

Aileron Main Line Valve Coating Assessment Report

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1 Introduction

Direct Current Voltage Gradient (DCVG) surveys have been conducted at each scraper station along the Amadeus Gas Pipeline (AGP) to give an indication of the condition of the coating at each site. However, the accuracy of these DCVG surveys at the scraper stations is uncertain due to the possibilities of Cathodic Protection (CP) shielding and interactions between different pipe sections.

To correlate the DCVG results to actual defects, 5 scraper stations, 4 Main Line Valves (MLVs) and 9 anchor blocks have been selected to be excavated and to undergo coating assessment. The results of these excavations and coating assessments will help determine the expected condition of the remaining stations and MLV's, and provide key information into the decision to excavate them or not.

Aileron is the fourth of the MLV sites to be excavated and assessed. This report compares the DCVG results for Aileron to the results of the coating assessment following excavation including Long Range Ultrasonic Testing (LRUT).

After coating assessments had been conducted, the station pipework was cleaned by abrasive blasting and recoated with Luxepoxy, a high build 2 part epoxy coating.

2 Method

In April 2012 a DCVG survey was conducted on the Aileron MLV. These results have been included in this report for comparison to determine if there is a correlation between the DCVG survey data and actual coating defects around the MLV.

The Aileron MLV has been excavated and assessed, see Appendix 1. For major defects a coating defect assessment has been conducted, completed coating defect assessment forms are in Appendix 2. Appendix 3 contains any referenced photos and the photo log.

The results of the DCVG survey and the coating defects assessments have been compared to determine if there is a correlation between the DCVG survey and actual coating defects in Section 4 Discussion.

Finally, the LRUT survey results from GL Noble are examined to determine whether there is any metal loss on the pipe within concrete anchor blocks or support blocks.

3 Results

3.1 DCVG

There was one recorded DCVG result at Aileron MLV. The defect is summarised in Table 1 below. As there is only the single result a plan and elevation drawing is shown in Appendix 1.

Table 1: DCVG Detected Defects

DCVG Defect Number	Section	IR
1	Aileron MLV	6.7 %

Dig up of the Aileron MLV reported the following coating defects of Table 2.

Table 2: Coating Defects Within Vicinity of DCVG Detected Defects

DCVG Defect Number	Defect ID#	Section	Photo Log / Notes
MLV 6.7% IR	1	MLV coating	Appendix 3, Photos 4825, 4827, 5085, 5086
MLV 6.7% IR	2	Tee north of MLV	Appendix 3, Photos 4819, 4829, 4830, 5078, 5083, 5084

3.2 Coating Inspection

There were coating defects found to the MLV CTE coating of the MLV, termite damage was found to the north (photos 0608, 0611) and south (photos 0667, 4823, 5076) of the MLV, and canusa sleeves north (photos 4818) and south (photos 4822, 4824) of the MLV were disbanded from the pipe. Coating Damage Assessment reports were prepared to document the coating defects which were attributed to metal loss only however, refer to Appendix 2.

3.3 Metal loss

Metal loss was reported underneath CTE coating on the MLV, and a small amount of corrosion was found at the tee north of the MLV. The metal loss defect ID #1 is attributed to a mill defect however as the coating did not jeep (refer photo 4827) and the shape of the defect is consistent with mill scale defects than corrosion. Minor pitting corrosion was detected in metal loss ID #2, with a maximum penetration depth of 0.28mm underneath the tape wrap. The area of corrosion was probably not detected by DCVG survey as the coating did not jeep out. Coating Damage Assessment reports were prepared for each are of metal loss found, refer to Appendix 2.

3.4 LRUT

LRUT was conducted at Aileron MLV from March 21, 2013. Extracts from the LRUT report are presented in Appendix 4. The diagram in Appendix 4 shows the setup and location of the LRUT probe when undertaking the test. Two LRUT 'shots' were conducted from the south (Test Point 1, TP1) and north (Test Point 2, TP2) in order to examine the condition of the pipe wall underneath the MLV support blocks.

Test Point 1

Test Point 1 is the forward LRUT shot at Aileron MLV looking north. The concrete support block begins 1.21m from the sensor head as shown in the scan results. As shown in the results of Appendix 4, a minor coating anomaly due to a pipe clamp is detected at 1.7m (refer photo 0667), tee-piece welds are detected at 1.96m and 2.49m and the valve body detected at 3.31m. Refer to photos 0667, and the schematic drawing of TP1 in Appendix 4 for cross references of these LRUT results. No corrosion was detected within the concrete support block.



Test Point 2

Test Point 2 is a forward shot at Aileron MLV, looking south, at the MLV north support block, refer to photo 0669. The LRUT detected three coating anomalies related to defects found in the coating due to termite damage at 0.44m, 0.65m and 0.93m. The pipe clamp was detected at a range of 1.39m, the two girth welds of the tee were detected at 1.75m and 2.36m, and the valve body detected at 3.17m. Refer to Appendix 4 for the LRUT result. No corrosion was detected within the concrete support block.

4 Discussion

Comparing the results of DCVG to the areas of dig up, it is possible to compare the results and correlate the DCVG data to areas of coating defects and corrosion. Due to the limited area of pipe which was dug up there are only few results to report.

DCVG and Coating Defects

There were several significant coating defect found at Aileron MLV associated with termite damage and canusa sleeve failure. Little or no trace of CP product build-up around any of the coating defects indicate that the DCVG result could be due to another nearby coating defect which was not uncovered, or due to a defect within the concrete support block which was not found. The DCVG did successfully identify the area as having coating defects however the accuracy is not conclusive in this case.

DCVG and Metal Loss Defects

Detected DCVG in the area of the Aileron MLV is likely to have resulted from coating defects. Metal loss due to shielding corrosion was found underneath the tape wrap of a tee next to the MLV which did not jeep out with several thousand volts. The DCVG measurement is not attributed to the corrosion at Aileron MLV as the corrosion is identified as due to CP shielding from the coating, and other defects in the area are the probable cause of DCVG reading.

Coating Condition

As can be seen in photos the tape wrap, CTE coating and canusa sleeves appeared to be in poor condition. The CTE coating on the MLV has reported to have several small defects and a significant amount of termite damage had completely removed areas of tapewrap coating.

LRUT

No corrosion was detected at the Aileron MLV by the LRUT survey.

5 Recommendation

LRUT survey reported that corrosion was not detected within the support blocks at Aileron MLV, and removal of coating of the north tee revealed only a minor amount of pit corrosion due to shielding.



The condition of the coating was generally poor due to termite damage to the tape wrap in many locations, CTE coating blisters on the MLV, and canusa sleeve disbondment.

The coating was removed, the exposed area of the pipe was blasted and recoated with Luxepoxy, a high build 2 part epoxy coating. No further recommendation is therefore made.

6 Conclusion

Due to the limited area of excavation at the site, conclusions on the effectiveness of the DCVG survey cannot be drawn on the basis of this survey alone. The DCVG result however successfully identified several coating defects around the MLV.

No anomalies were detected using LRUT and no metal loss was detected within the concrete support blocks. The general condition of the coating surrounding the MLV and piping was poor with a number defects discovered.



Appendix 1 MLV Layout.



Appendix 2 Coating Damage Assessment Forms

KP:

Work Order No:

Form created by Ben Parkin Apr 09
Approved by Henry Dupal

COATING DAMAGE ASSESSMENT

Page 1

Location

Pipeline: _____ Excavation Date: 17/3/2013
 Section: SOUTH SIDE OF VALVE Digup Reason: COATING INSPECTION
 Kilometre Point: American MLV DCVG Measurement: 6%
 Zone: _____ Defect Length from survey (m): _____
 Easting: _____ CMMS Work Order No: 144307
 Northing: _____
 Surrounding Description: _____
 (Buildings, drains, etc)

Photos

Has the camera date and time been set correctly?

Please remember to take both close up (no closer than 500mm) and wide photos.

Description	Time(s) photo taken or viewfinder number
Surrounding landscape	
Site facing increasing chainage	
Site facing decreasing chainage	
Pipe with coating	<u>4825, 4827</u>
Pipe with coating removed	<u>4825, 4827</u>
Pipe cleaned	<u>5086, 5085</u>
Pipe repaired	

Soil and CP

Soil Description (tick one or more from each column):

<input type="checkbox"/> Sand	<input type="checkbox"/> Fine	<input type="checkbox"/> Dusty
<input checked="" type="checkbox"/> Loam	<input type="checkbox"/> Coarse	<input type="checkbox"/> Dry
<input type="checkbox"/> Clay	<input type="checkbox"/> Gravel	<input checked="" type="checkbox"/> Damp
<input type="checkbox"/> Black	<input type="checkbox"/> Rocky	<input type="checkbox"/> Wet
<input type="checkbox"/> Red Dirt		

Pipeline Soil Cover Depth (m): 1.0 Soil pH: 6
 Pipe To Soil Potential (V): -1.862 Soil Resistivity (Ohms): _____ Pin Spacing 1.5m

Coating

Coating Description: _____ Is there a coating defect (Y/N)? Y
 Yellow Jacket Any white buildup from cathodic protection (Y/N)? N
 Sleeve Any evidence of termite damage (Y/N)? N
 Wrapping Any moisture inside the coating (Y/N)? Y
 FBE Any stress corrosion cracking (Y/N)? If yes, complete APA pipeline damage report N/A
 Paint Has the coating lifted away from the pipe (Y/N)? Y
 If yes, how far around the pipe has it lifted (mm)? 30
 Sketch of coating / corrosion damage completed (Y/N)? _____

Coating Defect Length (mm): 30 Coating Defect Width (mm): 30

Coating Defect Comments:
CTE PAINT HAD BLISTERS THROUGHOUT THE COATING.

COATING ON VALVE TIPPED OUT IN SEVERAL PLACES!

KP:

Work Order No:

Metal Loss

Is there any deformation of the pipe (dent, gouge or not round) (Y/N)?

N

If Yes, Engineering must be contacted IMMEDIATELY.

Is there any metal loss (Y/N)?

Y

If there is any metal loss, complete the remaining section of this form and contact Engineering IMMEDIATELY.

The following measurements should indicate whether defects INTERACT

Interaction Rules:

1. Consider each defect as a rectangular box.
2. Draw a larger box around each defect, extending length and width as per Figure 1.
3. IF BOTH larger boxes intersect with the original defect boxes, the defects interact.
4. The dimensions reported on this form are the dimensions of the defect after interaction - dimensions A and B as shown in Figure 1.

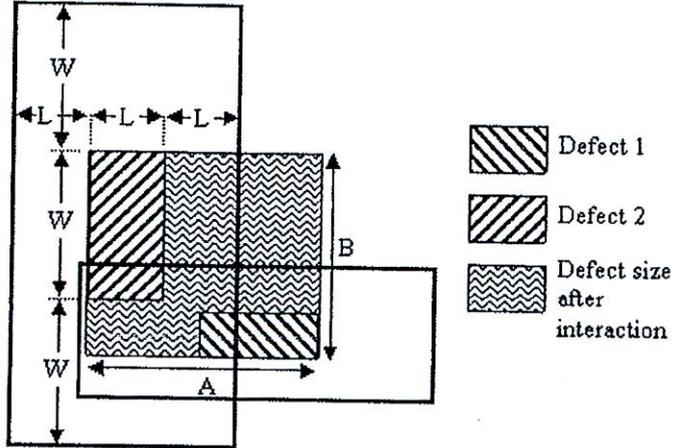


Figure 1

Maximum Depth (mm):

0.38

Wall thickness (mm):

Longitudinal dimension (A) (mm):

4

Circumferential dimension (B) (mm):

4

Clock Position (looking in direction of flow):

2:30

Distance from longitudinal weld (mm):

ON VALVE PIPE WORK.

Distance from nearest girth weld (mm):
(if no girth weld has been found, do not excavate further)

490

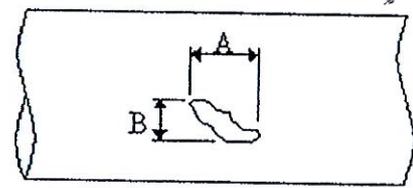


Figure 2

Repair

Length of Pipe Wrapped (mm): _____

Other Repair Information:

ENTIRE VALVE AND ASSOCIATED PIPE WORK WAS ABRASIVE BLASTED AND PAINTED WITH DULUX LUXAPOXY UHB.

Dig Up Comments:

SOIL WAS SOFT AND DAMP.

Operator: Wayne Duffy

Signature: _____

[Signature]

Date: 18/4/2013

KP:

Work Order No:

Form created by Ben Parkin Apr 09
Approved by Henry Dupal

COATING DAMAGE ASSESSMENT

Page 1

Location

Pipeline: _____
 Section: NORTHERN TIE
 Kilometre Point: ALLERON MLY
 Zone: _____
 Easting: _____
 Northing: _____

Excavation Date: 17/3/2013
 Digup Reason: COATING INSPECTION
 DCVG Measurement: _____
 Defect Length from survey (m): _____
 CMMS Work Order No: 144307

Surrounding Description: _____
 (Buildings, drains, etc)

Photos

Has the camera date and time been set correctly?

Please remember to take both close up (no closer than 500mm) and wide photos.

Description	Time(s) photo taken or viewfinder number
Surrounding landscape	
Site facing increasing chainage	
Site facing decreasing chainage	
Pipe with coating	<u>4829, 4819, 4830</u>
Pipe with coating removed	<u>5078</u>
Pipe cleaned	<u>5084, 5083</u>
Pipe repaired	

Soil and CP

Soil Description (tick one or more from each column):

<input type="checkbox"/> Sand	<input type="checkbox"/> Fine	<input type="checkbox"/> Dusty
<input checked="" type="checkbox"/> Loam	<input type="checkbox"/> Coarse	<input type="checkbox"/> Dry
<input type="checkbox"/> Clay	<input type="checkbox"/> Gravel	<input checked="" type="checkbox"/> Damp
<input type="checkbox"/> Black	<input type="checkbox"/> Rocky	<input type="checkbox"/> Wet
<input type="checkbox"/> Red Dirt		

Pipeline Soil Cover Depth (m): 1.0 Soil pH: 6

Pipe To Soil Potential (V): -1.862 Soil Resistivity (Ohms): _____ Pin Spacing 1.5m

Coating

Coating Description:	Is there a coating defect (Y/N)?	<u>N</u>
<input type="checkbox"/> Yellow Jacket	Any white buildup from cathodic protection (Y/N)?	<u>N</u>
<input type="checkbox"/> Sleeve	Any evidence of termite damage (Y/N)?	<u>N</u>
<input checked="" type="checkbox"/> Wrapping	Any moisture inside the coating (Y/N)?	<u>N</u>
<input type="checkbox"/> FBE	Any stress corrosion cracking (Y/N)? <small>If yes, complete APA pipeline damage report</small>	<u>N/A</u>
<input type="checkbox"/> Paint	Has the coating lifted away from the pipe (Y/N)?	<u>N</u>
	If yes, how far around the pipe has it lifted (mm)?	_____
	Sketch of coating / corrosion damage completed (Y/N)?	_____

Coating Defect Length (mm): _____ Coating Defect Width (mm): _____

Coating Defect Comments:
TIE WAS WRAPPED UP TO RISER. WRAP WAS OVER TIE.

COATING DID NOT JUMP.

KP:

Work Order No:

Metal Loss

Is there any deformation of the pipe (dent, gouge or not round) (Y/N)?

N

If Yes, Engineering must be contacted IMMEDIATELY.

Is there any metal loss (Y/N)?

Y

If there is any metal loss, complete the remaining section of this form and contact Engineering IMMEDIATELY.

The following measurements should indicate whether defects INTERACT

Interaction Rules:

1. Consider each defect as a rectangular box.
2. Draw a larger box around each defect, extending length and width as per Figure 1.
3. IF BOTH larger boxes intersect with the original defect boxes, the defects interact.
4. The dimensions reported on this form are the dimensions of the defect after interaction - dimensions A and B as shown in Figure 1.

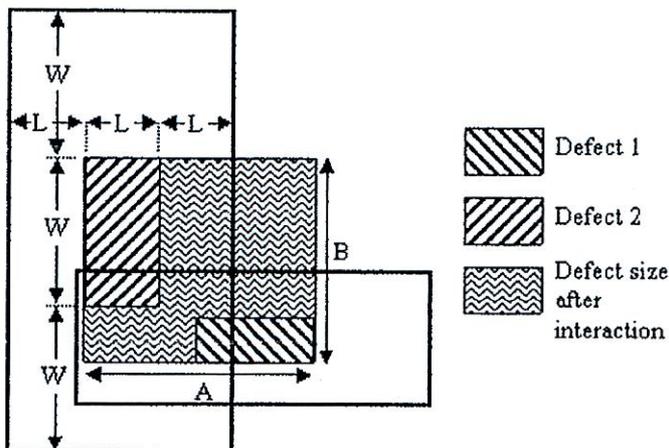


Figure 1

Maximum Depth (mm):

0.28

Wall thickness (mm):

Longitudinal dimension (A) (mm):

3

Circumferential dimension (B) (mm):

3

Clock Position (looking in direction of flow):

2

Distance from longitudinal weld (mm):

ON TIE

Distance from nearest girth weld (mm):
(if no girth weld has been found, do not excavate further)

80

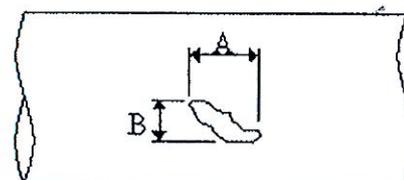


Figure 2

Repair

Length of Pipe Wrapped (mm): _____

Other Repair Information:

ENTIRE VALVE AND PIPE WORK FOR 3m EACH SIDE OF VALVE BODY WAS ABRASIVE BLASTED AND PAINTED WITH LUXAPOXY UHB

Dig Up Comments:

SOIL WAS SOFT LOAM AND DAMP. TERMITES MOUNDS IN THIS VICINITY.

Operator: Wayne Duff

Signature: [Signature]

Date: 17/4/2012



Appendix 3 Photo Log

Photos:

0667

0669

4818

4819

4822

4823

4824

4825

4827

4829

4830

5076

5078

5083

5084

5085

5086



Appendix 4 LRUT

INSPECTION REPORTS – Cont'd

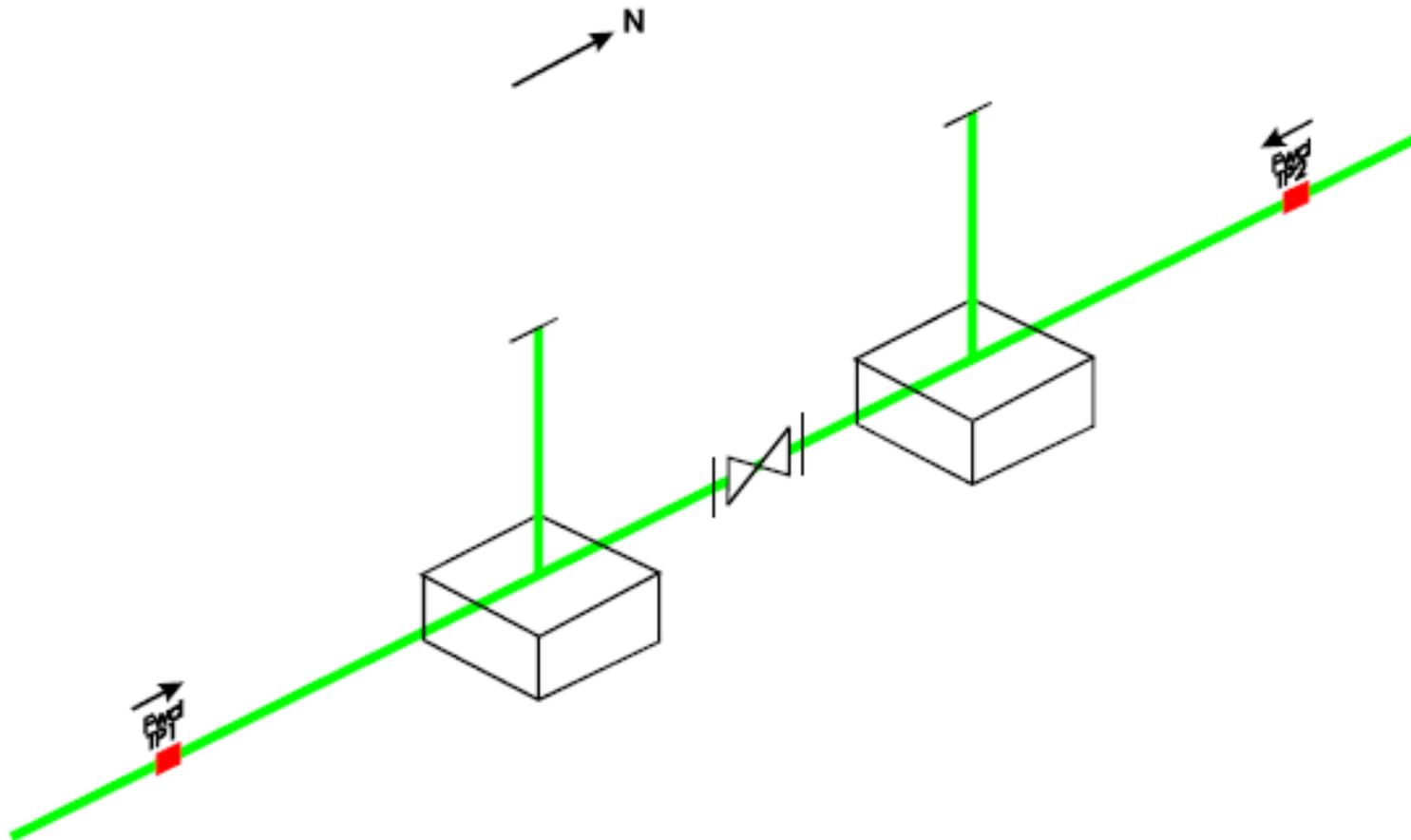
	Date of Insp.	Thickness measured at Head Location (mm)		LRUT Coverage Distance (m)			Anomaly categories			Inspection Findings / Comments / Remarks
		Min	Max	AG	UG	RC	1	2	3	
Line ID: 14" Wanchope scrapper station (Forward only)										
TP 12	20.3.2013	8.8	9.0	-	1.74	-				No significant findings noted along test length during testing.
Line ID: 10" Wauchope Blow down line (Forward only)										
TP 1	20.3.2013	7.8	8.0	-	2.73	-				A Vertical flexural mode recorded above the 9% threshold. Noted at 0.56m from sensor head
Line ID: 10" Wauchope Blow down line (Forward only)										
TP 2	20.3.2013	7.8	8.0	-	1.44	-				No significant findings noted along test length during testing.
Line ID: 10" Wauchope Blow down line (Forward only)										
TP 3	20.3.2013	7.8	8.0	-	1.54	-				No significant findings noted along test length during testing.
Line ID: 10" Wauchope Blow down line (Forward only)										
TP 4	20.3.2013	7.8	8.0	-	3.0	-				No significant findings noted along test length during testing.
Line ID: 10" Wauchope Blow down line (Forward only)										
TP 5	20.3.2013	7.8	8.0	-	1.54	-				No significant findings noted along test length during testing.
Line ID: 14" Aileron gas line (Forward only)										
TP 1	21.3.2013	8.8	9.0	-	3.31	-				A Horizontal and Vertical flexural mode recorded above the 9% threshold. Noted at 0.48 to 0.76m from sensor head.
Line ID: 14" Aileron gas line (Forward only)										
TP 2	21.3.2013	8.8	9.0	-	3.17	-				A Vertical flexural mode recorded above the 9% threshold. Noted at 0.44 to 0.93m from sensor head.

Legend: Underground (UG), Aboveground (AG), Road Crossing (RC), NRWT – Net Remaining Wall Thickness



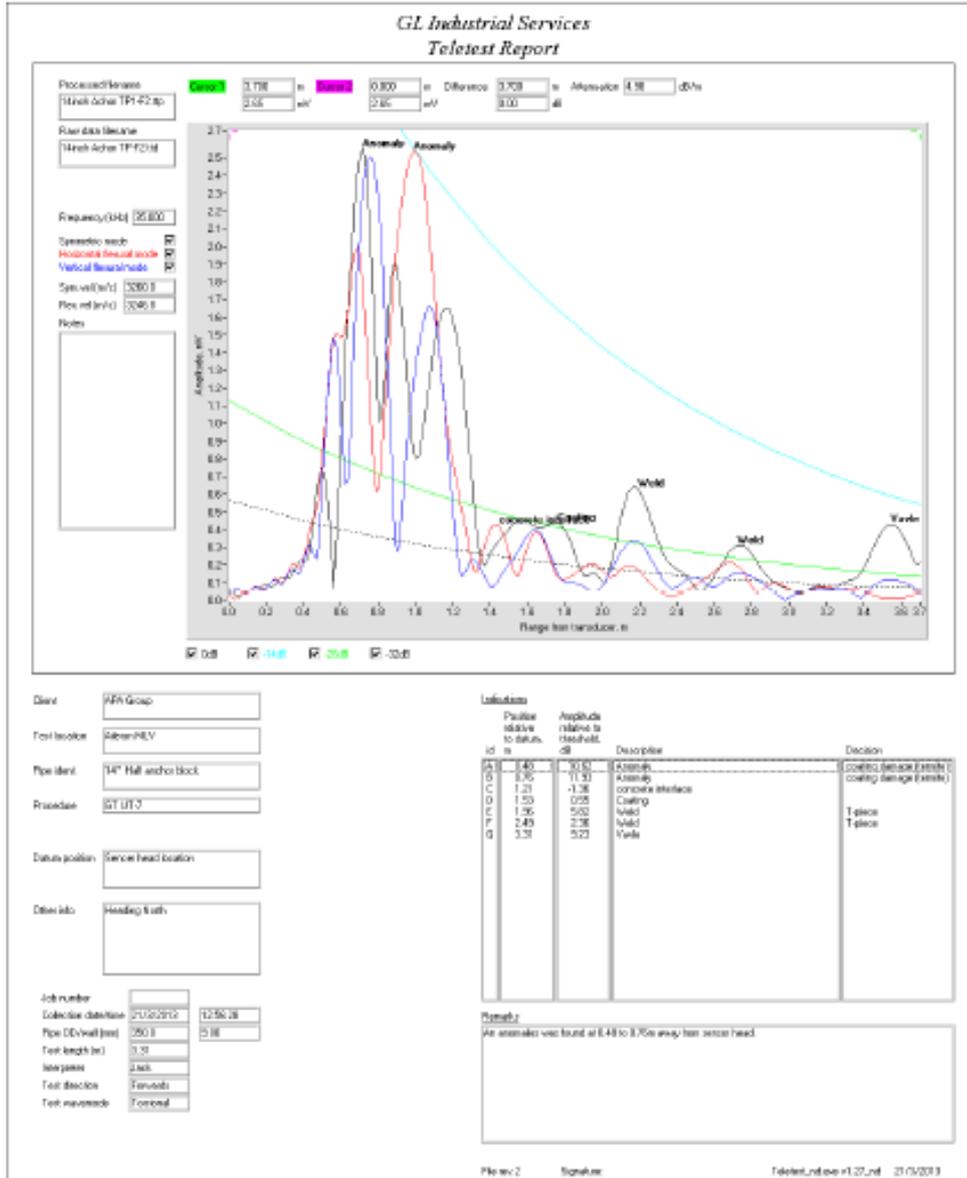
Line Identification: 14" Aileron gas line

Legend	
	Head location (IP)
	Valve Filling



Test Point 1 : 14" Aileron MLV gas line

(Forward Shot only)



Test Point 2 : 14" Aileron MLV gas line

(Forward Shot only)

