

## DFS PORTION of FCC 47 CFR PART 15 SUBPART E **DFS PORTION of INDUSTRY CANADA RSS-247 ISSUE 2**

**CERTIFICATION TEST REPORT** 

FOR

DOORBELL

**MODEL NUMBER: VR0014** 

FCC ID: JNZVR0014 IC: 4418A-VR0014

**REPORT NUMBER: 13426664-E5V4** 

**ISSUE DATE: NOVEMBER 2, 2020** 

Prepared for LOGITECH, INC. 7700 GATEWAY BLVD. NEWARK CA, 94560, U.S.A.

Prepared by **UL VERIFICATION SERVICES INC. 47173 BENICIA STREET** FREMONT, CA 94538, U.S.A. TEL: (510) 319-4000 FAX: (510) 661-0888



NVLAP LAB CODE 200065-0

## **Revision History**

Rev.	lssue Date	Revisions	Revised By
V1	10/14/2020	Initial Issue	
V2	10/21/2020	Update Date of Testing in Section 1	D. Anderson
V3	10/23/2020	Added document name for reports referenced under section 4	Edgard Rincand
V4	11/02/2020	Corrected software revision number under section 7.1.6 and updated FCC report version under section 4.	Edgard Rincand

Page 2 of 40

## TABLE OF CONTENTS

1.	ATTESTATION OF TEST RESULTS	4
2.	TEST METHODOLOGY	5
3.	SUMMARY OF TEST RESULTS	5
4.	REFERENCE DOCUMENTS	5
5.	FACILITIES AND ACCREDITATION	5
6.	DECISION RULES AND MEASUREMENT UNCERTAINTY	6
6	.1. METROLOGICAL TRACEABILITY	6
6	.2. DECISION RULES	6
7.	DYNAMIC FREQUENCY SELECTION	7
7	.1. OVERVIEW	
	7.1.2. TEST AND MEASUREMENT SYSTEM	.11
	<ul><li>7.1.3. TEST AND MEASUREMENT SOFTWARE</li><li>7.1.4. TEST ROOM ENVIRONMENT</li></ul>	
	<ul><li>7.1.4. TEST ROOM ENVIRONMENT</li><li>7.1.5. SETUP OF EUT</li></ul>	
	7.1.6. DESCRIPTION OF EUT	
7	.2. RESULTS FOR 20 MHz BANDWIDTH	.17
	7.2.1. TEST CHANNEL	
	<ul><li>7.2.2. RADAR WAVEFORM AND TRAFFIC</li></ul>	
	7.2.4. MOVE AND CLOSING TIME	
7	.3. RESULTS FOR 40 MHz BANDWIDTH	.24
	7.3.1. TEST CHANNEL	.24
	7.3.2. RADAR WAVEFORM AND TRAFFIC	
	<ul><li>7.3.3. OVERLAPPING CHANNEL TESTS</li><li>7.3.4. MOVE AND CLOSING TIME</li></ul>	
_		
1	.4. RESULTS FOR 80 MHz BANDWIDTH 7.4.1. TEST CHANNEL	
	7.4.2. RADAR WAVEFORM AND TRAFFIC	
	7.4.3. OVERLAPPING CHANNEL TESTS	.34
	7.4.4. MOVE AND CLOSING TIME	.34
	7.4.5. 30-MINUTE NON-OCCUPANCY PERIOD	.38
8.	SETUP PHOTOS	.39

## 1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	LOGITECH, INC. 7700 GATEWAY BLVD. NEWARK, CA, 94560, U.S.A.		
EUT DESCRIPTION:	DOORBELL		
MODEL:	VR0014		
SERIAL NUMBER:	2031LZN1FXC8		
DATE TESTED:	SEPTEMBER 23 to 24, 2020		
	APPLICABLE STANDARDS		
S	TANDARD	TEST RESULTS	
DFS Portion of	DFS Portion of CFR 47 Part 15 Subpart E		
DFS Portion of INDUS	TRY CANADA RSS-247 Issue 2	Complies	

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Approved & Released For UL Verification Services Inc. By:

Edges Mineral

**Edgard Rincand Operations Leader** CONSUMER TECHNOLOGY DIVISION UL Verification Services Inc.

Prepared By:

Douclas Comelección

DOUG ANDERSON Test Engineer CONSUMER TECHNOLOGY DIVISION UL Verification Services Inc.

Page 4 of 40

# 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with the DFS portion of FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC KDB 789033, KDB 905462 D02 and D03 and RSS-247 Issue 2.

# 3. SUMMARY OF TEST RESULTS

Requirement Description	Result	Remarks
DFS Portion of FCC 47 CFR PART 15 SUBPART E	Complies	
DFS Portion of INDUSTRY CANADA RSS-247	Complies	
ISSUE 2		

# 4. REFERENCE DOCUMENTS

Measurements of transmitter parameters as referenced in this report and all other manufacturer's declarations relevant to the RF test requirements are documented in UL Verification Services report reference 13426664-E2V3 FCC Report UNII and 13426664-E3V1 ISED Report UNII.

# 5. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, Fremont, California, USA. Specific facilities are also identified in the test results sections.

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code: 2324A.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0.

Page 5 of 40

# 6. DECISION RULES AND MEASUREMENT UNCERTAINTY

## 6.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

## 6.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement).

Page 6 of 40

# 7. DYNAMIC FREQUENCY SELECTION

## 7.1. OVERVIEW

## 7.1.1. LIMITS

#### INDUSTRY CANADA

IC RSS-247 is closely harmonized with FCC Part 15 DFS rules. The deviations are as follows:

RSS-247 Issue 2

**Note:** For the band 5600–5650 MHz, no operation is permitted.

Until further notice, devices subject to this annex shall not be capable of transmitting in the band 5600–5650 MHz. This restriction is for the protection of Environment Canada weather radars operating in this band.

#### FCC

§15.407 (h), FCC KDB 905462 D02 "COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED-NATIONAL INFORMATION INFRASTRUCTURE DEVICES OPERATING IN THE 5250-5350 MHz AND 5470-5725 MHz BANDS INCORPORATING DYNAMIC FREQUENCY SELECTION" and KDB 905462 D03 "U-NII CLIENT DEVICES WITHOUT RADAR DETECTION CAPABILITY".

Page 7 of 40

#### 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 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	

Additional requirements for	Master Device or Client with Radar DFS	Client (without DFS)			
devices with multiple bandwidth modes	Rauai DFS	(without DF3)			
U-NII Detection Bandwidth and Statistical Performance Check	All BW modes must be tested	Not required			
Channel Move Time and Channel Closing Transmission Time	Test using widest BW mode available	Test using the widest BW mode available for the link			
All other tests	Any single BW mode	Not required			
<b>Note:</b> 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 all 20 MHz channel blocks and a null frequency between the bonded 20 MHz channel blocks.					

Page 8 of 40

publication 662911 D01.

Table 1. DES Beanance requir

# Table 3: Interference Threshold values, Master or Client incorporating In-Service Monitoring

Maximum Transmit Power	Value			
	(see notes)			
E.I.R.P. ≥ 200 mill watt	-64 dBm			
E.I.R.P. < 200 mill watt and	-62 dBm			
power spectral density < 10 dBm/MHz				
E.I.R.P. < 200 mill watt that do not meet power spectral	-64 dBm			
density requirement				
<b>Note 1:</b> This is the level at the input of the receiver assuming a 0 dBi receive antenna <b>Note 2:</b> 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.				
<b>Note 3:</b> E.I.R.P. is based on the highest antenna gain. For MI	MO devices refer to KDB			

Parameter	Value
Non-occupancy period	30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds (See Note 1)
Channel Closing Transmission Time	200 milliseconds + approx. 60 milliseconds over remaining 10 second period. (See Notes 1 and 2)
U-NII Detection Bandwidth	Minimum 100% of the U- NII 99% transmission power bandwidth. (See Note 3)

**Note 1:** Channel Move Time and the Channel Closing Transmission Time should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst.

**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 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.

#### Table 5 – Short Pulse Radar Test Waveforms

Radar	Pulse	PRI	Pulses	Minimum	Minimum
Туре	Width	(usec)		Percentage	Trials
	(usec)			of Successful	
				Detection	
0	1	1428	18	See Note 1	See Note
					1
1	1	Test A: 15 unique		60%	30
		PRI values randomly			
		selected from the list	Roundup:		
		of 23 PRI values in	{(1/360) x (19 x 10 <sup>6</sup> PRI <sub>usec</sub> )}		
		table 5a			
		Test B: 15 unique			
		PRI values randomly			
		selected within the			
		range of 518-3066			
usec. With a minimum increment					
		PRI values selected			
		in Test A			
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
		Aggregate (Radar T	ypes 1-4)	80%	120
		<b>,</b>	ld be used for the Detection Bai	ndwidth test, Ch	annel
Move T	ime, and	Channel Closing Time to	ests.		

Table 6 – Long Pulse Radar Test Signal

Radar	Pulse	Chirp	PRI	Pulses	Number	Minimum	Minimum
Waveform	Width	Width	(µsec)	per	of	Percentage	Trials
Туре	(µsec)	(MHz)		Burst	Bursts	of Successful	
		. ,				Detection	
5	50-100	5-20	1000-	1-3	8-20	80%	30
			2000				

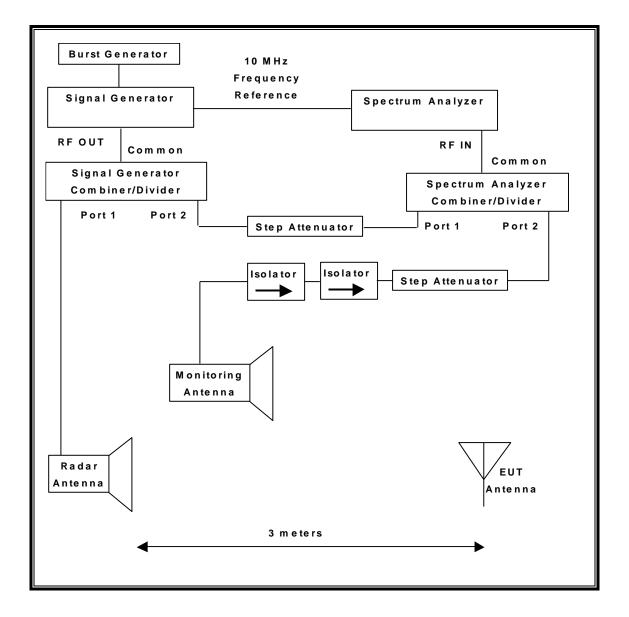
#### Table 7 – Frequency Hopping Radar Test Signal

Radar	Pulse	PRI	Pulses	Hopping	Hopping	Minimum	Minimum
Waveform	Width	(µsec)	per	Rate	Sequence	Percentage of	Trials
Туре	(µsec)		Нор	(kHz)	Length	Successful	
					(msec)	Detection	
6	1	333	9	0.333	300	70%	30

Page 10 of 40

## 7.1.2. TEST AND MEASUREMENT SYSTEM

#### RADIATED METHOD SYSTEM BLOCK DIAGRAM



Page 11 of 40

#### SYSTEM OVERVIEW

The short pulse and long pulse signal generating system utilizes the NTIA software. The Vector Signal Generator has been validated by the NTIA. The hopping signal generating system utilizes the CCS simulated hopping method and system, which has been validated by the DoD, FCC and NTIA. The software selects waveform parameters from within the bounds of the signal type on a random basis using uniform distribution.

The short pulse types 1, 2, 3 and 4, and the long pulse type 5 parameters are randomized at run-time.

The hopping type 6 pulse parameters are fixed while the hopping sequence is based on the August 2005 NTIA Hopping Frequency List. The initial starting point randomized at run-time and each subsequent starting point is incremented by 475. Each frequency in the 100-length segment is compared to the boundaries of the EUT Detection Bandwidth and the software creates a hopping burst pattern in accordance with Section 7.4.1.3 Method #2 Simulated Frequency Hopping Radar Waveform Generating Subsystem of KDB 905462 D02. The frequency of the signal generator is incremented in 1 MHz steps from  $F_L$  to  $F_H$  for each successive trial. This incremental sequence is repeated as required to generate a minimum of 30 total trials and to maintain a uniform frequency distribution over the entire Detection Bandwidth.

The signal monitoring equipment consists of a spectrum analyzer. The aggregate ON time is calculated by multiplying the number of bins above a threshold during a particular observation period by the dwell time per bin, with the analyzer set to peak detection and max hold.

#### SYSTEM CALIBRATION

A 50-ohm load is connected in place of the spectrum analyzer, and the spectrum analyzer is connected to a horn antenna via a coaxial cable, with the reference level offset set to (horn antenna gain – coaxial cable loss). The signal generator is set to CW mode. The amplitude of the signal generator is adjusted to yield a level of –64 dBm as measured on the spectrum analyzer.

Without changing any of the instrument settings, the spectrum analyzer is reconnected to the Common port of the Spectrum Analyzer Combiner/Divider. The Reference Level Offset of the spectrum analyzer is adjusted so that the displayed amplitude of the signal is –64 dBm.

The spectrum analyzer displays the level of the signal generator as received at the antenna ports of the Master Device. The interference detection threshold may be varied from the calibrated value of –64 dBm and the spectrum analyzer will still indicate the level as received by the Master Device.

Page 12 of 40

#### ADJUSTMENT OF DISPLAYED TRAFFIC LEVEL

A link is established between the Master and Slave and the distance between the units is adjusted as needed to provide a suitable received level at the Master and Slave devices. Traffic that meets or exceed the minimum loading requirement is streamed from the Master device to the Slave Device. The monitoring antenna is adjusted so that the WLAN traffic level, as displayed on the spectrum analyzer, is at lower amplitude than the radar detection threshold.

#### TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST							
Description	Manufacturer	Model	ID No.	Cal Due			
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	T1634	01/28/21			
Signal Generator, MXG X-Series RF Vector	Agilent	N5182B	T1633	01/24/21			

## 7.1.3. TEST AND MEASUREMENT SOFTWARE

The following test and measurement software was utilized for the tests documented in this report:

TEST SOFTWARE LIST						
Name Version Test / Function						
Aggregate Time-PXA	3.1	Channel Loading and Aggregate Closing Time				
PXA Read	PXA Read 3.1 Signal Generator Screen Capture					
SGXProject.exe	1.7	Radar Waveform Generation and Download				

## 7.1.4. TEST ROOM ENVIRONMENT

The test room temperature and humidity shall be maintained within normal temperature of 15~35 °C and normal humidity 20~75% (relative humidity).

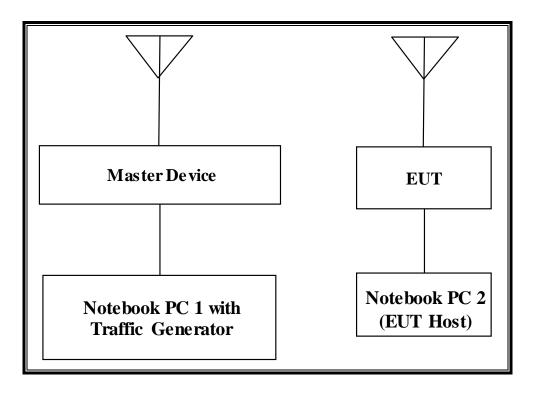
#### ENVIRONMENT CONDITION

Parameter	Value
Temperature	23.8 °C
Humidity	46 %

Page 13 of 40

### 7.1.5. SETUP OF EUT

#### RADIATED METHOD EUT TEST SETUP



#### SUPPORT EQUIPMENT

The following support equipment was utilized for the tests documented in this report:

PERIPHERAL SUPPORT EQUIPMENT LIST						
Description	Manufacturer	Model	Serial Number	FCC ID		
802.11ac Dual Band Wireless	Cisco	AIR-CAP3702E-A	FTX181570A6	LDK102087		
Access Point (Master Device)		K9				
P.O.E. Injector (Master Device)	Phihong	POE30U-560(G)	PHI170102N2	DoC		
Notebook PC 1 (Traffic Generator)	Lenovo	Туре 4236-В92	PB-HEX04 12/05	DoC		
AC Adapter (Notebook PC 1)	Lenovo	42T4418	11S42T4418Z1ZGW	DoC		
			G08R90M			
Notebook PC 2 (EUT Host)	Dell	Latitude E7240	6CRWW31	DoC		
AC Adapter (Notebook PC 2)	Lite On	LA90PM111	CN-0Y4M8K-72438-	DoC		
	Technology		32Q-5B21-A00			

Page 14 of 40

## 7.1.6. DESCRIPTION OF EUT

The EUT operates over the 5250-5350 MHz and 5470-5725 MHz ranges.

The EUT is a Slave Device without Radar Detection.

The highest power level within these bands is 20.64 dBm EIRP in the 5250-5350 MHz band and 23.54 dBm EIRP in the 5470-5725 MHz band.

The highest gain antenna assembly utilized with the EUT has a gain of 3.18 dBi in the 5250-5350 MHz band and 4.21 dBi in the 5470-5725 MHz band. The lowest gain antenna assembly utilized with the EUT has a gain of 1.92 dBi in the 5250-5350 MHz band and 4.16 dBi in the 5470-5725 MHz band.

Two antennas are utilized to meet the diversity and MIMO operational requirements.

The rated output power of the Master unit is > 23dBm (EIRP). Therefore the required interference threshold level is -64 dBm. After correction for procedural adjustments, the required radiated threshold at the antenna port is -64 + 1 = -63 dBm.

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

The EUT uses two transmitter/receiver chains, each connected to an antenna to perform radiated tests.

WLAN traffic that meets or exceeds the minimum required loading was generated by transferring a data stream from the Master Device to the Slave Device using iPerf version 2.0.5 software package.

TPC is not required since the maximum EIRP is less than 500 mW (27 dBm).

The EUT utilizes the 802.11ac architecture. Three nominal channel bandwidths are implemented: 20 MHz, 40 MHz and 80 MHz.

The software installed in the EUT is revision 7.35.

The software installed in the access point is AP3G2-K9W7-M Version 15.3(3)JAB.

Page 15 of 40

#### UNIFORM CHANNEL SPREADING

This is requirement not applicable to Slave Devices.

#### OVERVIEW OF MASTER DEVICE WITH RESPECT TO §15.407 (h) REQUIREMENTS

The Master Device is a Cisco Access Point, FCC ID: LDK102087. The minimum antenna gain for the Master Device is 6 dBi.

The rated output power of the Master unit is > 23dBm (EIRP). Therefore the required interference threshold level is -64 dBm. After correction for procedural adjustments, the required radiated threshold at the antenna port is -64 + 1 = -63 dBm.

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

The software installed in the access point is AP3G2-K9W7-M Version 15.3(3)JAB.

Page 16 of 40

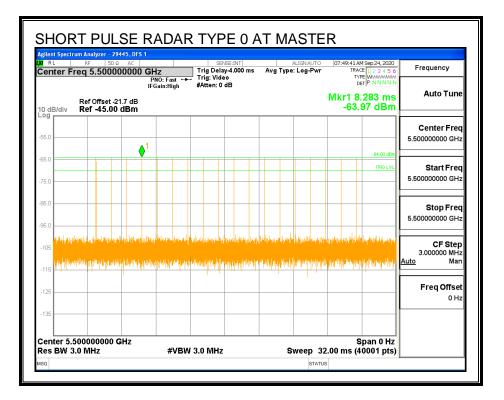
## 7.2. RESULTS FOR 20 MHz BANDWIDTH

## 7.2.1. TEST CHANNEL

All tests were performed at a channel center frequency of 5500 MHz.

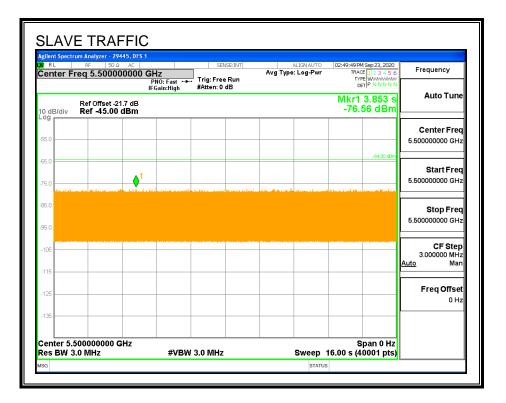
## 7.2.2. RADAR WAVEFORM AND TRAFFIC

#### RADAR WAVEFORM



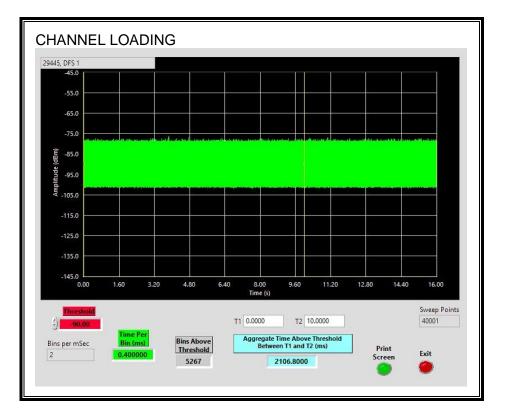
Page 17 of 40

#### **TRAFFIC**



Page 18 of 40

#### **CHANNEL LOADING**



The level of traffic loading on the channel by the EUT is 21.06%

Page 19 of 40

## 7.2.3. OVERLAPPING CHANNEL TESTS

#### **RESULTS**

These tests are not applicable.

## 7.2.4. MOVE AND CLOSING TIME

#### **REPORTING NOTES**

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time = (Number of analyzer bins showing transmission) \* (dwell time per bin)

The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

#### **RESULTS**

Channel Move Time	Limit
(sec)	(sec)
0.0748	10

Aggregate Channel Closing Transmission Time	Limit
(msec)	(msec)
0	60

Page 20 of 40

#### MOVE TIME

enter Freq 5	yzer - 29445, DFS 50 Ω AC .5000000000		SENSE:INT Trig: Free Run #Atten: 0 dB	ALIGN AUTO Avg Type: Log-Pwr	02:53:09 PM Sep 23, 2020 TRACE 1 2 3 4 5 6 TYPE WWWWWWW DET P N N N N N	Frequency
0 dB/div Ref	Dffset -21.7 dB - <b>45.00 dBm</b>			Δ	Mkr1 74.80 ms -13.48 dB	Auto Tune
og 55.0 66.0	Δ2				-64.00 dBm	Center Fred 5.500000000 GHz
35.0 95.0 105						Start Fred 5.500000000 GH:
115 125 135						<b>Stop Fred</b> 5.500000000 GH;
enter 5.50000 es BW 3.0 MH		#VB\	V 3.0 MHz	Sweep 1	Span 0 Hz 16.00 s (40001 pts)	CF Step 3.000000 MH
KR MODE TRC SCL $1  \Delta 2  1  t$	(A)	74.80 ms (Δ)		UNCTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Mar
2 F 1 t 3 4 5 6		1.515 s	-65.40 dBm		E.	Freq Offse 0 Ha
7 8 9 10						

UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc. FORM NO: CCSUP4701J TEL: (510) 319-4000 FAX: (510) 661-0888

Page 21 of 40

#### **CHANNEL CLOSING TIME**

RL RF enter Freq 5.5		PNO: Fast +++	SENSE:IN	ALIGN AUTO e: Log-Pwr	02:57:06 PM Sep 23, 2020 TRACE 1 2 3 4 5 6 TYPE WWWWWW DET P N N N N N	Frequency
	set -21.7 dB 5.00 dBm	FGain:High	#Atten: 0 dB	Δ	/kr1 200.0 ms -38.67 dB	Auto Tune
5.0					1RIG LVL	Center Free 5.500000000 GH:
5.0						Start Free 5.500000000 GH:
5.0						<b>Stop Free</b> 5.500000000 GH:
05 Hill had ben had ben 15				Allen of production designs in the second		CF Step 3.000000 MH: <u>Auto</u> Mar
25						Freq Offse 0 H
enter 5.500000	000 GHz				Span 0 Hz	

UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Page 22 of 40

#### AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the aggregate monitoring period.



Page 23 of 40

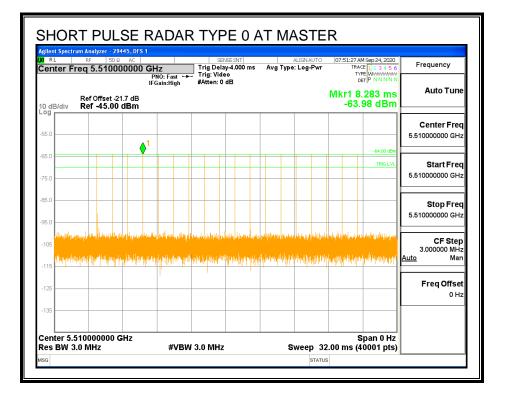
## 7.3. RESULTS FOR 40 MHz BANDWIDTH

## 7.3.1. TEST CHANNEL

All tests were performed at a channel center frequency of 5510 MHz.

## 7.3.2. RADAR WAVEFORM AND TRAFFIC

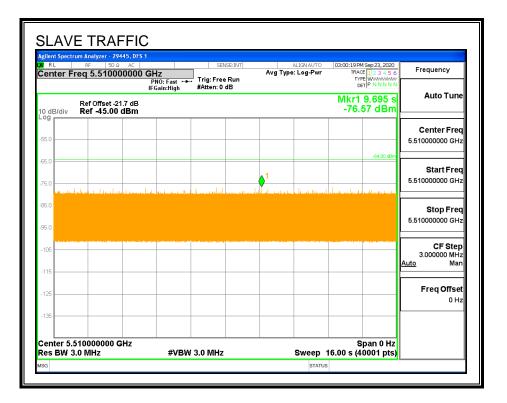
#### RADAR WAVEFORM



UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc. FORM NO: CCSUP4701J TEL: (510) 319-4000 FAX: (510) 661-0888

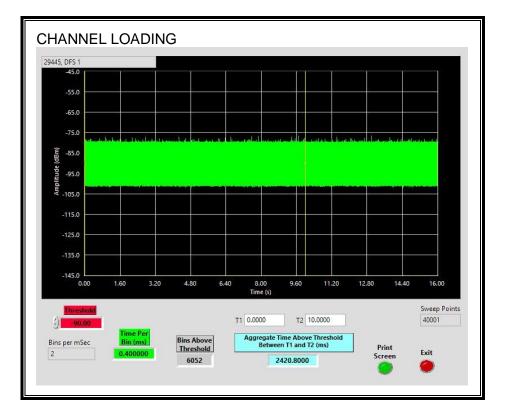
Page 24 of 40

#### **TRAFFIC**



Page 25 of 40

#### **CHANNEL LOADING**



The level of traffic loading on the channel by the EUT is 24.2%

Page 26 of 40

## 7.3.3. OVERLAPPING CHANNEL TESTS

#### **RESULTS**

These tests are not applicable.

## 7.3.4. MOVE AND CLOSING TIME

#### **REPORTING NOTES**

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time = (Number of analyzer bins showing transmission) \* (dwell time per bin)

The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

#### **RESULTS**

Channel Move Time	Limit
(sec)	(sec)
0.0892	10

Aggregate Channel Closing Transmission Time	Limit
(msec)	(msec)
0	60

Page 27 of 40

#### MOVE TIME

RL RF 50 Ω enter Freq 5.510000	PNO: Fast 🕶	SENSE:INT Trig: Free Run #Atten: 0 dB	ALIGNAUTO Avg Type: Log-Pwr	03:03:16 PM Sep 23, 2020 TRACE 1 2 3 4 5 6 TYPE WWWWWWW DET P N N N N N	Frequency
Ref Offset -21. 0 dB/div Ref -45.00 (		watten. 0 db	Δ	Mkr1 89.20 ms -14.15 dB	Auto Tune
•g 55.0 55.0 75.0				-64.00 dBm	Center Fred 5.510000000 GHz
25.0 105 105 105 105 105 105 105 10				There is a first free income in the second	Start Fred 5.510000000 GHz
.115					<b>Stop Fred</b> 5.510000000 GHz
enter 5.510000000 G tes BW 3.0 MHz		V 3.0 MHz	Sweep 1	Span 0 Hz 6.00 s (40001 pts)	CF Step 3.000000 MHz
$\frac{1}{\Delta 2} \frac{\Delta 2}{1} \frac{1}{t} (\Delta)$	× 89.20 ms (Δ)	-14.15 dB	UNCTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
2 F 1 t 3 4 5 6 7 9	1.510 s	-64.42 dBm			Freq Offset 0 Hz
8 9 10					

UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Page 28 of 40

#### **CHANNEL CLOSING TIME**

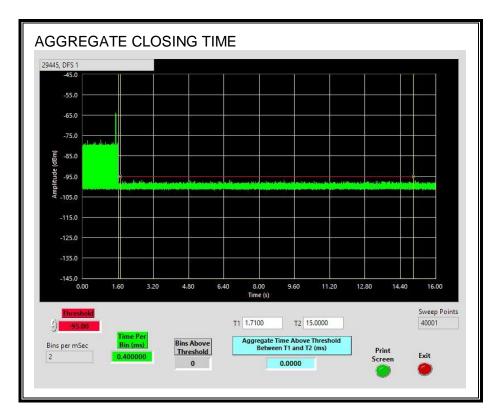
enter Freq 5.510000	000 GHz PNO: Fast	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	03:06:20 PM Sep 23, 2020 TRACE 1 2 3 4 5 6 TYPE WWWWWWW DET P N N N N N	Frequency
Ref Offset -21.7		#Atten: 0 dB	١Δ	/lkr1 200.0 ms -37.78 dB	Auto Tune
5.0				-64.00 dBm	Center Fred 5.51000000 GH;
5.0					Start Fred 5.510000000 GH:
5.0					<b>Stop Free</b> 5.510000000 GH:
05 A set of set	aljadionarodi i uzbeli hati yoʻldi. Animayo kon a najorozatisha kari	22 ong menadologi nitu kang berkin kang ng manang bilaka matang bilang pang pang pang pang pang pang pang p	un de States de la sen de servicit de la servicit.	eredaj <del>di ajani tak ang tinjakana anj kap</del>	CF Step 3.000000 MH: Auto Mar
25					Freq Offse 0 H:
35					

UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Page 29 of 40

#### AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the aggregate monitoring period.



Page 30 of 40

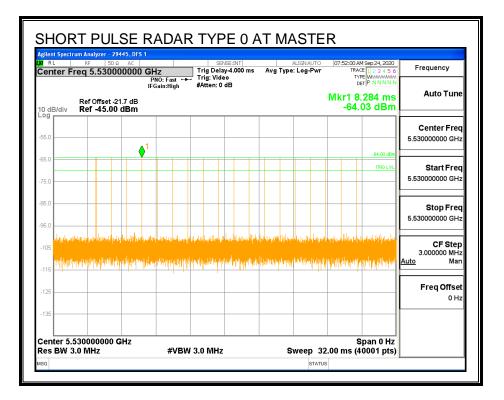
## 7.4. RESULTS FOR 80 MHz BANDWIDTH

## 7.4.1. TEST CHANNEL

All tests were performed at a channel center frequency of 5530 MHz.

## 7.4.2. RADAR WAVEFORM AND TRAFFIC

#### RADAR WAVEFORM



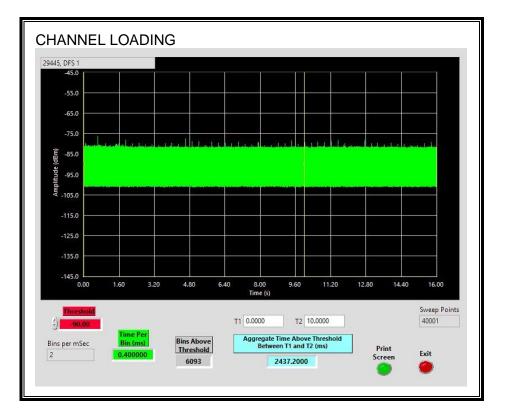
Page 31 of 40

#### **TRAFFIC**

cilici i req 5.55	50 Ω AC 60000000 GHz PN0: Fast ↔	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	03:08:00 PM Sep 23, 2020 TRACE 1 2 3 4 5 6 TYPE WWWWWWW DET P N N N N N	Frequency
0 dB/div Ref -45	IFGain:High et -21.7 dB .00 dBm	#Atten: 0 dB		Mkr1 630.0 ms -76.41 dBm	Auto Tune
<b>og</b> (5.0				-64.00 dBm	Center Fred 5.530000000 GHz
75.0				-04.00 00m	Start Freq 5.530000000 GHz
1979/1996-900 (1996-90) 15.0	len ter til atter her beskallak her her beskallar her	las her her ter tiss die ter ter das her h	eh (an laga laga laga laga laga laga laga sanagan	laded of technic barrets bed	<b>Stop Fred</b> 5.530000000 GHz
105					<b>CF Step</b> 3.000000 MHz <u>Auto</u> Mar
					Freq Offset 0 Hz
125					

Page 32 of 40

#### **CHANNEL LOADING**



The level of traffic loading on the channel by the EUT is 24.37%

Page 33 of 40

## 7.4.3. OVERLAPPING CHANNEL TESTS

#### **RESULTS**

These tests are not applicable.

## 7.4.4. MOVE AND CLOSING TIME

#### **REPORTING NOTES**

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time = (Number of analyzer bins showing transmission) \* (dwell time per bin)

The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

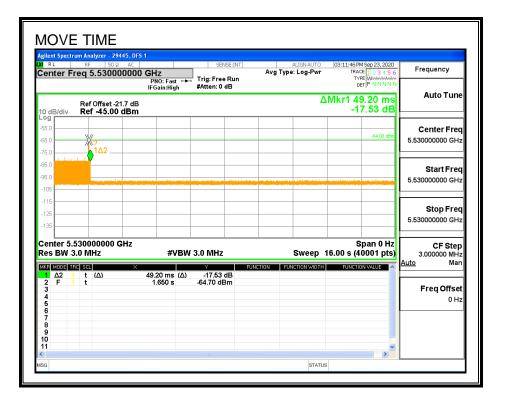
#### **RESULTS**

Channel Move Time	Limit
(sec)	(sec)
0.0492	10

Aggregate Channel Closing Transmission Time	Limit
(msec)	(msec)
0	60

Page 34 of 40

#### MOVE TIME



Page 35 of 40

#### **CHANNEL CLOSING TIME**

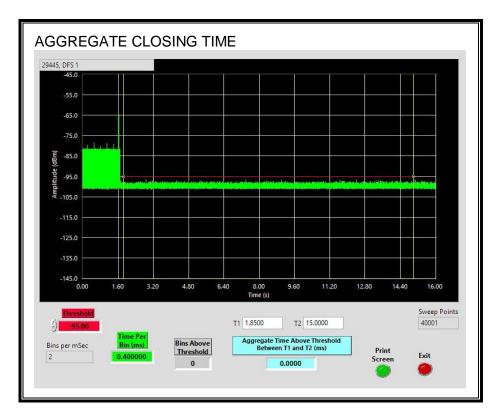
RL RF 50 Ω enter Freq 5.530000	000 GHz PNO: Fast +++ Trig	SENSE:INT	ALIGNAUTO Avg Type: Log-Pwr	03:14:27 PM Sep 23, 2020 TRACE 1 2 3 4 5 6 TYPE WWWWWWWW DET P N N N N	Frequency
Ref Offset -21.7 dB/div Ref -45.00 dl	dB	en:0 dB	Δ١	Vkr1 200.0 ms -34.38 dB	Auto Tune
5.0				-64.00 dBm	Center Free 5.53000000 GH
5.0					Start Fred 5.530000000 GH;
5.0	1 <u>\</u>				<b>Stop Fred</b> 5.530000000 GH:
11 PPU pa bas set antegrad antegrad (1990) 05 mart bas to entry to entry (1990) 15	hill an spectrum of an			an a	CF Step 3.000000 MH: Auto Mar
25					Freq Offse 0 H
enter 5.530000000 GH	z #VBW 3.0			Span 0 Hz .0 ms (40001 pts)	

UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 319-4000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Page 36 of 40

#### AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the aggregate monitoring period.



Page 37 of 40

## 7.4.5. 30-MINUTE NON-OCCUPANCY PERIOD

#### **RESULTS**

No EUT transmissions were observed on the test channel during the 30-minute observation time.

enter Freq 5.5300	Ω AC 000000 GHz	SEN Fast ↔ Trig: Free		ALIGN AUTO	03:50:35 PM Sep 23, 2 TRACE 1 2 3 4 TYPE WWWW	Frequency
Ref Offset - 0 dB/div <b>Ref -45.0</b>	IFGain 21.7 dB		IB		0er <u> PNNN</u> 1.800 -33.86 (	ks Auto Tune
5.0						Center Free 5.530000000 GH;
5.0 <mark>2</mark> 5.0 LL					-64.00	Start Free 5.530000000 GH:
5.0 <b></b>	hanitah era minakani tau		- Marine State State State State	e d'aut e parente d'anne di	1A	2 <b>Stop Free</b> 5.530000000 GH
15						CF Step 3.000000 MH <u>Auto</u> Mar
25						Freq Offse
enter 5.530000000 es BW 3.0 MHz		#VBW 3.0 MHz			Span 0 000 ks (40001 p	

Page 38 of 40