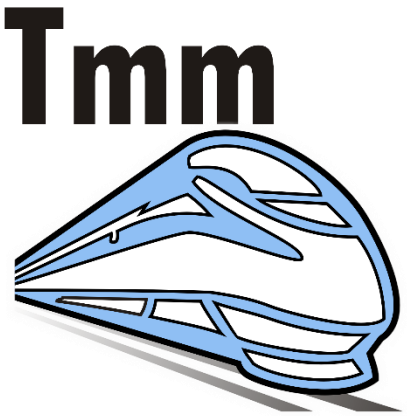
TmmXpress

ISDB-Tmm Signal Generator



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Revision History

Revision	Date	Changes
v1.3.0.9	2023.07.06	Added DTA-2116 support
v1.2.0.6	2016.03.29	Added DTU-315 support
v1.1.0.5	2014.04.24	Added DTA-2115 support
v1.0.2.4	2014.02.25	Improved input file bitrate estimation
v1.0.1.3	2013.12.06	Fixed license check failure
v1.0.0.2	2013.11.25	Initial version

1. Introduction

The DTC-382 ***TmmXpress*** software package is designed to create ISDB-Tmm, ISDB-T_{SB} or ISDB-T signals in the form of I/Q sample files or RF output signals. ***TmmXpress*** can be installed by the user on any qualifying PC, as specified in section 2.

ISDB-Tmm (Terrestrial Mobile Multimedia) broadcasting standard is based on ISDB-T and provides options to concatenate blocks of 13- and 1-segments up to a total of 33 segments without the need for a guard band.

TmmXpress allows you to make any combination of 13-, 3- and 1-segments and create signals of up to 33 segments, specify the modulation parameters, select the sources, add noise, add multiple channel simulation paths and generate an ISDB-Tmm, T_{SB} or T signal.

The I/Q sample file can be processed by your application or it can be played out through the ***StreamXpress***.

Note: The ***TmmXpress*** functions depend on the installed options, as specified in section 3.

2. Minimum PC Requirements

Platform	Windows 2k12/2k16/2k19, 7,8,10,11
Processor*	Core i5 minimum Core i7 recommended

* Or equivalent AMD processor

3. TmmXpress Software Options

The ***TmmXpress*** software requires a valid license to be installed. Without a valid license installed, ***TmmXpress*** will operate in demo mode. In demo mode the option to generate signals is disabled and a message is shown in the title-bar.
The ***DTC-382-ISDBTMM*** is installed as a combination of a ***DTC-370-ISDB*** and ***DTC-380-16MHZ***.

The following options are available:

Option	Description
DTC-370-ISDB + DTC-380-16MHZ	***TmmXpress***: Enables ISDB-Tmm/T_{SB}/T RF output
DTC-371-IQ	Option to enable ISDB-Tmm/T_{SB}/T I/Q sample generation, and playout of I/Q samples through the ***StreamXpress***
DTC-305-CM	Option to enable channel modelling

4. TmmXpress Software Installation

The ***TmmXpress*** software installation and ***TmmXpress*** license installation instructions can be found in the 'DTC-382 TmmXpress Installation' document, which is included in the install package.

5. TmmXpress Overview

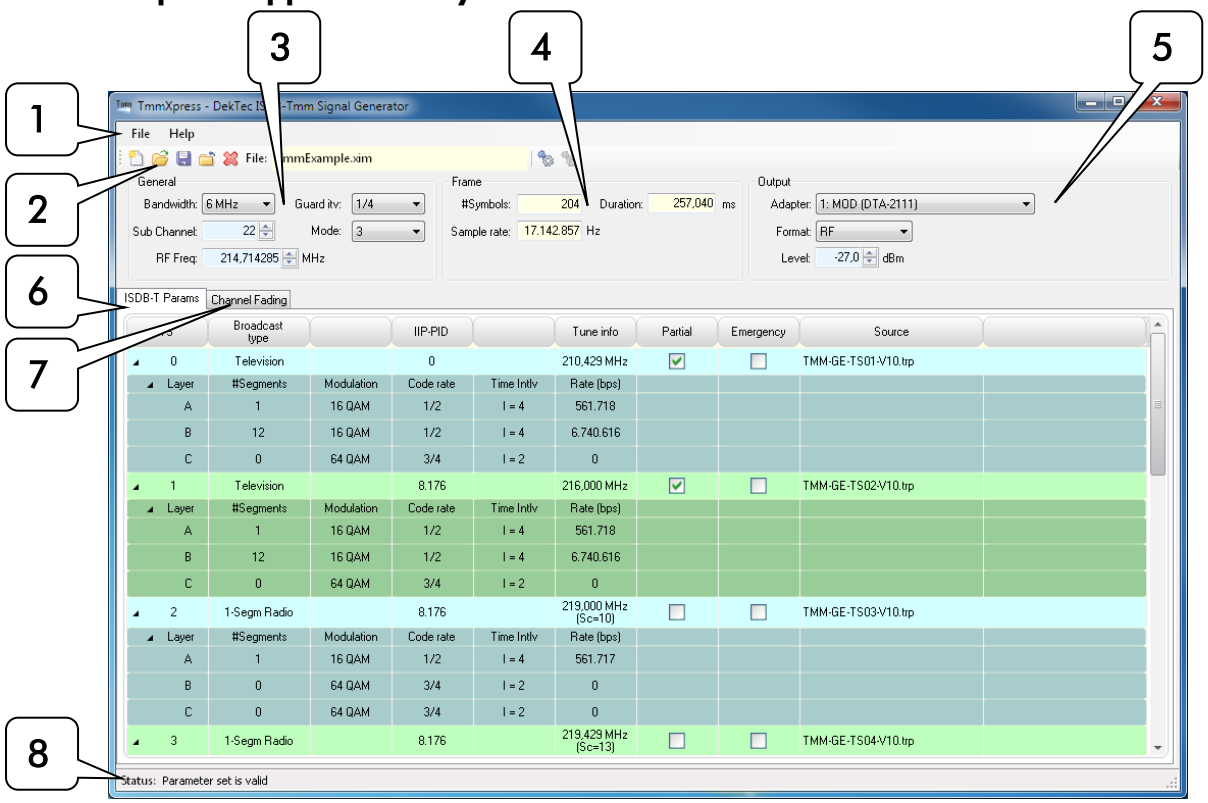
5.1. Launching TmmXpress

The *TmmXpress* program can be started simply from the Start Menu:

Start > All Programs > DekTec > TmmXpress

A dialog appears that allows you to specify all parameters, to save and load parameter sets from file, and to start generation of the ISDB-Tmm/T_{SB}/T signal.

5.2. TmmXpress Application Layout



1. Menu Bar

The top area of the *TmmXpress* application contains two menus: File and Help.

2. Tool Bar

This area contains the following commands: New File, Open File, Save File, Close File, Clear, Generate output and Cancel. This area also displays the name of the TmmXpress-settings file.

3. General Parameters

This area allows you to set the general ISDB-Tmm/T_{SB}/T transmission parameters.

4. Frame Information

This area displays the ISDB-Tmm/T_{SB}/T frame information.

5. Output Settings

This area allows you to specify the name, location, size and the format for the generated signals.

6. ISDB-T Settings

This area allows you to specify the number of segments, the parameters per layer and to select the transport-stream source per block of segments.

7. Channel Fading
This area allows you to add noise to the output signal and to specify multiple simulated fading paths. For each path you can specify the channel-simulation parameters.

8. Status Bar
The status bar shows the validity of the ISDB-Tmm/T_{SB}/T parameter set.

6. Walkthrough: Generation of a ISDB-Tmm RF signal

This walkthrough will guide you through the generation of an ISDB-Tmm RF signal.

- Start TmmXpress application
  TmmXpress can be started from the start menu or using the desktop shortcut.
  After start-up all ISDB-T parameters are set to default values.
- Set general ISDB-Tmm parameters
  The sub-channel specifies the sub-channel of the centre segment of the connected ISDB-Tmm segments.
- Select the source and set layer parameters
  For each block of 13- 3- or 1-segments select the transport stream source, double click on the source parameter and select a transport-stream file. If the file has valid TMCC information, these ISDB-T parameters can be used by checking the "Use TMCC info" checkbox; otherwise the layer-mapping has to be specified manually.
  If the TMCC is used, the layer parameters are fixed and cannot be changed.
  To add a transport stream right-click the mouse in parameter area and select: Add TS. Alternatively, the Insert key can be used.
  To remove a complete TS, select the TS then right-click the mouse and select: Remove TS. The shortcut key in this case is Delete.
  To navigate through the layer parameters, use the arrow keys. After selection you can press the Enter key to modify the parameter. When done, press the Enter key for further navigation.
- Set Output Format
  Set the Format to *RF,* thereafter you can specify the output adapter, RF frequency and RF level.
- Check Status Bar
  The status bar should indicate: *Parameter set is valid*. If otherwise, correct the settings.
- Save TmmXpress-Settings
  Optionally save the current TmmXpress settings to file by pressing the save button  in the toolbar, or selecting Save File in the menu bar.
- Generate RF signal

  The generation of the RF signal can be started by pressing the Generate output button  in the toolbar, or selecting Generate output in the menu bar.

  The generation can be stopped by pressing the Cancel generation button  in the toolbar, or selecting Cancel generation in the menu bar.

7. TmmXpress Application GUI

The following sections describe the parameter groups and areas in the GUI of the ***TmmXpress*** application.

7.1. Menu Bar

The menu bar contains two menus:

- File Menu

Submenu	Description
New	Create a new TmmXpress-settings file; Settings are set to default
Open …	Open an existing TmmXpress-settings file
Save	Save the current TmmXpress-settings to file
Save As …	Save the current TmmXpress-settings to file using a different file name
Close	Close the current file
Clear	Clear the current settings. All settings are set to default
Generate output	Start the generation of the ISDB-Tmm/T_{SB}/T signal
Cancel generation	Cancel the generation of the ISDB-Tmm/T_{SB}/T signal

- Help Menu

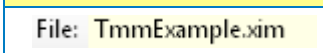
Submenu item	Description
About	Provide information about the current ***TmmXpress*** version

7.2. Tool Bar

- Toolbar buttons

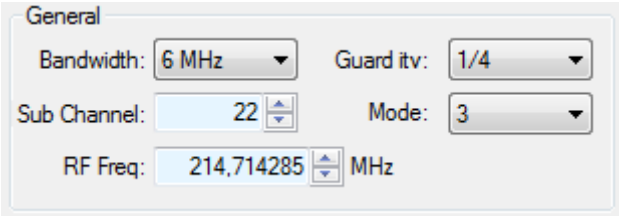
Toolbar button	Description
	Create a new TmmXpress-settings file; Settings are set to default
	Open an existing TmmXpress-settings file
	Save the current TmmXpress-settings to file
	Close the current file
	Clear the current settings; All settings are set to default
	Start the generation of the ISDB-Tmm/T_{SB}/T signal
	Cancel the generation of the ISDB-Tmm/T_{SB}/T signal

- Additional information

Toolbar info	Description
	The name of the current TmmXpress-settings file.
	During the generation of the output file(s) the progress is displayed.

7.3. General Parameters

This group of parameters allows you to specify the general ISDB-Tmm/T_{SB}/T parameters.

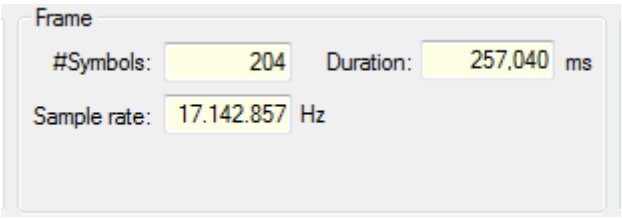


Parameter	Description
Bandwidth	Reference channel bandwidth: 6, 7 or 8 MHz
Sub Channel	Sub-channel number. For ISDB-Tmm this is the centre segment of the connected ISDB-Tmm segments. This implicitly specifies the sub-channel numbers of all 1-segment streams in the signal. The valid range is 0 … 41.
RF Freq	Carrier frequency of the RF signal
Guard itv	Guard Interval length: 1/32, 1/16, 1/8 or 1/4
Mode	Transmission mode: Mode1 (2k), Mode 2 (4k) or Mode 3 (8k)

Note: if one of the sources is using TMCC-information, guard interval and transmission mode are fixed.

7.4. Frame Information

This group shows information on the OFDM-frame structure.



If the ISDB-T parameter set is valid, this area displays the derived frame information.

Parameter	Description
#Symbols	The number of symbols per OFDM-frame
Duration	The duration of one OFDM-frame in milliseconds
Sample rate	The sample rate in Hertz

7.5. Output settings

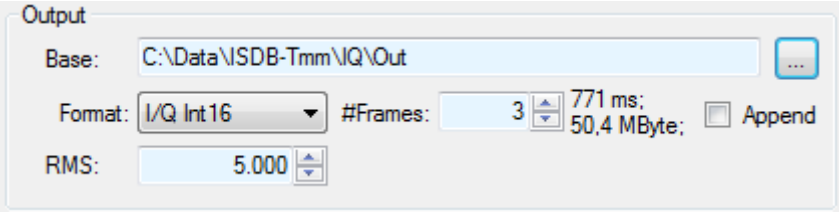
This area allows you to specify the output settings. Dependant on the selected output format, other selection fields are shown in this area.

- Format

Format	Description
I/Q Float32	Pairs of 32-bit floats in I, Q order
I/Q Int16	Pairs of signed 16-bit integers in I, Q order, little Endian: Byte #0: Least-significant byte I Byte #1: Most-significant byte I Byte #2: Least-significant byte Q Byte #3: Most-significant byte Q Etc.
I/Q Text	Text (ASCII)-based format consisting of pairs of four-character hexadecimal values with 0x prefix in I, Q order. The I and Q values are separated by a TAB and I/Q pairs are separated by a linefeed. Example: 0x2b45<TAB>0x1c3f<LF> 0xfeA9<TAB>0x0073<LF>
RF	ISDB-Tmm/T_{SB}/T RF output through the selected modulator port

7.5.1. I/Q Output Settings

In case the output type I/Q samples is selected (I/Q Float32, I/Q Int16 or I/Q Text), this area allows the selection of the location and the base name of the generated I/Q sample file.

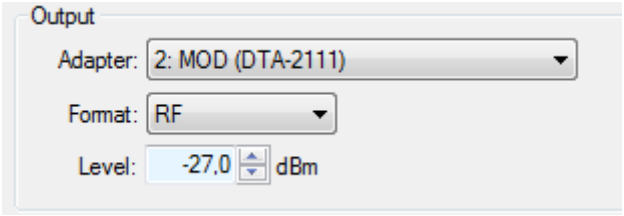


I/Q samples file settings

- #Frames
  The number of OFDM-frames to be generated. The resulting file length and size are displayed.
- Append files
  If not checked, TmmXpress overwrites the previously generated file. If checked, the TmmXpress appends the new generated data to the end of the existing file.
- RMS
  The Root Mean Square (RMS) of the complex samples. This value should be set as large as possible to have the largest SNR, but small enough to avoid saturation. When a DekTec card is used for play-out of the I/Q samples, the value 5000 is a good value.

7.5.2. RF Output settings

In case the output type RF is selected this area allows the selection of the ISDB-Tmm/T_{SB}/T capable modulator card and the RF parameters.



ISDB-Tmm/T_{SB}/T RF output settings

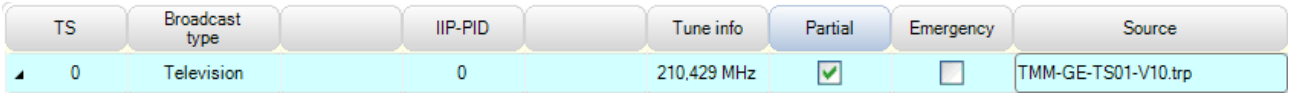
- **Level**
  Level (in dBm) of the output signal.

7.6. TS and Layer Parameters

The ISDB-T parameter tab allows you to specify the transport stream, number of segments and modulation parameters for each block of 13- 3- or 1-segments.

7.6.1. TS ISDB-T Parameters

Each light coloured row specifies the transport stream source and the common ISDB-T parameters of a block of segments.



TS parameter	Description
TS	Displays the TS number
Broadcast type	Broadcast type: Television (13-segments), 1-segments-radio or 3-segments radio
IIP-PID	PID of the IIP
Tune info	Displays the centre frequency of this block of segments
Partial	Partial reception: on or off
Emergency	Emergency: on or off
Source	Displays the selected source. When double clicking on the source, a dialog is opened that allows you to select the source. If the selected transport stream file has valid TMCC information, the modulation parameters and layer mapping can be used by checking the "Use TMCC info" checkbox; otherwise the layer-mapping has to be specified manually. If the TMCC information is used, the layer parameters are fixed and cannot be changed.

To add more TS-es, right-click the mouse in the ISDB-T parameter area and select: *Insert TS*. Alternatively, the Insert key can be used.

To remove a TS, select the TS then right-click the mouse and select: *Remove TS*. The shortcut key in this case is Delete.

To navigate through the TS parameters, use the arrow keys. After selection you can press the Enter key to modify the parameter. When done, press the Enter key for further navigation.

7.6.2. Layer Parameters

Each dark coloured row below the TS parameters specifies the parameters for the hierarchical layers.

Layer	#Segments	Modulation	Code rate	Time Intlv	Rate (bps)
A	1	16 QAM	1/2	I = 4	561.718
B	12	16 QAM	1/2	I = 4	6.740.616
C	0	64 QAM	3/4	I = 2	0

Layer parameter	Description
Layer	Specifies the layer: A, B or C
#Segments	The number of segments for this layer: 0 … 13
Modulation	Modulation type used for this layer: DQPSK, QPSK, 16-QAM or 64-QAM
Code rate	Code rate used for this layer: 1/2, 2/3, 3/4, 5/6 or 7/8
Time Intlv	Time Interleaving length
Rate (bps)	Displays the bitrate

Note: if one of the sources is using TMCC-inform all parameters are fixed.

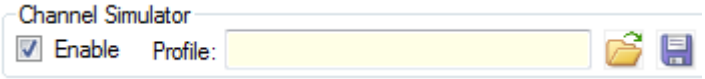
To navigate through the layer parameters, use the arrow keys. After selection you can press the Enter key to modify the parameter. When done, press the Enter key for further navigation.

7.7. Channel Fading

The channel-fading tab allows you to specify the parameters for the channel simulator:
- White noise
- Reflections (multipath echo's)
- Doppler effects because of a moving receiver

7.7.1. Channel Simulator

The Channel-Simulator group contains the overall enable box.

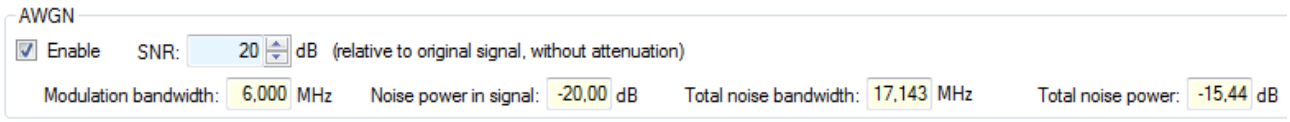


If checked, channel simulation is enabled and noise and fading-path parameters can be specified. If unchecked, no channel simulation is applied.

The File Open button enables you to load a previously saved set of channel-simulation settings. The File Save button allows you to save the current settings.

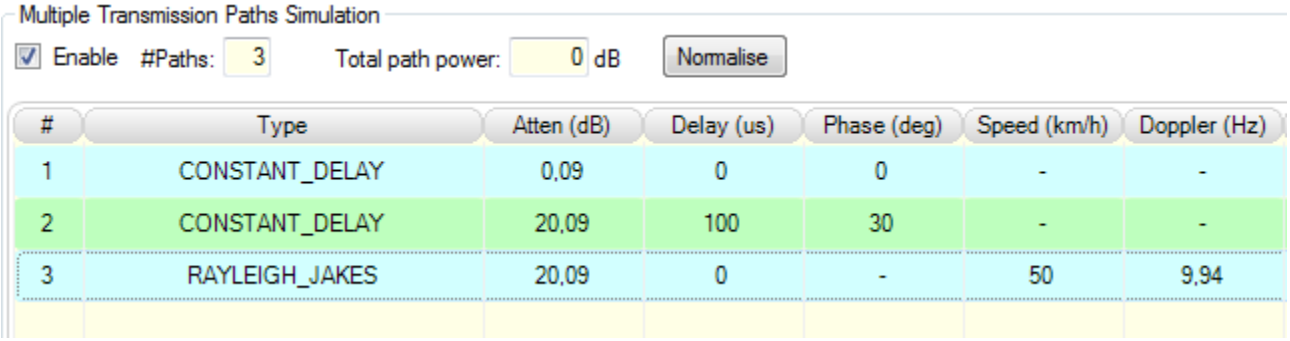
7.7.2. AWGN

The AWGN group enables you to specify parameters for the addition of Gaussian-distributed noise to the I/Q samples. If the Enable box is checked, the Signal-To-Noise ratio relative to the original signal can be specified.



7.7.3. Multiple Transmission Paths Simulation

This group allows you to specify up to 32 transmission paths.



The following parameters can be specified per fading path:

Parameter	Description
Type	Echo Type: Constant Delay, Constant Doppler, Rayleigh fading with Gaussian spectrum or Rayleigh fading with Jakes spectrum
Atten (dB)	Attenuation of the path in dB
Delay (us)	Delay of the path in microseconds
Phase (deg)	Phase shift of the path in degrees. Only for Constant Delay and Constant Doppler path types
Speed (km/h)	Speed of the simulated moving receiver in km per hour. The resulting Doppler frequency in Hz is displayed. Only for Constant Doppler, Rayleigh Jakes and Rayleigh Gaussian path types.

If the Multiple Transmission Paths Simulation is disabled, it acts as a single path without attenuation and without delay. If the Multiple Transmission Paths Simulation is enabled and no paths are defined, it acts as a pure noise generator.

The sum of path power is displayed. The normalize button allows you to normalize the attenuation of the paths such that the total power is 0dB again.

7.8. Status Bar

The Status Bar appears in the lower left corner of the ***TmmXpress*** application. The Status Bar indicates whether the combination of current ISDB-Tmm/T_{SB}/T parameters is valid.