



TECHNICAL COLUMNS

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DID YOU KNOW? Q&A WRAPUP

By **RON HRANAC**

In December 2010, Senior Technology Editor Ron Hranac hosted a 90-minute Webcast (www.cable360.net/ct/webcasts) focused not only on sharing his institutional knowledge about some of the broadband industry's technical minutia, but also on answering myriad questions submitted by the audience. There were so many queries, however, that time ran out before they could be addressed. Here are those questions and Ron's answers to them:

Regarding preventive maintenance, is there an established industry standard for how often to perform sweep'n balance for each node and amplifier? What about PM for UPS and batteries in the field? How frequently are these serviced?

There is no industry standard for how often to sweep plant, conduct preventive maintenance on power supplies, etc., but a good place to start is every 18 months or so.

What test equipment would you recommend for testing a GPON or PON network?

Use RF test equipment for any part of the network that carries RF signals and optical test equipment for the optical plant (optical signal source, optical power meter, OTDR, etc.).

How many node/receivers do you recommend per CMTS port on the upstream path? This is referenced from your July 1, 2009, column in Communications Technology, "Broadband: Upstream CNR."

A better metric might be the number of cable modems per CMTS upstream port. The number of modems depends on several factors, such as the make/model of CMTS, software version, memory, processing power, service tiers, data rates, etc. A good place to start is around 200 modems per upstream port, and work from there.

EVM is a ratio similar to MER, different by a scale. Why, when and where should one use one versus the other?

The use of EVM versus MER is a personal preference. Because MER is expressed in decibels, it's a metric that often is more familiar to cable technical personnel. With EVM, which is expressed in percentages, the target is the lowest value possible. With MER, the goal is the highest value possible.

Have you used the carrier-to-composite-noise tool in JDSU's PathTrak? Is this a useful tool to determine what the CNR level per node/channel is?

No, I have not used this feature in JDSU's PathTrak. However, in a cable network with a large number of QAM signals present, the noise-like distortions (composite intermodulation noise) from those QAM signals and regular thermal noise combine to create "composite noise." Thus, it's better to measure carrier-to-composite-noise ratio, because one cannot differentiate thermal noise from composite intermodulation noise on a spectrum analyzer, and there is no way to measure just the CNR.

What is your source for referring to BER as "bit error ratio" instead of "rat?"

Rohde & Schwarz, among others.

Question: Do you think cable systems do enough preventive maintenance? Answer: One can never do enough preventive maintenance.



Did you know that the decibel originally was called the "transmission unit," a unit of power ratio used in telephone engineering? It was renamed the "bel" in honor of Alexander Graham Bell.

dBm, or decibel milliwatt, is a ratio of some power level in milliwatts to a "0 dB" reference of 1 milliwatt: $\text{dBm} = 10\log(\text{mW}/1 \text{ mW})$

Why is it important to test unequalized MER?

Equalized MER tends to mask problems caused by linear distortions.

Why only 750 plant? I assume this question pertains to the FCC's rules in 76.640 regarding the requirement that digital signals meet the technical parameters in SCTE-40. If so, I don't know why the FCC chose 750 MHz.

Would you talk a bit about CSO in the upstream path and how closely it is related to DFB laser loading or the amplitude of input carrier? How often do you see this in cable systems? Is it better to test with two CWs or what?

Such composite distortions as composite second order (CSO) are the result of a large number of downstream signals present in the spectrum. In the upstream, composite distortions manifest themselves as common path distortion. As for the laser, discrete second order might be a better metric.

Would you please clarify dBc? I see that techs often include the "c" but I do not think it's needed.

dBc commonly is used to express a ratio to some specified carrier power ("c").

Where do you see the return band in a few years? 100 MHz? 200 MHz? Or do you see the reduction of "devices" served per node as the alternative?

It's hard to say where the return path will be in the future, but DOCSIS 3.0 already supports between 5 MHz and 85 MHz. Options being considered by the cable industry include from 5 MHz and 200 MHz along with something called "top split," where return signals might be carried above, say, 1 GHz.

How much electronics knowledge do installers and service techs really need?

A foundation in basic electronics is, in my opinion, something that all installers and technicians should have.

Do you see any new technologies that could be implemented that would affect me, a sweep contractor?

As long as we have any RF on our networks, it's my opinion that sweep is necessary. Fiber to the home (FTTH) likely will mean that sweep no longer is needed.

What analyzer makes/models do you recommend that can detect linear distortions on the return path?

Check with your favorite test equipment manufacturer. Most of the major players, including JDSU, Sunrise Telecom, Trilithic, VeEx, etc., have this sort of equipment available.

In a high-power cable transmission with heavy tilt and analog to ~80ch with QAM carriers to 1 GHz, the CIN distortion from the high end can cause some major issues at the low end. Would you say it's advisable and, if so, are you aware of a decent method to characterize amplifiers for their CIN performance as distinct from CNR (thermal noise performance) in this situation?

As digital loading increases, it becomes impossible to measure CNR, where the "N" in CNR is thermal noise. Because thermal noise combines with composite intermodulation noise to produce composite noise, one should instead measure carrier-to-composite noise ratio. The measurement method is the same as CNR.

One of our four HSO upstream channels is near the diplex filter roll-off frequency, at 35 MHz. What do you recommend on troubleshooting low SNR on that specific channel?

The low "SNR" (actually MER) is normal and expected behavior when operating at the upper end of the return spectrum. The low MER is caused by diplex filter-related group delay. Short of moving to a lower frequency, this is not something that can be "fixed." Instead, turn on the cable modems' upstream pre-equalization.

Do you think cable systems do enough preventive maintenance?
One can never do enough preventive maintenance!

When will the cable industry move to GPON-like solutions instead of RF solutions?
Probably not for many years. HFC still has a LOT of life left.

What is the best solution for a system that has three or four pilot carriers, with three of them analog carriers, and wanting to get all-digital with one pilot carrier?
Unless your system's amplifiers have QAM-compatible AGC, you'll likely need at least two CW carriers or analog TV channels: one for AGC and the other for signal-leakage purposes. If you swap out your amplifier AGC for QAM-compatible ones, you can get away with one CW carrier in the aeronautical band, at least until the widespread availability of digital-compatible leakage detectors.

In calculating total power on the input of CM, should we take into consideration the power of analog channels?
The power of ALL downstream signals MUST be taken into consideration when calculating total power at the input of a cable modem.

As far FCC Proof-of-Performance testing is concerned and 24-hour tests, should we show the digital level (aka analog) in the bi-annual report? What are the specs resulting a failure?
76.640 of the FCC rules states that, in 750 MHz-and-greater systems, the digital signals MUST comply with the technical parameters in SCTE-40. The 24-hour tests, as I understand, apply to analog TV channels.

Our upstream test QAM sent for testing is either below or above the modem carrier. Can it be clean on the test signals but still be an issue where the modems are transmitting?
Yes, it's possible for an active upstream DOCSIS channel to have problems (in-channel ingress, for example) when a test QAM signal at a different frequency is problem-free.

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