

Adjustment Procedures for Amplifier Group AN/GSA-33 and Audio Amplifier AM-413A/G Background.

Some confusion exists at many activities concerning the use and proper adjustment of constant level amplifiers. It is imperative that the proper adjustment procedures be employed in order to derive the benefits for which the amplifiers were provided. Misuse of a constant level amplifier or improper adjustment of the amplifier can seriously degrade a communications system rather than provide the intended improvement.

A comprehensive article is currently in the process of preparation concerning the proper use and adjustment of constant level amplifiers pertaining to their use in the entire Naval Communication Service. This information will be disseminated to all activities concerned at a later date.

The following information is presented, as an interim measure, to aid activities which have experienced difficulty with adjustment of AN/GSA-33 and AM-413A/G amplifiers in an operational status. The basic elements of the system under discussion are shown in block diagram form, figure 1.

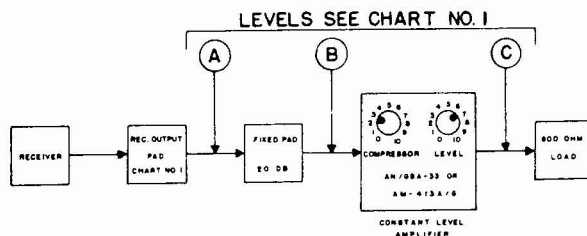


Figure 1. Adjustment Procedures for: Amplifier Group AN/GSA-33 and Audio Amplifier AM-413A/G.

The system consists of a receiver, a fixed pad at the output of the receiver (not always required), a fixed 20 db pad at the input to the amplifier, a constant level amplifier, and the load, which in most cases, is either a telephone line or a voice channel in a microwave link.

The reason for installing a fixed pad at the output of some receivers is to allow the final amplifier stage in the receiver to operate in the most favorable region of its dynamic range, without the possibility of exceeding acceptable levels on the lines feeding the constant level amplifiers. A 20 db fixed pad is required at the input to the constant level amplifier because the compressor control is difficult to set properly at scale settings between zero and 2 or 3 scale divisions. In other words, the 20 db pad provides compatibility between the level of the input signal and the most favorable range of the compressor control.

The reason for the constant level amplifier in the system is two-fold: (1) The gain feature of the amplifier enhances the level of weak signals thus processing them for satisfactory transmission over a telephone line and (2) the compression feature of the amplifier automatically limits excessively strong signals to the same satisfactory level;

the desired peak level in either case being approximately zero vu. The term vu (volume units) is used exclusively in the remainder of the article in connection with level measurements because the signals to be measured are of a complex waveform (nonsinusoidal), and, accordingly, cannot be measured satisfactorily with a db meter.

The levels shown in chart No. 1, figure 2 are indicative of the levels to be expected at various points in the system.

Since a proper understanding of the function of the two controls associated with constant level amplifiers of the AN/GSA-33 and the AM-413A/G type is essential, a brief explanation follows: The COMPRESSOR control in the AM-1910/G (a unit of AN/GSA-33) is nothing more than an attenuator and its range is approximately 40 db.

CONDITION	A	B	C
NOISE ONLY	-10 VU	-30 VU	-20 VU -10 VU (SEE NOTE 1)
WEAK VOICE SIGNAL	-4 TO -6 VU AVERAGE	-24 TO -26 VU AVG.	-4 TO -6 VU PEAKING NEAR 0 VU
STRONG VOICE SIGNAL	+9 TO +11 VU AVERAGE	-9 TO -11 VU AVERAGE	-4 TO -6 VU PEAKING NEAR 0 VU
NOTE 1 - FOR RECEIVERS EQUIPPED WITH SQUELCH, ADJUST FOR -10 VU WITH SQUELCH OFF.			
NOTE 2 - USE TS-629/U OR OTHER VU METER.			

Figure 2. Chart No. 1

The action of the COMPRESSOR control in the AM-413A/G amplifier is identical to that in the AM-1910/G although the manner in which the attenuation is accomplished is a little more sophisticated. So bear in mind, that with either type of compression amplifier, adjustment of the COMPRESSOR control serves one purpose and that is to attenuate the input signal applied to the amplifier. Amplifier AM-413/G does not have a variable compressor control; it has only a compressor on-off switch; and, for this reason, its use in the system being considered is not recommended. It can be used, however, provided a variable attenuator, having a range of approximately 40 db, is inserted between the 20 db fixed pad, shown in figure 1, and the input to the amplifier. The variable pad then becomes the compressor control. The LEVEL control in either amplifier serves one purpose only. That purpose is to establish the amplifier output signal level at a prescribed maximum for the system in which it is used.

Adjustment Procedure (for receivers equipped with noise silencer or squelch).

Before making any adjustments, be sure the basic elements of the system shown in figure 1 are operating satisfactorily and that the appropriate pads are installed. The receivers listed in chart No.2, figure 3, require a 15 db pad installed directly at the output terminals. Refer to chart No. 3, figure 4, for details concerning the construction of 15 and 20 db pads.

RECEIVER TYPE	OUTPUT PAD
AN/FRR-26-27 AN/FRR-30-31	15 DB
AN/FRR-49 AN/FRR-502 R-274B/URR	15 DB
RECEIVERS WITH MAX. OUTPUTS OF LESS THAN 60 MW IN 600 OHMS DO NOT REQUIRE PADS.	
INSTALL PADS DIRECTLY AT RECEIVER OUTPUT TERMINALS.	

Figure 3. Chart No. 2

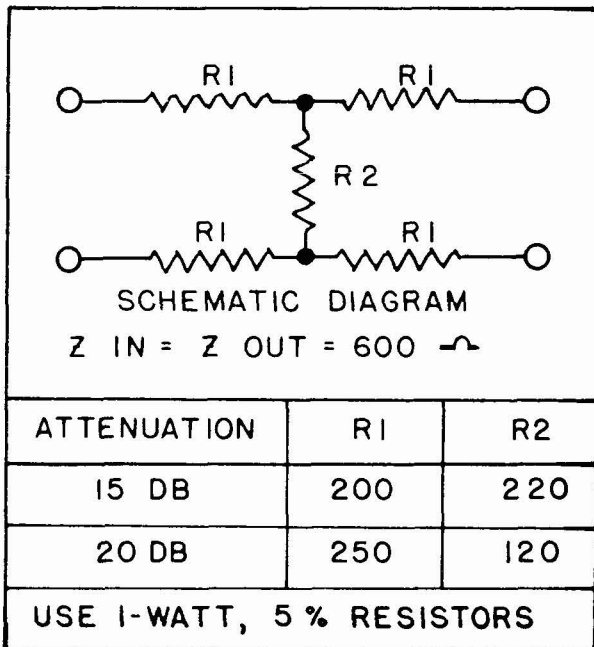


Figure 4. Chart No. 3

To simplify the adjustment procedure, receiver residual noise can be used as a signal source. A typical example of the proper adjustment procedure follows:

Step 1. Initial Control settings.

(a) Turn receiver and amplifier power switches ON.

(b) Turn receiver silencer or squelch OFF.

(c) Turn amplifier compressor switch ON and turn COMPRESSOR control maximum clockwise.

Step 2. Turn the receiver RF GAIN control maximum clockwise and adjust the receiver AF GAIN control for -10 vu noise output (in the absence of any signal) as measured on the line side of the receiver output pad. Use a bridging type vu meter, TS-629/U for example, to make this and subsequent measurements. Do not use a db meter.

Step 3. Adjust the amplifier LEVEL control for zero vu noise level as measured at the output of the amplifier. This is the final adjustment of this control.

Step 4. Adjust the amplifier COMPRESSOR control for a -10 vu noise level at the output of the amplifier. This is the final adjustment of the amplifier controls.

Step 5. Switch the receiver silencer or squelch ON, tune in a useable signal and adjust the silencer control in accordance with the procedures outlined in the receiver instruction book.

Step 6. Check the results achieved. When the above procedures have been followed, the levels in the system will be within the limits shown in chart No. 1, figure 2. The object is to set the receiver gain controls and the controls on the constant level amplifier in such a manner as to allow the receiver to operate at near optimum conditions. The weakest useable voice signal (approximately 10 db above the noise level) should appear at the output of the amplifier at approximately -4 to -6 vu, peaking near zero, and all signals of greater amplitude at the output of the receiver will be limited in the compression amplifier to approximately the same value. On some voice signals infrequent peaks may reach +1 or +2 vu.

It should be noted that it may be possible for signal levels measured at the input to the amplifier to exceed the levels measured at the output of the amplifier. This is merely indicative of the fact that the compression amplifier is performing its task in the system.

Adjustment Procedure (for receivers not equipped with squelch).

Step 1. Follow the procedures listed in paragraph 2 above with the following exceptions:

(a) Omit step 1 (b).

(b) In step 4, adjust the amplifier COMPRESSOR control for a -20 vu noise level at the output of the amplifier. It should be noted that a small movement of the COMPRESSOR control results in a considerable amount of attenuation, and, accordingly, adjustment of this control should be made precisely.

Step 2. Check your results. Tune the receiver to a weak signal and again to a moderately strong signal. In either case the levels at the various points in the system should agree closely with the levels shown in chart No. 1, figure 2. (SS)