HUAWEI ENTERPRISE A BETTER WAY

Consideration on dual channel PD detection

Rui Hua, Huawei Technologies

Yan Zhuang, Huawei Technologies

enterprise.huawei.com

HUAWEI TECHNOLOGIES CO., LTD.

Motivation

- Investigate the dual channel PD detection for the bt standard, especially when detection signature falls within “the gray zone”.

Outlines

- Review AF/AT detection
- Detection results of 2 channel detection
- Uncertainty of the “gray zone” detection signature
- Summary
- Assume bt PD uses single channel design

Review of AF/AT detection

1.What's AF/AT PoE powering ?

According to 802.3 at Page21：

33.2.5 PSE detection of PDs

In any operational state, the PSE shall not apply operating power to the PI until the PSE has successfully detected a PD requesting power.

The PSE probes the link section in order to detect a valid PD detection signature. The PSE PI is connected to a PD through a link segment. In the following subclauses, the link is not called out to preserve clarity.

The PSE is not required to continuously probe to detect a PD signature. The period of time when a PSE is not attempting to detect a PD signature is implementation dependent. Also, a PSE may successfully detect a PD but then opt not to power the detected PD.

The PSE shall turn on power only on the same pairs as those used for detection.

PD can only be powered on the same pair s as the PSE used for detection.

2.What's the requirement of AF/AT Detection signature?

According to 802.3 at 33.3.8：

Table 33–5—Valid PD detection signature electrical characteristics

Item	Parameter	Symbol	Unit	Min	Max	Additional information
1	Accept signature resistance	R_{good}	kΩ	19.0	26.5	—

Table 33–6—Invalid PD detection signature electrical characteristics

Item	Parameter	Symbol	Unit	Min	Max	Additional information
1	Reject signature resistance	R_{bad}	kΩ	15.0	33.0	—

A PSE may accept or reject a signature resistance in the band between R_{good} min and R_{bad} min, and in the band between R_{good} max and R_{bad} max. A PSE may accept or reject a parallel signature capacitance in the band between C_{good} max and C_{bad} min.

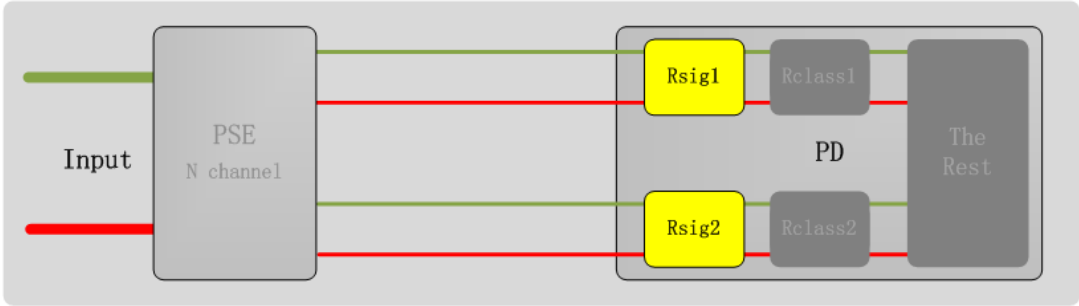
Gray Zones exists for "may" decision

There is always a gray zone of detection signature between "Yes" and "No", which brings ambiguous optional choices for PSE side.

A PSE Connects to the dual channel PD

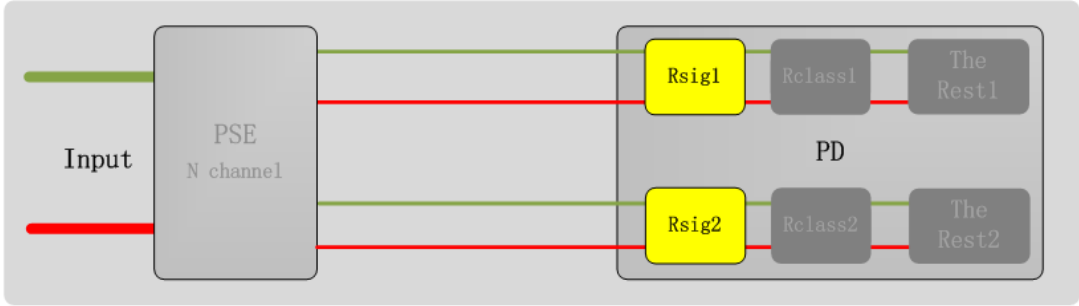
When a PSE connects to a dual channel PD, we have the architectures as below:

Two Channel PD- One LoaD



The dual channel PD has only one load.

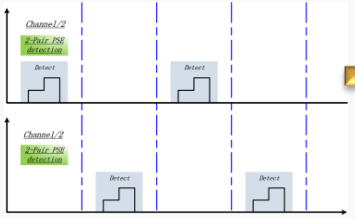
Two Channel PD- Two Load



The dual channel PD has two loads.

Detection results of 2 channel detection

The possible detection results of 2 channel detection are shown as below in which the “gray zone” detection signature brings more undeterminable results.



2 channel detection will have the following results.

	Power	May Power	May Power	Not Power	Not Power	Not Power	Not Power
Channel1/2 PD Detection	PD	$R_{Gray\ zone}$ $C_{Gray\ zone}$	PD	PD	PD	Open	R_{bad} C_{bad}
Channel1/2 PD Detection	PD	$R_{Gray\ zone}$ $C_{Gray\ zone}$	$R_{Gray\ zone}$ $C_{Gray\ zone}$	Open	R_{bad} C_{bad}	Open	R_{bad} C_{bad}

The PD signature that falls within the gray zone has 4 possible results.

	Power	May Power	May Power	Not Power
Channel1 PD Gray Zone	PD	Non-PD	PD	Non-PD
Channe2 PD Gray Zone	PD	PD	Non-PD	Non-PD

	Power	May Power
Channel1 PD Gray Zone	PD	Non-PD
Channe2 PD	PD	PD

***To Power* (determinable)**

Only when PSE identifies a PD on each channel, the PSE can provide power.

***May Power* (Undeterminable)**

If the signature falls within the Gray Zone, we need more information to make a power-on decision.

***Not Power* (Determinable)**

If either channel detects a bad Rsig or circuit open , then PSE will not power up the PD.

In “may power”, the system has extra interoperation work before to make a power-on decision.

Uncertainty of the “gray zone” detection signature

If the detection signature on each channel is **within the Gray zone**, there are 4 possible results.

PD	Detection Result			
	Result 1	Result 2	Result 3	Result 4
Channel 1 PD	PD[note1#]	Non-PD[note2#]	PD[note1#]	Non-PD[note2#]
Channel 2 PD	PD[note1#]	PD[note1#]	Non-PD[note2#]	Non-PD[note2#]

Notes:

1. note1#: the signature falls within the Gray zone, PSE identifies the device on this channel as a PD.
2. note2#: when the signature falls within the Gray zone, PSE identifies the device on this channel as a Non-PD.

If one detection signature is **within the Gray Zone** while the other is “good”, there are 2 possible results.

PD	Detection Result	
	Result 1	Result 2
Channel 1 PD	PD[note1#]	Non-PD[note2#]
Channel 2 PD	PD	PD

Notes:

1. note1#: the signature falls within the Gray zone, PSE identifies the device on this channel as a PD.
2. note2#: when the signature falls within the Gray zone, PSE identifies the device on this channel as a Non-PD.

- ***Detection signatures within the gray zone may cause different detection results on each channel.***
- ***Then, what’s the right decision on PSE side? To power on or not?***

Summary

The presence of two PD signatures
complicates the PSE power on decision and increases the probability of interoperability issues.

1.Poorly designed PDs and complex applications exist, some exhibit Rsigs in the gray zone.

2. Failure modes are binary with single signature PDs.

➢Power on or not

➢ Dual signature PDs will generate additional vendor support issues.

3. In particular, Dual signature PDs introduce a new interoperability failure mode .

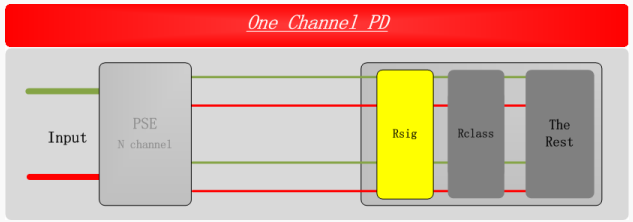
➢ 1 of 2 channels powered on.

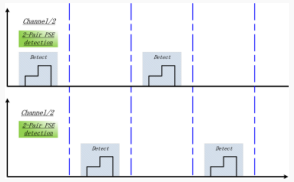
➢ That makes the system design more complex.

We have a better choice which is much easier and with better interoperability if bt PD is single signature design.

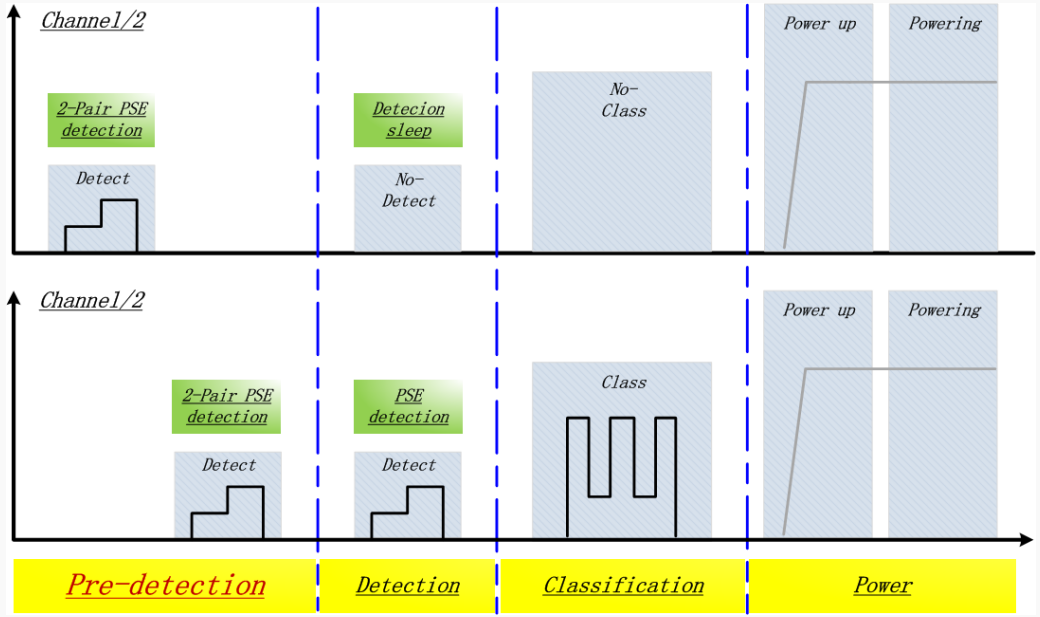
Assume bt PD uses single channel design

An example solution: After the pre-detection process, the PSE turns off one channel and use only one channel for PD detection and Mutual identification.





Use a "Pre- detection" way



For the single channel PD design, after a special "Pre-detection", the PSE can follow AT solution and don't increase interoperability issues that makes things simple.

Thank you!