

# Evaluation Report

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## 2DTG's DPM Decoder for HandHeld's Mobile Computer Nautiz X4

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### 1. Objective

The objective of this study was to evaluate DPM (Direct Part Marking) decoding performance of the **HandHeld's Nautiz X4 Mobile Computer** upgraded with **icEveryCode™ DPM Decoder**.

3 devices were selected for this study:

- 1.1 **HandHeld's Nautiz X4 Mobile Computer** (Standard Range barcode reader), upgraded with the **icEveryCode™ DPM Decoder** (DPM decoding software) by 2DTG.
- 1.2 **HandHeld's Nautiz X4 Mobile Computer** (Standard Range barcode reader), with original decoding software.
- 1.3 **Xenon 1900HD by Honeywell Corp.**, upgraded with the **icEveryCode™ DPM Decoder** (DPM decoding software) by 2DTG.

Xenon 1900HD is not directly comparable to Nautiz X4 as they have different reading range - it was chosen for reference purpose only.

Three performance parameters were measured on the sample set of DPM marks (Set #1):

**Decode Rate** or **Success Rate** - defined as a ratio equal to the percentage of the successful decoding within the given set of samples.

**Operating Range** - industries require DPM readers to be capable to decode DPM marks at the distance up to 7- 8 inches for the 20-40 mils symbols.

**Decode time** - defined as the full time required for successful decoding: from starting to aim at the symbol until it is decoded.

## 2. Test Procedure

### 3.1. Samples

DPM samples represent “typical” materials (steel, duralumin, plastic, etc.), surfaces (cast, polished, etc.) and type of DPM marks (Dot Peen, Laser etching, ink jet) were selected for the test. Some of the samples have been chosen intentionally challenging. Though the spectrum of the samples was broad enough, most of them came from automotive industry.

#### Set #1

Set contains 21 Data Matrix DPM samples: laser etched - 10, Dot panned - 10, Ink jetted - 1. Module size is ranging from 6.5 to 38 mil. Sample images - as captured by Xenon1900 - are shown in the Exhibit 1.

### 3.2. Description

All decode results fall under the 3 categories:

- **“Stable Decoding”** – meaning that decoding was successful from the first try – no lighting or distance adjustment, or aiming angle optimization was required.
- **“Conditional Decoding”** - decoding was successful, but some adjustments had to be made during the image capturing process: image capture has to be performed under the certain angle to the surface (from 45 to 65 degrees) to avoid direct light reflection from the substrate. “Optimal” value of this angle as well as distance from the target depends both on surface condition and ambient light. Accordingly, this “optimal” angle and distance has to be worked out by operator experimentally and capture time depends on operator experience.
- **“Undecodable”**

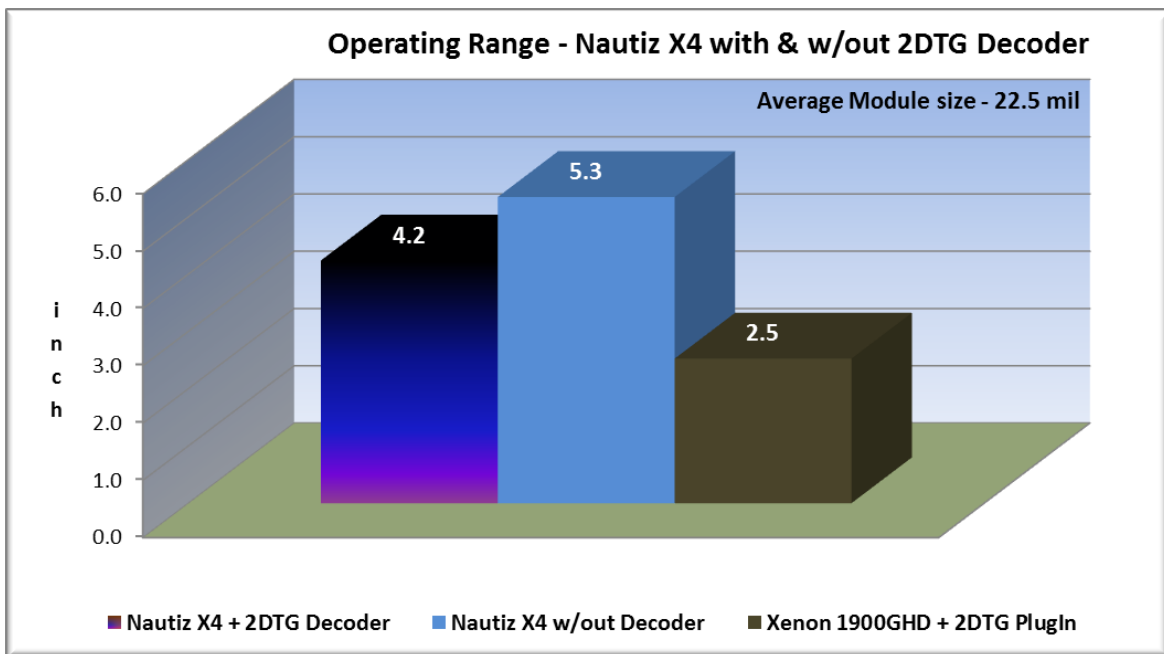
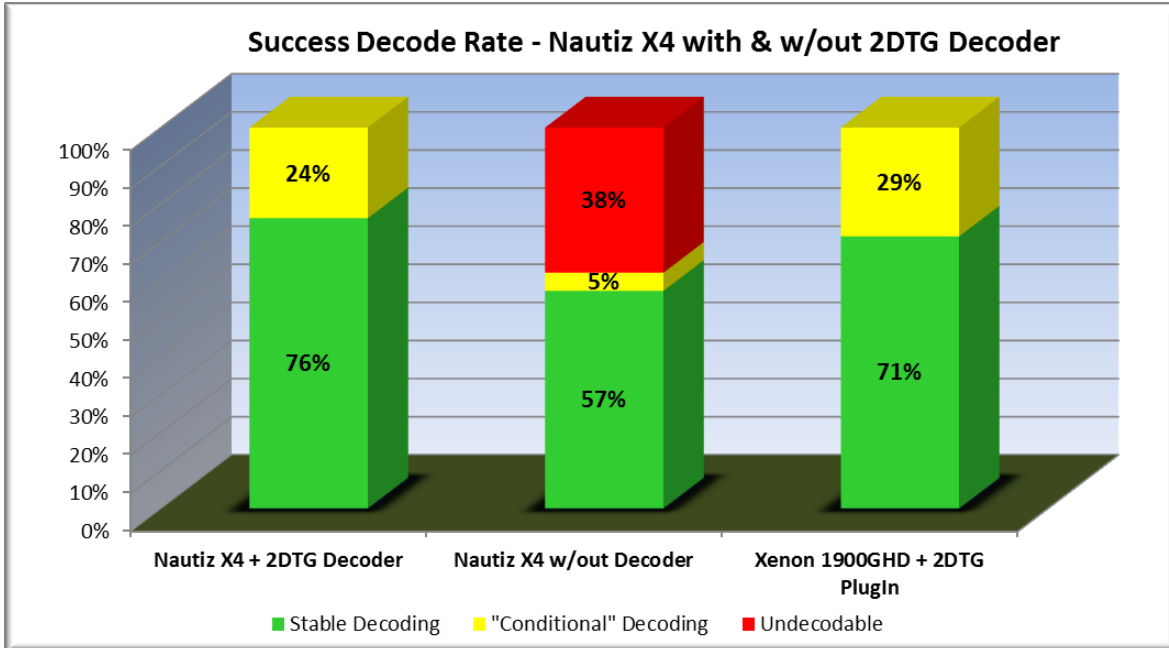
The time stamp for the **“Stable Decoding”** we considered to be up to 2 sec; for the **“Conditional Decoding”** – up to 5 sec; and for **“Undecodable”** – more than 5 sec.

**Operating Range** was calculated as the difference between the maximum and minimum **Reading Distance**.

## 3. Test Results

Overall results of the side-by-side comparison are demonstrated by the diagrams below.

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## 4. Conclusion

Nautiz x4, upgraded with DPM Plugin, demonstrates very "reasonable" DPM performance – on par with the Xenon 1900 upgraded for DPM reading.

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## 5. Exhibit 1 - SET #1 Samples

<b>1</b> Painted Al 26x26; 15 mil	<b>2</b> Intel chip 18x18; 10 mil	<b>3</b> Chrome-plated Steel 18x18; 9 mil	<b>4</b> Chrome-plated Steel 18x18; 9 mil	<b>5</b> Zinc-plated Steel 18x18; 9 mil
<b>6</b> Zinc-plated Steel 18x18; 9 mil	<b>7</b> Milled Al 8x32; 20 mil	<b>8</b> Milled Al 18x18; 14 mil	<b>9</b> Milled Al 18x18; 28 mil	<b>10</b> Cast Duralumin 18x18; 22 mil
<b>11</b> Cast Steel 16x16; 31 mil	<b>12</b> Curved polished Steel 18x18; 20 mil	<b>13</b> Painted Steel 22x22; 25 mil	<b>14</b> Curved polished Steel 14x14; 31 mil	<b>15</b> Polished Steel 12x12; 7 mil
<b>16</b> Fluoroplastic 14x14; 13 mil	<b>17</b> Celeron Chip 18x18; 6.5 mil	<b>18</b> Mirror-like Steel 14x14; 13 mil	<b>19</b> Painted Steel 26x26; 30 mil	<b>20</b> Polished Steel 22x22; 28 mil
<b>21</b> Painted Metal 64x64; 38 mil				