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

Switched digital video over cable networks

Requirement of channel switching service over hybrid fibre and coaxial based network

Recommendation ITU-T J.1105

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Summary

Recommendation ITU-T J.1105 describes the requirement of channel switching service over Hybrid fibre and coaxial based network. The cable broadcasting system has been changed to use resources efficiently and transmits it to easily accommodate the varying needs of subscribers. Therefore, it is necessary to define the requirement of channel switching service using bandwidth effectively on HFC network environment. This Recommendation contains descriptions for requirement of channel switching service over hybrid fibre coaxial (HFC) based networks.

History

Edition	Recommendation	Approval	Study Group	Unique ID[*]
1.0	ITU-T J.1105	2016-10-14	9	11.1002/1000/13057

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FOREWORD

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Requirement of channel switching service over hybrid fibre and coaxial based network

1   Scope

The proposed channel switching service is possible to share and provide the same frequency bandwidth for communication and broadcasting service without implementing a complicated system. The proposed channel switching service is required to support downstream service only.

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.210]   Recommendation ITU-T J.210 (2006), *Downstream RF interface for cable modem termination systems.*

[ITU-T J.222.1]   Recommendation ITU-T J.222.1 (2007), *Third-generation transmission systems for interactive cable television services – IP cable modems*: *Physical Layer specification.*

[ITU-T J.222.2]   Recommendation ITU-T J.222.2 (2007), *Third-generation transmission systems for interactive cable television services – IP cable modems*: *MAC and Upper Layer protocols.*

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

HFC   Hybrid Fibre Coaxial

MAC   Media Access Control

QAM   Quadrature Amplitude Modulation

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 Recommendation 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 Recommendation 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

Channel switching service over HFC-based network can be provided on a cable channel switching system as shown in Figure 1. The cable channel switching system includes control function, channel switching function, multiplexing and transmission function, and receiver function.
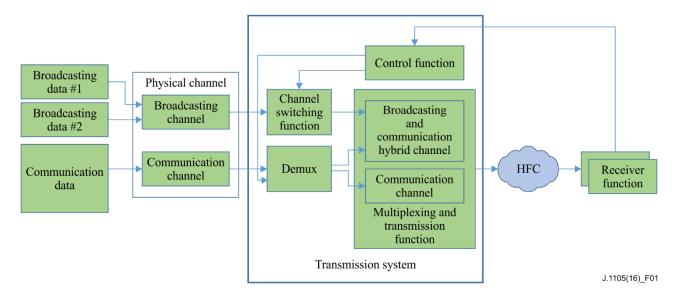

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Figure 1 – Channel switching service and system

It is possible that one or more broadcasting services is contained in one physical channel (i.e., 6 or 8 MHz). The frequency allocation of broadcasting service and communication service is shown in Figure 2.
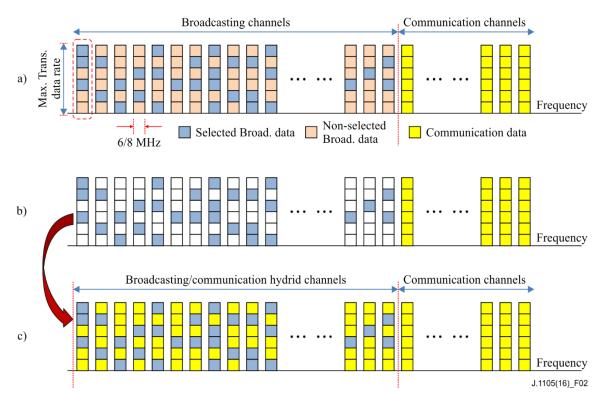
Figure 2 – Frequency allocation of channel switching service

7 Requirements

7.1 Control function

The control function of the channel switching service system is required to collect the subscriber's selected broadcasting service channel information in real time.

The control function of the channel switching service system is required to update the subscriber's selected broadcasting service channel information in real time.

7.2 Channel switching function

The channel switching function of the channel switching service system is required to distinguish a packet of selected broadcasting channel. It is required to send only packets of selected broadcasting channel as well as to drop packets of non-selected broadcasting channel.

7.3 Transmission function

7.3.1 Physical channel

Each physical channel of the channel switching service system is required to include one and/or more broadcasting service data.

The broadcasting and communication hybrid service channel switching service system is required to be provided in the broadcasting channels.

The communication data of the channel switching service system is required to transmit using the non-selected broadcasting channels.

7.3.2 Service stream

Identifier in service packet header of the channel switching service system is required to distinguish the broadcasting service data from the communication service data.

Communication service data of channel switching service system is required to change media access control (MAC) frame to MPEG-2 TS packet.

7.3.3   Multiplexing

The broadcasting data stream and communication data stream of the channel switching service system is required to multiplex in order to create a hybrid transmission data stream. In addition, the broadcasting data stream is required to be multiplexed prior to the communication data stream.

7.3.4   Transmission

The input data format of quadrature amplitude modulation (QAM) modulator of channel switching service system is required to support the MPEG-2 TS.

The selected broadcasting channels of the channel switching service system are required to be transmitted.

Data stream for communication service of the channel switching service system is required to be transmitted according to transmission scheduling for each physical channels.

Channel bonding of the channel switching service system is recommended to be supported for communication data service.

7.4   Subscriber function

The selected channel of the channel switching service system is required to be received without any change.

The information of channel switching of the channel switching service system is required to be transmitted to the transmission system.

The cable modem (CM) of the channel switching service system is required to obtain communication data by removing the broadcasting data in case of hybrid transmission data stream.

Channel bonding of the channel switching service system is required to combine several distributed communication data.

Annex A

Example of channel switching service

(This annex forms an integral part of this Recommendation.)

Every cable broadcasting service operator may have a different channel allocation, but in most cases, the channel allocation is divided into an upstream transmission frequency and a downstream transmission frequency. The downstream transmission frequency is further divided into analogue broadcasting, digital broadcasting and communication data transmission.

For example, channel switching service in cable TV uses a 6 MHz channel bandwidth and 256 QAM. This supposes that several logical channels are included in a physical channel. The transmission data rates of a physical channel is about 38.8 Mbit/s. Therefore, if the frequency bandwidth of a channel is 8 MHz or uses 64 QAM or 1024 QAM, an additional analysis may be requested.

Channel switching in digital broadcasting is the transmission of the subscriber's selected channels only and not the unilateral transmission of all broadcasting channels. This is a service to increase the efficiency of frequency use by transmitting subscriber's selected channels only and using other channel bands for communication service. Figure A.1 shows an example of switching in typical digital cable broadcasting.

In typical cable broadcasting, the broadcast channel band is distinguished from the communication channel band, and there are selected channels and non-selected channels of subscribers as shown in Figure A.1(a). The example in Figure A.1(c) shows only selected channels that are re-multiplexed and redistributed and other channels are used as data over cable service interface specifications (DOCSIS) channel for data communication.. However, it is very difficult to implement switching system and operate channels in real time. Whenever a selected channel is changed in real time, the channel should be re-multiplexed. So re-multiplexer for each physical channel is requested. Devices to input logical channel data to the physical channel are requested because logical data to each physical channel is continuously changed to currently selected channels. The data of signalling information and program specific information by re-multiplexing should be updated in real time as logical channel of physical channel is changed.

Consideration should be given on how to improve the efficiency of frequency use by providing a system that implements broadcast channel switching without introducing unnecessary complications.

Figure A.2 shows how to increase the efficiency of frequency use by combining communication data with broadcasting data, and transmitting them to idle bandwidth by each channel, without transmitting those channels that were not selected.

This does not need to re-multiplex broadcast channels transmitting after broadcast channel switching and also to change channel signalling information because physical channels transmitting broadcast channels are not changed. If adding communication data to idle bandwidth of the physical channel and transmitting them by transmitting only broadcasting data watched now from a physical channel through broadcast channel switching in real time against subscriber's channel switching continuously, it is possible to get the same efficiency of frequency use.
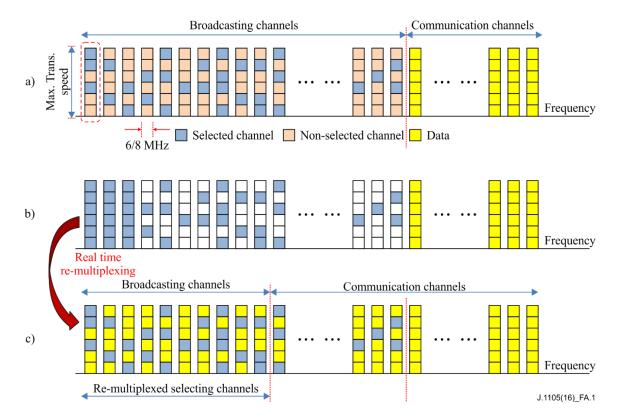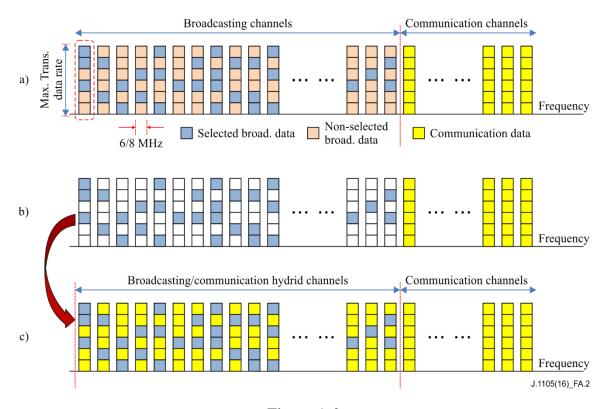
Figure A.1

Figure A.2

Bibliography

[b-ANSI/SCTE 133 2010]   ANSI/SCTE 133 (2010), *Downstream RF interface for Cable Modem Termination Systems*.

[b-ANSI/SCTE 135-1 2008]   ANSI/SCTE 135-1(2008), *DOCSIS 3.0 Part 1: Physical Layer Specification*.

[b-ANSI/SCTE 135-2 2008]   ANSI/SCTE 135-2 (2008), *DOCSIS 3.0 Part 2: MAC and Upper Layer Protocols*.

[b-ANSI/SCTE 135-4 2008]   ANSI/SCTE 135-4 (2008), *DOCSIS 3.0 Part 4: Operations Support Systems Interface*.

[b-ANSI/SCTE 135-5 2009]   ANSI/SCTE 135-5 (2009), *DOCSIS 3.0 Part 5: Cable Modem to Customer Premise*.

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