COMMON CABLE DELAYS

(from **http://www.andrew.com/products/heliax/catalog37.asp** and **http://www.timesmicrowave.com/products/military/milcable.htm)**

Delays are calculated from:

$$\Delta t = \frac{l * (ppm)}{10^6 * V_{rel} * c}$$

Where l is the cable length in meters, ppm is the part per million change in length per degree C at a given temperature, V_{rel} is the propagation velocity relative to the speed of light in a vacuum and c is the speed of light in a vacuum ($3.0*10^8$ m/s). The results are given in ps/°C/m and are for the minimum and maximum delay over a temperature range of -30°C to +40°C. If the two values have different signs then there is a temperature at which the temperature coefficient is 0 – these points are tabulated in the T_0 column.

CABLE	**Vrel** (%)	**ΔPPM min**	**ΔPPM max**	**ps/°C/m min**	**ps/°C/m max**	**T_0 [°C]**	**L1 loss dB/100 m**	**L2 loss dB/100 m**
RG-58	0.66							
RG-142	0.695	-75	-50	-0.36	-0.24			
RG-214	0.66	-79	-44	-0.4	-0.22			
RG-223	0.66	-150	-150	-0.76	-0.76			
RG-393	0.695	-71.4	-18	-0.35	-0.087			
FSJ1-50A	0.84	-7	9	-0.028	0.036	20	24.8	21.7
FSJ2-50	0.83	-9	9	-0.036	0.036	30	17.0	14.3
FSJ4-50B	0.81	-2	6	-0.0083	0.025	40	15.2	13.2
LDF2-50	0.88	-8	6	-0.031	0.023	14	14.8	12.9
LDF4-50A	0.88	7	16	0.027	0.061		9.75	8.50
LDF5-50A	0.89	5	12	0.019	0.045		4.97	4.56
ETS1-50T	0.82	-16	10	-0.066	0.041	2, 28	24.4	21.4
ETS2-50T	0.83	-8	13	-0.032	0.053	14, 26	17.8	15.4
HJ4-50	0.914	5	11	0.018	0.04	74	10.9	9.58
HJ5-50	0.916	5	12	0.018	0.044	80	5.26	4.60

Notes:

- For this calculation the length is set to 1 meter to get a delay per meter.
- The ppm values are either from the Andrew specs or they are derived from graphs in the web page. They constitute minimum and maximum slopes over the of -30°C to +40°C temperature range. These values are essentially a worst case over a range larger then would be usually necessary. Significant improvement can be obtained by using a cable that has a tempco of zero near the most likely operating temperature.
- $\Delta t < 0$ means an advance; $\Delta t > 0$ means a delay.
- For the loss columns the results are expressed for the L1 and L2 frequencies (1575.42 MHz and 1226.6 MHz respectively) used in GPS. The given values are obtained by extrapolating tabulated values to L1 and L2 which are valid for standard conditions: VSWR 1.0; ambient temperature 24°C.
- The manufacturer (Andrew) claims that the relative velocity doesn't vary by more than ±2% over the entire range meaning that there is no anomolous dispersion over this range. This claim probably bears some verification (I did not do). If true, then at least to 2%, the same V_{rel} can be used for both L1 and L2 and the tempco will be the same for both.