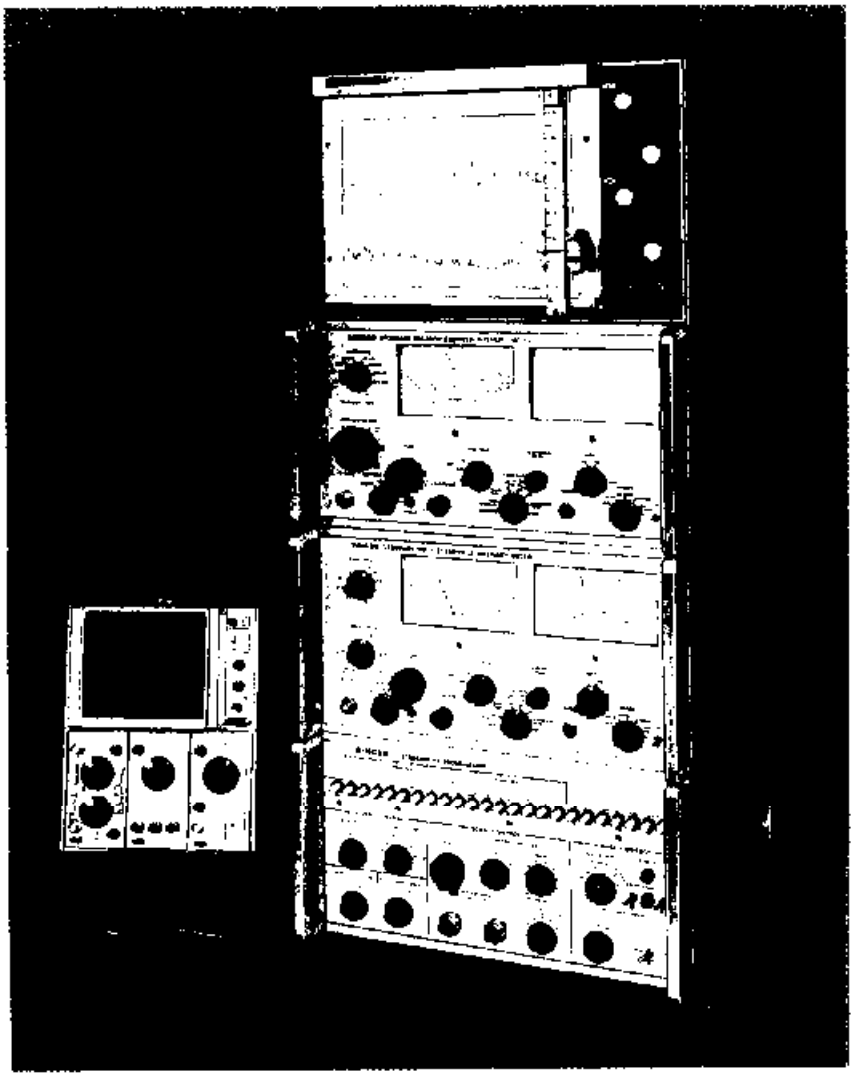
SINGER
INSTRUMENTATION



# Automatic EMI Data Collection System

**EMI METER, MODEL NM-17/27**
**10 kHz - 32 MHz**

**EMI METER, MODEL NM-37/57**
**30 MHz - 1 GHz**

**PROGRAMMER, MODEL P-7**

## FEATURES

### THE SINGER* AUTOMATIC EMI DATA COLLECTION SYSTEM . . .

- Performs automatic EMI measurements, radiated or conducted.
- Provides choice of three frequency ranges: 10 kHz - 32 MHz, 30 MHz - 1 GHz or 10 kHz - 1 GHz.
- Consists of modularized, independent EMI meters and programmer.
- Becomes an improved spectrum analyzer with built-in pre-selection when used with a regular oscilloscope.
- Provides center frequency ($f_o$) and dispersion ($\Delta f$) controls for spectrum analyzer operation.
- Scans and records up to sixteen bands in the range 10 kHz to 1 GHz by simple pushbutton programming
- Scans a band in 0.03 to 300 seconds.
- Gives outstanding gain flatness of $\pm 2$ dB over the entire frequency range which greatly simplifies measurements and plotting of amplitude versus frequency.
- Can be computer controlled.
- Plots 1, 4, 8 or 16 bands on a single chart.
- Allows quick identification of frequencies on multi-plot charts by means of "dedicated" position plotting.
- Permits an X-Y plotter to be remotely calibrated from the programmer in seconds.
- Allows expansion of a very narrow band of frequencies for detailed investigation.
- Provides trace marker to indicate tuning frequency when tuned manually.

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## APPLICATIONS

- Use as a spectrum analyzer for EMI measurements.
- Interference surveys.
- Propagation studies.
- Antenna pattern studies.
- Continuous range surveillance.
- Site surveys.
- Satellite tracking.
- Insertion loss measurements.
- Circuit design evaluations.
- Frequency selective microvoltmeter.

## DESCRIPTION

The SINGER Automatic EMI Data Collection System (AEDC System) consists of two EMI/Field Intensity meters and a programmer. It performs automatic EMI measurements, conducted or radiated, in the range 10 kHz to 1 GHz.* This range is broken down into eight frequency bands on each EMI/FI meter, making a total of sixteen bands. The AEDC System will scan any selection of these sixteen bands over a wide range of scanning speeds according to the program set up by switches on the front panel of the programmer.

Simultaneous with the scanning action, the programmer supplies a choice of output signals. These include signals appropriate for input to the X-Y axes of an oscilloscope, an X-Y plotter of other display and recording devices, either singly or in combination.

The programmer is provided with full scan controls (including Δf and sector scan) similar to those of a spectrum analyzer. The AEDC System can thus be used as a spectrum analyzer - with tracked preselection - when the X and Y outputs of the programmer are supplied to a regular or variable persistence oscilloscope.

In addition, the programmer supplies special outputs for automatic calibration of an X-Y plotter. After this initial calibration, automatic multiple plots of frequency versus amplitude of 4, 8 or 16 bands are possible. For example, on command the system will plot all 16 bands of both EMI/FI meters on a single 8 1/2 x 11-inch graph. This mode will compress the extremely wide range of about 1000 MHz onto a single sheet. The 16 bands are charted in four rows, four bands per row (see figure 3). Each band in each row is distinctly separated for easy identification of its frequency range. (For even greater convenience, charts preprinted with the frequency range at each band baseline can be used.)

The system can scan at the maximum speed of the plotter, with adequate resolution over most of the system's 1000 MHz frequency range. For "quick look" purposes, using a typical recorder, all 16 bands may be scanned in as little as five minutes.

*Two additional EMI/FI meters are currently in development. One covers the range 20 Hz to 50 kHz, the other the range 1 GHz to 12.4 GHz. The upper frequency limit will be extended to a higher frequency at a future date.

The programmer will also plot 8 bands, 4 bands, 1 band or a sector of a band on a single 8 1/2 x 11-inch chart (see figures 4 and 5). In each case, the full area of chart is used. This allows the user to obtain varying degrees of resolution for detailed investigations.

The AEDC System consists of three independent modules: the programmer, Model P-7, and the two EMI/FI meters, Models NM-17/27 (10 kHz - 32 MHz) and NM-37/57 30 MHz - 1 GHz).

Either EMI/FI meter can be used alone as a conventional manual or semi-automatic instrument. Also, either one can be used alone with the programmer to form an automatic test system with a frequency range determined by the frequency range of the EMI/FI meter.

When used in a system configuration, all major functions of the EMI/FI meters are selected and controlled remotely by the controls on the front panel of the programmer. However, all indicators on the EMI/FI meter such as the frequency and amplitude readouts and the band indicators remain operational.

When frequency bands are selected on both EMI/FI meters, the transition from one meter to the other is uninterrupted. This ensures a continuous flow of data to the display/recording device across the frequency range of both EMI meters.

For advanced applications, the AEDC System can accept inputs from and provide outputs to a computer (through suitable interfaces) to form a completely automated system. Consultation on specific applications is available on request.

### The EMI Meters

The NM-17/27 and NM-37/57 meters cover the frequency ranges 10 kHz to 32 MHz and 30 MHz to 1 GHz, respectively. Each one can be operated manually from its own front panel controls. Each one can also be operated directly from a computer with suitable interfacing circuitry.

When controlled by the P-7 programmer, the band, bandwidth, detector function, and scan controls are all superseded.

Full information on the NM-17/27 and the NM-37/57 meters is contained in Data Bulletins RFI 104 and RFI-103 respectively.

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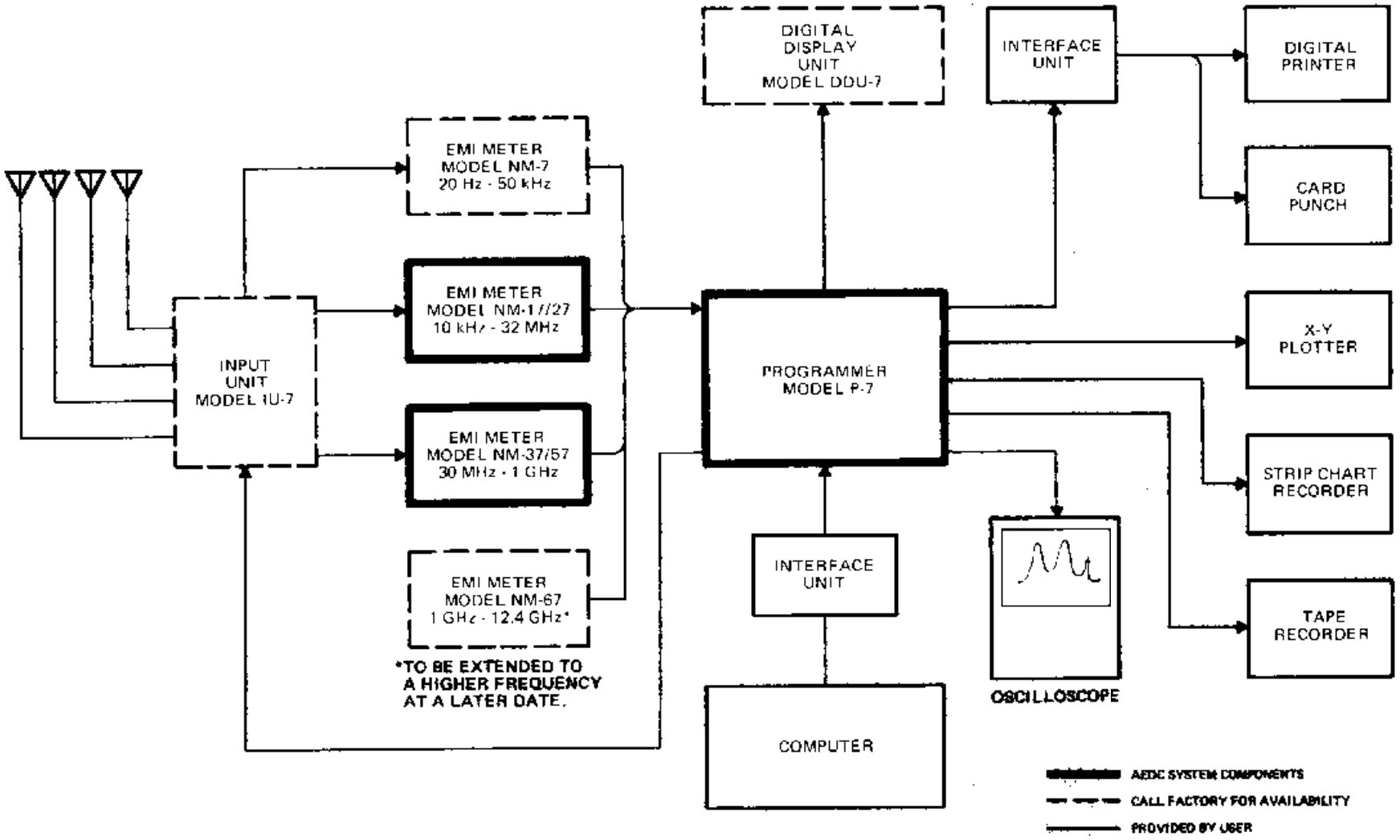


**Figure 1. Block Diagram - AEDC System**

continued from page 2.

**Programmer, Model P-7** (description keyed to figure 2)**

1. **Band Selection Switches**

   Sixteen of the twenty-four switches provided are used for selecting frequency bands on the NM-17/27 and NM-37/57 meters. (The remaining eight switches are intended for the future NM-7 and NM-67 meters). The illumination level on the band switches indicates which bands have been called up and which band is being scanned.

2. **Bandwidth Switch**

   Selects any one of the bandwidths on the selected EMI/FI meter.

3. **Detector Mode Switch**

   Selects the calibrate mode and five detector functions. Note that the FI (Field Intensity) or "average" output signal is available at all times at the rear panel FI output connector for simultaneous plotting of FI plus another detection mode such as Direct Peak.

4. **Remote Attenuator**

   This switch controls an external, remotely programmable attenuator on the IU-7 Input Unit.

5. **Programmer Mode Switch**

   This switches control of the system to either the P-7 front panel controls or to the rear panel remote input connector (DIGITAL CONTROLLER) for computer control of the system.

**Scan Controls**

The scan controls determine mode of scan, sweep speeds and selection of frequency sectors within any one band.

6. **Range Switch**

   Selects scan times in decade steps from 0.03 to 30 seconds or selects manual tuning.

7. **Vernier Control**

   Varies the selected decade step over a 10:1 range.

8. **Manual Control**

   When the range switch is at MANUAL, the MANUAL control manually tunes the meter frequency. When using the system as a spectrum analyzer, the frequency to which the MANUAL control is tuned is indicated by a marker on the trace.

9. **Scan Mode Switch**

   Selects full band sweep, "Δf" spectrum analyzer mode or sector sweep.

10. **Δf/Sector Calibrate Controls**

    When in "Δf" scan mode, these two controls set $f_o$ (center frequency) and Δf (dispersion). When in sector mode, these two controls set $f_{min}$ and $f_{max}$ of the frequency sector to be scanned.

**Data Controls**

11. **Display Mode Switch**

    Selects CRT (oscilloscope) display, and single or multiple-plot X-Y recording. At the 4-band-plot position, the programmer will plot up to 4 selected bands on a single chart. However, plot positions on the chart are not dedicated in this mode. For instance, if the third, fifth and seventh bands of one of the meters were being scanned, the programmer would plot in the first three positions on the chart leaving the fourth position blank. (See figure 6)

    In the 8 and 16-band-plot modes, each position on the chart corresponds to a specific band on the meters (see figures 3 and 7).

    (Note: The 24-band-plot mode is intended for use with the NM-17/27 and the NM-37/57 plus the two receivers presently under development).

12. **X-Y Recorder Switches**

    Used for calibrating the "zero" and "maximum" points on an X-Y plotter and for remote control of pen.

13. **Start/Stop/Reset Switches**

    The "start" switch starts a program in operation. Cycling continues until the "stop" switch is pressed, or the cycle is completed. The program will continue from the point at which it stopped when the "stop" switch is pressed a second time. The "reset" switch sets a program back to the beginning of the cycle.

**For full information on programmer, Model P-7, see Data Bulletin RFI-106.

## Future Equipment (see block diagram, figure 1)

The Automatic EMI Data Collection System forms the core of the projected Series 7 System. The latter will contain:

Four meters (NM-7, NM-17/27, NM-37/57, NM-67)

Programmer (P-7)

Digital Display Unit (DDU-7)

Input Unit (IU-7)

The frequency range of the Series 7 system will be 20 Hz to 12.4 GHz and will be extended to a higher frequency at a later date. The Digital Display Unit will digitize the output of the system, presenting it visually in digital form and preparing the signal for input to a digital data processing system

The Input Unit automatically switches between antennas when the programmer switches between meters and is controlled by the programmer. The Input Unit also switches between bands on a single antenna, and contains an attenuator controlled from the programmer in 20 dB steps.

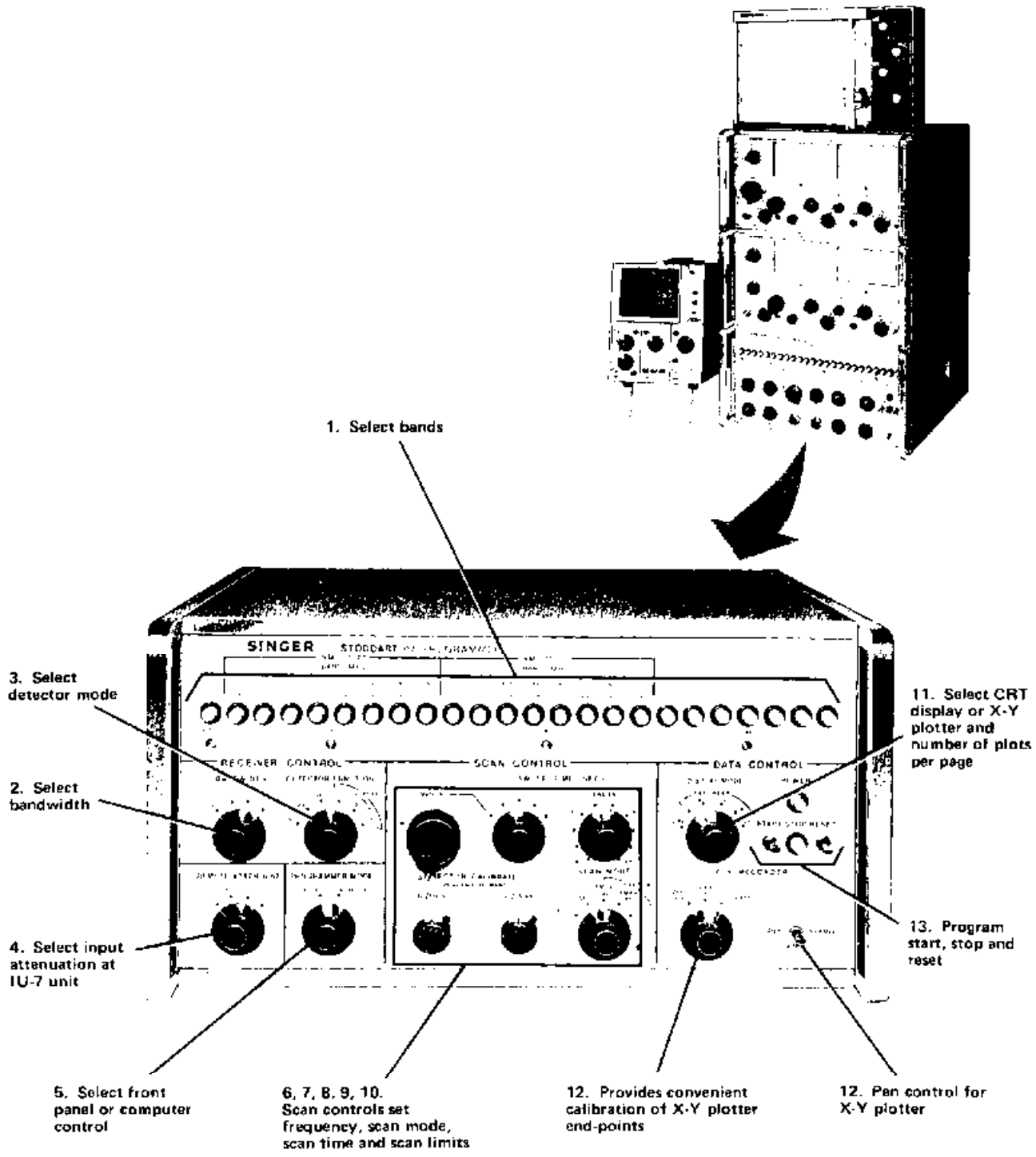


Figure 2. Programmer Unit Model P-7

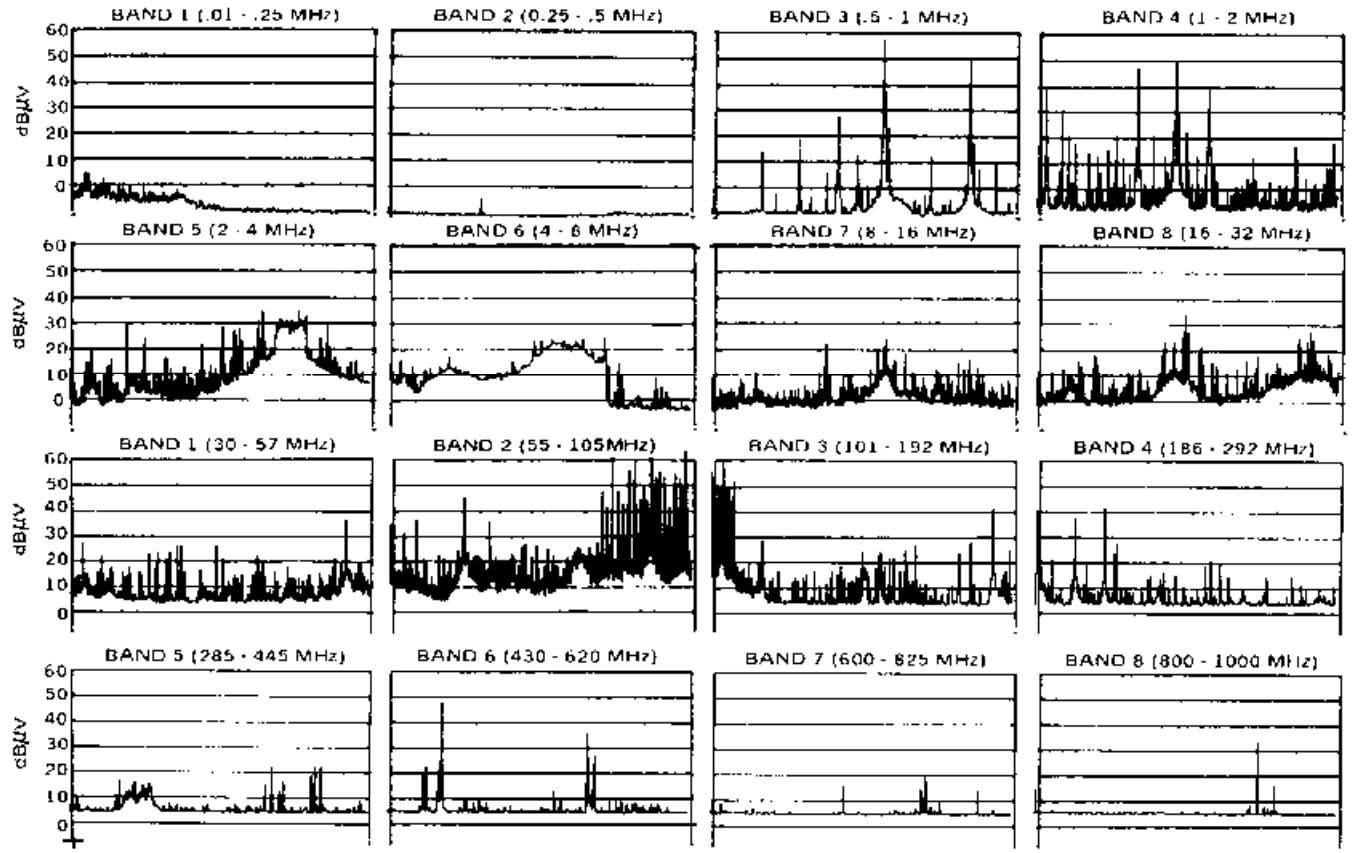


**Figure 3.** Actual plot of all 16 bands of the NM-17/27 and the NM-37/57 on a single 8 1/2 x 11-inch sheet using the 16-band plot mode of the programmer.

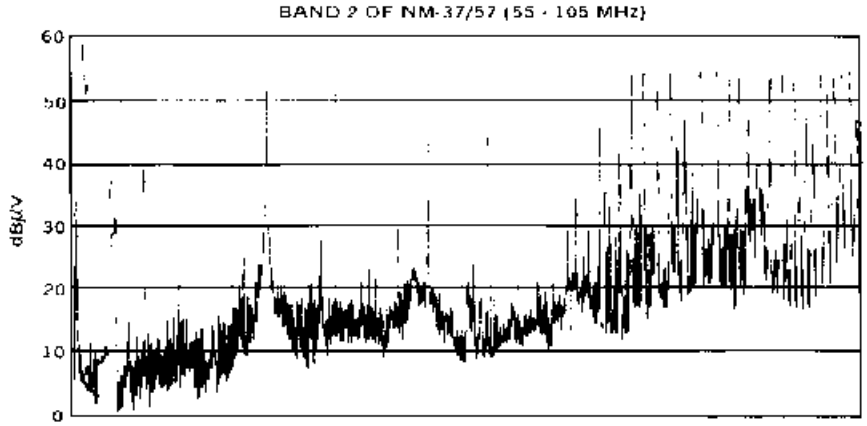


**Figure 4.** Actual plot of Band 2 of the NM-37/57 on a full 8 1/2 x 11-inch sheet using the single-band plotting mode of the programmer.

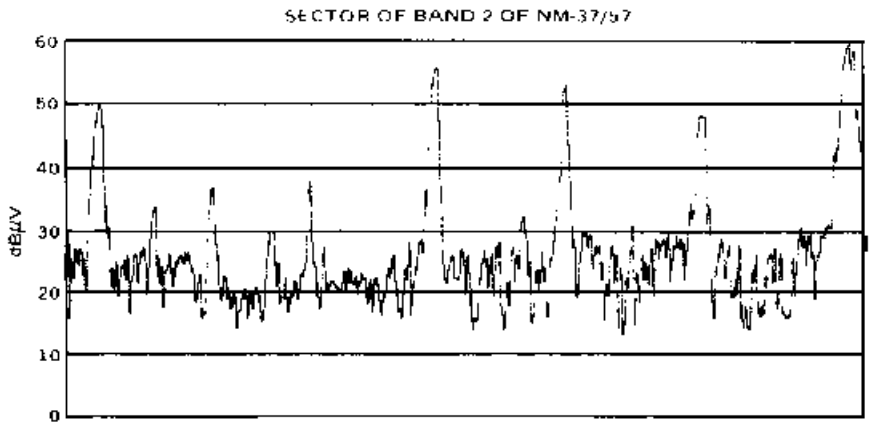


**Figure 5.** Actual plot on a full 8 1/2 x 11-inch sheet of the small band segment shown in blue in figure 4, using the sector scan mode of the programmer.