Obsolete

Balanced to Unbalanced Transformer 17 June 1965

This device designed in 1956 for used at 520 kc at Kempton. A Faraday shield is used between windings. Originally a powdered iron core 1" dia x 4" long was incorporated. The permeability was about ten. This core has disappeared. Device was tested on a Q machine using air core. The windings were connected in operative manner.

MC	pf	Q	R

Balanced

1,2	456	41	6.0Ω
2.4	52	5	99Ω

$C_o = \frac{456 - 4.52}{3} = 83 pf$

$L_o = 1/(6.28 \cdot 1.2)^2 (456+83) = 1/56.7 \cdot 539 = 10^{-3}/30.6 = 32.7 \mu h$

$R = 32.7 \cdot 6.28 \frac{MC}{Q} = 206 \frac{MC}{Q}$

$\omega_0 = 1/6.28(32.7 \cdot 10^{-6} \cdot 83 \cdot 10^{-12})^{1/2} = 1/6.28(2710)^{1/2} \cdot 10^{-9} = 10^6/.327 = 3.06$ mc

Unbalanced

1.25	455	28	
2.5	37	3?	

$C_o = \frac{455 - 4.37}{3} = 102 pf$

$L_o = 1/(6.28 \cdot 1.25)^2 (455+102) = 1/61.5 \cdot 557 = 10^{-3}/34.2 = 29.2 \mu h$

$\omega_0 = 1/6.28(29.2 \cdot 10^{-6} \cdot 102 \cdot 10^{-12})^{1/2} = 1/6.28(2980)^{1/2} = 10^6/.342 = 2.92$ mc

This device has one to one transformation, presumably 50Ω to 50Ω at 520 kc. The self resonances are too low. The device is not useful for tests at 1.5 to 6.0 megacycles between 600Ω balanced and 50Ω unbalanced.

230 Ω to 50 Ω
Balanced to Unbalanced Transformer 22 June 1965

The balanced winding is 32 turns $\frac{9}{16}$" dia, 2" long, wire 0.045" dia. The unbalanced winding is two parallel sections, each $14\frac{1}{2}$ turns with taps at $10\frac{1}{2}$ turns, wire 0.045" dia. Coil $\frac{15}{16}$" dia, 2" long total. A ferrite core $\frac{1}{2}$" dia x 3" long is in center of assembly. No faraday shield is used. Windings tested disconnected. Entire $14\frac{1}{2}$ turns of balanced windings used both in parallel.

Balanced.

MC	pf	Q	R
1.05	447	99	3.4
2.1	110	120	5.6
3.7	37	135	8.8

$C_0 = \frac{447 - 4 \cdot 110}{3} = \frac{7}{3} = 2.3 pf.$

$L_0 = 1/(6.28 \cdot 1.05)^2 (447+3) = 1/43.5 \cdot 449$
$= 10^{-6}/.01955 = 51.2 \mu h$

$R = 51.2 \cdot 6.28 MC/Q = 322 MC/Q$

$f_0 = 1/6.28(51.2 \cdot 10^{-6} \cdot 2.3 \cdot 10^{-12})^{1/2} = 1/6.28 \cdot 117.7^{1/2} = 10^9/6.28 \cdot 10.85 = 14.7 mc$

$51.2 \mu h = 230$ ohms at $f = X/2\pi L = 230/6.28 \cdot 51.2 \cdot 10^{-6} = 0.71 mc$

Unbalanced

MC	pf	Q	R
2.2	456	111	1.4
4.4	105	135	2.3
7.0	37	69	7.2

$C_0 = \frac{456 - 4 \cdot 105}{3} = \frac{36}{3} = 12 pf$

$L_0 = 1/(6.28 \cdot 2.2)^2 (456+12) = 1/191 \cdot 468$
$= 10^{-6}/.0894 = 11.2 \mu h$

$R = 11.2 \cdot 6.28 MC/Q = 70.4 MC/Q$

$f_0 = 1/6.28(11.2 \cdot 10^{-6} \cdot 12 \cdot 10^{-12})^{1/2} = 1/6.28 \cdot 134^{1/2} \cdot 10^{-9} = 10^6/.073 = 13.7 mc$

$11.2 \mu h = 50$ ohms at $f = X/2\pi L = 50/6.28 \cdot 11.2 \cdot 10^{-6} = 0.71 mc$

actual ratio $= \frac{51.2}{11.2} = 4.6$ Desired ratio $= \frac{230}{50} = 4.6$

This was measured on Q machine at PMG

This is a good design for 230 Ω balanced to 50 Ω unbalanced. A more desirable design for 600 Ω balanced would use a balanced winding of $(600/230)^{1/2} \times 32 = 52$ turns of smaller wire.

600 Ω to 50 Ω

Balanced to Unbalanced Transformer — 29 June 65

The balanced winding is 52 turns $\frac{9}{16}$" dia. $2\frac{1}{2}$" long, 0.025" dia wire. The unbalanced winding is two parallel sections, each $14\frac{1}{2}$ turns of 0.045" dia wire, $2\frac{1}{8}$" total length. A ferrite core $\frac{1}{2}$" dia × 3" long is in center of assembly. No faraday shield is used. Windings tested disconnected.

Balanced

MC	pf	Q	R ohms
0.7	410	116	4.8
1.4	100	142	7.8
2.65	27	151	13.8

$C_0 = (410 - 4\cdot 100)/3 = 10/3 = 3.3$ pf

$L_0 = 1/(6.28\cdot .7)^2(410+3.3) = 1/19.3\cdot 413$

$= 10^{-6}/.008 = 126$ μh

$R = 6.28\cdot 126\,MC/Q = 788\,MC/Q$

$f_0 = 1/6.28(126\cdot 3.3)^{1/2}\cdot 10^{-9} = 10^9/6.28\cdot 20.4 = 10^6/.128 = 7.8$ mc

126 μh = 600 Ω at $f = 600/6.28\cdot 126\cdot 10^{-6} = 600/792 = 0.76$ mc

Unbalanced

MC	pf	Q	R ohms
2.2	459	150	1.0
4.4	97	120	2.5
6.8	27	50	9.3

$C_0 = (459 - 4\cdot 97)/3 = 71/3 = 24$ pf

$L_0 = 1/(6.28\cdot 2.2)^2(459+24) = 1/191\cdot 483$

$= 10^{-6}/.092 = 10.85$ μh

$R = 10.85\cdot 6.28\,MC/Q = 68.1\,MC/Q$

$f_0 = 1/6.28(10.85\cdot 24)^{1/2}10^{-9} = 10^9/6.28\cdot 16.2 = 10^6/.102 = 9.9$ mc

10.85 μh = 50 Ω at $f = 50/6.28\cdot 10.85\cdot 10^{-6} = 50/68.1 = 0.73$ mc

Actual ratio $= \frac{126}{10.85} = 11.6$ Desired ratio $= \frac{600}{50} = 12$

This was measured on Q machine at University.

230 Ω to 230 Ω
Balanced to Unbalanced Transformer
15 July 65

The balanced winding is 32 turns $\frac{9}{16}$" dia. $2\frac{3}{4}$" long, .045" wire, 11.7 tpi. The unbalanced winding is two parallel sections each $31\frac{1}{2}$ turns of .015" wire .890" dia, $1\frac{3}{16}$" long, 27.8 tpi. Overal $2\frac{1}{2}$" long. A ferrite core $\frac{1}{2}$" dia × 3" long is in center of assembly. No faraday shield is used. Windings tested disconnected.

Balanced

MC	pf	Q	R ohms.
1.2	403	119	2.7
2.4	97.5	133	4.9
3.85	37	130	8.0

$C_o = (403 - 4\cdot 97.5)/3 = 13/3 = 4.3\,pf$

$L_o = 1/(6.28\cdot 1.2)^2(403+4.3) = 1/56.9\cdot 407$

$= 10^{-6}/.0232 = 43.2\,\mu h$

$R = 6.28\cdot 43.2\,MC/Q = 271\,MC/Q$

$f_o = 1/6.28(43.2\cdot 4.3)^{1/2}\cdot 10^{-9} = 10^9/6.28\cdot 13.65 = 1000/85.8 = 11.7\,mc$

$43.2\,\mu h = 230\,\Omega$ at $f = 230/6.28\cdot 43.2\cdot 10^{-6} = 230/271 = 0.85\,mc$

Unbalanced

MC	pf	Q	R ohms.
1.2	420	115	2.7
2.4	101	125	5.0
3.9	37	125	8.1

$C_o = (420 - 4\cdot 101)/3 = 16/3 = 5.3\,pf.$

$L_o = 1/(6.28\cdot 1.2)^2(420+5) = 1/56.9\cdot 425$

$= 10^{-6}/.0242 = 41.3\,\mu h$

$R = 6.28\cdot 41.3\,MC/Q = 260\,MC/Q$

$f_o = 1/6.28(41.3\cdot 5.3)^{1/2}\cdot 10^{-9} = 10^9/6.28\cdot 14.8 = 1000/93 = 10.8\,mc$

$41.3\,\mu h = 230\,\Omega$ at $f = 230/6.28\cdot 41.3\cdot 10^{-6} = 230/260 = 0.88\,mc$

Actual ratio $= \frac{43.2}{41.3} = 1.045$ Desired ratio $= \frac{230}{230} = 1.00$

This was measured on Q machine at PMG.