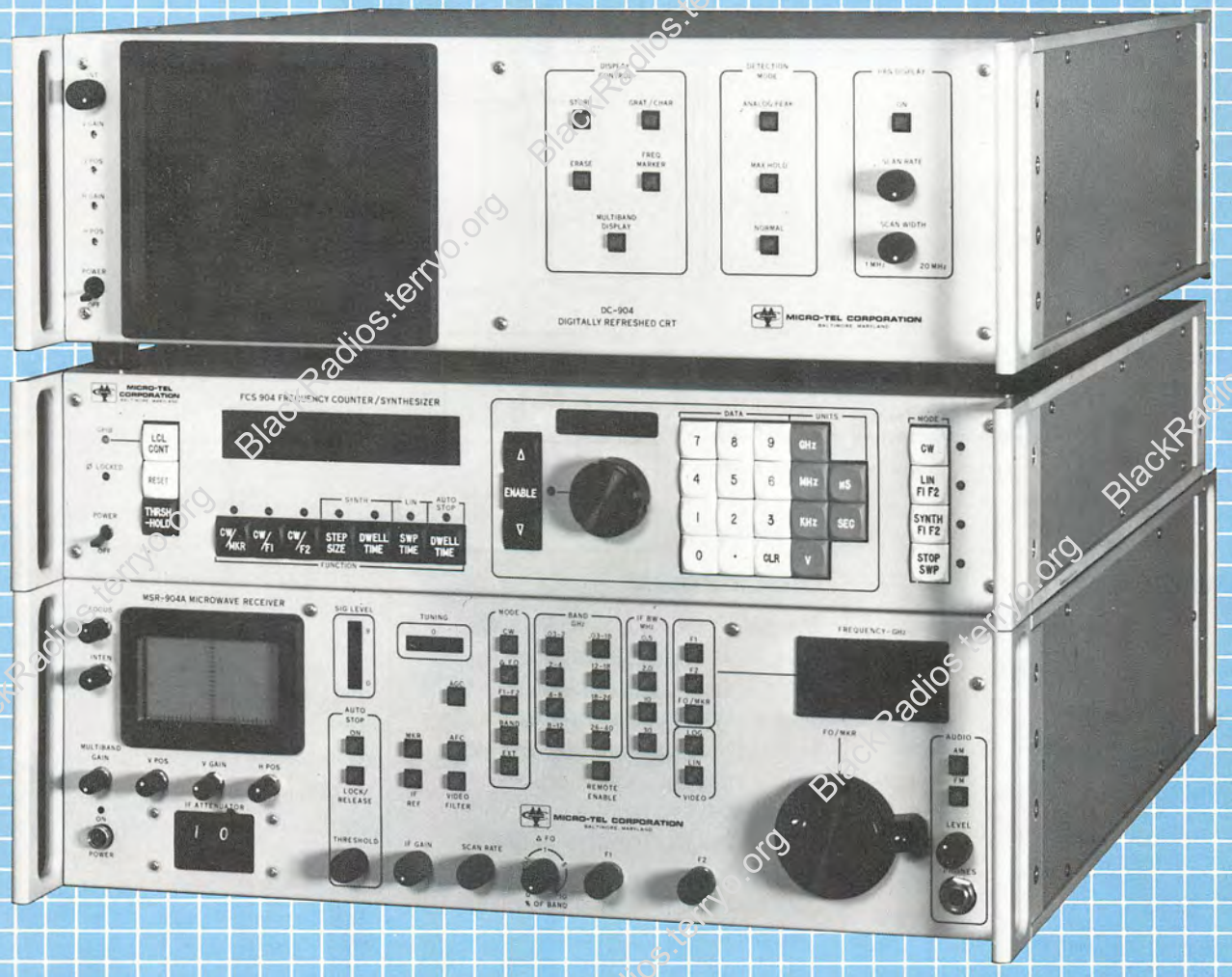
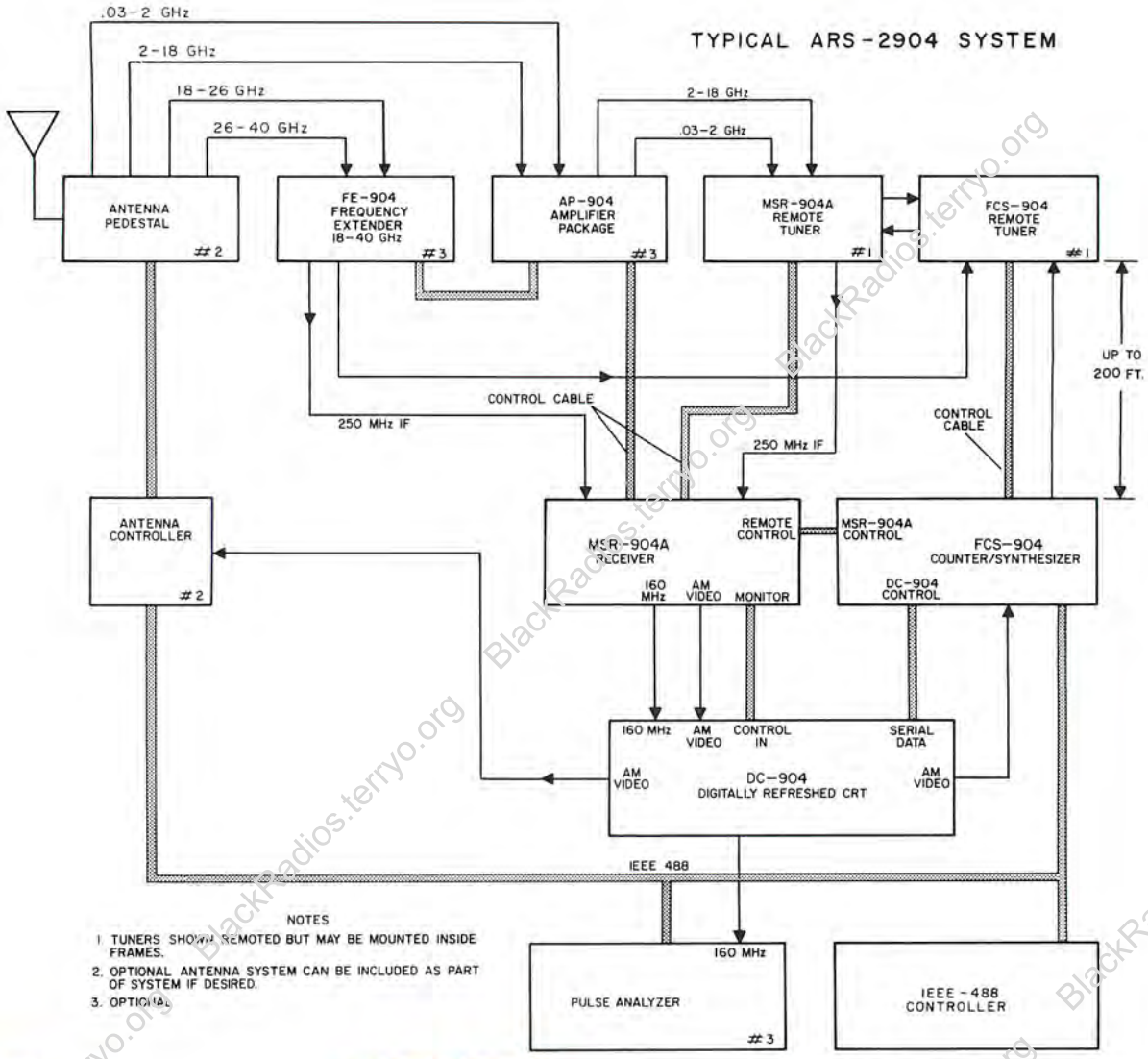
Adams Russell

MICRO-TEL DIVISION

ARS-2904

AUTOMATIC
RECEIVING SYSTEM





FEATURES

- Cost-Effective - Turn-Key
- Synthesized .03-40 GHz
- Low Phase Noise
- Low Group Delay
- High NPR
- Computer Controllable via IEEE-488 (GPIB)
- Auto-Stop
- Frequency Counting
- Remoteable RF Assemblies
- Expandable
- Log/Linear
- RFI Shielded

DESCRIPTION

The ARS-2904 Automatic Receiving System is a cost effective and versatile data collection and analysis system covering the frequency range from 30 MHz to 40 GHz. It may be configured in various ways to meet a wide variety of applications. The system can range from three instruments operated manually to a computer controlled system consisting of multiple receivers, synthesizers, preamplifier packages, displays, demodulator, pulse analyzers and multiple antennas. However the system is configured, it is operational when deliverd to the customer with all necessary interconnection cables. A small library of programs is available for the ARS-2904 system, allowing even an untrained user to operate an effective automated system. The programs may be used as they exist or they can be modified with relative ease. Custom programming from Micro-Tel is also available.

A basic system contains an MSR-904A .03-18 GHz Receiver, an FCS-904 Frequency Counter-Synthesizer and a DC-904 Digitally Refreshed CRT. These three instruments allow a user to manually operate a .03 to 18 GHz state of the art receiving system. The MSR-904A has the wide bandwidths, remote tuner and various detection modes critical in meeting modern receiving requirements. The FCS-904 has the speed, frequency control and low phase noise necessary to complement the MSR-904A capabilities. Defected signals are displayed on the DC-904 Digitally Refreshed CRT along with alpha-numerics for operator convenience.

ADDITIONAL EXPANSION CAPABILITIES

Further expansion is possible simply by adding fixed tuned receivers such as the SMR-1100 Synthesized Microwave Receiver to permit the user to locate a signal with the MSR-904A and set the SMR-1100 to the same frequency to monitor the desired signal for an extended period of time without interrupting the MSR-904A swept receiver operation.

SYSTEM INTERFACES

The ARS-2904 was designed to operate as a system without degrading or limiting the performance of any of the individual instruments in any way. For example, the DC-904 uses the 160 MHz from the MSR-904A and an auxiliary 160 MHz output was included so that other 160 MHz instruments may be operated simultaneously.

SPECIFICATIONS (Continued)

FM	DC coupled, low impedance with post detection bandwidths of .05, 0.5, 2.5 and 15 MHz corresponding to selected IF bandwidth. Output level 1 volt peak-to-peak at 50 ohms with deviation equal to IF bandwidth.
Audio	.1 mw, 600 ohms phone jack, variable with audio gain control

Counter/Synthesizer (FCS-904)

Frequency Range	.03-18 GHz (Expandable to 40 GHz)
Tuning Resolution:	
.03-18 GHz	100 Hz
18-40 GHz	10 KHz
Tuning:	
Accuracy	.000001%
Long term Aging Rate	3 parts in 10^{-9}/24 hours
Short term Stability	1 part in 10^{-10}/Second 5 MHz Oven Oscillator
Tuning Method:	Either Analog Sweep or Digitally Stepped
Tuning Techniques	Keypad Optical Encoder IEEE-488 (GPIB)
Remote Tuner	Up to 200 ft. (Option 4)

Digitally Refreshed Display (DC-904)

CRT	6-inch, electrostatic
Resolution	11-Bit, (2048 x 2048)
Interface	16 Bit TTL I/O
Scan Display	1 to 5 traces—256V x 512H in Multi-trace mode 256V x 1024H in Single trace mode
SDU Display	1 Trace 256V x 1024
Detection Modes	Analog Peak, Max. Hold, Normal

Frequency Extender (FE-904)

Frequency Range (FE-904K/KA)	18-40 GHz
Frequency Control	Controlled by MSR-904A
Noise Figure	14dB Typical without pre-selection 22dB Typical with pre-selection (Option 1)
Pre-Selection	3 Ball YIG Filter (Option 1)
L.O. Sample	-7dBm min (Option 2)
Antenna Input:	
18-26.5 GHz	SSMA Coaxial Standard, WR-42 Waveguide (Option 3)
26.5-40 GHz	WR-28 Waveguide, Std.

COMPUTER CONTROL

As already described, the ARS-2904 System is a powerful operational system with many innovative characteristics such as the Auto-Stop frequency counting, synthesized marker accuracy, combination SCAN and SDU display and synthesized 30 MHz to 40 GHz operation.

The power of the ARS-2904 System is multiplied when computer control is added. The fast response and non-tiring operation of a computer may supplement, and in some cases, even replace a human operator.

To realize the expanded capability of automation, the user need only add a computer/controller with IEEE-488 interface capability.

A typical program may be one to identify and store the electrical environment over a programmed frequency range. The computer can perform this function well, operating for days finding, comparing and storing data for later retrieval and evaluation.

ANTENNA CONTROL (DF SYSTEMS)

Another logical step in the ARS-2904 expansion scheme is to add a computer controlled antenna. Signals are monitored and the incoming information logged and processed in the computer utilizing both signal data and antenna data as well.

SPECIFICATIONS

Receiver (MSR-904A)

Frequency Range	.03-18 GHz (Expandable to 40 GHz)
Accuracy	±1% Manual or if synthesized, accuracy of FCS-904
Noise Figure:	
.03-18 GHz	20 dB Typical
18-40 GHz	22 dB Typical
Auto-Stop Threshold	60 dB Range
Tuning	Manual, Synthesized with the FCS-904 or remotely with IO-1000 and IEEE-488 Control*
Preselection	Tracked YIG Filter in all tuning modes above .5 GHz; low-pass filter below .5 GHz
Antenna Conducted LO	-70 dBm, .03-12 GHz; -60 dBm 12-18 GHz; -50 dBm 18-26 GHz; -40 dBm 26-40 GHz
Antenna Inputs (GHz):	
.03-2	Type N; 50 ohms nominal
2-18	Type N; 50 ohms nominal
18-26.5	SSMA Sub-Miniature Coaxial or WR-42 Waveguide with UG-595/U Flange (Option 3)
26.5-40	WR-28 Waveguide with UG-599/U Flange
Radiated and Conducted Noise	Fully RFI Shielded
Image Rejection:	
.03-12 GHz	70 dB, minimum
12-18 GHz	60 dB, minimum
18-26.5 GHz	60 dB, minimum
26.5-40 GHz	55 dB, minimum
IF Rejection:	
.03-18 GHz	80 dB, minimum
18-40 GHz	70 dB, minimum
3rd Order Intercept	+5 dBm
IF Outputs	250 MHz (standard); bandwidth of 40 MHz min, pre-selector limited; RF/IF gain + 7 dB nominal. 21.4 MHz (standard); bandwidth of 8 MHz nominal; output of −20 ±2 dBm leveled. 160 MHz (option 4B); bandwidth of 20 MHz nominal; RF/IF gain + 10 dB nominal.
IF Gain Control	60 dB range
IF Bandwidths	Four: .1, 1, 5, 30 MHz (Other Bandwidths Optional)
LOG—all bandwidths	70 dB, Linear within ±2 dB over 70 dB range
Demodulator Outputs: AM	DC coupled, low impedance with post detection bandwidths of .05, 0.5, 2.5 and 15 MHz corresponding to IF Bandwidth selected; 2 volt peak at 50 ohms.

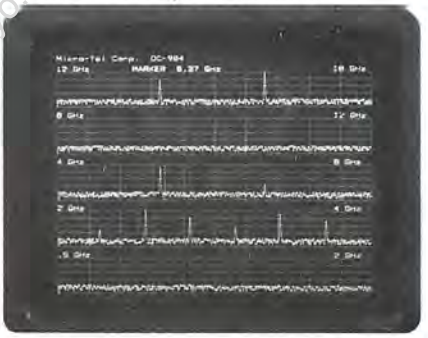
*IEEE-488 and GPIB are synonymous in this case.

The user programs the signal detection mode, Auto Stop threshold level, IF bandwidth, IF attenuator and IF gain using the MSR-904A Receiver front panel controls. The MSR-904A has the capability to control the received frequency, sweep limits and sweep rate, but when the FCS-904 is available, it assumes command of all frequency controls including fixed frequency control, sweep frequency limits, the sweep rate and the marker frequency. Priority is given to the FCS-904 over the MSR-904A frequency controls due to the excellent frequency accuracy and added features provided by the FCS-904.

While the various IF functions are controlled by the MSR-904A, the FCS-904 programs the receiving frequency parameters such as frequency sweep limits, sweep rate, sweep or fixed tune mode plus a synthesized accuracy marker. In addition, the FCS-904 performs a very special function—the incoming frequency counting function! The user sets a threshold level from the FCS-904 front panel (or GPIB when a computer is utilized). When a signal penetrates the threshold level, the FCS-904 internal microprocessor initiates an algorithm which tests the signal to insure that it is a true signal rather than a noise spike, centers the signal, displays the frequency of the signal on the FCS-904 front panel and then makes the frequency data available to the GPIB interface so the data may be extracted by a system controller.

After phase locking the receiver at the received signal frequency, the operator may examine the signal more closely or may return the system to the original swept operation. The FCS-904 uses the frequency accuracy of the synthesizer to generate a marker which is transmitted from the FCS-904 to the DC-904 where the marker is presented on the digitally refreshed display. Thus, the user can position the marker over a signal and obtain frequency accuracy limited only by the display and IF bandwidth.

The DC-904 Digitally Refreshed Display is the third element in the basic system and performs two major functions. First, it operates as a "SCAN" display presenting an amplitude versus frequency display of the receiver video information as the receiver frequency (First L.O.) is swept. The video data presented may be either Log or Linear as selected by the user, but is most often Log Video information. The SCAN display may be presented as a single F^1-F^2 trace or up to five traces presenting standard "Octave" band presentations.



When the system is expanded to cover 18-40 GHz, a single trace covering the 18-26.5 GHz or 26.5-40 GHz band is used.

Sweep limits may be displayed at the beginning and end of each trace. In addition, the marker frequency is presented at the top of the display.

The second major function performed by the DC-904 is the presentation of a panoramic display or Signal Display Unit (SDU) presentation. In this mode of operation the 160 MHz IF signal from the MSR-904A is mixed with a swept local oscillator. The IF signal is detected and displayed on the DC-904 CRT. This mode is most useful when the receiver is operated in a fixed tune mode (CW) of operation. The operator may switch to the "SDU" mode and observe an amplitude versus frequency presentation of the receiver IF output. The MSR-904A must have Option 4B to work with the DC-904.

The system also has remote tuner capability for both the MSR-904A Receiver and the FCS-904 Frequency Counter/Synthesizer. This allows the tuners to be placed at the antenna site, up to 200 feet from the operator location, thus minimizing cable loss between the antenna and tuner.

The MSR-904A connects to the FCS-904 via coaxial and control cables including an RF sample, coarse tune and sweep control, a phase lock line and a multi-pin control cable. The MSR-904A connects to the DC-904A via a 160 MHz IF output, a LOG/LIN video cable and a multi-pin control cable. The DC-904 connects to the FCS-904 via a multi-pin control cable.

SYSTEM EXPANSION

The extent to which the system may be expanded is nearly unlimited. Below are a few of the typical instruments which can be added to the system to increase capability or performance.

AP-904

Applications which require the maximum sensitivity possible, can be accommodated by adding an AP-904 Antenna Preamplifier to the ARS-2904 System. The AP-904 has internal microwave switches as well as GASFET preamplifiers, to assist in interfacing various antennas to the MSR-904A receiver. The MSR-904A provides logic levels to the AP-904 which enables automatic antenna/preamplifier switching based upon the receiver operating frequency.

FE-904

The FE-904 Frequency Extender is an accessory unit to the MSR-904A, designed to extend the frequency coverage to 40 GHz. It operates from 18-40 GHz with optional pre-selection and can be remoted along with other system tuners. The MSR-904A controls the FE-904 operation. Since the MSR-904A can be controlled by an FCS-904 Synthesizer, the FCS-904, MSR-904A and FE-904 combination can provide synthesized operation from 30 MHz to 40 GHz.

System Physical Characteristics

Size: (Inches)

MSR-904A Receiver	5¼ x 17 x 19
FCS-904 Counter/Synthesizer	5¼ x 17 x 19.5
DC-904 Digitally Refreshed Display	5¼ x 17 x 19
AP-904 Antenna Preamp	5 x 7.75 x 11
FE-904 Frequency Extender	8.5 x 5.25 x 13.85

Weight: (Pounds)

MSR-904A Receiver	40
FCS-904 Counter/Synthesizer	40
DC-904 Digitally Refreshed	25
AP-904 Antenna Preamplifier	12
FE-904 Frequency Extender	13

Power Requirements:

2904 System	115/230 VAC, 50-60 Hz
Environmental (°C)	0 to +50

ORDERING INFORMATION (Please see latest price list.)

MSR-904A Receiver (.5-18 GHz)	Requires the FCS-904 or IO-1000-904 to be controlled via the IEEE-488 interface bus.
FCS-904 Counter/Synthesizer	Requires the MSR-904A and/or FE-904 Extender to have Option 2 LO Sample.
DC-904 Digitally Refreshed Display	Requires the MSR-904A to have Option 4B, 160 MHz Output
FE-904 Frequency Extender	Requires the MSR-904A to have Option 8 provision for 18-40 GHz.

WARRANTY

All Micro-Tel products are unconditionally warranted for a period of one year except for physical damage, provided the equipment is returned to the plant in Hunt Valley.