COLLINS RADIO COMPANY
CEDAR RAPIDS, IOWA

FIELD SERVICE

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SUBJECT: What's Watt with SSB

There seems to be considerable confusion existing on the subject of measuring SSB input and output power. Persons using transmitters capable of 2 kw PEP input seem disappointed when their r-f wattmeter shows only 150 watts output.

To better understand this apparent loss in power, perhaps recalling some of the characteristics of the human voice will help. An oscilloscope pattern of speech shows random high peaks and an abundance of low level energy. Much research has been done on this subject by such people as the Bell Telephone Company and the Army Signal Corps. Measurements of thousands of voices have revealed the following peak to average power ratio of the human voice:

Bell Telephone	15 db
Signal Corps	13.8 db

By using some sort of compression, such as ALC, this peak to average ratio can be reduced to about 10 db. This is an average figure and can vary widely from voice to voice.

To see how this peak to average ratio will affect the performance of a SSB transmitter, assume a peak plate input of 2 kw. If the amplifier efficiency is 60%, there will be output power peaks of 1200 watts. But since the r-f wattmeter indicates average power only, a voice with 10 db peak to average ratio will indicate only 120 watts on the wattmeter.

For some time Collins wattmeters were built with an electrolytic capacitor connected in the metering circuit. The purpose of this capacitor was to make the meter tend to be peak reading. On voice, this wattmeter would read much higher than one without the capacitor. However, this version was not capable of indicating either true peak power or true average power, and since some commercial tests required a meter which measures only average power, the circuit was modified to delete the peaking capacitor. Both versions will still read true power under steady carrier conditions. So when making voice output comparisons with other amateurs using similar equipment, do so with caution. One wattmeter may have the peaking circuit and the other one not. Externally, they appear identical.

The operation of the tuning meter on the 30S-1 linear seems to be causing some confusion. This metering circuit is designed so that the transmitter can be tuned for proper operation without exceeding the legal input of 1 kw during tune-up. The power that is supplied to the antenna under these conditions is quite small, (150-200 watts), because the efficiency of the amplifier is poor at low drive levels. When this circuit is adjusted at the factory, the linear is first tuned up with full input into a dummy load for maximum efficiency and lowest distortion. The drive is then reduced so that "tune" input conditions exist, and the metering bridge is then balanced to read zero under these conditions. So if the customer repeats the process in reverse, i.e. tunes for zero on the tuning meter, he is assured of proper output at maximum input conditions.

The plate current meter on the 30S-1 is highly damped in accordance with current interpretation of the FCC Regulations. That is, it does not respond to short voice peaks. If it had normal action, it would indicate inputs of over 1 kw during speech and would be illegal by FCC definition. This high degree of damping is achieved by using a very large magnet inside the meter. It is because of this large magnet that it is difficult to adequately illuminate this meter by internal lighting.

Also, because of this damping action, different voices will cause different degrees of deflection. A low pitched voice will generally "talk up" higher than a higher pitched voice. However, don't worry about it if you can't talk the meter up as high as the next guy; your ALC is riding gain for you and your peaks are going right up to where they belong.

In making power output checks on a linear, Collins suggests using continuous carrier conditions only. CW output can be measured by closing the key and increasing the carrier until 1 kw input is indicated. Read output power on the wattmeter. The same can be done on SSB by using the exciter on CW and the linear in SSB. Increase CW drive until grid current just starts to show on the 30S-1. <u>CAUTION</u>: read the input and output fast and back off the drive immediately because the power supply is not designed to handle 2 kw input continuously. Also, to be legal, this last test should be done into a dummy load. The power outputs observed on these two tests should be about 600 W on CW and between 1000-1200 watts on SSB. If outputs of this magnitude are obtained under steady tone conditions, peak outputs slightly greater under voice conditions will be realized (because of power supply regulation); the ALC will not operate until this power is reached! So if ALC voltage is indicated on the ALC Meter, the operator can rest assured that voice peaks are going right up to the maximum capability of your 30S-1, regardless of what the wattmeter or plate milliammeter are indicating.

A word of caution about trick tune-up schemes that are supposed to yield higher r-f output power on speech. The only way that a higher average power can be achieved on a properly tuned 30S-1 is to mis-tune the exciter to the point where peak clipping (flattopping) occurs in the low level stages. This clipping will raise the average to peak ratio of the voice and indicate more watts output. However, the peaks in the 30S-1 are still being held down by the ALC circuits so what has been gained? Just a broad signal that doesn't talk any louder than before.