FCC PART 15.407
ISED RSS-247 ISSUE 3
DYNAMIC FREQUENCY SELECTION
TEST REPORT

For

Brilliant Home Technology Inc.

155 Bovet Road, Suite 500
San Mateo, CA 94402, USA

FCC ID: 2APQV-BCPUSMG
IC: 23875-BCPCAMG

Report Type: Original Report		**Product Type:** Control Panel
Prepared By	Kevin Chau RF Test Engineer	
Report Number	R2310194 -DFS	
Report Date	2024-03-20	
Reviewed By	Christian McCaig RF Lead Engineer	
Bay Area Compliance Laboratories Corp. 1274 Anvilwood Ave Sunnyvale, CA 94089, USA Tel: (408) 732-9162, Fax: (408) 732 9164		

TABLE OF CONTENTS

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R2310194 -DFS	Original Report	2024-03-20

1 General Description

1.1 Product Description for Equipment under Test (EUT)

This test report was prepared on behalf of *Brilliant Home Technology Inc.*and their product FCC ID: 2APQV-BCPUSMG, IC: 23875-BCPCAMG, as referred to as EUT in this report. The product is touch screen smart home control panel.

Note: 5600-5650 MHz range shall not be applicable to ISED.

1.2 Mechanical Description of EUT

Length (cm)	Width (cm)	Height (cm)	Weight (kg)	S/N
21	13.2	0.8	0.25	FA4AMS20F2

1.3 Objective

This report is prepared on behalf of *Brilliant Home Technology Inc.* in accordance with FCC CFR47 §15.407 (h), RSS-247 Issue 3, and KDB: 905462 D02 UNII DFS Compliance Procedures New Rules v02.

The objective was to determine compliance with FCC and ISED rules for Channel Closing Transmission Time, Channel Move time, and Non-Occupancy Period.

1.4 Related Submittal(s)/Grant(s)

N/A

1.5 Test Methodology

FCC CFR 47 Part2, Part15.407 (h), RSS-247 Issue 3

KDB: 905462 D02 UNII DFS Compliance Procedures New Rules v02.

COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED-NATIONAL INFORMATION INFRASTRUCTURE DEVICES OPERATING IN THE 5250-5350 MHz AND 5470-5725 MHz BANDS INCORPORATING DYNAMIC FREQUENCY SELECTION

1.6 Test Facility Registrations

BACLs test facilities that are used to perform Radiated and Conducted Emissions tests are currently recognized by the Federal Communications Commission as Accredited with NIST Designation Number US1129.

BACL's test facilities that are used to perform Radiated and Conducted Emissions tests are currently registered with Industry Canada under Registration Numbers: 3062A-1, 3062A-2, and 3062A-3.

BACL is a Chinese Taipei Bureau of Standards Metrology and Inspection (BSMI) validated Conformity Assessment Body (CAB), under Annex B, Phase I Procedures of the APEC Mutual Recognition Arrangement (MRA). BACL's BSMI Lab Code Number is: SL2-IN-E-1002R

BACL's test facilities that are used to perform AC Line Conducted Emissions, Telecommunications Line Conducted Emissions, Radiated Emissions from 30 MHz to 1 GHz, and Radiated Emissions from 1 GHz to 6 GHz are currently recognized as Accredited in accordance with the Voluntary Control Council for Interference [VCCI] Article 15 procedures under Registration Number A-0027.

1.7 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- ***An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2017 by A2LA (Test Laboratory Accreditation Certificate Number 3297.02),*** in the fields of: Electromagnetic Compatibility and Telecommunications. Unless noted by an Asterisk (*) in the Compliance Matrix (See Section 3 of this Test Report), BACL's ISO/IEC 17025:2017 Scope of Accreditation includes all of the Test Method Standards and/or the Product Family Standards detailed in this Test Report..

BACL's ISO/IEC 17025:2017 Scope of Accreditation includes a comprehensive suite of EMC Emissions, EMC Immunity, Radio, RF Exposure, Safety and wireline Telecommunications test methods applicable to a wide range of product categories. These product categories include Central Office Telecommunications Equipment [including NEBS - Network Equipment Building Systems], Unlicensed and Licensed Wireless and RF devices, Information Technology Equipment (ITE); Telecommunications Terminal Equipment (TTE); Medical Electrical Equipment; Industrial, Scientific and Medical Test Equipment; Professional Audio and Video Equipment; Industrial and Scientific Instruments and Laboratory Apparatus; Cable Distribution Systems, and Energy Efficient Lighting.

B- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3297.03)*** to certify

- For the USA (Federal Communications Commission):
    1- All Unlicensed radio frequency devices within FCC Scopes A1, A2, A3, and A4;
    2- All Licensed radio frequency devices within FCC Scopes B1, B2, B3, and B4;
    3- All Telephone Terminal Equipment within FCC Scope C.
- For the Canada (Industry Canada):
    1 All Scope 1-Licence-Exempt Radio Frequency Devices;

2 All Scope 2-Licensed Personal Mobile Radio Services;
3 All Scope 3-Licensed General Mobile & Fixed Radio Services;
4 All Scope 4-Licensed Maritime & Aviation Radio Services;
5 All Scope 5-Licensed Fixed Microwave Radio Services
6 All Broadcasting Technical Standards (BETS) in the Category I Equipment Standards List.

- For Singapore (Info-Communications Development Authority (IDA)):

1 All Line Terminal Equipment: All Technical Specifications for Line Terminal Equipment – Table 1 of IDA MRA Recognition Scheme: 2011, Annex 2
2. All Radio-Communication Equipment: All Technical Specifications for Radio-Communication Equipment – Table 2 of IDA MRA Recognition Scheme: 2011, Annex 2

- For the Hong Kong Special Administrative Region:

1 All Radio Equipment, per KHCA 10XX-series Specifications;
2 All GMDSS Marine Radio Equipment, per HKCA 12XX-series Specifications;
3 All Fixed Network Equipment, per HKCA 20XX-series Specifications.

- For Japan:

1 MIC Telecommunication Business Law (Terminal Equipment):
- All Scope A1 - Terminal Equipment for the Purpose of Calls;
- All Scope A2 - Other Terminal Equipment

2 Radio Law (Radio Equipment):
- All Scope B1 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 1 of the Radio Law
- All Scope B2 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 2 of the Radio Law
- All Scope B3 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 3 of the Radio Law

C- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3297.01)*** to certify Products to USA's EnvCobaltmental Protection Agency (EPA) ENERGY STAR Product Specifications for:

1 Electronics and Office Equipment:
- for Telephony (ver. 3.0)
- for Audio/Video (ver. 3.0)
- for Battery Charging Systems (ver. 1.1)
- for Set-top Boxes & Cable Boxes (ver. 4.1)
- for Televisions (ver. 6.1)
- for Computers (ver. 6.0)
- for Displays (ver. 6.0)
- for Imaging Equipment (ver. 2.0)
- for Computer Servers (ver. 2.0)

2 Commercial Food Service Equipment
- for Commercial Dishwashers (ver. 2.0)
- for Commercial Ice Machines (ver. 2.0)
- for Commercial Ovens (ver. 2.1)
- for Commercial Refrigerators and Freezers

3 Lighting Products
- For Decorative Light Strings (ver. 1.5)
- For Luminaires (including sub-components) and Lamps (ver. 1.2)
- For Compact Fluorescent Lamps (CFLs) (ver. 4.3)
- For Integral LED Lamps (ver. 1.4)

4 Heating, Ventilation, and AC Products
- for Residential Ceiling Fans (ver. 3.0)
- for Residential Ventilating Fans (ver. 3.2)

5 Other

- For Water Coolers (ver. 3.0)

D- ***A NIST Designated Phase-I and Phase-II Conformity Assessment Body (CAB) for the following economies and regulatory authorities under the terms of the stated MRAs/Treaties:***

- Australia: ACMA (Australian Communication and Media Authority) – APEC Tel MRA -Phase I;
- Canada: (Innovation, Science and Economic development Canada - ISEDC) Foreign Certification Body – FCB – APEC Tel MRA -Phase I & Phase II;
- European Union:
    - EMC Directive 2014/30/EU US-EU EMC & Telecom MRA CAB (NB)
    - Radio Equipment (RE) Directive 2014/53/EU US-EU EMC & Telecom MRA CAB (NB)
    - Low Voltage Directive (LVD) 2014/35/EU
- Hong Kong Special Administrative Region: (Office of the Telecommunications Authority – OFTA) APEC Tel MRA -Phase I & Phase II
- Israel – US-Israel MRA Phase I
- Republic of Korea (Ministry of Communications - Radio Research Laboratory) APEC Tel MRA -Phase I
- Singapore: (Infocomm Media Development Authority - IMDA) APEC Tel MRA -Phase I & Phase II;
- Japan: VCCI - Voluntary Control Council for Interference US-Japan Telecom Treaty VCCI Side Letter-
- USA:
    - ENERGY STAR Recognized Test Laboratory – US EPA
    - Telecommunications Certification Body (TCB) – US FCC;
    - Nationally Recognized Test Laboratory (NRTL) – US OSHA
- Vietnam: APEC Tel MRA -Phase I;

2 EUT Test Configuration

2.1 Justification

The EUT was configured for testing according to FCC Part 15.407(h), RSS-247 Issue 3, and KDB: 905462 D02 UNII DFS Compliance Procedures New Rules v02.

2.2 EUT Exercise Software

The test used TeraTerm and test commands, provided by *Brilliant Home Technology Inc.*, the software is compliant with the standard requirements being tested against.

Traffic was generated by iperf 3.1.3

The EUT firmware version:

Linux brilliant-i350 5.15.42-mtk+g7dce97e2731f #1 SMP PREEMPT Mon Sep 18 19:52:17 UTC 2023 aarch64 aarch64 aarch64 GNU/Linux

2.3 Equipment Modifications

N/A

2.4 Local Support Equipment

Manufacturer	Description	Model	Serial Number
Dell	Laptop	Latitude E7440	C71SYZ1
TP-Link	Router	Archer C7(FCC ID: TE7C7V2)	216C514000252
Dell	Laptop	Latitude E6410	FFXR4Q1
Dell	Laptop	Latitude 5401	8CKH733

2.5 Remote Support Equipment

Manufacturer	Description	Model
-	USB/Serial Breakout	213-00068 Rev 1

2.6 Interface Ports and Cables

Cable Description	Length	To	From
Ethernet cable	2 m	Laptop	Router
Ethernet cable	2 m	Router	Laptop
Serial Port cable	2 m	EUT	Laptop

3 Summary of Test Results

The following result table represents the list of measurements required under the FCC CFR47 §15.407 (h), RSS-247 Issue 3, and KDB: 905462 D02 UNII DFS Compliance Procedures New Rules v02.

Items	Description of Test	Results
In-Service Monitoring	Channel Move Time	Compliant
	Channel Closing Transmission Time	Compliant
	Non-Occupancy Period	Compliant

Disclaimer: *BACL is responsible for all the information provided in this report, except when information is provided by the customer as identified in this report. Information provided by the customer, e.g., antenna gain, can affect the validity of results.*

4 Applicable Standards

4.1 DFS Requirement

FCC CFR47 §15.407 (h), RSS-247 Issue 3, and KDB: 905462 D02 UNII DFS Compliance Procedures New Rules v02.

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 Device or Client with Radar Detection	Client Without Radar Detection
DFS Detection Threshold	Yes	Not Required
Channel Closing Transmission Time	Yes	Yes
Channel Move Time	Yes	Yes
U-NII Detection Bandwidth	Yes	Not Required

Additional requirements for devices with multiple bandwidth modes	Master Device or Client with Radar Detection	Client Without Radar Detection
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 each of the bonded 20 MHz channels and the channel center frequency.		

Table 3: Interference Threshold for Master and Client with Radar Detection

Maximum Transmit Power	Value (See Notes 1, 2 and 3)
EIRP≥ 200 milliwatt	-64 dBm
EIRP< 200 milliwatt and power spectral density < 10dBm/MHz	-62 dBm
EIRP< 200 milliwatt that do not meet the power spectral density requirement	-64 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.
Note3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.

Table 4: DFS Response Requirement Values

Parameter	Value
Non-occupancy period	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds ***See Note 1***.
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. ***See Notes 1 and 2***.
U-NII Detection Bandwidth	Minimum 100% of the UNII 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 Type	Pulse Width (Microseconds)	PRI (Microseconds)	Pulses	Minimum Percentage of Successful Detection	Minimum Number of Trials
0	1	1428	18	See Note 1	See Note 1
1	1	Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a Test B: 15 unique PRI values randomly selected within the range of 518-3066 µsec, with a minimum increment of 1 µsec, excluding PRI values selected in Test A	$\text{Roundup}\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot10^6}{\text{PRI}_{\mu\text{sec}}}\right)\right\}$	60%	30
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 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 Type	Bursts	Chirp Width (MHz)	PRI (usec)	Number of Pulses per Burst	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Number of Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

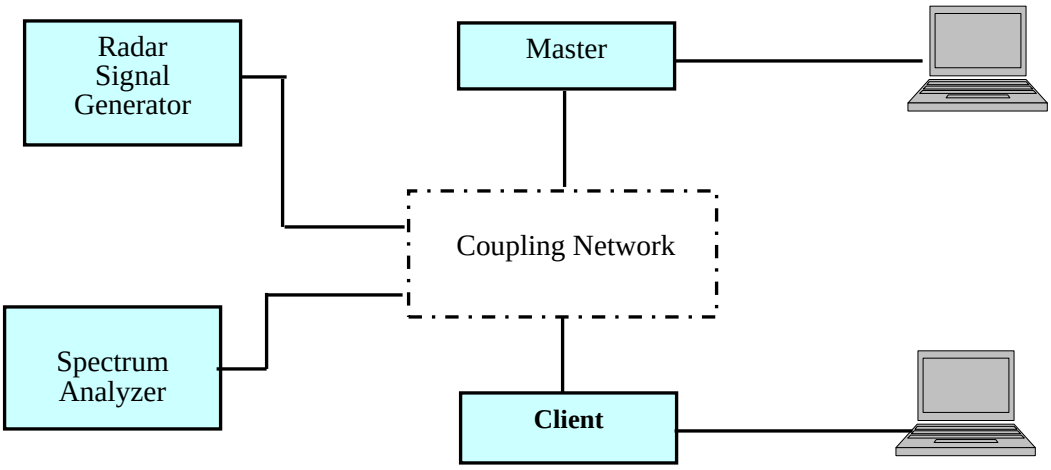
Table 7: Frequency Hopping Radar Test Signal

Radar Type	Pulse Width (usec)	PRI (usec)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (msec)	Minimum Percentage of Successful Detection	Minimum Number of Trials
6	1	333	9	0.333	300	70%	30

4.2 DFS Measurement System

BACL DFS measurement system consists of two subsystems: (1) The radar signal generating subsystem and (2) the traffic monitoring subsystem.

4.3 System Block Diagram



4.4 Radiated Method

7.3.2 Client with injection at the Master

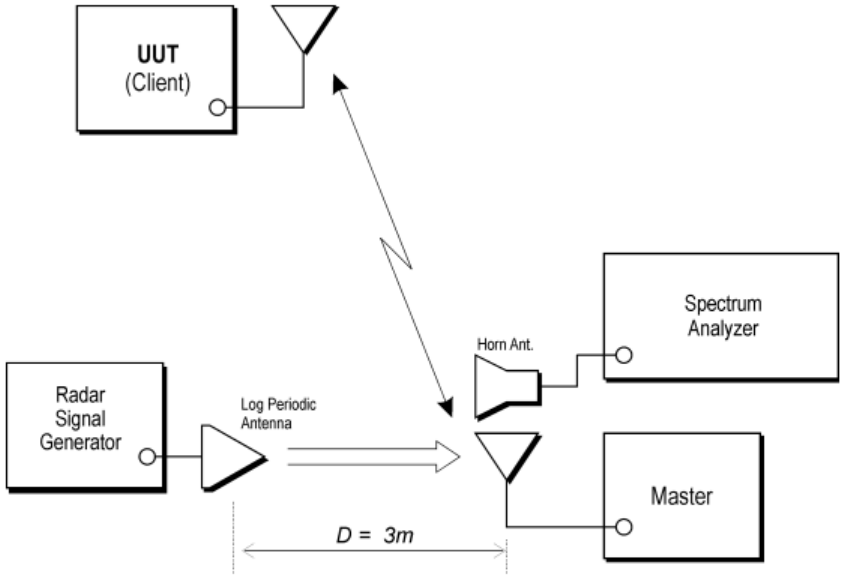


Figure 6: Example Radiated Setup where UUT is a Client and Radar Test Waveforms are injected into the Master

4.5 Test Procedure

A spectrum analyzer is used as a monitor that verifies the EUT's status, which includes the Channel Closing Transmission Time and the Channel Move Time. The Spectrum analyzer is used to monitor the equipment under test (EUT) does not transmit on the same channel during the Non-Occupied Period after the radar detection.

5 Test Results

5.1 Description of EUT

The EUT operates in 5250-5350 MHz and 5470-5725 MHz range in client mode.

The master device was configured to channels 58, 106, 122, and 138 for testing in 80 MHz bandwidth mode.

Please refer to the detailed antenna information in the next section.

WLAN traffic is generated by running iperf3.

5.2 Antenna Description

Antenna Type	Supplier	Antenna Part No.	Frequency (GHz)	Lowest Antenna Gain across band (dBi)
Dipole Antenna	TP-LINK	3101501493	5150-5850	5
Dipole Antenna	TP-LINK	3101501495	5150-5850	5
Dipole Antenna	TP-LINK	3101501496	5150-5850	5

Note: Antenna information provided is for the supporting master device with radar detection.
Note: A worst case threshold of -64dBm was considered and calibrated for.

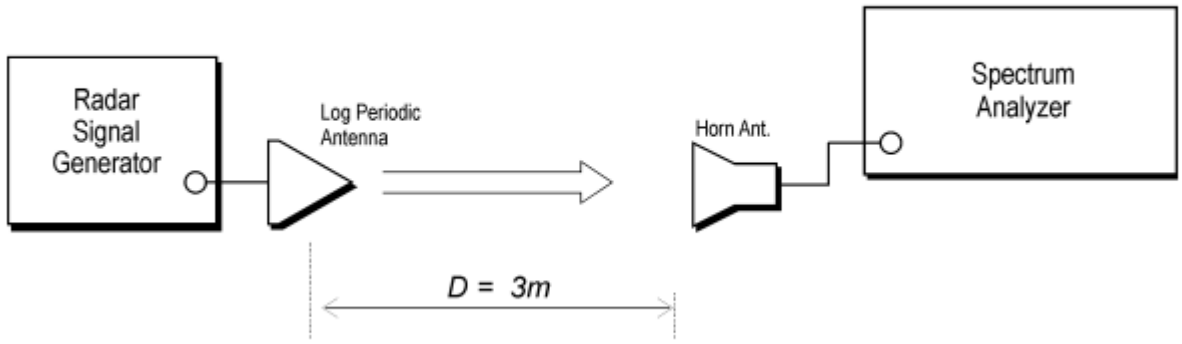
5.3 Test Equipment List and Details

BACL No.	Manufacturer	Equipment Description	Model	S/N	Calibration Date	Calibration Interval
424	Agilent	Analyzer, Spectrum	E4440A	US45303156	2024-03-06	1 year
1128	Agilent	EXA Signal Analyzer	N9010A	MY48030852	2023-04-25	1 year
688	Keysight	Vector Signal Generator	N5182B	MY51350070	2023-10-09	12 Months
188	Sunol Sciences	Antenna, Horn	DRH-118	A052704	2023-11-06	2 Years
473	EMCO	Antenna, Horn	3115	9511-4627	2022-11-22	2 Years
-	MEGAPHASE	RF Cable > 3m	-	-	Each Time[1]	Each Time[1]
-	-	RF Cable 1m	-	-	Each Time[1]	Each Time[1]

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with the latest version of A2LA policy P102 "A2LA Policy on Metrological Traceability".*

5.4 Radar Waveform Calibration



5.5 Test Environmental Conditions

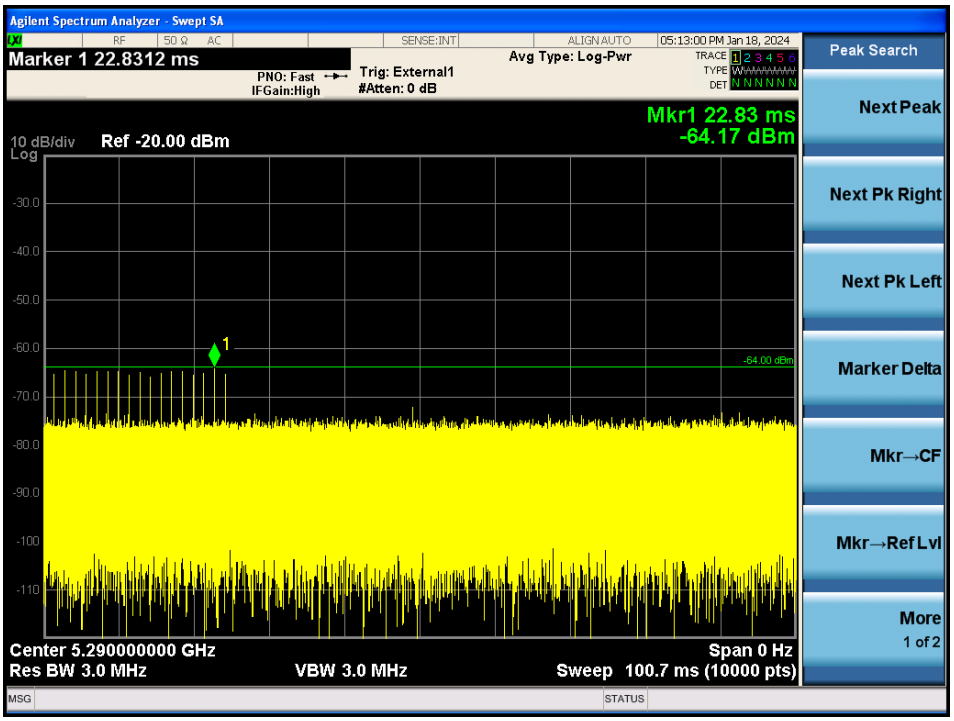
Temperature:	19.9°C
Relative Humidity:	38.5%
ATM Pressure:	101.0-101.9 kPa

Testing was performed by Kevin Chau on 2023-12-28 to 2023-12-29 and 2024-01-18 at the DFS testing site.

Plots of Radar Waveform

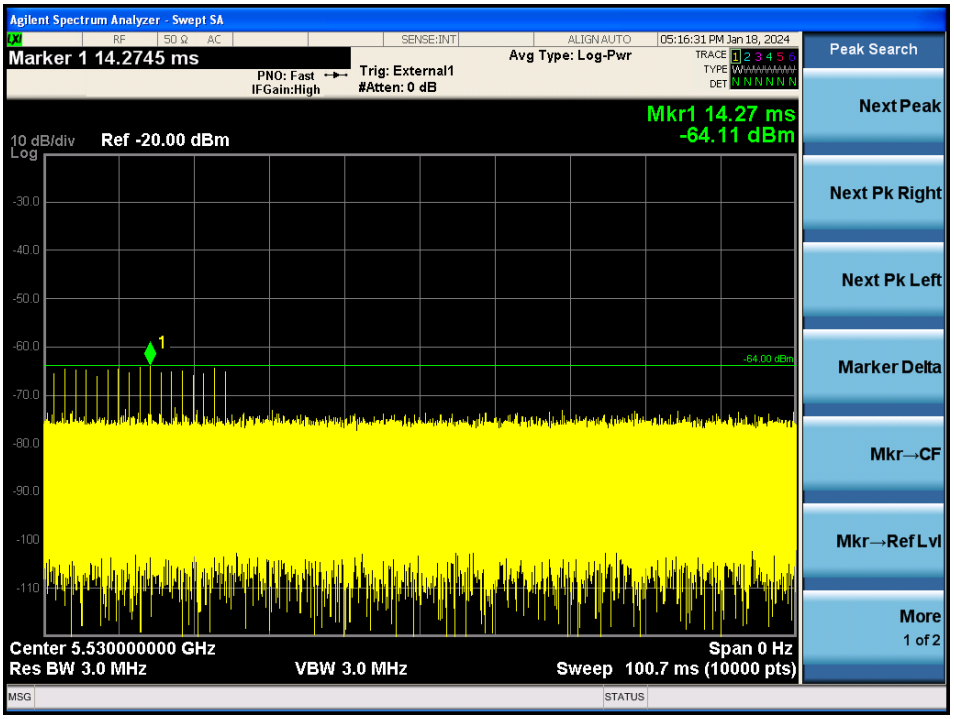
5290 MHz, 80MHz Channel Bandwidth

Radar Type 0



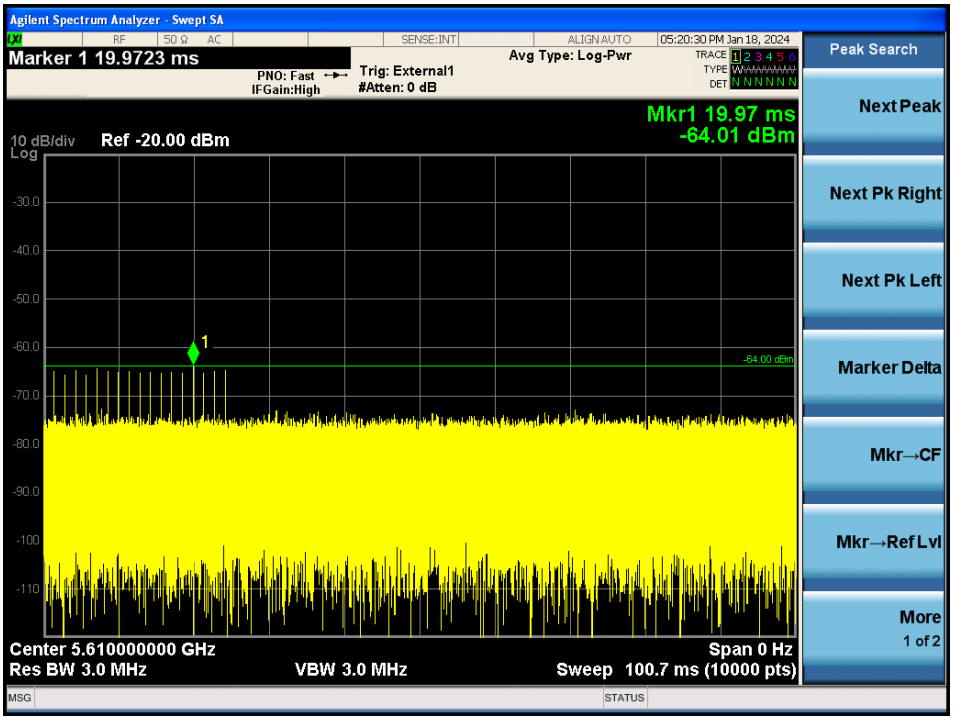
5530 MHz, 80MHz Channel Bandwidth

Radar Type 0



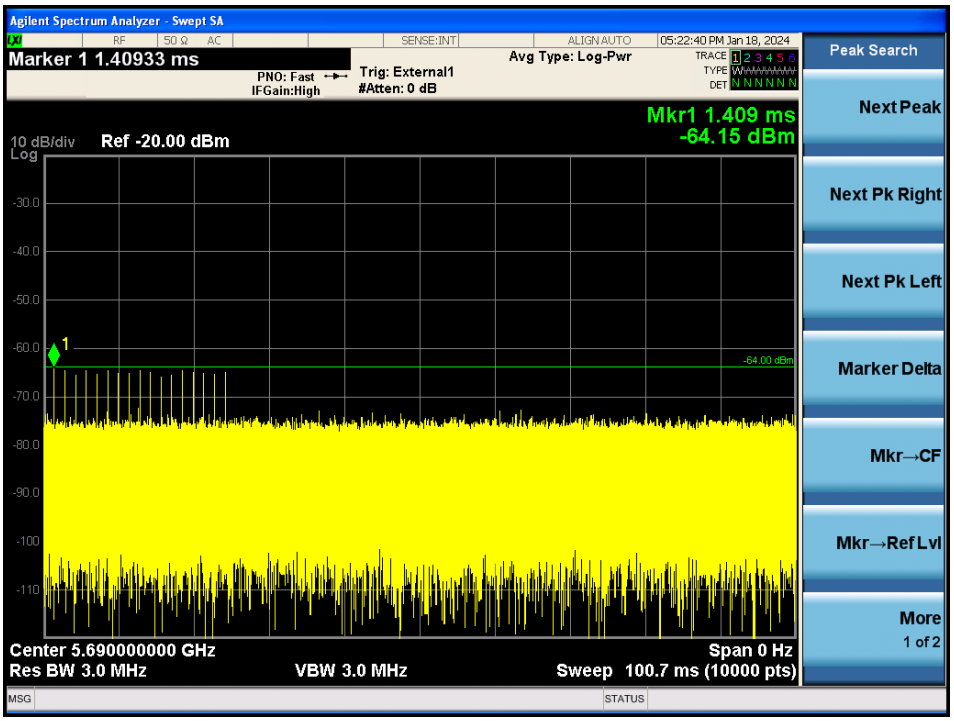
5610 MHz, 80MHz Channel Bandwidth

Radar Type 0



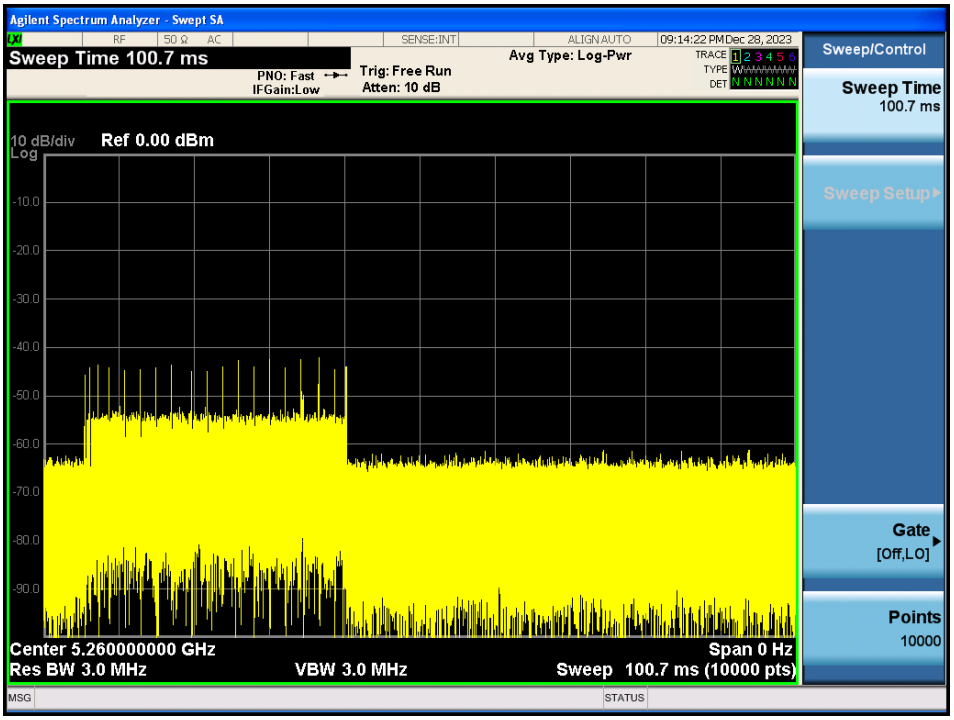
5690 MHz, 80MHz Channel Bandwidth

Radar Type 0

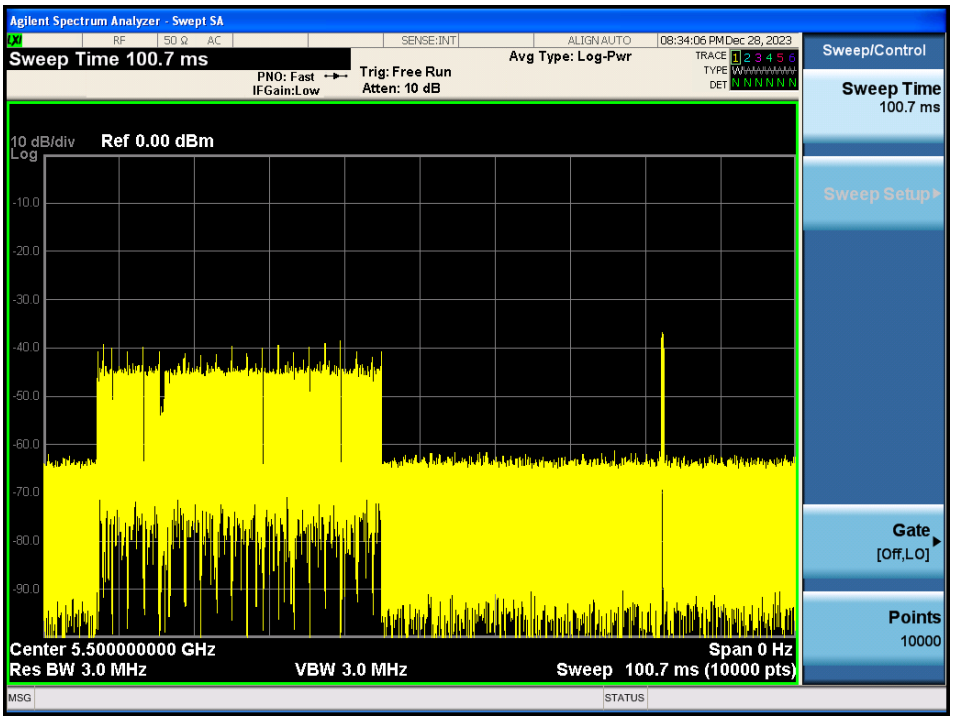


5.6 Radar Traffic Duty Cycle Example

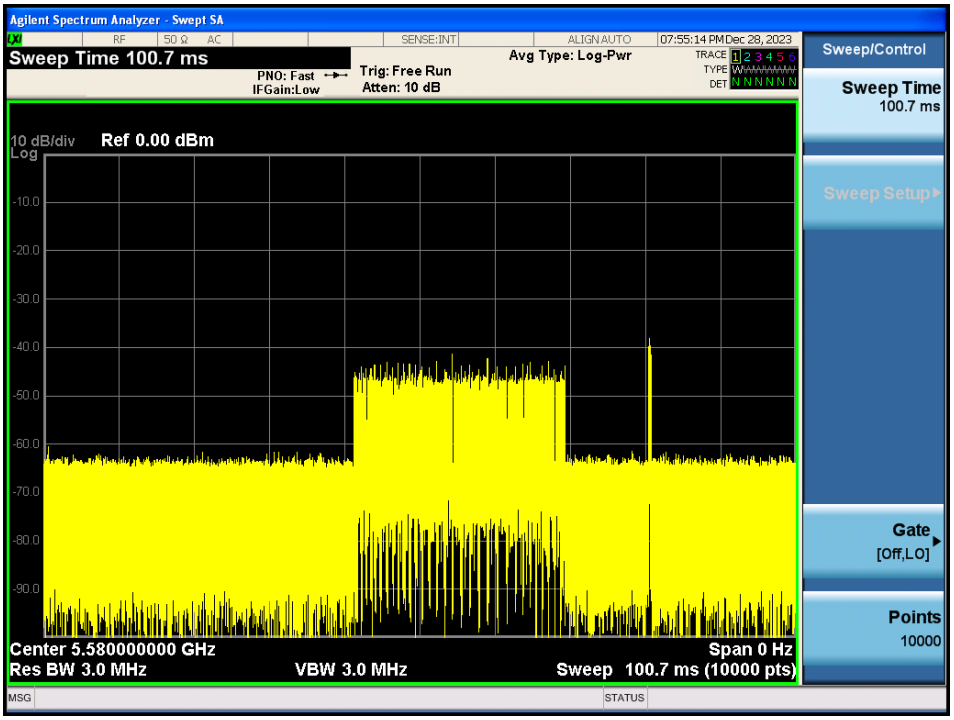
5260 MHz, 80MHz Bandwidth



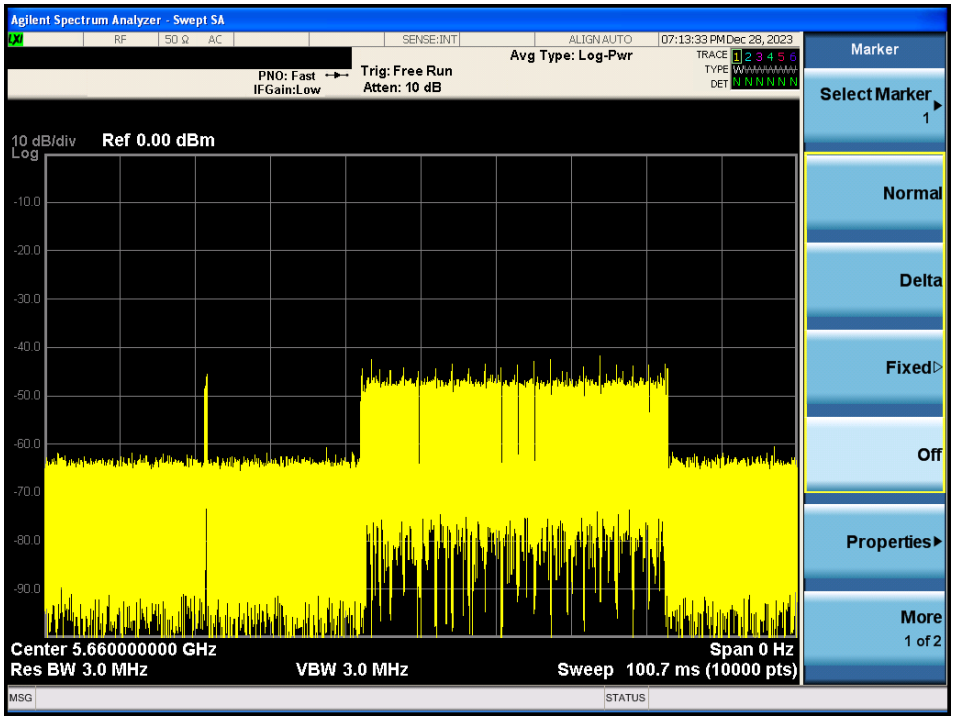
5500MHz, 80MHz Bandwidth



5580 MHz, 80MHz Bandwidth



5660 MHz, 80MHz Bandwidth



The Duty Cycle of the traffic is greater than 17%

6 Channel Move Time and Channel Closing Transmission Time

6.1 Test Procedure

BACL used type 0 radar signal to test the channel move time and channel closing transmission time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time = N * Dwell Time

N is the number of spectrum analyzer bins showing a device transmission
Dwell Time is the dwell time per bin (i.e. Dwell Time = S/B, S is the sweep time and B is the number of bin, i.e. 8192)

6.2 Test Results

5.3 GHz

Frequency (MHz)	Bandwidth (MHz)	Radar Type	Results
5290	80	Type 0	Compliant

5.6 GHz

Frequency (MHz)	Bandwidth (MHz)	Radar Type	Results
5530	80	Type 0	Compliant
5610	80	Type 0	Compliant
5690	80	Type 0	Compliant

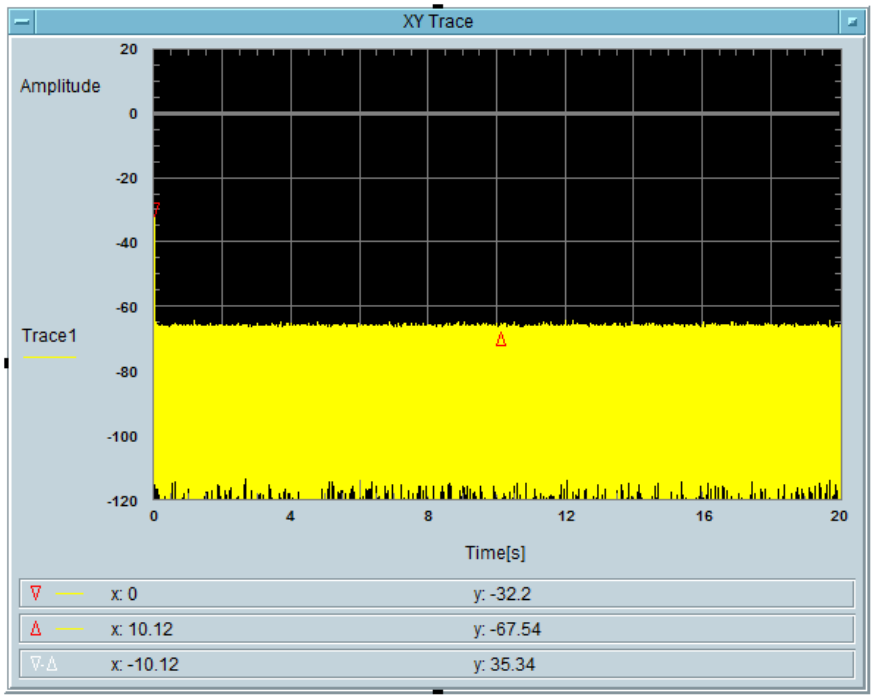
Please refer to the following tables and plots.

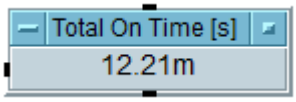
5290 MHz, Bandwidth 80 MHz

Type 0 radar channel move time and channel closing transmission time result:

Channel closing transmitting time (ms)	Limit (ms)	Result
12.21+0	200+60	Pass

Channel move time (s)	Limit (s)	Result
< 10	10	Pass



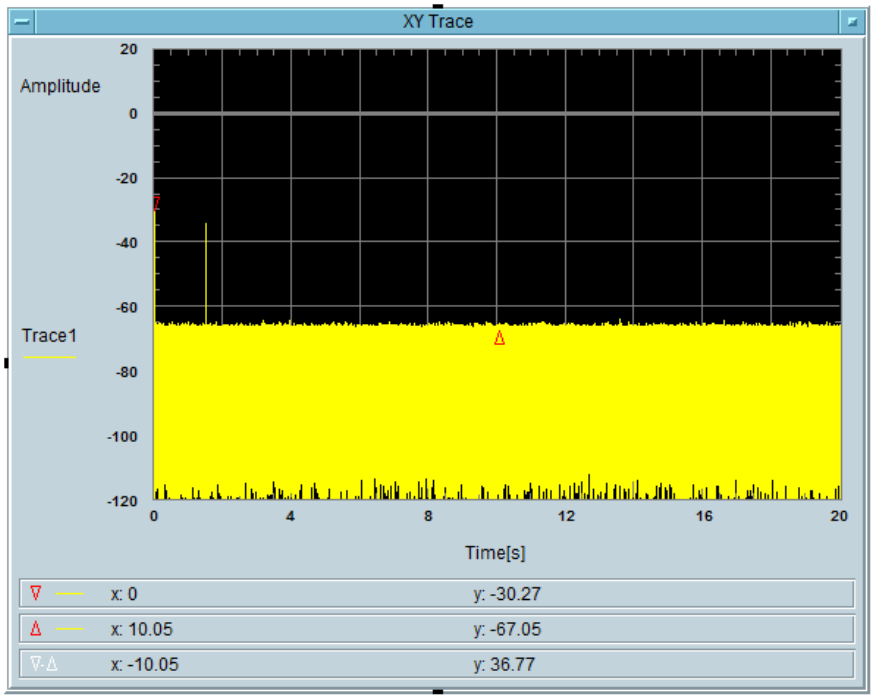


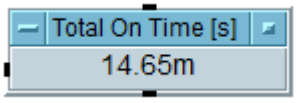
5530 MHz, Bandwidth 80 MHz

Type 0 radar channel move time and channel closing transmission time result:

Channel closing transmitting time (ms)	Limit (ms)	Result
14.65+2.441	200+60	Pass

Channel move time (s)	Limit (s)	Result
< 10	10	Pass



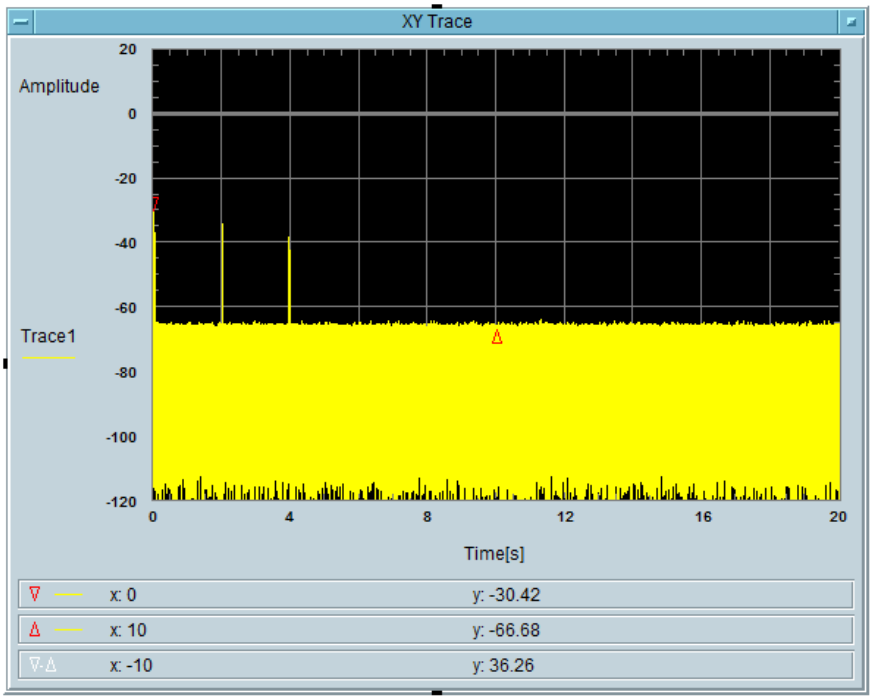


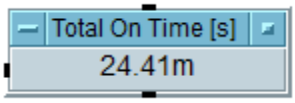
5610 MHz, Bandwidth 80 MHz

Type 0 radar channel move time and channel closing transmission time result:

Channel closing transmitting time (ms)	Limit (ms)	Result
24.41+7.324	200+60	Pass

Channel move time (s)	Limit (s)	Result
< 10	10	Pass



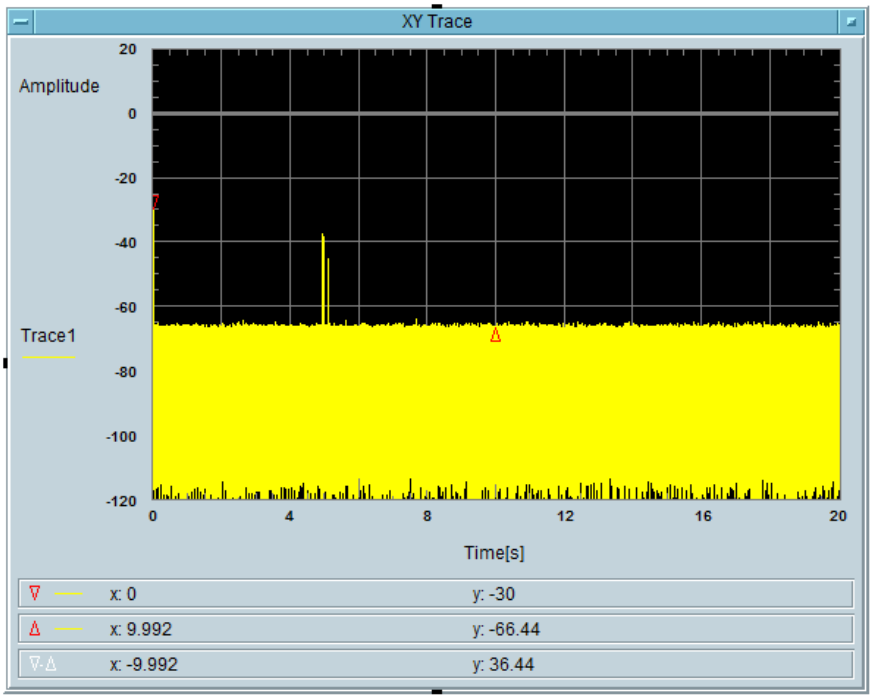


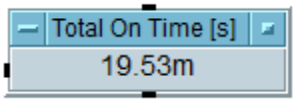
5690 MHz, Bandwidth 80 MHz

Type 0 radar channel move time and channel closing transmission time result:

Channel closing transmitting time (ms)	Limit (ms)	Result
19.53+7.324	200+60	Pass

Channel move time (s)	Limit (s)	Result
< 10	10	Pass





7 Non-Occupancy Period

7.1.1 Test Procedure

Measure the EUT for more than 30 minutes following the channel close/move time to verify that the EUT does not resume any transmissions on this channel. Provide one plot to demonstrate no transmission on the channel for the non-occupancy period (30 minutes observation time).

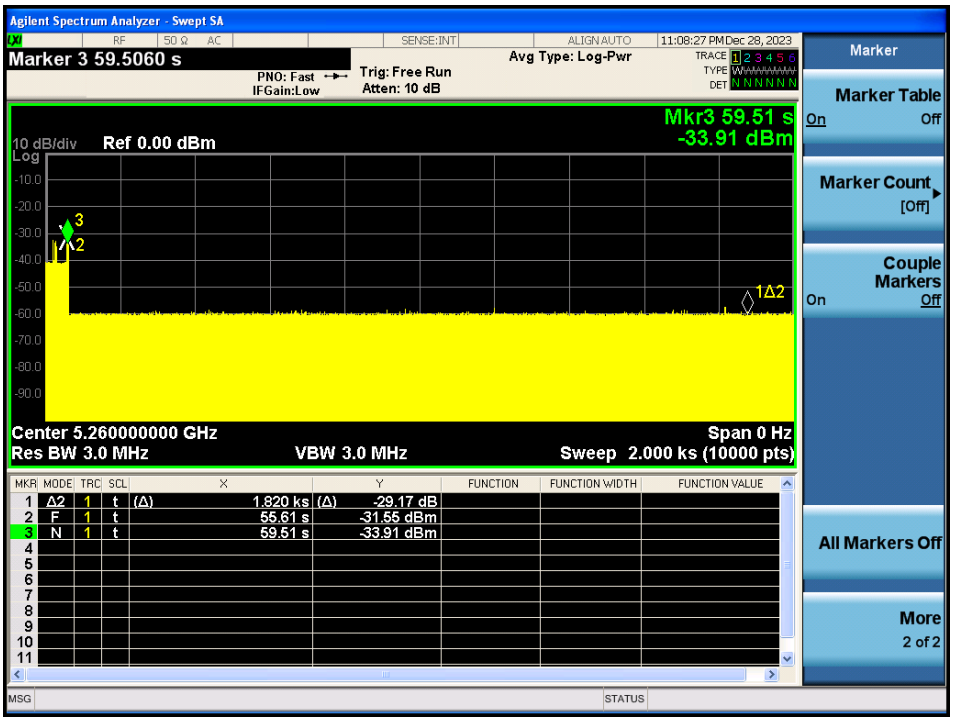
7.1.2 Test Results

Frequency (MHz)	Bandwidth (MHz)	Spectrum Analyzer Display
5290	80	No transmission within 30 minutes
5530	80	No transmission within 30 minutes
5610	80	No transmission within 30 minutes
5690	80	No transmission within 30 minutes

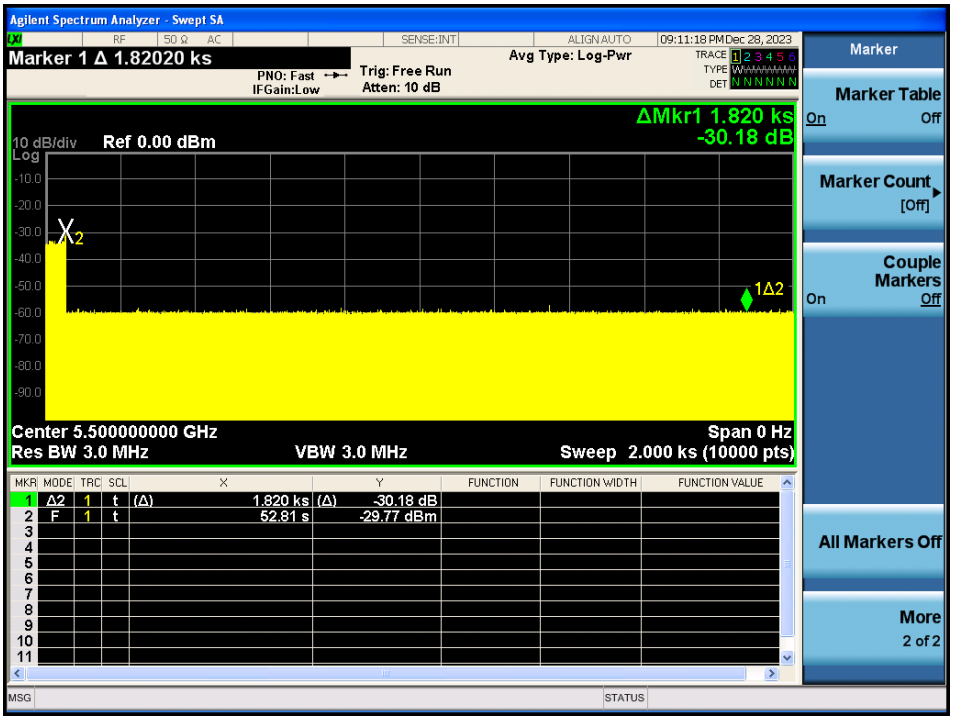
Note: The primary channels contain the control signal. Therefore, the primary channels were monitored during the test.

Please refer to the following plots.

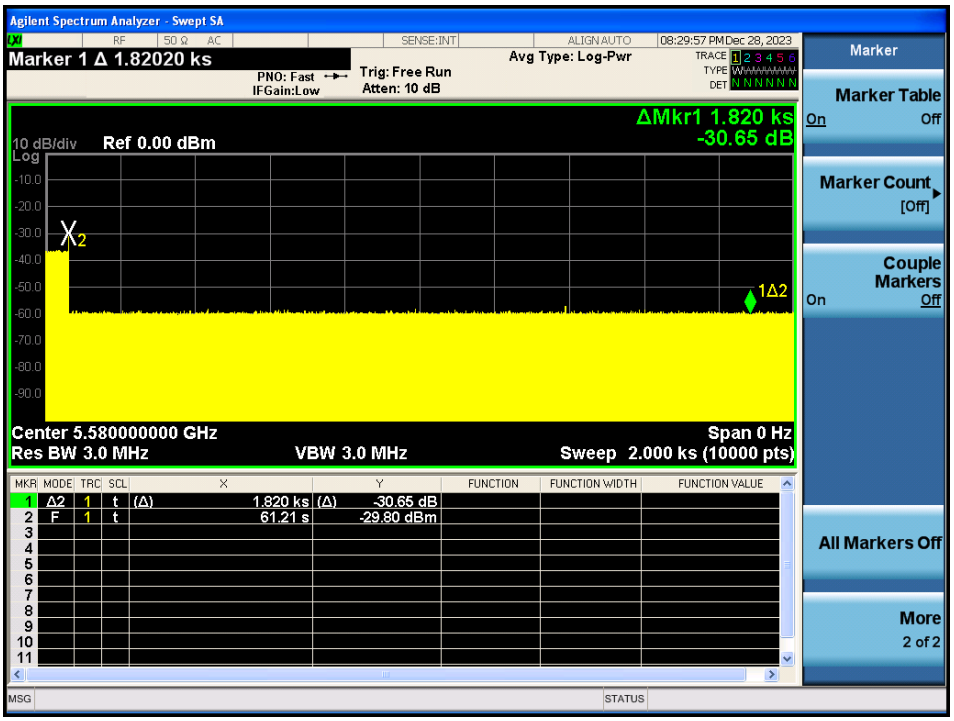
5290 MHz, Bandwidth 80 MHz



5530 MHz, Bandwidth 80 MHz



5610 MHz, Bandwidth 80 MHz



5690 MHz, Bandwidth 80 MHz

8 Annex B (Normative) - A2LA Electrical Testing Certificate

Accredited Laboratory

A2LA has accredited

BAY AREA COMPLIANCE LABORATORIES CORP.

Sunnyvale, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets A2LA *R222 - Specific Requirements EPA ENERGY STAR Accreditation Program*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 21st day of December 2022.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3297.02
Valid to September 30, 2024

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

Please follow the web link below for a full ISO 17025 scope

https://www.a2la.org/scopepdf/3297-02.pdf

--- END OF REPORT ---