

111 年委託研究報告

「依據最新國際與產業標準研擬電信管制射  
頻器材及電信終端設備技術規範委託研究採  
購案」

精簡英文版本

委託機關：國家通訊傳播委員會

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中華民國 111 年 12 月



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財團法人電信技術中心

計畫主持人

蔡奇霖

研究人員

蔡奇霖、周傳凱、張簡耀暉、陳耀坤、簡子翔、楊清方、徐翊菱、廖  
婉如

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## 計畫摘要

關鍵詞：衛星地球電臺、低軌衛星、同步衛星、纜線數據機、CM、  
低功率射頻器材、LP0002

### 一、 研究緣起

鑒於無線通訊技術快速發展，本研究將透過廣泛蒐集國際組織因應新興射頻器材技術標準發展趨勢，研析瞭解各國針對低軌衛星/同步衛星、纜線數據機及低功率射頻器材等檢驗及管理規定，同時蒐集國內廠商意見，據以對既有技術規範提供精進修訂建議，以利通傳會未來修訂我國相關規定及配套措施，進而帶動我國電信技術產業再升級。

### 二、 研究方法及過程

本研究依據各委託辦理工作項目，採用文獻分析法、個案研究與比較分析法，並規劃辦理座談會議蒐集國內現況及產官學等意見，最終整合各研究方法與工作項目的產出，提出我國就案關低軌衛星/同步衛星、纜線數據機及低功率射頻器材之檢驗技術規範修訂或草案具體建議。

### 三、 重要發現

#### (一) 低軌衛星/同步衛星

本研究介紹了國際組織與先進國家有關低軌衛星/同步衛星設備之使用規則與檢測規定；其中 ITU 透過無線電規則、組織法與公約，記錄同步與非同步軌道衛星的頻率指配與軌道資訊，以使國際承認相關的權利與義務；歐盟則主要透過 ECC 決定(ECC Decision)及 ECC 報告

(ECC Report)共同形成技術監理框架，以有效管理並促進市場競爭；本研究亦研析美國 FCC Part 25 中同步與非同步衛星地球電臺之檢驗標準，並依據該內容進一步提出衛星地球電臺設備技術規範之草案建議，以完備國內相關技術法規與我國電信產業創新研發之環境。

## (二) 纜線數據機

美國 FCC 對纜線數據機電信終端設備必須符合 Part 15 Subpart B，證明環境中或交流電源線上的輻射是受到適當限制，如內置無線路由器的纜線數據機必須符合 Part 15 Subpart C 的要求，確保其無線信號不會對其他無線設備造成不應有的干擾。歐盟對 DOCSIS 纜線數據機電信終端設備要求須符合 RED(2014/53/EU)及 LVD(2014/35/EU)指令有關電磁相容性及安全規範的要求。中國對 DOCSIS 纜線數據機電信終端設備要求須符合中國「工業和信息化部」於 2000 年 9 月公告的《YD/T 1076-2000 接入網技術要求—電纜調製解調器 (CM)》技術標準，並規定纜線數據機運作環境適應性及設備安全性等要求。

## (三) 低功率射頻器材技術規範

國內《低功率射頻器材技術規範》係依電信管理法第 66 條第 2 項授權訂定，為我國各類常見資通訊產品所應遵守之技術規範。為使《低功率射頻器材技術規範》能適用於各類創新應用之通訊設備，應透過研析國際檢測規定與標準以期能與全球接軌。本研究已重新盤點檢視現行規範架構、法規溯源，參照國際最新低功率射頻器材相關技術標準及國內歷年低功率射頻器材會議重要結論，補充更新、調和修訂。

#### 四、 主要建議事項

##### (一) 立即可行建議

###### 1. 衛星地球電臺設備技術規範草案

本研究詳細討論了案例國家有關低軌衛星終端設備檢驗技術規範之關注焦點，為精進我國相關射頻審驗措施，加速開放新頻率及低軌衛星射頻設備進入市場提供服務，進而提升相關產業發展效益，本研究將向通傳會提出低軌衛星終端設備之技術規範修訂(或研擬)草案具體建議，以完備國內相關技術法規，將有利於主管機關建構我國電信產業創新研發之環境。

###### 2. 纜線數據機電信終端設備(CM)技術規範

由於纜線數據機(CM)設備係連接混合同軸光纖網路(HFC)經頭端系統介接網際網路提供訂戶上網服務之電信終端設備；而「HFC網路」屬《電信管理法》下公眾電信網路類型之「固定通信網路」，並依「公眾電信網路審驗辦法」及「公眾電信網路審驗技術規範」進行審驗檢測；故宜適用電信管理法第44條第1項規定之。本研究參酌美國FCC管理方式將攸關民眾安全的電磁相容及電氣安全列為本草案之應施檢驗項目，研擬「纜線數據機電信終端設備(CM)技術規範」草案建議。

### 3. 衛星管理規定建議

#### (1) 衛星地球電臺設備申請型式認證建議填寫之相關資料

本研究參考美國 FCC 衛星業務並製作申請表格，主管機關可參考該表內容增修或刪減衛星地球電臺所需申請資訊，申請者可詳細填寫衛星地球電臺各項資料提供予主管機關進行相關審驗。

#### (2) 衛星地球電臺與終端設備同頻干擾之相關建議事項

本研究建議衛星地球電臺可因應最大輸出功率相對應降低工作週期以符合最大電磁暴露量（功率密度），並進而使衛星通信業務干擾現有射頻業務的風險降低，其最大電磁暴露量計算可參考 SpaceX 所提出之文件，並以最接近人體的天線表面功率密度進行評估。

### (二) 中長期性建議

#### 1. 低功率射頻器材技術規範

為使我國低功率射頻器材技術規範能與國際法規接軌，本研究追溯 LP0002 中所有技術規範之法源出處，並研析最新國際法規原文，且對我國 LP0002 各條文逐一盤查，其法源範圍除 FCC 法規外，尚包含 FCC KDB、IEEE C63.10、ETSI、日本 STD 與我國 1~80 一致性會議紀錄，並依據上述法源內容，重新增修訂我國 LP0002 技術規範，故本研究研擬「低功率射頻器材技術規範」草案建議。

#### 2. 纜線數據機設備管理規定建議

目前國內的纜線數據機均由有線電視業者自行提供予消費者，且相容在自己的纜線網路系統，並無在公開市場販售或供消費者自行取得，



與美國消費者可於市場購買取得存在差異。如該設備兼具有無線電技術之功能，應遵循符合所對應之無線電技術規範。建議通傳會參考美國 FCC 的管理作法，維持僅驗證纜線數據機是否符合電器安全之容許與電磁相容之頻率和諧有效的檢驗事項。

# Abstract

**Keywords:** Satellite earth station, low-Earth-orbit satellite, geostationary satellite, cable modem (CM), low-power radio frequency equipment, LP0002

## 1. Origin of the study

In view of the rapid development of wireless communications technology, this study aimed to analyze and understand the inspection and management provisions on low-Earth-orbit satellites/ geostationary satellites, cable modems, and low-power radio frequency equipment in various countries through extensively collecting the development trends of international organizations' standards in response to the emerging radio frequency equipment technologies. Meanwhile, based on opinions collected from domestic vendors, the study aimed to provide refined and advanced suggestions for revising existing technical specifications, to support the National Communications Commission (NCC) in enacting relevant provisions and measures of Taiwan in the future, thus driving the upgrades of the Taiwanese telecommunications technology industry.

## 2. Study methods and process

Based on each commissioned work item, the study adopted the document analysis method, case study method, and comparison analysis method for research, as well as planned and held workshops to confirm the current domestic market status and collect opinions from the industry, officials, and universities. Finally, by integrating each analysis method and the results of the work items, the study is proposing specific suggestions for revisions or drafts of Taiwanese technical specifications on inspecting low-Earth-orbit satellites/ geostationary satellites, cable modems, and low-power radio frequency equipment.

### **3. Important discoveries**

#### **(1) Low-Earth-orbit satellite / Geostationary satellite**

The study introduced the usage rules and inspection regulations enacted by international organizations and advanced countries related to low-Earth-orbit satellite/ geostationary satellite equipment. Specifically, ITU records the frequency assignment and orbit information of synchronous and non-synchronous orbit satellites through radio rules, organizational laws, and conventions, to ensure the international recognition of related rights and obligations. The European Union mainly forms its technical supervision framework through ECC Decisions and ECC Reports, to achieve effective management while promoting market competition. The study also analyzed the inspection standards for synchronous and asynchronous satellite earth stations specified in Part 25 of the US FCC, and based on the results, the study further offered a draft proposal for the technical specifications of satellite earth station equipment, to complete the relevant domestic technical regulations and the environment for innovative research and development of the Taiwanese telecommunications industry.

#### **(2) Cable modem (CM)**

The US FCC standards require the cable modem telecommunications terminal equipment must comply with the requirements of Part 15 Subpart B by proving that the radiation in the environment or on the AC power line is adequately restricted. For example, the cable modem of the built-in wireless router must comply with the requirements of Part 15 Subpart C to ensure its wireless signals do not cause undue interference to other wireless equipment. The EU standards require that DOCSIS cable modem type of telecommunications terminal equipment must comply with the requirements of the RED (2014/53/EU) and LVD (2014/35/EU) directives on electromagnetic compatibility (EMC) and safety specifications. The Chinese standards require that DOCSIS cable modem telecommunications terminal equipment) must comply with the requirements of *Technical Requirements for YD/T 1076-2000 Access Network - Cable Modem (CM)* technical standards published in September 2000 by the Ministry of Industry and Information Technology of China, which also stipulated requirements such as the cable modem's adaptability to the operating environment and equipment safety, etc.

### **(3) Technical specifications for low-power radio frequency equipment**

The contents of *Technical Specifications for Low-Power Radio Frequency Equipment* in Taiwan are formulated following the provisions of Paragraph 2 of Article 66 of the *Telecommunications Management Act*, and constitute the technical specifications for all types of common information and communications products in Taiwan to abide by. To make the *Technical Specifications for Low-Power Radio Frequency Equipment* applicable to communications equipment for various innovative applications, international inspection regulations and standards should be analyzed to update and bring the specifications in line with global standards. The study has re-examined the current specifications structure and legal sources of the related regulations, referencing the latest international technical standards related to low-power radio frequency equipment and important conclusions from domestic meetings on low-power radio frequency equipment over the years, to provide supplements, updates, reconciliations, and revisions.

## **4. Main suggestions**

### **(1) Immediate feasible suggestion**

#### **A. Draft of technical specifications for satellite earth station equipment**

The study discussed the focus of technical specifications for the inspection of the terminal equipment of low-Earth-orbit satellites in the countries selected for the case study. To enhance the relevant measures for radio frequency inspections in Taiwan, and accelerate the authorization of new frequencies and low-Earth-orbit satellite radio frequency equipment entering the market, thus further enhancing the development benefits of related industries, the study will propose to the National Communications Commission (NCC) with specific suggestions on a draft for the revision (or stipulation) of technical specifications for the terminal equipment of low-Earth-orbit satellites, to complete relevant technical regulations in Taiwan, which shall offer advantages to the competent

authority in building an environment for innovative researches and developments of the Taiwanese telecommunications industry.

## **B. Technical specifications for cable modem (CM) telecommunications terminal equipment**

Cable modem (CM) equipment is a type of telecommunications terminal equipment that connects to a hybrid fiber coaxial network (HFC) through the head-end system to interface the Internet and provide subscribers with Internet services. As the "HFC network" is classified as a "fixed communication network" type of public telecommunications network under the *Telecommunications Management Act*, which shall be inspected and tested following the *Regulations for Examination of Public Telecommunications Networks* and *Technical Specifications for Examination of Public Telecommunications Network*, therefore it is appropriate to apply the provisions of Paragraph 1 of Article 44 of the *Telecommunications Management Act* for regulations. Referencing the US FCC management approaches, the study developed and proposed the draft of "*Technical Specifications for Cable Modems (CMs) telecommunications terminal equipment*" which lists critical public safety items related to electromagnetic compatibility and electrical safety as mandatory inspection items, along with other suggestions.

## **C. Suggestions for provisions of satellite management**

### **(A) Suggested required Information for satellite earth station equipment type certification application**

Referencing the US FCC satellite specification, the study formulated an application form, while the competent authority can add, add, modify or delete the information required for the application of satellite earth station certification based on the suggested form. Applicants can fill in the detailed info about their satellite earth stations and submit the application data to the competent authority for relevant reviews.

**(B) Suggested items related to co-channel interference between satellite earth stations and terminal equipment**

The study suggested that satellite earth stations can reduce their duty cycle in response to the maximum output power to meet the maximum electromagnetic exposure (power density), which further reduces the risk of the satellite communication services interfering with existing radio frequency services. The maximum electromagnetic exposure can be calculated referencing the documents proposed by SpaceX, and can be evaluated based on the power density of the antenna surface closest to the human body.

**(2) Medium and long-term suggestions**

**A. Technical specifications for low-power radio frequency equipment**

To ensure that Taiwan’s technical specifications of low-power radio frequency equipment are in line with international regulations, the study traced the legal sources of all technical specifications stated in LP0002, while analyzing the source texts of the latest international regulations. Further examination has also been conducted on every single article of Taiwan’s LP0002. In addition to FCC regulations, other legal sources include FCC KDB, IEEE C63.10, ETSI, the Japanese STD, and minutes of Taiwan’s 1~80 consistency meetings. Based on the content of these legal sources, Taiwan’s LP0002 technical specifications have been revised and added with new contents, resulting in the suggested draft of “*Technical Specifications for Low-Power Radio Frequency Equipment*” proposed by the study.

**B. Suggestions for provisions of management of cable modem equipment**

Currently, cable modems in the Taiwanese market are provided to consumers by cable TV operators, which are only compatible with the operators’ own cable network systems. Such cable modems are not sold or acquired by consumers in the open market, which is very different from how American consumers usually

acquire cable modems from the market. If any of such equipment is also equipped with radio functions, it must comply with the corresponding radio technology specifications. The study recommended that the National Communications Commission (NCC) reference the approaches applied by the US FCC, which is to only maintain the inspection items that simply verify whether the cable modem meets the electrical safety tolerance, and the frequency's harmony and effectiveness for electromagnetic compatibility.