INSTRUCTION MANUAL

MODEL 245

CIRCUIT SNIFFER

Radar Engineers Inc.
9535 NE Colfax Street
Portland, Oregon 97220

_____

_____

245 DSL/UVERSE PROCEDURE

(DSL for short)

BACKGROUND:

A. The Model #245 is not smart. It simply reacts to "noise" sources in its frequency range.

B. The strongest source detected by the Model #245 is likely the one interfering with your DSL line, but that is not always the case.

C. So far it is our assessment that 80% plus of DSL interference sources are electronic, not power line sparking, in origin. And the majority of the electronic sources originate in the customer's home or the neighbor's home served by the same transformer. Examples of electronic sources include light dimmer controllers, switching power supplies, variable speed drives, fluorescent lights etc.

D. Safety: 

The Model #245 is not insulated. Exercise caution at all times.

PROCEDURE:

1. Confirm the "Noise" Source is Active:

   Check with your network monitors or with your customer before going to the customer's house. (It will serve no purpose to look for an EMI source that is not on. There are lots of EMI sources on all the time but most do not interfere with your customers.)

2. Set Up:

   Gain on max. You can always reduce the gain. In the case that the red LED's are all on, reduce the gain. Frequency selection on LF to start. We believe most electronic sources will be detectable in the LF position and we think most DSL/RFI sources will be electronic in origin. Still, if LF does not detect anything, try HF (HF will be most sensitive to power line sparking).

3. Start the Locate at Your Customer's Residence:

   Since it appears that indoor DSL interference sources are of a very high signal level, most are

likely detectable from outside of your customer's home.

a. If the telephone, CATV and electric conductors are overhead, walk the sidewalk in front of the customer's home and neighbor homes served by the same transformer
b. Note the difference in received signal from the overhead conductors (electric, CATV, telephone). The house fed by the conductors with the highest level is the likely source.
c. Go to Electric Meter/CATV Splitter/Tel. Arrestor.

   To confirm your suspicion, another measurement can be made at the electric meter of the suspect home. Hold the Model #245 antenna underneath the horizontal to the meter base.

   Note the signal level on the LED's. Next obtain a signal level at the CATV splitter and at the telephone surge arrestor. Whichever RF path provided you with the highest signal level reading is the one to use for

comparison purposes at adjacent homes. Gross comparisons can be made by comparing LED's. However, a more sure technique is to set the gain just high enough that only the electric meter, the CATV splitter, or the tel. line turns on one or two LED's.

4. Inside the home with the highest signal level:

    a. A sure way to determine which circuit in the house has the noise sources is to monitor the DSL modem while breakers are turned off one at a time. (Of course, you will need the customers consent for this).
    b. An alternative to "flipping breakers" is use the "Probe" on the Model #245. Slide the frequency selector to the "Probe" position. Scan the breakers. See #245 manual. The circuit that lights up the most LED's is the likely sources. (Reduce the gain until only one circuit causes one or two LED's to turn on).
    c. Identify the individual noise device:
        i. Go to the room fed by the circuit identified above. Select the LF position.

ii. While monitoring the DSL line unplug each item on the circuit until the noise goes away. (Some electronic sources make noise even when turned off).

iii. Alternately, you could use the Model #245 to compare signal levels at the various appliances. Then unplug the source with the highest level.

5. Power Line Sources:

If you cannot locate an indoor source (at your customers or neighbors) then the problem is likely to be a power line source, such as a tracking lightening arrestor. Preliminary observations indicate that power line sparks which interfere with DSL are usually within a few poles of the affected customers. It also appears that by comparing signal levels (using the HF setting) at the base of nearby poles, the source pole can be identified.

(Radar Engineers Inc. has several other products specific for locating power line sparks.)

09/29/22

MODEL 245 MANUAL

Table of Contents

I. SAFETY NOTE

Do not touch energized conductors with the Model 245.

Do not use Model 245 where circuit breaker panels have been removed.

The Model 245 is not a voltage or current sensor and will not indicate whether a wire is energized.

The Model 245 is not insulated. Observe all safety rules and procedures.

II. INTRODUCTION

It is estimated that up to 50% of all radio and TV interference sources which cause complaints originate inside the home, office or plant of that customer.

Historically the first step taken to locate indoor sources was to enter the customers home or business and turn off individual circuits until the noise ceased. The problem with this approach is that it is time consuming. It irritates many customers who must reset their electronic appliances such as clocks, radios and computers after the circuit breaker is opened. Turning off breakers can also make it more difficult to find some sources.

The Model 245 is a short range interference locator designed primarily for indoor use. It was developed to speed up indoor RFI locating and to minimize the need to turn off circuit breakers as part of that process.

III. BACKGROUND

RFI can originate indoors as well as on power lines. The resulting RFI will look and sound similar on affected equipment (radio, TV, Ham receivers, etc.) regardless of whether it originates indoors or outdoors.

On power lines the source is usually a spark at a loose or corroded connection between two pieces of hardware. When two pieces of metal are not making good contact they can become charged to different voltage levels, and if this difference becomes large enough a spark will jump from one piece to the other. Power line sparking radiates broadband interference.

Indoor Sources:

A. Sparking sources

Indoor sparking sources are often cause by pitted contacts or worn commutators/brushes. These sparking sources radiate broadband noise. Sparks from a single source can often be detected from 1 KHz to 1 GHz.

Examples of devices that can cause sparking:

- Fishtank thermostats
- Doorbell transformers
- Electric fans
- Water heater thermostats
- Electric blankets

B. Electronic Sources

Electronic components such as SCR's do not actually spark, but their extremely rapid current switching can have a similar RFI effect. Electronic noise is also broadband but is not ordinarily detected or a problem above about 30 MHZ.

Examples of equipment that can electronically generate interference:

- Touch lamps
- UPS systems
- Electrofluorescent lights
- Photo electric devices
- Variable speed motor drives
- Light dimmer controls
- Ultrasonic pest control devices
- VCRs
- Electronic air filters

Indoor sources can interfere with radio and TV reception. Indoor sources can also jam electronic systems, like computer control systems, that transmit or receive data via indoor wiring.

CIRCUIT SNIFFER

IV. FEATURES

1. **ON/GAIN** – Use this control to turn the instrument on/off and to set the sensitivity. The higher the setting the more sensitive the instrument is.

2. **ON/LOW BATT LED** – This LED turns green when the Model 245 is on. The LED will change color to red when the 9 volt battery is getting low and has about 1 hour of operation left with reduced sensitivity.

3. **SIGNAL LEVEL METER** – An LED bar graph indicates the received signal strength. The higher the numbered segment the stronger the signal.

4. **SPEAKER** – A two inch polycarbonate speaker reproduces the distinctive buzz of RFI.

5. **MODE**

   A. Probe – The probe is located at the right side of the chassis near the tip of the arrow. This search mode is used to probe meters and circuit breakers only. It is selected by moving the slide switch to the far right position.

   B. Antenna: Low Frequency – The antenna is used as a proximity locator to identify specific devices causing interference. The low frequency position is usually selected when searching for a noise source that causes A.M. radio, low band Ham or computer controller interference. Low frequency interference can be caused by electronic sources (such as light dimmer switches or UPS systems), as well as sparking sources (such as doorbell transformers).

   C. Antenna: High Frequency – This position is usually selected to identify the source of TV interference or Ham interference over about 20 MHz. Indoor high frequency interference usually originates in sparking devices such as doorbell transformers and fishtank heaters.

(FIG. 2) PROBING THE METER

6. **BATTERY** – The Model 245 uses one 9V alkaline battery. Battery life is about 9 hours.

V. OPERATION

Step 1. Outdoors Direction Finding:

From outside the building scan the area with a directional antenna and receiver (such as the Radar Engineers Inc. Model M-330 or Model 239). If the noise appears to come from the power line continue your search with the direction finding equipment. If the noise appears to come from inside the building, go to the meter.

Step 2. Probe The Meter:

A. Select the Probe mode.

B. Turn on the instrument and set sensitivity at 5 or 6.

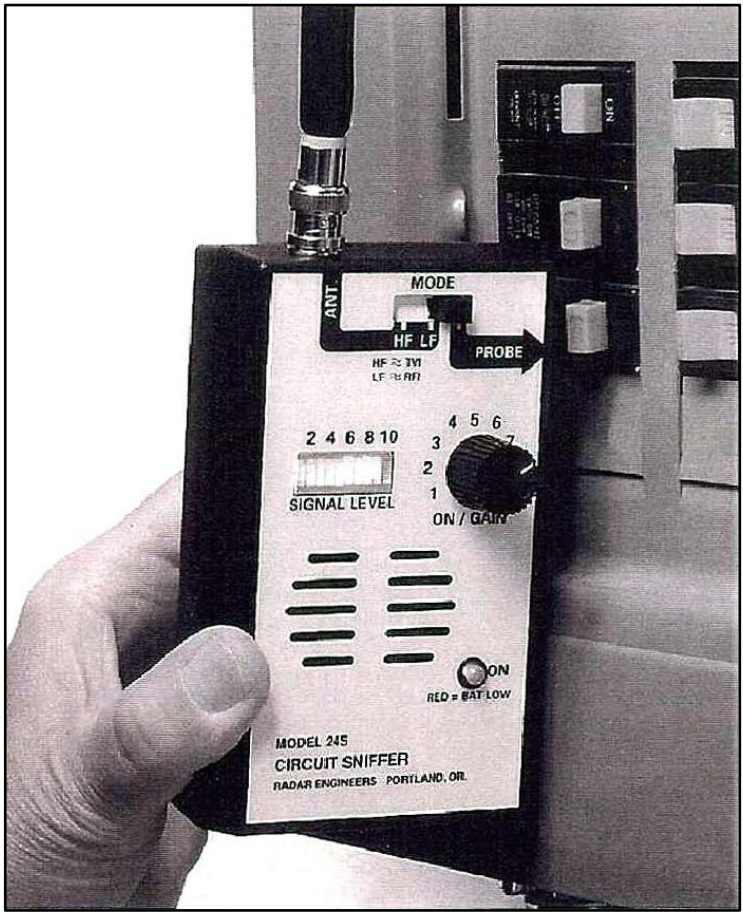
C. Hold the chassis of the instrument next to and perpendicular to the conduit feeding the meter. . See Figure 2.

D. Point the arrow at the conduit.

E. If you are unable to hear the noise increase the gain setting until you can.

F. If there are multiple meters compare the readings. The meter with the strongest reading is the likely source circuit. (Please note, however, that RFI detected at a meter can originate either inside or outside of a building. This is why it is useful to do a direction finding sweep from outside the building first.)

G. Once you have confirmed that the noise is coming from inside the building go to Step 3.



(FIG.3) PROBING CIRCUIT BREAKERS

Step 3. Probe The Circuit Breaker or Fuse Box:

A. Using the probe orient the Model 245 chassis perpendicular to the wires feeding the circuit breaker. Rest the edge of the Model 245 with the plastic button next to the circuit breaker panel. See Figure 3.

B. Slowly scan each breaker for noise.

C. Once noise is detected turn down the signal strength until just one or two LED segments are on.

Repeat this process of turning down the gain at each breaker with noise on it. In this way you will be left with the circuit with the loudest signal level. This is your likely source circuit. (Please note however, a nearby but weak RFI noise source may have a higher reading at the circuit breaker than a stronger source farther away.)

At this point you may be tempted to turn off the suspected breaker to verify that you have identified the noisy circuit. However, it is better practice to leave the breakers undisturbed and go to the area of the building controlled by the identified breaker.

Turning a breaker off may interrupt a source. The interrupted source may not emit noise when the breaker is turned back on which can lead to false conclusions.

(FIG. 4) ANTENNA SCAN OF A SUSPECT NOISE SOURCE

Step 4. Identify The Sparking Source With The Antenna:

A. Proceed to the area fed by the previously identified circuit.

Select the Low Frequency setting to scan for sources causing radio and low Ham band interference.

Select the High Frequency setting to scan for sources of TV interference, and Ham interference over about 20 MHz.

In many cases, noise sources can be located with either the low or high frequency settings. If you are unsure which settings to use, start with low. Of course, if one setting does not work, try the other one.

Generally, RFI sources loud enough to prompt a customer complaint can be detected several feet from the antenna, or even farther when the noise gets on the wiring in the building. However, the closer the antenna is to the source the more positive the conclusion will be. Typical detection range for the Model 245 is 2-12 feet from a noise source, depending on the strength of the source. Reduce the gain until only one suspected device gives an indication of RFI. That is the strongest and likely problem source. See Figure 4.

B. Turn off or unplug the suspected noise source to verify that the noise stops and the customer's receiver is no longer affected.

MISC:

1. Buildings are full of noisy devices most of which do not usually cause customer complaints. For example fluorescent displays in microwaves and stereos, switching power supplies in telephones and computer monitors, each can cause detectable levels of RFI. But they may not be the source of the customers' complaint.

2. The model 245 can be overloaded by a very strong radio signal, such as an AM radio station. In this case the apparent sensitivity may decrease when the gain is set above 7.

3. The Model 245 is designed to detect fast rise time events (such as sparks) or electronic circuitry that turns on and off rapidly. It is very sensitive to those kind of sources. As a consequence, it is not as sensitive to RFI caused by slow rise time devices such as oscillators in a touch lamp. The customers most likely to be affected by these are Ham operators. You will be able to determine if the source is an oscillator by listening to his Ham set. If the RFI peaks predictably, such as every 200-300 KHz, it is probably an oscillator. If this is the case, an A.M. radio would be a useful locating tool to try as well.

VI. SPECIFICATIONS

Typical Detection Distance	-	2'- 12' directly from source and also at breaker panel or meter base when RFI gets on building wiring.
	-	Range can be decreased to 0.5 – 1.0 ft. using sensitivity control.
Battery	-	9V. Alkaline
Battery Life	-	9 Hours
Mechanical		
Dimensions	-	5.5" X 3.25" X 1.5" (Less Antenna)
Weight	-	12 oz.

Frequency Response

LF	-	Less than 4 MHZ.
HF	-	More than 4 MHZ.

VII. WARRANTY AND NOTICE TO PURCHASER

All products manufactured by Radar Engineers Inc. are warranted against all defects in material and workmanship for a period of one year following shipment. Our liability is specifically limited to replacing or repairing, at our option, defective equipment. THIS WARRANTY IS MADE IN LIEU OF ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Neither seller nor manufacturer shall be liable for any injury, loss or damage, direct or consequential, arising out of the use of this product.

All statements, technical information and recommendations contained herein are based on information believed to be reliable, but the accuracy or completeness thereof is not guaranteed. Before using, the user shall determine the suitability of the product for his intended use, and user assumes all risk and liability whatsoever in connection therewith.

VIII. REPAIRS AND CUSTOMER SERVICE

Radar Engineers Inc. maintains a complete instrument repair service. Should this instrument ever require repairs do not attempt to repair it yourself. Return it to the following address:

RADAR ENGINEERS INC.
9535 N.E. Colfax Street
Portland, Oregon 97220

When returning the instrument for repairs, it should be shipped Prepaid and Insured. A note should be included describing the defect and the name and phone number of the person to contact in case additional information is needed.

If you have questions regarding the operation of this instrument, call Radar Engineers Inc at: (503) 256-3417.

09-29-22