RADIO TEST REPORT

For

MODEL NO. 1631

Test Report No. R-TR42-NA_DFS-3
Issue Date: May 16, 2014

FCC 15.407 (DFS)
RSS-210 (DFS)

Prepared by
Microsoft EMC Laboratory
17760 NE 67th Ct,
Redmond WA, 98052, U.S.A.
425-421-9799
sajose@microsoft.com

ACCREDITED
TESTING CERT #3472.01

1 Record of Revisions

Revision	Date	Section	Page(s)	Summary of Changes	Author/Revised By:
1.0	05/09/2014	All	All	First Version	Jennifer Liu
2.0	05/14/2014	9	18,23,28,33	Added Non-occupancy test data.	Jennifer Liu
3.0	05/16/2014	9.3, 9.4	24-33	Added test data for 40MHz with Cisco AIR-AP1252AG-A-K9 Access Point.	Jennifer Liu

©Microsoft EMC Laboratory

Table of Contents

1 Record of Revisions 2
2 Deviations from Standard 5
3 Facilities and Accreditations 5
3.1 Test Facility 5
3.2 Accreditations 5
3.3 Test Equipment 5
4 Product Description 6
4.1 EUT Details 7
4.2 Test Method 7
4.3 Environmental Conditions 7
4.4 Antenna Requirements 7
4.5 Equipment Modifications 7
5 Test Results Summary 8
6 Test Equipment List 9
7 DFS Test Description and Requirements 10
7.1 Requirements for Client devices: 10
7.2 DFS Requirements: 10
7.3 Radar Test Waveform: 12
8 Test Setup 13
9 Test Results 14
9.1 Chain A: 20 MHz Bandwidth of Operation 14
9.2 Chain B: 20 MHz Bandwidth of Operation 19
9.3 Chain A: 40 MHz Bandwidth of Operation 24
9.4 Chain B: 40 MHz Bandwidth of Operation 29

©Microsoft EMC Laboratory

Microsoft

Test Report Attestation

Microsoft Corporation
Model: 1631
FCC ID: C3K1631
IC ID: 3048A-1631

Applicable Standards

Specification	Test Result
DFS Requirements of FCC CFR 47 Rule Parts15.407	Pass
DFS Requirements of RSS-210, Issue 8	Pass

Microsoft EMC Laboratory attests that the product model identified in this report has been tested to and meets the requirements identified in the above standards. The test results in this report solely pertains to the specific sample tested, under the conditions and operating modes as provided by the customer. All indications of Pass/Fail in this report are opinions expressed by the Microsoft EMC Laboratory based on interpretations and/or observations of test result on the tested sample only.

This report shall not be used to claim product certification, approval, or endorsement by A2LA or any agency of any Government.
Reproduction, duplication or publication of extracts from this test report requires prior written approval of Microsoft EMC Laboratory.

Written By: Jennifer Liu
EMC Test Engineer

Reviewed/Issued By: Sajay Jose
EMC/RF Lab Manager

©Microsoft EMC Laboratory

2 Deviations from Standard

None

3 Facilities and Accreditations

3.1 Test Facility

All test facilities used to collect the test data are located at Microsoft EMC Laboratory: 17760 NE 67th Ct, Redmond, WA, 98052, USA.

3.2 Accreditations

The lab is established and follows procedures as outlined in IEC/ISO 17025 and A2LA accreditation requirements.

A2LA Accredited Testing Certificate Number: 3472.01

3.3 Test Equipment

The site and related equipment are constructed in conformance with the requirements of ANSI C63.4, CISPR 16-1-1, KDB 905462 and other equivalent applicable standards.

The calibrations of the measuring instruments, including any accessories that may affect such calibration, are checked frequently to assure their accuracy. Adjustments are made and correction factors applied in accordance with instructions contained in the user manual for the measuring equipment.

©Microsoft EMC Laboratory

4 Product Description

Company Name:	Microsoft Corporation
Address:	One Microsoft Way
City, State, Zip:	Redmond, WA 98052
Customer Contact:	Mike Boucher
Model:	1631
Functional Description of EUT:	Handheld Computing Device
Frequency bands of Operation:	2402- 2480 MHz 5150- 5250 MHz 5250- 5350 MHz 5470-5600 MHz 5650- 5725 MHz 5725- 5825 MHz
Radio Technologies Supported:	Bluetooth™ IEEE 802.11 a/b/g/n/ac
Bandwidths supported:	20 MHz, 40 MHz and 80 MHz
DFS Bands of Operation:	5250 - 5350MHz; 5470-5725MHz
DFS Operational Mode:	Client Device – No Ad-Hoc functionality and No Radar Detection.
Antenna Information:	Internal Antenna.
Manufacturer stated Maximum antenna Gains (dBi):	2400- 2483.5 MHz: 3.0 5150- 5250 MHz: 3.6 5250- 5350 MHz: 3.5 5470- 5725 MHz: 3.7 5725- 5825 MHz: 3.6
Transmit Power Control:	TPC is not implemented.
System Architecture:	IP Based
Power on cycle:	Master: 2 mins Client EUT: 30 secs.
Dates of Testing:	5/5/2014- 5/16/2014
Equipment Condition:	Pre-production sample; good condition.

©Microsoft EMC Laboratory

4.1 EUT Details

Model No.	1631
Serial number:	041149240753
SW/FW on the EUT:	Windows 8.1 Pro V 1.110.0 (20140310)

4.2 Test Method

Radiated test method was followed to perform the tests.

4.3 Environmental Conditions

Ambient air temperature of 10 ºC to 40 ºC (50 ºF to 104 ºF) and Humidity levels of 10% to 90% were maintained during the course of the tests.

4.4 Antenna Requirements

The antennas are permanently attached and there are no provisions for connection to an external antenna.

4.5 Equipment Modifications

No modifications were made during testing.

©Microsoft EMC Laboratory

5 Test Results Summary

Test Description	Limit	Test Result
Channel Move Time	10s (FCC/IC)	Pass
Channel Closing Transmission Time	60 ms (FCC) 260 ms (IC)	Pass
Non Occupancy Period	30 mins	Pass

©Microsoft EMC Laboratory

6 Test Equipment List

Manufacturer	Description	Model #	SN:	Cal Due
Aeroflex	DFS system With in-built Generator and Digitizer Modules.	Aeroflex 3005	93-70423-5910	9/23/2014
Asus	Dual Band 3x3 802.11AC Router (FCC ID: MSQ-RTAC66U)	RT-AC66U	D71A0B009667	N/A
Cisco Systems	Aironet 802.11 a/b/g Access Point (FCC ID: LDK102055)	AIR-AP1242AG-A-K9	FTX1610B0BP	N/A
Cisco Systems	Aironet 802.11 a/b/g/n Access Point (FCC ID: LDK102061)	AIR-AP1252AG-A-K9	FTX1449919Q	N/A
Rohde-Schwarz	Spectrum Analyzer	ESU40	100420	2/14/2015
Rosenburger	RF Cables	L72-449-915	EMC-324, EMC-318	N/A
Sunol Sciences	Horn Antenna	DRH-118	A122412-1, -2	N/A

©Microsoft EMC Laboratory

7 DFS Test Description and Requirements

A U-NII network will employ a DFS function to detect signals from radar systems and to avoid co-channel operation with these systems.

7.1 Requirements for Client devices:

a) A Client device will not transmit before receiving an appropriate control signals from a Master device.

b) A Client device will stop its transmissions on a channel whenever instructed by a Master device and will comply with the Channel Move Time and Channel Closing Transmission Time requirements as specified in Table 7-4. The client device will not resume any transmissions on this channel until it has received an appropriate control signals from a Master device.

c) If a Client is performing In-Service Monitoring and detects a Radar Waveform above the DFS Detection Threshold as shown in Table 7-3, it will inform the Master device.

7.2 DFS Requirements:

Requirement	Operational Mode		
	Master	**Client (without DFS)**	**Client (with DFS)**
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 7-1 DFS Requirements

©Microsoft EMC Laboratory

Requirement	Operational Mode		
	Master	**Client (without DFS)**	**Client (with DFS)**
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

Table 7-2 Applicability of DFS requirements during normal operation

Maximum Transmit Power	**Value (see Notes 1,2)**
≥ 200 mW	-64 dBm
< 200 mW	-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.	

Table 7-3 DFS Detection Threshold Level

©Microsoft EMC Laboratory

Parameter	Value
Non-occupancy	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds (see Note 1)
Channel Closing Transmission Time	200 ms + an aggregate of 60 ms over remaining 10 sec period. (see Notes 1, 2)
U-NII Detection Bandwidth	Minimum 80% of the UNII 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 7-4 DFS Requirement Values

7.3 Radar Test Waveform:

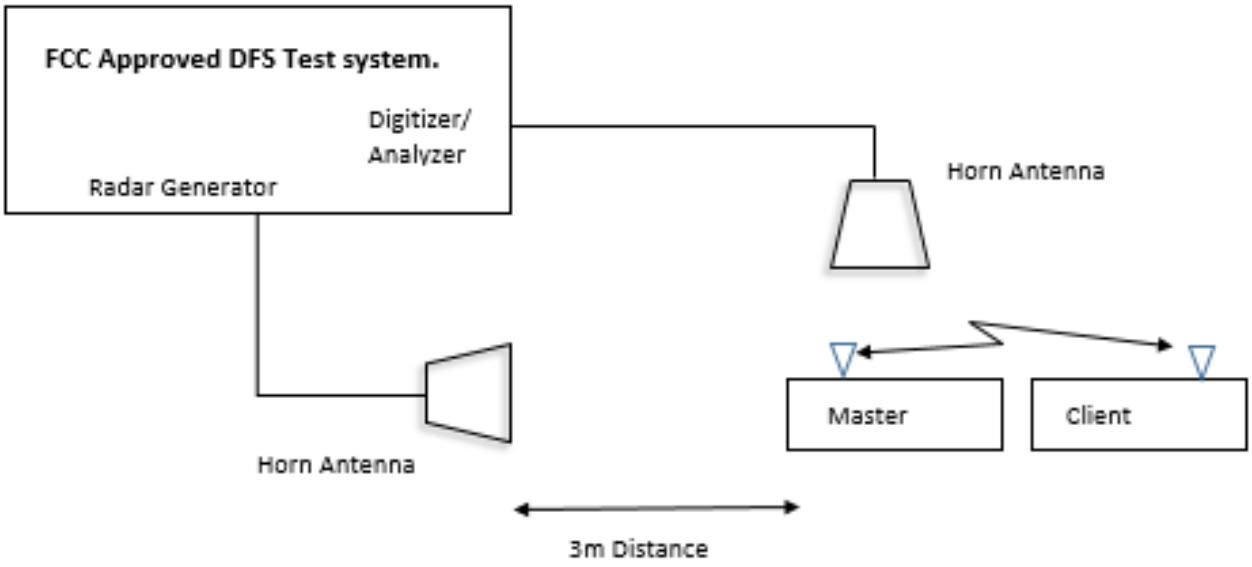
For a Client device without DFS detection, the Channel Move Time and Channel Closing Transmission Time requirements will be verified with Short Pulse Radar Type 1 with the following characteristics:

Radar Type: 1
Pulse Width: 1 µsec
PRI: 1428 µsec
Number of Pulses: 18

©Microsoft EMC Laboratory

8 Test Setup

The DFS test was performed in an RF shielded environment in Radiated mode per the diagram shown below.



The test setup consists of a Radar Signal Generator, Signal Analyzer, Master Device and Client Device and applicable power combiners/splitters/attenuators. The DFS detection threshold was set to -61dBm per conditions in Table 7-3.

The Asus Router was used to communicate with the Master Device (Cisco Access Point Model AIR-AP1242AG-A-K9 for 20 MHz operation and Model AIR-AP1252AG-A-K9 for 40 MHz operation) to setup the required channels of test. A communication link is established between the Master and Client EUT.

An external Spectrum Analyzer (Rohde-Schwarz ESU 40) was used to measure the non-occupancy period.

Channel Loading: The designated MPEG test file from http://ntiacsd.ntia.doc.gov/dfs/ was used to transfer from the Master to Client Device for all test configurations.

Testing was performed on both chains of the device, for 20MHz and 40 MHz bandwidths of operation and for one channel within 5.25-5.35 GHz and 5.47-5.725 GHz bands.

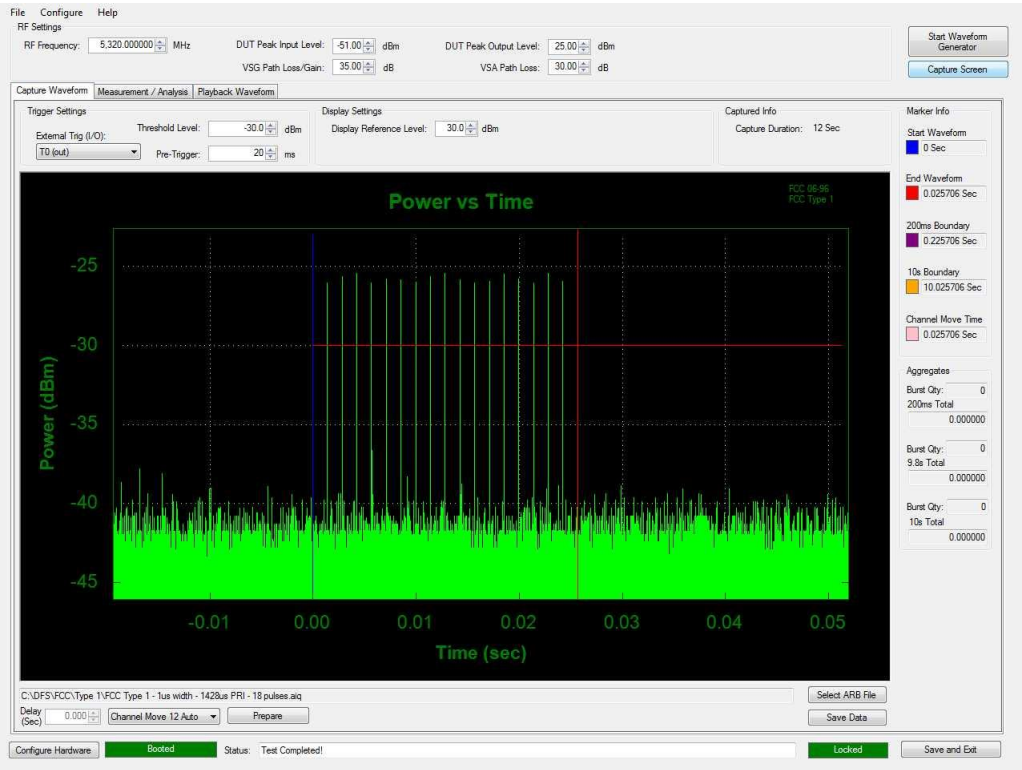
©Microsoft EMC Laboratory

9 Test Results

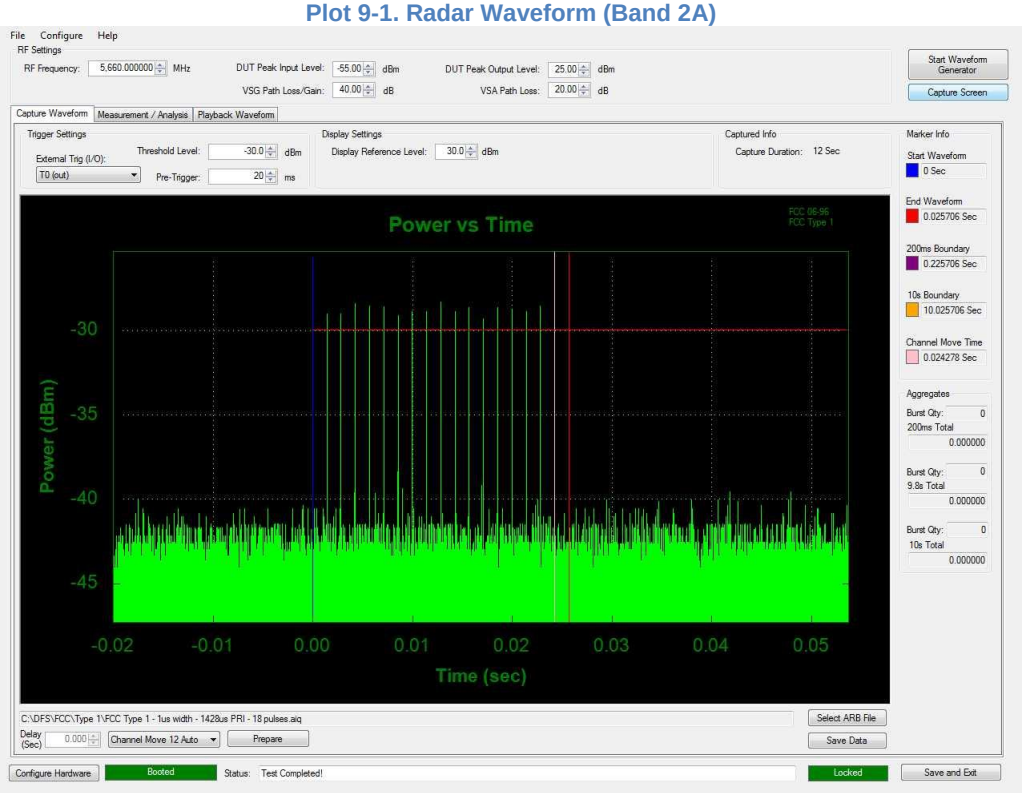
9.1 Chain A: 20 MHz Bandwidth of Operation

Frequency Channel (MHz)	Channel Move Time (ms)	Limit (ms)	Channel Closing Transmission Time (ms)	FCC Limit (ms)	IC Limit (ms)	Pass/Fail
5320	2114.215	10000	7.963	60	260	Pass
5520	1166.754	10000	1.134	60	260	Pass

©Microsoft EMC Laboratory

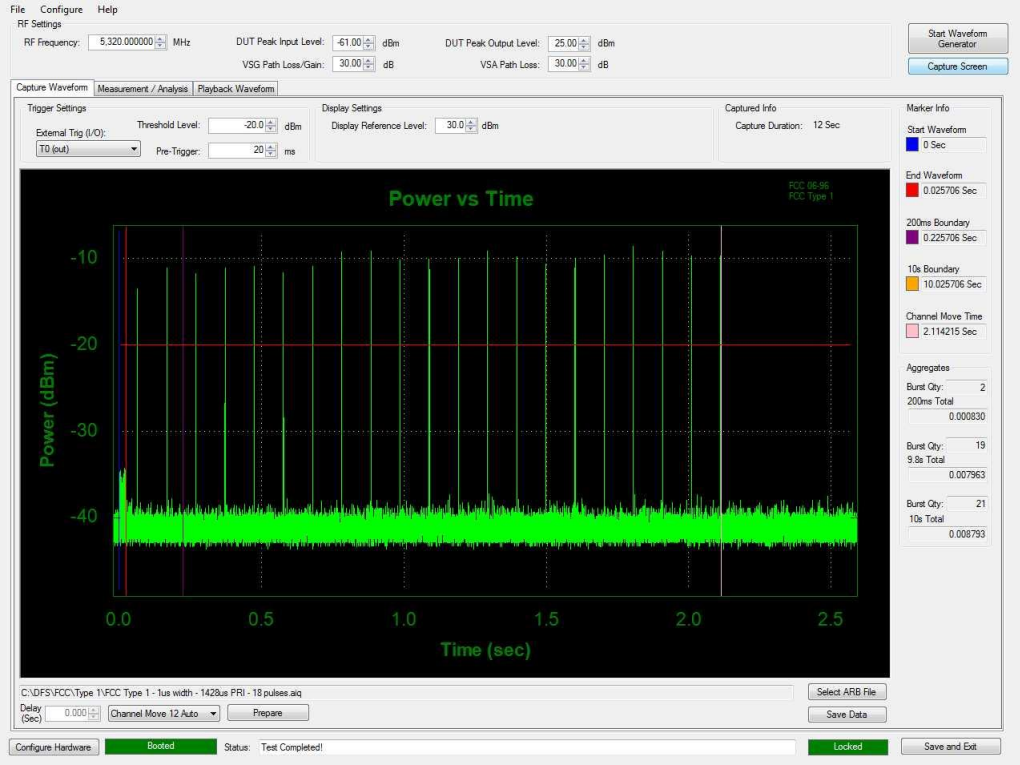


Plot 9-1. Radar Waveform (Band 2A)

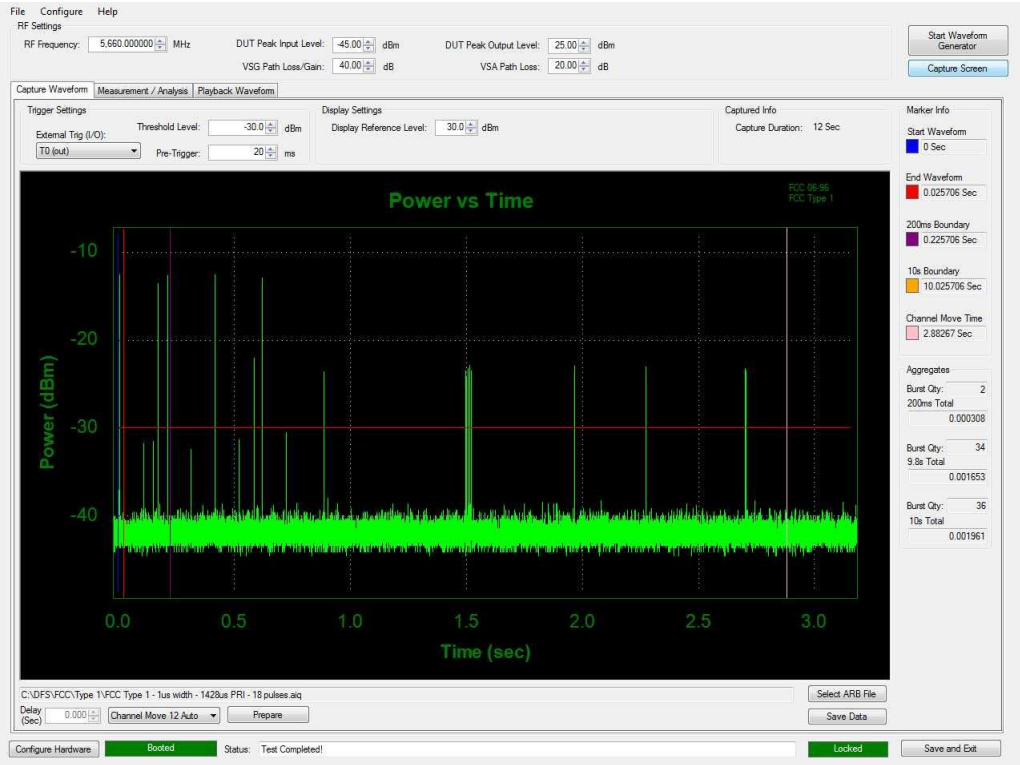


Plot 9-2. Radar Waveform (Band 2C)

©Microsoft EMC Laboratory

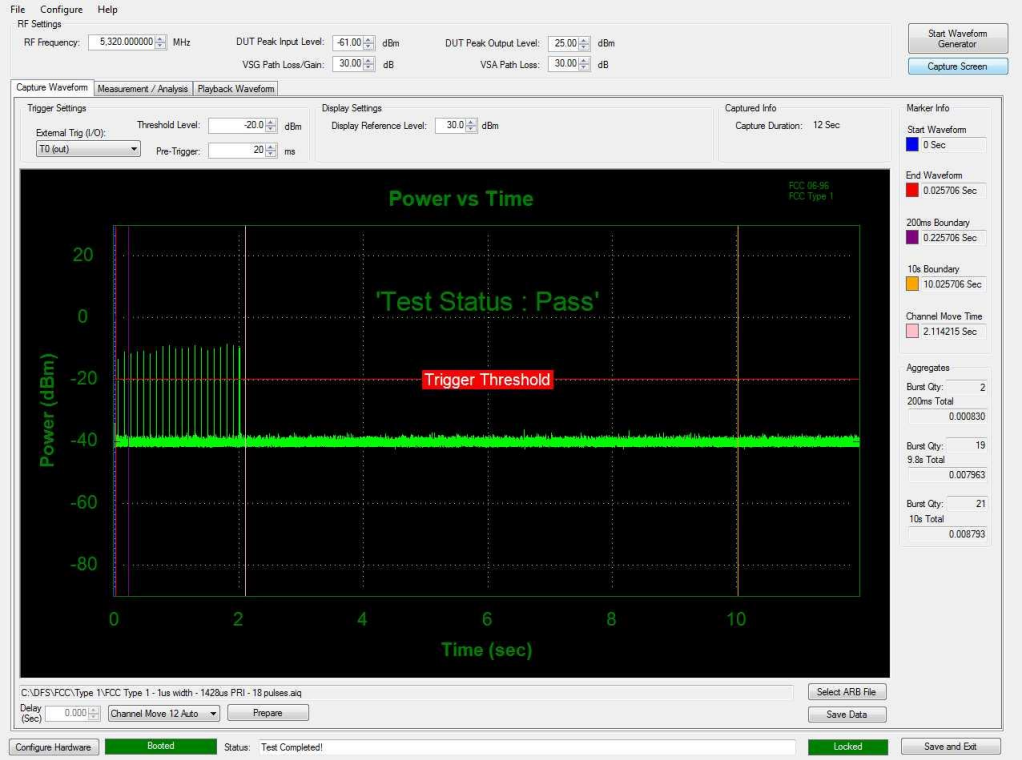


Plot 9-3. Channel Move Time – Band 2A



Plot 9-4. Channel Move Time – Band 2C

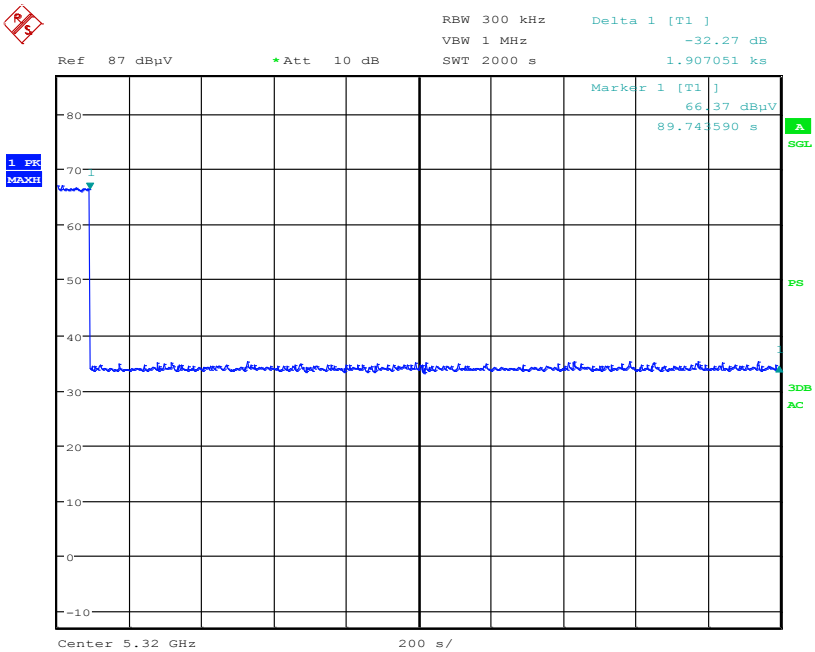
©Microsoft EMC Laboratory



Plot 9-5. Channel Closing Transmission Time – Band 2A

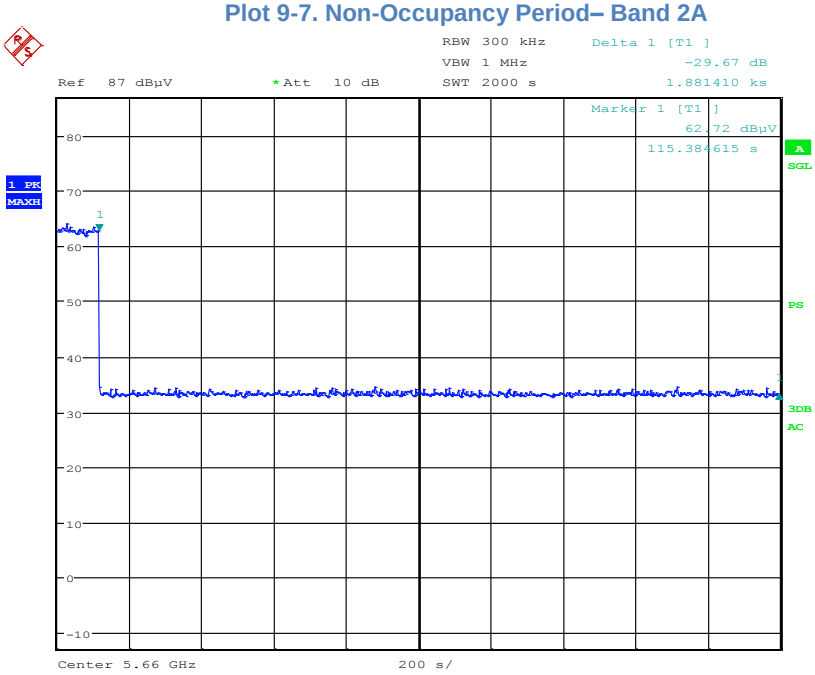
Plot 9-6. Channel Closing Transmission Time – Band 2C

©Microsoft EMC Laboratory



Date: 15.MAY.2014 02:51:50

Plot 9-7. Non-Occupancy Period– Band 2A



Date: 15.MAY.2014 03:29:45

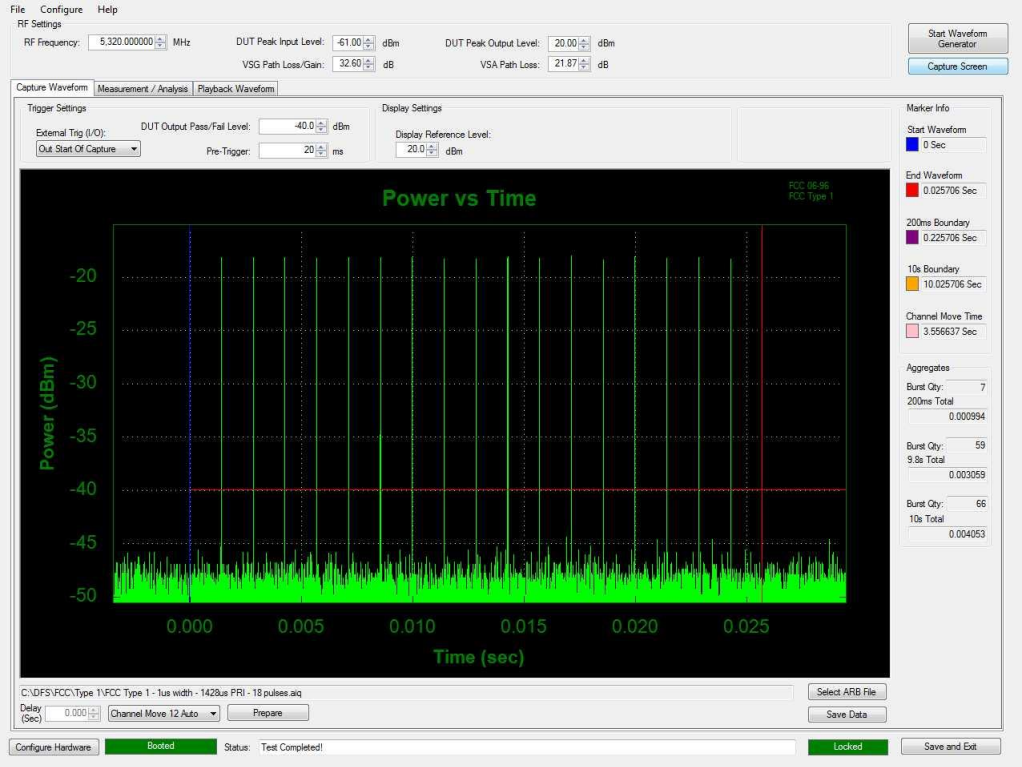
Plot 9-8. Non-Occupancy Period– Band 2C

©Microsoft EMC Laboratory

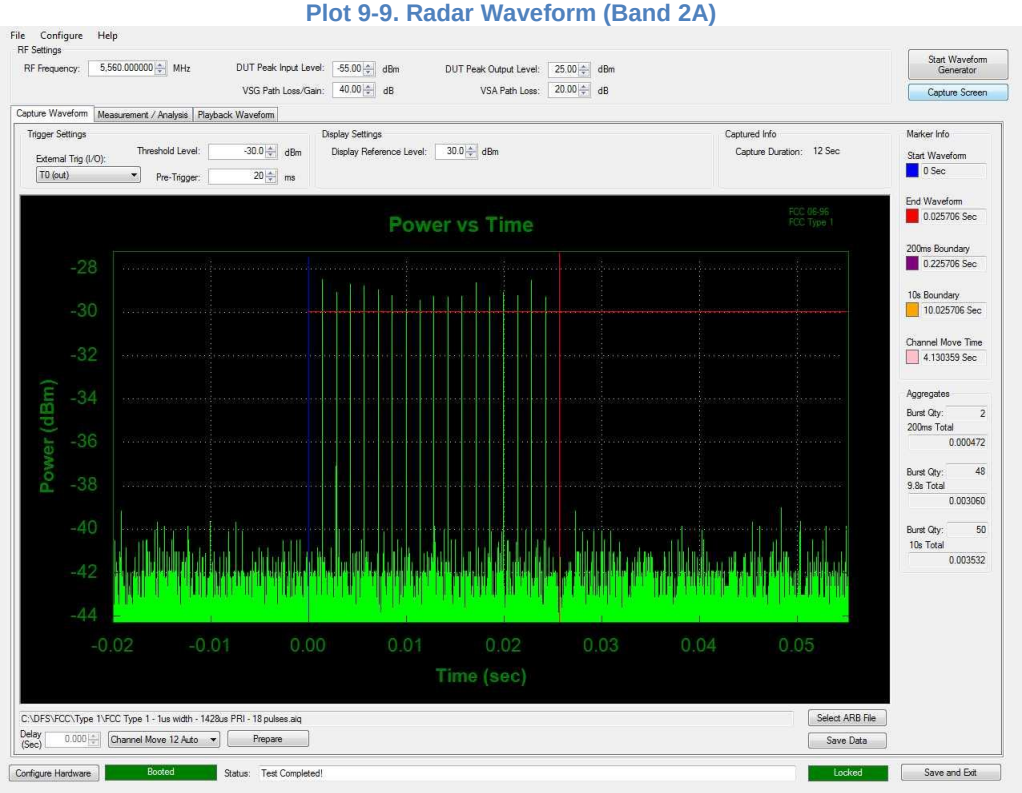
9.2 Chain B: 20 MHz Bandwidth of Operation

Frequency Channel	Channel Move Time (ms)	Limit (ms)	Channel Closing Transmission Time (ms)	FCC Limit (ms)	IC Limit (ms)	Pass/Fail
5320	2149.667	10000	8.389	60	260	Pass
5500	3659.381	10000	3.462	60	260	Pass

©Microsoft EMC Laboratory

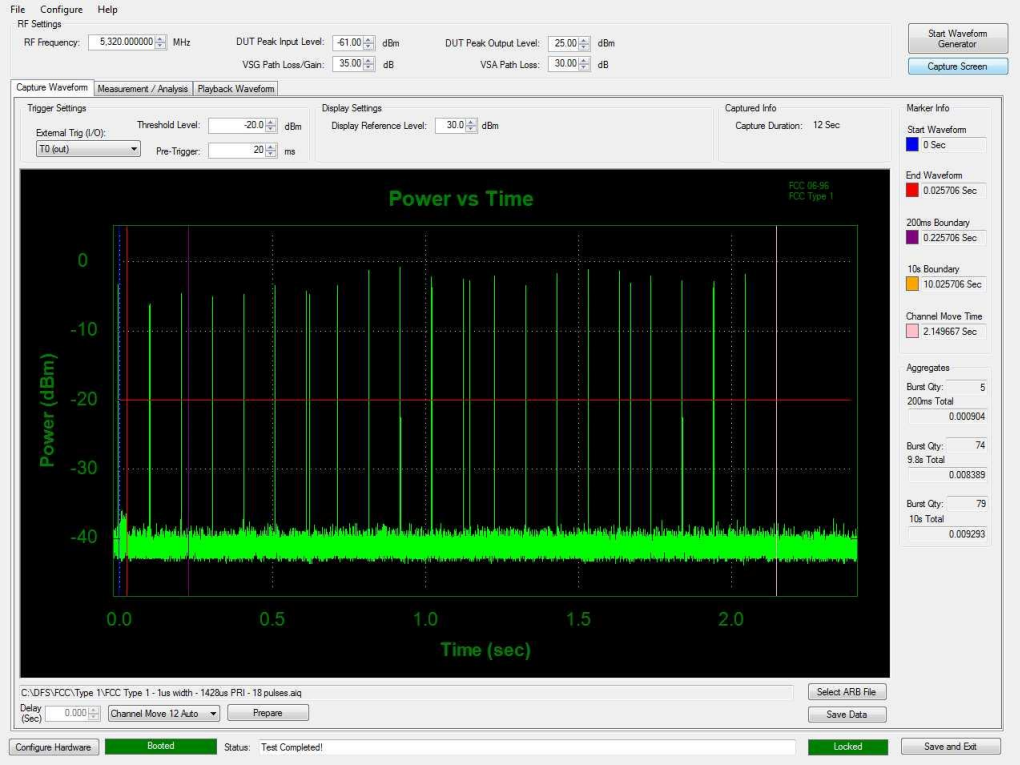


Plot 9-9. Radar Waveform (Band 2A)

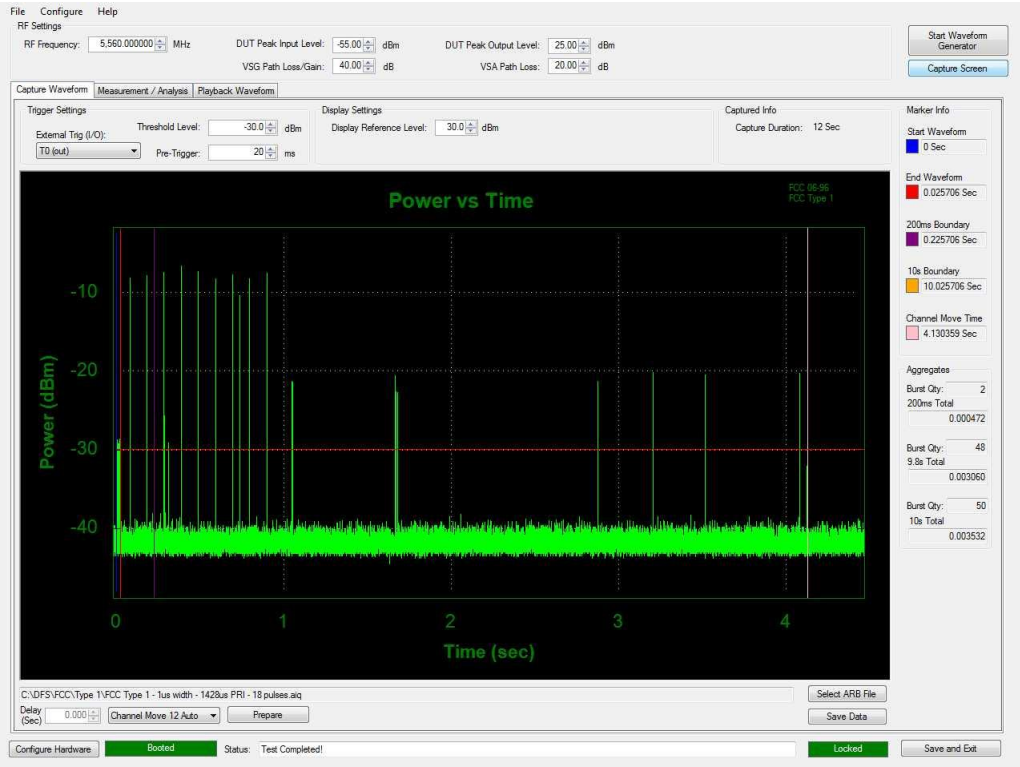


Plot 9-10. Radar Waveform (Band 2C)

©Microsoft EMC Laboratory

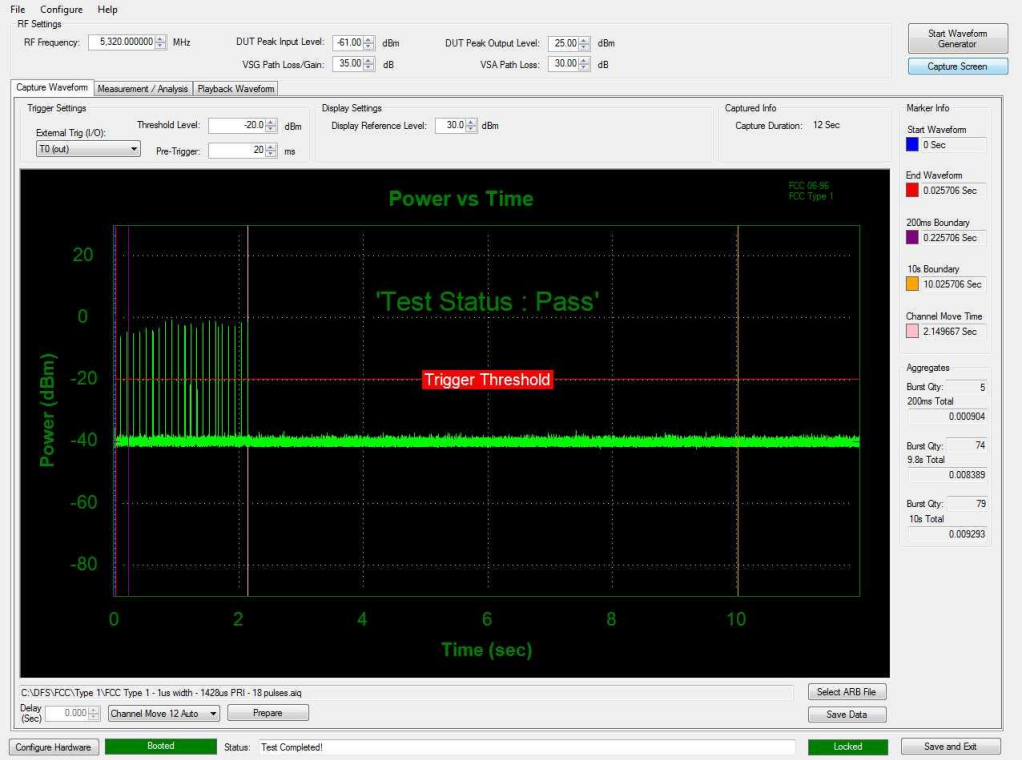


Plot 9-11. Channel Move Time – Band 2A



Plot 9-12. Channel Move Time – Band 2C

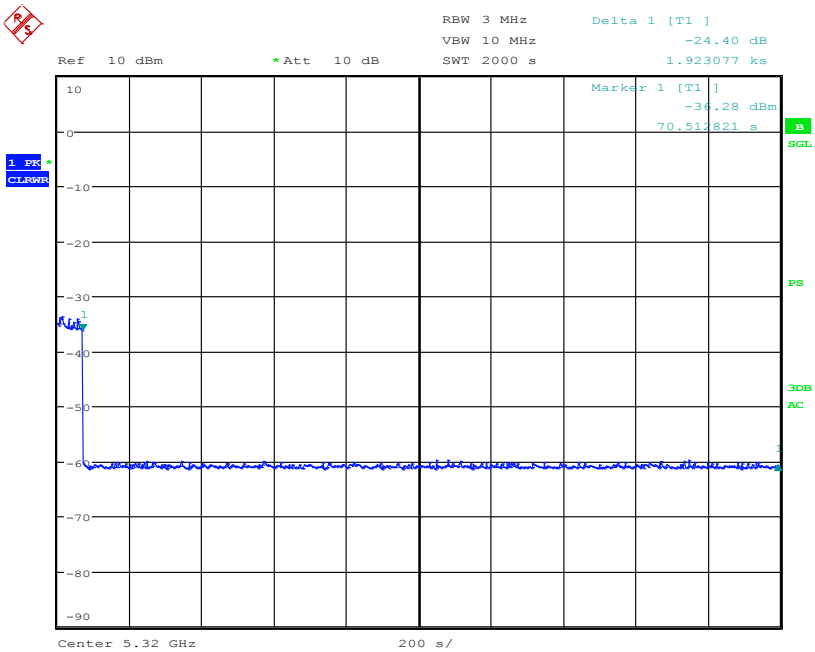
©Microsoft EMC Laboratory



Plot 9-13. Channel Closing Transmission Time – Band 2A

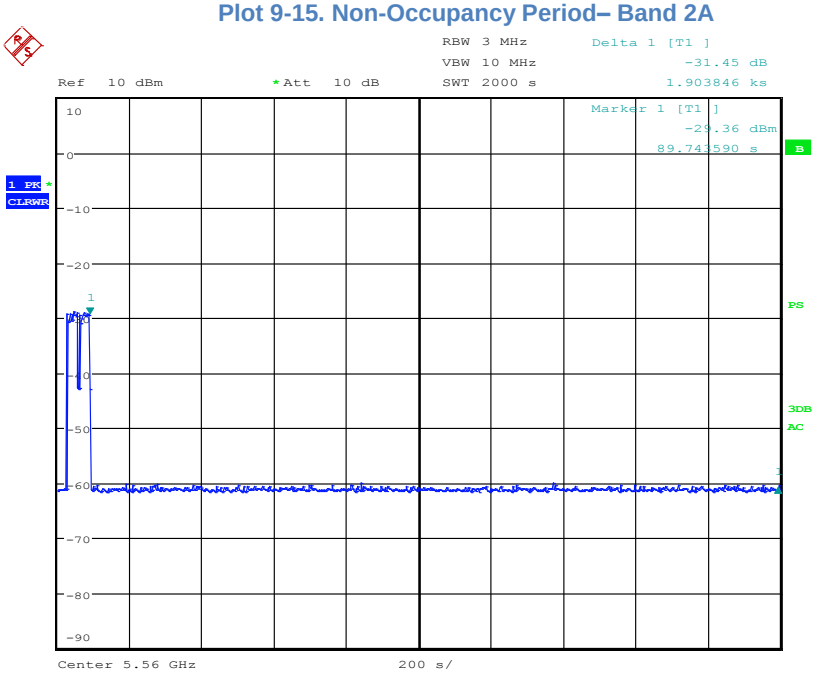
Plot 9-14. Channel Closing Transmission Time – Band 2C

©Microsoft EMC Laboratory



Date: 14.MAY.2014 03:39:39

Plot 9-15. Non-Occupancy Period– Band 2A



Date: 14.MAY.2014 05:55:59

Plot 9-16. Non-Occupancy Period– Band 2C

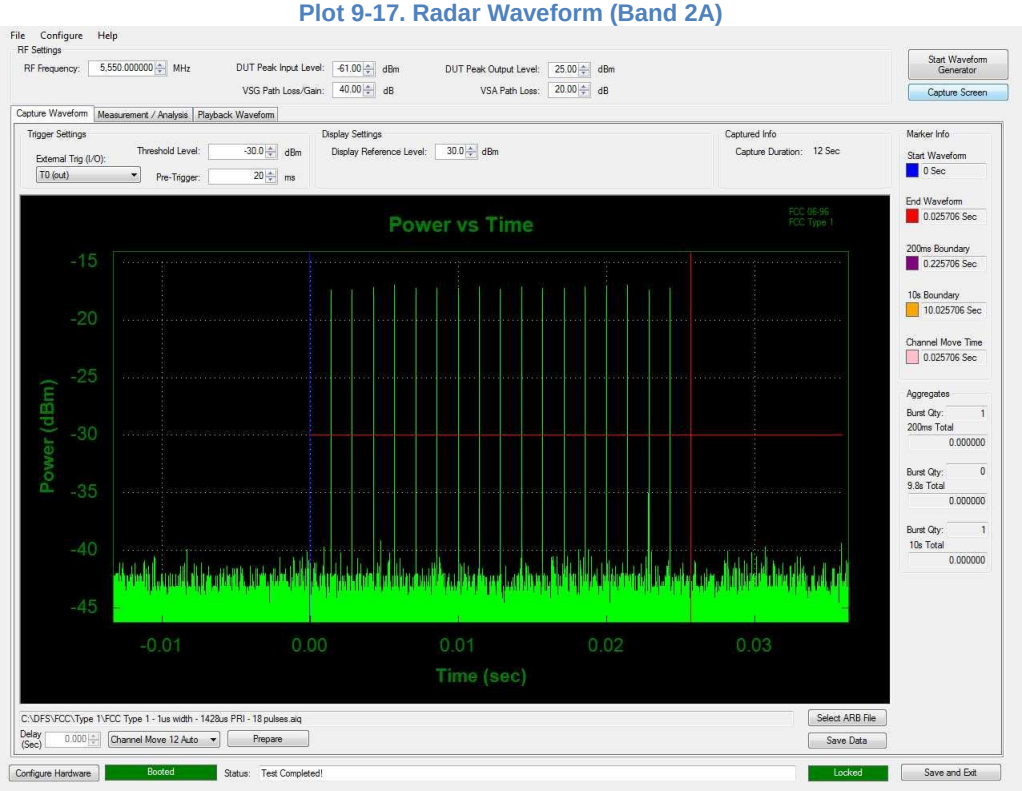
©Microsoft EMC Laboratory

9.3 Chain A: 40 MHz Bandwidth of Operation

Frequency Channel (MHz)	Channel Move Time (ms)	Limit (ms)	Channel Closing Transmission Time (ms)	FCC Limit (ms)	IC Limit (ms)	Pass/Fail
5270	526.545	10000	0.592	60	260	Pass
5550	535.718	10000	0.592	60	260	Pass

©Microsoft EMC Laboratory

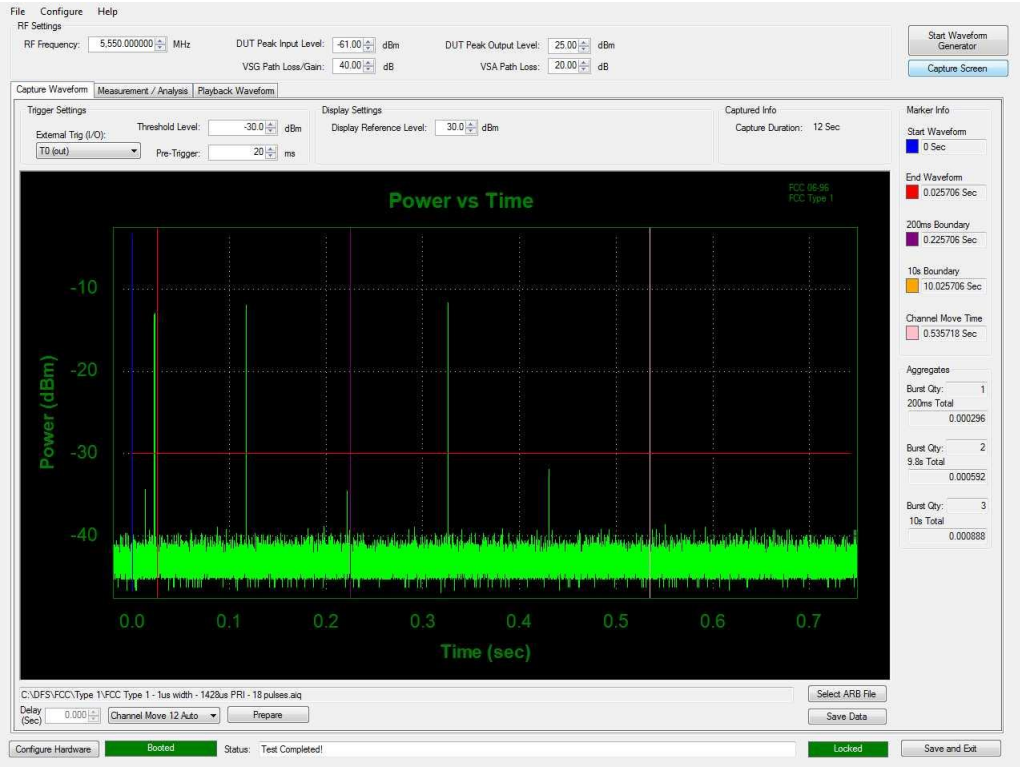
Plot 9-17. Radar Waveform (Band 2A)



Plot 9-18. Radar Waveform (Band 2C)

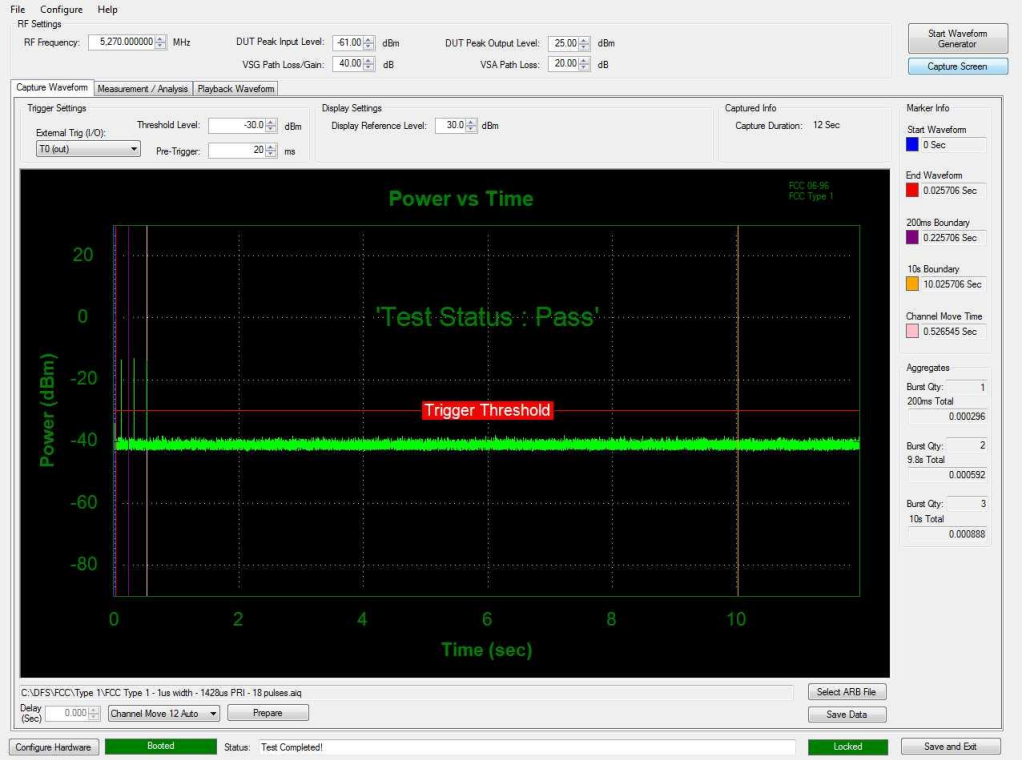
©Microsoft EMC Laboratory

Plot 9-19. Channel Move Time – Band 2A



Plot 9-20. Channel Move Time – Band 2C

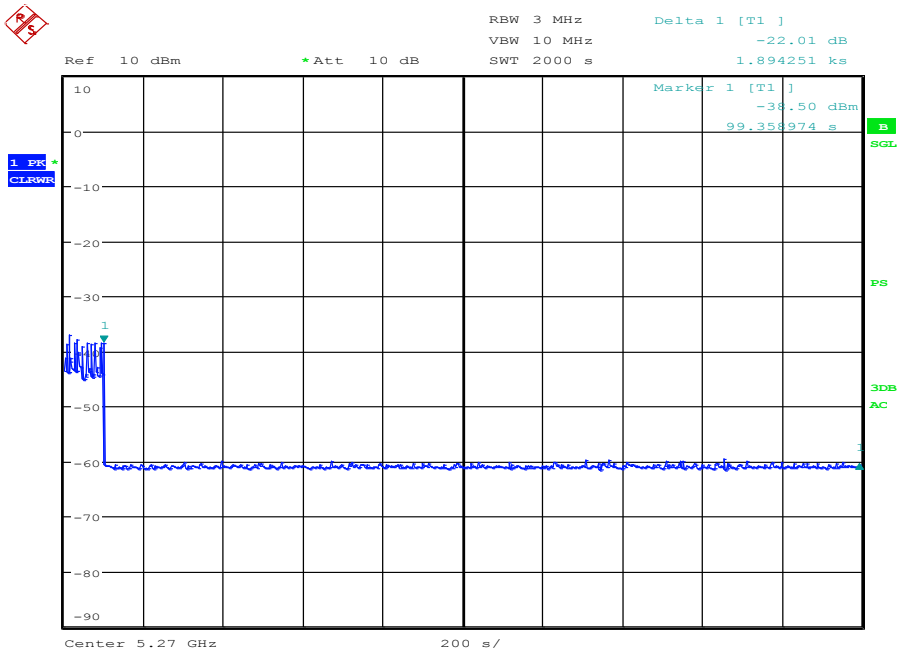
©Microsoft EMC Laboratory



Plot 9-21. Channel Closing Transmission Time – Band 2A

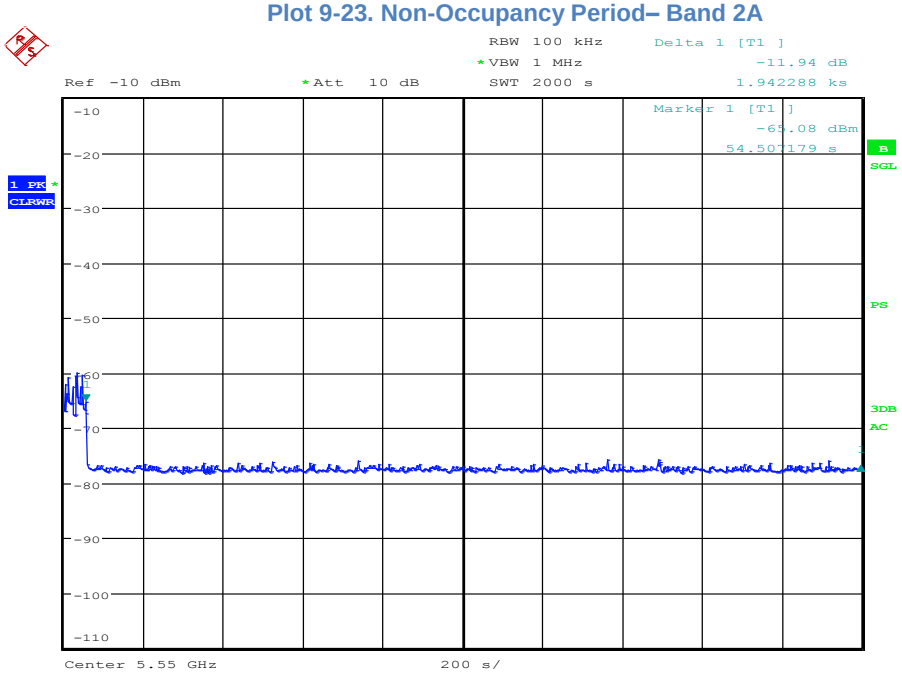
Plot 9-22. Channel Closing Transmission Time – Band 2C

©Microsoft EMC Laboratory



Date: 15.MAY.2014 23:01:27

Plot 9-23. Non-Occupancy Period– Band 2A



Date: 16.MAY.2014 20:34:47

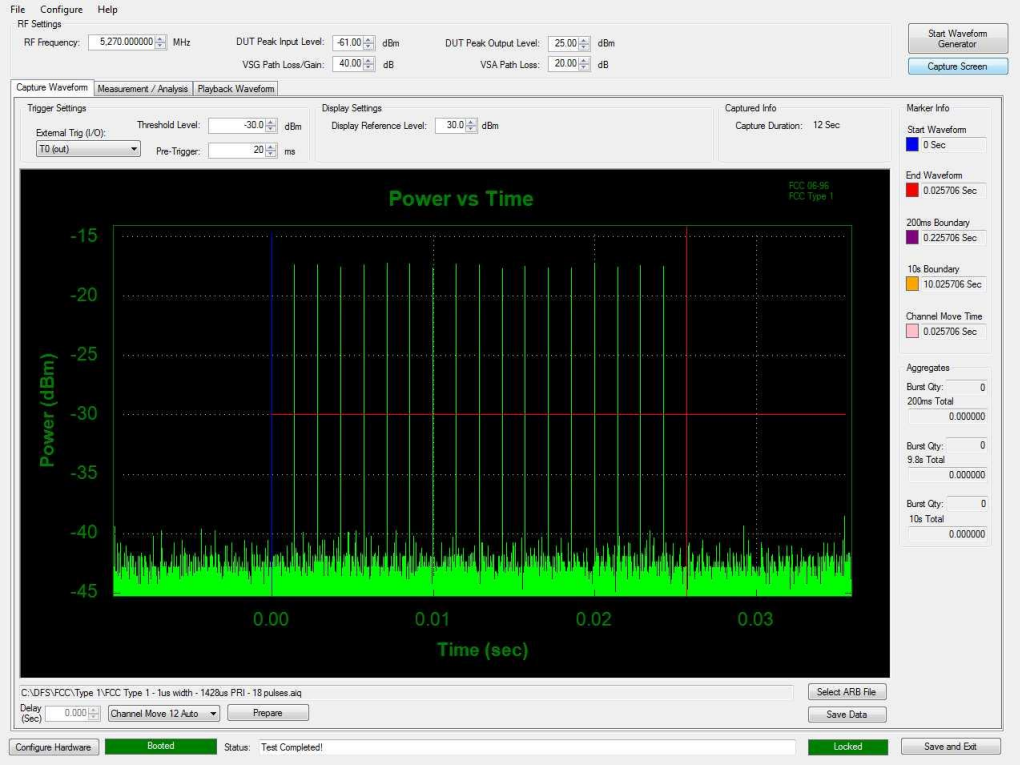
Plot 9-24. Non-Occupancy Period– Band 2C

©Microsoft EMC Laboratory

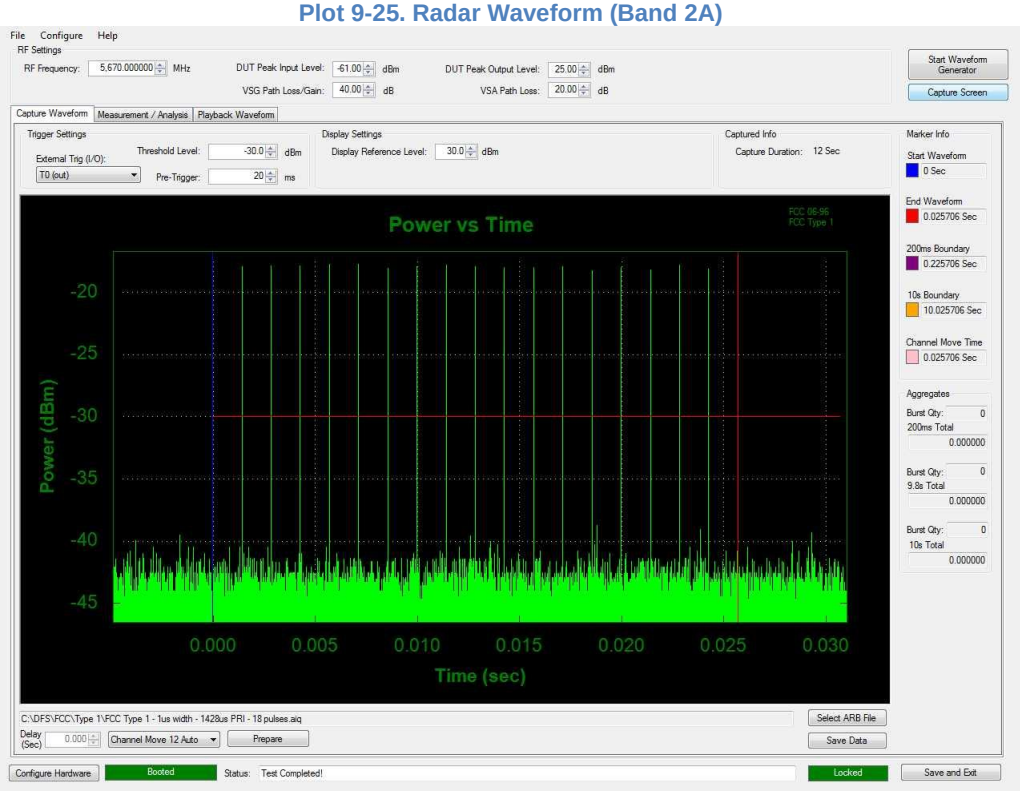
9.4 Chain B: 40 MHz Bandwidth of Operation

Frequency Channel	Channel Move Time (ms)	Limit (ms)	Channel Closing Transmission Time (ms)	FCC Limit (ms)	IC Limit (ms)	Pass/Fail
5270	2895.951	10000	1.796	60	260	Pass
5670	4933.23	10000	0.591	60	260	Pass

©Microsoft EMC Laboratory

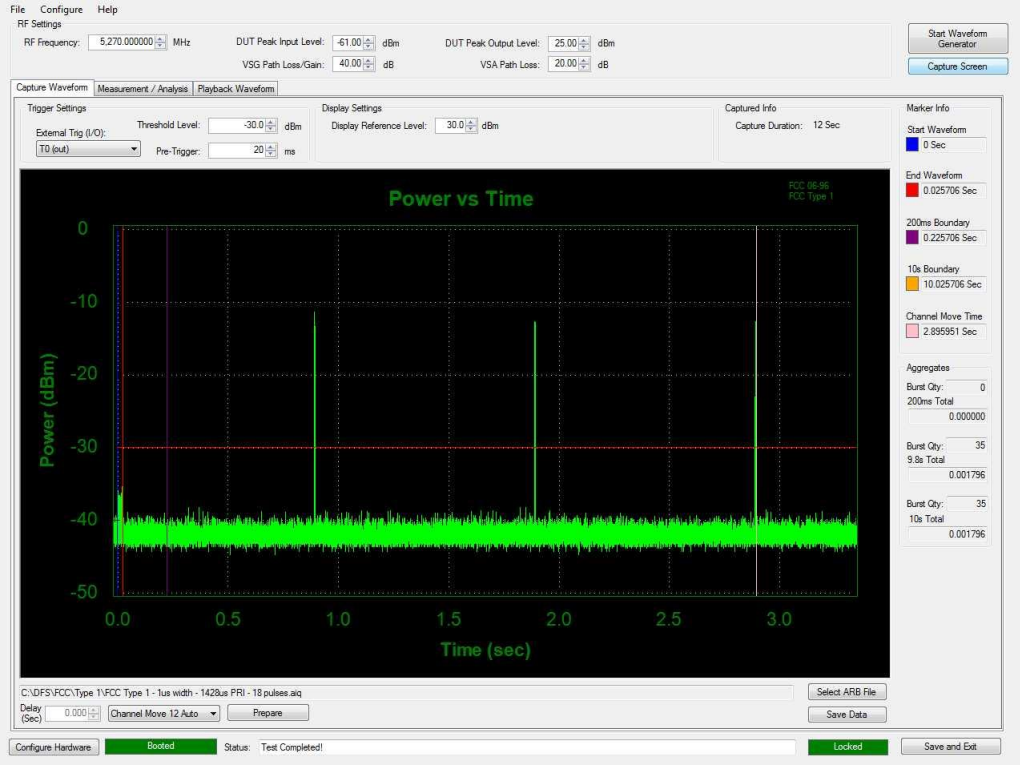


Plot 9-25. Radar Waveform (Band 2A)

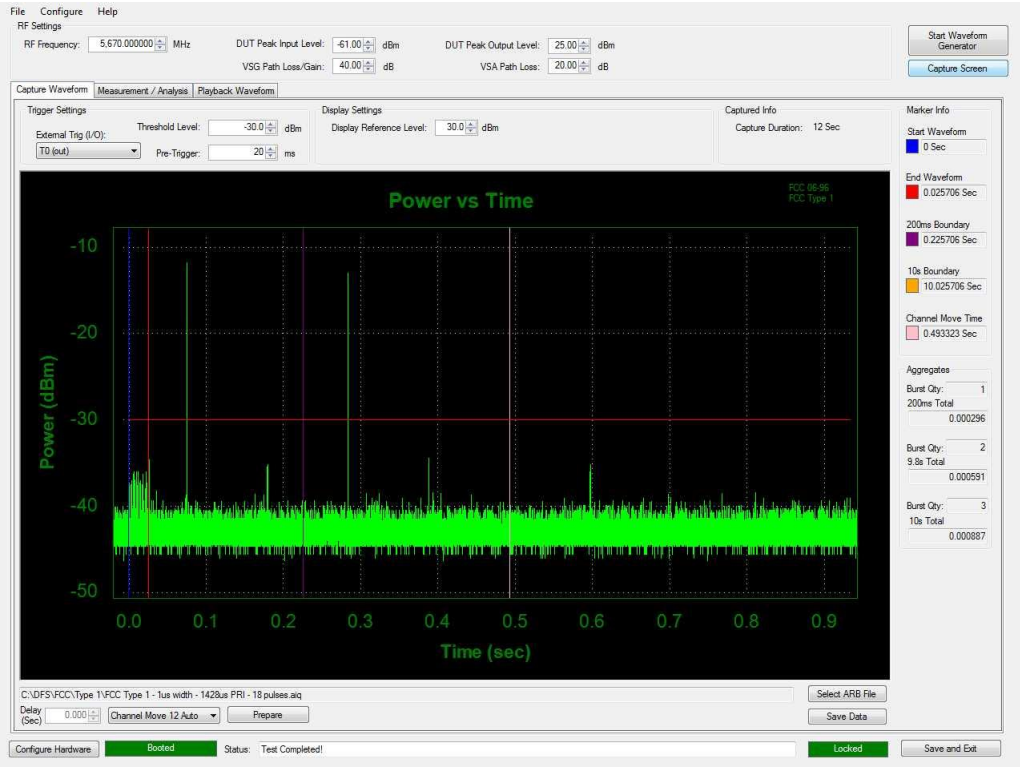


Plot 9-26. Radar Waveform (Band 2C)

©Microsoft EMC Laboratory

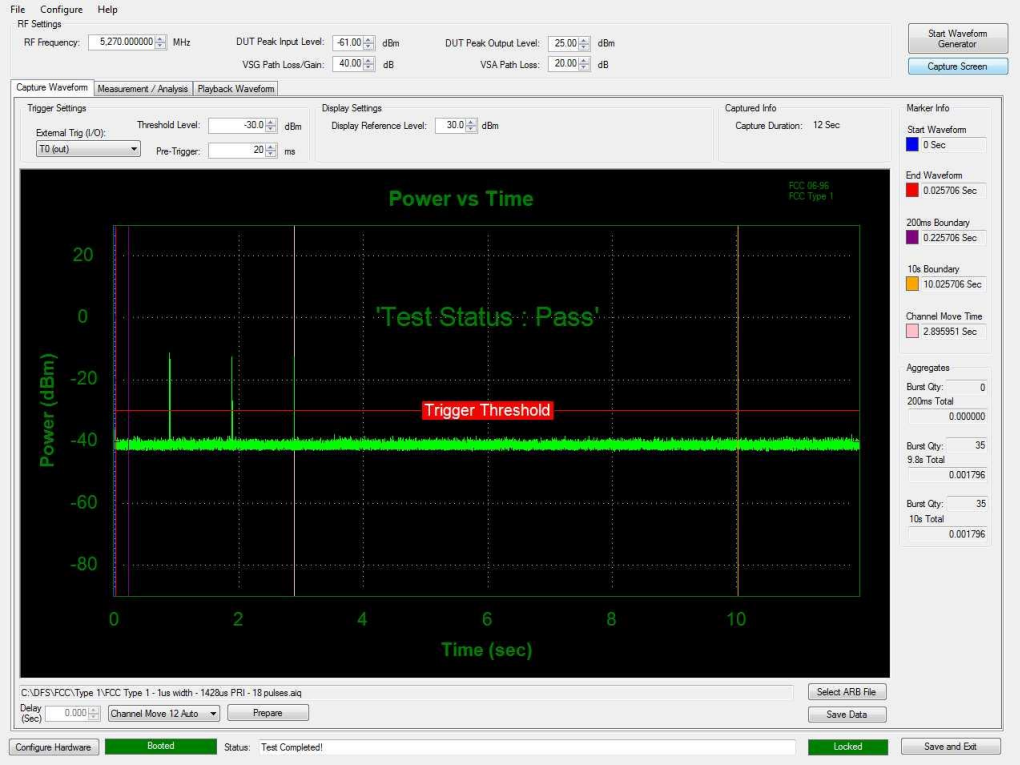


Plot 9-27. Channel Move Time – Band 2A



Plot 9-28. Channel Move Time – Band 2C

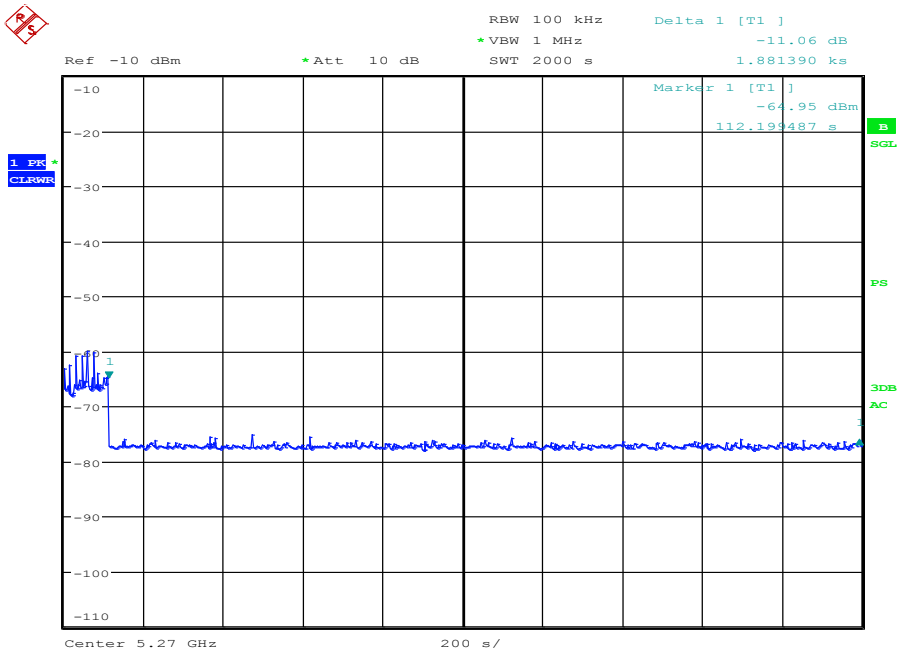
©Microsoft EMC Laboratory



Plot 9-29. Channel Closing Transmission Time – Band 2A

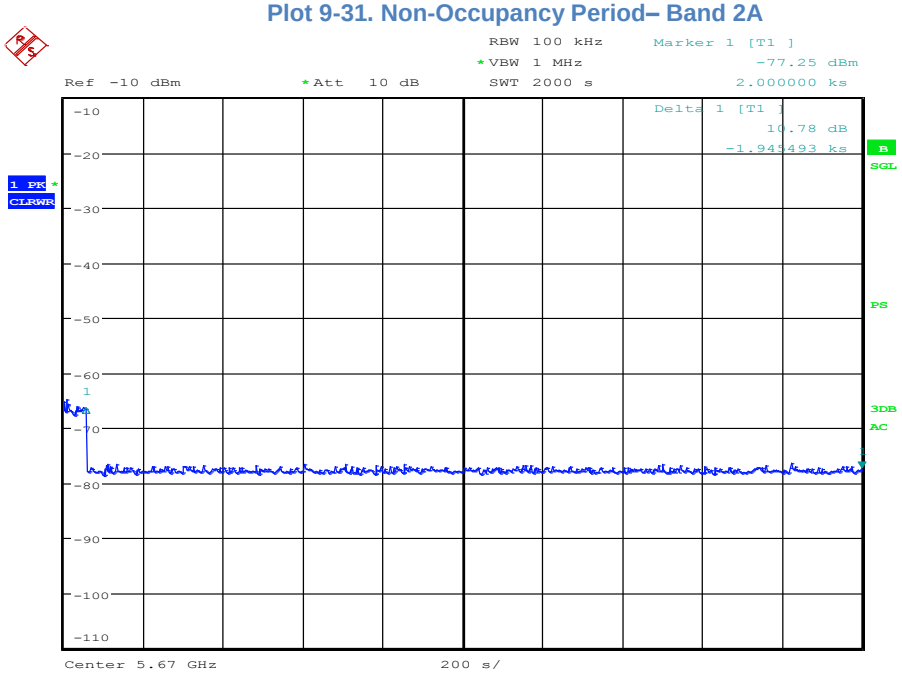
Plot 9-30. Channel Closing Transmission Time – Band 2C

©Microsoft EMC Laboratory



Date: 16.MAY.2014 03:07:42

Plot 9-31. Non-Occupancy Period– Band 2A



Date: 16.MAY.2014 04:50:46

Plot 9-32. Non-Occupancy Period– Band 2C

©Microsoft EMC Laboratory

End of Report

©Microsoft EMC Laboratory