Tech Note

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Preparing for DOCSIS 3.0
Headend Preparation for mCMTS
(eQAM Output Power)

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Introduction

Prior to a DOCSIS 3.0 mCMTS deployment the headend RF levels should be analyzed to make sure they are compatible with the output level limitations of the eQAM. If the losses in the headend are too large the number of bonded channels or how many nodes a bonded group can serve will be limited.

If required, headend wiring changes to meet the RF level limitations of the eQAM will have significant lead times. There will also be a potential for significant customer impact as the wiring is changed. To limit the customer and schedule impact the RF levels should be one of the first items considered when preparing for DOCSIS 3.0.

Background

Modular CMTS (mCMTS) uses eQAMs to overlay DOCSIS 3.0 onto an existing DOCSIS CMTS. In a typical (and simplest) DOCSIS 3.0 mCMTS deployment the existing CMTS downstream channel will remain in place, serving as the primary channel for both the Legacy DOCSIS (v1.0/1.1/2.0) and the DOCSIS 3.0 channels. The eQAM supplies the bonded (secondary) channels. More information on the DOCSIS 3.0 channel types can be found in the Tech Note "*Preparing for DOCSIS 3.0 – Downstream Channel Bonding and Alignment.*" Figure displays the channel space diagram for an example DOCSIS 3.0 mCMTS deployment.

Figure – DOCSIS 3.0 mCMTS Example Channel Space Diagram

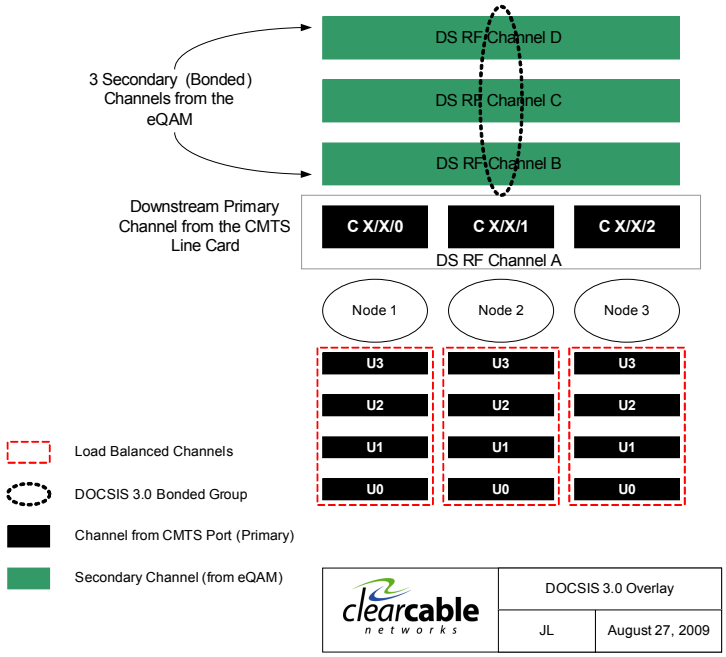
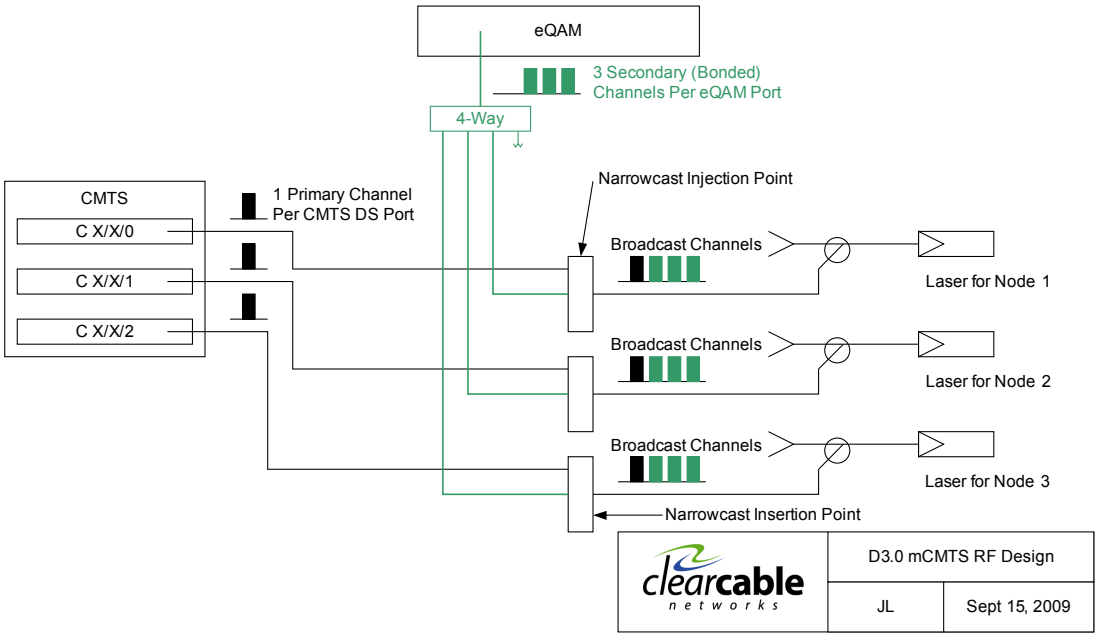


Figure shows the downstream wiring diagram for the example channel space diagram in Figure .

Figure – DOCSIS 3.0 mCMTS Example RF Wiring



eQAM Output Level

The DOCSIS specification assumes a constant total RF output power per eQAM port, therefore as the number of channels increases per eQAM port the power per RF channel decreases. The formula for eQAM output level is:

60 – ceil [3.6*$\log_2$(Number of Channels)] dBmV[1]

Based on the above formula the output power per RF channel for 1 through 16 RF channels per port can be found in Table .

Table - eQAM Output Power by Number of Channels

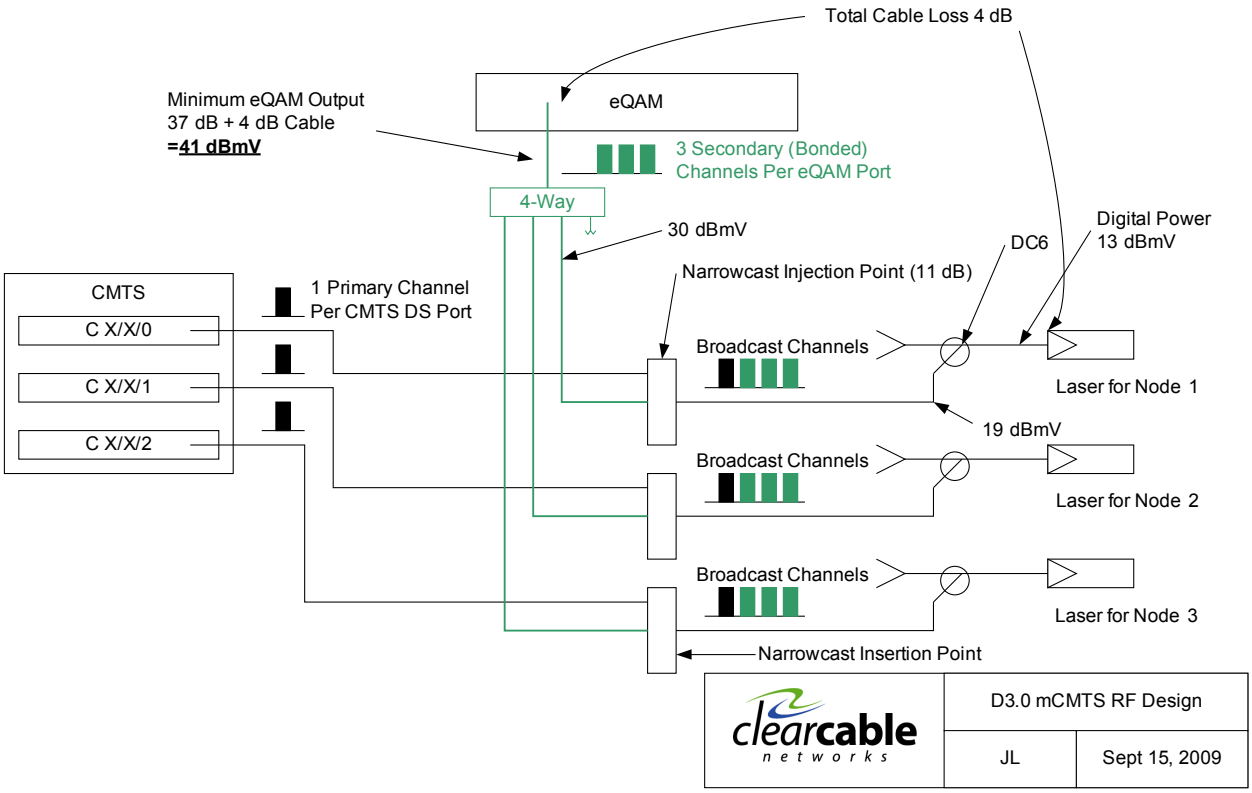
Number of RF Channels Per Port	Power per Channel
1	60
2	56
3	54
4	**52**
5	51
6	50
7	49
8	**49**
9	48
10	48
11	47
12	47
13	46
14	46
15	45

1 CableLabs Downstream RF Interface Specification CM-SP-DRFI-I07-081209 Pages 14 and 15, section 6.3.5.1.1, http://www.cablelabs.com/specifications/CM-SP-DRFI-I07-081209.pdf

In the design highlighted in Figure and Figure there are three active channels per eQAM port. The headend combining must at the very minimum accommodate a maximum eQAM output level of 54 dBmV/RF channel, this assumes that there will be no expansion beyond three bonded channels or that the eQAM will not be multitasked to also provide SDV or VOD. Most of the eQAMs shipping today can provide 4 to 8 RF channels per port. The next generation eQAMs will increase this number to 16 RF channels, Cable Operators should plan for 16 channels today. Sixteen channel eQAMs that meet the DOCSIS specification will have an output of 45 dBmV/RF channel (or more).

Figure displays the example wiring diagram including RF loss and power levels.

Figure – DOCSIS 3.0 mCMTS Example RF Wiring with Power Levels



In this example the eQAM output level must be at least 41 dBmV, providing 4 dB of margin for an eventual 16 channel deployment. Not all headends will meet the specification, problem areas include:

- The use of a high isolation combiner for the Narrowcast Insertion Point.

- The use of a higher loss directional coupler (higher than 6 dB) for combining narrowcast and broadcast signals at the laser.
- Lasers requiring high input levels.
- Long cable runs between the eQAM and the laser.
- Combining the CMTS and eQAM outputs together before the Narrowcast Insertion Point.
- Splitting the eQAM output to feed more than four nodes.

If the eQAM output level is required to be more than 45 dBmV today, the headend design should be reviewed to make sure it can be modified in the future to accommodate the lower output level of the next generation of eQAMs.