Supplementary data for "Digitally Intensive Frequency Synthesis and Modulation Exploiting a Time-mode Arithmetic Unit"

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This dataset supplements the Ph.D. dissertation of "Digitally Intensive Frequency Synthesis and Modulation Exploiting a Time-mode Arithmetic Unit" with the codes (in the format of .m) and raw data (in the format of .mat, .txt, .emf, and .xlsx) to duplicate the reported measurement figures. Running the codes requires the software of MATLAB (2018b or later). Reading the raw data require the softwares of MATLAB (for .mat files), a general text reader (for .txt files), a general picture viewer (for .emf files), and Microsoft Excel (for .xlsx files).

1 Data for Chapter 2

1.1 Figure 2.27 and Figure 2.28

The figures are plotted by running the Matlab file of TAU_INL_plot_v2.m, which reads raw data simulated by Cadence Virtuoso. The simulation testbench is the same as explained in Section 2.6.

1.2 Figure 2.34

The figure is plotted by running the Matlab file of pll_analyze_v4.m. The circuit noise files are simulated by Cadence Virtuoso and collected in the folder of ./data/noise_ISSCC.

1.3 Figure 2.35

The figure is plotted by running the Matlab file of jitter_plot.m. The raw data (measured phase noise profile) are collected in the folder of ./data/jitter_int_vs_freq.

1.4 Figure 2.38

The figure is plotted by running the Matlab file of spur_jitter_plot_JSSC.m. Most raw data (measured phase noise profile) are collected in the folder of

./data/spur_vs_FCWF_2P7G_JSSC_V2.

2 Data for Chapter 3

2.1 Figure 3.10 and Figure 3.13

The figures are plotted by running the Matlab file of spur_plot_tp2_2760M_analysis.m.
The raw data files(i.e., .mat files collecting the spur levels and offset frequencies)
are designated in the main Matlab file and stored in the folder of ./data/spur_tp2_cls/spurSwp_int69
with the prefix "rsltPLLSwp" in the file name. Snapshots of the correspond-
ing measured phase-noise profiles with spurs highlighted are also stored in the
folder of ./data/spur_tp2_cls/spurSwp_int69 with the prefix "pnSpurSweep" in
the subfolder name. The "Frac_xx" in the name of each snapshot file annotates
the fractional FCW, i.e., $\text{FCW}_{\text{frac}} = 2^{-xx}$.

2.2 Figure 3.18

The figures are plotted by running the Matlab file of spur_cls_angel_cross.m.
The raw data files are designated in the main Matlab file and stored in the
folder of ./data/spur_tp2_cls/autoCal/rhoSearch.

2.3 Figure 3.20

Subfigure (a) is plotted by running the Matlab file of spur_plot_tp2_2760M_cls_excel.m,
and subfigure (b) is plotted by running the Matlab file of spur_plot_tp2_2760M_cls_jitter_excel.m.
The corresponding snapshots of measured phase-noise profiles with highlighted
spurs are collected in the folder of ./data/spur_tp2_cls/spurSwp_int69_final. The
"Frac_xx" in the name of each snapshot file annotates the fractional FCW, i.e.,
$\text{FCW}_{\text{frac}} = 2^{-xx}$.

3 Data for Chapter 4

3.1 Figure 4.13

The figure is plotted by running the Matlab file of EVM_sim_NUCC_plot_V3_ideal_wi_DM_only.m.

3.2 Figure 4.18 and Figure 4.19

The figures are plotted by running the Matlab file of DCO_INL_plot_V3_wi_ind_v2.m.
The raw data (frequency versus oscillator tuning words) are stored in the folder
of ./data/DCO_INL and processed by an auxiliary function funDCOINLFit.m

myScopeSample_TX_IQ_64PSK_RC_10M_fosc_3160M_D2_KNL_ON_LUT_KDCO_CNST_NUCC_ON_FcwFrac_N9

Fractional FCW (optional).
Nxx: $FCW_{frac}=2^{-xx}$

NUCC options: on and off

LUT (for K_E) content options.

OFF: turn off LUT compensation
KDCO_CNST: determined by a KDCO-calibration-like algorithm
LMS: determined by a piecewise LMS algorithm

Phase-domain DPD options: on and off

Dx: Feedforward frequency division by x

Nominal oscillation frequency of the DCO (MHz)

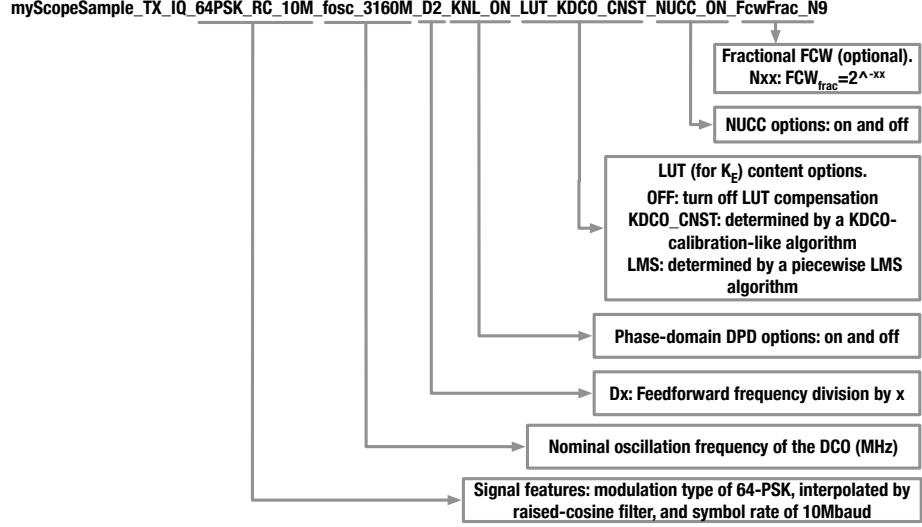Signal features: modulation type of 64-PSK, interpolated by raised-cosine filter, and symbol rate of 10Mbaud

Figure 1: Naming convention of the raw data files of the measured RF modulation signal.

3.3   Figure 4.21

Each constellation diagram is plotted by running the Matlab file of SigEvalSeg-PSK_thesis.m. The raw data file (containing transmitted symbols and sampled RF signal) is designated by setting the filename to the variable of parPM-Proc.measFileName. These data files are stored in the folder of ./data/PSK_RC, and the naming convention is illustrated in Figure 1.

3.4   Figure 4.24

Sub-figure (a) is plotted by running the Matlab file of EVM_vs_frac_plot.m. The EVM of each point is evaluated the same as Section 3.3. Sub-figure (b) is plotted by running the Matlab file of PM_data_histogram.m.

3.5   Figure 4.25

The figure is plotted by running the Matlab file of EVM_vs_freq_plot_V2.m. The EVM of each point is evaluated the same as Section 3.3.