Analog Carrier-to-Noise Measurement Best Practices

While the JDSU Digital Services Activation Meter (DSAM) and the JDSU Stealth Digital Analyzer (SDA) measure the actual carrier-to-noise ratio (C/N) somewhat differently, several tips and techniques can be employed with both instruments when taking measurements that maximizes the capability of the meter to guarantee that the results are as accurate as possible.

As downstream bandwidth increases towards 1 GHz and beyond and the number of quadrature amplitude modulation (QAM) channels continues to grow resulting in an ever increasing amount of total radio frequency (RF) power on the input of the field meters.

This "total RF power" includes the level of the channel being tested as well as an aggregate of all of the channels present, both analog and digital, on the entire downstream plant. Therefore, the normal system alignment and balancing can very easily result in too much total RF power going into the meter that can then produce inconsistent results.

What signal level should go into the meter?

- DSAM: For channels up to 750 MHz, at least 0 dBmV; for channels above 750 MHz, at least +6 dBmV
- SDA: For optimum accuracy, +14 dBmV is recommended, but at least +10 dBmV is required

In-band C/N screen for the DSAM

If signal levels are too high, overdriving the meter becomes possible. Running a C/N test on Channel 2 using a DSAM with the level at +10 dBmV and a system of 18 dB of tilt will result in the high pilot carrier of +28 dBmV, in this case. The 18 dB of tilt and all the channels at those high levels, particularly the QAM channels, going into the meter simultaneously that cause inconsistent readings.

So, how do we keep all of those channels from overloading the front end of the unit and causing problems to the measurement on the channel being tested?

The ultimate solution is a tunable band pass filter that could be tuned to the frequency of the channel being testing, so that absolutely no other signals could interfere with the reading. But band pass filters, especially tunable ones, are bulky and heavy, making them less than optimal for carrying into the field, and they can be very costly.

The next best solution is a cable simulator that will compensate for differential frequency losses across a length of cable by attenuating signal levels of higher frequencies until they equal those of lower frequencies. Cable simulators are relatively inexpensive, easy to carry, and come in various tilt values. Using a cable simulator with 18 dB of tilt in the above scenario would bring all the signals down to levels that would not overdrive the meter, regardless of the channel being tested.

Finally, if all else fails and you cannot obtain a cable simulator, actual cable works just as well. U.S. Federal Communications Commission (FCC) specification 76.605(a)(7) states:

"As measured at the end of a 30 meter (100 foot) cable drop, the ratio of RF visual signal level to system noise shall not be less than 43 decibels."

In the days of only analog signals and the 550 MHz plant, 30 meters (100 feet) of cable was typically sufficient; but now with speeds of 1 GHz being commonplace and QAM channels filling the bandwidth, an additional 30 to 45 meters (100 to 150 feet) of RG-6 may be required. Although, 75 meters (250 feet) should provide enough attenuation of the higher frequencies until they nearly match the lower ones and allow the meter to make the most consistent, accurate measurement possible while meeting FCC specification.

Considerations for Measuring In-Channel (IC) C/N

Video Source Switching: Sometimes switching the video source to local ad insertion will interrupt the sync sequence and the measurement can provide inaccurate results.

Offset Frequency: For IC C/N, offset frequency is a positive offset from the video carrier making a noise measurement within the video carrier line information. The offset frequencies used by the meters are for a standard channel plan. The presence of additional carriers (for example, STB, sweep telemetry, and sweep pulses) may result in unknown intermodulation products that can cause interference to C/N. If unsure, try adjusting the offset frequency to get the best results.

Local Ad Insertion: Inserted ads from a tape can result in low C/N appearing only during those ads, which can make the video source noisy.

No Blank Lines: It is possible that some European channels will never have blank lines, making the use of a blank line inserter necessary in those cases.

Things to Watch Out for When Measuring Out-of-Band (OOB) C/N

Offset Frequency: For OOB C/N, offset frequency is a negative offset from the video carrier making a noise measurement within the guard band. The same points as above with IC C/N also apply.

Non-Clean Spectrum: If the channel below has lower adjacent dual audio or nicam carriers, problems can occur. Measurements require clear spectrum for accuracy.

Modulator Filtering: Indications show that the filtering for some modulators of the lower vestigial side band was inadequate for supporting the OOB C/N measurement.

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