

TWELP™ 3600 bps Vocoder



[TWELP vocoders](#), [TWELP 1200 bps](#), [TWELP 2400 bps](#)

November 24, 2011 - DSP Innovations Inc. (DSPINI) announces proprietary 2400/3600 bps vocoder, based on the newest speech coding technology TWELP™, for DMR/dPMR and other markets.

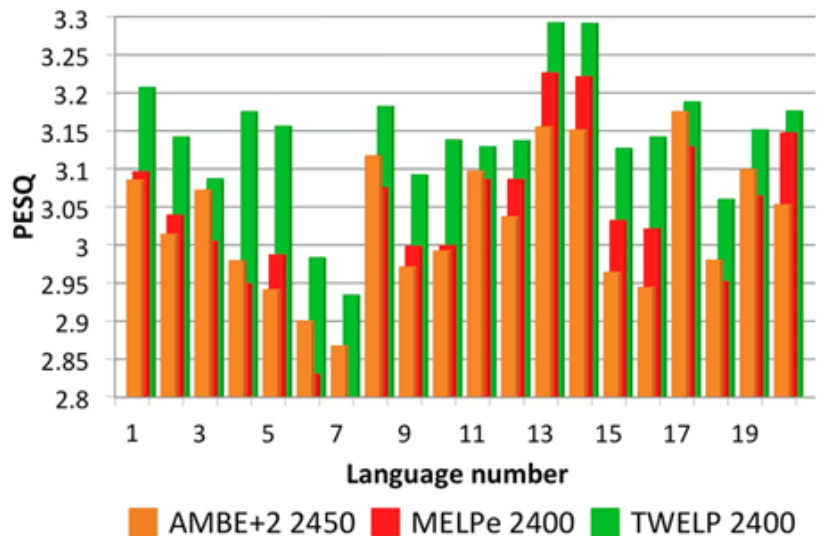
TWELP™ technology features. The vocoder is based on newest technology of speech coding called "Tri-Wave Excited Linear Prediction"™ (TWELP) that was developed by experts of DSPINI. The technology provides the best speech quality among competitors today. Please visit: <http://twelp.pro> for details.

Superiority in speech quality. Here is the comparison with AMBE+2 vocoder. TWELP 2400 bps vocoder and AMBE-3000 HDK (Rate#33: AMBE+2 2450 bps vocoder) were tested, using ITU-T P.50 speech base for 20 different languages. ITU-T P.862 utility was used for estimation of the speech quality in PESQ terms:

Data for the chart: speech quality (in PESQ)

		AMBE+2	MELPe	TWELP
1	American	3,085	3,096	3,207
2	Arabic	3,014	3,039	3,142
3	British	3,072	3,005	3,087
4	Chinese	2,979	2,949	3,175
5	Danish	2,941	2,987	3,156
6	Dutch	2,9	2,83	2,983
7	Finnish	2,867	2,791	2,934
8	French	3,117	3,075	3,182
9	German	2,971	2,998	3,092
10	Greek	2,992	2,999	3,138
11	Hindi	3,097	3,086	3,129
12	Hungarian	3,037	3,086	3,137
13	Italian	3,155	3,226	3,292
14	Japanese	3,151	3,221	3,291
15	Norwegian	2,964	3,032	3,127
16	Polish	2,944	3,021	3,142
17	Portuguese	3,175	3,129	3,188
18	Russian	2,98	2,952	3,06
19	Spanish	3,099	3,064	3,151
20	Swedish	3,053	3,147	3,176
Average:		3,02965	3,03665	3,13945
TWELP advantage over AMBE+2:		+ 0,1098		
TWELP advantage over MELPe:		+ 0,1028		

Speech Quality Comparison
TWELP 2400 vs MELPe 2400 & AMBE+2 2450



A diagram demonstrates significant superiority of TWELP over AMBE+2 and MELPe in speech quality.

A few independent experts tested by listening TWELP vocoder in comparison with AMBE+2 and MELPe 2400, using method of preferences. Majority of experts preferred AMBE+2 to MELPe and significant majority of the experts preferred TWELP to AMBE+2 and MELPe, having noted much more natural human-sounding of voice in the TWELP vocoder.

Superiority in quality of the non-speech signals. In contrast to other LBR vocoders (MELPe, AMBE+2, etc.), TWELP vocoders provide high quality of non-speech signals, including police, ambulance, fire sirens, etc. This feature in conjunction with high quality natural human-sounding of voice makes TWELP vocoders well suitable for replacement of analog radio by digital radio and also for other applications where high quality transmitting of non-speech signals is relevant along with high quality transmitting of speech signals.

High robustness to acoustic noise. In contrast to other LBR vocoders, TWELP vocoders are well robust to acoustic noise thanks to robust reliable method of pitch estimation and other features of TWELP technology.

High Robustness to the channel errors. "Robust" versions of the TWELP vocoders include FEC that are integrated with vocoder on base of "joint source-channel coding" approach that provides high speech quality simultaneously in noisy channel as well as in noiseless channel. FEC can operate with "soft decisions" as well as with "hard decisions" from a modem. Mode of "soft decisions" provides much better robustness in comparison with mode of "hard decisions".

Additional functionalities. The following additional functionalities are developed by DSPINI and integrated into TWELP vocoders:

- Automatic Gain Control (AGC),
- Noise Cancellation for Speech Enhancement (NCSE)
- Voice Activity Detector (VAD),
- Tone Detection/Generation (Single tones and Dual tones). The tones are transmitted through vocoder.

Technical characteristics and resource requirements:

Technical characteristics

Bit Rate w/o FEC / with FEC (bps)	Algorithm	Frame size (ms)	Algorithmic delay (including frame size) (ms)	Sampling rate (kHz)	Signal format	Bit stream format
2400/3600	TWELP	20	40	8	Linear 16-bit PCM	48/72

Additional functionalities

Name	Functionality	Technical characteristics	
		Name	Value
AGC	Automatic Gain Control	Control range:	0 ... +20 dB
NCSE	Noise Canceller - Speech Enhancer	SNR increasing	> 6 dB
		Speech quality improvement	> 0.1 PESQ
Tone Detector	Single/Dual tones detection	In accordance with international standards	
Tone Generator	Single/Dual tones generation	Special generator, kept continuity of signal (phase and amplitude of signal of previous frame)	
VAD	Voice Activity Detection	Reliable detection speech in background noise	
CNG	Comfort Noise Generation	Type of noise	"white"
		Level	- 60 dB

Resources for TI's C64 DSP platform

Module	MIPS* peak	Memory (KBytes)			
		Program	Data		
			Constants	Channel	Heap
Voice Encoder	20.8				

NCSE	3.7	322	37	11.8	6.0	2.1
AGC	0.1					
Voice Decoder	5.5					
Voice Encoder + Voice Decoder	26.3					
Total	30.1					

Resources (estimated) for TI's C55 DSP platform

Module	MIPS* peak	Memory (KBytes)				
		Program	Data			
			Constants	Channel	Heap	Stack
Voice Encoder	32	32	50	12.2	6.0	2.1
FEC Encoder	0.2					
NCSE	6.9					
AGC	0.2					
FEC Decoder	5					
Voice Decoder	10.0					
Voice Encoder + Voice Decoder	42					
Total	54.3					

* DSPINI continues optimization of the TWELP algorithm and code in order to minimize computational complexity of the vocoder.

Guarantee and support. DSPINI guarantees a quality and accordance of all technical characteristics of the product to requirement of current specifications. Testing and other method of quality control are used for guarantee support.

Any platform. DSPINI can port this vocoder software into any other DSP, RISC or general- purposes platform inshort time: 2-3 months.

Microchip. TWELP 2400/3600 bps vocoder is available also as chip (IC) from [CML Microcircuits](http://www.cml-microcircuits.com).



Licensing terms. To use the vocoder, customer should obtain a license from DSPINI only.

Low price is another advantage of this vocoder. Please contact us to check it out.

Prospects. DSPINI are developing a set of new vocoders with range from 600 bps up to 9600 bps, based on TWELP technology. Please visit the <http://twelp.pro> web-site to get more information.

Related software. This vocoder may be effectively used in a bundle with other DSPINI's products:

- Linear and acoustic echo cancellers,
- Multichannel noise cancellers (including two-microphone adaptive array),
- Wired or radiomodems for any types of channels and bitrates,
- Other products.

More DSPINI's products on <http://www.dspini.com>

Please contact to evaluate and purchase:

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