

Hitron Technologies
Digital Terminal Division
Conditional Access Kernel
IRD Command Specification
V 1.3.2

This document contains confidential and privileged information.
The reproduction of any part of the document is strictly prohibited
without the prior written consent of Nagravision S.A.

Table Of Contents

<u>1</u>	<u>Introduction</u>	4
1.1	<u>Purpose</u>	4
1.2	<u>Document History</u>	4
1.3	<u>Definitions, Acronyms, and Abbreviations</u>	4
1.4	<u>Notational Conventions</u>	5
1.5	<u>References</u>	5
1.6	<u>Trademarks</u>	5
1.7	<u>Overview</u>	5
<u>2</u>	<u>IRD Command Format</u>	7
<u>3</u>	<u>Generic IRD Commands</u>	8
3.1	<u>Reset PIN Code</u>	8
3.2	<u>Mail</u>	8
3.3	<u>Force Tune</u>	9
3.4	<u>Force Identification</u>	10
3.5	<u>Set Macrovision CPS</u>	10
3.6	<u>Configure STB</u>	11
3.7	<u>Set Network ID</u>	13
<u>4</u>	<u>Specific IRD Commands</u>	14

List Of Tables

Table 1 - Document History	4
Table 2 - Definitions, Acronyms, and Abbreviations	4
Table 3 - Commands Summary	5

1 Introduction

1.1 Purpose

This document defines the general format of an IRD command as well as generic NagraVision commands, such as "Reset PIN Code" or "Force Tune". It also defines the rules for defining manufacturer's or operator's specific commands.

1.2 Document History

Version	Date	Author	Description
1.3.2	05-Jul-2002	Jean-Luc Bussy	Added the Set Network ID command.
1.3.1	02-Dec-2001	Jean-Luc Bussy	Improved description of the Mail command, added "Configure STB" command and changed the way to handle specific commands.
1.3.0	06-Juin-2001	Jean-Luc Bussy	Added Macrovision command and renamed the document StbCakIrdSpe.
1.2	06-Oct-2000	Jean-Luc Bussy	Added the Force Identification command and several manufacturer's command id.
1.1	01-Feb-2000	Patrick Schyrr	Add ADB and Microsoft specific command id. * MERGEFORMAT
1.0	07-Sep-1999	Philippe Stransky	First issue. Extracted from the EMM and ECM descriptions. Includes a range for STB manufacturers.

Table 1 - Document History

1.3 Definitions, Acronyms, and Abbreviations

Acronym Abbreviation	Definition
CA	Conditional Access
CAK	Conditional Access Kernel
DVB	Digital Video Broadcasting
IRD	Integrated Receiver Decoder
STB	Set-Top Box
NVM	Non-volatile memory

Table 2 - Definitions, Acronyms, and Abbreviations

1.4 Notational Conventions

All source code occurrences appear in `courier` writing style

1.5 References

[1] Force Identification, Implementation Guidelines V1.0.0

1.6 Trademarks

Any company's or product name(s) found herein may be the trademarks or registered trademarks of their respective companies.

1.7 Overview

IRD commands allow the head-end to send messages to the set-top box in a secured way. IRD commands are carried by EMMs. They can benefit from EMM addressing mode. It means that a message can be addressed to one single set-top box or in the opposite to all set-top boxes.

The CA Kernel embedded in the set-top box is not dependent at all on IRD commands. It gets the command from the smartcard and forward it to the set-top box application without additional processing. The set-top box application is completely responsible of IRD command management. Periodicity of commands (coming from the fact that commands are carried by EMMs) has to be managed by the set-top box application by means of the sequence number. If a command has to be split in several commands due to the EMM length limitation, it is also the responsibility of the set-top box application to re-build the original command.

NagraVision has defined a set of generic commands. The table here below gives a synopsis of these commands along with the associated command identifier. Refer to §3 for a detail description.

Name	command_id	operation
Reset PIN Code	0x12	0x01
Mail	0xC0	0x01
Force Tune	0xC1	0x01
Force Identification	0xC2	0x01
Set Macrovision CPS	0xC4	0x01
Configure STB	0xC5	0x01
Set Network ID	0xC6	0x01

Table 3 - Commands Summary

All commands required by a manufacturer or an operator that doesn't belongs to this list may result in a specific command. Refer to §4 for a description of the procedure allowing the definition of a specific command.

CONFIDENTIAL

2 IRD Command Format

Description

Defines the general format of an IRD command.

Format

```
IRD_command() {  
    EMM_command      8    uimbsf    value 0x64  
    length            8    uimbsf    maximum value = 55 (0x37)  
    command_body {  
        sequence_number 32    uimbsf  
        command_id      8    uimbsf  
        operation        8    uimbsf  
        for(i=0; i < N; i++) {  
            data          8    bs1bf  
        }  
        checksum         8    bs1bf  
    }  
}
```

Parameters

sequence_number	value incrementing with each command. Command with the same sequence number is processed only once.
command_id	command identifier number, described in the next sections.
operation	used in conjunction with the command_id. The couple (command_id, operation) uniquely identifies a command.
data	additional data.
checksum	two's complement of the sum of all bytes from the command_id to the last data byte. The sum of all bytes from the command_id to the checksum must be equal to 0.

3 Generic IRD Commands

3.1 Reset PIN Code

Description

Forces the STB clear the parental code. This may be required if the subscriber loses its PIN code, or when reclaiming the STB from the field.

Format

command_id	0x12	Reset PIN code
operation	0x1	PIN code #1
checksum	8 bslbf	checksum

Parameters

None.

Notes

1. If multiple PIN codes are available, then the operation field indicates the PIN code number.

3.2 Mail

Description

This command provides mail messages to the STB. The management of the messages is the STB responsibility.

Format

command_id	0xC0	Mail message
operation	0x1	Mail type 1
data{		
mail_id	10 uimbsf	Mail message number
total_segment	6 uimbsf	Total number of segments
priority	2 uimbsf	0 = normal priority, 1 = high priority, 2 = emergency, 3 = reserved
segment_number	6 uimbsf	
for (i=0; i < N; i++){		
message	8 uimbsf	Mail message body
}		
checksum	8 bslbf	Checksum

Parameters

mail_id	Unique mail number
total_segment	Total number of segments required to carry the whole message. It's a 6-bit variable covering the range [1..63]. Each segment may carry up to 45 bytes.
priority	Influences the STB behaviour. For example, normal priority would not affect the display, while emergency mail would be displayed on the screen without manual intervention.
segment_number	Identifies the current segment. The first segment is equal to 0 and the last segment is equal to total_segment-1.

Notes

1. If the total length of a mail is larger than 45 bytes, then the message is split in several segments, each having the same mail id and consecutive segment numbers. As there is at the most 63 segments of 45 bytes per message, the maximum length of a message is equal to 2835 bytes.

3.3 Force Tune

Description

This command forces the STB to tune to a service defined by the network_id/transport_id/service_id. If the STB is able to query the access rights needed for the service, then the tuning should occur only if the subscriber has access to the service.

Format

command_id	0xC1		Force tune
operation	0x1		
data{			
network_id	16	uimsbf	network_id
transport_id	16	uimsbf	transport_id
service_id	16	uimsbf	service_id
}			
checksum	8	bslbf	checksum

Parameters

network_id	corresponds to the network_id as described in the DVB Network Information Table (NIT).
transport_id	corresponds to the network_id as described in the DVB Network Information Table (NIT).
service_id	corresponds to the service_id as described in the DVB Service Description Table (SDT). It may also correspond to the program number found in the MPEG Program Map Table (PMT).

3.4 Force Identification

Description

Forces the STB to display its Nagra S/N along with the UA of its smartcard on the screen for a while.

Format

command_id	0xC2	Force identification
operation	0x1	
checksum	8 bslbf	checksum

Parameters

None

Note

See document [1] for more information about this command.

3.5 Set Macrovision CPS

Description

The Macrovision system uses a chip inside the set-top box that acts on the analog video output to prevent the recording, but not the viewing. The chip accepts configuration data and operational data. Configuration data allows to parameterize the different ways to mess the signal: how long to rotate the colors, how high is the peak in the signal, and so on. This is a 136-bit string called CPS by Macrovision. Operational data says which way has to be applied: turn color stripe on, turn v sync off, and so on. This is a 8-bit string called the Mode byte by Macrovision.

The purpose of this IRD command is to provide the CPS string to a set-top box, in order to parameterize its Macrovision chip. The Mode byte is not transmitted through this command and will be part of a private descriptor present in the EIT.

Format

command_id	0xC4	Macrovision
operation	0x01	
data{		
for (i=0; i < N; i++){		
cps	8 uimbsf	CPS string
}		
checksum	8 bslbf	checksum

Parameters

cps

CPS (Copy Protection Setup) string defined by Macrovision. The actual Macrovision chip expects this string to be 136 bits long (17 bytes). However the current specification defines it of variable length in order to support future version. The length can be deduced from global "length" field of the IRD command.

3.6 Configure STB

Description

This command allows the head-end to enable or disable features in a set-top box. Each feature is associated to a single bit set to 1 when enabled and 0 when disabled. All features are disabled by default. The features configuration has to be stored in NVM so that no information is lost after power-cycling the set-top box.

Format

command_id	0xC5	Configure STB	
operation	0x01		
data{			
compatible_mode	1	bslbf	
video	1	bslbf	
audio	1	bslbf	
smartcard_1	1	bslbf	
smartcard_2	1	bslbf	
harddisk	1	bslbf	
dvd	1	bslbf	
serial_port_1	1	bslbf	
serial_port_2	1	bslbf	
parallel_port	1	bslbf	
usb_port	1	bslbf	
1394_port	1	bslbf	
spare_port_1	1	bslbf	
spare_port_2	1	bslbf	
peripheral_1	1	bslbf	
peripheral_2	1	bslbf	
for(i=0; i<N; i++){			
pattern	8	bslbf	optional
}			
checksum	8	bslbf	checksum

Parameters

compatible_mode	Usually set to 1 when the set-top box is fully DVB compliant and set to 0 when the set-top box usage is restricted to a specific network only. In case the set-top box is configured for a specific network but is connected to another network, the set-top box application shall display a proper message and all features shall be disabled. The compatible mode could be used by operators willing to avoid rented set-top boxes to be used in other networks.
video	Video decoding shall be disabled when set to 0.
audio	Audio decoding shall be disabled when set to 0.
smartcard_1	Smartcard reader 1 shall be disabled when set to 0.
smartcard_2	Smartcard reader 2 shall be disabled when set to 0.
harddisk	Hard disk shall be disabled when set to 0.
dvd	Dvd shall be disabled when set to 0.
serial_port_1	Access to serial port 1 shall be disabled when set to 0.
serial_port_2	Access to serial port 2 shall be disabled when set to 0.
parallel_port	Access to parallel port shall be disabled when set to 0.
usb_port	Access to usb port shall be disabled when set to 0.
1394_port	Access to IEEE 1394 port shall be disabled when set to 0.
spare_port_1	Access to spare port 1 shall be disabled when set to 0.
spare_port_2	Access to spare port 2 shall be disabled when set to 0.
peripheral_1	Peripheral 1 shall be disabled when set to 0.
peripheral_2	Peripheral 2 shall be disabled when set to 0.
pattern	Optional additional bit fields. Their absence shall be interpreted as value 1 by the set-top box application.

3.7 Set Network ID

Description

This command sets the set-top box network ID to a specific value. This allows the set-top box to retrieve the Network Information Table (NIT) defining the topology of a particular local area. This command can also be used to assign testing network ID to specific set-top boxes.

Format

command_id	0xC6		Set network ID
operation	0x01		
data{			
network_id	16	uimbsf	Network ID
original_network_id	16	uimbsf	Original network ID
}			
checksum	8	bslbf	Checksum

Parameters

network_id	Unique identifier indicating the network ID.
original_network_id	Unique identifier indicating the original network ID.

4 Specific IRD Commands

For any specific commands required by a manufacturer that doesn't belong to the set of generic commands defined in §3, the procedure here after has to be followed:

- The manufacturer has to issue a formal document specifying the format and the behavior of the specific command. The command must comply with the general format defined in §2, but is restricted to the definition of the *operation* and *data* fields:

```
IRD_command() {  
    EMM_command      8  
    length            8    uimsbf  
    command_body {  
        sequence_number 32    uimsbf  
        command_id      8    uimsbf  
        operation        8    uimsbf  
        for(i=0; i < N; i++) {  
            data          8    bslbf  
        }  
        checksum         8    bslbf  
    }  
}
```

- The specification is provided to NagraVision for approval by sending an email to the following address:
cak@nagra.com
- NagraVision evaluates the specification to know whether it is acceptable and assign a value to the *command_id* field. This allows to guarantee a global consistency all over the networks and allows to avoid conflicts between different commands.
NagraVision reserves the right to modify the command and move it in the set of generic commands if its usage suits a wider scope.
- In case the command remains a specific command, the manufacturer updates the specification with the *command_id* assigned by NagraVision and publishes a new version of the document.
- In case the command becomes a generic command, NagraVision updates the present document with the new command and publishes a new version.

If the request for a specific commands comes from an operator instead of a manufacturer, the procedure here above remains the same, except that the specification is written by the operator. It is then provided to manufacturers providing set-top boxes over the operator network for implementation.