MPH™ Industries

BEE III™

Automatic Same Direction™ Traffic Radar

Operation and Service Manual

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Introduction

MPH Industries, Inc. designed the BEE III Doppler radar with the police officer in mind. The radar is easy to operate and includes the performance and features needed for today's traffic environment. The BEE III is the most useful and flexible radar available; it is a full-featured moving radar with fastest and same direction capability.

The BEE III utilizes MPH's patented Automatic Same Direction™ (ASD™) technology. ASD allows the BEE III to automatically measure the speeds of targets moving in the same direction as the patrol vehicle, thereby eliminating the slower/faster button required by the previous generation of same direction radars. ASD™ also allows the radar to measure the speed of stationary targets moving in one direction while completely ignoring targets moving in the opposite direction. In addition, the BEE III utilizes MPH's exclusive POP™ technology, allowing it to measure speeds while simultaneously remaining invisible to radar detectors.

The BEE III employs state-of-the-art digital signal processing (DSP) technology, which allows the unit to have both high performance and high reliability in a small package. The digital signal processor is a specialized microprocessor chip, which can perform the required calculations for detecting patrol and target speeds very efficiently.

The MPH BEE III is composed of one or two antennas, a wireless remote control, and a separable display/counting unit. MPH designed the BEE III using only the highest quality parts. Combined with the workmanship provided by MPH`s Manufacturing Department, the BEE III will provide years of high performance.

The MPH BEE III offers more than features and performance. MPH provides training through our network of experienced field representatives. We know that our success depends upon your success with our equipment. We are dedicated to keeping our customers satisfied. The following pages describe the operation of the MPH BEE III radar. We can also provide useful information on the legal aspects of traffic radar at your request.

We at MPH Industries thank you for purchasing our equipment. We wish you the greatest success in your speed enforcement program. We are proud that the BEE III is a part of your department.

A Detailed Explanation of the BEE III's Features

Practical use of the BEE III

The BEE III allows the operator to choose various types of use and operation. The radar may be used as a conventional MOVING, STATIONARY, or PACING radar. The BEE III also features the SAME DIRECTION MOVING and FASTEST features. Each of these uses is described below.

Stationary radar

As a stationary radar, the MPH BEE III allows the officer to monitor traffic coming or going while the patrol vehicle is stopped. This type of operation is usually carried out in known locations of high-speed traffic or complaint areas. In the stationary mode, the patrol window is not used.

ASD™ technology allows the operator to select a direction of traffic to monitor in stationary mode: in the same direction as the patrol vehicle, in the opposite direction, or in both directions. This selection can be made on either the front or rear antenna. Also, the operator can choose to monitor that fastest target traveling in the selected direction in addition to the strongest target.

Moving radar (opposite direction)

As a moving radar, the MPH BEE III allows the officer to monitor traffic speeds while carrying on other routine patrol activities. The unit monitors the speed of each approaching vehicle, displaying that vehicle's speed in the target window.

The patrol vehicle speed is continuously displayed so that the operator may check the speed displayed against the speedometer reading. If these two speeds correspond, then the officer is assured that the reading of the violator's speed is correct at the instant of determination.

In opposite direction mode, care should be taken by the operator to recognize that the violator is traveling at a higher rate of speed than the norm; that the vehicle is out front, by itself, and nearest the radar; that proper identification of the violating vehicle is made; and at the time of speed determination the patrol vehicle's speed indication on the radar is the same as the reading on the speedometer. If these steps are taken, and the radar was properly checked for calibration beforehand, the officer knows the radar was operating properly and that the radar made a true and accurate determination of the vehicle's speed.

Fastest Mode

Historically, traffic radar has displayed the strongest target. Case law has centered on the ability of the radar operator to confidently identify what vehicle is associated with that indication. It was relatively simple for analog radars to process this method.

Modern DSP radar such as the BEE III can process many targets at the same time, but there is no practical way to display multiple targets and associate them with the corr ect vehicles. Fastest mode gives the operator an opportunity to view one other target besides the strongest. In this mode, the BEE III considers all possible targets (there may be several in range of the radar) and displays the fastest one. Doppler audi o is also provided for this target.

While the speeds indicated in the fastest mode are as accurate as normal targets, visual identification of the offending vehicle is more difficult. For this reason, the BEE III only displays fastest targets on request from a momentary switch and does not allow them to be locked. It is intended to be used as a way to gather additional information about a specific situation.

Same direction moving radar

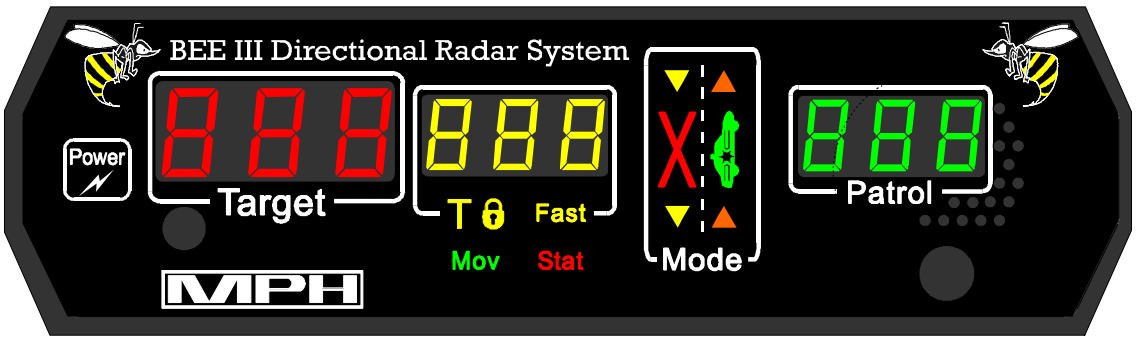
Same direction mode allows the BEE III to track targets moving fas ter or slower and in the same direction as the patrol vehicle. This mode is best used in light traffic where visual target identification is easier. With this feature active, the target speed range is limited to patrol speed ±70%. The target must be mov ing at a speed at least 3 mph faster or slower than patrol.

Pacing radar

The BEE III radar allows the officer an accurate means of pacing vehicles. In this mode, the BEE III essentially functions as a calibrated speedometer. The radar should be placed in the stationary mode for this type of operation.

Display

The BEE III uses a high contrast LED display with automatic dimming.



Mode

The mode section shows what the radar is doing. The display is set up like a roadway. A large red "X" icon in th e left lane tells at a glance that the transmitter is in standby. A large green car in the right line indicates that the transmitter is on.

The operating mode of the BEE III is illustrated with the scene of a patrol car and selected targets. In opposite direction moving mode, the scene shows an arrow in the left lane of traffic; it is ahead of the patrol car if the front antenna is selected and behind the patrol car if the rear antenna is selected. In same direction moving mode, the arrows target vehi cle is shown moving the same direction as the patrol car. In addition, moving mode is indicated by "MOV" appearing under the middle speed display window.

In stationary mode, the Mode window works similarly. Indicators appear in front of or behind the patrol vehicle icon to indicate the selected antenna. If the opposite direction of traffic is selected, only the arrow in the left lane lights. If the same direction of traffic is selected, the arrow in the right lane lights. If both directions of traffic are selected, arrows in both lanes light. Stationary mode is indicated by "STAT" appearing below the middle speed display window.

Speed windows

The BEE III has three windows for speed display. These are arranged by function and use color for quick identification at night.

The leftmost display is a dedicated red target window. This window always displays the strongest target's speed, even in fastest mode. Error conditions such as radio frequency interference (rFi), low voltage (Lo), and general sy stem errors (Err) are also displayed in this window.

The middle speed window is yellow and performs two functions; an icon located directly below the window indicates each function. If the window is being used to display a locked target speed, a T - lock icon is lit. Only the speed of the strongest target can be locked. If the middle window is being used to display the speed of the fastest vehicle (fastest mode), a FAST icon is lighted.

The green window on the right side of the display shows the patro l vehicle's speed in moving mode and is unused (filled with dashes) in stationary mode. The speed displayed in this window should always correspond with the vehicle's speedometer.

Doppler audio

The BEE III features a speaker on the front panel for Doppl er audio. The BEE III's audio is derived directly from the received Doppler signal (not synthesized) and is useful as an aid in target identification. The loudness is proportional to the strength of the received signal and increases as the target vehicle approaches. The pitch of the audio signal increases with higher closing speeds. When the fastest target mode is enabled, the Doppler audio corresponds to the fastest target and not to the strongest target.

Display dimming and infrared remote sensor

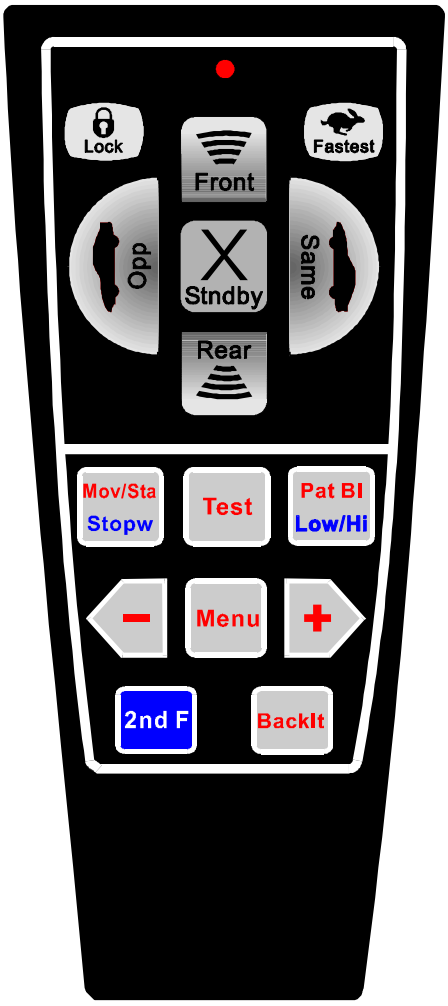
A photocell is located on the display panel to automatically adjust the brightness of the display to the ambient light conditions. An infrared sensor is located adjacent to the photocell to receive commands from the remote control when the radar is dash -mounted. A second sensor is located on the bottom of the radar to receive commands from the wireless remote when it is attached to the radar.

Power button

This button controls the power for the BEE III radar. When the BEE III is turned off, the radar remembers it's user settings (volume level, range, mode, etc.), but it does ***not*** remember speeds and it starts up in standby mode. When the unit is next turned on, it powers up using the same settings, saving the user the trouble of resetting the radar to his or her desired

Remote Control

The remote is a battery-powered infrared remote control, much like one for a television. There is no action required to turn power on or off on the remote, but try to avoid storing the remote with any switch depressed in order to avoid draining its batteries.



The BEE III has two main sections of controls located on its face. These sections are separated by a heavy white line on the label.

Operating mode keys

The most commonly used keys, those used while driving, are at the top of the remote. They are raised rubber keys and are contoured so that the operator's thumb is cradled in the center of a five-key cluster, allowing easy control of the radar's operating mode while allowing the operator to keep his eyes on the road. All of these keys are backlighted for use at night.

Front: Places the radar into front antenna mode.

Rear: Places the radar into radar antenna mode.

Standby: Places the radar into Standby.

Opposite: Places the radar into opposite direction mode when moving mode is selected.

Same: Places the radar into same direction mode when moving mode is selected.

Lock: Causes the radar to lock the Target speed in the Lock window. Double-clicking the Lock button releases the speed in the Lock window.

A target locked for 15 minutes will automatically be cleared. If the unit is in standby, a countdown will be shown in the target window, allowing the officer time to note the speeds before they are erased.

Fastest: Toggles the radar between fastest vehicle and strongest vehicle modes.

Less-frequently used keys.

These keys are flat membrane -type keys which are embossed around their edges to make them easy to identify by feel.

Some of the keys have two colors of text identifying them. The red text is the default function of the key; pressing the key by itself will cause it to perform this function. The function in blue text is initiated by first pressing the blue "2ndF" key.

Mov/Sta – Toggles the radar between moving and stationary operating mode s.

Stopw – Toggles the radar between normal radar mode and stopwatch modes.

Test – Manually initiates a self -test of the radar. The radar will momentarily light all of its displays and icons. Then it will test itself at various speeds. If no problems are found, the radar will return to its previous mode of operation. If a problem is found, the radar will display "Err" in the target window and cease to measure speeds.

The radar performs additional self -tests invisibly during normal operation (initia ted automatically) and only alerts the operator if an error is detected.

Pat Bl – When the radar is in Standby mode, pressing this button will cause the radar to blank the patrol speed display. Pressing the button while the display is blanked will cause the locked patrol speed to reappear.

Low/Hi – Adjusts the patrol speed between its low and high speed ranges.

"—" – Works with the menu button. Causes the radar to move backward through the menu selections if no selection has been made. Decreases the s etting of the menu item if a menu selection has been made.

Menu – Allows the selection of modes and setting that do not have individual buttons on the remote. Is described further in the Menu section of this manual.

"+"– Works with the menu button. Cau ses the radar to advance through the menu selections if no selection has been made. Increases the setting of the menu item if a menu selection has been made.

2nd F – Causes the radar to select the blue second function of a key instead of the red primary function of the key. "2nd" appears in the middle window when it is pressed. Pressing this key a second time causes "2nd" to disappear and allows the radar to select the primary (red) function of a key.

Backlt – Manually causes the backlight of the remot e control to turn on for 7 seconds. Once activated, the backlight stays on automatically for 7 seconds after a key is pressed.

Menu

No presses of the menu button – Adjust the audio volume

Audio volume has 7 settings (including mute). During volume adjustment, "A" is displayed in the middle window of the radar, followed by the current setting.

On its initial power-up, the volume is initially set to level 3. On subsequent power-ups, the BEE III retains the volume setting it had when the radar was turned off.

Pressing the "—" key lowers the volume one level; pressing the "+" raises the volume. Pressing the Menu key after making and adjustment returns the radar to its normal operating mode. Pressing the Menu key without making an adjustment causes the radar to move on to the next menu setting.

One press of the menu button – Adjust the range

The range has 7 settings. The range setting does not affect the transmitted power, only the sensitivity of the radar. During range adjustment, "r" is displayed in the middle window of the radar, followed by the current setting.

On its initial power-up, the range is initially set to maximum. On subsequent power-ups, the BEE III retains the range setting it had when the radar was turned off.

Pressing the "—" key decreases the range one level; pressing the "+" increases the range. Pressing the Menu key after making and adjustment returns the radar to its normal operating mode. Pressing the Menu key without making an adjustment causes the radar to move on to the next menu setting.

Two presses of the menu button – Adjust the squelch

The squelch has two settings: on and off. Squelch on causes the radar to only produce an audio tone when a target is present, while Squelch off causes the Doppler return signal to be amplified at all times. During squelch adjustment, "S" is displayed in the middle window of the radar, followed by the current setting ("n" for on and "f" for off).

On its initial power-up, the squelch is initially on. On subsequent power-ups, the BEE III retains the squelch setting it had when the radar was turned off.

Pressing either the "—" key or the "+" increases causes the radar to toggle between Squelch on and Squelch off. Pressing the Menu key after making and adjustment returns the radar to its normal operating mode. Pressing the Menu key without making an adjustment causes the radar to move on to the next menu setting.

Operation

Power up

When the BEE III is turned on, it will go through a complete self test. The radar will first perform a light test, in which all of the display's indicators will light, and then the radar will perform a speed test on the internal circuitry

When the BEE III is first plugged in, it will also go through a complete self test and then power down. This allows the user to know the radar is OK when the remote batteries are dead.

BEE III tuning fork tests in general

A tuning fork test is the standard test for proving that the antenna and counting unit are functioning properly. In older analog radars, the dual tuning fork tests actually checked two different circuits, one each for patrol and target speeds. However, the BEE III uses a single circuit, the digital signal processor (DSP), to determine both speeds, so that testing the BEE III with a single tuning fork in stationary mode actually ensures that the entire radar is working. Despite this fact, MPH recommends that you follow your court-proven department guidelines for performing tuning fork checks.

Stationary mode tuning fork tests

To perform a stationary mode tuning fork test, strike the tuning fork on wood or plastic and hold the ringing fork in a fixed position two or three inches in front of the antenna with the narrow edge of the fork facing the antenna front. This will cause the target speed window to display the speed labeled on the fork ($\pm$ 1 mph). While performing the tuning fork test, the audio volume level may be set to a desirable level.

Fastest mode may be tested by using the lower speed tuning fork as above and by placing the ringing higher speed fork into the antenna beam at a greater distance since the fastest target should be a weaker signal than the target. The fastest button must be pressed and held on the remote. The audio will switch to the fastest target when present. For example, for forks marked 35 mph and 65 mph, the target would read 35 (the closer fork) and the fastest window would read 65.

Moving mode tuning fork tests

Moving radar units are designed to acquire a patrol speed and look for target speeds that are faster (opposite direction) or slower (same direction) than the patrol speed. These two speeds can be simulated using tuning forks. The two forks are manufactured to vibrate at different frequencies. One will be used to simulate patrol speed and the other target speed. In moving mode, the speed printed on the target fork will not match the speed shown on the BEE III display. It will be added to or subtracted from the patrol speed depending on the mode switch selections.

For opposite direction moving mode, the lower speed fork will simulate patrol speed while the higher speed fork will represent the target. For same direction moving mode, the higher speed will be the patrol fork while the lower speed will be the target.

To perform the tuning fork te st, strike the patrol fork on a hard nonmetallic surface and hold the ringing fork in a fixed position two or three inches in front of the antenna with the narrow edge of the fork facing the antenna. The speed will be shown in the patrol window. While co ntinuing to hold the ringing fork in place, strike the other fork and hold it next to the patrol speed fork. Both forks must be vibrating while being held an equal distance from the antenna.

For opposite direction moving mode, the radar should display th e low speed fork as patrol and the difference between the forks as the target speed. For example, for forks marked 35 mph and 65 mph, the patrol would read 35 (low speed fork) and the target would read 30 (high -speed fork minus low speed fork).

For same direction moving mode, the radar should display the high -speed fork as patrol and the sum of the forks as the target speed. For example, for forks marked 35 mph and 65 mph, the patrol would read 65 (high speed fork) and the target would read 100 (high spe ed fork plus low speed fork).

For same direction moving mode with slow mode selected, the radar should display the high -speed fork as patrol and the difference between the forks as the target speed. For example, for forks marked 35 mph and 65 mph, the pa trol would read 65 (high -speed fork) and the target would read 30 (high-speed fork minus low speed fork).

Harmonic detection

In moving mode, the BEE III receives a large reflection from the road, which is used to compute the patrol speed. Some situation s, such as when guardrails or large signs are present, cause the signal to be excessively large. This can sometimes cause a harmonic frequency of twice the patrol speed to appear. These signals would normally be displayed as a target with a speed equal t o the patrol speed and prevent the BEE III from reading the speed of real targets, but harmonic detection circuitry inside the BEE III inhibits this. Unfortunately, the harmonic detection circuitry also may reduce the range of actual target vehicles that are moving at the same speed as the patrol vehicle. This is normal and can be avoided by patrolling at a different speed than the offending targets.

Range and radar placement

The range of the radar is influenced by how it is mounted in the vehicle. Hea ter fans are moving targets and will be picked up if energy from the antenna is reflected toward the fan. The best solution to this problem is to find a location that minimizes this effect. To determine this location, place the unit in stationary mode, t urn the volume up, and open the squelch. This lets any target or interference be heard. If changing fan speeds changes the audio signal, the fan is being picked up in that mounting position; try to find a different location. Reducing the fan speed may a lso reduce the problem. Reducing the range setting of the radar will also reduce the problem. If you have persistent problems with the BEE III reading the fan speed, call the factory for suggestions specific to your particular vehicle.

Power Source

Cigarette lighter receptacles have been the traditional source of power for traffic radar. However, poor grounding, electronic ignition bleed over, and alternator noise in newer cars can combine to create an unacceptably high level of ambient electronic i nterference. In some instances, an unusually noisy vehicle ignition/alternator noise can result in false readings and/or reduce the range of the BEE III.

To combat this, it is recommended that a shielded cable be run from the battery directly to an auxiliary receptacle installed under the dash or on the console. This should effectively eliminate any power source problems.

Fuse Replacement

The BEE III is shipped with a fused cigarette lighter plug. The fuse is housed inside the tip of the plug. (See arrow in below illustration.) To remove fuse: unscrew and remove the tip and the fuse. Replacement fuses should be commonly available 2 Amp, AGC type fuses. Substitutions are not recommended and may violate the BEE III's warranty.

Remote control batteries

The BEE III wireless remote uses 2 AA disposable alkaline batteries. These require periodic replacement by the user. (A typical set of batteries *should last approximately six months*.) The first indication that the batteries need replaced will b e a reduced range of the wireless remote and a need to point the control toward the radar. In the case of totally dead batteries, the radar unit will go through its self-test when plugged in, but not respond to the normal power up command from the remote.

The batteries are changed as follows:

- On the back side of the remote, slide the ribbed retaining latch of the battery cover down. The latch may be difficult to slide the first few times the batteries are replaced.
- Carefully pivot the battery cover off of the remote, trying not to damage the guide hooks on the bottom of the battery cover.
- Remove the batteries and replace them with new ***alkaline*** batteries
- Carefully replace the battery cover, inserting the guide hooks into the housing first and then pivoting the cover back into position.
- Slide the ribbed retaining latch up to lock the battery cover.

IV. MPH BEE III Specifications

The MPH BEE III is designed for convenient use by law enforcement agencies to measure the speed of motor vehicles when operated from a moving or stationary patrol vehicle. The BEE III utilizes the well-known and legally accepted Doppler principle and has been type accepted by the Federal Communications Commission.

A. SYSTEM SPECIFICATIONS

Nominal Power Supply Voltage: 13.6 Vdc

Low Voltage Condition Level:	10.8 Vdc
Low Voltage Condition Alert:	When supply voltage decreases below 10.8 Vdc, a message is displayed on the front panel to warn the officer of a low voltage condition.
Power Requirements & Voltage:	10.8 Vdc-16.5 Vdc (13.6 Vdc Nominal)
Current:	Standby, no displays (.5A typical) Front antenna "on", no target (.8A typical) Front antenna "on", with target (1.0A typical) Front antenna "on", during LED test (1.6A typ.)
Stationary Operating Speed:	Stationary mode operating speed range is from 15 mph up to 200 mph.
Moving Operating Speed:	In opposite direction mode, Patrol Speed range is 12 mph to 80 mph. Target Speed Range is 20 mph up to a closing speed of 200 mph. In same direction mode, Patrol Speed range is 20 mph to 80 mph. Target Speed Range is patrol speed ±70%. There must be a minimum difference of 3 mph between target and patrol speeds.
Operating Temperature Range:	-30°C (-22°F) to 60°C (+140°F)
Operating Humidity Stability:	Operates normally up to at least 90% relative humidity at 99°F (37°C).
Automatic Performance Check:	The radar automatically and invisibly checks itself for proper operation. If an error is detected, the fault is indicated in the target window.

B. DISPLAY UNIT

Speed Display:	Three windows for LED speed display on Lexan scratch resistant front panel. LED displays automatically adjust brightness to ambient conditions.
Display windows:	Target Speed (red, on the left side of the display) Auxiliary (yellow, in middle of display, shows locked target speed or fastest target speed.) Patrol Speed (green, on the right side of display)
LED Indicators:	Mov (moving mode) Sta (stationary mode) Fast (fastest vehicle mode) T-Lock (locked target speed) X (standby) Patrol car (transmitting) Four arrows (selected antenna and lane)
Switches:	Power
Connectors:	Counting unit. (DB-15)
Physical Size:	Weight = 0.4 lb. (0.18 kg) Depth = 1.6" (4.0cm) Width = 5.0" (12.8cm) Height = 1.47" (3.7cm)

C. COUNTING UNIT

Connectors:	Front antenna Rear antenna Display unit (DB-15) Power cord RS-232 data port (DB-9)
Physical Size:	Weight = 0.65 lb. (0.28 kg) Depth = 2.7" (6.9cm) Width = 5.0" (12.8cm) Height = 1.47" (3.7cm

C. REMOTE CONTROL

Data link:	Serial data stream via infrared light link.
Power:	Two AA alkaline batteries (3.0 Volts nominal)

Backlighting:	Activated for 7 seconds when Backlt button is pressed. Once activated, stays on for 7 seconds after any button is pressed.
Raised, shaped keys:	Front antenna Rear antenna Standby Same direction Opposite direction Lock Fastest
Flat panel keys:	Mov/Sta (Stopw) Test Pat Bl (Low/Hi) – Menu + 2nd Backlt
Physical Size:	Weight = 0.35 lb. (0.16 kg) Width = 2.4" (6.2 cm) at top 1.5" (3.8 cm) at base Height = 5.5" (14.0 cm) Depth = 1.3" (3.4 cm)

E. ANTENNA UNIT

Circularly polarized antenna operating in the Ka band. All electrical components are enclosed in a sealed metal housing to defeat radio frequency interference. Metal housing has a black polycarbonate radome (housing) over it to protect the internal components, including the antenna lens, from physical damage and from damage from the elements. Plastic housing creates a waterproof O-ring seal, allowing all-weather operation outside of the patrol vehicle. Has aiming sights.

Operating Frequency:	Ka band: 33.8 GHz $\pm$ 100 MHz
Microwave Source:	Solid state Gunn effect diode.
Output Power:	Nominal 12-30 mW / Maximum 50 mW
Radiated Power Density:	Less than 2mW/cm^2 at 5 cm.
Type:	Circularly polarized conical horn
Beam Width:	13° Nominal

Beam Width Variance:	$\pm 1^{\circ}$ at maximum manufacturer's tolerance
Side Lobe:	25 dB down from main beam
Received Microwave Beam:	Utilizes transmitting antenna. Isolation accomplished by a turnstile phase shifter.
Transmitter:	Complies with FCC Part 90 (applied for)
FCC Type Acceptance:	CJR-KABEE-003 (being applied for)
Mixer Diode:	Schottky barrier type rated for 100 mW burnout.
Range:	4000 ft (1219m) typical for average size vehicle. Range varies by size of vehicle, terrain, traffic conditions, weather conditions, and other external conditions present in various locations.
Physical Size:	Weight: 0.5 lb. (.23 kg) Length: 3.6” (9.1 cm) Diameter: 2.0” (5.2 cm) (2.6” (6.5 cm) at waterproof seal)