

中華民國國家標準

C N S

**電力系統管理及關聯資訊交換－資料及通訊
安全－第 100-6 部：CNS 61850-8-1 及 CNS
15733-9-2 之網宇安全符合性測試**

**Power systems management and associated
information exchange – Data and
communication security – Part 100-6:
Cybersecurity conformance testing for IEC
61850-8-1 and IEC 61850-9-2**

CNS 62351-100-6:2024

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前言

本標準係依據 2022 年 8 月發行之第 1.0 版 IEC TS 62351-100-6，不變更技術內容，制定成為中華民國國家標準者。

本標準係依標準法之規定，經國家標準審查委員會審定，由主管機關公布之中華民國國家標準。

依標準法第四條之規定，國家標準採自願性方式實施。但經各該目的事業主管機關引用全部或部分內容為法規者，從其規定。

本標準並未建議所有安全事項，使用本標準前應適當建立相關維護安全與健康作業，並且遵守相關法規之規定。

本標準之部分內容，可能涉及專利權、商標權與著作權，主管機關及標準專責機關不負責任何或所有此類專利權、商標權與著作權之鑑別。

簡介

INTRODUCTION

裝置生產者之品質系統形成開發及生產活動中可靠測試的基礎。裝置開發期間許多內部測試皆將導致單元層級之測試，其至少將由裝置提供者執行，若適用標準有要求時，則亦將由獨立測試機構執行。於本標準之全景中，用語型式測試僅限於裝置的功能行為。

The quality system of a device producer forms the basis of reliable testing in development and production activities. Many internal tests during the development of a device result in a unit level test performed at least by the provider and – if required by applicable standards – by an independent test authority. In the context of this document, the term type test is restricted to the functional behavior of the device.

符合性測試並不取代專案特定系統相關測試，諸如 FAT (工廠驗收測試)及 SAT (現場驗收測試)。FAT 及 SAT 係對專用變電所自動化系統依特定客戶要求事項，由系統整合者完成，通常由客戶見證。此等測試提高已識別及解決系統中所有潛在問題之信心度。此等測試建立所交付之變電所自動化系統係依規定執行。符合性測試可降低 FAT 及 SAT 失效之風險。

Conformance testing does not replace project-specific system related tests such as the FAT (Factory acceptance Test) and SAT (Site Acceptance Test). The FAT and SAT are based on specific customer requirements for a dedicated substation automation system and are done by the system integrator and normally witnessed by the customer. These tests increase the confidence level that all potential problems in the system have been identified and solved. These tests establish that the delivered substation automation system is performing as specified. The conformance testing reduces the risks of failure during the FAT and SAT.

本標準旨在涵蓋所有可能情況，除考量正常運作測試案例且亦考量失效測試案例，以展現“待測裝置”(device under test, DUT)依 CNS 62351-6 之規定方式與其他裝置一起運作的能力。

The purpose of this part of IEC 62351 is to cover all possible situations taking into consideration the normal operating test cases and also the failure test cases to demonstrate the capability of the DUT (Device Under Test) to operate with other devices in the specified way according to the IEC 62351-6.

透過本標準(其係 IEC 62351 標準套組之一部)，測試設施能證明 CNS 62351-100-6，其描述實作 CNS 62351-6 部變電所自動化系統(substation automation system, SAS)及遠距控制系統資通訊安全之互運性符合性測試的測試案例。

本標準所描述之測試不評估實作的安全性。因此，引用本標準之符合性並不意味著相對應的產品或使用該產品之系統已達成任何特定的安全等級。

Through this part of IEC 62351, a test facility can prove the IEC TS 62351-100-6:2022 (E), which is a technical specification, is part of the IEC 62351 suite of standards, which describes test cases for interoperability conformance testing of data and communication security for Substation Automation Systems [SAS] and telecontrol systems which implement IEC TS 62351-6. The tests described in this part do not evaluate the security of the implementation. Thus, citing conformance to this part does not imply that any particular security level has been achieved by the corresponding product, or by the system in which it is used.

本標準旨在藉由提供測試協定實作之標準方法以實現互運性，但並不保證裝置的完全互運性。預期於測試期間使用本規格將使不可互運性之風險降至最低。要求額外測試及保證措施以查證 CNS 62351-6 之特定實作已正確實作所有安全功能，且能保證其存在於所有交付的產品中。其他相關標準(例：CNS 62443)中亦涵蓋此主題。

The goal of this part of IEC 62351 is to enable interoperability by providing a standard method of testing protocol implementations, but it does not guarantee the full interoperability of devices. It is expected that using this specification during testing will minimize the risk of non- interoperability. Additional testing and assurance measures will be required to verify that a particular implementation of IEC TC 62351-6 has correctly implemented all the security functions and that they can be assured to be present in all delivered products. This topic is covered in other IEC standards, for example IEC 62443.

本標準之範圍係規定 CNS 62351-6、CNS 61850-8-1、IEC 61850-9-2 的符合性及/或互運性測試之共同可用程序及定義，以及其對於 IEC 62351-3 之剖繪(包括 TCP/IP)的建議，以及對於 CNS 62351-4 之剖繪(包括 MMS)的建議。此等建議係 CNS 61850 系列標準及其衍生標準之安全延伸，得以針對 CNS 62351-6 及其配套標準協定實作能進行明確且標準化的評估。

The scope of this document is to specify common available procedures and definitions for conformance and/or interoperability testing of IEC 62351-6, the IEC 61850-8-1, IEC 61850-9-2 and also their recommendations over IEC 62351-3 for profiles including TCP/IP and IEC 62351-4 for profiles including MMS. These are the security extensions for IEC 61850 and derivatives to enable unambiguous and standardized evaluation of

IEC TS 62351-6 and its companion standards protocol implementations.

各配套標準之詳細測試案例，其中包含各安全通訊應用功能、安全應用服務資料單元(application service data unit, ASDU)及傳輸程序的必備及選項必備測試案例。其他功能可能需額外測試案例，但此非屬本標準範圍。本標準係上述配套標準之技術規格。

The detailed test cases per companion standard, containing among others mandatory and optional mandatory test cases per Secure Communication Application Function, secure ASDU (Application Service Data Unit) and transmission procedures, will become available as technical specifications (TS). Other functionality may need additional test cases, but this is outside the scope of this part of IEC 62351. This document is such a technical specification for the mentioned companion standard.

本標準主要處理資料及通訊安全符合性測試；因此，未涵蓋其他要求事項，諸如設施安全或 EMC (電磁相容性)。此等要求事項涵蓋於其他標準中(若適用)，而此等主題之遵循性證明係依此等標準完成。DUT 通訊子系統(或其一部分)之 SMV 符合 CNS 62351-6。

This document deals mainly with data and communication security conformance testing; therefore, other requirements, such as safety or EMC (Electromagnetic compatibility) are not covered. These requirements are covered by other standards (if applicable) and the proof of compliance for these topics is done according to these standards. SMV at the DUT communication subsystem (or a part of it) conforms to IEC 62351-6.

本標準中所描述之測試案例不保證含括完整的網宇安全符合性測試。其宜與其他測試套組相補充。

The tests cases described in this specification do not guarantee full cybersecurity conformance testing. It should be complemented with other test suites.

1. 適用範圍

1 Scope

透過本標準(其係 IEC 62351 標準套組之一部)，測試設施機構能證明查驗 CNS 62351-100-6:2022，其描述實作 CNS 62351-6 部變電所自動化系統(substation automation system, SAS)及遠距控制系統資通訊安全之互運性符合性測試的測試案例。本標準所描述之測試不評估實作的安全性。因此，引用本標準之符合性並不意味著相對應產品或使用該產品的系統已達成任何特定安全等級。

IEC TS 62351-100-6, which is a technical specification, is part of the IEC 62351 suite of standards, which describes test cases for interoperability conformance testing of data and communication security for Substation Automation Systems [SAS] and telecontrol systems which implement IEC TS 62351-6. The tests described in this part do not evaluate the security of the implementation. Thus, citing conformance to this part does not imply that any particular security level has been achieved by the corresponding product, or by the system in which it is used.

本標準旨在藉由提供測試協定實作之標準方法以實現互運性，但其並不保證裝置的完全互運性。預期於測試期間使用此規格將不可互運性之風險降至最低。要求額外測試及保證措施以查證 CNS 62351-6 之特定實作已正確實作所有安全功能，且能保證其存在於所有交付的產品中。其他相關標準(例：CNS 62443)中亦涵蓋此主題。

The goal of this part of IEC 62351 is to enable interoperability by providing a standard method of testing protocol implementations, but it does not guarantee the full interoperability of devices. It is expected that using this specification during testing will minimize the risk of non- interoperability. Additional testing and assurance measures will be required to verify that a particular implementation of IEC TC 62351-6 has correctly implemented all the security functions and that they can be assured to be present in all delivered products. This topic is covered in other IEC standards, for example IEC 62443.

本標準之範圍係規定 CNS 62351-6、CNS 61850-8-1、IEC 61850-9-2 的符合性及/或互運性測試之共同可用程序及定義，以及其對於 IEC 62351-3 之剖繪(包括 TCP/IP)的建議，以及對於 CNS 62351-4 之剖繪(包括 MMS)的建議。此等建議係 CNS 61850 及其衍生標準之安全延伸，得以針對 CNS 62351-6 及其配套標準協定實作能進行明確且標準化的評估。

The scope of this document is to specify common available procedures and definitions for conformance and/or interoperability testing of IEC 62351-6, the IEC 61850-8-1, IEC 61850-9-2 and also their recommendations over IEC 62351-3 for profiles including TCP/IP and IEC 62351-4 for profiles including MMS. These are the security extensions for IEC 61850 and derivatives to enable unambiguous and standardized evaluation of IEC TS 62351-6 and its companion standards protocol implementations.

各配套標準之詳細測試案例，其中包含各安全通訊應用功能、安全應用服務資料單

元(application service data unit, ASDU)及傳輸程序的必備及選項必備測試案例。其他功能可能需額外測試案例，但此非屬本標準範圍。本標準係上述配套標準之技術規格。

The detailed test cases per companion standard, containing among others mandatory and optional mandatory test cases per Secure Communication Application Function, secure ASDU (Application Service Data Unit) and transmission procedures, will become available as technical specifications (TS). Other functionality may need additional test cases, but this is outside the scope of this part of IEC 62351. This document is such a technical specification for the mentioned companion standard.

本標準主要處理資料及通訊安全符合性測試；因此，不涵蓋其他要求事項，諸如設施安全或 EMC (電磁相容性)。此等要求事項涵蓋於其他標準中(若適用)，而此等主題之遵循性證明係依此等標準完成。

This document deals mainly with data and communication security conformance testing; therefore, other requirements, such as safety or EMC (Electromagnetic compatibility) are not covered. These requirements are covered by other standards (if applicable) and the proof of compliance for these topics is done according to these standards.

2. 引用標準

2 Normative references

下列標準因本標準所引用，成為本標準之一部分。下列引用標準適用最新版(包括補充增修)。

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62351-3 Power systems management and associated information exchange – Data and communications security – Part 3: Communication network and system security – Profiles including TCP/IP

CNS 62351-4 電力系統管理及關聯資訊交換－資料及通訊安全－第 4 部：包括 MMS 及衍生之剖繪

~~IEC 62351-4 Power systems management and associated information exchange – Data and communications security – Part 4: Profiles including MMS and derivatives~~

CNS 62351-6 電力系統管理及結合資訊交換－資料及通訊安全－第 6 部：CNS 61850 系列標準之安全性

~~IEC 62351-6 Power systems management and associated information exchange – Data and communications security – Part 6: Security for IEC 61850~~

IEC 62351-9 Power systems management and associated information exchange – Data and communications security – Part 9: Cyber security key

management for power system equipment

3. 用語及定義

3 Terms and definitions

本標準無用語及定義。

No terms and definitions are listed in this document.

ISO 及 IEC 於下列網址維護用於標準化之辭彙資料庫：

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia：可於 <http://www.electropedia.org/> 取得。
- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO 線上瀏覽平台：可於 <https://www.iso.org/obp> 取得。
- ISO Online browsing platform: available at <https://www.iso.org/obp>

4. 一般

4 General

4.1 一般指導綱要

4.1 General guidelines

測試環境應盡可能接近最終環境。為執行測試，專門設計之測試裝置係用以測試 DUT。由於智慧電子裝置(intelligent electronic device, IED)能於發布者或訂用者模式下進行測試，因此存在 2 個版本之測試裝置。

The test environment shall be as close as possible to the final environment. To perform the test, a specially designed testing device is used to test the DUT. Since the IED (Intelligent Electronic Device) can be tested in publisher or subscriber mode, there exist two versions of testing devices.

為實現本標準中所描述之測試，測試設備(test equipment, TEQ)應支援分析所有 CNS 62351-6 要求事項的能力，並能產生無效訊息以測試 DUT 之穩健性。DUT 應提供報告/顯示內部狀態之方法(參照 4.3.4)，以向測試工程師提供足夠資訊，以驗核狀態機狀態及測試結果。

To realize the tests described in this document, a test equipment (TEQ) shall support the capability of analysis all the IEC 62351-6 requirements and be able to generate invalid messages to test the robustness of the DUT. The DUT shall provide means of reporting/displaying internal status (see 4.3.4) to provide to the test engineer enough information in order to validate the state machine status and the results of the tests.

測試設施可能使用單一發布者/訂用者模擬器，但並未限制使用 1 個發布者/訂用者(僅支援某些通訊服務)，並使用另一個發布者/訂用者完成其餘工作，亦即只要伺服器/客戶端模擬器能涵蓋測試案例/DUT 之輸入要求事項。此等測試環境調適應書面記錄於測試報告中。

The **test facility** will likely use a single publisher/subscriber simulator, but there is

no restriction on using one publisher/subscriber which only supports certain communication services and using another to do the rest i.e. as long as the server(s)/client(s) simulators can cover the input requirements to the test case/DUT. Such test environment adaptations shall be documented in the test report.

測試亦要求憑證機構。

A certificate authority is also required for the tests.

4.2 測試方法論

4.2 Test methodology

4.2.1 一般

4.2.1 General

測試係採非侵入模式實現。DUT 與生產系統具相同之軟體及參數。為實現符合性測試，應用層級之 IED 功能係用以產生 GOOSE 或 SV (取樣值) 訊息。當運作失效時，DUT 應具能力向測試器提供輸出以查證失效測試。輸出可能透過下列至少一項：DUT 日誌及安全事件(例：本系列標準第 14 部)、內部資料表示(例：若支援 LGOS，則為應用程式中之資料變更)及網路管理 MIB (例：本系列標準第 7 部)。此等測試依各型式分群表列。於此等表格中，測試程序具數字參引。若測試案例需多個步驟，則將其列舉為 1(a)、1(b)等。若測試包含不同變異，則將其列舉為 1-1、1-2 等。本標準中之測試案例宜參引如下：“表 1-1(a)”。

The tests are realized in a non-intrusive mode. The DUT has the same software and parameters as the production system. To realize the conformity testing, IED functions, at application level, are used to generate GOOSE or SV (Sampled Values) messages. When an operation fails, the DUT shall have the capability to provide an output to the tester to verify failing tests. The output may be through at least one of the following: DUT logs and security events (e.g. IEC 62351-14), internal data representation (e. g. if LGOS is supported, the data change in the application) and network management MIBs (e.g. IEC 62351-7). The tests are grouped in tables for each type of tests. In these tables, the test procedures have numeric references. If the test case needs more than one step, it will be enumerated as 1a), 1b), etc. If the test comprises different variants, it will be enumerated as 1-1, 1-2, etc. The test cases in this document should be referred as follows: "Table 1-1a)".

詳細之測試程序非屬本標準的一部分，而係由測試實驗室負責。宣稱有能力對此等部件執行符合性測試之測試實驗室，應取得國際公認組織的品質及技術能力認證。

The detailed test procedures are not part of this document and are left to the test labs. Test labs claiming the ability to perform conformance testing to these parts shall be accredited for quality and technical competency by an internationally recognized organization.

4.2.2 正常程序測試及韌性測試

4.2.2 Normal procedure tests and resiliency tests

CNS 62351-6 規定各 IED (客戶端及伺服器)於正常條件下應如何執行程序(預期行為)，以及於其執行期間發生非預期或故障事件時應如何表現(負面行為)。

IEC 62351-6 specifies how each IED (client and server) shall execute the procedures in normal conditions (expected behavior) and how it shall behave when unexpected or fault events occur during their execution (negative behaviors).

對於參引 CNS 62351-6 之標準所要求的必備密碼套組之一，應至少執行 1 次正常程序測試及韌性測試。

Normal procedure tests and resiliency tests shall be performed at least once for one of the mandatory cipher suites required by the standard referencing IEC 62351-6.

4.3 符合性測試要求事項

4.3 Conformance testing requirements

4.3.1 於應用全景內測試

4.3.1 Testing within the context of an application

本標準中列出之測試案例應於應用全景內執行。宣稱符合 CNS 62351-6 之 DUT 應執行要求符合 CNS 62351-6 的標準中所定義之應用協定。

The test cases listed in this document shall be executed within the context of an application. The DUT claiming conformance to IEC 62351-6 shall execute an application protocol defined in a standard requiring conformance to the IEC 62351-6.

4.3.2 待測裝置之要求事項

4.3.2 Requirements for the device under test

於此符合性測試前，DUT 宜已成功執行基底協定之符合性測試，其中可能包括 CNS 61850 系列標準 MMS 及/或 GOOSE 及/或 SV。預期提交用於此等測試之 DUT 與基底協定測試中使用的韌體版本具相同之韌體版本。

Prior to the present conformity testing, the DUT should have successfully performed the conformity testing for the base protocol which may include IEC 61850 MMS and/or GOOSE and/or SV. It is expected that the DUT submitted for these tests has the same firmware version as the one used in the base protocol testing.

於開始測試前，於開始測試前，記載 IED 中所實作特定協定的所有參數、設定值及選項之 PID (協定實作文件)為必要文件。提供所需之 PID 文件包括 PICS (協定實作符合性聲明)及 PIXIT (測試用協定實作額外資訊)，此等文件將被提供予測試實驗室並於測試期間當作參考。

Before the beginning of the testing, the PIDs (Protocol Implementation Documents) that includes all the required parameters, settings and options for a particular

protocol implemented in the IED is required. The required PIDs documents include the PICS (Protocol Implementation Conformance Statement) and PIXIT (Protocol Implementation eXtra Information for Testing) that will be provided and referenced by the test lab during the tests.

提交裝置進行測試之單位應提供下列事項：

The entity submitting the device for testing shall provide the following:

(a) 備妥進行測試之 DUT。

a) The DUT ready for testing;

(b) PICS。

b) PICS (Protocol Implementation Conformance Statement);

(c) PIXIT。

c) PIXIT (Protocol Implementation eXtra Information for Testing);

(d) 使用說明手冊，詳細說明裝置之安裝及操作或測試期間操作 DUT 之協助。

d) Instruction manuals detailing the installation and operation of the device or assistance for operating the DUT during the test.

當滿足下列條件時，裝置即備妥進行測試：

A device is ready for testing when the following are satisfied:

(a) DUT 能依 PICS 中所述作為訂用者及/或發布者進行運作。

a) The DUT is able to operate as a subscriber and/or publisher according to what has been stated in the PICS.

(b) DUT 之組態應被設定為與針對客戶端/伺服器符合性測試提交類似組態。PICS 中宣稱之所支援的安全功能組態，應被設定為容許執行所有適用的測試案例。

b) The DUT shall be configured with a similar configuration submitted for a Client/Server Conformance Test. The supported security features declared in the PICS shall all be configured to allow all applicable test cases to be executed.

(c) 依 DUT 基底協定 PIXIT 中所描述，組態中之數位及/或類比資料應能以人類可讀方式查證，例：藉由 MMS 客戶端讀取資料模型、經由 DUT HMI、LED、SNMP MIB 資料點等。若支援，則此查證亦能包括符合本系列標準第 14 部之 Syslog 事件。

c) The digital and/or analogue data that is in the configuration shall be verifiable in human readable way e.g., by an MMS client read of the data model, via the DUT HMI, LEDs, SNMP MIB Datapoint etc. as described in the DUT base protocol PIXIT. This verification can also include Syslog events according to IEC 62351-14 if supported.

(d) DUT 已成功通過初始 PID 查證，以確保所有支援之功能均已呈現並詳細說明。此查證預期於任何測試案例開始前進行。

- d) The DUT has successfully passed the initial PIDs verification to ensure all supported features have been presented and detailed. This verification is expected to be in advance of the any test case commencement.

61850 DUT 亦應包括：

61850 DUT shall also include:

- (e) SCL (變電所組態語言)格式之 IED 能力描述(ICD)
- e) IED capability description in SCL (Substation Configuration Language) format (ICD)
- (f) 支援之 SCL 格式的 CID (組態設定之 IED 描述)及/或 SCD (變電所組態描述) 及/或 IID (實例化之 IED 描述)檔案。組態設定之 SCL 檔案中的組態亦應與 PID 中所陳述之支援的功能相匹配。
- f) CID (Configured IED Description) and/or SCD (Substation Configuration Description) and/or IID (Instantiated IED description) file in SCL format as supported. The configuration within the configured SCL file shall also match the supported features stated in the PIDs.

4.3.3 測試設施要求事項

4.3.3 Requirements for the test facility

測試設施應符合下列要求事項：

The following requirements shall be satisfied by the test facility:

- 應檢視隨 DUT 提供之文件的正確性及完全性。
- The documentation provided with the DUT shall be inspected for correctness and completeness.
- 應查證 DUT 之軟體版本及硬體版本。
- The software and hardware versions of the DUT shall be verified.
- 應依基底剖繪及安全性 PID 中識別之能力為 DUT 客製化符合性測試。針對此客製化，測試設施應傳達該客製化測試計畫將涵蓋的內容。
- Conformance testing shall be customized for the DUT based on the capabilities identified in the base profile and Security PIDs. Upon this customization, the test facility shall communicate what the tailored test plan will cover.
- 表 4 及表 5 中所列之測試案例，於測試期間應不可偵測出任何錯誤。
- The test cases listed in Table 4 and Table 5 shall be performed with no errors detected during testing.
- 測試案例宜列出之次序執行，且應依循各測試案例中的步驟，此意指 DUT 能依特定測試案例中所描述作用。
- The test cases should be performed in the order listed and the steps in each test case shall be followed, which means that the DUT is able to function as described in the specific test case.

- 對於各測試案例，需於測試結果圖表之適切欄中標記測試結果。各測試案例可能通過測試(passed)、未通過測試(failed)、不適用(N.A.) (當裝置未支援該組態值時)，或未執行測試案例(empty)。理想情況下，測試完成後不宜有空框。
- For each test case, the test results need to be marked in the appropriate column of the test result chart. Each test case can either pass the test (Passed), fail the test (Failed), not applicable (N.A.), when the configuration value is not supported by the device, or the test case was not performed (Empty). Ideally, there should be no empty box when testing is complete.
- 向測試請求者發布 DUT 之符合性測試報告。
- Release a conformance test report of the DUT to the test requester.

測試能由測試軟體自動查證，或於執行後藉由人工審查測試歷程日誌以查證，前提為測試歷程日誌能清楚敘明執行哪個測試案例。若完整測試程序日誌無法提供明確敘明並清楚分離之測試案例參引，則預期將於個別測試案例後檢視其日誌。模擬器最好能彈性新增或變更測試案例，以便調適協定標準及隨 DUT 提供之 PID 的變更。於所有情況下，此測試結果應能讓測試工程師隨時於測試設施中重現。

The tests can be verified automatically by a testing software or verified manually by review of the test history log after execution provided that the test history log can clearly state which test case is run. If a complete test procedure log is not able to provide a separation with clearly stated test case references, it is expected that a log is inspected after each individual test case. The simulator is preferably flexible in adding or changing test cases in order to be adaptable to changes in the protocol standard and the PID provided with the DUT. In all cases, the test shall be reproducible over time by test engineers in the test facility.

測試之所有先決條件，包括 PID 版次、DUT 軟體版本、測試模擬器版本等，皆宜擷取於測試報告中，並於測試工程師需重現相同測試(例：因失效而重新測試)時進行維護。

All prerequisites of the tests including PID version numbers, DUT software version, Test Simulator version etc. should be captured in the Test Report and maintained in the event where test engineers need to reproduce the same test e.g., a retest due to failure.

於運作使用中，裝置可能顯示通訊及/或行為錯誤，此迫使供應者重現完整之符合性測試(例：用於事後查證)或僅重現顯示錯誤的測試。預期提供給測試設施之 DUT 及軟體版本非 Beta 版本，且已備妥上市。

In operational use, the device may show communication and/or behavior errors which forces the supplier to reproduce the complete conformance test (for example for verification afterwards) or for reproducing only the tests that were shown to have errors. It is expected that the DUT and Software version supplied to the test

facility is not a Beta version and ready for market.

測試僅聚焦於 PID 中所描述之協定元件及功能；測試不包括受測系統之應用邏輯及運作。

The test focuses only on the protocol elements and functions as described in the PIDs; the test does not include the application logic and the operation of the tested system.

對於客戶端測試，應使用經認可之伺服器。此伺服器應具發送符合及錯誤訊息之能力。

For client testing, a homologated server shall be used. This server shall have the capability of sending conformant and erroneous message.

對於伺服器測試，應使用經認可之客戶端。此客戶端應具發送符合及錯誤訊息之能力。

For server testing, a homologated client shall be used. This client shall have the capability of sending conformant and erroneous message.

重大軟體版本變更時，應重新進行符合性測試。

Conformity testing shall be performed again on major software revision changes.

對於微小之軟體修訂，僅重新測試修改後的功能係最低要求。依所實作之微小變更的顯著性，微小之修訂變更可能需或可能不需進行全面符合性測試。最低要求由測試設施而定，重新測試中進行之測試應書面記錄於測試報告中。

For minor software revision, retesting of the modified features only is a minimum requirement. Minor revision changes may or may not warrant a full conformance testing based on the significance of the minor changes implemented. The minimum requirement is at the discretion of the test facility and the tests performed in the retest shall be documented within the test report.

4.3.4 測試驗核

4.3.4 Test validation

於執行符合性測試期間，應提供下列 DUT 資訊以用於測試結果分析：

During the execution of conformance testing, the following information shall be made available by the DUT for test results analysis:

- 通訊事件(訂用、隱私)。
- communication events (subscribing, privacy);
- 應用程式更新資訊。
- Application update information;
- 監督更新資訊。
- Supervision update information.

表 2 及表 3 應由製造者填寫，以指示測試工程師如何獲得應用及監督資訊。

Table 2 and Table 3 shall be filled by the manufacturer to indicate how the Application and Supervision information is available to the test engineer.

4.4 PICS

4.4 PICS

本標準中所描述之測試程序處於抽象層級。使用者應補充此資訊以執行符合性測試。為此，測試者須為應用層級實作準備 PICS。

The test procedures described in this document are at an abstract level. The user should complement this information to perform conformity testing. To do so, the tester must prepare the PICS for the application-level implementation.

4.5 PIXIT

4.5 PIXIT

本標準規定 PIXIT 以指示如何進行及記錄測試程序。表 1 列出涵蓋所有測試之一般 PIXIT。表 2 及表 3 列出測試期間能使用之 DUT 監視及存錄能力。

This standard specifies PIXIT to indicate how to conduct and document the test procedures. Table 1 lists general PIXIT that cover all the tests. Table 2 and Table 3 list the DUT monitoring and logging capabilities that can be used during the tests.

表 1 基底剖繪之 PIXIT
Table 1 – PIXIT for Base Profile

ID	說明 Description	值/產品行為 Value/Product Behavior
Base1	描述測試期間所使用之網宇安全政策及架構： Describe the cybersecurity policies and architecture used during the tests: <ul style="list-style-type: none">• DUT• DUT• 憑證機構• Certificate Authority	
Base2	描述如何強制 DUT 由其基底剖繪啟用安全性之方法，例：組態工具、HMI 等。 Please describe the method(s) on how the DUT is forced from its base profile to security enabled e.g. Configuration Tool, HMI etc	

表 2 用於 GOOSE 安全延伸及重演測試之 PIXIT

Table 2 – PIXIT for GOOSE security extension and replay testing

ID	說明 Description	值/產品行為 Value/Product Behavior
1	描述如何強制 DUT 起始群組金鑰交換之方法 Describe the method(s) on how the DUT is forced to initiate a group- key exchange	
2	應用程式監視： Application monitoring: 描述 DUT 如何顯示或記錄應用程式更新 Describe how the DUT displays or records Application updates <ul style="list-style-type: none"> 量測值 Measurements 狀態 Status 	
3	監測監視： Supervision monitoring: 描述 DUT 如何顯示或記錄監測更新(CNS 62351 之 6.2.1.4) Describe how the DUT displays or records Supervision updates (IEC 62351-6:2020, 6.2.1.4) <ul style="list-style-type: none"> LGOS 更新 LGOS update <ul style="list-style-type: none"> 預期之 St St expected SecViol (延伸之 LGOS，依 CNS 62351-6 第 10 節中所定義) SecViol (extended LGOS as defined in IEC 62351-6 clause 10) GSAL 本地日誌 local logs, 標準化安全日誌 standardized security logs, 專屬網路管理 MIB proprietary network management MIBs 安全事件建立 security event creation, CNS 62351-7 標準化 MIB IEC 62351-7 standardized MIBs 	

表 2 用於 GOOSE 安全延伸及重演測試之 PIXIT(續)

Table 2 – PIXIT for GOOSE security extension and replay testing

ID	說明 Description	值/產品行為 Value/Product Behavior
4	描述 DUT 如何揭露安全核對未通過 Describe how the DUT exposes security check failing <ul style="list-style-type: none"> • 無效之 mAC • invalid mAC • 無效之金鑰 ID • invalid KeyID • 加密錯誤 • Encryption error 	
5	描述 DUT 如何揭露重演封包 Describe how the DUT exposes replay packet <ul style="list-style-type: none"> • 失序狀態編號(stNum) • out-of-order state numbers (stNum) • 失序序號(sqNum) • out-of-order sequence numbers (sqNum) • 交付時間偏差 • time delivery deviation 	
6	描述 DUT 如何揭露封包遺失偵測 Describe how the DUT exposes packet loss detection <ul style="list-style-type: none"> • 容許存活之時間逾期(等於 0) • time allowed to live expired (equal zero) <ul style="list-style-type: none"> – 如何計算 intTAL • – how intTAL is calculated 	
7	描述 DUT 如何揭露 GOOSE 關聯遺失 Describe how the DUT exposes the GOOSE association loss <ul style="list-style-type: none"> • 描述 DUT 如何判定關聯遺失 • Describes how the DUT determines association loss 	
8	描述 DUT 如何揭露模擬模式 Describe how the DUT exposes the Sim mode	
9	描述 DUT 如何揭露模擬資料(應用程式監視) Describe how the DUT exposes the Simulated data (Application monitoring)	

表 3 用於 SV 安全延伸及重演測試之 PIXIT

Table 3 – PIXIT for SV security extension and replay testing

ID	說明 Description	值/產品行為 Value/Product Behavior
1	<p>描述如何強制 DUT 起始群組金鑰交換之方法？</p> <p>Describe the method(s) on how the DUT is forced to initiate a group-key exchange?</p>	
2	<p>應用程式監視：</p> <p>Application monitoring:</p> <p>描述 DUT 如何顯示或記錄應用程式更新</p> <p>Describe how the DUT displays or records Application updates</p> <ul style="list-style-type: none"> 量測值 Measurements 狀態 Status 	
3	<p>監測監視：</p> <p>Supervision monitoring:</p> <p>描述 DUT 如何顯示或記錄監測更新(CNS 62351-6 之 6.2.2.3.3)</p> <p>Describe how the DUT displays or records Supervision updates (IEC 62351-6:2020, 6.2.2.3.3)</p> <ul style="list-style-type: none"> ΛΣςΣ更新 ΛΣςΣ υπδατε <ul style="list-style-type: none"> Σεχςιολ (延伸之ΛΣςΣ，依XNΣ 62351-6第10節中所定義) SecViol (extended LSVS as defined in IEC 62351-6 clause 10) ΓΣΑΛ 本地日誌。 λοχαλ λογς, 標準化安全日誌。 ςτανδαρδιζεδ σεχυριτυ λογς, 專屬網路管理MIB。 προπριεταρψ νετωορκ μαναγεμεντ MIBς 安全事件建立。 security event creation, CNS 62351-7 標準化 MIB。 IEC 62351-7 standardized MIBs 	

表 3 用於 SV 安全延伸及重演測試之 PIXIT(續)

Table 3 – PIXIT for SV security extension and replay testing

ID	說明 Description	值/產品行為 Value/Product Behavior
4	描述 DUT 如何揭露安全核對未通過 Describe how the DUT exposes security check failing <ul style="list-style-type: none"> 無效之 mAC invalid mAC 無效之金鑰 ID invalid KeyID 加密錯誤 Encryption error 	
5	描述 DUT 如何揭露重演封包 Describe how the DUT exposes replay packet <ul style="list-style-type: none"> 安全時戳重演 security time stamp replay smpCnt 錯誤 smpCnt error 	
6	描述 DUT 如何揭露 SV 封包遺失 ? Describe how the DUT exposes the SV packet loss ? <ul style="list-style-type: none"> 描述 DUT 如何計算下一個封包之時間延遲 (expNxtPkt) [參照 CNS 62351-6 之 6.2.2.3 (6)] Describe how the DUT calculates time delay for next packet (expNxtPkt) (ref IEC 62351-6 6.2.2.3 6)) 	
7	描述 DUT 如何揭露 SV 連接遺失 ? Describe how the DUT exposes the SV connection loss ?	

4.6 訂用者型式 DUT 之測試案例

4.6 Tests cases for subscriber-type DUT

表 4 62351-6 訂用者遵循性

Table 4 – 62351-6 Subscriber Compliance

測試案例 Test Case	標題 Title	測試案例說明 Test Case Description	結果 Results
表 9 Table 9	GOOSE 訂用者安全 延伸之查證 Verification of GOOSE subscriber security extension	驗核 DUT 遵循： Validate DUT compliancy to: <ul style="list-style-type: none"> 機密性 Confidentiality 鑑別 Authentication 	必備 mandatory <input type="checkbox"/> 通過 <input type="checkbox"/> Passed <input type="checkbox"/> 未通過 <input type="checkbox"/> Failed
表 11 Table 11	GOOSE 重演要求事 項之查證 - Verification of GOOSE Replay Requirements	驗核 DUT： Validate that the DUT: <ul style="list-style-type: none"> 處理鑑別值 Process the AuthenticationValue 重演驗核 Replay validation 逾時偵測 Time-out detection 	必備 mandatory <input type="checkbox"/> 通過 <input type="checkbox"/> Passed <input type="checkbox"/> 未通 過 <input type="checkbox"/> Failed
表 14 Table 14	SV 訂用者安全延伸 之查證 Verification of SV Subscriber Security Extension	驗核 DUT 遵循：(c1) Validate DUT compliancy to: (c1) <ul style="list-style-type: none"> 鑑別 Authentication 	必備 mandatory <input type="checkbox"/> 通過 <input type="checkbox"/> Passed <input type="checkbox"/> 未通 過 <input type="checkbox"/> Failed
表 16 Table 16	SV 訂用者重演要求 事項之查證 Verification of SV subscriber Replay Requirements	驗核 DUT： Validate that the DUT: <ul style="list-style-type: none"> 處理鑑別值 Process the AuthenticationValue 重演驗核 Replay validation 逾時偵測 Time-out detection 	必備 mandatory <input type="checkbox"/> 通過 <input type="checkbox"/> Passed <input type="checkbox"/> 未通過 <input type="checkbox"/> Failed

表 17 Table 17	SCL 延伸之查證 Verification of SCL extensions	驗核 DUT 支援所有 SCL 延伸 Validate that the DUT supports all the SCL extensions	必備 mandatory <input type="checkbox"/> 通過 <input type="checkbox"/> Passed <input type="checkbox"/> 未通過 <input type="checkbox"/> Failed
C1：不建議對取樣值使用加密。 C1: Use of encryption is not recommended for sampled values			

4.7 發布者型式 DUT 之測試案例

4.7 Tests cases for publisher-type DUT

表 5 62351-6 發布者遵循性

Table 5 – 62351-6 Publisher Compliance

測試案例 Test Case	標題 Title	測試案例說明 Test Case Description	結果 Results
表 10 Table 10	GOOSE 發布者安全延伸之查證 – Verification of GOOSE publisher security extension	驗核 DUT 遵循： Validate DUT compliancy to: • 機密性 • Confidentiality • 鑑別 • Authentication	必備 mandatory <input type="checkbox"/> 通過 <input type="checkbox"/> Passed <input type="checkbox"/> 未通過 <input type="checkbox"/> Failed
表 15 Table 15	SV 發布者安全延伸之查證 – Verification of SV publisher security extension	驗核 DUT 遵循： Validate DUT compliancy to: • 機密性 • Confidentiality • 鑑別 • Authentication	必備 mandatory <input type="checkbox"/> 通過 <input type="checkbox"/> Passed <input type="checkbox"/> 未通過 <input type="checkbox"/> Failed
表 17 Table 17	SCL 延伸之查證 Verification of SCL extensions	驗核 DUT 支援所有 SCL 延伸 Validate that the DUT supports all the SCL extensions	必備 mandatory <input type="checkbox"/> 通過 <input type="checkbox"/> Passed <input type="checkbox"/> 未通過 <input type="checkbox"/> Failed

5. 62351-6 之符合性測試

5 Conformity Testing for 62351-6

5.1 62351-6 安全剖繪之 PICS

5.1 PICS for 62351-6 security profile

宣稱符合本標準之實作應提供延伸的 PICS，如下列子節所描述。對於某些剖繪，可能需提供額外之 PIXIT 資訊。

Implementations claiming conformance to this specification shall provide an extended PICS as set forth in the following subclauses. For some profiles, additional PIXIT information may need to be provided.

應針對宣稱支援本標準之實作提供表 6 中的資訊。廠商及測試實驗室宜使用 CNS 62351-6 中之 PICS 表及 PIXIT 表。

The information in Table 6 shall be provided for an implementation claiming support for this specification. Vendor and test laboratory should use PICS and PIXIT tables from the IEC 62351-6.

表 6 符合性表

Table 6 – Conformance table

	剖繪說明 Profile Description	客戶端 Client	伺服器 Server	值/註解 Value/Comment
		f/s	f/s	
G1	支援 CNS 61850-8-1/ISO 9506 安全客戶端/伺服器 Support for IEC 61850-8-1/ISO 9506 security Client/ Server	o	o	AtLeastOne(1)
G2	支援 CNS 61850-8-1 L2 GOOSE 安全 Support for IEC 61850-8-1 L2 GOOSE security	o	o	AtLeastOne(1)
G3	支援 IEC 61850-9-2 L2 SV 安全 Support for IEC 61850-9-2 L2 SV security	o	o	AtLeastOne(1)
G4	支援 CNS 61850-8-1 可路由 GOOSE 安全 Support for IEC 61850-8-1 routable GOOSE security	o	o	AtLeastOne(1)

表 6 符合性表(續)

Table 6 – Conformance table

	剖繪說明 Profile Description	客戶端 Client	伺服器 Server	值/註解 Value/Comment
G5	支援 IEC 61850-9-2 可路由 SV 安全 Support for IEC 61850-9-2 routable SV security	o AtLeastOne(1)	o AtLeastOne(1)	
G6	支援 CNS 61850-8-2 Support for IEC 61850-8-2	o	o	
G7	支援 SNTP 安全 Support for SNTP security	o	o	

5.2 GOOSE 安全符合性測試

5.2 GOOSE Security Conformity Testing

5.2.1 一般

5.2.1 General

宣稱符合 CNS 62351-6 之 GOOSE 訂用者 DUT 應成功通過表 9 及表 11 中所描述的測試。測試參照表 7 所示之狀態。表 8 列出不同之安全性剖繪。

GOOSE subscriber DUT claiming conformance to IEC 62351-6 shall successfully pass the tests described in Table 9 and Table 11. The tests refer to the states shown Table 7. Table 8 lists the different security profiles.

測試程序要求使用至少 2 個 GOOSE 發布者以驗核第 1 個 GOOSE 訂用中存在之安全違反事項不影響第 2 個訂用的 GOOSE。若安全違反事項影響第 2 個 GOOSE 訂用，則測試案例結果未成功。

The test procedures require the use of at least two GOOSE publishers to validate that the presence of security violation in the first GOOSE subscription does not impact the second subscribed GOOSE. Should a security violation impact the second GOOSE subscription, the test cases result failed.

表 7 中顯示之某些狀態係暫態，測試程序中未提及。

Some of the states shown in Table 7 are transient and are not mentioned in the test procedures.

宣稱符合 CNS 62351-6 之 GOOSE 發布者 DUT 應成功通過表 10 中所描述的測試。GOOSE publisher DUT claiming conformance to IEC 62351-6 shall successfully pass the tests described in Table 10.

於執行測試程序前，安全政策及群組金鑰配發(GDOI)應已成功執行。測試此等要求事項非屬本標準範圍。

Before performing the test procedures, security policies and group key distribution (GDOI) shall have been performed successfully. Testing these requirements is outside the scope of IEC 62351-100-6.

測試結果能使用表 2 中所描述之工具查證。

Test results can be verified using the tools described in Table 2.

於執行所有測試案例前，測試設施應對 PID 格式及內容進行初始查證。

An initial verification of the PIDs format and contents shall be undertaken by the test facility prior to any test cases being performed.

表 7 GOOSE 狀態變遷測試矩陣

Table 7 – GOOSE State Transition Tests Matrix

狀態 State	最終 Final														
初始 Initial	id	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	1	-	tG1	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	tG2	-	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	tG3	-	-	-	-	tG4	-	-	-	-	-
	4	-	-	-	-	tG5	-	-	-	-	-	tG6	-	-	-
	5	-	-	-	-	-	tG5	-	-	-	-	-	-	-	-
	6	-	-	-	-	-	-	tG5	-	-	-	-	-	-	-
	7	-	-	-	-	-	-	-	tG5	-	-	-	-	-	-
	8	-	-	tG7	-	-	-	-	-	-	-	tG11	-	-	-
	9	-	-	-	-	-	-	-	tG4	-	-	-	-	-	-
	10	-	-	-	-	-	-	-	tG6	-	-	-	-	-	-
	11	-	-	-	-	-	-	-	-	-	-	-	tG8	-	-
	12	-	-	-	-	-	-	-	-	-	-	-	-	tG8	-
	13	-	-	-	-	-	-	-	-	-	-	-	-	-	tG8
	14	-	tG8	-	-	-	-	-	-	-	-	-	-	-	-

表 8 L2-GOOSE 及 R-GOOSE 安全剖繪

Table 8 – L2-GOOSE and R-GOOSE Security profiles

	發布者 Publisher	組態設定 GSEControl.securityEnabled之訂用者： Subscriber with GSEControl.securityEnabled configured:	未組態設定 GSEControl.securityEnabled之訂用者： Subscriber with GSEControl.securityEnabled non configured:	註解 Comment
不安全 Non-secure	發送未具 AuthenticationValue 之 PDU。 Send PDU without AuthenticationV alue	m	m	tG3s-1
具鑑別 With Authentication	發送具 AuthenticationValue及 未加密之PDU。 Send PDU with AuthenticationValue and PDU not encrypted	m	o, c1	tG3s-2 tG3s-3 tG3s-4
具鑑別及隱私 With authentication and privacy	發送具 AuthenticationValue 及 加密之PDU。 Send PDU with AuthenticationValue and encrypted PDU	m, c2	未支援 Not supported	tG3s-5 tG3s-6
c1：使用鑑別接受PDU。 c1: The PDU is accepted with authentication c2：此剖繪不宜用於L2 GOOSE。 c2: This profile should not be used for L2 GOOSE				

5.2.2 測試程序

5.2.2 Test Procedures

表 9 GOOSE 訂用者安全延伸之查證

Table 9 – Verification of GOOSE subscriber security extension

編號 No	測試 Test	預期結果 Expected result	參引 Reference	要求 Required
tG1s	DUT 訂用啟用安全延伸之 GOOSE 訊息。 DUT subscribes to GOOSE message with security extensions enabled.	DUT 接收訂用確認。 DUT to receive subscription confirmation. DUT 等候 GOOSE 訊息(狀態 2)。 DUT to wait for GOOSE message (state 2)	CNS 62351-6 之 6.2.1 (1) IEC 62351-6:2020, 6.2.1 1)	m
tG3-1s	TEQ 發送 GOOSE PDU : TEQ to send GOOSE PDU: 無鑑別值延伸 without Authentication value extension	若 DUT 組態設定為 GSEControl.securityEnabled : If the DUT has GSEControl.securityEnabled configured: <ul style="list-style-type: none"> 若 DUT 偵測出 PDU 未具安全延伸並發出錯誤信號，則測試成功。 The test succeeds if the DUT detect that the PDU does not have security extension and signal an error. 若 DUT 未偵測出錯誤，則測試未成功。 The test fails if the DUT does not detect the error. 若 DUT 未組態設定為 GSEControl.securityEnabled，則 If the DUT does not have GSEControl.securityEnabled configured <ul style="list-style-type: none"> 訂用者應接受傳入之 GOOSE 訊息，且不應起始安全核對失效。 The subscriber shall accept the incoming GOOSE message 	CNS 62351-6 之 6.2.1 (2)及(3) IEC 62351-6:2020, 6.2.1 2) and 3) CNS 62351-6 之 6.2.1.2 IEC 62351-6:2020, 6.2.1.2 PIXIT 表 2-2 PIXIT table 2-2 PIXIT 表 2-3 之 ICD PIXIT table 2-3, ICD	m

		and shall not initiate a security check failure.		
tG3-2s	<p>TEQ 發送 GOOSE PDU :</p> <p>TEQ to send GOOSE PDU:</p> <p>包括鑑別值延伸</p> <p>that includes Authentication value extension</p> <p>未加密之 PDU :</p> <p>unencrypted PDU:</p>	<p>若 DUT 組態設定為 GSEControl.securityEnabled :</p> <p>If the DUT has GSEControl.securityEnabled configured:</p> <ul style="list-style-type: none"> • 若 DUT 未偵測出錯誤，則測試成功。 • The test succeeds if the DUT does not detect the error. • 若 DUT 發出錯誤信號，則測試未成功。 • The test fails if the DUT signals an error. <p>若 DUT 未組態設定為 GSEControl.securityEnabled，則</p> <p>If the DUT does not have GSEControl.securityEnabled configured</p> <ul style="list-style-type: none"> • 訂用者應接受傳入之 GOOSE 訊息，且不應起始安全核對失效。 • The subscriber shall accept the incoming GOOSE message and shall not initiate a security check failure 	<p>CNS 62351-6 之 6.2.1 (2)及(3)</p> <p>IEC 62351-6:2020, 6.2.1 2) and 3)</p> <p>CNS 62351-6 之 6.2.1.2</p> <p>IEC 62351-6:2020, 6.2.1.2</p> <p>PIXIT 表 2-2</p> <p>PIXIT table 2-2</p> <p>PIXIT 表 2-3 之 ICD</p> <p>PIXIT table 2-3, ICD</p>	m

編號 No	測試 Test	預期結果 Expected result	參引 Reference	要求 Required
tG3-3s	<p>TEQ 發送 GOOSE PDU :</p> <p>TEQ to send GOOSE PDU</p> <ul style="list-style-type: none"> • 包括鑑別值延伸 • that includes Authentication value extension • 未加密之 PDU • Unencrypted PDU • 無效之 mAC • invalid mAC 	<p>若 DUT 組態設定為 GSEControl.securityEnabled :</p> <p>If the DUT has GSEControl.securityEnabled configured:</p> <ul style="list-style-type: none"> • 若 DUT 偵測出 mAC 錯誤，則測試成功。 • 若 DUT 未偵測出 mAC 錯誤，則測試未成功。 • The test succeeds if the DUT detects the mAC error. • The test fails if the DUT does not detect the mAC error <p>若 DUT 未組態設定為 GSEControl.securityEnabled，則</p> <p>If the DUT does not have GSEControl.securityEnabled configured</p> <ul style="list-style-type: none"> • 訂用者應接受傳入之 GOOSE 訊息，且不應起始安全核對失效。 • The subscriber shall accept the incoming GOOSE message and shall not initiate a security check failure. 	<p>CNS 62351-6 之 6.2.1(2) 及 (3)</p> <p>IEC 62351-6:2020, 6.2.1 2) and 3)</p> <p>CNS 62351-6 之 6.2.1.2</p> <p>IEC 62351-6:2020, 6.2.1.2</p> <p>PIXIT 表 2-2</p> <p>PIXIT table 2-2</p> <p>PIXIT 表 2-3 之 ICD</p> <p>PIXIT table 2-3, ICD</p> <p>PIXIT 表 2-4</p> <p>PIXIT table 2-4</p>	m
tG3-4s	<p>TEQ 發送 GOOSE PDU :</p> <p>TEQ to send GOOSE PDU:</p> <ul style="list-style-type: none"> • 包括鑑別值延伸 • includes Authentication value extension • 未加密之 PDU • Unencrypted PDU • 無效之 mAC • Invalid KeyID 	<p>若 DUT 組態設定為 GSEControl.securityEnabled :</p> <p>If the DUT has GSEControl.securityEnabled configured:</p> <ul style="list-style-type: none"> • 若 DUT 偵測出 KeyID 錯誤，則測試成功。 • The test succeeds if the DUT detects the KeyID error. • 若 DUT 未偵測出 KeyID 錯誤，則測試未成功。 • The test fails if the DUT does not detect 	<p>CNS 62351-6 之 6.2.1 (2)及 (3)</p> <p>IEC 62351-6:2020, 6.2.1 2) and 3)</p> <p>CNS 62351-6 之 8.2.2.6</p> <p>IEC 62351-6:2020, 8.2.2.6</p> <p>CNS 62351-6 之 6.2.1.2</p>	m

		<p>the KeyID error</p> <p>若 DUT 未組態設定為 GSEControl.securityEnabled，則</p> <p>If the DUT does not have GSEControl.securityEnabled configured</p> <ul style="list-style-type: none"> 訂用者應接受傳入之 GOOSE 訊息，且不應起始安全核對失效。 The subscriber shall accept the incoming GOOSE message and shall not initiate a security check failure 	<p>IEC 62351-6:2020, 6.2.1.2</p> <p>PIXIT 表 2-2</p> <p>PIXIT table 2-2</p> <p>PIXIT 表 2-3 之 ICD</p> <p>PIXIT table 2-3, ICD</p> <p>PIXIT 表 2-4</p> <p>PIXIT table 2-4</p>	
tG3-5s	<p>TEQ 發送 GOOSE PDU：</p> <p>TEQ to send GOOSE PDU:</p> <ul style="list-style-type: none"> 包括鑑別值延伸 includes Authentication value extension 加密之 PDU encrypted PDU: 	<p>DUT 應驗核鑑別延伸</p> <ul style="list-style-type: none"> The DUT shall validate the authentication extension 若 DUT 未偵測出錯誤，則測試成功。 The test succeeds if the DUT does not detect an error. 若 DUT 發出錯誤信號，則測試未成功。 The test fails if the DUT signals an error 	<p>CNS 62351-6 之 6.2.1 (2)及 (3)</p> <p>IEC 62351-6:2020, 6.2.1 2) and 3)</p> <p>CNS 62351-6 之 8.2.2</p> <p>IEC 62351-6:2020, 8.2.2</p> <p>CNS 62351-6 之 6.2.1.2</p> <p>IEC 62351-6:2020, 6.2.1.2</p> <p>PIXIT 表 2-2</p> <p>PIXIT table 2-2</p> <p>PIXIT 表 2-3 之 ICD</p> <p>PIXIT table 2-3, ICD</p> <p>PIXIT 表 2-4</p> <p>PIXIT table 2-4</p>	m

編號 No	測試 Test	預期結果 Expected result	參引 Reference	要求 Required
tG3-6s	<p>TEQ 發送 GOOSE PDU:</p> <p>TEQ to send GOOSE PDU:</p> <ul style="list-style-type: none"> • 包括鑑別值延伸 • includes Authentication value extension • PDU 發生加密錯誤。 • PDU having an encryption error 	<p>DUT 應驗核鑑別延伸</p> <p>The DUT shall validate the authentication extension</p> <ul style="list-style-type: none"> • 若 DUT 偵測出並發出加密錯誤信號，則測試成功。 • The test succeeds if the DUT detects and signals the encryption error. • 若 DUT 發出錯誤信號，則測試未成功。 • The test fails if the DUT signals an error 	<p>CNS 62351-6 之 6.2.1 (2) 及 (3)</p> <p>IEC 62351-6:2020, 6.2.1 2) and 3)</p> <p>CNS 62351-6 之 8.2.2</p> <p>IEC 62351-6:2020, 8.2.2</p> <p>CNS 62351-6 之 6.2.1.2</p> <p>IEC 62351-6:2020, 6.2.1.2</p> <p>PIXIT 表 2-2</p> <p>PIXIT table 2-2</p> <p>PIXIT 表 2-3 之 ICD</p> <p>PIXIT table 2-3, ICD</p> <p>PIXIT 表 2-4</p> <p>PIXIT table 2-4</p>	m

表 10 GOOSE 發布者安全延伸之查證

Table 10 – Verification of GOOSE publisher security extension

編號 No	測試 Test	預期結果 Expected result	參引 Reference	要求 Required
	雙側皆組態設定安全政策，其中敘明哪些憑證及/或憑證機構係可接受。 Both sides are configured with a security policy, which states, which certificates and/or certificate authorities are acceptable	DUT 具群組金鑰及相關聯之安全政策。 The DUT possesses the group keys and the associated security policy.		
tG1p	TEQ 訂用 DUT GOOSE 發布者。 TEQ to subscribe to DUT GOOSE publisher	TEQ 應驗核鑑別值。 <ul style="list-style-type: none"> Version TimeofCurrentKey TimeofNextKey InitializationVector KeyID TEQ shall validate the authentication value. <ul style="list-style-type: none"> Version TimeofCurrentKey TimeofNextKey InitializationVector KeyID 	CNS 62351-6 之 6.2.1 (1) IEC 62351-6:2020, 6.2.1 1) CNS 62351-6 之 8.2.2.4 IEC 62351-6:2020, 8.2.2.4 CNS 62351-6 之 8.2.2.3 IEC 62351-6:2020, 8.2.2.3	m

表 11 GOOSE 重演要求事項之查證

Table 11 – Verification of GOOSE Replay Requirements

編號 No	測試 Test	預期結果 Expected result	參引 Reference	要求 Required
	雙側皆組態設定安全政策，其中敘明哪些憑證及/或憑證機構係可接受。 Both sides are configured with a security policy, which states, which certificates and/or certificate authorities are acceptable	DUT 具群組金鑰及相關聯之安全政策。 The DUT possesses the group keys and the associated security policy.		

tG1s	<p>DUT 訂用 GOOSE 訊息。</p> <p>DUT subscribes to GOOSE message</p>	<p>DUT 接收訂用確認。</p> <p>DUT to receive subscription confirmation.</p> <p>DUT 等候 GOOSE 訊息 (狀態 2)。</p> <p>DUT to wait for GOOSE message (state 2)</p>	<p>CNS 62351-6 之 6.2.1.1</p> <p>(1)及(2)</p> <p>IEC 62351-6:2020, 6.2.1.1</p> <p>1) and 2)</p>	m
tG5s	<p><u>正常狀態</u></p> <p><u>Normal state</u></p> <p>TEQ 發送具各種狀態變更之 GOOSE PDU</p> <p>TEQ to send GOOSE PDUs with various states changes</p> <ul style="list-style-type: none"> 有效之安全延伸 valid security extensions 有效之 stNum sqNum 值 valid stNum sqNum values 	<ul style="list-style-type: none"> 若 DUT 未偵測出任何錯誤，則測試成功。 The test succeeds if the DUT does not detect any error. 宜於應用程式層級更新值。 Value should be updated at the application level 發出良好封包信號並記錄於監測層級。 Good packet signalled and recorded at the supervision level 若 DUT 偵測出並發出錯誤信號，則測試未成功。 The test fails if the DUT detects and signals an error. <p>DUT 等候另一 GOOSE PDU (狀態 8)。</p> <p>The DUT waits for another GOOSE PDU (state 8)</p>	<p>CNS 62351-6 之 6.2.1.1</p> <p>(4)至(8)</p> <p>IEC 62351-6:2020, 6.2.1.1</p> <p>4) to 8)</p> <p>CNS 62351-6 之 6.2.1.3</p> <p>IEC 62351-6:2020-6.2.1.3</p> <p>CNS 62351-6:2020 之 6.2.1.4</p> <p>IEC 62351-6:2020-6.2.1.4</p> <p>PIXIT 表 2-2</p> <p>PIXIT table 2-2</p> <p>PIXIT 表 2-3 之 ICD</p> <p>PIXIT table 2-3, ICD</p>	
tG6s-1	<p><u>重演偵測</u></p> <p><u>Replay detection</u></p> <p>當發送有效之 GOOSE PDU 時，TEQ 發送 GOOSE PDU</p> <p>While sending valid GOOSE PDU, the TEQ sends a GOOSE PDU</p> <ul style="list-style-type: none"> 有效之安全延伸 	<ul style="list-style-type: none"> 若 ΔYT 偵測出並發出時間偏差錯誤信號，則測試成功。 Της τεστ συχχρεδ σ ιφ της ΔΥΤ δετεχτισ ανδ σιγναλσ της τιμε δεπιατ ιον ερρορ. 若 ΔYT 未偵測出時間偏差錯誤，則測試未成功。 Της test fails if the DUT does not detect 	<p>CNS 62351-6 之 6.2.1.1</p> <p>(4)至(8)</p> <p>IEC 62351-6:2020, 6.2.1.1</p> <p>4) to 8)</p> <p>CNS 62351-6 之 6.2.1.3</p> <p>IEC</p>	m

	<ul style="list-style-type: none"> valid security extensions 有效之 stNum sqNum 值 valid stNum sqNum values 時戳 - lastRcvT > 本地交付偏差 timestamp - lastRcvT > local delivery deviation 	<p>the time deviation error</p> <p>DUT 等候另一 GOOSE PDU (狀態 8)。</p> <ul style="list-style-type: none"> The DUT waits for another GOOSE PDU (state 8) 	<p>62351-6:2020, 6.2.1.3</p> <p>CNS 62351-6:2020 之 6.2.1.4</p> <p>IEC 62351-6:2020-6.2.1.4</p> <p>PIXIT 表 2-2</p> <p>PIXIT table 2-2</p> <p>PIXIT 表 2-3 之 ICD</p> <p>PIXIT table 2-3, ICD</p> <p>PIXIT 表 2-5</p> <p>PIXIT table 2-5</p>	
tG6s-2	<p><u>重演偵測</u></p> <p><u>Replay detection</u></p> <p>當發送有效之 GOOSE PDU 時, TEQ 發送 GOOSE PDU</p> <p>While sending valid GOOSE PDU, the TEQ sends a GOOSE PDU</p> <ul style="list-style-type: none"> 有效之安全延伸。 valid security extensions 重演之 stNum。 replayed stNum 	<ul style="list-style-type: none"> 若 DUT 偵測出並發出重演之 stNum 信號, 則測試成功。 The test succeeds if the DUT detects and signals the. replayed stNum 若 DUT 未偵測出重演之 stNum, 則測試未成功。 The test fails if the DUT does not detect the replayed stNum <p>DUT 等候另一 GOOSE PDU(狀態 8)。</p> <p>The DUT waits for another GOOSE PDU (state 8)</p>	<p>CNS 62351-6 之 6.2.1.1 (4)至(8)</p> <p>IEC 62351-6:2020-6.2.1.1</p> <p>4) to 8)</p> <p>CNS 62351-6:2020 之 6.2.1.3</p> <p>IEC 62351-6:2020-6.2.1.3</p> <p>CNS 62351-6:2020 之 6.2.1.4</p> <p>IEC 62351-6:2020-6.2.1.4</p> <p>PIXIT 表 2-2</p> <p>PIXIT table 2-2</p> <p>PIXIT 表 2-3 之 ICD</p> <p>PIXIT table 2-3, ICD</p> <p>PIXIT 表 2-5</p> <p>PIXIT table 2-5</p>	m

編號 No	測試 Test	預期結果 Expected result	參引 Reference	要求 Required
tG6s-3	<p>重演偵測 Replay detection</p> <p>當發送有效之 GOOSE PDU 時，TEQ 發送 GOOSE PDU</p> <p>While sending valid GOOSE PDUs, the TEQ sends a GOOSE PDU</p> <ul style="list-style-type: none"> 有效之 security 延伸 valid security extensions 重演 sqNum replayed sqNum 	<ul style="list-style-type: none"> 若 DUT 偵測出並發出重演之 stNum 信號，則測試成功。 The test succeeds if the DUT detects and signals the. replayed sqNum 若 DUT 未偵測出重演之 stNum，則測試未成功。 The test fails if the DUT does not detect the replayed sqNum <p>DUT 等候另一 GOOSE PDU(狀態 8)。</p> <p>The DUT waits for another GOOSE PDU (state 8)</p>	<p>CNS 62351-6 之 6.2.1.1(4) 至 (8)</p> <p>IEC 62351-6:2020-6.2.1.1 4) to 8)</p> <p>CNS 62351-6:2020 之 6.2.1.3</p> <p>IEC 62351-6:2020-6.2.1.3</p> <p>CNS 62351-6:2020 之 6.2.1.4</p> <p>IEC 62351-6:2020-6.2.1.4</p> <p>PIXIT 表 2-2</p> <p>PIXIT table 2-2</p> <p>PIXIT 表 2-3 之 ICD</p> <p>PIXIT table 2-3, ICD</p> <p>PIXIT 表 2-5</p> <p>PIXIT table 2-5</p>	m
tG6s-4	<p>正常至模擬變遷 Normal to Sim transition</p> <p>TEQ 發送具各種狀態變更之 GOOSE PDU</p> <p>TEQ to send GOOSE PDUs with various states changes</p> <ul style="list-style-type: none"> 有效之 security 延伸 valid security extensions 	<p>DUT 不應偵測出任何錯誤。</p> <p>The DUT shall not detect any errors.</p> <p>應用程式監視應顯示狀態變更(狀態 5) – 模擬值之指示。</p> <p>Application monitoring shall display the status changes (state 5) – Indication of simulated value</p>	<p>CNS 62351-6 之 6.2.1.1 (4) 至 (8)</p> <p>IEC 62351-6:2020-6.2.1.1 4) to 8)</p> <p>CNS 62351-6:2020 之 6.2.1.3</p> <p>IEC</p>	m

	<ul style="list-style-type: none"> • LPHD.sim = TRUE • LPHD.sim = TRUE • 有效之 stNum sqNum 值 • valid stNum sqNum values 	<p>監督監視應顯示“良好封包監督更新”(狀態 6 及 7)。</p> <p>Supervision monitoring shall display "good packet supervision update" (state 6 and 7)</p> <p>DUT 等候另一 GOOSE PDU(狀態 8)。</p> <p>The DUT waits for another GOOSE PDU (state 8)</p>	<p>62351-6:2020-6.2.1.3</p> <p>CNS 62351-6:2020 之 6.2.1.4</p> <p>IEC 62351-6:2020-6.2.1.4</p> <p>PIXIT 表 2-2</p> <p>PIXIT table 2-2</p> <p>PIXIT 表 2-3 之 ICD</p> <p>PIXIT table 2-3, ICD</p> <p>PIXIT 表 2-8</p> <p>PIXIT table 2-8</p> <p>PIXIT 表 2-9</p> <p>PIXIT table 2-9</p>	
tG6s-5	<p><u>模擬至正常變遷</u></p> <p><u>Sim to Normal transition</u></p> <p>TEQ 發送具各種狀態變更之 GOOSE PDU</p> <p>TEQ to send GOOSE PDUs with various states changes</p> <ul style="list-style-type: none"> • 有效之 security 延伸 • valid security extensions • LPHD.sim = FALSE • LPHD.sim = FALSE <p>有效之 stNum sqNum 值</p> <p>valid stNum sqNum values</p>	<p>DUT 不應偵測出任何錯誤。</p> <p>The DUT shall not detect any errors.</p> <p>應用程式監視應顯示狀態變更(狀態 5)。</p> <p>Application monitoring shall display the status changes (state 5)</p> <p>監測監視應顯示“良好封包監測更新”(狀態 6 及 7)。</p> <p>Supervision monitoring shall display "good packet supervision update" (state 6 and 7)</p> <p>DUT 等候另一 GOOSE PDU (狀態 8)。</p> <p>The DUT waits for another GOOSE PDU (state 8)</p>	<p>CNS 62351-6 之 6.2.1.1 (4)至(8)</p> <p>IEC 62351-6:2020-6.2.1.1 4) to 8)</p> <p>CNS 62351-6:2020 之 6.2.1.3</p> <p>IEC 62351-6:2020-6.2.1.3</p> <p>CNS 62351-6:2020 之 6.2.1.4</p> <p>IEC 62351-6:2020-6.2.1.4</p> <p>PIXIT 表 2-2</p> <p>PIXIT table 2-2</p>	m

			PIXIT 表 2-3 之 ICD PIXIT table 2-3, ICD PIXIT 表 2-8 PIXIT table 2-8 PIXIT 表 2-9 PIXIT table 2-9	
tG8s	<p><u>關聯遺失偵測</u></p> <p>Association lost detection</p> <p>於此測試前，TEQ 應維持現用關聯且 DUT 應備妥接收 GOOSE PDU (狀態 8)。</p> <p>Prior to this test, the TEQ shall maintain an active association and the DUT shall be ready to receive a GOOSE PDU (state 8)</p> <p>TEQ 停止發送 GOOSE PDU。</p> <p>TEQ to stop sending GOOSE PDU</p>	<ul style="list-style-type: none"> 若 DUT 偵測出並發出依“容許存活之內部時間” intTAL 到期而遺失的多播關聯之信號，則測試成功。 The test succeeds if the DUT detects and signals a multicast association lost based on expiration of "internal time allowed to live" intTAL. <ul style="list-style-type: none"> lastRcvStNum 設定為無效。 lastRcvStNum is set to invalid lastRcvSqNum 設定為無效。 lastRcvSqNum is set to invalid 若 DUT 未偵測出多播遺失，則測試未成功。 The test fails if the ΔYT does not detect the multicast lost <p>DUT 等候另一 GOOSE PDU(狀態 2)。</p> <p>The DUT waits for another GOOSE PDU (state 2)</p>	CNS 62351-6 之 6.2.1.1 (8) 及 11 至(14) IEC 62351-6:2020-6.2.1.1 8) and 11 to 14) CNS 62351-6:2020 之 6.2.1.4 IEC 62351-6:2020-6.2.1.4 PIXIT 表 2-2 PIXIT table 2-2 PIXIT 表 2-3 之 ICD PIXIT table 2-3, ICD PIXIT 表 2-7 PIXIT table 2-7	m

5.3 SV 安全符合性測試

5.3 SV Security Conformity Testing

5.3.1 一般

5.3.1 General

宣稱符合 CNS 62351-6 之 SV 訂用者 DUT，應成功通過表 14 及表 16 中所描述的測試。測試參照表 12 中所示之狀態。表 13 列出不同之安全性剖繪。

SV subscriber DUT claiming conformance to IEC 62351-6 shall successfully pass the tests described in Table 14 and Table 16. The tests refer to the states shown in Table 12. Table 13 lists the different security profiles.

測試程序要求使用至少 2 個 SV 發布者以驗核第 1 個 SV 訂用中存在之安全違反事項不影響第 2 個訂用的 SV。若安全違反事項影響第 2 個 SV 訂用，則測試案例結果未成功。

The test procedures require the use of at least two SV publishers to validate that the presence of security violation in the first SV subscription does not impact the second subscribed SV. Should a security violation impact the second SV subscription, the test cases result failed.

表 12 中顯示之某些狀態係暫態，且於測試程序中未提及。

Some of the states shown in Table 12 are transient and are not mentioned in the test procedures.

宣稱符合 CNS 62351-6 之 SV 發布者 DUT 應成功通過表 15 中所描述的測試。

SV publisher DUT claiming conformance to IEC 62351-6 shall successfully pass the tests described in Table 15.

於執行測試程序前，安全政策及群組金鑰配發(GDOI)應已成功執行。測試此等要求事項非屬本標準範圍。

Before performing the test procedures, security policies and group key distribution (GDOI) shall have been performed successfully. Testing these requirements is outside the scope of this document.

測試設施宜仔細調整發布速率，以便能驗核測試結果。發布速率將依 DUT 所提供之監視能力而定。

The test facility should carefully adjust the publishing rate to be able to validate the tests result. The publishing rate will depend on the monitoring capabilities offered by the DUT.

測試結果能使用表 3 中所描述之工具查證。

Test results can be verified using the tools described in Table 3.

於執行所有測試案例前，**測試設施**應對 PID 格式及內容進行初始查證。

An initial verification of the PIDs format and contents shall be undertaken by the **test facility** prior to any test cases being performed.

5.3.2 測試程序

5.3.2 Test Procedures

表 12 SV 狀態變遷測試矩陣

Table 12 – SV State Transition Tests Matrix

狀態 State	最終 Final													
	id	1	2	3	4	5	6	7	8	9	10	11	12	13
初始 Initial	1	-	tSV1	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	tSV2	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	tSV3	-	-	-	-	tSV4	-	-	-	-
	4	-	-	-	-	tSV5	-	-	-	-	-	tSV6	-	-
	5	-	-	-	-	-	tSV5	-	-	-	-	-	-	-
	6	-	-	-	-	-	-	tSV5	-	-	-	-	-	-
	7	-	-	-	-	-	-	-	tSV5	-	-	-	-	-
	8	-	-	tSV7	-	-	-	-	-	-	-	tSV8	-	-
	9	-	-	-	-	-	-	-	tSV4	-	-	-	-	-
	10	-	-	-	-	-	-	-	tSV6	-	-	-	-	-
	11	-	tSV9	-	-	-	-	-	-	-	-	-	tSV10	-
	12	-	-	-	-	-	-	-	-	-	-	-	-	tSV10
	13	-	tSV10	-	-	-	-	-	-	-	-	-	-	-

表 13 L2-SV 及 R-SV 安全剖繪

Table 13 – L2-SV and R-SV Security profiles

	發布者 Publisher	具 GSEControl.security Enabled 組態設定 之訂用者： Subscriber with GSEControl.security Enabled configured:	具 GSEControl.securityE nabled 未組態設定 之訂用者： Subscriber with GSEControl.securityE nabled non configured:	註解 Comment
不安全 Non-secure	發送未具 AuthenticationValue 之 PDU。 Send PDU without AuthenticationValue	m	m	tSV3s-1
具鑑別 With Authentication	發送具 AuthenticationValue 及 PDU 未加密之 PDU。 Send PDU with AuthenticationValue and PDU not	m, c2	o, c1	tSV3s-2 tSV3s-3 tSV3s-4

	encrypted			
具鑑別及隱私 With authentication and privacy	發送具 AuthenticationValue 及加密 PDU 之 PDU。 Send PDU with AuthenticationValue and encrypted PDU	m, c2	未支援 Not supported	tSV3s-5 tSV3s-6
c1：使用鑑別接受 PDU。 c1: The PDU is accepted with authentication c2：此剖繪不宜用於 L2 SV。 c2: This profile should not be used for L2 SV				

表 14 SV 訂用者安全延伸之查證

Table 14 – Verification of SV Subscriber Security Extension

編號 No	測試 Test	預期結果 Expected result	參引 Reference	要求 Required
	二側皆組態設定安全政策，其中敘明哪些憑證及/或憑證機構係可接受。 Both sides are configured with a security policy, which states, which certificates and/or certificate authorities are acceptable	DUT 持有群組金鑰及相關聯之安全政策。 The DUT possesses the group keys and the associated security policy.	PIXIT 表 3-1 PIXIT table 3-1	
tSV3-1s	TEQ 發送 SV PDU: TEQ to send SV PDU: <ul style="list-style-type: none">無鑑別值延伸without Authentication value extension	若 DUT 組態設定為 SampledValueControl.securityEnabled： If the DUT has SampledValueControl.securityEnabled configured: <ul style="list-style-type: none">若 DUT 偵測出 PDU 未具安全延伸並發出錯誤信號，則測試成功。The test succeeds if the DUT detects that the PDU does not have security extension and signal an error.若 DUT 未偵測出錯	IEC 62351-6:2020 之 6.2.2.3 (2)及(3) IEC 62351-6:2020-6.2.2.3 2) and 3) CNS 62351-6 之 6.2.2.3.1 IEC 62351-6:2020-6.2.2.3.1 CNS 62351-6 之 8.2.2	m

		<p>誤，則測試未成功。</p> <ul style="list-style-type: none"> The test fails if the DUT does not detect the error. <p>若 DUT 未組態設定為 SampledValueControl.securityEnabled，則</p> <p>If the DUT does not have SampledValueControl.securityEnabled configured</p> <ul style="list-style-type: none"> 訂用者應接受傳入之 GOOSE 訊息，且不應起始安全核對失效。 The subscriber shall accept the incoming SV message and shall not initiate a security check failure. 	<p>IEC 62351-6:2020, 8.2.2</p> <p>PIXIT 表 3-2</p> <p>PIXIT table 3-2</p> <p>PIXIT 表 3-3 之 ICD</p> <p>PIXIT table 3-3, ICD</p> <p>PIXIT 表 3-4</p> <p>PIXIT table 3-4</p>	
tSV3-2s	<p>TEQ 發送 SV PDU</p> <p>TEQ to send SV PDU:</p> <ul style="list-style-type: none"> 包括鑑別值延伸 that includes Authentication value extension unencrypted PDU: 	<p>若 DUT 組態設定為 SampledValueControl.securityEnabled：</p> <p>If the DUT has SampledValueControl.securityEnabled configured:</p> <ul style="list-style-type: none"> 若 DUT 未偵測出錯誤，則測試成功。 The test succeeds if the DUT does not detect the error. 若 DUT 發出錯誤信號，則測試未成功。 The test fails if the DUT signals an error. <p>若 DUT 未組態設定為 SampledValueControl.securityEnabled，則</p> <p>If the DUT does not have SampledValueControl.securityEnabled configured</p> <ul style="list-style-type: none"> 訂用者應接受傳入之 GOOSE 訊息，且不應起始安全核對失效。 The subscriber shall accept the incoming GOOSE 	<p>IEC 62351-6:2020 之 6.2.2.3</p> <p>(2)及(3)</p> <p>IEC 62351-6:2020-6.2.2.3</p> <p>2) and 3)</p> <p>CNS 62351-6 之 6.2.2.3.1</p> <p>IEC 62351-6:2020-6.2.2.3.1</p> <p>CNS 62351-6 之 8.2.2</p> <p>IEC 62351-6:2020, 8.2.2</p> <p>PIXIT 表 3-2</p> <p>PIXIT table 3-2</p> <p>PIXIT 表 3-3 之 ICD</p> <p>PIXIT table 3-3, ICD</p> <p>PIXIT 表 3-4</p> <p>PIXIT table</p>	m

		message and shall not initiate a security check failure	3-4	
tSV3-3s	<p>TEQ 發送 SV PDU: TEQ to send SV PDU</p> <ul style="list-style-type: none"> • 包括鑑別值延伸 • that includes Authentication value extension • 未加密之 PDU • Unencrypted PDU • 無效之 mAC • invalid mAC 	<p>若 DUT 組態設定為 SampledValueControl.securityEnabled :</p> <p>If the DUT has SampledValueControl.securityEnabled configured:</p> <ul style="list-style-type: none"> • 若 DUT 未偵測出 mAC 錯誤，則測試成功。 • The test succeeds if the DUT detects the mAC error. • 若 DUT 未偵測出 mAC 錯誤，則測試未成功。 • The test fails if the DUT does not detect the mAC error <p>若 DUT 未組態設定為 SampledValueControl.securityEnabled，則</p> <p>If the DUT does not have SampledValueControl.securityEnabled configured</p> <ul style="list-style-type: none"> • 訂用者應接受傳入之 GOOSE 訊息，且不應起始安全核對失效。 • The subscriber shall accept the incoming GOOSE message and shall not initiate a security check failure. 	<p>IEC 62351-6:2020 之 6.2.2.3 (2)及(3)</p> <p>IEC 62351-6:2020-6.2.2.3 2) and 3)</p> <p>CNS 62351-6 之 6.2.2.3.1</p> <p>IEC 62351-6:2020-6.2.2.3.1</p> <p>CNS 62351-6 之 8.2.2</p> <p>IEC 62351-6:2020, 8.2.2</p> <p>PIXIT 表 3-2</p> <p>PIXIT table 3-2</p> <p>PIXIT 表 3-3 之 ICD</p> <p>PIXIT table 3-3, ICD</p> <p>PIXIT 表 3-4</p> <p>PIXIT table 3-4</p>	m

編號 No	測試 Test	預期結果 Expected result	參引 Reference	要求 Required
tSV3-4s	TEQ 發送 SV PDU : TEQ to send SV PDU: <ul style="list-style-type: none"> 包括鑑別值延伸。 includes Authentication value extension 未加密之 PDU。 Unencrypted PDU 無效之 KeyID。 Invalid KeyID 	若 DUT 組態設定為 SampledValueControl.securityEnabled : If the DUT has SampledValueControl.securityEnabled configured: <ul style="list-style-type: none"> 若 DUT 偵測出 KeyID 錯誤，則測試成功。 The test succeeds if the DUT detects the KeyID error. 若 DUT 未偵測出 KeyID 錯誤，則測試未成功。 The test fails if the DUT does not detect the KeyID error 若 DUT 未組態設定為 SampledValueControl.securityEnabled，則： If the DUT does not have SampledValueControl.securityEnabled configured <ul style="list-style-type: none"> 訂用者應接受傳入之 GOOSE 訊息，且不應起始安全核對失效。 The subscriber shall accept the incoming SV message and shall not initiate a security check failure 	IEC 62351-6:2020 之 6.2.2.3 (2)及(3) IEC 62351-6:2020-6.2.2.3 2) and 3) CNS 62351-6 之 6.2.2.3.1 IEC 62351-6:2020-6.2.2.3.1 CNS 62351-6 之 8.2.2 IEC 62351-6:2020, 8.2.2 PIXIT 表 3-2 PIXIT table 3-2 PIXIT 表 3-3 之 ICD PIXIT table 3-3, ICD PIXIT 表 3-4 PIXIT table 3-4	m
tSV3-5s	TEQ 發送 SV PDU : TEQ to send SV PDU: <ul style="list-style-type: none"> 包括鑑別值延伸。 includes Authentication value extension 加密之 PDU encrypted PDU: 	DUT 應驗核鑑別延伸 The DUT shall validate the authentication extension <ul style="list-style-type: none"> 若 DUT 未偵測出錯誤，則測試成功。 The test succeeds if the DUT does not detect an error. 若 DUT 發出錯誤信 	IEC 62351-6:2020 之 6.2.2.3 (2)及(3) IEC 62351-6:2020-6.2.2.3 2) and 3) CNS 62351-6 之	m

		號，則測試未成功。 • The test fails if the DUT signals an error.	6.2.2.3.1 IEC 62351-6:2020- 6.2.2.3.1 CNS 62351-6 之 8.2.2 IEC 62351-6:2020, 8.2.2 PIXIT 表 3-2 PIXIT table 3-2 PIXIT 表 3-3 之 ICD PIXIT table 3-3, ICD PIXIT 表 3-4 PIXIT table 3-4	
tSV3-6s	TEQ 發送 SV PDU : TEQ to send SV PDU: • 包括鑑別值延伸。 • includes Authentication value extension • PDU 發生加密錯誤。 • PDU having an encryption error	DUT 應驗核鑑別延伸 The DUT shall validate the authentication extension • 若 DUT 偵測出並發出加密錯誤信號，則測試成功。 • The test succeeds if the DUT detects and signals the encryption error. • 若 DUT 發出錯誤信號，則測試未成功。 • The test fails if the DUT signals an error	IEC 62351-6:2020 之 6.2.2.3 (2)及(3) IEC 62351-6:2020-6.2.2.3 2) and 3) CNS 62351-6 之 6.2.2.3.1 IEC 62351-6:2020- 6.2.2.3.1 CNS 62351-6 之 8.2.2 IEC 62351-6:2020, 8.2.2 PIXIT 表 3-2 PIXIT table 3-2 PIXIT 表 3-3	m

			之 ICD PIXIT table 3-3, ICD PIXIT 表 3-4 PIXIT table 3-4	
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表 15 SV 發布者安全延伸之查證

Table 15 – Verification of SV publisher security extension

編號 No	測試 Test	預期結果 Expected result	參引 Reference	要求 Required
	二側皆組態設定安全政策，其中敘明哪些憑證及/或憑證機構係可接受。 Both sides are configured with a security policy, which states, which certificates and/or certificate authorities are acceptable	DUT持有群組金鑰及相關聯之安全政策。 The DUT possesses the group keys and the associated security policy.		
tG1p	TEQ 訂閱 DUT SV 發布者。 TEQ to subscribe to DUT SV publisher	TEQ應驗核鑑別值。 <ul style="list-style-type: none"> Version TimeofCurrentKey TimeofNextKey InitializationVector KeyID 	CNS 62351-6之 6.2.2.2 IEC 62351-6:2020, 6.2.2.2	m
		TEQ shall validate the authentication value. <ul style="list-style-type: none"> Version TimeofCurrentKey TimeofNextKey InitializationVector KeyID 	CNS 62351-6之 8.2.2.4 IEC 62351-6:2020, 8.2.2.4	
		TEQ亦應驗核SV協定之安全性欄位。 TEQ shall also validate the security field of the SV protocol. <ul style="list-style-type: none"> 具時間精度優於208 μsec之timestamp。 timestamp that has a time accuracy better than 208 μsec 	CNS 62351-6之 8.2.2.3 IEC 62351-6:2020, 8.2.2.3	

表 16 SV 訂用者重演要求事項之查證

Table 16 – Verification of SV subscriber Replay Requirements

編號 No	測試 Test	預期結果 Expected result	參引 Reference	要求 Required
	二側皆組態設定安全政策，其中敘明哪些憑證及/或憑證機構係可接受。 Both sides are configured with a security policy, which states, which certificates and/or certificate authorities are acceptable	DUT持有群組金鑰及相關聯之安全政策。 The DUT possesses the group keys and the associated security policy.	PIXIT表3-1 PIXIT table 3-1	
tSV4s	<u>正常狀態</u> Normal state TEQ發送具各種值之SV PDU TEQ to send SV PDUs with various values <ul style="list-style-type: none"> 包括鑑別值延伸 includes Authentication value extension <ul style="list-style-type: none"> 有效之安全延伸 valid security extensions 有效之 stNum 值 valid stNum value 	<ul style="list-style-type: none"> 若 DUT 未偵測出任何錯誤，則測試成功。 The test succeeds if the DUT does not detect any error. <ul style="list-style-type: none"> 宜於應用程式層級更新值。 Value should be updated at the application level 發出良好封包信號並於監測層級記錄之。 Good packet signalled and recorded at the supervision level 若 DUT 偵測出並發出錯誤信號，則測試未成功。 The test fails if the DUT detects and signals an error. DUT 等候另一 GOOSE PDU(狀態8)。 The DUT wait for another GOOSE PDU (state 8)	CNS 62351-6之 6.2.2.3 (4)至(7) IEC 62351-6:2020, 6.2.2.3 4) to 7) CNS 62351-6之 6.2.2.3.2 IEC 62351-6:2020, 6.2.2.3.2 PIXIT表3-2 PIXIT table 3-2 PIXIT表3-3 之 ICD PIXIT table 3-3, ICD	m
tSV6s-1	<u>重演偵測</u> Replay detection 當發送有效之 SV PDU時，TEQ發送的 SV PDU包括： While sending valid	<ul style="list-style-type: none"> 若 DUT 偵測出 T < lastRcvT 並發出重演信號，則測試成功。 The test succeeds if the DUT detects that T < lastRcvT and 	CNS 62351-6之 6.2.2.3 (4)、(8)、(10) IEC 62351-6:2020	m

	<p>SV PDU, the TEQ sends an SV PDU that includes:</p> <ul style="list-style-type: none"> • 不同之SV值。 • a different SV value • T值低於先前發送之值。 • a value of T lower than the previous value sent 	<p>signals a replay.</p> <ul style="list-style-type: none"> – 接收到之值不應傳送至應用層。 – The received value shall not be transferred to application layer • 若 DUT 未偵測出時間錯誤，則測試未成功。 • The test fails if the DUT does not detect the time error <p>DUT 等候另一 GOOSE PDU (狀態8)。</p> <p>The DUT wait for another GOOSE PDU (state 8)</p>	<p>20, 6.2.2.3 4), 8), 10)</p> <p>CNS 62351-6之 6.2.2.3.2</p> <p>IEC 62351-6:2020, 6.2.2.3.2</p> <p>PIXIT表3-2</p> <p>PIXIT table 3-2</p> <p>PIXIT表3-3之ICD</p> <p>PIXIT table 3-3, ICD</p> <p>PIXIT表3-5</p> <p>PIXIT table 3-5</p>	
tSV6s-2	<p>重演偵測</p> <p>Replay detection</p> <p>當發送有效之SV PDU時，TEQ發送的SV PDU包括：</p> <p>While sending valid SV PDU, the TEQ sends an SV PDU that includes:</p> <ul style="list-style-type: none"> • 不同之SV值。 • a different SV value • SmpCnt值低於或等於先前發送之值。 • a value of SmpCnt lower or equal to the previous value sent 	<ul style="list-style-type: none"> • 若 DUT 偵測出 SmpCnt自上次發布以來未增加並發出重演信號，則測試成功。 • The test succeeds if the DUT detects that SmpCnt has not increased since the previous publication and signals a replay. – 接收到之值不應傳送至應用層。 – The received value shall not be transferred to application layer • 若 DUT 未偵測出時間錯誤，則測試未成功。 • The test fails if the DUT does not detect the time error <p>DUT 等候另一 GOOSE PDU (狀態8)。</p> <p>The DUT wait for another GOOSE PDU (state 8)</p>	<p>CNS 62351-6之 6.2.2.3 (4)、(8)、(10)</p> <p>IEC 62351-6:2020, 6.2.2.3 4), 8), 10)</p> <p>CNS 62351-6之 6.2.2.3.2</p> <p>IEC 62351-6:2020, 6.2.2.3.2</p> <p>PIXIT表3-2</p> <p>PIXIT table 3-2</p> <p>PIXIT表3-3之ICD</p> <p>PIXIT table 3-3, ICD</p> <p>PIXIT表3-5</p> <p>PIXIT table 3-5</p>	m

編號 No	測試 Test	預期結果 Expected result	參引 Reference	要求 Required
tSV8s	<p>封包遺失偵測</p> <p><u>Packet loss detection</u></p> <p>當發送有效之 SV PDU 時，TEQ 停止發送 1 個 (1) 取樣值，並於之後正常繼續。</p> <p>While sending valid SV PDU, the TEQ stop sending one (1) sample and continuing normally after</p>	<ul style="list-style-type: none"> 若 DUT 偵測出封包遺失(計時器 1 逾時)，則測試成功。 The test succeeds if the DUT detects a packet loss (timer 1 expires). <ul style="list-style-type: none"> 應通知應用層 SV 未刷新。 Application layer shall be informed that the SV is not refreshed DUT 應繼續查證關聯遺失偵測。 The DUT shall continue to verify for association loss detection 若 DUT 未偵測出封包遺失，則測試未成功。 The test fails if the DUT does not detect a packet loss 	<p>CNS 62351-6 之 6.2.2.3</p> <p>(8)及(11)。</p> <p>IEC 62351-6:2020, 6.2.2.3</p> <p>8) and 11).</p> <p>CNS 62351-6 之 6.2.1.4。</p> <p>IEC 62351-6:2020, 6.2.1.4</p> <p>PIXIT 表 3-2</p> <p>PIXIT table 3-2</p> <p>PIXIT 表 3-3 之 ICD</p> <p>PIXIT table 3-3, ICD</p> <p>PIXIT 表 3-6</p> <p>PIXIT table 3-6</p>	m
tSV11s	<p>多播關聯遺失偵測</p> <p><u>Multicast association loss detection</u></p> <p>TEQ 停止發送 SV PDU。</p> <p>TEQ to stop sending SV PDU</p>	<ul style="list-style-type: none"> 若 DUT 偵測出訂用不再有效(計時器 2 逾時)(偵測出封包遺失後)，則測試成功。 The test succeeds if the DUT detects that the subscription is no longer active (timer 2 expires) (after detection of packet loss) <ul style="list-style-type: none"> 應通知應用層關聯遺失。 Application layer shall be informed that the association is loss DUT 應等候 PDU 	<p>CNS 62351-6 之 6.2.2.3</p> <p>(8)、(11)至(14)</p> <p>IEC 62351-6:2020, 6.2.2.3</p> <p>8), 11) to 14)</p> <p>CNS 62351-6 之 6.2.1.4</p> <p>IEC 62351-6:2020, 6.2.1.4</p> <p>PIXIT 表 3-2</p>	m

		(狀態 2)。 – DUT shall wait for a PDU (state 2) • 若 DUT 未偵測出封包遺失，則測試未成功。 • The test fails if the DUT does not detect a packet loss	PIXIT table 3-2 PIXIT 表 3-3 之 ICD PIXIT table 3-3, ICD PIXIT 表 3-7 PIXIT table 3-7	
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6. SCL 延伸之要求事項測試

6 SCL extension requirements testing

為符合 62351-6，IED 及其組態工具應支援表 17 中所列出之 SCL 延伸。

To conform with 62351-6, the IED and its configuration tool shall support the SCL extension listed in Table 17.

表 17 SCL 延伸之查證

Table 17 – Verification of SCL extensions

編號 No	查證 Verification	參引 Reference	要求 Required
1	接收點支援 GOOSE 發布者之安全性 Access Point support security for GOOSE Publisher • scl:tGSESettings 具 kdaParticipant 之延伸屬性。 • scl:tGSESettings extended with an attribute kdaParticipant • scl:tGSESettings 具 scl:McSecurity 之延伸子元件。 • scl:tGSESettings extended with sub-element scl:McSecurity – McSecurity 元件描述所支援之安全選項 – McSecurity element describes the supported security options • 簽章(Signature)。 • Signature • 加密(Encryption)。 • Encryption	CNS 62351-6 之 6.9.1.1 IEC 62351-6:2020, 6.9.1.1	m
2	接收點支援 SV 發布者之安全性 Access Point support security for SV Publisher	CNS 62351-6 之 6.9.1.2	m

	<ul style="list-style-type: none"> • scl:tSMVSettings 具 kdaParticipant 之延伸屬性。 • The scl:tSMVSettings extended with an attribute kdaParticipant • scl:tSMVSettings 具 scl:McSecurity 之延伸子元件。 • scl:tSMVSettings extended with sub-element scl:McSecurity <ul style="list-style-type: none"> – McSecurity 元件描述所支援之安全選項 – McSecurity element describes the supported security options • 簽章(Signature)。 • Signature • 加密(Encryption)。 • Encryption 	IEC 62351-6:2020, 6.9.1.2	
	<p>接取點支援 GOOSE 及 SV 發布者之安全性</p> <p>Access Point support security for GOOSE and SV subscriber</p> <pre><xs:element name="Security" type="tSecurity" minOccurs="0" maxOccurs="1"> <xs:complexType name="tSecurity"> <xs:attribute name="ACSEAuthentication" type="xs:boolean" default="false"/> <xs:attribute name="E2ESecurity" type="xs:boolean" default="false"/> <xs:attribute name="IEC61850-8-2" type="xs:boolean" default="false"/> </xs:complexType></pre>	CNS 62351-6 之 6.9.1.3 IEC 62351-6:2020, 6.9.1.3	m
	<p>伺服器接取點支援 TPAA 安全性</p> <p>Server Access Point support security for TPAA</p> <pre><xs:element name="Security" type="tSecurity" minOccurs="0" maxOccurs="1"> <xs:complexType name="tSecurity"> <xs:attribute name="ACSEAuthentication" type="xs:boolean" default="false"/> <xs:attribute name="E2ESecurity" type="xs:boolean" default="false"/> <xs:attribute name="IEC61850-8-2" type="xs:boolean" default="false"/> </xs:complexType></pre>	CNS 62351-6 之 6.9.1.4 IEC 62351-6:2020, 6.9.1.4	m

編號 No	查證 Verification	參引 Reference	要求 Required
	<p>客戶端接取點支援 TPAA 安全性</p> <p>Client Access Point support security for TPAA</p> <pre><xs:element name="Security" type="tSecurity" minOccurs="0" maxOccurs="1"> <xs:complexType name="tSecurity"> <xs:attribute name="ACSEAuthentication" type="xs:boolean" default="false"/> <xs:attribute name="E2ESecurity" type="xs:boolean" default="false"/> <xs:attribute name="IEC61850-8-2" type="xs:boolean" default="false"/> </xs:complexType></pre>	<p>CNS 62351-6 之 6.9.1.5</p> <p>IEC 62351-6:2020, 6.9.1.5</p>	m
	<p>啟用安全性之發布</p> <p>Publish with security enabled</p> <ul style="list-style-type: none"> GOOSE <ul style="list-style-type: none"> scl:tGSEControl 之 屬性 securityEnabled (預設 = "none") 啟動安全延伸。 attribute securityEnabled (default = 'none') of scl:tGSEControl activates the security extension SV <ul style="list-style-type: none"> scl:tSampledValueControl 之 屬性 securityEnabled (預設 = "none") 啟動安全延伸。 attribute securityEnabled (default = 'none') of scl:tSampledValueControl activates the security extension 金鑰政策及管理 Key Policy and Management <ul style="list-style-type: none"> 金鑰資訊，以及雜湊及加密之演算法選擇係遵循本系列標準第 9 部及 RFC 8052 中的 GDOI 規格。 key information, and the algorithm selection for hash and encryption, are compliant to the GDOI specification found in IEC 62351-9 and RFC 8052 	<p>CNS 62351-6 之 6.9.2.1</p> <p>IEC 62351-6:2020, 6.9.2.1</p> <p>CNS 62351-6 之 6.9.2.2</p> <p>IEC 62351-6:2020, 6.9.2.2</p> <p>CNS 62351-6 之 6.9.2.3</p> <p>IEC 62351-6:2020, 6.9.2.3</p>	<p>m</p> <p>m</p> <p>m</p>
	<p>模擬之使用</p> <p>Use of Simulation</p> <ul style="list-style-type: none"> 模擬之 APDU，使用與源自非測試裝置的來源封包相同之網宇政策及資訊。 Simulated APDUs, use the same cyber policies and information as the source packets from the non-test device 	<p>CNS 62351-6 之 6.9.3</p> <p>IEC 62351-6:2020, 6.9.3</p>	m

名詞對照

–A–

acceptance	驗收；接受
application service data unit, ASDU	應用服務資料單元
association	關聯
authentication	鑑別

–B–

base profile	基底剖繪
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–C–

certificate authority	憑證機構
communication	通訊；溝通或傳達
completeness	完全性
compliance	遵循性；遵循
competency	能力
companion standard	配套標準
confidentiality	機密性
configured IED description, CID	已組態設定之 IED 描述
conformance testing	符合性測試
context	全景
correctness	正確性
cybersecurity	網宇安全

–D–

detection	偵測
development	發展；開發
device under test, DUT	待測裝置

–E–

equipment	設備
evaluation	評估
event	事件
evidence	證據

–F–

facility	設施
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factory acceptance test, FAT	工廠驗收測試
-G-	
group-key exchange	群組金鑰交換
guideline	指導綱要
-I-	
IED capability description, ICD	IED 能力描述
impact	衝擊；影響
implementation	實作
instantiated IED description, IID	實例化 IED 描述
instruction manual	使用說明手冊
intelligent electronic device, IED	智慧電子裝置
interoperability	互運性
interoperability testing	互運性測試
-L-	
log	日誌
logging	存錄
-M-	
measure	量測；措施
measurement	量測；量測值
methodology	方法論
monitor	監視； 監督
-O-	
out-of-order sequence number	失序序號
out-of-order state number	失序狀態編號
-P-	
policy	政策
privacy	隱私
procedure	程序
profile	剖繪
proof	證明
protocol	協定
protocol implementation conformance statement,	協定實作符合性聲明

PICS

protocol implementation document, PID
protocol implementation extra information for
testing, PIXIT

publisher

協定實作文件
測試用協定實作額外資訊

發布者

–R–

replay

requirements

resiliency

resiliency test

review

risk

robustness

重演

要求事項

韌性

韌性測試

審查

風險

穩健性

–S–

security check failing

simulator

site acceptance test, SAT

specification

subscriber

subscription

substation

substation automation system, SAS

substation configuration description, SCD

substation configuration language, SCL

suite

supervision

supplier

安全核對未通過

模擬器

現場驗收測試

規格

訂用者

訂用

變電所

變電所自動化系統

變電所組態描述

變電所組態語言

套組

監測

供應者

–T–

technical specification, TS

telecontrol system

terms and conditions

test case

test equipment, TEQ

testing device

test plan

技術規格

遠距控制系統

條款及條件

測試案例

測試設備

測試裝置

測試計畫

timestamp	時戳
–V–	
validation	驗核
validity	有效性
verification	查證

參考資料

[1] CNS 62351-2 電力系統管理及關聯資訊交換－資料及通訊安全－第 2 部：詞彙

~~IEC TS 62351-2, Power systems management and associated information exchange
Data and communications security – Part 2: Glossary of terms~~

相對應國際標準

IEC TS 62351-100-6:2022 Power systems management and associated information exchange – Data and communication security – Part 100-6: Cybersecurity conformance testing for IEC 61850-8-1 and IEC 61850-9-2