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Digital Processing of Voice-Band Signals Line Format for 32-kbit/s Adaptive Differential Pulse-Code Modulation (ADPCM) (channel-control templates and robbed-bit signaling alarm transmission)

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digital processing of voice-band signals – line format for 32-kbit/s adaptive differential pulse-code modulation (ADPCM)

(channel-control templates and robbed-bit signaling alarm transmission)

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Purpose

This supplement addresses two oversights of ANSI T1.302-1989, *Digital Processing of Voice-Band Signals – Line format for 32-kbit/s Adaptive Differential Pulse-Code Modulation*. Clause 3 of ANSI T1.302-1989 describes the line format for transcoders using the bundle format but does not specify a line format for channels that are programmed to bypass the ADPCM algorithm and that are transmitted as digital or PCM data. Clause 5 of ANSI T1.302-1989 describes the line format for transcoders using robbed-bit signaling but does not specify a method for transmitting downstream alarms. The purpose of this supplement is to eliminate these oversights.

Channel control templates: This supplement specifies the delta channel format for applications requiring 64-kbit/s pass-through channels. This supplement also includes annex A, which contains 64 suggested channel-control templates, specifically, thirty-seven general-purpose channel-control templates, twenty-five channel-control templates for Integrated Services Digital Network (ISDN) applications, as well as applications that use the old data port plug-ins, and two 768-kbit/s and 1536-kbit/s templates. These channel-control templates provide for the integration of voice, voice-band data, and digital data signals.

Alarm transmission: This supplement specifies the method by which downstream alarms received on streams X or Y are transmitted on stream Z when robbed-bit signaling is used.

Channel-control template additions

Add the following to the end of 3.1.2.4.1 starting with a new paragraph:

The delta channel format as shown in table 3 shall also apply to channel-control templates that contain 64-kbit/s channels. All 64-kbit/s channels shall occupy contiguous 32-kbit/s time-slots **2i-1** and **2i** in stream Z, where **i** is an integer in the range of 1 to 24 inclusive. Channel-control templates, that specify signaling in a bundle, shall use the last time-slot

in the bundle (12, 24, 36 or 48) for the bundled-format signaling. The order of the channels in stream Z shall remain in the same order as the channels in streams X and Y. Annex A contains some commonly-used channel-control templates.

A channel that is passed through as a 64-kbit/s channel in a bundle always displaces a channel in that bundle. Although the information band-width is displaced, the signaling bandwidth for the displaced channel is retained; hence, the delta channel format in table A.3 is preserved irrespective of the channel rate of 64-kbit/s pass-through or 32-kbit/s. For example, in the seventh channel-control template in table A.1 of annex A, signaling band-width is reserved for channel 2, although channel 1 displaces the information band-width for channel 2. Signaling band-width is never provided for channels 12 and 24 of streams X and Y, even though data band-width can be provided.

Downstream alarm transmission additions

Replace the last sentence in the first paragraph of Section 5 with:

This is called the robbed-bit signaling format. As an option, X/Y alarm conditions can be transmitted over stream Z using alarm delta channels.

Change the numbers of 5.1.2.4, 5.1.2.4.1 and 5.1.2.4.2 to 5.1.2.5, 5.1.2.5.1 and 5.1.2.5.2, respectively.

Add the following:

5.1.2.4 Alarm delta channels associated with the alarm transparency option

5.1.2.4.1 Alarm delta channels

Alarm conditions that occur at the send side of port X or Y may be conveyed to the receive side of the connecting transcoder via stream Z using alarm delta channels. Alarm delta channels are delta channels, which are present on the ADPCM stream (stream Z), ONLY when there is a need to transmit alarm data. The alarm delta channels in bundles 1 and 2 are associated with port X, and the alarm delta channels in bundles 3 and 4 are associated with port Y. The format of the alarm delta channel is identical to the delta channel used in the bundle format (table 3). However, only the M2, M3, and M4 bits in bit 2 position and the multiframe alignment signal in bit 4 position will be used.

5.1.2.4.2 Alarm delta channel multiframe alignment signals

Bit 3 of the delta channel, as shown in table 3, contains the delta channel multiframe alignment signal. Alarm indication bits carried in the delta channel are considered valid only when proper multiframe alignment has been established.

5.1.2.4.3 Loss and recovery of alarm delta channel multiframe alignment

Delta channel multiframe alignment shall be declared when the correct sequence of 24 valid delta channel framing bits are detected, beginning with the first frame of the multiframe.

Loss of the delta channel multiframe alignment signal is declared when 2 out of any 4 consecutive delta channel framing bits are in error. When delta channel alignment is lost, the alarm indication bits contained in the affected delta channels are considered invalid and signalling reverts to the pre-alarm RBS format within 20 to 1000 ms.

5.1.2.4.4 Alarm delta channel fault conditions

The transcoder shall detect the following fault conditions associated with stream Z:

– Bundle AIS-Red (M2) received from the remote end on both bundles associated with port X or both bundles associated with port Y;

– Bundle AIS-Yellow (M3) received from the remote end on both bundles associated with port X or both bundles associated with port Y.

5.1.2.4.5 Alarm indications in alarm delta channels

Since alarm delta channels are only present when there is a need to transmit alarm data, the absence of the alarm delta channel multiframe alignment signal represents a no-alarm condition. Consequently, there is no need to declare a bundle Red alarm at any time when

RBS is used. As a result, the absence of the bundle Red alarm obviates the transmission and declaration of the bundle Yellow (M1) alarm. Therefore, M1 is not used.

The stream Z is continuously monitored by the transcoder for the presence of alarm delta channels. A bundle AIS-Red or AIS-Yellow is declared when M2 or M3 has been set for 335 to 1000 milliseconds. A bundle AIS-Red or AIS-Yellow is released when M2 or M3 has been reset for 20 to 1000 milliseconds. M4 is set by the send side whenever M2 or M3 is set.

Add the following:

5.1.3.3 Bundle fault conditions associated with the alarm transparency option

A summary of the bundle fault conditions associated with stream Z and the consequent actions are listed in table 15.

The transcoder shall detect the following fault conditions associated with stream Z:

– Bundle AIS-Red (M2) received from the remote end on both bundles associated with port X or both bundles associated with port Y;

– Bundle AIS-Yellow (M3) received from the remote end on both bundles associated with port X or both bundles associated with port Y.

5.1.3.4 Consequent actions associated with the alarm transparency option

Upon detection of the bundle fault conditions in stream Z, the following consequent actions shall be taken, as indicated in table 15:

(A) A DS1 AIS shall be applied to the receive side of stream X (for bundles 1 and 2) and stream Y (for bundles 3 and 4). The AIS consists of an all 1s signal in all channels including the framing bits;

(B) A DS1 Yellow alarm signal shall be applied to the receive side of stream X (for bundles 1 and 2) and stream Y (for bundles 3 and 4);

(C) A bundle AIS-Red shall be declared to indicate the reception of a bundle AIS-Red indication in the M2 bit of the affected alarm delta channels in bundles 1 and 2, or bundles 3 and 4;

(D) A bundle AIS-Yellow shall be declared to indicate the reception of a bundle AIS-Yellow indication in the M3 bit of the affected alarm delta channels in bundles 1 and 2, or bundles 3 and 4.

Delete 5.2 of T1.302-1989.

Renumber 3.2 through 3.2.4.1 as 5.2 through 5.2.4.1.

Add the following:

5.2.4.2 Consequent actions without the alarm transparency option

Upon detection of the DS1 fault conditions in stream X and Y, the following consequent actions shall be taken as indicated in table 14 of ANSI T1.302-1989:

(A) Declare Red alarm on the send side of the port X or Y;

(B) Send Yellow alarm signal on the receive side of port X or Y;

(C) Condition the data in the affected channels on the send side of stream Z to provide a signal in all channels that is compatible with downstream equipment;

(D) Condition the signaling in the affected channels on the send side of stream Z to provide a signal in all channels, that is compatible with downstream equipment;

(E) Declare DS1 AIS on the send side of port X or Y;

(F) Declare DS1 Yellow alarm on the send side of port X or Y.

5.2.4.3 Consequent actions associated with the alarm transparency option

Upon detection of the DS1 fault conditions in stream X and Y, the following consequent actions shall be taken as indicated in table 8:

(A) Declare Red alarm on the send side of the port X or Y;

(B) Send Yellow alarm signal on the receive side of port X or Y;

(C) Send a bundle AIS-Red alarm signal to the remote end by forcing the M2 and M4 bits within the affected alarm delta channels of bundles 1 and 2, or bundles 3 and 4 to 1;

(E) Declare DS1 AIS on the send side of port X or Y;

(F) Declare DS1 Yellow alarm on the send side of port X or Y;

(G) Send a bundle AIS-Yellow alarm signal to the remote end by forcing the M3 and M4 bits within the affected alarm delta channels of bundles 1 and 2, or bundles 3 and 4 to 1.

Add the line "Bundle format" to the title of table 7 as shown in the following:

Table 7 – Bundle format – Bundle fault conditions associated with stream Z and consequent actions

Add the following table after table 14:

Table 15 – RBS alarm transparency option – Bundle fault conditions associated with stream Z and consequent actions

Consequent actions → / **↓ Fault conditions**	**Send DS1 AIS on X or Y** (A)	**Send DS1 Yellow on X or Y** (B)	**Declare bundle AIS-Red** (C)	**Declare bundle AIS-Yellow** (D)
Bundle AIS-Red Received (Bundle pair) (1)	Yes	–	Yes	–
Bundle AIS-Yellow Received (Bundle pair) (2)	–	Yes	–	Yes

Add the following annex to the end of the standard:

Annex A
(informative)

A.1 Suggested channel-control templates

This annex contains a description of specific channel-control templates and is for information purposes only. Compliance with this annex is neither necessary nor sufficient to maintain compliance with the standard. Table A.1 contains general-purpose channel-control templates. Table A.2 contains channel-control templates for Integrated Services Digital Network (ISDN) applications, and applications that use the older data port plug-ins for primary multiplexes when multiple plug-ins are required, and mobile radio applications.

A.2 Templates

The templates include 32-kbit/s or 64-kbit/s channels, or both, and 128-kbit/s, 384-kbit/s, 768-kbit/s, and 1536-kbit/s pass-through channels. Because transcoding primary multiplexes are also included in these applications, and are always positioned at end-points in the digital network, only some of the templates apply to this equipment. The 32-kbit/s and 64-kbit/s channels can be programmed to pass signaling or inhibit signaling. Since mobile radio applications often use:

channel 9, or
channels 9 and 16

for common channel signaling, 64-kbit/s pass-through capability for these channels is desirable. Table A.2 also contains some of the more commonly used channel-control templates for mobile radio applications that use the above-mentioned common channel signaling format.

Transcoders should only allow the programming of a 64-kbit/s channel within a DS0 time-slot boundary. In other words, a channel overlapping DS0 time-slot boundary, e.g. occupying nibbles 2 and 3 in stream Z, should not be allowed. The channel-control templates include mixtures of 32 kbit/s and 64 kbit/s. The 32-kbit/s and 64-kbit/s channels can be programmed to pass signaling or inhibit signaling.

A **32, 64, 384, 768,** or **1536** indicates the bandwidth in kbit/s allocated to the corresponding channel(s) in stream Z. An **s**[3] or **n** indicates that signaling will be allowed or inhibited, respectively, on the corresponding channel. A **yes** or **no** indicates that a delta channel is required or not required in that bundle. A "–" under a channel signifies that the channel in streams X or Y is unused.

A.2.1 32- and 64-kbit/s templates

Table A.1 contains thirty-seven optional channel-control templates that allow pure 32-kbit/s channels, pure 64-kbit/s channels, and mixtures of 32- and 64-kbit/s channels.

Table A.2 contains twenty-five channel-control templates that provide for ISDN and data port applications with channel 24 provisioned for 64 kbit/s. The data port channel-control templates accommodate the older data ports that require every adjacent physical slot be empty when multiple data port plug-ins are used. These templates also allow pure 32-kbit/s channels, pure 64-kbit/s channels, and mixtures of 32-kbit/s and 64-kbit/s channels.

The templates provide for a variety of customer applications that include digital data service. All of these templates are applicable to transcoder applications. Some, but not all, of these templates are applicable to transcoding primary multiplexes such as digital channel banks.

A.2.2 768- and 1536-kbit/s templates

Table A.3 contains two channel-control templates that allow 768- and 1536-kbit/s templates. This table also includes various combinations of 768-kbit/s channels and 384-kbit/s templates that can be accommodated on line Z. These templates are applicable to transcoders only; there are no primary multiplex applications that will use these tem-

3) A delta channel is assigned to a bundle if at least one channel in that bundle is provisioned for signaling denoted by **s**. See 3.1.2.4.1

plates. Port Z can allow two bundles to be programmed for a 768-kbit/s template and the remaining two bundles to be programmed for channel-control templates similar to those in tables A.1 and A.2.

A.2.3 Other templates

Transcoders should allow programming of other combinations of channel-control templates, and should not be limited to the templates indicated in this contribution; this includes the passing of information at 32 kbit/s or 64 kbit/s without signaling in channels 12 and 24. Transcoders should only allow the programming of a 64-kbit/s channel within a DS0 time-slot boundary. In other words, a channel overlapping DS0 time-slot boundary, e.g., occupying nibbles 2 and 3 in stream Z, should not be allowed.

Table A.1 – Bundled format – General-purpose channel-control templates

Port X/Y channel numbers												DEL T A
1	2	3	4	5	6	7	8	9	10	11	12	
OR												
13	14	15	16	17	18	19	20	21	22	23	24	
32s	32s	32s	32s	32s	32s	32s	32s	32s	32s	32s	–	yes
32n	32n	32n	32n	32n	32n	32n	32n	32n	32n	32n	32n	no
32s	–	32s	64s	32s	32s	32s	32s	32s	32s	32s	–	yes
32s	32s	–	64n	32s	32s	32s	32s	32s	32s	32s	–	yes
32s	32s	32s	32s	64s	64s	64s	32s	–	–	–	–	yes
64n	–	32s	32s	32s	32s	32s	32s	32s	32s	32s	–	yes
64s	–	32s	32s	32s	32s	32s	32s	32s	32s	32s	–	yes
64n	64n	–	–	32s	32s	32s	32s	32s	32s	32s	–	yes
64n	64s	–	–	32s	32s	32s	32s	32s	32s	32s	–	yes
64s	64s	–	–	32s	32s	32s	32s	32s	32s	32s	–	yes
64n	64n	64n	–	–	–	32s	32s	32s	32s	32s	–	yes
64n	64n	64s	–	–	–	32s	32s	32s	32s	32s	–	yes
64n	64s	64s	–	–	–	32s	32s	32s	32s	32s	–	yes
64s	64s	64s	–	–	–	32s	32s	32s	32s	32s	–	yes
64n	64n	64n	64n	–	–	–	–	32s	32s	32s	–	yes
64n	64n	64n	64s	–	–	–	–	32s	32s	32s	–	yes
64n	64n	64s	64s	–	–	–	–	32s	32s	32s	–	yes
64n	64s	64s	64s	–	–	–	–	32s	32s	32s	–	yes
64s	64s	64s	64s	–	–	–	–	32s	32s	32s	–	yes
64n	64n	64n	64n	64n	–	–	–	–	–	32s	–	yes
64n	64n	64n	64n	64s	–	–	–	–	–	32s	–	yes
64n	64n	64n	64s	64s	–	–	–	–	–	32s	–	yes
64n	64n	64s	64s	64s	–	–	–	–	–	32s	–	yes
64n	64s	64s	64s	64s	–	–	–	–	–	32s	–	yes
64s	64s	64s	64s	64s	–	–	–	–	–	32s	–	yes
64n	64n	64n	64n	64n	64n	–	–	–	–	–	–	no
64n	–	32n	32n	32n	32n	32n	32n	32n	32n	32n	32n	no
64n	64n	–	–	32n	32n	32n	32n	32n	32n	32n	32n	no
64n	64n	64n	–	–	–	32n	32n	32n	32n	32n	32n	no
64n	64n	64n	64n	–	–	–	–	32n	32n	32n	32n	no
64n	64n	64n	64n	64n	–	–	–	–	–	32n	32n	no
64n	64n	–	32s	32s	32s	32s	64n	32s	–	–	–	yes
64n	64n	64n	–	64n	–	–	–	32s	32s	32s	–	yes
64n	–	32s	32s	64n	–	32s	32s	64n	–	32s	–	yes
64s	32s	32s	64s	–	32s	32s	32s	32s	32s	–	–	yes
64n	64n	–	–	–	–	64s	64s	32s	32s	32s	–	yes
64s	64s	64n	–	64n	32s	32s	32s	–	–	–	–	yes

Legend

"n" – no signaling on the transmit full-rate channel.

"s" – signaling on the transmit full-rate channel.

"–" – unused channel.

"yes" – signaling channel assigned.

"no" – no signaling channel assigned.

"32" – 32 kbit/s coding.

"64" – pass-through at 64 kbit/s.

Table A.2 – Bundled format – Channel-control templates for ISDN, data port and mobile radio applications

Port X/Y channel numbers												DEL TA
1	2	3	4	5	6	7	8	9	10	11	12	
OR												
13	14	15	16	17	18	19	20	21	22	23	24	
ISDN applications												
–	–	–	–	–	–	64n	64n	64n	64n	64n	64n	no
–	32n	32n	32n	32n	32n	32n	32n	32n	32n	32n	64n	no
64n	–	–	32n	32n	32n	32n	32n	32n	32n	32n	64n	no
64n	64n	–	–	–	32n	32n	32n	32n	32n	32n	64n	no
64n	64n	64n	–	–	–	–	32n	32n	32n	32n	64n	no
64n	64n	64n	64n	–	–	–	–	–	32n	32n	64n	no
64n	64n	64n	64n	64n	–	–	–	–	–	–	64n	no
–	–	32n	32n	32n	32n	32n	32n	32n	32n	64n	64n	no
64n	–	–	–	32n	32n	32n	32n	32n	32n	64n	64n	no
64n	64n	–	–	–	–	32n	32n	32n	32n	64n	64n	no
64n	64n	64n	–	–	–	–	–	32n	32n	64n	64n	no
Data port applications												
64n	–	64n	–	32s	32s	32s	32s	32s	32s	32s	–	yes
64n	–	64n	–	64n	–	32s	32s	32s	32s	32s	–	yes
64n	–	64n	–	64n	–	64n	–	32s	32s	32s	–	yes
64n	–	64n	–	32n	32n	32n	32n	32n	32n	32n	32n	no
64n	–	64n	–	64n	–	32n	32n	32n	32n	32n	32n	no
64n	–	64n	–	64n	–	64n	–	32n	32n	32n	32n	no
64n	–	64n	–	64n	–	64n	–	64n	–	32n	32n	no
64n	–	–	64n	32s	32s	32s	32s	32s	32s	32s	–	yes
64n	–	64n	–	64n	–	–	32s	32s	64n	32s	–	yes
ISDN/Data port applications												
64n	–	64n	–	–	32n	32n	32n	32n	32n	32n	64n	no
64n	–	64n	–	64n	–	–	32n	32n	32n	32n	64n	no
64n	–	64n	–	64n	–	64n	–	–	32n	32n	64n	no
64n	–	64n	–	–	–	32n	32n	32n	32n	64n	64n	no
64n	–	64n	–	64n	–	–	–	32n	32n	64n	64n	no
Mobile radio applications												
32n	32n	32n	32n	32n	32n	32n	32n	64n	–	32n	32n	no
32n	32n	–	64n	32n	32n	32n	32n	32n	32n	32n	32n	no

Table A.3 – 1536 – 768 kbit/s pass-through – 384-kbit/s channel-control templates

Template number per bundle			
1	**2**	**3**	**4**
Port X		Port Y	
1 – 12		1 – 12	13 – 24
768 kbit/s		384 kbit/s	384 kbit/s
Port X		Port Y	
13 – 24		1 – 12	13 – 24
768 kbit/s		384 kbit/s	384 kbit/s
Port X		Port Y	
1 – 12	13 – 24	1 – 12	
384 kbit/s	384 kbit/s	768 kbit/s	
Port X		Port Y	
1 – 12	13 – 24	13 – 24	
384 kbit/s	384 kbit/s	768 kbit/s	
Port X			Port Y
1 – 12	13 – 24		13 – 24
384 kbit/s	768 kbit/s		384 kbit/s
Port X	Port Y		
1 – 12	1 – 12		13 – 24
384 kbit/s	768 kbit/s		384 kbit/s
Port X		Port Y	
1 – 12		1 – 12	
768 kbit/s		768 kbit/s	
Port X		Port Y	
1 – 12		13 – 24	
768 kbit/s		768 kbit/s	
Port X		Port Y	
13 – 24		1 – 12	
768 kbit/s		768 kbit/s	
Port X		Port Y	
13 – 24		13 – 24	
768 kbit/s		768 kbit/s	
Port X			
1 – 24			
1536 kbit/s			
Port Y			
1 – 24			
1536 kbit/s			

Legend

"384" – 384 kbit/s channel-control template similar to table A.1.

"768" – pass-through at 768 kbit/s.

"1536" – pass-through at 1536 kbit/s.