

SeeGull MXflex[®] Scanning Receiver Hardware Reference Manual

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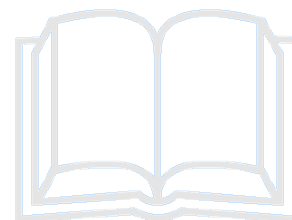


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1. Preface

1.1. Purpose

This document is a user's manual for the SeeGull MXflex Scanning Receiver. It describes the main features and options available for the SeeGull MXflex and provides instructions related to setup, operation, and maintenance of the scanners. This document may be supplemented by other documentation for the SeeGull MXflex or related PCTEL products and applications.

1.2. Applicability

The SeeGull MXflex Scanning Receiver conducts drive test and site-specific measurements of mobile networks around the world to optimize wireless network performance, survey tower sites, monitor base stations, demodulate RF signals and analyze wireless market data.

The SeeGull MXflex Scanning Receiver is a software-defined receiver, capable of supporting multiple protocols and up to 8 frequency ranges. It can be configured for TD-LTE, LTE FDD, NB-IoT, WCDMA, CDMA, EV-DO, GSM and 5G New Radio (NR) technologies.

The following 3GPP bands are supported for 5G New Radio (NR)

- N1 (UL: 1920 MHz – 1980 MHz, DL: 2110 MHz – 2170 MHz)
- N2 (UL: 1850 MHz - 1910 MHz; DL: 1930 MHz - 1990 MHz)
- N3 (UL: 1710 MHz – 1785 MHz; DL: 1805 MHz – 1880 MHz)
- N5 (UL: 824 MHz – 849 MHz; DL: 869 MHz – 984 MHz)
- N7 (UL: 2500 MHz – 2570 MHz; DL: 2620 MHz – 2690 MHz)
- N8 (UL: 880 MHz – 915 MHz; DL: 925 MHz – 960 MHz)

- N12 (UL: 699 MHz - 716 MHz; DL: 729 MHz - 746 MHz)
- N20 (UL: 832 MHz - 862 MHz; DL: 791 MHz - 821 MHz)
- N25 (UL: 1850 MHz - 1915 MHz; DL: 1930 MHz - 1995 MHz)
- N28 (UL: 703 MHz – 748 MHz; DL: 758MHz – 803MHz)
- N34 (UL/DL: 2010 MHz - 2025 MHz)
- N38 (UL/DL: 2570 MHz - 2620 MHz)
- N39 (UL/DL: 1880 MHz - 1920 MHz)
- N40 (UL/DL: 2300 MHz - 2400 MHz)
- N41 (UL/DL: 2496 MHz – 2690MHz)
- N50 (UL/DL: 1432 MHz - 1517 MHz)
- N51 (UL/DL: 1427 MHz - 1432 MHz)
- N65 Band (UL: 1920 MHz - 2010 MHz; DL: 2110 MHz - 2200 MHz)
- N66 Band (UL: 1710 MHz - 1780 MHz; DL: 2110 MHz - 2200 MHz)
- N70 (UL: 1695 MHz – 1710 MHz, DL: 1995 MHz – 2020 MHz)
- N71 (UL: 653 MHz – 698MHz, DL: 617 MHz – 652MHz)
- N74 (UL: 1427 MHz – 1470 MHz, DL: 1475 MHz – 1518 MHz)
- N75 (1432 MHz – 1517 MHz)
- N76 (1427 MHz – 1432 MHz)
- N77 (3300 MHz – 4200 MHz)
- N78 (3300 MHz – 3800 MHz)
- N79 (4400 MHz – 5000MHz)
- N80 (1710 MHz – 1785 MHz)
- N81 (880 MHz – 915 MHz)
- N82 (832 MHz – 862 MHz)
- N83 (703 MHz – 748 MHz)
- N84 (1920 MHz – 1980 MHz)
- N86 (1710 MHz – 1780 MHz)

The following bands are supported for LTE FDD with a subset of these bands supported for WCDMA, CDMA, EV-DO and GSM:

- E-UTRA 1 (2100 MHz UMTS)
- E-UTRA 2 (1900 MHz)
- E-UTRA 3 (1800 MHz)

- E-UTRA 4 (2100 MHz AWS)
- E-UTRA 5 (850 MHz)
- E-UTRA 6 (850 Japan)
- E-UTRA 7 (2600 MHz IMT)
- E-UTRA 8 (900 MHz UMTS)
- E-UTRA 9 (1700 MHz Japan)
- E-UTRA 10 (Ext. AWS)
- E-UTRA 11 (1500 MHz Japan)
- E-UTRA 12 (Lower 700 MHz A/B/C)
- E-UTRA 13 (Upper 700 MHz C)
- E-UTRA 14 (Upper 700 MHz D)
- E-UTRA 17 (Lower 700 MHz B/C)
- E-UTRA 18 (Lower 800 MHz Japan)
- E-UTRA 19 (Upper 800 MHz Japan)
- E-UTRA 20 (800 MHz EU)
- E-UTRA 21 (1510 MHz Japan)
- E-UTRA 22 (3.5 GHz)
- E-UTRA 23 (2 GHz S-Band)
- E-UTRA 24 (L Band 1600)
- E-UTRA 25 (1990 MHz [Ext. 1900])
- E-UTRA 26 (Upper Ext 850 MHz)
- E-UTRA 27 (Lower Ext 850 MHz)
- E-UTRA 28 (700 APAC CALA)
- E-UTRA 29 (700 MHz D/L US)
- E-UTRA 30 (2.3 GHz WCS)
- E-UTRA 31 (450 MHz)
- E-UTRA 32 (1500 MHz L-Band D/L)
- E-UTRA 65 (2100+)
- E-UTRA 66 (2110-2200 MHz)
- E-UTRA 67 (700 EU, DL only)
- E-UTRA 68 (700 ME)
- E-UTRA 69 (IMT-E 2570-2620 MHz)
- E-UTRA 70 (AWS-4)
- E-UTRA 71 (US 600)
- E-UTRA 72 (APAC 450)
- E-UTRA 73 (PPDR, EU PMR/PAMR 45)
- E-UTRA 74 (L-Band)
- E-UTRA 75 (1500 SDL 1432-1517 MHz)
- E-UTRA 76 (1400, 1427-1432 MHz)
- E-UTRA 85 (Lower 700 A+)
- E-UTRA 252 (U-NII-1)
- E-UTRA 255 (U-NII-3)

The following bands are supported for TD-LTE:

- E-UTRA 33 (1900 TDD)
- E-UTRA 34 (2000 TDD)
- E-UTRA 35 (1900 PCS Lower TDD)
- E-UTRA 36 (1900 PCS Upper TDD)
- E-UTEA 37 (1900 PCS Center Gap TDD)
- E-UTRA 38 (IMT Extension 2.5G)
- E-UTRA 39 (1.9 TDD)
- E-UTRA 40 (2.3 TDD)
- E-UTRA 41 (2.5 TDD)
- E-UTRA 42 (3.4 TDD)
- E-UTRA 43 (3.6 TDD)
- E-UTRA 44 (700 APAC TDD)
- E-UTRA 45 (TD 1500)
- E-UTRA 46 (TD Unlicensed 5500 MHz)
- E-UTRA 47 (TD Unlicensed 5855–5925 MHz)
- E-UTRA 48 (3550-3700 MHz)
- E-UTRA 49 (CBRS Band for TD-LAA 3550-3700 MHz)
- E-UTRA 50 (1432-1517 MHz)
- E-UTRA 51 (1427-1432 MHz)
- E-UTRA 52 (3300-3400 MHz)
- TDD Proprietary (170 MHz)
- TDD Proprietary (1.4 MHz)
- TDD Proprietary (1.8 MHz)

The following bands are supported for RSSI channel measurements:

- TETRA Public Safety 380, 390 Band (380 - 390 MHz MS, 390 - 400 MHz BS)
- TETRA Public Safety 410, 420 Band (410 - 420 MHz MS, 420 - 430 MHz BS)
- TETRA Public Safety 450, 460 Band (450 - 460 MHz MS, 460 - 470 MHz BS)
- TETRA Public Safety 870, 915 Band (870 - 876 MHz MS, 915 - 921 MHz BS)

Features

- Blindscan for NR/
GSM/CDMA/EVDO/WCDMA/LTE:
 - High-Speed
 - Fast-Speed with Extended Detection
 - High Dynamic Range
- Mobile Measurement
- Concurrent measurements
- Fast TopN/eTopN scanning speeds
- High dynamic range
- Low false detection rate
- Scans multiple bands without performance degradation
- Built-in GPS
- LTE FDD Measurement Averaging
- LTE FDD and TD-LTE MIMO
- LTE FDD eMBMS
- LTE, WCDMA, GSM Layer 3,
- NB-IoT TopN measurements
- Outdoor and Indoor Modes
- USB Interface
- Plug-and-play capabilities
- Compatibility with industry-leading drive test, data analysis, and RF planning tools
- Modular architecture for easy upgrades
- Ignition sense
- Sleek, durable design

Supported Measurements

5G New Radio (NR)

- Maximum # of Channels: 24
- NR Top N Reference Signal Scan
- PCI/Beam Index
- PSS_RP, PSS_RQ, PSS_CINR
- SSS_RP, SSS_RQ, SSS_CINR, SSS_delay spread
- RSPBCH_RP, RSPBCH_RQ, RSPBCH_CINR, SSB_RSSI, SSB_RP, SSB_RQ, SSB_CINR, SSB_idx

- MIB
- Time Offset

LTE (FDD and TDD)

- Top N and Top N Reference Signal Scan
- Automatic Bandwidth detection or manual selection
- P-SCH/S-SCH RP, RQ, CINR, Time Offset
- RSRP, RSRQ, CINR
- Cyclic Prefix
- Time Offset
- Multi-Path Delay Spread
- Averaging Modes (LTE FDD only)
- Sub-band
- Antenna Path (2 x 1 or 2 x 2) for RSRP, RSRQ, CINR, Time Offset and Multi-Path Delay Spread

TD-LTE Specific

- Uplink/Downlink Configuration #
- DwPTS Symbol

The following parameters are available for LTE MIMO only

- Top N 2x2 and 4x4 MIMO Specific Parameters including Condition Number (CN), Estimated Channel Quality Indicator (ECQI) and Estimated Throughput (ETPUT) for four LTE Transmission Modes
- Top N 4x4 MIMO Specific Parameters including Eigen Value Ratio and Rank
- Channel Matrix (for Top N 4x4, 4x2 and 2x2 MIMO only) Specific Parameters including Channel Matrix and noise Level

The following parameters are available for LTE eMBMS only

- eMBMS Area ID
- eMBMS Cluster ID

- eMBMS Frame Configuration

NB-IoT

- Measurement Modes:
 - Top N NRS (Narrowband Reference Signal)
 - NPSS (Narrowband Primary Synchronization Signal)
 - NSSS (Narrowband Secondary Synchronization Signal)
- Data Modes:
 - NRS: RP, RQ, RSSI, CINR
 - Time Offset
 - NPSS: RP, RQ, RSSI, CINR
 - NSSS: RP, RQ, RSSI, CINR, Time Offset
- Operation Mode:
 - In-Band
 - Guard Band
 - Stand-alone

GSM

- BSIC Decoding Scan
- RSSI Channel Scan
- C/I (Co-Channel Interference)

WCDMA

- Maximum # of Channels: 24
- Top N Scan
- P-SCH/S-SCH Scan
- Ec
- Ec/Io and Aggregate Ec/Io
- Signal to Interference Ratio (SIR)
- Rake Finger Count
- Time Offset
- Multi-Path Delay Spread
- Eps/Io and Ess/Io
- RSSI Channel Scan

CDMA

- Maximum # of Channels: 24
- Top N Scan

- Ec
- Ec/Io and Aggregate Ec/Io
- Pilot Delay and Delay Spread
- RSSI Channel Scan

EV-DO

- Maximum # of Channels: 24
- Top N Scan
- Ec
- Ec/Io and Aggregate Ec/Io
- Pilot Delay and Delay Spread
- RSSI Channel Scan

MULTI-TECHNOLOGY

- Aggregate Power measurement (RSSI, EPS or Spectrum Analysis)
- Delay and Signal Strength of neighboring cells
- Peak Preamble Power measurement
- RSSI Channel Scans
- Spectrum Analyzer measurements
- High Performance GPS Receiver

For more information please visit www.pctel.com.

1.3. Notices

WARNING: These devices have no protection against lightning. Please turn off the scanning receiver during a thunderstorm and, if applicable, take antennas inside the vehicle before a thunderstorm approaches. The scanning receiver itself is not intended for “in weather” outdoor use.

NOTICE: There are no user serviceable parts inside the SeeGull MXflex scanning receivers.



ISO Compliance

RF Solutions Quality Management System has been certified to be compliant with ISO 9001:2015.

1.4. Compliance

CE Safety Compliance

PCTEL SeeGull MXflex Scanning Receivers are compliant to EN 60950-1 Information Technology Equipment-Safety- Part 1: General Requirements.



EMC Compliance

PCTEL SeeGull MXflex Scanning Receivers are compliant to EN 301 489-1 Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common Technical Requirements.

RoHS Compliance

PCTEL SeeGull MXflex Scanning Receivers delivered to participating European nations are compliant to EU Directive 2011/65/EU (RoHS).

PCTEL SeeGull MXflex Scanning Receivers are compliant to "Administrative Measure on the Control of Pollution Caused by Electronic Information Products" ("China RoHS").

2. Overview and System Requirements

This section describes the SeeGull MXflex Scanning Receiver, including the applicable system configuration and software requirements.

2.1. General Description

The SeeGull MXflex Scanning Receiver (*Figure 1*) is a tool for signal strength and modulation measurement, engineered for the rigors of mobile network testing during planning, installation, and maintenance of wireless networks. It supports up to seven protocols with 4 band-designated receive antenna (RX) ports.



Figure 1. SeeGull MXflex Scanning Receiver

The USB communication link allows the host to control the operation of the scanner and to receive measurement results.

Initial Inspection

Upon receipt of the scanning receiver, inspect the shipping container and verify that the contents are complete and match the packing list. The receiver should look similar to the picture in *Figure 1*. If the contents are incomplete or the SeeGull MXflex Scanning Receiver appears damaged, please call the Technical Support line at (240) 460-8833.

2.2. Measurement Options

Optional multi-technology measurements available for the SeeGull MXflex are described below. These options can be installed at the time of purchase or later as a field upgradeable option. Please contact your PCTEL sales or marketing representative for pricing and delivery information.

Enhanced Power Scan (EPS[™]) Option (OP533)

EPS Mode provides customizable power measurements, improving flexibility and precision over RSSI and Spectrum Analyzer measurements for highly-tuned analysis of individual parts of the RF signal. EPS features include:

- Absolute Time Stamp
- Auto and Immediate Measurement Modes
- Ability to set both Time and Frequency parameters
- Measure Frequency Spans from 7.5 kHz to 20 MHz user selectable in multiples of 2.5 kHz
- Measures Time Periods from 1 chip (50 μ s) to 20,000 chips (1sec)

Spectrum Analyzer Option (OP532)

The built-in Spectrum Analyzer feature provides an effective means to detect and troubleshoot frequency-related problems. The Spectrum Analyzer shows a wealth of information about the signal spectrum that is not obtainable from the standard channel power measurement.

The Spectrum Analyzer measures and reports power spectral density using frequency domain techniques (a segmented FFT approach that ensures various resolution bandwidths and fast update

rates), whereas RSSI measurements use analog and digital filters to select the right frequency band and subsequently measure total power.

One advantage of this approach is that the Spectrum Analyzer can analyze the fast-changing spectrum of an unstable transmitter. The RSSI measurement in this case will most often show a normal smooth picture, as it averages a limited set of data over time. The Spectrum Analyzer, however, if used with an appropriate resolution bandwidth, will reveal erratic signal behavior due to its fast update rate and unaveraged data.

The user may set the resolution bandwidth to 5, 10, 20, 40 or 80 kHz. Output data may be set to an average of 1, 2, 4, 8, or 16 sweeps.

LTE eMBMS (OP546)

LTE eMBMS monitoring is available for FD-LTE. These measurements verify the correct setup by comparing collected data on eMBMS subframes to Layer 3 messages. It verifies there are no overlapping Area IDs and detects synchronization problems. We provide a custom measurement, Cluster ID, to determine out of network interfering PCIs or unsynchronized cell. It also verifies proper operation and coverage for each MBSFN

- CINR, RFRP, RSRQ etc.
- Period, offset, # of subframes

Blind Scan Options

(OP534 All Blind Scan Technologies)
(OP534-GSM)
(OP534-WCDMA)
(OP534-FD-LTE)
(OP534-TD-LTE)
(OP534-CDMA)

(OP534-EVDO)

Blind Scan is available for 5G NR, LTE FDD, TD-LTE, WCDMA, GSM, CDMA and EVDO technologies. This feature scans the selected band and provides the active channel numbers. Blind Scan is useful for conducting a full band network search where prior knowledge about active channels is incomplete or unknown. It is also beneficial for network benchmarking to obtain a first-glance view of the RF infrastructure density and configuration.

Mobile Blind Scan Option (Mobile Measurement):

OP540 - All Technologies except 5G NR
OP540-GSM
OP540-WCDMA
OP540-CDMA
OP540-EVDO
OP540-TD-LTE
OP540-FD-LTE

Mobile Blindscan (Mobile Measurement) combines the functionality to detect new channels in defined Bands, known as Blindscan, and performs additional measurement on the identified channels. When channels are no longer recognized, they are removed from the monitoring channels.

LTE Power Analysis (OP537)

LTE Power Analysis is available for TD-LTE and provides power of the resource block and slot of the TD-LTE frame. This enables users to identify interference that is time (slots) or frequency (RBs)-selective, to obtain a snapshot of overall traffic levels, and to determine whether base station is properly using the available resources.

Layer 3 Options

(OP535 All Layer 3 Options)
(OP535-GSM)
(OP535-TD-LTE)
(OP535-FD-LTE)
(OP535-WCDMA)

Layer 3 decoding is available for GSM, LTE FDD, TD-LTE, and WCDMA technologies. This option provides decoding for:

- GSM BCCH (Broadcast Control Channel) messages
- WCDMA BCH (Broadcast Control Channel) Type 3 messages
- LTE BCCH (Broadcast Control Channel)

In the GSM BCCH, types 1, 2, 3, 4, 9, and type 13 messages are supported. In the WCDMA BCH, the Master Information Block (MIB) and the System Information Blocks (SIBs) 1, 2, 3, 5, 7, 11 and 19 are supported. In the GSM BCCH and the WCDMA BCH, these messages contain the Cell Identity and Local Area Identification information broadcast by the network infrastructure. This information includes the:

- MCC (Mobile Country Code),
- MNC (Mobile Network Code),
- LAC (Location Area Code)
- RAC (Routing Area Code)

These messages also contain significant information on the configuration, activity and performance of the network. This includes information concerning:

- Neighbor list
- Mobility management (handovers, etc.)
- Group and broadcast call control
- GPRS mobility management, transparent transport and session management

- Radio resource management
- SMS messages
- Location services
- Uplink Interference parameters (WCDMA only).

LTE BCCH layer 3 messages convey system information about the cell. These messages contain the cell identity, channel bandwidth, mobility management (handovers), neighbor lists, barred cells, intra-frequency selection, public safety messages, etc. It supports decoding of the MIB and SIBs 1-13.

The SeeGull MXflex supports scanning of numerous GSM BCCH, WCDMA BCH, and LTE BCCH channels during the same test.

LTE (FDD and TDD) 2x2 MIMO Option (OP536)

MIMO testing is available for 2x2 LTE FDD and TD-LTE. This enables users to determine the maximum throughput capability of the RF environment and the degree of correlation between the two base station transmit antennas for the purpose of optimizing throughput.

LTE (FDD and TDD) 4x4 MIMO Option (OP440) and Upgrade 2x2 to 4x4 MIMO (OP440-U)

MIMO testing is available for 4x4 LTE FDD and TD-LTE. This enables users to determine the maximum throughput capability of the RF environment and the degree of correlation between the 4 base station transmit antennas for the purpose of optimizing throughput. This option includes 4x4, 4x2 and 2x2 capability.

LTE (FDD and TDD) Channel Matrix for 4x4, 4x2 and 2x2 MIMO Option (OP539)

When testing MIMO 4x4, 4x2 and 2x2 LTE FDD and TD-LTE, this option adds the initial measurements created for the MIMO results in the form of the Channel Matrix and the Noise values. The 4x4 option is required.

2.3. System Requirements

This section describes the system requirements for the SeeGull MXflex Scanning Receiver.

Typical System

Various hardware and software components may be used in the scanning system along with the SeeGull MXflex Scanning Receiver. However, a typical configuration will include a host PC running the user's application software with a USB cable connection to the scanner.

Antenna Requirements

Use a 50 Ohm impedance antenna with an SMA male connector at the end of the cable. Refer to PCTEL's product offering matrix in *Section 5* for part number information.

Note: Outdoor antennas, including those used by other devices, should be placed a minimum of 6 in. (15 cm) apart, with a recommended distance of 34 in. (86 cm).

Power Source Requirements

The SeeGull MXflex Scanning Receiver uses 10 to 16 VDC using the cigarette lighter cable or the 12 foot battery/fuse box cable (measured at the battery connector) and draws 6.0 amps (nominal) @ 12 VDC. The maximum current rating is 10 amps.

The scanner can be powered by a vehicle battery, a 12-volt battery, or an AC/DC adapter. The power source must be capable of supplying the receiver with the voltage and current levels as above. PCTEL HIGHLY recommends that the power supply voltage not exceed the working range of the SeeGull MXflex Scanning Receiver. Applying excessive voltage to the receiver will void the unit's warranty.

The scanning receiver must be powered through the power cable provided by PCTEL. The power cable is equipped with an additional tab to sense the voltage drain of the vehicle's battery or if the vehicle's ignition is turned off. This feature is called **Ignition Sense Feature** and is very useful to prevent the vehicle's battery from discharging if the scanner is left on when the vehicle is turned off. In order to prevent the scanner from draining the vehicle's battery, the ignition sense wire turns off the scanner when it senses the vehicle ignition has been off for 30 minutes or the available power drops below the usable voltage. The wire connects to any fuse socket on the vehicle that has power when the vehicle's ignition is turned on. **Note, for ignition sense to operate, the application software must support this feature. If the application does not support ignition sense, the connection of the ignition sense wire is not required.**

Use of another power cord will void any warranties and may result in an unsafe condition. Refer to Section 7.1 for further details on power cord troubleshooting.

3. Installation

This section describes how to set up the SeeGull MXflex Scanning Receiver.

3.1. Integration

There are four (4) mounting holes (4-40 screw) on the chassis of the unit that are used for mounting in the user's enclosure/rack.

Avoid obstructing airways when mounting this unit in a system enclosure, rack, or case. Unobstructed convection airflow is recommended.

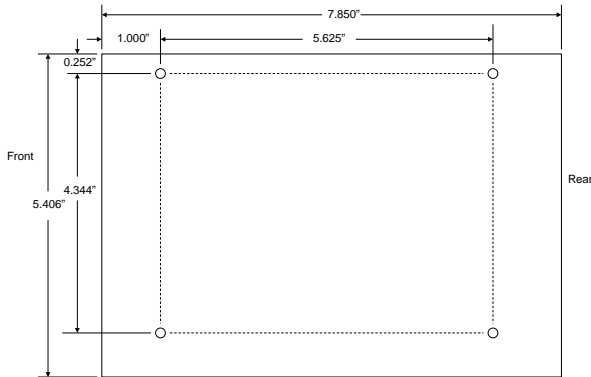


Figure 2. SeeGull MXflex Scanning Receiver Base Dimensions

Note: Do not obstruct air intakes or exhaust on unit. Do not place the unit intakes next to the exhaust of another heat source.

Airway intakes are located on the right, and airway exhaust is located on the left, as shown in *Figure 3* and *Figure 4*.

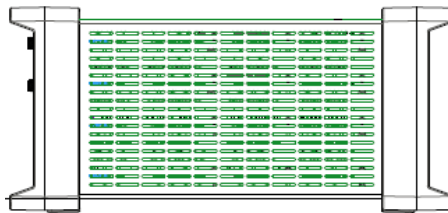
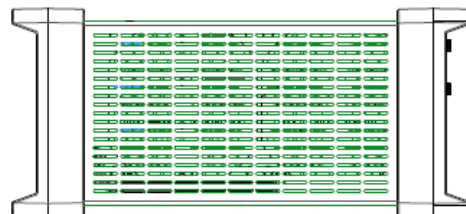


Figure 3. SeeGull MXflex Scanning Receiver Air Intake (Right Side View)

Figure 4. SeeGull MXflex Scanning Receiver Air Exhaust (Left Side View)



3.2. Setup

Follow the steps below to connect the unit to the host PC and power source before collecting data.

1. For antenna connections, the MXflex can be operated in automated mode where the MXflex selects which frequency are available for each port or in manual mode where the user selects which frequencies are available for each port. In automated mode all 4 antennas need to be connected. In manual mode, the user has control over which ports require antennas. **Check the manual for your data collection application regarding antenna configuration. Wrong setup of antennas will result in wrong measurement result.**
2. Connect the GPS antenna (or input) to the GPS SMA connector (4). An SMA to SMB adapter is shipped in a bag labeled OP225 with the SeeGull MXflex to allow the OP034H SMB connector on the GPS antenna to mate with the SeeGull MXflex GPS port.
3. Connect the USB data connector (2) to a PC USB port with the USB cable.
4. Connect the power cable to the scanner's power connector (6) and to the vehicle's cigarette lighter adapter. Make sure to line up the red dots on the cable and the power connector.
5. Optionally, connect the ignition sense wire, a wire on the power cable which can be used to sense power to your ignition. Refer Section 2.3 for further details of the ignitions sense feature. The scanner will operate normally whether or not the ignition sense wire is used.
6. Turn the SeeGull MXflex scanner on by moving the Indoor/Outdoor switch (5) from the OFF position to the INDOOR or ON position. ON mode is used for normal outdoor operation. INDOOR mode reduces the fan noise emanating from the scanner for indoor operation.

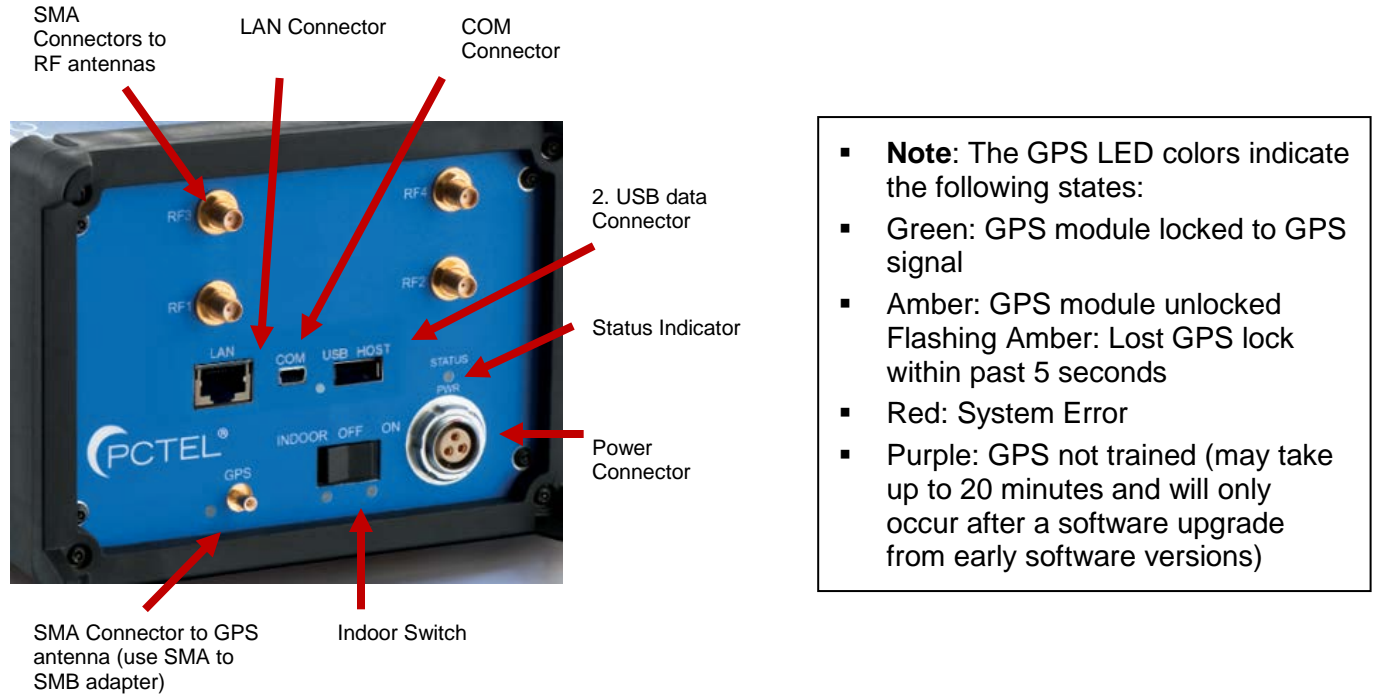


Figure 5. Connections and Switches for SeeGull MXflex

7. During power-up, the status LED (3) is amber for approximately **1 minute**. After initialization is complete the status LED turns green. If the LED turns dark red, the unit has failed the power-up test. Please contact Technical Support.
8. Install and start your PC drive test program. If you are using SeeHawk, refer to the SeeHawk User Manual for specific instructions.
9. The system is ready for use. Afterwards, please turn the Indoor/Outdoor switch (5) to OFF and disconnect all cables.

4. Operation

This section discusses calibration, software upgrades, and integration of the SeeGull MXflex Scanning Receiver into the user's test system.

4.1. Calibration

SeeGull MXflex Scanning Receivers are calibrated at the factory. Recalibration is recommended every two years in order to maintain specified accuracy levels. The date of the last calibration is listed on a label attached to the SeeGull MXflex. Please refer to the Calibration Notice in Section 8.3 for more information. Re-calibration is available as an optional service from PCTEL.

Note: PCTEL recommends having the SeeGull MXflex Scanning Receiver recalibrated every 2 years.

4.2. Software Upgrades

- The SeeGull MXflex Scanning Receiver stores the application program in internal, non-volatile memory, enabling software-based upgrades to the scanner. Upgrades may be needed to incorporate new features or bug fixes. Please note that some upgrades can only be performed at PCTEL's factory.

5. RF Antenna Information

This section discusses antennas that are used with the SeeGull Scanning Receiver system.

5.1. Antenna Verification

Verify that all the necessary antennas are included in the shipment and that each is marked. Each antenna comes in a bag labeled with the antenna's model number and its corresponding frequency range, while the antenna itself is labeled by the frequency range.

5.2. Cellular Antennas

PCTEL offers several antennas that are industry superior antennas supporting low dB loss cable, extended temperature ranges and a frequency range wide enough to cover PCTEL's SeeGull MXflex scanning receiver.



Figure 6 - OP123

The OP123 supports a frequency range of 450 to 512 MHz. It provides unity gain¹ of 1 dBi across the entire spectrum. The antenna comes standard with a magnetic mounting base and a male SMA² connector for the RF, as shown in *Figure 6*.



Figure 7 - OP278H

¹ dBi gain does not include base and cable losses. Gain measured on a 1x1 foot ground plane.

² Torque specification for SMA connector is 3-5 in-lb (0.3 – 0.6 N-m)

The OP278H supports a wide frequency range from 698 MHz to 3.8 GHz. The antenna gain is shown in *Figure 8*. The antenna comes standard with a magnetic mounting base and a male SMA connector for the RF, as shown in *Figure 7*.

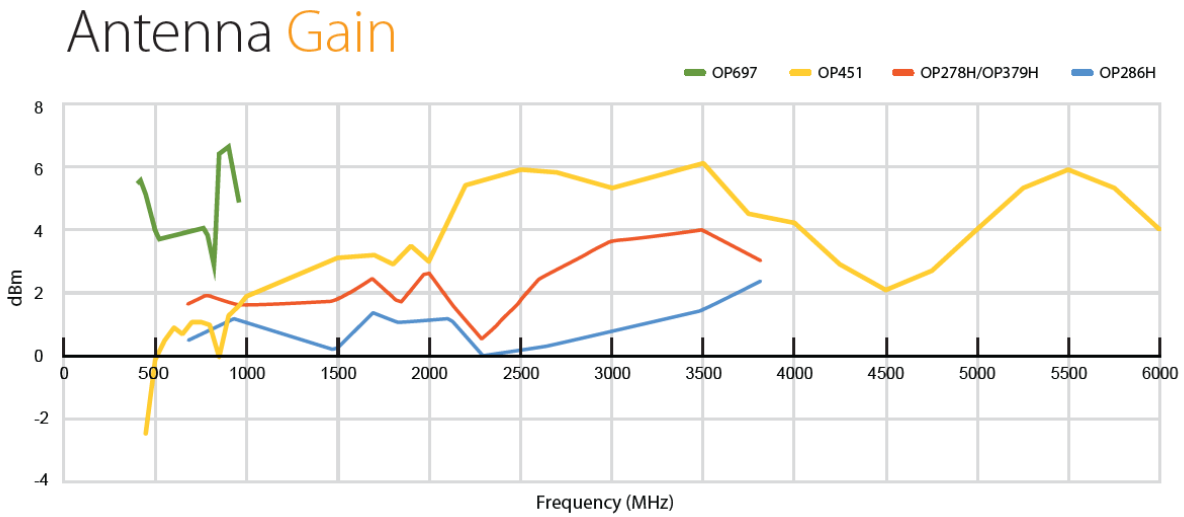


Figure 8 - Antenna Gain for OP278H, OP379H, OP697 and OP451



Figure 9 - OP379H

The OP379H shown in *Figure 9* supports a wide frequency range from 698 MHz to 3.8 GHz. The antenna gain is shown in *Figure 8*. These antennas come standard with a male SMA² connector for the RF and an SMB (push-on/pull-off) adapter for the GPS.



Figure 10 - OP451

The OP451 is a wide frequency range antenna from 450 MHz to 6GHz. The antenna gain is shown in *Figure 8*. The antenna comes standard with a magnetic mounting base and a male SMA connector for the RF.



Figure 11- OP697



OP697 is a multi-band mag mount high performance antenna used for lower bands. It supports 136-174 MHz and 380 – 960 MHz. The gain for the antenna is show in Figure 8. It mates with a 1-1/8 -18 threaded mounts including NMO 3/4” hole mounts. The extra strength magnetic mount required for the antenna is sold separately.

5.3. Indoor RF Antenna Information

PCTEL offers an antenna for indoor use.

- OP691: Indoor Antenna, 600 MHz - 6 GHz



5.4. GPS Antenna Information

PCTEL offers a single standalone GPS antenna, the OP034H. The OP034H is a High Gain GPS standalone antenna which comes standard with a magnetic mounting base and a SMB connector.



Figure 12- OP034H

6. Indoor Kit Information

Deployment of wireless data services is resulting in further increases in indoor traffic and coverage requirements. The measurement, enhancement and optimization of indoor coverage are now an increasingly important aspect of wireless engineering.

The PCTEL SeeHawk Indoor Kit comprises a complete set of accessories that enable the indoor use of the PCTEL SeeGull scanning receivers. The Indoor Kit provides a cost effective solution for evaluating existing in-building coverage and for planning, deploying and testing indoor coverage systems.

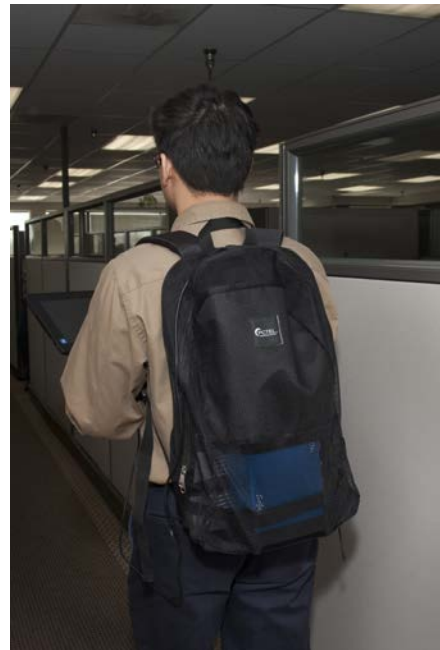
The PCTEL Indoor Kit provides the right solution for indoor walk testing that enables wireless engineers to address the three key steps of indoor coverage assessment and planning:

- Evaluating Indoor Coverage from Outside Networks
- Planning New In-Building Networks
- Coverage Validation for New or Existing In-Building Networks

6.1. Indoor Kits

The indoor kit for the SeeGull MXflex consists of a backpack (shown below) and related accessories for convenient indoor measurements using the SeeGull scanning receiver for indoor measurements. One battery life cycle is approximately 2.75 hours. The Dual Battery Power Pack's hot swap battery system allows for continuous use. The OP431 Indoor Kit consists of

- Backpack
- Battery with integrated charger
- MXflex USB data cable
- MXflex power cord
- AC power cord
- EU adapter for AC power cord



7. Troubleshooting

This section includes suggested procedures for addressing potential user-serviceable problems with SeeGull MXflex operation.

7.1. No Power: Receiver LED not Illuminated

When the scanning receiver is turned on and receiving power, the Status Indicator LED located on the face of the scanner lights up. If the scanner is not receiving power, follow these steps:

1. Check the connection to the power source.
2. If the connection is secure, check the fuse, which is located in the cigarette lighter end of the power cord. Remove the cigarette lighter plug end from the power source. Refer to *Figure 13* for an illustration of the power plug.

Note: Check The Fuse in the Cigarette Lighter Plug Before Sending the Scanner for Service

The fuse can be “blown” by a surge in the portable or mobile battery system. A temporarily shorted wire can also cause other problems.

The fuse is the first line of defense should any short circuit, large spike, or other problems occur within the power wiring circuitry. If the fuse is not operating normally, it will open up, thereby disconnecting the input power from the SeeGull MXflex Scanning Receiver. When the fuse “blows”, there will be no power to the receiver.

3. Loosen the fuse-holding finger nut by turning it counter-clockwise until the plug comes apart. The fuse is inside the power plug housing and can be removed.

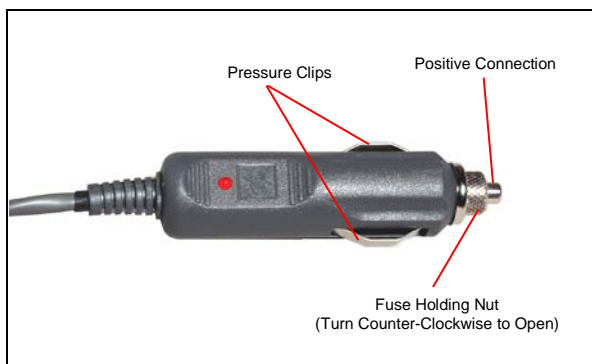


Figure 13. SeeGull MXflex Scanning Receiver Power

4. Replace the fuse with an identical 12-amp fast blow fuse.

Note: Only use a 12-amp fast blow fuse; any other fuse value may cause severe problems with the unit and void the warranty. In order not to violate the safety approval of the receiver, the fuse must be safety approved.

5. Insert the new fuse in the housing and re-assemble the plug by turning the knurled finger nut in a clockwise direction. Tighten this nut as tight as you can with your fingers.

Note: Do Not Use Tools to Tighten

7.2. Received Signal Strength Appears Low

A received signal strength that appears to be lower than expected is likely caused by one of the following problems:

1. an incorrect antenna is being used
2. an antenna is not properly connected
3. the antenna or antenna cable is damaged.

Check that the antenna is properly connected to the scanner, and that the antenna is of the correct frequency.

8. Support

This section provides support information, including PCTEL contacts, warranty information, calibration notice, and technical specifications.

8.1. Contact Information

For more information, visit <http://rfsolutions.pctel.com>.

Phone Numbers	
Departments	Contact Information
CUSTOMER SUPPORT / RMA REQUESTS	+1-240-460-8833
QUALITY MANAGER	+1-301-444-2045

Table 1: Phone Numbers

Email Addresses	
Departments	Contact Information
PRODUCT FEEDBACK	PRODUCTFEEDBACK@PCTEL.COM
CUSTOMER SUPPORT / RMA REQUESTS	SUPPORT.RFSG@PCTEL.COM
QUALITY MANAGER	QUALITY.RFSG@PCTEL.COM
SALES	RFS.SALES@PCTEL.COM

Table 2: Email Addresses

8.2. Warranty Information

WARRANTY

PCTEL warrants that the SeeGull MXflex will be free from defects in material and workmanship for a period of five (5) years from the date of shipment under normal use and operation. PCTEL's sole and exclusive obligation under the foregoing warranty shall be, at its option, to repair or replace any defective Product which fails during the warranty period, provided that PCTEL receives written notice of the defect during the warranty period. The expense of removal and reinstallation of any item(s) of equipment is not included in this warranty. This warranty shall only apply to the Product purchased or licensed and shall not apply to any other equipment and its removal and reinstallation. THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Repair or replacement in the manner provided above shall be the sole and exclusive remedy of Buyer for breach of warranty and shall constitute fulfillment of all liabilities of PCTEL with respect to the quality and performance of the Products. PCTEL shall have no obligation to make repairs or replacement necessitated by catastrophe, fault, negligence, misuse, abuse or accident of Buyer or other users. IN NO EVENT SHALL PCTEL BE LIABLE FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES TO BUYER OR ANY THIRD PARTY ARISING OUT OF THESE TERMS AND CONDITIONS OR ANY DEFECTIVE PRODUCT WHETHER THE DEFECT IS WARRANTED AGAINST OR NOT, WHETHER THE CLAIM IS BASED UPON CONTRACT, TORT, STRICT LIABILITY OR OTHERWISE, NOR SHALL PCTEL BE LIABLE TO BUYER FOR ANY AMOUNT EXCEEDING THE PURCHASE PRICE OF THE PRODUCT.

Warranty Procedures

See Return Material Authorization (RMA) Process further below.

8.3. Calibration Notice

Note: PCTEL recommends having the SeeGull MXflex Scanning Receiver recalibrated every 2 years.

SeeGull MXflex Scanning Receivers are calibrated at the factory as an optional service from PCTEL. PCTEL recommends recalibration every 2 years in order to maintain specified accuracy levels.

SeeGull Scanning Receivers are calibrated for several sources of variations, including amplitude levels, ambient temperature, input frequency, and internal noise levels for narrow and wide channel bandwidths. Automated test and calibration stations use proprietary software which performs the calibration process with minimum human intervention. Calibration is followed by a fully automated production test. The test results are stored in a central quality database and then extracted and used for periodic quality audits.

Every unit that passes the calibration and test process successfully receives a Certificate of Calibration. This Certificate is shipped back with the unit.

The complexity of the calibration process precludes field calibration. PCTEL recommends returning scanning receivers to the factory biennially to maintain the units' exceptional measurement capability.

8.4. Return Material Authorization Procedure for the SeeGull MXflex Scanning Receivers

NOTICE: There are no user serviceable parts inside the SeeGull Receiver. *Any tampering with the components within the unit will void any applicable warranties.*

All repairs must be performed by PCTEL in accordance with the procedure outlined below:

1. Complete the RMA form on the website at:

<http://pctel.com/rma>

2. A response including an RMA number and in-warranty or out-of-warranty information will be provided within 24 hours, or the next working day.
3. Please ship the unit to:

PCTEL, Inc.
RF Solutions
Attn: RMA Coordinator
20410 Observation Drive
Suite 200
Germantown, MD 20876
+1 240.460.8833

4. Reference PCTEL's RMA number on all shipping documentation.

Note: Units returned to PCTEL without an RMA number cannot be processed.



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