

	TEST EQUIPMENT GROUP	KIT DESCRIPTION	SUPPLIER	MODEL	SPECIFICATION
Ph	Software	ADS	ADS	EM Pro, System Vue	
Ph	Software	Solidworks	Solidworks	Solidworks Professional	Mechanical CAD.
Ph	Software	COMSOL	COMSOL	Heat Transfer, Semiconductor, Wave Optics modules	Multiphysics simulation.
Ph	Software	Zemax	Zemax	OpticStudio Professional	Advanced Optical System Design.
Ph	Software	LabView	National Instruments	LabView Professional	
Ph	Emitter Control and Test	LIV Test - SMU (Source Measure Unit)	Keysight	B2902A	Measurement range: $\pm 210$ V, $\pm 3$ A (DC), $\pm 10.5$ A (pulsed). Source and measurement resolution down to 10 fA and 100 nV. Programmable Signal Generator, min pulse width 50 $\mu$ s.
Ph	Emitter Control and Test	LIV Test - Device Mounting	ThorLabs	LDM56/M	TO-Can Mount for $\varnothing 3.8$ mm, $\varnothing 5.6$ mm, or $\varnothing 9.0$ mm TO-Can Laser Diodes. TEC controller interface (range and accuracy below), and RF input (100 kHz to 500 MHz).
Ph	Emitter Control and Test	LIV Test - Device Mounting	ThorLabs	LM14S2	Universal 14 pin Butterfly laser diode mount.
Ph	Emitter Control and Test	LIV Test - Thermal Control	ThorLabs	TED200C	TEC Output (Low Noise): $\pm 2$ A / 12 W Temperature Range from $-45$ °C to $+145$ °C (AD590) or 10 $\Omega$ to 200 k $\Omega$ (Thermistor) Temperature Resolution: 0.01 °C (IC-Sensor) or 1 $\Omega$ (Thermistor) Temperature Stability: $\leq 0.002$ °C
Ph	Emitter Control and Test	LIV Test - Vision System	Nikon	HD-013-E-L	Vision system for probe alignment.
Ph	Emitter Control and Test	LIV Test - Probe and Micropositioners	MPI	MP40	Micropositioner for probe to chip/COS. 13 mm travel range in XYZ. 300 $\mu$ m screw resolution in XYZ.
Ph	Emitter Control and Test	LIV Test - Detection	Newport	819C-SL-2 & 2936-R	Integrating Sphere 4-port 2 inch. High Performance Power Meter, dual channel.
Ph	Emitter Control and Test	Laser Diode Driver	ThorLabs	CLD1015	Laser Diode and Temperature Controller with Butterfly Mounting.

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Ph	Emitter Control and Test	Laser Diode/TEC Controller for QCLs	ThorLabs	ITC4005QCL	High Compliance Voltages Designed to Support QCL Lasers up to 20 V. Drive Currents up to 5 A. Provides TEC Currents up to $\pm 15$ A. 0.002 °C Temperature Stability Over 24 hrs.
Ph	Emitter Control and Test	Power Supplies	RS	RS Pro Power Supply Programmable Linear	220 W, 3 output, 0 to 32 V, 2.5 to 5 V, 3.2 A
Ph	Emitter Control and Test	Beam Quality Analysis	ThorLabs	M2MS-BP209IR/M	M2 Measurement System IR 900 - 1,700 nm. Configurable to other wavelength ranges spanning 250 - 2,700 nm.
Ph	Emitter Control and Test	Beam Profiler	AMS Technologies	BeamOn WSR UV NIR	Wide spectral range CCD camera (190 - 1,600 nm) with motorized filter wheels and in-built filters. 2D/3D profile and Intensity Plots for beam analysis.
Ph	Emitter Control and Test	Wide Range Optical Spectrum Analysis	Yogokawa	AQ6374-10-L1-F/FC/RFC	350 - 1,750 nm (includes full Vis, C, L & O bands). 50 pm resolution. Dynamic Range >60 dB.
Ph	Emitter Control and Test	Tunable Laser Source	Santec	TSL-550-C-480630-P-F-AP-00-1	Tuning Range 1,480 - 1,630 nm. Linewidth 200 kHz. Accuracy +/- 5 pm. SMSR >45 dB.
Ph	Oscilloscopes	500 MHz 2 channel Oscilloscope	RS	RTM3002	500 MHz bandwidth.
Ph	Detectors	Silicon Photodiode Power Sensor	ThorLabs	S120VC	200-1,100 nm, 50 nW to 50 mW, 1 nW resolution.
Ph	Detectors	Germanium Photodiode Power Sensor	ThorLabs	S122C	700-1,800 nm, 40 mW, 2 nW resolution.
Ph	Detectors	InGaAs Fibre Photodiode Power Sensor	ThorLabs	S155C	800-1,700 nm, 1 nW to 20 mW, 100 pW resolution.
Ph	Detectors	InGaAs Variable-Gain APD	ThorLabs	APD430C/M	900-1,700 nm. Output bandwidth DC - 400 MHz. Continuous variable M factor 4 - 20.

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Ph	Optical Fibre Alignment	6-axis NanoMax Stage	ThorLabs	MAX601D/M	4 mm (0.16") of X, Y, and Z Travel. 6° (105 mrad) of $\theta_x$ , $\theta_y$ , $\theta_z$ (Roll, Pitch, and Yaw) Travel. $\mu\text{m}$ level positioning Resolution.
Ph	Optical Fibre Alignment	6-axis NanoMax Stage	ThorLabs	MAX607L/M	6 axis translation stage.
Ph	Optical Fibre Alignment	Tip, Tilt and Rotation Stage	ThorLabs	TTR001/M	$\pm 5^\circ$ yaw, pitch and roll range. $\pm 0.036^\circ$ pitch and roll resolution.
Ph	Optical Fibre Alignment	Single-Axis Translation Stage	ThorLabs	MS1S/M	6.5 mm single-axis travel.
Ph	Fibre Optics	Fibre Splicer	Fujikura	FSM-100P+	Splicer (SM, MM, PM fibre types supported, Dual splice loss estimation, LDF splicing capability, Photonic crystal fibres and fibres with different MFD, Endview observation system, typical splice loss: SMF 0.03 dB, NZDSF/LDF = 0.05dB, MMF = 0.02 dB, PMF = 0.06 dB), cleaver (cladding diam. up to 1,250 $\mu\text{m}$ , cleaving = 5 - 40 mm, angled cleaving capability = 0 - 15 deg.), ultrasonic cleaner (Ethyl-alcohol or IsoPropanol) and Hot Jacket Stripper.
Ph	Fibre Optics	Fibre Polarisation Controller	ThorLabs	FPC 031	Convert Between Linear, Circular, and Elliptical Polarization States. Operates over Full Fiber Bandwidth (1260 - 1625 nm). FC/PC Connectors.
Ph	Fibre Optics	Fibre Polarisation Controller (Angled Fibre)	ThorLabs	FPC 032	Convert Between Linear, Circular, and Elliptical Polarization States. Operates over Full Fiber Bandwidth (1260 - 1625 nm). FC/APC Connectors.
Ph	Fibre Optics	Variable Fibre Attenuator	ThorLabs	VOA50-FC	Up to 50 dB in-line attenuation (1310/1550 nm), 300 mW Max Power, FC/PC Connectors

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Ph	Reliability	Optoelectronic Accelerated Lifetest	Yelo	Y1000-MR	<p>Lifetest for laser diodes, photodetectors and packaged optoelectronic devices.</p> <p>Mounting options from COS, to TO-can, butterfly and custom optoelectronic packages.</p> <p>32 DUT per module typical, 16xmodules 1,000 mA source and 16xmodules 100 mA source.</p> <p>Emitters (VCSELs, EELs, LEDs) and detectors (photodiodes, APDs, SPADs) accepted.</p> <p>0 - 3.5 V Compliance Voltage.</p> <p>External photodiode (400 nm – 1,700 nm responsivity range) and internal photodiode monitoring options.</p> <p>Heat Sink Temperature range 25°C to 150°C.</p> <p>LIV monitored over time - MTTF,MTBF calculated.</p>
Ph	Reliability	Vibration Shaker Table	Alphatech	M2232-PA126	<p>Shock and Vibration shaker table can be used in isolation or in combination with the climatic chamber.</p> <p>In-situ test support with access ports for test equipment and power supplies.</p> <p>5 Hz to 3 kHz.</p> <p>Peak Sinusoidal acceleration of 100 g.</p> <p>Random vibration &gt; 70 g.</p> <p>Shock of 43 kN (over 6 ms half sine).</p> <p>Support payloads up to 160 kg.</p>
Ph	Reliability	Climatic Chamber	Alphatech	THV-1200-10	<p>Climatic chamber with thermal cycling and humidity control can be used in isolation or in combination with the shaker table.</p> <p>-70°C to +180 °C Temperature Range.</p> <p>&gt;10 °C/min Ramp Rate.</p> <p>10% to 98% RH.</p>
Ph	Materials Analysis	FTIR Specrometer	Bruker	INV-R	<p>Spectral Range 8,000 to 350 cm<sup>-1</sup>.</p> <p>Wide band Spectral Range extension MIR (MCT detection) 12,000 - 600 cm<sup>-1</sup>.</p> <p>Spectral Resolution 0.16 cm<sup>-1</sup>.</p> <p>External laser input channel.</p>

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Power	System Test	10kVA Grid-tied 4 Quadrant Power Supply	ETPS	EAC-ACS-4Q	modern power system with full 4 quadrant operation. Each output phase has individually programmable test parameters state of the art multilevel double inverter technology 5 to 40°C operation, liquid cooled Grid Simulation Mode RLC Load Simulation Mode Constant Current Amplifier Mode
Power	System Test	High Voltage Programmable Power Supply	Magna-Power	X6000-0.33/240SP+HS+LXI	Programmable 6kV, 0.33A, 2kW high voltage power supply
Power	System Test	High Voltage Programmable Power Supply	Magna-Power	X2000-1.0/240SP+HS+LXI	Programmable 2kV, 1A, 2kW high voltage power supply
Power	System Test	High Current Power Supply	ETPS	LAB-HP 2020	Programmable 20V, 1kA, 20KW high current power supply
Power	System Test	AC Power Source	Keysight	AC6800	Programmable AC single phase, 270V, 20A, 4kVA
Power	System Test	Hardware-in-the-loop	Speedgoat	Kintex 7 IO325k	Performance real-time target machine Kintex 7 IO325k FPGA Analogue inputs: 16 x 5MHz 16bit sampling Analogue outputs: 16 x 2MHz 16bit simultaneous Digital IO: 64 Matlab/Simulink interface
Power	System Test	Three Phase Power Analyzer	Newtons4th Ltd	PPA5500	3 phase power and efficiency measurement 0.01% basic accuracy Up to 50 Arms (1000 Apk) & 1000 Vrms (3000 Vpk) direct input Frequency range DC and 10mHz to 2MHz 5 millidegree phase accuracy necessary for low power factor applications
Power	System Test	Frequency Response & Impedance Analyzer	Newtons4th Ltd	PSM3750+IAI2	frequency response analysis and impedance analysis from 0.1µHz to 50MHz 500Vpk isolated generator and 500Vpk isolated inputs 0.01dB gain accuracy, 0.025° phase accuracy

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Power	System Test	Radiated Near Field Plotter	Detectus	RSE644	radiated EMI emission and immunity pre-compliance testing x,y,z scanner robot + Tektronix RSA306B USB Real Time Spectrum + Keysight MXG signal generator
Power	System Test	8 Ch 1GHz Oscilloscope	Tekronix	MS058	8 Channels 1 GHz bandwidth 6.25 GS/s 50 MHz Arbitrary function generator
Power	System Test	Optically Isolated Differential Probe	Tekronix	IsoVu TIVH08	floating measurements, example high side gate drivers up to 120dB CMRR at 100 MHz
Power	Power Device Characterisation	Power Device Analyzer/ Curve Tracer	Keysight	B1505A	All-in-one solution for power device characterization up to 1500 A/10 kV Medium current measurement with high voltage bias (e.g. 500 mA at 1200 V) $\mu\Omega$ resistance measurement capability Accurate sub-picoamp level current measurement at high voltage bias Fully automated thermal test from -50 to +250 °C
Power	Power Device Characterisation	Advance Temperature Source	Thermostream	ATS-750-M-11	temperature range -75 to 225°C 0.1°C temperature resolution -55 to 125°C transition in 10 seconds 125 to -55°C transition is 10 seconds
Power	Power Device Characterisation	Power and Thermal Cycler	Mentor	MicReD 1500A	12 channels, 1.5kA max load current Automated failure detection based on UCE, $\Delta T_j$ , $T_{jmax}$ , $R_{th}$ increase 1 $\mu s$ Voltage measurement time base Gate driving voltage -10V to +20V

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RF	Device Characterisation	Vector Network Analyzer	Keysight	N5247B	PNA-X Microwave Network Analyzer, 900 Hz/10 MHz to 67 GHz
RF	Device Characterisation	SMU (Source Measure Unit)	Keysight	B2902A	Measurement range: $\pm 210$ V, $\pm 3$ A (DC), $\pm 10.5$ A (pulsed). Source and measurement resolution down to 10 fA and 100 nV. Programmable Signal Generator, min pulse width 50 $\mu$ s.
RF	Device Characterisation	Semi-Auto 6" probe station	MPI	TS2000-SE	Advanced probe system equipped with automated single wafer loader with local environment chamber providing an excellent EMI- and light-tight shielding for ultra-noise measurements, temperature configuration - 60°C to + 300°C.
RF	Device Characterisation	Manual 4" probe station	MPI	T150	Manual probe station for on wafer device characterisation
RF	Reliability	Burn In Life Test (BILT) system	AMCAD		5-slot chassis, 100-230V power line, 250W, up to 120V, 30A pulsed, 5A DC drain source, 25V, 20mA Gate pulser, 2-6 GHz RF control.
RF	Device Characterisation	Passive Tuner	Focus Microwave		Passive Tuner for Load-pull testing up to 50GHz frequency
RF	System Test	Signal generator	Holzworth	HSX9001A	RF Synthesiser - Phase coherent with 1x Channel (HSX) 10MHz-24GHz frequency range
RF	System Test	Spectrum Analyser	Keysight	N9010A	N9010A EXA signal Analyzer 26.5GHz, phase noise analysis, Noise Figure Analysis.
RF	Emitter Control and Test	Power Supplies	Keysight	N6701C	600W DC module, 35V, 1.5A, 52.5W - 60V, 5A, 300W
RF	Emitter Control and Test	Power Supplies	Keysight	E36313A	160W power output, 0 to 6V/0 to 10A (CH1), 0 to 25V/0 to 2A (CH2), 0 to 25V/ 0 to 2A (CH3) DC output