MO-180 DVB-T/H Modulator for SFN & MFN Broadcasting

- ***Built-in Precorrector***
- ***SNMP compatible***
- ***10 MHz GPS reference input.***
- ***6 dBm output power (option)***

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 an 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.

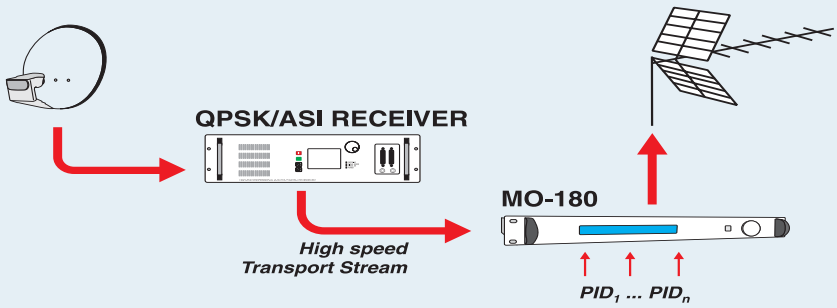
The channel bandwidth can be set to 5, 6, 7 and 8 MHz with no variation in performance. The DVB-T/H signal is output in both IF (36 MHz, 0 dBm) and RF (45 MHz to 875 MHz, at -27 dBm with the option of going up to 6 dBm) with a resolution of 1 Hz. The polarity of the spectrum may be set to normal or inverted.

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.

PID Filtering

Transport streams coming from satellite receivers (QPSK) contain normally a high number of services and have too high bit rate to be connected to a COFDM modulator directly.

MO-180 has a PID FILTERING function. This allows to enter a high speed transport stream, coming from a satellite receiver for instance, to the modulator ASI input at once. It is possible then to select a certain number of services from the original transport stream by entering their PID's on the **MO-180** dedicated menu. The selected services are filtered and will not be modulated.



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SPECIFICATIONS	MO-180
INPUTS	
MPEG-2 Transport Stream	Two DVB-ASI inputs, 75 Ω female BNC One DVB-SPI input, LVDS DB-25 TS packets of length 188 or 204 bytes (automatic detection) Support for burst and continuous packet modes
Operating modes	
Clock synchronisation	
Master MFN	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
Slave MFN	TS data rate equal to the value given in the DVB-T/H specification ± 0.1‰
SFN	External 10 MHz reference or input TS data rate
Additional features	Automatic seamless switching between ASI inputs in the event of a sync loss. DVB-SI NIT table may be updated (network ID, transmitter ID and transmitter centre frequency)
GPS inputs	50 Ω BNC female connector
10 MHz input	Selectable input impedance (50 Ω / High), 50 mV min to 3.3 V max
1 pps input	Active high or low, selectable impedance (50 Ω/High), 2 V min to 5 V max
IF Output	
Type	50 Ω BNC female connector
Spectrum polarity	Normal or inverted
Power level (average)	0 dBm average power
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[2]	> 41 dB
Out-of-band spectral	
Frequency stability	20 ppm
characteristics[1]	
@ ± 3.805 MHz	0 dBc
@ ± 4.25 MHz	-46 dBc (2k), -56 dBc (8k)
@ ± 5.25 MHz	-56 dBc
RF Outputs	50 Ω N-Type female connector F-BNC
Frequency	45 to 875 MHz, adjustable (1 Hz steps)
Spectrum polarity	Selectable via the front panel controls
Avg. power level	From -27 dBm to -87 dBm (1 dB steps)
Harmonics and spurious	< -50 dBc
MER	> 38 dB
Phase noise	< -85 dBc/Hz @ 1 kHz typical
DVB-T/H parameters	
Carriers	2k, 4k, 8k
Guard intervals	1/4, 1/8, 1/16, 1/32
HP & LP code rates	1/2, 2/3, 3/4, 5/6, 7/8
In-depth DVB-H symbol interleavers	In 2k and 4k
Constellations	QPSK, 16QAM, 64QAM
Hierarchical modes	16QAM and 64QAM constellations with α = 1, 2 or 4
SFN and MFN operation	Yes
Pre-corrector	Non-linear, Crest Factor
TPS signalling	Cell ID, DVB-H's time slicing and MPE-FEC
Channel bandwidths	5, 6, 7 and 8 MHz
Modulation parameters	May be extracted from the MIP packet
Processing delays	
MFN	The static delay may be adjusted between 0 and 1 second with a resolution given by the DVB-T/H elementary clock period
SFN	Dynamic delay automatically calculated from the 10 MHz GPS reference, the 1 pps signal and the MIP packet embedded in the HP TS multiplex. The resolution is 100 ns ± 838.8 ms local delay offset may be added as long as the total delay is never greater than 1 s or lower than the inherent latency of the modulator. Synchronisation accuracy better than ±200 ns. Estimate of the network delay from the SFN adapter output to the modulator TS inputs.
Test Modes	
Carrier blanking	Blank a number of carriers (start index to stop index) within the COFDM ensemble. This allows to measure in-band intermodulation and quantisation noise
Pilot carriers	Generate the pilot carriers only (continual and TPS)
Single carrier	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
TS packet generation	Internal generation of test TS using PRBS sequences of length 15 or 23 embedded within NULL packets as specified in document ETSI TR 101 290
PRBS generation	Map a PRBS sequence into constellation points following the guidelines of document ETSI TR 101 290
Bit error injection	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).
Control interface	Ethernet RJ-45 connector (SNMP compatible)
Power supply	
Voltage	90 - 250 VAC
Frequency	50-60 Hz
Consumption	20 W
Mechanical specification	
Dimensions	19" wide 1U high rack chassis
Weight	6.3 kg

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.