

Voice Pick Code: A simple solution to the 'Milestone 7' problem

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Enhanced traceability is coming to the produce industry. The PMA, CPMA, United Fresh, retailers, and dozens of shippers have endorsed the Produce Traceability Initiative (PTI) to implement a whole chain traceability system for produce supply chains.

The PTI requires that every case of produce have a label with a barcode incorporating a 14 digit GTIN, a Lot Code, and an optional date code. While the early burden is on produce shippers, the key to the initiative is the recording of the case's GTIN and Lot Code (and optional date) at each step of the supply chain, for example at the point of packing, at the point of receiving, and at the point of distribution to the store or restaurant. This last step is called PTI Milestone 7.

It is not practical, however, for a large distribution center to scan each barcode label on each case as cases are received or picked to fulfill an order. Manually scanning outbound cases would create a significant increase in labor cost, equipment costs, and distribution time. The Voice Pick Code was developed to *completely eliminate* the need to scan cases. The system was originally invented by YottaMark, and is being provided at no cost to software vendors, growers, shippers, retailers, and other produce industry participants to simplify PTI implementation (see our Non Assertion Letter dated July 18th, 2010). The technology was originally called VoiceCode, which is a registered trademark of YottaMark, Inc. The standard version is now commonly called Voice Pick Code.

The Voice Pick Code is printed on the PTI label, and designed to integrate with the voice picking systems popular in large warehouse management systems (WMS). The Voice Pick Code itself is a 4 digit digest¹ of the GTIN and Lot Code (and optional Date) that is calculated using a well proven, standard algorithm. The Voice Pick Code is included as one of the elements on the PTI case label, when the label is printed. When a pallet arrives at a distribution center, the GTINs and Lot Codes (and optional date) for cases on the pallet are loaded into the WMS either by EDI/Advanced Shipping Notice or by scanning the Hybrid Pallet Tag. **No additional labeling or data entry at receiving is required.**

Figure 1 shows an example of how the Voice Pick Code could be represented on a PTI label.

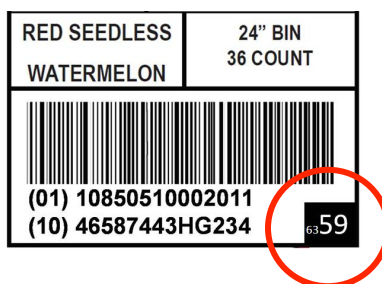


Figure 1. Example Label Showing Voice Pick Code 63-59

¹ A digest is a short, one-way digital signature that is calculated based on a longer set of data



When a pallet is moved into a pick location, the WMS ‘knows’ the GTINs and Lot Codes (and Dates) present on the pallet. If all the cases on the pallet come from the same GTIN/Lot/Date, the distribution center operator need only confirm the quantity of cases picked from the pallet.

When picking cases from a *mixed* pallet the voice picking system simply instructs the operator to read the Voice Pick Code on the label, and/or get verbal confirmation of the cases selected. Because the code is numeric, it is easy for voice pick systems to instruct/understand. With Voice Pick Code, the WMS can record all GTINs and Lot Codes (and dates) associated with a pick transaction, completing the traceability chain. And, this can be done without scanning the barcode on the case.

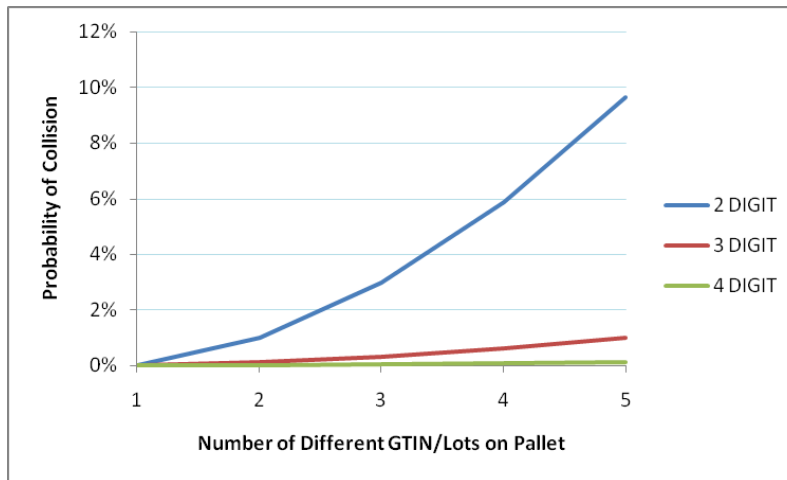
To speed operation within the distribution center, the two *least significant* digits of the Voice Pick Code are printed large, and are all that is required for most transactions when dealing with a mixed pallet because of the low likelihood of a *collision*² on a pallet. In the event that there’s a collision on a pallet, the two *most significant* digits can also be used. A four digit Voice Pick Code results in less than a 1 in a 1,000 chance of a collision even with five different GTINs and Lots mixed on a single pallet (see Figure 2)³. A mixed pallet with two different items will have a 1 in 10,000 chance of a collision at the 4-digit level. You can immediately see why a 2 digit Voice Pick Code is not sufficient: with 5 different GTIN/Lot/Dates on a pallet, the system would be unable to discriminate cases on a pallet 1 in 10 times.

As an additional benefit, the Voice Pick Code will identify when a pallet has been incorrectly put away or let down in a slot. To benefit from this feature, the voice picking system would default to using the Voice Pick Code for every pick.

When printing PTI labels, the Voice Pick Code does not have to be linked to the specific pallet. So labels can be printed in bulk and applied to pallets, offering packer/shippers many workflow options for PTI labeling. The Voice Pick Code only needs to discriminate cases on a single pallet.

² A collision occurs when two cases with *different* GTINs or Lots on the same pallet have the *same* Voice Pick Code

³ The formula for calculating collision probabilities is:
$$p(\text{collision}) = 1 - (10^x)(10^x - 1) \dots (10^x - N + 1) / (10^x)^N$$
where x is number of digits in Voice Pick Code and
 N is the number of *different* GTIN or Lots on a pallet
A simple approximation for this is:
$$p(\text{collision}) \approx 1 - e^{-N^2/2 \times 10^x}$$



		VoiceCode Digits Used		
		2 DIGIT	3 DIGIT	4 DIGIT
number of different GTIN/lots on a pallet	1	0.00%	0.00%	0.00%
	2	1.00%	0.10%	0.01%
	3	2.98%	0.30%	0.03%
	4	5.89%	0.60%	0.06%
	5	9.65%	1.00%	0.10%

Figure 2. Collision Probabilities

The role of the Voice Pick Code is to provide a quick and simple way to identify a case with a given GTIN/Lot/Date. Because a pallet may have cases with the same GTIN but different Lot Codes (or vice versa), it is important that the Voice Pick Code digits vary significantly, i.e. all digits should vary, even when there’s only a small change in the GTIN or Lot. Figure 3 shows an example of Voice Pick Codes for a random selection of GTIN and Lot Codes – some with Dates, some without. You can see that small changes in the GTIN, Lot or Date create a very different Voice Pick Code.

Note in Figure 3, there is a collision – the two digit Voice Pick Code “59” shows up twice. In this case, the voice picking system (which anticipates the collision at the two digit level because it ‘knows’ what GTIN/Lots/Dates are in a particular pick location) will automatically require the two *most* significant digits to discriminate the cases on the pallet, i.e. 63-59 and 37-59 in this example. In the rare event that there is a collision on the pallet at the 4-digit level (approx. every 1 in 5-10,000 mixed pallets), the WMS system can anticipate it, and can use additional digits (e.g. the last digit of the GTIN) to distinguish the cases.



GTIN (AI 01)	Batch/Lot # (AI 10)	Date (YYMMDD) (AI 13/15)	VoiceCode
10850510002011	46587443HG234		63 59
10614141000581	1234	100124	08 20
45565656565656	1		90 95
65457886676767	2	100126	58 36
10614141000581	3	100127	72 12
10614141000581	4	100127	64 10
10614141000581	124	100128	26 96
12345678910000	1111	100130	29 25
12345678910333	BBBBBBBBBB	100131	52 44
11223344556677	CCCCCCCCCC		37 59
11223344556677	SCCCCCCCCC		28 34
11223344556677	CCCCCCCCCCD		34 86
11223344556677	CCCCCCCCCC E		41 43
11223344556677	CCCCCCCCCC E	100203	33 90

Figure 3. Voice Pick Codes for Sample GTIN/Lot/Date combinations

The Voice Pick Code is superior to highlighting or using a few characters of the Lot Code, for three reasons:

- first, a Lot Code is high collision (different products could easily have the same last few characters),
- second, a Lot Code can include letters, which voice picking systems have problems understanding, and
- finally the Lot Code may not be date specific.

Figure 4 shows the logic flow used in a voice picking system to instruct a picker using Voice Pick Codes. Assuming that 10% of cases are mixed, then a distribution center that handles 10 million pallets/year would have to revert to the GTIN/Lot number only 100 times a year. This is likely far smaller than the number of pallets that will be handled that do not have PTI labels at all.

The Voice Pick Code method and algorithm are being made available as an open industry standard (see Fig 6) for easy addition to label printing systems, warehouse management systems and their interfaces



to voice picking systems. We have included an example code segment implementation of Voice Pick Code in the appendix.

We have also created an online check site, where you can enter a GTIN, lot and date and generate the Voice Pick Code, to confirm that your own calculations are correct (Fig 5). The Voice Pick Code calculator can be found at:

<http://www.producetraceability.org/resources/voicecode>

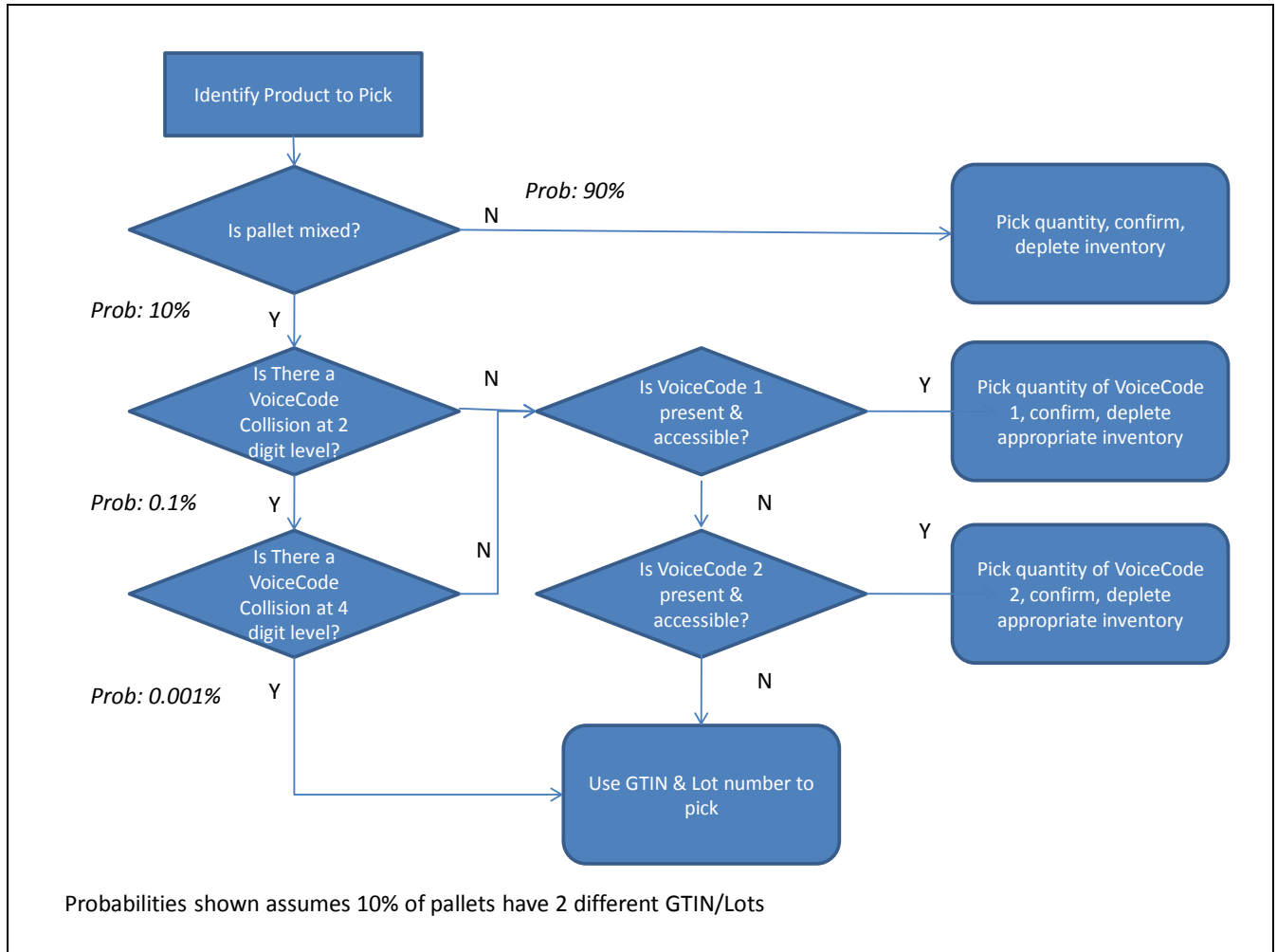


Figure 4. Sample Logic Flow For Picking Using Voice Pick Code

Voice Pick Code Calculator

VoicePick Code Generator

GTIN:

Lot Code:

Pack Date: YYMMDD
(Optional)

Generate Code

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Using the Calculator

- Enter your Global Trade Item Number (GTIN - 14 digits) and your Lot Code (1-20 alphanumeric characters) in the related fields. Optionally, you may also enter a Pack Date, using YYMMDD format.
- Click on the "Generate Code" button.
- A 4-digit voice pick code will appear in the output field. Copy that code onto your PTI-compliant label.

Figure 5. Online Voice Pick Code Calculator

[Download Source Code](#)



Voice Pick Code Specification

A Voice Pick Code is a 4 digit number computed using the GTIN, Lot, and optional Date from a PTI Case Label representing a hash of this information. This computation is performed as follows:

- 1) Compute PlainText
 - a. PlainText is the 14 digit GTIN appended by the Lot Code and the Date (where present) **in that order**.
 - b. **Do not** include the application identifier, prefixes or parentheses
 - c. There are no spaces between the GTIN, Lot and Date fields.
 - d. Date if present is represented as YYMMDD with zero packing and no “/” characters
- 2) Compute ANSI CRC-16 Hash of the PlainText ASCII bytes using the standard ANSI CRC-16 hash with the polynomial of $X^{16} + X^{15} + X^2 + 1$
- 3) Compute the Voice Pick Code by from the Hash by taking the 4 least significant digits in **decimal** form (Hash mod 10000).
- 4) Print the two least significant digits large, and the two most significant digits small

Example:

GTIN = (01) 10850510002011

Lot = (10) 46587443HG234

PlainText = 1085051000201146587443HG234

CRC-16 Hash = 26359

Voice Pick Code = 6359

Large Digits = 59

Small Digits = 63

Figure 6. Voice Pick Code Specification

APPENDIX

Sample Source Code for Implementing Voice Pick Code

```
/// <summary>
/// Provides static methods for Voice Pick Code operations.
/// </summary>
public static class Voice Pick Code
{
    /// <summary>
    /// Compute a 4 digit Voice Pick Code from specified GTIN, lot, and
optional pack date
    /// </summary>
    /// <param name="GTIN">14 digit GTIN number.</param>
    /// <param name="lot">Lot information.</param>
    /// <param name="packDate">Pack Date used with the GTIN and
Lot.</packDate>
    /// <returns>4 digit Voice Pick Code computed from a hash of the
input parameters.</returns>
    public static string Compute(string GTIN, string lot, DateTime?
packDate)
    {
        ushort crc =
Crc16.ComputeChecksum(Encoding.ASCII.GetBytes(string.Format("{0}{1}{2}",
GTIN, lot, packDate.HasValue ? packDate.Value.ToString("yyMMdd") :
string.Empty)));
        return string.Format("{0:0000}", crc % 10000);
    }
}
```



```
public static class Crc16
{
    #region static members
    private const ushort polynomial = 0xA001;
    private static ushort[] table = new ushort[256];
    static Crc16()
    {
        ushort value;
        ushort temp;
        for (ushort i = 0; i < table.Length; ++i)
        {
            value = 0;
            temp = i;
            for (byte j = 0; j < 8; ++j)
            {
                if (0 != ((value ^ temp) & 0x0001))
                {
                    value = (ushort)((value >> 1) ^ polynomial);
                }
                else
                {
                    value >>= 1;
                }
                temp >>= 1;
            }
            table[i] = value;
        }
    }
    #endregion

    public static ushort ComputeChecksum(byte[] bytes)
    {
        ushort crc = 0;
        for (int i = 0; i < bytes.Length; ++i)
        {
            byte index = (byte)(crc ^ bytes[i]);
            crc = (ushort)((crc >> 8) ^ table[index]);
        }
        return crc;
    }
}
```



FAQs

1. *Is the Voice Pick Code solution **only** available as part of a HarvestMark solution?* No. The team at HarvestMark invented the Voice Pick Code method using well-proven algorithms in order to solve the PTI “Milestone 7” problem for retailers and distributors. However, HarvestMark has made it freely available to anyone in the produce industry.
2. *Do I have to buy label printing software from HarvestMark?* No, the method is freely available for integration into in-house and vendor provided printing systems. The Voice Pick Code is integrated into the HarvestMark PTI solution.
3. *If I print my own labels, how do I get the Voice Pick Code algorithm?* Example code segments are included in this white paper. YottaMark does not provide custom VB or C scripts.
4. *Why is YottaMark giving away technology?* We believe that solving the Milestone 7 problem will benefit the industry as it looks to implement enhanced traceability. Each distribution system uses different and often custom enterprise software solutions to drive fulfillment and pick transactions. We believe this solution needs to be standard to facilitate supply chain implementation.
5. *Does this add to the cost of doing PTI?* No, in fact it will reduce the cost substantially for handlers who need to build mixed pallets and use a voice picking system, by eliminating the need to scan labels.
6. *Do I have to change my Voice Picking system/Warehouse Management System (WMS)?* Yes. The WMS will need to process hybrid pallet tags and/or ASN’s with GTIN and Lot Number data. The Voice Code algorithm and workflow can be easily added to voice picking systems and WMS.
7. *Is this part of the GS1 standard?* No, but we would welcome adoption by GS1 and adaptation of the solution into GS1 standards. Voice Pick Code combines GS1 standard components to enhance the PTI label, specifically to assist in the handling of produce.
8. *Does a whole pallet need to have the same Voice Pick Code?* No. The Voice Pick Code works just like the GTIN/Lot. They can span multiple pallets
9. *Does this replace the GTIN/Lot barcode?* No. The Voice Pick Code works instead of scanning the barcode, but you’ll still need the barcode to enable handlers to record cases when they don’t use voice picking systems.
10. *Does the Voice Pick Code link to the pallet?* No. The Voice Pick Code only represents the GTIN/Lot (and Date where present).
11. *Does it matter if different vendors’ products are in the same warehouse or pick location?* No. The Voice Pick Code discriminates between GTIN, Lot and Date – so as long as all vendors use the standard Voice Pick Code algorithm, then the system works.



12. *Does this change the Hybrid Pallet Tag?* No. The hybrid pallet tag communicates the GTIN and Lots, Dates and quantities on a pallet to the warehouse management system. The Voice Pick Codes are regenerated when the cases are picked.
13. *Does the Voice Pick Code need to be printed on the label, or can this all be done in software?* The Voice Pick Code **must** be printed on the label, because that's what the operator picking the case is using to identify the case visually.
14. *Will this work with inkjet?* Yes. Inkjet printers can print inverse characters. Alternatively, the Voice Pick Code could be represented by a heavily outlined box (this approach may also be used to reduce wear on thermal transfer heads).
15. *How do I find out more?* Just email us at info@harvestmark.com

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