IRIG STANDARD 215-12

TELECOMMUNICATIONS AND TIMING GROUP

ASYNCHRONOUS ASCII EVENT COUNT STATUS CODES

WHITE SANDS MISSILE RANGE
REAGAN TEST SITE
YUMA PROVING GROUND
DUGWAY PROVING GROUND
ABERDEEN TEST CENTER

NAVAL AIR WARFARE CENTER WEAPONS DIVISION, PT. MUGU
NAVAL AIR WARFARE CENTER WEAPONS DIVISION, CHINA LAKE
AVAL AIR WARFARE CENTER AIRCRAFT DIVISION, PATUXENT RIVER
NAVAL UNDERSEA WARFARE CENTER DIVISION, NEWPORT
PACIFIC MISSILE RANGE FACILITY
NAVAL UNDERSEA WARFARE CENTER DIVISION, KEYPORT

30TH SPACE WING
45TH SPACE WING
AIR FORCE FLIGHT TEST CENTER
AIR ARMAMENT CENTER
ARNOLD ENGINEERING DEVELOPMENT CENTER

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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Form Approved
OMB No. 0704-0188

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INTER-RANGE INSTRUMENTATION GROUP (IRIG)
STANDARD 215-12

ASYNCHRONOUS ASCII EVENT COUNT STATUS CODES

MARCH 2012

Prepared by

TELECOMMUNICATIONS AND TIMING GROUP (TTG)

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PREFACE

This Standard presents the results of work performed by the Telecommunications and Timing Group (TTG) under Task TT-53 for the Range Commanders Council (RCC). The TTG efforts produced a standard format for an N-channel asynchronous multiplex signal, suitable for N-channels of low speed data, including range count signals. The TTG has expanded work previously done on this document to include network-based transmission of count status. Many ranges utilize one or more "counts" (i.e. countdowns) to coordinate support activities in support of test range operations. Multiplexing of the multiple counts into one composite signal will lessen data transfer infrastructure requirements. The standardization of the multiple count data exchange formats shown herein is a large enhancement for range inter-operability. The use of the formats in this Standard will provide much needed compatibility at the ranges.

For development of this Standard, the RCC acknowledges the excellent work by the many participating members on this effort. The RCC gives special recognition to:

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ASYNCHRONOUS ASCII EVENT COUNT (EC) STATUS CODES

1. General Description of This Standard

This standard describes five event count (EC) status formats to be used to transfer EC status over conventional asynchronous serial telecommunications circuits and Ethernet networks. The formats are American Standard Code for Information Interchange (ASCII) data formats. These formats provide EC status information suitable for most computer, dumb terminal, line printer, and remote visual displays. Precise EC status transfer is not an objective of this standard; therefore, there is no attempt to provide greater than 100 ms or 1second resolution for these formats. It should also be noted that even though the figures in the following sections appear to depict an exact bit alignment for the characters in each frame, the data is "asynchronous" and therefore may vary depending on inter-character delays. This standard provides systems engineers and equipment vendors with an Inter-range Instrumentation Group (IRIG) Standard for ASCII-formatted EC status transfer, which can be used in specifications for the procurement of equipment used on all United States test ranges and other military or civilian facilities.

2. General Description of Formats

An overview of the formats is given in the following paragraphs. See Figure 1 through Figure 6.

2.1 IRIG CS-511z

The IRIG CS-511z is a Time-of-Year format with 1-second resolution and frame length see Figure 1). The accuracy of this format at the receiver end is primarily dependent on the characteristics (fixed and variable transmission delays) of the communications circuits between the transmitting and receiving equipment. The ASCII expression for this format is:

<SOH>I<SP>±DDD<SP>HH:MM:SS<SP>#<CR><LF>

Where:

<SOH>	=	start of header (01_{16}).
I	=	identification character -- space (2016) is default, any alpha or numeric ASCII character.
<SP>	=	space (2016).
±	=	the EC sign.
DDD	=	the EC day.
HH	=	the EC hour of the day.
<:>	=	colon (3A16).
MM	=	the EC minute of the hour.
SS	=	the EC second of the minute.
#	=	the EC status -- space (2016) is default, H (4816) if holding.
<CR>	=	carriage return (0D16).
<LF>	=	line feed (0A16).

The IRIG CS-511z uses the first 20 characters of the 1-second frame. The remaining bits are idle (logic level = 1) for the remainder of the frame. The frame length is 1 second when using serial data, regardless of the baud rate.

The identification character is an ASCII “space” character by default, although any alpha numeric ASCII character may be used. The definition or function of the identification character is left to the user. Suggested uses might be identification of a net or network, an event, a test number, or a user number.

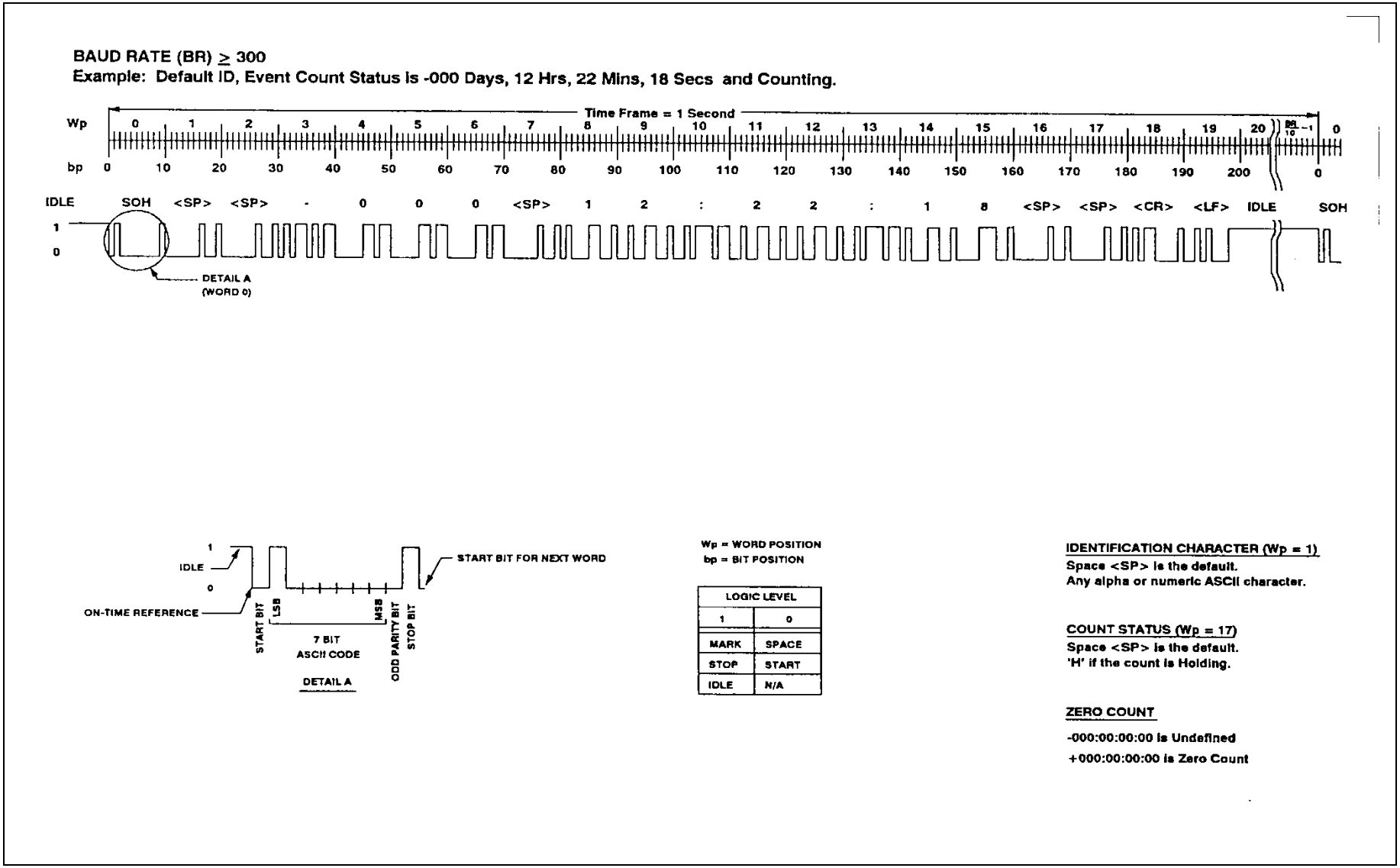


Figure 1. ASCII event count status format CS-511z.

2.2 IRIG CS-522z

The IRIG CS-522z is a Time-of-Year format with 100-millisecond resolution and frame length (see Figure 2). The accuracy of this format at the receiver end is primarily dependent on the characteristics (fixed and variable transmission delays) of the communications circuits between the transmitting and receiving equipment. The ASCII expression for this format is

<SOH>I<SP>±DDD<SP>HH:MM:SS.S<SP>#<CR><LF>

Where:

<SOH>	=	start of header (0116).
I	=	identification character -- space (20_{16}) is default, any alpha or numeric ASCII character.
<SP>	=	space (2016).
±	=	the EC sign.
DDD	=	the EC day.
HH	=	the EC hour of the day.
<:>	=	colon (3A16).
MM	=	the EC minute of the hour.
SS.S	=	the EC second and tenth of second of the minute {period "." = (2E16)}.
#	=	the EC status -- space (2016) is default, H (4816) if holding.
<CR>	=	carriage return (0D16).
<LF>	=	line feed ($0A_{16}$).

The IRIG CS-522z uses the first 22 characters of the 100 ms frame. The remaining bits are idle (logic level = 1) for the remainder of the frame. The frame length is 100 milliseconds when using serial data, regardless of the baud rate.

The identification character is an ASCII "space" character by default, although any alpha numeric ASCII character may be used. The definition or function of the identification character is left to the user. Suggested uses might be identification of a net or network, an event, a test number, or a user number.

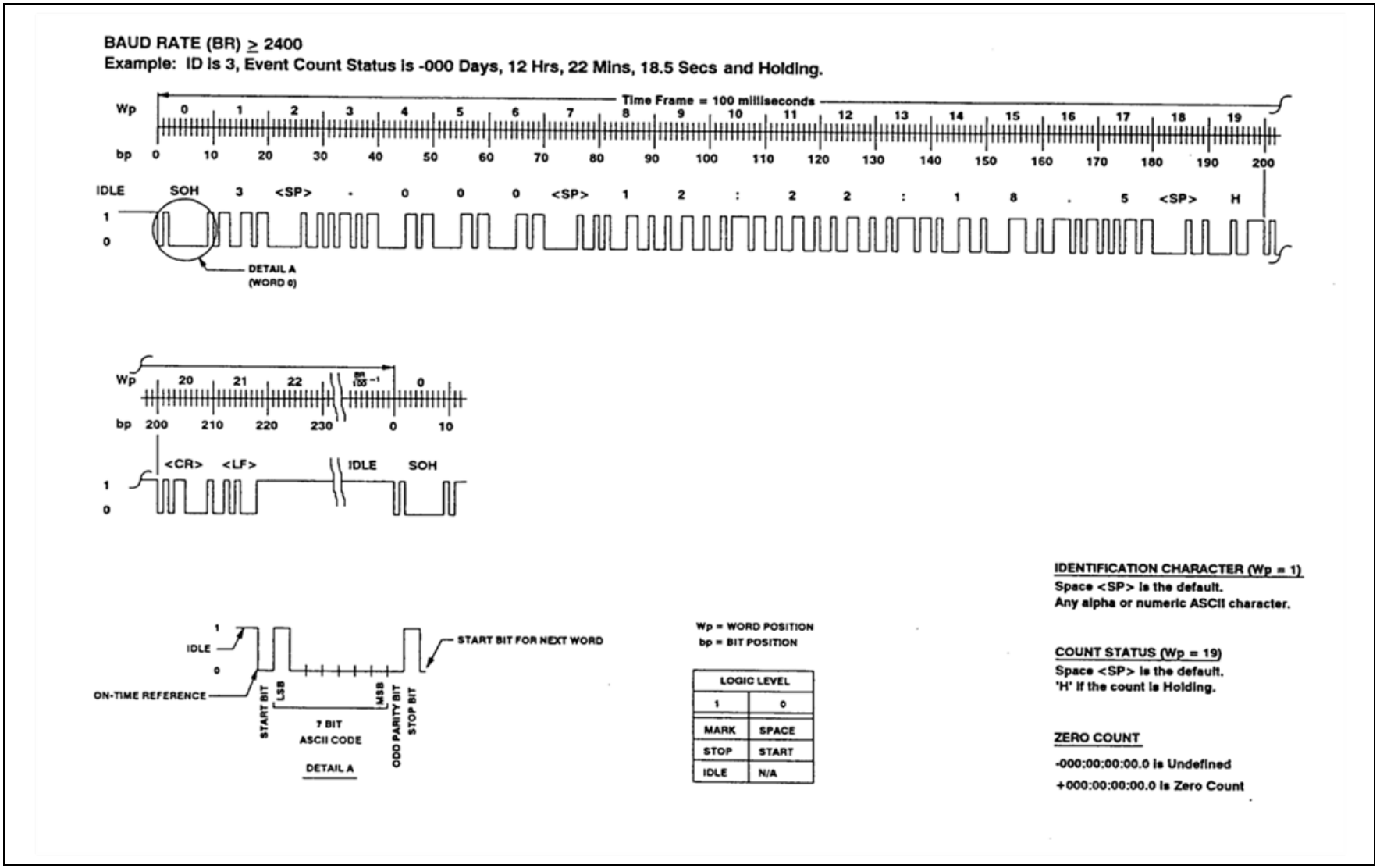


Figure 2. ASCII event count status format CS-522z.

2.3 IRIG CS-513z

The IRIG CS-513z is a Time-of-Year format with 1-second resolution and frame length (see Figure 3). In addition to the EC status, this format has information regarding the predicted time of launch or the actual time of launch if launch has occurred. The accuracy of this format at the receiver end is primarily dependent on the characteristics (fixed and variable transmission delays) of the communications circuits between the transmitting and receiving equipment. The ASCII expression for this format is:

<SOH>I<SP>±
DDD<SP>HH:MM:SS<SP>#<SP>ddd<SP>hh:mm:ss.sss<SP>&<CR><LF>

Where:

<SOH>	=	start of header (01_{16}).
I	=	identification character -- space (2016) is default, any alpha or numeric ASCII character.
<SP>	=	space (2016).
±	=	the EC sign.
DDD	=	the EC day.
HH	=	the EC hour of the day.
<:>	=	colon (3A16).
MM	=	the EC minute of the hour.
SS	=	the EC second of the minute.
#	=	the EC status -- space (2016) is default, H (4816) if holding.
ddd	=	predicted/actual launch day.
hh	=	predicted/actual launch hour of the day.
mm	=	predicted/actual launch minute of the hour.
ss.sss	=	predicted/actual launch second and milliseconds of the minute {period "." = (2E16)}.
&	=	launch time information -- P(5016) predicted, A(4116) actual.
<CR>	=	carriage return (0D16).
<LF>	=	line feed ($0A_{16}$).

The IRIG CS-513z uses the first 39 characters of the 1-second frame. The remaining bits are idle (logic level = 1) for the remainder of the frame. The frame length is 1 second when using serial data, regardless of the baud rate.

The identification character is an ASCII "space" character by default, although any alpha numeric ASCII character may be used. The definition or function of the identification character is left to the user. Suggested uses might be identification of a net or network, an event, a test number, or a user number.

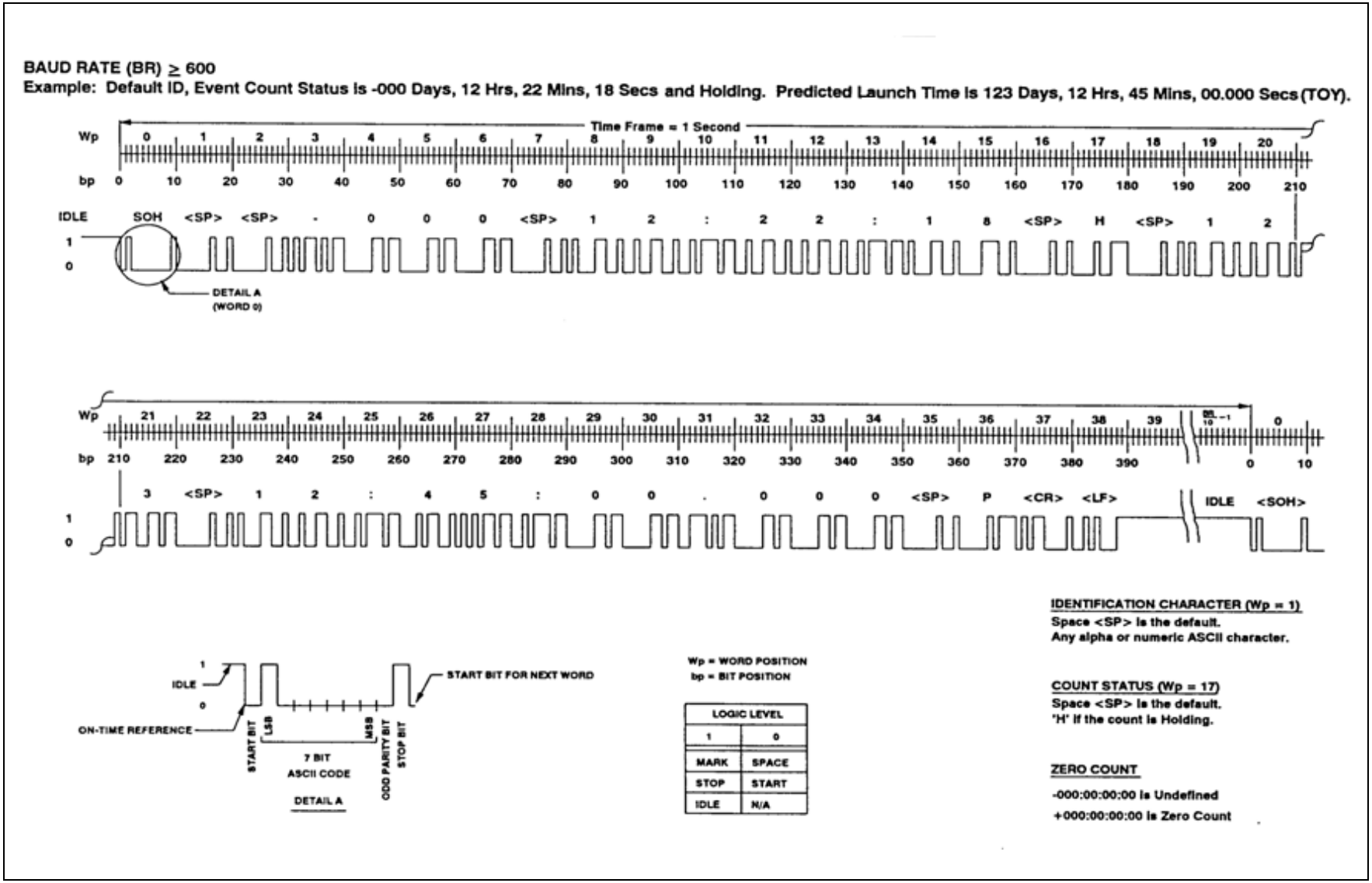


Figure 3. ASCII event count status format CS-513z.

2.4 IRIG CS-524z

The IRIG CS-524z is a Time-of-Year format with 100-millisecond resolution and frame length (see Figure 4). In addition to the EC status, this format has information regarding the predicted time of launch or the actual time of launch if launch has occurred. The accuracy of this format at the receiver end is primarily dependent on the characteristics (fixed and variable transmission delays) of the communications circuits between the transmitting and receiving equipment. The ASCII expression for this format is:

<SOH>I<SP>±
DDD<SP>HH:MM:SS.S<SP>#<SP>ddd<SP>hh:mm:ss.sss<SP>&<CR><LF>

Where:

<SOH>	=	start of header (0116).
I	=	identification character -- space (2016) is default, any alpha or numeric ASCII character.
<SP>	=	space (2016).
±	=	the EC sign.
DDD	=	the EC day.
HH	=	the EC hour of the day.
<:>	=	colon (3A16).
SS.S	=	the EC second and tenth of second of the minute {period "." = (2E16)}.
#	=	the EC status -- space (2016) is default, H (4816) if holding.
ddd	=	predicted/actual launch day.
hh	=	predicted/actual launch hour of the day.
mm	=	predicted/actual launch minute of the hour.
ss.sss	=	predicted/actual launch second and milliseconds of the minute.
&	=	launch time information -- P(5016) predicted, A(4116) actual.
<CR>	=	carriage return (0D16).
<LF>	=	line feed ($0A_{16}$).

The IRIG CS-524z uses the first 41 characters of the 100-millisecond frame. The remaining bits are idle (logic level = 1) for the remainder of the frame. The frame length is 100 milliseconds when using serial data, regardless of the baud rate.

The identification character is an ASCII "space" character by default, although any alpha numeric ASCII character may be used. The definition or function of the identification character is left to the user. Suggested uses might be identification of a net or network, an event, a test number, or a user number.

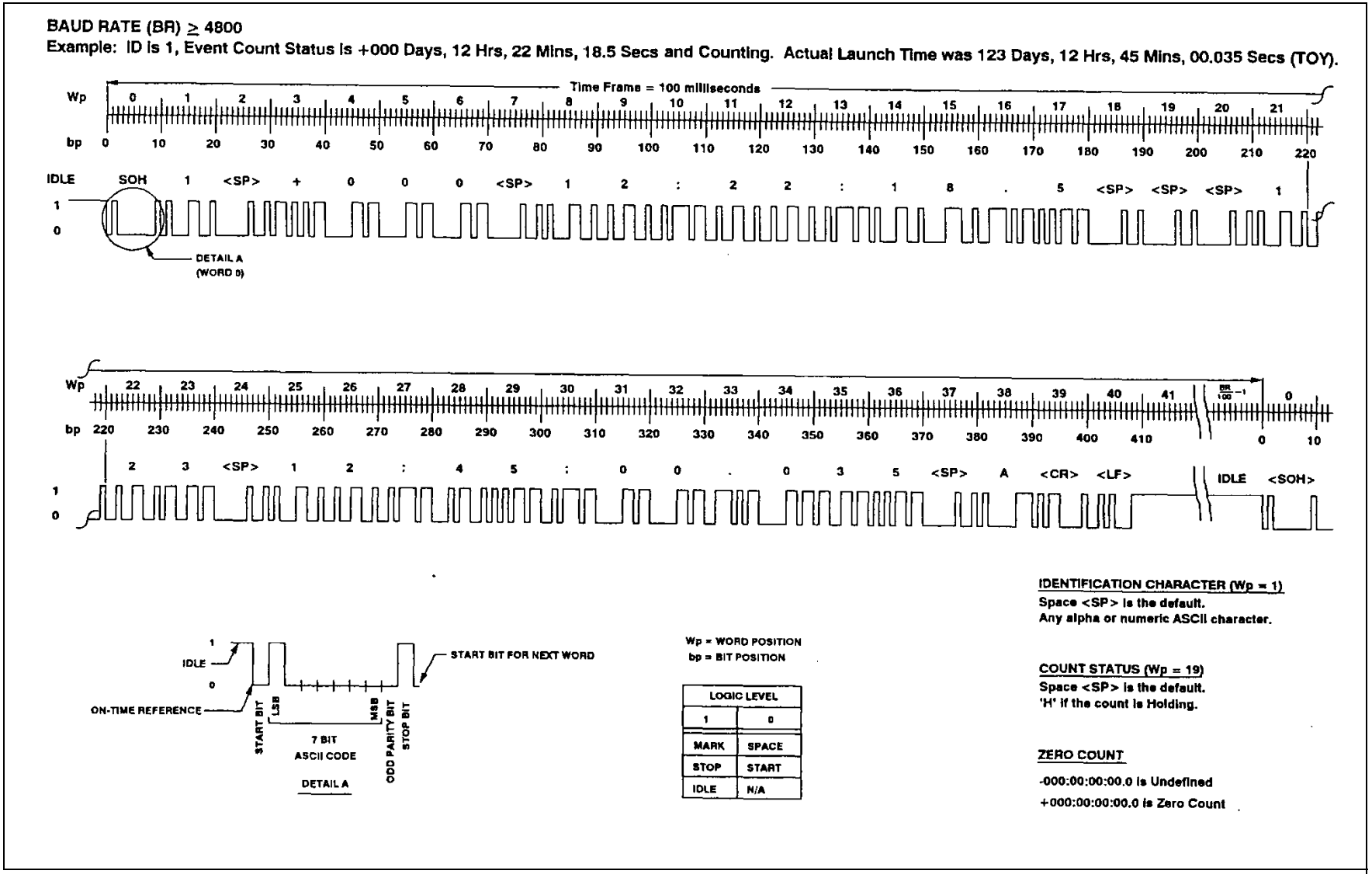


Figure 4. ASCII event count status format CS-524z.

2.5 IRIG CS-525z

The IRIG CS-525z is a multiplexed, eight-channel version of the IRIG CS-524z format (described in paragraph 2.4) transmitted at 38,400 baud when using serial data. The eight channels are asynchronous, relative to each other.

Each 100 ms frame of data contains 382 ASCII characters (as described in paragraph 3.1).

This format also allows each of the eight channels to have an associated 16 character "Tag" transmitted with the count data, which can be used for an Operation Number, or any label (L Count, T Count, etc.) for the channel. Figure 5 illustrates the data frame.

The start of the CS-525z data frame is identified by a "Frame Marker" character, which is a hexadecimal 1C ($1C_{16}$). The second character in the data frame is the Index character to identify the channel and location of the tag data. The following four characters contain Tag characters. The next eight characters are the first available IRIG CS-524z characters from each of the eight channels of data. The following eight characters are the second available characters from each of the eight channels, and the sequence is repeated until 47 characters are provided for each of the eight channels. The remaining bits will be idle until the end of the 100 ms frame.

NOTE	The first available IRIG CS-524z characters can be from anywhere within its data stream (i.e. may not be the Start of Header (SOH) character). However, receiving equipment will not begin decoding the channel data until the SOH (01_{16}) is received. When no data is available for a channel, a substitute character ($1A_{16}$) is sent.

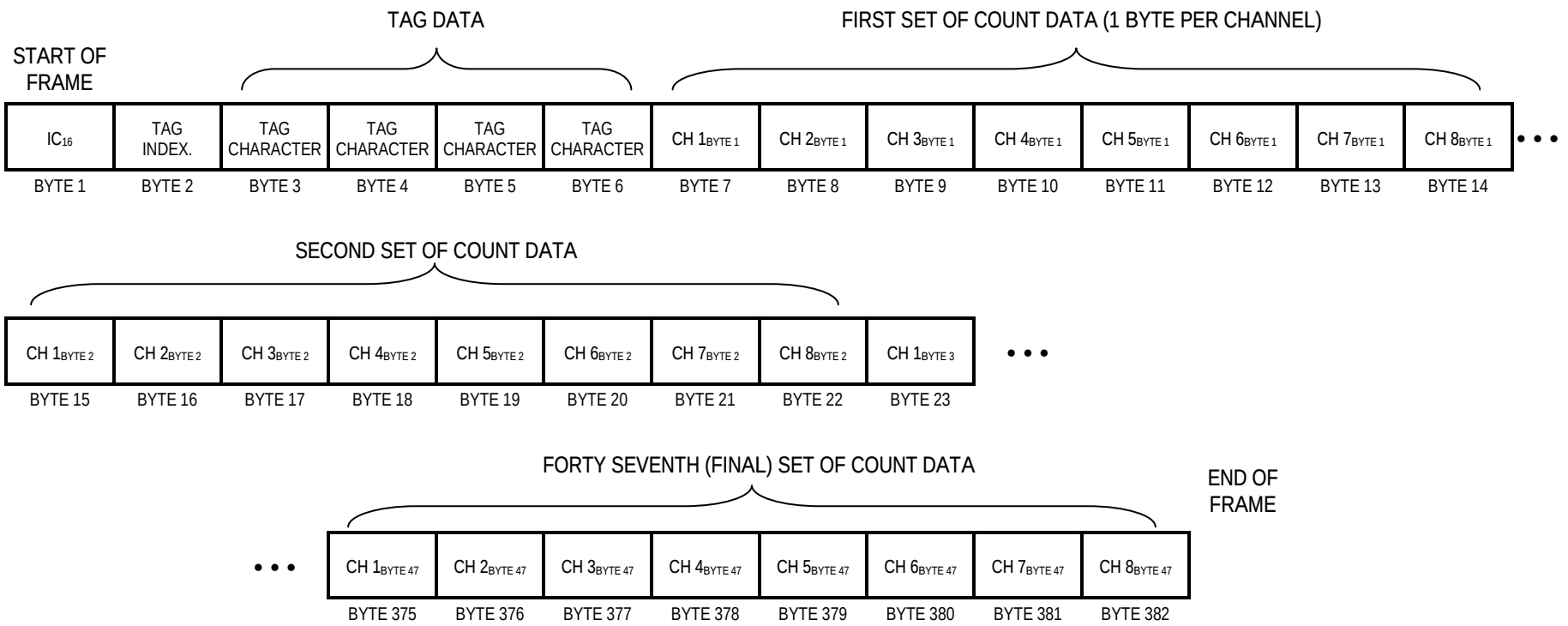
The Tag is sent within the count data stream in four-byte increments per 100 ms frame. It takes 32 data frames (3.2 seconds) to load the labels for all eight channels. An Index Character is transmitted with each 100 ms data frame to identify the destination of the four character tag data in each frame. The Index character repeatedly increments, logically, from 1 to 32 (21_{16} to 40_{16}) to fill the 128 bytes of label data every 3.2 seconds. See Table 1 for Index character assignments. When no Tag character is assigned, the Index character is 55_{16}.

Figure 6 illustrates how the Tag data is transmitted with the data frames.

NOTE	To avoid conflict with special control characters, the Index character starts at 21_{16} (the ASCII "!"), and increments through 40_{16} (the ASCII "@"). Subtracting a constant (20_{16}) from the Index character will return a number from 01_{16} to 20_{16}. In addition, the data contained in the Tag should only include characters from "space" (20_{16}) to "~" ($7E_{16}$).

TABLE 1. TAG INDEX CHARACTER ASSIGNMENTS

Index Character	Channel	Tag Character	Index Character	Channel	Tag Character
21_{16}	1	1 – 4	31_{16}	5	1 – 4
22_{16}	1	5 – 8	32_{16}	5	5 – 8
23_{16}	1	9 – 12	33_{16}	5	9 – 12
24_{16}	1	13 – 16	34_{16}	5	13 – 16
25_{16}	2	1 – 4	35_{16}	6	1 – 4
26_{16}	2	5 – 8	36_{16}	6	5 – 8
27_{16}	2	9 – 12	37_{16}	6	9 – 12
28_{16}	2	13 – 16	38_{16}	6	13 – 16
29_{16}	3	1 – 4	39_{16}	7	1 – 4
$2A_{16}$	3	5 – 8	$3A_{16}$	7	5 – 8
$2B_{16}$	3	9 – 12	$3B_{16}$	7	9 – 12
$2C_{16}$	3	13 – 16	$3C_{16}$	7	13 – 16
$2D_{16}$	4	1 – 4	$3D_{16}$	8	1 – 4
$2E_{16}$	4	5 – 8	$3E_{16}$	8	5 – 8
$2F_{16}$	4	9 – 12	$3F_{16}$	8	9 – 12
30_{16}	4	13 – 16	40_{16}	8	13 – 16



Notes:

a. In each 100 ms frame, 382 bytes of data are transmitted and remaining time is idle.
b. Byte 1 is the frame marker, IC_{16}.
c. Byte 2 is the Tag Index, 21_{16} - 40_{16} (see Table 1 and Figure 6).
d. Byte 2 is 55_{16} when no tag data is available.
e Bytes 3 - 6 are tag data (see Figure 6).
f. Bytes 7 - 382 are 8 channels of CS-524z count data.
g. CS-524z data may begin (SOH) at any point in the data stream (asynchronously)
h. When no count data is available, a $1A_{16}$ is sent.
i. Data stream is sent with odd parity.

Figure 5. ASCII event count status format CS-525z.

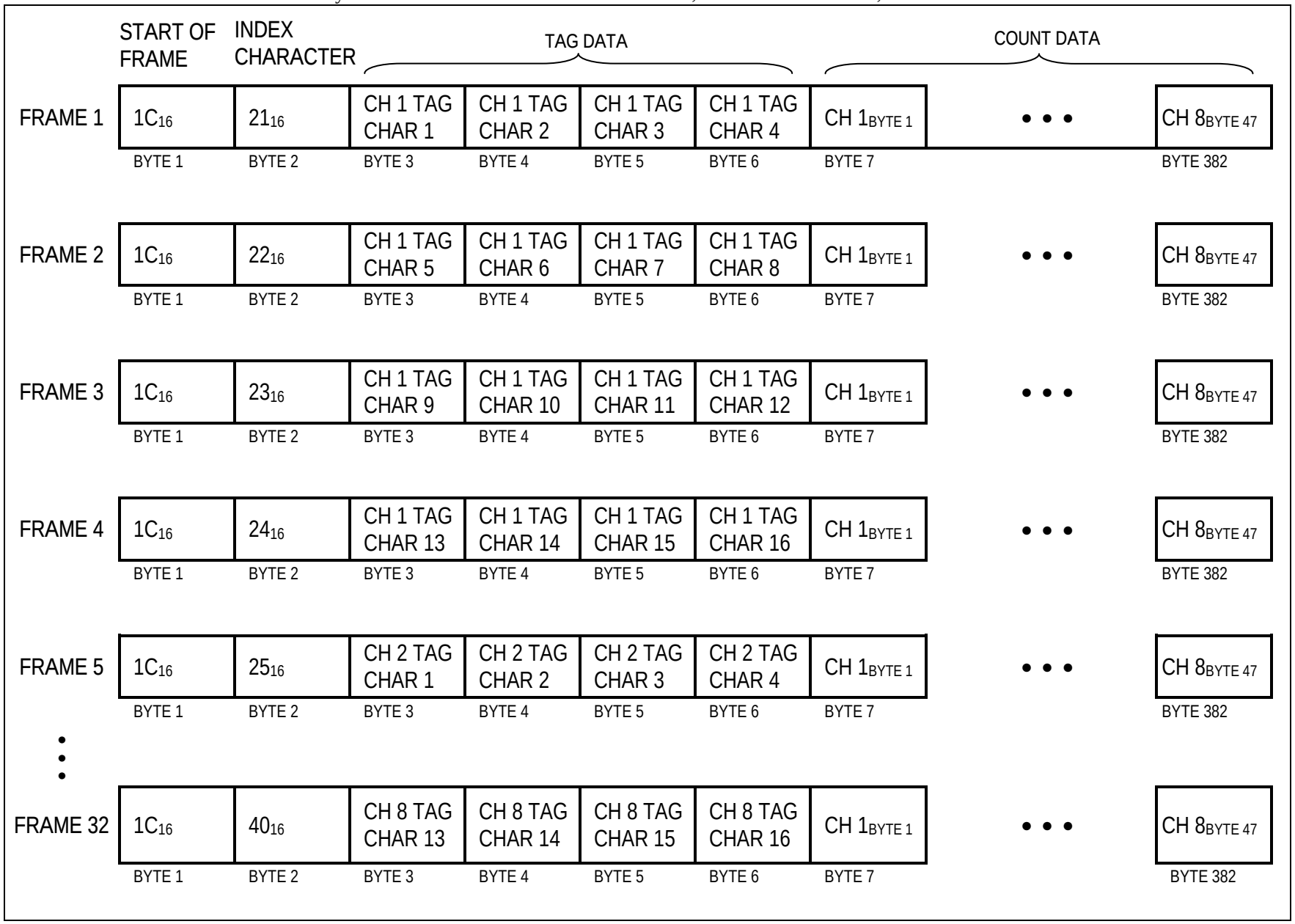


Figure 6. CS525z Channel tagging illustration.

3. Detailed Guidance

3.1 Word Description

Each ASCII word (character position) contains exactly 10 bits (b_0 - b_9) as shown below.

b0	=	Start bit.
b1 - b7	=	7-bit sequence for ASCII character, least significant bit (lsb) first.
b8	=	Odd parity bit.
b9	=	Stop bit.

3.2 Parity

This Standard employs odd parity only.

3.3 Baud Rates

The baud rates for the five ASCII event count status formats are:

CS-511z	≥	300 baud
CS-522z	≥	2,400 baud
CS-513z	≥	600 baud
CS-524z	≥	4,800 baud
CS-525z	≥	38,400 baud

3.4 IRIG CS Format Designation Description

3.4.1 IRIG CS format. The IRIG CS format and baud rates can be uniquely described by specifying x, y, and z in IRIG CS-5xyz, using the following values.

x	=	1	for 1 second resolution.
	=	2	for 0.1 second resolution.
y	=	1	for format described in paragraph 2.1.
	=	2	for format described in paragraph 2.2.
	=	3	for format described in paragraph 2.3.
	=	4	for format described in paragraph 2.4.
	=	5	for format described in paragraph 2.5.
z	=	2	for 300 baud rate.
	=	3	for 600 baud rate.
	=	4	for 1,200 baud rate.
	=	5	for 2,400 baud rate.
	=	6	for 4,800 baud rate.
	=	7	for 9,600 baud rate.
	=	8	for 19,200 baud rate.
	=	9	for 38,400 baud rate.

3.4.2 IRIG CS Format Example. The IRIG CS-5226 describes the ASCII format containing EC status with 100 ms resolution and frame length which is transmitted at 4,800 baud.

3.5 Common IRIG CS Formats

Table-2 contains a list of common formats.

TABLE 2. COMMON IRIG CS FORMATS				
IRIG CS-5112	IRIG CS-5225	IRIG CS-5133	IRIG CS-5246	IRIG CS-5259
IRIG CS-511N	IRIG CS-522N	IRIG CS-513N	IRIG CS-524N	IRIG CS-525N

4. Network Packet Structure

4.1 Ethernet Overhead

The Ethernet overhead consists of header and trailer information that is added to the Communications over Internet Protocol (CoIP) Layer 6 Payload. The contents of the payload are described in the individual CS5 format descriptions (i.e. CS-524N contains 41 characters in the payload and is transmitted 10 times per second).

4.2 Multicast Packets

4.1.1 Internet Protocol (IP)/User Datagram Protocol (UDP). The IP/UDP multicast supports communications from one transmitter to multiple receivers over an IP network. Support for a large number of receivers is inherent, as the identity of the receiver and the number of receivers is not required. Multicast is bandwidth efficient because the transmitter has to send the packet only once. The packets are replicated by the downstream nodes as required to support delivery to all receivers.

4.1.2 Multicast Group Addresses. Multicast packets use special types of IP addresses that identifies to the network that the packet contains multicast traffic. These IP addresses are referred to as multicast group addresses. Multicast addresses are identified by the pattern "1110" in the first 4 bits, which corresponds to a first octet of 224 to 239. The full range of multicast addresses is from 224.0.0.0 to 239.255.255.255.

4.2.3 Internet Group Management Protocol. At the network ingress, the network transmit stream will be constructed with the multicast group address as the destination address. If a node wants to receive traffic from a particular multicast group, it must inform the network. The receiver "joins" the multicast group. Once the receiver has joined a particular multicast group, the network equipment in the path forwards the packets for that multicast group to the receiver. If no receivers have joined a multicast group, the network equipment will not forward these packets. In this fashion, multicast traffic only consumes network bandwidth when a receiver requests the traffic. The protocol used by receivers to join a multicast group is called the Internet Group Management Protocol (GMP).

4.2.4 Additional Protocols. An additional set of protocols, Session Announcement Protocol (SAP) and Session Description Protocol (SDP), allow multicast senders to communicate the characteristics of their multicast streams to potential receivers. The receivers monitor the SAP packets to identify potential streams that they may want to decode. The SAP listening applications can listen to the well-known SAP multicast addresses and construct a guide of all advertised multicast sessions. The SAP uses SDP as the format of the session descriptions.

****** NOTHING FOLLOWS ******