# CATC SA*Tracer™ / Trainer™*
# Application Note: Spread Spectrum Clocking

## What is Spread Spectrum Clocking and why is it needed in Serial ATA implementation?

Serial ATA (SATA) attached HDDs are targeted at the low-cost desktop market. One of the components in the SATA connected system is the SATA internal cable itself.  These cables are thin, easy to connect and disconnect and provide improved cooling efficiency with less airflow obstruction.  To keep costs down, these internal cables are not designed with shielding for EMI.  However at the desktop enclosure level, the radiated energy should be kept below specified limits to avoid interfering with radio equipment.  Spread Spectrum Clocking (SSC) technique helps keep the EMI levels low on Serial ATA cables.

If a very tightly controlled clocking scheme is used, the radiated energy tends to concentrate in very few frequency values.   The radiated emission could exceed limits at these few frequencies.  However, by intentionally making the clock drift within a specified range, the average energy emitted at any given frequency is reduced profoundly.  The sample diagram shows this effect.  The drift introduced on the edges is well within the range of Phase Locked Loops used to provide proper clocking to recover parallel data from the serial stream.
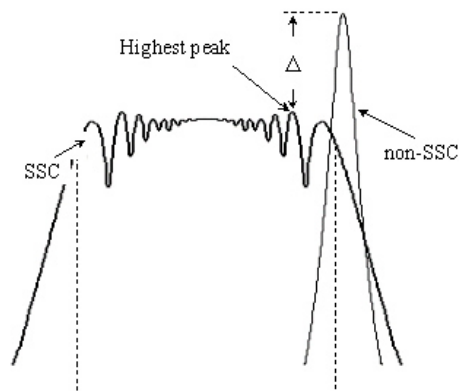


SSC is accomplished by "down-spreading" the clock frequency using a deviation of no more than 0.5% down-spread (+0% -0.5%) $\Delta$ = peak reduction

The CATC SATracer v1.4 analyzer, and later versions, can record traffic from Serial ATA devices that utilize spread spectrum clocked (SSC) signaling.  SSC modulates the operating frequency of a circuit slightly to spread its radiated emissions over a range of frequencies rather than just one tone. By distributing emissions for a given frequency, SSC transmissions help devices meet FCC requirements.

The Serial ATA I Specification states that SSC transmission is optional on the transmitter (TX) side for both host and device. However, SSC is a mandatory capability for all Serial ATA receivers (RX). This requirement eliminates compatibility issues by ensuring that all Serial ATA devices can tolerate SSC signals when attached to a device that transmits SSC signaling.

CATC's SA*Trainer* traffic generator for Serial ATA, released in July of 2003, allows spread spectrum transmissions to be enabled/disabled dynamically while generating traffic. This is a valuable capability for validating SSC operation for both host and device side silicon.

**Sources:**
Serial ATA Specification 1.0  Copyright 2001 (All Rights Reserved)
Serial ATA Working Group