

INVENTION DISCLOSURE

1. Invention Title.

Pre-Equalization based pro-active network maintenance process model for CMs transmitting on multiple upstream channels

2. Invention Summary.

This disclosure extends the process for analyzing the pre-equalization information to determine the gravity of the network problem and geographically isolating the source of the problem when the CM is transmitting on multiple upstream channels. Using multiple channels for upstream transmission is a feature in DOCSIS 3.0 to increase the transmission speeds. Though the pre-equalization parameters on multiple channels provide more comprehensive information on the spectral distortion, additional complexity is introduced in the analysis of these parameters. This disclosure and the attached paper explains the methodology used to address the frequency dependency of the micro-reflection and correlating this information across multiple channels.

3. Invention Description.

- a. **Describe the invention in detail and/or attach a description, drawing(s) and/or diagram(s), if available. Please include flow charts for descriptions of software processes, and block diagrams for descriptions of hardware systems. Include the description/attachments in electronic form if possible.**

The following are the key areas where the single channel model in the previous disclosure was extended to support the multiple channel transmission by the CM:

- i) The micro-reflections may be frequency sensitive. In this case, a CM transmitting using multiple channels may show different amplitude/delay pair (referred to as signature) for the different channels.
- ii) The number of micro-reflections for each channel may also be different.
- iii) In addition to the delay, the paper introduces another parameter, the distance between impedance mismatch by taking into account the group velocity for coax cable. This facilitates the technicians to identify the location of the plant where the problem is present more easily.
- iv) In analyzing the multiple channels, it is assumed that multiple micro-reflections are present when different channels show different signatures or when at least one channel shows multiple micro-reflections. Different scenarios to address frequency dependency of micro-reflections are addressed.

The model incorporates analyzing all active channels to get a better estimate of number of micro-reflections affecting that CM and the distortion introduced on the signal. See the attached paper for more details on the process model, impairment characterization and correlation across multiple channels.

b. Why was the invention developed? What problem(s) does the invention solve? How is it better?

The pro-active maintenance model for DOCSIS 1.1 and 2.0 was developed in 2007 to define a method that members can use to localize fault by using the tools in DOCSIS. With the introduction of DOCSIS 3.0 devices, we extended the model for multiple channel transmission. The extension introduced some new elements resulting from frequency dependency of the micro-reflection across the multiple channels. The analysis is more complex as outline above.

c. Briefly outline the potential commercial value and customers of the invention.

Operators are planning to deploy US Channel bonding feature defined in DOCSIS 3.0 for offering higher and symmetric data rate services. As noted in the previous disclosure for the single channel case, by performing proactive maintenance operators can reduce the trouble report calls and develop a process to maintain the health of the process thus achieving the expected grade of service for their customer

4. HOW is your invention different from existing products, processes, systems? Please list the closest publication(s), product(s), method(s), patent(s), etc. to your invention. For each item, how is your invention different?

This disclosure extends the analysis defined in the previous disclosure and applies it to DOCSIS 3.0. This is specific to DOCSIS 3.0 feature and we are not aware of other patents on this topic.