

DOCSIS 3.1 BER testing on CATV amplifiers with R&S®CLGD and R&S®FSW

Your task

The need for higher data rates and flexibility for IP and cable TV (CATV) has led to the introduction of DOCSIS 3.1. With channel bandwidths up to 192 MHz in the downstream and 96 MHz in the upstream and the cable network frequency extension up to 1.2 GHz (1.8 GHz as a future extension), cable components must meet significantly higher technical requirements. Testing requirements include supporting a full channel load and coexistence of both DOCSIS 3.0 and DOCSIS 3.1 signals (in some cases analog TV as well).

Rohde & Schwarz solution

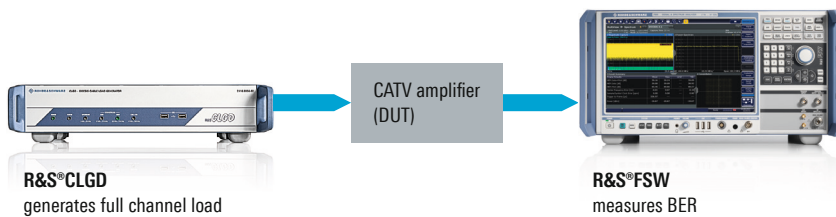
The R&S®CLGD is the only flexible and compact solution available on the market that can meet these testing requirements. The introduction of much wider bandwidths for DOCSIS 3.1 along with higher constellation modes (up to 16kQAM) require very powerful spectrum and signal analyzers. The R&S®FSW is ideal since it can measure MER that is typically 57 dB and higher and also provide BER measurements based on DOCSIS 3.1 signals.

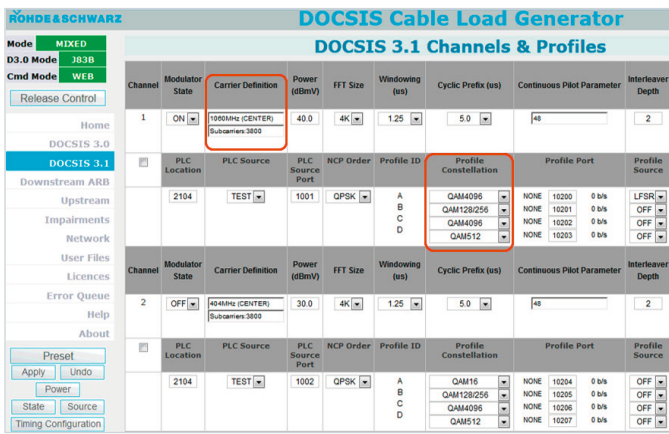
Bit error rate (BER) test solution for DOCSIS 3.1

The bit error rate (BER) is an important measurement for CATV component manufacturers. In order to measure the BER, the data sequence sent by the signal generator must be known by the signal analyzer in advance.

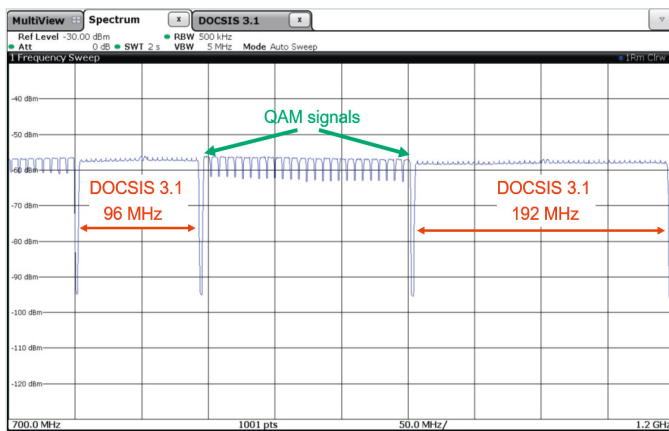
For the R&S®FSW, this is not necessary because it uses the detected bit errors from the LDPC decoder in the R&S®FSW-K192 DOCSIS 3.1 analysis option to calculate BER. The R&S®FSW compares the measured (demodulated) data with the available reference information and calculates the BER by itself.

CATV amplifier testing setup with R&S®CLGD and R&S®FSW

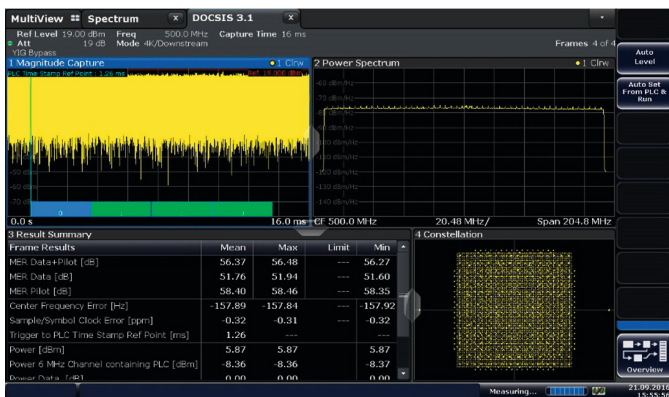




R&S®CLGD GUI for setting up DOCSIS 3.1 channels.



Full channel load generated by the CLGD as an input to the CATV amplifier.

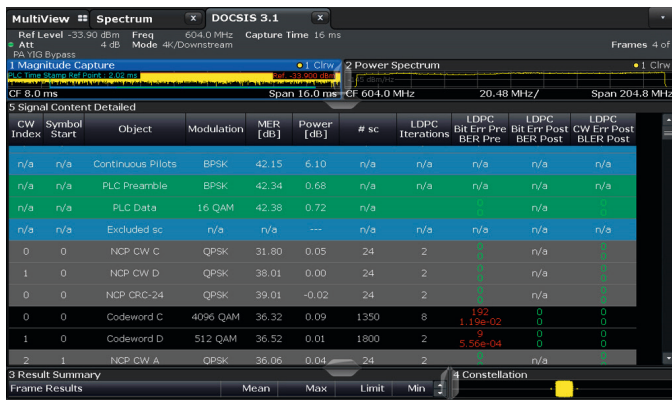


DOCSIS 3.1 downstream analysis with the R&S®FSW-K192.

The R&S®CLGD can generate a full channel load with DOCSIS 3.1 signals. A typical signal configuration for DOCSIS 3.1 is shown in the figure on the left. The most important parameters are highlighted in the red boxes (frequency and constellation of the DOCSIS profiles).

In a similar way, the R&S®CLGD can generate a full channel load with DOCSIS 3.0 signals to occupy the entire CATV frequency spectrum. The RF output frequency and power of the signals can be independently adjusted, making R&S®CLGD a very flexible cable load generator for simulating complex scenarios to the DUT.

The RF output from the DUT is directly connected to the R&S®FSW RF input port. On the R&S®FSW, select “Mode” and choose “DOCSIS 3.1” from the popup menu. Then choose the downstream measurement option and set the correct frequency. On the right-hand menu, press “Auto Level” and “Auto Set From PLC&Run” to automatically adjust all DOCSIS 3.1 parameters.



DOCSIS 3.1 BER measurement screenshot from the R&S®FSW signal and spectrum analyzer.



The R&S®FSW signal and spectrum analyzer with the R&S®CLGD DOCSIS cable load generator.

In the R&S®FSW view mode, select the “Signal Content Detailed” option to display a detailed analysis of all the PLC data, codewords on different DOCSIS 3.1 profiles, etc. BER measurements are provided for pre-LDPC and post-LDPC. This example shows a DOCSIS 3.1 profile with 4096QAM. This test can be performed either by increasing the RF output power or by adjusting the AWGN settings on the R&S®CLGD. The user can monitor these changes by observing the BER analysis window as shown in the figure on the left.

Conclusion

The R&S®CLGD and R&S®FSW offer all the necessary functionality for testing amplifiers, DFB lasers and other components in a DOCSIS 3.1 network. Plus the two instruments can be used to generate and analyze existing DOCSIS 3.0 signals, making the solution very cost efficient.

Ordering information			
Designation	Quantity	Type	Order No.
R&S®CLGD DOCSIS Cable Load Generator			
R&S®CLGD Base Unit 1.2 GHz	1	R&S®CLGD	2118.6956.02
Downstream Full Channel Load Generator (DOCSIS 3.1/3.0, J.83/A/B/C, analog TV)	1	R&S®CLGD-K200	2118.6962.02
Downstream Frequency Range Extension 252 MHz to 1794 MHz	1	R&S®CLGD-K3018	2118.6985.02
Signal Impairment Simulation	1	R&S®CLGD-K1050	2118.6991.02
R&S®FSW Signal and Spectrum Analyzer			
R&S®FSW Base Unit up to 8 GHz	1	R&S®FSW8	1312.8000.02
DOCSIS 3.1 OFDM Downstream	1	R&S®FSW-K192	1325.4138.02
320 MHz Analysis Bandwidth	1	R&S®FSW-B320	1325.4867.04
Vector Signal Analysis (VSA) on digitally modulated single carrier signals	1	R&S®FSW-K70	1313.1416.02

Service that adds value

- ▮ Worldwide
- ▮ Local and personalized
- ▮ Customized and flexible
- ▮ Uncompromising quality
- ▮ Long-term dependability

About Rohde & Schwarz

The Rohde & Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, radiomonitoring and radiolocation. Founded more than 80 years ago, the independent company which is headquartered in Munich, Germany, has an extensive sales and service network with locations in more than 70 countries.

Sustainable product design

- ▮ Environmental compatibility and eco-footprint
- ▮ Energy efficiency and low emissions
- ▮ Longevity and optimized total cost of ownership

Certified Quality Management

ISO 9001

Certified Environmental Management

ISO 14001

Rohde & Schwarz GmbH & Co. KG

www.rohde-schwarz.com

Rohde & Schwarz training

www.training.rohde-schwarz.com

Regional contact

- ▮ Europe, Africa, Middle East | +49 89 4129 12345
customersupport@rohde-schwarz.com
- ▮ North America | 1 888 TEST RSA (1 888 837 87 72)
customer.support@rsa.rohde-schwarz.com
- ▮ Latin America | +1 410 910 79 88
customersupport.la@rohde-schwarz.com
- ▮ Asia Pacific | +65 65 13 04 88
customersupport.asia@rohde-schwarz.com
- ▮ China | +86 800 810 82 28 | +86 400 650 58 96
customersupport.china@rohde-schwarz.com

R&S® is a registered trademark of Rohde & Schwarz GmbH & Co. KG

Trade names are trademarks of the owners

PD 5214.8119.92 | Version 01.00 | December 2016 (ch)

DOCSIS 3.1 BER testing on CATV amplifiers with R&S®CLGD and R&S®FSW

Data without tolerance limits is not binding | Subject to change

© 2016 Rohde & Schwarz GmbH & Co. KG | 81671 Munich, Germany



5214811992