INVESTIGATING UNKNOWN IRIG CHAPTER 4, CLASS I OR II FORMATS

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ABSTRACT

This describes one approach to investigating an unknown IRIG 106, Chapter, 4 Class I or Class II Pulse Code Modulation (PCM) format. The assumption is that you are supplied with decrypted data and clock signals for the unknown PCM stream. This technique is optimized for 16, 12, or 8-bit Word Minor Frames. Standard IRIG 106, Appendix C, Table C-1, Frame Synchronization (Frame Sync) values of 32, 24, 16-bit patterns are simpler to investigate. Other IRIG Frame Sync patterns can also be investigated, but are not dealt with in this document. This document will utilize a sample 24-bit Frame Sync pattern, because it will produce Endian issues in the recorded data.

INTRODUCTION

The system used to investigate the unknown PCM Frame is Windows based. The Decommutator utilizes a mode that records the raw data from the Decom Current Value Table memory onto the Hard Drive as 16-bit Words that are Little Endian swapped. The 16-bit Word 0x1234 in CVT memory is stored onto the HD as 0x3412. Using a combination of real-time Raw Data Buffer, Frame Buffer and recorded data inspected with a Hexadecimal Viewer will give insight into the unknown Frame. Using this information to update the Decom settings and repeating this inspection process, eventually a successfully lock on the unknown PCM Frame format will be achieved.

PROCEDURE

Setup the Decommutator (Decom) for PCM Frame investigation as shown in Figure 1.



Figure 1: Initial Decom Setup

This configuration is optimal for 16, 12, 8, bit Words. **Note:** the G Mode selected above allows locking onto the Frame Synchronization (Frame Sync) pattern if found. However, even if no Frame Sync pattern is found, the Decom will collect buffers of data and then record them to the hard drive when placed in the archiving mode.

Since the format is unknown, we will try 32, 24 and 16-bit Frame Sync patterns until the pattern is found. This is accomplished by tying each Frame Sync pattern and observing the Raw Data Buffer (indicated by the term **FPI** in the banner). Starting with the 32-bit Frame Sync pattern 0xFE6B2840, the Raw Data Buffer is inspected for this Frame Sync pattern in Figure 2.

MF D)ecom	i (Ls5	0P2) Card	1 FPI Seri	ial Da	ta											×
File	Fram	e List	Quick List	Hardcopy	Sna	p File											
Cw Wj Nu	vl pf im Sf	16 2048 1	Sfl Sfl Sfl	d Word 20 d Msb 5 d Start 0	Setuj 149	o Info	Minor Fr FPI Card Mo	Rate 30.5 16 de 0	5	Data Va Drdy Co Time	Stat alid N punter 0: 2:	t us Info O x000000C5 23:13:00:5	0 Fra 54.531746	mes Lost	Reset Co 0x00000	unter 12E0	
P	ause						Pau	se	Œ	ush Bufte	a.)						
							T1	T2	T3	T4	S1	1	2	3	4	5	6
						0	2302	0013	5354	4617	1031	8778	6880	B050	8770	3A81	6065
						1	2302	0013	5654	1445	1032	9022	07F0	5D80	7852	04B0	1606
						2	2302	0013	5954	8272	1033	0203	D01D	8310	1F06	886A	8078
						3	2302	0013	6354	5000	1034	8648	6E01	C80C	0190	6C00	2013
						4	2302	0013	6654	1828	1035	880B	0508	7703	A816	0658	5D83
						5	2302	0013	6954	8655	1036	5E85	D807	8520	4B01	606F	0798
						6	2302	0013	7254	5483	1037	01D8	3101	F068	86A8	0786	105E
						7	2302	0013	7654	2211	1038	E01C	80C0	1906	C002	0138	7707
						8	2302	0013	7954	9038	1039	5087	703A	8160	6585	D834	0588
						9	2302	0013	8254	5866	103A	8078	5204	B016	06F0	7982	F81E
						10	2302	0013	8554	2694	103B	101F	0688	6A80	7861	05E8	2702
						11	2302	0013	8954	9421	103C	0C01	906C	0020	1387	707A	0738
						12	2302	0013	9254	6249	103D	03A8	1606	585D	8340	5886	1825
						13	2302	0013	9554	2977	103E	204B	0160	6F07	982F	81E0	2801
						14	2302	0013	9954	9704	103F	6886	A807	8610	5E82	7020	8210
						15	2302	0013	0255	6532	1040	06C0	0201	3877	07A0	7384	F865
					_	•											Þ

Figure 2: Raw Data Buffer, no 0xFE6B2840 pattern found

Reconfigure the Decom to look for 24-bit Frame Sync pattern 0xFAF320 then inspect the Raw Data Buffer as in Figure 3.

al 16 pf 2048 an Sf 1	Sfid Word 2049 Sfid Mord 2049 Sfid Mob 5 Sfid Start 0	tup Info	Minor Fr I FPI Card Mor	Rate 30.5 16 de 0	i	Data Va Drdy Co Time	Stat alid N Junter 0: 2:	tus Info 0 :000016B 22:14:39:3	0 Fra 39.762938	mes Lost	Reset Co 0x00000	unter BA3	
ause			Pau	e	(P	ush Bufte							
			T1	T2	T3	T4	S1	1	2	3	4	5	6
		0	2202	3914	7639	3829	11A2	FAF3	2001	A040	OFEO	BB00	FQA
		1	2202	3914	7939	0657	11A3	40C3	06C0	0407	A03B	0620	3E0
		2	BOBB	0680	B10C	304B	0290	960F	E08B	0EB0	C90D	C039	01
		3	DOBA	0EB0	BB00	F0A4	0960	2C0D	E0F3	05F0	3C05	0024	06
		4	E0F4	0E70	9F0C	B064	0C30	6C00	407A	0380	6203	E0D1	00
		5	60A1	0EE0	7502	COCB	0880	680B	10C3	04B0	2909	60FE	08
		6	1042	043F	AF32	001B	06B0	9F0B	BOOF	0A40	9602	CODE	OF
		7	8032	0D80	0402	70EE	0F40	E709	FOCB	0640	C306	C004	07
		8	10BF	0D70	EFOD	1016	0A10	EE07	502C	0CB0	BB06	80B1	00
		9	2202	3814	5813	7613	114B	0000	0000	0000	0000	0000	00
		10	2202	3814	6113	4441	114C	0000	0000	0000	0000	0000	00
		11	2202	3814	6413	1269	114D	0000	0000	0000	0000	0000	00
		12	2202	3814	6713	8096	114E	0000	0000	0000	0000	0000	00
		13	2202	3814	7113	4824	114F	0000	0000	0000	0000	0000	00
		14	2202	3814	7413	1652	1150	0000	0000	0000	0000	0000	00
		15	2202	3814	7713	8479	1151	0000	0000	0000	0000	0000	00

Figure 2: Raw Data Buffer, 0xFAF320 pattern found

The unknown PCM Frame uses a 24-bit Frame Sync. Record Raw Data and review this recording using a Hex Viewer looking for the Frame Sync. Since the recorded data is Little Endian swapped, look for the pattern 0xF3FA as in Figure 3.

😐 [C:\Lu	mist	ar_f	54\L	dps_	8×\l	Jser	\Ser	verF	iles\	Misc	Use	r\LS	50P2	2_RA	WD	ATA_	STR	EAM	_1.8	IN]-	- frhed	- 🗆 ×
File Edit	Vie	w (Option	ns F	Regist	try	Book	mark	s H	elp												
00000	02	22 FII	14	42	45	67	97 13	01 ell	Ъ2 f 0	11	f3 05	fa 3c	00 24	20	9a	Ъ0 06	20 0d	00 bf	00 ef	ЪЪ 70	.".BEg². <mark>óú</mark> *.	.»
00028	10	bû	IR	G T	IME	LO	50	07	0c	FF	RAM	ES	YNC	5	0c	bl	4b	30	90	02	i.P±K0	<u> </u>
00030	e7	40	fO	09	06	cb	c3	40	39 C0	ōō	0 7	ō4	зъ	-2 a0	20	80	00 0d	02 3e	d5	ee 10	c@ðËÃ@à;>	ð.
00064	fO	00	0b	c2	4e	d0	10	04	04	42	af	3f	00	32	09	0c	01	b0	ь0	Ob	ອ້ÅNĐΒີ?.2* ສໄ ນ ດໄ ⊵∋ສສ	*.
0008c	d1	fO	60	01	0e	a1	75	eO	c0	02	0b	cb	68	ьо	10	0b	04	c3	29	ьо	Nö`iuàĀEh*Ā	5î
000a0 000b4	60 0e	09 f4	08 9f	te 70	eb b0	DC DC	90 0c	0C 64	03 6c	dc 30	18 40	90	20	03 7a	62	<u>д</u> 8 р0	27 e0	40	e0 0d	0e d1	þe*UØ'@ ô.p*dl0@zb*à.	.N
80000	Of f0	50	20	0c	04	bd 60	41	e0	20	04 f3	fa 3c	43 £0	20	f3	d0	00	00 bf	9c	ЪЪ 70	00	.P¥Aà .úC óĐ	». D
01000	b0	ef	16	10	10	0a	07	ee	20	50	ьо	0c	06	bb	Ы1	80	30	0c	02	4b	.ïî.P*»±.0.	, K
00104	40	90 0f	e0 09	e7	cb	8D f 0	40	06	06	c3	04	39 C0	32 a0	07	80	3b	3e	20	ee 10	0d	@çËð@Ã.À;>	1p
0012c	00	d5	c2 40	f0 0a	d'	0Ъ 96	04 de	4e	42	10 0f	3f 03	04 5f	32	af cf	0e 40	00	d0 0b	09 61	0b d7	00 f 0	.ÕÅðÐNB.?.2Đ. *@ ÞÀN PÀ@ a	 Xð
00154	fO	0e	01	dī	al	60	eO	0e	02	75	cb	cO	ьо	0b	0b	68	C3	10	ьо	04	ð. Ni`à. uÉĀ*. hÃ.	
00168 0017c	f 4	e0	70	Ve	0c	9f	64	b0	30	90 0c	00	03 60	7a	40	<u>а</u> е b0	03	03	62	d1	e0	ôàpd*0lz@*b	Ńà
00190 001a4	50	0d bb	00	0f f0	60	20 09	e0 0d	04 2c	04 f 3	41 e0	43 f0	20	f3 05	fa 3c	00 24	20	9e 10	£0 06	00 b0	00 bf	P½ àAC óúč	
4	- 4	20	1 ô	ć ć	0-	10		10	r o	0.2	0-	2-	LL	ĩ.	ōó	ñć.	ñ-	21	12	20		
Selected: (Offset	: 10=	0xa	to 11	=0xb	(2 b	yte(s))												AN	NSI / OVR / L Size: 105	51136 //

Figure 3: First Frame Sync location using a Hex Viewer

The first Frame Sync found has a 10 byte offset value. **Note:** this Decom will prepend 10 bytes of data in front of the Frame Sync. This is comprised of an IRIG Time Stamp and various status flags. The next Frame Sync occurrence is shown in Figure 4.

🔍 [C:\Lu	mist	ar_(64\L	dps_	8x\l	Jser	\Ser	verF	iles\	Misc	Use	r\LS	50P2	2_RA	WD/	ATA_	STR	EAM	_1.8	IN]-	- frhed	_ 🗆 X
File Edit	Vie	w (Option	ns F	Regisl	try	Book	mark	s H	elp												
00000 00014 00028 0003c 00050 00064 00078 0008c 00000000	02 a4 10 e7 f0 0a d1 60 e7 f0 0d 96 40 00 ff0 ff0 00 ff0 00 ff0 00 ff0 00 ff0 00 ff0 00 ff0 00 ff0 00 ff0 00 ff0 00 ff0 00 ff0 00 ff0 00 ff0 00 ff0 00 ff0 00 ff0 00 ff0 00 ff0 ff0 00 ff0 00 ff0 00 ff0 f f ff0 ff0 ff0 ff0	222 f0 0d 966 400 0f f0 96 f0 0f f0 96 f0 0f d5 00 eff 00 d5 00 d5 00 eff 00 d5 00 00 f0 90 00 f0 f	14 60 8b f0 0b 96 60 99 60 99 60 99 60 99 60 99 60 90 91 60 90 92 40 01 fe 70 00 40	42 09 16 09 09 22 40 00 24 00 00 24 00 00 24 00 00 24 00 00 24 00 00 24 00 00 24 00 00 20 00 20 40 00 00 20 00 20 00 00 20 00 00 20 00 00	45 0d ee b0 06 4e c0 0e eb b0 04 c2 c0 0e eb b0 04 c2 c0 0e cb 0 06 cb 0 06 ec b0 ec b ec b	67 2cc 0cb 02 02 02 02 02 02 02 02 02 02 02 02 04 00 05 05 05 05 05 05 05 05 05 05 05 05	97 f3 50 d3 10 0f 75 90 0c 40 07 c9 40 04 e0 0c 64 e0 0c	01 e0 07 40 04 e0 04 e0 04 e0 06 4e b0 06 4e b0 06 4e b0 06 2c 0 2c 0 0 2c 0 2c 0 2c 0 2c 0 2c	b2 f0 0 39 c0 04 5 5 f 20 05 2 c0 05 2 c0 06 20 05 2 c0 06 20 05 2 c0 04 5 f c0 0 3 9 c0 0 4 5 f c0 0 0 5 f c0 0 0 5 f c0 0 0 5 f c0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	11 05 20 06 42 30 02 dc 30 04 f3 00 dc 30 04 f3 00 c 30 04 f3 00 c 04 c 00 c 04 c 00 c 00 c 00 c 00	f3 05 b80 07 af 00 18 40 fa 3c 00 18 3c 00 18 01 04 3f 00 43 f0 00 43 f0	fa 3cb 01 04 3f 02 00 43 f0 02 03 04 5f 03 00 04 5f 00 03 00 05 F	00 24 80 3b 00 02 68 20 02 68 20 02 68 20 02 68 20 03 20 00 32 32 50 03 250 03 250 832 50 832 50 832 50 832 50 832 832 80 832 80 832 80 80 832 80 80 80 80 80 80 80 80 80 80 80 80 80	20 006 32 50 03 7a 50 05 bb 03 7a 65 05 05 07 af 05 05 07 af 05 05 07 80 07 af 20 06 32 50 03 250 06 32 250 06 32 250 06 32 250 06 32 250 06 32 250 06 32 250 06 32 250 06 32 250 06 32 250 06 32 250 06 32 250 06 32 250 06 32 250 07 32 250 07 32 250 07 32 250 07 32 250 07 32 250 07 32 250 07 32 250 07 32 250 07 32 250 07 32 250 07 32 250 07 32 250 07 32 250 07 32 250 07 32 250 07 32 250 07 32 20 32 20 32 20 32 20 32 20 32 20 32 20 32 20 32 20 32 20 32 20 32 20 32 20 32 35 20 32 20 32 20 32 20 32 20 32 20 35 35 35 35 35 35 35 35 35 35 35 35 35	9a 10 02 09 61 10 06 06 06 00 00 00 00 00 00 00 00 00 00	b0 06 b1 80 00 40 00 24 80 00 20 20 20 20 20 20 20 20 2	20 0d 4b 70 0d 01 f0 04 27 e0 0b f 30 02 3e d0 0b c3 00 05 c3 9e 10	00 bf 302 b0 03 b0 03 00 04 20 04 20 04 20 04 10 00 61 00 62 f0 06	00 ef 90 d5 b0 29 e0 0d bb 70 02 ee 10 0b d7 b0 ed 10 00 d7 b0 00 d7 b0 00 d7 b0 00 d7 00 d5 0 d5 0 d5 0 d5 0 d5 0 d5 0 d5 0 d5 0 d5 0 d5 0 d5 0 d5 0 d5 0 0 d5 0 0 d5 0 d5 0 0 0 0	bb 702 eee 10 0b d7 b0 0d d1 00d d1 00d d4 00 0d 00 00 f0 00 00 f0 00 bf	<pre>".BEg. 2.6ú. *; "8", 648</pre>	
Selected: (Offsel	: 412	=0×1	9c to	9413	=0×1	9d (2	: byte	e(s))											AN	ISI / OVR / L Size: 1051:	.36 //.

Figure 4: 2nd Frame Sync location

This Frame Sync has a 412 byte offset value.

Looking 10 bytes to the left of the Frame Sync, shows there is no IRIG timestamp and Status bytes. Therefore Minor Frame length (the number of bytes between Frame Syncs) can be calculated.

(412 bytes - 10 bytes) = 402 bytes or 201 16-bit Words

Since the Decom is set for 16 bit Words, reconfigure the Decom to look for **201** 16-bit word Minor Frames. The incoming data now indicates a Frame Lock in Figure 5.

🚰 MF Status
Overflow Count Kml 0 (Stream 1) Overflow Count DII 2
Minor Frame LOCK Time 222:15:17:06.067 Frame Count 26560 Lost 0 Clock Rate 1.000001 Mbps Maj Frame Rate 310.9
Irig State RTC Irig Time 222:15:17:06.156

Figure 5: Frame Lock Indicator

The Frame Lock affirms the Minor Frame length or it is a multiple of the Minor Frame length. To determine which is the case, look in the middle of the Raw Data Buffer in Figure 6.

MF Deco	m (Ls5	0P2) Card 1 FPI Se	rial Dat	a											×
Eile Fran	me List	Quick List Hardcop	by <u>S</u> hap	o File											
Cwl Wpf Num Sf	16 201 1	Sfld Word 2 Sfld Msb 5 Sfld Start 0	Setup 202 5	info	Minor Fr I FPI Card Mod	Rate 310. 16 de 0	9	Data Va Drdy Co Time	Stat alid YE punter Ox 22	us Info 29 200038FD 22:15:28:1	0 Fra 11.289741	mes Lost	Reset Co 0x00000	unter 000	
Pause	I				Paus	æ	F	lush Buffe	er						
					97	98	99	100	101	102	103	104	105	106	107
				0	0C20	BD04	E041	0420	43FA	F320	00D0	9C01	DOBB	00F0	A409
				1	0C20	BD04	E041	0420	43 <mark>F</mark> A	F320	0110	A003	50BB	00F0	A409
				2	0C20	BD04	E041	0420	43 <mark>F</mark> A	F320	0150	A405	10BB	00F0	A409
				3	0C20	BD04	E041	0420	43FA	F320	0190	A807	00BB	00F0	A409
				4	0C20	BD04	E041	0420	43FA	F320	0020	ACOD	10BB	00F0	A409
				5	0C20	BD04	E041	0420	43FA	F320	0060	BOOB	60BB	00F0	A409
				6	0C20	BD04	E041	0420	43FA	F320	00A0	B409	70BB	00F0	A409
				7	0C20	BD			43FA	F320	00E0	B807	70BB	00F0	A409
				8	0C20	BD F	RAME	SYNC	4. FA	F320	0120	BC05	80BB	00F0	A409
				9	0C20	BD04	E041	0420	43FA	F320	0160	C003	BOBB	00F0	A409
				10	0C20	BD04	E041	0420	43FA	F320	01A0	C402	30BB	00F0	A409
				11	0C20	BD04	E041	0420	43FA	F320	0030	C809	FOBB	00F0	A409
				12	0C20	BD04	E041	0420	43FA	F320	0070	030B	DOBB	00F0	A409
				13	0C20	BD04	E041	0420	43 <mark>F</mark> A	F320	00B0	070D	70BB	00F0	A409
				14	0C20	BD04	E041	0420	43FA	F320	00F0	OBOE	BOBB	00F0	A409
				15	0C20	BD04	E041	0420	43FA	F320	0130	OFOF	90BB	00F0	A409
L				•											F

Figure 6: Raw Data Buffer Mid Frame Inspection

This Frame Sync is offset by one byte midway down the current Minor Frame. Recalculating to reduce the Minor Frame length.

(201 16-bit words / 2) = 100.5 16-bit Words

Set the new Decom settings to **101** 16-bit Words with Word **101** set to **8** bits in length. Again look for a Frame Sync mid Minor Frame in the Raw Data Buffer, Figure 7.

MF Decom	n (Ls 5	0P2) Card 1 FF	PI Seria	l Dat	a											×
File Fram	ie List	Quick List Ha	rdcopy	Snap) File				-							
				Setup	Info			_		Sta	tus Info			Poort Co	unter	
UWI Wof	16	Stid Wi Stid Ma	ord 102 sh 5			Minor Fri FPI	Hate 521. 16	9	Data Va Drdu Co	alid Y Nunter D	165 MAAAAAA	0 Fra	mes Lost			
Num Sf	1	Sfld Sta	art 0			Card Mod	de Ö		Time	2	22:15:38:5	55.77063		0.00000	0.0	
Pause						Paus	se	F	ush Buffe	er						
						47	48	49	50	51	52	53	54	55	56	57
					0	C20B	D04E	0410	4204	3 FAF	3200	1507	D028	0880	OFOA	4096
					1	C20B	D04E	0410	4204	3 FAF	3200	1707	F01D	OBBO	OFOA	4096
					2	C20B	D04E	0410	4204	3FAF	3200	1908	1014	OBBO	OFOA	4096
					3	C20B	D04E	0410	4204	3FAF	3200	1B08	300C	OBBO	OFQA	4096
					4	C20B	D04E	0410	4204	3FAF	3200	0208	50B6	OBBO	OFOA	4096
					5	C20B	D04E	0410	4204	3FAF	3200	0408	70C4	OBBO	OFOA	4096
					6	C20B	D04E	0410	4204	3 FAF	3200	0608	90D1	OBBO	OFOA	4096
					7	C20B	D04E	0410	4204	3 FAF	3200	0808	BODC	0880	OFOA	4096
					8	C20B	D FR	AME S	YNC .	FAF	3200	0A08	D0E7	0880	OFOA	4096
					9	C20B	D			3FAF	3200	0C08	FOEF	0880	OFOA	4096
					10	C20B	D04E	0410	4204	3FAF	3200	0E09	10F6	OBBO	OFOA	4096
					11	C20B	D04E	0410	4204	3 FAF	3200	1009	30FB	OBBO	OFQA	4096
					12	C20B	D04E	0410	4204	3 FAF	3200	1209	50FE	OBBO	OFQA	4096
					13	C20B	D04E	0410	4204	3FAF	3200	1409	70FF	OBBO	OFQA	4096
					14	C20B	D04E	0410	4204	3FAF	3200	1609	90FE	OBBO	OFQA	4096
					15	C20B	D04E	0410	4204	3 FAF	3200	1809	BOFB	OBBO	OFOA	4096
				•	•					_						Þ

Figure 7: Raw Data Buffer, 2ndrMid Frame Inspection

This indicates the Minor Frame length is still twice the required size, recalculating.

(100.5 16-bit words / 2) = 50.25 16-bit Words

Change the Decom settings to **51** 16-bit Words with Word **51** set to **4** bits in length and look at the Raw Data Buffer for a Frame Sync mid Minor Frame - none was found. The Minor Frame length has been determined. Take the Decom out of the Raw Data mode to allow it to lock appropriately on the Minor Frame with no SFID.

Since the 16-bit Minor Frame Word count requires a variable word, calculate the Minor Frame length in 12 bit words.

(50.25 Word * 16 bits/Word) / 12 bits/Word = 67 12-bit Words

After setting these new values into the Decom, look at the Frame Buffer (indicated by <u>NO</u> **FPI** term in the banner), there are no dropped Frames seen in Figure 8.

MF De	com (Ls5	0P2) Card 1	Serial Da	ata											×
File F	rame List	Quick List	Hardcopy	Snap File											
Cwl Wpf Num	16 51 Sf 1	Sfid Sfid Sfid	Word 52 Msb 5 Start 0	Setup Info	Minor Fr FPI Card Mo	Rate 124 16 de 0	3.8	Data Va Data Va Time	Sta alid Y xannet U 2	tus Info /ES x00043A3 /22:15:51:	0	Frames 0x0000	Lost Res 0000	set Counte Analysis	3
Pau	se				Pau	ise	(T	lush Bufte	a.						
1					T1	T2	T3	T4	S1	1	2	3	4	5	6
				0	2202	5115	8417	7709	5045	FAF3	2001	8017	0880	BB00	F0A4
															•

Figure 8: Frame Buffer Showing No Lost Frames

Change the raw data buffer size to maximum (255 with this hardware). This buffer will be Frame aligned for easier inspection as seen in Figure 9.

MF D	ecom (Ls5	0P2) Card 1	FPI Seria	l Data	3											×
Eile	Frame List	Quick List	<u>H</u> ardcopy	<u>S</u> nap	File											
Cw Wp Nu	l 12 /f 67 m Sf 1	Sfld Sfld Sfld	tword 68 Msb 5 Start 0	Setup	Info	Minor Fr FPI Card Mo	Rate 124 255 de 0	3.8	Data V Drdy Co Time	Stat alid YI ounter 0x 22	us Info ES (000524) 23:18:44:	26 Fr 28.49919	ames Lost 10	Reset Co 0x0000	ounter 0000	
Pa	ause					Pau	se	Œ	lush Buffe	er.)						
						T1	T2	T3	T4	S1	1	2	3	4	5	6 🔺
					0	2302	4418	4928	9091	50AB	FAF	320	001	05D	0CA	OBB
					1	2302	4418	4928	9499	50AC	FAF	320	002	05E	0D1	OBB
					2	2302	4418	5028	9807	50AD	FAF	320	003	05F	0D7	OBB
					3	2302	4418	5028	0216	50AE	FAF	320	004	060	ODC	OBB
					4	2302	4418	5028	0624	50AF	FAF	320	005	061	0E2	OBB
					5	2302	4418	5028	1032	50B0	FAF	320	006	062	0E7	OBB
					6	2302	4418	5028	1440	50B1	FAF	320	007	063	0EB	OBB
					7	2302	4418	5028	1848	50B2	FAF	320	008	064	0EF	OBB
					8	2302	4418	FRA	ME SY	'NC 🏊	FAF	320	009	065	0F3	OBB
					9	2302	4418		2001	4	FAF	320	00A	066	0F6	OBB
					10	2302	4418	5028	3072	50B5	FAF	320	00B	067	0F9	OBB
					11	2302	4418	5028	3480	50B6	FAF	320	00C	068	OFB	OBB
					12	2302	4418	5028	3888	50B7	FAF	320	00D	069	0FD	OBB
					13	2302	4418	5028	4296	50B8	FAF	320	00E	06A	OFE	OBB
					14	2302	4418	5128	4604	50B9	FAF	320	00F	06B	OFF	OBB
					15	2302	4418	5128	5012	50BA	FAF	320	010	06C	OFF	OBB
					16	2302	4418	5128	5420	50BB	FAF	320	011	06D	OFF	OBB 🖵
				•	<u>آ</u>						<u> </u>					

Figure 9: Raw Data Buffer Shows No Lost Frames

Now use the Decom's Snap File feature which records a snapshot of the entire Raw Data Buffer into a text file. Using Excel to import this text file and organize the data into columns. Look for possible Subframe ID (SFID) data in Figure 10.

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	A	В	С	D	E	F	G	н	1	J	К	L	M	N	-
20	223:18:48	: 2302	4818	9233	9414	500F	FAF	320	12	01A	97	OBB	00F	0A4	
21	223:18:48	: 2302	4818	9233	9822	5010	FAF	320	13	01B	08F	OBB	00F	0A4	
22	223:18:48	: 2302	4818	9233	231	5011	FAF	320	14	01C	88	OBB	00F	0A4	
23	223:18:48	: 2302	4818	9233	639	5012	FAF	320	15	01D	80	OBB	00F	0A4	
24	223:18:48	: 2302	4818	9233	1047	5013	FAF	320	16	01E	77	OBB	00F	0A4	
25	223:18:48	: 2302	4818	9233	1455	5014	FAF	320	17	01F	70	OBB	00F	0A4	
26	223:18:48	: 2302	4818	9233	1863	5015	FAF	320	18	20	68	0BB	00F	0A4	
27	223:18:48	: 2302	48	SFID 0x1B	2271	5016	FAF	320	19	21	60	OBB	00F	0A4	
28	223:18:48	: 2302	4810	5255	2679	5017	FAF	320	01A	22	58	0BB	00F	0A4	
29	223:18:48	: 2302	48	SEID 0-01-	3087	5018	FAF		01B	23	51	OBB	00F	0A4	
30	223:18:48	: 2302	48	SFID 0X01-	3495	5019	FAF	320	1	24	51	OBB	00F	0A4	
31	223:18:48	: 2302	4818	9333	3803	501A	FAF	320	2	25	58	OBB	00F	0A4	
32	223:18:48	: 2302	4818	9333	4211	501B	FAF	320	3	26	60	OBB	00F	0A4	
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Rea	idy 🔛											100% (3	2 - e	2 .::

Figure 10: Reviewing Raw Data Snapshot for SFID Data

The SFID is seen to rollover at 27 and starts with 1, indicating a total of 27 Minor Frames. Using this new information and making note of the SFID bit alignment, make final Decom settings for this Frame as shown in Figure 11.



Figure 11: Final Decom Configuration with Solid Locks

l 12 of 67 mSf 27	Sild Word 3 Sild Msb 4 Sild Start 1	up Info	Minor Fr FPI Card Mo	Rate 124 255 de 0	3.8	Data V Drdy Co Time	Stat slid Y punter 0: 2	tus Info ES k0001F90 23 19:03	27,75404	Frames 0x0000	Lost Rese 10000 A	rt Count nalysis	er (
ause			Pau	se	F	lush Buffe	er 🛛						
	-		T1	T2	T3	T4	S1	1	2	3	4	5	6
i.		1	2302	0319	7727	5757	7001	FAF	320	001	003	0F9	OB
		2	2302	0319	7527	5348	7002	FAF	320	002	0B2	010	OB
1		3	2302	0319	7527	5756	7003	FAF	320	003	0B3	00C	OB
		4	2302	0319	7527	6164	7004	FAF	320	004	084	009	OB
		5	2302	0319	7527	6572	7005	FAF	320	005	085	006	OB
		6	2302	0319	7527	6980	7006	FAF	320	006	086	004	OB
		7	2302	0319	7527	7388	7007	FAF	320	007	087	002	0B
		8	2302	0319	7527	7796	7008	FAF	320	800	088	001	OB
		9	2302	0319	7627	8104	7009	FAF	320	009	089	000	OB
		10	2302	0319	7627	8512	700A	FAF	320	00A	OBA	000	OB
		11	2302	0319	7627	8920	7008	FAF	320	00B	OBB	000	0B
		12	2302	0319	7627	9328	700C	FAF	320	000	OBC	001	OB
		13	2302	0319	70-77	0700	7000	FAF	320	00D	nen	902	0B
		14	2302	0319	FR/	AMESY	NC -	FAF	320	00E	SFID	04	OB
		15	2302	0319	7627	0553	700F	FAF	320	00F	UBF	006	0B
		16	2302	0319	7627	0961	7010	FAF	320	010	000	009	0B
		17	2302	0319	7627	1369	7011	FAF	320	011	0C1	00C	OB
		18	2302	0319	7627	1777	7012	FAF	320	012	0C2	010	OB
		19	2302	0319	7627	2185	7013	FAF	320	013	0C3	014	OB
		20	2302	0319	7627	2593	7014	FAF	320	014		018	OB
		21	2302	0319	7727	2901	7015	FAF	320	015	0C5	01D	OB
		22	2302	0319	7727	3309	7016	FAF	320	016	0C6	023	OB
		23	2302	0319	7727	3717	7017	FAF	320	017	0C7	028	OB
		24	2302	0319	7727	4125	7018	FAF	320	018	0C8	02E	0B
		25	2302	0319	7727	4533	7019	FAF	320	019	000	035	OB
		26	2302	0319	7727	4941	701A	FAF	320	01A	001	03B	OB
		27	2302	0319	7727	5349	701B	FAF	320	018	002	042	OB

Finally, Looking at the Frame Buffer, no lost Frames are seen in Figure 12.

The IRIG Chapter 4 Frame Format has been determined and can be recorded for later data reduction by Analysts.

CONCLUSIONS

This example was based on a 12-bit word, 24 bit Frame Sync Encoder. If this had been based on an encoder using 8-bit words the SFID would be bit shifted. This shift would still be identified with this technique. To further investigate the SFID alignment, there is a binary Data Radix display mode for the Raw Data and Frame Buffers. The data can be paused and the displayed data can be reviewed to more easily identify the SFID rollover pattern in this binary form.

This investigative approach has been successfully used for 32 and 16-bit Frames Syncs also. Other word length data and Frame Syncs will require changing the bits per word after finding the proper Frame Sync pattern to align bit boundaries. Resulting fill data will need to be taken into account when determining the final Decom configuration.

REFERENCES

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- [2] Lumistar Inc., "P2" Platform PCM Decommutator LS-50-P2 (R5) Technical Manual, Document U500501, August 2008