

### Overview

Acoustic Echo Canceller (AEC) – is the vital VoIP component for all modern communication devices like mobile phones, smart phones, tablet PCs etc. Acoustic Echo Canceller enables full duplex hands-free communication and have to suppress echo even in noisy and non-linear environment working through poor speakers and microphones.

Traditional 8kHz AEC consumes too many memory and CPU resources and still cant be practically used in multimedia gadgets which mostly have ARM-like processor with small internal cache and low-speed memory to keep power consumption as small as possible. Everybody knows that wide band VoIP is progressive technology and voice being sampled at 16kHz sounds very native and clear. Taking into account memory and performance restrictions of mobile processors nobody expects to see true acoustic echo cancellation there. All known gadgets have been using simplified narrow band AEC-like ad-hoc techniques to suppress echo somehow and, of course, it works awful – unsuppressed echo, audible distortions and musical noise make hands-free communication uncomfortable.

Fortunately there is a good solution bringing true wide band quality in mobile and hand-held devices. IntegrIT has developed nonlinear wide-band acoustic echo canceler **IntegrIT AEC WB**, based on proprietary **IntegrIT CrystalSpeech** technology. **IntegrIT AEC WB** is especially suitable for small communication devices with limited resources. It can work in both narrow/wide band modes and consumes minimum resources to fit in mobile processors. **IntegrIT AEC WB** works reliably in wide range of environmental conditions and insensitive to many dynamic impacts.

### Features

- Wide band voice representation at 16kHz sampling rate returning true 8kHz voice bandwidth.
- Variable echo path in range 64-512msec.
- Computationally light so it can be used in video conferencing even on portable devices.
- Consumes less data memory and therefore minimizes memory read/write operations, cache misses and stall cycles due to cache invalidation.
- Insensitive to synchronization between playback and recording paths.
- Insensitive to audio path non-linearity.
- Integrated noise suppression and automatic gain control functions enable communications even in very noisy places
- Perfectly integrated with wide band vocoders G711.1, G729.1, G722 and AMR WB.
- Support dynamic switching in narrow band (8kHz) mode.
- Ready for usage in Android, MeeGo, Symbian, iPhone smartphones.
- Several profiles for various environments: HEADSET, OFFICE, HALL, STREET, CAR

### Applications

- IP phones
- Smart phones
- VoIP devices
- Video conferencing
- Hands-free communications

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### Contacts

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## Specifications

Modes	narrowband (sample rate 8 kHz), wideband (sample rate 16 kHz), optionally supplied with resamplers to support most popular sample rates
Robustness to delay variation or time drift	yes
Echo cancellation	full-duplex and half-duplex modes
Nonlinear/intermodulation distortion compensation	yes
Additional ac harmonic suppression	yes
Comfort noise generator	yes
Maximum echopath	up to 512 msec
Compensation of audio drivers delay	up to 512 msec
Total algorithmic delay	60 msec
Equalizer with resonance blocking	yes
Voice activated automatic gain control	yes
Noise suppression	joint echo-noise cancellation
Musical noise removal	yes
MIPS consumption	see Table below
Maximum data requirements	worst case: 130 kbytes data RAM + 52 kbytes scratch data (wideband mode)
Supported CPUs	ARM9e, ARM11, Cortex, Marvell Kirwood/Armada, C64xx/DaVinci/OMAP, Tensilica HiFi2/HiFi3/ConnXD2, x86
Operating systems	Linux, Maemo/MeeGo, Windows, Windows CE/Mobile/Phone, MacOS, Android, DSP-BIOS

Typical MIPS consumption

Algorithm	MIPS consumption			
	C64xx	ARM9e	ARM11	HiFi2
Full-duplex echo+noise cancellation, narrowband	6	73	39	27
Half-duplex echo+noise cancellation, narrowband	2,5	23	12	9
Full-duplex echo+noise cancellation, wideband	13	137	80	46
Half-duplex echo+noise cancellation, wideband	6	53	30	19

## Bit exactness proved by ITE

**IntegrIT AEC WB** is delivered with fully automated IntegrIT Testing Environment (ITE) for target platform based on reference ITU-T vectors set along with extended IntegrIT proprietary vectors and methods.

## Availability

This software package is available in binary/source code written on fully portable C-language for:

- Texas Instruments TMS320C64xx, DaVinci, OMAPs
- Marvell KirKwood/ARMADA
- ARM9E, ARM11, Cortex A8, Cortex M4
- x86
- Tensilica HiFi2, HiFi3, D2
- Windows, Linux, DSP/BIOS, MacOS, Android, iPhone
- Other platforms and OS are under request

IntegrIT Design House offers engineering services for software adaptation, customization and drivers development under Customer's software and hardware and platforms.

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