Keysight Wireless Test Sets

M1740A mmWave Transceiver

Getting Started
Guide

KEYSIGHT
TECHNOLOGIES

Notices

Trademark Acknowledgments

Warranty

Technology Licenses

U.S. Government Rights

Safety Notices

CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

A **WARNING** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Where to Find the Latest Information

Documentation is updated periodically. For the latest information about these products, including instrument software upgrades, application information, and product information, browse to one of the following URLs, according to the name of your product:

http://www.keysight.com/find/m1740a

To receive the latest updates by email, subscribe to Keysight Email Updates at the following URL:

http://www.keysight.com/find/MyKeysight

Information on preventing instrument damage can be found at:

www.keysight.com/find/PreventingInstrumentRepair

Is your product software up-to-date?

Periodically, Keysight releases software updates to fix known defects and incorporate product enhancements. To search for software updates for your product, go to the Keysight Technical Support website at:

http://www.keysight.com/find/techsupport

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M1740A mmWave Transceiver

Getting Started Guide

1 Safety & Environmental Information

The following topics can be found in this section:

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Warning Statements and Symbols

Caution and Warning notices are used in this document are described below.

CAUTION   A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING   A WARNING denotes a hazard. It calls attention to an operating procedure, practice or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

See also: .

Safety

This product has been designed and tested in accordance with accepted industry standards, and has been supplied in a safe condition.The documentation contains information and warnings that must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

Safety Compliance

This product complies with the essential requirements of the European Low Voltage Directive as well as current editions of the following standards (dates and editions are cited in the Declaration of Conformity):

— IEC/EN 61010-1

— Canada: CSA C22.2 No. 61010-1

— USA: UL std no. 61010-1

Acoustic statement (European Machinery Directive)

Acoustic noise emission
LpA <70 dB
Operator position
Normal operation mode per ISO 7779

General Safety Notices

WARNING If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.

WARNING No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock, do not remove covers.

Environmental Conditions (Operating)

This product is designed for use in the following conditions:

— For indoor use only

— Altitude up to 3000 m

— Temperature 10 to 40°C

— Maximum relative humidity 95% (non-condensing)

CAUTION   This product is designed for use in INSTALLATION CATEGORY II and POLLUTION DEGREE 2, per IEC 61010-1 Third Edition and 664 respectively.

Environmental Information

Samples of this product have been type tested in accordance with the Keysight Environmental Test Manual and verified to be robust against the environmental stresses of Storage, Transportation and End-use; those stresses include but are not limited to temperature, humidity, shock, vibration, altitude and power line conditions.

Test Methods are aligned with IEC 60068-2 and levels are similar to MIL-PRF-28800F Class 3.

EMC (Electromagnetic Compatibility)

This product complies with the essential requirements of the European Directive as well as current editions of the following standards (dates and editions are cited in the Declaration of Conformity):

— IEC/EN 61326-1

— CISPR Pub 11 Group 1, class A

— AS/NZS CISPR 11

— ICES/NMB-001
This ISM device complies with Canadian ICES-001.
Cet appareil ISM est conforme a la norme NMB-001 du Canada.

South Korean Class A EMC declaration

This equipment is Class A suitable for professional use and is for use in electromagnetic environments outside of the home.

A 급 기기 (업무용 방송통신기자재)이 기기는 업무용 (A 급) 전자파적합기기로서 판 매자 또는 사용자는 이 점을 주 의하시기 바라 며 , 가정외의 지역에서 사용하는 것을 목적으 로 합니다 .

Declaration of Conformity

The Declaration of Conformity for any Keysight product can be found on the website:
http://www.keysight.com/go/conformity

Ventilation

CAUTION VENTILATION REQUIREMENTS: When installing the instrument(s) into a cabinet, consideration shall be given to the convection flow into and out of the cabinet. Consideration shall also be given to the individual instruments to avoid having the heated discharge of one instrument, now becoming the cooling intake air for another instrument.

Another area of concern is verification that the maximum ambient operating temperature of the instrument(s) is not exceeded by cabinet installation.

Keysight recommends forced air convection whenever an instrument(s) are installed in a cabinet and further recommends that the maximum operating temperature of the cabinet be reduced 10°C from the lowest, of the maximum operating temperature of a single instrument.

If there are any concerns or special requirements an Keysight Field Engineer should be consulted to assure instrument(s) temperature compliance and performance.used.

Power requirements

The M1740A does not have an AC power connection. It is powered by a DC voltage from the E7760B Wideband Transceiver or the E7770A Common Interface Unit; this voltage is supplied over the RF Cable Assembly to the **LO/Pwr/Ctrl/IF In** connector. The DC supply does not represent a risk of personal injury.

CAUTION The RF Cable Assembly should not be connected to, or disconnected from, the M1740A while it is suppling DC power from the E7760B or E7770A. This connection should be made only when the E7760B is powered off, or the cable is not connected to the E7760B or E7770A. If the LED status indicator on the front of the M1740A is lit, this indicates that it is powered up and the cable should not be disconnected.

Using Accessories

When the M1740A is used in connection with the E7760B Wideband Transceiver or the E7770A Common Interface Unit, use only the RF Cable Assembly that was supplied with the M1740A to connect it with the other instrument, and connect it only to the mmW ports on that instrument.

Weight and Dimensions

The weight and dimensions of the M1740A are as follows.

— Weight: 2.2 kg

— Height: 66 mm

— Width: 139 mm

— Depth: 183 mm

Protecting against electrostatic discharge

Electrostatic discharge (ESD) can damage or destroy electronic components (the possibility of unseen damage caused by ESD is present whenever components are transported, stored, or used).

Test equipment and ESD

To help reduce ESD damage that can occur while using test equipment:

WARNING   Do not use these first three techniques when working on circuitry with a voltage potential greater than 500 volts.

- Before connecting any coaxial cable to a test set connector for the first time each day, momentarily short the center and outer conductors of the cable together.

- Personnel should be grounded with a 1 MΩ resistor-isolated wrist-strap before touching the center pin of any connector and before removing any assembly from the test set.

- Be sure that all instruments are properly earth-grounded to prevent build-up of static charge.

- Perform work on all components or assemblies at a static-safe workstation.

- Keep static-generating materials at least one meter away from all components.

- Store or transport components in static-shielding containers.

- Always handle printed circuit board assemblies by the edges. This reduces the possibility of ESD damage to components and prevent contamination of exposed plating.

Additional information about ESD

For more information about ESD and how to prevent ESD damage, contact the Electrostatic Discharge Association (http://www.esda.org). The ESD standards developed by this agency are sanctioned by the American National Standards Institute (ANSI).

Instrument Maintenance

Cleaning the Instrument

CAUTION   Disconnect the M1740A from all cables before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.

Cleaning the Connectors

Cleaning connectors with isopropyl alcohol shall only be done with all cables disconnected, and in a well-ventilated area. Allow all residual alcohol moisture to evaporate, and the fumes to dissipate prior to energizing the instrument.

WARNING   Keep isopropyl alcohol away from heat, sparks, and flame. Store in a tightly closed container. The alcohol shall not be stored, or left open, in the area of the equipment. Use isopropyl alcohol with adequate ventilation to prevent the combustions of fumes or vapors.

Avoid contact with eyes, skin, and clothing, as isopropyl alcohol causes skin irritation, may cause eye damage, and is harmful if swallowed or inhaled. It may be harmful if absorbed through the skin. Wash thoroughly after handling. In case of spill, soak up with sand or earth. Flush spill area with water. Dispose of isopropyl alcohol in accordance with all applicable federal, state, and local environmental regulations.

In case of fire, use alcohol foam, dry chemical, or carbon dioxide; water may be ineffective.

2 Quick Start

The following topics can be found in this section:

Initial Inspection

Inspect the shipping container and the cushioning material for signs of stress. Retain undamaged shipping materials for future use, as you may wish to ship the test set to another location or to Keysight Technologies for service. Verify the contents of the container against the table below.

Item	Deliverable	Description
Getting Started Guide (this document)		Provides first-time power on instructions, licensing information, operating system information, and general hardware information.
Keysight M1740A mmWave Transceiver		
RF Cables (One or more of M1740-60006 and/or M1740-60014; quantity depends on options ordered at time of purchase)		In addition to IF and LO signals, these cables carry control signals and DC supply voltages from the E7760B Wideband Transceiver (M1740-60006 cable) or from the E7770A Common Interface Unit (M1740-60014 cable).

NOTE   The M1740A is often used in conjunction with the E7760B Wideband Transceiver or the E7770A Common Interface Unit, but those are separate purchase and are not always shipped with the M1740A.

Shipping Problems?

If the shipping materials are damaged or the contents of the container are incomplete:

— Contact the nearest Keysight Technologies office.

— Keep the shipping materials for the carrier's inspection.

— If you must return a test set to Keysight Technologies, use the undamaged original or comparable shipping materials. See "Returning Your Test Set for Service" on page 37.

Location and Mounting

It is recommended to suspend the transceiver above the Device Under Test (DUT), with the mmWave port pointed downwards at the DUT, so that heat given off by the transceiver will rise away from the DUT. Leave a minimum clearance of 2.5 inches (7 cm) around the transceiver. Also, ensure there is enough room to attach all necessary cables between the transceiver and other devices.

3 Exterior Features

The following topics can be found in this section:

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DUT–Facing Side

Figure 3-1 M1740A, DUT-facing side

The features are described in the following table.

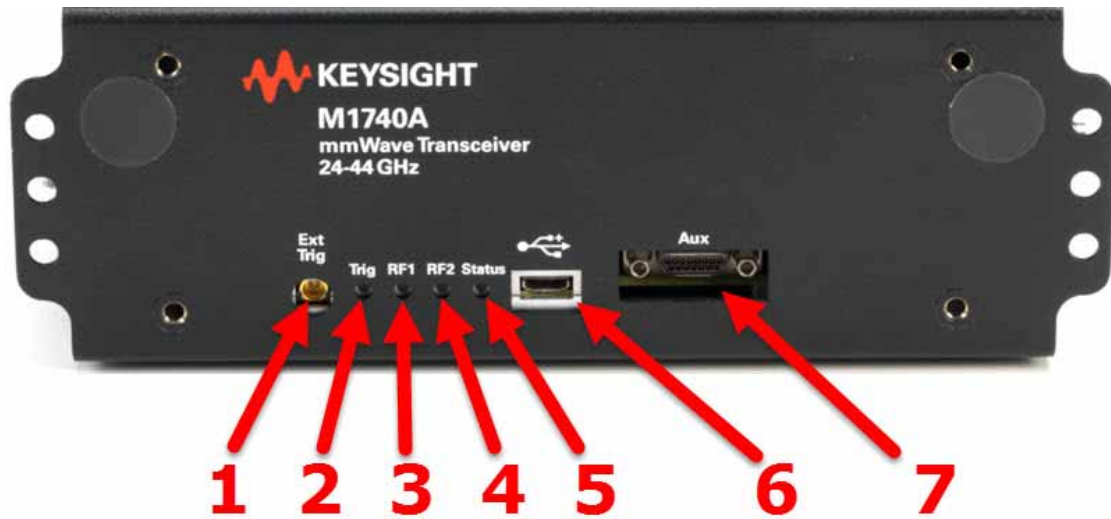| Number	Name	Description
1	RF Tx/Rx 1 (2.4 mm connector)	A port which can be configured either to supply a mm wave signal to the DUT, or to receive it from the DUT.
2	RF Tx/Rx 2 (2.4 mm connector)	A port which can be configured either to supply a mm wave signal to the DUT, or to receive it from the DUT.

Figure 3-2   M1740A regulatory labels

See "Labels and Symbols" on page 24 for information about these labels.

Figure 3-3   M1740A interface features

The features are described in the following table.

Number	Name	Description
1	**Ext Trig** (connector)	A trigger input (used by Keysight in testing; usually not needed for customer use). In normal usage, the trigger input is included in the combined input signal to the **LO/Pwr/Ctrl/IF In** port.
2	**Trig** (LED)	A trigger indicator (used by Keysight in testing; not needed for customer use). In normal usage (as described above for **Ext Trig**) the LED does not light.
3	**RF1** (LED)	Indicates the current status of the **RF Tx/Rx 1** port, according to the color scheme: — Blue = Tx (port is in transmit mode) — Green = Rx (port is in receive mode) — White = Idle (port is not in use) During switching between modes, intermediate shades of color occur temporarily.
4	**RF2** (LED)	Indicates the current status of the **RF Tx/Rx 2** port, according to the color scheme described for **RF1** above.
5	**Status** (LED)	Lights to indicate that the M1740A is currently under the control of the E7760B or other instrument, according to the color scheme: — Orange = connected, but no active communication currently — Green = connected, with active communication currently
6	**USB** (connector)	A control input (used by Keysight in testing; not needed for customer use).
7	**Aux** (connector)	A power input (used by Keysight in testing; not needed for customer use).

Instrument-Facing Side

Figure 3-4   M1740A instrument-facing side
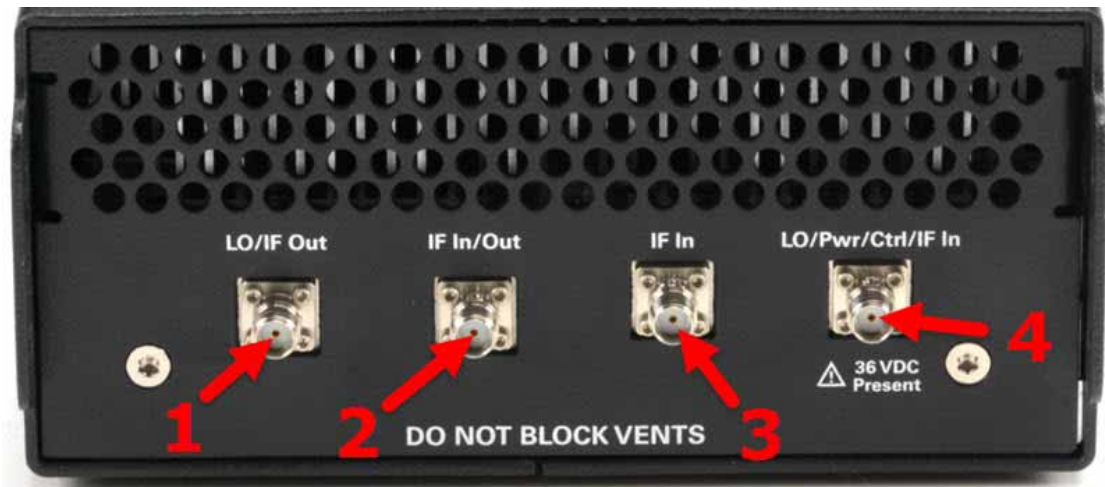
These ports are typically cabled to the input and output ports of the E7760B Wideband Transceiver, or other test equipment. The ports are described in the following table.

Number	Name	Description
1	**LO/IF Out** (SMA connector)	This port provides the IF output of the downconverter in the M1740A (that is, the downconverted return signal from the DUT). This port also accepts an LO input to be used by the downconverter.
2	**IF In/Out** (SMA connector)	This port can be used either to accept an IF input to the upconverter in the M1740A (this is the test signal to be upconverted and sent to the DUT) or to provide the IF output of the downconverter in the M1740A (this is the downconverted return signal from the DUT).
3	**IF In** (SMA connector)	This port accepts an IF input to the upconverter in the M1740A (this is the test signal to be upconverted and sent to the DUT).
4	**LO/Pwr/Ctrl/IF In** (SMA connector)	This port accepts an IF input to the upconverter in the M1740A (this is the test signal to be upconverted and sent to the DUT). This port also accepts the following inputs, which are combined with the IF input signal:
		— An LO input to be used by the upconverter and/or downconverter in the M1740A.
		— A DC voltage input to power the M1740A.
		— A control signal to operate the M1740A.
	CAUTION	Do not connect or disconnect the RF cable, at either end, while the connected instrument is powered on.

Port Connections to Measurement Instruments

Ports on the instrument-facing side of the M1740A are used in accordance with the requirements of the connected instrument.

E7760B Wideband Transceiver

When the M1740A is connected to the E7760B Wideband Transceiver, port connections are always as follows:

— **LO/Pwr/Ctrl/IF In** on the M1740A is connected to one of the "A" mmW Ports of the E7760B (**A1**, **A2**, or **A3**).

— **LO/IF Out** on the M1740A is connected to one of the "B" mmW Ports of the E7760B (**B1**, **B2**, or **B3**).

— The **A** and **B** mmW Ports on the E7760B are numerically paired (**A1/B1**, **A2/B2**, and **A3/B3**). In other words, if **A2** is the output port, then only **B2** can be used as the input port.

— These cabling connections are **not** to be changed if a "B" mmW port is configured as an output rather than an input; signal routing through the M1740A is automatically adjusted in such cases, to avoid the need for re-cabling.

Other Instruments (by way of E7770A Common Interface Unit)

When the M1740A is connected to another type of test set, by way of the E7770A CIU, port connections are always as follows:

— **LO/Pwr/Ctrl/IF In** on the M1740A is connected to the **LO/CTRL/PWR** port for a given channel on the CIU

— **IF In** on the M1740A is connected to the **DUT IF OUT/HEAD OUT** port for the same channel on the CIU.

— **IF In/Out** on the M1740A is connected to the **DUT IF IN/HEAD IN** connector for the same channel on the CIU.

Labels and Symbols

Labels and symbols which may be on the exterior of the M1740A are described below.

Symbol	Description
⚠	The instruction documentation symbol. The product is marked with this symbol when it is necessary for the user to refer to instructions in the documentation.
CE	The CE mark is a registered trademark of the European Community.
RCM	The RCM mark is a registered trademark of the Australian Communications and Media Authority.
KC	South Korean Certification (KC) mark; includes the marking's identifier code which follows this format: MSIP-REM-YYY-ZZZZZZZZZZZZZZZ
ICES/NMB-001 ISM GRP.1 CLASS A	ICES / NMB-001 Cet appareil ISM est conforme a la norme NMB du Canada. This is a marking to indicate product compliance with the Industry Canadian Interference-Causing Equipment Standard (ICES-001). This is also a symbol of an Industrial Scientific and Medical Group 1 Class A product (CISPR 11, Clause 4).
♻	This symbol indicates separate collection for electrical and electronic equipment mandated under EU law as of August 13, 2005. All electric and electronic equipment are required to be separated from normal waste for disposal (Reference WEEE Directive 2002/96/EC).
♻	This symbol on all primary and secondary packaging indicates compliance to China standard GB 18455-2001.
40	Indicates the time period during which no hazardous or toxic substance elements are expected to leak or deteriorate during normal use. Forty years is the expected useful life of the product.

4 Functionality

The following topics can be found in this section:

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Simplified Block Diagram

The simplified functional block diagram below omits most of the routing, splitting, filtering, and other signal-conditioning functions in order to show how signals (in some cases combined signals) to and from measurement instruments (the right side of the illustration) can be routed to the upconverter and downconverter, and how the upconverter and downconverter interface with the DUT-facing ports of the test head (the left side of the illustration). There are many possible signal routings.

There are various possible ways to provide LO inputs to the upconverter and downconverter, and various possible ways for the test head to receive from a test instrument an IF input to the upconverter, or to return to that instrument an IF output to the downconverter. How the ports at the right of the diagram are used depends partly on the type of test equipment the test head is being used with.

The RF ports at the left of the diagram can be configured either as Tx or as Rx, by connecting each port either to the upconverter (if it's to be used as a Tx port) or the downconverter (if it's to be used as an Rx port).

Figure 4-1 M1740A block diagram (simplified)
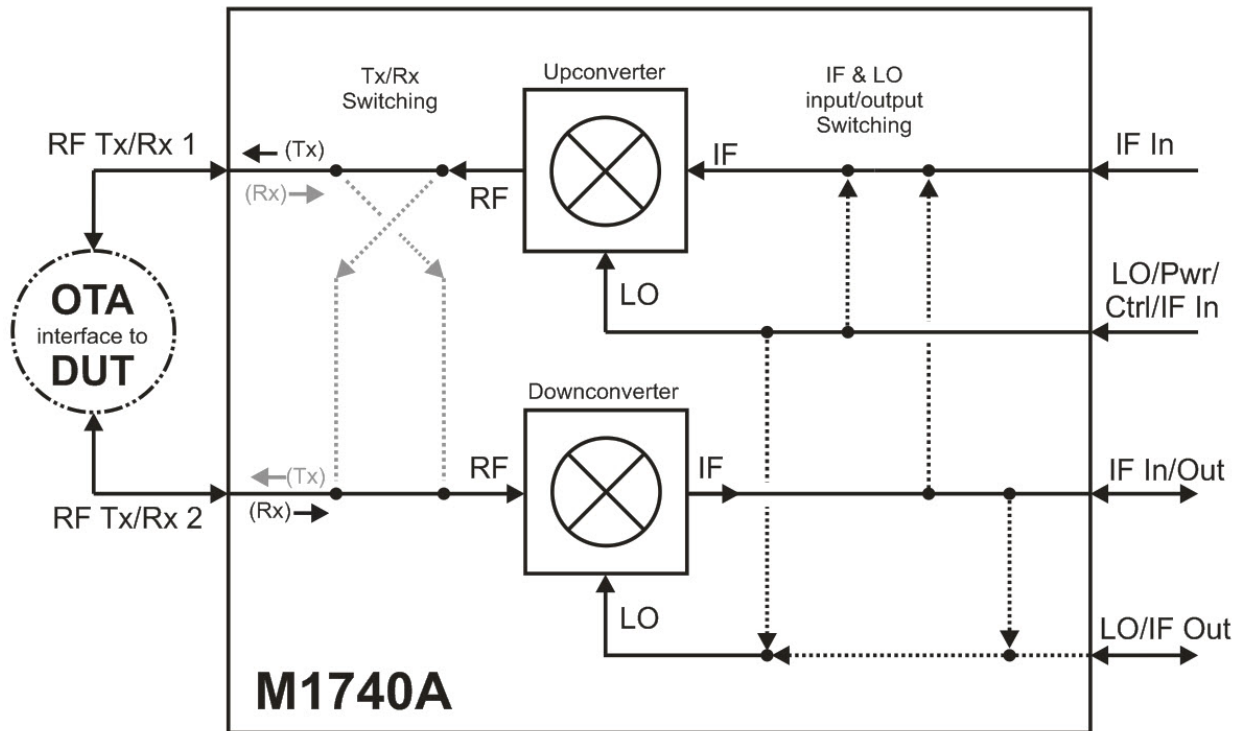
The LO input signal to the upconverter stage is supplied at the **LO/Pwr/Ctrl/IF In** port; this input can also be applied to the downconverter stage. Alternatively, a separate LO input can be supplied to the downconverter stage at the **LO/IF Out** port. Both ports combine LO signals with IF signals.

The IF input signal to the upconverter can be supplied at any one of these ports: the **LO/Pwr/Ctrl/IF In** port, the **IF In** port, or the bi-directional **IF In/Out** port.

The IF output signal generated by the downconverter can be routed to the bi-directional **IF In/Out** port or the bi-directional **LO/IF Out** port.

Signal routing is controlled from the instrument to which the M1740A is connected; the combined signal at the **LO/Pwr/Ctrl/IF In** port includes a control signal for this purpose. It also includes a DC voltage to power the test head.

| NOTE	License-based restrictions apply to various bands within the full frequency range of the M1740A, but the licenses are issued specifically for other instruments which interface with the M1740A (for example, theE7760B Wideband Transceiver, which has licensed options for several different frequency bands).

Configuration Example: M1740A used with E7760B

The E7760B Wideband Transceiver is designed specifically to use the M1740A; all six of the mm wave ports of the E7760B are able to provide a combined IF, LO, DC, and Control signal to the **LO/Pwr/Ctrl/IF In** port of the M1740A.

In the example illustrated below, the IF test signal to the DUT (generated by the E7760B) is applied to the **LO/Pwr/Ctrl/IF In** port. The LO input to the upconverter is combined with the IF input at the same port. The signal returned from the DUT is downconverted and supplied to the **LO/IF Out** port. The port to which this is connected on the E7760B also provides an LO input to the downconverter.

NOTE	For more detailed information about port usage on the E7760B, see the *5G User's Guide* for the Keysight E7760B Wideband Transceiver.

Figure 4-2 M1740A used with E7760B
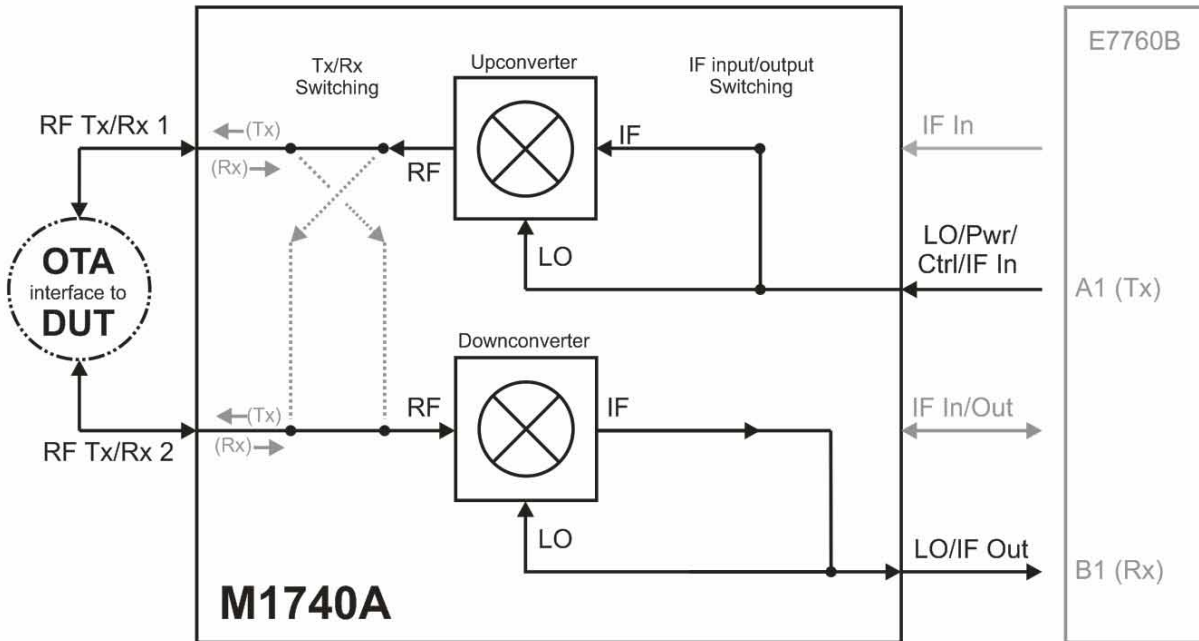
The same example setup is illustrated below, in a broader view. The M1740A up-converts an output from the E7760B **A1** port to the higher frequency range of the DUT. A returned signal from the DUT is downconverted and delivered (by way of the LO/IF Out port) to the E7760B **B1** port. In this example, an IF output from the DUT is also provided, by way of an RF coupler, to one of the **IF I/O** ports of the E7760B.

Figure 4-3 Using the M1740A with the E7760B
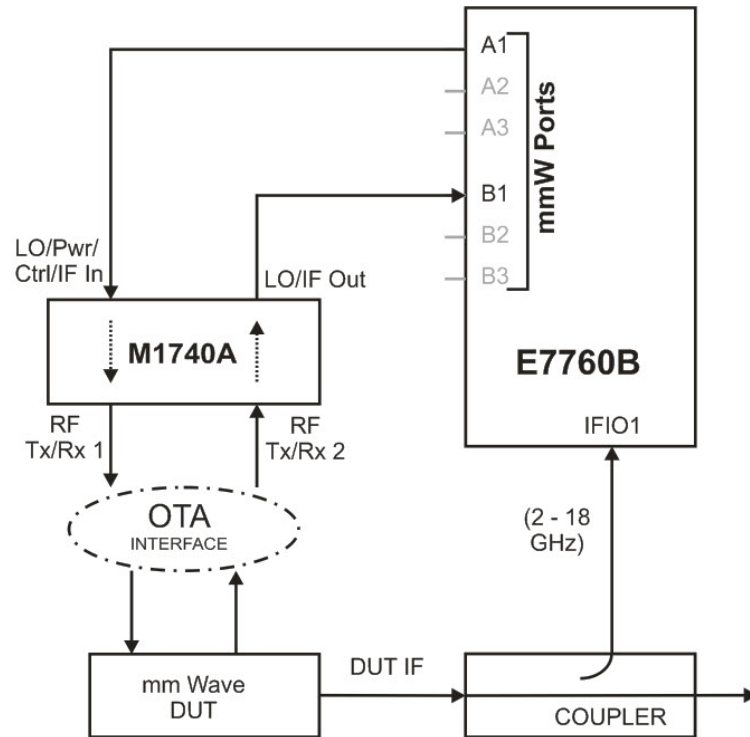
Additional M1740As can be used, for types of testing which require this.

Figure 4-4 Multiple test heads used with the E7760B

Configuration Example: M1740A used with the E7770A CIU

The E7770A Common Interface Unit is designed to act as an intermediary between the M1740A and test sets which were not originally designed for connection with the M1740A. In this example, the test signal to the DUT is applied to the **LO/Pwr/Ctrl/IF In** port, and is routed to the IF input of the upconverter. The same input also includes an LO input (supplied to both the upconverter and downconverter in this case), together with control signals and DC power. The signal returned from the DUT is downconverted and supplied at the **IF In/Out** port.

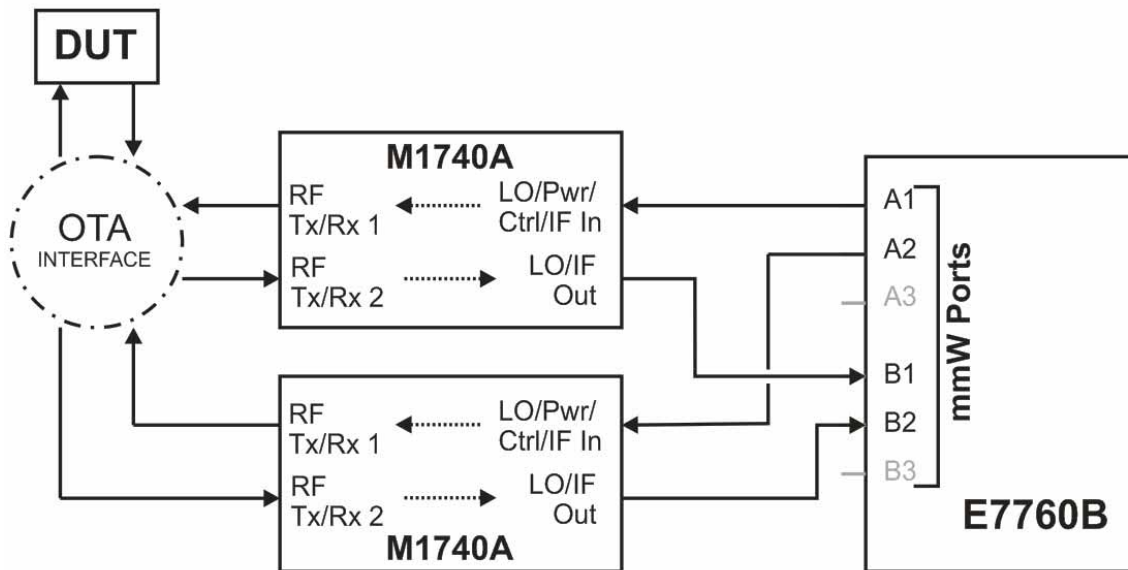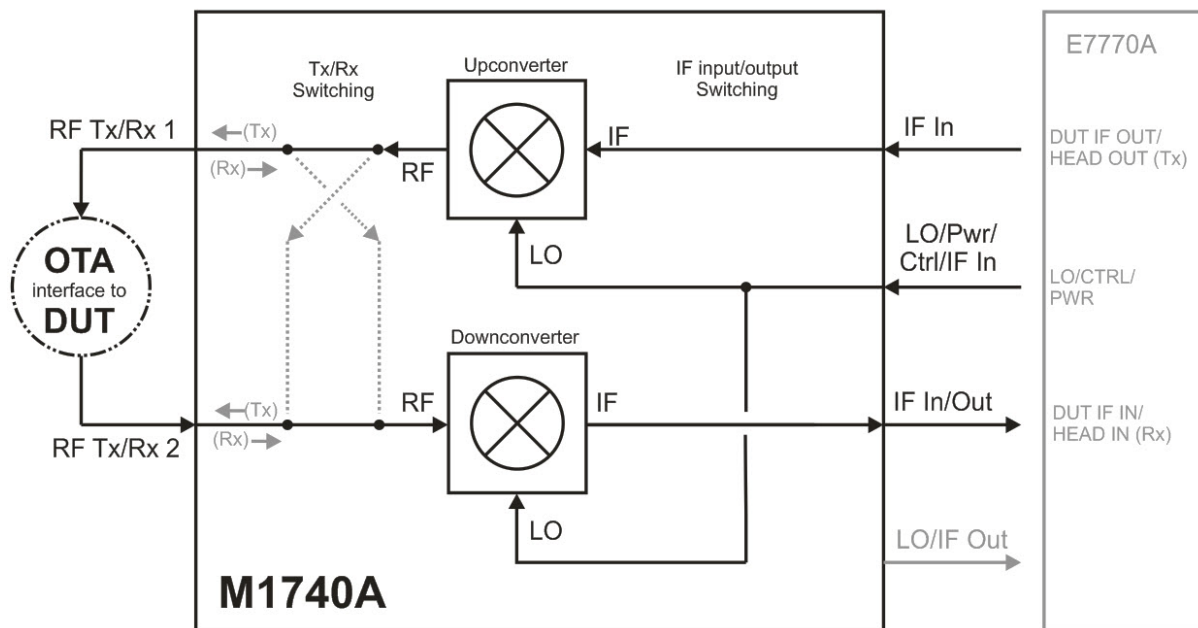| NOTE	For more detailed information about port usage on the E7770A, see the *User's Guide* for the Keysight E7760A Common Interface Unit.

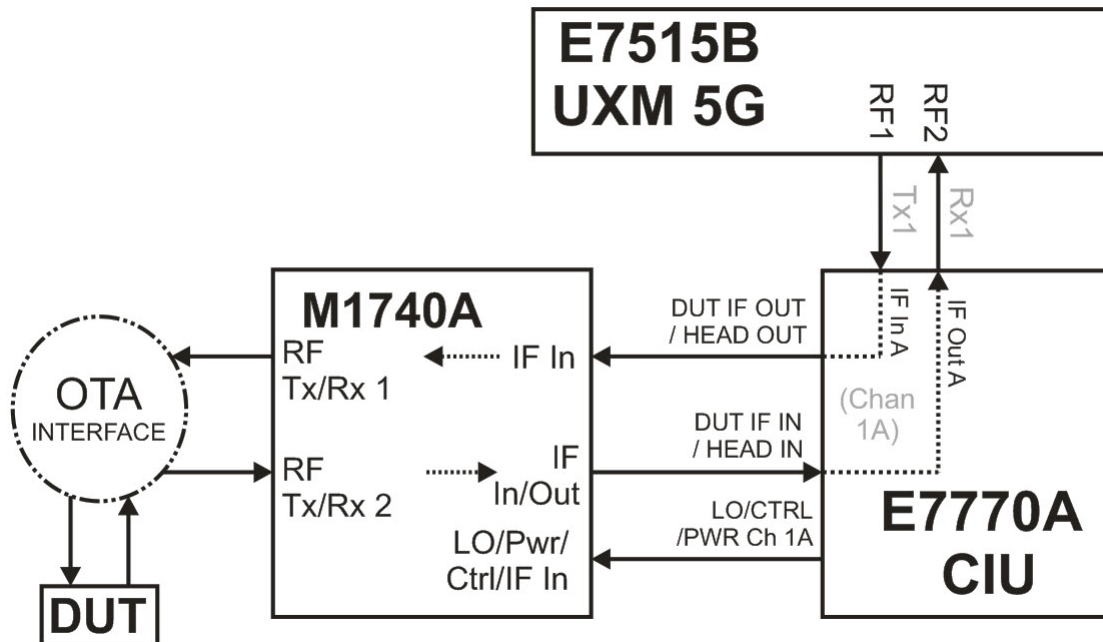Figure 4-5   M1740A used with E7770A

The same example setup is illustrated below, in a broader view. The M1740A up-converts an output from the E7770A **DUT IF OUT/HEAD OUT** port, received at the M1740A **IF In** port, to the higher frequency range of the DUT. A returned signal from the DUT is downconverted and delivered (by way of the **IF In/Out** port) to the E7770A **DUT IF IN/HEAD IN** port. (The ultimate source and destination of the IF signals is the test set which is using the E7770A as a signal interface -- the E7515B in this case.)

Because the E7515B is not designed specifically for use with the M1740A, some elements of the combined signal which is required at the M1740A's **LO/Pwr/Ctrl/IF In** port have to be provided by the E7770A, as an input distinct from any IF path. The E7770A furnishes the LO, DC power, and control signals to this port.

Other instruments besides the E7515B might also take the place of the E7515B in this example.

Figure 4-6 Using the M1740A with the E7515B and E7770A

Additional M1740As can be used, for types of testing which require this.

Figure 4-7 Multiple test heads used with the E7770A
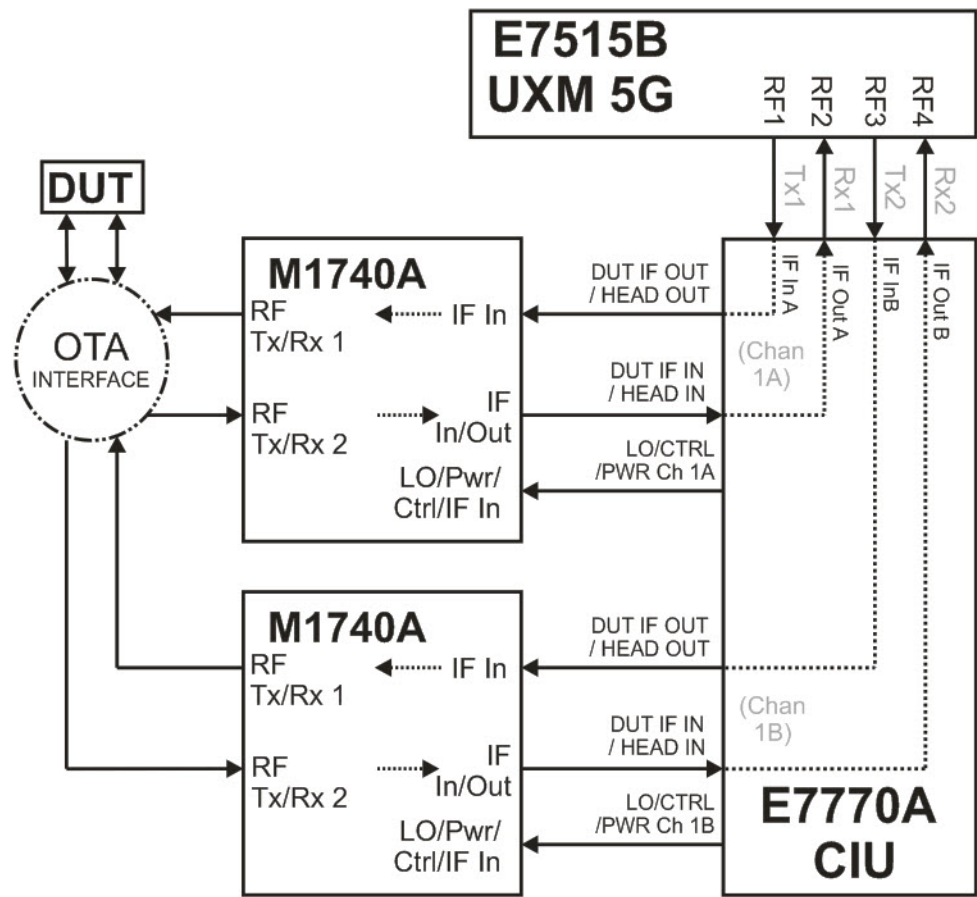
Functionality
Configuration Example: M1740A used with the E7770A CIU

5 Troubleshooting

The following topics can be found in this section:

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Where to get technical help

For online assistance: http://www.keysight.com/find/assist

To contact Keysight Technologies: http://www.keysight.com/find/contactus

Also, see "Locations for Keysight Technologies" on page 38.

Identifying Problems

WARNING   No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock do not remove covers.

If the status indicator on the M1740A is not lit, or if it appears that mmWave signals are not being exchanged with the Device Under Test check the following:

1. Are the RF cables connected appropriately between the M1740A and the measurement instrument? (See "Port Connections to Measurement Instruments" on page 23.)

2. Is the E7760B (or other measurement instrument) powered on?

3. Is the E7760B (or other measurement instrument) properly configured (for example, are the input and output ports selected appropriately for your test setup?).

If no obvious problem in the test setup can be found, contact Keysight Technologies to ask for technical support.

Returning Your Test Set for Service

Calling Keysight Technologies

Keysight Technologies has offices around the world to provide you with complete support for your wireless test set. To obtain servicing information, or to order replacement parts, contact the nearest Keysight Technologies office listed under "Locations for Keysight Technologies" on page 38. In any correspondence or telephone conversations, refer to your test set by its product number and full serial number.

Locations for Keysight Technologies

For online assistance: http://www.keysight.com/find/assist

To contact Keysight Technologies: http://www.keysight.com/find/contactus

Alternately, contact the nearest Keysight sales office:

Americas		
Canada (877) 894 4414	Brazil 55 11 3351 7010	Mexico 001 800 254 2440
United States (800) 829 4444		

Asia & Pacific		
Australia 1 800 629 485	China 800 810 0189	Hong Kong 800 938 693
India 1 800 112 929	Japan 0120 (421) 345	Korea 080 769 0800
Malaysia 1 800 888 848	Singapore 1 800 375 8100	Taiwan 0800 047 866
Other Asia-Pacific countries: (65) 6375 8100		

Europe & Middle East		
Austria 0800 001122	Belgium 0800 58580	Finland 0800 523252
France 0805 980333	Germany 0800 6270999	Ireland 1800 832700
Israel 1 809 343051	Italy 800 599100	Luxembourg +32 800 58580
Netherlands 0800 0233200	Russia 8800 5009286	Spain 0800 000154
Sweden 0200 882255	Switzerland 0800 805353 Opt. 1 (DE), Opt. 2 (FR), Opt. 3 (IT)	United Kingdom 0800 0260637

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