R-110 RECEIVER

SPECIFICATION

March 5, 1990

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1. SCOPE

This specification defines design requirements for the R-110 receiver.

1.1 SOW Specification Cross Reference

Table 1-1 is a cross reference of this specification's paragraph numbers with the Statement-of-Work (SOW).

To supplement the list, the paragraphs of this specification are also prefaced with references to the related paragraphs in the SOW. Wherever this specification differs from the SOW requirement because of changes approved after contract award, the paragraph is prefaced with a "DSI".

2. APPLICABLE DOCUMENTS

The following documents are the basis for this specification. The SOW supersedes this document; DSI's proposal and subsequent letter are subsidiary.

2.1 Government

Statement of Work (SOW) (Classified)
NACSIM 5100A, Compromising Emanation Lab. Test Reqmts (Classified)
NACSEM 5108, Receiver and Amplifier Characteristics Meas. Procedures
MIL-STD-461B, Electromagnetic Emission and Susceptibility Reqmts.
Specification PBS-1002, Jan. 1979, Technical Manual Reqmts.
Specification PBS-1005, Aug. 1985, Elect/Mech. Equip. Environ. Cert. Test Spec.
Federal Standard 595A

2.2 Industry

EIA Specification	RS-232C Data Communication
IEEE Specification	IEEE-488-1978 Instrumentation Bus

2.3 Dynamic Sciences

Proposal, reference 890512-05, June 22, 1989
Letter, DSI, Response to questions, July 11, 1989

Table 1-1 SOW Specification Cross-Reference

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6.6	Technical Manual	N/A
7.0	Project Reviews	N/A

3. REQUIREMENTS

3.1 Mechanization

(DSI) The R-110 receiver shall be configured as shown in the block diagram, Figure 1.

3.1.1 Major Sections

(DSI) The major sections of the R-110 and their functions shall be as follows:

RF	-	Processes RF input; converts to 21.4 MHz IF
IF	-	Performs bandpass filtering, AGC
DC IF	-	Performs narrow-band filtering
Video	-	Detects IF; provides buffered video and audio outputs; provides optional pulse stretch and slide-back
Synthesizer	-	Provides LO signals for frequency conversion
Control	-	Controls operation of all modules; includes front panel and remote control
Power Supply	-	Provides regulated power to receiver circuits (uses linear design to minimize EMI)

3.2 Functional Description

RF Signal Processing: As shown in Figure 1, inputs shall be received from either the "RF Input 1" or "2" BNC connectors; these inputs shall be switched by a low loss coaxial relay which can be either manually or remotely selected. Break-before-make contacts shall be used to insure that only one of the inputs shall be connected to the receiver's front-end circuitry; the unselected input shall be left open.

The signal from the selected input connector shall be routed to the input attenuator which can be manually or automatically controlled. A selector switch shall then route the attenuated signals above 15 MHz to the Band 3 stage; lower frequency signals shall be routed to the Band 1 and Band 2 stages. Limiters shall be incorporated in each stage to protect the circuitry from damage due to large input power levels.

Band 3 shalll cover a range of 15 MHz to 1.0 GHz. Band 3 signals shall be processed by up-conversion of the signal to the 1st IF stage (1450 MHz), followed by down-conversion to 550 MHz and another down-conversion to the 21.4 MHz output.

The Band 2 range shall be 250 KHz to 14.99.. MHz. Band 2 signals shall be first amplified and filtered, and then up-converted to 21.4 MHz. Band 1 signals (1 KHz to 249.99.. KHz) shall be up-converted to 3 MHz, amplified and filtered, and again up-converted to 21.4 MHz, sharing Band 2's converter, amplifiers and filters.

IF Signal Processing: The IF section shall provide amplification and filtering of the converted RF signals. Bandwidths filters of 300 KHz, 1 MHz, 4 MHz, and 15 MHz shall be provided. All filters shall be selectable either from the front panel or via the IEEE-488 bus. The IF circuitry shall incorporate variable gain amplifiers for AGC and manual gain control, limiters to protect from overloads, splitters to supply signals for monitoring and processing, and detectors to sense overload conditions.

DC IF Signal Processing: A DC IF section shall be used for narrowband filtering of the IF signal. Multiple narrow bandwidth filters shall be implemented (50 Hz to 100 KHz in 1:2:5 sequence). The DC IF uses an I-Q detector and analog processing circuitry. The 21.4 MHz IF signal shall be received from the IF Section, split into its in-phase and quadrature components, and the I and Q signals processed in identical programmable active-filter channels. The channels receive commands from the microprocessor in the Control section to specify the filter break-points. The filtered I and Q signals from the two channels shall be recombined using a squaring circuit, and the resulting DC-video shall be routed to the Video Section.

Video Signal Processing: The IF output signal shall be detected with a precision AM detector. A BFO circuit permits CW operation. A video selector circuit automatically selects the output from the AM detector or the DC IF, depending on the bandwidth selected. A log detector and amplifier provide a logarithmic video output, and a video buffer shall provide a separate output for Z-axis monitoring. DC coupled video shall be provided. Optional pulse stretch and slide-back functions shall be available for monitoring and evaluating impulsive signals.

Synthesizer: A 100 MHz quartz oscillator shall be used as the basic frequency reference for the receiver. Digital tuning commands (from the panel or IEEE-488 bus) command a direct digital synthesis (DDS) circuit. The DDS drives phase-locked-loops (PLL) which create the variable-frequency and fixed-frequency LOs. All LOs shall be referenced to the quartz oscillator.

Control: Control of the receiver shall be accomplished by a microprocessor, interface electronics, and front panel displays and controls. The microprocessor shall provide control signals to the receiver circuits based on switch and control settings received from the front panel or commands from the IEEE-488 bus. Firmwshall be routines shall be stored in non-volatile memories, and can be modified at the factory to accommodate enhancements and improvements. An IEEE-488 bus communicates with external devices.

Power Supply: A linear power supply shall provide regulated DC voltages to the receiver circuitry. AC power shall be received from the power line, and shall be delivered to the power transformer. A switch selects either 115 vac or 230 vac power sources. Another switch adjusts the voltage for low or high line conditions. The input power and the regulated voltages shall be continually monitored to determine if operation is within specified tolerances; out-of-tolerance warnings shall be supplied to the microprocessor and displayed on the front panel.

3.3 Receiver Operation

3.3.1 Modes of Operation

(DSI, SOW 4.3.3.1) The receiver shall provide AM and CW detection in manual and automated modes of operation. In the automated mode the receiver shall be controlled from a computer via the IEEE-488 interface. Manual operation of the receiver shall be accomplished using the front panel's controls and displays. Figure 2 shows the front panel layout. The panel uses individual displays for the tuning frequency, attenuation, bandwidth, and relative gain. Dedicated indicators provide mode and status information.

The main modes of operation shall be Manual Mode, Scan Mode, Remote Mode and Microwave Downconverter Mode.

3.3.1.1 Manual Mode

The receiver shall be manually tuned using the keypad, tuning knob, and the up-down arrow keys. To enter a frequency with the keypad, the value shall be entered either in MHz, KHz or in Hz, using the appropriate "M", "K", or "H" button. The displayed value shall be presented with a MHz, KHz or Hz legend. The arrow keys shall work like the knob and shall be provided for operator convenience. Tuning resolution (in decade steps) shall be set with pushbuttons; the selected resolution shall be indicated by flashing the associated digit of the frequency display. Intermediate tuning resolutions shall be set using the keypad.

Attenuation of the input signal shall be accomplished with attenuator pushbuttons and a 4-digit display. A single-knob gain control shall be used to optimally adjust both the RF and IF gains; the relative gain setting shall be displayed (a "delta" gain display shall also be available). Bandwidth shall be selected using pushbuttons and the bandwidth display. Additional controls shall be provided for BFO, Z-axis, and optional pulse stretch and slideback. A pushbutton shall enable the BFO, and the BFO control shall manually tune the oscillator. The Z-axis control shall set the level of the output; lighted pushbuttons shall enable and invert the signal. The optional pulse stretch control shall provide variation of the pulse width of impulsive video signals. The optional slideback control shall set the AM threshold level; a LED indicator on the frequency display window shall show when the peak value of the detected AM video is above the threshold setting.

3.3.1.2 Automatic Scan Mode

(DSI) Automatic scanning shall be controlled by the keypad and the display resolution/scan control pushbuttons. The operator shall enter the desired start and stop frequencies, frequency step size and rate using the keypad with the ALT key. The display resolution/scan control pushbuttons shall serve to control the direction and pausing of the scan. Multiple pressing of the pushbuttons shall accelerate (or decelerate) the scan.

3.3.1.3 Remote Mode

(DSI) In the remote mode, the receiver shall be remotely controlled via the IEEE-488 bus by a host computer. All of the features of the receiver shall be available with the exception of the optional slideback. The mode shall be selected by the host via a command on the bus, illuminating a LED indicator on the frequency display. Note: The remote mode will be implemented in the prototype units if time permits.

3.3.1.4 Microwave Downconverter Mode

This mode shall be enabled when the R-110 is integrated with the R-1180 Microwave Downconverter. Tuning and gain control shall be accomplished with the Microwave Downconverter's controls and displays, with the R-110 automatically tracking to receive and process the downconverted signal. All of the other R-110 functions shall be available, including bandwidth and detection mode selection. Communication between the units shall be via the IEEE-488 bus. The REMOTE lightbar shall be illuminated in this mode. Note: Provisions will be made in the hardware/firmware to allow implmentation of this mode in the future.

3.4 Front and Rear Panel Components

3.4.1 Front Panel

The receiver's front panel shall be configured as shown in Figure 2. Tabel 3-1 defines the controls, displays and connectors.

Table 3-1 Front Panel Components

CONNECTORS:	
1. RF Input #1	Female BNC connector for input of RF signals.
2. RF Input #2	Female BNC connector for input of RF signals.
3. X-Axis	Female BNC connector for output of X-Axis scan signal
4. Video	Female BNC connector for output of video signal
5. Audio Jack	Phone jack for output of audio signal
PUSHBUTTONS AND SWITCHES:	
6. Power	Two position rocker switch that controls the input power to the receiver.
7. RF Input #1	Pushbutton switch to select RF Input #1; includes light emitting diode (LED) which lights when RF Input #1 connector is selected.
8. RF Input #2	Pushbutton switch to select RF Input #2; includes indicator LED
9. Input Attenuation	Dual pushbutton switches to select input signal attenuation level.
10. Bandwidth	Dual pushbutton switches to select bandwidth
11. Keypad	15 pushbutton switches used to enter frequencies and rates, decimal point location, tuning resolution, and repetition modes.

12. Alt — Pushbutton switch (nested with keypad) (with LED indicators) used to select secondary modes and functions

13. Tuning resol./scan — Three pushbutton switches (with LED indicators) used to select display resolution and to control the scan mode

14. Tuning — Dual pushbutton switches for tuning

15. AM slideback — Pushbutton switch (with LED indicator) to activate optional slideback

16. Pulse stretch — Pushbutton switch (with LED indicator) to activate optional pulse stretch

17. BFO — Pushbutton switch (with LED indicator) to activate BFO

18. Z-Axis (on) — Pushbutton switch (with LED indicator) to activate Z-axis output

19. Z-Axis (inv) — Pushbutton switch (with LED indicator) to invert Z-axis output

20. Log — Pushbutton switch (with LED indicator) to select log detection mode

ALPHANUMERIC LED DISPLAYS:

21. Tuning — 12-character display for frequency presentation
22. Input Attenuation — 4-Character display indicating attenuator setting
23. Gain — 4-Character display indicating receiver gain or delta gain
24. Bandwidth — 4-Character display indicating bandwidth setting

LED LIGHT-BAR INDICATORS:

25. Unlock — Synthesizer unlocked
" RFOVL — Front-end overload
" IF/DET OL — IF or video overload
" PwrHi — Power line voltage higher than nominal
" PwrLo — Power line voltage lower than nominal
" Unreg — Power supply out of regulation
" △GAIN — Differential gain mode or alt. gain (CW vs. Impulsive)
" AGC — AGC on
" Alt BW — Alternative set of narrow BW selected
" Thresh — Slideback threshold indication
26. Start — Entering scan mode start frequency
" Stop — Entering scan mode stop frequency
" Step — Entering step size
" Rate — Entering step rate
" Scan — Scan mode
" Tune — Tune mode
" Bright — Brightness control mode
" Beep — Beeper level control mode
" Addr — IEEE-488 address display mode
" Remote — Remote control enabled; most controls disabled

ROTARY CONTROLS:

27. Tuning — Tunes receiver
28. Gain — Sets receiver gain
29. Audio — Adjusts audio output level
30. BFO — Adjusts BFO frequency
31. Z-Axis — Adjusts Z-axis output amplitude

32.	Slideback	Adjusts AM slideback threshold
33.	Pulse-stretch	Adjusts Pulse stretch

AUDIBLE ALARM:

34.	Beeper	Sounds when operational limit is exceeded.

3.4.2 Rear Panel

The receiver's rear panel shall be configured as shown in Figure 3. Table 3-2 defines the components.

Table 3-2 Rear Panel Components

CONNECTORS:

A Ref.Oscillator	Female BNC for frequency reference
B Signal Monitor	Female BNC for IF monitor (prior to BW filtering)
C Z-Axis	Female BNC for Z-axis monitoring
D IF Output	Female BNC for IF output (after BW filtering)
E 1450 MHz IF Output	Female BNC for Wide BW IF (1450 MHz) (optional)
F IEEE-488 Interface	Std. IEEE-488 Bus Conn.
G Status/Control	Female 25D Conn. for Status/Control discretes
H AC Input	3-contact NEMA Receptacle with line fuses
I Ground Stud	1/4"x20 Single-point ground for receiver

SWITCHES:

J Line Voltage Range	115/230 vac select
K Line Voltage Adjust	Line voltage adjustment switch

3.5 General Performance Requirements

Section 4.3.3 of the Statement-of-Work (SOW) defines the key electrical and performance specifications for the receiver. Table 3-3 summarizes these requirements. Each entry is prefaced with the applicable paragraph number from Section 4.3.3 of the SOW or a "DSI", indicating that the item is in addition to the specified requirements. An "*" indicates that the specification paragraph has been revised. The "Nominal" entries show the anticipated operation/performance of the prototype and production receivers; a "Same" means "same as specified requirement". The "SOW Specification" entries shall be from the SOW and approved revisions.

Table 3-3 General Performance Requirements

SOW PARA.		AS DESIGNED	SPECIFICATION
(4.3.3.1)	Modes of Operation	Same plus Scan and Downconverter Modes	Manual (standard) and Remote (optional)
(4.3.3.3)*	RF Inputs	Same	Two inputs, remote or locally selectable, break-before-make switching
(4.3.3.4)	Frequency Range:	Same	Both inputs tunable over range of 1 KHz to 1 GHz
(4.3.3.5)	Noise Figure:	10 dB	Less than 15 dB
(4.3.3.5)	Spurious-free Dynamic Range :	70 dB	Not less than 60 dB between RF input and AM video output, and between RF input and IF output
(4.3.3.3)	Input VSWR:	Same	Less than 2:1 over full freq. range
(4.3.3.3)	Input Impedance:	Same	50 ohms nominal
(4.3.3.3)*	Maximum Tolerated RF Input:	1 watt average CW	
(4.3.3.3)	Isolation between inputs:	80 dB	At least 60 dB
(4.3.3.8)	LO Leakage at Input Connector:	Same	Less than -90 dBm
(4.3.3.8)	Residual Spurious Responses:	< -120 dBm	Less than -107 dBm
(4.3.3.6)	IF Rejection:	Same	At least 80 dB
(4.3.3.6)	Image Rejection:	Same	At least 80 dB

SOW PARA.		AS DESIGNED	SPECIFICATION
(DSI)	Input Attenuator: Range: Operation: Switching Time:	 0-70 dB in 10 dB steps Manual and auto.selection Less than 30 ms	
(4.3.3.5,.6)*	Gain:	Quasi-continuous, 50 dB range. RF, IF, pre-detection gains optimally adjusted	
(DSI)	Bands:	Three bands cover the frequency range; the bands are automatically selected as a function of input frequency	
(DSI)	Band Switching/Settling Time:	30 msec typical	
(DSI)	Band Frequency Ranges: (hysteresis provided across band breaks)	Band 1: 1 KHz to 249.99..KHz Band 2: 250 KHz to 14.99..MHz Band 3: 15 MHz to 999.99..MHz	
(4.3.3.4)*	Tuning:	Single knob tuning with selectable tuning rate; dual switches for pushbutton tuning; switches for automatic scan	
(4.3.3.4)*	Tuning Resolution:	0.1 Hz below 250 KHz 1.0 Hz from 250 KHz to 15 MHz 100 Hz above 15 MHz	
(4.3.3.3)	Tuning interference:	Same	No detectable tuning interference in video and audio outputs
(DSI)	Reference Oscillator Type:	100 MHz oven-controlled, Quartz oscillator (TCXO); adjustable frequency	
(DSI)	Ref. Oscillator Aging:	1 PPM per year	
(DSI)	Ref. Oscillator Temperature Stability:	0.05 PPM, 0 to 60 C	
(4.3.2.2)	Reference Oscillator Output:	> 0 dBm	Level not defined

SOW PARA.		NOMINAL	SPECIFICATION
(4.3.3.4)	Receiver Frequency Stability:	Same as Ref.Osc. after 30 min.	1 PPM after 30 minutes
(4.3.3.4)	Receiver Frequency Accuracy:	Same as Ref.Osc. after 30 min.	1 PPM after 30 minutes warm-up
(DSI)	Frequency Display:	12 digit alphanumeric character, LED, adjustable intensity	
(4.3.3.4)	Frequency Display Readability:	Same	Readable with/without backlighting
(DSI)	Wide-BW IF Output Frequency:	1450 MHz nominal	
(DSI)	Wide-BW IF Output Level:	At least -30 dBm into 50 Ohms	
(4.3.3.7)	Signal Monitor Center Frequency:	Same	21.4 MHz
(4.3.3.7)	Signal Monitor Output Bandwidth:	Same	4 MHz minimum
(4.3.3.7)	Signal Monitor Output Level:	at least 100 uV	At least 10 uV peak into 50 Ohms with RF input of -107 dBm and full RF gain
(4.3.3.7)	IF Center Frequency:	Same	21.4 MHz
(4.3.3.6)*	IF Bandwidths (default set):	500 Hz to 100 KHz (in 1-2-5 sequence), 300 KHz, 1 MHz, 4 MHz, 15 MHz	
(DSI)	IF Bandwidths (alternate set):	50 Hz to 100 KHz (in 1.0-1.25-1.6-2.0-2.5-3.2-4.0-5.0-6.4-8.0 sequence), 300 KHz, 1 MHz, 4 MHz, 15 MHz	
(4.3.3.6)	IF Bandwidth Impulse Response:	Less than 5%	Overshoot less than 8% for BW <150 KHz, 12 % for BW >150 KHz
(4.3.3.6)	IF Selectivity:	4:1 typical	Shape Factor better than 10:1 (60 to 6 dB)
(4.3.3.7)	IF Output Level:	At least 10 dBm	At least 0 dbm into 50 Ohms

SOW PARA.		AS DESIGNED	SPECIFICATION
(DSI)	AGC:	Selectable with keyboard	
(4.3.3.2)	Detection Modes:	Same	AM, CW
(DSI)	Detection Type:	AM peak	
(4.3.3.7)	Video Output Modes:	Same	AM (Linear), Log, Z-axis
(DSI)	Optional AM Video Functions:	Slideback, pulse stretch	
(4.3.3.7)*	Video Bandwidths:	Not less than 1/2 selected IF bandwidth	
(4.3.3.7)	AM Video Dynamic Range:	At least 35 dB	At least 30 dB
(4.3.3.7)	Log Dynamic Range:	At least 70 dB	At least 60 dB
(4.3.3.7)	AM, Log and Z-Axis Impedances:	Same	50 Ohms nominal
(4.3.3.7)	AM, Log Output Levels:	At least 3 volts	At least 2 Volts (into 50 Ohms)
(4.3.3.7)	Z-axis Operation:	Same with 3 volts	Output adjustable to 2 Vrms and reversible
(4.3.3.7)	Audio 3 dB Freq. Response:	20 Hz to 20 KHz	30 Hz to 12 KHz
(4.3.3.7)	Audio Output Level:	At least 8 V rms	At least 1 Vrms into 8 Ohms
(4.3.3.6)	BFO Tuning Range:	Same	At least 4 KHz
(4.3.3.6)	BFO Tuning Resolution:	Continuous	At least 10 Hz steps
(4.3.3.8)	IEEE-488 Codes:	Same	SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0
(DSI)	Remotely Controllable Functions:	Frequency, Input attenuation, IF bandwidth, detection mode/gain, RF gain, AGC mode, RF input select, Step Size, Step Up, Step Down, plus Calibration and Service functions	
(4.3.3.8)	Power cord:	Same	Shielded cord
(4.3.3.8)	Protection from power damage:	Same	No damage when improperly powered
(4.3.3.8)	Line voltage select:	Rotary switch	Slide switch

3.6 Additional Requirements

3.6.1 Audio Output

(DSI)(SOW 4.3.3.7.a) The audio output level shall be manually adjustable with an audio-taper. Both monaural and stereo headphones shall be operable with the output. The beep-tone warning signal shall be combined with the audio output.

3.6.2 Beep Tone

The beep-tone shall warn of improper and out-of-range operations. Provisions for adjusting the level of the beep tone and for disabling the beep tone shall be incorporated.

3.6.3 Audible Alarm

An audio transducer shall be included in the front portion of the receiver to warn of improper and out-of-range operation. The transducer shall sound when the beep-tone is outputted. Provisions for disabling the alarm shall be incorporated.

3.6.4 RS-232C Interface

The RS-232C interface shall be provided within in the Control Section with a suitable internal connector. Baud rate shall be internally settable.

3.6.5 Scan Ramp Output

The x-axis scan ramp output shall have a 0 to 1 vdc range while driving a 50 ohm load. The output shall be zero at the lowest frequency of the scan, and maximum at the highest frequency of the scan.

3.7 Requirements for Optional Features

3.7.1 Pulse Stretch

(DSI) The optional pulse stretcher circuit shall provide a variable pulse stretch from a minimum of _____ to a maximum of _TBD_. A rotary control shall provide video pulse width variation; a pushbutton with an LED shall enable its operation.

3.7.2 Slideback

(DSI) The optional slideback circuit shall provide a variable range of ___ to ___. A rotary control shall set the AM threshold level; a LED indicator shall indicate when the peak value of the detected AM video is above the threshold setting. A pushbutton with a LED shall enable slideback operation.

3.8 Power Supply

(SOW 4.4, 4.3.3.8 d,e,f) The receiver shall operate from 115 V/230 V +/-10%, 48 to 62 Hz power. A line voltage selector switch shall be provided on the rear panel and additional input voltage range shall be provided by the line voltage range switch. These switches shall allow the receiver to operate with an extended line voltage range of +/-14%. The front panel's status display shall advise of low or high line voltage conditions.

A shielded power cord shall be provided with the receiver. Protection from damage due to line overvoltage shall be provided by line fuses.

3.8.1 Maximum Input Current

The input AC current shall not exceed one (1) amp (steady-state).

3.9 Connectors

3.9.1 Front Panel Connectors

(SOW 4.3.2.1, revised) Two BNC connectors shall be provided for RF inputs; they shall be labeled RF Input 1 and 2 and shall be both manually and remotely selectable. A BNC connector shall be provided for the AM video output. A standard three-conductor 0.21" phone jack shall be provided for the audio output; the audio signal shall be connected to both output terminals of the phone jack. A BNC connector shall be provided for the X-axis ramp output.

3.9.2 Rear Panel Connectors

(SOW 4.3.2.2, 4.3.3.8) The receiver's rear panel shall include connectors for signal and power, and controls for power line voltage selection. BNC connectors shall be provided for Z-axis output, IF Output, Reference Oscillator Output, Signal Monitor, and the optional Wide Band IF Output (BNC). A standard IEEE-488 connector shall be provided for the IEEE-488 bus. A female DB-25 connector shall be used for the Status discretes. A standard 3-contact AC receptacle shall be used for input AC power.

3.10 Construction

(DSI, SOW 4.3.1, 4.5, 4.6) The receiver shall use modular construction to facilitate repair by a qualified technician. The receiver shall comply with all requirements of best commercial practice for design, construction and workmanship. Standard components and/or assemblies shall be used to the maximum extent possible. The R-110 shall use fabricated sheet metal construction to minimize weight. Front panel knobs shall not extend more than 1". Handles shall not extend more than 1.5".

(SOW 4.3.1) The receiver shall be configured to permit rack mounting in instrument shipping cases. Rack mounting slides and hardware shall be provided.

3.10.1 Color

The exterior of the receiver shall use colors consistent with other Dynamic Sciences products. The front panel shall use light blue Perma resin epoxy-based enamel (No. 25526). The covers and external surfaces shall use blue semi-gloss Perma resin epoxy-based enamel (No. 25177). The keyboard keys shall be gray with black lettering, except for the ALT key which shall be a contrasting color. Panel legends shall use contrasting color(s). Legends associated with secondary commands shall use a color consistent with the ALT key.

3.10.2 Nameplate/Markings

The receiver shall have a nameplate secured by adhesive backing to the rear panel indicating the model number, nomenclature, serial number and manufacturer.

3.11 Environmental Requirements

(SOW 4.7) The receiver shall be designed to withstand the shipping, storage, and operational tests specified in Section 4, below. Operating and non-operating temperature requirements shall be specified in the following paragraphs.

3.11.1 Non-Operating Temperature

(SOW 4.7) The receiver shall withstand a non-operating ambient temperature range of -32C (-25F) to +71C (160F).

3.11.2 Operating Temperature

(SOW 4.7) The unit shall operate in accordance with specified requirements in a ambient temperature range of +5C (+40F) to +40C (+105F).

3.12 EMC Requirements

(SOW 4.7) The receiver's conducted and radiated emissions and susceptibility shall be consistent with the MIL-STD-461/462 testing requirements defined in Section 4, below.

3.13 Physical Characteristics

3.13.1 Weight

(DSI, SOW 4.5) The target design weight of the receiver shall be 39.0 pounds. The weight shall not exceed 75 pounds.

3.13.2 Dimensions

(DSI, SOW 4.5) The design target dimensions shall be 5.25" x 18" x 17" (H x D x W). The dimensions of the receiver shall not exceed 7" x 21" x 17.5" (H x D x W).

3.14 Maintenance Requirements

(SOW 4.6) The receiver shall be designed to facilitate repair. The receiver shall have a mean-time-to-repair (MTTR) of less than one hour. Factory produced modules shall be interchangeable.

4. TESTING

4.1 Acceptance Testing

(SOW 4.8) Each receiver shall be tested in accordance with a customer-approved Factory Acceptance Test procedure.

4.2 Environmental Testing

(DSI, SOW 4.7) Environmental tests shall be performed to verify the design. Test reports shall be provided to the customer after completion of the environmental tests. The tests are to be conducted at a test facility in the Chatsworth area.

The mechanical tests (shipping and handling) shall be as follows:

Packaged Drop - Ten 36" drops (one on each face, one on a corner, and one on each of three different edges).

Packaged Vibration -

Restrained Vibration - As specified in the double-amplitude versus frequency profile and the accompanying notes of Figure 3.2 on page 6-13 of the SOW.

Loose Cargo Vibration - The test parameters will be:

1. Input acceleration of 1-g
2. Table double-amplitude of 1"
3. Test duration of 10 minutes on each of six faces for a total of 60 minutes

Packaged Temperature - Soak at the temperature extremes of 160F and -25F

Packaged Altitude - Expose to pressure commensurate to an altitude of 15,000 feet for 1 hour

Drop - Four 4" raised-edge drops on each reasonable face

These tests shall be conducted with the unit not powered. The unit shall be inspected for damage after each test.

The two operating tests shall be as follows:

Temperature (Indoor, Controlled Temperature) - The unit shall be soaked at the temperature extremes of 40C (105F) and 5C (40F) for 48-hours while operating. The unit must perform in accordance within the specification requirements at any time during the soak.

EMC - MIL-STD-461/462 Test - These tests will be conducted to demonstrate that the unit is not susceptible to conducted or radiated interference, nor does it interfere with the proper operation of other equipment, in accordance with requirements for Army Class I Communication-Electronic equipment.

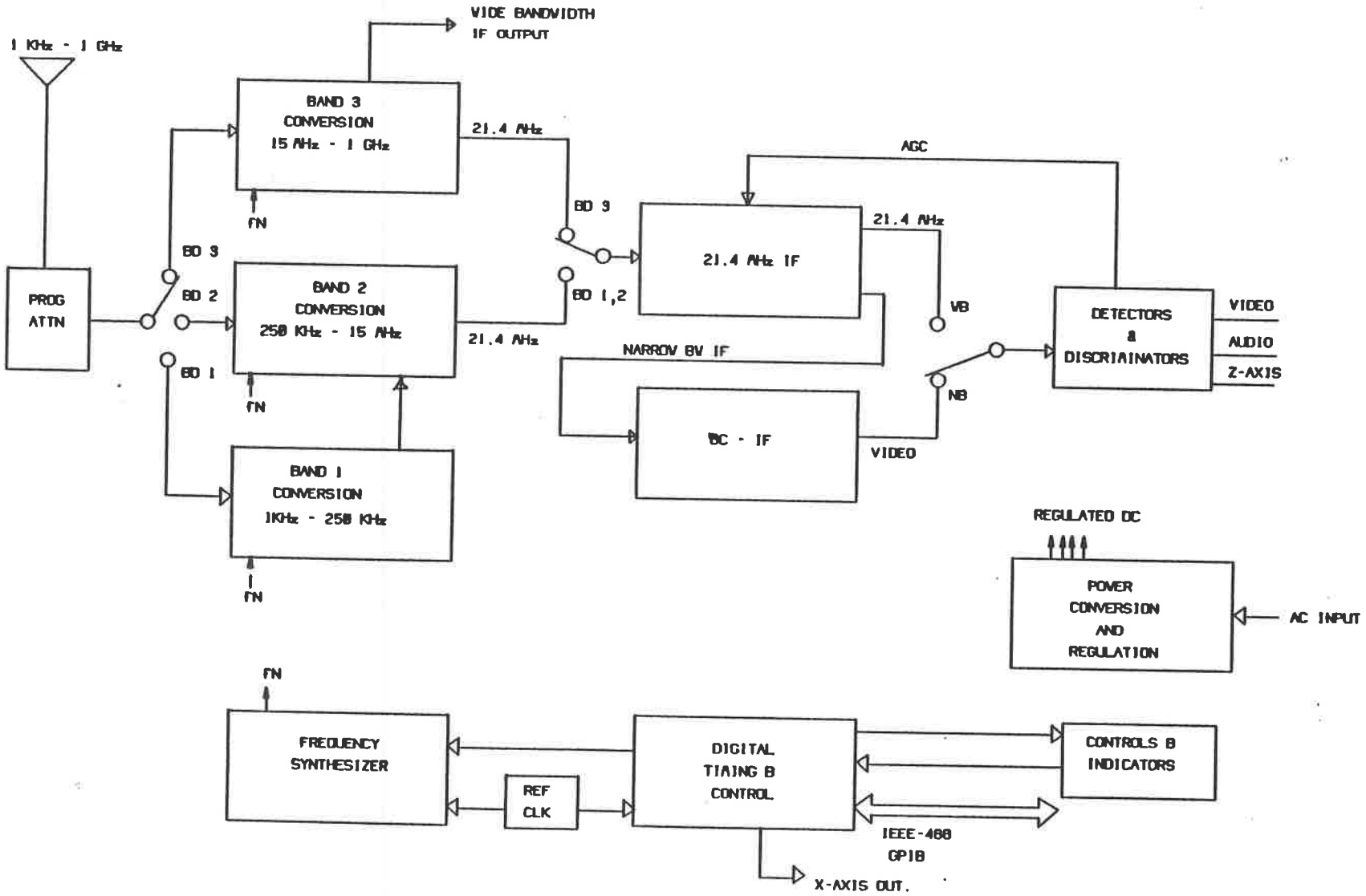

FIGURE 1 RECEIVER BLOCK DIAGRAM

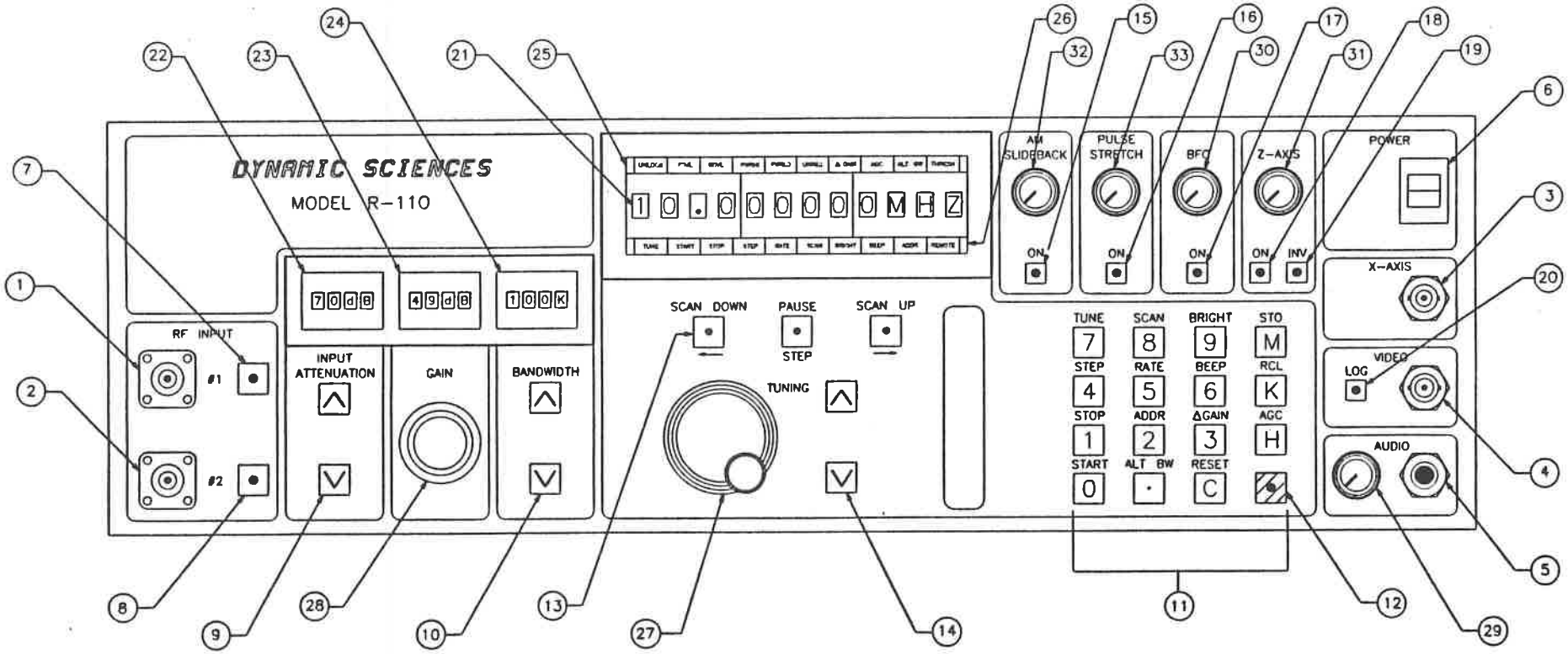

FIGURE 2 FRONT PANEL

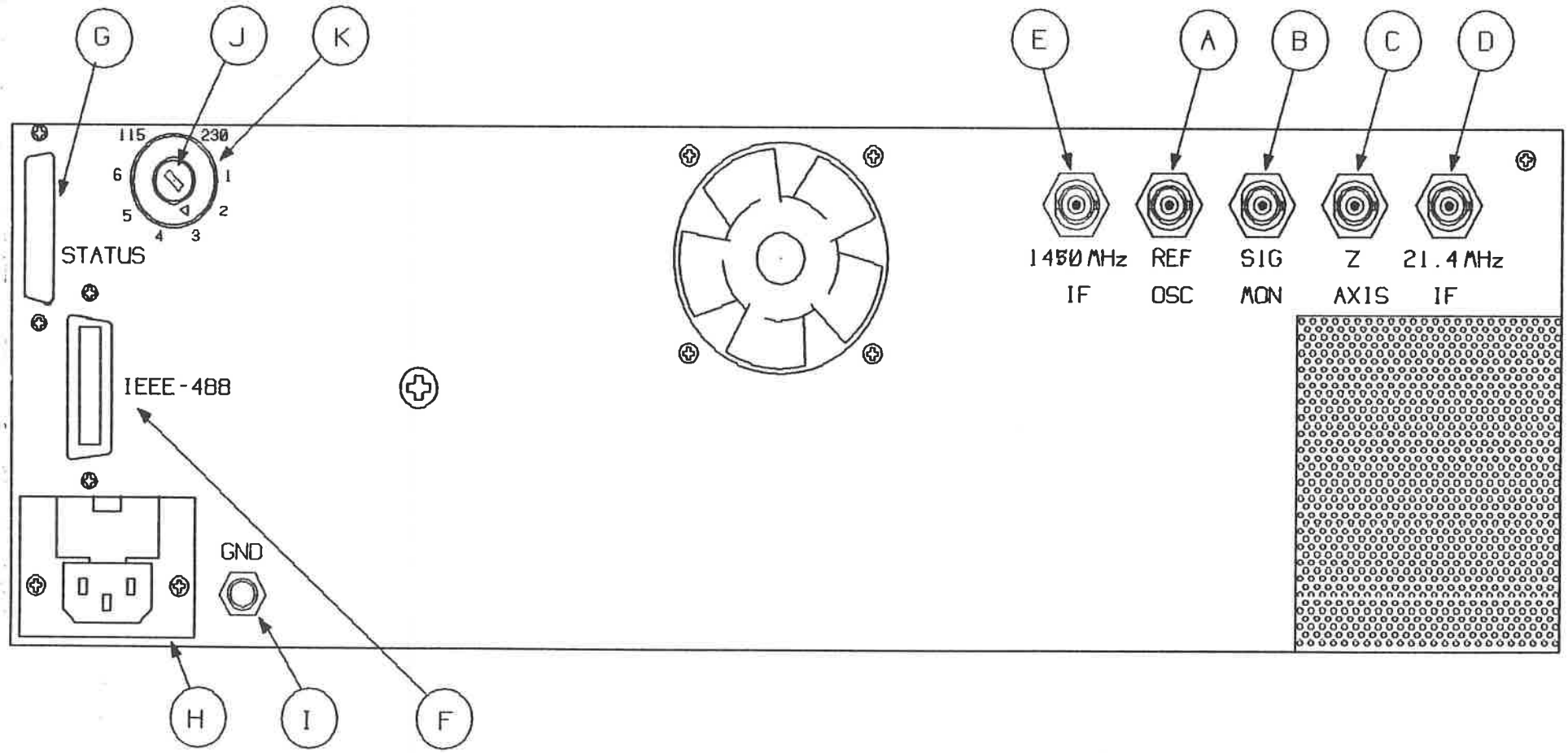

FIGURE 3 REAR PANEL