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Declaration of Safety of Rapiscan Systems, Inc. X-Ray and Gamma Inspection Systems on Sensitive Electronics from Incidental Irradiation during Scanning Procedures

The purpose of this document is to provide assurance to customers and end users that no degradation or impairment of long-term performance shall occur within metal oxide semiconductors (MOS), and similar devices as a result of the incidental irradiation of such devices during a routine scan of a cargo container which may contain such items.

MOS integrated circuits, particularly those of the complementary form (CMOS) are very suitable for use in high-performance electronics such as timers, battery-powered computers, robots, missiles, and space vehicles. As these devices employ unique features such as very low power demands and voltage signals highly immune to noise, they are uniquely suited to advanced data handling and control systems. Unfortunately, these same devices demonstrate a strong, variable and long-lived response to total dose radiation. In any radiation environment exceeding 10 Gy (1000 rads), there is a proven effect of oxide trapping and interface-state generation. In addition, heavy ions and intense pulses of radiation can also cause the upset of logic states. Without going into a detailed discussion, the chart below shows the relative doses that are necessary to create damage among typical MOS and CMOS devices.

Main degradation effect	Dose at which degradation affect typically occurs
Minor "noise immunity reduction"; possible minor loss in switching speed; device "out of specification"	8×10^2 rads
Sharp quiescent current increase due to "Vt of n-channel crossing zero"	5×10^3 rads
Switching speed reduction	1×10^4 rads
Change of logic state impossible: "Logic Failure"	3×10^4 rads

It should be noted from the table above that in all cases, the radiation doses necessary to create degradation of the device are typically very high. By contrast, the highest energy x-ray generation current provided by Rapiscan Systems, Inc. when utilized at the typical scan time for a cargo container produces a total dose for the contents of 0.000146 Gray or 0.0146 rads, thousands of times lower than the minimum dose known to degrade sensitive MOS and CMOS integrated circuits. It should be noted that degradation of fiber optic components requires an even higher dose than those indicated in the table above.

Customers and end users of Rapiscan Systems, Inc. inspection systems can use such devices on cargo that may contain sensitive electronics without concern of adversely affecting these devices due to incidental irradiation during the inspection process.

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