Waveform Processing Airborne Laser Scanning System

NEW

RIEGL VQ®-580 II

- *high accuracy ranging based on RIEGL Waveform-LiDAR technology*
- *high laser pulse repetition rate up to 2MHz*
- *measurement rate up to 1,250,000 measurements/sec*
- *perfectly linear and parallel scan lines*
- *wide field of view of 75°*
- *excellently suited to measure on snow & ice*
- *interfaces for up to 5 optional cameras*
- *mechanical and electrical interface for IMU/GNSS integration*
- *removeable storage card and integrated Solid State Disk (SSD) for data storage*
- *compact, & lightweight design*
- *compatible with stabilized platforms and even small hatches*
- *seamless integration and compatibility with other RIEGL ALS systems and software packages*

In further development of the *RIEGL* VQ-580 Airborne Laser Scanner Series – the new *RIEGL* VQ-580 II presents itself in a completly new design that successfully takes up the already proven qualities and leads them to a new standard of performance and user-friendliness.

Its new sophisticated design allows to further reduce the overall weight and enables the seamless integration into stabilized platforms, e.g. standard gyromounts, and also into even small hatches. The scanner is well suited for the use in manned aircrafts like helicopters, small fixed-wing aircrafts, or ultra-light planes.

Based on *RIEGL*'s proven Waveform-LiDAR technology, the VQ-580 II provides highly accurate point clouds, excellent vertical target resolution, calibrated reflectance readings, and pulse shape deviation for unsurpassed information content on each single measurement. With a measurement rate of up to 1,250,000 measurements/second and an extremely wide field of view of 75°, the scanner offers itself as the first choice for airborne surveying applications like corridor mapping, city modeling, and agriculture & forestry. The laser wavelength makes it especially suited for measurements on ice and snow.

An easy to remove CFast® storage card and an integrated Solid State Disk and/or the option for streaming the scan data via LAN TCP/IP interface are provided for data transfer and storage.

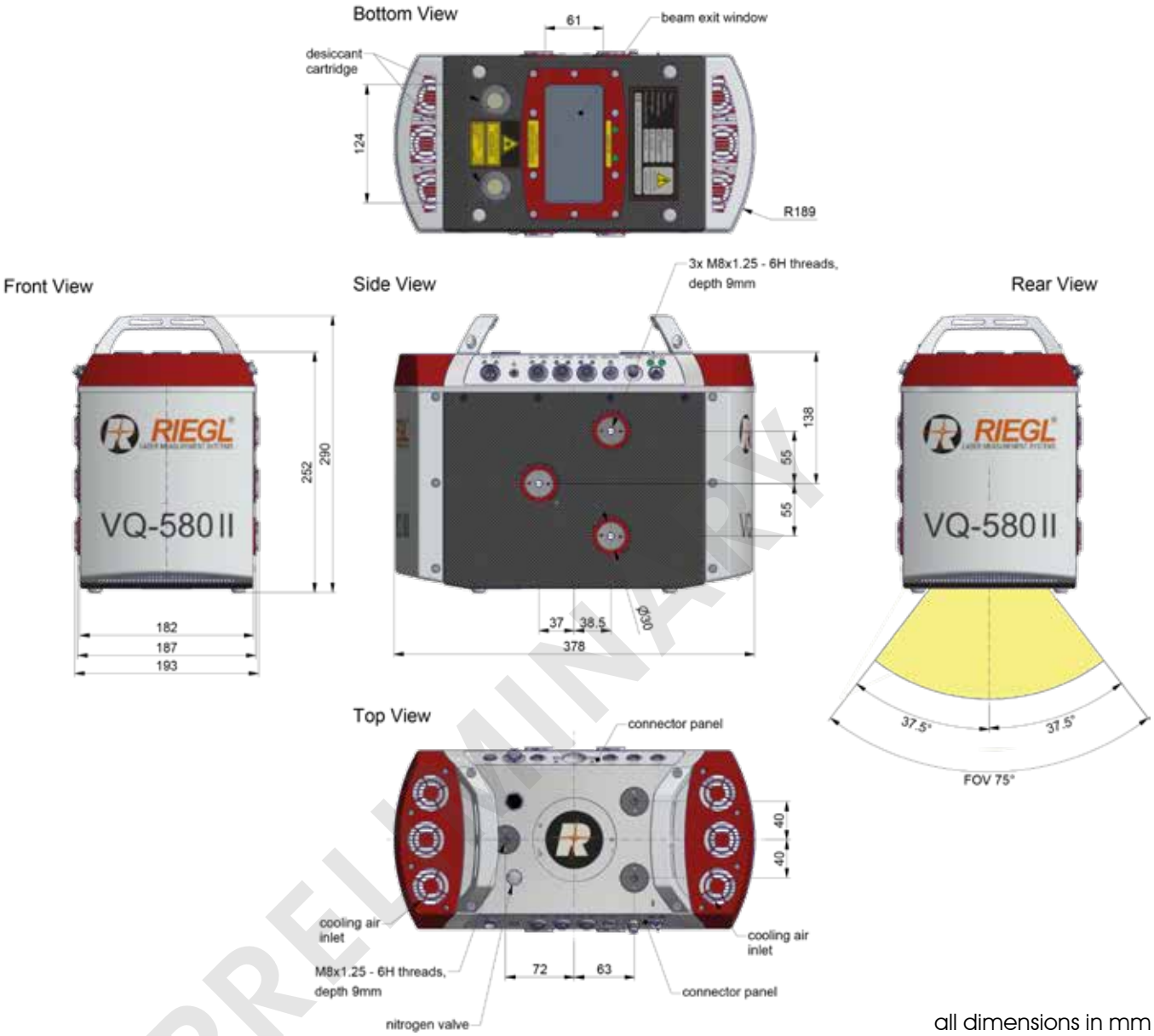
Typical applications include

- *Corridor Mapping*
- *Agriculture & Forestry*
- *Especially suited for Glacier Mapping and Snowfield Mapping*
- *Moist Grassland Mapping*
- *City Modeling*

visit our website
www.riegl.com

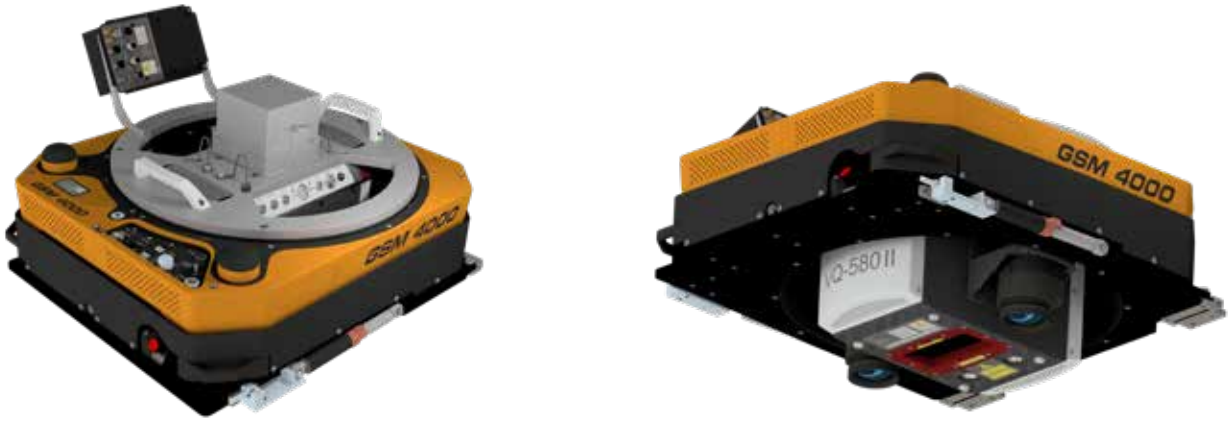
RIEGL®
LASER MEASUREMENT SYSTEMS

Dimensional Drawings *RIEGL* VQ®-580 II

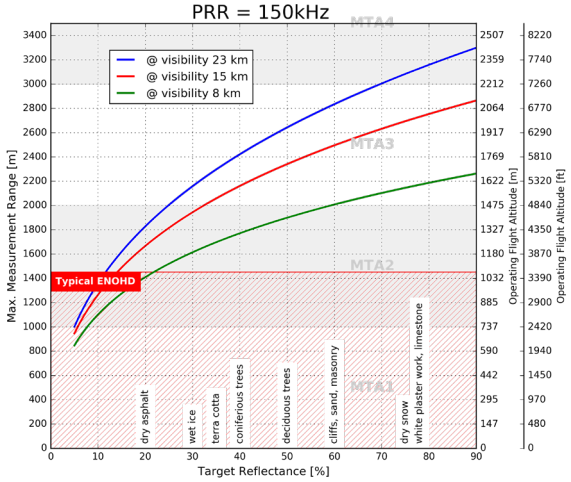


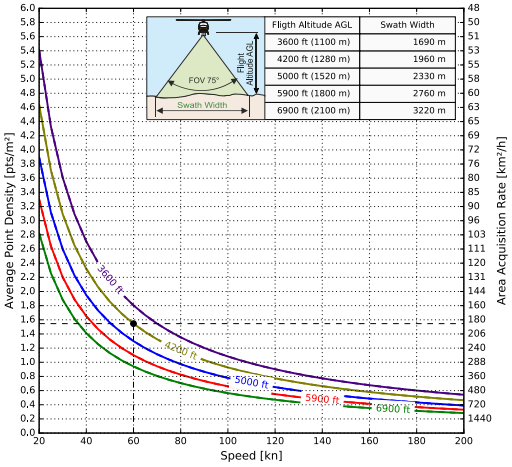
all dimensions in mm

RIEGL VQ®-580 II Installation Example



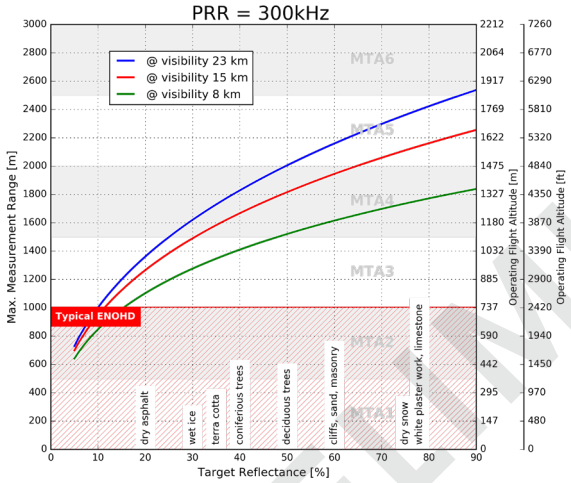
RIEGL VQ-580 II installed on GSM-4000 stabilized platform to be used in a helicopter or fixed-wing aircraft

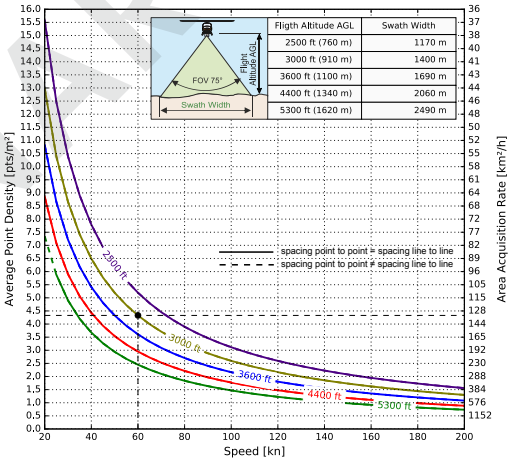




Example: VQ-580 II at 150,000 pulses/sec, laser power level 100%
Altitude = 4,200 ft AGL, Speed 60 kn

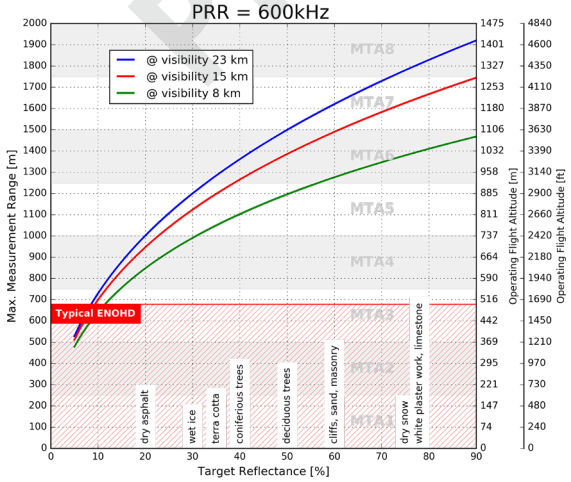
Results: Point Density ~ 1.55 pts/m²

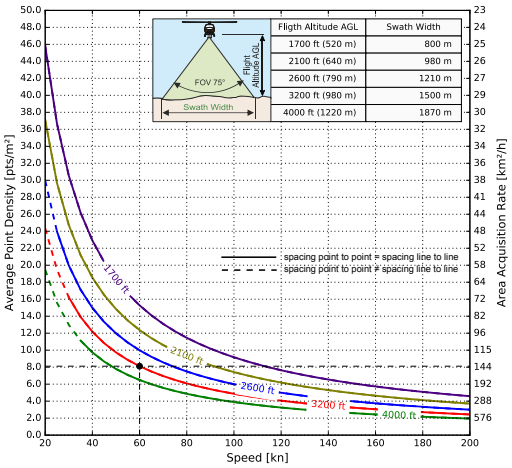




Example: VQ-580 II at 300,000 pulses/sec, laser power level 100%
Altitude = 3,000 ft AGL, Speed 60 kn

Results: Point Density ~ 4.33 pts/m²



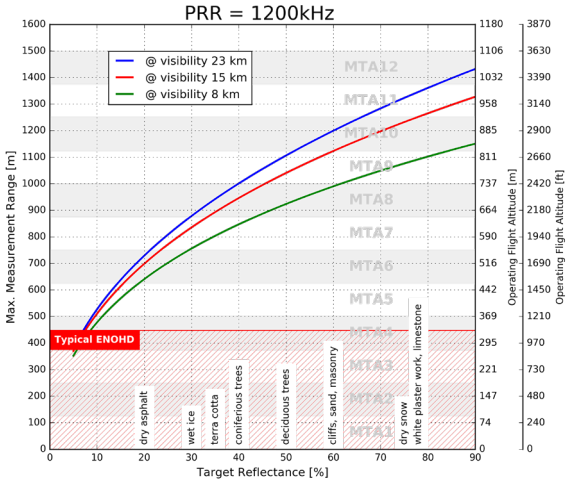


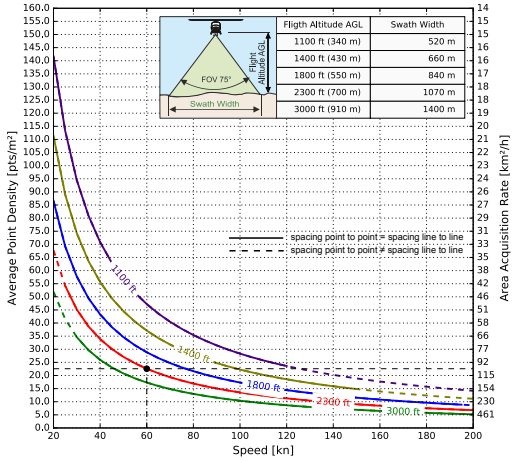
Example: VQ-580 II at 600,000 pulses/sec, laser power level 100%
Altitude = 3,200 ft AGL, Speed 60 kn

Results: Point Density ~ 8.12 pts/m²

The following conditions are assumed for the Operating Flight Altitude AGL

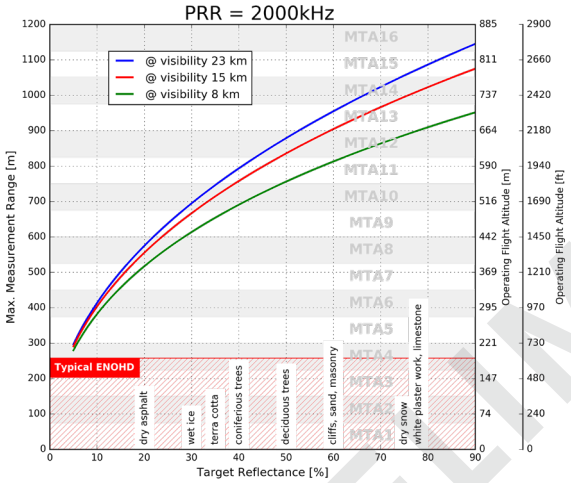
- ambiguity resolved by multiple-time-around (MTA) processing
- roll angle ±5°
- target size ≥ laser footprint
- average ambient brightness
- operating flight altitude given at a FOV of +/- 37.5°

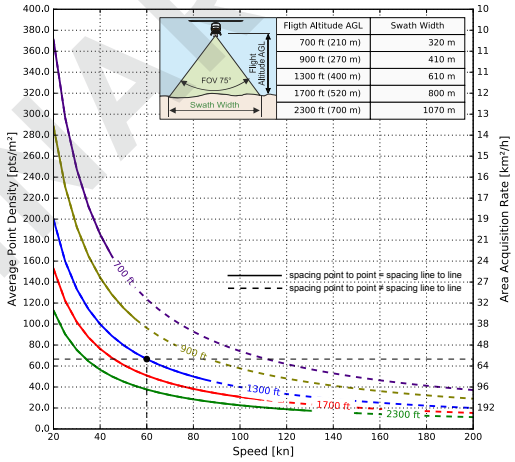




Example: VQ-580 II at 1,200,000 pulses/sec, laser power level 100%
Altitude = 2,300 ft AGL, Speed 60 kn

Results: Point Density ~ 22.58 pts/m²





Example: VQ-580 II at 2,000,000 pulses/sec, laser power level 100%
Altitude = 1,300 ft AGL, Speed 60 kn

Results: Point Density ~ 66.60 pts/m²

The following conditions are assumed for the Operating Flight Altitude AGL

- ambiguity resolved by multiple-time-around (MTA) processing
- roll angle ±5°
- target size ≥ laser footprint
- average ambient brightness
- operating flight altitude given at a FOV of +/- 37.5°

Laser Product Classification

Class 3B Laser Product according to IEC 60825-1:2014

The following clause applies for instruments delivered into the United States: Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.

The instrument must be used only in combination with the appropriate laser safety box.

Range Measurement Performance

Measuring Principle: echo signal digitization, online waveform processing, time-of-flight measurement, multiple target capability

Laser Pulse Repetition Rate PRR [1]	150 kHz	300 kHz	600 kHz	1200 kHz	2000 kHz
Max. Measuring Range [2] [3]					
natural targets ρ ≥ 20 %	1850 m	1350 m	1000 m	750 m	550 m
natural targets ρ ≥ 60 %	2850 m	2150 m	1600 m	1200 m	950 m
Max. Operating Flight Altitude [2] [4] Above Ground Level (AGL)					
natural targets ρ ≥ 20 %	1350 m 4450 ft	1000 m 3280 ft	750 m 2450 ft	550 m 1800 ft	400 m 1300 ft
natural targets ρ ≥ 60 %	2100 m 6900 ft	1600 m 5250 ft	1200 m 3950 ft	900 m 2950 ft	700 m 2300 ft
NOHD [5]	160 m	110 m	70 m	40 m	30 m
ENOHD [5]	1020 m	710 m	480 m	310 m	200 m
Max. Number of Target per Pulse [6]	15	15	15	9	5

1) Rounded average PRR
2) Typical values for average conditions and average ambient brightness. In bright sunlight, the max. range is shorter than under an overcast sky.
3) The maximum range is specified for flat targets with size in excess of the laser beam diameter, perpendicular angle of incidence, and for atmospheric visibility of 23 km. Range ambiguities have to be resolved by multiple-time-around processing.
4) Typical values for reflectivity ρ ≥ 60%, max. effective FOV 75°, additional roll angle ± 5°
5) Nominal Ocular Hazard Distance (NOHD) and Extended Nominal Ocular Hazard Distance (ENOHD), based upon MPE according to IEC 60825-1:2014, for non-persisting beam viewing (less than 600 laser pulses within a time period of 10 s) and non overlapping beam footprints. NOHD and ENOHD increase when number of laser pulses exceeds this limit (persistent viewing).
6) If more than one target is hit, the total laser transmitter power is split and, accordingly, the achieveable range is reduced.

Minimum Range	20 m
Accuracy [7] [9]	20 mm
Precision [8] [9]	20 mm
Laser Pulse Repetition Rate [10]	up to 2000 kHz
Max. Effective Measurement Rate	up to 1 250 000 meas./sec. (@ 2000 kHz PRR & 75° scan angle)
Echo Signal Intensity	provided for each echo signal
Laser Wavelength	near infrared
Laser Beam Divergence	0.25 mrad [11]

7) Accuracy is the degree of conformity of a measured quantity to its actual (true) value.
8) Precision, also called reproducibility or repeatability, is the degree to which further measurements show the same result.
9) One sigma @ 150 m range under *RIEGL* test conditions.
10) User selectable.
11) Measured at $1/e^2$ points, 0.25 mrad corresponds to an increase of 25 mm of beam diameter per 100 m distance.

Scanner Performance

Scanning Mechanism	rotating polygon mirror
Scan Pattern	parallel scan lines
Scan angle range	± 37.5° = 75°
Total Scan Rate	30 [12] – 300 lines/sec.
Angular Step Width Δ ϑ	0.002° ≤ Δ ϑ ≤ 0.24° [13] [14]
Angle Measurement Resolution	0.001°

12) The minimum scan rate depends on the selected laser PRR.
13) The angular step width depends on the selected laser PRR.
14) The maximum angular step width is limited by the maximum scan rate.

Data Interfaces

Configuration	LAN 10/100/1000 MBit/sec
Scan Data Output	LAN 10/100/1000 MBit/sec
Synchronization	Serial RS232 interface, TTL input for 1 pps synchronization pulse, accepts different data formats for GNSS-time information
Camera Interface	5x power, RS232, 1 pps, trigger, exposure

Data Storage

Permanently Installed Data Storage	Solid State Disc SSD, 1 TByte
Removable Data Storage	Cardholder for CFAST®[15] storage cards (up to 256 GByte)

15) CFast is a registered trademark of CompactFlash Association.

General Technical Data

Power Supply Input Voltage	18 - 34 V DC
Power Consumption	typ. 70 W, max. 220 W [1]
Main Dimensions (L x W x H)	378 mm x 193 mm x 252 mm (without mounted carrying handles)
Weight	
without integrated IMU/GNSS	9.9 kg
with integrated IMU/GNSS	10.3 kg
Humidity	non condensing
Protection Class	IP54, dust-proof and splash-proof
Max. Flight Altitude	
operating & not operating	18500 ft (5600 m) above MSL (Mean Sea Level)
Temperature Range	-5°C up to +40°C (operation) / -10°C up to +50°C (storage)

Integrated IMU & GNSS (optional) [2]

IMU Accuracy	
Roll, Pitch	0.015°
Heading	0.035°
IMU Sampling Rate	200 Hz
Position Accuracy (typ.)	
horizontal	≤ 0.05 m
vertical	≤ 0.1 m

1) Max. scan rate, all heaters in operation.
2) Accuracy specifications for post-processed data.

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