Use An ALC Meter
To Avoid Distortion & Interference
Advice From Two Ham Radio Experts

本篇文章係取自於 HamRadioAndVision 網站的一篇文章

導讀:BV2KI/Bruce

A、前言

An Automatic Level Control (ALC) circuit governs the signal strength going into the power amplifier in a ham radio transmitter. It keeps the amplifier input in the designed range for linear operation.

自動電平控制（ALC）電路控制進入業餘無線電收發機功率放大器的信號強度。它將放大器輸入保持在線性操作的設計範圍內。

Depending on the ALC circuit design and how hard it is driven (by the microphone output level and mic gain setting), the ALC circuit can distort the signal and cause interference.

根據 ALC 電路設計和驅動強度（由麥克風輸出電平和麥克風增益設置），ALC 電路可能會使信號失真並造成干擾。

This article is about how to operate a transmitter at the optimum point—where the average signal level is as high as possible without noticeable distortion or interference. The key is knowing how to use the ALC meter.

本文介紹如何在最佳點操作收發機，即平均信號電平盡可能高，而不會產生明顯的失真或干擾。關鍵是知道如何使用 ALC 儀錶。

Choosing an optimum amount of ALC activity is easy if the radio manufacturer tells you the ideal ALC meter reading. The Elecraft K3, Flex Radios, and Yaesu FT DX-3000D are good examples.

如果無線電製造商告訴您理想的 ALC 儀錶讀數，則選擇最佳的 ALC 活動量很容易。Elecraft K3、Flex Radios 和 Yaesu FT DX-3000D 就是很好的例子。

It's not as easy when the recommended range on the ALC meter is wide. You might be tempted to operate at the top of the range for a more powerful signal, but the signal quality may suffer.

當 ALC 儀錶的推薦範圍很寬時，就不那麼容易了。您可能很想在範圍頂部操作以獲得更強大的信號，但信號品質可能會受到影響。

This article summarizes practical advice about using an ALC meter from two experts on amateur radio signal quality.

本文總結了兩位業餘無線電信號質量專家提供的有關使用 ALC 儀表的實用建議。

The final section summarizes access to ALC meters for blind and vision-impaired hams.

最後一部分總結了盲人和視力受損火腿使用 ALC 儀錶的情況。

The article does not apply to digital modes, such as PSK31, that are more sensitive to nonlinearity from ALC action than are voice modes.

本文不適用於數位模式，例如 PSK31，與語音模式相比，PSK31 對 ALC 動作的非線性更敏感。

B、The Experts
專家的話

Julius Jones, W2IHY, and his company W2IHY Technologies, produce high quality audio equipment designed to work with ham radios. He has listened to the signals of hundreds of hams while helping them set up their radios and his products. He also has hands-on experience with Icom 756PRO-series radios of his own, and he was kind enough to answer my questions about ALC.

W2IHY/Julius Jones 和他的公司 W2IHY Technologies 生產高品質的音訊設備，旨在與業餘無線電配合使用。他聽取了數百個火腿的信號，同時幫助他們調配了收發機和他的

產品。他還擁有自己的 Icom 756PRO 系列無線電的實務經驗，他很友善地回答了我關於 ALC 的問題。

Martin Ehrenfried, G8JNJ, is an electrical engineer who has written many excellent articles on ham radio topics. The article, Audio Processing and ALC in the FT-897D (pdf), describes his research and gives advice on optimum microphone gain and processor settings. His study was prompted in part by low transmitted average power levels.

G8JNJ/Martin Ehrenfried，是一名電氣工程師，他寫了許多關於業餘無線電主題的優秀文章。FT-897D 中的音訊處理和 ALC 一文（pdf）介紹了他的研究，並就最佳麥克風增益和處理器設置提供了建議。他的回應是有關低傳輸平均功率水準研究部分。

C、Average Power Of SSB Signals
SSB 信號的平均功率

The average power of a typical single sideband signal is much lower than the peak power. For uncompressed speech a typical SSB peak to average power ratio is 14 dB. Audio processing can improve this ratio, but depending on the radio and on voice characteristics, a typical signal peaking at 100 watts might have an average power of only 4 - 10 watts.

典型的單邊帶信號的平均功率遠低於峰值功率。對於未壓縮語音，典型的 SSB 峰均功率比為 14 dB。音訊處理可以提高這一比率，但根據無線電和語音特性，峰值為 100 瓦的典型信號可能只有 4-10 瓦的平均功率。

D、A High ALC Reading Is Tempting
高 ALC 讀數很誘人

G8JNJ found that "with modest ALC action" the average output power from his FT-897D for a single sideband phone signal was 10 dB below a single tone at maximum peak power. By amplifying the audio input and pushing the ALC reading to the top of the scale, he could increase the average power by 3 dB.

Which raises the question, what is the optimum ALC level for your radio?

G8JNJ 發現，在「適度的 ALC 動作」下，他的 FT-897D 在最大峰值功率下對單邊帶話務信號的平均輸出功率比單個音低 10 dB。通過放大音頻輸入並將 ALC 讀數推到刻度的頂部，他可以將平均功率提高 3 dB。這就提出了一個問題，您的收音機的最佳 ALC 電平是多少？

E、Signal Distortion
信號失真

The clarity of your signal depends in part on the particular ALC circuit in the transmitter and how hard it is driven (as indicated by the ALC meter reading).

信號的清晰度部分取決於發射機中特定的 ALC 電路及其驅動強度（如 ALC 儀錶讀數所示）。

For radios with a wide recommended range on the ALC meter, W2IHY advises keeping the ALC reading in the lower part of the range to avoid distortion. For example, he reports that Icom 746/756 PRO-series radios can produce noticeable distortion when the ALC reading is in the upper part of the bracketed range on the meter scale.

對於 ALC 儀錶上推薦範圍較寬的無線電，W2IHY 建議將 ALC 讀數保持在範圍的較低端的部分以避免失真。例如，他報告說，當 ALC 讀數位於儀錶刻度上括號範圍的上部時，Icom 746/756 PRO 系列無線電會產生明顯的失真。

His warning is borne out by my tests with an IC-746PRO. In Monitor mode I recorded the audio signal from the earphone jack using Audacity software. With the mic gain high enough to drive the ALC reading into the upper third of the range, speech is muffled—noticeably less clear and crisp.

我的 IC-746PRO 測試證實了他的警告。在監聽模式下，我使用 Audacity 軟體錄製了來自耳機插孔的音訊信號。當麥克風增益足夠高，可以將 ALC 讀數驅動到範圍的上三分之一時，語音會變得低沉-明顯不那麼清晰和清晰。

This result matches guidance in the Icom user manual. With the stock Icom HM-36 microphone, the recommended mic gain control setting is between 10 and 12

o'clock. That corresponds to ALC readings in the bottom half of the range bracketed on the meter.

此結果與 Icom 使用者手冊中的指導一致。對於庫存的 Icom HM-36 麥克風，建議的麥克風增益控制設置在 10 點到 12 點之間。這對應於儀錶上括弧內範圍下半部分的 ALC 讀數。

F、Interference
介面

Interference on adjacent frequencies is another problem with high ALC levels. Your contact will not hear this splatter, but hams operating on nearby frequencies might, and it can show up on a bandscope.

對相鄰頻率的干擾是「高 ALC」電平的另一個問題。您的 QSO 對方不會聽到這種「飛濺」，但在附近頻率上運行的火腿可能會聽得到，並且可以顯示在示波器上。

The transceiver testing authority, Rob Sherwood, NC0B, describes in his Dayton Contest University 2008 video the ALC-caused splatter from his mobile rig at the default settings.

收發機測試權威 Rob Sherwood，NC0B 在他的代頓競賽大學 2008 年視頻中演示了在預設設置下，ALC 引起的行動裝置「飛濺」

In one test G8JNJ turned up the audio input to his FT-897D so the ALC meter reached the top of the scale. A spectrum analyzer connected to a second radio showed a 20 dB increase in his signal 10 kHz from the carrier. His article includes a photo of the broadened signal spectrum.

在一次測試中，G8JNJ 將音頻輸入調到他的 FT-897D，使 ALC 儀表達到音階的頂部。連接到第二個無線電的頻譜分析儀顯示，他的信號從載波 10 kHz 增加了 20 dB。他的文章包括一張拓寬信號頻譜的照片。

G、Additional Speech Compression
額外的語音壓縮

Ideally, compression increases the perceived volume of speech and the average power. However, when G8JNJ fed compressed audio into the FT-897D, phase distortion in the radio triggered the ALC circuit, resulting in minimal improvement in the average power.

理想情況下，壓縮會增加感知的語音音量和平均功率。然而，當 G8JNJ 將壓縮音訊饋送到 FT-897D 時，無線電中的相位失真觸發了 ALC 電路，導致平均功率的改善很小。

By contrast, some hams report their average signal power is 30 watts or more at 100 watts peak power, and they get good signal reports. This demonstrates a wide variation in the performance of speech processors and ALC circuits.

相比之下，一些火腿報告他們的平均信號功率在 30 瓦峰值功率為 100 瓦或更高，並且他們得到了良好的信號報告。這表明語音處理器和 ALC 電路的性能存在很大差異。

On my Icom 746PRO, mid-range COMP settings (corresponding to low COMP level readings on the multi-meter) cause noticeable distortion of the audio.

在我的 Icom 746PRO 上，中檔 COMP 設置（對應於萬用表上的低 COMP 電平讀數）會導致音訊明顯失真

H、Signal Intelligibility
信號清晰度

Single sideband audio components in the 1600 - 3200 Hz range have a big effect on signal intelligibility. Some microphones enhance these frequencies, and some radios have built-in equalizer functions. External audio-quality speech enhancers, such as the W2IHY 8 Band Audio Equalizer, are also available.

1600-3200 Hz 範圍內的單邊帶音訊元件對信號清晰度有很大影響。一些麥克風增強了這些頻率，一些無線電具有內置均衡器功能。還提供外部音訊品質語音增強器，例如 W2IHY 8 頻段音訊均衡器。

I、Access To ALC Meter Readings
訪問 ALC 儀錶讀數

For blind and vision-impaired hams, spoken ALC meter readings are available from some radios:

對於盲人和視力受損的火腿，可以從一些收發機之 ALC「報讀器」取得資訊：

(1) Precise multi-meter measurements can be read using the HamPod K3 Reader, Icom Reader, and Kenwood Reader. The K3 Texter program works with K3's.

使用 HamPod K3 Reader, Icom Reader,及 Kenwood Reader 等「報讀器」可以測得精確的萬用表測量值；K3 Texter 程式則適用於 K3 收發機上(導讀者註:本段所述之「讀報器」之「鍊接」位址有誤；請勿前往拜訪)

(2) The Kenwood VGS-1 Voice Guide accessory can announce multi-meter readings from the TS-590S.

建伍的 VGS-1 語音指南配件可報讀 TS-590S 的萬用表讀數。

(3) The Kenwood TS-990S has a standard voice guide feature that announces multi-meter measurements.

建伍 TS-990S 具有標準的語音指南功能，可宣讀萬用表測量值。

A number of programs can display a multi-meter graphically on a computer screen, where it can be magnified. In the HamRadioAndVision Table of Contents there are two groups of articles with details—the Rig Monitoring section and the Transceiver Multi-Meter section.

許多程式可以在計算機螢幕上以圖形方式顯示萬用表，並且可以將其放大。在 HamRadioAndVision 目錄中，有兩組詳細介紹的文章 收發機監控部分和收發機萬用表部分

J、Conclusions
結論

- The ALC meter is an important tool for finding the best mic gain. Check the operating manual for recommendations. Many, but not all, radios are designed to work best when the ALC meter indicates only minimal activity.
- ALC 電平錶是查找最佳麥克風增益的重要工具。查看操作手冊以獲取建議。許多（但不是全部）無線電設計為在 ALC 儀錶僅指示最小活動時最佳工作
- Both experts advise keeping ALC activity low—setting the mic gain so the meter just shows ALC activity on your voice peaks (eg, 3 - 4 bars on the FT-897D).
- 兩位專家都建議保持較低的 ALC 活動-設置麥克風增益，以便儀錶僅顯示語音峰值上的 ALC 活動（例如，FT-897D 上的 3-4 小節）
- Alternatively, use a wattmeter to find the point where the peak power stops increasing as you turn up the mic gain, and operate just below that gain setting. Note that the average power continues to increase with mic gain, well past the onset of ALC activity. Use the ALC meter, and avoid the temptation to maximize average power.
- 或者，使用功率計找到峰值功率在調高麥克風增益時停止增加的點，並在該增益設置下端位置運行。請注意，平均功率隨著麥克風增益而繼續增加，遠遠超過 ALC 活動的開始。使用 ALC 儀錶，避免最大化平均功率的誘惑。
- Speech compression circuits (sometimes called speech processors) can cause distortion that decreases the intelligibility of your signal. G8JNJ advises turning off compression in the FT-897D unless your signal to noise level is low because of band conditions.
- 語音壓縮電路（有時稱為語音處理器）可能會導致失真，從而降低信號的清晰度。G8JNJ 建議關閉 FT-897D 中的壓縮，除非您的信號雜訊水平由於頻段條件而較低

- If possible, use a second radio or the monitor function on your transceiver to listen to recordings of your audio.
- 如果可能，請使用收發器上的第二個收音機或監聽功能收聽音訊錄音
- Collect on-air signal reports in a variety of band conditions.
- 在各種波段條件下收集「線上」信號報告

K、For More Informatione
更多信息

Explaining Your Transceiver's ALC and AGC, R.A.B. Freire, PY2RAF, *QST* June 2021, 34-5.

R.A.B. Freire，PY2RAF 著:「解釋收發器的 ALC 和 AGC」，QST 2021 年 6 月，34-5

Audio Processing and ALC in the FT-897D by G8JNJ

G8JNJ 著「FT-897D 中的音訊處理 ALC」

Improving the Intelligibility of SSB Transmissions by G8JNJ

G8JNJ 著:「提高 SSB 傳輸的可理解性」

The Abominable ALC by SM5BSZ

SM5BSZ 著:「可惡 ALC」

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L、Author Information
關於作者

Peter DeNeef, AE7PD, is an Extra Class amateur radio operator in the U.S. This Web site has no ads or conflicts of interest.

Peter DeNeef，AE7PD，是美國的一名特等級業餘無線電操作員。本網站沒有廣告或利益衝突

Email: HamRadioAndVision "at" gmail "dot" com

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