



234 Littleton Road
Westford, MA 01886 USA

Tel: (978) 392-0002
Fax: (978) 392-8866

e-mail: info@dvsinc.com
www.dvsinc.com

AMBE-3000FTM-SAT Vocoder Chip Description

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Digital Voice Systems, Inc.
234 Littleton Rd.
Westford, MA 01886 USA
Phone: (978) 392 0002
Fax: (978) 392 8866
Email: info@dvsinc.com

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1 Introduction

This document provides details of features that have been added to the AMBE-3000F™ vocoder chip to create the AMBE-3000F™-SAT. This chip is identical** to the AMBE-3000F™ vocoder chip except that it supports additional custom rates. These included rates provide full interoperable with the following satellite networks:

- TerreStar (Rates = 2450 bps and 4000 bps)
- MexSat (Rates = 2450 bps and 4000 bps)
- GlobalStar (Rate = 4000 bps)

**NOTE: For full details regarding the AMBE-3000™ SAT chip refer to the AMBE-3000F™ Users Manual.

2 Additional Rates (Rate 62 and Rate 63)

The AMBE-3000F™-SAT vocoder chip supports all the same rates and features as described in the AMBE-3000F™ vocoder chip User's Manual with two additional rates indexes (Rate 62 and Rate 63). Interleaving is disabled for both of these rates. Note that for the AMBE-3000™, interleaving occurs even for rates that do not use FEC however, these two rates have interleaving disabled.

AMBE-3000F™-SAT Vocoder Chip Rates			
Rate Index #	Total Rate (bps)	Speech Rate (bps)	FEC Rate
62	2450	2450	0
63	4000	4000	0

Table 1 Rate Index Numbers

Total Rate (bps)	Speech Rate (bps)	FEC Rate (bps)	RCW 0	RCW 1	RCW 2	RCW 3	RCW 4	RCW 5	Hardware Pin Numbers					
									121 / E5	122 / A4	123 / B4	124 / C4	125 / D4	126 / A3
2450	2450	0	0x0631	0x0754	0x0000	0x0000	0x0000	0x0331	1	1	1	1	1	0
4000	4000	0	0x064F	0x0986	0x0000	0x0000	0x0000	0x0350	1	1	1	1	1	1

Table 2 Rate control words

The rate for the AMBE-3000F™-SAT Vocoder Chip can be set through hardware pins or control words. For additional information regarding setting the rate with control words refer to the PKT_RATE_T or PKT_RATE_P packet section in the AMBE-3000F™ User’s Manual.

2.1 PKT_RATE_T field (2 bytes total)

PKT_RATE_T Field – TerreStar and MexSat @ 2450 bps	
Field Identifier	Control Field Data
1 Byte	1 Byte
0x09	0x3E

Table 3 PKT_RATE_T Field for TerreStar and MexSat @ 2450bps

PKT_RATE_T Field – TerreStar, MexSat, and GlobalStar @ 4000 bps	
Field Identifier	Control Field Data
1 Byte	1 Byte
0x09	0x3f

Table 4 PKT_RATE_T Field for TerreStar, MexSat, and GlobalStar @ 4000 bps

2.2 PKT_RATE_P field (13 bytes total) Custom Rate words

PKT_RATE_P Field – TerreStar and MexSat @ 2450 bps						
Field Identifier	Control Fields Data					
1 Byte	Rate Control Words (6 Words)					
0x0A	0x0631	0x0754	0x0000	0x0000	0x0000	0x0331

Table 5 PKT_RATE_P Field for TerreStar and MexSat @ 2450bps

PKT_RATE_P Field – TerreStar, MexSat, and GlobalStar @ 4000 bps						
Field Identifier	Control Fields Data					
1 Byte	Rate Control Words (6 Words)					
0x0A	0x064F	0x00986	0x0000	0x0000	0x0000	0x0350

Table 6 PKT_RATE_P Field for TerreStar, MexSat, and GlobalStar @ 4000 bps

3 Revised Packet Fields

The AMBE-3000F™-SAT has two control packet response fields that are different than the ones found in the AMBE-3000F™ User’s Manual. They are in response to the PKT_PRODID and the PKT_VERSTRING control packets. Other than these two revised

control field response packets all other control packet fields are the same as for AMBE-3000F™ vocoder chip.

3.1 PKT_PRODID Response field (11 byte)

This field is a null-terminated string that contains the AMBE-3000F™-SAT product identification as
"AMBE3000SATF"

PKT_PRODID Response Field - AMBE-3000™-SAT	
Field Identifier	Response Field Data
1 Byte	varies <= 16 Bytes
0x30	Product ID Data ("AMBE3000SATF")

Table 7 PKT_PRODID Response Field

3.2 PKT_VERSTRING Response field (n + 2 bytes)

This field is a null-terminated string that contains the product version number for the AMBE-3000F™-SAT as
"V140.E100.XXXX.C107.G514.R011.A0030608.C0020208"

PKT_VERSTRING Response Field – AMBE-3000™-SAT	
Field Identifier	Response Field Data
1 Byte	varies <= 48 Bytes
0x31	Version Data ("V140.E100.XXXX.C107.G514.R011.A0030608.C0020208")

Table 8 PKT_VERSTRING Response Field

4 Additional Packet Fields

Besides the two revised control packet fields the AMBE-3000F™-SAT provides the following additional packet field:

4.1 PKT_STEAL field (2 bytes total)

PKT_STEAL is used to support bit-stealing for **rate 62 only**. The PKT_STEAL packet can be used in speech packets to steal bits from the encoder as well as, in channel packets to specify the number of bits that were stolen bits to the decoder.

PKT_STEAL Field – Format		
Field Identifier	Control Field Data	
1 Byte	4 Bits (MSBs)	4 Bits (LSBs)

0x4F	Bits to steal from the encoder	Number of bits stolen
------	--------------------------------	-----------------------

Table 9 PKT_STEAL Field Format

4.1.1 PKT_STEAL can be input into speech packets

The 4 MSBs of the control field data byte specify the number of bits that will be stolen from the encoder. The 4 LSBs must be 0. The value of the 4 MSBs must be either 0,1,2,3, or 4. (see Table 10 PKT_STEAL Field Values for Speech Packets)

The resulting channel packet will have the requested number of bits stolen. Stolen bits are output as “0” in the resulting channel packet.

Values for PKT_STEAL Control Field for Speech Packets		
Description	4 Bits (MSBs)	4 Bits (LSBs)
	1 byte	
Steal one bit from encoder	0x1	0x0
Steal two bits from encoder	0x2	0x0
Steal three bits from encoder	0x3	0x0
Steal four bits from encoder	0x4	0x0

Table 10 PKT_STEAL Field Values for Speech Packets

4.1.2 PKT_STEAL can be input into Channel Packets

For codec mode, the 4 MSBs of the control field data byte specify the number of bits to be stolen from the encoder. The 4 LSBs specify to the decoder, the number of bits that were stolen. The value of the MSBs and the LSBs must be between 0 and 4 bits. (0x0 to 0x4)

Values for PKT_STEAL Control Field for Channel Packets (Codec Mode)		
Description	4 Bits (MSBs)	4 Bits (LSBs)
	1 byte	
	number of bits to steal from encoder	the number of bits that were stolen

Table 11 PKT_STEAL Field Values for Channel Packets (Codec Mode)

For packet mode, the 4 MSBs of the control field data byte must be 0 (0x0). The 4-LSBs are used to tell the decoder how many bits were stolen in the current channel packet. (see Table 12 PKT_STEAL Field Values for Channel Packets (Packet Mode)).

Values for PKT_STEAL Control Field for Channel Packets (Packet Mode)		
Description	4 Bits (MSBs)	4 Bits (LSBs)
(tells the Decoder)	1 byte	
No bits were stolen from encoder	0x0	0x0
One bit was stolen from encoder	0x0	0x1
Two bits were stolen from encoder	0x0	0x2

Three bits were stolen from encoder	0x0	0x3
Four bits were stolen from encoder	0x0	0x4

Table 12 PKT_STEAL Field Values for Channel Packets (Packet Mode)

4.1.3 PKT_STEAL may be output in channel packets.

For codec mode, PKT_STEAL will be output in a channel packet in response to an input channel packet that includes a PKT_STEAL field requesting that bits be stolen from the encoder. When bit stealing is used, the PKT_STEAL field in the output packets, indicates the number of bits that were stolen from the channel data for the current packet.

Note: that for codec mode, PKT_STEAL is only output in response to a PKT_STEAL field input in a prior input channel packet.

For packet mode, PKT_STEAL will be output in the response channel packet when PKT_STEAL is input in the speech input packet and the number of stolen bits is greater than 0. The 4 LSBs of the succeeding byte indicate how many bits were stolen from the encoder.

Note: that for packet mode, PKT_STEAL is only output in the response channel packet if PKT_STEAL is used in the input speech packet.

4.2 PKT_TONEXMT (0x50) is followed by 3 bytes (idx, amp, dur).

The field specifies that the encoder produce a tone.

PKT_TONEXMT Field – Format			
Field Identifier	Control Field Data		
	3 Bytes		
1 Byte	Idx (1 byte)	amp (1byte)	dur (1byte)
0x50	See User's Manual	See User's Manual	0x0 to 0xFF

Table 13 PKT_TONEXMT Field Format

Idx specifies the index of the tone. See AMBE-3000F™ User's Manual for detailed information. Refer to the tone table for idx.

Amp specifies the level of the tone in dbm0 (-90 <= amp <= +3). AMBE-3000F™ User's Manual for detailed information. Refer to the tone amplitude values table.

Dur specifies the duration of the tone in 20 ms frames. The value set in dur will indicate the number of 20ms frames to make the tone last. As a special case, the value of dur=255 (0xFF) requests that the encoder output a tone indefinitely, or until a new PKT_TONEXMT field with a duration of less than 255 is received.

For packet mode, it can be used for input speech packets.

For codec mode, it can be used for input channel packets.

4.3 PKT_TONEGEN (0x51) is followed by 3 bytes (idx, amp, dur).

The field specifies that the decoder synthesizes a tone (the channel data is ignored).

PKT_TONEGEN Field – Format			
Field Identifier	Control Field Data		
	3 Bytes		
1 Byte	Idx (1 byte)	amp (1byte)	dur (1byte)
0x51	See User's Manual	See User's Manual	0x0 to 0xFF

Table 14 PKT_TONEGEN Field Format

Idx specifies the index of the tone. See AMBE-3000F™ User's Manual for detailed information. Refer to the tone table for idx.

Amp specifies the level of the tone in dbm0 ($-90 \leq \text{amp} \leq +3$). AMBE-3000F™ User's Manual for detailed information. Refer to the tone amplitude values table.

Dur specifies the duration of the tone in 20 ms frames. The value set in dur will indicate the number of 20ms frames to make the tone last. As a special case, the value of dur=255 (0xFF) requests that the encoder output a tone indefinitely, or until a new PKT_TONEGEN field with a duration of less than 255 is received.

For packet mode it can be used for input channel packets.

For codec mode, it can be used for input channel packets

4.4 PKT_TONEDET (0x52) is followed by 2 bytes (idx, amp).

It occurs in output channel packets only if enabled using a preceding PKT_TONEMODE field. The packet indicates the index and the amplitude of a tone detected by the encoder. PKT_TONEMODE field is used to specify when PKT_TONEDET is output. The choices are “never”, “always”, “only when the index changes”, or “only when the index is a valid tone”.

Note that by default the tone mode is “never” meaning that PKT_TONEDET will not occur in the output channel packets. If the mode is set to “always” then every channel packet output will contain this field. Packets for which there was no tone detected will contain idx=0xFF (255) and amp=0xA6 (-90).

PKT_TONEDET Field – Format		
Field Identifier	Control Field Data	
	2 Bytes	
1 Byte	idx (1 byte)	amp (1byte)
0x52	See User's Manual	See User's Manual

Table 15 PKT_TONEDET Field Format

4.5 PKT_TONERCV (0x53) is followed by 2 bytes (idx, amp).

PKT_TONEMODE field is used to specify when PKT_TONERCV is output. The choices are “never”, “always”, “only when the index changes”, or “only when the index is a valid tone”.

PKT_TONERCV Field – Format		
Field Identifier	Control Field Data	
	2 Bytes	
1 Byte	idx (1 byte)	amp (1byte)
0x53	See User’s Manual	See User’s Manual

Table 16 PKT_TONERCV Field Format

Note that by default the tone mode is “never” meaning that PKT_TONERCV will not occur in the output packets. If the mode is set to “always” then every channel packet (codec mode) / speech packet (packet mode) output will contain this field. Packets for which there was no tone received will contain idx=0xFF (255) and amp=0xA6 (-90).

For packet mode, it occurs in output speech packets only if enabled using a preceding PKT_TONEMODE field. The packet indicates the index and the amplitude of a tone received by the decoder.

For codec mode, it occurs in output channel packets only if enabled using a preceding PKT_TONEMODE field.

4.6 PKT_TONEMODE (0x54) is followed by a single byte named “mode”.

This is a control packet. The response field will have PKT_TONEMODE followed by 0. The mode byte specifies the tone reporting mode. This field determines when/if PKT_TONEDET and PKT_TONERCV fields are output. By default, PKT_TONEDET and PKT_TONERCV fields are not output.

Bits 1 and 0 determine when PKT_TONEDET is output.

Bits 5 and 4 determine when PKT_TONERCV is output.

The remaining bits in mode are reserved and should be input as “0”.

PKT_TONEMODE Field – Format	
Field Identifier	Control Field Data “Mode”
1 Byte	1 Byte
0x54	See Table 18 PKT_TONEMODE Field Values for “Mode”

Table 17 PKT_TONEMODE Field Format

Values for PKT_TONEMODE Control Field “Mode”	
Description	Mode (1 byte)
	Bits
	7 6 5 4 3 2 1 0
encoder tone detection status is never reported by PKT_TONEDET	R R X X R R 0 0
encoder tone detection status is always reported by PKT_TONEDET	R R X X R R 0 1
encoder tone detection status is only reported by PKT_TONEDET when the tone idx changes	R R X X R R 1 0
encoder tone detection status is only reported by PKT_TONEDET when the tone idx indicates a valid tone	R R X X R R 1 1
decoder tone reception status is never reported by PKT_TONERCV	R R 0 0 R R X X
decoder tone reception status is always reported by PKT_TONERCV	R R 0 1 R R X X
decoder tone reception status is only reported by PKT_TONERCV when the tone idx changes	R R 1 0 R R X X
decoder tone reception status is only reported by PKT_TONERCV when the tone idx indicates a valid	R R 1 1 R R X X

Table 18 PKT_TONEMODE Field Values for “Mode”

Note that R = reserved for future use and should be set to 0
Note that X = don’t care.