

PCTEST ENGINEERING LABORATORY, INC.

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### MEASUREMENT REPORT FCC PART 15.407 / ISED RSS-247 DFS

Applicant Name:	Date of Testing:	
Apple Inc.	10/31-1/31/2018	
1 Infinite Loop	Test Site/Location:	
Cupertino, CA 95014	PCTEST Lab. Morgan Hill, CA, USA	
United States	Test Report Serial No.:	
	1C1710060005-04-R1.BCG	
FCC ID:	BCGA1893	

APPLICANT:	Apple Inc.
IC:	579C-A1893
FCC ID.	DCGA1095

Application Type:	Certification
Mode/HVIN:	A1893
EUT Type:	Client Only Device, No Radar Detection Capability
Max. RF Output Power:	100.00 mW (20.00 dBm) Conducted
	(802.11n UNII Band 2A)
	100.00 mW (20.00 dBm) Conducted
	(802.11n UNII Band 2C)
Frequency Range:	5250 – 5350 MHz (UNII-2A Band)
	5470 – 5725 MHz (UNII-2C Band)
FCC Classification:	Unlicensed National Information Infrastructure (UNII)
Test Procedure(s):	KDB 905462 D02 v02

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in KDB 905462 D02 v02 Compliance Measurement Procedures for Unlicensed-National Information Infrastructure Devices Operating in the 5.25 - 5.35 GHz and 5.47 - 5.725 GHz Bands Incorporating Dynamic Frequency Selection. Test results reported herein relate only to the item(s) tested.

This revised Test Report (S/N: 1C1710060005-04-R1.BCG) supersedes and replaces the previously issued test report (S/N: 1C1710060005-04.BCG) on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

ndy Ortanez President



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### 1.0 INTRODUCTION

#### Scope 1.1

This report has been prepared to demonstrate compliance with the requirements for Dynamic Frequency Selection (DFS) as stated in KDB 905462 D02 v02. Testing was performed on the Apple, Inc. Tablet FCC ID: BCA1893. As of July 20, 2007, all devices operating in the 5250 - 5350 MHz and/or the 5470 - 5725 MHz bands (excluding 5600-5650MHz for ISED Canada) must comply with the DFS requirements. As the EUT does not have radar detection capability it was evaluated as a Client Only Device. All test results reported herein are applicable to the sample selected for testing. The unit used for testing was supplied by Apple Inc.

### **1.2 Evaluation Procedure**

Conducted test methodology was used for the DFS evaluation procedure of the EUT. No deviations to the test procedure and test methods occurred during the evaluation of the EUT.

#### 1.3 Summary of Test Results

The EUT was found to be compliant with the requirements for DFS as required for a Client Device per Part 15.407(h), RSS-247 and KDB 905462 D02 v02. The following table lists the measured parameters. The actual data and plots can be found in Section 5 and 6 of this report.

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			Measured				
	Mode	Parameter	20MHz Bandwidth	40MHz Bandwidth	80MHz Bandwidth	Limit	Result
		Channel Move Time	4.060 s	0.026 s	0.229 s	10 seconds	Pass
1 Client Mode	Channel Closing Transmission Time	< 200ms + 7.431 ms (aggregate)	< 200ms + 0.001 ms (aggregate)	< 200ms + 1.686 ms (aggregate)	200 ms + aggregate of 60ms over remaining 10 second period	Pass	
		Client beacon test	Monitored for 10 minutes with no client transmission	Monitored for 10 minutes with no client transmission	Monitored for 10 minutes with no client transmission	No client transmission occurred	Pass
lda)		Channel Move Time	5.122 s	0.206 s	0.231 s	10 seconds	Pass
SED Cana	<b>2</b> Client to Client	Channel Closing Transmission Time	< 200ms + 7.133 ms (aggregate)	< 200ms + 13.694 ms (aggregate)	< 200ms + 6.293 ms (aggregate)	200 ms + aggregate of 60ms over remaining 10 second period	Pass
5725 MHz 0MHz for I 2C Band	725 MHz for I MHz for I C Band	Client beacon test	Monitored for 10 minutes with no client transmission	Monitored for 10 minutes with no client transmission	Monitored for 10 minutes with no client transmission	No client transmission occurred	Pass
0 – 5 5650 III – 2		Channel Move Time	4.916 s	0.197 s	0.353 s	10 seconds	Pass
5470 – 5725 MHz (excluding 5600-5650MHz for ISED Canada) UNII – 2C Band	<b>3</b> Peer to Peer	Channel Closing Transmission Time	< 200ms 36.116 ms (aggregate)	< 200ms + 20.973 ms (aggregate)	< 200ms + 10.045 ms (aggregate)	200 ms + aggregate of 60ms over remaining 10 second period	Pass
(exclue	reei	Client beacon test	Monitored for 10 minutes with no client transmission	Monitored for 10 minutes with no client transmission	Monitored for 10 minutes with no client transmission	No client transmission occurred	Pass
		Channel Move Time	3.275 s	0.237 s	0.332 s	10 seconds	Pass
4 Peer to	Channel Closing Transmission Time	< 200ms + 12.512 ms (aggregate)	< 200ms + 12.815 ms (aggregate)	< 200ms + 7.476 ms (aggregate)	200 ms + aggregate of 60ms over remaining 10 second period	Pass	
Peer		Client beacon test	Monitored for 10 minutes with no client transission	Monitored for 10 minutes with no client transmission	Monitored for 10 minutes with no client transmission	No client transmission occurred	Pass

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### 2.0 PRODUCT INFORMATION

### 2.1 Equipment Description

The Client is the Apple Inc. Tablet FCC ID: BCGA1893 / IC: 579C-A1893

#### Mode of Operation:

Master Device	
Client Device (No radar detection)	$\boxtimes$
Client Device with Radar Detection	

Parameters of Client:			
Frequency	5250 – 5350 MHz, 5470 – 5725 MHz (FCC) 5250 – 5350 MHz, 5470 – 5600 MHz, 5650 – 5725MHz (ISED Canada)		
Max Output Power:	100.000 mW (20.00 dBm) (802.11n UNII Band 2A MIMO) 100.000 mW (20.00 dBm) (802.11n UNII Band 2C MIMO)		
Max Antenna Gain	5.29 dBi (UNII Band 2A - MIMO) 6.26 dBi (UNII Band 2C - MIMO)		
Max EIRP Level:	25.11 dBm (UNII Band 2A - MIMO) 26.22 dBm (UNII Band 2C - MIMO)		
Modulation:	OFDM		
Channel Bandwidth:	20, 40, 80 MHz		
EUT Software version	11.3 (15E173)		

#### Table 2-1. Parameters of EUT

#### Test Device Serial No.: DMPVV02FJM48

Parameters of Master:		
Minimum Antenna Gain	1.4 dBi	
EIRP Level:	23 dBm	
Access Point Software Version	7.7.4f0 dev	

#### Table 2-2. Parameters of Master

### 2.2 EUT Capabilities

This device contains the following capabilities:

802.11b/g/n WLAN, 802.11a/n/ac UNII, Bluetooth (1x, EDR, LE)

#### 2.3 Modifications

No modifications to the EUT were required to comply with the DFS specifications.

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## 3.0 DESCRIPTION OF DYNAMIC FREQUENCY SELECTION TEST

### 3.1 Applicability

The following table from KDB 905462 D02 v02 lists the applicable requirements for the DFS testing. The device evaluated in this report is considered a client device without radar detection capability.

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		
Uniform Spreading	Yes	Not required	Not required		
U-NII Detection Bandwidth	Yes	Not required	Yes		

Table 3-1. DFS Applicability

Requirement	Operational Mode				
	Master Without Rada 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		

Table 3-2. DFS Applicability During Normal Operation

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#### 3.2 Requirements

Per KDB 905462 D02 v02 the following are the requirements for Client Devices:

- a) A Client Device will not transmit before having received appropriate control signals from a Master Device.
- b) A Client Device will stop all its transmissions whenever instructed by a Master Device to which it is associated and will meet the Channel Move Time and Channel Closing Transmission Time requirements.

The Client Device will not resume any transmissions until it has again received control signals from a Master Device.

- c) If a Client Device is performing In-Service Monitoring and detects a Radar Waveform above the DFS Detection Threshold, it will inform the Master Device. This is equivalent to the Master Device detecting the Radar Waveform and d) through f) of section 5.1.1 apply.
- d) Irrespective of Client Device or Master Device detection the Channel Move Time and Channel Closing Transmission Time requirements remain the same.

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Channel Move Time and Channel Closing Transmission Time requirements are listed in the following table.

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 Note 1 and 2.
U-NII Detection Bandwidth	Minimum 80% of the U- NII 99% 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.

**Table 3-3: DFS Response Requirements** 

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### 3.3 DFS Detection Threshold Values

The DFS detection thresholds are defined for Master devices and Client Devices with In-service monitoring. These detection thresholds are listed in the following table.

Maximum Transmit Power	Value (See Notes 1 and 2)
≥ 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.

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: For this test, the radiated output power of the Master Unit is greater than 23 dBm. Hence, DFS Detection Threshold Value was set to -64dBm.

Table 3-4: Detection Thresholds for Master Devices and Client Devices with Radar Detection

### 3.4 Parameters of DFS Test Signals

As the EUT is a Client Device with no Radar Detection only one type radar pulse is required for the testing. Radar Pulse type 1 was used in the evaluation of the Client device for the purpose of measuring the Channel Move Time and the Channel Closing Transmission Time. Table 3-5 lists the parameters for the Short Pulse Radar Waveforms. A plot of the Radar Pulse Type 1 used for testing is included in Section 7.0 of this report.

Radar Type	Pulse Width (µsec)	PRI (µsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Number of 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 (Ra	adar Types 1-4)	80%	120		

Table 3-5: Parameters for Short Pulse Radar Waveforms

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Radar Type	Pulse Width (μsec)	Chirp Width (MHz)	PRI (µsec)	Number of Pulses per <i>Burst</i>	Number of <i>Bursts</i>	Minimum Percentage of Successful Detection	Minimum Number of Trials
5	50 - 100	5 - 20	5 – 20	1 - 3	8 - 20	60%	30

#### Table 3-6. Parameters for Long Pulse Radar Waveforms

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

Table 3-7. Parameters for Frequency Hopping Radar Waveforms

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#### 3.5 System Overview and Procedure

KDB 905462 D02 v02 describes a radiated test setup and a conducted test setup. The conducted test setup was used for this testing. Figure 3-1 shows the typical test setup. In Band 2C, one channel selected between 5470 and 5725 MHz was chosen for testing.

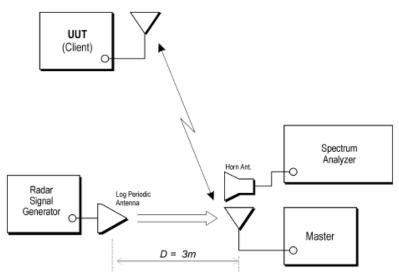


Figure 3-1. Radiated Test Setup for DFS

- 1. The "Aeroflex PXI DFS Radar Simulator and Analyzer Test Suite" is setup to provide a simulated radar pulse at the frequency that the Master and Client are operating. A Type 0 radar pulse was used.
- 2. The Client Device (EUT) is set up per the diagram in Figure 3-1 and communications between the Master device and the Client is established.
- 3. The FCC video test file is streamed from the Master to the Client to properly load the network.
- 4. The "Aeroflex PXI DFS Radar Simulator and Analyzer Test Suite" is set to record and display 12 seconds of time, starting from where the simulated radar is generated. This time domain plot captures any transmissions occurring up to and after 10sec. Aggregate time is computed to ensure compliance. (Note: the channel may be different since the Master and Client have changed channels due to the detection of the initial radar pulse.)
- 5. After the initial radar burst the channel is monitored for 10 minutes to ensure no transmissions or beacons occur. A second monitoring setup is used to verify that the Master and Client have both moved to different channels.

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### 3.6 System Calibration:

Radar pulses generated at the PXI RF Synthesizer's Output Port (as depicted as 'RADAR Test Signal Generator' in Figure 3-1) was injected through the Vivaldi Antenna. It was received by the horn antenna at a 3m distance. The horn antenna was connected by a low loss RF cable with the spectrum analyzer. The offset of the spectrum analyzer was calculated based on the loss of the RF cable and gain of the horn antenna. In the 'PXI DFS Radar Simulator & Analyzer' Software, Signal Generator was set to Continuous Wave mode. The 'DUT Peak Input Level Setting' is adjusted to yield a level of -64dBm as measured on Spectrum Analyzer. This value will be used when the main DFS testing would be performed as described in section 3.4.

After collecting the plots of the Radar pulses, the spectrum analyzer was reconnected with the DFS test system as shown in Figure 3-1. The spectrum analyzer displays the transmission level of the signal generator using the Vivaldi Antenna and the transmission is received using Horn Antenna that is 3 meters away from the antenna post where the Master device will reside during testing. The interference detection threshold may be varied from the calibrated value of -64dBm and the Spectrum analyzer will still indicate the level as received by the Master Device.

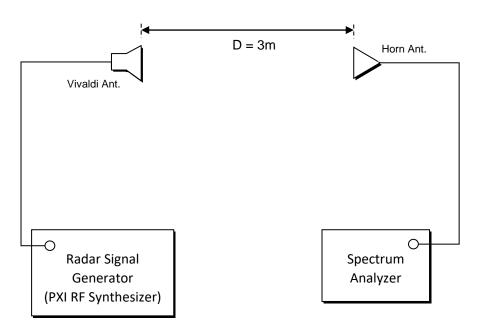


Figure 3-2. Test Setup Calibration

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### 4.0 TEST EQUIPMENT AND SOFTWARE

#### **Test Equipment:**

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2006.

Manufacturer	Type/Model	Description	Cal. Date	Cal. Interval	Cal. Due Date	Serial No.
Aeroflex	PXI 82531	PXI RF Synthesizer/DFS Radar Simulator & Analyzer	9/22/2016	Biennial	9/22/2018	1082329
Rohde & Schwarz	ESW44	ESW/EMI Test Reciever	11/14/2017	Biennial	11/14/2018	101570
Rohde & Schwarz	TC-TA18	Cross-Pol Antenna 400MHz-18GHz	1/19/2018	Annual	1/19/2019	101056
ETS-Lindgren	3117	1M Horizontal & Vertical / 3M Free Space	1/18/2017	Annual	1/18/2018	205956
Seekonk	NC-100	Torque Wrench 5/16", 8" lbs.	3/2/2016	Biennial	3/2/2018	N/A

Table 4-1. Annual Test Equipment Calibration Schedule

Note: For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

#### **Support Equipment:**

The following equipment was used in support of the DFS testing.

Device	Manufacturer	Model	Description	S/N:	FCC ID:
Master	Apple	A1521	Access Point	C86PJ5RUFJIR	BCGA1521
	, , , , , , , , , , , , , , , , , , , ,	MacBook Air	Controller	C02P41RZG086	QDS-BRCM1072
		Apple TV	Controller	C07PR001GPWK	BCGA1625
Client	Apple	MacBook Air	Controller	C02P52H6G085	QDS-BRCM1072
	Dell	U24177HJ	Monitor Display	0RXP1N-74261- 71Q-0APL-A01	N/A

Table 4-2. Support Equipment

#### **Test Software:**

Automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The list is given below,

- 1. DFS threshold count v1.1
- 2. DFS Radar Simulator and Analyzer (Aeroflex Inc.)
- 3. iPerf Software

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### 5.0 EUT TEST SETUP

The EUT was tested in 4 different test configurations,

Mode 1: Client Mode

Mode 2: Client to Client

Mode 3: Peer to Peer (EUT)

Mode 4: Peer to Peer (Apple TV)

#### Mode 1: Client Mode

Client is connected to Master (AP) via WLAN network and plays a video test file "6 ½ Magic Hours" in a Server (MacBook Air). This Server is connected to the Master (AP) via ethernet cable. The Horn antenna is adjusted so that the WLAN traffic level, as displayed on the spectrum analyzer, is at lower amplitude than the radar detection threshold.

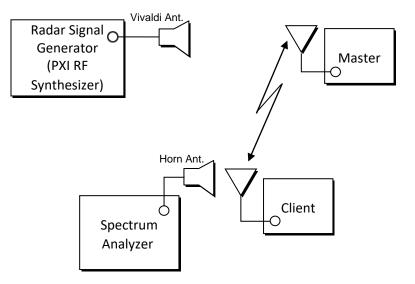


Figure 5-1. Mode-1 Test Setup

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#### Mode 2: Client-to-Client Communications Mode

Client plays the video test file that is streamed to generate WLAN while linked to Master and streamed the video through Apple TV to Monitor display. The Horn antenna is adjusted so that the WLAN traffic level, as displayed on the spectrum analyzer, is at lower amplitude than the radar detection threshold.

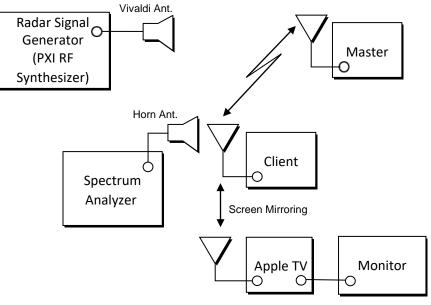


Figure 5-2. Mode-2 Test Setup

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#### Mode 3: Peer-to-Peer (EUT) Communications Mode

Generate and inject additional transmission:

- 1. Client and Apple TV must be linked to the Master.
- 2. Client plays video that is saved within its internal storage and begin mirroring screen via Apple TV.
- 3. Connect the Apple TV and Client to the support laptop and initiate additional transmission using iPerf.
- 4. After the additional transmission is injected, the Client must be disconnected to the Master.
- 5. Client stops and re-start mirroring screen.

Client plays video that is saved within its internal storage and streamed through Apple TV to the Monitor display. The receive antenna/ monitoring antenna is placed near the EUT. Additional data traffic was sent from the EUT (Client) to Apple TV (Server) using iPerf. The Horn antenna is adjusted so that the WLAN traffic level, as displayed on the spectrum analyzer, is at lower amplitude than the radar detection threshold.

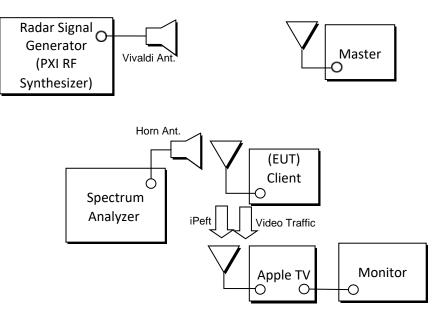


Figure 5-3. Test Setup (Mode 3)

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#### Mode 4: Peer-to-Peer (Apple TV) Communications Mode

Generate and inject additional transmission:

- 1. Client and Apple TV must be linked to the Master.
- 2. Client plays video that is saved within its internal storage and begin mirroring screen via Apple TV.
- 3. Connect the Apple TV and Client to the support laptop and initiate additional transmission using iPerf.
- 4. After the additional transmission is injected, the Client must be disconnected to the Master.
- 5. Client stops and re-start mirroring screen.

Client plays video that is saved within its internal storage and streamed through Apple TV to the Monitor display. The receive antenna/ monitoring antenna is placed near the Apple TV. Additional data traffic was sent from the Apple TV (Client) to the EUT (Server) using iPerf. The Horn antenna is adjusted so that the WLAN traffic level, as displayed on the spectrum analyzer, is at lower amplitude than the radar detection threshold.

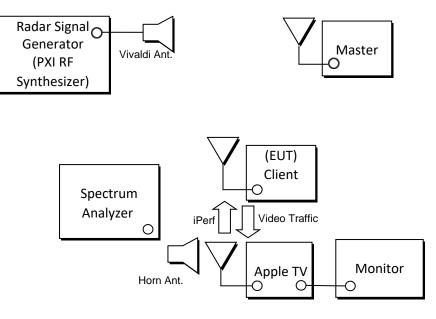


Figure 5-4. Test Setup (Mode 4)

In summary, for Modes 1 and Mode 2, Client is linked to the Master, and for Modes 3 and Mode 4, Client is not linked to the Master.

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## 6.0 RADAR PULSES AND TRAFFIC SIGNALS

#### Radar Waveform Calibration: 6.1

#### **Radar Pulse Notes:**

The radiated plots of the RADAR pulse signals (Type 0) are given below after performing the system calibration as described in section 3.6,

MultiView #	Receiver	X Spe	ctrum	×					•
Ref Level -2.5 Att Input	53 dBm Offse 0 dB = SWT 1 AC PS	t 2.47 dB • RB 40 ms • VB On No	W 3 MHz	SGL			Fn	equency 5.50	000000 GHz
1 Zero Span	IAC P3							●1Pk C	rw • 2Pk Clrw
								M1[1]	-64.05 dBm
to day.									36.780000 ms
-10 dBm									
-20 dBm									
-30 dBm									
-40 dBm									
-50 dBm									
-50 uBIII-									
-60 dBm									M1
									T I I
-70 dBm									
-70 0011									
Louis and the designation	dia ka india dia ka	Producti Mahelph (M) Postrice	A second states and states	وسيعينه إيلا أخرج والارجد وترابا		a la fa a philisean an an an an an Anna	alasia ing kang dari kana dalam dari	Kalind profing to be to pa	a a chait in a bhan an th
		· · · · ·							· · · · · ·
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-90 dBm	the second se								History and the fit
-100 dBm									
CF 5.5 GHz	-			4000	1 pts				4.0 ms/
					Read	/	24.01.2 04:33	018 Att	RBW

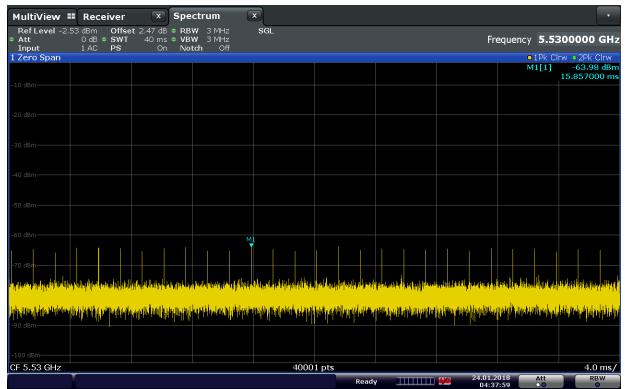
Figure 6-1. 5500MHz - RADAR Pulses Type 0 (20MHz)

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MultiView 🚥	-		×					•
Ref Level -2.5 Att	0 dB <b>⊃ SWT</b> 40 r	dB ● RBW 3 MHz ms ● VBW 3 MHz	SGL			Fre	equency 5.5:	L00000 GHz
Input 1 Zero Span	1 AC PS (	On <b>Notch</b> Off					o 1Pk Cl	rw • 2Pk Clrw
12010 00011							M1[1]	-64.07 dBm
-10 dBm								34.268000 ms
-10 dBm								
-20 dBm								
-30 dBm								
-30 ubm								
-40 dBm								
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Station in the second second	موالأه فالألبان أشرفا الرافية الروقية الألا	, and the state of t	فحافظها للمغرف فطاطاته	فتأسر المأر إرتار ويبأر والملاز والأرار	aller a tringet i be	ى ((بايلارىغازار)مانا، (بىلايار)	halid an international faith and faith	وأفر الماران التربية والطوالل
-90 dBm	C. Martha L. 1993							
-100 dBm								
CF 5.51 GHz			4000			21.01.3	010	4.0 ms/
				Ready	/	24.01.2	018 Att	RBW





#### Figure 6-3. 5530MHz - RADAR Pulses Type 0 (80MHz)

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### 6.1 Traffic Signal:

#### **Traffic Signal Notes:**

The traffic signals were generated by the EUT different modes of operations, and the corresponding plots were captured accordingly.

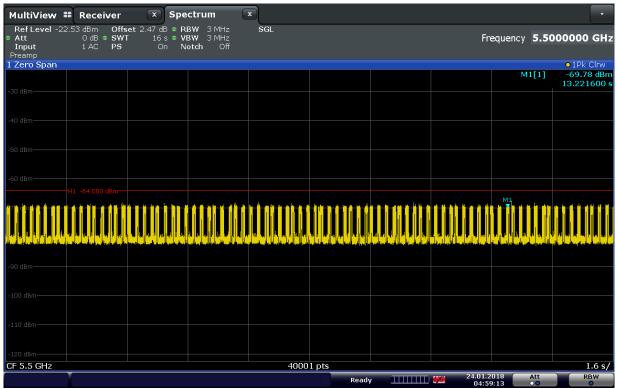


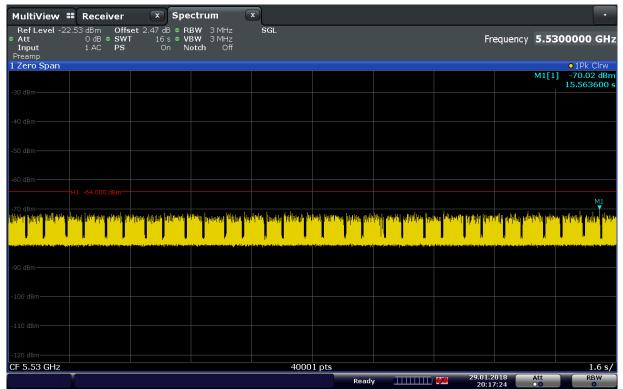
Figure 6-4. 5500MHz - Traffic Signals Type 0 (20MHz)

FCC ID: BCGA1893		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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MultiView 👪 Spectrum	n							·
Ref Level         -23.00 dBm         Of           • Att         0 dB         SY           Input         1 AC         PS           Preamp         1         PS		3W 3 MHz 3W 3 MHz otch Off	SGL			Fre	equency 5.51	.00000 GHz
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-40 dBm								
-50 dBm								
-60 dBm								
H1 -64.000 dBm-	M1							
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-100 dBm								
100 dbm								
-110 dBm								
-120 dBm								
CF 5.51 GHz			4000	1 pts				1.0 s/
				Ready		26.01.2 03:10		RBW

Figure 6-5. 5510MHz - Traffic Signals Type 0 (40MHz)



#### Figure 6-6. 5530MHz - Traffic Signals Type 0 (80MHz)

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## 7.0 TEST RESULTS - CHANNEL LOADING

#### 7.1 Channel Loading Mode1/Mode2:

#### **Channel Loading Notes:**

Per KDB 905462 D02 v02, timing plots are required with calculations demonstrating a minimum channel loading of approximately 17% or greater. For example, you can zero span the spectrum analyzer and approximate the transmission time.

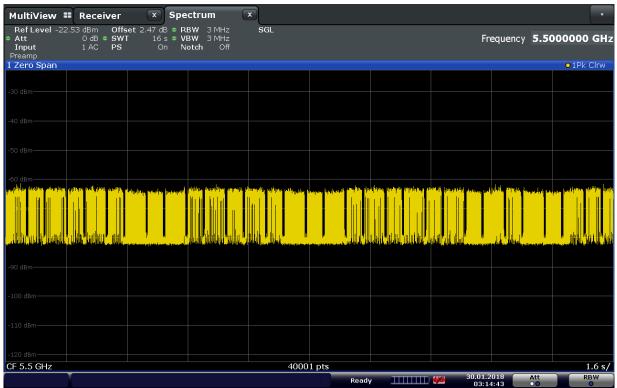


Figure 7-1. 5500MHz - Channel Loading (20MHz)

Thr	reshold		20.00
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20MHz Du	ity Cycl	e.DAT	
20MHz Du Number of Points over th	points	= 40001	

Figure 7-2. 5500MHz - Channel Loading Calculation (20MHz)

FCC ID: BCGA1893		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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MultiView	Receiver	× Spe	ctrum	×					•
Ref Level -2: Att Input Preamp	2.53 dBm Offs 0 dB = SW1 1 AC PS		BW 3MHz BW 3MHz otch Off	SGL			Fn	equency 5.5:	100000 GHz
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-40 dBm									
10 dbm									
-50 dBm									
-60 dBm									
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-100 dBm									
-110 dBm									
-120 dBm									
CF 5.51 GHz				4000	1 pts				1.6 s/
					Read	,	<b>30.01.2</b> 03:11	018 Att	RBW
							03:1.		

Figure 7-3. 5510MHz - Band - Channel Loading (40MHz)

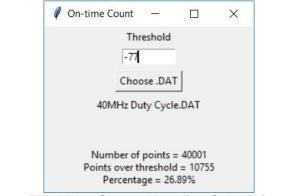


Figure 7-4 5510MHz - Channel Loading Calculation (40MHz)

FCC ID: BCGA1893		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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MultiView =			<u> </u>	×					Ţ
Ref Level -22 Att Input Preamp	53 dBm Offs 0 dB = SW1 1 AC PS		BWY 3 MHz BWY 3 MHz otch Off	SGL			Fr	equency 5.	5300000 GHz
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-30 dBm									
-40 dBm									
-50 dBm									
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CF 5.53 GHZ	T			4000			30.01.2	2018 Att	1.6 s/
					Read	y	03:0	9:10 0	•

Figure 7-5. 5530MHz - Channel Loading (80MHz)

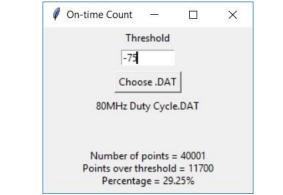


Figure 7-6. 5530MHz - Channel Loading Calculation (80MHz)

FCC ID: BCGA1893		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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### 7.2 Channel Loading Mode3/Mode4:

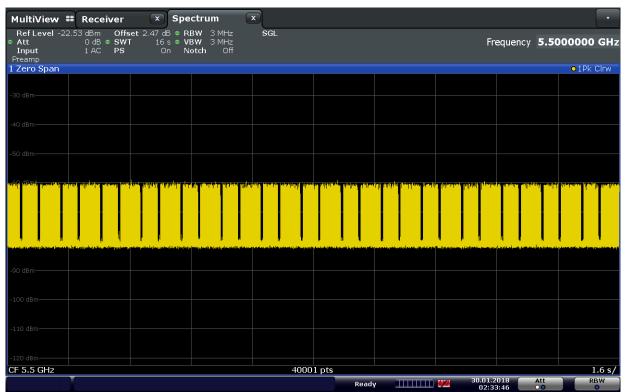


Figure 7-7. 5500 MHz - Channel Loading (20MHz)

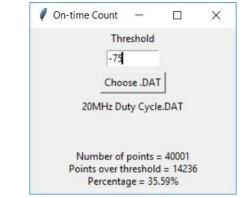


Figure 7-8. 5500MHz - Channel Loading Calculation (20MHz)

FCC ID: BCGA1893		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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MultiView =	Receiver	× Spe	ctrum 💽	×					•
Ref Level -22 Att Input Preamp 1 Zero Span	.53 dBm Offs 0 dB = SW1 1 AC PS		BWY 3 MHz BWY 3 MHz Dotch Off	SGL			Fr	equency 5.5	100000 GHz
1 Zero opari									
-30 dBm									
-40 dBm									
-50 dBm									
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100 10									
-100 dBm									
-110 dBm									
-120 dBm									
CF 5.51 GHz				4000	1 nts				1.6 s/
				1000	Read	y	<b>30.01.2</b> 02:20	2018 Att 6:54 • •	RBW

Figure 7-9. 5510MHz - Channel Loading (40MHz)

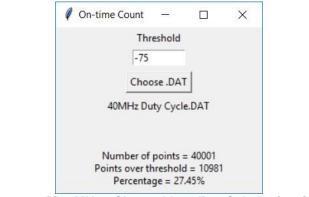


Figure 7-10. 5510MHz - Channel Loading Calculation (40MHz)

FCC ID: BCGA1893		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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MultiView		× Spe	ctrum 🕃	×					•
Ref Level -22 Att Input Preamp	2.53 dBm Offs 0 dB = SW1 1 AC PS		33W 3 MHz 33W 3 MHz otch Off	SGL			Fr	equency 5.5	300000 GHz
1 Zero Span								1	●1Pk Clrw
-30 dBm									
-40 dBm									
-50 dBm									
-50 0811									
-60 dBm									
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-100 dBm									
-110 dBm									
-120 dBm									
CF 5.53 GHz	-			4000			30.01.2		1.6 s/
					Ready	/	<b>990</b> 30.01.2 02:43	2018 Att 2:32 • •	RBW

Figure 7-11. 5530MHz - Channel Loading (80MHz)

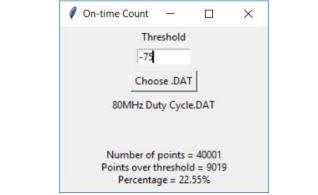


Figure 7-12. 5530MHz - Channel Loading Calculation (80MHz)

FCC ID: BCGA1893		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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## 8.0 TEST RESULTS - MOVE TIME AND AGGREGATE TIME

#### 8.1 Move Time and Aggregate Time Mode 1:

#### Result

Parameter	20MHz Bandwidth	40MHz Bandwidth	80MHz Bandwidth	Limit
Channel Move Time	4.06 s	0.026 s	0.229 s	10 seconds
Channel Closing Transmission Time	< 200ms + 7.431 ms (aggregate)	< 200ms + 0.001 ms (aggregate)	< 200ms + 1.686 ms (aggregate)	200 ms + aggregate of 60ms over remaining 10 second period

#### Notes:

- 1. Trigger Threshold was configured to only capture client pulses. The pulses shown in the plots below have been determined to be from the Master AP.
- 2. Marker Info and Aggregate time results are shown on the right side of the plots below.

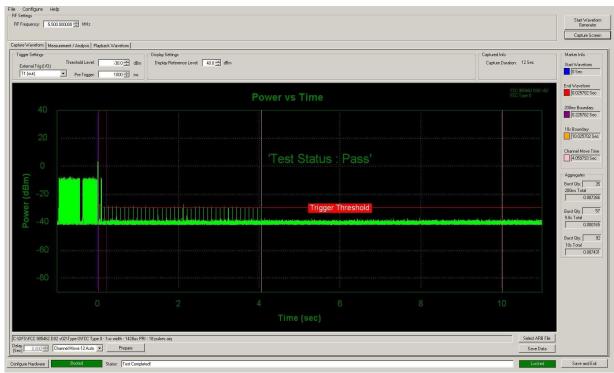


Figure 8-1. 5500MHz - Move Time and Aggregate Time (20 MHz)

FCC ID: BCGA1893		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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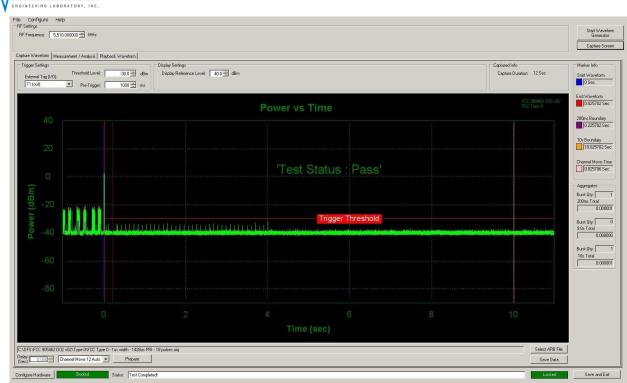


Figure 8-2. 5510MHz - Move Time and Aggregate Time (40 MHz)

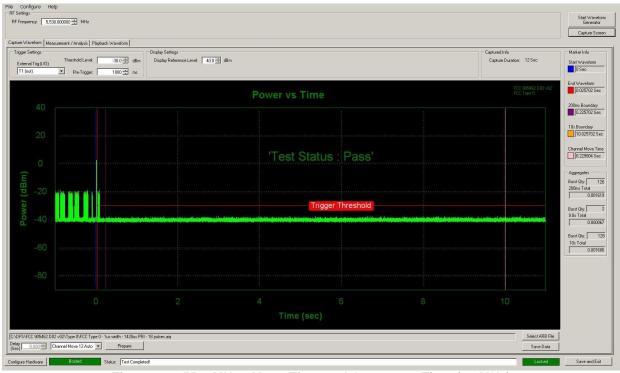


Figure 8-3. 5530MHz - Move Time and Aggregate Time (80 MHz)

FCC ID: BCGA1893		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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#### 8.2 Move Time and Aggregate Time Mode 2:

#### **Result:**

Parameter	20MHz Bandwidth	40MHz Bandwidth	80MHz Bandwidth	Limit
Channel Move Time	5.122 s	0.206 s	0.231 s	10 seconds
Channel Closing Transmission Time	< 200ms + 7.133 ms (aggregate)	< 200ms + 13.694 ms (aggregate)	< 200ms + 6.293 ms (aggregate)	200 ms + aggregate of 60ms over remaining 10 second period

#### Notes:

- Trigger Threshold was configured to only capture client pulses. The pulses shown in the plots below 1. have been determined to be from the Master AP.
- 2. Marker Info and Aggregate time results are shown on the right side of the plots below.

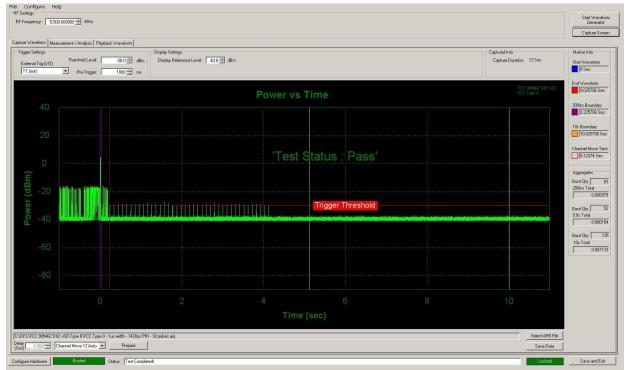


Figure 8-4. 5500MHz - Move Time and Aggregate Time (20 MHz)

FCC ID: BCGA1893		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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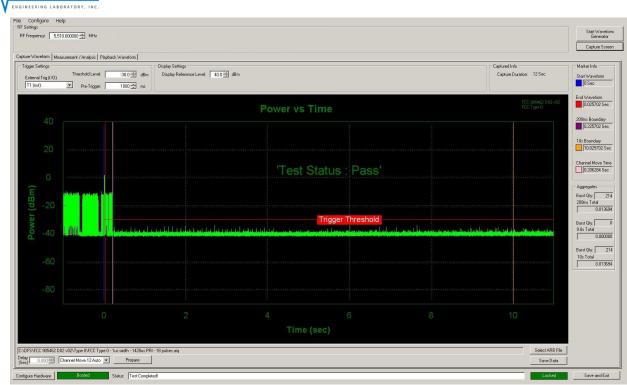


Figure 8-5. 5510MHz - Move Time and Aggregate Time (40 MHz)

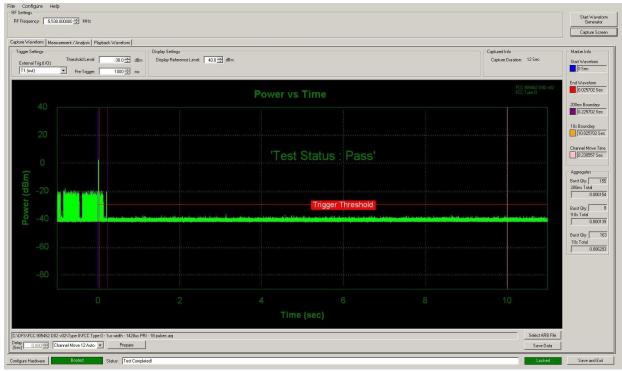


Figure 8-6. 5530MHz - Move Time and Aggregate Time (80 MHz)

FCC ID: BCGA1893		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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#### 8.3 Move Time and Aggregate Time Mode 3:

#### **Result:**

Parameter	20MHz Bandwidth	40MHz Bandwidth	80MHz Bandwidth	Limit
Channel Move Time	4.916 s	0.197 s	0.353 s	10 seconds
Channel Closing Transmission Time	< 200ms 36.116 ms (aggregate)	< 200ms + 20.973 ms (aggregate)	< 200ms + 10.045 ms (aggregate)	200 ms + aggregate of 60ms over remaining 10 second period

#### Notes:

- 1. Trigger Threshold was configured to only capture client pulses. The pulses shown in the plots below have been determined to be from the Master AP.
- Marker Info and Aggregate time results are shown on the right side of the plots below. 2.

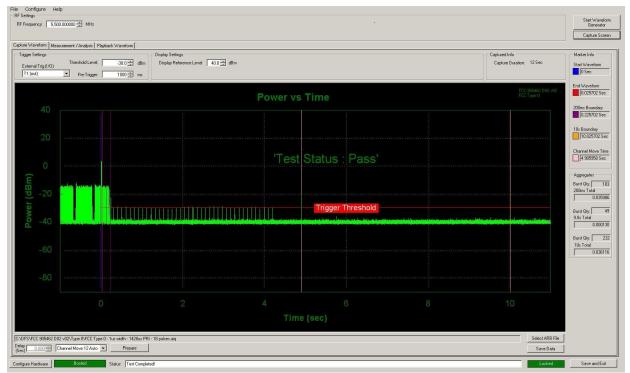


Figure 8-7. 5500MHz - Move Time and Aggregate Time (20 MHz)

FCC ID: BCGA1893		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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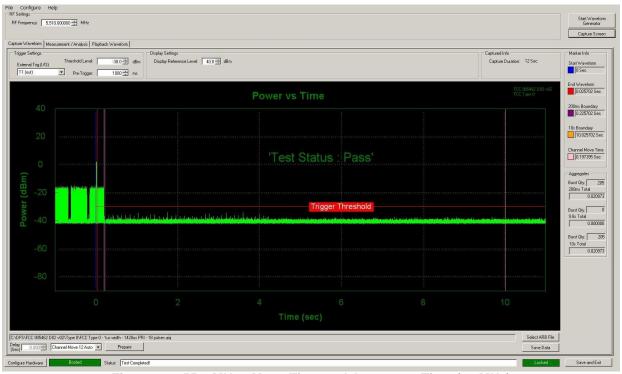


Figure 8-8. 5510MHz - Move Time and Aggregate Time (40 MHz)

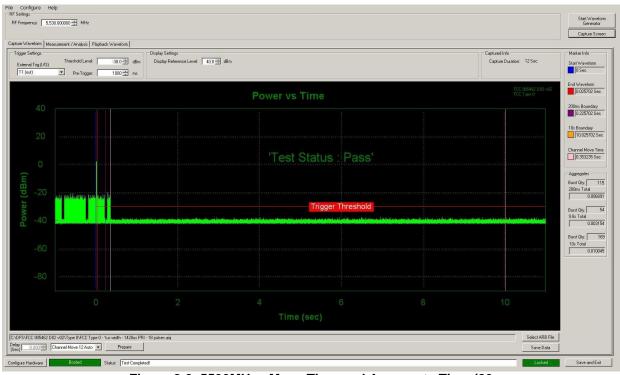


Figure 8-9. 5530MHz - Move Time and Aggregate Time (80 MHz)

FCC ID: BCGA1893		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager	
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#### 8.4 Move Time and Aggregate Time Mode 4:

#### **Result:**

Parameter	20MHz Bandwidth	40MHz Bandwidth	80MHz Bandwidth	Limit	
Channel Move Time	3.275 s	0.237 s	0.332 s	10 seconds	
Channel Closing Transmission Time	< 200ms + 12.512 ms (aggregate)	< 200ms + 12.815 ms (aggregate)	< 200ms + 7.476 ms (aggregate)	200 ms + aggregate of 60ms over remaining 10 second period	

#### Notes:

- 1. Trigger Threshold was configured to only capture client pulses. The pulses shown in the plots below have been determined to be from the Master AP.
- Marker Info and Aggregate time results are shown on the right side of the plots below. 2.

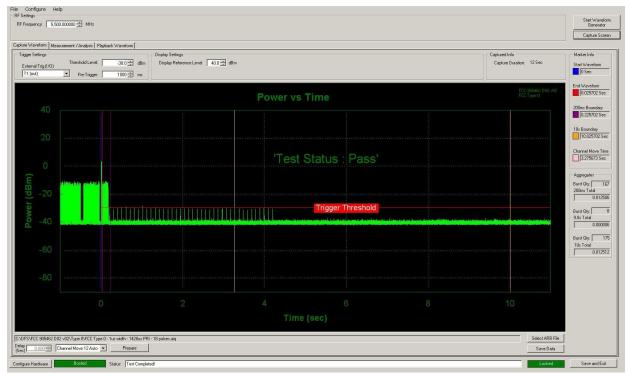


Figure 8-10. 5500MHz - Move Time and Aggregate Time (20 MHz)

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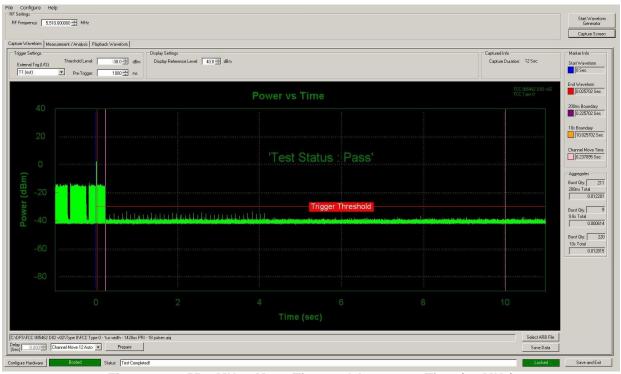


Figure 8-11. 5510MHz - Move Time and Aggregate Time (40 MHz)

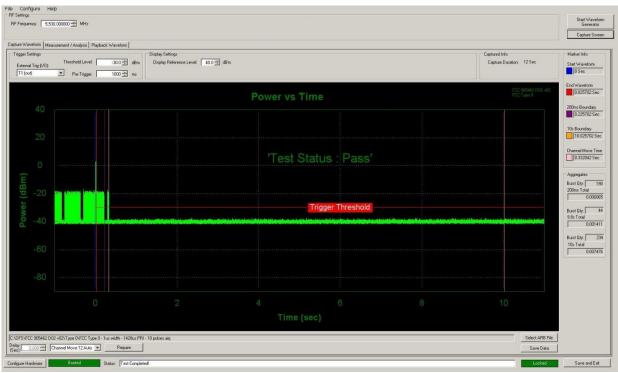


Figure 8-12. 5530MHz - Move Time and Aggregate Time (80 MHz)

FCC ID: BCGA1893		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager	
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## 9.0 TEST RESULTS - CLIENT BEACON TEST (10 MINUTES)

### 9.1 Monitoring 10 minutes Mode 1:

#### Notes:

1. No frequency transmission detected during the aggregate 10 monitoring period.

Ref Level -22	Receiver	aet 2.47 dB • F	ectrum	SGL					
Att Input reamp	0 dB = SW 1 AC PS	T 720 s = 🔪	<b>/BW</b> 3 MHz Notch Off				Fn	equency 5.	5000000 G
Zero Span									01Pk Cln
) dBm									
a barrapapapan in the second	anten contractor and be	terroll constitute and statistical	and the second special data and the special data and the special data and the special data and the special data		ardinele-anderstation	and and the subsection of the	and a sharp the sould be particular	and have encoded by man	and the produced base of the second
					أشذا بمانت الشراعات التحالية	a des de la constante de la factura de la constante de la constante de la constante de la constante de la const	فأنفر ومانعة والباري والتعرفين معاملاتها والمتعرفين		
) dBm									
10 dBm									
5.5 GHz				4000	1 nts				72.0

Figure 9-1. 5500MHz - Monitoring 10 minutes (20MHz)

FCC ID: BCGA1893		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager	
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MultiView 🎫 Spec	trum							·
Input 1 AC Preamp		'BW 3 MHz	SGL			Fn	equency 5.5	100000 GHz
1 Zero Span								01Pk Clrw
-30 dBm							M1	[1] -56.85 dBm 4.57920 s
-30 0611								
-40 dBm								
-50 dBm								
-60 dBm								
-70 dBm								
n An an	ang sa 1965 ka sa king pata ina dikinda kina kita pata kita	er - en Werkin zur datele selten setteren set	ويسترك والقريقة والمتعرف والتراسية	والمرابقة والمرابعة	والمتعاولية والمتحاو أواليه المعاو	ta kost   un mistorial costs la cas	فادمد الالتحالب بخد إغتاله ، من بنتائي	laylalla oz deskilalikus er er svortenilliku
					NA MUTA/PLANMIN BLUM BLUM			
-90 dBm								
-100 dBm								
100 dbm								
-110 dBm								
-120 dBm								
CF 5.51 GHz			10000	)1 pts				72.0 s/
				Ready		26.01.2 02:03	2018 Att 3:30 • •	RBW

Figure 9-2 5510MHz - Monitoring 10 minutes (40MHz)

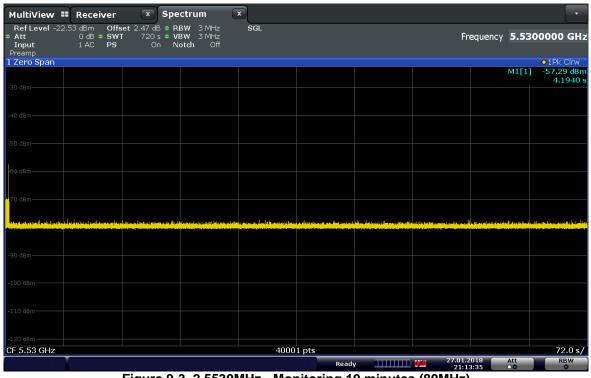


Figure 9-3. 2 5530MHz - Monitoring 10 minutes (80MHz)

FCC ID: BCGA1893		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager	
Test Report S/N:	Test Dates:	EUT Type:	Dage 27 of 11	
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@ 2010 DOTECT Engineering Labo	roton ( loo		17 4 4/40/2040	



9.1 Monitoring 10 minutes Mode 2:

#### Notes:

1. No frequency transmission detected during the aggregate 10 monitoring period.

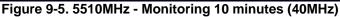
Ref Level -22	Receiver	et 2.47 dB • F	ectrum	SGL					
Att Input Preamp	0 dB = SWT 1 AC PS		'BW 3 MHz	391			Fn	equency <b>5.50</b>	00000 GI
Zero Span									• 1Pk Clrv
30 dBm								M1[1]	-57.71 d 4.464
i0 dBm									
	Literature description in the second s		lisetteriteren in in	en li di si se di silante po di solo sui:	alizzati pertentisti fanni istictura.	e motele reporte de vez mête servel al lives			
0 dBm									
.20 dBm									
F 5.5 GHz				4000	1 pts				72.0

Figure 9-4. 5500MHz - Monitoring 10 minutes (20MHz)

FCC ID: BCGA1893		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager	
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MultiView	Receiver	× Spe	ectrum 🕻	×					Ţ
<ul> <li>Att Input Preamp</li> </ul>	2.53 dBm Offs 0 dB = SW1 1 AC PS		'BW 3 MHz	SGL			Fn	equency 5.	5100000 GHz
1 Zero Span					1				●1Pk Clrw
								M1[	1] -79.16 dBm 5.6700 s
-30 dBm									
-40 dBm									
-50 dBm									
-30 0611									
-60 dBm									
70 dBm									
			والمراجع والمحمر الملح والمحاوم والمحمول						
a service and a service and a service of the servic								pedia per portingation	
-90 dBm									
-100 dBm									
-110 dBm									
-120 dBm				10.00					
CF 5.51 GHz	<b>T</b>			4000			27.01.2	010	72.0 s/
					Ready	/	20:03	018 Att 5:27 • 0	RBW



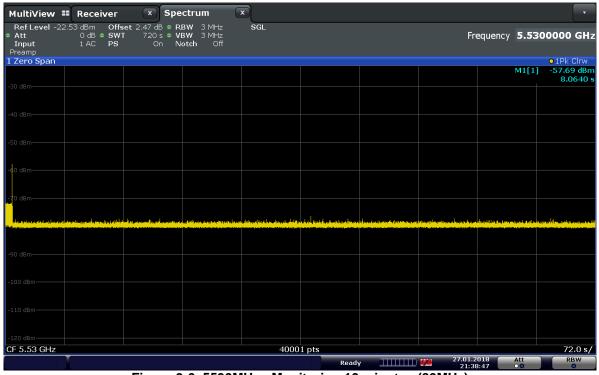


Figure 9-6. 5530MHz - Monitoring 10 minutes (80MHz)

FCC ID: BCGA1893		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager	
Test Report S/N:	Test Dates:	EUT Type:	Dage 20 of 14	
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@ 2010 DOTECT Engineering Labo	roton ( loo		V7 4 4/4C/0040	



### 9.2 Monitoring 10 minutes Mode 3:

#### Notes:

1. No frequency transmission detected during the aggregate 10 monitoring period.

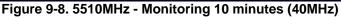
	Receiver			×					
Ref Level -22 Att Input Preamp	2.53 dBm Offs 0 dB = SW1 1 AC PS	et 2.47 dB = R 720 s = V On N	BW 3 MHz	SGL			Fre	equency 5.50	
l Zero Span									●1Pk Clrw
								M1[1]	-67.96 dB 5.0 n
dilana da danah selitani.	Dest life concerns the Hill street	ne in distante in la instance in a		and the survey of the second	en de la companya de la companya de	es di chi da ca da ci la charte e c	ale enderstate de santa e statemente	le de la seguera de la la la	a lanten olatis in katon
F 5.5 GHz				4000	1 nts				72.0

Figure 9-7. 5500MHz - Monitoring 10 minutes (20MHz)

FCC ID: BCGA1893		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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MultiView =				×					·
Ref Level -22 Att Input Preamp	2.53 dBm Offs 0 dB = SW1 1 AC PS	et 2.47 dB ● Ri I 720 s ● Vi On No	3W 3 MHz	SGL			Fn	equency 5.	5100000 GHz
1 Zero Span									o1Pk Clrw
-30 dBm								M1[	1] -58.19 dBm 5.6700 s
oo abiii									
-40 dBm									
-50 dBm									
-60 dBm									
,70 dBm									
distance in the Descention	فيصاد والمقرأ ويرد وسيقاله والم	entitettis dealerde ditensis da	and belief in the shift of the	and a descent to all the			المتريح أبعادهم أبرأه ومرعي متروط		, distanti dan data ang
-90 dBm									
-100 dBm									
-110 dBm									
-120 dBm									
CF 5.51 GHz	•			4000	1 pts		07.04.0		72.0 s/
					Ready	y (1111111)	27.01.2 20:22	2018 Att 3:22 00	RBW



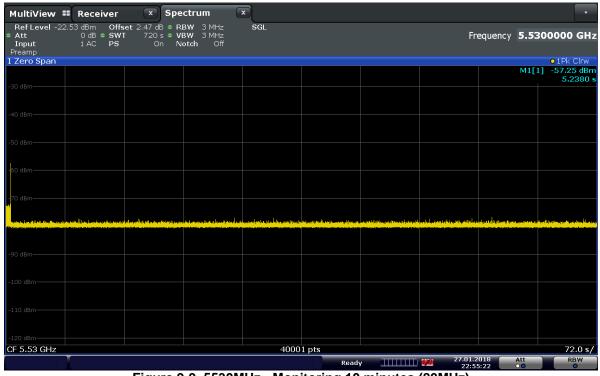


Figure 9-9. 5530MHz - Monitoring 10 minutes (80MHz)

FCC ID: BCGA1893		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager	
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© 0040 DOTEOT Excitation Labor	natany lan		17 4 4 4 0 00 4 0	



### 9.3 Monitoring 10 minutes Mode 4:

#### Notes:

1. No frequency transmission detected during the aggregate 10 monitoring period.

	Receiver			×					
RefLevel -22. Att Input Preamp	53 dBm Offs 0 dB = SW1 1 AC PS	et 2.47 dB ● 7 720 s ● On	VBW 3 MHz	SGL			Fr	equency 5.	5000000 GH
Zero Span						1	1		●1Pk Clrw
40 dBm									
n hi daa yaa da Tiyaa ahaa ahaa yaa ka	Jacques Materia, second second	and the interior to continue	and the other association of the state of the	halls happed age of the tay happen all has do	والمالية ومنافعتهم وتقويمة أبادوه	alarana dia tana araatan taa fahat	والمرابعة الاقتار أكانته ورجوه المتعادية	and the state of the	and a state of the
A DECEMBER OF THE OWNER OWNE									
L10 dBm									
ero-aBIII									
.20 dBm									
F 5.5 GHz				4000	1 pts				72.0

Figure 9-100. 5500MHz - Monitoring 10 minutes (20MHz)

FCC ID: BCGA1893		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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Ref Level -22.5		et 2.47 dB = R		SGL		 		
Att nput eamp	0 dB • SW1 1 AC PS		BW 3 MHz otch Off			Fn	equency 5.51	00000 GH
ero Span								01Pk Clrw
							M1[1]	-70.23 dB 4.8600
uom								
ah ka datanti kan dari tak di							i yana tilayan kata kata kata k	eren bistiki in su
0 dBm								
orabin								
					1 pts			72.0

Figure 9-11 5510MHz - Monitoring 10 minutes (40MHz)

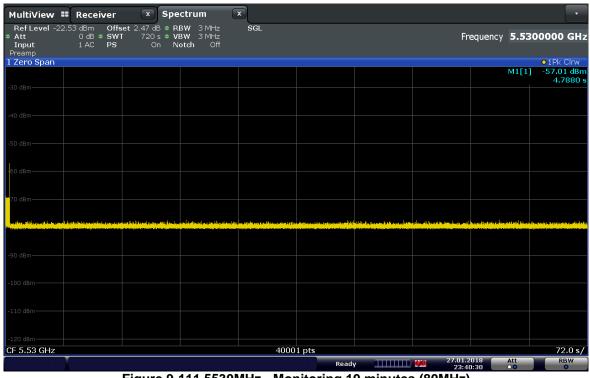


Figure 9-111 5530MHz - Monitoring 10 minutes (80MHz)

FCC ID: BCGA1893		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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### 10.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Apple Tablet FCC ID: BCGA1893** is in compliance with the DFS requirements for a Client Device without radar detection in accordance with Part 15.407 of the FCC Rules and RSS-247 of the Innovation, Science and Economic Development Canada Rules.

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