A Rocky Mountain Chapter White Paper: "What's a QAM?"

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The following is adapted from an article about cable industry terminology that I wrote for the May 2007 issue of *Communications Technology*.

Every industry has its own jargon, some of which is often incomprehensible to outsiders. This is certainly true of the cable industry. Much of cable's terminology is technical in nature, making some of our favorite words, phrases, and abbreviations even more difficult to sort out. Further complicating things is misuse of some of our lingo, which is the subject of this month's column. With apologies to the late Andy Rooney of CBS's "60 Minutes," here goes.

One of the most commonly misused among cable's lexicon is the lowly *decibel*, more specifically its abbreviation: *dB*. By itself the decibel expresses a ratio between two power levels – it cannot represent an absolute value. For example, one can correctly say that a 100 watt stereo has about 3 dB more power than a 50 watt stereo; the RF output signal level of a two-way splitter is about 4 dB less than the input signal level; an attenuator has 10 dB of loss; or an amplifier has 20 dB of gain. It's incorrect to say the signal level at the input to a set-top box or cable modem is –3 dB. One must append dB with a reference in order to use it to express an absolute value, as in "the input to a STB is –3 dBmV." Even here, we're still technically expressing a ratio of one value to a reference value (1 millivolt in the case of dBmV), but the point is that signal level must be stated in dBmV, dBµV, dBV, etc., not dB.

Do you remember when the Federal Communications Commission introduced the following in Part 76?

> "(1) prior to carriage of signals in the aeronautical radio bands and at least once each calendar year, with no more than 12 months between successive tests thereafter, based on a sampling of at least 75% of the cable strand, and including any portion of the cable system which are known to have or can reasonably be expected to have less leakage integrity than the average of the system, the cable operator demonstrates compliance with a cumulative signal leakage index by showing either that (i) 10 log I_{3000} is equal to or less than –7 or (ii) 10 log I_{∞} is equal to or less than 64, using one of the following formula…"

[Note: In a recent revision to Part 76, I_{3000} was eliminated, leaving just I_{∞}.]

What the FCC calls cumulative signal leakage index – more commonly referred to *cumulative leakage index* or simply *CLI* – is a mathematical calculation that represents a "snapshot" of a cable network's signal leakage performance at a given point in time. Like dB, the abbreviation CLI is frequently misused, sometimes even by test equipment manufacturers. One cannot measure CLI, nor is there such a thing as a cumulative leakage index test. We measure signal leakage, and then calculate a CLI.

Next on my list is *MSO*, an abbreviation for *multiple system operator*. What is an MSO? It's a corporate entity that owns or manages more than one cable system. MSO is not a generic abbreviation that can be used to describe a cable company or the cable

industry in the same way that, say, PSTN (public switched telephone network) describes a telco. Important point: Not all cable operators are MSOs, but all MSOs are cable operators. Local cable systems aren't MSOs, either. For example, the cable system that serves the Denver, Colorado area is not an MSO. It's a cable system that is owned by an MSO – Comcast in this case. What about "cable MSO"? This clearly fits into the department of redundancy department. It's just MSO.

And then there is *headend*. Most readers of this paper know what a headend is, so I won't define it here. But it's headend, not head-end or head end.

Not only is some terminology misused, sometimes it gets hijacked – and then misused. Case in point: *bandwidth*. Those of us who work in the world of RF (radio frequency) technology know that bandwidth describes how much of the electromagnetic spectrum, expressed in units of hertz (Hz), is used for some purpose. A cable network with a downstream spectrum from 54 MHz to 870 MHz has 870 – 54 = 817 MHz of downstream bandwidth. That network's downstream bandwidth isn't 870 MHz, because the latter is the upper frequency limit of the downstream. Likewise, a single analog NTSC TV signal's bandwidth is 6 MHz, as is an ITU-T J.83 Annex B single carrier quadrature amplitude modulation (SC-QAM) signal's bandwidth. The data world decided that bandwidth ought to be synonymous with data rate, throughput or capacity, as in "1.544 megabits per second of bandwidth." 1.544 Mbps is not bandwidth, it's the number of bits per second.

Service providers have for many years been quite successful with something known as the *triple play*: video, data and voice. Note that these three things are *types of services* being provided to customers, not ways to deliver them. The cable industry uses its fiber and coaxial cable networks to deliver video, data and voice. Somewhere along the way someone coined the term *quadruple* or *quad play*, adding wireless (or mobility) to the mix. The types of services being provided over wireless networks are still the triple play: video, data and voice. Wireless is just one more way to deliver them.

Reliability is often used when *availability* is what was meant. These two words cannot be used interchangeably. Availability is the percentage of time out of a defined total amount of time that a service, device or system is available or operational. Reliability is the probability that a system or device will not fail during some specified period. So, it's okay to say that a cable network has four nines (99.99%) availability, but one cannot say it has four nines reliability. I remember a major telecommunications equipment manufacturer's ad in a cable industry trade publication, in which a product was stated to have five nines reliability. Five nines availability, perhaps, but not five nines reliability.

Another addition to the list of abused and misused cable jargon is *QAM*. I've seen QAM used to describe the digitally modulated signals carried on a cable network (they are QAM signals or digitally modulated signals, not QAMs), but by far the most common misuse is calling a *QAM modulator* a QAM, edge-QAM, EQAM, universal QAM or UQAM. There is no such thing as a QAM. QAM is a *type of modulation*: quadrature amplitude modulation. Calling an edge-QAM modulator a QAM is no different than calling your favorite FM radio station's broadcast transmitter a "FM." Hmmm, how would that be pronounced? Foom?

I could go on, but I think you get the point. Andy Rooney stick-on eyebrows back in the desk drawer.