

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

TEST REPORT

FOR

INDUSTRIAL PC GATEWAY

MODEL NUMBER: SYS-C31-DMV-01-I0

FCC ID: 2ALZB-AW276 ISED ID: 22688-AW276

REPORT NUMBER: R14438810-D1

ISSUE DATE: 2022-09-26

Prepared for SECO S.p.A. VIA ACHILLE GRANDI 20 52100 AREZZO AR, ITALY

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Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2022-08-24	Initial Issue	John E. Manser III
	2022-09-01	Corrected FCC and ISED ID numbers	John E. Manser III
V3	2022-09-26	Corrected Antenna Gain and EIRP values – pg 14	John E. Manser III

DATE: 2022-09-26

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SECO S.p.A.

Via Achille Grandi 20 52100 Arezzo AR, Italy

EUT DESCRIPTION: Industrial PC Gateway

MODEL: SYS-C31-DMV-01-I0

SERIAL NUMBER: 220405438

DATE TESTED: 2022-08-17 to 2022-08-18

APPLICABLE STANDARDS

STANDARD TEST RESULTS

DFS Portion of CFR 47 Part 15 Subpart E Complies
DFS Portion of ISED CANADA RSS-247 Issue 2 Complies

UL LLC 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 LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document.

Approved & Released For

ULLIC By:

Prepared By:

Henry Lau

Senior Project Engineer

CONSUMER TECHNOLOGY DIVISION

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John E. Manser III Laboratory Supervisor

CONSUMER TECHNOLOGY DIVISION

UL LLC

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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	None
DFS Portion of ISED CANADA RSS-247 ISSUE 2	Complies	None

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 Bureau Veritas Consumer Products Services (H.K.) Ltd., report number RF161216E08-2.

This report contains data provided by the customer which can impact the validity of results. UL LLC is only responsible for the validity of results after the integration of the data provided by the customer.

5. FACILITIES AND ACCREDITATION

UL LLC is accredited by A2LA, certification # 0751.06, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
	Building: 12 Laboratory Dr. RTP, NC 27709, U.S.A	US0067	2180C	825374
\boxtimes	Building: 2800 Perimeter Park Dr. Suite B Morrisville, NC 27560, U.S.A	030007	27265	020374

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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.

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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).

7. DYNAMIC FREQUENCY SELECTION

7.1. OVERVIEW

7.1.1. LIMITS

INNOVATION, SCIENCE and ECONOMIC DEVELOPMENT CANADA (ISED)

ISED 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".

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

Requirement	Operatio	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 devices with multiple bandwidth modes	Master Device or Client with Radar DFS	Client (without DFS)
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

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 all 20 MHz channel blocks and a null frequency between the bonded 20 MHz channel blocks.

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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	

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: E.I.R.P. is based on the highest antenna gain. For MIMO devices refer to KDB publication 662911 D01.

Table 4: DFS Response requirement values

rable ii bi e respense requirement values	
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		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 ⁶ /PRI _{usec})}		
		table 5a			
		Test B: 15 unique			
		PRI values randomly			
		selected within the			
		range of 518-3066			
		usec. With a			
		minimum increment			
		of 1 usec, excluding			
		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

Note 1: Short Pulse Radar Type 0 should be used for the *Detection Bandwidth* test, *Channel Move Time*, and *Channel Closing Time* tests.

Table 6 - Long Pulse Radar Test Signal

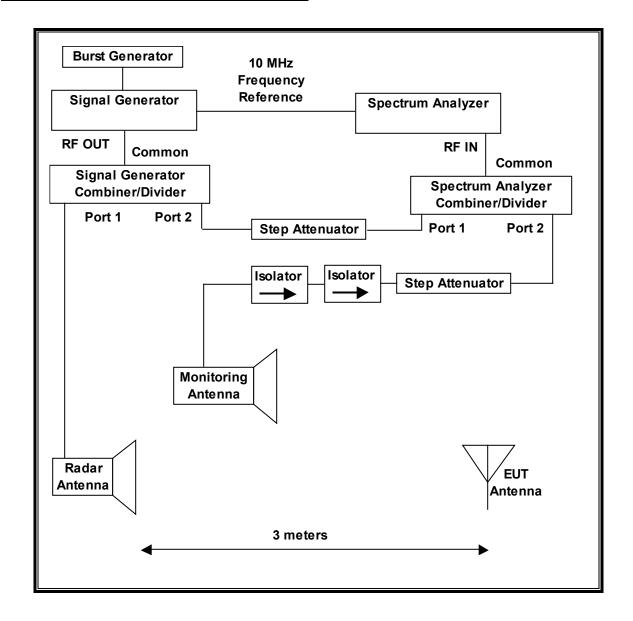
Radar	Pulse	Chirp	PRI	Pulses	Number	Minimum	Minimum
Waveform	Width	Width	(µsec)	per	of	Percentage	Trials
Type	(µsec)	(MHz)		Burst	Bursts	of Successful	
	,	, ,				Detection	
5	50-100	5-20	1000-	1-3	8-20	80%	30
			2000				

Table 7 – Frequency Hopping Radar Test Signal

Table / Trequency Hopp				ig i waai	i cot oigi	iai		
	Radar	Pulse	PRI	Pulses	Hopping	Hopping	Minimum	Minimum
	Waveform	Width	(µsec)	per	Rate	Sequence	Percentage of	Trials
	Type	(µsec)		Hop	(kHz)	Length	Successful	
	-					(msec)	Detection	
	6	1	333	9	0.333	300	70%	30

7.1.2. TEST AND MEASUREMENT SYSTEM

RADIATED METHOD SYSTEM BLOCK DIAGRAM



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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.

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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 using iPerf version 2.0.10. 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:

Description	Manufacturer	Model	ID No.	Cal Due
Spectrum Analyzer, PXA, 3Hz to 8.4GHz	Keysight	N9030A	SA0021	2023-07-14
Signal Generator, MXG X-Series RF Vector	Agilent	N5182B	SIG003	2023-05-19
Environmental Meter	Fisher Scientific	14-650-118	HI0096	2022-09-21

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	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).

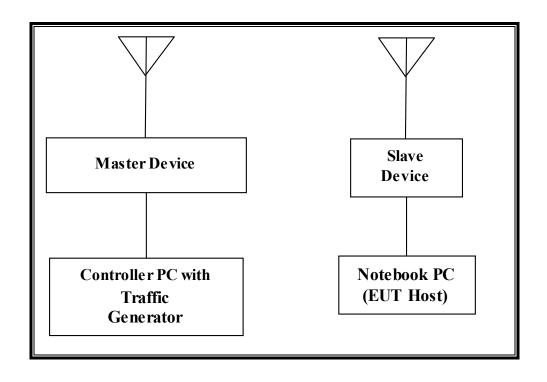
ENVIRONMENT CONDITION

Parameter	Value
Temperature	24.5 - 26.1 °C
Humidity	35 - 42 %

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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
Support Laptop	Lenovo	T440	SD20F82751	20B6-
				002AUS
Laptop Power supply	Lenovo	ADLX45NCC2A	11S45N0299Z1ZS9341 9JX1	N/A
DC Regulated Power Supply	CircuitSpeciali sts	CSI3003X5	653668	N/A
WiFi 6E Tri-Band Gaming Router	ASUS	GT-AXE11000	M9IG0X400839JKM	MSQ- RTAXJF00
AP Power Supply	AcBel	ADD011	17AG213403440A	N/A
EUT Mouse	Logitech	B100	1451HS05PWZ8	N/A
EUT Monitor	ViewSonic	VS15453	V1X203841229	N/A
EUT Keyboard	Dell	RT7D50	CN-0W7658-37172-637- 0DQI	N/A
HDMI cable	Volex	2027C	N/A	N/A

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7.1.6. DESCRIPTION OF EUT

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

For ISED the EUT operates over the 5250-5350 MHz and 5470-5725 MHz ranges, excluding the 5600-5650 MHz range.

The EUT is a Slave Device without Radar Detection.

The highest power level within these bands is 22.6 dBm EIRP in the 5250-5350 MHz band and 21.36 dBm EIRP in the 5470-5725 MHz band.

The antenna(s) gain and type, as provided by the manufacturer' are as follows:

The highest gain antenna assembly utilized with the EUT has a gain of 0.89 dBi in the 5250-5350 MHz band and -0.01 dBi in the 5470-5725 MHz band. The lowest gain antenna assembly utilized with the EUT has a gain of -1.93 dBi in the 5250-5350 MHz band and -3.72 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 and one receive only chain, 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 2.0.10 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.

Channel puncturing is not supported.

The software installed in the EUT is C31DMVYY.BBB.

The software installed in the access point is 3.0.0.4.386.42489.

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UNIFORM CHANNEL SPREADING

This function is not required per KDB 905462.

This is requirement not applicable to Slave Devices.

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

The Master Device is an Asus Access Point, FCC ID: MSQ-RTAXJF00. The minimum antenna gain for the Master Device is 3.8 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 3.0.0.4.386.42489.

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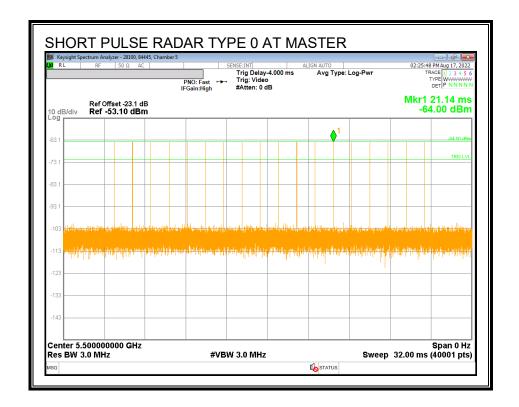
7.2. RESULTS FOR 20 MHz BANDWIDTH

7.2.1. TEST CHANNEL

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

7.2.2. RADAR WAVEFORM AND TRAFFIC

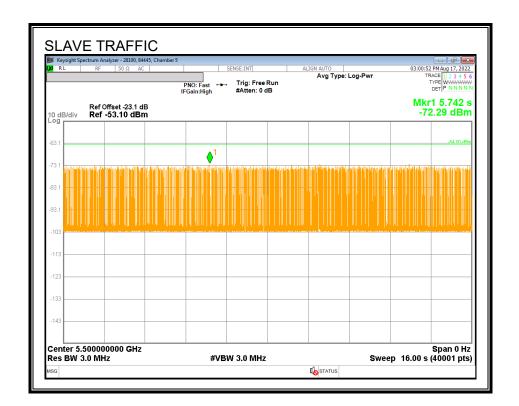
RADAR WAVEFORM



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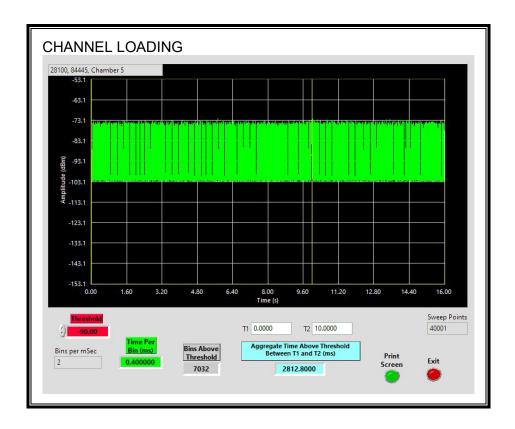
DATE: 2022-09-26

TRAFFIC



DATE: 2022-09-26

CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 28.1%

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)
0.8828	10

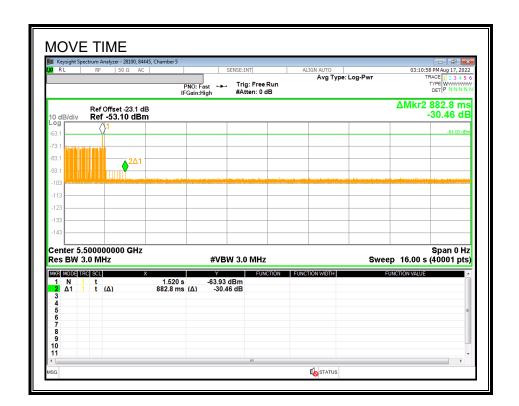
Aggregate Channel Closing Transmission Time	Limit
(msec)	(msec)
8.4	60

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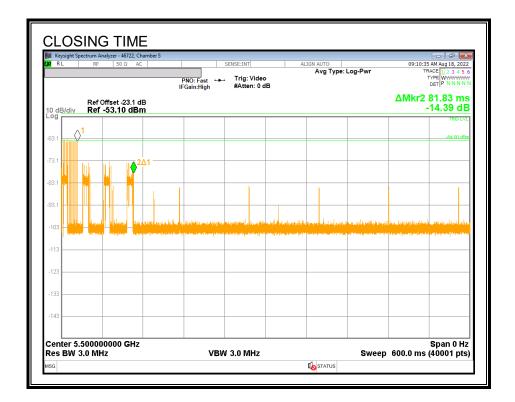
MOVE TIME



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CHANNEL CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

Only intermittent transmissions are observed during the aggregate monitoring period.



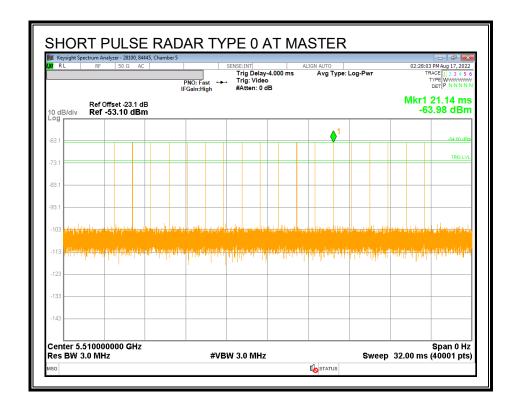
7.3. RESULTS FOR 40 MHz BANDWIDTH

7.3.1. TEST CHANNEL

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

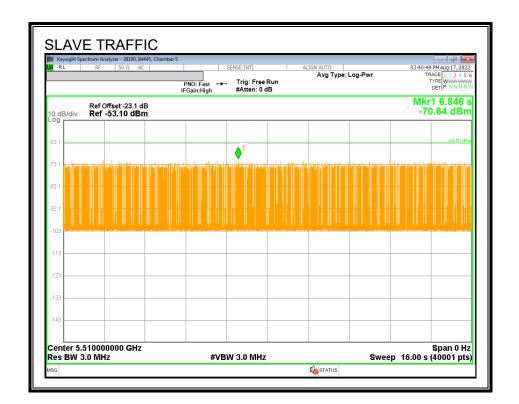
7.3.2. RADAR WAVEFORM AND TRAFFIC

RADAR WAVEFORM



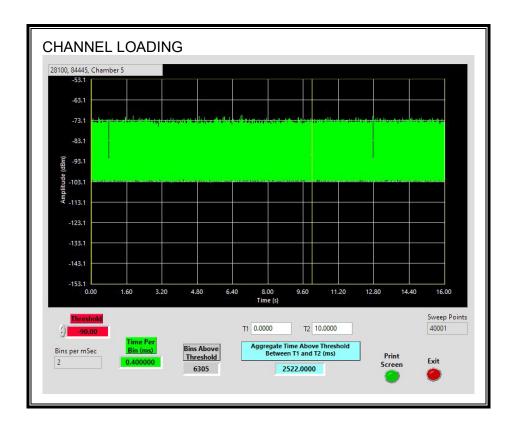
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CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 25.2%

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)
0.8344	10

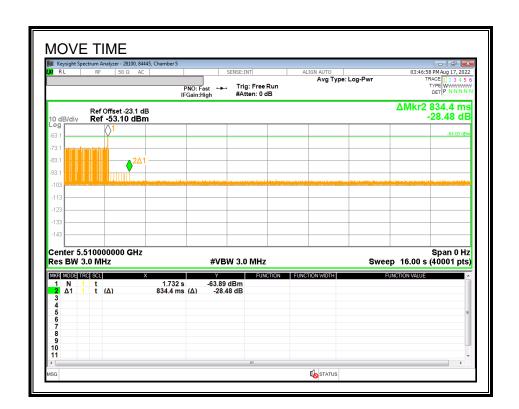
Aggregate Channel Closing Transmission Time	Limit
(msec)	(msec)
8.4	60

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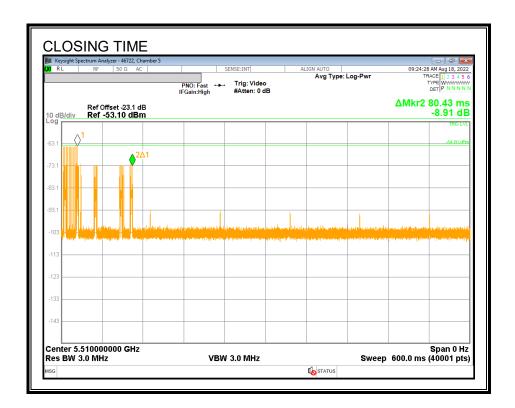
MOVE TIME



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CHANNEL CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

Only intermittent transmissions are observed during the aggregate monitoring period.



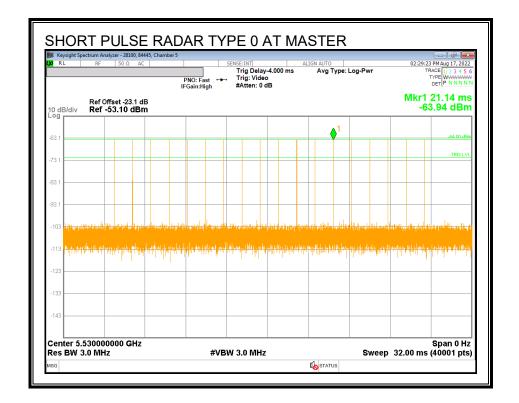
7.4. RESULTS FOR 80 MHz BANDWIDTH

7.4.1. TEST CHANNEL

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

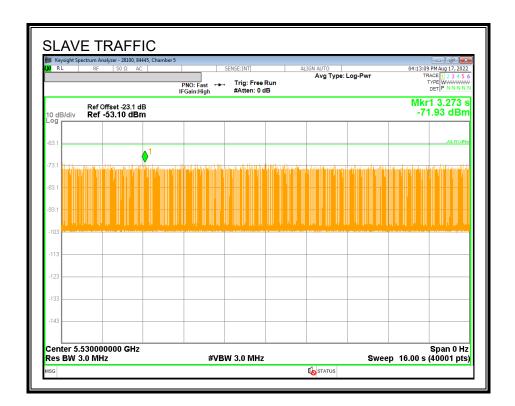
7.4.2. RADAR WAVEFORM AND TRAFFIC

RADAR WAVEFORM



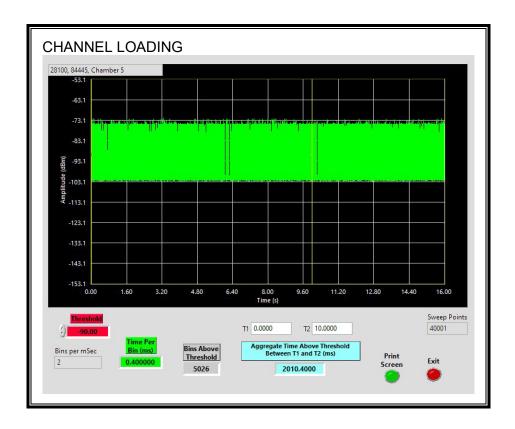
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CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 20.1%

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)
0.0324	10

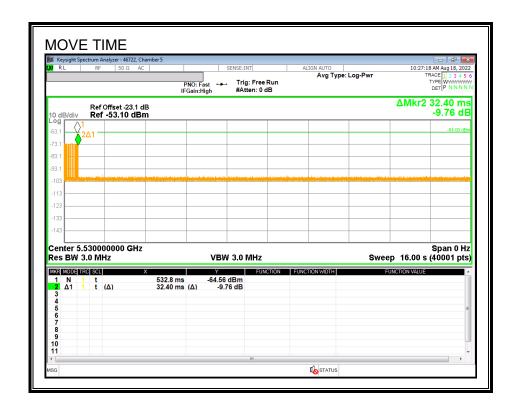
Aggregate Channel Closing Transmission Time	Limit
(msec)	(msec)
0	60

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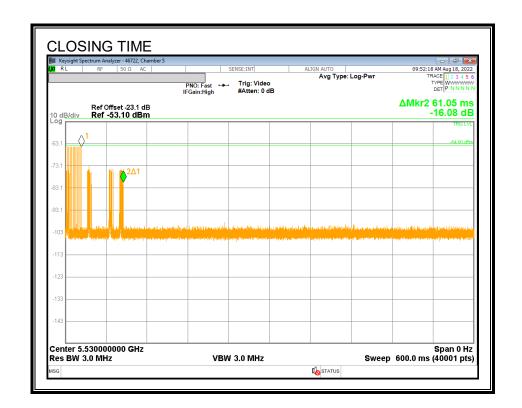
DATE: 2022-09-26

MOVE TIME



DATE: 2022-09-26

CHANNEL CLOSING TIME

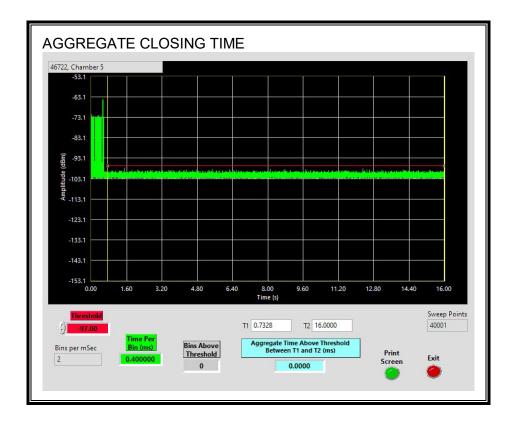


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AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

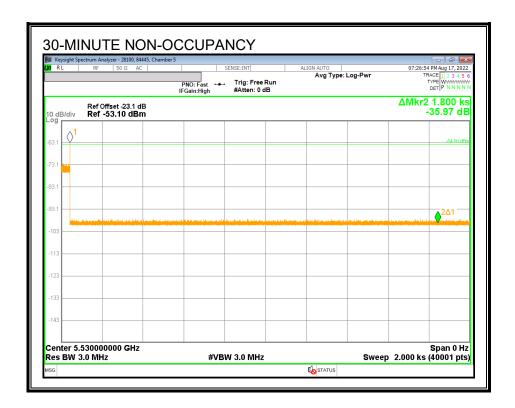
No transmissions are observed during the aggregate monitoring period.



7.4.5. 30-MINUTE NON-OCCUPANCY PERIOD

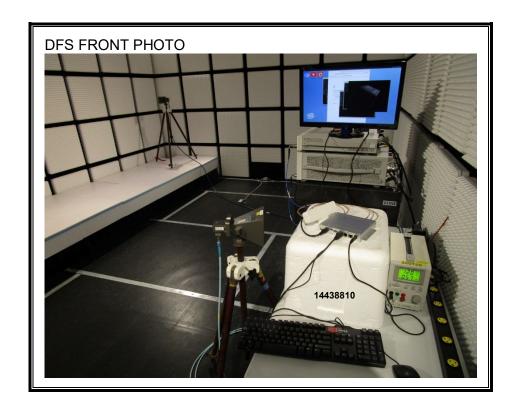
RESULTS

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



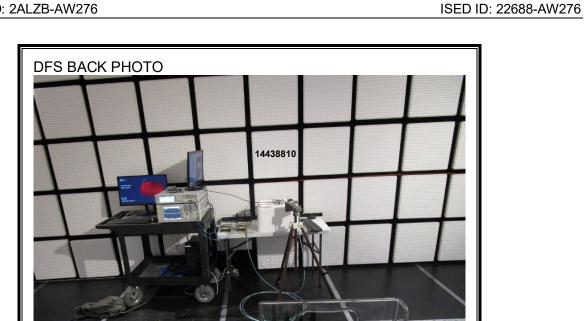
8. SETUP PHOTOS

DYNAMIC FREQUENCY SELECTION MEASUREMENT SETUP



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END OF TEST REPORT

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