DESCRIPTION

Being fully compliant to the second standard for Digital Video Broadcasting over Satellite (DVB-S2, EN 302307), the Newtec satellite modulator NTC/2277/xF is one of the first modulators to offer the advantages of DVB-S2:

> **1° much better spectral efficiency than DVB-S thanks to the use of new advanced high-level coding techniques: BCH replaces Reed Solomon and LDPC replaces Viterbi**
> **2° new modulation schemes: 16 APSK & 32 APSK**
> **3° more roll-off factors (20, 25 & 35 %)**

Implementing all these new techniques, DVB-S2 results in a bandwidth saving of up to 30 % in CCM (or 2,5 dB gain margin) and up to 65% in VCM mode compared to DVB-S.
The NTC/2277/xF is also capable of working in DVB-S and DVB-DSNG mode.

Like its predecessor, the NTC/2177 DVB-S modulator, the NTC/2277/xF is a member of the field-proven modular Azimuth series and is designed to packetize, encode and modulate one or more digital signals such as IP traffic or MPEG Transport Streams. At the output, the signal is converted to an IF band signal (50-180 MHz).

The NTC/2277/xF has been designed for the broadcasting, contribution or distribution of digital television signals as well as the transmission of high-speed TELCO data in backbone infrastructures and data content distribution networks.

The NTC/2277/xF has two physical input interface positions that can be fitted with a range of interface modules: A DVB (ASI, SPI, LVDS) and a TELCO (HSSI/G703) interface module provide a standard data input to the modulator. The NTC/2277/xF can be fitted with any combinations of these cards. An IP GbE interface is also available. This module has an RJ-45 input and 2 ASI inputs/outputs. In combination with the GbE module (NTC/7015/xx) VCM/ACM applications become reality. For an overview see "Versions & Options" on page 2.

The DVB-S2 modulator NTC/2277/xF handles symbol rates from 0.05 up to 68 Mbaud, using a QPSK, 8PSK, 16APSK or 32APSK modulation scheme. The roll-off factor is selectable between 0.2, 0.25 or 0.35 in both DVB-S and DVB-S2 mode.

The NTC/2277/xF is standard equipped with an IF-band output. An L-band monitoring output is provided for connection of e.g. an IRD or spectrum analyzer. Optionally, the NTC/2277/xF can be equipped with an additional L-band output. A programmable digital equalizer is provided to compensate for external amplitude slopes.

The optional **Equalink**™ concept provides for pre-compensation of linear and non-linear satellite link distortions resulting in optimization of transponder data throughput.

All Control and Monitoring parameters are available locally on the front panel (LCD display & keyboard) and remotely through a web interface (Http) or through the RS-485/232 port or through the 10/100 Base-T

Ethernet port. The last two use the RMCPv2 protocol. There is optionally an SNMP + MIB agent.
A dual contact closure output is available for 2 types of summary alarms: one contact is operated in case of device alarms, while the other contact opens (or closes) in case of input or output interface alarms.

Inherent to its modular design, the modulator can be SW-upgraded to a higher capability (data rate, modulation schemes, functionalities, etc.) after ordering the corresponding password, which is simply keyed-in by the customer

APPLICATIONS

Up to 68 Mbaud data rate transmission of satellite services such as broadcast, distribution or contribution of Digital TV (HDTV / SDTV) signals, Digital Satellite News Gathering, data content distribution, trunking and other professional applications

FEATURES

- DVB-S2 compliant (EN 302307)
- DVB-S compliant (EN 300421)
- DVB-DSNG compliant (EN 301210)
- Data rates & modulation schemes are coupled on the available DVB-S2 data rates and modulation schemes.
- Two optional DVB, TELCO input interface
- CCM (Constant Coding and Modulation)
- VCM/ACM (Variable Coding and Modulation / Adaptive Coding and Modulation) mode, requires the GbE interface card
- Insertion of MPEG Transport Stream framing
- Independent error coding and modulation scheme for each physical or logical input
- 50 kbit/s up to 216 Mbps interface rate (FEC- & interface dependent)
- QPSK, 8PSK,16APSK and 32APSK for optimal bandwidth Efficiency in DVB-S2
- Automatic (redundancy switching) or manual ASI data input switching
- Ovenised 10.0 MHz reference frequency (option)
- External 10.0 MHz reference input/output (option)
- L-band monitoring output (fixed frequency)
- Programmable external LO frequency
- Level indication offset
- Programmable amplitude slope equalizer
- The **Equalink**™ option for compensation of linear amplitude and group-delay distortions and non-linear distortions over the satellite link.
- Local & remote M&C access to all menus through a
  * web interface (Http protocol)
  * RS-485/RS-232 (RMCP v2 protocol)
  * 10/100 Base-T Ethernet port (RMCP v2 protocol)
- 50 or 75 Ohm IF output selectable
- User-programmable menu structure
- Action Keys (group of commands under single button)
- Real-time clock for alarm occurrence logging

- Internal test-generator and detector (PRBS counter)
- Very compact: 1Ru (hight:4.4 cm !)
- highly reliable Newtec design
- CE label
- Dynamic build-up of alarm menu
- Diagnostics generator
- The NTC/2277/xF can also be ordered to work in DVB-S mode only (as replacement of the NTC/2177)

• VERSIONS & OPTIONS

The modular architecture opens various possibilities and application fields: Firmware-packages will determine the usage and capabilities of the unit.

1. Base Band Data Interface Module :

The interchangeable Base Band data interface modules provide a wide range of input interfaces via coaxial and/or sub-D connectors. Optical inputs and outputs are also available.

- NTC/3453.BA.Ax: DVB ASI/SPI/Serial-LVDS interface card
  Hardware option: optical ASI in/out plug-in NTC/3453.x.x.A
  Firmware options:
    * Automatic rate adapter NTC/3453.x.xB
    * BISS 0,1 & E scrambler NTC/3453.x.xC
    * Automatic rate adapter + BISS scrambler NTC/3453.x.xD

- NTC/3458.Ax.x: TELCO HSSI+2x single rate G703 interface card
    * NTC/3458.AA.A: HSSI-G.703 input 2 to 52 Mbps
    * NTC/3458.AA.B: HSSI-G.703 input 2 to 110 Mbps

    NTC/3343/AA: G.703 at 8.448 Mb/s submodule used on NTC/3458
    NTC/3343/AB: G.703 at 6.312 Mb/s submodule used on NTC/3458
    NTC/3344/AA: G.703 at 16.896 Mb/s submodule used on NTC/3458
    NTC/3344/AB: G.703 at 34.368 Mb/s submodule used on NTC/3458
    NTC/3348/AA: G.703 at 44.736 Mb/s submodule used on NTC/3458
    NTC/3349/AA: G.703 at 2.048 Mb/s submodule used on NTC/3458

- NTC/7015/xx: IP GbE & ASI in/out interface

2. Modulator Board:

The Variable Rate IF-band DVB-S2 Modulator is fitted with a modulator board of the NTC/7020 series. The available modulation schemes, maximum baud rates and the **Equalink**™ predistortion are part of the firmware capabilities, which are password upgradeable :

Available Symbol rates:
 5, 15, 30, 45 (both in DVB-S2 & DVB-S/DSNG mode), 60(DVB-S) and 68 (DVB-S2)

Available Modulation schemes:
DVB-S2 QPSK
DVB-S2 QPSK / 8PSK
DVB-S2 QPSK / 8PSK / 16APSK
DVB-S2 QPSK / 8PSK / 16APSK / 32APSK

DVB-S/DSNG QPSK
DVB-S/DSNG QPSK / 8PSK
DVB-S/DSNG QPSK / 8PSK / 16QAM

Types to be specified for the modulator when ordering:

NTC/7020/**BB**xx: DVB-S2/DSNG/S, CCM mode
NTC/7020/**BV**xx: DVB-S2/DSNG/S, CCM/VCM/ACM mode

NTC/7020/BB**A**x: QPSK modulation scheme (DVB-S2 mode)
             Works also in QPSK in DVB-S/DSNG mode
NTC/7020/BB**B**x: QPSK+8PSK modulation scheme (DVB-S2-mode)
              QPSK+8PSK when working in DVB-S/DSNG mode
NTC/7020/BB**C**x: QPSK+8PSK+16APSK modulation scheme (DVB-S2

mode)
              QPSK+8PSK+16 QAM when working in DVB-S/DSNG
              mode
NTC/7020/BB**D**x: QPSK+8PSK+16APSK+32APSK modulation (DVB-S2
              mode)
              QPSK+8PSK+16 QAM when working in DVB-S/DSNG
              mode

NTC/7020/BBx**A**: max   5 Mbaud
NTC/7020/BBx**B**: max 15 Mbaud
NTC/7020/BBx**C**: max 30 Mbaud
NTC/7020/BBx**D**: max 45 Mbaud
NTC/7020/BBx**E**: max 68 Mbaud (60 Mbaud when working in DVB-S/
              DSNG mode)

For example, if the modulator has to work (DVB-S2, CCM mode) in QPSK+8PSK+16APSK at a max baud rate of 45 Mbaud, the NTC/7020/BBCD has to be ordered.
This modulator NTC/7020/BBCD will also work in DVB-S/DSNG mode (QPSK+8PSK+ 16QAM at 45 Mbaud)

For the **Equalink**™ option, order NTC/2030/AA (in combination with DVB-S2 modulation only).

For customers who want to work in DVB-S/DSNG only (as replacement of the NTC/2177), the following types are available:

NTC/7020/**AC**xx: DVB-S/DSNG

NTC/7020/AC**A**x: QPSK modulation scheme
NTC/7020/AC**B**x: QPSK+8PSK modulation scheme
NTC/7020/AC**C**x: QPSK+8PSK+16QAM modulation scheme

NTC/7020/ACx**A**: max   5 Mbaud
NTC/7020/ACx**B**: max 15 Mbaud
NTC/7020/ACx**C**: max 30 Mbaud
NTC/7020/ACx**D**: max 45 Mbaud
NTC/7020/ACx**E**: max 60 Mbaud

3. 2nd Tx outgoing L-band (optional):

The NTC/2277/xF modulator can be fitted with the NTC/3474/AA L-band (950-1750 MHz) agile frequency convertor.

With this option installed, the NTC/2277/xF can be used in two different modes of operations:

1) as IF modulator with an agile IF output: In this mode, the L-band output is disregarded, and the IF band is fully agile (the output frequency can be ranging between 52 and 88 or 104 and 176 MHz).

2) as L-band modulator with an agile L-band output and fixed IF band output: the L-band output frequency can be any value between 950 and 1750 MHz, while the IF output is selectable between 70MHz or 140 MHz.

In both cases a fixed L-band monitoring (1080 MHz) output is available.

4. 10 MHz Reference Board :

One of the following 10 MHz ref. boards is always required whenever an external 10 MHz reference input and/or output is required.

- NTC/3462.AB.A : 10 MHz OCXO reference Oscillator (normal use)
              Temperature stability: 0,05 ppm
- NTC/3462.AA..A : 10 MHz OCXO High Stability Ref. Oscillator
               (recommended only with carriers < 1MHz)
               Temperature stability: 0,002 ppm))

5. SNMP agent and MIB library

Needed whenever the unit needs to be controlled over Ethernet via proprietary NMS.

- NTC/2277.xx.xB.

• DATA SUMMARY

DATA INTERFACE
- ASI/SPI/serial-LVDS (see data sheet NTC/3453.x.xx) and/or
- Single rate G703 w. Ext. clock + HSSI (see data sheet NTC/3458.Ax.x), or
- IP Gigabit Ethernet card (see datasheet NTC/7015/P).

IF-BAND OUTPUT
Operational output
Level	: -30/+5 dBm (± 3 dB)
frequency	: 50 - 180 MHz (adjustable in steps of 50 Hz)
connector	: BNC (F) - 75 Ohm (intermateable with 50 Ohm or 75 Ohm BNC)
return loss	: 50 Ohm : > 14 dB
	75 Ohm : > 20 dB

with the L-band output installed, the IF output becomes fixed (70 or 140 MHz) and output level range is -34/+1 dBm (+/- 3 dB).

L-BAND MONITORING OUTPUT
level	: -45 dBm
frequency	: 1080 MHz (fixed frequency)
connector	: SMA (F) - 50 Ohm
return loss (50):	> 7 dB

L-BAND OUTPUT (option)
Output connector	: SMA (F)
L-band output impedance	: 50 Ohm
L-band output level	: -30 to + 0 dBm (+/- 3dBm)
L-band 1 dB compres. outp	: +10 dBm
Programmable L-band gain	: -20 to +20 dB
	(750MHz @-10dBm => L-band)
L-band gain stepsize	: 0.1 dB

IF-BAND ONLY (frequency agile) OUTPUT mode is selectable and is enabled after a power reset.

PHASE NOISE
10 Hz	: < -50 dBc/Hz
100 Hz	: < -70 dBc/Hz
1 kHz	: < -80 dBc/Hz
10 kHz	: < -85 dBc/Hz
100 kHz	: < -95 dBc/Hz
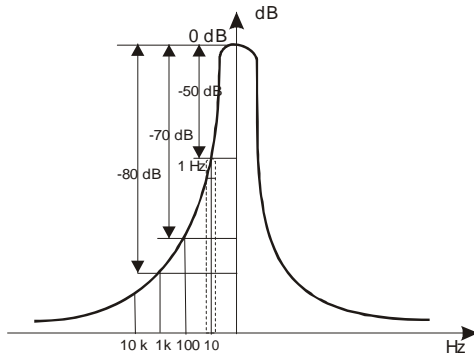
SPURIOUS
better than 65 dBc @ -10 dBm

INNER FEC CODING (LDPC)
1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4
4/5, 5/6, 8/9, 9/10
16200 and 64800 bit blocks

BIT MAPPING
QPSK, 8PSK, 16APSK, 32APSK

DVB-S2 COMPLIANT (EN 302307)
Single or multiple Transport Stream/Data Input interface
Null-packet deletion
CRC-8 Encoding
Base Band Signaling
Base Band Scrambling
Outer FEC coding (BCH)
Bit Interleaving
Physical Layer Framing
Physical Layer Dummy Frame insertion
Physical Layer Scrambling
Base Band Shaping (roll-off 0.2, 0.25, 0.35)

in DVB-S mode only : 300421 and EN 301210 compliant :
MPEG-2 interface synchronisation
MPEG-2 transport adaptation
Energy dispersal (synchronous)
RS-coding : 188/204
Convolutional interleaving I = 12
FEC-coding :   1/2, 2/3, 3/4, 5/6, 7/8 with QPSK modul.
                2/3, 5/6, 8/9 with 8PSK modulation
                3/4, 7/8 with 16QAM modulation
Base Band Shaping (roll-off 0.2, 0.25, 0.35)

INTERNAL REFERENCE FREQUENCY
- standard : ± 5 ppm
  Ageing : ± 5 ppm/10 years
- optional 10 MHz reference board :
  see datasheet NTC/3462.Ax.A
            AA.A version: +/- 0.002 ppm
            AB.A versions:+/-0,05 ppm

EXTERNAL 10.0 MHz REFERENCE (option):
Input level	: -3 dBm up to +7 dBm
Output level	: +7 dBm
Connector	: BNC (F) - 50 Ohm

MONITOR & CONTROL INTERFACES :
a) protocol	: Http (via web-browser)
connector	: RJ-45
electrical	: Ethernet 10 base-T
b) protocol	: RMCP **version 2 only**
connector	: 9 pin sub-D female
electrical	: RS-485 / RS-232
c) protocol	: RMCP **version 2 only** over TCP-IP or UDP, SNMP
connector	: RJ-45
electrical	: Ethernet 10 base-T

ALARM INTERFACE :
connector	: 9 pin sub-D (F)
electrical	: interface + device alarms

MECHANICAL :
19" sub rack, height: 1RU, weight 6 kg, depth 51 cm

POWER SUPPLY :
90-130/180-260V, 105VA, 47-63 Hz

TEMPERATURE:
operational	: 0° up to +40°C
storage	: -40° up to +70°C

Control

Physical input selection, logical input selection (VLAN tag or MAC address), interface rate (1 bit/s resol.) and symbol rate (1 baud resol.), data framing (MPEG TS internal/external, generic mode, Data Piping), rate adaptation, input buffer size, FEC-rate, Modulation scheme, IF frequency (95 Hz resol.), 10.0 MHz source (internal or external), internal PRBS generator/detector

- ## PERFORMANCE

Interface bit rate vs satellite baud rate in DVB-S mode :

Satellite baud rate: 50 kbaud to 68 Mbaud

Interface Rate -   188 byte   .

		MPEG frames (Mbps)			Bandw./interf.R 35% roll-off	
Modul.	FEC	50 kbaud	1 Mbaud	60 Mbaud	-3dB	-26 dB
QPSK	1/2	0.046	**0.922**	55.294	1.085	1.465
QPSK	2/3	0.061	**1.229**	73.725	0.814	1.099
QPSK	3/4	0.069	**1.383**	82.941	0.723	0.977
QPSK	5/6	0.077	**1.536**	92.156	0.651	0.879
QPSK	6/7	0.079	**1.580**	94.789	0.633	0.855
QPSK	7/8	0.081	**1.613**	96.764	0.620	0.837
QPSK	N.A.	0.092	**1.844**	110.588	0.543	0.732
8PSK	2/3	0.092	**1.844**	82.941	0.543	0.678
8PSK	5/6	0.115	**2.304**	103.676	0.434	0.509
16QAM	3/4	0.138	**2.765**	124.412	0.362	0.452
16QAM	7/8	0.161	**3.226**	145.147	0.310	0.388

This table indicates for a certain modulation scheme the input bit stream needed to obtain an output symbol rate of 1Mbaud (also shown for an output symbol rate of 0,05 and 68 Mbaud)

For example: modulation is in 8PSK 2/3, to obtain an output stream of 1Mbaud, the input stream has to be 1,844 Mbit/s. This means a spectral efficiency of 1,844 bits/Hz. For your convenience the table also mentions the input stream to obtain output streams of resp 0,05 Mbaud and 60 Mbaud (these symbol rate limits of the modulator)

Interface bit rate vs satellite baud rate in DVB-S2 mode

		Interface Rate (Mbps) (64800 bit FEC frames)			Bandw./Interf.R. (35% Roll-off)	
Modul.	FEC	50kBaud	1MBaud	65MBaud	-3dB	-26dB
QPSK	1/4	0,025	0,490	31,866	2,040	2,754*
QPSK	1/3	0,033	0,656	42,669	1,523	2,057*
QPSK	2/5	0,039	0,789	51,312	1,267	1,710
QPSK	1/2	0,049	0,989	64,276	1,011	1,365
QPSK	3/5	0,059	1,188	77,240	0,842	1,136
QPSK	2/3	0,066	1,322	85,946	0,756	1,021
QPSK	3/4	0,074	1,487	96,686	0,672	0,908
QPSK	4/5	0,079	1,587	103,168	0,630	0,851
QPSK	5/6	0,083	1,655	107,553	0,604	0,816
QPSK	8/9	0,088	1,766	114,819	0,566	0,764
QPSK	9/10	0,089	1,789	116,260	0,559	0,755
8PSK	3/5	0,089	1,780	115,699	0,562	0,758
8PSK	2/3	0,099	1,981	128,741	0,505	0,682
8PSK	3/4	0,111	2,228	144,828	0,449	0,606
8PSK	5/6	0,124	2,479	161,107	0,403	0,545
8PSK	8/9	0,132	2,646	171,991	0,378	0,510
8PSK	9/10	0,134	2,679	174,148	0,373	0,504
16APSK	2/3	0,132	2,637	171,418	0,379	0,512+
16APSK	3/4	0,148	2,967	192,837	0,337	0,455+
16APSK	4/5	0,158	3,166	205,765	0,316	0,426+
16APSK	5/6	0,165	3,300	214,512	0,303	0,409+
16APSK	8/9	0,176	3,523	229,004	0,284	0,383+
16APSK	9/10	0,178	3,567	231,877	0,280	0,378+

+ = no verification possible above 45 Mbaud
Formulas : see ETSI EN 302 307 v1.1.1 (2004-01) table 5 & 11
Efficiency taken into account the BB header (80 bits) and the PL frame header (1 slot per PLFRAME) without pilots.

• BLOCK DIAGRAM
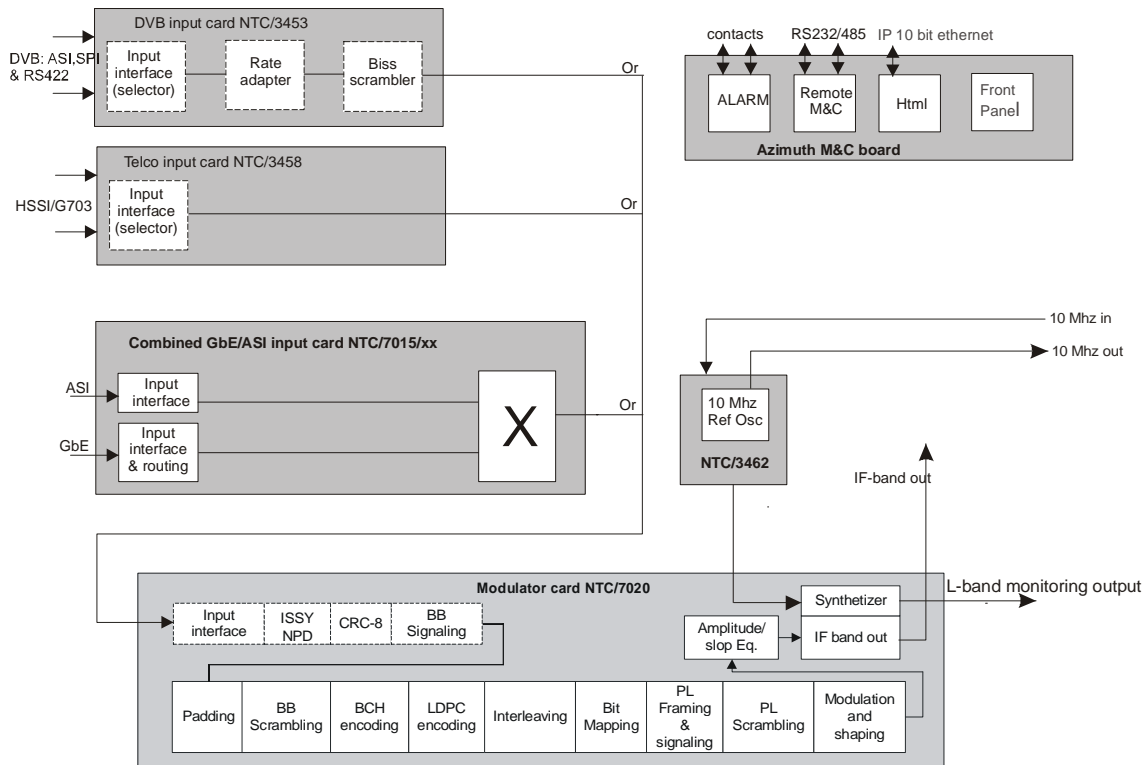
• TECHNICAL LITERATURE & REFERENCES (ALSO AVAILABLE ON OUR WEBSITE)

Other related products

NTC/2137	Transport stream ASI concentrator-deconcentrator
NTC/2263/xU	DVB-S2 L-band satellite demodulator
NTC/2280/xF	DVB-S2 L-band satellite modulator
NTC/3453	SI/SPI/serial LVDS DVB interface board
NTC/3458	Dual rate G.703/HSSI data interface board
NTC/3462	10 MHz reference frequency module
NTC/3474/AA	IF to L-band agile frequency converter
NTC/7015/xx	Combined GbE/ASI input/output card
NTC/7020	DVB-S2 IF-band modulator board
NTC/7030	DVB-S2 L-band modulator board

Application notes and technical publications

NTC/2280/APN01	Comparison between DVB-S2 (ACM) and DVB-S