DVB-C2 receiver tests in a simulated cable TV network with full channel load

The R&S®BTC broadcast test center generates DVB-C2 signals for receiver tests with a variety of simulated interference types. The selection tests stipulated by the DVB Project require a cable TV network with full channel load. Combining the R&S®BTC broadcast test center and the R&S®CLG cable load generator makes it quick and easy to create a flexible cable TV network with full channel load and to simulate all types of realistic interference, permitting tests in accordance with DVB.

Your task

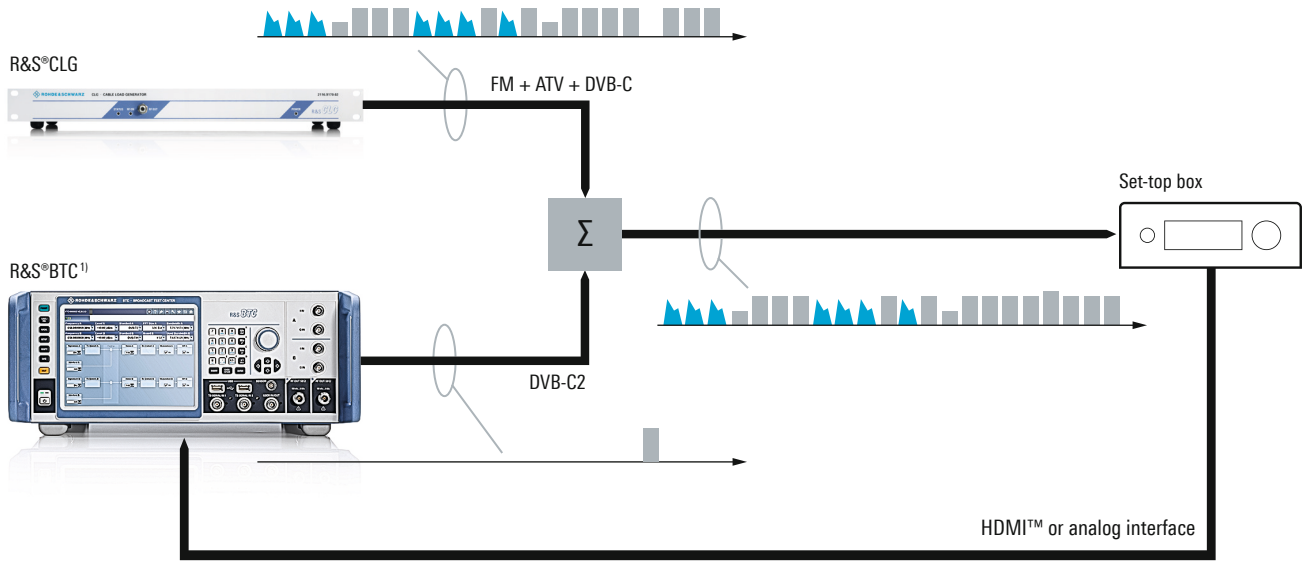
A TV receiver in a typical cable TV network must be capable of handling various types of interference.

Amplifier noise: In a typical cable TV network, amplifiers are cascaded along the transmission path. Their inherent noise and the noisy input signals, consisting of thermal noise, intermodulation products, etc., are amplified.

Phase noise: When the headend generates the signal, the oscillators produce phase noise.

Impulsive noise: The noise resulting from switching on electrical devices is simulated with single or repeated pulses of random strength, duration and occurrence.

Test setup for DVB-C2 receiver tests with the R&S®BTC and R&S®CLG



1) The combination of an R&S®SFU and an R&S®VTE/R&S®VTC can be used instead of the R&S®BTC broadcast test center.

Microreflections: Impedance mismatches, especially at cable junctions on the last mile and in in-building distribution systems, can lead to reflections.

AC hum: The amplifiers' supply voltage generates AC hum along the transmission path.

Narrowband interference: Narrowband interference can be caused by mobile phones, for example.

These types of interference originate primarily in the cable TV network or in the headend. At the same time, adjacent channels make channel selection difficult and the sheer number of channels causes intermodulation in the receiver. The DVB Project (www.dvb.org) is therefore calling for DVB-C2 receiver tests in a simulated cable TV network operating at full channel load. One option for implementing these tests is to participate in a Kabel Deutschland GmbH Plug Fest. However, this requires extensive planning, is time-consuming, expensive and only possible on specific Plug Fest dates.

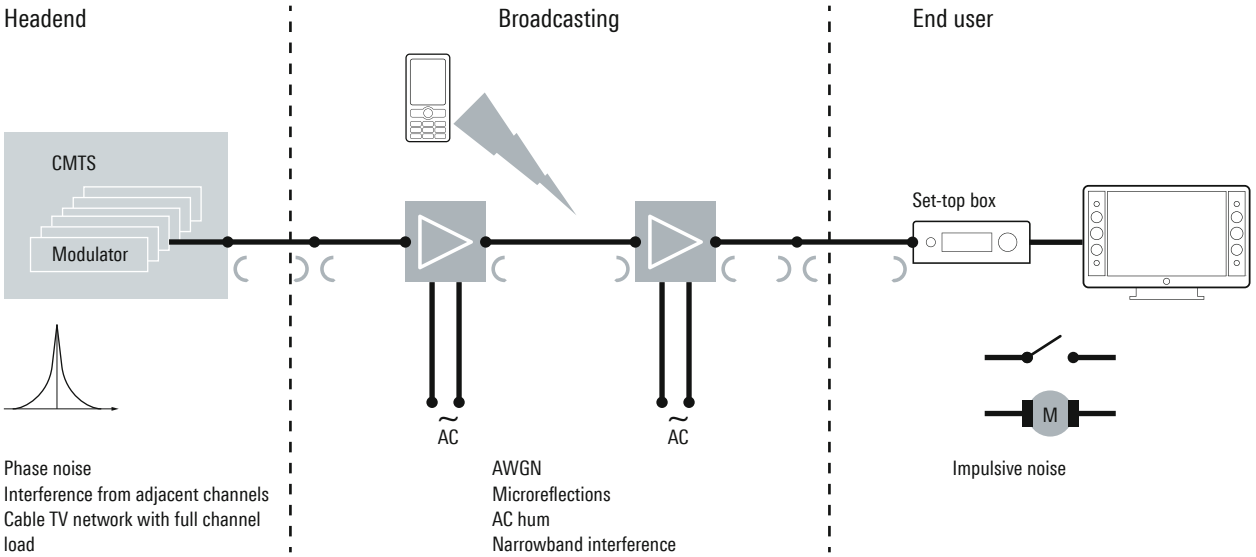
Performing DVB-C2 receiver tests on a cable TV network with full channel load directly in the development lab would both lower costs and increase flexibility. In addition to checking the receiver's functionality (Go/NoGo test), the resulting A/V quality should be evaluated from a T&M perspective. Users must be able to configure the various influences as needed in order to isolate problems and simulate extreme scenarios.

T&M solution

The R&S®BTC broadcast test center together with the R&S®CLG cable load generator simulates a cable TV network with full channel load, including a DVB-C2 signal and all realistic types of interference. The R&S®BTC uses its DVB-C2 realtime coder to generate highly precise standard-compliant DVB-C2 signals with 8 MHz or 16 MHz RF bandwidth and to reproducibly simulate amplifier noise, phase noise, impulsive noise, microreflections and AC hum.

A receiver's ability to process a noisy signal and output it with as few errors as possible can be tested using the bit error ratio (BER) measurement integrated in the R&S®BTC. However, this measurement does not reveal whether errors are visible to the end user. If the assessment is to be done from the end user perspective or if the measuring point required for the BER measurements is not accessible in the receiver, the R&S®BTC can analyze the output A/V signal at the DVB-C2 receiver's A/V ports (analog, HDMI™). An objective, reproducible and automatable assessment of the signal being processed by the receiver is achieved with a delta analysis between the A/V signal under test and the previously recorded, interference-free reference signal. The measurement shows visible errors and audio dropouts that would be noticed by the end user. Instead of the R&S®BTC broadcast test center, an R&S®SFU broadcast test system can be used for signal generation and either an R&S®VTC or R&S®VTE video tester be used for A/V quality tests.

Typical cable TV network impairments



The R&S®CLG cable load generator simulates channel load for up to 120 channels with 8 MHz bandwidth. The user can select any frequency and level for each channel in 0.1 dB steps. Channels can be assigned anywhere within the frequency range from 47 MHz to 1002 MHz. A signal mix, e.g. comprising DVB-C, ATV, FM and narrowband signals, is configured via a web GUI – either manually or, very conveniently, using configuration files. The R&S®CLG is even capable of completely simulating the Kabel Deutschland GmbH (KDG) network in Berlin.

The configuration file for KDG's channel load can be downloaded for free from www.rohde-schwarz.com, search term: "7BM88".

Configuration

Testing a DVB-C2 receiver is easy using a simulated cable signal on the R&S®CLG cable load generator:

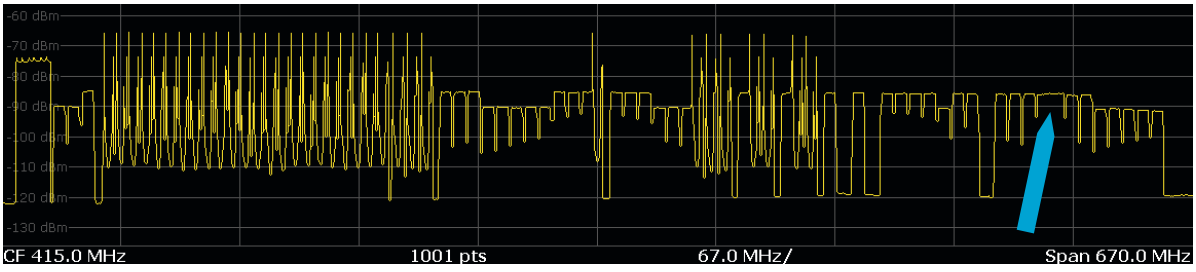
- Run the configuration file
- Enable AC hum (e.g. 3 % at 50 Hz) to simulate the AC hum of the channel load generated by the R&S®CLG
- Switch the modulated wanted channel (e.g. D562) to CW and reduce the signal level; use this CW signal to simulate narrowband interference in the channel received by the TV receiver

Perform the following steps on the R&S®BTC broadcast test center:

- Configure the DVB-C2 signal for the wanted channel (e.g. frequency, level, QAM)
- Configure the amplifier noise (comparable to white noise) using the AWGN generator and the carrier-to-noise (C/N) ratio functionality
- Configure the phase noise
- Configure the impulse noise
- Configure fading to simulate both AC hum in the measurement channel and microreflections (same fading profile as for the R&S®SFU; for more information, visit www.rohde-schwarz.com, Application Note 7BM68)

The signals from the R&S®CLG and the R&S®BTC are combined and fed to the DVB-C2 receiver. This simulation of a flexible and realistic cable TV network with all types of interference can be used at any time in the development lab. The dimensions of the test setup are just 483 mm × 222 mm × 483 mm (19 in × 8.75 in × 19 in), requiring no more space than two standard desktop PCs.

Cable TV network with full FM, ATV and DVB-C channel load (QAM64 and QAM256 modulated) and with a 16 MHz DVB-C2 channel (at 670 MHz).



Product overview

Designation	Type
Cable load generator (including power cable and manual)	R&S®CLG
Broadcast test center	R&S®BTC
DVB-C2 coder	R&S®BTC-K517
AWGN noise	R&S®BTC-K1040
Impulsive noise and phase noise	R&S®BTC-K1043
Fading simulator	R&S®BTC-B1031 or R&S®BTC-B1032

Designation	Type
HDMI™ RX 225 MHz [1)]	R&S®VT-B2360
HDMI™ RX 300 MHz [1)]	R&S®VT-B2361
Analog A/V RX module [1)]	R&S®VT-B2370
A/V distortion analysis	R&S®VT-K2111
A/V inspection	R&S®VT-K2110

[1)] Only one of these options is required, depending on the DUT interface.

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Certified Quality System ISO 9001

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