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

Switched digital video over cable networks

Requirement for radio over IP transmission system

Recommendation ITU-T J.1106

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Requirement for radio over IP transmission system

Summary

As cable television (TV) networks migrate to deep fibre or fibre to the home (FTTH) architecture, it is now easier to provide bidirectional high-quality media services that require very high-speed digital transmission of various high-quality contents. As cable TV networks provide services by transmitting radio frequency (RF) signals between headend and a cable modem (CM), the configuration and devices of the cable TV network are optimized for RF signal transmission. For migration to all-fibre access, the existing cable TV network devices of service operators (SOs), which provide broadcasting services and various data services through a TV network based on hybrid fibre coaxial (HFC) cable, are recommended for change to new network devices. Therefore, a cost-effective solution for deployable and acceptable migration towards optic-based cable TV networks is required. Recommendation ITU-T J.1106 provides a cost-effective solution to convert HFC-based cable TV network devices into those based on optic cable.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T J.1106	2017-07-29	9	11.1002/1000/13287

Keywords

Cable, optic, RoIP, TV

* 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.

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1 Scope

This Recommendation describes the functional requirements for radio over Internet protocol (RoIP) transmission systems based on data over cable service interface specifications (DOCSIS). The purpose of an RoIP system is to transmit data (DOCSIS based) over an upstream (US) radio frequency (RF) signal from a cable modem (CM) to a cable modem termination system (CMTS) through Internet protocol (IP) transmission in an optic-based cable television (TV) network.

2 References

None.

3 Definitions

3.1 Terms defined elsewhere

None.

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	Downstream
FTTH	Fibre To The Home
HFC	Hybrid Fibre Coaxial
IP	Internet Protocol
OLT	Optical Line Terminal
OMUX	Optical Multiplexer
RF	Radio Frequency
RoIP	Radio over Internet Protocol
SO	Service Operator
STB	Set-Top Box
TV	Television
US	Upstream

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 document 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

In order to transmit an RF signal through an optic-based cable TV network, optical amplitude modulation (AM) converting an RF signal into an analogue optical signal is required. However, since the unit price of an optical AM converter is high, there is a heavy cost for service operators (SOs) to apply optical AM to all subscriber terminals. A new transmission technology that does not use or replaces optical AM is therefore needed. The proposed transmission technology can provide a cost-effective solution to adapt existing cable TV network devices, based on hybrid fibre coaxial (HFC), for an optic-based cable TV network. An RoIP system is not required to equip an optical AM module to transmit a US RF signal because such a signal is transmitted through IP packets.

As shown in Figure 1, the RoIP system consists of an RoIP terminal and an RoIP headend. The RoIP terminal is located at the end point of an optic-based cable TV network and the RoIP headend is located between the CMTS and optical network end point such as an optical line terminal (OLT). It is required to synchronize and transmit US using a DOCSIS-based protocol for IP transmission.

The cable headend is required to convert a downstream (DS) RF signal of the CMTS into an optical signal, and transmit it to the CM. The RoIP terminal is required to convert an optical signal into an electrical RF signal, and transmit it to the cable set-top box (STB). Also, the RoIP terminal is required to convert an US RF signal into IP data, and transmit it to the RoIP headend. The RoIP headend is required to convert IP data into an RF signal, and transmit it to the CMTS.

The RoIP terminal and RoIP headend are required to transmit a synchronized signal with a DOCSIS-based TDMA scheme between the CMTS and CM. The RoIP headend is required to synchronize with the CMTS, and the RoIP terminal is required to synchronize with the CM. After receiving a US signal from the CM, the RoIP terminal has to obtain the acquisition time that is sent to the RF signal by the CM. The time information is transmitted to the CMTS by the IP. When the RoIP terminal transmits a digitized RF signal and time information to the CMTS, bandwidth allocation information proposed by the CMTS for sending the signal requires reference by each CM.

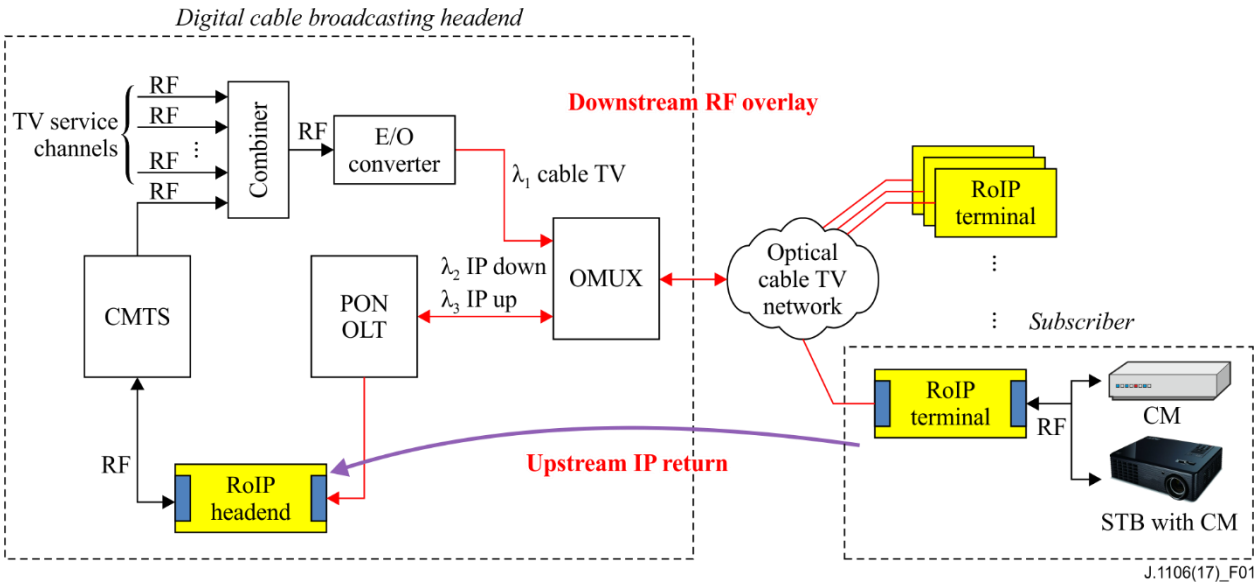

Figure 1 – System architecture for radio over Internet protocol

The RoIP system consists of two subsystems, namely the RoIP headend and the RoIP terminal.

The function of the RoIP terminal subsystem is as follows:

– reception of an US RF signal from the CM;

– transmission of the digitized RF signal to the RoIP headend over an optic-based cable TV network for IP transmission;

– synchronization with the CM;

– transmission of the DS RF signal to the CM.

The function of the RoIP headend subsystem is as follows:

– reception of digitized RF data from RoIP terminals over IP-based networks;

– reconstruction of the RF signals from the digitized RF data encapsulated in the IP packet;

– transmission of the RF signals to the CMTS;

– time synchronization with the CMTS.

7 Requirements

7.1 RoIP Terminal

[RoIP-Terminal-01] The RoIP Terminal subsystem is required to detect and acquire an RF signal from the CM.

[RoIP-Terminal-02] The RoIP Terminal subsystem is required to convert an RF signal into digitized RF data.

[RoIP-Terminal-03] The RoIP Terminal subsystem is required to acquire timestamps of RF signals.

[RoIP-Terminal-04] The RoIP Terminal subsystem is required to packetize the IP and transmit RF signals.

[RoIP-Terminal-05] The RoIP Terminal subsystem is required to transmit the acquisition times of the RF signals.

[RoIP-Terminal-06] The RoIP Terminal subsystem is recommended to compress the digitized RF data.

[RoIP-Terminal-07] The RoIP Terminal subsystem is required to synchronize the clock between the CM and RoIP terminal by using a DOCSIS management SYNC message.

[RoIP-Terminal-08] The RoIP Terminal subsystem is required to compensate network time by using the acquisition time of the RF signal and the bandwidth allocation information provided by the CMTS.

[RoIP-Terminal-09] The RoIP Terminal subsystem is required to receive a DS RF overlay signal from the CMTS.

[RoIP-Terminal-10] The RoIP Terminal subsystem is required to convert from an optical to an electrical signal.

[RoIP-Terminal-11] The RoIP Terminal subsystem is required to transmit the RF signal to the CM. See [b-ANSI/SCTE 135-1] [b-ANSI/SCTE 135-5 2009] for more information.

7.2 RoIP Headend

[RoIP-Headend-01] The RoIP Headend subsystem is recommended to decompress compressed digital RF data.

[RoIp-Headend-02] The RoIP Headend subsystem is required to buffer the digitized RF data to compensate for transmission delay variation.

[RoIP-Headend-03] The RoIP Headend subsystem is required to schedule the RF signals according to the permitted time period.

[RoIP-Headend-04] The RoIP Headend subsystem is required to convert digitized RF data into an RF signal.

[RoIP-Headend-05] The RoIP Headend subsystem is required to transmit RF signals at a scheduled time.

[RoIP-Headend-06] The RoIP Headend subsystem is required to synchronize clock between the CMTS and the RoIP headend using a DOCSIS management SYNC message.

[RoIP-Headend-07] The RoIP Headend subsystem is required to synchronize the network time using a ranging process.

[RoIP-Headend-08] The RoIP Headend subsystem is required to process bandwidth allocation information provided by the CMTS.

Bibliography

[b-ANSI/SCTE 135-1] ANSI/SCTE 135-1 2013, *DOCSIS 3.0 Part 1: Physical layer specification*.

[b-ANSI/SCTE 135-5 2009] ANSI/SCTE 135-5 2009, *DOCSIS 3.0 Part 5: Cable modem to customer premise equipment interface*.

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