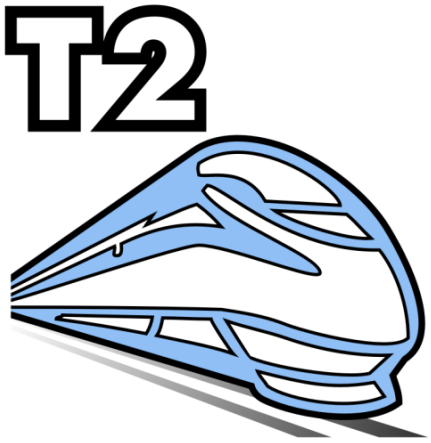
T2Xpress

DVB-T2 Signal Generator



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Revision History

Revision	Date	Changes
V2.7.0.57	2018.05.30	Added PLP-mute option
V2.6.3.56	2017.03.17	Fixed DTA-2115B 8 channel inverted spectrum issue
V2.6.2.55	2016.08.23	Added DTA-2115B support
V2.6.1.54	2016.01.20	Fix for potential crash seen on some PC's
V2.6.0.53	2015.08.12	Added DTU-315 support
V2.5.1.52	2015.02.23	Improved T2-MI time-stamping to reduce buffering Set the O.151 PRBS generator's initial state according the V&V reference streams
V2.5.0.51	2014.07.18	Added support for real-time changing channel fading (SNR and paths) Added support for real-time changing RF-level Fixed T2-MI generation when IL_TYPE=1 Improved error reporting
V2.4.0.50	2014.04.24	Added DTA-2115 support
V2.3.7.49	2013.09.25	Fixed number of leap seconds
V2.3.6.48	2013.03.29	Fixed performance issues Fixed crash after stopping generation Ignores In-band B-flag for T2 version 1.1.1 Improved error reporting
V2.3.2.44	2013.02.21	Added warning when type 1 PLPs are used and number of sub-slices!=1 Fixed T2MI FEF sub-part encoding
V2.3.1.43	2012.06.11	Fixed IQ and T2MI output to file Fixed T2MI output when license is stored on a dongle
V2.3.0.42	2012.05.15	Based on new DTAPI and driver
V2.2.2.40	2011.12.09	Added display of design delay values when Auto is selected Added append-file option for IQ-output Added L1 change counter for IQ-output. Maximum one L1 post FEC block for T2 Lite Updated 'Tdecode' RBM parameter for T2 Lite Allowed bias balancing with V1.3.1 Fixed multi PLP output for T2 Lite profile Fixed T2MI multi profile output Fixed in band signaling type A when P_I > 1 Fixed T2MI output with frame interval > 1 Fixed RBM crash
V2.1.0.37	2011.08.30	Added support for DVB-T2 version 1.3.1 including the T2 Lite profile Added support for multiple component signal generation Added continuity count correction and PCR adaption after TS-file looping Added display of total play out time
V1.10.6.33	2011.04.28	Improved DTU-215 support
V1.10.5.32	2011.02.15	Adapted TS-file input for stream generation according to DVB-T2 V&V Working Group model Fixed noise generation for MISO TX1+TX2 Fixed SDT-Other generation in common PLP Removed .NET 2.0 SP2 dependency

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V1.10.2.28	2011.01.17	Fixed RF-frequency and RF-level
V1.10.1.27	2011.01.10	Fixed 1.7MHz bandwidth
V1.9.3.25	2010.07.08	Added support for PLP stream generation according to DVB-T2 V&V Working Group model. Added Receiver Buffer Model validation option Added option to add dummy AUX streams Fixed Pilot Pattern #8 Fixed continuity count errors in SDT-table Fixed ISCR generation Fixed SYNCD computation Fixed Compensation Delay computation
V1.7.0.17	2010.04.08	Added Transmitter Signature parameters Two independent channel simulation paths for MISO Added Message tab page Added options for PAT, PMT and PCR insertion in T2-MI Reduced de-jitter buffer size requirements when IL-Type 1 is used Fixed PRBS for bias balancing cells Scheduler fixes Fixed TTO rounding in in-band type B signalling
V1.6.0.15	2010.02.26	Added DVB-T2 Version 1.2.1 support Improved PAPR TR algorithm Improved L1 ACE algorithm FEF signal selection fixed
V1.5.0.14	2010.01.25	Name changed into T2Xpress Design delay computation updated Rare L1 BCH error fixed Parameters for PAPR testing added Vclip in PAPR specified in Volt
V1.4.0.12	2009.12.03	Design Delay parameter added “Big-TS” Splitting hanging fixed T2-MI generated file size fixed At least 3 BB-frames with ISSY per IL-frame are created.
V1.3.0.8	2009.10.28	ACE and TR PAPR reduction added T2-MI improvements T2-MI DVB-T2 timestamp support added T2-MI over IP output format added
V1.1.0.6	2009.09.04	“Big-TS” Splitting added T2-MI output format added DVB-T2 RF output format added T2MI over ASI output format added TTO error related to DTG164 fixed L1_POST_INFO_SIZE field of the L1 current packet in T2MI fixed
V1.0.0.4	2009.07.09	First released version

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1. Introduction

The DTC-378 ***T2Xpress*** software package is designed to create DVB-T2 test signals in the form of I/Q sample files, T2-MI files, DVB-T2 RF output and T2-MI over ASI output. ***T2Xpress*** can be installed by the user on any qualifying PC, as specified in section 2.

T2Xpress allows you to set the DVB-T2 parameters, specify the T2-frame structure, PLP parameters and select the PLP sources, add noise, add multiple channel simulation paths and generate the DVB-T2 test signals. Generation of DVB-T2 signals using the T2-base, T2-lite profile and a combination of both profiles are supported.

The I/Q sample file and T2-MI file can be processed by your application or it can be played out through the ***StreamXpress***.

Note: The ***T2Xpress*** functions depend on the installed options, as specified in section 3.

2. Minimum PC Requirements

Platform	Windows 2k3/2k8,Vista,7,8/8.1,10
Processor*	P4@2.0GHz (off-line generation) Core 2, Core i7 (real-time output)
RAM	1 GB

* Or equivalent AMD processor

3. T2Xpress Software Options

The ***T2Xpress*** software requires a valid license to be installed. Without a valid ***DTC-378-T2*** license installed, ***T2Xpress*** will operate in demo mode and is to not enable to generate DVB-T2 signals.

The following options are available:

Option	Description
DTC-378-T2	***T2Xpress***: Enables DVB-T2 T2-MI generation and DVB-T2 RF output ***StreamXpress***: Enables single-PLP (from TS) and T2-MI playout
DTC-371-IQ	Option to enable DVB-T2 I/Q sample generation, Test Point data generation, and playout of I/Q samples through the ***StreamXpress***
DTC-305-CM	Option to enable channel modelling

4. T2Xpress Software Installation

The ***T2Xpress*** software installation and ***T2Xpress*** license installation instructions can be found in the 'DTC-378 T2Xpress Installation' document, which is included in the install package.

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5. T2Xpress Overview

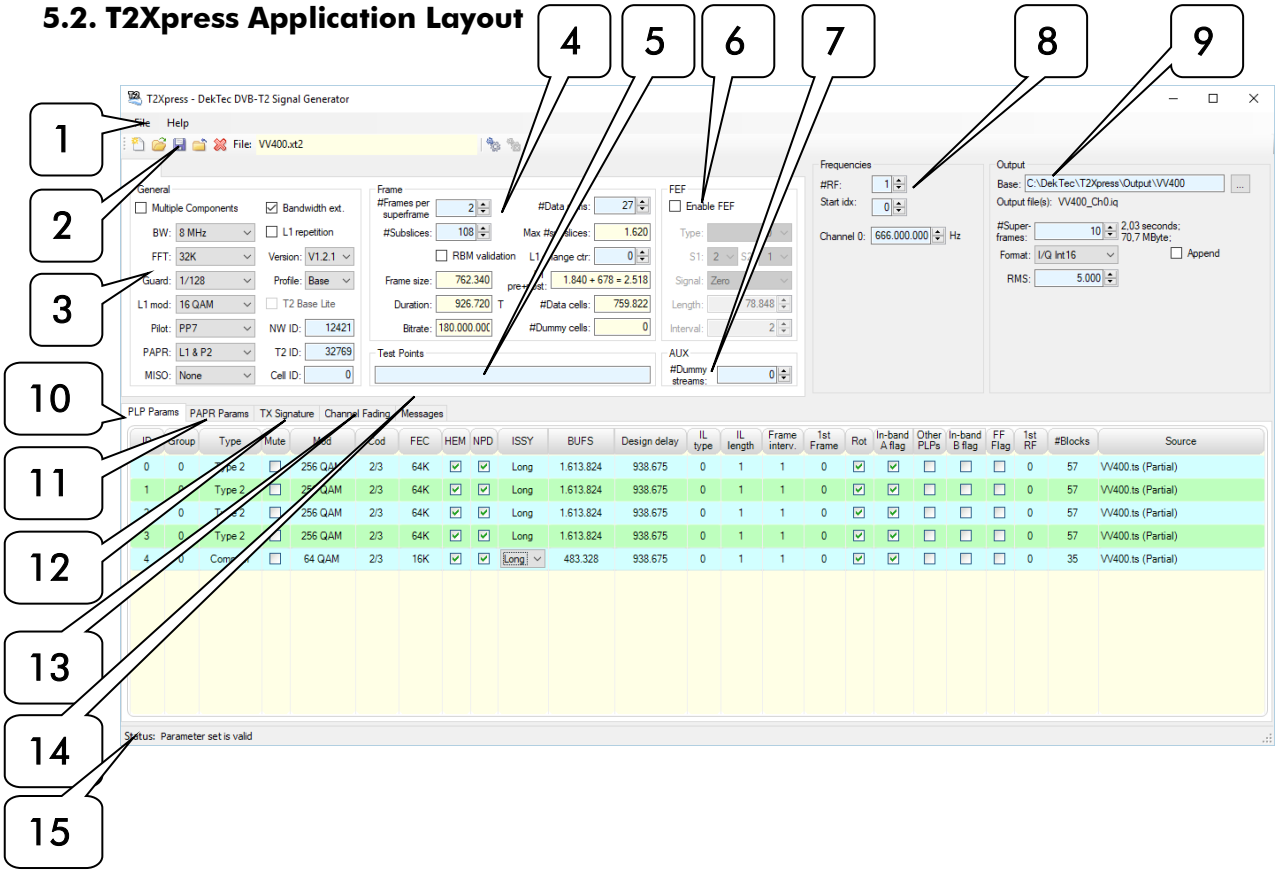
5.1. Launching T2Xpress

The *T2Xpress* program can be started simply from the Start Menu:

Start > All Programs > DekTec > T2Xpress

A dialog appears that allows you to specify all parameters, to save and load parameter sets from file, and to start generation of the DVB-T2 signal.

5.2. T2Xpress Application Layout



1. Menu Bar

The top area of the *T2Xpress* 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 T2Xpress -settings file.

3. General DVB-T2 Parameters

This area allows you to set the general DVB-T2 parameters.

4. Frame Parameters

This area allows you to specify the T2-frame structure. If the DVB-T2 parameter set is valid, it also displays the derived parameters.

5. Test Points

This area allows you to specify the output of test point data files according to the document: "Generating DVB-T2 Reference Streams".

6. FEF Parameters
This area allows you to insert and specify the Future Extension Frame settings.

7. AUX Streams Parameters
This area allows you to insert additional dummy auxiliary streams.

8. Frequencies
This area allows you to set the carrier frequency. In case of Time-Frequency Slicing (TFS) you can set multiple frequencies.

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

10. PLP Parameters
This area allows you to specify the parameters for each PLP and to select the Transport Stream source for each PLP.

11. PAPR Parameters
This area allows you to specify the Peak-to-Average-Power-Ratio (PAPR) reduction parameters.

12. TX Signature
This area allows you to specify the transmitter signature in the FEF part and AUX streams.

13. 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.

14. Messages
In this area interesting events are shown.

15. Status Bar
The status bar shows the validity of the DVB-T2 parameter set.

5.3. Multiple Component Signal Generation

T2Xpress allows the generation of a DVB-T2 signal containing two components, one component using the T2-base profile and another component using the T2-lite profile. Checking the Multiple Component check box enables this option. In case this option is enabled, the T2Xpress user interface allows you to specify for each component:
- General DVB-T2 parameters
- Frame parameters
- Test Points parameters
- FEF parameters,
- AUX Stream parameters
- PLP parameters
- PAPR parameters
- TX Signature parameters

Note that the components have to use the same bandwidth. Multiple component T2-MI output is not yet supported.

6. Walkthrough: Creating a DVB-T2 T2-MI File

This walkthrough will guide you through creating a DVB-T2 T2-MI file.

- **Start T2Xpress application**
  T2Xpress can be started from the start menu or using the desktop shortcut.
  After start-up all DVB-T2 parameters are set to default values.
- **Set general DVB-T2 parameters**
- **Set T2-Frame parameters**
  Only the fields with light-blue background can be set. The other fields are derived from the DVB-T2 parameters and are displayed if the parameter set is valid.
- **Set Future Extension Frames (FEF) parameters (optional)**
- **Set Frequencies**
  Set the carrier frequency of the DVB-T2 RF channel. In case TFS is used, multiple frequencies have to be set.
- **Set PLP Parameters**
  Modify the PLP parameters and optionally add more PLPs.
  To add more PLPs, right-click the mouse in the PLP parameter area and select: Insert PLP. Alternatively, the Insert key can be used.
  To remove a PLP, select the PLP then right-click the mouse and select: Remove PLP. The shortcut key in this case is Delete.
  To navigate through the PLP 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.
  To modify the PLP's source, double click on the PLP's source parameter and select a Transport-Stream file or the O151 PRBS test signal.
- **Check Status Bar**
  The status bar should indicate: *Parameter set is valid*. If otherwise, correct the settings.
- **Set Output File**
  Specify the name, location, size and format of the generated T2-MI file.
- **Save T2Xpress-Settings**
  Optionally save the current T2Xpress settings to file by pressing the save button  in the toolbar, or selecting Save File in the menu bar.
- **Generate T2-MI File**
  The generation of the output file can be started by pressing the Generate output button  in the toolbar, or selecting Generate output in the menu bar.
  After starting, the progress bar shows the percentage of work done. After completion, the result of the generation is displayed.
- **Play-out of T2-MI File**
  The generated T2-MI file can be processed by your application directly or it can be played out through the ***StreamXpress*** with a DTA-115 PCI modulator or DTU-215 USB modulator.
  To use the ***StreamXpress*** for play-out: Start the ***StreamXpress*** application, select an appropriate modulator card, select modulation type *T2MI* and select the file to be played-out.

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7. T2Xpress Application GUI

The following sections describe the parameter groups and areas in the GUI of the *T2Xpress* application.

7.1. Menu Bar

The menu bar contains two menus:

- File Menu

Submenu	Description
New	Create a new T2Xpress-settings file; Settings are set to default
Open …	Open an existing T2Xpress-settings file
Save	Save the current T2Xpress-settings to file
Save As …	Save the current T2Xpress-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 DVB-T2 signal
Cancel generation	Cancel the generation of the DVB-T2 signal

- Help Menu

Submenu item	Description
License Manager	Open the License Manager dialog providing information about the installed licenses and enabling the installation of new licenses
About	Provide information about the current *T2Xpress* version

7.2. Tool Bar

- Toolbar buttons

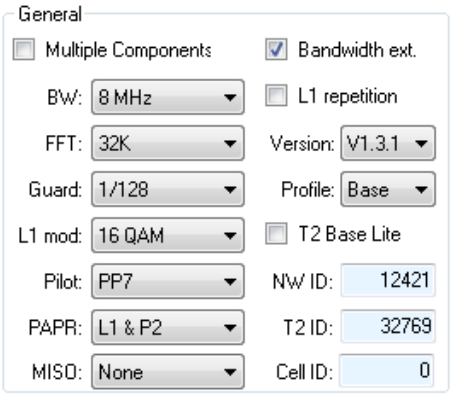
Toolbar button	Description
	Create a new T2Xpress-settings file; Settings are set to default
	Open an existing T2Xpress-settings file
	Save the current T2Xpress-settings to file
	Close the current file
	Clear the current settings; All settings are set to default
	Start the generation of the DVB-T2 signal
	Cancel the generation of the DVB-T2 signal

- Additional information

Toolbar info	Description
File: VV400.xt2	The name of the current T2Xpress-settings file.
65%	During the generation of the output file(s) the progress is displayed.
Time: 00:00:09	During the generation of the RF signals the total time is displayed.

7.3. General DVB-T2 Parameters

This group of parameters allows you to specify the general DVB-T2 parameters.



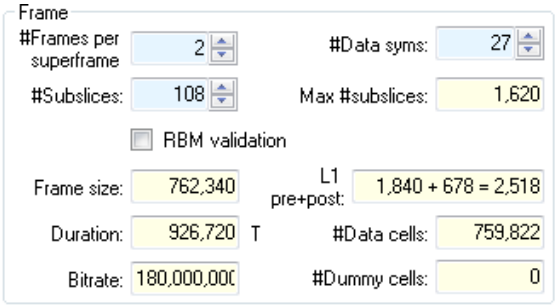
General DVB-T2 parameters

Parameter	Description
Multiple Components	If checked, enables the option to create a DVB-T2 signal containing two components, one component using the T2-base profile and another component using the T2-lite profile; If not checked, a single profile DVB-T2 signal is created.
BW	The bandwidth of the channel: 1.7, 5, 6, 7, 8 or 10 MHz
FFT	FFT mode (or size) in the channel: 1K, 2K, 4K, 8K, 16K or 32K
Guard	Guard Interval: 1/32, 1/16, 1/8, 1/4, 1/128, 19/128 or 19/256
L1 mod	L1 Modulation, the constellation of the L1-post signalling block: BPSK, QPSK, 16-QAM or 64-QAM
Pilot	Pilot Pattern used for the data OFDM symbols: PP1, PP2, PP3, PP4, PP5, PP6, PP7 or PP8
PAPR	The PAPR reduction used: None, ACE only, TR only or both ACE and TR **Note**: In case of I/Q or RF output, PAPR can be applied to the DVB-T2 signal in other cases PAPR is only signalled.
MISO	Multiple Input Single Output mode: None (=SISO), Tx1 only, Tx2 only, the sum of Tx1 and Tx2 or both Tx1 and Tx2 Note that the option "Tx1 and Tx2" is not available for RF output.
Bandwidth ext.	Bandwidth Extension. If checked, the extended carrier mode is used
L1 repetition	L1 Repetition Flag. If checked, L1-post signalling is provided also for the next frame

Version	DVB-T2 version selection: 1.1.1, 1.2.1 or 1.3.1
Profile	DVB-T2 profile selection: Base or Lite
T2 Base Lite	T2 Base Lite flag to indicate that the T2-base profile parameters must be consistent with the T2-lite profile restrictions.
NW ID	Network ID. Uniquely identifies the DVB-T2 network
T2 ID	T2 System ID. Uniquely identifies a T2 system within the DVB-T2 network
Cell ID	Cell ID. Uniquely identifies a geographic cell in a DVB-T2 network

7.4. T2-Frame Parameters

This group of parameters allows you to specify the DVB-T2 frame structure.



DVB-T2 frame related parameters

Parameter	Description
#Frames per superframe	The number of T2-frames in a super frame
#Subslices	The number of sub-slices per T2-frame for each RF channel
#Data syms	The number of data OFDM symbols per T2-frame, excluding P1 and P2
RBM validation	If checked, Receiver Buffer Model (RBM) validation is performed. In case errors are detected, they are reported in the "Messages" tab. Note that RMB validation uses some extra CPU time, therefore it can't be executed real-time for all parameter settings.

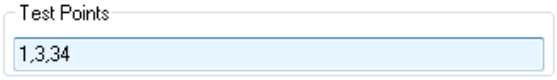
If the DVB-T2 parameter set is valid, this area also displays the derived frame information.

Parameter	Description
Optimum #subslices	The largest allowable sub-slicing value
Frame size	The total number of cells per T2-frame
Duration	The duration of a T2-frame in number of elementary periods
Bitrate	The total Transport Stream bitrate of the PLPs
L1 pre+post	The number of L1 signalling cells in a T2-frame
#Data cells	The number of data cells in a T2-frame
#Dummy cells	The number of dummy cells in a T2-frame

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7.5. Test Points

In case the output type I/Q samples is selected (I/Q Float32, I/Q Int16 or I/Q Text), this area allows you to specify the test point data files to be generated.

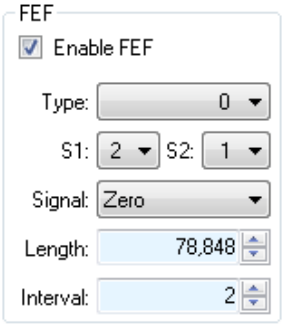


Test Point parameters

The generation of test point data files is according to the document: "Generating DVB-T2 Reference Streams". Test points have to be separated by commas. The following test test points are supported: 1, 3, 4, 6, 8, 9, 11, 12, 15, 16, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 32, 33, 34, 50, 51 and 53.

7.6. FEF Parameters

This group of parameters allows you to specify the insertion of Future Extension Frames (FEFs).



FEF parameters

Parameter	Description
Enable FEF	If checked, Future Extension Frames (FEFs) are inserted; If not checked, no FEFs are inserted and the parameters below have no meaning
Type	Specifies the FEF-type
S1	The S1-field value in the P1 signalling data
S2	The S2-field value in the P1 signalling data
Signal	The generated signal during the FEF period can be Zero or a random test signal made from 1k OFDM transformations of a PRBS signal
Length	FEF-length; the length of a FEF-part in number of samples
Interval	FEF-interval; the number of T2-frames between two FEF-parts

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7.7. AUX Parameters

This group of parameters allows you to specify the insertion of additional auxiliary streams.

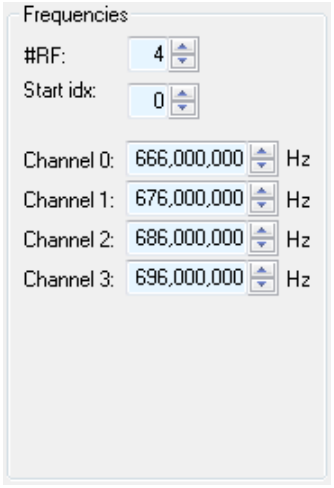


AUX parameter

Parameter	Description
#Dummy streams	The number of additional dummy auxiliary streams inserted.

7.8. Frequencies

This group of parameters allows you to specify the RF channels. Default a T2 system has a single RF channel. For a Time-Frequency Slicing (TFS) system, multiple RF channels can be specified.



TFS parameters

Parameter	Description
#RF	The number of RF channels. In case no TFS is used, this should be set to 1
Start idx	Specifies the index of the starting frequency
Channel 0	The centre frequency of RF channel 0 in Hz
Channel 1	The centre frequency of RF channel 1 in Hz
Channel 2	The centre frequency of RF channel 2 in Hz
Channel 3	The centre frequency of RF channel 3 in Hz
Channel 4	The centre frequency of RF channel 4 in Hz
Channel 5	The centre frequency of RF channel 5 in Hz
Channel 6	The centre frequency of RF channel 6 in Hz

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7.9. Output settings

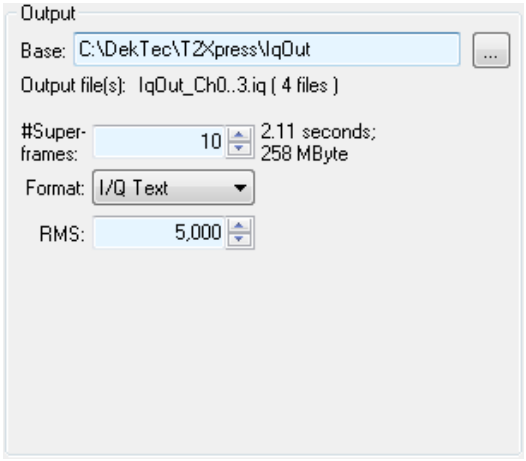
This area allows you to specify the output settings. Dependant on the selected output format, other selection fields are shown in this area.

- 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>
T2MI TS188	T2-MI packets encapsulated into DVB/MPEG Transport Stream packets
T2MI over ASI	T2-MI output through the selected ASI-port
T2MI over IP	T2-MI output through the selected IP-port
RF	DVB-T2 RF output through the selected DVB-T2 modulator port

7.9.1. 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(s). After specifying the base name of the file, ***T2Xpress*** adds suffices to create unique output file names for each RF channel (TFS) and for each Tx channel (MISO).



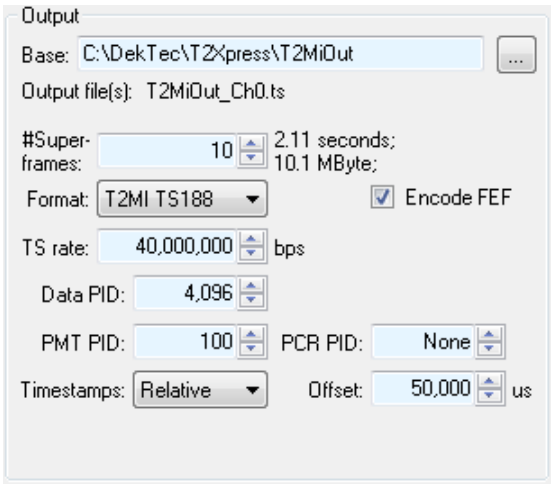
I/Q samples file settings

- #Superframes
  The number of super frames to be generated. The corresponding file length and size are displayed.

- **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.

7.9.2. T2-MI File Output settings

In case the output type T2-MI file is selected (T2MI TS188), this area allows the selection of the location and the base name of the generated T2-MI file. After specifying the base name of the file, *T2Xpress* adds suffices to create unique output files.



T2-MI file settings

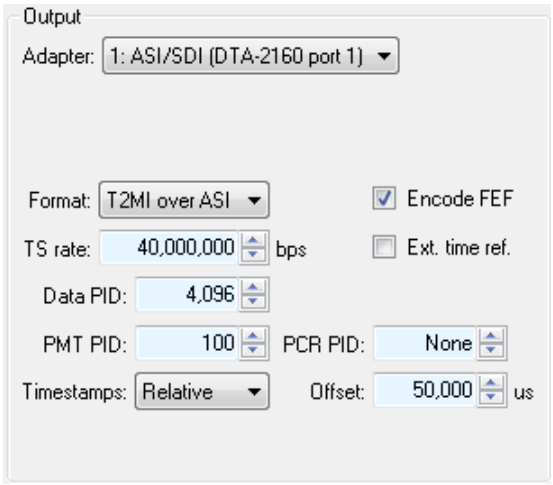
- **#Superframes**
  The number of super frames to be generated. The corresponding file length and size are displayed.
- **Encode FEF**
  If checked outputs a FEF part composite packet with the required subpart; otherwise, only outputs a FEF part NULL packet when FEF is enabled.
- **TS rate**
  The rate of the output Transport Stream. Null packets are added to the stream to keep the rate constant. When VBR (0) is selected, no null packets are added to the stream.
- **Data PID**
  The PID of the Transport Stream packets carrying the T2-MI data.
- **PMT PID**
  The PID of the PMT-table that refers to the T2-MI data stream. If a PMT PID is specified a PAT-table is also added to the stream. If None (-1) is selected, no PAT-table and no PMT-table are added to the stream.
- **PCR PID**
  The PID of Transport-Packets carrying the PCR samples. PCR-samples can be added to the T2-MI stream to make the play-out and modulator synchronisation (bitrate estimation) easier. If None (-1) is selected, no PCR-samples are added to the stream.
- **Timestamps**
  The DVB-T2 timestamps in the T2-MI stream: None, Relative or Absolute.

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- **Offset**
  Time offset added to the DVB-T2 timestamps.

7.9.3. T2-MI over ASI Output settings

In case the output type T2-MI over ASI is selected this area allows the selection of the ASI output adapter and the Transport-Stream parameters.



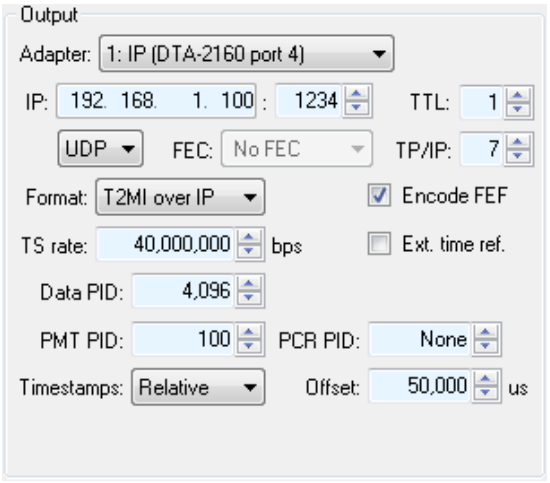
T2-MI over ASI settings

- **Ext. time ref.**
  External time reference clock used; when checked the T2-MI stream is synchronized with the Windows system time.
  Note: In this case Windows system time has to synchronize with the external time reference.
- **Encode FEF**
  If checked outputs a FEF part composite packet with the required subpart; otherwise, only outputs a FEF part NULL packet when FEF is enabled.
- **TS rate**
  The rate of the output Transport Stream.
- **Data PID**
  The PID of the Transport Stream packets carrying the T2-MI data.
- **PMT PID**
  The PID of the PMT-table that refers to the T2-MI data stream. If a PMT PID is specified a PAT-table is also added to the stream. If None (-1) is selected, no PAT-table and no PMT-table are added to the stream.
- **PCR PID**
  The PID of Transport-Packets carrying the PCR samples. PCR-samples can be added to the T2-MI stream to make the play-out and modulator synchronisation (bitrate estimation) easier. If None (-1) is selected, no PCR-samples are added to the stream.
- **Timestamps**
  The DVB-T2 timestamps in the T2-MI stream: None, Relative or Absolute.
- **Offset**
  Time offset added to the DVB-T2 timestamps.

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7.9.4. T2-MI over IP Output settings

In case the output type T2-MI over IP is selected this area allows the selection of the IP output adapter, IP-transmission parameters and the Transport-Stream parameters.



T2-MI over ASI settings

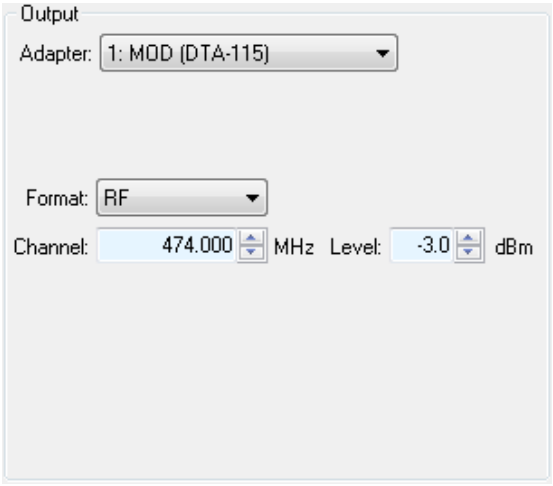
- **IP**
  The IP-address and port number used for transmission.
- **TTL**
  Time-To-Live value used for transmission.
- **Protocol**
  Protocol used for Transmission: UDP or RTP.
- **FEC**
  Error correction mode used.
- **TP/IP**
  Number of Transport Packets (TPs) stored in one IP packet.
- **Encode FEF**
  If checked outputs a FEF part composite packet with the required subpart; otherwise, only outputs a FEF part NULL packet when FEF is enabled.
- **TS rate**
  The rate of the output Transport Stream.
- **Ext. time ref.**
  External time reference clock used; when checked the T2-MI stream is synchronized with the Windows system time.
  Note: In this case Windows system time has to synchronize with the external time reference.
- **Data PID**
  The PID of the Transport Stream packets carrying the T2-MI data.
- **PMT PID**
  The PID of the PMT-table that refers to the T2-MI data stream. If a PMT PID is specified a PAT-table is also added to the stream. If None (-1) is selected, no PAT-table and no PMT-table are added to the stream.

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- **PCR PID**
  The PID of Transport-Packets carrying the PCR samples. PCR-samples can be added to the T2-MI stream to make the play-out and modulator synchronisation (bitrate estimation) easier. If None (-1) is selected, no PCR-samples are added to the stream.
- **Timestamps**
  The DVB-T2 timestamps in the T2-MI stream: None, Relative or Absolute.
- **Offset**
  Time offset added to the DVB-T2 timestamps

7.9.5. RF Output settings

In case the output type DVB-T2 RF is selected this area allows the selection of the DVB-T2 capable modulator card and the RF parameters.



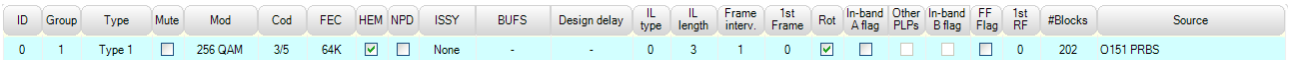
DVB-T2 RF output settings

- **Channel**
  Carrier frequency for the RF signal.
- **Level**
  Level (in dBm) of the output signal.

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7.10. PLP Parameters

Each row specifies the parameters for a PLP.



PLP parameter	Description
ID	Unique identification of a PLP within a T2 system
Group	PLP Group ID. Identifies the PLP group with which the PLP is associated
Mute	Mute the PLP, if check the PLP doesn't contribute to the generated T2-signal
Type	PLP Type: Common PLP, Data PLP Type1 or Data PLP Type 2
Mod	Modulation type used by the PLP: QPSK, 16-QAM, 64-QAM or 256-QAM
Cod	Code rate used by the PLP: 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5 or 5/6
FEC	FEC type used by the PLP: 16K LDPC or 64K LDPC
HEM	High Efficiency Mode / Normal Mode selection. If checked, the PLP uses High Efficiency Mode
NPD	Null Packet Deletion. If checked, the PLP uses Null Packet Deletion
ISSY	Input Stream Synchronization mechanism: None, Long (=3byte) or Short (=2byte) field
BUFS	Maximum size of the requested receiver buffer to compensate for delay variations. This variable uses the ISSY field and therefore it is only enabled if the ISSY field is used
Design delay	Specifies the design delay in units of the elementary period *T*. When the design delay is set to '0', T2Xpress will automatically choose a valid design delay.
IL type	Time IL Type 0: One Interleaving Frame corresponds to one T2-frame 1: One Interleaving Frame is carried in multiple T2-frames
IL length	Time IL Length If the Time IL Type is set to '0', this parameter specifies the number of TI-block per Interleaving Frame If the Time IL Type is set to '1', this parameter specifies the number of T2-frames to which each Interleaving Frame is mapped
Frame interv.	Frame Interval. Specifies the T2-frame interval within the super-frame for the PLP
1st Frame	First Frame IDX. Specifies the index of the first frame of the super-frame in which the PLP occurs
Rot	PLP Rotation. If checked, the PLP uses constellation rotation
In-band A flag	In-Band A Flag. If checked, the PLP carries in-band signalling information
Other PLPs	Other PLPs in the in-band signalling. If checked, all other PLPs are included in the in-band signalling of the PLP. This option is only enabled if the In-Band Flag is checked
In-band B flag	In-Band B Flag. Only used for DVB-T2 version >= version1.2.1

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FF Flag	FF Flag If checked, then the PLP in a TFS system occurs on the same RF channel in each T2 frame. In case TFS is not used or the PLP Type is not Data PLP Type1, this flag has no meaning
1st RF	First RF IDX Specifies on which RF channel the PLP occurs in the first frame of a super-frame in a TFS system. In case TFS is not used or the PLP Type is not Data PLP Type1, this parameter has no meaning
#Blocks	PLP Num Blocks Max. Specifies the maximum number of FEC blocks contained in an Interleaving Frame for the PLP. In case scheduling method Static is selected, all Interleaving Frames contain this number of FEC blocks
Source	Displays the selected source. When double clicking on the source, a dialog is opened that allows you to select the source. See PLP Source Selection.

To add more PLPs, right-click the mouse in the PLP parameter area and select: *Insert PLP*. Alternatively, the Insert key can be used.

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

To navigate through the PLP 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.

7.10.1. PLP Source Selection

Transport Stream bitrate of the PLP can be specified independent on the type of the source.



- PLP bitrate
  Transport Stream bitrate of the PLP. Can be set to zero if no null packet deletion is active.

Dependant on the selected PLP source selection fields are shown in this dialog.

7.10.1.1. 0151 PRBS test signal

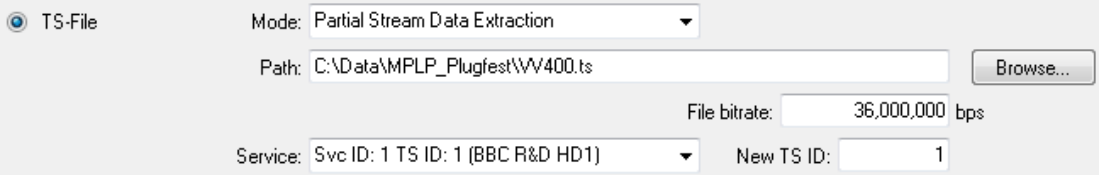
In case O151 PRBS test signal is selected this dialog allows you to specify the PID and null packet insertion.



- PID
  PID value of the data packets
- P
  Number of non-null packets in a sequence
- Q
  Number of null packets in a sequence. If Q==0 null packet insertion is disabled.

7.10.1.2. TS-File

In case TS-File is selected, this dialog allows you to specify the Transport Stream file and optionally to specify "Big-TS" splitting. Three modes of Transport Stream insertion are supported.



- Mode

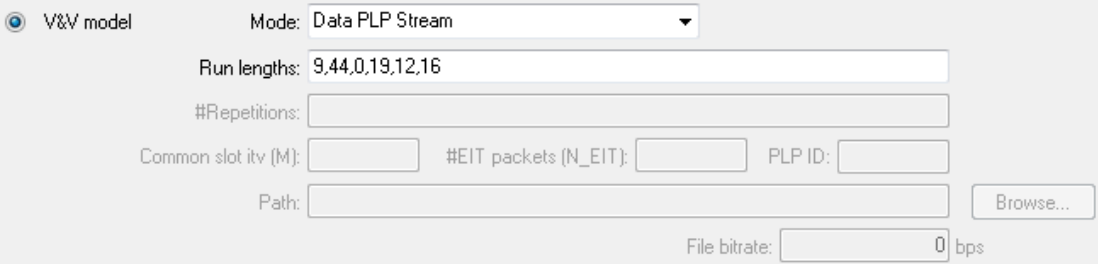
Mode	Description
Complete Stream	The complete contents of the selected Transport Stream file is included in the PLP
Partial Stream Data Extraction	One service from the selected Transport Stream file is extracted from the file and included in the data PLP. The included data comprises the service components, the PAT, the SDT-actual and the PMT-table.
Partial Stream Common Extraction	All common data related to the selected services in the same PLP group is extracted from the Transport Stream file and included in the common PLP. This common data is co-timed with the data in the data PLPs.

- Path
  Path of the selected Transport Stream file
- File bitrate
  If possible the bitrate is estimated automatically; otherwise the bitrate has to be specified.
- Service
  If the Mode is set to 'Partial Stream Data Extraction', this parameter specifies the service that will be extracted from the "Big-TS" and included in the data PLP
- New TS ID
  If the Mode is set to 'Partial Stream Data Extraction', this parameter specifies the Transport Stream ID that will be used in the PAT and SDT tables that are included in the data PLP

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7.10.1.3. V&V model

In case V&V model is selected, the PLP streams are generated according to the DVB-T2 V&V Working Group "Generating DVB-T2 Reference Streams" document. Four modes of stream generation are supported.



- Mode

Mode	Description
Data PLP Stream	Generates a sequence of Transport Stream packets for a data PLP containing a PRBS payload.
Common PLP Stream	Generates a sequence of Transport Stream packets for the common PLP containing a PRBS, SDT and EIT-table payload.
Common PLP with Data Stream (PRBS)	Transport Packets carrying the PRBS are split over the common PLP and selected data PLP. After combining the selected data PLP and common PLP in the receiver it results in one single and complete PRBS stream. This mode deviates a little from the V&V Working Group generation model it enables BER measurement of the combined streams.
Common PLP with Data Stream (TS-File)	Transport Packets carrying the TS-file contents are split over the common PLP and selected data PLP. If necessary stuffing packets are generated on PID 0x1FFE. After combining the selected data PLP and common PLP in the receiver it results in one single and complete Transport Stream again. This mode enables visual validation of the combined streams.

- Run lengths
  If the Mode is set to 'Data PLP Stream', this parameter specifies the number of packets that are generated when it is this PLP's turn. Each PLP in the group gets its turn. Within one chapter this pattern is repeated a number of times. The length of the runs within the chapters is separated by commas.
- #Repetitions
  This parameter is common for all PLPs in the group. Therefore it is only specified in the common PLP. This parameter specifies the number of repetitions within a chapter. The number of repetitions is separated by commas.
- Common Slot itv
  Interval between common PLP packets

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- **#EIT packets**
  If the Mode is set to 'Common PLP Stream', this parameter specifies the number of successive packets in the common PLP carrying EIT packets for a given PLP.
- **PLP ID**
  If the Mode is set to 'Common PLP with Data Stream', this parameter specifies from which data PLP the PRBS will be included in the common PLP.
- **Path**
  Path of the selected Transport Stream file
- **File bitrate**
  If possible the bitrate is estimated automatically; otherwise the bitrate has to be specified.

7.11. PAPR Reduction Parameters

If PAPR is used in combination with I/Q or RF output, the PAPR-parameter tab allows you to specify the parameters for the two peak-to-average power ratio reduction techniques:
- Active Constellation Extension technique (ACE),
- Tone Reservation technique (TR).

Note that not all PAPR-reduction parameter settings can be performed real-time.

7.11.1. PAPR ACE

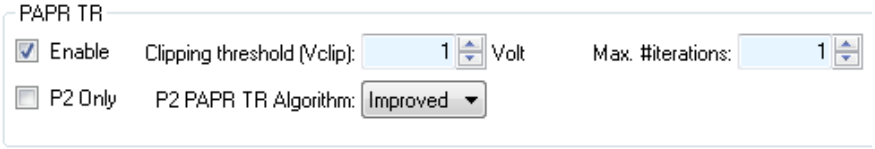
The PARP-ACE group enables you to specify the parameters for the Active Constellation Extension technique. If the Enable box is checked, the clipping threshold, gain, limit and interpolation factor can be specified.



PAPR ACE settings

7.11.2. PAPR TR

The PARP-TR group enables you to specify the parameters for the Tone Reservation technique. If the Enable box is checked, the clipping threshold and the maximum number of iterations, and the algorithm can be specified. The P2Only checkbox allows you to specify to apply PAPR TR only on the P2 symbol regardless if PAPR is signalled in the L1 information.



PAPR TR settings

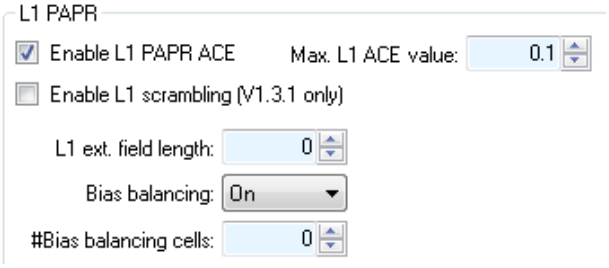
7.11.3. L1 PAPR

The L1 PAPR group allows you to enable features for P2 PAPR reduction. These features are available when DVB-T2 version V1.2.1 or V1.3.1 is selected. Available features:

- L1 specific ACE PAPR reduction including a parameter for specifying the maximum constellation extension value.
- L1 post scrambling, only is available when V1.3.1 is selected.

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- Bias balancing to enable the filling of the L1 reserved field and L1 extension field to reduce the P2 PAPR.
- Number of bias balancing cells added after the L1 data cells to reduce the P2 PAPR. Select 0 cells to disable this feature.



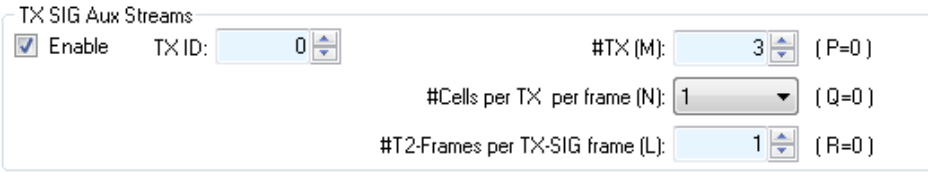
L1 PAPR settings

7.12. TX Signature

This area allows you to specify the transmitter signature. The transmitter signature can be transmitted by using auxiliary streams or through the FEF parts.

7.12.1. TX Signature in Auxiliary Streams

The TX SIG Aux Streams group allows you to specify the transmitter signature, using auxiliary streams.



Transmitter signature using auxiliary streams settings

If the Enable box is checked, the transmitter signature using auxiliary streams is enabled and the signature information can be specified.

- TX ID
  Transmitter identification.
- #TX(M)
  The number of transmitters to be signaled
- #Cells per TX per frame (N)
  The actual number of cells in the auxiliary stream per transmitter and frame.
- #T2-Frames per TX-SIG frame (L)
  The number of T2 frames per TX-SIG frame.

7.12.2. TX Signature in the FEF part

The TX SIG FEF group allows you to specify the transmitter signature, using the FEF part.



Transmitter signature using the FEF part settings

If the Enable box is checked, the transmitter signature using the FEF part is enabled and the signature information can be specified.

- ID1
  Identification sent during the first signature period
- ID2
  Identification sent during the second signature period

7.13. Channel Fading

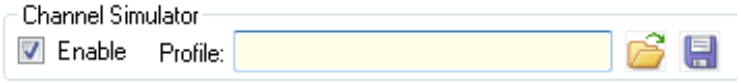
The channel-fading tab allows you to specify the parameters for the channel simulator:
- White noise
- Reflections (multipath echo's)
- Doppler effects because of a moving receiver

If MISO is used, the number of channel-simulation parameter sets you can specify depends on the selected MISO mode:
- For modes Tx1 and Tx2, the parameters for a single fading path can be set
- If "Both Tx1 and Tx2" or "Tx1+Tx2" is specified, two independent parameter sets can be specified: One for Tx1, the other for Tx2

Note: If the mode "Tx1+Tx2" is selected, only one AWGN noise source can be specified, that is added to the summed signal.

7.13.1. Channel Simulator

The Channel-Simulator group contains the overall enable box.

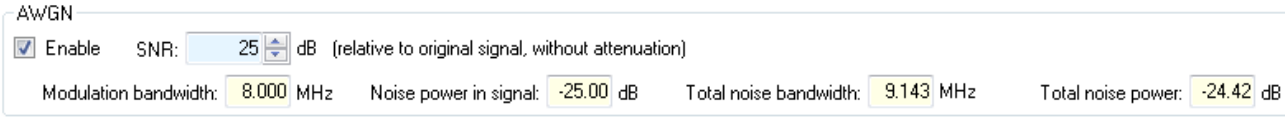


If checked, channel simulation is enabled and noise and fading-path parameters can be specified. If unchecked, no channel simulation is applied.

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.

7.13.2. AWGN

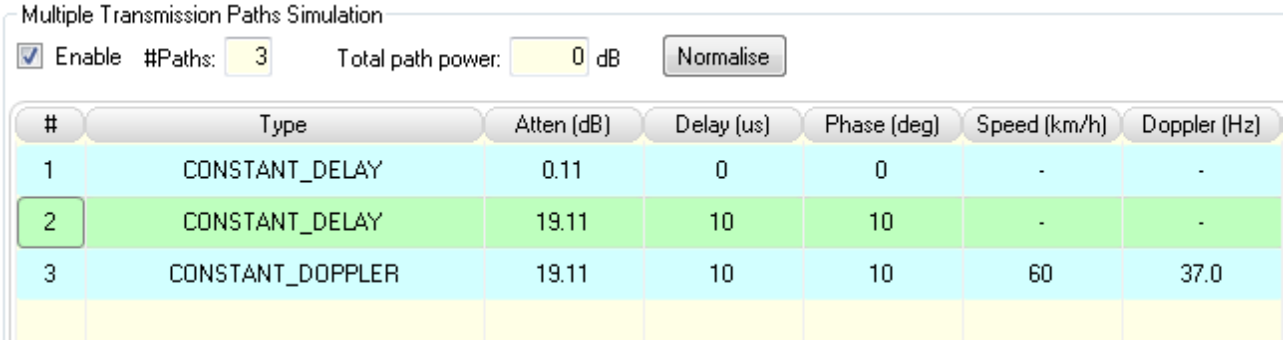
The AWGN group enables you to specify parameters for the addition of Gaussian-distributed noise to the I/Q samples. If the Enable box is checked, the Signal-To-Noise ratio relative to the original signal can be specified.



AWGN parameters

7.13.3. Multiple Transmission Paths Simulation

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



Transmission paths simulation parameters

The following parameters can be specified per fading path:

PLP 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.

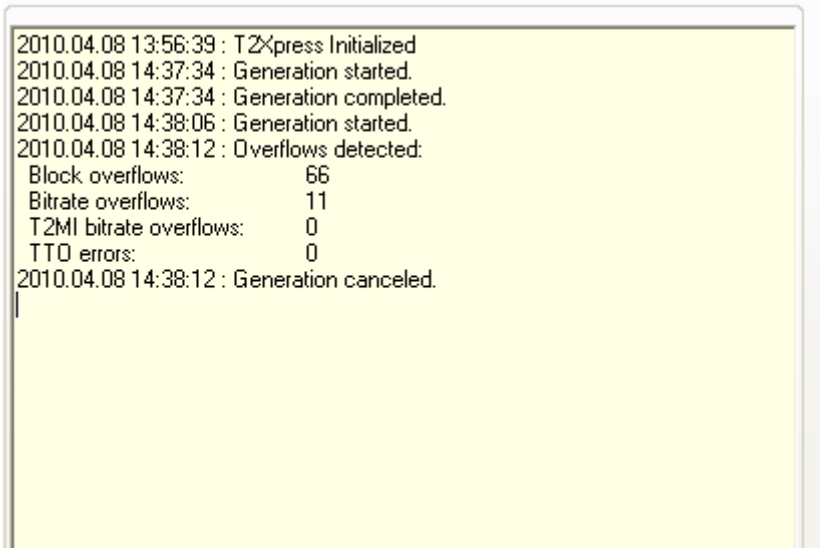
If the Multiple Transmission Paths Simulation is disabled, it acts as a single path without attenuation and without delay. If the Multiple Transmission Paths Simulation is enabled and no paths are defined, it acts as a pure noise generator.

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.

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7.14. Messages

The message tab page displays interesting events and errors that occurred during the generation of the DVB-T2 signal.



T2Xpress Messages

7.15. Status Bar

The Status Bar appears in the lower left corner of the ***T2Xpress*** application. The Status Bar indicates whether the combination of current DVB-T2 parameters is valid.

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