



# EM-MBD41000 SERIES DUPLEXED ANTENNA CONFIGURATIONS FOR EFFICIENT MULTI-BAND OPERATION

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Wireless radio technologies appear to be advancing with the onset of every major trade show, specifically wide band and multi-band applications. Multi-band radio designs have rapidly progressed over the past decade, and are now the prevailing technology available from most of the large radio OEM's. These new software defined radio platforms are in direct response to Homeland Security initiatives released by the US Federal Government, spawning new standards, specifically P25 for interoperability, augmenting communications between various first responding agencies. These mandates are driving advancements in Land Mobile/Public Safety services and sometimes in conjunction with complimentary commercial services operating portable and mobile radio communications. Competing technologies are continuously announced, offering integrations in data, GPS/GLONASS location, remote IP addressable/configurable capabilities and most importantly, the silent inclusion of multi-banded antennas. The antenna: that unwanted appendage, taking form in a black flexible stub, jabbing at the first responder's side, or an unsightly wire emanating from the trunk lid of that sleek new 400 hp police package, rolling by you on the interstate. The antenna is the most critical and essential component of a highly sophisticated digital wireless radio system, and if not designed to perform efficiently and reliably, will render the system completely ineffective.

## **Multi-Band Mobile Antenna Deficiencies**

Mobile antennas are available in many physical forms, and the designer enjoys a profession full of creative opportunities and challenges, recently accelerated by advancements in electromagnetic simulation/solution software. The designer virtually pursues their craft with apparent endless bounds. New challenges continue to load the development cycles, and keeping pace with new radio configurations can be overwhelming. Every new design includes trade-offs and compromises in performance. Realized gain, impedance match, directivity and aperture size typically limit optimized results. Optimization is often accomplished in narrow band antenna design, however when broad banding and multi-banding an antenna, the design criteria changes significantly. The antenna's physical aperture must now support the required directivity and match efficiency for wider bandwidths and multi-frequency operation. Many times, the compromises are too great to achieve the required gain and system coverage, resulting in significant performance degradation. Impedance mismatches in the form of high input VSWR and poor directivity in the radiation pattern are direct results of these broadband/multi-band antenna designs, attempting to solve the radio OEM's system requirements. Of course, all of this has to be integrated to include many types of installations with varying vehicle sizes presenting a multitude of ground plane configurations.

Most antenna manufacturers are clearly aware of these highly compromised designs, and continue their pursuit to resolve the inherent design deficiencies. Rest assured, there will come a time when mature, sophisticated design solutions will be available. However, while this evolutionary process unfolds, first responders and safety forces require immediate solutions to provide efficient interoperable coverage with their various wide band and multi-band systems currently being deployed.

## **Duplexed Antenna Solutions**

To meet the immediate system coverage requirements, E/M Wave is providing an efficient, fundamental solution incorporating a highly efficient, low insertion loss duplexer, EM-MBD41000-NJ. A duplexed configuration provides full duplex operation (transmit and receive) for two or more operational bands by splitting the signal between VHF and UHF/700-800 MHz bands. The duplexer augments splitting a single radio output into two separate channels, feeding two independently located antennas, with desired directivity and VSWR match. Each antenna can be chosen as a wide or narrow band type, required by the RF system with the key advantage of providing efficient single band performance with high directivity and gain. The antenna performance is critical to achieving the total RF system performance, and by incorporating a low insertion loss, wide band, high isolation duplexer, system engineers can now move forward to provide reliable, high performance wireless communications within statewide, multi-state or larger territorial coverage regions. Additionally, E/M Wave provides a full tri-band solution using the EM-MBD41000-NJ duplexer. A typical tri-band mobile antenna system is accomplished by incorporating the EMFLX-M10008-WB Wide Band VHF antenna on the VHF output port and the dual band EM-M22001 UHF/700-800 MHz on the UHF/700-800 MHz port. This configuration accommodates simultaneous operation for 144-174/450-520/746-870 MHz systems. Additional duplexed antenna configurations are available from E/M Wave, and can be referenced within the attached duplexer antenna configuration matrix.

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## Antenna Configuration Matrix EM-MBD41000-NJ



VHF	UHF	700/800
<a href="#">EM-M10001</a> VHF/UHF Broad Band quarter-wave roof mount antenna w/S.S. spring 108-512 MHz	<a href="#">EM-M10003</a> UHF 3dB gain roof mount antenna w/S.S. spring 420-470 MHz (tunable range)	<a href="#">EM-M11003</a> Roof mount antenna, 3dB gain, 764-869 MHz
<a href="#">EMFLX-M10001</a> VHF/UHF Broad Band quarter-wave roof mount antenna, <b>e/m-Flex</b> ® Poly spring 108-512 MHz	<a href="#">EM-M10003-GPI</a> UHF 2dB gain roof mount antenna w/S.S. spring 380-512 MHz (tunable range) Ground Plane Independent	<a href="#">EM-M11005</a> Quarter-wave roof mount antenna, 746-960 MHz
<a href="#">EM-M10004</a> VHF 3dB gain roof mount antenna w/S.S. spring 132-174 MHz (tunable range)	<a href="#">EMFLX-M10003</a> UHF 3dB gain roof mount antenna, <b>e/m-Flex</b> ® Poly spring 420-470 MHz (tunable range)	<a href="#">EM-M11008</a> Roof mount antenna, 3dB gain, 806-894 MHz
<a href="#">EM-M10004-GPI</a> VHF 2dB gain roof mount antenna w/S.S. spring 132-174 MHz (tunable range) Ground Plane Independent	<a href="#">EMFLX-M10003-GPI</a> UHF 2dB gain roof mount antenna, <b>e/m-Flex</b> ® spring 380-512 MHz (tunable range) Ground Plane Independent	<a href="#">EM-M20007</a> LTE Poly Pro flexible antenna for NMO applications, 698-960 MHz/1710-2500 MHz
<a href="#">EMFLX-M10004</a> VHF 3dB gain roof mount antenna, <b>e/m-Flex</b> ® Poly spring 132-174 MHz (tunable range)	<a href="#">EM-M10007</a> UHF 5dB gain roof mount antenna w/S.S. spring 420-470 MHz (tunable range)	<a href="#">EM-M22001</a> LMR Poly Pro, Dual Band low profile flexible antenna for NMO applications, UHF 450-520 MHz/746-960 MHz
<a href="#">EMFLX-M10004-GPI</a> VHF 2dB gain roof mount antenna, <b>e/m-Flex</b> ® Poly spring 132-174 MHz (tunable range) Ground Plane Independent	<a href="#">EM-M10007-GPI</a> UHF 3dBd gain roof mount antenna, w/S.S. spring 440-480 MHz Ground Plane Independent	<a href="#">EM-MX0746</a> "X"-Nut™ quarter-wave 746-894 MHz
<a href="#">EM-M10014</a> VHF 3dB gain roof mount antenna w/S.S. spring 144-174 MHz (tunable range)	<a href="#">EMFLX-M10007</a> UHF 5dB gain roof mount antenna, <b>e/m-Flex</b> ® Poly spring 420-470 MHz (tunable range)	<a href="#">EM-MX0108-FT</a> "X"-Nut™ 108-960 MHz - Field Tunable
<a href="#">EM-M10014-GPI</a> VHF 2dB gain roof mount antenna w/S.S. spring 144-174 MHz (tunable range) Ground Plane Independent	<a href="#">EMFLX-M10007-GPI</a> UHF 3dBd gain roof mount antenna, <b>e/m-Flex</b> ® spring 440-480 MHz Ground Plane Independent	
<a href="#">EMFLX-M10014</a> VHF 3dB gain roof mount antenna, <b>e/m-Flex</b> ® Poly spring 144-174 MHz (tunable range)	<a href="#">EM-M22001</a> LMR Poly Pro, Dual Band low profile flexible antenna for NMO applications, UHF 450-520 MHz/746-960 MHz	
<a href="#">EMFLX-M10014-GPI</a> VHF 2dB gain roof mount antenna, <b>e/m-Flex</b> ® Poly spring 144-174 MHz (tunable range) Ground Plane Independent	<a href="#">EM-MX0450</a> "X"-Nut™ quarter-wave UHF 450-520 MHz	
<a href="#">EM-MX0152</a> "X"-Nut™ quarter-wave VHF 152-162 MHz	<a href="#">EM-MX0108-FT</a> "X"-Nut™ 108-960 MHz - Field Tunable	
<a href="#">EMFLX-M10008WB</a> VHF Wide Band quarter-wave roof mount antenna, <b>e/m-Flex</b> ® Poly spring 144-174 MHz, No Tuning Required		
<a href="#">EM-MX0108-FT</a> "X"-Nut™ 108-960 MHz - Field Tunable		

**NMO Mounts & cable Assemblies:** [EM-M11001](#), [EM-M11001-058](#), [EM-MTR11001](#), [EM-MTR11001-058](#)  
**NMO/GPS Combo Mounts:** [EM-MG11006-SP](#), [EM-MG11006-SP-195](#), [EM-MG11022-SP-195](#)