

# FCC DFS TEST REPORT

**For**

**Prepared by**

**Product Name: Wireless Presentation & Collaboration System**

**Brand Name: DELTA , VIVITEK**

**Model No.: NP2000**

**Series Model.: DS200**

**FCC ID: H79-0120C8**

**Test Report Number:**

**C151118R01-RPW3**

**Issued to**

**Delta Electronic Incorporated.**

**3 Tungyung rd., Chungli Industrial Zone, Taoyuan County 32063 Taiwan**

**Issued by**

**Compliance Certification Services Inc.**

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TESTING CERT #2541.01

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# Compliance Certification Services Inc.

Date of Issue : May 14, 2016  
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## Revision History

| Rev. | Issue Date   | Report NO.      | Effect Page | Contents |
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|      |              |                 |             |          |

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## 1. TEST RESULT CERTIFICATION

**Applicant:** Delta Electronic Incorporated.  
3 Tungyung rd., Chungli Industrial Zone, Taoyuan County  
32063 Taiwan

**Equipment Under Test:** Wireless Presentation & Collaboration System

**Trade Name:** DELTA , VIVITEK

**Model:** NP2000

**Date of Test:** May 3, 2016 ~ May 13, 2016

| APPLICABLE STANDARDS         |                         |
|------------------------------|-------------------------|
| STANDARD                     | TEST RESULT             |
| FCC 47 CFR Part 15 Subpart E | No non-compliance noted |

**Statement:**

Compliance Certification Services Inc. tested the above equipment. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10: 2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.407.

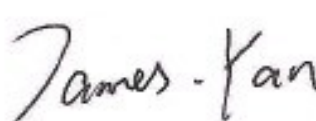
The test results of this report relate only to the tested sample identified in this report.

**Approved by:**

Jeff.Fang

RF Manager

Compliance Certification Service Inc.

**Tested by:**

James.Yan

Test Engineer

Compliance Certification Service Inc.

## 2. EUT DESCRIPTION

|                                  |   |
|----------------------------------|---|
| <b>Product Name</b>              | Wireless Presentation & Collaboration System  |
| <b>Brand Name</b>                | DELTA , VIVITEK   |
| <b>Model Name</b>                | NP2000  |
| <b>Model Discrepancy</b>         | N/A   |
| <b>Series Model</b>              | DS200   |
| <b>Received Date</b>             | November 18, 2015   |
| <b>Power Supply</b>              | Power supply and ADP (rating):<br>Model: W12-010N3A<br>Input: 100-240V-50/60Hz 0.3A<br>Output: 5V 2A  |
| <b>Operating Frequency Range</b> | 5250 MHz ~ 5350 MHz<br>5470 MHz ~ 5725 MHz  |
| <b>EUT support WLAN function</b> | <5250 MHz ~ 5350 MHz><br>802.11a<br>802.11n HT20<br>802.11n HT40<br>802.11ac VHT20<br>802.11ac VHT40<br>802.11ac VHT80<br><5470 MHz ~ 5725 MHz ><br>802.11a<br>802.11n HT20<br>802.11n HT40<br>802.11ac VHT20<br>802.11ac VHT40<br>802.11ac VHT80 |
| <b>Type of Modulation</b>        | 802.11a : OFDM (6,9,12,18,24,36,48 and 54 Mbps)<br>802.11n : OFDM (MCS0~MCS7)<br>802.11ac : OFDM (MCS0~MCS7)  |
| <b>Antenna Specification</b>     | Antenna1 Gain: 3.0 dBi<br>Antenna2 Gain: 3.0 dBi  |
| <b>Antenna Designation</b>       | PCB Antenna   |
| <b>DFS Function</b>              | Client without radar detection function   |

**LOCAL SUPPORT EQUIPMENT:**

| No. | Device Type | Brand    | Model | Series No.     | FCC ID    | Data Cable |
|-----|-------------|----------|-------|----------------|-----------|------------|
| 1.  | Notebook PC | Dell     | E5430 | CN8YYW1        | FCC DoC   | N.C.R      |
| 2   | AP Router   | Aerohive | AP130 | 01301503311156 | WBV-AP130 | N.C.R      |

**EUT OPERATION FREQUENCY:**

| <b>UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE (U-NII)</b> |            |
|---|------------|
| <b>CHANNEL</b>  | <b>MHz</b> |
| 36  | 5180       |
| 38  | 5190       |
| 40  | 5200       |
| 44  | 5220       |
| 46  | 5230       |
| 48  | 5240       |
| 52  | 5260       |
| 54  | 5270       |
| 56  | 5280       |
| 60  | 5300       |
| 62  | 5310       |
| 64  | 5320       |
| 100   | 5500       |
| 102   | 5510       |
| 104   | 5520       |
| 108   | 5540       |
| 110   | 5550       |
| 112   | 5560       |
| 116   | 5580       |
| 118   | 5590       |
| 120   | 5600       |
| 124   | 5620       |
| 126   | 5630       |
| 128   | 5640       |
| 132   | 5660       |
| 134   | 5670       |
| 136   | 5680       |
| 140   | 5700       |
| 149   | 5745       |
| 153   | 5765       |
| 157   | 5785       |
| 161   | 5805       |
| 165   | 5825       |

### 3. FACILITIES AND ACCREDITATIONS

#### FACILITIES

All measurement facilities used to collect the measurement data are located at

☒ **No.10Weiye Rd., Innovation park, Eco&Tec, Development Zone, Kunshan City, Jiangsu, China.**

The sites are constructed in conformance with the requirements of ANSI C63.10:2013 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

#### TABLE OF ACCREDITATIONS AND LISTINGS

Our laboratories are accredited and approved by the following accreditation body according to ISO/IEC 17025.

|              |      |
|--------------|------|
| <b>USA</b>   | A2LA |
| <b>China</b> | CNAS |

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

|               |                 |
|---------------|-----------------|
| <b>Canada</b> | Industry Canada |
| <b>Japan</b>  | VCCI            |
| <b>Taiwan</b> | BSMI            |
| <b>USA</b>    | FCC             |

Copies of granted accreditation certificates are available for downloading from our web site, <http://www.ccsrf.com>.



**4. SUMMARY OF TEST RESULTS**

| UNII                          | Bandwidth and Channel      | Description                                 | Measured                            | Limit  | Result |
|-------------------------------|----------------------------|---|-------------------------------------|--|--------|
| UNII Band 2-A<br>5250-5350MHz | 80MHz<br>(CH58)<br>5530MHz | Channel Move Time                           | 409.5 ms                            | 10 sec   | Pass   |
|                               |                            | Channel Closing Transmission time           | <200ms +<br>4.5 ms<br>(aggregate)   | 200 ms +<br>aggregate of 60 ms over<br>remaining 10 s period | Pass   |
|                               |                            | Non-Occupancy Period and Client Beacon Test | No transmission or Beacons occurred | 30 minutes   | Pass   |
| UNII Band 2-C<br>5470-5725MHz | (CH106)<br>5530MHz80 MHz   | Channel Move Time                           | 355.5 ms                            | 10 sec   | Pass   |
|                               |                            | Channel Closing Transmission time           | <200ms +<br>6.0 ms<br>(aggregate)   | 200 ms +<br>aggregate of 60 ms over<br>remaining 10 s period | Pass   |
|                               |                            | Non-Occupancy Period and Client Beacon Test | No transmission or Beacons occurred | 30 minutes   | Pass   |

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

## 5. REQUIREMENTS AND PARAMETERS FOR DFS TEST

### 5.1 Applicability of DFS Requirements

EUT is client and operates as client without radar detection function.

**Table 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                          |

**Table 2: Applicability of DFS requirements during normal operation**

| Requirement                       | Operational Mode |                                  |                              |
|-----------------------------------|------------------|----------------------------------|------------------------------|
|                                   | Master           | Client (without radar detection) | Client(with radar detection) |
| DFS Detection Threshold           | Yes              | Not required                     | Yes                          |
| Channel Closing Transmission Time | Yes              | Yes                              | Yes                          |
| Channel Move Time                 | Yes              | Yes                              | Yes                          |
| U-NII Detection Bandwidth         | Yes              | Not required                     | Yes                          |
| Client Beacon Test                | N/A              | Yes                              | Yes                          |

| Additional requirements for devices with multiple bandwidth modes  | Operational Mode                             |  |
|--|--|--|
|  | Master Device or Client with Radar Detection | Client Without Radar Detection                       |
| <b>U-NII Detection Bandwidth and Statistical Performance Check</b>   | All BW modes must be tested                  | Not required   |
| <b>Channel Move Time and Channel Closing Transmission Time</b>   | Test using widest BW mode available          | Test using the widest BW mode available for the link |
| <b>All other tests</b>   | Any single BW mode                           | Not required   |
| <b>Note</b><br>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. |  |  |

**Table 3: Interference Threshold values, Master or Client incorporating In-Service**

| Maximum Transmit Power   | Value (see note) |
|--|------------------|
| $\geq 200$ 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. |                  |

**Table 4: DFS Response requirement values**

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

## Table 5 – Short Pulse Radar Test Waveforms

| Radar Type                  | Pulse Width (Microseconds) | PRI (Microseconds) | Pulses  | Minimum Percentage of Successful Detection | Minimum Trials |
|-----------------------------|----------------------------|--------------------|---|--|----------------|
| 0                           | 1                          | 1428               | 18  | 60%  | 30             |
| 1                           | 1                          | Test A<br>Test B   | Roundup $\left\{ \left( \frac{1}{360} \right) \cdot \left( \frac{19 \cdot 10^6}{\text{PRI}_{\mu\text{sec}}} \right) \right\}$ | 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            |

Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a

Test B: 15 unique PRI values randomly selected within the range of 518-3066  $\mu\text{sec}$ , with a minimum increment of 1  $\mu\text{sec}$ , excluding PRI values selected in Test A

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.

If more than 30 waveforms are used for Short Pulse Radar Type 1, then each additional waveform is generated with Test B and must also be unique and not repeated from the previous waveforms in Tests A or B.

The aggregate is the average of the percentage of successful detections of short pulse radar types 1-4.



## 6. INSTRUMENT CALIBRATION

### MEASUREMENT EQUIPMENT USED

#### Test Equipment List

| Dynamic Frequency Selection |              |         |               |                  |                 |
|-----------------------------|--------------|---------|---------------|------------------|-----------------|
| Name of Equipment           | Manufacturer | Model   | Serial Number | Calibration Date | Calibration Due |
| Spectrum Analyzer           | RS           | FSU26   | 200789        | 2015-8-10        | 2016-8-9        |
| Vector Signal Generator     | R&S          | SMU200A | US42340162    | 2016-3-3         | 2016-3-2        |
| Horn-antenna                | SCHWARZBECK  | 9120D   | D:266         | 2016-3-7         | 2017-3-5        |
| Horn-antenna                | SCHWARZBECK  | 9120D   | D:267         | 2015-11-10       | 2016-11-9       |

**Remark:** Each piece of equipment is scheduled for calibration once a year.

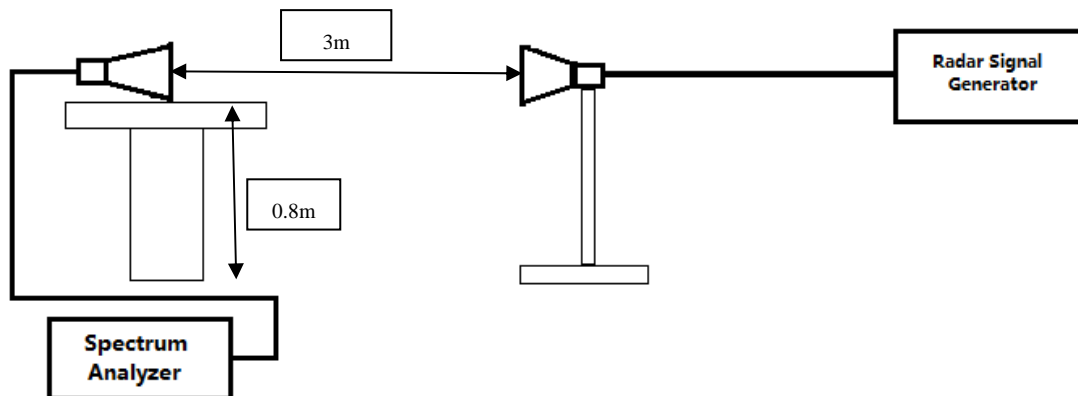
## 7. CALIBRATION SETUP AND DFS TEST RESULTS

### 7.1 CALIBRATION OF RADAR WAVEFORM

#### 7.1.1 RADAR WAVEFORM CALIBRATION PROCEDURE

The Interference Radar Detection Threshold Level is  $(-62\text{dBm}) + (0) [\text{dBi}] + 1 \text{ dB} = -61\text{dBm}$  that had been taken into account the output power range and antenna gain. The following equipment setup was used to calibrate the radiated Radar Waveform. A vector signal generator was utilized to establish the test signal level for radar type 0. During this process there were 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 3 MHz to measure the type 0 radar waveform. The spectrum analyzer had offset  $-7.4\text{dB}$  to compensate receiving horn antenna gain  $11.20\text{dBi}$  and RF cable loss  $3.8\text{dB}$ . The vector signal generator amplitude was set so that the power level measured at the spectrum analyzer was  $(-62\text{dBm}) + (0) [\text{dBi}] + 1\text{dB} = -61\text{dBm}$ . Capture the spectrum analyzer plots on short pulse radar waveform.

#### 7.1.2 RADIATED CALIBRATION SETUP

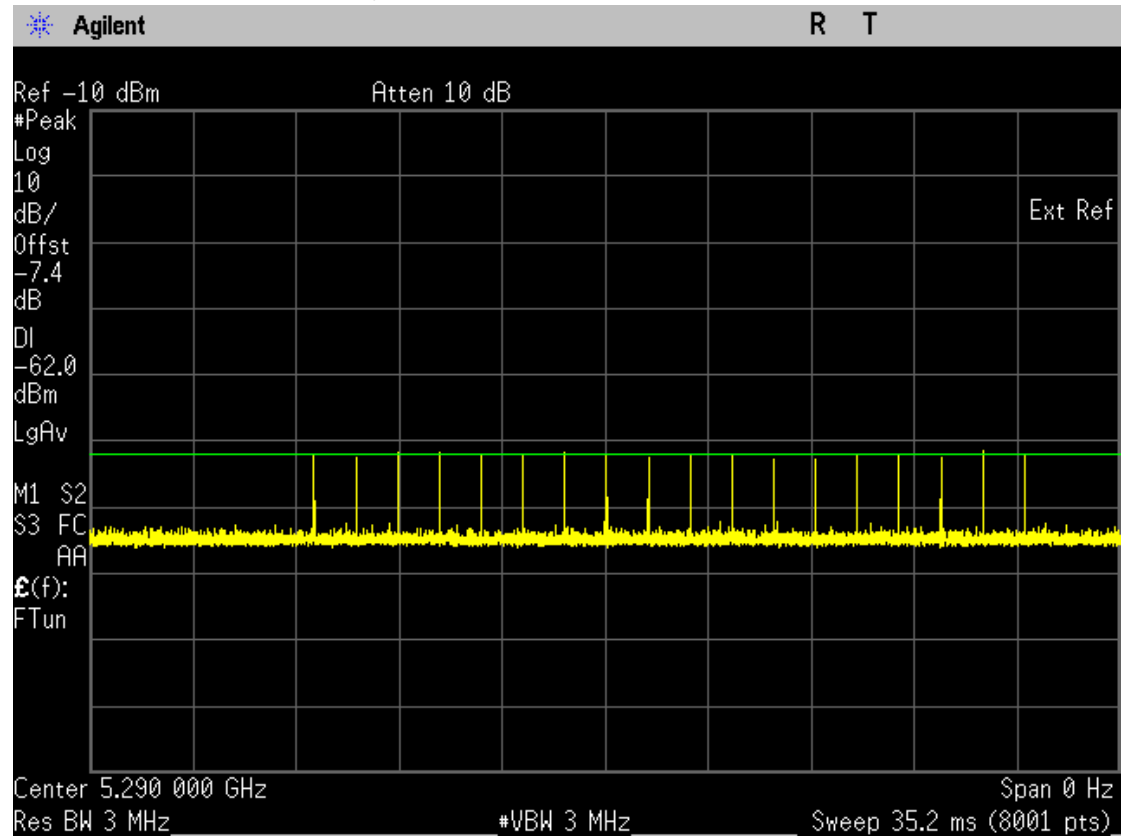


#### 7.1.3 CALIBRATION DEVIATION

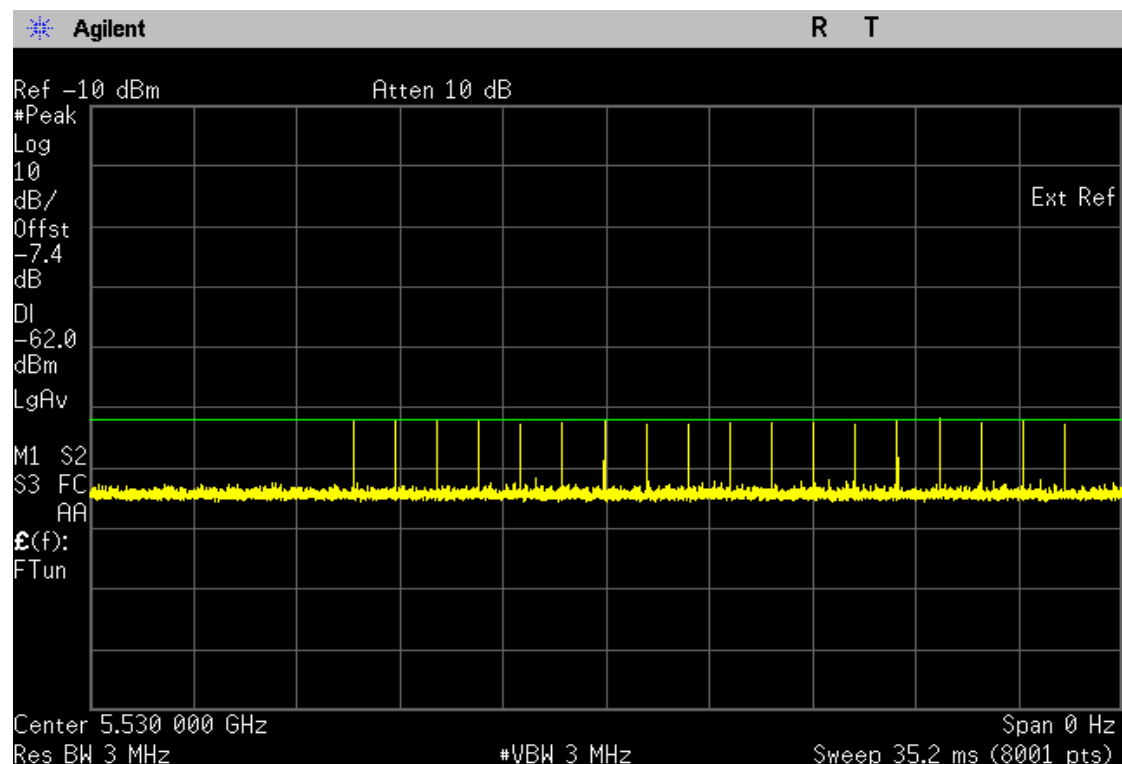
There is no deviation with the original standard.

## 7.1.4 RADAR WAVEFORM CALIBRATION RESULT

80MHz / 5290 MHz- Radar Type 0



80MHz / 5530 MHz- Radar Type 0





## **7.2 IN-SERVICE MONITORING: CHANNEL MOVE TIME, CHANNEL CLOSING TRANSMISSION TIME AND NON-OCCUPANCY PERIOD**

### **7.2.1 LIMIT OF IN-SERVICE MONITORING**

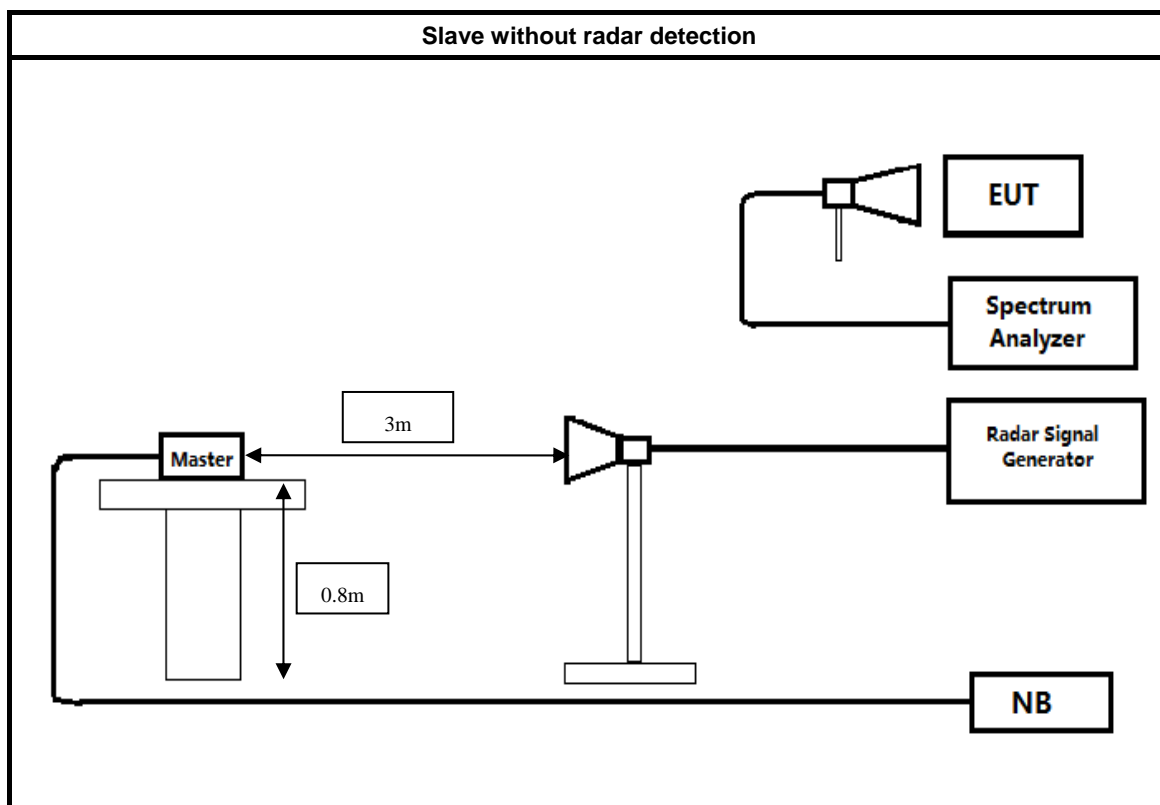
The EUT has In-Service Monitoring function to continuously monitor the radar signals, If radar is detected, it must leave the channel (Shutdown). The Channel Move Time to cease all transmissions on the current Channel upon detection of a Radar Waveform above the DFS Detection Threshold within 10 sec. The total duration of Channel Closing Transmission Time is 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. Non-Occupancy Period time is 30 minute during which a Channel will not be utilized after a Radar Waveform is detected on that Channel. The non-associated Client Beacon Test is during the 30 minutes observation time. The EUT should not make any transmissions in the DFS band after EUT power up.

## 7.2.2 TEST PROCEDURES

1. The radar pulse generator is setup to provide a pulse at frequency that the Master and Client are operating. A type 0 radar pulse with a 1us pulse width and a 1428 us PRI is used for the testing.
2. The vector signal generator is adjusted to provide the radar burst (18 pulses) at a level of approximately -62dBm at the antenna of the Master device.
3. A trigger is provided from the pulse generator to the DFS monitoring system in order to capture the traffic and the occurrence of the radar pulse.
4. A U-NII device operating as a Client Device will associate with the Master at Channel. The MPEG file "TestFile.mpg" specified by the FCC is streamed from the "file computer" through the Master to the Client Device and played in full motion video using Media Player Classic Ver.6.4.8.6 in order to properly load the network for the entire period of the test.
5. 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. At time T0 the Radar Waveform generator sends a Burst of pulse of the radar waveform at Detection Threshold + 1dB.
6. 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 seconds plot is 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 zoom in 600ms plot of the Short Pulse Radar Type.
7. 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:  $Dwell (1.5ms) = S (12000ms) / B (8001)$ ; 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:  $C (ms) = N \times Dwell (1.5 ms)$ ; 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.
8. Measure the EUT for more than 30 minutes following the channel move time to verify that no transmissions or beacons occur on this Channel.

## 7.2.3 TEST SETUP

Radiated Test Setup Photo



## 7.2.4 TEST DEVIATION

There is no deviation with the original standard.

## 7.2.5 RESULT OF CHANNEL MOVE TIME, CHANNEL CLOSING TRANSMISSION TIME AND NON-OCCUPANCY PERIOD FOR CLIENT BEACON TEST

|                    |                                |                            |        |
|--------------------|--------------------------------|----------------------------|--------|
| <b>Test Mode :</b> | Client without radar detection | <b>Temperature:</b>        | 20°C   |
| <b>Test By:</b>    | James.Yan                      | <b>Relative Humidity :</b> | 45~48% |

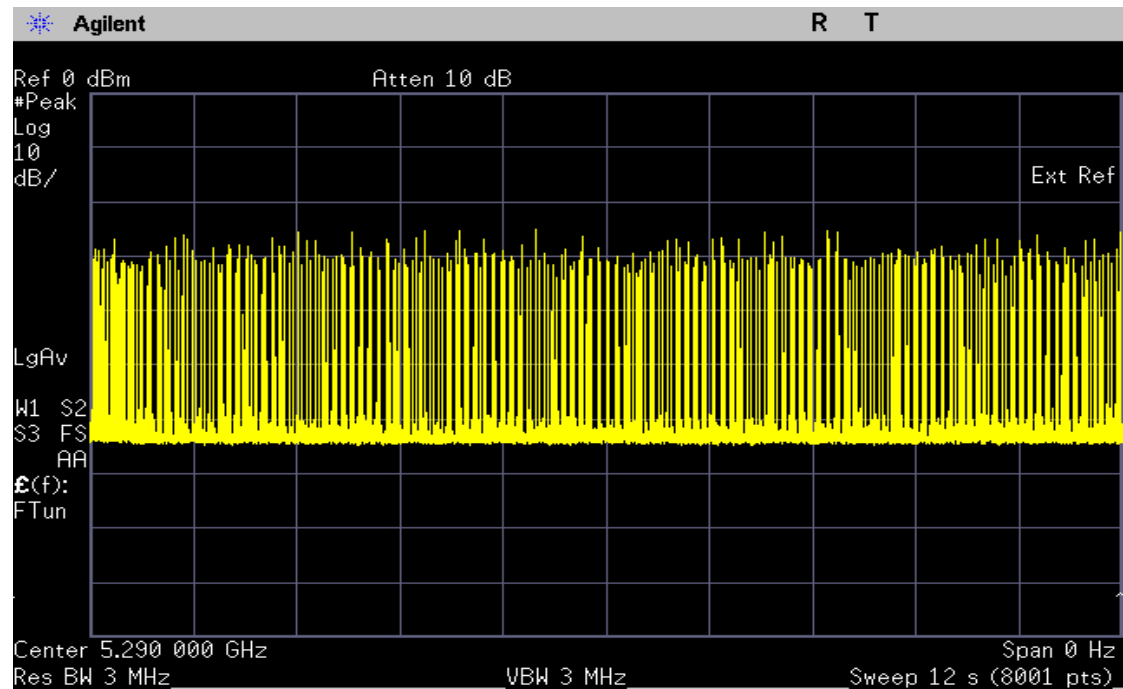
| BW/Channel    | Test Item                         | Test Result    | Limit    | Pass/Fail |
|---------------|-----------------------------------|----------------|----------|-----------|
| 80MHz/5290MHz | Channel Move Time                 | 409.5 ms       | < 10s    | Pass      |
|               | Channel Closing Transmission Time | 200ms + 4.5 ms | < 260ms  | Pass      |
|               | Non-Occupancy Period              | ≥ 30           | ≥ 30 min | Pass      |
| 80MHz/5530MHz | Channel Move Time                 | 355.5 ms       | < 10s    | Pass      |
|               | Channel Closing Transmission Time | 200ms + 6.0 ms | < 260ms  | Pass      |
|               | Non-Occupancy Period              | ≥ 30           | ≥ 30 min | Pass      |

**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.

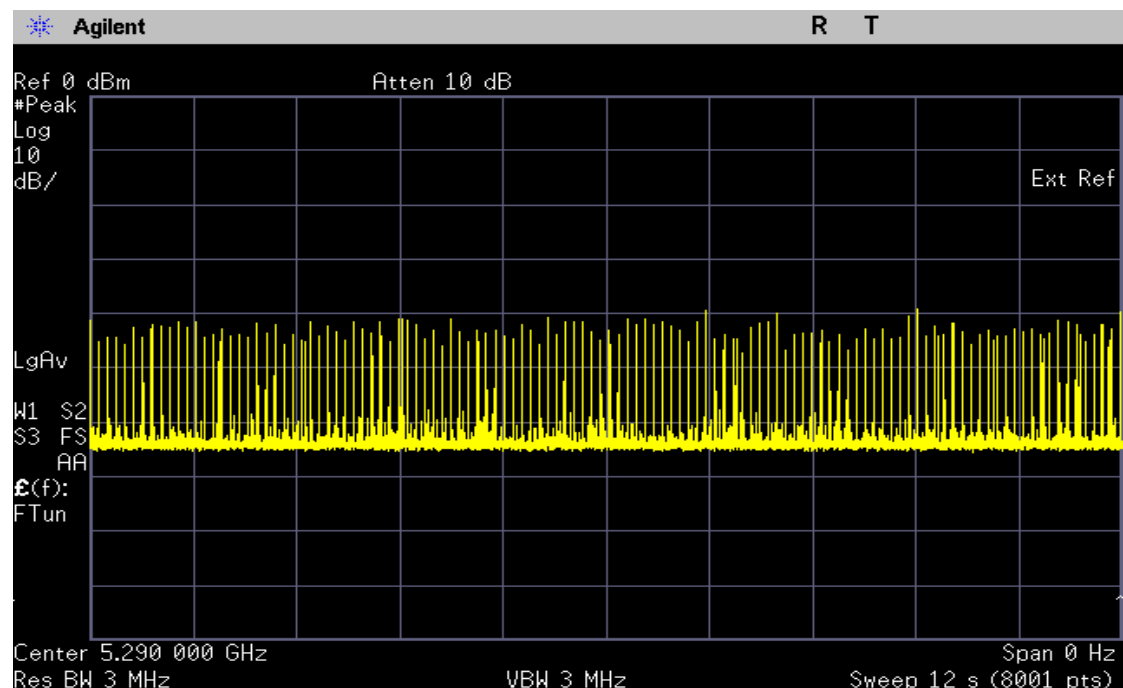
## 7.2.6 CHANNEL MOVE TIME, CHANNEL CLOSING TRANSMISSION TIME AND NON-OCCUPANCY PERIOD FOR CLIENT BEACON TEST PLOTS

Data Traffic and Noise Floor Plots

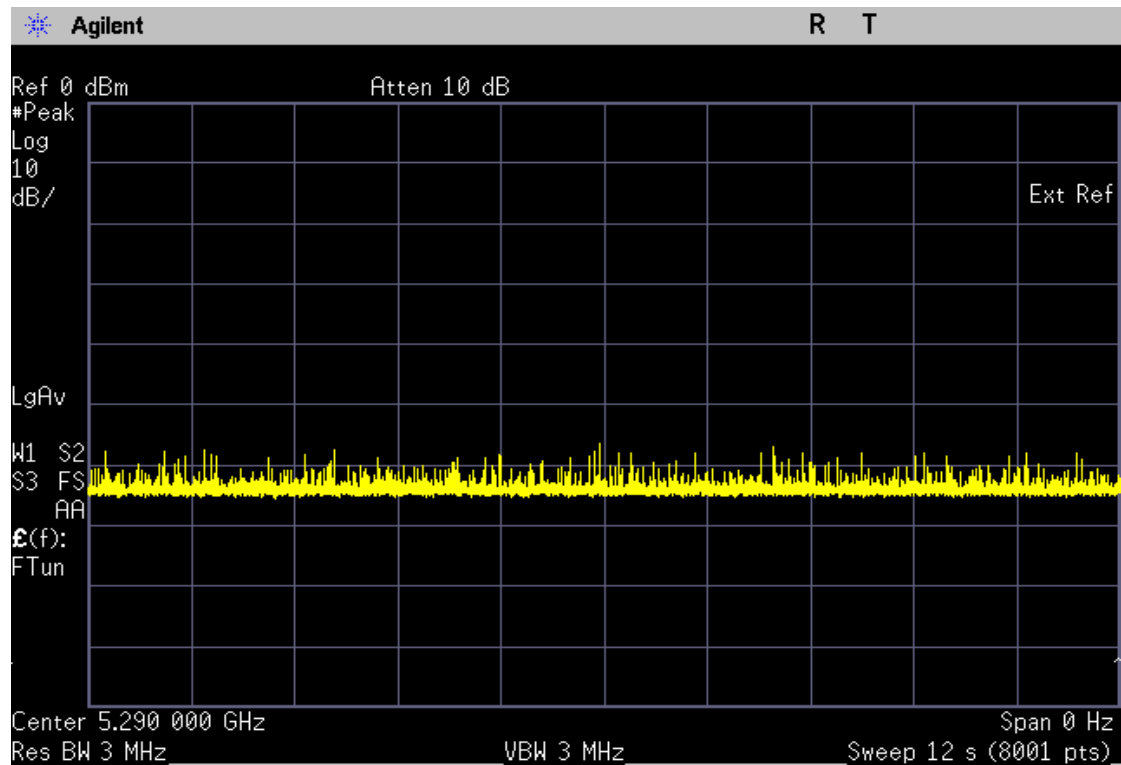
EUT data traffic (Client)- 80MHz / 5290 MHz



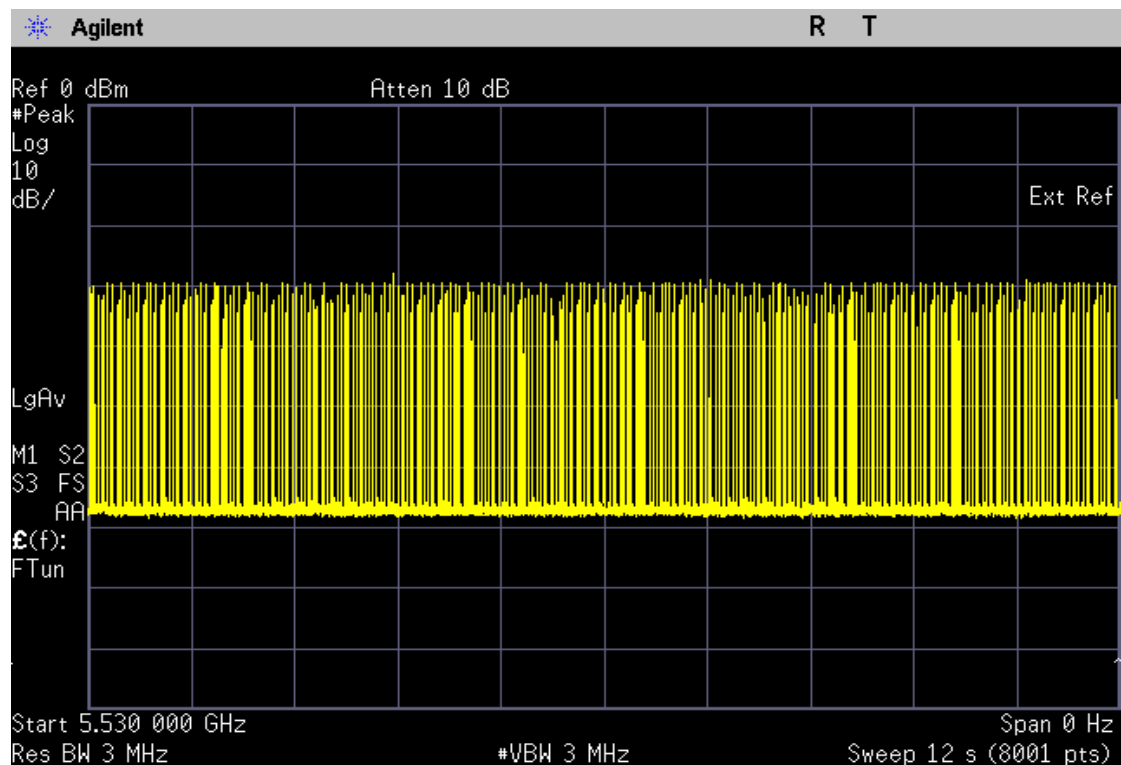
Access Point data traffic (Master) - 80MHz / 5290 MHz



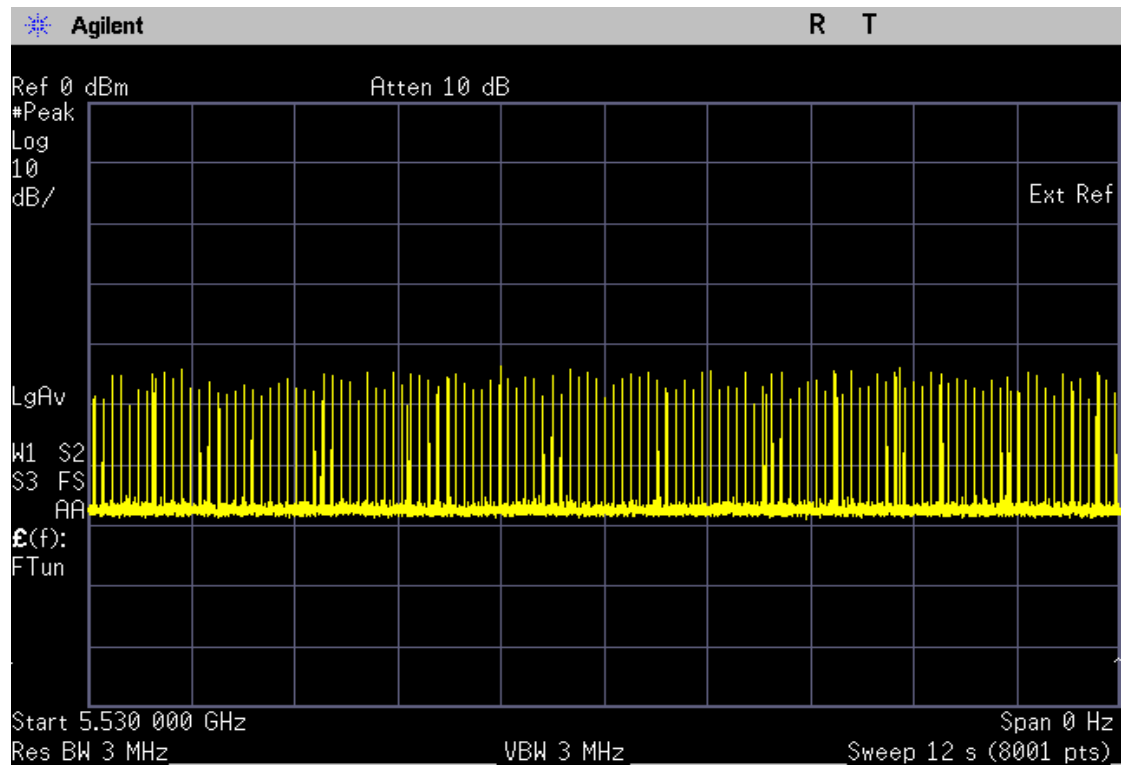
**Noise Floor (No transmission) - 80MHz / 5290 MHz**



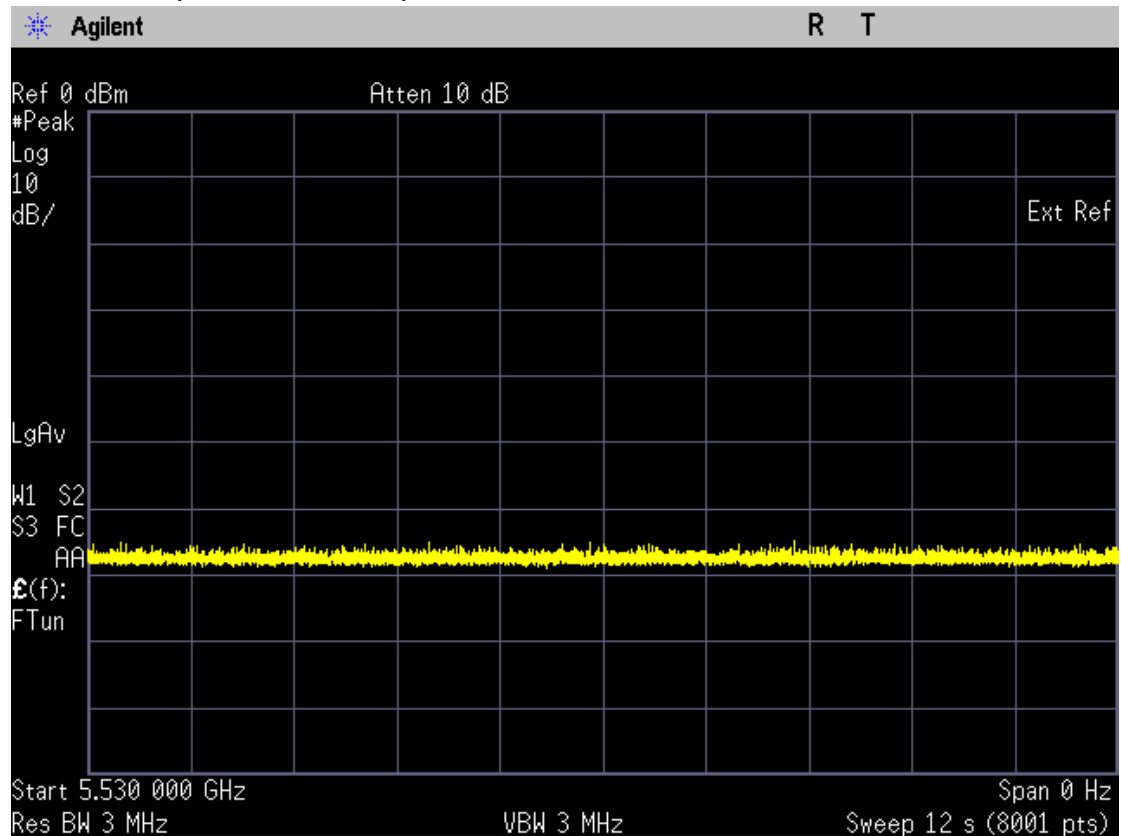
**EUT data traffic (Client)- 80MHz / 5530 MHz**



**Access Point data traffic (Master) - 80MHz / 5530 MHz**

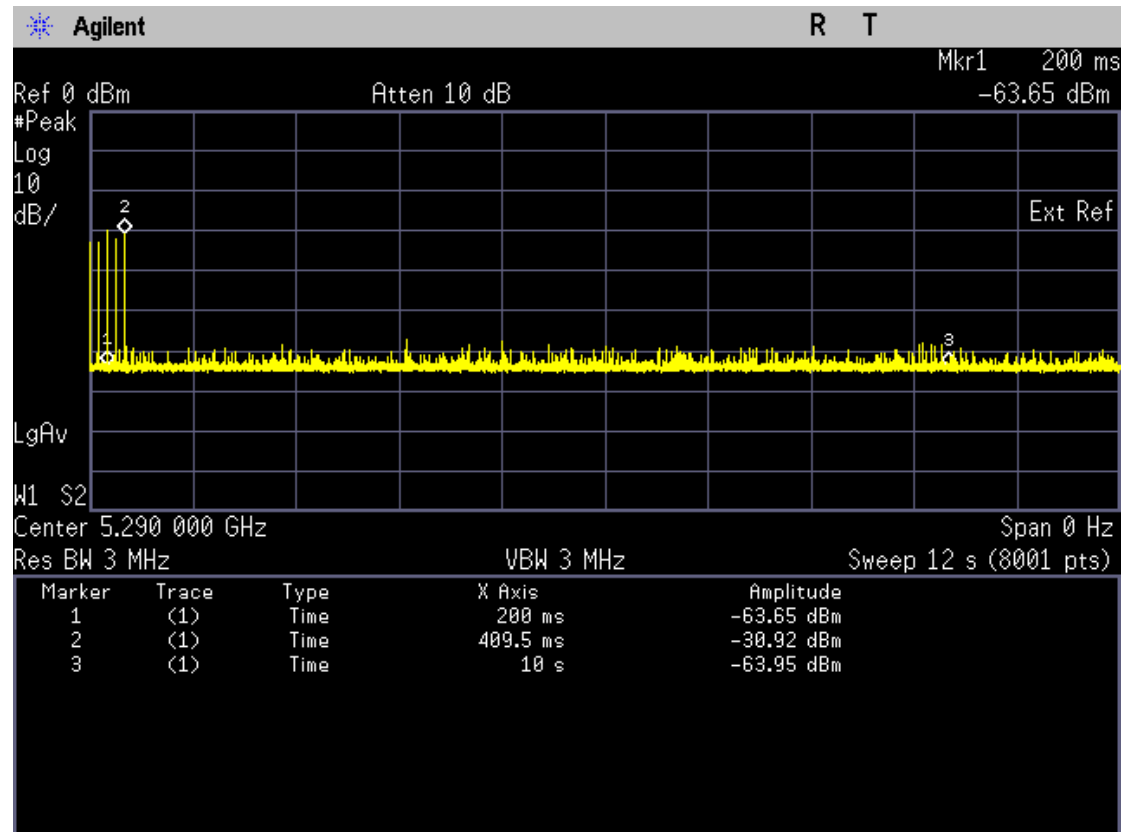


**Noise Floor (No transmission) - 80MHz / 5530 MHz**



**80MHz / 5290 MHz**

**Channel Move Time & Channel Closing Transmission Time**



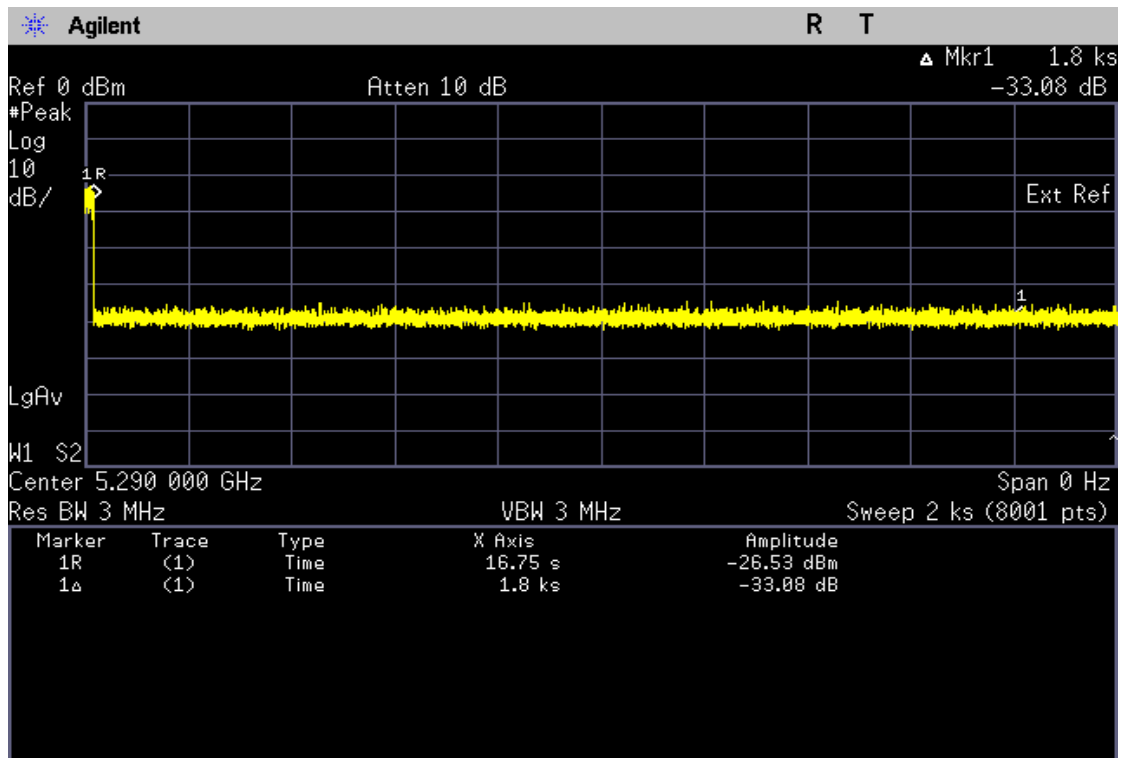
**Note:**

Dwell (1.5 ms)= Sweep Time (12000 ms) / Sweep Point Bins (8001)

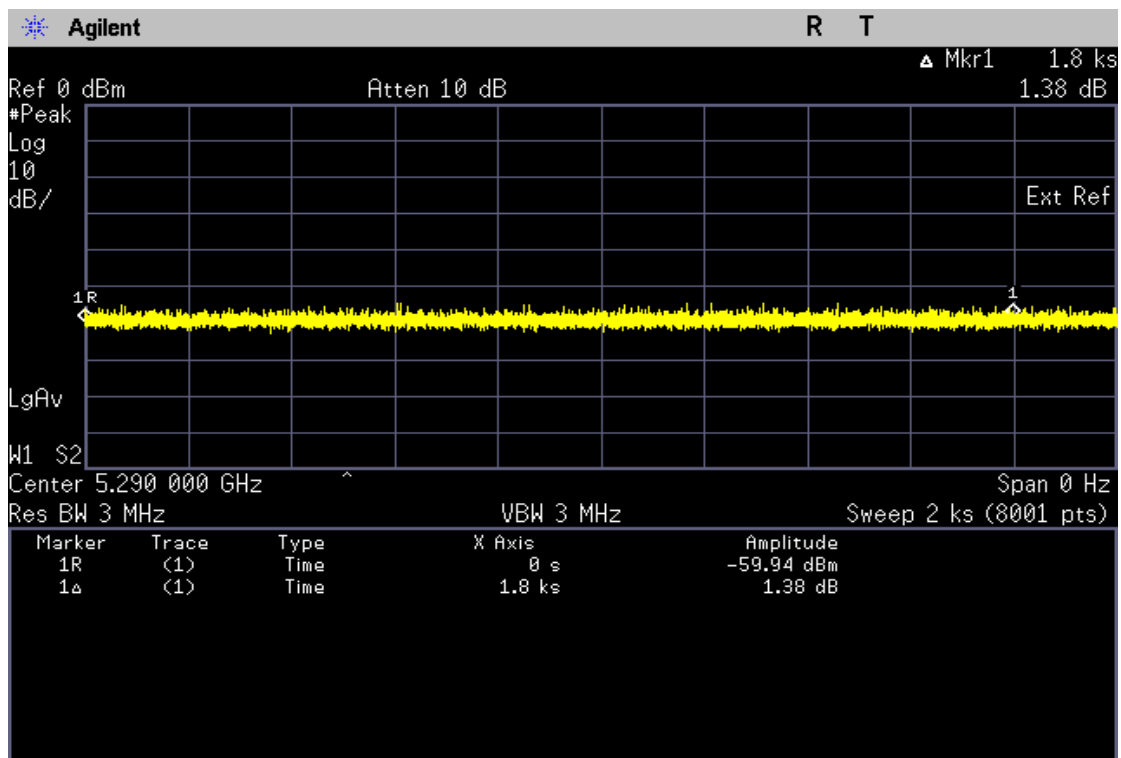
Channel Closing Transmission Time (200 + 4.5 ms) = 200 + Number (3 X Dwell (1.5 ms) < 260ms



## Non-Occupancy Period

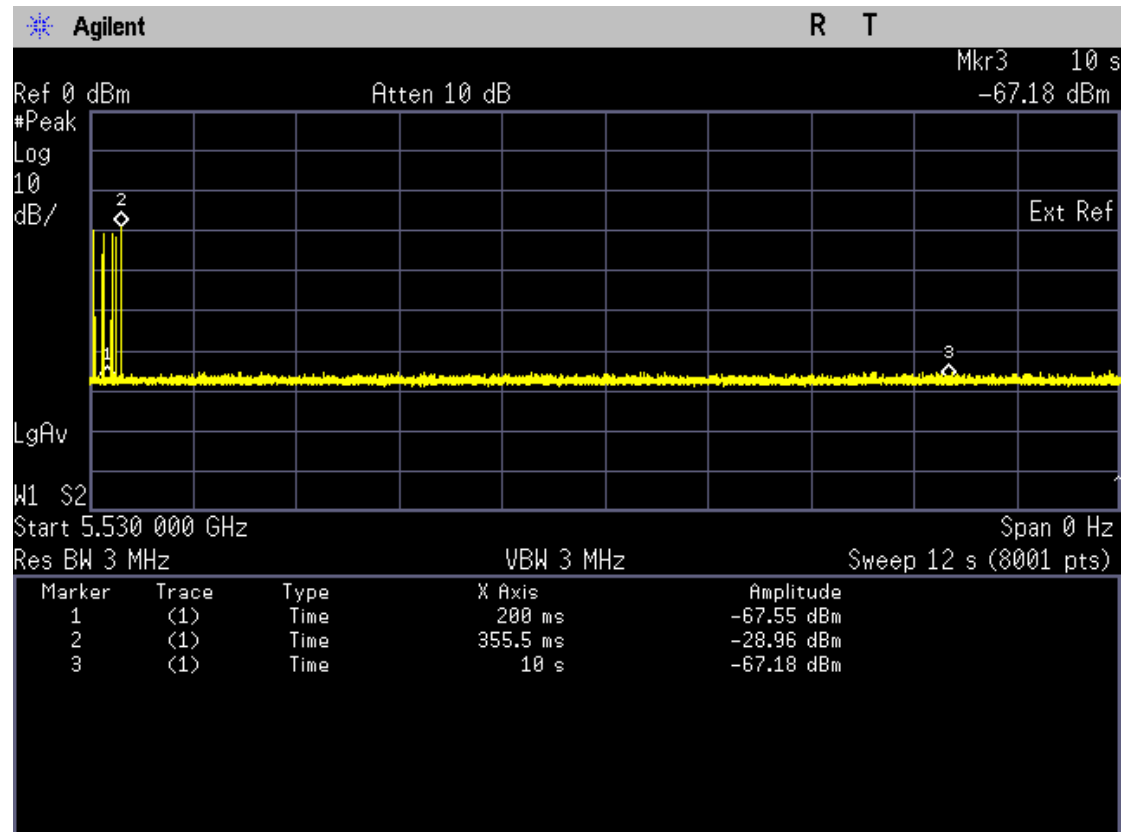


## Non-associated test Master was off. (beacon test)



**80MHz / 5530 MHz**

**Channel Move Time & Channel Closing Transmission Time**

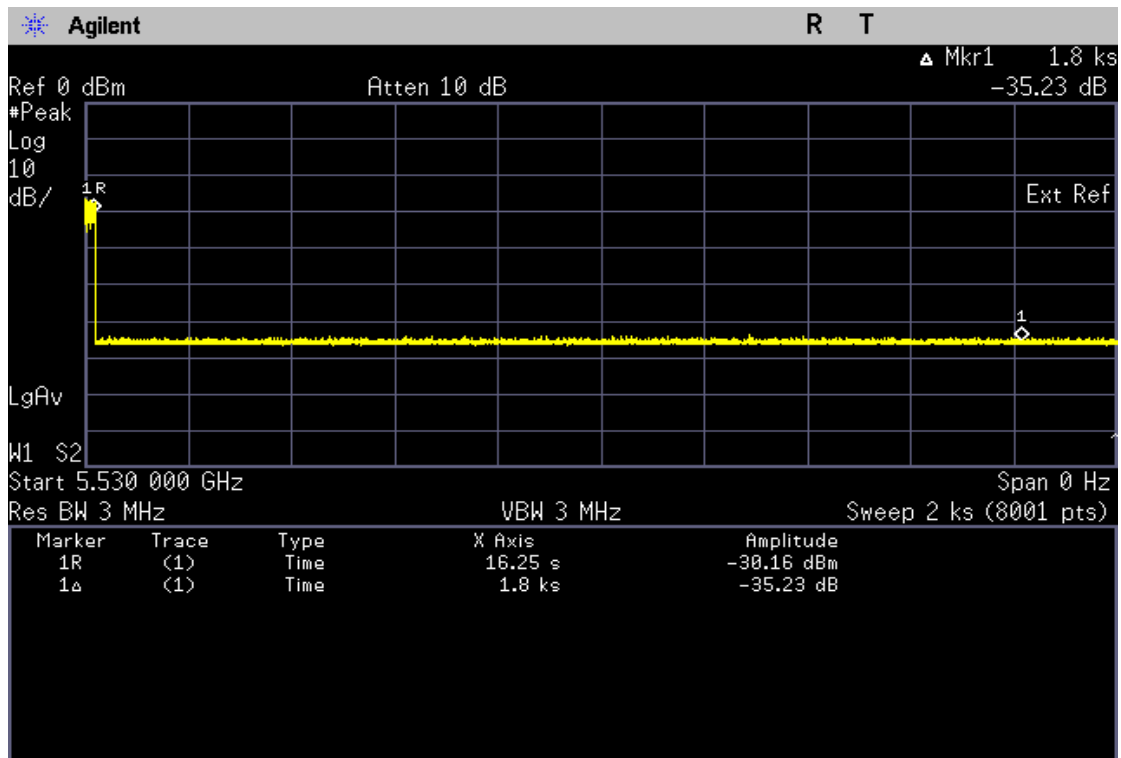


**Note:**

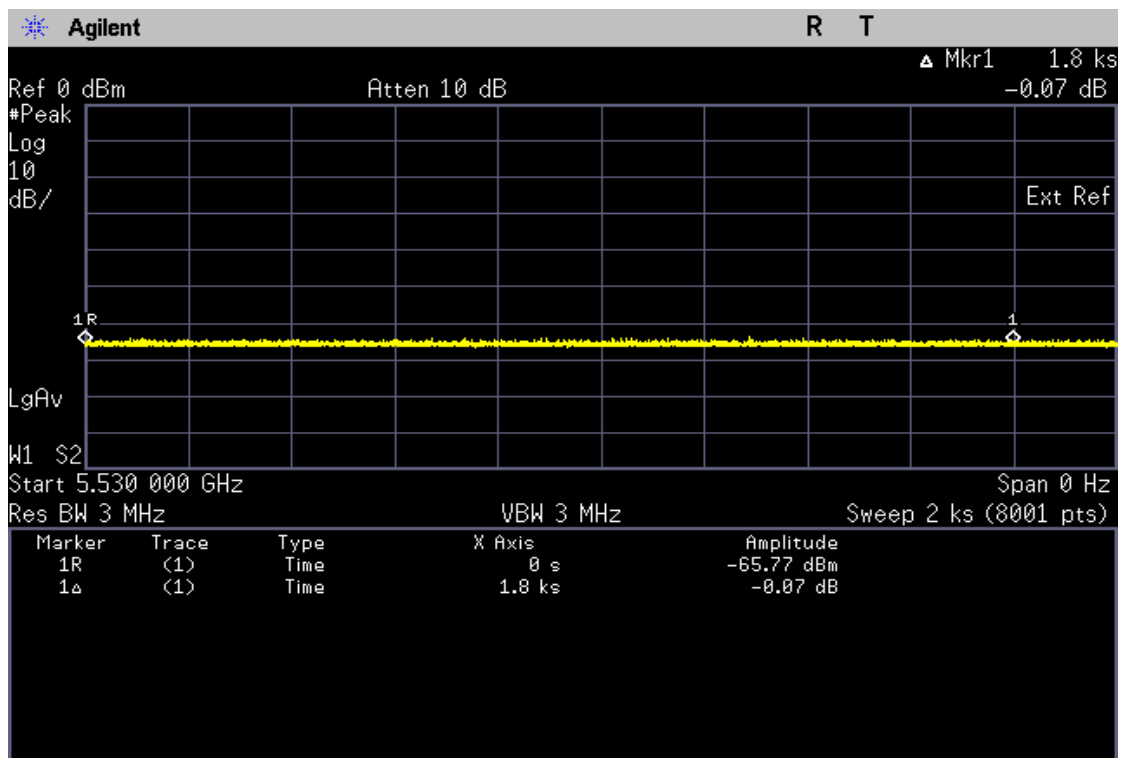
Dwell (1.5 ms) = Sweep Time (12000 ms) / Sweep Point Bins (8001)

Channel Closing Transmission Time (200 + 6.0 ms) = 200 + Number (4 X Dwell (1.5 ms)) < 260ms

## Non-Occupancy Period



## Non-associated test Master was off. (beacon test)



## APPENDIX 1 - PHOTOGRAPHS OF EUT SETUP

