



**Copyright Notice**

Copyright © 1999 Verilink Corporation. All rights reserved.

This document does not create any express or implied warranty about Verilink or about its products or services. Verilink’s sole warranty is contained in its product warranty. The end-user documentation is shipped with Verilink’s products and constitutes the sole specifications referred to in the product warranty. Verilink has made reasonable efforts to verify that the information contained herein is accurate, but Verilink assumes no responsibility for its use or for any infringement of patents or other rights of third parties that may result. The customer is solely responsible for verifying the suitability of Verilink’s products for its use. Specifications are subject to change without notice.

Manual reorder # 34-00292.2

2<sup>nd</sup> Edition, April 1999


**Trademarks**


Verilink is a registered trademark Verilink Corporation.

Any named products herein are trademarks of their respective companies.

**FCC Requirements**

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user is required to correct the interference at his own expense. This device must also accept any interference received, including interference that may cause undesired operation.

 *For use only with a certified Class 2 power supply. See Power Source in Specifications on page 10.*

 *Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.*

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

- 1 This device may not cause harmful interference.
- 2 This device must accept any interference received, including interference that may cause undesired operation.

**Notice to Users of 1.544 Mbps Service**

The following instructions are provided to ensure compliance with FCC Rules, Part 68.

- 1 All direct connections to T1 lines must be made using standard plugs and jacks.
- 2 The following information may be required by the local telephone company when applying for leased line facilities:

Port ID	SOC	FIC	USOC Jack
1.544 Mbps (SF)	6.0 N	04DU9-BN	RJ-48C
1.544 Mbps (SF) (B8ZS)		04DU9-DN	
1.544 Mbps (ESF)		04DU9-IKN	
1.544 Mbps (ESF) (B8ZS)		04DU9-ISN	

- 3 If the unit appears to be malfunctioning, it should be disconnected from the telephone lines until you learn whether the source of trouble is your equipment or the telephone line. If your equipment needs repair, it should not be reconnected until it is repaired.
- 4 The unit has been designed to prevent harm to the T1 network. If the telephone company finds that the equipment is exceeding tolerable parameters, they can temporarily disconnect service. In this case, the telephone company will give you advance notice, if possible.

- 5 Under FCC rules, no customer is authorized to repair this equipment. This restriction applies regardless of whether the equipment is in or out of warranty.
- 6 If the telephone company alters their equipment in a manner that will affect the use of this device, they must give you advance warning so that you can have the opportunity for uninterrupted service. You will be advised of your right to file a complaint with the FCC.
- 7 The attached affidavit must be completed by the installer.
- 8 In the event of equipment malfunction, all repairs should be performed by our company or an authorized agent. It is the responsibility of users requiring service to report the need for service to our company or to one of our authorized agents.

## Canadian Emissions Requirements

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques (de la class A) prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

**Notice:** The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. The Industry Canada does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

**Caution:** Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

## Warranty

Verilink's product warranty covers repair or replacement of all equipment under normal use for a five-year period from date of shipment. Replacement products may be new or reconditioned. Any replaced or repaired product or part has a ninety (90) day warranty or the remainder of the initial warranty period, whichever is longer. Our in-house Repair Center services on a standard 10-workday-turnaround basis.

## Customer Service

Verilink offers the following services:

- ◆ System Engineers at regional sales offices for network design and planning assistance (800) 837-4546
- ◆ Technical Assistance Center for free 24x7 telephone support during installation, maintenance, and troubleshooting at (800) 285-2755 and support@verilink.com
- ◆ Return Materials Authorization (RMA) (800) 926-0085, ext. 2282
- ◆ Maintenance contracts and leasing plans (800) 837-4546, ext. 206
- ◆ Technical Training on network concepts and Verilink products at (800) 837-4546, ext. 346 and training@verilink.com
- ◆ Web site at www.verilink.com
- ◆ FAX-On-Demand at (800) 957-5465

**Returning  
Products**

A product must be assigned a Return Materials Authorization (RMA) number before it is sent to Verilink for repair. An RMA number is issued by Verilink Customer Service at (800) 926-0085, ext. 2282.

**Safety  
Precautions**

When handling this equipment, follow these basic safety precautions to reduce the risk of electric shock and injury:

- ◆ Follow all warnings and instructions marked on the product and in the manual.
- ◆ Unplug the hardware from the wall outlet before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a slightly damp cloth for cleaning.
- ◆ Do not place this product on an unstable cart, stand, or table. It may fall, causing serious damage to the product.
- ◆ This product should be operated only from the type of power source indicated on the marking label and manual. If you are unsure of the type of power supply you are using, consult your dealer or local power company.
- ◆ Do not allow anything to rest on the power cord. Do not locate this product where the cord will interfere with the free movement of people.
- ◆ Do not overload wall outlets and extension cords, as this can result in fire or electric shock.
- ◆ Never push objects of any kind into the unit. They may touch dangerous voltage points or short out parts that could result in fire or electric shock. Never spill liquid of any kind on this equipment.
- ◆ Unplug the equipment from the wall outlet and refer servicing to qualified service personnel under the following conditions:
  - ◇ When the power supply cord or plug is damaged or frayed.
  - ◇ If liquid has been spilled into the product.
  - ◇ If the product has been exposed to rain or water.
  - ◇ If the product has been dropped or if the housing has been damaged.

# Table of Contents

Copyright Notice .....	ii
Trademarks .....	ii
FCC Requirements .....	ii
Notice to Users of	
1.544 Mbps Service .....	ii
Canadian Emissions Requirements .....	iii
Warranty .....	iii
Customer Service .....	iii
Returning Products .....	iv
Safety Precautions .....	iv

## About This Manual

What is a Reference Manual? .....	7
Where to go for Information .....	7
Conventions .....	7

## 1 General

Introduction .....	9
Features .....	9
Specifications .....	10
Network Interface .....	10
Equipment Interface .....	10
Mechanical .....	10
Power Source .....	10
Industry Standards .....	10
Environmental .....	10

## 2 Installation and Configuration

Introduction .....	11
Safety Summary .....	11
Wallmount Installation .....	12
Using Adhesive Strips .....	12
Using Screws .....	12
Connections .....	12
Equipment and Network	
Connections .....	12
Power .....	13

Configuration .....	13
Configuration Switch SW1 .....	13
Line Coding .....	13
EQ LBO .....	14
Equipment Loop .....	14
Network Loop .....	14
Network LBO .....	14

## 3 Testing

Introduction .....	15
Indicators .....	15
Power .....	15
Loopback .....	15
Network LOS .....	15
DTE LOS .....	15
Loopbacks .....	16
Equipment .....	16
Network .....	16
Test Jacks .....	16



# ABOUT THIS MANUAL

## What is a Reference Manual?

This is a reference manual. It provides information about unit installation, configuration, testing and troubleshooting on a function-by-function basis. It is not a user's guide containing step-by-step procedures. This manual contains specific information about a command, menu field, port, etc. Unless otherwise noted, the information in this manual applies only to the Verilink T Lite (also referred to as the unit.)




## Where to go for Information

The chapters and appendices in this manual are arranged for quick reference. It is not necessary to read previous chapters to understand the subsequent chapters.

- 1 General - This chapter introduces the unit, lists the features, and provides specifications.
- 2 Installation and Configuration - This chapter describes unit installation, port and power connections, and switch settings.
- 3 Testing - This chapter describes the indicators, test switch, loopbacks, and test jacks.

## Conventions

The following table lists the conventions used throughout this manual.

Convention	Description
	<i>Notices</i> call attention to important features or instructions.
	<i>Cautions</i> alert you to personal safety risk, system damage, or data loss.
	<i>Warnings</i> alert you to the risk of severe personal injury.
<i>italics</i>	Italics denote <i>new terms</i> or <i>emphasis</i> .
<u>underline</u>	Default settings are underlined.



# 1

# GENERAL

## Introduction

The Verilink T Lite CSU provides an economical solution for providing the T1 interface between customer premises equipment and T1 facilities (telco or private). Each unit is compatible with all T1 carrier transmission equipment and is designed to comply with all industry-standard specifications. Both the transmitted and received 1.544 Mbps signals are conditioned.

The T Lite is an industry standard, frame transparent T1 channel service unit. It detects and activates network initiated loopbacks, monitors bipolar violations, and maintains pulse density of the transmitted signal. The unit works with any T1 line format and is transparent to framed (D4 or ESF) or unframed T1 signals. The T Lite is transparent to line coding and can operate in either AMI or B8ZS coding. The T Lite can transcode B8ZS signals from the network into AMI signals for the equipment and AMI signals from the equipment into network B8ZS signals.

The unit is designed to be wallmounted using hook-and-loop fasteners or "T" openings on the base (like a telephone). The unit can also be set on a desktop.

The unit provides ALBO circuitry on the network receive path. The network ALBO supports a receive range from +1 to -30 decibels. The DTE supports DSX1 signal ranges up to 655 feet. The unit also provides line build out (LBO) circuitry on both network and DTE. The network transmit LBO is user selectable in four increments (from 0 to -22.5 decibels). The DTE transmit LBO is user selectable in five increments from 0 to 655 feet.

The T Lite operates from an external VAC power source. Network and DTE connections are made through RJ-48C connectors. The units have primary and secondary surge protection on both the network and DTE side (meeting the UL 1950 requirements).

## Features

- ◆ Provides T1 facility interface and jitter tolerance per ANSI T1.102, T1.403, and AT&T TR 62411
- ◆ Transparent to ESF-formatted data
- ◆ Supports framed and unframed signal formats
- ◆ Space-saving design can be desktop or wall mounted
- ◆ Standard 5-year warranty

## Specifications

<b>Network Interface</b>	Line Rate:	1.544 Mbps ( $\pm 50$ ppm)
	Line Framing:	D4 or ESF
	Line Code:	AMI or B8ZS
	Line Impedance:	balanced 100 $\Omega$ ( $\pm 5\%$ )
	Input Signal:	DS1, +1 to -30 dB (ALBO)
	Output Signal:	3.0 V, $\pm 15\%$ , base-peak into 100 $\Omega$
	Line Build Out:	0, -7.5, -15, and -22.5 dB attenuation
	Line Protection:	1000 V lightning, fused input and output
	Jitter Control:	per TR 62411 and T1.403
	Pulse Density:	per TR 62411
<b>Equipment Interface</b>	Line Rate:	1.544 Mbps ( $\pm 50$ ppm)
	Line Framing:	D4 or ESF
	Line Code:	AMI or B8ZS
	Line Impedance:	balanced 100 $\Omega$ ( $\pm 5\%$ )
	Input Signal:	DSX1 to 655 feet
Output Signal:	Selectable DSX1 signal level from 0 to 655 feet	
Line Protection:	1000 V lightning, input and output	
<b>Mechanical</b>	Mounting:	desktop or wallmount
	Dimensions:	1.25" H, 3.5" W, 5.75" D
	Weight:	1 pound
<b>Power Source</b>	External:	Input: 115 VAC Output: 9 VAC, 750 mA
	<b>Industry Standards</b>	FCC Compliance: Part 15 Class A Subpart B, Part 68 U.S. Safety: UL 1950 Canadian Safety: CSA C22.2 No. 950-95 Industry Canada: CS-03, Issue 8 Bellcore: GR-1089-CORE
<b>Environmental</b>	Operating Temp:	0° to 50°C (32° to 122°F)
	Storage Temp:	-20° to 70°C (-4° to 158°F)
	Humidity:	95% max (non-condensing)

# 2

# INSTALLATION AND CONFIGURATION

## Introduction

This chapter contains information and instructions required to prepare the Verilink T Lite for use. Included are initial inspection procedures, mounting instructions, configuration guidelines, connection and powering information.

## Safety Summary

This manual contains information and warnings that must be followed to ensure safe operation and retain the equipment in a safe condition.



*This WARNING sign denotes a potential hazard to the operator. It calls attention to a procedure or practice that, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.*



*Caution: Units are susceptible to damage caused by static electricity. Use ESD (electrostatic discharge) precautionary measures, such as wearing electrostatic grounding straps.*

## Unpacking and Inspection

This unit is carefully packaged to prevent damage in shipment. Upon receipt, inspect the shipping container for damage. If the shipping container or cushioning material is damaged, notify the carrier immediately and make a notation on the delivery receipt that the container was damaged (if possible, obtain the signature and name of the person making delivery). Retain the packaging material until verifying the contents of the shipment are complete and the unit has been checked both mechanically and electrically.

If the contents of the shipment are incomplete or, if there is mechanical damage or defect, notify Verilink. If the shipping container is also damaged, or the cushioning material shows signs of stress, notify the carrier of the damage as well as Verilink. Keep the shipping materials for the carrier's inspection. Verilink will arrange for repair or replacement without waiting for claim settlement.

## Supplied Materials

The T Lite is shipped from the factory with the following standard equipment.

- ◆ external AC power supply
- ◆ reference manual
- ◆ adhesive strip
- ◆ two 9-foot RJ48-to-RJ48 cables (part number 9-1544-619-009)

## Wallmount Installation

### Using Adhesive Strips

- 1 Select a place close to an 115 VAC outlet with clearance for the signal and power cables as well as for bantam test cables. The indicators and switches should be easily accessible.
- 2 Verify the mounting surface is clean.
- 3 Cut the adhesive strip to the desired length and affix the backing of one piece to the underside of the unit.
- 4 Attach the other adhesive strip to the piece on the underside of the unit.
- 5 Remove the backing to expose the sticky surface.
- 6 Press the underside of the unit firmly against the selected place.

### Using Screws

- 1 Select a place close to an 115 VAC outlet with clearance for the signal and power cables as well as for bantam test cables. The indicators and switches should be easily accessible.
- 2 Vertically place two #6 screws 3-13/32 inches apart at the selected place. Leave the screws out about an eighth of an inch.
- 3 Place the upright unit over the screws until the holes engage and slide the unit down until it locks.

## Connections

The T Lite has RJ-48C connectors for the network and equipment interfaces and a terminal strip for the power connection. The following paragraphs describe these connections.

### Equipment and Network Connections

Table 2-1 shows the pinout for the network and equipment connectors. The interface for these connectors is an RJ-48C jack.


Table 2-1 Equipment and Network Connector Pinout

Pin	NET	Equipment
1	R1 (ring, receive from network)	R1 (ring, transmit to equipment)
2	T1 (tip, receive from network)	T1 (tip, transmit to equipment)
4	R (ring, transmit to network)	R (ring, receive from network)
5	T (tip, transmit to network)	T (tip, receive from network)
3, 6-8	not used	not used

**Power** Plug the connector from the power supply into the unit. Plug the transformer into an appropriate outlet. This applies power to the unit.

## Configuration

This section describes the configuration of the T Lite. This unit is configured using DIP switches. Refer to Figure 2-1 for switch locations. The T Lite unit is transparent to framed (D4 or ESF) and unframed T1 signals. It can also be configured as transparent to line coding and operates with AMI and B8ZS.

 *On power up, each unit is configured to the settings of the option switches. Changes to the NET LBO and EQ LBO switches do not take effect until the unit is reset. Reset the unit by removing power from the unit and then reapplying power. The loopback switches activate as soon as they are thrown.*

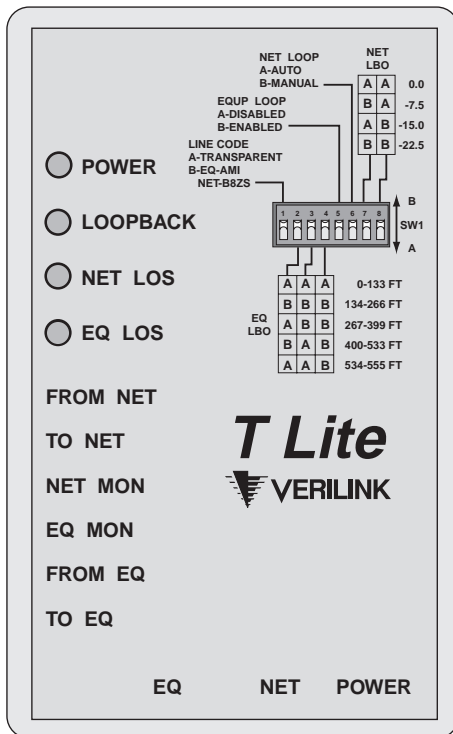


Figure 2-1 Verilink T Lite

### Configuration Switch SW1

Switch SW1 is located on the CSU cover. This switch provides the following configuration parameters.

**Line Coding** Position SW1-1 sets the line coding. Setting the switch to Transparent (A) makes the unit transparent to B8ZS

and AMI line code. Setting the switch to EQ-AMI NET-B8ZS (B) presents a B8ZS signal to the network and sets the equipment to AMI line code.

**EQ LBO** Positions SW1-2, SW1-3, and SW1-4 set the EQ LBO (line build out) transmit signal value towards the customer equipment. The value should match the cable length from the EQ port to the attached equipment. The default is 0 to 133 feet (AAA).

**Equipment Loop** Position SW1-5 sets equipment loopback functions. When the switch is set to Enabled (B), the unit is placed into an equipment loopback where the equipment receives all the data it sends. The unit remains in equipment loopback until the switch is set to Disabled (A). The unit sends an unframed all 1s pattern to the network.

**Network Loop** Position SW1-6 sets network loopback functions. NET LOOP can be set to Auto or Manual. Auto (A) enables the unit to respond to network loop requests (a 1 in 5 pattern) and remain looped until it receives a 1 in 3 pattern. Setting the switch to Manual (B) forces the unit into a manual network loopback until the switch is returned to Auto. The unit sends an unframed all 1s pattern to the equipment.

**Network LBO** Positions SW1-7 and SW1-8 set the network line build out signal level transmitted towards the T1 facility. The default output level is 0 dB (AA). Change the signal level to  $-7.5$  dB,  $-15$  dB, or  $-22.5$  dB as necessary. The telco can provide the proper setting. If unsure of the setting, leave it at 0 dB.

# 3

# TESTING

## Introduction

This chapter describes the diagnostic and test features of the Verilink T Lite. The unit is controlled manually using front panel DIP switches (the DIP switches are discussed on page 13). The front panel indicators and side bantam jacks are described below.

## Indicators

The unit indicators convey major alarm conditions and looping status.

**Power** This green indicator lights when power is applied to the unit.

**Loopback** This amber indicator lights under the following conditions: the NET LOOP switch is set to Manual, the EQUIP LOOP is placed in the Enabled position, or the unit receives an in-band loop code for greater than five seconds.

**Network  
LOS** This red indicator lights if the internal alarm circuitry detects a loss of signal condition for  $\geq 175$  bit times from the network. The indicator stays lit until the unit detects  $\geq 4$  pulses in 32 bit times.

**DTE  
LOS** This red indicator lights if the internal alarm circuitry detects a loss of signal condition for  $\geq 175$  bit times from the DTE. The indicator stays lit until the unit detects  $\geq 4$  pulses in 32 bit times.

## Loopbacks

**Equipment** Position SW1-5 sets equipment loopback functions. When the switch is set to Enabled, the unit is placed into an equipment loopback where the DTE receives all the data it sends. The unit sends an unframed all 1s pattern to the network end. The unit remains in equipment loopback until the switch is set to Disabled.

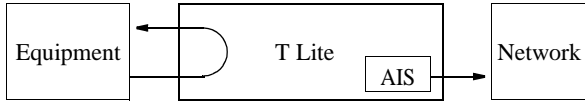


Figure 3-1 Local Loopback

**Network** Position SW1-6 sets network loopback functions. NET LOOP can be set to Auto or Manual. Auto enables the unit to respond to network loop requests (a 1 in 5 pattern) and remain looped until it receives a 1 in 3 pattern. Setting the switch to Manual forces the unit into a manual network loopback until the switch is returned to Auto. The unit sends an unframed all 1s pattern to the equipment end unless the equipment is also in loopback.

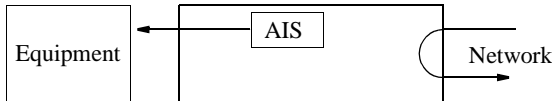



Figure 3-2 Remote Loopback

## Test Jacks

The bantam jacks located on the left side of the unit provide signal access as follows. The FROM NET and TO NET jacks can be used to break the network connection to the T Lite internal circuitry and connect the network to a piece of test equipment. The NET MON and EQ MON jacks are used for passively monitoring received signals passing through the unit (between the DTE and the network). The FROM EQ and TO EQ jacks can be used to break the equipment connection to the T Lite internal circuitry and connect the equipment to a piece of test equipment.

 When connected to the TO EQ and FROM EQ jacks, the EQ LOSS indicator lights. This is due to the test connection and is not an indication of signal loss from the equipment.

# AFFIDAVIT FOR THE CONNECTION OF CUSTOMER PREMISES EQUIPMENT TO 1.544 MBPS AND/OR SUBRATE DIGITAL SERVICES

For work to be performed in the certified territory of

Telco's Name: \_\_\_\_\_

State of \_\_\_\_\_

County of \_\_\_\_\_

I, \_\_\_\_\_, of \_\_\_\_\_,  
(Authorized Representative Name) (Customer Name)

\_\_\_\_\_, \_\_\_\_\_,  
(Customer Address) (Telephone Number)

being duly sworn, state:

I have responsibility for the operation and maintenance of the terminal equipment to be connected to \_\_\_\_\_ 1.544 Mbps and/or \_\_\_\_\_ subrate digital services. The terminal equipment to be connected complies with Part 68 of the Commission's rules except for the encoded analog content, and billing protection specifications. With respect to encoded analog content and billing protection:

- ◆ I attest that all operations associated with the establishment, maintenance, and adjustment of the digital CPE with respect to encoded analog content and encoded billing information continuously complies with Part 68 of the FCC's Rules and Regulations.
- ◆ The digital CPE does not transmit digital signals containing encoded analog content or billing information which is intended to be decoded within the telecommunications network.
- ◆ The encoded analog and billing protection is factory set and is not under the control of the customer.

I attest that the operator(s) maintainer(s) of the digital CPE responsible for the establishment, maintenance, and adjustment of the encoded analog content and billing information has (have) been trained to perform these functions by successfully completing one of the following: Check appropriate ones(s).

- A. Training course provided by the manufacturer/grantee of the equipment used to encode analog signals; or
- B. Training course provided by the customer or authorized representative, using training materials and instructions provided by the manufacturer/grantee of the equipment used to encode analog signals; or
- C. Independent training course (e.g., trade school or technical institution) recognized by the manufacturer/grantee of the equipment used to encode analog signals; or
- D. In lieu of the proceeding training requirements, the operator(s) maintainer(s) is (are) under the control of a supervisor trained in accordance with \_\_\_\_\_ above.

I agree to provide \_\_\_\_\_ with proper documentation to  
*(Telco's Name)*

demonstrate compliance with the information as provided in the proceeding paragraph, if so requested.

\_\_\_\_\_ (Signature)

\_\_\_\_\_ (Title)

\_\_\_\_\_ (Date)

Subscribed and Sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 19\_\_\_\_.

\_\_\_\_\_

Notary Public

My Commission expires \_\_\_\_\_.