R&S®BTC Broadcast Test Center
Customer Presentation

ROHDE&SCHWARZ

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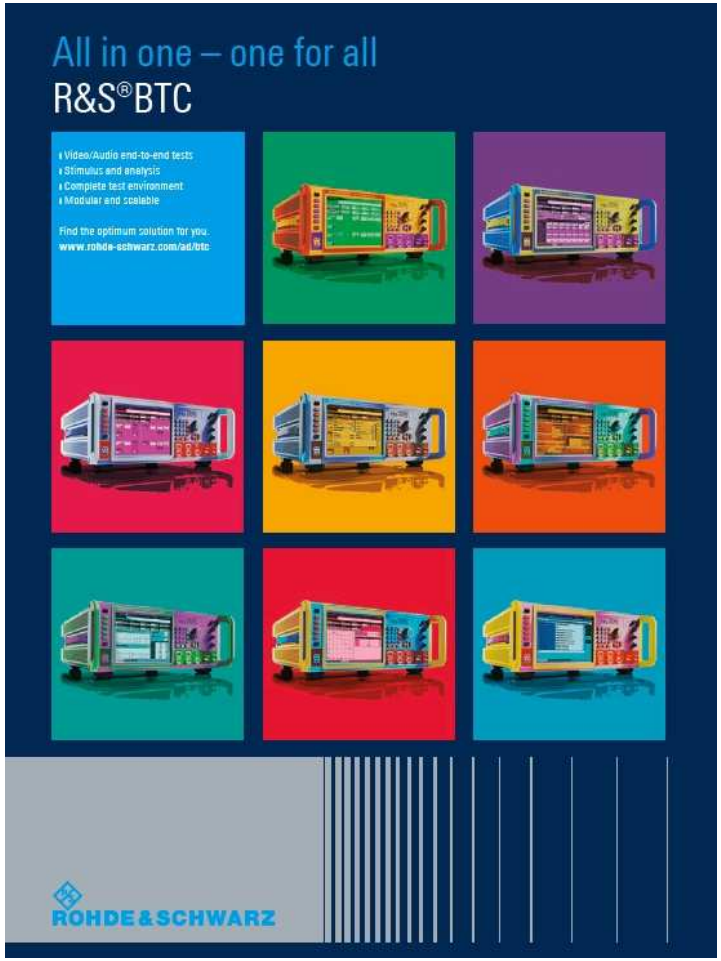
R&S®BTC – Broadcast Test Center



R&S®BTC – Market Segments

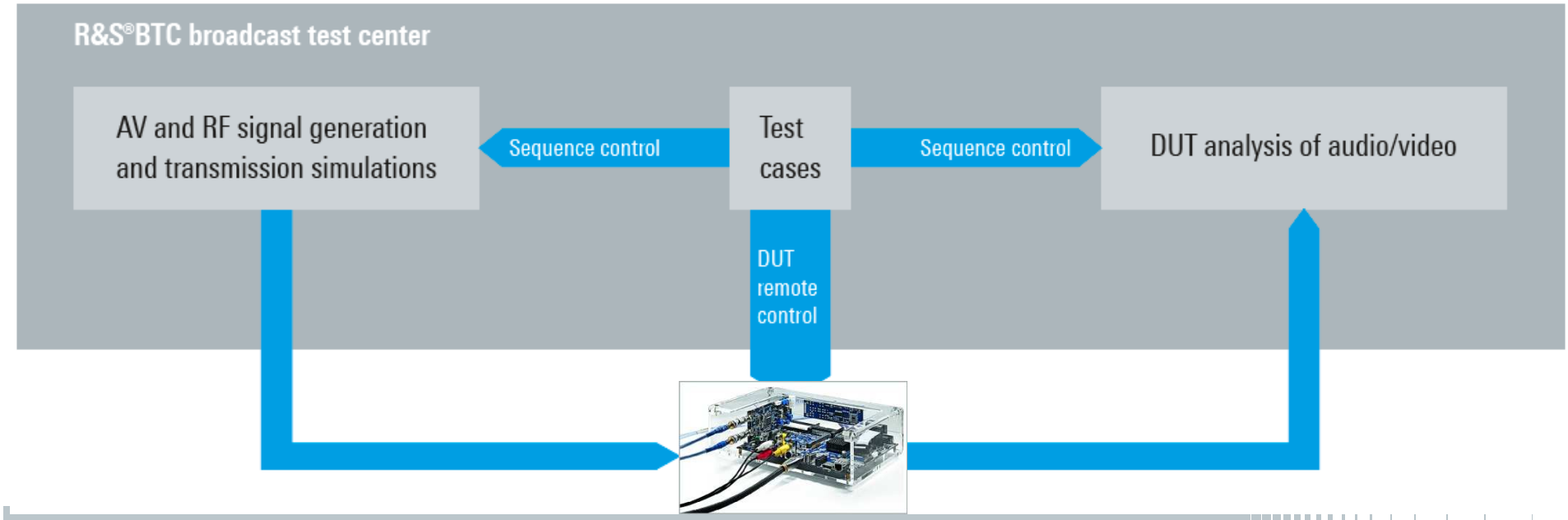
- Typical consumer electronics markets
  - Broadcast receiver manufacturers
  - Broadcast receiver chip set manufacturers
  - Car radio entertainment manufacturers
  - Test houses

R&S®BTC – Market Segments

- Professional markets
  - Broadcast and mobile network operators
  - Government and public authorities
  - Professional equipment manufacturers

R&S®BTC – Unique Solution Concept

- Complete test bed for RF, video/audio/data signal generation and DUT analysis
  - New high-end T&M platform
  - Signal generation and DUT analysis



R&S®BTC – Innovative Rohde & Schwarz T&M Platform for Tomorrows Demands

- **Future-proof T&M platform concept**
  - DUT stimulus and analysis
  - Modular and scalable design
  - Full End-to-End testing for video/audio
  - High end RF signal generation
  - Two independent RF paths up to 6 GHz
  - RF bandwidth up to 160 MHz
  - Latest transmission simulation technologies
  - Integrated automated testing

R&S®BTC – Broadcast Test Center
The All-in-One Solution

Signal Generation
RF Performance
Tests

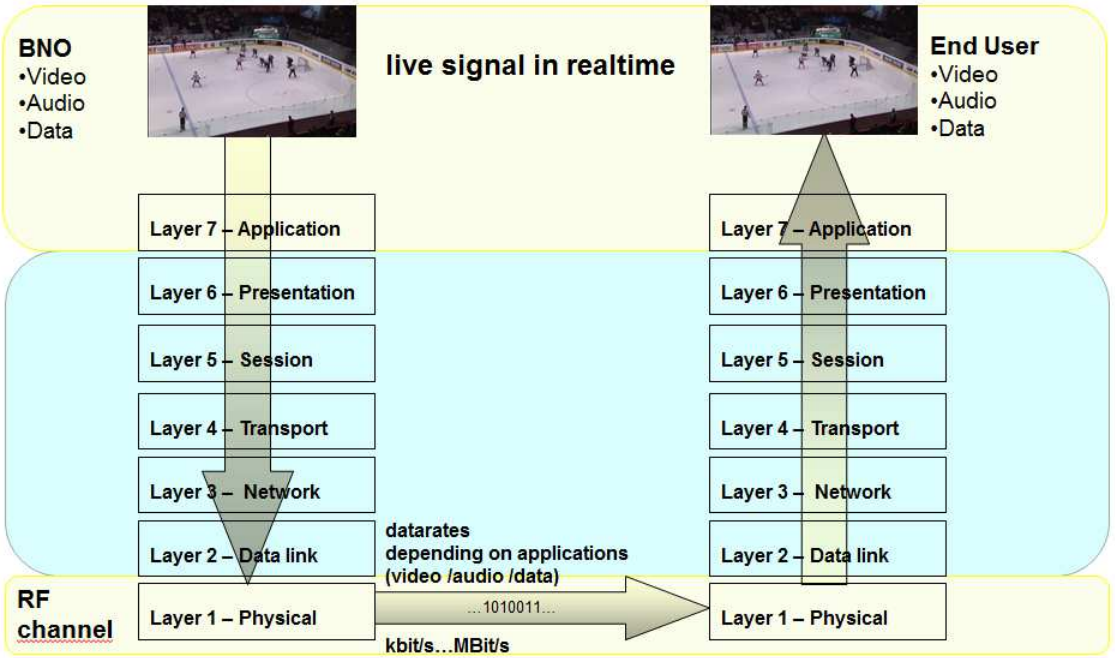
DUT

Analysis

Automated Testing
Test Suites

Realtime End-to-End Testing

- End-to-end transmission simulations over all OSI layers
  - A/V realtime signal generation
  - A/V stress tests
  - Transmission simulations
  - A/V Rx quality analysis



- Target for automotives
  - Satisfy end-user experience

R&S®BTC – Base Unit

R&S®BTC *Broadcast Test Center*

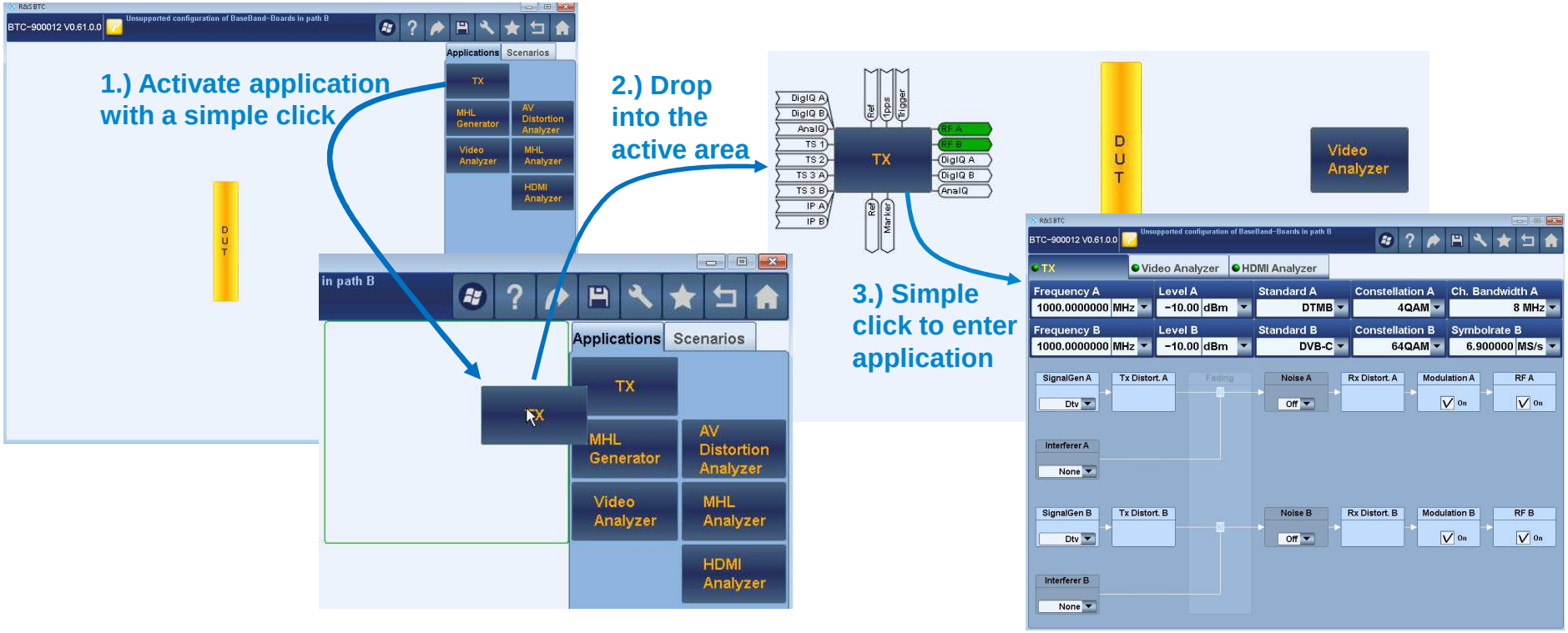
Housing	**19“, 4 HU, 435mm x 192 mm x 460 mm (17.1 in x 7.6 in x 18.1 in)**
Number of modules	**Up to 6**
Display	**8.4“ 1024 x 768 (XVGA) touch screen**
Front	**Number block, wheel and navigation keys, USB, power sensor, analog IQ, TS and RF connectors**
Software	**Use of R&S compass platform with Windows 7 Embedded and touchscreen graphical user interface**

R&S®BTC – Scalable Platform

- Modular design
- Perfect scalable to requirements and tasks
- Support of R&S®VT-modules like analyzers and interfaces
- Support of R&S®BTC coder and transmission simulation modules
- Prepared for the future

R&S®BTC – Realtime Test Application

- Complete DUT signal stimulus and analysis in a single box
  - Customize your application!
  - High performance signal generation + DUT video/audio output analysis



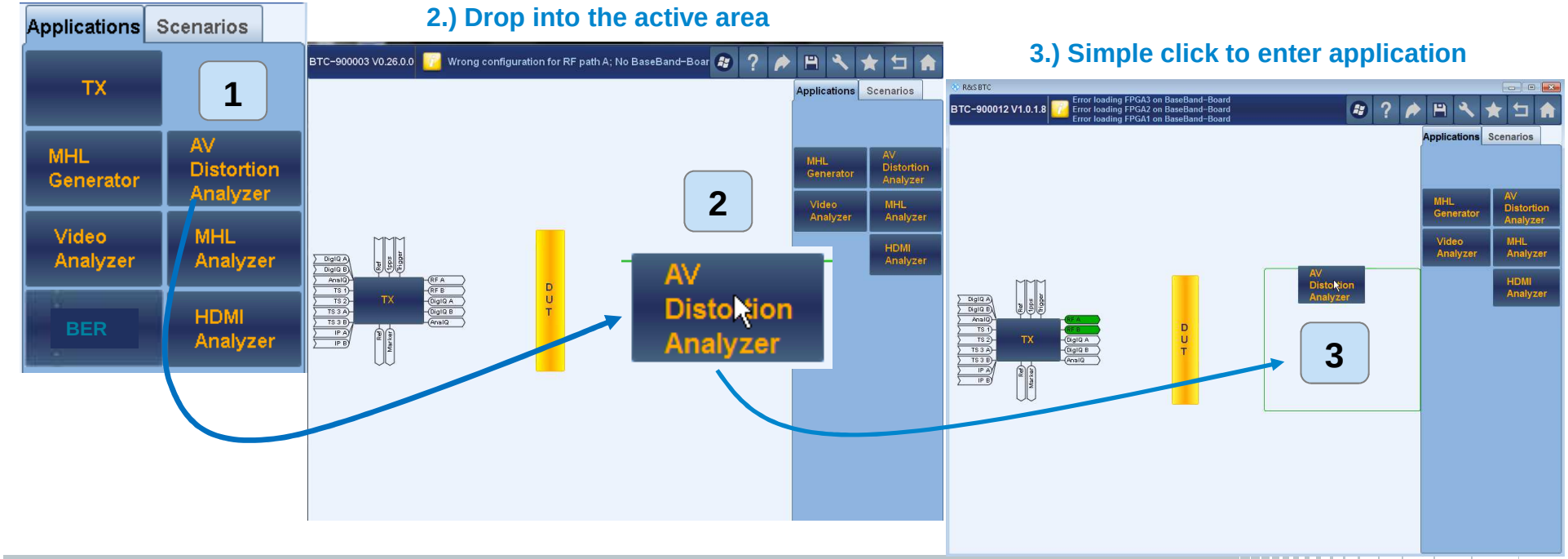
R&S®BTC – Analyzer Applications

- Analyzer applications
  - Available in the „*applications*“ area
  - Simple activation by drag and drop into active area in 3 steps

1.) Activate application with a simple click

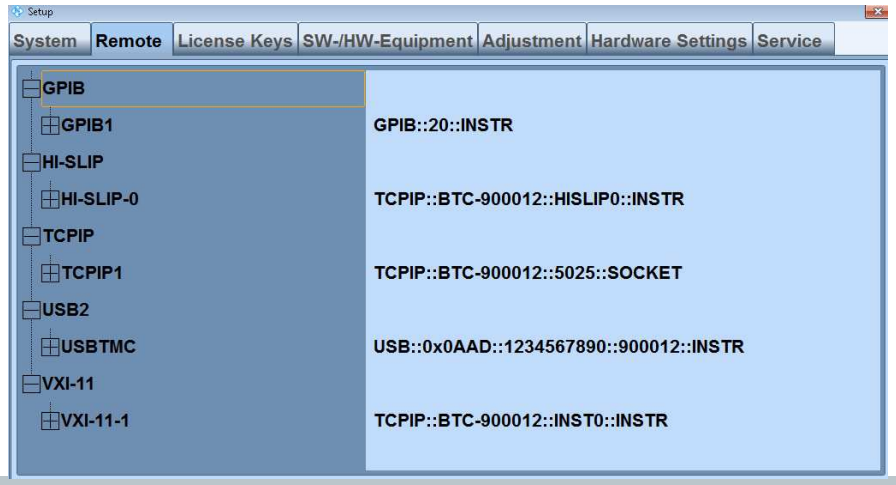
2.) Drop into the active area

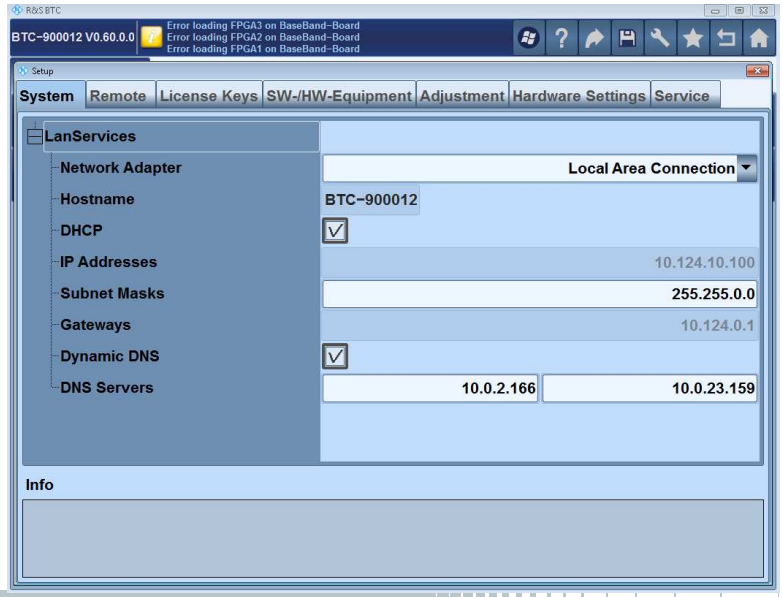
3.) Simple click to enter application



R&S®BTC – Remote Control Interfaces

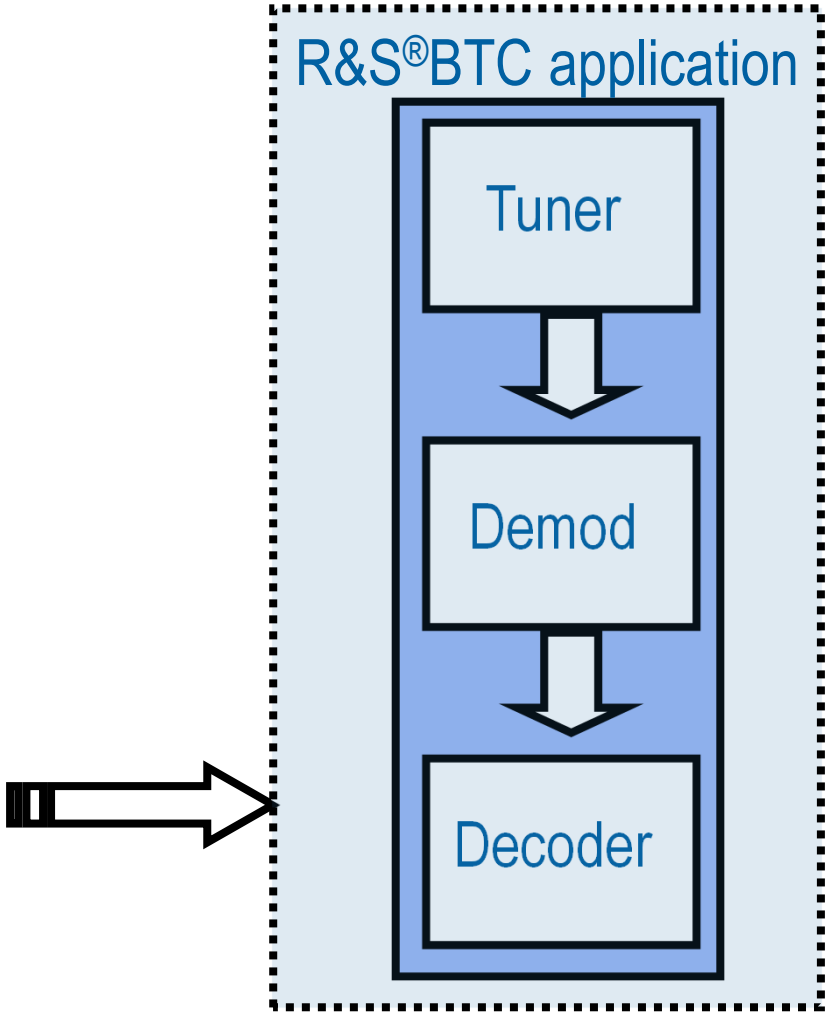
- Remote control interfaces
  - GBIP (IEEE), LAN and USB





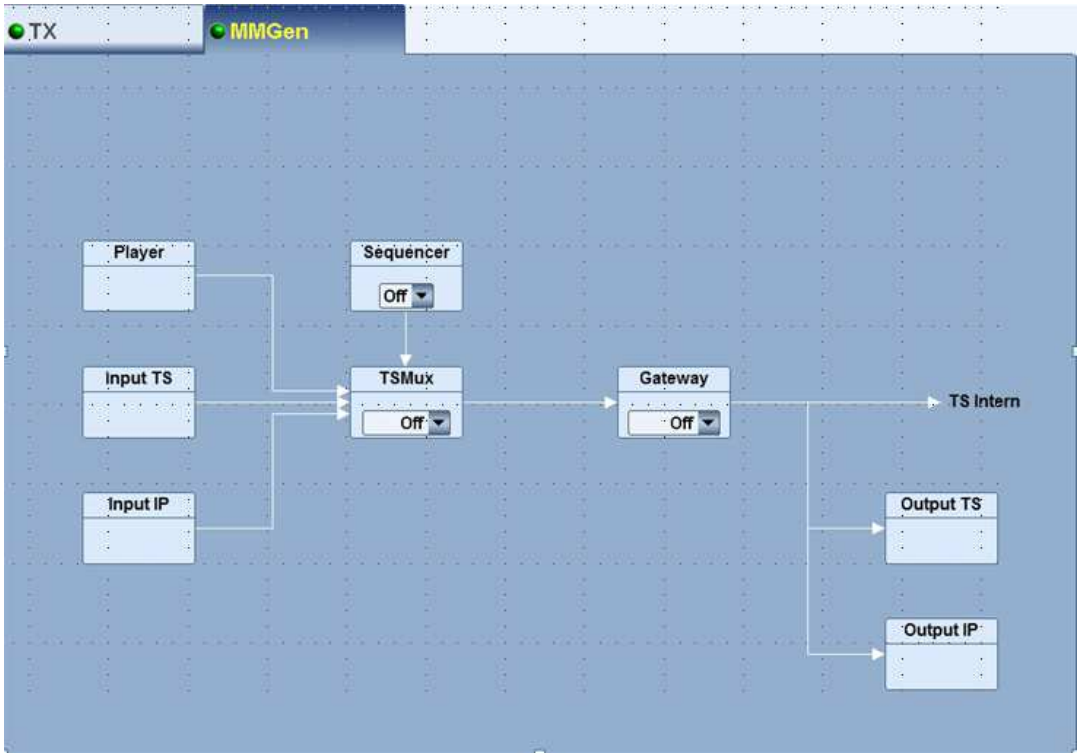
R&S®BTC – Complete Receiver Testing

- Tuner, Demodulator and Decoder Testing
  - End-to-end transmission chain testing
  - Perfect for receiver testing with integrated decoders and application-software through all OSI-layers
  - Decoder stress test
- Available since
  - Firmware 1.50 (already included)



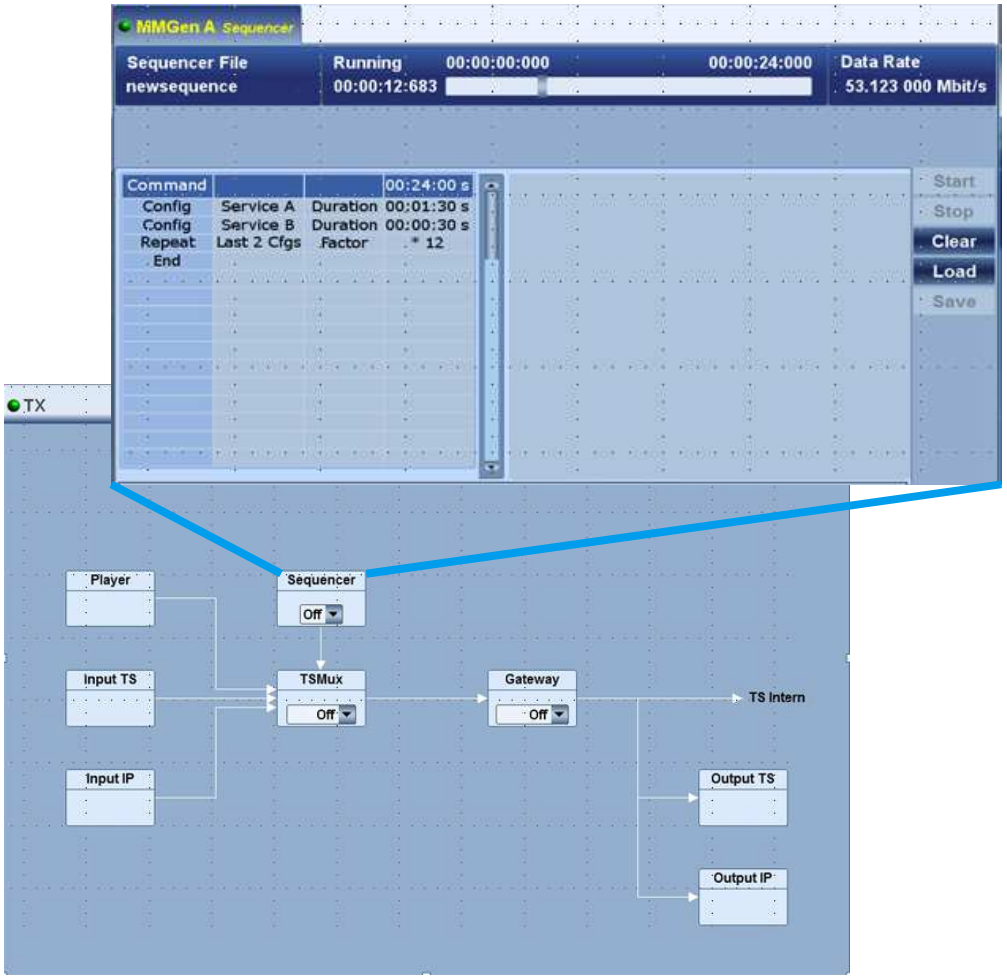
R&S®BTC – Multi Media Generator / Apps

- Multi Media Generator applications
- Inputs
  - Internal
    - Players (up to 2 players)
  - External (in preparation)
    - IP, ASI, SMPTE
- TS Multiplexer (Remux)
- Sequencer (in preparation)
- T2-MI Gateway (in preparation)
- Outputs
  - Internal to coder(s)
  - External
    - ASI, SMPTE, ETI, IP (in preparation)



R&S®BTC – Multi Media Generator / Sequencer

- Multi Media Generator sequencer
- Sequencer functionality
  - Definable and time depending
    - Remultiplexer configurations
    - Execution time
    - Loops
- Applications
  - Configuration of dynamic multiplexing scenarios
  - Automated decoder stress test
  - Test sequence definition
- Availability
  - Firmware 1.70

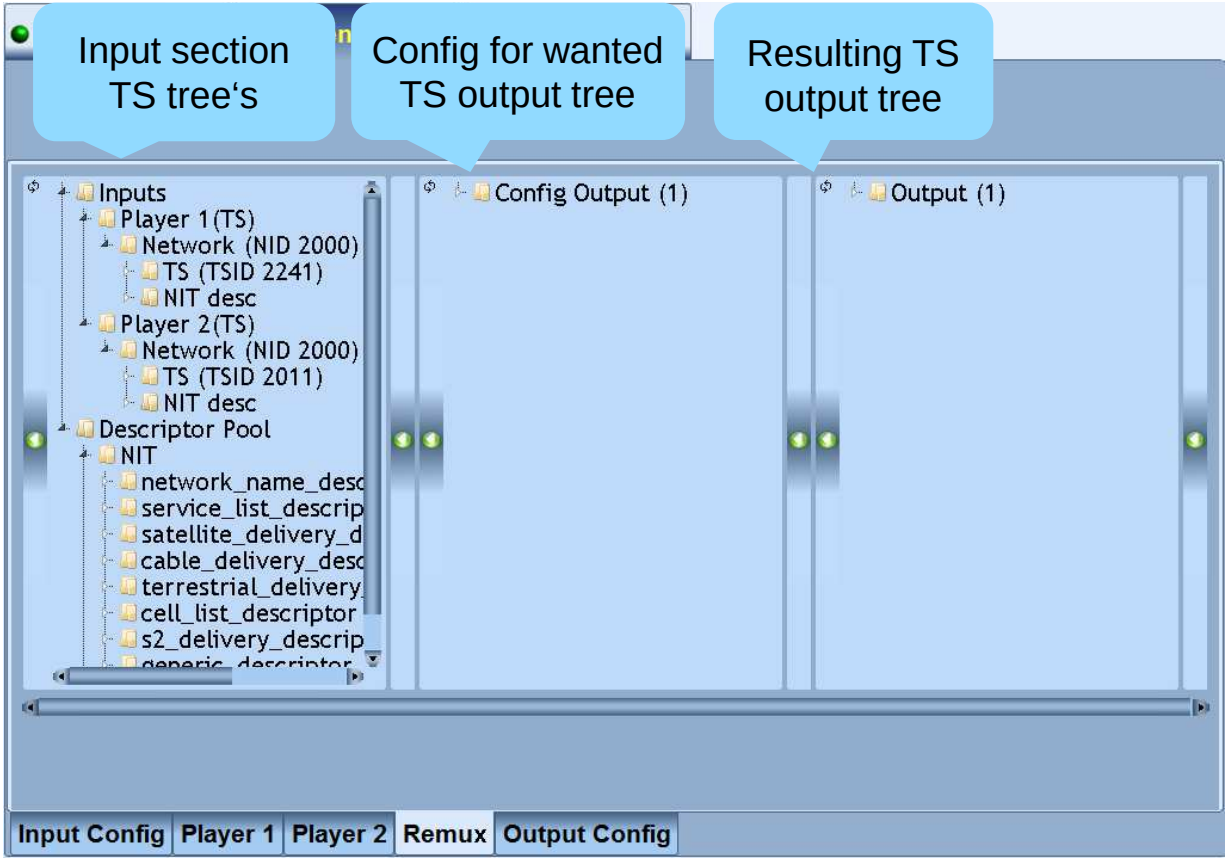


R&S®BTC – Multi Media Generator / Player

- Access to Player 1 and Player 2 in Multi Media Generator 1 and 2
- Each MMGen includes
  - 2 Players (Player 1 / Player 2)

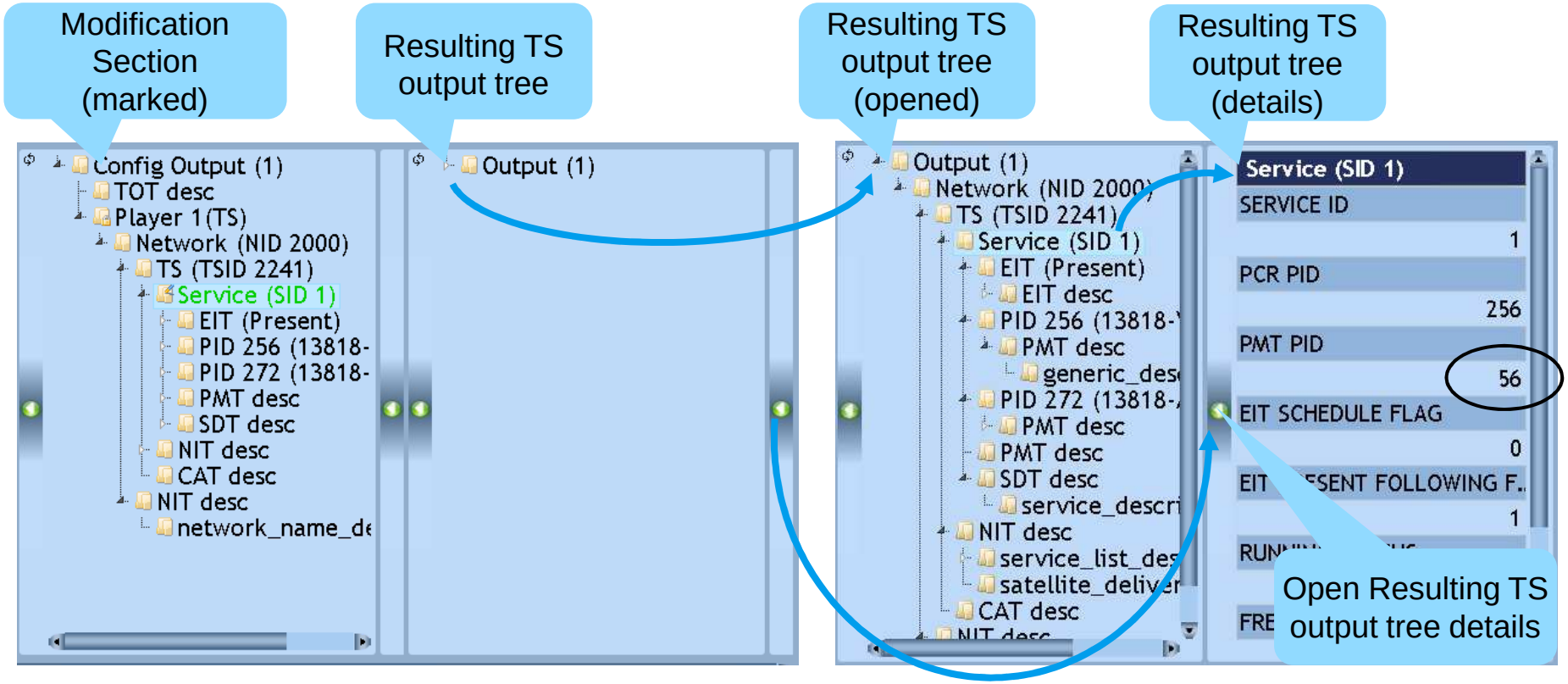
R&S®BTC – Multi Media Generator / Remultiplexer

- Remultiplexer functionality
- 3 Main sections
  - Input TS
  - TS configuration
  - Output TS
- Technical details
  - MPEG-2 TS
  - Input analysis
  - Realtime modifications
  - Continuous TS playout
    (no disruption)
- Available since
  - Firmware 1.50
- Included always in base unit as BTC-K20
  (no extra order required)



R&S®BTC – TS Output Tree / Active Modifcations

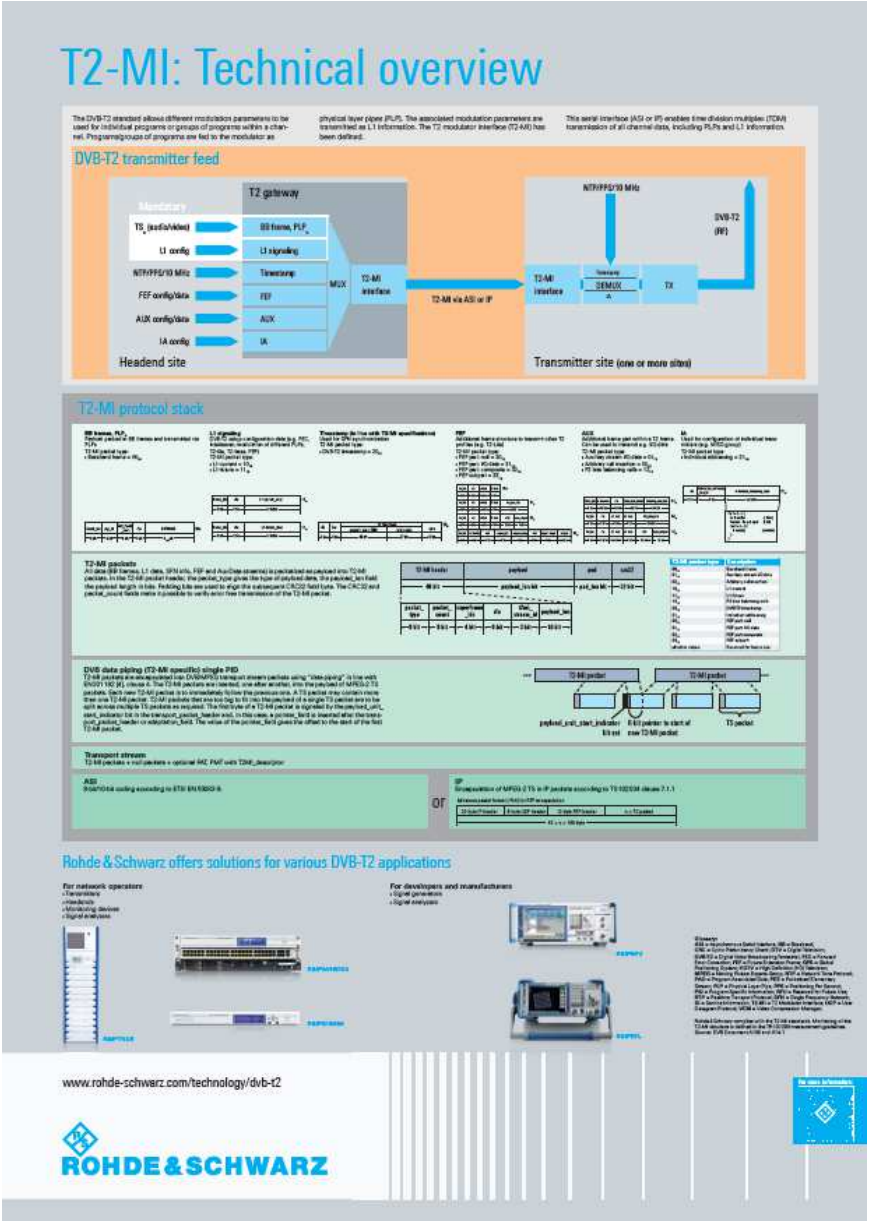
- Output tree configuration
  - Active TS immediately after modification



T2-MI Gateway Functions

Technical background

- Technical background information



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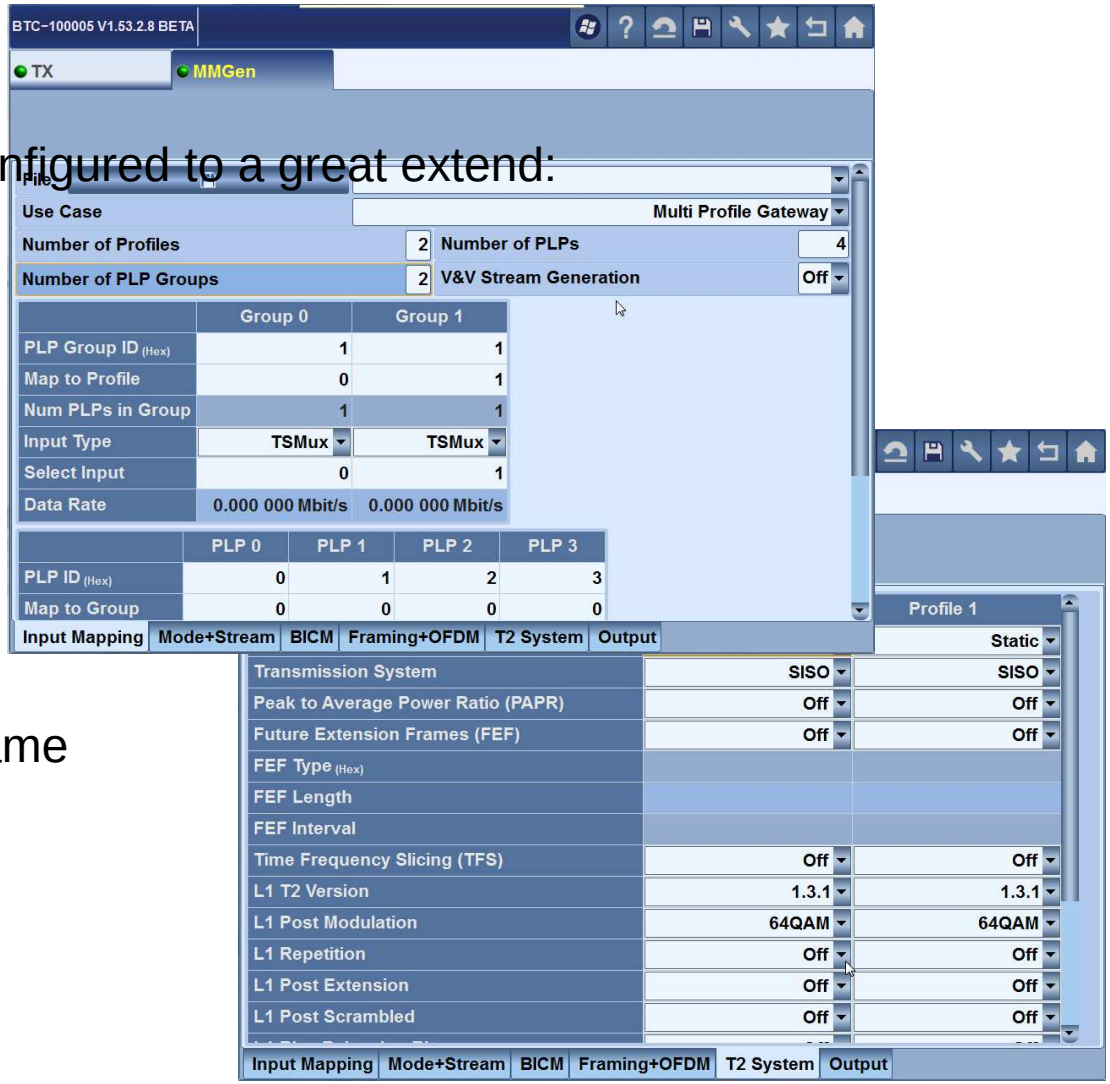
T2-MI Gateway Functions

Configuration

The T2-MI gateway can be configured to a great extend:

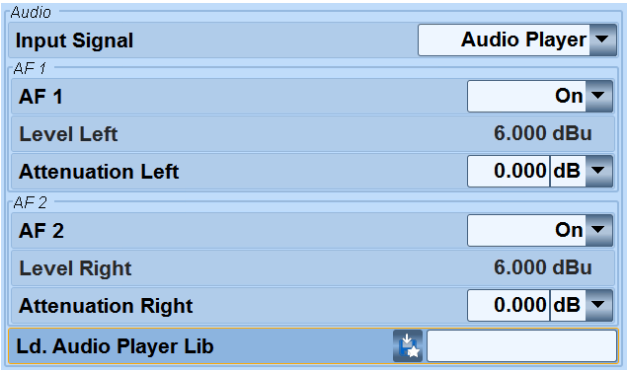
- Number of PLPs
- Number of PLP groups
- Programs per PLP
- Modulator settings
  - Constellation
  - Pilot Pattern
  - FFT size
  - . . .
- Use of Future Extension Frame
- . . .

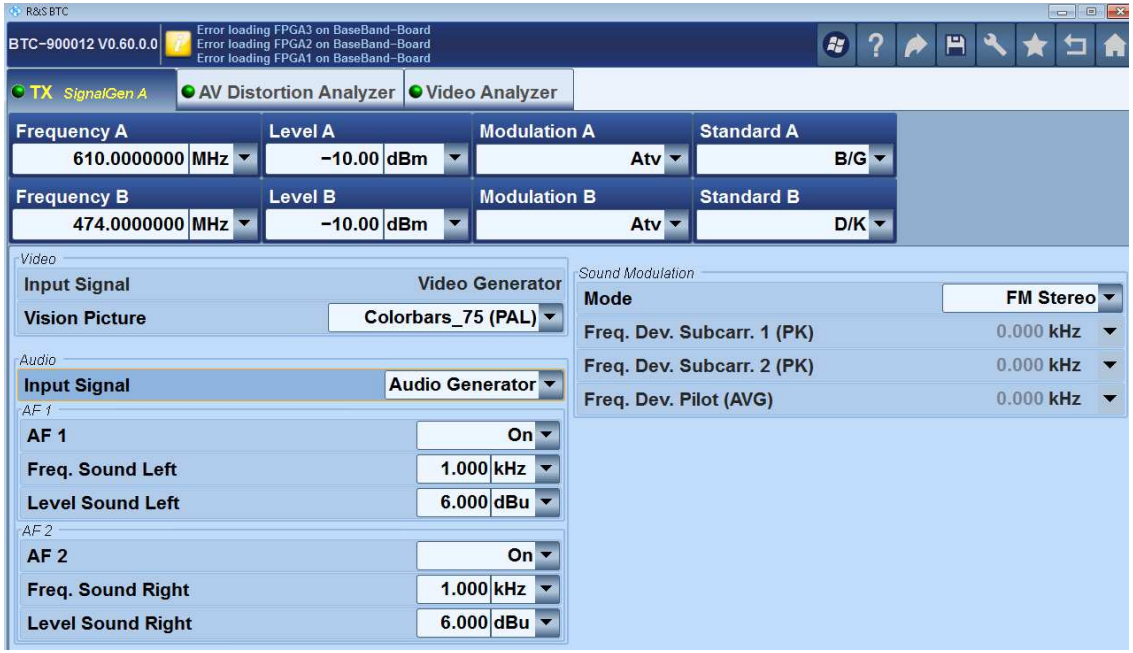


R&S®BTC – Audio / Video Signal Generator

- Audio and video signal generation for all analog standards
- Video generator
  - File player

- Analog audio
  - Sine generator
  - File player

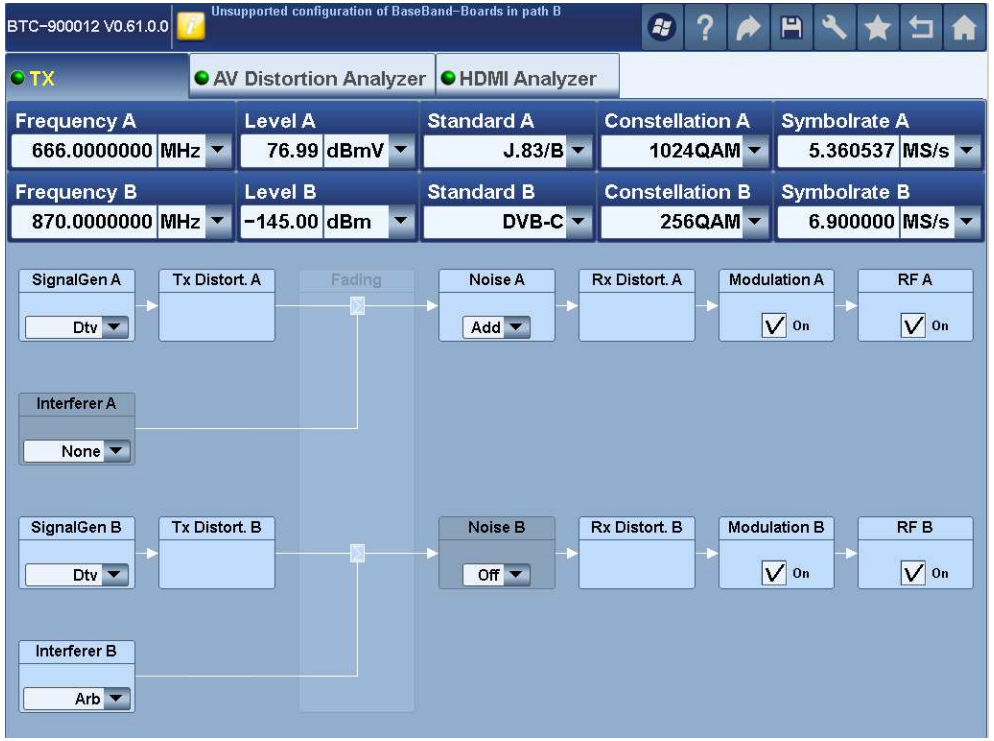




R&S®BTC – Signal Generator Application

- Tx Application GUI
  - 2 signal path
  - Realtime coders
  - Interference
  - Channel simulations
  - Modulators
  - RF upconverters

- Interference Testing
  - Co-channel and adjacent-channel interference
  - Digital Dividend (LTE, WCDMA)
  - User-defined signals (I/Q test vectors)



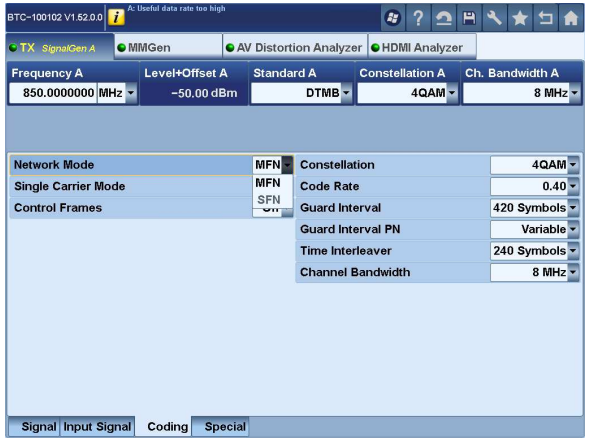
R&S®BTC – Broadcasting Standards

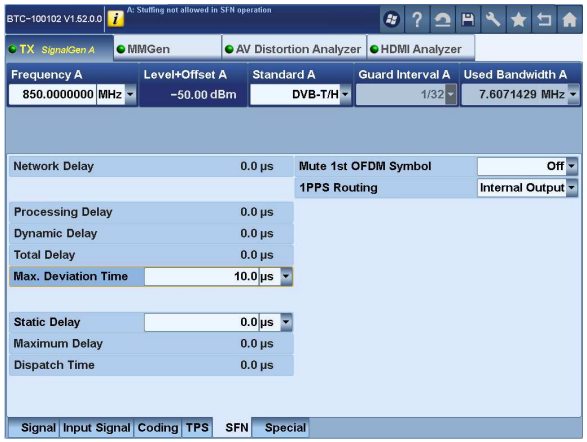
Digital TV	Mobile TV	Analog TV	Audio Broadcasting
DVB-T2	DVB-H	B/G	AM
DVB-T	ISDB-T 1 seg.	D/K	FM / RDS
ISDB-T	ISDB-Tmm	I/I1	DAB
ATSC / 8VSB	ATSC-M/H	M/N	DAB+
DTMB	CMMB	L/L`	ISDB-T_{sb}
DVB-S / S2 / S2X	T-DMB		DRM
ISDB-S			DRM+
DirecTV			HD Radio™
DVB-C2 / J.382			
DVB-C			
ISDB-C			
J.83/B			

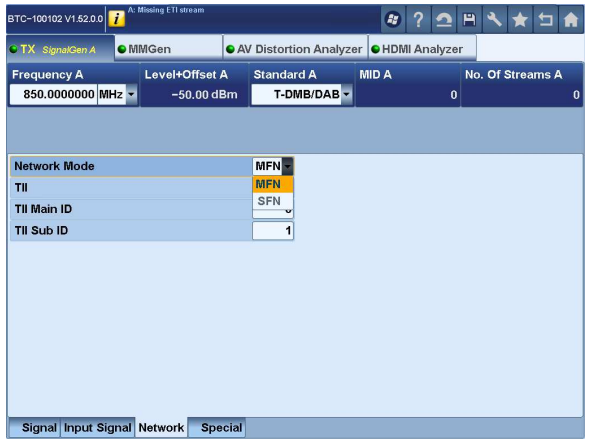
R&S®BTC – Realtime Coders SFN Functionality

- Simulation of Single Frequency Networks (SFN)

- Supported terrestrial transmission standards
  - DVB-T2 since firmware 1.42
  - DVB-T since firmware 1.50
  - ISDB-T since firmware 1.50
  - T-DMB/DAB since firmware 1.60
  - DTMB with firmware 1.70



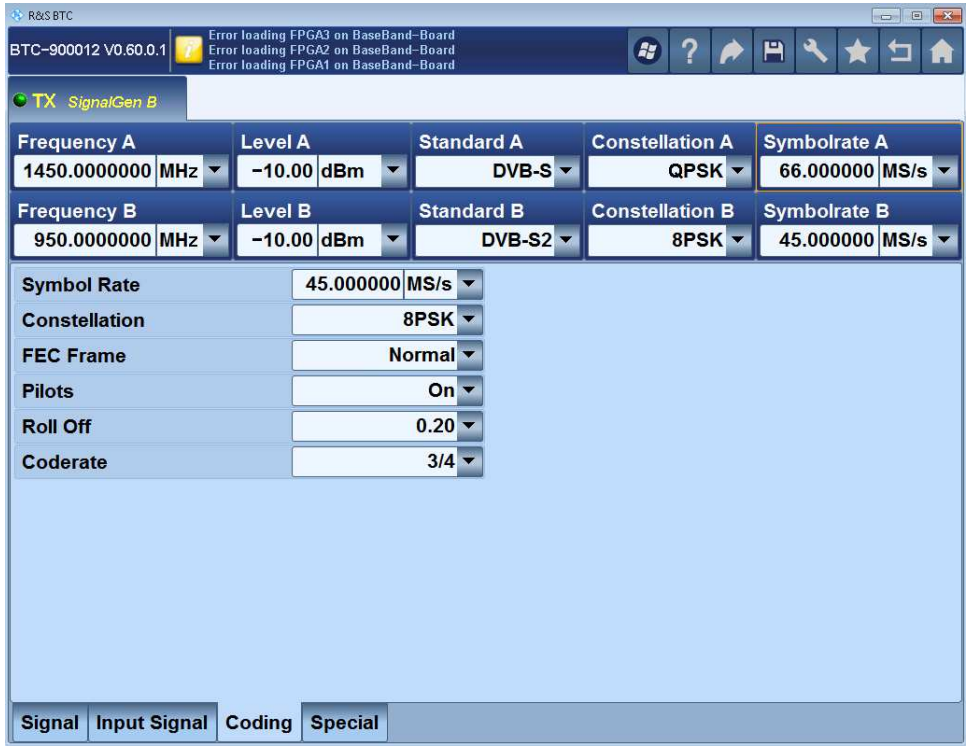




R&S®BTC – DVB-S/S2 Coder

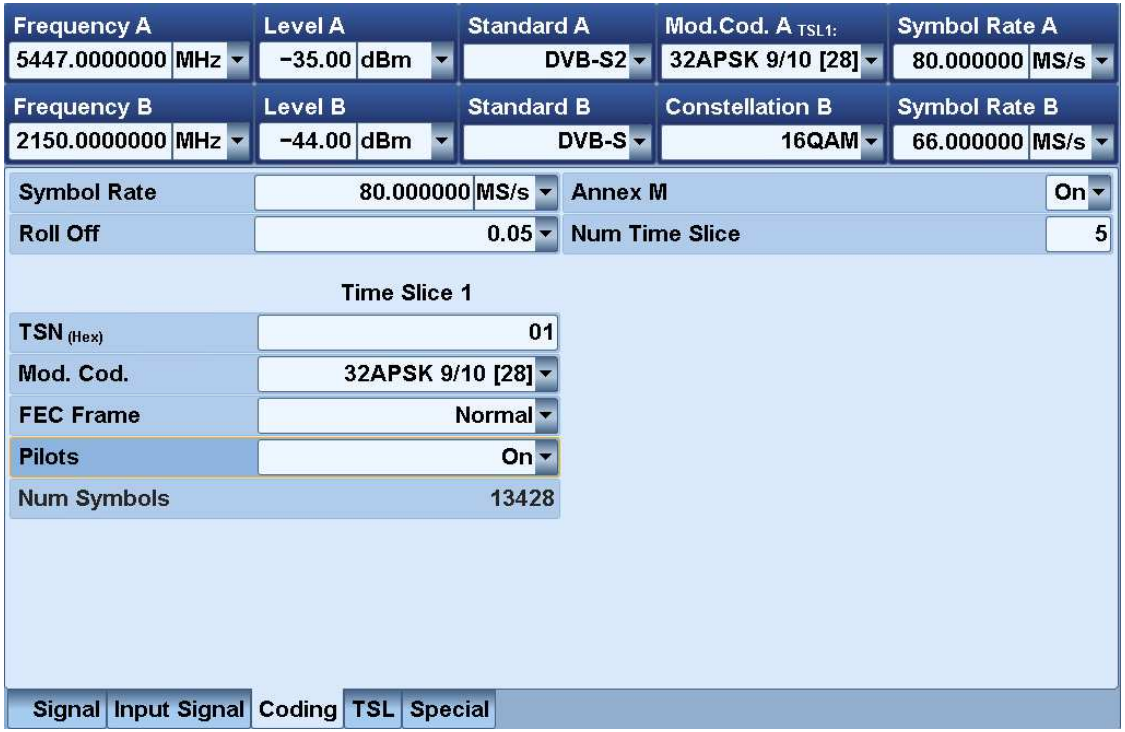
- DVB-S coder
  - Symbol rates up to 66 Msps

- DVB-S2 coder
  - All DVB-S2 services supported
    - Broadcast services
    - Interactive services
    - DSNG services
    - Professional services
    - Symbol rates up to 80 Msps



R&S®BTC – Full DVB-S2 Standard Support

- DVB-S2 services
  - Broadcast
  - Professional
  - Interactive
  - DSNG
- Symbol rates
  - DVB-S2 up to 80 Msps
  - DVB-S up to 66 Msps
- Modulation Codings
- ACM, VCM (MIS), CCM
- Annex M wideband
  - Time slicing
  - Up to 8 slices



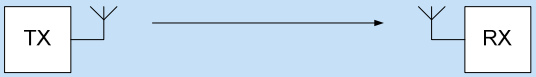
	Time Slice 2	Time Slice 3	Time Slice 4	Time Slice 5
TSN (Hex)	02	03	04	05
Mod Cod	QPSK 2/3 [6]	QPSK 2/3 [6]	QPSK 8/9 [10]	QPSK 2/3 [6]
FEC Frame	Normal	Normal	Normal	Normal
Pilots	On	On	On	On
Num Symbols	33372	33372	33372	33372

R&S®BTC – Channel Configurations

SISO

one TX, one RX antenna

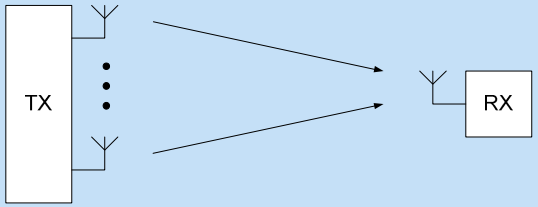
channel capacity according to Shannon's law



MISO

two or more TX, one RX antenna

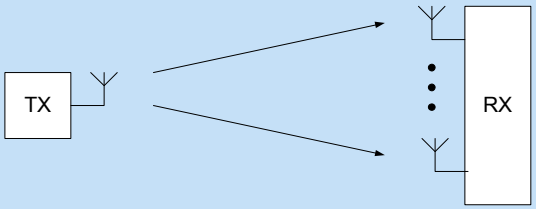
also called transmit diversity



SIMO

one TX, two or more RX antenna

also called receive diversity

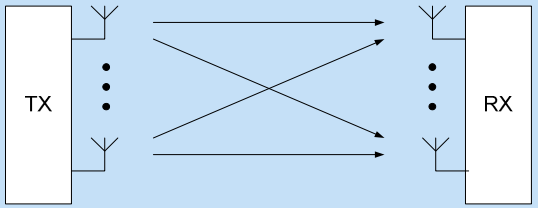


MIMO

two or more TX and RX antenna

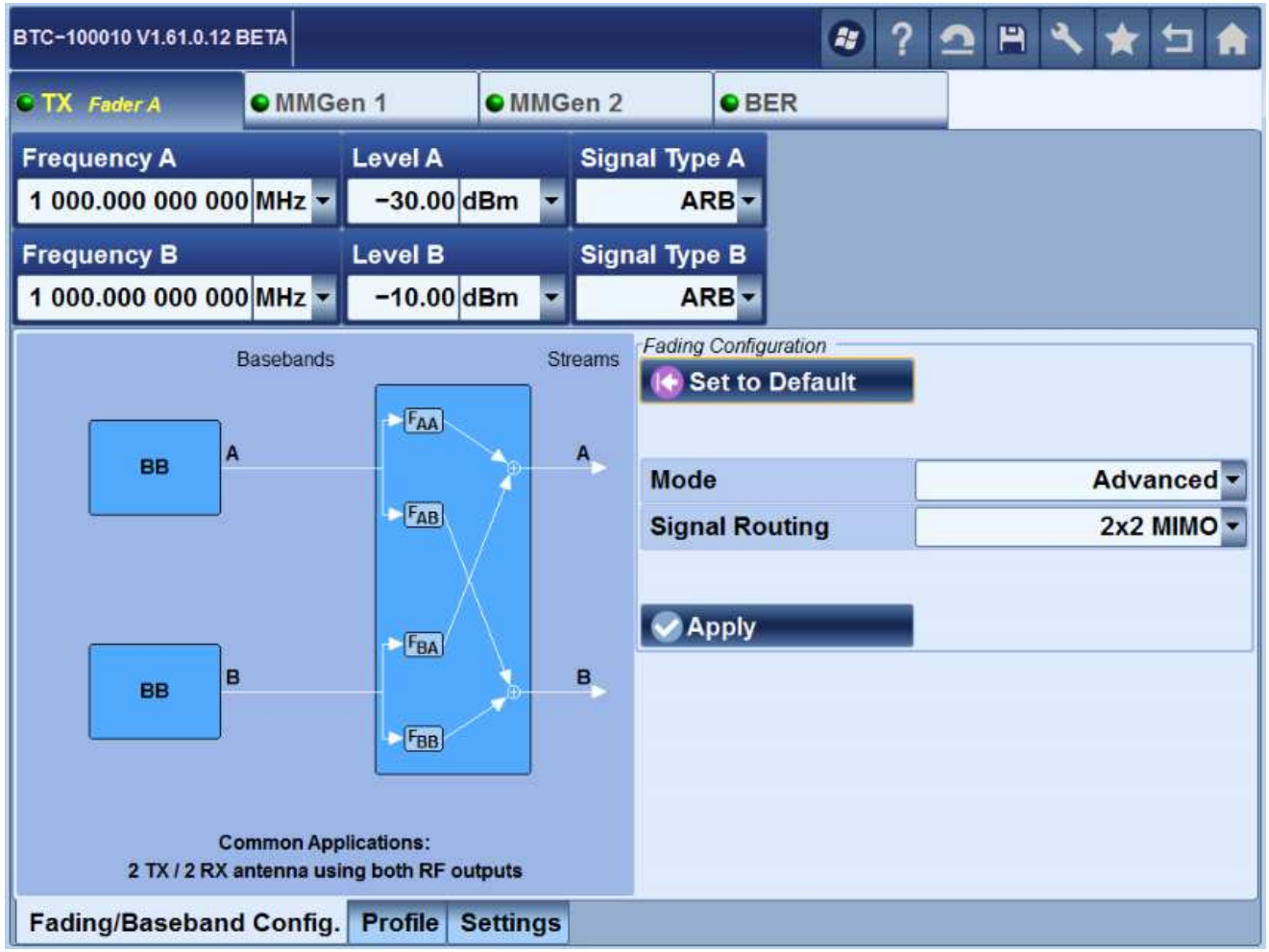
spatial multiplexing

"true MIMO"



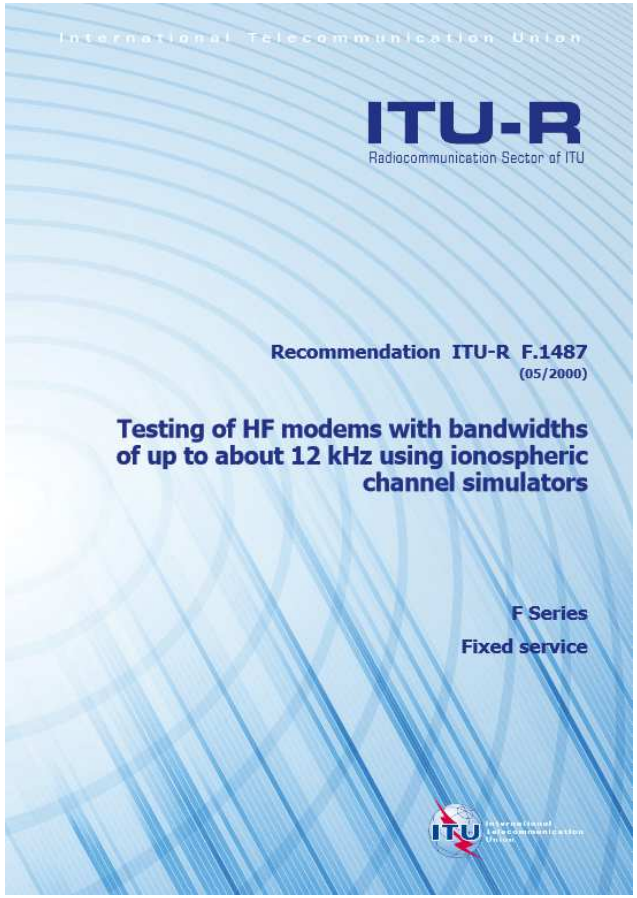
R&S®BTC – 2x2 MIMO

- Configuration
  - Signal Routing



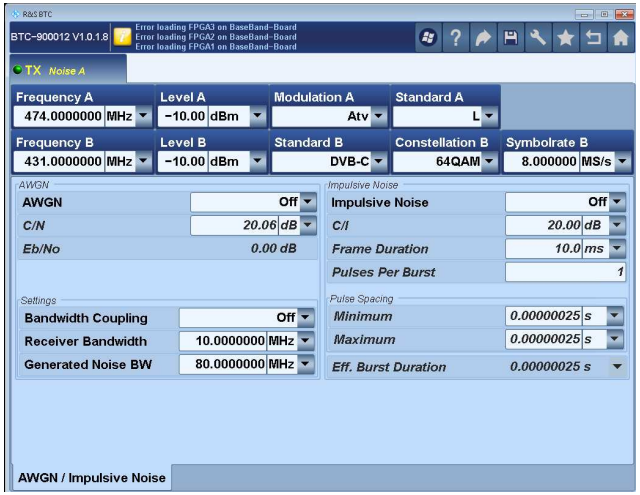
R&S®BTC – DRM Fading Profiles

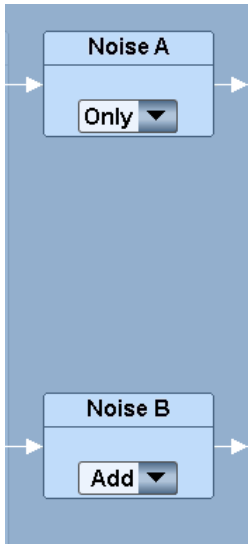
- Fading Simulator BTC-B1031 and BTC-B1032
- Additional fading profile for small band signals
  - Acc. to ITU-R F.1487
  - Profile based on Watterson model
  - Ionospheric channel simulation
  - HF channel (high frequency band / 3…30 MHz)
  - Typical for DRM transmissions
- Available since
  - Firmware 1.60

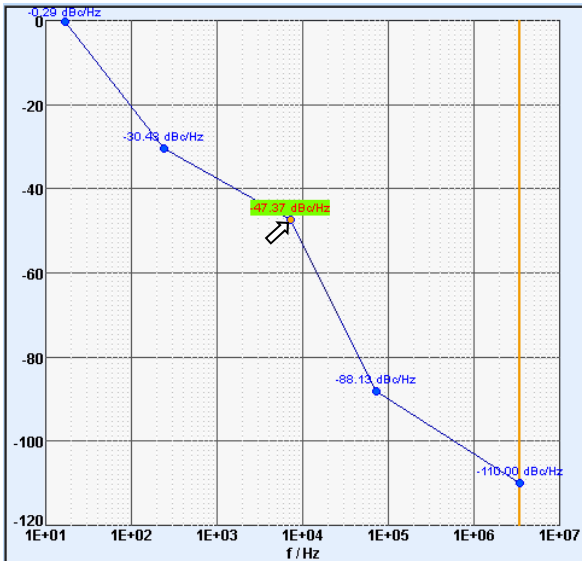


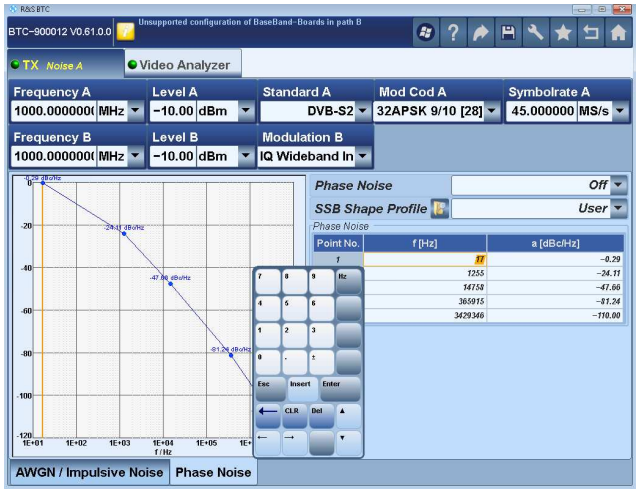
R&S®BTC – Noise Sources

- Independent noise sources for each RF-path
  - Broadband AWGN
  - Band limited AWGN
  - Impulsive noise
  - Phase noise (direct GUI entry or loadable file)









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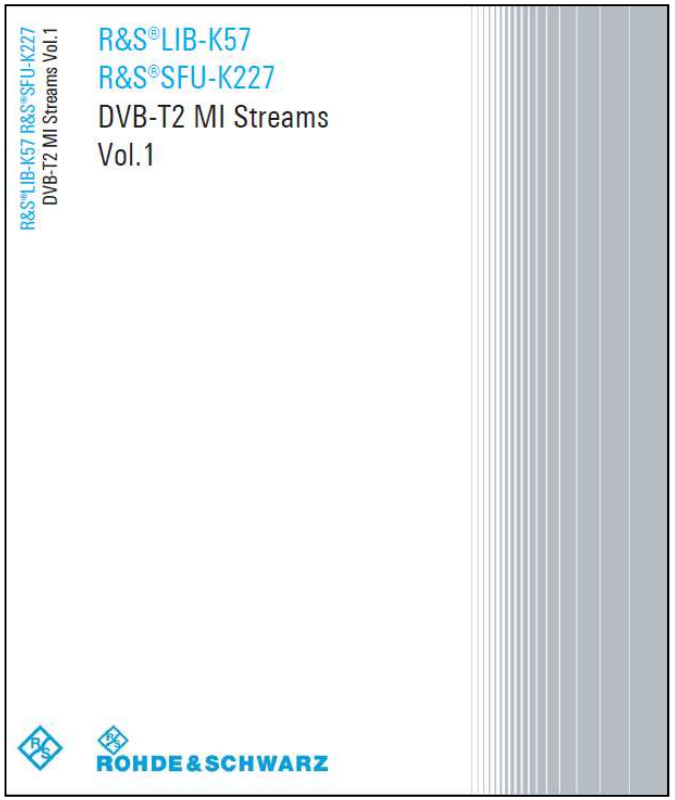
R&S®BTC – LIB-K57 (SFU-K227) + SCPI Scripts

- LIB-K57 (SFU-K227) update with modification of SCPI configuration scripts on BTC and SFx instruments to support:
- Latest NorDig configuration scripts acc. to
  - 2.4 Test Plan
  - NorDig 2.2.2 Unified Test Specifications
- Additional V&V configuration scripts acc. to
  - "V&V Parameter Sets79"
  - "V&V Parameter Sets82"
- Functionality equivalent to SFU
- Available since
  - Firmware 1.60 (LIB-K57 release)



R&S®BTC – HEVC Stream Library

- HEVC (Lib-Kxx) stream library
  - under development
  - will contain different formats
  - co-development with 7HA (headends) and GMIT
- Availability
  - asap, latest BTC firmware 1.70

R&S®BTC – HD+ Stream Libraries

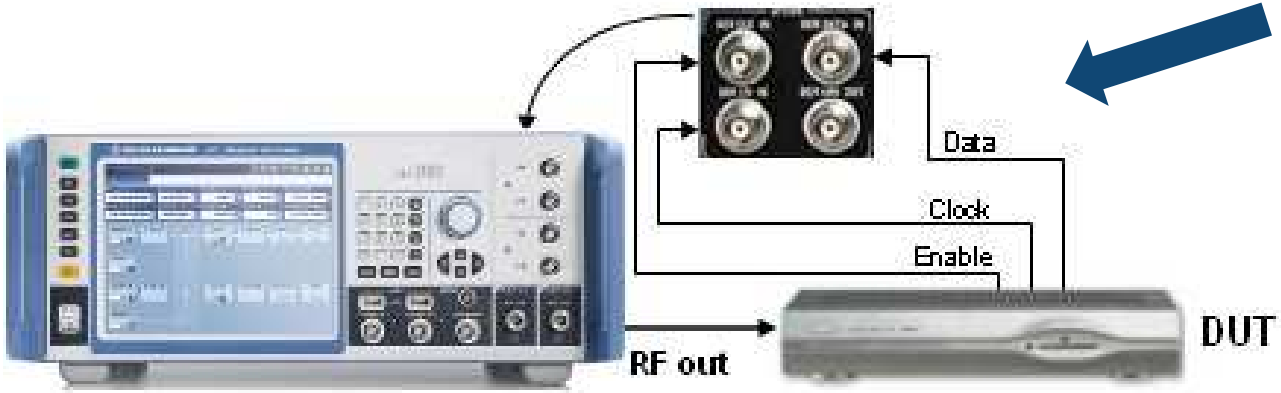
- Pre-conditions for sales
  - End customer needs signed legal license agreement with SES
  - Sales only possible if end customer is listed as Authorized Purchaser by SES

Description	Option
HD+ Basic STB Stream Library	LIB-K74
HD+ SmarTV STB Stream Library	LIB-K75
HD+ CI+ CAM Host Device Stream Library	LIB-K76
LCN International Stream Library	LIB-K77

- Available since
  - Firmware 1.60

R&S®BTC – BER Measurements

- BERT interfaces
  - IP and ASI

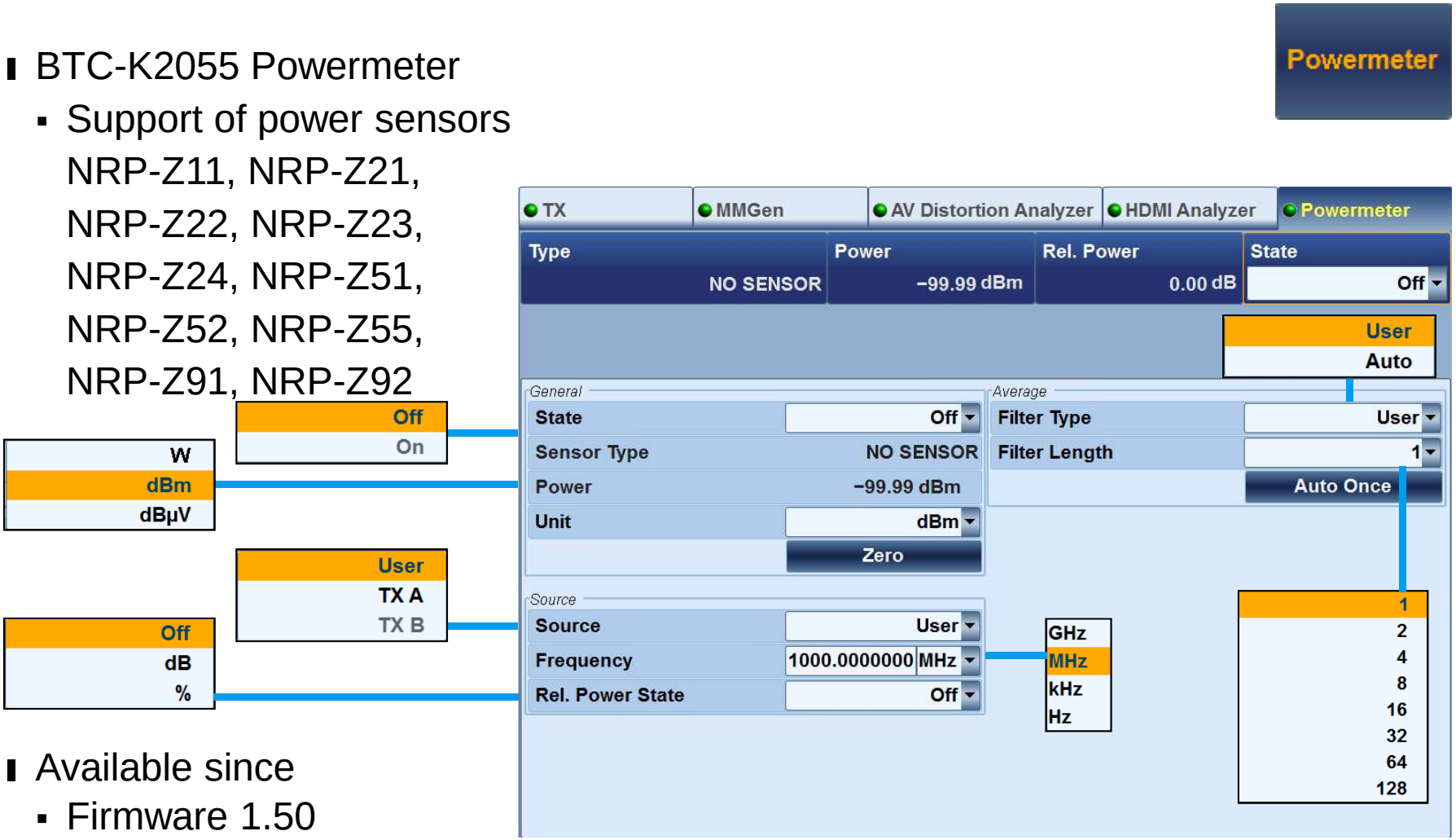


Data access with R&D firmware and interface

Transport stream access e.g. with CI adapter

R&S®BTC – Power Sensor Support

- BTC-K2055 Powermeter
  - Support of power sensors NRP-Z11, NRP-Z21, NRP-Z22, NRP-Z23, NRP-Z24, NRP-Z51, NRP-Z52, NRP-Z55, NRP-Z91, NRP-Z92



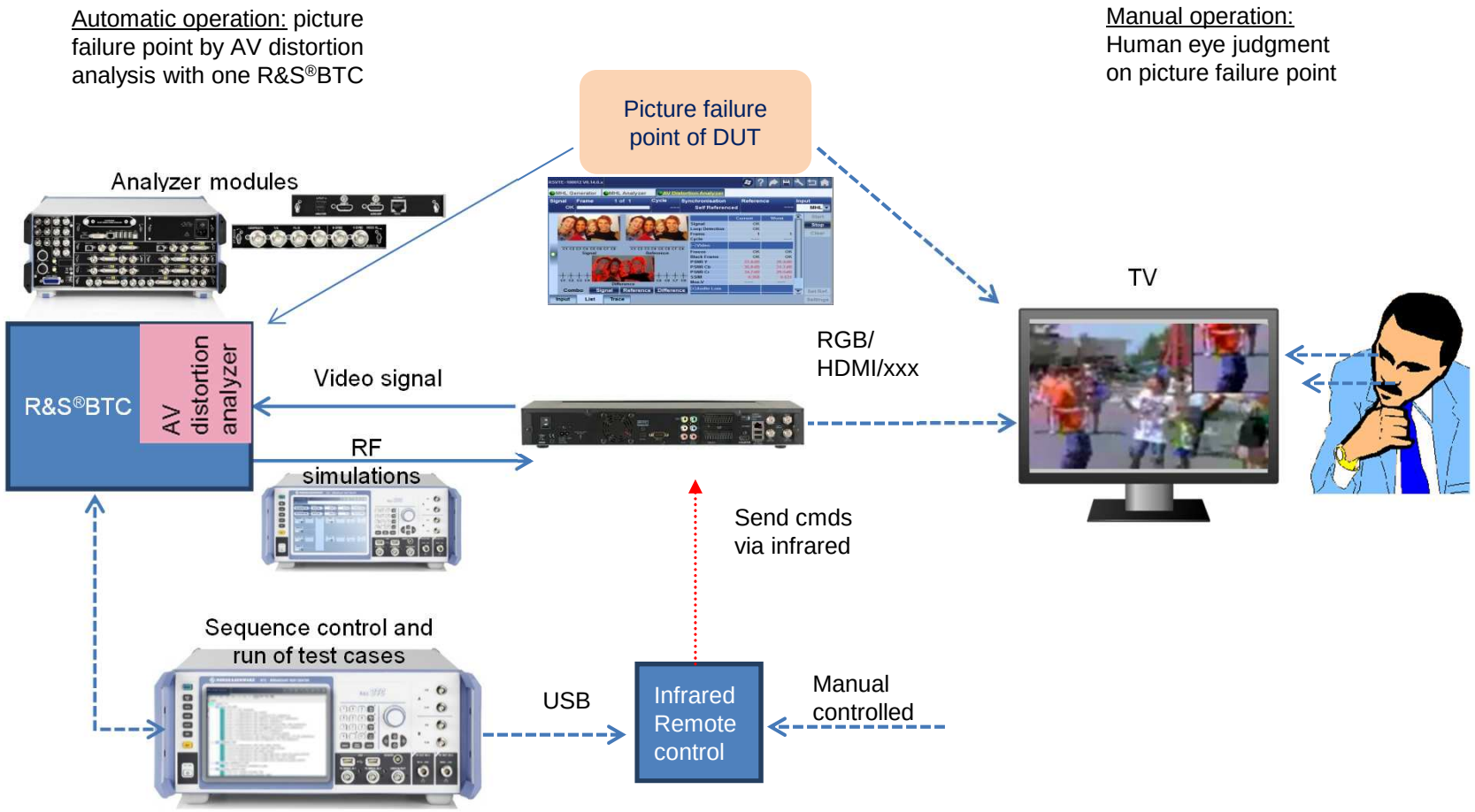
- Available since
  - Firmware 1.50

R&S®BTC – Support of VT Hardware Modules

- BTC supported VT hardware modules which can be installed
- Typical used VT modules
  - VT-B2361 HDMI RX 300 MHz
  - VT-B2370 Analog AV RX
- Additional available VT modules
  - VT-B360 HDMI TX 300 MHz
  - VT-B361 HDMI TX extension
  - VT-B2360 HDMI RX 225MHz
  - VT-B2350 MHL RX/TX
  - VT-B2351 MHL2.0 RX PACKEDPIXEL

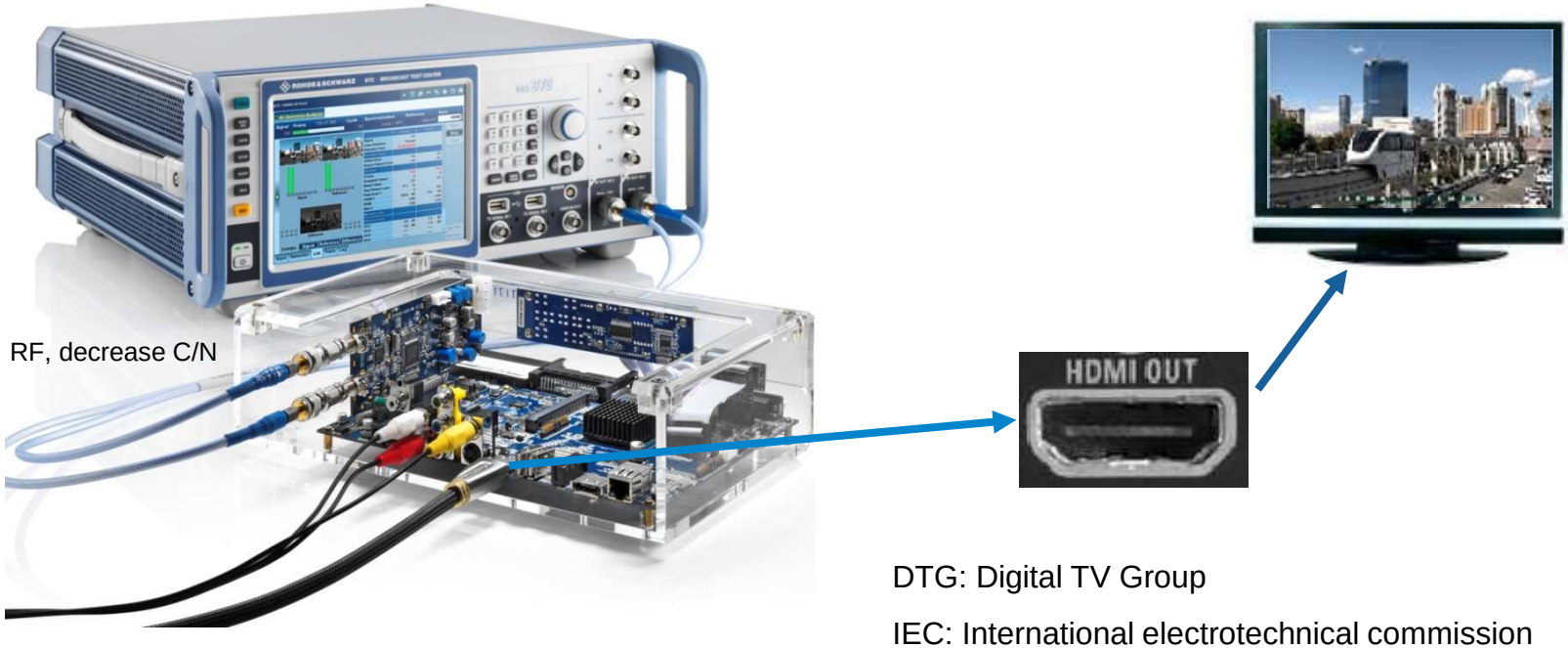
- New VT module based on SFC signal generator with all transmission standards
  - VT-B600 Broadcast modulator (planned for BTC firmware 1.80)

R&S®AVBrun Test Suite
Subjective and Automated Testing



R&S®AVBrun – A/V Distortion Measurement

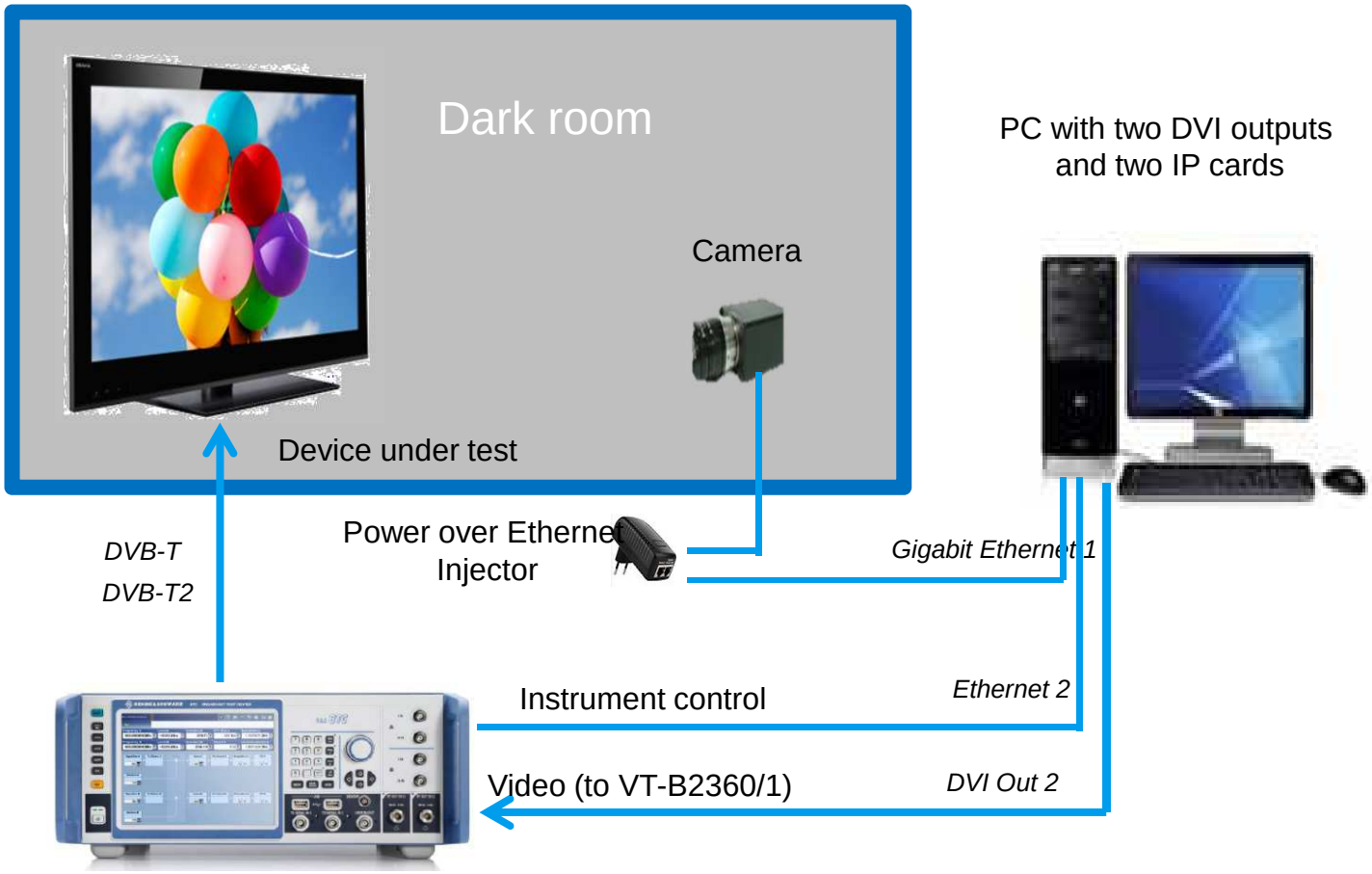
- Picture failure point (PFP) detection in frontend testing
  - For CE broadcast receiver performance testings
  - Automated measurement – reproducible results
  - Based on DTG D-Book, E-Book, NorDig



DTG: Digital TV Group

IEC: International electrotechnical commission

Preliminary study of camera capturing video from TV screen for picture quality analysis



R&S®BTC – Broadcast Test Center

Thank you for your time!