Application Note

DTA-2137 – Retrieving Baseband Frames

1. Overview

The DTA-2137 is a DVB-S2 receiver card for PCI Express that can receive a Transport Stream from an L-Band modulated DVB-S2 signal. Starting from firmware version v2, the DTA-2137 also supports DVB-S2 baseband frames (BBFRAMEs). This application note explains three different ways in which you can use the DTA-2137 for receiving and processing BBFRAMEs.

If your DTA-2137 still has firmware version v1, you can freely upgrade to firmware version v2. Please refer to §3 for upgrading instructions.

1.1. Reading BBFRAMEs with DTAPI

The first method to receive BBFRAMEs is using DTAPI with a custom application. See Figure 1 below.

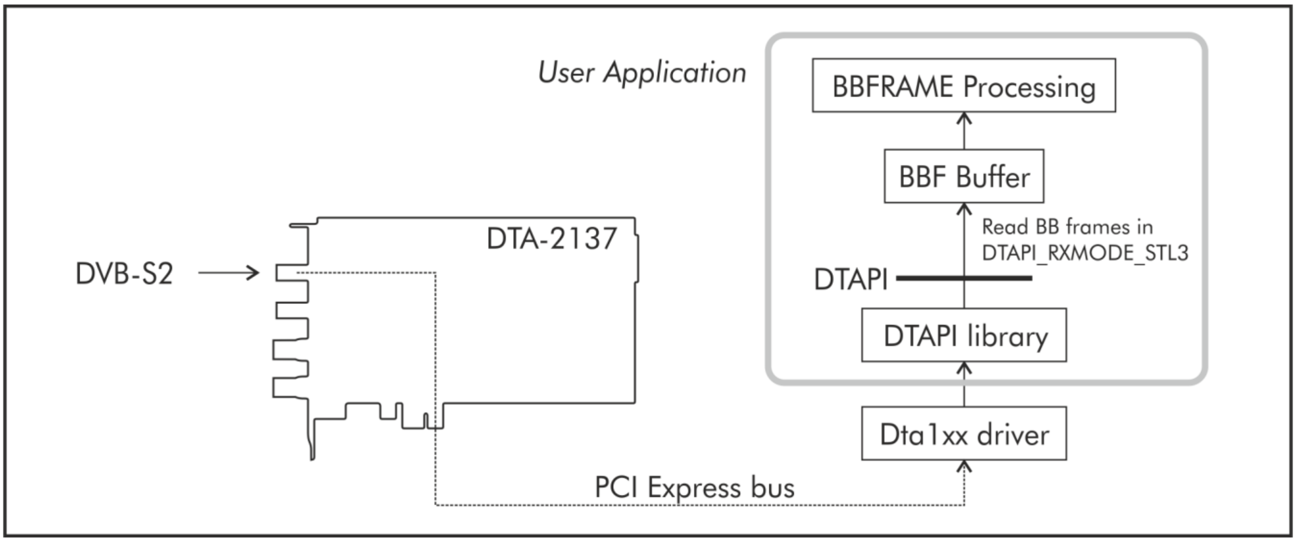


Figure 1 - Retrieving BBFRAMEs with DTAPI

The custom application ("User Application" in Figure 1) opens an input channel and uses **`DtInpChannel::SetRxMode`** to select receive mode **`DTAPI_RXMODE_STL3`**. This instructs the DTAPI to wrap the received BBFRAMEs in an L.3 frame. When **`DtInpChannel::Read`** is called, the L.3 frames are stored in a user buffer ("BBF Buffer" in Figure 1). The format of an L.3 frame is described in §4.

Figure 1 shows the retrieval of BBFRAMEs from port 1 of the DTA-2137. The same method can be used for reception of BBFRAMEs through port 2.

1.2. Looping BBFRAMEs to the ASI Output Ports

The second method to obtain BBFRAMEs from the DTA-2137 is looping the demodulated DVB-S2 signal in hardware to either of the DVB-ASI ports, as shown in Figure 2.

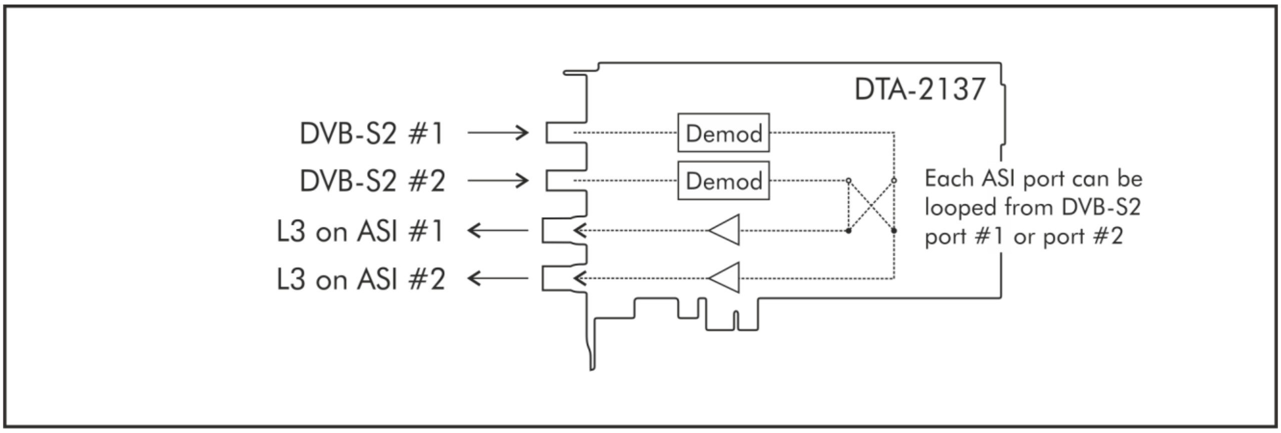
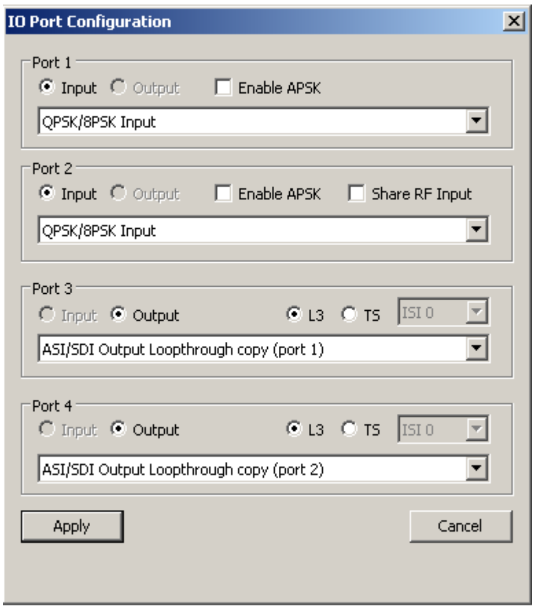


Figure 2 – Looping through BBFRAMEs to the ASI output ports

The BBFRAMEs are wrapped in L.3 frames (§4), and transmitted on the ASI outputs. Output #1 and output #2 can both be looped from either DVB-S2 input #1 or #2. It is possible to loop input #1 to both ASI output #1 and ASI output #2, so that both ASI outputs carry the same signal.

The DTA-2137 can be configured this way with DekTec's configuration utility DtInfo (download from http://www.dektec.com/Downloads/Utilities.asp). Use the 'Change' button to get the I/O Port Configuration window.



IO Port Configuration

Port 1
● Input ○ Output □ Enable APSK
QPSK/8PSK Input

Port 2
● Input ○ Output □ Enable APSK □ Share RF Input
QPSK/8PSK Input

Port 3
○ Input ● Output ● L3 ○ TS ISI 0
ASI/SDI Output Loopthrough copy (port 1)

Port 4
○ Input ● Output ● L3 ○ TS ISI 0
ASI/SDI Output Loopthrough copy (port 2)

Figure 3 – Configuring the ASI outputs for looping through BBFRAMEs

The 'ASI/SDI Output Loopthrough copy (port 1)' setting, in combination with the 'L3' radio button, lets the hardware loopthrough L.3 frames to the ASI output.

1.3. Extracting Transport Streams from BBFRAMEs

An additional hardware feature supported by the DTA-2137 is extracting a Transport Stream from the BBFRAMEs based on ISI, and transmitting the extracted TS to the DVB-ASI ports. See Figure 4.

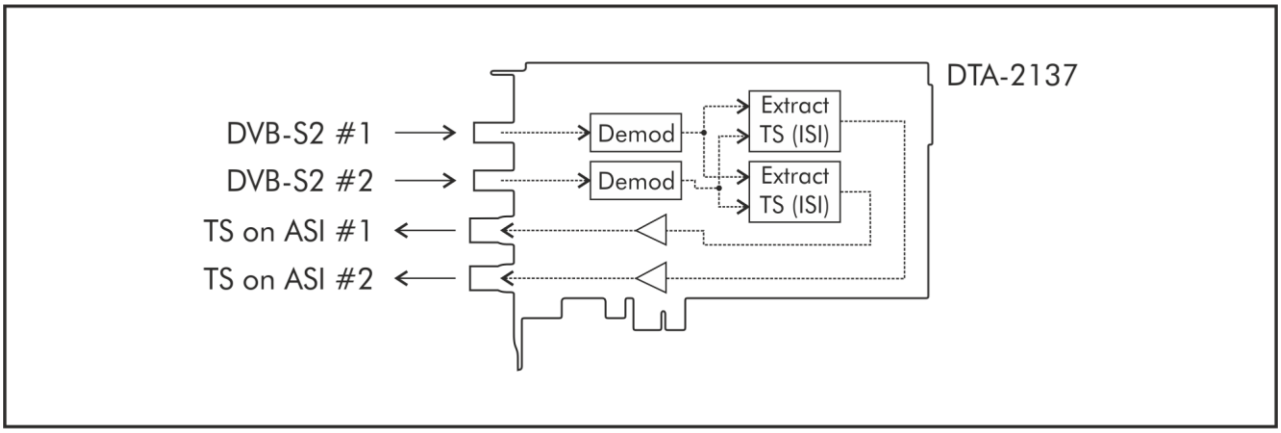
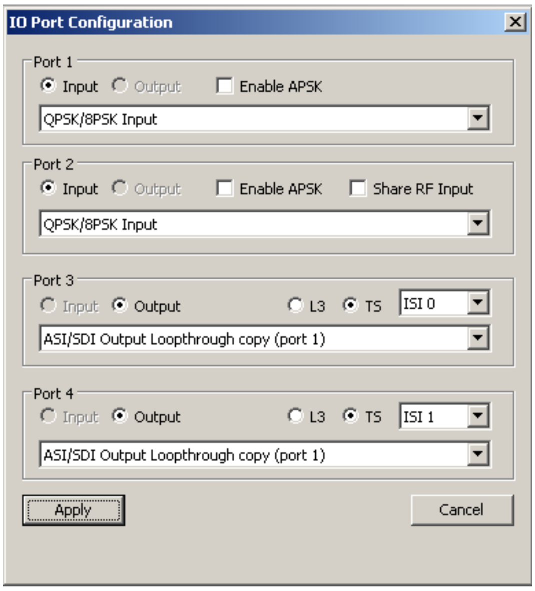


Figure 4 – Extracting a specific Transport Stream BBF to the ASI output ports

This mode can be selected using DtInfo, as shown in Figure 5



IO Port Configuration

Port 1
● Input ○ Output □ Enable APSK
QPSK/8PSK Input

Port 2
● Input ○ Output □ Enable APSK □ Share RF Input
QPSK/8PSK Input

Port 3
○ Input ● Output ○ L3 ● TS ISI 0
ASI/SDI Output Loopthrough copy (port 1)

Port 4
○ Input ● Output ○ L3 ● TS ISI 1
ASI/SDI Output Loopthrough copy (port 1)

Figure 5 - Configuring the ASI outputs for extracting Transport Streams from BBFRAMEs

This time, the ‘TS’ radio button must be selected. The ISI combobox has to be set to the requested ISI value.

2. Recording L.3 Baseband Frames with DtRecord

DtRecord, the open-source stream recording application included in DekTec's SDK, is extended with options to record BBFRAMEs encapsulated in L.3 frames. Two modes are supported:

(1) Standard recording of L.3 frames, using command-line option **`-m STL3`**;

(2) Recording of L.3 frames with a timestamp preceding each L.3 frame. In this case, command-line option **`-m STL3TS`** has to be used.

Below you find two command line examples for recording BBFRAMEs with DtRecord:

Without timestamps from DVB-S2 input #1:

```
DtRecord DVBS2.ts -t 2137 -i 1 -mt DVBS2 -mf 950 -m STL3
```

With timestamps from DVB-S2 input #2:

```
DtRecord DVBS2.ts -t 2137 -i 2 -mt DVBS2 -mf 950 -m STL3TS
```

3. Upgrading the Firmware of your DTA-2137

The DTA-2137 supports reception of BBFRAMEs starting from firmware version 2. If your DTA-2137 is loaded with firmware v1, you can easily upgrade to the latest firmware version using the following steps on a Windows PC:

1. Download the latest version of DtInfo from the DekTec website; (http://www.dektec.com/Downloads/Utilities.asp)
2. Install DtInfo, including the latest Dta1xx device driver and DTAPI Service;
3. Launch DtInfo and upgrade the firmware of your DTA-2137 by clicking on the Upgrade button;
4. Shutdown your computer, wait at least 5 seconds and turn on your computer again;

If you want to write a custom application that processes BBFRAMEs:

5. Download the latest version of the Windows or Linux SDK from the DekTec website; (http://www.dektec.com/Downloads/Drivers.asp)
6. Compile your application with the latest version of the DTAPI.

4. L.3 Frame Format

An L.3 frame contains the following fields:

Table 1 - L.3 frame format

Syntax	**#bits**	**Mnemonic**
L3_frame() {		
if (timestamp_flag) {		
TimeStamp[7..0]	**8**	**uimsbf**
TimeStamp[15..8]	**8**	**uimsbf**
TimeStamp[23..16]	**8**	**uimsbf**
TimeStamp[31..24]	**8**	**uimsbf**
}		
if (firmware_version < 7) {		
FrameId	**8**	**uimsbf**
}		
L3Sync	**8**	**uimsbf**
AcmCommand	**8**	**uimsbf**
CNI	**8**	**uimsbf**
PlFrameId	**8**	**uimsbf**
BBHEADER() {		
MaType1	**8**	**uimsbf**
MaType2	**8**	**uimsbf**
Upl	**16**	**uimsbf**
Dfl	**16**	**uimsbf**
Sync	**8**	**uimsbf**
SyncD	**16**	**uimsbf**
Crc8	**8**	**uimsbf**
}		
for (i=0; i<n; i++)		
PayloadByte	**8**	**uimsbf**
}		

Notes:

- The `Timestamp` field is not present when looping-through L.3 Baseband frames to the ASI output port(s).
- Dummy frames are deleted by the firmware.

`TimeStamp`

The timestamp is a 32-bit field that indicates the value of the system reference clock at the moment the first byte of the payload enters the input channel.

`FrameId`

This field is only included in firmware version 0 to 6. Starting from firmware version 7 the field is dropped to be bit-for-bit compatible with the L.3 format. `FrameId` is a modulo-256 frame counter generated by the firmware. The counter is incremented for each received baseband frame.

`L3Sync`

BBFRAME synchronisation word: fixed value 0xB8.

AcmCommand

Received **MODCOD** and frame type:
Bit 7..3 **MODCOD** (refer to table 2 of this document)
Bit 2..1 **TYPE**
Bit 0 Not used (set to 0)
Please note that dummy frames (**MODCOD**=0) are deleted by the firmware.

CNI (SNR)

8-Bit Carrier-to-Noise plus interference ratio.
Computed over all received data bytes, updated every 50ms.
Resolution: 0.125 dB/LSB
Range: -1.0 … 30.75 dB

Coding:

Value	Meaning
0x00	Receiver unlocked, CNI not available
0x01	-1.0 dB
0x02	-0.875 dB
...	…
0xFE	30.625 dB
0xFF	≥ 30.75 dB

PlFrameId

Modulo-256 frame counter generated by the demodulator.
The counter is incremented for each baseband frame detected by the demodulator.

BBHEADER()

The DVB-S2 BBHEADER. Refer to the DVB-S2 specification.

MaType1, MaType2

Describe the input stream format, the type of Mode Adaptation and the transmission roll off.

Upl

User Packet Length in bits, in the range 0…65535.

Dfl

Data Field Length in bits, in the range 0…58112.

Sync

Copy of the User Packet Sync-byte (e.g. 0x47 for MPEG2 Transport Stream packets)

SyncD

Distance in bits from the beginning of the DATA FIELD and the first UP from this frame (first bit of the CRC-8).

Crc8

Error detection code applied to the first 9 bytes of the BBHEADER.

PayloadByte

The baseband frame payload bytes.

5. SetIoConfig and GetIoConfig

The DTAPI **SetIoConfig** and **GetIoConig** methods are updated in order to configure the ASI loop-though mode. The new functionality of **SetIoConfig** is explained below. The same parameters apply to the **GetIoConfig** method.

```
DTAPI_RESULT DtDevice::SetIoConfig (
  [in] int   Port,            // Physical port number
  [in] int   ConfigCode       // Config code
  [in] int   IoConfig         // DTAPI_IOCONFIG_XXX
  [in] __int64   ParXtra      // Optional extra configuration parameter
);
```

Parameters

Port

Physical port number.

ConfigCode

Value	Meaning
DTAPI_IOCONFIG_S2LOOPMODE	L.3 or TS loop-through copy of another port.

IoConfig

Configuration options for S2 Loopmode

Value	Meaning
DTAPI_S2LOOPMODE_TS	Loop though a specific MPEG2 Transport Stream.
DTAPI_S2LOOPMODE_L3	Loop through L.3 baseband frames.

ParXtra

ISI, the Input Stream Identifier (e.g. Transport Stream). The valid range is 0…255.

Result

Added DTAPI result codes for **SetIoConfig** and **GetIoConfig**:

DTAPI_RESULT	Meaning
DTAPI_E_INVALID_PARS	*IoConfig* is not set to either **DTAPI_S2LOOPMODE_TS** or **DTAPI_S2LOOPMODE_L3**.
DTAPI_E_NOT_SUPPORTED	The method is applied to either another device rather than a DTA-2137 or an invalid port number is given
DTAPI_E_FIRMW_INCOMP	The firmware is incompatible with the requested configuration, please upgrade the firmware
DTAPI_E_SERVICE_INCOMP	The DTAPI service needs to be updated
DTAPI_E_INVALID_MODE	The I/O configuration of the corresponding ASI port is not in loop-though mode
DTAPI_E_INVALID_ISI	An invalid ISI is given. The valid range is 0…255.

6. MODCOD

In DVB-S2, **`MODCOD`** identifies the code rate and the Viterbi code rate according to Table 2.

Table 2 - L.3 MODCOD values

MC	Mode	MC	Mode	MC	Mode	MC	Mode
`0x00`	Dummy frame	`0x08`	QPSK 4/5	`0x10`	8PSK 8/9	`0x18`	32APSK 3/4
`0x01`	QPSK 1/4	`0x09`	QPSK 5/6	`0x11`	8PSK 9/10	`0x19`	32APSK 4/5
`0x02`	QPSK 1/3	`0x0A`	QPSK 8/9	`0x12`	16APSK 2/3	`0x1A`	32APSK 5/6
`0x03`	QPSK 2/5	`0x0B`	QPSK 9/10	`0x13`	16APSK 3/4	`0x1B`	32APSK 8/9
`0x04`	QPSK 1/2	`0x0C`	8PSK 3/5	`0x14`	16APSK 4/5	`0x1C`	32APSK 9/10
`0x05`	QPSK 3/5	`0x0D`	8PSK 2/3	`0x15`	16APSK 5/6	`0x1D`	Reserved
`0x06`	QPSK 2/3	`0x0E`	8PSK 3/4	`0x16`	16APSK 8/9	`0x1E`	Reserved
`0x07`	QPSK 3/4	`0x0F`	8PSK 5/6	`0x17`	16APSK 9/10	`0x1F`	Reserved

Please note that the DTA-2137 firmware deletes dummy frames (**`MODCOD`**=**`0x00`**).