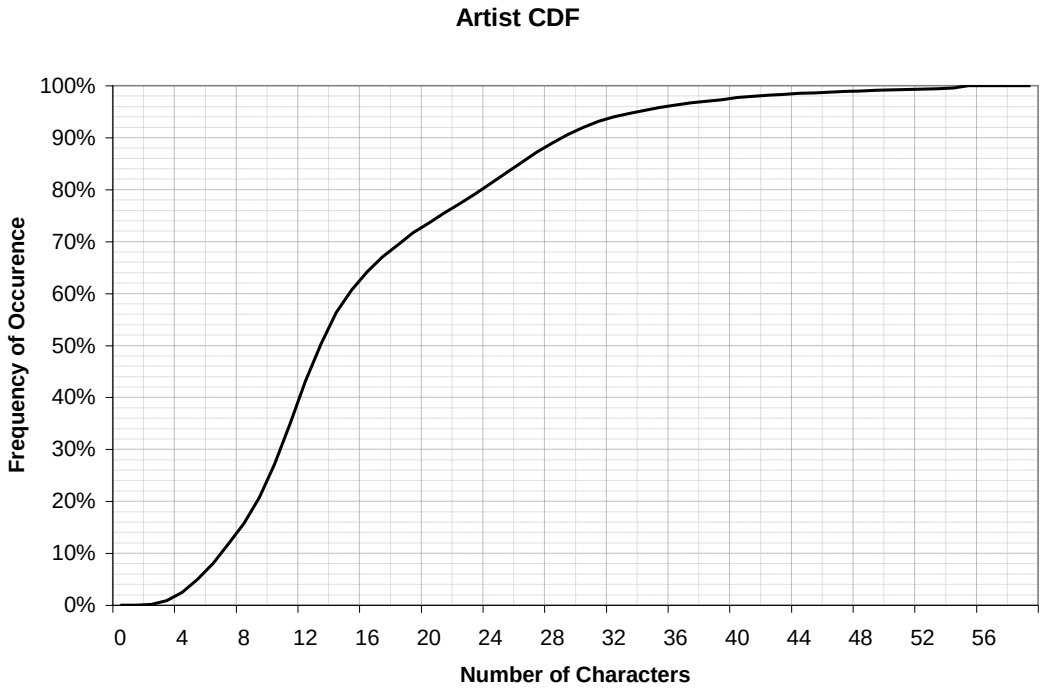

Figure 2. Artist Field – CDF of frequency of occurrence of number of characters in Artist Strings

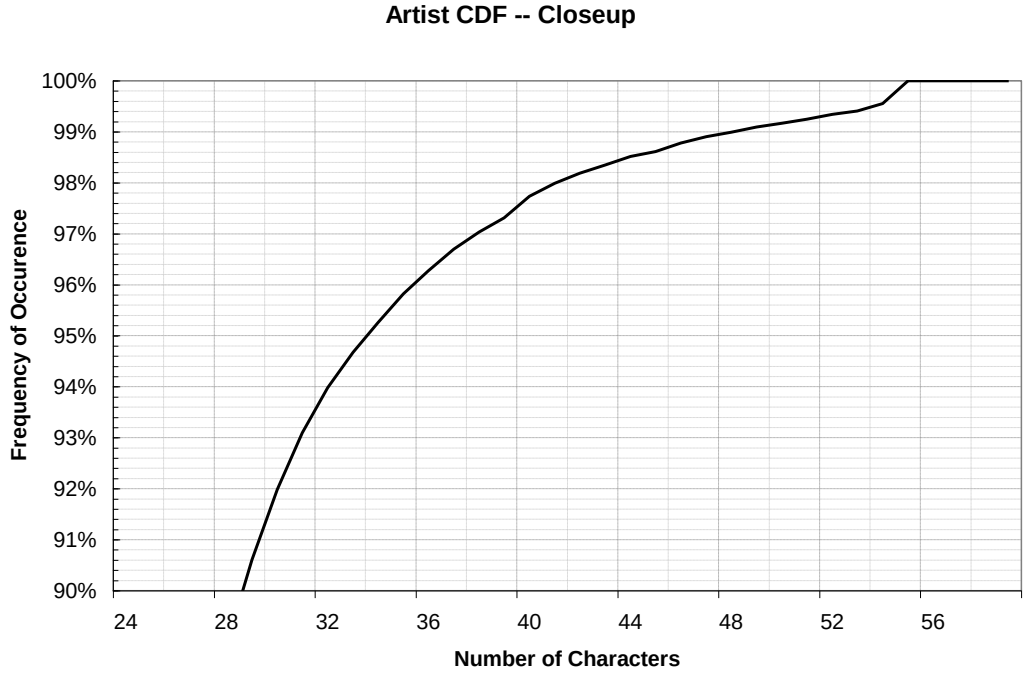

Figure 3. Close-up view of CDF from Figure 2

5.2 Title String Length Frequency Histogram and CDF

Title string length frequency information is shown in Figure 4 through Figure 6. Here it can be seen that 96% of song titles fit into 32 characters.

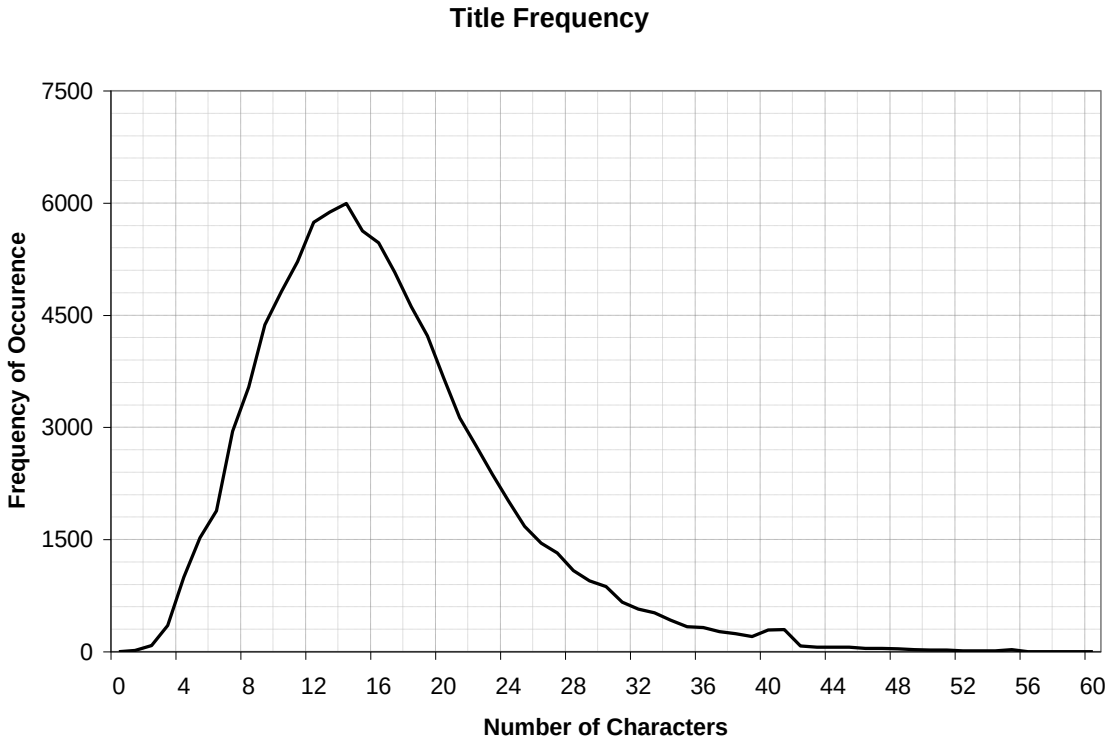

Figure 4. Song Title field – frequency of occurrence of number of characters

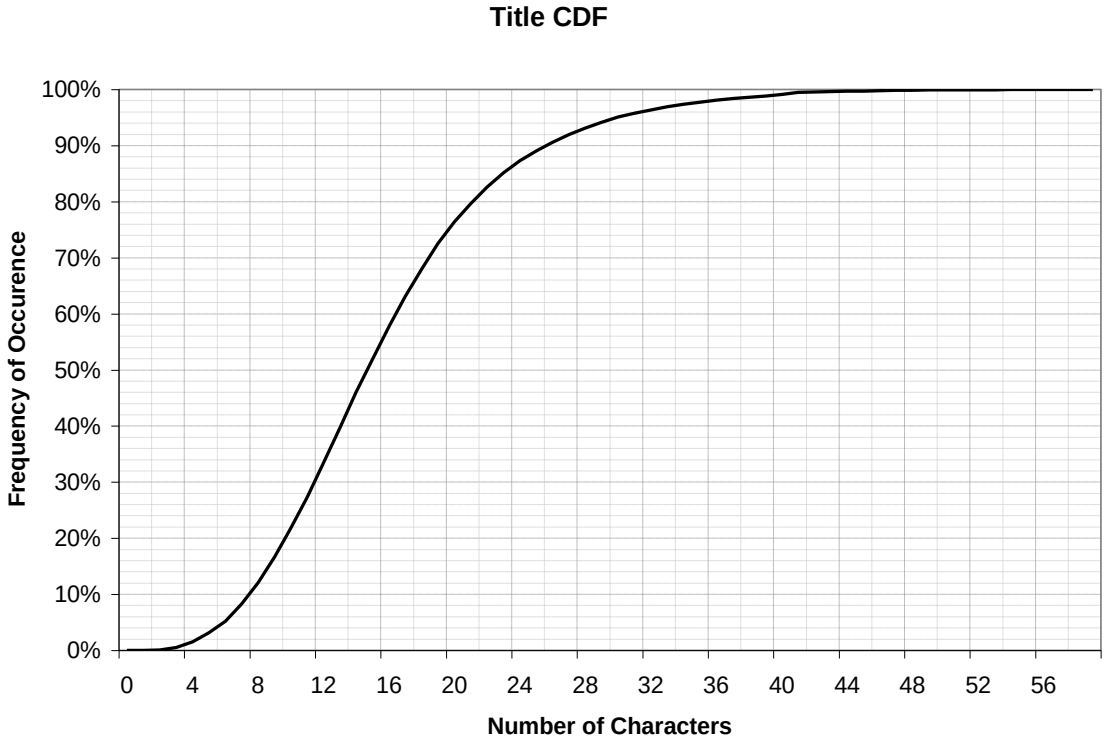

Figure 5. Song Title field – CDF of frequency of occurrence of number of characters in Title strings

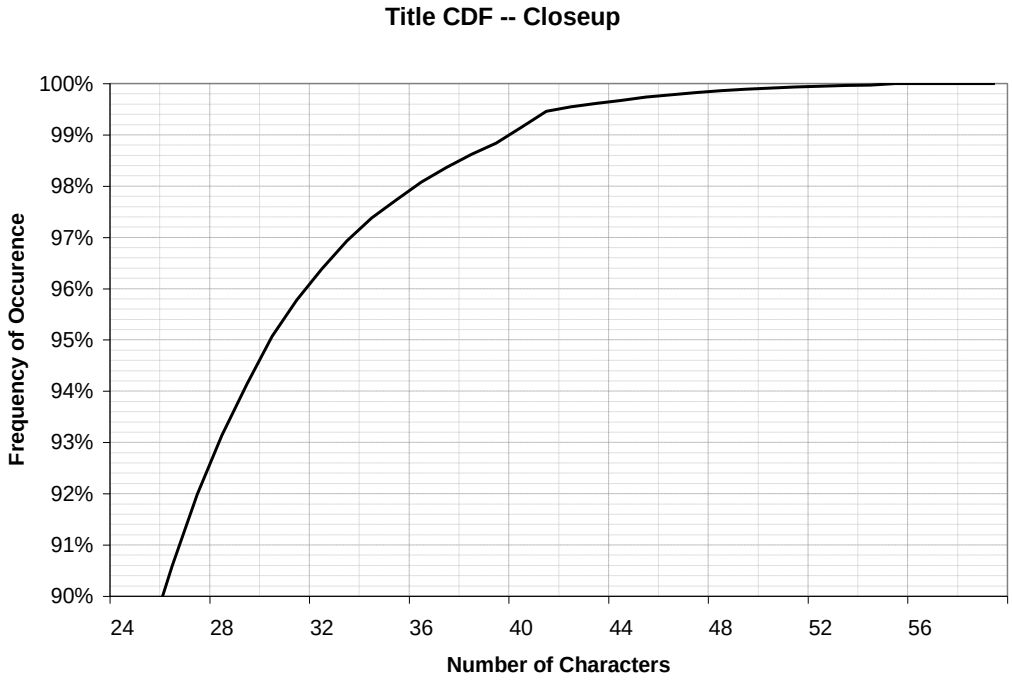

Figure 6. Close-up view of CDF from
Figure 5

5.3 Album String Length Frequency Histogram and CDF

Album string length information is shown in Figure 7 through Figure 9. However, the Album information does not have the same roll-off as Artist and Title.

Note that this database design includes a unique feature. Many of the Album strings in the Demonstration Database have a year appended to the actual album name. For example, the Hall & Oates album, "16 Biggest Hits", is coded in the Demonstration Database as "16 Biggest Hits, 2000".

This increases the length of the Album string in those cases. Therefore, the following charts show the original data ("*Original Data*" on the charts) and the data with the year extracted ("*Data with Year Information Removed*" on the charts), for comparison.

To get to 96% coverage for the Album names in the original database requires 52 characters. After the year information was removed, the 96% coverage point was reached with 48 characters.

One might note that the addition of six characters, e.g. ", 2001", to the Album field should increase the Album field length by six characters. Inspecting the curves in Figure 7 through Figure 10 shows that this is not demonstrated by the curves. Instead, the two curves in each plot differ by 3 to 5 characters, depending on where you look at the curve. This is primarily due to the fact that only about 60% of the Album names in the database have year information added; there is also an effect from truncation as the curves merge together at the 55 character point.

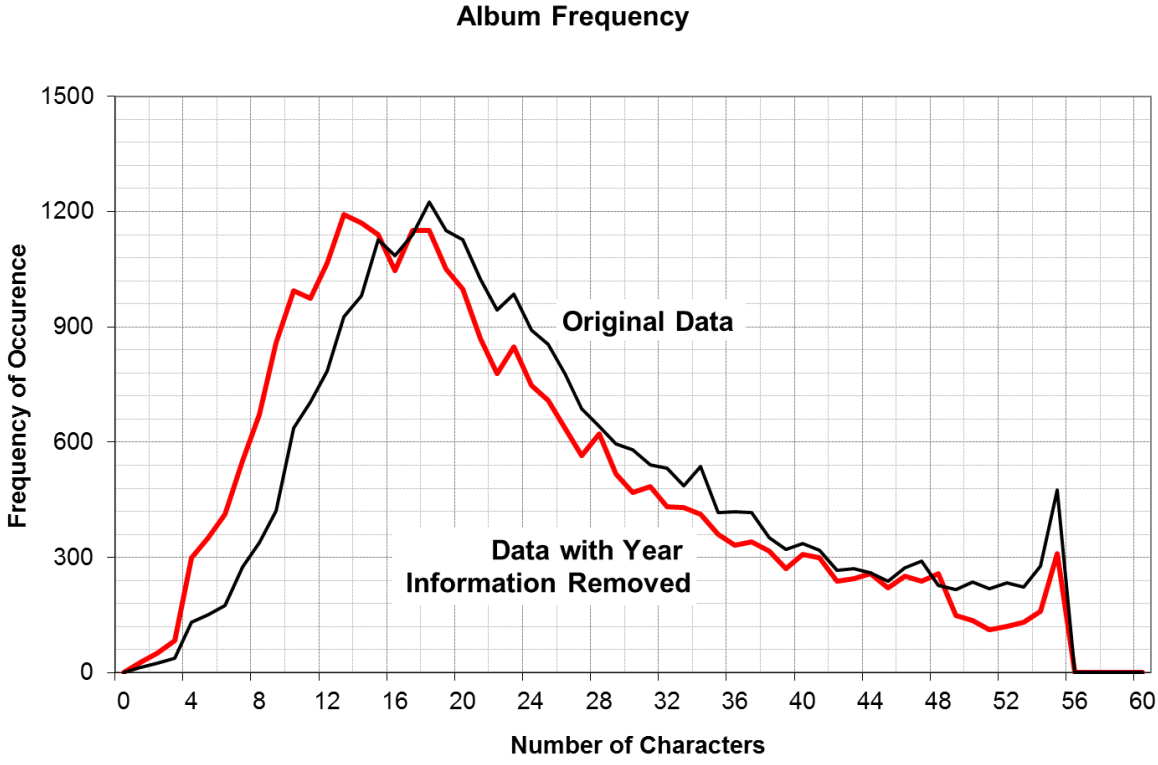

Figure 7. Album field – frequency of occurrence of number of characters in Album strings

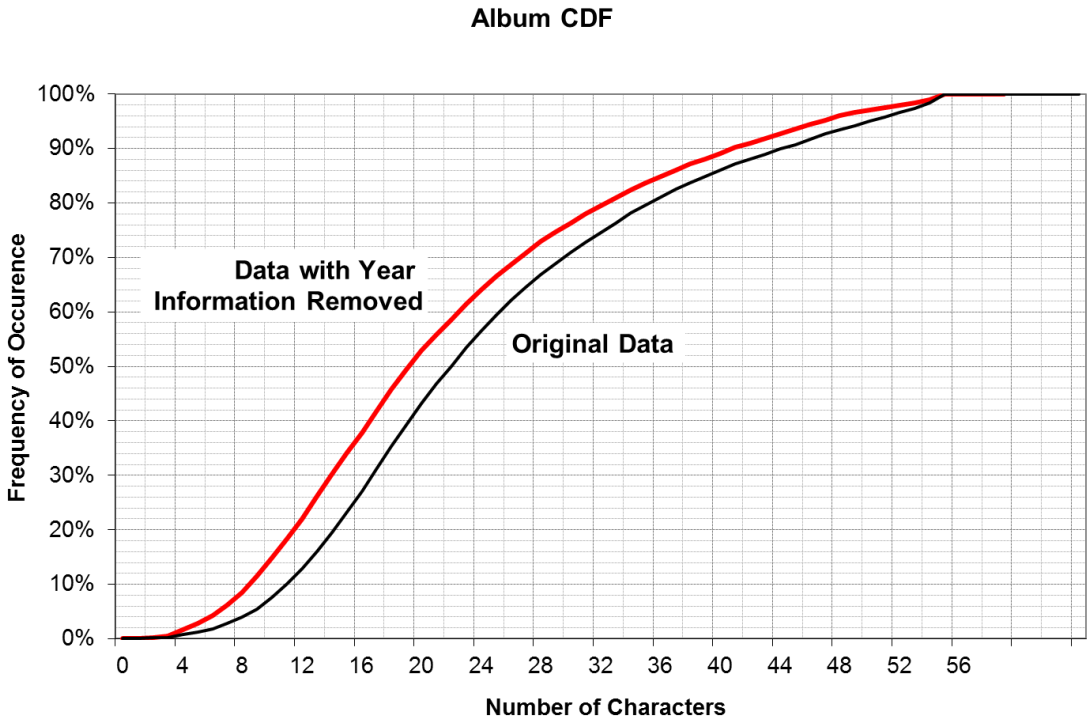

Figure 8. Album field – CDF of frequency of occurrence of number of characters in Album strings

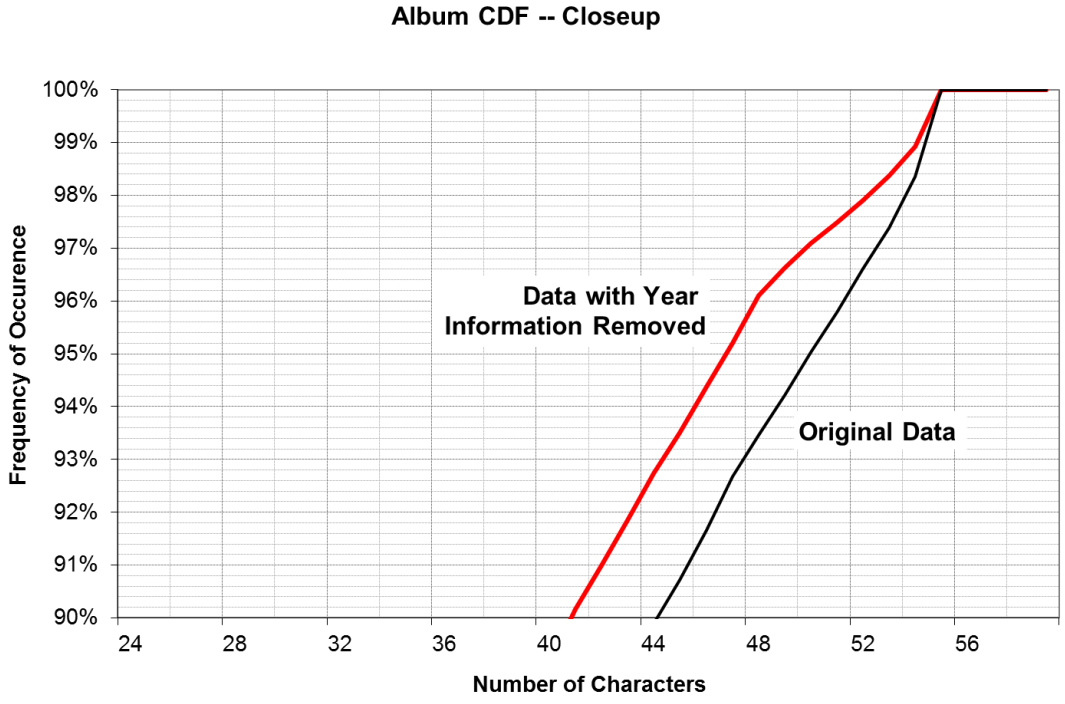

Figure 9. Close-up view of CDF from Figure 8

5.4 Combined CDF

For comparison, all three groups are shown in the detailed chart below. It is clear that the Title fields contain the shortest strings, closely followed by Artist. The Album field statistically shows longer strings. This is in part due to the database coding. As mentioned previously, about 60% of the Album fields have six additional characters added for the year, e.g., ", 1980". The red line (solid triangle markers) shows that, even with the year information removed from the strings, the Album length information is quite a bit longer than Artist or Title. There is further discussion on this in Section 6 below.

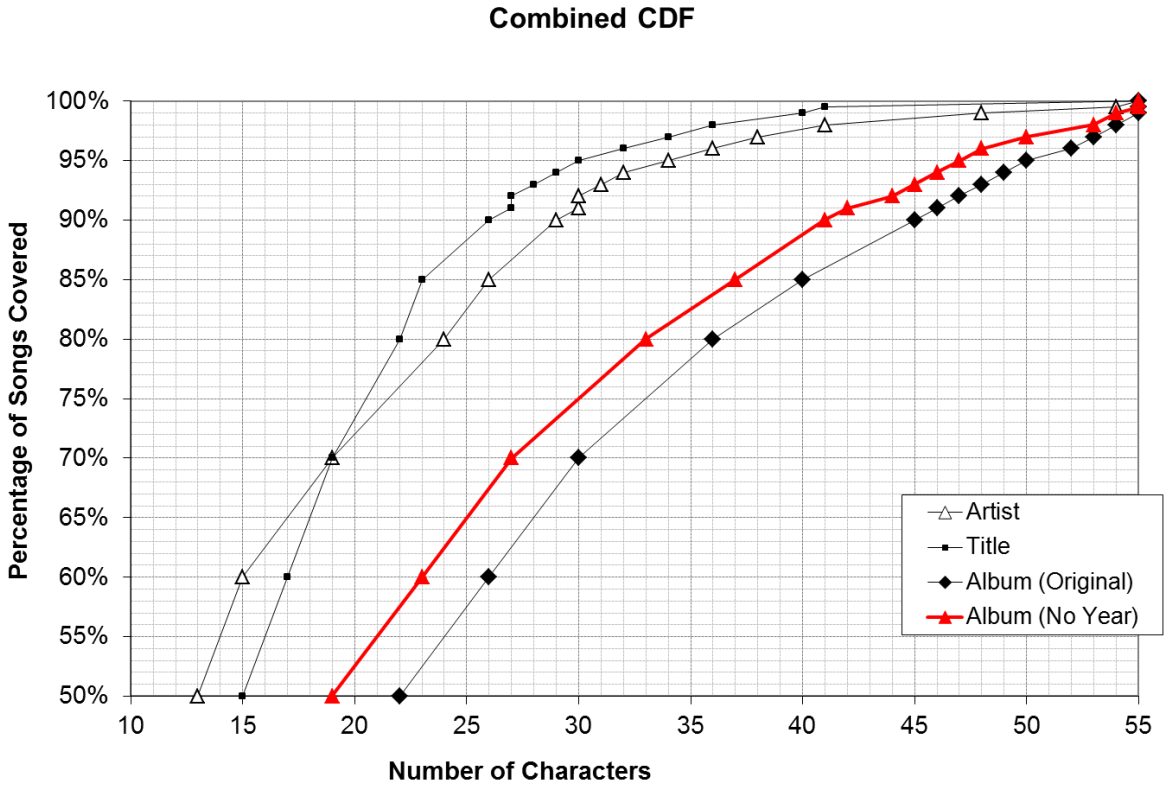

Figure 10. Combined CDF for string lengths in Artist, Title, and Album fields

6 DISCUSSION OF RESULTS

6.1 Demonstration Database Considerations

As mentioned in Section 1, the source database for this study was a real-world database from a major broadcast group ("Demonstration Database"). As such, there are some elements of the Demonstration Database design to consider when interpreting these results.

The database was created from the information in the stations' various NexGen Digital systems but was designed as a multi-purpose central song repository with the ability to provide RBDS and HD Radio program associated text information.[2]

[2] NexGen Digital is a studio automation product by RCS Works, a subsidiary of Clear Channel Communications.

The Demonstration Database represents many program formats, including Rock, Classical, Jazz, Latino, Talk and others.

The following sections discuss some specific features of the design of the Demonstration Database that may impact interpretation of the results.

6.1.1 Demonstration Database Field Length Limits

The Clear Channel Demonstration Database was developed from Clear Channel's NexGen music storage and playout system, which has a 55 character limit for each field (Artist, Title and Album). This limit is evident in the Artist and Album statistics shown in Figure 1 and Figure 7, respectively. These two histograms show a bump up at 55 characters, followed by a drop to zero above the 55 character count. These bumps indicate that there are Artist names and Album names greater than 55 characters in length that had to be truncated or abbreviated to 55 characters, creating the bulge at the 55 character count in the histogram.

The cumulative distribution function curves in Figure 2 and Figure 3 suggest the Artist database field could have been larger (perhaps up to the 64 characters limit of RBDS) to capture 99.9% of all Artist names without abbreviation. This can be estimated by visualizing the CDF curve if it were to continue asymptotically to the right, without the deviation at bin 55.

The CDF curves show the Clear Channel 55 character limit has the greatest impact on the Album name, with a discontinuity beginning at about 53 characters on Figure 8. The close-up view of the CDF in Figure 9 shows the curve continues to rise steeply between 45 and 55 characters. In comparison, the other two CDF curves (Figures 3 and 6) are moving toward leveling off in the same range. This suggests a database field substantially larger than 55 characters would be required to capture 99.9% of Album names and show a smooth CDF curve. Visualizing the Album curves continuing asymptotically past the 55 character database limit, it appears that 99.9% of Album strings (without dates) could be covered by a field that is about 64 characters long. Since RBDS RT is limited to 64 characters, 64 is the upper limit for Album strings using RT.

These observations are not a criticism of the Demonstration Database generously provided for this analysis. Rather, this real world database shows that decisions were made to modify some Artist and Album names upon creation of the database. Other broadcast databases may or may not have similar character limits. In the event that another broadcast database were to have captured all Artist, Title, and Album text strings in large fields, we can deduce from the information developed from this database analysis that:

- the 55 character limit employed by the Demonstration Database is consistent with the sizes of the Song Titles in the database;
- an estimated 64 character limit in a database would be effective in covering nearly all strings from the source material, resulting in minimal abbreviation or truncation of some strings (particularly for the longest Album names).

Although 64 characters are needed to approach 100% coverage without abbreviation or truncation, the Demonstration Database 55 character limit has a negligible impact on Artist and Title strings, and a discernible and relatively low impact on Album strings. Other databases may of course have different limits. The receiver designer can anticipate that some broadcasters may utilize the full 64–character space in the RBDS RT message for the contents of a single field (Artist, Title, or Album) from time to time. The receiver designer can use this report to make informed judgments about the trade-offs involved in selecting a DCC for a receiver design. The CDFs demonstrate these characteristics in numeric form.

6.1.2 Text Variation and the Database Field Structure

For a given song, the fields (Artist, Title or Album) created by one broadcaster may not match those created by another broadcaster. Some examples of this show up in the way the Demonstration Database was designed:

- The Demonstration Database combines multiple artists in the Artist field, like “Frank Sinatra, Dean Martin & Sammy Davis, Jr”.
- For the Demonstration Database, many Album fields have a year appended to the album name text in the Album field.

The policies used to create the Demonstration Database recognize that there is only one Artist field. So the Database does not contain three separate Artist fields. Instead, for example, it contains a string of three artist names concatenated together, as in the example above. The Demonstration Database design assumes that the receiver will be able to display all or most of this text to the listener.

Similarly, Clear Channel chose to put the album year in the Album field, reportedly to make it available to on-air talent. Consequently, it is also transmitted on RBDS and HD Radio PSD for the benefit of listeners. The additional six characters, “, 1980”, change the Album histogram by increasing the character counts for each Album name. From the CDFs, it is clear that the Album names tend to be longer than Artist and Title strings. As shown in Figure 7 through Figure 10, the larger string lengths of the Album names is evident even after accounting for these six appended characters.

6.1.3 Display Scrolling/Paging

Obviously, receiver display fields must be long enough to carry the most meaningful information most of the time, including as many as possible of the longer strings in the data set. At the same time, transmitted strings must be short enough to be meaningful when presented on the variety of receiver displays in the marketplace.

Receivers that implement some form of scrolling/paging will accommodate the display of text that is longer than the receiver display. Since not all receivers are implemented in this fashion, the database should ideally be designed so that the key information is at the very front of the text string.

6.1.4 Support For Other Media

It must be stressed that this study used a real world database of fields which are actually being transmitted over RBDS and HD Radio text transports. Radios are displaying the data which are represented in these histograms and CDFs continuously throughout the US markets.

However, the broadcaster transmits these same data over other presentation media where there is a richer text display capability—for example, over the Internet. So although the Demonstration Database was initially designed anticipating RBDS presentation (among other uses), it is used for other purposes and delivery mechanisms as well. It is currently being used for RBDS, HD Radio PSD, streaming meta-data and iTunes tagging as well as various reporting features such as BMI and ASCAP reporting.

If a broadcaster were to create a database with two sets of fields, one for radio receivers and one for media with a richer display, one set of fields could be abbreviated to maximize the quality of the listener experience over a wide variety of receiver types, and the other set could be used to provide unabbreviated content to other delivery systems. Other database design options exist for the same purpose and will be apparent to the database programmer.

6.2 Broadcaster and Receiver Manufacturer Considerations

For consumers, clearly the more complete the character display, the better. Hardware scrolling and paging can help when display real estate is limited, but the user experience is better when the consumer can see the whole field in a single glance.

The following discussion assumes that the broadcaster is sending only one field of text at a time (Artist, Title, or Album) over the RBDS RadioText application.

Consider the Artist CDF shown in Figure 2. A display of 16 characters can show 63% of the Artist fields without scrolling/paging or truncation; a display of 24 characters can show 80% of them. To reach 90% of Artist fields requires 29 characters. Table 1 summarizes the minimum DCC required to support certain percentiles of string lengths without scrolling/paging or truncation.

Table 1 – Minimum Displayable Character Counts Required to Support Certain Percentiles of String Lengths Without Scrolling/Paging or Truncation

	Field (character count)			
Percentile of String Lengths	**Artist**	**Title**	**Album (Original)**	**Album (No Year)**
50%	13	15	22	19
60%	15	17	26	23
70%	19	19	30	27
80%	24	22	36	33
85%	26	23	40	37
90%	29	26	45	41
91%	30	27	46	42
92%	30	27	47	44
93%	31	28	48	45
94%	32	29	49	46
95%	34	30	50	47
96%	36	32	52	48
97%	38	34	53	50
98%	41	36	54	53
99%	48	40	55	54
99.5%	54	41	55	55
100%	55	55	55	55

For in-car applications, larger displays mean that the driver can observe more information with one glance, and spend more time with their eyes on the road. There is a limit to how much information can be captured in the one glance. Nevertheless, with a static display, the driver can determine when to glance back for to read the rest of the information. Scrolling/paging, on the other hand, requires the driver to glance repeatedly until the next block of text is displayed or scrolled.

Extra text, such as the phrase “Now Playing ”, will lengthen the time it takes for a driver to observe the real information being conveyed on the display (i.e., Title, Artist, Album). It adds 12 characters to the required text length, and removes the key information (the Title) from the prime location (the beginning of the text string on the display).

As an example, consider a dot-matrix display of 20 characters width. This display can handle 73% of Artist fields in the sample database (see Figure 2). However, if “Now Playing” is prefixed to the transmitted text, the display can handle only 14% of Artist fields before scrolling.

Some radios page between “first half of text” and “second half of text” at the press of a button. The 20 character display in the 2010 Ford Fusion allocates 19 characters to RT, with such an option to flip between the first and second half of the text. However, due to the display length, there are only 19+19 = 38 characters available for RT, in total. That 38 characters, if used for transmission of only the Artist field, would be enough for 98% of Artist fields. However, if “Now Playing” is prefixed, that figure drops to 85%.

Another example is the song “A HARD DAY'S NIGHT”. On the display mentioned above, the Artist would show on the second page as, “THE B” as the DCC ran out of space at 40 characters. Leaving off the “Now Playing “ at the front would allow the Artist to read, “The Beatles”.

And again assuming “Now Playing “ is transmitted at the front of the RT field, the songs “I'LL FOLLOW THE SUN”, “ROLL OVER BEETHOVEN” and “WHEN I'M SIXTY-FOUR” would show the Artist as simply “The”.

Placing the information for which the field is intended at the beginning of each string (*e.g.*, Title information in the beginning of the Title field) appears to be the best way to get that information onto a display. Rather than combining, for example, Artist and Album into one database entry, unintended consequences might be avoided by maintaining separate database fields and doing the concatenation, if necessary, during the transmission process. The Album “*Smooth Grooves: Soulful Duets, 2002*” was coded with the artist name as “*Teddy Pendergrass Smooth Grooves: Soulful Duets, 2002*”. This may have the unintended consequence of presenting only the artist’s name and little or no album title information on a receiver with limited DCC. On the other hand, an eponymous album such as “*Temple of the Dog*”, by Temple of the Dog, presents an odd appearance if the broadcaster is populating the album title field by prefixing the album title with artist name (“Temple of the Dog Temple of the Dog ,1990”).

6.3 The Impact of RT+

RT+ applications provide a means for the broadcaster to tag information on the RT transport that RT+ receivers can deconstruct. For instance, a station might transmit the string “That Don’t Impress Me Much by Shania Twain” on RBDS RT. The station would have chosen to concatenate the Title, the word “by” and the Artist into a single string for RT transmission. The ordinary RT-enabled receiver will present this information up to the limit of its DCC. Using RT+, however, the broadcaster can tag the RT information to identify the text that is the Title and the text that is the Artist. RT+ enabled receivers can parse the tagged data and put the Artist string in an Artist field and the Title string in a Title field. There are 64 content classes to which RT content can be assigned (using RT+). The most commonly-used RT+ fields, including ITEM.TITLE, ITEM.ARTIST, and ITEM.ALBUM can be mapped to HD Radio PSD fields; see [3] for NRSC recommendations on such mapping.

Since RT is limited to 64 characters, the use of RT+ requires splitting the 64 character string among various field types. As RT+ becomes more popular, the prevalence of RT+ enabled receivers may result in more abbreviation and/or truncation to combine multiple fields (e.g. Artist, title and Album) into a single 64 character RT field.

Alternatively, more receivers may be able to present more information to more users if RT+ is employed without concatenating strings in individual 64-character RT transmissions. RT+ can be utilized either by concatenating strings in a single 64 character transmission, and tagging each string with RT+, or by cyclically transmitting strings of each field in separate 64 character transmissions, with RT+ tags. With receivers supporting a variety of DCCs, the latter method will enable a larger subset of non-RT+ receivers to display at least part of each field.

For instance, “I’m Gonna Love You Through It by Martina Mc Bride” could be transmitted in a single RT field by concatenating Title, the word “by” and Artist. For RT+ capable radios, the individual field strings

can be tagged. However, to see the entire message a receiver's DCC must support at least 49 characters (or 46 characters if the word "by" is eliminated). By transmitting the Title string for a period of time, then the Artist string for a period of time, the receiver with a shorter DCC will be able to display both Artist and Title, while still enabling RT+ to tag each string.

7 SUMMARY

This section summarizes the key observations from the statistical analysis of the Demonstration Database and the discussion of results which follows:

● Artist field – frequency of occurrence peaks at 13 characters covering 41% of the Artist strings.

● Title field - frequency of occurrence peaks at 15 characters covering 50% of the Title strings.

● Album field – frequency of occurrence peaks at 19 characters (original data) or 14 characters (data with year information removed), covering 39% and 30% of the Album strings, respectively.

● To reach 96% of songs covered, these approximate field lengths are required: Title – 32, Artist – 36, Album (no year) – 48, Album (with year) – 52.
- For comparison, coverage at the 36 character limit used by the satellite radio services is 98th percentile for Title, 96th percentile for Artist, and 82nd percentile for Album (with year removed).

● Demonstration Database field length limit of 55 characters impacted results of statistical analysis such that there was no information available for occurrences of field lengths greater than this.

● It is possible that database fields will contain more information than the field name suggests. For example, a song with multiple artists may have more than one artist name in the Artist field, and the Album field may be modified to also include the year of the album.

● Receiver displays in the marketplace utilize various implementations of “scrolling” and “paging” which allow the receiver to display a field that has more characters than does the display.

● Title, Artist and Album databases may be used for a variety of delivery methods including RDS/RBDS, HD Radio digital radio, and Internet streaming.

● Larger in-car receiver displays make it possible for drivers to observe more information with one glance.

● Concise text that excludes extraneous words such as “Now Playing” is most effective for getting the actual Title, Artist and Album information onto the display.

● Use of RT+ may impact the way in which a database is constructed in order to optimize the use of the 64 character string (in a RT message) among various field types. For example, the prevalence of RT+ enabled receivers may result in more abbreviation and/or truncation to combine multiple fields (*e.g.,* Artist, title and Album) into a single 64 character RT field.

● For greatest compatibility with existing non-RT+ receiver displays, the use of RT+ for multi-field concatenation in a single RT message may not be as effective as using RT+ on a series of independent RT messages sent sequentially over a period of time.

NRSC Document Improvement Proposal

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