

International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

J.1108

(01/2019)

SERIES J: CABLE NETWORKS AND TRANSMISSION
OF TELEVISION, SOUND PROGRAMME AND OTHER
MULTIMEDIA SIGNALS

Switched digital video over cable networks

**Transmission specification for radio over IP
transmission systems**

Recommendation ITU-J.1108

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Transmission specification for radio over IP transmission systems

Summary

As cable TV network is migrating to deep fibre or fibre to the home (FTTH) architecture, it is now possible and easy to provide bidirectional high quality media services that require very high speed digital transmission of various high quality contents. Cable TV networks provide services by transmitting radio frequency (RF) signals between headend and cable modems (CM), the configuration and devices of cable TV networks are optimized for RF signal transmission. For the migration of all-fibre access cable TV networks, the existing network devices of service operators (SOs) providing broadcasting services and various data services through the hybrid fibre coaxial (HFC) based cable TV network is recommended to change into the new network devices. Therefore, a cost-effective solution for deployable and acceptable migration toward an optic-based cable TV network is required.

Recommendation ITU-T J.1108 provides a cost-effective adaptable solution for HFC-based cable TV network devices in an optic-based cable TV network. The purpose of a radio over IP (RoIP) system is to transmit data over cable service interface specifications (DOCSIS) based up stream (US) RF signals of a cable modem (CM) to a cable modem termination system (CMTS) through IP transmission in optic-based cable TV networks.

History

Edition	Recommendation	Approval	Study Group	Unique ID ^a
1.0	ITU-T J.1108	2019-01-13	9	11.1002/1000/13838

- ^{a)} To access the Recommendation, type the URL <http://handle.itu.int/> in the address field of your web browser, followed by the Recommendation's unique ID. For example, <http://handle.itu.int/11.1002/1000/11830-en>.

Keywords

Radio over IP, RoIP.

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Table of Contents

	Page
1. Scope.....	1
2. References.....	1
3. Definitions.....	1
3.1. Terms defined elsewhere.....	1
3.2. Terms defined in this recommendation.....	1
4. Abbreviations and acronyms.....	1
5. Conventions.....	2
6. Overview.....	2
7. Functional architecture.....	2
8. Timing processing specification.....	3
Bibliography.....	5

Recommendation ITU-T J.1108

Transmission specification for radio over IP transmission systems

1. Scope

Recommendation ITU-T J.1108 describes the transmission specification for a radio over IP (RoIP) transmission system in a hybrid fibre coaxial (HFC) based network. The architecture described in this Recommendation is defined according to [\[ITU-T J.1106\]](#). The transmission specifications described in this Recommendation are defined as follows:

- Radio over IP terminal system.
- Radio over IP headend system.

The most important part of the RoIP transmission system is having the correct network timing synchronization between the RoIP headend and RoIP terminal. The transmission specifications described in this Recommendation are defined in the timing processing specification.

2. References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T J.1106]*Requirement for radio over IP transmission system*, 1st edition.

[ITU-T J.1107]*Architecture and specification for radio over IP transmission systems*, 1st edition.

[ITU-T J.210]*Downstream RF interface for cable modem termination systems*, 1st edition.

[ITU-T J.222.1]*Third-generation transmission systems for interactive cable television services – IP cable modems: Physical layer specification*, 1st edition.

[ITU-T J.222.2]*Third-generation transmission systems for interactive cable television services – IP cable modems: MAC and Upper Layer protocols*, 1st edition.

3. Definitions

3.1. Terms defined elsewhere

This Recommendation uses the following term defined elsewhere:

3.1.1. local clock: The collection of hardware and software that comprises a local source of time for a system.

3.2. Terms defined in this recommendation

None.

4. Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

CM

Cable Modem

CMTS	Cable Modem Termination System
DOCSIS	Data Over Cable Service Interface Specifications
DS	Down Stream
E/O	Electric to Optic
FTTH	Fibre To The Home
HFC	Hybrid Fibre Coaxial
OLT	Optical Line Terminal
OMUX	Optical Multiplexer
PON	Passive Optical Network
RF	Radio Frequency
RoIP	Radio over IP
SO	Service Operator
STB	Set-Top Box
US	Up Stream

5. Conventions

In this Recommendation:

The keywords "is required to" indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this document is to be claimed.

The keywords "is recommended" indicate a requirement which is recommended but which is not absolutely required. Thus this requirement need not be present to claim conformance.

The keywords "is prohibited from" indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this document is to be claimed.

The keywords "can optionally" indicate an optional requirement which is permissible, without implying any sense of being recommended. This term is not intended to imply that the vendor's implementation must provide the option and the feature can be optionally enabled by the network operator/service provider. Rather, it means the vendor may optionally provide the feature and still claim conformance with the specification.

In the body of this Recommendation and its annexes, the words *shall*, *shall not*, *should*, and *may* sometimes appear, in which case they are to be interpreted, respectively, as *is required to*, *is prohibited from*, *is recommended*, and *can optionally*. The appearance of such phrases or keywords in an appendix or in material explicitly marked as *informative* are to be interpreted as having no normative intent.

6. Overview

The overview is defined according to [\[ITU-T J.1106\], Clause 6](#).

7. Functional architecture

The functional architecture is defined according to [\[ITU-T J.1107\], Clause 7](#).

8. Timing processing specification

It is important to synchronize upstream data based on the data over cable service interface specification (DOCSIS) with the existing cable network through the optical IP network (i.e., xPON networks). The most important part of the RoIP transmission system is having the correct network timing synchronization between the RoIP headend and RoIP terminal.

Since many cable modems (CMs) on the subscriber side share one physical medium, it is required to transmit data according to a synchronous time-division multiplexing method, that is, the CMs are required to transmit data during time slots allocated by the cable modem termination system (CMTS). In the uplink band, the collision avoidance time of the allocated band between the terminals is 1us or less and very strict timing synchronization is required. In order to operate the RoIP transmission system, accurate timing synchronization between the terminal and the headend is required. Specifically, it is necessary to establish synchronization between the IP network and a mixed heterogeneous network, not a single RF network.

Therefore, the following requirements are required to perform the function of timing processing.

TIME-REQ-01	The RoIP terminal for terminal access network synchronization is required to synchronize the local clock which is adjusted to the CMTS reference clock using the timestamp in the SYNC message coming from the CMTS.
TIME-REQ-02	The RoIP terminal for terminal access network synchronization is required to acquire burst time information.
TIME-REQ-03	The RoIP terminal for terminal access network synchronization is required to estimate and compensate a transmission time.
TIME-REQ-04	The RoIP terminal for detection and acquisition of transmission RF burst is required to store the acquisition time information.
TIME-REQ-05	The RoIP terminal for IP network access is required to transmit the transmitted RF burst and the acquired time information.
TIME-REQ-06	The RoIP headend for headend access network synchronization is required to synchronize the local clock which is adjusted to the CM reference clock using MAP information during DOCSIS ranging.
TIME-REQ-07	The RoIP headend for headend access network synchronization is required to acquire the synchronized time information.
TIME-REQ-08	The RoIP headend for RF signal scheduling of IP network interworking is required to acquire burst time information.
TIME-REQ-09	The RoIP headend for RF signal scheduling of IP network interworking is required to schedule the received burst.

TIME-REQ-10

The RoIP headend for RF signal reconstruction is required to reconstruct RF compressed signal.

TIME-REQ-11

The RoIP headend for RF signal reconstruction is required to transform Digital to Analogue and frequency band.

Bibliography

- [b-ITU-T X.743]*Information technology – Open Systems Interconnection – Systems Management: Time Management Function*, 1st edition.
- [b-ANSI/SCTE 135-1]*DOCSIS 3.0 Part 1: Physical Layer Specification*.
- [b-ANSI/SCTE 135-2]*DOCSIS 3.0 Part 2: MAC and Upper Layer Protocols*.
- [b-ANSI/SCTE 135-4]*DOCSIS 3.0 Part 4: Operations Support Systems Interface*.
- [b-ANSI/SCTE 135-5]*DOCSIS 3.0 Part 5: Cable Modem to Customer Premise Equipment Interface*.