FCC / IC DFS Master Test Report

FOR:

Virscient Limited

Model Name:
Trimble Comm board Tornado

Product Description:
WIFI/BT Module

FCC ID: YK5-73350047
IC ID: ----------

Applied Rules and Standards:
47 CFR Part 15.407 (UNII)
RSS-247 Issue 2 (DTSs)

REPORT #: EMC_VIRSC_003_15.407_DFS_Master

DATE: 2019-02-08

A2LA Accredited

IC recognized #
3462B-1

***CETECOM* Inc.**
411 Dixon Landing Road ◆ Milpitas, CA 95035 ◆ U.S.A.
Phone: + 1 (408) 586 6200 ◆ Fax: + 1 (408) 586 6299 ◆ E-mail: info@cetecom.com ◆ http://www.cetecom.com
CETECOM Inc. is a Delaware Corporation with Corporation number: 2905571

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1 Assessment

The following device was evaluated against the applicable DFS criteria specified in FCC rules Parts 15.407 of Title 47 of the Code of Federal Regulations and the relevant ISED Canada standard RSS-247.

No deviations were ascertained.

Company	Description	Model #
Virscient Limited	WIFI/BT Module	V0009F

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2019-02-08	Compliance	Cindy Li (EMC Lab Manager)	Cindy Li Digitally signed by Cindy Li DN: cn=Cindy Li, o=Cetecom Inc., ou=EMC, email=cindy.li@cetecom.com, c=US Date: 2019.02.08 16:40:33 -08'00'

Responsible for the Report:

Date	Section	Name	Signature
2019-02-08	Compliance	Kevin Wang (Senior EMC Engineer)	kevin.wang@cetecom.com Digitally signed by: kevin.wang@cetecom.com DN: CN = kevin.wang@cetecom.com Date: 2019.02.08 15:47:20 -08'00'

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Street Address:	411 Dixon Landing Road
City/Zip Code	Milpitas, CA 95035
Country	USA
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Compliance Manager:	Cindy Li
Responsible Project Leader:	Kris Lazarov

2.2 Identification of the Client

Applicant's Name:	Virscient Limited
Street Address:	Ruakura Research Centre, 10 Bisley Road
City/Zip Code	Hamilton/3214
Country	New Zealand

2.3 Identification of the Manufacturer

Manufacturer's Name:	Trimble Jena GmbH
Manufacturers Address:	Carl-Zeiss-Promenade 10
City/Zip Code	Jena/07745
Country	Germany

3 Equipment Under Test (EUT)

3.1 EUT Specifications

<table>
<tr><td>Model No:</td><td>Trimble Comm board Tornado</td></tr>
<tr><td>HW Version :</td><td>F</td></tr>
<tr><td>SW Version :</td><td>v4.5.10.016.DFS</td></tr>
<tr><td>FCC-ID :</td><td>YK5-73350047</td></tr>
<tr><td>IC-ID:</td><td>--------</td></tr>
<tr><td>FWIN:</td><td>--------</td></tr>
<tr><td>HVIN:</td><td>--------</td></tr>
<tr><td>PMN:</td><td>--------</td></tr>
<tr><td>Product Description:</td><td>WIFI/BT Module</td></tr>
<tr><td>Frequency Range / number of channels:</td><td>
<table>
<tr><td>Frequency Range (MHz)</td><td>Channel Number</td></tr>
<tr><td>5250-5350</td><td>52-64[4]</td></tr>
<tr><td>5470-5725</td><td>100-144 [12]</td></tr>
</table>
</td></tr>
<tr><td>Modes of Operation / Channel Bandwidths:</td><td>
<table>
<tr><td>IEEE Std. 802.11(xxxx)</td><td>Data Rate / MCS</td></tr>
<tr><td>a</td><td>6-54 Mbps</td></tr>
<tr><td>n: HT20 & HT40</td><td>MCS 0-7; MCS 8-15</td></tr>
</table>
</td></tr>
<tr><td>Transmit Chains(N_{TX})</td><td>1 & 2</td></tr>
<tr><td>Type(s) of Modulation:</td><td>BPSK, QPSK, 16-QAM, 64QAM</td></tr>
<tr><td>Antenna Information as declared:</td><td>Pulse W3334B0150, 2.4G 4dBi 5G 5.5dBi</td></tr>
<tr><td>Max. Output Power:</td><td>17.26dBm</td></tr>
<tr><td>Power Supply/ Rated Operating Voltage Range:</td><td>Vmin: 4.75 VDC/ Vnom: 5 VDC / Vmax: 5.5 VDC</td></tr>
<tr><td>Operating Temperature Range</td><td>-20 ºC to 70 ºC</td></tr>
<tr><td>Other Radios included in the device:</td><td>Bluetooth BR / EDR
WIFI 802.11b/g/n/ac</td></tr>
<tr><td>Sample Revision</td><td>Prototype Unit; ■Production Unit; ☐Pre-Production</td></tr>
</table>

3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Notes/Comments
1	311	F	V4.5.10.016.DFS	Radiated Emissions
2	351	F	V4.5.10.016.DFS	Conducted RF

3.3 Accessory Equipment (AE) details

AE #	Type	Manufacturer	Model	Serial Number
1	Laptop	Dell	Latitude 3440	CB1P2Z1
2	Laptop	Dell	Latitude E6230	C2RNTY1
3	Wi-Fi module	Compex	WLE600V5-27	104336146

3.4 Test Sample Configuration

EUT Set-up #	Combination of AE used for test set up	Comments
1	EUT#2 + AE#1 + AE#2	The radio of the EUT was configured to a fixed channel transmission with highest possible duty cycle using software “QRCT” provided by client that is not available to the end user. The measurement equipment was connected to the 50 ohm RF port of the EUT.
2	EUT#1 + AE#1	The radio of the EUT was configured to a fixed channel with highest possible duty cycle using software “QRCT” provided by client that is not available to the end user. The external antenna “Pulse W3334B0150” provided by client was used for radiated testing.

3.5 Testing Notes

4 Subject of Investigation

The objective of the measurements done by CETECOM Inc. was to assess the DFS performance of the EUT according to the relevant requirements specified in FCC rules Part 15.407 of Title 47 of the Code of Federal Regulations and Radio Standard Specification RSS-247 of ISED Canada.

This test report is to support a request for new equipment authorization under the FCC ID: YK5-73350047 IC ID: ----------

5 Measurement Results Summary

The tests in this section are run sequentially and the EUT must pass all tests successfully. If the EUT fails any one of the tests it will count as a failure of compliance. To show compliance, all tests must be performed with waveforms randomly generated as specified with test results meeting the required percentage of successful detection criteria. All test results must be reported to the FCC. One frequency will be chosen from the operating Channels of the UUT within the 5250-5350 MHz or 5470-5725 MHz bands.

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	NA	NP	Result
§15.407(h) RSS-247 6.3	U-NII Detection Bandwidth	Nominal	802.11n / All Supported OBW	■	☐	☐	Complies
§15.407(h) RSS-247 6.3	Performance Requirements Check	Nominal	802.11n / HT20	■	☐	☐	Complies
§15.407(h) RSS-247 6.3	In Service Monitoring	Nominal	802.11n / HT20	■	☐	☐	Complies
§15.407(h) RSS-247 6.3	Statistical Performance Check	Nominal	802.11n / All Supported OBW	■	☐	☐	Complies

Note: NA= Not Applicable; NP= Not Performed.

6 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus, with 95% confidence interval (in dB delta to result), based on a coverage factor k=1.

Radiated measurement

1 GHz to 40 GHz ±2.3 dB (Horn Antenna)

Conducted measurement

RF conducted measurement ±0.5 dB

According to TR 102 273 a multiplicative propagation of error is assumed for RF measurement systems. For this reason the RMS method is applied to dB values and not to linear values as appropriate for additive propagation of error. Also used: http://physics.nist.gov/cuu/Uncertainty/typeb.html. The above calculated uncertainties apply to direct application of the Substitution method. The Substitution method is always used when the EUT comes closer than 3 dB to the limit.

6.1 Environmental Conditions during Testing:

The following environmental conditions were maintained during the course of testing:

- Ambient Temperature: 20-25° C
- Relative humidity: 40-60%

6.2 Dates of Testing:

12/03/2018 - 12/14/2018

7 DFS Requirements in the 5250-5350 MHz and 5470-5725 MHz Bands

The test methods used for this DFS functionality evaluation are based on FCC 905462 D02 UNII DFS Compliance Procedures New Rules v02

A U-NII network will employ a DFS function to detect signals from radar systems and to avoid co-channel operation with these systems. This applies to the 5250-5350 MHz and/or 5470-5725 MHz bands

7.1 Applicability of DFS Requirements Prior to Use of a Channel

Requirement	Operational Mode		
	Master	**Client Without Radar Detection**	**Client With Radar Detection**
Non-Occupancy Period	Yes	Not required	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required
U-NII Detection Bandwidth	Yes	Not required	Yes

7.2 Applicability of DFS requirements during normal operation

Requirement	Operational Mode	
	Master Device or Client With Radar Detection	**Client Without Radar Detection**
DFS Detection Threshold	Yes	Not required
Channel Closing Transmission Time	Yes	Yes
Channel Move Time	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required

Additional requirements for devices with multiple bandwidth modes	**Master Device or Client With Radar Detection**	**Client Without Radar Detection**
U-NII Detection Bandwidth and Statistical Performance Check	All BW modes must be tested	Not required
Channel Move Time and Channel Closing Transmission Time	Test using widest BW mode available	Test using the widest BW mode available for the link
All other tests	Any single BW mode	Not required
Note: Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.		

7.3 DFS Detection Thresholds for Master Devices and Client Devices with Radar Detection

Maximum Transmit Power	**Value (See Notes 1, 2, and 3)**
EIRP ≥ 200 milliwatt	-64 dBm
EIRP < 200 milliwatt and power spectral density < 10 dBm/MHz	-62 dBm
EIRP < 200 milliwatt that do not meet the power spectral density requirement	-64 dBm

Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna.

Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.

Note3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.

7.4 DFS Response Requirement Values

Parameter	**Value**
Non-occupancy period	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds - See Note 1.
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. - See Notes 1 and 2.
U-NII Detection Bandwidth	Minimum 100% of the U-NII 99% transmission power bandwidth. See Note 3.

Note 1: *Channel Move Time* and the *Channel Closing Transmission Time* should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst.

Note 2: The *Channel Closing Transmission Time* is comprised of 200 milliseconds starting at the beginning of the *Channel Move Time* plus any additional intermittent control signals required to facilitate a *Channel* move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.

Note 3: During the *U-NII Detection Bandwidth* detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.

7.5 Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (µsec)	PRI (µsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Number of Trials
0	1	1428	18	See Note 1	See Note 1
1	1	Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a	$\text{Roundup}\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot 10^6}{\text{PRI}_{\mu\text{sec}}}\right)\right\}$	60%	30
		Test B: 15 unique PRI values randomly selected within the range of 518-3066 µsec, with a minimum increment of 1 µsec, excluding PRI values selected in Test A			
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120

Note 1: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.

7.6 Long Pulse Radar Test Waveform

Radar Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Number of Pulses per *Burst*	Number of *Bursts*	Minimum Percentage of Successful Detection	Minimum Number of Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

7.7 Frequency Hopping Radar Test Waveform

Radar Type	Pulse Width (µsec)	PRI (µsec)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (msec)	Minimum Percentage of Successful Detection	Minimum Number of Trials
6	1	333	9	0.333	300	70%	30

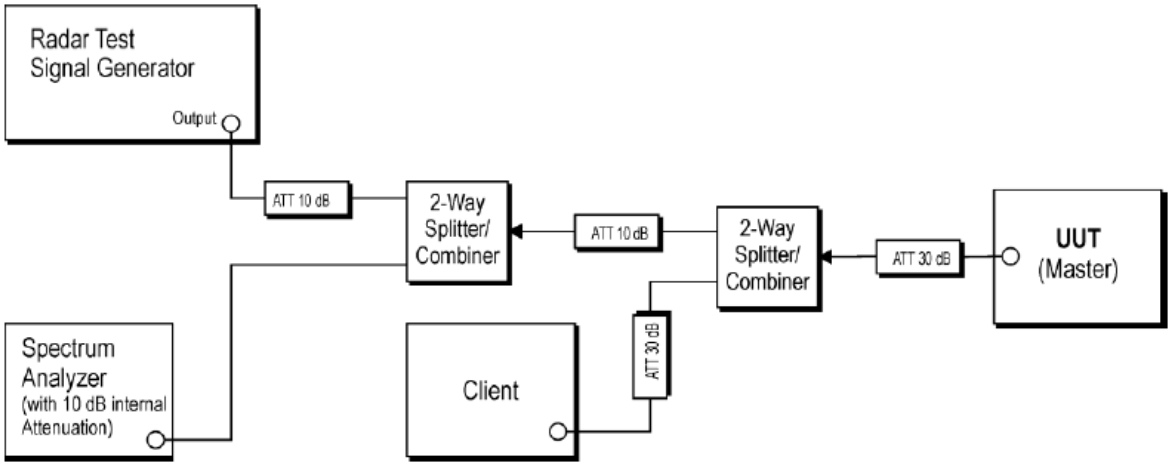
8 Measurement Procedures

8.1 Radar Waveform Generation

DFS waveform generator system NI PXI-1042 is used for all testing. The PXI system is a standard RF test system from National Instruments, Inc. It includes an embedded controller (with Windows XP), an RF signal generator comprised of an arbitrary waveform generator and two up / down-conversion modules. The parameters of the generated by the system waveforms are set and controlled through the integrated testing application iDFS by Redwolf Technology, LLC. The application is modeled around the FCC (06-96) guidelines for performing repetitive testing of different pre-defined radar signals along with scoring each trial in a test. The results of a test composed of a series of trials, typically 30 or more, can be save to a text file. That file is compatible with other applications, such as Microsoft's Word or Excel. The chirp has been verified by detuning the center frequency of the spectrum analyzer from the center frequency of the radar pulse and observing the slope on the burst.

8.2 DFS Test Setup Block Diagram

The section below contains block diagram example of conducted setup, where the EUT is master and the radar test waveforms are injected into the master.



For other test configurations for client testing and radiated measurements please refer to FCC 905462 D02 UNII DFS Compliance Procedures New Rules v02.

8.3 Setting the Test Signal Level

The test setup was calibrated at the EUT antenna port to the appropriate DFS threshold level are specified in Table 3 of the FCC 905462, with a spectrum analyzer according to Section 7.5 of the same KDB publication. The spectrum analyzer was centered on the channel under test and configured to zero span mode with a peak detector at a resolution and video bandwidth of at least 3MHz.

Signal level verification plots are included in section 9.1 of this report.

8.4 Channel Loading / Data Streaming

System testing will be performed with channel-loading using means appropriate to the data types that are used by the unlicensed device. The following requirements apply:

- The data file must be of a type that is typical for the device (i.e., MPEG-2, MPEG-4, WAV, MP3, MP4, AVI, etc.) and must generally be transmitting in a streaming mode.
- Software to ping the client is permitted to simulate data transfer but must have random ping intervals.
- Timing plots are required with calculations demonstrating a minimum channel loading of approximately 17% or greater. For example, channel loading can be estimated by setting the spectrum analyzer for zero span and approximate the Time On/ (Time On + Off Time). This can be done with any appropriate channel BW and modulation type.
- Unicast or Multicast protocols are preferable but other protocols may be used. The appropriate protocol used must be described in the test procedures.

Signal level verification plots are included in section 9.2 of this report.

9 Test Result Data

9.1 Test Signal Level Calibration

9.1.1 Measurement according to FCC 905462 D02 UNII DFS Compliance Procedures New Rules v02.

Spectrum Analyzer Settings

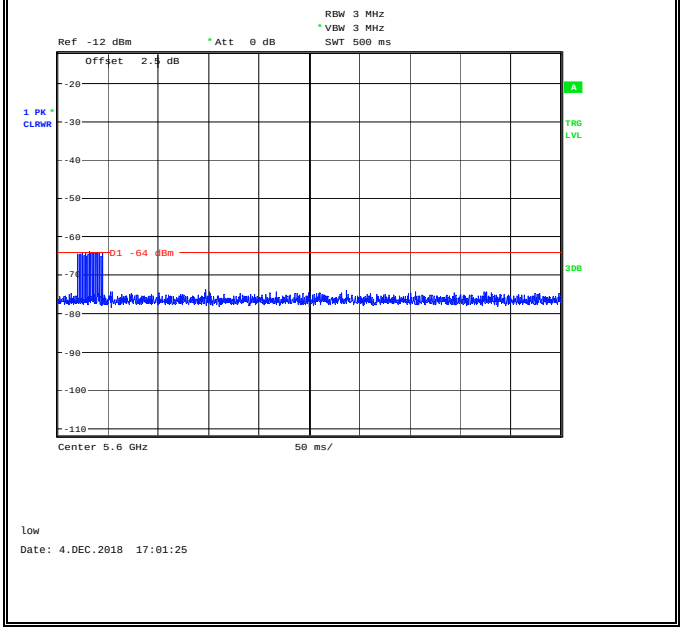
- Center Frequency = Channel Frequency
- Span = Zero Span
- RBW ≥ 3 MHz
- VBW ≥ 3 MHz
- Detector = Peak

9.1.2 Target Signal Level:

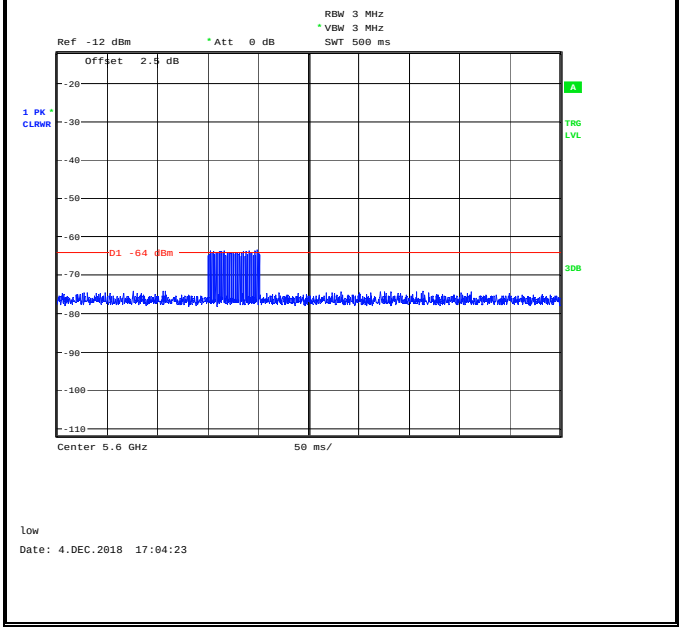
- For all DFS test pulses the target level is -64 dBm.

9.1.3 Measurement result:

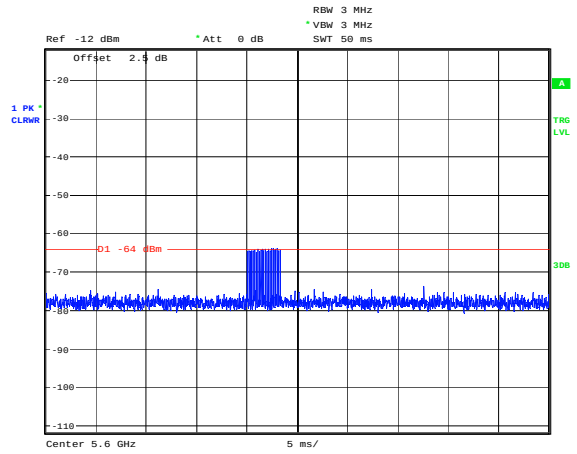
Radar Pulse Type 0 Level



Radar Pulse Type 1 Level



Radar Pulse Type 2 Level



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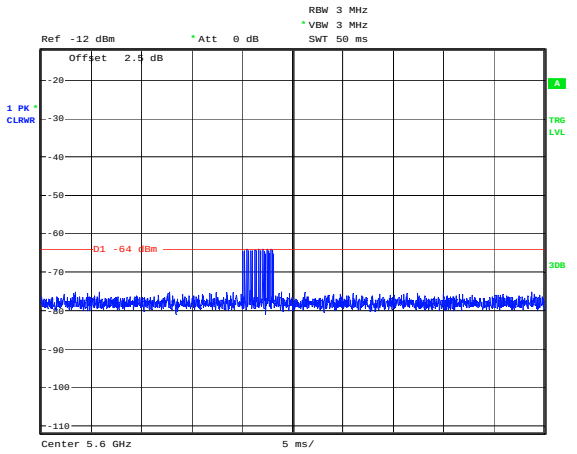
Radar Pulse Type 3 Level



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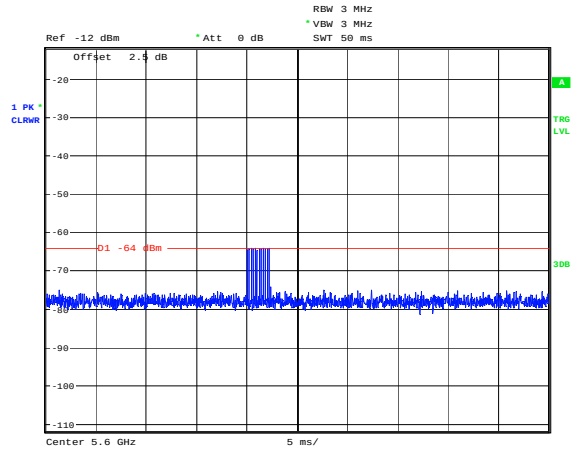
Radar Pulse Type 4 Level



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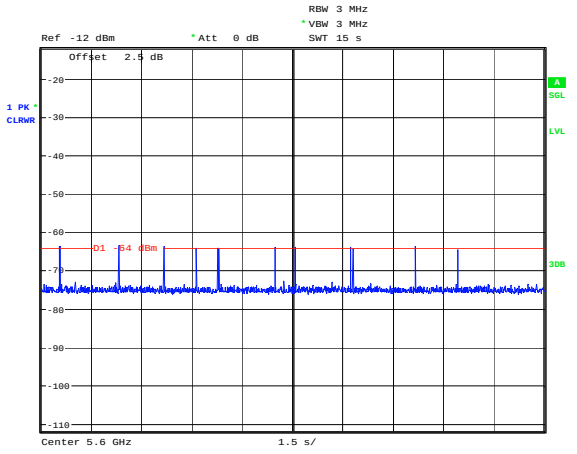
Radar Pulse Type 5 Level



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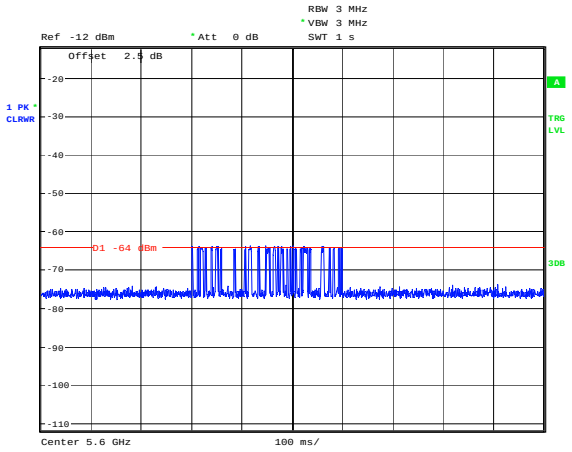
Radar Pulse Type 6 Level



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9.2 Channel Loading

9.2.1 Measurement according to FCC 905462 D02 UNII DFS Compliance Procedures New Rules v02

Spectrum Analyzer Settings

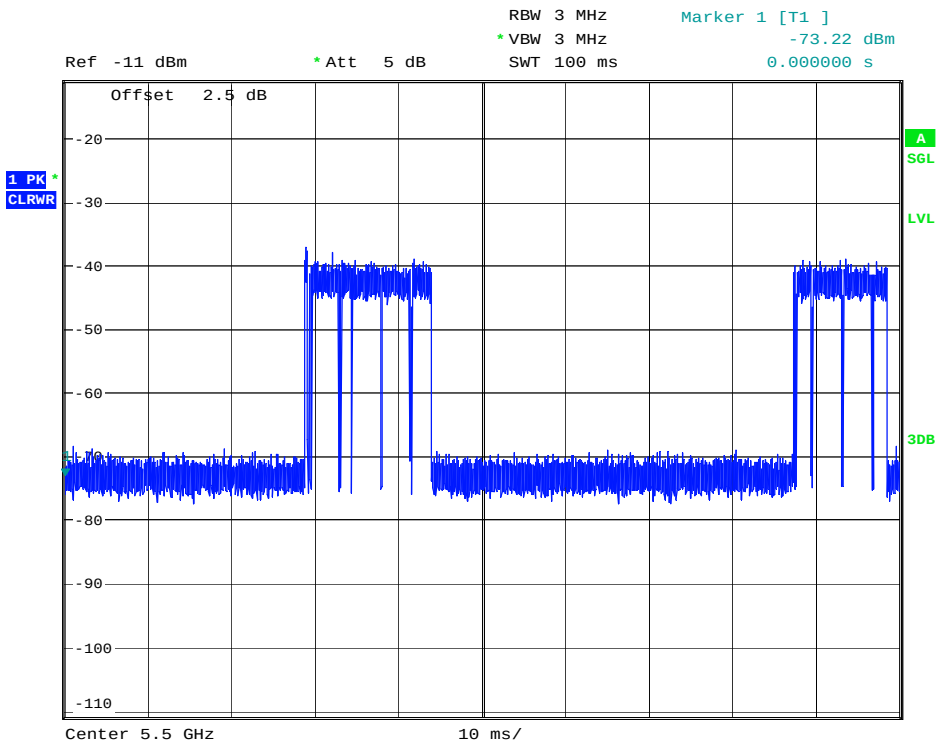
- Center Frequency = Channel Frequency
- Span = Zero Span
- RBW ≥ 1 MHz
- VBW ≥ 3 MHz
- Detector = Peak

9.2.2 Target Channel Loading Level:

- The channel loading shall be 17% or greater for each mode of operation

9.2.3 Measurement result:

Channel Loading



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Date: 3.DEC.2018 16:55:58

9.3 99% Emission Bandwidth

9.3.1 Measurement according to FCC 789033 D02 General UNII Test Procedures New Rules v02r01

Spectrum Analyzer Settings

- Set center frequency to the nominal EUT channel center frequency
- Set span = 1.5 times to 5.0 times the OBW
- Set RBW = 1% to 5% of the OBW
- Set VBW ≥ 3 x RBW
- Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used
- Use the 99% power bandwidth function of the instrument (if available)
- If the instrument does not have a 99% power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies

9.3.2 Test conditions and setup:

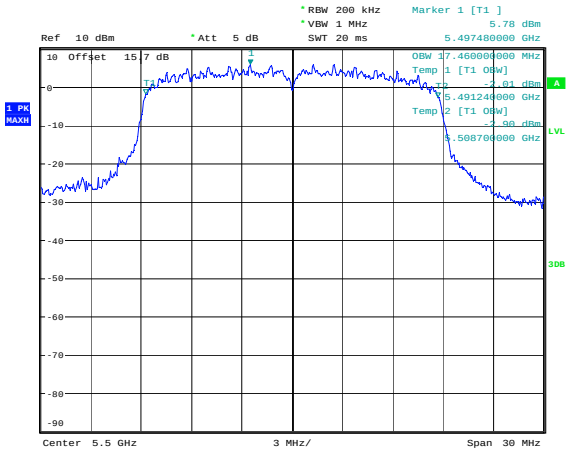
Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
22° C	1	802.11n	5VDC

9.3.3 Measurement result:

Plot #	Operating Mode	Frequency (MHz)	99% Emissions Bandwidth (MHz)
1	HT20	5500	17.46
2	HT40	5510	36.12

9.3.4 Measurement Plots:

Plot # 1		
HT 20		99%



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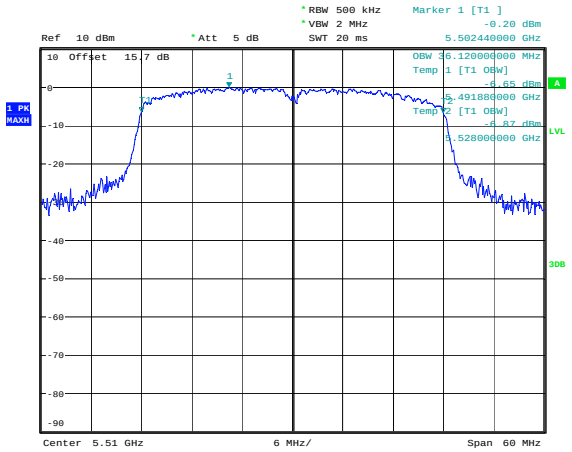
Plot # 2		
HT 40		99%



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9.4 U-NII Detection Bandwidth

9.4.1 Measurement according to FCC 905462 D02 UNII DFS Compliance Procedures New Rules v02

Waveform Generator Settings

- Radar pulse used = Type 0
- Center frequency of the radar pulse = EUT operating channel
- Radar Pulse amplitude = DFS detection threshold level
- Radar bursts for each frequency step = 10

EUT Settings

- The EUT was set up as a standalone device with no traffic.
- The EUT was set to all supported modes

U-NII Detection Bandwidth is calculated as follows

- Starting at the center frequency of the UUT operating Channel, increase the radar frequency in 5 MHz steps, repeating the above test sequence, until the detection rate falls below the U-NII Detection Bandwidth criterion. Repeat this measurement in 1MHz steps at frequencies 5 MHz below where the detection rate begins to fall. Record the highest frequency (denote as FH) at which detection is greater than or equal to the U-NII Detection Bandwidth criterion.
- Starting at the center frequency of the UUT operating Channel, decrease the radar frequency in 5 MHz steps, repeating the above test sequence, until the detection rate falls below the U-NII Detection Bandwidth criterion. Repeat this measurement in 1MHz steps at frequencies 5 MHz above where the detection rate begins to fall. Record the lowest frequency (denote as FL) at which detection is greater than or equal to the U-NII Detection Bandwidth criterion.
- U-NII Detection Bandwidth = FH – FL

9.4.2 Requirements FCC§15.407; RSS-247:

- Radar type 0must be detected with minimum 100% of the U-NII 99% transmission power bandwidth.
- For each frequency step the minimum percentage of detection is 90 percent.

9.4.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Antenna Gain
22° C	1	802.11n	5 VDC	5.5 dBi

9.4.4 Measurement result:

Mode	Channel	F_H (MHz)	F_L (MHz)	Detection Bandwidth (MHz)	Limit (99% OBW) (MHz)	Result
HT20	120	5588	5555	33	17.46	Pass
HT40	118	5650	5570	80	36.12	Pass

9.5 Performance Requirements Check

9.5.1 Measurement according to FCC 905462 D02 UNII DFS Compliance Procedures New Rules v02

Waveform Generator Settings

- Radar pulse used = Type 0
- Center frequency of the radar pulse = EUT operating channel
- Radar Pulse amplitude = DFS detection threshold level

Spectrum Analyzer Settings

- Center Frequency = Channel Frequency
- Span = Zero Span
- Sweep Time ≥ 150 s
- RBW ≥ 3 MHz
- VBW ≥ 3 MHz
- Detector = Peak

EUT Settings

- The EUT was set up as a standalone device with no traffic.
- The EUT was set to HT20 mode

9.5.2 Requirements FCC§15.407; RSS-247:

Initial Channel Availability Check Time

- The UUT should not transmit any beacon or data transmissions until at least 1 minute after the completion of the power-on cycle.

Radar Burst at the Beginning of the Channel Availability Check Time

- The EUT should avoid operation on a test channel when a radar burst occurs at the beginning of the Channel Availability Check Time.

Radar Burst at the End of the Channel Availability Check Time

- The EUT should avoid operation on a test channel when a radar burst occurs at the end of the Channel Availability Check Time.

9.5.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Antenna Gain
22° C	1	HT20	5 VDC	5.5 dBi

9.5.4 Measurement result:

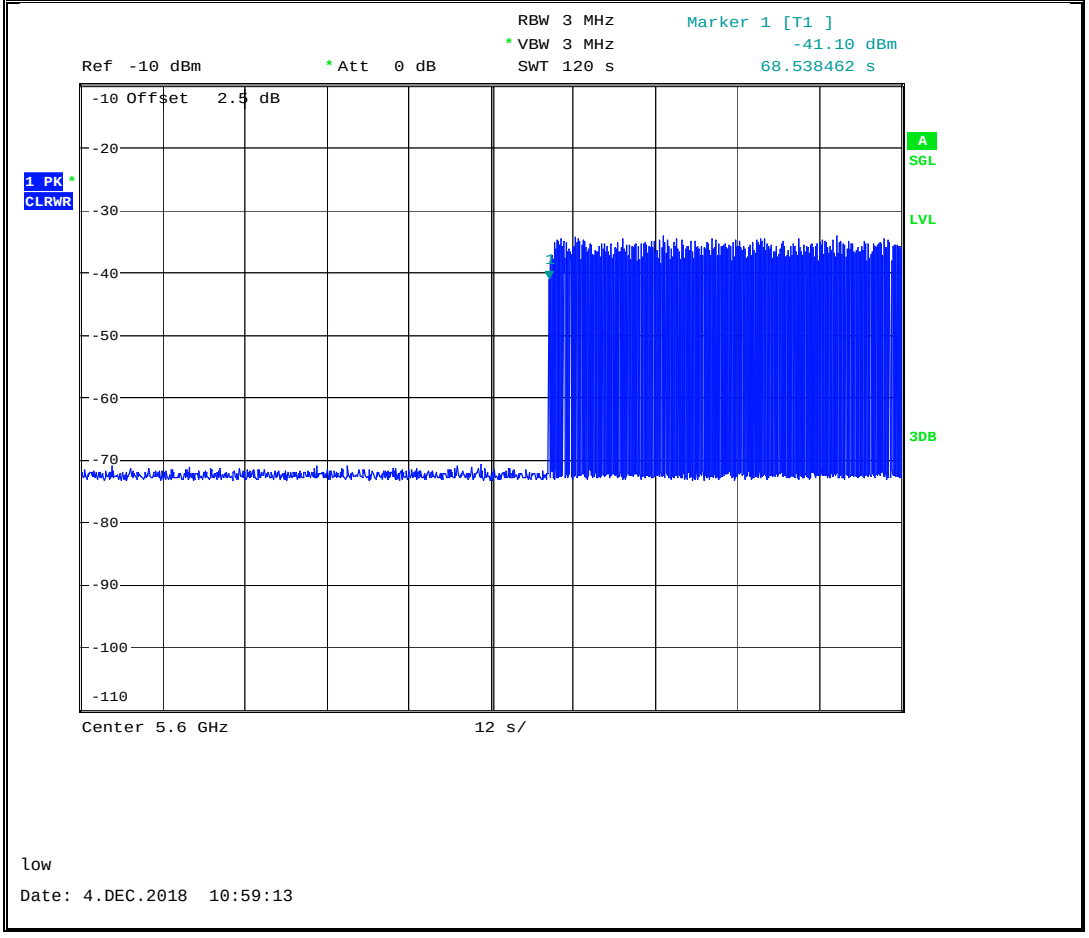
Plot #	Frequency (MHz)	Radar Burst Timing (s)	Sweep Time (s)	EUT Reaction	Limit	Result
1	5600	N/A	160	No Transmission for the CAC period Tpower_up * + 60 s	No Transmission for the CAC period Tpower_up * + 60 s	Pass
2	5600	Tpower_up * + 6 s	210	Detect radar and avoid channel	Detect radar and avoid channel	Pass
3	5600	Tpower_up * + 54 s	270	Detect radar and avoid channel	Detect radar and avoid channel	Pass

* The power up cycle (Tpower_up) was determined by subtracting 60 seconds from the initial transmissions.

9.5.5 Measurement Plots:

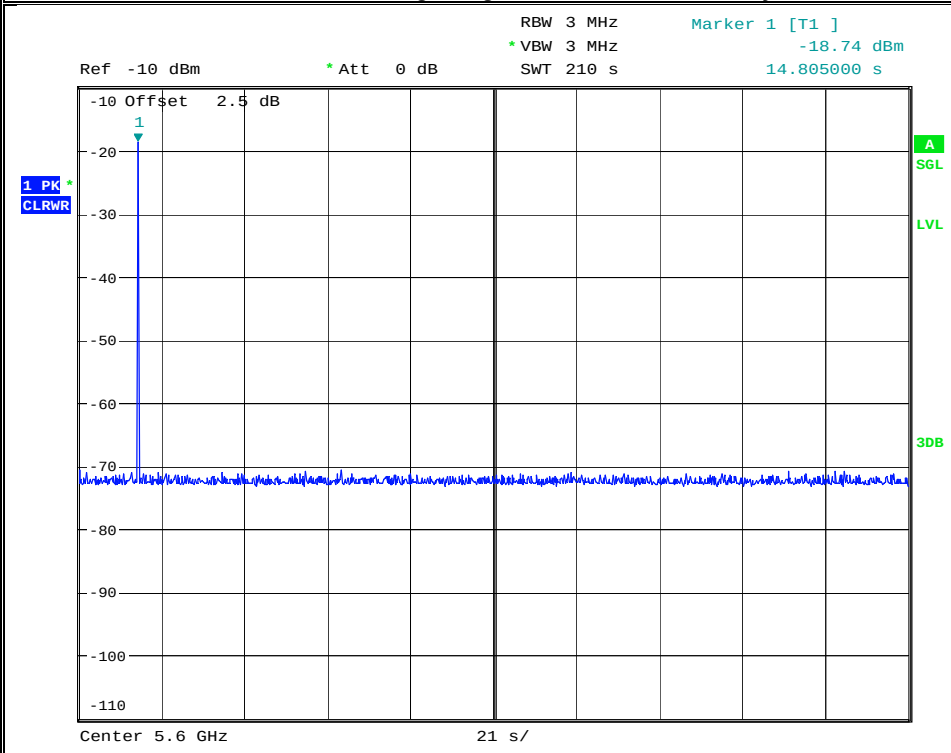
Plot #1

Initial Channel Availability Check Time



Plot #2

Radar Burst at the Beginning of the Channel Availability Check Time

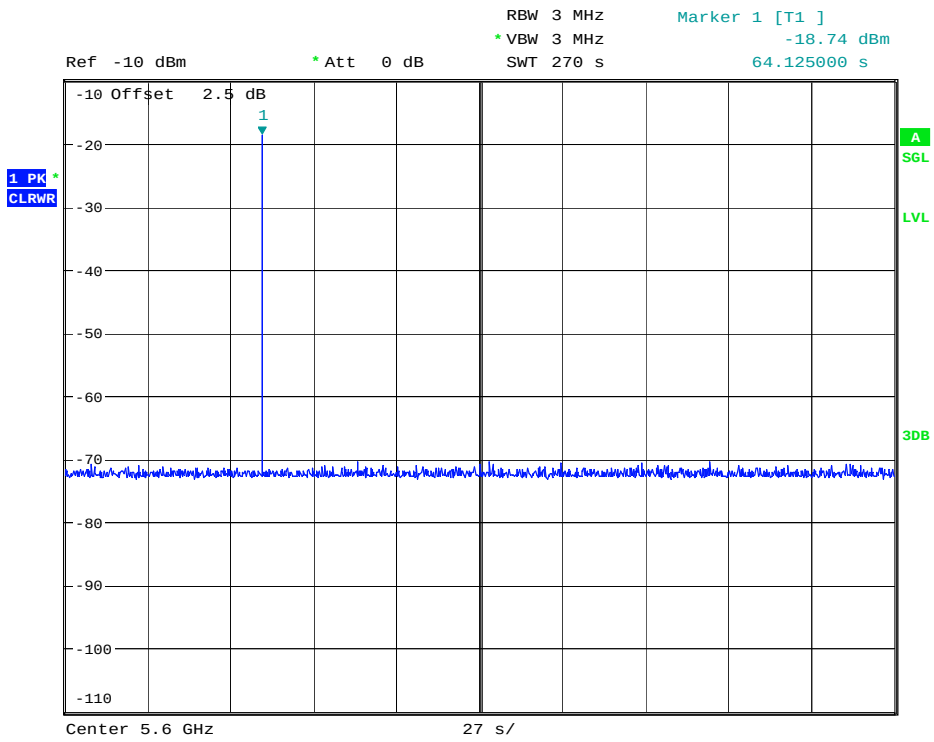


low

Date: 4.DEC.2018 11:31:23

Plot #3

Radar Burst at the End of the Channel Availability Check Time



low

Date: 4.DEC.2018 11:41:30

9.6 In Service Monitoring

9.6.1 Measurement according to FCC 905462 D02 UNII DFS Compliance Procedures New Rules v02

Waveform Generator Settings

- Radar pulse used = Type 0
- Center frequency of the radar pulse = EUT operating channel
- Radar Pulse amplitude = DFS detection threshold level

Spectrum Analyzer Settings

- Center Frequency = Channel Frequency
- Span = Zero Span
- Sweep Time ≥ 11 s
- RBW ≥ 1 MHz
- VBW ≥ 3 MHz
- Detector = Peak

EUT Settings

- The EUT was streaming the channel loading test file to the Client Device
- The EUT was set to HT40 mode
- The EUT was set to a channel where control signals are detected

9.6.2 Requirements FCC§15.407; RSS-247:

Channel Closing Transmission Time

- 10 seconds

Channel Move Time

- 200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period

Non-occupancy period

- Minimum 30 minutes

9.6.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
22° C	1	802.11n	5VDC

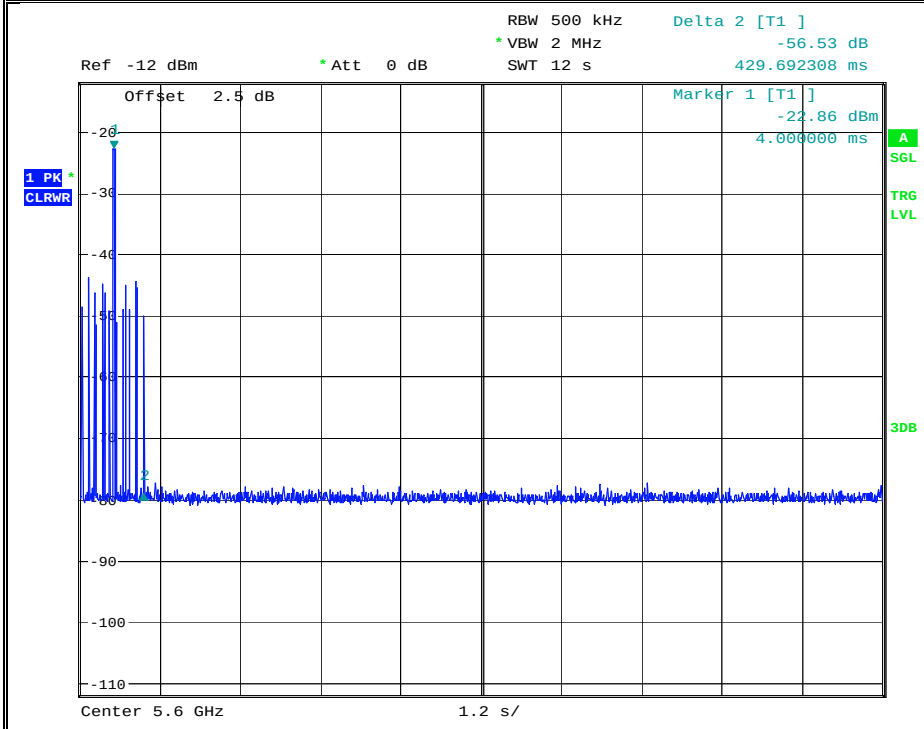
9.6.4 Measurement result:

Plot #	Frequency (MHz)	Channel Closing Transmission Time (s)	Channel Move Time (s)	Non-occupancy period (s)	Limit (s)	Result
1	5600	N/A	429.69	N/A	<10	Pass
1	5600	429.69	N/A	N/A	See 9.6.2	Pass
2	5600	N/A	N/A	> 1800	> 1800	Pass

9.6.5 Measurement Plots:

Plot #1

Channel Closing Transmission Time and Channel Move Time

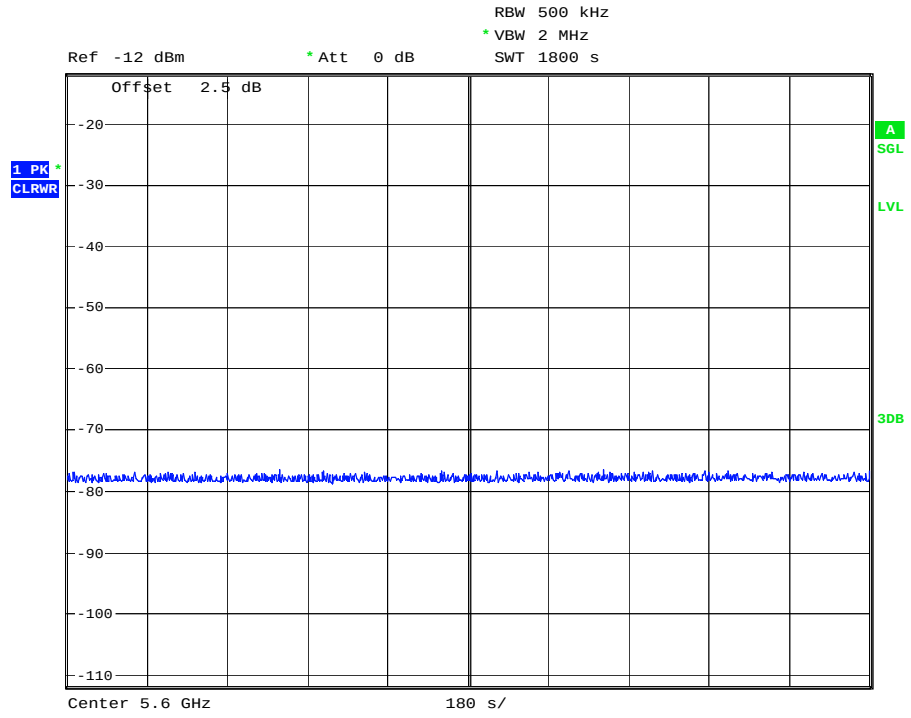


low

Date: 4.DEC.2018 13:24:32

Plot #2

Non-occupancy period



low

Date: 4.DEC.2018 14:07:39

9.7 Statistical Performance Check

9.7.1 Measurement according to FCC 905462 D02 UNII DFS Compliance Procedures New Rules v02

Waveform Generator Settings

- Radar pulse used = Type 1 - 6
- Center frequency of the radar pulse = EUT operating channel (one for each supported U-NII sub band)
- Radar Pulse amplitude = DFS detection threshold level

Spectrum Analyzer Settings

- Center Frequency = Channel Frequency
- Span = Zero Span
- Sweep Time ≥ 10 s
- RBW ≥ 3 MHz
- VBW ≥ 3 MHz
- Detector = Peak

EUT Settings

- The EUT was streaming the channel loading test file to the Client Device
- The EUT was set to each of the supported bandwidth modes for all radar pulses

9.7.2 Requirements FCC§15.407; RSS-247:

The EUT shall meet the minimum percentage of successful detection requirements found in sections; 7.5, 7.6, and 7.7 of this report.

9.7.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
22° C	1	802.11n	5 VDC

9.7.4 Measurement result summary:

9.7.4.1 Short Pulse Radar Test Data

EUT Mode of Operation	Pulse Type	Pulse Parameters	Number of Trails	Successful Detection Percentage (%)	Limit (%)	Result
HT20	1	See Section 7.5	30	100	60	Pass
HT20	2	See Section 7.5	30	100	60	Pass
HT20	3	See Section 7.5	30	96.7	60	Pass
HT20	4	See Section 7.5	30	86.7	60	Pass
HT20	Aggregate		120	95.85	80	Pass

EUT Mode of Operation	Pulse Type	Pulse Parameters	Number of Trails	Successful Detection Percentage (%)	Limit (%)	Result
HT40	1	See Section 7.5	30	100	60	Pass
HT40	2	See Section 7.5	30	100	60	Pass
HT40	3	See Section 7.5	30	83.3	60	Pass
HT40	4	See Section 7.5	30	93.3	60	Pass
HT40	Aggregate		120	94.15	80	Pass

9.7.4.2 Long Pulse Radar Test Data

EUT Mode of Operation	Pulse Type	Pulse Parameters	Number of Trails	Successful Detection Percentage (%)	Limit (%)	Result
HT20	5	See Section 7.6	30	100	80	Pass

EUT Mode of Operation	Pulse Type	Pulse Parameters	Number of Trails	Successful Detection Percentage (%)	Limit (%)	Result
HT40	5	See Section 7.6	30	90	80	Pass

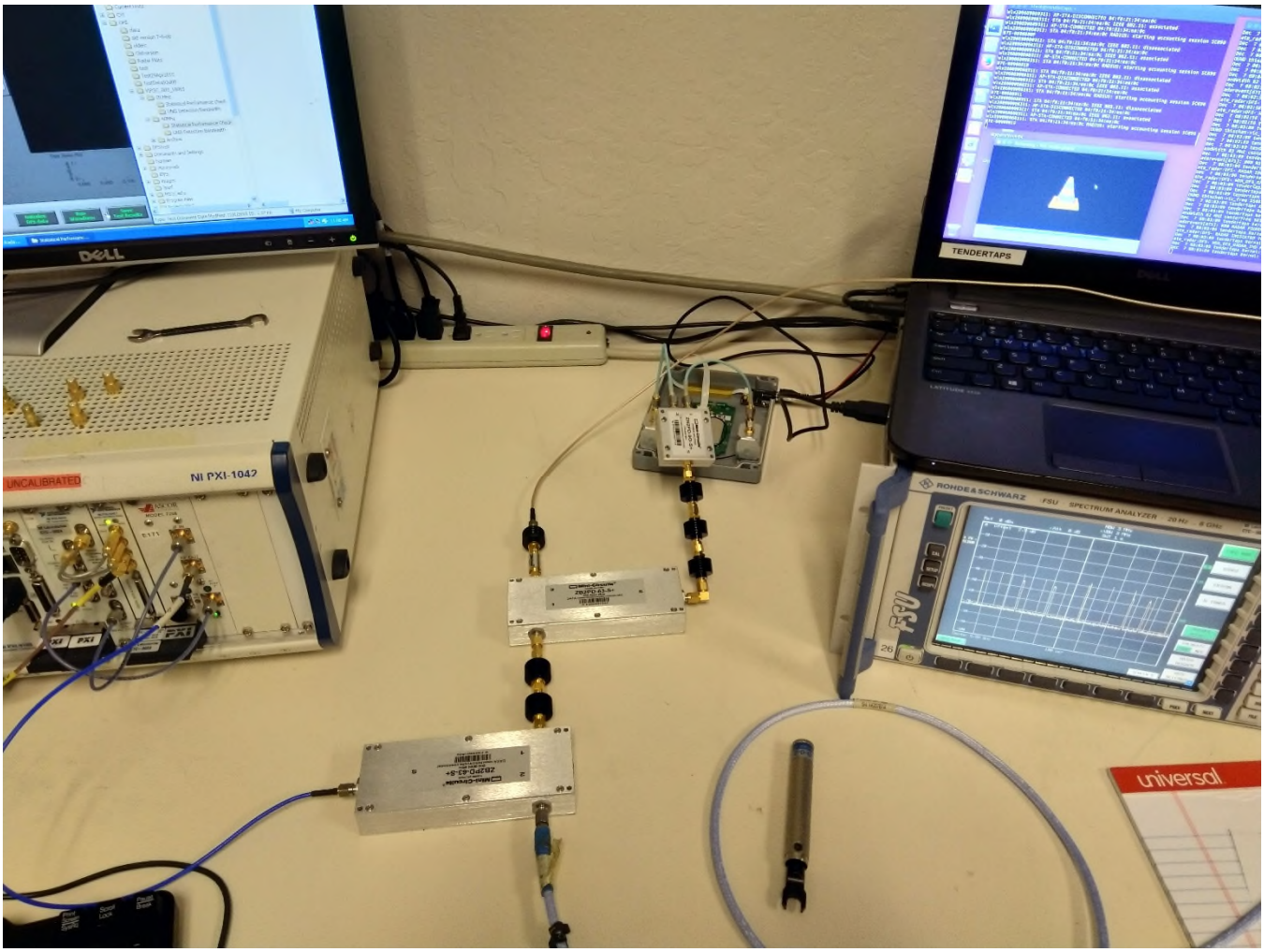
9.7.4.3 Frequency Hopping Radar Test Data

EUT Mode of Operation	Pulse Type	Pulse Parameters	Number of Trails	Successful Detection Percentage (%)	Limit (%)	Result
HT20	6	See Section 7.7	30	100	70	Pass

EUT Mode of Operation	Pulse Type	Pulse Parameters	Number of Trails	Successful Detection Percentage (%)	Limit (%)	Result
HT40	6	See Section 7.7	30	96.7	70	Pass

10 Test Setup Photo

DFS Setup



11 Test Equipment And Ancillaries Used For Testing

Item Name	Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
Spectrum Analyzer	Spectrum Analyzer	Rohde & Schwarz	FSU26	200065	2 years	7/3/2017
DFS Generator	DFS Signal Generator	NI	PXI-5421	E153	3 years	1/27/2016

Note:

1. Equipment used meets the measurement uncertainty requirements as required per applicable standards for 95% confidence levels.

Calibration due dates, unless defined specifically, falls on the last day of the month. Items indicated "N/A" for cal status either do not specifically require calibration or is internally characterized before use.

12 History

Date	Report Name	Changes to report	Report prepared by
2019-02-05	EMC_VIRSC_003_15.407_DFS_Master	Initial Version	Kevin Wang