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# Evaluation of an EFM copper PHY

# Evaluation of a PHY for EFM

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- Spectral compatibility
- Maturity
  - Chips released for production will be evaluated
- Compliance with performance objectives
  - Real life situations found in the public and private network cable plant.
  - While providing all the required services
- Interoperability

# Evaluation of maturity

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- Maturity of PHY technology is critical to exploit the broad market potential for the 802.3ah copper standard.
- To ensure maturity and market needs the following should be verified:
  - Power consumption of the complete unit under test (the whole box) of less than 2.0W/PHY during all evaluation phases and performance tests.
  - Evaluation of devices from at least 2 vendors.
  - Test of a random sample of 3 pairs out of 10 supplied to the test bed.

# Spectral compatibility

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- Compliance with T1.417 shall be demonstrated by standard methods
- Since T1.417 doesn't address remote cabinets and in-building cabinet installations, demonstrate compatibility of cabinet installations with CO-based xDSLs, using criteria specified in T1.417

# Performance (1)

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- Use standard test loops, impairments, PSD masks and power limits specified in T1.424.
- All tests should be performed while providing at least 10Mbps full-duplex Ethernet traffic.
- The FTTC and FTTB should be the considered as the major deployment scenarios under test
- A capability to share the loop with POTS/BR-ISDN should be considered as an advantage

# Performance (2)

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- Loops:
  - Loop 0 (null loop)
  - Loop 1 with  $x=750\text{m}$
- PSD mask: M2
- Main impairments:
  - Xtalk from 20 same systems
  - AWGN of  $-140\text{dBm/Hz}$
  - ADSL & legacy systems (as shown in next slide)

# Performance (3)

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- Additional impairments - from T1-424:
  - Alien crosstalk: 16 ISDN, 10 EC-ADSL, 4 SHDSL
  - Impulse noise: 500us/250us erasures
  - RFI: AM (Model 1 or Model 2) and HAM
  - Bridged taps: 15.2m, CPE side
  - POTS telephone connected with test performed while telephone on hook and off hook.
- *Additional impairments, especially bridged taps, may cause a reduction of the loop reach (TBD).*

# Performance (3)

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- Impulse noise – Meet required BER while:
  - Injecting 500 microsecond bursts of white noise, capable of erasing the data, at 1 sec intervals (G7 impairment generator from T1.4242). T1.424 section 6.2.3 defines 20 msec latency in this test. 250 microsecond protection can be applied with 10 ms latency.
- RFI (HAM)
  - Transmit notching of ham radio frequencies (down to – 80 dBm/Hz) will be applied to verify compliance to emission requirements (T1.424 section 7.1.3.3).



# Performance (4)

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- Mixed distance deployment scenarios (PBO)
  - Remote units that are fed from the same location (in the same cable binder) will be placed at different distances to verify the upstream power back off capability. All the remote units, up to 750 meters, must continue to receive the defined 10/10 service.
  - T1.424 defines the need for PBO in section 7.1.3

# Interoperability

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- Interoperability of at least 2 technology vendors will be preferred
- The BER tests should be run for at least 24 hours.