



Test report No. : 4788166493A-US-R5-V0
Page : 1 of 19
Issued date : 2017/11/24
FCC ID : A43-WISP5

DFS TEST REPORT

Applicant : **Portwell, Inc.**
Model No. : **WiSP**
FCC ID : **A43-WISP5**
Test regulation : **FCC 47 CFR Part 15 Subpart E (Section 15.407)**
Test Result : **Complied**

Date of test: 2017/10/30~2017/11/3

Sample received Date: 2017/9/29

Representative test engineer:

Wayne Chen

Bill Chen

Approved by:



Testing Laboratory

3398

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1. Attestation of Test Results

Applicant

Company Name: Portwell, Inc.
Address: No. 242, Bo-Ai St., Shu-Lin Dist., New Taipei City 238, Taiwan
Model Name WiSP

Manufacturer

Company Name: Portwell, Inc.
Address: No. 242, Bo-Ai St., Shu-Lin Dist., New Taipei City 238, Taiwan
Model Name WiSP

APPLICABLE STANDARDS	
STANDARD	Test Results
FCC 47 CFR PART 15 Subpart E (Section 15.407)	PASS

1. This test report shall not be reproduced in full or partial, without the written approval of UL Taiwan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.

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2. Test Methodology

The tests documented in this report were performed in accordance with FCC CFR 47 Part 15.407, and KDB905462 D02 v02.

3. Facilities and Accreditation

Test Location	UL Verification Services Taiwan Co., Ltd
Address	Building B & E, No.372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County 310, Taiwan (R.O.C.)
Accreditation Certificate	UL Verification Services Inc. is accredited by TAF, Laboratory Code 3398. The full scope of accreditation can be viewed at http://www.taftw.org.tw/wSite/sp?xdUrl=/wSite/taf/lalab.jsp&mp=1

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4. Measurement Uncertainty

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k=2$.

Test Item	Measurement Frequency Range	K	U(dB)
Conducted disturbance at mains terminals ports	0.15MHz ~ 30MHz	2	2.6
RF Conducted	9 kHz - 40GHz	2	0.94
Radiated disturbance below 30MHz	9 kHz - 30 MHz	2	2.4
Radiated disturbance below 1 GHz	30MHz ~ 1GHz	2	5.5
Radiated disturbance above 1GHz	1GHz ~ 40GHz	2	5.0

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5. Equipment under Test

5.1. Description of EUT

Product	Wireless Service Platform	
Model Name	WiSP	
Power Supply	1. EUT power Rating : 100-240V 2. Internal Battery Rating:11.1V, 2500mAh / 28Wh	
Operation Mode	Client without radar detection function without ad-hoc function	
Operating Frequency	802.11a/n HT20	5260~5320 MHz
		5500~5700 MHz (exclude 5600~5650MHz)
	802.11n HT40	5270~5310 MHz
		5510~5670 MHz (exclude 5600~5650MHz)
Data rate	802.11a	6, 9, 12, 18, 24, 36, 48, 54 Mbps
	802.11n HT20/HT40	MCS 0~15
Type of Modulation	802.11a/n : OFDM(BPSK,QPSK,16-QAM,64-QAM)	
Number of channels	802.11a / HT20 : 12 Channels 802.11n HT40: 5 Channels	

Modulation	Chain 0	Chain 1
802.11a	V	X
802.11n HT20	V	V
802.11n HT40	V	V

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5.2. Software And Firmware

The EUT firmware installed during testing was version 0.23.

5.3. Test Condition

Test Item	Test Site No.	Environmental Condition	Input Power
Antenna Port Conducted Measurement	SR4	24°C / 60%RH	120Vac / 60Hz

5.4. Description Of Available Antennas

Frequency Band (GHz)	Brand Name	Model Name	Antenna Type	Antenna Gain(dBi)	
				Chain 0	Chain 1
5	Aristotle	RFA-25-L2M2	Dipole Antenna	2	2

5.5. Support Equipment

Item	Equipment	Manufacturer	Model	FCC ID
1	802.11ac Dual Band concurrent Wall-mount AP	Edimax	WAP-1750	NDD9576791401

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6. Test Equipment

Test Equipment List					
Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
Antenna Port Conducted Measurement					
Spectrum Analyzer	Keysight	N9010A	MY56070834	Nov. 21, 2016	1 year
Signal Generator	Keysight	N5182B	MY56200244	Dec. 19, 2016	1 year

UL Software

Software	Test Item	Version
N7607B Signal Studio	DFS Radar Profiles	3.0.0.0
ISMointor10	DFS measurement	10.0.0.0

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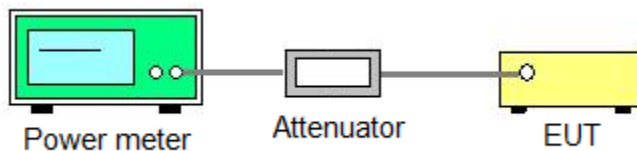
7. Test Result

7.1. Transmit Power Control (TPC)

Requirements

Transmit power control (TPC). U-NII devices operating in the 5.25-5.35 GHz band and the 5.47-5.725 GHz band 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.

Test Setup



Test Data

N/A, The e.i.r.p is less than 500 mW.

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7.2. Dynamic Frequency Selection (DFS)

Requirements

Table 1: Applicability of DFS Requirements Prior to Use of a Channel

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

Table 2: Applicability of DFS requirements during normal operation

Requirement	Operational Mode	
	Master Device or Client with Radar Detection	Client Without Radar Detection
<i>DFS Detection Threshold</i>	Yes	Not required
<i>Channel Closing Transmission Time</i>	Yes	Yes
<i>Channel Move Time</i>	Yes	Yes
<i>U-NII Detection Bandwidth</i>	Yes	Not required

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

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The calibrated radiated DFS Detection Threshold level is set to -64 dBm. The tested level is lower than the required level hence it provides a margin to the limit.

Table 3: DFS Detection Thresholds for Master Devices and Client Devices with Radar Detection

Maximum Transmit Power	Value (See Notes 1, 2, and 3)
EIRP \geq 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
<p>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. Note 3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.</p>	

Table 4: DFS Response Requirement Values

Parameter	Value
<i>Non-occupancy period</i>	Minimum 30 minutes
<i>Channel Availability Check Time</i>	60 seconds
<i>Channel Move Time</i>	10 seconds See Note 1.
<i>Channel Closing Transmission Time</i>	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.
<i>U-NII Detection Bandwidth</i>	Minimum 100% of the U-NII 99% transmission power bandwidth. See Note 3.
<p>Note 1: <i>Channel Move Time</i> and the <i>Channel Closing Transmission Time</i> should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst. Note 2: The <i>Channel Closing Transmission Time</i> is comprised of 200 milliseconds starting at the beginning of the <i>Channel Move Time</i> plus any additional intermittent control signals required to facilitate a <i>Channel</i> 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 <i>U-NII Detection Bandwidth</i> 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.</p>	

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Table 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	Roundup $\left\{ \left(\frac{1}{360} \right) \cdot \left(\frac{19 \cdot 10^6}{PRI_{\mu sec}} \right) \right\}$	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.					

Table 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

Table 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

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**Power Test Result**

Mode	Channel	Frequency (MHz)	Output Power (dBm)	Duty Cycle Factor (dB)	Total Power (dBm)	Output Power Limit (dBm)	Margin (dB)
802.11a Chain 0	52	5260	11.28	0	11.28	23.93	-12.65
	60	5300	11.20	0	11.20	23.87	-12.67
	64	5320	11.8	0	11.80	23.90	-12.10
	100	5500	11.53	0	11.53	23.91	-12.38
	116	5580	11.19	0	11.19	23.89	-12.70
	140	5700	11.25	0	11.25	23.92	-12.67

Mode	Channel	Frequency (MHz)	Output Power (dBm)		Output Power (mW)		Duty Cycle Factor (dB)	Total Power (dBm)	Output Power Limit (dBm)	Margin (dB)
			Chain 0	Chain 1	Chain 0	Chain 1				
802.11n HT20	52	5260	8.59	8.29	7.23	6.75	0	11.45	23.97	-12.52
	60	5300	8.54	8.65	7.14	7.33	0	11.61	23.94	-12.33
	64	5320	8.94	8.34	7.83	6.82	0	11.66	23.97	-12.31
	100	5500	8.36	8.45	6.85	7.00	0	11.42	23.94	-12.52
	116	5580	8.67	8.57	7.36	7.19	0	11.63	23.97	-12.34
	140	5700	8.47	8.36	7.03	6.85	0	11.43	23.98	-12.55

Mode	Channel	Frequency (MHz)	Output Power (dBm)		Output Power (mW)		Duty Cycle Factor (dB)	Total Power (dBm)	Output Power Limit (dBm)	Margin (dB)
			Chain 0	Chain 1	Chain 0	Chain 1				
802.11n HT40	54	5270	8.46	8.5	7.01	7.08	0	11.49	23.98	-12.49
	62	5310	8.71	8.17	7.43	6.56	0	11.46	23.98	-12.52
	102	5510	8.14	8.05	6.52	6.38	0	11.11	23.98	-12.87
	110	5550	8.77	8.16	7.53	6.55	0	11.49	23.98	-12.49
	134	5670	8.68	8.36	7.38	6.85	0	11.53	23.98	-12.45

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Test Setup

Setup for Client with injection at the Master

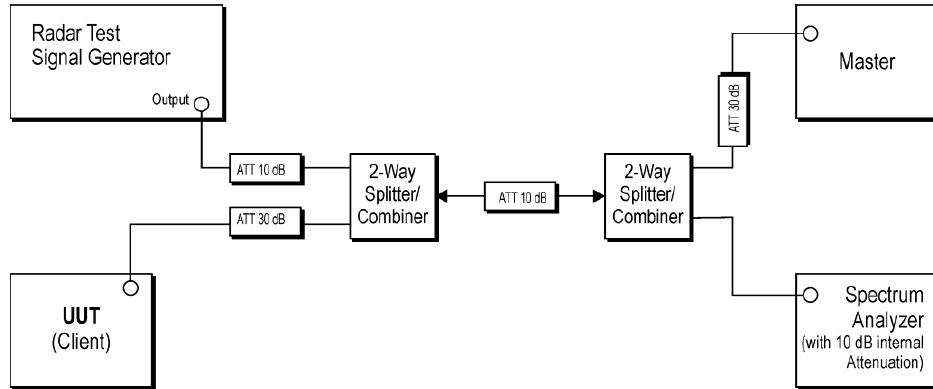


Figure 3: Example Conducted Setup where UUT is a Client and Radar Test Waveforms are injected into the Master

Test Data

Channel Move Time(s)	Limit(s)	Result
0.48	10	PASS

Channel Closing Transmission Time(ms)	Limit(ms)	Result
2.4	60	PASS

Non-Occupancy Period (min)	Limit(min)	Result
> 30	30	PASS

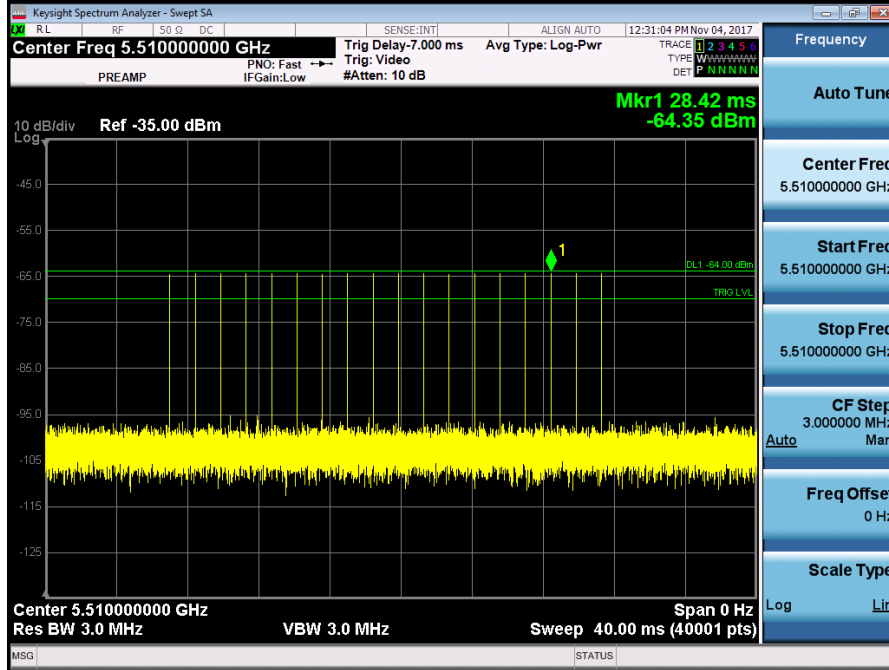
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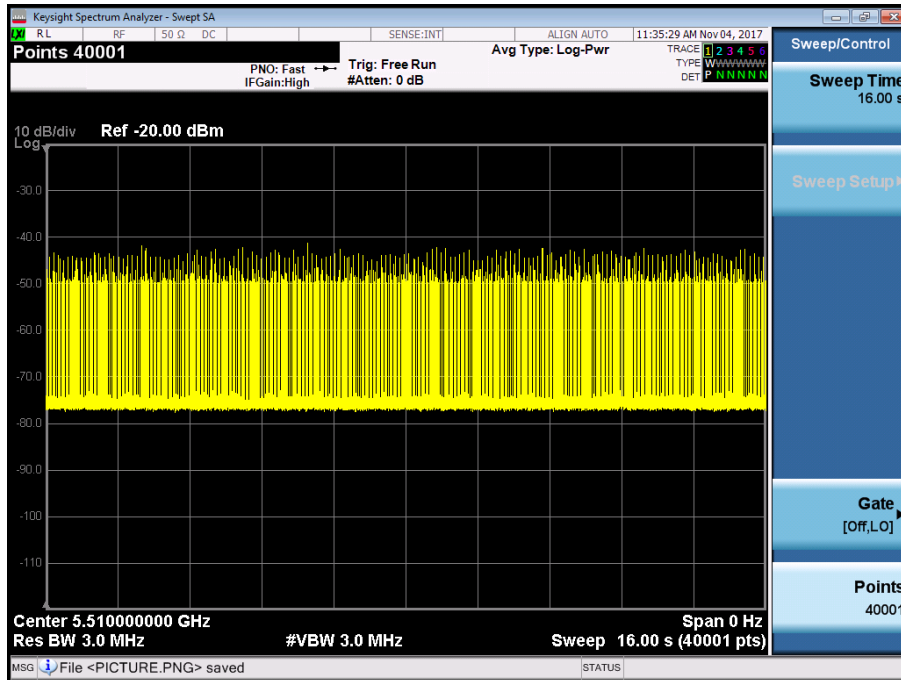
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Radar Waveform Type 0 5510MHz



Traffic Payload



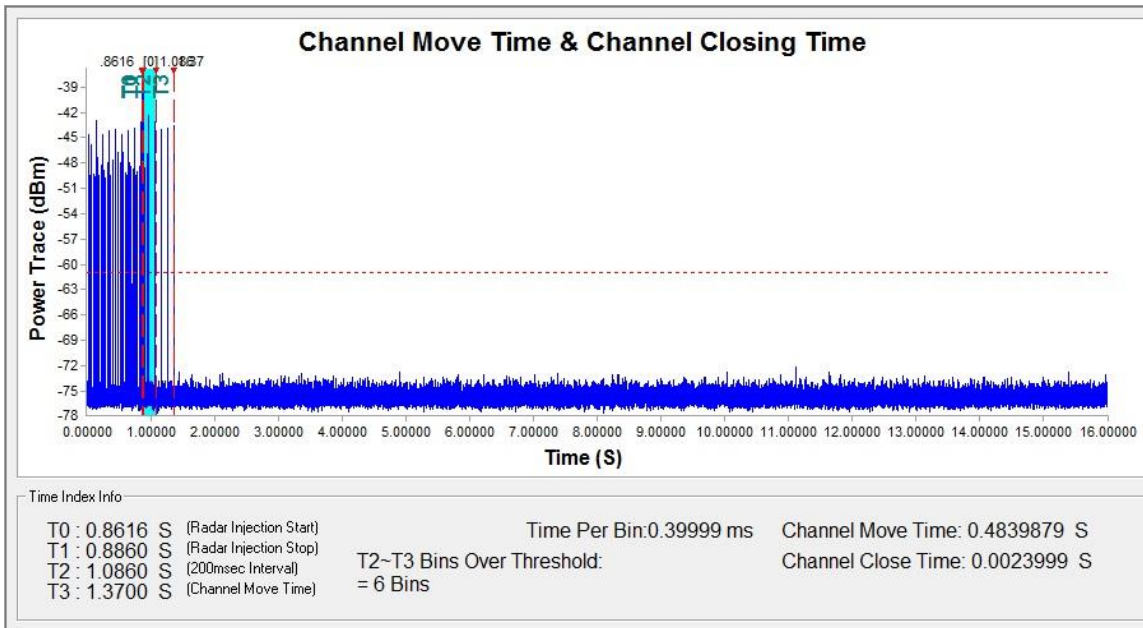
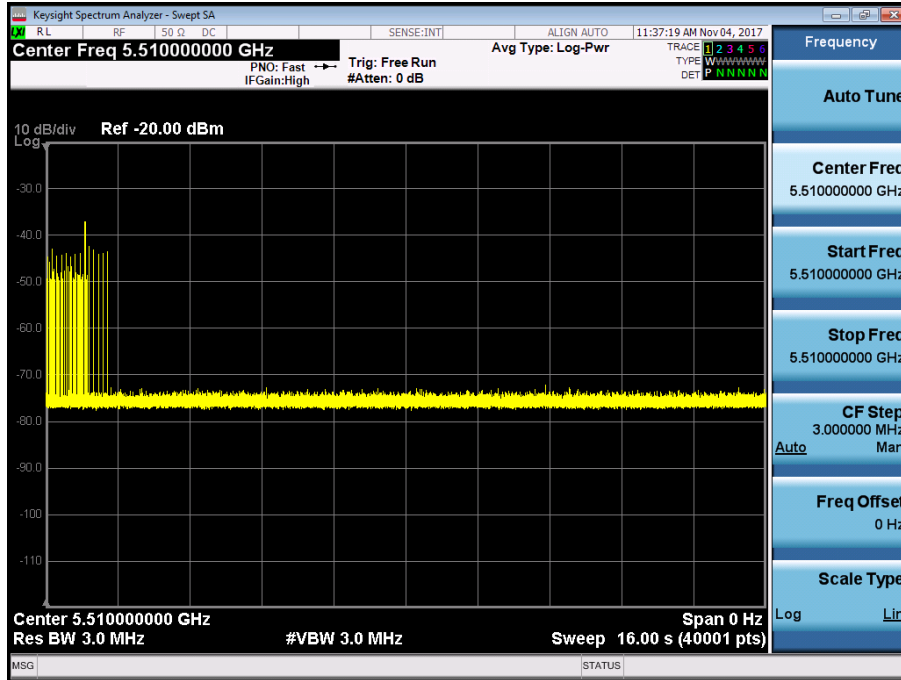
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Channel Move Time & Channel Closing Transmission Time



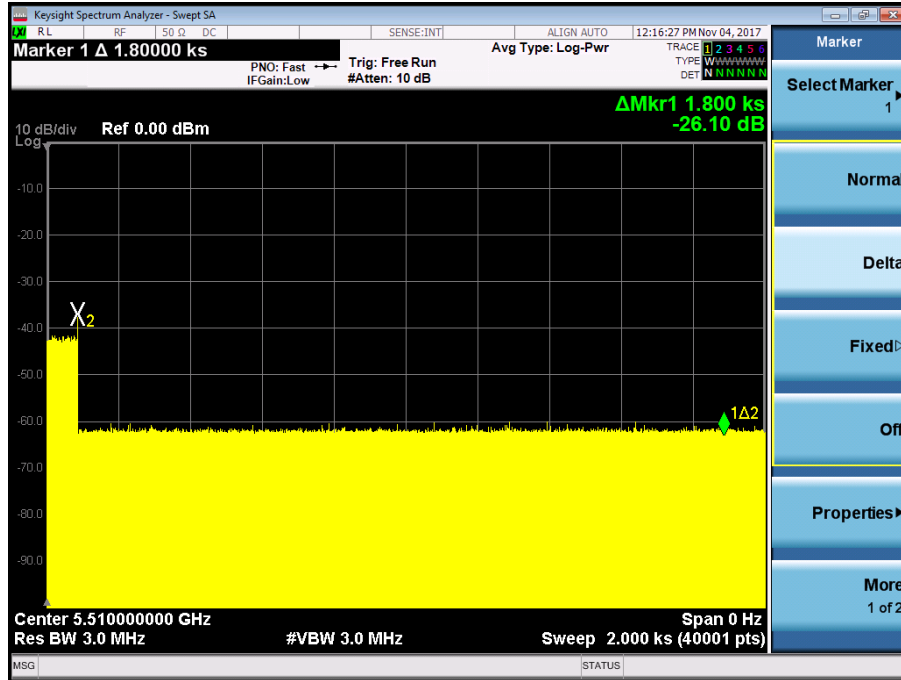
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Non-Occupancy Period



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8. DFS Measurement Setup Configuration



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