

## Beacon Tracking Receivers

DrawCom tracking receivers have been designed to track and measure pilots or beacons of all known commercial and military satellites. They are particularly suited to track satellite beacons (frequency and power stable signals generated on board satellites, used for telemetry and control) in earth stations using large antennae requiring good boresight alignment and stable uplink power.

These receivers are synthesized in 10kHz steps, allowing accurate targeting of the pilot (generated on the ground and re-transmitted on board) on the on-board beacon.

The most common tracking receiver has an input at L-band, 940 to 1,750MHz, optionally 940 to 2,150MHz. The L-band signals are downconverted to around 70MHz and then processed by a coherent tracking and detection module.

The tracking module uses a 2kHz PLL, optionally 300Hz, for signal acquisition and level measurement by coherent detection. A search device tunes a VCO (usually by  $\pm 200$ kHz, optionally wider or narrower customer defined values) close to acquisition. Phase lock is at that point achieved by PLL pull-in. An anti-sideband (ASB) device prevents lock to telemetry sidebands. This is designed to avoid sidebands between 2kHz and 50kHz from carrier.

The VCO sweep/search and the PLL tracking enable these receivers to find and re-acquire a beacon in all loss of lock circumstances and make them ideal to track beacons of highly inclined orbit satellites where Doppler shift may be larger than the AFC range of simpler tracking receivers.

300Hz PLL receivers have a re-acquisition threshold of 35dBHz and require around 90 seconds to lock (for a VCO sweep of  $\pm 200$ kHz). They are recommended for antenna or propagation measurements where dynamic and measuring range is important.

2kHz PLL receivers have a re-acquisition threshold of 43dBHz and require less than 1 second to lock (for a VCO sweep of  $\pm 200$ kHz). They combine fast acquisition with the advantages of a coherent system, and are recommended for tracking applications. They are ideal for tracking the BPSK modulated beacons of the military satellites and the ASTRA 1A, ASTRA 1B and G-Star satellite type beacons, with analogue phase modulation ( $\pm 0.5$ rad or  $\pm 1$ rad peak phase deviation) of the beacon main carrier by a 1,024b/s telemetry digital stream. In this case an incoherent (peak) detector is used to accurately measure the beacon's aggregate power spread over a finite band while a PLL is still used for locking and tracking.

## Beacon Tracking Receivers (cont.)

The tracking receivers may be used for Automatic Frequency Compensation (AFC), in conjunction with frequency up and downconverters, in earth stations of satellite systems such as INMARSAT. In this case the phase-locking loop is closed via an L-band downconverter and the measured frequency drift in the received pilot is used to pre-compensate transmitted traffic at C-band.

DrawCom's tracking receivers are also used in conjunction with the uplink power controller, UPC300, for simple uplink power control applications.

Our tracking receivers are commonly packaged in 1U 19" standard rack mounted chassis, but they may be also packaged in compact ruggedised aluminium IP67 boxes for field deployable earth stations or splash proof enclosures for outdoor protected environments. These packages use a newer more integrated and compact design which significantly reduces the size of the required electronics.

A key consideration is reliability. Novella's production techniques and high level of circuit integration is reflected in a standard warranty period of 36 months which may be extended to 5 years for a nominal fee. All products are stressed for a minimum of 24 hours at 50°C and 12 hours at -25°C and must be fully functional at the end of each cycle.

DrawCom offers a wide range of COTS and bespoke tracking receivers for S, X and Ka-bands, based around a standard L-band tracking module with a S, X or Ka to L-band block downconverter. Please consult our Sales Department quoting your requirements for a solution and a quotation.



## Beacon Tracking Receivers (cont.)

Selection Guide:				L band		
Model	Input band, MHz	Step size, kHz	Input level, dBm	PLL, Hz	Threshold, dBHz	Acquisition time, seconds
<b>B350</b>	940 to 1,750	10	-70	300	35dBHz	<90
<b>B351</b>	940 to 2,150	10	-70	300	35dBHz	<90
<b>B355</b>	940 to 1,750	10	-70	2,000	43dBHz	<1
<b>B355A (1)</b>	940 to 1,750	10	-70	2,000	43dBHz	<1
<b>B355B (2)</b>	940 to 1,750	10	-70	2,000	43dBHz	<1
<b>B356</b>	940 to 2,150	10	-70	2,000	43dBHz	<1
<b>B356A (1)</b>	940 to 2,150	10	-70	2,000	43dBHz	<1
<b>B356B (2)</b>	940 to 2,150	10	-70	2,000	43dBHz	<1

(1) Specially adapted for BPSK beacons of NATO, Skynet and DSCS satellites.

(2) Specially adapted for ASTRA 1A/1B beacons.

Receivers with 300Hz PLL have a threshold of 35dBHz or better and re-acquire lock within 90seconds. They may be specially aligned for 33dBHz threshold and reacquisition in 120 seconds. They are recommended for antenna and propagation experiments. They are not well suited for tracking.

Receivers with 2kHz PLL have a threshold of 43dBHz and re-acquire lock within 1 second. They are the best choice for antenna tracking.

Receivers with 2kHz PLL may be also used for military applications, with beacons with BPSK low bit rate modulation (~1,000bit/sec). Add suffix **A** to the model number if this option is required.

Receivers with 2kHz PLL may be also used with beacons of the ASTRA 1A and 1B type where the beacons are phase-modulated ( $\pm 0.5\text{rad}$  or  $\pm 1\text{rad}$ ) by telemetry data, rate around 1,000bps. Add suffix **B** to model number if this option is required.

All L-band receivers may be supplied with DC feed facility and/or frequency display at C, X or Ku-band, or a combination of these.

Polarisation/channel switching is also available, with 2 and 4 inputs selectable via an internal coaxial switch. LNB polarisation and/or band switching is also available through DC level change and/or 22kHz tone insertion.

Selection Guide:				C band		
Model	Input band, GHz	Step size, kHz	Input level, dBm	PLL, Hz	Threshold, dBHz	Acquisition time, seconds
<b>B550</b>	3.625 to 4.2	10	-80	300	35	<90
<b>B551</b>	3.4 to 4.2	10	-80	300	35	<90
<b>B552</b>	4.0 to 4.8	10	-80	300	35	<90
<b>B555</b>	3.625 to 4.2	10	-80	2,000	43	<1
<b>B556</b>	3.4 to 4.2	10	-80	2,000	43	<1
<b>B567</b>	4.0 to 4.8	10	-80	2,000	43	<1

Selection Guide:				X band		
Model	Input band, GHz	Step size, kHz	Input level, dBm	PLL, Hz	Threshold, dBHz	Acquisition time, seconds
<b>B650</b>	7.25 to 7.75	10	-80	300	35	<90
<b>B655</b>	7.25 to 7.75	10	-80	2,000	43	<1
<b>B655A (1)</b>	7.25 to 7.75	10	-80	2,000	43	<1

(1) Specially adapted for BPSK beacons of NATO, Skynet and DSCS satellites.

## Beacon Tracking Receivers (cont.)

Selection Guide:				Ku band		
Model	Input band, GHz	Step size, kHz	Input level, dBm	PLL, Hz	Threshold, dBHz	Acquisition time, seconds
<b>B750</b>	10.94 to 11.7	10	-80	300	35	<90
<b>B751</b>	11.7 to 12.25	10	-80	300	35	<90
<b>B752</b>	12.25 to 12.75	10	-80	300	35	<90
<b>B753</b>	10.7 to 12.75	10	-80	300	35	<90
<b>B754</b>	10.7 to 11.7	10	-80	300	35	<90
<b>B755</b>	11.7 to 12.75	10	-80	300	35	<90
<b>B760</b>	10.94 to 11.7	10	-80	2,000	43	<1
<b>B761</b>	11.7 to 12.25	10	-80	2,000	43	<1
<b>B762</b>	12.25 to 12.75	10	-80	2,000	43	<1
<b>B763</b>	10.7 to 12.75	10	-80	2,000	43	<1
<b>B764</b>	10.7 to 11.7	10	-80	2,000	43	<1
<b>B765</b>	11.7 to 12.75	10	-80	2,000	43	<1

Selection Guide:				S band		
Model	Input band, MHz	Step size, kHz	Input level, dBm	PLL, Hz	Threshold, dBHz	Acquisition time, seconds
<b>B450</b>	2,000 to 2,300	10	-60	300	35dBHz	<90
<b>B451</b>	2,000 to 2,400	10	-60	300	35dBHz	<90
<b>B455</b>	2,000 to 2,300	10	-60	2,000	43dBHz	<1
<b>B456</b>	2,000 to 2,400	10	-60	2,000	43dBHz	<1
<b>B455A (1)</b>	2,000 to 2,300	10	-60	2,000	43dBHz	<1
<b>B456A (1)</b>	2,000 to 2,400	10	-60	2,000	43dBHz	<1

(1) Specially adapted for BPSK beacons of NATO, Skynet and DSCS satellites.

Selection Guide:				Other bands		
Model	Input band	Step size, kHz	Input level, dBm	PLL, Hz	Threshold, dBHz	Acquisition time, seconds
<b>B150</b>	70MHz ± 200kHz	n.a.	-30	300	35	<90
<b>B155</b>	70MHz ± 200kHz	n.a.	-30	2,000	43	<1
<b>B155A (1)</b>	70MHz ± 200kHz	n.a.	-30	2,000	43	<1
	Input band, GHz					
<b>B790P</b>	3.4 to 4.2, plus 10.7 to 12.75	10	-80	300	35	<90
<b>B791P</b>	3.4 to 4.2, plus 7.25 to 7.75, plus 10.7 to 12.75	10	-80	300	35	<90
<b>B795P</b>	3.4 to 4.2, plus 10.7 to 12.75	10	-80	2,000	43	<1
<b>B796P (1)</b>	3.4 to 4.2, plus 7.25 to 7.75, plus 10.7 to 12.75	10	-80	2,000	43	<1

(1) Specially adapted for BPSK beacons of NATO, Skynet and DSCS satellites.