

## COMPACT DUAL ANTENNA SPAN ENCLOSURE DELIVERS 3D POSITION, VELOCITY AND ATTITUDE



### SPAN: WORLD-LEADING GNSS+INS TECHNOLOGY

Synchronous Position, Attitude and Navigation (SPAN) technology brings together two different but complementary technologies: Global Navigation Satellite System (GNSS) positioning and inertial navigation. The absolute accuracy of GNSS positioning and the stability of Inertial Measurement Unit (IMU) gyro and accelerometer measurements are tightly coupled to provide an exceptional 3D navigation solution that is stable and continuously available, even through periods when satellite signals are blocked.

### SPAN CPT7 OVERVIEW

The SPAN CPT7 is a compact, single enclosure GNSS+INS receiver, powered by NovAtel's world class OEM7<sup>®</sup> technology. Capable of delivering up to centimetre-level accuracy, customers can choose from a variety of positioning modes to ensure they have the optimal level of accuracy for their application.

The SPAN CPT7 contains a high performing and highly reliable Honeywell HG4930P Micro Electromechanical System (MEMS) IMU to deliver leading-edge NovAtel SPAN technology in an integrated, single enclosure solution. It provides tactical grade performance for unmanned vehicles, mobile mapping and other commercial and/or military guidance applications. The SPAN CPT7 is a small, lightweight and low power solution with multiple communication interfaces for easy integration on multiple platforms.

### SPAN CPT7 ADVANTAGES

The tight coupling of the GNSS and IMU measurements delivers the most satellite observations and the most accurate, continuous solution possible. Further, SPAN-CPT7 is comprised entirely of commercial components, simplifying export restrictions involved with traditional GNSS+INS systems.

### IMPROVE SPAN CPT7 ACCURACY

Take advantage of NovAtel CORRECT<sup>®</sup> to receive your choice of accuracy and performance, from decimetre to RTK-level positioning. For more demanding applications, Inertial Explorer<sup>®</sup> post-processing software can be used to post-process SPAN data to provide the system's highest level of accuracy.

### BENEFITS

- + Continuous, stable positioning
- + Easy integration into space and weight constrained applications
- + Future proof for upcoming GNSS signal support
- + Multiple communication interfaces
- + Commercially exportable system (non-ITAR)
- + Small, low power, all-in-one GNSS/INS enclosure

### FEATURES

- + MEMS gyros and accelerometers
- + Increased satellite availability with 555 channel capability
- + SPAN Land Vehicle technology
- + Optional SPAN Profiles support
- + Advanced interference mitigation features
- + Dual antenna ALIGN<sup>®</sup> heading

If you require more information about our SPAN products, visit [www.novatel.com/span](http://www.novatel.com/span)

# SPAN CPT7



## SPAN SYSTEM PERFORMANCE<sup>1</sup>

### Channel Count

555 Channels

### Signal Tracking<sup>2,3</sup>

GPS L1 C/A, L1C, L2C, L2P, L5

GLONASS<sup>4</sup> L1 C/A, L2 C/A, L2P,

L3, L5

BeiDou<sup>5</sup> B1, B2

Galileo E1, E5 AltBOC, E5a, E5b

NavIC (IRNSS) L5

SBAS L1, L5

QZSS L1 C/A, L1C, L2C, L5

L-Band (Primary RF only)

up to 5 channels

### Horizontal Position Accuracy (RMS)

Single Point L1 1.5 m

Single Point L1/L2 1.2 m

NovAtel CORRECT™

» SBAS<sup>6</sup> 60 cm

» DGPS 40 cm

» PPP<sup>7</sup>

TerraStar-L 40 cm

TerraStar-C 4 cm

» RTK 1 cm + 1 ppm

Initialization time < 10 s

Initialization reliability > 99.9%

### ALIGN Heading Accuracy

Baseline Accuracy (RMS)

2 m 0.08 deg

4 m 0.05 deg

### Maximum Data Rate

GNSS Measurements up to 20 Hz

GNSS Position up to 20 Hz

INS Position/Attitude up to 200 Hz

### Time to First Fix

Cold start<sup>8,14</sup> < 40 s (typ)

Hot start<sup>9,14</sup> < 19 s (typ)

### Signal Reacquisition

L1 < 0.5 s (typ)

L2/L5 < 1.0 s (typ)

Time Accuracy<sup>10</sup> 20 ns RMS

Velocity Accuracy

< 0.03 m/s RMS

Velocity Limit<sup>11</sup> 515 m/s

### IMU PERFORMANCE<sup>12</sup>

Gyroscope Performance

Technology MEMS

Input rate (max) ±200°/s

Accelerometer Performance

Technology MEMS

Range ±20 g

IMU Raw Data Rate 100 Hz

PHYSICAL AND ELECTRICAL

Dimensions<sup>13</sup> 90 x 60 x 60 mm

Weight 450 g

Power

Power consumption<sup>14</sup> 7 W (typ)

Input voltage +9 to +32 VDC

Antenna LNA Power Output

Output voltage 5 VDC ±5%

Maximum current 200 mA

Input/Output Connectors

Antennas 2 x SMA

Power and I/O 2 x Fischer

Core 16 pin DPBU

104 A086 140G/240G

## COMMUNICATION PORTS

RS-422 1

RS-232 (230400 bps max) 1

USB Device 1

CAN Bus 1

Event Input 2

Event Output 2

## ENVIRONMENTAL

### Temperature

Operating -40°C to +71°C

Storage -40°C to +85°C

Humidity 95% non-condensing

### Environment

Submerion 2 m for 12 hours

(IEC 60529 IP68)

Water MIL-STD-810G(Ch1),

Method 512.6

Dust MIL-STD-810G(Ch1),

Method 510.6

### Vibration (operating)

Random MIL-STD-810G(Ch1),

Method 514.7,

Category 24, 7.7 g RMS

Sinusoidal IEC 60068-2-6

Acceleration (operating)

MIL-STD-810G(Ch1),

Method 513.7, Procedure II

(G Loading - 15 g)

Bump (operating)

IEC 60068-2-27 Ea (25 g)

### Shock (operating)

MIL-STD-810G(Ch1),

Method 516.7, Procedure 1,

40 g, 11 ms terminal sawtooth

Compliance<sup>18</sup> FCC, ISED, CE,

RoHS, WEEE

INCLUDED ACCESSORIES

• Power and I/O cable

• NovAtel Connect™

FIRMWARE SOLUTIONS

• Field upgradeable firmware and software models

• Configurable PPS output

• SPAN Land Vehicle

• ALIGN

• TerraStar PPP

• NovAtel CORRECT with RTK

• RTK ASSIST

• API

OPTIONAL ACCESSORIES

• Mounting Plate

• VEXXIS series antennas

• ANT series antennas

• GrafNav/GrafNet®

• Inertial Explorer®

For the most recent details of this product:

[www.novatel.com/products/span-gnss-inertial-systems/span-combined-systems/SPAN-CPT7/](http://www.novatel.com/products/span-gnss-inertial-systems/span-combined-systems/SPAN-CPT7/)

## PERFORMANCE DURING GNSS OUTAGES<sup>16,17</sup>

Outage Duration	Positioning Mode	POSITION ACCURACY (M) RMS		VELOCITY ACCURACY (M/S) RMS		ATTITUDE ACCURACY (DEGREES) RMS		
		Horizontal	Vertical	Horizontal	Vertical	Roll	Pitch	Heading
0 s	RTK <sup>14</sup>	0.02	0.05	0.015	0.010	0.010	0.010	0.030
	SP	1.20	0.60	0.015	0.010	0.010	0.010	0.030
	PP <sup>15</sup>	0.01	0.02	0.015	0.010	0.005	0.005	0.010
10 s	RTK <sup>14</sup>	0.12	0.10	0.040	0.020	0.020	0.020	0.040
	SP	1.30	0.65	0.040	0.020	0.020	0.020	0.040
	PP <sup>15</sup>	0.01	0.02	0.020	0.010	0.005	0.005	0.010
60 s	RTK <sup>14</sup>	3.82	0.75	0.165	0.035	0.030	0.030	0.055
	SP	5.10	1.30	0.165	0.035	0.030	0.030	0.055
	PP <sup>15</sup>	0.15	0.05	0.020	0.010	0.007	0.007	0.012

<sup>1</sup> Typical SPAN system performance values when using this IMU. Performance specifications subject to GNSS system characteristics, Signal-in-Space (SIS) operational degradation, ionospheric and tropospheric conditions, satellite geometry, baseline length, multipath effects and the presence of intentional or unintentional interference.

<sup>2</sup> Model-configurable to track L5/E5a (all / Galileo) through L2 (GPS) or L3/E5b/B2 (GLONASS / Galileo / BeiDou) through L2 (GLONASS). See manual for details.

<sup>3</sup> The secondary antenna input does not support L-Band or SBAS signals.

<sup>4</sup> Hardware ready for L3 and L5.

<sup>5</sup> Designed for BeiDou Phase 2 and 3, B1 and B2 compatibility (where applicable).

<sup>6</sup> GPS-only.

<sup>7</sup> Requires subscription to TerraStar data service. Subscriptions available from NovAtel.

<sup>8</sup> Typical value. No almanac or ephemerides and no approximate position or time.

<sup>9</sup> Typical value. Almanac and recent ephemerides saved and approximate position and time entered.

<sup>10</sup> Time accuracy does not include biases due to RF or antenna delay.

<sup>11</sup> Export licensing restricts operation to a maximum of 515 metres per second, message output impacted above 500 m/s.

<sup>12</sup> Supplied by IMU manufacturer.

<sup>13</sup> Dimensions do not include mounting feet.

<sup>14</sup> Typical values using serial port communication without interference mitigation. Consult the OEM7 Installation & Operation User Manual for power supply considerations

<sup>15</sup> 1 ppm should be added to all position values to account for additional error due to baseline length.

<sup>16</sup> Post-processing results using Inertial Explorer. The survey data used to generate these statistics is ground vehicle data collected with frequent changes in azimuth (i.e. as normally observed in ground vehicle environments).

<sup>17</sup> Outage statistics were calculated by taking the RMS of the maximum errors over a minimum of 30 complete GNSS outages. Each outage was followed by 120 seconds of full GNSS availability before the next outage was applied. High accuracy GPS updates (fixed ambiguities) were available immediately before and after each outage. The survey data used to generate these statistics is ground vehicle data collected with frequent changes in azimuth (i.e., as normally observed in ground vehicle environments).

<sup>18</sup> Outage performance achieved with one antenna.

<sup>19</sup> Pending.

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61-400-883-601

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# VEXXIS™ Antennas GNSS-501

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## HIGH PERFORMANCE ANTENNA FOR TERRESTRIAL APPLICATIONS

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### PATENTED TECHNOLOGY

The VEXXIS GNSS-500 series antennas provide outstanding circularly polarized, symmetric radiation patterns with superior multipath rejection performance. This is achieved with a patented multi-point feeding network which provides uniquely low loss and frequency independent amplitude/phase balance. Strictly balancing signals and sequentially feeding the GNSS antenna at multiple points is the key to achieving remarkable performance.

### OPTIMIZED FOR TERRESTRIAL APPLICATIONS

The GNSS-501 antenna is designed with a low profile, aerodynamic enclosure, ideal for ground vehicles in applications such as agriculture, machine control and mobile mapping. Magnetic mounts makes the antenna easy to install or move between ground vehicle platforms. The combination of intelligent enclosure design along with multi-constellation and L-Band support makes it ideal for any terrestrial application.

### RUGGEDIZED FOR CHALLENGING ENVIRONMENTS

The GNSS-501 has been thoroughly tested to withstand even the most challenging environments. It endured over 1000 hours of intense vibration testing to earn its MIL-STD-810G rating. It is also water resistant under heavy rainfall or high pressure spray, ensuring its long survivability under the toughest operating conditions.

### FEATURES

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- + Supports single-frequency GPS, GLONASS, Galileo and BeiDou signals
- + L-Band signal reception, supporting correction services such as TerraStar
- + Multi-point antenna feed provides stable phase center and enhanced multipath rejection
- + Designed for high quality performance when used with NovAtel's STEADYLINE® technology
- + Low-profile design ideal for machine control applications

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# GNSS-501



## PERFORMANCE

### Signal Received

GPS	L1
GLONASS	L1
Galileo	E1
BeiDou	B1
L-Band	

### Pass Band (typical)

Upper passband	1569.0 ± 43.0 MHz
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### Out-of-Band Rejection

Band edges ± 50 MHz	15 dB (typical)
Band edges ± 100 MHz	25 dB (typical)

<b>LNA Gain</b>	29 dB (typical)
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### Gain at Zenith (90°)

L1/B1/E1/G1	+4.0 dBic minimum
L-Band	+4.0 dBic minimum

### Gain Roll-Off (from Zenith to Horizon)

L1/B1/E1/G1	12 dB
L-Band	12 dB

<b>Phase Center Stability</b>	<5.0 mm
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<b>Noise Figure</b>	2.5 dB (typical)
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<b>VSWR</b>	≤2.0 : 1
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<b>Group Delay Ripple</b>	<15 ns
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<b>Nominal Impedance</b>	50 Ω
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## PHYSICAL AND ELECTRICAL

<b>Dimensions</b>	155 mm D × 45 mm H
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<b>Weight</b>	450 g
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<b>Connector</b>	TNC female
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<b>Mounting</b>	2 × magnetic mounts 2 × M4 screw inserts
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### Power

Input voltage	+3.3 to +18.0 VDC
Current	20 mA (typical)

## ENVIRONMENTAL

### Temperature

Operating	-40°C to +85°C
Storage	-55°C to +85°C

<b>Humidity</b>	95% non-condensing
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<b>Salt Fog</b>	MIL-STD-810G (CH1), 509.6
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<b>Water/Dust Resistance</b>	IP67, IP69K
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### Vibration (operating)

Random	MIL-STD-810G (CH1), 514.7 (15 g) Annex E Procedure 1, Category 24
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<b>Shock</b>	MIL-STD-810G (CH1), 516.7 (40 g) Procedure 1
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<b>Bump</b>	IEC 68-2-27 Ea (25 g)
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<b>Regulatory Compliance</b>	FCC, CE
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<b>RoHS</b>	EU Directive 2011/65/EU
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For the most recent details of this product:  
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# VEXXIS™ Antennas GNSS-502

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## HIGH PERFORMANCE ANTENNA FOR TERRESTRIAL APPLICATIONS

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### PATENTED TECHNOLOGY

The VEXXIS GNSS-500 series antennas provide outstanding circularly polarized, symmetric radiation patterns with superior multipath rejection performance. This is achieved with a patented, multi-point feeding network which provides uniquely low loss and frequency independent amplitude/phase balance. Strictly balancing signals and sequentially feeding the GNSS antenna at multiple points is the key to achieving remarkable performance.

### OPTIMIZED FOR TERRESTRIAL APPLICATIONS

The GNSS-502 antenna is designed with a low profile, aerodynamic enclosure, ideal for ground vehicles in applications such as agriculture, machine control and mobile mapping. Magnetic mounts make the antenna easy to install or move between ground vehicle platforms. The combination of intelligent enclosure design along with multi-constellation and L-Band support makes it ideal for any terrestrial application.

### RUGGEDIZED FOR CHALLENGING ENVIRONMENTS

The GNSS-502 has been thoroughly tested to withstand even the most challenging environments. It endured over 1000 hours of intense vibration testing to earn its MIL-STD-810G rating. It is also water resistant under heavy rainfall or high pressure spray, ensuring its long survivability under the toughest operating conditions.

### FEATURES

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- + Supports dual-frequency GPS, GLONASS, Galileo, BeiDou and SBAS signal reception
- + L-Band signal reception, supporting correction services such as TerraStar
- + Multi-point antenna feed provides stable phase center and enhanced multipath rejection
- + Designed for high quality performance when used with NovAtel's STEADYLINE® technology
- + Low-profile design ideal for machine control applications

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# GNSS-502



## PERFORMANCE

### Signal Received

GPS	L1, L2
GLONASS	L1, L2
Galileo	E1, E5b
BeiDou	B1, B2
L-Band	

### Pass Band (typical)

Upper passband	1569.0 ± 43.0 MHz
Lower passband	1220.0 ± 31.0 MHz

### Out-of-Band Rejection

Band edges ± 50 MHz	15 dB (typical)
Band edges ± 100 MHz	25 dB (typical)

### LNA Gain

29 dB (typical)

### Gain at Zenith (90°)

L1/B1/E1/G1	+4.0 dBic minimum
L2/B2/E5b/G2	+4.0 dBic minimum
L-Band	+4.0 dBic minimum

### Gain Roll-Off (from Zenith to Horizon)

L1/B1/E1/G1	12 dB
L2/B2/E5b/G2	12 dB
L-Band	12 dB

### Phase Center Stability

<5.0 mm

### Noise Figure

2.5 dB (typical)

### VSWR

≤2.0 : 1

### L1-L2 Differential Propagation Delay

7 ns (maximum)

### Group Delay Ripple

<15 ns

### Nominal Impedance

50 Ω

## PHYSICAL AND ELECTRICAL

### Dimensions

155 mm D × 45 mm H

### Weight

450 g

### Connector

TNC female

### Mounting

2 × magnetic mounts  
2 × M4 screw inserts

### Power

Input voltage +3.3 to +18.0 VDC  
Current 20 mA (typical)

## ENVIRONMENTAL

### Temperature

Operating -40°C to +85°C  
Storage -55°C to +85°C

### Humidity

95% non-condensing

### Salt Fog

MIL-STD-810G (CH1), 509.6

### Water/Dust Resistance

IP67, IP69K

### Vibration (operating)

Random MIL-STD-810G (CH1),  
514.7 (15 g) Annex E  
Procedure 1, Category 24

### Shock

MIL-STD-810G (CH1),  
516.7 (40 g) Procedure 1

### Bump

IEC 68-2-27 Ea (25 g)

### Regulatory Compliance

FCC, CE

### RoHS

EU Directive 2011/65/EU

For the most recent details of this product:  
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