



► **MEX - MULTIMODE EXCITER FOR ANALOGUE AND DIGITAL TRANSMISSIONS**

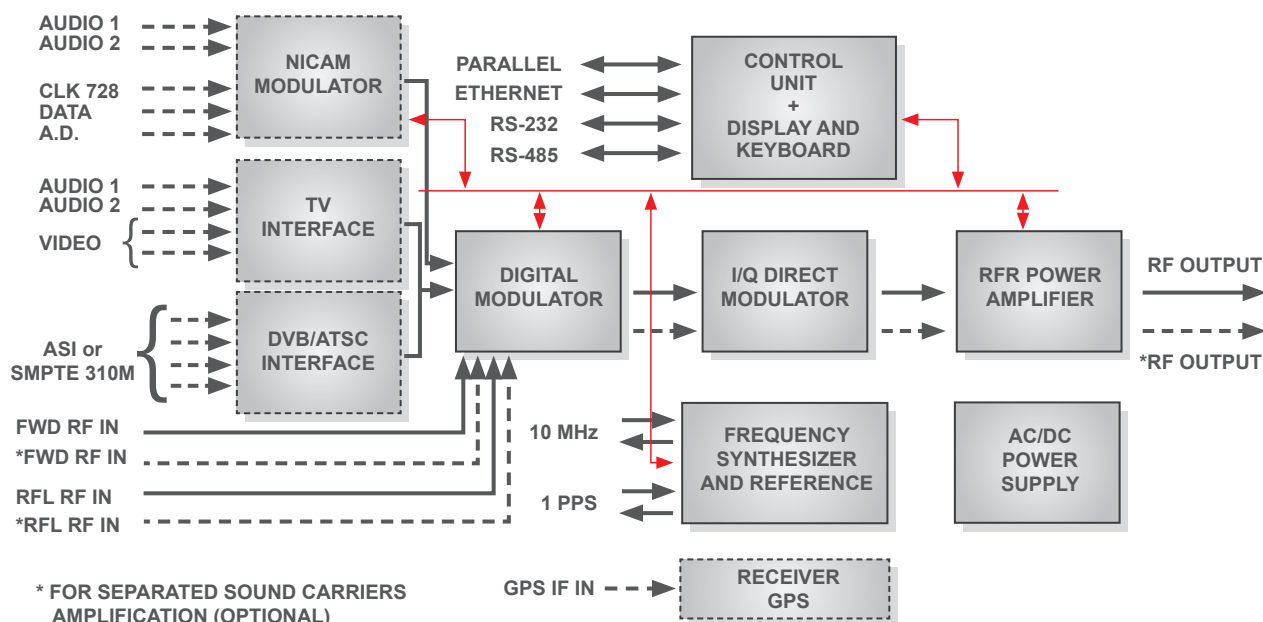
- Fully numerical signal elaboration and modulation
- I/Q Direct RF Modulation
- Automatic pre-distorter and pre-equalizer
- Dual cast transmitter (switch between two standards by a simple software command)
- Band III - Band IV/V frequency agile
- Optional integrated GPS receiver
- Ethernet control with HTTP, TFTP, and SNMP protocols
- Remote software upgrading of the signal elaboration cards

MULTIMODE EXCITER (MEX)



Multimode is the State-of-The-Art Exciter capable of all modulation modes by means of fully digital signal processing. Only by changing the modulator card firmware, the exciter can implement analog TV (all standards), DVB-T/H, ATSC 8VSB and can operate in dual cast. Using

the MEX dual cast transmitter is very simple: it is possible to switch between digital and analog TV transmission by a simple software command (locally by means of keyboard or remotely by using HTTP web browser, SNMP or Electrosys proprietary control software).



DIGITAL MODULATOR

The digital modulator card performs the modulation compliant according to the various transmission standards: analogue TV, DVB-T/H, ATSC DTV, DAB, etc. The modulator provides analogue base band I and Q signals for the direct conversion to the RF channel. This card is provided with several RF inputs to monitor the forward and reflected transmitter output power in order to perform the Automatic Level Control function and transmitter po-

wer measurements. Digital preequalizer compensates for the linear (amplitude and group delay) antenna filter distortions and digital pre-distorter for the non-linear final HPA distortions. The pre-distorter set up can be manual or automatic (supplying the modulator with the HPAs RF output signal). Full configurable muting function available in case of loss of input, frequency reference, etc.

Analog TV Version

No trimming operations are needed due to fully digital video and audio modulation, obtaining an exceptionally performance stability over environment conditions changes. The exciter has a stereo/dual sound encoder with automatic mode selection using dedicated teletext line and, one wide band (up to 120

KHz) input for an external audio encoder. Optionally, an integrated NICAM modulator, which can also accept an external pre-codified NICAM 728 Kbit/s stream and additional data, is available. Additional RF sound output for sound separated amplification transmitters is available.

VIDEO CHARACTERISTICS

TV standard	B, G, D, H, I, K, K1, M, N
Colour standard	TAL, NTSC, SECAM
Number of video input	2 (not simultaneously working), BNC
Input impedance	75 Ω
Return loss	> 36 dB (0 – 6 MHz)
Input voltage level	1 V _{pp} $\pm$ 6 dB
Input AGC	Manual or on ITS line
Manual gain adjustment step	0.1 dB
Clamping	Back porch level
Modulation depth	5 $\div$ 15 %
White limiter	85 $\div$ 95 % modulation
Sync pulse regeneration	20 $\div$ 30 %
Video filtering	According to the standard or by-passed
Differential gain variation	<0.5 %
Differential phase variation	<0.5 °
Static linearity	$\pm$ 0.1 dB (25 Hz $\div$ f _{max} , depending on the st.)
Amplitude frequency response	<-60 dB (freq. > f _{max} , depending. on the st.)

AUDIO CHARACTERISTICS

Number of audio input	2, XLR
Input impedance	600 Ω />5 K Ω (balanced and unbalanced)
Nominal input level	0 dBm, -6, +21 dB
Gain adjustment step	0.1dB
Hard limiter	adjustable 1KHz step, 0 $\div$ 100 KHz deviation
Channel cross-talk	>70 dB (40 Hz $\div$ 15 KHz)
Stereo cross-talk	>40 dB (40 Hz $\div$ 15 KHz)
Harmonic distortion (with preemphasis)	< 0.1% (40 Hz $\div$ 15 KHz, $\pm$ 50 KHz deviation)
FM SNR (unweighted)	< - 70 dB ($\pm$ 50 KHz deviation at 500 Hz)
FM SNR (weighted)	< - 65 dB ($\pm$ 50 KHz deviation at 500 Hz)
AM Noise	< - 60 dB
Preemphasis	50/75 μ s ($\pm$ 0.1 dB; can be switched off)
Input frequency response	$\pm$ 0.1 dB, 40 Hz $\div$ 15 KHz $\pm$ 0.1 dB, 40 Hz $\div$ 120 KHz in wide band mode
Pilot signal generation	54.6875 KHz (Locked to the line frequency)
Pilot carrier modulation	AM
Pilot modulation depth	50 %
Pilot modulation tone frequency	0 (mono), f line/133 (stereo), f line/57 (dual)
Audio encoder mode	Mono, stereo, dual sound, wide band, auto

NICAM CHARACTERISTICS

Number of audio inputs	2, XLR
Input impedance	600 Ω />5 K Ω (balanced and unbalanced)
Nominal input level	0 dBm $\pm$ 10 dB
Pre-codified NICAM data input	728 Kbit/s, BNC, high impedance TTL
Additional data input	728 Kbit/s, BNC, high impedance TTL
Clock for external coder or additional data	728 KHz, select. in/out, BNC, high imp. TTL
Frequency reference output	38.9 MHz, BNC, TTL
Carrier Frequency	6.552 MHz (I), 5.85 MHz (B/G)
Harmonics and spurious	> 50 dB below NICAM carrier level
Spectrum Shaping	$\pm$ 0.5 dB from nominal
Amplitude Imbalance	< 0.1 dB
Quadrature error	< 1 °
THD+N at 2 KHz tone input	< 0.1 % at nominal input level
Encoder mode	Mono, stereo, dual sound, mono+data

DVB-T/H Version

The modulator is fully compliant with EN 300 744, TS 101 191 and EN 50083-9 standards including hierarchical modulation and DVB-H. In case of SFN operations, the card provides the extraction of the MIP (Megaframe Initialization Packet) information, to carry out the automatic delay compensation and optional function elaboration (time offset, frequency offset and power control functions). In case of MFN operation, bit rate adaptation by inserting or discarding

null packets is performed and, in order to avoid PCR jitter, PCR restamping is done. The modulator continuously checks the input transport stream to find any first priority error (according to TR 101 290); in case of error, it can switch to the other input. If the two input transport streams are identical, the switching is seamless. For test purposes, a contiguous block of carriers can be switched off or, on the contrary, can be switched on.

DVB T/H CHARACTERISTICS

Inputs	4 BNC 75 Ω , DVB-ASI,
Input Data format	188/204 bytes packets, continuous and burst mode
Input Bit Rate	According to ETS 30 744 in SFN Bit rate adaptation and PCR restamping in MFN
IFFT	2K, 4K, 8K
Code rate	1/2, 2/3, 3/4, 5/6, 7/8
Guard interval	1/4, 1/8, 1/16, 1/32
Interleaver	Native, in-depth
Constellation	QPSK, 16QAM, 64QAM
Hierarchical (alpha)	1, 2, 4
Network operation	MFN, SFN
Bandwidth	5, 6, 7, 8 MHz
MER	> 40 dB
Shoulders	> 50 dB
Carrier suppression (center frequency)	> 60 dBc
Average amplitude imbalance	<1 %
Average quadrature error	<1 °
Spurious level in band	<- 70 dBc
Spurious level out band	<- 60 dBc

ATSC Version (8VSB DTV)

The modulator is fully compliant with ATSC specifications.

The system clock can be locked to the input data (the input bit rate must be 19.392658 Mbit/s) or to the 10 MHz reference (internal, external or from the integrated GPS receiver); in this case the bit rate adapter (described in the DVB-T/H section) allows the exciter to accept any input bit rate. The

modulator continuously checks the input transport stream to find any first priority error (according to TR 101 290); in case of error, it can switch to the other input. Optionally, if the two input transport streams are identical, the switching is seamless. Both pre-distorter and pre-equalizer can be set manually or automatically.

ATSC CHARACTERISTICS

Inputs	2 BNC 75 Ω , SMPTE 310M
System clock	locked to the input data or 10 MHz reference
Input Bit Rate	19.392658 Mbit/s (lock to the input data) Bit rate adaptation and PCR restamping (lock to the 10 Mhz)
Modulation	8-VSB
Bandwidth	6 MHz
EVM	< 1.5 % rms
Shoulders	> 50 dB
Spurious level in band	<- 70 dBc
Spurious level out band	<- 60 dBc
Maximum spectrum ripple	± 0.25 dB

I/Q DIRECT MODULATOR

The I/Q modulator performs a direct RF conversion on bands III, IV and V. High stability circuits are used to avoid amplitude and phase unbalance, which causes signal

quality degradation. This means a very simple and reliable agile up-conversion system, without any tuned filters.

FREQUENCY SYNTHESIZER AND REFERENCE

This card generates all the frequency signals necessary to excite operations: 10 MHz internal reference and local oscillator for up conversion (locked to the internal reference) with 10⁻⁷ stability. If better than 10⁻⁷ stability is needed, it is possible to lock the 10 MHz internal reference to an external frequency reference (5, 10 MHz). In case of external reference loss, the board keeps on generating the internal reference maintaining the accuracy of the external one, without discontinuity; a software routine estimates the

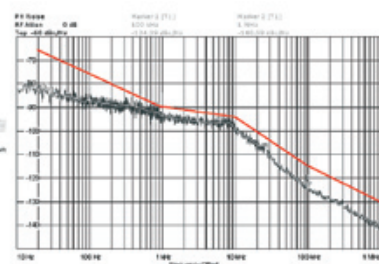
frequency and time drift allowing the RF muting when these drifts overcome a settable threshold. When the external reference returns a software procedure assures a soft re-lock without discontinuity. An integrated GPS receiver (optional) is available when the exciter is used in DVB-T/DAB Single Frequency Networks (SFN), obtaining a frequency stability of 5x10⁻¹¹. The state-of-the-art local oscillator has an extraordinary phase noise performance, suitable both for analogue TV and COFDM transmissions.

FREQUENCY REFERENCE CHARACTERISTICS

Local oscillator frequency range	Band III, IV-V
Local oscillator frequency offset	±10 KHz DVB/ATSC, ± 50 KHz TV, 1 Hz step
Local oscillator monitor	1BNC, 50 Ω, 0 dBm
Frequency reference input	1 BNC, 50 Ω, 10 MHz, 7 dBm± 6 dB
Frequency reference output	1 BNC, 50 Ω, 10 MHz, 7 dBm
1 PPS input	1 BNC, 50 Ω, TTL
1 PPS output	1 BNC, 50 Ω, TTL
GPS input	1 N, 50 Ω, up to 250 m RG58 cable
OCXO frequency aging	±1x10 ⁻⁷ /year, ± 3x10 ⁻⁷ /10 years
GPS frequency accuracy	±1x10 ⁻¹² average 24h of sync
GPS frequency aging	± 5x10 ⁻¹⁰ /24h free running
GPS frequency short term stability	<3x10 ⁻¹¹ , 10 s Allen variance
GPS 1 PPS accuracy	±1 μ s during the first 20 minutes
	±100 ns after 20 minutes from sync
	± 4 μ s, 4h hold over
	± 22 μ s, 24h hold over

Synthesizer phase noise mask

10 Hz	65 dBc
100 Hz	80 dBc
1 KHz	90 dBc
10 KHz	95 dBc
100 KHz	115 dBc
1 MHz	130 dBc



RF POWER AMPLIFIER

The final power amplifier generates up to 1W rms DVB/ATSC - 5W ps TV signal appropriate for subsequent high power RF amplification. As a standalone transmitter, the output power can reach up to 100W rms

DVB/ATSC and 200 W ps TV. The power amplifier module uses latest LDMOS technology, achieving unsurpassed peak power margin and efficiency, due to advanced circuit design.

RF CHARACTERISTICS

RF output (exciter)	1 N, 50 Ω, 1 Wrms DVB/ATSC, 5 W ps TV
Max RF output power (transmitter)	100 Wrms DVB/ATSC, 200 W ps TV
Auxiliary RF output (separated sound)	1 N, 50 Ω, 10 dB below RF video peak sync
Forward RF input (power meter)	1 N, 50 Ω, 0 dBm +3, -7 dB
Aux forward RF input (power meter)	1 N, 50 Ω, 0 dBm +3, -7 dB
Reflected RF input (power meter)	1 BNC, 50 Ω, 0 dBm +3, -7 dB
Aux forward RF input (power meter)	1 BNC, 50 Ω, 0 dBm +3, -7 dB
RF monitor	1 BNC, 50 Ω, 0 dBm
Auxiliary RF monitor	1 BNC, 50 Ω, 0 dBm

▶ CONTROL UNIT

The multimode exciter control unit allows commands, configuration and parameters monitoring. The ESS (Electrosys Supervisory System) software allows the remote control and monitoring of the exciter by means of a proprietary Electrosys protocol or HTTP (Web Server) and SNMP protocols. Moreover the ESS supports also TFTP and Telnet protocols for service operations, including the remote firmware upgrade of all the exciter digital parts. In this way any adjustments, due to standard specification changes or specific customer requirements, can be accomplished without replacing any

part, from a remote position. The Control Unit can also perform all the operations required for the control and setting of a whole high power transmitter (embedded transmitter control system) obtaining a very compact and cost effective system. In the dual exciter configuration, one exciter acts as master and the second one as slave; in case of fault of the master, automatically the slave replaces it, obtaining also the system control redundancy. A front display and a keyboard allow a complete control of the exciter and/or transmitter without any external PC including the pre-correction.

REMOTE INTERFACES

RS-232	for proprietary control protocol
RS-485	for embedded transmitter control system
Ethernet	for HTTP, TFTP, SNMP and Telnet protocols
Parallel	for simple control and commands

GENERAL CHARACTERISTICS

Power supply	88 ÷ 240 V, 50 ÷ 60 Hz
Temperature	0 ÷ 45 °C
Relative Humidity	0 ÷ 90 % (non condensing)
Storage temperature	-40 ÷ 70 °C

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Printed in Italy

Version 1.00 - February 2010

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