

# 3D LINK

## Bi-directional Data Link for Drones and Robotics

3D Link provides robust video and control channels for drones and robotics in Non Line-of-Sight (NLOS) conditions.

3D Link is based on enhanced OFDM technology able to generate not only a high spectral efficiency waveforms but also a direct sequence spread spectrum (DSSS) waveforms. This unique feature gives 3D Link an ability to support high throughput up to 64 Mbps in video channel and superior robustness in control channel.

You need not more separate modems for video and control channels. Simply connect video channel through Ethernet interface and control channel through Ethernet, RS232 or CAN interfaces.

3D Link supports point-to-point, point-to-multipoint and relay net topologies. For high robustness it equipped with algorithms for suppression of narrowband and pulse interference.



3D Link supports also such interesting features as an adaptive transmission power control, TX-RX range estimation and IPv4 frames routing. Low weight and small physical dimensions.

### Package content

Onboard unit	1
Ground unit	1
Cable for aerial/ground antenna	2

Aerial antenna	2
Ground antenna	2
Mounting kit for ground antenna	1

## Main features

Communication range over flat terrain with standard antennas set and for 2 m (6.56 feet) ground station antenna height:

Scenario 1	6.1 Mbps in video channel and 85 kbps in control channel for 50 m (164 feet) drone altitude: up to 20 km (12.4 miles) in video channel and up to 33 km (20.5 miles) in control channel;
Scenario 2	6.1 Mbps in video channel and 85 kbps in control channel for 500 m (1640 feet) drone altitude: up to 62 km (38.5 miles) in video channel and up to 78 km (48.5 miles) in control channel;
Scenario 3	85 kbps in control channel with an increased robustness profile for 500 m (1640 feet) drone altitude: up to 83 km (51.5 miles).

Spread spectrum mode features:

Spreading factor	2–106 (any even number)
SNR (spreading factor 106)	- 17 dB (BER=10 <sup>-6</sup> )
Maximal signal search duration	1 sec

Interfaces	Ethernet 100 BASE-TX;
	RS232;
	CAN (in onboard unit only);
	USB 2.0 (service information only);
	SMA (antenna port).
User can change DSSS codes.	
RX diversity.	

Communication technology	proprietary scalable OFDM with 1024 subcarriers
Duplexing mode	TDD
Bandwidth	4 - 20 МГц (smoothly variable)
Modulation	BPSK, QPSK, 8QAM, 16QAM, 64QAM, 256QAM
FEC	LDPC
FEC rates	1/2, 2/3, 3/4, 5/6
Air link frame duration	2 - 20 ms
Cyclic prefix duration	1/32, 1/16, 1/8, 1/4
Carrier frequency	2,4 - 2,5 GHz (other frequencies are available on request)
Maximal TX output power	+25 dBm
RX sensitivity	up to -122 dBm
Maximal latency	20 msec
Supported network topologies	point-to-point, point-to-multipoint, relay (repeater)
Net configurations	transparent bridge, IPv4 router
Power	7–30 Volt (onboard unit)
	18–75 Volt or PoE (ground unit)
Power consumption	6.7 W (12 MHz bandwidth, full TX mode +25 dBm)
Operating temperature range	-40°C/+85°C (-40°F/+185°F) for an OEM onboard unit with external cooler
	-40°C/+45°C (-40°F/+113°F) for onboard unit in case or for ground unit

Available statistical information about channel via SDR_Surfer free software	input signal samples;
	spectrum of useful signal;
	spectrum analyzer mode;
	RSSI;
	timing offset;
	frequency offset;
	FEC FER;
	FEC decoder iterations number;
TX-RX range calculated from signal delay.	



Ability to use different carrier frequencies for video and control channels or for links ground station → drone and drone → ground station.

3D Link's receiver sensitivity [dBm] in high speed mode, 10 MHz bandwidth [dBm]

FEC rate	Modulation					
	BPSK	QPSK	8QAM	16QAM	64QAM	256QAM
1/2	-101,1	-98,1	-95,1	-92,6	-87,6	-81,6
2/3	-99,6	-96,6	-93,1	-89,6	-83,6	-
3/4	-98,6	-95,6	-92,1	-87,6	-81,6	-
5/6	-97,6	-94,6	-90,6	-86,6	-80,6	-

3D Link's receiver sensitivity [dBm] in spread spectrum mode, 10 MHz bandwidth [dBm]

Spreading factor						
4	8	16	32	40	64	106
-104,3	-108,3	-111,3	-113,3	-114,3	-116,3	-118,5

Information rate [Mbps] in high speed mode, 20 MHz bandwidth [Mbps]

FEC rate	Modulation					
	BPSK	QPSK	8QAM	16QAM	64QAM	256QAM
1/2	8,12	16,24	24,36	32,48	48,74	64,96
2/3	10,82	21,64	32,48	43,32	64,96	-
3/4	12,18	24,36	36,56	48,72	-	-
5/6	13,54	27,08	40,62	54,16	-	-

Information rate [Mbps] in spread spectrum mode, 20 MHz bandwidth [Mbps]

Spreading factor						
4	8	16	32	40	64	106
4,06	2,02	1,014	0,506	0,406	0,192	0,116

Information rate [Mbps] in high speed mode, 10 MHz bandwidth [Mbps]

FEC rate	Modulation					
	BPSK	QPSK	8QAM	16QAM	64QAM	256QAM
1/2	4,06	8,12	12,18	16,24	24,37	32,48
2/3	5,41	10,83	16,24	21,66	32,48	-
3/4	6,09	12,18	18,28	24,36	36,56	-
5/6	6,77	13,54	20,31	27,08	40,62	-

Information rate [Mbps] in spread spectrum mode, 10 MHz bandwidth [Mbps]

Spreading factor						
4	8	16	32	40	64	106
2,03	1,01	0,507	0,253	0,203	0,096	0,058

All specifications are subject to change without notice.