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Application for West Virginia Tracking Device Certification

For

Miner & Equipment Tracking System (METS)

Tab 6 - Demonstration Results

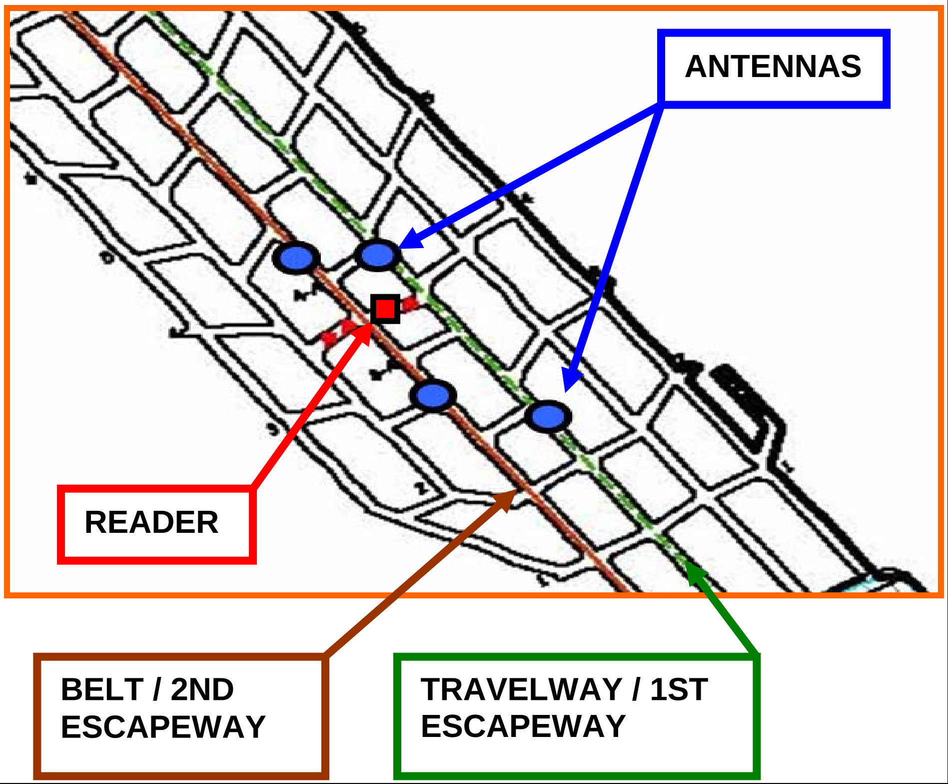
6.1 Miner to Reader Test Data

6.1.1 Test Site A & B

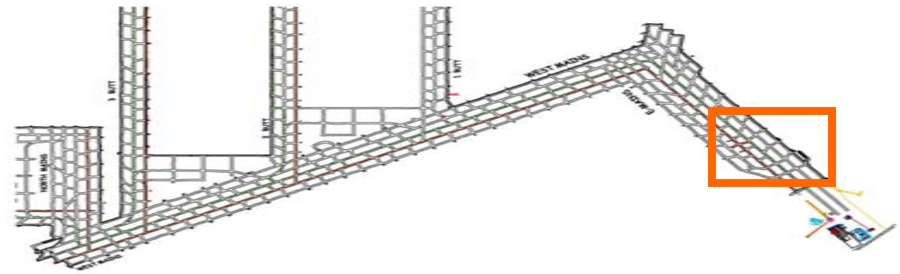
Equipment	Test Site	Comm Type	Number of Miners	Distance to Reader or Coverage Area	Rate of Travel	Describe Ride	Entry/Crosscut Conditions			
							Height	Width	Scenario	Notes
METS T1000 Tag R1000 Reader	MDG - 070509-A*	433 MHz	4	200' radius 400' diameter (coverage)	281 FPM	On Foot	8.6'	16'	#9 - 2 persons each simultaneously passing a reader in opposite directions. #7, #5	8.0% slope, Location: 4 Brk Travelway/Pri Esc, Inby Antenna
METS T1000 Tag R1000 Reader	MDG - 070509-A*	433 MHz	8	?	1056 FPM	Covered Hummer	8.6'	16'	#10 - 8 Miners in an enclosed Hummer passing a reader at the maximum speed typical for the mine	8.0% slope, Location: 4 Brk Travelway/Pri Esc, Both Antennas
METS T1000 Tag R1000 Reader	MDG - 070509-B*	433 MHz	2	60'**	281 FPM	On Foot	8.6'	16'	#3 – Entry with axis that contains a 54" belt, center of entry	8.0% slope, Location: 4 Brk Belt/Sec Esc, Inby Antenna
METS T1000 Tag R1000 Reader	MDG - 070509-B	433 MHz	3	20'	0 FPM	On Foot	8.6'	16'	#6 – Entry with axis that is blocked by stopping (concrete with steel door)	8.0% slope, Location: 4 Brk Belt/Sec Esc, Inby Antenna

* See drawings next page
** Reading seems inconsistent with normal range, will re-test

Top View –
MDG-070509-A (4 Brk Travelway/Primary Escapeway)
MDG-070509-B (Belt/Secondary Escapeway)



Relative Mine Location



Side Elevation

Side Elevation Unavailable on 5/30/07.
Slope 8.0%.
Uniform elevation.

Name of Mine: Mettiki Mountainview	Date of Testing: May 9, 2007	Certifying Engineer: Mike Ricci, PE

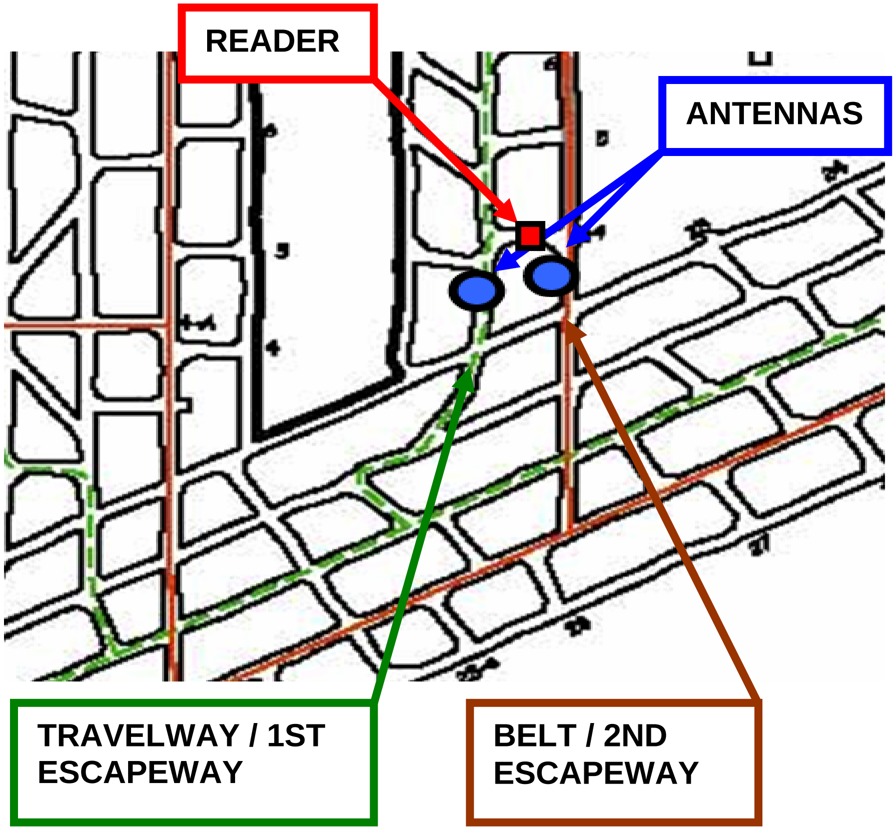
6.1.2 Test Site C

<u>Equipment</u>	Test Site	Comm Type	Number of Miners	Distance to Reader or Coverage Area	Rate of Travel	Describe Ride	Entry/Crosscut Conditions			
							Height	Width	Scenario	Notes
METS T1000 Tag R1000 Reader	MDG - 0705 09-C	433 MHz	1	180’	281 FPM	On Foot	9’	16’	#2 – Entry with curvature that prevents line of sight. #4	3.1% slope, Location: 3 Butt Travelway/Pri Esc Walking Outby
METS T1000 Tag R1000 Reader	MDG - 0705 09-C	433 MHz	1	225’	281 FPM	On Foot	9’	16’	#1 - Entry with an axis that allows for uninterrupted line of sight	3.1% slope, Location: 3 Butt Travelway/Pri Esc Walking Inby

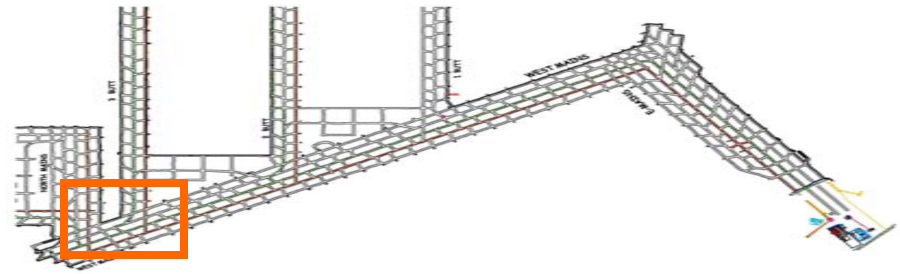
*See drawings next page

Note: Scenario 8 was not tested. 433 MHz signals are not expected to penetrate/traverse a coal pillar

Top View –
MDG-070509-C (3 Butt Travelway/Primary Escapeway)



Relative Mine
Location



Side Elevation

Side Elevation Unavailable on 5/30/07.
Slope 3.1%.
Uniform elevation.

Name of Mine: Mettiki Mountainview	Date of Testing: May 9, 2007	Certifying Engineer: Mike Ricci, PE

Legend:

- **Equipment** – The make and model of the device(s) whose function is being demonstrated
- **Test Site** – provide a unique reference code to the attached diagram (unique select three letters that will be unique to your company insert hyphen then 6 digit date insert hyphen then a unique letter for that test example ABC-051607-A)
- **Comm Type** – what type of wireless communications used between the miner and the reader
- **Number of miners** – how many miners passed reader at same time
- **Distance to reader or coverage area** – provide the distance between the miners and the reader or coverage area (in the case of wifi coverage cloud)
- **Rate of Travel** – how fast were the miners moving in feet per minute
- **Describe Ride** –- describe the means of travel (on foot or in vehicle with description of vehicle)
- **Height** – what is the height of the entry or crosscut noting
- **Width** – what is the width of the entry or crosscut
- **Scenario** – relevant demonstration scenario number from list below (if not one of the standardized scenarios a description is required
- **Notes** – any thing you feel are relevant for understanding

Process Notes:

Miner-to-reader testing is to be done with the tag on miners situated in realistic scenarios not with loose tags

Scenarios:

1. **An entry or crosscut with an axis that allows for uninterrupted line-of-sight**
2. **An entry or crosscut with an axis that has a curvature which precludes line-of-sight**
3. **An entry or crosscut with an axis that contains a belt noting belt width & placement**
4. **An entry or crosscut with an axis that contains a metal overcast**
5. **An entry or crosscut with an axis that contains a wire-mesh roof**
6. **An entry or crosscut with an axis that is blocked by stopping noting type**
7. **An entry or crosscut with an axis that has a power line parallel to path of transmission**
8. **The effectiveness to transverse one or more coal pillars**
9. **Miners simultaneously passing a reader in opposite directions**
10. **Miners in a mantrip passing a reader at the maximum speed typical for the mine**

6.2 Reader to Surface Test Data

Equipment System/Miner	Test Site	Comm Type	Distance Reader to Surface Comm-Center	Entry/Crosscut Conditions				Number Amps/Nodes to Surface Comm- Center
				Height inches	Width feet	Scenario	Notes	
METS R1000 Reader Server	**MDG-070509-A**	**FIBER**	**600'**	**8.6'**	**16'**	**#5, 7, 9, 10**	**No data was lost in any test from a reader to the server.**	**3**
METS R1000 Reader Server	**MDG-070509-B**	**FIBER**	**600'**	**8.6'**	**16'**	**#3, 6**	**No data was lost in any test from a reader to the server.**	**3**
METS R1000 Reader Server	**MDG-070509-C**	**FIBER**	**5,800'**	**9'**	**16'**	**#1, 2, 4**	**No data was lost in any test from a reader to the server.**	**6**

Legend:

- **Equipment** – The make and model of the device(s) whose function is being demonstrated
- **Test Site** – provide a unique reference code to the attached diagram (unique select three letters that will be unique to your company insert hyphen then 6 digit date insert hyphen then a unique letter for that test example ABC-051607-A)
- **Comm Type** – what type of communications used between the reader and the surface
- **Distance to reader or coverage area to surface communication** – provide the distance between the reader or coverage area (in the case of wifi coverage cloud) and the surface
- **Height** – what is the height of the entry or crosscut noting
- **Width** – what is the width of the entry or crosscut
- **Scenario** – relevant demonstration scenario number from list below (if not one of the standardized scenarios a description is required) (not all may be relevant to all technologies)
- **Notes** – any thing you feel are relevant for understanding
- **Number pf Amps/Nodes to Surface Comm**-Center – provide the number of powered components required between the device reading the tag and signal tracking device and the surface

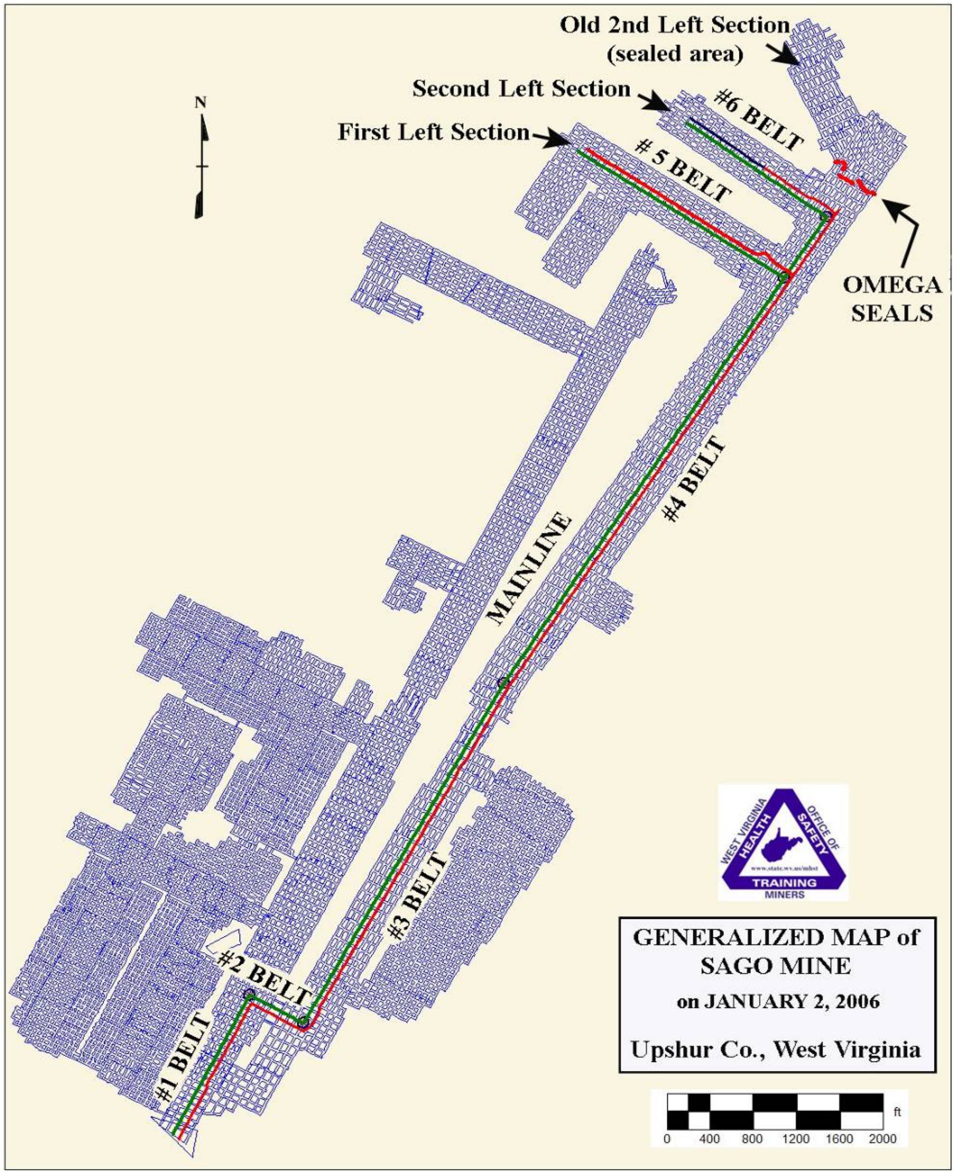
Process Notes:

Miner-to-reader testing is to be done with the tag on miners situated in realistic scenarios not with loose tags

Scenarios:

1. **An entry or crosscut with an axis that allows for uninterrupted line-of-sight**
2. **An entry or crosscut with an axis that has a curvature which precludes line-of-sight**
3. **An entry or crosscut with an axis that contains a belt noting belt width & placement**
4. **An entry or crosscut with an axis that contains a metal overcast**
5. **An entry or crosscut with an axis that contains a wire-mesh roof**
6. **An entry or crosscut with an axis that is blocked by stopping noting type**
7. **An entry or crosscut with an axis that has a power line parallel to path of transmission**
8. **The effectiveness to transverse one or more coal pillars**

6.3 Survivability/Re-Establish

<table>
<tr><th>Representative Mine Layout
(Noting Proposed Element Locations)</th><th colspan="2">Survivability Options Provided
Assuming Explosion in Old 2nd Left</th></tr>
<tr><td rowspan="5">
</td><td>Individual System Element(s)</td><td>Reader, Infrastructure (typically fiber)</td></tr>
<tr><td>Damage by Dynamic Impact</td><td>Per the reference scenario mandated below, if there is a large explosion, the reader and infrastructure will likely be destroyed. Readers can easily be redeployed as they have one cable connection. Fiber infrastructure can also be easily redeployed using fiber on reels with pre-terminated military connectors at each end. No testing was done to simulate the dynamic impact conditions described below.</td></tr>
<tr><td>Damage by Fire/Heat</td><td>Per the reference scenario mandated below, if there is a very large fire, the reader and infrastructure will likely be destroyed. Readers can easily be redeployed as they have one cable connection. Fiber infrastructure can also be easily redeployed using fiber on reels with pre-terminated military connectors at each end. No testing was done to simulate the fire conditions described below.</td></tr>
<tr><td>Damage by Static Pressure</td><td>Per the reference scenario and legend below, if there is static pressure in excess of 150 psi, the reader and infrastructure will likely be destroyed. Readers can easily be redeployed as they have one cable connection. Fiber infrastructure can also be easily redeployed using fiber on reels with pre-terminated military connectors at each end. No testing was done to simulate static pressure damage.</td></tr>
<tr><td>Function in Power Interruption</td><td>If there is a power interruption, the reader and infrastructure will survive if battery backup is available. If battery backup is not available, the reader and infrastructure will resume operation when power is restored. Both battery backup and non-battery backup testing was done. In the first case, the system continued to function normally. In the second case, the system resumed normal operation when power was restored.</td></tr>
</table>

Legend:

- **Element** – provide the name and description of each element of the product/system
- **Dynamic Impact** – in the top cell describe what is likely to happen if the Element is in the path of explosion moving down an entry and in the lower cell describe what options there are for re-establishing the system in the case the element is rendered non-functional and what testing was done to verify performance
- **Fire** – in the top cell describe what is likely to happen if the Element is subjected to a fire and in the lower cell describe what options there are for re-establishing the system in the case the element is rendered non-functional and what testing was done to verify performance
- **Static Pressure** – the top cell describe what is likely to happen if the Element is subject to a static pressure as the result of an explosion and in the lower cell describe what options there are for re-establishing the system in the case the element is rendered non-functional and what testing was done to verify performance
- **Power Interruption** – in the top cell describe what is likely to happen if power to the Element is interrupted and in the lower cell describe what options there are for re-establishing the system in the case the element is rendered non-functional and what testing was done to verify performance

Process Notes:

For purposes of comparison, manufacturers should reference the Sago Reports on the WV OMHS&T web page. The reference scenario is that event.

It is difficult to predict specific impacts on each technology because of the variety means of placing specific elements of the communication-tracking systems within the entry or cross section. Generally most likely worst case event is an explosion which will destroy all devices protruding from the rib, roof or floor for a distance of 2000 feet. The second most likely worst case event is a fire or extreme heat that has propagated though out an area of 500 feet of entry or cross cut and has destroyed all man-made devices protruding from the rib, roof or floor. Manufacture may assume their devices will survive these events if they have demonstrated survival and are able to document such. In all other cases the response should assume that all elements of their product have been rendered non-functional and should discuss means for re-establishing functionality.

Redundant signal pathways and hardening options provided by the technology may be described in addressing survivability.

Provisions for rapid reconnection unique to the technology should be described.