Collision Prevention Systems EMI/EMC Overview and Summary

INDUSTRY ALIGNMENT ON TMM REGULATIONS; SPECIAL PROJECT

OF THE MINERALS COUNCIL SOUTH AFRICA

REV 1.0

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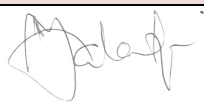
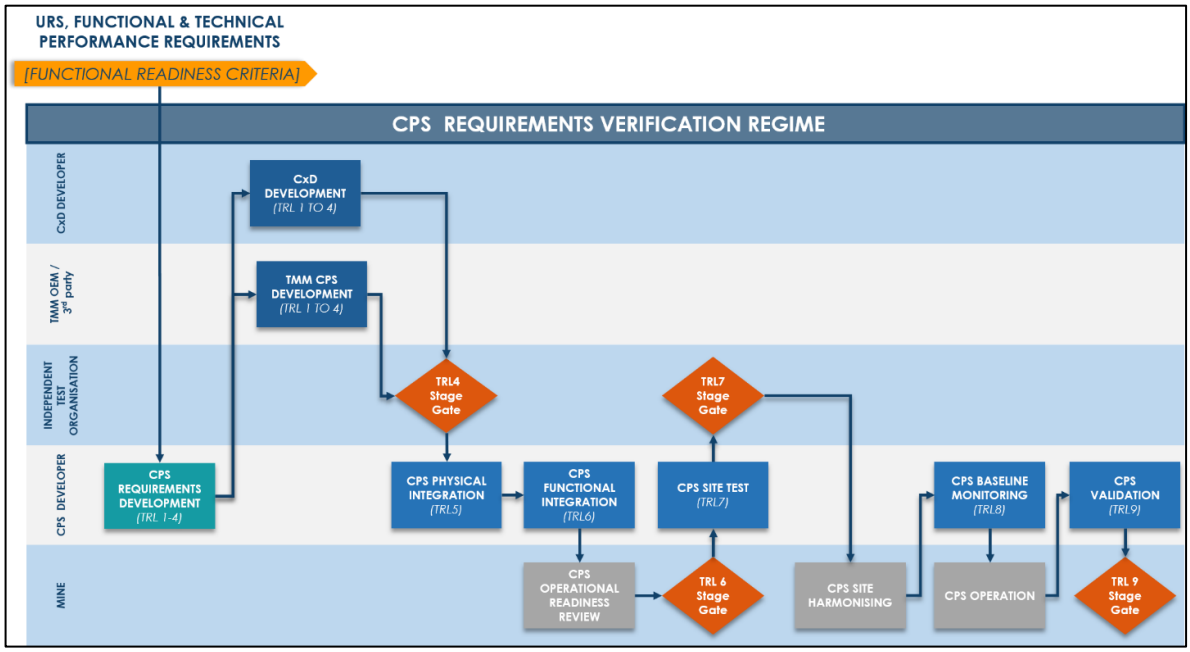
Stanford Malatji	**Minerals Council**		17/12/2025

CPS EMI/EMC Testing

Electromagnetic compatibility testing of CPS systems should form part of the Integrated CPS Testing Regime (Click here for more details). The following approach is recommended:



TRL 4

The CPS products should be tested in a laboratory setting as if testing for ICASA approval. ICASA requires EMC, RF and Safety testing in accordance with the relevant SANS, IEC and ETSI standards. The standards that are applicable to each product are dependent on the type of technology that is integrated into the CPS system (for example Bluetooth, WiFi etc.). Any EMC, RF and Safety testing laboratory should be able to provide guidance on the correct standards to select for each product.

TRL 7

When CPS products are installed on vehicles, the complete system should undergo EMC tests on a mining site to verify that the machines/TMMs and its existing features do not adversely affect the sensitivity or functionality of the CPS system. Examples of components or elements that may interfere with the CPS system include emergency lights, distance between the antennas mounted on the vehicle, the locations and lengths of looms on the vehicle etc.

Fault Finding

Should the CPS malfunction (produce false positives or fail to detect) after installation on a vehicle, custom fault-finding tests and techniques could be used to identify whether the cause of the malfunction is EMC/EMI related. These tests should be conducted before the TLR 9 stage gate, to ensure that mitigation is applied and verified before rollout. A custom test plan should be drafted to ensure repeatability of the chosen methods and techniques.

Resources

The resources below offer valuable insights into EMI/EMC principles and their relevance to CPS systems:

STANDARDS GAP ANALYSIS

A gap analysis is a document that describes the differences between standards. A gap analysis was drafted to describe the differences between the following EMC standards that are applicable to mining vehicles and CPS systems:

- SANS 13766:2006
- ISO 13766-1:2018
- ISO 13766-2:2018

Click here to view the document.

FREQUENCY SPECTRUM MANAGEMENT PLAN

Frequency spectrum management is the process of regulating and overseeing the use of the radio frequency spectrum. Spectrum management aims to minimise interference between devices on a mining site (including CPS systems), by identifying and understanding the sources of all radio frequency transmissions and planning ahead for new systems that may function within the same frequency bands.

For guidance on the compilation of a Frequency Spectrum Management Plan, click here.

EMI/EMC TEST METHODOLOGY & PROCEDURES

During the development and integration of CPS systems, the systems are subjected to various tests, including safety testing and functional testing. EMC testing is a vital part of this process. CPS systems should undergo EMC tests at subassembly level in a controlled environment (test laboratory) and after installation on a machine/TMM. Specific measurement methods and techniques applicable to these systems are described in the CPS EMC Test Methodology and Protocols document. Click here to view the document.

AMBIENT MEASUREMENTS AND DATA

Ambient measurements and results at mining sites form part of the test instructions for CPS devices and is useful for manufacturers to understand the environment in which CPS devices would need to function. It further allows mines to understand and manage known radio frequency emissions on site to avoid adverse influences of RF devices on CPS. The Minerals Council commissioned the measurement of ambient environments on several mining sites. The findings of the tests can be sourced here. The data can be viewed and compared here.