INSTALLATION AND OPERATION MANUAL

FOR THE

E2730B AND E2731B AGILENT

TECHNOLOGIES VXI RF TUNER

P/N 904480-001, Revision 50

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E2730B AND E2731B VXI RF TUNER

INSTALLATION AND OPERATION MANUAL

REVISION RECORD

Revision	Description	Date
50	Prototype Release per 043131.	04/2003

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SECTION 1 GENERAL DESCRIPTION

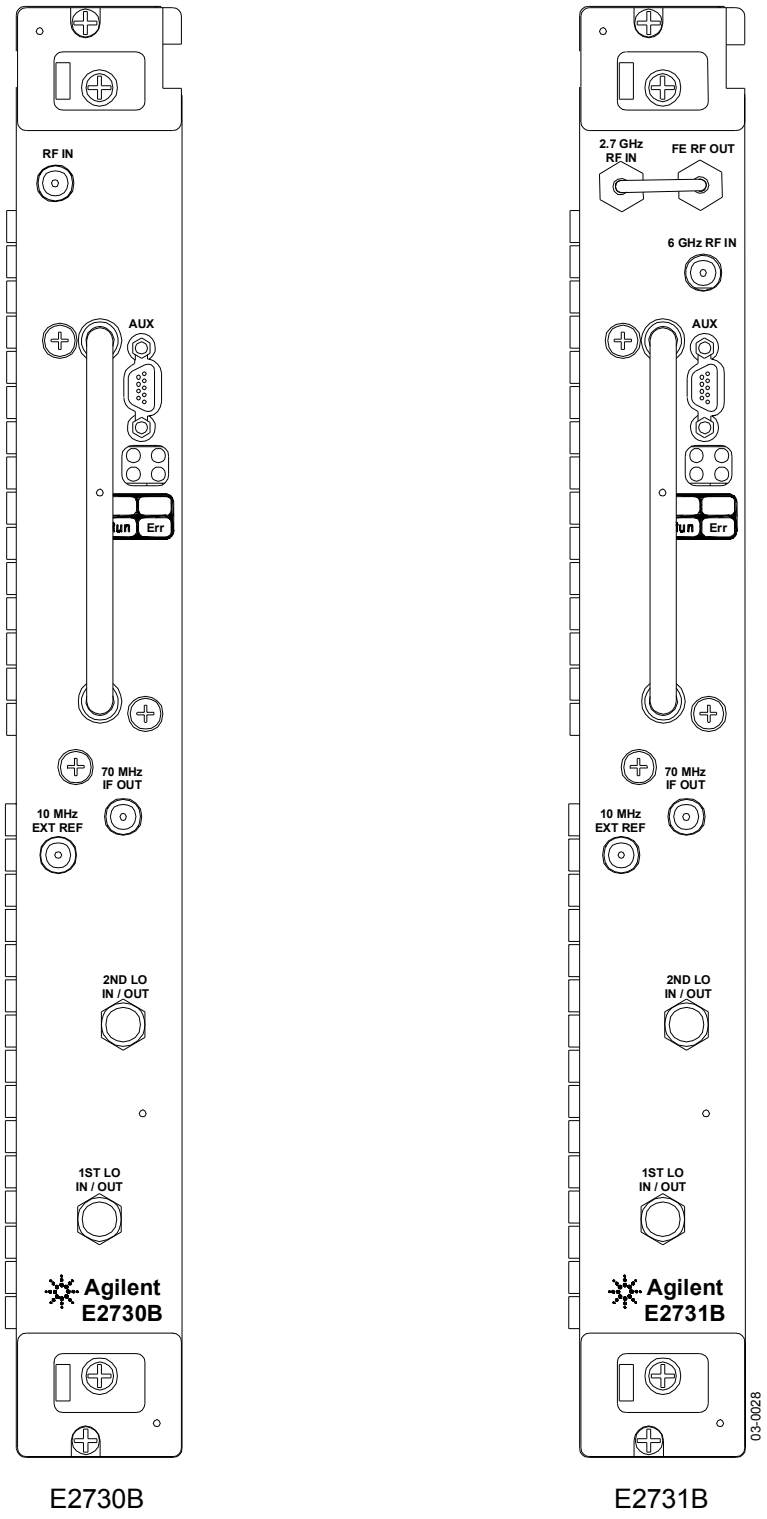
1.1 ELECTRICAL CHARACTERISTICS

The E2730B and E2731B tuners shown in **Figure 1-1** are general purpose, microprocessor-controlled synthesized VXI RF tuners. Packaged in a single slot "size C" VXI (VMEbus Extension for Instrumentation) module, the units are ideal for applications where high density and a high degree of integration are required.

The E2730B covers the 20 to 2700 MHz frequency range, while the E2731B provides extended frequency coverage from 20 to 6000 MHz. The units feature low phase noise frequency synthesizers and provide high dynamic range. General performance specifications for the E2730B and E2731B are provided in **Table 1-1** and **Table 1-2** respectively.

The tuners monitor and report the lock status of the local oscillator loops contained in the tuner module via a front panel indicator. A wideband 70 MHz IF output signal with a 36 MHz bandwidth is provided on a front panel mounted SMA connector. Other outputs include samples of the 1st LO and 2nd LO synthesizers that provide the capability to form a two-channel, phase coherent tuner pair operating in a master/slave LO distribution configuration.

The units support remote operation via the rear panel VXI interface; or optionally, by the RS-232 serial port located on the front panel. Installing the tuner directly on a standard instrumentation and computing bus simplifies and enhances system integration providing access to all tuner functionality via the VXI interface. Data is transferred to and from the unit using VXI standard word serial protocol with a command format based on the IEEE-488.2 standard.



E2730B E2731B

Figure 1-1. E2730B and E2731B VXI RF Tuners

Table 1-1. E2730B Technical Specifications

Frequency Range	20 MHz to 2700 MHz
Tuning Resolution	1 kHz
Internal Reference Accuracy	± 1.0 ppm, maximum (0°C to 40°C)
External Reference Input	
Input	VXI backplane or Front Panel
Frequency	10 MHz
Level	0 dBm
RF Input	
Impedance	50 ohm
Voltage Standing Wave Ratio (VSWR) at Tuned Frequency	1.5:1, typical, 2.2:1, maximum
Maximum Safe Input Power	+20 dBm (average continuous); 50 Volts (DC)
Noise Figure (Pre-amp on)	
20 MHz to 1200 MHz	12 dB maximum
1200 MHz to 2400 MHz	13 dB maximum
2400 MHz to 2700 MHz	14 dB maximum
Input Third Order Intercept (Pre-amp on) (Measured at the 70 MHz IF output with –20 dBm signals within the final IF bandwidth of 36 MHz)	+5 dBm minimum
Input Second Order Intercept (Pre-amp on) (Measured at the 70 MHz IF output with –20 dBm signals within the final IF bandwidth of 36 MHz)	+23 dBm minimum
IF Output	
Center Frequency	70 MHz
20 MHz to 2700 MHz	Spectrum Inverted
IF Bandwidth	36 MHz
IF Bandwidth Flatness Variation over 36 MHz	1 dB maximum
Gain to 70 MHz IF Output (Measured at a case temperature of 40°C located on the 1st LO cover)	17 dB minimum; 23 dB maximum
Gain Stability Over Specification Compliant Temperature Range	±0.50 dB
Gain Variation Due to Operational Mode Selection (Independent, Master, Slave) (For master and slave modes, mating tuner meets it's performance specifications)	±0.3 dB
Gain Control	
Mode	Manual
Range	56 dB
Step Size	2 dB, typical
Image Rejection	90 dB
IF Rejection	90 dB

Table 1-1. E2730B Technical Specifications (Continued)

Phase Noise
- 20 kHz Offset ..... –97 dBc/Hz, maximum
- 20 kHz Offset, tuned to 1 GHz ..... –100 dBc/Hz, maximum
- 100 kHz Offset ..... –110 dBc/Hz, maximum

Frequency Step
- Step Time between two frequencies (F1 to F2) with 36 MHz separation ..... 5 msec, typical to within 1 kHz

LO Level at RF Input ..... -90 dBm, maximum

Internally Generated Spurious ..... -110 dBm equivalent RF input adjusted for actual tuner gain, maximum

Differential Group Delay (across 36 MHz) ..... 50 ns, peak to peak, maximum

Discrete LO Sidebands
- 1 kHz - 3 kHz Offset ..... -70 dBc, maximum
- Greater than 3 kHz Offset ..... -72 dBc, maximum

Master/Slave Isolation
- (Measured with two tuners in a master/slave configuration. Measured at the 70 MHz IF output of the first tuner (master or slave) with a –30 dBm signal at the input of the second tuner (slave or master)). ..... -102 dBm equivalent RF input to the first tuner (master or slave) adjusted for actual tuner gain, maximum

Maximum Power Consumption ..... 26 W

Operating Current

DC Supply	DC Current (Typical)	DC Current (Maximum)	Dynamic Current (Typical)
+5 V	2.2 A	4.0 A	1.11 A
+12 V	860 mA	1.0 A	2.24 A
-12 V	110 mA	0.25 A	2.86 A
-5.2 V	400 mA	2.0 A	0.10 A
+24 V	50 mA	0.4 A	0.49 A
-24 V	0 A	0.3 A	0 A
-2 V	30 mA	0.5 A	0 A

Module Size ..... VXIbus C-size module, 1-slot wide

VXI Interface ..... Message-based device, VXI servant

Data Transfer
- Handshake ..... Normal Transfer Mode
- Capability A24, D16

Non-Volatile User Data Memory ..... 30 KB, non-volatile

Table 1-1. E2730B Technical Specifications (Continued)

Front Panel Interfaces

LEDs ..... Run (green)
Error (amber)

RF Connectors (SMA Female) ..... RF Input
70 MHz IF Output
10 MHz External Reference
2nd LO Input/Output
1st LO Input/Output

RS-232 Connectors (9-pin D-type micro) ..... Auxiliary RS-232 Control

EMI Shielding ..... Completely enclosed module

Environmental Specifications

Temperature

Full Specification Compliance Case Temperature Range ..... +35° to +45°C (95° to 113°F)
(Measured on the 1st LO Cover)

Operating Case Temperature Range ..... +15° to +65°C (59° to 149°F)
(Measured on the 1st LO Cover)

Ambient Non-operating Temperature Range ..... -40° to +70°C (-40° to 158°F)

Humidity ..... 10% to 90%, non-condensing

Altitude ..... 0 to 12,000 feet (3,657.6 meters) above MSL

CE Compliance

Safety ..... Complies with the requirements of the EU Low Voltage Directive 72/23/EEC, safety of information technology equipment, incorporating EN60950:1992 with amendments A1:1/1993, A2:8/1993, A3:10/1995, A4:3/1997, and A11:10/1997.

Electromagnetic Compatibility ..... Complies with the requirements of EU EMC Directive 89/336/EEC for equipment used in controlled electromagnetic environments incorporating the following tests:

Description	European Normal	Standard	Test Severity	Performance Criterion
Radiated Emissions	EN55022	CISPR 22	Class A	
Electrostatic Discharge	EN61000-4-2	IEC61000-4-2:1995	±4 kV contact discharge/ ±8 kV air discharge	B
Radiated Immunity	EN61000-4-3	IEC61000-4-3:1996	3 V/m	A
Burst Transients	EN61000-4-4	IEC61000-4-4:1995	±1 kV AC Power Line/ ±0.5 kV I/O Signal/Control	B
Surge Immunity	EN61000-4-5	IEC61000-4-5:1995	±1 kV line to line/ ±2 kV line to ground	B
Conducted RF	EN61000-4-6	IEC61000-4-6:1996	3 Vrms	A
Voltage Dips	EN61000-4-11	IEC61000-4-11:1994	230 Vac: 30% @ 10 mS, 60% @ 100 mS Voltage Interruption > 95% @ 5 seconds	B and C

Table 1-2. E2731B Technical Specifications

Frequency Range ..... 20 MHz to 6000 MHz

Tuning Resolution ..... 1 kHz

Internal Reference Accuracy ..... ± 1.0 ppm, maximum (0°C to 40°C)

External Reference Input

- Input ..... VXI backplane or Front Panel
- Frequency ..... 10 MHz
- Level ..... 0 dBm

RF Input

- Impedance ..... 50 ohm
- Voltage Standing Wave Ratio (VSWR) at Tuned Frequency ..... 1.5:1, typical; 3.0:1, maximum

Maximum Safe Input Power ..... +20 dBm (average continuous); 50 Volts (DC)

Noise Figure (Pre-amp on)

- 20 MHz to 1200 MHz ..... 15 dB maximum
- 1200 MHz to 2400 MHz ..... 15 dB maximum
- 2400 MHz to 2700 MHz ..... 16.5 dB maximum
- 2700 MHz to 6 GHz ..... 16.5 dB maximum

Input Third Order Intercept (Pre-amp on)
(Measured at the 70 MHz IF output with –20 dBm signals within the final IF bandwidth of 36 MHz

- 20 MHz to 2700 MHz ..... +4 dBm minimum
- 2700 MHz to 6 GHz ..... +0 dBm minimum

Input Second Order Intercept (Pre-amp on) ..... +22 dBm minimum
(Measured at the 70 MHz IF output with –20 dBm signals within the final IF bandwidth of 36 MHz)

IF Output

- Center Frequency ..... 70 MHz
- 20 MHz to 2700 MHz ..... Spectrum Inverted
- 2700 MHz to 6 GHz ..... Spectrum Not Inverted
- IF Bandwidth ..... 36 MHz
- IF Bandwidth Flatness Variation over 36 MHz ..... 1.5 dB maximum

Gain to 70 MHz IF Output
(Measured at a case temperature of 40°C located on the 1st LO cover)

- 20 MHz to 2700 MHz ..... 17 dB minimum, 25 dB maximum
- 2700 MHz to 6 GHz ..... 16 dB minimum, 25 dB maximum

Gain Variation Due To Operational Mode Selection (Independent, Master, Slave) ..... ±0.3 dB
(For master and slave modes, mating tuner meets it's performance specifications)

Gain Stability Over Specification Compliant Temperature Range

- 20 MHz to 2700 MHz ..... ±0.50 dB
- 2700 MHz to 6 GHz ..... ±0.75 dB

Table 1-2. E2731B Technical Specifications (Continued)

Gain Control
- Mode ..... Manual
- Range ..... 56 dB
- Step Size ..... 2 dB, typical

Image Rejection
- 20 MHz to 2700 MHz ..... 90 dB
- 2700 MHz to 6 GHz ..... 80 dB

IF Rejection
- 20 MHz to 2700 MHz ..... 90 dB
- 2700 MHz to 6 GHz ..... 80 dB

Phase Noise
- 20 kHz Offset ..... –97 dBc/Hz, maximum
- 20 kHz Offset, tuned to 1 GHz ..... –100 dBc/Hz, maximum
- 100 kHz Offset ..... –110 dBc/Hz, maximum

Frequency Step
- Step Time between two frequencies (F1 to F2) with 36 MHz separation ..... 5 msec, typical to within 1 kHz

LO Level at RF Input
- 20 MHz to 2700 MHz ..... -90 dBm, maximum
- 2700 MHz to 6 GHz ..... -80 dBm, maximum

Internally Generated Spurious ..... -110 dBm equivalent RF input adjusted for actual tuner gain, maximum

Differential Group Delay (across 36 MHz) ..... 50 ns, peak to peak, maximum

Discrete LO Sidebands
- 1 kHz – 3 kHz Offset ..... -70 dBc, maximum
- Greater than 3 kHz Offset ..... -72 dBc, maximum

Master/Slave Isolation
(Measured with two tuners in a master/slave configuration. Measured at the 70 MHz IF output of the first tuner (master or slave) with a –30 dBm signal at the input of the second tuner (slave or master)). ..... -102 dBm equivalent RF input to the first tuner (master or slave) adjusted for actual tuner gain, maximum

Maximum Power Consumption ..... 35 W

Operating Current

DC Supply	DC Current (Typical)	DC Current (Maximum)	Dynamic Current (Typical)
+5 V	3.08 A	4.0 A	1.11 A
+12 V	850 mA	1.0 A	2.24 A
-12 V	110 mA	0.25 A	2.86 A
-5.2 V	370 mA	2.0 A	0.10 A
+24 V	60 mA	0.4 A	0.49 A
-24 V	0 A	0.3 A	0 A
-2 V	30 mA	0.5 A	0 A

Module Size ..... VXIbus C-size module, 1-slot wide

VXI Interface ..... Message-based device, VXI servant

Table 1-2. E2731B Technical Specifications (Continued)

Data Transfer

Handshake	Normal Transfer Mode
Capability	A24, D16
Non-Volatile User Data Memory	30 KB, non-volatile
Front Panel Interfaces	
LEDs (Light Emitting Diodes)	Run (green) Error (amber)
RF Connectors (SMA Female)	2.7 GHz RF Input FE RF Output 6 GHz RF Input 70 MHz IF Output 10 MHz External Reference 2nd LO Input/Output 1st LO Input/Output
RS-232 Connectors (9-pin D-type micro)	Auxiliary RS-232 Control
EMI Shielding	Completely enclosed module
Environmental Specifications	
Temperature	
Full Specification Compliance Case Temperature Range (Measured on the 1st LO Cover)	+35° to +45°C (95° to 113°F)
Operating Case Temperature Range (Measured on the 1st LO Cover)	+15° to +65°C (59° to 149°F)
Ambient Non-operating Temperature Range	-40° to +70°C (-40° to 158°F)
Humidity	10% to 90%, non-condensing
Altitude	0 to 12,000 feet above MSL
CE Compliance	
Safety	Complies with the requirements of the EU Low Voltage Directive 72/23/EEC, safety of information technology equipment, incorporating EN60950:1992 with amendments A1:1/1993, A2:8/1993, A3:10/1995, A4:3/1997, and A11:10/1997.
Electromagnetic Compatibility	Complies with the requirements of EU EMC Directive 89/336/EEC for equipment used in controlled electromagnetic environments incorporating the following tests:

Description	European Normal	Standard	Test Severity	Performance Criterion
Radiated Emissions	EN55022	CISPR 22	Class A	
Electrostatic Discharge	EN61000-4-2	IEC61000-4-2:1995	±4 kV contact discharge/ ±8 kV air discharge	B
Radiated Immunity	EN61000-4-3	IEC61000-4-3:1996	3 V/m	A
Burst Transients	EN61000-4-4	IEC61000-4-4:1995	±1 kV AC Power Line/ ±0.5 kV I/O Signal/Control	B
Surge Immunity	EN61000-4-5	IEC61000-4-5:1995	±1 kV line to line/ ±2 kV line to ground	B
Conducted RF	EN61000-4-6	IEC61000-4-6:1996	3 Vrms	A
Voltage Dips	EN61000-4-11	IEC61000-4-11:1994	230 Vac: 30% @ 10 mS, 60% @ 100 mS Voltage Interruption > 95% @ 5 seconds	B and C

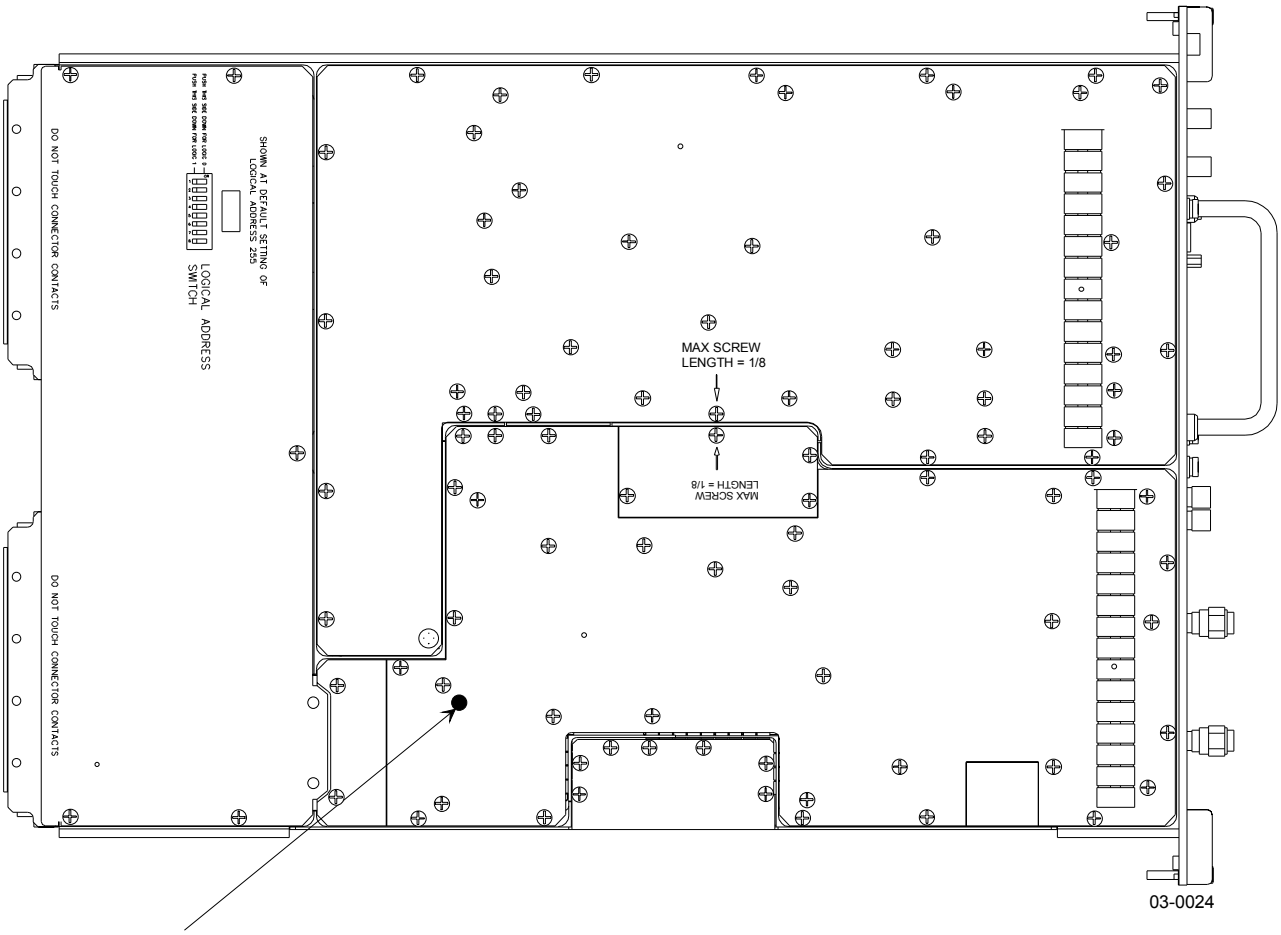


Figure 1-2. Specification Temperature Measurement Location

1.2 MECHANICAL CHARACTERISTICS

The E2730B and E2731B tuners are each packaged in a single-slot, C-size, VXI chassis (9.2 inches high x 13.6 inches deep x 1.2 inches wide (23.37 x 34.54 x 3.05 cm)). The mechanical packaging design uses modern surface-mount technology. The unit's multi-layer PC boards are attached to a milled aluminum chassis to optimize of RF isolation.

SMA connectors are provided on the front panel to pass RF/analog signals in and out of the unit. The front panel also contains an AUX micro-miniature D-type connector that provides a RS-232 interface port for serial external control. The VXI P1 and P2 multi-pin connectors for the VXI interface are mounted on the rear panel of the unit. Refer to **Section 2** for further details on the unit's input/outputs.

Front panel LEDs ERR and RUN monitor elements of the tuner's operation and provide visual indications of the operational state of the unit. Refer to **Section 3** for more information on these indicators.

The E2730B tuner contains seven circuit assembly modules. Six of the modules are PC boards that contain surface-mounted components and plug-in metal-cased components. The seventh module is a plug-in YIG oscillator assembly.

The circuit assemblies within the E2731B are identical to those of the E2730B with the addition of a Frequency Extender assembly that extends its upper frequency range to 6000 MHz.

Refer to **Foldout FO-1** for a detailed main chassis schematic of the tuner depicting each assembly, its reference designator, and all module internal interconnections.

1.3 EQUIPMENT SUPPLIED

Equipment supplied consists of the tuner, an accessory kit, and an *Installation and Operation Manual for the E2730B and E2731B VXI RF Tuner* (P/N: 904480-001).

1.4 EQUIPMENT REQUIRED BUT NOT SUPPLIED

To fully utilize the tuner, equipment from the following list should be selected:

1. VXI vertical (C-size) mainframe.
2. VXI slot 0 controller.
3. RF Source with 50-ohm impedance.

1.5 SOFTWARE VERSION HISTORY

The initial software version is 02.01.00, released March 3, 2003.

SECTION 2

INSTALLATION

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SECTION 2 INSTALLATION

2.1 UNPACKING AND INSPECTION

E2730B and E2731B and their accessories are shipped cushioned between molded-in-place expanded plastic pads in a double-walled carton. After unpacking the equipment, retain the shipping container and packing material until the equipment has been thoroughly inspected and it is ensured that reshipment is not necessary. Perform the following initial inspection:

1. Carefully inspect the outside of the shipping container for discoloring, stains, charring, or other signs of exposure to excessive heat, moisture or liquid chemicals. Check for any physical damage to the shipping container such as dents, snags, rips, crushed areas, or similar signs of excessive shock or careless handling.
2. Remove all equipment and accessories from the shipping container. If any items are missing, contact the factory or your Agilent Technologies Customer Engineer.
3. Carefully inspect the equipment looking for dents, scratches, damaged or loose controls, indicators, or connectors, or any other signs of physical abuse or careless handling.

If damage is found, forward an immediate request to the delivering carrier to perform an inspection and prepare a concealed-damage report. Do not destroy any packing material until it has been examined by an agent of the carrier. Concurrently, report the nature and extent of damage to your Customer Engineer through your local Agilent Technologies Service Center. Under U.S. shipping regulations, damage for claims must be collected by the consignee; do not return the equipment to Agilent Technologies until a claim for damages has been established.

2.2 CONNECTOR SIGNALS

The following paragraphs describe the input and output signals and their associated connectors provided on the front and rear panels of the tuner.

Table 2-1 lists all of the tuner's external connectors, their reference designators and basic functions. **Table 2-2** provides mating connector types, their associated part numbers and manufacturer's CAGE code (if applicable). **Figure 2-1** shows the location of all external connectors. The signals present on the rear panel VXIbus P1/P2 connectors are described in detail within the VXIbus System Specification; however, for convenience VXI pin assignments are provided within **Table 2-3** and **2-4**.

Table 2-1. List of Connectors

Connector	Ref Des	Function/(Type)
VXI P1	A1P1	Standard VXIbus P1 Connection (3x32)
VXI P2	A1P2	Standard VXIbus P2 Connection (3x32)
Aux	A5J2	Auxiliary RS-232 Control (D-Type, 9-Pin)
2.7 GHz RF In (1)	J2	20-2700 MHz RF Input (SMA female)
10 MHz Ext Ref	J8	10 MHz External Reference Input (SMA female)
70 MHz IF Out	W4J4	70 MHz IF Output (SMA female)
2nd LO In/Out	W3J3	2nd Local Oscillator Bi-directional Input/Output (SMA female)
1st LO In/Out	W1J1	1st Local Oscillator Bi-directional Input/Output (SMA female)
6 GHz RF In (2)	FE-W3J9	Frequency Extender 20-6000 MHz RF Input (SMA female)
FE RF Out (2)	FE-W4J10	Frequency Extender 20-2700 MHz RF Output (SMA female)

NOTES:
1 J2 is labeled "RF In" on the E2730B (20 - 2700 MHz) version of the tuner.
2 Present only on the E2731B (20 - 6000 MHz) version of the tuner.

Table 2-2. List of Mating Connectors

Connector	Reference Designation	Mating Connector (CAGE Code)
VXI P1	A1P1	VXI Frame Interface
VXI P2	A1P2	VXI Frame Interface
Aux	A5J2	MDSM-9SC-Z11 (71468)
2.7 GHz IF In (1)	J2	SMA male 9001-9023-005 (19505)
10 MHz Ext Ref	J8	SMA male 9001-9023-005 (19505)
70 MHz IF Out	W4J4	SMA male 9001-9023-005 (19505)
2nd LO In/Out	W3J3	SMA male 9001-9023-005 (19505)
1st LO In/Out	W1J1	SMA male 9001-9023-005 (19505)
6 GHz RF In (2)	FE-W3J9	SMA male 9001-9023-005 (19505)
FE RF Out (2)	FE-W3J10	SMA male 9001-9023-005 (19505)

NOTES:
1 J2 is labeled "RF In" on the E2730B (20 - 2700 MHz) version of the tuner.
2 Present only on the E2731B (20 - 6000 MHz) version of the tuner.

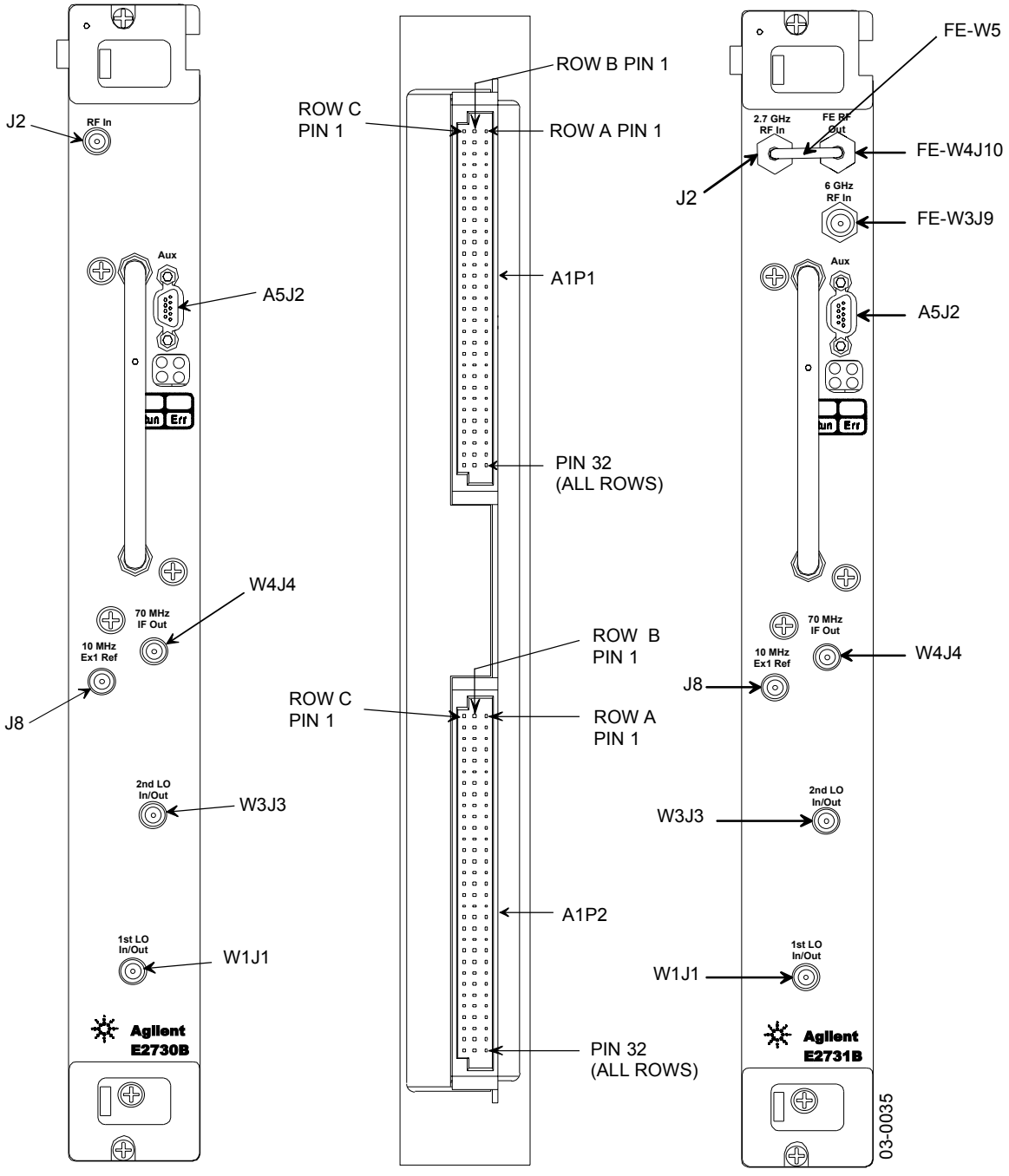


Figure 2-1. Location of External Connectors and Indicators

2.2.1 VXIP1, STANDARD VXIbus P1 (A1P1)

This connector is the standard multipin VXIbus P1 connector. Refer to Section B of the VXIbus System Specification for details on the signals resident at this connector.

Table 2-3. Pin Assignments of the Standard VXIbus P1 Connector

Pin	Row A Signals	Row B Signals	Row C Signals
1	D00	BBSY*	D08
2	D01	BCLR*	D09
3	D02	ACFAIL*	D10
4	D03	BG0IN*	D11
5	D04	BG0OUT*	D12
6	D05	BG1IN*	D13
7	D06	BG1OUT*	D13
8	D07	BG2IN*	D15
9	GND	BG2OUT*	GND
10	SYSCLK	BG3IN*	SYSFAIL*
11	GND	BG3OUT*	BERR*
12	DS1*	BR0*	SYSRESET*
13	DS0*	BR1*	LWORD*
14	WRITE*	BR2*	AM5
15	GND	BR3*	A23
16	DTACK*	AM0	A22
17	GND	AM1	A21
18	AS*	AM2	A20
19	GND	AM3	A19
20	IACK*	GND	A18
21	IACKIN*	not connected	A17
22	IACKOUT*	not connected	A16
23	AM4	GND	A15
24	A07	IRQ7*	A14
25	A06	IRQ6*	A13
26	A05	IRQ5*	A12
27	A04	IRQ4*	A11
28	A03	IRQ3*	A10
29	A02	IRQ2*	A09
30	A01	IRQ1*	A08
31	-12V	+5V STBY	+12V
32	+5V	+5V	+5V

*Indicates active low signal.

2.2.2 VXIP2, STANDARD VXIbus P2 (A1P2)

This connector is the standard multipin VXIbus P2 connector. Refer to Section B of the VXIbus System Specification for details on the signals resident at this connector.

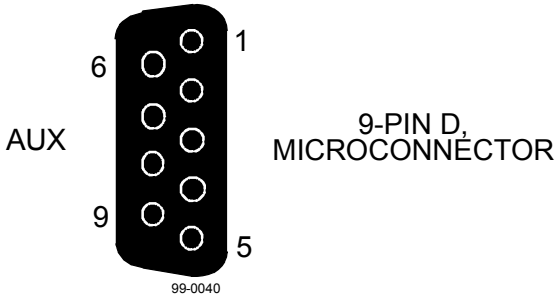
Table 2-4. Pin Assignments of the Standard VXIbus P2 Connector

Pin	Row A Signals	Row B Signals	Row C Signals
1	ECLTRG0	+5V	CLK10+
2	-2V	GND	CLK10-
3	ECLTRG1	RSV1	GND
4	GND	A24	-5.2V
5	LBUSA00	A25	LBUSC00
6	LBUSA01	A26	LBUSC01
7	-5.2V	A27	GND
8	LBUSA02	A28	LBUSC02
9	LBUSA03	A29	LBUSC03
10	GND	A30	GND
11	LBUSA04	A31	LBUSC04
12	LBUSA05	GND	LBUSC05
13	-5.2V	+5V	-2V
14	LBUSA06	D16	LBUSC06
15	LBUSA07	D17	LBUSC07
16	GND	D18	GND
17	LBUSA08	D19	LBUSC08
18	LBUSA09	D20	LBUSC09
19	-5.2V	D21	-5.2V
20	LBUSA10	D22	LBUSC10
21	LBUSA11	D23	LBUSC11
22	GND	GND	GND
23	TTLTRG0*	D24	TTLTRG1*
24	TTLTRG2*	D25	TTLTRG3*
25	+5V	D26	GND
26	TTLTRG4*	D27	TTLTRG5*
27	TTLTRG6*	D28	TTLTRG7*
28	GND	D29	GND
29	RSV2	D30	RSV3
30	MODID	D31	GND
31	GND	GND	+24V
32	SUMBUS	+5V	-24V

*Indicates active low signal.

2.2.3 AUX (A5J2)

The Aux connector is a nine-pin D-type connector that provides auxiliary RS-232C serial control of the tuner. The default baud rate is 19200. Baud rates of 1200 to 38400 are supported via the #CBR command as described in **Section 3** of this manual. The interface supports eight-bit, no parity operation with one stop bit. **Figure 2-2** provides signal-to-pin data for the connector.



1.	TX	6.	GND
2.	RX	7.	SPARE
3.	SPARE	8.	GND
4.	GND	9.	SPARE
5.	SPARE		

Figure 2-2. AUX Pin Assignments

2.2.4 RF In (E2730B) 2.7 GHz RF In (E2731B) (J2)

On the E2730B version of the tuner, this connector is labeled RF In and accepts the 20 to 2700 MHz antenna input signal.

The connector is labeled 2.7 GHz RF In on the E2731 version and accepts the Frequency Extender output signal from the FE RF OUT (FE-W4J10) connector.

J2 is a female SMA connector with a nominal input impedance of 50 ohms. Maximum RF input without incurring damage is +20 dBm (100 milliwatts.)

2.2.5 10 MHz EXT REF (J8)

The 10 MHz Ext Ref SMA connector accepts a 10 MHz input from an external reference source for use as the tuner's time base. The external

signal must be a 0 dBm minimum signal from a 50-ohm source. To utilize the external reference signal, the tuner must be set to the external reference mode of operation via the REF command (**Section 3**).

2.2.6 70 MHz IF OUT (W4J4)

The 70 MHz IF Out SMA connector provides a sample of the 70 MHz IF output. The signal has a bandwidth of 36 MHz and a nominal level of 20 dB above the RF input level with the RF attenuator set to 0 dB, the frequency extender attenuator set to 0 dB and the RF preamplifier turned on. The output impedance is 50 ohms. The 70 MHz frequency spectrum is inverted with respect to RF inputs in the 20 - 2700.000 MHz range and non-inverted with respect to RF input in the 2700.001 - 6000 MHz range.

2.2.7 2ND LO IN/OUT (W3J3)

The 2nd LO In/Out SMA bi-directional connector provides a sample of the 2nd LO synthesizer frequency. The 2nd LO frequency ranges from 3710.001 MHz to 3712.5 MHz in 1-kHz steps. The signal has a +10 dBm (minimum) output level from a characteristic impedance of 50 ohms. The connector can also function as an input depending on how the tuner is configured via remote command. Three LO operating modes are supported:

- Independent (W3J3 provides a 2nd LO sample)
- Master (W3J3 provides a 2nd LO sample)
- Slave (W3J3 accepts a 2nd LO sample)

When phase-coherent LO operation is desired, the tuner is designated as a master or slave unit by use of the LOM command described in **Section 3** of this manual. Phase-coherent master/slave operation requires the use of a short semi-rigid RF cable between the LO inputs and outputs of the tuner pair. When the tuner is not used in the master/slave mode, these cables must be disconnected to prevent spurious signals from appearing in both tuners.

NOTE: When not used, all LO IN/OUT connectors should be terminated with a mating termination dust cap.

2.2.8 1ST LO IN/OUT (W1J1)

The 1st LO In/Out SMA bi-directional connector provides a sample of the 1st LO synthesizer frequency. The 1st LO frequency ranges from 3802.5 MHz to 6482.5 MHz in 2.5-MHz steps. The signal has a +7 dBm (minimum) output level from a characteristic impedance of 50 ohms. The connector can also function as an input depending on how the tuner is configured via remote command. Three LO operating modes are supported:

- Independent (W1J1 provides a 1st LO sample)
- Master (W1J1 provides a 1st LO sample)
- Slave (W1J1 accepts a 1st LO sample)

When phase-coherent LO operation is desired, the tuner is designated as a master or slave unit by use of the LOM command described in **Section 3** of this manual. Phase-coherent master/slave operation requires the use of a short semi-rigid RF cable between the LO inputs and outputs of the tuner pair. When the tuner is not used in the master/slave mode, these cables must be disconnected to prevent spurious signals from appearing in both tuners.

NOTE: When not used, all LO IN/OUT connectors should be terminated with a mating termination dust cap.

2.2.9 6 GHz RF IN (FE-W3J9) (E2731B Only)

The 6 GHz RF In SMA connector is designed to accept 20 to 6000 MHz input signals from an antenna. The connector's nominal input impedance is 50 ohms and accepts signals with a maximum level of +20 dBm (100 milliwatts.)

2.2.10 FE RF OUT (FE-W4J10) (E2731B Only)

When the tuner is tuned to frequencies at or below 2700 MHz, the frequency extender's down converter circuitry is bypassed and the signal is routed from FE-W4J10 without processing to the 1st converter A3 via an external semi-rigid coaxial cable.

For input frequencies of 2700.001 to 6000 MHz the signal present on the connector represents the inverted 1200 to 2100 MHz IF output of the frequency extender that is then routed via an external semi-rigid coaxial cable to the 1st converter. The characteristic output impedance is 50 ohms.

2.3 POWER AND COOLING REQUIREMENTS VERSUS MAINFRAME SELECTION

Three major factors must be considered when selecting a mainframe for a VXI system: module size, power requirements, and cooling requirements. The tuner is mechanically designed as a C-size VXI module; therefore, a mainframe capable of housing C-size modules is required. **Table 2-5** lists the specific power and cooling requirements for the tuner.

Table 2-5. Power and Cooling Requirements

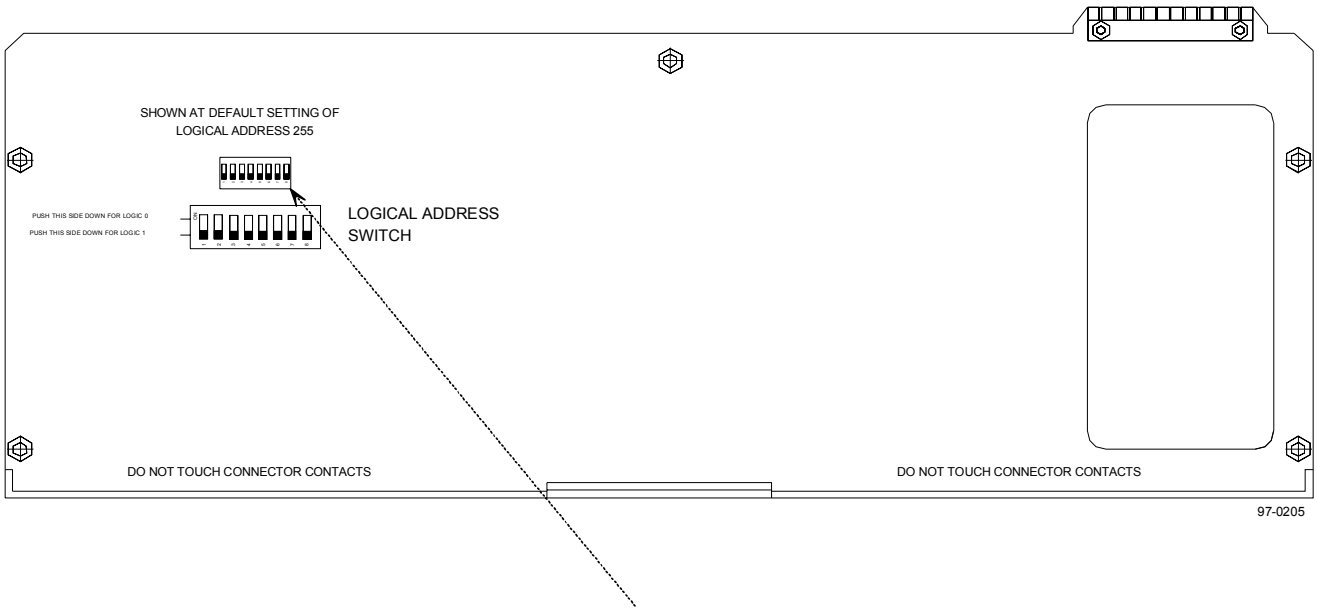
DC Volts	DC Current	Dynamic Current	Cooling
+5 V	3.08 A	1.11 A	+15 to +65°C Operating Ambient Temperature
+12 V	850 mA	2.24 A	0.20 mm H_2O Back Pressure
-12 V	110 mA	2.86 A	3.5 L/S Air Flow
-5.2 V	370 mA	100 mA	
+24 V	60 mA	490 mA	
-24 V	0 A	0 A	
-2 V	30 mA	0 A	

2.4 SETTING THE TUNER'S LOGICAL ADDRESS

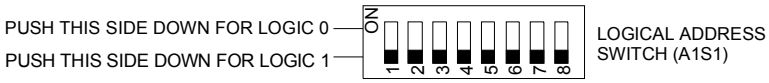
All modules in a VXI system must be assigned a logical address to allow controller to device communications. The tuner is assigned a logical address via either: Dynamic or Static Configuration. Refer to Section F in the VXIbus specification for details on these configurations.

The tuner is set to either Dynamic or Static Configuration by a DIP switch located on the Digital Control Assembly (A1). The switch is accessible through a hole in the Digital Control cover on the left side of the tuner as shown in **Figure 2-3.** The tuner is shipped from the factory configured for Dynamic Configuration by setting all switches to OFF position (255). When the tuner is configured as a Dynamic Configuration device, the Resource Manager assigns a logical address to the tuner during the power-on sequence.

Any other combination of switch settings places the tuner in the Static Configuration mode with its address determined by the decimal equivalent of the binary value of the switch settings (ON = logic 0, OFF = logic 1). **Figure 2-3** provides the switch settings required for various addresses. When the tuner is configured as a Static Configuration device, it responds to controller commands only after receiving an address that matches the address set by the DIP switch.



SHOWN AT DEFAULT SETTING OF
LOGICAL ADDRESS 255



NOTE: BLACK SQUARES DENOTE SWITCH POSITIONS.

ADDRESS EXAMPLES								
SWITCH POSITION								ADDRESS
8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	SC 0*
0	0	0	0	0	0	0	1	SC 1
0	0	0	0	0	0	1	0	SC 2
0	0	0	0	0	1	0	0	SC 4
0	0	0	0	1	0	0	0	SC 8
1	1	1	1	1	1	1	1	DC 255

* This address is not a Slot 0 Controller recognized servant address. **DO NOT** configure the switch to provide this address.

Figure 2-3. Setting the Tuner's Logical Address

2.5 INSTALLING THE UNIT IN THE MAINFRAME

CAUTION **Damage to the tuner can result if it is installed or removed in a mainframe with power applied. Ensure that power is removed before installing or removing the tuner.**

CAUTION **Damage to the tuner can result if power is applied to the unit while it is improperly seated in a VXI module slot of the mainframe. Ensure the tuner is firmly seated and VXI mounting screws are fully tightened before applying power. See Figure 2-4.**

NOTE: Before installing the tuner, ensure its logical address is set to the proper setting (refer to **paragraph 2.4**).

The tuner is installed vertically in a C-size mainframe. Refer to the equipment manual provided with the mainframe being used for proper module installation instructions. Refer to **Foldout FO-2** for the tuner's critical dimensions. Refer also to the VXIbus Specification for proper module installation procedures and details on configuring the interrupt daisy chain on the mainframe backplane to bypass empty slots, if required.

Figure 2-4 shows the E2731A properly installed in a vertical mainframe.

2.6 VXI COMPLIANCE D16/D32

The tuner supports both 16 or 32-bit VXI data bus access.

2.7 VXI SIGNAL LIST

The tuner utilizes standard multipin VXIbus P1 and P2 connectors. The signals associated with these connectors are fully defined in Section B of the VXIbus System Specification and summarized for convenience in **paragraphs 2.2.1** and **2.2.2** of this manual.

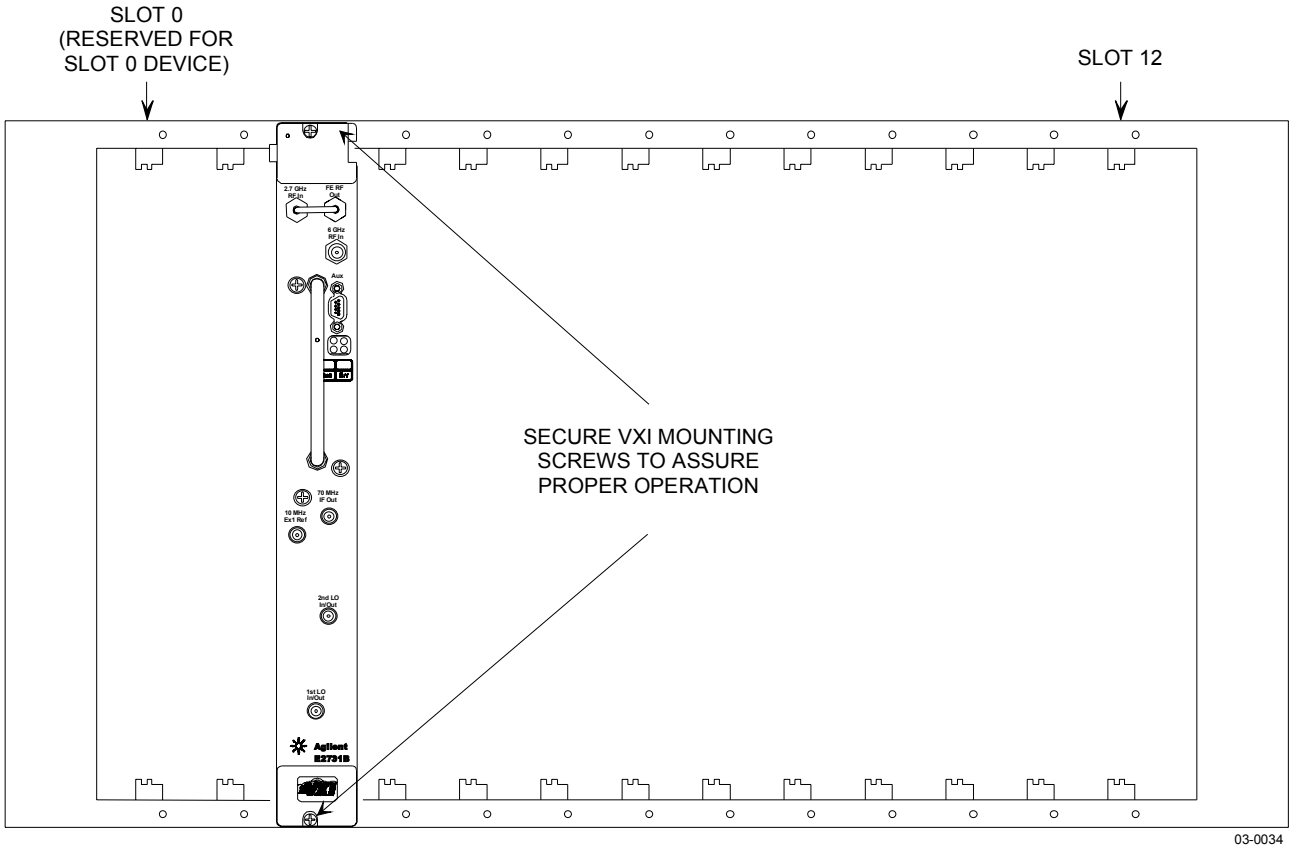


Figure 2-4. Tuner Properly Installed in a Vertical Mainframe

A VXI 10 MHz reference signal is generated by the slot zero controller and distributed throughout the VXIbus. The VXI 10 MHz reference is a differential ECL signal, which is available on the CLK10+ and CLK10-lines. To utilize the VXI 10 MHz reference, each tuner must be remotely set to the VXIBus reference mode of operation via the REF command as explained in **Section 3**. Optionally, an external 10 MHz reference signal can be applied to the Slot 0 Controller and then distributed to each tuner via the VXI bus.

NOTE: The 10 MHz reference generated within the slot zero controller generally does not provide sufficient accuracy to meet system tuning requirements. In most cases the user is advised to apply an external 10 MHz reference signal to the controller that may then be distributed to the tuners through the VXI bus.

2.8 SERVICE AND SUPPORT

All adjustments, maintenance, or repair of this product must be performed by qualified personnel. Contact your customer engineer through your local Agilent Technologies Service Center.

2.8.1 AGILENT ON THE WEB

You can find information about technical and professional services, product support, and equipment repair and service on the Web:

http://www.agilent.com/contacts/English/noscript.html

Double-click the link to Test & Measurement. Select your country from the drop-down menus. The Web page that appears next has contact information specific for your country.

2.8.2 AGILENT BY PHONE

If you do not have access to the Internet, call one of the numbers below:

Agilent Call Centers and Regional Headquarters.

United States and Canada: Test and Measurement Call Center, (800) 452 4844 (toll-free in US)

Europe: (41 22) 780 8111

Japan: Measurement Assistance Center (81) 0426 56 7832

Latin America: 305 269 7548

Asia-Pacific: (85 22) 599 777

2.9 PREPARATION FOR RESHIPMENT OR STORAGE

If the equipment must be prepared for reshipment, the packaging method should follow the pattern established in the original shipment. Use the best packaging materials available to protect the equipment during reshipment or storage. When possible, use the original packing containers and cushioning material. If the original packing materials are not available, use the following procedure:

1. Wrap the equipment in sturdy paper or plastic.

2. Place the wrapped equipment in a strong shipping container and place a layer of shock-absorbing material (3/4-inch minimum thickness) around all sides of the equipment to provide a firm cushion and to prevent movement inside the container.

3. Thoroughly seal the shipping container and mark FRAGILE.

SECTION 3

OPERATION

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SECTION 3 OPERATION

3.1 INTRODUCTION

The E2730B and E2731B VXI RF tuners are controlled using either word serial commands or binary commands via the VXI Interface. In addition, the RS-232 port (the Aux connector located on the front panel) also accepts the same mnemonics that are used with the word serial VXI commands. The following paragraphs provide the details required for the system integrator to access, control, and monitor the tuner's operation. The following discussions assume that the system integrator is familiar with the rules and guidelines contained in the VXIbus Specification and RS-232 interface specifications. A copy of the VXIbus Specification can be requested by writing to:

VXIbus Consortium, Inc.
P.O. Box 1736
Vancouver, WA 98668 U.S.A.

3.2 INDICATORS

All tuner indicators are located on the front panel. Two LEDs are provided for monitoring the operating status of the unit. The following paragraphs further explain the function of each LED.

3.2.1 RUN INDICATOR, GREEN LED

This green LED illuminates approximately one second after power is applied to the tuner, indicating that the tuner’s microcontroller is active and running properly.

3.2.2 ERR INDICATOR, AMBER LED

This amber LED illuminates when internal diagnostic circuitry detects any of the following tuner errors:

- Any Unlocked LO
- EEPROM Defaulted (illuminate for three seconds only)

Note that the ERR indicator does not indicate the receipt of invalid remote messages.

3.3 TUNER CONTROL USING THE VXI INTERFACE

The tuner is configured as a Message-Based and Memory-Based Servant Device using communications registers accessible by other devices. The tuner is controlled by using word serial commands and IEEE-488.2 protocol. Binary registers may also be used for some of the most common functions. The following paragraphs provide further details on how the unit is controlled in the VXI architecture using either command method.

3.3.1 VXIBus INTERFACE

All tuner operations are directed by commands received over the VXIbus. VXIbus word serial commands are processed by the VXI interface to control and configure the tuner as a message-based VXIbus module. IEEE-488.2 ASCII commands/queries are then transmitted to the unit via word serial byte available commands. Refer to **Table 3-1** for a listing of word serial commands.

Responses to IEEE-488.2 ASCII queries are transferred to the VXIbus in response to the word serial byte commands.

Table 3-1. Word Serial Commands

Command	Description
Abort Normal Operation	Causes device to cease normal operation. Device returns to its default configuration, aborting all operations.
Begin Normal Operation	Notifies device that it can begin normal operation
Byte Available	Used to send a byte of data from a Commander to a Servant.
Byte Request	Used to request a byte of data from a Servant by a Commander.
Clear	Clears the VXIbus interface and any pending operations.
End Normal Operation	Causes device to cease normal operation in an orderly manner.
Read Protocol	Determines which protocols in addition to the Word Serial protocol that the Servant supports.
Read Protocol Error	Requests the most recent error code from the Servant.
Read STB	Requests the status byte from the Servant.
Assign Interrupter Line	Assigns VXIbus IRQ line to an Interrupter.
Read Interrupter Line	Used to determine which VXIbus IRQ line that a particular Interrupter in the Servant device is connected to.
Read Interrupters	Used to determine the number of Interrupters within a Servant device.

3.3.2 ADDRESSING

The unit has registers located within 64-byte blocks in the A16 address space. The base address of the unit's registers is determined by its unique logical address. This address is set via an eight-position DIP switch located on the left side panel. Refer to **Section 2** for details on setting the logical address with this switch.

If the switch is set for dynamic configuration (255), the address of the unit is determined by the Resource Manager by reading the tuner's MODID (module identification) line during the power-up and initialization routine. The unit contains an offset register that is written to by the resource manager to define its address. Refer to Section F in the VXIbus Specification for further details on dynamic configurations.

If the switch is set for static configuration (1-254), the Resource Manager reads and acknowledges the set address.

3.3.3 CONFIGURATION REGISTERS

At startup, it is the responsibility of the Resource Manager to read the configuration register of the unit (refer to the VXIbus Specification). The unit returns the following data from its configuration register:

ID Register

Bits:	Contents:	Value:
0-11	Manufacturer ID	$0xFFF_{16}$
12,13	Address Space	$0x0_{16}$ (A16/A24)
14,15	Device Class	$0x2_{16}$ (Message Based)

Device Type Register

Bits:	Contents:	Value:
0-11	Model Code	0x2D8
12-15	Required Memory	64k (bytes)

3.3.4 COMMUNICATION PROTOCOL

Operation of the unit is normally controlled using word serial commands (refer to the VXIbus Specification) and IEEE-488.2 modeled ASCII mnemonics. The tuner also supports register-based VXI operations. Each communication method is discussed in the following paragraphs.

3.3.5 WORD SERIAL IEEE-488.2 COMMANDS

The word serial command messages used with the unit consist exclusively of ASCII-encoded data.

COMMAND MESSAGE FORMAT

Command headers consist of three-character mnemonics which are defined in the command tables provided in this section. Headers are case independent and may be entered in upper or lower case letters. IEEE 488.2 communication commands must be prefixed with an "*" character. All queries must be suffixed with the "?" character. The command parser ignores all "white space" (ASCII 0 through 20 hex, with exceptions being communication protocol characters). The parser accepts numeric arguments in the forgiving numeric representation form (described below). Multiple commands must be separated by the ";" character. Multiple arguments of a single command must be delimited with "," character(s). Message strings sent to the tuner must be terminated with a linefeed (0A hex) character or VXI (END).

COMMAND MESSAGE PROCESSING

All command message data is stored in the input buffer until a valid message termination is received. The message is then parsed and executed. Additional command message data may be sent to the unit within the boundaries of the input buffer.

The command message format is checked for validity as the message is parsed and executed. If the command message fails to meet the restrictions of the command message format, an error is generated in an Event Status Register and the rest of the message is processed normally.

QUERY RESPONSE FORMAT

Query responses maintain a fixed field format. Query responses begin with the mnemonic in upper case letters. Responses containing numeric arguments separate the first argument and the mnemonic with a " " (space) character. Numeric arguments are represented by the least number of digits necessary to represent the entire range of the argument. If the argument can be negative then a sign character ("+" or "-") is given. Multiple arguments are delimited by "," character(s). Responses to concatenated queries are concatenated in the output buffer, delimited by “,” characters. The tuner terminates all query responses with a carriage return (0D hex) character followed by a linefeed (0A hex).

NUMERIC DATA REPRESENTATION

Numeric arguments used with commands are accepted in a forgiving numeric representation. Numeric arguments that appear in query responses are in a fixed field format. Specific details on numeric representation used in this document are given below.

nrf - forgiving numeric representation

The nrf data element is composed of the sequential fields listed below. All fields are optional with one restriction: at least one digit must be present within the active data element.

1. Plus (+) or minus (-) sign.
2. Any number of digits, up to eight.
3. Decimal point.
4. Any number of digits, up to eight.
5. Uppercase or lower case "E,e" followed by an optional sign and at least one digit but no more than three digits.

This format specifies all numeric input data. If the unit receives an nrf argument of a precision greater than it can handle, rounding is used.

nr1 - numeric response data - integers

This numeric response data format is composed of an optional sign, followed by any number of digits. The decimal point is implicitly defined to follow the last digit and is not present in the data element.

nr2 - nr2 numeric response data - real

This numeric response data format is composed of an optional sign field, followed by any number of digits, a decimal point, and any number of digits. As implied, there must be at least one digit on either side of the decimal point. The resolution of this numeric data for frequency responses may be selected with the #FFE User Configuration message. Refer to **Table 3-14** for details on the #FFE command.

3.3.6 REGISTER BASED VXI OPERATIONS

The unit supports control of base hardware functions with optimized binary register based commands. These commands are optimized for tightly integrated VXI systems. The register based commands save VXI I/O time and internal tuner firmware processing time. In order to minimize the processing time required for these commands error checking is minimal. It is the responsibility of the user application to only send valid commands and data. The unit will accept a combination of binary register operations and word serial operations with the last operation executed taking precedence. The available VXI binary commands are discussed in the following paragraphs.

BINARY COMMANDS

The unit may be controlled by writing commands to either the VXI device dependent registers or through the lower portion of upper memory as assigned by the Resource Manager. Binary commands allow control of frequency and attenuation. Binary commands allow a higher speed of operation than word serial operations. Binary Commands also require less data transfer time and parsing than word serial commands. To optimize performance, there is a minimum of error checking with the binary commands and it is the responsibility of the user's application to prevent sending invalid binary commands to the tuner.

The unit has the ability to accept VXI commands via the Command RAM which acts as a bank of registers for binary communications. Also, the same data may be written to the upper memory area of the VXI memory. A memory map of the available binary commands is shown in **Table 3-2**. Note that the various parameters associated with the binary commands have the same value ranges and settings as the word serial commands, with the exception of the frequency and attenuator commands. The frequency is entered in units of 10s of hertz. For example, to tune to 214.34560 MHz (0d21434560 = 0x14710C0), the value 0x014710C0 needs to be written to the frequency data registers (0x0147 to the High Word and 0x10C0 to the Low Word). The attenuator data range is from 0 to 28, in 1-dB steps, representing the word serial range of 0 through 56 in 2-dB steps.

Table 3-2. VXI Memory/Register Based Commands

Address Base + 0x00xx	Description
20	Fast Command 1 - Not Used
22	Fast Command 2 - Not Used
24	Fast Command 3 - Not Used
26	Fast Command 4 - Not Used
28	Fast Command 5 - Not Used
2A	Binary Command - Bit-Mapped register that indicates what commands to execute. Bit 15-12 - Not Used Bit 11 - Manual ATE Command Bit (ATE) Bit 10 - Not Used Bit 9 - Not Used Bit 8 - Not Used Bit 7 - Not Used Bit 6 - Not Used Bit 5 - Not Used Bit 4 - Manual ATN Command Bit (ATN, PAM) Bit 3 - Not Used Bit 2 - Not Used Bit 1 - Not Used Bit 0 - FRQ Command Bit
2C	FRQ_HI_DATA - High Word of Frequency long word (10 Hz resolution)
2E	FRQ_LO_DATA - Low Word of Frequency long word (10 Hz resolution)
30	Not Used
32	MAN_ATTN_DATA_1 - Manual Attenuation Data Word 1 Bit 15-9 - ATN Value : Range = 0 - 28 in increments of 1. Represents 0 - 56 dB in 2-dB increments. Bit 8 - PAM Mode : 0 = OFF ; 1 = ON Bit 7-0 - Not Used
34	Not Used
36	Not Used
38	MAN_ATE_DATA - Manual ATE Data Word Bit 15-4 - Not Used Bit 3 - 0 - ATE Value – 0-, 6-, 12-dB
3A	Not Used
3C	Binary Status Word - This register is reserved to supply status to the user of various tuner functions. Bit 15-3 – Unused Bit 2 - Binary Command Status : 0 = No Error ; 1 = Error Bit 1 - IF_VALID - Set at the end of a tune word when the IF is valid Bit 0 - LO_LOCK - Set at the end of a tune word when the LOs are Locked
3E	Not Used

BINARY COMMAND PROTOCOL

A specific protocol is required when implementing binary commands. The control application must first check to see that all previous binary commands have been completed. This is done by reading the binary command register to see that it is clear. If it is not clear, then the application must wait until it is. Then a new binary command may be entered. First, the application must update the desired data in the data registers (2C-38) and then set the bits in the binary command register (2A) for each data parameter that is to be updated. When the binary command register is written, the unit starts processing the new binary command data. The data registers must not be rewritten until the binary command register is cleared by the tuner. In the event multiple bits are set in the command register, processing will be in the sequence indicated below:

1. FRQ
2. Manual Attenuation
   a. ATN
   b. PAM
3. Manual FE Attenuation (ATE)

The frequency command is processed first because it takes the longest to complete.

After the tuner has processed a command, the corresponding bit in the binary command register is cleared. The application must wait until all the bits in the binary command have been cleared before issuing another set of commands. However, the application may take advantage of polling the binary command register and updating the data registers before the tuner has processed the last piece of data; i.e., while the tuner is processing attenuation data, the user can update the frequency data.

3.3.7 INTERRUPTERS

The tuner is a message-based VXI device with interrupter capability. The tuner requires one VXIbus interrupt line for operation. The interrupt line is used when the tuner has asserted a service request (SRQ). The "*assign interrupt line"* word serial command (see **paragraph 3.3.1**) is used to assign interrupt lines to a VXIbus device.

The tuner asserts an SRQ from error status conditions. The details of SRQ generation are presented in **paragraph 3.4.4**.

3.4 TUNER OPERATIONS

The following paragraphs describe the word serial commands which are used to control and query the operational parameters of the unit. All commands use IEEE-488.2 ASCII mnemonics and the command messages consist exclusively of ASCII-encoded data. Refer to **paragraph 3.3.4** for

specific details on communication protocol. **Table 3-3** contains an alphabetical listing of unit commands and queries. Word serial commands are divided into the following operational subcategories:

- Setup Operations
- Manual Control
- Memory Operation
- Communication
- Error Messages
- Master/Slave LO's
- User Configuration
- Factory Configuration
- Maintenance

Table 3-3. Command/Query Alphabetical Listing

Command	Table Number	Description
ADC	3-17	Request ADC Reads for all eight inputs to the ADC.
ATE nrf	3-8	Set Frequency Extender Attenuation
ATE?	3-8	Request Frequency Extender Attenuation
ATI nrf	3-17	Set IF attenuators
ATI?	3-17	Request current IF attenuator setting
ATN nrf	3-8	Set tuner attenuation
ATN?	3-8	Request current tuner attenuation value
ATR nrf	3-17	Set RF attenuators
ATR?	3-17	Request RF attenuator setting
BND nrf	3-17	Set the preselector band
BND?	3-17	Returns the active preselector band
#CBR nrf	3-14	Set User BAUD Rate for RS-232 port
#CBR?	3-14	Request current user BAUD Rate
#CCT nrf	3-15	Copy Memory
#CCT?	3-15	Returns status of memory copy
CDE?	3-12	Request the current device Error Register contents
#CDT nrf,nrf,nrf	3-16	Set the date of configuration
#CDT?	3-16	Request the configuration date
CFG nrf	3-14	Set configuration status on or off
CFG?	3-14	Request status of the configuration mode
CLM nrf	3-6	Clear specified channel storage memory

Table 3-3. Command/Query Alphabetical Listing (Continued)

Command	Table Number	Description
*CLS	3-11	Clear all communication status registers.
#COP nrf	3-16	Set the options configured in the unit
#COP?	3-16	Request the options configured in the unit
#CSN nrf	3-14	Set the unit's serial number
#CSN?	3-14	Request the unit's serial number
DDE?	3-12	Request the latched error status
#EED 0	3-16	Load default configuration data to EEPROM
#EED?	3-16	Return current value in EEPROM
*ESE nrf	3-11	Set up the Event Status Enable Register
*ESE?	3-11	Read the current value of the Event Status Enable Register
*ESR?	3-11	Return the current setting of the Event Status Register
#FFE nrf	3-14	Set nr2 Output Format
#FFE?	3-14	Request current nr2 output style
FRG?	3-7	Request the lower and upper frequency limits of the tuner
FRQ nrf	3-7	Set tuned frequency of tuner
FRQ?	3-7	Request current tuned frequency
*IDN?	3-11	Request tuner’s identity
LOM nrf	3-13	Set LO Mode
LOM?	3-13	Request current LO Mode
#MDL	3-16	Set the unit's model number
#MDL?	3-16	Request the unit's model number
*OPC	3-11	Operation complete switch
*OPC?	3-11	Respond with OPC string when the operation is complete
*OPT?	3-11	Request a bit-mapped value of the installed options
PAM nrf	3-17	Turn preamplifier on or off
PAM?	3-17	Request preamplifier setting
RCE nrf	3-10	Recall and execute the specified memory channel
REF nrf	3-4	Set Reference to Internal or External
REF?	3-4	Request Reference Setting
RMD nrf?	3-9	Recall current tuner parameters from specified memory channel
*RST	3-5	Set all tuner device messages to the reset values
RTK nrf?	3-11	Request Token

Table 3-3. Command/Query Alphabetical Listing (Continued)

Command	Table Number	Description
RTK	3-11	Return token to tuner allowing it to be requested by another controller
SMD nrf,nrf,nrf, nrf,nrf,nrf, nrf,nrf,nrf, nrf,nrf,nrf, nrf,nrf,nrf, nrf,nrf,nrf	3-9	Store directly to the specified memory channel
*SRE nrf	3-11	Setup the Service Request Enable Register
*SRE?	3-11	Read Service Request Enable Register
*STB?	3-11	Request the Status Byte Register
STO nrf	3-10	Store current parameters to the memory channel specified
TSP nrf	3-7	Selects tuning resolution
TSP?	3-7	Request current tuning resolution
*TST?	3-12	Returns same value as DDE? query
#YCL	3-16	Initiates a Calibration of the YIG DAC
#YCL?	3-16	This returns the status of the most recent YIG DAC calibration
#YIG nrf,nrf	3-16	Set the YIG DAC tuning voltage values at 0 MHz and 2700 MHz respectively
#YIG?	3-16	Request Current YIG DAC Settings

3.4.1 SETUP OPERATIONS

Tuner setup operations are global commands that affect the unit regardless of the current operational mode. These commands include external reference selection, the tuner reset operation, and the clear storage memory operation. The commands in this message category are described in the following paragraphs.

REFERENCE SELECTION

The unit can have its frequency referenced to one of three sources: an internal reference oscillator, an external 10 MHz input on the front panel of the tuner, or the VXI 10 MHz bus reference. The tuner always powers up using the internal reference oscillator. If an external reference is selected, it must be present (otherwise the tuner LOs will become unlocked). The commands in this message category are listed in **Table 3-4**.

Table 3-4. Reference Selection

Command	Response	Description
REF nrf		Set Reference to Internal or External 0 = Internal Reference 1= VXI Bus Reference 2 = External Reference
REF?	REF nr1	Request Reference Setting Reset: REF 0 Example: REF 1

RESET

The *RST command returns all tuner parameters to their reset values (the same values which occur at power up). The reset command does not affect the contents of channel memory or SRQ registers. The commands in this message category are listed in **Table 3-5.**

Table 3-5. Reset

Command	Response	Description
*RST		Set all tuner device messages to the reset values.

MEMORY CLEAR

The memory clear (CLM) command allows clearing of channel storage memory. If the CLM 1 command is sent, storage memory will be cleared. The command in this message category is listed in **Table 3-6**.

Table 3-6. Memory Clear

Command	Response	Description
CLM nrf		Clear channel storage memory. nrf Description 1 Clear channel storage memory

3.4.2 MANUAL CONTROL

When the tuner is in the manual operating mode, the operating frequency and tuner attenuation parameters may be controlled. Frequency and tuner attenuation operations are described in the following paragraphs.

FREQUENCY OPERATIONS

The tuner supports a frequency range query (FRG?) that returns the upper and lower frequency limits of the tuner. This query allows an application to configure itself based on the current frequency limits. The frequency query (FRQ?) is always valid and will return the current tuner frequency.

Use the frequency command (FRQ) to set the tuner's frequency. The limit of the command is 0 MHz to 6000 MHz.

The tuner supports two combinations of tuning speed and tuning resolution. These tuning modes are selected by the tuning speed command (TSP). This allows tuning to be optimized for either speed or resolution. Tuning speed one (TSP 1) offers 100 Hz resolution and a worst case tuning time of less than 8 ms. Tuning speed two (TSP 2) offers 1 kHz resolution and a typical tuning time of less than 3 ms for 25 kHz steps. The worst case tuning time for TSP 2 is less than 6 ms. When TSP 2 is active, the tuner always accepts the frequency inputs with a resolution of 100 Hz and then internally rounds the value to the nearest 1 kHz before tuning the second LO. A query response will retain the originally input 100 Hz value. The default tuning speed setting is TSP 2 (1 kHz).

The frequency operations commands (frequency range query, frequency, and tuning resolution commands) are listed in **Table 3-7**.

Table 3-7. Frequency Operations

Command	Response	Description
FRG?	FRG nr2, nr2	Request the lower and upper frequency limits of the tuner. Reset: n/c Example: FRG 0002.0000, 2700.0000 (E2730B) FRG 0002.0000, 6000.0000 (E2731B)
FRQ nrf		Set tuned frequency of tuner. Range: 0 – 27 MHz (E2730B) 0 – 6000 MHz, (E2731B) 100 Hz resolution
FRQ?	FRQ nr2	Request current tuned frequency. Reset: FRQ 0020.0000 Example: FRQ 2699.9999
TSP nrf		Selects tuning resolution 1 = 100 Hz, 2 = 1 kHz
TSP?	TSP nr1	Request current tuning resolution Reset = TSP 2 Example = TSP 1

TUNER ATTENUATION OPERATIONS

Gain control of the tuner is accomplished using the ATN and ATE commands. The ATN command allows the reduction of gain from maximum (ATN 0) in approximately 2-dB increments to gain minimum (ATN 56). The ATE command provides for three attenuation steps (0 dB, 6 dB and 12 dB) used to incorporate frequency extender attenuation in the system attenuation. The commands in this message category are listed in **Table 3-8**.

Table 3-8. Tuner Attenuation

Command	Response	Description
ATE nrf		Set the Frequency Extender attenuation. 0-dB, 6-dB, or 12-dB (E231B only).
ATE?	ATE nr2	Request current Frequency Extender attenuation (E2731B only).
ATN nrf		Set the tuner attenuation. Range 0-56 dB, resolution is 2-dB.
ATN?	ATN nr2	Request current tuner attenuation. Reset: ATN 000 Example: ATN 030

3.4.3 MEMORY OPERATION

A memory channel contains an entire setup for a single frequency. A total of 200 memory channels are provided. Memory channels may be accessed directly via the Store Memory Direct (SMD) and Read Memory Direct (RMD) commands. Memory channels may also be accessed by setting up the single frequency parameters and then storing them with the Store Channel (STO) command or by recalling a specified channel with the Recall and Execute (RCE) command and then reading the channel data with the individual queries.

DIRECT MEMORY COMMANDS

Direct memory commands allow access to memory channels without impacting the current tuner operation. The first argument after the SMD or RMD command identifies the channel number (which can be zero to indicate current tuner operations or one to 200 to specify a memory channel). The remaining fields are the data values associated with the mnemonic parameters as indicated in the **Table 3-9**.

The SMD command can be sent in abbreviated form after any completed field. The remaining fields in the channel will be unchanged. Fields that are not to be altered may be skipped by concatenation of the commas.

The commands in this message category are listed in **Table 3-9**.

Table 3-9. Direct Memory Commands

Command	Response	Description
RMD nrf?	SMD nr1, nr1, nr2,nr1,nr1,nr1, nr1,nr1,nr1,nr1, nr1,nr1,nr2,nr2, nr2,nr1,nr2,nr2	Recall current tuner parameters from specified memory channel. Response parameters are the same as the SMD Command. Reset: SMD 001,0,0020.000,01,+00,1,0, 000,0,+000,-001,+00,0020.0000,2700.0000, 0000.1000,1,+0.00,+0000.0000 Example: SMD 001,0,1234.5678,01,+00,1,0, 024,0,+000,+005,+00,0002.0000,2700.0000, 0000.1000,0,+0.00,+0000.0000
SMD nrf,nrf, nrf,nrf,nrf,nrf, nrf,nrf,nrf,nrf, nrf,nrf,nrf,nrf, nrf,nrf,nrf,nrf		Store directly to the specified memory channel the following data list. Field — Parameter — Range 1 Memory Channel Number 0 to 200 2 Idle Mode Status (IDM) Ignored 3 Tuned Frequency (FRQ) See FRQ 4 Bandwidth Slot (BWS) Ignored 5 COR (COR) Ignored 6 Detection Mode (DET) Ignored 7 AGC Mode (AGC) Ignored 8 Attenuation Setting (ATN) 0 to 56 9 AFC Mode (AFC) Ignored 10 Pre Dwell (PDW) Ignored 11 Signal Dwell (SDW) Ignored 12 Loss Dwell (LDW) Ignored 13 Sweep Start Freq. (FRA) Ignored 14 Sweep Stop Freq. (FRB) Ignored 15 Sweep Increment Freq. (INC) Ignored 16 Sweep Direction (SWD) Ignored 17 BFO Frequency (BFO) Ignored 18 IFO Frequency (IFO) Ignored

STORE AND RECALL OPERATIONS

Store and recall memory operations allow the current tuner operating parameters to be stored in a memory channel and allow the parameters associated with a memory channel to be recalled as the current operating parameters.

The Store (STO) command stores the current tuner parameters in the memory channel specified. The Recall (RCE) command causes the tuner to use the parameters of the specified memory channel for current operations. The commands in this message category are listed in **Table 3-10**.

Table 3-10. Store and Recall Operations

Command	Response	Description
RCE nrf		Recall and execute the specified memory channel. Range: 1 to 200 (valid memory channels)
STO nrf		Store current parameters to the memory channel specified. Range: 1 to 200 (valid memory channels)

3.4.4 COMMUNICATION MESSAGES AND SERVICE REQUEST OPERATIONS

The mnemonics in this message category are always valid. These commands establish communications and control the event interrupts between the unit and the controller and do not alter the hardware functions of the tuner. The commands associated with this message category are described in the following paragraphs.

Most of the messages in this category are used to control and monitor the SRQ operation of the tuner. The exceptions are the Identity query (*IDN) which responds with the tuner's identity, a future Option query (*OPT?), and the Request Token (RTK) command. The RTK command allows the tuner to indicate (with a numeric argument) who is in control. This command can be used to arbitrate control between the VXI interface and the RS-232 interface of the tuner.

The unit supports the IEEE-488.2 Service Request (SRQ) capability. This capability is implemented through a series of layered enable and status registers. The tuner is capable of generating (SRQ) interrupts for numerous events. These include communication errors and hardware errors. The SRQ structure diagram is shown in **Figure 3-1**. This diagram shows the layers of enable and status registers that support the SRQ operation.

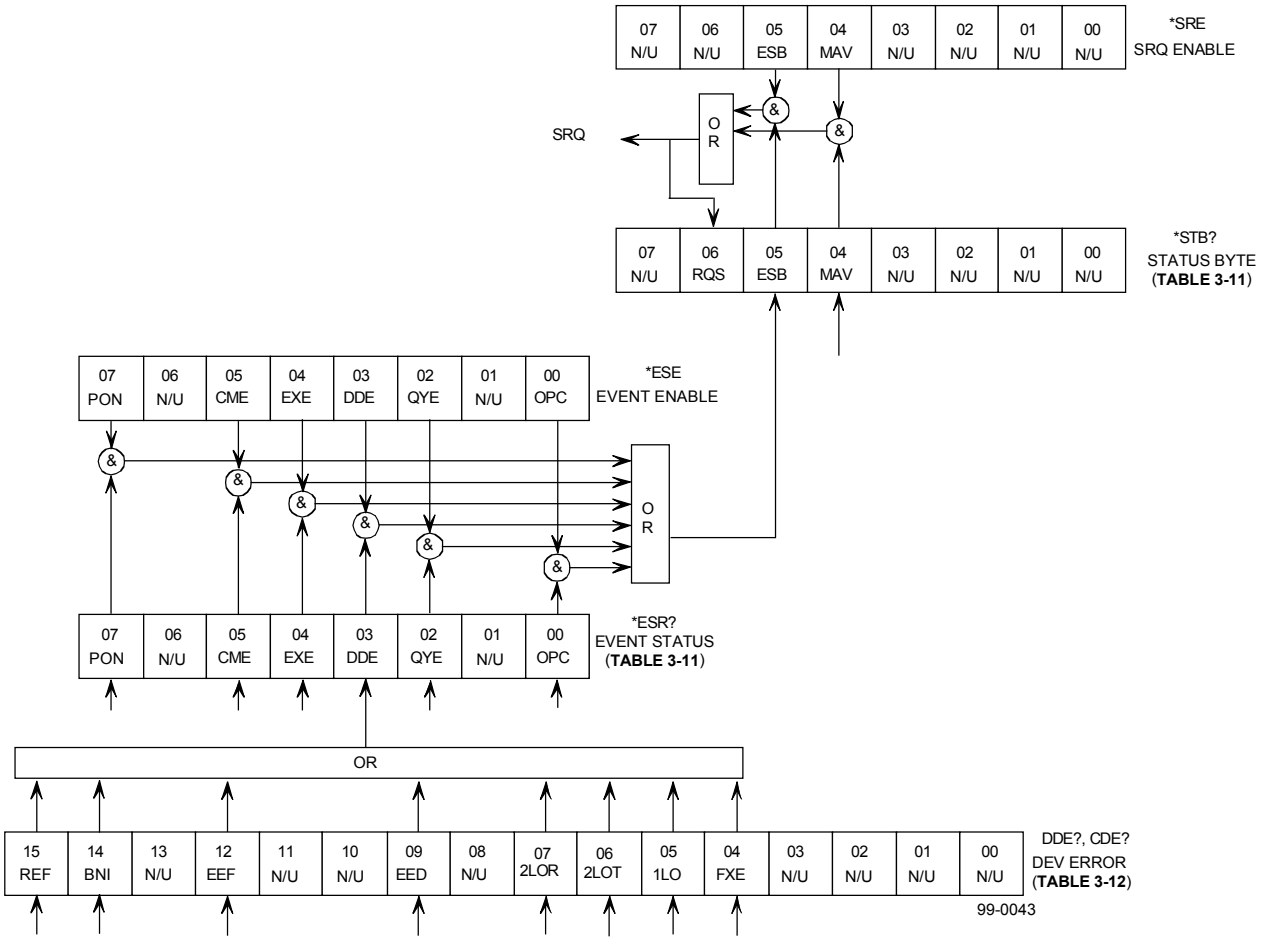

Figure 3-1. Service Request Structure Diagram

The highest level registers are the Service Request Enable (*SRE) and Status Byte (*STB) registers. The *STB register contains the Message Available (MAV) bit, Event Status Bit (ESB), and Request for Service Bit (RQS). Each of these event bits (except the RQS) may be enabled via the *SRE register. SRQ generation occurs when the event bit and its corresponding enable bit are both true. The event bits are set regardless of the status of the corresponding enable bit. The user's application is responsible for "anding" the status register with the enable register to determine the cause of the SRQ. Both registers can be read non-destructively. The event bits are cleared when their corresponding registers are read. The RQS bit indicates that an enabled event has set SRQ in this tuner. This bit is cleared by the VXI Spool Read STB operation.

The ESB bit indicates an enabled event in the Event Status Register (*ESR) occurred. The *ESR contains bits to indicate Operation Complete (OPC), Query Error (QYE), Device Dependent Error (DDE), Execution Error (EXE), Command Error (CME), and Power On (PON). The Event Status Enable Register (*ESE) contains a corresponding enable bit for each event. The OPC event is set upon completion of the parsing of a command string which includes the *OPC command. A QYE event is generated when previously queried data is discarded without having been read. The DDE event occurs when the tuner detects a failure of one or more of the monitored hardware subsystems and the enable DDE bit in the *ESE is set. Reading the DDE register indicates the cause for the failure event. The EXE bit is set to indicate that the tuner has received a valid command with an out-of-bounds argument. The CME bit indicates the tuner has received an unknown or invalid command mnemonic. The PON bit is set whenever the unit power is cycled. Anytime the control software restarts, the PON bit is set.

The mnemonics associated with this message category are listed in **Table 3-11**.

Table 3-11. Communications Messages and SRQ Operations

Command	Response	Description
*CLS		Clear all communication status registers.
*ESE nrf		Set up the Event Status Enable Register. Bit definitions are same as Error Status Register (*ESR).
*ESE?	*ESE nr1	Read the current value of the Event Status Enable Register. Reset: n/c Example: *ESE 000
*ESR?	*ESR nr1	Return the current setting of the Event Status Register. Bit / Value / Description 0 / 1 / OPC operation 1 / 2 / Not Used 2 / 4 / QYE (query error) 3 / 8 / DDE (device-dependent error) 4 / 16 / EXE (execution error) 5 / 32 / CME (command error) 6 / 64 / Not Used 7 / 128 / PON (power on) Reset: N/C Example: *ESR 128

Table 3-11. Communications Messages and SRQ Operations (Continued)

Command	Response	Description
*IDN?	*IDN str	Request the tuner's identity. Response is manufacture, model, serial number, and firmware version number. Reset: n/c Example: *IDN Agilent Technologies, E2731B US39440101, 02.00.06
*OPC		Operation complete switch. Causes SRQ upon event processing if enabled.
*OPC?	*OPC 1	Respond with OPC string when the operation is complete.
*OPT?	*OPT nr1	Request a bit-mapped value of the installed options. Bit 0 - 6 GHz Frequency Extender installed Bits 7 thru 1 - Reserved Bit 8 - 32K EEPROM Bits 15 thru 9 - Not Used Reset: n/c Example: *OPT 00000
RTK nrf?	RTK nr1	Request Token. Returned value will either be the number entered or another controller's token value if the token was not zero when the request was received. The valid arguments are 0 to 99. Reset: n/c Power up: RTK 00 Example: RTK 01
RTK 0		Return token to tuner allowing it to be requested by another controller. Sets tuner token to 0.
*SRE nrf		Set up the Service Request Enable Register. Bit definitions are same as Status Byte Register (*STB) except that bit 6 is not used in this register.
*SRE?	*SRE nr1	Read Service Request Enable Register. Reset: n/c Example: *SRE 000
*STB?	*STB nr1	Request the Status Byte Register. Bit Value Description 0 1 Not Used 1 2 Not Used 2 4 Not Used 3 8 Not Used 4 16 MAV, Message Available bit 5 32 ESB, Event Summary bit 6 64 RQS, Request Service bit 7 128 Not Used Reset: n/c Example: *STB 064

3.4.5 HARDWARE ERROR MESSAGES

The unit performs both startup built-in internal tests and continuous monitoring of key tuner operations. The tuner responds to a command which reruns the startup test and also queries to determine the current status of these operations along with the history since the last status request. The errors indicated in these messages are all hardware errors and should not occur as a result of normal operation. When the tuner detects one of these errors the ERR LED on the front panel illuminates indicating the error condition.

At startup, the tuner verifies proper logic download and LO lock status. The error status bits are set to indicate the results of startup tests.

During normal operation the tuner LO status is continually monitored. The error status bits are set to indicate the results of the monitoring operations.

The tuner includes three command queries for determining hardware error status. Each of the commands returns a bit-mapped value between 0 and 65535, where each bit indicates the hardware status of a particular subsystem of the tuner.

The Current Device Error status query (CDE?) returns the current status of the LO subsystems. This is not a latched register. If an LO went unlocked and then re-locked prior to the CDE? query, there would be no evidence of this error in the response.

The Device Dependent Error status query (DDE?) returns a latched history of any errors that have occurred since the last read of this register. Reading the DDE register clears any latched errors. If the error condition still exists, the bit will be immediately reactivated.

The *TST command responds with same data as the DDE? query. However, the *TST status query does not clear the latched Device Dependent Error status register.

The mnemonics associated with this message category are listed in **Table 3-12**.

Table 3-12. Hardware Error Messages

Command	Response	Description
CDE?	CDE nr1	Request the current device Error Register contents. Reading this register does not affect its contents. This is a bit-mapped response where 0 = (Okay) and 1 = (Fault). Bit / Value / Description 0 / 1 / Not Used 1 / 2 / Not Used 2 / 4 / Not Used 3 / 8 / Not Used 4 / 16 / FXE, FLEX Bootload failure 5 / 32 / 1LO, 1st LO unlocked 6 / 64 / 2LOT, 2nd LO Translation Loop unlocked 7 / 128 / 2LOR, 2nd LO Resolution Loop unlocked 8 / 256 / Not Used 9 / 512 / EED, EEPROM has been defaulted 10 / 1024 / Not Used 11 / 2048 / Not Used 12 / 4096 / EEF, EEPROM failure to be written 13 / 8192 / Not Used 14 / 16384 / BNI, Board Not Installed 15 / 32768 / REF, Reference Generator unlocked Reset: n/c Example: CDE 00016

Table 3-12. Hardware Error Messages (Continued)

Command	Response	Description
DDE?	DDE nr1	Request the latched error status. Reading this register clears it until the fault reoccurs. This is a bit-mapped response where 0 = (Okay) and 1 = (Fault). Bit / Value / Description 0 / 1 / Not Used 1 / 2 / Not Used 2 / 4 / Not Used 3 / 8 / Not Used 4 / 16 / FXE, FLEX Bootload failure 5 / 32 / 1LO, 1st LO unlocked 6 / 64 / 2LOT, 2nd LO Translation Loop unlocked 7 / 128 / 2LOR, 2nd LO Resolution Loop unlocked 8 / 256 / Not Used 9 / 512 / EED, EEPROM has been defaulted 10 / 1024 / Not Used 11 / 2048 / Not Used 12 / 4096 / EEF, EEPROM failure to be written 13 / 8192 / Not Used 14 / 16384 / BNI, Board Not Installed 15 / 32768 / REF, Reference Generator unlocked Reset: n/c Example: DDE 00000
*TST?	*TST nr1	Returns same value as DDE? query. This query does not clear the latched error register. Reset: n/c Example: *TST 00000

3.4.6 MASTER/SLAVE MESSAGES

The commands in this message category control the master/slave LO operations. These commands are used when tuners are connected in multiple configurations and phase coherence is required.

The commands that are used to control the master/slave LO operation are listed in **Table 3-13**.

Table 3-13. Master/Slave Messages

Command	Response	Description
LOM nrf		Set the LO Mode. 0 – Independent 1 – Master 2 – Slave
LOM?	LOM nr1	Request current LO Mode. Reset: LOM 0 Example: LOM 1

3.4.7 USER CONFIGURATION MESSAGES

The commands in this message category, which begin with the pound sign (#), are valid only when the tuner is in configuration mode. These commands are used to configure the tuner's EEPROM. The parameters associated with these commands are retained by the tuner and are not reset on power up. To use these commands the tuner must first be placed in the configuration mode by sending the CFG 1 command. After setting the configuration parameters, the tuner must be removed from the configuration mode by sending CFG 0. The mnemonics associated with this message category are listed in **Table 3-14**.

Table 3-14. User Configuration Messages

Command	Response	Description
#CBR nrf		Set User BAUD Rate for RS-232 port. Valid Values: 1200, 2400, 4800, 9600, 19200, 38400
#CBR?	#CBR nr1	Request current user BAUD Rate Default: #CBR 19200 Example: #CBR 09600
CFG nrf		Set configuration status on or off. Normal operation is with configuration off (0). When configuration is on (1) EEPROM data in the tuner may be written.
CFG?	CFG nr1	Request status of the configuration mode. 0 = Unit is set to operation mode 1 = Unit is set to configuration mode Reset: n/c Example: CFG 0
#CSN		Set the customer serial number
#CSN?	#CSN nr1	Request the unit's serial number. Default: #CSN US00000000 Example: #CSN US39440722
#FFE nrf		Set nr2 output format. 0 nr2 output format = xxxx.xxxx 1 nr2 output format = xxxx.xxxxx 2 nr2 output format = xxxxx.xxxx 3 nr2 output format = xxxxx.xxxxx
#FFE?	#FFE nr1	Return current nr2 output format. Default: #FFE 0 Example: #FFE 0

DATA STORAGE/RETRIEVAL

In addition to storing radio configuration data, the EEPROM offers storage for 30 KBytes of user data.

To place user data in the EEPROM, data is written to shared memory in the A24 memory space beginning at offset 0x40 from the base address of the device's A24 memory assigned by the VXI Resource Manager. The data may extend up to, but not include, offset address 0x7840. The data is interpreted as binary data and thus the format does not matter.

Once data has been written into the shared memory by the user, it can be written to the EEPROM by using the #CCT 1 command (Refer to **Table 3-15**). This command transfers a 30Kbyte block of data from shared memory to the EEPROM. To query the status of the copy, the #CCT? query is used.

NOTE: Data is transferred from the EEPROM to shared memory on power up.

User data can be read from the EEPROM into shared memory using the #CCT 2 command. Once issued, a 30Kbyte block of data is transferred from the user programmable portion of the EEPROM to the shared memory.

NOTE: The #CCT2 command is only used if shared memory has been overwritten and needs to be restored using the data currently in the EEPROM.

Table 3-15. Data Storage/Retrieval Messages

Command	Response	Description
#CCT nrf		Copy memory. 1 – Copy from shared memory to EEPROM 2 – Copy from EEPROM to shared memory
#CCT?	#CCT nr1	This returns the status of the most recent memory copy. Results: -1 – Complete and Error Copying +0 – Complete and Copied +1 – Copy in Progress +2 – Copy not Started/Idle

3.4.8 FACTORY CONFIGURATION MESSAGES

The commands in this message category, which begin with the pound sign (#), are valid only when the tuner is in configuration mode. These commands are used to configure the tuner's EEPROM with parameters required for proper operation. These parameters should not be altered without factory direction. To use these commands the tuner must first be placed in the configuration mode by sending the CFG 1 User Configuration command (refer to **Table 3-14**). After setting the configuration parameters, the tuner must be removed from the configuration mode by sending CFG 0. The mnemonics associated with this message category are listed in **Table 3-16**.

> **NOTE:** Many of these parameters are unique to the particular tuner serial number and should not be changed.

Table 3-16. Factory Configuration Messages

Command	Response	Description
#CDT nrf,nrf,nrf		Set the date of configuration. Field — Parameter — Range 1 — Month — 1 to 12 2 — Day — 1 to 31 3 — Year — 0000 to 9999
#CDT?	#CDT nr1,nr1,nr1	Request the configuration date. Default: #CDT 01,01,2000 Example: #CDT 06,25,1997
#COP nrf		Set the options configured in the unit. Bit — Options 0 — Reserved 8 — Reserved Bits 1 thru 7 — Not used Bits 9 thru 15 — Not used
#COP?	#COP nr1	Request the options configured in the unit. Default: #COP 00000 Example: #COP 00000
#EED 0		Load default configuration data to EEPROM.
#EED?	#EED nr1	Return current value in EEPROM. Example: #EED 43690
#MDL str		Set the unit's model number. This command also sets the unit's VXI Hexadecimal Model Code. The change in model code affects the VXI Model code register when the unit is power cycled. Example: #MDL 'E2731B'

Table 3-16. Factory Configuration Messages (Continued)

Command	Response	Description
#MDL?	#MDL str, nr3	Request the unit's model number and VXI Hexadecimal Model Code. Default: #MDL 'E2731B ', 2D8 Example: #MDL 'E2731B ', 2D8 Note: The first six of the seven characters must never change. If they do, then the EEPROM will be reset upon the next power-up of the unit.
#YCL		Initiates a Calibration of the YIG DAC. This command should only be issued by qualified personnel and only after the tuner is at normal operational temperature.
#YCL?	#YCL nr1	This returns the status of the most recent YIG DAC calibration. Results: -1 - Complete and Uncalibrated +0 - Complete and Calibrated +1 - Calibration In Progress Example: #YCL +0
#YIG nrf,nrf		Set the YIG DAC tuning voltage values at 0 MHz and 2700 MHz respectively. This command should only be used by qualified personnel.
#YIG?	#YIG nr1,nr1	Request Current YIG DAC Settings. Example: #YIG +00000,+00000

3.4.9 MAINTENANCE MESSAGES

The commands in this message category are for maintenance operations only. These commands are not intended for normal applications and may interact with normal operations of the tuner. Powering the tuner down and back up will eliminate any of those interactions and return the tuner to normal operation. The mnemonics associated with this message category are listed in **Table 3-17**.

Table 3-17. Maintenance Messages

Command	Response	Description
ADC?	ADC nr1,nr1,...nr1	Request ADC Reads for all eight inputs to the ADC.
ATI nrf		Set IF attenuators. Range: 0 to 30, 2-dB steps
ATI?	ATI nr1	Request current IF attenuator setting. Reset : ATI 00 Example: ATI 14
ATR nrf		Set RF attenuators. Range: 0 to 30 - 2 dB steps
ATR?	ATR nr1	Request current RF attenuator setting. Reset: ATR 00 Example: ATR 22
BND nrf		Sets the preselector band. Range: 1 - 6 Where: 1 – Selects the 0 to 982 MHz band (E2730B) 2 – Selects the 982 to 2700 MHz band (E2730B) 3 – Selects the 2700 to 3600 MHz band (E2731B) 4 – Selects the 3600 to 4400 MHz band (E2731B) 5 – Selects the 4400 to 5200 MHz band (E2731B) 6 – Selects the 5200 to 6000 MHz band (E2731B)
BND?	BND nrl	Returns the active preselector band. Reset: BND 1 Default: BND 1
PAM nrf		Turn Pre-Amplifier OFF and ON. 0 = OFF 1 = ON
PAM?	PAM nr1	Request Pre-Amplifier Setting. Reset: 1 Default: 1

NOTES

SECTION 4

REPLACEMENT PARTS LIST

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SECTION 4 REPLACEMENT PARTS LIST

4.1 UNIT NUMBERING METHOD

The method of numbering used throughout the unit includes the assignment of reference designations (electrical symbol numbers) to identify: assemblies, subassemblies, modules within an assembly, and discrete components. An example of the unit numbering method is as follows:

Subassembly Designation A1	R1 Class and No. of Item
Identify from right to left as:	First (1) resistor (R) of first (1) subassembly (A)

On the main chassis schematic, components which are an integral part of the main chassis have no subassembly designations.

4.2 REFERENCE DESIGNATION PREFIX

The use of partial reference designations are used on the equipment and on the manual illustrations. This partial reference designation consists of the component type letter(s) and the identifying component number. The complete reference designation may be obtained by placing the proper prefix before the partial reference designation. Reference designation prefixes are included on the drawings and illustrations in the figure titles (in parenthesis).

4.3 LIST OF MANUFACTURERS

Mfr. Code	Name and Address
14632	Signia-IDT, Inc. 700 Quince Orchard Rd. Gaithersburg, MD 20878-1794 (301) 948-7550
71468	ITT Corp 666 E. Dyer Road Santa Ana, CA 92702
7Y213	Mica Microwave Group 7017 Realm Drive San Jose, CA 95119 (408) 363-9200

4.4 PARTS LIST

The following parts list contains all the major electrical components used in the unit, along with any mechanical parts which may be subject to unusual wear or damage. When ordering replacement parts, specify the unit type and the serial number. Also include the reference designation and the description of each item ordered. The list of manufacturers, provided in **paragraph 4.3** and the manufacturer's part number, provided in **paragraph 4.5** are supplied as a guide to aid the user of the equipment while in the field. The parts listed may not necessarily be identical with the parts installed in the unit. However, the parts listed in **paragraph 4.5** or **4.6** will provide satisfactory unit operation.

Replacement parts may be obtained from any manufacturer provided that the physical characteristics and electrical parameters of the replacement item are compatible with the original part. In the case where components are defined by a military or industrial specification, a vendor which can provide the necessary component is suggested as a convenience to the user.

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURERS PART NO.	MFR. CODE	RECM VENDOR

4.5 TYPE E2730B VXI RF TUNER — MAIN CHASSIS

	Revision B				
A1	Digital Control PC Assembly	1	483136-002	14632	
A1U18	EPROM, Programmed	1	181665-001	14632	
A1U19	Same as A1U18				
A2	1st LO PC Assembly	1	483134-001	14632	
A3	1st Converter PC Assembly	1	904409-001	14632	
A3U7	Upconversion Mixer, 3.7 GHz	1	092863-001	14632	
A4	2nd Converter PC Assembly	1	904412-001	14632	
A4T1	3.6-4.2 GHz Isolator, 18 dB	2	SMF950-F0310	7Y213	
A4T2	Same as A4T1				
A5	Front Panel Interface PC Assembly	1	902142-001	14632	
A5J2	Connector, D-Micro, 9-pin, Right Angle	1	MDSM-9PE-210	71468	
A6	Digital Interconnect PC Assembly	1	902184-001	14632	
A7	Not Used				
A8	YIG Assembly	1	384286-001	14632	

4.6 TYPE E2731B VXI RF TUNER — MAIN CHASSIS

	Revision B			
A1	Digital Control PC Assembly	1	483136-002	14632
A1U18	EPROM, Programmed	1	181665-001	14632
A1U19	Same as A1U18			
A2	1st LO PC Assembly	1	483134-001	14632
A3	1st Converter PC Assembly	1	904409-001	14632
A3U7	Upconversion Mixer, 3.7 GHz	1	092863-001	14632
A4	2nd Converter PC Assembly	1	904412-001	14632
A4T1	3.6-4.2 GHz Isolator, 18 dB	2	SMF950-F0310	7Y213
A4T2	Same as A4T1			
A5	Front Panel Interface PC Assembly	1	902142-001	14632
A5J2	Connector, D-Micro, 9-pin, Right Angle	1	MDSM-9PE-210	71468
A6	Digital Interconnect PC Assembly	1	902184-001	14632
A7	Not Used			
A8	YIG Assembly	1	384286-001	14632
A9	6 GHz Frequency Extender Assembly	1	9116B/FREQ/6G	14632
FE-W1	Cable Assembly, Flat, 10-Conductor	1	21039-0256	27264
FE-W2	Cable Assembly, Coaxial, MMCX for RG-405	1	902452-001	14632
FE-W3	Cable Assembly	1	902453-001	14632
FE-W4	Cable Assembly	1	902454-001	14632
FE-W5	Cable Assembly, RF, SMA to SMA	1	902584-001	14632
FL1	3.7 GHz Filter Assembly	1	384767-001	14632
J2	Connector, Modified	2	384205-001	14632
J8	Same as J2			

INDEX

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INDEX

INDEX (Continued)

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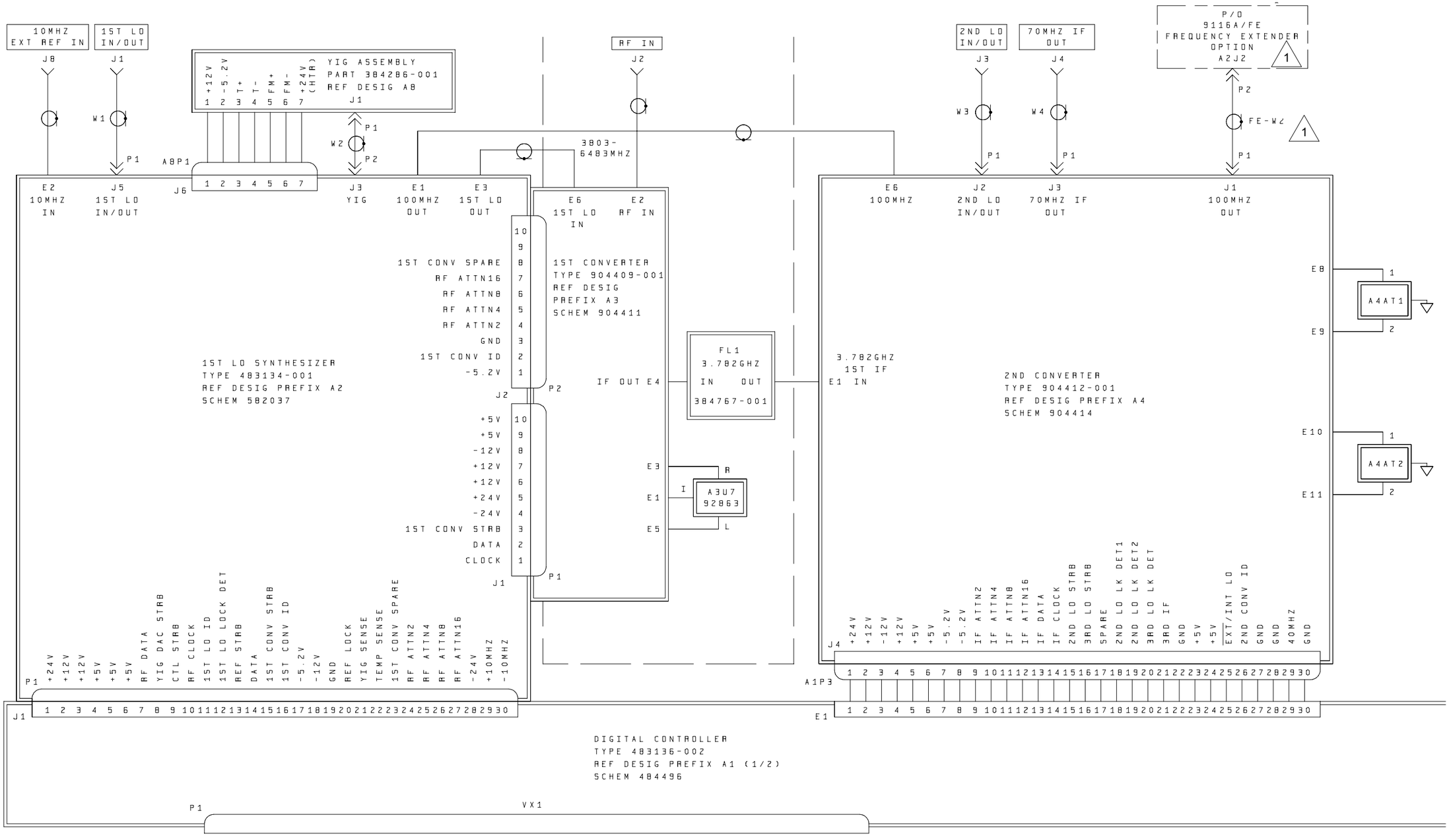
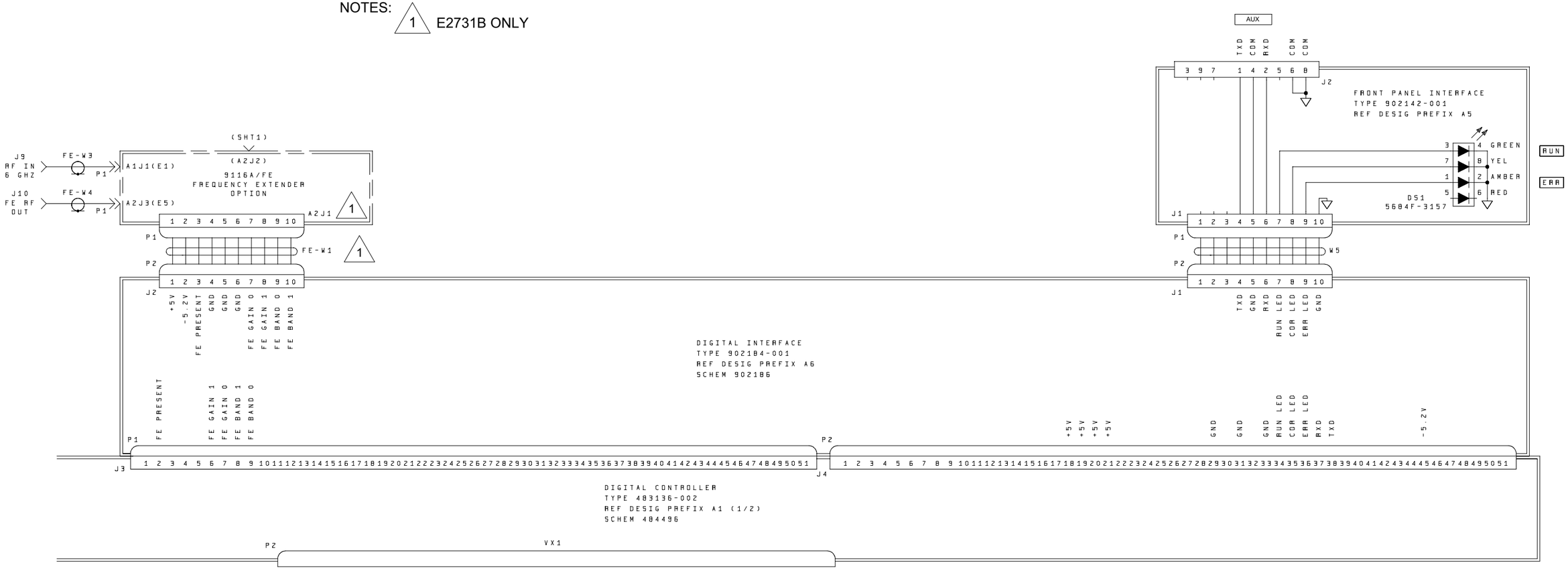
NOTES: 1 E2731B ONLY



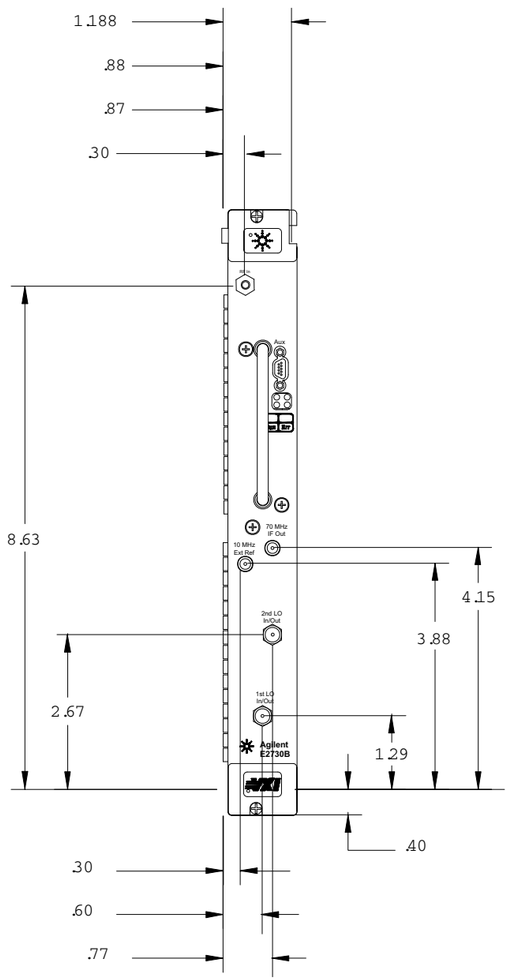
FO-1. E2731A VXI RF Tuner, Main Chassis Schematic Diagram 904425 (51) (Sheet 1 of 2)

NOTES:
1. E2731B ONLY



FO-1. E2731A VXI RF Tuner, Main Chassis Schematic Diagram 904425 (51 (Sheet 2 of 2)

E2730B



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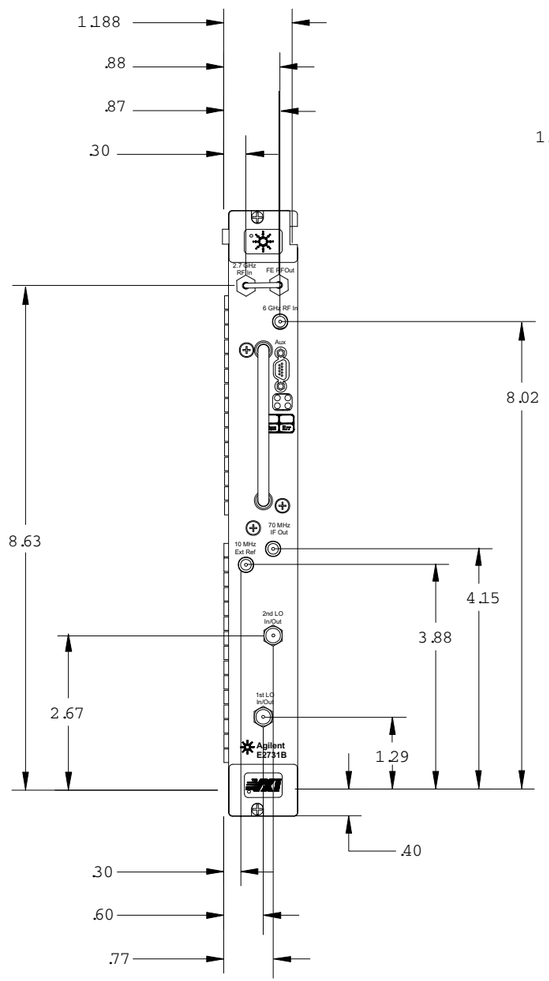

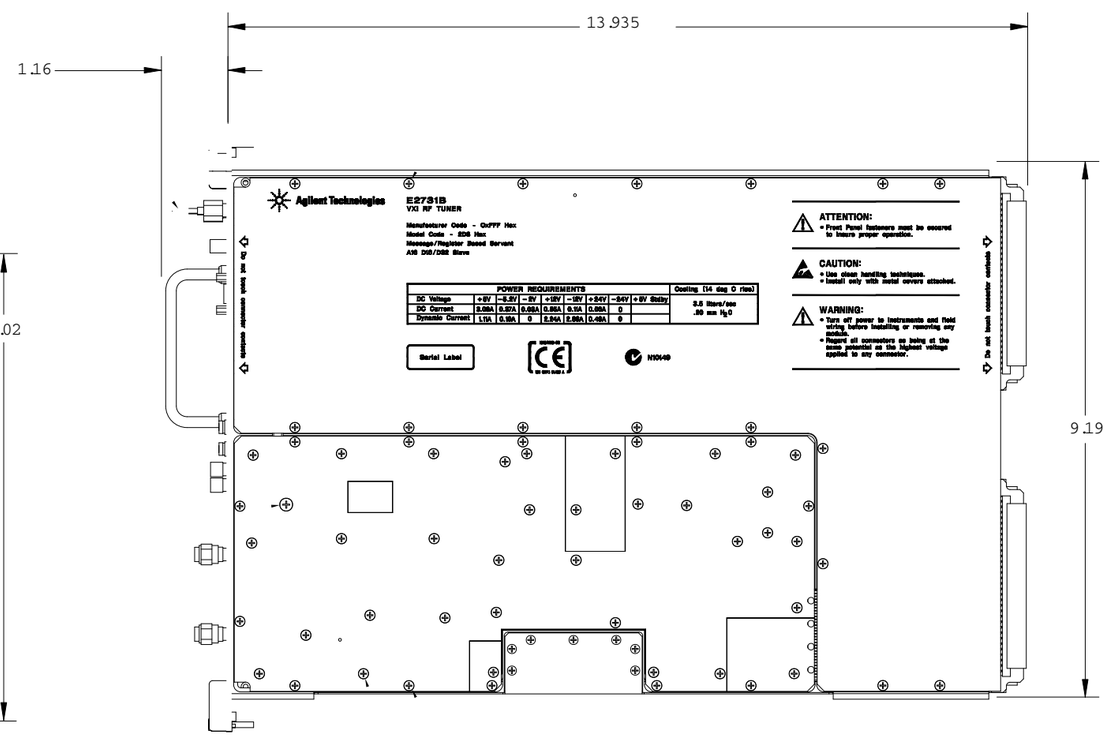

FO-2. Unit Critical Dimensions
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