52.9.11.1

a. Page 476, line 23. Delete 2nd sentence of 2nd paragraph. This information is clear from the block diagram.
b. Page 478, line 7. Modify the words as follows "…effects should be minimized, resulting in good trace visibility on sampling oscilloscopes." Move the last sentence of the paragraph to a separate paragraph at the end of section 52.9.11.1.
c. Page 478, line 14. Rewrite to "…filter should have the appropriate frequency response to result in the appropriate level…".
d. Page 478, line 15. Delete the sentence about filter tolerance.
e. Page 478, line 17. Modify to "Electrical summing requires high linearity of all elements including the E/O modulator. Summing with an optical coupler after the modulator is an option that eases linearity requirements, but requires a 2nd source for the interfering signal, will complicate settings of extinction ratio, and add more RIN.
f. In Figure 52-11, re-label the Sinusoidal generator block to "Sinusoidal interference". Also, search and change all text instances of "AM" to "interference".
g. In Figure 52-11, add a label to the signal coming from Clock source to "Sinusoidal jitter signal".

52.9.11.2

a. Page 478, line 33. Reword paragraph to "Signal characteristics are described below along with suggested approaches for calibration." Then, add the following steps (this new text replaces all text from page 478, line 38 through all of page 479.

1. Set the signaling speed to satisfy the requirements of 52.5.1, 52.6.1, and 52.7.1.

2. Enable the appropriate test pattern per 52.9.1.

3. Set the optical extinction ratio (ER). ER should be 3-4 dB. See 52.9.4 for a test method. All sinusoidal interference and jitter signals should be turned off at this point. If optical summing is used, ER may need to be adjusted after the sinusoidal interference signal is added below.

4. Measure the OMA of the test signal. At this point in calibration, OMA should be measured at high power without attenuation to be well above the instrument noise floor. OMA is measured as in 52.9.5. A suggested method uses the means of vertical histograms for P1 and P0.

**Editor's note – the method of this section assumes that OMA is based on the settled topline and baseline of the signal. There may be a movement to change this definition of OMA, which could require a change to this section.
**

5. The VECP of the test signal shall comply with the VECP values given in Table 52-9 for 10GBASE-S, Table 52-14 for 10GBASE-L, Table 52-18 for 10GBASE-E. This is

measured relative to the measured OMA value and based on the innermost traces of the eye pattern. Greater than one-half of VECP should be created by use of a linear phase, low jitter filter (such as Bessel Thomson), and the remainder must be created with sinusoidal interference. VECP includes the effects of sinusoidal interference, but is calibrated before vertical closure due to application of sinusoidal jitter (note, sinusoidal jitter is distinct from sinusoidal interference).

**Editor's note – insert old VECP equation and supporting text in here, per line 17 etc., page 479 of D4.1.
**

Again, the filtering must be very carefully designed to minimize jitter and baseline wander and improve signal visibility on a scope. A small amount of residual (from all sources) jitter is normal, even desirable, but should not exceed 0.25 UI peak-peak (approximately 0.02 UI rms).

**Editor's note – an eye pattern example would be useful here. This and others suggested below would replace the present Figure 52-12 and be more representative of this method.
**

6. After the filtering is applied, turn on the sinusoidal interference until the correct total value of VECP is achieved relative to the OMA value measured above. The frequency of the sinusoidal interference should be set between 100 MHz and 2 GHz, although be careful to avoid a synchronous or harmonic relationship between the sinusoidal interference and the data rate and the pattern repetition rate.

**Editor's note – an eye pattern example would be useful here.
**

7. Verify that at least 5 psec peak-peak of pulse shrinkage jitter has been added by the sinusoidal interference. If not, then the percentage of filter-induced vertical closure must be decreased and the percentage of sinusoidal interference-induced closure must be increased. The jitter created by the sinusoidal interference will exhibit a bimodal probability density function (pdf) when observed with a time histogram at the waist of the eye crossing. The peaks of the bimodal distribution may be visible if other, residual jitter is kept small. If not visible, then a peak-peak comparison before and after addition of the sinusoidal interface may be adequate (keep all other measurement conditions and times identical). Measuring with a square wave pattern will eliminate DDJ and may help improve visibility.

   If high linearity exists, then the sinusoidal interference should not change the OMA value. Otherwise, OMA must be measured again and iterated with VECP and pulse shrinkage jitter to achieve the appropriate combination of values.

8. Typically, the OMA of the test signal is initially measured at a high power above instrument noise. The average optical power can be measured at the same time. Then

the signal amplitude is decreased with the optical attenuator by the appropriate amount as the final step in calibration. The resulting OMA of the test signal must comply with the OMA values given in Table 52-9 for 10GBASE-S, Table 52-14 for 10GBASE-L, Table 52-18 for 10GBASE-E.

9. The final part of the stressed eye is sinusoidal jitter (phase modulation). Sinusoidal jitter must be added per the template of Table 52-20. The sum of the peak-peak value of sinusoidal jitter and the peak-peak value of the pulse shrinkage jitter due to the sinusoidal interference added above should equal 0.3 UI peak-peak (at sinusoidal jitter frequencies above 4 MHz). Sinusoidal jitter is most commonly calibrated in the frequency domain, but like pulse shrinkage jitter, it may also be measured by the distance between the peaks of its bimodal distribution. These peaks will be most evident if the sinusoidal interference is temporarily turned off and/or if a square wave pattern is used.

**Editor's note – another eye pattern example would be useful here.
**
**Editor's note – do we want the equations and more detailed description of the frequency domain method for calibrating sinusoidal jitter? I can dig them up, if desired.
**

b. Page 480, line 9. Change to "the specified requirements."