[illegible]

2213A/2215A/2235/2236 POWER SUPPLY AUDIBLE NOISE

RE: Mod #54681

Implemented in Manufacturing:

2213A	B016090
2215A	B013550
2235	B015626
2236	B014886

The preregulator and DC-DC converter frequencies may be harmonically close enough to produce an audible beat. This anomaly will only occur after changing some major power supply frequency determining part, e.g. T944. Engineering changed R919 to a selectable part, allowing a Technician to alter the preregulator frequency a small, but sufficient amount, thereby, stopping the audible beat.

R919 Nominal value 10Kohm 315-0103-00
Alternate value #1 11Kohm 315-0113-00
Alternate value #2 9.1Kohm 315-0912-00

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2220/2230 AUDIBLE NOISE FROM POWER SUPPLY

REF: Mod #60432
Mod #60111
Mod #60530

Over the years there have been power supply audio noise problems associated with 2200 series oscilloscopes. The usual fix has been to replace T948 or R919. During the manufacturing introduction of the 2220/30 this problem has shown up in a large percentage of instruments, necessitating research into the problem. It was discovered that in reality there are several noise sources. They are as follows: T948, T906, and C907. Each component has it's own mode of noise generation. As far as we know these are the only noise sources.
The solutions to these problems are to replace the above items with modified or different parts as follows:

1) T948 changed to Tektronix P/N 120-1601-01

2) T906 changed to Tektronix P/N 120-1439-01

3) C907 changed to Tektronix P/N 285-1177-01

The differences in these parts are as follows:

1) T948: the -01 version will have the filament winding bobbin firmly attached to the main body of the transformer. Also, the shield band around the outside of the transformer will be modified to prevent it's possible vibration.

2) T906: the -01 version will have the center hole filled with appropriate silicone rubber to damp core vibration.

3) C907: will change to a different P/N which is a metallized polypropylene construction in cylindrical form, which has better audio characteristics. Also, this part is better electrically than the original part.

These changes were incorporated in the manufacture of the 2220/30 at the following serial number breaks.

1) T948: 2220, B020100
2230, B020100

2) T906: 2220, B010149
2230, B011391

3) C907: 2220, B010149
2230, B011391

Similar changes in the rest of the 2200 series will follow.

If the circuit board can be flexed and the sound comes and goes, then T948 should be changed. If the sound is constant while flexing the board, then T906 and C907 should be changed.

Building Your Own Precision Sonic Wave Analyzer

Many methods were tried in an attempt to locate the problem components, such as a spectrum analyzer and a D.S.O.

The problem components were discovered by using a precision sonic wave analyzer which can be built to assist in locating the actual noise sources in the instruments. It consists of a two-foot length of 3/8 inch outside diameter clear PVC tubing. This material should be readily available at hardware stores or plumbing supply shops at a very low cost per foot. It is used by holding one end near the ear with one hand, and probing around the power supply circuitry with the other end, thus acting as a stethoscope to locate the noise sources. **CAUTION: Make sure that the tubing is not conductive. Exercise extreme caution when attempting to do this since line voltage and CRT high voltage supplies are present in this area.**

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WIZARD WORKSHOP ARTICLES

2213A/2215A/2235/2236 AUDIBLE NOISE FROM POWER SUPPLY

REF: Mod #61544

S/N: Not available

There have been three "speakers" identified in the 2200 Series which emit high-frequency audible sound from the power supply. Due to the urgency of this change to the field, only two of these components have been changed on this mod. These components and new Tektronix part numbers are as follows:

T906: Tektronix P/N 120-1439-01
C907: Tektronix P/N 285-1177-01

In a very few instruments T948 was found to be the third culprit. Changing this part number will require UL testing and recertification, so some testing and evaluation need to be conducted before the part can be modified.

If an instrument comes into the Service Center with this problem, try changing C907 first. If this does not eliminate the sound, change T906.

FOR TEKTRONIX INTERNAL USE ONLY:

The "Precision Sonic Wave Analyzer" described in the 2220/2230 Audible Noise from Power Supply WIZARD article, Issue 16-15, could be a tool for tracking down the source of sound.

Thanks to Marty Jost of the Dallas Service Center for his SAR and valuable information on this problem.

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2213A/2220/2221/2230/2235/2236/
2245A/2246A: Audible Noise

REF: 120-1349-00
120-1594-00
120-1601-01
120-1685-01
Lot Dates 8821-8838

The core of the transformer used in the 2200 series was cracking due to stresses during the manufacturing process because of a change in the type of ferrite material used in the transformer's core. This cracking occured in transformers with lot dates of 8821 through 8838 inclusive.

Starting in week 29,instruments were reworked in manufacturing by adding a plastic clip (black in color) to the top of the transformer. On the 2245A and 2246A the part number tag was applied to the top of the transformer clip. The part number will not be visible on the other 2200's which were reworked for a cracked transformer. This method of repair was only used on reworked instruments.

Transformers built and shipped from weeks 29-88 through 38-88 had a possibility of producing audible noise, however the core cracking problem was corrected. After week 38, an improved core assembly method was used which reduced the tendency to produce audible noise.

Instruments received for service with a complaint of audible noise and that have a transformer with a lot date between 8821 and 8838 should have the transformer changed.

The redesigned transformers that were manufactured and shipped after Week 38 do not have a tendency to produce audible noise.

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