User's Guide

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For Safety information and Regulatory information, see the pages at the end of this manual.

Infiniium Option 100 and E2625A Telecommunications Mask Template Kit

In This Book

This Telecommunications Mask Template Kit User's Guide contains the following information:

Introduction to Option 100 and E2625A Telecommunications Mask Template Kit

Chapter 1 introduces specific product information about the Mask Template Kit. It also discusses the recommended oscilloscope configuration, and shows an overview of the Mask Test Setup dialog box.

Getting Started and Using Masks

Chapter 2 describes Mask Testing and shows you ways to use the standard masks to verify compliance of your instrument waveforms.

Standard Masks

Chapter 3 lists file names for the standard masks in the Telecommunications Mask Template Kit, along with line impedances and bit rates. The templates for each standard mask are also shown.

Contents

1

Introduction to Option 100 and E2625A Telecommunications Mask Template Kit

Introduction to Option 100 and E2625A Telecommunications Mask Template Kit

The Infiniium Oscilloscopes Option 100 Telecommunications Mask Template Kit includes the materials necessary for you to verify that your instrument waveforms comply with industry standards. Option 100 provides a quick method for you to certify waveform integrity during early development and later during manufacturing tests.

This manual helps you use the standard masks supplied with Option 100. It shows you how to load standard waveform masks into Infiniium Oscilloscopes and use them to test the compliance of your waveforms. All of the standard masks supplied are shown in Chapter 3.

Adding Option 100 to an existing Infiniium Oscilloscope

The Option 100 Telecommunications Mask Template Kit is orderable as E2625A for customers who already have an Infiniium Oscilloscope.

Supplied items

The Option 100 Telecommunications Mask Template Kit contains the following items:

Mask Template Kit Item	Description	Separately Orderable Agilent Part Number
Floppy disk	Mask template library floppy disk	E2626A
Adapter	100/110/120 Ω differential impedance adapter with bantam (f) connector, bantam (m) to Siemens (f) adapter cable	E2621A
Adapter cable	Bantam (m) to Siemens (f) adapter cable	E2623A
Adapter	75 Ω single-ended impedance adapter with BNC (f) connector	E2622A
Adapter cable	Dual-bantam (f) to RJ48C (m) adapter cable	E2624A
Adapter/coupler	RJ48C (f) to RJ48C (f)	E2627A
Adapter	Bantam (m) to BNC (f); for system verification of E2621A adapter and Infiniium oscilloscope	E2628A
Adapter	BNC (m) to BNC (f) 50-to-75 ohm adapter; for system verification of E2622A adapter and Infiniium oscilloscope	E2629A
Cable	BNC (m) to BNC (m) cable; 30 cm long	8120-1838
Storage case	Hard-shell case for storage of all kit accessories	E2625-45501

Recommended accessories

Other Agilent accessories recommended for use in mask testing include:

Agilent Part Number	Accessory Item	Description
E2630A	Patch cable	Bantam (m) to bantam (m) patch cable
E2632A	Patch cable	Siemens (m) to Siemens (m) patch cable

What not to do

You should not use the Mask Test master disk for daily use. Instead, you should use a copy of the master disk, as described in Chapter 2.

Oscilloscope models

You can use the Telecommunications Mask Template Kit with these Infiniium Oscilloscopes:

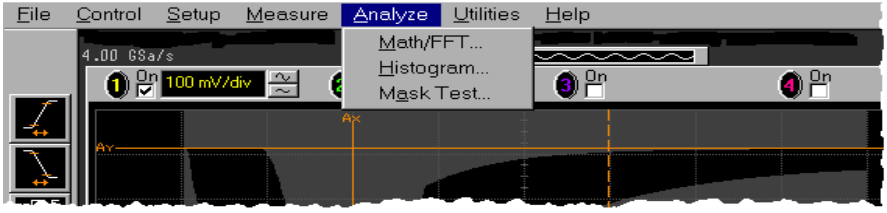
Agilent Model	Channels	Bandwidth	Sample Rate	Memory Depth
54810 [1]	2	500 MHz	1 GSa/s	32k
54815 [1]	4	500 MHz	1 GSa/s	32k
54820 [1]	2	500 MHz	2 GSa/s	32k
54825 [1]	4	500 MHz	2 GSa/s	32k
54835 [1]	4	1.5 GHz	2 GSa/s — 4 ch 4 GSa/s — 2 ch	32k — 4 ch 64k — 2 ch
54845 [1]	4	1.5 GHz	4 GSa/s — 4 ch 8 GSa/s — 2 ch	32k — 4 ch 64k — 2 ch
54846 [1]	4	2.25 GHz	4 GSa/s — 4 ch 8 GSa/s — 2 ch	32k — 4 ch 64k — 2 ch
54830 [2]	2	600 MHz	2 GSa/s — 4 ch 4 GSa/s — 2 ch	2M — 4 ch 4M — 2 ch
54831 [2]	4	600 MHz	2 GSa/s — 4 ch 4 GSa/s — 2 ch	2M — 4 ch 4M — 2 ch
54832 [2]	4	1 GHz	2 GSa/s — 4 ch 4 GSa/s — 2 ch	2M — 4 ch 4M — 2 ch

[1] Requires system software version A.03.00 or later.

[2] Requires system software version A.02.00 or later.

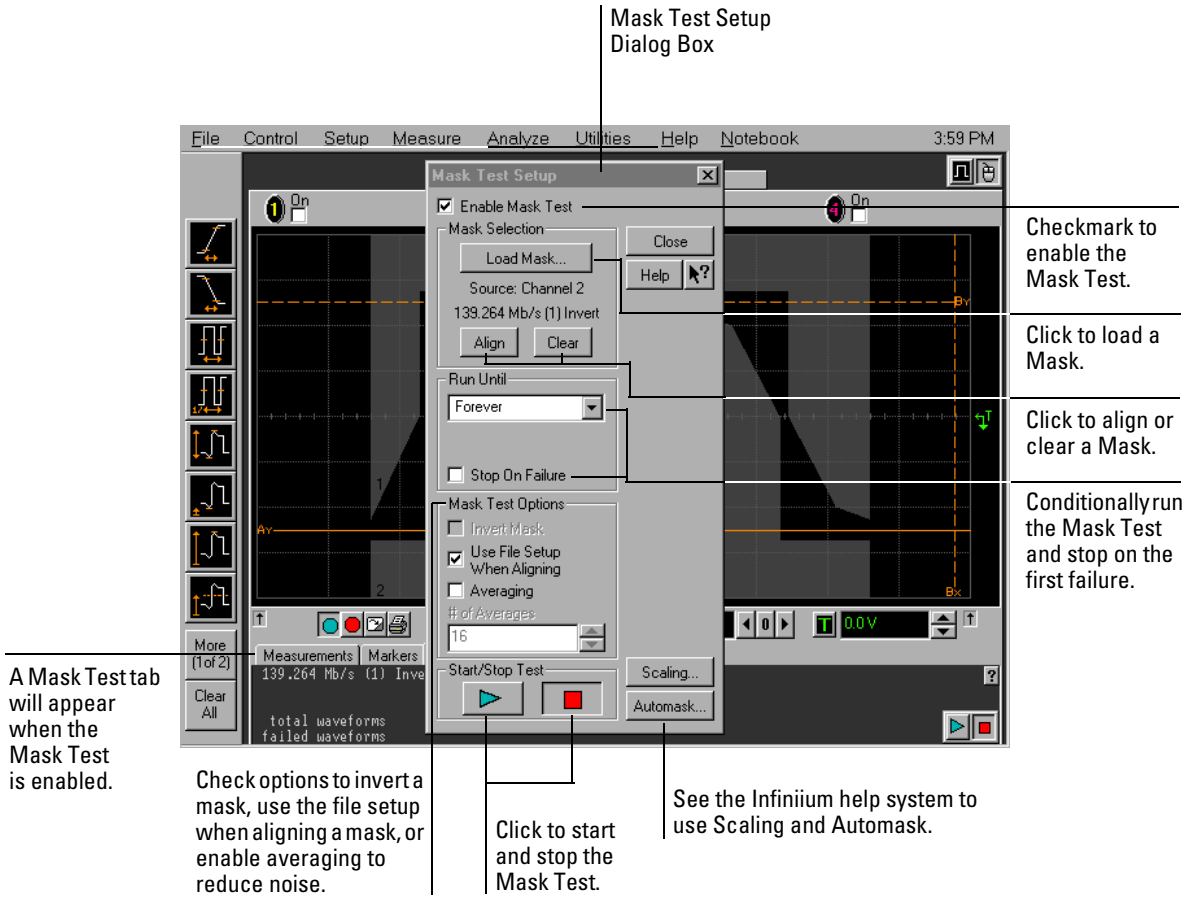
To access the Mask Test Setup dialog box

Select **Analyze**, then **Mask Test...** from the oscilloscope main menu, as shown here, to access the Mask Test Setup dialog box:



Overview of the Mask Test Setup dialog box

You will use the Mask Test Setup dialog box shown here to load and use masks with the Infiniium Oscilloscope. Standard masks are shown in Chapter 3. How to load and use a mask is described in Chapter 2.



2

Getting Started and Using Masks

Getting Started and Using Masks

Telecommunications (telecom) and data communications (datacom) industries have established standards for equipment manufacturers. One of these standards defines the electrical parameters for waveforms. By applying these standards, both telecom and datacom equipment manufacturers can ensure that their equipment will operate properly together by first certifying waveform integrity.

To verify waveform integrity during the equipment manufacturing phase, Infiniium Oscilloscopes have a feature called Mask Testing. Within seconds, you know whether your equipment's waveform complies with the industry standard.

Introduction to Mask Testing

What is a Mask?

A mask is a template that you load into the oscilloscope used during mask testing. The mask shows the acceptable electrical parameters of a waveform by defining regions of the oscilloscope display where the waveform must not intersect. If the waveform crosses the boundary of a region of the mask, it fails the mask test.

The types of masks that you can use to test waveforms include:

- Industry standard masks

  Industry standard masks are included in this Mask Template Kit.
- Automatically generated masks
- User-defined masks

When to use Mask Testing

You should use mask testing whenever your waveform must conform to an industry standard. You can do mask testing during manufacturing to ensure that your design meets the requirements of the telecom or datacom industries.

How Infiniium does Mask Testing

When you start the mask test, Infiniium creates a database that has unique locations for every pixel in the waveform viewing area. Each location in the database has a 21-bit counter for a maximum count of 2,097,151.

Each time a data point from a channel memory illuminates a pixel in the waveform viewing area, the counter for that pixel is incremented. During mask testing, any data point that illuminates a pixel in the mask violation region causes a mask test failure.

The oscilloscope's database continues to build until the oscilloscope stops acquiring data or until mask testing is deactivated.

The oscilloscope's database is also used for histogram analysis and color grade persistence. Refer to the Infiniium help system for detailed information about these other waveform analysis features.

How to do Mask Testing

The remaining topics in this chapter show you how to do mask testing. Chapter 3 shows the standard masks supplied in the Mask Template Kit.

Make a copy of the Mask Test disk

A disk containing the standard masks is shipped with Infiniium Option 100 and E2625A. Before you install the Mask Test templates, you should make a copy of the Mask Test master disk and use the copy of the Mask Test disk for the installation.

To install the Standard Masks

Use the copy of the Mask Test disk to install standard masks onto the Infiniium hard drive. The Mask Test disk contains many of the available standard masks that you may need to use during mask testing.

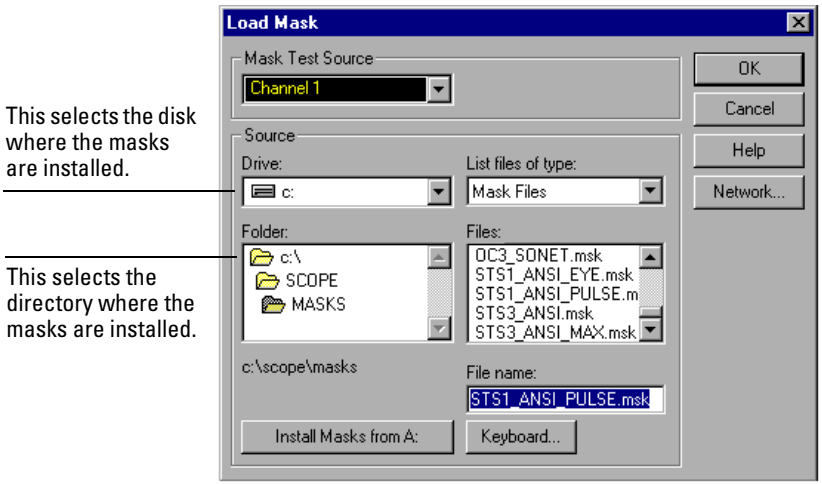
1 Insert the copy of the Mask Test disk in the floppy drive.

2 From the oscilloscope main menu, select **Analyze**, then **Mask Test**.

3 In the Mask Test Setup dialog box, select the **Enable Mask Test** control.

4 In the Mask Test Setup dialog box, click the **Load Mask...** button.

The Load Mask dialog box will resemble:



5 Click the **Install Masks from A:** button.

To calibrate the oscilloscope

Your Infiniium should be at optimum performance when performing mask testing. If your Infiniium has not been calibrated in the last year or if the Calibration ΔTemp is greater than ±5 °C, you should recalibrate the oscilloscope before performing a mask test. You can find the Calibration ΔTemp in the Calibration dialog box by clicking on the **Utilities** menu and selecting **Calibration**.

1. Make sure Infiniium has warmed up for at least 30 minutes.
2. From the oscilloscope main menu click **Utilities**, then **Calibration**.
3. Make sure that the **Cal Memory Protect** check box is unchecked.

Cal Memory Protect	This option protects the oscilloscope's calibration factors from accidentally being changed.
Details	When checked, this option displays a list of anything that has failed during the calibration. You can use the failure information to help repair the oscilloscope.

4. Click **Start.**

   Infiniium will display additional instructions and guide you through the step-by-step calibration procedure.

To choose a proper probe for Mask Testing

You can use any oscilloscope probe that fits your application. Depending on the type of waveform you are testing, you may need to use one of the probe adapters.

Calibrating the probe adapter

Depending on the requirements of your Telecom or Datacom industrial standard, you may need to use the E2622A 75 Ω probe adapter or the E2621A differential probe adaptor. Before performing a mask test, you should calibrate the probe adapter using the following instructions:

1. In the Channel Setup dialog box, click the **Probes...** button.
2. In the Probes Setup dialog box, click the **Calibration...** button.
3. Follow the step-by-step instructions to calibrate the probe.

To get your waveform on the oscilloscope display

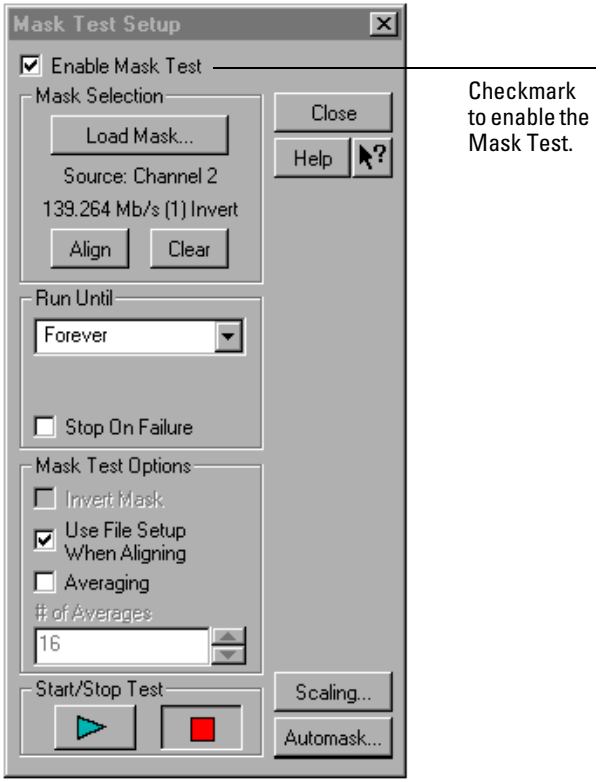
When doing mask testing, you will try to fit the mask to your waveform. This is how you will verify whether your waveform meets the acceptable electrical parameters defined by the standard mask. By having your waveform displayed on the oscilloscope screen before doing mask testing, when you load and use the mask, you will know immediately if the waveform passes the mask test.

1. Display the waveform you want to test on the oscilloscope screen.
2. Begin mask testing using a standard mask, as described in the following topics.

To enable the Mask Test

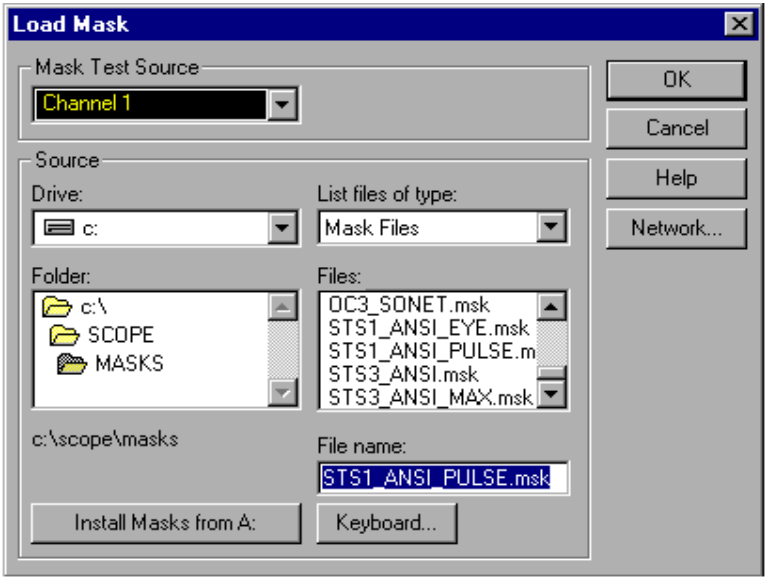
1. Click **Analyze**, then **Mask Test** to access the Mask Test Setup dialog box.
2. In the Mask Test Setup dialog box, click **Enable Mask Test** to checkmark the box.

   When enabled, a Mask Test tab appears beneath the waveform viewing area.



To load a Mask

1 Click **Analyze**, then **Mask Test** to access the Mask Test Setup dialog box.
2 Make sure the mask test is enabled.
3 Click the **Load Mask...** button.



4 In the Load Mask dialog box, click the **Mask Test Source** field to select an oscilloscope channel for the mask test. The active channel is the default.
5 Click the **Drive:** field and select the drive where the mask you want to load is located. In the **List files of type:** field, Mask Files will be displayed by default.
6 To load a standard mask from the Infiniium hard drive, make sure the **Folder:** shows c:\scope\masks. Then view the list of standard masks by scrolling them in the **Files:** field.
7 When you find the standard mask that you want to load, double-click the file in the **Files:** field. The mask file name will be entered and highlighted in the **File name:** field, and Infiniium will load the mask.
Chapter 3 lists the standard mask file names and shows the mask waveforms.

To align a Mask to the waveform

1 Access the Mask Test Setup dialog box and make sure the mask test is enabled.

2 Locate the **Use File Setup When Aligning** option.

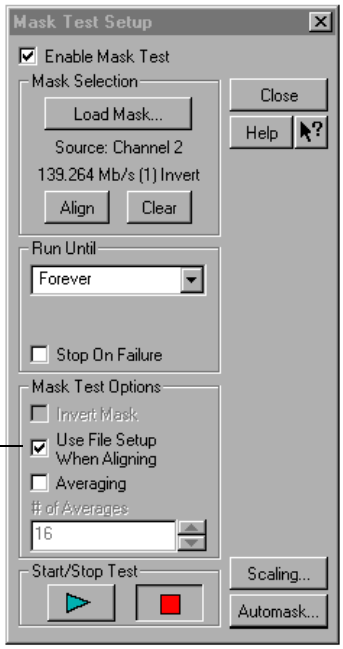
When aligning a mask to the waveform, these settings are used:

- Channel range and offset
- Time base range and position
- Trigger mode and level
- Mask test scaling source, position(s), and delay

You can either use the current oscilloscope settings, or you can use the standard settings defined in the mask file.

3 If you want to use the standard settings defined in the mask file, checkmark the **Use File Setup When Aligning** option.

4 If you want to use the current oscilloscope settings, do not checkmark this box.



When aligning a mask, you can use the current settings for the oscilloscope setup, or use the standard settings in the mask file.

5 Click the **Align** button to align the mask.

To start and stop the Mask Test

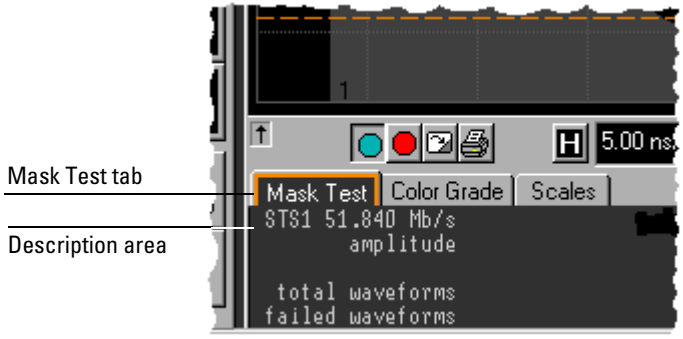
1. Access the Mask Test Setup dialog box and make sure the mask test is enabled.
2. At the bottom of the Mask Test Setup dialog box, locate the start and stop mask test buttons.
   - The green triangle starts the mask test.
   - The red square stops the mask test.

3. Click the green triangle to start the mask test.
   When you start a mask test, Infiniium also starts the acquisition system.

To understand the Mask Test tab description area

After you have enabled the mask test in the Mask Test Setup dialog box, you will see a Mask Test tab on the lower left of the oscilloscope screen, beneath the waveform viewing area. The description area below the Mask Test tab shows:

- Mask title
- Amplitude specifics (for ANSI T1.102 North American Standard Masks only)
- Total number of waveforms in the duration of the mask test
- Number of failed waveforms in the mask test
- Regions in the mask
- Waveform violations



When any of the ANSI T1.102 North American Standard Masks are loaded, the Mask Test tab description area will show minimum and maximum amplitude values. These values are the result of testing for specifics of the standard, and indicate the upper or lower limit that the standard allows.

To run the Mask Test conditionally

1 Access the Mask Test Setup dialog box and make sure the mask test is enabled.

2 Click the **Run Until** selection arrow to view the options.

a If **Stop on Failure** is disabled, you can stop the mask test based on the following conditions:

- Forever

  The mask test will run continuously. This is the default selection.

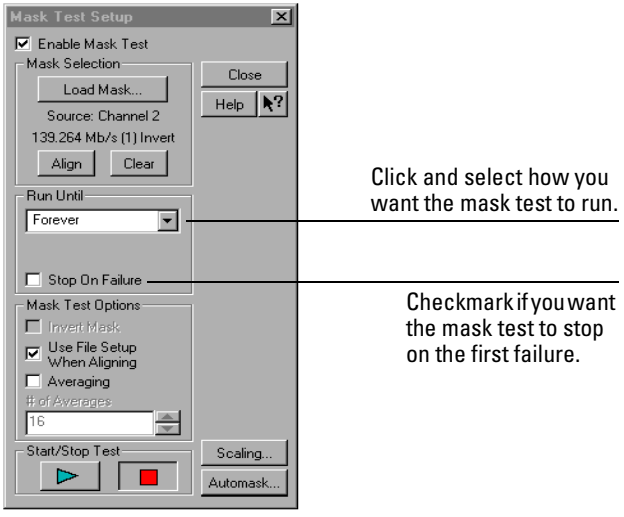
- Number of Waveforms

  The mask test will run until the number of waveforms specified has been acquired. The number of waveforms is from 1 to 1,000,000,000.

- Time

  The mask test will run until the amount of time specified has elapsed. The time is in seconds, from 0.1 minute to 1440.0 minutes. The default is 1.0 minute.

b If **Stop on Failure** is enabled, the first time the waveform crosses the mask violation region, the mask test will stop. See the next topic.



3 Select the **Run Until** option you want to use for the mask test.

To stop the Mask Test on the first failure

1. Access the Mask Test Setup dialog box and make sure the mask test is enabled.
2. Click **Stop On Failure** to checkmark the box.
3. Run the mask test.

   When the mask test encounters the first failure, the test will stop and the failure result will be displayed in the Mask Test tab description area.

Analyzing a failure

If your waveform crosses the boundary of the mask violation region, the waveform cross-over areas will be displayed in red. All waveform locations displayed in red indicate that the waveform fails the mask test in these areas. If the waveform just "touches" the boundary, the mask test fails.

Standard masks and the designated violation regions are shown in chapter 3.

When you start the mask test with **Stop On Failure** enabled, if Infiniium encounters a failure, the oscilloscope acquisition system will be stopped.

3

Standard Masks

Standard Masks

The Infiniium Option 100 and the E2625A Telecommunications Mask Template Kit disk contains standard masks used by the telecommunications and data communications industries. These are the masks you can load into the oscilloscope to test your waveform's compliance against industry standards.

To use any of these masks, follow the procedures in chapter 2.

Standard Masks

The types of standard masks include:

- ITU G.703 International Standard Masks
- ANSI T1.102 North American Standard Masks
- FCC Part 68.308 Options A, B, and C Masks
- Pre-Compliance SONET Masks
- IEEE 802.3 Masks

ITU G.703 International Standard Masks

Mask File Name	Line Impedance	Bit Rate
1544kb_ITU_DS1.msk	100 Ω twisted pair	1.544 Mbps
2Mb_ITU_120.msk	120 Ω twisted pair	2.048 Mbps
2Mb_ITU_75.msk	75 Ω coax	2.048 Mbps
6312kb_ITU_110_DS2.msk	110 Ω twisted pair	6.312 Mbps
6312kb_ITU_75_DS2.msk	75 Ω coax	6.312 Mbps
8Mb_ITU.msk	75 Ω coax	8.448 Mbps
34Mb_ITU.msk	75 Ω coax	34.368 Mbps
44736kb_ITU_DS3.msk	75 Ω coax	44.736 Mbps
140Mb_ITU_0.msk	75 Ω coax	139.264 Mbps
140Mb_ITU_1.msk	75 Ω coax	139.264 Mbps
140Mb_ITU_1_INV.msk	75 Ω coax	139.264 Mbps
155Mb_ITU_0.msk	75 Ω coax	155.520 Mbps
155Mb_ITU_1.msk	75 Ω coax	155.520 Mbps
155Mb_ITU_1_INV.msk	75 Ω coax	155.520 Mbps

ANSI T1.102 North American Standard Masks

Mask File Name	Line Impedance	Bit Rate
DS1_ANSI.msk	100 Ω twisted pair	1.544 Mbps
DS1A_ANSI.msk	100 Ω twisted pair	2.048 Mbps
DS1C_ANSI.msk	100 Ω twisted pair	3.152 Mbps
DS2_ANSI.msk	110 Ω twisted pair	6.312 Mbps
DS3_ANSI.msk	75 Ω coax	44.736 Mbps
DS4NA_ANSI.msk	75 Ω coax	139.264 Mbps
DS4NA_ANSI_MAX.msk	75 Ω coax	139.264 Mbps
STS1_ANSI_EYE.msk	75 Ω coax	51.840 Mbps
STS1_ANSI_PULSE.msk	75 Ω coax	51.840 Mbps
STS3_ANSI.msk	75 Ω coax	155.520 Mbps
STS3_ANSI_MAX.msk	75 Ω coax	155.520 Mbps

FCC Part 68.308 Options A, B, and C Masks

Mask File Name	Line Impedance	Bit Rate
FCC_68_OPT_A.msk	100 Ω twisted pair	1.544 Mbps
FCC_68_OPT_B.msk	100 Ω twisted pair	1.544 Mbps
FCC_68_OPT_C.msk	100 Ω twisted pair	1.544 Mbps

Pre-Compliance SONET Masks

Mask File Name	Bit Rate
OC1_SONET.msk	51.840 Mbps
OC3_SONET.msk	155.520 Mbps
OC12_SONET.msk	622.080 Mbps

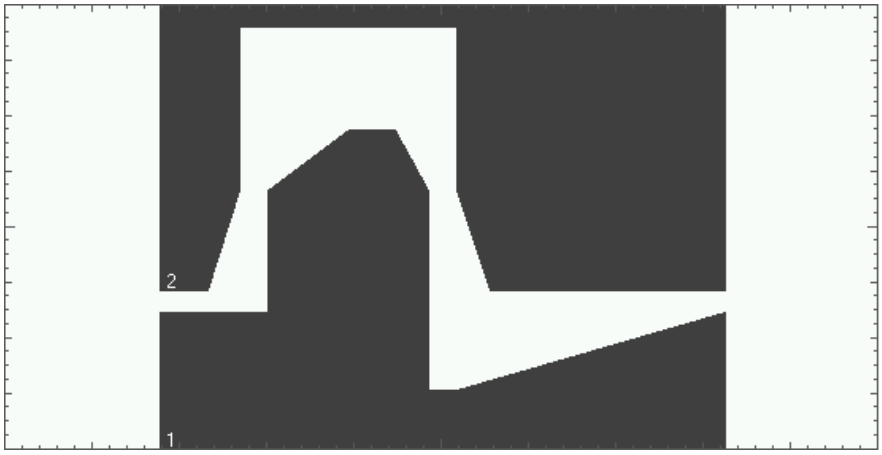
IEEE 802.3 Masks

Mask File Name	Bit Rate
10BASE_T_IDL.msk	10 Mbps
10BASE_T_LINK.msk	10 Mbps
100BASE_TX_STP.msk	100 Mbps
100BASE_TX_UTP.msk	100 Mbps

ITU G.703 International Standard Masks

The ITU G.703 International Standard Masks resemble the following:

1544kb_ITU_DS1.msk

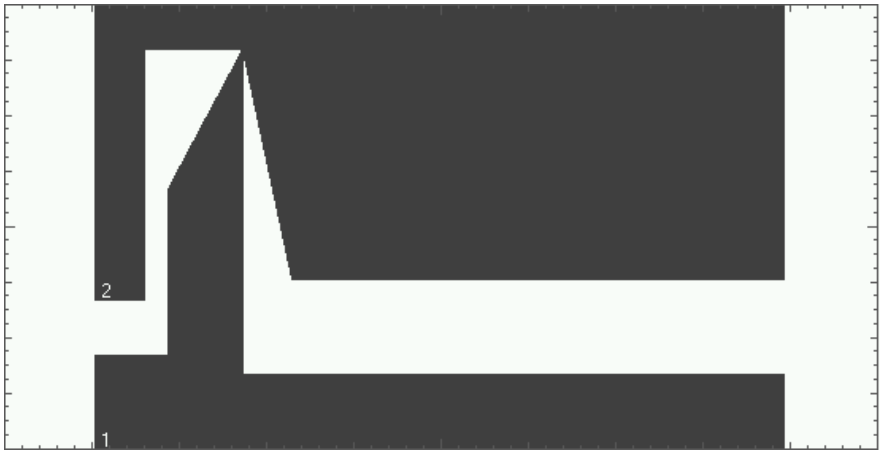


2Mb_ITU_120.msk

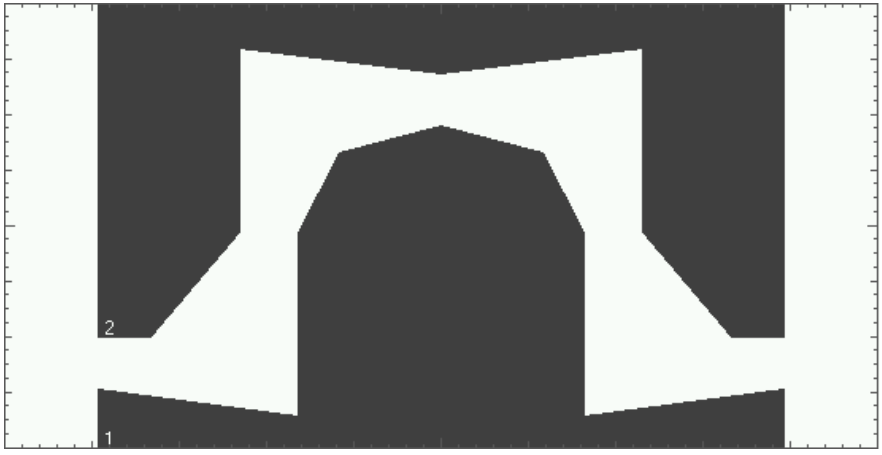
2Mb_ITU_75.msk

6312kb_ITU_110_DS2.msk

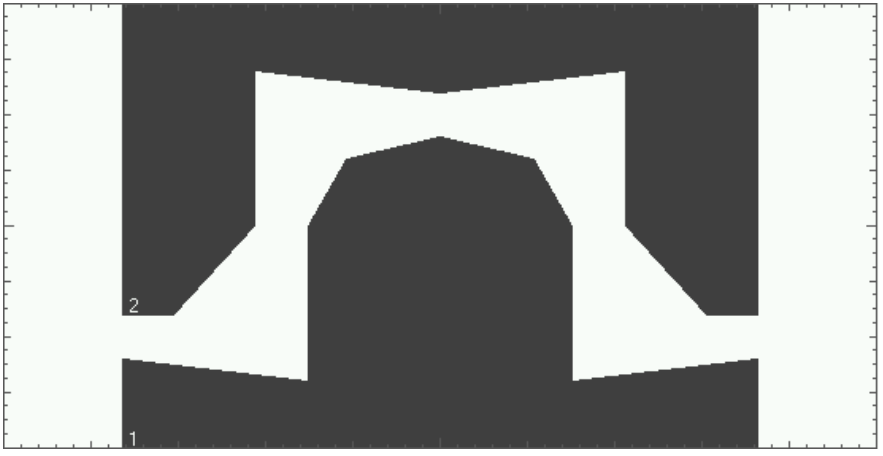
6312kb_ITU_75_DS2.msk



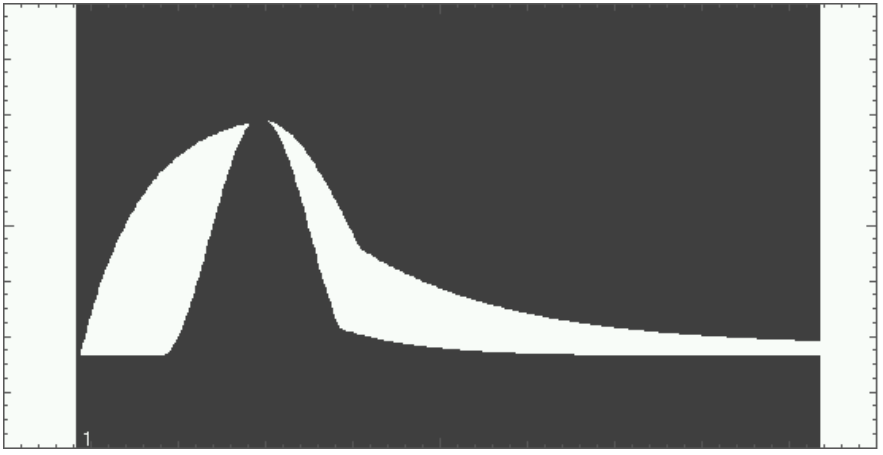
8Mb_ITU.msk



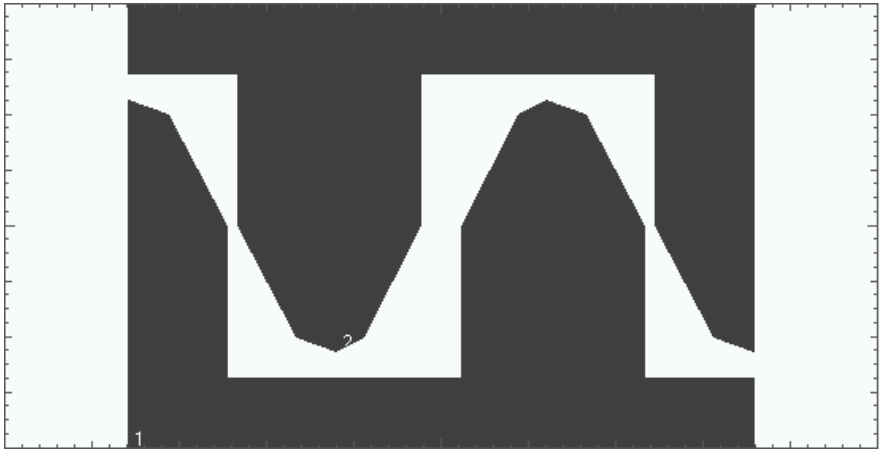
34Mb_ITU.msk



44736kb_ITU_DS3.msk



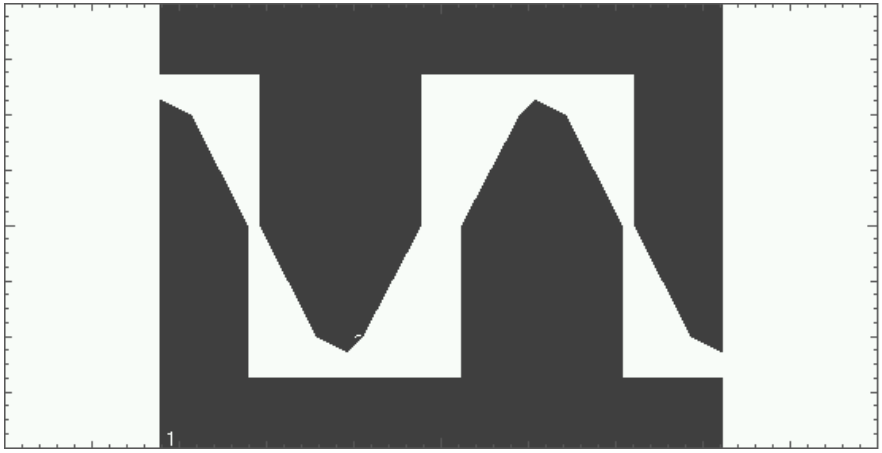
140Mb_ITU_0.msk



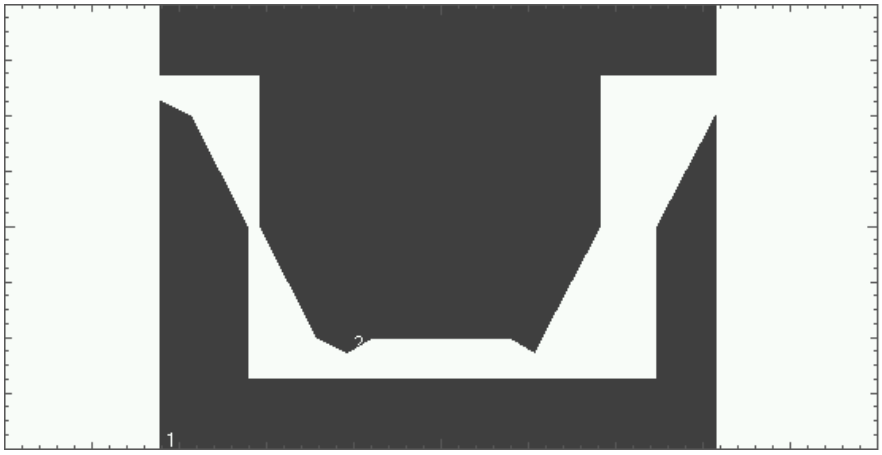
140Mb_ITU_1.msk

140Mb_ITU_1_INV.msk

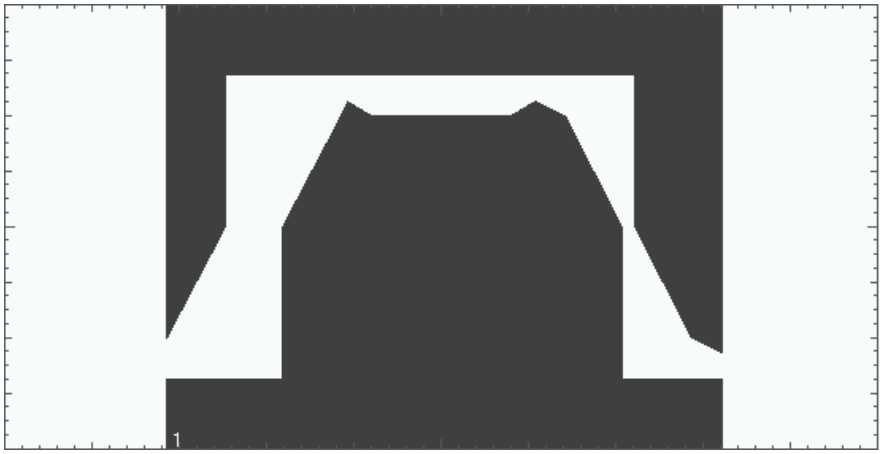
155Mb_ITU_0.msk



155Mb_ITU_1.msk



155Mb_ITU_1_INV.msk

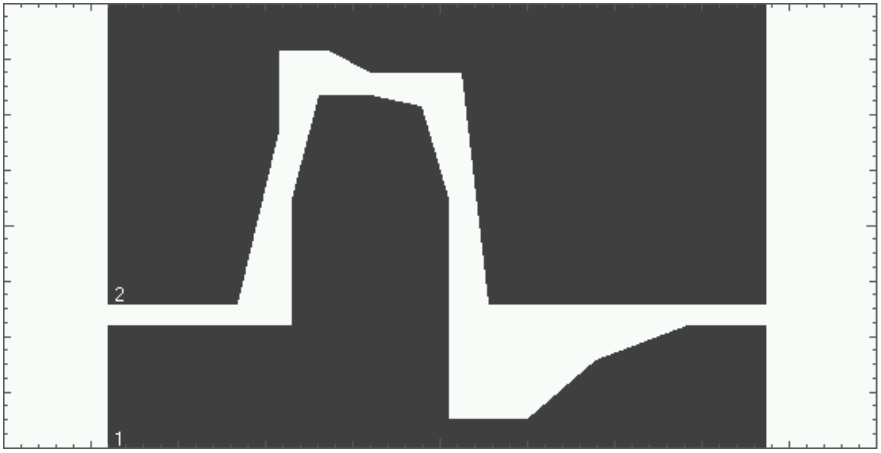


ANSI T1.102 North American Standard Masks

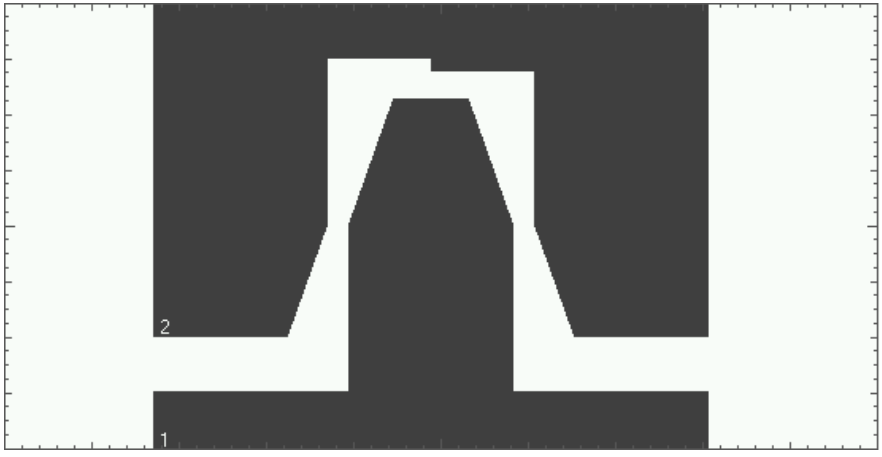
The ANSI T1.102 North American Standard Masks resemble the following:

DS1_ANSI.msk

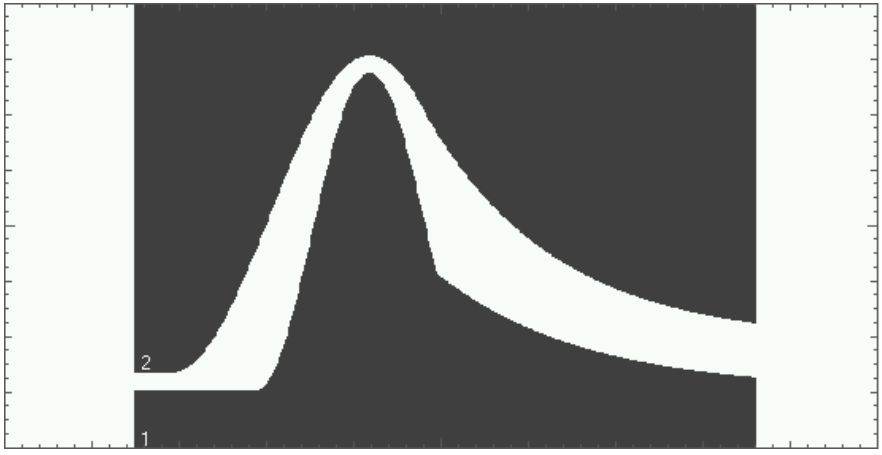
DS1A_ANSI.msk



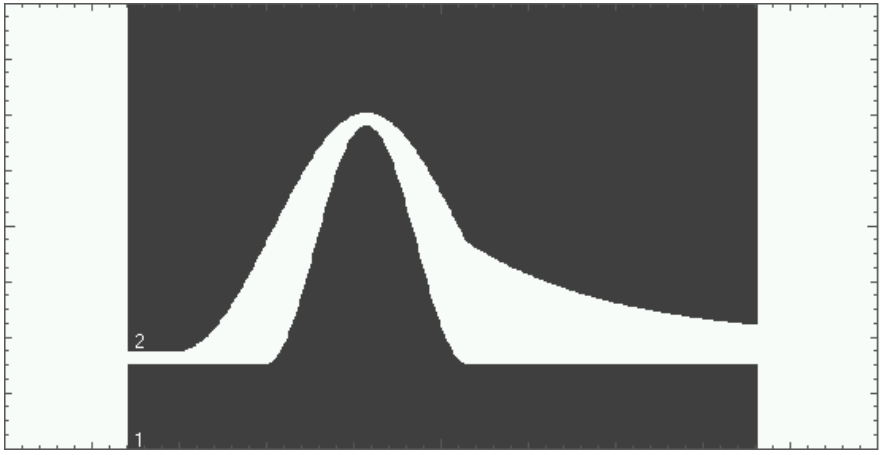
DS1C_ANSI.msk



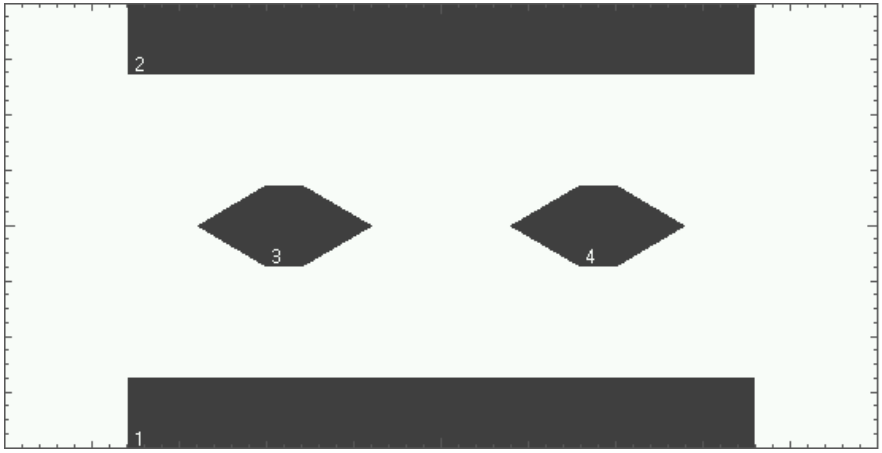
DS2_ANSI.msk



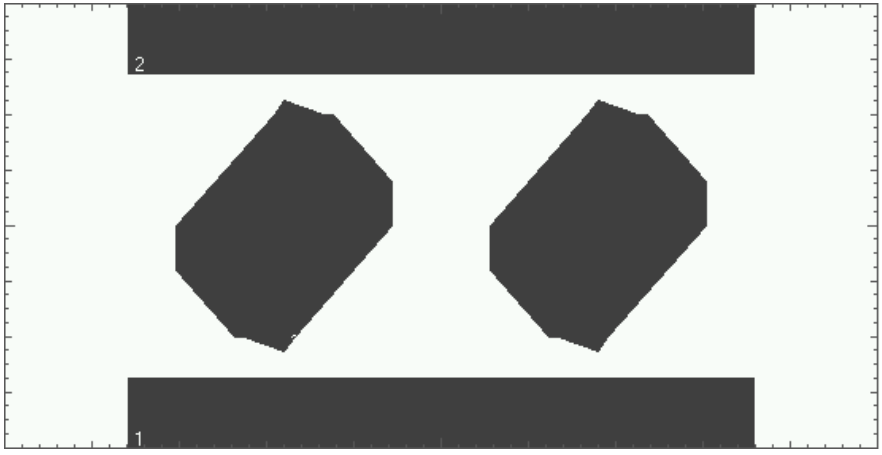
DS3_ANSI.msk



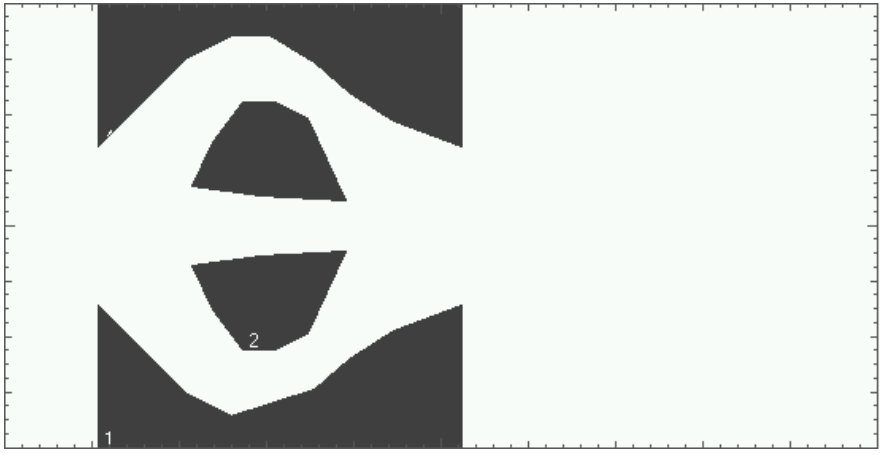
DS4NA_ANSI.msk



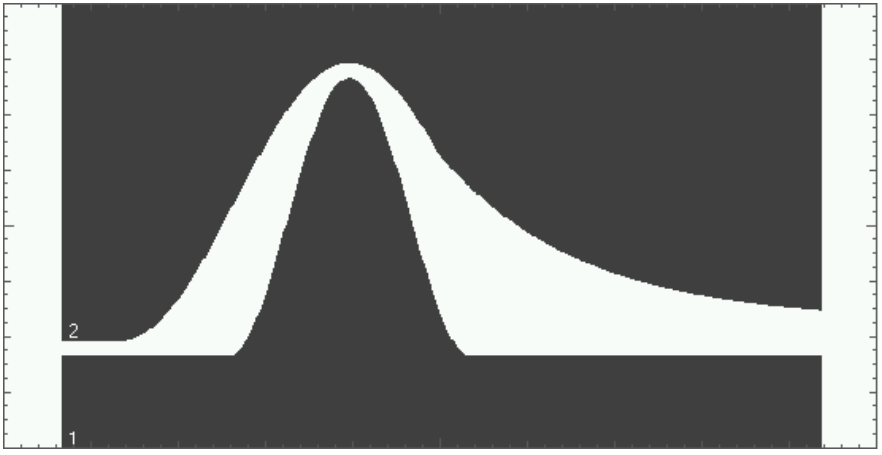
DS4NA_ANSI_MAX.msk



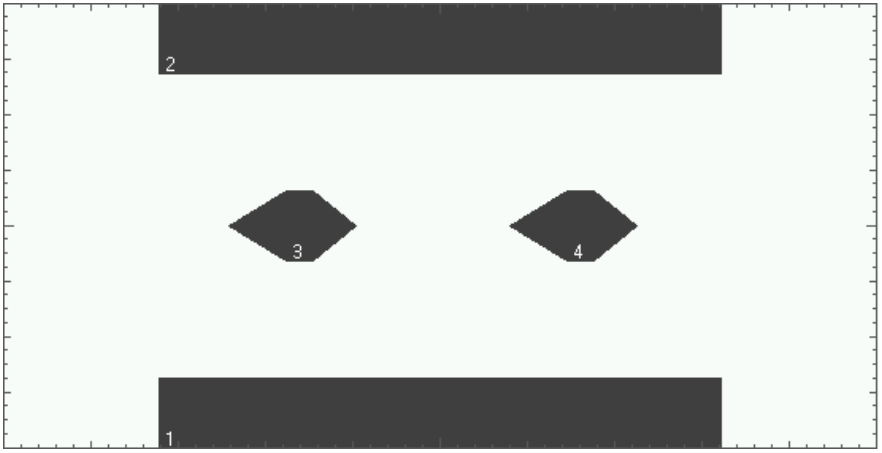
STS1_ANSI_EYE.msk



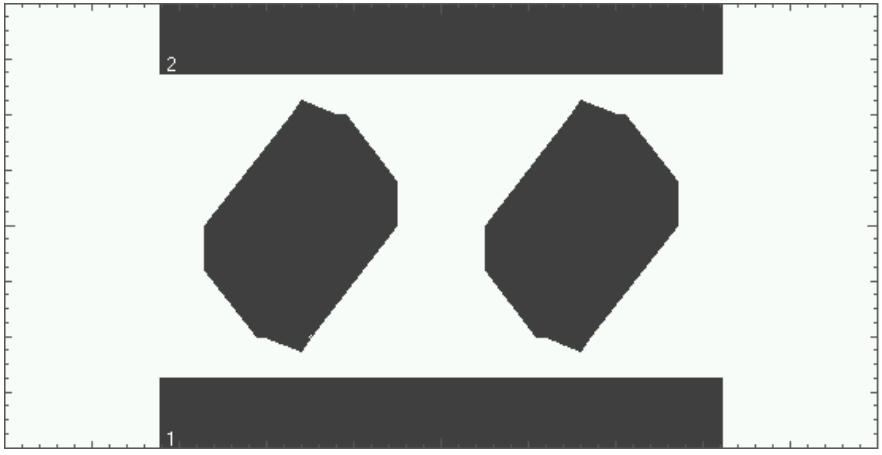
STS1_ANSI_PULSE.msk



STS3_ANSI.msk



STS3_ANSI_MAX.msk

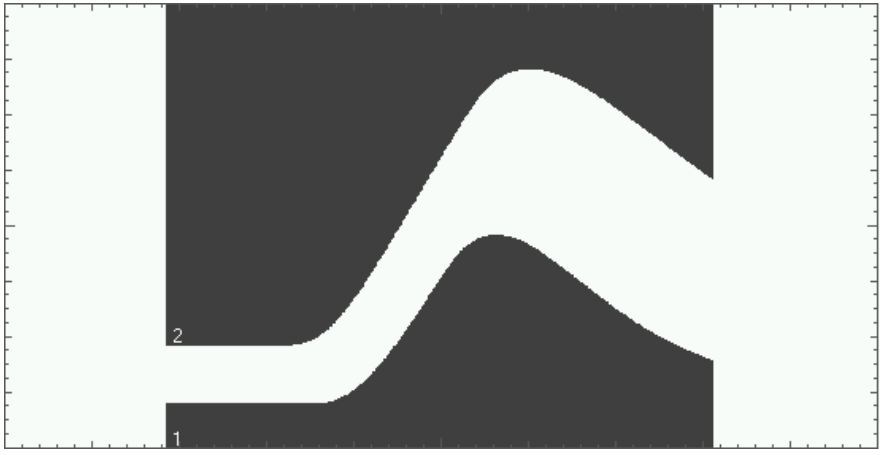


FCC Part 68.308 Options A, B, and C Masks

FCC_68_OPT_A.msk

FCC_68_OPT_B.msk

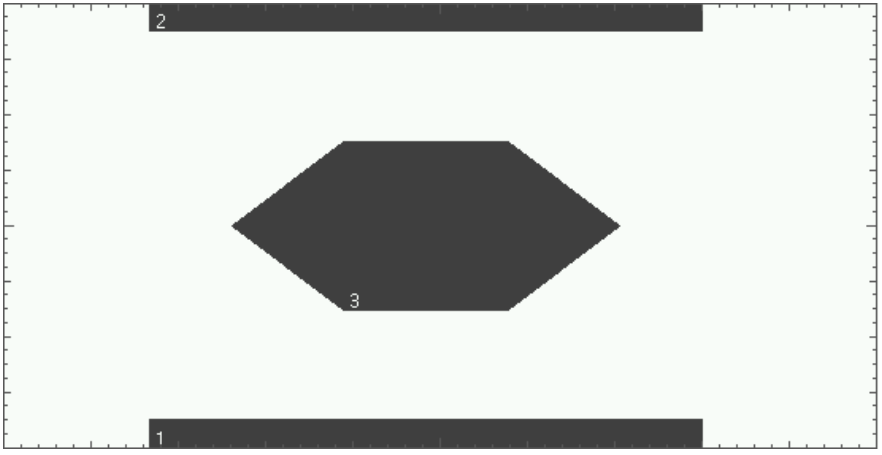
FCC_68_OPT_C.msk



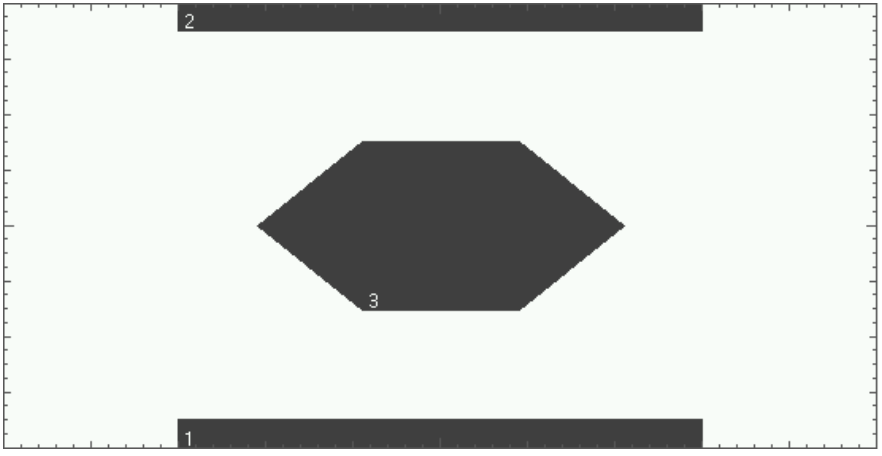
Pre-Compliance SONET Masks

The Pre-Compliance SONET Masks resemble the following:

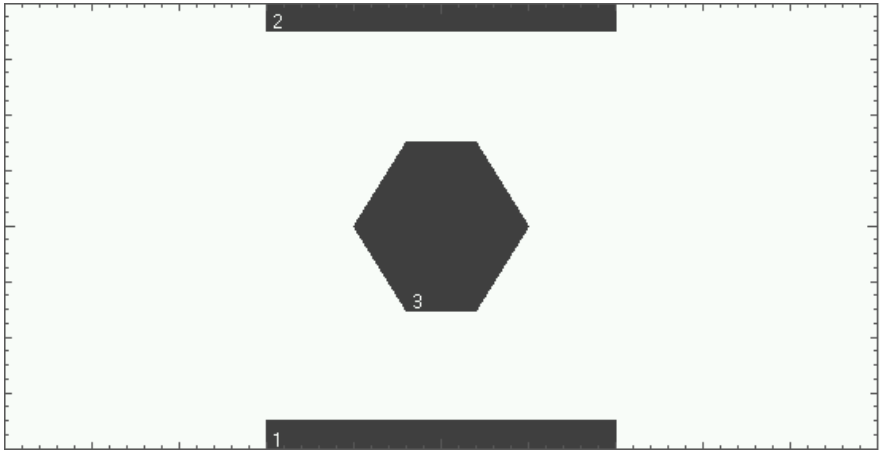
OC1_SONET.msk



OC3_SONET.msk



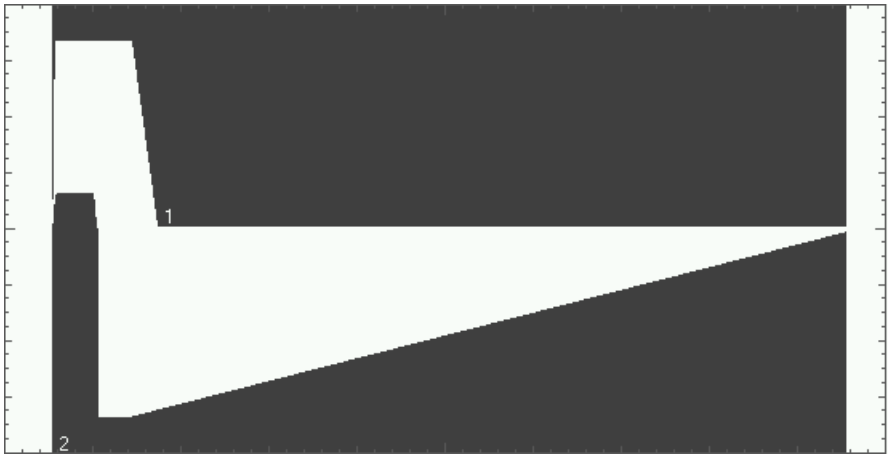
OC12_SONET.msk



IEEE 802.3 Masks

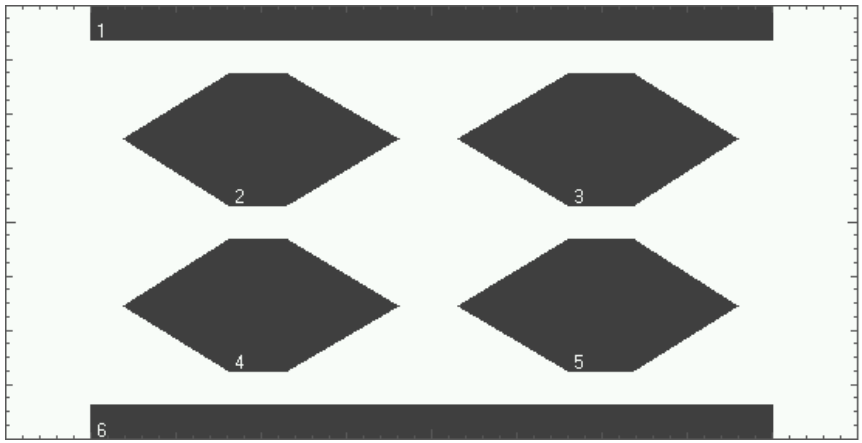
The IEEE 802.3 Masks resembles the following:

10BASE_T_IDL.msk

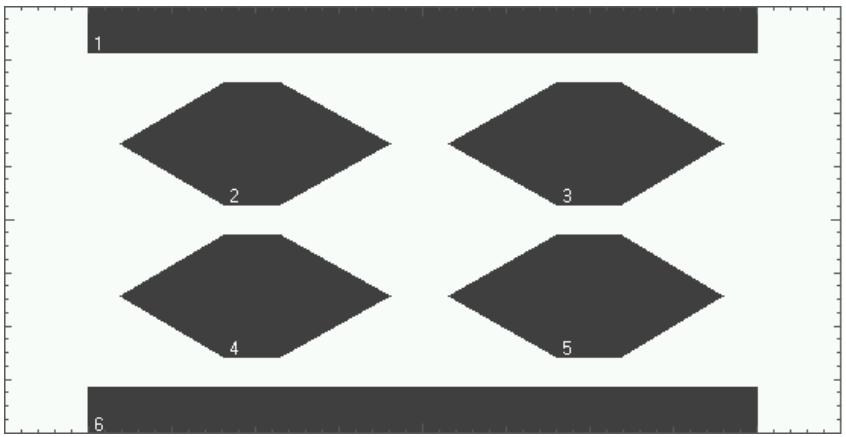


10BASE_T_LINK.msk

100BASE_TX_STP



100BASE_TX_UTP



Safety Notices

This apparatus has been designed and tested in accordance with IEC Publication 1010, Safety Requirements for Measuring Apparatus, and has been supplied in a safe condition. This is a Safety Class I instrument (provided with terminal for protective earthing). Before applying power, verify that the correct safety precautions are taken (see the following warnings). In addition, note the external markings on the instrument that are described under "Safety Symbols."

Warnings

• Before turning on the instrument, you must connect the protective earth terminal of the instrument to the protective conductor of the (mains) power cord. The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. You must not negate the protective action by using an extension cord (power cable) without a protective conductor (grounding). Grounding one conductor of a two-conductor outlet is not sufficient protection.

• Only fuses with the required rated current, voltage, and specified type (normal blow, time delay, etc.) should be used. Do not use repaired fuses or short-circuited fuseholders. To do so could cause a shock or fire hazard.

• If you energize this instrument by an auto transformer (for voltage reduction or mains isolation), the common terminal must be connected to the earth terminal of the power source.

• Whenever it is likely that the ground protection is impaired, you must make the instrument inoperative and secure it against any unintended operation.

• Service instructions are for trained service personnel. To avoid dangerous electric shock, do not perform any service unless qualified to do so. Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

• Do not install substitute parts or perform any unauthorized modification to the instrument.

• Capacitors inside the instrument may retain a charge even if the instrument is disconnected from its source of supply.

• Do not operate the instrument in the presence of flammable gasses or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

• Do not use the instrument in a manner not specified by the manufacturer.

To clean the instrument

If the instrument requires cleaning: (1) Remove power from the instrument. (2) Clean the external surfaces of the instrument with a soft cloth dampened with a mixture of mild detergent and water. (3) Make sure that the instrument is completely dry before reconnecting it to a power source.

Safety Symbols

Instruction manual symbol: the product is marked with this symbol when it is necessary for you to refer to the instruction manual in order to protect against damage to the product..

Hazardous voltage symbol.

Earth terminal symbol: Used to indicate a circuit common connected to grounded chassis.

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Notices

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CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

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