Application Note DT-AN-CID-1

DVB-CID Decoding with the DTU-331

11 September 2023

Summary

This application note serves as a guide for decoding DVB-CID signals using DekTec's DTU-331 RF Probe and StreamXpert Analyzer software. As satellite communications grow more congested, DVB-CID helps mitigate interference by uniquely identifying carriers. The note covers essential system requirements and offers a step-by-step guide for signal detection, decoding, and troubleshooting.

1. Introduction to DVB-CID

DVB-CID (Digital Video Broadcasting - Carrier ID) is an advanced technology designed specifically for satellite communication systems. Its primary objective is to address the challenges of interference caused by overlapping satellite signals. By introducing a unique identifier for each carrier, DVB-CID enables operators to efficiently track and manage satellite transmissions. As the number of deployed satellites and services continues to grow, the need for accurate carrier identification has become vital. DVB-CID effectively resolves this concern by embedding a distinct identification code within the satellite signal. This code enables seamless tracking and facilitates interference management.

To avoid interference with the primary DVB-S/S2 signal, the DVB-CID signal is strategically placed at a level far below it, utilizing spread spectrum techniques. As a result, the signal is essentially embedded within the noise floor. To reliably detect it, advanced signal search algorithms are required. Given their computational demands, it's imperative that the host PC meets specific minimum hardware requirements.

The DVB-CID standard is particularly sensitive to phase noise. Within a satellite link, the LNB (Low Noise Block) is often the primary source of phase noise. As a result, choosing an LNB with excellent phase noise performance is crucial for the accurate decoding of DVB-CID signals.

2. Introduction to the DTU-331 RF Probe

The DTU-331 is a USB-3 powered SDR receiver from DekTec, designed for measurements of cable, terrestrial, and satellite signals. It features dual tuners and a frequency range of 42 to 3,220MHz. It is capable of receiving signals with a narrow bandwidth in the L band. Due to these characteristics, the DTU-331 is the only DekTec product that can decode DVB-CID.

3. Hardware and Software for Reliable DVB-CID Decoding

Given the complexities of DVB-CID decoding discussed in the previous section, using well-specified hardware and software components is essential for achieving reliable decoding results.

Hardware and software components:

CPU	Intel Core i7-9xxx *Note*: The CPU must meet or exceed the specifications of an Core i7-9xxx to handle the computational demands of DVB-CID decoding.
LNB	Ultra-low phase noise is critical for reliable DVB-CID decoding. The following LNB is recommended: WDL Dual output PLL LNB – Ku-Band *Manufacturer*: SMW (Swedish Microwave AB) *SKU*: WDL-PLL ULP type B N Product Link
DTU-331 RF Probe	DekTec's SDR receiver with dual tuners, covering 42 to 3,220MHz. *Note*: This the only DekTec product capable of decoding DVB-CID.
StreamXpert	DekTec's industry-standard stream analyzer. *Note*: Recently extended with support for DVB-CID decoding.

These components have been validated by DekTec and have demonstrated their effectiveness in providing reliable DVB-CID decoding.

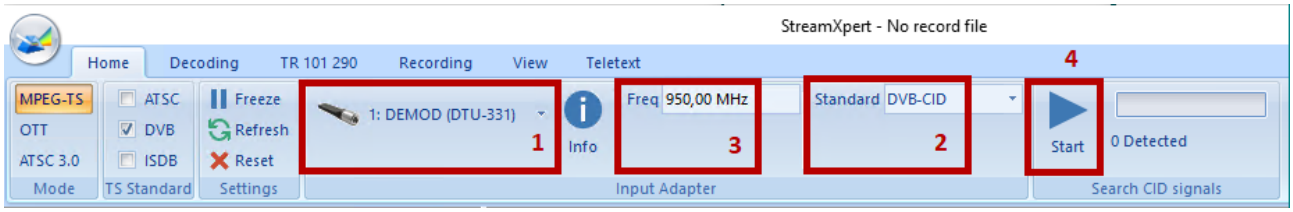
4. Step-by-Step Guide: Setting Up and Analyzing DVB-CID Signals

4.1. Starting Signal Detection

To begin DVB-CID signal detection, follow these steps:

1. Open the adapter list and select the DTU-331 device.
2. Choose DVB-CID from the drop-down menu as the desired decoding standard.
3. In the "Freq" field, enter the frequency for the DVB-CID signal.
4. Click the "Start" button to launch the detection process.

Note: The algorithm will search for the DVB-CID signal within a range of+/- 100kHz around the specified frequency. The progress of the detection process will be indicated by the progress bar.

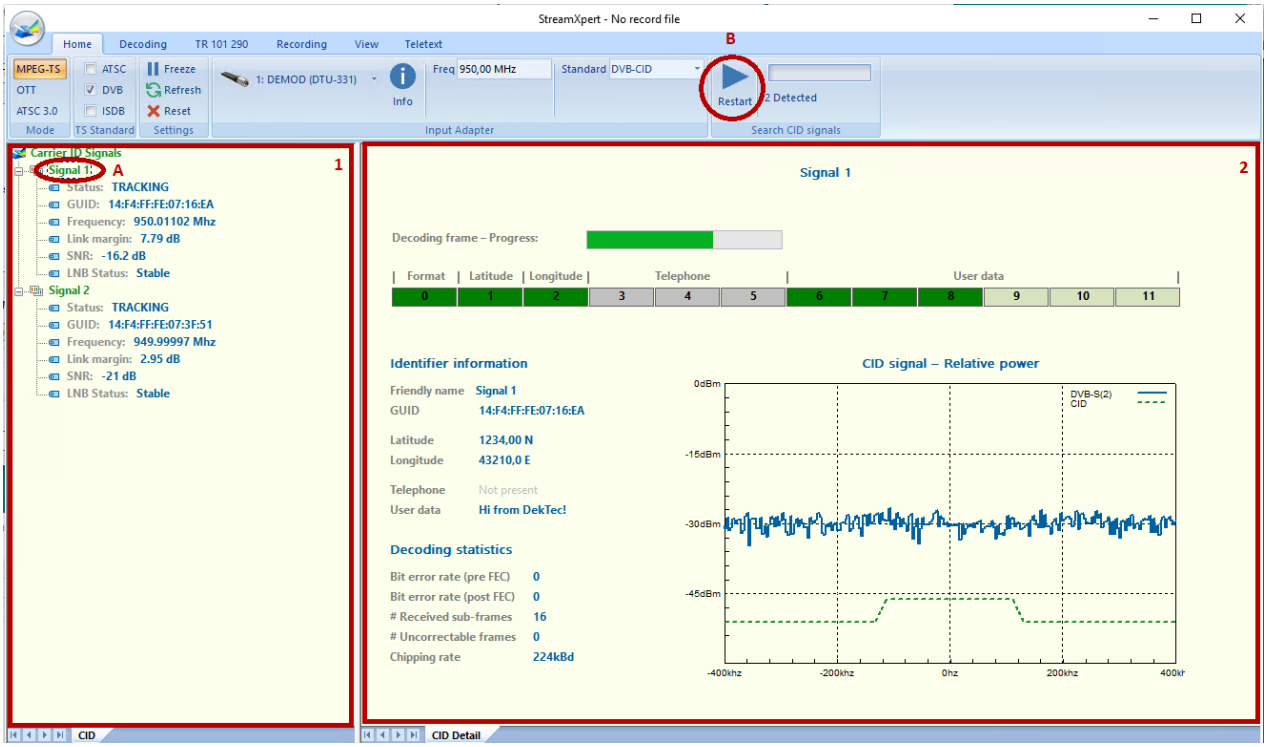


4.2. Signal Decoding and Analysis

Upon detecting a signal, it is shown in the signal tree on the left-hand side (1), and decoding will start automatically. Clicking on a signal in signal tree (A) will show detailed information about the signal in the "CID Detail" view on the right (2).

The DVB-CID standard has an inherently slow frame rate, requiring 4.5 seconds to transmit a single frame, which is then repeated 4 times. Expect the full identifier decoding to take around 2 minutes.

Once the progress bar in the "Search CID signals" panel is empty, no further signals will be detected. To scan for new signals, manually restart the search algorithm by clicking "Restart" (B).



In the displayed graph, the real time spectrum is shown in blue, featuring both the DVB-S/S2 signal and DVB-CID signals. To provide an indication of the level of the DVB-CID signal in comparison to the DVB-S2 signal, the DVB-CID signal is represented by a dotted green line.

4.3. Resolving Interference Issues with DVB-CID

DVB-CID's primary purpose is to address interference scenarios. Let's say you can't receive your intended DVB-S2 signal due to another carrier on the same frequency. This mutual interference may make both signals undecodable. DVB-CID offers a way to identify and resolve such issues.

Follow the below steps to resolve the interference:

1. Start the detection of DVB-CID signals as described in Section 4.1, “Starting Signal Detection.”
2. If the DVB-S/S2 signal is being interfered with another carrier, two signal should be detected.
3. Use the known GUID displayed in the tree view on the left-hand side of the interface to identify your desired signal.
4. Click on the signal that is not the desired signal.
5. Examine the identifier information of the interfering signal and find the telephone number.
6. Call the number you've retrieved and politely ask them to stop using your frequency band.

5. Troubleshooting

5.1. Assessing LNB Status

In StreamXpert's signal tree view, you'll find the LNB status for all detected signals. This is a rough measure indicating if the LNB may be causing problems. If the status reads "Stable," the LNB likely satisfies the DVB-CID decoding requirements. A "Not Stable" status suggests the opposite; make sure the LNB meets the requirements stated in Section 3.

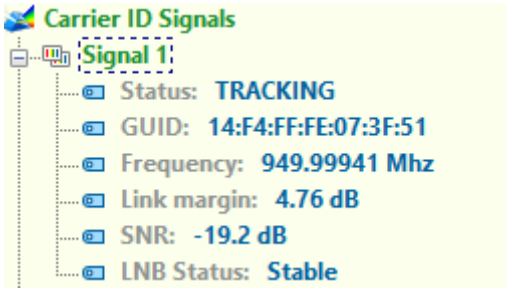


Figure 1. Signal tree view in StreamXpert

5.2. Addressing Hardware Overflows

Hardware overflows are displayed in the StreamXpert's 'Messages' view. Such overflows indicate your PC can't get the signal data from the hardware quickly enough. First, check your Windows power settings and ensure the PC is running in high-performance mode. If that's the case, your CPU may not meet the minimal requirements specified earlier.

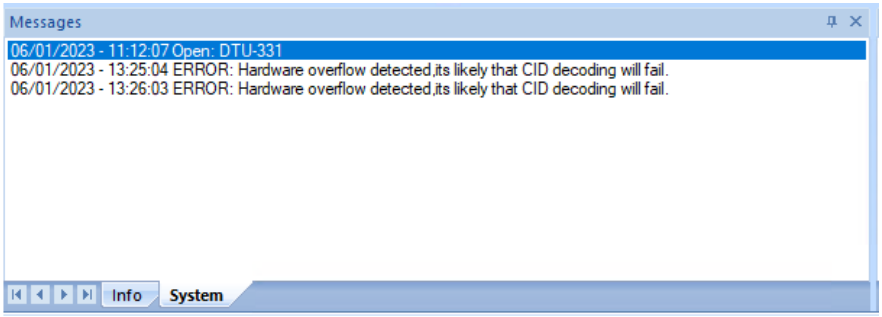


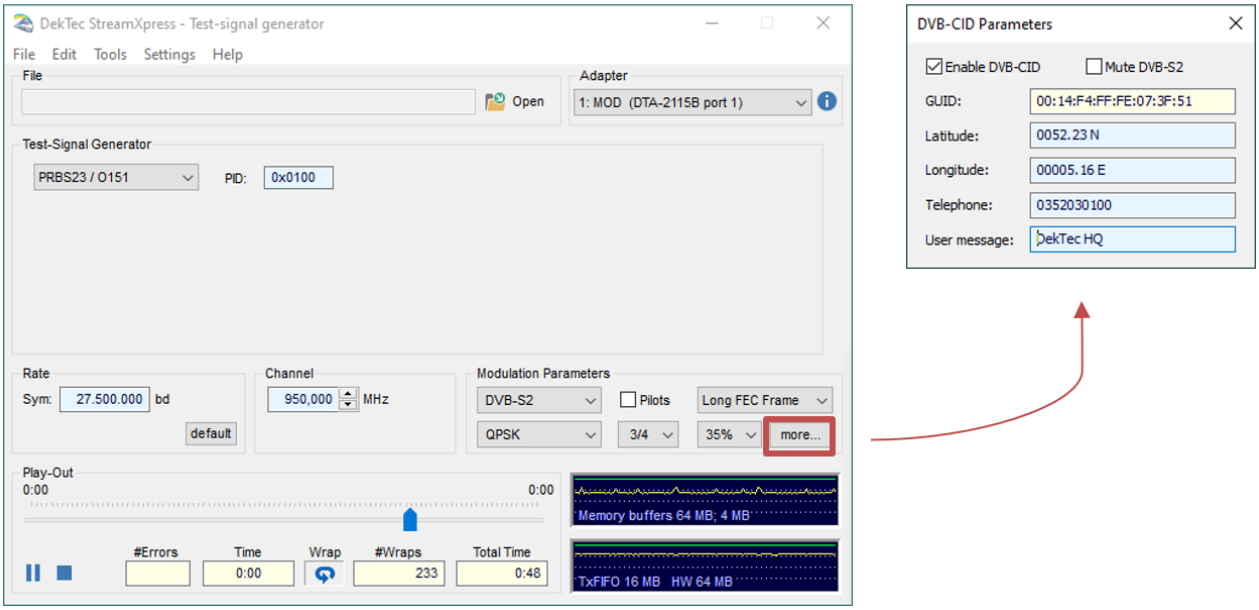
Figure 2. 'Messages' view in StreamXpert displaying hardware overflows

6. DVB-CID Playout with StreamXpress

While this Application Note focuses on DVB-CID decoding, DekTec also offers DVB-CID encoding and playout capabilities through StreamXpress, in conjunction with our satellite modulator products such as the DTU-315, DTA-2115, and DTA-2116. This can be very useful for practicing and experimenting with DVB-CID decoding.

To add a DVB-CID signal to a DVB-S2 signal, follow the below steps:

1. Select DVB-S2(X) as the modulation standard.
2. Click the "more…" button (shown in red in the screenshot below).
3. Check "Enable DVB-CID".
4. Fill in any desired information into the DVB-CID parameters window.



It's also possible to playout the DVB-CID only by muting the DVB-S2 signal.

Please note that the DekTec DVB-CID receiver is not calibrated for this specific mode. As this is not a scenario that is typically encountered in the field, using this mode may lead to inaccurate detections.