5.1 RF Test Data

5.1.1 RF Generation Circuitry

5.1.1.1 Frequency Stability of Stable Local Oscillator

This test was performed to generate the data to demonstrate the frequency stability of the digital frequency input to the Klystron transmitter over a range of -20 to +50 degrees Celsius.

It should be noted at this time that the frequency generation circuits are phase locked to a highly stable 10 MHz crystal oscillator employed in the up conversion process. For this test, the frequency generation circuitry and 10 MHz reference oscillator were placed in an environmental test chamber and subjected to temperature variations ranging from -20 to +50 degrees Celsius. The environmental test chamber utilized is a Bemco F series high-low temperature chamber with a Watlow F4S/D temperature controller. The following procedure was utilized in order to perform the stability testing.

- Step 1: The unit under test, further referred to as UUT, was placed in the environmental chamber and a thermocouple was installed on the base plate of the UUT. The thermocouple for the temperature chamber used was also referenced. The RF signal cable, digital control cable, operating voltages and thermocouple cable were routed out of the temperature chamber access hole.
- Step 2: The environmental chamber was programmed to reach 0 degrees Celsius before any testing was started. This allowed the UUT to "cold soak".
- Step 3: The UUT was energized and the temperature chamber was placed at -20 degrees Celsius. The time it took for the de energized UUT and the temperature chamber to reach -20 degrees was recorded.
- Step 4: Once the UUT and temperature chamber temperature stabilized, frequency measurements were taken in 1 minute intervals using a Rohde & Schwarz FSP spectrum analyzer.
- Step 5: Once 5 measurements were taken and frequency measurements were acceptable, the chamber temperature was increased to the next increment until the thermocouple temperature attached to the UUT stabilized at the testing temperature.
- Step 6: Step 4 and 5 were repeated until completion of the testing at +50 degrees Celsius.

The block diagram in figure 5 *(pg. 13)* depicts the test setup for the frequency stability versus temperature testing.
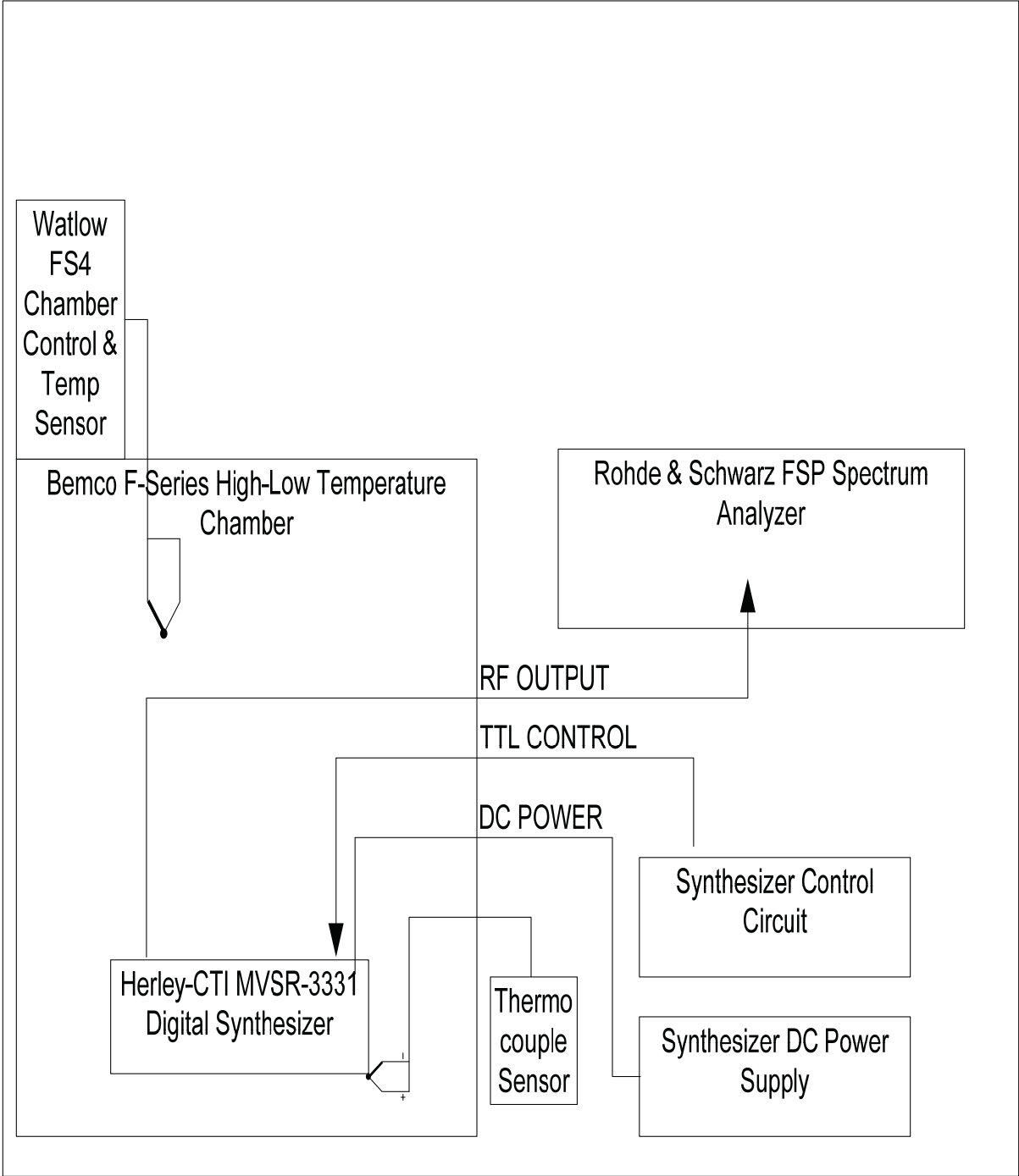
Figure 5: Test setup for "Frequency Stability Versus Temperature" test

Within the figure:
- Watlow FS4 Chamber Control & Temp Sensor
- Bemco F-Series High-Low Temperature Chamber
- Rohde & Schwarz FSP Spectrum Analyzer
- RF OUTPUT
- TTL CONTROL
- DC POWER
- Herley-CTI MVSR-3331 Digital Synthesizer
- Thermo couple Sensor
- Synthesizer Control Circuit
- Synthesizer DC Power Supply

MVSR-3331 DIGITAL STALO FREQUENCY VS TEMPERATURE STABILITY		
TIME (minutes)	TEMPERATURE (deg C)	FREQUENCY (MHz)
CHAMBER STARTING TEMPERATURE, 0 C		
TIME TO STABALIZE TEMPERATURE FROM 0 TO -20, APPROX **22 MINS**		
1	-20 ˚C	3550.0006 MHz
2	-20 ˚C	3550.0006 MHz
3	-20 ˚C	3550.0006 MHz
4	-20 ˚C	3550.0006 MHz
5	-20 ˚C	3550.0006 MHz
TIME TO STABALIZE TEMPERATURE FROM -20 TO -10, APPROX **2 MINS**		
1	-10 ˚C	3550.0006 MHz
2	-10 ˚C	3550.0006 MHz
3	-10 ˚C	3550.0006 MHz
4	-10 ˚C	3550.0006 MHz
5	-10 ˚C	3550.0006 MHz
TIME TO STABALIZE TEMPERATURE FROM -10 TO 0, APPROX **1.5 MINS**		
1	00 ˚C	3550.0006 MHz
2	00 ˚C	3550.0006 MHz
3	00 ˚C	3550.0006 MHz
4	00 ˚C	3550.0006 MHz
5	00 ˚C	3550.0006 MHz
TIME TO STABALIZE TEMPERATURE FROM 0 TO 10, APPROX **1.25 MINS**		
1	10 ˚C	3550.0006 MHz
2	10 ˚C	3550.0006 MHz
3	10 ˚C	3550.0006 MHz
4	10 ˚C	3550.0006 MHz
5	10 ˚C	3550.0006 MHz
TIME TO STABALIZE TEMPERATURE FROM 10 TO 20, APPROX **1 MINS**		
1	20 ˚C	3550.0006 MHz
2	20 ˚C	3550.0006 MHz
3	20 ˚C	3550.0006 MHz
4	20 ˚C	3550.0006 MHz
5	20 ˚C	3550.0006 MHz
TIME TO STABALIZE TEMPERATURE FROM 20 TO 30, APPROX **1.25 MINS**		
1	30 ˚C	3550.0006 MHz
2	30 ˚C	3550.0006 MHz
3	30 ˚C	3550.0006 MHz
4	30 ˚C	3550.0006 MHz
5	30 ˚C	3550.0006 MHz

MVSR-3331 DIGITAL STALO FREQUENCY VS TEMPERATURE STABILITY TESTING		
TIME (minutes)	*TIME (minutes)*	*TIME (minutes)*
*TIME TO STABALIZE TEMPERATURE FROM 30 TO 40, APPROX **1.5 MINS***		
1	40 ˚C	3550.0006 MHz
2	40 ˚C	3550.0006 MHz
3	40 ˚C	3550.0006 MHz
4	40 ˚C	3550.0006 MHz
5	40 ˚C	3550.0006 MHz
*TIME TO STABALIZE TEMPERATURE FROM 40 TO 50, APPROX **1.5 MINS***		
1	50 ˚C	3550.0006 MHz
2	50 ˚C	3550.0006 MHz
3	50 ˚C	3550.0006 MHz
4	50 ˚C	3550.0006 MHz
5	50 ˚C	3550.0006 MHz

TOTAL TEST TIME (In minutes)	67
TOTAL TEMPERATURE RANGE (In degrees Celsius)	-20 C to +50 C
OVERALL FREQUENCY VARIATION (In MHz)	0 MHz