ARINC 429 Release Notes, Release 7.4

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Context

The ARINC 429 decoder supports several modes of decoding, called “8+24”, “8+2+19+2+1” and “User Defined”. The most advanced mode is called “User Defined” and allows users to drive the interpretation of the 24 bit data segment of 32 bit ARINC word as they wish, by creating a User Label Definition File” (ULDF). The ULDF files support 3 types of “Signals”: Binary, BCD and Enumerated. In early 2014, a customer in Italy reported the absence of a “Signed Binary” mode. After investigating the ARINC specifications, it was determined that none of the existing modes could properly/fully support “Signed Binaries”, hence an additional mode was needed.

The ARINC 429 documentation is under: http://www.lahniss.com/_parinc429/arinc429.shtml

The ARINC 429 manual: http://www.lahniss.com/_parinc429/arinc429userlabeldescriptionfile_v6.pdf

This note briefly summarizes the currently supported “Binary” mode, (which is in fact “Unsigned Binary”), and details the new mode, for “Signed Binaries”, with a few examples.

This note also documents the test procedure used to validate the conversion over a range of values, for and angle in degrees ranging from -180 to + 177 degrees.

Currently supported Symbolic modes

All releases of the ARINC 429 Decoder up to 7.3 support the "Binary" mode shown in the image below. In this mode the bits spanned by SigBits are interpreted as powers of 2's.

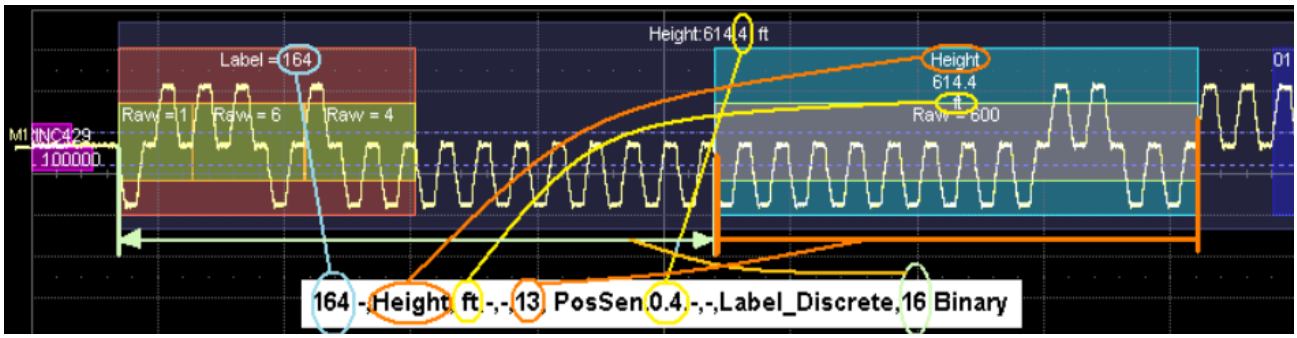

Figure 1: Binary Signal with bits 512 and 1024 high is interpreted as 0x600 (or 1536 decimal)

New "Signed Binaries" mode

Syntax explanation

The "Signed Binary" format, used for the Signed Binary signals, only slightly differs from the "Binary" labels recapitulated above and allows the positioning of the Signed Binary fields inside the Label.

The format is defined to exceed the ARINC 429 specification, which states that bit 29 is the sign bit. However, given the countless deviations from the standard since its inception in 1978, the implementation does not assume that the sign bit is necessarily located in bit 29. Its position results of the sum of **SigBits**[7] (in bits) and **Offset**[13] (in bits) specified by the user in the ULDF file and can therefore be located anywhere in the data segment of the ARINC word.

As specified in the main ARINC 429 manual:

> *The line structure of a single USigD in the Comma Separated File (CSV) contains 12 to 14 tokens, separated by commas as follows:*
>
> Label[1],EquipementID[2],Name[3],Units[4],Min[5],Max[6],**SigBits**[7],PosSense[8],Resolution[9],MinTransit[10],MaxTransit[11],LabelType1[12],**Offset**[13],DetailsList[14]

In order to clearly distinguish "Signed Binaries" from Unsigned Binaries (supported under "Binaries") the ULDF syntax is extended as follows

110,-, Signal Name,-,-,-, 21, PosSen, 0.000171661376953125,--,--,Label_Discrete,8,**SignedBinary**

The new **SignedBinary** keyword in the DetailsList instructs the algorithm to interpret the bits spanned by **SigBits**[7] and **Offset**[13] as a 2's Binary complement

Example 1

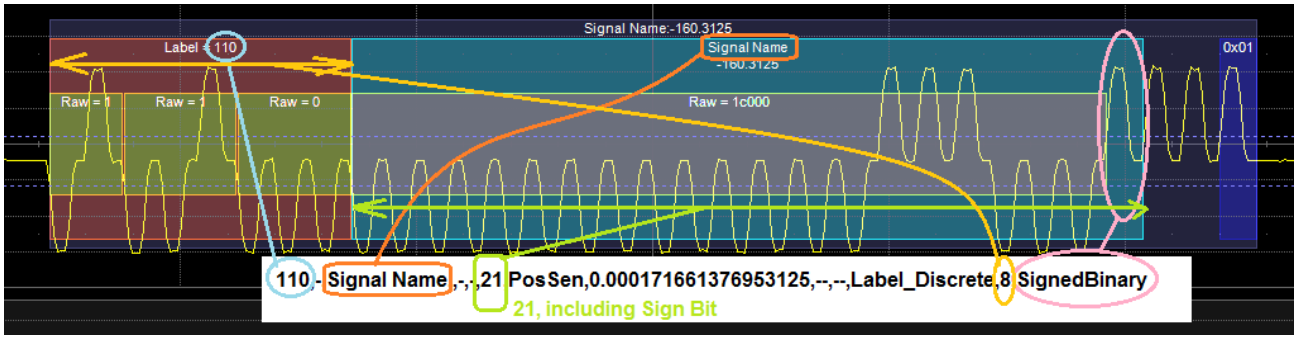

Figure 2: Example of a Signed Binary of 21 bits starting at bit 8, with Sign bit in position 29

Example 2

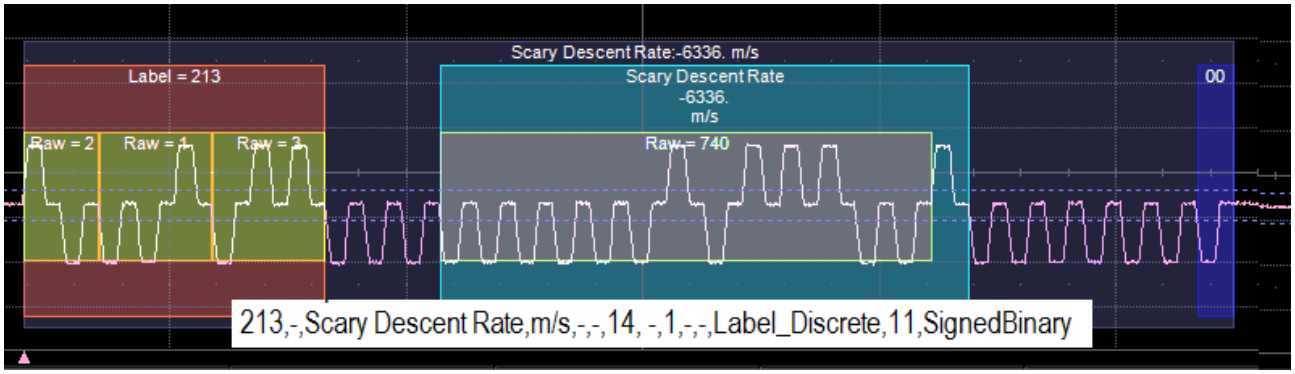

Figure 3: Example of a Signed Binary of 14 bits starting at bit 11

Example 3

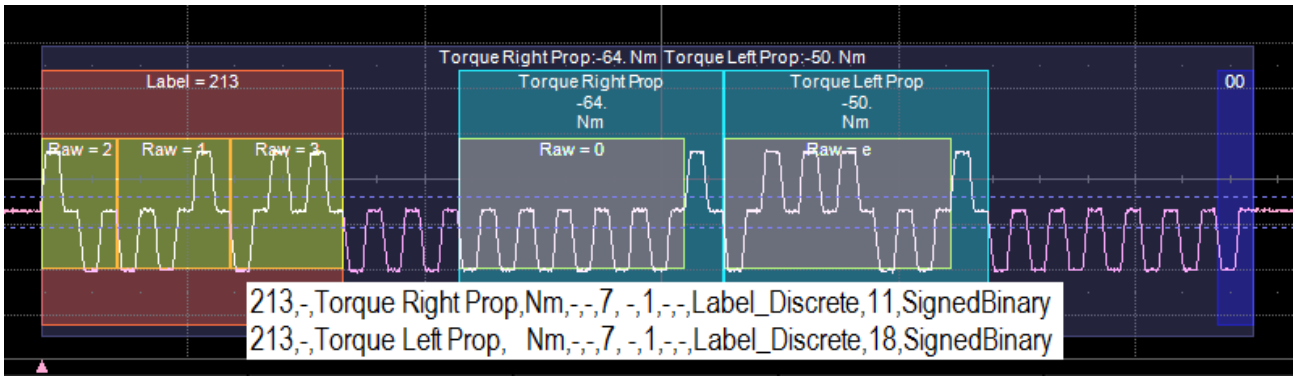

Figure 4: Example of 2 adjacent Signed Binaries, both in Label 213

Test case for Signed Binary

The user who reported the error also kindly provided a test case for the Signed Binary case. The test case is a TRC file of Label 110, with angles varying from -180 degrees to + 180 degrees in increments of 2.8125 degrees. The corresponding screen dump is shown below, along with the UsigD line

// USigD for Label 110,

110,-,GPS Latitude ,Deg,-,-,20,PosSen,0.000171661376953125,--,--,Label_Discrete,8, **SignedBinary**

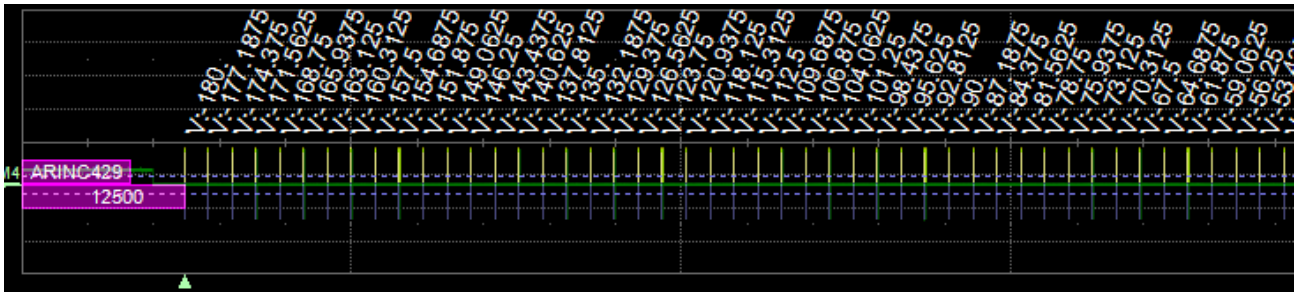

Figure 5: First segment of Test case, angles from -180 to -56 degrees

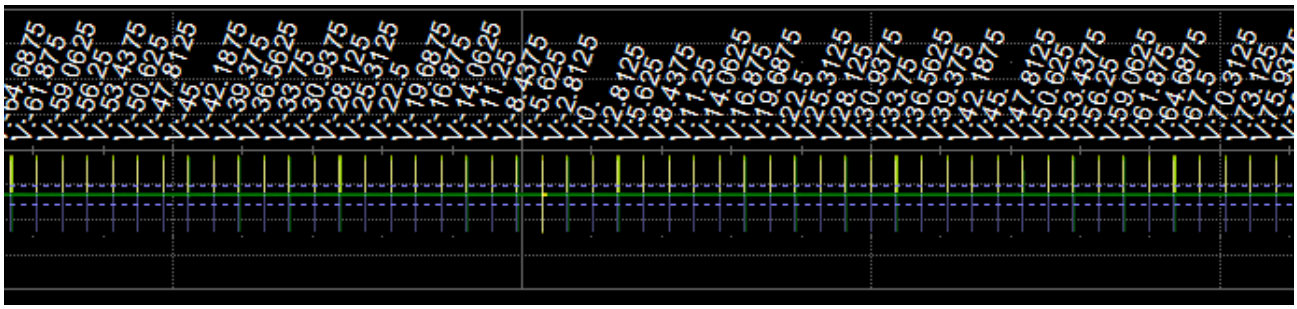

Figure 6: Second segment of Test case, angles from -61 to -73 degrees

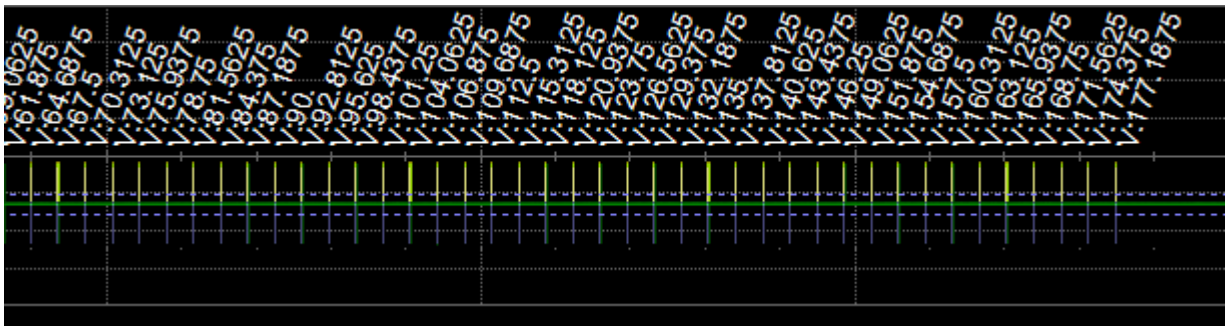

Figure 7: Third segment of Test case, angles from 64 to -177 degrees

Conclusion

The addition of « Signed Binary “ Signal Types should help in covering this very frequent type. Note that if other gaps are reported, they will be addressed in the same way. Note that the sign bit has been left out of the grey rectangle annotating the data carrying bits.