RF TEST REPORT

Report No.:	SET2016-17304
Product Name:	WiFi Module
FCC ID:	2AGM4-WUS14
IC:	20960-WUS14
Model No. :	WUS-AC14
Applicant:	Dongguan Digital AV Technology Corp., Ltd.
Address:	4th,5th&6th floor, building A, No. 39 Haibin Road, Wusha, Chang'an Dongguan China
Dates of Testing:	08/26/2016 — 09/28/2016
Issued by:	CCIC-SET
Lab Location:	Building 28/29, East of Shigu, Xili Industrial Zone, Xili Road, Nanshan District, Shenzhen, Guangdong, China **Tel:** 86 755 26627338 **Fax:** 86 755 26627238

Test Report

Product Name ..... :	WiFi Module
Brand Name ..... :	OPPO
Trade Name ..... :	OPPO
Applicant ..... :	Dongguan Digital AV Technology Corp., Ltd.
Applicant Address ..... :	4th,5th&6th floor, building A, No. 39 Haibin Road, Wusha, Chang'an Dongguan China
Manufacturer ..... :	Dongguan Digital AV Technology Corp., Ltd.
Manufacturer Address ..... :	4th,5th&6th floor, building A, No. 39 Haibin Road, Wusha, Chang'an Dongguan China
Test Standards ..... :	47 CFR Part 15 Subpart E §15.407 IC RSS-247(Issue 1, May 2015)
Test Result ..... :	PASS
Tested by ..... :	2016.09.29 Sunday.Hu, Test Engineer
Reviewed by..... :	2016.09.29 Zhu Qi, Senior Egineer
Approved by ..... :	2016.09.29 Wu Li'an, Manager

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Change History		
Issue	Date	Reason for change
1.0	2016.09.29	First edition

1. General Information

1.1. EUT Description

EUT Type	WiFi Module
Hardware Version	2UDP1603-0
Software Version	UDP20X-02-0729
EUT supports Radios application	WLAN2.4GHz 802.11b/g/n (HT20/HT40) WLAN5.0GHz 802.11a/n (HT20/40)/ac(VHT20/40/80)
Operation	☐Master device
	☐Slaver device with radar detection function
	☒ Slaver device without radar detection function
Modulation Type	CCK, DQPSK, DBPSK for DSSS 256QAM, 64QAM,16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode only
Transfer Rate	802.11a: 54/48/36/24/18/12/9/6 Mbps 802.11n : up to 135 Mbps 802.11ac: up to V9
Frequency Range	Band UNII-2A: 5250 ~ 5350MHz Band UNII-2C: 5470 ~ 5725MHz
Channel Bandwidth	802.11a: 20MHz 802.11n: 20MHz/40MHz 802.11ac: 20MHz/40MHz/80MHz
Channel Number	5250 MHz ~ 5350MHz: 4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20) 2 for 802.11n (HT40), 802.11ac (VHT40) 1 for 802.11ac (VHT80) 5470 MHz ~ 5725MHz: 11 for 802.11a, 802.11n (HT20), 802.11ac (VHT20) 5 for 802.11n (HT40), 802.11ac (VHT40) 1 for 802.11ac (VHT80)
Antenna Type	PCB Antenna
Antenna Gain	Antenna 0: 3.0dBi Antenna 1: 3.0dBi ;
Output Power (Max.)	802.11a: 14.06dBm 802.11n(HT20): 16.79dBm 802.11n(HT40): 16.89dBm 802.11ac(VHT20): 16.74dBm 802.11ac(VHT40): 16.83dBm 802.11ac(VHT80): 19.50dBm

1.2. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart E for the EUT FCC Certification:

No.	Identity	Document Title
1	47 CFR Part 15 Subpart E § 15.407	Radio Frequency Devices
2	IC RSS-247 (Issue 1, May 2015	Digital Transmission Systems (DTSs), Frequency Hopping Systems(FHSs) and Licence-Exemp Local Area Network (LE-LAN) Devices
3	KDB Publication 905462 D02v01	UNII DFS Compliance Procedures New Rules

Test detailed items/section required by FCC rules, IC rules and results are as below:

No.	FCC Rule	IC Rule	Description	Result
1	15.407	RSS-247. 6.3	Channel Move Time	PASS
2	15.407	RSS-247,6.3	Channel Closing Transmission Time	PASS
3	15.407	RSS-247,6.3	Non- Occupancy Period	PASS

1.3. Test Facility

Site	Compliance Certification Service(Shenzhen) Inc.
Location	No10-1, Mingkeda Logistics Park, No.18 Huanguan South Rd., Guan Lan Town, Baoan District, Shenzhen, China
FCC Registration No.	441872
IC Registration No.	2324I

2. U-NII DFS Rule Requirements

2.1. Working modes and required test items

The manufacturer shall state whether the UUT is capable of operating as a Master and/or a Client. If the UUT is capable of operating in more than one operating mode then each operating mode shall be tested separately. See tables 1 and 2 for the applicability of DFS requirements for each of the operational modes.

Table 1: Applicability of DFS Requirements prior to use a channel

Requirement	Operational Mode		
	Master	Client without radar detection	Client with radar detection
Non-Occupancy Period	√	Not required	√
DFS Detection Threshold	√	Not required	√
Channel Availability Check Time	√	Not required	Not required
Uniform Spreading	√	Not required	Not required
U-NII Detection Bandwidth	√	Not required	√

Table 2: Applicability of DFS Requirements during normal operation

Requirement	Operational Mode		
	Master	Client without radar detection	Client with radar detection
DFS Detection Threshold	√	Not required	√
Channel Closing Transmission Time	√	√	√
Channel Move Time	√	√	√
U-NII Detection Bandwidth	√	Not required	√

2.2. Test limits and radar signal parameters

DFS Detection thresholds for Master Devices and Client Devices with Radar Detection

Maximum Transmit Power	Value (See Note 1 and 2)
≥ 200 millwatt	-64 dBm
< 200 millwatt	-62 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.

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	100% of the UNII transmission 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 Waveform.
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 1 is used and for each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.

Parameters of DFS test signals

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.

Short pluse 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 Test B:15 unique PRI values randomly selected within the range of 518-3066 μsec, with a minimum increment of 1μsec, excluding PRI values selected in Test A	$\text{Roundup}\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot 10^5}{PRI_{\mu sec}}\right)\right\}$	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
Note 1: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.					

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

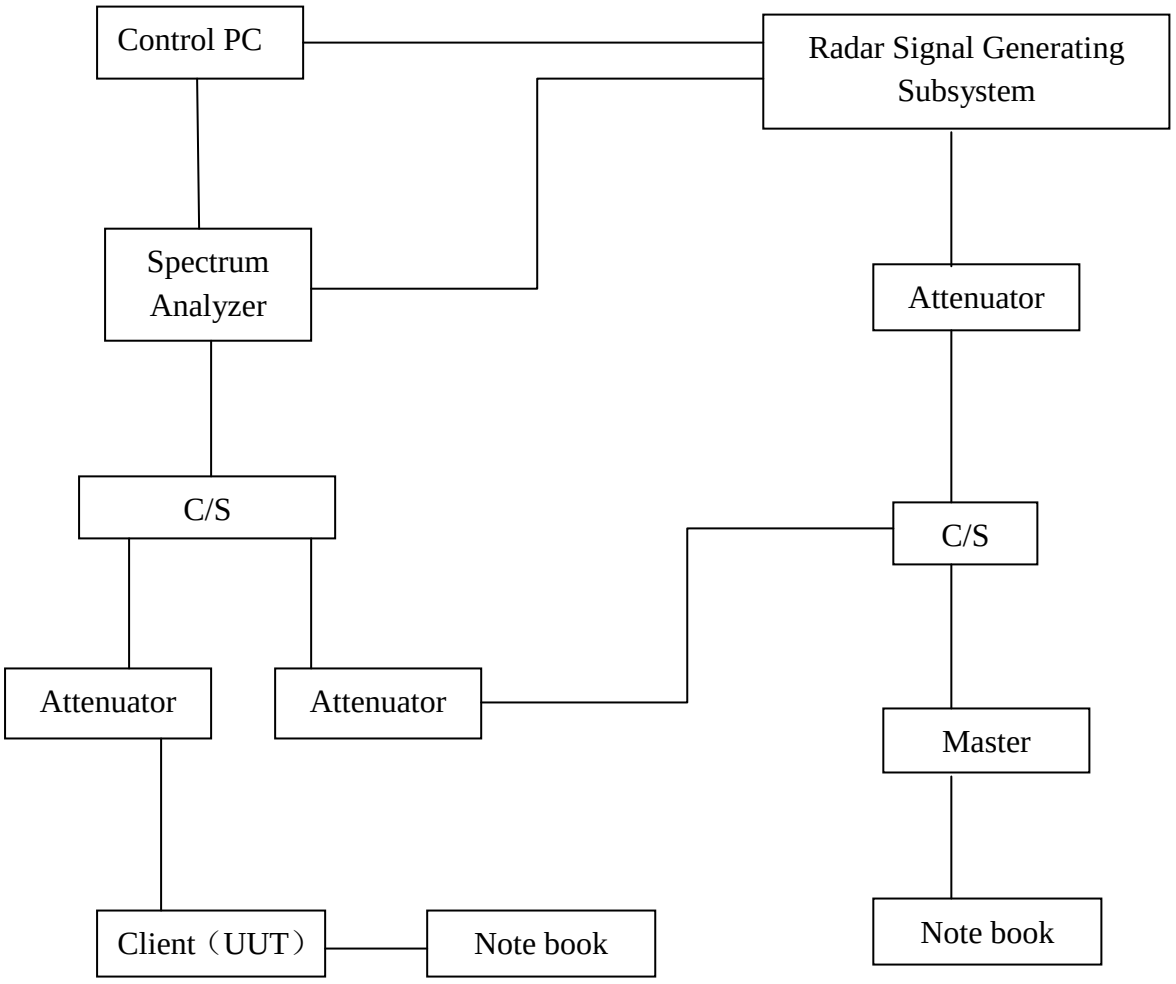
Frequency hopping radar test waveform

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

3. Test Procedure

3.1. DFS Test Setup configuration

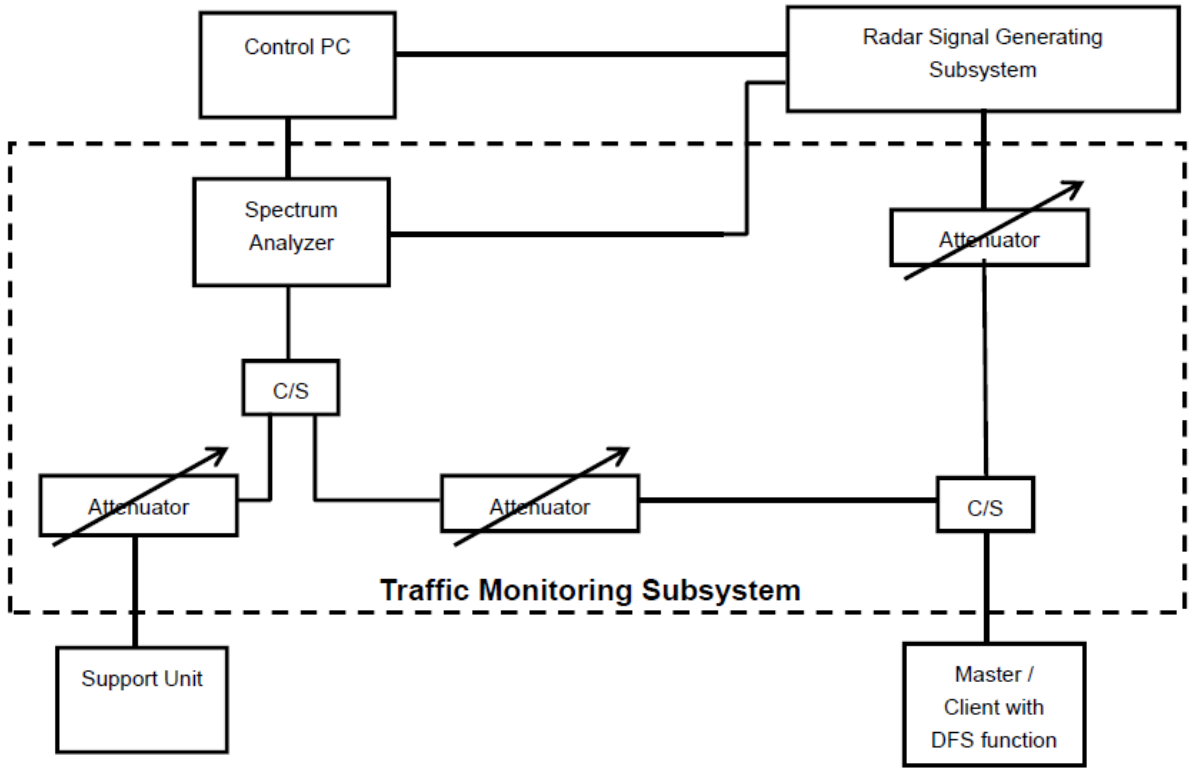
Client without Radar Detection Mode



The UUT is a UNII device operating in client mode without radar detection. The radar test signals are injected into the master device.

3.2. BVADT DFS Measurement system:

A complete BVADT DFS Measurement System consists of two subsystems: (1) the Radar Signal Generating Subsystem and (2) the Traffic Monitoring Subsystem. The control PC is necessary for generating the Radar waveforms in Table 1, 2. The traffic monitoring subsystem is specified to the type of unit under test (UUT).

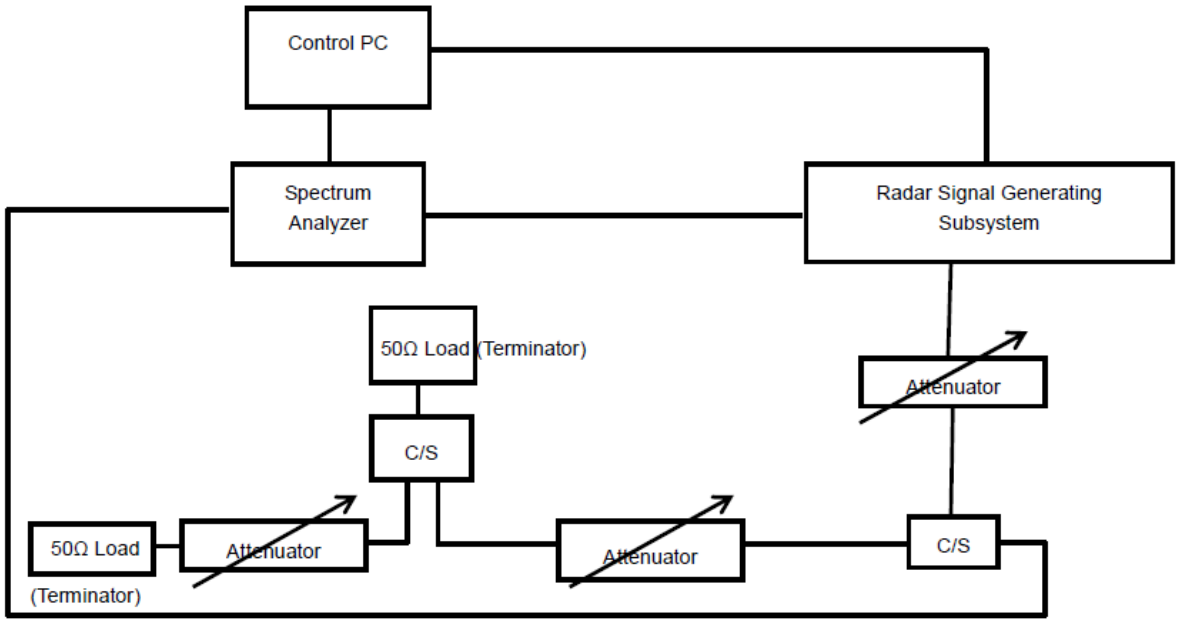


The test transmission will always be from the Master Device to the Client Device. While the Client device is set up to associate with the Master device and play the MPEG file (6 1/2Magic Hours) from Master device, the designated MPEG test file and instructions are located at: http://ntiacsd.ntia.doc.gov/dfs/.

Calibration of DFS detection threshold level:

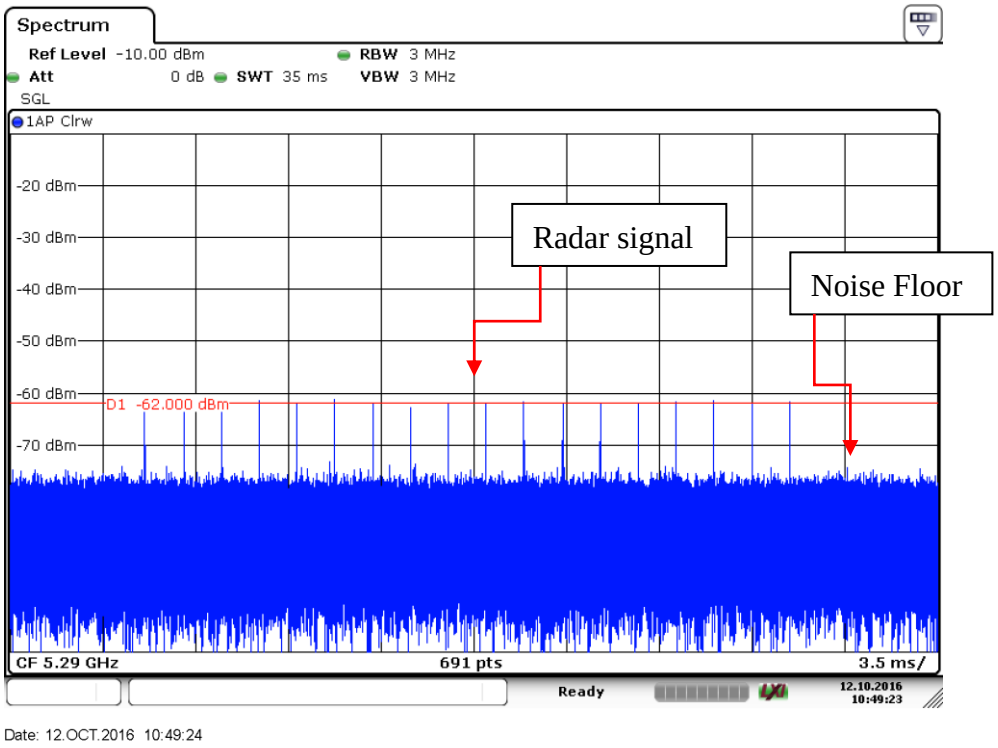
The measured channel is 5290 MHz and 5530MHz in 80MHz Bandwidth. The radar signal was the same as transmitted channels, and injected into the antenna port of AP (master) or Client Device with Radar Detection, measured the channel closing transmission time and channel move time.

Conducted setup configuration of calibration of DFS detection threshold level

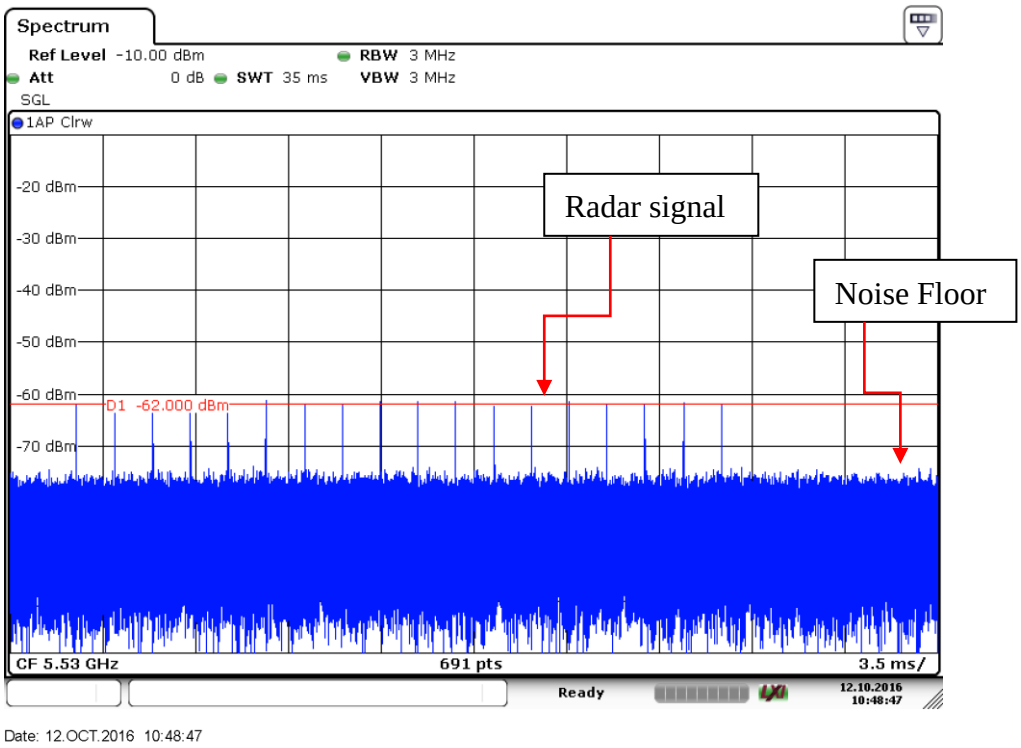


Calibration plots for each of the required radar waveforms

Radar type 0

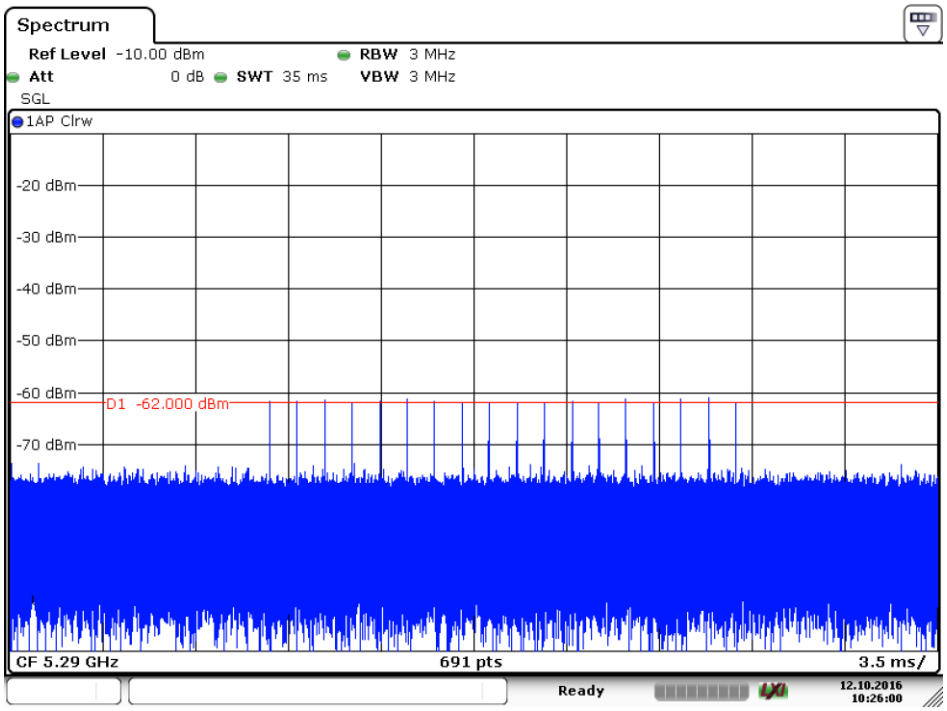


Radar Type 0 – 5290MHz

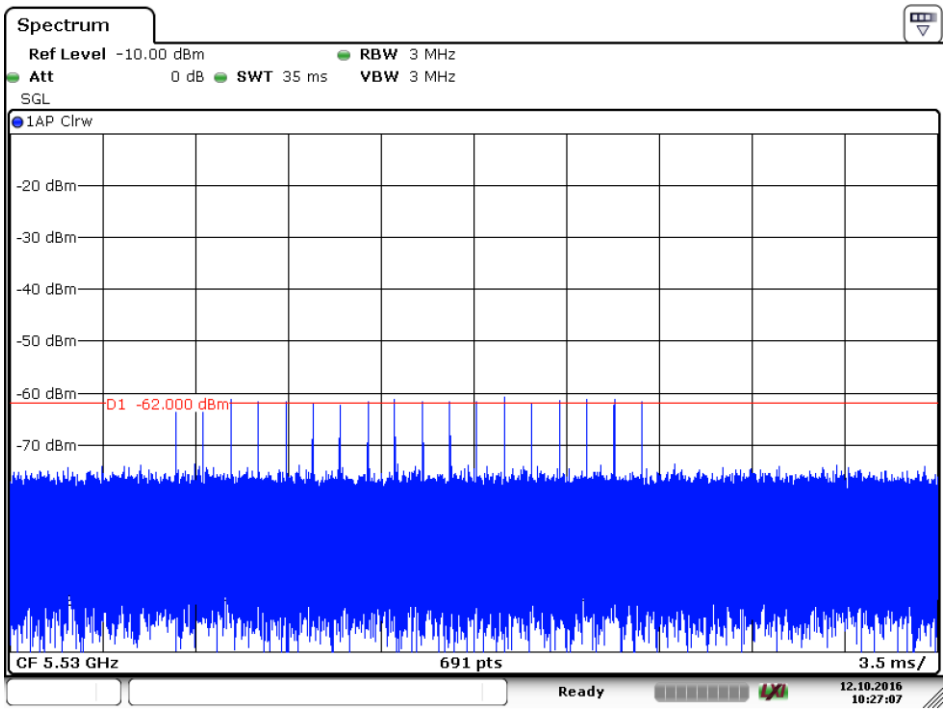


Radar Type 0 – 5530MHz

Radar type 1-A

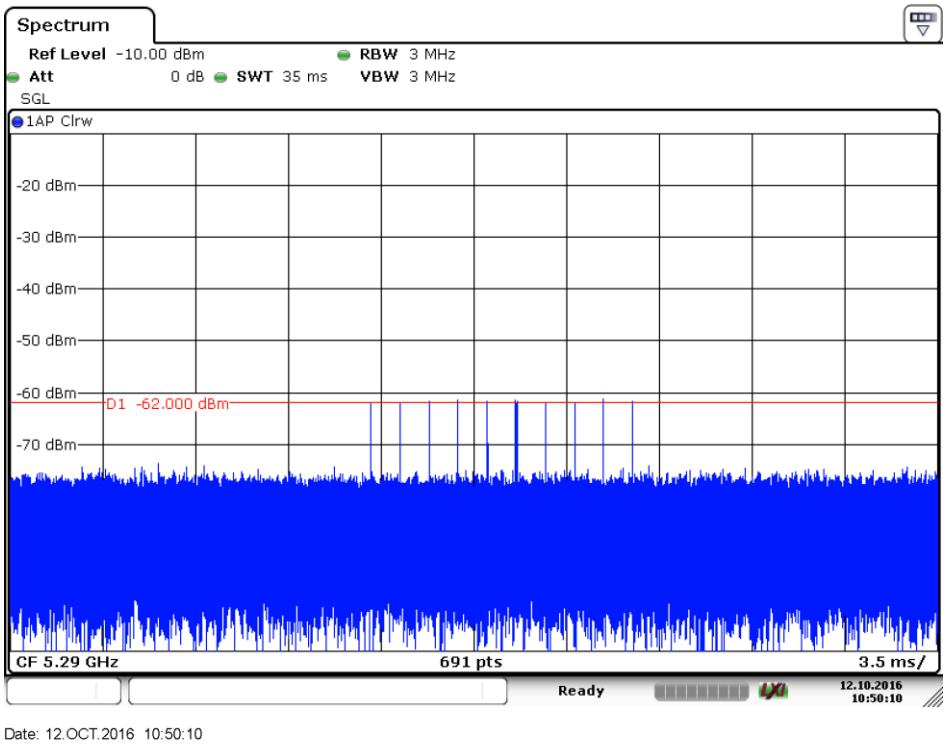


Radar Type 1A – 5290MHz

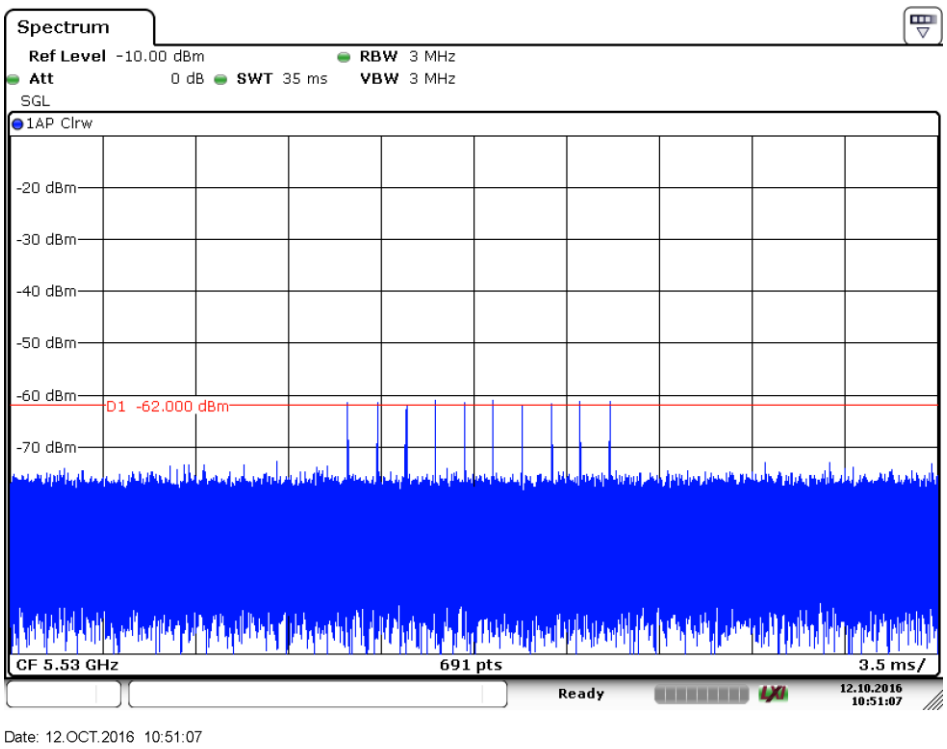


Radar Type 1A – 5530MHz

Radar type 1-B

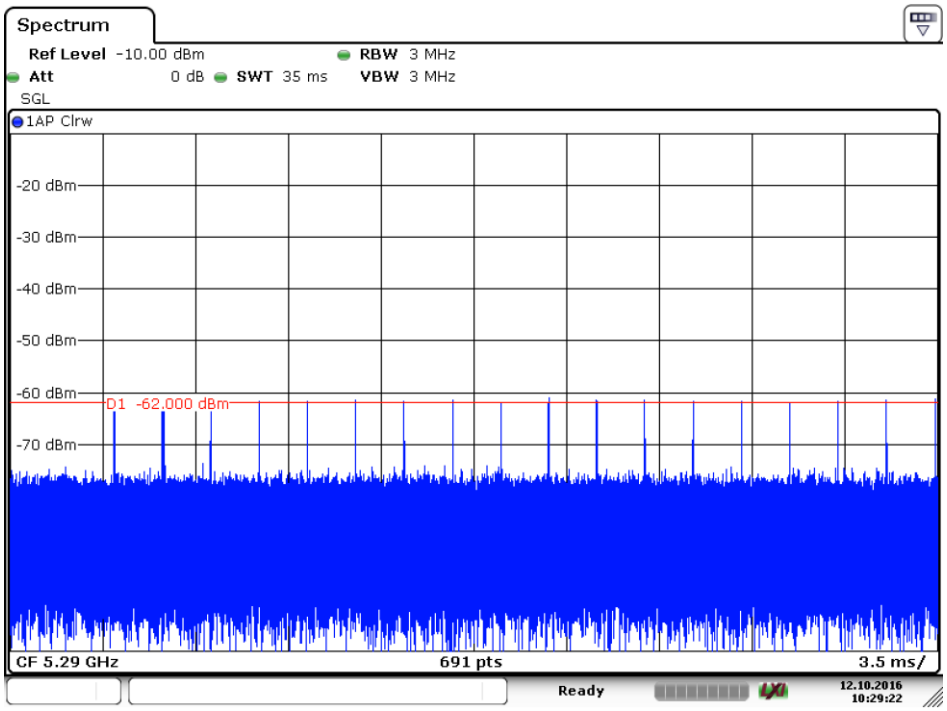


Radar Type 1B – 5290MHz



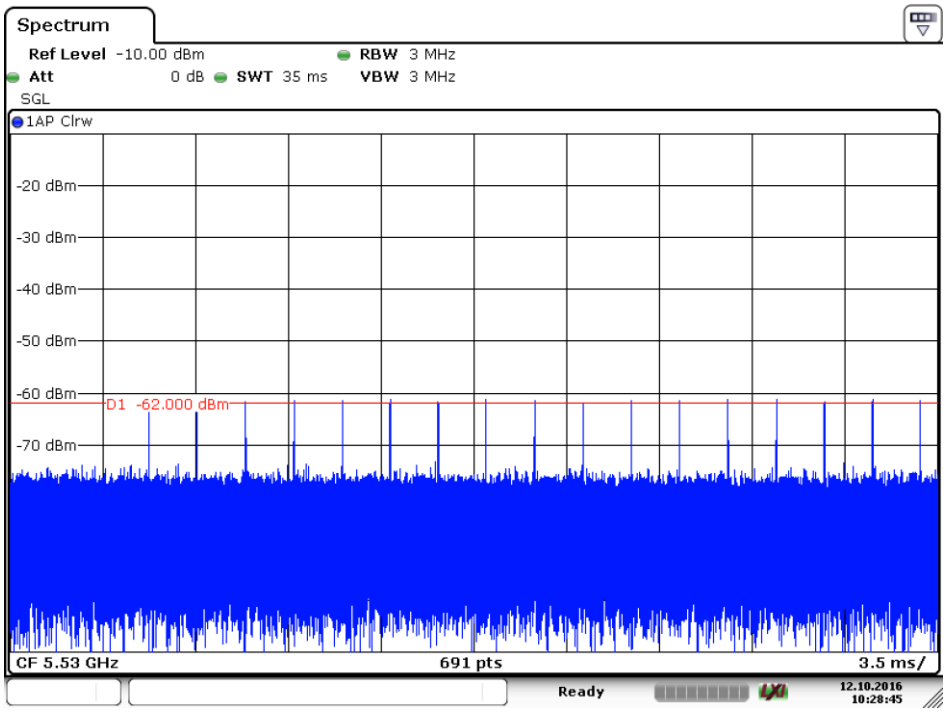
Radar Type 1B – 5530MHz

Radar type 2



Date: 12.OCT.2016 10:29:22

Radar Type 2 – 5290MHz



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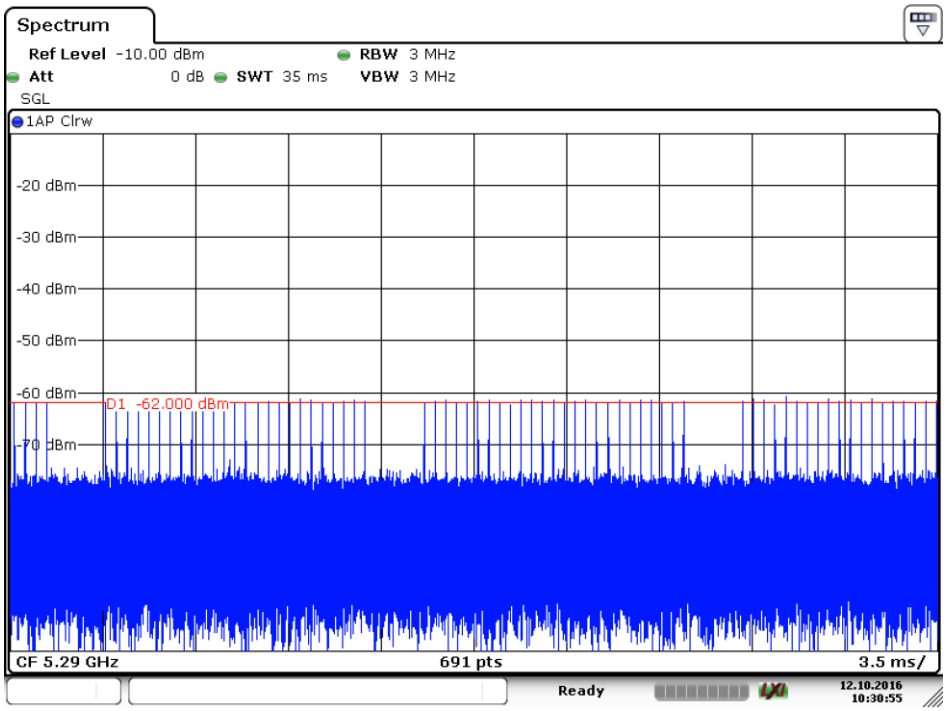
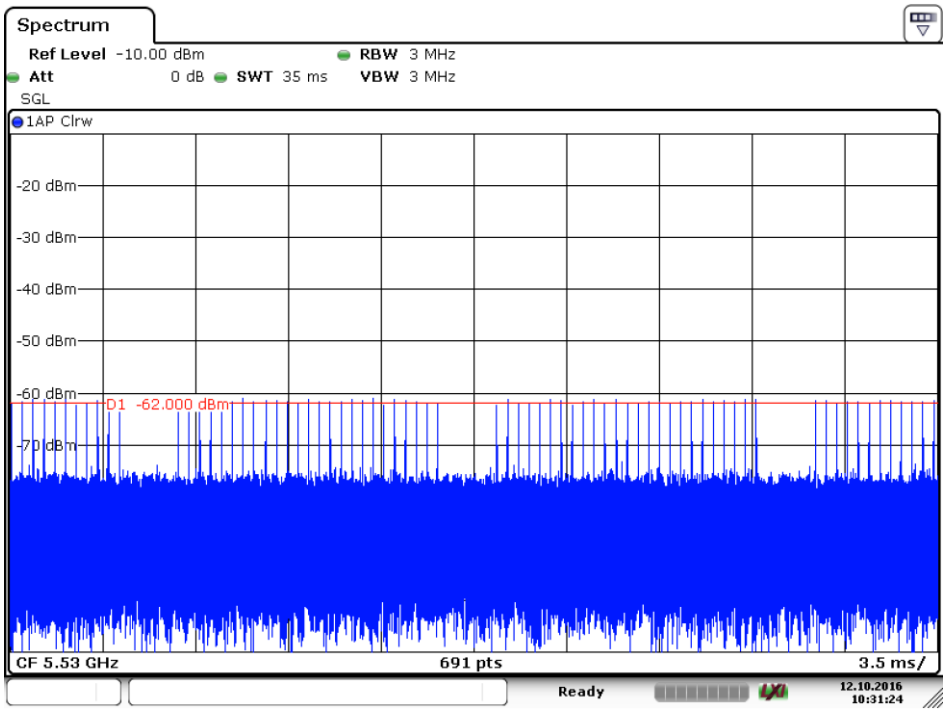
Radar Type 2 – 5530MHz

Radar type 3

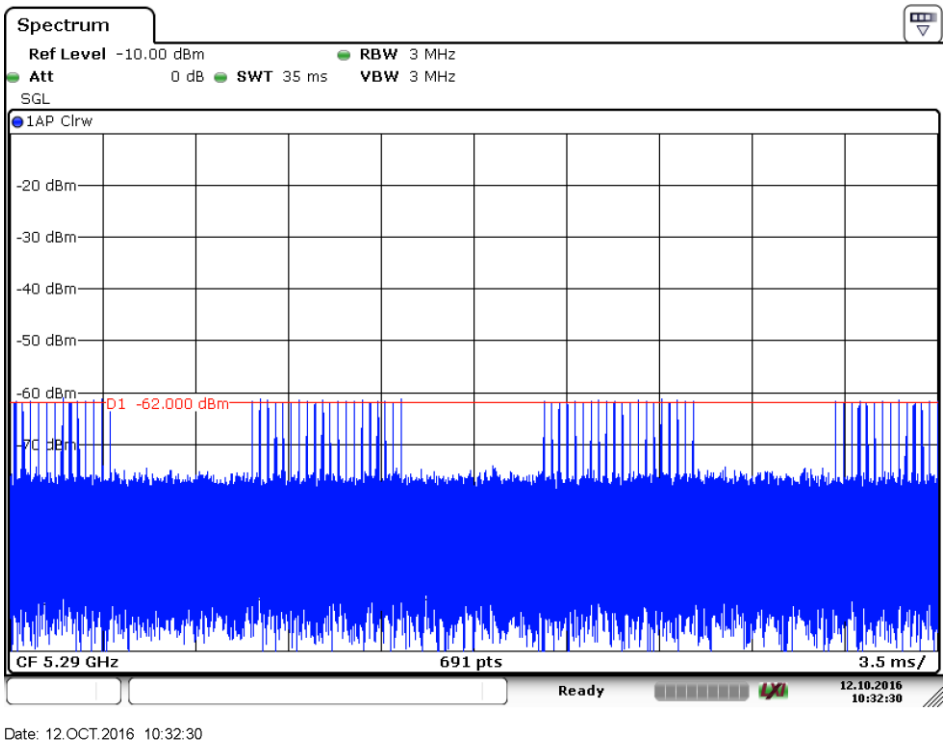


Radar Type 3 – 5290MHz

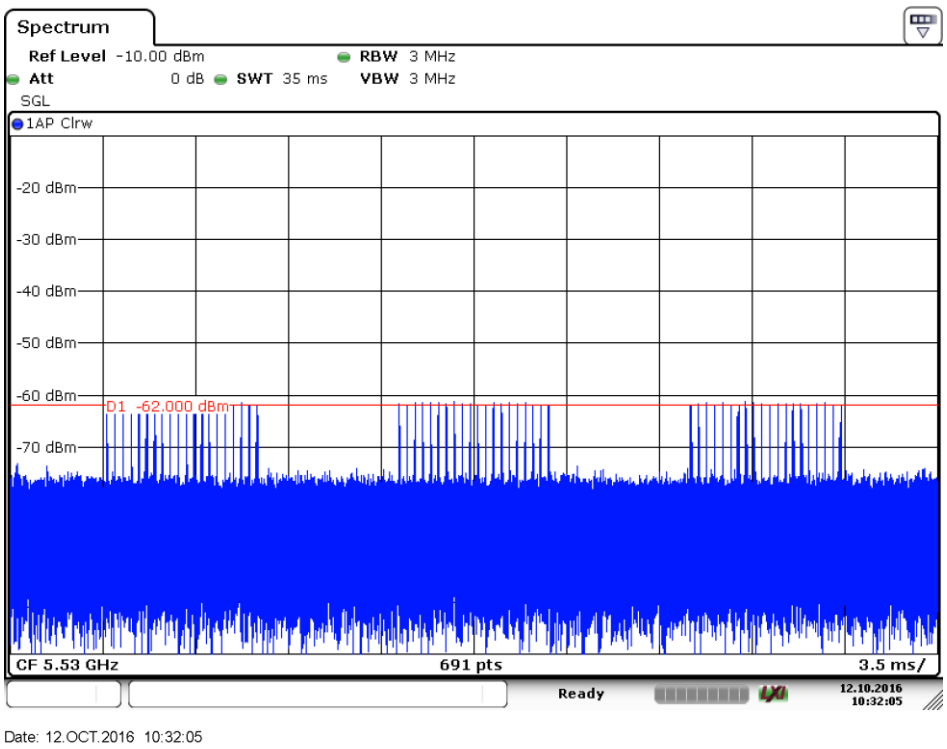


Radar Type 3 – 5530MHz

Radar type 4

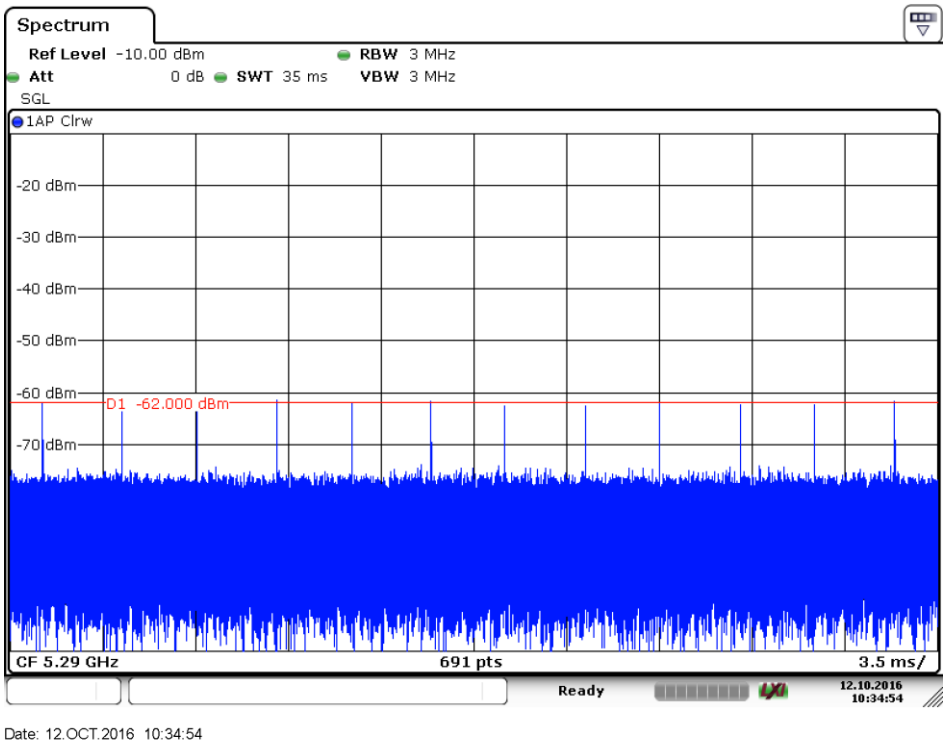


Radar Type 4 – 5290MHz

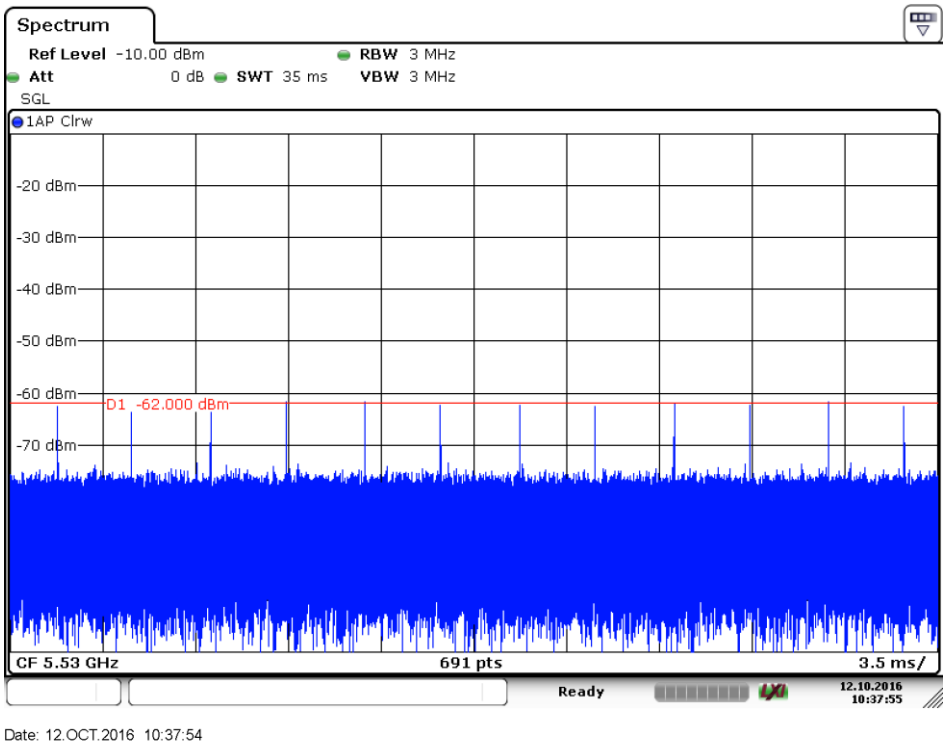


Radar Type 4 – 5530MHz

Radar type 5

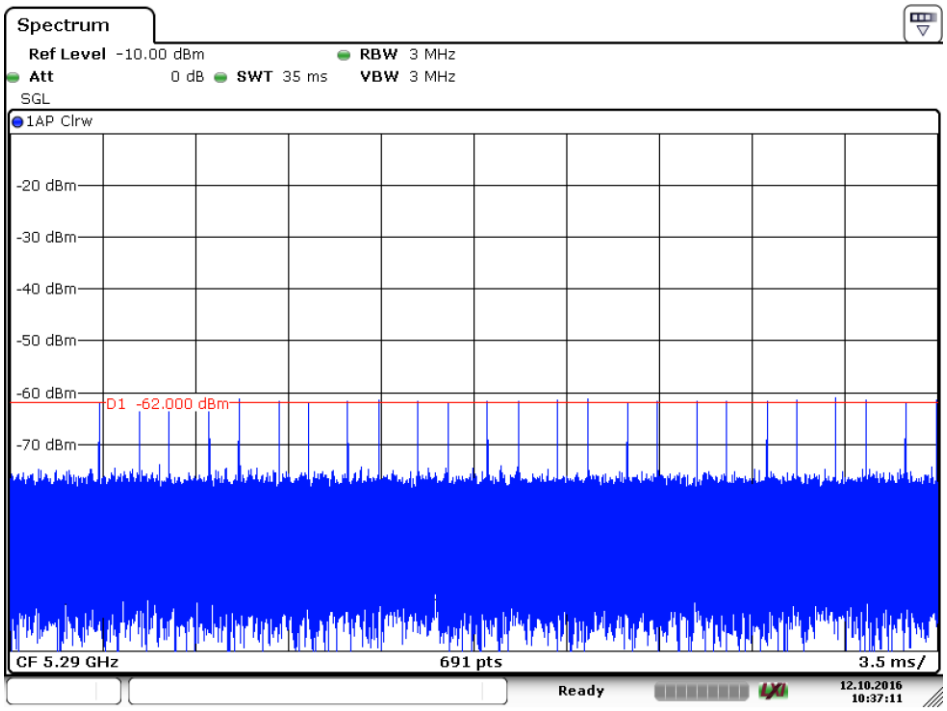


Radar Type 5 – 5290MHz



Radar Type 5 – 5530MHz

Radar type 6



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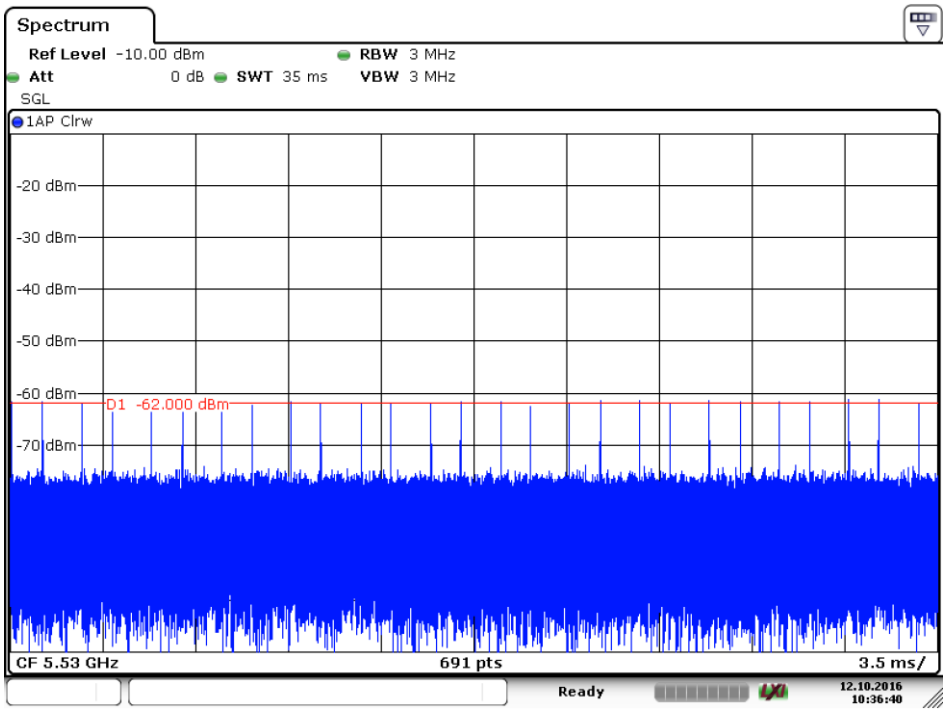
Radar Type 6 – 5290MHz



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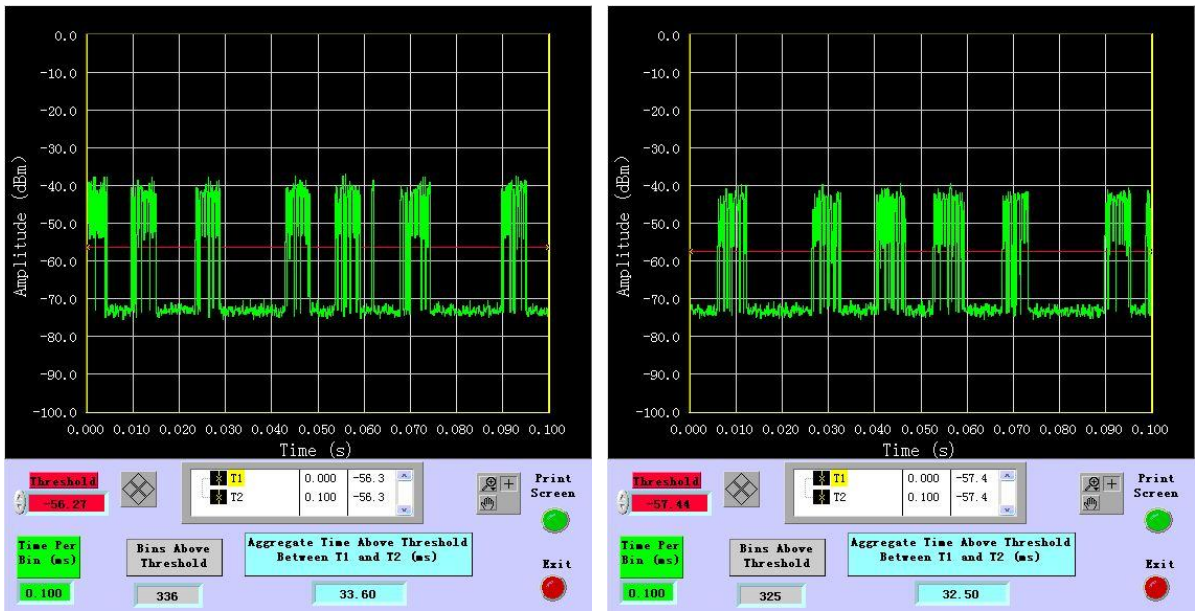
Radar Type 6 – 5530MHz

4. Test Results

4.1. The timing plot of the channel loading



5290MHz 5530MHz

Note: The whole time was 100ms; Aggregate Time above Threshold between T1 and T2 is 32.50ms

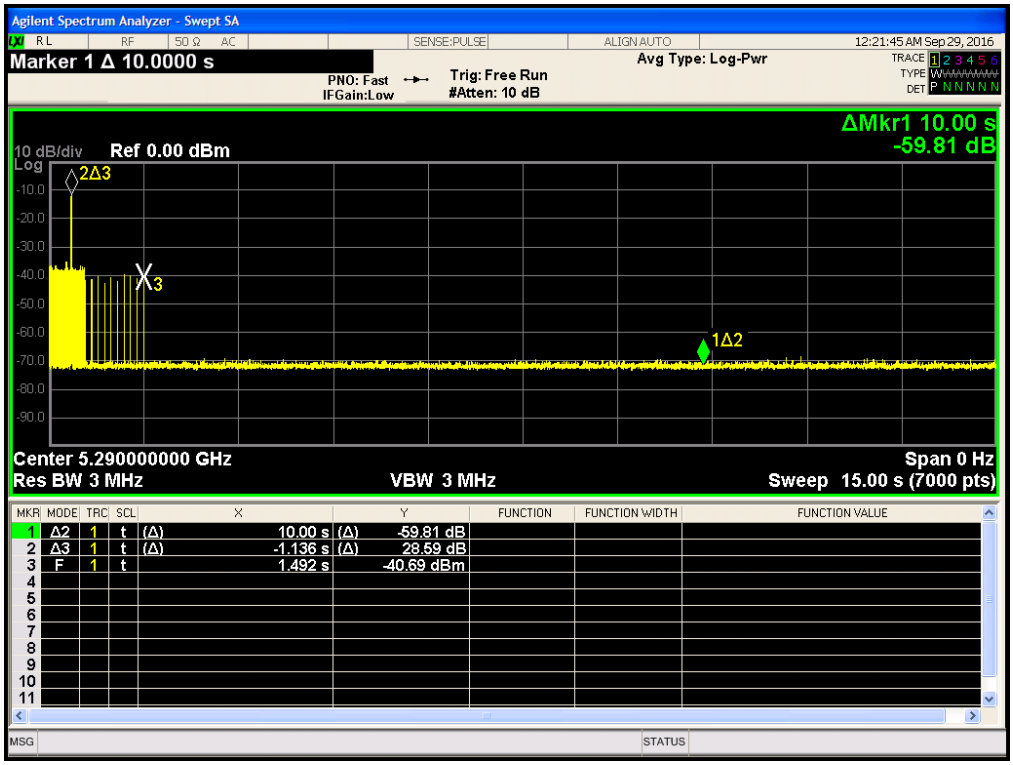
Formula: Payload=33.60/100*100%=33.6 %(5290MHz)

Payload=32.50/100*100%=32.5 %(5530MHz)

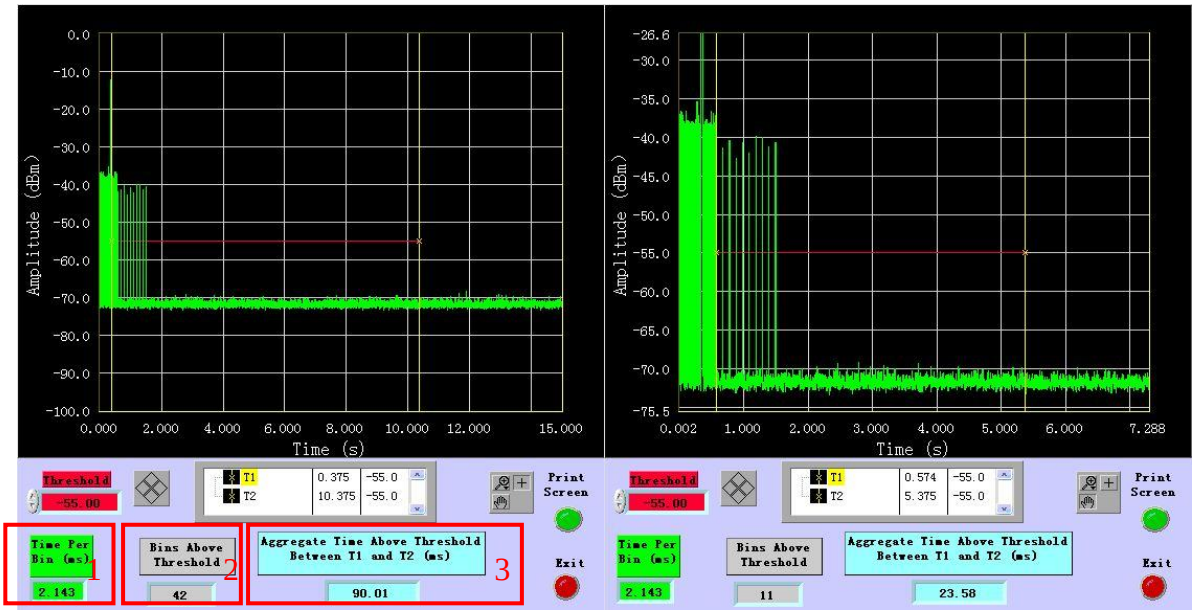
Limit for FCC: At least 17%

4.2. Channel closing transmission and channel move time:

Test Item	Operation Channel	Test Result	Limit	Pass / Fail
Channel Move Time	58	1.136s	＜10s	Pass
Channel Closing Transmission Time		90.01ms	＜1000ms	Pass
Channel Move Time	106	1.196s	＜10s	Pass
Channel Closing Transmission Time		135.01ms	＜1000ms	Pass



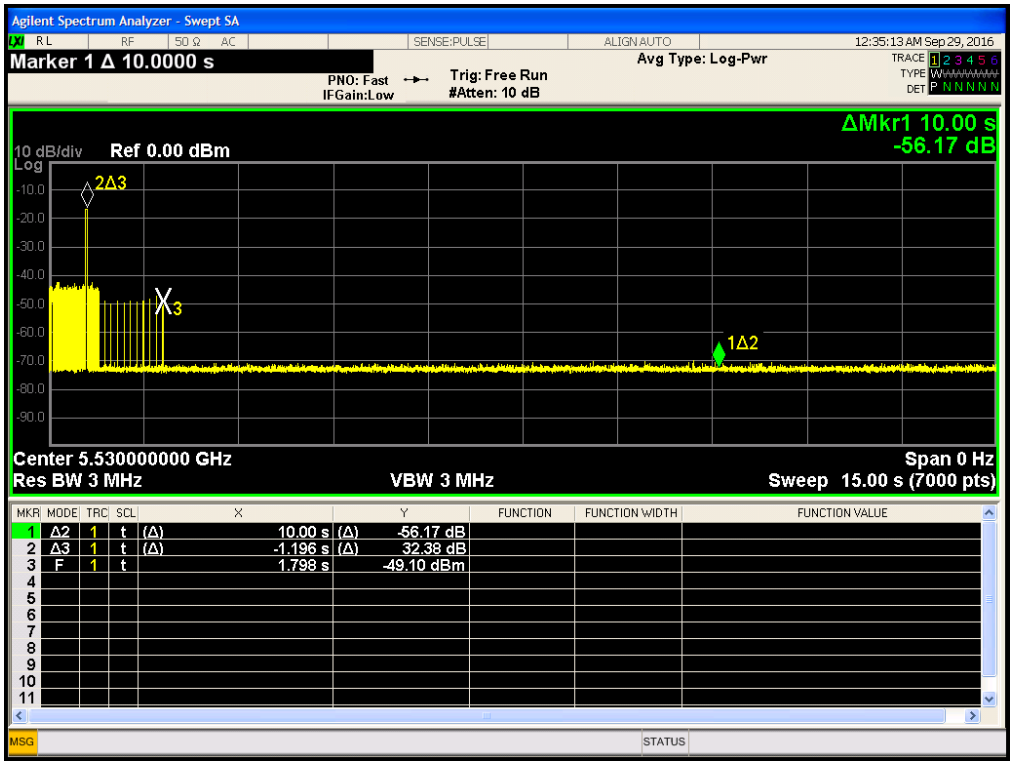
80MHz / 5290 MHz Channel Move Time



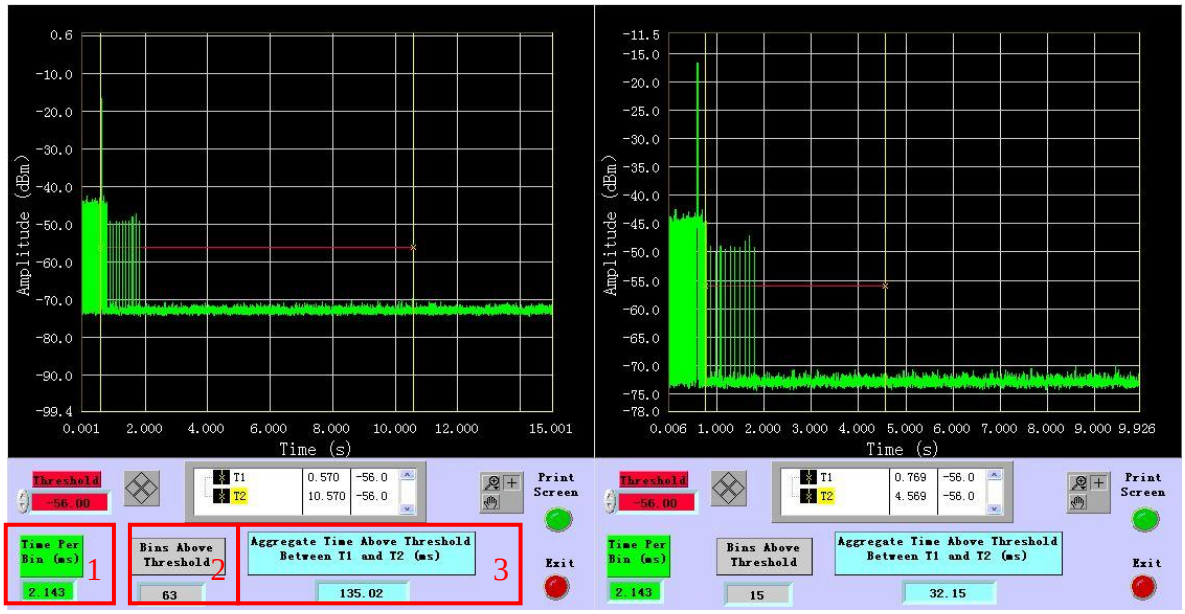
80MHz / 5290 MHz Channel Closing Transmission Time

Note: The whole time was 15s, the software of this paragraph of time recording points is 7000, average each point represents the time is 2.143ms (numerical display in figure in a red box 1), the threshold is -55.00, T1-T2 this period of time is higher than the threshold the total number is 42 (numerical display in the red box in Figure 2), the results of 42*2.143 T1-T2 is higher than that among -55.00 points total time red box 3 value

Formula: Dwell=S/B=15000ms/7000=2.143ms, C=N*Dwell=42*2.143=90.01ms



80MHz / 5530 MHz Channel Move Time



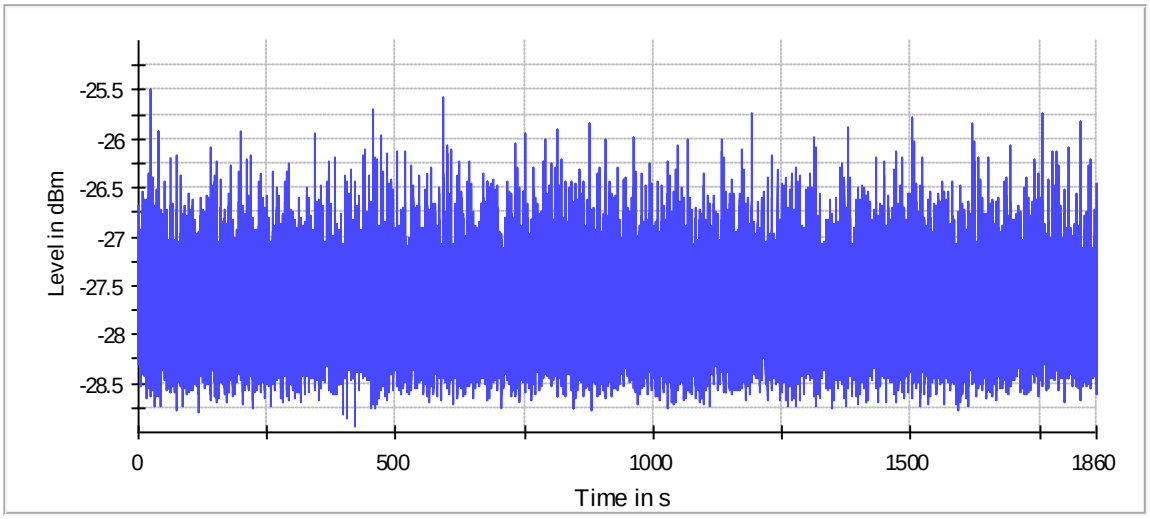
80MHz / 5530 MHz Channel Closing Transmission Time

Note: The whole time was 15s, the software of this paragraph of time recording points is 7000, average each point represents the time is 2.143ms (numerical display in figure in a red box 1), the threshold is -56.00, T1-T2 this period of time is higher than the threshold the total number is 63 (numerical display in the red box in Figure 2), the results of 63*2.143 T1-T2 is higher than that among -56.00 points total time red box 3 value

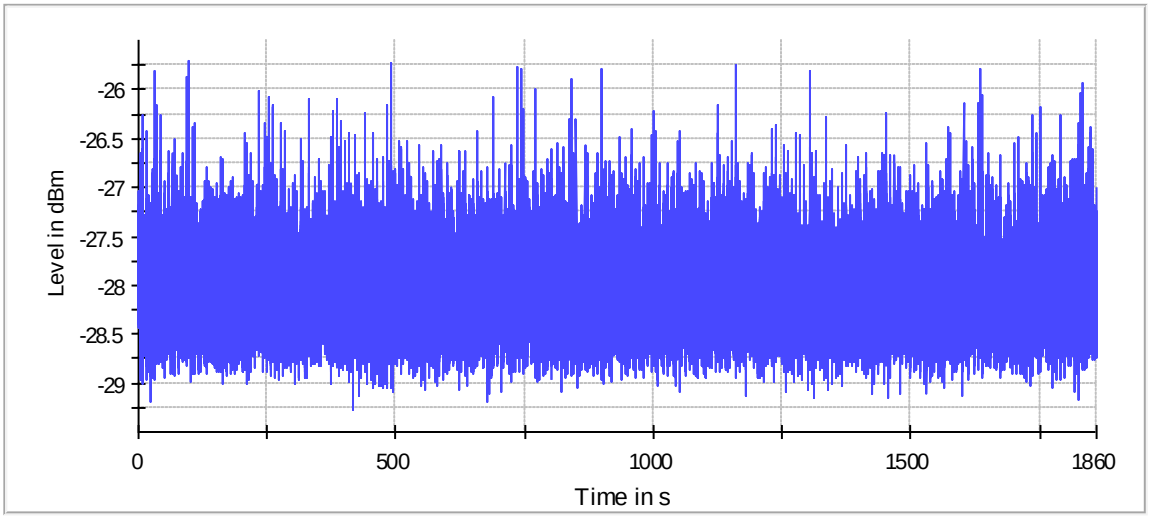
Formula: Dwell=S/B=15000ms/7000=2.143ms, C=N*Dwell=63*2.143=135.01ms

4.3. Non-Occupancy period:

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



80MHz / 5290 MHz Non-Occupancy period



80MHz / 5530 MHz Non-Occupancy period

5. List of measuring equipment

DFS Test System						
No.	Equipment Name	Serial No.	Model No.	Manufacturer	Cal Date	Due Date
1	Spectrum Analyzer	MY54420153	N9020A	KEYSIGHT	2016.04.12	2017.04.11
2	Signal Generator	MY53051596	N5182B	KEYSIGHT	2016.04.12	2017.04.11
3	30dB Attenuator	272.4410.50	30	MCE/Weinschel	2016.04.12	2017.04.11
4	20dB Attenuator	04702	779	narda	2016.04.12	2017.04.11
5	6dB Attenuator	BM8173	2	MCE/Weinschel	2016.04.12	2017.04.11

Support Unit used in test configuration and system				
Equipment	Trade Name	Model Name	FCC ID	Serial No.
WLAN AP	D-Link	DIR-826	KA2IR826LMO1	QBQ91C6000056
Notebook	Lenovo	E40	\	TP00005A

** END OF REPORT **