PLAIN TALK AND Technical Tips

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AUDIO POWER OUTPUT

Many methods have been and still are being used in making measurements on high fidelity audio equipment. Each method of measurement is devised to rate the amplifier on the basis of different characteristics. As a result, the power output rating of a given amplifier can be expressed in terms of several different wattages depending upon the method of measurement.

There are two standards of measurement in common use, one established by the Electronic Industries Association (EIA) which applies to "packaged" (complete audio equipment for home use) equipment, and another by the Institute of High Fidelity Manufacturers (IHFM) generally used to rate "component" equipment. The Electronics Industries Association (EIA), in an effort to standardize the rating of amplifiers, has adopted a standard known as RS-234 for the "power output ratings of packaged audio equipment for home use." This standard, defined as "Music Power Output" (EIA standard RS-234), sets forth the method to be used in determining the power output of an amplifier and how it should be stated. While the EIA test conditions specify many factors such as power supply regulation, line voltage, warm-up conditions and equipment terminations, the major criteria of RS-234 is that the single frequency power obtained at 5% or lesstotal harmonic distortion is measured immediately after the application of a signal and for a time duration sufficiently short that supply voltages within the amplifier have not changed from their no signal values.

RCA Victor uses "Music Power Output" (EIA RS-234) to rate their amplifiers and in addition the "Peak Power Output" is stated. The chart, Figure 6, illustrates various power output ratings, the test condition under which they are taken, and the manner in which the output is stated.

The IHFM rating is also made under certain prescribed test conditions; however, the percentage of distortion permitted during the test is quoted in the rating in conjunction with the power output.

It should be noted that under any of the ratings wherein a self-contained power supply is used, the result will be governed by the regulation of the power supply. A supply with good regulation can give better results than one with poor regulation. It should also

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UHF RECEPTION

Interest in UHF television is increasing rapidly since many new UHF stations are going on the air. Recent FCC studies and new rulings affecting UHF transmission and the manufacture of "all channel" television receivers has given rise to this interest in UHF.

UHF broadcasting provides for 70 new channels, making possible a television station in practically every community. These channels are numbered from 14 to 83 and have been allocated for both educational and commercial purposes.

UHF reception characteristics vary with distance, terrain and transmitter power output. Under ideal conditions over fairly level terrain and water, good reception can be obtained at 35 miles. By using an efficient outdoor antenna, good reception is often obtained at a 50 mile radius or more.

Tests indicate that interference problems in the UHF band are few compared to the VHF band. Ignition, diathermy and similar interferences encountered in VHF reception do not normally occur at UHF. For example, one UHF installation was made in a city about 10 miles from the transmitter where interference on VHF was severe due to heavy truck traffic, machine shops and diathermy. VHF signals there were jittery and difficult to lock in, while the UHF installation showed no trace of interference.

Selecting the Antenna

UHF antennas in general are smaller, less conspicuous and offer much less wind resistance than VHF antennas. However greater care should be exercised when installing a UHF antenna since the orientation

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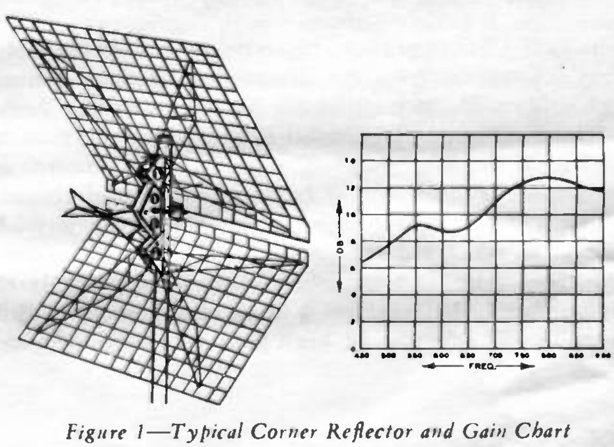

Figure 1—Typical Corner Reflector and Gain Chart

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and placement of the antenna is somewhat more critical than with VHF.

The question of which antenna is most suitable for a particular UHF installation is of major concern to the service technician. Simplicity of construction (cost), the ease of installation and the resulting picture quality are the factors to consider in any antenna installation.

With these factors in mind, a standard approach may be taken toward each new UHF installation.

It has been demonstrated that under many conditions, the indoor antenna may perform satisfactorily. When results indicate that the indoor antenna does not produce a satisfactory picture, it will be necessary to make use of an outdoor antenna for UHF reception.

There is a wide selection of good UHF antennas available today. The choice of outdoor antenna type will have to be based upon the actual signal conditions at any given location.

The *Corner Reflector* antenna is designed for high gain and good directivity throughout the UHF band. This is recommended for locations where the signal is weak or reflections are a problem. An illustration of this antenna and the gain characteristics are shown in Figure 1.

The *"Bowtie"* antenna is an inexpensive antenna which is considered flexible in operation because of the many ways it may be employed. This antenna may be used singly, in pairs, without reflectors or with reflectors. Stacking the dipoles increases gain and adding reflectors provides unidirectional characteristics. The "Bowtie" is a very rigid antenna and small in size. Operation at the VHF frequencies is only fair but in strong signal areas it could be used for combination VHF-UHF operation, provided no reflection problems are encountered. An illustration of this antenna and its gain characteristics are shown in Figure 2.

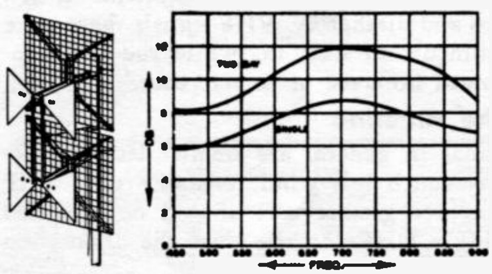

Figure 2—Typical "Bowtie" Antenna and Gain Chart

The *Yagi* antenna is useful in the UHF spectrum as well as in the VHF band. The gain of this antenna is exceptionally high and it has a narrow band characteristic. The Yagi is a high performance antenna with respect to reflection elimination and unwanted signal reduction. Also, in areas where there is only one UHF channel and the receiver is in a fringe section, this antenna will provide the high gain necessary for good reception. These antennas may be "stacked" to provide even higher gain. In general, the Yagi is considered a "one-station" antenna and for this reason its use will be limited compared to the types previously described.

Antenna Installation

One common method of installing an outdoor UHF antenna is to mount the UHF antenna on the existing VHF antenna mast. In this case, either a separate UHF transmission line or a common VHF-UHF line may be used. If a common lead-in is used, a crossover network must be employed to match the outputs of the two antennas to the common lead-in. This network may be installed on the same mast with the antennas for the convenience of making connections.

Since the reception of UHF signals is rather critical with respect to antenna location and orientation, the VHF antenna mast (with a UHF antenna mounted on it) may be found to be situated in a poor location for UHF reception. In such cases it will be necessary to either relocate the VHF-UHF antenna mast for better UHF reception (without a sacrifice to VHF reception) or use a separate mast for the UHF installation. If a separate mast is used, it is advisable to use a separate transmission line which will keep losses at a minimum. However, even though a separate mast is used, it still may be practical to use a crossover network at the UHF antenna and have a common UHF-VHF line from there to the receiver.

Many experienced technicians place strong emphasis on the "survey" system of determining the proper antenna to be used for each installation. This might seem to be an expensive way to make an installation; but if the job is right at the time of initial installation, costly readjustments are eliminated, and optimum performance is realized.

Selection of Transmission Line

A review of the characteristics of some commonly used transmission lines will illustrate the importance of selecting the correct type for a particular installation. Two important factors which influence the selection are impedance matching and line loss.

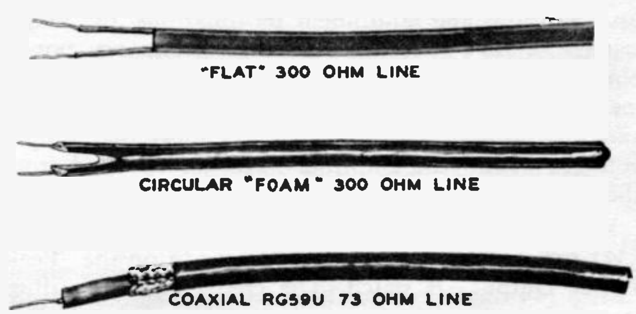

Figure 3—Transmission Line Types

Impedance matching presents no major problems since either a 72-ohm or a 300-ohm impedance input is used at the receiver. The 300-ohm is more common. The impedance of the line selected, therefore, should be approximately 72 ohms or 300 ohms. Most lines have an impedance which approximates either value. If an impedance transformation is found necessary, a balun may be used.

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UHF RECEPTION

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The line loss is the more important consideration in the selection of a type of transmission line. In addition to the usual conductor and dielectric losses, other factors have to be considered. One is the exposure of the line varying kinds of weather and atmospheric conditions. Another is the placement or run of the line. Either will influence the line loss.

Three hundred ohm (300-ohm) flat twin lead is most commonly used in VHF installations. Its characteristic impedance is 300 ohms. At 100 mc. the line loss is 1.1 db per 100 feet. When the line is moist or is lying along a conductive surface, the loss on high VHF channels may increase to as much as 5 db per 100 feet. Because of this difficulty, it is an impractical line for use on UHF installations since the loss is even greater at UHF. Although the loss at 600 mc. is 3 db per 100 feet when the line is dry, the loss may be over 10 db per 100 feet at 600 mc. when the line is wet.

Three hundred ohm (300-ohm) circular foam line provides for particularly good results in both VHF and UHF installations. Its impedance is also approximately 300 ohms.

The air cell structure between the conductors makes the loss of this line slightly lower than the loss of flat twin lead. This construction also affords protection against weather and atmospheric conditions. Such deposits on the line as moisture, salt or soot will not increase the dielectric loss to the extent that occurs on flat twin lead. The requirements of a good line run when using circular foam line is similar to that of flat twin lead.

Special care in routing the line run should be taken Avoid sharp bends; use long stand-offs to keep the line away from metallic objects and surfaces which would become damp. At the point of entry, through an outside wall, use a drip loop to prevent accumulation of water near the line.

In instances where electrical codes require shielding of transmission lines, coaxial cable can be used, however, the losses of this type transmission line is considerably higher than either flat line or foam line.

Future issues of "Plain Talk and Technical Tips" will discuss some other aspects of UHF television such as the UHF converter and the servicing of UHF receivers. In general however, it is interesting to note that most every model RCA Victor receiver is either factory equipped or convertible to UHF for all-channel reception. Your local RCA Victor distributor can furnish information as to the convertibility of a given RCA television receiver and the accessories which may be required for conversion to UHF.

THE DECIBEL

The use of the decibel as a unit of measurement is very popular in today's field of electronics. Catalogs and technical literature make use of the decibel to describe the performance of amplifiers, antennas and filter networks.

Actually, the decibel provides a convenient shorthand notation for power and voltage ratios and simplifies overall system calculations.

The decibel is merely a *relative* unit of measurement used to express changes in power or voltage in either audio or radio frequency systems. The ease with which the decibel enables us to express power and voltage gain or loss, through elimination of the necessity of handling large numbers, has resulted in widespread usage.

By using a chart such as the one illustrated in Figure 4, we can find the voltage gain or power gain represented in terms of decibels. As an example, we might have an amplifier which is rated as having a voltage gain of 20 db; by referring to the chart we would find that this corresponds to a 10 to 1 voltage gain. Another example might be that we find that an amplifier delivers 2 watts of output when 5 milliwatts are applied to the input. The ratio of power output to

Power Gain	*Voltage Gain*	*Gain in db*
1	1	0
2	1.41	3
3	1.73	4.8
4	2	6
5	2.24	7
6	2.45	7.8
7	2.65	8.5
8	2.82	9
9	3	9.5
10	3.16	10
20	4.47	13
50	7.07	17
100	10	20
400	20	26
1000	31.6	30
10,000	100	40

Figure 4—Voltage and Power Gains

power input is 400. This is found by dividing 5 milliwatts into 2 watts. By referring to the chart, it will be seen that a power gain of 400 is expressed as a power gain of 26 db.

When a loss is experienced as would be the case with transmission lines, splitters, or traps, the db figure ,4, we can find the voltage gain or power gain sible to add all of the db gains of a system and subtract the db losses from this total, and one would find the overall gain or loss of a system.

Since the decibel is a unit based upon the *ratio* of two powers or voltages, it may not be used as an indication of an absolute value of power or voltage unless a reference level (or zero level) is known. There are many so-called "standard" reference levels; however, 1 milliwatt is commonly used.

The expression "dbm" implies that a 1 milliwatt reference level is used; thus it is possible to express an absolute power in terms of dbm. The abbreviation "dbv" indicates a 1 volt reference level. The abbreviation "VU" is used to express the level of complex wave in terms of decibels above or below a reference level of 1 milliwatt in 600 ohms.

With frequent use and practice you will become more familiar with the decibel; since it saves the handling of large numbers, the decibel makes it convenient to evaluate signal levels by the use of simple addition.

BIFILAR IF TRANSFORMERS

Bifilar wound IF transformers are used in many television receivers to couple stagger-tuned IF stages.

The construction of a bifilar transformer differs from the usual IF transformer in the following manner: Instead of winding a single wire on the coil form, two wires are simultaneously wound parallel and directly adjacent to each other from the start of the winding to the finish. This type of construction provides extremely tight coupling—a coefficient of coupling that approximates 90% or as close to unity coupling as physically possible.

The bifilar transformer offers several advantages: one is that since this method is transformer coupling the DC blocking capacitor normally used in impedance coupled circuits is eliminated, another advantage is in simplicity of construction and ease of adjustment, still another feature obtained by the use of bifilar transformers is improved noise immunity brought about by the low resistances of the secondary winding in the IF grid circuits.

In capacitor coupled circuitry it is possible for noise pulses to develop a charge on the coupling capacitor resulting in a temporary excess bias on the tube which would cause momentary reduction of stage gain. Picture quality and sync are also affected by large noise pulses in the capacitor type circuit. The use of bifilar transformers greatly reduce this objectionable condition. In Figure 5 a portion of the IF circuit of the RCA CTC 15 color receiver is shown. The bifilar interstage coupling transformers are identified as T301, T302 and T303. Notice that the schematic symbol for the bifilar transformer suggests the adjacent winding of the primary and secondary wires; the insulation on

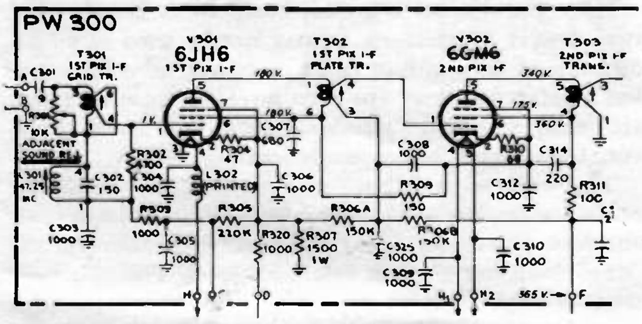

Figure 5—Typical Application of Bifilar Transformers

the two windings is colored differently for identification and a single powdered iron core accessible from either top or bottom of the chassis is used for tuning the bifilar transformer.

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AUDIO POWER OUTPUT

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be noted that in some cases the Peak Power Output can be the highest rating while in other cases the Maximum Power Output can be the highest.

POWER OUTPUT RATING	TEST CONDITION	HOW STATED
Music Power Output (MPO)	RMS Readings using an External Regulated Power Supply	EIA (Standard #234) IHFM @ Stated Distortion
Continuous Power Output (CPO)	RMS Readings Using a Self-contained Power Supply	IHFM @ Stated Distortion
Peak Power Output (PPO)	External *or* Self-contained Power Supply	2 Times RMS Power (Computed, using any one of above readings)
Maximum Power Output (MMPO or MCPO)	External *or* Self-contained Power Supply	Maximum obtainable RMS Readings regardless of distortion content

Figure 6—Various Power Output Ratings

A comparison of power outputs should never be made between amplifiers when different test conditions are used in rating each amplifier.

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