Certified Satellite Installer—CSI
Competency Requirements

The following proposed Skills Standards and Competencies are for workers studying to become satellite systems installers and technicians. These Competencies are also for use as a curriculum or syllabus outline for educational institutions providing training for satellite industry personnel. A CSI should be knowledgeable in the following:

A. BASIC – CSI, SMALL DISH CAPABILITIES

1.0 Satellite Communications History and Theory

1.1 Demonstrate an understanding of electrostatic and electromagnetic wave propagation.
1.2 Identify common frequencies utilized by various common services - frequency bands and relationships - TV lo-hi-UHF bands - FM - AM.
1.3 Identify C, Ka and Ku frequency bands and the services provided by each
1.4 Identify common satellite services available from DBS systems
1.5 Describe the process of encoding and decoding satellite programming
1.6 List the orbital slots and names of DirecTV and DISH satellites
1.7 Explain the term: footprint
1.8 Describe the Clarke Belt

2.0 Satellite Dish Reflectors

2.1 Explain gain of a dish reflector
2.2 Explain how the Low-Noise Block-Feed/Feedhorn (LNBF) operates and why it is needed.
2.3 Demonstrate ability to track the Clarke belt and aim a DBS dish properly
2.4 Explain how the North Star Polaris is related to dish aiming
2.5 Describe declination and elevation adjustments required for DBS systems
2.6 Explain the terms: FOCAL POINT and FOCAL DISTANCE
2.7 Explain how reflector and Low-Noise Block (LNB) gain is related to receiver gain
2.8 Explain the advantages of offset feed-horns and LNBF's

3.0 Cabling

3.1 Calculate, measure and compare the signal loss in lengths of RG 6 vs 59 coax cable
3.2 Demonstrate proper waterproofing of cabling at the dish reflector
3.3 Explain building entry - crawl space and attic precautions - wall fishing – carpet- cutting precautions and wall plate usage
3.4 Demonstrate the ability to properly install coaxial fittings and splices
3.5 Explain methods of overcoming obstacles such as walks, driveways, underground wiring, roots and other impediments in underground cabling
3.6 Explain unnecessary length and tight coiling or bending of coaxial cable

4.0 Amplifiers

4.1 Describe the function of line boosters, in-line amplifiers and distribution amplifiers and where they are used
4.2 Explain how in-line amplifiers are powered
4.3 Describe amplifier gain options
4.4 Explain why rooftop antenna preamplifiers and amplifiers are used and describe potential problems they may present for satellite installers
4.5 List where bandsplitters, diplexers and attenuators are used
4.6 Describe Video Switch Boxes and list their usages
4.7 Name 5 types of equipment where RF modulators may be used and explain the functions of an RF modulator
4.8 Explain the function of band pass filters, signal combiners, multi-switches and amplified signal combiners

5.0 Satellite Dish Feed-horns, LNBs and LNBFs

5.1 Describe fixed-diode, tone switching, and dual feeds
5.2 Explain wave-guide theory - LNBF's, and why scaler rings are used on feed-horns
5.3 Explain the difference between horizontal/vertical polarity and circular signal transmission and reception

6.0 Satellite System Installation – Site Surveys

6.1 Demonstrate use of common and special satellite, antenna, cable and Telco hand tools
6.2 Describe trenching of satellite and antenna cables and special precautions
6.3 Describe how to locate and mark buried cables
6.4 Explain boring principles (street, sidewalks, etc.)
6.5 List building-entry precautions and decision-making pertaining to dish wiring
6.6 Describe types of roof mounts for antennas and satellites, including non-penetrating mounting procedures
6.7 List important concepts when making a satellite site survey
6.8 Explain anti-twist pole modification - concrete calculation and work procedures waterproofing - safety - wall mounts - chimney and tri-pod mounts
6.9 Explain in-ground water runoff and cable routing for concrete pole mounts

7.0 Satellite Receivers – Digital Technology

7.1 Explain the differences between C/Ku, DirecTV, DISH Network and commercial system receivers
7.2 Demonstrate how to authorize consumer or commercial programming
7.3 Describe the fuses commonly used in receivers
7.4 Explain special codes, parental supervision functions and remote hand unit use
7.5 Describe basic (block diagram) receiver circuitry (IF input - decoding - audio & video processing - baseband signals - and stereo)
7.6 Describe satellite receiver gain and receiver input signal ranges as they relate to the entire dish system
7.7 Describe secondary audio programs - subcarriers - SCPC and pay-per-view services
7.8 Describe captioning and on-screen graphics
7.9 Describe the purpose of telephone connections to the receiver and computer interfacing with the satellite receiver
7.10 Explain how channel tuning voltages perform their functions within the receiver
7.11 Demonstrate the uses for menus, programming information and receiver/set up functions of the receiver
7.12 Draw an installation diagram showing proper hookup for multi-LNBF, multi-satellite, multi-receiver reception of DirecTV and DISH HDTV programming

8.0 Interfacing With Other Consumer Electronics Equipment

8.1 Explain and demonstrate ability to properly utilize interconnections for TV and other consumer electronics equipment
8.2 Describe the TV requirements for audio and video signals, RF-out (on channel 3/4) and list proper signal levels expected from receiver ports
8.3 Explain how signal modulators work and list appropriate circumstances for them
8.4 Describe the usage of video switch boxes, combiners & reverse splitters
8.5 Explain the use for cable/normal and VCR/TV switches
8.6 Describe telephone wiring and interconnection to satellite receivers

9.0 Transmission – Internet Systems

9.1 Describe mounting precautions and rules for transmission outside units
9.2 Explain transmission theory and power levels
9.3 Compare StarBand, DirectWay, DISH and competing systems features

10.0 Troubleshooting, Repairs, Sun Outage

10.1 Describe rain fade and sun outage
10.2 List typical distribution system problems such as open and shorted connections
10.3 Explain standing waves and identify their presence in a video picture
10.4 Describe interference types and methods of prevention or reduction

10.5 List possible UHF remote control problems and their solutions
10.5 Identify rooftop antenna problems
10.6 List problems that are frequently caused when interconnecting various customer owned pieces of equipment
10.7 Demonstrate proper use of satellite service equipment including dish alignment tools, electronic service and substitution test equipment
10.8 Describe how signal splitters, taps, diplexers and similar cabling equipment can cause problems with the customer's satellite system
10.9 Demonstrate proper soldering and de-soldering techniques

11.0 Safety

11.1 Explain Electrostatic Discharge (ESD), its causes and potential dangers to electronics equipment
11.2 Explain the safety rules OSHA dictates for workers at heights
11.3 List ANSI A14 safety rules for ladder usage
11.4 Describe proper grounding procedures for satellite equipment
11.5 List some possible hazards to electronic equipment caused by defects in building wiring or in associated and connected equipment
11.6 Describe grounding rules set by the National Electrical Code (NEC®)
11.7 Explain potential problems involved in equipment usage and storage in service vehicles

B. ROOFTOP ANTENNA SYSTEMS (Antenna Endorsement)

12.0 Antenna Theory

12.1 Demonstrate an understanding of electrostatic and electromagnetic wave propagation
12.2 Identify common frequencies utilized by various broadcast services – frequency bands and relationships between bands of frequencies
12.3 Describe polar patterns of common TV and radio antennas; directivity and ghosts reflections
12.4 Explain different types of antennas and special usages for each
12.5 Describe the dipole antenna – horizontal, circular & vertical polarity – ground plane – physical length and thickness considerations of antenna elements
12.6 Define parasitic elements – directors – reflectors – resonators
12.7 Explain antenna gain – front-to-back ratios and their usages
12.8 Perform calculations using dB's; 0 dBmV reference; dBmV relationship and use wavelength formula to calculate antenna length or resonant frequency
12.9 Describe antenna and OSHA safety rules for working at heights
12.10 Describe how towers and rotors are utilized
12.11 Properly demonstrate safe use of linemans belts and ladders

13.0 Components

13.1 Name the uses of splitters – taps – filters – and terminators
13.2 List where hi/lo and U/V bandsplitters, diplexers, tilt compensators and attenuators are used
13.3 Describe Video Switch Boxes and list their usages
13.4 Name 5 types of electronic equipment where RF modulators are used and explain the RF modulator function
13.5 Explain the function of band pass filters, signal combiners, diplexers, multi-switches and amplified signal combiners

14.0 Installation Procedures

14.1 Demonstrate use of common and special antenna, cable and Telco hand tools
14.2 Explain trenching of satellite and antenna cables and precautions
14.3 Describe how to locate and mark buried cables
14.4 Describe wall and chimney mounts
14.5 Describe types of roof mounts for antennas and satellites, including non-penetrating mounting procedures
14.6 Describe NEC® antenna grounding rules and building wiring standards

15.0 Antenna Positioners

15.1 Explain the operation of an antenna rotator system
15.2 Explain the voltage readings or resistance readings to be expected on rotor cables
15.3 Describe methods used to re-synchronize an antenna rotor
15.4 List anticipated difficulties when replacing either unit of a rotor

16.0 Towers

16.1 Describe the parts of an antenna tower
16.2 Explain how concrete bases should be installed to prevent metal rot
16.3 Explain mounting procedures for installing rotor, preamplifier and antennas on towers
16.4 Explain proper grounding of antenna towers
16.5 Describe procedures for co-locating scanner, FM, ham, satellite or other equipment on antenna towers
16.6 Explain what a gin pole is and how it is used
16.7 Demonstrate the proper use of a lineman's belt and body harness

17.0 Interference

17.1 Explain the difference between co-channel and adjacent channel interference
17.2 Describe the symptoms indicating overdrive signal levels
17.3 Define signal egress and ingress
17.4 Describe anticipated problem when combining signals
17.5 Explain the uses for signal traps and filters
17.6 Describe power line hash and its causes

18.0 Troubleshooting and Repairs

18.1 List typical antenna reception problems caused by open and shorted connections
18.2 Explain standing waves and identify their presence in a video picture
18.3 Describe interference types and methods of prevention or reduction
18.4 Identify and solve rooftop antenna problems caused by RF or power interference
18.5 List problems which are frequently caused when interconnecting various customer-owned equipment
18.6 Demonstrate proper use of antenna signal measurement service equipment including volt-ohm-meter; signal strength meter; signal generating equipment and signal substitution equipment

C. C/Ku LARGE DISH SYSTEMS (C/Ku Endorsement)

19.0 Dish Reflector Theory

19.1 Explain gain of a dish reflector
19.2 Explain how the LNBF operates and why it is needed. Define skew alignment
19.3 Calculate Focal Point and F/D ratio of a prime focus satellite dish reflector
19.4 Properly center the feed-horn of a C/Ku satellite dish and check warpage
19.5 Demonstrate ability to track the Clarke belt and aim a C/Ku band dish properly
19.6 Describe declination and elevation adjustments required for satellite reflectors

20.0 Line Amplifiers

20.1 Describe the function of line boosters, in-line and distribution amplifiers and where they are used
20.2 Explain the use of pre amplifiers – powering – gain – traps – tilt and installation requirements and precautions
20.3 Explain the symptoms and causes of signal overdrive

21.0 Components

21.1 Explain wave-guide theory, scaler rings and polarity aspects of feed-horn types
21.2 Describe servo motor operation, supply and control circuitry
21.3 Compare various types of LNBFs, down converters, LNBs and LNAs
21.4 Explain how terrestrial interference filters work
21.5 Describe the functions of diplexers, multi-switches and signal combiners

22.0 Feedhorns, LNA's, LNB's, LNBF's, Downconverters

22.1 Explain the differences between LNB's, Down Converters, LNA's and LNBF's
22.2 State the supply voltages required to operate LNB's and LNBF's
22.3 Explain switching voltages contained on the LNBF signal coax
22.4 List the approximate gain expected of various LNB or LNBF types and the DC or AC current requirements.
22.5 Explain dual vs single LNBF's
22.6 Explain the difference between analog and digital signal transmission
22.7 Describe coaxial cable requirements for proper LNB operation
22.8 Explain the splitting of LNB signals and how to connect LNB line amplifiers

23.0 Cabling Installation Procedures

23.1 Calculate and measure the signal loss in lengths of RG 6 vs 59 coax cable and compare the two
23.2 Demonstrate precautions important in long cable runs
23.3 Demonstrate proper polarotor (servo motor), drive motor wiring and weather-proofing
23.4 Explain home/building entry - crawl space and attic precautions - wall fishing - carpet cut precautions and wall plate usage
23.5 Demonstrate the ability to properly install and use diplexers and to configure multiple receiver installations
23.6 Explain cable signal leakage requirements by law and how the CSI could contribute to leakage violations if he were ignorant of the rules
23.7 Explain signal leakage and its possible effects to the system that has the leaks and the effects on adjacent equipment.
23.8 Describe flat cable for tight entry, under rugs and thru glass technology

24.0 IRD's, Integrated Receiver, Descrambler/Positioners

24.1 Explain the differences between C/Ku - DirecTV, DISH Network and commercial systems
24.2 Describe how GI stand-alone decoders are installed and how to operate VC II menus
24.3 Demonstrate how to obtain consumer or commercial programming
24.4 Describe the fuses commonly used in IRD's (Integrated Receiver/Decoders)
24.5 Explain special codes, parental supervision functions and remote hand unit use
24.6 Describe basic receiver circuitry (IF input - decoding - audio & video processing - baseband signals - remote control circuitry basics and stereo processing)
24.7 Explain, properly connect and adjust servo and motor-drive circuits and connections
24.8 Describe secondary audio programs - subcarriers - SCPC and pay-per-view services
24.9 Describe captioning, on-screen graphics, telephone connections and computer interfacing with the satellite receiver
24.10 Explain how channel and audio tuning voltages function
24.11 Describe the effects dried out electrolytic capacitors may have in the video circuits

25.0 Troubleshooting – Installation/Tools, Test Equipment, T.I.

25.1 List typical distribution system problems such as open and shorted connections
25.2 Explain standing waves and identify their presence in a video picture
25.3 Describe interference types and posible methods of prevention or reduction
25.4 List possible UHF remote control problems
25.5 List problems that are frequently caused when interconnecting various customer-owned products
25.7 Demonstrate proper use of satellite service equipment including dish alignment tools, electronic service and substitution test equipment such as DMM, Signal Level meter, in-line satellite RF meters and spectrum analyzer
25.8 List common problems associated with drive-positioning arms

26.0 Positioners and Aiming

26.1 Describe power requirements for positioners
26.2 Explain how various types of sensors operate
26.3 Explain resolution and positioner accuracy
26.4 Properly connect drive system to IRD or positioner control

26.5 Explain common fusing of positioners
26.6 Describe proper limit switch setting procedures

D. COMMERCIAL SYSTEMS (Commercial Endorsement)

27.0 VSAT Theory (C, Ka, Ku)

27.1 Define VSAT and name various services
27.2 List frequencies used by Ku and Ka bands
27.3 Explain the use of single-purpose receivers
27.4 Describe cross polarization (cross-pole) and polarization (co-pole) requirements
27.5 Describe Internet two-way satellite systems
27.6 Identify the transmit power utilized by 2-way Internet dish services
27.7 Define MAC - Media Access Control
27.8 Define IDU and ODU; AZ/EL and SKEW
27.9 Define PING and explain the term CW
27.10 Explain the reasons for telecommunications connections to transceivers and the differences between USB and RJ45 or other telecom cable connectors

28.0 Components

28.1 Describe various V-SAT mounts
28.2 Compare V-Sat LNB's, LNBF's and feeds with consumer versions

29.0 Offset Reflectors

29.1 Compare size requirements for various satellite systems
29.2 Describe declination and elevation adjustments required for satellite reflectors and explain methods for aiming V-SAT reflectors
29.3 Demonstrate ability to install, aim and connect V-SAT commercial dish systems, including proper roof protection, penetration and waterproofing

30.0 Feedhorns, LNB's, LNBF's, RFU's, OSU's

30.1 Compare differences in TVRO and 2-way receive/transmit systems
30.2 State the supply voltages required to operate LNB's and LNBF's
30.3 Compare different reflector types used in V-SAT
30.4 Describe how both C and Ku LNB's are mounted and connected to a head-end
30.5 Describe multiple LNB arrays for multi-bird reception
30.6 Explain focal distance, F/D ratio and centering requirements for prime focus reflectors

31.0 Special Installation Procedures

31.1 Describe types of roof mounts for antennas and satellites, including non-penetrating mounting procedures
31.2 List important concepts when making a satellite site survey
31.3 Explain anti-twist pole modification - concrete calculation and work procedures
31.4 Describe wall mounts and tri-pod mounts
31.5 Describe how to locate and mark dog fences, power and Telco cabling, gas lines, water supply lines, etc.

32.0 Receivers, Decoders, Authorizations

32.1 Explain the differences between C/Ku - DirecTV, DISH Network and commercial systems
32.2 Describe how GI decoders are installed and how to utilize VC II menus
32.3 Demonstrate how to obtain consumer or commercial programming
32.4 Draw a block diagram of a cable or SMATV head-end
32.5 Explain programming 'transport' systems
32.6 Describe secondary audio programs - subcarriers - SCPC and pay-per-view services
32.7 Describe captioning, on-screen graphics, telephone connections and computer interfacing with the satellite receiver
32.8 Describe the signal symptoms in a head-end that is too hot or too cold temperature-wise
32.9 Describe the problems rodents may cause inside the head-end facility
32.10 Explain advertising and EWS insertion principles
32.11 Describe billing and customer contact service and methods and Pay-per-view

33.0 Transmitters

33.1 List common uplink frequencies used for Internet services
33.2 Describe the power requirements and precautions for transmitters
33.1 Describe switching methods

34.0 Troubleshooting Reception/Transmission Systems

34.1 Explain causes for the need to reprogram or reauthorize programming
34.2 Describe unit substitution methods of location defective units
34.3 Explain decoder operation, checks and connections
34.4 List problems associated with cabling and connections in a head-end or to outdoor equipment
34.5 Describe multi-receiver LNB powering, DC Blocks and potential problems
34.6 Describe power measurements required to locate defective equipment

E. SMATV – SIGNAL DISTRIBUTION SYSTEMS (SMATV Endorsement)

35.0 Head-end Components and Environment

35.1 Describe differences between consumer and commercial satellite receivers
35.2 Describe equipment used for off-air TV signal reception
35.3 Explain power requirements and UPS equipment
35.4 Explain how combiners work and how splitters may be used in their place
35.5 Describe heating-cooling requirements for head-end rooms
35.6 List problems caused by rodents and insect pests in head-ends
35.7 Describe channel deletion hardware
35.8 Describe different methods to provide backup power during outages
35.9 Explain why distribution or line amplifiers are required in SMATV systems
35.10 Describe the functions of band-pass filters and channel deletion filters
35.11 List all of the components required for proper lightning protection at the head-end
35.12 List the advantages of marking head-end equipment

36.0 Head-end Signal Balancing

36.1 List the uses of signal-level meters with head-end equipment
36.2 Identify head-end signals and signal levels using a spectrum analyzer
36.3 Explain requirements for audio levels
36.4 List problems that may occur with out-of-range video levels
36.5 Explain FCC rules for signal levels, aircraft frequencies and leakage
36.6 Describe proper bonding and grounding of head-end equipment
36.7 List causes of hum in channel video audio signals
36.8 Describe overdrive and list causes
36.9 Explain reasons for proper documentation of head-end signals

37.0 Underground – Overhead Cabling

37.1 List locations conduit is often used for distribution cabling
37.2 Explain how boring and trenching is accomplished
37.3 Describe splicing hardware and waterproofing techniques
37.4 Define ‘Messenger’ cable and drop cabling
37.5 List the tools needed and technology of Hard Line connectors
37.6 List reasons for using tilt devices
37.7 Describe how mid-span power insertion is accomplished

38.0 Multi-channel Signal Combining

38.1 Explain the difference between powered and non-powered combiners
38.2 Explain how channel deletion and conversion equipment is used
38.3 Describe methods of location and reducing interference
38.4 List uses for channel traps
38.5 Explain the need for balancing the channel levels throughout the system

39.0 Uninterruptible Power Supplies (UPS)

39.1 Explain why temporary AC power may be needed

39.2 Explain the advantages of DC power-bus instead of AC UPS systems
39.3 Explain how gasoline-powered generators are used for power back up

40.0 Daisy Chain Cabling Technology

40.1 Draw a SMATV distribution system and show signal-power budget
40.2 List daisy chain system components
40.3 Explain how taps, splitters and terminators are used
40.4 Describe where and how line amplifiers may be used

41.0 SMATV Trunk and Feeder Line Components

41.1 Properly install a hard-line connector
41.2 Describe a Telecommunications pedestal and show how it is installed
41.3 Describe junction boxes where multiple subscriber drops may converge
41.4 Explain attic and crawl space hazards
41.5 Define strand and lashing cable and list where they are used
41.6 Explain when contracting underground or overhead plant is the best decision
41.7 Describe pole-mounted taps, splitters, tilt hardware
41.8 Explain AC power budgeting

42.0 Test Equipment and Troubleshooting

42.1 Demonstrate how to use a signal level meter
42.2 Explain the use of a TDR – Time domain reflectometer
42.3 List situations where signal injection equipment is required in troubleshooting
42.4 List 10 situations where a DMM is used in troubleshooting a system
42.5 Explain how 2-way radio communications can aid a crew in troubleshooting
42.6 Explain how signal leakage detectors work
42.7 List types of Interference detector equipment
42.8 Explain how substitution of equipment may be the quickest method of locating system defects

43.0 Home Run Installation Techniques

43.1 Identify the TIA-EIA standard for routing cables
43.2 Compare various multi-splitters used in SMATV systems
43.3 Describe traps and subscriber disconnect methods
43.4 Describe drop verification methods and documentation requirements
43.5 Explain the importance of labeling system components and drops

44.0 Programming Providers

44.1 Explain how to contract directly with program providers
44.2 List wholesale SMATV programming providers and the benefits of using
44.3 Explain transport service for SMATV systems
44.4 List special equipment requirements needed for subscriber services offered by SMATV system operators

45.0 Line Sweeping, TDR, OTDR, FDR Equipment

45.1 List problems caused by inadequate head end integrity
45.2 List ways to locate shorts and opens in cabling
45.3 Explain the need for proper cable terminations
45.4 List reasons for cable anomalies and types of problems they cause
45.5 Describe proper power wiring
45.6 Describe fiber optic cabling safety concerns
45.7 Describe various types of cabling jumpers and commons problems
45.8 Explain where and why gas filled transmission lines may be used

End of all Certified Satellite Installer Competencies (including ALL Endorsements)

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