

# TWELP™ 480 bps Vocoder



[TWELP vocoders](#), [TWELP 300 bps](#), [TWELP 480 bps](#), [TWELP 600 bps](#), [TWELP 1200 bps](#), [TWELP 2400 bps](#), [TWELP Robust 3600 bps](#)

*March 18, 2015 - DSP Innovations Inc. (DSPINI) announces proprietary 480 bps vocoder (exact bit rate is 478.125 bps), based on the newest speech coding technology TWELP™, for HF Radio 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.

**Speech quality.** TWELP 480 bps vocoder was 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. Average PESQ (2.24) is close to MELPe 600 bps vocoder (2.31)

A few independent experts tested by listening TWELP 480 vocoder and found that speech quality and intelligibility of the TWELP 480 bps vocoder is acceptable for voice communication, especially in hard conditions. Moreover, they found that in spite of the such low bit rate, vocoder keeps even recognizability of voice of speaker.

**Quality of the non-speech signals.** In spite of the very low bit rate, TWELP 480 bps vocoder provides acceptable quality of non-speech signals, including police, ambulance, fire sirens, etc. This feature in conjunction with acceptable speech quality makes TWELP 480 bps vocoder well suitable for usage in applications, where analog radio is used traditionally, but in such conditions, when analog radio is not capable to work at all.

**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 (bps)	Algorithm	Frame size (ms)	Algorithmic delay (including frame size) (ms)	Sampling rate (kHz)	Signal format	Bit stream format
478.125	TWELP	320	340	8	Linear 16-bit PCM	153

**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 ARM Cortex-M4 platform

Module	MIPS* peak	Memory (KBytes)				
		Program	Data			
			Constants	Channel	Heap	Stack
Voice Encoder	32.1	41	36	4.7	11.2	1.0
NCSE	7.5					
AGC	0.2					
Voice Decoder	12.7					
Voice Encoder + Voice Decoder	44.8					
Total	51.4					

\* MIPS is measured on STM32F4DISCOVERY board by usage of cycle counter register DWT\_CYCCNT.

\* Program and tables are placed in Flash memory.

\* State, heap and stack are placed in RAM memory.

Note that floating point unit (FPU) is not used.

### Resources for TI's C64 DSP platform

Module	MIPS* peak	Memory (KBytes)				
		Program	Data			
			Constants	Channel	Heap	Stack
Voice Encoder	11.2	75	54	4.7	10.2	1.0
NCSE	3.7					
AGC	0.1					
Voice Decoder	3.7					
Voice Encoder + Voice Decoder	14.9					
Total	17.6					

### Resources (estimated) for TI's C55 DSP platform

Module	MIPS* peak	Memory (KBytes)				
		Program	Data			
			Constants	Channel	Heap	Stack
Voice Encoder	21.9					
NCSE	6.9					

AGC	0.2	33	54	4.7	10.2	1.0
Voice Decoder	8.4					
Voice Encoder + Voice Decoder	30.3					
Total	34.1					

\* 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.

**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 300 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.

[Download a datasheet \(pdf\)](#)

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

Please contact to evaluate and purchase:

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