



FCC CFR47 PART 15 SUBPART H

DATABASE TEST REPORT

FOR

FIXED TV BAND DEVICE

MODEL NUMBER: ACRS 2.0

REPORT NUMBER: 13U15452 -5

FCC ID: A2UACRS20F

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Prepared for

ADAPTRUM

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Adaptrum
25 E. Trimble Road
San Jose, CA 95131

EUT DESCRIPTION: FIXED TV BAND DEVICE

MODEL: ACRS 2.0

SERIAL NUMBER: BASE: A2F0JA01
CLIENT: A2F0JA02

DATE TESTED: JANUARY 13 to14, 2014

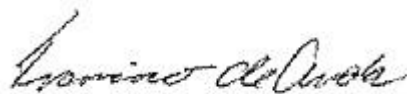
APPLICABLE STANDARDS	
SECTION	TEST RESULTS
DATABASE PORTIONS OF FCC PART 15 SUBPART H	Pass

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Verification Services Inc. By:

Tested By:



FRANCISCO DE ANDA
PROJECT LEAD
UL Verification Services Inc.



J. VANG
EMC ENGINEER
UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 15 Subpart H and KDB 416271 D01 White Space Test Procedures v02.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamplifier Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	±3.52 dB
Radiated Disturbance, 30 to 1000 MHz	±4.94 dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT are Adaptrum ACRS 2.0 base and client radios operating as Fixed TV Band Devices in compliance with Part 15 Subpart H of Title 47 of the Code of Federal Regulations. Adaptrum ACRS 2.0 radios are broadband wireless communication equipment operating in the UHF TV band with frequency range from 473 Mhz to 695 MHz (Channels 14 – 51 excluding Channels 36 to 38) and modulation modes QPSK, 16QAM and 64QAM.

5.2. DATABASE information

Google TVWS Database, referred to as the TVWS Database throughout this report.

5.3. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power of 21.18 dBm (131 mW).

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio can be configured with the following antenna types, and highest gain for each type:

- Log Periodic (Flag) with 8 dBi Assembly Gain (combination of 10 dBi antenna gain and 2 dB cable loss)
- DB2E with 9 dBi Gain
- PCB with 2 dBi Gain

5.5. SOFTWARE AND FIRMWARE

The software installed in the EUT during testing was version 3.5.0.1 firmware.

5.6. DETAILS OF TESTED SYSTEM

SUPPORT EQUIPMENT & PERIPHERALS

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	S/N	FCC ID
Base PC	Dell	Latitude E6510	G4H2VM1	DoC
AC Adapter	Dell	HA65NS5-00	A065R039L	DoC
Client PC	Dell	Latitude E6510	D4H2VM1	DoC
AC Adapter	Dell	FA90PM111	CN-0YY20N-73245-169-8180-A00	DoC
Router	TP-Link	TL-R860	137B4300251	DoC
AC Adapter	TP-Link	T090060-2B1	N/A	DoC
P.O.E Power	P.O.E Power Supply	MH-480100	DLW201211001017808	DoC
P.O.E Power	SL Power P.O.E	PENB1032E4800F0	N/A	DoC

TEST SETUP

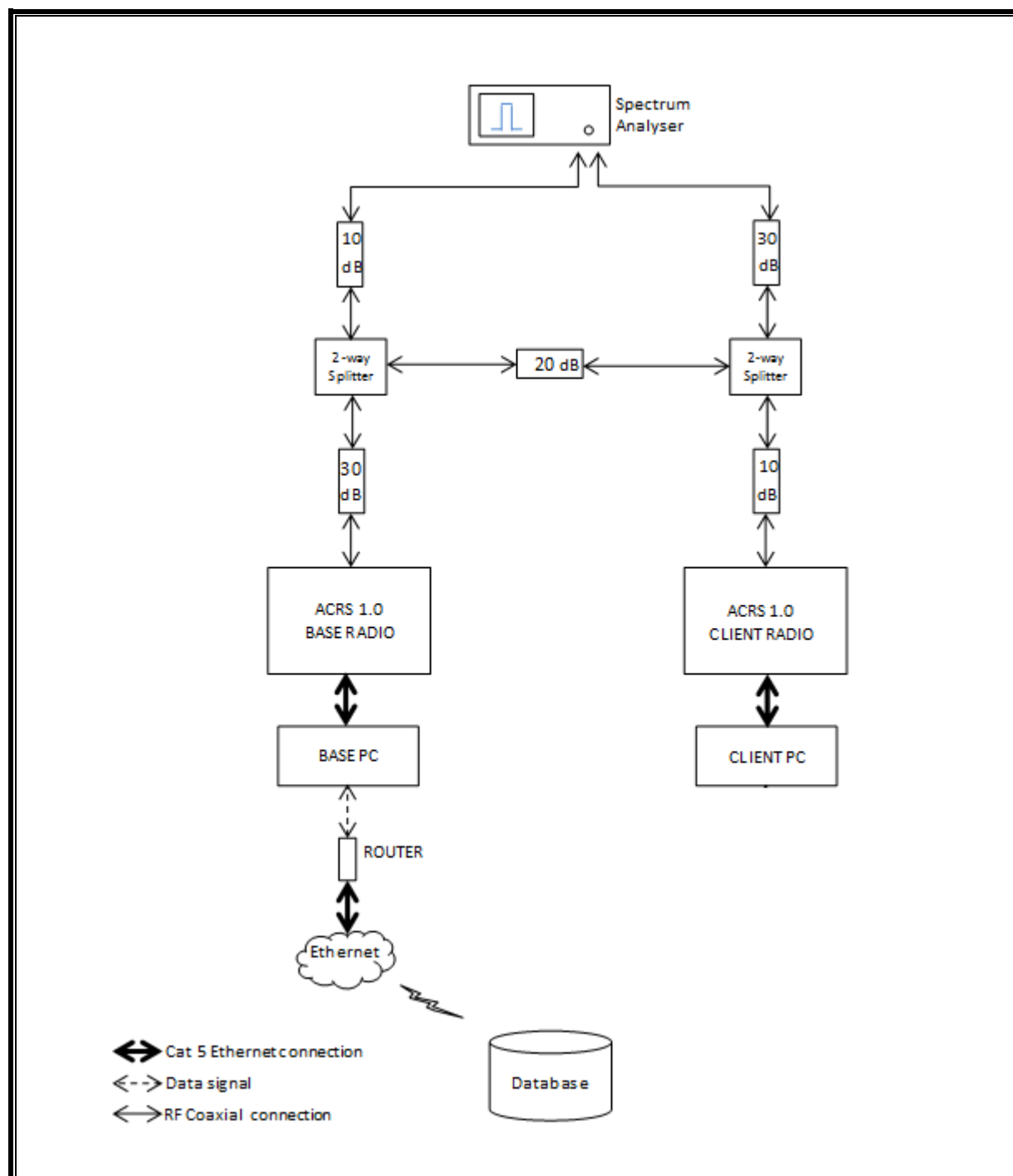
As illustrated in the following setup diagram, the EUT are the Adaptrum ACRS 2.0 base and client radios connected through cable assembly with proper attenuation to form a broadband communications system allowing the client-side PC to connect to the Internet (on the base side) through the TV White Space connection between the client and base radios. The BASE PC and CLIENT PC are used to configure the radio devices and monitor the device-and-database interactions.

The ACRS 2.0 radios are Fixed TV Band Devices that require professional installation. The ACRS 2.0 radio software has a database module that communicates with the TVWS Database and controls the radio operation in accordance with FCC Part 15 Subpart H rules. The EUT radios have been provisioned in the TVWS Database prior to the testing. For the testing conducted in this report, the EUT software was configured in the installer mode to demonstrate the compliance to the Part 15 Subpart H database rules. Once the device registration and location information has been entered into the radio software by the professional installer, the devices will communicate with the TVWS Database to perform device registration and retrieve TVWS channel list. After the installation, the device registration information will be stored in the device firmware and used by the device to automatically perform device registration and channel list request upon power cycling.

As shown in the diagram, the base radio has a direct connection to the Internet and upon power cycling will automatically communicate with the TVWS Database to 1) perform device registration and 2) retrieve TVWS channel list using the device registration information including device type, serial number, location, contact information, etc. The base radio can only operate on a channel that is within the channel list returned from the TVWS Database. Upon power cycling, the client radio will first scan a specified set of channels to look for the base signal. Once the client detects the base signal on a channel, it will send a connection request to the base which contains the client serial number and location information. The base will contact the TVWS Database on behalf of the client to perform device registration and channel list request. Only when the device registration is successful and the returned channel list for the client device contains the channel that the base is currently operating on, the base will grant the connection request from the client.

During normal operation, the base radio will periodically contact the TVWS Database to retrieve the updated channel lists for itself and on behalf of the client radio. The client channel list will be sent over the air to the client. If either the base or the client discovers its current operating channel is no longer in its updated channel list, it will cease operation on the channel immediately.

TEST SETUP DIAGRAM



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Asset	Cal Due
Spectrum Analyzer, 44 GHz	Agilent	E4446A	C01012	10/21/2014

7. DATABASE CERTIFICATION REQUIREMENTS

The following database related rules apply to TV White Space Systems under FCC CFR47 PART 15 SUBPART H for Fixed TVBD devices per KDB 416721 D01 White Space Test Procedures v02, Part 2:

§15.713(f)(3) Fixed TVBD Registration
§15.707(a) Fixed TVBD Relocated
§15.711(b)(3)(iii) Fixed & Mode II TVDB Database Update
§15.711(b)(3)(i)(ii), §15.713(a)(1) 48 Hour Channel Scheduling
§15.707, §15.711(b)(3)(i)(ii)(iv),(c), §15.712 TVBD Channel Availability
§15.709(a)(2) 1st-Adjacent Power reduction
§15.715(f) Security

8. BASE STATION DATABASE CERTIFICATION TEST RESULTS

8.1. §15.713(F)(3) FIXED TVBD REGISTRATION

REQUIREMENT

- The Fixed TVBD must be able to provide the required information to the TVWS database and obtain a successful registration:
- The database must indicate a failed device registration if any of the following data provided by the TVBD is invalid:
 - i. FCC ID
 - ii. Serial Number
 - iii. Restricted Coordinates
 - iv. HAAT > 250 m
 - v. Antenna Height AGL > 30 m
 - vi. Incomplete contact information
- For a fixed TVBD without a direct connection to the internet, confirm that registration through a registered fixed device takes place only on a channel available to that registered device.

8.1.1. SUCCESSFUL REGISTRATION

TEST PROCEDURE

- Configure the base EUT with correct registration information:
 - The FCC ID and serial number are permanently programmed to the device and cannot be modified.
 - Known acceptable geographic coordinates, antenna height AGL and contact information were entered into the EUT.
- The base EUT automatically contacts the TVWS Database to perform device registration.
- Upon successful registration, the base EUT automatically contacts the TVWS Database to retrieve device channel list.
- Selects a channel from the channel list returned from the TVWS Database and start normal radio operation on the selected channel.
- Verify base output signal on the selected channel on the spectrum analyzer.

RESULTS

The EUT successfully registered when correct registration information was submitted to the TVWS Database . The EUT transmission was observed on the spectrum analyzer on the selected TV channel (Channel 20) from the returned channel list from the TVWS Database.

Test Results	
Pass	Fail
<input checked="" type="checkbox"/>	<input type="checkbox"/>

BASE SOFTWARE SHOWING SUCCESSFUL DEVICE REGISTRATION WITH THE TVWS DATABASE

Adaptrum TVBD Control Panel :: Base

Log | Link | System Information | Diagnostics | Database | Installation

Registration

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2F0JA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Contact

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Registrant

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Register Device

Channel Request

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2F0JA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Other Information:

Select From Available DB Channels
Update Interval:
BASE MAC: FF:FF:FF:FF:FF:FF 16, 17, 19, 20, 21, 26, 27, 29, 35, 39
CLIENT MAC: 00:26:B9:F5:FB:A3 16, 17, 19, 20, 39
Reset Channel Request

Device & Channel

Fixed PPI PPII Test 0 dB Full Power Broadcast Auto Channel CH 20 (509 MHz) Start/Stop Start Service Stop Service Status Update Status Auto Update

✓ ff:ff:ff:ff:ff:ff Device Registration Successful.....15:20:03 01/13/2014
Base Device Channel List.....15:20:05 01/13/2014
Expires in 47Hours 59Mins 58Secs.....15:20:05 01/13/2014
✓ 00:26:b9:f5:fb:a3 Device Registration Successful.....15:20:05 01/13/2014

GOOGLE TVWS DATABASE BASE FIXED TVBD REGISTRATION RECORD

Google Spectrum Database Registration Record

ENTITY_TYPE	FIXED_TVBD
FCCID	A2UACRS20F
SERIAL_NUM	A2F0JA01
LOCATION_TYPE	POINT
LOCATION	(41.408090, -75.643320)
AGL_METERS	10
REGISTRANT	lin sun lin sun 25 E. Trimble Road san jose CA 95131 US\n, lin@adaptrum.com 408-850-0545

SPECTRUM ANALYZER SHOWING ACTIVE BASE SIGNAL ON THE SELECTED CHANNEL (CHANNEL 20)

Agilent 07:09:13 Jan 13, 2014

R T

Freq/Channel

Ref -40 dBm

#Atten 0 dB

Mkr1 509.00 MHz

-60.53 dBm

#Avg

Log

10

dB/

PAvg

M1 S2

S3 FS

AA

□(f):

FTun

Swp

Center 509.00 MHz

#Res BW 3 kHz

VBW 3 kHz

Sweep 12.71 s (601 pts)

Span 30 MHz

Center Freq
509.000000 MHz

Start Freq
494.000000 MHz

Stop Freq
524.000000 MHz

CF Step
3.00000000 MHz
Auto Man

Freq Offset
0.00000000 Hz

Signal Track
On Off

Copyright 2000-2010 Agilent Technologies

8.1.2. FAILED REGISTRATION – RESTRICTED COORDINATES

TEST PROCEDURE

- Configure the EUT with restricted coordinates: (LAT= 41.882282, LNG= -131.628036) which is a location outside US regulatory boundaries
- Observe the base EUT registration failure indicated by the database message

RESULT

The base EUT failed to register when restricted coordinates information were submitted to the TVWS Database.

Test Results	
Pass	Fail
<input checked="" type="checkbox"/>	<input type="checkbox"/>

BASE SOFTWARE SHOWING FAILED DEVICE REGISTRATION DUE TO RESTRICTED COORDINATES

Adaptrum TVBD Control Panel :: Base

Log | Link | System Information | Diagnostics | Database | Installation

Registration:

Device Information:

DEV_ID: A2UACRS20F
DEV_SN: A2FQJA01
DEV_MODE: F
LAT: 41.882282
LNG: -131.628036
Height AGL: 10 meters

Contact:

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Registrant:

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Register Device

Channel Request:

Device Information:

DEV_ID: A2UACRS20F
DEV_SN: A2FQJA01
DEV_MODE: F
LAT: 41.882282
LNG: -131.628036
Height AGL: 10 meters

Other Information:

Select From Available DB Channels

Update Interval:

BASE MAC: FF:FF:FF:FF:FF:FF
CLIENT MAC: 00:26:B9:F5:FB:A3 16, 17, 19, 20, 39

Reset Channel Request

Device & Channel:

Fixed PPI PPII Test 0 dB Full Power Broadcast Auto Channel CH 20 (509 MHz)

Start/Stop: Start Service Stop Service

Status: Update Status Auto Update

ff:ff:ff:ff:ff:ff Channel List Failed (0 Channels).....15:45:36 01/13/2014

Base Device Channel List.....15:45:59 01/13/2014

ff:ff:ff:ff:ff:ff Device Registration Failed.....15:45:59 01/13/2014

8.1.3. FAILED REGISTRATION – HAAT

TEST PROCEDURE

- Configure the EUT with Height Above Average Terrain(HAAT) > 250 m: the Mount Shasta coordinates (LAT=41.4092, LNG=-122.1949) were used.
- Observe the base registration failure indicated by the database message.

RESULTS

The base EUT failed to register when it is set to a location with HAAT above the limit.

Test Results	
Pass	Fail
<input checked="" type="checkbox"/>	<input type="checkbox"/>

MOUNT SHASTA HAS NO TVWS CHANNELS DUE TO HAAT LIMIT AS INDICATED BY THE GOOGLE TVWS DATABASE WEB INTERFACE

Spectrum Database - Google - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Spectrum Database - Google

https://www.google.com/get/spectrumdatabase/channel/

Google Spectrum Database

Home Browse Spectrum Use the Database Register Protected Entity Download Data Learn More FAQ

Search for white space spectrum in your area:

Device type: (What's this?)
☒ Fixed ☐ Portable

Address:
Search for a location

Latitude: Longitude:
41.409200 -122.194900

Height (m):
10

Height type:
Above ground level

Search Reset

The spectrum availability overlay is not available at this zoom level. Zoom out to view the overlay.

Map Satellite

©2014 Google - Map data ©2014 Google 2 km Terms of Use Report a map error

☒ Spectrum availability (as of January 13, 2014)

Available Spectrum: None

Channel Details

Channel Number	2	3	4	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	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
----------------	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

BASE SOFTWARE SHOWING FAILED DEVICE REGISTRATION

Adaptrum TVBD Control Panel - Base

Log | Link | System Information | Diagnostics | Database | Installation

Registration

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQIA01
DEV_MODE: F
LAT: 41.4092
LNG: -122.1949
Height AGL: 10 meters

Contact

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Registrant

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Register Device

Channel Request

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQIA01
DEV_MODE: F
LAT: 41.4092
LNG: -122.1949
Height AGL: 10 meters

Other Information: Select From Available DB Channels

Update Interval:

BASE MAC: FF:FF:FF:FF:FF:FF
CLIENT MAC: 00:26:B9:F5:FB:A3 16, 17, 19, 20, 39

Reset Channel Request

Device & Channel

Fixed PPI PPII Test 0 dB Full Power Broadcast Auto Channel CH 20 (509 MHz) Start/Stop Start Service Stop Service Status Update Status Auto Update

Base Device Channel List.....15:41:33 01/13/2014
✗ ff:ff:ff:ff:ff:ff Device Registration Failed.....15:41:33 01/13/2014
Base Device Channel List.....15:42:36 01/13/2014
✗ ff:ff:ff:ff:ff:ff Device Registration Failed.....15:42:36 01/13/2014

8.1.4. FAILED REGISTRATION – ANTENNA HEIGHT AGL

TEST PROCEDURE

- Configure the EUT with antenna height Above Ground Level (AGL) > 30 meters.
- Observe the base registration failure indicated by the database message.

RESULTS

The base EUT failed to register when it is set to a location with antenna AGL above the limit.

Test Results	
Pass	Fail
<input checked="" type="checkbox"/>	<input type="checkbox"/>

BASE SOFTWARE SHOWING FAILED DEVICE REGISTRATION DUE TO AGL LIMIT

Adaptrum TVBD Control Panel :: Base

Log | Link | System Information | Diagnostics | Database | Installation

Registration

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQJA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 31 meters

Contact

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Registrant

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Register Device

Channel Request

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQJA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 31 meters

Other Information: Select From Available DB Channels

Update Interval:

BASE MAC: FF:FF:FF:FF:FF:FF 16, 17, 19, 20, 21, 26, 27, 29, 35, 39
Client MAC:

Reset Channel Request

Device & Channel

Fixed PPI PPII Test 0 dB Full Power Broadcast Auto Channel CH 20 (509 MHz)

Start/Stop Start Service Stop Service

Status Update Status Auto Update

ff:ff:ff:ff:ff:ff Device Registration Failed.....15:50:41 01/13/2014
Base Device Channel List.....15:50:52 01/13/2014
ff:ff:ff:ff:ff:ff Device Registration Failed.....15:50:52 01/13/2014

8.1.5. FAILED REGISTRATION – INCOMPLETE CONTACT INFORMATION

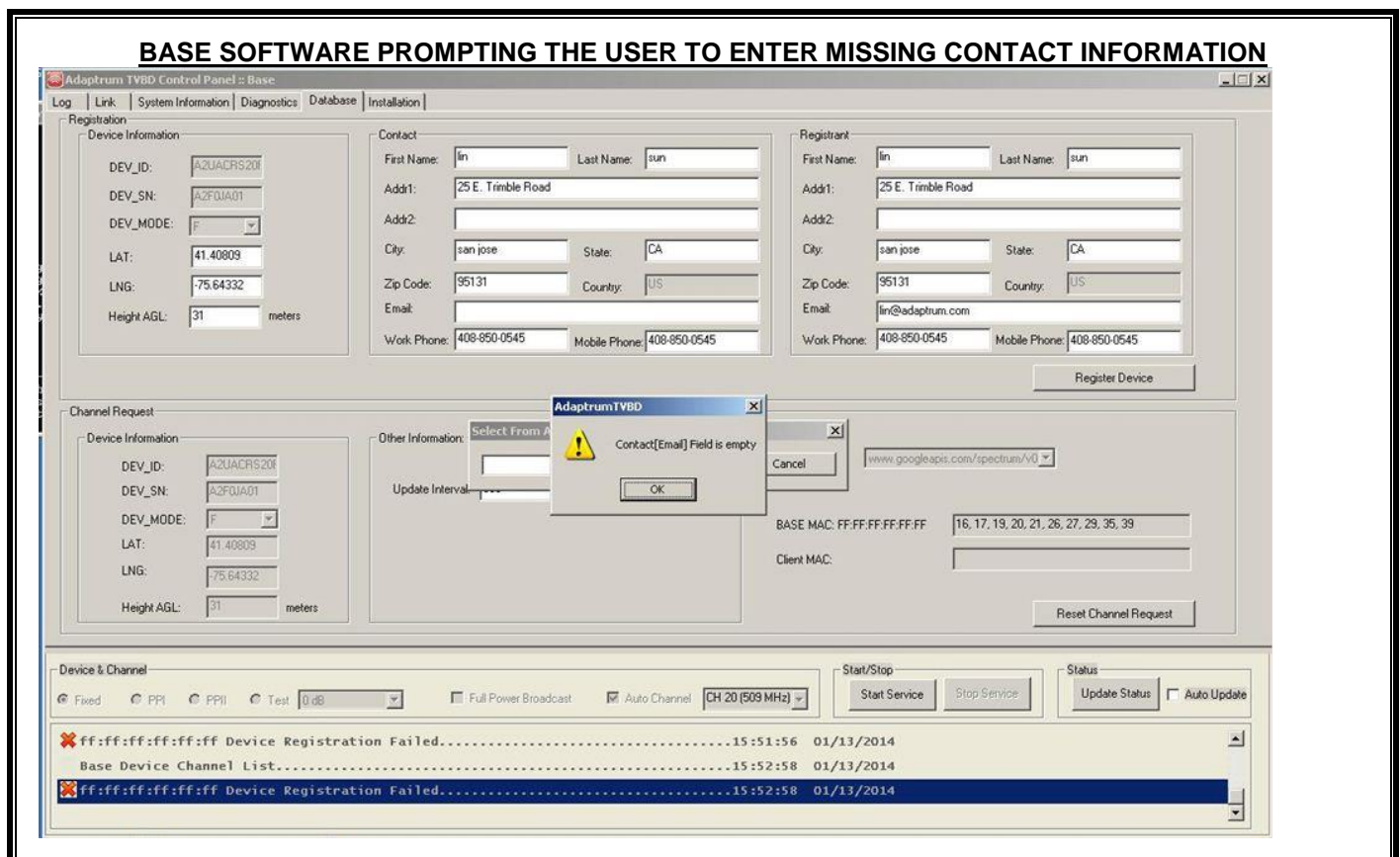
TEST PROCEDURE

- Configure the base EUT with missing contact information, e.g. email.
- The device software cannot proceed with registration and prompts user to enter the missing information.

RESULTS

Software didn't proceed with registration when contact information fields are missing.

Test Results	
Pass	Fail
<input checked="" type="checkbox"/>	<input type="checkbox"/>



8.2. §15.707(A) FIXED TVBD RELOCATED

REQUIREMENT

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

TEST PROCEDURE

- The base EUT geographic coordinates are entered at registration time and stored in the device. The device channel list request uses the same coordinates established at registration time. No separate coordinates can be entered for channel list request.
- The device requires professional installation and device registration information including device location will be entered by the professional installer.
- Once the registration is complete, upon power cycling the device will use the stored registration location for channel list request.

RESULTS

The device only uses its registered location for channel list request. The device registered location will be established at installation time by a professional installer and cannot be altered after installation – see ACRS 2.0 Professional Installer Manual and ACRS 2.0 User Manual.

Test Results	
Pass	Fail
<input checked="" type="checkbox"/>	<input type="checkbox"/>

BASE SOFTWARE ONLY ALLOWS DEVICE REGISTRATION LOCATION INFORMATION TO BE ENTERED DURING INSTALLATION AND THE SAME DEVICE LOCATION IS USED FOR CHANNEL LIST REQUEST

Adaptrum TVBD Control Panel - Base

Log | Link | System Information | Diagnostics | Database | Installation

Registration

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2F0UA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Contact

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Registrant

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Register Device

Channel Request

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2F0UA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Other Information

Select From Available DB Channels
Update Interval:
Select Cancel
www.googleapis.com/spectrum/v0
BASE MAC: FF:FF:FF:FF:FF:FF 16, 17, 19, 20, 21, 26, 27, 29, 35, 39
Client MAC:
Reset Channel Request

Device & Channel

Fixed PPI PPII Test 0 dB Full Power Broadcast Auto Channel CH 20 (509 MHz) Start/Stop Start Service Stop Service Status Update Status Auto Update

Base Device Channel List.....15:55:12 01/13/2014
Expires in 47Hours 59Mins 58Secs.....15:55:12 01/13/2014
✓ ff:ff:ff:ff:ff:ff Channel List Successful (10 Channels).....15:55:12 01/13/2014

8.3. §15.711(B)(3)(III) FIXED & MODE II TVDB DATABASE UPDATE

REQUIREMENT

- §15.711(B)(3)(III) If a fixed or Mode II personal/portable TVBD fails to successfully contact the TV bands database during any given day, it may continue to operate until 11:59 p.m. of the following day at which time it must cease operations until it re-establishes contact with the TV bands database and re-verifies its list of available channels.

Block access to the database from the TVBD. All other radio functions, including internet connectivity should be maintained. Confirm that the TVBD shuts down by 11:59 PM on the following day. All other radio functions, including internet connectivity should be maintained.

TEST PROCEDURE

- Set the base EUT to normal operation mode:
 - Enter proper registration information on the base.
 - Base contacts the TVWS to perform registration.
 - Base contacts the TVWS to retrieve channel list.
 - Select an operating channel from returned channel list.
 - Enable base transmission.
- Observe the base EUT output signal on the spectrum analyzer.
- Use a programmable router to block the database URL.
- Observe that there is no output signal from the base after 11:59 PM on the following day.

RESULTS

During normal operation, the base and client channel lists are updated periodically by sending channel list requests to the TVWS Database . For test purposes this time period was set to 5 minutes. After the database access was blocked, the next channel list requests failed and the EUTs stopped transmission immediately.

Test Results	
Pass	Fail
<input checked="" type="checkbox"/>	<input type="checkbox"/>

BASE SOFTWARE BEFORE DATABASE BLOCKING (BASE ON CHANNEL 20)

Adaptrum TVBD Control Panel - Base

Log | Link | System Information | Diagnostics | Database | Installation

Registration

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQIA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Contact

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Registrant

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Register Device

Channel Request

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQIA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Other Information: Select From Available DB Channels

Update Interval: [] Select Cancel

BASE MAC: FF:FF:FF:FF:FF:FF 16, 17, 19, 20, 21, 26, 27, 29, 35, 39
Client MAC: []

Reset Channel Request

Device & Channel

Fixed PPI PPII Test 0 dB Full Power Broadcast Auto Channel CH 20 (509 MHz)

Start/Stop Start Service Stop Service Status Update Status Auto Update

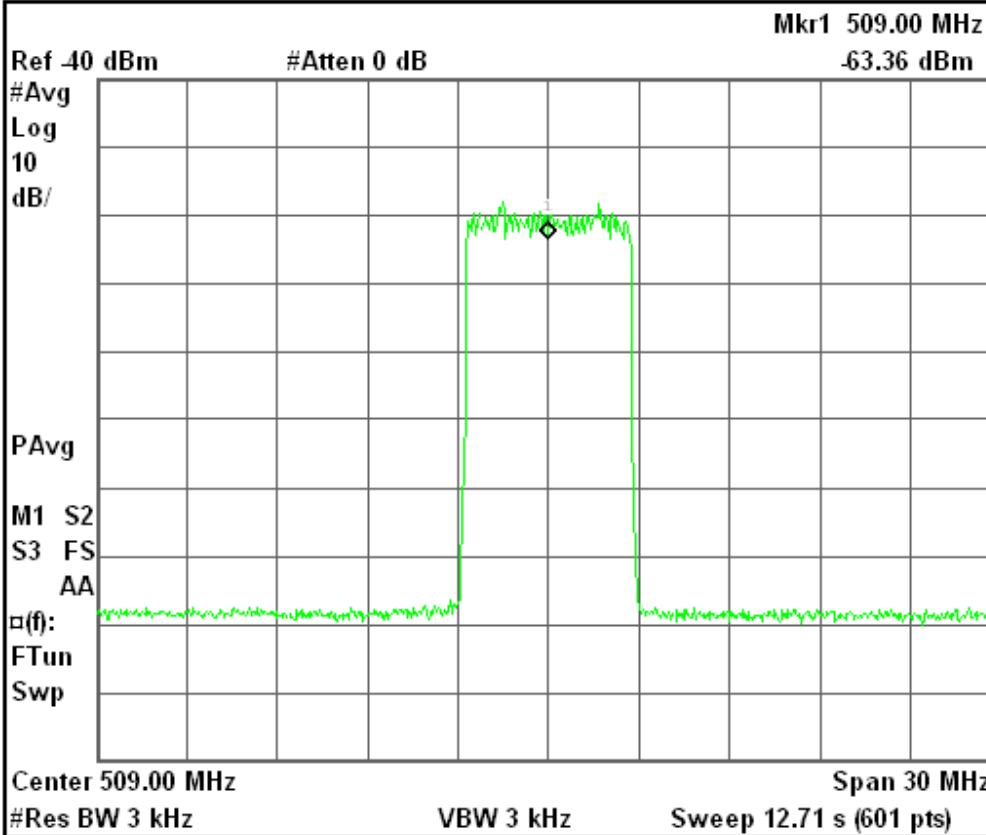
Base Device Channel List.....15:55:12 01/13/2014
Expires in 47Hours 59Mins 58Secs.....15:55:12 01/13/2014
ff:ff:ff:ff:ff:ff Channel List Successful (10 Channels).....15:55:12 01/13/2014

BASE SIGNAL SPECTRUM BEFORE DATABASE BLOCKING

Agilent 07:36:57 Jan 13, 2014

R T

Freq/Channel



Center Freq
509.000000 MHz

Start Freq
494.000000 MHz

Stop Freq
524.000000 MHz

CF Step
3.00000000 MHz
Auto Man

Freq Offset
0.00000000 Hz

Signal Track
On Off

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BASE SOFTWARE 5 MINUTES AFTER DATABASE BLOCKING (BASE STOPPED)

Adaptrum TVBD Control Panel :: Base

Log | Link | System Information | Diagnostics | Database | Installation

Registration

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQIA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Contact

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Registrant

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Register Device

Channel Request

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQIA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Other Information: Select From Available DB Channels

Update Interval: [] Select Cancel

BASE MAC: FF:FF:FF:FF:FF:FF
Client MAC:

Reset Channel Request

Device & Channel

Fixed PPI PPII Test 0 dB Full Power Broadcast Auto Channel CH 20 (509 MHz)

Start/Stop: Start Service Stop Service

Status: Update Status Auto Update

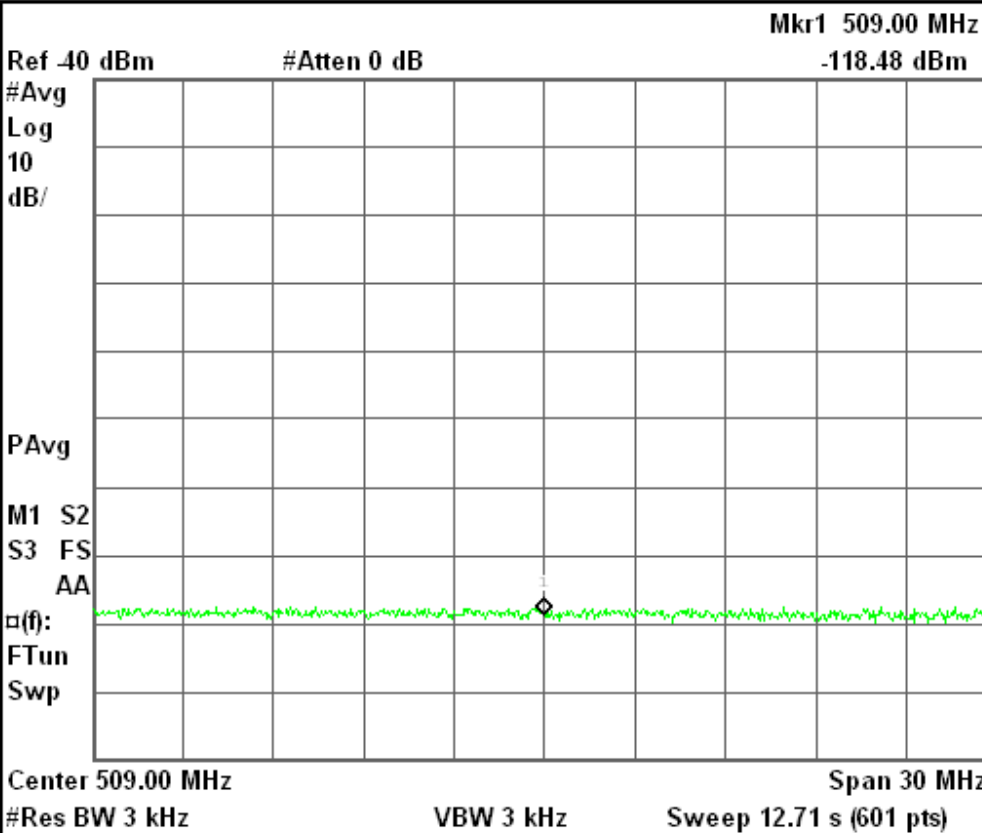
ff:ff:ff:ff:ff:ff Channel List Failed (0 Channels).....16:01:10 01/13/2014
Base Device Channel List.....16:01:26 01/13/2014
ff:ff:ff:ff:ff:ff Channel List Failed (0 Channels).....16:01:26 01/13/2014

BASE SIGNAL SPECTRUM 5 MINUTES AFTER DATABASE BLOCKING

Agilent 07:39:48 Jan 13, 2014

R T

Freq/Channel



Center Freq
509.000000 MHz

Start Freq
494.000000 MHz

Stop Freq
524.000000 MHz

CF Step
3.00000000 MHz
Auto Man

Freq Offset
0.00000000 Hz

Signal Track
On Off

Copyright 2000-2010 Agilent Technologies

8.4. §15.711(B)(3)(I)(II), §15.713(A)(1) 48 HOUR CHANNEL SCHEDULING

REQUIREMENT

- §15.711(B)(3)(I) Fixed devices must access a TV bands database over the Internet to determine the TV channels that are available at their geographic coordinates, taking into consideration the fixed device's antenna height, prior to their initial service transmission at a given location. Operation is permitted only on channels that are indicated in the database as being available for such TVBDs. Fixed TVBDs shall access the database at least once a day to verify that the operating channels continue to remain available. Operation on a channel must cease immediately if the database indicates that the channel is no longer available. Fixed TVBD must adjust their use of channels in accordance with channel availability schedule information provided by their database for the 48-hour period beginning at the time of the device last accessed the database for a list of available channels.

After receiving an available channel list, register a low-power auxiliary device on the TVBD operating channel. Repeat the available channel request after the update interval and confirm that the low-power device is accounted for in the schedule. Using the system management software, confirm that the device changes channels at the scheduled time.

TEST PROCEDURE

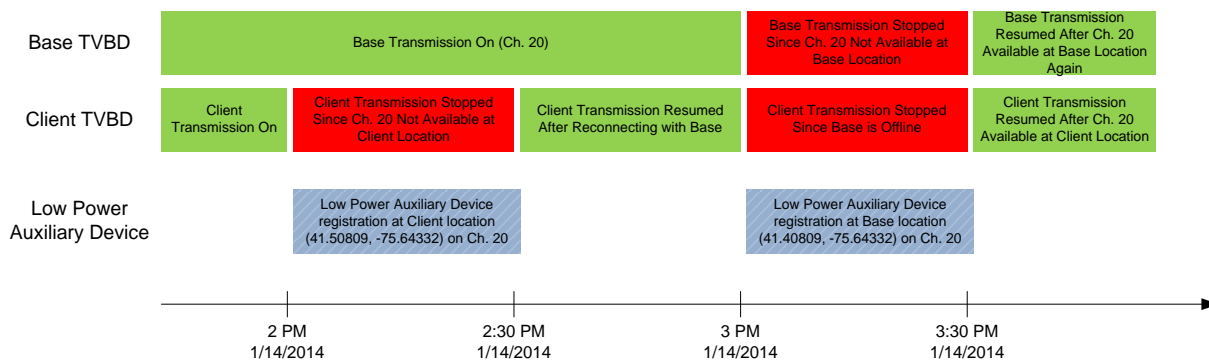
- Referring to the following testing timeline diagram. Low Power Auxiliary Devices are registered and scheduled for protection at both base and client locations, i.e. from 3 PM to 3:30 PM on 1/14/2014 at base location and from 2 PM to 2:30 PM on 1/14/2014 at client location.
- Allow the base and client EUT to enter normal operations prior to the base scheduling, i.e. on Channel 20 before 3 PM 1/14/2014.
- Upon channel list request to the TVWS Database, the base EUT obtains the channel list expiration time (at 3 PM on 1/14/2014) reflecting the Low Power Auxiliary Device's registered protection period.
- The base EUT requests new channel list upon the channel list expiration time (3 PM on 1/14/2014) and the base EUT's current operating channel (Channel 20) is no longer in the returned channel list.
- The base EUT ceases transmission on Channel 20 immediately.
- The client EUT ceases operation on Channel 20 right after the base EUT since the client EUT won't transmit without receiving the base signal.
- The base EUT continues sending periodic channel list requests to the TVWS Database . The returned channel list expiration time (3:30 PM on 1/14/2014) reflecting the ending time of the registered protection period for the Low Power Auxiliary Device.
- The base EUT requests new channel list upon the channel list expiration time (3:30 PM on 1/14/2014) and Channel 20 becomes available again in the returned channel list from the TVWS Database . The base EUT will resume transmission on Channel 20.
- The client EUT will detect the base EUT signal on Channel 20 and reconnect with the base EUT.

RESULTS

The base EUT correctly ceased transmission on the protected channel over the protection period of the Low Power Auxiliary Device registered at the same location.

Test Results	
Pass	Fail
<input checked="" type="checkbox"/>	<input type="checkbox"/>

48 HOUR CHANNEL SCHEDULING TESTING TIMELINE ILLUSTRATION



48 HOUR CHANNEL SCHEDULING LOW POWER AUXILIAR DEVICE REGISTRATION RECORD AT BASE LOCATION

Google Spectrum Database Registration Record	
ENTITY_TYPE	LP_AUX
CHANNEL	20
CALL_SIGN	KLKN
LOCATION_TYPE	MULTI_POINT
LOCATION	(41.408090, -75.643320)
REGISTRANT	Test Test 800 Schultz Court\nScranton, PA 18150\nUS 650-253-0000
EVENT_START	2014/01/14-23:00:00.000 (GMT)
EVENT_END	2014/01/14-23:30:00.000 (GMT)

48 HOUR CHANNEL SCHEDULING BASE SOFTWARE BEFORE PROTECTION PERIOD

Adaptrum TVBD Control Panel :: Base

Log | Link | System Information | Diagnostics | Database | Installation

Registration

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQJA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Contact

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Registrant

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Register Device

Channel Request

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQJA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Other Information

Select From Available DB Channels

Update Interval: [] Select Cancel

BASE MAC: FF:FF:FF:FF:FF:FF 16, 17, 19, 20, 21, 26, 27, 29, 35, 39
CLIENT MAC: 00:26:B9:F5:FB:A3 16, 17, 19, 20, 39

Reset Channel Request

Device & Channel

Fixed PPI PPII Test 0 dB Full Power Broadcast Auto Channel CH 20 (509 MHz)

Start/Stop

Start Service Stop Service

Status

Update Status Auto Update

Base Device Channel List.....14:55:50 01/14/2014
Expires in 0Hours 4Mins 10Secs.....14:55:50 01/14/2014
ff:ff:ff:ff:ff:ff Channel List Successful (10 Channels).....14:55:50 01/14/2014

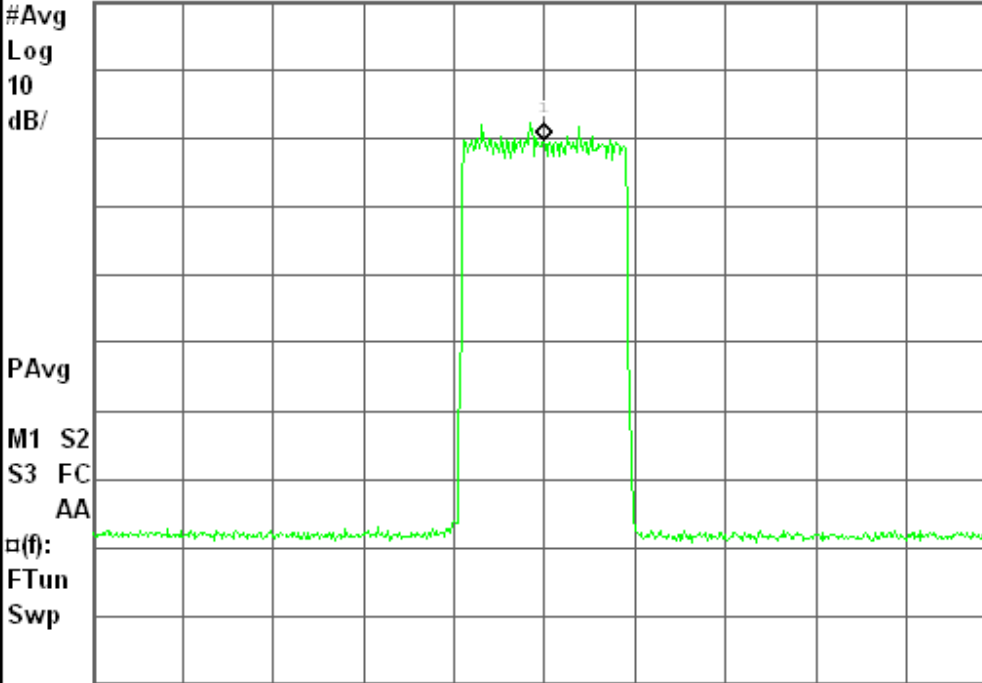
48 HOUR CHANNEL SCHEDULING BASE SIGNAL SPECTRUM BEFORE PROTECTION PERIOD

Agilent 17:30:48 Jan 14, 2014

R T

Freq/Channel

Ref -40 dBm #Atten 0 dB Mkr1 509.00 MHz -60.47 dBm



Center 509.00 MHz Span 30 MHz
#Res BW 3 kHz #VBW 3 kHz Sweep 12.71 s (601 pts)

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Center Freq
509.000000 MHz

Start Freq
494.000000 MHz

Stop Freq
524.000000 MHz

CF Step
3.00000000 MHz
Auto Man

Freq Offset
0.00000000 Hz

Signal Track
On Off

48 HOUR CHANNEL SCHEDULING BASE SOFTWARE DURING PROTECTION PERIOD (CHANNEL 20 UNAVAILABLE)

Adaptrum TVBD Control Panel - Base

Log | Link | System Information | Diagnostics | Database | Installation

Registration

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQIA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Contact

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Registrant

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Register Device

Channel Request

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQIA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Other Information: Select From Available DB Channels

Update Interval: [] Select Cancel

BASE MAC: FF:FF:FF:FF:FF:FF 16, 17, 19, 21, 26, 27, 29, 35, 39
CLIENT MAC: 00:26:B9:F5:FB:A3 16, 17, 19, 20, 39

Reset Channel Request

Device & Channel

Fixed PPI PPII Test 0 dB Full Power Broadcast Auto Channel CH 20 (509 MHz)

Start/Stop Start Service Stop Service Status Update Status Auto Update

Base Device Channel List.....15:01:07 01/14/2014
Expires in 0Hours 28Mins 53Secs.....15:01:07 01/14/2014
ff:ff:ff:ff:ff:ff Channel List Successful (9 Channels).....15:01:07 01/14/2014

**48 HOUR CHANNEL SCHEDULING BASE SIGNAL SPECTRUM DURING PROTECTION PERIOD
(TRANSMISSION STOPPED)**

Agilent 16:59:21 Jan 14, 2014

R T

Freq/Channel

Ref -40 dBm #Atten 0 dB Mkr1 509.00 MHz
-118.87 dBm

#Avg
Log
10
dB/

PAvg

M1 S2
S3 FS
AA

□(f):
FTun
Swp

Center Freq
509.000000 MHz

Start Freq
494.000000 MHz

Stop Freq
524.000000 MHz

CF Step
3.00000000 MHz
Auto Man

Freq Offset
0.00000000 Hz

Signal Track
On Off

Center 509.00 MHz

Span 30 MHz

#Res BW 3 kHz

#VBW 3 kHz

Sweep 12.71 s (601 pts)

Copyright 2000-2010 Agilent Technologies

48 HOUR CHANNEL SCHEDULING BASE RESUMES ON CHANNEL 20 AFTER PROTECTION PERIOD

Adaptrum TVBD Control Panel :: Base

Log | Link | System Information | Diagnostics | Database | Installation

Registration

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQIA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Contact

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Registrant

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Register Device

Channel Request

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQIA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Other Information: Select From Available DB Channels

Update Interval: [] Select Cancel

BASE MAC: FF:FF:FF:FF:FF:FF 16, 17, 19, 20, 21, 26, 27, 29, 35, 39
CLIENT MAC: 00:26:B9:F5:FB:A3 16, 17, 19, 20, 39

Reset Channel Request

Device & Channel

Fixed PPI PPII Test 0 dB Full Power Broadcast Auto Channel CH 20 (509 MHz)

Start/Stop: Start Service Stop Service Status: Update Status Auto Update

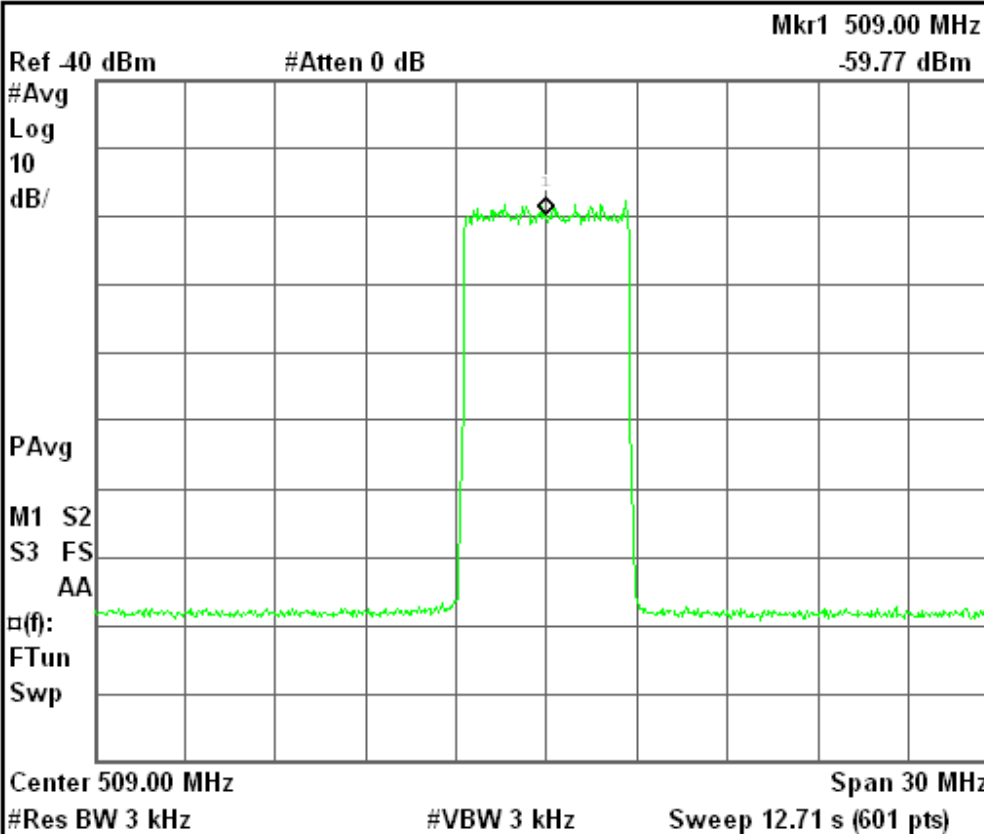
Base Device Channel List.....15:30:34 01/14/2014
Expires in 47Hours 59Mins 57Secs.....15:30:34 01/14/2014
ff:ff:ff:ff:ff:ff Channel List Successful (10 Channels).....15:30:34 01/14/2014

48 HOUR CHANNEL SCHEDULING BASE RESUMES TRANSMISSION ON CHANNEL 20 AFTER PROTECTION PERIOD

Agilent 17:29:05 Jan 14, 2014

R T

Freq/Channel



Center Freq
509.000000 MHz

Start Freq
494.000000 MHz

Stop Freq
524.000000 MHz

CF Step
3.00000000 MHz
Auto Man

Freq Offset
0.00000000 Hz

Signal Track
On Off

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8.5. §15.707, §15.711(B)(3)(I)(II)(IV),(C), §15.712 TVBD CHANNEL AVAILABILITY

REQUIREMENT

- 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

- Configure the base EUT with correct registration information.
- The base EUT automatically contacts the TVWS Database to perform device registration.
- Upon successful registration, base automatically contacts the TVWS Database to retrieve device channels.
- The base EUT software only allows the user to select a channel from the channel list returned from the database (see base software screen capture below) which are within the device operating frequency range 470 – 698 MHz (Channels 14 – 51 excluding Channels 36 to 38) as approved by FCC for ACRS 2.0 Fixed TVBD.
- Test pre-condition: The device is configured to operate at a power level less than or equal to that which is authorized by the Grant.
- Upon successful registration the database returns the allowable power according to the device type, Fixed 36 dBm eirp in this example.
- Verify on the spectrum analyzer that the base EUT is operating on the selected channel, i.e. Channel 20.

RESULTS

The EUT operates on a channel from the authorized channel list and at the authorized power level.

The EUT cannot select and operate on any channel other than those within the authorized channel list returned from the TVWS Database , which are within the device operating frequency range.

Test Results	
Pass	Fail
<input checked="" type="checkbox"/>	<input type="checkbox"/>

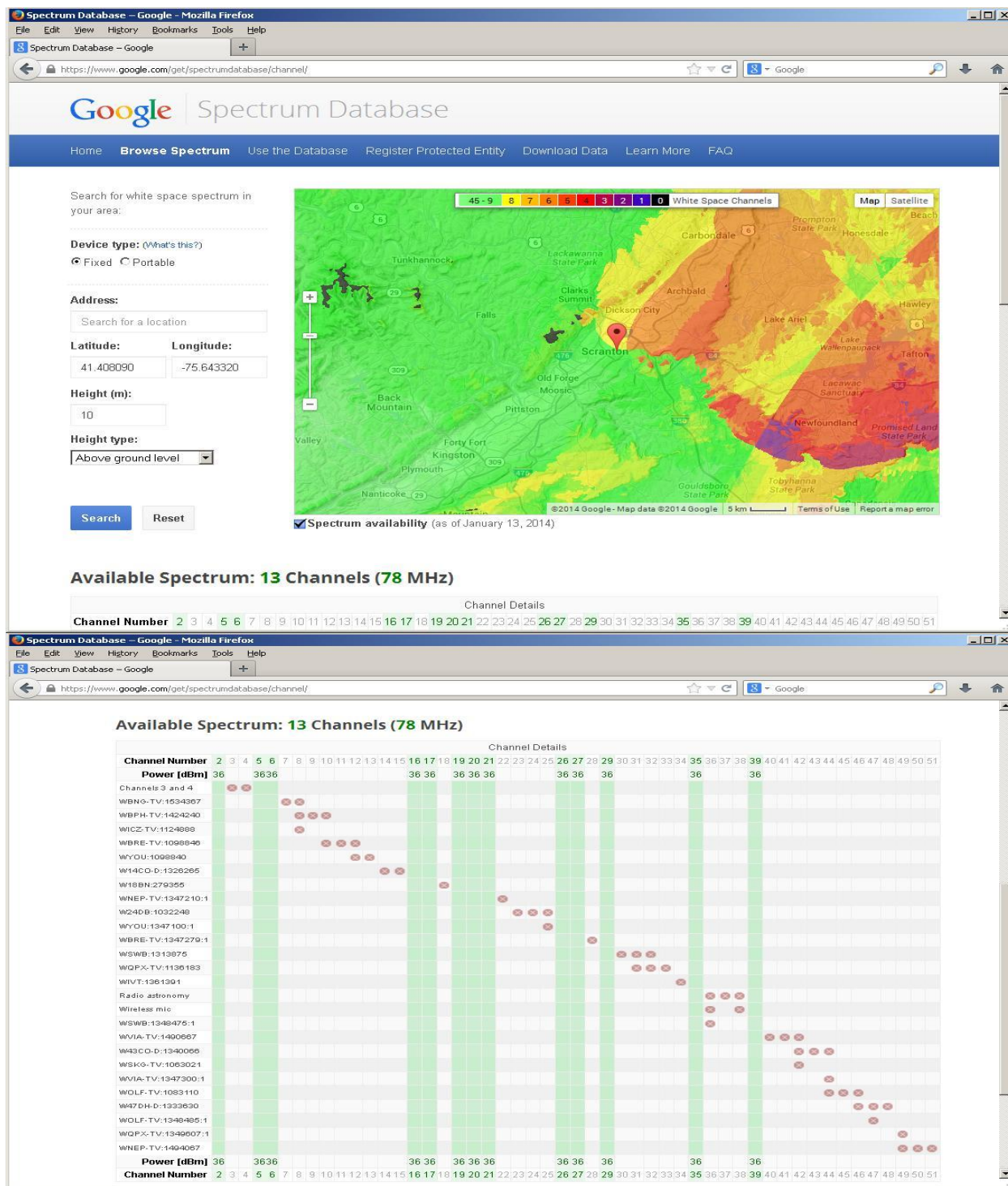
BASE SOFTWARE ONLY ALLOWS A CHANNEL FROM AUTHORIZED CHANNEL LISTS TO BE SELECTED FOR DEVICE OPERATION

The screenshot displays the 'Adaptrum TVBD Control Panel :: Base' software interface. It features several tabs: Log, Link, System Information, Diagnostics, Database, and Installation. The 'Registration' tab is active, showing fields for Device Information (DEV_ID: A2UACRS20F, DEV_SN: A2FQJA01, DEV_MODE: F, LAT: 41.40809, LNG: -75.64332, Height AGL: 10 meters), Contact information (First Name: lin, Last Name: sun, Address: 25 E. Trimble Road, City: san jose, State: CA, Zip Code: 95131, Country: US, Email: lin@adaptrum.com, Work Phone: 408-850-0545, Mobile Phone: 408-850-0545), and Registrant information (First Name: lin, Last Name: sun, Address: 25 E. Trimble Road, City: san jose, State: CA, Zip Code: 95131, Country: US, Email: lin@adaptrum.com, Work Phone: 408-850-0545, Mobile Phone: 408-850-0545). A 'Register Device' button is present.

The 'Channel Request' tab is also visible, showing fields for Device Information (DEV_ID: A2UACRS20F, DEV_SN: A2FQJA01, DEV_MODE: F, LAT: 41.40809, LNG: -75.64332, Height AGL: 10 meters), Other Information (Update Interval: CH 16, CH 17, CH 19, CH 20, CH 21, CH 26, CH 27, CH 29, CH 35, CH 39), and a 'Select From Available DB Channels' dialog box. The dialog box shows a list of channels (CH 16, CH 17, CH 19, CH 20, CH 21, CH 26, CH 27, CH 29, CH 35, CH 39) and a 'Select' button. The 'Channel Request' tab also includes fields for BASE MAC (FF:FF:FF:FF:FF:FF), Client MAC, and a 'Reset Channel Request' button.

The 'Device & Channel' tab is at the bottom, showing a 'Start/Stop' section with 'Start Service' and 'Stop Service' buttons, and a 'Status' section with 'Update Status' and 'Auto Update' checkboxes. The 'Device & Channel' tab also displays a 'Base Device Channel List' with columns for Channel, Power, and Date. The list shows channels 16, 17, 19, 20, 21, 26, 27, 29, 35, 39, and a status message: 'ff:ff:ff:ff:ff:ff Channel List Successful (10 Channels)'. The status message is highlighted in blue.

GOOGLE WEB INTERFACE SHOWING AUTHORIZED CHANNELS AT THE DEVICE LOCATION. NOTE ONLY A SUBSET (CHANNELS 16, 17, 19, 20, 21, 26, 27, 29, 35 AND 39) OF THE 13 AVAILABLE CHANNELS ARE WITHIN THE ACRS 2.0 TVBD BASE OPERATING FREQUENCY RANGE.

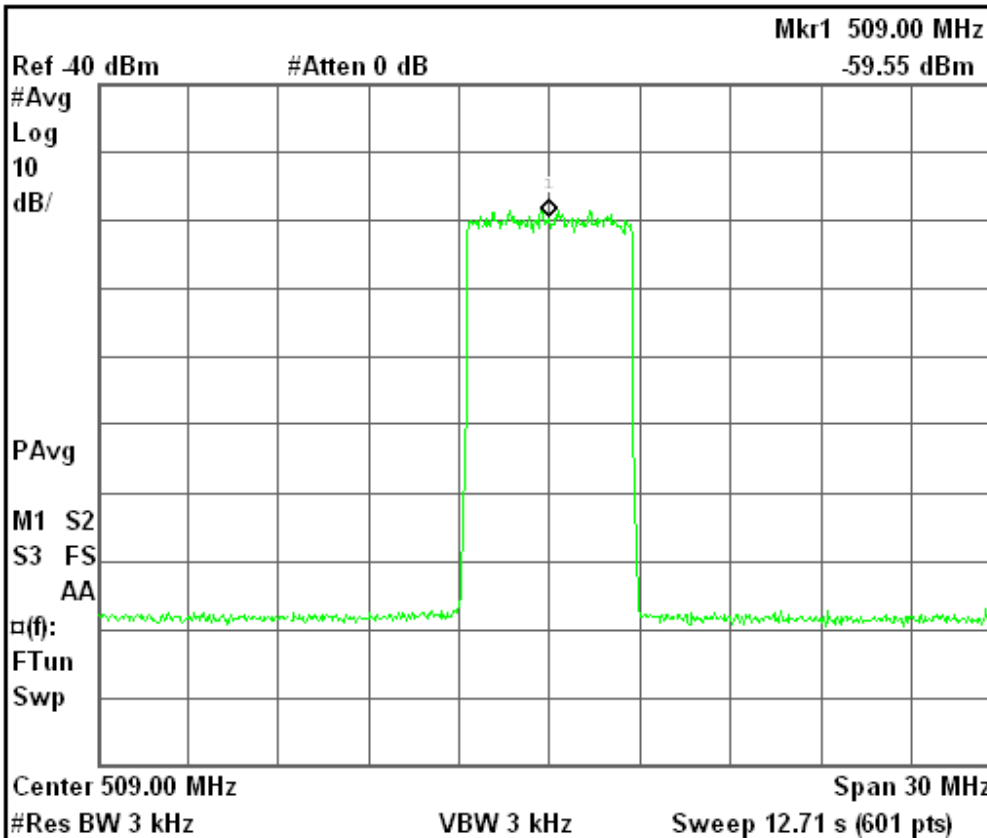


BASE SIGNAL SPECTRUM ON THE AUTHORIZED CHANNEL

Agilent 07:50:26 Jan 13, 2014

R T

Freq/Channel



Center Freq
509.000000 MHz

Start Freq
494.000000 MHz

Stop Freq
524.000000 MHz

CF Step
3.00000000 MHz
Auto Man

Freq Offset
0.00000000 Hz

Signal Track
On Off

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8.6. §15.715(F) SECURITY

REQUIREMENT

- The device operations procedures must include documentation with a detailed explanation of the following for each database the device is expected to work with:
 - i. What communication protocol is used between the database and the TVBD?
 - ii. How are communications initiated?
 - iii. How does the TVBD validate messages from the database?
 - iv. How does the device handle failure to communicate or authenticate the database?
 - v. How does the database validate messages from a TVBD?
 - vi. What encryption method is used?
 - vii. How does the database ensure secure registration of protected devices?

ANSWERS

i. What communication protocol is used between the database and the TVBD?

The device uses a proprietary protocol, described in the “Google Spectrum API Device to White Space Database API.pdf” document, built on top of JSON messages over HTTPS.

ii. How are communications initiated?

The database requires a single HTTP request that contains all information necessary for (1) authentication - API key, (2) registration - contact information and device identifiers (3) obtaining a list of channels - location and device type. If all information was validated successfully, the database will log the request, update the device registration record if necessary, and generate a channel availability response.

iii. How does the TVBD validate messages from the database?

The database authenticity, as well as the integrity and confidentiality of the response is ensured by the HTTPS scheme. A valid response is described by the API specification. Any deviation in from the specification is considered an invalid response. In addition, the database signals any malfunction by means of error codes.

iv. How does the device handle failure to communicate or authenticate the database?

Per FCC rules, failure to communicate or authenticate with the the database will cause the device to retry after an arbitrary duration. If the device was already transmitting at the time, and communication could not be re-established by 11:59 PM of the following calendar day, it will cease any transmission. The device will not begin to transmit without a valid response from the database.

v. How does the database validate messages from a TVBD?

The database verifies the API key and FCC ID against a white list. Additionally, the device serial number is also verified against a black list. Finally, the database verifies that requests for Fixed devices supply non-empty contact information. Lastly, the device must supply a geographic location that lies within the jurisdiction boundary of FCC regulations.

vi. What encryption method is used?

The communication is secured using the HTTPS protocol, which employs X.509 certificates to exchange a symmetric key used for the data exchange.

vii. How does the database ensure secure registration of protected devices?

Protected devices are registered through web forms that verify mandatory inputs, as well as match any FCC-specific information, such as callsign, ULS file number, etc. The registration data is stored in secure storage areas protected from public access. The registration data is exchanged with peer databases through HTTPS/SFTP channels, both of which use TLS encryption and server authentication, as well as an additional layer of X.509 signatures for tamper prevention.

9. CLIENT STATION - DATABASE CERTIFICATION TESTS

9.1. §15.713(F)(3) FIXED TVBD REGISTRATION

REQUIREMENT

- The Fixed TVBD must be able to provide the required information to the TVWS database and obtain a successful registration:
- For a fixed TVBD without a direct connection to the internet, confirm that registration through a registered fixed device takes place only on a channel available to that registered device.

9.1.1. SUCCESSFUL REGISTRATION

TEST PROCEDURE

- Configure the client EUT with correct registration information:
 - The FCC ID and serial number are permanently programmed to the device and cannot be modified.
 - Known acceptable location coordinates, antenna height AGL were entered into the EUT software.
 - Client device uses the same contact information as the base device (both client device and base device are managed by the same operator).
- Proper scan channel set is entered on the client EUT which contains the base EUT's current operating channel.
- The client EUT makes the connection request to the base.
- The base EUT contact the TVWS Database to register the client device.
- Upon successful registration, the base retrieves channel list on behalf of the client device.
- Client connection request is granted if the base operating channel is within the returned client channel list from the TVWS Database . The base EUT also informs the client EUT about the retrieved client channel lists.
- The client EUT starts normal radio operation.
- Verify client output signal (on the same channel as the base EUT) on spectrum analyzer.

RESULTS

The client EUT was successfully registered with the TVWS Database with proper registration information through the base EUT. The client EUT entered normal operation on the same channel (Channel 20) as that of the base EUT which is within the returned client channel list.

The client EUT didn't have a direct connection to the Internet. It sent the registration request to the base EUT on the base EUT operating channel. The base EUT then sent the client registration request to the TVWS Database to register the client.

Test Results	
Pass	Fail
<input checked="" type="checkbox"/>	<input type="checkbox"/>

CLIENT SOFTWARE WITH DEVICE LOCATION INFORMATION AND PROPER SCAN CHANNEL SET (THAT INCLUDES THE CURRENT BASE OPERATING CHANNEL – CHANNEL 20)

GOOGLE TVWS DATABASE CLIENT FIXED TVBD REGISTRATION RECORD

Google Spectrum Database Registration Record	
ENTITY_TYPE	FIXED_TVBD
FCCID	A2UACRS20F
SERIAL_NUM	A2FOJA02
LOCATION_TYPE	POINT
LOCATION	(41.508090, -75.643320)
AGL_METERS	5
REGISTRANT	lin sun lin sun 25 E. Trimble Road san jose CA 95131 US\n, lin@adaptrum.com 408-850-0545

BASE SOFTWARE SHOWING SUCCESSFUL CLIENT REGISTRATION AND CHANNEL LIST REQUEST

Adaptrum TVBD Control Panel - Base

Log | Link | System Information | Diagnostics | Database | Installation

Registration

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQJA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Contact

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Registrant

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Register Device

Channel Request

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQJA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Other Information: Select From Available DB Channels

Update Interval: [] Select Cancel

BASE MAC: FF:FF:FF:FF:FF:FF 16, 17, 19, 20, 21, 26, 27, 29, 35, 39
CLIENT MAC: 00:26:B9:F5:FB:A3 16, 17, 19, 20, 39

Reset Channel Request

Device & Channel

Fixed PPI PPII Test 0 dB Full Power Broadcast Auto Channel CH 20 (509 MHz)

Start/Stop: Start Service Stop Service

Status: Update Status Auto Update

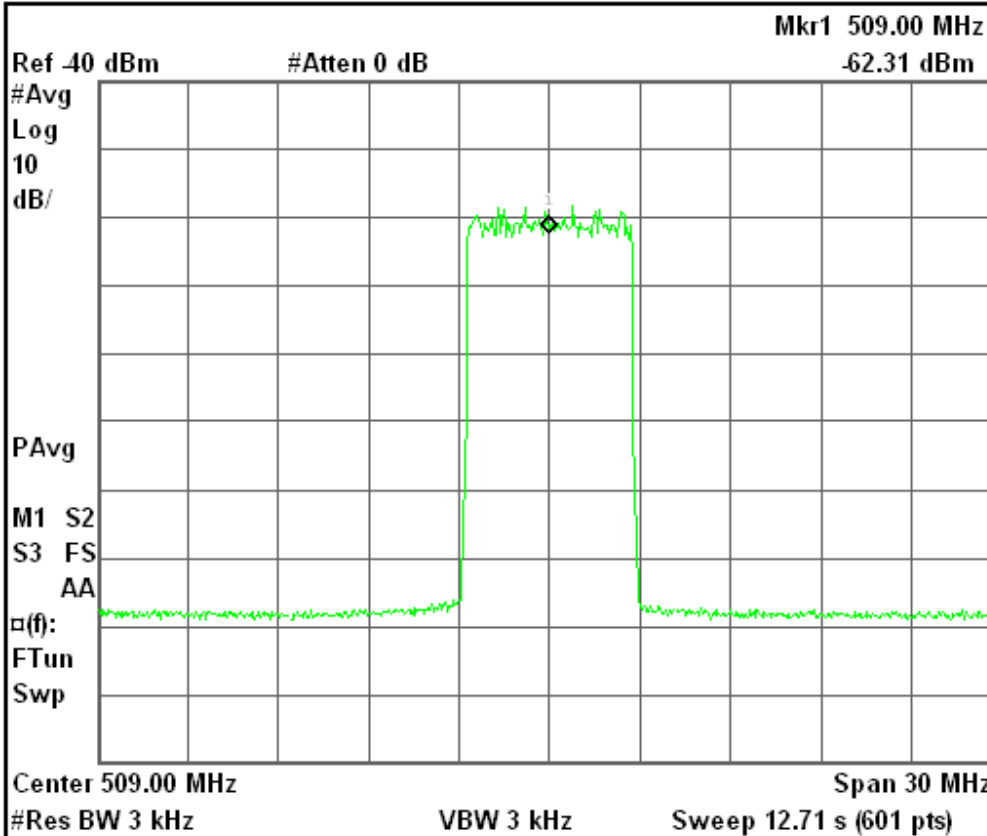
Client 00:26:b9:f5:fb:a3 Created. Past Logins 1.....16:15:28 01/13/2014
00:26:b9:f5:fb:a3 Device Channel List16:15:29 01/13/2014
Expires in 47Hours 59Mins 58Secs.....16:15:29 01/13/2014
00:26:b9:f5:fb:a3 Device Registration Successful.....16:15:29 01/13/2014

ACTIVE CLIENT SIGNAL SPECTRUM ON CHANNEL 20

Agilent 08:59:35 Jan 13, 2014

R T

Freq/Channel



Center Freq
509.000000 MHz

Start Freq
494.000000 MHz

Stop Freq
524.000000 MHz

CF Step
3.00000000 MHz
Auto Man

Freq Offset
0.00000000 Hz

Signal Track
On Off

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9.1.2. FAILED REGISTRATION – RESTRICTED COORDINATES

TEST PROCEDURE

- Set the base EUT to normal operation (on Channel 20).
- Configure the client EUT with restricted coordinates:
(LAT= 41.882282, LNG= -131.628036), which are outside US regulatory boundaries.
- Configure the client EUT scan channel set to include Channel 20.
- The client EUT sends connection request to the base EUT.
- The base EUT will contact the TVWS Database to register the client.
- Observe the client registration failure indicated by the database message.

RESULTS

The client EUT failed to register when restricted coordinates information were submitted to the TVWS Database .

Test Results	
Pass	Fail
<input checked="" type="checkbox"/>	<input type="checkbox"/>

CLIENT SOFTWARE WITH RESTRICTED COORDINATES

Adaptrum TVBD Control Panel - Client

Log | Link | System Information | Diagnostics | Database | Installation

Device Configuration

Device Information

DEV_ID: A2UACRS20F

DEV_SN: A2F0IA02

DEV_MODE: F

LAT: 41.882282

LNG: -131.628036

Height AGL: 5 meters

Scan Channel Set: 20 [Update Now]

Set Device Info

Device & Channel

Fixed PPI PPII Test 0 dB [Auto Channel] CH 20 (509 MHz) [Start/Stop] [Update Status] [Auto Update]

Client 00:26:b9:f5:fb:a3 Created.....16:37:40 01/13/2014

Channel Search Failed On Channel -1.....16:37:40 01/13/2014

Channel Search Started On Channel 20.....16:37:40 01/13/2014

BASE SOFTWARE SHOWING FAILED CLIENT REGISTRATION DUE TO RESTRICTED COORDINATES

Adaptrum TVBD Control Panel :: Base

Log | Link | System Information | Diagnostics | Database | Installation

Registration

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQ1A01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Contact

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Registrant

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Register Device

Channel Request

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQ1A01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Other Information: Select from Available DB Channels

Update Interval: [] Select Cancel

www.googleapis.com/spectrum/v0

BASE MAC: FF:FF:FF:FF:FF:FF 16, 17, 19, 20, 21, 26, 27, 29, 35, 39
CLIENT MAC: 00:26:B9:F5:FB:A3

Reset Channel Request

Device & Channel

Fixed PPI PPII Test 0 dB Full Power Broadcast Auto Channel CH 20 (509 MHz)

Start/Stop Start Service Stop Service Status Update Status Auto Update

✓ ff:ff:ff:ff:ff:ff Channel List Successful (10 Channels).....16:35:54 01/13/2014
✓ Client 00:26:b9:f5:fb:a3 Created. Past Logins 0.....16:38:16 01/13/2014
00:26:b9:f5:fb:a3 Device Channel List16:38:17 01/13/2014
✗ 00:26:b9:f5:fb:a3 Device Registration Failed.....16:38:17 01/13/2014

9.1.3. FAILED REGISTRATION – HAAT

TEST PROCEDURE

- Set the base EUT to normal operation (on Channel 20).
- Configure the client EUT with the Mount Shasta coordinates (LAT= 41.4092, LNG= -122.1949).
- Configure the client EUT scan channel set to include Channel 20.
- The client EUT sends connection request to the base EUT.
- The base EUT will contact the TVWS Database to register the client.
- Observe the client registration failure indicated by the database message.

RESULTS

The client EUTs failed to register when it is set to a location with HAAT above the limit.

Test Results	
Pass	Fail
<input checked="" type="checkbox"/>	<input type="checkbox"/>

MOUNT SHASTA HAS NO TVWS CHANNELS DUE TO HAAT LIMIT

Spectrum Database - Google - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Spectrum Database - Google

https://www.google.com/get/spectrumdatabase/channel/

Google Spectrum Database

Home Browse Spectrum Use the Database Register Protected Entity Download Data Learn More FAQ

Search for white space spectrum in your area:

Device type: (What's this?)
☒ Fixed ☐ Portable

Address:
Search for a location

Latitude: Longitude:
41.409200 -122.194900

Height (m):
10

Height type:
Above ground level

Search Reset

The spectrum availability overlay is not available at this zoom level. Zoom out to view the overlay.

Map Satellite

©2014 Google - Map data ©2014 Google 2 km Terms of Use Report a map error

☒ Spectrum availability (as of January 13, 2014)

Available Spectrum: None

Channel Details

Channel Number
2
3
4
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
30
31
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33
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51

CLIENT SOFTWARE CONFIGURED WITH MOUNT SHASTA COORDINATES

Adaptrum TVBD Control Panel :: Client

Log | Link | System Information | Diagnostics | Database | Installation

Device Configuration

Device Information

DEV_ID: A2UACRS20F

DEV_SN: A2F01A02

DEV_MODE: F

LAT: 41.4092

LNG: -122.1949

Height AGL: 5 meters

Scan Channel Set: 20 Update Now

Set Device Info

Device & Channel

Fixed PPI PPII Test 0 dB Auto Channel CH 20 (509 MHz) Start/Stop Status Update Status Auto Update

Client 00:26:b9:f5:fb:a3 Created.....16:48:02 01/13/2014

Channel Search Failed On Channel -1.....16:48:02 01/13/2014

Channel Search Started On Channel 20.....16:48:02 01/13/2014

BASE SOFTWARE SHOWING FAILED CLIENT REGISTRATION DUE TO HAAT LIMIT

Adaptrum TVBD Control Panel :: Base

Log | Link | System Information | Diagnostics | Database | Installation

Registration

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQ1A01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Contact

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Registrant

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Register Device

Channel Request

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQ1A01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Other Information: Select from Available DB Channels

Update Interval: [] Select Cancel

BASE MAC: FF:FF:FF:FF:FF:FF 16, 17, 19, 20, 21, 26, 27, 29, 35, 39
CLIENT MAC: 00:26:B9:F5:FB:A3

Reset Channel Request

Device & Channel

Fixed PPI PPII Test 0 dB Full Power Broadcast Auto Channel CH 20 (509 MHz)

Start/Stop Start Service Stop Service Status Update Status Auto Update

Client 00:26:b9:f5:fb:a3 Created. Past Logins 0.....16:48:41 01/13/2014
00:26:b9:f5:fb:a3 Device Channel List16:48:43 01/13/2014
00:26:b9:f5:fb:a3 Device Registration Failed.....16:48:43 01/13/2014

9.1.4. FAILED REGISTRATION – ANTENNA HEIGHT AGL

TEST PROCEDURE

- Set the base EUT to normal operation (on Channel 20).
- Configure the client EUT with antenna height Above Ground Level (AGL) > 30 meters.
- Configure the client EUT scan channel set to include Channel 20.
- The client EUT sends connection request to the base EUT.
- The base EUT will contact the TVWS Database to register the client.
- Observe the client registration failure indicated by the database message.

RESULTS

The client EUT failed to register when it is set to a location with antenna height AGL above the limit.

Test Results	
Pass	Fail
<input checked="" type="checkbox"/>	<input type="checkbox"/>

CLIENT SOFTWARE WITH AGL ABOVE LIMIT

Adaptrum TVBD Control Panel :: Client

Log | Link | System Information | Diagnostics | Database | Installation

Device Configuration

Device Information

DEV_ID: A2UACRS20F

DEV_SN: A2F01A02

DEV_MODE: F

LAT: 41.50809

LNG: -75.64332

Height AGL: 31 meters

Scan Channel Set: 20 ... Update Now

Set Device Info

Device & Channel

Fixed PPI PPII Test 0 dB

Auto Channel CH 20 (509 MHz)

Start/Stop

Status Update Status Auto Update

Client 00:26:b9:f5:fb:a3 Created.....16:53:57 01/13/2014

Channel Search Failed On Channel -1.....16:53:57 01/13/2014

Channel Search Started On Channel 20.....16:53:57 01/13/2014

BASE SOFTWARE SHOWING FAILED CLIENT REGISTRATION DUE TO AGL LIMIT

Adaptrum TVBD Control Panel :: Base

Log | Link | System Information | Diagnostics | Database | Installation

Registration

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQIA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Contact

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Registrant

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Register Device

Channel Request

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQIA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Other Information: Select from Available DB Channels

Update Interval: Select Cancel

BASE MAC: FF:FF:FF:FF:FF:FF 16, 17, 19, 20, 21, 26, 27, 29, 35, 39
CLIENT MAC: 00:26:B9:F5:FB:A3

Reset Channel Request

Device & Channel

Fixed PPI PPII Test 0 dB Full Power Broadcast Auto Channel CH 20 (509 MHz) Start/Stop Start Service Stop Service Status Update Status Auto Update

Client 00:26:b9:f5:fb:a3 Created. Past Logins 0.....16:54:22 01/13/2014
00:26:b9:f5:fb:a3 Device Channel List16:54:23 01/13/2014
00:26:b9:f5:fb:a3 Device Registration Failed.....16:54:23 01/13/2014

9.1.5. FAILED REGISTRATION – INCOMPLETE CONTACT INFORMATION

TEST PROCEDURE

- The client EUT uses the same contact information as the base EUT as both the base and the client are managed by the same operator.

RESULTS

Base software won't proceed with registration when contact information fields are missing.

Test Results	
Pass	Fail
<input checked="" type="checkbox"/>	<input type="checkbox"/>

BASE SOFTWARE PROMPTING THE USER TO ENTER MISSING CONTACT INFORMATION

The screenshot displays the 'Adaptrum TVBD Control Panel :: Base' interface. The 'Registration' tab is active, showing fields for Device Information, Contact, and Registrant. A modal dialog box titled 'AdaptrumTVBD' is open, displaying a yellow warning icon and the message 'Contact[Email] Field is empty'. The dialog has 'OK' and 'Cancel' buttons. In the background, the 'Contact' and 'Registrant' sections show fields for First Name, Last Name, Address, City, State, Zip Code, Country, Email, Work Phone, and Mobile Phone. The 'Email' field in the 'Contact' section is empty. Below the dialog, the 'Channel Request' section shows device information and a 'Reset Channel Request' button. At the bottom, the 'Device & Channel' section shows a log of events, including a failed registration attempt.

9.2. 15.707(A) FIXED TVBD RELOCATED

REQUIREMENT

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

TEST PROCEDURE

- The client EUT geographic coordinates are entered at registration time and stored in the device. The device channel list request uses the same coordinates established at registration time. No separate coordinates can be entered for channel list request.
- The device requires professional installation and device registration information including device location will be entered by the professional installer.
- Once the registration is complete, upon power cycling the device will use the stored registration location for channel list request.

RESULTS

The device only uses its registered location for channel list request. The device registered location will be established at installation time by a professional installer and cannot be altered after installation – see ACRS 2.0 Professional Installer Manual and ACRS 2.0 User Manual.

Test Results	
Pass	Fail
<input checked="" type="checkbox"/>	<input type="checkbox"/>

CLIENT SOFTWARE ONLY ALLOWS DEVICE REGISTRATION LOCATION INFORMATION TO BE ENTERED DURING INSTALLATION AND SAME DEVICE LOCATION IS USED FOR CHANNEL LIST REQUEST

Adaptrum TVBD Control Panel - Client

Log | Link | System Information | Diagnostics | Database | Installation

Device Configuration

Device Information

DEV_ID: A2UACRS20F

DEV_SN: A2F0UA02

DEV_MODE: F

LAT: 41.50809

LNG: -75.64332

Height AGL: 5 meters

Scan Channel Set: 20 Update Now

Set Device Info

Device & Channel

Fixed PPI PPII Test 0 dB

Auto Channel CH 20 (509 MHz)

Start/Stop

Status Update Status Auto Update

Channel Search Failed On Channel -1.....17:06:31 01/13/2014

Channel Search Started On Channel 20.....17:06:31 01/13/2014

Channel Search Success On Channel 20.....17:08:32 01/13/2014

BASE SOFTWARE USE CLIENT REGISTRATION LOCATION INFORMATION TO RETRIEVE CHANNEL LIST ON BEHALF OF THE CLIENT

Adaptrum TVBD Control Panel - Base

Log | Link | System Information | Diagnostics | Database | Installation

Registration

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQIA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Contact

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Registrant

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Register Device

Channel Request

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQIA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Other Information: Select From Available DB Channels
Update Interval:
Select Cancel www.googleapis.com/spectrum/v0

BASE MAC: FF:FF:FF:FF:FF:FF 16, 17, 19, 20, 21, 26, 27, 29, 35, 39
CLIENT MAC: 00:26:B9:F5:FB:A3 16, 17, 19, 20, 39

Reset Channel Request

Device & Channel

Fixed PPI PPII Test 0 dB Full Power Broadcast Auto Channel CH 20 (509 MHz) Start/Stop Start Service Stop Service Status Update Status Auto Update

00:26:b9:f5:fb:a3 Device Registration Successful.....17:08:28 01/13/2014
00:26:b9:f5:fb:a3 Device Channel List17:08:29 01/13/2014
Expires in 47Hours 59Mins 58Secs.....17:08:29 01/13/2014
00:26:b9:f5:fb:a3 Channel List Successful (5 Channels).....17:08:29 01/13/2014

9.3. §15.711(B)(3)(III) FIXED & MODE II TVDB DATABASE UPDATE

REQUIREMENT

- §15.711(B)(3)(III) If a fixed or Mode II personal/portable TVBD fails to successfully contact the TV bands database during any given day, it may continue to operate until 11:59 p.m. of the following day at which time it must cease operations until it re-establishes contact with the TV bands database and re-verifies its list of available channels.

Confirm that Block access to the database from the TVBD. All other radio functions, including internet connectivity should be maintained. Confirm that the TVBD shuts down by 11:59 PM on the following day.

TEST PROCEDURE

- Set the base EUT to normal operation mode.
- Set the client EUT to normal operation mode:
 - Enter proper registration information on the client.
 - Choose a proper set of scan channels on the client that includes the base operating channel.
 - The client sends connection request to the base.
 - The base performs registration and channel list request on behalf of the client.
 - The base verifies the current operating channel is in the returned client channel list and grants the client connection request and sends the client channel list to the client.
 - The client verifies its operating channel is in the client device channel list and enters normal operation.
- Observe output signal from the client EUT on the spectrum analyzer.
- Use a programmable router to block the database URL.
- Observe that there is no output signal from the client after 11:59 PM on the following day.

RESULTS

During normal operation, the base and client channel lists are updated periodically by sending channel list requests to the TVWS Database . Currently the period is set to 5 minutes. After the database access was blocked, the next channel list requests failed and the EUTs stopped transmission immediately.

Test Results	
Pass	Fail
<input checked="" type="checkbox"/>	<input type="checkbox"/>

BASE SOFTWARE BEFORE DATABASE BLOCKING (CLIENT/BASE ON CHANNEL 20)

Adaptrum TVBD Control Panel - Base

Log | Link | System Information | Diagnostics | Database | Installation

Registration

Device Information	Contact	Registrant
DEV_ID: A2UACRS20F	First Name: lin Last Name: sun	First Name: lin Last Name: sun
DEV_SN: A2FQIA01	Addr1: 25 E. Trimble Road	Addr1: 25 E. Trimble Road
DEV_MODE: F	Addr2:	Addr2:
LAT: 41.40809	City: san jose State: CA	City: san jose State: CA
LNG: -75.64332	Zip Code: 95131 Country: US	Zip Code: 95131 Country: US
Height AGL: 10 meters	Email: lin@adaptrum.com	Email: lin@adaptrum.com
	Work Phone: 408-850-0545 Mobile Phone: 408-850-0545	Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Register Device

Channel Request

Device Information	Other Information	Channel Request
DEV_ID: A2UACRS20F	Select From Available DB Channels	BASE MAC: FF:FF:FF:FF:FF:FF 16, 17, 19, 20, 21, 26, 27, 29, 35, 39
DEV_SN: A2FQIA01	Update Interval: [] Select Cancel	CLIENT MAC: 00:26:B9:F5:FB:A3 16, 17, 19, 20, 39
DEV_MODE: F		Reset Channel Request
LAT: 41.40809		
LNG: -75.64332		
Height AGL: 10 meters		

Device & Channel

Fixed PPI PPII Test 0 dB Full Power Broadcast Auto Channel CH 20 (509 MHz)

Start/Stop: Start Service Stop Service Status: Update Status Auto Update

00:26:b9:f5:fb:a3 Device Channel List17:08:29 01/13/2014

Expires in 47Hours 59Mins 58Secs.....17:08:29 01/13/2014

00:26:b9:f5:fb:a3 Channel List Successful (5 Channels).....17:08:29 01/13/2014

Agilent 08:49:44 Jan 13, 2014

R T



BASE SOFTWARE 7 MINUTES AFTER DATABASE BLOCKING (CLIENT STOPPED)

Adaptrum TVBD Control Panel :: Base

Log | Link | System Information | Diagnostics | Database | Installation

Registration

Device Information:

DEV_ID: A2UACRS20F
DEV_SN: A2FQJA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Contact:

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Registrant:

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Register Device

Channel Request

Device Information:

DEV_ID: A2UACRS20F
DEV_SN: A2FQJA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Other Information:

Select From Available DB Channels
Update Interval:
Select Cancel
www.googleapis.com/spectrum/v0

BASE MAC: FF:FF:FF:FF:FF:FF
CLIENT MAC: 00:26:B9:F5:FB:A3

Reset Channel Request

Device & Channel

Fixed PPI PPII Test 0 dB Full Power Broadcast Auto Channel CH 20 (509 MHz)

Start/Stop: Start Service Stop Service Status: Update Status Auto Update

00:26:b9:f5:fb:a3 Channel List Failed (0 Channels).....17:14:51 01/13/2014
00:26:b9:f5:fb:a3 Device Channel List17:15:06 01/13/2014
Base Device Channel List.....17:15:22 01/13/2014
00:26:b9:f5:fb:a3 Channel List Failed (0 Channels).....17:15:22 01/13/2014

CLIENT SIGNAL SPECTRUM ~5 MINUTES AFTER DATABASE BLOCKING

Agilent 08:52:17 Jan 13, 2014

R T

Freq/Channel

Ref -40 dBm #Atten 0 dB Mkr1 509.00 MHz -117.34 dBm

#Avg
Log
10
dB/

PAvg

M1 S2
S3 FS
AA

□(f):
FTun
Swp

Center Freq
509.000000 MHz

Start Freq
494.000000 MHz

Stop Freq
524.000000 MHz

CF Step
3.00000000 MHz
Auto Man

Freq Offset
0.00000000 Hz

Signal Track
On Off

Center 509.00 MHz

Span 30 MHz

#Res BW 3 kHz

VBW 3 kHz

Sweep 12.71 s (601 pts)

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9.4. §15.711(B)(3)(I)(II), §15.713(A)(1) 48 HOUR CHANNEL SCHEDULING

REQUIREMENT

- After receiving an available channel list, register a low-power auxiliary device on the TVBD operating channel. Repeat the available channel request after the update interval and confirm that the low-power device is accounted for in the schedule. Using the system management software, confirm that the device changes channels at the scheduled time.

TEST PROCEDURE

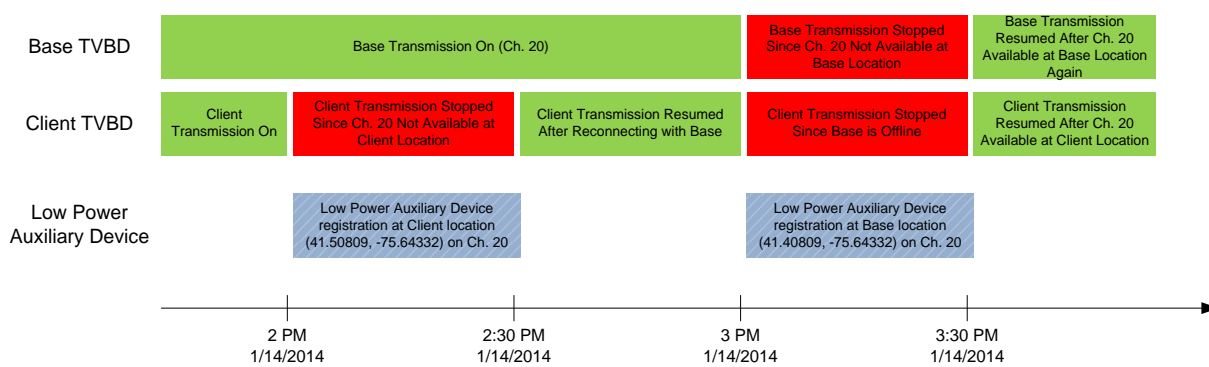
- Referring to the following testing timeline diagram. Low Power Auxiliary Devices are registered and scheduled for protection at both base and client locations, i.e. from 3 PM to 3:30 PM on 1/14/2014 at base location and from 2 PM to 2:30 PM on 1/14/2014 at client location.
- The base and client EUTs are in normal operation prior to the time when the Low Power Auxiliary Device protection period begins at the client location (2 PM on 1/14/2014).
- Upon channel list request to the TVWS Database , the base obtains the updated channel list expiration time for the client (at 2 PM on 1/14/2014) and sends the information to the client
- The base requests new client channel list upon the channel list expiration (2 PM on 1/14/2014) and the current operating channel (Channel 20) is no longer in the returned client channel list. The base sends the information to the client.
- The client ceases operation on Channel 20 immediately after receiving the updated channel list information from the base.
- The base continues sending periodic client channel list requests to the TVWS Database . The returned channel list expiration time (2:30 PM on 1/14/2014) reflecting the ending time of the registered protection period for the Low Power Auxiliary Device at the client location.
- The base requests new channel list for the client upon the channel list expiration (2:30 PM on 1/14/2014) and Channel 20 becomes available again. The base send the updated client channel list to the client.
- The client reconnects with the base and starts normal operation on Channel 20 after receiving the updated channel list that includes Channel 20.

RESULTS

The client EUT correctly ceased transmission on the protected channel over the protection period of the Low Power Auxiliary Device at the same location.

Test Results	
Pass	Fail
<input checked="" type="checkbox"/>	<input type="checkbox"/>

48 HOUR CHANNEL SCHEDULING TESTING TIMELINE ILLUSTRATION



48 HOUR CHANNEL SCHEDULING LOW POWER AUXILIAR DEVICE REGISTRATION RECORD AT CLIENT LOCATION

Google Spectrum Database Registration Record	
ENTITY_TYPE	LP_AUX
CHANNEL	20
CALL_SIGN	KLKN
LOCATION_TYPE	MULTI_POINT
LOCATION	(41.508090, -75.643320)
REGISTRANT	Test Test 800 Schultz Court\nScranton, PA 18150\nUS 650-253-0000
EVENT_START	2014/01/14-22:00:00.000 (GMT)
EVENT_END	2014/01/14-22:30:00.000 (GMT)

48 HOUR CHANNEL SCHEDULING BASE SOFTWARE BEFORE PROTECTION PERIOD FOR THE CLIENT LOCATION

Adaptrum TVBD Control Panel :: Base

Log | Link | System Information | Diagnostics | Database | Installation

Registration

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQJA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Contact

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Registrant

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Register Device

Channel Request

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQJA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Other Information

Select From Available DB Channels

Update Interval: Select Cancel

www.googleapis.com/spectrum/v0

BASE MAC: FF:FF:FF:FF:FF:FF 16, 17, 19, 20, 21, 26, 27, 29, 35, 39
CLIENT MAC: 00:26:B9:F5:FB:A3 16, 17, 19, 20, 39

Reset Channel Request

Device & Channel

Fixed PPI PPII Test: 0 dB Full Power Broadcast Auto Channel CH 20 (509 MHz)

Start/Stop Start Service Stop Service Status Update Status Auto Update

00:26:b9:f5:fb:a3 Device Channel List13:36:04 01/14/2014
Expires in 0Hours 23Mins 56Secs.....13:36:04 01/14/2014
00:26:b9:f5:fb:a3 Channel List Successful (5 Channels).....13:36:04 01/14/2014

48 HOUR CHANNEL SCHEDULING CLIENT SOFTWARE BEFORE PROTECTION PERIOD FOR THE CLIENT LOCATION

Adaptrum TVBD Control Panel - Client

Log | Link | System Information | Diagnostics | Database | Installation

Device Configuration

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2F01A02
DEV_MODE: F
LAT: 41.50809
LNG: -75.64332
Height AGL: 5 meters

Scan Channel Set: 20 [Update Now]

[Set Device Info]

Device & Channel

Fixed PPI PPII Test 0 dB [Auto Channel] CH 20 (509 MHz) [Start/Stop] [Update Status] [Auto Update]

Channel Search Started On Channel 20.....	12:55:13	01/14/2014
✓ Channel Search Success On Channel 20.....	12:55:51	01/14/2014
✓ Channel Search Success On Channel 20.....	13:30:33	01/14/2014

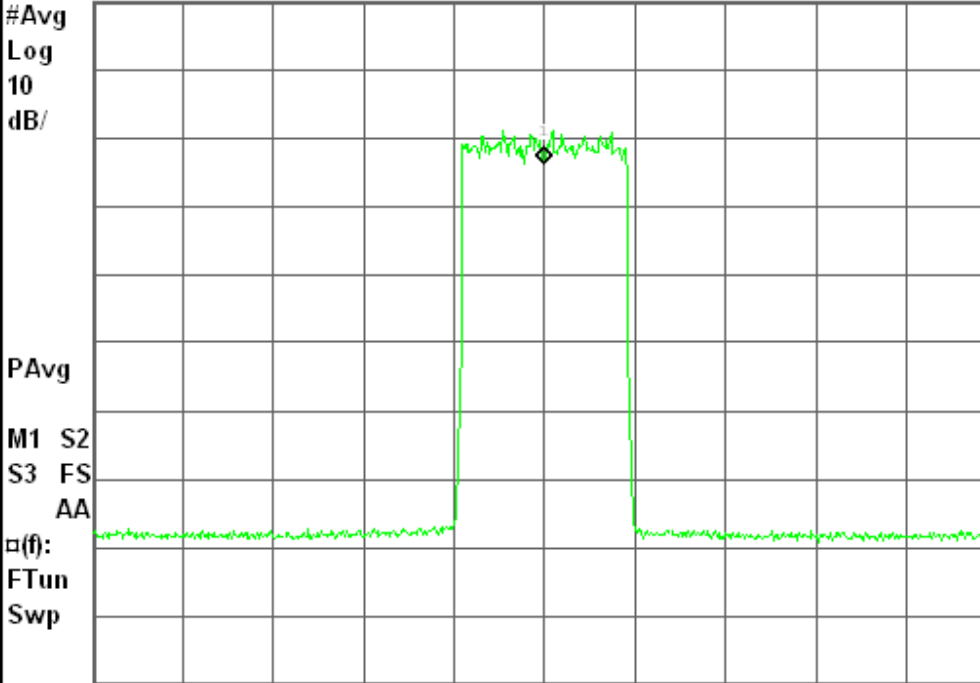
48 HOUR CHANNEL SCHEDULING ACTIVE CLIENT SIGNAL SPECTRUM PRIOR TO PROTECTION PERIOD

Agilent 15:33:46 Jan 14, 2014

R T

Freq/Channel

Ref -40 dBm #Atten 0 dB Mkr1 509.00 MHz
-63.87 dBm



Center Freq
509.000000 MHz

Start Freq
494.000000 MHz

Stop Freq
524.000000 MHz

CF Step
3.00000000 MHz
Auto Man

Freq Offset
0.00000000 Hz

Signal Track
On Off

Center 509.00 MHz Span 30 MHz
#Res BW 3 kHz #VBW 3 kHz Sweep 12.71 s (601 pts)

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48 HOUR CHANNEL SCHEDULING BASE SOFTWARE DURING PROTECTION PERIOD FOR THE CLIENT LOCATION (CHANNEL 20 NOT AVAILABLE AT THE CLIENT LOCATION)

Adaptrum TVBD Control Panel :: Base

Log | Link | System Information | Diagnostics | Database | Installation

Registration

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQJA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Contact

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Registrant

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Register Device

Channel Request

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQJA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Other Information

Select From Available DB Channels

Update Interval: Select Cancel

www.googleapis.com/spectrum/v0

BASE MAC: FF:FF:FF:FF:FF:FF 16, 17, 19, 20, 21, 26, 27, 29, 35, 39
CLIENT MAC: 00:26:B9:F5:FB:A3 16, 17, 19, 39

Reset Channel Request

Device & Channel

Fixed PPI PPII Test: 0 dB Full Power Broadcast Auto Channel CH 20 (509 MHz)

Start/Stop Start Service Stop Service Status Update Status Auto Update

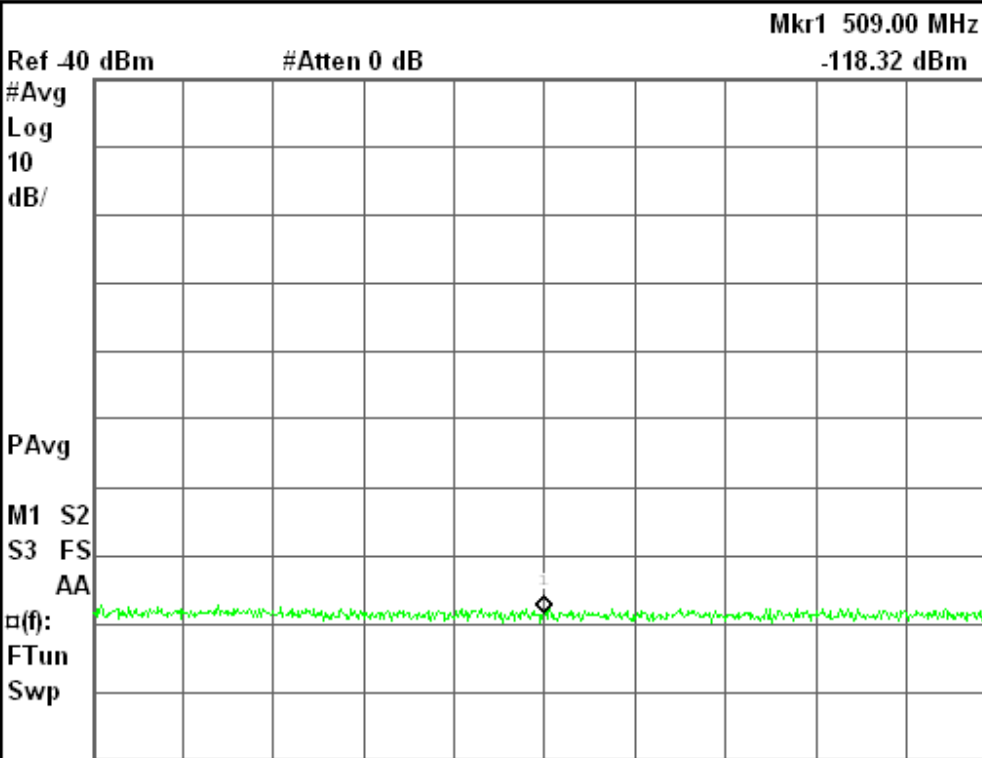
00:26:b9:f5:fb:a3 Device Channel List14:01:02 01/14/2014
Expires in 0Hours 28Mins 58Secs.....14:01:02 01/14/2014
00:26:b9:f5:fb:a3 Channel List Successful (4 Channels).....14:01:03 01/14/2014

48 HOUR CHANNEL SCHEDULING CLIENT SIGNAL NOT ACTIVE DURING THE PROTECTION PERIOD

Agilent 15:58:59 Jan 14, 2014

R T

Freq/Channel



Center Freq
509.000000 MHz

Start Freq
494.000000 MHz

Stop Freq
524.000000 MHz

CF Step
3.00000000 MHz
Auto Man

Freq Offset
0.00000000 Hz

Signal Track
On Off

Center 509.00 MHz Span 30 MHz
#Res BW 3 kHz #VBW 3 kHz Sweep 12.71 s (601 pts)

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48 HOUR CHANNEL SCHEDULING BASE SOFTWARE AFTER PROTECTION PERIOD FOR THE CLIENT LOCATION (CHANNEL 20 AVAILABLE AGAIN)

Adaptrum TVBD Control Panel :: Base

Log | Link | System Information | Diagnostics | Database | Installation

Registration

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQJA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Contact

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Registrant

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Register Device

Channel Request

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQJA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Other Information

Select From Available DB Channels

Update Interval: Select Cancel

BASE MAC: FF:FF:FF:FF:FF:FF 16, 17, 19, 20, 21, 26, 27, 29, 35, 39
CLIENT MAC: 00:26:B9:F5:FB:A3 16, 17, 19, 20, 39

Reset Channel Request

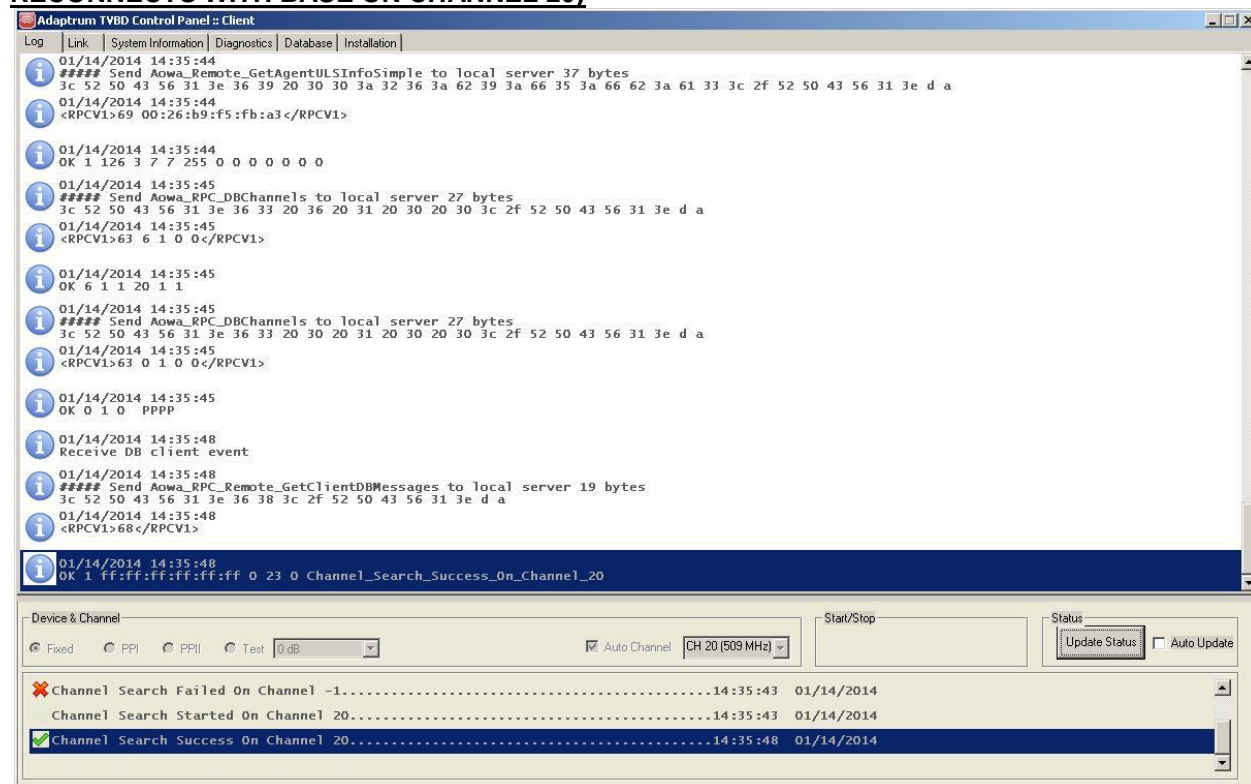
Device & Channel

Fixed PPI PPII Test: 0 dB Full Power Broadcast Auto Channel CH 20 (509 MHz)

Start/Stop: Start Service Stop Service Status: Update Status Auto Update

00:26:b9:f5:fb:a3 Device Channel List14:35:50 01/14/2014
Expires in 1Hours 54Mins 10Secs.....14:35:50 01/14/2014
00:26:b9:f5:fb:a3 Channel List Successful (5 Channels).....14:35:50 01/14/2014

48 HOUR CHANNEL SCHEDULING CLIENT SOFTWARE AFTER PROTECTION PERIOD (CLIENT RECONNECTS WITH BASE ON CHANNEL 20)

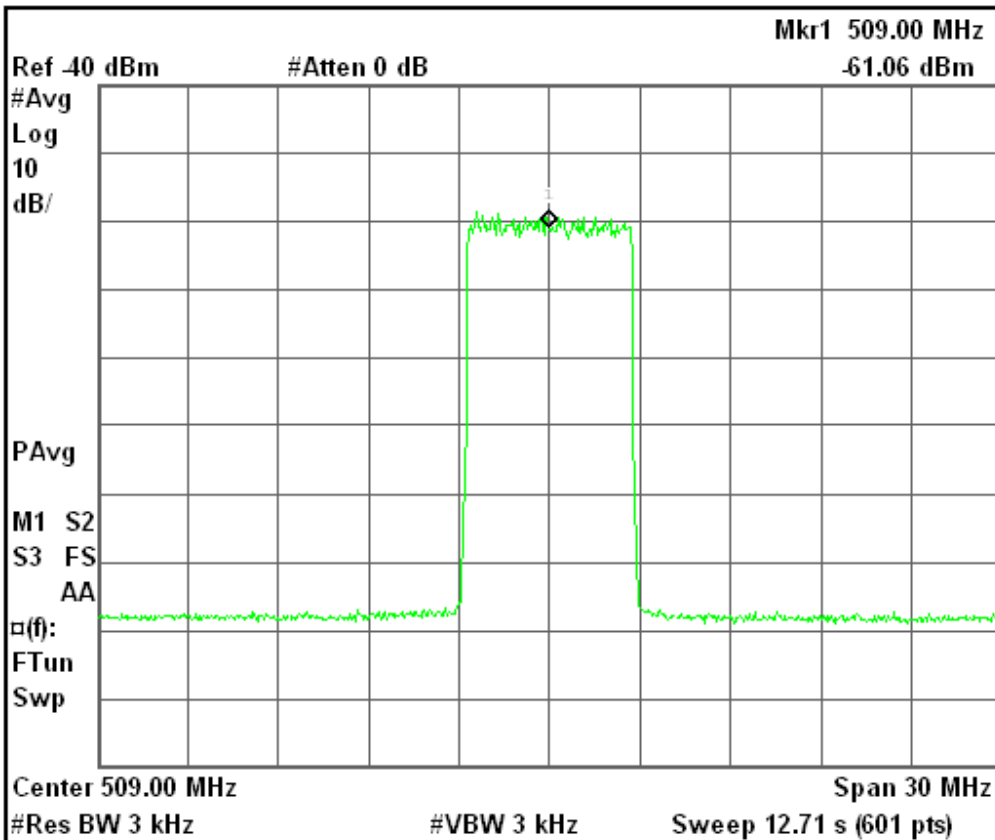


48 HOUR CHANNEL SCHEDULING CLIENT SIGNAL RESUMED AFTER THE PROTECTION PERIOD

Agilent 16:35:18 Jan 14, 2014

R T

Freq/Channel



Center Freq
509.000000 MHz

Start Freq
494.000000 MHz

Stop Freq
524.000000 MHz

CF Step
3.00000000 MHz
Auto Man

Freq Offset
0.00000000 Hz

Signal Track
On Off

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9.5. §15.707, §15.711(B)(3)(I)(II)(IV),(C), §15.712 TVBD CHANNEL AVAILABILITY

REQUIREMENT

- 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

- Set the base EUT to normal operation (on Channel 20).
- Configure the client EUT with correct registration information.
- Configure the client with proper scan channel set that includes the base EUT operating channel. The client will issue connection request to the base.
- Observe the base performing device registration and channel list request on behalf of the client. The base operating channel is within the returned channel list for the client.
- The base grants connection request from the client and the client starts normal operation on the channel (Channel 20).
- The client EUT can only operate on a channel if all of the following are true:
 - The channel is within the authorized channel list for the base
 - The channel is the current operating channel of the base EUT
 - The channel is within the authorized channel list for the client
 - The channel is within the client device operating frequency range, i.e. 470 – 698 MHz (Channels 14 – 51 excluding Channels 36 to 38) as approved by FCC for ACRS 2.0 Fixed TVBD.
- Test pre-condition: The device is configured to operate at a power level less than or equal to that which is authorized by the Grant.
- Upon successful registration the database returns the allowable power according to the device type, Fixed 36 dBm eirp in this example.
- Verify the client transmission on the spectrum analyzer.

RESULTS

The EUT operates on a channel from the authorized channel list and at the authorized power level.

Refer to the testing in Section 0, when the base EUT operating channel (Channel 20) was no longer in the channel list authorized for the client, the client ceased operation on the channel immediately. The testing verifies that the client EUT cannot operate on any channel other than those within the authorized channel list for the client returned from the TVWS Database .

Test Results	
Pass	Fail
<input checked="" type="checkbox"/>	<input type="checkbox"/>

CLIENT SOFTWARE SHOWING CLIENT SCANNING AND MAKING CONNECTION WITH THE BASE ON CHANNEL 20

The screenshot displays the 'Adaptrum TVBD Control Panel - Client' window. The top menu bar includes 'Log', 'Link', 'System Information', 'Diagnostics', 'Database', and 'Installation'. The main area is divided into two sections: 'Device Configuration' and 'Device & Channel'.

Device Configuration:

- Device Information:**
 - DEV_ID: A2UACRS20F
 - DEV_SN: A2F0UA02
 - DEV_MODE: F (dropdown)
 - LAT: 41.50809
 - LNG: -75.64332
 - Height AGL: 5 meters
- Scan Channel Set:** 20 (input field) with an 'Update Now' button.
- Set Device Info** button.

Device & Channel:

- Fixed** (selected), PPI, PPII, Test (radio buttons).
- Auto Channel** (checked), CH 20 (509 MHz) (dropdown).
- Start/Stop** button.
- Status:** Update Status button, Auto Update checkbox.
- Log:**
 - Channel Search Started On Channel 20.....17:06:31 01/13/2014
 - ✓ Channel Search Success On Channel 20.....17:08:32 01/13/2014
 - ✓ Channel Search Success On Channel 20.....17:18:11 01/13/2014

BASE SOFTWARE SHOWING SUCCESSFUL CLIENT CHANNEL LIST REQUEST

Adaptrum TVBD Control Panel - Base

Log | Link | System Information | Diagnostics | Database | Installation

Registration

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQIA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Contact

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Registrant

First Name: lin Last Name: sun
Addr1: 25 E. Trimble Road
Addr2:
City: san jose State: CA
Zip Code: 95131 Country: US
Email: lin@adaptrum.com
Work Phone: 408-850-0545 Mobile Phone: 408-850-0545

Register Device

Channel Request

Device Information

DEV_ID: A2UACRS20F
DEV_SN: A2FQIA01
DEV_MODE: F
LAT: 41.40809
LNG: -75.64332
Height AGL: 10 meters

Other Information: Select From Available DB Channels

Update Interval: [] Select Cancel

BASE MAC: FF:FF:FF:FF:FF:FF 16, 17, 19, 20, 21, 26, 27, 29, 35, 39
CLIENT MAC: 00:26:B9:F5:FB:A3 16, 17, 19, 20, 39

Reset Channel Request

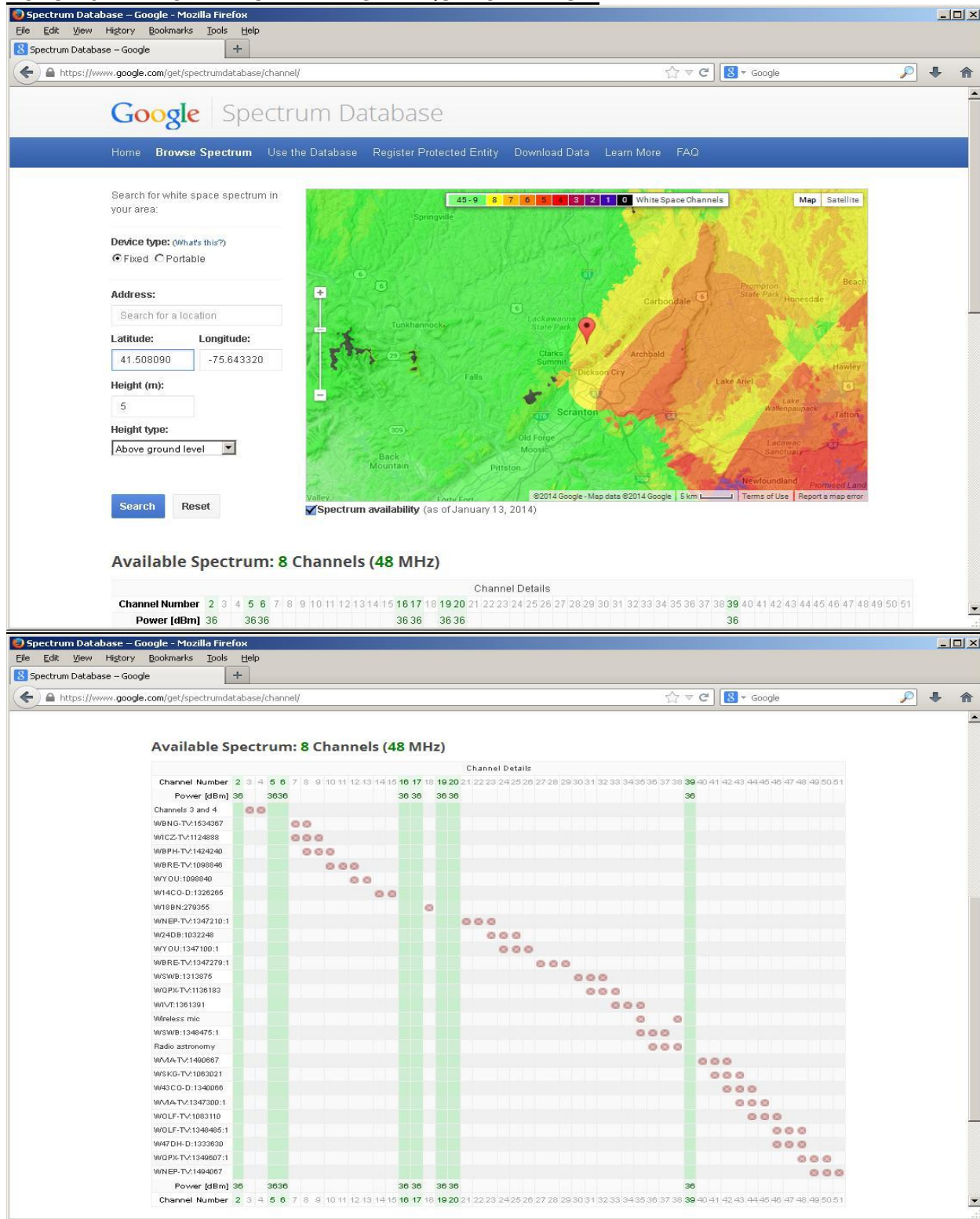
Device & Channel

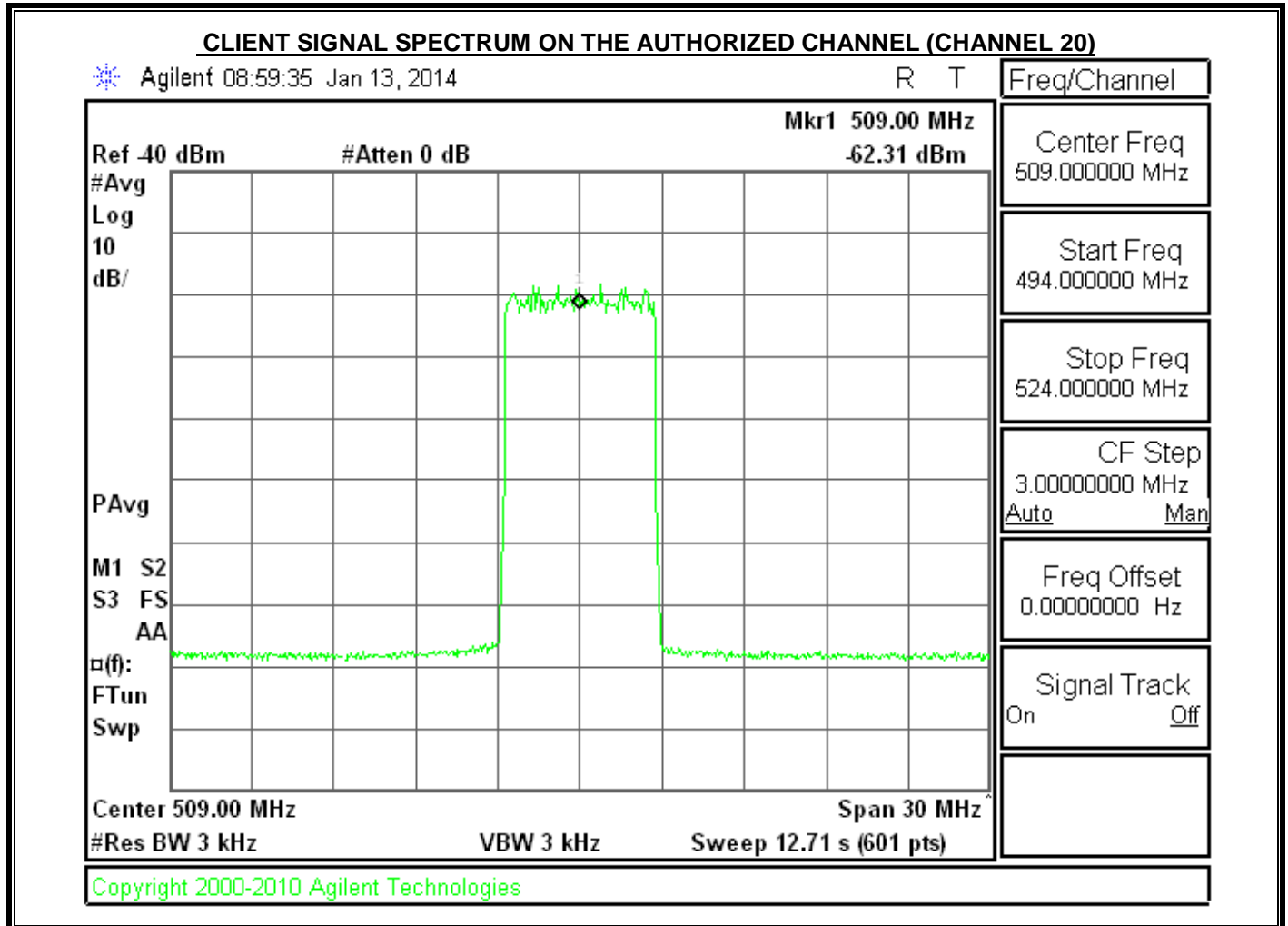
Fixed PPI PPII Test 0 dB Full Power Broadcast Auto Channel CH 20 (509 MHz)

Start/Stop Start Service Stop Service Status Update Status Auto Update

00:26:b9:f5:fb:a3 Device Channel List17:17:26 01/13/2014
Expires in 47Hours 59Mins 59Secs.....17:17:27 01/13/2014
✓ 00:26:b9:f5:fb:a3 Channel List Successful (5 Channels).....17:17:27 01/13/2014
Base Device Channel List.....17:17:42 01/13/2014

GOOGLE WEB INTERFACE SHOWING AUTHORIZED CHANNELS AT THE DEVICE LOCATION. NOTE ONLY A SUBSET (CHANNELS 16, 17, 19, 20 AND 39) OF THE 8 AVAILABLE CHANNELS ARE WITHIN THE ACRS 2.0 TVBD CLIENT OPERATING FREQUENCY RANGE.





9.6. §15.715(F) SECURITY

REQUIREMENT

- The device operations procedures must include documentation with a detailed explanation of the following for each database the device is expected to work with:
 - i. What communication protocol is used between the database and the TVBD?
 - ii. How are communications initiated?
 - iii. How does the TVBD validate messages from the database?
 - iv. How does the device handle failure to communicate or authenticate the database?
 - v. How does the database validate messages from a TVBD?
 - vi. What encryption method is used?
 - vii. How does the database ensure secure registration of protected devices?

ANSWERS

See answers in Section 8.6. Applicable to BASE and Client stations.