

Module AC common mode tolerance

(in support of comments 51, 55)

Adee Ran, Cisco

Supporters

Problem statement

- Module output is allowed to have some common-mode noise
- There is nothing in the host specifications that matches this allowance
 - No tolerance requirement
 - No AC CM component in the host stressed input test setup.

Table 120G-3—Module output characteristics (at TP4)

Parameter	Reference	Value	Units
Signaling rate, each lane (nominal)		53.125 ^a	GBd
AC common-mode output voltage (max, RMS)	120G.5.1	17.5	mV

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CI 120G SC 120G.3.3 P 255 L 34 # 51
Ran, Adee Cisco systems
Comment Type TR Comment Status X
The host should tolerate the AC common mode output allowed for the module output. Even
if this is not included in the stressed input test, this expectation should be part of the host
input specification.
SuggestedRemedy
Add a row to Table 120G-7 with parameter "AC common-mode input voltage tolerance
(RMS)" and value based on Table 120G-3.
Proposed Response Response Status O
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Problem statement (2)

- Same goes for host output and module tolerance.

Table 120G-1—Host output characteristics at TP1a

Parameter	Reference	Value	Units
Signaling rate, each lane (range)		53.125 ± 50 ppm ^a	GBd
DC common-mode output voltage (max)	120G.5.1	2.8	V
DC common-mode output voltage (min)	120G.5.1	-0.3	V
Single-ended output voltage (max)	120G.5.1	3.3	V
Single-ended output voltage (min)	120G.5.1	-0.4	V
AC common-mode RMS output voltage (max)	120G.5.1	17.5	mV

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Cl 120G   SC 120G.3.4   P 260   L 9   # 55
Ran, Adee   Cisco systems
Comment Type  TR   Comment Status X
The module should tolerate the AC common mode output allowed for the host output. Even
if this is not included in the stressed input test, this expectation should be part of the
module input specification.
SuggestedRemedy
Add a row to Table 120G-9 with parameter "AC common-mode input voltage tolerance
(RMS)" and value based on Table 120G-1.
Proposed Response   Response Status O
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Previous comments

CI 120G SC 120G.3.3.3.1 P 245 L 42 # 121

Ran, Adeo

Cisco

Comment Type TR Comment Status R TP4 SIT CM noise

The host stressed eye does not include any common-mode noise, even though a module output is allowed to have some common-mode AC content.

In a real system, the common-mode AC content of the module can be converted to differential noise at the host's receiver, via the S21DC of the host input channel, which is not specified at all. This will not be detected in the host test without common-mode content, and may not be addressed in host channel design - but it can cause compliant hosts to fail with real modules.

The common mode noise stress should be a sinusoid at any frequency up to the Nyquist frequency, and should be calibrated at TP4 to have the RMS value allowed for the module output in Table 120G-3.

SuggestedRemedy

In another comment I am suggesting to add a wideband noise source to the diagram in Figure 120G-9, between the pattern generator and the HCB.

If the other comment is accepted, an addition for this comment would be to make the noise source also have a common mode component. otherwise, add a common mode noise source in the same location instead.

Add the necessary text for calibrating the common mode output at TP4.

Editorial license is suggested, but if necessary for accepting the comment I can provide candidate text before comment resolution.

Response Response Status U

REJECT.

Resolve in conjunction with comment #124.

The suggested remedy does not provide sufficient detail to implement. A detailed proposal justifying the nature of the stress signal and details how to generate and apply it are required.

Further work on this subject and a consensus proposal are encouraged.

CI 120G SC 120G.3.4.1.1 P 248 L 1 # 124

Ran, Adeo

Cisco

Comment Type TR Comment Status R TP2 SIT CM noise

The module stressed eye does not include any common-mode noise, even though a host output is allowed to have some common-mode AC content.

In a real system, the common-mode AC content of the host can degrade the module's (electrical) receiver performance, via the module's allowed termination mismatch or by circuit sensitivity. This will not be detected in the module test without common-mode content, and may not be addressed in design - but it can cause compliant modules to fail with real hosts.

For uncorrelated common mode noise, a sinusoidal source should be used. However, for the host output it is likely that common-mode content is generated by conversion from a differential signal and is therefore correlated to it. In this test, it is suggested that p/n skew is the preferred way to create the allowed common-mode RMS level.

SuggestedRemedy

In another comment I am suggesting to add a wideband noise source to the diagram in Figure 120G-10, between the pattern generator and the frequency-dependent attenuator.

For adding correlated common-mode noise, a skew between the p and n components of the frequency-dependent attenuator should be added and calibrated to create the allowed common-mode RMS level. Alternatively, a sinusoidal common-mode signal can be added, at any frequency up to the Nyquist frequency.

Add the necessary text for calibrating the common mode output at TP1a.

Editorial license is suggested, but if necessary for accepting the comment I can provide candidate text before comment resolution.

Response Response Status U

REJECT.

Resolve using the response to comment #121.

detailed proposal is required – and I was encouraged to work on this subject 😊

Why is this difficult

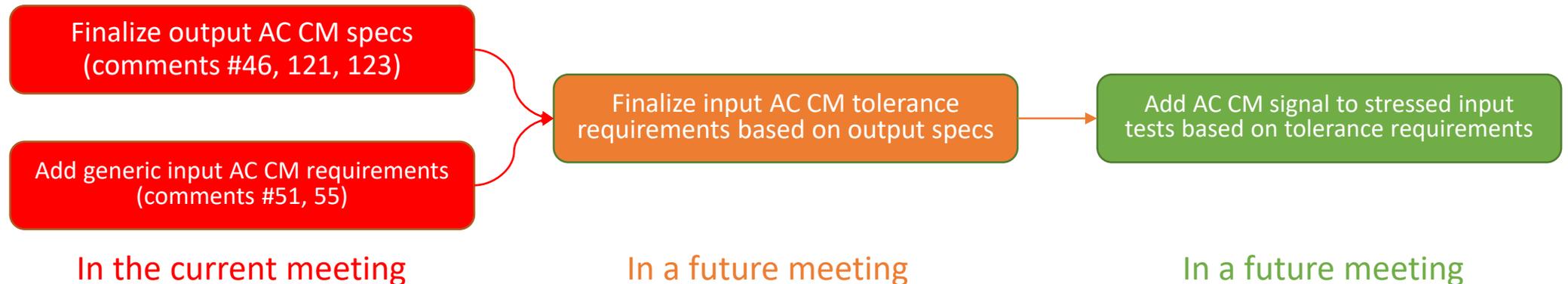
- Ideally we would:
 1. Agree on the types of CM noise that hosts and modules are allowed to create, e.g., correlated vs. uncorrelated, frequency mask vs. RMS of some filter output, limits, and test method
 2. Define the corresponding tolerance requirements, e.g., single tone vs. wideband, p/n skew...
 3. Add corresponding CM signal generation to the stressed input test
- However
 - #1 is still under debate
 - #2 may be debatable and #3 may be difficult to implement and calibrate
 - We don't want to stall the project

The situation

- Trilemma

- Creating a high-quality specification is difficult
- Creating a low-quality specification may create market confusion
- Not having any specification can cause poor design which would lead to interoperability problems

- Plan



Notes

- Having stated but not fully specified and testable expectations is not unprecedented
- Designers and internal validators will be able to do a better job if expectations are stated explicitly

Proposal for D2.2

- In Table 120G–7 add the following row and footnote c:

Parameter	Reference	Test point	Value	Units
AC common-mode input voltage tolerance (RMS) ^c	120G.5.1	TP4	17.5	mV

^c The host is expected to meet its input specifications with any AC common-mode output that a module may generate (see Table 120G–3).

- In Table 120G–9 add the following row and footnote c:

Parameter	Reference	Test point	Value	Units
AC common-mode input voltage tolerance (RMS) ^c	120G.5.1	TP1a	17.5	mV

^c The module is expected to meet its input specifications with any AC common-mode output that a host may generate (see Table 120G–1).

Values in red are subject of other comments and may change.