

## TRANSIENT FREQUENCY BEHAVIOR

The transmitter was tested for transient frequency behavior using the test method TIA/E1A-603. The test setup is shown in Fig. 1. The functions of the test receiver and storage oscilloscope were provided by the HP spectrum analyzer using the FM demodulator option with span set to zero. Resolution and video bandwidth were both set to 30 kHz. The spectrum analyzer was triggered using an enable signal from the transmitter which was delayed using a variable delay. The function of the RF power meter was provided by the spectrum analyzer. The 1 kHz test signal was provided by the Marconi Radio Communications test set.

Test Requirements per 90.214 are:

1. Frequency deviation during  $t_1$  may be greater than  $\pm 12.5$  kHz because power output is less than 6 watts.
2. Frequency deviation during  $t_2$  (10 ms to 25 ms) must be less than  $\pm 6.25$  kHz.
3. Frequency deviation after  $t_2$  (25 ms) must be less than FCC limits which are  $\pm 2.5$  PPM  $\times 460$  MHz =  $\pm 1.15$  kHz.
4. Frequency deviation during  $t_3$  may exceed  $\pm 12.5$  kHz because power output is less than 6 watts.

The upper plot of Fig. 2 shows the transmitter output spectrum with the attenuator = 0dB. The middle plot of Fig. 2 shows the unmodulated 1 kHz test signal set to 50 dB below the transmitter signal level. The lower plot of Fig. 2 shows the output spectrum of the modulated 1 kHz test signal.

The upper plot of Fig. 3 shows the test receiver output of the 1 kHz test signal with deviation =  $\pm 12.5$  kHz. The middle plot of Fig. 3 shows the device turn-on transient with the test signal unmodulated on a scale of  $\pm 12$  kHz. The lower plot of Fig. 3 shows the turn-on transient behavior of the transmitter on a  $\pm 12$  kHz scale. During the  $t_1$  interval the deviation exceeds  $\pm 12.5$  kHz which is allowed because power output is less than 6 watts. During the  $t_2$  interval the deviation is within the  $\pm 6.25$  kHz limit. The frequency resolution is not sufficient to accurately check the deviation after the  $t_2$  interval. For better resolution the top and bottom plots of Fig. 4 were made with

the vertical scale reduced to  $\pm 4$  kHz (limit =  $1.15 \text{ kHz} \times 1 \text{ div/kHz} = 1.15 \text{ div}$ ). From the bottom plot the deviation is clearly within the limits after the  $t_2$  interval.

The upper plot of Fig. 5 shows the transmitter switch-off behavior. The lower plot of Fig. 5 shows the same signal but with increased vertical resolution of  $\pm 4$  kHz. The frequency deviation during the  $t_3$  interval is less than  $\pm 12.5$  kHz.

## CONCLUSION

The transmitter has been verified to comply with the FCC requirements of paragraph 90.214 for the transient behavior during switch-on and switch-off conditions.

## MEASUREMENT EQUIPMENT:

Hewlett Packard Spectrum analyzer Model 8591A  
S/N 3212AO2920  
Options 004, 021, 102

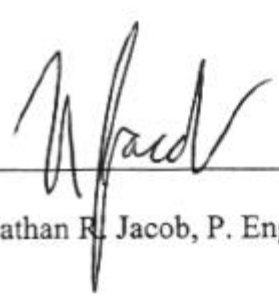
10 MHz Rubidium Frequency Standard  
EFRATOM Model FRK-L S/N 25016879

Marconi Instruments  
Radio Communications Test Set Type 52955-900A  
S/N 132085/227

HP VJF Attenuator Model 355D  
50 SL, 10dB steps  
S/N 1204A23633

Measurements made and recorded by:

Sept. 16, 1999

  
Nathan R. Jacob, P. Eng.

| REVISIONS |             |               |
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| LTR       | DESCRIPTION | BY DATE APP'D |
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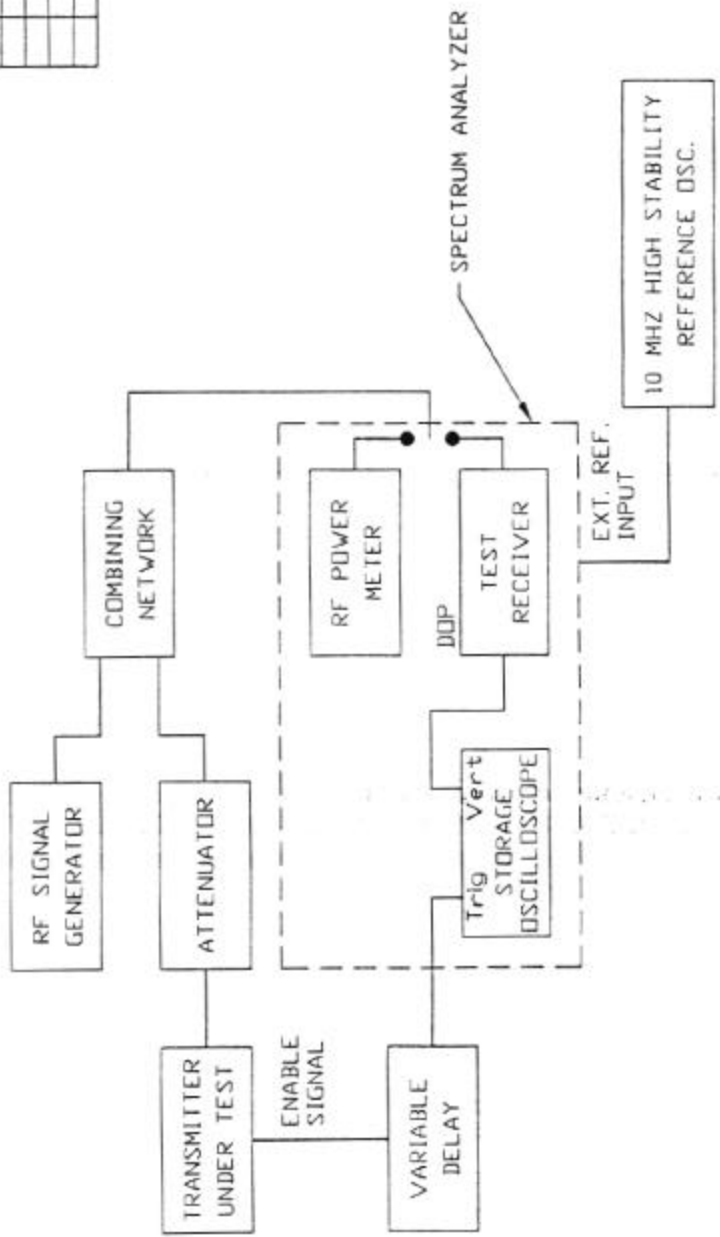
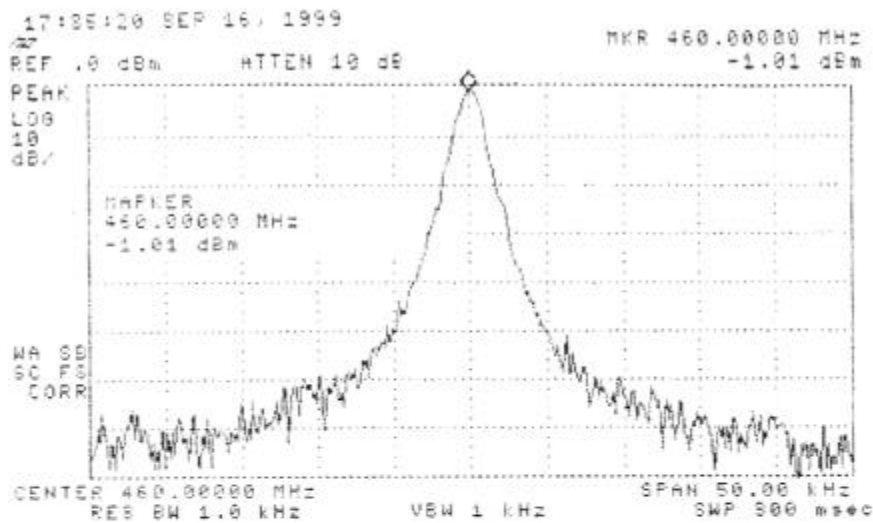


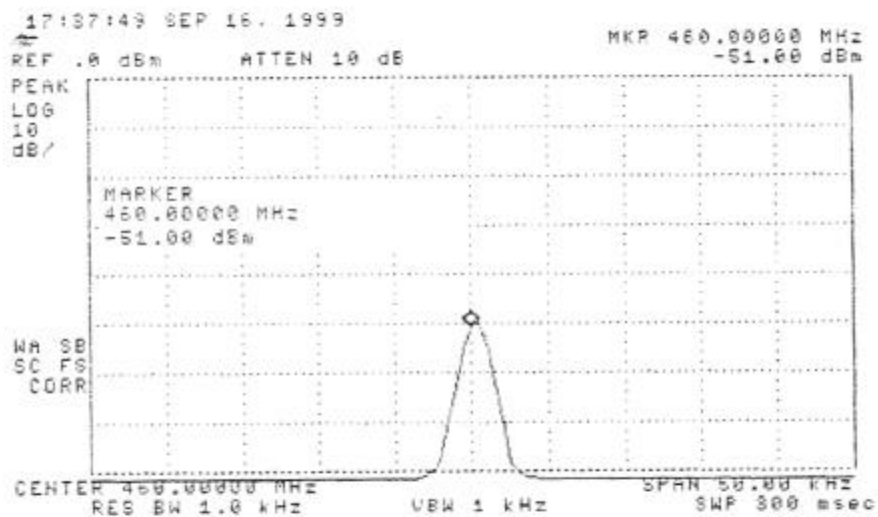
FIG. 1  
TRANSIENT FREQUENCY BEHAVIOR  
TEST SET-UP

|                                                                                                                                     |  |                                                             |                  |
|-------------------------------------------------------------------------------------------------------------------------------------|--|-------------------------------------------------------------|------------------|
| UNLESS OTHERWISE SPECIFIED<br>DIMENSIONS ARE IN INCHES<br>FRACTIONS DECIMALS ANGLES<br>1/16 1/32 1/64 1/8 1/4 1/2 3/4 1 1 1/2 2 3 4 |  | APPROVAL<br>DRAWN J.E.G.<br>CHECKED<br>APPROVED<br>INT-REV. | DATE<br>12-11-97 |
| MATERIAL<br>FINISH<br>SCALE                                                                                                         |  | TITLE<br>HEXAGRAM, INC.<br>CLEVELAND, OHIO<br>LLB6327       |                  |
| USED ON:                                                                                                                            |  | DRAWING NO.<br>REV.                                         |                  |
| BLOCK2.dwg                                                                                                                          |  | DO NOT SCALE DRAWING<br>SIZE B SHEET OF                     |                  |

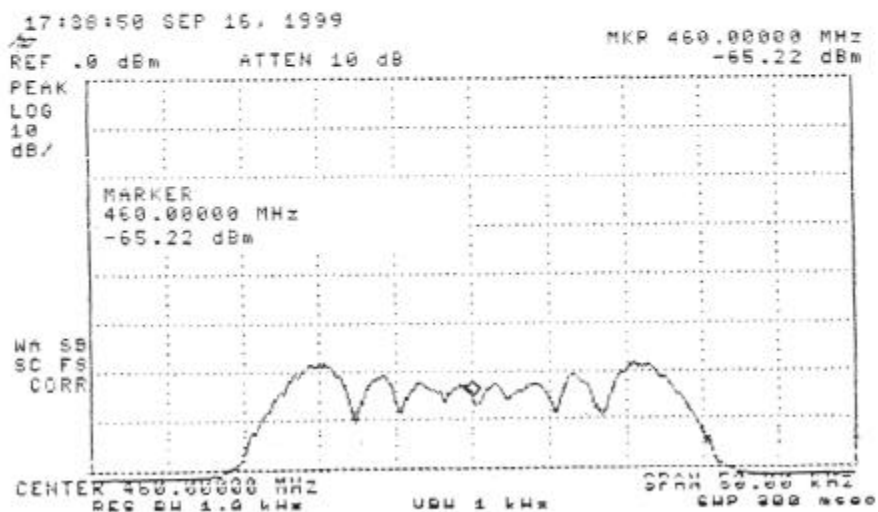


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**Star Flatpac**  
Spectrum  
Power Level = -1.22 dBm



**1 kHz Test Signal (unmodulated)**  
Spectrum  
Power Level = -50.21 dBm

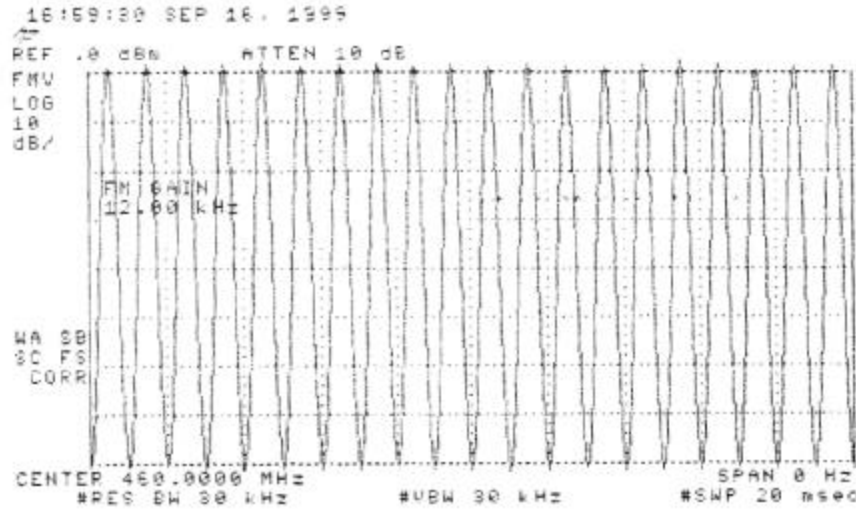


**1 kHz Test Signal**  
Spectrum  
±25 kHz deviation

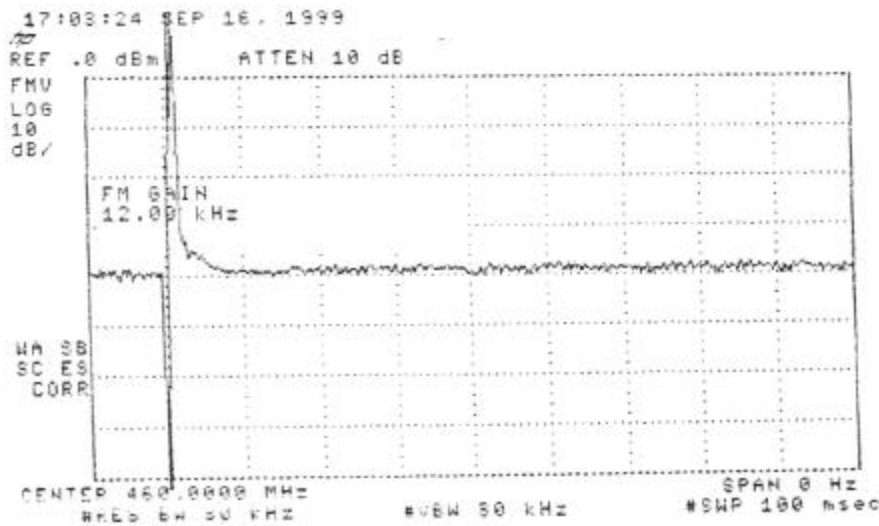
**Figure 2**

Figure 3

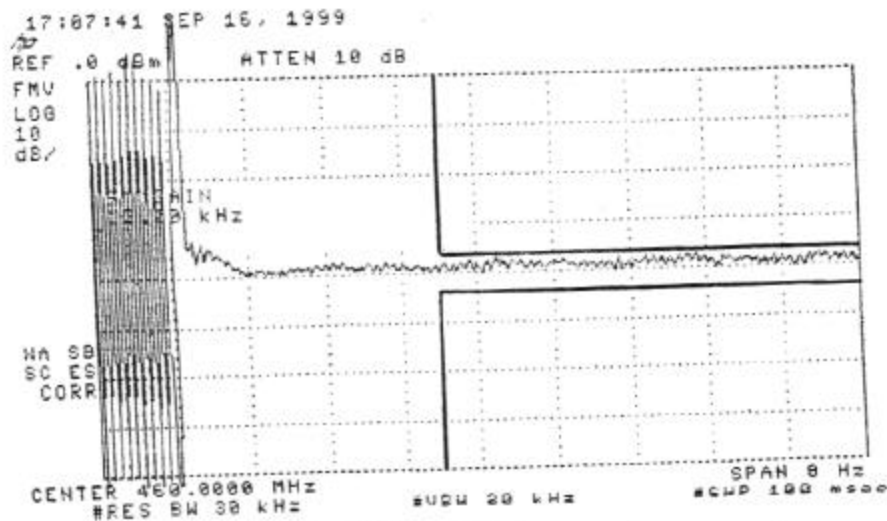
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**1 kHz Test Signal**  
Test Receiver Output  
 $\pm 25$  kHz deviation

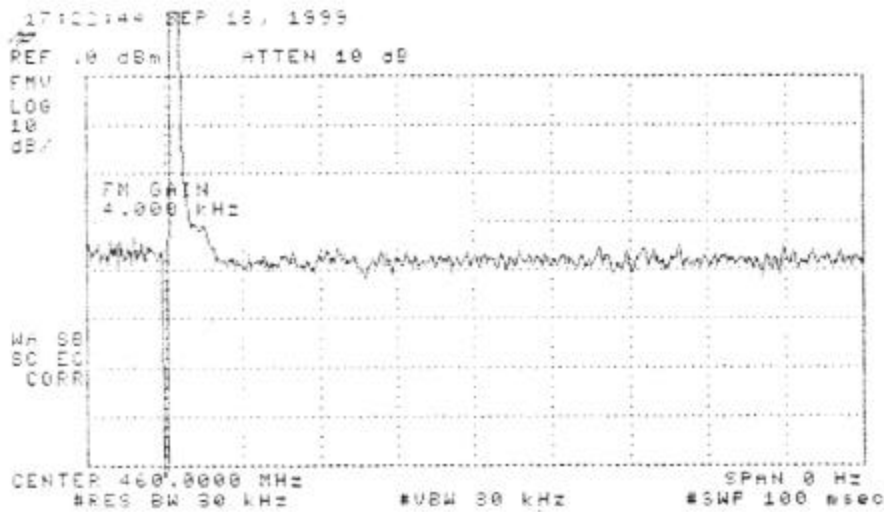


**Star Flatpac Turn-on**  
Test Receiver Output  
3.0 kHz / div  
Test Signal unmodulated

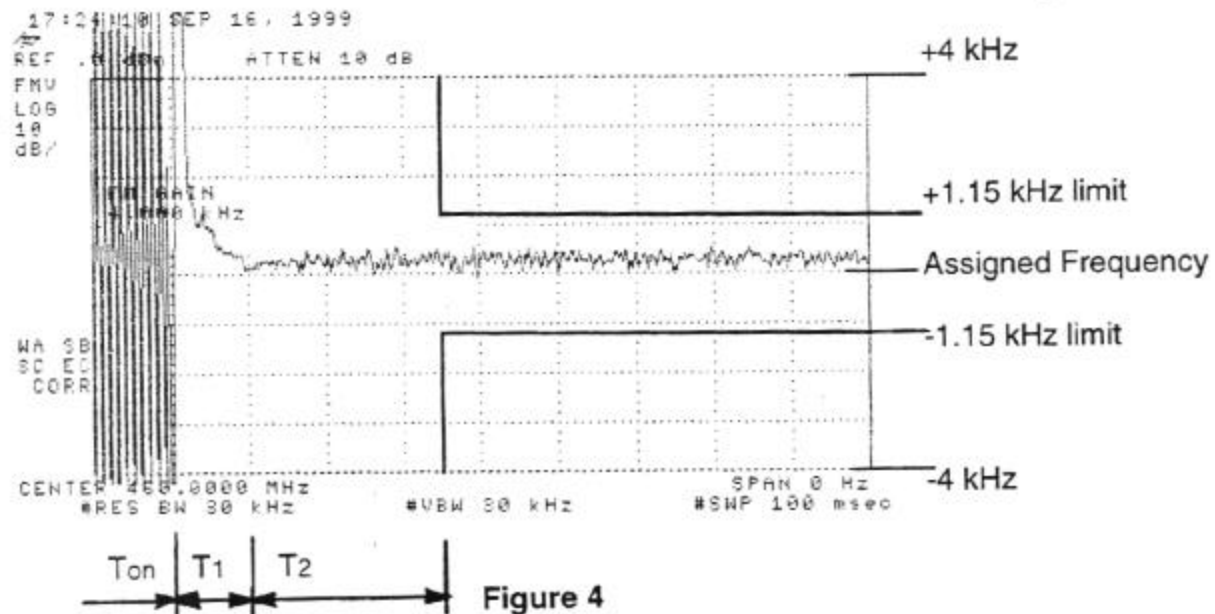


**STAR Flatpac Turn-on**  
Test Receiver Output  
3.0 kHz / div  
Test Signal modulated

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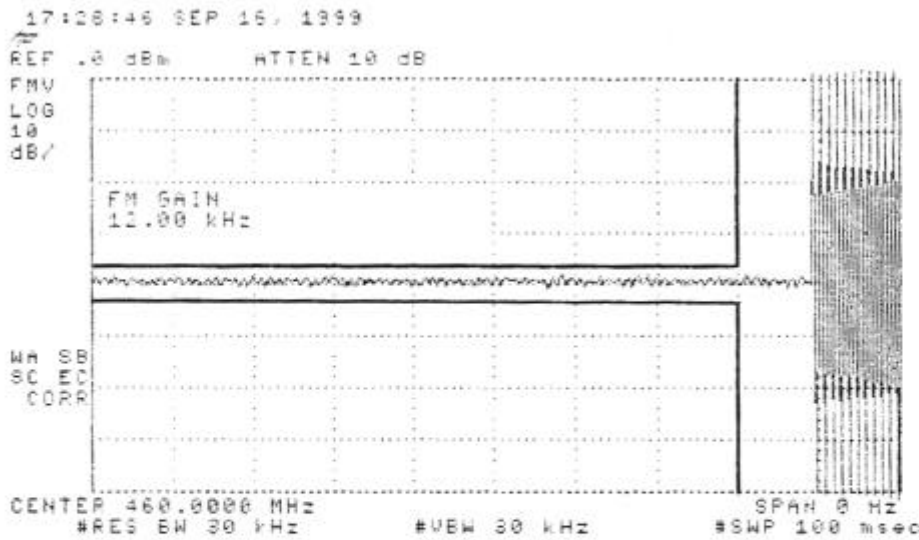


**Star Flatpac Turn-on**  
 Test Receiver Output  
 1.0 kHz / div  
 Test Signal unmodulated



**Figure 4**

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**Star Flatpac Turn-off**  
Test Receiver Output  
3.0 kHz / div  
Test Signal unmodulated

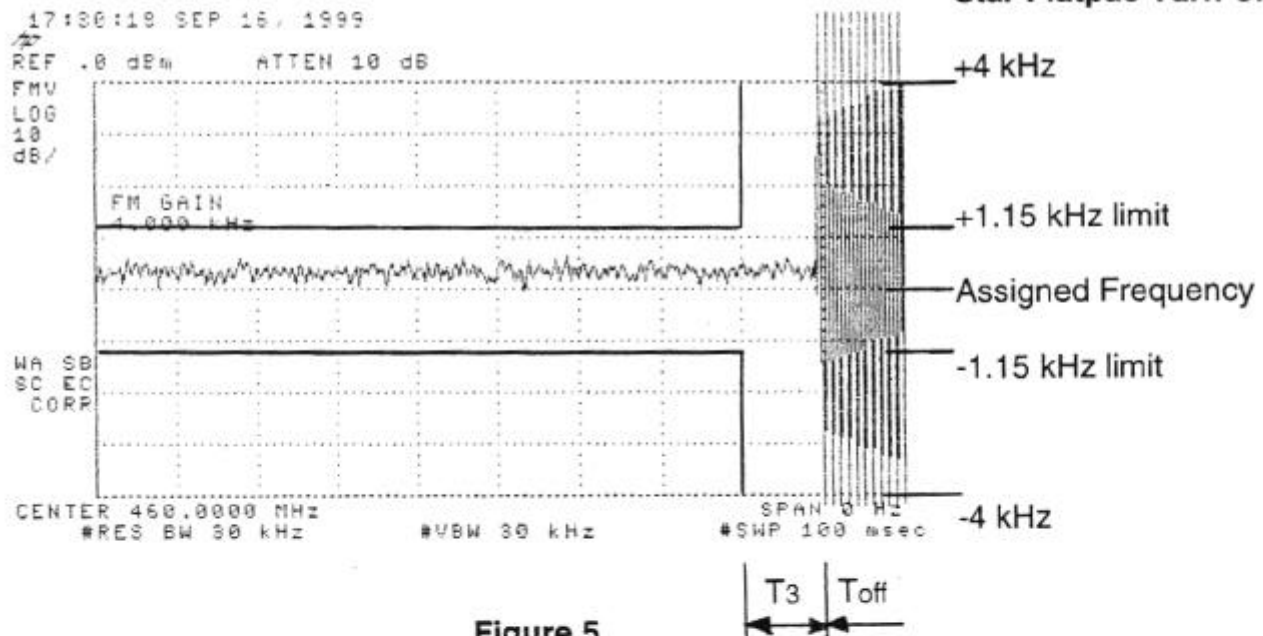


Figure 5