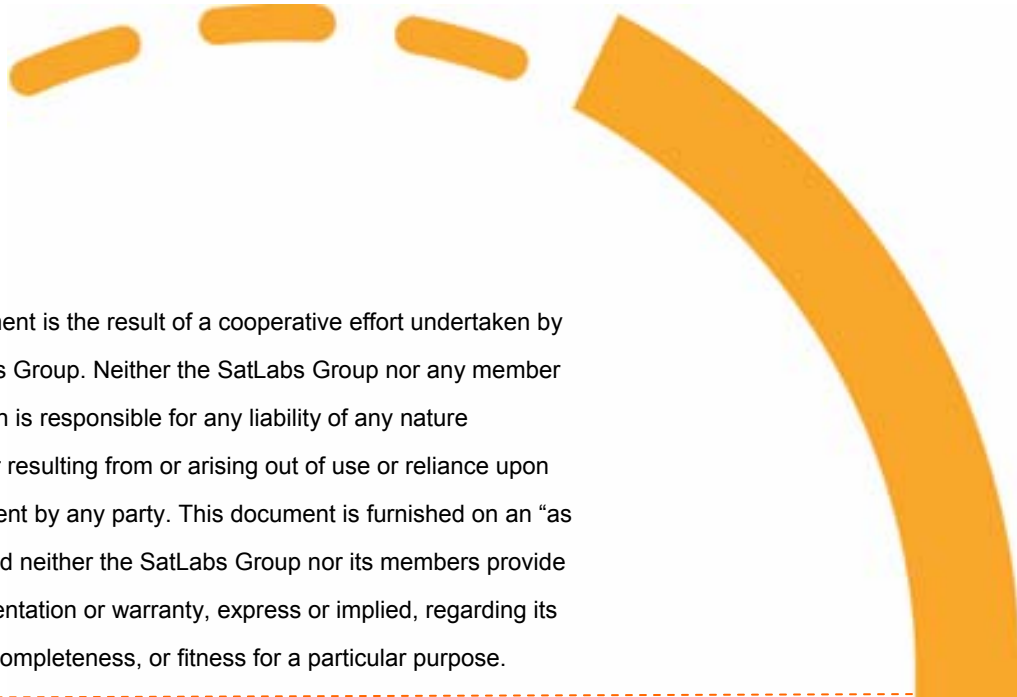




SatLabs Recommendation for a Common Inter-Facility Link for DVB-RCS terminals

Version 1.8 - 11/03/2008

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Foreword

The SatLabs Group is an international, not-for-profit association whose members are committed to bringing the deployment of the DVB-RCS standard to large-scale adoption. SatLabs membership is formed by service providers, satellite operators, system integrators, terminal manufacturers and technology providers with an interest in DVB-RCS.

The mission of SatLabs is to complement the DVB-RCS standard with recommendations and guidelines to facilitate DVB-RCS terminal interoperability, and to provide a mechanism for formal DVB-RCS interoperability certification.

While the Inter-Facility Link (IFL) is not actually part of the DVB-RCS Specification itself, different options for the IFL are described in detail in the DVB-RCS Guidelines. This Recommendation builds on that work and from experience gained by many SatLabs members, in order to agree a baseline specification for the IFL. This will open the way for interoperability between Indoor units and Outdoor units from different manufacturers.

Common IFL Specification for DVB-RCS terminals

1 Introduction

This document describes the latest version of the ESA Satlabs WG#1 agreed target specification of the Common IFL physical interface definition of DVB-RCS terminals.

In the Common IFL specification consist of a detailed description of the inter-facility link interface between DVB-RCS modem and outdoor unit. In this version both internal- as well as external ODU local oscillator frequency reference systems are covered. The required Local Oscillator reference system can be selected by DiSEqC command.

2 RX IF specification

The RX IF system interfaces between LNB and modem. The definition is directly derived from the ETS 300 784 and EN 61319-1 for "Universal" DBS/DTH terminals.

	Parameter	Value	Unit	Note
2.1	Frequency scheme	no spectral inversion		
2.1.1	RF input range, low band	See table below		
2.1.2	IF output range, low band	950 – 1950	MHz	
2.1.3	RF input range, high band	See table below		
2.1.4	IF output range, high band	1100 – 2150	MHz	
2.2	IF Impedance	75	Ohm	
2.3	Return loss LNB & modem	> 8	dB	
2.4	Connector type	F-type		
2.5	Connector & cable color code	blue		
2.6	Cable loss @ 2150 MHz	< 40	dB/100m	
2.7	LNB band switch tone command acc. EN 61319-1			
2.7.1	Low band selected	0.0 – 0.2	Vpp	18 – 26 kHz
2.7.2	High band selected	0.4 – 0.8	Vpp	

2.8	Polarization	fixed linear, orthogonal with TX ¹		
2.9	DC supply voltage	11 - 19	V	on the LNB
2.10	DC supply current	< 300	mA	

Typical RF Input Ranges include:

Band	RF [GHz]	LO [GHz]	IF [MHz]
C-Band	3.7 - 4.2	5.15	950 – 1450
Ku-band - Low band	10.7 – 11.7	9.75	950 - 1950
Ku-band – High band	11.7 -12.75	10.6	1100 – 2150
Ka-band	19.7 – 20.2	18.75	950 – 1450

3 TX IFL functionality

The TX IFL system interfaces between modem and BUC. A single coaxial cable carries:

- The TX IF signal in L-band
- The TX LO frequency reference signal.
- A low frequency sub-carrier for DiSEqC signaling
- The DC power supplying the BUC

4 TX IFL specification

4.1 IF frequency scheme

In general L-band is recommended for all RCS terminals according to following scheme, with no spectral inversion, according:

¹ If dual-polarisation reception is supported then the voltage (13/17V) switching command as specified in EN61319-1 shall be used.

Band	RF [GHz]	LO [GHz]	IF [MHz]
Ku-band	14.00 – 14.50	13.05	950 – 1450
Extended Ku-band	13.75 – 14.25	12.80	950 – 1450
Full extended Ku-band	13.75 – 14.50	12.80	950 – 1700
Ka-band	29.50 – 30.00	28.55	950 – 1450

4.2 IFL system specification

Recommended is a fixed cable loss IFL system for constant gain BUCs. This common system uses a fixed set IF drive level at modem output, as well as fixed cable attenuation and constant BUC gain. The IFL cable loss and slope are compensated at installation of the terminal by setting-up standard level values in the modem. Condition that cable loss and slope as well as the BUC gain are well known and do not change over operational conditions or life-time of the terminal.

	Parameter	Value	Unit	Note
4.2.1	IF drive level	set once during modem installation		
4.2.2	IF impedance	75	Ohm	
4.2.3	Return loss BUC & modem	> 13	dB	
4.2.4	Return loss cable	> 16	dB	
4.2.5	Connector type	F-type		
4.2.6	Connector & Cable color code	Red		
4.2.7	Cable attenuation @ 1700 MHz	< 30	dB/100m	
4.2.8	Cable attenuation uniformity	< 0.3	dB/MHz	
4.2.9	Cable length	< 50	m	

5 BUC LO frequency reference system

The LO reference system can be selected by the modem using a DiSEqC command string [see chapter 6]. The default system setting is to external reference mode.

Internal mode can be selected by the transmission of the “enable int ref” DiSEqC command.

This mode shall be cleared either by a full reset command or power down.

Note: Absence of 10 MHz does not change mode (absence of 10 MHz in ext mode may be used to set alarm state and deactivate SSPA)

5.1 Internal Reference system specification

In the internal LO reference system, a 10 MHz reference signal is derived from the BUC PLO and send back to the modem to enable frequency correction of the TX-IF signal.

	Parameter	Value	Unit	Note
5.1.1	Reference type	frequency synchronous		
5.1.2	Frequency	10	MHz	sinusoidal
5.1.3	Frequency tolerance	< +/- 30	ppm	overall*
5.1.4	Level	-5 +/- 5	dBm	
5.1.5	Level on PLO un-lock alarm	< -30	dBm	Optional
5.1.5	Spurious level	< 30 dBc		0.01 – 20 MHz

* Note: The frequency tolerance includes set up error, temperature drift and 10 years ageing.

5.2 External Reference system specification

In the external LO reference system, a NCR derived 10 MHz reference signal is sent from the modem to synchronize the BUC PLO.

	Parameter	Value	Unit	Note
5.2.1	Reference type	frequency synchronous		
5.2.2	Frequency	10	MHz	sinusoidal
5.2.3	Frequency tolerance	< +/- 25	ppm	overall*

5.2.4	Level	0 +/- 5	dBm	
5.2.5	Spurious level	< 30 dBc		0.01 – 20 MHz
5.2.6	Phase Noise:	10 Hz	-86	dBc/Hz
		100 Hz	-124	dBc/Hz
		1 kHz	-134	dBc/Hz
		10 kHz	-144	dBc/Hz
		100 kHz	-152	dBc/Hz

Figures derived from TR101790

* Note: The reference signal is derived from the NCR of the forward link, therefore is highly accurate.

6 BUC DiSEqC™ signaling

DiSEqC IFL signaling between modem and BUC enables a number of advanced applications and features. The DVB-RCS Guidelines, TR101790, suggest the use of either 22 kHz AM on/off modulation or 10.7 MHz FSK. SatLabs proposes for 22 kHz AM.

6.1 Physical layer specification

The signaling commands from modem to radio will be make use of on/off voltage modulation as suggested in the Guidelines TR101 790.

	Parameter	Value	Unit	Note
6.1.1	Carrier frequency	22 +/- 4	kHz	acc. EN 61319-1
6.1.2	Modulation type	on/off using voltage superimposing		
6.1.3	Carrier level, logical 0/1	0 / 0.6	Vpp	

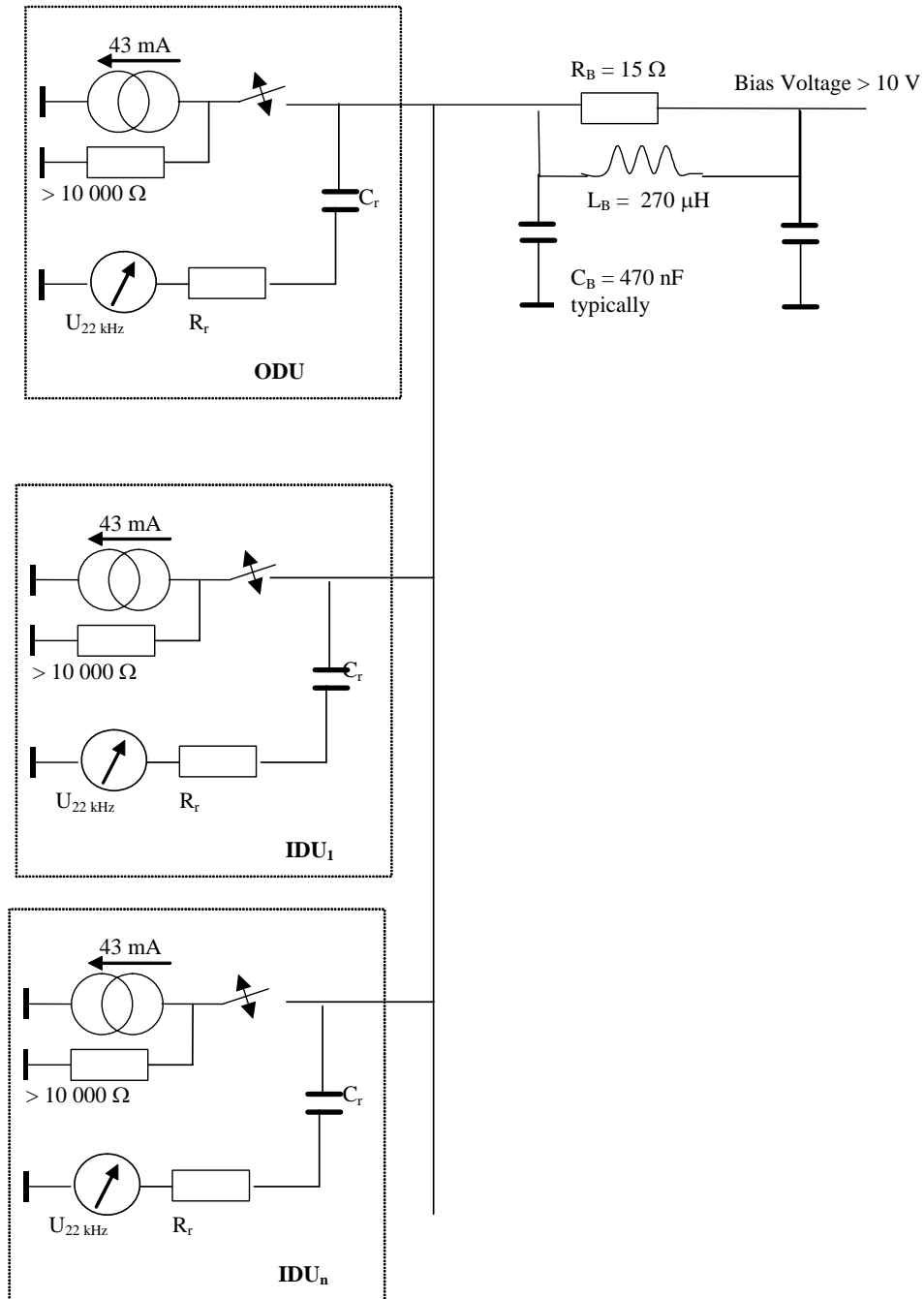
The low data rate communication between the IDU and the ODU is based on a 22 kHz PWK signal as used by DiSEqC. The impedance of the bus at 22 kHz shall be 15 Ω . A parallel inductor of 270 μH can be used to support a DC power supply. In this case a capacitor to ground should be supplied to shape the 22 kHz signal. The DC feeding point is grounded for 22 kHz with a capacitor. If a DC is not needed for powering peripheral devices, then in order to

maintain correct operation of the DiSEqC bus, there should be a minimum of 10 V bias applied, but the inductor and capacitor can be omitted.

The control signal from every device on the bus is produced by a 43 mA current shunt producing a 650 mV signal which is monitored by every device. This amplitude of the DiSEqC carrier tone on the bus is normally too small to detect directly on a "TTL" or "CMOS" compatible pin on a microcontroller, so usually a "comparator" input, or a simple external (one-transistor) amplifier, is required. In any case, it is important not to make the input too sensitive to small-amplitude signals which may be "noise" or interference. It is recommended that the smallest amplitude normally detected is about 200 mV peak-peak. This can be achieved either with hysteresis (positive feedback applied around the comparator/amplifier) or with a DC bias offset (equivalent to about 100 mV) applied to the input of the amplifier/comparator. Hysteresis (if symmetrical) can maintain a reasonably constant 50 % duty cycle for the detected carrier tone, whilst the DC offset method may generate a less desirable asymmetric (pulse) waveform when the carrier amplitude approaches the lower limit.

All devices are connected in parallel on the bus and shall therefore have high impedance.

Figure 6-1 22 kHz PWK bus concept



6.2 Specifications

	Parameter	Value	Unit	Note
6.2.1	Carrier frequency	22	kHz	± 20 %
6.2.2	Bus load impedance R_B	15	Ω	± 5 %
	DC supply			
6.2.3	Bus load inductance L_B	270	μ H	± 5 %
6.2.4	Bus load capacitance C_B	470	nF	typical
	Current source			
6.2.5	current amplitude	43	mA	± 10 %
6.2.6	source impedance	> 10	k Ω	
6.2.7	22 kHz carrier detection device resistance R_r	5 to 10	k Ω	typical
6.2.8	DC block capacitor	typically a few nF, but depends on the value R_r , it should be chosen so as to give a time constant of around 100 μ S		
	Bit definition			
6.2.9	timing base	0.5	ms	± 0,1
6.2.10	bit length	1.5	ms	
6.2.11	"0"	1,0 ms burst + 0,5 ms pause		
6.2.12	"1"	0,5 ms burst + 1,0 ms pause		

6.3 Basic DiSEqC functionality

This two-way system supports should support the DiSEqC commands set as described in the DVB-RCS Guidelines, TR 101 790. As a minimum the system must support the following sub-set of command messages.

Hex byte	Command	Description	Note
00	Reset	Reset all ODU functions	
0A	Soft reset	ODU soft reset	
12	Monitoring	ODU status request	
C6	SSPA on	Enable SSPA	
C7	SSPA off	Disable SSPA	ETSI mandatory

C8	Set SSPA Power level	Enable Constant Power mode and set level	See below
CE	TX off	Disable TX	power save
CF	TX on	Enable TX	
DD	Int Ref on	Enable int. freq. ref. mode	Default off See description below

6.3.1 Set SSPA Power Level command 0xC8

Default mode is off; IDU does not send command automatically.

IDU should allow via both the local or air interfaces the command to be enabled (on), in which case the 0xC8 command with data value "00" is sent immediately.

If positive reply received from ODU then "Constant Power mode" is enabled and message "E2 82 C8 00" is sent each time on boot-up.

If a negative reply is received, IDU remains in default mode, error message generated.

Once enabled, any values for level (+/-128) may be set via both local and air interfaces.

Constant Power mode shall be cleared by full reset command or at power down.

For ODUs that do not support constant power mode they send NACK "E5" request not supported.

For ODUs that support constant power mode (they must also support constant gain) they will switch to CP mode after receiving message "E2 82 C8 00" and reply with ACK "E4" command accepted.

Thereafter the IDU may set SSPA level by instructions received via both the local or air interfaces as described above.

6.3.2 Internal Reference mode Enable (0xDD)

This command allows the IDU to enable the Internal Reference Mode in the ODU. This mode shall be cleared by either a full reset "00" or on power down.

