No.	TRL	Test protocol	Test objective	Test site
1	4	TMM ISO 21815 Interface Test	Confirm that TMM can interface with CxD according to ISO 21815-2:2021	Test conducted in UP laboratory/OEM site/mine site
2	4	TMM Log keeping test	Logs needed to; • Conduct investigations should an incident occur • Maximize benefit derived from CPS – improved site control, production management, etc. • Record data at higher TRL testing	Test conducted in UP laboratory/OEM site/mine site
3	4	TMM Machine sensing test	TMM needs to share information with CxD to enhance CxD performance and avoid duplication. Information shared: • Speed • Direction • Gear selection • Payload status (empty, full, overloaded, fault) • Others	Test conducted on UP campus/OEM site/mine site
4	4	TMM self – diagnostic test	TMM needs to be able to detect failure modes and fail to safe should a critical failure be present	Test conducted on UP campus/OEM site/mine site
5	4	Surface TMM Machine Controller Test	TMM needs to implement commands (such as SLOW_DOWN or CONTROLLED_STOP) sent by CxD. This test verifies that the TMM can implement these instructions.	Test conducted on UP campus/OEM site/mine site
6	4	Underground TMM Machine Controller Test	TMM needs to implement commands (such as SLOW_DOWN or CONTROLLED_STOP) sent by CxD. This test verifies that the TMM can implement these instructions.	Test conducted on UP campus/OEM site/mine site
7	4	CxD ISO 21815 Interface Test	Confirm that CxD can interface with TMM according to ISO 21815-2:2021	Test conducted in UP laboratory
8	4	CxD Log keeping Test	Logs needed to; • Conduct investigations should an incident occur • Maximize benefit derived from CPS – improved site control, production management, etc. • Record data at higher TRL testing	Test conducted in UP laboratory
9	4	Surface TMM CxD Self-diagnostic Test	CxD needs to be able to detect failure modes and fail to safe should a critical failure be present	Test conducted on UP campus
10	4	Underground TMM CxD Self-diagnostic Test	CxD needs to be able to detect failure modes and fail to safe should a critical failure be present	Test conducted on UP campus
11	4	Surface TMM Effective Warning Test	CxD must warn the operator effectively prior to initiating an automatic slow and stop event.	Test conducted at Gerotek Test Facility
12	4	Underground TMM Effective Warning Test	CxD must warn the operator effectively prior to initiating an automatic slow and stop event.	Test conducted at Gerotek Test Facility
13	4	Surface TMM CxD Basic Detection and Tracking Test	CxD must be able to detect TMMs within the specified detection range, and maintain this detection for the duration that the TMM is within the detection range. Logs essential to the successful performance of this test.	Test conducted at Gerotek Test Facility
14	4	Underground TMM CxD Basic Detection and Tracking Test	CxD must be able to detect pedestrians within the specified detection range, and maintain this detection for the duration that the pedestrian is within the detection range. Logs essential to the successful performance of this test.	Test conducted at Gerotek Test Facility
15	4	Surface TMM CxD Scenario Test	CxD algorithm tested by performing choreographed interaction scenarios.	Suitable test site to be identified
16	4	Underground TMM CxD Scenario Test	CxD algorithm tested by performing choreographed interaction scenarios.	Test conducted at Gerotek Test Facility
18	6	Surface TMM CPS Integration Test	Integration of CxD with TMM tested	Test conducted at Gerotek Test Facility
19	6	Underground TMM CPS Integration Test	Integration of CxD with TMM tested	Test conducted at Gerotek Test Facility
17	4	Underground CxD Robustness Test	CxD sensing functionality tested in a representative environment. * *Note this test was moved from line 17, original intention was to test this in mine mock-up on surface.	Suitable test site to be identified, test must be conducted in representative environment with real TMM (e.g. underground mine)

No.	TRL	Test protocol	Test objective	Test site
20	7	Surface TMM Advanced CxD Test	Sub-set of interaction scenarios tested in Test 15 repeated in representative environment to ensure robustness of CPS products	Suitable test site to be identified, representative environment needed with real TMMs.
21	8	Surface CPS Test	Limited roll-out of CPS to a dedicated portion of the mine. Logs monitored for a set period. Logs essential to conduct this test.	Mine site
22	8	Underground CPS Test	Limited roll-out of CPS to a dedicated portion of the mine. Logs monitored for a set period. Logs essential to conduct this test.	Mine site
23	9	Surface CPS Validation	Full-scale roll-out of CPS to entire mining operation where significant risk exists. Logs monitored for a set period. Logs essential to conduct this test.	Mine site
24	9	Underground CPS Validation	Full-scale roll-out of CPS to entire mining operation where significant risk exists. Logs monitored for a set period. Logs essential to conduct this test.	Mine site