BS EN 50607:2015

BSI Standards Publication

Satellite signal distribution over a single coaxial cable — Second generation

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee EPL/100/4, Cable distribution equipment and systems.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Satellite signal distribution over a single coaxial cable - Second generation

Distribution de signaux par satellite sur un seul câble coaxial - Deuxième génération

Verteilen von Satellitensignalen über ein Koaxialkabel - Zweite Generation

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

This document (EN 50607:2015) has been prepared by CLC/TC 209 “Cable networks for television signals, sound signals and interactive services”.

The following dates are fixed:

• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2015-10-20
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2017-10-20

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Introduction

In EN 61319-1:1996, the interfaces for the control and command of the devices associated with the satellite receivers are described in the following clauses:

- Clause 4: Interfaces requirements for polarizer and polar switchers;
- Clause 5: Interfaces requirements for low-noise block converters (LNB).

In these clauses, analogue techniques are described for controlling the LNB and polar switchers.

In the DiSEqC™ Bus Functional Specification, the “Digital Satellite Equipment Control Bus” (called DiSEqC) is introduced as a single method of communication between the satellite and the peripheral equipment, using only the existing coaxial cables. The existing EN 50494 “Satellite signal distribution over a single coaxial cable in single dwelling installations” describes a system for distributing signals via single coaxial cable issued from different bands and polarisations to several satellite receivers This specification is limited to 8 units per output of the Single Cable Interface and to 8 Satellite IF banks (bands, feeds, polarisations).

The second generation described in this standard is intended for single and multiple dwelling installations and includes the following enhancements compared to EN 50494:

- The number of demodulators is extended to a maximum of 32 units per output of the Single Cable Interface (hereafter referred to as SCIF) device.
- The system is scaled for a maximum number of 256 Satellite IF banks (bands, feeds, polarisations)
- The SCIF replies, which may be used during installation process, are also based on DiSEqC.
- Equipment according to this standard is downwards compatible to the specifications provided by EN 50494.

1 Scope

This European Standard describes:

- the system physical structure;
- the system control signals, which implement a set of messages using DiSEqC physical layer but not the DiSEqC message structure;
- the definition of identified configurations;
- the management of the potential collisions in the control signals traffic.

Figure 1 illustrates the physical system configuration considered in this standard.

Several satellite signal demodulators can receive signals from any of the input signal banks (Bank 1, Bank 2, Bank M, with M ≤ 256) of the LNB or the switch. The signals selected by the demodulators (or receivers) are transported via a single cable to these demodulators (Receiver 1, Receiver 2, Receiver N, with $N \leq 32$).

To achieve these single cable distributions, the Single Cable Interface (SCIF, likely embedded in a LNB or a Switch) features some specific functions and characteristics.

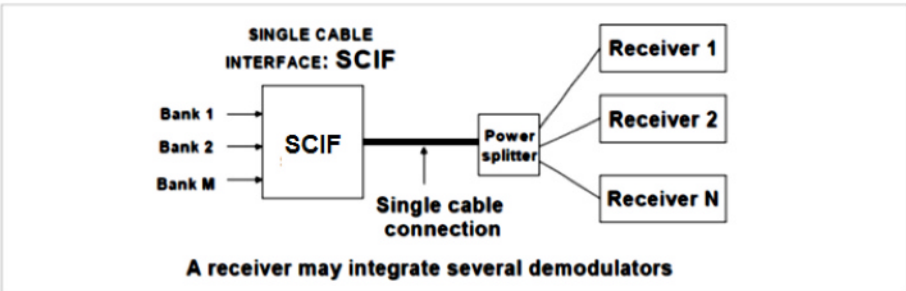

Figure 1 — General architecture of the single cable distribution

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 50494, *Satellite signal distribution over a single coaxial cable in single dwelling installations*

EN 60728-1, *Cable networks for television signals, sound signals and interactive services – Part 1: System performance of forward paths (IEC 60728-1)*

EN 60728-4, *Cable networks for television signals, sound signals and interactive services – Part 4: Passive wideband equipment for coaxial cable networks (IEC 60728-4)*

EN 61319-1:1996, *Interconnections of satellite receiving equipment – Part 1: Europe (IEC 61319-1:1995)*

IEC 60050-371, *International Electrotechnical Vocabulary - Chapter 371: Telecontrol*

IEC 60050-721, *International Electrotechnical Vocabulary - Chapter 721: Telegraphy, facsimile and data communication*

DiSEqC^{TM} Bus Functional Specification, Version 4.2, February 25, 1998[1]

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-371, IEC 60050-721, EN 60728-1 and the following ones apply.

3.1.1
bank
group of contiguous channels belonging to a polarisation and/or a band

3.1.2
channel
radio frequency transponder signal

3.1.3
command
information used to cause a change of state of operational equipment; could be part of message

[SOURCE: IEC 60050-371:1984, 371-03-01, modified]

3.1.4
committed switch
switch with specified functions (band, polarity, position, option)

3.1.5
demodulator
electronic device transposing the selected channel into the required content

3.1.6
idle mode
operation mode on low DC level

3.1.7
message
group of characters and function control sequences which is transferred as an entity from a transmitter to a receiver, where the arrangement of the characters is determined at the transmitter

[SOURCE: IEC 60050-721:1991, 721-09-01]

3.1.8
multi dwelling unit
MDU
building with many homes or offices used by single owners where television signals and sound signals are distributed and with access to interactive services

[SOURCE: IEC 60728-1:2014, 3.1.64, modified]

3.1.9
nibble
half byte

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[1] Available from http://www.eutelsat.com/satellites/4_5_5.html

3.1.10
receiver
electronic equipment embedded in a cabinet and integrating all functions for demodulating and decoding the received satellite signals (a receiver may integrate several demodulators)

3.1.11
SCIF control signal
signal sent by the demodulator to select the bank and the frequency of the desired channel and to designate the UB slot allocated to the requesting receiver

3.1.12
single cable interface
SCIF
central unit of a single cable distribution system which selects the desired channels from different banks at its input ports and allocate them to the designated UB slots at its output port

3.1.13
single dwelling installation
installation for a home or office used by a single owner where television signals and sound signals are distributed and there is access to interactive services

3.1.14
tuning word
information carried by the command *ODU_Channel_change* to select the desired channel in the SCIF

3.1.15
uncommitted switch
switch without specified functions

3.1.16
universal architecture
LNB with the following characteristics: operation in the Ku band (10,7 GHz to 12,75 GHz); local oscillator frequency is 9,75 GHz for signal frequencies lower than 11,7 GHz and local oscillator frequency is 10,6 GHz otherwise

3.1.17
user band
UB
part of the bandwidth of the shared coaxial cable which is allocated to one receiver connected to the single coaxial cable distribution system for the reception of the desired channel

3.1.18
user band slot
UB slot
one of N bands in which the total transmission bandwidth is sub-divided

Note 1 to entry: The number of user band slots *Nb_ub is a characteristic of the SCIF used.*

Note 2 to entry: The system defined in this standard limits the number of UB slots to 32 per output of the SCIF.

3.1.19
wideband architecture
LNB with the following characteristics: operation in the Ku band (10,7 GHz to 12,75 GHz); with only one local oscillator. Universal-LNB functionality is emulated by the SCIF by adding or subtracting an offset for frequency conversion according to lowband/highband selection

3.2 Abbreviations

CSS	Channel Stacking System
CW	Continuous Wave
DC	Direct Current
DiSEqC	Digital Satellite Equipment Control
High_DC	High level of DC voltage DC_{High}
IF	Intermediate Frequency
LNB	Low Noise Blockconverter
Low_DC	Low level of DC voltage DC_{Low}
LSB	Least Significant Bit
MDU	Multiple Dwelling Unit
MSB	Most Significant Bit
Nb_B	Number of Banks Nb_B
Nb_ub	Number of user bands Nb_{ub}
ODU	Out-Door Unit
PCR	Program Clock Reference
PIN	Personal Identification Number
PWK	Pulse Width Keying
SCD2	Single Cable Distribution 2 (second generation)
SCIF	Single Cable Interface
STB	Set-Top Box
UB	User Band
UB-ID	User Band Identifier

3.3 Used commands

ODU_Channel_change	Unidirectional command sent by the receiver for tuning to a required channel
ODU_Channel_change_PIN	Option for PIN protection of UB in the *ODU_Channel_change* command
ODU_PowerOFF	Unidirectional command sent to SCIF before the receiver turns into standby
ODU_PowerOFF_PIN	Unidirectional command to turn-off the PIN protected UB slot
ODU_UB_avail	Bidirectional command for requesting information about user bands available
ODU_UB_frequ	Bidirectional command for requesting the centre frequency of a specific user band
ODU_UB_inuse	Bidirectional command for requesting information about user bands currently in use
ODU_UB_PIN	Bidirectional command for requesting information about PIN protected user bands
ODU_UB_switches	Bidirectional command for requesting information about the available bank switches of a specific user band
ODU_UBxSignal_ON	Command from a receiver, specified in EN 50494, which causes the SCIF to switch on CW tones at the centre of all (maximum 8) user bands

4 System architecture

In the single coaxial cable distribution system, the bandwidth of the shared coaxial cable is divided into slots (user band: UB). The number of slots Nb_ub varies from one application to another; the number of slots Nb_ub is a characteristic of the SCIF.

The system defined in this standard limits the number of UB slots to 32 per output of the SCIF.

Each receiver connected to the single coaxial cable distribution is allocated to one UB slot. This allocation is done either in static or other modes.

In the static mode, the allocation of the UB slot is done during the installation of the satellite receiver. Only the static mode is considered in this document.

NOTE Other modes are not described in this document but could be considered in a further release or annex of this standard.

After the slot allocation, the tuner of the receiver operates at a single frequency (centre of the slot UB). To select a desired channel (frequency Fd), the demodulator sends a SCIF control signal that provides the following information:

- select the bank (band, feed, polarization) that carries the desired signal;
- select the frequency (Fd) of the desired signal;
- designate the UB slot on which the desired signal is expected.

Figure 2 illustrates the frequency mapping for such a single coaxial cable system.

Figure 3, Figure 4, Figure 5 and Figure 6 illustrate various examples for implementing the single cable distribution system (other application scenarios are possible).

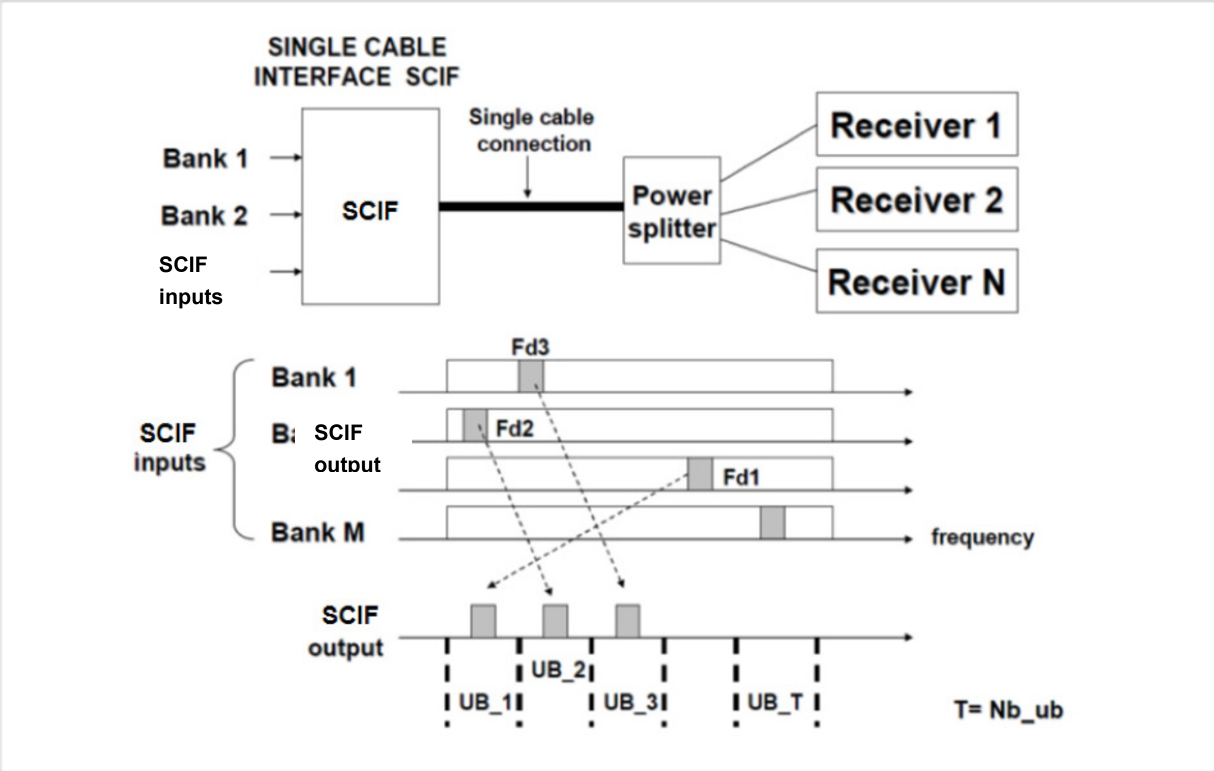


Figure 2 — General system operation and UB slot frequency mapping

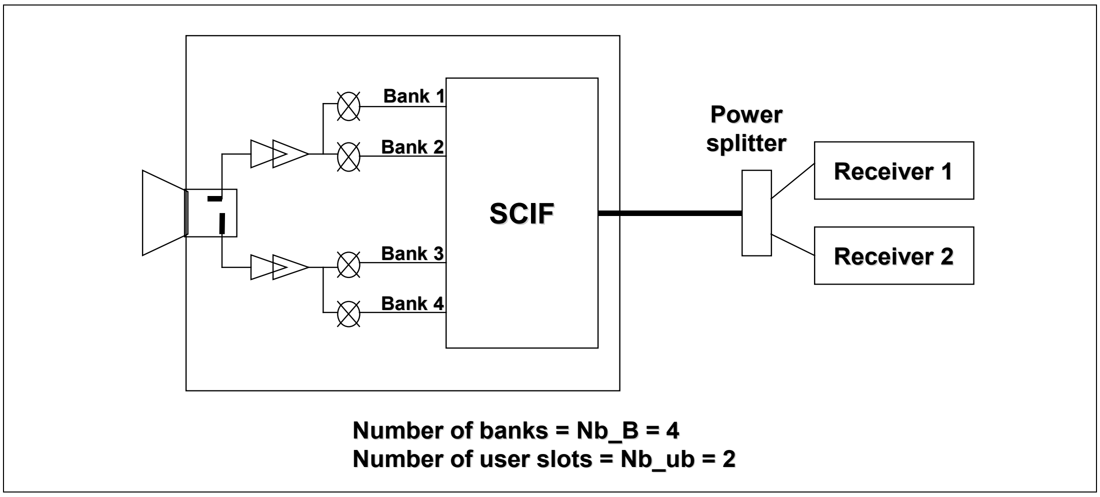
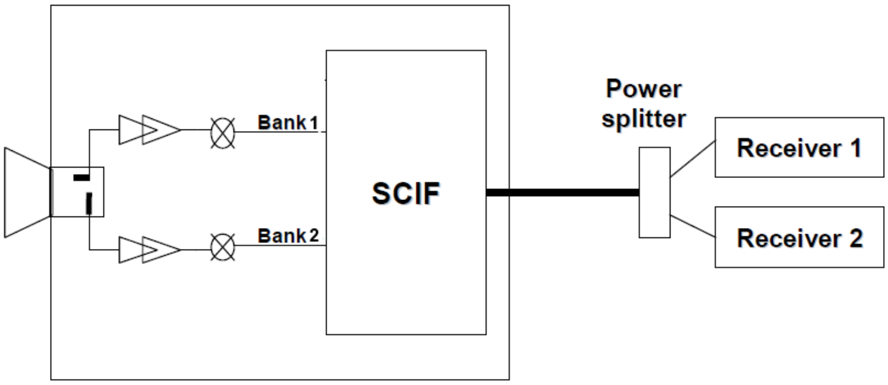


Figure 3 — Installation example, universal architecture system with reception of one orbital position (4 Satellite IF banks) by two receivers (2 UB slots)



Key

Number of banks	Nb_B = 2
Number of user slots	Nb_ub = 2

Figure 4 − Installation example, wideband architecture system with reception of one orbital position (2 Satellite IF banks) by two receivers (2 UB slots)

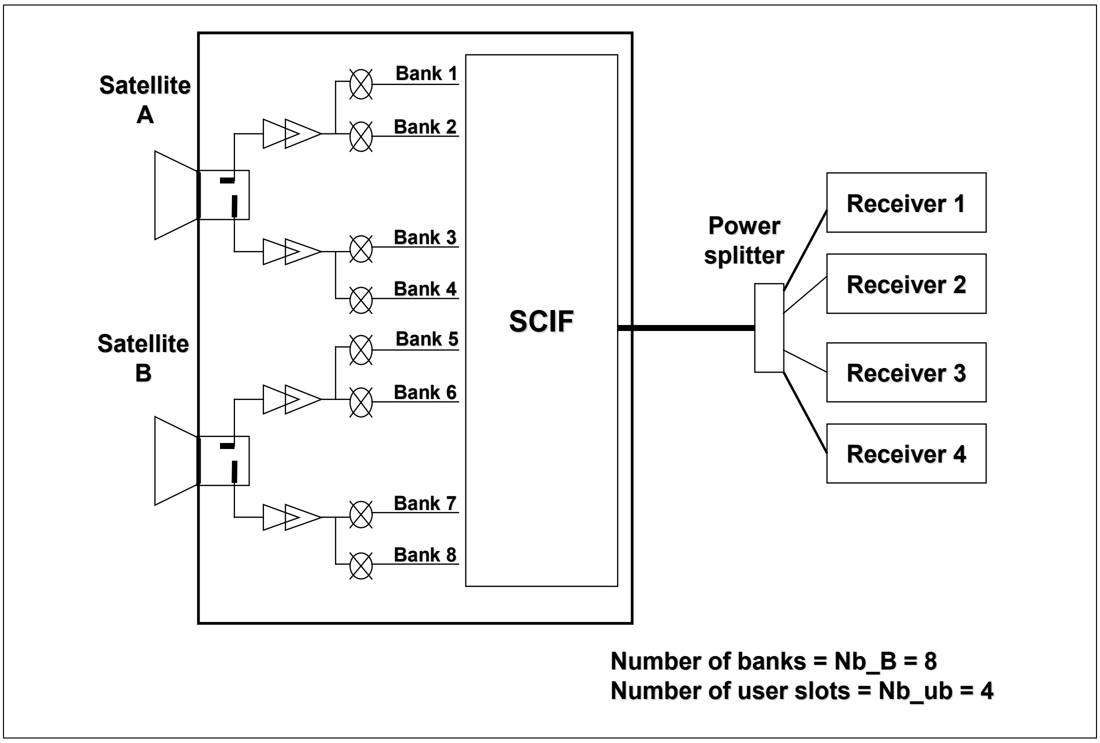


Figure 5 — Installation example implementing the reception of two orbital positions (8 satellite IF banks) by four receivers (4 UB slots)

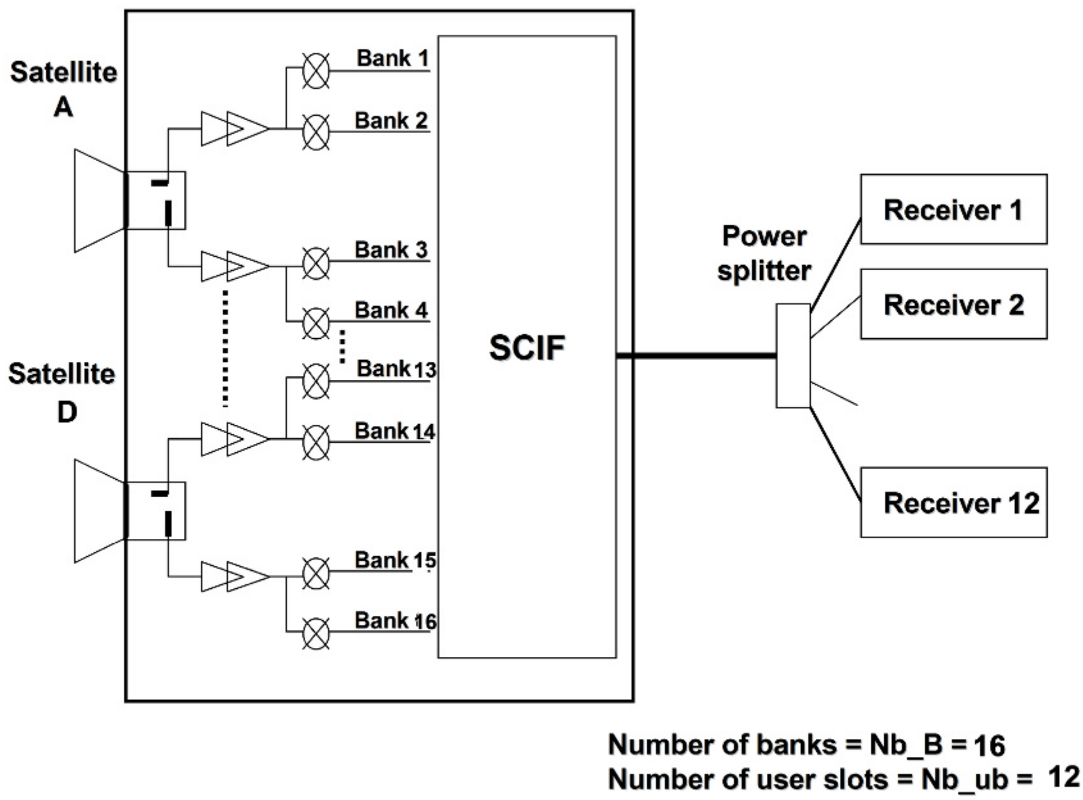


Figure 6 — Installation example implementing the reception of four orbital positions (16 satellite IF banks) for 12 receivers (12 UB slots)

5 SCIF control signals

5.1 DC levels

In a single coaxial cable distribution system, all controls issued by the receivers (demodulators) use the DiSEqC physical layer.

The single coaxial cable distribution system is not backwards compatible with the former 13/18 V control associated with a continuous 22 kHz tone. The single coaxial cable distribution system is also not backwards compatible with the tone burst signalling.

In single coaxial cable distribution systems, the signal-sending receiver generates a high DC level upon which the SCIF control signals are added. After sending the SCIF control signal, the receiver returns to an idle mode in which it generates a low DC level onto the single cable distribution system (see Figure 7). With reference to the DiSEqC™ Bus Functional Specification, the low and high DC level shall have the following limits on the signal-sending-receiver side:

- LOW_DC value: 12,5 V to 14 V;
- HIGH_DC value: 17 V to 19 V.

For uni-directional communication (DiSEqC level 1.0; based on the DiSEqC™ Bus Functional Specification), the timing shall have the following limits according to Table 1:

Table 1 — Timing for unidirectional communication

Time period	Minimum duration [ms]	Maximum duration [ms]	Description
T1+T2		22	Rise Time and Setup Time
T2	2		Setup time
T3	54	67,5	13,5 ms per byte
T4	2		Wait time after end of DiSEqC message (T3)
T4+T5		40	Fall time and Wait Time
T1 up to T5		129,5	

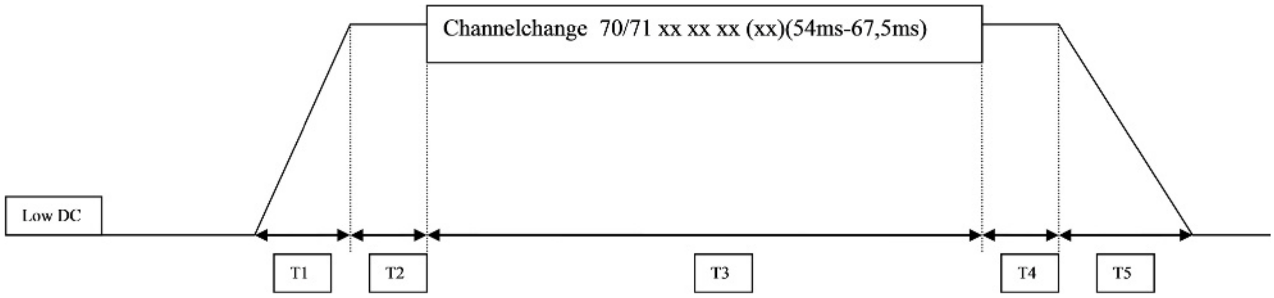


Figure 7 — Signal sent by the receiver for uni-directional communication

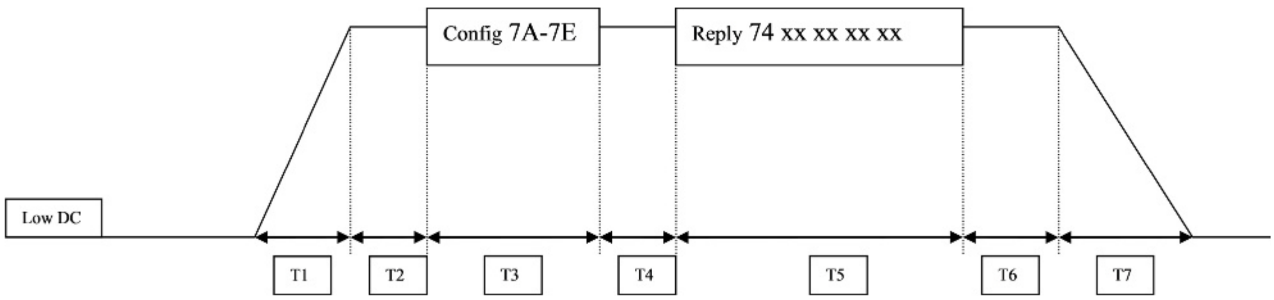
In Clause 7, the channel-change commands (70/71 in Figure 7) are described in detail.

After each uni-directional message, SCIF reply or reply timeout, the voltage shall return to “LOW_DC” before sending another message (see Figure 7).

For bi-directional communication (DiSEqC level 2.0; based on the DiSEqC™ Bus Functional Specification), the timing shall have the following limits according to Table 2:

Table 2 — Timing for bidirectional communication

Time period	Minimum duration [ms]	Maximum duration [ms]	Description
T1+T2		22	Rise Time and Setup Time
T2	2		
T3	13,5	27	13,5 ms per byte
T4	15	25	Return to Low DC after Timeout of 50 ms (receiver)
T5	40,5	67,5	13,5 ms per byte
T6	2		Wait Time after DiSEqC message (T5)
T6+T7		40	Wait Time and Fall Time
T1 up to T7		181,5	



NOTE Maximum 4 Data Bytes due to 32 UB slots in reply.

Figure 8 — Signal sent by the receiver for bi-directional communication

In Clause 7, the Config and Reply commands (7A-7E and 74xx… in Figure 8) are described in detail. The hardware of the communication bus shall be realized according to the DiSEqC^{TM} Bus Functional Specification. Some additional care shall be taken to ensure an appropriate impedance of the installation during the SCIF control signals. In Annex A, some implementation rules are given.

5.2 Method of the data bit signalling

DiSEqC uses base-band timings of 500 µs (±100 µs) for a one-third-bit PWK coded signal on a nominal 22 kHz (± 4 kHz) carrier according to the DiSEqC^{TM} Bus Functional Specification. Figure 9 shows the 22 kHz time envelope for each bit transmitted, with nominally 22 cycles for a bit “0” and 11 cycles for a bit “1”.

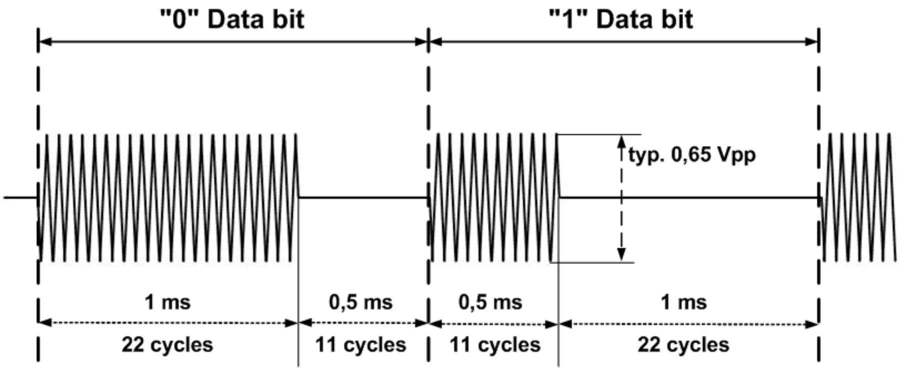


Figure 9 — Bit signalling according to DiSEqC format

6 Structure and format of the messages of the 2nd generation single cable distribution system (SCD2)

6.1 Backwards Compatibility to EN 50494

For compatibility reasons all SCIF devices supporting SCD2 shall also include the corresponding functionality of EN 50494.

6.2 Non-DiSEqC structure

SCD2 uses DiSEqC physical layer, but a non-DiSEqC message structure optimised for single cable operation.

FRAMING: the framing is reduced to the first four bits (7 to 4) of the first byte. The value is “7 h”. Commands with this framing will be ignored by known DiSEqC slaves.

ADDRESS: as remote tuning systems only have one slave there is no addressing of multiple devices required, and therefore the DiSEqC address scheme is not used.

COMMAND: the commands are already transmitted in the lower nibble of the first byte (.3 to 0,0).

The length of the complete message can vary between one byte only and eight bytes.

6.3 Uni-directional operation

Uni-directional operation is used for regular tuning commands such as “70 h” and “71 h”. Voltage levels and timings are defined in Figure 7.

6.4 Bi-directional operation

Bi-directional operation may be used for receiver installation purposes. Voltage levels and timings are defined in Figure 8. To use bi-directional communication, hardware according to DiSEqC level 2.0 in the DiSEqC™ Bus Functional Specification shall be used (see A.2). Receivers shall send the request on the “HIGH_DC” and hold this high DC level until either the reply was received or 50ms after the request have passed (timeout condition). In case of improper reply, the receiver may send the request up to five times using the repeat mechanism described in Clause 9.

Support of bidirectional operation is optional for the receiver and mandatory for the SCIF.

7 SCD2 commands

7.1 ODU_Channel_change

7.1.1 Formats

The receiver uses this uni-directional command when tuning to a (new) channel is required. Timing is described in Figure 7.

ODU_Channel_change format:

70h	Data 1	Data 2	Data 3

Data 1 format:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
UB [4:0]					T [10:8]		

Data 2 format:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
T [7:0]							

Data 3 format:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
“Uncommitted switches”				”Committed switches”			

- UB [4:0] bits select the UB slot on which the desired signal is expected (Userband-ID).
- “Uncommitted switches” is extended satellite selection known from DiSEqC 1.1. Lower data nibble of DiSEqC command “39h” can be mapped in here (“uncommitted switch 1” is Bit 4).
- “Committed switches” is the band (.0), polarity (.1), position (.2) and option (.3) bits known from DiSEqC 1.0. Lower data nibble of DiSEqC command “38h” can be mapped in here (“band” is LSB).
- The T[..] word is the tuning word calculated by the receiver as follows:

$T = F_{IF} - 100$

where

T	is the decimal value of the tuning word T[..]. (see above);
F_{IF}	is the IF frequency in MHz (where the tuner would tune to when connected directly);
100	is the constant value used to compress the T[..] word.

7.1.2 "Special" frequencies

Some frequencies are defined as control modes:

Tuning value "0": Turn off UB (ODU_PowerOFF).

This command shall be sent to the SCIF before the receiver turns into Standby mode.

Tuning value "1": Switch on CW tone at the centre of UB.

This command is intended for receivers which support this standard but are not capable of receiving DiSEqC based installation replies (see 7.3 up to 7.7). In this case, such a receiver can use tone detection as described in EN 50494.

Tuning value "2": Switch on CW tone at the centre of UB plus 20 MHz.

This command is intended for receivers which support this standard but are not capable of receiving DiSEqC based installation replies (see 7.3 up to 7.7). In this case, such a receiver can use tone detection as described in EN 50494. In addition to Tuning value "1", the UB slot frequency can be shifted by 20 MHz which excludes the possibility that the receiver had detected any interferer at the position of the nominal UB slot frequency.

Tuning value "3": Switch on CW tones at the centre of all UBs (only for test purposes for example application of a measurement receiver). This command shall not be used in STB.

This remark is related to backward compatibility to EN 50494. If a receiver which only supports EN 50494 but not the specifications of this standard sends "ODU_UBxSignal_On"(as defined in EN 50494), the SCIF shall only switch on those 8 UB slots with the eight lowest IF frequencies.

Tuning value "4": Switch off all CW tones.

Tuning value "5" to "9": reserved for future use.

Tuning value ≥ "10": regular tuning.

7.2 ODU_Channel_change_PIN

The use of this command is optional for MDU application.

The receiver uses this uni-directional command when tuning to a (new) channel is required. The UB will be protected by a PIN.

ODU_Channel_change format:

71h	Data 1	Data 2	Data 3	Data 4

Data 1, Data 2 and Data 3 are identical to command 70h.

Data 4 is foreseen for an additional PIN Code P[7:0]. The PIN code is intended for optional pairing of UB-Slot and receiver which is necessary for more reliable operation in multi-dwelling installations.

When a UB slot is unprotected, any receiver of the installation can access to it with or without a PIN code. But once a UB slot has been accessed with its granted PIN code, the SCIF only gives access to this UB slot to commands carrying the proper PIN code. This operation mode remains until the UB slot is turned-off with the proper ODU_PowerOFF_PIN command.

This specification only covers manual handling of PIN codes which also needs strong central administration by the installer, operator etc. Therefore, PIN codes shall be stored in a non-volatile way in the SCIF. Additional commands like retrieving PIN codes from the SCIF etc. are not implemented in this specification to keep the implementation as simple as possible. The SCIF manufacturer shall provide the UB slot to PIN code pairing to the end-users (e.g. by a printed label on the SCIF cover).

7.3 ODU_UB_avail

The receiver uses this bi-directional command to request information about available userbands. Circuitry with bi-directional capability according to Annex A is required. Timing is described in Figure 8.

Receiver request ODU_UB_avail:

7Ah

The implementation of this command in the receiver is optional and can be used for installation aid purposes.

ODU reply:

74h	Data 1	Data 2	Data 3	Data 4

Data 1 format:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
UB_32	UB_31	UB_30	UB_29	UB_28	UB_27	UB_26	UB_25

Data 2 format:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
UB_24	UB_23	UB_22	UB_21	UB_20	UB_19	UB_18	UB_17

Data 3 format:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
UB_16	UB_15	UB_14	UB_13	UB_12	UB_11	UB_10	UB_9

Data 4 format:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
UB_8	UB_7	UB_6	UB_5	UB_4	UB_3	UB_2	UB_1

Available user bands will be reported as “1”, not available user bands are reported as “0”.

The implementation of the reply message in the SCIF is mandatory.

7.4 ODU_UB_PIN

The receiver uses this bi-directional command to request information about PIN protected user bands. Circuitry with bi-directional capability according to Annex A is required. Timing is described in Figure 8. The implementation of this command in the receiver is optional and can be used for installation aid purposes.

Receiver request ODU_UB_PIN:

7Bh

The implementation of the request command in the receiver is optional.

ODU reply:

74h	**Data 1**	**Data 2**	**Data 3**	**Data 4**

Data 1 format:

Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
UB_32	UB_31	UB_30	UB_29	UB_28	UB_27	UB_26	UB_25

Data 2 format:

Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
UB_24	UB_23	UB_22	UB_21	UB_20	UB_19	UB_18	UB_17

Data 3 format:

Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
UB_16	UB_15	UB_14	UB_13	UB_12	UB_11	UB_10	UB_9

Data 4 format:

Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
UB_8	UB_7	UB_6	UB_5	UB_4	UB_3	UB_2	UB_1

Actually protected user bands (tuning with ODU_Channel_Change_PIN) will be reported as “1”, non-protected user bands are reported as “0”.

The implementation of the reply message in the SCIF is mandatory.

7.5 ODU_UB_inuse

The receiver uses this bi-directional command to request information about user bands currently in use. Circuitry with bi-directional capability according to Annex A is required. Timing is described in Figure 8. “In use” means UB having a tuning value of “10” or greater. Tone beacons are reported as “not in use”.

Receiver request ODU_UB_inuse:

7Ch

The implementation of this command in the receiver is optional and can be used for installation aid purposes.

ODU reply:

74h	Data 1	Data 2	Data 3	Data 4

Data 1 format:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
UB_32	UB_31	UB_30	UB_29	UB_28	UB_27	UB_26	UB_25

Data 2 format:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
UB_24	UB_23	UB_22	UB_21	UB_20	UB_19	UB_18	UB_17

Data 3 format:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
UB_16	UB_15	UB_14	UB_13	UB_12	UB_11	UB_10	UB_9

Data 4 format:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
UB_8	UB_7	UB_6	UB_5	UB_4	UB_3	UB_2	UB_1

User bands in use will be marked as “1”, not in use will be reported as “0”.

The implementation of the reply message in the SCIF is mandatory.

7.6 ODU_UB_freq

The receiver uses this bi-directional command to request the centre frequency of a specific user band. Circuitry with bi-directional capability according to Annex A is required. Timing is described in Figure 8.

Receiver request ODU_UB_freq:

7Dh	Data 1

Data 1 format:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
UB [4:0]					Set to “0”		

The implementation of this command in the receiver is optional and can be used for installation aid purposes.

ODU reply:

74h	Data 1	Data 2

Data 1 format:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
UB [4:0]					T [10:8]		

Data 2 format:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
T [7:0]							

The centre frequency of a specific user band is calculated as follows:

$F_{UB} = T + 100$

where

T	is the decimal value of the tuning word T[..];
F_{UB}	is the UB centre frequency in MHz;
100	is the constant value used to compress the T[..] word.

The implementation of the reply message in the SCIF is mandatory.

7.7 ODU_UB_switches

The receiver uses this bi-directional command to request the available bank switches of a specific user band. Circuitry with bi-directional capability according to Annex A is required. Timing is described in Figure 8. This command is similar to DiSEqC commands “14h” and “15h” in multi-switch environments.

Receiver request ODU_UB_switches:

7Eh	Data 1

Data 1 format:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
UB [4:0]					Set to “0”		

The implementation of the request command in the receiver is optional.

ODU reply:

74h	Data 1	Data 2

Data 1 format:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
UB [4:0]					Set to “0”		

Data 2 format:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Available “uncommitted switches”				Available „committed switches“			

- “Uncommitted switches” is extended satellite selection known from DiSEqC 1.1. Uncommitted switch 1 is Bit 4. Available control switch is signalled as “1”, non-available switch is reported as “0”.
- “Committed switches” is band (.0), polarity (.1), position (.2) and option (.3) bit known from DiSEqC 1.0. Available control switch is signalled as “1”, non-available switch is reported as “0”.

The implementation of the reply message in the SCIF is mandatory.

8 Conventions

8.1 UB slots numbering

Table 3 describes the numbering order of the UB slots.

Table 3 — UB slot numbering

UB slot	UB[3:0]
UB_1	00h
UB_2	01h
UB_3	02h
UB_4	03h
UB_5	04h
UB_6	05h
UB_7	06h
UB_8	07h
UB_9	08h
UB_10	09h
UB_11	0Ah
UB_12	0Bh
UB_13	0Ch
UB_14	0Dh
UB_15	0Eh
UB_16	0Fh
UB_17	10h
UB_18	11h
UB_19	12h
UB_20	13h
UB_21	14h
UB_22	15h
UB_23	16h

UB_24	17h
UB_25	18h
UB_26	19h
UB_27	1Ah
UB_28	1Bh
UB_29	1Ch
UB_30	1Dh
UB_31	1Eh
UB_32	1Fh

Definition: UB_1 features always the lowest centre frequency among the slots available in the system, UB_2 the second lowest and so forth.

The centre frequency of the UB slots shall respect the following limits: 950 MHz ≤ F_{UB} ≤ 2 150 MHz.

8.2 Numbering of satellite IF banks

The numbering of satellite IF banks (committed/uncommitted switches) is according to EN 61319-1.

9 Traffic collision management rules

9.1 General

The single coaxial cable installation actually implements a multi-master to one slave architecture. Therefore, collisions may happen between SCIF control signals issued by different receiver units.

When a collision event happens, the SCIF cannot decode any of the conflicting SCIF control signals; this means that the SCIF control signals are not processed.

Receivers shall implement an automatic detection of control signal collision and repetition of control signals, thereby:

- achieving practically 100 % reliability of collision detection,
- largely avoiding generation of subsequent collisions and
- keeping the time until start of decoding of the desired channel as short as possible,

in order to provide a positive user experience for all users connected to the system.

9.2 Automatic detection of SCIF control signal failure

In case of SCIF control signal failure, the transport stream being decoded remains unchanged; this situation shall be detected after a delay Tw (Twait, refer to Figure 10) by different methods:

- The absence of corrupted packet after the SCIF control signal: this detection is operated at the demodulator level.; Tw_max = SCIF control signal duration +10 ms.
- Continuity in the programme clock reference (PCR) counter: this detection is operated in the low-level software drivers of the de-multiplexer. For details, see ISO/IEC 13818-1. Tw_max = SCIF control signal duration + 200 ms (PCR is refreshed every 100 ms).
- Continuity in the transport_stream_id value: Tw_max = SCIF control signal duration + 1 000 ms (500 ms maximum duration between service information carrying the transport_stream_id).

Each of the aforementioned methods can be used alone or in combination with other methods for a double check.

9.3 Pseudo-random repeat

9.3.1 Handling of SCIF control signal

Each of the conflicting receivers detects the failure of its SCIF control signal. The SCIF control signal is repeated after a random delay. In case of subsequent collisions or temporary signal loss, the SCIF control signal is repeated continuously.

For channel search, the command should not be repeated more than five times. After that a “not successful” message should be displayed.

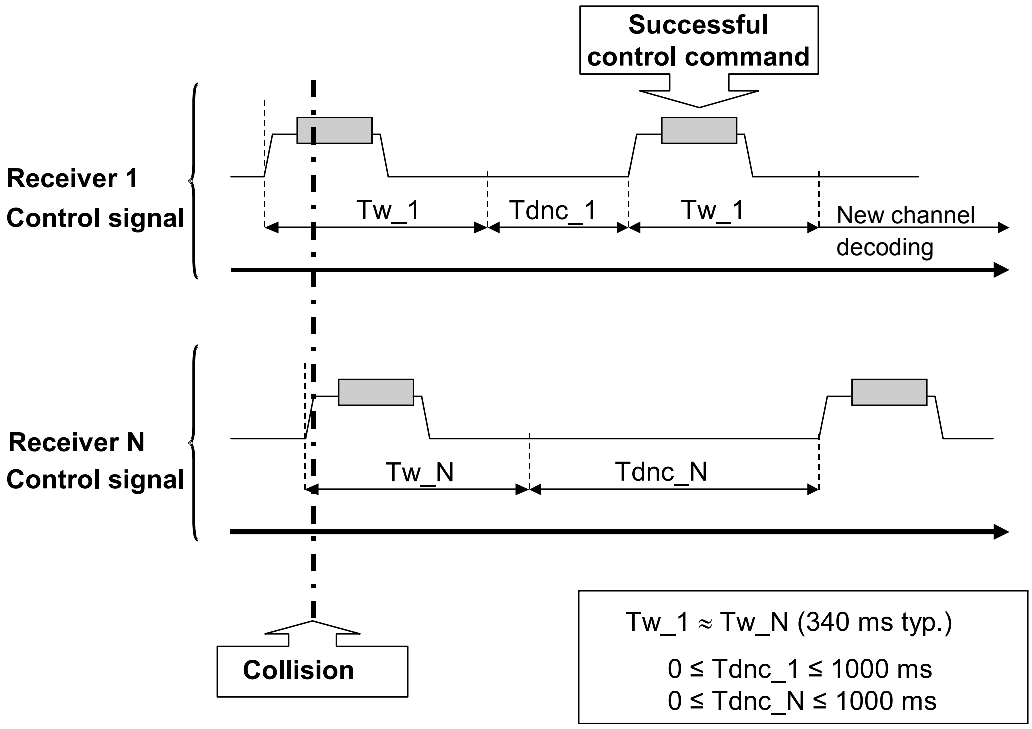


Figure 10 — SCIF control signal collision between two receivers and recovery mechanism

9.3.2 Random delay generation law

After detection of the SCIF control signal failure, the receiver waits for a random duration period of time Tdnc (T delay new control) before generating a new SCIF control signal (Figure 10). The time delay Tdnc shall adhere to the following rules:

- Minimum duration is 0 ms, maximum duration is 1 000 ms.
- The delay is generated as discrete value with the smallest step size that the receiver implementation permits.
- The generated values exhibit a discrete uniform probability distribution in the interval defined above.

- The start condition of the generator of random numbers should be based on unique characteristics of the individual receiver (e.g. user band ID or serial number).

Annex A
(normative)

Implementation rules

A.1 User interface

To simplify installation and prevent misconfiguration, the satellite receiver menus shall be standardized e.g. as follows:

- There shall be a mode selection either for direct Sat IF connection (no stacking), channel stacking according to EN 50494 or channel stacking according to SCD2 tuning format.
- To prevent user misunderstanding, in the user-interface the user band-ID shall be decimally counted from “1” to “32”.
- The satellite receiver shall always allow to manually enter UB-ID and UB-frequency (without any need of SCIF reply).

A.2 Installation impedance

The hardware of the communication bus shall be realized according to the DiSEqC bus functional specification. Some additional care shall be taken to ensure an appropriate impedance of the installation during the SCIF control signals.

At the interface between the receiver and the network a diode shall be integrated for decoupling purposes. A diode could be part of the system outlet or of the first splitter in front of the receiver. Figure A.1 describes two typical installation cases. But care shall be taken during installation to avoid too high voltage drops due to several diodes in series.

For bi-directional use, the receiver shall provide an impedance of 15 Ohm at 22 kHz according to the DiSEqC™ Bus Functional Specification 4.2.

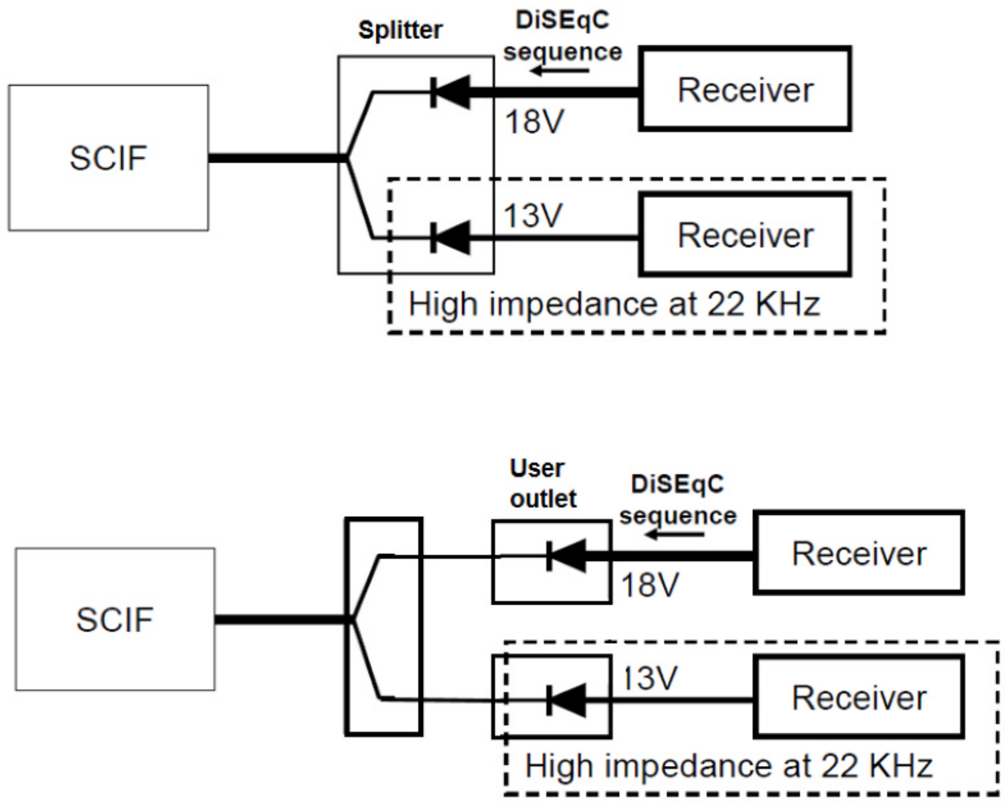


Figure A.1 — Solution for masking the impedance of the installation during the SCIF control signals

A.3 Signal reflection and return loss in installations

In single cable installations, care has to be taken about signal echoes generated by poorly terminated or by un-terminated cables. To avoid potential problems, attention shall be paid to the isolation characteristics of the power splitters implemented in the installation. With reference to EN 60728-4, the splitters shall feature isolation figures better or equal to Category A.

A.4 Power supply of the SCIF

Timing Sequence at power on, as described in DiSEqC Bus Specification, Figure 10, might not be sufficient due to soft-start, switch-mode converters and large buffer-capacitors in SCIF devices.

Therefore:

- receivers shall not send a command before 500 ms after power on;
- SCIF units shall be ready to receive tuning commands 500 ms after power on.

Overcurrent protection circuits in receivers shall allow higher peak currents during the very first start-up phase. In case of overcurrent-detection, receivers shall automatically retry to switch on LNB power again.

In some cases the current consumption of the SCIF may exceed the maximum LNB supply current capability of a receiver (usually max. 350 mA); in such cases the SCIF device shall be supplied independently as shown in Figure A.2,

- either with a separate power supply cable (self-powered SCIF);
- or via a power “inserter”.

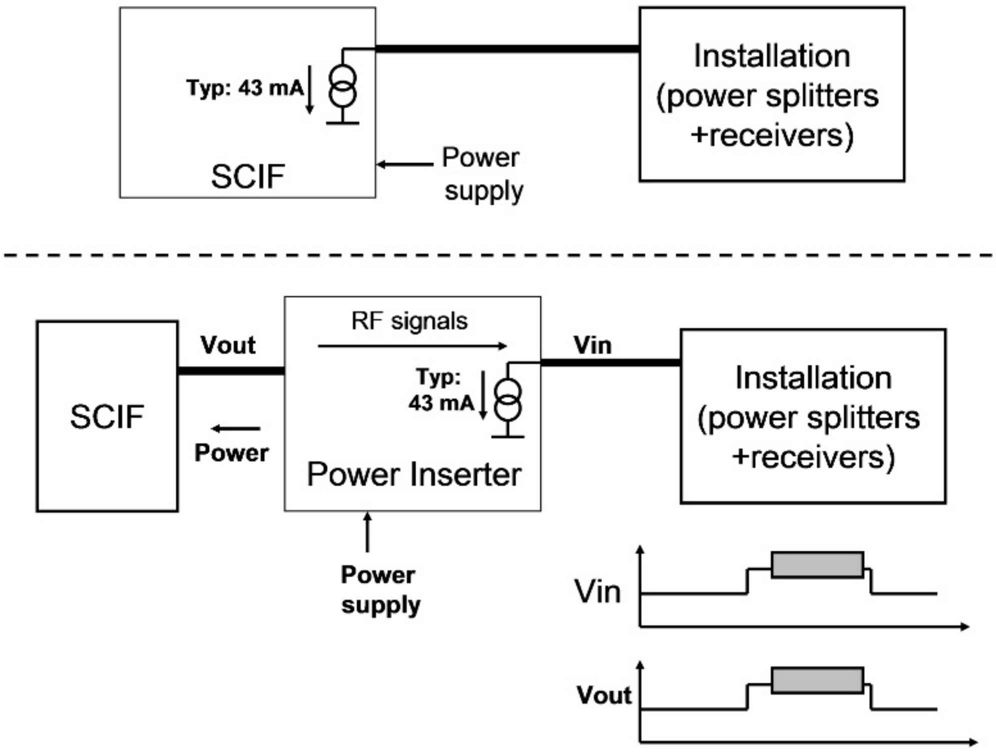


Figure A.2 — Implementation of an external power supply

The power inserter is required to transmit the SCIF control signals and the DC levels to the SCIF.

SCIF units shall load each channel stacking system (CSS) bus with a minimum of 20 mA under all circumstances to “open” all diode paths in the distribution network and allow reliable transmission of 22 kHz control data.

A.5 Remarks concerning power supply

SCIF turns off all UB slots when the DC voltage on the cable is lower than 5 V (all receivers of the installation are turned off).

The power inserter does not deliver power to the SCIF when the DC voltage on the cable (Vin_DC) is lower than 5 V. This situation corresponds to: all receivers are turned off.

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