INVENTION DISCLOSURE

1. **Invention Title.**.

   ## Pre-Equalization based pro-active network maintenance process model

2. **Invention Summary.**
   This disclosure describes process for analyzing the pre-equalization information to determine the gravity of the network problem and geographically isolating the source of the problem. Even though this embodiment details the pro-active maintenance process using pre-equalization parameters and DOCSIS defined parameters, the methodology can be applied to other impairments along with their related network health metrics.

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 process model for characterizing and isolating the location of the fault is defined using the following processes.

   1) Network performance monitoring and data collection

   2) Evaluation of performance metrics for impairment identification.

   3) Impairment characterization

   4) Mapping of end device to physical path (end device to/from HE path)

   5) Fault analysis and fault localization

   6) Determining course of action

The first process is used to systematically collect data from a collection of CM-CMTS pairs both in a lab environment for validating the criteria used for characterization in the other processes and in the field.. For detection of linear distortion impairments such as micro-reflections, the pre-eq coefficients at the CM and the CMTS are analyzed. In the second process, the pre-eq coefficients are analyzed to determine whether there has been a micro-reflection. In this analysis, even though packet loss is a factor to consider, the absence does not indicate there is no micro reflection. And there may still be a degradation of service. In the third process, the impairments are characterized using discrete Fourier transform (DFT).to determining the signature of the micro reflection uniquely identified by the level/delay pair This process also identifies whether there are

multiple or single micro-reflection occurring in the upstream path. the information of all CMs sharing a specific micro-reflection is correlated to its physical topology to determine the potential location of the problem. The location is isolated using the naming convention for paths and devices defined in another disclosure. By analyzing the path of devices that show SNR issues the location of the problem is determine. The last process defines a grading scheme to determine the course of action in terms of three levels: no action, monitor and immediate action.

The attached paper and the list of claims explain the details of the process model and the relevant claims for this invention. The Visio diagram describing the model is also attached.

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

Currently a process for performing pro-active maintenance on cable networks is not available. As cable networks continue to evolve and many diverse services such as telephony, data, video, business and advanced services (i.e. tele-medicine, remote education, home monitoring) are carried over them, the demand for maintaining a high level of reliability for services is increasing. To achieve that, operators have a growing need to fix problems before they have any impact on service.

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

Operators by performing proactive maintenance can reduce the trouble report calls and develop a process to maintain the heath 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?

Even though parameters such as pre-equalization defined in DOCSIS are collected by some operators, there is no defined methodology or process to analyze this information. The process described here facilitates the development of an automation tool that can be used by operators to maintain their network before the problem gets worse resulting in customer calls.