

SFN & MFN DVB-T/H Modulator



Main features

- ✓ Fully compliant with the DVB-T/H standard
- ✓ Seamless automatic switching between DVB-ASI inputs
- ✓ 2k, 4k and 8k carriers
- ✓ Hierarchical and non-hierarchical modulations
- ✓ SFN and MFN operation
- ✓ 5, 6, 7 and 8 MHz channel bandwidths
- ✓ Locks to external/internal 10 MHz reference or to incoming TS data rate
- ✓ Frequency agile (1 Hz resolution)
- ✓ High-quality IF and RF outputs
- ✓ MER > 35 dB in RF, > 41 dB in IF

The **MO-180** is an SFN/MFN DVB-T/H modulator fully compliant with the DVB-T/H specifications ETSI EN 300 744 v1.5.1 (including annex F referring to DVB-H), ETSI TS 101 191 v1.4.1 (SFN synchronisation) and ETSI EN 300 468 v1.6.1 (DVB-SI). The unit is contained in a standard 19" 1U chassis.

The modulator has two DVB-ASI Transport Stream (TS) inputs and one DVB-SPI TS input. It also has a 1 pps and a 10 MHz input which, together with the MIP packet embedded in the transport stream, are used for SFN synchronisation purposes. A loop-through 10 MHz output is available as well.



In MFNs we can operate the modulator in master and slave modes. In slave mode the modulator is locked to the incoming TS data rate, which is defined in document ETSI EN 300 744 for each choice of DVB-T/H transmission parameters. In master mode the modulator is locked to either the internal 10 MHz TCXO or to an external 10 MHz reference. The input bit rate has to be strictly smaller than the value given in the DVB-T/H specification. The **MO-180** drops or inserts NULL TS packets as required to adapt the bit rate to the required value.

PCR re-stamping is implemented to minimise the impact of the bit rate adaptation process on the timing jitter of the MPEG-2 TS multiplex.



In SFN mode, the modulator can be synchronised with the external 10 MHz GPS reference or with the incoming TS data rate. A loss of sync with the external 10 MHz reference can be used to make the modulator lock to the input TS rate, and vice versa. This means that disruptions to the output IF/RF COFDM signals are minimised. Periodic or aperiodic MIP packets are constantly monitored so as to dynamically adjust the delay of the modulator.

In non-hierarchical transmissions the modulator seamlessly switches between ASI inputs when it detects a sync loss on the currently selected TS input. An additional test TS can be generated internally. This allows to generate compliant DVB-T/H signals even in the absence of a valid TS input.

The channel bandwidth can be set to 5, 6, 7 and 8 MHz with no variation in performance. The DVB-T/H signal is output in both IF (36 MHz, 0 dBm) and RF (45 MHz to 875 MHz, at 80 dB μ V with the option of going up to 6 dBm) with a resolution of 1 Hz. The polarity of the spectrum may be set to normal or inverted. The MO-180 supports 2k, 4k and 8k modes and non-hierarchical and hierarchical transmissions. Several test modes are available (blanking of carriers, single tone output, test TS generation, CBER and VBER injection). The MER typically measured in IF is above 41 dB. In RF we measure MERs greater than 35 dB.

SPECIFICATIONS		DVB-T/H parameters	
MPEG-2 TS Inputs Inputs TS packets length Clock synchronisation Master MFN Slave MFN SFN Additional features GPS inputs 10 MHz input 1 pps input	2xDVB-ASI, female BNC, 75 Ω 1xDVB-SPI, DB-25, LVDS 188 or 204 bytes (automatic detection). Support for burst and continuous packet modes Internal TCXO or external 10 MHz GPS reference. Input TS bit rate strictly below the value given in the DVB-T/H specification. Packet stuffing for bit rate adaptation and PCR re-stamping carried out automatically TS data rate equal to the value given in the DVB-T/H specification $\pm 0.1\%$ External 10 MHz reference or input TS data rate Automatic seamless switching between ASI inputs in the event of a sync loss. DVB-SI NIT table may be updated (network ID and transmitter centre frequency) Selectable input impedance (50 Ω /High), 50 mV min to 3.3 V max Active high or low, selectable impedance (50 Ω /High), 2 V min to 5 V max	Carriers 2k, 4k, 8k Guard intervals HP & LP code rates In-depth DVB-H symbol interleavers Constellations Hierarchical modes SFN and MFN operation TPS signalling Channel bandwidths Modulation parameters	1/4, 1/8, 1/16, 1/32 1/2, 2/3, 3/4, 5/6, 7/8 In 2k and 4k QPSK, 16QAM, 64QAM 16QAM and 64QAM constellations with $\alpha = 1, 2$ or 4 Yes Cell ID, DVB-H's time slicing and MPE-FEC 5, 6, 7 and 8 MHz May be extracted from the MIP packet
		Outputs 36 MHz IF output Out-of-band spectral characteristics RF output Frequency Spectrum polarity Avg. power level Harmonics and spurious MER Phase noise Auto muting	50 Ω BNC female connector 0 dBm average power Normal or inverted spectrum In-band amplitude ripple < 0.2 dB In-band group delay ripple < 10 ns IQ amplitude imbalance < 0.02% IQ quadrature error < 0.02° Central carrier suppression < -55 dBc Harmonics and spurious < -60 dBc MER > 41 dB Auto muting in the presence of errors @ ± 3.805 MHz: 0 dBc @ ± 4.25 MHz: -39 dBc (2k), -47 dBc (8k) @ ± 5.25 MHz: -56 dBc 50 Ω BNC female connector 45 to 875 MHz, adjustable (1 Hz steps) Selectable via the front panel controls From 15 dB μ V to -80 dB μ V (1 dB steps) < -50 dBc > 35 dB < -85 dBc/Hz @ 1 kHz typical In the presence of errors
Test modes	Blank a set of carriers (start index to stop index) within the COFDM ensemble Generate a single carrier at the central frequency whose level equals the average COFDM output power Test Transport Stream packet generation using PRBS sequences of length 15 or 23 bits embedded within NULL packets as specified in document ETSI TR 101 290 Bit error injection 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)		
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 Ethernet RJ-45 connector		
		Mechanical specification	19" wide 1U high rack chassis