

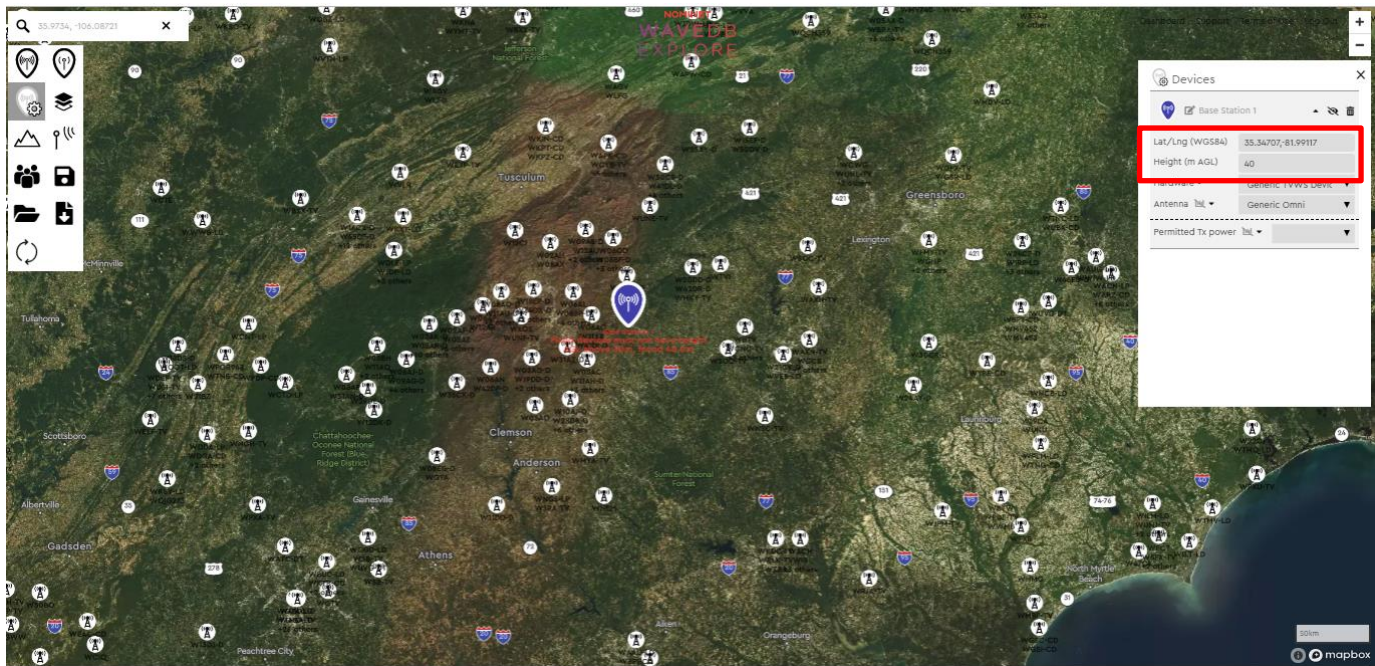


Figure 8.14-8: Example of congested area location with no available channels for antenna height of 40 m

System

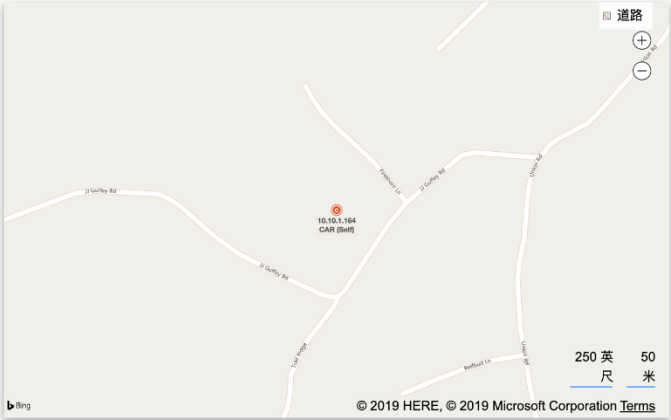
System	Network	Tools	Features	Database
Device Characteristics:				
Manufacturer ID:	6harmonics	Antenna Height (0-100m):	40	
Model ID:	GWS5002	Antenna Height Type:	AGL	
FCC TvbdDevice Type:	FIXED	Antenna Gain:	2	
FCC ID:	TEST-FCC-ID	Height Uncertainty:	0	
Location:				
Latitude:	35.347074	Longitude:	-81.991132	
Database Parameters:				
Token:	d-cadd2107-1387-44b6-ab3f-24fef6df18c1	Database Weblisting:	https://paws-usa.wavedb.com	
Owner Information				
Name:	6H	Address Line1:	Suite 10-21	
Telephone:	+16133661768	Address Line2:	Concours Gate	
Email:	info@6harmonics.com	City:	Ottawa	
ZIP/Post Code:	K2E7S4	State/Region:	ON	
		Country:	CA	
Operator Information				

Figure 8.14-9: Antenna height adjusted to the specific height.



Core Adaptive Radio (CAR) Status

Status	
Radio Type / MAC	GWS5002 / AC:EE:3B:03:3E:FE
Connected Stations	No station connected
IP / SSID	10.10.1.164 / 6harmonicsGWS
LAN Speed Duplex	100 Mbps full duplex
Location	(35.347077 , -81.991185) PE<7.8m, 95%CL
Channel / Region	CH 42 (641 MHz) / 0
Tx State / Tx Power	TX DOWN / 20 dBm
RX Gain	Auto
Temperature	44.00 °C
Channel Bandwidth	6 MHz
System Up Time	0h:15m:32s-0 d-0 m-0 y
Free Memory	MemFree: 89968 kB



Spectrum Channel Scan

Database Agent Status

Database access	nominetus	System time	Fri Jun 28 10:15:29 EDT 2019
T-validity	3118 minutes	T-Update	665 seconds
Agent status	Query Master Operation Parameters Failed. Sleep 30s...	Database error log	Agent Error: Error : Fixed devices must not have height AGL above 30m, found 40.0m (-202)

Connection Status

Figure 8.14-10: System location settings and Database error due to antenna height, that exceeded the limit

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	June 27, 2019
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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	June 27, 2019
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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-ca.wavedb.com*. 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

System

System Network Tools Features Database

Device Characteristics:	
Manufacturer ID:	6harmonics
Model ID:	GWS5002
FCC TvdbDevice Type:	FIXED
FCC ID:	TEST-FCC-ID
Location:	
Latitude:	38.445795
Longitude:	-86.641033
Database Parameters:	
Token:	d-cadd2107-1387-44b6-ab3f-24fef6df18c1
Database Weblisting:	https://paws-ca.wavedb.com
Owner Information	
Name:	6H
Telephone:	+16133661768
Email:	info@6harmonics.com
ZIP/Post Code:	K2E7S4
Operator Information	
Name:	Smith
Telephone:	+16133661768
Email:	info@6harmonics.com
ZIP/Post Code:	K2E7S4

Figure 8.17-1: Wrong database URL setting

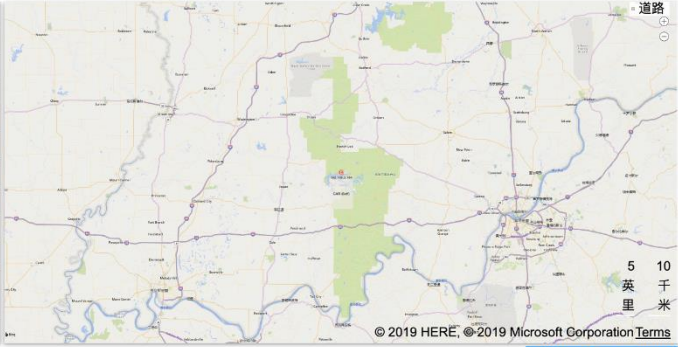
Section 8
Test name
Specification

Testing data
FCC 15.711(c)(2)(iii), FCC 15.711(h) Fixed & Mode II TVDB database update
FCC Part 15 Subpart H



Core Adaptive Radio (CAR) Status

Status			
Radio Type / MAC	GWS5002 / AC:EE:3B:03:3E:FE		
Connected Stations	No station connected		
IP / SSID	192.168.3.164 / 6harmonicsGWS		
LAN Speed Duplex	100 Mbps full duplex	Diagnosis	
Location	(38.445822, -86.641094) PE<7.8m, 95%CL	Map	
Channel / Region	CH 34 (593 MHz) / 0	Config	
Tx State / Tx Power	TX DOWN / 7 dBm	Config	
RX Gain	Auto		
Temperature	47.00 °C		
Channel Bandwidth	6 MHz	Config	
System Up Time	1h:18m:31s-0 d-0 m-0 y		
Free Memory	MemFree: 89160 kB		



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Spectrum Channel Scan

Database Agent Status

Database access	nominetus	System time	Thu Jun 27 12:44:54 EDT 2019
T-validity	3118 minutes	T-Update	681 seconds
Agent status	Query Initial Failed. Sleep 30s...	Database error log	Agent Error: Error : Failed to send request. Please check Internet accessibility on device. (-200)

Connection Status

No Station Connected

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

System	Network	Tools	Features	Database
--------	---------	-------	----------	----------

Device Characteristics:	
Manufacturer ID:	6harmonics
Model ID:	GWS5002
FCC TvbdDevice Type:	FIXED
FCC ID:	TEST-FCC-ID
Location:	
Latitude:	38.445795
Longitude:	-86.641033
Database Parameters:	
Token:	d-cadd2107-1387-44b6-ab3f-24fef6df18c2
Database Weblisting:	https://paws-usa.wavedb.com
Owner Information	
Name:	6H
Address Line1:	Suite 10-21
Telephone:	+16133661768
Address Line2:	Concours Gate
Email:	info@6harmonics.com
City:	Ottawa
ZIP/Post Code:	K2E7S4
State/Region:	ON
Country:	CA
Operator Information	
Name:	Smith
Address Line1:	Suite 10-21
Telephone:	+16133661768
Address Line2:	Concours Gate
Email:	info@6harmonics.com
City:	Ottawa
ZIP/Post Code:	K2E7S4
State/Region:	ON
Country:	CA

Reset Save

Save

Figure 8.17-3: Database parameter: token was removed

Section 8
Test name
Specification

Testing data
FCC 15.711(c)(2)(iii), FCC 15.711(h) Fixed & Mode II TVDB database update
FCC Part 15 Subpart H

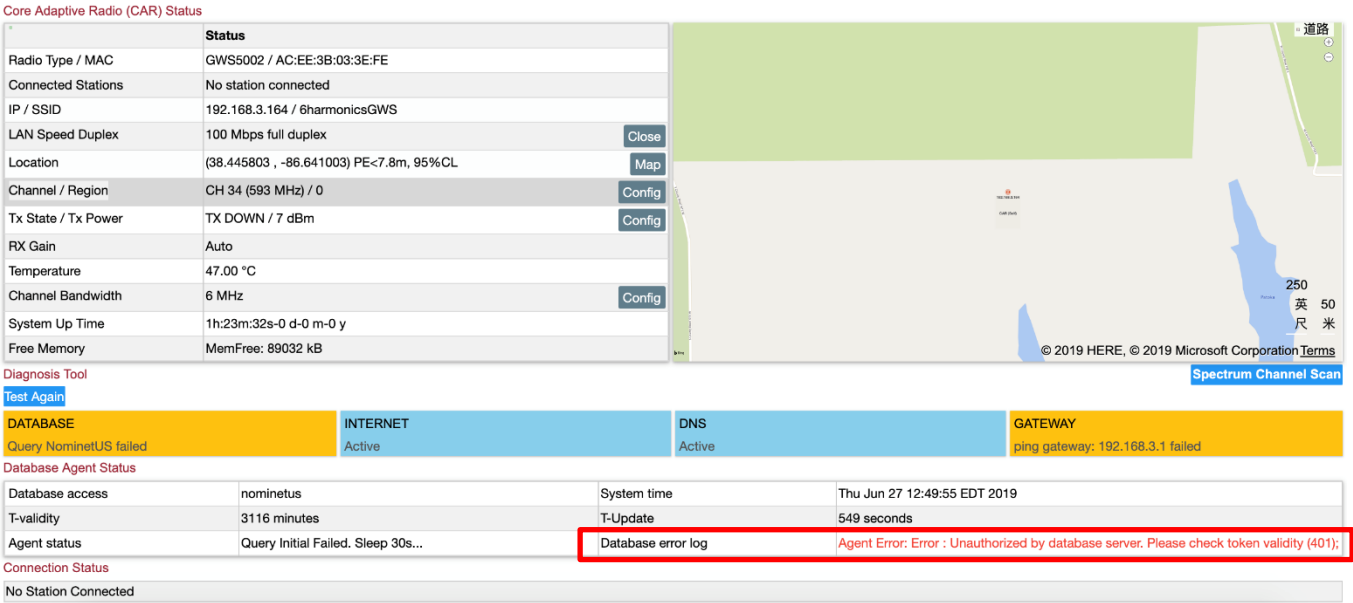


Figure 8.17-4: Unsuccessful registration due to a missing token.

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)(I).

8.18.2 Test summary

Test date June 27, 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

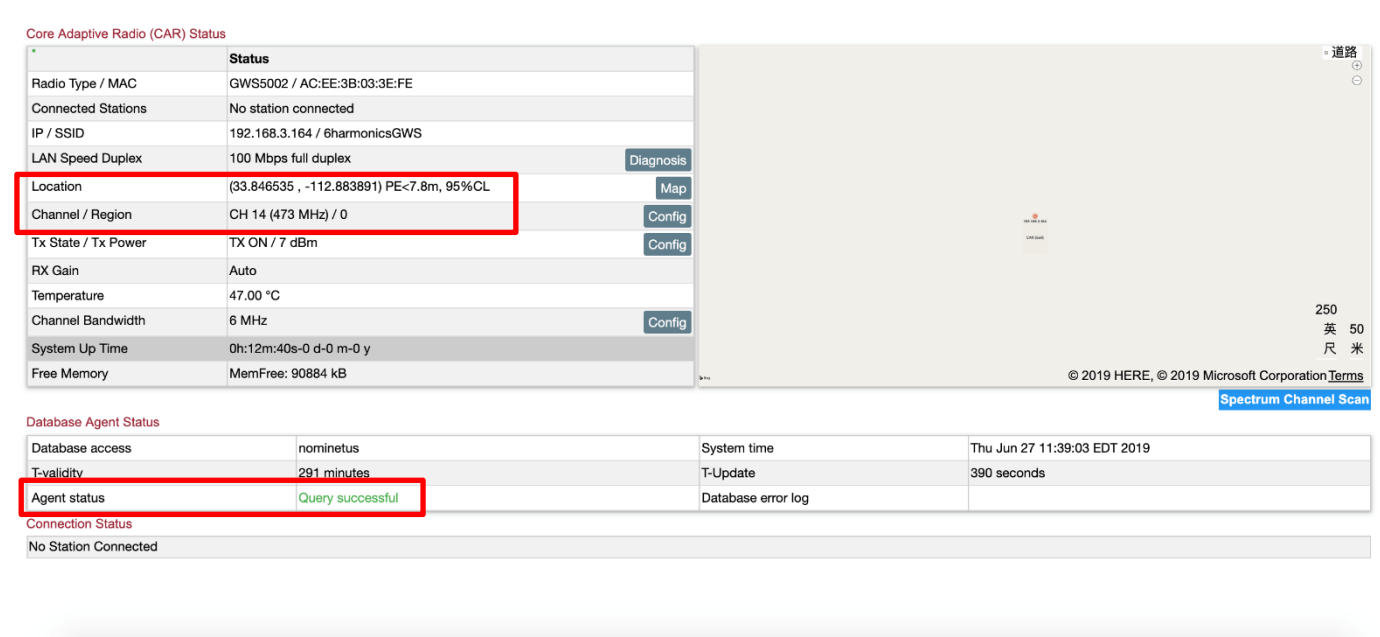


Figure 8.18-1: Successful registration before the registration of LP device on the channel 14

NOMINET
WAVEDB

USA TVWS Protected Entity Registration

Channel Search Protected Entity Registration▼

Station Information

Channel Number(s)* 14

Callsign* BLN00751

Location & Duration

Location (NAD83) Decimal DMS

Latitude* 33.846489

Longitude* -112.883868

Duration

Start Time (UTC)* June 27, 2019 3:00 PM

End Time (UTC)* June 27, 2019 9:30 PM

Contact Details

Contact Name* Alex

Street Address* Suite 10-21

City* Los Angeles

State* California

Country* United States

ZIP Code

Phone Number* 6133661768

Email* 6harmonics@gmail.com

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

Reset Submit

Figure 8.18-2: Registration of LP device on the channel 14 at the same location

Core Adaptive Radio (CAR) Status

	Status
Radio Type / MAC	GWS5002 / AC:EE:3B:03:3E:FE
Connected Stations	No station connected
IP / SSID	192.168.3.164 / 6harmonicsGWS
LAN Speed Duplex	100 Mbps full duplex
Location	(33.846474 , -112.883815) PE<7.8m, 95%CL
Channel / Region	CH 14 (473 MHz) / 0
Tx State / Tx Power	TX DOWN / 7 dBm
RX Gain	Auto
Temperature	48.00 °C
Channel Bandwidth	6 MHz
System Up Time	0h:19m:35s-0 d-0 m-0 y
Free Memory	MemFree: 89612 kB

Diagnosis Map Config Config

Database Agent Status

Database access	nominetus	System time	Thu Jun 27 11:45:58 EDT 2019
T-validity	284 minutes	T-Update	N/A
Agent status	Failed to Notify the database MOP usage, will retry after 5s... Sleep 5s...	Database error log	Agent Error: Error : OPERATIONAL_PARAMETERS_MARKED_INVALID (200)

Connection Status

No Station Connected

Figure 8.18-3: Unsuccessful registration after the registration of LP device on the channel 14.

Core Adaptive Radio (CAR) Status

Status			
Radio Type / MAC	GWS5002 / AC:EE:3B:03:3E:FE		
Connected Stations	No station connected		
IP / SSID	192.168.3.164 / 6harmonicsGWS		
LAN Speed Duplex	100 Mbps full duplex	Diagnosis	
Location	(33.846466, -112.883807) PE<7.8m, 95%CL	Map	
Channel / Region	CH 43 (647 MHz) / 0	Config	
Tx State / Tx Power	TX ON / 7 dBm	Config	
RX Gain	Auto		
Temperature	48.00 °C		
Channel Bandwidth	6 MHz	Config	
System Up Time	0h:20m:0s-0 d-0 m-0 y		
Free Memory	MemFree: 89460 kB		



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Spectrum Channel Scan

Database Agent Status

Database access	nominatus	System time	Thu Jun 27 11:46:23 EDT 2019
T-validity	297 minutes	T-Update	795 seconds
Agent status	Query successful	Database error log	

Connection Status

No Station Connected

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Figure 8.18-4: Successful registration on channel 43 after the registration of LP device on the channel 14.

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	June 27, 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.

8.19.4 Test data

System

System		REBOOT
System Info		
System Time	Thu Jun 27 14:04:27 EDT 2019 - EST5EDT	
Firmware Version	GWS5002-FCC-Rel-2.0.0-Beta Jun 26 2019 18:14:54-build	
Serial Number	520000010	
Ethernet MAC Address	AC:EE:3B:03:3E:FE	
Location	(38.400088 , -86.500107)	Config
GWS Mode	CAR (Core Adaptive Radio)	
Valid Database Channels	(15) (16); (19); (20); (21); (22); (23); (24); (25); (27); (29); (30); (31); (32); (33); (34); (35); (36); (46)	
Full Channel List	(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)	
Set User Account +		
Set System Time +		
Firmware Upgrade +		

Figure 8.19-1: Received channel list for coordinates set in scenarios (a) and (b). DCA channel 18 at location coordinates 38.4N, 86.5W

System

System		REBOOT
System Info		
System Time	Thu Jun 27 14:06:52 EDT 2019 - EST5EDT	
Firmware Version	GWS5002-FCC-Rel-2.0.0-Beta Jun 26 2019 18:14:54-build	
Serial Number	520000010	
Ethernet MAC Address	AC:EE:3B:03:3E:FE	
Location	(39.800004 , -80.000068)	Config
GWS Mode	CAR (Core Adaptive Radio)	
Valid Database Channels	(16); (21); (22); (24); (26); (29); (30); (31) (32); (35); (46); (49); (51)	
Full Channel List	(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)	
Set User Account +		
Set System Time +		
Firmware Upgrade +		

Figure 8.19-2: Received channel list for coordinates set in scenarios (a) and (b). DRT channel 33 at location coordinates 39.8N, 80.0W

System

System	Network	Tools	Features	Database
REBOOT				
System Info				
System Time	Thu Jun 27 14:08:40 EDT 2019 - EST5EDT			
Firmware Version	GWS5002-FCC-Rel-2.0.0-Beta Jun 26 2019 18:14:54-build			
Serial Number	520000010			
Ethernet MAC Address	AC:EE:3B:03:3E:FE			
Location	(35.660027 , -114.000061) Config			
GWS Mode	CAR (Core Adaptive Radio)			
Valid Database Channels	(15); (17); (19); (20); (22); (24); (26); (27); (28); (31); (36)			
Full Channel List	(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) Config			
Set User Account +				
Set System Time +				
Firmware Upgrade +				

Figure 8.19-3: Received channel list for coordinates set in scenarios (a) and (b). DTS channel 32 at location coordinates 35.66N, 114.0W

System

System	Network	Tools	Features	Database
REBOOT				
System Info				
System Time	Thu Jun 27 14:12:05 EDT 2019 - EST5EDT			
Firmware Version	GWS5002-FCC-Rel-2.0.0-Beta Jun 26 2019 18:14:54-build			
Serial Number	520000010			
Ethernet MAC Address	AC:EE:3B:03:3E:FE			
Location	(33.000038 , -115.300084) Config			
GWS Mode	CAR (Core Adaptive Radio)			
Valid Database Channels	(14); (15); (16); (17); (18); (19); (20); (21); (23); (24); (25); (27); (28); (29); (30); (31); (32); (33); (34); (35)			
Full Channel List	(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) Config			
Set User Account +				
Set System Time +				
Firmware Upgrade +				

Figure 8.19-4: Received channel list for coordinates set in scenarios (a) and (b). DTV channels 22 and 36 at location coordinate 33.0N, 115.3W

6HARMONICS

MonitorSystemAbout

System

SystemNetworkToolsFeaturesDatabase

REBOOT

System Info

System Time

Thu Jun 27 14:13:35 EDT 2019 - EST5EDT

Firmware Version

GWS5002-FCC-Rel-2.0.0-Beta Jun 26 2019 18:14:54-build

Serial Number

520000010

Ethernet MAC Address

AC:EE:3B:03:3E:FE

Location

(33.700011 , -113.800015)

Config

GWS Mode

CAR (Core Adaptive Radio)

Valid Database Channels

(14); (15); (16); (17); (18); (19); (20); (22); (23); (25); (28); (30); (32); (34); (35); (36)

Full Channel List

(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)

Config

Set User Account

+

Set System Time

+

Firmware Upgrade

+

Figure 8.19-5: Received channel list for coordinates set in scenario (a) and (b). LPA channel 27 at location coordinates 33.7N, 113.8W

System

SystemNetworkToolsFeaturesDatabase

REBOOT

System Info

System Time

Thu Jun 27 13:21:18 EDT 2019 - EST5EDT

Firmware Version

GWS5002-FCC-Rel-2.0.0-Beta Jun 26 2019 18:14:54-build

Serial Number

520000010

Ethernet MAC Address

AC:EE:3B:03:3E:FE

Location

(48.000034 , -111.000099)

Config

GWS Mode

CAR (Core Adaptive Radio)

Valid Database Channels

(14); (15); (16); (17); (18); (19); (20); (22); (23); (24); (25); (26); (27); (28); (29); (30); (31); (32); (33); (34); (35)

Full Channel List

(14); (15); (16); (17); (18); (19); (20); (21); (22); (23); (24); (25); (26); (27); (28); (29); (30); (31); (32); (33); (34); (35); (39); (40); (41); (42); (43); (44); (45); (46); (47); (48); (49); (50); (51)

Config

Set User Account

+

Set System Time

+

Firmware Upgrade

+

Figure 8.19-6: Received channel list for coordinates set in scenario (a) and (b). LPD channel 11 at location coordinates 48.0N, 111.0W

System

System Network Tools Features Database		REBOOT
System Info		
System Time	Thu Jun 27 13:23:08 EDT 2019 - EST5EDT	
Firmware Version	GWS5002-FCC-Rel-2.0.0-Beta Jun 26 2019 18:14:54-build	
Serial Number	520000010	
Ethernet MAC Address	AC:EE:3B:03:3E:FE	
Location	(48.870057 , -111.190114)	Config
GWS Mode	CAR (Core Adaptive Radio)	
Valid Database Channels	(14); (15); (16); (17); (18); (19); (20); (21); (22); (23); (24); (25); (26); (28); (29); (30); (31)	
Full Channel List	(14); (15); (16); (17); (18); (19); (20); (21); (22); (23); (24); (25); (26); (27); (28); (29); (30); (31); (32); (33); (34); (35); (39); (40); (41); (42); (43); (44); (45); (46); (47); (48); (49); (50); (51)	Config
Set User Account +		
Set System Time +		
Firmware Upgrade +		

Figure 8.19-7: Received channel list for coordinates set in scenario (a) and (b). LPT channel 27 and TV receive site channel 11 at location coordinates 48.87N, 111.19W

System

System Network Tools Features Database		REBOOT
System Info		
System Time	Thu Jun 27 14:10:50 EDT 2019 - EST5EDT	
Firmware Version	GWS5002-FCC-Rel-2.0.0-Beta Jun 26 2019 18:14:54-build	
Serial Number	520000010	
Ethernet MAC Address	AC:EE:3B:03:3E:FE	
Location	(33.000038 , -114.300038)	Config
GWS Mode	CAR (Core Adaptive Radio)	
Valid Database Channels	(14); (15); (16); (18); (19); (20); (21); (23); (25); (27); (28); (30); (32); (34); (35)	
Full Channel List	(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)	Config
Set User Account +		
Set System Time +		
Firmware Upgrade +		

Figure 8.19-8: Received channel list for coordinates set in scenario (a) and (b). LPX channels 24, 26, 29, 31 and 33 at location coordinates 33N, 114.3W

System

System	Network	Tools	Features	Database
REBOOT				
System Info				
System Time	Thu Jun 27 13:24:49 EDT 2019 - EST5EDT			
Firmware Version	GWS5002-FCC-Rel-2.0.0-Beta Jun 26 2019 18:14:54-build			
Serial Number	520000010			
Ethernet MAC Address	AC:EE:3B:03:3E:FE			
Location	(34.000049 , -113.000084) Config			
GWS Mode	CAR (Core Adaptive Radio)			
Valid Database Channels	(14); (15); (16); (18); (19); (21); (22); (23); (25); (27); (28); (29); (30); (32); (33); (34); (35)			
Full Channel List	(14); (15); (16); (17); (18); (19); (20); (21); (22); (23); (24); (25); (26); (27); (28); (29); (30); (31); (32); (33); (34); (35); (39); (40); (41); (42); (43); (44); (45); (46); (47); (48); (49); (50); (51) Config			
Set User Account +				
Set System Time +				
Firmware Upgrade +				

Figure 8.19-9: Received channel list for coordinates set in scenario (a) and (b). MVPD channel 26 at location coordinates 34.0N, 113.0W

System

System	Network	Tools	Features	Database
REBOOT				
System Info				
System Time	Thu Jun 27 13:27:39 EDT 2019 - EST5EDT			
Firmware Version	GWS5002-FCC-Rel-2.0.0-Beta Jun 26 2019 18:14:54-build			
Serial Number	520000010			
Ethernet MAC Address	AC:EE:3B:03:3E:FE			
Location	(33.200007 , -112.000084) Config			
GWS Mode	CAR (Core Adaptive Radio)			
Valid Database Channels	(23) (30)			
Full Channel List	(14); (15); (16); (17); (18); (19); (20); (21); (22); (23); (24); (25); (26); (27); (28); (29); (30); (31); (32); (33); (34); (35); (39); (40); (41); (42); (43); (44); (45); (46); (47); (48); (49); (50); (51) Config			
Set User Account +				
Set System Time +				
Firmware Upgrade +				

Figure 8.19-10: Received channel list for coordinates set in scenario (c). Fixed BAS link channel 36 at location coordinates 33.2N, 112.0W

System

System		Network	Tools	Features	Database	REBOOT
System Info						
System Time	Thu Jun 27 13:30:45 EDT 2019 - EST5EDT					
Firmware Version	GWS5002-FCC-Rel-2.0.0-Beta Jun 26 2019 18:14:54-build					
Serial Number	520000010					
Ethernet MAC Address	AC:EE:3B:03:3E:FE					
Location	(36.100023 , -117.900084)					Config
GWS Mode	CAR (Core Adaptive Radio)					
Valid Database Channels	(14); (18); (22); (23); (24); (25); (26); (27); (28); (29); (30); (31); (32); (34); (35)					
Full Channel List	(14); (15); (16); (17); (18); (19); (20); (21); (22); (23); (24); (25); (26); (27); (28); (29); (30); (31); (32); (33); (34); (35); (39); (40); (41); (42); (43); (44); (45); (46); (47); (48); (49); (50); (51)					Config
Set User Account +						
Set System Time +						
Firmware Upgrade +						

Figure 8.19-11: Received channel list for coordinates set in scenario (d). PLMRS/CMRS operations channel 16 at location coordinates 36.1N, 117.9W

System

System		Network	Tools	Features	Database	REBOOT
System Info						
System Time	Thu Jun 27 13:32:23 EDT 2019 - EST5EDT					
Firmware Version	GWS5002-FCC-Rel-2.0.0-Beta Jun 26 2019 18:14:54-build					
Serial Number	520000010					
Ethernet MAC Address	AC:EE:3B:03:3E:FE					
Location	(28.600046 , -97.700107)					Config
GWS Mode	CAR (Core Adaptive Radio)					
Valid Database Channels	(14); (18); (20); (21); (22); (23); (26); (27); (31); (32); (34); (35)					
Full Channel List	(14); (15); (16); (17); (18); (19); (20); (21); (22); (23); (24); (25); (26); (27); (28); (29); (30); (31); (32); (33); (34); (35); (39); (40); (41); (42); (43); (44); (45); (46); (47); (48); (49); (50); (51)					Config
Set User Account +						
Set System Time +						
Firmware Upgrade +						

Figure 8.19-12: Received channel list for coordinates set in scenario (e). Offshore radiotelephone on channel 15 at location coordinates 28.6N, 97.1W

System

System Network Tools Features Database

REBOOT

System Info

System Time

Thu Jun 27 13:52:11 EDT 2019 - EST5EDT

Firmware Version

GWS5002-FCC-Rel-2.0.0-Beta Jun 26 2019 18:14:54-build

Serial Number

520000010

Ethernet MAC Address

AC:EE:3B:03:3E:FE

Location

(31.350084 , -111.000198)

Config

GWS Mode

CAR (Core Adaptive Radio)

Valid Database Channels

(14); (15); (16); (17); (18); (20); (21); (22); (24); (26); (27); (28); (29); (31); (32); (33); (35); (36); (46); (47); (48); (49); (50); (51)

Full Channel List

(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)

Config

Set User Account

+

Set System Time

+

Firmware Upgrade

+

Figure 8.19-13: Received channel list for coordinates set in scenario (g). Mexico border at location coordinates 31.35N, 111.0W

Location (NAD83)

Decimal

DMS

Latitude*

31.35

Longitude*

-111

Height (AGL/m)

2

Search

Available Channels with Power Limits

Channel	Fixed	TVWS Equipment	
		Mode1	Mode2
2	40dBm	x	x
3	40dBm	x	x
4	40dBm	x	x
5	40dBm	x	x
6	40dBm	x	x
7	40dBm	x	x
8	16dBm	x	x
10	16dBm	x	x
11	40dBm	x	x
12	40dBm	x	x
13	40dBm	x	x
14	40dBm	20dBm	20dBm
15	20dBm	20dBm	20dBm
16	24dBm	20dBm	20dBm
17	20dBm	20dBm	20dBm
18	16dBm	16dBm	16dBm
20	16dBm	16dBm	16dBm
21	40dBm	20dBm	20dBm
22	16dBm	16dBm	16dBm
24	16dBm	16dBm	16dBm
26	16dBm	16dBm	16dBm
27	40dBm	20dBm	20dBm
28	40dBm	20dBm	20dBm
29	16dBm	16dBm	16dBm
31	16dBm	16dBm	16dBm
32	16dBm	16dBm	16dBm
33	16dBm	16dBm	16dBm
35	16dBm	16dBm	16dBm
36	36dBm	20dBm	20dBm
46	16dBm	16dBm	16dBm
47	40dBm	20dBm	20dBm
48	40dBm	20dBm	20dBm
49	40dBm	20dBm	20dBm
50	40dBm	20dBm	20dBm
51	40dBm	20dBm	20dBm

Figure 8.19-14: Channel availability for coordinates set in scenario (g). Mexico border at 31.35N, 111.0W

System

System Network Tools Features Database

REBOOT

System Info

System Time

Thu Jun 27 13:56:23 EDT 2019 - EST5EDT

Firmware Version

GWS5002-FCC-Rel-2.0.0-Beta Jun 26 2019 18:14:54-build

Serial Number

520000010

Ethernet MAC Address

AC:EE:3B:03:3E:FE

Location

(48.980065 , -111.000107)

Config

GWS Mode

CAR (Core Adaptive Radio)

Valid Database Channels

(14); (15); (16); (17); (18); (19); (20); (21); (22); (23); (24); (25); (26); (28); (29); (30); (31)

Full Channel List

(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)

Config

Set User Account

+

Set System Time

+

Firmware Upgrade

+

Figure 8.19-15: Received channel list for coordinates set in scenario (g). Canada border at location coordinates 48.98N, 111.0W

Decimal DMS

Latitude*

48.98

Longitude*

-111

Height (AGL/m)

2

Search

Available Channels with Power Limits

Channel	TVWS Equipment		
	Fixed	Mode1	Mode2
2	40dBm	x	x
3	40dBm	x	x
4	40dBm	x	x
5	40dBm	x	x
6	40dBm	x	x
7	40dBm	x	x
8	40dBm	x	x
9	40dBm	x	x
10	40dBm	x	x
11	40dBm	x	x
12	40dBm	x	x
13	40dBm	x	x
14	40dBm	20dBm	20dBm
15	40dBm	20dBm	20dBm
16	40dBm	20dBm	20dBm
17	40dBm	20dBm	20dBm
18	40dBm	20dBm	20dBm
19	40dBm	20dBm	20dBm
20	40dBm	20dBm	20dBm
21	40dBm	20dBm	20dBm
22	40dBm	20dBm	20dBm
23	40dBm	20dBm	20dBm
24	40dBm	20dBm	20dBm
25	40dBm	20dBm	20dBm
26	16dBm	16dBm	16dBm
28	16dBm	16dBm	16dBm
29	40dBm	20dBm	20dBm
30	40dBm	20dBm	20dBm
31	16dBm	16dBm	16dBm

Figure 8.19-16: Channel availability for coordinates set in scenario (g). Canada border at 48.98N, 111.0W

System

System	Network	Tools	Features	Database	REBOOT
System Info					
System Time	Thu Jun 27 14:00:56 EDT 2019 - EST5EDT				
Firmware Version	GWS5002-FCC-Rel-2.0.0-Beta Jun 26 2019 18:14:54-build				
Serial Number	520000010				
Ethernet MAC Address	AC:EE:3B:03:3E:FE				
Location	(30.500053 , -103.800107) Config				
GWS Mode	CAR (Core Adaptive Radio)				
Valid Database Channels	(14); (15); (16); (17); (18); (19); (20); (21); (22); (23); (24); (25); (26); (27); (28); (29); (30); (31); (32); (33); (34); (35); (36)				
Full Channel List	(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) Config				
Set User Account +					
Set System Time +					
Firmware Upgrade +					

Figure 8.19-17: Received channel list for coordinates set in scenario (h). Radio astronomy services on channel 37 at location coordinates 30.5N, 103.8W

System

System	Network	Tools	Features	Database	REBOOT
System Info					
System Time	Thu Jun 27 13:59:25 EDT 2019 - EST5EDT				
Firmware Version	GWS5002-FCC-Rel-2.0.0-Beta Jun 26 2019 18:14:54-build				
Serial Number	520000010				
Ethernet MAC Address	AC:EE:3B:03:3E:FE				
Location	(42.300080 , -85.700091) Config				
GWS Mode	CAR (Core Adaptive Radio)				
Valid Database Channels	(14); (15); (16); (18); (21); (23); (25); (27); (29); (30); (31); (33); (34); (35)				
Full Channel List	(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) Config				
Set User Account +					
Set System Time +					
Firmware Upgrade +					

<https://192.168.3.164/gws/System.html#>

Figure 8.19-18: Received channel list for coordinates set in scenario (i). 600 MHz service band on channels 39–42, 47–50 at location coordinates 42.3N, 85.7W



System

System Network Tools Features Database

REBOOT

System Info

System Time

Thu Jun 27 14:02:47 EDT 2019 - EST5EDT

Firmware Version

GWS5002-FCC-Rel-2.0.0-Beta Jun 26 2019 18:14:54-build

Serial Number

520000010

Ethernet MAC Address

AC:EE:3B:03:3E:FE

Location

(21.500057 , -158.000107)

Config

GWS Mode

CAR (Core Adaptive Radio)

Valid Database Channels

(14); (16); (18); (21); (24); (25); (28); (29); (30); (34); (36)

Full Channel List

(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)

Config

Set User Account

+

Set System Time

+

Firmware Upgrade

+

Figure 8.19-19: Received channel list for coordinates set in scenario (k). 488–494 MHz band in Hawaii channel 17 at location coordinates 21.5N, 158.0W

8.20 FCC 15.711(c)(2)(ii), (d)(3), 15.715(e) Fixed and Mode II Power level reduction

8.20.1 Definitions and limits

Using system management software, make a channel availability request to the database. Using the spectrum analyzer, confirm that the WSD operates at no more than the maximum power level indicated by the database and that the power level cannot be set to a higher level than indicated by the database at that specific location. If the device cannot reduce power, it must cease operation. Testing in accordance with KDB 416721 D01, III (2)(o).

8.20.2 Test summary

Test date June 27, 2019

8.20.3 Observations, settings and special notes

EUT was configured with proper registration information and the successful registration was verified. After receiving channel EIRP limit, EUT Tx power and Antenna gain were modified to exceed the limit. It was verified that the output power was automatically reduced to comply with EIRP restriction for the operation channel used.

8.20.4 Test data

```
#####  
-----14-----  
Channel   : 14  
freq      : 470  
PWR LIMIT for Master  
6MHz PWR : 24  
  
PWR LIMIT for Slave  
6MHz PWR : 24
```

Figure 8.20-1: Attempt 1 (antenna gain 4 dBi) Database provided an EIRP limitation of 24 dBm for channel 14

system

System

Network

Tools

Features

Database

Device Characteristics:

Manufacturer ID:

6harmonics

Model ID:

GWS5002

FCC TvbdDevice Type:

FIXED

FCC ID:

TEST-FCC-ID

Antenna Height (0-100m):

2

Antenna Height Type:

AGL

Antenna Gain:

4

Height Uncertainty:

0

Location:

Latitude:

38.469916

Longitude:

-86.704946

Database Parameters:

Token:

d-cadd2107-1387-44b6-ab3f-24fef6df18c1

Database

https://baws-usa.wavedb.com

Figure 8.20-2: Attempt 1 (antenna gain 4 dBi) Antenna gain settings

	Status
Radio Type / MAC	GWS5002 / AC:EE:3B:03:3E:FE
Connected Stations	No station connected
IP / SSID	10.10.1.164 / 6harmonicsGWS
LAN Speed Duplex	100 Mbps full duplex
Location	(38.47 , -86.704977) PE<7.8m, 95%CL
Channel / Region	CH 14 (473 MHz) / 0
Tx State / Tx Power	TX ON / 20 dBm
RX Gain	Auto
Temperature	47.00 °C
Channel Bandwidth	6 MHz
System Up Time	0h:34m:28s-0 d-0 m-0 y
Free Memory	MemFree: 80672 KB

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10.10.1.164

CAR (Self)

250 英尺

50 米

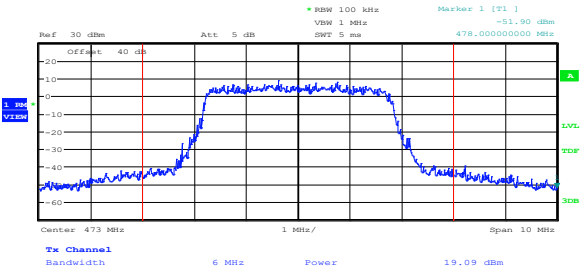
Figure 8.20-3: Attempt 1 (antenna gain 4 dBi) Transmit max power settings for compliance with the EIRP requirement: 24 dBm (EIRP limit) – 4 dBi (Antenna gain) = 20 dBm (Tx power)

Report reference ID: 376028-2TRFWL

Applicant: 6harmonics Inc.

Model: GWS-5000

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Date: 27.JUN.2019 15:00:28

Figure 8.20-4: Attempt 1 (antenna gain 4 dBi) Output power measurement on the channel 14 after registration and reception max EIRP limit.

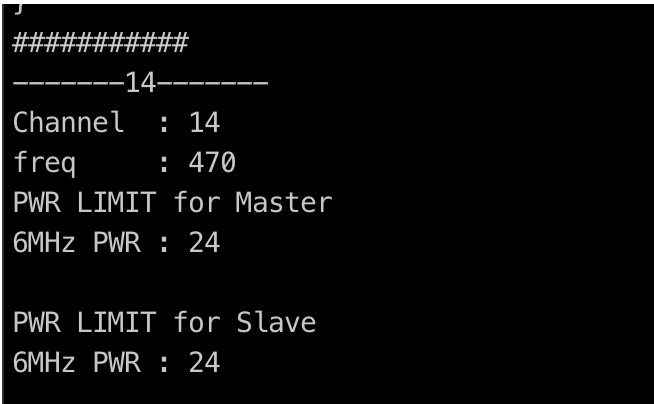


Figure 8.20-5: Attempt 2 (antenna gain 8 dBi) Database provided an EIRP limitation of 24 dBm for channel 14

System	Network	Tools	Features	Database																
Device Characteristics: <table><tbody><tr><td>Manufacturer ID:</td><td>6harmonics</td><td>Antenna Height (0-100m):</td><td>2</td></tr><tr><td>Model ID:</td><td>GWS5002</td><td>Antenna Height Type:</td><td>AGL</td></tr><tr><td>FCC TvbdDevice Type:</td><td>FIXED</td><td>Antenna Gain:</td><td>8</td></tr><tr><td>FCC ID:</td><td>TEST-FCC-ID</td><td>Height Uncertainty:</td><td>0</td></tr></tbody></table>					Manufacturer ID:	6harmonics	Antenna Height (0-100m):	2	Model ID:	GWS5002	Antenna Height Type:	AGL	FCC TvbdDevice Type:	FIXED	Antenna Gain:	8	FCC ID:	TEST-FCC-ID	Height Uncertainty:	0
Manufacturer ID:	6harmonics	Antenna Height (0-100m):	2																	
Model ID:	GWS5002	Antenna Height Type:	AGL																	
FCC TvbdDevice Type:	FIXED	Antenna Gain:	8																	
FCC ID:	TEST-FCC-ID	Height Uncertainty:	0																	
Location: <table><tbody><tr><td>Latitude:</td><td>38.469916</td><td>Longitude:</td><td>-86.704946</td></tr></tbody></table>					Latitude:	38.469916	Longitude:	-86.704946												
Latitude:	38.469916	Longitude:	-86.704946																	
Database Parameters: <table><tbody><tr><td>Token:</td><td>d-cadd2107-1387-44b6-ab3f-24fef6df18c1</td><td>Database Weblisting:</td><td>https://paws-usa.wavedb.com</td></tr></tbody></table>					Token:	d-cadd2107-1387-44b6-ab3f-24fef6df18c1	Database Weblisting:	https://paws-usa.wavedb.com												
Token:	d-cadd2107-1387-44b6-ab3f-24fef6df18c1	Database Weblisting:	https://paws-usa.wavedb.com																	

Figure 8.20-6: Attempt 2 (antenna gain 8 dBi) Antenna gain settings

Status

Radio Type / MAC	GWS5002 / AC:EE:3B:03:3E:FE	
Connected Stations	No station connected	
IP / SSID	10.10.1.164 / 6harmonicsGWS	
LAN Speed Duplex	100 Mbps full duplex	Diagnosis
Location	(38.470004 , -86.704954) PE<7.8m, 95%CL	Map
Channel / Region	CH 14 (473 MHz) / 0	Config
Tx State / Tx Power	TX ON / 16 dBm	Config
RX Gain	Auto	
Temperature	47.00 °C	
Channel Bandwidth	6 MHz	Config
System Up Time	0h:39m:54s-0 d-0 m-0 y	
Free Memory	MemFree: 90124 kB	

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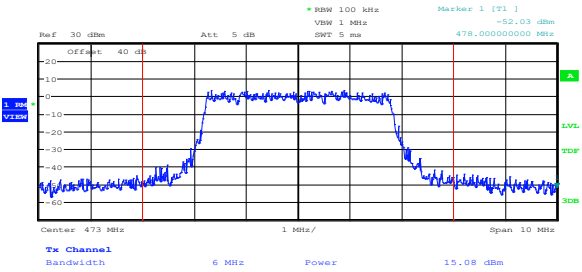
10.10.1.164
CAR (Self)

250 英尺 50 米

Bing

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Figure 8.20-7: Attempt 2 (antenna gain 8 dBi) Transmit max power settings for compliance with the EIRP requirement: 24 dBm (EIRP limit) – 8 dBi (Antenna gain) = 16 dBm (Tx power)



Date: 27.JUN.2019 15:01:39

Figure 8.20-8: Attempt 2 (antenna gain 8 dBi) Output power measurement on the channel 14 after registration.

8.21 FCC 15.711(j) Security

8.21.1 Definitions and limits

White space devices shall incorporate adequate security measures to ensure that they are capable of communicating for purposes of obtaining lists of available channels only with databases operated by administrators authorized by the Commission, and to ensure that communications between white space devices and databases are secure to prevent corruption or unauthorized interception of data. This requirement applies to communications of channel availability and other spectrum access information between the databases and fixed and Mode II devices (it is not necessary for white space devices to apply security coding to channel availability and channel access information where they are not the originating or terminating device and that they simply pass through).

8.21.2 Test summary

Test date	June 27, 2019
-----------	---------------

8.21.3 Observations, settings and special notes

Information provided by the manufacturer

8.21.4 Test data

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

The Fixed WSD (WSD) connects to the Nominet database using HTTPS over SSL/TLS. The Nominet database is certified by FCC which includes the protocol of how WSD interact with the database.

ii. How are communications initiated?

When the WSD boots up the WSD first ensures a connection to the internet with a valid DNS and gateway. Then the radio accesses the URL of the database and undergoes a TLS v1.2 handshake before exchanging data. This ensures a secure exchange. The WSD initiates communication with the Nominet database by initially sending an INIT_REQ message which includes the WSD Descriptor.

The WSD Descriptor contains;

- the device serial number
- manufacturer ID
- model ID
- FCC ID

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

The identity of the Nominet database is validated through verification of the Nominet SSL/TLS certificate through standard third-party certificate authority mechanisms, ensuring communications are secure and authenticated between the WSD and the database.

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

If the WSD does not successfully communicate with an authenticated database (as above), it will not allow operations to begin. If the device fails to communicate with the database, it will re-try every 30 seconds.

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

A unique database token installed in the radio during manufacture is required to validate the exchange. Only devices that have a valid database token can receive communications from the database. The database validates the token against the provided serial number, manufacturer name, model ID and FCC ID.

The list of valid serial numbers is generated by the device manufacturer. Using the Nominet database web interface authorized users can generate tokens for specific devices with specific serial numbers. Users are authorized by Nominet via an account name and password, which is only available to persons authorized by the device manufacturer.

vi. What encryption method is used?

SSL/TLS1.2 encryption is used to encrypt packets sent between the WSD and the database.

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

Protected devices are entities authorized by the rules for protection from WSD transmissions. Nominet provides a public interface to register protected devices in the database web tool using a valid account, valid username and valid password.

Section 9. Block diagrams of test set-ups

9.1 Test setup diagram

