DTT: DEVICE TEST TRACEABILITY AN ENHANCED APPROACH FOR UNIT LEVEL TRACEABILITY IN FINAL TEST

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ABSTRACT

Traceability plays a critical role in manufacturing; may it be single die traceability or unit level traceability.

This paper focuses on the requirement of customers to have device test traceability for non-barcoded product types. Operators need to encode manually per device to ensure device traceability per test. This is effective for low volume devices and impractical for high volume runners.

Another challenge is that for automated testing on Final test, unit numbers should be in sequence and no skipped numbers otherwise incorrect serials might be read by tester.

Evaluation is done taking into consideration the following: scope and limitation, DTT Set-up, DTT System Optimization (SCAT) and Controls. Updates on the current resources such as test recipes and routine are also done.

With the implementation of device number traceability on non-barcoded products for Final test correct serials are tested and ensures that correct and passed units are tested based from previous process. With the updates on the existing resources, challenges on unit level traceability for high volume device types are addressed.

1. 0 INTRODUCTION

Traceability plays a significant role in manufacturing. May it be unit level traceability limited to test data or single die traceability from womb to tomb: diffusion level until test data.

For single die traceability this requires barcodes on the units and necessary equipped resources.

The authors focused on the unit level traceability where devices with serial numbers are non-barcoded, and customers require device test traceability.

1.1 Background of the Study

For SPAR (Scattering Parameter) and RF Final Test, testing is manual, and operator needs to encode serials marked on the caps for all the units per lot. This is sufficient for low volume, however for high volume this will be a challenge not only for TPT (through put time) but as well as risks for wrong encoding.

In DC Final Test, which is capable of automated testing using handler, operator does not need to encode the serials marked on the caps when it is numbered sequentially (e.g., 1-100) and no skipped numbers. However, this is not always true for all units since rejects prior DC test can be encountered thus, handler can't be used yet.

With these challenges for unit level traceability, an evaluation is done to have full device number traceability for high volume on manual and/or handler set-up using current resources in testing and data analysis.

2. 0 REVIEW OF RELATED WORK

The review of related literature is based from the blog by Patrick Lemay (Traceability in Manufacturing: What is it and How you can)[1] which presented the significance of traceability in manufacturing. Traceability is defined as the ability to track every part and product throughout the manufacturing process, from the raw materials used until the final products are shipped. Information including inspection results, assembly details and time spent at each station is recorded from end-to-end.

Benefits of traceability were also discussed which is not limited to products subject for recalls. It was mentioned that traceability enables manufacturers to have in-depth root cause analysis. Improvement opportunities are lost when genealogical data are not accessible. Knowing where and when bottlenecks occur makes real-time optimization possible. Traceability facilitates value stream mapping since it monitors how products move through the manufacturing process. Since part traceability in the entire

production line can also find key points where quality controls should be added and increases accountability and engagement on the shop floor. The author also stressed that traceability is an obligation of manufacturers.

Indeed, traceability in manufacturing is essential, however it should also be taken into consideration the current state of the product and how traceability can be implemented using the available resources.

3.0 EXPERIMENTAL SECTION

For the evaluation of DTT on Final Test, the following are considered: Scope and Limitation, DTT Set-up, DTT System Optimization (SCAT) and Controls.

3.1 Scope and Limitation

DTT on Final Test is applicable on DC, SPAR and RF both handler and manual as applicable, units with part ID marked on caps and will be limited on FT device number test traceability. Complete Scope and Limitation is defined on Table 1.

Table 1. Scope and Limitation

Scope	Limitation
DC (Handler/Manual)	Roos Tester (RFDC)
SPAR (Rack and Stack)	Non marked device types
RF (Rack and Stack)	Single Die Traceability
Part Id (marked) on Caps	
FT device number test traceability	

3.2 DTT Set-up

3.2.1 SCAT:

DTT data are based on the passed units of the previous process, for DC1 it would be SCAT as in Figure 1.

Fig. 1. DTT Flow

For DTT (SCAT passed) to be available in DC1, DTT services is created to convert CSAM disposition file into DTT file (Figure 2). Sending and uploading of SCAT disposition files are done manually.

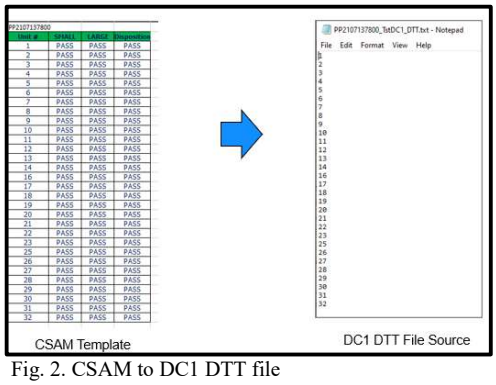


Fig. 2. CSAM to DC1 DTT file

3.2.2 DTT Set-up: DC Test

DTT is enabled by setting inside the Test Recipe Field DTT to "1". See Figure 3.

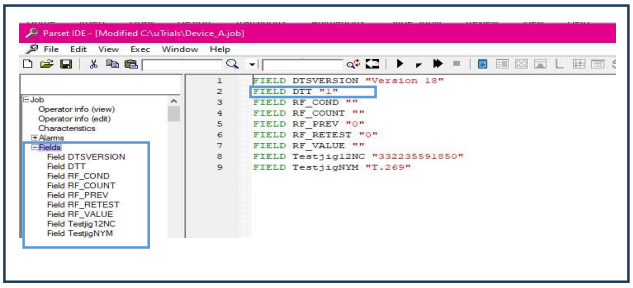


Fig. 3. DTT Field in Test Job

Test recipe is updated with DTT variant as seen below (Figure 4).

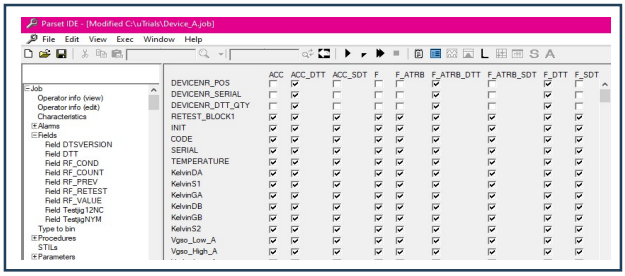


Fig. 4. Sample Test Job

Special test recipes are created to be used in the operator menu for DTT. These will be used for the following:

1. Send DTT information to Tester Test Station
2. Read All DTT information from Tester Test Station
3. DTT functionality inside Production Program

Arrangement of units are based on the actual units on sequence and placement JEDEC tray (Figure 5) when used in handler, this is also available in the operator menu.

3	2	1
6	5	4
9	8	7
12	11	10
15	14	13
18	17	16
21	20	19
24	23	22
27	26	25
30	29	28
33	32	31
36	35	34

Fig. 5. Sequence and placement of units on JEDEC tray.

3.2.3 DTT Set-up: SPAR and RF Test

For SPAR and RF test the following requirements should be fulfilled:

1. A visual representation of JEDEC tray will appear at Start of the Test
2. DUT name will automatically follow the DUT name from previous operation.
3. The computer must have access to the shared drive.
4. Retests should follow the serial loaded.
5. DTT file name format: Lot ID_Operation ,csv
6. Information exchange will be done via communication port.

As with DC, the test routine is updated to fulfill the requirements.

3.3 DTT System Optimization: SCAT

In section 3.2.1 DTT Set-up: SCAT it was discussed that sending and uploading of SCAT disposition files are done manually, update was done to have a 3rd party tool that will be used for disposition handling, logging and DTT file creation. This tool has an option to send disposition status to the group, create and view logs based on the current requirements from the process team and display SCAT images which are non-pixelated.

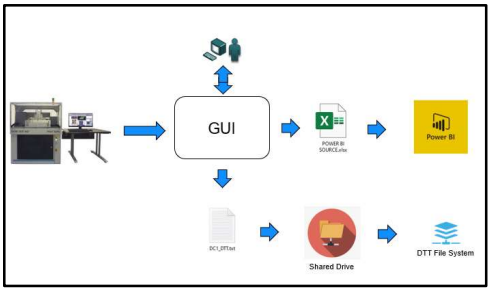


Fig. 6. SCAT Data Handling

3.4 Controls

With the set-up for DTT ready and other requirements fulfilled, controls on checking if no incorrect serials used are also implemented also known as Serial Tool Checker (STC).

Initially quite tedious tasks hence a tool is created to check Final Test data, serials per operation and formatting/printing of necessary data. See Figure 7 for the STC Flow.

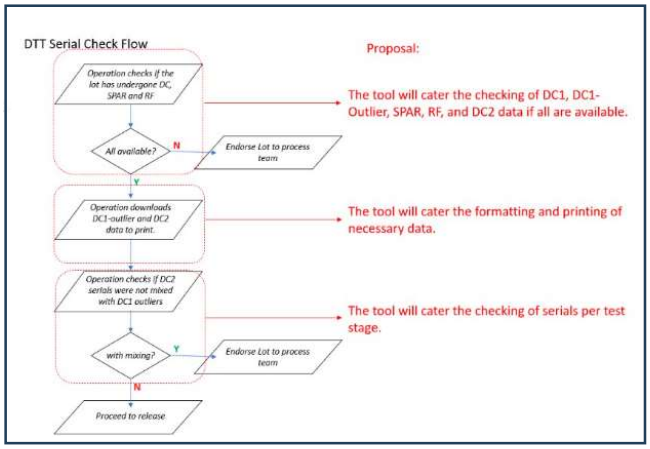


Fig. 7. STC Flow

4.0 RESULTS AND DISCUSSION

4.1 How DTT Works

4.1.1 SCAT Disposition Tool

The optimized SCAT disposition tool options and features are as follows:

Built-in web browser window, automatic unzip of downloaded ZIP files from web browser, DUT navigation and selection, non-pixelated images, maximize option for images, automatic encoding, storing, and handling of disposition of results, automatic summary logging, export option for the results of processed lots, automatic mail sending and JEDEC tray visualization. See Figure 8.

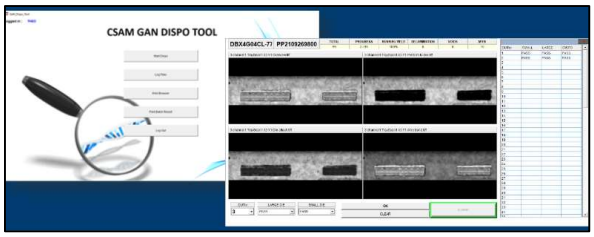


Fig. 8a. SCAT Disposition Tool

Fig. 8b. SCAT Disposition Tool

4.1.2 DTT Set-up: Final Test

After begin batch in DC test, the DTT form will be loaded including the contents of the DTT file based on SCAT disposition tool. Operator will check if actual units are aligned with the GUI with respect to quantity, serial, and arrangement (Figure 9a). If there are no issues, the operator will agree and if there is any misalignment the operator has an option to disagree and will inform Test Process for proper handling.

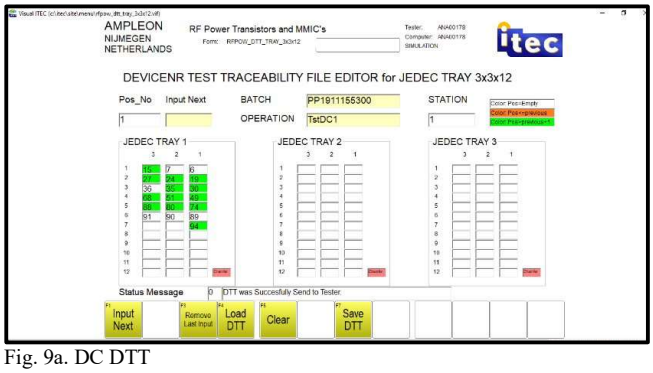
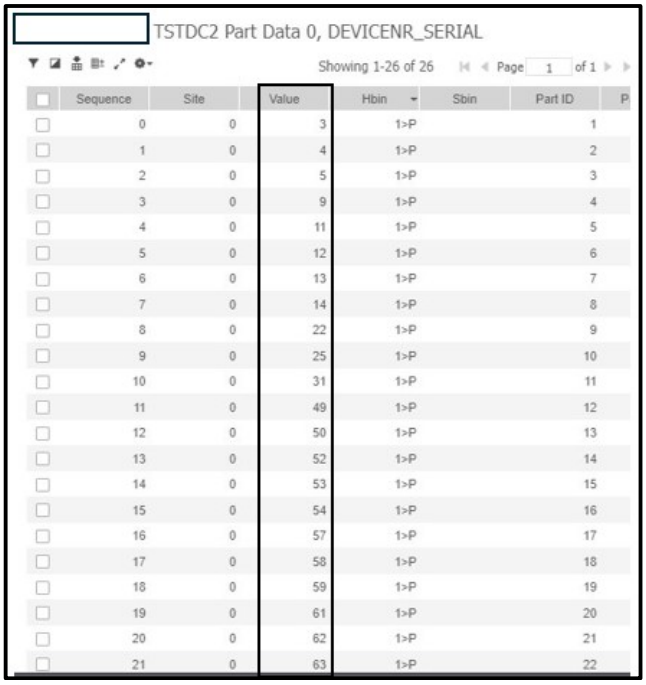


Fig. 9a. DC DTT

For the DTT on Veepower, a panel representing DUT number on JEDEC tray is available as with DC DTT display. Data (serial numbers) are coming from DC1 passed units for SPAR and SPAR passed units for RF. Operator will check if aligned, any issues operator will inform Test process for proper handling. Once accepted, the DUT numbers displayed on the JEDEC tray panel will be used as DUTname for the batch. See Figure 9b.

Fig. 9b. SPAR/RF DTT

Once tests are completed, actual serial numbers are available in data. For DC, these are reflected in another parameter, for SPAR and RF these are reflected as Part ID. See Figure 10a and 10b.



Sequence	Site	Value	Hbin	Sbin	Part ID
0	0	3	1>P		1
1	0	4	1>P		2
2	0	5	1>P		3
3	0	9	1>P		4
4	0	11	1>P		5
5	0	12	1>P		6
6	0	13	1>P		7
7	0	14	1>P		8
8	0	22	1>P		9
9	0	25	1>P		10
10	0	31	1>P		11
11	0	49	1>P		12
12	0	50	1>P		13
13	0	52	1>P		14
14	0	53	1>P		15
15	0	54	1>P		16
16	0	57	1>P		17
17	0	58	1>P		18
18	0	59	1>P		19
19	0	61	1>P		20
20	0	62	1>P		21
21	0	63	1>P		22

Fig. 10a. DC Data

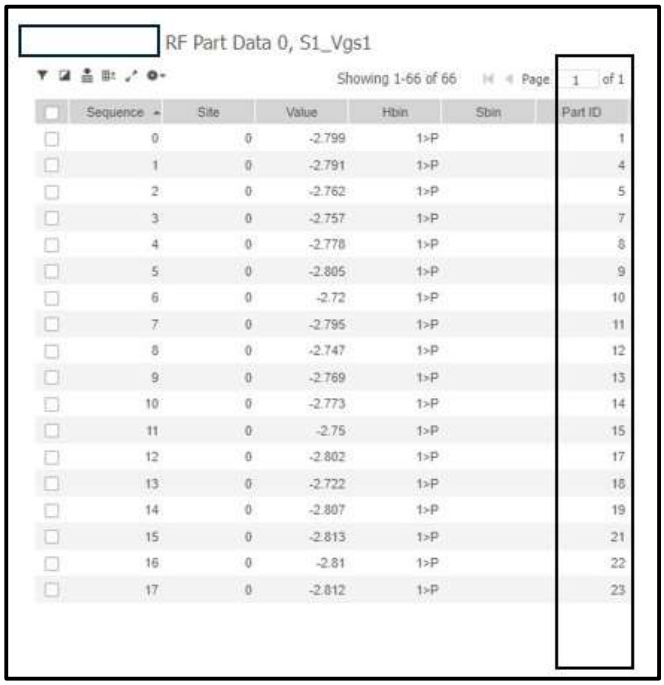


Fig. 10b. RF Data

4.1.3 Controls: DTT Serial Checker Tool (STC)

DTT checking after DC2 is also done to avoid any quality issues due to incorrect serialized testing. DTT STC tool is created to cater checking of DC1, SPAR, RF and DC2 data availability as well as checking the serial numbers per test process. This is a convenient way of printing DC2 passed units which are checked by quality. See Figure 11a.

Any discrepancies in unit numbers per operation will be checked and will be highlighted in red for unit numbers with discrepancy as seen in Figure 11b.

Fig. 11a. DTT Serial Checker Tool

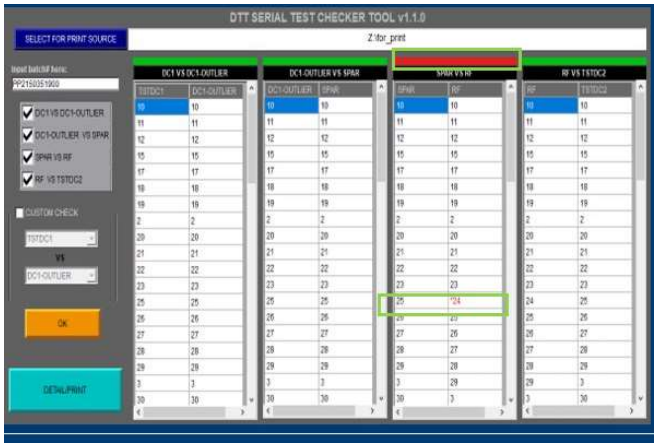


Fig. 11b. DTT Serial Checker Tool (with discrepancies)

5.0 CONCLUSION

The implementation of device number traceability on non-barcoded products for Final test ensures integrity of test data with respect to correct device number serialization. Correct and passed units are tested based from previous process. With the updates on the existing resources, challenges on unit level traceability for high volume device types are addressed.

6.0 RECOMMENDATIONS

Device test traceability is limited to unit level traceability specifically Final Test, it is recommended to explore Single Die Traceability (2D barcode) which is already overseen by another team.

7.0 ACKNOWLEDGMENT

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Rob Van der Sanden – Senior Engineer, Characterization
Mary Bliss Saulong – Technician, Process Control

8.0 REFERENCES

1. Patrick Lemay, “Traceability in Manufacturing: What is It and How you can Improve It, April 22, 2021.

9.0 ABOUT THE AUTHORS

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