

## Description

The STK4(MST1) Kinase Assay Kit is designed to measure STK4(MST1) kinase activity for screening and profiling applications using Kinase-Glo<sup>®</sup> MAX as a detection reagent. The assay kit comes in a convenient 96-well format, with enough purified recombinant STK4(MST1) kinase, kinase substrate, ATP, and kinase assay buffer for 100 enzyme reactions.

## Background

STK4 (serine/threonine-protein kinase 4), also known as MST1 (Mammalian STE20-like protein kinase 1), belongs to a family of proteins that share similarity with budding yeast serine/threonine kinase Ste20 (sterile-20). It is a core component of the Hippo signaling pathway, the pathway that regulates organ size via cell proliferation or apoptosis and is widely expressed throughout the human body. In the presence of stressful stimuli, autophosphorylation of STK4 at Thr183 initiates caspase-mediated cleavage to create a highly active, 36 kDa STK4 fragment. Examples of stressors are okadaic acid (protein phosphatase PP-1 and PP-2A inhibitor) and staurosporine (a broad-spectrum protein kinase inhibitor). Overexpression of STK4 can initiate apoptosis in mammalian cells when transiently expressed with MST2, a closely related Class II GC (protein Ser/Thr) Kinase, or in the presence of SAPK (stress-activated protein kinase). Inhibition of STK4 can lead to failure to arrest proliferation or to developmental apoptosis in certain cell types. STK4 is a potential diagnostic biomarker and therapeutic target for the treatment of various types of cancer.

## Application(s)

- Study enzyme kinetics and screen small molecular inhibitors for drug discovery and high throughput (HTS) applications.

## Supplied Materials

Catalog #	Name	Amount	Storage
40017	STK4(MST1), GST-tag Recombinant*	5 µg	-80°C
79334	Kinase assay buffer 1 (5x)	1.5 ml	-20°C
79686	ATP (500 µM)	100 µl	-20°C
	Axltide (1 mg/ml)	1 ml	-20°C
79696	White 96-well plate	1	Room Temperature

\*The concentration of the protein is lot-specific and will be indicated on the tube

## Materials Required but Not Supplied

Name	Catalog #
Kinase-Glo MAX	Promega #V6071
DTT (Dithiothreitol), 1M, optional	
Microplate reader capable of reading luminescence	
Adjustable micropipettor and sterile tips	
30°C incubator	

## Storage Conditions



This assay kit will perform optimally for up to **6 months** from date of receipt when the materials are stored as directed.

**Safety**

This product is for research purposes only and not for human or therapeutic use. This product should be considered hazardous and is harmful by inhalation, in contact with skin, eyes, clothing, and if swallowed. If contact occurs, wash thoroughly.

**Assay Principle**

Kinase activity is measured using **Kinase-Glo™ Max** (Promega #V6071). The addition of the reagent results in the generation of a luminescent signal that correlates with the amount of ATP. The reagent is linear to 100µM ATP.

**Contraindications**

The final concentration of DMSO in the assay should not exceed 1%.

**Assay Protocol**

- All samples and controls should be tested in duplicate.

1. Thaw 5x Kinase assay buffer, ATP and Axltide (1 mg/ml) substrate.
2. Prepare 3 ml of 1x Kinase assay buffer by mixing 600 µl of 5x Kinase assay buffer with 2400 µl water.  
*Note: Three (3) ml of 1x Kinase assay buffer is sufficient for 100 reactions.*
3. Prepare the Master Mix (25 µl/well): N wells x (5 µl of 5x Kinase assay buffer + 1 µl of ATP (500 µM) + 10 µl of Axltide (1 mg/ml) + 9 µl of distilled water). Add 25 µl to every well.
4. Prepare the Test Inhibitor (5 µl/well): for a titration, prepare serial dilutions at concentrations 10-fold higher than the desired final concentrations. The final volume of the reaction is 50 µl.

If the Test Inhibitor is water-soluble (*without DMSO*):

- 4.1. Prepare serial dilutions in the 1x Kinase Assay Buffer, 10-fold more concentrated than the desired final concentrations.
- 4.2. For the positive and negative controls, use 1x Kinase Assay Buffer (Diluent Solution).

**Or**

If the Test inhibitor is soluble in DMSO (*with DMSO*):

- 4.1 Prepare the test inhibitor at 100-fold the highest desired concentration in DMSO, then dilute the inhibitor 10-fold in 1x Kinase Assay Buffer to prepare the highest concentration of the 10-fold intermediate dilutions. The concentration of DMSO is now 10%.
- 4.2 Prepare serial dilutions of the Test Inhibitor at 10-fold the desired final concentrations using 10% DMSO in 1x Kinase Assay Buffer to keep the concentration of DMSO constant.
- 4.3 For positive and negative controls, prepare 10% DMSO in (vol/vol) so that all wells contain the same amount of DMSO (Diluent Solution).  
*Note: The final concentration of DMSO should not exceed 1%.*

- Add 5  $\mu\text{l}$  of Test Inhibitor to each well labeled "Test Inhibitor." For the "Positive Control" and "Blank," add Diluent Solution (either distilled water or 10% DMSO in 1x kinase buffer, as described above).
- To the wells designated as "Blank," add 20  $\mu\text{l}$  of 1x Kinase assay buffer.
- Thaw STK4(MST1) kinase on ice. Briefly spin the tube to recover its full contents. Dilute the protein kinase to 2.5 ng/ $\mu\text{l}$  using 1x Kinase assay buffer.

*Note: The concentration of protein is lot-specific and is indicated on the tube. Verify the initial concentration and dilute accordingly.*



*Note: This kinase is particularly sensitive to freeze/thaw cycles. Avoid multiple freeze/thaw cycles. Do not re-use the thawed protein and do not re-use the diluted kinase.*

- Initiate the reaction by adding 20  $\mu\text{l}$  of diluted Kinase to the wells designated "Positive Control" and "Test Inhibitor".

Component	Blank	Positive Control	Test Inhibitor
Master Mix	25 $\mu\text{l}$	25 $\mu\text{l}$	25 $\mu\text{l}$
Test Inhibitor	-	-	5 $\mu\text{l}$
Diluent Solution	5 $\mu\text{l}$	5 $\mu\text{l}$	-
1x Kinase Buffer	20 $\mu\text{l}$	-	-
STK4(MST1) (2.5 ng/ $\mu\text{l}$ )	-	20 $\mu\text{l}$	20 $\mu\text{l}$
<b>Total</b>	<b>50 <math>\mu\text{l}</math></b>	<b>50 <math>\mu\text{l}</math></b>	<b>50 <math>\mu\text{l}</math></b>

- Incubate at 30°C for 45 minutes.
- During the incubation, thaw the Kinase-Glo Max reagent. At the end of the 45-minute reaction, add 50  $\mu\text{l}$  of Kinase-Glo Max reagent to each well. Cover the plate with aluminum foil and incubate the plate at room temperature for 15 minutes.
- Immediately read in a luminometer or a microplate reader capable of reading luminescence. The "Blank" value is subtracted from all other readings.

### Reading Luminescence

Luminescence is the emission of light resulting from a chemical reaction. The detection of luminescence requires no wavelength selection because the method used is emission photometry and not emission spectrophotometry.

To properly read luminescence, make sure the plate reader is set for LUMINESCENCE mode. Typical integration time is 1 second, delay after plate movement is 100 msec. Do not use a filter when measuring light emission. Typical settings for the Synergy 2 BioTek plate reader: use the "hole" position on the filter wheel; Optics position: Top; Read type: endpoint. Sensitivity may be adjusted based on the luminescence of a control assay without enzyme (typically we set this value as 100).

## Example Results

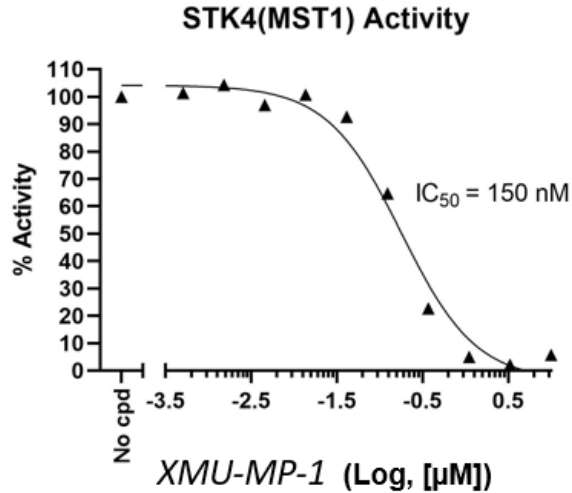


Figure 1: Inhibition of STK4(MST1) Kinase Activity by XMU-MP-1.

The inhibition of STK4(MST1) kinase activity was measured in the presence of increasing concentrations of inhibitor XMU-MP-1 (Selleckchem #S8334) using the STK4(MST1) Kinase Assay Kit (BPS Bioscience #78500). The Blank value was subtracted from all other values. Results are expressed as percent of control (kinase activity in the absence of inhibitor, set at 100%).

Data shown is representative, for lot-specific information, please contact BPS Bioscience, Inc. at [support@bpsbioscience.com](mailto:support@bpsbioscience.com).

### Troubleshooting Guide

Visit [bpsbioscience.com/assay-kits-faq](http://bpsbioscience.com/assay-kits-faq) for detailed troubleshooting instructions. For all further questions, please email [support@bpsbioscience.com](mailto:support@bpsbioscience.com)

### References

Praskova M, *et al.*, Biochem J. 2004; 381(Pt 2):453-462.  
Li W, *et al.*, J Clin Invest. 2015 Nov 2; 125(11):4239-4254.

### Related Products

Products	Catalog #	Size
Lok1 (Stk10), His-tag Recombinant	40074	10 µg
MST3, GST-tag Recombinant	40133	10 µg
SOK1, GST-tag Recombinant	40276	10 µg
STK3(MST2), GST-tag Recombinant	40013	10 µg