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FCC PART 15.Subpart H White Spaces System
Part 2 TEST REPORT
Fixed TVBD Device

Applicant	6HARMONICS, INC.
Address	21 CONCOURSE GATE SUITE 10 OTTAWA ON K2E 7S4
FCC ID	2AAST GWS-3000
Model Number	GWS 3000
Product Description	WHITE SPACE TVBD DEVICE
Date Sample Received	August/05/2013
Date Tested	August/05 – 09/2013
Tested By	Mario de Aranzeta
Approved By	Mario de Aranzeta
Report Number	1379UT13TestReport.docx
Test Results	☒ PASS ☐ FAIL

THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.

ACCREDITED

Testing Certificate # 0955-01

TABLE OF CONTENTS

TABLE OF CONTENTS **2**

GENERAL INFORMATION **4**

EMC EQUIPMENT LIST **5**

TEST PROCEDURES **6**

TEST CONFIGURATIONS: **7**

DEVICE AND SYSTEM OPERATION **8**

TEST NETWORK CONFIGURATION **8**

TEST SUMMARY **9**

TEST RESULT SUMMARY **9**

DATABASE ENROLLMENT INFORMATION **10**

SETUP PHOTO **11**

§15.713(F)(3) FIXED TVBD REGISTRATION **12**

A) SUCCESSFUL REGISTRATION, 15.713(F)(3) – FIXED TVBD WITH DIRECT CONNECTION TO INTERNET (BASE STATION) 12
B) SUCCESSFUL REGISTRATION, 15.713(F)(3) – FIXED TVBD WITHOUT A DIRECT CONNECTION TO THE INTERNET(SUBSCRIBER) 14
C) UNSUCCESSFUL REGISTRATION, 15.713(F)(3) – RESTRICTED CO-ORDINATES 16
D) UNSUCCESSFUL REGISTRATION, 15.713(F)(3) – INCOMPLETE CONTACT INFORMATION 19
E) UNSUCCESSFUL REGISTRATION, 15.713(F)(3) – HAAT > 250M 22
F) UNSUCCESSFUL REGISTRATION, 15.713(F)(3) –ANTENNA HEIGHT AGL> 30M 24
G) UNSUCCESSFUL REGISTRATION, 15.713(F)(3) – FCC ID, SERIAL NUMBER 26

§15.707(A) FIXED TVBD RELOCATED **27**

§15.711(B)(3)(III) FIXED & MODE II TVDB DATABASE UPDATE **29**

§15.707, §15.711(B)(3)(I)(II)(IV),(C), §15.712 TVBD CHANNEL AVAILABILITY **39**

§15.711(F) SECURITY: **44**

GENERAL REMARKS

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

The test results relate only to the items tested.

Summary

The device under test does:

☒ fulfill the general approval requirements as identified in this test report

☐ not fulfill the general approval requirements as identified in this test report

Attestations

The scope of this document is to report the results of the Fixed TVBD Part 2 Database Interface Certification tests.

There are three (3) components of the White Spaces technology;

- **TV Band devices (Fixed TVBD for Certification).**
- **TV Bands Database (Spectrum Bridge Certified White Space Database)**
- **TV Band System,** Made up of Fixed TVBD's database, and layer of interaction between the devices and the databases.

To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025: 2005 requirements.

ACCREDITED

Testing Certificate # 0955-01

I attest that the necessary measurements were made, under my supervision, at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, Fl 32669

Authorized Signatory Name:

Compliance Engineer
Date: August 09, 2013

GENERAL INFORMATION

EUT Description

General:

Need 6Harmonics EUT description here, it has been requested.

EUT Specification:

Applicable Standard	Part 15 Subpart H TV Band White Space Fixed Device		
EUT Description	Transceiver – Single preferred channel		
FCC ID	2AAST GWS-3000		
Application:	High capacity, long range communications links		
Operating Frequency	473-695 MHz		
Number of channels	TV Channels 14 -35 and 39-51 (473MHz-599MHz and 623MHz-695MHz)		
Transmit Power(dBm):	+20dBm maximum per RF channel		
EUT Power Source	☐ 110–120Vac/50– 60Hz		
	☒ DC		
	☐ Battery Operated Exclusively		
Test Item	☐ Prototype	☐ Pre-Production	☒ Production
Type of Equipment	☒ Fixed - WGF	☐ Mobile – WG1	☐ Portable – WG2
	☐ Fixed - WSF	☐ Mobile – WS1	☐ Portable – WS2
Antenna Connector	50 ohm N- connector		
Antenna model			
Network Port	RJ 45		
Indicators	☐		
	☐		
	☐		

Test Facility	Timco Engineering Inc. 849 NW State Road 45 Newberry, FL 32669 USA.
Test Conditions	Temperature: 26ºC Relative humidity: 50%
Test Exercise	The EUT was tested in normal operator mode.

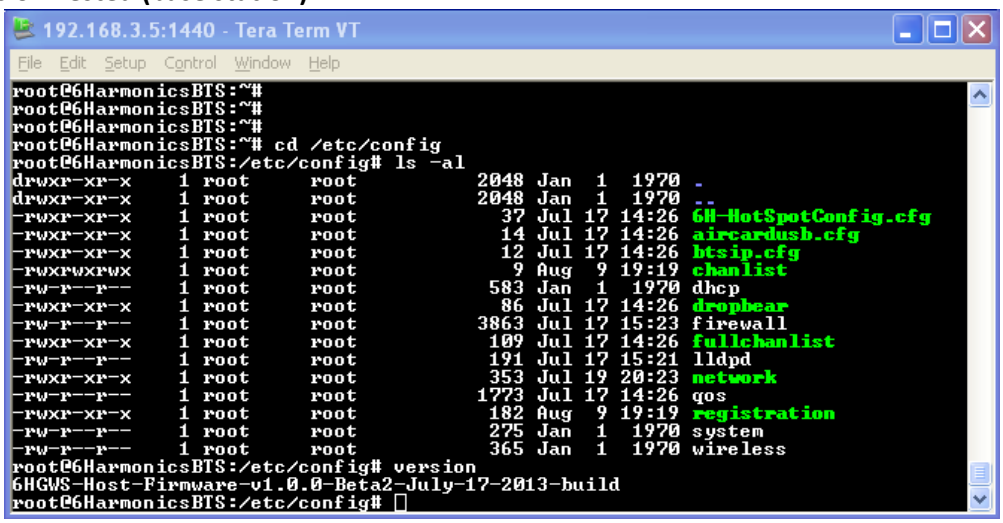
EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Digital Multimeter	Fluke	8000A	520258	02/25/13	02/25/15
Digital Multimeter	Fluke	77	43850817	02/22/12	02/22/14
Spectrum Analyzer	R & S	ESU40	5000-309011540	3/21/2013	3/21/2015

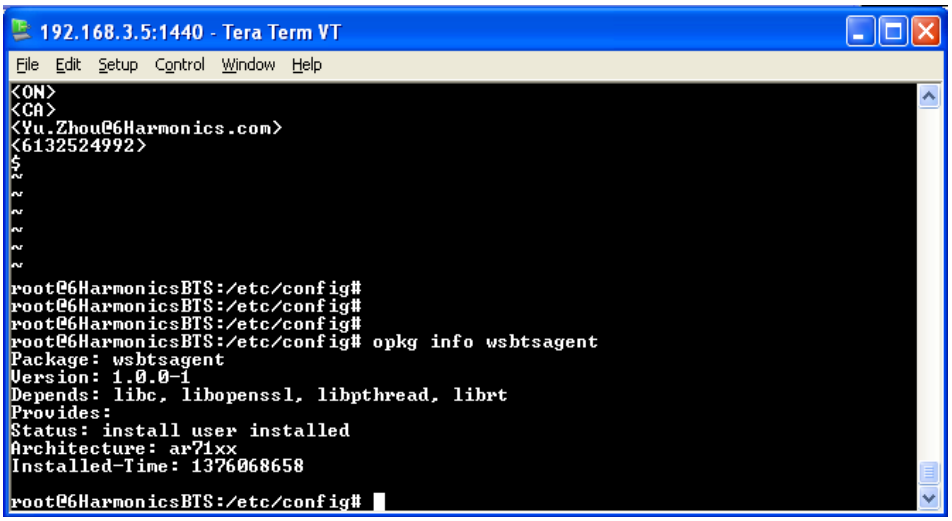
TEST PROCEDURES

Database Test: Certification Test Procedures for TV Band (White Spaces) Devices Authorized under Subpart H of the Part 15 Rules, 416721 DO1 White Space Test Procedures v02.

Firmware Version Tested (base station)



(CPE)



TEST CONFIGURATIONS:

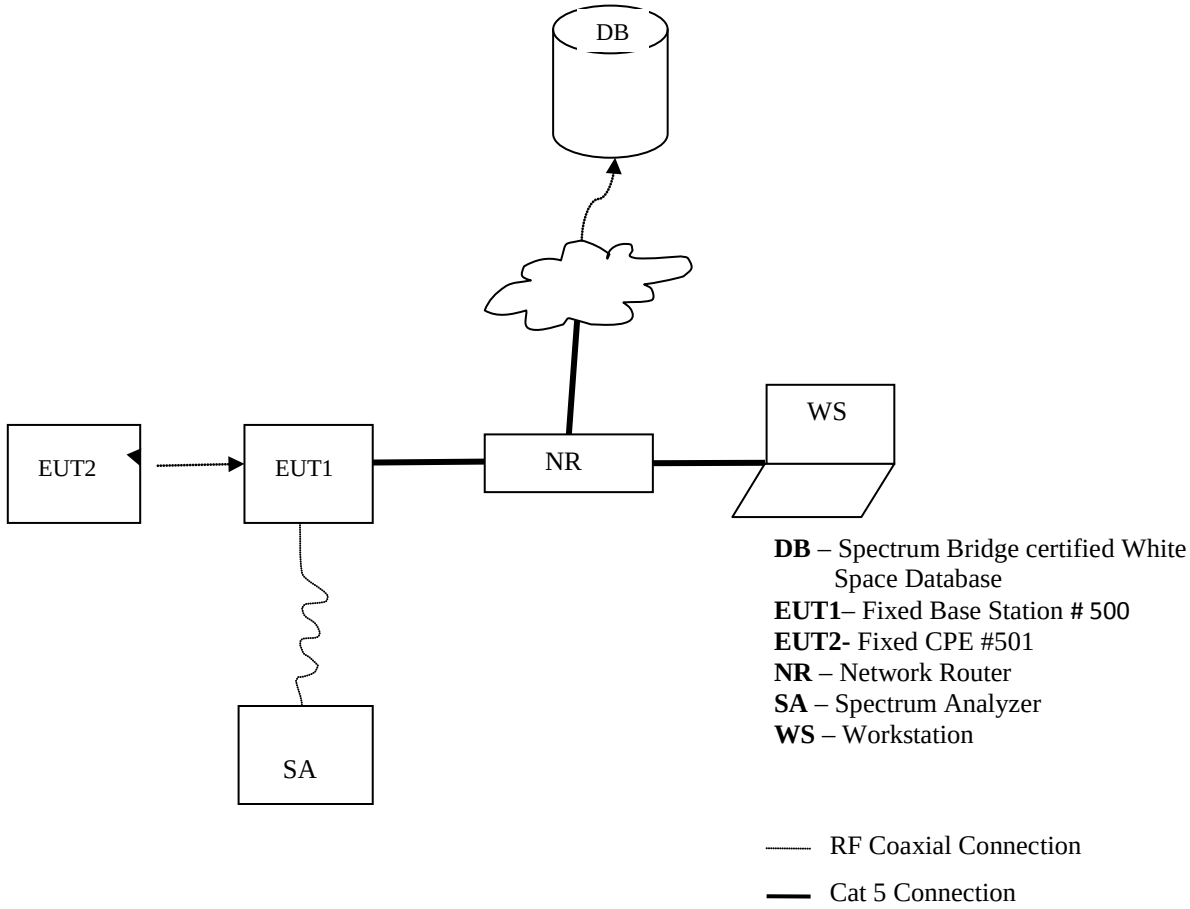


Figure 1 TVBD Configuration

Device and System Operation

The 6Harmonics Inc. GWS radios are a new class of radios designed for the global white space radio market. The GWS-3000 is designed to provide up to 20 dBm of transmit power, offer a sensitivity of up to -100 dBm, and provide 14.4 Mbps of UDP throughput in a 6 MHz television channel. The product can be used for Point to Point or Point to Multi-point operation.

Test Network Configuration

The GWS 3000 transmits on a single pre-configured or preferred TV White Space channel in the UHF frequency band based on the available channels for the registered location. The bench test network configuration is shown in Figure 1 above. The elements of the test setup are:

- EUT1 –Base Station White Space Radio Serial #500
- EUT2 –CPE White Space Radio Serial #501
- NR – standard network router/switch
- WS – workstation (laptop computer) to access TVBD control GUI and record measurements
- SA – spectrum analyzer
- RF attenuators and cabling

The workstation is physically connected to one of the network router LAN ports via RJ45 and establishes a network connection to the EUT and the internet. The routers WAN port connection is required to be capable of providing Internet access.

EUT1 is physically connected to a network router LAN port via its RJ45 network port. EUT1 is called the Base station and has direct connection to the internet. EUT2 (the CPE) is connected to EUT1 via a Coax link. EUT2 has no direct connection to the internet. EUT2 can have access to the internet only when the EUT1-EUT2 RF link is operating. All of the device/database tests were executed in normal operational mode. Configuration of EUT is accomplished using command line Telnet and SSH sessions.

EUT1 is programmed with the 'personality' of a base station and EUT2 is programmed with a 'personality' of a subscriber or CPE.

As defined in the FCC's White Spaces Final Rules, the EUT only operates and is tested as Fixed TV Band Devices (TVBDs). The EUT is provisioned or enrolled prior to testing by a Spectrum Bridge representative. In addition, the EUT1 and EUT2 must be configured with registration information to register with Spectrum Bridge WSDB. The firmware loaded in the EUT includes the database interface agent that includes the Spectrum Bridge White Space services URL.

The EUT must be configured with complete registration information using the SSH command line interface and will not transmit until it registers and receives a valid channel list. When power is applied and the radio establishes an Internet connection; the Base Station EUT/TVBD sends the registration information to the database via the Internet. The WSDB verifies the TVBD's FCC ID and serial number and upon confirmation, registers the device. The device then requests a channel map for its location. Upon receiving a list of available channels from the database the TVBD will verify if the pre-configured or preferred channel is available before enabling transmission.

The following tests address the Radios functionality as a Fixed TVBD and compliance with the FCC's TV White Space Database Interface Certification Rules Part 2.

TEST Summary

This document provides test overviews and test results that apply specifically to Fixed TVBD's operating in TV White Spaces on an unlicensed secondary use basis.

Test Result Summary

Test Case	P/F/I
§15.713(f)(3) Fixed TVBD Registration(Successful Registration)	**P**
§15.713(f)(3) Fixed TVBD Registration(Restricted Co-ordinates)	**P**
§15.713(f)(3) Fixed TVBD Registration(Incomplete Contact Information)	**P**
§15.713(f)(3) Fixed TVBD Registration(HAAT)	**P**
§15.713(f)(3) Fixed TVBD Registration(Antenna Height AGL)	**P**
§15.713(f)(3) Fixed TVBD Registration(FCCID/Serial Number)	**P**
§15.707(a) Fixed TVBD Relocated	**P**
§15.711(b)(3)(iii) Fixed & Mode II TVDB Database Update	**P**
§15.711(b)(3)(i)(ii), §15.713(a)(1) 48 Hour Channel Scheduling	**P**
§15.707, §15.711(b)(3)(i)(ii)(iv),(c), §15.712 TVBD Channel Availability	**P**
§15.711(f) Security:	**P**

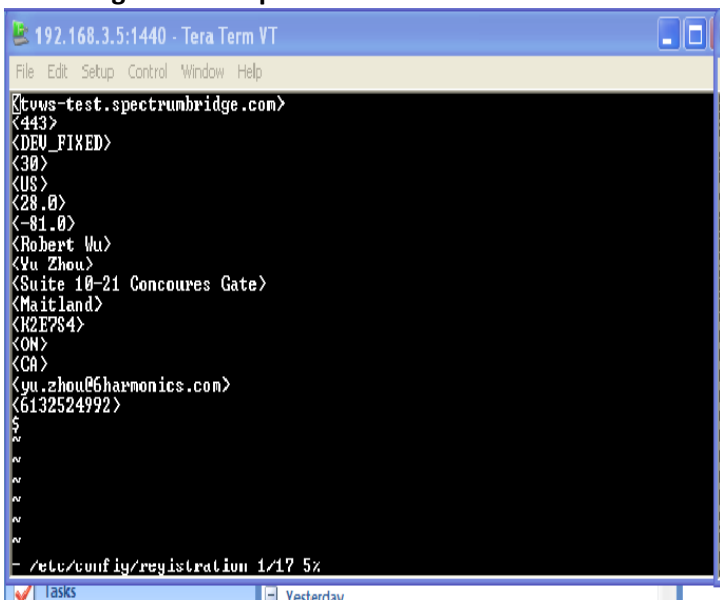
P-Pass **F-Fail** **I-Inconclusive** **N.A.-not applicable/not supported**

Database Enrollment Information

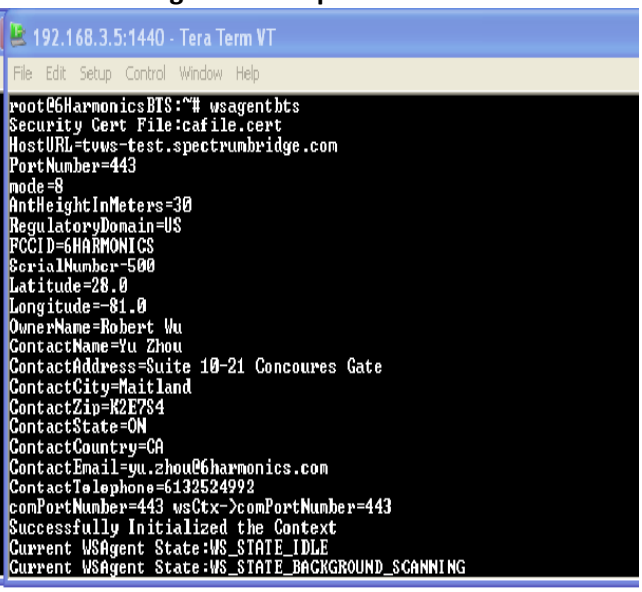
The following screenshot of the log shows the TVBD enrolled in the Spectrum Bridge whitespace database prior to the testing.

FCCID	Serial #	Entity Name	Expires
6Harmonics	500	6Harmonics Inc.	12/31/2013
6Harmonics	501	6Harmonics Inc.	12/31/2013

Radio Registration Input File



Radio Registration Input

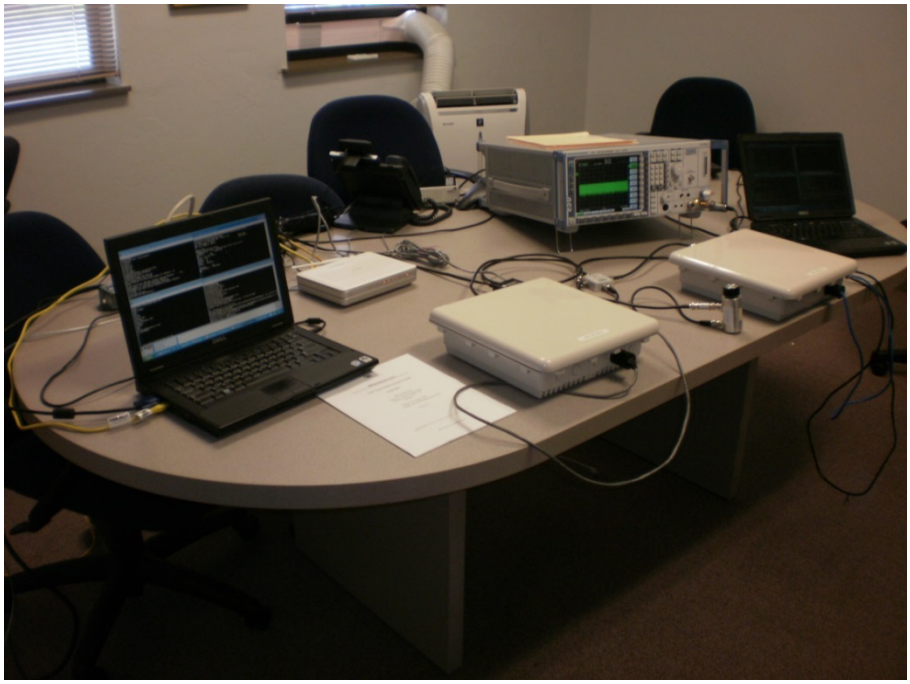


WSDB Record

Date	Ip	Url	Status	RT (ms)	Data
8/8/2013 5:17:21 PM	71.43.255.210	/v3/channels/US/28.0/-81.0/?fccid=6HARMONICS&serial=500&type=8	Success (0)	826	Response
8/8/2013 5:17:20 PM	71.43.255.210	/v3/devices/US/6HARMONICS/500	Success (0)	313	Request

Entity Name: **6HARMONICS, INC.**
Serial No: **Base unit: 500, CPE: 501**
FCC ID: **2AAST GWS-3000**

Setup Photo



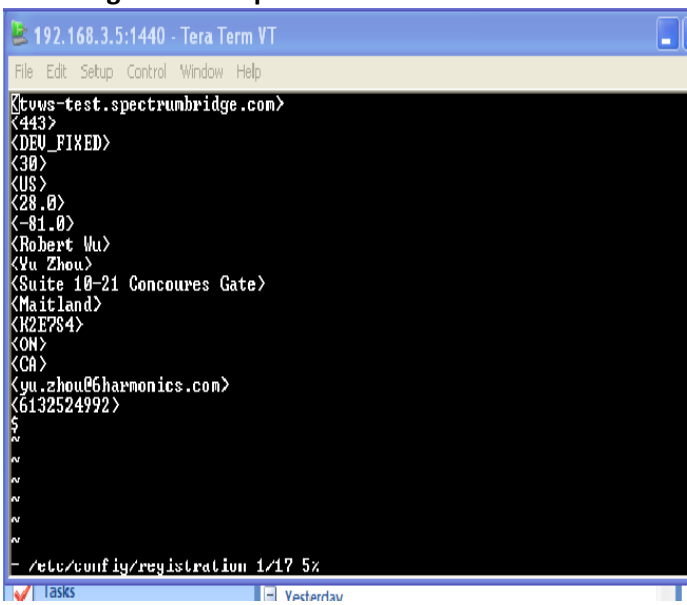
§15.713(f)(3) Fixed TVBD Registration

a) Successful Registration, 15.713(f)(3) – Fixed TVBD with direct connection to Internet (Base Station)

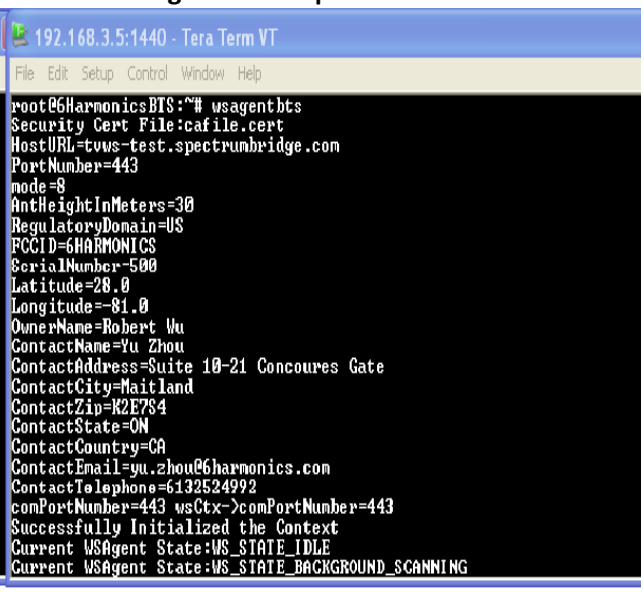
Test procedure:
Configure the EUT with the required registration information. Verify the required registration information is sent and stored in the white space data base.
Successful registration should be verified by accessing the WSDB registration interface and also the EUT status information page.

Test pre-conditions:
The FCC ID and the serial # of the radio are programmed in the firmware of the radio and cannot be modified with the EUT configuration web tool. A known acceptable location was put into the TVBD.
The TVBD was configured as follows and the information submitted for registration to the WSDB**.**

Radio Registration Input File



Radio Registration Input



Test Results:

The registration request and the response for the successful registration can be seen on the WSDB log below.

Date	Ip	Url	Status	RT (ms)	Data
8/8/2013 5:17:21 PM	71.43.255.210	/v3/channels/US/28.0/-81.0/?fccid=6HARMONICS&serial=500&type=8	Success (0)	826	Response
8/8/2013 5:17:20 PM	71.43.255.210	/v3/devices/US/6HARMONICS/500	Success (0)	313	Request

```
<?xml version="1.0" encoding="utf-16"?>
<RegistrationRequest xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <DeviceType>Fixed</DeviceType>
  <Latitude>28.0</Latitude>
  <Longitude>-81.0</Longitude>
  <AntennaHeight>15</AntennaHeight>
  <DeviceOwner>Robert Wu</DeviceOwner>
  <ContactName>Yu Zhou</ContactName>
  <ContactStreet>1021 Westgate Rd</ContactStreet>
  <ContactCity>Maitland</ContactCity>
  <ContactState>ON</ContactState>
  <ContactZip />
  <ContactCountry>CA</ContactCountry>
  <ContactEmail>Yu.Zhou@6Harmonics.com</ContactEmail>
  <ContactPhone>6132524992</ContactPhone>
</RegistrationRequest>
```

Successful Registration

Result: PASS

b) Successful Registration, 15.713(f)(3) – Fixed TVBD without a direct connection to the internet(Subscriber)

Test procedure:

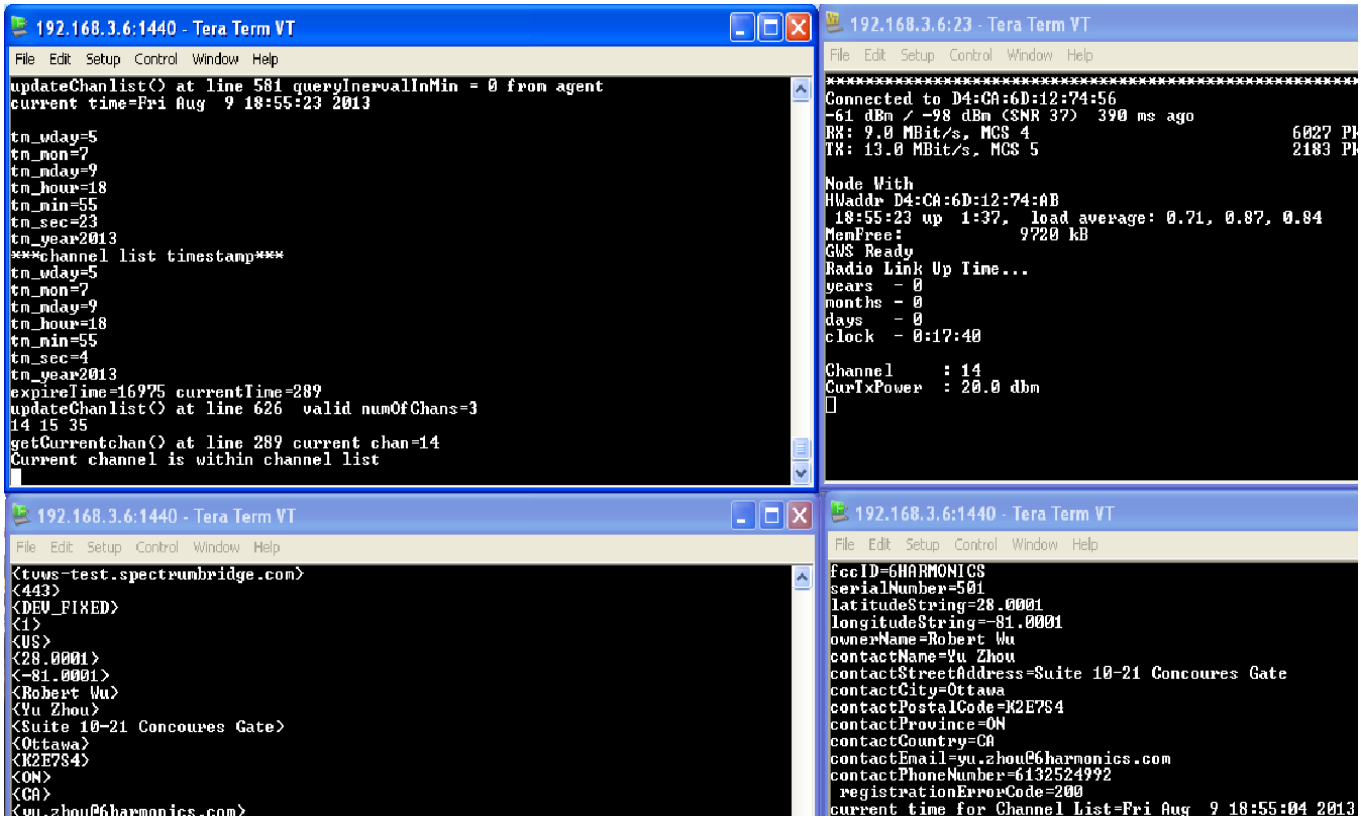
Configure the base station with the required registration information. Verify that the required registration information is sent and stored in the white space data base.

Operating channel should be verified on the subscriber (radio without the internet connection) using the EUT GUI

Test pre-conditions:

The Base station TVBD was configured and the information submitted for registration to the WSDB**.**
The subscriber operating channel was verified with the GUI.

Radio Record



Test Results:

The registration request and the response for the successful registration can be seen on the WSDB log below for the subscriber.

Date	Ip	Url	Status	RT (ms)	Data
8/9/2013 2:38:08 PM	98.191.81.133	/v3/channels/US/28.0001/-81.0001/?fccid=6HARMONICS&serial=501&type=8	Success (0)	860	Response
8/9/2013 2:38:07 PM	98.191.81.133	/v3/devices/US/6HARMONICS/501	Success (0)	296	Request

The WSDB log shown below confirms the successful registration of the subscriber. Operating Channel is 14. The transmitter did not turn ON until the database exchange was successfully completed.

```
<?xml version="1.0" encoding="utf-16"?>
<RegistrationRequest xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <DeviceType>Fixed</DeviceType>
  <Latitude>28.0001</Latitude>
  <Longitude>-81.0001</Longitude>
  <AntennaHeight>1</AntennaHeight>
  <DeviceOwner>Robert Wu</DeviceOwner>
  <ContactName>Yu Zhou</ContactName>
  <ContactStreet>Suite 10-21 Concoures Gate</ContactStreet>
  <ContactCity>Ottawa</ContactCity>
  <ContactState>ON</ContactState>
  <ContactZip>K2E7S4</ContactZip>
  <ContactCountry>CA</ContactCountry>
  <ContactEmail>yu.zhou@6harmonics.com</ContactEmail>
  <ContactPhone>6132524992</ContactPhone>
</RegistrationRequest>
<?xml version="1.0" encoding="utf-16"?>
<ChannelResponse xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <ChannelCount>10</ChannelCount>
  <ChannelList>2,5,6,7,8,9,13,14,15,35</ChannelList>
  <RefreshIn>48</RefreshIn>
</ChannelResponse>
```

Result: PASS

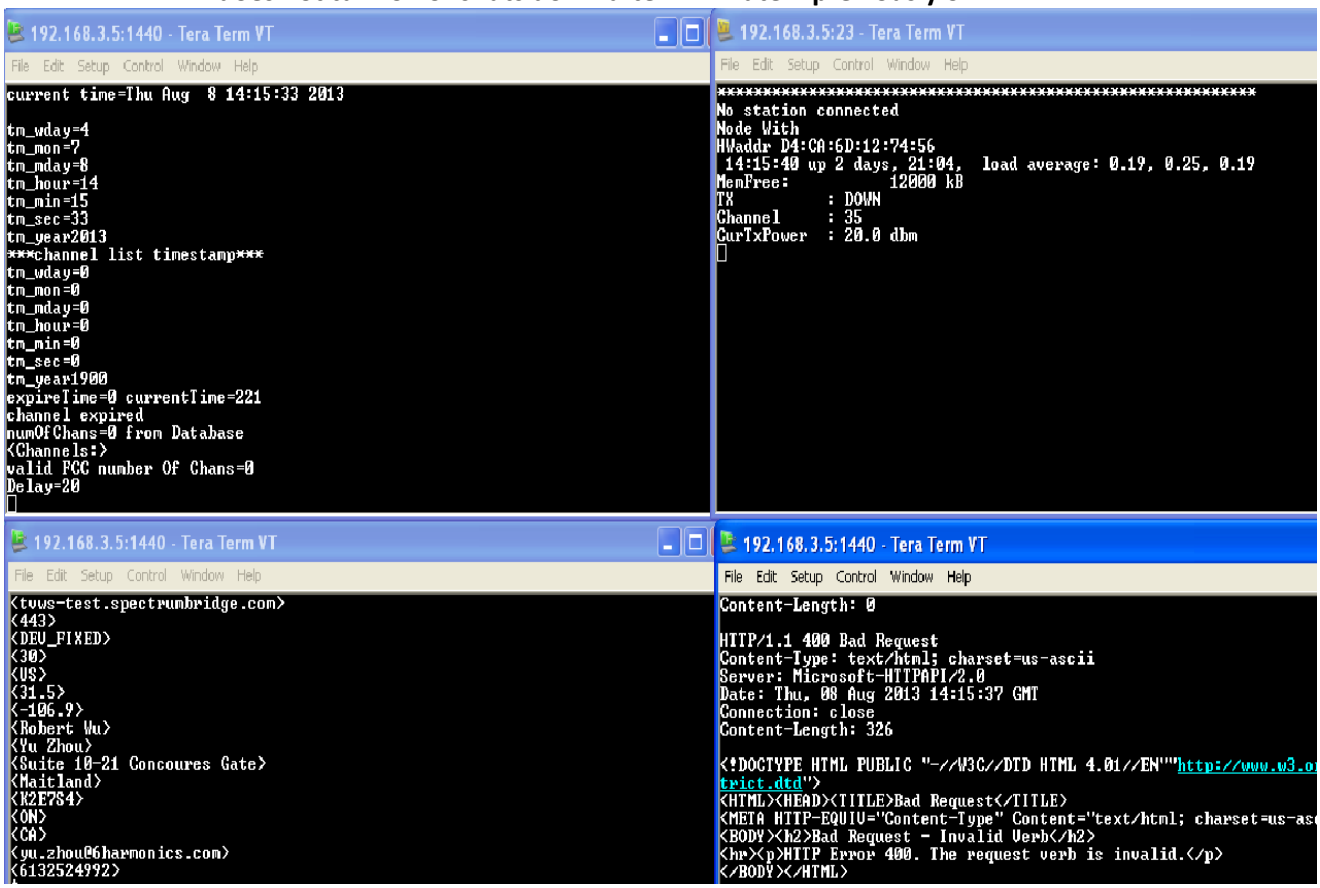
c) Unsuccessful Registration, 15.713(f)(3) – Restricted co-ordinates

Test Procedure:
Configure the EUT with restricted co-ordinates (Outside US Regulatory boundaries, example 31.5, -106.9).
Verify the required registration information is sent and stored in the white space data base.
Registration failure should be verified by accessing the WSDB registration interface and also the EUT GUI.

Test Pre-conditions:
A location outside US regulatory boundaries (31.5, -106.9) was entered into the radio and the information submitted for registration to the WSDB**.**

Radio Record

TX does not turn on or shuts down after 1 minute if previously on.



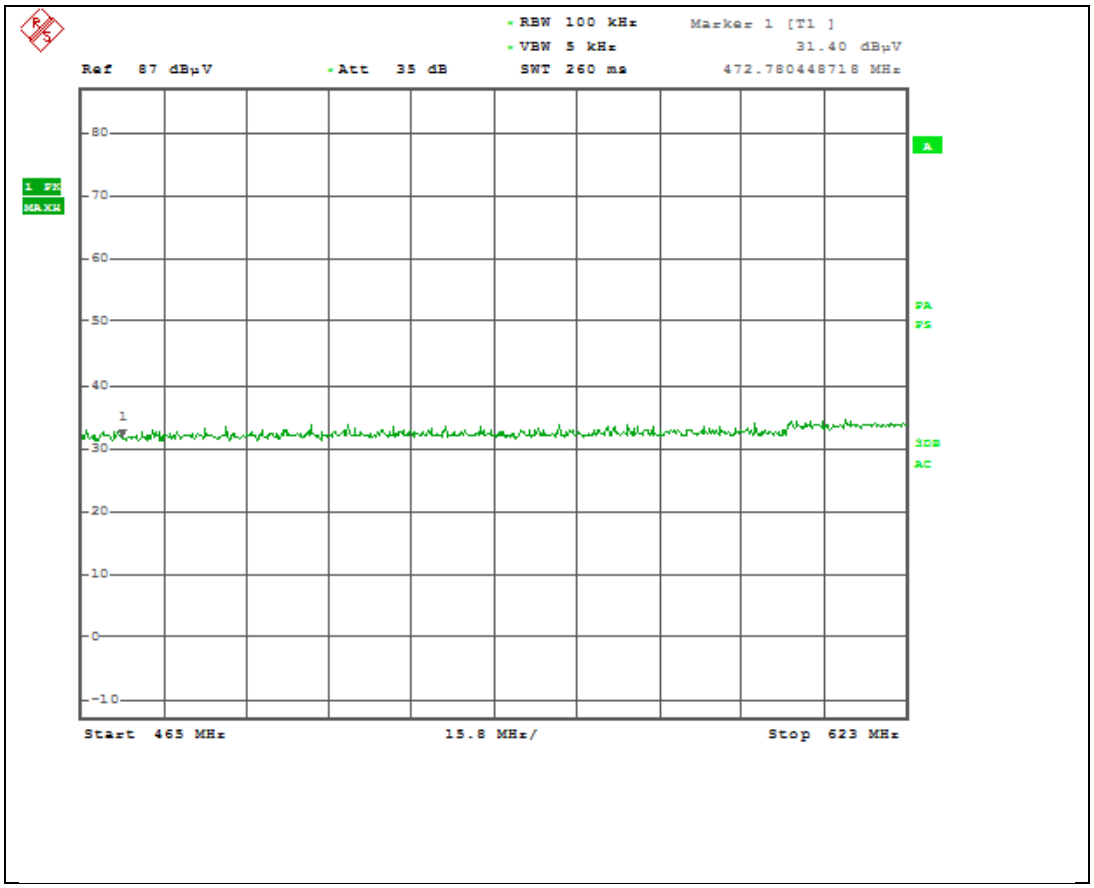
Test Results:

The failed registration with the reason for failure can be seen on the WSDB log below.

Date	Ip	Url	Status	RT (ms)	Data
8/8/2013 10:04:44 AM	71.43.255.210	/v3/devices/US/6HARMONICS/500	LocatedOutsideRegulatoryDomain (9)	156	Request

```
<?xml version="1.0" encoding="utf-16"?>
<RegistrationRequest xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <DeviceType>Fixed</DeviceType>
  <Latitude>31.5</Latitude>
  <Longitude>-106.9</Longitude>
  <AntennaHeight>30</AntennaHeight>
  <DeviceOwner>Robert Wu</DeviceOwner>
  <ContactName>Yu Zhou</ContactName>
  <ContactStreet>Suite 10-21 Concoures Gate</ContactStreet>
  <ContactCity>Maitland</ContactCity>
  <ContactState>ON</ContactState>
  <ContactZip>K2E7S4</ContactZip>
  <ContactCountry>CA</ContactCountry>
  <ContactEmail>yu.zhou@6harmonics.com</ContactEmail>
  <ContactPhone>6132524992</ContactPhone>
</RegistrationRequest>
```

Spectrum Analyzer plot:



Unsuccessful Registration, no tx

Result: PASS

d) Unsuccessful Registration, 15.713(f)(3) – Incomplete Contact Information

Test Procedure:

Configure the EUT with Incomplete Information (e.g. Contact information). Verify the required registration information is sent and stored in the white space data base.

Registration failure should be verified by accessing the WSDB registration interface and also the EUT.

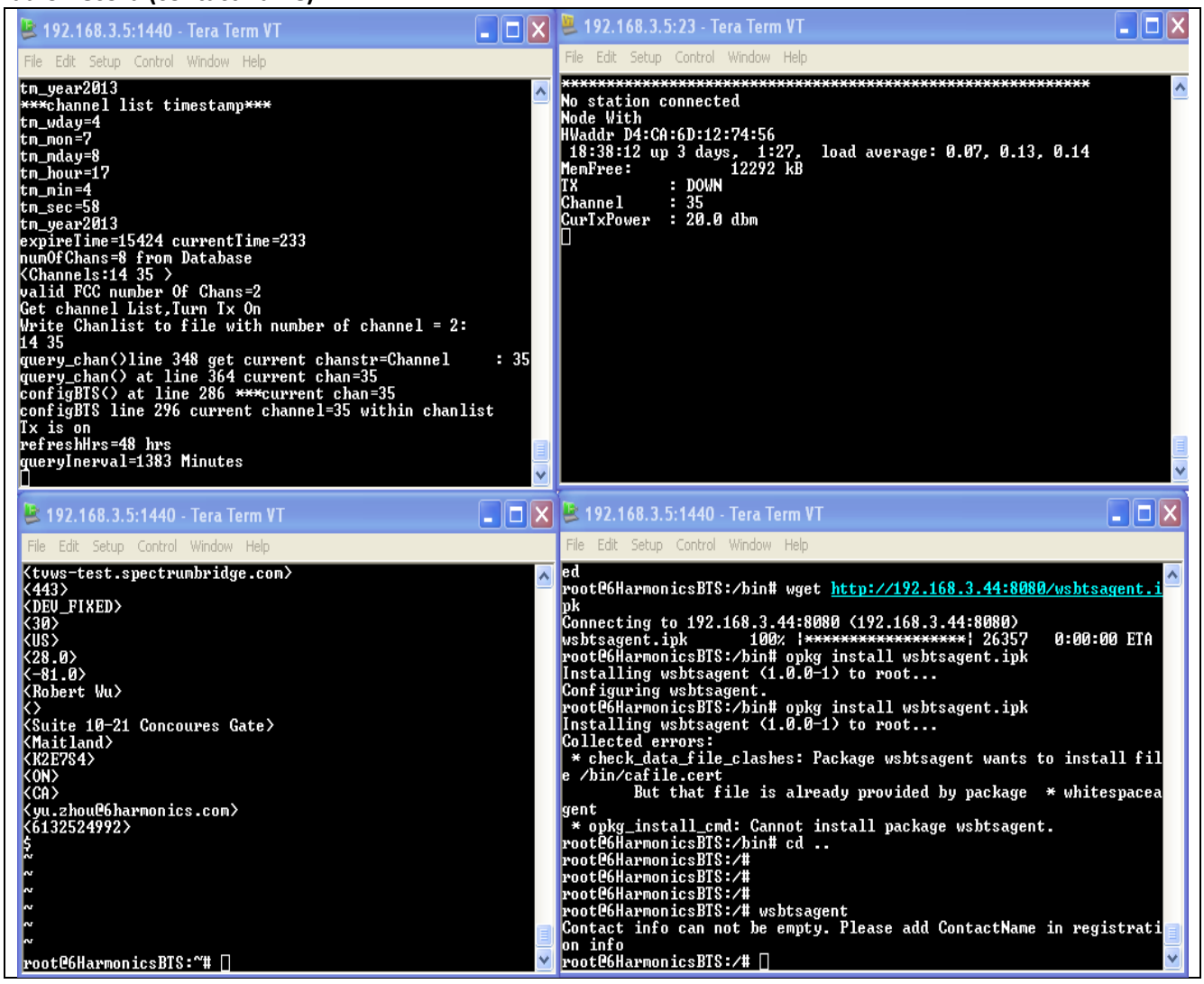
Test Pre-conditions:

The 'Contact Name' Information field should be left blank**.**

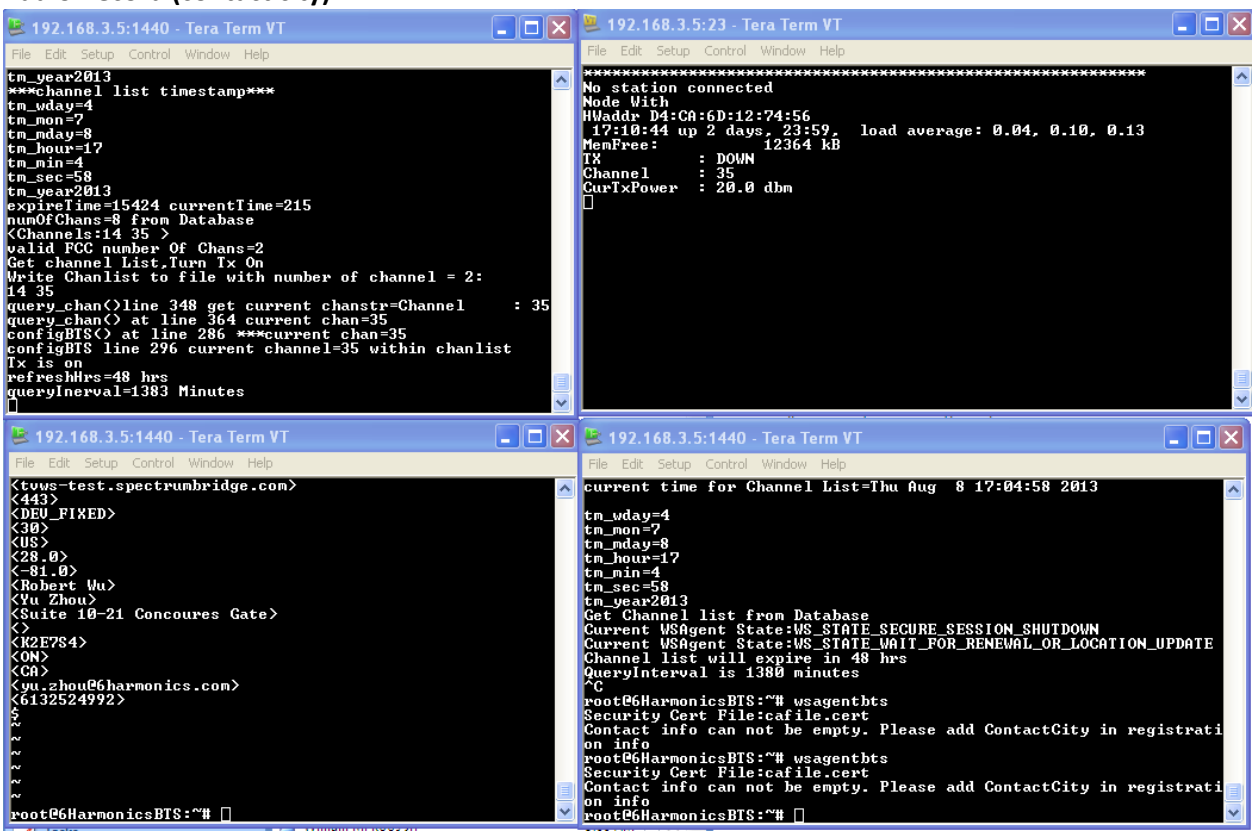
Test Results:

There was no attempted WSDB registration and the Base Station transmitter was off

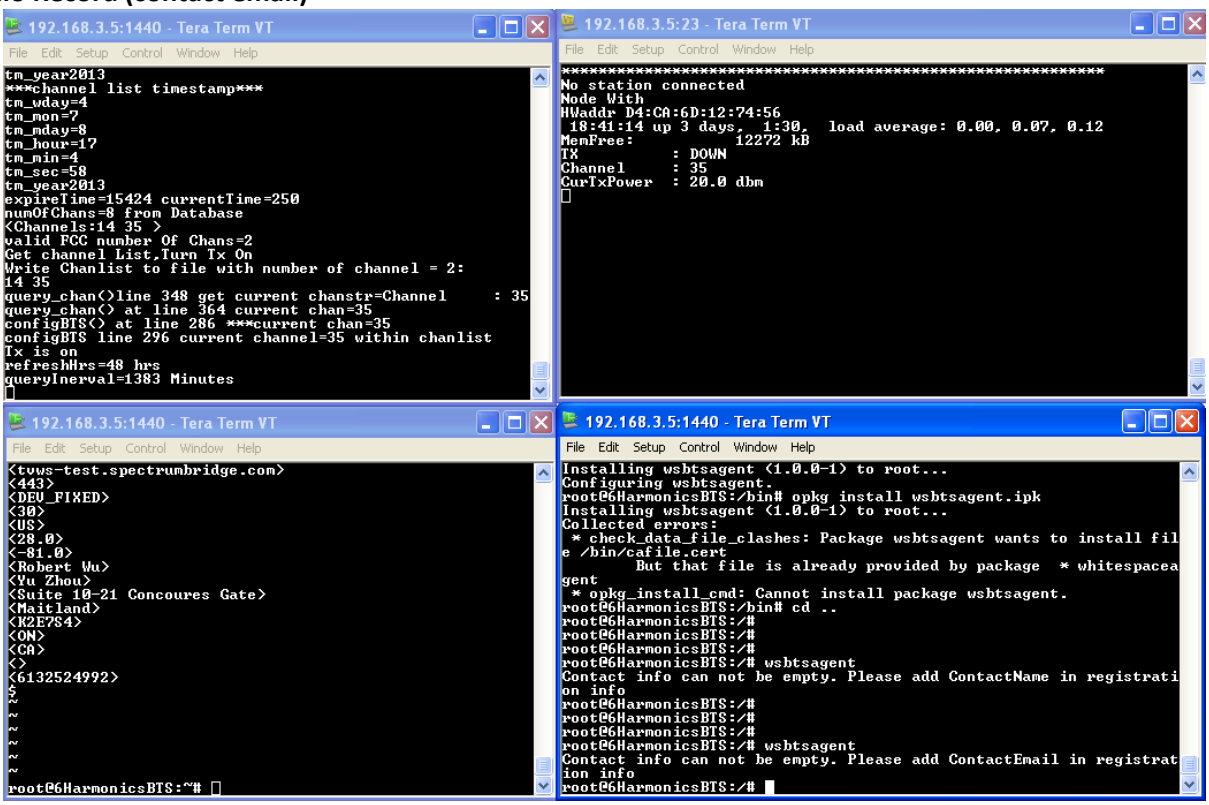
Radio Record (contact name)



Radio Record (contact city)



Radio Record (contact email)



Test Results:

The TVBD shown above confirms the failed registration. No registration request was sent to the WSDB. All combinations of missing information were tried and the behavior verified. The TVBD does not send a registration request to WSDB with missing contact information.

The transmitter did not turn ON. Spectrum analyzer was used to verify no transmission.

Result: PASS

e) Unsuccessful Registration, 15.713(f)(3) – HAAT > 250m

Test Procedure:

Configure the EUT with such that HAAT>250m. Verify the required registration information is sent and stored in the white space data base.

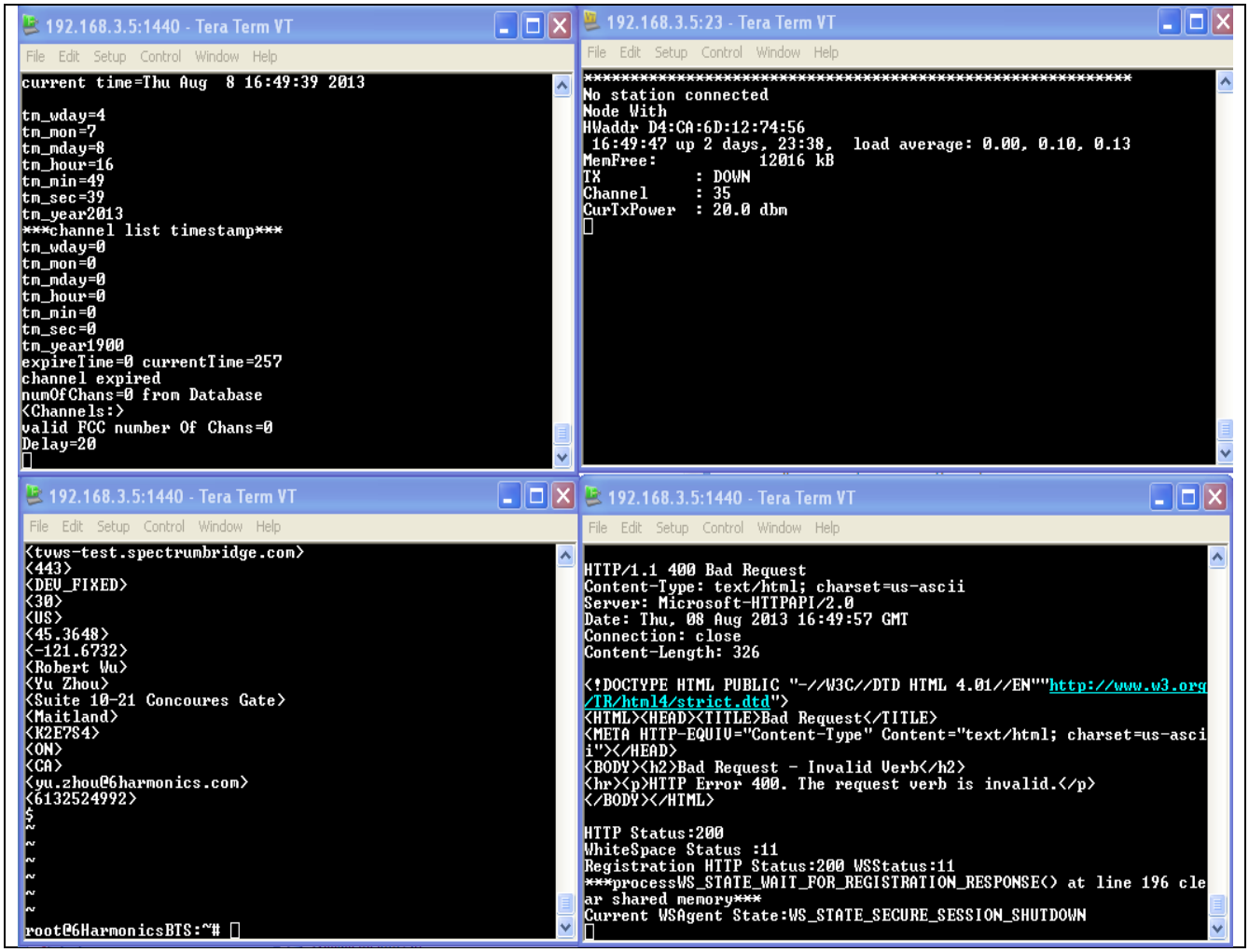
Registration failure should be verified by accessing the WSDB registration interface and also the EUT status web page.

Test Pre-conditions:

.

A location with a HAAT> 250 m (Derived from location, invalid HAAT example - Mt. Hood 45.3648, -121.6732) was entered into the radio and the information submitted for registration to the WSDB**.**

Radio Record



Test Results:

The failed registration with the reason for failure can be seen on the WSDB log below.

Date	Ip	Url	Status	RT (ms)
8/8/2013 12:49:41 PM	71.43.255.210	/v3/devices/US/6HARMONICS/500	HaatAbove250m (11)	406

```
<?xml version="1.0" encoding="utf-16"?>
<RegistrationRequest xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <DeviceType>Fixed</DeviceType>
  <Latitude>45.3648</Latitude>
  <Longitude>-121.6732</Longitude>
  <AntennaHeight>30</AntennaHeight>
  <DeviceOwner>Robert Wu</DeviceOwner>
  <ContactName>Yu Zhou</ContactName>
  <ContactStreet>Suite 10-21 Concoures Gate</ContactStreet>
  <ContactCity>Maitland</ContactCity>
  <ContactState>ON</ContactState>
  <ContactZip>K2E7S4</ContactZip>
  <ContactCountry>CA</ContactCountry>
  <ContactEmail>yu.zhou@6harmonics.com</ContactEmail>
  <ContactPhone>6132524992</ContactPhone>
</RegistrationRequest>
```

The transmitter did not turn ON. Spectrum analyzer was used to verify no transmission.

Result: PASS

f) Unsuccessful Registration, 15.713(f)(3) –Antenna Height AGL> 30m

Test Procedure:

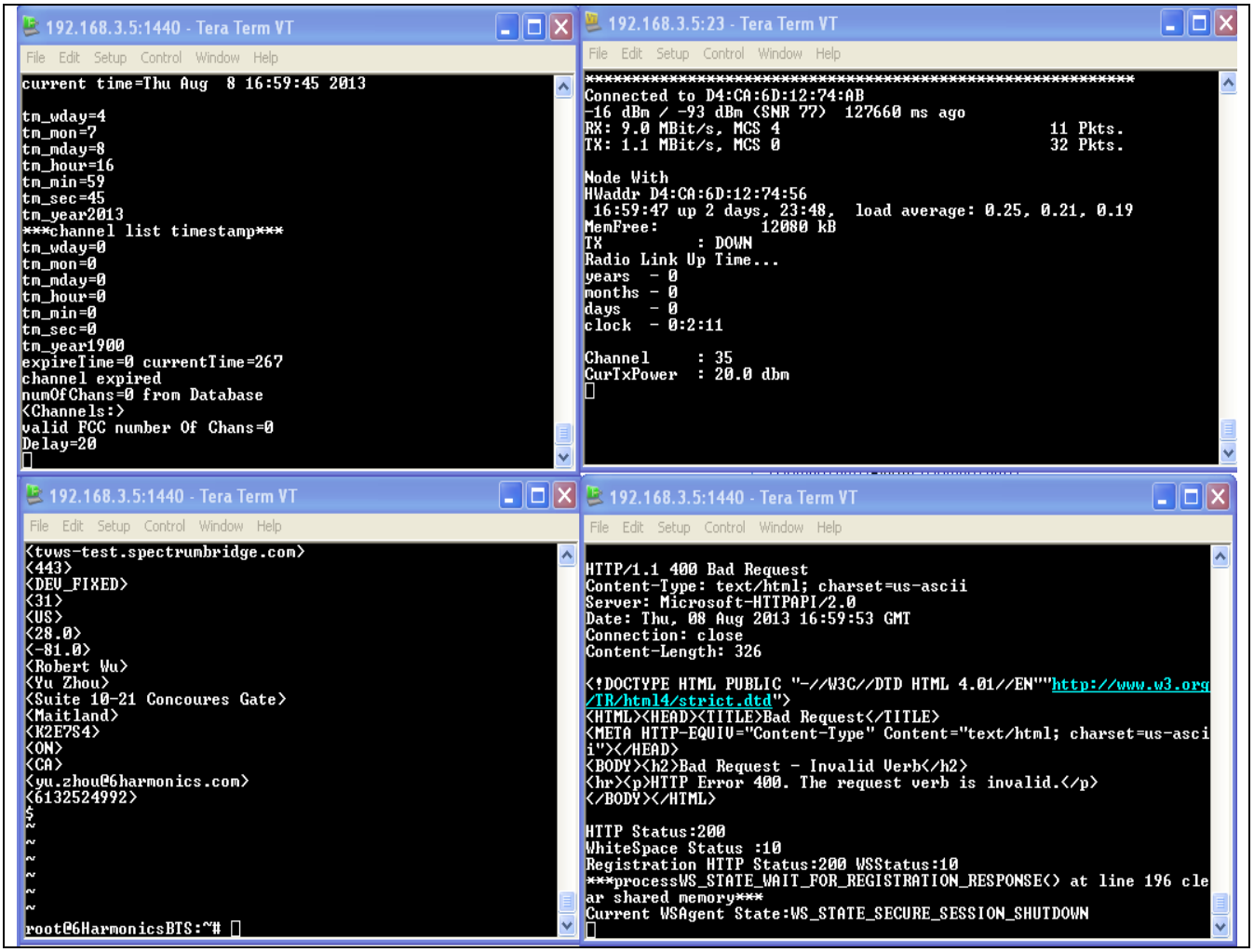
Configure the EUT with such that AGL>30m. Verify the required registration information is sent and stored in the white space data base.

Registration failure should be verified by accessing the WSDB registration interface and also the EUT status web page.

Test Pre-conditions:

Antenna height = 31 m was entered into the radio and the information submitted for registration to the WSDB**.**

Radio Record



Test Results:

The failed registration with the reason for failure can be seen on the WSDB log below.

Date	Ip	Url	Status	RT (ms)	Data
8/8/2013 12:58:52 PM	71.43.255.210	/v3/devices/US/6HARMONICS/500	AntennaHeightAbove30m (10)	0	Request

```
<?xml version="1.0" encoding="utf-16"?>
<RegistrationRequest xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <DeviceType>Fixed</DeviceType>
  <Latitude>28.0</Latitude>
  <Longitude>-81.0</Longitude>
  <AntennaHeight>31</AntennaHeight>
  <DeviceOwner>Robert Wu</DeviceOwner>
  <ContactName>Yu Zhou</ContactName>
  <ContactStreet>Suite 10-21 Concoures Gate</ContactStreet>
  <ContactCity>Maitland</ContactCity>
  <ContactState>ON</ContactState>
  <ContactZip>K2E7S4</ContactZip>
  <ContactCountry>CA</ContactCountry>
  <ContactEmail>yu.zhou@6harmonics.com</ContactEmail>
  <ContactPhone>6132524992</ContactPhone>
</RegistrationRequest>
```

The transmitter did not turn ON. Spectrum analyzer was used to verify no transmission.

Result: PASS

g) Unsuccessful Registration, 15.713(f)(3) – FCC ID, Serial Number

The registration interface does not contain a mechanism by which the FCC ID of the radio can be changed. The FCC ID is flash programmed during the manufacturing process and cannot be changed without being returned to the manufacturer.

The registration interface does not contain a mechanism by which the serial number of the radio can be changed. The serial number is flash programmed during the manufacturing process and cannot be changed without being returned to the manufacturer.

§15.707(a) Fixed TVBD Relocated

Confirm that the database will not provide a channel list for a Fixed TVBD at a location other than that registered.

Test Procedure:

- ✓ Configure the fixed device with a location that will yield an authorized channel list. Verify proper channel operation using a spectrum analyzer and the device management interface.
- ✓ Reconfigure (change) the configured location of the fixed device. Power cycle the device.
- ✓ Verify that the fixed device receives a channel map request exception, and does not transmit using white space frequencies using a spectrum analyzer and the device management interface.

Test Data:

WSDB Log for successful registration of the EUT:

Simulator requesting a channel list on a location different from where it was registered:

WSDB Log for the response to the TVBD relocated channel request:

Date	Ip	Url	Status	RT (ms)	Data
8/8/2013 6:09:27 PM	71.43.255.210	/v3/channels/US/34.091/-107.42/?fccid=6HARMONICS&serial=5018&type=8&ant=15	RequestDoesNotMatchRegistration (14)	210	

Result: PASS

§15.711(b)(3)(iii) Fixed & Mode II TVDB Database Update

Test Procedure:
Using a programmable router or similar network device, block the access to the database URL or IP address from the TVBD. Confirm that the TVBD shuts down by 11:59 PM on the following day.

- ✓ Configure the fixed or Mode II device with a location that will yield an authorized channel list. Verify proper channel operation using a spectrum analyzer and the device management interface.
- ✓ Restrict the access to the database.
- ✓ Verify that the device does not transmit using white space frequencies after 23:59 hrs. Verify using a spectrum analyzer and the device management interface.

Test Results:

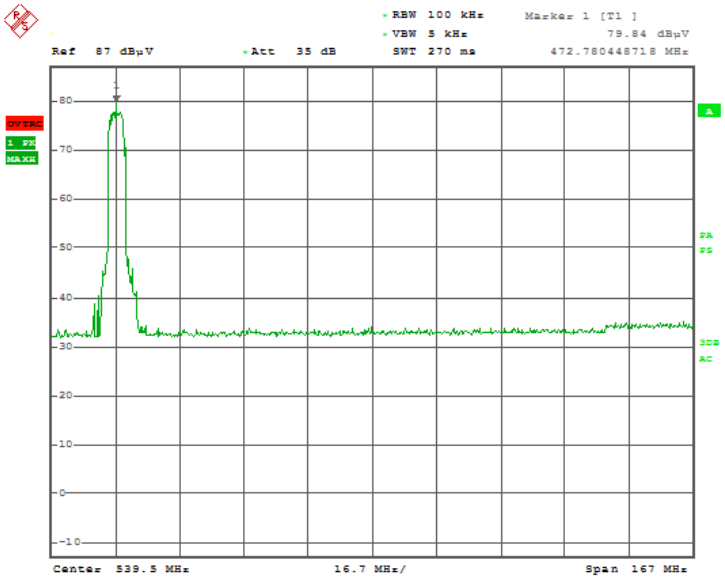
8/05/2013 4:11pm – Last successful base station channel request.

8/5/2013 4:11:55 PM	71.43.255.210	/v3/channels/US/28.0/-81.0/?fccid=6HARMONICS&serial=500&type=8&ant=30	Success (0)	830	Response
8/5/2013 4:11:54 PM	71.43.255.210	/v3/devices/US/6HARMONICS/500	Success (0)	250	Request

8/05/2013 4:21pm – A laptop is connected to the terminal radio and a ping is started to the WSDB across the WS radio link to the base station and out to the internet through the commercial router.
8/5/2013 4:23pm – The WAN connection between the Internet and the commercial router in the test set up is disconnected/blocked
8/5/2013 4:23pm – The base station transmitter stays on, the ping to the commercial router gateway across the wireless link continues successfully and is stored in a log.

Pinging 192.168.3.1 with 32 bytes of data:
Reply from 192.168.3.1: bytes=32 time=8ms TTL=64
Ping statistics for 192.168.3.1:
Packets: Sent = 1, Received = 1, Lost = 0 (0% loss),
Approximate round trip times in milliseconds:
Minimum = 8ms, Maximum = 8ms, Average = 8ms
Mon 08/05/2013 at 16:23:55.11

The device was initially powered up and it successfully registered with the database at approximately 4:10 PM. The device received a channel list and started transmitting on channel 14. The connection to the database was then blocked, while maintaining regular access to the internet.



Device transmitting on CH 14

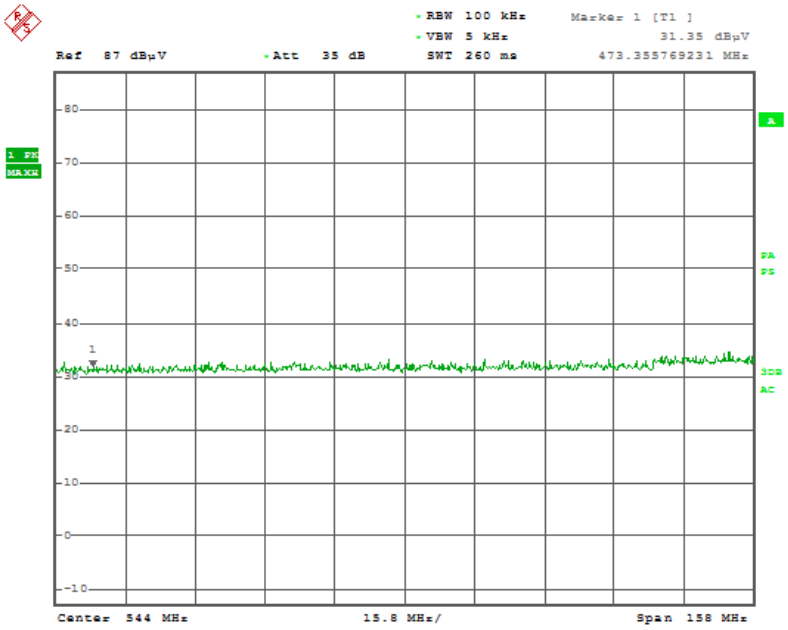
8/6/2013 11:17am - The base station transmitter turns off and the wireless link goes down, Ping to the WSDB across the wireless link fails approximately 23 hours and 2 minutes after the last successful channel request.

Transmitter On

Ping statistics for 192.168.3.1:
Packets: Sent = 1, Received = 1, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 7ms, Maximum = 7ms, Average = 7ms
Tue 08/06/2013 at 15:12:55.11

Transmitter OFF
Pinging 192.168.3.1 with 32 bytes of data:
Reply from 192.168.3.40: Destination host unreachable.
Ping statistics for 192.168.3.1 :
Packets: Sent = 1, Received = 0, Lost = 1 (100% loss),
Tue 08/06/2013 at 15:13:55.20

The following spectrum analyzer plot was captured to make sure the transmission had stopped.



Result: PASS

§15.711(b)(3)(i)(ii), §15.713(a)(1) 48 Hour Channel Scheduling

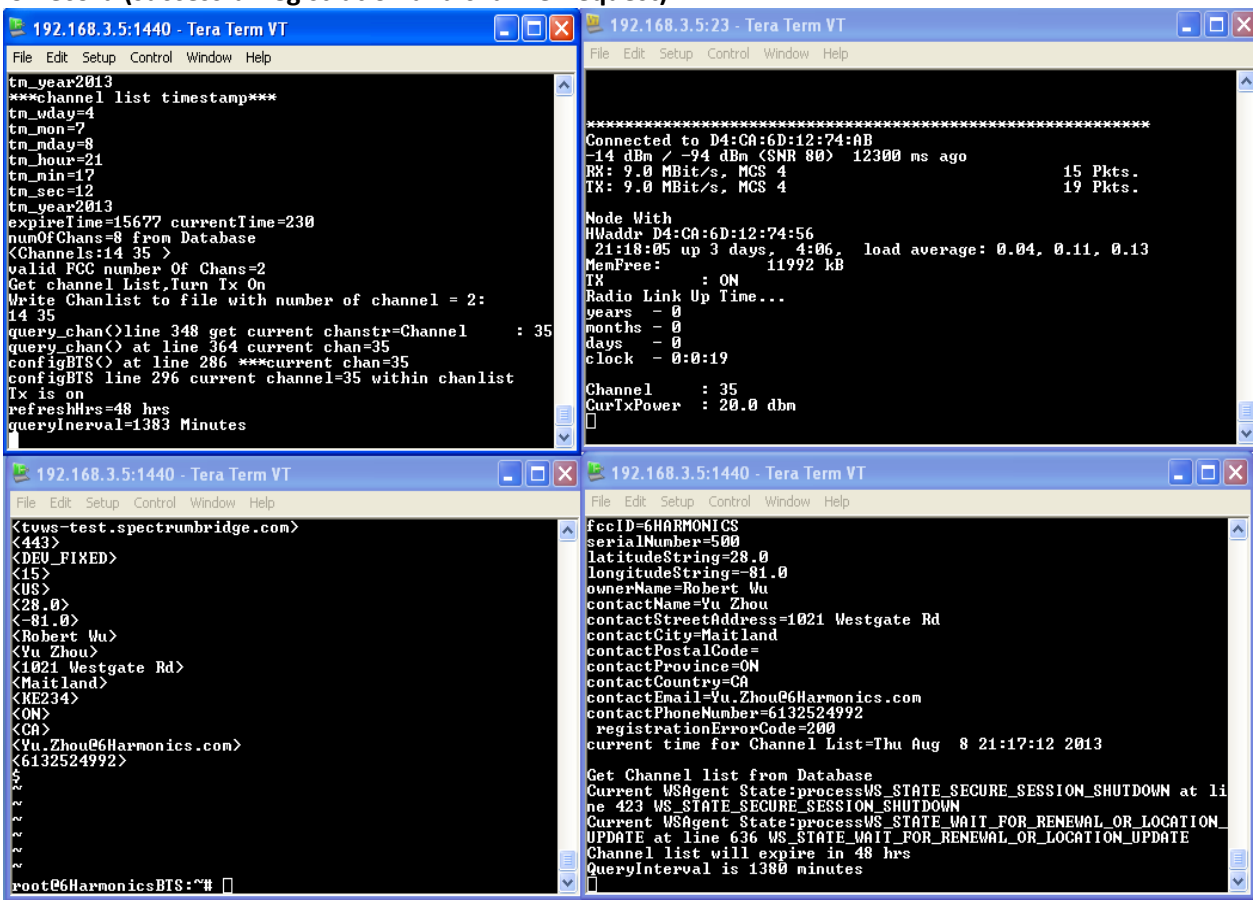
Use the database interface to register protection for a low-power auxiliary device for the same location and channel on which the TVDB (EUT) has selected and is operating. The registered protection for the low-power auxiliary device should be scheduled for protection within the next 48 hour period.

Test Procedure:

- ✓ Configure the TVBD (EUT) such that it can access the database.
- ✓ Verify that EUT requests and receives a valid channel list. Verify the EUT is using an authorized channel using a spectrum analyzer and the device management interface.
- ✓ Use the database interface to register protection for a low-power auxiliary device for the same location and channel on which the TVDB (EUT) has selected and is operating. The registered protection for the low-power auxiliary device should be scheduled for protection within the next 48 hour period.
- ✓ Verify that the EUT requests and receives a new channel list at the scheduled time of the registered low-power channel protection is to take effect.
- ✓ Verfiy the new channel map does not contain the channel previously protected when the low-power auxiliary device was registered.
- ✓ Verify the EUT is operating on a different channel from what was previously used and subsequently reserved using a spectrum analyzer and the device management interface.

Test Data:

Radio Record (successful registration and channel request)



Operating Channel before an auxiliary device is registered.

The EUT was registered (at 5:17 PM) and verified that a valid channel list was received. The device was transmitting on channel 35.

WSDB Log:

Date	Ip	Url	Status	RT (ms)	Data
8/8/2013 5:17:21 PM	71.43.255.210	/v3/channels/US/28.0/-81.0/?fccid=6HARMONICS&serial=500&type=8	Success (0)	826	Response
8/8/2013 5:17:20 PM	71.43.255.210	/v3/devices/US/6HARMONICS/500	Success (0)	313	Request

The refresh time was verified by clicking on 'response' hyperlink on the WSDB website. The channel list refresh time is indicated to be 48 Hours.

```
<?xml version="1.0" encoding="utf-16"?>
<RegistrationRequest xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <DeviceType>Fixed</DeviceType>
  <Latitude>28.0</Latitude>
  <Longitude>-81.0</Longitude>
  <AntennaHeight>15</AntennaHeight>
  <DeviceOwner>Robert Wu</DeviceOwner>
  <ContactName>Yu Zhou</ContactName>
  <ContactStreet>1021 Westgate Rd</ContactStreet>
  <ContactCity>Maitland</ContactCity>
  <ContactState>ON</ContactState>
  <ContactZip />
  <ContactCountry>CA</ContactCountry>
  <ContactEmail>Yu.Zhou@6Harmonics.com</ContactEmail>
  <ContactPhone>6132524992</ContactPhone>
</RegistrationRequest>
```

```
<?xml version="1.0" encoding="utf-16"?>
<ChannelResponse xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <ChannelCount>8</ChannelCount>
  <ChannelList>2,5,6,8,9,13,14,35</ChannelList>
  <RefreshIn>48</RefreshIn>
</ChannelResponse>
```

Using the database interface here http://whitespaces-test.spectrumbridge.com a low-power auxiliary device was registered for the same location and channel on which the TVDB (EUT) has selected and is operating (CH35). The registered protection for the low-power auxiliary device was scheduled for 4 PM.

Entity Information

Entity Type	Low Power Auxilary Stations
Channel Numbers	35
Transmitter Call Sign	LP001

Usage Schedule

Usage	One Time Event
Time Zone	(UTC-05:00) Eastern Time (US & Canada)
Event Starts	8/8/2013 6:00:00 PM
Event Ends	8/8/2013 7:00:00 PM

Contact Information

Name of Entity Owner	Jim Lancaster
Contact Name	Jim Lancaster
Country	US
Address	1064 Greenwood Blvd
City	Lake Mary
State	FL
Postal Code	32746
Contact Phone	3522427119
Contact Email	j.lancaster@spectrumbridge.com

Location(s)

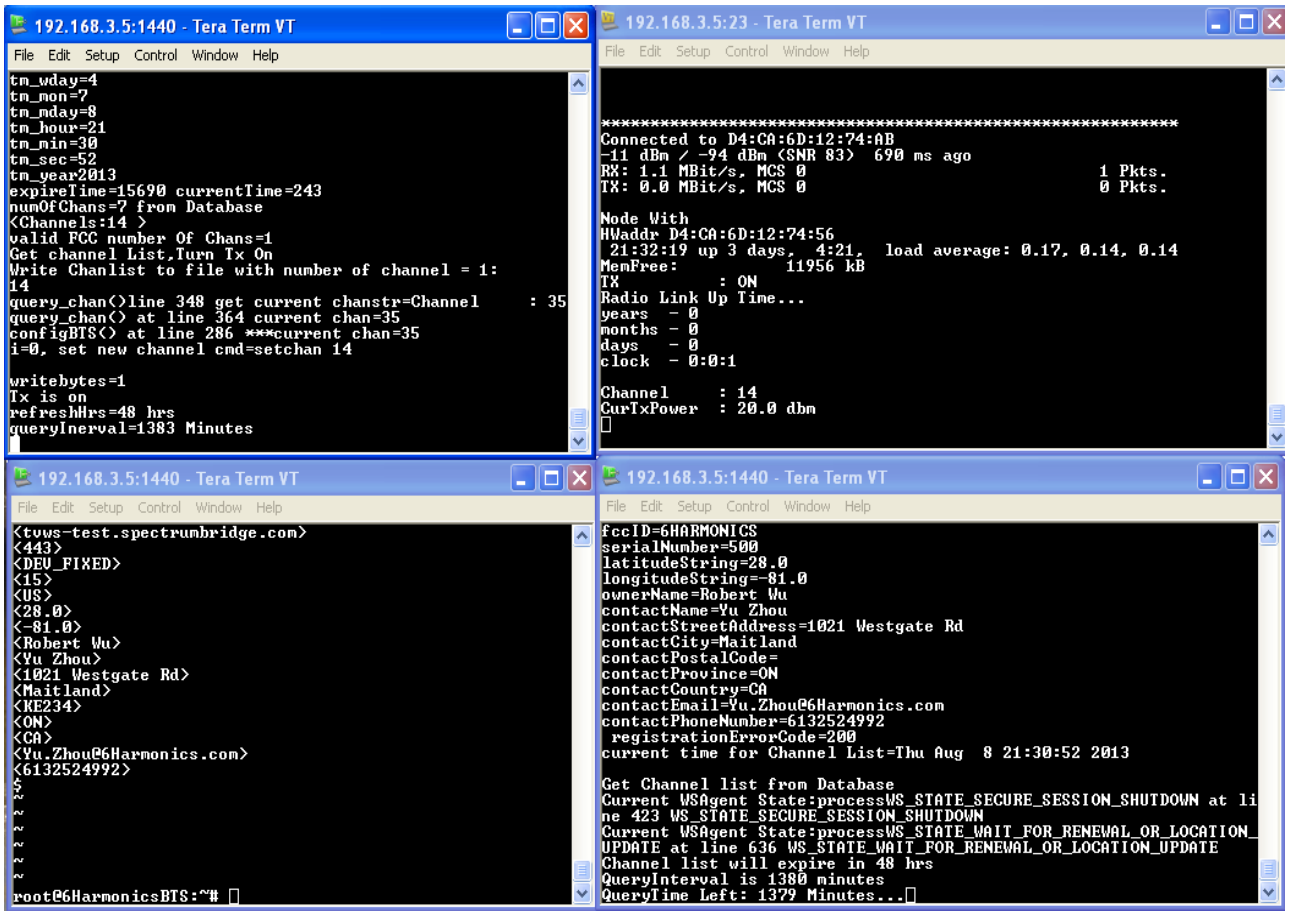
Point: 28 -81

Auxiliary Device Enrollment

Channel Availability after registration of Low Power Auxiliary Device

With the next channel request, the TVBD receives the updated channel list which excludes CH35 and the Transmitter changes channel to 14.

Radio Record



WSDB Record

Date	Ip	Url	Status	RT (ms)	Data
8/8/2013 5:49:04 PM	71.43.255.210	/v3/channels/US/33.62070/-100.3228/?fccid=6HARMONICS&serial=500&type=8	Success (0)	546	Response
8/8/2013 5:49:02 PM	71.43.255.210	/v3/devices/US/6HARMONICS/500	Success (0)	1203	Request

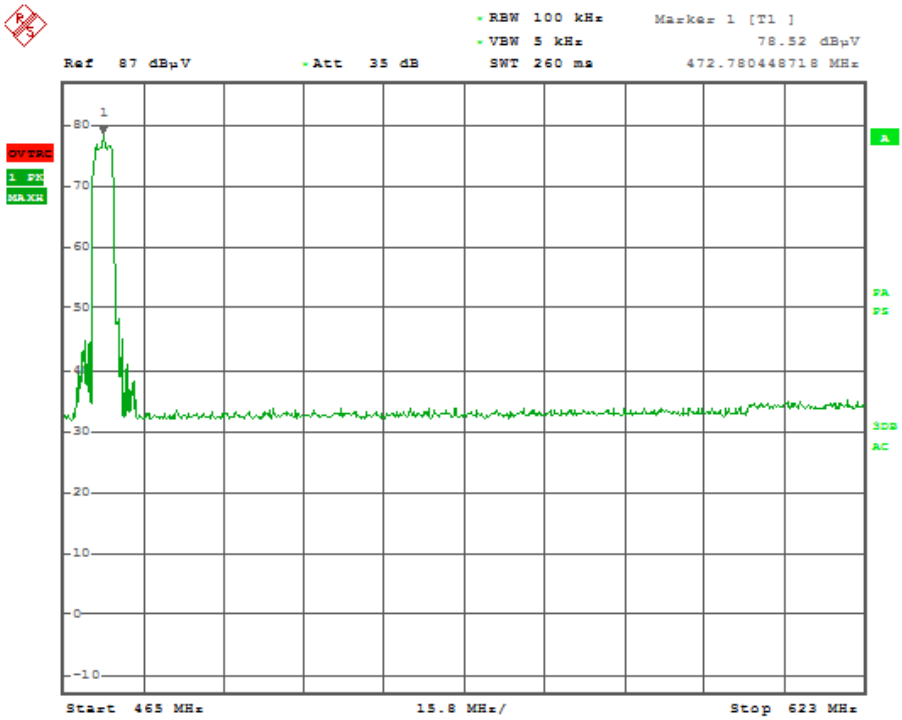
Channel list response :

```
<?xml version="1.0" encoding="utf-16"?>
<RegistrationRequest xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <DeviceType>Fixed</DeviceType>
  <Latitude>33.62070</Latitude>
  <Longitude>-100.3228</Longitude>
  <AntennaHeight>15</AntennaHeight>
  <DeviceOwner>Robert Wu</DeviceOwner>
  <ContactName>Yu Zhou</ContactName>
  <ContactStreet>1021 Westgate Rd</ContactStreet>
  <ContactCity>Maitland</ContactCity>
  <ContactState>ON</ContactState>
  <ContactZip />
  <ContactCountry>CA</ContactCountry>
  <ContactEmail>Yu.Zhou@6Harmonics.com</ContactEmail>
  <ContactPhone>6132524992</ContactPhone>
</RegistrationRequest>
```

```
<?xml version="1.0" encoding="utf-16"?>
<ChannelResponse xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <ChannelCount>45</ChannelCount>

<ChannelList>2,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,3(
  <RefreshIn>48</RefreshIn>
</ChannelResponse>
```

Spectrum Plot: (CH 14 TX)



Results:

After receiving the updated channel listing the EUT changes channel to 14. This was verified by observing the spectrum analyzer.

§15.707, §15.711(b)(3)(i)(ii)(iv),(c), §15.712 TVBD Channel Availability

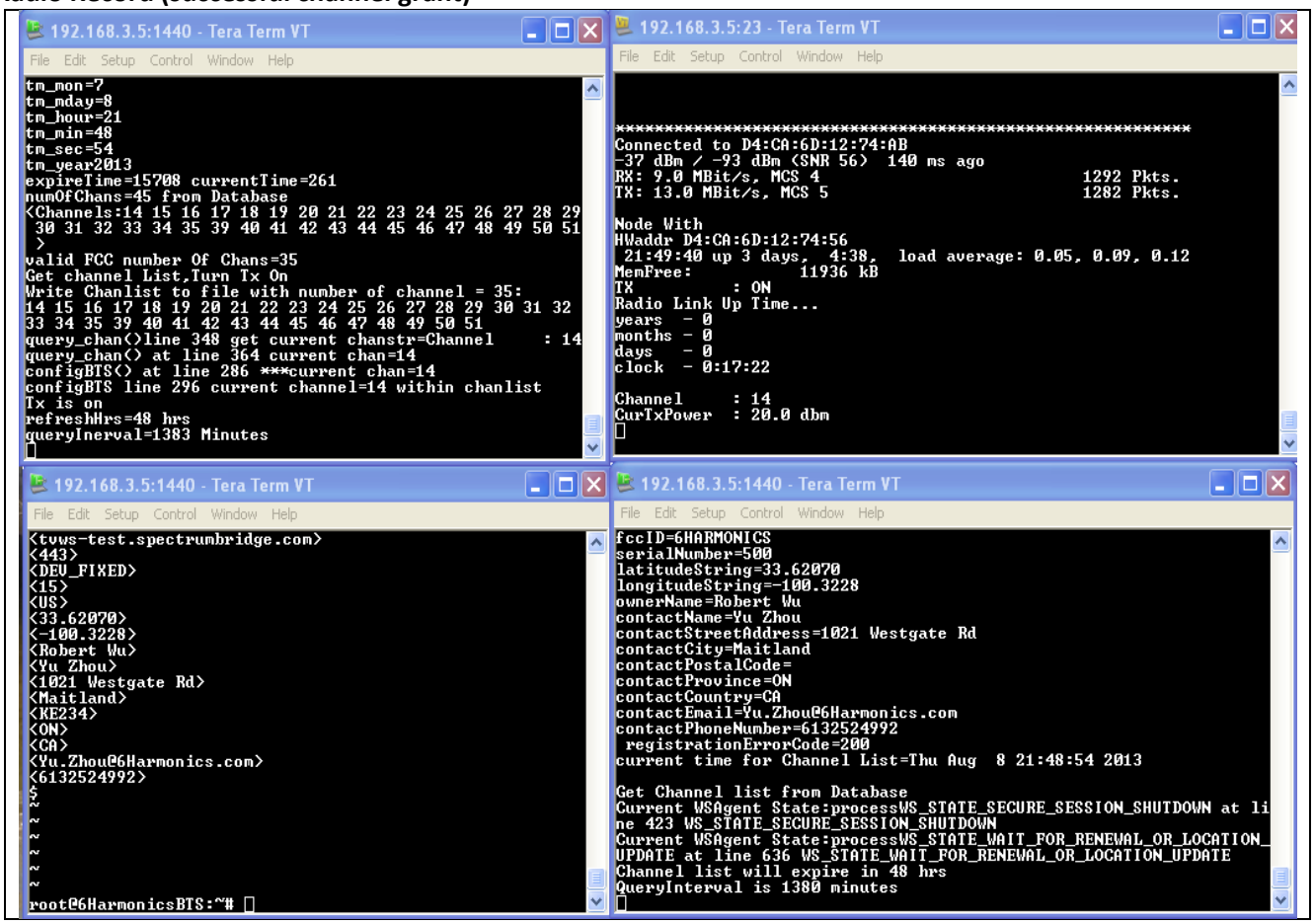
Confirm that the channel list provided by the database conforms with those allowable to the class of TVBD under test. Confirm that the TVBD is operating on a channel from the list at authorized power and cannot be made to operate on an unauthorized channel.

Test Procedure:

1) Register the TVBD with valid location information.
   Verify that the channel list provided by the WSDB conforms to the device type of the TVBD under test.

2) All Device types
   - ✓ Configure and register the devices location (33.62070 N, -100.3228 W) such that the database returns a channel list that does not allow operation on any channel.
   - ✓ Use a spectrum analyzer to verify that the EUT does not transmit on any white space channel.
   - ✓ Verify that the EUT does not transmit on any channel until it successfully registers and receives a channel list

Radio Record (successful channel grant)



Test Result 1:

Date	Ip	Url	Status	RT (ms)	Data
8/8/2013 5:49:04 PM	71.43.255.210	/v3/channels/US/33.62070/-100.3228/?fccid=6HARMONICS&serial=500&type=8	Success (0)	546	Response
8/8/2013 5:49:02 PM	71.43.255.210	/v3/devices/US/6HARMONICS/500	Success (0)	1203	Request

```
<?xml version="1.0" encoding="utf-16"?>
<RegistrationRequest xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <DeviceType>Fixed</DeviceType>
  <Latitude>33.62070</Latitude>
  <Longitude>-100.3228</Longitude>
  <AntennaHeight>15</AntennaHeight>
  <DeviceOwner>Robert Wu</DeviceOwner>
  <ContactName>Yu Zhou</ContactName>
  <ContactStreet>1021 Westgate Rd</ContactStreet>
  <ContactCity>Maitland</ContactCity>
  <ContactState>ON</ContactState>
  <ContactZip />
  <ContactCountry>CA</ContactCountry>
  <ContactEmail>Yu.Zhou@6Harmonics.com</ContactEmail>
  <ContactPhone>6132524992</ContactPhone>
</RegistrationRequest>
```

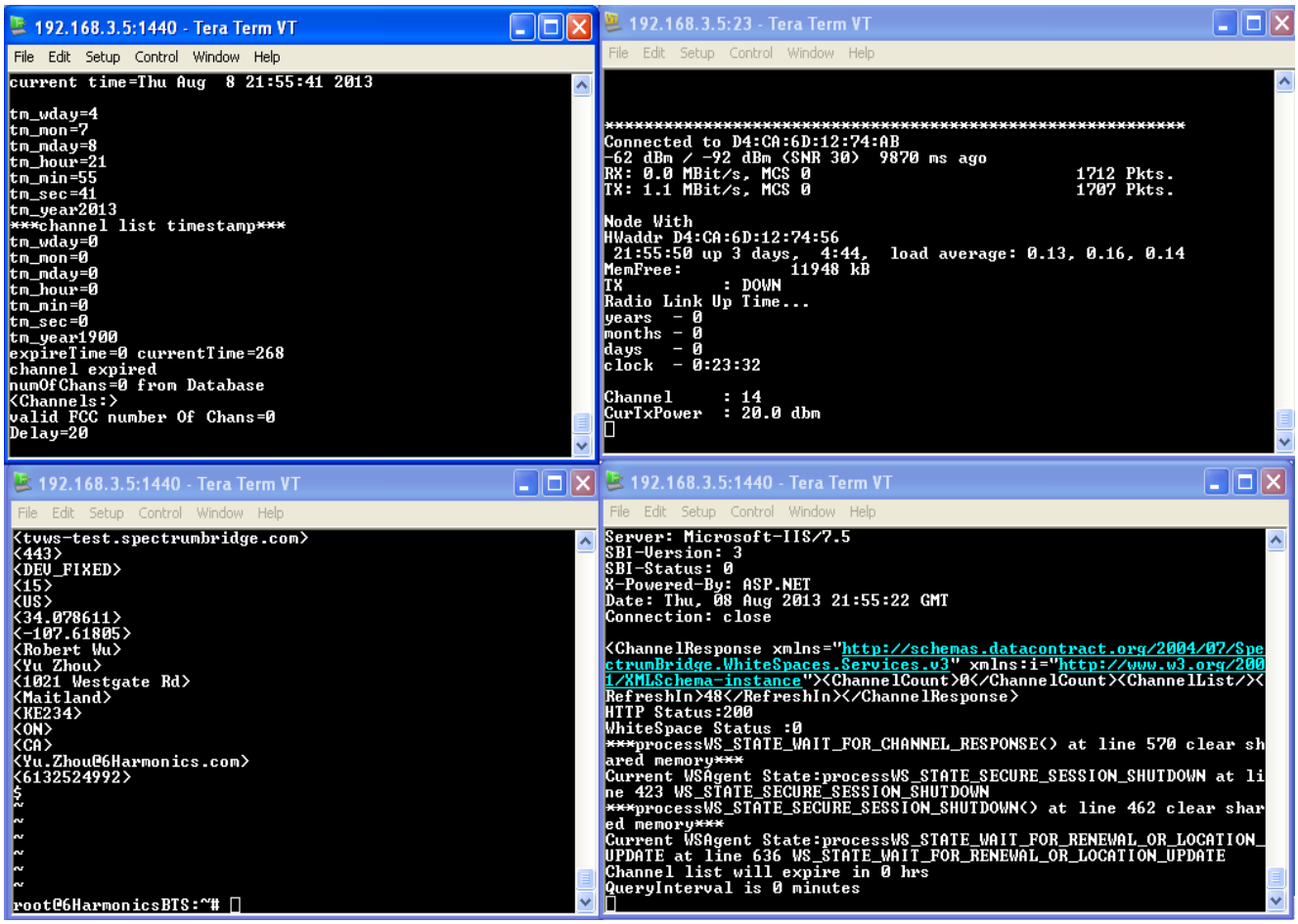
```
<?xml version="1.0" encoding="utf-16"?>
<ChannelResponse xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <ChannelCount>45</ChannelCount>

<ChannelList>2,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,3(
  <RefreshIn>48</RefreshIn>
</ChannelResponse>
```

Test Result 1:
The database identifies the device type correctly and the channel list provided is correct for the device type.

Test Precondition :
A Registration request is sent for a location with no known available channels. Eg: (34.078611, -107.61805)

Radio Record



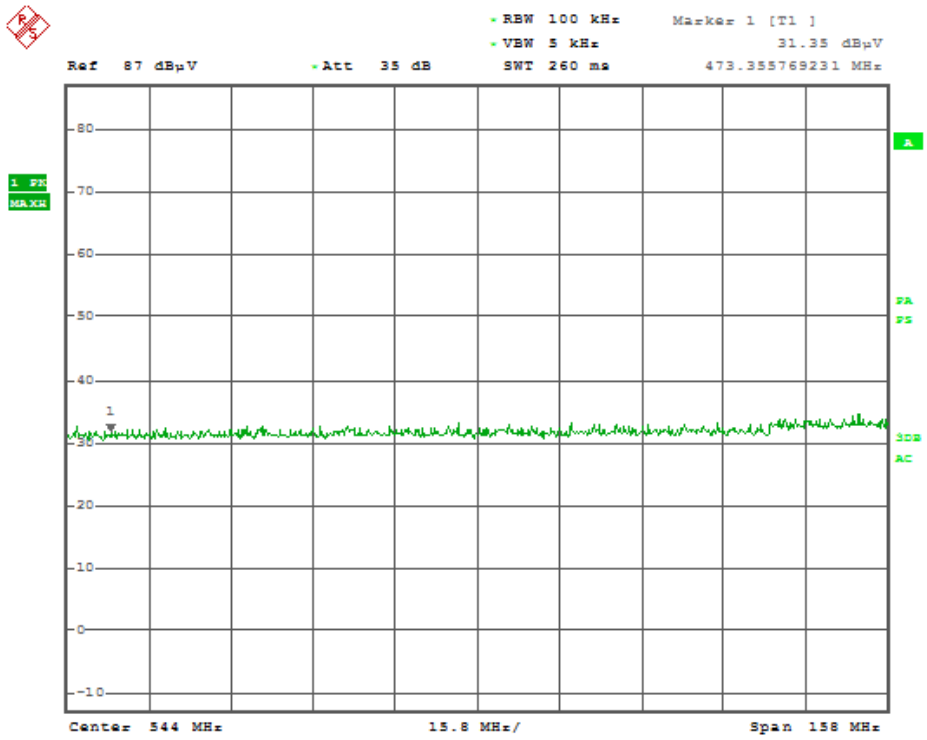
Test Result 2:
An empty channel list is received and the transmitter turned off immediately.

Date	Ip	Url	Status	RT (ms)	Data
8/8/2013 5:57:23 PM	71.43.255.210	/v3/channels/US/34.078611/-107.61805/?fccid=6HARMONICS&serial=500&type=8	Success (0)	360	Response
8/8/2013 5:56:22 PM	71.43.255.210	/v3/channels/US/34.078611/-107.61805/?fccid=6HARMONICS&serial=500&type=8	Success (0)	296	Response
8/8/2013 5:55:22 PM	71.43.255.210	/v3/channels/US/34.078611/-107.61805/?fccid=6HARMONICS&serial=500&type=8	Success (0)	313	Response
8/8/2013 5:54:21 PM	71.43.255.210	/v3/channels/US/34.078611/-107.61805/?fccid=6HARMONICS&serial=500&type=8	Success (0)	406	Response
8/8/2013 5:54:15 PM	71.43.255.210	/v3/devices/US/6HARMONICS/500	Success (0)	6123	Request

```
<?xml version="1.0" encoding="utf-16"?>
<RegistrationRequest xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <DeviceType>Fixed</DeviceType>
  <Latitude>34.078611</Latitude>
  <Longitude>-107.61805</Longitude>
  <AntennaHeight>15</AntennaHeight>
  <DeviceOwner>Robert Wu</DeviceOwner>
  <ContactName>Yu Zhou</ContactName>
  <ContactStreet>1021 Westgate Rd</ContactStreet>
  <ContactCity>Maitland</ContactCity>
  <ContactState>ON</ContactState>
  <ContactZip />
  <ContactCountry>CA</ContactCountry>
  <ContactEmail>Yu.Zhou@6Harmonics.com</ContactEmail>
  <ContactPhone>6132524992</ContactPhone>
</RegistrationRequest>
```

```
<?xml version="1.0" encoding="utf-16"?>
<ChannelResponse xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <ChannelCount>0</ChannelCount>
  <ChannelList />
  <RefreshIn>48</RefreshIn>
</ChannelResponse>
```

Spectrum Analyzer screenshot:



Results: The radio did not/does not transmit until it receives a valid channel list.

§15.711(f) Security:

Please see the attached document, TVBD Secure Communications.pdf