.ODUCT SUPPORT PLAN

May 1983
Supersedes: None

To: PT-01, PT-11, and PT-21
INSTRUMENT SALES AND SERVICE OFFICES

From: NETWORK MEASUREMENTS DIVISION (NMD, Div 4500)
SANTA ROSA, CALIFORNIA

Subject: 85020A, 85020B, 85021A, 85021B, & 85021C
DIRECTIONAL BRIDGES

DESCRIPTION

GENERAL DESCRIPTION: The 85020A, 85020B, 85021A, 85021B, and 85021C Directional Bridges are bridge-type accessories for making scalar (magnitude-only) reflection measurements on microwave components. The 8502X-Family features 40dB directivity in a wide variety of frequency ranges and connectors. These Directional Bridges complement the new 8756A Scalar Network Analyzer to make scalar microwave measurements easier and more accurate than ever before. (Refer to the separate 8756A Product Support Plan for 8756A support strategies.) All Directional Bridges are directly compatible with the 8755A/B/C Swept Amplitude Analyzers.

Dave Engelder

HEWLETT PACKARD

The 8502X-Family is summarized below, with frequency range, domestic list price, connector types, and impedance:

HP 85020A; 10MHz to 4.3GHz; $950
RF In Connector: Type N, Female, 50 Ohms
Test Port Connector: Type N, Female, 50 Ohms

HP 85020B; 10MHz to 2.4GHz; $1050
RF In Connector: Type N, Female, 75 Ohms
Test Port Connector: Type N, Female, 75 Ohms

HP 85021A; 10MHz to 18GHz; $2500
RF In Connector: Type N, Female, 50 Ohms
Test Port Connector: APC-7, 50 Ohms

HP 85021B; 10MHz to 26.5GHz; $2800
RF In Connector: APC-3.5, Female, 50 Ohms
Test Port Connector: APC-3.5, Female, 50 Ohms

HP 85021C; 10MHz to 18GHz; $2560
RF In Connector: Type N, Female, 50 Ohms
Test Port Connector: Type N, Female, 50 Ohms

First customer shipments occurred in May 1983. Approximately 50 demo instruments have been shipped to date.

MECHANICAL/ENVIRONMENTAL/ELECTRICAL DESCRIPTION: Refer to 8756A Technical Data Sheet (HP P/N 5953-8850).

PRODUCT/SYSTEM CONFIGURATION: To make measurements, the 8502X-Family requires a swept microwave source and analyzer. The 8350B Sweep Oscillator, with an RF Plug-in, and 8756A Scalar Network Analyzer, are recommended.

(The 8756A support strategy is described separately in the 8756A Product Support Plan.)

(The 8502X-Family will be components of the 8756S Scalar Network Analyzer System. The system will include a 9826/36 Desktop Computer, user software, 8350B with RF Plug-in, detectors, verification kits, and more. The 8756S support strategies will be covered in a separate 8756S Product Support Plan.)

COMPARISON WITH SIMILAR HP PRODUCTS: The 8502X-Family Directional Bridges are similar to the 11666A Reflectometer Bridge. The 8502X-Family Directional Bridges offer these benfits: 40dB directivity (11666A has 26dB to 18 GHz); more types of connectors; single diode detection (11666A has two detected outputs); more rugged; and generally less expensive. The 8502X-Family replaces the 11666A in all applications except those requiring two detected outputs. They are compatible with the 8755A/B/C.

TARGETED MARKET: The 8502X-Family is targeted for microwave component production environments. However, its high directivity makes it suitable for the test bench and R&D.

SUPPORT STRATEGY

SALES SUPPORT STRATEGY: Approximately 50 demo instruments are installed in PT-01 sales offices around the world to date. Be aware that some demo instruments do not meet final customer specifications. Refer to Sec VII: Backdating of the appropriate Operating & Service Manual for details and a list of serial numbers affected..

HARDWARE SUPPORT STRATEGY: The 85020A/B and 85021A/B/C repair strategy is PT-01 bench repair to the component level at regional repair centers.

The hearts of the 8502X-Family Directional Bridges -- the microcircuits -- are not repairable. However, replacement microcircuits are available in both: 1) a new version; and 2) a restored version at reduced cost through the Blue Stripe Exchange Program. Certain connectors can also be independently repaired or replaced. See Attachment 1: Replacement Microcircuits. Replacement microcircuits will include new self-adhesive backside labels, since these labels are destroyed to remove the old microcircuit. The instrument serial number must be typed on the new label before attaching it to the Directional Bridge housing.

The cable, with its connector attached, is separately replaceable. The internal preamplifier PC board is repairable to the component level; however, the assembly is inexpensive, so board replacement is acceptable.

Verifying the Directional Bridges' key specification -- 40dB directivity -- will be difficult in the field. The traditional method of simply terminating the Test Port requires a fixed load with 52dB return loss! Loads of this quality are not commonly available. Therefore, the Performance Test procedure in the Operating & Service Manuals describes the degradation of directivity measurements due to imperfect loads, and prescribes directivity test limits (somewhat worse than 40dB) dependent on the load quality. NMD is comfortable with this approach, since both theory and production experience indicate that marginal directivity failures are unlikely. (i.e. If the instrument fails, its directivity goes grossly out of specification.)

The NMD production line uses custom-made precision airlines and a computer-controlled 8756A system to measure directivity to the 40dB limits (plus guard band). The system uses a ripple technique, with extensive math processing to

extract the actual directivity. NMD plans to export this test capability to selected service depots worldwide within six months.

In the meantime, however, the support organization will have to use the manual method and degraded test limits. Please help educate our customers about the problems in verifying 40dB directivity. If a customer insists on 100% specification certification, the Directional Bridge will have to be returned to NMD for testing. The customer will be charged for this service.

In repair situations where customer down-time is critical, NMD will cooperate with arranging loaner instruments.

CUSTOMER SELF-SUPPORT: The 8502X-Family is customer supportable.

WARRANTY

TYPE: The 8502X-Family Directional Bridges carry the normal one-year, return-to-HP warranty policy for instruments.

TRAINING

PT-01 BENCH TECHNICIAN TRAINING: No specific training is necessary for these products. However, the 8756A training will include a brief 8502X-Family familiarization segment. (Refer to Attachment 2: 8756A Service Training Calendar.)

LITERATURE

DEMONSTRATION SUPPORT LITERATURE: Sales literature for the 8502X-Family Directional Bridges is generally included in 8756A sales literature. The 8756A Technical Data Sheet (HP P/N 5953-8850) and 8756A Flyer (HP P/N 5953-8856) are the primary sales literature tools. The 8756A Reference Binder, including data sheet, flyer, demo guide, and programming notes, will be distributed to all sales offices in June 1983.

OPERATING & SERVICE LITERATURE: The 8502X-Family Directional Bridges are documented in two Operating & Service Manuals. The 85020A/B Operating & Service Manual (HP P/N 85020-90001) documents the 85020A and 85020B. The 85021A/B/C Operating & Service Manual (HP P/N 85021-90001) documents the 85021A, 85021B, and 85021C. Operating Information supplements are planned to be included with shipments by October 1983.

BASIC SUPPORT DATA

EXPECTED SERVICEABILITY PERFORMANCE: The 8502X-Family Directional Bridges are forecasted to have a Reported Failure Rate (FR) of 3%. Refer to Attachment 3: Basic Support Data for additional details. (Note that the figures in Attachment 3 reflect total failures for all five models of Directional Bridges.)

PERIODIC MAINTENANCE SCHEDULE: None. (Maintenance required depends heavily on connector use and wear. Customers making frequent connections and disconnections should consider using a high-quality adapter.)

RECOMMENDED CALIBRATION CYCLE: One year.

REPAIR FORECAST BY REGION: The anticipated number of repairs per region for the first year of shipments is shown in Attachment 4: Predicted Number of Repairs. (Note that the figures in Attachment 4 reflect total repairs for all five models of Directional Bridges.)

SUPPORT EQUIPMENT

EXPENSED ITEMS: None.

CAPITAL ITEMS: Equipment required to performance test, adjust, and troubleshoot the 8502X-Family Directional Bridges is listed in Attachments 5-1 and 5-2: Recommended Test Equipment. Note that equipment requirements vary considerably between different Directional Bridges due to different frequency ranges and connector types.

PARTS SUPPORT

RECOMMENDED FIELD SERVICE INVENTORY: None at this time. (Future Product Support Plans will include this information, as history is developed.)

UNIQUE PARTS: All unique replaceable parts have been priced and set up on the Replacement Parts Price List. Many have been stocked at both Corporate Parts Center and Parts Center Europe.

Both new and restored (Blue Stripe Exchange Program) microcircuits have been priced, set up, and stocked at Corporate Parts Center and Parts Center Europe. Refer to Attachment 1: Replacement Microcircuits for details.

The Service Engineer for the 8502X-Family Directional Bridges is Dave Engelder at Network Measurements Division, (707) 525-1400, Ext. 2163; COMSYS 4500. Please call or write if you have any questions or comments about these instruments.

Attachment 1:

REPLACEMENT MICROCIRCUITS

The 8502X-Family Directional Bridge microcircuits are not repairable. New microcircuits are available for replacement; however, these may cost up to 90% of the instrument selling price. Restored (Blue Stripe Exchange) microcircuits cost approximately 50% less than new microcircuits, and offer an inexpensive repair option.

85020A

New: HP P/N 5086-7375; $750
Restored: HP P/N 5086-6375; $450

85020B

New: HP P/N 5086-7391; $750
Restored: HP P/N 5086-6391; $450

85021A

New: HP P/N 5086-7376; $1800
Restored: HP P/N 5086-6376; $ 900

(APC-7 connector collar separately replaceable.)

85021B

New: HP P/N 5086-7377; $2150
Restored: HP P/N 5086-6377; $1000

85021C

New: HP P/N 5086-7399; $1800
Restored: HP P/N 5086-6399; $ 900

Attachment 2:

8756A SERVICE TRAINING CALENDAR (1983)

May 9 - May 10	ISD, Mt. View, CA
May 12 - May 13	Los Angeles, CA
June 6 - June 7	Lexington (Boston), MA
June 9 - June 10	Paramus, NJ
July 25 - July 26	Richardson (Dallas), TX
July 28 - July 29	Atlanta, GA
August 1 - August 2	Rolling Meadows (Chicago), IL
October 17 - October 21	Orsay (Paris), France

All 8756A Service Training will include brief seminar segment on the 8502X-Family Directional Bridges and 8756S Automatic Scalar Network Analyzer. PT-11 CEs may wish to attend. Contact the office's Service Manager for class openings and other information.

Attachment 3 : BASIC SUPPORT DATA WORKSHEET
HARDWARE SUPPORT

Component Model # 85020A/B 85021A/B/C Option # N/A Division NMD (4500)
Product Line Scalar Net.Anl. System Model # N/A System Option # N/A

I. HARDWARE SUPPORT STRATEGY

A. STRATEGY: Check one or both boxes below and complete applicable sections that follow.

On-Site ☐ Bench ☒

B. COMMENTS ON STRATEGY: Blue Stripe Exchange Program for microcircuits.

C. POTENTIAL SUPPORT PROBLEMS: Key spec. – 40dB directivity – is difficult to Performance Test in the field.

II. SCHEDULED MAINTENANCE

A. ROUTINE PREVENTATIVE MAINTENANCE: (Show preventative maintanance time only.)

	Bench	On-Site
1. PM Cycle:	N/A (xx) PM/yr	N/A (xx) PM/yr
2. Average PM Time:	N/A (xx.x) h/PM	N/A (xx.x) h/PM

B. CALIBRATION: Full specification check and adjustment as needed.

1. Is calibration: (Check one or both boxes. If both apply, show both manual and automated data below.)
   Manual ☒ (Automated ☒ Planned for September 1983)
2. Automated tests are performed on: SCAT ☐ PCU ☐ Other ☒
   If Other, describe HP 9826/36, 8350B, 8756A, + Special Tools

		Bench	On-Site
3. Calibration Cycle:		1 (xx) Cal/yr	N/A (xx) Cal/yr
4. Average Cal Time:	(Manual)	2.0 (xx.x) h/Cal	N/A (xx.x) h/Cal
	(Automatic)	1.0 (xx.x) h/Cal	N/A (xx.x) h/Cal

5. Is calibration required as part of: Repair ☒ PM ☐ Other ☐
   If other, specify _____

C. OPERATION VERIFICATION. Short procedure providing a 90% level of confidence that the product meets its published specifications.

1. Is operation verification: Manual ☒ Automated ☐
2. If automated, are tests performed on: SCAT ☐ PCU ☐ Other ☐
   If Other, describe N/A

	Bench	On-Site
3. Op Ver Cycle:	N/A OV/yr (xx)	N/A OV/yr (xx)
4. Average OP Ver Time:	N/A h/OV (xx.x)	N/A h/OV (xx.x)

5. Operation verification is a required part of:

Repair ☐ PM ☐ Other ☐

If other, specify N/A

D. FUNCTIONAL TEST. Verifies that the product performs its designed functions.

	Bench	On-Site
1. Functional Test Cycle:	N/A FT/yr (xx)	N/A FT/yr (xx)
2. Ave Functional Test time:	0.1 h/FT (xx.x)	N/A h/FT (xx.x)

3. Is a functional test required as part of:

Repair ☒ PM ☐ Cal ☐ Other ☒

If other, specify Suitable as daily Functional Test.

III. UNSCHEDULED MAINTENANCE – REPAIRS

A. DIAGNOSIS AND REPAIR. Time and materials required to setup and diagnose the fault, determine the corrective action and replace defective components. Does *not* include post-repair testing, (part B below).

	Bench	On-Site
1. Est Failure Factor*:	0.03 Fail/inst-yr (xx)	N/A Fail/inst-yr (xx)
2. Mean Time to Repair:	2.5 h/repair (xx.x)	N/A h/repair (xx.x)
3. Average Parts Charge: (Use List Price)	#600 $/repair (xxxx)	N/A $/repair (xxxx)

* Data should be based on 2000 operating hours/year of product use under normal environmental and operating conditions. Failure factor is calculated as the annualized percent Failure Rate divided by 100.

B. POST-REPAIR CALIBRATIONS/OPERATION VERIFICATIONS/FUNCTIONAL TESTS If the time required to perform these operations after the repair differs from that shown in Section II, please explain and show charges below; otherwise enter "N/C" (No Change):

1. Explanation: Repairs not involving microcircuit can be verified by Functional Test.

	Bench	On-Site
2. Average Cal Time:	N/C h/Cal (xx.x)	N/A h/Cal (xx.x)
3. Average Time Op Ver Time:	N/C h/OV (xx.x)	N/A h/OV (xx.x)
4. Average Funct Test Time: (Use List Price)	N/C h/FT (xx.x)	N/A h/FT (xx.x)

IV. OTHER HARDWARE SERVICES: Complete this section for base system. show only incremental time for options (if applicable).

A. SITE PREP (On-Site only): Site review prior to installation to assess power and environmental requirements. Do *not* include travel time.

1. SITE PREP Time: N/A h
   (xx.x)
2. When performed: N/A

B. INSTALLATION (On-Site only): Inventorying, unpacking, installing and verifying the system is functioning (PT11). Start-up operator training (PT21). Do *not* include travel time.

1. System Hardware integration and Startup: N/A h
   (xx.x)
2. Start-up Operator Training: N/A h
   (xx.x)

C. LOANERS: If provision of loaner instruments is part of the service strategy for this product, attach a sheet giving model numbers needed, recommended quantity, and estimated probability of need.

V. SPECIAL COSTS NOT COVERED ABOVE (Period Overhauls, Expensive Parts, PM Suppliers, Vendor Repairs, Special Cals, etc.)

A. DESCRIPTION OF COSTS: N/A

	Bench	On-Site
B. TOTAL LABOR HOURS:	N/A h/yr	N/A h/yr
C. TOTAL PARTS CHARGE:	N/A $/yr	N/A $/yr
D. ADDITIONAL COSTS:	N/A $/yr	N/A $/yr

Basic support data shown applies to all five 8502X-family Directional Bridges.

Attachment 4. Predicted Number of Repairs

REGION	Q3-83	Q4-83	Q1-84	Q2-84	Q3-84
Eastern	0.3	0.7	1.0	1.6	2.1
Midwestern	0.1	0.2	0.4	0.6	0.8
Southern	0.1	0.2	0.4	0.6	0.8
Neely/ISC	0.3	0.7	1.0	1.6	2.1
U.S. - TOTAL	0.8	1.8	2.8	4.4	5.8
Great Britain	0.1	0.2	0.4	0.6	0.8
France	0.1	0.2	0.4	0.6	0.8
Germany	0.1	0.2	0.3	0.4	0.5
North European	0.1	0.2	0.3	0.4	0.5
South European	0.1	0.2	0.3	0.4	0.5
EUROPE - TOTAL	0.5	1.0	1.7	2.4	3.1
Canada	0.0	0.1	0.2	0.2	0.2
Australia	0.0	0.0	0.1	0.1	0.2
Japan	0.2	0.3	0.5	0.8	1.2
Other Int'l	0.0	0.1	0.2	0.2	0.2
WORLDWIDE - TOTAL	1.5	3.3	5.5	8.1	10.7

* Predicted failures are based on best estimates at this time. They should be interpreted as rough estimates and updated as new information becomes available. Predictions are based on 2000 operating hours per year for each instrument.

Repair estimates shown include all five 8502X-family Directional Bridges.

Attachment 5-1: 85020A/B Recommended Test Equipment

		85020A	85020B
Instrument	**Critical Specifications**	**Recommended Test Model**	
Scalar Network Analyzer	Operating Frequency: 27.8 kHz 85020A/B compatible Includes display	8756A or 8755C/ 182T	8756A or 8755C/ 182T
Sweep Oscillator plus RF Plug-In	8756A compatible Frequency: 0.01-2.4 GHz	8350A/B	8350A/B 83522A
or	Frequency: 0.01-4.3 GHz	83525A/B	or 83525A/B
Synthesized Sweeper	Frequency: 0.01-4.3 GHz	8340A	8340A
Detectors (2)	Frequency: 0.01-4.3 GHz	11664A	11664A
System Verification Set (Table 1-3)	Type-N, 50 ohms Type-N, 75 ohms (includes 75-ohm matching pad)	85023C	85023D
Step Attenuator	Frequency: DC-4.0 GHz 0-70 dB in 10-dB steps	8495A Opt. 001	8495A Opt. 001
Digital Multimeter	Accuracy: ±0.01% Input Impedance: ≥10M Ohms	3456A	3456A
Storage Normalizer	For use with 8755C where memory is required	8750A	8750A

This equipment is used for performance testing, adjustment, and troubleshooting.

Attachment 5-2: 85021A/B/C Recommended Test Equipment

		85021A	85021B	85021C
Instrument	**Critical Specifications**	**Recommended Test Model**		
Scalar Network Analyzer	Operating Frequency: 27.8 kHz 85021A/B/C compatible Includes display	8756A or 8755C/ 182T	8756A or 8755C/ 182T	8756A or 8755C/ 182T
Sweep Oscillator plus RF Plug-In	8756A compatible Frequency: 0.01-18 GHz	8350B 83592A/B	8350B	8350B 83592A/B
or	Frequency: 0.01-26.5 GHz	or 83595A	83595A	or 83595A
Synthesized Sweeper	Frequency: 0.01-26.5 GHz	8340A	8340A	8340A
Detectors (2)	Frequency: 0.01-18 GHz Frequency: 0.01-26.5 GHz	11664A *	11664B	11664A
Power Splitter	Frequency: 0.01-18 GHz Frequency: 0.01-26.5 GHz	11667A	Weinschel 1579B	11667A
System Verification Set	APC-7 APC-3.5 Type-N (50 ohms)	85023A	85023B	85023C
50 ohm Sliding Load	APC-7/Type-N, 1.8-18 GHz APC-3.5, 2-26.5 GHz	905A	911C	905A
Digital Multimeter	Accuracy: ±0.01% Input Impedance: ≥10M Ohms	3456A	3456A	3456A
Storage Normalizer	For use with 8755C where memory is required	8750A	8750A	8750A
Amplifier	Output power: +15 dBm	8447E	8447E	8447E

This equipment is used for performance testing, adjustment, and troubleshooting.

*Option 001 (APC-7)


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