PD69200 & PD69200M

IEEE802.3bt Standard Compliant Firmware Requirements

Version 2.0

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Microsemi
Power Matters.™

1 Introduction

The following document introduces key IEEE802.3bt standard features and terminology, describes the new communication protocol commands and recommends an on-going operation flow chart needed to satisfy IEEE802.3bt standard requirements.

The PoE controller PD69200 and PD69200M Firmware version 3.xx supports:

- **Microsemi PoE PSE Manager: PD69208M**
- **Microsemi PoE PSE Manager: PD69208T4**
- **Microsemi PoE PSE Manager: PD69204T4**

Please refer to "PD69200 Serial Communication Protocol User Guide" version 3.09,

And “Shared Memory Protocol” version 4.00 (PD69200M only).

2 IEEE802.3bt – General Introduction:

Terminology -

- **Connection-check** is implemented by the PSE before the IEEE signature detection, in order to identify the PD's structure (single or dual signature).

- **Classification** is implemented by the PSE after the IEEE signature detection, in order to identify the PD power consumption level and to introduce its power capability to the PD.
  Classification stage includes up to 5 events which represent the power capability of the PSE.
  Based on the amount of class events generated by the PSE, the PD recognizes the capability of the PSE to deliver power.
  Please refer to *IEEE Draft P802.3bt/D3.3* tables 145-11, 145-26 & 145-27.

- **Pairset** refers to two pairs of the Ethernet cable, each alternative is a pairset (A or B).

- **Class_Sig_A** refers to first two class events.

- **Class_Sig_B** refers to class events from the 3rd class event.

- **First Class Long Event (LCE)** is generated by the PSE to indicate if it is a Type 3 or Type 4 PSE, during the LCE the PSE and PD determine if both support Autoclass.

- **AutoClass** refers to the method of how the PSE determines the actual maximum power drawn by the connected PD.
  - During the LCE, the PD changes its class from class4 to class 0.
  - After the port is powered-up, during a defined time window, the PD consumes its maximum consumption, while the PSE measures it.
  - Based on that measurement the PSE determines the maximum power it shall allocate to that PD.
  - Autoclass is optional for both PSE and PSE.

- **Assigned class** represents the lowest class level which is set between the PD request and PSE power availability.
  Example: PD requests class 8 (90Watt), but PSE can support Class 6 only (60Watt), therefore the assigned class for the PSE/PD will be class 6.
  {**Assigned class= min(pse_availble_pwr, pd_reqsted_class)= min(6,8)=6}**

- **Single Signature (S.S)** Where the PD has a single signature & classification circuit which serves both paireset.

- **Dual Signature (D.S)** Where each preset has an independent signature & classification circuit which serve only that paireset.

- **4PID** The PSE determines whether a connected PD is a candidate to receive power on both pairsets, before applying the power on both pairsets.

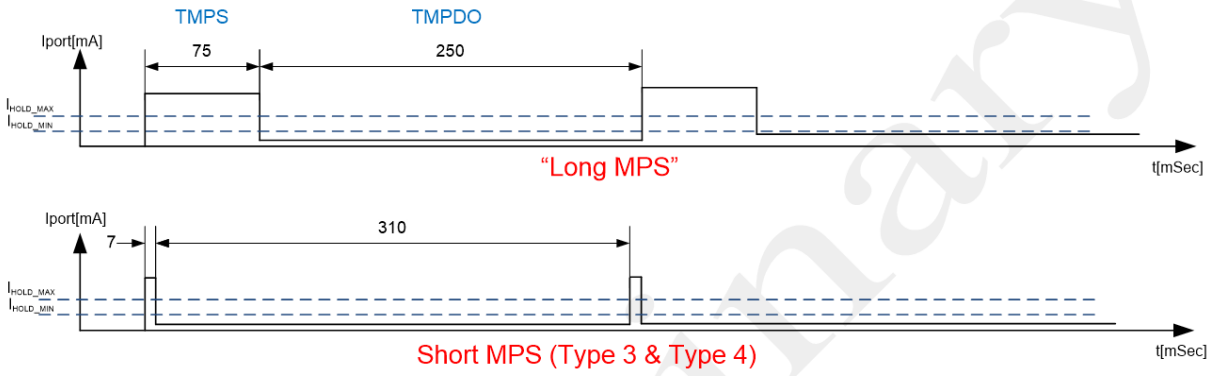
- **MPS (Maintain Power Signature)** Is the minimum PD power consumption which will keep the PSE port alive.

  Below that level, the PSE removes the power from the port.

  The IEEE802.3bt defines the requirements of both PSE and PD:

  For PSE requirements, please refer to tables *Table 145–16 IEEE Draft P802.3bt/D3.3.*

  For PD requirements, please refer to tables *Table 145–32 IEEE Draft P802.3bt/D3.3.*



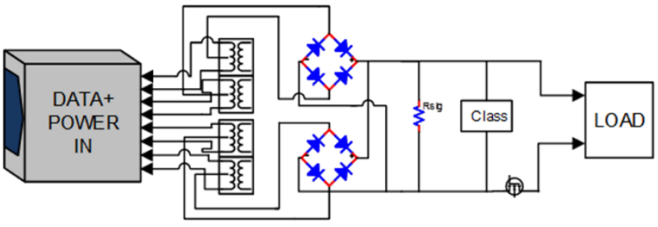
General -

The IEEE802.3bt interduces two additional types of PoE device, type 3 and type 4, which add additional 4 classes (class 5 to class 8), which supports up to 90Watt over all 4 pairs of the Ethernet cable.

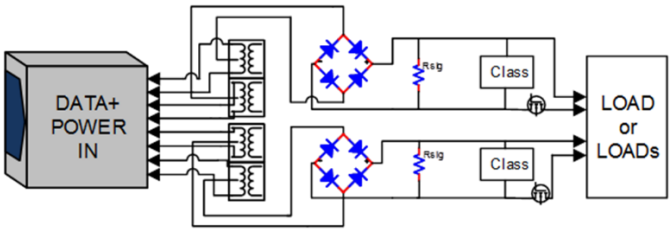
To optimize the PoE system in terms of power utilization, the PSE and the PD should identify one another, the mutual identification is applied by the **connection-check**, **classification** and **autoclass**.

A compliant PD can be implemented in 2 methods:

- **Single Signature (S.S)** – Where the PD has a single signature & classification circuit which serves both pairsets (all 4 pairs of the cable).
  S.S supports classes 1 to 8.
  Please refer to *IEEE Draft P802.3bt/D3.3* tables 145-26.



- **Dual Signature (D.S) –** Where each pairset has an independent signature & classification circuit which serves only that pairset (2 out of 4 pairs).
  Each of the 2 D.S. classification circuits support classes 1 to 5.
  Please refer to *IEEE Draft P802.3bt/D3.3* tables 145-27, which describes to one pairset.



Example:

Dual signature PD -

- Alt A is class 5
- Alt B is class 2

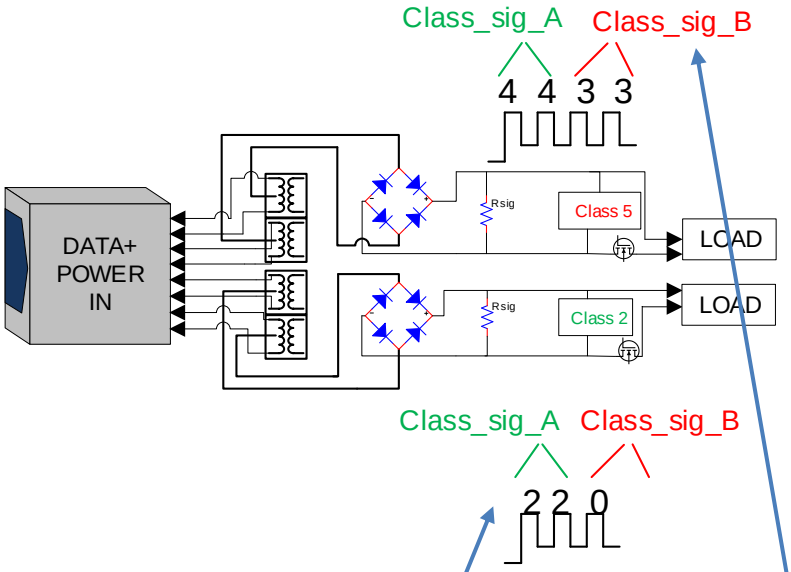


Table 145–27—Physical Layer classifications and Multiple Event Responses for dual-signature PDs

PD Type	Requested Class per pairset	class_sig_A class signature	class_sig_B class signature	Requested power (W)
3	1	1	0	3.84
	2	2	0	6.49
	3	3	0	13
	4	4	0	25.5
4	5	4	3	35.6

- **Polarity –** The BT standard defines the required polarity from the PSE.
  Type 4 (class7 & 8) PSE is limited to fixed polarity in MDI-X & B(S).
  Please refer to *IEEE Draft P802.3bt/D3.3* tables 145-3 & 145-4.

Table 145–3—PSE Pinout Alternatives

Conductor	Alternative A (MDI-X)	Alternative A (MDI)	Alternative B(X)	Alternative B(S)
1	Negative V_{PSE}	Positive V_{PSE}	—	—
2	Negative V_{PSE}	Positive V_{PSE}	—	—
3	Positive V_{PSE}	Negative V_{PSE}	—	—
4	—	—	Negative V_{PSE}	Positive V_{PSE}
5	—	—	Negative V_{PSE}	Positive V_{PSE}
6	Positive V_{PSE}	Negative V_{PSE}	—	—
7	—	—	Positive V_{PSE}	Negative V_{PSE}
8	—	—	Positive V_{PSE}	Negative V_{PSE}

PSEs shall use only the permitted polarity configurations associated with Alternative A and Alternative B listed in Table 145–4 corresponding with their Type. For further information on the placement of MDI vs. MDI-X, see 14.5.2.

Table 145–4—Permitted Pinout Alternatives per Type

PSE Type	Alternative A (MDI-X)	Alternative A (MDI)	Alternative B(X)	Alternative B(S)
Type 3	Yes	Yes	Yes	Yes
Type 4	Yes	No	No	Yes

- **Power definition –** The BT standard defines the electrical requirements from the PSE, The table below summarizes Type 3 & 4 parameters

Capability	Type 3	Type 4
VPSE (MIN)	50V	52V
PSE Polarity	Flexible	Fixed
4P Capable	Class 1-4 over 2 Pairs. Class 1-6 over 4 pairs.	Class 7-8 over 4 Pairs.
Auto Class	Optional	Optional
Short MPS	YES (PSE), Optional (PD)	YES (PSE), Optional (PD)
Port Power	60W	90W – 99W
Supported PSE Classes	Class 1 – 6 for SS-PD Class 1 – 4 for DS-PD	Class 7 – 8 for SS-PD Class 5 for DS-PD
Classification	Multi event (can support a single event, but with mark)	Multi event (can support a single event, but with mark)
Data Link layer	PSE: Optional PD: Optional for Class 1-3 Mandatory for Class 4-6	PSE: Optional PD: Optional for Class 1-3 Mandatory for Class 4-8

3 Release Content – System Level New Commands

The following commands are new in the Microsemi 15 bytes serial protocol, and replace the commands which are used in the IEEE802.3af/at/POH solution (firmware versions 1.xx, 2.xx).

The following new commands shall be implemented to support IEEE802.3bt.

3.1 Get BT System Status

[0] KEY	[1] ECHO	[2] SUB	[3] SUB1	[4] SUB2	[5] DATA	[6] DATA	[7] DATA	[8] DATA	[9] DATA	[10] DATA	[11] DATA	[12] DATA
0x02	##	0x07	0xD0	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E
Request		Global	BT System Status	N	N	N	N	N	N	N	N	N
0x03	##	Val	Val	Val	Val	Val	Val	Val	0x4E	0x4E	0x4E	Val
Telemetry		0x00	CPU Status2 Err Codes	Factory Default	0x00	RAM Private Label	NVM User Byte	Found Devices	N	N	N	Event Exist

Note! This command replaces the previous **"Get system status"**, which is not valid in firmware 3.xx

3.2 Set BT Events Interrupt Mask

[0] KEY	[1] ECHO	[2] SUB	[3] SUB1	[4] SUB2	[5] DATA	[6] DATA	[7] DATA	[8] DATA	[9] DATA	[10] DATA	[11] DATA	[12] DATA
0x00	##	0x07	0x64	Val	Val	Val	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E
Command		Global	BT IRQ Mask	System Events Mask Register	Device Events Mask Register	Port Events Mask Register	N	N	N	N	N	N

Note! This command replaces the previous **"Set Interrupt Mask"**, which is not valid in firmware 3.xx

3.3 Get BT Events Interrupt Mask

[0] KEY	[1] ECHO	[2] SUB	[3] SUB1	[4] SUB2	[5] DATA	[6] DATA	[7] DATA	[8] DATA	[9] DATA	[10] DATA	[11] DATA	[12] DATA
0x02	##	0x07	0x64	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E
Request		Global	BT IRQ Mask	N	N	N	N	N	N	N	N	N
0x03	##	Val	Val	Val	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E
Telemetry		System Events Mask Register	Device Events Mask Register	Port Events Mask Register	N	N	N	N	N	N	N	N

Note! This command replaces the previous **"Get Interrupt Mask"**, which is not valid in firmware 3.xx

3.4 Set BT Power Indication LED

[0] KEY	[1] ECHO	[2] SUB	[3] SUB1	[4] SUB2	[5] DATA	[6] DATA	[7] DATA	[8] DATA	[9] DATA	[10] DATA	[11] DATA	[12] DATA
0x00	##	0x07	0x08	Val	Val	Val	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E
Command		Global	BT Power Indication	Indication Type	% / Watts Indication ON	% / Watts Indication OFF	N	N	N	N	N	N

Note! This command replaces the previous **"Set Power Indication LED"**, which is not valid in firmware 3.xx

3.5 Get BT Power Indication LED

[0] KEY	[1] ECHO	[2] SUB	[3] SUB1	[4] SUB2	[5] DATA	[6] DATA	[7] DATA	[8] DATA	[9] DATA	[10] DATA	[11] DATA	[12] DATA
0x02	##	0x07	0x08	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E
Request		Global	BT Power Indication	N	N	N	N	N	N	N	N	N
0x03	##	Val	Val	Val	Val	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E
Telemetry		% Indication ON	% Indication OFF	Watts Indication ON	Watts Indication OFF	N	N	N	N	N	N	N

Note! This command replaces the previous **"Set Power Indication LED"**, which is not valid in firmware 3.xx

3.6 Get BT Event Cause

[0] KEY	[1] ECHO	[2] SUB	[3] SUB1	[4] SUB2	[5] DATA	[6] DATA	[7] DATA	[8] DATA	[9] DATA	[10] DATA	[11] DATA	[12] DATA
0x02	##	0x07	0xD1	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E
Request		Global	BT Event	N	N	N	N	N	N	N	N	N
0x03	##	Val	Val	Val	Val	Val	Val	Val	0x4E	Val	Val	
Telemetry		Port Cause Event bits [7..0]	Port Cause Event bits [15..8]	Port Cause Event bits [23..16]	Port Cause Event bits [31..24]	Port Cause Event bits [39..32]	Port Cause Event bits [47..40]	System Event	N	System OkReg	Device event	

Note! This command replaces the previous **"Get Port Event Cause"**, which is not valid in firmware 3.xx

3.7 Set BT Class Additional Power

[0] KEY	[1] ECHO	[2] SUB	[3] SUB1	[4] SUB2	[5] DATA	[6] DATA	[7] DATA	[8] DATA	[9] DATA	[10] DATA	[11] DATA	[12] DATA
0x00	##	0x07	0xD2	Val	Val	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E
Command		Global	BT Class Power	Class Type	Added Class Power Value	N	N	N	N	N	N	N

Note! This command replaces the previous **"Set Class Power"**, which is not valid in firmware 3.xx

3.8 Get BT Class Power

[0] KEY	[1] ECHO	[2] SUB	[3] SUB1	[4] SUB2	[5] DATA	[6] DATA	[7] DATA	[8] DATA	[9] DATA	[10] DATA	[11] DATA	[12] DATA
0x02	##	0x07	0xD2	Val	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E
Request		Global	BT Class Power	Class Type	N	N	N	N	N	N	N	N
0x03	##	Val		Val	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E
Telemetry		Class Power Value		Added Class Power Value	Max Added Class Power	N	N	N	N	N	N	N

Note! This command replaces the previous **"Get Class Power"**, which is not valid in firmware 3.xx

4 Release Content – Port Level New Commands

4.1 Set BT Port Parameters

[0] KEY	[1] ECHO	[2] SUB	[3] SUB1	[4] SUB2	[5] DATA	[6] DATA	[7] DATA	[8] DATA	[9] DATA	[10] DATA	[11] DATA	[12] DATA
0x00	##	0x05	0xC0	Val	Val	Val	Val	Val	0x4E	0x4E	0x4E	0x4E
Command		Channel	BT Port Config1	Port Num	Port Mode CFG1	Port Mode CFG2	Port Operation Mode	Add Power for Port Mode	Priority	N	N	N

Note! This command replaces the previous **"Set Port Parameters"** and **"Set 4-Pair Port Parameters"**, which is not valid in firmware 3.xx

4.1 Get BT Port Parameters

[0] KEY	[1] ECHO	[2] SUB	[3] SUB1	[4] SUB2	[5] DATA	[6] DATA	[7] DATA	[8] DATA	[9] DATA	[10] DATA	[11] DATA	[12] DATA
0x02	##	0x05	0xC0	Val	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E
Request		Channel	BT Port Config1	Port Num	N	N	N	N	N	N	N	N
0x03	##	Val	Val	Val	Val	Val	Val	0x4E	0x4E	0x4E	0x4E	Val
Telemetry		Port Status	Port Mode CFG1	Port Mode CFG2	Port Operation Mode	Add Power for Port Mode	Priority	N	N	N	N	4.3.7 MSCC Use12

Note! This command replaces the previous **"Get Port Parameters"** and **"Get 4-Pair Port Parameters"**, which is not valid in firmware 3.xx

4.2 Get BT Port Status

[0] KEY	[1] ECHO	[2] SUB	[3] SUB1	[4] SUB2	[5] DATA	[6] DATA	[7] DATA	[8] DATA	[9] DATA	[10] DATA	[11] DATA	[12] DATA
0x02	##	0x05	0xC1	Val	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E
Request		Channel	BT Port Status	Port Num	N	N	N	N	N	N	N	N
0x03	##	Val	Val	Val	Val		0x4E	0x4E	0x4E	Val	Val	Val
Telemetry		Port Status	Port Mode CFG1	Assigned Class	Measured Port Power		N	N	Last Shutdown Error Status	Port Event	4.3.8 MSCC Use11	4.3.8 MSCC Use12

Note! This command replaces the previous **"Get Single Port Status" , "Get All Ports Status",** and **"Get Extended Port Status"** which is not valid in firmware 3.xx

4.3 Get BT Port Counters

[0] KEY	[1] ECHO	[2] SUB	[3] SUB1	[4] SUB2	[5] DATA	[6] DATA	[7] DATA	[8] DATA	[9] DATA	[10] DATA	[11] DATA	[12] DATA
0x02	##	0x05	0XC2	Val	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E
Request		Channel	BT Port Counters	Port Num	N	N	N	N	N	N	N	N
0x03	##	Val	Val	Val	Val	Val	Val	0x4E	0x4E	0x4E	Val	Val
Telemetry		Port Status	UDL count	OVL count	SC count	Invalid Signature count	Power Denied count	N	N	N		

Note! This command replaces the previous "**Get UDL Counters**" , "**Get Detection Failure Counters**", "**Get Global Port Counters"** and "**Get Extended Port Status**" which is not valid in firmware 3.xx

4.4 Get BT Port Class

[0] KEY	[1] ECHO	[2] SUB	[3] SUB1	[4] SUB2	[5] DATA	[6] DATA	[7] DATA	[8] DATA	[9] DATA	[10] DATA	[11] DATA	[12] DATA
0x02	##	0x05	0xC4	Val	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E
Request		Channel	BT Port Class	Port Num	N	N	N	N	N	N	N	N
0x03	##	Val	Val	Val	Val	Val		Val	Val		Val	
Telemetry		Port Status#	Port PHY Info	Measured Class	Requested Class	Requested Power		Assigned Class	Assigned Power (TPPL_BT)		Auto Class Measurement + Support Result	

Note! This command replaces the previous "**Get All Ports Class**" and "**Get Extended Port Status**" which is not valid in firmware 3.xx

4.5 Get BT Port Measurements

[0] KEY	[1] ECHO	[2] SUB	[3] SUB1	[4] SUB2	[5] DATA	[6] DATA	[7] DATA	[8] DATA	[9] DATA	[10] DATA	[11] DATA	[12] DATA
0x02	##	0x05	0xC5	Val	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E	0x4E
Request		Channel	BT Port Mease	CH Num	N	N	N	N	N	N	N	N
0x03	##	Val		Val		Val		0x4E	Val		0x4E	0x4E
Telemetry		Vmain Voltage		Calculated Current		Measured Port Power		N	Port Voltage		N	N

Note! This command replaces the previous "**Get All Ports Class**" and "**Get Extended Port Status**" which is not valid in firmware 3.xx

5 Recommended on-going flowchart

The following flowchart is recommended to be implemented by the host. This will keep the PoE management by the host efficient PoE management, with minimum efforts and transactions by the host.

This flowchart is for the on-going operation only, and does not include the initialization of the PoE system (i.e set power banks, ports matrix, priority, port setting…..).

The on-going flowchart uses 5 commands from the **Serial Communication Protocol ver 3.21**:

4.1.7 Get BT Event Cause
4.2.2 Get BT PoE Device Status
4.3.8 Get BT Port Status
4.3.9 Get BT Port Counters
4.3.11 Get BT Port Class
4.4.1 Get Total Power

The number of transactions is described in the following example in a 48 ports system:

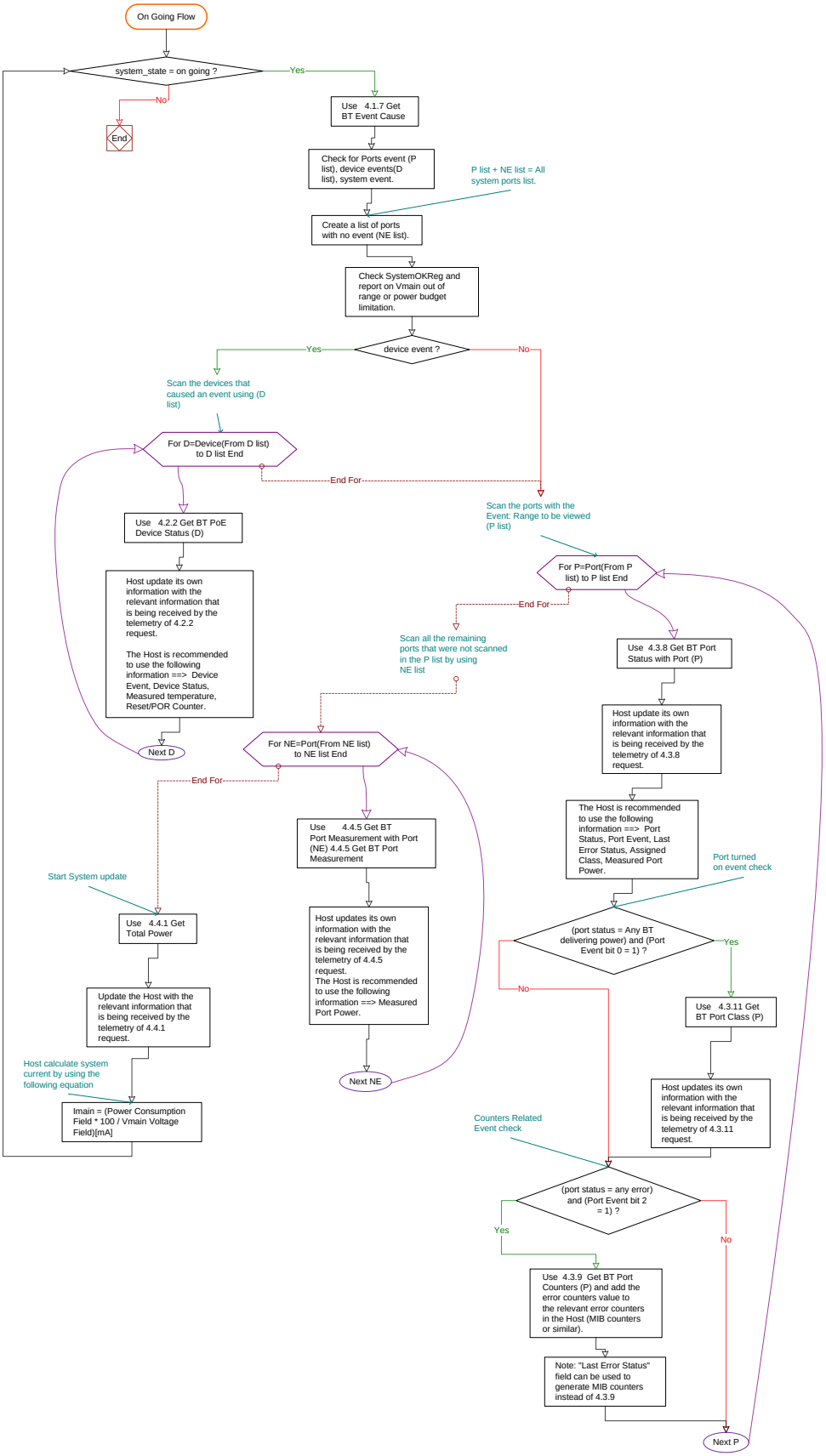
- Number of transactions in steady state:

  (Get BT Event Cause) + (48x Get BT Port Status) + (Get Total Power)= 1+48+1= **50 transactions**

- Number of transactions when all 48 ports generate event* (i.e overload, underload, error…):

  (Get BT Event Cause) + (12x Get BT PoE Device Status) + (48x Get BT Port Status& Get BT Port Class& Get BT Port Counters) + (Get Total Power)= 1+12+48x3+1= **158 transactions**

  *all 48 ports generate event is very rare scenario.


On Going Flow
system_state = on going ?
Yes
No
End
Use 4.1.7 Get BT Event Cause
Check for Ports event (P list), device events(D list), system event.
P list + NE list = All system ports list.
Create a list of ports with no event (NE list).
Check SystemOKReg and report on Vmain out of range or power budget limitation.
device event ?
Yes
No
Scan the devices that caused an event using (D list)
For D=Device(From D list) to D list End
End For
Use 4.2.2 Get BT PoE Device Status (D)
Host update its own information with the relevant information that is being received by the telemetry of 4.2.2 request.
The Host is recommended to use the following information ==> Device Event, Device Status, Measured temperature, Reset/POR Counter.
Next D
Scan the ports with the Event: Range to be viewed (P list)
For P=Port(From P list) to P list End
End For
Scan all the remaining ports that were not scanned in the P list by using NE list
For NE=Port(From NE list) to NE list End
End For
Use 4.3.8 Get BT Port Status with Port (P)
Host update its own information with the relevant information that is being received by the telemetry of 4.3.8 request.
The Host is recommended to use the following information ==> Port Status, Port Event, Last Error Status, Assigned Class, Measured Port Power.
Port turned on event check
(port status = Any BT delivering power) and (Port Event bit 0 = 1) ?
Yes
No
Use 4.3.11 Get BT Port Class (P)
Host updates its own information with the relevant information that is being received by the telemetry of 4.3.11 request.
Use 4.4.5 Get BT Port Measurement with Port (NE) 4.4.5 Get BT Port Measurement
Host updates its own information with the relevant information that is being received by the telemetry of 4.4.5 request.
The Host is recommended to use the following information ==> Measured Port Power.
Next NE
Start System update
Use 4.4.1 Get Total Power
Update the Host with the relevant information that is being received by the telemetry of 4.4.1 request.
Host calculate system current by using the following equation
Imain = (Power Consumption Field * 100 / Vmain Voltage Field)[mA]
Counters Related Event check
(port status = any error) and (Port Event bit 2 = 1) ?
Yes
No
Use 4.3.9 Get BT Port Counters (P) and add the error counters value to the relevant error counters in the Host (MIB counters or similar).
Note: "Last Error Status" field can be used to generate MIB counters instead of 4.3.9
Next P

Description:

Do While system_state = on going

Use 4.1.7 Get BT Event Cause

Check for Ports event (P list), device events(D list), system event.

Create a list of ports with no event (NE list). 'P list + NE list = All system ports list.

Check SystemOKReg and report on Vmain out of range or power budget limitation.

' Scan the devices that caused an event using (D list)

IF device event then

For D=Device(From D list) to D list End

Use 4.2.2 Get BT PoE Device Status (D)

Host update its own information with the relevant information that is being received by the telemetry of 4.2.2 request.

The Host is recommended to use the following information ==> Device Event, Device Status, Measured temperature, Reset/POR Counter.

Next D

End IF

' Scan the ports with the Event: Range to be viewed (P list)

For P=Port(From P list) to P list End

Use 4.3.8 Get BT Port Status with Port (P)

Host update its own information with the relevant information that is being received by the telemetry of 4.3.8 request.

The Host is recommended to use the following information ==> Port Status, Port Event, Last Error Status, Assigned Class, Measured Port Power.

IF (port status = Any BT delivering power) and (Port Event bit 0 = 1) then 'Port turned on event check

Use 4.3.11 Get BT Port Class (P)

Host updates its own information with the relevant information that is being received by the telemetry of 4.3.11 request.

End IF

IF (port status = any error) and (Port Event bit 2 = 1) then 'Counters Related Event check

Use 4.3.9 Get BT Port Counters (P) and add the error counters value to the relevant error counters in the Host (MIB counters or similar).

Note: "Last Error Status" field can be used to generate MIB counters instead of 4.3.9

End IF

Next P

' Scan all the remaining ports that were not scanned in the P list by using NE list

For NE=Port(From NE list) to NE list End

Use 4.4.5 Get BT Port Measurement with Port (NE) 4.4.5 Get BT Port Measurement

Host updates its own information with the relevant information that is being received by the telemetry of 4.4.5 request. The Host is recommended to use the following information ==> Measured Port Power.
Next NE

' Start System update

Use 4.4.1 Get Total Power

Update the Host with the relevant information that is being received by the telemetry of 4.4.1 request.

Imain = (Power Consumption Field * 100 / Vmain Voltage Field)[mA] 'Host calculate system current by using the following equation

Loop

'Scan all the remaining ports that were not scanned in the P list by using NE list

For NE=Port(From NE list) to NE list End

Use 4.3.8 Get BT Port Status with Port (NE)

Host update its own information with the relevant information that is being received by the telemetry of 4.3.8 request.

The Host is recommended to use the following information ==> Port Status, Assigned Class, Measured Port Power .

Next NE

'Start System update

Use 4.4.1 Get Total Power

Update the Host with the relevant information that is being received by the telemetry of 4.4.1 request.

Imain = (Power Consumption Field * 100 / Vmain Voltage Field)[mA] 'Host calculate system current by using the following equation

Loop

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