Technical Documentation

DRC 1.x - Overview

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(3) Approval. Updated document status. Updated (Figure 2-1) and conclusion.
(4) Updated document number.

Glossary

VAD	Voice Activity Detector/Detection
DRC	Dynamic Range Compressor
DBB	Digital Base Band
AEC	Acoustic Echo Canceller

References

[1] L1D_AS378-1 - TRD for the Dynamic Range Compressor – DRC 1.x
[2] L1D_AS371-1 – DRC 1.x – API Definition
[3] L1D_AS250 – VAD 1.x, 2.x - Overview

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1 Introduction

This document provides an overview of the Dynamic Range Compressor (DRC) module [1], [2]. This document applies for DRC 1.0, DRC 1.1 and next upgrades DRC 1.x. DRC 1.0 operates at 8 kHz and 16 kHz with speech signal only while DRC 1.1 operates at various sampling frequencies for speech and music applications.

A first chapter presents the overview of the DRC. A second chapter is dedicated to a top level description of the DRC module.

2 Dynamic Range Compressor 1.x - Overview

The primary goal of Dynamic Range Compressor is to increase the perceptual loudness at the loudspeaker. The DRC is then implemented on the RX path in the Digital Base Band (DBB).

The typical crest factor of speech and music signals is typically within a 14dB to 20dB interval. For music, the crest factor can be as high as 90dB. This results in large loudness difference between the signal in quiet parts and loud parts. A dynamic range compression algorithm typically amplifies the quiet parts and attenuates loud parts of the input signal so that the final dynamic range of the output signal fits into a fixed range (Figure 2-1).

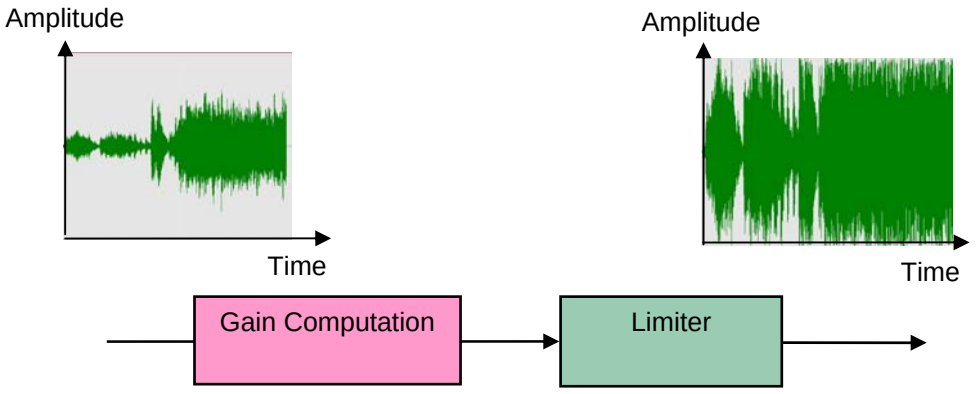

Figure 2-1 DRC 1.x – Module Overview

The DRC 1.x embeds a limiter function and a multiband processing to reduce risk of non-linearities at the loudspeaker. This functionality is particularly suitable to preserve the performances of the Acoustic Echo Canceller (AEC).

3 Dynamic Range Compressor 1.x - Description

The DRC computation is based on 10ms or 20ms frames with respectively 5ms or 10ms sub-frames processing. An algorithm overview is given below (Figure 3-1). The algorithm starts with measuring the energy of the input signal, $\hat{E}_{sp}(m)$, where *m* represents the frame number. After energy is measured, the compressor algorithm maps the input energy to a gain term, $g_l(m)$, that brings the input signal's energy to a desired energy level when applied.

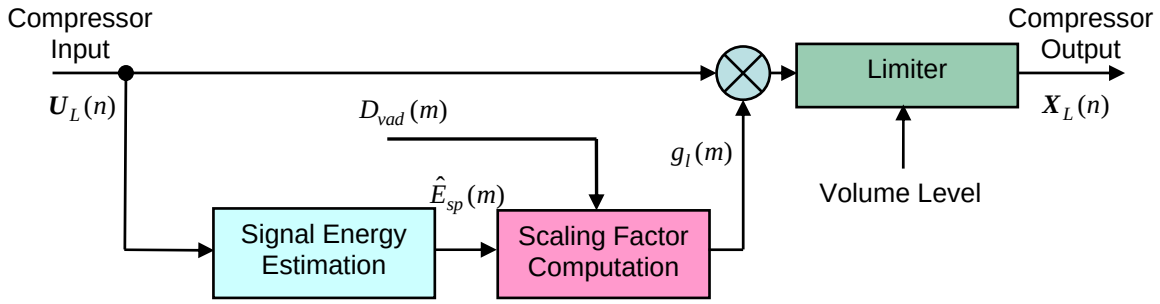

Figure 3-1 Dynamic Range Compressor 1.x Algorithm Overview

To avoid amplifying background noise more than speech signal, the VAD 2.x [3] is used as a sub-module to give to the DRC the information on presence of speech in the frame (represented by $D_{vad}(m)$). If there is no speech in the signal, the gain is then frozen. After input signal is scaled to proper level, the limiter algorithm verifies if amplitude of any sample exceeds the allowed threshold and attenuates if necessary to avoid clipping artifacts.

4 Conclusion

The DRC 1.x module enables the compression/expansion of various speech and music signals. When used with speech, it uses VAD 2.x decision to avoid background noise fluctuation. DRC 1.x increases perceptual loudness and reduce risk of non-linearities at the loudspeaker.