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DATE: 6 July 2015

I.T.L. (PRODUCT TESTING) LTD.

FCC Radio Test Report according to Subpart H, Part 2

for

Runcom Technologies Ltd.

Equipment under test:

Base Station

RNU4000-TVWS

Tested by: _____
I. Siboni

Approved by: _____
D. Shidlowsky

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This report relates only to items tested.

ISRAEL TESTING LABORATORIES
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Measurement/Technical Report for

Runcom Technologies Ltd.

Base Station

RNU4000-TVWS

FCC ID: XYMBTSTVWS-1

6 July 2015

This report concerns:	Original Grant: X Class I Change: Class II Change:
Equipment type:	WGF- White Space Device with Geo-location – Fixed
Limits used:	47CFR15 Subpart H White Spaces System

Measurement procedure used is ANSI C63.4-2009 and KDB 416721 D01 White Space Test Procedures v 02

Application for Certification
prepared by:
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1. General Information

1.1 *Administrative Information*

Manufacturer:	Runcom Technologies Ltd.
Manufacturer's Address:	11 Moshe Levi St. Rishon Le Zion 75658 Israel Tel: +972-3-952-8440 Fax: +972-3-952-8805
Manufacturer's Representative:	Tzvi Marcu
Equipment Under Test (E.U.T):	Base Station
Equipment Model No.:	RNU4000-TVWS
Equipment Serial No.:	Not designated
Date of Receipt of E.U.T:	20.04.2015
Start of Test:	20.04.2015
End of Test:	30.04.2015
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod ISRAEL 7120101
Test Specifications:	FCC Part 15, Subpart H, Part 2

1.2 *List of Accreditations*

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), FCC Designation No. US1004.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-1350, R-1285.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site No. IC 4025A-1.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

1.3 *Product Description*

Runcom's RNU4000BS is a fully integrated outdoor WiMAX Base Station (BS) that provides flexible, cost-effective WiMAX network deployment solutions in the TVWS band (470-698MHz) where increased capacity and coverage are required.
'All-in-one' architecture combined with simple, single-handed installation and fast rollout make these BSs an ideal solution for operators that want to get in on the ground floor of WiMAX deployment that can connect subscribers in Non Line of Site (NLOS) situations at significant CAPEX reductions and maximum return on their network investment.
The RNU4000BS is designed for coverage flexibility: depending on the required scenario, the same BS can be configured to cover more sectors with relatively sparse concurrent user requirements or fewer sectors with higher needs.
RNU4000BS BSs provide adaptable solutions, allowing interoperability with other MSS devices as well as ASN-GW vendors.

1.4 Test Methodology

Radiated testing was performed according to the procedures ANSI C63.4: 2009 and KDB 416721 D01 White Space Test Procedures v 02.

Radiated testing was performed at an antenna to EUT distance of 1 and 3 meters.

1.5 *Test Facility*

Radiated emissions tests were performed at I.T.L.'s testing facility in Lod, Israel. I.T.L.'s EMC Laboratory is accredited by A2LA, certificate No. 1152.01 and its FCC Designation Number is US1004.

2. System Test Configuration

2.1 *Justification*

The E.U.T. was tested in installation position with power strength and modulation reflecting actual set up.

2.2 *EUT Exercise Software*

No special exercise software was used.

2.3 *Special Accessories*

No special accessories were needed to achieve compliance.

2.4 *Equipment Modifications*

No modifications were necessary in order to achieve compliance.

2.5 *Configuration of Tested System*

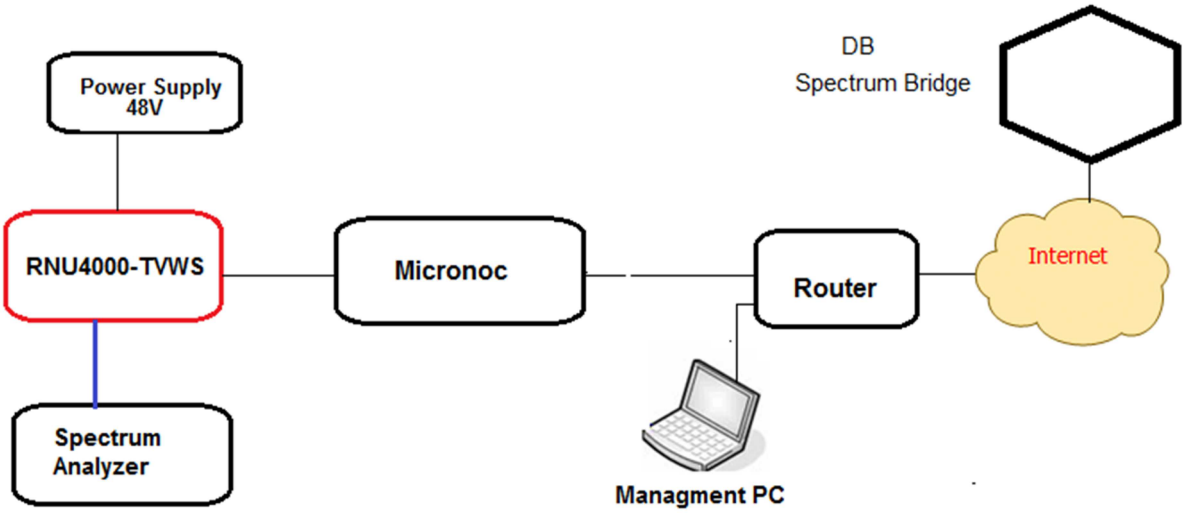

Figure 1. Configuration of Tested System

3. Test Set-up Photo

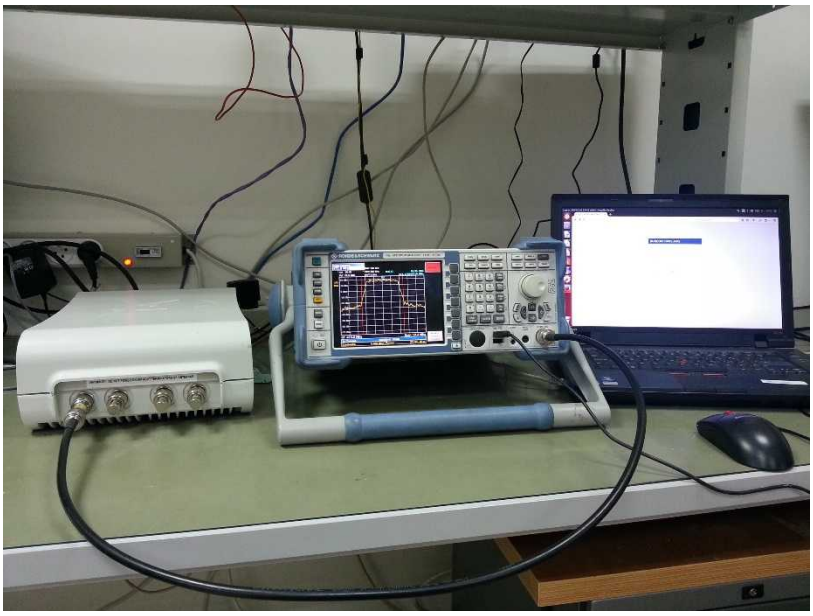

Figure 2. Test Set Up

4. §15.713(F)(3) – Fixed TVBD Registration

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

4.1.1 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.

4.1.2 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.

4.1.3 Test Results:

JUDGEMENT: PASS

The registration request and the response for the successful registration were seen on the WSDB log, *Figure 3.*

The TVBD GUI status page confirmed the successful registration. Operating Channel is 14, see *Figure 4.*
The transmitter did not turn ON until the database exchange was successfully completed.

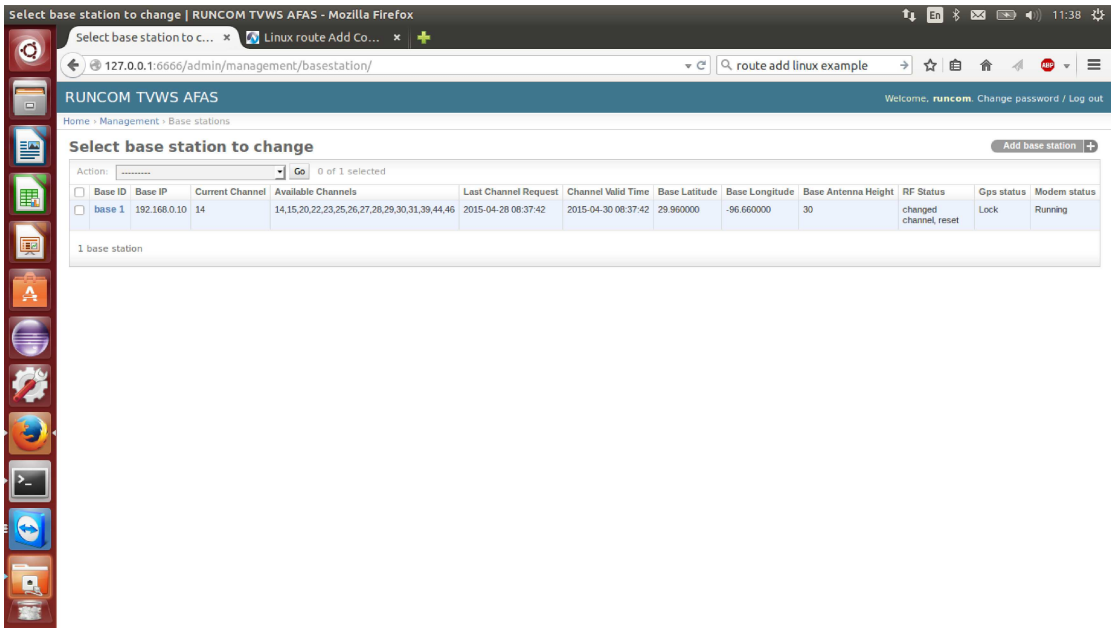

Figure 3. WSDB Log

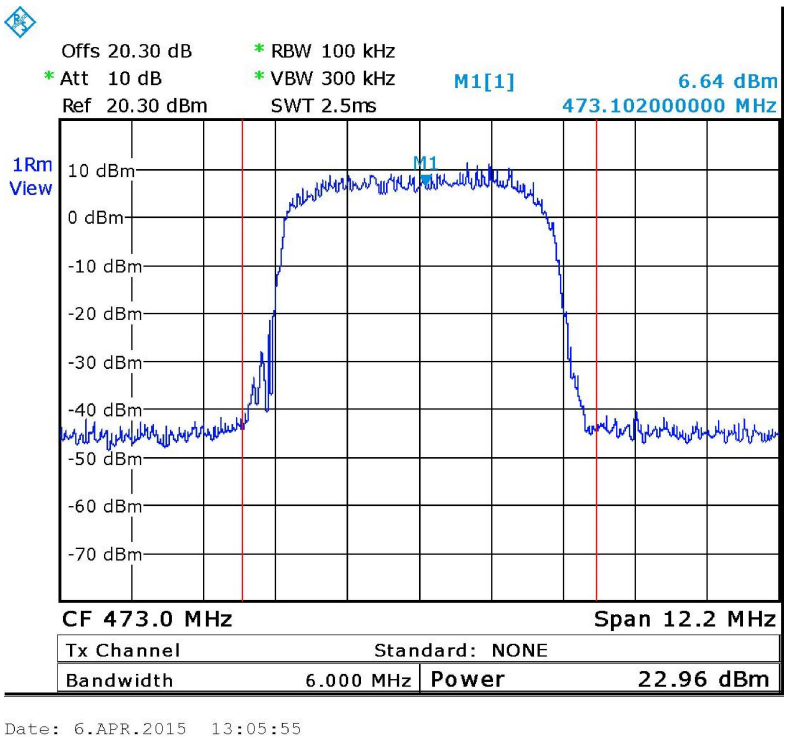

Figure 4. Spectrum Analyzer Plot for Channel 14

4.2 *Successful Registration, 15.713(f)(3) – Incomplete Contact Information*

4.2.1 Test Pre-conditions:

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

4.2.2 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 GUI.

4.2.3 Test Results:

JUDGEMENT: PASS

The system message tab on the TVBD GUI, see *Figure 5*, confirmed the successful registration. No registration request was sent to the WSDB. All combinations of missing information were tried and the behavior verified. The TVBD GUI did 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.

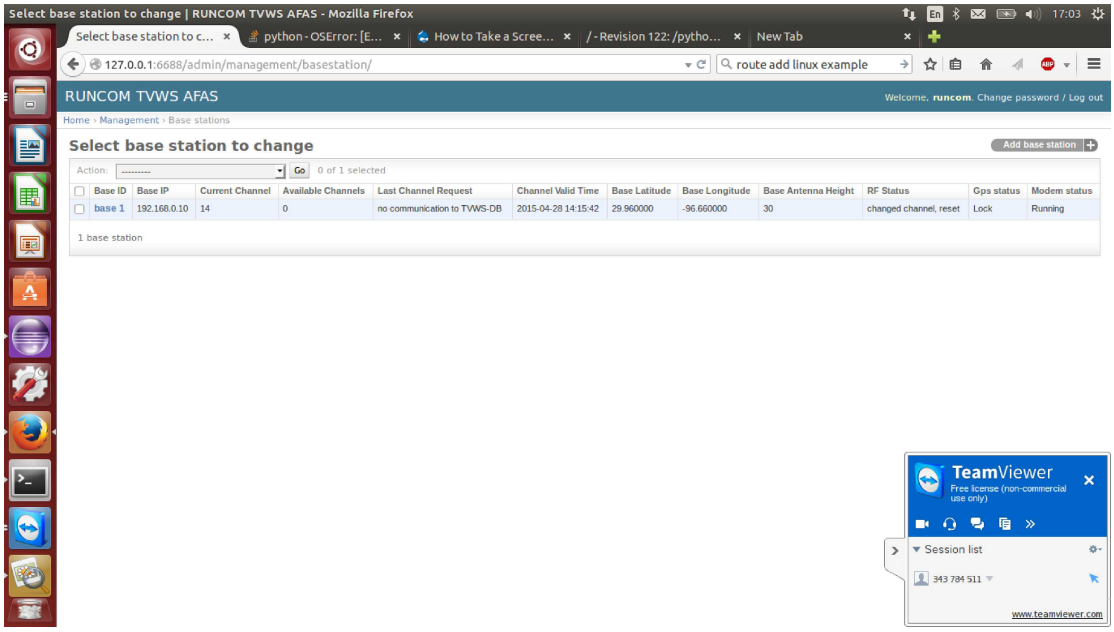

Figure 5. TVBD GUI

4.3 *Successful Registration, 15.713(f)(3) – FCC ID, Serial Number*

FCC ID and the Serial Number is a part of the TVBD firmware and cannot be changed.

5. §15.707(a) Fixed TVBD Relocated

5.1 *Test Purpose:*

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

5.2 *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.

5.3 *Test Data:*

The radio was not capable of separating the registration and channel request commands, so a simulator was used to verify this test. Spectrum Bridge had worked with the radio vendor to implement and test the interface between the radio device and Spectrum Bridge's FCC certified TVWS database.
When the channel request was sent through the simulator as a type 8 device (fixed) channel list is not granted by the database and an error 14 code is sent.

5.4 *Test Result:*

JUDGEMENT: PASS

Simulator requested a channel list on a location different from where it was registered. For additional information see *Figure 6.*

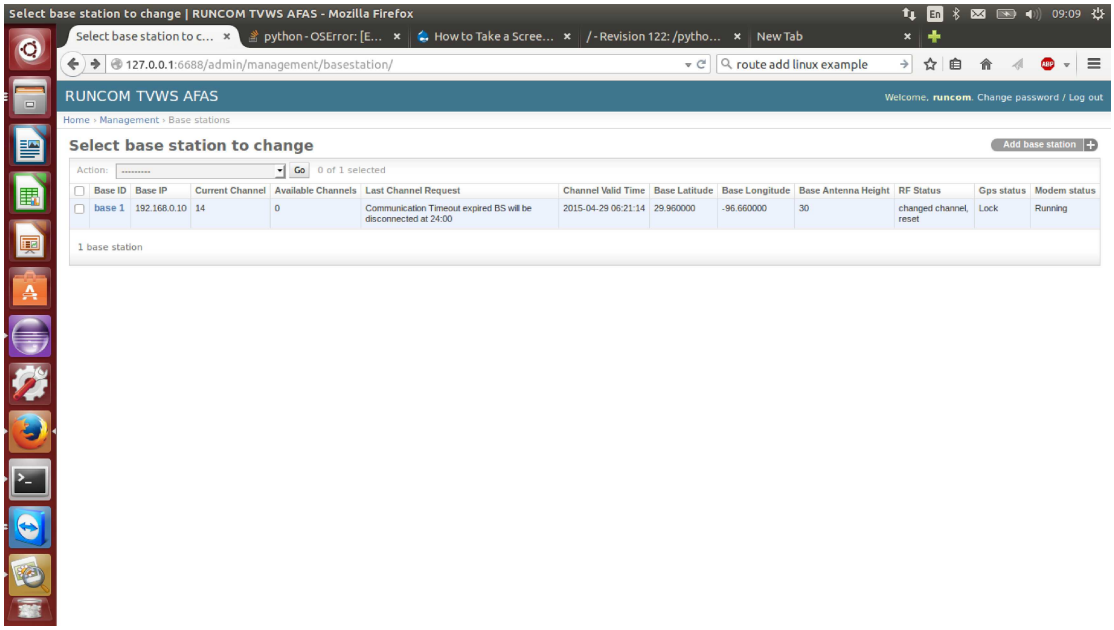

Figure 6. WSDB Log for the Response to the TVBD Relocated Channel Request

6. §15.711(b)(3)(iii) Fixed & Mode II TVDB Database Update

6.1 *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 11:59 PM the following day. Verify using a spectrum analyzer and the device management interface.

6.2 *Test Results:*

JUDGEMENT: PASS

The device is configured to shuts down by 11:59 PM on the following day if access to the database is blocked.
The device was initially powered up and it successfully registered with the database at approximately 5:30 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.

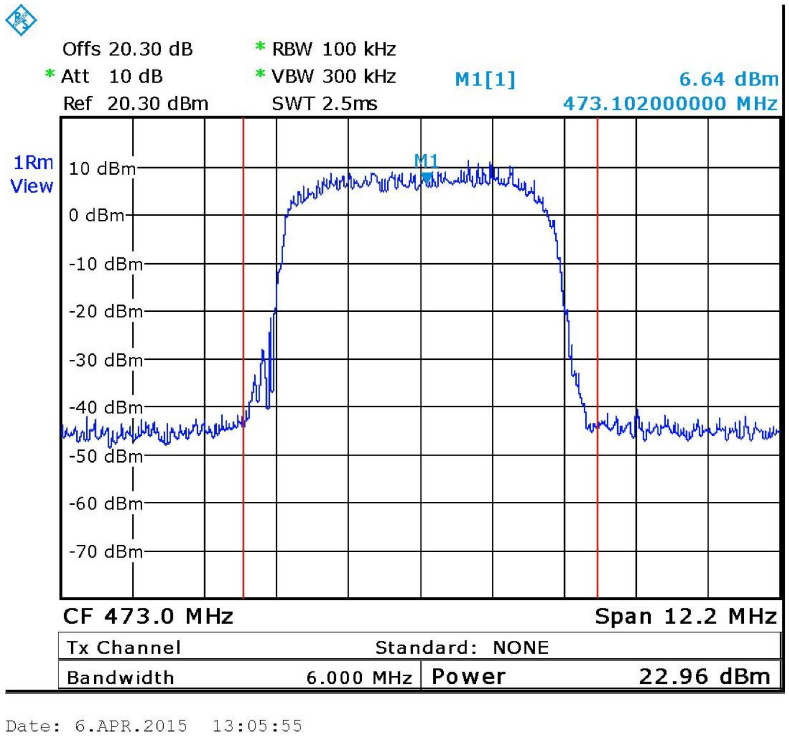

Figure 7. Device Transmitting on CH14

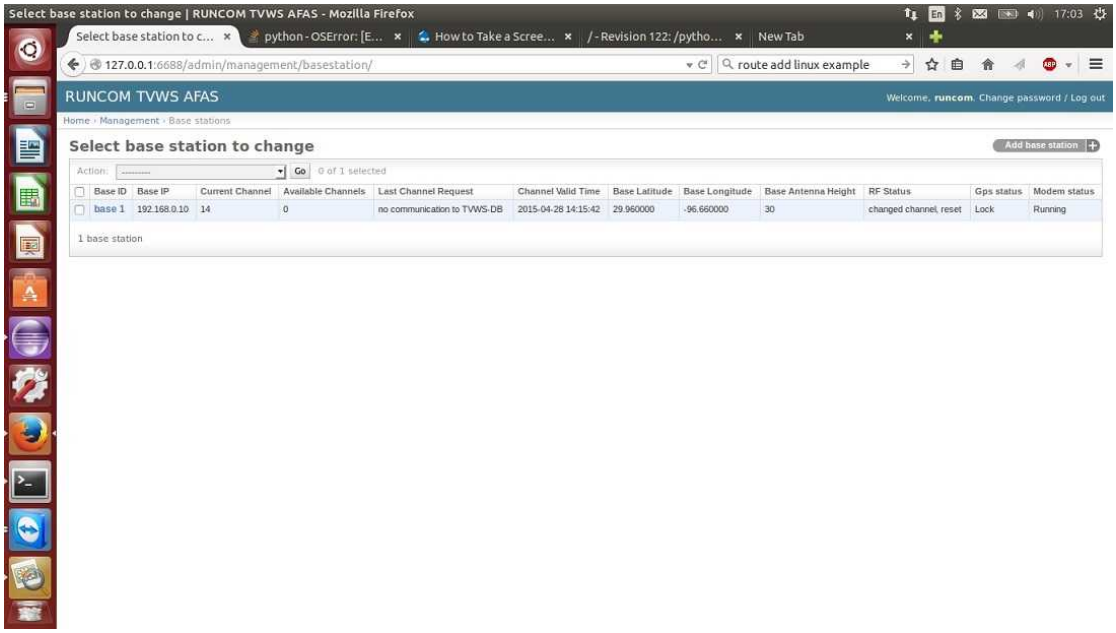

Figure 8- Communication to Database is blocked

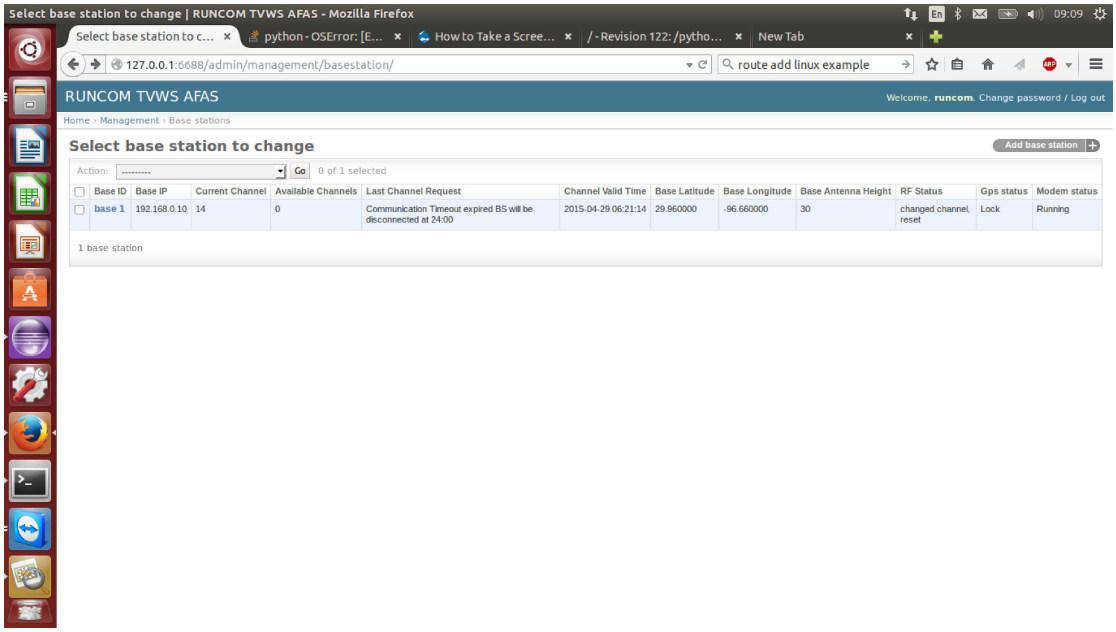

Figure 9. Alert that the EUT will be disconnected at 24:00

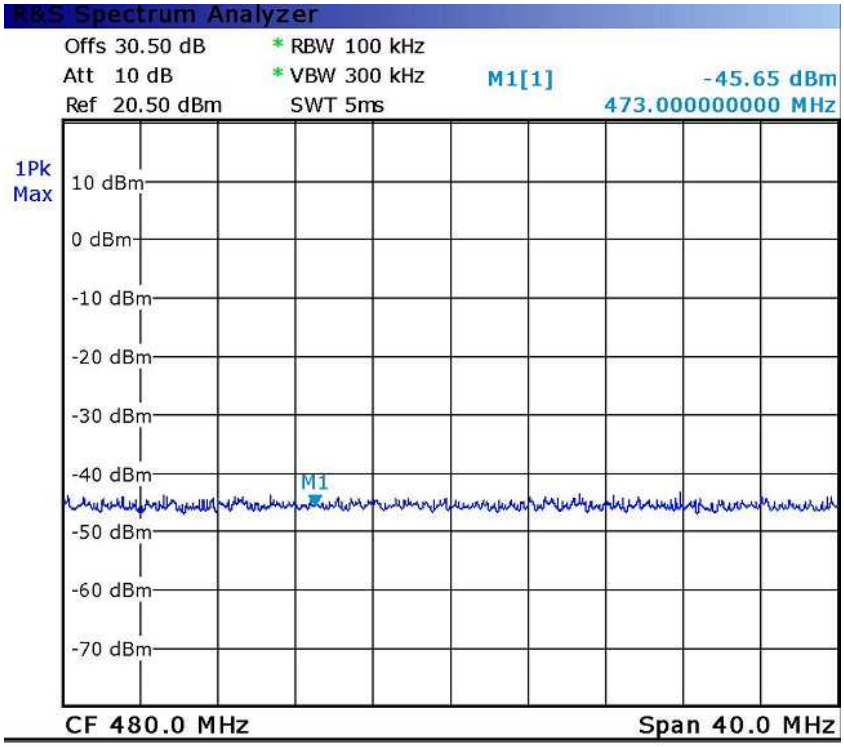

Figure 10. EUT disconnected

7. §15.711(b)(3)(i)(ii), §15.713(a)(1) 48 Hour Channel Scheduling

7.1 *Test Purpose*

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.

7.2 *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.
Verify 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.

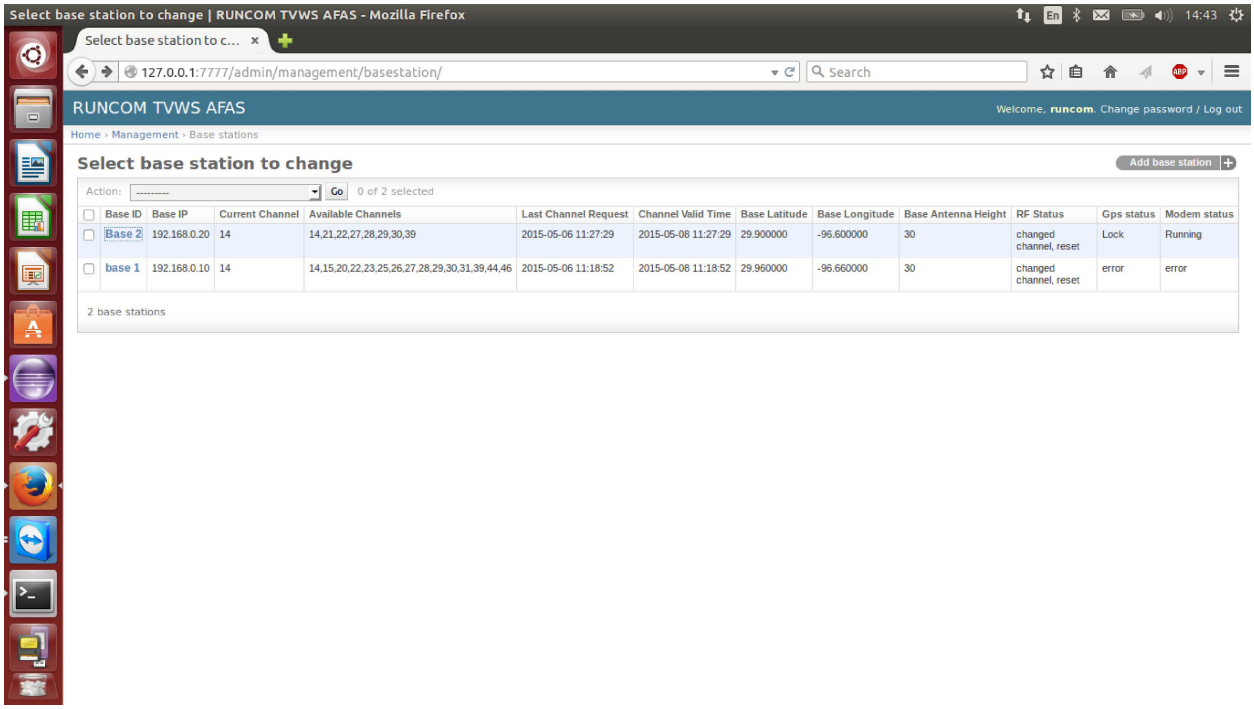

Figure 11. – Channel 14 is allocated

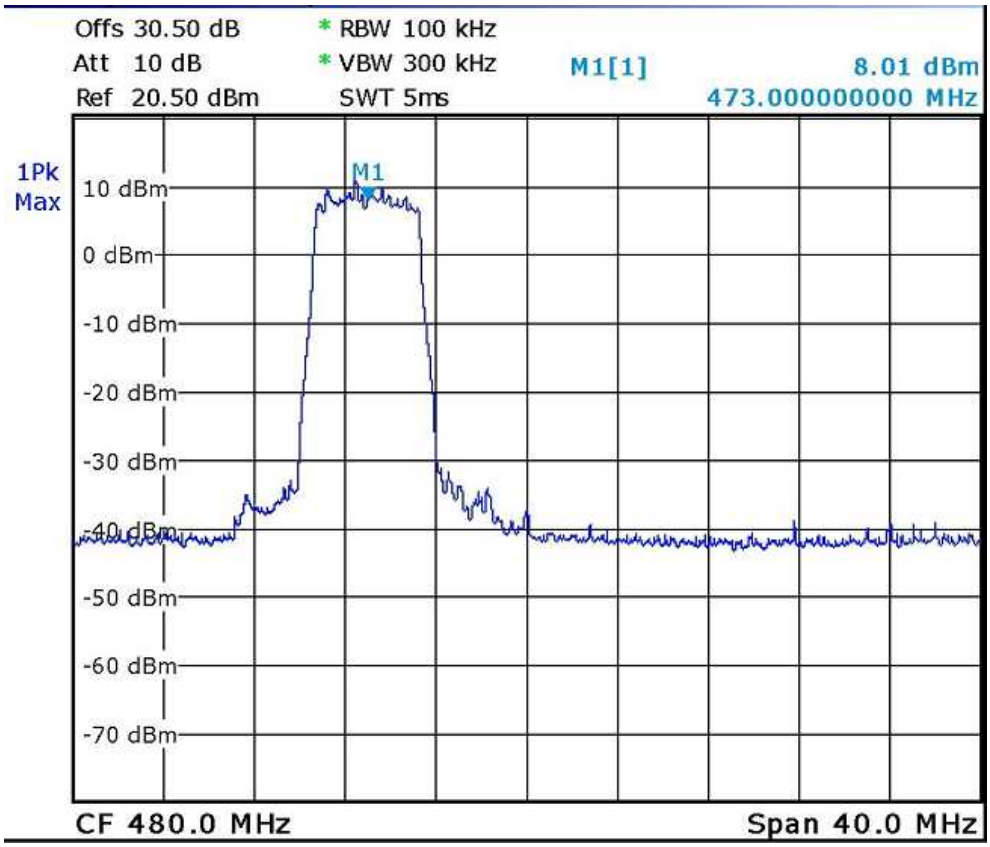

Figure 12. - EUT is transmitting in channel 14

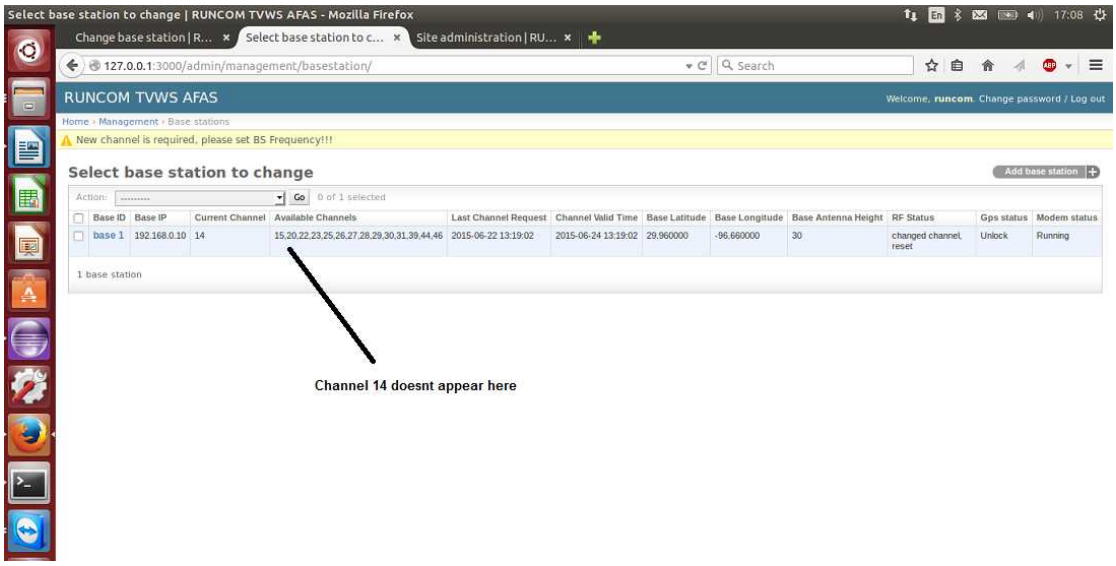

Figure 13. - Channel 14 is omitted from Available channels

✓ 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.

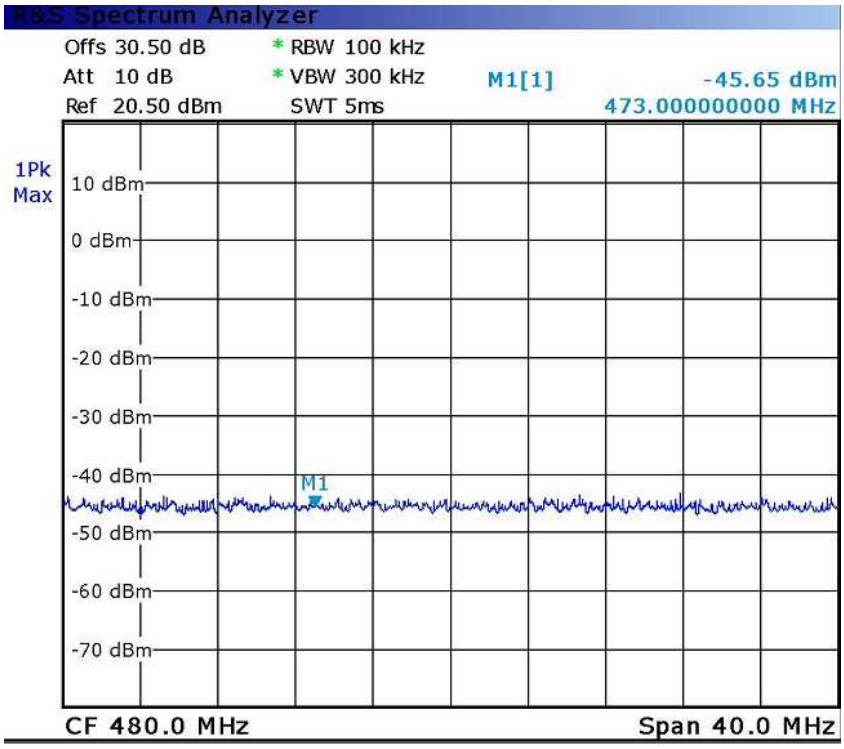

Figure 14. – EUT is not transmitting at Channel 14

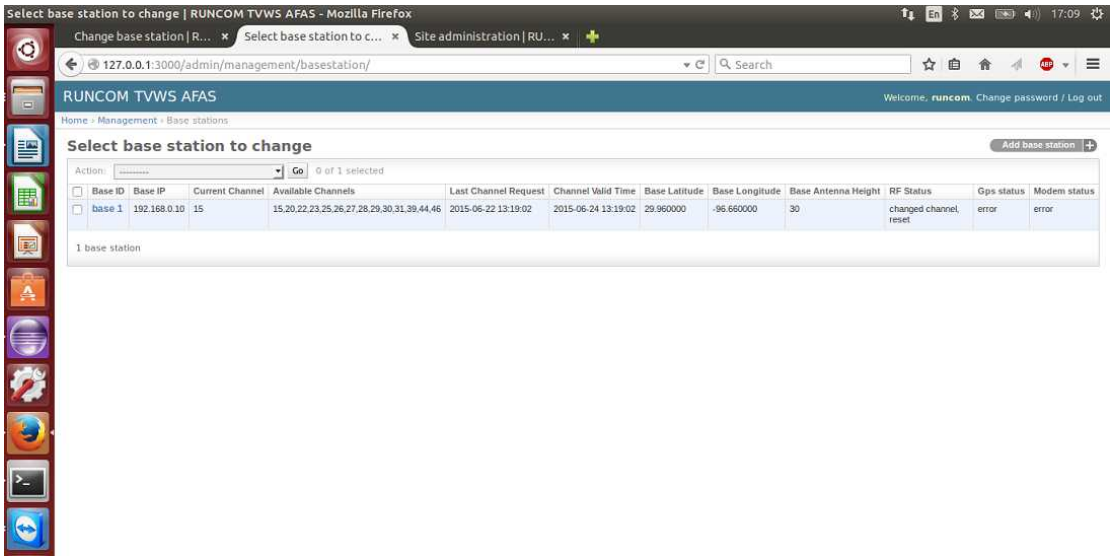

Figure 15. – Channel 15 is allocated to EUT

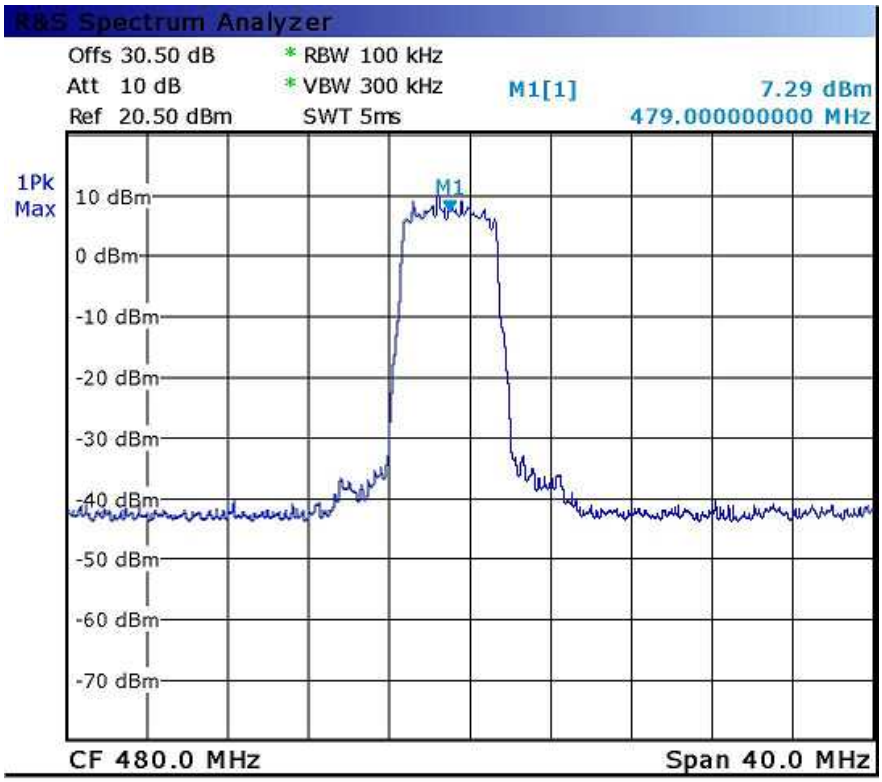

Figure 16. – EUT is transmitting at Channel 15

7.3 *Test Result:*

JUDGEMENT: PASS

8. §15.707, §15.711(b)(3)(i)(ii)(iv), (c), §15.712 TVBD Channel Availability

8.1 *Test Purpose:*

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.

8.2 *Test Procedure:*

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.
Configure and register the devices location (N 29.9600 W. -96.6600) 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.

8.3 *Test Result:*

JUDGEMENT: PASS

The database identified the device type correctly and the channel list provided is correct for the device type. For additional information see *Figure 17* and *Figure 18.*

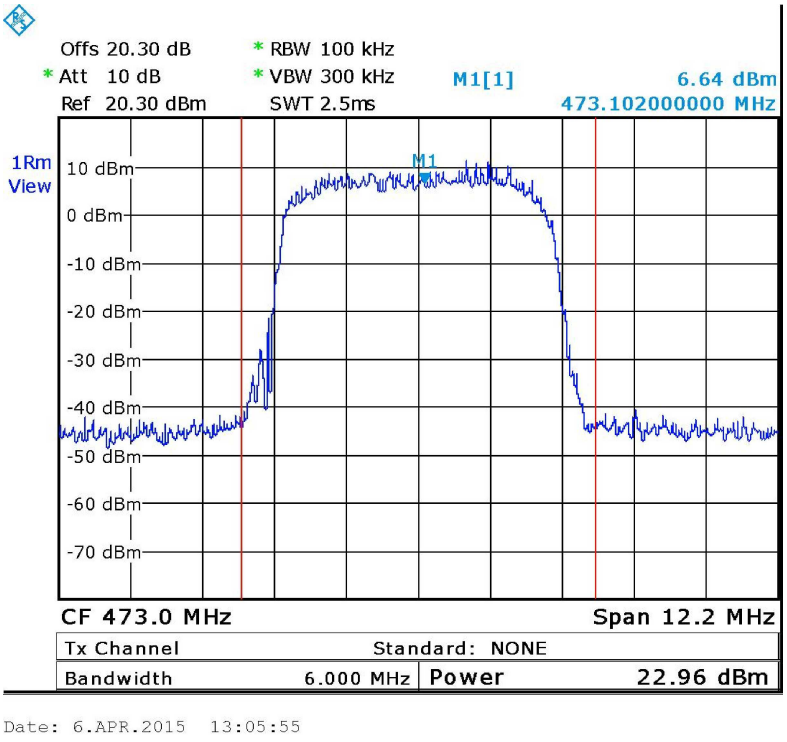

Figure 17. Verification for Channel Selection via Spectrum Analyzer

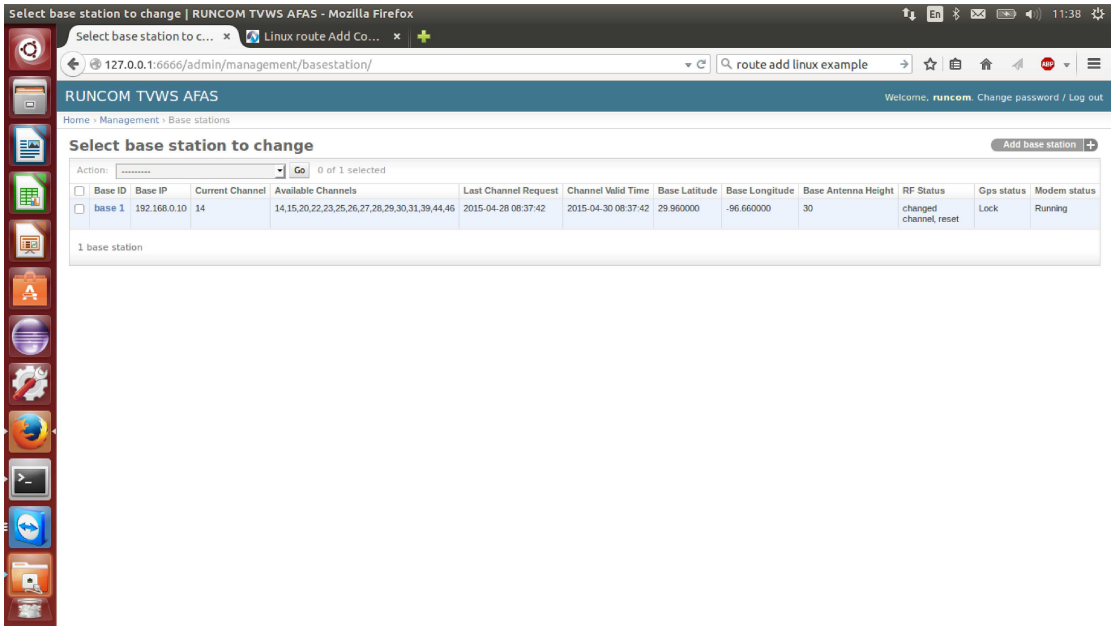

Figure 18. Channel List

9. §15.711(f) Security

Runcom Technologies Ltd.

Date: June 18, 2015

To: Timco Engineering Inc.

RNU4000-TVWS Connection with Spectrum Bridge Database Security

Connection security is accomplished in a multi-layered approach

Device Enrollment - At first each RNU4000-TVWS serial numbers is enrolled with Spectrum Bridge database prior to shipment.
Devices that contact the database are authenticated against the FCC database of FCCID and the enrollment list. Only devices that pass both tests are serviced by Spectrum Bridge database.
All other mandatory parameters in the registration message and channel request messages must be correct.
Location is checked and must be within the FCC jurisdiction.
RNU4000-TVWS is a fixed device so if its location changes in future requests the RNU4000-TVWS will not be serviced until it registers.

Protocol - Communication is via HTTPS secured protocol and uses various internet protocol security mechanisms
Communication Initiation - Communication is initiated by RNU4000-TVWS related AFAS server establishing a session and registering with the database.

Validation - Communication is via a pre-configured (in firmware) URL – the RNU4000-TVWS AFAS is programmed to only talk to the certified database.
Software provided by the Database (Agent) validates the correct format of messages from the database.

Communication Failure - If the RNU4000-TVWS AFAS fails to communicate with the database RNU4000-TVWS will carry on to operate and related AFAS will continue to contact the database for T update. If the RNU4000-TVWS AFAS fails to contact the database within T update it will cease RNU4000-TVWS transmission until it establishes a connection with the database and receives a response to a channel request.

Link security - Registration can only be accomplished via the secure Internet connection and only by the electronic communication between the database and the RNU4000-TVWS related AFAS.

Thank you,

Tzvi Marcu,
Technical Support Manager