Application Brief

High-Frequency Clock (> 20GHz) Skew Variation Between Two RF Synthesizers Across Temperature

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High Frequency Clock(>20GHz) Skew variation between two RF Synthesizer(LMX2820) across temperature is evaluated. In general, one time adjustment is done at room temperature using MASH_SEED option in LMX2820, if needed. But the clock skew should not vary across temperature such that timing issues like setup violation can be avoided. This is particularly critical at high clock frequency where clock period is less and margin for the variation is less. Board containing two LMX2820s mentioned in TIDA-010230 is used for evaluating the variation in clock to clock skew across temperature. Block level diagram of test setup is shown in Figure 1.

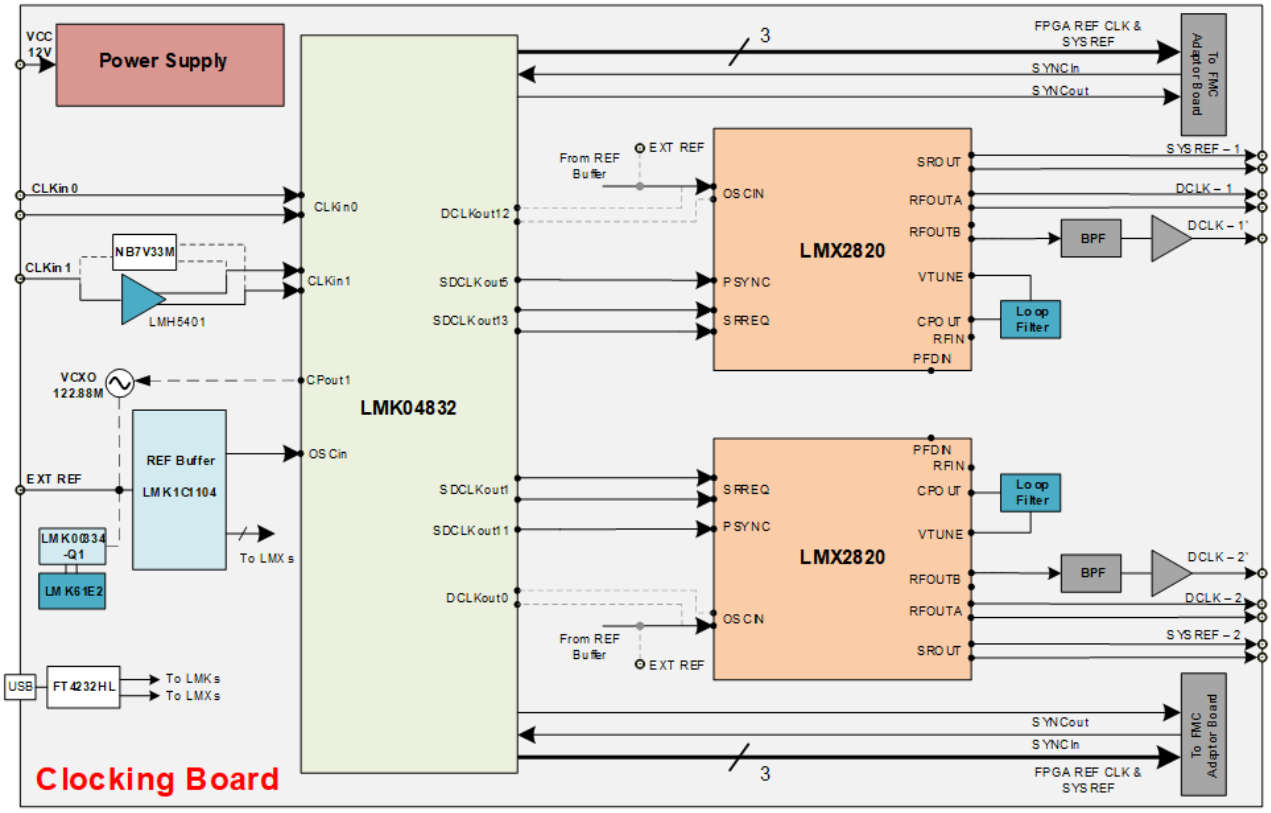

Figure 1. TIDA-010230 Multi-Site Clocking Board

High Sampling scope used for this evaluation is DSO-X 93304Q (Agilent Technologies Digital Storage Oscilloscope which has 33GHz BW and 80GSa/s). LMK04832 is used for syncing both LMX2820. Initial Clk-Clk skew between two LMX2820 depends on the doubler calibration settings, if doubler is engaged.

Table 1 summarizes the Clk-Clk skew at room temperature if doubler calibration settings are different between two LMX2820s. Traces from LMX2820_A and LMX2820_B till the scope input is matched for this measurement. Table 1 is taken when doubler is engaged at the output. There is uncertainty of 0.6ps in measurement due to scope noise.

Table 1. LMX2820 Doubler Calibration Converged Codes Comparison Between Two LMX2820s

S. No	CLK-CLK Delta (delta delay in ps)	2820_A Pregen captrim	2820_B Pregen captrim	2820_A Amp captrim	2820_B Amp captrim
1	8.96	1	1	0	0
2	16.86	2	1	0	0
3	23.1	3	1	0	0
4	28.4	4	1	0	0
5	21	1	1	1	0
6	32	1	1	2	0

Figure 2 shows the Oscilloscope measurement at 22.16GHz as output frequency for LMX2820_A and LMX2820_B.

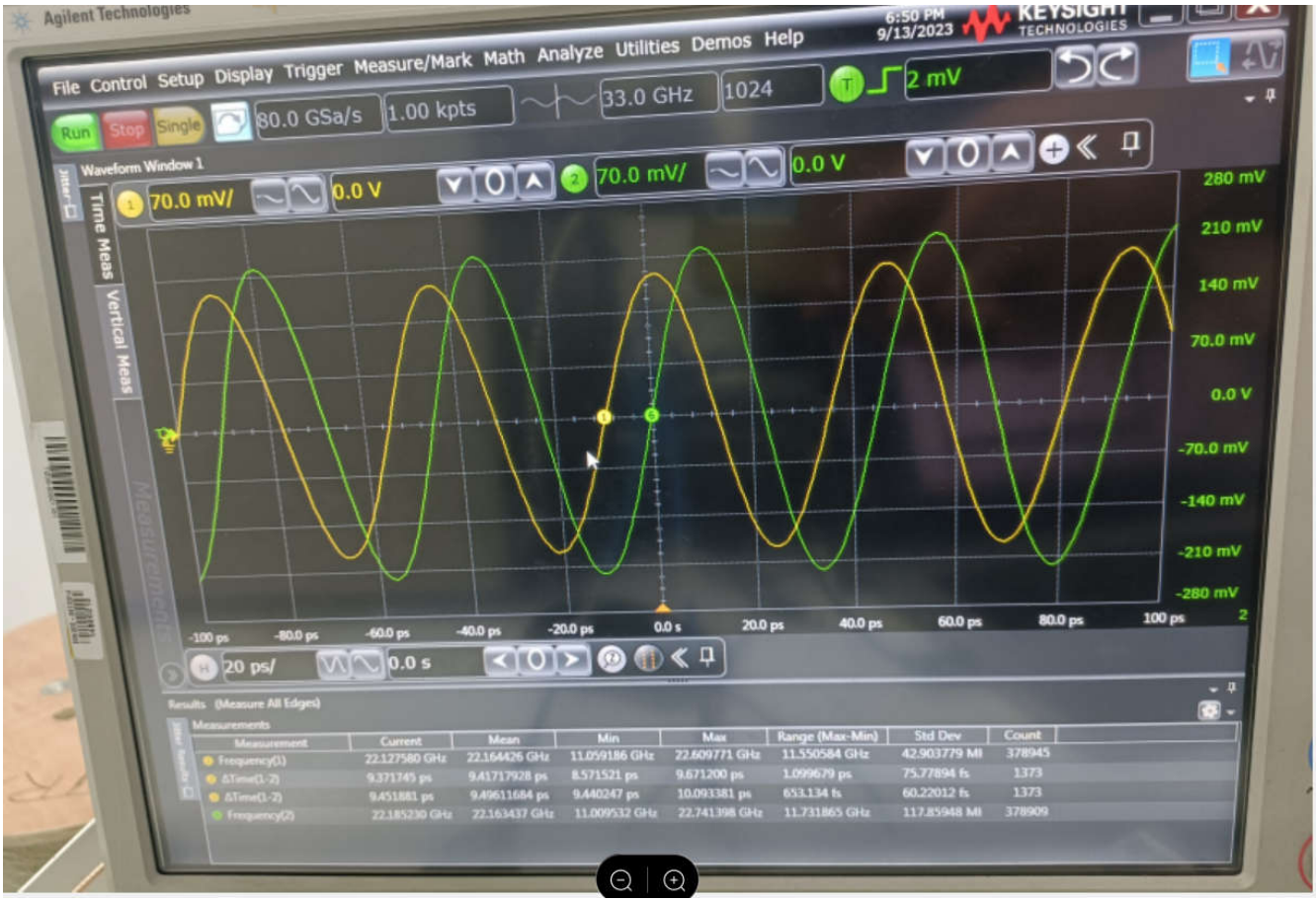

Figure 2. Capturing Output of Two LMX2820s on DSO-X 93304Q Scope

Table 2 summarizes the Clk-Clk skew variation when temperature varies for LMX2820.

Table 2. Temperature Evaluation Based on Internal Temperature Sensor Codes.

Case	2820_A_TEMP_SENS_RD/ 2820_B_TEMP_SENS_RD	Temp_2820_A (degree C)--> Temp Sensor Reading	Temp_2820_B (degree C)-->Temp Sensor Reading	CLK-CLK Delay	Ambient Thermostream
1	624/619	83.928	81.068	2.9ps	25 deg (Room temp)
2	760/774	161.72	169.728	-1ps	Hot temp
3	553/538	43.316	34.736	3.5ps	Cold temp

Internal temperature of the die is read using temperature sensor present on chip, and conversion formula is used to evaluate the temperature.

$$Die\ temperature \approx (A \times rb\_TEMP\_SENS) - B + Err \quad (1)$$

$$A = 0.572$$

$$B = 273$$

$$rb\_TEMP\_SENS = R76\,[10:0]\ in\ decimal$$

$$Err = temperature\ sensor\ measurement\ accuracy = \pm 5\ degC$$

Delay Variation seen is less than **5ps across temperature** between two LMX2820s across temperature.

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