



- **6, 7 & 8 MHz channel bandwidths (user-selectable)**
- **2k, 4k & 8k modes**
- **Master and slave operation**
- **Hierarchical modes**
- **Frequency agility (1 Hz step)**
- **High MER**

DVB-T and DVB-H (*) Modulator MO-170 General overview

The **MO-170** is a general purpose **DVB-T/H modulator** contained in a 19" 1U chassis. The unit has three selectable MPEG-2 TS inputs (two serial ASI inputs and one parallel SPI input).

Either of these inputs can be used to modulate the COFDM signal in both **hierarchical** (one TS input) and **non-hierarchical** (two TS inputs) modes. An additional **test TS** can be generated internally in the modulator. This allows to generate compliant DVB-T/H signals even in the absence of a valid TS input.

In **slave** mode, the useful bit rate at the TS input to the COFDM modulator has to be the one defined in ETSI EN 300 744 for each choice of DVB-T/H transmission parameters.

When using hierarchy, the user has to choose which TS (HP or LP) the selected TS input is mapped to. The other hierarchical TS is generated internally as a PRBS test sequence.

In **master** mode, the **MO-170** is able to work with any incoming bit rate as long as this is strictly lower than the value given in the DVB-T/H specification for the modulation parameters in use. The input TS bit rate is adapted to the useful bit rate required by the DVB-T/H signal by stuffing the TS with NULL packets (packet stuffing). This stuffing process alters the sequence of PCR values

embedded in the TS. These values have to be re-stamped for the resultant PCR jitter to remain within the limits specified by the DVB. In hierarchical modes, operating the MO-170 as master has the added advantage over the slave mode of being able to use any of the three TS inputs as the HP input, LP input or both.

The modulator can be configured to generate any of the transmission modes listed in the DVB-T/H specification. In hierarchical modes, the HP and LP streams can be encoded with different convolutional code rates. The channel bandwidth can be set by the user to 6, 7 or 8 MHz as required by the application. Several test modes are available in the **MO-170** (blanking of carriers, single tone output, test TS generation, CBER and VBER injection).

DVB-H only features are 4k carriers, two extra TPS signalling bits (time slicing and MPE-FEC), native/in-depth symbol interleaving and selectable transmitter cell ID.

The operation of the **MO-170** is done via the front panel LCD display and controls. The modulator can be easily configured by navigating through the intuitive set of menus.

Control interface

- Pushable rotary control on the front panel with navigation key and LCD display
- Two LEDs indicating the power and synchronisation status of the equipment
- RS232 DB9 male connector

SPECIFICATIONS	MO-170
INPUTS MPEG-2 Transport Stream Operating modes Master Slave	2xDVB-ASI, 75 Ω female BNC // 1xDVB-SPI input, LVDS DB-25 TS packets of length 188 or 204 bytes (automatic detection) Support for burst and continuous packet mode Input TS bit rate strictly below the value given in the DVB-T specification. Packet stuffing for bit rate adaptation automatically Input TS bit rate constant and equal to the value given in the DVB-T document (no stuffing). Tolerance $\pm 0.1\%$
IF OUTPUT Type Frequency range Spectrum polarity Power level (average) In-band amplitude ripple In-band group delay ripple Out-of-band spectral characteristics ¹ @ ± 3.805 MHz @ ± 4.35 MHz @ ± 5.25 MHz IQ amplitude imbalance IQ quadrature error Central carrier suppression Harmonics and spurious MER ²	50 Ω female connector Variable between 32 and 36 MHz, 1 Hz. Fixed at 36 MHz when RF output is off. Selectable via front panel controls 0 dBm (107 dB μ V) fixed < 0.2 dB < 10 ns 0 dBc -46 dBc (2k), -56 dBc (8k) -56 dBc < 0.02% < 0.2° ≤ 55 dBc ≤ 60 dBc > 43 dB
RF OUTPUT Type Frequency range Spectrum polarity Power level (average) Level of harmonic and spurious Frequency stability MER SSB phase noise	50 Ω N-type female connector Adjustable between 45 and 875 MHz in 1 Hz steps Selectable via front panel controls Approx. 80 dB μ V with no attenuation. Variable attenuation of 0 to 60 dB in 1 Hz steps. ≤ 50 dBc 20 ppm > 36 dB ≤ -87 dBc/Hz @ 2 kHz
DVB-T/H PARAMETERS IFFT size Guard intervals Code rates Symbol interleaver Constellations Hierarchical modes MFN operation TPS signalling Channel bandwidth	2k, 4k, 8k 1/4, 1/8, 1/16, 1/32 1/2, 2/3, 3/4, 5/6, 7/8 Native and in-depth (2k & 4k DVB-H only) QPSK, 16QAM, 64QAM 16QAM and 64QAM constellations with constellation ratio $\alpha = 1, 2$ or 4 Available Cell ID, DVB-H's time-slicing and MPE-FEC 6, 7 and 8 MHz (user-selectable)
TEST MODES Carrier blanking Pilot carriers Single carrier TS packet generation PRBS generation Bit error injection	Blank a number of carriers within the COFDM ensemble. Generate the pilot carriers only (continual and TPS) Generate a single carrier at the channel central frequency whose level equals the average COFDM output power or is set to the maximum available. This is intended for signal level alignment. Internal generation of test TS using PRBS sequences of length 15 or 23 embedded with NULL packets as specified in document ETSI TR 101 290 Map a PRBS sequence into constellation points following the guidelines of document ETSI TR 101 290 Inject bit errors at the input to the constellation mapper (results in a non-zero CBER before the Viterbi decoder) or at the input to the convolutional encoder (results in a non-zero VBER after the Viterbi decoder).
OPTIONS OP-170-E OP-170-H OP-170-P	White noise generator for C/N testing. Fixed and portable channel simulation in SFN/MFN networks. DVB-H signal generation 6 dBm output.
POWER SUPPLY Voltage Consumption	90 - 250 V AC (50 - 60 Hz) 20 W

¹ Frequencies are referred to the central frequency for an 8 MHz channel. Peak levels measured using a 10 kHz bandwidth are referred to the carriers located on either side of the spectrum. Values shown are the worst case and correspond to guard intervals of 1/32.

² Value measured in master mode. In slave mode, the MER is greater than 38 dB for 8 MHz channels, and around 35 dB for 7 and 6 MHz.