

ABOUT MODULATION

Modulation levels oftentimes can have negative effects on the outcome of the required annual NRSC measurements. The FCC rules contain very specific limits regarding the modulation levels of AM & FM stations. Interestingly though, the rules for AM NRSC measurements do not contain requirements for checking modulation levels. In my travels I have discovered that a sizable number of my client stations were not passing the NRSC measurements due to spurious emissions being generated beyond their licensed frequencies. Ultimately, after careful measurements with precision test equipment, I determined that some of the NRSC measurement failures were being caused by **excessive** modulation.

In a continuing effort to find ways to enhance and bring added value to the services that I provide to my clients, I include a modulation level check and analysis for each of my clients stations. The modulation analysis report includes a graphical display of a 10- minute segment of on-air audio at the time of measurement. There is much useful information that can be derived from this analysis including peak modulation, average modulation, dynamic range, modulation density, etc. There is **no additional charge** for this service.

In addition to enabling a more complete understanding of the NRSC measurement data for each station, there are other benefits to be derived by knowing exactly what's going on with your modulation. **Over modulation** has been shown to produce some rather nasty audible side effects, and potential interference to other stations. On the other hand, **under modulation** can cost you coverage, listeners, and ultimately money. I have discovered that many stations are over modulated and surprisingly, a near equal percentage of stations that are under modulated, some severely.

If you don't know this already, AM modulation translates into power. A fully legally modulated transmitter will emit up to 1.5 times its licensed power. If you are not utilizing that power, you are not reaching out as far as you could otherwise. Audio processing density is also another important factor to consider. Suffice it to say that I have found many stations that are at a coverage disadvantage simply because they are poorly processed. For all of my clients, I include measurements for modulation and follow-up analysis with each annual NRSC report.

If you would like to discuss this (or any other) matter and possible solutions in greater detail, I can be reached at any time at (918) 521-8693. Additional information, including a list of the other services that I provide, please go to my web site:

www.diproservices.com

Norm Laramee

MODULATION INFO

STATION:	KPRV-AM
Date Measured:	10/5/2022
Positive Peak/Avg Mod:	100%
Negative Peak/Avg Mod:	-100%
Absolute Legal Limits:	+125% / -100%

(See the full **KPRV** modulation analysis on the next page.)

MODULATION - GENERAL TECHNICAL NOTES

- ◆ Most transmitters and audio processors today are capable of asymmetrical modulation. Legal limits are 125% positive and 100% negative modulation. Technically it is not possible to modulate more than -100% since it would result in a 100% reduction of the carrier (no signal). It is usually best practice to shoot for about -97% and never hit -100%. Depending on the transmitter and antenna system, all kinds of distortive effects usually result beyond -100%.
- ◆ It's ok to modulate evenly at 100% positive & negative. But to do so means losing potential coverage since full non-symmetrical modulation will increase your output power 1.5 times.
- ◆ 125% is the absolute legal limit for positive modulation. Most stations shoot for 120% or so and leave a little headroom so they don't exceed 125%. Going beyond 125% can generate some serious spurious signals above and below your licensed frequency with some transmitters. This could cause some interference to other stations, and possibly a hefty fine if the FCC were to find out.
- ◆ Special attention should be paid to making sure that the wiring between the output of the peak limiter and the input of the transmitter is properly polarized. If the positive and negative wire connections are reversed you will never do better than an even 100% positive/negative modulation. Any attempt at that point to modulate non-symmetrically will only get you increasingly less and less positive modulation relative to the negative. I have seen a number of stations operating in this manner and when possible, have helped them correct the situation.

*Note: FCC rules do not require modulation measurements as part of NRSC compliance.
The data presented here is for informational purposes only.*

ANALYSIS

EXHIBIT KPRV-1:

Shows the spectrum 25 kHz above and below the carrier frequency. (*Emissions 10.2 kHz to 20 kHz removed from the carrier must be attenuated at least 25 dB below the unmodulated carrier level. Emissions 20 kHz to 30 kHz removed from the carrier must be attenuated at least 35 dB below the unmodulated carrier level.*)

Narrow band performance is within acceptable limits.

EXHIBIT KPRV-2:

Shows the spectrum 50 kHz above and below the carrier frequency. (In addition to the above: *Emissions 30 kHz to 60 kHz removed from the carrier must be attenuated at least $[5 + 1 \text{ dB/kHz}]$ below the unmodulated carrier level.*)

Mid band performance is within acceptable limits.

EXHIBIT KPRV-3:

Shows the spectrum 100 kHz above and below the carrier frequency and indicates the full NRSC mask which additionally requires that emissions 60 kHz to 75 kHz removed from the carrier be at least 65 dB below the carrier. (In addition to all of the above: *Emissions between 60 kHz and 75 kHz of the carrier frequency must be attenuated at least 65 dB below the unmodulated carrier level. Emissions removed by more than 75 kHz must be attenuated at least $43 + 10 \text{ Log (Power in watts)}$ or 80 dB below the unmodulated carrier level, whichever is the lesser attenuation, except for transmitters having power less than 158 watts, where the attenuation must be at least 65 dB below carrier level.*)

In this case, at 1000w, emissions removed by more than 75 kHz must be attenuated at least -73db below the carrier level.

All excursions above the mask were verified as not related to the KPRV main carrier.

Wide band performance is within acceptable limits.

CONCLUSION:

The measurement results confirm that KPRV emissions are within NRSC limits and there appear to be no transient problems.

Harmonic measurements confirmed that the emissions at the second harmonic are less than the required -73db below the carrier and therefore in compliance. However, Emissions at the third harmonic are at -64db which is 9db above the required limit.

It is believed that KPRV is in compliance with FCC 73.44.