



***Reconnaissance Electronics
Technology Division***

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***Electronic Systems Division
Condensed Catalog***

WATKINS-JOHNSON COMPANY

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This catalog contains a brief description of the products and capabilities of the Reconnaissance Electronics Technology (RET) Division of Watkins-Johnson Company. The RET and Communication Electronics Technology (CET) Divisions, comprise the Electronic Equipment Group of Watkins-Johnson Company.

The Electronic Equipment Group designs, develops and manufactures broadband and narrowband receiving equipment and related products at the San Jose and Gaithersburg plants. The Wake County plant is a valuable manufacturing and service facility.

Watkins-Johnson (W-J), headquartered in Palo Alto, California, is a diversified electronics company engaged in the research, development and production of advanced electronic systems and devices. W-J is organized into three groups: the Defense Group, the Electronic Equipment Group, and the Commercial Group. These groups, together with a newly established Environmental Services Division, constitute the major operating elements of the company.

Watkins-Johnson Company is a leader in the manufacture and development of microwave devices, frequency synthesizers, microwave subsystems, electronic warfare systems and automatic test equipment used in COMINT, ELINT, ESM and ECM applications. The company has more than \$33,000,000 worth of capital equipment. It employs more than 3,100 people and has over 900,000 square feet of manufacturing facilities. These facilities are located in Palo Alto, California; San Jose, California; Scotts Valley, California; Gaithersburg, Maryland; Wake County, North Carolina; Columbia, Maryland; Bonn and Munich, West Germany; Windsor, England and Rome, Italy.

W-J is presently engaged in research, development and production of advanced electron devices; ESM/ECM systems; microwave electron beam and solid state devices; microwave components; fiber-optic components; satellite and ground station communications systems; radar systems; range instrumentation; airborne, shipboard and ground-based reconnaissance systems; RFI systems; advanced receiving systems; radar threat warning systems; antennas and direction-finding systems.

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Palo Alto



San Jose

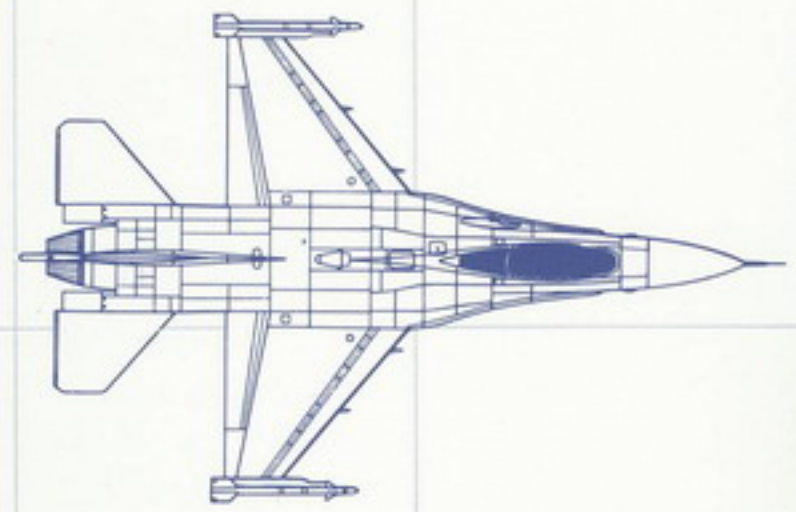


Gaithersburg



Wake County

Electronic
Equipment
Group



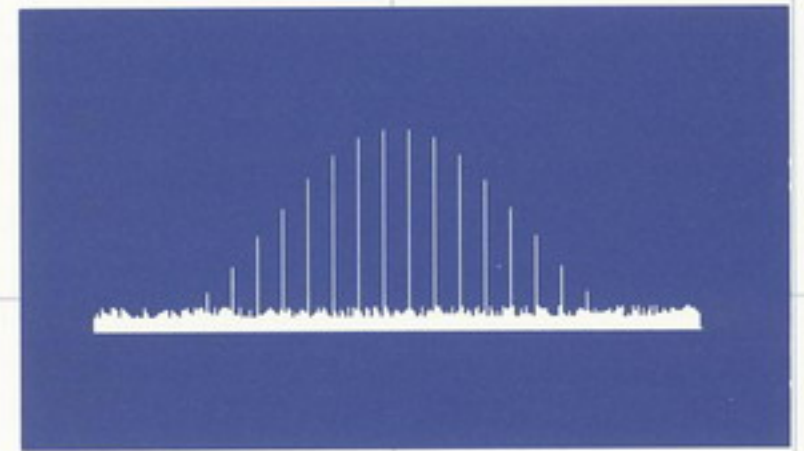
The Electronic Equipment Group (EEG) was established on January 1, 1989 and consists of two operating divisions and a manufacturing facility in Wake County, North Carolina. The two operating divisions, CET and RET, design, develop and produce SIGINT intercept and collection equipment. The Group has a comprehensive collection of receiving equipment and peripheral units which cover the entire radio frequency spectrum. The units described in this short form catalog are available as standard catalog items. These products can be used as stand alone units or they may be integrated into more complex systems or subsystems.

Watkins-Johnson Company prides itself on four decades of producing equipment which has kept pace with a rapidly changing electromagnetic environment. W-J has a well deserved reputation as a leading supplier of innovative, state-of-the-art, high-quality, reliable products serving the United States government, commercial customers and friendly countries worldwide.

**Reconnaissance
Electronics
Technology
Division**

RET Division, located at the San Jose plant, designs and produces microwave receivers, tuners, demodulators, and synthesizers for the U.S. military, prime contractors, and international markets. These products, which range from wideband to narrowband, manual control to digital control, and commercial grade to Mil-Spec, are produced using the latest packaging and manufacturing techniques. RET Division focuses its products in the microwave and millimeter frequency ranges.

The W-J special purpose and military frequency synthesizers are an important product line for RET Division. W-J synthesizers have been an industry leader for over fifteen years. Products from this area, and other W-J equipment, form the nucleus of our specialized EW and Radar Simulator systems.

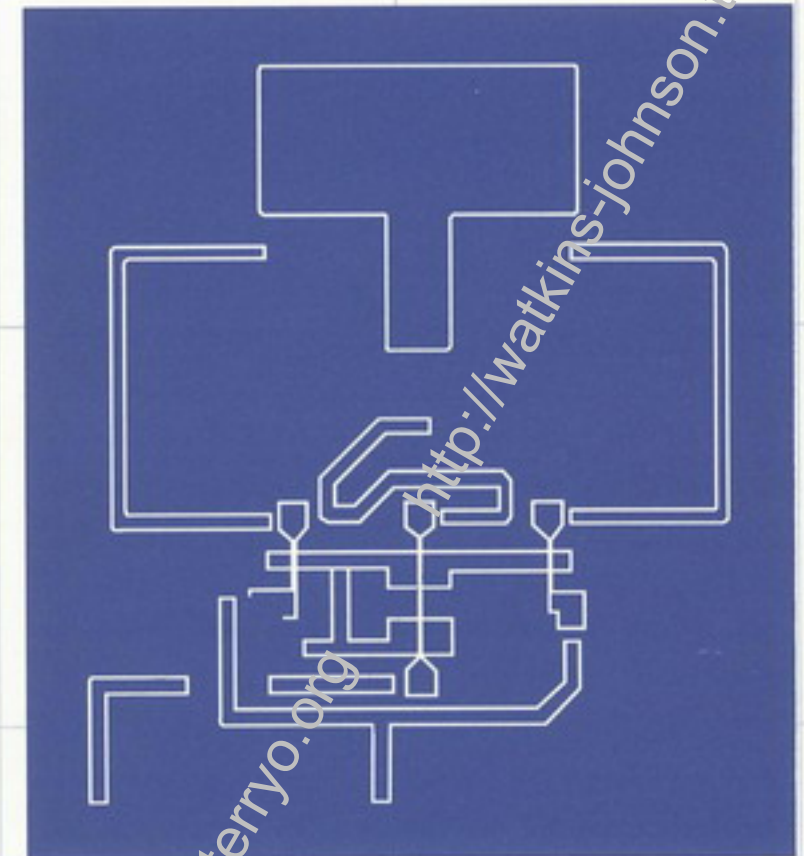


**Communication
Electronics
Technology
Division**

CET Division, located in Gaithersburg, Maryland, manufactures a diverse array of communications equipment, such as surveillance receivers, direction-finders, demodulators, signal processors, jammers, EMC/TEMPEST test systems, and accessory equipment. These products cover the frequency spectrum from 1 Hz to greater than 18 GHz. Many are stand-alone units that can be interfaced with other equipment to develop complex sub-system and/or system configurations.

CET Division is rapidly developing new electronic circuit design, packaging, and manufacturing methods. Surface mount technology (SMT) is becoming a dominant manufacturing and interconnect design media. In addition, an in-house thick film microelectronics facility has been developed for both internal corporate and external customer needs. The CET thick film facility can apply a practical and cost-effective microelectronic solution to high-density electronic packaging requirements.

CET engineers continue to design and develop general-purpose and specialized receiving equipment integrating analog, digital, and RF technologies. Their efforts are being focused on meeting the ever-increasing demands in the strategic and tactical communications environments. In addition, training courses on production equipment are provided.



Wake County Facility

Watkins-Johnson Company's Wake County support services facility is located in the vicinity of North Carolina's Research Triangle. This facility presently provides precision fabrication, test, and assembly of various W-J products, and has the capabilities to undertake most build-to-print manufacturing.

Watkins-Johnson has incorporated over 80 years of combined management experience with the latest in automated machinery to smoothly and efficiently produce quality products. We stress our ability to perform tasks in a timely and cost-effective manner. Computerized materials inventory and computer-aided design techniques are employed for tracking the large quantities of raw materials kept on hand, enabling rapid response times to customer needs.

Integrated Logistics Support (ILS)

- **T**rainning
 - On-site, in-house or factory
 - Video training
 - Operations/maintenance
 - Troubleshoot/repair
 - Written course material
- Production of all levels of MIL-Spec technical manuals (-10 through -34);
- Production of all levels of Repair Parts and Special Tools Lists (RPSTLs);
- Preparation of both Short-Form and Long-Form Provisioning Parts Lists (SFPPs and LFPPs);
- Logistics Support Analysis (LSA) and preparation and maintenance of Logistics Support Analysis Records (LSAR) on in-house computers;
- Level of Repair Analysis (LRA);
- Interim Support Items Lists (ISIL) and Recommended Spares Listings (RSL); and
- Preparation of Ground Support Equipment Selection Data (GSESD).



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RET Key Products and Technologies

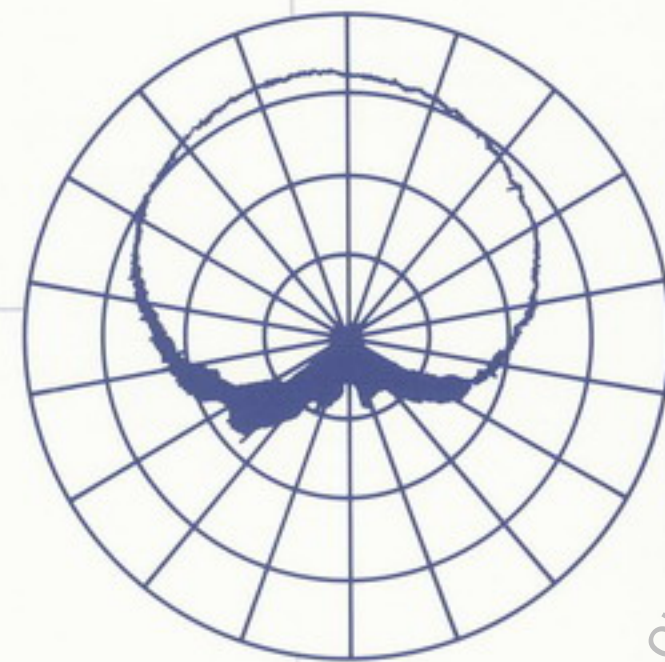
The following list of product areas and technologies represent the primary interests of RET Division. The specific items shown in this condensed catalog represent a general cross-section of units in production which may be provided as off-the-shelf equipment or used as a baseline for customer-specific applications requiring similar technologies.

Products

- Microwave/millimeter-wave receivers
- Superheterodyne tuners
- Block frequency converters
- Demodulators
- Video processors/analyzers
- IFM receivers
- Controllers/operator interfaces
- Spectrum displays
- RF distributions
- Frequency synthesizers
- Laboratory synthesizers
- Military synthesizers
- EW simulators

Technologies

- Military packaging (Mil-E-5400, Hi-Rel)
- Miniaturization/hybridization
- Fast tune synthesis/direct digital synthesis
- Low phase noise (high stability)
- Low group delay reception
- Phase and amplitude tracking
- Alternate receiver approaches (channelizer, acousto-optical, compressive, digital)
- Fine resolution tuning
- TEMPEST/EMI packaging



New Product Announcements

The following items are examples of recent development efforts for the RET Division. Programs in-place, internal R&D or planned products are included in this list. More information on each of these items is available by contacting RET Division Applications Engineers.

WJ-8969B TEMPEST Qualified Microwave Receiver

The WJ-8969B is a 0.5 to 20 GHz receiver that provides a 70 MHz IF output with the tuner, controller and demodulator housed in a single 3½" high rack-mount package. Performance is similar to that of the WJ-8969 or WJ-8969A systems while meeting TEMPEST qualifications.

70 MHz IF Digitally Refreshed Display

This unit is a TEMPEST qualified display for RF Scan and IF Pan activity. The unit is intended for use with 70 MHz IF output receivers such as the WJ-8969A or WJ-8969B.

TUX518/WJ-8969 Tuner

The newest addition to the WJ-8969 family of tuners, this unit covers the full frequency range of 0.5 to 18 GHz in a single half-rack unit.

WJ-38000 Microwave Receiving System

The WJ-38000 is a portable receiving system which combines search, direction-finding, manual analysis and automatic signal identification capabilities intended for ELINT applications on a wide variety of platforms.

New Product Announcements (Continued)

WJ-45XXX Low Noise Signal Generator

The WJ-45XXX Low Noise Signal Generator has a frequency range of 0.01 to 26.5 GHz. This signal generator has exceptional phase noise, -90 dBc/Hz at 1 kHz and -120 dBc at 100 kHz. The WJ-45XXX has 1 Hz resolution with 20 msec tuning speed and a -60 dBc spurious response.

WJ-45100 Direct Digital Synthesizer

The WJ-45100 Direct Frequency Synthesizer provides broadband 0.01 to 18 GHz frequency coverage while tuning anywhere in the band in under 1 μ sec. It utilizes advanced synthesis techniques and provides output power of +10 dBm and spurious of -60 dBc.

Fast-tuning Receivers

Many of W-J's standard tuner architectures can be implemented with the synthesizer capabilities of the WJ-45100 to yield a receiver capable of tuning in 1 μ sec for use in fast-tuning requirements.

WJ-45800 Direct Digital Synthesizer

The WJ-45800 provides broadband 6 to 18 GHz coverage while tuning under 1 μ sec over the agile bandwidth of 200 MHz (up to 1 GHz). Output power is +10 dBm, accuracy is ± 20 ppm, resolution is 1 kHz and spurious is -60 dBc.

TN-223 Dual-Channel Tuner

The TN-223 houses two independent 0.5 to 18 GHz tuners which provide outputs suitable for wideband or narrowband signal reception. When included in a WJ-9008 system configuration, this unit provides a high-performance and economical approach to microwave signal reception.

TN-101 Tuner

The TN-101 is a low band frequency extension covering the 0.1 to 0.5 GHz spectrum for use in standard microwave receiver architectures.

WJ-36500 System Compatible Tuners

Virtually all tuners presently manufactured by RET are available for compatibility with the WJ-36500 system architecture. Customer-owned tuners such as WJ-1740, WJ-1240, WJ-1840, QRC-259 and others can now be easily modified to be compatible with this system.

TN-124 Microwave Tuner

This tuner provides simultaneous 1 GHz IF and 160 MHz IF outputs with extremely low phase noise of approximately 0.5 degrees while fixed-tuned. The TN-124 can rapidly scan the microwave spectrum and provide 500 MHz instantaneous bandwidth for scanning or analysis.

WJ-45400 Synthesizer

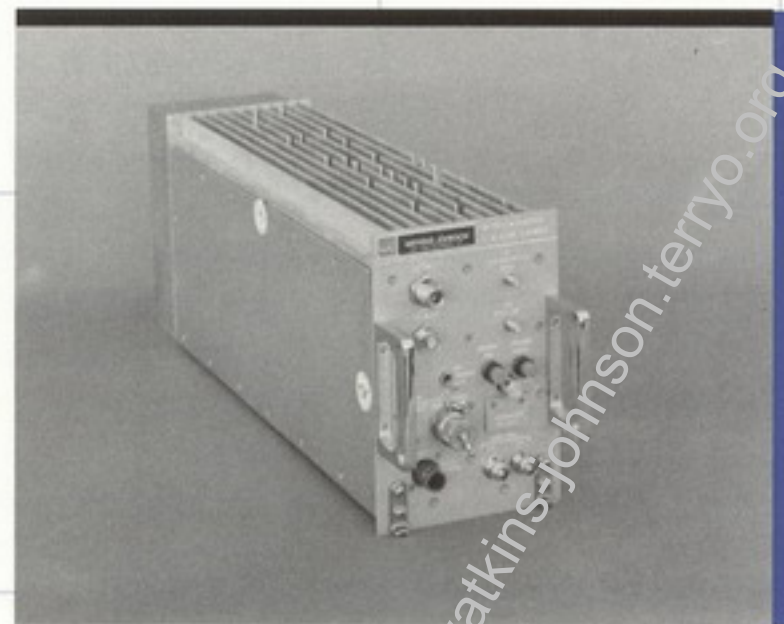
The WJ-45400 is a hybrid PLL/Direct Digital Synthesizer, custom-built for a manpack communications transceiver requirement which imposes tight restrictions on weight, power consumption, size and performance. Operating in X-band, this unit provides very fine resolution with excellent switching speed and low spurious.

Miniaturization

Company capabilities in MMIC, surface mount, thick and thin film and integrated assembly techniques are being utilized to design and manufacture equipment for standard products and specialized customer applications. Emphasis is on small size, light weight and low power consumption designs, combined with unique circuit architectures.



WJ-45100



TN-101

WJ-8969 Microwave Receiver

- Frequency synthesized tuning in 1 kHz steps
- AM, FM, pulse and CW detection
- 0.1 to 20 GHz frequency coverage
- IEEE-488 or front panel control
- Wideband and narrowband applications
- Single interconnecting cable for remote tuner control
- Excellent performance
 - Phase noise (-80 dBc/Hz at 1 kHz offset)
 - NPR (40 dB, typical)
- Microprocessor-controlled with battery-backed internal memory
- Self-test and fault location
- IF cable loss calibration
- Field-replaceable filters
- Multiple monitor outputs
 - 160 MHz IF (unfiltered)
 - Switched IF (unfiltered)
 - 70 MHz (optional)
 - FM video
 - Audio
 - 21.4 MHz IF (unfiltered)
 - Log video (optional)
 - AM video
 - Selected video
- Automatic scan and step operations

The WJ-8969 Microwave Receiving System is designed for wideband and narrowband applications in the 0.1 to 18 GHz frequency range. Its tuning capability is determined by interchangeable tuner units which provide the appropriate conversion scheme and RF preselection for the desired frequency range. Four wideband IF bandwidths (160 MHz center frequency) of the customer's choice are supplied as standard with each receiver. The system can provide up to eight operator-selectable bandwidths, comprised of four narrowband (10 kHz to 5 MHz) and four wideband (65 MHz to 50 MHz) bandwidths. The installation of any narrowband IF bandwidth filters (21.4 MHz center frequency) requires an optional internal downconversion module. Detection modes include simultaneous AM and FM, as well as CW and pulse. Options for the WJ-8969 Receiver include: log detector; RF to IF bandwidths to as much as 80 MHz; stand-alone tuner control; and a 70 MHz IF output. Many peripherals are also available, such as a digitally refreshed display (DRD) and IF PAN display, to complement the system.

The system is comprised of the WJ-8969/IFC IF demodulator/controller and a WJ-8969/TU-XXXX tuner unit. The two half-rack units, both 3½" high, can be attached side by side and installed in a standard 19" equipment frame, or the tuner unit can be installed in a remote location. The 1 to 18 and 0.5 to 18 GHz tuners are full-rack width packages. Signal and control interconnection is provided by a single 50 ohm coaxial cable that can be as long as 300 feet. By using special low-loss cables, this length may extend up to 1,000 feet.



WJ-8969

Frequency Range

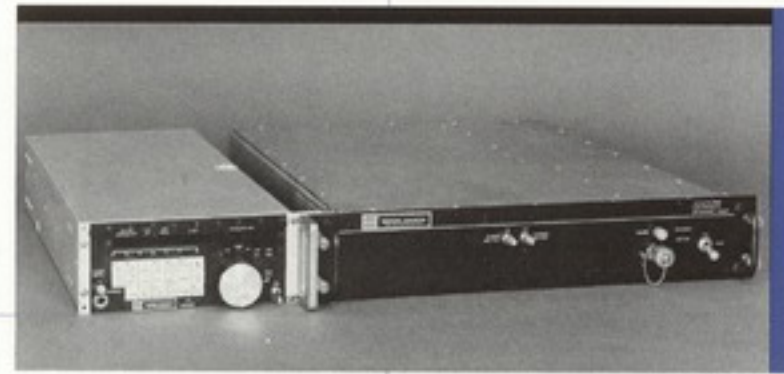
Determined by tuner unit:	
TU0145	1 to 4.5 GHz
TU0412	4 to 12.4 GHz
TU1218	12 to 18 GHz
TU0112	1 to 12.4 GHz
TU0118	1 to 18 GHz
TUX545	0.5 to 4.5 GHz
TUX145	0.1 to 4.5 GHz
TU-123 (standard)	0.5 to 18 GHz
TU-123 (option)	1 to 20 GHz
TU-123 (option)	0.5 to 20 GHz
TU-123 (option)	0.1 to 20 GHz

WJ-8969A Enhanced Microwave Receiving System

- Compact size
- 70 and 140 MHz selectable IF output
- 0.1 to 20 GHz frequency coverage
- TEMPEST packaging
- Ultra-low phase noise
- Frequency synthesized tuning in 1 kHz steps
- Low group delay using SAW filters
- Excellent performance for digital signal reception
- High NPR for FDM reception
- AM, FM and pulse detection modes
- IEEE-488 control
- Built-in test/self calibration

The WJ-8969A Microwave Receiving System combines the superior phase noise and group delay performance of the TU-123 tuner with the control and demodulation capabilities of the WJ-8969 IFC IF demodulator/control unit specially configured for 140 and 70 MHz IF outputs and demodulation. This system is designed to exceed the specifications necessary to receive many different types of transmissions including high data rate digitally coded signals such as PSK, QAM and other types of signals in the 0.1 to 20 GHz spectrum.

The IFC uses SAW filters to define the IF bandwidth on either the 70 or 140 MHz IF output of the tuner. The standard IFC is available in a front panel control half-rack 3½" high unit with external computer control or, alternately, as a full-rack 1¾" high unit with exclusive computer control and blank front panel. The IFC provides all system control and performs built-in test routines to perform automatic calibrations and identify installed filter values, as well as check for critical faults in the system during operation. Manual tuning, as well as automatic operations, such as scan and step memory programming and implementation, are performed from the front panel or over the IEEE-488 or RS-232 interfaces. The IFC implements demodulators with CW, AM and FM, pulse and FM AGC modes, AFC, programmable COR threshold and up to six selectable SAW filters, ranging from 250 kHz to 40 MHz bandwidths, and provides analysis and audio outputs.



WJ-8969A

**WJ-1840A
(AN/APR-46A)
Wideband
Microwave
Receiving
System**

- Superheterodyne receiver sensitivity and selectivity
- .03 to 18 GHz frequency coverage
- 400 MHz IF (0.5 to 18 GHz) with selectable bandwidth of up to 200 MHz
- 160 MHz IF (.03 to 0.5 GHz) with 10 MHz bandwidth
- Digital control with multiple mode operation
- Eight-trace refreshed display with alphanumeric frequency readout
- Band scan, sector scan, and manual modes
- Log video and audio output included
- Rugged military design

The WJ-1840A (AN/APR-46A) Wideband Microwave Receiving System is a high-performance, ruggedized, VHF/UHF/microwave receiver for processing and displaying pulsed and amplitude-modulated signals.

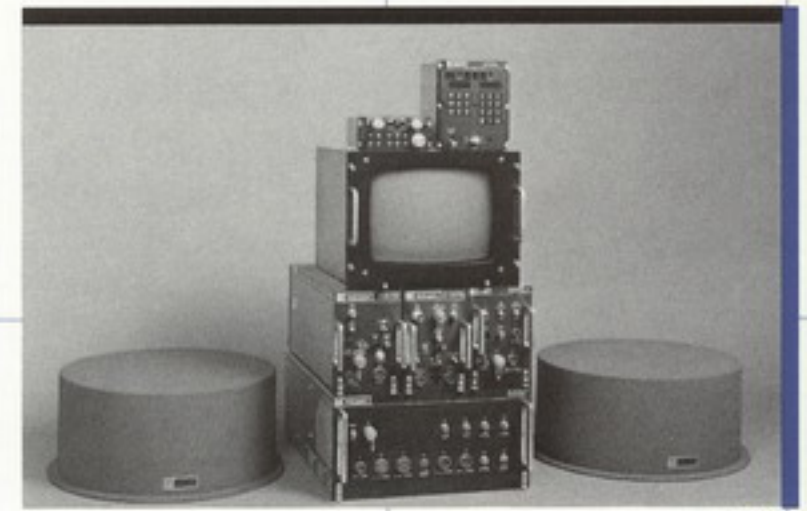
The WJ-1840A (AN/APR-46A) is comprised of two WJ-8535-15 0.5 to 18.0 GHz omnidirectional antennas, a MD-127A demodulator, a TN-130 0.03 to 0.5 GHz RF tuner, a TN-118A 0.5 to 18.0 GHz RF tuner, SRL 2700 pan display, a C-115A remote receiver control unit, and a C-125A remote priority scan unit.

The system divides the microwave frequency spectrum into six bands: 0.03 to 0.5 GHz, 0.5 to 4.0 GHz, 4.0 to 7.5 GHz, 7.5 to 11.0 GHz, 11.0 to 14.5 GHz and 14.5 to 18.0 GHz. Each band is displayed on a separate trace on the CRT, with the 0.03 to 0.5 GHz band on the top trace and the 14.5 to 18.0 GHz band on the sixth trace. The frequency spectrum of the two remaining traces are operator selectable.

A marker, represented as a vertical line below the trace, is displayed on the trace selected by the band switch during all modes. A numeric readout of the frequency is displayed below the marker. By placing the marker directly below the pertinent signal, the operator can determine the frequency of that signal.

The receiving system provides band scan, sector scan, or manual scan of the 0.03 to 18.0 GHz frequency spectrum via the remote priority scan control unit, and displays the received RF emissions on the digitally refreshed display CRT. Additional outputs of the receiving system include log video and audio.

The WJ-1840A (AN/APR-46A) is currently used in significant quantities by the U.S. Air Force. Maintenance and logistic support measures are currently in place.



WJ-1840A

**WJ-36500 SIRS
Microwave
Receiving
System**

- Single/independent or multi/interactive operator positions
- 0.03 to 40 GHz frequency reception (with extensions up to 110 GHz)
- Basic system controls 15 RF tuners and demodulators; other peripheral equipment is available
- Narrowband and wideband tuners/demods for signal analysis (see typical tuner chart page 16 & 17)
- High-resolution alphanumeric/graphic displays

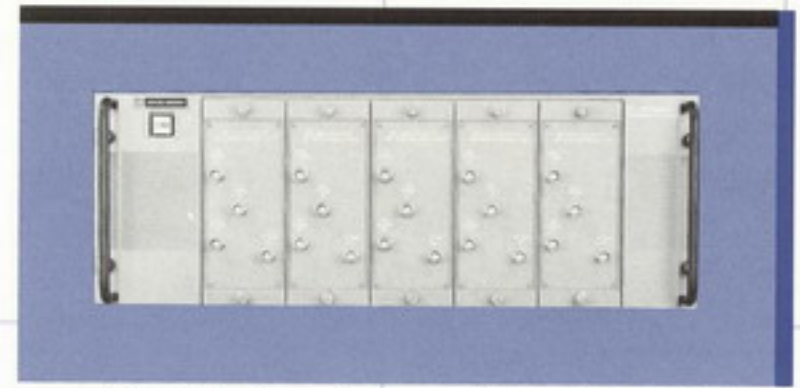
The WJ-36500 Signals Intelligence Receiving System (SIRS) is a 0.03 to 40.0 GHz ESM/ELINT/COMINT receiver which maximizes current capability and future adaptability. This modularly designed superheterodyne receiver consists of a C-100 control/display unit; an optional C-200 scan display; an EF-100 equipment frame which contains internal power supplies and video switching and accepts up to five demodulators, depending upon desired IF bandwidth and video performance; and one or more octave or multioctave tuners, or the FXT-1XX millimeter extensions.

The C-100 controls SIRS operations; displays operating parameters, status, IF Pan and analysis mode video; and accepts configuration programming. This unit has internal removable mass memory and supports multiple standard interfaces including: IEEE-488, RS-422, RS-232C, Mil-STD-1553 and ethernet.

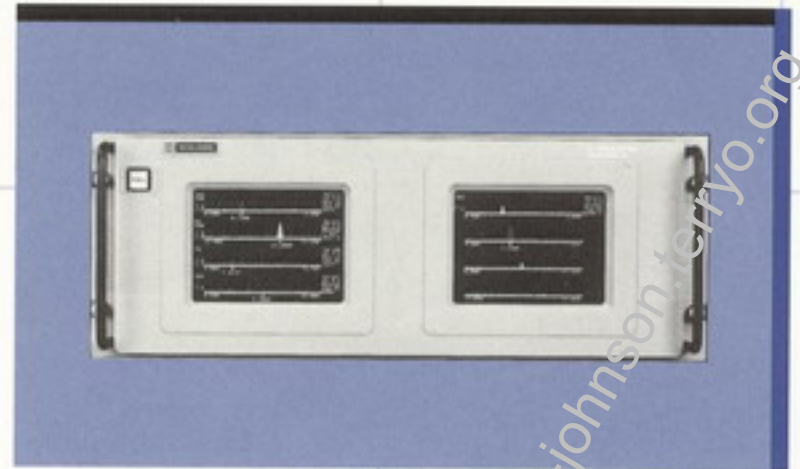
The C-100 electroluminescent (EL) display provides operation, configuration, and diagnostic reports; BITE status; flexible RF, IF and time spectrum displays with a selectable refresh/decay rate; as well as an AM/FM display mode for accurate measurement of broadband emitters' frequency excursions.

The C-200 scan display is capable of displaying 8 traces of RF panoramic activity for any additional tuners in the system configuration.

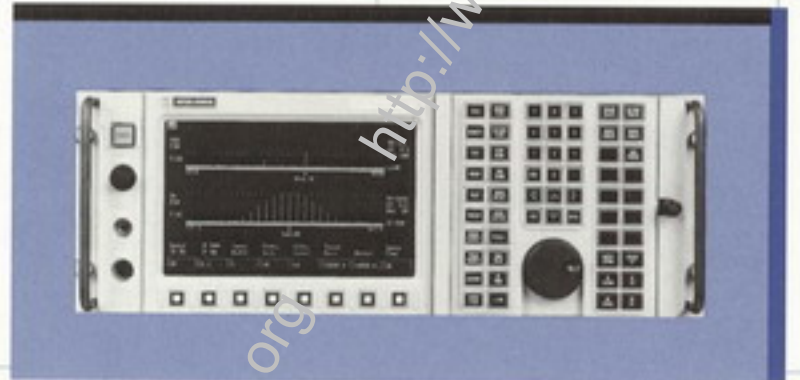
The WJ-36500 supports configurations allowing a "pool" of receiving equipment to be controlled or monitored by multiple operators. The control and display capability built into the C-100 allows a wide variety of modes to effectively search, analyze or manage RF signal activity.



EF-100 Equipment Frame with plug-in Demodulators



C-200 Scan Display



C-100 Control/Display

Series	Demodulator Models	
	IF Frequency	Bandwidths
MD-100	21.4 MHz	10 kHz - 8 MHz
MD-200	70.0/140 MHz	250 kHz - 20/50 MHz
MD-300	160.0 MHz	1 MHz - 50 MHz
MD-400	400.0 MHz	5 MHz - 200 MHz
MD-500	1000.0 MHz	25 MHz - 500 MHz

WJ-1240
0.03 to 40 GHz
Microwave
Receiving System

- **C**ompletely independent control for each tuner
- Includes 1 to 15 tuners in any combination of bands
- Capability for shared control from as many as 8 control stations
- "MIL" nomenclature (AN/FRR-94(V)) and federal stock numbers

The WJ-1240 is a digitally controlled microwave receiving system covering the frequency range from 0.03 GHz to 40 GHz. Modular RF tuners covering the frequency spectrum in octave bands are utilized to provide maximum flexibility for use in a wide variety of applications. The system is ideally suited to operating environments requiring multiple operator control, parallel signal analysis, and high probability of intercept.

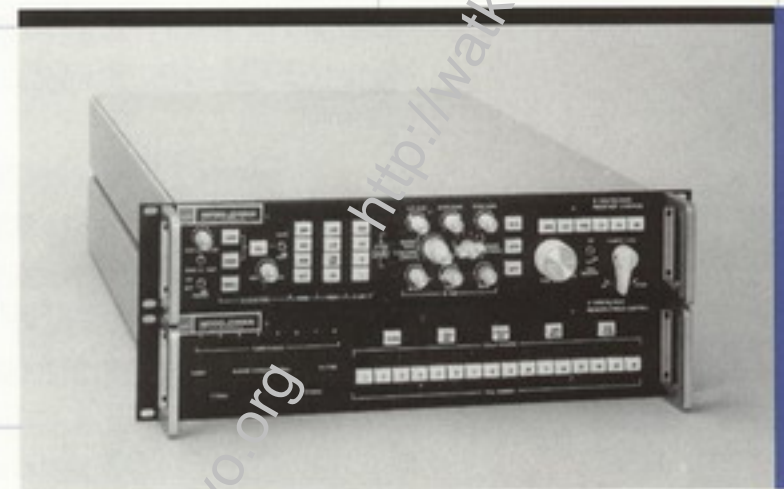


WJ-1240

WJ-1440 Series
0.03 to 40 GHz
"Memory Scan"
Microwave
Receiving System

- **A**utomatic "memory scan" with 16 operator-set scan blocks
- Automatic acquisition operation
- Microprocessor controlled
- Synchronous, parallel band scan for activity detection
- Full analysis control
- Alphanumeric frequency and status readouts on analysis display CRT
- Use of miniature WJ-940 tuners available as option
- Phase locked LO synchronizer for high frequency accuracy and stability
- "Hold" mode available for each tuner
- Design based on fully-militarized WJ-1740
- TILOS (Tuner Internal LO Synchronizer) option

The WJ-1440 is a microprocessor-controlled system derived from the fully-militarized WJ-1740 system. In addition to the basic capabilities of the WJ-1740, the newer, lower-cost WJ-1440 provides a unique "memory scan" capability that has previously been available only with computer-controlled systems.

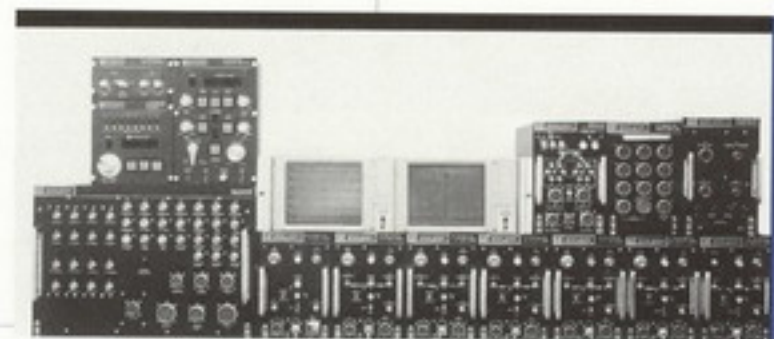


WJ-1440

WJ-1740
0.03 to 40 GHz
Microwave
Receiving System

- **A**nalysis channel capabilities:
 - 0 to 90 dB IF attenuation in 10 dB steps
 - Selectable 1, 5, 20 MHz, or maximum IF bandwidths
 - Linear with or without AGC, log, and FM video outputs
 - Phase-lock LO synchronizer control for frequency accuracy and stability to 1 part in 10^7 per day
 - Manual, sector scan, or band scan analysis modes
 - IF pan or activity signal display
- Field proven—over 100 systems fielded, airborne, ground, ship-based
- MIL-Spec documentation
 - Technical orders
 - Test procedures
 - IPB (illustrated parts breakdown)
- Dedicated LO synchronizer capability
- Auxiliary IF, video, and audio outputs
- Full manual or computer-assisted operation
- Multi-operator systems
- Alphanumeric readout on analysis display
- System capability for more than 12 tuners
- Modular construction permits tailoring of system to customer requirements
- IEEE-488 interface available
- TILOS (Tuner Internal Local Oscillator Synronizer) available for all tuners

The WJ-1740 is a parallel-scanned, digitally controlled, superheterodyne receiver system which can include as many as eight tuners (12 or more for special applications) in any combination of frequency bands. The tuners allow coverage of the 0.03 to 40 GHz frequency range in eight or nine frequency bands. Multi-octave tuner compatibility is also available.



WJ-1740

WJ-945A
Receiving
System

- **C**ontrol flexibility
 - Activity monitoring
 - Programmable scan strategies
 - Preprogrammed mission cartridges
 - Built in PROM programming station

The WJ-945A Receiving System is a compact receiver system covering the frequency range from 0.5 to 18.0 GHz. It is capable of both manual and automatic control, as well as automatic pre-programmable control by means of PROM mission cartridges that insert into the C-200 receiver control front panel.



WJ-945A

SR-100 Set-on Receiver

- Threat detection, identification and countermeasure control in a single unit
- 8.6 to 10.2 GHz frequency coverage; other bands are available
- Modular architecture
- 10 MHz frequency accuracy
- Temperature range -54°C to 71°C

The SR-100 Set-on Receiver adds electronic countermeasures (ECM) capabilities to platforms facing size, weight and power consumption constraints. When deployed in conjunction with a customer-supplied frequency source, the SR-100 provides rapid, accurate threat jamming in a multi-emitter environment.

To minimize the response time to a threat, the receiver employs an IFM architecture. The SR-100's frequency discrimination process occurs directly at the emitter's RF frequency, eliminating the need for costly downconversion hardware.

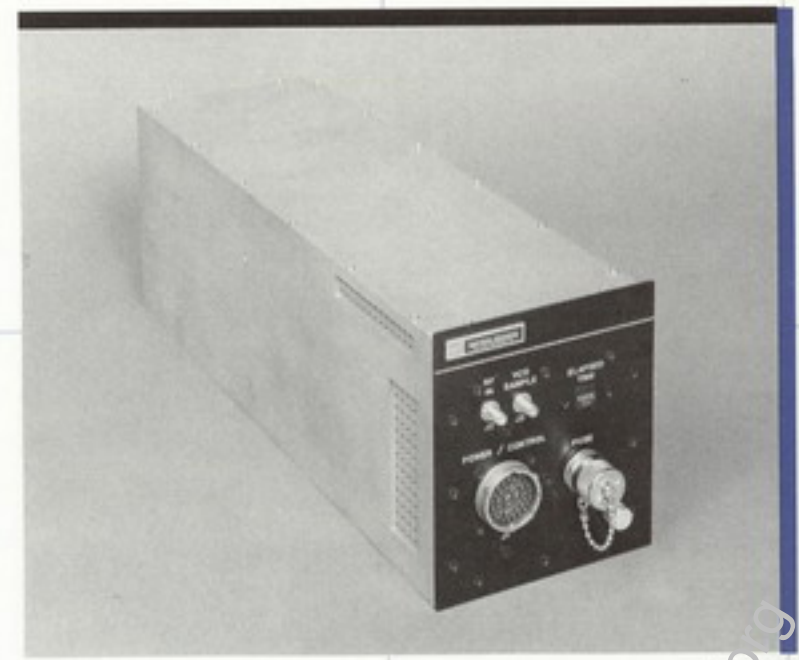
Frequency and pulse repetition interval (PRI) values are computed for all intercepts. A jammer control signal is generated for emitters which meet preprogrammed frequency and PRI criteria. These jammer control signals are available in an analog or digital format.

Signal prioritization parameters can be set and stored in nonvolatile memory via an RS-232 link. Multiple missions can subsequently be run without further human operator intervention until parameter modifications are necessary.

For operation in dense signal environments, frequency lockout regions can be enabled by the operator. This feature can prevent a high pulse-density (i.e. pulse Doppler) emitter from obscuring the presence of lower pulse-density emitters.

In order to survive a hostile tactical environment, the SR-100 Set-on Receiver has been designed to comply with the major environmental criteria outlined in MIL-STD-810D.

Standard models of the SR-100 are available for X-Band or S-Band frequency coverage. Other frequency ranges are also available.

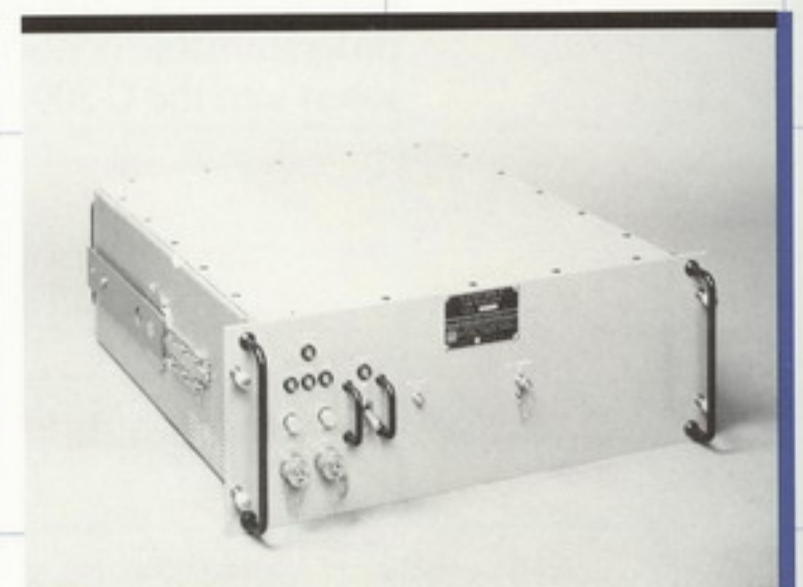


SR-100

FR-100 IFM Receiver

- Tuning range of 2.0 to 18 GHz
- Instantaneous bandwidth of 500 MHz
- Log video, coarse and fine sine/cosine video outputs

The FR-100 IFM Receiver combines a superheterodyne tuner and an IFM demodulator in a 19" rack mountable housing. The tuner covers a frequency range of 2.0 to 18 GHz with an instantaneous bandwidth of 500 MHz. The IFM demodulator accepts the tuner IF frequency of 1000 MHz, processes the received signal and provides the following outputs: log video output, coarse $\sin(f)$, coarse $\cos(f)$, fine $\sin(f)$ and fine $\cos(f)$.

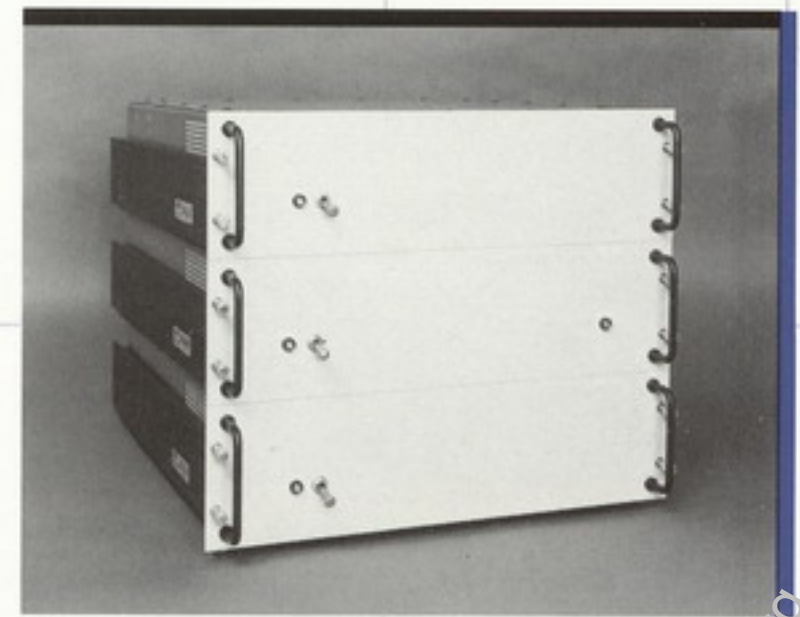


FR-100

Multi-Channel Tuners/Receivers

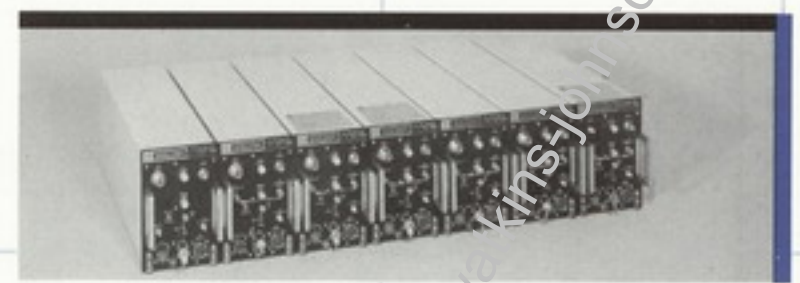
- Multi-converter channels using common LOs
- 0.1 to 18 GHz in one band or various bands
- Typical superhet specifications
- Selectable IF bandwidths
- IF passband phase tracking for all channels
- Up to 500 MHz of instantaneous bandwidth

This is an example of W-J's capability to package its modular tuners into a single subsystem. A subsystem such as the one pictured contains up to eight tuners driven by common local oscillators. The subsystem can have a variety of selectable IF bandwidths depending on the IF frequency. IF frequencies are available from 70 MHz to 1 GHz. This subsystem possesses very good phase tracking characteristics from channel to channel.



WJ-1740 Tuners

The WJ-1740 series of octave band RF tuners are packaged in A1D sized ATR boxes and are standard octave based from 0.03 to 40 GHz. Each tuner can be remotely controlled and provides a 160 MHz IF output.



TILOS (Tuner Internal Local Oscillator Synchronizer)

- Frequency stability: 1 part in 10^7 per 24-hour period (typical)
- Single sideband phase noise: <45 dBc (1 Hz bandwidth at 10 kHz)
- Field retrofitable or factory installed
- Improved frequency accuracy
- Simultaneous synchronization of tuners
- Cost effective: saves approximately two-thirds the cost of an external synchronizer
- Improved maintainability: only two modules, providing a very low MTTR
- Improved reliability: a calculated 10,607 hours MTBF
- Quick and easy alignment of frequency accuracy

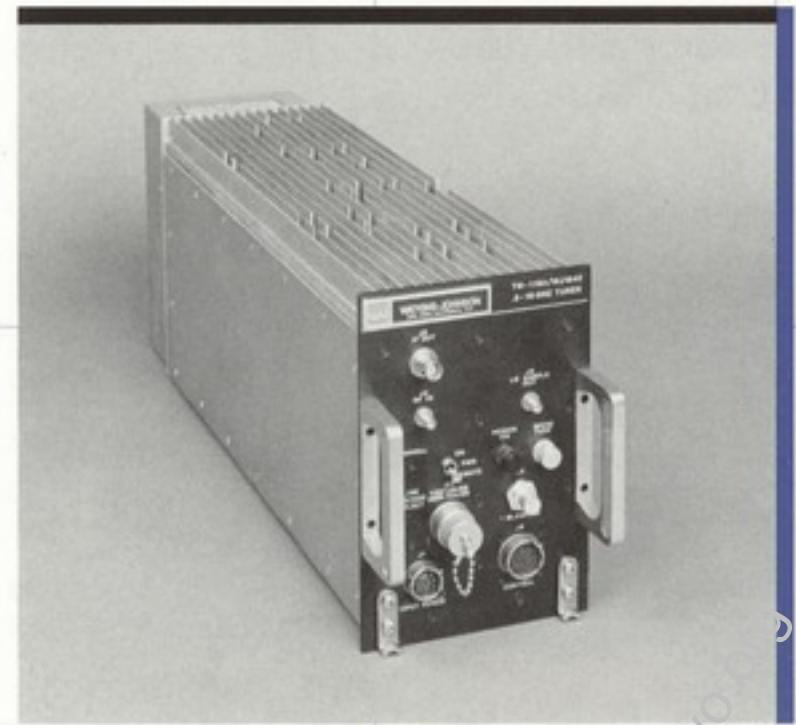
TILOS is a tuner-integral stabilizer which phase-locks the local oscillator to a reference standard frequency. This technique improves frequency accuracy and reduces IFM (incidental frequency modulation). All of the TILOS circuits, including the reference oscillator, are contained within the host tuner. Using TILOS, all tuners may be simultaneously synchronized, using either an internal or external reference source. Currently, standard WJ-945, WJ-1140, WJ-1240, WJ-1440 and WJ-1740 octave band microwave tuners can be purchased or retrofitted with this circuitry to provide local oscillator stabilization.



Standard W-J Broadband Microwave Tuners

Watkins-Johnson Company tuners are available in a variety of package sizes, bandwidths, tuning ranges, IF frequencies, and tuning step sizes.

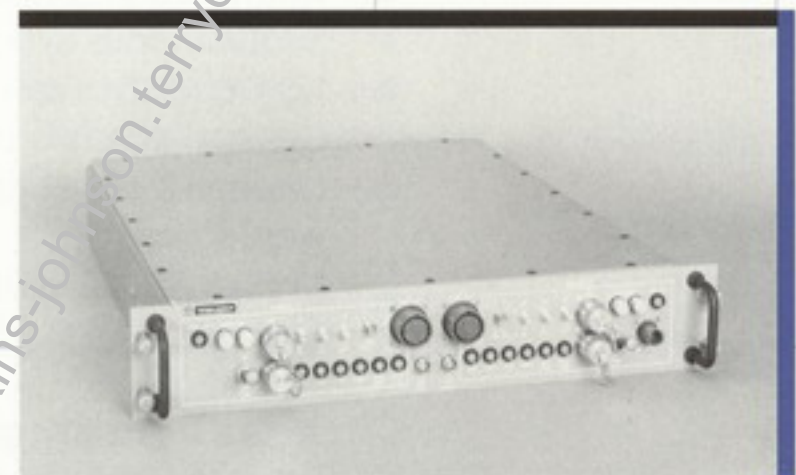
Parameter	TN-118A	TU-123	TN-218
RF input frequency range	0.5 to 18 GHz	0.5 to 18 GHz (0.1 to 20 GHz optional)	2 to 18 GHz (dual channel)
IF output center frequency	400 MHz or 160 MHz	160, 140, or 70 MHz	160 MHz
RF-to-IF bandwidth	200/50 MHz	70 MHz typ.	40 MHz
Tuning step size	100 kHz	1 kHz	100 kHz
Noise figure			
0.5 to 8 GHz	16 dB typ. 20 dB max.	16 dB max.	17 dB typ.
8 to 18 GHz	18 dB typ. 23 dB max.	18 dB max.	(2 to 18 GHz)
Single sideband phase noise (synchronizer option) 10 kHz offset	-60 dBc/Hz	-90 dBc/Hz typ. -85 dBc/Hz max.	-60 dBc/Hz
Image rejection over RF input range	60 dB min.	80 dB min.	60 dB min.
Local oscillator radiation	-80 dBm max.	-80 dBm max.	-90 dBm max.
1 dB gain compression dynamic range (1 MHz bandwidth)	85 dB min.	85 dB min.	90 dB typ.
Input 1 dB compression point	-10 dBm min. -5 to 0 dBm typ.	-10 dBm min. -5 to 0 dBm typ.	-3 dBm min. +5 dBm typ.
Single-signal spurious-free dynamic range (1 MHz bandwidth)			
0.5 to 8 GHz	55 dB min.	60 dB min.	65 dB min.
8 to 18 GHz	60 dB min.	60 dB min.	65 dB min.
Frequency accuracy			
Unsynchronized	±30 MHz	N/A	±30 MHz
Synchronized to internal reference	5 parts in 10 ⁷ min. over temperature	3 kHz per 6 months	determined by external reference crystal
Input voltage	110/220 VAC, 50 to 400 Hz	110/220 VAC, 50 to 400 Hz	110/220 VAC, 50 to 400 Hz
Size (H x D x W inches)	A1D (7.44 x 19.65 x 4.94)	5.0 x 19.6 x 15.4	3.5 x 20.5 x 16.75 for 19-inch rack-mount
Operating temperature	-20°C to 50°C with airflow	0°C to 50°C	0°C to 50°C



TN-118A



TU-123

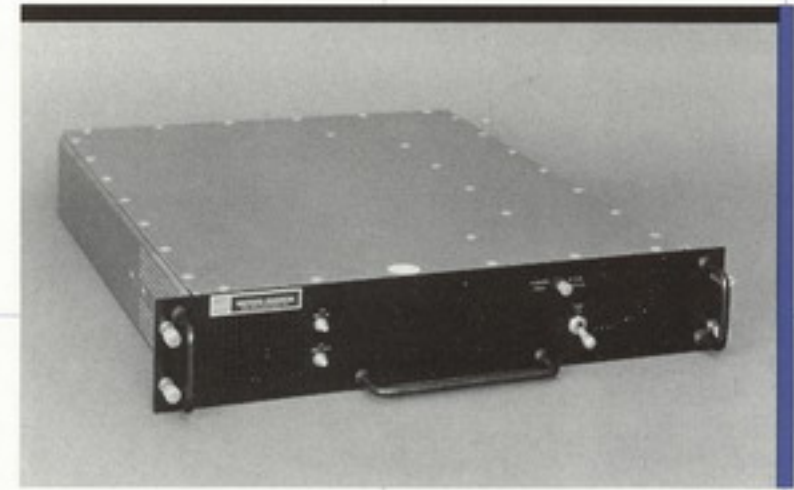


TN-218

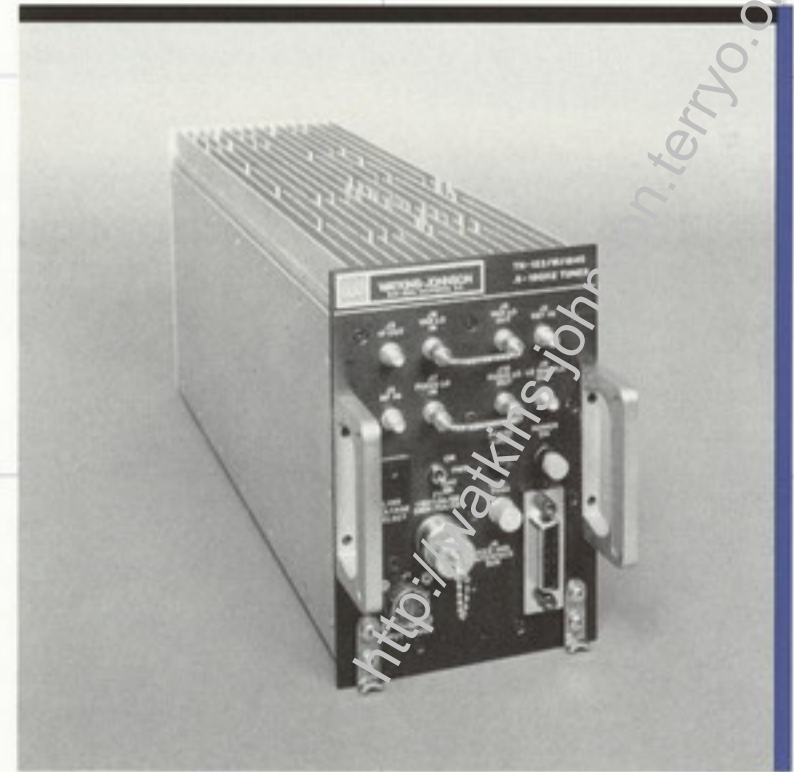
**Standard W-J
Broadband
Microwave
Tuners**

Tuners with special ranges, alternative packaging arrangements and other special features can be provided on request.

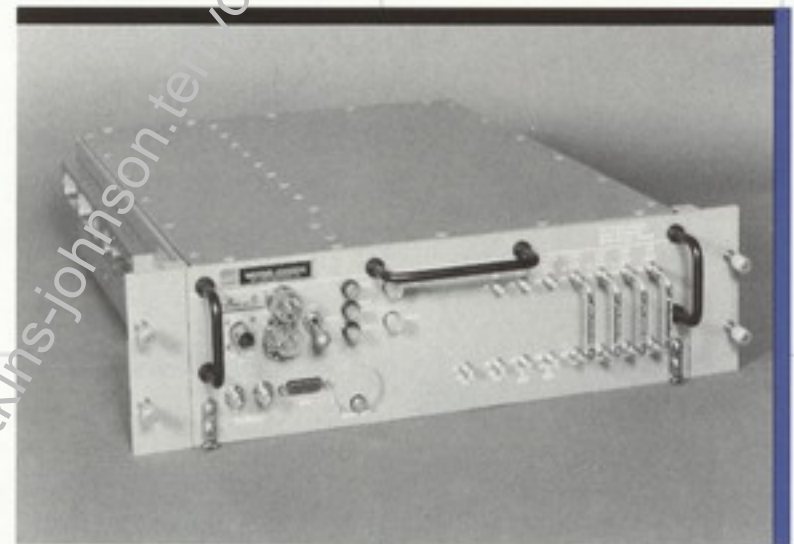
Parameter	TN-223	TN-122	TN-123
RF input frequency range	0.5 to 18 GHz (dual channel)	0.5 to 18 GHz	0.5 to 18 GHz
IF output center frequency	450 MHz	1.0 GHz	1.0 GHz
RF-to-IF bandwidth	140 MHz	500 MHz	500 MHz nom.
Tuning step size	100 MHz, synthesized	100 kHz, synthesized	1 kHz or 5 MHz, synthesized
Noise figure			
0.5 to 8 GHz	14 dB max.	16 dB typ. 20 dB max.	16 dB typ. 20 dB max.
8 to 18 GHz	14 dB max.	18 dB typ. 23 dB max.	18 dB typ. 23 dB max.
Single sideband phase noise (synchronizer option)			
10 kHz offset	-85 dBc/Hz	-60 dBc/Hz	-90 dBc/Hz typ. -85 dBc/Hz max.
Image rejection over RF input range	70 dB min.	65 dB min.	65 dB min.
Local oscillator radiation	-65 dBm max.	-70 dBm max.	-80 dBm max.
1 dB gain compression dynamic range (1 MHz bandwidth)	85 dB min.	85 dB	85 dB
Input 1 dB compression point	-10 dBm min.	-7 dBm min. -5 to 0 dBm typ.	-7 dBm min. -5 to 0 dBm typ.
Single-signal spurious-free dynamic range (1 MHz bandwidth)			
0.5 to 8 GHz	57 dB min.	55 dB min.	55 dB min.
8 to 18 GHz	57 dB min.	55 dB min.	55 dB min.
Frequency accuracy			
Unsynchronized	N/A	±30 MHz	N/A
Synchronized to internal reference	±5 x 10 ⁻⁷ min. over temperature	100 kHz at +23°C 50 ppm over temperature	1.5 x 10 ⁻⁹ per 6 months
Input voltage	115/220 VAC, 50 to 400 Hz	115/230 VAC, 50 to 400 Hz	115/220 VAC, 47 to 440 Hz
Size (H x D x W inches)	3.5 x 20.75 x 16.75	A1D (7.44 x 19.65 x 4.94)	5.0 x 19.6 x 15.4
Operating temperature	0°C to 50°C	-20°C to 50°C	0°C to 50°C



TN-223



TN-122

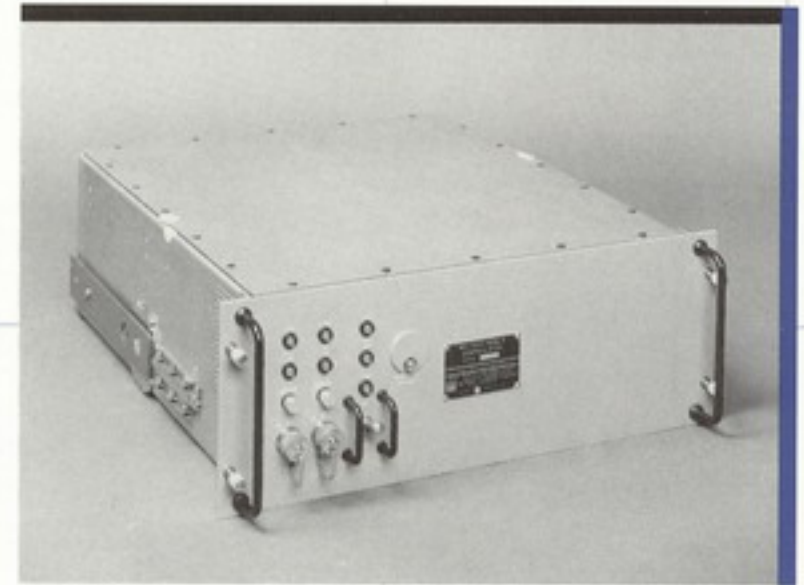


TN-123

**MD-100/WJ-35050
Multi-Channel
Demodulator**

- Internal frequency conversion for tape recording (Pre-D)
- 6 channels of log, lin, FM
- 5 selectable IF bandwidths
- IEEE-488 control
- Built-in test functions

The MD-100 is a 6-channel demodulator which provides simultaneous log, lin, FM and pre-D outputs. IF bandwidths of 2, 5, 10, 20, and 60 MHz are gain-bandwidth normalized and independently selectable via the IEEE-488 interface bus. BIT functions include power supply monitoring, phase-lock indicators and internal test signals.



MD-100

**EF-100/WJ-36500
Equipment Frame**

- Internal video matrix
- Demodulator plug-ins
- Internal power supply
- Special purpose plug-ins

A large family of demodulators and special purpose plug-ins are available for the EF-100 equipment frame. All demodulators provide 5 selectable bandwidths and log, AM and FM video outputs. Auxiliary IF outputs, audio and selected video signals are also available. Plug-ins may perform internal downconversion along with IF and video switch matrix functions for special applications. Demodulators supporting 1000, 400, 160, 140, 70 and 21.4 MHz IF inputs are available.

The modular construction and versatility of this frame allow for a wide variety of functions to be performed by the plug-in units such as IF switching, downconversion, IF pan demodulation or other special functions. The EF-100 equipment frame is available with a wide variety of computer control formats and plug-ins may incorporate front panel control and front/rear panel access points for signal routing.



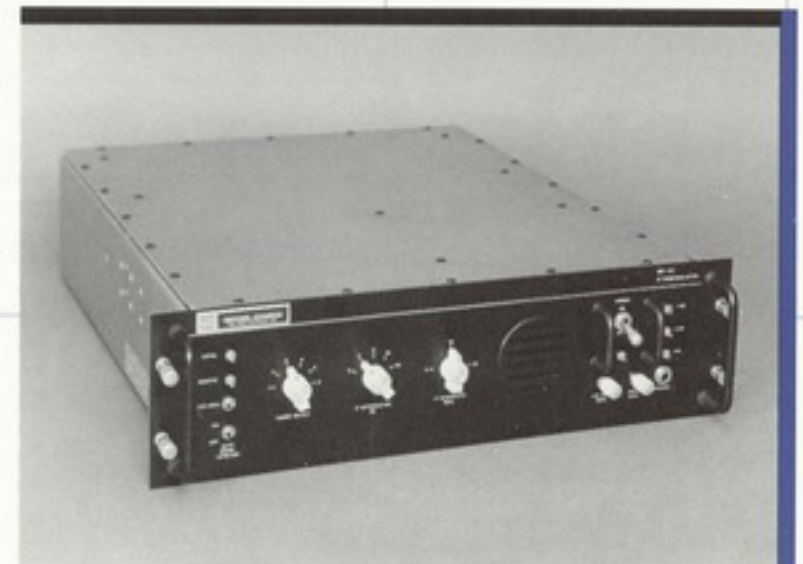
EF-100

Demodulator Models		
Series	IF Frequency	Bandwidths
MD-100	21.4 MHz	10 kHz-8 MHz
MD-200	70.0/140 MHz	250 kHz-20/50 MHz
MD-300	160.0 MHz	1 MHz-50 MHz
MD-400	400.0 MHz	5 MHz-200 MHz
MD-600	1000.0 MHz	25 MHz-500 MHz

**MD-132
Demodulator**

- Simultaneous log, lin, FM, audio outputs
- 3 selectable IF bandwidths
- 4 selectable IF attenuation values
- Signal center frequency determination
- Automatic noise leveling circuitry

The MD-132 is a 160 MHz IF demodulator which accepts signals selected from one of six inputs and provides simultaneous log, lin, FM, and audio outputs. Bandwidths of 2, 10, and 20 MHz, and IF attenuation values of 0, 4, 8, 16, or 32 dB can be selected at the front panel or by the remote interface. Signal-centering circuitry detects if the received signal deviates from the center frequency. An automatic noise-leveling circuit can be switched in or out of the control path to maintain a uniform noise floor.

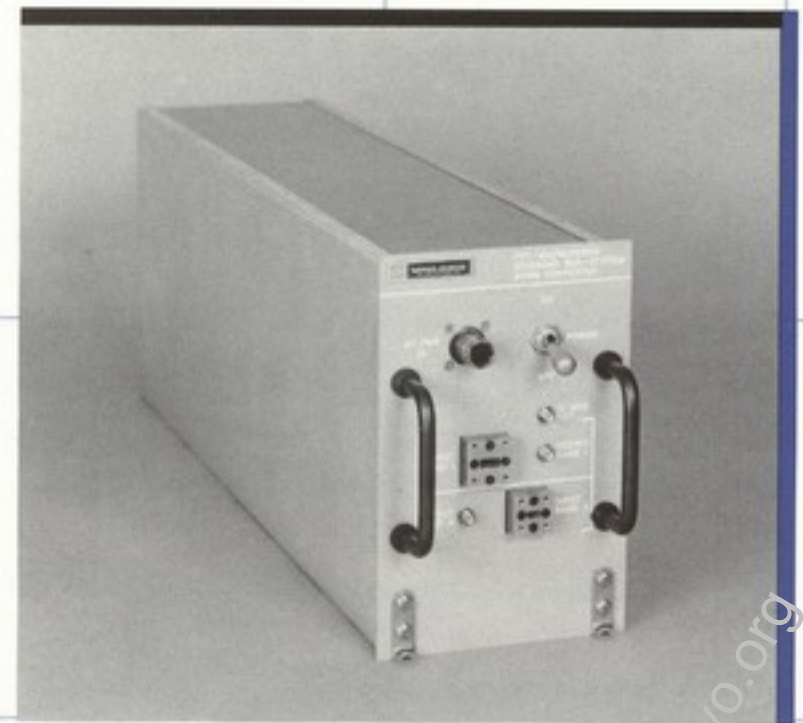


MD-132

FXT-100 Downconverter

- **L**ow noise figure
- 18-40 GHz coverage in two bands
- High-side, phase-locked local oscillators

The FXT-100 is a dual-channel downconverter covering the 18 to 26.5 GHz and 26.5 to 40.0 GHz bands. The output spectrums fall within the 2 to 18 GHz range and are inverted using high-side local oscillator, low spurious conversion techniques. The unit may be procured with or without preamps depending on the noise figure/dynamic range tradeoff desired.



FXT-100

CV-100/WJ-35050 Radio Frequency Converter

- **A**ccepts 12 input channels and converts them into eight baseband ranges
- Low noise, high gain, and broadband
- All local oscillators can be phase locked to external 5 MHz reference
- Built-in-test (BIT) circuits for functional test of all RF paths
- LO sample input for precise calibration
- Microprocessor-controlled via IEEE-488 bus

The CV-100 RF converter provides frequency conversion of signals from Ultra-F to millimeter-wave into eight baseband outputs in the frequency range from 2 GHz through 18 GHz. Each output channel has a programmable threshold detector circuit to indicate the presence of any RF signal. Built-in-test functions check continuity of the various RF chains. An LO input can be switched to any one of the output bands for injection into the overall system.



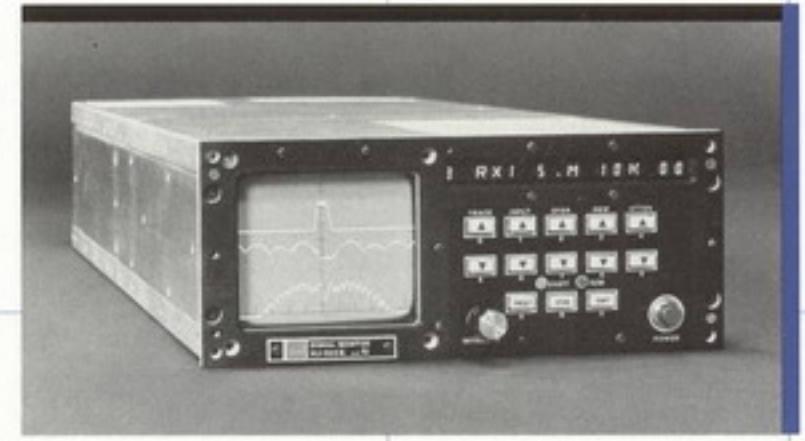
CV-100

WJ-9204 Signal Monitor

- **S**mall size
- Wide on-screen dynamic range
- PLL oscillators and autocentering
- Digitally refreshed display
- X-Y monitor mode
- BITE

The WJ-9204 Signal Monitor is intended as a companion unit for the WJ-8969 Microwave Receiver but may also be used with any other type receiver.

It accepts 160 MHz inputs from up to three receivers and will display spectrum traces for up to three of these inputs simultaneously on its 4.0 inch (diagonal) CRT.



WJ-9204

WJ-8969/DRD Digitally Refreshed Display

- **C**ompact size
- RF spectrum and IF pan display in a single unit
- Unique interactive tuner control for manual tuning
- IEEE-488 remote interface

The WJ-8969/DRD Digitally Refreshed Display Unit is intended to be used in conjunction with the WJ-8969 Microwave Receiving System for both a visual representation of captured RF signal activity and for IF signal analysis.

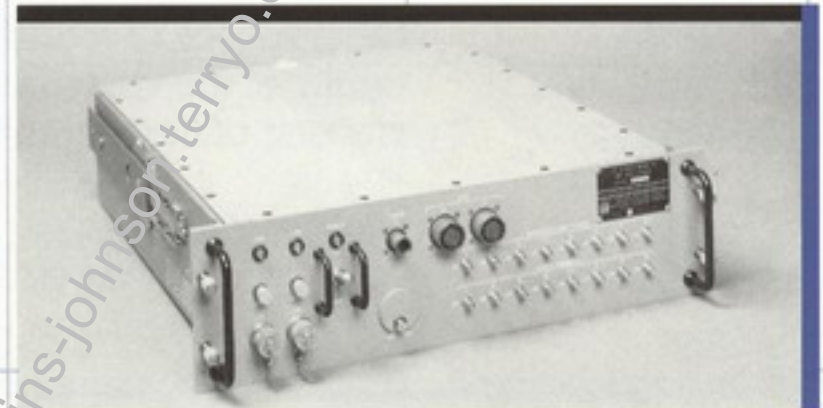


WJ-8969/DRD

CU-100 RF Splitter Unit

- **S**tandard 19-inch rack-mount
- 2 to 18 GHz frequency range
- IEEE-488 control bus

The CU-100 RF Splitter accepts 8 RF inputs and provides eight switched RF outputs. Each output may be switched from any input and any number of outputs may be switched to any input (non-blocking) via the digital control bus.

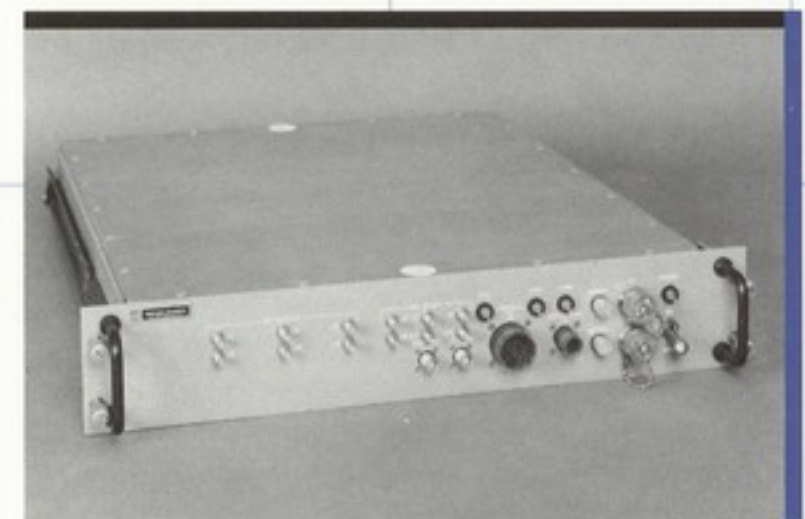


CU-100

CU-200 RF Splitter Unit

- **L**ow noise figure
- 0.5 to 18 GHz frequency range
- 20 dB gain
- Expanded tuning range for TN-218 RF tuner

The CU-200 RF Splitter accepts 6 RF inputs covering 0.5 to 18 GHz which are distributed and converted into 6 output base bands, each covering 2 to 18 GHz. The output is compatible with the TN-218 RF tuner, resulting in a receiver system capable of 6 separate channels, each covering 0.5 to 18 GHz.

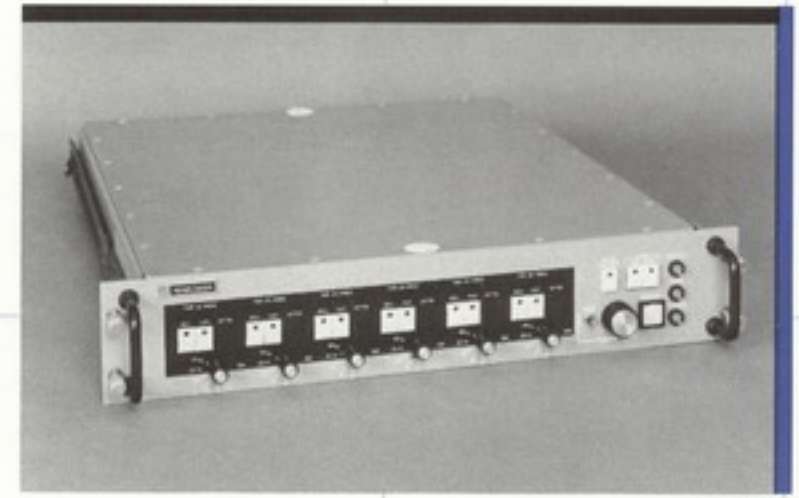


CU-200

C-100/WJ-35050 Controller

- Controls up to three TN-218/WJ-35050 dual tuners
- Controls a 6-channel 160 MHz demodulator (MD-100/WJ-35050)

The C-100 Controller provides the primary user interface for a maximum of three TN-218 dual tuners and a 6-channel demodulator. Each tuner channel can be selectively tuned and attenuated from the controller front panel. Demodulator control consists of switching between 5 IF bandwidth filters for each of the six channels.



C-100

WJ-1921-1 Pulse Interval Processor

- Real time determination of PRI
- Deinterleaves multiple pulse trains in a dense signal environment
- Wide-open PRI detection
- System outputs useful in generating ECM response

The WJ-1921-1 Pulse Interval Processor (PIP) uses a novel time domain transform to provide instantaneous deinterleaving of multiple radar pulse trains on the basis of pulse repetition interval (PRI).

This processor operates from the video output of any receiver and provides a wide-open, real-time determination of all fundamental pulse periodicities in the video data stream. The output is displayed on a digitally-refreshed spectrum display as activity (Y-axis) vs. PRI (X-axis). The cursor allows the operator to display either PRI or PRF of a selected signal. A predictive time gate is available for isolating any particular individual pulse train.

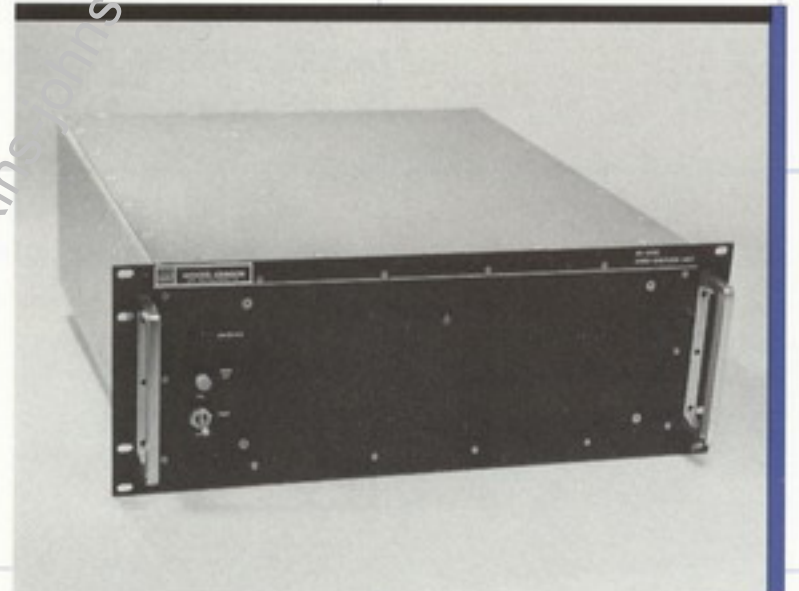


WJ-1921-1

WJ-1205C Video Digitizer Unit

- Pulse-to-pulse analysis capable of 100 nanosecond resolution
- Self-test capability
- I/O compatible with computer, TTY or line printer
- Phase locked to internal 10 MHz clock or external reference frequency

The WJ-1205C video digitizer unit is a microprocessor-controlled pulse train analyzer with a pulse sample capacity of up to 3,999 pulses. Pulses are digitized for analysis of pulse width (PW), pulse repetition interval (PRI) and average pulse amplitude. The WJ-1205C comes supplied with its own internal temperature-controlled crystal oscillator or it may be phase locked to a reference frequency provided by an external signal source such as a video tape recorder. Pulse analysis may be accomplished by visual inspection of pulse rates on a terminal display, data transfer to a computer, or hard copy print-out from a line or serial printer.



WJ-1205C

Frequency Synthesizers

Introduction

Products include:

- Direct and indirect synthesizers
- YIG- and VCO-based units
- Synthesizer-based subsystems

Available features include:

- Small, rugged configurations
- Broadband and narrowband models
- Low phase noise
- Fast switching
- Suitability for military and commercial environments

Watkins-Johnson Company's RET Division builds broadband frequency synthesizers for a multitude of applications, including advanced EW receivers, communications systems, transmitters, rugged test equipment, antenna measurement systems. Wide-ranging experience in the EW field, combined with an excellent technical staff and extensive in-house production facilities, provides W-J with a quick-reaction capability to satisfy a customer's specific requirements. Customer needs can be met either with existing products, or through the design and fabrication of new units. W-J offers a variety of standard YIG- and VCO-based synthesizer designs to meet your requirements. W-J also custom designs synthesizers for special purpose applications.

Military Synthesizers

Our military synthesizers are built for rugged applications that typically require performance under demanding environmental conditions. All units can be built to operate across a wide range of temperature, altitude, and humidity. Other special requirements, such as resistance to high vibration, can also be designed into these units.

All of the standard military synthesizers are subject to rigorous automated testing to guarantee

full performance over the specified temperature range. This procedure provides thorough testing of frequency accuracy, power level, phase noise, and switching speed. Complete test data is provided with each unit and special testing can be accommodated.

The WJ-1265, WJ-1295 and WJ-1296, and WJ-40000 frequency synthesizers are standard units based on phase-locked loop designs. A wide range of options makes these units ideal for a number of applications and new capabilities are continually being developed.

Internally, these synthesizers feature a micro-processor-controlled digital interface which can be utilized with a parallel or serial bus. The micro-processor also implements self-calibration routines to counteract aging characteristics and to ensure long-term reliability.

Special Purpose and Standard Laboratory Applications

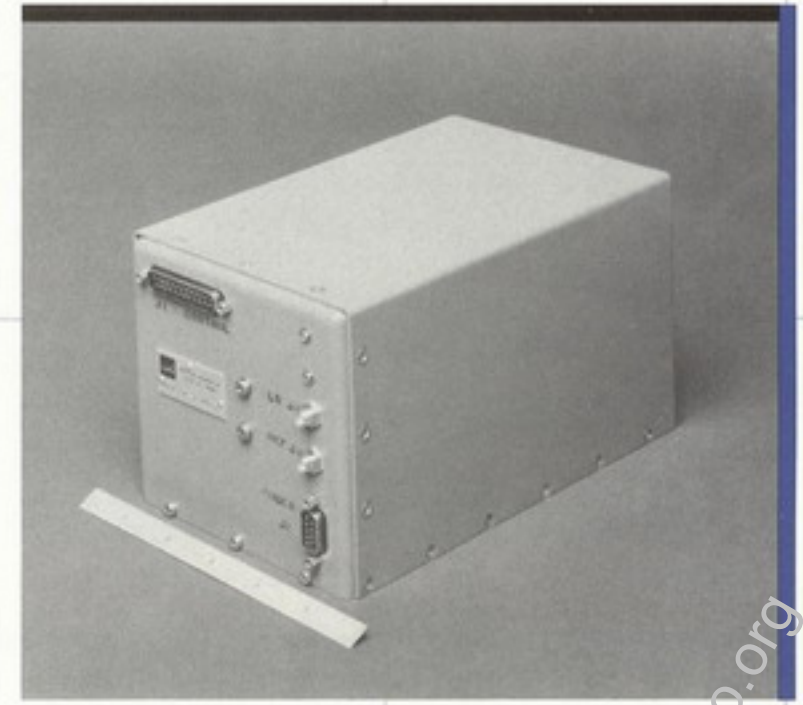
W-J's experience in the design and production of microwave receivers and other EW systems has led to the development of a line of direct frequency-synthesized signal generators and synthesizer-based subsystems used for testing these types of systems. The WJ-45100 and WJ-45800 find wide use in automatic microwave test systems, EW receivers, radar and general purpose simulators and production test systems. Capabilities and features of this product line include broadband frequency coverage, micro-second tuning, CW and swept operation, modulation, power leveling and wide dynamic range, compatibility with other standard test equipment, and remote programmability. Typical options include frequency extension to 60 GHz, increased frequency resolution, lower harmonics, step attenuation, MATE compatible interface, parallel BCD interface and pulse modulators.

WJ-1265

The WJ-1265 uses a single YIG oscillator to cover bandwidths as wide as 6 to 18 GHz in a 270-cubic-inch package.

WJ-1265 Specifications

<i>Frequency Range*</i>	2 to 18 GHz (-3) 2 to 18 GHz (-4) 8 to 18 GHz (-7) 6 to 18 GHz (-X)
<i>Resolution</i>	1 MHz
<i>RF Output Power</i>	+10 dBm min.
<i>Spurious</i>	-70 dBc
<i>Harmonics</i>	-15 dBc
<i>Phase Noise</i>	-60 dBc/Hz @ 1 kHz offset -90 dBc/Hz @ 100 kHz offset
<i>Tuning Speed</i>	300 μ sec for steps under 15 MHz 15 msec max. for any step
<i>Temperature</i>	-40° to 71°C
<i>Dimensions</i>	5 x 6 x 9 in.



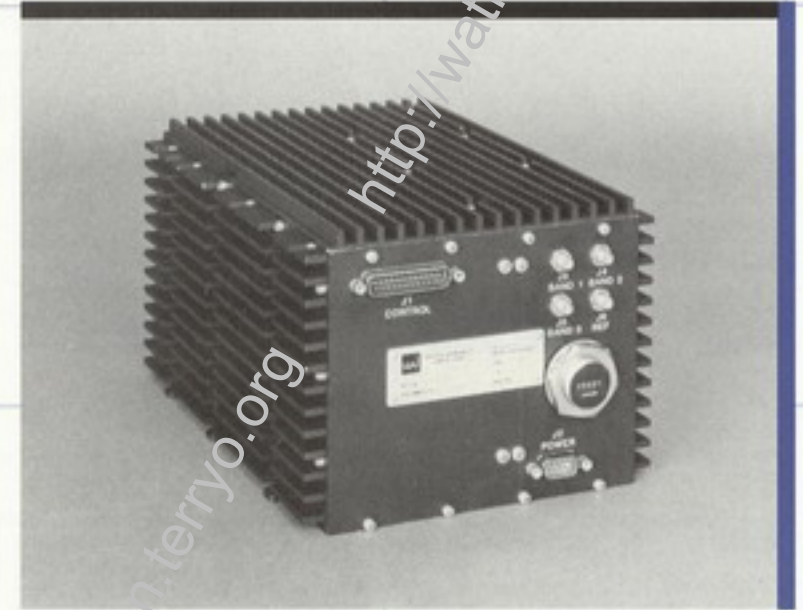
WJ-1265

WJ-1295

The WJ-1295 covers bandwidths as wide as 0.5 to 18 GHz in a 270-cubic-inch package.

WJ-1295 Specifications

<i>Frequency Range*</i>	2 to 18 GHz (-2) 0.5 to 18 GHz (-3)
<i>Resolution</i>	1 MHz
<i>RF Output Power</i>	+5 dBm min.
<i>Spurious</i>	-70 dBc
<i>Harmonics</i>	-15 dBc
<i>Phase Noise</i>	-60 dBc/Hz @ 1 kHz offset -90 dBc/Hz @ 100 kHz offset
<i>Tuning Speed</i>	300 μ sec for steps under 15 MHz 20 msec for max. step
<i>Temperature</i>	-40° to 71°C baseplate
<i>Dimensions</i>	5 x 6 x 9 in.



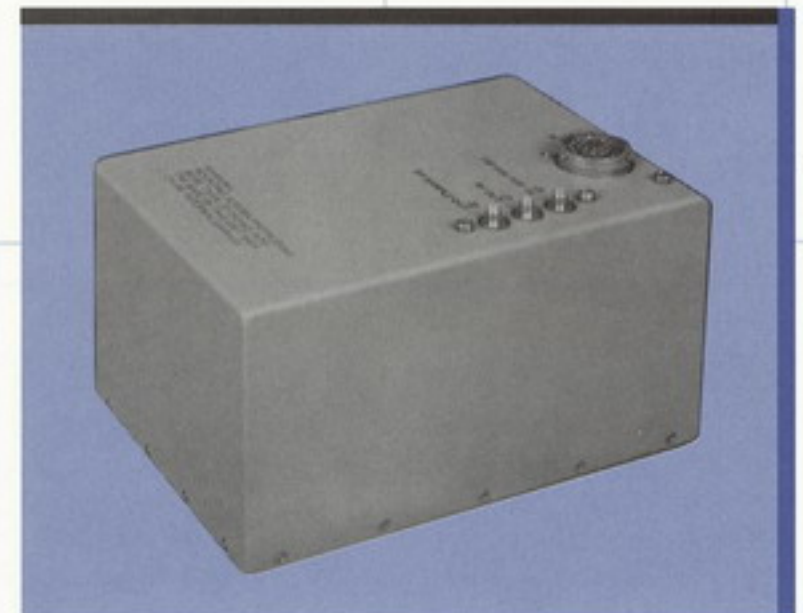
WJ-1295

WJ-1296

The WJ-1296 is a VCO-based synthesizer that covers 2 to 8 GHz or 8 to 18 GHz and occupies less than 160 cubic inches of space.

WJ-1296 Specifications

<i>Frequency Range*</i>	2 to 18 GHz (-3) 8 to 18 GHz (-4)
<i>Resolution</i>	2.5 MHz
<i>RF Output Power</i>	+5 dBm min.
<i>Spurious</i>	-50 dBc
<i>Harmonics</i>	-15 dBc
<i>Phase Noise</i>	-60 dBc/Hz @ 1 kHz offset -75 dBc/Hz @ 100 kHz offset
<i>Tuning Speed</i>	250 μ sec any steps
<i>Temperature</i>	-40° to 70°C
<i>Dimensions</i>	2.5 x 7 x 9 in.

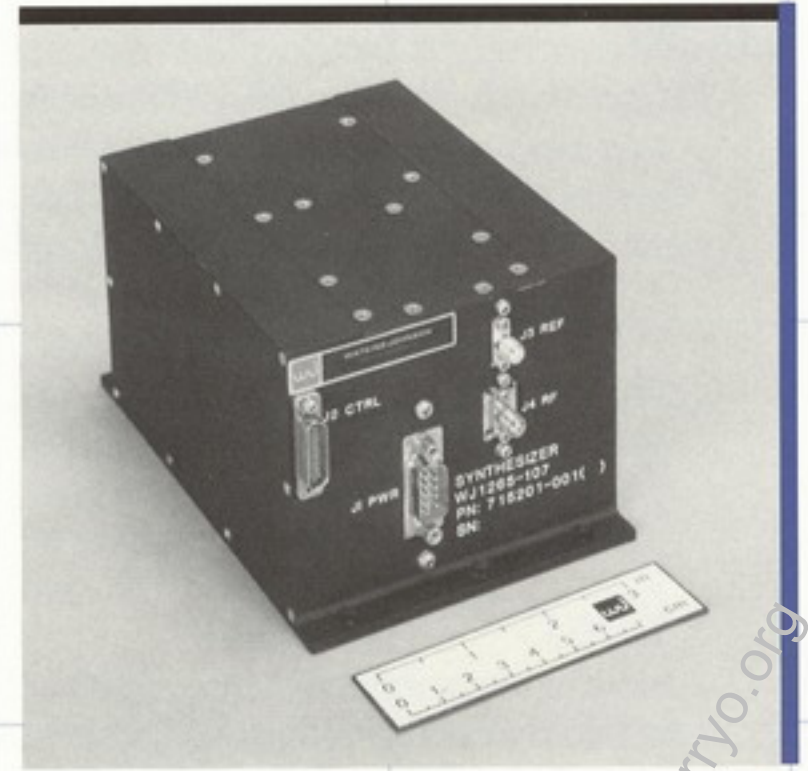


WJ-1296

*Different versions of each model, based on frequency range, are indicated by the dash numbers in parentheses. Other ranges are available.

WJ-1265-107

The WJ-1265-107 is a smaller version of the standard WJ-1265 with similar performance capabilities, but in a 65-cubic-inch package. Specifications are the same as those for the WJ-1265 except for dimensions. Those of the WJ-1265-107 are 3.25 x 4 x 5.8 inches.



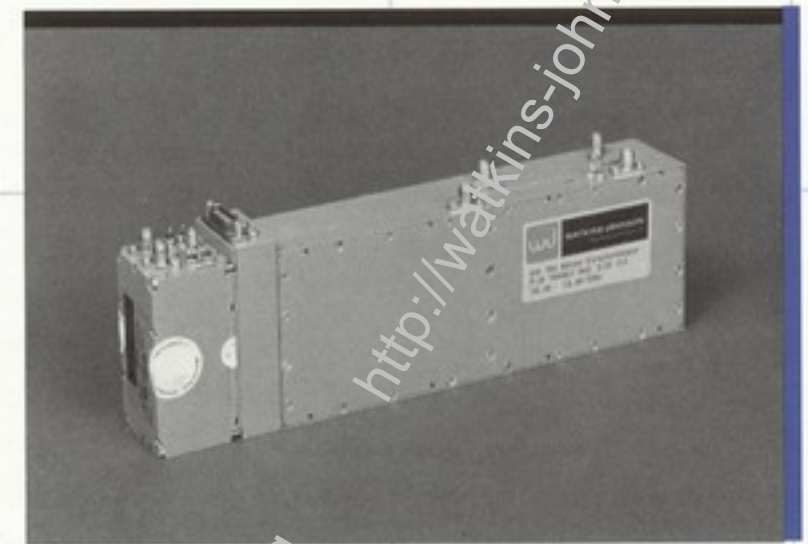
WJ-1265-107

SN-701

The SN-701 broadband synchronizer provides a versatile PLL building block for various frequency resolution requirements.

SN-701 Specifications

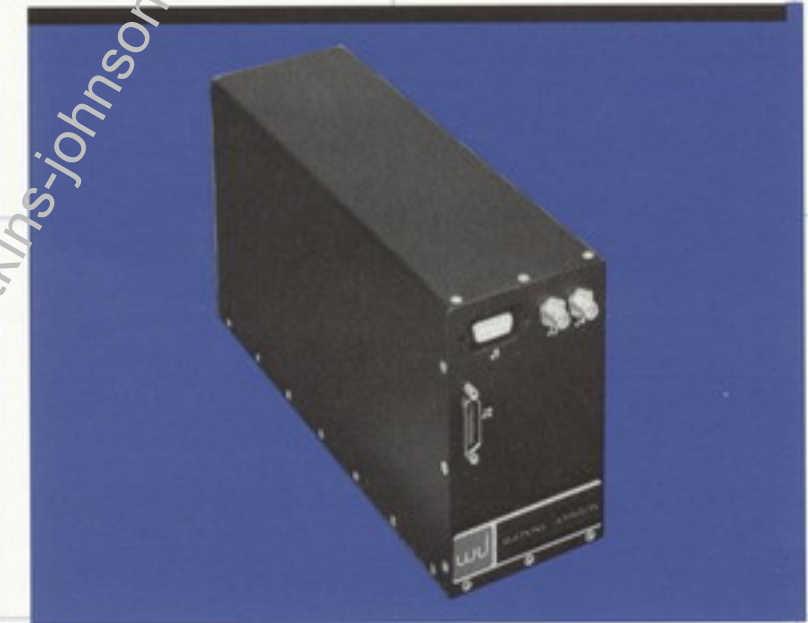
Frequency Lock Range	2 to 22 GHz
Tuning Resolution	1 MHz (100 kHz optional)
RF Source Requirements	YIG oscillator
Spurious	-65 dBc
Tuning Speed	300 μ sec for steps under 15 MHz 10 msec max. for any step
Temperature	-40° to 85°C
Dimensions	8.5 x 1.4 x 3.0 in.



SN-701

WJ-1295-107

The WJ-1295-107 is a smaller version of the standard WJ-1295 with similar performance capabilities, but in a 65-cubic-inch package. Specifications are the same as those for the WJ-1295 except for dimensions. Those of the WJ-1295-107 are 3.25 x 4 x 5.8 inches.



WJ-1295-107

WJ-40000

The WJ-40000 is a miniature synthesizer utilizing dual phase-locked loops in a 26-cubic-inch package. Its versatile design, combined with its small size and weight, makes it an ideal choice for systems requiring the ultimate in packing density.

WJ-40000 Specifications

Frequency Range	11 to 13.5 GHz
Resolution	2.5 MHz
Phase Noise	-70 dBc/Hz @ 1 kHz offset
Accuracy	10 ppm
Size	26 cubic inches
Weight	1.7 lbs.



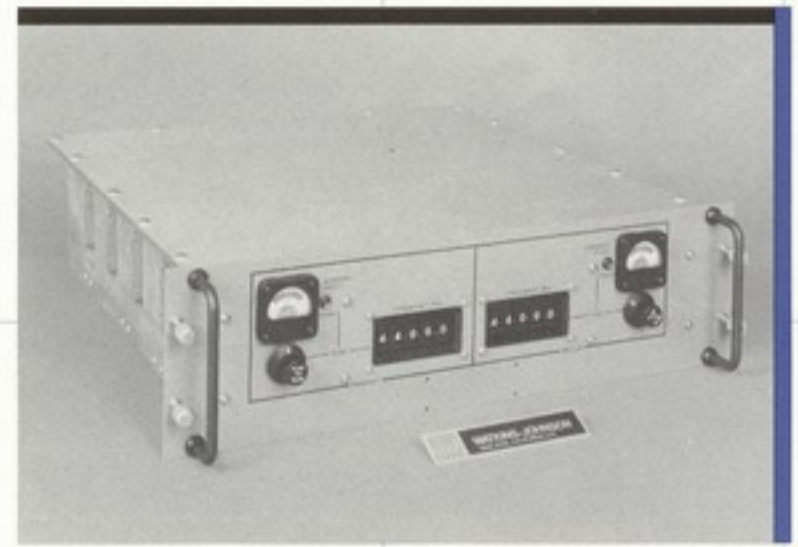
WJ-40000

WJ-1206-1

The WJ-1206-1 dual synthesizer was developed and built for the AN/TRC-170 Troposcatter Communications System. The manually tuned, dual phase-locked source is used for digital and voice communications.

WJ-1206-1 Specifications

Frequency	4.5 to 5.1 GHz
Resolution	100 kHz
Accuracy	10 ppm
Phase Noise	-80 dBc/Hz @ 300 Hz offset



WJ-1206-1

WJ-40010

New synthesizers, like the WJ-40010, are being developed and produced for applications requiring fast settling times which are unachievable with ordinary phase-locked loop designs.

WJ-40010 Specifications

Frequency Range	X Band
Resolution	8 kHz
Tuning Speed	22 μ sec, max.
Accuracy	10 ppm
Stability	10 ⁻⁹ /second
Phase Noise	-85 dBc/Hz @ 1 kHz offset



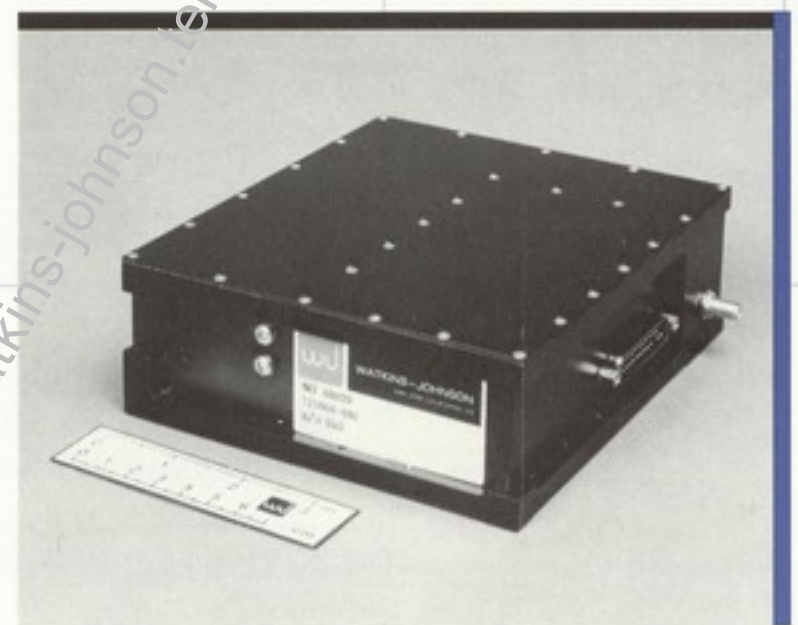
WJ-40010

WJ-40020

The WJ-40020 is a lightweight synthesizer. Frequency coverage of 2 to 18 GHz in four bands. Dimensions are 2.2 x 5.5 x 6.3 inches. The 40020 meets airborne MIL-Spec.

WJ-40020 Specifications

Frequency Range	2 to 18 GHz
Resolution	2.5 MHz
Accuracy	10 ppm
Tuning Speed	250 μ sec
Phase Noise	-90 dBc/Hz @ 100 kHz offset
Weight	1.6 Kg



WJ-40020

WJ-40050

The WJ-40050 is a VCO-based UHF synthesizer for use in various communications applications.

WJ-40050 Specifications

Frequency Range	350 to 600 MHz
Resolution	4 MHz
RF Output Power	+23 dBm
Harmonics	-15 dBc
Spurious	-60 dBc
Phase Noise	-85 dBc/Hz @ 1 kHz offset
Tuning Speed	50 msec
Temperature	0° to 80°C
Dimensions	7 x 3 x 2 inches



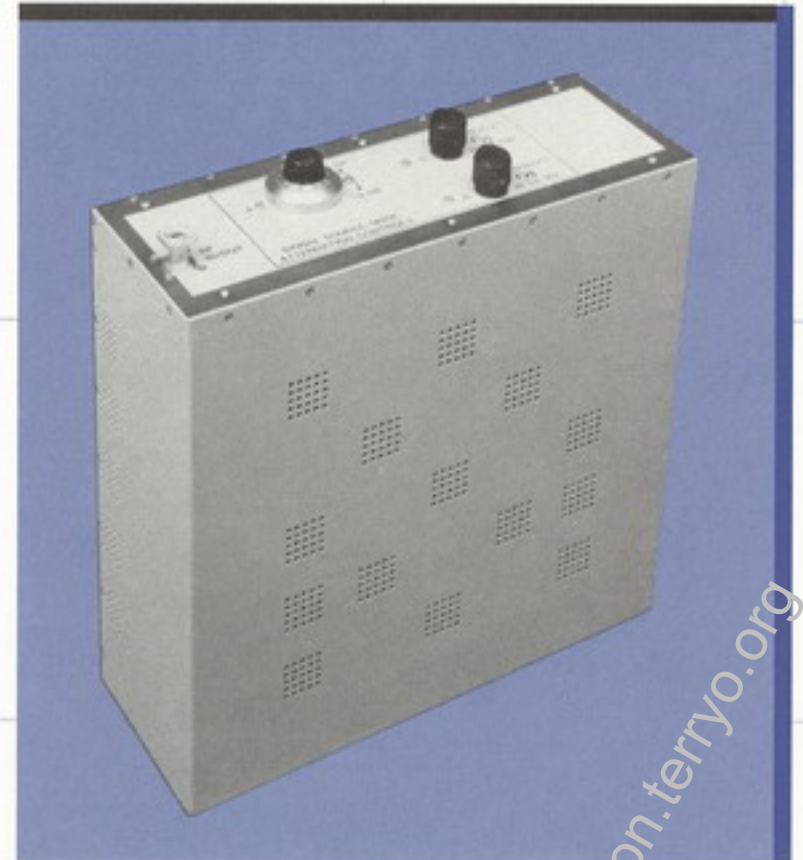
WJ-40050

WJ-40060

The WJ-40060 is a synthesizer-based test system, including a spectrum analyzer synthesized signal source and pulsed power meter. It is used in such applications as radar test sets.

WJ-40060 Specifications

Frequency Range	33.0 to 33.4 GHz
Power Output	-100 dBm to -25 dBm
Modulation	AM
Bandwidth	100 kHz to 500 MHz
Dynamic Range	80 dB
Temperature	0° to 66°C
Dimensions	36 x 18 x 16 in.



WJ-40060

WJ-1204-1

The WJ-1204-1 Sweeping Synthesized Signal Generator is ideally suited for testing radar and EW systems. Frequency coverage up to 60 GHz is available.

WJ-1204-1 Specifications

Frequency Range	0.01 to 26 GHz
Resolution	10 kHz to 1 MHz
RF Output Power	-90 dBm to -0 dBm, leveled
Power Metering	-15 dBm to -10 dBm
Harmonics	-55 dBc, typ.
Spurious	-55 dBc, typ.,
Operating Modes	CW, sweep, ramp, $F \pm \Delta F$, Square wave and pulse modulation
Temperature	0° to 50°C
Dimensions	7.5 x 17 x 21 in.



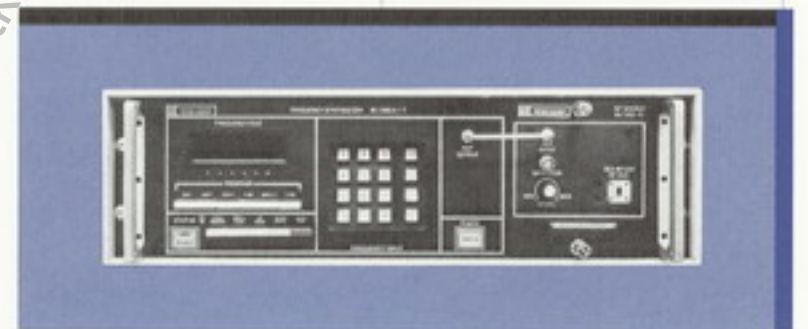
WJ-1204-1

WJ-1250A

The WJ-1250A Microwave Frequency Synthesizer finds wide use in test applications requiring stability, special printing and computer programmability.

WJ-1250A Specifications

Frequency Range	0.01 to 18 GHz (optional to 60 GHz)
Resolution	100 kHz (1 Hz optional)
Switching Speed	40 msec for 100 MHz step
Harmonics	-20 dBc
Spurious	-60 dBc
Temperature	0° to 50°C
Operating Modes	CW, sweep, power leveling
Dimensions	5.2 x 19 x 22 inches



WJ-1250A

WJ-1204-4X

The WJ-1204-4X is a family of millimeter-wave frequency extenders. Broadband frequency coverage is from 18 to 60 GHz. These frequency extenders are compatible with any microwave signal generator.

WJ-1204-4X Specifications

Output Frequency	18 to 60 GHz
Output Power	0 to +7 dBm
Input Frequency	8.66 to 16.66 GHz
Harmonics	-20 dBc
Subharmonics	-20 dBc
Weight	10 lbs.
Operating Temperature	0° to 50°C



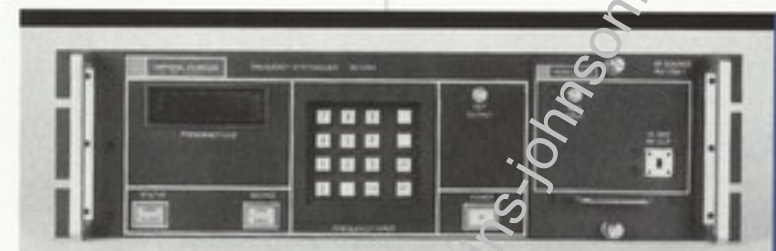
WJ-1204-4X

WJ-1294

The WJ-1294 provides RF output in the millimeter-wave frequency range. The switching speed is optimized to provide 200 microseconds for a 5 MHz step.

WJ-1294 Specifications

Frequency Coverage	35 GHz \pm 500 MHz
Output Power	50 mW (+17 dBm)
Output Flatness	\pm 1 dB
Switching speed (5 MHz step)	200 msec
Resolution	5 MHz



WJ-1294

WJ-45100

The WJ-45100 is a direct frequency synthesizer that finds wide use in simulator and laboratory applications.

WJ-45100 Specifications

Frequency Range	0.01 to 18 GHz
Resolution	1 MHz
Harmonics	-15 dBc
Settling Time	1 μ sec
Spurious	-60 dBc
Output Power	+10 dBm
Digital Control	25 bit parallel
Modulator	AM/FM and PM



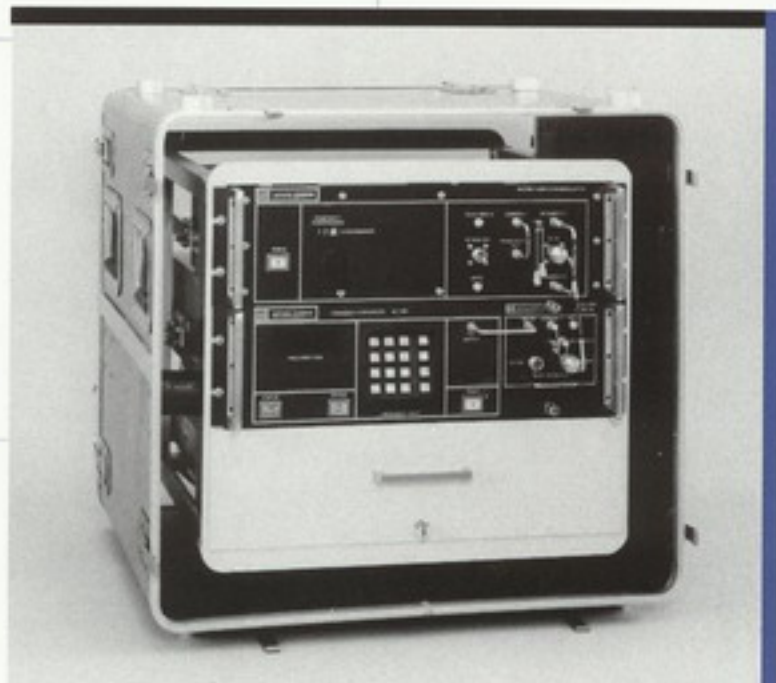
WJ-45100

WJ-1221-23

The WJ-1221-23 is a radar extender simulation system that provides a low-noise, highly stable and accurate microwave signal in the 9.2 to 10.2 GHz frequency range.

WJ-1221-23 Specifications

Frequency Coverage	9.2 to 10.2 GHz
Resolution	100 kHz
Output Power	+19 dBm



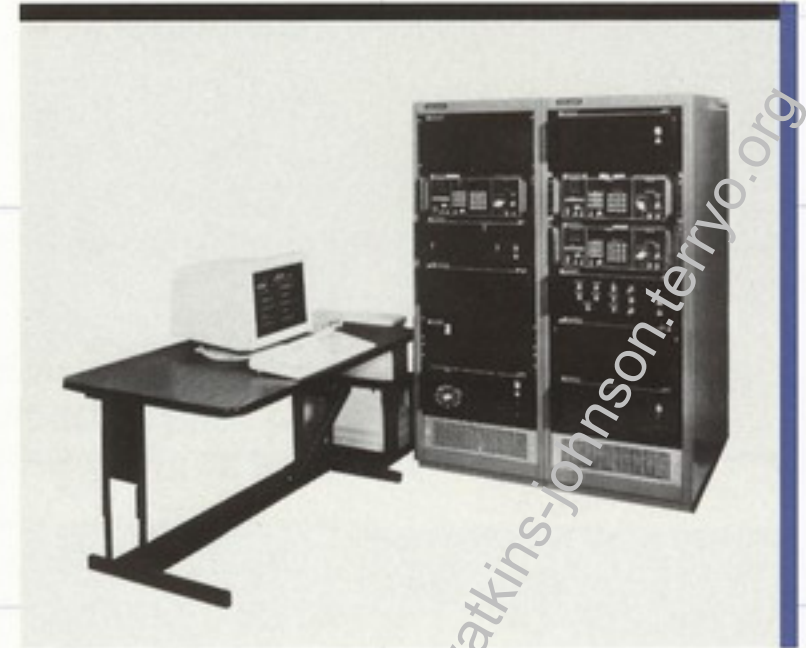
WJ-1221-23

Watkins-Johnson Company has developed a line of standard equipment which can be used to replicate or stress command control and communication (C³) links, receivers, radar systems and ECM systems or to train operators under realistic conditions. Generic, versatile systems which feature modular design and computer control have been designed and updated to reflect an ever-changing threat.

Electronic Warfare Simulator System (EWSS)

- **R**eplicates all known exotic threats
- Diverse software menus
- Distributed processing
- Modular design for growth
- Interchangeable RF sources
- Operates anywhere in the 0.1 to 40 GHz range

EWSS provides realistic training and testing of microwave receiving systems. The EWSS produces realistic RF and radar signal environments. The EWSS replicates all known threat radars and has the ability to provide 500,000 pps pulse density.

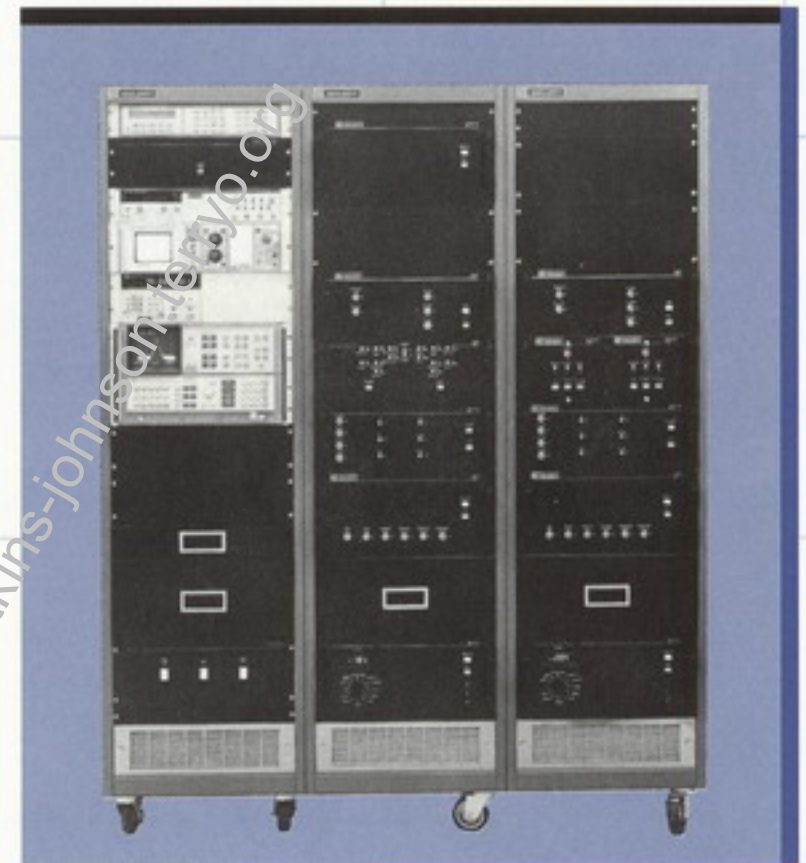


EWSS

WJ-47100 Coherent Jammer Simulator (COJAS)

- **F**ully computer controlled
- Complex waveform generation
- Velocity and range gate pull-off capability
- Software user friendly
- Built-in-test feature
- High level of stability and repeatability

The WJ-47100 provides coherent and non-coherent deceptive jamming techniques such as RGPO, VGPO and doppler noise. The modularity of the system allows for expanded capabilities for new ECM techniques.



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