

SECONDARY CONSTANTS OF NONLOADED CABLE  
19 GAUGE CNB, ENB, FNB

At 68° F.\*

Freq. kHz	Characteristic Impedance			
	R Ohms	X Ohms (Neg.)	Z Ohms	Angle Degrees (Neg.)
.1	906	898	1275	44.8
.2	643	633	902	44.6
.3	527	515	737	44.4
.5	411	397	571	44.0
1	296	276	405	43.1
2	216	190	287	41.3
3	182	150	236	39.5
5	151	110	186	36.1
8	130	80	153	31.5
10	123	68	141	28.9
15	114	50	125	23.6
20	110	40	117	19.8

Through Carrier Frequencies – At 55° F.\*

Freq. kHz	Characteristic Impedance			
	R Ohms	X Ohms (Neg.)	Z Ohms	Angle Degrees (Neg.)
.1	895	887	1260	44.7
.2	635	625	891	44.6
.5	406	392	564	44.0
1	292	273	400	43.0
2	214	187	284	41.1
5	150	108	184	35.8
10	123	67	140	28.5
15	114	49	124	23.1
20	110	39	117	19.4
50	104	20	106	10.6
100	101	12	102	6.9
200	99	8	100	4.6
250	98	7	99	4.0
500	96	4	96	2.7
1000	94	3	94	1.8
2000	92	2	92	1.1
4000	91	1	91	0.7
5000	91	1	91	0.6
10000	90		90	0.3

\* For temperature variations see page 3.

At 68° F.\*

Freq. kHz	Propagation Constant Per Mile			Phase Delay Sec./Mile ( $\times 10^{-6}$ )	Velocity of Propagation Miles/Sec. ( $\times 10^3$ )
	Attenuation		Phase Shift $\beta$ Radians		
	$\alpha$ Nepers	dB			
.1	.0476	.41	.0478	76.08	13.1
.2	.0671	.58	.0678	53.97	18.5
.3	.0819	.71	.0833	44.20	22.6
.5	.105	.91	.108	34.46	29.0
1	.146	1.27	.156	24.76	40.4
2	.200	1.74	.227	18.08	55.3
3	.238	2.07	.287	15.25	65.6
5	.290	2.52	.395	12.58	79.5
8	.339	2.94	.547	10.87	92.0
10	.361	3.14	.646	10.28	97.2
15	.398	3.46	.897	9.51	105.1
20	.424	3.68	1.151	9.16	109.2

Through Carrier Frequencies – At 55° F.\*

Freq. kHz	Propagation Constant Per Mile			Phase Delay Sec./Mile ( $\times 10^{-6}$ )	Velocity of Propagation Miles/Sec. ( $\times 10^3$ )
	Attenuation		Phase Shift $\beta$ Radians		
	$\alpha$ Nepers	dB			
.1	.0468	.41	.0470	74.82	13.4
.2	.0660	.57	.0667	53.09	18.8
.5	.103	.90	.107	33.92	29.5
1	.144	1.25	.153	24.38	41.0
2	.197	1.71	.224	17.82	56.1
5	.285	2.47	.390	12.43	80.5
10	.353	3.07	.640	10.19	98.1
15	.389	3.38	.890	9.44	105.9
20	.414	3.60	1.145	9.11	109.8
50	.540	4.69	2.706	8.61	116.1
100	.711	6.18	5.279	8.40	119.0
200	.988	8.59	10.32	8.22	121.7
250	1.105	9.60	12.77	8.13	123.0
500	1.637	14.2	24.87	7.92	126.3
1000	2.513	21.8	48.74	7.76	128.9
2000	3.885	33.7	95.83	7.63	131.1
4000	6.074	52.8	189.7	7.55	132.5
5000	6.982	60.6	236.6	7.53	132.8
10000	10.79	93.8	469.7	7.48	133.8

Notes: dB = 8.686  $\alpha$ phase delay =  $\beta / 2\pi f$ velocity of propagation =  $2\pi f / \beta$ 

\* For temperature variations see page 3.

## Estimated Average Temperature Variation\*

Freq. kHz	Per Mile Per Degree F.			
	dB	Phase Radians	R Ohms	X Ohms
.3	.0009	.00011	.462	-.479
.5	.0012	.00014	.355	-.376
1	.0017	.00019	.245	-.274
2	.0024	.00026	.167	-.198
3	.0030	.00031	.126	-.169
5	.0039	.00038	.090	-.138
10	.0057	.00047	.046	-.101
15	.0065	.00050	.023	-.072
20	.0074	.00053	.012	-.051
50	.0079	.00077	-.009	-.035
100	.0080	.00133	-.013	-.020
200	.0084	**	**	**
250	.0088			
500	.0119			
1000	.0209			
2000	.0470			
4000	.1120			
5000	.1465			
10000	.3405			

\* Average values between 34° and 76°F.

\*\* At high frequency, inductance has a significant effect on phase shift and impedance; therefore, due to the uncertainty of the effect of temperature variation on inductance, the phase and impedance variations above 100 kHz are not given.