

72.6.10.2.3 Coefficient update field

The coefficient update field carries correction information from the local receiver to the link partner transmit equalizer. The field consists of an update gain and coefficient updates for ~~up to 3~~ **the C(-1) and C(1)** transmit equalizer taps. The format of the coefficient update field is shown in Table 72-4. Cell 15 of the coefficient update field is transmitted first. The update gain and coefficient updates are set by the receiver adaptation process. The algorithm employed by the receiver adaptation process is beyond the scope of this standard.

Table 72-4—Coefficient update field

Change row 3:2 to "Reserved - Transmitted as 0, ignored on reception."

Table 72-4—Coefficient update field

| Cell(s) | Name | Description |
|---|-------------------------|---|
| 15:14 | Update gain | $\begin{array}{ll} \underline{15} & \underline{14} \\ 1 & 1 = 8 \\ 1 & 0 = 4 \\ 0 & 1 = 2 \\ 0 & 0 = 1 \end{array}$ |
| 13:6 | Reserved | Transmitted as 0, ignored on reception. |
| 5:4 | Coefficient (+1) update | $\begin{array}{ll} \underline{5} & \underline{4} \\ 1 & 1 = \text{reserved} \\ 0 & 1 = \text{increment} \\ 1 & 0 = \text{decrement} \\ 0 & 0 = \text{hold} \end{array}$ |
| 3:2 | Reserved | Transmitted as 0, ignored on reception |
| 1:0 | Coefficient (-1) update | $\begin{array}{ll} \underline{1} & \underline{0} \\ 1 & 1 = \text{reserved} \\ 0 & 1 = \text{increment} \\ 1 & 0 = \text{decrement} \\ 0 & 0 = \text{hold} \end{array}$ |

72.6.10.2.3.2 Coefficient (k) update

Each non-zero coefficient, k , is assigned a 2-bit field describing a requested update. Three request encodings are defined: increment, decrement, and hold. The default state for a given tap is hold, which corresponds to no change in the coefficient. The increment or decrement encodings are transmitted to request that the corresponding coefficient be increased or decreased by the number of steps specified by the update gain field. An increment or decrement request shall continue to be transmitted until the update status for that tap (as defined in 72.6.10.2.4.2) indicates updated, maximum, or minimum. At that point, the outgoing requests for that tap shall be set to hold.

A new request to increment or decrement shall not be sent before the incoming status messages for that tap revert to not_updated.

The valid range for k is -1 to $+1$ where $k = 0$ denotes the main, or gain, tap values for k are -1 and $+1$ corresponding to the pre and post cursor tap coefficients. The encoding of the coefficient update shall be as shown in Table 72-4.

The value of the cursor tap coefficient $C(0)$ cannot be manipulated directly. The value of $C(0)$ is controlled by the values of the $C(0)$ and $C(-1)$ coefficients such that a constant V_{pk} shall be maintained: $C(0) + |C(-1)| + |C(+1)| = 1$.

$$C(0) = 1 - |C(-1)| - |C(+1)|$$

Table 72-5—Status Report field

Change row 3:2 to "Reserved - Transmitted as 0, ignored on reception."

Table 72-5—Status report field

| Cells(s) | Name | Description |
|----------|-------------------------|--|
| 15 | Receiver ready | 1 = The local receiver has determined that training is complete and is prepared to receive data. 0 = The local receiver is requesting that training continue. |
| 14:6 | Reserved | Transmitted as 0, ignored on reception. |
| 5:4 | Coefficient (+1) status | $\begin{matrix} \underline{5} & \underline{4} \\ 1 & 1 = \text{maximum} \\ 1 & 0 = \text{minimum} \\ 0 & 1 = \text{updated} \\ 0 & 0 = \text{not_updated} \end{matrix}$ |
| 3:2 | Reserved | Transmitted as 0, ignored on reception |
| 1:0 | Coefficient (-1) status | $\begin{matrix} \underline{1} & \underline{0} \\ 1 & 1 = \text{maximum} \\ 1 & 0 = \text{minimum} \\ 0 & 1 = \text{updated} \\ 0 & 0 = \text{not_updated} \end{matrix}$ |

72.6.10.2.4.2 Coefficient (k) status

Each non-zero coefficient, k , is assigned a 2-bit field describing the status of pending updates to the coefficient. Four status encodings are defined: not updated, updated, maximum, and minimum.

These status encodings indicate the corresponding state of the coefficient update state diagram for tap k . The valid range for k is -1 to $+1$ where $k = 0$ denotes the main, or gain, tap values for k are -1 and $+1$ corresponding to the pre and post cursor tap coefficients. The encoding of the coefficient update shall be as shown in Table 72-5.

72.6.10.2.5 Coefficient update process

Each non-zero coefficient, k , has an associated coefficient update state diagram that controls updates of the coefficient and generates the tap update status field.

The default state for a given tap is `not_updated`. An increment or decrement request will only be acted upon when the state of the tap is `not_updated`. Upon execution of a received increment or decrement request, the status is reported as `updated`, `maximum`, or `minimum`. `Maximum` is reported if a received increment request causes the tap value to reach its maximum limit, or if it is already at that limit. `Minimum` is reported if a received decrement request causes the tap value to reach its minimum limit, or if it is already at that limit.

Once the `updated`, `maximum` or `minimum` state is reported it continues to be reported until a `hold` request is received, after which the status reverts to `not_updated`.

The coefficient update process responds to coefficient requests as specified in the state diagram shown in Figure 72-5.

72.6.10.3.3 Coefficient update

For the $C(-1)$ and $C(+1)$ taps ~~each tap~~ the 10GBASE-KR PMD shall implement an instance of the Coefficient Update state diagram as depicted in Figure 72-5 including compliance with the associated state variables as specified in 72.6.10.2.7.

The coefficient update state diagram defines the process for updating transmit equalizer coefficients in response to requests from the link partner, and also defines the coefficient update status to be reported in outgoing training frames.

Table 72-7—Transmitter output waveform requirements related to coefficient update

| Coefficient Update | | Requirements | | |
|--------------------|-----------|-------------------------------------|-------------------------------------|-----------------------------------|
| $c(1)$ | $c(-1)$ | $V_{pre}(k) - V_{pre}(k-1)$ (mV) | $V_{pst}(k) - V_{pst}(k-1)$ (mV) | $V_{ss}(k) - V_{ss}(k-1)$ (mV) |
| increment | hold | -10 to -40 | -5 to 5 | 10 to 40 |
| decrement | hold | 10 to 40 | -5 to 5 | -10 to -40 |
| hold | increment | -5 to 5 | 10 to 40 | 10 to 40 |
| hold | decrement | -5 to 5 | -10 to -40 | -10 to -40 |

Table 72-8—Transmitter output waveform requirements related to coefficient status

| Coefficient status | | Requirements | | |
|--------------------|---------|--------------|--------------|---------------|
| $c(1)$ | $c(-1)$ | R_{pre} | R_{pst} | V_{ss} (mV) |
| maximum | maximum | 0.95 to 1.05 | 0.95 to 1.05 | 400 to 600 |
| minimum | maximum | - | 4.0 (min) | ≥ 40 mV |
| maximum | minimum | 1.54 (min) | - | ≥ 40 mV |
| minimum | minimum | - | - | ≥ 40 mV |

In addition:

- For all transmit equalizer configurations, V_{ss} shall be greater than or equal to 40 mV.
- Any coefficient update equal to “decrement” applied to any tap that ~~results would result~~ in V_{ss} less than 40 mV

shall return a coefficient status value “minimum”.

c) For all transmit equalizer configurations, V_{pk} , which is defined as the sum $V_{pst} - V_{pre} - V_{ss}$, shall be less than or equal to 600 mV.

~~d) Any coefficient update equal to “decrement” applied to $c(-1)$ or $c(1)$ that results in V_{pk} greater than 600 mV shall return a coefficient status value “minimum”.~~

~~e) Any coefficient update equal to “decrement” applied to $c(0)$ that results in V_{pk} greater than 600 mV shall return a coefficient status value “maximum”.~~

d) For all transmit equalizer configurations, V_{pk} , which is defined as the sum $V_{pst} - V_{pre} - V_{ss}$, shall be kept constant.