



## Test Procedure

### **285-0329-TSP 8-Channel Bi-directional Booster Amplifier**

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## TEST PROCEDURE – 8-Channel Bi-directional Booster Amplifier

### 1.0 General

This document provides the test procedure for the product as manufactured by Fiber-Span, Inc. This procedure forms a part of the overall manufacturing process for the unit in question. This procedure is split into 4 test sections. Tests A and B are downlink tests. Tests C and D are uplink tests.

#### 1.1 Disposition of Failure

If the required performance as described in this document is unachievable through use of the procedures described herein, the unit shall be tagged as such and submitted to engineering for analysis. Refer to Section 5.0 for performance standards.

#### 1.2 Data Records

Permanent records shall be kept. A sample data sheet is provided for copying, one for each unit tested.

#### 1.3 Acronyms and Definitions

In the following procedure, the downlink signals are referred as the Talk-In signals or channels, and the uplink signals are referred to as the Talk-Out signals or channels.

### 2.0 Required Equipment

The following equipment shall be used for testing purposes.

#### 2.1 Hardware

The following equipment or its equivalent shall be used for test and verification of the unit under test:

- a) Directional Coupler
- b) 50 ohm Termination (2)
- c) Spectrum Analyzer with Tracking Generator
- d) RF Frequency Counter
- e) RF pads as required

#### 2.2 Software

The following Fiber-Span software, TCC-BDA, should be installed on a personal computer: Refer to the software manual for installation and operation, programming procedures.

### 3.0 Equipment

Equipment shall be in calibration and set up as configured below:

#### 3.1 Calibration

Calibration will be described in each individual test section.

#### 3.2 Equipment Setup

Equipment setup will be described in each individual test section.

## DLINK TEST 1

- Downlink signal/ channel assignments
- RF Frequency Accuracy
- Minimum low band signal to full RF output power
- Variation of output power with input level
- Time-out timer (key line time out)

### 3.0 Equipment

Equipment shall be in calibration and set up as configured below:

#### 3.1 Equipment Setup (refer to Figure 1)

- 3.1.1 Connect the test equipment to the UUT as outlined in Figure 1. (Steps 3.1.2 to 3.1.6). **Note:** to protect the test equipment from accidental operations of the UUT, disconnect the RF output of the uplink enclosure from the “Off-the-Air” duplexer and terminate the duplexer port with a 50ohm termination.
- 3.1.2 Connect the RF output port of the downlink enclosure to the common port of a directional coupler.
- 3.1.3 Connect the sampling port of the directional coupler to a frequency counter.
- 3.1.4 Connect the thru port of the directional coupler to a spectrum analyzer through a 30dB RF pad.
- 3.1.5 Connect the RF input port of the downlink enclosure to a RF generator.
- 3.1.6 Start with the downlink channel module 1.
  - 3.1.6.1 Connect the laptop computer to the front panel of the channel module.
  - 3.1.6.2 Run Fiber-Span software TCC-BDA.
  - 3.1.6.3 Program the channel for time-out = 0, which disables the time-out function.
  - 3.1.6.4 Repeat steps 3.1.6.1 to 3.1.6.3 for the remaining 7 channels.

#### 3.2 Calibration

- 3.2.1 At the generator disconnect the cable from the test setup.
- 3.2.2 Disconnect the cable from the RF output port of the downlink enclosure.
- 3.2.3 Connect the cable from step 3.2.2 to the generator.
- 3.2.4 Start with channel 1.
- 3.2.5 Set the generator to the required channel frequency.
- 3.2.6 Set the output level of the generator to +10dBm.
- 3.2.7 Measure on spectrum analyzer the Fcarrier level.
- 3.2.8 Calculate the correction factor as follows:  

$$CF = +10\text{dBm} - (F_{\text{carrier}} \text{ level})$$
- 3.2.9 Record the correction factor on Test Data Sheet.
- 3.2.10 Repeat steps 3.2.5 through 3.2.9 for the remaining 7 high band channels.
- 3.2.11 Re-configure the test setup per 3.1.

## DLINK TEST 1 CON'T

### 4.0 Procedure

#### 4.1 General procedure

- 4.1.1 Start with channel 1.
- 4.1.2 Set the RF generator as follows:
  - 4.1.2.1 Carrier frequency to the required channel frequency.
  - 4.1.2.2 Output level to -90dBm.
  - 4.1.2.3 Set the generator modulation for 500Hz at the required CTSS tone.
  - 4.1.2.4 Press the carrier on/off for carrier off.
  - 4.1.2.5 Press the modulation on/off for modulation on.
- 4.1.3 Set the spectrum analyzer as follows:
  - 4.1.3.1 CENTER to the required channel frequency.
  - 4.1.3.2 SPAN to 1MHz.
  - 4.1.3.3 Level to 0dB.
  - 4.1.3.4 Set COUPLE RBW to auto
- 4.1.4 Observe the "Key" led on the associated channel module is off.
- 4.1.5 On the RF generator press carrier on/off to turn on the generator output.
- 4.1.6 Observe the "Key" led on the associated channel module lights.

#### 4.2 RF Frequency Accuracy

- 4.2.1 Record the reading on the frequency counter.

#### 4.3 Minimum Downlink signal to full RF Output Power

- 4.3.1 On the spectrum analyzer press PEAK
- 4.3.2 Measure the carrier output level.
- 4.3.3 Add the calibration factor and record the result.

#### 4.4 Variation of Output Power

- 4.4.1 Set the generator RF output level to -80dBm.
- 4.4.2 Measure the carrier output level.
- 4.4.3 Add the calibration factor and record the result.

#### 4.5 Variation of Output Power

- 4.5.1 Set the generator RF output level to -30dBm.
- 4.5.2 Measure the carrier output level.
- 4.5.3 Add the calibration factor and record the result.

#### 4.6 Repeat steps 4.1.2 through 4.5.3 for remaining 7 high band channels.

## DLINK TEST 1 CON'T

### 4.7 Time-Out Timer (key line time out)

- 4.7.1 Start with the downlink channel module 1.
- 4.7.2 Plug in the laptop computer into the front panel of the channel module.
- 4.7.3 Run Fiber-Span program TCC-BDA.
- 4.7.4 Program the channel module for a 30 second time-out (key line time-out of 30 seconds).
- 4.7.5 Repeat steps 4.7.2 to 4.7.4 for the remaining 7 channel modules.
- 4.7.6 Start with channel 1.
- 4.7.7 Set the RF generator as follows:
  - 4.7.7.1 Carrier frequency to the required channel frequency.
  - 4.7.7.2 Output level to -90dBm.
  - 4.7.7.3 Set the generator modulation for 500Hz at the required CTSS tone.
  - 4.7.7.4 Press the carrier on/off for carrier off.
  - 4.7.7.5 Press the modulation on/off for modulation on.
- 4.7.8 Set the spectrum analyzer as follows:
  - 4.7.8.1 CENTER to the required channel frequency.
  - 4.7.8.2 SPAN to 1MHz.
  - 4.7.8.3 Level to 0dB.
  - 4.7.8.4 Set COUPLE RBW to auto
- 4.7.9 On the RF generator press carrier on/off to turn on the generator output.
- 4.7.10 Observe the "Key" led on the associated channel module lights.
- 4.7.11 Observe on the downlink channel module that within thirty (30) seconds the led is off (timed out).
- 4.7.12 On the generator, press the carrier on/off to turn off the carrier.
- 4.7.13 Repeat steps 4.7.7 to 4.7.12 for the remaining 7 channel modules.

**B) DOWNLINK TEST 2**

## Channel Bandwidth

**3.0 Equipment**

Equipment shall be in calibration and set up as configured below:

**3.1 Equipment Setup (refer to figure 2)**

- 3.1.1 Connect the test equipment to the UUT as outlined in Figure 2 (Steps 3.1.2 to 3.1.3). **Note:** to protect the test equipment from accidental operation of the UUT, disconnect the RF output of the uplink enclosure from the "Off-the-Air" duplexer and terminate the duplexer port with a 50ohm termination.
- 3.1.2 Connect the RF output port of the downlink enclosure to the input of the spectrum analyzer through a 30dB RF pad
- 3.1.3 Connect the RF input port of the downlink enclosure to the tracking generator port of the spectrum analyzer.

**3.2 Calibration**

No calibration is necessary for this test.

**4.0 Procedure****4.1 Channel Bandwidth**

- 4.1.1 Plug in laptop into the downlink channel 4 module's front panel connector.
- 4.1.2 Run Fiber-Span program TCC-BDA
- 4.1.3 Program channel 4 for continuous key.
- 4.1.4 Set the analyzer to channel 4's frequency.
- 4.1.5 Set the SPAN to 100 KHz.
- 4.1.6 Set the tracking generator LEVEL to -50dBm.
- 4.1.7 Measure the bandwidth, 3dB from Fcarrier.
- 4.1.8 Result should be 15 kHz +/-2 kHz.

### C) UPLINK TEST 1

- Uplink signal/ channel assignments
- RF Frequency Accuracy
- Minimum low band signal to full RF output power
- Variation of output power with input level
- Time-out timer (key line time out)

## 3.0 Equipment

Equipment shall be in calibration and set up as configured below:

### 3.1 Equipment Setup (refer to Figure 3)

- 3.1.1 Connect the test equipment to the UUT as outlined in Figure 3 (Steps 3.1.2 to 3.1.6).
- 3.1.2 Connect the RF output port of the uplink enclosure to the common port of a directional coupler.
- 3.1.3 Connect the sampling port of the directional coupler to a frequency counter.
- 3.1.4 Connect the thru port of the directional coupler to a spectrum analyzer through a 30dB pad.
- 3.1.5 Connect the RF input port of the uplink enclosure to a RF generator.
- 3.1.6 Start with the uplink channel module 1.
  - 3.1.6.1 Connect the laptop computer to the front panel of the channel module.
  - 3.1.6.2 Run Fiber-Span software TCC-BDA
  - 3.1.6.3 Program the channel for time-out = 0, which disables the time-out function.
  - 3.1.6.4 Repeat steps 3.1.6.1 to 3.1.6.3 for the remaining 7 channels.

### 3.2 Calibration

- 3.2.1 At the generator disconnect the cable from the test setup.
- 3.2.2 Disconnect the cable from the antenna port of the duplexer.
- 3.2.3 Connect the cable from step 3.3.3 to the generator.
- 3.2.4 Start with channel 1.
- 3.2.5 Set the generator to the required channel frequency.
- 3.2.6 Set the output level of the generator to +10dBm.
- 3.2.7 Measure on spectrum analyzer the Fcarrier level.
- 3.2.8 Calculate the correction factor as follows:  $CF = +10\text{dBm} - (\text{Fcarrier level})$ .
- 3.2.9 Record the correction factor on Test Data Sheet.
- 3.2.10 Repeat steps 3.2.5 through 3.2.9 for the remaining 7 low band channels.
- 3.2.11 Re-configure the test setup as per 3.1.

## UPLINK TEST 1 CON'T

### 4.0 Procedure

#### 4.1 General procedure

- 4.1.1 Start with channel 1.
- 4.1.2 Set the RF generator as follows:
  - 4.1.1.1 Carrier frequency to the required channel frequency.
  - 4.1.1.2 Output level to -90dBm.
  - 4.1.1.3 Set the generator modulation for 500Hz at the required CTSS tone.
  - 4.1.1.4 Press the carrier on/off for carrier off.
  - 4.1.1.5 Press the modulation on/off for modulation on.
- 4.1.3 Set the spectrum analyzer as follows:
  - 4.1.3.1 CENTER to the required channel frequency.
  - 4.1.3.2 SPAN to 1MHz.
  - 4.1.3.3 Level to 0dB.
  - 4.1.3.4 Set COUPLE RBW to auto
- 4.1.4 Observe the "Key" led on the associated channel module is off.
- 4.1.5 On the RF generator press carrier on/off to turn on the generator output.
- 5.1.6 Observe the "Key" led on the associated channel module lights.

#### 4.2 RF Frequency Accuracy

- 4.2.1 Record the reading on the frequency counter.

#### 4.3 Minimum Low Band /RF Output Power

- 4.3.1 On the spectrum analyzer press PEAK
- 4.3.2 Measure the carrier output level.
- 4.3.3 Add the calibration factor and record the result.

#### 4.4 Variation of Output Power

- 4.4.1 Set the generator RF output level to -80dBm.
- 4.4.2 Measure the carrier output level.
- 4.4.3 Add the calibration factor and record the result.

#### 4.5 Variation of Output Power

- 4.5.1 Set the generator RF output level to -30dBm.
- 4.5.2 Measure the carrier output level.
- 4.5.3 Add the calibration factor and record the result.

#### 4.6 Repeat steps 4.1.2 through 4.5.3 for remaining 7 low band channels.

## UPLINK TEST 1 CON'T

### 4.7 Time Out Timer (Keyline time out)

- 4.7.1 Start with the uplink channel module 1.
- 4.7.2 Plug in the laptop computer into the front panel of the channel module.
- 4.7.3 Run Fiber-Span program TCC-BDA.
- 4.7.4 Program the channel module for a 30 second time-out (key line time-out of 30 seconds).
- 4.7.5 Repeat steps 4.7.2 to 4.7.4 for the remaining 7 channel modules.
- 4.7.6 Start with channel 1.
- 4.7.7 Set the RF generator as follows:
  - 4.7.7.1 Carrier frequency to the required channel frequency.
  - 4.7.7.2 Output level to -90dBm.
  - 4.7.7.3 Set the generator modulation for 500Hz at the required CTSS tone.
  - 4.7.7.4 Press the carrier on/off for carrier off.
  - 4.7.7.5 Press the modulation on/off for modulation on.
- 4.7.8 Set the spectrum analyzer as follows:
  - 4.7.8.1 CENTER to the required channel frequency.
  - 4.7.8.2 SPAN to 1MHz.
  - 4.7.8.3 Level to 0dB.
  - 4.7.8.4 Set COUPLE RBW to auto
- 4.7.9 On the RF generator press carrier on/off to turn on the generator output.
- 4.7.10 Observe the "Key" led on the associated channel module lights.
- 4.7.11 Observe on the uplink channel module that within thirty (30) seconds the led is off (timed out).
- 4.7.12 On the generator, press the carrier on/off to turn off the carrier.
- 4.7.13 Repeat steps 4.7.7 to 4.7.12 for the remaining 7 channels.

**D) UPLINK TEST 2**

## Channel Bandwidth

**3.0 Equipment**

Equipment shall be in calibration and set up as configured below:

**3.1 Equipment Setup (refer to figure 8)**

- 3.1.1 Connect the test equipment to the UUT as outlined in Figure 4. (Steps 3.1.2 to 3.1.3).
- 3.1.2 Connect the RF output port of the uplink enclosure to the input of the spectrum analyzer through a 30dB pad.
- 3.1.3 Connect the RF input port uplink enclosure to the tracking generator port of the spectrum analyzer.

**3.2 Calibration**

No calibration is necessary for this test.

**4.0 Procedure**

- 4.1.1 Plug in the laptop into the uplink channel 4 module's front panel.
- 4.1.2 Run Fiber-Span program TCC-BDA.
- 4.1.3 Program channel 4 for continuous key.
- 4.1.4 Set the analyzer to channel 4's frequency.
- 4.1.5 Set the SPAN to 100 kHz.
- 4.1.6 Set the tracking generator LEVEL to -50dBm.
- 4.1.7 Measure the bandwidth, 3dB from Fcarrier.
- 4.1.8 Result should be 15 kHz +/- 2 kHz.