INTRODUCTION

Designed to meet the most demanding requirements of today’s Digital Terrestrial Television Broadcast Market, the DVB-T/H Modulator DTE-1000 from Broad Telecom, S.A. (BTESA) is ranked number one in its class. A key factor in the product’s success is the quality of the coding and modulation process. The modular design makes the unit highly flexible and the modulator is easily adaptable to provide the exact features required in a specific application.

This means that you will only have to pay for the functional features that you need. Retrofitting of features is easy by uploading new firmware and software from a standard PC.

APPLICATION

The performance and flexibility of the DTE-1000 allows it to excel in any application related to DVB-T modulation. Being a DVB-T/H modulator, the core function of the DTE-1000 is to modulate an MPEG-2 transport stream (input) onto a DVB-T compliant COFDM spectrum (output) in accordance with the rules for channel coding and modulation specified in the DVB-T/H standard ETSI EN 300 744.

BASIC VERSION

The basic version of the DTE-1000 delivers the COFDM spectrum on a user defined frequency between 35 and 37 MHz. Inverted/non-inverted spectrum is selected on the front panel. The spectrum bandwidth may be user configured to 8 or 7 MHz as required. This flexibility will allow the user to interface the IF signal to a wide range of transmitters and frequency converters.

The basic unit has two MPEG-2 inputs (ASI format). Switching between the two inputs can be done manually and automatically. The latter option provides near seamless switching to a secondary transport stream in case the primary transport stream source fails (a truly valuable feature for broadcast applications.)

The user can configure the basic version to any transmission mode listed in ETSI EN 300 744 (excluding hierarchical mode/DVB-H mode and SFN mode.)
OPTIONAL FEATURES

A broad range of optional features allows tailoring the modulator for the specific application.

If the output COFDM spectrum is required on a frequency not covered by the basic version (35-37 MHz) the RF Converter option O-1001 is the answer. This high performance converter covers the entire frequency range from 30 MHz to 1 GHz in steps of just 1 Hz. The user can freely set the polarity of the spectrum to inverted or Non-inverted as required. With this converter the DTE1000 will cover any spectrum application and frequency requirement that you will come across in the field of DVB-T.

To upgrade the DTE-1000 for SFN transmission you will only need to add the SFN option O-1102. This option provides the DTE1000 with market leading SFN performance with respect to basic timing accuracy and extent of the local delay offset range. Also, even when the SFN option is installed you can still select MFN mode via the front panel controls. A convenient feature when conducting pre-testing and alignment of RF parameters on transmitter installations before the timing references and transport stream with MIP are in place (as a general rule SFN modulators must mute the output if either of these signals is absent).

To extend the standard range of transmission modes to include support of hierarchical modulation the Hierarchical Modulation option O-1103 must be added. Hierarchical modulation allows simultaneous transmission of two MPEG-2 transport streams. The compromise between data rate and ruggedness can be set differently between the two virtual channels. For example:

- a highly protected channel for transmission to mobile and/or portable receivers and
- a high capacity channel, at the expense of ruggedness, for transmission to rooftop antennas.

Another typical application is simulcasting of the same program in high definition resolution and standard definition resolution. A significant benefit of hierarchical modulation is that the total data-rate available in a system with two hierarchically modulated RF channels is higher than what is available for a two-channel non-hierarchical system where one RF channel is strictly dedicated to mobile/portable receivers and the other RF channel is strictly dedicated for transmission to rooftop antennas.

The hierarchical option itself is often supplemented by adding also an extra set of ASI inputs (dual input option O-1002), thereby upping the total to four ASI inputs. Access to four ASI inputs will preserve the possibility also in hierarchical mode to switch almost seamlessly to a secondary transport stream source in case the primary transport stream source fails (HP primary input, HP secondary input, LP primary input, LP secondary input).

By adding the 6MHz BW option O-1104, the DTE-1000 will, in addition to the standard 8 and 7 MHz BW, also support transmission in the 6 MHz bandwidth mode that is intended for applications in North and South America, Korea, Japan and elsewhere where 6 MHz channel raster is standard. Including this option for T&M and R&D applications is also highly attractive as the user simply executes the switching between the three bandwidths via the instrument front panel (one instrument covers all bandwidths defined by the ETS for DVB-T transmission). Further addition of 5MHz bandwidth is possible by option O-1105.

O-1106 DVB-H extension: The DVB-H extension expands the DTE-1000 (and the Modulator part of DRE-1000) to be compatible with the physical layer of the DVB-H standard. This includes:
- Support of the 4K IFFT mode
- Cell-ID support (standard feature in DTE-1000)
- DVB-H signaling in the TPS-bits
- Support of the 8K symbol-interleaver also in the 2K and 4K mode (In-depth or Native Interleaving)

To maximise the performance of the transmitter in which the modulator is installed the Digital Linear and Non-linear Precorrection option O-1101 is recommended. The Nonlinear pre-corrector balances out gain and phase non-linearity in the transmitter RF power amplifier thereby reducing significantly the in-band as well as out of band intermodulation generated by the amplifier. This optimisation of the performance will extend the transmitters coverage area and ease the performance requirement from the transmitter output filter used for suppressing the radiation in adjacent channels below the maximum allowed level. The linear pre-corrector balances out level and group delay variations over the channel bandwidth caused by the transmitter antenna filter and/or channel combiner filers. The linear optimisation of the signal radiated from the transmitter means that the channel equalizer of the DVB-T/H receiver may focus all its correction capacity on level and group delay errors originating from the actual transmission path. The characteristics of the linear and non-linear precorrection curves are set by means of an easy to use and highly intuitive graphical user interface, the IMD Buster Mc Two software package (Windows compatible).
The WebLink and SNMP client option O-1007 allows remote control of the DTE-1000 via Ethernet (TCP/IP). The weblink system is based on a Web server mounted inside the DTE-1000. The Web pages stored on the Web server are designed as a complete graphical user interface (GUI) for testing the status and setting the parameters of the modulator. The WebLink concept is popular because remote control with this system only requires a standard PC with a network interface card (NIC) and a Web browser (Microsoft Explorer 5.0). The SNMP client allows remote control of the DTE-1000 in accordance with the SNMP protocol (Get, Set and SNMP traps). This remote control option is intended for systems solutions where it is desired to integrate the control of a range of (SNMP compliant) equipment in a common management system, the SNMP manager. The management system must be adapted/design to the specific systems requirements and it is therefore not included with the supplied SNMP client option.

**Signal processing**

**Supported modes**
- IFFT: 2K, 8K (4k with option O-1106)
- Interleaver: Native
- Interleaver (option O-1106): In-depth and native
- Guard intervals: ¼, 1/8, 1/16, 1/32
- Code rates: ½, 2/3, ¾, 5/6, 7/8
- Constellations: QPSK, 16-QAM, 64-QAM
- Hierarchical modes (option O-1103): 16-QAM and 64-QAM in alpha-1, alpha-2 and alpha-4
- Network mode: MFN
- Network mode (option O-1102): SFN and MFN
- Bandwidth: 8MHz and 7MHz
- Bandwidth (option O-1104): 8MHz, 7MHz and 6MHz (5MHz with option O-1105)

**Electrical specifications**

**Inputs**
- MPEG-2: Two ASI inputs, BNC 75ohm (four ASI inputs with option O-1002 installed)
- Clock reference (carrier frequency and SFN timing):
  - Connector: BNC
  - Frequency: 10MHz
  - Level: 100mV-3Vpp
  - Impedance: 50ohm/>1kohm, user selectable
- Time reference (SFN timing):
  - Connector: BNC
  - Frequency: 1 PPS

**Outputs**

**Output (standard version)**
- Level: 0-5V
- Trigger: Selective rising/falling
- Impedance: 50ohm/>1kohm, user selectable

**Output (Option O-1001)**
- IF output: As for standard version except centre frequency fixed 36MHz
- RF output:
  - Connector: N 50 ohm
  - Centre frequency: Adjustable 30-1000MHz in steps of 1Hz

**Power supply**
- Voltage: 90-132VAC / 180-250VAC
- Frequency: 47-63Hz
- Consumption: Max. 25VA

**Test modes**
- Removal of one carrier: Moveable one-carrier hole for noise test
- Removal of 50 carriers: Moveable 50-carrier hole for test of IM and quantisation noise
Data Sheet

- Single carrier: COFDM spectrum replaced by a single carrier at centre frequency. The level of the single carrier is equivalent to average RMS level of normal COFDM spectrum. The signal is intended for level alignment.
- TS-Stuffing: PRBS sequence in accordance with ETR290 paragraph 9.16.1

Pre-correction (option O-1101)
The pre-corrector option supports non-linear pre-correction (gain and phases vs. power level) and linear pre-correction (level and group delay response vs. frequency). The pre-corrector allows furthermore control of the peak power clip level (range +12dB to +2dB peak power relative to average RMS level).

- Non-linear correction:
  - Curve formats: S21 and VO/VI
  - Amplitude scale: Linear and logarithmic
  - Correction points: Max 256, user-defined position.
  - Gain correction: Max 12dB, subject to available headroom.
  - Phase correction: -6 to +30 degrees, subject to available headroom.
- Linear correction:
  - Correction points: 21
  - Point spacing: 1/20 of nominal spectrum BW
  - Amplitude correction: ±10dB
  - Amplitude resolution: 0.01dB
  - Group delay correction: ±1000ns
  - Group delay resolution: 1ns

Control Interface
The basic version of the DTE1000 can be operated via the front panel (LCD display and cursor/execute keys) and via RS232 interface (note: the RS232 interface is also used for uploading Precorrection curves to the O-1101 option when installed). Two independent RS232 interfaces are available in the basic version of the DTE-1000. Only one RS232 interface is available when option O-1007 is installed. A connector is provided for signalling user programmable alarm events (floating relay contacts) and for muting and resetting via external switches.

- RS232 interface:
  - Connector: 9-pin SUB-D Male
  - Command protocol: SCPI based
- HW interface:
  - Connector: 9-pin SUB-D Female
  - Output: Two user programmable alarms via separate floating relays, common make break contacts, contact rating 60V / 0.2A (5W max)
  - Input: Separate Reset control and Output muting control, activated by ground closure.

Environmental Specification
- Climatic
  - Temperature range operating: 0°C to +50°C (+32°F to +122°F)
  - Temperature range within specs: +5°C to +45°C (41°F to +113°F)
  - Temperature range storage: -30°C to +70°C (-22°F to +158°F)
  - Humidity operating: max 90% RH
  - Humidity storage: max 90% RH
- EMC
  - Compliant to EN50081-1, EN50082-1, EN50081-2, EN50082-2
- Safety
  - Compliant to EN60950

Mechanical Specification
- Cabinet: 19" wide, 1RU high
- Height: 483mm (19")
- Depth: 483mm (19")
- Weight: 6kg (16lbs)
- Cooling: Temperature controlled fan to assist natural convection
- Transport and storage: Vibration acc. to IEC Publ.68

Ordering Information

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<tr>
<th>Type no.</th>
<th>Description</th>
<th>Ordering code</th>
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<td>Basic modulator</td>
<td>DVB-T Modulator, MFN, IF, 8 + 7MHz BW</td>
<td>371PT5780</td>
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<td>Options for extension of transmission modes</td>
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<tr>
<td>O-1102</td>
<td>SFN support</td>
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<td>O-1104</td>
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<tr>
<td>O-1101</td>
<td>RF converter (note 2)</td>
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<td>O-1106</td>
<td>DVB-H extension</td>
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<td>Other options</td>
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<td>Digital linear and non-linear pre-corrector</td>
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<td>18 dBm output Amplifier (class A) (note 2)</td>
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<td>O-1007</td>
<td>WebLink and SNMP Client (note 2)</td>
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<td>O-1006</td>
<td>LVDS SPI input (note 2)</td>
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<td>O-1004</td>
<td>Precision TCXO [0.01ppm] (note 2)</td>
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<td>O-1020</td>
<td>20dB attenuator for protection of RF output</td>
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Note 1: Frequencies are relative to centre frequency for 8MHz version (scale down by 7/8, 6/8 and 5/8 for 7MHz, 6MHz and 5 MHz versions respectively). Levels are measured in 10kHz bandwidth, where 0dB is the level of the carriers at the edge of the spectrum. Harmonics and spurious not included.

Note 2: Factory installation

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