



Unique Broadband Systems Ltd.

## Outdoor Terrestrial Transmitter / Repeater

### Product Features

- Compact, outdoor, self-contained unit
- Environmentally protected light-weight cabinet
- Thermal electric and forced air cooling system with easily replaceable air filter
- Internal heater
- Front and rear hinged doors for access to various test ports
- Protected AC output for powering external test equipment
- Modular construction for easy maintenance
- Scalable design supporting 1 multiplex with optional hardware upgrade to 2 or 3 multiplexes
- Universal platform supports multiple waveforms
- Exciter module includes modulator/controller, upconverter, band pass filter, GPS or GPS/GLONASS receiver (optional) and DVB-S/S2 receiver (optional)
- High performance LDMOS power amplifier
- RF overdrive, high VSWR and over-temperature protection
- DVB-ASI, IP (based on Pro-MPEG Forum CoP #3), G.703/G.704, SMPTE-310M and DVB-S/S2 input interfaces supported
- Linear and Non-linear Digital Pre-correction
- Remote control and self monitoring via Web GUI
- SNMP for network management



Transmitter/Repeater

### Optional Features

- Adaptive Non-linear Pre-correction
- Output band pass filter, coupler and RF detectors
- UPS allows alarm reporting and remote access for several minutes following a power outage

### Frequency Bands

1452 MHz - 1492 MHz  
 1610 MHz - 1675 MHz  
 1980 MHz - 2010 MHz  
 2100 MHz - 2300 MHz)  
 2500 MHz - 2700 MHz)  
*(custom frequencies available upon request)*

### Waveforms Supported

ATSC, ATSC-M/H, CMMB, DTMB, DVB-T, DVB-T2, DVB-H, DVB-SH(A), DVB-SH(B), DAB, DAB+, T-DMB, ISDB-T/T<sub>B</sub> and Proprietary (XM, SIRIUS, etc.)

### Output Power Level

50W, 100W and 200W  
 (400W optional)

## Outdoor Terrestrial Transmitter / Repeater



### Transmitter/Repeater Overview

The Outdoor Transmitter/Repeater is a compact, outdoor, weatherproof cabinet that includes an Exciter, High Power Amplifier (HPA) and Power Distribution unit, with an optional Bandpass Filter, Coupler and RF Detectors. In addition to a Modulator, the Exciter system includes an internal Upconverter, Controller, optional GPS Receiver and optional DVB-S/S2 Receiver.

**The Universal Exciter** can receive a structured MPEG-2 TS, CMMB multiplex stream or ISDB-T/T<sub>B</sub> multiplexed TS on its ASI inputs. G.703/G.704 inputs are used in DAB mode and accept either NA or NI signals. Optionally, two serial SMPTE-310M inputs can be supplied. The Exciter is also accepts an IP encapsulated MPEG-2 structured Transport Stream on the RJ-45 Ethernet port. The IP input is protected using an MPEG PRO CoP #3 FEC protocol.

The Exciter modulator board converts the digital ASI, NA, NI or IP input stream into a digital waveform and creates a single analog RF output suitable for amplification in the Power Amplifier (PA). The coding and modulation of the data depends on the selected waveform.

**The System Controller** supports transmitter/repeater operation, configuration, management and status reporting. The site control includes power up, power down, RF control processes, control commands for status requests and operating parameters, etc.

The transmitter/repeater identity (name, password, local IP address, SNMP, etc.) can be configured remotely or locally. Remote upgrade of the transmitter/repeater software is supported.

The Exciter supports a web interface (Web GUI) for its user interface and is responsible for software and configuration management. Remote control of the transmitter/repeater is typically managed via an SNMP agent.

**The GPS or GPS/GLONAS Receiver**, located in the exciter chassis, supplies 10 MHz and 1PPS for synchronization purposes.

**The DVB-S/S2** receiver demodulates an incoming satellite signal and provides an output ASI signal.

**The PA** is designed to operate as a final amplification stage for the indoor transmitter/repeater system. It amplifies the Exciter output signal to a power level of 50, 100 or 200 Watts, while maintaining acceptable output emission levels.

The PA architecture is based on a solid state design operating in the Class A/AB linear mode and is fully protected against input overdrive, overheating and output load VSWR conditions. The protection circuits are all self-correcting, allowing restoration of the amplifier to the normal operational state upon removal of the fault condition.

**The Output Bandpass Filter** is constructed using high performance dielectric resonator (DR) coupled cavities. The DR design minimizes the size and weight of the filter, while maintaining low insertion loss and providing high rejection of out-of-band components.

**The Output Coupler** provides sample ports for output signal level control and monitoring. It employs coaxial air line design for low losses and high directivity. **The RF Detectors** provide accurate forward and reverse RMS power level measurements from the Output Coupler. The power level measurement is waveform and temperature independent.

**Digital Linear and Non-linear Pre-correctors** (pre-distorters) significantly improve the performance of the Power Amplifier. The Non-linear pre-corrector compensates for the HPA non-linearity and is able to provide separate adjustment for the low and high frequency shoulders of the wide channel spectrum. The Linear pre-corrector compensates for the the group delay created by an output filter.

**The Adaptive Non-linear Pre-corrector** is a superior pre-distortion solution that compensates for RF Power Amplifier non-linearities including AM/AM and AM/PM distortion and protects against IMD and spectral regrowth while maximizing EVM performance. The complex signal processing is done in the RF domain and supports a fully adaptive operation: the feedback signal (HPA output) is compared to the exciter's RF output signal (HPA input) in order to optimize the correction which will improve the shoulders of the RF output.

**An optional UPS** (80 Watt / 450 VA) is intended to supply backup power to the Exciter. This will ensure site monitoring will continue during a power outage as well as signal generation to ensure a fast recovery time once power is restored. The HPA includes redundant power supplies.

**The Power Distribution Unit (PDU)**, mounted on the bottom of the cabinet, receives ~ 220 VAC and distributes the required power to each transmitter/repeater sub-module. The PDU includes 7 circuit breakers, 2 surge suppressors, 2 RFI power line filters, 2 latching relays, 40 two-stage feed-through terminal blocks and 1 double grounding terminal.

**The Outdoor Cabinet** is weatherproof and made out of light-weight aluminum. It includes a heater, thermal electric cooler and fans for cooling. Front and rear hinged doors allow for easy access to repeater sub-modules.

The cabinet is divided into lower and upper compartments. The lower compartment air flow is provided by the Exciter fans while the upper compartment air flow is provided by rear door and HPA heat sink fans.



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## Outdoor Terrestrial Transmitter / Repeater

### Product Specifications

#### Control Interfaces

|                        |   |
|------------------------|---|
| Front Panel            | LCD display and cursor/<br>execute keys   |
| Ethernet Interface     | Connector: 2x RJ45<br>Speed: 10/100/1000 Base-T   |
| USB Interface          | Connector: USB Type B   |
| RS232 Interface        | Connector: 9-pin SUB-D (M)  |
| RS485 Interface        | Connector: 9-pin SUB-D (F)  |
| I/O Interface          | Connector: 9-pin SUB-D (F)  |
| Web GUI                | Internet Explorer, Firefox, etc.<br>Connector: Ethernet   |
| CLI (Command Line)     | Connector: USB (Hyperterminal)<br>or Ethernet (HyperTerminal and<br>Telnet)                       |
| SNMP Control Interface | Ethernet 10/100/1000 Base-T<br>MIBs are provided  |
| Alarm Relays           | Connector: RS232, RS485<br>and I/O<br>2 Dry Contact Alarm relays,<br>triggered by any major alarm |

#### Exciter Inputs

|   |  |
|---|--|
| DVB-ASI   | 2x BNC (F), 75 $\Omega$                                      |
| G.703/G.704                                       | 2x BNC (F), 50 $\Omega$                                      |
| SMPTE-310M  | 2x BNC (F), 75 $\Omega$ (optional)                           |
| GbE Transport Stream<br>(DAB and DVB-T2 excluded) | Protocol: Pro-MPEG CoP #3 /<br>SMPTE-2022<br>Connector: RJ45 |

#### Exciter Monitoring Outputs

|                                      |   |
|--------------------------------------|---|
| DVB-ASI                              | 2x BNC (F), 75 $\Omega$   |
| G.703/G.704                          | 2x BNC (F), 50 $\Omega$   |
| RF Monitor                           | SMA (F), 50 $\Omega$  |
| Reference Monitor                    | BNC (F), 50 $\Omega$<br>Frequency: 10 MHz<br>Level: 2 Vpp             |
| 10 MHz (Clock Reference)<br>(Note 1) | BNC (F), High Impedance<br>Level: 10dBm $\pm$ 2.5 dB sinewave         |
| 1PPS (Time Reference)<br>(Note 1)    | BNC (F), High Impedance<br>Level: TTL<br>Trigger: Positive transition |

#### Amplifier RF Output

|  |   |
|--|---|
| Output Frequency:                            | TBD   |
| Connector                                    | N-type (F), 50 $\Omega$ or<br>7/16" DIN (F), 50 $\Omega$                        |
| Digital Average Output Power                 | 50W, 100W or 200W   |
| Gain Variation over Temperature              | $\leq \pm 1$ dB   |
| Gain Variation over the Signal BW            | $\leq 0.5$ dB   |
| In-band IMD                                  | $\leq -27$ dBc (without pre-correction)   |
| Spectral Regrowth<br>(at rated output power) | $\leq -30$ dBc (without pre-correction)<br>$\leq -36$ dBc (with pre-correction) |
| Frequency Stability                          | Internal reference 0.3ppm /<br>or in accordance with<br>external ref. accuracy  |

#### Exciter RF Output

|  |  |
|--|--|
| Spectrum Polarity  | Inverted or non-inverted,<br>selectable  |
| Level  | -10 dBm to 0 dBm in 0.1 dB step  |
| Level Stability  | $\pm 0.3$ dB   |
| Return Loss  | > 20 dB  |
| Shoulder Level   | < -50 dBc  |
| Spurious Level Outside Channel                           | < -60 dBm  |
| MER  | $\geq 45$ dB<br>$\geq 42$ dB (DVB-T2)  |
| Amplitude Flatness<br>Center frequency $\pm 3.8$ MHz:    | $\pm 0.3$ dB   |
| Group delay response:<br>Center frequency $\pm 3.8$ MHz: | $\pm 10$ ns  |
| Phase Noise SSB<br>(measured @ 474 MHz)                  | 10 Hz: < -60 dBc/Hz<br>100 Hz: < -85 dBc/Hz<br>1 kHz: < -100 dBc/Hz<br>10 kHz: < -105 dBc/Hz<br>100 kHz: < -120 dBc/Hz<br>1 MHz: < -135 dBc/Hz |

**Note 1:** The 10MHz and 1PPS connectors are inputs, except when the exciter is equipped with an internal GPS receiver. In this case, the 10MHz and 1PPS connector become monitoring outputs (high impedance).

# Outdoor Terrestrial Transmitter / Repeater



## Product Specifications

### Manual Digital Pre-Correction

#### Non-Linear Pre-Correction

|                             |  |
|-----------------------------|--|
| Curve Formats               | S 21 and VO/VI                                   |
| Amplitude Scale             | Linear and Logarithmic                           |
| Correction Points           | Max. 256, user-defined position                  |
| Spectral Regrowth Reduction | Max. 12 dB, subject to available headroom        |
| Phase Correction            | -6 to +30 degrees, subject to available headroom |

#### Linear Pre-Correction

|                        |   |
|------------------------|---|
| Correction Points      | 61  |
| Point Spacing          | 1/60 of nominal spectrum BW                                   |
| Amplitude Correction   | ±10 dB  |
| Amplitude Resolution   | 0.01 dB   |
| Group Delay Correction | ±2000 ns  |
| Group Delay Resolution | 1 ns  |
| Peak Power Clip Level  | +17 dB to +7 dB<br>(peak power relative to average RMS level) |

### Adaptive Non-linear Pre-Correction

|                             |  |
|-----------------------------|--|
| HPA FB Connector            | To be coupled from the PA output when the Adaptive Pre-corrector is used |
| Frequency                   | 470 MHz - 860 MHz<br>1600 MHz - 2800 MHz                                 |
| Spectral Regrowth Reduction | 7 dB ±2 dB (Note 2)  |

**Note 2:** Greater improvement is possible under particular conditions. Performance depends upon power level, frequency and waveform.

### Power Supply (50W Transmitter/Repeater)

|                   |  |
|-------------------|--|
| Voltage           | 198 – 242 VAC (220 VAC ±10%)               |
| Frequency         | 50/60 Hz                                   |
| Power Consumption | 800 W (typical)<br>(1.8 kW with heater on) |

### Power Supply (100W Transmitter/Repeater)

|                   |   |
|-------------------|---|
| Voltage           | 198 – 240 VAC (220 VAC ±10%)                |
| Frequency         | 50/60 Hz                                    |
| Power Consumption | 1.3 kW (typical)<br>(2.3 kW with heater on) |

### Power Supply (200W Transmitter/Repeater)

|                   |   |
|-------------------|---|
| Voltage           | 198 – 242 VAC (220 VAC ±10%)                |
| Frequency         | 50/60 Hz                                    |
| Power Consumption | 2.2 kW (typical)<br>(3.2 kW with heater on) |

### Mechanical (50W Transmitter/Repeater)

|  |   |
|--|---|
| Dimensions (W x H x D)                     | 69.53 cm x 86.4 cm x 120.65 cm<br>(27.375" x 34.0" x 47.5") |
| Weight<br>(with 1 Exciter, no BPF, no UPS) | 87 – 97 kg<br>(192 – 214 lbs.)                              |
| Weight<br>(with 1 Exciter, BPF and UPS)    | 107 – 117 kg<br>(236 – 258 lbs.)                            |

### Mechanical (100W and 200W Transmitter/Repeater)

|  |   |
|--|---|
| Dimensions (W x H x D)                     | 69.53 cm x 86.4 cm x 120.65 cm<br>(27.375" x 34.0" x 47.5") |
| Weight<br>(with 1 Exciter, no BPF, no UPS) | 116 kg (256 lbs.)   |
| Weight<br>(with 1 Exciter, BPF and UPS)    | 136 kg (300 lbs.)   |

### Environmental

|                       |   |
|-----------------------|---|
| Operating Temperature | +0° C to +50° C<br>(+32° F to +122° F)  |
| Storage Temperature   | -30° C to +65° C<br>(-22° F to +149° F) |
| Relative Humidity     | max. 95%, non condensing                |
| Cooling               | Forced air                              |



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### Product Specifications

#### GPS Receiver

|   |   |
|---|---|
| Input Connector                               | F-type (F), 75 $\Omega$<br>5 Vdc biased   |
| Recommended Antenna                           | Bullet III GPS antenna – Trimble model no. 57860-10 or equivalent   |
| Receiver Architecture                         | L1 1575.42 MHz  |
| 12 Parallel Channels                          | C/A code (1.023 MHz chip rate)<br>Code plus carrier tracking<br>(carrier aided tracking)  |
| Tracking Capability                           | 12 simultaneous satellite vehicles  |
| Acquisition Time<br>(Time To First Fix, TTFF) | < 15 seconds typical TTFF-hot<br>(with current almanac, position, time and ephemeris)<br>< 150 seconds typical TTFF-cold<br>(no stored information) |
| Positioning Accuracy                          | < 5 m, 1 – sigma<br>< 10 m, 2 – sigma   |
| Timing Accuracy                               | < 2 ns, 1 – sigma<br>< 6 ns, 6 – sigma  |
| Holdover Time                                 | $\pm 1$ usec during 2 hours   |
| 10 MHz Output Signal                          | Internally connected to the exciter input<br>Level: 10 dBm $\pm 2.5$ dBm, sine wave<br>Harmonic Level: -40 dBc max.                                 |
| Phase Noise:                                  | 1 Hz: < -75 dBc/Hz<br>10 Hz: < -110 dBc/Hz<br>100 Hz: < -125 dBc/Hz<br>1 kHz: < -135 dBc/Hz<br>10 kHz: < -155 dBc/Hz<br>100 kHz: < -155 dBc/Hz      |
| 1PPS Output Signal                            | Internally connected to the modulator input<br>Level: TTL   |

#### DVB-S/S2 Receiver

|                    |   |
|--------------------|---|
| Input Connector    | VSAT Antenna: F-type (F), 75 $\Omega$   |
| Input Frequency    | Range 950 MHz - 2150 MHz                |
| Input Signal Level | -65 dBm to -25 dBm                      |
| Modulation Type    | QPSK, 8PSK                              |
| FEC                | DVB-S and DVB-S2 compliant              |
| Symbol Rate        | 1 - 45 Mbaud                            |
| Output Connectors  | 2 DVB-ASI outputs: BNC (F), 75 $\Omega$ |

#### GPS/GLONASS Receiver

|   |   |
|---|---|
| Input Connector   | F-type (F), 75 $\Omega$<br>5 Vdc biased   |
| Recommended Antenna   | Bullet III GPS antenna – Trimble model no. 57860-10 or equivalent   |
| Receiver Architecture   | L1 - 1575.42 MHz /<br>GLONASS - L1 frequency range  |
| 32 Parallel Channels  | GPS C/A code (1.023 MHz chip rate) /<br>GLONASS PT code - WASS / EGNOS<br>Code plus carrier tracking (carrier aided tracking)   |
| Tracking Capability   | 24 simultaneous satellite vehicles  |
| Acquisition Time<br>(Time To First Fix, TTFF)<br>(Tested at -40°C to +85°C) | < 15 s typical TTFF-hot (with current almanac, position, time and ephemeris)<br>< 40 s typical TTFF-warm (with current almanac, position, time) < 150 s typical TTFF-cold (No stored information) |
| Positioning Accuracy  | GPS: < 10m / 20m<br>GLONASS: < 10 m / 20m   |
| Timing Accuracy<br>1PPS + 10MHz   | < 100 ns  |
| Holdover Time   | $\leq 2.5$ $\mu$ sec during 2 hours   |
| 10 MHz Output Signal  | Internally connected to the exciter input<br>Level: 10 dBm $\pm 2.5$ dBm, sine wave<br>Harmonic Level: -30 dBc max.   |
| Phase Noise:  | 1 Hz: < -75 dBc/Hz<br>10 Hz: < -110 dBc/Hz<br>100 Hz: < -125 dBc/Hz<br>1 kHz: < -135 dBc/Hz<br>10 kHz: < -155 dBc/Hz<br>100 kHz: < -155 dBc/Hz  |
| 1PPS Output Signal  | Internally connected to the modulator input<br>Level: TTL   |

#### UPS

|             |                           |
|-------------|---------------------------|
| Height      | 1RU                       |
| Power       | 280 Watts / 450 VA        |
| Backup Time | 10 Minutes (Exciter Only) |



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Part Number Configuration



**Band**  
 YL – L-Band  
 YS – S-Band  
 YC – C-Band  
 YX – X-Band  
 KU – Ku-Band  
 KA – Ka-Band

**Output Power**  
*L-Band*  
 0250W,0500W  
*S-Band*  
 0150W, 0300W  
*C-Band*  
 0010W, 0020W, 0040W,  
 0080W,0100W, 0150W,0200W,  
 0250W,0300W, 0325W,0400W,  
 0650W,0800W  
*X-Band*  
 0275W, 0550W  
*Ku-Band*  
 0060W,  
 0080W,0100W, 0150W,0200W,  
 0300W,0400W, 0800W,  
*Ka-Band*  
 TWTA, UP TO 1.5KW  
 AVAILABLE PLEASE CALL FOR INQUIRY  
**FOR HIGH POWER 1KW AND ABOVE PLEASE CONTACT OUR SALES DEPARTMENT**

**Sub Band**  
*L-Band*  
 A (1.0-2.0 GHz)  
 B (1.5-3.0 GHz)  
 C (1.0- 2.5 GHz)  
*S-Band*  
 A (2.02-2.12 GHz)  
 B (2.20-2.30 GHz)  
*C-Band*  
 A (5.850-6.425 GHz)  
 B (5.750-6.475 GHz)  
 C (5.750-6.670 GHz)  
 D (5.850-6.725 GHz)  
 E (6.425-6.725 GHz)  
 F (6.725-7.025 GHz)  
*X-Band*  
 A (7.70-8.40 GHz)  
 B (7.90-8.40 GHz)  
 C (7.50-8.50 GHz)  
 D (9.50-10.50 GHz)  
*Ku-Band*  
 A (14.00-14.50 GHz)  
 B (13.75-14.50 GHz)  
 C (12.75-13.25 GHz)  
 D (13.00-14.50 GHz)  
 E (13.25-13.75 GHz)  
*Ka-Band*  
 A (27.5-31.0 GHz)

**Configuration/Options**  
 STD – Standard  
 ISP – Input Sample Port  
 WGF\* – 90° Output W/G Flange  
 WSP \* – 90° Output W/G Flange with Input Sample Port  
 FPS\*\* – Front Panel Power Switch  
 RPM – Reflected Power Monitor  
 FRM\*\* – Front Panel Power Switch and Reflected Power Monitor  
 EPS – External, Redundant Power Supply, 1RU N+1  
 EPE – External Power Supply, 1RU N+1 and Rear Panel  
 \* Available in all but S-Band-and L-Bands  
 \*\* Not Available with External 1RU N+1 Redundant Power Supply

**Block Up Converter**  
 B - BUC  
 X – Not Available

**Enclosure**  
 I - Indoor  
 O - Outdoor