

CityScape Station Test Suite – Recommended Knob Configurations.

Assumption

Assumed Hardware Setup: USRP N2x0 + UBX-40 Daughterboard, connected to a host PC (which runs the test suite program).

Assumed Goal: to collect and visualise PSD estimates of the 31 bands which SSC has suggested.

Recommended Configurations for Important Knobs

The screenshot shows the 'CityScape Test Suite' application window. At the top, there is a 'Measurement Station Access ID' field with a UUID. Below this, the 'Experiment Type 2 - Time Averaged PSD' section is active, showing radio buttons for 'Output PSD Data' (selected), 'Output Raw IQ Data', and 'Single Scan'. It also includes input fields for 'Minutes of Data Per Scan File' (5) and 'Seconds of Data Per Sample' (60). The 'Experiment Type 1 - RAW IQ' section is also visible, with fields for 'Start Frequency MHz' (10), 'Stop Frequency MHz' (3000), 'File Duration In Seconds' (600), and 'Retention Seconds' (3600). The 'Scanner Configuration' section at the bottom contains a grid of fields for various parameters like 'Min Start Frequency MHz', 'Max Stop Frequency MHz', 'Start Frequency MHz', 'Stop Frequency MHz', 'PLL Flag Poll Delay', 'Number of Samples to Throw Away', 'Additional Tune Delay (msec)', 'Descriptive Name', 'Device Type', 'Device Address', 'RX Gain', 'Samples Per Snapshot', 'No. of Snapshots per Channel Visit', 'Antenna Port', 'Scan Pattern', 'Communications Channel', 'Eff. Sampling Rate (ESPS In Hz)', 'GPS Enabled', and 'Locking Communication Channel'. A 'Devices' list on the right shows 'UW USRP UBX' selected. At the bottom right, there are buttons for 'Add /Update Device', 'Load From File...', and 'Save As...'.

Experiment Type 2 – Time Averaged PSD

- ‘Output PSD Data’ checked: My plotting tool do not support Raw I-Q data files yet. (Will only accept CityScape PSD estimate data files). Check “Output Raw IQ Data” if you want to use something else to analyze the data and if you want Raw I-Q data instead of the PSD estimates.
- **Minutes of Data Per Scan File: Depends on the number of averages that you want to have for the PSD estimates (See Section 3).**

Experiment Type 1 – RAW IQ

- Experiment Type 1 can be ignored if you are only generating PSD estimate files (not applied if running on PSD-only mode).

Scanner Configuration

- Min Start Frequency MHz, Max Stop Frequency MHz : 10 MHz / 6000 MHz (Min/Max frequency for UBX-40 daughterboard).
- Start Frequency MHz, Stop Frequency MHz : 10 MHz / 3000 MHz (Min frequency for UBX-40 daughterboard and the maximum frequency of the 31 bands of interest).
- Additional Tune Delay (msec) : 30ms, to prevent possible data quality issues due to the excessively fast retuning speed.
- RX Gain: Level of the LNA gain to test. Low value : increased noise figure, Higher value : higher chance of nonlinearities.
- Samples Per snapshot: (“Eff. Sampling Rate” knob) / (Desired FFT bin width), since “Samples Per Snapshot” currently also determines the FFT size. 1024 is usually good enough.
- “Eff.Sampling Rate” : 25000000 (25MS/s). Allowed Range : 100e6/512 (Approximately 200kS/s) – 100e6/4 (25MS/s), but in integer.

Estimating Number of Averages Used for the PSD Estimates

* TL;DR: For a sweep of 10MHz to 3000MHz, “Additional Tune Delay” of 30 ms, and the Effective Sampling rate of 25MS/s, Setting “Experiment Type 2 – Time Averaged PSD :: Minutes of Data Per Scan File” field to **13 minutes (780 seconds)** will let you generate PSD estimate files with about 100 sweeps averaged averaged and aggregated together.

Currently, the test suite does not let you configure the number of averages used for the PSD estimates. Fortunately, however, this can be estimated and somewhat controlled.

Assuming “No. of Snapshots per Channel Visit” = 1, typical time cost per each snapshot is:

Time cost per a Snapshot = processing delay + retune delay + data collection delay

. This is approximately 1.5ms + “Additional Tune Delay” knob when “Samples per snapshot” is 1024 and a average modern PC is used as a host PC.

When the scan pattern is set as “DCSpikeAdaptiveScan”, the station takes two snapshots per each 25MHz (or per each “Eff. Sampling Rate in Hz” knob, if you are not using the recommended 25MS/s effective sampling rate). So, the total snapshots required to sweep through the configured bandwidth is:

$$\text{Number of Snapshots per a Sweep} = \text{ceil}\left(\frac{\text{Stop Frequency MHz} - \text{Start Frequency MHz}}{\text{Eff. Sampling Rate MHz}}\right) * 2$$

So, the time cost per each sweep is:

$$\text{Time cost per a sweep} = \text{ceil}\left(\frac{\text{Stop Frequency MHz} - \text{Start Frequency MHz}}{\text{Eff. Sampling Rate MHz}}\right) * 2 * \text{Time Cost per a Snapshot}$$

. This equates to about **7.7 seconds per a sweep** when the range is from 10MHz to 3000MHz, “Additional Tune Delay” is 30ms, and the Effective Sampling rate is 25MS/s. So, to get a PSD estimates with 100 times of averages, you can set “Experiment Type 2 – Time Averaged PSD :: Minutes of Data Per Scan File” field to **13 minutes (780 seconds)**. The plotting tool that I provided will automatically aggregate the provided PSD estimate file and will generate a max hold / average / min hold plots and Matlab data files from the data.