Explaining Your Transceiver's ALC and AGC

ALC deals with transmitting, while AGC deals with receiving levels.

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I wrote this article to help radio amateurs to properly understand automatic level control (ALC) and automatic gain control (AGC) — two very important functions in amateur radio transceivers. I use my Yaesu FT-991A as an example. [Consult your specific radio manual, because ALC and AGC operations and settings vary with different transceivers. — *Ed.*]

ALC Functions

ALC is only active during transmission. It is a circuit that automatically levels a strong signal by reducing signal amplification due to excessive microphone gain or excessive digital mode signal drive. When the strong signal peaks cease, the ALC slowly increases the amplification (ALC release) to allow the output of lower level signals. Usually, ALC is quick to attack, and slow to release. Attack time, hold time, and release time are explained in the Maxim application note, **https://pdfserv.maximintegrated.com/en/an/AN3673.pdf**.

ALC is important in SSB voice and data modes; it is intended to keep the transmitted signal gain within a safe envelope — within the blue ALC bar range limit in Figure 1 — avoiding overdrive distortion and signal clipping. It also helps keep power amplifier non-linearity reined in.

The ALC bar graph on the FT-991A indicator provides a visual cue on how you are driving your equipment, so you can adjust your gain settings to an optimal range for the operating modulation mode.

Configuring the ALC Indicator

Select your radio meter/indicator to measure ALC. A bar graph above that blue bar indicates that the ALC level is selected. There are different ALC requirements for voice and for data modes. Some transceivers, like mine, integrate the ALC with the SWR reflected power signal, causing the radio to fold back the transmitter power in order to avoid damage to the equipment. My FT-991A manual states: "ALC meter deflection may be caused...by reflected power (SWR)...ALC meter action may be observed that is not related to the proper setting of the microphone gain." The manual further recommends that you "make microphone gain adjustments into a dummy load or antenna system presenting impedance very close to 50 Ω."

Settings for SSB Phone

Set the ALC level for voice modes with the Microphone Gain Control; there are different settings for SSB and other modulation modes. The object is to keep the bar graph meter within the blue bar ALC scale. Set your microphone gain so that your peak modulation reaches the end of the ALC scale, but does not exceed it. Signal distortion can be caused

Figure 1 — The red portion of the ALC bar graph, extending beyond the blue bar operating range, indicates an excessive ALC setting.

by an excessive ALC setting, like the red meter bars extending beyond the blue ALC scale in Figure 1.

Settings for Data Modes

Digital modes like PSK and *WSJT-X* modes, including FT8, have entirely different ALC requirements. [See the recommendations in **https://www.physics.princeton.edu/pulsar/K1JT/FT8_Operating_Tips.pdf**. — *Ed.*] Excessive signal drive can cause signal distortion and will likely result in the transmission of an undecipherable signal from your station.

An appropriate ALC level for digital modes is a none-too-slight indication. If you are getting past half the scale, you are way off the optimal settings.

AGC Functions

AGC is a receiver function that decreases amplification on a strong received signal, keeping the reception at a comfortable level. In the absence of a strong signal, the AGC increases the receive gain, so you can listen to weak signals.

On the flip side, a nearby signal will force the AGC to reduce the gain while you are trying to copy a weaker signal. Suppose that you are listening to a weak signal in 7105 kHz, and then suddenly a strong signal pops up on 7107 kHz, and it is within your receiving passband. That signal will force your AGC into reducing the receiver gain, and perhaps rendering your 7105 kHz signal unreadable. Many transceivers have adjustable and narrow-band filters, so they can reduce the radio receiving bandwidth, and position the offending signal outside the bandwidth.

Many transceivers provide AGC controls that range from fast to slow, so there are different circumstances to use each.

Slow AGC

If you are ragchewing and receiving medium-to-strong signals, you will find that your reception will be more comfortable with a slow AGC. The silence in SSB means there is no transmitted power, so during small pauses between spoken words, your slow AGC setting will increase the gain slowly, making these small pauses more silent instead of having a quick AGC recovery, where you would likely listen to the band noise. So, if you are are in digital modes or operating SSB voice mode, and receiving signals at a comfortable level, use slow AGC.

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Fast AGC

Fast AGC is needed while using digital modes or in challenging voice reception conditions — like static crashes, and with strong nearby signals. Fast AGC will cause the receiver amplifier to raise its gain quickly, returning to the noise floor faster. So, if you are in digital modes or operating SSB voice with static crashes hampering the reception, use fast AGC.

Final Comments

Because of individual SSB voice modulation characteristics, differences in microphones, operating different phone or digital modes, and a variety of signal-hampering conditions, you should set your ALC and AGC levels so the transceiver can yield its best performance for each modulation mode.

If you want to make an SSB phone contact even more comfortable in medium-to-marginal conditions, use the RF gain/attenuation control to the point where the S-meter stops swinging during your contact partner's transmission.

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