**SPORTON International Inc.**
No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.
Ph: 886-3-327-3456 / FAX: 886-3-327-0973 / www.sporton.com.tw

# FCC Dynamic Frequency Selection Test Report

| | |
|---|---|
| Applicant's company | **Realtek Semiconductor Corp.** |
| Applicant Address | No. 2,Innovation Road II, Hsinchu Science Park, Hsinchu 300,Taiwan |
| FCC ID | **TX2RTL8812AENF** |
| Manufacturer's company | **Realtek Semiconductor Corp.** |
| Manufacturer Address | No. 2,Innovation Road II, Hsinchu Science Park, Hsinchu 300,Taiwan |

| | |
|---|---|
| Product Name | 802.11a/b/g/n/ac RTL8812AENF Combo module |
| Brand Name | REALTEK |
| Model No. | RTL8812AENF |
| Test Rule Part(s) | 47 CFR FCC Part 15 Subpart E § 15.407 |
| Test Freq. Range | 5250~5350 / 5470~5725 MHz |
| Received Date | Mar. 07, 2014 |
| Final Test Date | Apr. 02, 2014 |
| Submission Type | Original Equipment |
| Operating Mode | Slave without radar detection function |

## Statement

The test result in this report refers exclusively to the presented test model / sample.
Without written approval of SPORTON International Inc., the test report shall not be reproduced except in full.
The measurements and test results shown in this test report were made in accordance with the procedures and found in compliance with the limit given in **FCC OET Order 06-96A (2006)**, **47 CFR FCC Part 15 Subpart E** and **KDB905462 D01 v01**.
The test equipment used to perform the test is calibrated and traceable to NML/ROC.

Testing Laboratory
1190

# Table of Contents

# History of This Test Report

| REPORT NO. | VERSION | DESCRIPTION | ISSUED DATE |
|---|---|---|---|
| FZ422118 | Rev. 01 | Initial issue of report | Jan. 13, 2015 |
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Certificate No.: CB10312071

# 1. CERTIFICATE OF COMPLIANCE

| | | |
|---|---|---|
| Product Name | : | 802.11a/b/g/n/ac RTL8812AENF Combo module |
| Brand Name | : | REALTEK |
| Model No. | : | RTL8812AENF |
| Applicant | : | Realtek Semiconductor Corp. |
| Test Rule Part(s) | : | 47 CFR FCC Part 15 Subpart E § 15.407 |

Sporton International as requested by the applicant to evaluate the EMC performance of the product sample received on Mar. 07, 2014 would like to declare that the tested sample has been evaluated and found to be in compliance with the tested rule parts. The data recorded as well as the test configuration specified is true and accurate for showing the sample's EMC nature.

Sam Chen

SPORTON INTERNATIONAL INC.

# 2. SUMMARY OF THE TEST RESULT

| Applied Standard: OET Order 06-96A (2006) | | | |
|---|---|---|---|
| **Part** | **Appendix** | **Description of Test** | **Result** |
| 5.2 | 7.8.3 | In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period | Complies |

Note: Since the product is client without radar detection function, only Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period are required to be performed.

# 3. GENERAL INFORMATION

## 3.1. Standard Requirement

47 CFR FCC Part 15 Subpart E § 15.407: U-NII devices operating in the 5250~5350 / 5470~5725 MHz shall employ a TPC mechanism. The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW.

U-NII devices operating in the 5250~5350 / 5470~5725 MHz shall employ a DFS radar detection mechanism to detect the presence of radar systems and to avoid co-channel operation with radar systems.

## 3.2. Product Specification Table

| Specification Items | Description |
|---|---|
| Product Type | WLAN (1TX/2TX, 2RX) |
| Radio Type | Intentional Transceiver |
| Power Type | From host system |
| Modulation | see the below table for 802.11n/ac<br>OFDM (BPSK / QPSK / 16QAM / 64QAM) for IEEE 802.11a |
| Data Rate (Mbps) | see the below table for 802.11n/ac<br>OFDM (6/9/12/18/24/36/48/54) for IEEE 802.11a |
| Test Frequency Range | 5250~5350 / 5470~5725 MHz |
| Channel Bandwidth | 20/40/80 MHz operating channel bandwidth |
| DFS Function | Slave without radar detection function |
| TPC Function | ☒ Yes / ☐ No |
| Weather Band (5600~5650MHz) | ☐ Yes / ☒ No |
| Max. Con. Power (DFS band) | 11ac:<br>Band 2: MCS0 (VHT 20): 20.83 dBm;MCS0 (VHT 40): 20.65 dBm ;<br>MCS0 (VHT 80): 18.82 dBm<br>Band 3: MCS0 (VHT 20): 20.77 dBm;MCS0 (VHT 40): 20.71 dBm ;<br>MCS0 (VHT 80): 16.73 dBm<br>11a:<br>For 1TX: Band 2: 17.78 dBm ; Band 3: 17.88 dBm<br>For 2TX: Band 2: 20.76 dBm ; Band 3: 20.67 dBm |
| Min. Con. Power (DFS band) | 11ac:<br>Band 2: MCS0 (VHT 20): 14.83 dBm;MCS0 (VHT 40): 14.65 dBm ;<br>MCS0 (VHT 80): 12.82 dBm<br>Band 3: MCS0 (VHT 20): 14.77 dBm;MCS0 (VHT 40): 14.71 dBm ;<br>MCS0 (VHT 80): 10.73 dBm |

| | |
|---|---|
| | 11a:<br>For 1TX: Band 2: 11.78 dBm ; Band 3: 11.88 dBm<br>For 2TX: Band 2: 14.76 dBm ; Band 3: 14.67 dBm |
| Max. EIRP Power (DFS band) | 11ac:<br>Band 2: MCS0 (VHT 20): 25.83 dBm;MCS0 (VHT 40): 25.65 dBm ;<br>MCS0 (VHT 80): 23.82 dBm<br>Band 3: MCS0 (VHT 20): 25.77 dBm;MCS0 (VHT 40): 25.71 dBm ;<br>MCS0 (VHT 80): 21.73 dBm<br>11a:<br>For 1TX: Band 2: 22.78 dBm ; Band 3: 22.88 dBm<br>For 2TX: Band 2: 25.76 dBm ; Band 3: 25.67 dBm |
| Min. EIRP Power (DFS band) | 11ac:<br>Band 2: MCS0 (VHT 20): 19.83 dBm;MCS0 (VHT 40): 19.65 dBm ;<br>MCS0 (VHT 80): 17.82 dBm<br>Band 3: MCS0 (VHT 20): 19.77 dBm;MCS0 (VHT 40): 19.71 dBm ;<br>MCS0 (VHT 80): 15.73 dBm<br>11a:<br>For 1TX: Band 2: 11.78 dBm ; Band 3: 11.88 dBm<br>For 2TX: Band 2: 14.76 dBm ; Band 3: 14.67 dBm |
| Operating Mode | Slave without radar detection function |
| Communication Mode | IP based system |
| Power-on cycle | NA (No Channel Availability Check Function) |
| Software Version (Slave) | 2012.12.325.2014 |
| Carrier Frequencies | Please refer to section 3.5 |
| Antenna | Please refer to section 3.6 |

**Antenna & Band width**

| Antenna | Single (TX) | | | Two (TX) | | |
|---|---|---|---|---|---|---|
| Band width Mode | 20 MHz | 40 MHz | 80 MHz | 20 MHz | 40 MHz | 80 MHz |
| IEEE 802.11a | V | X | X | V | X | X |
| IEEE 802.11n | V | V | X | V | V | X |
| IEEE 802.11ac | V | V | V | V | V | V |

IEEE 11n/ac Spec.

| Protocol | Number of Transmit Chains (NTX) | Data Rate / MCS |
|---|---|---|
| 802.11n (HT20) | 1 / 2 | MCS 0-7 / 0-15 |
| 802.11n (HT40) | 1 / 2 | MCS 0-7 / 0-15 |
| 802.11ac (VHT20) | 1 / 2 | MCS 0-8/Nss1 / MCS 0-8/Nss1-2 |
| 802.11ac (VHT40) | 1 / 2 | MCS 0-9/Nss1 / MCS 0-9/Nss1-2 |
| 802.11ac (VHT80) | 1 / 2 | MCS 0-9/Nss1 / MCS 0-9/Nss1-2 |
| Note 1: IEEE Std. 802.11n modulation consists of HT20 and HT40 (HT: High Throughput). Then EUT support HT20 and HT40.<br>Note 2: IEEE Std. 802.11ac modulation consists of VHT20, VHT40, VHT80 and VHT160 (VHT: Very High Throughput). Then EUT support VHT20, VHT40 and VHT80.<br>Note 3: Modulation modes consist of below configuration:<br>HT20/HT40: IEEE 802.11n, VHT20/VHT40/VHT80: IEEE 802.11ac | | |

## 3.3. Accessories

N/A

## 3.4. Table for DFS Band Carrier Frequencies

There are three bandwidth systems.

For 20MHz bandwidth systems, use Channel 52, 56, 60, 64, 100, 104, 108, 112, 116, 132, 136, 140.

For 40MHz bandwidth systems, use Channel 54, 62, 102, 110, 134.

For 80MHz bandwidth systems, use Channel 58, 106.

| Frequency Band | Channel No. | Frequency | Channel No. | Frequency |
|---|---|---|---|---|
| 5250~5350 MHz Band 2 | 52 | 5260 MHz | 60 | 5300 MHz |
| | 54 | 5270 MHz | 62 | 5310 MHz |
| | 56 | 5280 MHz | 64 | 5320 MHz |
| | 58 | 5290 MHz | - | - |
| 5470~5725 MHz Band 3 | 100 | 5500 MHz | 112 | 5560 MHz |
| | 102 | 5510 MHz | 116 | 5580 MHz |
| | 104 | 5520 MHz | 132 | 5660 MHz |
| | 106 | 5530 MHz | 134 | 5670 MHz |
| | 108 | 5540 MHz | 136 | 5680 MHz |
| | 110 | 5550 MHz | 140 | 5700 MHz |

## 3.5. Antenna Information

| Ant. | Brand | Model Name | Antenna Type | Connector | Gain (dBi) | |
|---|---|---|---|---|---|---|
| | | | | | 2.4GHz | 5GHz |
| 1 | LYNwave | ALA110-222050-300011 | PIFA Antenna | IPEX MHF4 | 3.5 | 5 |

**<For 2.4GHz Band>**

**For IEEE 802.11b mode (1TX, 1RX)**

Only Chain 1 can be used as transmitting/receiving antenna.

**For IEEE 802.11g mode (1TX/2TX, 2RX)**

The EUT can support both 1TX and 2TX functions.

For 1TX

Only Chain 1 can be used as transmitting antenna.

Chain 1 and Chain 2 could receive simultaneously.

For 2TX

Both Chain 1 and Chain 2 can be used as transmitting/receiving antenna.

Chain 1 and Chain 2 could both transmit/receive simultaneously.

**For IEEE 802.11n mode (1TX/2TX, 2RX)**

The EUT can support both 1TX and 2TX functions.

For 1TX

Only Chain 1 can be used as transmitting antenna.

Chain 1 and Chain 2 could receive simultaneously.

For 2TX

Both Chain 1 and Chain 2 can be used as transmitting/receiving antenna.

Chain 1 and Chain 2 could both transmit/receive simultaneously.

**<For 5GHz Band>**

**For IEEE 802.11a mode (1TX/2TX, 2RX):**

The EUT can support both 1TX and 2TX functions.

For 1TX

Only Chain 1 can be used as transmitting antenna.

Chain 1 and Chain 2 could receive simultaneously.

For 2TX

Both Chain 1 and Chain 2 can be used as transmitting/receiving antenna.

Chain 1 and Chain 2 could both transmit/receive simultaneously.

**For IEEE 802.11n/ac mode (1TX/2TX, 2RX):**

The EUT can support both 1TX and 2TX functions.

For 1TX

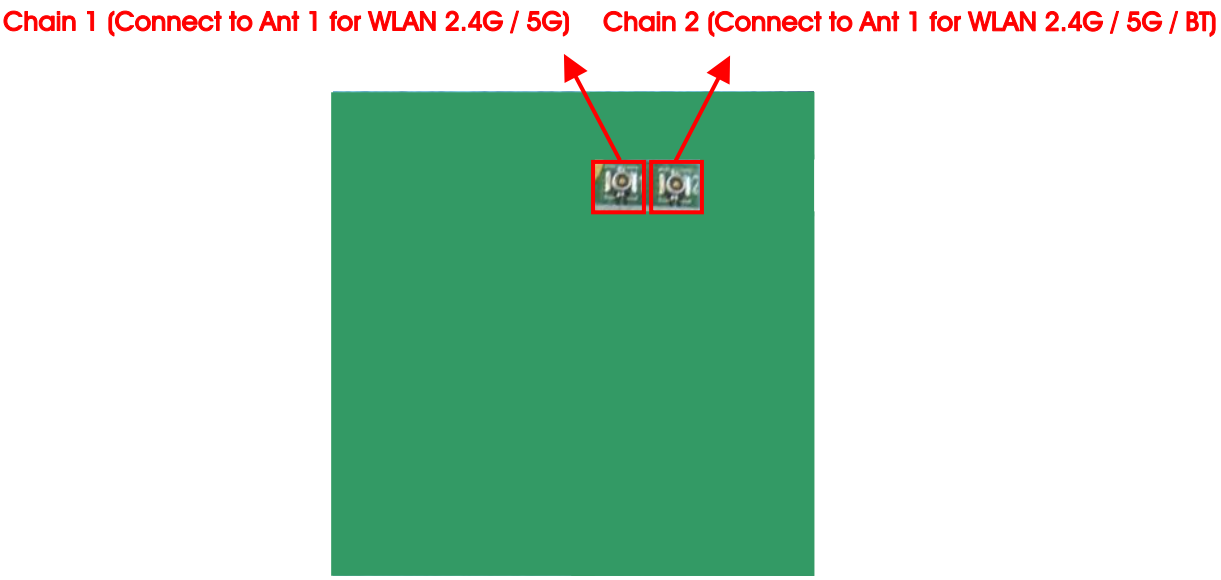
Only Chain 1 can be used as transmitting antenna.

Chain 1 and Chain 2 could receive simultaneously.

For 2TX

Both Chain 1 and Chain 2 can be used as transmitting/receiving antenna.

Chain 1 and Chain 2 could both transmit/receive simultaneously.




## 3.6. Testing Location Information

| Testing Location | | | | | |
|---|---|---|---|---|---|
| ☐ | HWA YA | ADD : No. 52, Hwa Ya 1st Rd., Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. | | | |
| | | TEL : 886-3-327-3456 | | FAX : 886-3-327-0973 | |
| ☒ | JHUBEI | ADD : No.8, Lane 724, Bo-ai St., Jhubei City, HsinChu County 302, Taiwan, R.O.C. | | | |
| | | TEL : 886-3-656-9065 | | FAX : 886-3-656-9085 | |
| **Test Condition** | | **Test Site No.** | **Test Engineer** | **Test Environment** | **Test Date** |
| DFS Site | | DF01-CB | Cliff Chang | 23°C / 63% | 2014/03/15 ~ 2014/04/02 |

# 4. DFS DETECTION THRESHOLDS AND RADAR TEST WAVEFORMS

## 4.1. Interference Threshold values, Master or Client incorporating In-Service Monitoring

| Maximum Transmit Power | Value (see note) |
|---|---|
| ≥ 200 milliwatt | -64 dBm |
| < 200 milliwatt | -62 dBm |
| Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna.<br>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. | |

The radar *Detection Threshold*, lowest antenna gain is the parameter of Interference *radar DFS detection threshold*, The Interference ***Detection Threshold*** is the *-64 dBm + 0 [dBi] + 1 dB* = -63 *dBm*.

## 4.2. 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 80% of the 99% power bandwidth See Note 3. |

Note 1: The instant that the *Channel Move Time* and the *Channel Closing Transmission Time* begins is as follows:

- For the Short pulse radar Test Signals this instant is the end of the *Burst*.
- For the Frequency Hopping radar Test Signal, this instant is the end of the last radar *Burst* generated.
- For the Long Pulse radar Test Signal this instant is the end of the 12 second period defining the radar transmission.

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 *Channel* changes (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 1 is used and for each frequency step the minimum percentage of detection is 90%. Measurements are performed with no data traffic.

## 4.3. Radar Test Waveforms Minimum Step

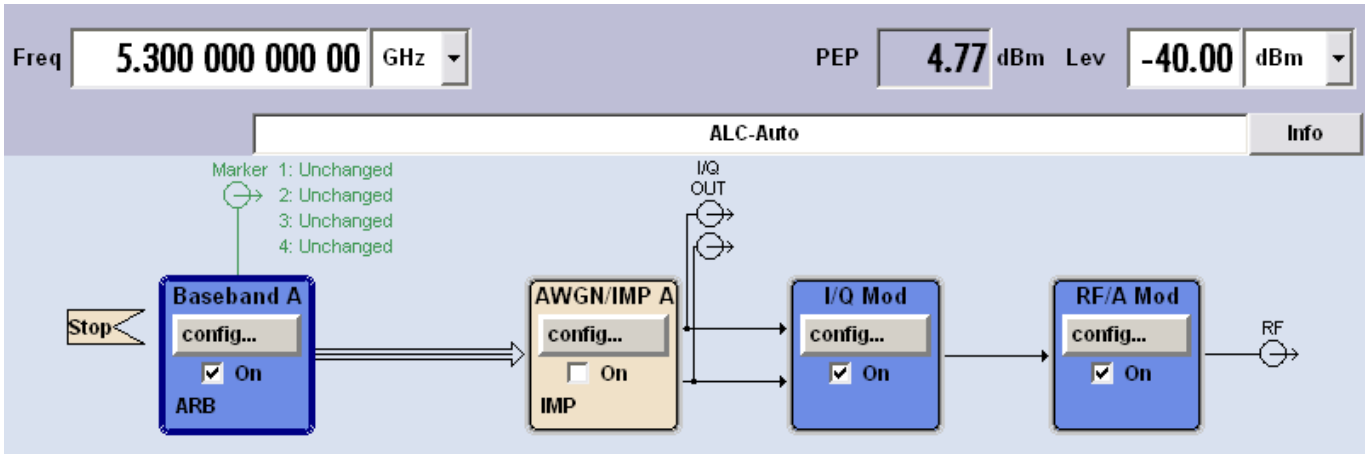
Step intervals of 0.1 microsecond for Pulse Width, 1 microsecond for PRI, 1 MHz for chirp width and 1 for the number of pulses will be utilized for the random determination of specific test waveforms.

## 4.4. Short Pulse Radar Test Waveforms

| Radar Type | Pulse Width (μsec) | PRI (μsec) | Number of Pulses | Minimum Percentage of Successful Detection | Minimum Trials |
|---|---|---|---|---|---|
| 1 | 1 | 1428 | 18 | 60% | 30 |
| 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 |

A minimum of 30 unique waveforms are required for each of the short pulse radar types 2 through 4. For short pulse radar type 1, the same waveform is used a minimum of 30 times. If more than 30 waveforms are used for short pulse radar types 2 through 4, then each additional waveform must also be unique and not repeated from the previous waveforms. The aggregate is the average of the percentage of successful detections of short pulse radar types 1-4.

**Radar Types (1~4) System Diagram**




Used R&S SMU200A (Vector SG with one ARB) or SG + ARB

B11: Base-band Generator with ARB (16 M samples) and Digital Modulation

B13: Base-band Main Module

B106: frequency range (100 kHz to 6 GHz)

For selecting the waveform parameters from within the bounds of the signal type, system were random selection using uniform distribution.

## 4.5. 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 Trials |
|---|---|---|---|---|---|---|---|
| 5 | 50-100 | 5-20 | 1000-2000 | 1-3 | 8-20 | 80% | 30 |

The parameters for this waveform are randomly chosen. Thirty unique waveforms are required for the Long Pulse radar test signal. If more than 30 waveforms are used for the Long Pulse radar test signal, then each additional waveform must also be unique and not repeated from the previous waveforms. Each waveform is defined as follows:

(1) The transmission period for the Long Pulse Radar test signal is 12 seconds.

(2) There are a total of 8 to 20 Bursts in the 12 second period, with the number of Bursts being randomly chosen. This number is Burst_Count.

(3) Each Burst consists of 1 to 3 pulses, with the number of pulses being randomly chosen. Each Burst within the 12 second sequence may have a different number of pulses.

(4) The pulse width is between 50 and 100 microseconds, with the pulse width being randomly chosen. Each pulse within a Burst will have the same pulse width. Pulses in different Bursts may have different pulse widths.

(5) Each pulse has a linear FM chirp between 5 and 20 MHz, with the chirp width being randomly chosen. Each pulse within a Burst will have the same chirp width. Pulses in different Bursts may have different chirp widths. The chirp is centered on the pulse. For example, with a radar frequency of 5300 MHz and a 20 MHz chirped signal, the chirp starts at 5290 MHz and ends at 5310 MHz.

(6) If more than one pulse is present in a Burst, the time between the pulses will be between 1000 and 2000 microseconds, with the time being randomly chosen. If three pulses are present in a Burst, the time between the first and second pulses is chosen independently of the time between the second and third pulses.

(7) The 12 second transmission period is divided into even intervals. The number of intervals is equal to Burst_Count. Each interval is of length (12,000,000 / Burst_Count) microseconds. Each interval contains one Burst. The start time for the Burst, relative to the beginning of the interval, is between 1 and [(12,000,000 / Burst_Count) – (Total Burst Length) + (One Random PRI Interval)] microseconds, with the start time being randomly chosen. The step interval for the start time is 1 microsecond. The start time for each Burst is chosen independently.

A representative example of a Long Pulse radar test waveform:

(1) The total test signal length is 12 seconds.

(2) 8 Bursts are randomly generated for the Burst_Count.

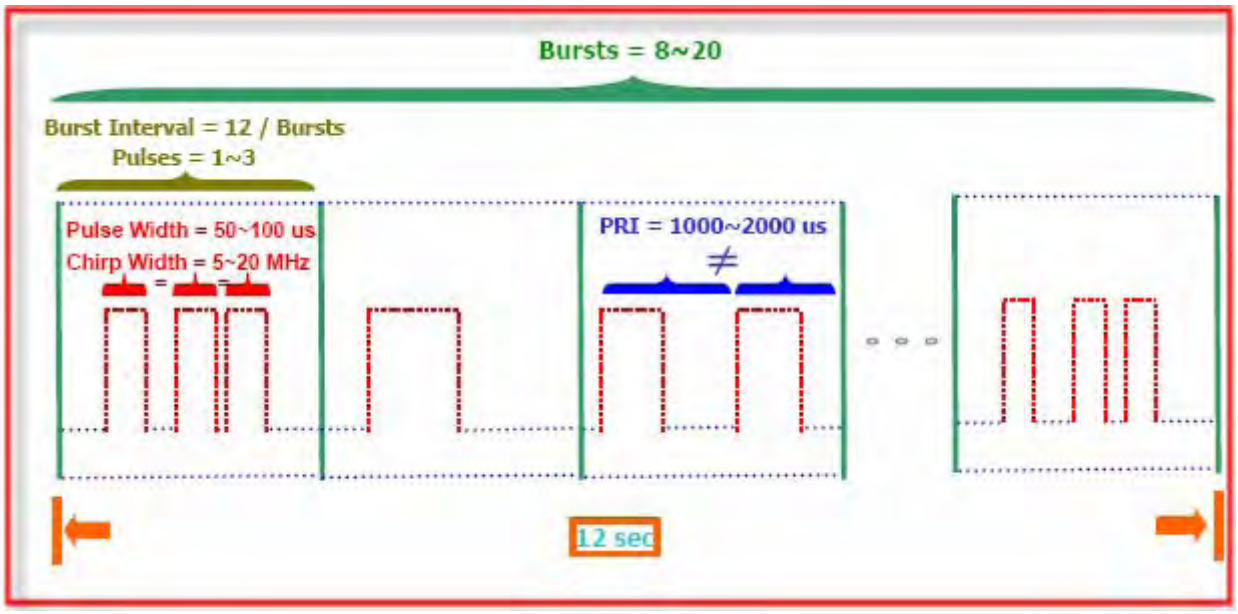
(3) Burst 1 has 2 randomly generated pulses.

(4) The pulse width (for both pulses) is randomly selected to be 75 microseconds.

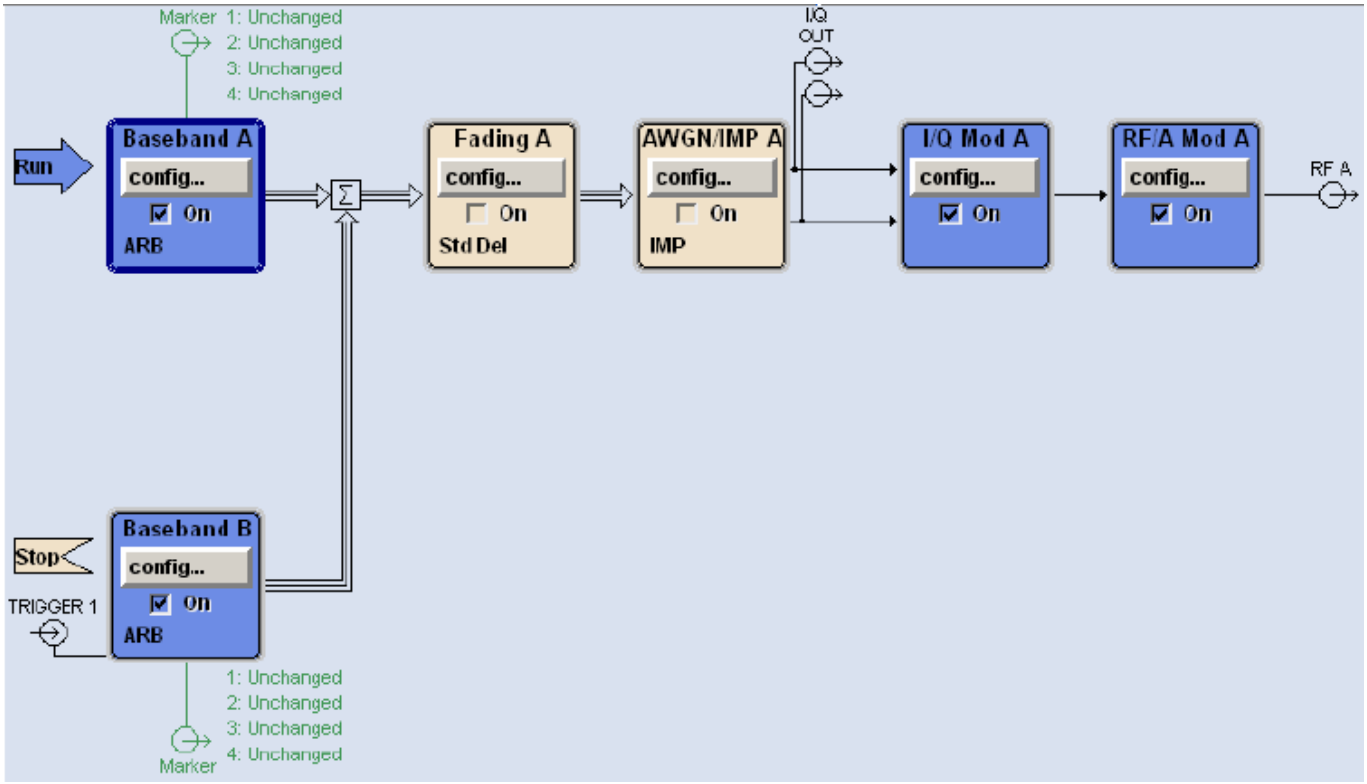
(5) The PRI is randomly selected to be at 1213 microseconds.

(6) Bursts 2 through 8 are generated using steps 3 – 5.

(7) Each Burst is contained in even intervals of 1,500,000 microseconds. The starting location for Pulse 1, Burst 1 is randomly generated (1 to 1,500,000 minus the total Burst 1 length + 1 random PRI interval) at the 325,001 microsecond step. Bursts 2 through 8 randomly fall in successive 1,500,000 microsecond intervals (i.e. Burst 2 falls in the 1,500,001 – 3,000,000 microsecond range).



**Radar Types (5) System Diagram**




Used R&S SMU200A (Vector SG with two ARB)

Path A / Path B Two B11: Base-band Generator with ARB (16 M samples) and Digital Modulation

B13: Base-band Main Module

B106: frequency range (100 kHz to 6 GHz)

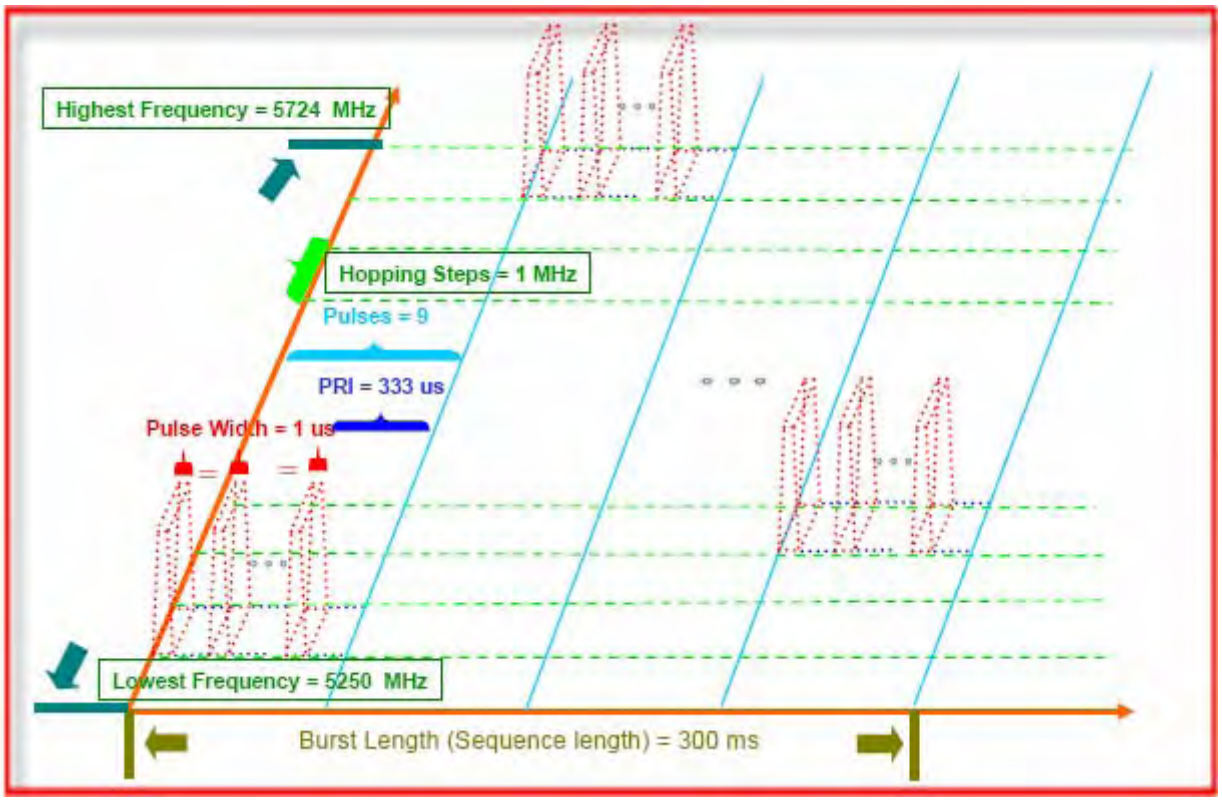
For selecting the waveform parameters from within the bounds of the signal type, system was random selection using uniform distribution.

## 4.6. Frequency Hopping Radar Test Waveform

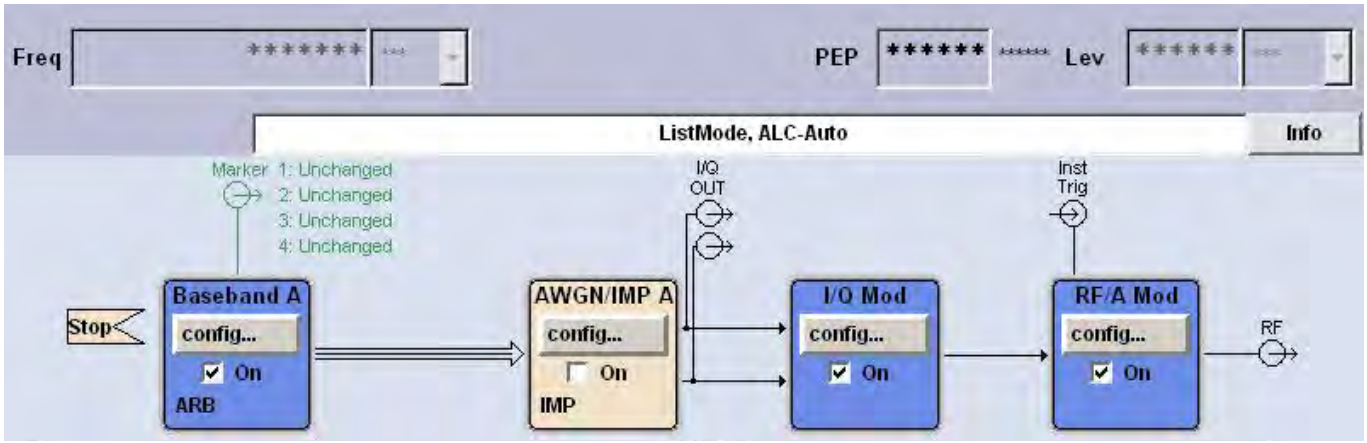
| Radar Type | Pulse Width (μsec) | PRI (μsec) | Pulses per Hop | Hopping Rate (kHz) | Hopping Sequence Length (msec) | Minimum Percentage of Successful Detection | Minimum Trials |
|---|---|---|---|---|---|---|---|
| 6 | 1 | 333 | 9 | 0.333 | 300 | 70% | 30 |

For the Frequency Hopping Radar Type, the same Burst parameters are used for each waveform. The hopping sequence is different for each waveform and a 100-length segment is selected from the hopping sequence defined by the following algorithm:

The first frequency in a hopping sequence is selected randomly from the group of 475 integer frequencies from 5250 – 5724 MHz. Next, the frequency that was just chosen is removed from the group and a frequency is randomly selected from the remaining 474 frequencies in the group. This process continues until all 475 frequencies are chosen for the set. For selection of a random frequency, the frequencies remaining within the group are always treated as equally likely.



**Radar Types (6) System Diagram**




Used R&S SMU200A (Vector SG with one ARB)

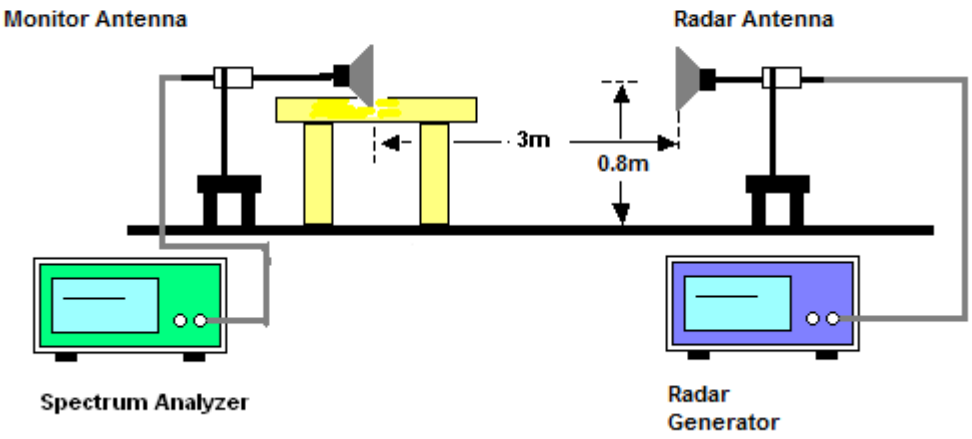
B11: Base-band Generator with ARB (16 M samples) and Digital Modulation

B13: Base-band Main Module

B106: frequency range (100 kHz to 6 GHz)

For selecting the waveform parameters from within the bounds of the signal type, system were random selection using uniform distribution.

## 4.7. Radiated Calibration Setup



## 4.8. Radar Waveform Calibration Procedure

The Interference **Radar Detection Threshold Level** is *-64 dBm + 0 [dBi] + 1 dB = -63 dBm* that had been taken into account the output power range and antenna gain. The above equipment setup was used to calibrate the conducted Radar Waveform. A vector signal generator was utilized to establish the test signal level for each radar type. During this process there were replace 50ohm terminal form Master and Client device and no transmissions by either the Master or Client Device. The spectrum analyzer was switched to the zero span (Time Domain) at the frequency of the Radar Waveform generator. Peak detection was used. The spectrum analyzer resolution bandwidth (RBW) and video bandwidth (VBW) were set to at least 3 MHz. The vector signal generator amplitude was set so that the power level measured at the spectrum analyzer was *-64 dBm + 0 [dBi] + 1 dB = -63 dBm*. Capture the spectrum analyzer plots on short pulse radar types, long pulse radar type and hopping radar waveform.

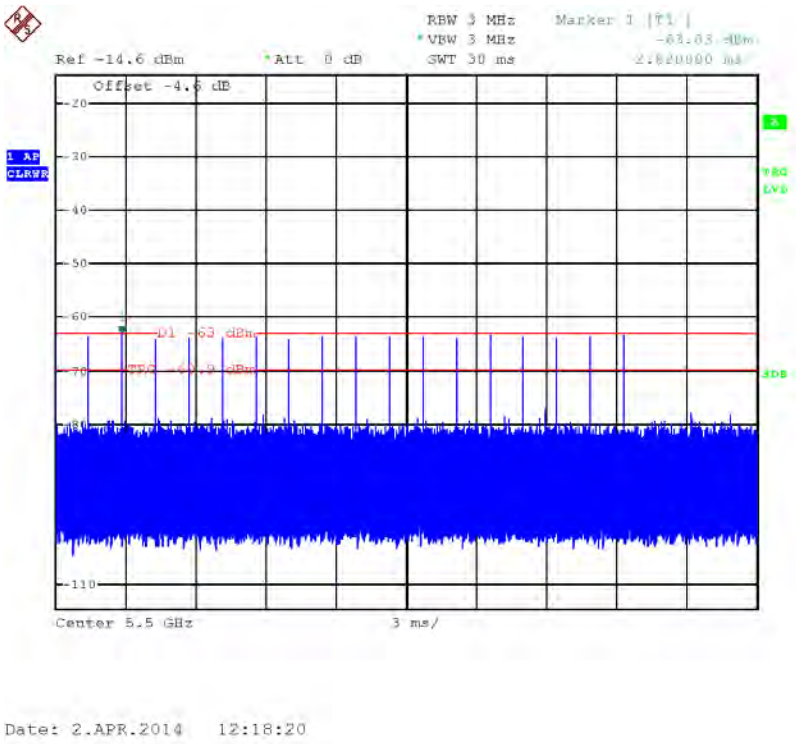
## 4.9. Calibration Deviation

There is no deviation with the original standard.

## 4.10. Radar Waveform Calibration Result

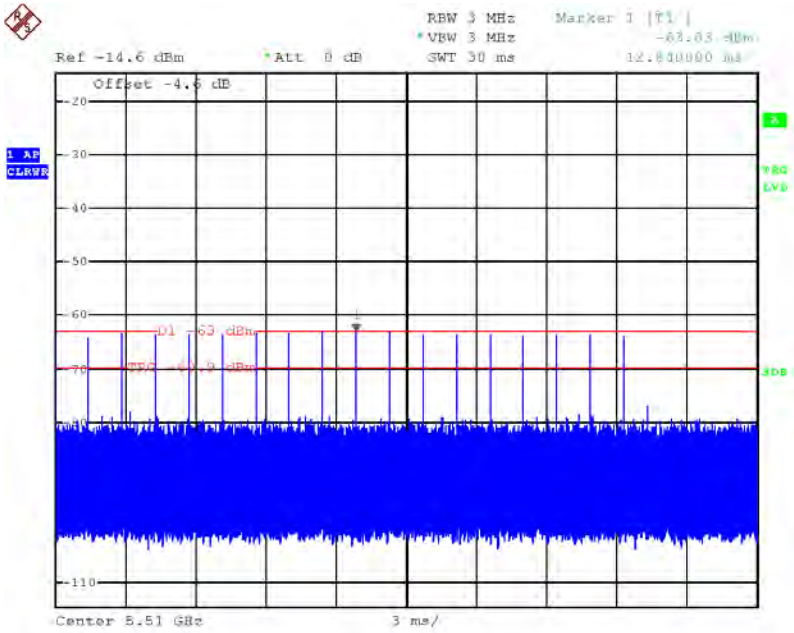
**<For 20MHz>**

**Radar #1 DFS detection threshold level and the burst of pulses on the Channel frequency**



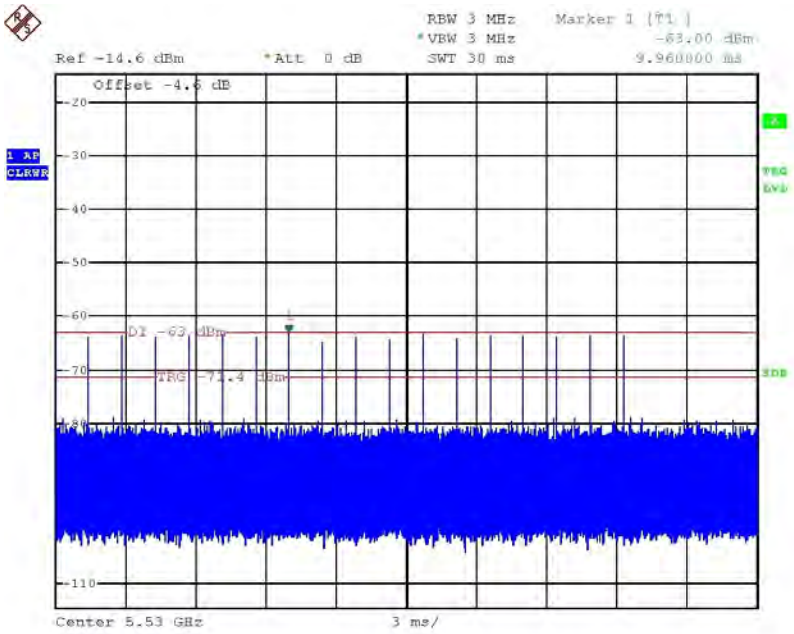
**<For 40MHz>**

**Radar #1 DFS detection threshold level and the burst of pulses on the Channel frequency**



**<For 80MHz>**

**Radar #1 DFS detection threshold level and the burst of pulses on the Channel frequency**

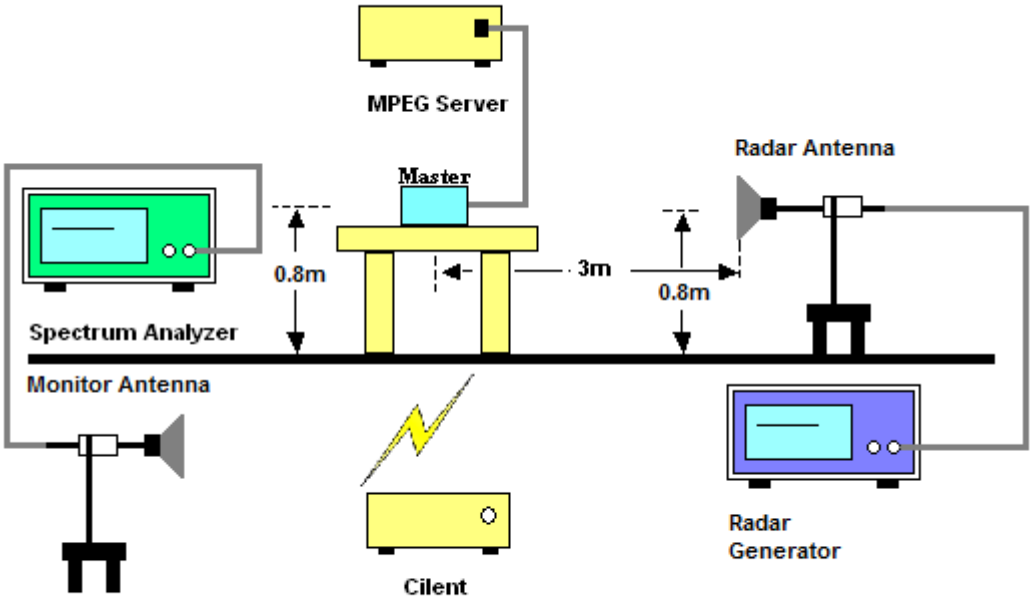


# 5. TEST SETUP AND TEST RESULT

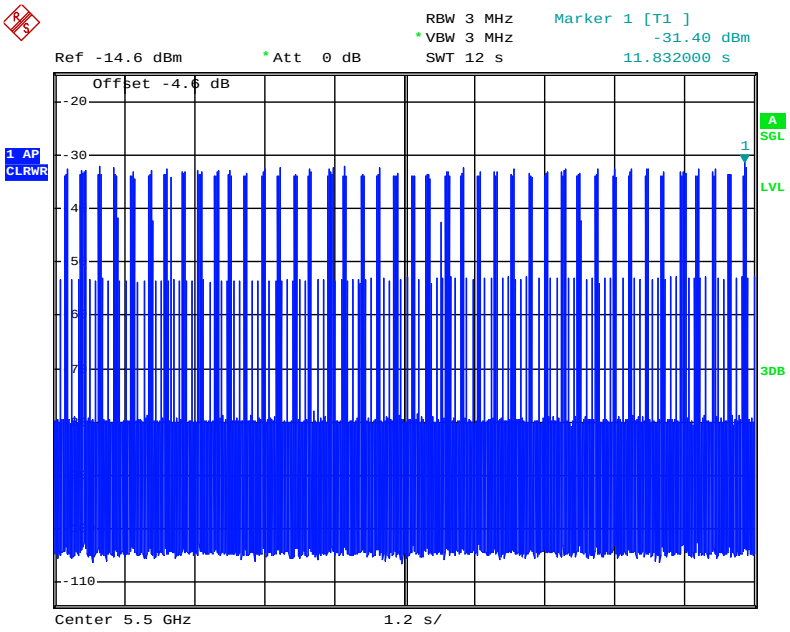
## 5.1. Test setup

### 5.1.1. Test Setup Diagram

Following is the test setup for generate the radar waveforms and used to monitor UNII device.

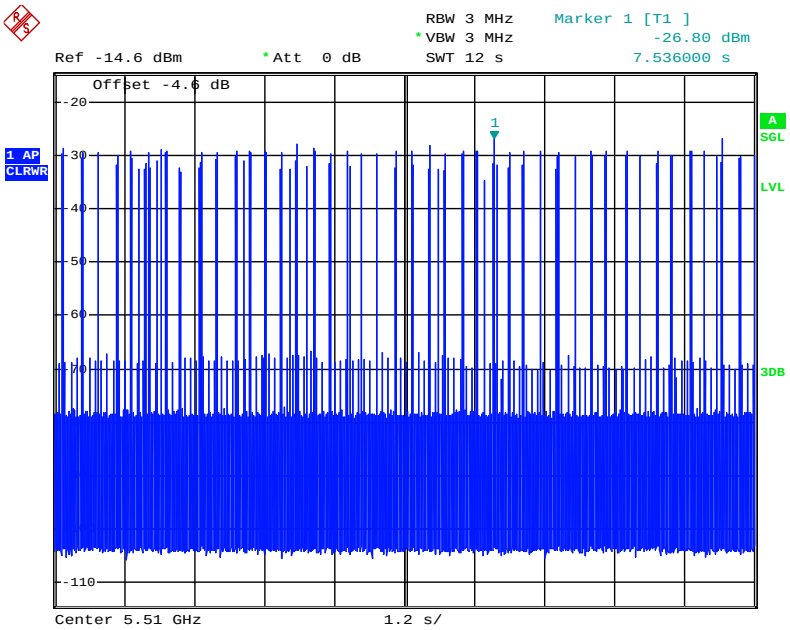


## EUT (Slave) Data Traffic Plot (20 MHz)



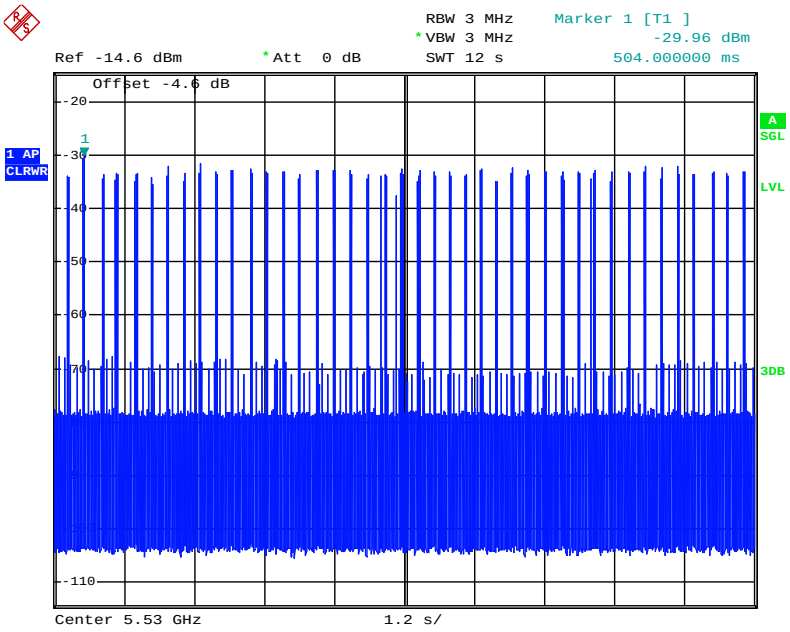

Date: 15.MAR.2014 02:24:17

## EUT (Slave) Data Traffic Plot (40 MHz)



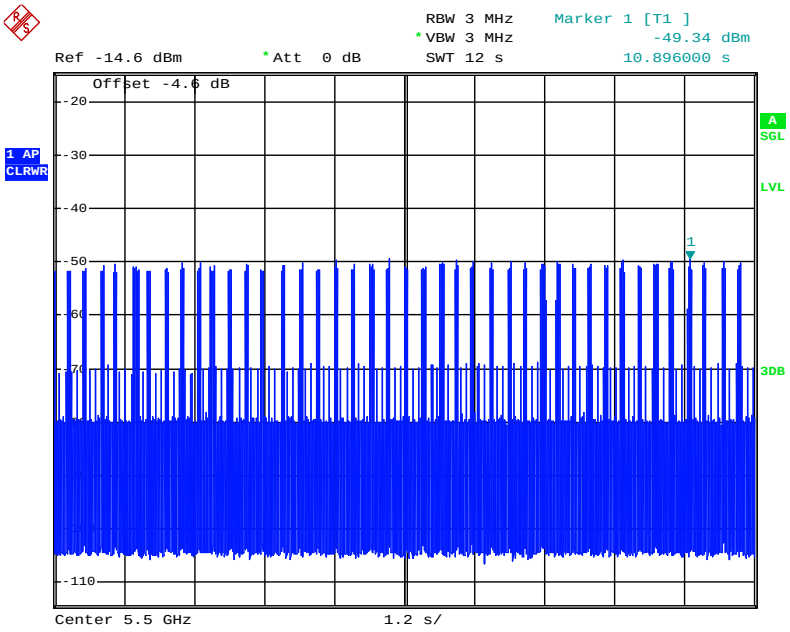

Date: 1.APR.2014 23:57:32

## EUT (Slave) Data Traffic Plot (80 MHz)



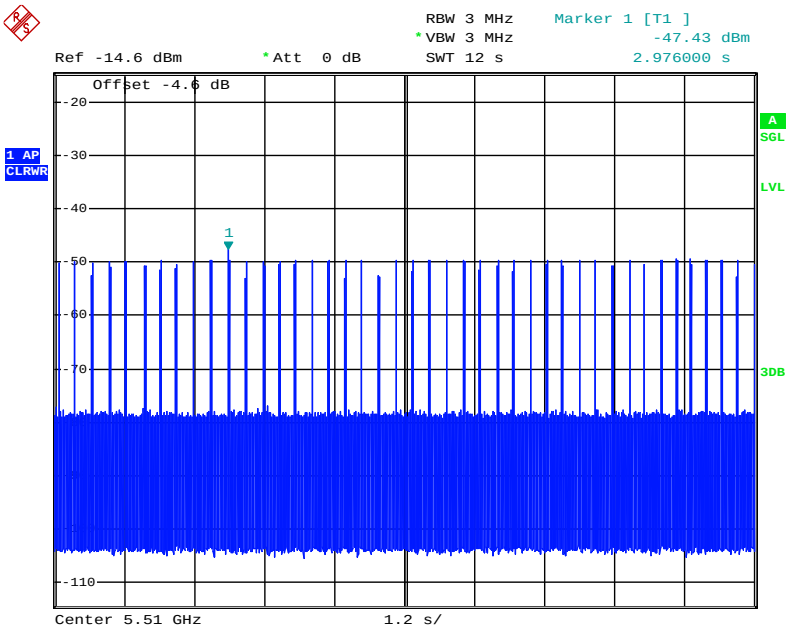

Date: 2.APR.2014 01:25:48

## Master Data Traffic Plot (20MHz)



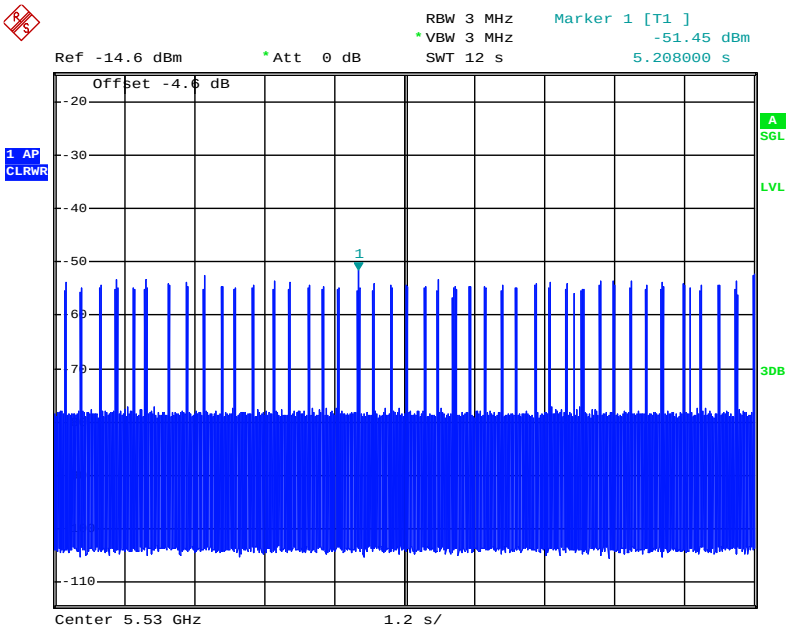

Date: 15.MAR.2014 02:24:58

## Master Data Traffic Plot (40MHz)



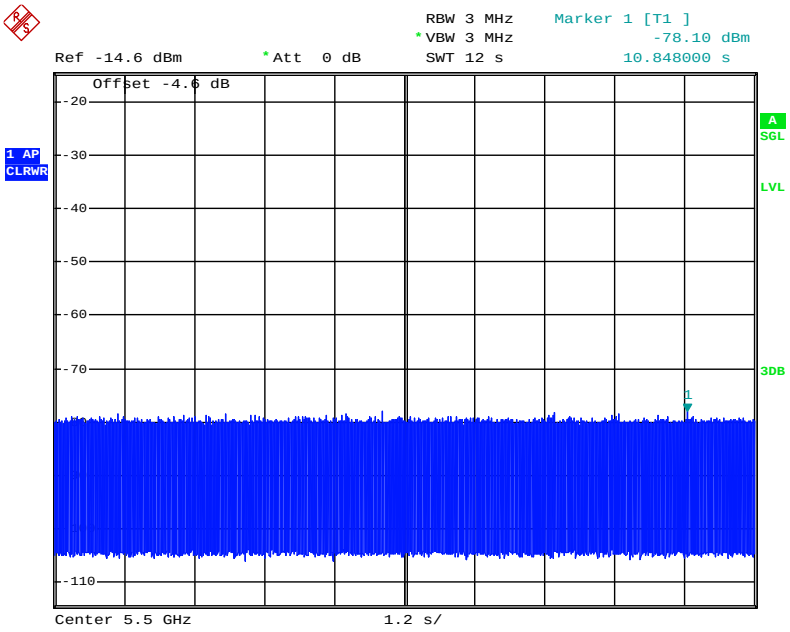

Date: 1.APR.2014 23:58:03

## Master Data Traffic Plot (80MHz)



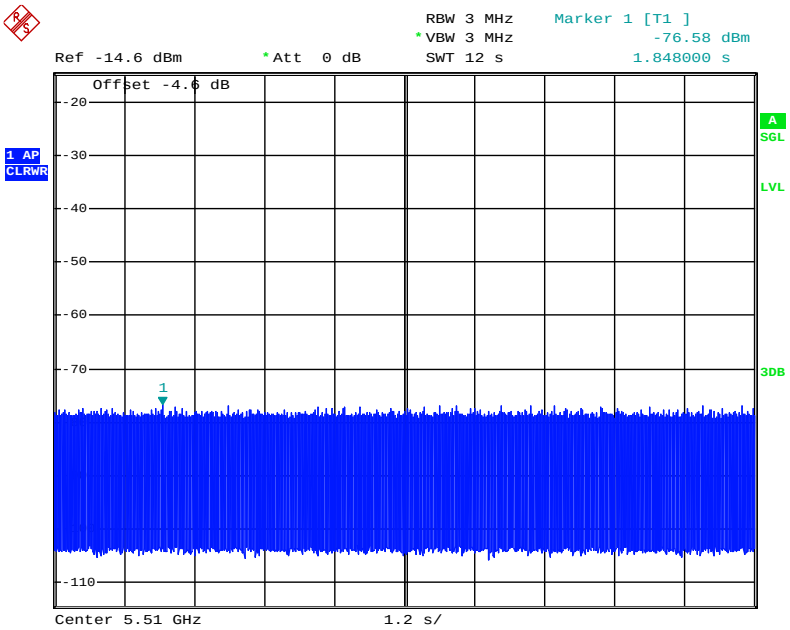

Date: 2.APR.2014 01:26:20

## Without Data Traffic Plot (Noise Plot) (20MHz)



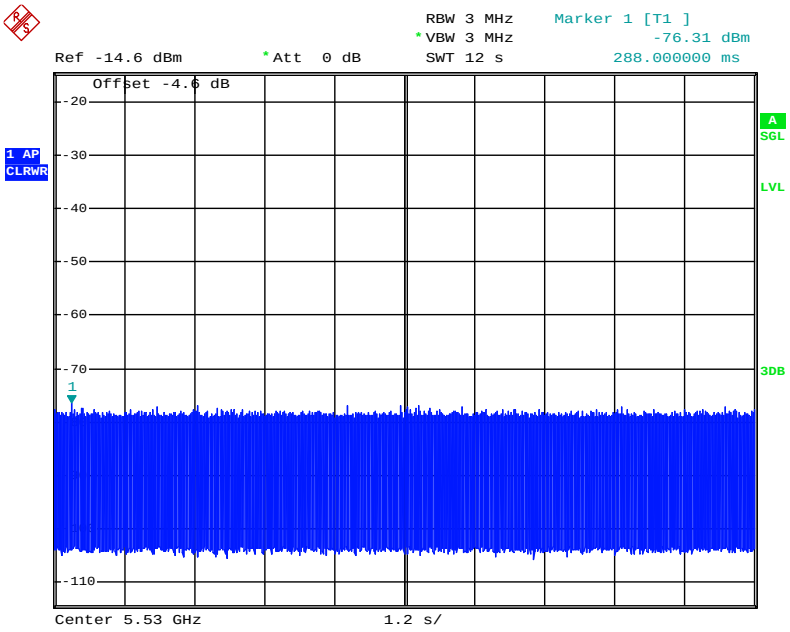

Date: 15.MAR.2014 02:25:42

## Without Data Traffic Plot (Noise Plot) (40MHz)




Date: 1.APR.2014 23:58:21

## Without Data Traffic Plot (Noise Plot) (80MHz)




Date: 2.APR.2014 01:33:51

### 5.1.2. Supporting Units

| Support Units | Brand | Model No. | Serial No. | FCC ID | Software Version |
|---|---|---|---|---|---|
| Notebook | Notebook | DELL | NB-A | E2KWM3945ABG | Win 7 |
| Notebook | Notebook | DELL | NB-B | E2KWM3945ABG | Win 7 |
| Wireless AP | ALPHA | WMC-AC02 | AP | RRK-201270022 | 1.01 |
| Test Fixture | Realtek | NGFF Adapter | N/A | N/A | Win 7 |

### 5.1.3. Test Setup Operation

System testing was performed with the designated MPEG test file that streams full motion video from the Access Point to the Client in full motion video mode using the media player with the V2.61 Codec package. This file is used by IP and Frame based systems for loading the test channel during the In-service compliance testing of the U-NII device.

The waveform parameters from within the bounds of the signal type are selected randomly using uniform distribution.

A spectrum analyzer is used as a monitor to verify that the EUT has vacated the Channel within the (Channel Closing Transmission Time and Channel Move Time, and does not transmit on a Channel during the Non-Occupancy Period after the detection and Channel move. It is also used to monitor EUT transmissions during the Channel Availability Check Time.

## 5.2. In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period Measurement

### 5.2.1. Limit

The EUT has In-Service Monitoring function to continuously monitor the radar signals, If radar is detected, must leave the channel (Shutdown). The Channel Move Time to cease all transmissions on the current Channel upon detection of a Radar Waveform above the DFS Detection Threshold within 10 sec. The total duration of Channel Closing Transmission Time is 260ms, consisting of data signals and the aggregate of control signals, by a U-NII device during the Channel Move Time. The Non-Occupancy Period time is 30 minute during which a Channel will not be utilized after a Radar Waveform is detected on that Channel.

### 5.2.2. Test Procedures

1. When a radar Burst with a level equal to the DFS Detection Threshold + 1dB is generated on the Operating Channel of the U-NII device. A U-NII device operating as a Client Device will associate with the Master at Channel. Stream the MPEG test file from the Master Device to the Client Device on the selected Channel for the entire period of the test. At time T0 the Radar Waveform generator sends a Burst of pulses for each of the radar types at Detection Threshold + 1dB.
2. Observe the transmissions of the EUT at the end of the radar Burst on the Operating Channel. Measure and record the transmissions from the EUT during the observation time (Channel Move Time). One 12 second plot been reported for the Short Pulse Radar Types 1. The plot for the Short Pulse Radar Types start at the end of the radar burst. The *Channel Move Time* will be calculated based on the plot of the Short Pulse Radar Type. The Short Pulse Radar Type plot show the device ceased transmissions within the 10 second window after detection has occurred. The plot for the Long Pulse Radar Type should start at the beginning of the 12 second waveform.
3. Measurement of the aggregate duration of the Channel Closing Transmission Time method. With the spectrum analyzer set to zero span tuned to the center frequency of the EUT operating channel at the radar simulated frequency, peak detection, and max hold, the dwell time per bin is given by: **Dwell = S / B** ; where **Dwell** is the dwell time per spectrum analyzer sampling bin, **S** is the sweep time and **B** is the number of spectrum analyzer sampling bins. An upper bound of the aggregate duration of the intermittent control signals of *Channel Closing Transmission Time* is calculated by: **C = N X Dwell** ; where **C** is the Closing Time, **N** is the number of spectrum analyzer sampling bins (intermittent control signals) showing a U-NII transmission and **Dwell** is the dwell time per bin.
4. Measure the EUT for more than 30 minutes following the channel close/move time to verify that the EUT does not resume any transmissions on this Channel.

### 5.2.3. Test Deviation

There is no deviation with the original standard.

## 5.2.4. Result of Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period

**For 20MHz**

| Parameter | Test Result | Limit |
|---|---|---|
| | Type 1 | |
| Test Channel (MHz) | 5500 MHz | - |
| Channel Move Time (sec.) | 4.128 | < 10s |
| Channel Closing Transmission Time (ms) (Note) | 40 | < 60ms |
| Non-Occupancy Period (min.) | ≧30 | ≧ 30 min |

Note: 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 seconds period. The aggregate duration of control signals will not count quiet periods in between transmissions.

**For 40MHz**

| Parameter | Test Result | Limit |
|---|---|---|
| | Type 1 | |
| Test Channel (MHz) | 5510 MHz | - |
| Channel Move Time (sec.) | 4.176 | < 10s |
| Channel Closing Transmission Time (ms) (Note) | 41.25 | < 60ms |
| Non-Occupancy Period (min.) | ≧30 | ≧ 30 min |

Note: 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 seconds period. The aggregate duration of control signals will not count quiet periods in between transmissions.

**For 80MHz**

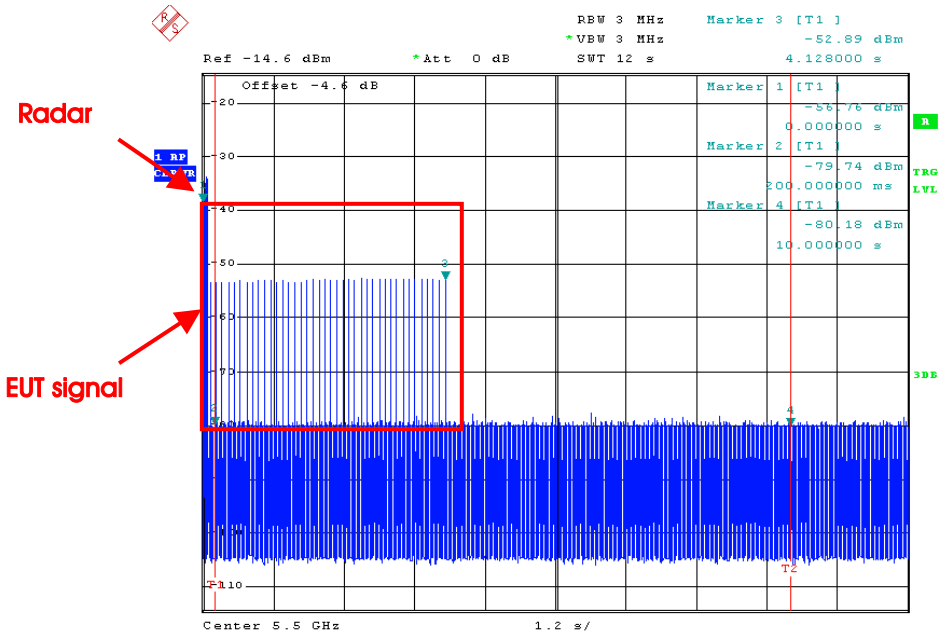
| Parameter | Test Result | Limit |
|---|---|---|
| | Type 1 | |
| Test Channel (MHz) | 5530 MHz | - |
| Channel Move Time (sec.) | 4.152 | < 10s |
| Channel Closing Transmission Time (ms) (Note) | 41.875 | < 60ms |
| Non-Occupancy Period (min.) | ≧30 | ≧ 30 min |

Note: 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 seconds period. The aggregate duration of control signals will not count quiet periods in between transmissions.

## 5.2.5. Channel Move Time Plot

### For 20MHz

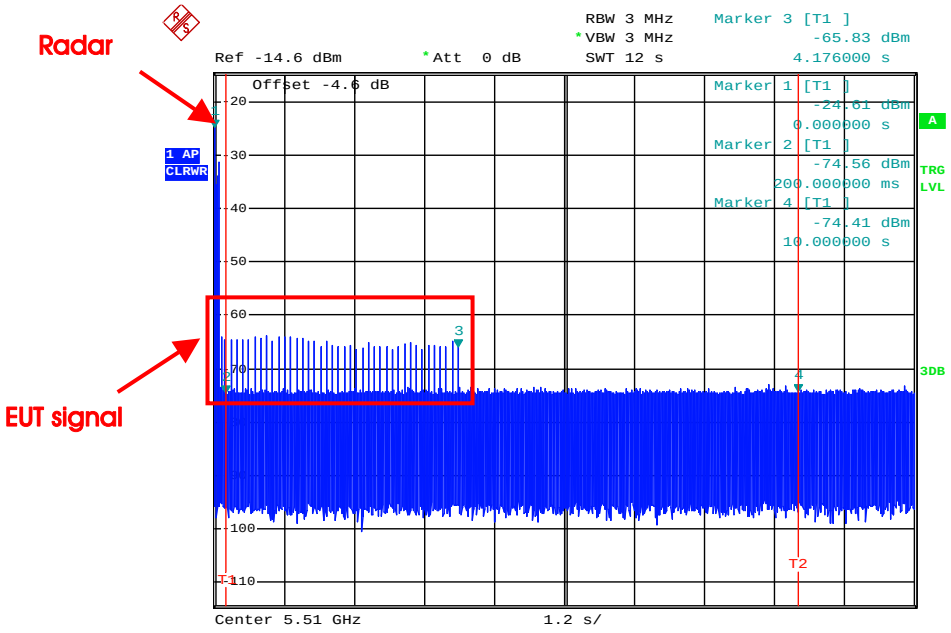
### Radar #1 Channel Move Time




Date: 15.MAR.2014 02:31:06

## For 40MHz

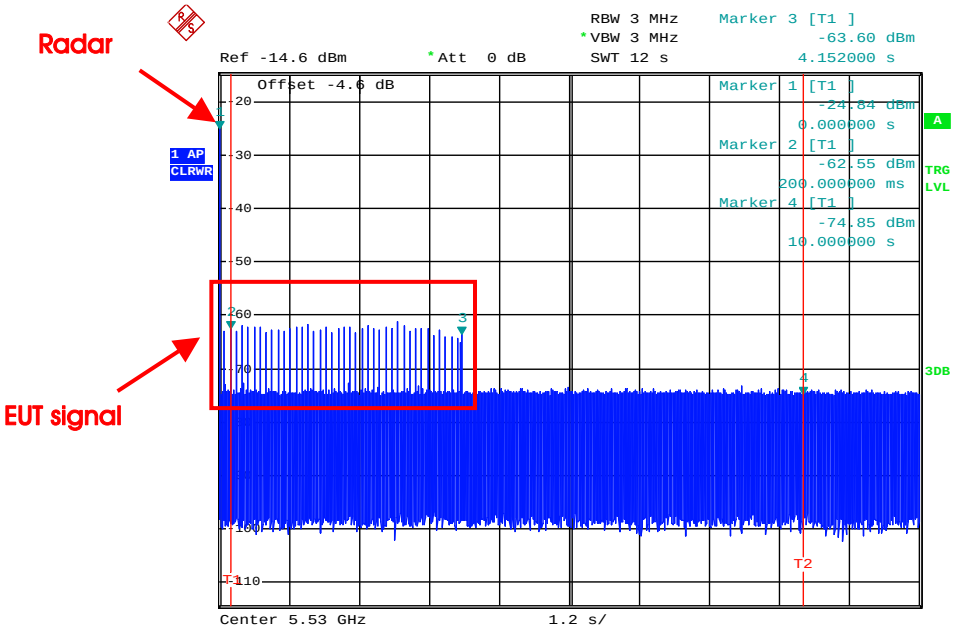
### Radar #1 Channel Move Time




Date: 2.APR.2014 00:13:10

## For 80MHz

### Radar #1 Channel Move Time

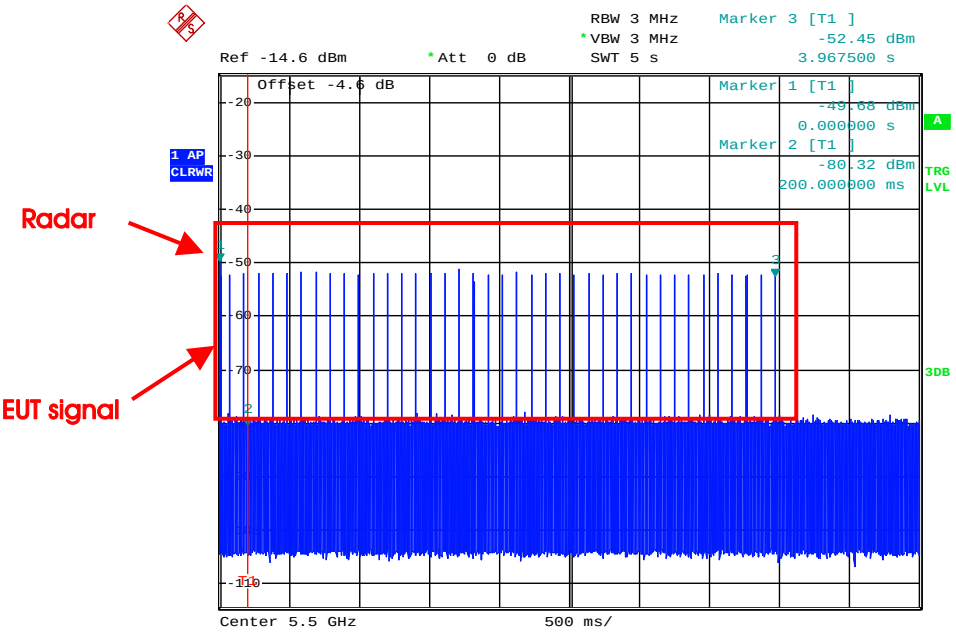



Date: 2.APR.2014 01:36:02

## 5.2.6. Channel Closing Transmission Time Plot

For 20MHz

Radar #1 Channel Closing Transmission Time is comprised of 200 ms starting at the beginning of the Channel Move Time plus 60ms additional intermittent control signals




Date: 15.MAR.2014 02:41:43

Dwell is the dwell time per spectrum analyzer sampling bin.

S is the sweep time

B is the number of spectrum analyzer sampling bins

C is the intermittent control signals of Channel Closing Transmission Time

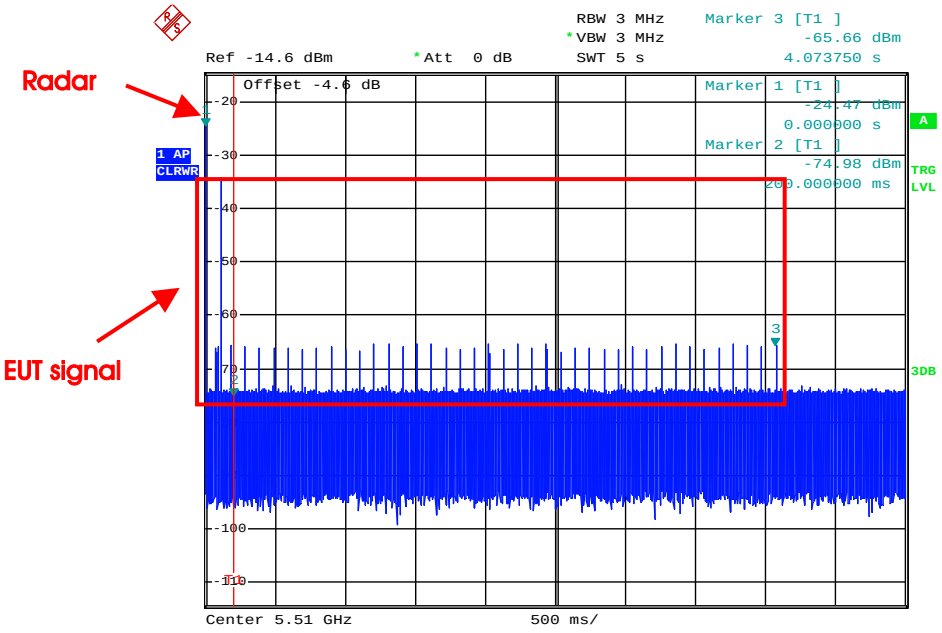
N is the number of spectrum analyzer sampling bins (intermittent control signals) showing a U-NII transmission

Dwell (0.625 ms)= S (5000 ms) / B (8000)

C (40 ms) = N (64) X Dwell (0.625 ms)

For 40MHz

Radar #1 Channel Closing Transmission Time is comprised of 200 ms starting at the beginning of the Channel Move Time plus 60ms additional intermittent control signals




Dwell is the dwell time per spectrum analyzer sampling bin.

S is the sweep time

B is the number of spectrum analyzer sampling bins

C is the intermittent control signals of Channel Closing Transmission Time

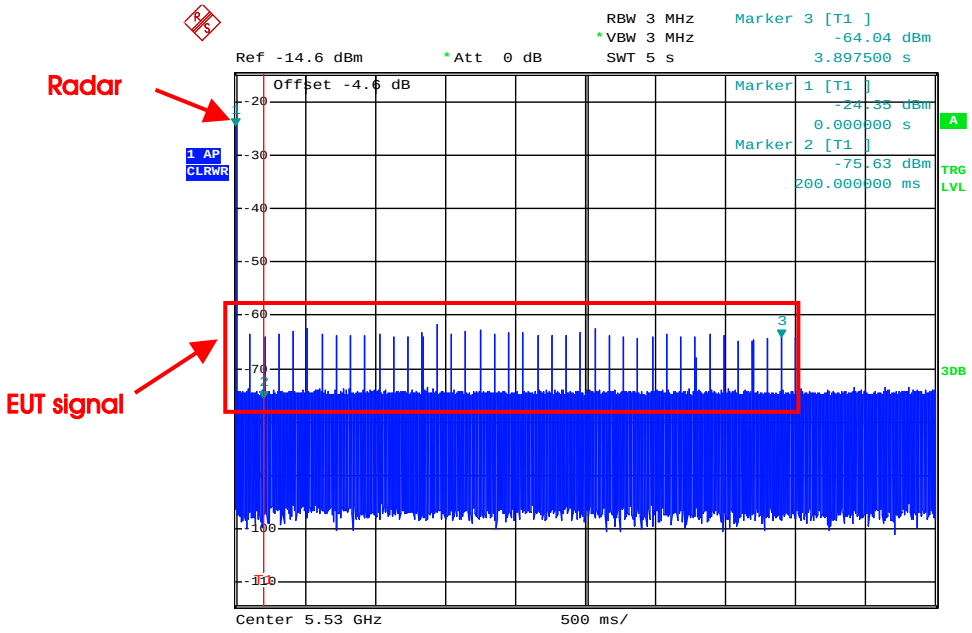
N is the number of spectrum analyzer sampling bins (intermittent control signals) showing a U-NII transmission

Dwell (0.625 ms)= S (5000 ms) / B (8000)

C (41.25 ms) = N (66) X Dwell (0.625 ms)

For 80MHz

Radar #1 Channel Closing Transmission Time is comprised of 200 ms starting at the beginning of the Channel Move Time plus 60ms additional intermittent control signals




Date: 2.APR.2014 01:42:59

Dwell is the dwell time per spectrum analyzer sampling bin.

S is the sweep time

B is the number of spectrum analyzer sampling bins

C is the intermittent control signals of Channel Closing Transmission Time

N is the number of spectrum analyzer sampling bins (intermittent control signals) showing a U-NII transmission

Dwell (0.625 ms)= S (5000 ms) / B (8000)

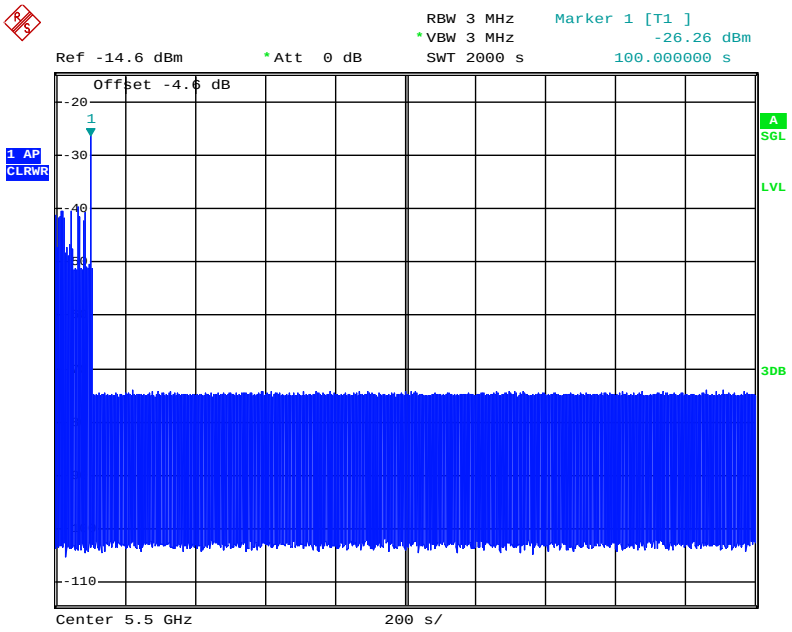
C (41.875 ms) = N (67) X Dwell (0.625 ms)

## 5.2.7. Non-Occupancy Period Plot

### For 20MHz

### Non-Occupancy Period

During the 30 minutes observation time, UUT did not make any transmissions on a channel after a radar signal was detected on that channel by either the Channel Availability Check or the In-Service Monitoring.

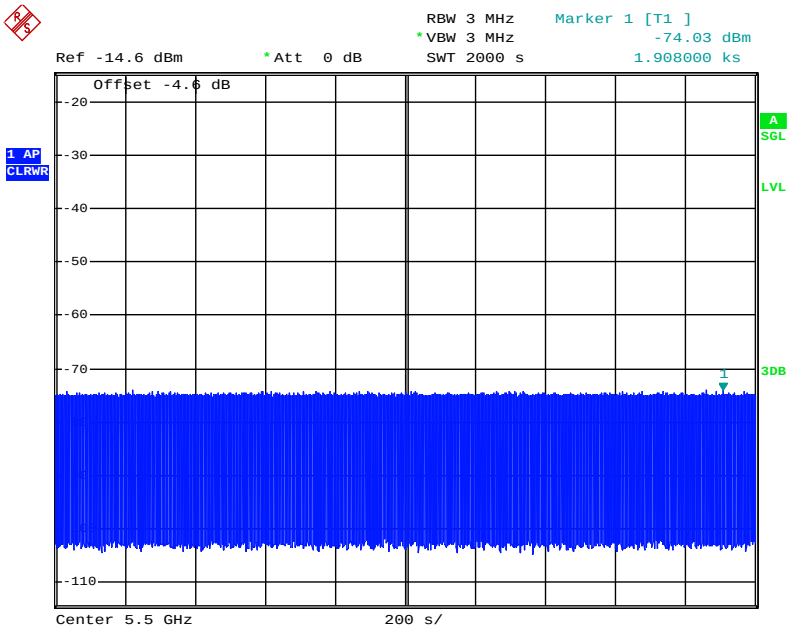



Date: 15.MAR.2014 03:46:02

**Non-associated test**

Master was off.

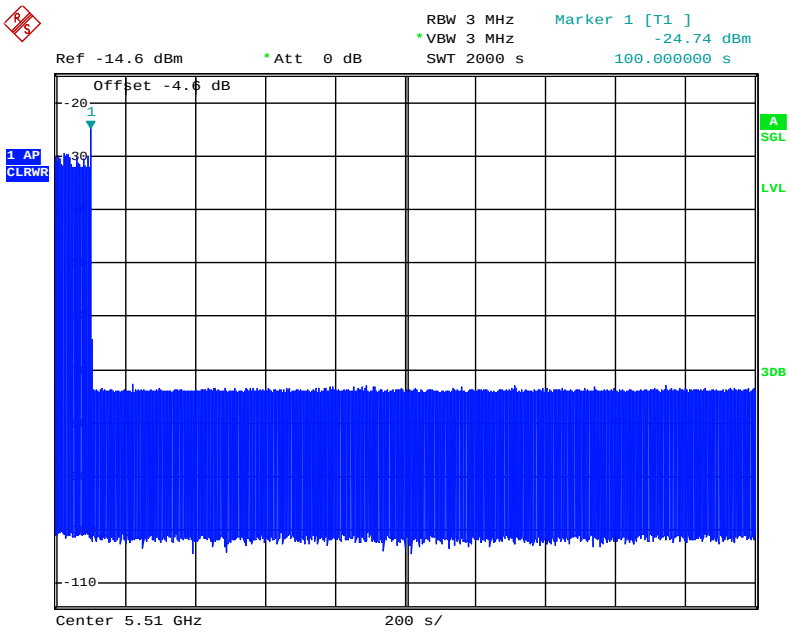
During the 30 minutes observation time, The UUT did not make any transmissions in the DFS band after UUT power up.



**For 40MHz**

**Non-Occupancy Period**

During the 30 minutes observation time, UUT did not make any transmissions on a channel after a radar signal was detected on that channel by either the Channel Availability Check or the In-Service Monitoring.

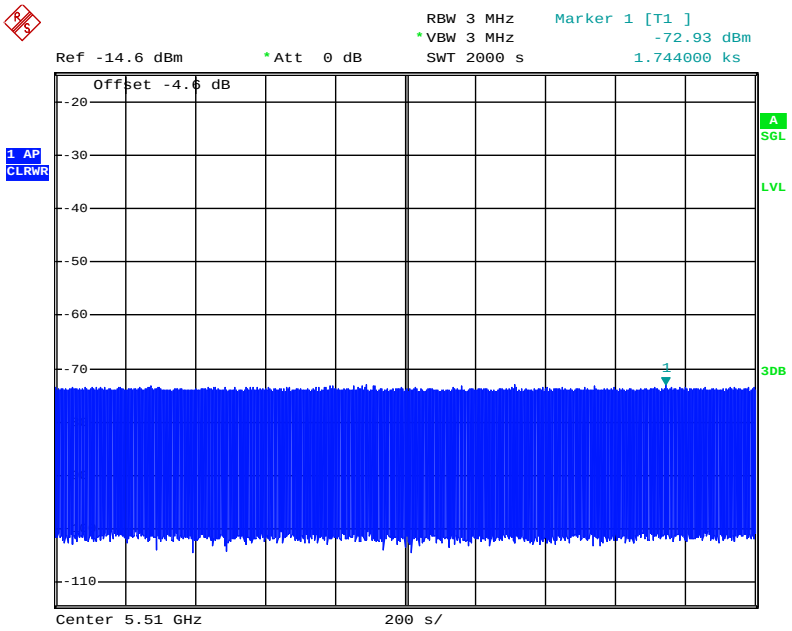



Date: 2.APR.2014 01:16:37

**Non-associated test**

Master was off.

During the 30 minutes observation time, The UUT did not make any transmissions in the DFS band after UUT power up.

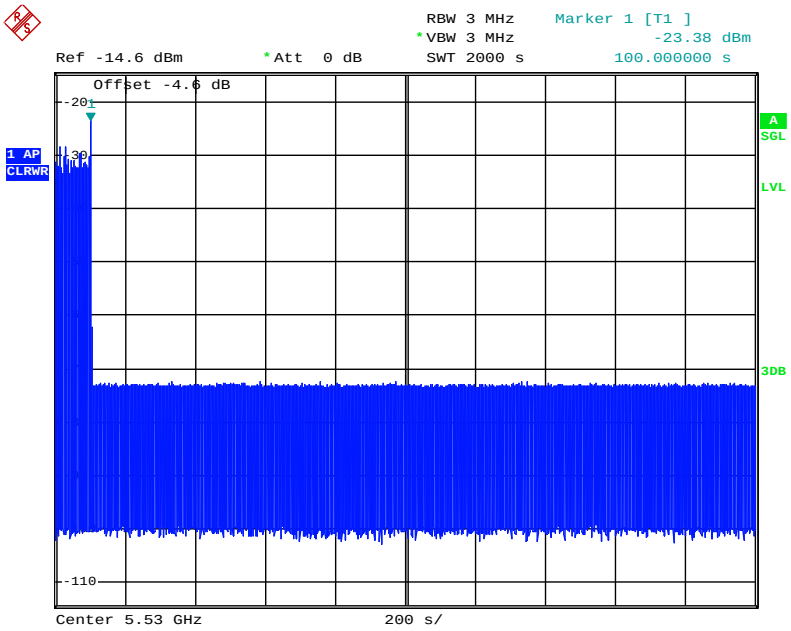



Date: 2.APR.2014 01:21:43

**For 80MHz**

**Non-Occupancy Period**

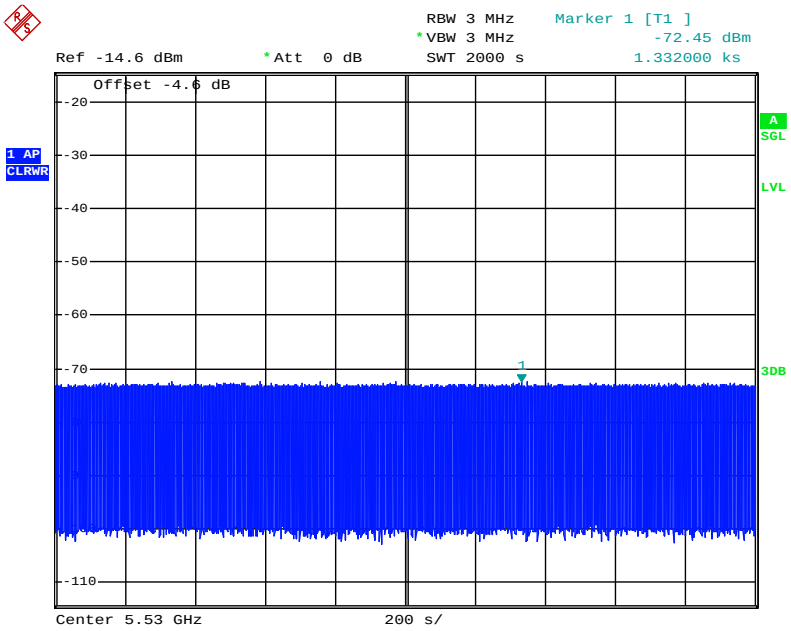
During the 30 minutes observation time, UUT did not make any transmissions on a channel after a radar signal was detected on that channel by either the Channel Availability Check or the In-Service Monitoring.



**Non-associated test**

Master was off.

During the 30 minutes observation time, The UUT did not make any transmissions in the DFS band after UUT power up.




Date: 2.APR.2014 02:54:41

# 6. LIST OF MEASURING EQUIPMENTS

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Remark |
|---|---|---|---|---|---|---|
| Spectrum analyzer | R&S | FSP40 | 100019 | 9kHz~40GHz | Dec. 02, 2013 | Conducted (TH01-CB) |
| RF Power Divider | Woken | 2 Way | 0120A02056002D | 2GHz ~ 18GHz | Nov. 17, 2013 | Conducted (TH01-CB) |
| RF Power Divider | Woken | 3 Way | MDC2366 | 2GHz ~ 18GHz | Nov. 17, 2013 | Conducted (TH01-CB) |
| RF Power Divider | Woken | 4 Way | 0120A04056002D | 2GHz ~ 18GHz | Nov. 17, 2013 | Conducted (TH01-CB) |
| Signal generator | R&S | SMU200A | 102782 | 25MHz-6GHz | Nov. 15, 2013 | Conducted (TH01-CB) |
| Horn Antenna | COM-POWER | AH-118 | 071187 | 1GHz – 18GHz | Jul. 03, 2013 | Conducted (TH01-CB) |
| Horn Antenna | COM-POWER | AH-118 | 071042 | 1GHz – 18GHz | Nov. 20, 2013 | Conducted (TH01-CB) |
| RF Cable-high | Woken | High Cable-7 | - | 1 GHz – 26.5 GHz | Nov. 17, 2013 | Conducted (TH01-CB) |
| RF Cable-high | Woken | High Cable-8 | - | 1 GHz – 26.5 GHz | Nov. 17, 2013 | Conducted (TH01-CB) |
| RF Cable-high | Woken | High Cable-9 | - | 1 GHz – 26.5 GHz | Nov. 17, 2013 | Conducted (TH01-CB) |
| RF Cable-high | Woken | High Cable-10 | - | 1 GHz – 26.5 GHz | Nov. 17, 2013 | Conducted (TH01-CB) |
| RF Cable-high | Woken | High Cable-11 | - | 1 GHz – 26.5 GHz | Nov. 17, 2013 | Conducted (TH01-CB) |
| Power Sensor | Anritsu | MA2411B | 0917223 | 300MHz~40GHz | Sep. 18, 2013 | Conducted (TH01-CB) |
| Power Meter | Anritsu | ML2495A | 1035008 | 300MHz~40GHz | Sep. 18, 2013 | Conducted (TH01-CB) |

Note: Calibration Interval of instruments listed above is one year.

# 7. MEASUREMENT UNCERTAINTY

| Test Items | Uncertainty | Remark |
|---|---|---|
| Radiated Emission | 2.9 dB | Confidence levels of 95% |