DFP-1000 DF BEARING PROCESSOR
USER FUNCTIONAL TEST PROCEDURE

I DESCRIPTION

This procedure provides users with the means to implement a "closed-box" functional test of the DFP-1000 DF Bearing Processor and Display to verify essential performance characteristics. It is organized to test as many features as practical in an abbreviated test with a minimum of test equipment and accessories. The procedure requires only basic familiarity with electronic test equipment and procedures, and does not require that the unit be removed from its cabinet. It is suitable both as a user acceptance test procedure as well as a means of performance verification. It is particularly recommended that this procedure be implemented prior to returning a DFP-1000 to the factory for repair, since the results will quickly point the factory technician to the source of trouble.

II APPLICABILITY

This procedure is applicable to all DFP-1000 DF processors with serial numbers from 001 to 098 inclusive. A separate procedure (doc. # fp1000a1.tpu) is required for DFP-1000A DF processors with serial numbers 099 and above.

III APPLICABLE DOCUMENTS

A. RF Products DFP-1000A DF Bearing Processor/Display Operator's Manual (doc. # dfp1000a.oma)

B. RF Products DTI-100A DF Bearing Synthesizer Operator's Manual (doc. # dti100a.oma)

IV TEST EQUIPMENT REQUIRED

A. RF Products DTI-100/DTI-100A DF Bearing Synthesizer.

B. RF signal generator, 10.7 MHz and 455 kHz frequency capability, 50 ohm output, with internal and external AM and FM modulation capability (HP 8640B, HP 8656B, Marconi 2019A, or similar).

C. Regulated DC power supply, +13.8 VDC nominal output with 3 ampere minimum

output current capacity (Astron RS-7A or similar).

D. Multi-meter, w/DC current measurement ability up to 3 amperes (Micronta 22-185A or similar).

E. IBM PC/XT/AT-compatible computer w/available COM1 or COM2 serial port and DFDATA test software (required only for units having computer interface option).

F. (Optional.) Oscilloscope (Tektronix 465 or similar).

G. Miscellaneous plugs, cables, and adaptors as required.

V TEST PROCEDURE

A. PHYSICAL INSPECTION, MECHANICAL ALIGNMENT, & PRELIMINARY STEPS

1__ With the DFP-1000 disconnected from its power source, carefully inspect the unit for any signs of physical damage.

2__ Remove the fuse from the fuse-holder (located on the rear-panel) and inspect it to verify that it is a GMA-type 5 mm x 20 mm 2.5 ampere fast-blow fuse. If not, replace it with the correct type. Otherwise, reinstall it in the fuse-holder.

3__ Exercise all front-panel knobs, switches, and push-buttons to verify that all knobs rotate smoothly without binding, the toggle switches can be set to all their positions without excessive force, and the push-buttons can be depressed without sticking.

4__ Verify that the **CRT GAIN**, **SQUELCH**, **VOLUME**, and **BFO/FINE TUNE** knobs audibly "click" when rotated fully counter-clockwise to their respective detented positions.

5__ Verify that the CRT bezel can be rotated in both directions without binding. Return it back to its normal detented position with its white alignment marker matching the black front-panel reference index.

6__ Verify that the white alignment marker lines of the **CRT GAIN**, **SQUELCH**, and **VOLUME** knobs are aligned with their respective black dots when these knobs are set fully counter-clockwise to their detented positions. Use an Allen wrench as required to loosen the set screws (two per knob) and slip the knobs on the control shafts to restore mechanical alignment. **Do not** attempt mechanical realignment of the **BFO/FINE TUNE** knob (see cautionary statement below).

CAUTION

*Do not attempt to realign the **BFO/FINE TUNE** knob* - this knob has been mechanically aligned at the factory so that the DFP-1000 is tuned to its nominal center frequency when the white marker index line is set at 12 o'clock.

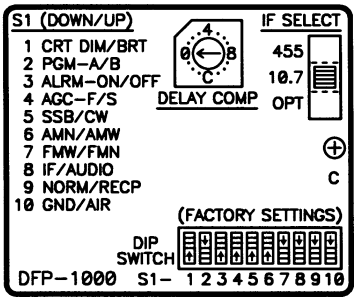
7__ Verify that the **SIGNAL STRENGTH** meter needle points to zero on the meter scale. If it is misaligned, insert a small screwdriver into the hole immediately below the meter and carefully rotate the meter adjustment screw to restore mechanical alignment. *Be sure that the DFP-1000 is set normally on a flat horizontal surface before attempting this adjustment.*

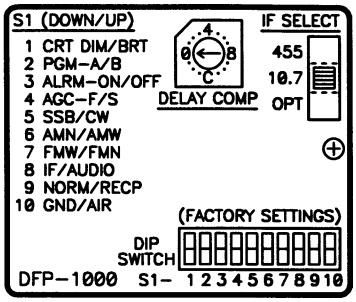
8__ Set the front-panel controls as follows:

TRACK & HOLD - **OFF**
CRT - **MED**
PLL - **OFF**
MODE - **CW**
BFO/FINE TUNE - 12 o'clock
CRT GAIN - 8 o'clock
SQUELCH - 8 o'clock
VOLUME - **OFF**

Note: The **PLL** switch may not be present on some later model units.

9__ Remove the rear-panel configuration setup cover plate (by first loosening the four captive thumbscrews) to expose the configuration setup switches. Carefully verify that all 10 dip-switches and the **IF SELECT** slide switch are positioned at their standard factory settings as indicated on the leftmost configuration setup label illustration below. If any of these switches are not set as per this standard configuration setup label, change these switch settings appropriately.





CAUTION

If any of the configuration setup switches need to be changed, *record the original settings now* on the blank rightmost configuration setup label above so that these switches can be restored to their user settings as called for upon completion of this procedure.

10__ (Optional.) Verify that the spare fuse is present (it is located immediately above the dip-switches and to the immediate left of the **DELAY COMP** switch). *Carefully* pry it out of its two holding clamps and inspect it to verify that it is a GMA-type 5 mm x 20 mm 2.5 ampere fast-blow fuse. Also verify that this fuse is good, preferably using an ohmmeter. If an ohmmeter is unavailable, rely instead on visual inspection. Once verified, reinstall the fuse in its holding clamps.

B. POWER-UP TESTS

1__ With the **VOLUME** knob still set to **OFF**, connect the DFP-1000 to the +13.8 VDC regulated power source.

2__ Power-up the DFP-1000 by rotating the **VOLUME** knob slightly clockwise until a click is heard. Set the **VOLUME** knob at 8 o'clock.

3__ Set the CRT **INTEN** adjustment fully counter-clockwise.

4__ After a 30 second warm-up, verify with the multi-meter that the current drawn by the DFP-1000 from the +13.8 VDC supply is approximately 1.1 amperes. **Note:** While the DFP-1000 CRT is warming up, current drain can exceed 2 amperes.

5__ Verify that the **SIGNAL STRENGTH** meter illuminates.

6__ Verify that the **FREQ** indicator displays a valid digit (1, 2, 3, 4, 5, 6, 7, 8, 9, or 0).

7__ Verify that the **FREQ** indicator increments in the proper order when the upper push-button is depressed, and that all ten digits can be obtained in succession (wrap-around occurs from 9 to 0).

8__ Verify that the **FREQ** indicator decrements in the proper order when the lower push-button is depressed, and that all ten digits can be obtained in succession (wrap-around occurs from 0 to 9).

9__ With the unit still powered-up, turn it upside down and remove the rear cabinet screw (located adjacent to the rear rubber mounting foot closest to the 11-16 VDC rear-panel power connector) using a #2 Phillips screwdriver. Verify that the removal of this screw powers-down the unit (this confirms proper operation of the safety interlock mechanism), re-install the screw, and return the unit to its normal upright position.

C. LISTEN-THROUGH TESTS

1__ Verify that the DFP-1000 front-panel controls are still set as per step V-A-8 (with the exception that the **VOLUME** control should be set at 8 o'clock).

2__ With the **MODE** switch still set to **CW**, advance the **VOLUME** control to 9 o'clock and verify that a "hissing" sound is audible from the speaker (if no hissing sound is heard, rotate the **SQUELCH** control slightly counter-clockwise). Re-adjust the **VOLUME** control as required for a comfortable listening level.

3__ Verify that the hissing sound can be squelched by rotating the **SQUELCH** control clockwise. The squelch should activate at approximately 8-10 o'clock. Set the **SQUELCH** control back to just below 8 o'clock to restore the hissing sound.

4__ Without changing the setting of the **VOLUME** control, set the **MODE** switch to **AM** and verify that the hissing sound becomes louder in volume than it was in **CW**. Again verify

that the hissing sound can be squelched with a **SQUELCH** setting of approximately 8-10 o'clock. Set the **SQUELCH** control back to just below 8 o'clock.

5__ Without changing the setting of the **VOLUME** control, set the **MODE** switch to **FM** and verify that the hissing sound becomes much louder than it was in **AM**. Again verify that the hissing sound can be squelched with a **SQUELCH** setting of approximately 8-10 o'clock, and then set the **SQUELCH** control back to just below 8 o'clock.

6__ With the **MODE** switch still in **FM**, set up the signal generator for a -55 dBm CW signal and connect the signal generator RF output to the DFP-1000 **RF/IF** input through a short (4' or less) length of 50 ohm coaxial cable. Set the signal generator frequency to 10.700 MHz.

7__ Verify that the application of the RF signal to the DFP-1000 fully quiets the FM hissing sound and results in an approximately half-scale **SIGNAL STRENGTH** meter indication.

8__ Set the signal generator for 3 kHz deviation internal FM at a 1 kHz modulation rate. A clean-sounding 1 kHz tone should be plainly audible. Adjust the **VOLUME** control as required for a comfortable listening level.

9__ Verify that the **SIGNAL STRENGTH** meter is still at approximately half-scale.

10__ (Optional.) Monitor the **HEADSET** audio output with the oscilloscope using an appropriate interface cable with a male phone plug at one end. Partially insert the phone plug into the **HEADSET** jack so that it is sufficiently inserted to view the 1 kHz tone waveform on the oscilloscope, but not sufficiently inserted to disconnect the speaker audio. Verify that a reasonably undistorted 1 kHz sine wave is visible on the oscilloscope. Apply hearing protection (see cautionary statement below) and slowly rotate the **VOLUME** control clockwise until the waveform begins peak clipping. Clipping should occur at a waveform amplitude of roughly 10 VPP (volts peak-to-peak). Return the **VOLUME** control to a setting that results in a comfortable listening level.

CAUTION

This step results in a speaker volume level that is uncomfortably loud. Use hearing protection for safety.

11__ Fully insert a phone plug into the **HEADSET** jack and verify that this disables the speaker audio. Remove the phone plug and set it aside.

12__ Set the DFP-1000 **MODE** switch to **AM** and reconfigure the signal generator for 50% internal AM at a 1 kHz modulation rate (be sure to disable signal generator FM). A clean-sounding 1 kHz tone should again be plainly audible. Adjust the **VOLUME** control as required for a comfortable listening level.

13__ Verify that the **SIGNAL STRENGTH** meter is still at approximately half-scale.

14__ (Optional.) Repeat step V-C-10.

15__ Set the DFP-1000 **MODE** switch to **CW** and reconfigure the signal generator for a CW (unmodulated) output at 10.701 MHz

16__ An audible tone of approximately 1 kHz should be heard. This tone should sound clean and undistorted. **Note:** If a tone near 1 kHz is not heard, change the signal generator frequency slightly as required.

17__ Verify that the **SIGNAL STRENGTH** meter is still at approximately half-scale.

18__ (Optional.) Repeat step V-C-10.

19__ Restore the signal generator frequency to 10.700 MHz. Leave the test setup intact and proceed to the next Section.

D. CRT DISPLAY PRELIMINARY TESTS

1__ Verify that the **CRT GAIN** control is still set at 8 o'clock.

2__ Rotate the **INTEN** control clockwise until a moderately bright dot appears on the CRT face and confirm that it can be sharply converged with the **FOCUS** control.

3__ Exercise the **VERT** and **HORZ** positioning controls to verify that the dot can be moved both vertically and horizontally along the CRT face.

4__ Once proper operation of the **VERT** and **HORZ** positioning controls has been confirmed, set these controls to center the dot on the CRT face and proceed to the next Section.

E. CRT DISPLAY AND INDICATOR TESTS

1__ Verify that the DFP-1000 front-panel controls are still set as per V-A-8 (with the exception that **VOLUME** control should be set near 9 o'clock and the **CRT GAIN** control to 9 o'clock.

2__ Verify that the signal generator is still set for a 10.700 MHz -55 dBm CW output.

3__ Connect the DTI-100A DF Bearing Synthesizer to the signal generator and DFP-1000 (refer to the DTI-100A Operator's Manual as required for details regarding this test setup). Set the DTI-100A **AZIMUTH** selector to 0° and the signal generator for 50% external AM (note that the DTI-100A **GAIN** control must be appropriately set in coordination with any relevant signal generator modulation gain controls to establish the required 50% modulation level).

4__ A 0° bearing should now be visible with a full-length CRT trace (be sure that the **CRT GAIN** control is set at 9 o'clock). Verify that the green **SIGNAL PRES** indicator is illuminated and the red **REDUCE CRT GAIN** indicator extinguished.

5__ Rotate the **BFO/FINE TUNE** control fully counter-clockwise until it clicks into its detented **OFF** position and verify that the **MODE** switch is still in **CW** and the **CRT** switch in **MED**. A warbling low frequency "signal presence" tone should be audible.

6__ Rotate the **CRT GAIN** control fully clockwise for maximum gain and verify that the red **REDUCE CRT GAIN** indicator illuminates after a moment or two.

7__ Set rear-panel dip-switch #1 to **DIM** (down) to enable the CRT screen-saver circuitry.

8__ Rotate the **CRT GAIN** control fully counter-clockwise so that it clicks into its detented **DF OFF** position. Both the **SIGNAL PRES** and **REDUCE GAIN** indicators should extinguish. The CRT dot should also disappear or dim, indicating proper operation of the CRT screen-saver circuitry (allow at least 30 seconds for the screen saver to activate).

9__ Set rear-panel dip-switch #1 to **BRT** (up) to disable the CRT screen-saver circuitry. The CRT trace should immediately reappear.

10__ Set the **CRT GAIN** control back to 9 o'clock to restore a full-length CRT trace.

11__ Set the **TRACK & HOLD** switch to **HOLD**.

12__ Disconnect the coaxial cable from the signal generator to interrupt the signal input to the DFP-1000. The 0° bearing displayed on the CRT should remain "frozen" for approximately 10 seconds before the trace collapses. **Note 1:** Since the signal must be interrupted suddenly for the track & hold to function properly, the coaxial cable should be disconnected rapidly. If the signal generator has a carrier on/off switch, this may also be used, but it is important that the activation of such a switch result in complete disabling of the signal generator output (with some signal generators, these switches only partially disable the output). **Note 2:** Some units are configured for a 2.5 (rather than 10) second hold time.

13__ Return the **TRACK & HOLD** switch to **OFF,** leave the test setup intact, and proceed to the next Section.

F. BEARING AND SENSITIVITY TESTS

1__ Verify that the DFP-1000 front-panel controls are still set as per V-A-8 (with the exception that **VOLUME** control should be set at 9 o'clock, the **CRT GAIN** control at 9 o'clock, and the **MODE** switch to **FM**).

2__ Verify that the DFP-1000 is correctly tuned to the signal generator frequency, the signal generator output is set to -55 dBm, the signal generator and DTI-100A are properly configured for a 0° bearing using 50% modulation, and a full-length 0° CRT trace is visible.

3__ Verify that the **CRT** switch is still in **MED** and rotate the DTI-100A **AZIMUTH** switch from 0° to 315°. The CRT bearing should correspondingly move from 0° to 315° in just over half a second.

4__ Set the **CRT** switch to **FAST** and rotate the DTI-100A **AZIMUTH** selector from 315° back to 0°. The CRT bearing should correspondingly move from 315° to 0° in well under half a second (the response should be visibly much faster than that observed in step V-F-3 above with the **CRT** switch in **MED**).

5__ Set the **CRT** switch to **SLOW** and rotate the DTI-100A **AZIMUTH** selector from 0° back to 315°. The CRT bearing should correspondingly move from 0° to 315° in approximately 2 seconds (the response should be visibly much slower than that observed in step V-F-3 above with the **CRT** switch in **MED**).

6__ Set the **CRT** switch to **MED** and confirm that the CRT bearing display is correct for all 12 DTI-100A azimuth selections. When completed, set the DTI-100A **AZIMUTH** switch back to 0°.

7__ Set the **CRT GAIN** control fully clockwise for maximum gain, reduce the signal generator output to -130 dBm, and confirm that a 0° CRT bearing is visible with a trace length approximately ¼ to ½ full-screen. Although bearing jitter will be present, the bearing should still be recognizable as being approximately 0° (to verify this, rotate the DTI-100A **AZIMUTH** selector back and forth between 0° and 22.5° - the resulting change in the CRT bearing should be clearly discernable). This step confirms DFP-1000 DF sensitivity.

8__ Repeat the above DF sensitivity test at 455 kHz after changing the signal generator frequency to 455 kHz and setting the rear-panel **IF SELECT** configuration setup switch to **455** (its uppermost position).

9__ Leave the test setup intact and proceed to the next Section.

G. DF ANTENNA BANDSWITCHING TESTS

1__ Exercise the DFP-1000 channel select push-buttons appropriately to select in succession channels 1, 2, 3, 4, and 5 on the **FREQ** indicator. The DTI-100A yellow **HI/LO BAND** indicator should remain extinguished for all these channels. This confirms that the DFP-1000 is sending the appropriate low-band antenna bandswitch code.

2__ Exercise the channel select push-buttons appropriately to select in succession channels 6, 7, 8, 9, and 0 on the **FREQ** indicator. The DTI-100A yellow **HI/LO BAND** indicator should illuminate for all these channels. This confirms that the DFP-1000 is sending the appropriate high-band antenna bandswitch code.

3__ **Note:** If an older DTI-100 or DFA-400 DF bearing synthesizer is used in lieu of the DTI-100A, the above steps cannot be directly implemented as a consequence of the fact that these earlier units do not have the **HI/LO BAND** indicator. In such a case, the antenna bandswitch line can be verified by directly monitoring the **HI/LO** band pin on the DFP-1000 rear-panel **ANTENNA CONTROL** connector with a voltmeter or oscilloscope. For units employing the standard 7-pin microphone connector, monitor pin 7 (the center pin). For units employing the 6-pin Bendix connector, monitor pin E (located at approximately 4 o'clock). In either case, a 0 VDC output corresponds to

low-band and a 5 VDC output corresponds to high-band.

H. MISCELLANEOUS

1__ If the DFP-1000 is equipped with a computer interface, appropriately exercise this feature to confirm proper operation. **Note:** To obtain the specified 0.5° RMS bearing accuracy, set the **CRT** switch to **SLOW**.

2__ Disconnect all test equipment and restore the DFP-1000 rear-panel configuration setup switches to their original positions (recorded in step V-A-9). If it is believed that some of these original switch settings are in error, resolve this matter first. Once these switches have been properly set, re-install the rear-panel configuration setup cover plate using the four captive thumbscrews.

VI RETURNING EQUIPMENT TO FACTORY FOR REPAIR

When returning equipment to the factory for repair, it is very important that the equipment be accompanied by a detailed report listing all symptoms, along with any background information regarding the circumstances that may have led to the failure. If a problem occurs intermittently or only in specific modes of operation, this should be noted as well. If the above user functional test procedure has been performed, the specific test(s) the unit failed should be listed. Before returning any equipment, please contact RF Products at (619) 583-2024 (Tel/Fax) or via e-mail at rfprodsdc@juno.com to obtain return authorization.

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Rev A02/09-97/dfp1000_tpu_01

September, 1997