Public consultation on the implementation of an EU system for trace-ability & security features pursuant to Art. 15/16 of the Directive 2014/40/EU

Additional comment Vesdo to point C28

1. Naming convention

Abbreviation	Full specification
TPD	Tobacco Products Directive 2014/40/EU
Impact Assessment	Inception Impact Assessment; Implementing and delegated acts under Article 15&16 of the TPD
Unique identifier	Definition according to TPD Art.15
Security Feature	Security Feature as defined in Article 16 of the TPD
Authentication	Evidence that the checked item is original product by checking the Security Feature
Feasibility Study	Analysis & Feasibility Assessment Regarding EU systems for Tracking and Tracing of Tobacco Products and for Security features No EAHC 2013/Health/11 2013/S 068-112544
BAM	**B**arcode **A**nomalies **M**apping = New security technology based on the deep analysis of finest barcode print deficiencies

2. New technologies in analyzing random print errors for authentication purpose

Security features based on the analysis of random structures of printable substrates are well known authentication products. Most of these "Fingerprint" technologies analyze the fiber structure of the printing substrate as e.g. the packaging carton. These technologies are mentioned and classified in chapter 1.5.1.3 of the Feasibility Study which has been published in 2015.

However, in the meantime new technologies are in the market which we call in this paper BAM (Barcode Anomalies Mapping). The basic principle of BAM is the deep analysis of finest print anomalies in the unique identifier code. Such printing anomalies exist even in excellent barcodes having a grade A quality level. In other words, the technology focus on the barcode print itself and not the substrate on

which the code is printed. Compared to the "fingerprint" technologies these analyzed anomalies are much coarser. Therefore, authenticating can be made with a normal smartphone without additional modifications. At the time being, two companies offer this technology, which is therefore not proprietary.

3.   Justification for proposing BAM technology

3.1. Location of the authentication feature on the package

One of the key issues of the current serialization model is the fact that copying serialization codes is simple because the deployed barcodes are standardized according ISO and therefore can be read with any barcode readers and re-coded easily (*See Feasibility Study chapter 4.2.4.1 and 8.6.3*). Consequently, the barcode is the area of the pack which needs to be protected most. Additionally, a solution which combines barcode reading with authentication would simplify the authentication process.

The BAM technology location is linked to the unique identifier; it is always clear where to authenticate. The unique identifier is always visible (*Art. 15 TPD*).

3.2. Generation of the BAM security key

Generating the BAM key is done directly at the packaging line, using the existing in-line camera, required for quality assessment of the barcodes and human readable text printed with a digital printing technology (Laser or inkjet). The image is processed on a local computer (industrial PC or virtual machine) and the generated BAM key is uploaded to a central data repository, normally an independent cloud database. As consequence no change of the workflow in the factory is required, the speed of the packaging line is not reduced and only minimal investments are required.

3.3. Authentication device

Traditional fingerprint technologies focus on the analysis of very fine surface structures of cartons or other printable substrates. As consequence high magnification optical devices are required as e.g. specific readers or smartphones equipped with auxiliary equipment (Lenses, illumination) to authenticate a fingerprint. That limits the fingerprint technology to a restricted user group.

However, the BAM technology analyze a much coarser structure; therefore, authentication can be made with normal smartphones without any additional equipment. The technology is therefore usable for public authentication if needed.

3.4. Efficiency of the BAM technology

The efficiency of an authentication technology can be calculated based on the following formula:

$$\text{Efficiency} = \frac{\text{Security x Authentication density}}{\text{Cost}}$$

Security: This parameter addresses the resistance of the Security Feature against all criminal attempts to compromise or reveres engineer the technology. The BAM feature analyzes small anomalies in the barcode pattern as e.g. distortion in the code geometry, variations in the module size, under- or overprint and many more. Depending on the code, up to 15 parameters are investigated. The origin of such anomalies result out of randomly distributed environmental effects as e.g. non homogenous print substrates, dirt particles or airflow. It is evident that such anomalies are not systematic and therefore cannot be reproduced, reverse engineered or faked.

Most security features investigated and validated in chapter 9 of the Feasibility Study are manmade and therefore copying, it is just a matter of effort and money.

Authentication density: The higher the number of authentications done in the field, the higher the probability to detect an illegitimate product. Therefore, high scanning rate is crucial. As BAM systems work with normal smartphones the prerequisite for a high authentication density is given.

Cost: BAM technology is basically a software solution which runs in the background. The cost for operating this system are low and in the frame of the values as indicated in the Feasibility Study in chapter11.4.3.2.2

3.5. Usability of the BAM technology for the TPD initiative

Regarding authentication technologies, the Feasibility Study has established in chapter 1.5.1.3 a list of technology clusters which are of interest for the Tobacco Products Directive 2014/40/EU:

1. Incorporating the security feature as part of the production of the packaging material itself.

2. Including the security feature in a specific element of the packaging that can be controlled (e.g. tear tape).

3. Printing the security feature using security inks directly onto the product.

4. Providing the security feature as self-contained security package as a label, film or stamp.

5. Security feature combined with fingerprinting of unique material properties of the package.

Fingerprinting according to bullet point 5 has been assessed as interesting technology. The BAM technology should therefore also be of interest for the TPD initiative

3.6. Critical success factors of the BAM technology

In chapter 1.3 Table 4 of the Feasibility Study the "*Critical success factors for security features*" have been summarized as follows:

1	Provide a reliable mechanism to authenticate the legitimacy of a tobacco product; (Article 16, §1)
2	Have overt elements which provide the modicum of authentication by the consumer without requiring specialised equipment / devices; (Article 16, §1 and impact assessment considerations)
3	Must be tamper proof and irremovable; (Article 16, §1)
4	Ensure that covert elements are accessible by authorised persons and protect commercially sensitive data, if necessary; (article 16, §1 and impact assessment considerations)
5	Provide court-admissible forensic evidence of security feature authentication;
6	As far as possible, be compatible with the current tobacco production, packaging trade environment and existing tax regimes and avoid unnecessary burden for business and/or authorities (internal market proportionality obligations).

The table below shows how the BAM technology covers these requirements outlined in the table above (the column number correspond with the table above).

Nr.	Qualification of BAM according to required success factors
1	By using the smartphone authentication is quick, simple and reliable
2	Public authentication is possible; therefore, the BAM feature can be used as overt security feature
3	The BAM feature is based on statistical, non-reproducible effects and cannot be reverse engineered. It is therefore highly secure. Tampering of the feature is impossible.
4	The unique identifier code must be always visible; therefore, the BAM feature can always be accessed. To query data in the database a restriction to authorized data owners is possible, as well as protecting commercially sensitive data.
5	No experiences so far, however should be possible. In legal cases the functionality and existence of a Security Feature must often be disclosed and becomes public. This can be an issue for traditional Security technologies. However, publication of the BAM basic rationale is not compromising the feature as its security is based on statistical, not reproducible barcode anomalies.
6	BAM technology runs completely in the background and does not require changing any existing business processes or established procedures. It does not require any security substances (e.g. security labels) which require a protected supply chain. No manual collection of tax labels from rejected packs required if BAM database is used for excise tax collection

3.7. Replacement of the classical Tax Stamps with BAM

Existing tax stamps are costly and require a complex application and reconciliation process. From a technical perspective it would be possible to replace the tax stamp regime by a BAM application. The following benefits would arise:

- Authentication of the tax stamp can be made by smartphone: Process is efficient, precise, remote and the result is documented in the database.

- Based on geo-tagging of authentications made by smartphones a statistical analysis is possible indicating in which market and when products are checked.

- Authentication of traditional tax stamps is a manual process and require a trained inspector. Authentication quality and speed are inferior compared to BAM

- Application of the tax stamp during the packaging process: No manual re-collection of tax stamps on rejects, easy reconciliation by authorities, no cumbersome supply chain for valuable physical tax stamps

- Significant overall cost savings and improvement of authentication accuracy can be realized.

4. Conclusion:

The BAM (Barcode Anomalies Mapping) is a new, promising technology which fulfills all Critical Success Factors as specified in the Feasibility Study and should therefore be included in the evaluation process for the future Security Feature according Article 16 of the TPD

Based on the BAM technology the **Tobacco Traceability Option 4** according to chapter 1.5.3.4. of the Feasibility Study can be realized in a cost effective manner as the feature can be in-line printed in the packaging line and no additional label is required.

Wollerau, August 29th 2016