

File: 0134-0538B.DOC
Doc.: 0134-0538
Rev.: B
ECN: 1838
Date: April 1, 2002

**T-BUG TEST STATION
CALIBRATION PROCEDURE
134A T-Bug / 135A E-Bug**

Used on:
0134-0519 E-Field Chamber
0134-0520 Initial Test Station
0134-0521 Final Test Station



Engineering approval:

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1 GENERAL

1.1 Applicability

This calibration procedure is applicable to the following E-Bug/T-Bug Test Stations:

- E-Field Chamber (0134-0519)
- Initial Test Station (0134-0520)
- Final Test Station (0134-0521)

1.2 Equipment List

The following is a list of equipment necessary for the test procedure:

- Fluke 77 DMM or Equivalent
- Frequency Counter
- Oscilloscope
- Signal Generator

2 CALIBRATION

2.1 Output Frequency

Make all frequency measurements with a 100Ω load across J2-1 to J2-2

2.1.1 ADSL

Establish the following switch settings on the TS being calibrated:

Switch	VERSION	PATTERN	AMPLITUDE	BATTERY	FREQUENCY	COUPLING	EXT. METER
Position	T1	1's	HI	N/A	ADSL	BAL	N/A

Measure the frequency seen across J2-1 to J2-2.

$$f_{\text{ADSL}} = 276\text{kHz} \pm 30\text{Hz}$$

2.1.2 US HDSL

Establish the following switch settings on the TS being calibrated:

Switch	VERSION	PATTERN	AMPLITUDE	BATTERY	FREQUENCY	COUPLING	EXT. METER
Position	T1	1's	HI	N/A	HDSL	BAL	N/A

Measure the frequency seen across J2-1 to J2-2.

$$f_{\text{US-HDSL}} = 27.965\text{kHz} \pm 10\text{Hz}$$

2.1.3 T1

Establish the following switch settings on the TS being calibrated:

Switch	VERSION	PATTERN	AMPLITUDE	BATTERY	FREQUENCY	COUPLING	EXT. METER
Position	T1	1's	HI	N/A	T1/E1	BAL	N/A

Measure the frequency seen across J2-1 to J2-2.

$$f_{T1} = 772\text{kHz} \pm 100\text{Hz}$$

2.1.4 E1

Establish the following switch settings on the TS being calibrated:

Switch	VERSION	PATTERN	AMPLITUDE	BATTERY	FREQUENCY	COUPLING	EXT. METER
Position	E1	1's	HI	N/A	T1/E1	BAL	N/A

Measure the frequency seen across J2-1 to J2-2.

$$f_{E1} = 1024\text{kHz} \pm 120\text{Hz}$$

2.1.5 European HDSL

Establish the following switch settings on the TS being calibrated:

Switch	VERSION	PATTERN	AMPLITUDE	BATTERY	FREQUENCY	COUPLING	EXT. METER
Position	E1	1's	HI	N/A	HDSL	BAL	N/A

Measure the frequency seen across J2-1 to J2-2.

$$f_{\text{Euro-HDSL}} = 32\text{kHz} \pm 10\text{Hz}$$

2.2 Output Amplitude

Make all amplitude measurements with a 100Ω load across J2-9 to J2-10.

2.2.1 ADSL - HI

Establish the following switch settings on the TS being calibrated:

Switch	VERSION	PATTERN	AMPLITUDE	BATTERY	FREQUENCY	COUPLING	EXT. METER
Position	T1	1's	HI	N/A	ADSL	DIFF	N/A

Measure V_{pp} seen across J2-9 to Gnd.

TS	0134-0519	0134-0520	0134-0521
$V_{PP-ADSL}$	1.7 ± 0.1	1.7 ± 0.1	1.7 ± 0.1

2.2.2 ADSL – LO

Establish the following switch settings on the TS being calibrated:

Switch	VERSION	PATTERN	AMPLITUDE	BATTERY	FREQUENCY	COUPLING	EXT. METER
Position	T1	1's	LO	N/A	ADSL	DIFF	N/A

Measure V_{pp} seen across J2-9 to Gnd.

TS	0134-0519	0134-0520	0134-0521
mV _{PP-ADSL}	6 ± 0.5	6 ± 0.5	6 ± 0.5

◆ 2.2.3 US HDSL - HI

Establish the following switch settings on the TS being calibrated:

Switch	VERSION	PATTERN	AMPLITUDE	BATTERY	FREQUENCY	COUPLING	EXT. METER
Position	T1	1's	HI	N/A	HDSL	DIFF	N/A

Measure V_{pp} seen across J2-9 to Gnd.

TS	0134-0519	0134-0520	0134-0521
V _{PP-US-HDSL}	1.7 ± 0.1	1.7 ± 0.1	1.7 ± 0.1

2.2.4 US HDSL -LO

Establish the following switch settings on the TS being calibrated:

Switch	VERSION	PATTERN	AMPLITUDE	BATTERY	FREQUENCY	COUPLING	EXT. METER
Position	T1	1's	LO	N/A	HDSL	DIFF	N/A

Measure V_{pp} seen across J2-9 to Gnd.

TS	0134-0519	0134-0520	0134-0521
mV _{PP-US-HDSL}	40 ± 3	40 ± 3	40 ± 3

2.2.5 T1 - HI

Establish the following switch settings on the TS being calibrated:

Switch	VERSION	PATTERN	AMPLITUDE	BATTERY	FREQUENCY	COUPLING	EXT. METER
Position	T1	1's	HI	N/A	T1/E1	DIFF	N/A

Measure V_{pp} seen across J2-9 to Gnd.

TS	0134-0519	0134-0520	0134-0521
V _{PP-T1}	1.7 ± 0.1	1.7 ± 0.1	1.7 ± 0.1

2.2.6 T1 - LO

Establish the following switch settings on the TS being calibrated:

Switch	VERSION	PATTERN	AMPLITUDE	BATTERY	FREQUENCY	COUPLING	EXT. METER
Position	T1	1's	LO	N/A	T1/E1	DIFF	N/A

Measure V_{pp} seen across J2-9 to Gnd.

TS	0134-0519	0134-0520	0134-0521
mV _{PP-T1}	40 ± 3	40 ± 3	40 ± 3

2.2.7 E1 - HI

Establish the following switch settings on the TS being calibrated:

Switch	VERSION	PATTERN	AMPLITUDE	BATTERY	FREQUENCY	COUPLING	EXT. METER
Position	E1	1's	HI	N/A	T1/E1	DIFF	N/A

Measure V_{pp} seen across J2-9 to Gnd.

TS	0134-0519	0134-0520	0134-0521
V _{PP-T1}	1.7 ± 0.1	1.7 ± 0.1	1.7 ± 0.1

2.2.8 E1 - LO

Establish the following switch settings on the TS being calibrated:

Switch	VERSION	PATTERN	AMPLITUDE	BATTERY	FREQUENCY	COUPLING	EXT. METER
Position	E1	1's	HI	N/A	T1/E1	DIFF	N/A

Measure V_{pp} seen across J2-9 to Gnd.

TS	0134-0519	0134-0520	0134-0521
mV _{PP-T1}	40 ± 3	40 ± 3	40 ± 3

2.2.9 European HDSL -HI

Establish the following switch settings on the TS being calibrated:

Switch	VERSION	PATTERN	AMPLITUDE	BATTERY	FREQUENCY	COUPLING	EXT. METER
Position	E1	1's	HI	N/A	HDSL	DIFF	N/A

Measure V_{pp} seen across J2-9 to Gnd.

TS	0134-0519	0134-0520	0134-0521
V _{PP-EUROHDSL}	1.7 ± 0.1	1.7 ± 0.1	1.7 ± 0.1

2.2.10 European HDSL - LO

Establish the following switch settings on the TS being calibrated:

Switch	VERSION	PATTERN	AMPLITUDE	BATTERY	FREQUENCY	COUPLING	EXT. METER
Position	E1	1's	LO	N/A	HDSL	DIFF	N/A

Measure V_{pp} seen across J2-9 to Gnd.

TS	0134-0519	0134-0520	0134-0521
$mV_{PP-EUROHDSL}$	40 ± 3	40 ± 3	40 ± 3

2.3 Power Source

Make all power voltage measurements with a 400Ω load across J5-1 to J5-4.

2.3.1 HI

Establish the following switch settings on the TS being calibrated:

Switch	VERSION	PATTERN	AMPLITUDE	BATTERY	FREQUENCY	COUPLING	EXT. METER
Position	T1	1's	HI	HI	T1/E1	BAL	N/A

$$V_{DC-HI} = 9.4 \pm 0.235$$

2.3.2 LO

Establish the following switch settings on the TS being calibrated:

Switch	VERSION	PATTERN	AMPLITUDE	BATTERY	FREQUENCY	COUPLING	EXT. METER
Position	T1	1's	LO	HI	T1/E1	BAL	N/A

$$V_{DC-LO} = 7.4 \pm 0.185$$

2.4 Current Monitor

2.4.1 UUT Current – HI Battery

Establish the following switch settings on the TS being calibrated:

Switch	VERSION	PATTERN	AMPLITUDE	BATTERY	FREQUENCY	COUPLING	EXT. METER
Position	T1	1's	HI	HI	T1/E1	BAL	CURRENT

With a load resistor of 400Ω (in series with a DMM) applied across J5-1 and J5-4,
 $\text{Gain} = V(\text{Rear DMM})/I(\text{Series DMM}) = 10 \pm 20\% (V/A)$

2.4.2 UUT Current – LO Battery

Establish the following switch settings on the TS being calibrated:

Switch	VERSION	PATTERN	AMPLITUDE	BATTERY	FREQUENCY	COUPLING	EXT. METER
Position	T1	1's	HI	Lo	T1/E1	BAL	CURRENT

With a load resistor of 400Ω (in series with a DMM) applied across J5-1 and J5-4,
 $\text{Gain} = V(\text{Rear DMM})/I(\text{Series DMM}) = 10 \pm 20\% (V/A)$

Note: Jumper J5-1 to J7-3 for the LED current measurements.

◆ 2.4.3 HDSL LED

Establish the following switch settings on the TS being calibrated:

Switch	VERSION	PATTERN	AMPLITUDE	BATTERY	FREQUENCY	COUPLING	EXT. METER
Position	T1	1's	HI	NORM	HDSL	BAL	CURRENT

With a load resistor of 750Ω (in series with a DMM) applied across J7-4 and J5-4.
 $\text{Gain} = V(\text{Rear DMM})/I(\text{Series DMM}) = 100 \pm 20\% (V/A)$

◆ 2.4.4 ADSL LED

Establish the following switch settings on the TS being calibrated:

Switch	VERSION	PATTERN	AMPLITUDE	BATTERY	FREQUENCY	COUPLING	EXT. METER
Position	T1	1's	HI	NORM	ADSL	BAL	CURRENT

With a load resistor of 750Ω (in series with a DMM) applied across J7-6 and J5-4.
 $\text{Gain} = V(\text{Rear DMM})/I(\text{Series DMM}) = 100 \pm 20\% (V/A)$

2.4.5 T1 LED

Establish the following switch settings on the TS being calibrated:

Switch	VERSION	PATTERN	AMPLITUDE	BATTERY	FREQUENCY	COUPLING	EXT. METER
Position	T1	1's	HI	NORM	T1/E1	BAL	CURRENT

With a load resistor of 750Ω (in series with a DMM) applied across J7-5 and J5-4.
 $\text{Gain} = V(\text{Rear DMM})/I(\text{Series DMM}) = 100 \pm 20\% (V/A)$

2.5 Audio Output

2.5.1 Disconnect the TS speaker at J4.

Apply a $1\text{kHz} \pm 1\text{Hz}$, $960 \pm 2 \text{ mV}_{\text{RMS}}$ Sin wave across J5-2 and J5-5.

2.5.2 Establish the following switch settings on the TS being calibrated:

Switch	VERSION	PATTERN	AMPLITUDE	BATTERY	FREQUENCY	COUPLING	EXT. METER
Position	T1	1's	HI	N/A	T1/E1	BAL	AUDIO

External Meter should read $mV_{DC} = 300 \pm 15$

2.5.3 Panel Meter = 50 ± 5

End of Procedure