Mobile Communications and Electronics Installer (MCEI)
Competency Requirements

This competency listing is an identification of basic individual subject topics in which Mobile Communications and Electronics Installers (MCEI) are expected to obtain knowledge in order to prepare for the ETA International MCEI certification examination. This includes basic knowledge concepts of land mobile radio (LMR) and associated electronics equipment installation. This also incorporates required skills applicable to all of the functions required to safely and completely install mobile communications and associated electronic equipment, including removal and reinstallation, into any type of mobile environment.

Basic Mobile Communication Electronics Installers must be knowledgeable in the following technical areas:

1.0 Mobile Installation Fundamentals

- 1.1 Describe the general safety guidelines for the following:
  - 1.1.1 Workplace
  - 1.1.2 Vehicular
    - 1.1.2.1 Airbags
    - 1.1.2.2 Fuel and other lines
    - 1.1.2.3 Voltage
  - 1.1.3 Tools
  - 1.1.4 Personal
    - 1.1.4.1 Personal Protective Equipment (PPE)
  - 1.1.5 RF Safety
  - 1.1.6 Other Equipment Safety
- 1.2 Explain basic electronics theory for the following:
  - 1.2.1 Current
  - 1.2.2 Voltage
  - 1.2.3 Resistance
  - 1.2.4 Standing Wave Ratio (SWR); Voltage SWR (VSWR)
- 1.3 Explain basic reading and comprehension abilities:
  - 1.3.1 Basic LMR terminology
  - 1.3.2 Follow installation checklist
  - 1.3.3 Follow schematics and diagrams
- 1.4 Explain basic mathematical skills needed for installation:
  - 1.4.1 Verify SWR(VSWR) at critical installation points
- 1.5 List Equipment, Tools, Measurements and Material
  - 1.5.1 Describe the following Installation Test Equipment that will be used
    - 1.5.1.1 Digital Multimeter (DMM) or Volt-Ohm-Meter (VOM) with accessories
    - 1.5.1.2. Polarity Tester
    - 1.5.1.3 SWR(VSWR) meter
  - 1.5.2 List the following Tools that could be used
    - 1.5.2.1 Common
    - 1.5.2.2 Special Purpose
  - 1.5.3 Describe the making of measurements
  - 1.5.4 List Materials and Hardware which will be used during installation
- 1.6 Explain basic electronics circuits and wiring
  - 1.6.1 Define low current, low voltage terminations
  - 1.6.2 Define high current, high voltage terminations

- 1.6.3 Describe soldering and desoldering techniques
- 1.6.4 Identify and connect basic electronics components
  - 1.6.4.1 Power Supplies
  - 1.6.4.2 Switches
  - 1.6.4.3 Resistors
  - 1.6.4.4 Diodes
  - 1.6.4.5 LEDs
  - 1.6.4.6 Relays
  - 1.6.4.7 Conductors
  - 1.6.4.8 Terminations
- 1.7 Describe communications skills for the following:
  - 1.7.1 Customer relations
  - 1.7.2 Coworker communications

2.0 Mechanical and Vehicle Basics

- 2.1 Describe basic vehicle construction
- 2.2 Describe basic vehicle electronics systems
- 2.3 Describe basic vehicle components

3.0 Land Mobile Radio Fundamentals

- 3.1 Describe LMR basic fundamentals:
  - 3.1.1 Terminology
  - 3.1.2. Mobile radio types
    - 3.1.2.1 Front Mounts
    - 3.1.2.2 Rear Mounts
    - 3.1.2.3 Low Power
    - 3.1.2.4 High Power
    - 3.1.2.5 Other LMR Mobile Specifics
  - 3.1.3 Frequency band splits
  - 3.1.4 Radio Systems
    - 3.1.4.1 Basic Simplex system functions
    - 3.1.4.2 Basic in-vehicle repeater systems
    - 3.1.4.3 Conventional
    - 3.1.4.4 Digital
    - 3.1.4.5 P25
    - 3.1.4.6 Trunking systems
    - 3.1.4.7 Commercial
  - 3.1.5 Interconnections between systems
- 3.2 Describe LMR overview
- 3.3 List Computer Basics

4.0 Basic Mobile Installation

- 4.1 Explain the importance of the following Vehicle Preparation items:
  - 4.1.1. Pre-installation considerations
    - 4.1.1.1 Review the “Pre-Install check list”
    - 4.1.1.2 Examine operation of existing accessories, lights, components
    - 4.1.1.2 Locate the mounting area of the proposed installation
    - 4.1.1.3 Explain the limits of height and clearance of the installation
    - 4.1.1.4 Examine radio/component access and locating
    - 4.1.1.5 Distinguish Common Connection types
    - 4.1.1.6 Define Low current terminations (low voltage)

- 4.1.1.7 Define High current terminations (high voltage)

4.2. Describe the procedures used for Vehicle Disassembly:
- 4.2.1. Interior
  - 4.2.1.1. Headliners
  - 4.2.1.2. Panels
  - 4.2.1.3. Seats
  - 4.2.1.4 Rear Decks
  - 4.2.1.5 Consoles
  - 4.2.1.6 Carpets
  - 4.2.1.7 Custom interiors
- 4.2.2. Exterior
  - 4.2.2.1 Metal
  - 4.2.2.2 Fiberglass/Composites
  - 4.2.2.3 Finishes

4.3. Describe the vehicular systems and components which will be affected by installation:
- 4.3.1 Batteries
- 4.3.2 Alternator
- 4.3.3 Fuses and breakers
- 4.3.4 Ignition
  - 4.3.4.1 Switch
  - 4.3.4.2 Low current circuits
- 4.3.5 High Current Power Cables circuits
- 4.3.6 Wiring and Wiring Harnesses
- 4.3.7 Grounding

4.4. Explain the basic procedures for the following Equipment Mounting:
- 4.4.1 Penetration
  - 4.4.1.1 Hole sizing
  - 4.4.1.2 Pilot Holes / location preparation
  - 4.4.1.3 Unibody construction
  - 4.4.1.4 Firewall Breaching
  - 4.4.1.5 Drills, bits and drilling
  - 4.4.1.6 Punches
- 4.4.2 Radio Mounting
  - 4.4.2.1. Standard
    - 4.4.1.6.1 Emergency Responder
    - 4.4.1.6.2 Commercial
  - 4.4.2.2. Fabricated
- 4.4.3. Auxiliary Equipment Mounting
  - 4.4.3.1. Airbag
  - 4.4.3.2. Anti-Theft System
  - 4.4.3.3. Automatic shutdown devices
  - 4.4.3.4. Automatic mobile equipment shut-off timer
  - 4.4.3.5. Battery isolators
  - 4.4.3.6. Comm controls and relays
  - 4.4.3.7. Computer
    - 4.4.3.7.1. Antenna
    - 4.4.3.7.2. Mounts
    - 4.4.3.7.3. Keyboards
    - 4.4.3.7.4. Mobile adapters
  - 4.4.3.8. Controls and Consoles
  - 4.4.3.9. DC Outlets

- 4.4.3.10. EMS
- 4.4.3.11. Flashers
- 4.4.3.12. GPS
- 4.4.3.13. Grill lights
- 4.4.3.14. Gun Locks
- 4.4.3.15. Headsets and Microphones
- 4.4.3.16. Hidden Switches
- 4.4.3.17. K9 Release Switch/control
- 4.4.3.18. License plate RFID readers
- 4.4.3.19. Lights and light bars
- 4.4.3.20. LoJack equipment
- 4.4.3.21. P.A.'s
- 4.4.3.22. Prisoner Containment Systems
- 4.4.3.23. Radar
- 4.4.3.24. RF / Cell modems
- 4.4.3.25. In Vehicle Repeaters
- 4.4.3.26. Shielding
  - 4.4.3.26.1. EMI
  - 4.4.3.26.2. RFI
- 4.4.3.27. Sirens
- 4.4.3.28. Speakers
- 4.4.3.29. Timed or Delayed switch options
- 4.4.3.30. Trunk Vaults
- 4.4.3.31. Two-Way Portable Radio(s) and Chargers
- 4.4.3.32. Video equipment
  - 4.4.3.32.1 Wireless microphone receivers (for dashcam transmitters)

4.4.4. Routing Cables and Wiring
- 4.4.4.1 Internal
- 4.4.4.2 External / Chassis
- 4.4.4.3 Hidden wiring and wear mitigation
- 4.4.4.4 Specialty package wiring options
- 4.4.4.5 Securing harnesses, cabling and wiring
- 4.4.4.6 Vibration mitigation for rough use vehicles
- 4.4.4.7 Common connection types

4.4.5. Power Connections Types
- 4.4.5.1 "Jump Points"
- 4.4.5.2 Low/High power outputs
- 4.4.5.3 Taps
- 4.4.5.4 Hot / On ignition switch

4.4.6. Equipment Grounding
- 4.4.6.1. Ground straps and bonding
- 4.4.6.2. Grounding non-metallic items
- 4.4.6.3. Static straps, chains, cables

4.4.7. Mobile Antenna and Coax
- 4.4.7.1. Basic knowledge of Antenna Types
- 4.4.7.2. Proper mobile antenna installation
  - 4.4.7.2.1. Preparing location
  - 4.4.7.2.2. Clearance limits
  - 4.4.7.2.3. Routing Cable/Coax
  - 4.4.7.2.4. Connectors

4.4.7.2.5. Cables and Harnesses
4.4.7.2.6. Vibration mitigation
4.4.7.3. Antenna Mounts
4.4.7.3.1. Common NMO
4.4.7.3.2. Glass
4.4.7.3.3. Magnet
4.4.7.3.4. Non-Metallic
4.4.7.3.5. Alternative
4.4.7.4. Cutting chart
4.4.7.5. Matching, Tuning and SWR measuring
4.4.7.6. Proper Grounding

4.5. Describe the procedures necessary for Vehicle Reassembly
4.5.1. Proper reverse order from disassembly
4.6. Explain the following required installation completion procedures:
4.6.1. Post-install checklist
4.6.1.1 Testing of installed item(s)
4.6.2. Reconnecting power
4.6.3. Resetting Electronic Devices
4.6.3.1 Checking operations of vehicle
4.6.3.2 Mobile RF safety check
4.6.4. Cleanup

5.0 Post Installation Procedures

5.1 Define work completed
5.2 Define any vehicle issues with supervisor
5.3 Explain basic mobile operator training to supervisor or customer
5.3.1 Explain final delivery
5.3.2 Explain RF safety
5.3.3 Explain other operating safety issues
5.4 Prepare final documentation and completion of project

End of Mobile Communications and Electronics Installer Competencies (with 5 major Categories and 153 Items/sub-items)

Find An ETA® Test Site http://www.eta-i.org/testing.html

Suggested Additional study material and resources for MCEI certification:

Manufacturer Manuals; first and foremost an MCEI should have manufacturer's manuals for the vehicle receiving the new installation and the manual for the item being installed.

National Institute for Automotive Service Excellence (ASE); look for additional guidance: https://www.ase.com/About-ASE.aspx

Appendix G, Standards and Guidelines for Communication Sites (R56) ©2017 Motorola Solutions, Inc. – Available from Motorola Training Services (learning.motorolasolutions.com)

Mobile Electronics Installer Study Guide; I.Wiesenfeld, J.MacFarlane, A.J.Wiesenfeld, R.Walker; ISBN 978-0-9915913-1-2; Self Published; 2014; softcover; @110 pgs.

Subject Matter Expert committee for the MCEI certification program:

John C. MacFarlane	W.I.N.S.; AZ.	john@winsnet.com
Ira M. Wiesenfeld, P.E., CETsr	IWA & Assoc.; TX	iwiesenfel@aol.com
R. Andy Bellendir, CETsr, CSM	W.A.C.; CO	andy.bellendir@wiradcom.com
Jacob L. Binder, CETa, MECPmaster	Avista; WA	
William A. Brinker, CETma	Commenco; KS; retired	
Dane R. Brockmiller, LAS,PIM	dBc, LLC; MO; retired	
Richard I. Buckner, CETsr, CSM	R.C.C.; SC	kk4b@firstpage.net
R. Darryl Buckner, CSM	R.C.C.; SC	darrylb@firstpage.net
Christopher L. Dalton, LAS	R.S.A.; VA	chris@RSAnalytics.com
Thomas K. Dover	D.T.S.; UT	tom@doverts.com
Bill Dow,	Westell; NY	
Donald E. Huston, SIT	BirdRF; OH	dhuston@birdrf.com
Andrew M. Leisenheimer, MSS, MWSE	W.W.I; MN	andyl@whitewaterwireless.com
Matthew P. Mercier, CETsr	N.C.I; CT	mmercier@norcomct.net
Patrick R. Mosca, MWSE, CSS, CSM	A.C.& E.; NM	pmosca@advtwoway.com
J. Shane Morris, CETma, CETms(RF)	MotoSol; WA	Shane.Morris@motorolasolutions.com
Jay Thompson, CETsr	TacticalRF, IN	jay@tacticalrf.com
William A. Webb, WCM, CSM	retired; OH	

ETA certification programs are accredited through the ICAC, complying with the ISO/IEC 17024 standard.

