

TABLE OF CONTENT

TITLE	PAGE
FORWARD	i
EXECUTIVE SUMMARY	ii
TABLE OF CONTENT	vi
LIST OF FIGURE	viii
LIST OF TABLE	ix
LIST OF ABBREVIATION	x
1. BACKGROUND	1
1.1. THE RELATIONSHIP BETWEEN FRAGMENT AND PRODUCTIVITY	1
1.2. CONSTRAINT AND SOLUTIONS	2
1.3. THE ORIGIN OF THE PROJECT	3
1.4. SELECTION SCHEDULE	4
1.5. SELECTION RESULT	4
1.6. AIM OF THE PROJECT	4
1.7. SCOPE OF THE PROJECT	5
2. TEST LOCATION	5
3. TEST PARTICIPANTS	7
3.1. CAMBODIAN MINE ACTION CENTRE (CMAC)	7
3.2. JAPAN INTERNATIONAL COOPERATION SYSTEM (JICS)	8
3.3. MANUFACTURER	8
3.3.1. PROJECT MEMBER	8
3.3.2. PRE-LIMINARY SURVEY BY MANUFACTURER	8
3.3.3. SCOPE OF THE PRELIMINARY SURVEY	8
3.3.4. TERMS OF THE PERMISSION FOR THE PRELIMINARY SURVEY	8
3.4. PARTICIPANTS OF PRELIMINARY SURVEY	8
3.5. FEATURES OF MINE DETECTORS –LAMDAR III	9
4. PREPARATION PRIO TO THE TEST	10
4.1. TRAINING	10
4.2. TEST LANE PREPARATION	10
4.2.1. GENERAL LAYOUT OF THE TEST AREA	10
4.2.2. TEST LANE	11
4.2.3. SOIL TYPE	14
4.2.4. SOIL CONDITION (WET & DRY)	15
4.2.5. THE USE OF LANDMINE/UXO IN THE CALIBRATION BOX	15
4.2.6. THE USE OF LANDMINE/UXO IN THE TEST LANE	19
4.2.7. DEFINITION OF DEPTH	21
5. TEST PROCEDURE	22
5.1. TEST SCHEDULE	22
5.2. TEST ACTIVITY	23
5.2.1. TEST 1: IN-AIR TEST	24
5.2.2. TEST 2: SENSITIVITY TEST	24
5.2.3. TEST 3 & 4: TARGET LOCATION ACCURACY TEST	24
5.2.4. TEST 5: PROXIMITY TEST (RESOLUTION OF ADJACENT TARGETS)	25
5.2.5. TEST 6: EFFECT OF RADIO FREQUENCY INTERFERENCE TEST	25

5.2.6. TEST 7: POWER/FUEL CONSUMPTION	25
5.2.7. TEST 8: DETECTION SPEED (PRODUCTIVITY).....	25
6. EVALUATION PROCEDURE.....	25
6.1. PASS OR FAIL DECISION BY DISTANCE.....	25
6.2. PASS OR FAIL DECISION BY DETECTED OBJECT	31
7. TEST RESULT	31
7.1. PASS AND FAIL TEST	32
7.1.1. TEST 3 & TEST 4: TARGET LOCATION ACCURACY TEST	32
7.1.1.1. PROBABILITY OF DETECTION	32
7.1.1.2. POSITIVE FALSE ALARM RATE	32
7.1.1.3. NEGATIVE FALSE ALARM RATE	32
7.1.1.4. DISTINCTION RATIO BETWEEN METAL AND MINE	32
7.1.1.5. CONSIDERATION OF NO. 3 AND NO. 4 TEST RESULTS	33
7.1.2. CONSIDERATION OF NO. 3 AND NO. 4 TEST RESULTS.....	33
7.1.2.1. PROBABILITY OF DETECTION FOR CLOSE-SET BURIED TWO TARGETS .	33
7.1.2.2. CONSIDERATION OF NO. 5 TEST RESULTS	33
7.1.3. TEST 6: EFFECT OF RADIO FREQUENCY INTERFERENCE TEST.....	34
7.1.3.1. PROBABILITY OF EFFECT OF RADIO FREQUENCY INTEFERENCE TEST .	34
7.1.3.2. CONSIDERATION OF NO. 6 TEST RESULTS	34
7.2. TEST FOR INFORMATION PURPOSE.....	34
7.2.1. TEST NUMBER 1: AIR-TEST	34
7.2.2. TEST NUMBER 2: CALIBRATION BOX	35
7.2.3. TEST NUMBER 7: FUEL/POWER CONSUMPTION	35
7.2.4. TEST NUMBER 8: DETECTION SPEED	35
8. CONCLUSION OF "PASS OR FAIL" TESTS.....	36
9. RECOMMENDATIONS.....	36
10. ADDITIONAL TEST BY DEVELOPERS	37
10.1. PROBABILITY OF DETECTION.....	38
10.2. POSITIVE FALSE ALARM RATE.....	38
10.3. NEGATIVE FALSE ALARM RATE	38
10.4. DISTINCTION RATIO BETWEEN METAL AND MINE	38
10.5. PROBABILITY OF DETECTION FOR CLOSE-SET BURIED TWO TARGETS.....	38
11. GENERAL COMMENTS FOR DEVELOPER / RESEARCHER.....	38
12. ALL RIGHTS RESERVED	39
ANNEX 1:LAMDAR III DURING TEST BY PICTURES.....	40
ANNEX 2:PROCEDURE TO BE APPLIED DURING TEST OF MINE DETECTOR.....	42
ANNEX 3:CMAC PROJECT MEMBER IN PICTURES.....	48

LIST OF FIGURE

TITLE	PAGE
Figure 1: Major constraints/solution in Mine Clearance Operation	2
Figure 2: test location in Siem Reap province, Cambodia	5
Figure 3: Project team structure	7
Figure 4: LAMDAR III during test at CMAC regional Centre (Siem Reap Province)	9
Figure 5: CMAC deminer is being trained by manufacturer in temporary field office of the manufacturer.....	10
Figure 6: Test zone in detail	11
Figure 7: Test lane is dug up to 1.5m. In case of present of water, water pump is used to dry the test lane before refilled with designated soil type.	13
Figure 8: soil is brought from original location by truck.....	13
Figure 9: Test land and calibration box are ready for testing	13
Figure 10: Location layout of buried targets in Calibration Box No.1 to No.6 for hand held type detector	17
Figure 11: Location layout of buried targets in Calibration Box No.1 to No.6 for vehicle-mounted type detector.....	18
Figure 12: Location layout of buried targets in Calibration Boxes No.7 (hand-held & vehicle mounted). ..	18
Figure 13: Definition of Depth for Level burial.....	21
Figure 14: Definition of Depth for vertical burial.....	21
Figure 15: Evaluation criteria for APM.....	26
Figure 16: Evaluation criteria for ATM & UXO	27
Figure 17: Flow chart of decisive method for Pass or Fail	30

LIST OF TABLE

TITLE	PAGE
Table 1: CMAC clearance result since 1993	1
Table 2: Selection Committee Schedule	4
Table 3: Successful candidates	4
Table 4: Summary soil type and calibration box property	14
Table 5: Summary soil type and test lane property	14
Table 6: Summary soil type and test lane property of lane number 7	15
Table 7: Summary soil type and test lane property of lane number 8	15
Table 8: Date of targets/mines buried for hand-held type	16
Table 9: Buried targets in Calibration Box No.1-No.6 (for hand-held type & vehicle mounted type).....	16
Table 10: Buried targets in Calibration Box No.7 (for hand-held type & vehicle mounted type detectors)	18
Table 11: Date of targets/mines buried for hand-held type.....	19
Table 12: Buried targets in Test Lane No.1-No.6 for hand-held type detectors	20
Table 13: Buried targets in Test Lane No.1-No.6 for vehicle mounted type detectors	20
Table 14: Buried targets in Test Lane No.7 (hand-held type & vehicle mounted type detectors)	20
Table 15: Buried targets in Test Lane No.8	20
Table 16: Total quantity of buried targets prepared by CMAC.....	21
Table 17: Test schedule of LAMDAR III.....	22
Table 18: List of Tests	23
Table 19: Pass or Fail criteria (Pattern A for APM)	28
Table 20: Pass or Fail criteria (Pattern B for APM).....	29
Table 21: Pass or Fail criteria (Pattern A for ATM and UXO).....	29
Table 22: Pass or Fail criteria (Pattern B for ATM and UXO)	29
Table 23: Evaluation criteria for APM	30
Table 24: Evaluation criteria for ATM & UXO	30
Table 25: Decisive method of Pass or Fail by detected object through GPR images.....	31
Table 26: Alarm function	31
Table 27: Radio frequency interference test result of LAMDAR III.....	34
Table 28: Maximum depth of detection (cm) – bottom of detector to the top of target.....	34
Table 29: Test result of Calibration box number 1 – 7 by Minelab A1F4	35
Table 30: Test result of Calibration box number 1 – 7 by LAMDAR III	35
Table 31: Detection speed by LAMDAR III.....	35
Table 32: Summary test result of LAMDAR III.....	36

ABBREVIATIONS

Ad	Additional valid detection
AP mine	Anti Personnel mine
AT mine	Anti Tank mine
CEN	The European Committee for Standardization
CMAC	Cambodian Mine Action Centre
CWA	CEN Workshop Agreement
EOD	Explosive Ordnance Disposal
FAR	False Alarm Rate
GICHD	Geneva International Centre for Humanitarian Demining
GPR	Ground Penetrating Rader
GPS	Global Positioning System
HF	High Frequency
IMAS	International Mine Action Standards
ITEP	International Test and Evaluation Programme
ITOP	International Test Operation Procedures
JST	Japan Science Technology Agency
MAC	Mine Action Centre
Pd	Probability of Detection
PMCS	Preventive Maintenance Checks and Services
SOP	Standard Operating Procedure
SOR	Standard Operating Requirement
TNT	Ttrinitrotoluene
UXO	Unexploded Ordnance
UNMAS	The United Nations Mine Action Service