



Choose Scandinavian trust

Wireless test report – 376028-4TRFWL

Type of assessment:

Original Certification

Applicant:

RADWIN Ltd.

Description of product as marketed:

Television Band Device (TVBD)

Model (BS):

TVWS BS EXT

Model number variant (BS):

RW-5PG5-02WS

FCC ID (BS):

Q3K-500TVWSBS

Model (CPE):

TVWS SU INT

Model number variant (CPE):

RW-5HA0-0PWS

FCC ID (CPE):

Q3K-500TVWSSU

Test Standard Specification:

FCC 47 CFR Part 15 Subpart H, §15.713

White Space devices; White space database.

Date of issue: December 10, 2019

Andrey Adelberg, Senior Wireless/EMC Specialist

Test engineer(s)

Signature

Kevin Rose, Wireless/EMC Specialist

Reviewed by

Signature



Test location

| | |
|--------------|--|
| Company name | Nemko Canada Inc. |
| Address | 303 River Road |
| City | Ottawa |
| Province | Ontario |
| Postal code | K1V 1H2 |
| Country | Canada |
| Telephone | +1 613 737 9680 |
| Facsimile | +1 613 737 9691 |
| Toll free | +1 800 563 6336 |
| Website | www.nemko.com |
| Site number | FCC: CA2040; (3 m semi anechoic chamber) |

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contained in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

Copyright notification

Nemko Canada Inc. authorizes the applicant to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Nemko Canada Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

© Nemko Canada Inc.

Table of contents

| | |
|--|-----------|
| Table of contents | 3 |
| Section 1. Report summary..... | 5 |
| 1.1 Applicant and manufacturer..... | 5 |
| 1.2 Test specifications..... | 5 |
| 1.3 Test methods | 5 |
| 1.4 Statement of compliance..... | 5 |
| 1.5 Exclusions..... | 5 |
| 1.6 Test report revision history | 5 |
| Section 2. Summary of test results | 6 |
| 2.1 FCC Part 15 Subpart H test results..... | 6 |
| Section 3. Equipment under test (EUT) details..... | 7 |
| 3.1 Sample information | 7 |
| 3.2 EUT information..... | 7 |
| 3.3 Technical information..... | 7 |
| 3.4 Product description and theory of operation..... | 7 |
| 3.5 Database information | 7 |
| Section 4. Engineering considerations | 8 |
| 4.1 Modifications incorporated in the EUT | 8 |
| 4.2 Technical judgment..... | 8 |
| 4.3 Deviations from laboratory tests procedures..... | 8 |
| Section 5. Test conditions | 9 |
| 5.1 Atmospheric conditions..... | 9 |
| 5.2 Power supply range | 9 |
| Section 6. Measurement uncertainty | 10 |
| 6.1 Uncertainty of measurement | 10 |
| Section 7. Test equipment | 11 |
| 7.1 Test equipment list | 11 |
| Section 8. Testing data..... | 12 |
| 8.1 FCC 15.713(g)(3) Fixed white space device registration..... | 12 |
| 8.2 FCC 15.713(a)(1), FCC 15.711(c)(2)(iii) 48-hour channel scheduling | 15 |
| 8.3 FCC 15.713(g)(3)(iii) Unsuccessful registration – restricted coordinates | 16 |
| 8.4 FCC 15.713(g)(3)(v) Unsuccessful registration due to incomplete information – missing owner..... | 19 |
| 8.5 FCC 15.713(g)(3)(vi) Unsuccessful registration due to incomplete information – contact name | 20 |
| 8.6 FCC 15.713(g)(3)(vii) Unsuccessful registration due to incomplete information – contact address..... | 21 |
| 8.7 FCC 15.713(g)(3)(vii) Unsuccessful registration due to incomplete information – contact state | 22 |
| 8.8 FCC 15.713(g)(3)(vii) Unsuccessful registration due to incomplete information – contact postal code.... | 23 |
| 8.9 FCC 15.713(g)(3)(vii) Unsuccessful registration due to incomplete information – contact city | 24 |
| 8.10 FCC 15.713(g)(3)(vii) Unsuccessful registration due to incomplete information – contact country..... | 25 |
| 8.11 FCC 15.713(g)(3)(viii) Unsuccessful registration due to incomplete information – contact email | 26 |
| 8.12 FCC 15.713(g)(3)(ix) Unsuccessful registration due to incomplete information – contact telephone..... | 27 |
| 8.13 FCC 15.713(e)(6) Unsuccessful registration due to HAAT > 250 m | 28 |
| 8.14 FCC 15.713(e)(6) Unsuccessful registration due to antenna height that exceeds 30 m | 29 |
| 8.15 FCC 15.713(g)(3)(i) and (ii) Unsuccessful registration due to incomplete information – FCC ID and Serial number | 33 |
| 8.16 FCC 15.713(a)(3) Relocation of fixed TVBD..... | 34 |

| | | |
|-------------------|--|-----------|
| 8.17 | FCC 15.711(c)(2)(i), FCC 15.711(h) Fixed & Mode II TVDB database update..... | 35 |
| 8.18 | FCC 15.711(c)(2)(iii) Low-power auxiliary device protection..... | 37 |
| 8.19 | FCC 15.712 Interference protection requirements (Fixed and personal/portable) | 40 |
| 8.20 | FCC 15.711(c)(2)(ii), (d)(3), 15.715(e) Fixed and Mode II Power level reduction..... | 51 |
| 8.21 | FCC 15.711(j) Security | 55 |
| Section 9. | Block diagrams of test set-ups..... | 56 |
| 9.1 | Test setup diagram | 56 |

Section 1. Report summary

1.1 Applicant and manufacturer

| | |
|-----------------|--------------------|
| Company name | RADWIN Ltd. |
| Address | 27 Habarzel Street |
| City | Tel Aviv |
| Province/State | – |
| Postal/Zip code | 6971039 |
| Country | Israel |

1.2 Test specifications

Code of Federal Regulations (CFR)

| | |
|------------|---|
| Title | 47 Telecommunication |
| Chapter | I Federal Communications Commission (FCC) |
| Subchapter | A General |
| Part | 15 Radio Frequency Devices |
| Subparts | H White Space Devices |

1.3 Test methods

| | |
|---------------------|-------------------------------|
| KDB 416721 D01 v03 | White Space Test Procedures |
| Nominet manual V1.0 | TVWS Radio Testing Manual FCC |

1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was performed against all relevant requirements of the test standard except as noted in section 1.5 below. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

1.5 Exclusions

None

1.6 Test report revision history

| Revision # | Date of issue | Details of changes made to test report |
|------------|-------------------|--|
| TRF | December 10, 2019 | Original report issued |

Section 2. Summary of test results

2.1 FCC Part 15 Subpart H test results

| Part | Test description | Verdict |
|---------------------------|---|---------|
| §15.713(g)(3) | Fixed white space device registration | Pass |
| §15.713(g)(3)(iii) | Unsuccessful registration – restricted coordinates | Pass |
| §15.713(g)(3)(v) | Unsuccessful registration due to incomplete information – missing owner | Pass |
| §15.713(g)(3)(vi) | Unsuccessful registration due to incomplete information – contact name | Pass |
| §15.713(g)(3)(vii) | Unsuccessful registration due to incomplete information – contact address | Pass |
| §15.713(g)(3)(vii) | Unsuccessful registration due to incomplete information – contact state (province) | Pass |
| §15.713(g)(3)(vii) | Unsuccessful registration due to incomplete information – contact zip (postal) code | Pass |
| §15.713(g)(3)(vii) | Unsuccessful registration due to incomplete information – contact city | Pass |
| §15.713(g)(3)(vii) | Unsuccessful registration due to incomplete information – contact country | Pass |
| §15.713(g)(3)(viii) | Unsuccessful registration due to incomplete information – contact email | Pass |
| §15.713(g)(3)(ix) | Unsuccessful registration due to incomplete information – contact telephone | Pass |
| §15.713(e)(6) | Unsuccessful registration due to HAAT > 250 m | Pass |
| §15.713(e)(6) | Unsuccessful registration due to antenna height that exceeds 30 m | Pass |
| §15.713(g)(3)(i) and (ii) | Unsuccessful registration due to incomplete information – FCC ID and Serial number | Pass |
| §15.713(a)(1) | 48-hour channel scheduling | Pass |
| §15.713(a)(3) | Relocation of fixed TVBD | Pass |
| §15.711(c)(2)(i) | Fixed & Mode II TVDB database update | Pass |
| §15.711(c)(2)(iii) | Low-power auxiliary device protection | Pass |
| §15.712 | Interference protection requirements (Fixed and personal/portable) | Pass |
| §15.711(c)(2)(ii) | Fixed and Mode II Power level reduction | Pass |
| §15.711(j) | Security | Pass |

Section 3. Equipment under test (EUT) details

3.1 Sample information

| | |
|------------------------|------------------|
| Receipt date | October 14, 2019 |
| Nemko sample ID number | 1 and 2 |

3.2 EUT information

| | |
|----------------|---------------------------------------|
| Product name | Television Band Device (TVBD) |
| Model | TVWS BS EXT (BS), TVWS SU INT (CPE) |
| Model variants | RW-5PG5-02WS (BS), RW-5HAO-0PWS (CPE) |
| Serial number | Prototypes |

3.3 Technical information

| | |
|--------------------|---|
| Frequency band | 470–698 MHz (channels 14–51) |
| Channel BW | 6, 12, 24 MHz |
| Type of modulation | OFDM (BPSK to 256-QAM) |
| Power requirements | 120 V _{AC} 60 Hz or 55 V _{DC} via PoE |

3.4 Product description and theory of operation

The **TVWS base station** is a small and compact outdoor unit that transmits two independent carriers. Each carrier provides up to 150Mbps by bonding 4 contiguous TVWS channels. The base station is deployed with an external MIMO 2x2 antenna. It is connected to the network through a GbE POE or SFP with DC input. The base station includes an embedded GPS with an integrated antenna or optional external antenna. The base station main features include up to 300Mbps (2 x 150Mbps) throughput, up to 256 QAM modulation rates in 6, 12, 24 MHz channel bandwidths, support of up to 64 subscribers.

The **TVWS subscriber unit** delivers up to 150Mbps and includes a directional integrated flat panel antenna for quick and easy installation. Ruggedized and IP-67 compliant the TVWS SU is highly robust, a mandatory requirement for maintaining low operational costs in remote rural networks. The SU incorporates an embedded GPS, enabling dynamic spectrum allocation according to the regulation. The TVWS SU is easily configured and commissioned via 2.4 GHz WiFi using WINTouch smartphone application.

3.5 Database information

Nominet White Space Data Base and Data base sandbox were used for devices registration and testing.

Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

4.2 Technical judgment

None

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

| | |
|-------------------|---------------|
| Temperature | 15–30 °C |
| Relative humidity | 20–75 % |
| Air pressure | 860–1060 mbar |

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages $\pm 5\%$, for which the equipment was designed.

Section 6. Measurement uncertainty

6.1 Uncertainty of measurement

UKAS Lab 34 and TIA-603-B have been used as guidance for measurement uncertainty reasonable estimations with regards to previous experience and validation of data. Nemko Canada, Inc. follows these test methods in order to satisfy ISO/IEC 17025 requirements for estimation of uncertainty of measurement for wireless products.

Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of $K = 2$ with 95% certainty.

Table 6.1-1: Measurement uncertainty

| Test name | Measurement uncertainty, dB |
|-------------------------------|-----------------------------|
| All antenna port measurements | 0.55 |

Section 7. Test equipment

7.1 Test equipment list

Table 7.1-1: Equipment list

| Equipment | Manufacturer | Model no. | Asset no. | Cal cycle | Next cal. |
|-------------------|-----------------|-----------|-----------|-----------|------------------|
| Spectrum analyzer | Rohde & Schwarz | FSU46 | FA001877 | 1 year | October 31, 2020 |

Section 8. Testing data

8.1 FCC 15.713(g)(3) Fixed white space device registration

8.1.1 Definitions and limits

Prior to operating for the first time or after changing location, a fixed white space device must register with the white space database by providing the information listed in paragraph (g)(3) of §15.713. Testing in accordance with KDB 416721 D01, III (2)(a)

8.1.2 Test summary

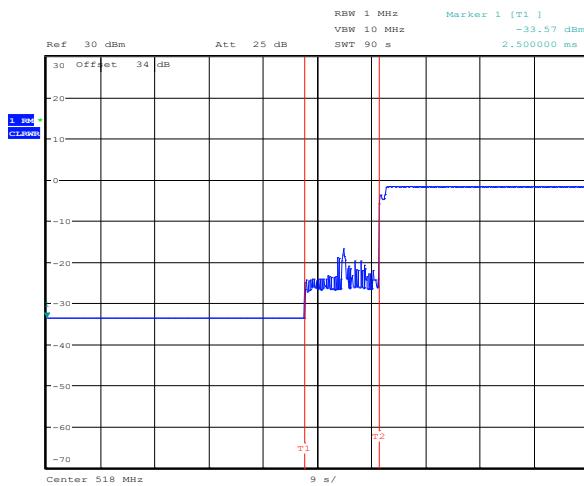
Test date December 2, 2019

8.1.3 Observations, settings and special notes

EUT was configured with the proper registration information. Successful registration with all required fields and as a Fixed device type was verified by showing on the GUI page.

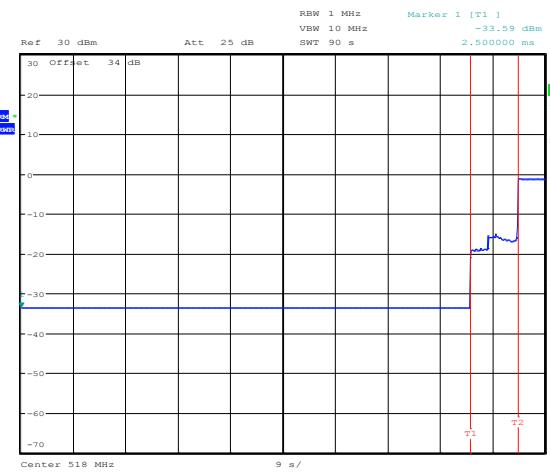
There were no emissions detected, on any channels, until it has successfully registered

8.1.4 Test data



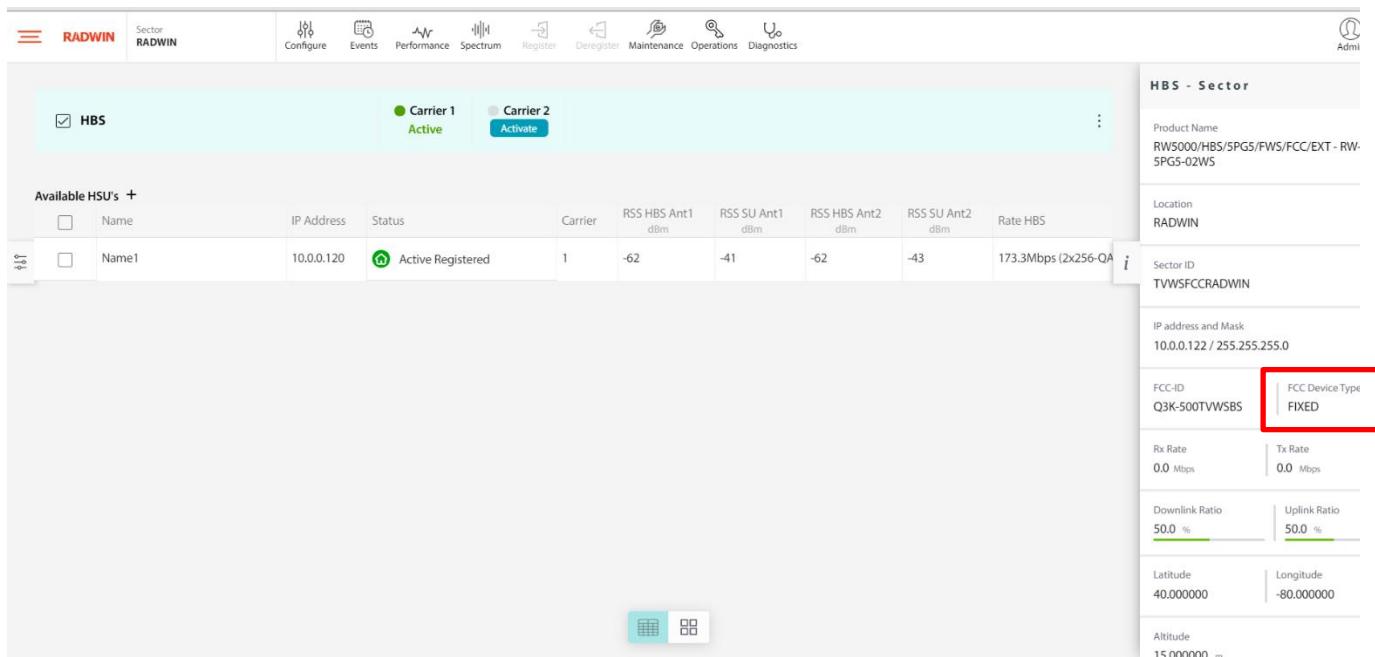
Date: 2.DEC.2019 10:28:38

Figure 8.1-1: Successful registration and transmission begins from Base station unit (lower level signal indicates beacon signal)



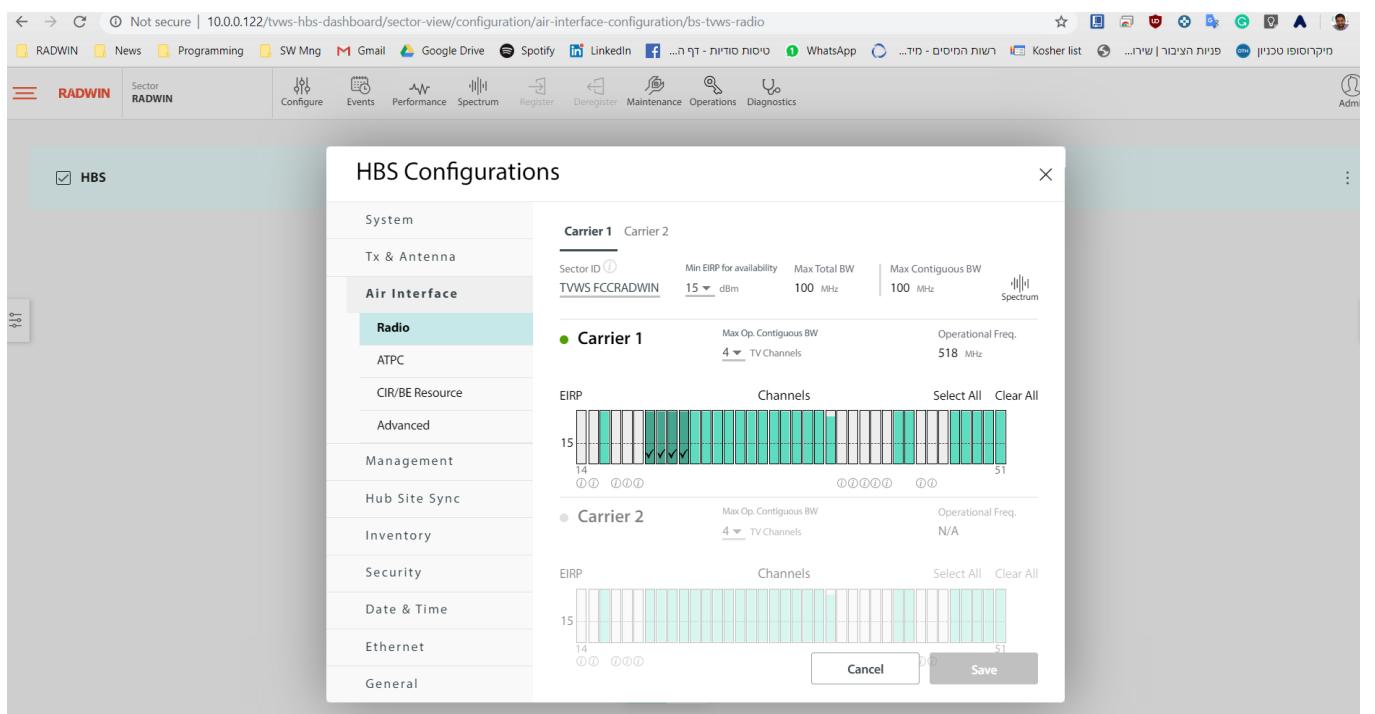
Date: 2.DEC.2019 10:34:11

Figure 8.1-2: Successful registration and transmission begins from CPE unit (lower level signal indicates beacon signal from base station)



The screenshot shows the RADWIN HBS dashboard. In the top right, there is a 'HBS - Sector' panel with device identification information. The 'FCC Device Type' field is highlighted with a red box and contains the value 'FIXED'. Other fields in the panel include Product Name (RW5000/HBS/5PG5/FWS/FCC/EXT - RW-5PG5-02WS), Location (RADWIN), Sector ID (TVWSFCCRADWIN), IP address and Mask (10.0.0.122 / 255.255.255.0), FCC-ID (Q3K-500TVWS85), and Latitude/Longitude coordinates (40.000000, -80.000000).

Figure 8.1-3: Successful registration and identification as Fixed Device Type device (BS)



The screenshot shows the 'HBS Configurations' dialog box. The 'Carrier 1' section is active, displaying parameters such as Sector ID (TVWSFCCRADWIN), Min EIRP for availability (15 dBm), Max Total BW (100 MHz), and Max Contiguous BW (100 MHz). The 'Carrier 1' table shows Max Op. Contiguous BW (4 TV Channels) and Operational Freq. (518 MHz). The 'Carrier 2' section shows Max Op. Contiguous BW (4 TV Channels) and Operational Freq. (N/A). The dialog box includes 'Cancel' and 'Save' buttons at the bottom.

Figure 8.1-4: Successful registration with received list of available channels

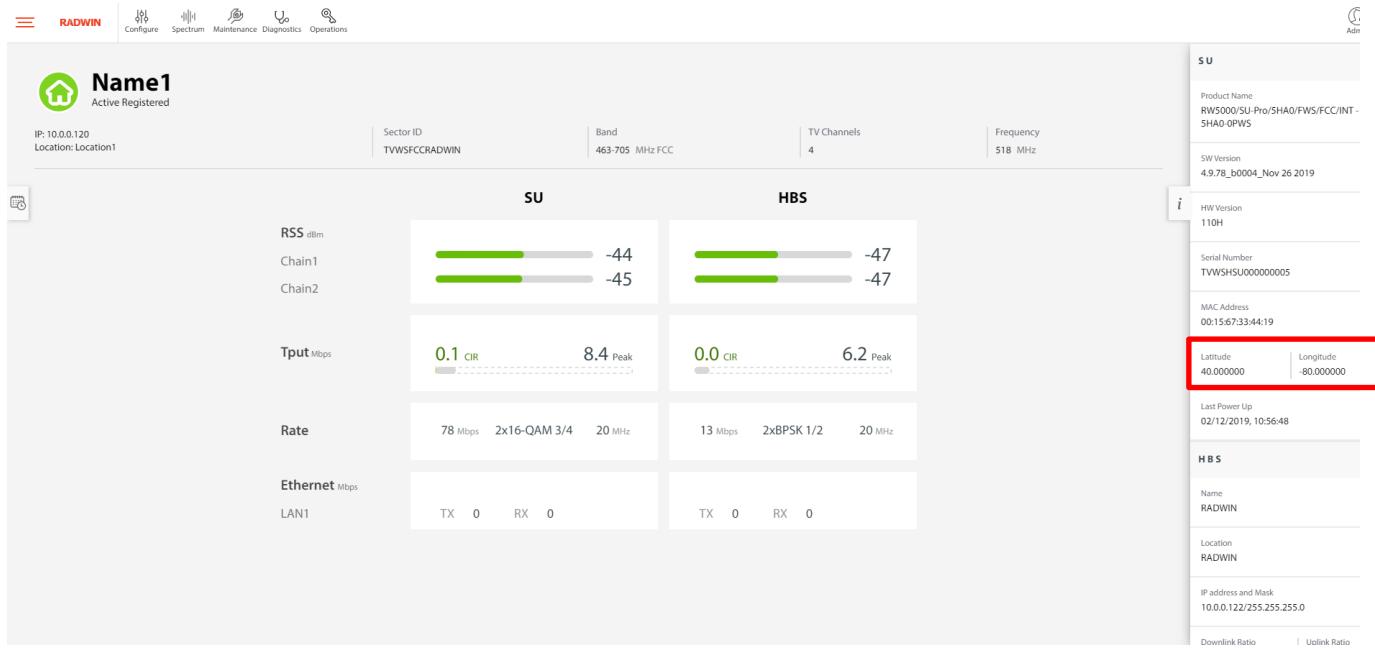


Figure 8.1-5: Successful registration of CPE

8.2 FCC 15.713(a)(1), FCC 15.711(c)(2)(iii) 48-hour channel scheduling

8.2.1 Definitions and limits

After receiving an available channel list, register a low-power auxiliary device on the WSD operating channel to operate on an available channel and in an upcoming time period when the device will be tested. Repeat the available channel request after the update interval and in the time period when the low-power auxiliary device is scheduled to operate 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. Testing in accordance with KDB 416721 D01, III (2)(h)

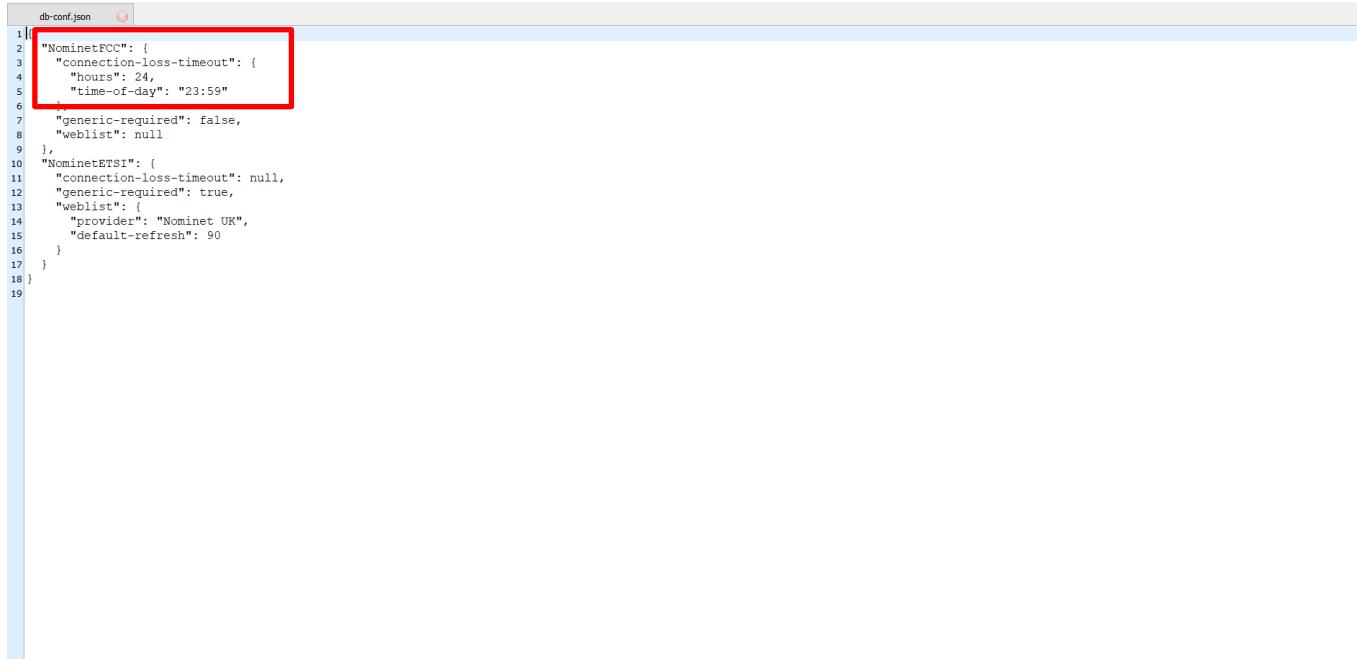
8.2.2 Test summary

Test date December 2, 2019

8.2.3 Observations, settings and special notes

EUT implements a refresh time of 24 hours instead of 48-hour push notification wait.

8.2.4 Test data



```
db-conf.json
1
2 "NominetFCC": {
3   "connection-loss-timeout": {
4     "hours": 24,
5     "time-of-day": "23:59"
6   },
7   "generic-required": false,
8   "weblist": null
9 },
10 "NominetETSI": {
11   "connection-loss-timeout": null,
12   "generic-required": true,
13   "weblist": {
14     "provider": "Nominet UK",
15     "default-refresh": 90
16   }
17 }
18 }
19 }
```

Figure 8.2-1: Refresh time (T-Update) instead of 48-hour push notification wait

8.3 FCC 15.713(g)(3)(iii) Unsuccessful registration – restricted coordinates

8.3.1 Definitions and limits

(3) The white space device registration database shall contain the following information for fixed white space devices:
(iii) Device's geographic coordinates (latitude and longitude (NAD 83));

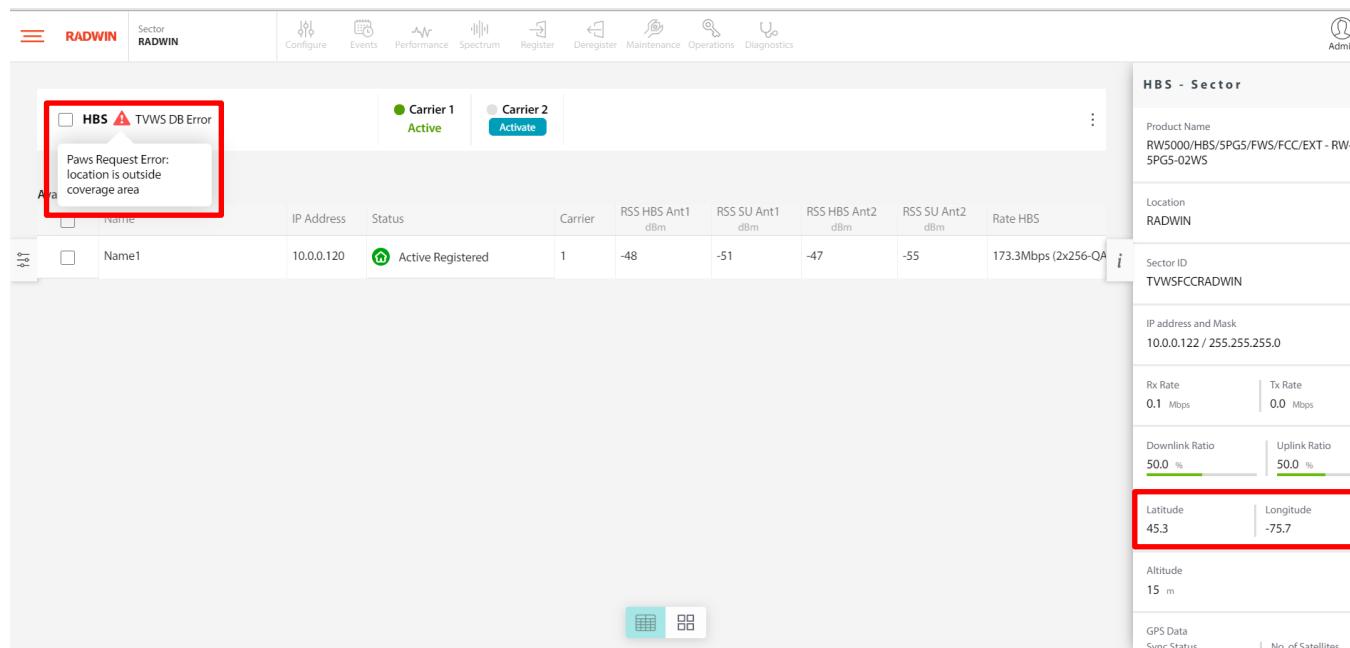
8.3.2 Test summary

Test date December 2, 2019

8.3.3 Observations, settings and special notes

The device was initially configured with a valid registration such that the device will begin to transmit on a given channel. Once the device was transmitting and the link was established, the registration data was modified to incorporate restricted coordinates. EUT was configured with restricted coordinates: outside US regulatory boundaries with latitude: 45.3° N and longitude: 75.7° W (within Canada). The registration process was re-initiated with the invalid coordinates. After database rejection, the EUT stopped the transmission.

8.3.4 Test data



The screenshot shows the RADWIN software interface. At the top, there are tabs for 'RADWIN' (selected), 'Sector RADWIN', and other options like 'Configure', 'Events', 'Performance', 'Spectrum', 'Register', 'Deregister', 'Maintenance', 'Operations', and 'Diagnostics'. On the left, there's a sidebar with 'Area' and a table with columns for 'Name', 'IP Address', 'Status', 'Carrier', 'RSS HBS Ant1 dBm', 'RSS SU Ant1 dBm', 'RSS HBS Ant2 dBm', 'RSS SU Ant2 dBm', and 'Rate HBS'. The table shows a single entry: 'Name1' with IP '10.0.0.120' and status 'Active Registered'. On the right, there's a detailed 'HBS - Sector' configuration panel. It shows 'Carrier 1 Active' and 'Carrier 2 Activate'. The 'Carrier 2' section has a red box around it, indicating an error: 'HBS TVWS DB Error' and 'Paws Request Error: location is outside coverage area'. The 'Carrier 2' section also has a red box around the 'Latitude' and 'Longitude' fields, which are both set to '45.3' and '-75.7' respectively. Other fields in the panel include 'Product Name: RWS000/HBS/SPG5/FWS/FCC/EXT - RWS02W', 'Location: RADWIN', 'Sector ID: TVWSFCRADWIN', 'IP address and Mask: 10.0.0.122 / 255.255.255.0', 'Rx Rate: 0.1 Mbps' and 'Tx Rate: 0.0 Mbps', 'Downlink Ratio: 50.0 %' and 'Uplink Ratio: 50.0 %', 'Altitude: 15 m', 'GPS Data Sync Status', and 'No. of Satellites'.

Figure 8.3-1: Unsuccessful registration with restricted coordinates (BS)

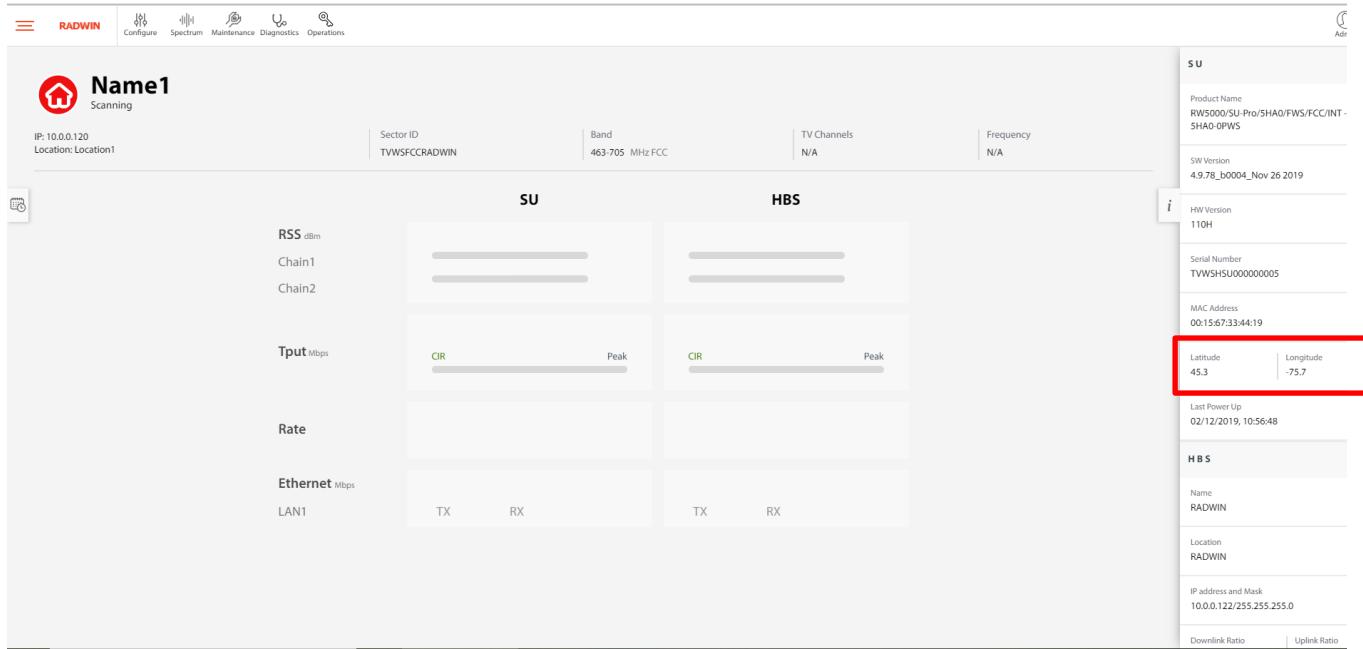


Figure 8.3-2: Unsuccessful registration with restricted coordinates (CPE)

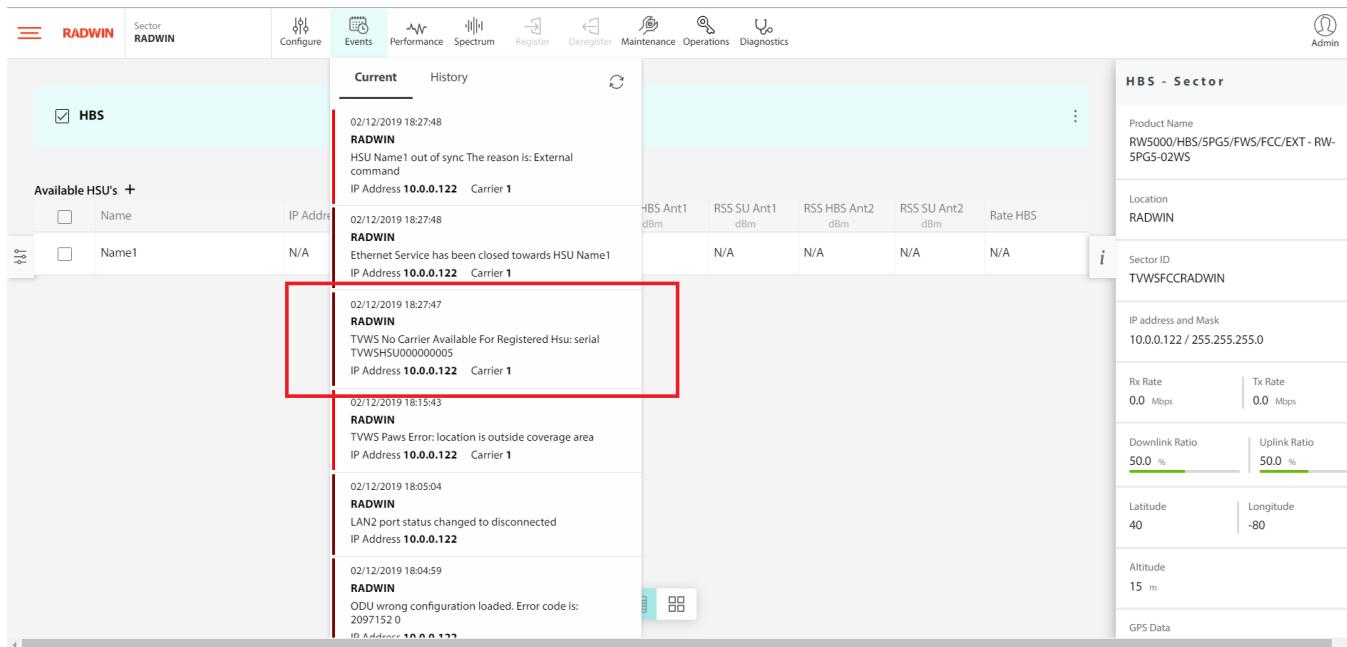
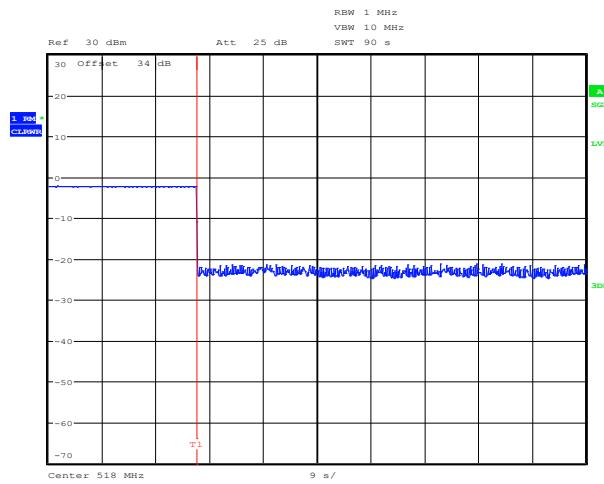
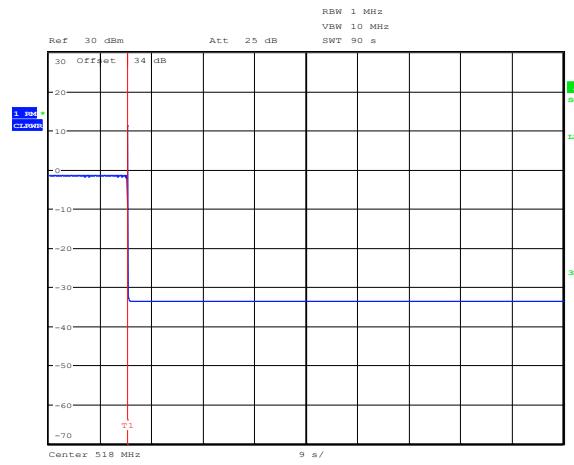


Figure 8.3-3: Unsuccessful registration with restricted coordinates (CPE)



Date: 2.DEC.2019 11:43:48

Figure 8.3-4: Unsuccessful registration and transmission stops (BS)



Date: 2.DEC.2019 11:16:54

Figure 8.3-5: Unsuccessful registration and transmission stops (CPE)

8.4 FCC 15.713(g)(3)(v) Unsuccessful registration due to incomplete information – missing owner

8.4.1 Definitions and limits

(3) The white space device registration database shall contain the following information for fixed white space devices:
(v) Name of the individual or business that owns the device

8.4.2 Test summary

Test date December 2, 2019

8.4.3 Observations, settings and special notes

EUT was configured with incomplete information: owner name field was left intentionally blank (instead of *John Dou*). It was verified, that after detecting missing contact information, EUT did not send any form request to database.

To test this feature the device was initially configured with valid information and allowed to transmit on the channel. The registration information was then modified to render it invalid and a registration request was not re-initiated. Once the device detects an invalid registration field, the device flagged the error in the GUI.

8.4.4 Test data

The screenshot shows a web-based configuration interface for a RADWIN HBS Sector. The main window is titled 'HBS Configurations' and displays various system settings. A red box highlights the 'Owner' field, which is empty and marked as a 'Required field'. The 'Contact' field contains the name 'John Dou'. The right side of the screen shows a sidebar with 'HBS - Sector' configuration details, including Product Name (RW5000/HBS/5PG5/FWS/FCC/EXT - RW 5PG5-02WS), Location (RADWIN), and various performance metrics like IP address and Mask (10.0.0.122 / 255.255.255.0), Rx Rate (0.0 Mbps), Tx Rate (0.0 Mbps), and Downlink Ratio (50.0%). The bottom right of the sidebar shows GPS Data and Sync Status.

Figure 8.4-1: Unsuccessful registration with missing owner name information

8.5 FCC 15.713(g)(3)(vi) Unsuccessful registration due to incomplete information – contact name

8.5.1 Definitions and limits

(3) The white space device registration database shall contain the following information for fixed white space devices:
(vi) Name of a contact person responsible for the device's operation

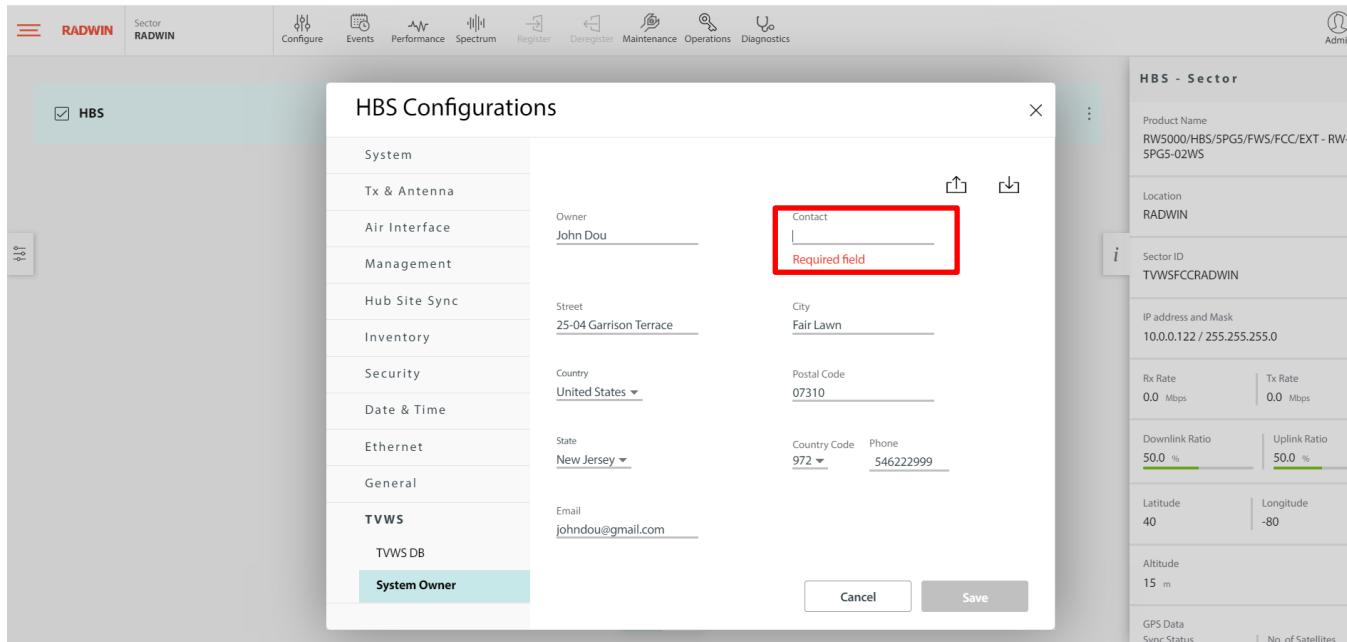
8.5.2 Test summary

Test date December 2, 2019

8.5.3 Observations, settings and special notes

EUT was configured with incomplete information: contact name field was left intentionally blank (instead of *John Dou*). It was verified, that after detecting missing contact information, EUT did not send any form request to database. To test this feature the device was initially configured with valid information and allowed to transmit on the channel. The registration information was then modified to render it invalid and a registration request was not re-initiated. Once the device detects an invalid registration field, the device flagged the error in the GUI.

8.5.4 Test data



The screenshot shows the RADWIN HBS Configurations window. The 'System' tab is selected. In the 'Management' section, the 'Owner' field is populated with 'John Dou'. The 'Contact' field is empty and highlighted with a red box, with the text 'Required field' displayed below it. The right side of the window displays various configuration parameters for the HBS-Sector, including Product Name (RW5000/HBS/5PG5/FWS/FCC/EXT - RW-5PG5-02WS), Location (RADWIN), Sector ID (TVWSFCCRADWIN), and GPS Data (Sync Status, No. of Satellites).

Figure 8.5-1: Unsuccessful registration with missing contact name

8.6 FCC 15.713(g)(3)(vii) Unsuccessful registration due to incomplete information – contact address

8.6.1 Definitions and limits

(3) The white space device registration database shall contain the following information for fixed white space devices:
(vii) Address for the contact person

8.6.2 Test summary

Test date December 2, 2019

8.6.3 Observations, settings and special notes

EUT was configured with incomplete information: owner contact address (street) field was left intentionally blank. It was verified, that after detecting missing contact information, EUT did not send any form request to database.
To test this feature the device was initially configured with valid information and allowed to transmit on the channel. The registration information was then modified to render it invalid and a registration request was not re-initiated. Once the device detects an invalid registration field, the device flagged the error in the GUI.

8.6.4 Test data

The screenshot shows the RADWIN HBS Configurations window. The 'System' tab is selected. In the 'Owner' section, the 'Street' field is empty and highlighted with a red box, displaying the error message 'Required field'. The 'Contact' section shows 'John Dou' in both the 'Name' and 'Address' fields. The 'Management' section includes 'Hub Site Sync' and 'Inventory' tabs. The 'Security' section shows 'Country: United States' and 'Postal Code: 07310'. The 'Date & Time' section shows 'State: New Jersey'. The 'Ethernet' section shows 'Country Code: 972' and 'Phone: 546222999'. The 'General' section shows 'Email: johndou@gmail.com'. The 'TVWS' section is visible. The 'TVWS DB' section is visible. The 'System Owner' section is visible. On the right, a sidebar titled 'HBS - Sector' displays product and location information, and a status bar shows 'Adm'.

Figure 8.6-1: Unsuccessful registration with missing owner contact address

8.7 FCC 15.713(g)(3)(vii) Unsuccessful registration due to incomplete information – contact state

8.7.1 Definitions and limits

(3) The white space device registration database shall contain the following information for fixed white space devices:
(vii) Address for the contact person

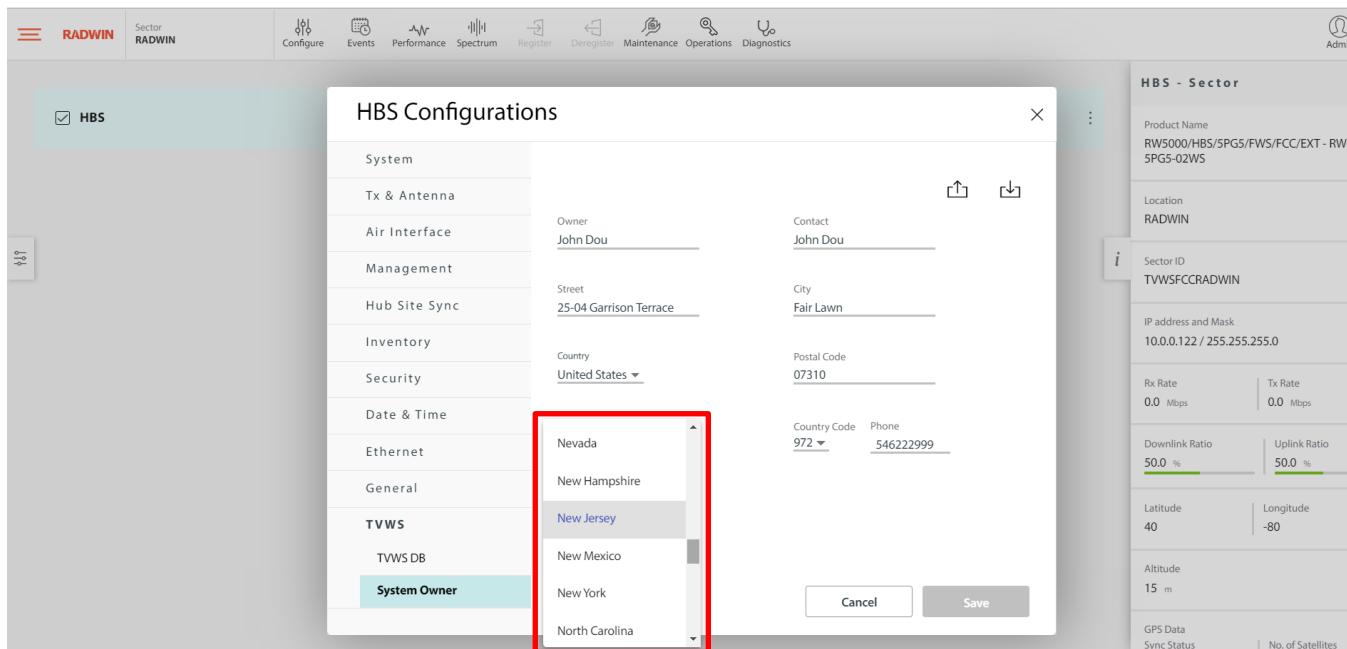
8.7.2 Test summary

Test date December 2, 2019

8.7.3 Observations, settings and special notes

GUI won't continue to the registration without selecting a "State" from the drop-down menu. It is impossible to leave this field blank.

8.7.4 Test data



The screenshot shows a software interface for managing HBS configurations. The main window is titled 'HBS Configurations' and displays various system settings. A red box highlights the 'State' dropdown menu in the 'System' tab, which is currently empty. The 'Owner' and 'Contact' fields are both populated with the name 'John Dou'. The right side of the interface shows a detailed view of the device, including its product name (RW5000/HBS/5PG5/FWS/FCC/EXT - RW5PG-02W5), location (RADWIN), and various performance metrics and coordinates.

Figure 8.7-1: Unsuccessful registration with missing owner contact state

8.8 FCC 15.713(g)(3)(vii) Unsuccessful registration due to incomplete information – contact postal code

8.8.1 Definitions and limits

(3) The white space device registration database shall contain the following information for fixed white space devices:
(vii) Address for the contact person

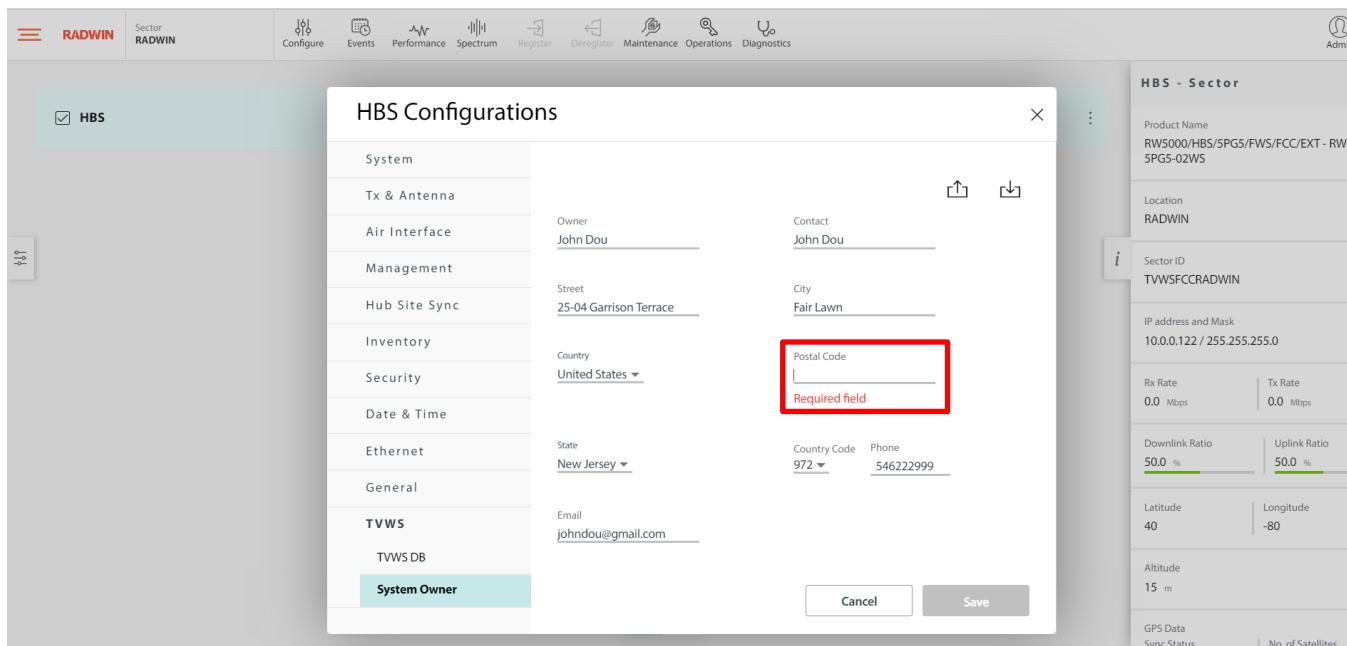
8.8.2 Test summary

Test date December 2, 2019

8.8.3 Observations, settings and special notes

EUT was configured with incomplete information: owner contact postal code field was left intentionally blank (instead of 07310). It was verified, that after detecting missing contact information, EUT did not send any form request to database, the EUT stopped the transmission.
To test this feature the device was initially configured with valid information and allowed to transmit on the channel. The registration information was then modified to render it invalid and a registration request was not re-initiated. Once the device detects an invalid registration field, the device flagged the error in the GUI.

8.8.4 Test data



The screenshot shows the RADWIN HBS Configurations interface. On the left, a sidebar lists various configuration sections: System, Tx & Antenna, Air Interface, Management, Hub Site Sync, Inventory, Security, Date & Time, Ethernet, General, TVWS, and TVWS DB. The 'System' section is currently selected. On the right, detailed configuration parameters are displayed. The 'Owner' field is populated with 'John Dou'. The 'Contact' field is also populated with 'John Dou'. The 'Street' field contains '25-04 Garrison Terrace'. The 'City' field contains 'Fair Lawn'. The 'Country' field is set to 'United States'. The 'Postal Code' field is empty and highlighted with a red box, with the text 'Required field' displayed below it. The 'State' field is set to 'New Jersey'. The 'Country Code' field is set to '972'. The 'Phone' field contains '546222999'. The 'Email' field contains 'johndou@gmail.com'. At the bottom right of the configuration window are 'Cancel' and 'Save' buttons. To the right of the configuration window, a sidebar titled 'HBS - Sector' provides additional information: Product Name (RW5000/HBS/5PG5/FWS/FCC/EXT - RW5PG5-02WS), Location (RADWIN), Sector ID (TVWSFCCRADWIN), IP address and Mask (10.0.0.122 / 255.255.255.0), Rx Rate (0.0 Mbps), Tx Rate (0.0 Mbps), Downlink Ratio (50.0 %), Uplink Ratio (50.0 %), Latitude (40), Longitude (-80), Altitude (15 m), GPS Data, and Sync Status.

Figure 8.8-1: Unsuccessful registration with missing owner contact postal code

8.9 FCC 15.713(g)(3)(vii) Unsuccessful registration due to incomplete information – contact city

8.9.1 Definitions and limits

(3) The white space device registration database shall contain the following information for fixed white space devices:
(vii) Address for the contact person

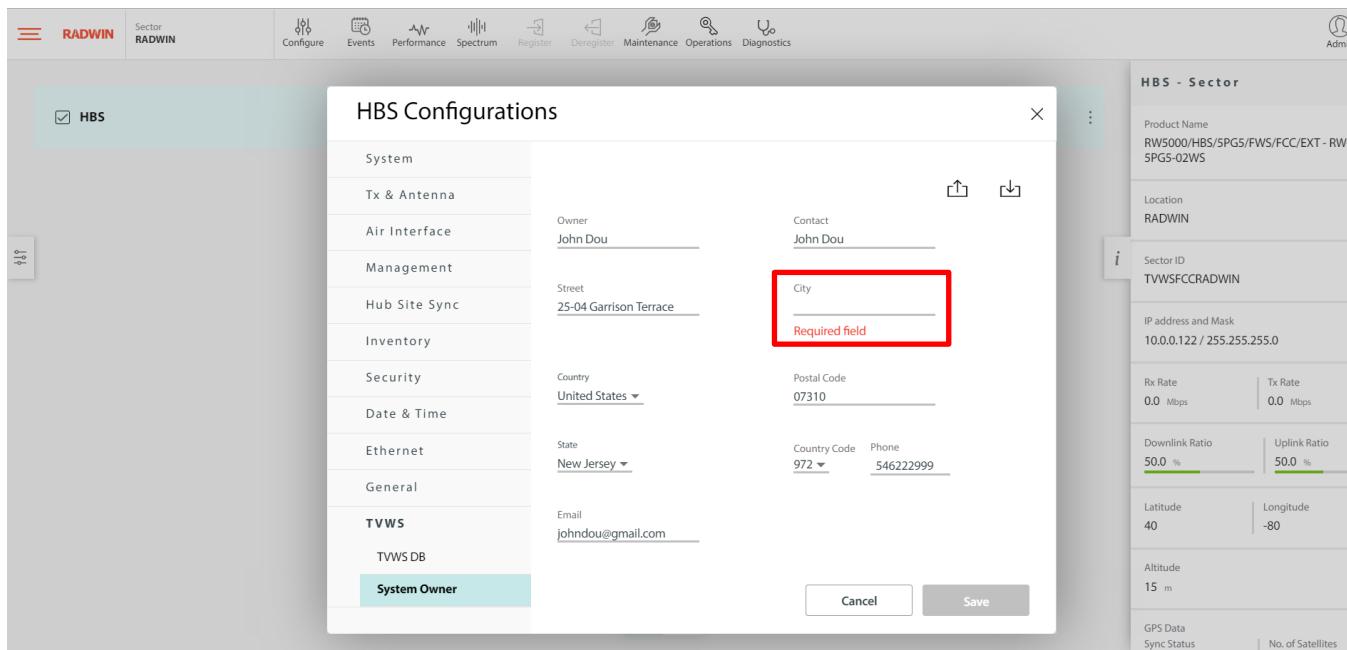
8.9.2 Test summary

Test date December 2, 2019

8.9.3 Observations, settings and special notes

EUT was configured with incomplete information: owner contact city field was left intentionally blank (instead of *Fail Lawn*). It was verified, that after detecting missing contact information, EUT did not send any form request to database. To test this feature the device was initially configured with valid information and allowed to transmit on the channel. The registration information was then modified to render it invalid and a registration request was not re-initiated. Once the device detects an invalid registration field, the device flagged the error in the GUI.

8.9.4 Test data



The screenshot shows the 'HBS Configurations' dialog box. On the left, a sidebar lists configuration categories: System, Tx & Antenna, Air Interface, Management, Hub Site Sync, Inventory, Security, Date & Time, Ethernet, General, TVWS, and TVWS DB. The 'System' category is currently selected. On the right, detailed configuration settings are shown:

| | |
|--------------|---|
| Owner | John Dou |
| Contact | John Dou |
| Street | 25-04 Garrison Terrace |
| City | <input type="text"/> (highlighted with a red box) |
| Country | United States |
| Postal Code | 07310 |
| State | New Jersey |
| Country Code | 972 |
| Phone | 546222999 |
| Email | johndou@gmail.com |

At the bottom of the dialog, there are 'Cancel' and 'Save' buttons. To the right of the dialog, a sidebar titled 'HBS - Sector' displays various device parameters:

| | |
|---------------------|--|
| Product Name | RW5000/HBS/5PG5/FWS/FCC/EXT - RW 5PG5-02WS |
| Location | RADWIN |
| Sector ID | TVWSFCCRADWIN |
| IP address and Mask | 10.0.0.122 / 255.255.255.0 |
| Rx Rate | 0.0 Mbps |
| Tx Rate | 0.0 Mbps |
| Downlink Ratio | 50.0 % |
| Uplink Ratio | 50.0 % |
| Latitude | 40 |
| Longitude | -80 |
| Altitude | 15 m |
| GPS Data | Sync Status |
| No. of Satellites | |

Figure 8.9-1: Unsuccessful registration with missing owner contact city

8.10 FCC 15.713(g)(3)(vii) Unsuccessful registration due to incomplete information – contact country

8.10.1 Definitions and limits

(3) The white space device registration database shall contain the following information for fixed white space devices:
(vii) Address for the contact person

8.10.2 Test summary

Test date December 2, 2019

8.10.3 Observations, settings and special notes

GUI won't continue to the registration without selecting a "Country" from the drop-down menu. It is impossible to leave this field blank.

8.10.4 Test data

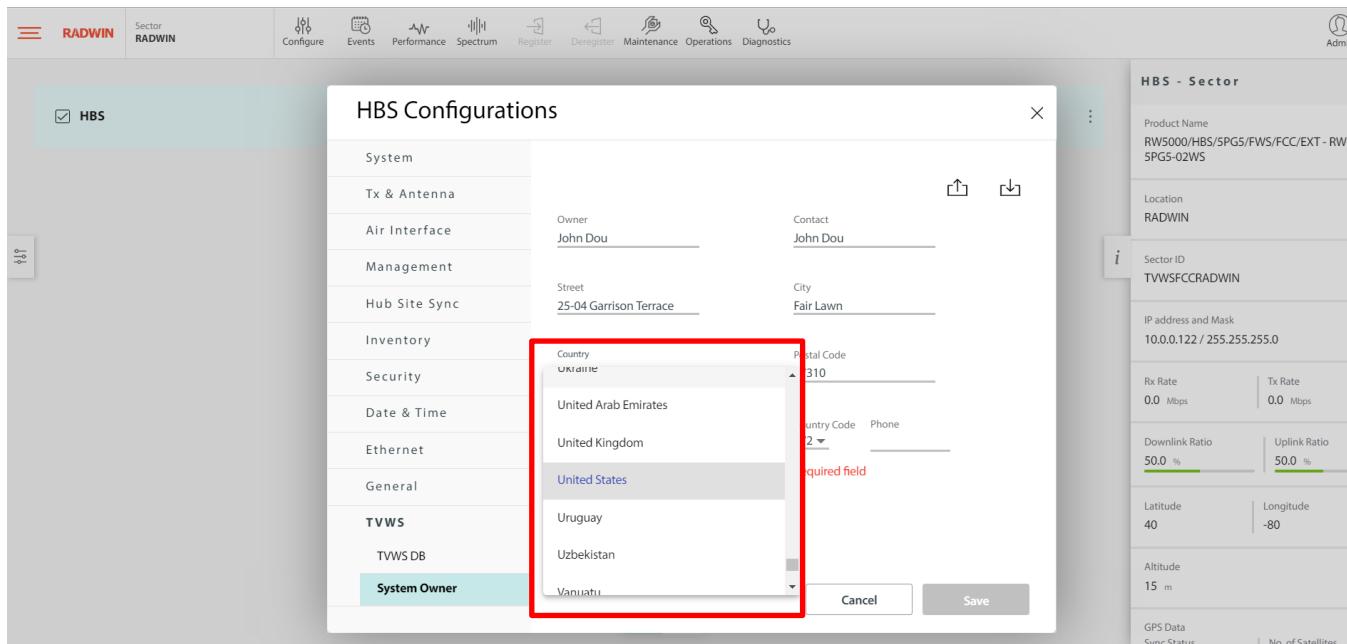


Figure 8.10-1: Unsuccessful registration with missing owner contact country

8.11 FCC 15.713(g)(3)(viii) Unsuccessful registration due to incomplete information – contact email

8.11.1 Definitions and limits

(3) The white space device registration database shall contain the following information for fixed white space devices:
(viii) Email address for the contact person

8.11.2 Test summary

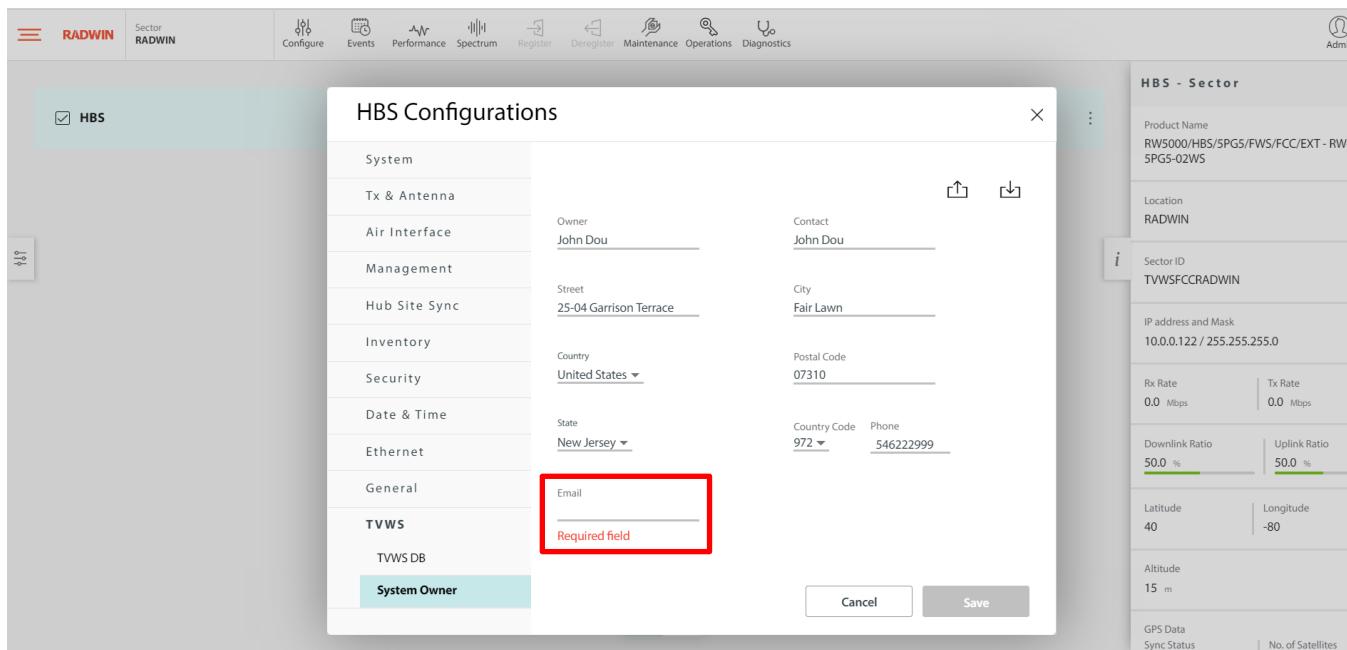
Test date December 2, 2019

8.11.3 Observations, settings and special notes

EUT was configured with incomplete information: owner contact email field was left intentionally blank (instead of *johndou@gmail.com*). It was verified, that after detecting missing contact information, EUT did not send any form request to database.

To test this feature the device was initially configured with valid information and allowed to transmit on the channel. The registration information was then modified to render it invalid and a registration request was not re-initiated. Once the device detects an invalid registration field, the device flagged the error in the GUI.

8.11.4 Test data



The screenshot shows the RADWIN HBS Configurations interface. The 'HBS' tab is selected. On the left, a sidebar lists categories: System, Tx & Antenna, Air Interface, Management, Hub Site Sync, Inventory, Security, Date & Time, Ethernet, General, TVWS, and TVWS DB. The 'System' category is currently active. On the right, detailed configuration settings are shown, including Product Name (RW5000/HBS/5PG5/FWS/FCC/EXT - RW5PG5-02WS), Location (RADWIN), Sector ID (TVWSFCCRADWIN), and various performance parameters like Rx Rate (0.0 Mbps) and Tx Rate (0.0 Mbps). In the 'General' section, there is a 'Required field' validation message in the 'Email' input field, which is highlighted with a red box. The 'Save' button is visible at the bottom right of the configuration panel.

Figure 8.11-1: Unsuccessful registration with missing owner contact email

8.12 FCC 15.713(g)(3)(ix) Unsuccessful registration due to incomplete information – contact telephone

8.12.1 Definitions and limits

(3) The white space device registration database shall contain the following information for fixed white space devices:
(xi) Phone number for the contact person

8.12.2 Test summary

Test date December 2, 2019

8.12.3 Observations, settings and special notes

EUT was configured with incomplete information: owner/operator contact telephone field was left intentionally blank (instead of 546222999). It was verified, that after detecting missing contact information, EUT did not send any form request to database.

To test this feature the device was initially configured with valid information and allowed to transmit on the channel. The registration information was then modified to render it invalid and a registration request was not re-initiated. Once the device detects an invalid registration field, the device flagged the error in the GUI.

8.12.4 Test data

The screenshot shows the RADWIN HBS Configurations interface. The main window displays various configuration tabs: System, Tx & Antenna, Air Interface, Management, Hub Site Sync, Inventory, Security, Date & Time, Ethernet, General, TVWS, and TVWS DB. The 'System' tab is selected. In the 'Owner' field, 'John Dou' is listed. The 'Contact' field is also 'John Dou'. The 'Street' field contains '25-04 Garrison Terrace'. The 'City' field is 'Fair Lawn'. The 'Country' field is 'United States'. The 'Postal Code' field is '07310'. The 'State' field is 'New Jersey'. The 'Country Code' dropdown is set to '972'. The 'Phone' field is empty and highlighted with a red border, with the error message 'Required field' displayed. The 'Email' field contains 'johnndou@gmail.com'. At the bottom of the main window are 'Cancel' and 'Save' buttons. To the right of the main window is a sidebar titled 'HBS - Sector' with various configuration parameters: Product Name (RW5000/HBS/5PG5/FWS/FCC/EXT - RW 5PG5-02WS), Location (RADWIN), Sector ID (TVWSFCCRADWIN), IP address and Mask (10.0.0.122 / 255.255.255.0), Rx Rate (0.0 Mbps), Tx Rate (0.0 Mbps), Downlink Ratio (50.0 %), Uplink Ratio (50.0 %), Latitude (40), Longitude (-80), Altitude (15 m), GPS Data, and Sync Status.

Figure 8.12-1: Unsuccessful registration with missing owner contact telephone

8.13 FCC 15.713(e)(6) Unsuccessful registration due to HAAT > 250 m

8.13.1 Definitions and limits

A fixed device with an antenna height above ground that exceeds 30 meters or an antenna height above average terrain (HAAT) that exceeds 250 meters shall not be provided a list of available channels.

8.13.2 Test summary

Test date December 2, 2019

8.13.3 Observations, settings and special notes

EUT was configured with information that included a location with HAAT of more than 250 m (at latitude 37.88° N and longitude 114.575° W). It was verified, that after database rejection, the EUT didn't start the transmission.

To test this feature the device was configured with invalid information and requested to transmit on the channel. Once the database responded with an empty channel list as a result of the antenna height above ground, or excessive HAAT, the EUT didn't start to transmit. Subscriber unit was waiting for the information from Base station and didn't start transmission as well.

8.13.4 Test data

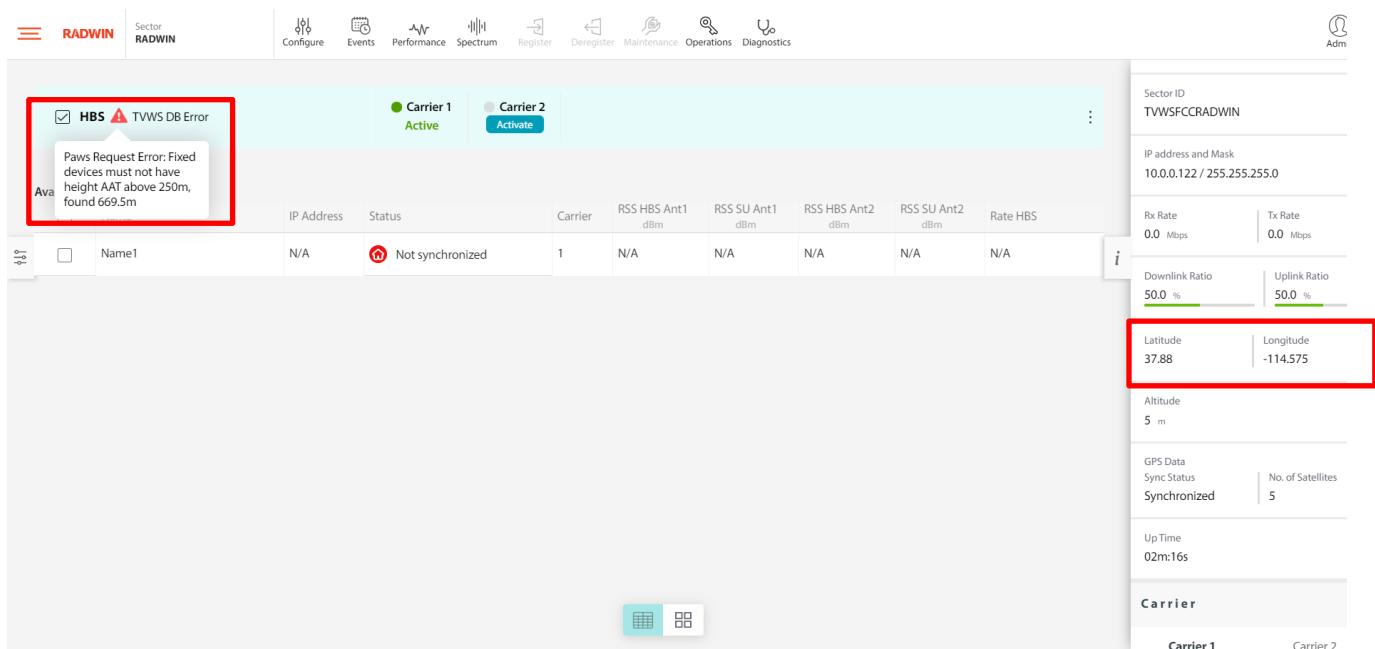


Figure 8.13-1: Unsuccessful registration with restricted HAAT location

8.14 FCC 15.713(e)(6) Unsuccessful registration due to antenna height that exceeds 30 m

8.14.1 Definitions and limits

A fixed device with an antenna height above ground that exceeds 30 meters or an antenna height above average terrain (HAAT) that exceeds 250 meters shall not be provided a list of available channels.

8.14.2 Test summary

Test date October 17, 2018

8.14.3 Observations, settings and special notes

EUT was configured with information that included an antenna height that exceeded 30 m limit in congested areas and 100 m in less congested areas (the limit is set by the database). It was verified, that after database rejection, the EUT stopped the transmission.

To test this feature the device was initially configured with valid information and allowed to transmit on the channel. The registration information was then modified to render it invalid and a registration request was re-initiated. Once the database responded with an empty channel list as a result of the antenna height above ground, the EUT stopped to transmit. For the Base station device, during the initial power up and registration, if the database returns an empty channel list, it will not turn on the transmitter. For the Subscriber device, the EUT will perform a passive scan and will attempt to connect to a Base station device on a channel where it detects a beacon. If the database responds with an empty channel list, or the device is unable to connect to the database, it will cease to transmit on the channel.

8.14.4 Test data

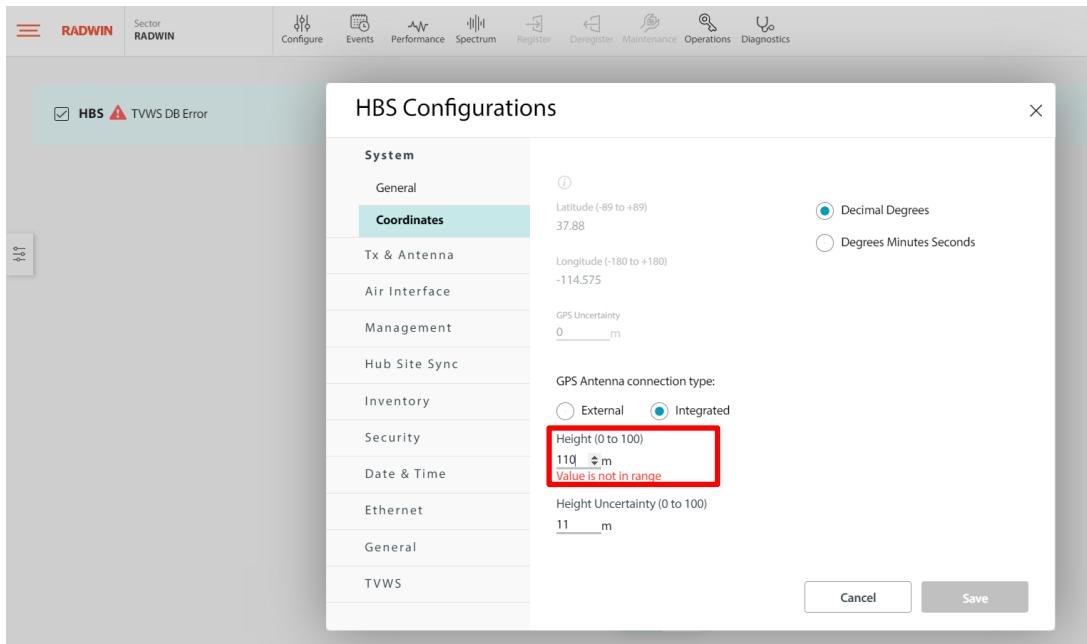


Figure 8.14-1: Unsuccessful registration with restricted antenna height in the less congested area

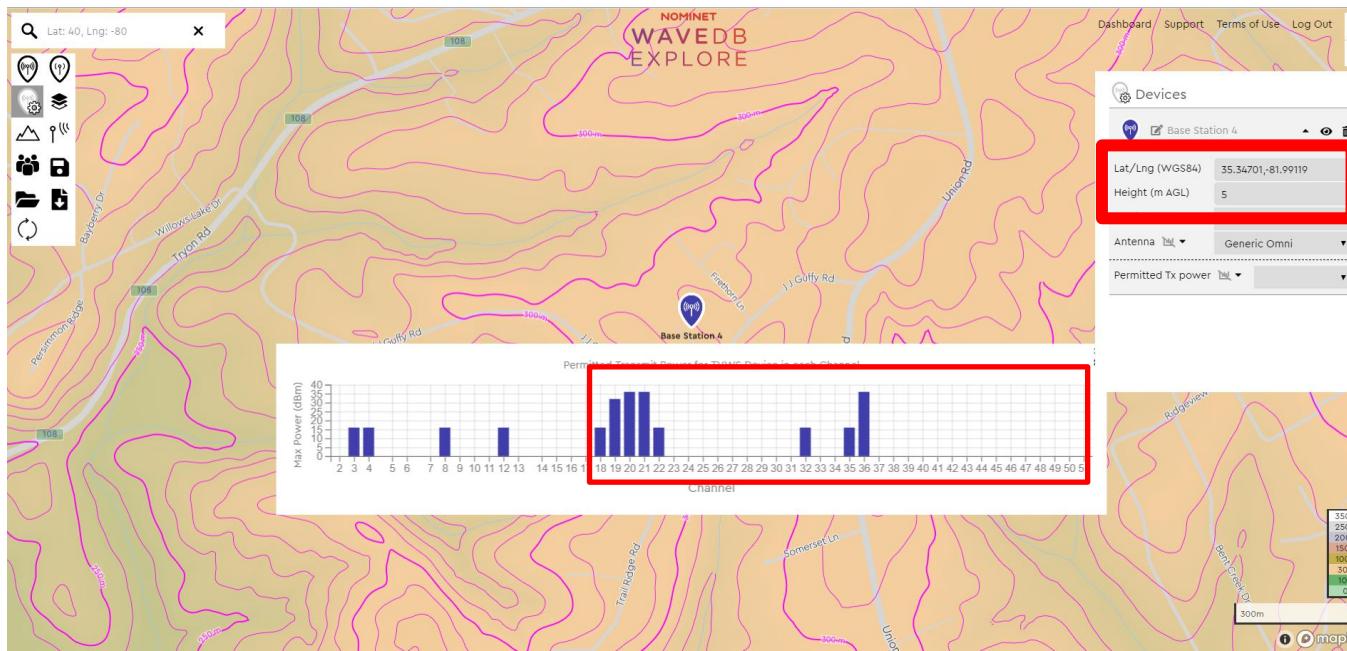


Figure 8.14-2: Example of congested area location with available channels for antenna height of 5 m (from Nominet)

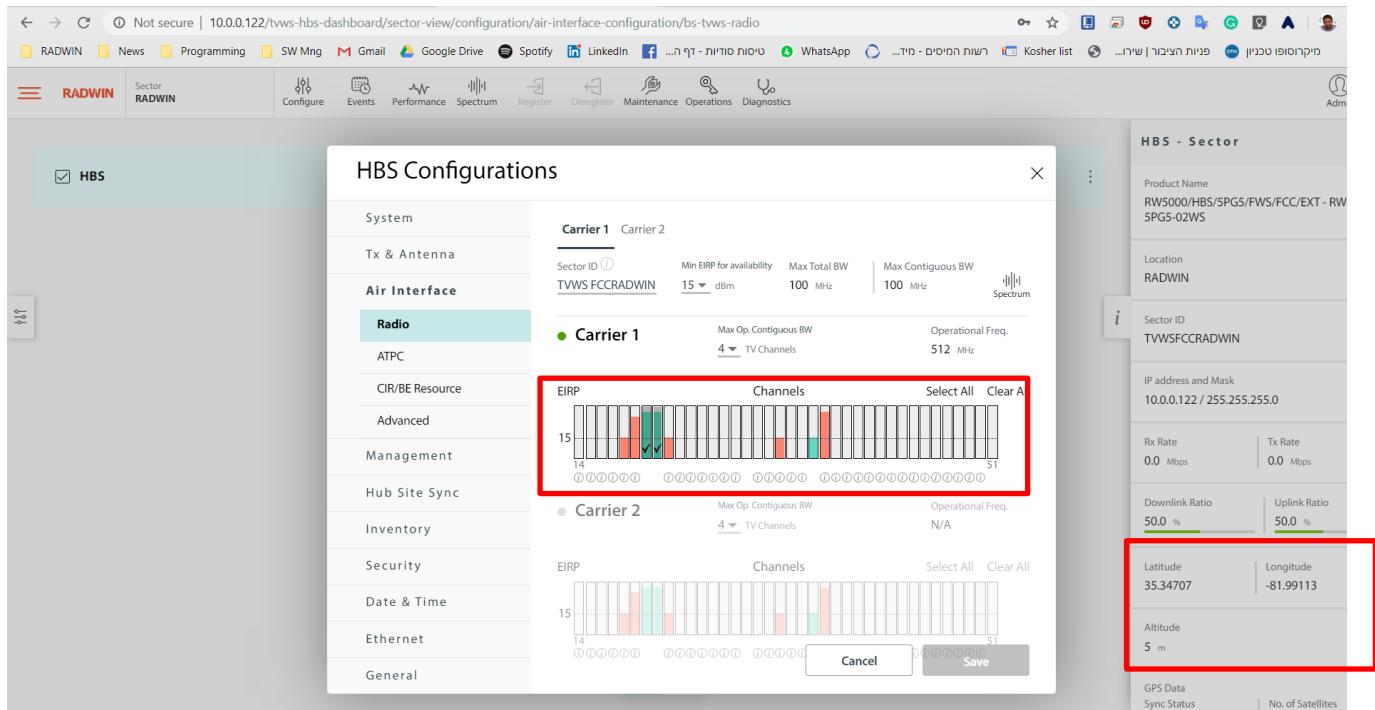


Figure 8.14-3: Antenna height adjusted to the specific height and available channels

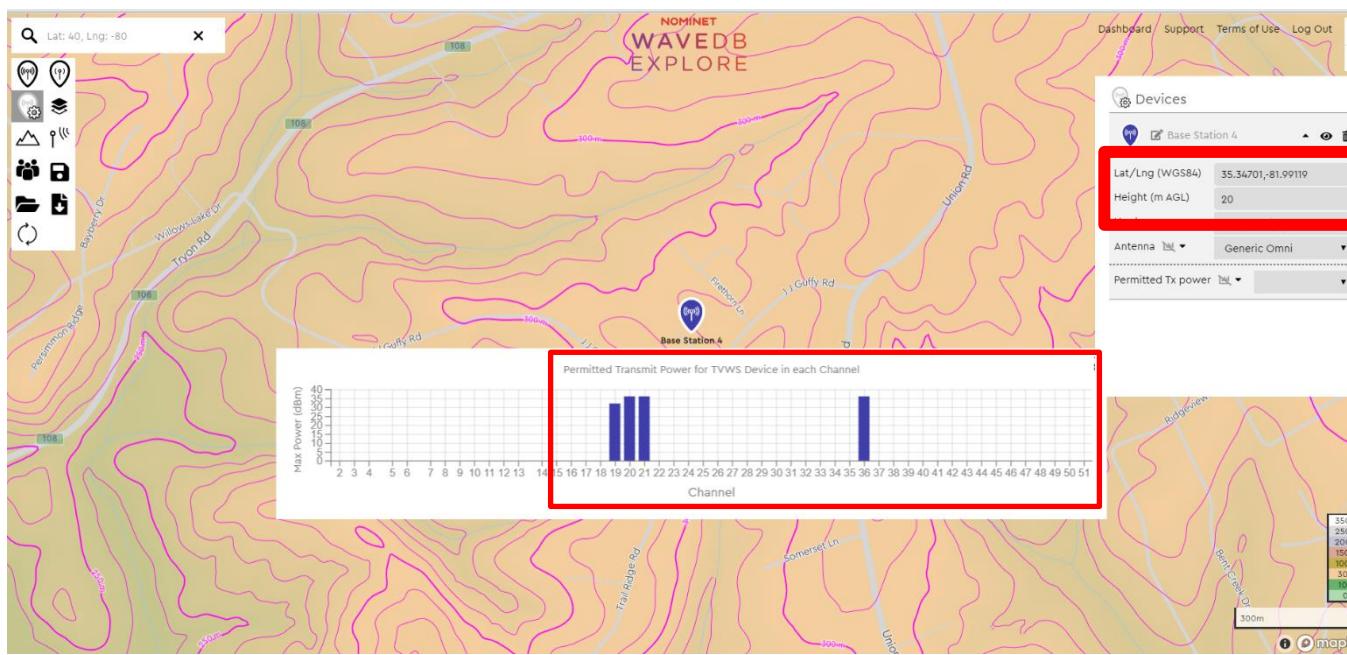


Figure 8.14-4: Example of congested area location with available channels for antenna height of 20 m (from Nominet)

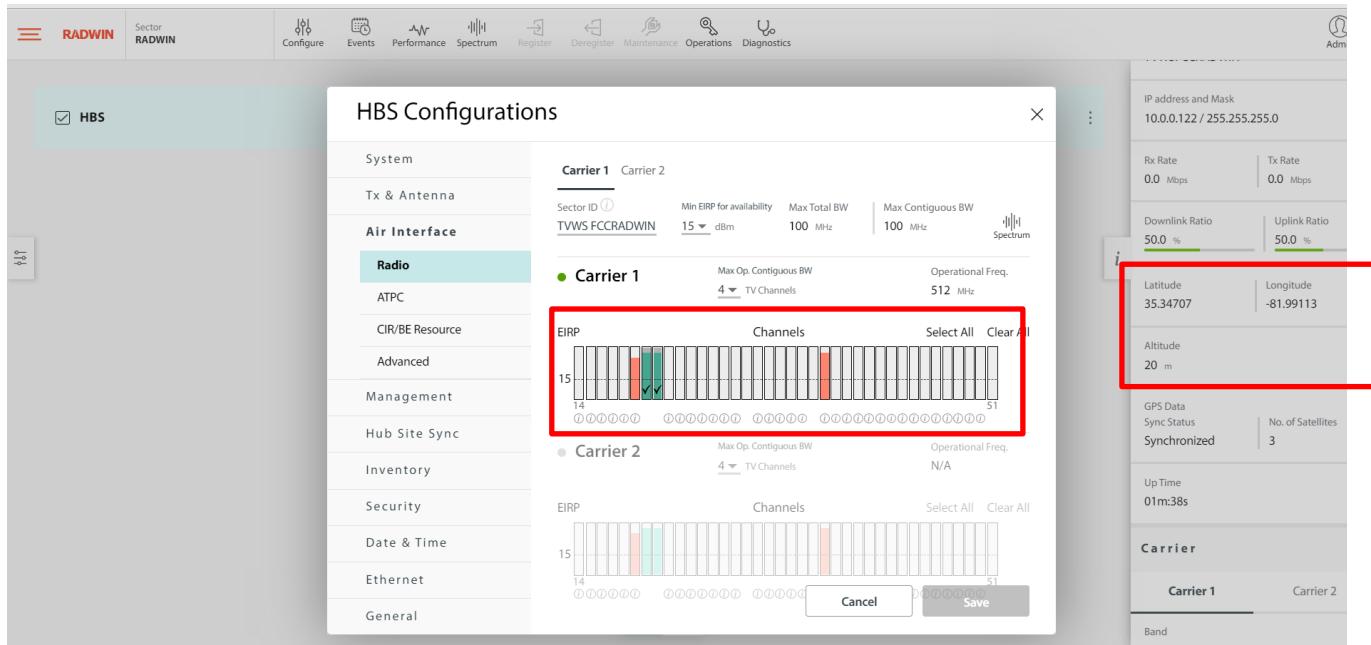


Figure 8.14-5: Antenna height adjusted to the specific height and available channels

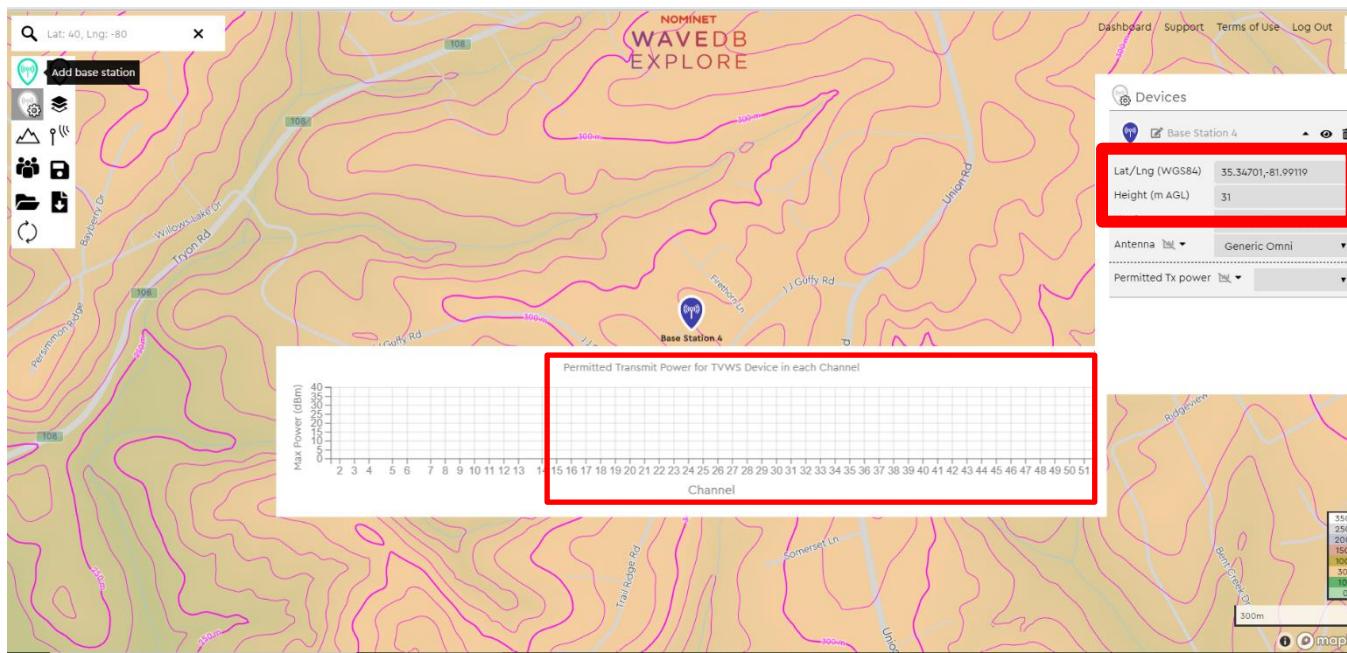


Figure 8.14-6: Example of congested area location with no available channels for antenna height of 31 m (from Nominet)

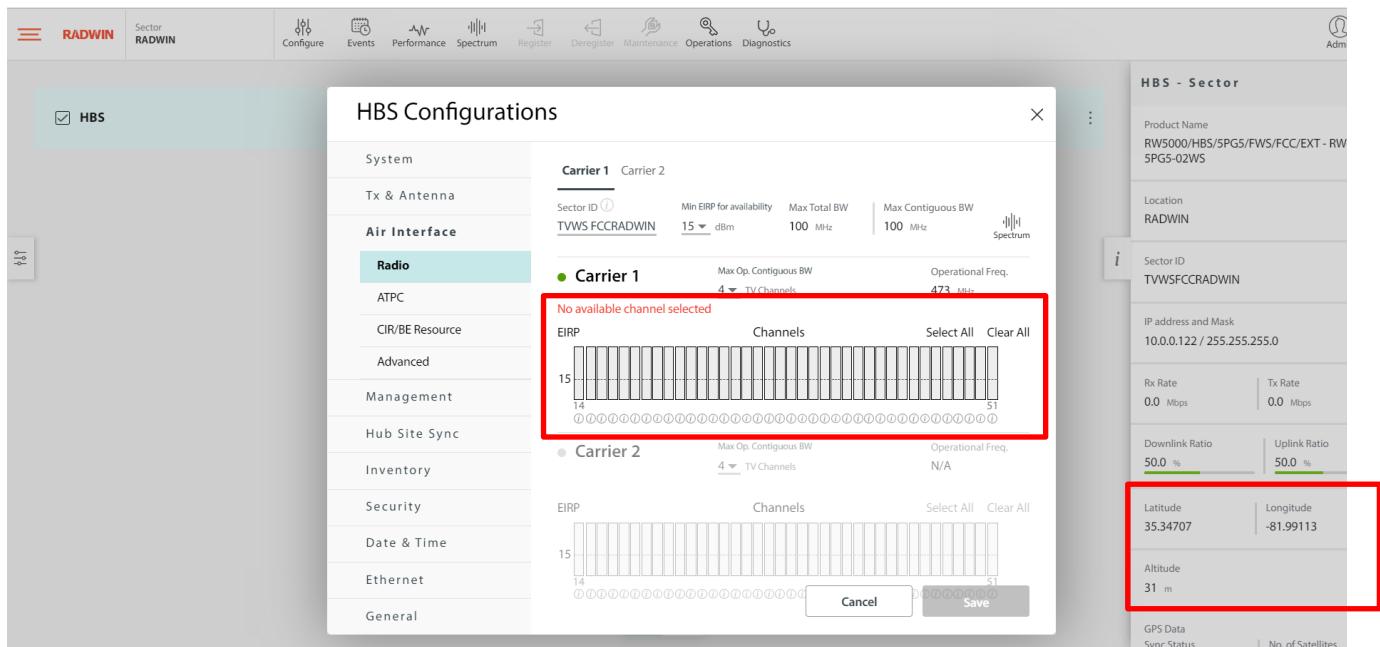


Figure 8.14-7: System location settings and Database error due to antenna height, that exceeded the limit

| | |
|----------------------|---|
| Section 8 | Testing data |
| Test name | FCC 15.713(g)(3)(i) and (ii) Unsuccessful registration due to incomplete information – FCC ID and Serial number |
| Specification | FCC Part 15 Subpart H |



8.15 FCC 15.713(g)(3)(i) and (ii) Unsuccessful registration due to incomplete information – FCC ID and Serial number

8.15.1 Definitions and limits

(3) The white space device registration database shall contain the following information for fixed white space devices:

- (i) FCC identifier (FCC ID) of the device;
- (ii) Manufacturer's serial number of the device

8.15.2 Test summary

Test date December 2, 2019

8.15.3 Observations, settings and special notes

The registration interface does not contain a mechanism by which the serial number or the FCC ID of the radio can be changed. The FCC ID and serial number are flash-programmed during the manufacturing process and could not be changed without being returned to the manufacturer.

8.16 FCC 15.713(a)(3) Relocation of fixed TVBD

8.16.1 Definitions and limits

The white space database serves the following function:

(3) To register the identification information and location of fixed white space devices and unlicensed wireless microphone users.
The Data base will not provide a channel list for a fixed TVBD at a location other than that registered.

8.16.2 Test summary

Test date December 2, 2019

8.16.3 Observations, settings and special notes

The implementation of the location input prevents the radio from requesting channels from another location other than the last successful registration. It is not possible for the user to input location information into the radio that would result in a channel request from a different location other than the current registration location. In the event of a change in the input location information, a new registration and channel request are sent using the same entered registration location information.

8.17 FCC 15.711(c)(2)(i), FCC 15.711(h) Fixed & Mode II TVDB database update

8.17.1 Definitions and limits

Each fixed white space device must access a white space database over the Internet to determine the available channels and the corresponding maximum permitted power for each available channel that is available at its geographic coordinates, taking into consideration the fixed device's antenna height above ground level and geo-location uncertainty, prior to its initial service transmission at a given location. Testing in accordance with KDB 416721 D01, III (2)(e)

8.17.2 Test summary

Test date June 27, 2019

8.17.3 Observations, settings and special notes

EUT was configured with proper registration information and the successful registration was verified. Database URL was modified from paws-usa.wavedb.com to paws-usa.wavedb.ca. After the time of channel allocation has passed it was verified that without the proper database access the EUT received empty channel list and stopped the transmission. Then the URL was changed back to and it was verified that with the proper database access the EUT received a channel list and started the transmission. Testing was repeated with Base station disconnected from the internet and it was verified, that after refresh time both EUTs ceased transmission.

8.17.4 Test data

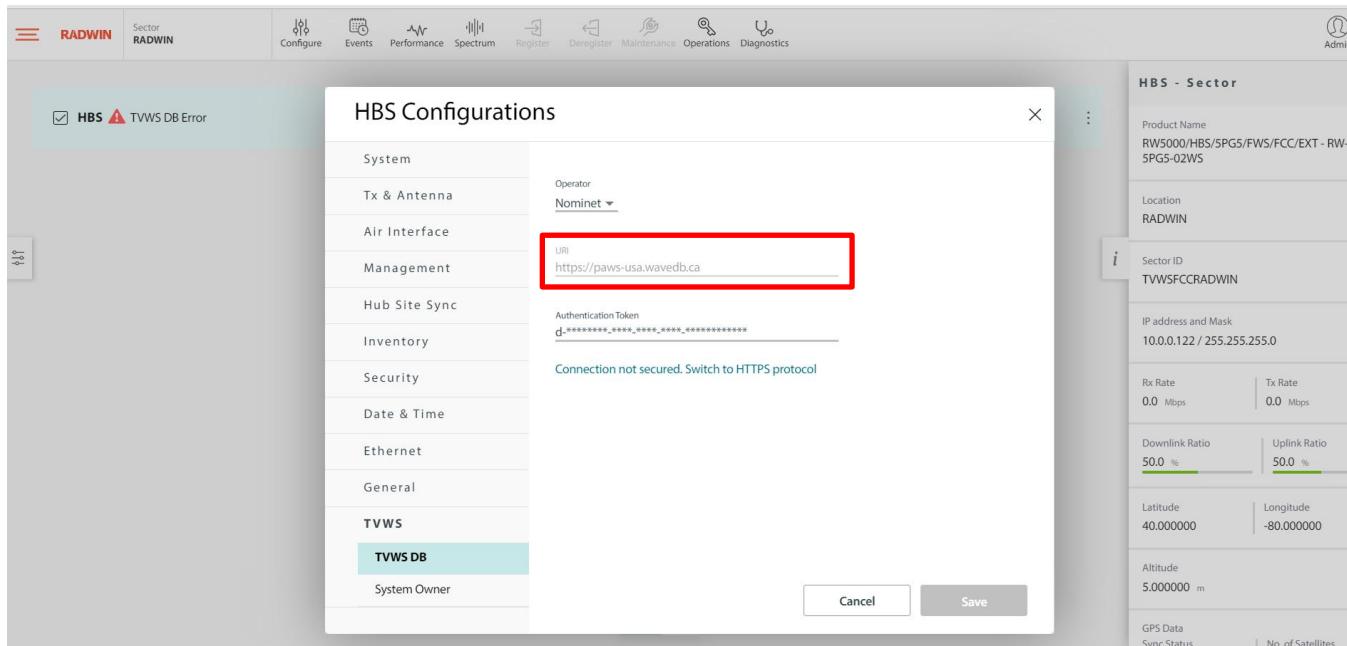


Figure 8.17-1: Wrong database URL setting

The screenshot shows the RADWIN Nemko software interface. At the top, there are several tabs: Sector, RADWIN, Configure, Events, Performance, Spectrum, Register, Deregister, Maintenance, Operations, and Diagnostics. The 'Sector' tab is selected. On the left, there is a sidebar with a red box highlighting an error message: 'HBS TVWS DB Error' with a checkmark and a warning icon. Below this, it says 'Paws Database Connection Error: Host Name Could Not Be Resolved'. To the right, there are two sections: 'Carrier 1' (red box) with the message 'No Channels Available' and 'Carrier 2' with a 'Activate' button. The main table below shows a single row for 'Name1' with 'N/A' in all columns except 'Status' (which shows 'Not synchronized'). On the right, there is a detailed sidebar for 'HBS - Sector' with various configuration parameters like Product Name (RW5000/HBS/5PG5/FWS/FCC/EXT - RW-SPGS-02WS), Location (RADWIN), Sector ID (TVWSFCCRADWIN), and GPS Data (Sync Status, No. of Satellites).

Figure 8.17-2: Unsuccessful registration due to wrong database URL

8.18 FCC 15.711(c)(2)(iii) Low-power auxiliary device protection

8.18.1 Definitions and limits

Each fixed white space devices shall access the database at least once a day to verify that the operating channels continue to remain available. Each fixed white space device must adjust its use of channels in accordance with channel availability schedule information provided by its database for the 48-hour period beginning at the time the device last accessed the database for a list of available channels.

Use of database protected entity interface to register protection for a low-power auxiliary device in the same location and channel which EUT has selected and operating. The registered protection for the low-power auxiliary device should be scheduled within the next 48-hour period. Testing in accordance with KDB 416721 D01, III (2)(l).

8.18.2 Test summary

Test date December 2, 2019

8.18.3 Observations, settings and special notes

EUT was configured with proper registration information and the successful registration was verified. The channel expiration time for testing purposes was reduced to 5 minutes. Meantime it was scheduled with WSDB that channel 30 would be registered for low-power device. After the time of channel allocation of the EUT has passed it was verified that the EUT stopped the transmission on the temporary restricted and removed from the channel list. Since EUT is not waiting 48 hours for the push notification but rather following refresh rate of 20 minutes.

8.18.4 Test data

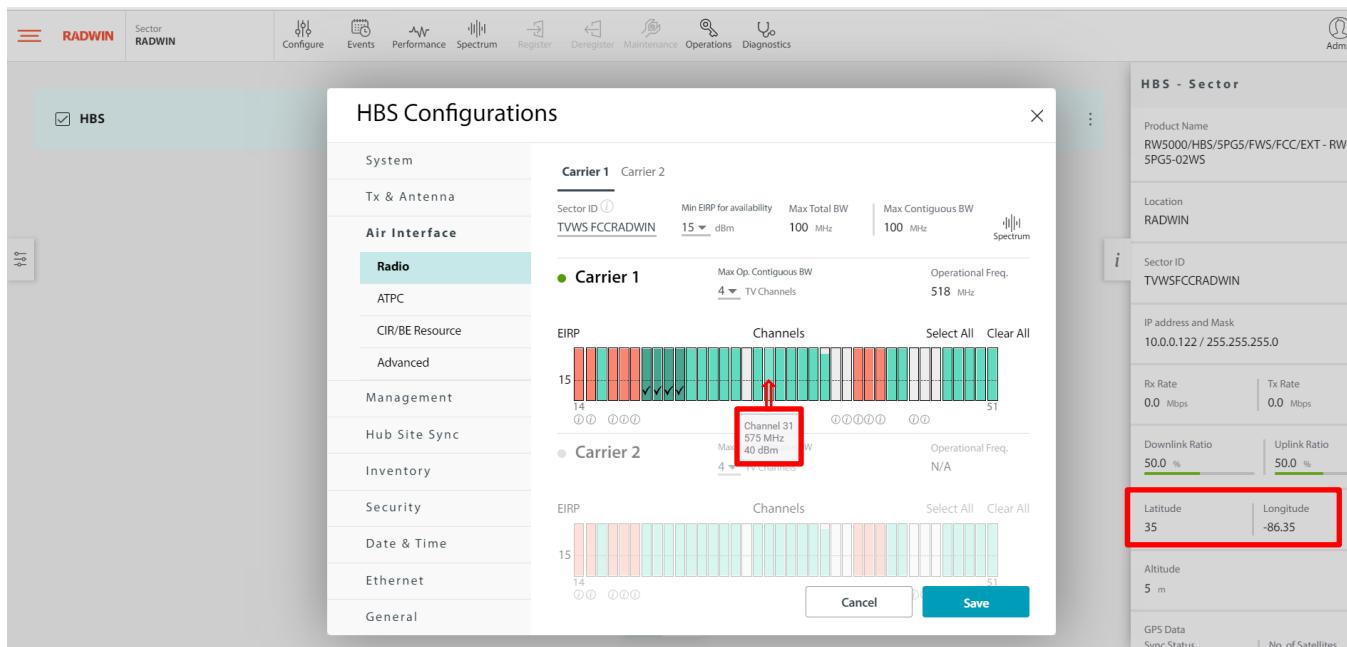


Figure 8.18-1: Successful registration before the registration of LP device on the channel 31 at 35N 86.35W

WAVED B

USA TVWS Protected Entity Registration

Channel Search Protected Entity Registration▼

Station Information

Channel Number(s)* 31 Callsign* BLN00751

+ Add

Location Point Polygon

Location (NAD83) Decimal DMS

Latitude* 35 Longitude* -86.35

Duration

Start Time (UTC)* December 2, 2019 12:00 AM

End Time (UTC)* December 2, 2019 11:30 PM

Contact Details

Contact Name* Andrey Adelberg

Street Address* Suite 10-21

City* Los Angeles

State* California

Country* United States

ZIP Code

Phone Number* 6137379680

Email* andrey.adelberg@nemko.com

Your Licensed Low Power Auxiliary Station has been successfully submitted and will immediately receive protection

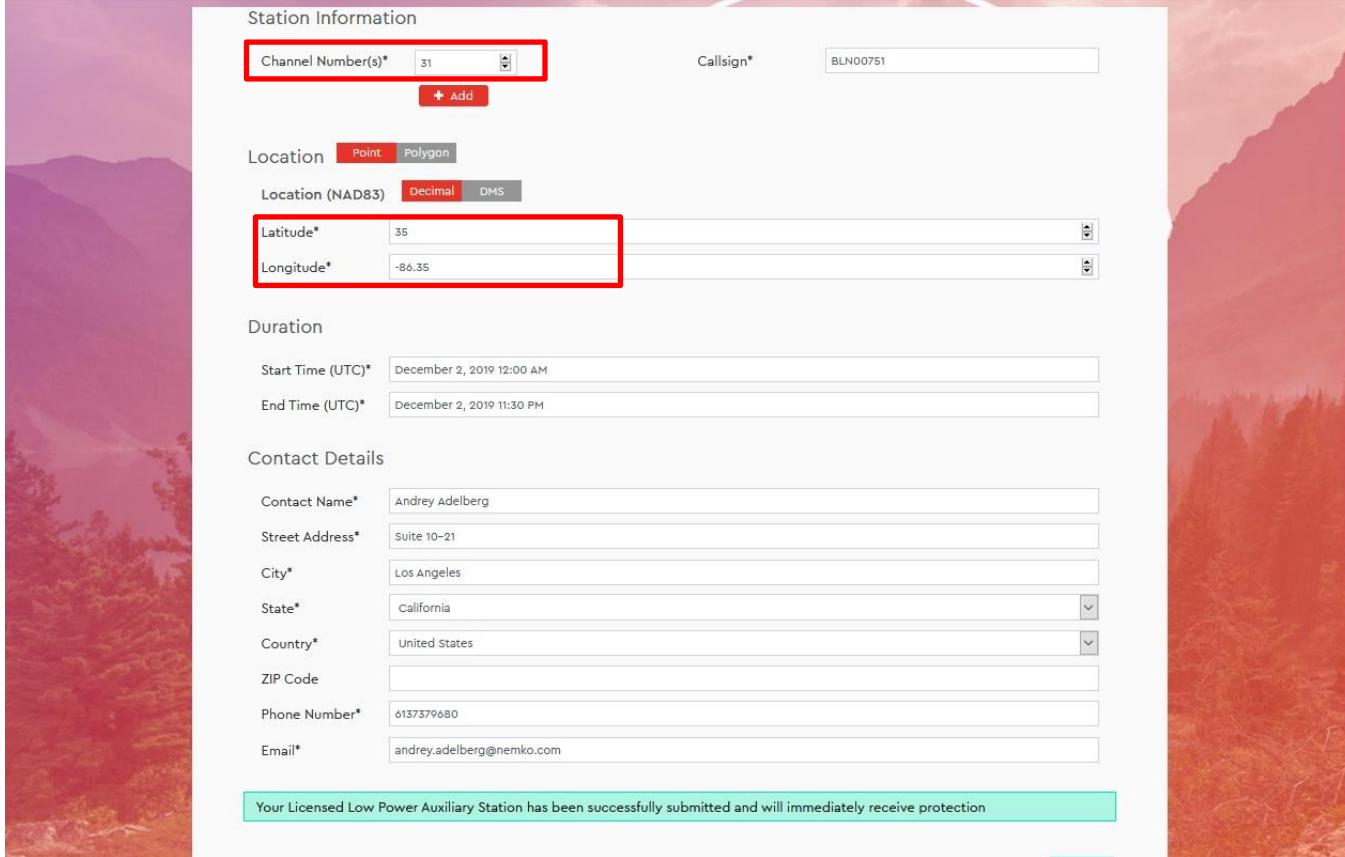


Figure 8.18-2: Registration of LP device on the channel 31 at the same location at 35N 86.35W

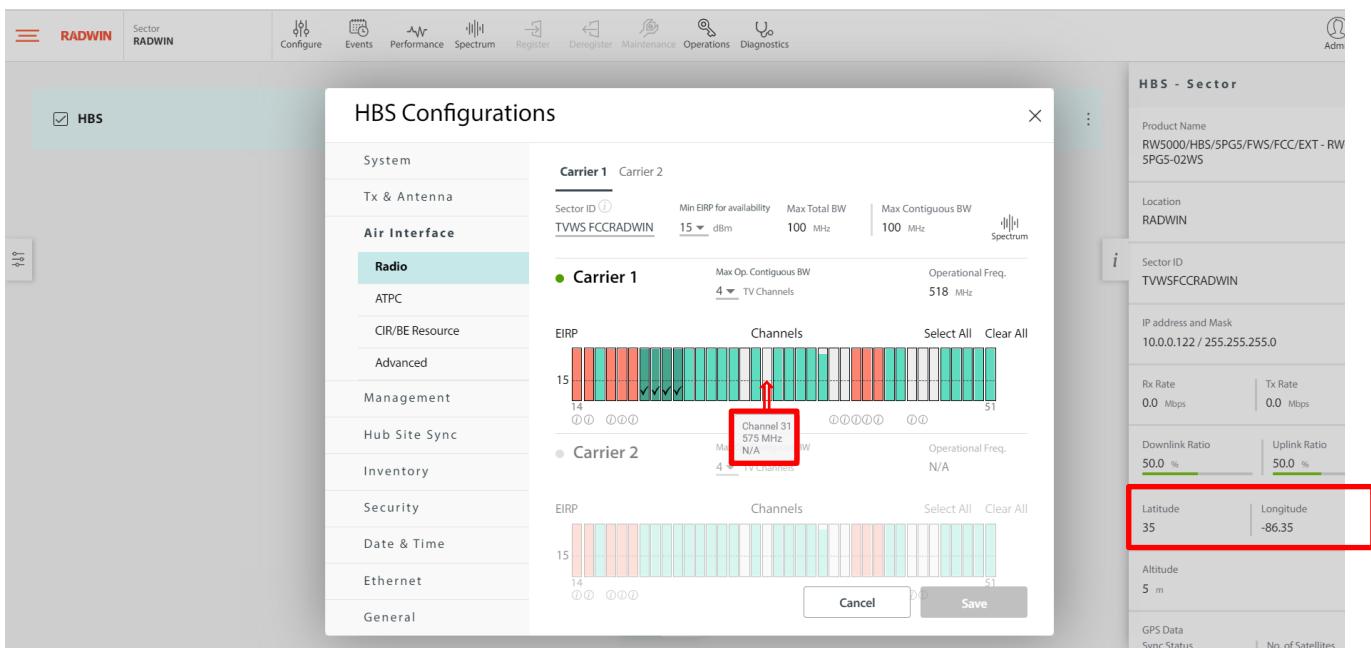


Figure 8.18-3: Unsuccessful registration after the registration of LP device on the channel 31.

8.19 FCC 15.712 Interference protection requirements (Fixed and personal/portable)

8.19.1 Definitions and limits

Using system management software or database, provide different location (coordinates) so that compliance with operating channel and power level is shown under each of the scenarios outlined in §15.712. Include a sample scan showing the total channel power and adjacent channel emission settings for test coordinates.

8.19.2 Test summary

Test date December 2, 2019

8.19.3 Observations, settings and special notes

EUT was configured with proper registration information and the successful registration was verified. The coordinates then were changed in accordance with FCC 15.712 test scenarios. Updated channel list with unavailable channels was verified. Once the device gets updated channel list, the device flagged the error in the GUI when trying to set the restricted channel.

Test scenarios were as follows:

- (a) Digital television stations, and digital and analog Class A TV, low power TV, TV translator and TV booster stations.
- (b) TV translator, Low Power TV (including Class A) and Multi-Channel Video Programming Distributor (MVPD) receive sites.
- (c) Fixed Broadcast Auxiliary Service (BAS) links.
- (d) PLMRS/CMRS operations.
- (e) Offshore Radiotelephone Service.
- (f) Low power auxiliary services, including wireless microphones - Duplicate of earlier tests
- (g) Border areas near Canada and Mexico.
- (h) Radio astronomy services.
- (i) 600 MHz service band.
- (j) Wireless Medical Telemetry Service. - No existing examples
- (k) 488-494 MHz band in Hawaii.