2.983 EMISSIONS AT ANTENNA PORT

Emission limits are defined as per Part 27.53. All attenuations are for signals outside of the licensed bandwidth and are referenced to the total RMS transmitter power, measured in a 1 MHz resolution bandwidth. The requirements are defined as follows:

27.53.a.1: Attenuation of frequencies between 2320 and 2345 MHz is at least 80 + 10 LOG (mean output in watts) below the mean output power. For a 2 Watt system this results in an attenuation of 83 db below reference power.

27.53.a.3: Attenuation of frequencies below 2300 MHz or above 2370 MHz is at least 70 + 10 LOG (mean output power in watts) below the mean output power. For a 2 Watt system this results in an attenuation of 73 db below reference power.

Attenuation of frequencies between 2300 and 2320 MHz or between 2334 and 2370 MHz that are outside of the licensed channel is at least 43+ 10 LOG (mean output power in watts) below the mean output power. For a 2 Watt system this results in an attenuation of 46 db below reference power.

Measurements near the transmitter frequency were made in a 30 kHz resolution bandwidth to provide more accuracy in measuring the spectrum shape. Tones and signals occupying less than a 30 kHz bandwidth will measure the same level as a 1 MHz resolution bandwidth and no adjustment is necessary. Any signal measurement occupying more than a 30 kHz bandwidth must be adjusted to the defined 1 MHz resolution bandwidth. For flat noise this adds 10log (1000/30) = 15 dB to the attenuation requirements.

All measurements were made with a transmitter tuned to operate at 2352.5 MHz. Noise level measurements were made at the frequency offset of the nearest channel band edge for each transmitter bandwidth.

Transmitter emissions were measured at the antenna port output using HP8566 Spectrum Analyzer. The signal level at the antenna port was adjusted to +33 dBm (normal output). The signal level into the analyzer was attenuated to a reference level of +29 dBm (1 dB below analyzer max input to prevent overload). Measurements were then offset by this reference level.

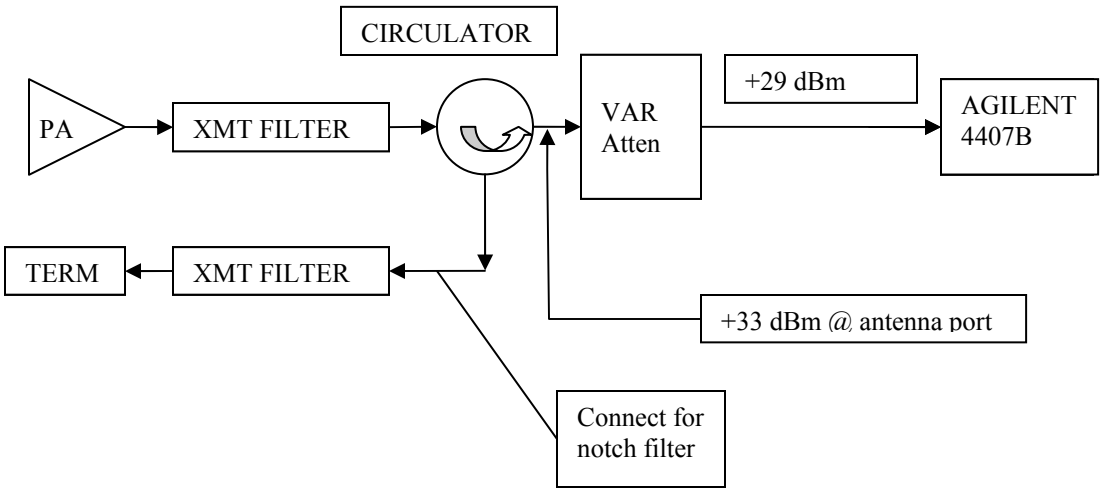

Figure 2 shows a close in view of the modulated spectrum. Figure 3 shows the same modulated spectrum over a wider range. The limits of the nearest channel edge are shown by the dark line. Section 27.53.a.3 specifies an attenuation of 46 + 15 = 61 dB for flat noise.

Since the emission measurements do not apply to signals within the licensed channel, the 1 MHz measurement is stopped 500 kHz from the channel edge. For most of the spectrums the emissions still appear as wideband noise and the 15 dB correction applies. For the spectrum shown in Figures 2 and 3 of JF6-8702-16 there is a slight spillover of the transmit signal into the adjacent1 MHz measurement band. This spillover appears as narrow band noise; therefore the 15 dB correction does not apply.

Due to the limited dynamic range of the analyzer, it was necessary to create a notch filter to attenuate the transmitter output when measuring attenuations greater than 70 dB. This was done by reversing the output circulator and connecting a second transmit bandpass filter, tuned to the transmitter frequency and terminated in 50 ohms, to the receiver port of the circulator. The circulator passes signals from the transmitter to the second filter. Signals in the passband of the second filter are passed through and absorbed by the termination. The circulator then passes the reflected signals to the attenuator and spectrum analyzer. This forms a notch filter where the rejectband is the passband of the second bandpass filter. The rejectbands of the second filter become the passbands of the notch filter.

The response of the transmitter output with the notch filter installed and the first transmit bandpass filter removed is included in Figure 4 to show the notch filter effects. The noise floor of the transmitter is attenuated in the reject band of the notch filter. The notch filter has no effect on the transmit signal at frequencies more than +/- 5 MHz from its center. The attenuation of the noise in the rejectband from the flat line response should be added to the noise levels measured at the transmitter output. For example, signals +/- 3 MHz from center are attenuated 10 dB. No adjustments were made to the transmitter output level with the notch filter installed, but the attenuation setting of the analyzer was reduced by 30 dB to increase the signal level above the analyzer noise and allow measurement of the transmitter noise floor. The reference level of the analyzer was also changed by 30 dB to compensate for the reduced attenuation.

Figure 5 represents the noise emissions at the nearest band edge of a transmitter operating in the 2305 to 2315 MHz or 2350 to 2360 MHz blocks. Section 27.53.a.1 requires the noise to be attenuated by 83 + 15 = 98 dB. The dark line shows the nearest application of this limit. The notch filter effects are negligible at this band edge. The section 27.53.a.3 limit is lower and farther away. Therefore, its limits are also met.

Figure 6 represents the noise emissions at the nearest band edge of a transmitter operating in the 2345 to 2350 MHz block (included only for radios that may operate in this block). Section 27.53.a.1 requires the noise to be attenuated by 83 + 15 = 98 dB. The dark line shows the nearest application of this limit. The section 27.53.a.3 limit is lower and farther away. Therefore, its limits are also met. The asymmetrical noise response is due to the combined effects of the transmit filter and the notch filter. When operating in the 2345 to 2350 MHz block, the transmit filter is centered above the transmitter operating frequency to provide additional rejection of the transmitter idle noise. When operating in the 2315 to 2320 MHz block, the transmit filter is centered below the transmitter operating frequency. The noise emissions are the same as in Figure 6, except they are mirrored about the operating frequency.

Figure 7 shows a wide view near the transmitter operating frequency to show the noise emissions that may fall in the section 27.53.a.1 attenuation range. It shows that there are no emissions that would exceed its attenuation limits of 83 + 16 = 98 dB.

Figure 8 shows the emissions from 1 MHz to 2300 MHz. This measurement was made with a 1 MHz resolution bandwidth. The section 27.53.a.3 attenuation limit of 73 dB applies without correction.

Figure 9 shows the emissions from 2370 MHz to 22 GHz. This measurement was also made with a 1 MHz resolution bandwidth. The section 27.53.a.3 attenuation limit of 73 dB applies without correction. Note that the noise response shown is due to the noise floor of the spectrum analyzer. The actual noise from the transmitter could not be measured, but is below this floor and therefore also meets the limits.

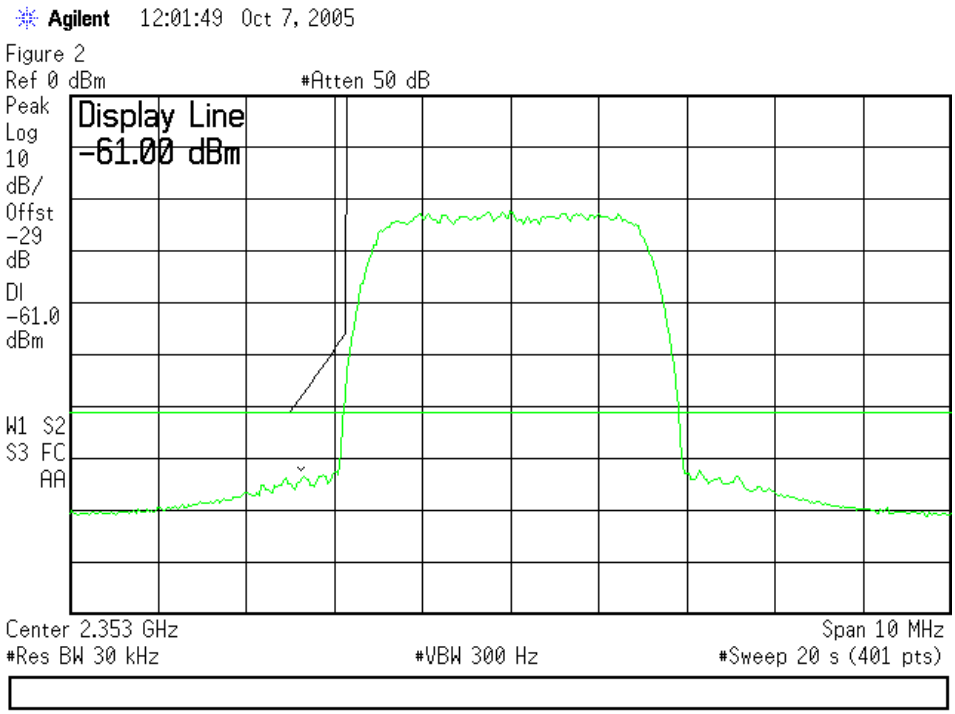

FIGURE 2.

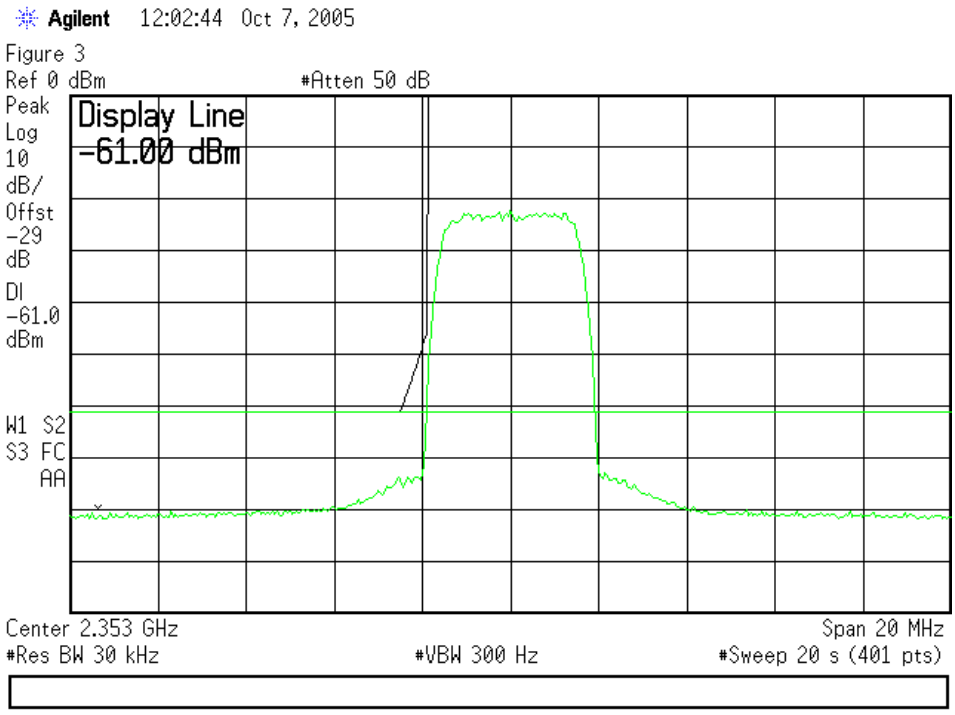

FIGURE 3.