TRANSFORMER CHARACTERISTICS WHEN USED IN MID-SPAN APPLICATIONS

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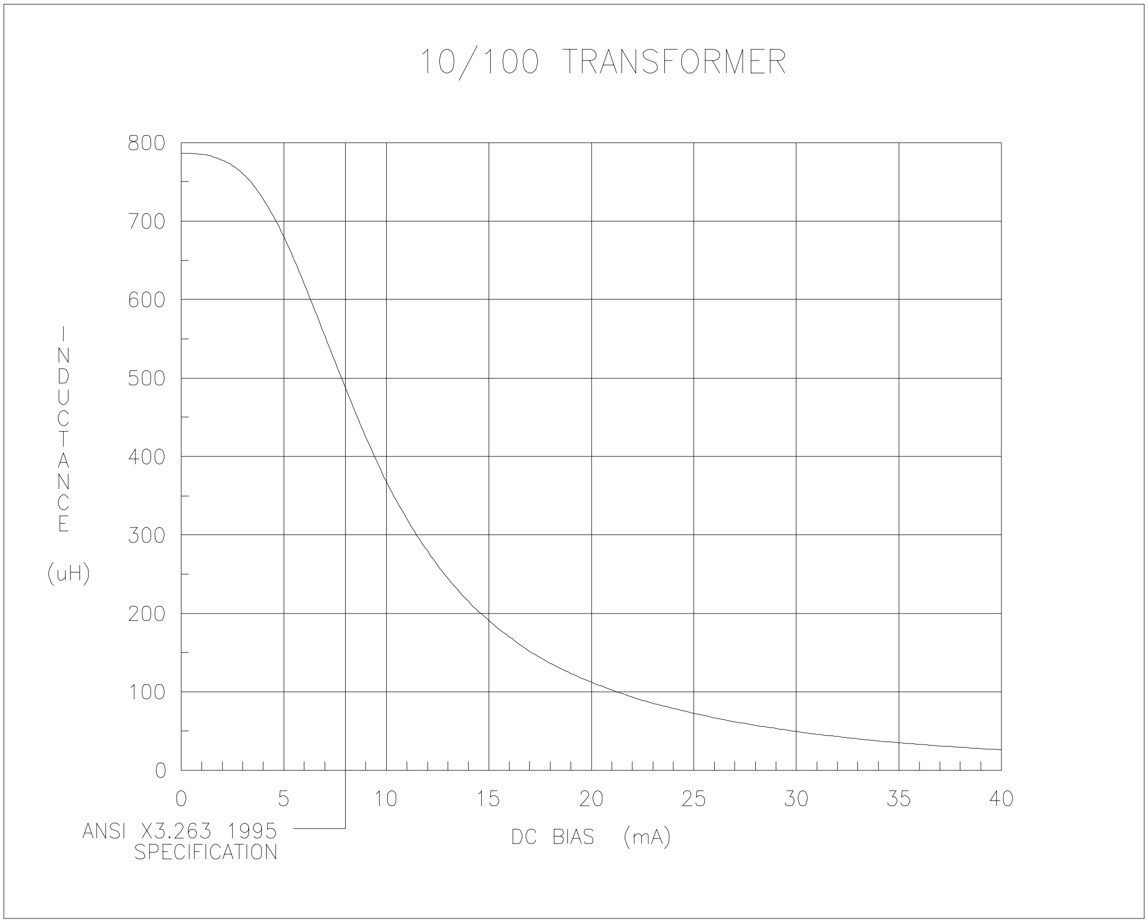
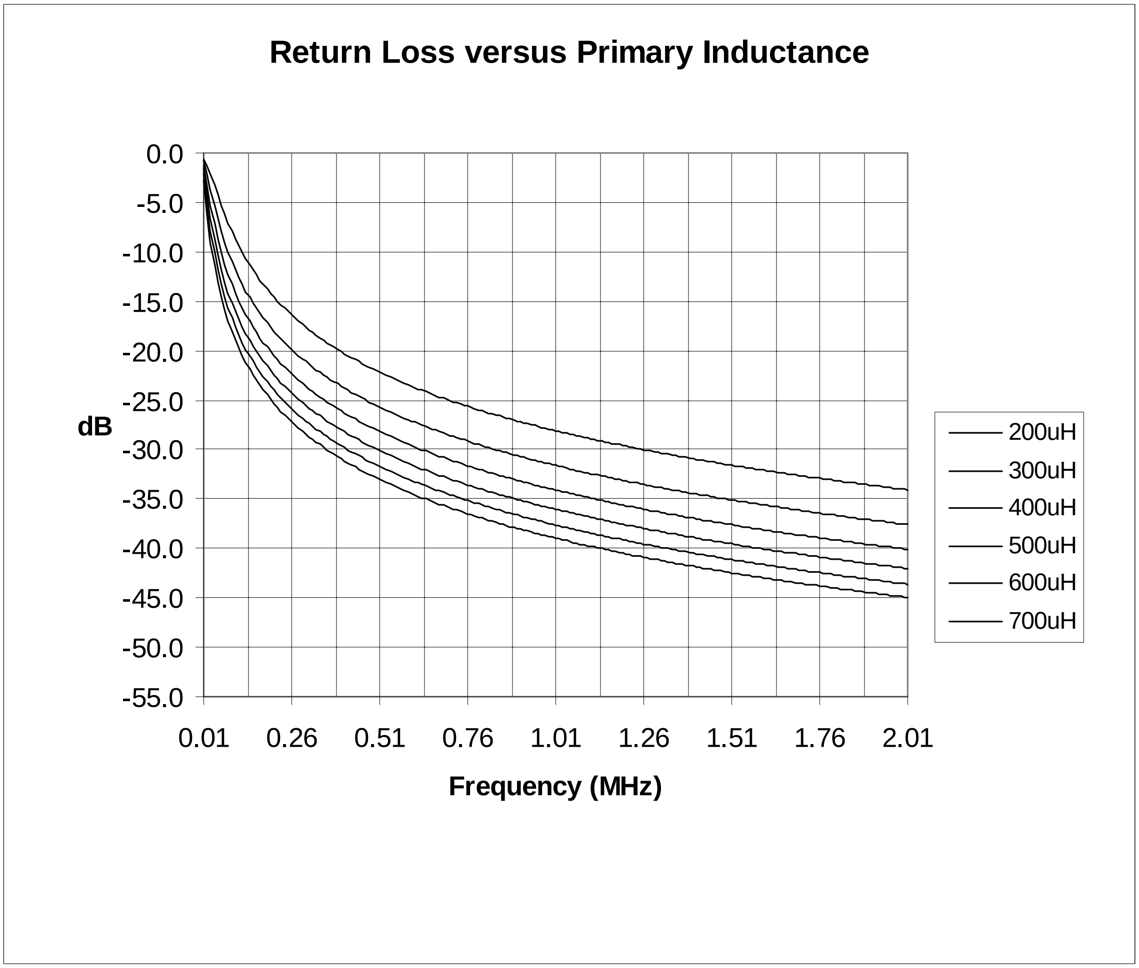


The transformer's bias current is the algebraic sum of all DC currents flowing in the core. Since the phantom current splits and flows in opposite directions from the center-tap, only the difference in these two currents creates a DC bias.

The difference in currents is due to the two transmission channel halves not having exactly the same resistance.

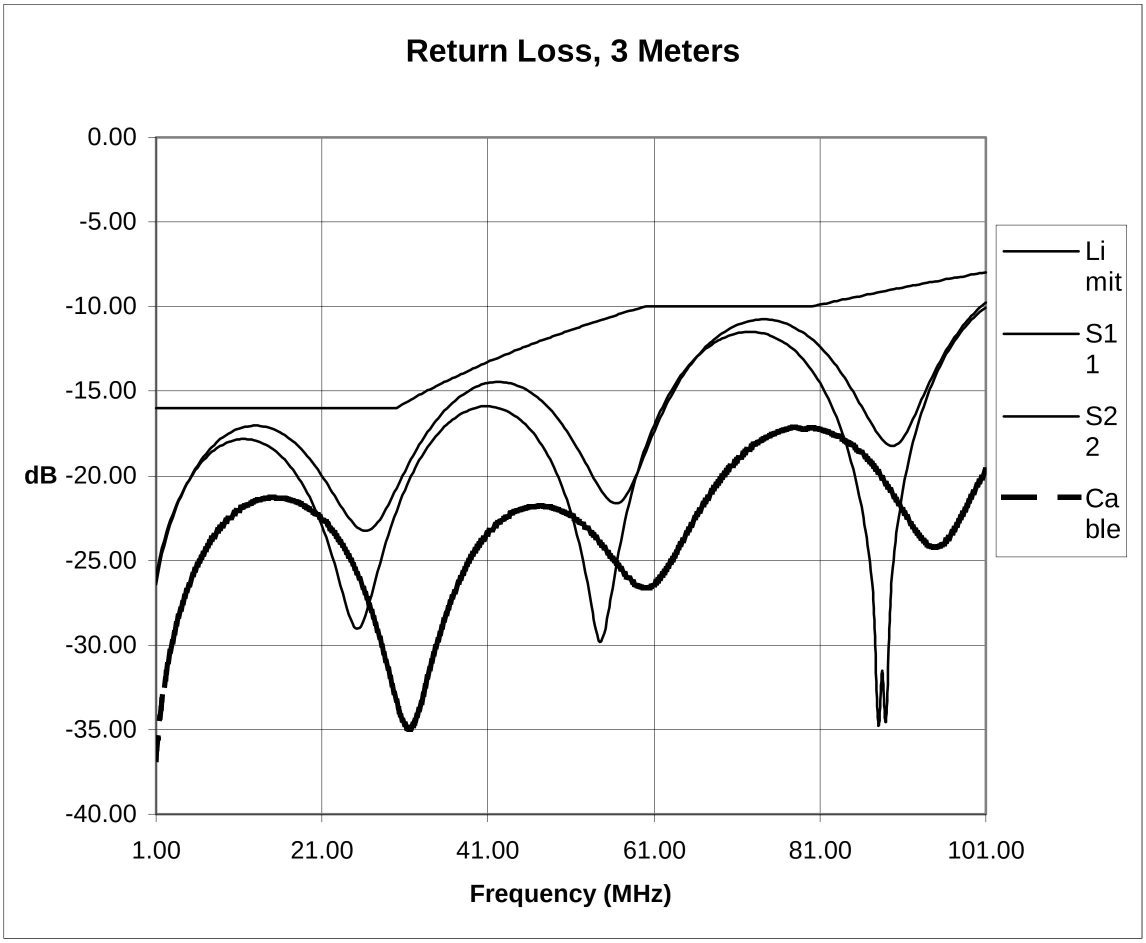
The above chart shows the effect DC bias current has on the transformer's primary inductance.



At the transformer's high pass pole frequency all of the high frequency parasitic elements disappear and the return loss equation becomes:

$$RL = 20 * LOG_{10} \left| \frac{\frac{(X_L * Rs)}{(X_L + Rs)} + Rw - Zref}{\frac{(X_L * Rs)}{(X_L + Rs)} + Rw + Zref} \right|$$

Where: X_L = Inductive reactance, Transformer
Rw = Winding resistance, Transformer
Rs = Reflected impedance, Source
Zref = Reference impedance (UTP = 100 Ohms)



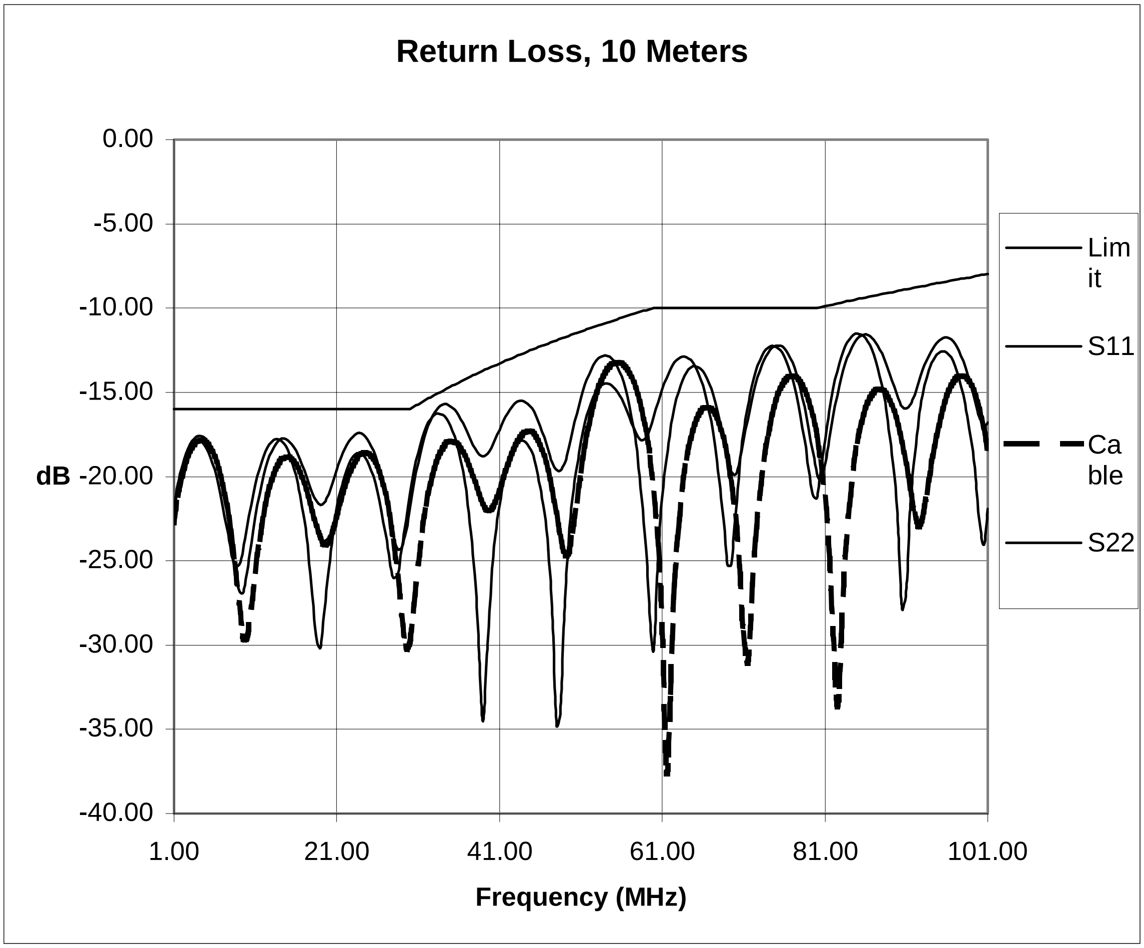
In the above graph the traces (in descending order) are:

1. IEEE return loss limit.

2. Looking into transformer's secondary followed by 3 meter length of cat #5 UTP cable terminated in 100 ohm load.

3. Looking into 3 meter length of cat #5 UTP cable followed by transformer terminated into 100 ohm load.

4. Looking into 3 meter length of cat #5 UTP cable terminated in 100 ohm load.



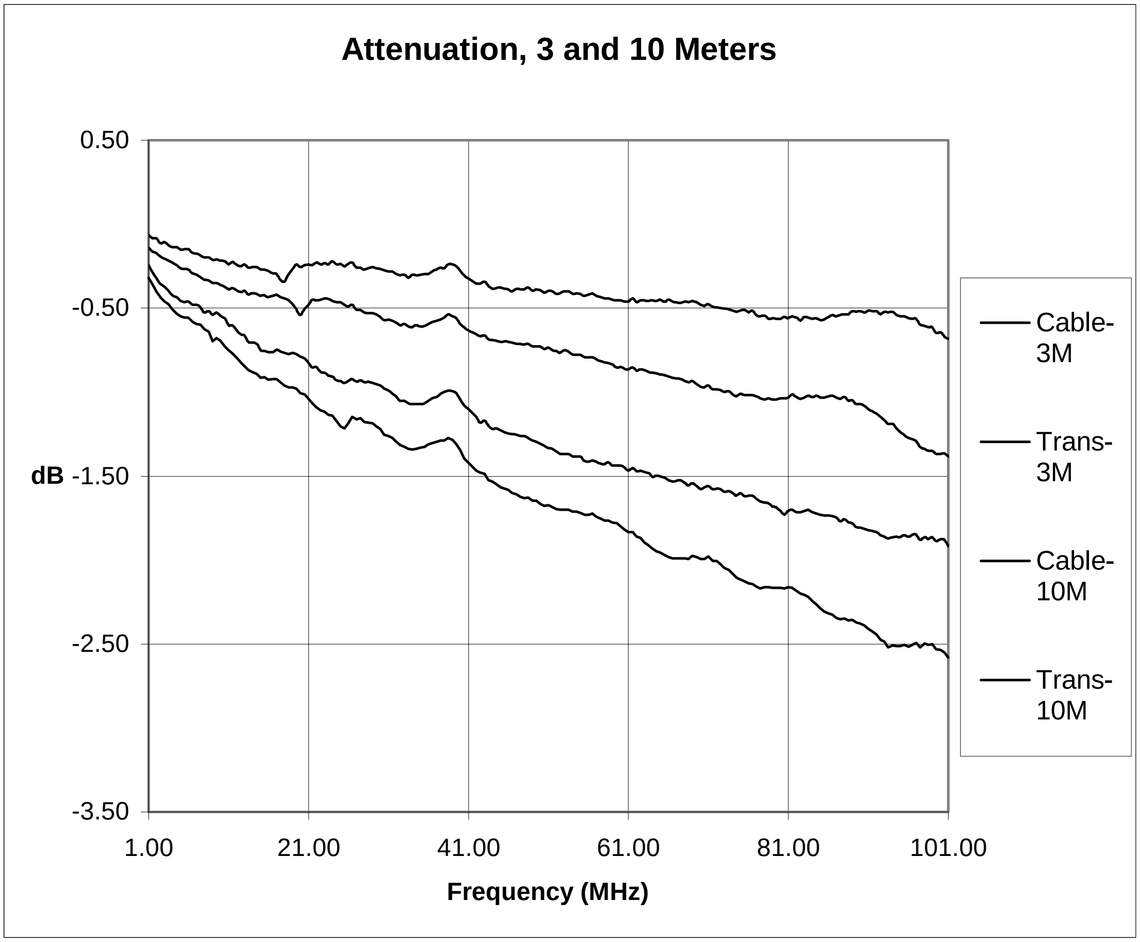
In the above graph the traces (in descending order) are:

1. IEEE return loss limit.

2. Looking into transformer's secondary followed by 10 meter length of cat #5 UTP cable terminated in 100 ohm load.

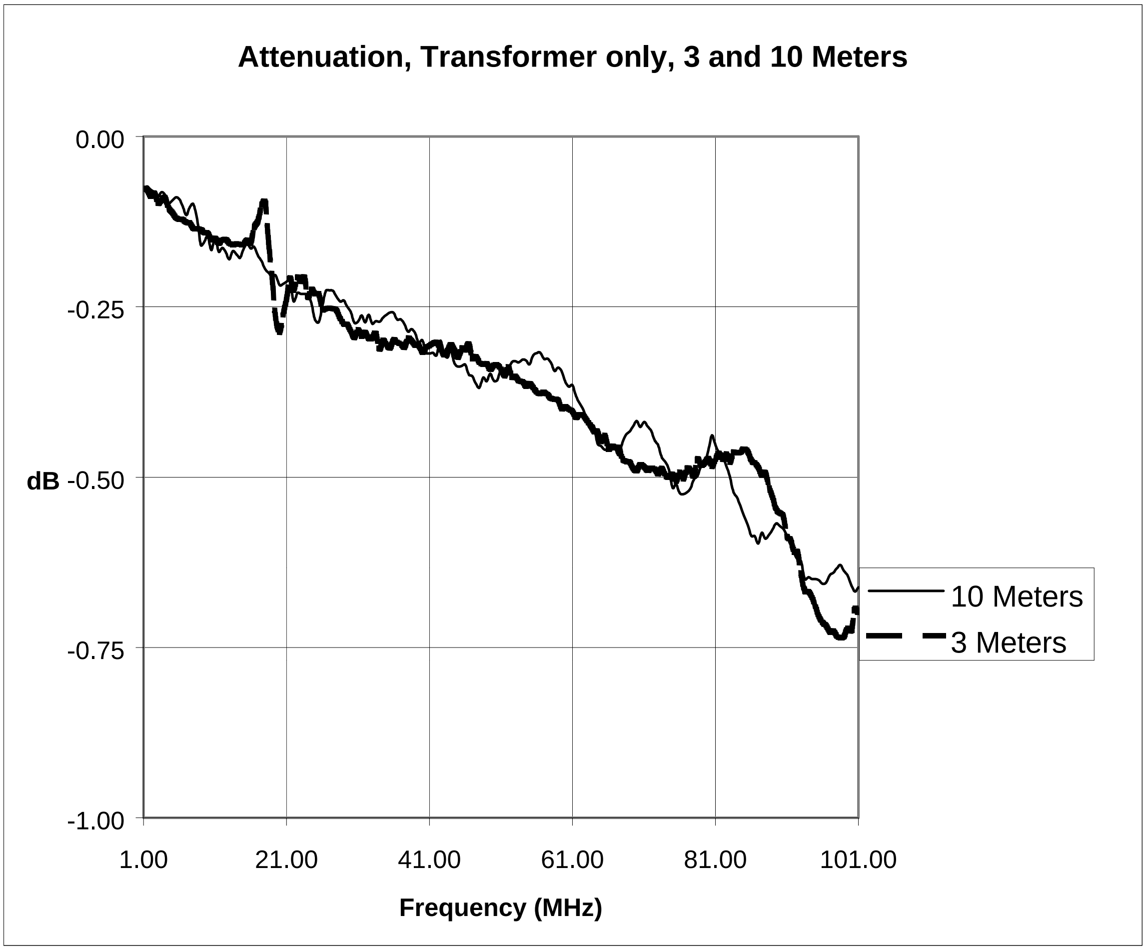
3. Looking into 10 meter length of cat #5 UTP cable terminated in 100 ohm load.

4. Looking into 10 meter length of cat #5 UTP cable followed by transformer terminated into 100 ohm load.



In the above graph the traces (in descending order) are:

1. 3 meter length of cat #5 UTP cable.
2. 3 meter length of cat #5 UTP cable and transformer.
3. 10 meter length of cat #5 UTP cable.
4. 10 meter length of cat #5 cable and transformer.



Attenuation, Transformer only, 3 and 10 Meters
0.00
-0.25
dB -0.50
-0.75
-1.00
1.00
21.00
41.00
61.00
81.00
101.00
Frequency (MHz)
10 Meters
3 Meters

SUMMARY

* TRANSFORMER'S OCL IS AFFECTED BY DIFFERENCES IN CURRENT BETWEEN THE WINDING SECTIONS, NOT THE ABSOLUTE CURRENT FLOWING IN WINDING.

  EACH WINDING SECTION USES A DIFFERENT COLOR INSULATION FOR IDENTIFICATION.

  RESISTANCE PER UNIT LENGTH IS DIFFERENT FOR EACH SPOOL OF WIRE.

  WORST CASE VARIATION IN RESISTANCE ≈ 4.7%

* TRANSFORMER OCL DETERMINES THE CHANNEL'S HIGH PASS CHARACTERISTIC.

  TRANSFORMER COIL IS IN PARALLEL WITH OUTPUT LOAD.

  WINDING RESISTANCES ARE IN SERIES WITH SOURCE.

  RETURN LOSS IS GREATER THAN −20 dB AT 250 KHz
  IF TRANSFORMER INDUCTANCE IS AT LEAST 300 uH.

* TRANSFORMER DOES NOT CAUSE NON−COMPLIANCE IN MID−SPAN INSERTION APPLICATIONS.

  RETURN LOSS EXCEEDS SPECIFIED STANDARD.