

Fanfare's FP-TRO HD Radio Translator System

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As many stations convert to digital transmission, FM translator operators have had two new problems to solve – getting translators and receivers that are compatible with the HD signal. Fanfare, long a manufacturer of high grade receivers, now offers a complete HD translator package.

With the introduction of HD Radio, there was a need for development of a “heterodyne” type re-transmitting system. A system was needed that could not only translate without de-modulation and re-modulation, but had the sensitivity to deal with low signal conditions.

DIGITAL VS ANALOG

For stations seeking to translate HD signals, especially in areas with problematical reception of the originating station, the FP-TRO from Fanfare may be just the product they need. Significantly, the translation occurs entirely within the analog domain.

There is no HD decoding or encoding going on anywhere in the translator chain. The apparatus of the receiving/rebroadcasting system is entirely analog from antenna to antenna. In addition, it is never demodulated nor decoded.

The development of the FP-TRO began in the year 2000 when I met with Omega Reception Technology's President Fred McCutcheon to discuss Omega's new AM radio circuit. Circuit designer Warren Brown had recently patented his new “no tailed pair” (NTP) based amplifier and extended the technology into a remarkable AM receiver.

NEW TECHNOLOGY – THE NTP AMPLIFIER

Brown's was a significant achievement, which is now the subject of a telephone-book-sized set of technical papers and a U.S. Patent.

What is NTP is all about? According to Brown it is quite simple. “If you are never to clip a signal, or drive any of the active stages into momentary overload – as is found in a lot of today's circuitry – you will not get as much static as you would if you did.”

In addition to TRF control circuits that do not drift and mixers that do not combine impulse noise with the signal, the NTP has made possible the construction of an IF strip with a wide bandwidth but very steep and deep flanges and a very high speed AGC. This AGC is used to remove any envelope content (AM interference – usually caused by multipath) from the IF signal before it is sent to the converter unit, which takes the cleaned and regulated IF signal from the receiver unit and, using a linear modulator technique similar to the one in the receiver, reconverts it back to a frequency on the FM band.

BUILDING A BETTER TUNER

In conventional tuners, or translator converters, it is common practice to use only one front end stage and many IF stages in order to get sufficient reduction of adjacent channels.



The Fanfare FP-TRO HD Radio translator system.

It also is common practice in FM tuners to bring the IF strip into limiting (clipping) as soon as possible. This is in order to attempt to remove the AM content from the signal before it is either demodulated or reconverted and rebroadcast. Unfortunately, doing so indelibly imprints the noise from the AM domain to the FM, or time, domain. A fast AGC, such as that used by Omega Technology in the Fanfare FP-TRO, does not exhibit this fault.

The Fanfare FP-TRO, is based on an ultra-high performance tuner section having a triple, dual-stage tuned-radio-frequency (TRF) front end, and a linear modulator based RF-to-IF conversion system. This circuitry can exhibit a 20 to 40 dB advantage over a conventional mixer in noisy reception conditions. Both of these system components were made possible and economically feasible through use of the NTP invention.

BRINGING THE SYSTEM TOGETHER

At the April, 2007 NAB show the Fanfare FP-TRO HD Radio translator system was demonstrated to an audience consisting of representatives from the Crown Broadcast engineering team and the well-known “translator doctor” Tom King of KCRW.

Each left the demo impressed with the fact that the FP-TRO could reliably translate all available Las Vegas HD stations, right down to the first adjacent, without any apparent signal loss or distortion.

TESTING IN THE FIELD

Field trials of the FP-TRO were next and Fanfare was fortunate to have Tom King as host. The group for which he contracts was actively looking at the effectiveness of translating HD Radio in the Oxnard/Santa Barbara area.

“The translator on which the FP-TRO was to be demonstrated was K272DI, 102.3 MHz, a translator of KCRU's 89.1 signal. KCRU is licensed as a satellite station of KCRW, Santa Monica,” said Steve Herbert, KCRW's Chief Engineer.

The original translator installation utilized a Crown FM-30 at 10 Watts. This installation also used the same 10-Watt output power level using Crown's LA-75 linear amplifier strapped to 10 Watts. The same antennas, transmission lines, and original signal source are used.

FIELD TESTING

The FP-TRO system consists of two boxes – one being the receiver and the other being the upconverter/translator. They are connected by a short length of 50 Ohm coax. The installation went off without a hitch. With the FP-TRO in place and fired up, retransmitting an HD Radio signal, the Fillmore, CA, area was alive with solid HD Radio coverage.

The equipment appeared to be performing well. To confirm this Steve Herbert radioed back his observations as he drove around the Fillmore valley taking signal strength and quality readings. “The receiver I used was a Kenwood KD-HDR1 coupled to a Kenwood EZ-500 car stereo,” He said. “I drove approximately 130 miles that day testing and listening to the station. The HD signal was solid to least seven miles out.”

Herbert continues: “The translator's analog signal carries about twenty miles before it is completely lost, but that varies depending on terrain. Bottom line – it worked and we look forward to extending to our translator listeners the opportunity to benefit from the additional features and services HD offers now and in the future.”

FIELD TRIAL A SUCCESS

The signal was just converted from one frequency to another without any of the multipath or impulse noise normally found in a rebroadcast signal. With this technology, any HD2 or HD3 signals are also translated. According to Tom King, the test was an “unqualified success.”

What had taken place was unique for a translator retransmitting an HD Radio signal. The receiving/rebroadcasting system was entirely analog from antenna to antenna. There was no demodulating, decoding or encoding anywhere in the translator chain.

“The installation was simple to accomplish with only a few more interconnects than usual,” said King. “The receiver did not overload with a 400 Watt station within twenty-five feet of the receive antenna. The HD signal coverage followed the 60 dBu contour of the station and was consistent throughout the area. Overall signal quality was excellent and modulation was very clean as expected for an IF translator.”

The FP-TRO has continued to do the “seemingly impossible” by solidly translating KCRW's HD Radio signal throughout – and beyond – the normal coverage footprint without any power boost.

MULTIPATH PROBLEMS OVERCOME

A conventional tuner – equipped with HD-R capability – was used to conduct some of the analog tests. As expected, its incoming signal was fraught with typical multipath noise. Yet, that same tuner exhibited no multipath on the incoming station as long as it was tuned to the FP-TRO's output. The FP-TRO had removed the effects of the multipath, even in the rebroadcast signal. (Of course, multipath that occurs between the FP-TRO's rebroadcast signal and the conventional tuner cannot be taken into consideration.)

Listeners have commented on how well the FP-TRO deals with annoying multipath. Even stations that were nearly unlistenable due to multipath on many good tuners and receivers were found to be crystal clear through the receiver unit of the FP-TRO pair.

According to Warren Brown the FP-TRO was the first tuner he has experienced that truly seemed to lick multipath interference. This was particularly true on some strong local stations with horrific multipath problems. The FP-TRO's receiver picked up weak stations without any “sputter and rattle” where Brown did not even know FM stations existed.

NOT A CURE-ALL

It is easy to view versatile equipment like the FP-TRO as a “panacea” for all translator reception woes, but we are not there as yet. We did find an area where there was strong HD signal on both second and first adjacent channels. In that instance the skirts of the heavily-modulated first or second adjacent HD signal could easily get mixed in with that of the fundamental and the translator might end up translating both, which we all realize is a no-no.

In this case, where the translation is of “dirty” next-adjacent HD stations, the FP-TRO might not offer the most cost-effective solution over that of a typical exciter-based setup. But that situation is far from the norm. In general, the FP-TRO has the cleanest tuner I have produced.

By the time this article appears, we will have our surface mount device (SMD) prototype in the field. As soon as trials are completed, production units will follow during the fourth quarter of 2007.

More information on Fanfare can be found at fanfarefm.com

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