

Soft Decision Error Decoding with the AMBE-2000/2020 Vocoder Chips

In modern communication systems the transmitter transmits information in the form of symbols. The demodulator takes the received signal and tries to decide which symbol was transmitted. In other words, the demodulator is making a decision based on the signal received. For instance, in a binary system, the symbols could be represented by a 1 and a 0. Because of interference and many other factors, these signals can be misinterpreted because of channel degradation. Significant improvement in FEC performance can be added by setting up the receiver so that the demodulator is making a finer estimation of the received energy prior to the decoder, this is called soft-decision decoding. There is a link below that describe this in more detail.

<http://www.mathworks.com/access/helpdesk/help/toolbox/commblocks/usersguide/tutor135.shtml>

The AMBE-2000/2020 utilizes a 4 bit soft decision decoder. The bits are defined as follows:

Decision Value (Binary)	Interpretation
0000	Most confident 0
0111	Least confident 0
1000	Least confident 1
1111	Most confident 1

Placing a logic high on pin 79 of either the AMBE-2000™ or AMBE-2020™ vocoder chips enables the soft decision error correction on the decoder. Enabling the soft-decision does nothing to the encoder packet. The packet will look like a normal encoded packet. The user must implement circuitry at the receive end of the channel for making a finer (4 bit) estimation of the received energy (see above link for an explanation of how this can be done).

The AMBE-2000/2020 decoder packet structure is altered. The decoder expects each voice data bit of the encoded packet to be represented by 4 soft decision (SD) bits. The decoder will make the decision of whether or not a 1 or a 0 is represented by the SD bits. Table 1 is an example of a soft-decision decoder packet.

20 ms frame	60 sixteen-bit words = 120 bytes = 960 bits	(12) 16 bit words of overhead (192 bits)	Word #	Description			
			0	Header always set to 0x13EC			
			1	Power Control (8 bits)		Control Word 1 (8 bits)	
			2	Rate info 0			
			3	Rate info 1			
			4	Rate info 2			
			5	Rate info 3			
			6	Rate info 4			
			7	Unused in Input			
			8	Unused in Input			
			9	Unused in Input			
			10	DTMF Control			
		11	Control Word 2				
		12	SD0	SD1	SD2	SD3	
		13	SD4	SD5	SD6	SD7	
		14	SD8	SD9	SD10	SD11	
		15	SD12	SD13	SD14	SD15	
		16	SD16	SD17	SD18	SD19	
		17	SD20	SD21	SD22	SD23	
		18	SD24	SD25	SD26	SD27	
		19	SD28	SD29	SD30	SD31	
		20	SD32	SD33	SD34	SD35	
		21	SD36	SD37	SD38	SD39	
		22	SD40	SD41	SD42	SD43	
		23	SD44	SD45	SD46	SD47	
		24	SD48	SD49	SD50	SD51	
		25	SD52	SD53	SD54	SD55	
		26	SD56	SD57	SD58	SD59	
		27	SD60	SD61	SD62	SD63	
		28	SD64	SD65	SD66	SD67	
		29	SD68	SD69	SD70	SD71	
		30	SD72	SD73	SD74	SD75	
		31	SD76	SD77	SD78	SD79	
		32	SD80	SD81	SD82	SD83	
		33	SD84	SD85	SD86	SD87	
		34	SD88	SD89	SD90	SD91	
		35	SD92	SD93	SD94	SD95	
		36	SD96	SD97	SD98	SD99	
		37	SD100	SD101	SD102	SD103	
		38	SD104	SD105	SD106	SD107	
		39	SD108	SD109	SD110	SD111	
		40	SD112	SD113	SD114	SD115	
		41	SD116	SD117	SD118	SD119	
		42	SD120	SD121	SD122	SD123	
		43	SD124	SD125	SD126	SD127	
		44	SD128	SD129	SD130	SD131	
		45	SD132	SD133	SD134	SD135	
		46	SD136	SD137	SD138	SD139	
		47	SD140	SD141	SD142	SD143	
		48	SD144	SD145	SD146	SD147	
		49	SD148	SD149	SD150	SD151	
		50	SD152	SD153	SD154	SD155	
		51	SD156	SD157	SD158	SD159	
		52	SD160	SD161	SD162	SD163	
		53	SD164	SD165	SD166	SD167	
		54	SD168	SD169	SD170	SD171	
		55	SD172	SD173	SD174	SD175	
		56	SD176	SD177	SD178	SD179	
		57	SD180	SD181	SD182	SD183	
58	SD184	SD185	SD186	SD187			
59	SD188	SD189	SD190	SD191			

Table 1. Soft-Decision Decoder Packet