EPON over Coax

EPoC Frequency Bands and Center Frequencies

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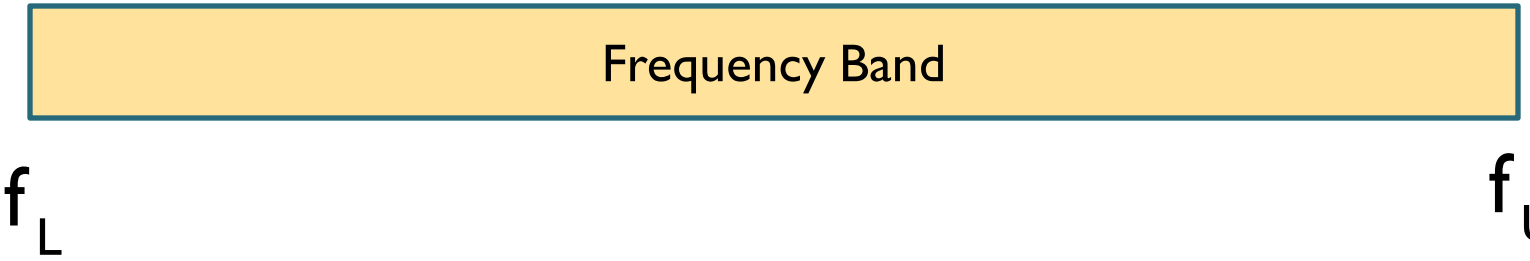
Outline

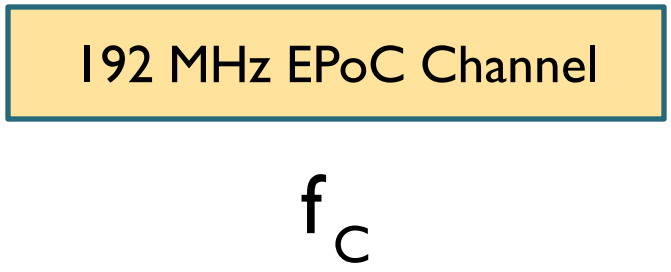
- Definitions
- Spectrum usage
- CNU categories
- Exclusion bands

Definitions



- The lower band edge (f_L) is the lowest frequency in the frequency band. The lower end of the 192 MHz EPoC channel must be no lower than f_L
- The upper band edge (f_U) is the highest frequency in the frequency band. The upper end of the 192 MHz EPoC channel must be no higher than f_U

Definitions



- The center frequency (f_C) of the 192 MHz EPoC Channel is the frequency at the center of the EPoC channel
- The standard will provide for a list of possible center frequencies at which the 192 MHz EPoC channel can be placed

Possible FDD Downstream Spectrum

- Current lower edge frequencies of the downstream spectrum: 65 MHz to 105 MHz
- Most of the spectrum up to 860 MHz is currently used for other services
- Among other spectrum, spectrum above 800 MHz is likely to be used for EPoC services
- Deployments in the near future may use frequencies up to 1200 MHz; in a couple of years, this range of frequencies may be extended to 1800 MHz.

Possible FDD Upstream Spectrum

- Like FDD Downstream, the FDD Upstream frequency band depends on available cable plant spectrum
- From [1] we know that the typical upstream spectrum today is 5-42 MHz
- From [2] we see that in the future upstream spectrum could expand. Possible upstream spectrum possibilities include:
  - 5-65 MHz
  - 5-85 MHz
  - 5-~200 MHz

Possible TDD Spectrum

- From [3] we see that in North America one frequency allocation suitable for TDD operation would be above the current downstream services
  - Spectrum from 700-1000 MHz is possible in a passive overlay today
  - Spectrum up to approximately 1700 MHz could be made feasible in the future using different taps
- In China today EoC systems use 0-68 MHz
  - Want to provide a second TDD band for low frequencies for China but up to 85 MHz to provide more spectrum
  - There is also interest in the 700-1000 MHz frequency band in China for TDD

Flexible Spectrum Usage

- Upper frequency limit?
  - Today probably the answer would be 1250 MHz
- But, what if it changes in the (near) future?
  - We are expecting operation at higher frequencies to be possible in the near future, both for FDD and TDD, e.g. up to 1800 MHz (components upgrades may be required)
- Therefore, the specification should support operation at higher frequencies from day one to avoid a cumbersome standard amendment in the (near) future
  - Probably the specification can be agnostic to the operational frequency but should support means for signaling it

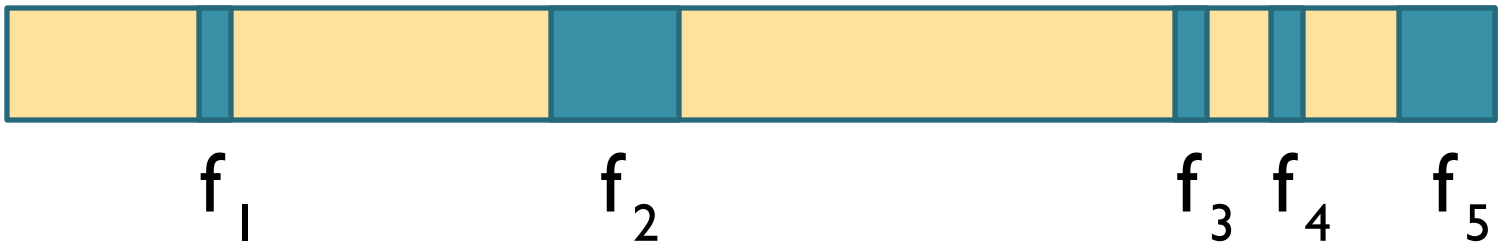
CNU Category or Capability

- A CNU category defines minimal requirements that a CNU must support to belong to the category, e.g.:
  - Number of EPoC channels that are supports
  - Lower and upper edge DS: $f_{L,DS} < x$ MHz and $f_{U,DS} > y$ MHz
  - Lower and upper edge US: $f_{L,US} < x$ MHz and $f_{U,US} > y$ MHz
  - Supported modes: FDD and/or TDD
- CNUs with different capabilities should be able to coexist
  - This coexistence should be built-in from day 1 in the specification to avoid cumbersome amendements in the future when adding spectrum and/or capabilities
- The specification shall provide means to signal the capabilities of the CNU
  - In addition, the CLT should have the means to provide the frequency configuration of EPoC in a given plant

CNU Category (Examples)

- CNU category 1: (today)
  - Number of EPoC channels supported: one
  - FDD support only
  - Lower edge DS FDD: $f_{L,DS}$ = 550 MHz; upper edge DS: $f_{U,DS}$ = 1250 MHz
  - Lower edge US FDD: $f_{L,US}$ = 5 MHz; upper edge US: $f_{U,US}$ = 85 MHz
- CNU category 2: (today)
  - Number of EPoC channels supported: one
  - FDD and TDD support
  - Lower edge DS FDD: $f_{L,DS}$ = 550 MHz; upper edge DS: $f_{U,DS}$ = 1250 MHz
  - Lower edge US FDD: $f_{L,US}$ = 5 MHz; upper edge US: $f_{U,US}$ = 85 MHz
- CNU category 3: (in future)
  - Number of EPoC channels supported: four
  - FDD and TDD support
  - Lower edge DS FDD: $f_{L,DS}$ = 220 MHz; upper edge DS: $f_{U,DS}$ = 1800 MHz
  - Lower edge US FDD: $f_{L,US}$ = 5 MHz; upper edge US: $f_{U,US}$ = 200 MHz

Exclusion Bands



- Exclusion bands are pieces of spectrum within an EPoC channel that are excluded from transmission due to, e.g.:
  - Legacy services
  - Channel impairments like ingress noise
- The specification shall support the signaling of the exclusion bands

References

1. Edwin Mallette, "Bright House Networks: Hybrid Fiber Coax and EPON over Coax," IEEE 802.3 EPOC Study Group, January, 2012
2. Edwin Mallette, "MSO Use Case Topologies for EPOC," Version 3.3, IEEE 802.3 Plenary Meeting, Waikoloa, HI, March 2012
3. Jorge Salinger, "EPoC RF Media Types," EPoC Study Group, 802.3 Plenary meeting, May 2012