ISCE

The Institute of Sound and Communications Engineers

Engineering Note 6.3

Methods of measurement for autotransformer loudspeaker line volume controls

J M Woodgate *FInstSCE*

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These methods are not in a standard yet, but may be in the future.

Measurements are made, except where stated, with the transformer loaded with a (low inductance) resistive load of the rated value, and in the highest power transfer condition (0 dB attenuation).

NOTE - The reason for measuring the low limit of the effective frequency range on-load is that it allows for the reduction of magnetic induction due to the voltage drop across the primary resistance.

Insertion loss

Apply rated line voltage V_r at 1 kHz to the winding, with attenuation set to as near 20 dB as possible and no load applied. Measure the output voltage V_a. Then connect the rated load resistance to the secondary winding, readjust the input to rated line voltage if necessary and measure the secondary voltage V_b again. Express the insertion loss I.L. in decibels, 20 $\lg(V_a/V_b)$.

NOTES

1. With no load, the transformer losses are normally very low at 1 kHz: the on-load copper loss is much greater than the iron loss at high attenuations, but is low at low attenuations.

2. The power delivered to the load resistor R is Vb^2/R. From Note 1, the power input to the transformer is (very nearly) Va^2/R, and this latter value can be compared with the rated value.

Effective frequency range

a) Low frequency end: Apply rated line voltage at 1 kHz and measure the input current (as voltage across a known low-value resistor in series if no suitable ammeter is available),with rated load connected to the transformer and attenuation set to 0 dB. Reduce the frequency until the current has risen by 11% (1 dB). Note the frequency as the low-frequency limit of the effective frequency range.

NOTE - The low frequency limit of an autotransformer is determined by the acceptable amount of increased load its inductance places on the amplifier. Distortion is not normally a factor, because the induction is forced to be sinusoidal by the low output source impedance of the amplifier. Distortion increases if significant cable resistance is present.

b) High-frequency end: Apply rated line voltage at 1 kHz and measure the output voltage with the attenuation set to as near 20 dB as possible. Increase the frequency until the output voltage falls by 3 dB. Note the frequency as the high-frequency limit of the effective frequency range.

Input impedance at surveillance frequencies:

Input impedance at 31.5 Hz and/or 20 Hz

Apply one twentieth of rated line voltage at 31.5 Hz or 20 Hz to the transformer with no load resistance. Measure the input current I_p and calculate the (modulus of the) input impedance $Z_{[freq.]} = V_r/20I_p$. State the frequency used with the result.

Input impedance at 20 kHz

Apply one twentieth of rated line voltage at 20 kHz to the transformer, with no load resistance Measure the input current Ip and calculate the (modulus of the) input impedance $Z_{20k} = V_r/20I_p$.