



SeeGull® MX | Multi-Band Scanning Receiver



**Unsurpassed
Measurement Performance for Complex
Multi-Technology Networks**

SIX TECHNOLOGIES

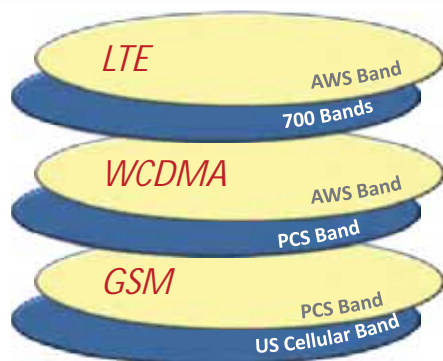
TD-LTE / LTE FDD /

UMTS [WCDMA/HSPA(+)] /

GSM / CDMA / EV-DO

PCTEL RF Solutions





Challenges in the Era of Broadband Wireless

With high-speed wireless communications demanding more and more bandwidth, network performance has become essential for service quality. As today's leading wireless operators overlay next generation technologies such as LTE on legacy 2G and 3G networks, deploying, maintaining, and optimizing networks becomes more complex.

The challenges facing network performance and optimization engineers in a world of constantly evolving networks, new technologies, and spectrum reallocations include:

- **Deployment of New Operating Bands** New spectrum made available through the reallocation of traditional analog services means that operators must deploy and maintain more operating bands than ever before.
- **Service Quality** Broadband services need highly optimized Radio Access Networks to leverage their data throughput advantages. Higher network performance equates to higher data rates and better service quality that drive greater subscriber satisfaction and retention.
- **Legacy Networks** Operators deploying new broadband technologies such as LTE must also maintain their existing 2G and 3G network by adding new capacity and services.
- **Managing Technology Migrations** As operators re-farm existing operating spectrum to new technologies and services, RF engineering teams must have flexible tools that can adapt to evolving network requirements.

SeeGull MX | The Ideal Solution for Optimizing Multi-Technology Wireless Networks



SeeGull MX, PCTEL's most technologically advanced scanning receiver, features a modular RF front end and high performance Signal Processing Engines that enable it to acquire, process, and report data from up to eight distinct RF operating bands with zero performance degradation when measuring up to three technologies concurrently. These performance advantages make SeeGull MX an essential tool for efficient, high quality measurements of emerging complex multi-technology broadband networks.





SeeGull MX | Features and Advantages

FEATURES	RF OPTIMIZATION & PERFORMANCE ADVANTAGES
Modular Multi-Band Architecture	<ul style="list-style-type: none"> Flexibility to meet evolving needs of complex multi-technology networks including MIMO
Up to 8 Independent Operating Bands	<ul style="list-style-type: none"> Ability to configure multiple technologies, including uplink bands, in single integrated receiver
Multiple Independent Signal Processing Engines	<ul style="list-style-type: none"> Enables SeeGull MX to perform fully concurrent measurements on up to 3 technologies without performance degradation Provides highest drive test data densities Eliminates the need to repeat test drives
20 MHz, MIMO-capable LTE Signal Acquisition	<ul style="list-style-type: none"> Supports emerging LTE/UMTS [WCDMA/HSPA(+)] /GSM, LTE/CDMA/EV-DO and TD-LTE/LTE FDD networks
High Capacity Receiver Platform	<ul style="list-style-type: none"> Enables multi-carrier measurements over multiple bands
Field-Proven SeeGull® Measurement Technology	<ul style="list-style-type: none"> Reliable high quality measurements compatible with leading commercial drive test solutions
High Quality and Accuracy	<ul style="list-style-type: none"> High dynamic range with high pilot detection and low false pilot rates High accuracy and low false detection rates improve RAN optimization Improved measurement quality at sector edges
Reconfigurable to Meet New Network Requirements	<ul style="list-style-type: none"> Adaptability in configuring multiple protocols Flexibility in configuring different measurement modes

MEASUREMENT CONCURRENCY: Why is it important?

Many commercial scanning receivers claim the ability to measure multiple wireless technologies, but there are distinct differences between simultaneous measurements and concurrent measurements.

Some commercial scanning receivers perform simultaneous measurements across multiple technologies by sharing the same internal RF and signal processing resources. However, the trade-off of this approach is that measurements are taken on each network technology sequentially, resulting in data collection gaps, compromised signal quality, and inferior performance.

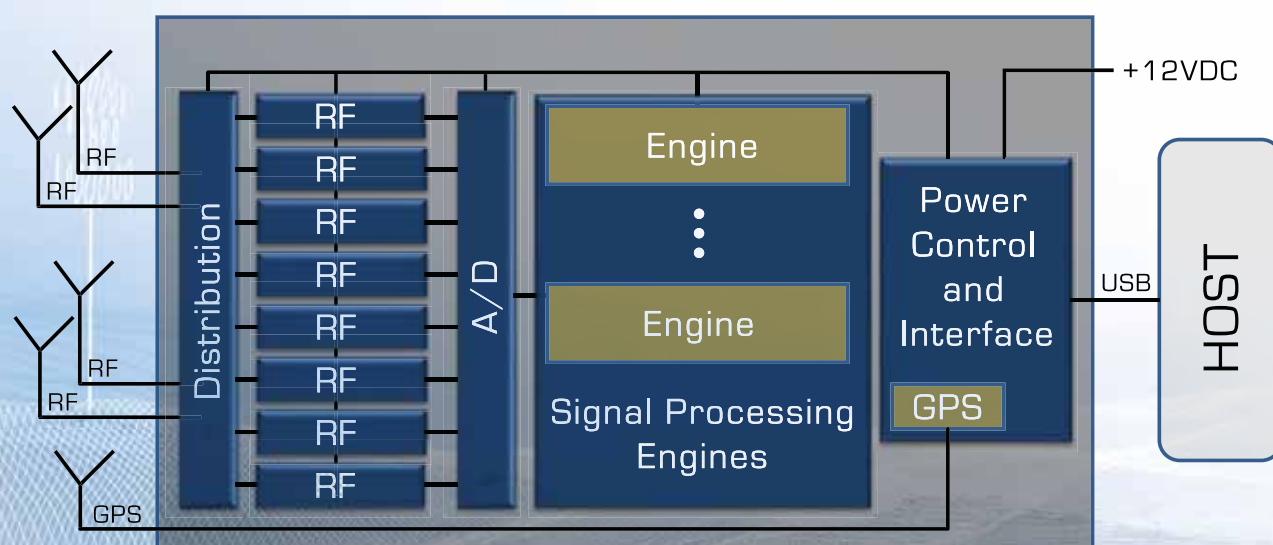
SeeGull MX utilizes multiple digital Signal Processing Engines to perform fully concurrent measurements. In a concurrent scan, data for each technology is collected on an independent path, as though multiple autonomous scanners are running in parallel. Since there is no sharing of resources, the scanning receiver achieves maximum performance.



Next-Generation | Scalable Receiver Technology

SeeGull MX's advanced Software-Defined Radio receiver architecture emphasizes performance, modularity, and scalability. The high performance Signal Processing Engines assure that processing power is available to meet the most stringent performance needs for any wireless network technology, including TD-LTE, LTE FDD, UMTS [WCDMA/HSPA(+)], CDMA, EV-DO, and GSM. Independent RF receiver front ends create the flexibility to configure operating bands to meet the needs of regional network operations or broader cross-operator benchmarking applications. Finally, decoupling the RF front ends from the Signal Processing Engines gives the SeeGull MX the adaptability to meet the needs of future network configurations.

SeeGull MX Modular Receiver Architecture

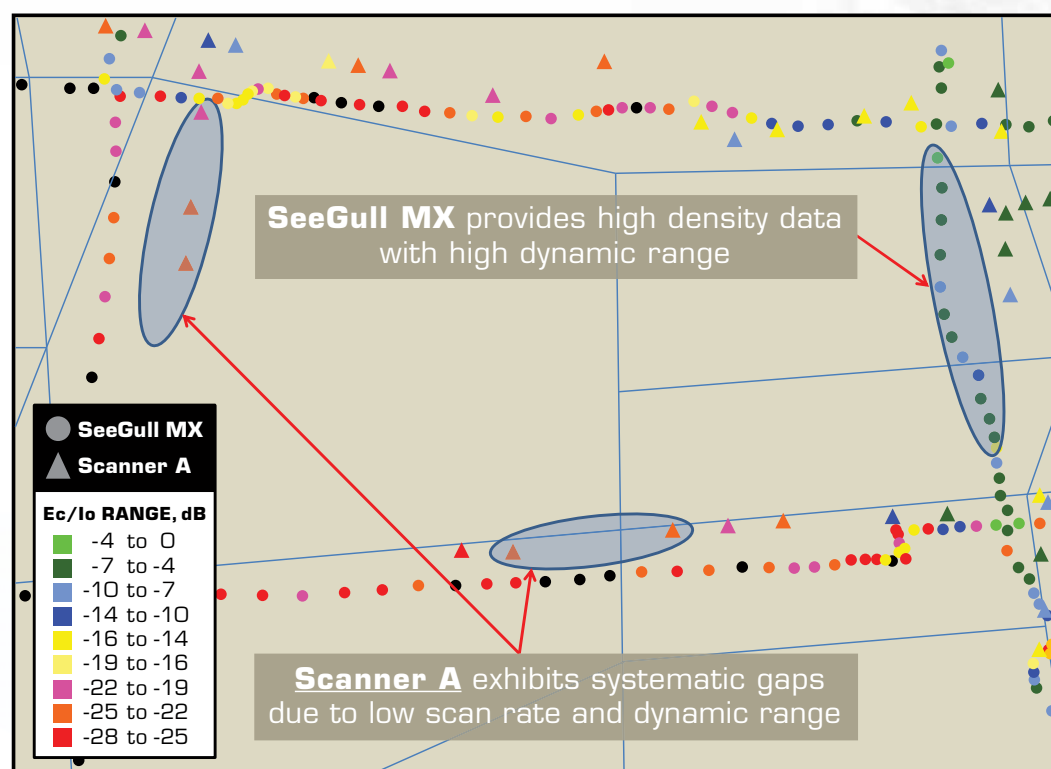


SeeGull MX | Performance Advantages in Action

HIGH SCANNING RATE: Delivers Maximum Drive Test Data Density

RF network and performance engineers need reliable data to deploy, troubleshoot and tune their networks. High density drive test data assures that statistically significant data is being used by tuning models and optimization software.

SeeGull MX provides industry-leading scanning rates powered by its multiple Signal Processing Engines, which work in conjunction with multi-band RF paths. These processing paths allow the SeeGull MX to perform concurrent measurements without processor resource sharing – and the performance degradation typically associated with it – when drive testing multi-technology networks.

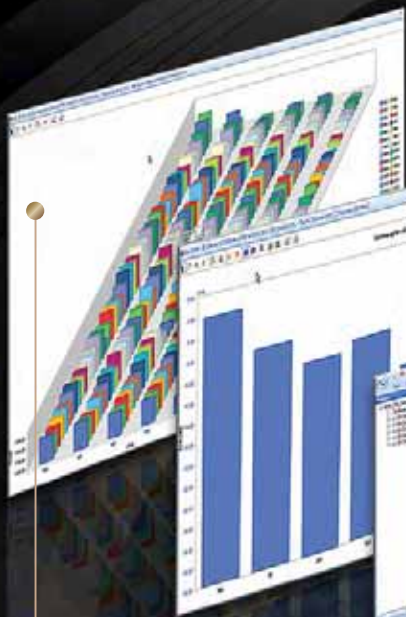


This drive test plot shows SeeGull MX with high data rates and dynamic range alongside Scanner A with lower data rates and dynamic range. The data from SeeGull MX provides more information about the network and increases the confidence level of the collected data.

SENSITIVITY: Why Dynamic Range Is Important

Scanning receivers used for optimizing LTE broadband networks must exhibit high dynamic range to detect low signal levels created by interference caused by network configuration or terrain. Dynamic range is essential for quality measurements, such as Carrier to Interference and Noise Ratio (CINR), which can be used to baseline expected LTE broadband data throughput. Thus, scanning receiver dynamic range is critically important for network optimization measurements needed to achieve higher quality of service.

Full Suite of Broadband Wireless Technology Measurements



LTE Measurements

- Carrier RSSI
- Top N Primary/Secondary Synchronization Channel
- Top N Reference Signals
- Top N Resource Blocks (Including Subbands)
- RSSI, Received Power, Received Quality, CINR, Cyclic Prefix, Time Offsets, and Delay Spread Data Modes
- Blind Scan for Easy Channel Detection
- Layer 3 Reporting
- TD-LTE Uplink/Downlink Configuration and Special Sub-frame Configurations
- TD-LTE Power Analysis of Resource Blocks, Slots, Frames, and Sub-frames
- Antenna Path

LTE MIMO Measurements

- Condition Number
- Estimated CQI and Estimated Throughput (Calculated from RF Measurements)
- Transmit and Receive MIMO Antenna Paths

UMTS [WCDMA/HSPA(+)] Measurements

- Top N CPICH
- I_o , E_c/I_o , Aggregate E_c/I_o , SIR, Rake Finger Count, Time Offset, Multi-path Delay Spread
- Blind Scan for Easy Channel Detection
- Layer 3 Reporting
- Clarify® Pilot

GSM Measurements

- BSIC Decoding
- C/I
- RSSI
- Blind Scan for Easy Channel Detection
- Layer 3 Reporting
- Clarify® BCCH

Power Measurements (All Technologies)

- RSSI: Aggregate Channel Power
- Spectrum Analysis: High Sweep Rate Frequency/Amplitude Measurements
- EPST™: Time-Stamped Power Measurements Selectable by Time and Frequency

CDMA/EV-DO Measurements

- Top N PN
- E_c , E_c/I_o , Aggregate E_c/I_o , Pilot Delay, Delay Spread
- Blind Scan for Easy Channel Detection



Complete Drive and Walk Test Systems

SeeGull MX can be used as a standalone receiver with PCTEL's SeeHawk® Wireless Drive and Walk Test Suite and PCTEL's MX Indoor Kits or can be integrated into leading third-party drive testing solutions.

SeeHawk® Wireless Drive and Walk Test Suite

SeeHawk is uniquely designed to leverage the features and performance power of PCTEL's SeeGull series Scanning Receivers. SeeHawk allows RF network and performance engineers to configure, measure, and collect real-time RF data from all major wide-area wireless technologies with all SeeGull receivers. SeeHawk features an easy-to-use Windows® 7 graphical user interface with point-and-click indoor navigation and a variety of data display summary reports. Data collected with SeeHawk can be easily exported to available from leading analysis tool providers.



EASY INTEGRATION WITH DRIVE TEST SOLUTIONS

PCTEL offers drive test solutions OEMs a complete Receiver Integration Kit to enable rapid integration with commercially available drive testing systems. The Receiver Integration Kit includes:

- API-based Integration Tools
- SeeGull Product Reference Manual
- Interface Specifications
- Drivers
- Reference Host Application Executables

With eight bands and six technologies in a single scanner, SeeGull MX is ideal for testing neutral-host and other multi-operator in-building wireless networks. Where some scanners may be unable to obtain accurate network timing indoors, MX's GPS timing holdover function allows for accurate indoor timing and measurement of CDMA and EV-DO networks.



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SeeGull MX | Specifications

LTE FDD and TD-LTE	Measurement Modes	Top N Synchronization Channel (P-SCH/S-SCH), Reference Signal, and Resource Block (Wideband, Subband)
	Data Modes	RP, RQ, CINR, Cyclic Prefix, Time Offsets, Delay Spread, Averaging (FDD Only); LTE MIMO: CN, ECQI, Est. Throughput
	Channel Bandwidths	1.4 / 3 / 5 / 10 / 15 / 20 MHz
	Antenna Techniques	SISO, MISO, MIMO (2x2)
	Measurement Rates: Top N Sync Channel RS	LTE FDD: 50/sec; 25/sec for 2x2 MIMO; TD-LTE: 20/sec
	Dynamic Range (CINR) @ 20 MHz: P-SCH/S-SCH RS	LTE FDD: -10 to +22 dB*; TD-LTE: -8 dB to +22 dB* LTE FDD / TD-LTE: -20 to +40 dB*
	Min. Detection Level: RS RP	-140 dBm @ 15 kHz
	Relative Accuracy (CINR): RS	± 2 dB (Typical)
UMTS [WCDMA/HSPA(+)]	Measurement Modes	Top N Pilot
	Data Modes	Io, Ec/Io, Aggregate Ec/Io, SIR, Rake Finger Count, Time Offset, Delay Spread
	Channel Bandwidths	200 kHz / 3.84 MHz
	Measurement Rate	50/sec
	Top N CPICH Dynamic Range (Ec/Io)	-28 dB*; -33 dB* with Clarify® Option (via Post Processing)
	Min. Detection Level	-127 dBm @ 90% Detection
	Relative Accuracy	± 1 dB
GSM	Measurement Modes	Color Code
	Data Modes	BSIC, C/I, RSSI
	Channel Bandwidths	30 kHz / 200 kHz
	Measurement Rate	Up to 200 BSIC Decodes/sec; Up to 270 BCCH Decodes/sec with Clarify® Option
	Dynamic Range, C/I	+2 dB*
	Min. BSIC Decode Detection Level	-110 dBm
	Relative Accuracy	± 1 dB
CDMA	Measurement Modes	Top N PN
	Data Modes	Ec, Io, Ec/Io, Aggregate Ec/Io, Pilot Delay, Delay Spread
	Channel Bandwidths	30 kHz / 1.25 MHz
	Measurement Rate	25/sec
	Top N PN Dynamic Range, Ec/Io	-28 dB*
	Min. PN Detection Level	-127 dBm @ 90% Detection
	Relative Accuracy	± 1 dB
EV-DO	Measurement Modes	Top N PN
	Data Modes	Ec, Io, Ec/Io, Aggregate Ec/Io, Pilot Delay, Delay Spread
	Channel Bandwidths	30 kHz / 1.25 MHz
	Measurement Rate	25/sec
	Top N PN Dynamic Range, Ec/Io	-18.5 dB*
	Min. PN Detection Level	-117 dBm @ 90% Detection
	Relative Accuracy	± 1 dB
Multi-Technology	Concurrent Measurement Capacity	Up to 3 Technologies (Protocol Decoding) and 1 Aggregate Power Measurement (RSSI, EPS, or Spectrum Analysis)
	Measurements Rate Degradation When Measuring LTE, WCDMA, and GSM Concurrently	None
	Measurements Rate Degradation When Measuring LTE, CDMA, and EV-DO Concurrently	None
	Typical Aggregate Measurement Rate	Up to 400/sec across 3 Simultaneous Technologies

* @ 90% Signal Detection with <0.1% False Detection Rate

SeeGull MX | Specifications [continued]

Power Measurements	RSSI MEASUREMENTS	
	Measurement Rate (Typical)	LTE 13,000 ch/sec UMTS [WCDMA/HSPA(+)] 6,500 ch/sec GSM 6,500 ch/sec CDMA 10,000 ch/sec EV-DO 10,000 ch/sec
	Absolute Accuracy	± 1 dB (across Basic RF Input Power Range)
	ENHANCED POWER SCAN (EPS™) MEASUREMENTS	
	Channel Bandwidths	7.5 kHz to 20 MHz in 2.5 kHz Increments
	Measurement Rate	1,000 MHz/sec @ 5 MHz (Typical)
	Absolute Accuracy	± 1 dB (across Basic RF Input Power Range)
	SPECTRUM ANALYSIS MEASUREMENTS	
	Measurement Range	>90 dB
	Measurement Rate (Single Sweep)	>270 MHz/sec
	Sensitivity	-110 dBm ± 1 dB @ 80 kHz; -120 dBm Min. Discernable Signal
	Accuracy	± 1 dB (across Basic RF Input Power Range)
	LTE POWER ANALYSIS MEASUREMENTS (Available for TD-LTE Only)	
	Channel Bandwidths	1.4 / 3 / 5 / 10 / 15 / 20 MHz
	Measurement Rate	50/sec @ 20 MHz
	Accuracy	± 1 dB (across Basic RF Input Power Range)
RF Characteristics	Internally Generated Spurious Response	-100 dBm Max.
	Protection Against Spurious Response Interference	+90 dB Min.
	Conducted Local Oscillator	- 90 dBm Max.
	RF Input Power Range	- 10 dBm Max. In-Band; +5 dBm Max. Out-of-Band
	Desensitization	Adjacent Channel >50 dB; Alternative Channel >60 dB
	Safe RF Input Range	≤10 dBm
GPS	Frequency Accuracy (Ambient)	±0.05 ppm (GPS Locked); ±0.1 ppm (GPS Unlocked)
	Type	50 Channel Internal Receiver
	Position Accuracy	±2.5 meter
	Acquisition Time	Cold Start: <30 sec; Hot Start: <2 sec
Physical	Sensitivity (Tracking)	>-150 dBm
	Input Power	+8 to +16 VDC (70W Nominal, 80W Max.)
	Size	9.5" D x 5.9" W x 4.3" H (241 mm D x 150 mm W x 110 mm H)
	Weight	4.6 lbs. (2.1 kg)
	Temperature Range	Operating: 0°C to +50°C; Storage: -40°C to +85°C
	Host Data Communications Interface	USB 2.0
	RF Input	RF: SMA Female (50Ω); GPS: Male (50Ω) SMB
	Safety (CE)	EN 60950-1
	EMC	EN 301 489-1
	Shock and Vibration	MIL-STD-810G, SAE J1455
	RoHS	Compliant (6/6)

**The SeeGull MX supports
TD-LTE, LTE FDD, WCDMA/HSPA+, GSM, CDMA and EV-DO
operating bands currently deployed around the world.**

Please contact your sales representative or email RFS.Sales@pctel.com for more details.



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About PCTEL

PCTEL, Inc. (NASDAQ: PCTI), develops antenna, scanning receiver, and engineered site solutions for public and private networks.

The company's **SeeGull®** scanning receivers, **SeeHawk®** visualization tool, and **Clarify®** system measure and analyze wireless signals for efficient cellular network planning, deployment, and optimization. PCTEL develops and supports scanning receivers for LTE, TD-LTE, EV-DO, CDMA, WCDMA, TD-SCDMA, GSM, and WiMAX networks.

PCTEL's **MAXRAD®**, **Bluewave™** and **Wi-Sys™** antenna solutions address private network, public safety, and government applications. PCTEL develops and delivers high-value YAGI, Land Mobile Radio, WiFi, GPS, In-Tunnel, Subway, and broadband antennas (parabolic and flat panel). The company's vertical markets include SCADA, Health Care, Smart Grid, Precision Agriculture, Indoor Wireless, Telemetry, Off-loading, and Wireless Backhaul. PCTEL **Connected Solutions™** designs and delivers Site Solutions for private and public wireless, data, and communication applications. PCTEL **Connected Solutions™** utilizes specialized towers, enclosures, fiber optic panels, fiber jumper cables, and a wide array of its **TowerWorx™** and **TelWorx™** products to deliver engineered site solutions. PCTEL Secure focuses on Android mobile platform security. PCTEL's products are sold worldwide through direct and indirect channels. For more information, please visit our company's web sites:

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PCTEL, Inc. RF Solutions
 20410 Observation Drive Suite 200
 Germantown Maryland USA 20876

rfsolutions.pctel.com | [p +1 301 515 0036](tel:+13015150036) | [f +1 301 515 0037](tel:+13015150037)

PCTEL RF Solutions products are protected under the following U.S. patents:

7,272,126; 7,236,746; 7,050,755; 7,013,113; 6,950,665; 6,931,235; 6,917,609; 6,816,709; 6,609,001; 5,819,177; 6,091,715; 7,639,985; 7,019,691; 7,301,920.

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