Automatic Gain Control - Field Guide

Fora Soft Learn

The two gain levers, the control loop, the decibel math, and which settings to expose.

The two levers

Analog gain	OS mic preamp, before the ADC	Adds real detail; slow & coarse
Digital gain	Software multiply on samples	Instant & precise; amplifies noise too

The control loop (every frame)

1. Measure	Voice level - only while VAD says speech
2. Compare	Level vs target (e.g. -18 dBFS)
3. Compute	Gain change = target - measured
4. Apply	Slow rise, fast fall; limiter never clips at 0 dBFS

Decibels & gain

Gain in dB = 20 x log10(output amplitude / input amplitude).

+6 dB = x2 amplitude; +12 dB = x4; -6 dB = x0.5.

Talker at -12 dBFS, target -18 -> gain = -18 - (-12) = -6 dB (cut).

Talker at -38 dBFS, target -18 -> gain = -18 - (-38) = +20 dB (boost; lifts noise too).

ITU-T G.169: gain must not rise faster than 10 dB/s; initial gain <= +4 dB.

Expose to users, or hide?

AGC on/off (autoGainControl)	**EXPOSE**	for music / pro-audio modes
Mic input-level slider	**EXPOSE**	as a manual override only
Target level (dBFS)	**HIDE**	wrong value ruins every talker
Max boost / compression (dB)	**HIDE**	too high amplifies noise
Attack / release times	**HIDE**	the pumping artefact lives here
Limiter on/off	**HIDE**	clip safety net; never disable on a call

Remember

- [ ] AGC evens out talkers so a faint voice and a loud one reach the listener at one level.
- [ ] Use analog gain for the coarse range, digital gain to fine-tune the last few decibels.
- [ ] The loop must rise slowly and fall fast, or the voice pumps and breathes.
- [ ] A voice detector must gate the loop, or AGC amplifies the silence between words into noise.
- [ ] WebRTC AGC2 leans on the digital path; the analog OS slider is a coarse helper that can surprise users.
- [ ] Meetings: keep AGC on. Music / studio: expose autoGainControl: false so the user keeps their own gain staging.