RESEARCH PAYS OFF

Electromagnetic Compatibility Improves Reliability and Safety

Electromagnetic interference (EMI) in rail transit systems has caused problems in both the operational reliability and the safety of those systems. The Urban Mass Transportation Administration (UMTA) Technical Assistance Program has developed an electromagnetic interference and compatibility (EMI/EMC) program that has been instrumental in identifying the source of interference and developing recommended testing practices for manufacturers and transit authorities to use in resolving these problems. In addition, the EMI/EMC program staff use their expertise in the technology to provide direct technical assistance to transit authorities.

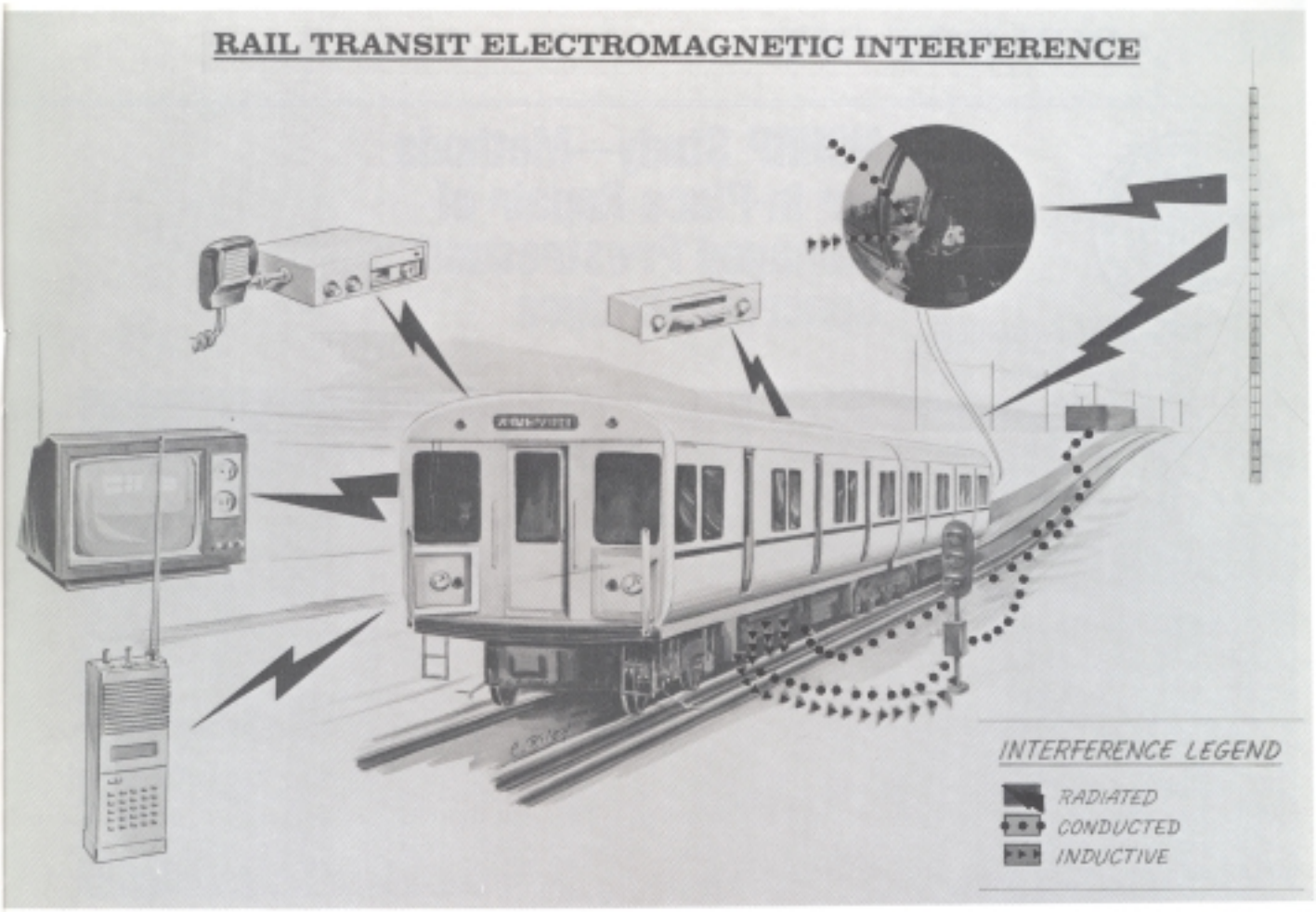
Problem The introduction of new technology, such as solid-state chopper motor controls, while providing many benefits to transit authorities, also has the potential for upsetting the electromagnetic balance existing within a transit system. EMI, generated by sources within the transit system, can have negative effects on other transit subsystems. EMI can cause both operational reliability problems and safety problems.

One example of an operational reliability problem might be a condition under which a train approaching a signal where there are no trains on the track monitored by that signal, i.e., a "clear block," would be forced to stop if EMI had falsely indicated the presence of a train in that block. This kind of interference results in delays to scheduled operations. The second and more hazardous effect of EMI could occur when a block is actually occupied, but interference has caused a "block clear" signal to be displayed. An approaching train would receive a clearance signal and proceed into the occupied block, which could result in a serious accident.

Solution UMTA; the Transportation Systems Center, U.S. Department of Transportation; and transit industry subsystem suppliers have formed an EMI/EMC Technical Working Group (TWG) composed of senior engineering personnel, whose purpose is to develop effective remedies to industrywide EMI/EMC problems. This group works in close cooperation with the American Public Transit Association to ensure that the results of its efforts are disseminated throughout the industry. To achieve consistency in measurement techniques and data analysis, and to eliminate inconclusive testing, TWG has developed a series of recommended practices for measuring interference-generating parameters in vehicle and wayside subsystems.

The process of developing recommended practices involves analysis by TWG members of the network under consideration to identify the interference parameters most likely to occur. These analyses include the particular track circuits under investigation and equivalent circuits representing the signal system transmitters, the track impedance with inter-rail mutual coupling coefficients, and the interference source signal levels and frequencies. Interference conducted through the third rail and running rail, interference induced directly into a signal system receiver from the train, and high-frequency signals radiated from vehicles to wayside points are some of the interference modes included in these analyses. The analytical methodology and results are then used to develop interactive computer models that can predict interference frequencies and amplitudes. This activity is followed by the development of test procedures to ensure accurate on-site measurement. The procedures undergo several field tests and modifications until they are validated, and then are distributed to the industry as recommended practices for use by the individual transit authorities and their consultants.

Application and Benefits Since 1979 the UMTA-sponsored Technical Working Group has used the EMI-recommended practices to provide testing services to a number of rail transit authorities including WMATA (Washington, D.C.), MTA-MD (Baltimore), MBTA (Boston), DCTA (Miami), NFTA (Buffalo), and BART (San



Francisco). This activity has resulted in significant financial savings and safety improvements during the past 6 years. For example, two transit authorities were faced with potentially expensive litigation (estimated at more than $50 million) on the basis that EMI was interfering with businesses located adjacent to the rail system's right-of-way. However, testing under the EMI/EMC program verified that the transit-generated interference was not adversely affecting the electronic systems in these business firms.

Transit authorities have used EMI test results as a guide in developing specifications to preclude the generation of EMI in signal and control systems. These test results have also been used to identify and eliminate sources of electromagnetic interference that jeopardize safety in operating rail systems.

The future benefits to be derived from emerging technologies, such as AC propulsion and computerized control systems, will be protected by the continued application of the techniques and the procedures developed by the Technical Working Group under the EMI/EMC program.

For more information, contact Steven Barsony, Office of Technical Assistance, Urban Mass Transportation Administration, Washington, D.C. 20590 (telephone 202-426-0090).