

SEMI T22-0212 (Reapproved 0618)

SPECIFICATION FOR TRACEABILITY BY SELF AUTHENTICATION SERVICE BODY AND AUTHENTICATION SERVICE BODY

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1 Purpose

- 1.1 Damage resulting from counterfeit goods is increasing. Conventional measures to counter counterfeit goods, such as conventional hologram labels are proving insufficient to reduce or mitigate this problem. Unique authentication codes assigned to individual products and devices in the market for identification purposes helps mitigate this problem.
- 1.2 Assigning unique codes (authentication codes) to individual products can help with investigation of nonfunctional units returning from the field for analysis. These same codes also assist in linking individual product performance data with manufacturing equipment settings to support yield improvement studies. Linking the authentication codes assigned to individual devices with the manufacturing data of products also allows product quality to be obtained.
- 1.3 Assigning unique codes (authentication codes) to individual products will also lead to prevention of the production of clones.
- 1.4 Integrated management of authentication codes will enable the verification of products. The system will know either products is false or if the same code is used at different places.
- 1.5 Authentication codes allow monitoring of information during the shipment process. Deviation from a predefined shipment route of products can be detected in real time, and the system may detect in which stage a counterfeit product has been included.
- 1.6 These unique authentication codes are embedded within two-dimensional or other machine readable codes.
- 1.7 Combines the authentication/verification system using the barcode reader with the mechanism of product shipping process trace or quality trace, which permits implementation of efficient measures to counter counterfeit goods and a traceability mechanism.
- 1.8 Building authentication code issuance management and authentication systems by each specific ASP is expensive. Defining a mechanism or method to share common function has a large cost advantage that alleviates some problems with the business model of each company and the operation of industries, combination of the self authentication service body (SASB) offered by each company with the authentication service body (ASB) operated by each industry shall make up the entire system.
- 1.9 The purpose of this Specification is to describe the authentication process to establish trusted identities of products and the mechanism of traceability for establishing identities in the product shipping process and traceability for linking manufacturing conditions.
- 1.10 This Specification is intended to enable reliable and safe product authentication and traceability through systemization for the semiconductor industry. Then, this will reduce the existence of illegal counterfeit items in the market.

2 Scope

- 2.1 These specifications define the structure, behaviors, and services for the organization configuration and objects for authenticating the semiconductors and relevant products using industry specific ASB and SASB.
- 2.2 These specifications define the structure, behaviors, and services for the configuration and objects for generating the access logs in the distribution points of the semiconductors and relevant products using industry specific ASB and SASB.
- 2.3 These specifications define the structure, behaviors, and services for the configuration and objects of the quality traceability of the semiconductors and relevant products using SASB.

2.4 These specifications define the requirements and qualifications when industry ASB offers the services defined in ¶¶ 2.1 and 2.2.

2.5 These specifications define the requirements and qualifications when SASB offers the services defined in ¶¶ 2.1, 2.2, and 2.3.

2.6 These specifications define the format and content of the authentication codes issued by semiconductor ASB for devices and license plates.

2.7 Figure 1 shows the image of the elimination system of counterfeit goods through verification by using the industrial ASB and SASB.

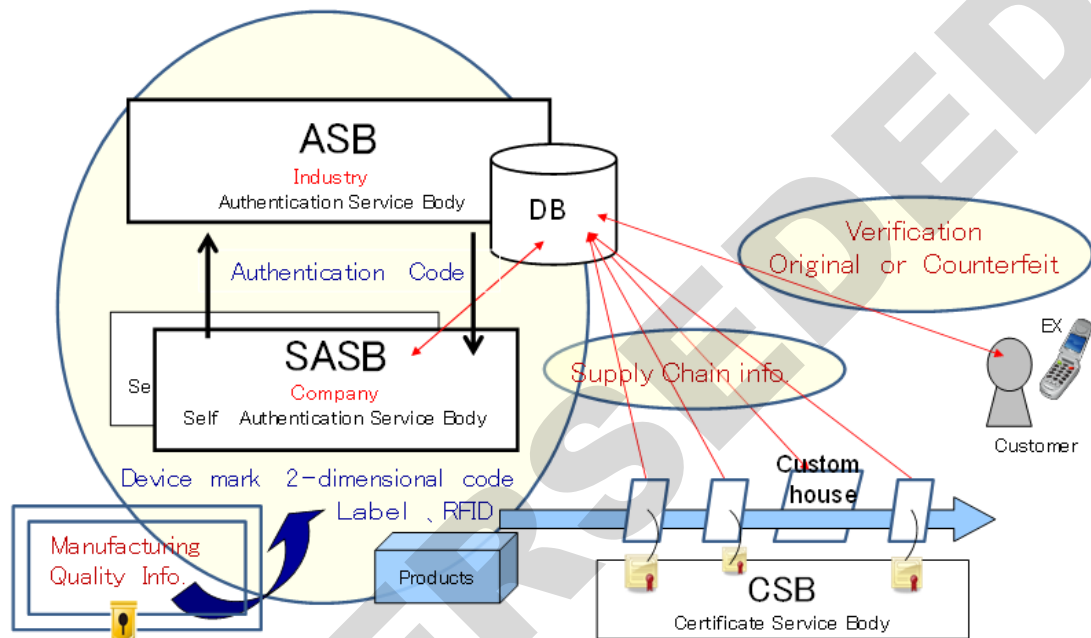


Figure 1
System of Authentication for Fake Elimination

2.8 Figure 2 shows an image when stamping the authentication codes for device and license plate on devices or displaying them on the outer case, intermediate box, and device tray.

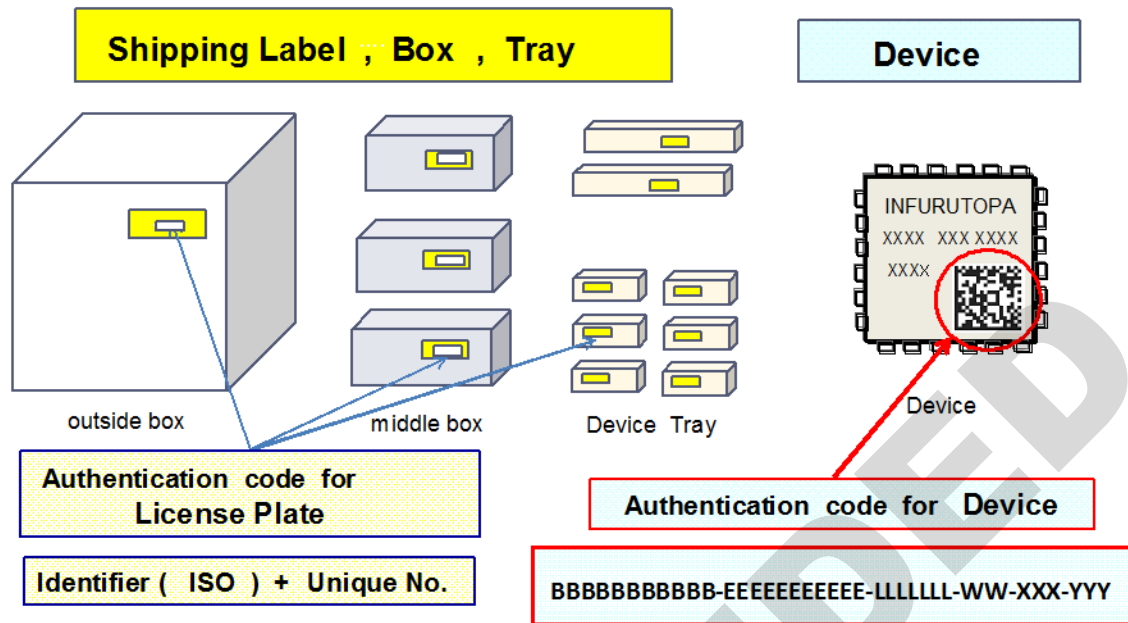


Figure 2
Mark of Authentication Code

NOTICE: SEMI Standards and Safety Guidelines do not purport to address all safety issues associated with their use. It is the responsibility of the users of the Documents to establish appropriate safety and health practices, and determine the applicability of regulatory or other limitations prior to use.

3 Limitations

3.1 These specifications are intended for the verification function in the distribution points. The verification function is not intended to get the product traceability in the supply chain. But, this verification function can be relatively easily extended to the product traceability function by accepting the credit accommodations, if not requesting them, from the buyers in the supply chain.

3.2 These specifications are not intended for the items below:

- Control the size or layout of any labels. Label specifications are out of scope.
- Communication protocol.
- Recovery procedure on the occurrence of service error.

4 Reference Standards and Documents

4.1 SEMI Standards and Safety Guidelines

SEMI T20 — Specification for Authentication of Semiconductors and Related Products

NOTE 1: The SEMI global Traceability Technical Committee is developing a Specification for Organization Identification by Digital Certificate Issued from Certificate Service Body (CSB) for Anti-Counterfeiting Traceability in Components Supply Chain intended to be used in conjunction with this Document.

4.2 ISO Standards¹

ISO 3166-2 — Codes for the Representation of Names of Countries and Their Subdivisions – Part 2: Country Subdivision Code

¹ International Organization for Standardization, ISO Central Secretariat, 1, ch. de la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland; Telephone: +41.22.749.01.11, Fax: +41.22.733.34.30, <http://www.iso.org>

NOTICE: Unless otherwise indicated, all documents cited shall be the latest published versions.

5 Terminology

5.1 Abbreviations and Acronyms

5.1.1 *ASB* — authentication service body

5.1.2 *SASB* — self authentication service body

5.2 Definitions

5.2.1 *access traceability* — traceability using the access logs when the authentication code for license plate is read in the distribution point and when the authentication code in ASB is accessed for verification.

5.2.2 *authentication code* — unique and discontinuous code issued by ASB for identifying a device or license plate. The authentication codes consist of authentication codes for devices and authentication codes for license plates for packages and delivery labels.

5.2.3 *authentication code for device* — unpredictable, unique, and discontinuous code issued by ASB for allocating it to each semiconductor device.

5.2.4 *authentication code for license plate* — unpredictable, unique, and discontinuous code issued by ASB for allocating it to each outer case, intermediate box, and device tray.

5.2.5 *code issuance* — issuance is a series of operations of generating a code, confirming its uniqueness, registering the code, and issuing (notifying of) the code. The issuance of authentication code has the functions below:

- Generate an Authentication Code
- Confirm a Uniqueness of Authentication Code
- Register an Authentication Code
- Issue an Authentication Code

5.2.6 *industrial authentication service body (ASB)* — is an agency to issue and register the authentication codes for products and license plates and offer the scheme for verification using the authentication codes. ASB is an agency to manage the access logs read in the distribution points. ASB is to be set up for each country and industry. Therefore, ASB in this document indicates the ASB for each industry.

5.2.7 *quality traceability* — in order to enable the tracing of production history data of device, the association information as a trigger is incorporated into the authentication code for the device. Thus, this quality traceability enables you to trace back to the production history data when identifying the parts configuration of final product or taking measures against a problem in the market. The traceability of the product quality is enabled by associating the authentication code allocated to each device with the product's manufacturing data.

5.2.8 *self authentication service body (SASB)* — is an agent which has the function to associate the authentication codes with the products to which the authentication codes are allocated and the scheme of quality traceability.

5.2.9 *user* — represents the following:

- End User
- Customer
- Distributor
- Brand Owner
- Buyer

5.2.10 *verification* — is to determine that the goods are not counterfeit by comparing the authentication codes allocated to the devices or license plates with the codes registered in ASB.

6 Convention

6.1 Unified Modeling Language (UML)

6.1.1 These specifications apply the UML notation method to all class diagrams, the objects taken for examples, and the activity diagrams.

6.1.2 *Class Diagram* — As the meaning of class diagram is definitely defined in the UML class diagram, these specifications are compliant with it. The details indicated by the diagram are not necessarily repeatedly described in this body text.

6.1.3 *Class Name* — The initial letters of class name and service are capitalized. The class attribute is written in lower case letters.

6.1.4 *Abstract and Concrete Classes* — A class is either abstract or concrete. The abstract class is not directly implemented (i.e., no instance). The class defined as concrete can be directly implemented. UML class diagram represents the abstract class name in italic letters. All classes used in these specifications are concrete classes.

6.1.5 *Class Attribute Definition* — The class attribute is defined in a table format, as shown in Table 1. UML class diagram represents the 'public' attribute by attaching a plus (+) sign to the front of the attribute. All attributes defined in these specifications are public. Therefore, the plus (+) sign is omitted.

Table 1 Attribute Table Format

<i>Attribute Name</i>	<i>Definition</i>	<i>Access</i>	<i>Mandatory</i>	<i>Type</i>
		RO or RW	Y or N	String or Integer

6.1.5.1 *Access* — The attribute becomes configurable (readable and writable: RW) or unconfigurable (read only: RO) through the interface to a service provider. Be aware that all attributes defined in these specifications are read only (RO).

6.1.5.2 *Mandatory* — Represents whether the attribute is mandatory or not. Y means mandatory and N does not mean mandatory.

6.1.6 Describe a number to express multiplicity by relations between class in the place that is near to related class. For example: brand owner has plural (multiplicity) products, but brand owner of products is one.

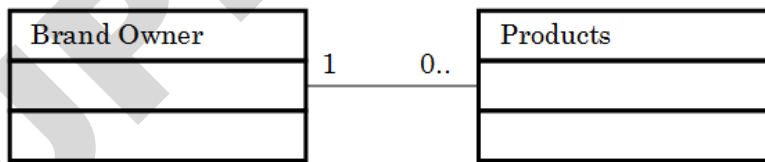


Figure 3
Class Diagram Format

Table 2 Multiplicity List

<i>Multiplicity</i>	<i>Description</i>
0..*	More than 0
0..1	0 or 1
1	Only as for 1
1..*	More than 1

6.2 *Service Notation* — The service is a function or method offered by a service agency. The service either requires or does not require a response (R and N types).

6.2.1 *Definition of Service*

6.2.1.1 The service definition table defines the service corresponding to the supposed service resource, as shown in the table below:

Table 3 Service Definition Table Format

<i>Service Name</i>	<i>Description</i>	<i>Type</i>

6.2.1.2 The type is either R which requires a response or N which does not require a response.

6.2.2 *Definition of Service Parameter*

6.2.2.1 The definition table of service parameter defines the name, description, and type of parameters used in the service, as shown in the table below:

Table 4 Service Parameter Table Format

<i>Parameter Name</i>	<i>Description</i>	<i>Type</i>

6.2.2.2 A row is allotted to each parameter of service in the table.

6.2.3 *Definition of Service Message*

6.2.3.1 The definition table of service message defines the parameters of the service as shown in the table below:

Table 5 Service Message Table Format

<i>Parameter Name</i>	<i>Request/Indication (Req/Ind)</i>	<i>Response/Confirmation (Res/Cnf)</i>	<i>Comment</i>

6.2.3.2 The columns, Request/Indication and Response/Confirmation, correspond to the direction of message flow. A message issued by a sender is called a 'request'. A recipient calls this message 'indication'. The recipient can send a 'response', but this is a 'confirmation' from the point of view of the first sender.

6.2.3.3 The signs below are to be filled in both Request/Indication or Response/Confirmation column for defining the parameters.

Table 6 Service Message List

M	Mandatory parameter: Must be a valid value.
C	Conditional parameter: Existent under some circumstances, but otherwise, nonexistent. It is optional or dependent on other parameter whether the value can be present.
-	Any parameter is not used.

7 Verification Requirements

7.1 *Verification Class Diagram* — Figure 4 shows the UML class diagrams of the requirements defined in this section.

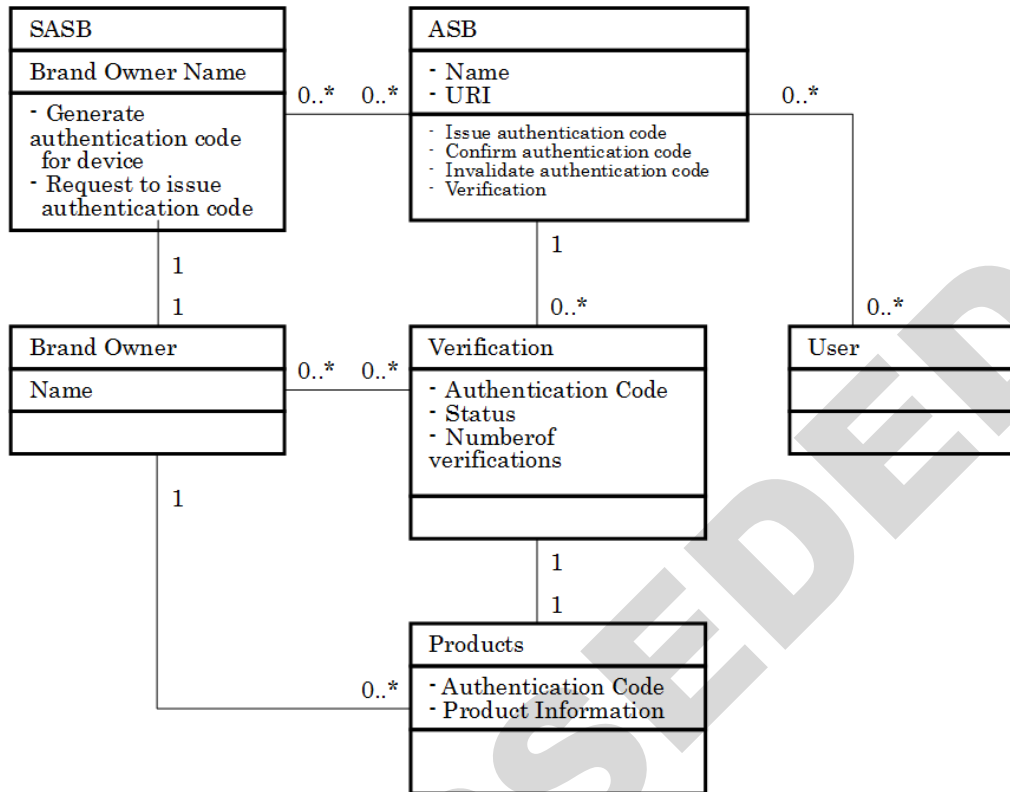


Figure 4
Verification Class Diagram

7.1.1 ASB

7.1.1.1 ASB issues the authentication code for the license plate.

7.1.1.2 ASB issues the authentication code for device generated by SASB.

7.1.1.3 ASB verifies the code.

NOTE 2: For information on the requirements for ASB, refer to § 10 Requirements and Qualifications for ASB.

Table 7 ASB Attribute

Attribute Name	Description	Access	Mandatory	Type
Name	ASB's identification name	RO	Y	String
URI	Uniquely represents the access destination of service offered by ASB	RO	Y	String

7.1.2 SASB

7.1.2.1 SASB generates the authentication code for device.

7.1.2.2 SASB requests ASB to issue the authentication code for device.

7.1.2.3 SASB requests ASB to issue the authentication code for license plate.

7.1.2.4 SASB offers the authentication code issued by ASB on the request of a brand owner.

7.1.2.5 SASB can request ASB to invalidate the authentication code issued.

NOTE 3: For information on the requirements for SASB, refer to § 11 Requirements and Qualifications for SASB.

Table 8 SASB Attribute

<i>Attribute Name</i>	<i>Description</i>	<i>Access</i>	<i>Mandatory</i>	<i>Type</i>
Brand owner name	Brand owner name offered by ASB	RO	Y	String

7.1.3 Brand Owner

7.1.3.1 The brand owner requests SASB to issue the authentication codes for device and license plate.

7.1.3.2 The brand owner attaches the authentication code to the device, outer case, intermediate box, or device tray.

7.1.3.3 The brand owner can request SASB to invalidate the authentication code issued.

Table 9 Brand Owner Attribute

<i>Attribute Name</i>	<i>Description</i>	<i>Access</i>	<i>Mandatory</i>	<i>Type</i>
Name	Brand owner name offered by ASB	RO	Y	String

7.1.4 *Products* — The Products represent the devices to which the authentication codes for devices are allocated and the outer case, intermediate box, or device tray to which the authentication codes for license plates are allocated.

Table 10 Products Attribute

<i>Attribute Name</i>	<i>Description</i>	<i>Access</i>	<i>Mandatory</i>	<i>Type</i>
Authentication code	Authentication code for device or license plate	RO	Y	String
Product information	The brand owner determines the attribute's field and its content	RO	Y	String

7.1.5 *Verification* — The User requests ASB to verify the product's authentication code. The authentication process can be repeated as many times as you want until the authentication code is invalidated.

Table 11 Verification Attribute

<i>Attribute Name</i>	<i>Description</i>	<i>Access</i>	<i>Mandatory</i>	<i>Type</i>
Code	Authentication code issued by ASB and attached to product	RO	Y	String
Verification count	Count verified after the code was issued	RO	Y	String
Status	Status is either valid or invalid	RO	Y	String

7.2 *Service* — Service which ASB and SASB should offer to a brand owner or user.

7.2.1 *ASB Service* — Service which ASB should offer to SASB or user.

Table 12 ASB Service

<i>Service Name</i>	<i>Description</i>	<i>Type</i>
Authentication code issuance for device	Confirms the uniqueness of the generated authentication code for device on the request of SASB, and registers it and notifies SASB of it. When the service fails, returns an error.	R
Authentication code issuance for license plate	On the request of SASB, issues the authentication code for license plate for particular product. When the service fails, returns an error.	R
Code invalidation	Invalidates specific authentication code on the request of SASB and returns a notice. When the service fails, returns an error.	R
Code confirmation	Extracts the information of the registered authentication code on the request of SASB and notifies SASB of it. When the service fails, returns an error.	R
Verification	Verifies whether the specific authentication code is genuine on the request of the user and returns the result. When the service fails, returns an error.	R

7.2.1.1 *Authentication Code Issuance for Device* — ASB confirms the uniqueness of the generated authentication code for device on the request of SASB, and registers it and notifies SASB of it.

Table 13 Authentication Code Issuance for Device, Service Parameter

<i>Parameter Name</i>	<i>Description</i>	<i>Type</i>
Quantity	Number of authentication codes for device requested for issuance	String
Manufacturer name	Name of brand owner requesting the issuance of authentication code for device	String
Code	Code generated by SASB	String
Format	Format of data matrix code	Format List
Product information	Product details	String
Issued code	Authentication code for device registered and formally issued by ASB	String
Error	Error returned when a service failed ‘Service unavailable’: Unavailable because the server is being down, the network is being down, etc. ‘Failed to acquire information’: The data is insufficient. ‘Quantity mismatch’: The number requested for issuance and the number of actual generated authentication codes for device do not match.	String

Table 14 Authentication Code Issuance for Device, Service Definition

<i>Parameter Name</i>	<i>Request/ Indication</i>	<i>Response/ Confirmation</i>	<i>Comment</i>
Quantity	M	-	
Manufacturer name	M	-	
Code	M	-	
Format	M	-	
Product Information	M	-	
Registered code	-	C	SASB is notified of those codes which can be registered

7.2.1.2 *Authentication Code Issuance for License Plate* — ASB issues the authentication code requested by SASB.

Table 15 Authentication Code issuance for License Plate, Service Parameter

<i>Parameter Name</i>	<i>Description</i>	<i>Type</i>
Quantity	Number of codes requested for issuance	String
Manufacturer name	Name of brand owner requesting the issuance of code	String
Product information	Product details	String
Issued code	Authentication code issued for license plate	String
Error	Error returned when a service failed: 'Service unavailable': Unavailable because the server is being down, the network is being down, etc. 'Failed to acquire information': The data is insufficient. 'Quantity mismatch': The number requested for issuance and the number of actual codes do not match (requested number cannot be issued).	String

Table 16 Authentication Code Issuance for License Plate, Service Definition

<i>Parameter Name</i>	<i>Request/ Indication</i>	<i>Response/ Confirmation</i>	<i>Comment</i>
Quantity	M	-	
Manufacturer name	M	-	
Product information	M	-	
Code	-	M	

7.2.1.3 *Code Invalidation* — ASB invalidates the registered authentication code on the request of SASB.

Table 17 Code Invalidation, Service Parameter

<i>Parameter Name</i>	<i>Description</i>	<i>Type</i>
Code	Code to be invalidated	String
Manufacturer name	Name of brand owner requesting the invalidation of code	String
Notice	Returned when a service is finished: 'Requested invalidation of code has finished'	String
Error	Error returned when a service failed: 'Service unavailable': Unavailable because the server is being down, the network is being down, etc. 'Failed to acquire information': The data is insufficient. 'Nonexistent code': The code is not registered. 'This code is already invalidated': The code has already been invalidated/ 'No authority to request invalidation': The request is from other than SASB requested for issuance.	String

Table 18 Code Invalidation, Service Definition

<i>Parameter Name</i>	<i>Request/ Indication</i>	<i>Response/ Confirmation</i>	<i>Comment</i>
Code	M	-	
Manufacturer name	M	-	
Notice	-	M	