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MEASUREMENT OF UHF NOISE FIGURES OF TV RECEIVERS

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MEASUREMENT PROCEDURE MP-2
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1. INTRODUCTION

1.1 This bulletin describes the recommended procedures for measurements of television receiver noise figures at UHF. Reference to this document may be made in connection with the report of measurements required by Section 15.77 of the rules, and the UHF noise figure performance report required by Section 15.66 for television receivers certified or verified after October 1, 1979.

2. MEASUREMENT PROCEDURE

2.1 The receiver to be tested and the equipment associated with the measurements of noise figures may be placed in a shielded room or other environment with levels of radio frequency energy low enough to minimize effects on the measurements.

2.2 Before testing, the television receiver and noise figure test equipment are to be subjected to a warm-up period of sufficient time for stabilization of factors which could affect the measurements. The supply for line-operated receivers is ascertained to be 120V ±5%, 60 Hz or as specified; that for battery-operated receivers is to be at the voltage specified.

2.3 Since television receiver noise figures are usually measured at a stage preceding video output, it must first be determined whether or not the noise figure contribution of the receiver following the measurement point exceeds 0.3 dB. This can be done by application of the equation

$$\Delta F = 10 \log [1 + (F_2 - 1)/F_1 G_1]$$

Where ΔF = noise figure contribution in dB of the receiver following the measurement point,

F_2 = noise factor following the measurement point, as a power ratio,

F_1 = noise factor from receiver antenna input terminals to measurement point, as a power ratio, and

G_1 = power gain of circuit from receiver antenna input terminals to measurement point.

Alternatively, the values in this equation may be calculated design characteristics or measured values. If ΔF exceeds 0.3 dB, it must be added to the value obtained at the measurement point to arrive at data submitted for certification and proof of performance. If ΔF does not exceed 0.3 dB, it may be neglected in the submitted noise figure data.

2.4 A solid state UHF noise source is connected to the receiver's UHF input through a matching network. Particular care is to be taken that the signal path from the receiver's external input to its tuner is not disturbed. Care is also taken that any twin lead from a balun to the TV receiver does not affect the measurements; e.g., by routing the twin lead away from metal. The insertion loss of a balun and/or the matching network may be subtracted from the measured values.

2.5 Automatic gain control bias, preceding the noise output measurement point, is maintained at the level existing when there is no input signal with the receiver's UHF input terminated in its nominal impedance. The receiver is otherwise operated so that the noise figure data are actually those inherent to it.

2.6 The TV receiver noise figure is preferably measured by coaxially connecting a noise figure indicating system to the tuner output. If this connection is not feasible, or the gain insufficient, the noise output is obtained through the use of a small loop, or other suitable probe, coupled to one of the intermediate frequency amplifier stages. The stage chosen is that which yields an adequate noise output without disturbing shielding or other circuit elements. In the event that this, too, is not a workable approach, an appropriate low capacitance probe is used instead of the loop. A low noise preamplifier is used between the noise output from the receiver and the input of the indicating instrument in order to obtain sufficient level, if necessary.

2.7 The center frequency of the television receiver's nominal intermediate frequency band at the measurement point is used as the center frequency of the noise figure indicator to which the receiver's noise output is connected. (For a television receiver with a nominal intermediate frequency band of 41 to 47 MHz at the noise measurement point, the center frequency would be 44 MHz.)

2.8 Receivers using continuously tunable oscillators are to have those oscillators adjusted to within plus or minus one megahertz of the desired oscillator frequency. If there is more than one such tuning control, that yielding higher noise figures is to be used. Tuners using discrete selection of UHF channels are to have their associated fine tuning control, if any, set so that the local oscillator frequency for channel 14 is within 0.25 MHz of the correct value.

2.9 Noise figure data in dB are reported, compensated with necessary correction factors. These factors including balun loss, impedance transformation loss, and the required ΔF contribution must be given if they are part of the final submitted noise figure values. Data are obtained for the following ten UHF channels:

14, 20, 26, 32, 38, 44, 50, 56, 62, 69.

Channels upper or lower to these may be used if necessitated by local ambient signal conditions but may vary by no more than ± 2 channels.

In addition to these discrete channels, the total range of the UHF channels is examined. The worst noise figure, with corrections as noted above, is reported along with that channel number.