This manual applies to the Vertex RSI Frequency Reference System with Microprocessor Controller, Model RMR1004.0001.
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ii Table of Contents
Section 1 General Information

1.1 How to Use This Manual

This manual contains information on how to install, operate, and maintain the VertexRSI Frequency Reference System with Microprocessor Controller and LNB Bandwidth Control. Information is organized according to section. Within each section, the pages, Figures, and Tables are numbered by section and by order of appearance within the section.

To locate information quickly, refer to the table of contents. To locate a figure or table, refer to the lists of figures and tables, which immediately follow the table of contents. To find a definition of an unfamiliar word or acronym, refer to the glossary of acronyms and terms at the end of the manual.

Section 7 contains warranty information and return procedures to be followed in the event that factory repair is required. Please refer to this section for information on how to contact the factory for service.

1.2 Safety Information

This equipment has been designed to minimize exposure of personnel to hazards, and is a safety class I device.

Servicing instructions are for use by service-trained personnel only. To avoid dangerous electric shock, do not perform any servicing unless qualified to do so. Do not replace components with the power cable connected to the equipment. Capacitors within the equipment may still be charged even if the power cable has been disconnected. Discharge before touching.

**WARNING**

Some adjustments described in this manual are performed with power applied while protective covers are removed. Always be careful not to come into contact with dangerous voltages while performing these procedures, and never work alone.

Do not operate this equipment in the presence of flammable gasses or fumes. Operation of any electrical equipment in
such an environment is dangerous, and can cause explosions and/or fires.

1.3 General Introduction

This technical manual provides operation and service instructions for the VertexRSI Frequency Reference System. The Frequency Reference System consists of a stable 10 MHz reference oscillator, power supply, microprocessor controller, and LNB frequency band controller, 6-way Tx combiner, and 6-way Rx splitter, all housed in a 2U rack chassis.

1.4 Purpose of Equipment

The Frequency Reference System is designed to provide two 10 MHz outputs at -2 dBm minimum level. The internal circuitry contains a precision 10 MHz oscillator that can operate as the primary reference or it can be phase locked to an external reference to ensure optimum performance.

Additionally the Frequency Reference System provides band-switch control signals and can provide +13 Vdc power to a Tunable Low Noise Block Downconverter (TLNB).

1.5 Equipment and Accessories Supplied

The Frequency Reference System includes the items listed in Table 1-1.

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Frequency Reference System</td>
</tr>
<tr>
<td>1</td>
<td>AC Line Power Cord</td>
</tr>
<tr>
<td>1</td>
<td>Operation and Maintenance Manual</td>
</tr>
</tbody>
</table>

1.6 Specifications

The electrical specifications of the Frequency Reference System are given in the product specification sheet included in Section 8, System Configuration.
2.1 General Introduction

To install the VertexRSI Frequency Reference System, use the information contained in this section.

- Inspect the equipment before installation. See Inspection, Section 2.2.
- For instructions on installing the equipment in a rack, see Mechanical Installation procedures in Section 2.3.
- For instructions on providing power and making RF connections to the system, see Electrical Interface, Section 2.4.

2.2 Inspection

Inspect the shipping containers for damage. If they or their cushioning material are damaged, keep them until the contents of the shipment have been checked for completeness and the system has been checked electrically and mechanically.

Carefully unpack the shipping containers. Check that all items in the list of Equipment and Accessories, Table 1-1, were received with the shipment. Also check the packing list in the shipping containers for a list of additional items that may have been ordered.

If the system has been damaged in shipment, file a claim with the carrier. Keep all packaging materials for the carrier's inspection. If the contents are incomplete or there is evidence of improper packaging, notify General Dynamics SATCOM Technologies immediately.

2.3 Mechanical Installation

The Frequency Reference System chassis is designed to be mounted in a 19" rack. See the outline drawing, Figure 2-1. The equipment should be mounted on brackets and securely fastened to the rack.
Figure 2-1. Frequency Reference System Outline
CAUTION

Do not try to support the unit by its front panel. Always use support rails. The front panel is not designed to support the weight of the unit.

2.4 Electrical Interface

2.4.1 AC – Line Input (IEC-320)

The Frequency Reference System operates from a 90-264 Vac, 47-63 Hz source. Connect the power cord to the IEC-320 line input.

2.4.2 L-Band Inputs (Type N Female 50 ohm)

Tx: J1 through J6
Rx: TLNB

These connections should be made with coaxial cables with type N connectors rated for the full operating frequency range.

2.4.3 L-Band Outputs (Type N Female 50 ohm)

Tx: BUC, TX SAMPLE
Rx: J7 through J12, RX SAMPLE

These connections should be made with coaxial cables with type N connectors rated for the full operating frequency range.

2.4.4 EXT REF – External Reference Input (Type BNC Female 50 ohm)

Connect the External Reference Signal to the EXT REF connector. The External Reference can be either 10 MHz or 5 MHz. The External Reference Frequency accuracy must be within ± 1.2 ppm of nominal frequency and the signal level must be 0 dBm to +10 dBm for proper operation.

When using an External Reference Signal the precision oscillator will be phase locked to the External Reference.

The default setting for the External Reference Frequency is 10 MHz. When using 5 MHz, that value must be selected through the Ethernet connection. See the External Reference Frequency paragraph of DCOM-21126 for details.
2.4.5 Ethernet Port – Network (RJ-45 Female)

The Network connector can be used to connect the unit to a 10 Mbps Ethernet network. A standard Category 5, Category 5e, or Category 6 patch cable should be used to connect the unit to a switch, hub, or other network infrastructure equipment. A Category 5, Category 5e, or Category 6 crossover cable is needed if the unit will be directly connected to a PC. See Document DCOM-21126 in Appendix B for more information on the communication protocol and command set.

2.4.6 TLNB Band Switch Control (Type 9-pin DSUB Male)

If the TLNB has selectable operating frequency bands, connect the TLNB Band Control Cable between the Frequency Reference System and the TLNB.

Refer to the TLNB Band Control Cable Assembly drawing and BOM in Section 6, Drawings. The mating connector for the RMR-1004 rear panel TLNB BSW connector is a 9-pin DSUB female; the mating connector for the TLNB is a 4-pin MS female. Wire connections are as follows:

<table>
<thead>
<tr>
<th>Function</th>
<th>DSUB 9-pin</th>
<th>MS 4-pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSW1</td>
<td>1</td>
<td>C</td>
</tr>
<tr>
<td>BSW2</td>
<td>2</td>
<td>D</td>
</tr>
<tr>
<td>Ground</td>
<td>3</td>
<td>B</td>
</tr>
</tbody>
</table>

The Band Switch control can be accessed through the front panel BAND SELECT button or through the Ethernet connection. Refer to the Band Switch Position paragraph of DCOM-21126 for details of band selection via the network.

2.4.7 DC Power – TLNB

DC Power can be supplied to the TLNB through the TLNB RF connector. This voltage can be enabled or disabled through the Ethernet connection. The default setting is DC power disabled.

The voltage set-point is adjustable from +13.0 Vdc through +20.0 Vdc in 0.5 volt steps. Setting tolerance is ± 10 % . The voltage set-point can be controlled through the Ethernet connection. The default set-point is +13.0 Vdc.

See the Power Switch Position and LNB PS Voltage Set-Point paragraphs in DCOM-21126 for details.
Section 3  Operation

3.1 General Introduction

This section describes basic operation of the VertexRSI Frequency Reference System.

• To obtain information about Operation of the system, refer to Section 3.2.

• To obtain information about Front Panel Push Button Switches, refer to Section 3.2.1.

• To obtain information about Status Indicators, refer to Section 3.2.2.

• Use of the Network Port is discussed in Section 3.2.3.

3.2 Operation

The Frequency Reference System may be controlled through the front-panel or the Ethernet network interface. The front-panel interface, described in Sections 3.2.2 and 3.2.3 below, provides only partial control of the unit. The RJ-45 Ethernet interface, described in Section 3.2.4, supports full configuration and control of the Frequency Reference System by the customer’s M/C system.

Before operating the Frequency Reference System ensure that the installation procedures in Section 2 have been completed and that all interconnecting power, RF, and interface connections are in place.

The RF operation of the Frequency Reference System is straightforward and consists of connecting the system cables to the appropriate rear panel connectors.

Care should be taken to ensure that the input signal to the EXT REF connector is not above the maximum specification limit, which could degrade the signal quality.

3.2.1 Front Panel Push Button Switch Operation

The front panel has three push button switches. The switch labeled “MODE SELECT” is used to toggle between LOCAL and REMOTE control. This is the only push button switch that is active when the unit is in REMOTE control mode.
The switch labeled “BAND SELECT” is used to toggle the active band of the TLNB. This switch is active when the unit is in LOCAL control mode.

The switch labeled “FAULT RESET” is used to turn off the FAULT indicator LED. This switch is active when the unit is in LOCAL control mode. The FAULT indicator LED may turn off if the condition causing the LED to light is corrected before the FAULT RESET switch is activated.

### 3.2.2 Status Indicators – LED Indicators

A front panel LED is provided to indicate that AC power is applied and the DC converter is providing power to the circuitry. The green LED next to “POWER” will be lit when power is present.

Front panel LED’s are provided to indicate the MODE of operation. The green LED next to “REMOTE” will be lit when the unit control is through the Network Connection. The green LED next to “LOCAL” will be lit when the unit control is through the front panel switches.

Front panel LED’s are provided to indicate the Active Frequency Band of the TLNB. The green LED next to “B1,” “B2,” or “B3,” respectively, is lit when BAND 1, BAND 2, or BAND 3 of the TLNB is active.

A front panel LED is provided to indicate that an External Reference Signal is present at the EXT REF connector. The green LED next to “EXT REF” will be lit when an External Reference Signal is present.

A front panel LED is provided to indicate that a FAULT Condition has occurred. The red LED next to “FAULT” will be lit when a FAULT Condition exists or when a corrected FAULT Condition occurred previously and has not been reset.

### 3.2.3 Network Port – Ethernet

A network interface is provided to allow the user to control the unit. The network interface will operate on a 10 Base-T network. SNMP V1 protocol is supported by the network interface. Refer to Document 21126 in Appendix B for further details.
Section 4 Theory of Operation

4.1 General Introduction

The Frequency Reference System consists of a stable 10 MHz reference oscillator, power supply, and microprocessor controller housed in a 2U rack chassis. Refer to the schematic diagram, drawing 20897-1, in Section 6, Drawings.

4.2 Reference Oscillator Operation

The Reference Oscillator is an oven-controlled crystal oscillator (OCXO) operating at 10 MHz. The Reference Oscillator when operating as the primary source has an initial set on tolerance of 10.000000 MHz ± 20 ppb (parts per billion) after a brief warm-up period.

The Reference Oscillator is capable of being phase locked to an External 10 MHz or 5 MHz Reference. See the External Reference Frequency paragraph of DCOM-21126 for details of selecting the frequency. DCOM-21126 is provided as Appendix B of this manual.

The External Reference must have a maximum frequency error of ±1.2 ppm and provide a signal level between 0 dBm and +10 dBm into 50 ohms at the EXT REF connector on the rear panel.

4.3 Power Supply

The power supply provides power for the unit. Primary power is derived from an AC to 24 Vdc Converter. The nominal +24 V output of the converter is routed to PCB assembly A1, from which the adjustable voltage (+Vdc) and +5.0 V is distributed for use in the system.

4.4 L-Band Inputs and Outputs

The Tx input connectors are J1 through J6. The Tx inputs are routed through a power combiner, high pass filter, and diplexer to the Tx output connector, labeled “BUC.” The diplexer allows the 10 MHz reference signal to be carried on the Tx output connector to the BUC.
The Rx input connector is labeled “TLNB.” The Rx input is routed through a triplexer, level control, amplifier, and power splitter to the RX outputs, J7 through J12. The triplexer allows +Vdc and the 10 MHz reference signal to be carried on the Rx connector to the TLNB. The level control provides attenuation levels of 0 dB to 20.0 dB in 0.5 dB steps. The amplifier provides gain to reduce insertion loss in the Rx path.

The level control and +Vdc adjustment are accessed through the Network connection. The +Vdc power can be disabled through the Network connection if not required. Refer to the LNB RF Attenuation, Power Switch Position, and LNB PS Set-Point paragraphs of DCOM-21126 for details.

Unused inputs and outputs must be terminated with 50 ohm terminations to give optimum VSWR performance. A DC block is required if a 50 ohm termination is applied to the Rx input connector (TLNB) if +Vdc is enabled.

### 4.5 System Control

The Frequency Reference System may be controlled through the front-panel or the Ethernet network interface. The front-panel interface, described in Section 3 of this manual, provides only partial control of the unit.

The RJ-45 Ethernet interface (located on the back-panel) supports full configuration and control of the Frequency Reference System by the customer’s M/C system. Configuration and control data is communicated via the Simple Network Management Protocol, or SNMP V1. The customer must have customized SNMP management software designed to utilize this interface. A Management Information Block (MIB) file is provided. This file may be used in conjunction with the SNMP management software to configure and control the Frequency Reference System. Document 21126 (see Appendix B) describes the interface requirements and capabilities.
Section 5  

5.1 General Introduction

To maintain, repair or verify performance of the VertexRSI Frequency Reference System, use the information contained in this section.

- For a list of test equipment and accessories recommended for maintenance, see Recommended Equipment, Section 5.2.
- Preventive Maintenance Procedures are in Section 5.3. Follow these regularly to keep the equipment in peak operating condition.
- To verify that the equipment is operating properly, see Performance Verification, Section 5.4.
- For information on troubleshooting or fault isolation, see Troubleshooting, Section 5.6

5.2 Recommended Equipment

Equipment recommended for use during the adjustment and performance verification procedures is listed in Table 5-1. Alternate items may be substituted if the listed item is unavailable and has equal or better performance and operation.

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP 437B</td>
<td>Power Meter with appropriate power sensor</td>
</tr>
<tr>
<td>HP 5351B</td>
<td>Frequency Counter with high stability reference option</td>
</tr>
<tr>
<td>DMM</td>
<td>Fluke 77</td>
</tr>
</tbody>
</table>

5.3 Preventive Maintenance

The following procedure should be performed at least every 12 months. It is recommended that a log be kept.
**WARNING**

Disconnect the equipment power cord before working on the interior of the unit. Dangerous voltages are present around the power input connector and the power supply. Always use caution and never work alone.

- **Periodic cleaning** - Keep the system free from dust and debris by cleaning the external surfaces with a soft brush.

### 5.4 Performance Verification

Use the procedure in this section to verify that the system is operating within specifications. This is similar to the procedure used at the factory for outgoing inspection. The procedure should be used as a tool for incoming inspection before initial installation, or whenever any problems are detected and the system is suspected as a source of the problems.

**Note**

These tests cannot be performed with the system on-line. Certain procedures will interrupt service to the system. Disconnect from service before doing performance verification tests.

Use a copy of the Measured Test Data form in Section 8, System Configuration, as a checklist and record of the measurement results.

It is assumed that the reader is familiar with standard RF and microwave test techniques such as power output and frequency measurement. Only minor details of these tests are given in this procedure to clarify test set-ups and operating modes. Refer to the manuals of your microwave test equipment for measurement details, if necessary.

The following parameters of the Frequency Reference System are measured and recorded on the test data sheet:

- Initial set-on frequency
- Phase Lock to External Reference
- Output Power
NOTE: For the following tests all RF connectors not being used must be terminated with the proper load. Failure to do so could give results that are not accurate. 50 ohm load at the TLNB connector must be AC coupled (DC block) to function properly when DC voltage is enabled.

a) **Initial set-on frequency:** After a short warm-up period, measure the frequency of the 10 MHz signal at the “BUC” connector and the “TLNB” connector with no signal applied to the “EXT REF” connector and no signal applied the L-Band connectors. Use a Frequency Counter to measure the frequency. Record the results on the test data sheet.

b) **Phase Lock to External Reference:** Measure the frequency at the “BUC” connector and the “TLNB” connector with a stable 10 MHz signal applied to “EXT REF” connector and no signal applied to the L-Band connectors. The frequency measured on the Frequency Counter should be 10.000000000 MHz. Record the results on data sheet.

NOTE: The External Reference Frequency applied to the “EXT REF” connector must be applied to the Reference Input of the Frequency counter for this test.

c) **Output power:** Using the Power Meter, measure the output power at “BUC” connector and at “TLNB” connector with no signal applied to the L-Band connectors. Record the results on data sheet.

NOTE: The test port not being measured must be terminated with a 50 ohm load to get accurate levels. The 50 ohm load at the “TLNB” connector must be AC coupled (DC block) to function properly when DC voltage is enabled.

5.5 **Internal Reference Oscillator Frequency Adjustment**

The internal Reference Oscillator Frequency can be adjusted through the Ethernet network connection. If this becomes necessary, see the 10 MHz Frequency Calibration paragraph of DCOM-21126 for details on adjusting frequency. DCOM-21126 is provided as Appendix B of this manual.
A frequency counter with a high stability OCXO Reference option with known accuracy is required to make this adjustment. No signal will be applied to the External Reference Connector for this adjustment.

### 5.6 Troubleshooting

**WARNING** Servicing instructions are for use by trained personnel only. To avoid dangerous electric shock, do not perform any servicing unless qualified to do so.

Use this section to help isolate faults in the system and to perform repairs. If qualified service personnel are not available, return the system to the factory for service. Refer to Section 7 for warranty repair and return procedures.

Before beginning troubleshooting procedures do the following:

- Verify that the problem has been isolated to this system. Ensure that other components connected to this system are not causing the problem.

- Verify that the system is connected to the correct power source and that any circuit breakers or fuses are installed and operational.

Use the schematic diagram located in Section 6, and Table 5-2 to isolate faults in an expedient manner.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Cause</th>
<th>Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>System completely inoperative</td>
<td>No power applied to the system</td>
<td>Check the power connections for the converter. Verify that any line protection devices (circuit breakers or fuses) are operational.</td>
</tr>
<tr>
<td>No 10 MHz Reference Signal</td>
<td>No power applied to A2</td>
<td>Verify that +15.0 Vdc is present on anode of diode CR1 of assembly A2.</td>
</tr>
</tbody>
</table>

After completing any repairs, use the performance verification tests in Section 5.4 to verify that the equipment is fully operational.
**Section 6  Drawings**

### 6.1 General Introduction

This section contains drawings needed to maintain and service the Block Converter System.

- Drawing types are briefly described in Table 6-1 below.
- Refer to the **Drawing Index**, Table 6-2, to locate a particular drawing.

<table>
<thead>
<tr>
<th>Drawing Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schematic</td>
<td>Standard electronic schematics with appropriate reference designators on components.</td>
</tr>
<tr>
<td>Assembly Drawing</td>
<td>Pictorial view of a circuit board, subassembly or unit. Components on the assembly drawing are identified by schematic designator or by item number. Item numbers refer to the bills of materials.</td>
</tr>
<tr>
<td>Bill of Materials</td>
<td>Shows quantities, manufacturer and manufacturer's part number of each item of an assembly. Also lists reference designators that appear on schematics.</td>
</tr>
</tbody>
</table>

All original drawings which were C size or larger have been reduced for inclusion in this manual.

Revisions to drawings are identified in the revision block in the upper right corner of the drawing. The initial release of a drawing has no revision. The first revision is A, the second B, and so on.

### 6.2 Drawing Index

Refer to Table 6-2 to locate a drawing. Drawings are inserted in the order in which they appear in the Table.
<table>
<thead>
<tr>
<th>Drawing Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>20897-1</td>
<td>Schematic, RMR-1004</td>
</tr>
<tr>
<td>20905-1, -2</td>
<td>Assembly, RMR-1004</td>
</tr>
<tr>
<td>AMAX-20905-1</td>
<td>Bill of Materials, Assembly, RMR-1004 Ref. Mod.</td>
</tr>
<tr>
<td>20568-1</td>
<td>Cable Assembly, TLNB Band Control</td>
</tr>
<tr>
<td>ACAB-20568-X</td>
<td>Bill of Materials, Cable Assembly, TLNB Band Control</td>
</tr>
</tbody>
</table>
Section 7  

Warranty

7.1 General Introduction

Specific warranty policies along with technical support, repair and return procedures are listed in this section.

- For help installing, maintaining or servicing the unit, see Technical Support, Section 7.2.
- For terms and conditions of the warranty, see Warranty, Section 7.3.
- Before returning any equipment for factory service, see Return Procedures, Section 7.4.

7.2 Technical Support

Technical support is available by calling General Dynamics SATCOM Technologies directly at (814) 238-2700 during working hours (USA Eastern time zone). Before calling, please have your technical manual at hand and the model and serial number of the relevant equipment.

7.3 Warranty

General Dynamics SATCOM Technologies, Inc. warrants that its products will be in accordance with the written specifications, will be the kinds and quality described in the agreement, and will be free from defects in material and workmanship, under normal use and service, when correctly installed and maintained, for a period of three (3) years from the date of shipment.

General Dynamics’ liability is limited solely, at its discretion, to replacing, repairing or issuing credit for products which become defective during the warranty period. General Dynamics must be notified by the buyer, in writing, of any discrepancy before any action may be taken. The buyer must provide General Dynamics with the opportunity to inspect and test the product(s) alleged to be defective.

Under no circumstances shall General Dynamics be held liable for any defective product(s) if examination of the product(s) shows that the defect was caused by misuse, abuse, improper
installation or application, improper maintenance or repair, alteration, accident or negligence in use, storage, transportation or handling.

7.4 Return Procedures

Before returning any materials to General Dynamics, the buyer must complete all of the following tasks:

- Contact either General Dynamics directly or the appropriate General Dynamics sales representative for issuance of a Return Materials Authorization (RMA) number. If the sales representative is contacted, they will in turn contact General Dynamics for approval to return materials.
- Supply sufficient information regarding the reason(s) for return.
- Supply the date and purchase order number through which the materials in question were purchased.
- Supply the location to which the materials are to be returned.
- Include a name and phone number of an individual to contact in case of questions regarding the return materials.

Materials approved for return must be accompanied by the information requested above. **All materials must have an RMA number.**

### Note:

Unauthorized returned materials will not be accepted by General Dynamics and will be shipped back to the buyer at the buyer's expense.

All returned materials must arrive with postage, duties and all handling costs prepaid by the buyer. General Dynamics will evaluate the returned materials to determine responsibility and will advise the buyer of any repair or replacement charges that apply.

Contact General Dynamics at
Voice: (814) 238-2700
or, FAX (814) 238-6589

**Shipping Address:**
2120 Old Gatesburg Road
State College, PA 16803 USA
Section 8  System Configuration

8.1 General Introduction

This section contains specific configuration information for your system as it was shipped from the factory. This information may include drawings peculiar to your configuration, manual supplements for any optional equipment ordered, and information on ancillary equipment.
## Appendix A  Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Ampere</td>
</tr>
<tr>
<td>AC or ac</td>
<td>Alternating current</td>
</tr>
<tr>
<td>BDC</td>
<td>Block Downconverter</td>
</tr>
<tr>
<td>BOM</td>
<td>Bill of Materials</td>
</tr>
<tr>
<td>BUC</td>
<td>Block Upconverter</td>
</tr>
<tr>
<td>°C</td>
<td>Degrees Celsius</td>
</tr>
<tr>
<td>C-Band</td>
<td>Frequencies in the range of 4 to 8 GHz</td>
</tr>
<tr>
<td>dB</td>
<td>Decibels</td>
</tr>
<tr>
<td>dBc</td>
<td>Decibels with reference to carrier power</td>
</tr>
<tr>
<td>dBm</td>
<td>Decibels with reference to 1 milliwatt of power</td>
</tr>
<tr>
<td>DC or dc</td>
<td>Direct current</td>
</tr>
<tr>
<td>DMM</td>
<td>Digital multimeter</td>
</tr>
<tr>
<td>EIA</td>
<td>Electronic Industries Association</td>
</tr>
<tr>
<td>GHz</td>
<td>Gigahertz</td>
</tr>
<tr>
<td>Hz</td>
<td>Hertz</td>
</tr>
<tr>
<td>IF</td>
<td>Intermediate frequency</td>
</tr>
<tr>
<td>IC</td>
<td>Integrated circuit</td>
</tr>
<tr>
<td>IEC</td>
<td>International Electrotechnical Commission</td>
</tr>
<tr>
<td>I/O</td>
<td>Input/output</td>
</tr>
<tr>
<td>L-Band</td>
<td>Frequencies in the range of 1 to 2 GHz</td>
</tr>
<tr>
<td>LED</td>
<td>Light emitting diode</td>
</tr>
<tr>
<td>mA</td>
<td>Milliampere</td>
</tr>
<tr>
<td>MHz</td>
<td>Megahertz</td>
</tr>
<tr>
<td>ms</td>
<td>Millisecond</td>
</tr>
<tr>
<td>mV</td>
<td>Millivolt</td>
</tr>
<tr>
<td>NC</td>
<td>Normally closed</td>
</tr>
<tr>
<td>NO</td>
<td>Normally open</td>
</tr>
<tr>
<td>ns</td>
<td>Nanosecond</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>--------</td>
<td>------------------------------------------------</td>
</tr>
<tr>
<td>OCXO</td>
<td>Oven-controlled crystal oscillator</td>
</tr>
<tr>
<td>OIP₃</td>
<td>Third-order output intercept point</td>
</tr>
<tr>
<td>ppb</td>
<td>Parts per billion</td>
</tr>
<tr>
<td>ppm</td>
<td>Parts per million</td>
</tr>
<tr>
<td>PS</td>
<td>Power supply</td>
</tr>
<tr>
<td>RF</td>
<td>Radio frequency</td>
</tr>
<tr>
<td>V</td>
<td>Volt</td>
</tr>
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<td>Vac</td>
<td>Volts alternating current</td>
</tr>
<tr>
<td>Vdc</td>
<td>Volts direct current</td>
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<tr>
<td>VSWR</td>
<td>Voltage standing wave ratio</td>
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<tr>
<td>W</td>
<td>Watt</td>
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Appendix B  User Communication

Document 21126,
Frequency Reference System
User Communication Specification