Frequency Distribution Systems

Precision Test Systems manufacture complete frequency distribution systems.

A system will typically consist of a redundant GPS disciplined, rubidium frequency standard and redundant distribution amplifiers. Often systems will have hundreds of outputs.

Problems to be overcome in a frequency distribution system

There are many problems to be overcome and some include:

- Distribution amplifiers may need to be operated in series. Phase noise increased every time an amplifier is placed in series with another. So this should be kept to a minimum with ultra low phase noise amplifiers.
- Amplifiers can become un-stable, when operated in series. So amplifiers should have the correct gain and be stable to prevent this from happening. Ideally amplifiers should have automatic gain control circuitry so the gain of the overall system is automatically set.
- Isolation between the outputs should be high, so any noise accidentally injected into one output does not affect any other outputs.
- As the outputs will be connected to different types of equipment, each channel of the distribution amplifier should have an output level control. This enables each channel output to be adjusted to match the equipment connected to it.
- All amplifier outputs must be stable into different load impedances.
- Often equipment to be synchronized is located in different buildings that may be located a long way from each other. The system designer must ensure noise is not picked up along long cable lengths.
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Precision Test Systems have designed systems with hundreds of outputs. Distribution amplifiers have been located in different buildings. Low phase noise has been retained despite all the amplifiers being inter-connected.

Case history 1. Our first ever installation, still going ten years later

Our first ever frequency distribution system consisted of eighteen RF test chambers. Each chamber was used to align two-way radios and the RF chambers had over 120 dB isolation. This was necessary so each chamber didn't interfere with each other.

As each chamber would effectively be connected to the other chambers via the distribution amplifier outputs, it was essential that the distribution amplifiers had very high isolation, otherwise the shielding of the test chamber would be compromised.

We installed a rubidium frequency standard and twenty distribution amplifiers and over 6 km of double screened high quality coaxial cable.

Once the installation was installed, we had to prove to the customer that our system hadn't compromised the shielding. We confirmed this by generating a 20 watt RF signal (+43 dBm) signal inside each RF chamber and using a spectrum analyzer, checking for any radiation outside the chamber. We could effectively measure to over 150 dB. The RF test chambers still made the screening specification (125 dB) and we had a happy customer.

Case History Two. Our toughest installation

A satellite company approached us and said they required a frequency distribution system with about 500 outputs.

The reference for this system was a 10 MHz OXCO oscillator with ultra low phase noise. We didn't supply the oscillator but were told it had cost them over USD 20, 000 as it was so state of the art.

We had to distribute this 10 MHz to over 500 outlets, located in many different buildings. That's the easy part. The hard part is that we had to maintain the phase noise of the reference (about -115 dBc/Hz @ 1 Hz offset) as the 10

MHz would eventually be multiplied to around 40 GHz.

We calculated we needed a distribution amplifier with a -130 dBc/Hz phase noise (at a 1 Hz offset) and a -165 dBc/Hz floor noise.

The customer also wanted AGC (automatic gain control) and high channel and reverse isolation.

Our existing amplifiers didn't achieve these specifications. Moreover , this amplifier had to achieve this ultra low phase noise, under vibration. The customer wouldn't allow an cooling fans to be used.

So we developed a new distribution amplifier and the DA1-100-10 was the result.

We shipped off about 45 pieces and the customer installed this system.

This was a few years ago and this is what the customer has told us:

We finished our FAT of the first project a few weeks ago and it went extremely well. Phase noise of the system was extremely good and very predictable, which was a pleasant surprise to me. The DA1-100-10 units behaved extremely well functionally and their performance was excellent and consistent with the data and specs for the units.

Later on they wrote:

*I was just thinking about your DA1-100-10 distribution amps. We are currently having trouble with some amps from one of your **competitors.** I was extremely impressed with how well **your** amplifiers worked in series - one amp feeding another, feeding another, which seems to be where my coworkers are running into trouble. There are no issues with your amps. The systems are installed in the field.*

Our DA1-100-10 is now our top selling distribution amplifier and is proving to be a reliable unit.

Case History Three. Our latest and largest installation

A full write up of our latest installation as at June 2010 is available by clicking here

Summary

Precision Test Systems has had a lot of experience in designing frequency distribution systems. We specialize in designing bespoke systems at a cost- effective price.

We guarantee our distribution amplifiers for three years.

Distribution Amplifiers - Click here for more details