Holography System Specifications

1. Frequency Range
   1.1 Primary Frequency:  
      1.1.1 Range  
      1.1.2 Step  
   1.2 Secondary Frequency:  
      1.2.1 Range  
      1.2.2 Step

   104.02 GHz
   103.8 to 104.24 GHz (320 steps)
   1.375 MHz
   78.92 GHz
   78.74 to 79.01 GHz (240 steps)
   1.125 MHz

2. Transmitter EIRP
   2.1 Antenna Gain
   2.2 TX power at antenna input

   > 10 dBm
   ≦ 33 dB
   > 1 μW

3. Receiver Dynamic Range

   3.1 Signal Channel
   3.1.1 Primary Freq. (regardless of Step Atten. Setting) ≦ 55 dB
   3.1.1 Secondary Freq. (regardless of Step Atten. Setting) ≦ 55 dB

   3.2 Ref. Channel
   3.2.1 Primary Freq.
      3.2.1.1 Atten. = 0 dB
      3.2.1.2 Atten. = 10 dB
      3.2.1.3 Atten. = 20 dB
      3.2.1.4 Atten. = 30 dB
      3.2.1.5 Atten. = 40 dB
      ≦ 25 dB
      ≦ 35 dB
      ≦ 45 dB
      ≦ 50 dB
      ≦ 53 dB

   3.2.2 Secondary Freq.
      3.2.2.1 Atten. = 0 dB
      3.2.2.2 Atten. = 10 dB
      3.2.2.3 Atten. = 20 dB
      3.2.2.4 Atten. = 30 dB
      3.2.2.5 Atten. = 40 dB
      ≦ 25 dB
      ≦ 35 dB
      ≦ 44 dB
      ≦ 51 dB
      ≦ 53 dB

4. Signal and Ref. Channels Isolation

   4.1 Signal-to-Ref Channel Isolation
   4.1.1 Primary Frequency (104.02 GHz)
      4.1.1.1 Input power = +11 dBm (at mixer input), Sig. Step Atten = 9 dB
      4.1.1.1 Ref. Step Atten. = 0 dB
      4.1.1.2 Ref. Step Atten. = 10 dB
      4.1.1.3 Ref. Step Atten. = 20 dB
      4.1.1.4 Ref. Step Atten. = 30 dB
      ≦ 44 dB
      ≦ 53 dB
      ≦ 64 dB
      ≦ 72 dB

      4.1.1.2 Input power = +11 dBm (at mixer input), Sig. Step Atten = 1 dB
      4.1.1.2.1 Ref. Step Atten. = 0 dB
      4.1.1.2.2 Ref. Step Atten. = 10 dB
      ≦ 50 dB
      ≦ 60 dB
4.1.2 Secondary Frequency (78.92 GHz)
4.1.2.1 Input Power = +13 dBm (at mixer input), Sig. Step Atten = 8 dB
   4.1.2.1.1 Ref. Step Atten. = 0 dB  ≅ 37 dB
   4.1.2.1.2 Ref. Step Atten. = 10 dB  ≅ 47 dB
   4.1.2.1.3 Ref. Step Atten. = 20 dB  ≅ 57 dB
   4.1.2.1.4 Ref. Step Atten. = 30 dB  ≅ 67 dB

4.2 Ref-to-Signal Channel Isolation
4.2.1 Primary Frequency
   (Test Condition: 
   Input Power = +13 dBm (at mixer input) 
   Ref. Step Atten. = 25 dB 
   Sig. Step Atten. = 0 dB)  
   > 90 dB

4.2.2 Secondary Frequency
   (Test Condition: 
   Input Power = +13 dBm (at mixer input) 
   Ref. Step Atten. = 36 dB 
   Sig. Step Atten. = 0 dB)  
   > 90 dB

5. Noise Temperature
5.1 Primary Frequency (104.02 GHz)
   5.1.1 Sig. Channel (step atten. = 10 dB)  ≅ 3700 K
   5.1.2 Sig. Channel (step atten. = 20 dB)  ≅ 5200 K
   5.1.3 Ref. Channel (step atten. = 10 dB)  ≅ 2300 K
   5.1.4 Ref. Channel (step atten. = 20 dB)  ≅ 2300 K

5.2 Secondary Frequency (78.92 GHz)
   5.2.1 Sig. Channel (step atten. = 10 dB)  ≅ 3000 K
   5.2.2 Sig. Channel (step atten. = 20 dB)  ≅ 4100 K
   5.2.3 Ref. Channel (step atten. = 10 dB)  ≅ 1800 K
   5.2.4 Ref. Channel (step atten. = 20 dB)  ≅ 2100 K
Figure 2. High-Band Gunn oscillator bias voltage vs. frequency.
Figure 3. Low-Band Gunn oscillator bias voltage vs. frequency.
Procedure

1. After start-up, change the Sig. Attenuation from 20 dB to 21 dB, then back to 20 dB. Also repeat this step for Ref. Attenuation.
2. Click on the Enable Synth. Control button.
3. Click on the Enable Gunn/PLL Control button.
4. Set Gunn select to High Band Gunn.
5. Click on Load Default Parameters on the high-band side to load the default parameters for the high band Gunn.
6. Set Gunn select to Low Band Gunn.
7. Click on Load Default Parameters on the low-band side to load the default parameters for the low band Gunn.
8. Set the Gunn select back to High Band Gunn.
9. Click on the Bias On/Off button.
10. Click on Open Loop button to select the Close Loop option. The loop should be locked and the green light should be on.
11. Click on Enable DSP readout.
12. Click on Reset DSP.
13. Notice the Vp-p readings on REF I channel [Vp-p], REF Q channel [Vp-p], SIG I channel [Vp-p] and SIG Q channel [Vp-p]. The maximum should be about 20V. For best dynamic range, adjust Sig. and Ref. step attenuators so the voltage readings are about 19V. When the step attenuator value is increased by 6 dB, the I and Q channel voltage should drop by 50%.

Note 1: For the PLL/Gunn to lock, the Monitored Value of the Gunn voltage and the Gunn Bias voltage have to be within 15 mV of each. If the user would change the frequency in big step, the user will need to adjust the Gunn bias for the PLL to lock. The user can refer to the measured Gunn bias voltage charts in the Figures 2 and 3 to set the Gunn Bias voltage.
Default Values of Control Variables

1. Sig. Attenuator: 20 dB
2. Ref. Attenuator: 20 dB
3. Synthesizer Frequency:
   a. High Band 9445 MHz
   b. Low Band 8755 MHz
4. Drive_Enable Low
5. Loop_Enable Low
7. Low band Gunn_Loop_Gain 1992.19 Ohm
8. High band Gunn_Tune_Range 19921.88 Ohm
9. Low band Gunn_Tune_Range 50000 Ohm
10. High band Nominal_Voltage 9.2 V
11. Low band Nominal_Voltage 9.09 V
12. Gunn_Select Low
To lock the high band Gunn, do the following:

1. Set_Synth_Frequency to 9445 MHz.
2. Set_Gunn_Select to Gunn_H which is 0.
3. Set_Drive_Enable to high.
4. Set_Nominal_Voltage to 9.365V.
7. Set_loop_enable to high to close the loop.

To lock the Low band Gunn, do the following:

1. Set_Synth_Frequency to 8755 MHz.
2. Set_Gunn_Select to Gunn_L which is 1.
3. Set_Drive_Enable to high.
4. Set_Nominal_Voltage to 9.097V.
7. Set_loop_enable to high to close the loop.
Note 1 Dynamic range is measured with $V_{p-p}$ at the A/D converter set at 20 V as the maximum. With the signal turned off, the noise floor is measured. 100 samples-averaging is used. RR and SS from the DSP are used as the measuring parameters.

Note 2 Signal-to-Ref-Channel isolation is measured by injecting a sinewave at the input of Sig. channel. The isolation is the ratio of the output power of injected sinewave at the Sig_15kHz_I port to that of the sinewave at Ref_15kHz_I. Ref-to-Signal-Channel isolation is measured by injecting a sinewave at the input of Ref. channel. The isolation is the ratio of the output power of injected sinewave at the Ref_15kHz_I port to that of the sinewave at Sig_15kHz_I.

**Ref. Channel and Sig. Channel Isolation**

The isolation from Ref. to Sig. channel is defined as the ratio of signal power at Ref_30 kHz_I to that of Sig_30kHz_I. Signal is transmitted into to the Ref. channel input. The Ref. step attenuator is adjusted so that the signal is 20V peak-to-peak at the A/D input and the Sig. step attenuator is set at 0 dB.

The isolation from Sig. to Ref. channel is defined as the ratio of signal power at Sig_30 kHz_I to that of Ref_30kHz_I. Signal is transmitted into to the Sig. channel input. The Sig. step attenuator is adjusted so that the signal is 20V peak-to-peak at the A/D input and the Ref. step attenuator is set at 0 dB.
OSC. LOCKED TO SAME REF.?  
BANDWIDTH (NARROW)

Bw
1-2 GHz

10mW

9.3 =>

1.2 GHz

94.18 GHz

TX Bw

CF < 1 KHz

PHASE LOCKED  
2 NOISE SOURCES

95 94.8 - 95.8

USB

9.8

6.8