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Report On

Application for Grant of Equipment Authorization of the
Lantronix, Inc.

Wireless Print Solutions Adapter; xPrintServer Wi-Fi
Professional and xPrintServer Wi-Fi Essential Ethernet to
Wireless Print Server

FCC Part 15 Subpart E §15.407 DFS
IC RSS-210 Issue 8 December 2010

Report No. SD72105305-0415K

July 2015



REPORT ON Radio Testing of the
Lantronix, Inc.
Ethernet to Wireless Print Server

TEST REPORT NUMBER SD72105305-0415K

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DATED July 07, 2015



Revision History

SD72105305-0415K Lantronix, Inc. Wireless Print Solutions Adapter; xPrintServer Wi-Fi Professional and xPrintServer Wi-Fi Essential Ethernet to Wireless Print Server					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
07/07/2015	Initial Release				Chip R. Fleury



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SECTION 1

REPORT SUMMARY

DFS verification of the
Lantronix, Inc.
Ethernet to Wireless Print Server



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Lantronix, Inc. Ethernet to Wireless Print Server to the requirements of FCC Part 15 Subpart E §15.407 DFS and IC RSS-210 Issue 8 December 2010.

Objective	To perform Radio Testing (DFS verification) to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Lantronix, Inc.
Model Number(s)	WPSA-100 (Xerox); XPS2140201S (Lantronix) and XPS2140101S (Lantronix)
FCC ID Number	R68XPSWF
IC Number	3867A-XPSWF
Serial Number(s)	N/A
Number of Samples Tested	2
Test Specification/Issue/Date	<ul style="list-style-type: none">• FCC Part 15 Subpart E §15.407 DFS (October 1, 2014).• RSS-210 - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment (Issue 8, December 2010).• 905462 D03 Client Without DFS New Rules v01r01 (U-NII Client Devices Without Radar Detection Capability) August 14, 2014.• 905462 D02 UNII DFS Compliance Procedures New Rules v01r02 (Compliance Measurement Procedures For Unlicensed-National Information Infrastructure Devices Operating In The 5250-5350 Mhz And 5470-5725 Mhz Bands Incorporating Dynamic Frequency Selection) May 15, 2015.• 905462 D04 Test Mode New Rules v01 (Operational Modes Suggested For DFS Testing) June 02, 2014.
Start of Test	July 02, 2015
Finish of Test	July 06, 2015
Name of Engineer(s)	Ferdinand Custodio
Related Document(s)	<ul style="list-style-type: none">• Normal Mode test instructions XPS2.doc• Supporting documents for EUT certification are separate exhibits.



1.2 TEST 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
Non-Occupancy Period	Yes	Not Required	Yes
DFS Detection Threshold	Yes	Not Required	Yes
Channel Availability Check Time	Yes	Not Required	Not Required
U-NII Detection Bandwidth	Yes	Not Required	Yes

Table 2: Applicability of DFS Requirements during normal operation

Requirement	Operational Mode		
	Master	Client Without Radar Detection	Client With Radar Detection
DFS Detection Threshold	Yes	Not Required	Yes
Channel Closing Transmission Time	Yes	Yes	Yes
Channel Move Time	Yes	Yes	Yes
U-NII Detection Bandwidth	Yes	Not Required	Yes

Additional requirements for devices with multiple bandwidths mode	Operational Mode		
	Master	Client Without Radar Detection	Client With Radar Detection
U-NII Detection Bandwidth and Statistical Performance Check	All BW modes must be tested	Not Required	All BW modes must be tested
Channel Move Time and Channel Closing Transmission Time	Test using widest BW mode available	Test using widest BW mode available for the link	Test using widest BW mode available
All other tests	Any single BW mode	Not Required	Any single BW mode

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.



1.3 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC Part 15 Subpart E §15.407 DFS with cross-reference to the corresponding IC RSS standard is shown below.

DFS verification in the U-NII 2A and U-NII 2C Bands (New Rules)					
Section	Spec Clause	RSS	Test Description	Result	Comments/ Base Standard
-	§15.407(h)(1)	RSS-210 A9.2(2) and (3)	Transmit Power Control	N/A	
-	§15.407(h)(2)(ii)	RSS-210 A9.3(b)(ii)	Channel Availability Check Time	N/A	
2.1	§15.407(h)(2)(iii)	RSS-210 A9.3(b)(iii)	Channel Move Time	Compliant	
2.2	§15.407(h)(2)(iii)	RSS-210 A9.3(b)(iv)	Channel Closing Time	Compliant	
-	§15.407(h)(2)(iv)	RSS-210 A9.3(b)(v)	Non-Occupancy Period	N/A	

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Lantronix, Inc. Wireless Print Solutions Adapter; xPrintServer Wi-Fi Professional and xPrintServer Wi-Fi Essential Ethernet to Wireless Print Server as shown in the photograph below. The EUT is a device intended to support Ethernet to Wi-Fi bridging in mobile printing applications. The device is intended to be connected to a printer over the Ethernet and/or Wireless networks. The device includes an NFC interface to allow tap to print transactions between a tablet or cell phone device. The NFC would provide the network configuration to the phone and the Ethernet and Wi-Fi would provide the high band width channel for print jobs. The Wireless Print Solutions Adaptor version will be marketed by Xerox. The XPrintServer2 product with dual Type A USB host connector will be directly sold and marketed by Lantronix. The only difference between the “Professional” and “Essential” is the software app. Lantronix controls the manufacturing for both versions. Lantronix controls the manufacturing for both versions. The EUT is a Client device without radar detection; the Channel Closing Transmission Time and Channel Move Time of the EUT were verified in this test report.



Equipment Under Test



1.4.2 EUT General Description

EUT Description	Ethernet to Wireless Print Server
Model Name	Wireless Print Solutions Adapter; xPrintServer Wi-Fi Professional and xPrintServer Wi-Fi Essential
Model Number(s)	WPSA-100 (Xerox); XPS2140201S (Lantronix) and XPS2140101S (Lantronix)
Rated Voltage	5VDC via AC Adapter (TOP Switching Power Supply P/N W050010GPX1 L1 Input: 100-240VAV 50/60Hz @0.2A Output: 5VDC @ 1.0A).
Mode Verified	802.11 n/ac WLAN (U-NII),
Capability	802.11 b/g/n/ac WLAN (DTS/U-NII), NFC (passive tag) and Bluetooth 4.0+EDR
Primary Unit (EUT)	<input type="checkbox"/> Production <input checked="" type="checkbox"/> Pre-Production <input type="checkbox"/> Engineering
Antenna Type	Savvi™ Embedded Ceramic WLAN 802.11 a/b/g Antenna 2.4 to 2.5 and 4.9 to 5.8 GHz (P/N M830510)
Antenna Gain	1.1 dBi (2.4GHz) 3.2 dBi (5GHz)
Number of Operating Frequencies	16 (4 in U-NII 2A and 12 in U-NII 2C)
Operation on U-NII 2A and 2C	EUT is a Client device that requires an external access point (Master) in order to work in these bands. The channel listing provided only support passive scanning. The EUT needs to be associated with a Master in which it relies for DFS detection when working in these bands.

1.4.3 Channel Table (802.11 n/ac)

5250-5350 MHz band (U-NII 2A)				
Channel	Frequency (MHz)	Bandwidth (MHz)	Modulation Technology	Power Level (dBm EIRP)
52	5260	20	OFDM	Min. = 14.12 Max. = 16.35
56	5280	20	OFDM	
60	5300	20	OFDM	
64	5320	20	OFDM	



5470-5725 MHz band (U-NII 2C)				
Channel	Frequency (MHz)	Bandwidth (MHz)	Modulation Technology	Power Level (dBm EIRP)
100	5500	20	OFDM	Min. = 12.23 Max. = 17.70
104	5520	20	OFDM	
108	5540	20	OFDM	
112	5560	20	OFDM	
116	5580	20	OFDM	
120	5600	20	OFDM	
124	5620	20	OFDM	
128	5640	20	OFDM	
132	5660	20	OFDM	
136	5680	20	OFDM	
140	5700	20	OFDM	
144	5720	20	OFDM	



1.5 EUT TEST CONFIGURATION

1.5.1 Test Configuration Description

Test Configuration	Description
Default	Normal Test Mode. Traffic running between support laptop and EUT via Ethernet and between support PC and EUT via WLAN. Manufacturer provided detailed instructions (Normal Mode test instructions XPS2.doc) to configure EUT and support equipment for this purpose. The EUT was associated with FCC ID: LDK102087 (Master). All channel settings were configured on the Master.

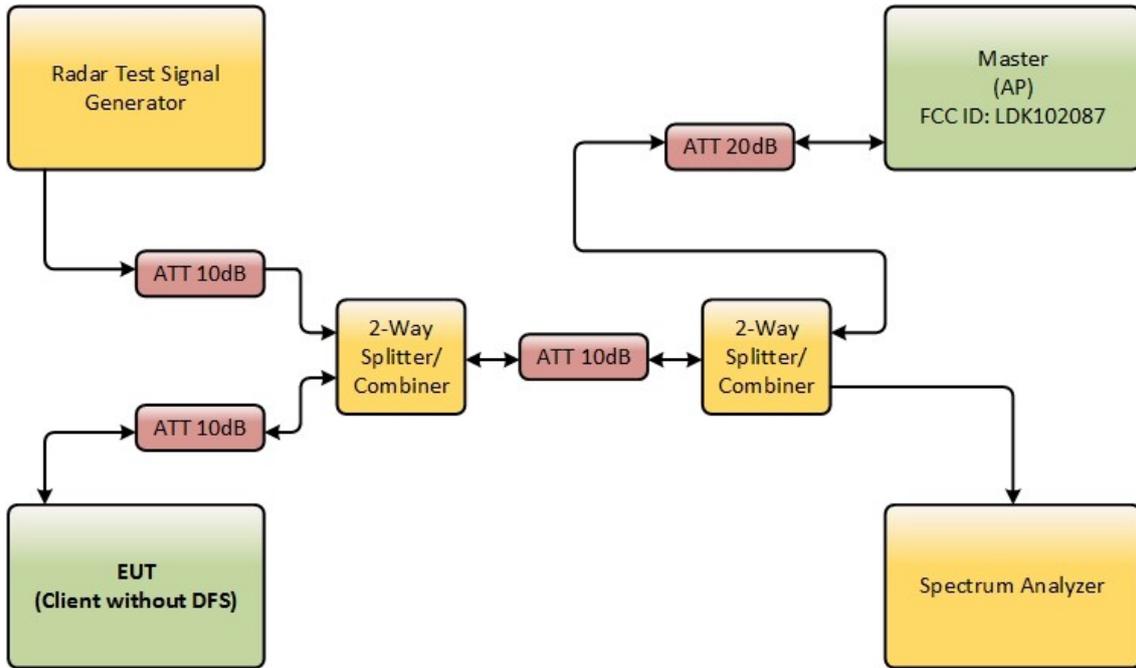
1.5.2 EUT Exercise Software

The following software were used to configure the EUT, support PC and support laptop: "tftpd32 by Ph. Jounin", "Teraterm" and "Jperf 2.0.2".

1.5.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
Topmicro.com	EUT AC Adapter (Switching Power Supply)	P/N W050010GPX1 L1 (5VDC @ 1A)
HP	Support Laptop (NC6220)	P/N PZ064UA#ABA S/N CNU62315QR
HP	Support Laptop AC Adapter	P/N 380467-003 S/N 592C60AYMSO26N
Pan International	Patch Cord (Ethernet EUT to Laptop)	1.5 meters, unshielded CAT5 patch cord
-	USB extension cable (EUT to terminated)	1.8 meters, shielded Type A USB extension cable
SanDisk	Support Flash Drive	Cruzer 16 GB SDCZ33
-	Support Flash Drive	4 GB generic USB flash drive (provided by Hirose Electric USA)
Cisco	Support Dual Band Access Point	Aironet 3700 M/N AIR-CAP3702E-A-K9 S/N FTX1853R2R0
Cisco	Support AC Adapter for Access Point	M/N AA25480L S/N ALD0736G2MD (48VDC @ 380mA)
Dell	Support Keyboard	M/N RT7D50 CN-0W7658-37172-643-0028
Logitech	Support Mouse	MX310 M/N M-BP86 P/N 830823-0000
Dell	Support Desktop PC	Dimension E520 M/N DCSM S/N 68B76D1
LG	Support Monitor	Flatron L1710B S/N 405KGUH08766

1.5.4 Simplified Test Configuration Diagram (Setup for Client with injection at the Master)





1.6 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.7 MODIFICATION RECORD

Description of Modification	Modification Fitted By	Date Modification Fitted
Serial Number N/A		
N/A		

The table above details modifications made to the EUT during the test programme. The modifications incorporated during each test (if relevant) are recorded on the appropriate test pages.

1.8 TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz and 905462 D02 UNII DFS Compliance Procedures New Rules v01r02 (Compliance Measurement Procedures For Unlicensed-National Information Infrastructure Devices Operating In The 5250-5350 MHz And 5470-5725 MHz Bands Incorporating Dynamic Frequency Selection) May 15, 2015.

1.9 TEST FACILITY LOCATION

1.9.1 TÜV SÜD America Inc. (Mira Mesa)

10040 Mesa Rim Road, San Diego, CA 92121-2912 (32.901268,-117.177681). Phone: 858 678 1400 FAX: 858-546 0364

1.9.2 TÜV SÜD America Inc. (Rancho Bernardo)

Sony Electronics Inc., Building #8 16530 Via Esprillo, San Diego, CA 92127-1708 (33.018644,-117.092409). Phone: 858 942 5542 FAX: 858-546 0364

1.10 TEST FACILITY REGISTRATION

1.10.1 FCC – Registration No.: US1146

TUV SUD America Inc. (San Diego), is an accredited test facility with the site description report on file and has met all the requirements specified in §2.948 of the FCC rules. The acceptance letter from the FCC is maintained in our files and the Registration is US1146.

1.10.2 Industry Canada (IC) Registration No.: 3067A

The 10m Semi-anechoic chamber of TUV SUD America Inc. (San Diego) has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No. 3067A.



SECTION 2

TEST DETAILS

DFS verification of the
Lantronix, Inc.
Ethernet to Wireless Print Server



2.1 CHANNEL MOVE TIME

2.1.1 Specification Reference

Part 15 Subpart E §15. 407(h)(2)(iii) and RSS-210 A9.3(b)(iii)

2.1.2 Standard Applicable

Channel Move Time. After a radar's presence is detected, all transmissions shall cease on the operating channel within 10 seconds. Transmissions during this period shall consist of normal traffic for a maximum of 200 ms after detection of the radar signal. In addition, intermittent management and control signals can be sent during the remaining time to facilitate vacating the operating channel.

2.1.3 Equipment Under Test and Modification State

Serial No: N/A /Default Test Configuration

2.1.4 Date of Test/Initial of test personnel who performed the test

July 05, 2015/FSC

2.1.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility.

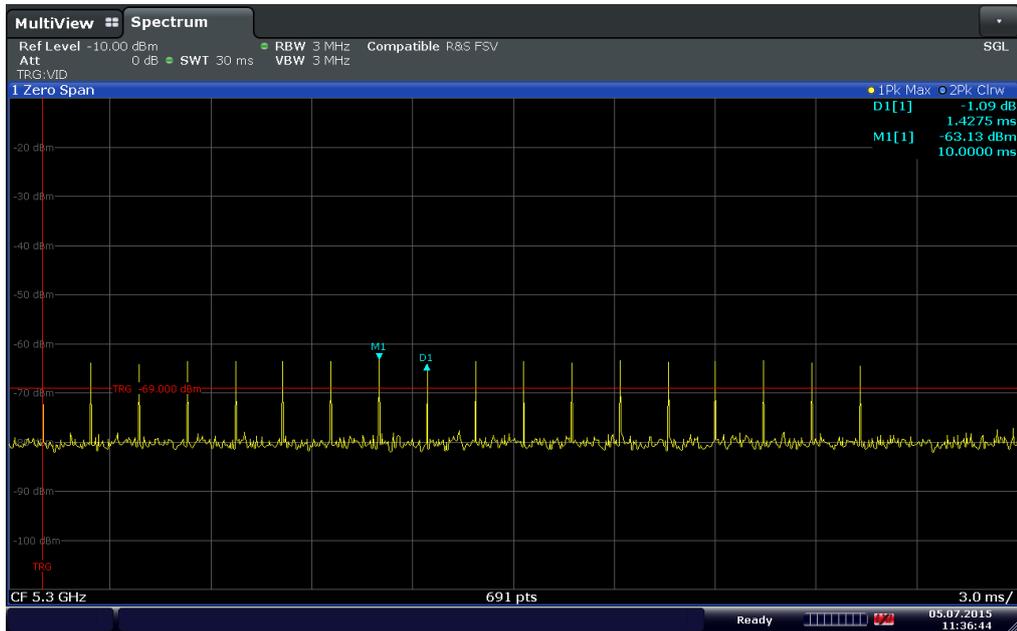
Ambient Temperature 23.8 °C
 Relative Humidity 59.3 %
 ATM Pressure 99.5 kPa

2.1.7 Additional Observations

- The EUT is a Client device without radar detection, therefore one Short Pulse Radar Type 0 will be used for this test on the Master:

Radars Type	Pulse Width (µsec)	PRI (µsec)	Number of Pulses
0	1	1428	18

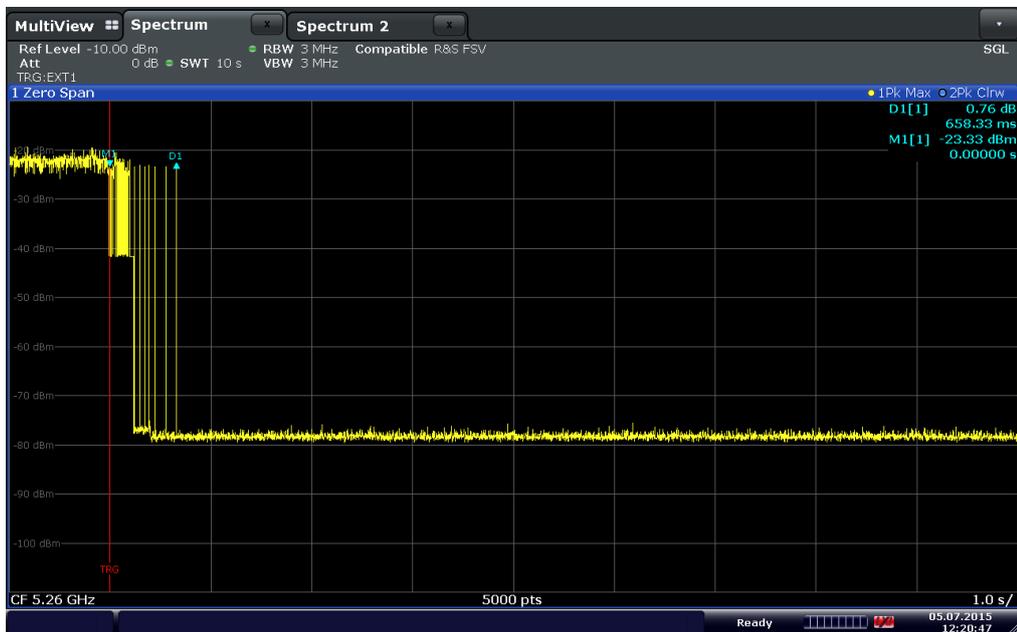
- DFS Detection Threshold applied is -63 dBm (-64 dBm +1) as per DFS Test Report of the Master (FCC ID: LDK102087). The threshold was calibrated by measuring the level at the Master antenna port terminal connection (50Ω).
- The spectrum analyzer was triggered by the Radar Test Signal Generator (Aeroflex 3005) for this test. Channel 52 (802.11 ac) of the band 5250-5350 MHz was verified.
- Trigger offset placed at -1.0 second.
- No other transmission observed after the *Channel Move Time*.



Date: 5 JUL 2015 11:36:44

Calibration of DFS Detection Threshold applied to the Master

2.1.8 Test Results



Date: 5 JUL 2015 12:20:47

Channel Move Time of 658.33 ms (<10 seconds, **EUT complies**)



2.2 CHANNEL CLOSING TIME

2.2.1 Specification Reference

Part 15 Subpart E §15. 407(h)(2)(iii) and RSS-210 A9.3(b)(iv)

2.2.2 Standard Applicable

Channel Move Time. After a radar's presence is detected, all transmissions shall cease on the operating channel within 10 seconds. Transmissions during this period shall consist of normal traffic for a maximum of 200 ms after detection of the radar signal. In addition, intermittent management and control signals can be sent during the remaining time to facilitate vacating the operating channel.

2.2.3 Equipment Under Test and Modification State

Serial No: N/A /Default Test Configuration

2.2.4 Date of Test/Initial of test personnel who performed the test

July 06, 2015/FSC

2.2.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility.

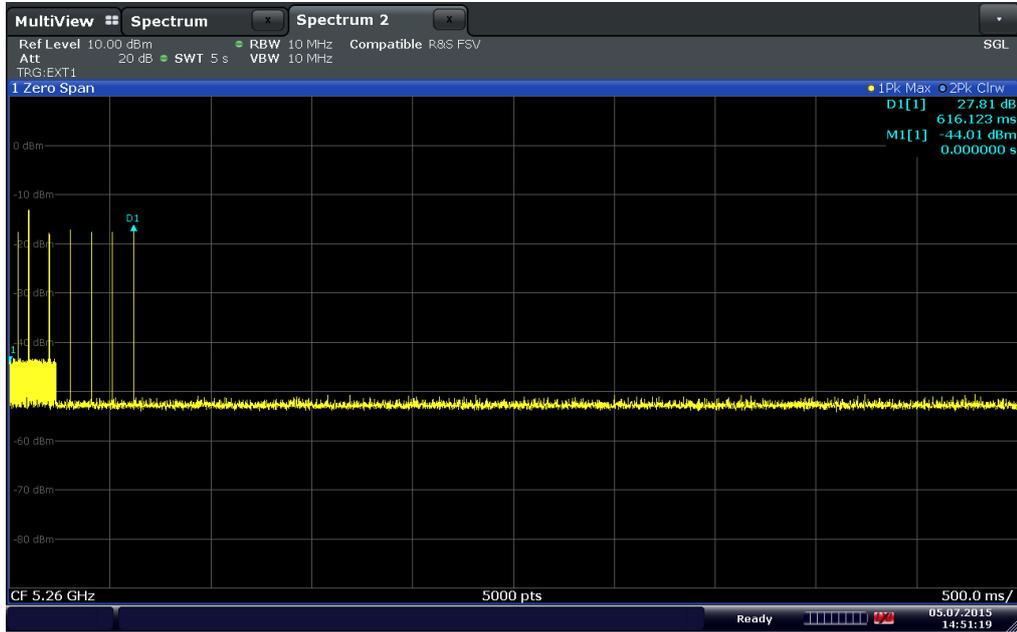
Ambient Temperature	24.4 °C
Relative Humidity	53.5 %
ATM Pressure	99.9 kPa

2.2.7 Additional Observations

- This is the extension of the previous test (Channel Move Time).
- Verification similar to Section 2.1.0 of this test report was performed with the exception of being triggered at 0 second. This will allow accurate measurement of the Channel Closing Time.
- RBW and VBW were set to maximum the SA can support.
- Sweep points set to at least 5000.
- Sweep time adjusted to encompass the Channel Move Time.
- There are no any additional intermittent control signals observed during the remainder of the 10 seconds period during Channel Closing Time verification.
- Resulting trace was exported to a corresponding ASCII file for further analysis.
- Data analyzer software was used to calculate the aggregate TX "on" time which is defined as Channel Closing Time.
- Channel 52 (802.11 ac) of the band 5250-5350 MHz was verified.

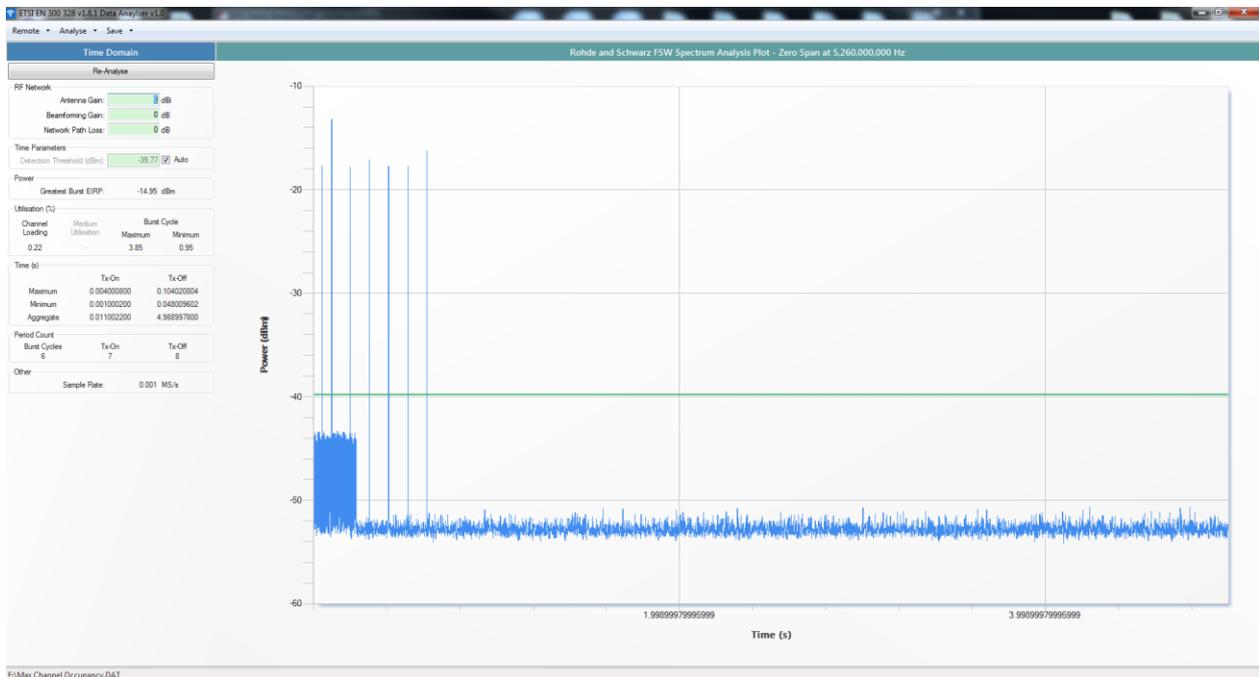


2.2.8 Test Results



Date: 5 JUL 2015 14:51:18

Channel Closing Time triggered @ 0 second



Channel Closing Time of 11 ms, trace data analyzed for aggregate TX on time (<200 ms, EUT complies)



SECTION 3

TEST EQUIPMENT USED



3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
Antenna Conducted Port Test Setup						
-	Power Splitter	ZN2PD-63-S+	SUU74001429	Mini-Circuits	Verified by 7611 and 7610	
-	Coaxial SMA Fixed Attenuator	VAT-30W2	N/A	Mini-Circuits	Verified by 7611 and 7610	
-	Coaxial SMA Fixed Attenuator	VAT-20+	N/A	Mini-Circuits	Verified by 7611 and 7610	
-	Coaxial SMA Fixed Attenuator	VAT-10+	N/A	Mini-Circuits	Verified by 7611 and 7610	
-	Coaxial SMA Fixed Attenuator	VAT-10+	N/A	Mini-Circuits	Verified by 7611 and 7610	
-	Power Splitter	ZFRSC-123-S+ DC-12GHz	N/A	Mini-Circuits	Verified by 7611 and 7610	
-	Low loss RF cable	JX50172-24	N/A	RF Precision Cables, Inc.	Verified by 7611 and 7610	
-	Low loss RF cable	70032199	N/A	Allied Electronics	Verified by 7611 and 7610	
7611	Signal/Spectrum Analyzer	FSW26	102017	Rhode & Schwarz	03/25/15	03/25/16
8825	20dB Attenuator	46-20-34	BK5773	Weinschel Corp.	Verified by 7611 and 7610	
7610	DFS Radar Simulator and Analyzer*	Aeroflex 3005	30050A/09L	Aeroflex international LTD. UK	03/04/2015	03/04/2016
Miscellaneous						
6792	Multimeter	3478A	2911A70964	Hewlett Packard	08/12/14	08/12/15
11312	Mini Environmental Quality Meter	850027	CF099-56010-340	Sper Scientific	04/09/15	04/09/16
	Test Software	ETSI EN 300 328 V1.8.1 Data Analyzer	V1.0	TUV SUD UK	N/A	



3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:

3.2.1 Conducted Antenna Port Measurement

Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.50	0.29	0.08
3	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):					0.72
Coverage Factor (k):					2
Expanded Uncertainty:					1.45



SECTION 4

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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