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FIG 1 **The R&S NetCCU®700 transmitter control unit offers numerous functions yet is very compact.**

Transmitter Control Unit R&S NetCCU®700

All-purpose instrument with integrated DVB-T receiver module

The R&S NetCCU®700 (FIG 1) can be used for many purposes – as a transmitter control unit, a local control unit or a network interface for web and SNMP applications in which the R&S NetCCU®700 provides the hardware platform. By adding the unit's optional DVB-T receiver module, you can broaden its range of applications even further.

DTV-B receiver module means more applications

By adding the optional DVB-T receiver module to the R&S NetCCU®700 transmitter control unit [*], you can greatly expand the unit's functionality. The module not only turns the unit into a retransmitter for demodulating an off-air signal but also enables it to monitor a transmitter's output signal.

Retransmitters do not require a signal feed since they receive the main transmitter signal off air and apply the demodulated RF signal at the transmitter's ASI input (FIG 2). This reduces network operator costs, as there is no need for feeding signals to the transmitter station. In contrast to a converter, a retransmitter refreshes the signal by applying the error protection technique specified by the DVB-T standard during demodulation.

Using the integrated DVB-T receiver module to **monitor the output signal** is very cost-efficient (FIG 3). Important parameters such as MER, BER, S/N, input level and information specific to the DVB-T mode can be monitored, output on the display and transmitted for remote control as needed. All these parameters are included in a hierarchical tree structure of the SNMP MIB and can be used to generate traps (FIGs 4 and 5).

Installing the DVB-T receiver module on the R&S NetCCU®700 yields compact and cost-efficient solutions and complements the entire Rohde&Schwarz product portfolio of DVB-T transmitters.

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Main features

- Can be used as a retransmitter or to monitor a transmitter's output signal
- Two-channel receiver version opens up numerous applications – for example, diversity reception – and ensures high flexibility
- Provides compact transmitter solutions by incorporating many functions into one instrument
- Offers a uniform concept for DVB-T transmitters of all power classes
- Can also be used as a stand-alone instrument

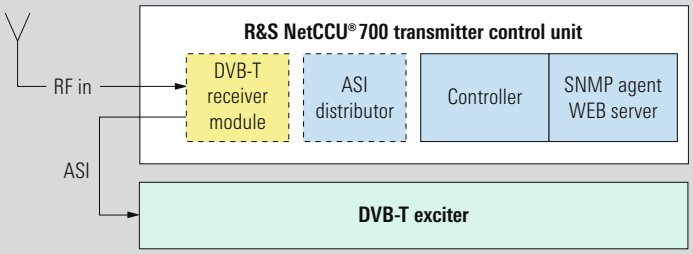


FIG 2
Configuration of the R&S NetCCU®700 as a retransmitter.

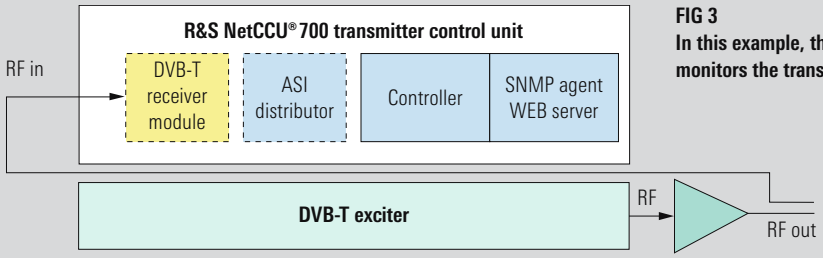
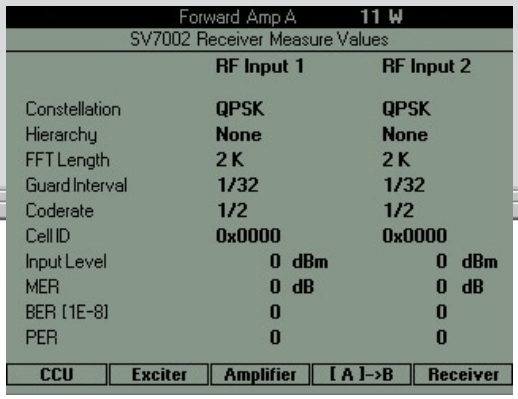


FIG 3
In this example, the R&S NetCCU®700 monitors the transmitter output signal.

FIG 4
Right: The DVB-T parameters shown on the R&S NetCCU®700 display. Below: Part of the SNMP MIB for the R&S NetCCU®700 with the DVB-T receiver module.



Input level	dBm
MER	dB
C/N	dB
BER	10^{-8}
PER	packets/s
AGC locked	Y / N
Carrier locked	Y / N
TPS locked	Y / N
Viterbi locked	Y / N
MPEG sync locked	Y / N
MPEG data locked	Y / N
Uncorrected MPEG packet	Y / N
FFT length	2k; 8k
Guard interval	1/32; 1/16; 1/8; 1/4
Constellation	QPSK; 16QAM; 64QAM
Code rate	1/2; 2/3; 3/4; 5/6; 7/8
Cell ID	0x000 to 0xFFFF
Hierarchy	none; $\alpha = 1$; $\alpha = 2$; $\alpha = 4$

FIG 5 The R&S NetCCU®700 can monitor these parameters and transmit them to remote locations.

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The DVB-T receiver module also allows the R&S NetCCU®700 to be used as a standalone instrument for other transmitters in retransmitter and monitoring applications. This offers network operators a uniform receiver interface, even if they use transmitters from different manufacturers in their networks.

Two versions of the DVB-T receiver module

The receiver module is available in two versions. In the **single-channel version**, the signal path consists of a tuner, demodulator and ASI interface. The R&S NetCCU®700's internal controller controls the receiver module via an RS-232-C interface.

The **two-channel version** has two identical signal paths (FIG 7) with the special feature that the two demodulators are interconnected via a signal bus, thus allowing four configurations (FIG 6). The box on the right shows three typical applications for the two-channel version.

Comprehensive transmitter concept

Due to its numerous functions, the R&S NetCCU®700 offers very compact, cost-efficient solutions. Moreover, identical functional groups in high-, medium- and low-power transmitters reduce training and spare parts costs for network operators.

By offering the DVB-T receiver module, Rohde&Schwarz is adding major new functions to its product portfolio while remaining true to its concept of modular and uniform transmitter families.

The DVB-T receiver module expands the functionality of the R&S NetCCU®700 for further applications. The two-channel version of the module offers maximum flexibility and unique applications such as diversity reception. The fact that the R&S NetCCU®700 can still be operated as a standalone instrument even after the receiver module has been added means that it remains a valuable all-purpose instrument.

Simone Gerstl; Manfred Reitmeier

Condensed data of the R&S NetCCU®700 DVB-T receiver module

Receive frequency range	VHF (172 MHz to 230 MHz) UHF (470 MHz to 862 MHz)
Bandwidth	6 MHz, 7 MHz or 8 MHz
Frequency offset	±167 kHz or ±125 kHz
Input level range	–92 dBm to –20 dBm (depending on the DVB-T mode)
Signal throughput time	typ. 7.8 ms (for e.g. 8 MHz, 8k, 1/32 QPSK 7/8)
TV standard	DVB-T ETS 300 744

Possible applications for the two-channel version

The two-channel version of the DVB-T receiver module offers maximum flexibility and a wide range of applications. It can be used for hierarchical, redundant or diversity reception but also as a module that operates as a retransmitter and simultaneously monitors the output signal. Some examples follow.

Its **use as a module that operates as a retransmitter and simultaneously monitors the output signal** (FIG 8) deserves a closer look. The first demodulation path of the module receives the main transmitter signal off air. The demodulated signal replaces the signal that is normally fed in via the ASI input. The second path demodulates and monitors the output signal of the transmitter. A 100 W retransmitter equipped with these features takes up only seven height units.

Another important application for the two-channel version is to **feed signals to two transmitters** (FIG 9), allowing them to be controlled cost-effectively via one R&S NetCCU®700.

Another unique application – especially under difficult reception conditions – is **diversity reception**, in which the two RF inputs of the receiver module are connected with two different receiving antennas for the same channel (FIG 10). The module analyzes both signals, and the signal of better quality is fed to the retransmitter. This is controlled by means of the diversity bus in the receiver module. This bus is used to continuously monitor the reception quality and, if necessary, toggle between the RF inputs.

All applications can be implemented using identical hardware. You can implement a different application simply by changing the software settings and switching the cable connections.

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Mode	RF inputs	ASI outputs
Dual input	RF 1, RF 2	ASI 1, ASI 2
Hierarchical	RF 1, RF 2	ASI 1 = HP or LP ASI 2 = LP or HP
Redundant	RF 1 = RF 2	ASI 1 = ASI 2
Diversity	RF 1 via antenna 1 RF 2 via antenna 2	ASI 1 = ASI 2

FIG 6 The four possible configurations of the two-channel version of the DVB-T receiver module.

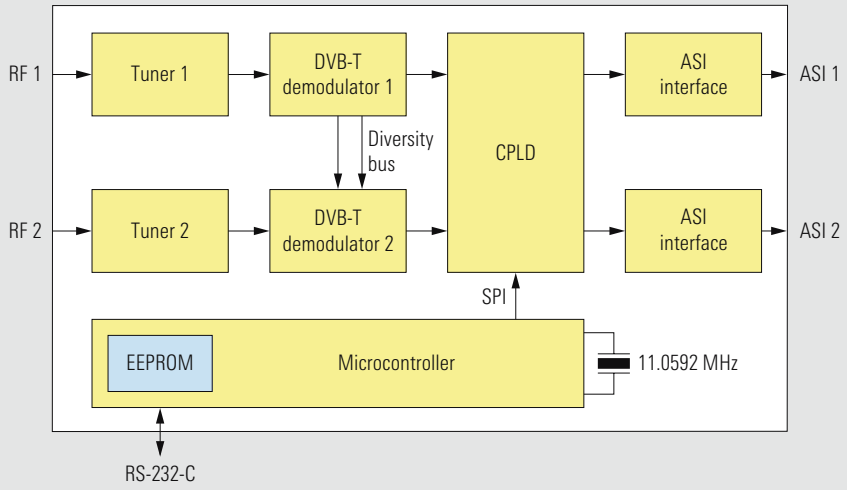


FIG 7 Basic design of the two-channel DVB-T receiver module.

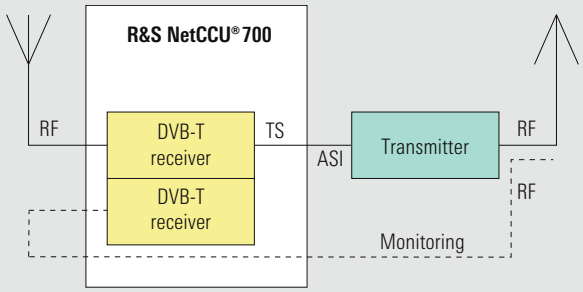


FIG 8 Simultaneous use as a retransmitter and for monitoring the output signal.

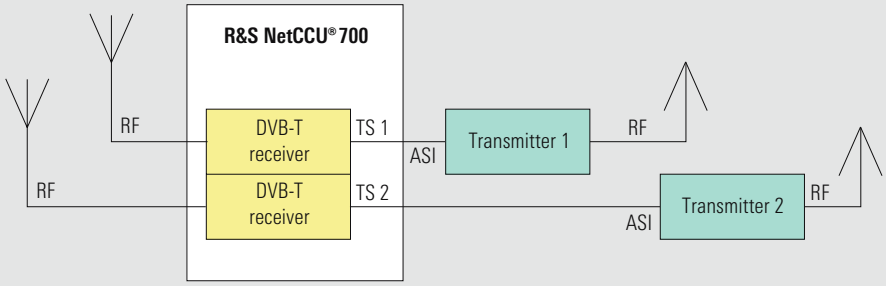


FIG 9 ASI feed for two transmitters.

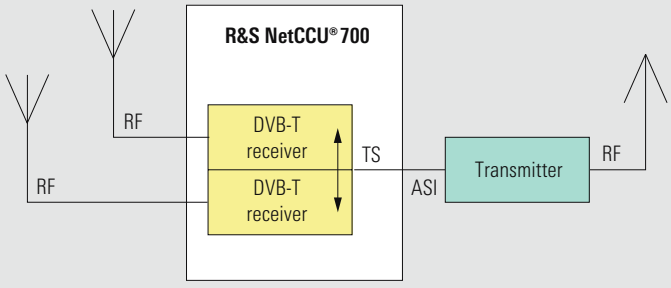


FIG 10 Configuration for diversity reception under difficult reception conditions.

Important abbreviations

ASI	Asynchronous serial interface
AGC	Automatic gain control
BER	Bit error ratio
CPLD	Complex programmable logic device
HP	High priority
LP	Low priority
MER	Modulation error ratio
MIB	Management information base
PER	Packet error ratio
SNMP	Simple network management protocol
SPI	Synchronous parallel interface
TS	Transport stream

More information at www.rohde-schwarz.com (search term: NetCCU)

REFERENCES

[*] Transmitter Control Unit R&S NetCCU®700: Transmitter control and remote monitoring in one unit. News from Rohde & Schwarz (2003) No. 179, pp 26–28

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