Technical Documentation

AGC 1.x - API Definition

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Change History

Date of change	Changed by	Approved by	Approval date	Version	Notes
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Notes

(1) Creation of the document.
(2) Approval.
(3) Minor correction in introduction. Updated (2.2).
(4) Major correction: API content from 9 to 11 parameters.
(5) Updated reference table.

Table of Contents

List of Figures and Tables

Glossary

API	Application Protocol Interface
AGC	Automatic Gain Control
VAD	Voice Activity Detector

References

[1] L1D_AS330 – AGC 1.x – Overview
[2] L1D_AS250 – VAD 1.x, 2.x – Overview

1 Introduction

The purpose of this document is to describe the Application Protocol Interface (API) related to the Automatic Gain Control (AGC) [1]. This document applies for AGC 1.0 and next upgrades AGC 1.x. operating at 8kHz or 16kHz sampling frequencies (10ms or 20ms frame processing).

The AGC 1.x uses the Voice Activity Detector (VAD 2.x) as external module operating at 8kHz or 16kHz sampling frequencies (10ms or 20ms frame processing) [2].

First chapter describes the API of the AGC 1.x module. A. Appendix is dedicated to the recommended values of AGC 1.x parameters through API.

2 AGC 1.x Module API

This chapter describes the parameter interface of the AGC 1.x module.

2.1 Entry Functions

2.1.1 Function f_agc_top ()

Prototype:

```
void      f_agc_top (T_AGC_STATIC_VAR *p_agc_data);
```

Description:

This AGC top level function contains the call of all signal processing functions necessary to perform the AGC algorithm. The function arguments are presented below (Table 2.1).

Arguments:

Type	Name	Flow	Description
T_AGC_STATIC_VAR	*p_agc_data	IN/OUT	Pointer on the AGC module static variables

Table 2.1 The AGC 1.x Top Function Arguments

The T_AGC_STATIC_VAR *p_agc_data structure pointer parameter is used to pass the static variables to the AGC top function as well as through the internal signal processing functions. In addition, the AGC configuration parameters are passed to the module through a data structure pointer T_AGC_PARAM *p_agc_param element of *p_agc_data. Those structures are detailed in the implementation document.

Requirements:

The entire signal processing functions code must be mapped on a single DSP page as it does not support extended addressing.

Reentrancy:

This API is reentrant.

Return value:

None.

2.1.2 Function f_agc_init ()

Prototype:

```
void      f_agc_init (T_AGC_STATIC_VAR *p_agc_data);
```

Description:

This function is used to initialize the AGC module. The function arguments are presented below (Table 2.2)

Arguments:

Type	Name	Flow	Description
T_AGC_STATIC_VAR	*p_agc_data	IN/OUT	Pointer on the AGC module static variables

Table 2.2 The AGC 1.x Initialization Function Arguments

Requirements:

The init function code must be mapped on a single DSP page as it does not support extended addressing.

Reentrancy:

This API is reentrant.

Return value:

None.

2.2 AGC 1.x Module Interface

This chapter focuses on the API for AGC module. The API description, format of range of parameters is presented below (Table 2.3), (Table 2.4).

&	Type	Name	Description
+0	T_UINT16	d_agc_control	AGC enable/disable
+1	T_UINT16	d_agc_frame_size	AGC acquisition/restoration frame size
+2	T_SINT16	d_agc_targeted_level	AGC targeted level from dBm0 spec.
+3	T_SINT16	d_agc_signal_up	AGC gain up from dB spec.
+4	T_SINT16	d_agc_signal_down	AGC gain down from dB spec.
+5	T_SINT16	d_agc_max_scale	AGC maximum gain from dB spec.
+6	T_SINT16	d_agc_gain_smooth_alpha	AGC gain smoothing factor
+7	T_SINT16	d_agc_gain_smooth_alpha_fast	AGC gain fast smoothing factor
+8	T_SINT16	d_agc_gain_smooth_beta	AGC gain smoothing factor
+9	T_SINT16	d_agc_gain_smooth_beta_fast	AGC gain fast smoothing factor
+10	T_SINT16	d_agc_gain_intp_flag	AGC gain interpolation enable/disable

Table 2.3 The AGC 1.x API Parameters Description

&	Type	Format	Range	Comments
+0	T_UINT16	16b/Q0	[0x0000,	AGC disabled,
			0x0001,	AGC enabled 8kHz
			0x0002]	AGC enabled 16kHz
+1	T_SINT16	16b/Q0	[0x0050,	80 samples, 1X10ms frame processing (FP) at 8kHz
			0x00A0,	160 samples, 2X10ms FP (8kHz), 1X10ms FP (16kHz)
			0x0140]	320 samples, 2X10ms FP (16kHz)
+2	T_SINT16	16b/Q15	[0x0502…	minimal: -22dBm0 power
			0x09FE…	nominal: -16dBm0 power, see also note (1)
			0x13F0]	maximal: -10dBm0 power
+3	T_SINT16	16b/Q10	0x7E7E	nominal: +15dB power, see also note (2)
+4	T_SINT16	16b/Q15	0x7FB4	nominal Ref. -0.01dB, see also note (3)
+5	T_SINT16	16b/Q12	0x59F9	nominal Ref. +15dB, see also note (4)
+6	T_SINT16	16b/Q15	0x7EB8	nominal Ref. 0.99
+7	T_SINT16	16b/Q15	0x7333	nominal Ref. 0.9
+8	T_SINT16	16b/Q15	0x7F5C	nominal Ref. 0.095
+9	T_SINT16	16b/Q15	0x7333	nominal Ref. 0.9
+10	T_SINT16	16b/Q0	0x0000	nominal, interpolation disabled, see also note (5)
			0x0001	interpolation enabled, see also note (5)

Table 2.4 The AGC 1.x API Parameters Format and Range

(1) The targeted level of the signal at AGC output could be computed from the specification of targeted level in dBm0 as follow:

$$\text{d\_agc\_targeted\_level} = round\left\{2^{15}.10^{\frac{L_{\text{Target}}-6.15}{20}}\right\}, \quad (2.1)$$

where the targeted level is L_{Target}. For example, $L_{Target} = -16dBm0$ leads to d_agc_targeted_level = 2558 i.e. d_agc_targeted_level = 0x09FE.

(2) The AGC gain increasing rate d_agc_signal_up could be customized from specification of rate in dB as follow:

$$\text{d\_agc\_signal\_up} = round\left\{\frac{2^{15}}{2^5}.10^{\frac{\Gamma_{up}}{10}}\right\}, \quad (2.2)$$

where the increasing rate is Γ_{up}. For example, $\Gamma_{up} = 15dB$ leads to d_agc_signal_up = 32382 i.e. d_agc_signal_up = 0x7E7E.

(3) The AGC gain decreasing rate d_agc_signal_down could be customized from specification of rate in dB as follow:

$$\text{d\_agc\_signal\_down} = round\left\{2^{15}.10^{\frac{\Gamma_{down}}{10}}\right\}, \quad (2.3)$$

where the increasing rate is Γ_{down}. For example, $\Gamma_{down} = -0.01dB$ leads to d_agc_signal_down = 32692 i.e. d_agc_signal_down = 0x7FB4.

(4) The AGC maximal amplification d_agc_max_scale could be customized from specification of amplification in dB as follow:

$$\text{d\_agc\_max\_scale} = round\left\{\frac{2^{15}}{2^3}.10^{\frac{g_{\max}}{20}}\right\}, \tag{2.4}$$

where the maximum amplification is $g_{\max}$. For example, $g_{\max} = 15dB$ leads to d_agc_max_scale = 23033 i.e. 0x59F9.

(5) The AGC gain is interpolated from frame to frame on 32 samples (8000Hz) or 64 samples (16000Hz). The interpolation can be enable/disable using d_agc_gain_intp_flag. Nominal value is d_agc_gain_intp_flag = 0.

Appendices

A. Appendix: AGC 1.x Parameters - Recommended Values

&	Type	Name	Values	Reference
+0	T_UINT16	d_agc_control	0x0001	8kHz
+1	T_UINT16	d_agc_frame_size	0x00A0	160 samples
+2	T_SINT16	d_agc_targeted_level	0x09FE	-16dBm0
+3	T_SINT16	d_agc_signal_up	0x7E7E	15dB
+4	T_SINT16	d_agc_signal_down	0x7FB4	-0.01dB
+5	T_SINT16	d_agc_max_scale	0x59F9	15dB
+6	T_SINT16	d_agc_gain_smooth_alpha	0x7EB8	0.99
+7	T_SINT16	d_agc_gain_smooth_alpha_fast	0x7333	0.9
+8	T_SINT16	d_agc_gain_smooth_beta	0x7F5C	0.095
+9	T_SINT16	d_agc_gain_smooth_beta_fast	0x7333	0.9
+10	T_SINT16	d_agc_gain_intp_flag	0x0000	no interp.

Table 2.5 The AGC 1.x Parameters Recommended Values at 8kHz – 20ms

&	Type	Name	Values	Reference
+0	T_UINT16	d_agc_control	0x0001	8kHz
+1	T_UINT16	d_agc_frame_size	0x0050	80 samples
+2	T_SINT16	d_agc_targeted_level	0x09FE	-16dBm0
+3	T_SINT16	d_agc_signal_up	0x7E7E	15dB
+4	T_SINT16	d_agc_signal_down	0x7FB4	-0.01dB
+5	T_SINT16	d_agc_max_scale	0x59F9	15dB
+6	T_SINT16	d_agc_gain_smooth_alpha	0x7EB8	0.99
+7	T_SINT16	d_agc_gain_smooth_alpha_fast	0x7333	0.9
+8	T_SINT16	d_agc_gain_smooth_beta	0x7F5C	0.095
+9	T_SINT16	d_agc_gain_smooth_beta_fast	0x7333	0.9
+10	T_SINT16	d_agc_gain_intp_flag	0x0000	no interp.

Table 2.6 The AGC 1.x Parameters Recommended Values at 8kHz – 10ms

&	Type	Name	Values	Reference
+0	T_UINT16	d_agc_control	0x0002	16kHz
+1	T_UINT16	d_agc_frame_size	0x0140	320 samples
+2	T_SINT16	d_agc_targeted_level	0x09FE	-16dBm0
+3	T_SINT16	d_agc_signal_up	0x7E7E	15dB
+4	T_SINT16	d_agc_signal_down	0x7FB4	-0.01dB
+5	T_SINT16	d_agc_max_scale	0x59F9	15dB
+6	T_SINT16	d_agc_gain_smooth_alpha	0x7EB8	0.99
+7	T_SINT16	d_agc_gain_smooth_alpha_fast	0x7333	0.9
+8	T_SINT16	d_agc_gain_smooth_beta	0x7F5C	0.095
+9	T_SINT16	d_agc_gain_smooth_beta_fast	0x7333	0.9
+10	T_SINT16	d_agc_gain_intp_flag	0x0000	no interp.

Table 2.7 The AGC 1.x Parameters Recommended Values at 16kHz – 20ms

&	Type	Name	Values	Reference
+0	T_UINT16	d_agc_control	0x0002	16kHz
+1	T_UINT16	d_agc_frame_size	0x00A0	160 samples
+2	T_SINT16	d_agc_targeted_level	0x09FE	-16dBm0
+3	T_SINT16	d_agc_signal_up	0x7E7E	15dB
+4	T_SINT16	d_agc_signal_down	0x7FB4	-0.01dB
+5	T_SINT16	d_agc_max_scale	0x59F9	15dB
+6	T_SINT16	d_agc_gain_smooth_alpha	0x7EB8	0.99
+7	T_SINT16	d_agc_gain_smooth_alpha_fast	0x7333	0.9
+8	T_SINT16	d_agc_gain_smooth_beta	0x7F5C	0.095
+9	T_SINT16	d_agc_gain_smooth_beta_fast	0x7333	0.9
+10	T_SINT16	d_agc_gain_intp_flag	0x0000	no interp.

Table 2.8 The AGC 1.x Parameters Recommended Values at 16kHz – 10ms