RTSA Suite PRO Frequency Offset Operation & External Tuning

Document V1.0 – FW – Initial version.

General

Using an external up- or down-converter is a common use case in space communication or fast moving radio applications. It also allows you to operate your SPECTRAN V6 device within the calibrated filter bank ranges, while the converter enhances your reception range.

This document describes the ways to reflect external frequency offsets and external tuning within the RTSA Suite PRO.

Frequency Offset Block

To translate a stream frequency by a given offset the ***"Frequency Offset Block"*** is used. It simply applies the configured offset to the given input frequency and also gives a simple calculation helper with the ***"Frequency Result"*** input control.

Figure 1

In Figure 1 and external converter with an offset of 125.000 MHz is installed on input 1 of the SPECTRAN V6 Device. The signal of interest is at 14.200 MHz. Use the ***"Frequency Result"*** input box from either the Ribbon bar or the Block's configuration area

As a result, the IQ stream frequency gets adjusted to the desired offset frequencies. When using the ***"Frequency Result"*** input, there are no manual calculations required, since the tuning frequency required at the SPECTRAN V6 tuner will be sent upstream to the block graph.

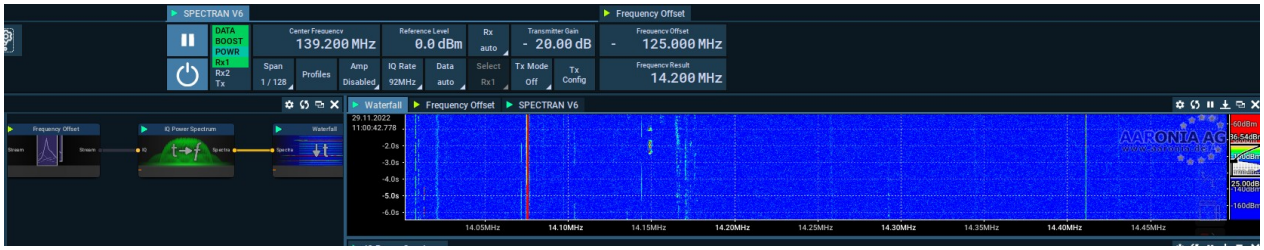

Figure 2

IQ Demodulator Lock Target Frequency

In some use cases like continuous doppler correction it is required to continuously re-tune the SPECTRAN V6. However, this would have an impact on relatively long-running DSP operations like large FFTs. The SPECTRAN V6 would retune, while for e.g. not all FFT bins have been filled, and that leads to gaps or invalid data. Also for recording it could lead to gaps or invalid data results. Therefore, the **"IQ Demodulator"** Block can be used:

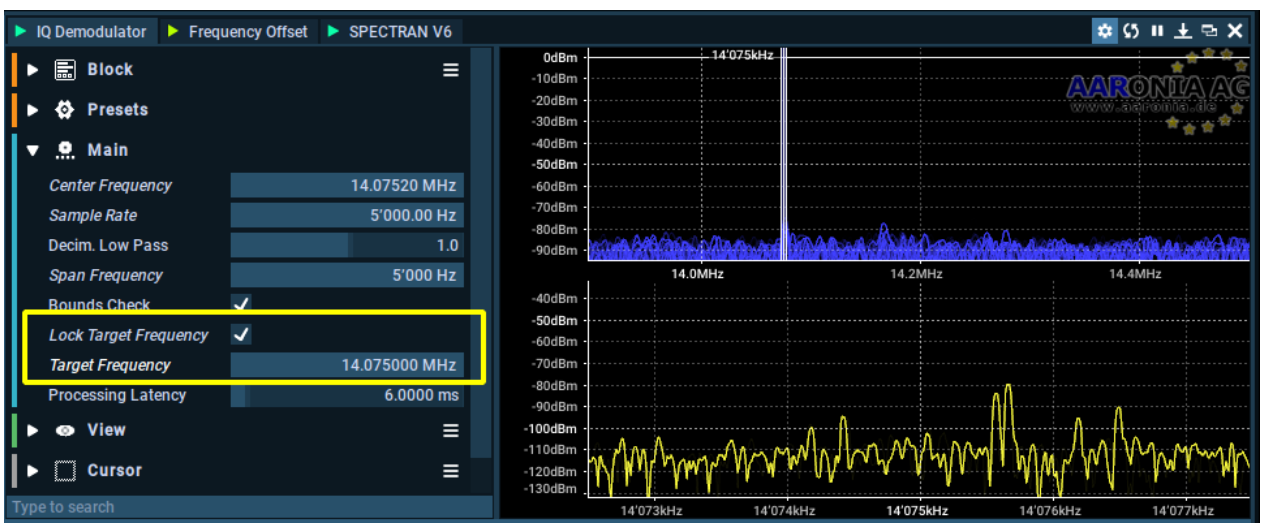

Figure 3

Figure 3 shows the usage of the ***"Lock Target Frequency"*** option. That means, the resulting IQ stream will be centered fixed at the configured ***"Target Frequency"***. This feature ensures a stable centered output stream while being able to freely re-tune the center frequency.

Use Case: Doppler Shift Correction with IQ Demodulator Offset Tuner

Let’s illustrate the combination of these features by the use case of doppler shift correction.

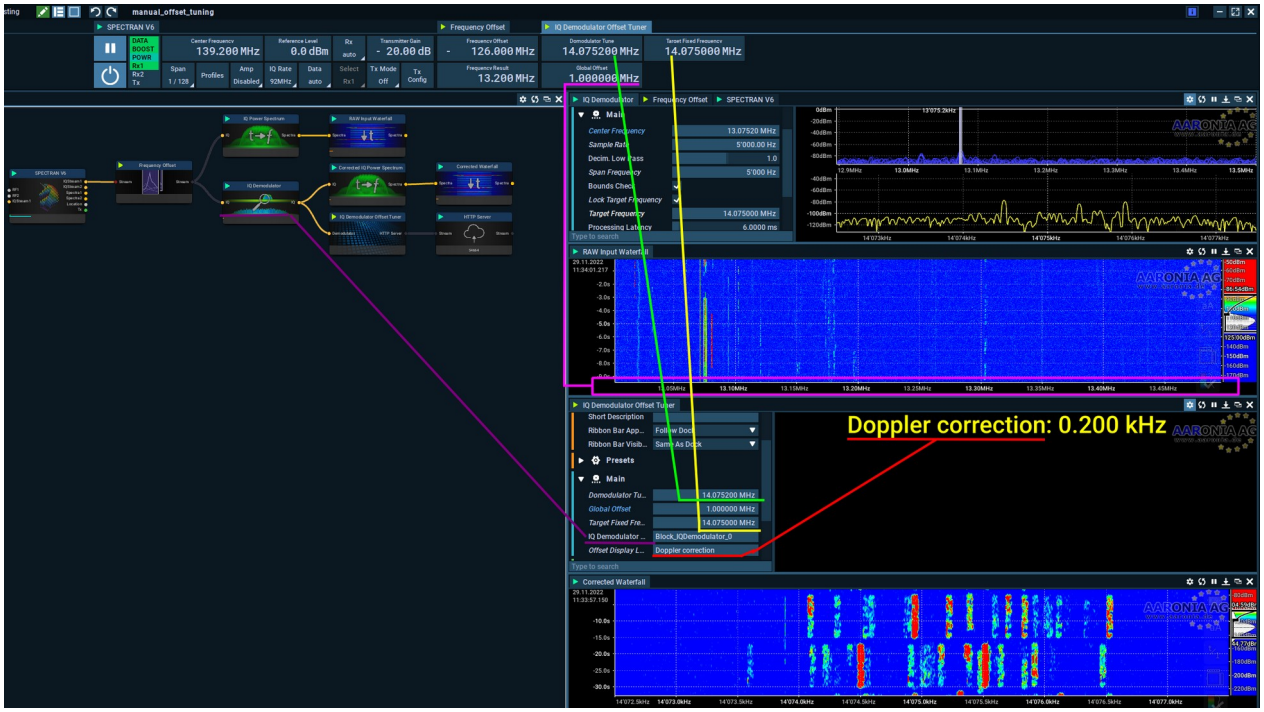

Figure 4

For even more flexibility in combining various corrections, the ***“IQ Demodulator Offset Tuner”*** block has been introduced. It helps you with control. Also, the IQ Demodulator Offset Tuner” makes it easy to visualize and enter corrections more conveniently, making the results easier to understand and monitor.

Figure 4 illustrates the following system properties:

- A global ***“Frequency Offset”*** of -126.000 MHz is applied. The SPECTRAN V6 gets tuned to 139.200 MHz, because the signal of interest for the Frequency Offset is set to 13.200 MHz.
- The ***“IQ Demodulator”*** setting ***“Lock Target Frequency”*** is set, the sample rate & Span Frequency is set to 5 kHz.
- The ***“IQ Demodulator Offset Tuner”*** applies an additional +1 MHz that results in a total system offset of 1 MHz.
- Demodulator Tune Is set to 14.07520, Target Fixed Frequency is set to 14.075 MHz, that results in a correction of 0.2 kHz applied in the ***“IQ Demodulator”***.

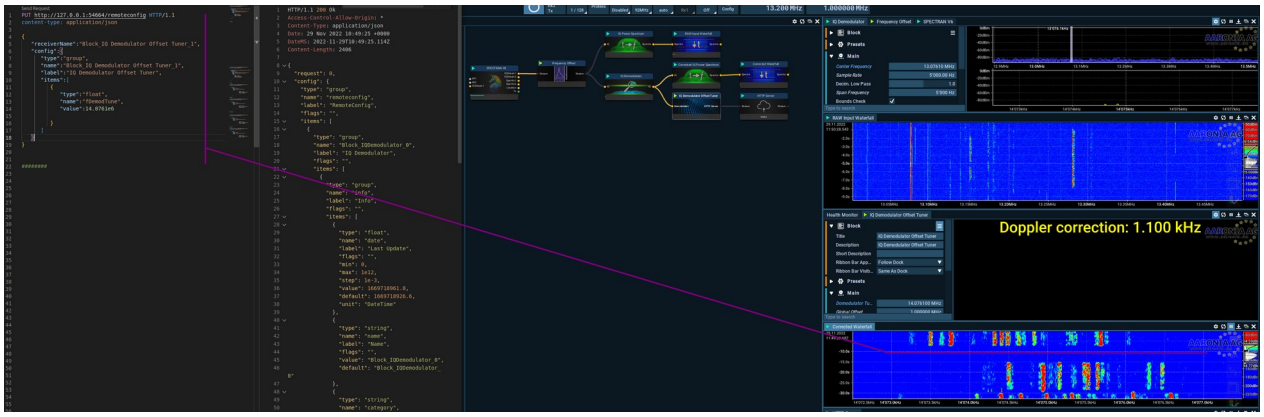

Figure 5

The ***"IQ Demodulator Offset Tuner"*** is the best solution to remote control for e.g. continuous doppler corrections. Let's say you want to update the demodulator center frequency from a remote system, that calculates the required signal of interest frequency. First we use the HTTP connector of the ***"IQ Demulator Offset Tuner"*** and connect it to a HTTP Server block. Use the following request to apply the remoteconfig to our block. Be sure to use the corresponding receiverName / name of the configuration:

```
PUT http://127.0.0.1:54664/remoteconfig HTTP/1.1
content-type: application/json

{
        "receiverName":"Block_IQ Demodulator Offset Tuner_1",
        "config":{
                        "type":"group",
                        "name":"Block_IQ Demodulator Offset Tuner_1",
                        "items":[
                                        {
                                                "type":"float",
                                                "name":"fDemodTune",
                                                "value":14.0761e6
                                        }
                                ]
                }
}
```

Tuning the ***"fDemodTune"*** property of the ***"IQ Demodulator Offset Tuner"*** keeps you DSP Blockgraph continuously streaming at the fixed target frequency, while the applied offset is reflected in the yellow label in the UI of the "IQ Demodulator Offset Tuner".

Note: if only a single global frequency offset applies, as in the illustrated example, the ***"Frequency Offset Block"*** is redundant with the **"IQ Demodulator Offset Tuner" "Global Offset"** setting. So, the **"Frequency Offset"** block could be removed from the mission while only maintaining the **"Global Offset"** property.