 File -- 998245

TECHNICAL REPORT NO. 1

PROJECT 135

FORMAT 12

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STATINTL

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DECLASS REVIEW by NIMA/DOD

1 GENERAL

In the course of debugging the Multi-Purpose Data Block Reader, two weeks (May 22 through June 2, 1967) were spent in an attempt to read and analyze the film samples, containing format 12 recordings, supplied by the Customer.

The purpose of this report is to inform the Customer of the incompatibilities between the reader and the recorded material, their possible reasons, and ways of correcting them.

2 TESTING PROCEDURE

2.1 DEFINITION OF THE TEST PHASE

The test phase for each format is defined as the effort dedicated to reading actual film formats. This test period begins after the logic for the format is successfully verified by use of simulated data signals instead of live film. At this point, the tester is assured that an error indicated by the reader is truly an error in reading and not a malfunction of the logic circuits.

2.2 TESTS PERFORMED

The following is a list of tests performed to determine the readability of the test material and their results.

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2.2.1 Film Density

The analog output of the read amplifiers was monitored, while reading under different light intensities, to insure sufficient output for density variations at different points of the test film. The result of this test showed that the density differential between dots and background is generally higher at the beginning of the film than at the end. No microdensitometer readings were taken; therefore, it is not known whether the dot densities were lower or the background density higher. The The variation, however, was tolerable, and the density differential seemed to stay above the minimum required for reading.

2.2.2 Dot Size

This test was performed both visually, by using an optical comparator, and electronically, by measuring the time lapse between the leading and trailing edges of the dots as they were read by the reader. Microdensitometer traces will be taken this week to confirm the results of these tests.

The test showed a wide disparity in dot sizes from file to file and within each file. In general, the index dots were smaller and the data dots larger. Occasionally, and with no particular pattern, a small data dot appeared in a line of larger data dots. It is estimated that most index dots are less than the required minimum of .006" at their half density points, while most data dots are within the allowed width. The micro-densitometer tracing will supply more conclusive information.

2.2.3 Data Accuracy - Recording

Both visual and reading checks were performed to determine the recording accuracy. The results showed that, out of 130 data blocks, 6 contained recording errors. All the errors consisted of extraneous bits rather than missing bits, and all error blocks contained more than a single error character. Some contained as many as ten error characters. In these cases, some of the error bits had normal density, and some were faded. The cause for these errors may be attributed either to noise bursts in the recording logic or failure to inhibit data change during the recording cycle.

2.2.4 Interference Test

This test verified that all interference dots and patterns on the test film are rejected by the reader logic.

2.2.5 Film Wander

A series of tests were performed to determine the combined wander of the film in the camera and reader and their effect on the reading. The result of these tests indicated that the camera has extremely low wander characteristics.

2.2.5.1 Up Wander

The data block was placed with its index row approximately .005" below the upper limit of the wander correction band of the reader. The roll of test film was then read in both forward and reverse directions. In both cases, the only errors indicated by the reader's error printout were in the blocks that had a recording error. All these blocks were indicated as reading errors. None were indicated as "Excess Wander - No Data".

2.2.5.2 Down Wander

The data block was placed with its index row approximately .005" above the lower limit of the wander correction band. After reading in both directions, still no excess wander errors were detected, but, in addition to the 6 blocks recorded in error, 2 more blocks indicated reading errors. This showed a need for further testing after completion of the film wander test. These were performed later under Reading Accuracy Tests.

2.2.5.3 Forced Wander

To verify that the previous results were correct, the film was placed with the data block just outside of the upper limit of the wander correction band. Upon reading, all blocks indicated "Excess Wander". The test was repeated for the lower limit with the same result.

2.2.6 Reading Accuracy

The data block was placed in the center of the wander correction band, and the film was read in both directions. A total of about 20 errors were recorded. By increasing the light intensity, more errors were detected. By decreasing the light intensity, "Incomplete Block and No Data" errors were indicated. Moving the position of the block within the wander correction band showed a variable number of errors with a "preference" for certain block numbers, which varied with each setting.

The Up Wander Test was then repeated, and the result, once again, was a perfect readout. The Down Wander Test was then repeated with a near perfect readout. An analysis was then made which resulted in the conclusion that the active diode groups in the read head are not selected correctly. A further analysis showed that this selection error does not occur due to logic errors but because of the variable dot sizes in the data block recording.

The reason for a perfect readout during the Up Wander Test was because the index dot only was present within the wander correction band. The data dots were outside of this band. Since the diode selection is done by the diode in the wander correction band only, the decision for each selection was done on the basis of one dot only, and, therefore, was correct.

Similarly, during the Down Wander Test, all three dots of the character were inside the band (the band is about 4 dots wide). In this case, the leading edge of the bigger data dot was seen first by the diodes, and the selection was again correct.

During the reading in mid-band, however, the index dots were inside the band, while the data dots were partially inside and partially outside the band. The data dot may be split by the band boundary, but due to its larger size, a sufficient part of the dot stays inside the boundary and is detected by the diode. Figure 1 shows such a case where the shaded areas on the dots represent a minimum area required for detection of a dot. Because of the larger size of the data dot, diodes A and C will be selected simultaneously, while the proper selection is A only.

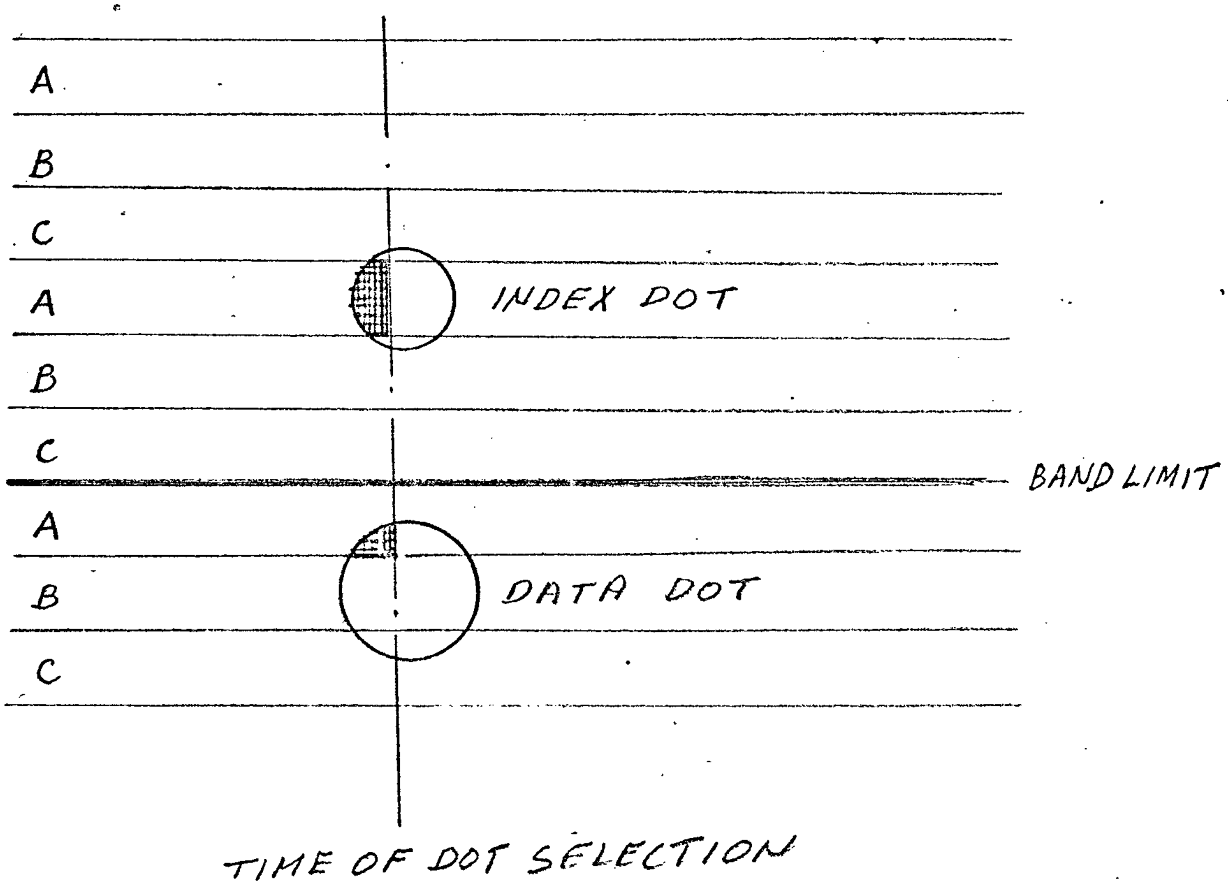
A
B
C
A
INDEX DOT
B
C
BAND LIMIT
A
B
DATA DOT
C
TIME OF DOT SELECTION

FIGURE 2

3 CONCLUSION

The major cause of erroneous reading seems to come from the variable size of the dots in the data block. The pattern in the dot variation seems to indicate that, during the recording, no current regulation is implemented in the diode firing circuitry. Possibly, a current limiter is applied to each file of dots so that, when a full file is fired (such as an index file), the diodes are starved, and the dots are smaller. When a data line with fewer dots is recorded, each diode receives a more generous amount of current and the dots are larger. If this approach is employed, a block with only one dot in the data line may cause too large a current in the selected single diode and the junction may be damaged.

The proper way of firing the diodes is with a large current source for each of the three files and 30 current regulators, one for each row. This will insure an even amount of current to each selected diode and, thereby, an even dot size and density throughout the data block.

The test results of this format show that the reading reliability increases appreciably when the dots are of the same size and density. The dot characteristics will have a more pronounced effect on positives where degradation of dot quality occurs almost invariably.

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