

TEST REPORT



CTK Co., Ltd.
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Report No.:
CTK-2024-00855
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1. Applicant

- Name : SOLUM CO.,LTD.
- Address : 4,5,6th F, 357, Guseong-ro, Giheung-gu, Yongin-si, Gyeonggi-do,
Republic of Korea (Zip 16914)
- Date of Receipt : 2023-12-26

2. Manufacturer

- Name : SOLUM CO.,LTD.
- Address : 4,5,6th F, 357, Guseong-ro, Giheung-gu, Yongin-si, Gyeonggi-do,
Republic of Korea (Zip 16914)

3. Factory

- Name : DONGGUAN SOLUM ELECTRONICS CO., LTD.
- Address : Building 2/4/6, No.35, Tongzhen Road, Tongsha, Dongcheng District,
Dongguan City, Guangdong Province, 523127 People's Republic of China

4. Use of Report : For FCC Conformance

5. Test Sample / Model : Signage / WC37FAPBDU0/SM

6. Date of Test : 2024-02-27 to 2024-03-27

7. Test Standard(method) used : FCC 47 CFR part 15 subpart E 15.407

8. Testing Environment : Temp.: (23 ± 1) °C, Humidity: (36 ± 3) % R.H.

9. Test Results : Compliance

10. Location of Test : Permanent Testing Lab On Site Testing
(Address : 5, Dongbu-ro 221beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Republic of Korea)

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This report cannot be reproduced or copied without the written consent of CTK

Approval	Tested by	Technical Manager
	Bong-seok Kim: (Signature)	Young-taek Lee: (Signature)

Remark. This report is not related to KOLAS accreditation and relevant regulation.

2024-03-27

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REPORT REVISION HISTORY

Date	Revision	Page No
2024-03-27	Issued (CTK-2024-00855)	all

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1. General Product Description

1.1 Applicant Information

Company	SOLUM CO.,LTD.
Contact Point	4,5,6th F, 357, Guseong-ro, Giheung-gu, Yongin-si, Gyeonggi-do, Republic of Korea (Zip 16914)
Contact Person	Name : Ki Dong Lee E-mail : kdlee007@solu-m.com Tel : +82-31-8006-7677 Fax : -

1.2 Product Information

FCC ID	2AFWN-WC37FAPBDW0	
Product Description	Signage	
Model name	WC37FAPBDU0/SM	
Variant Model name	-	
Operating Frequency	UNII 1	5 180 MHz – 5 240 MHz(20 MHz_BW) 5 190 MHz – 5 230 MHz(40 MHz_BW) 5 210 MHz(80 MHz_BW)
	UNII 2A	5 260 MHz – 5 320 MHz(20 MHz_BW) 5 270 MHz – 5 310 MHz(40 MHz_BW) 5 290 MHz(80 MHz_BW)
	UNII 2C	5 500 MHz – 5 720 MHz(20 MHz_BW) 5 510 MHz – 5 710 MHz(40 MHz_BW) 5 530 MHz – 5 690 MHz(80 MHz_BW)
	UNII 3	5 745 MHz – 5 825 MHz(20 MHz_BW) 5 755 MHz – 5 795 MHz(40 MHz_BW) 5 775 MHz(80 MHz)
RF Output Power	802.11a : 13.02 dBm(20.893 mW) 802.11n_HT20 : 12.04 dBm(15.996 mW) 802.11n_HT40 : 12.17 dBm(16.482 mW)s 802.11ac_VHT20 : 12.23 dBm(16.711 mW) 802.11ac_VHT40 : 12.44 dBm(17.539 mW) 802.11ac_VHT80 : 12.67 dBm(18.493 mW)	
Antenna Specification	Antenna type : PCB Antenna	
	UNII 1	Peak Gain : 2.80 dBi(ANT0), 2.80 dBi(ANT1)
	UNII 2A	Peak Gain : 2.94 dBi(ANT0), 2.94 dBi(ANT1)
	UNII 2C	Peak Gain : 3.61 dBi(ANT0), 3.61 dBi(ANT1)
UNII 3	Peak Gain : 3.04 dBi(ANT0), 3.04 dBi(ANT1)	
Antenna Configurations	802.11a : MIMO(ANT0+ANT1) 802.11n : MIMO(ANT0+ANT1) 802.11ac : MIMO(ANT0+ANT1)	
Type of Modulation	802.11a/n/ac : OFDM	
Data Rate	802.11a : 54 / 48 / 36 / 24 / 18 / 12 / 9 / 6 Mbps 802.11n : up to 300 Mbps 802.11ac : up to 867 Mbps	
Power Source	DC 19 V	
Dynamic Frequency Selection	Master Device	<input type="checkbox"/>
	Client Device (No radar detection)	<input checked="" type="checkbox"/>
	Client Device With Radar Detection	<input type="checkbox"/>



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1.3 Peripheral Devices

-For Conducted Measurement

Device	Manufacturer	Model No.	Serial No.
Notebook	HP Inc.	HP Probook 455 G7	5CD0234DWM
AC Adapter	HP Inc.	PPP012D-S	677777-003
Wi-Fi Router	ASUSTek Computer Inc.	RT-AX88U	-

1.4 Model Differences

Not applicable

2. Accreditations

2.1 Laboratory Accreditations and Listings

Country	Agency	Registration Number
USA	FCC	805871
CANADA	ISED	CN : 8737A CAB ID : KR0025
KOREA	NRRA	KR0025

2.2 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

3. Test Specifications

3.1 Standards

FCC Part Section(s)	Requirement(s)	Status (Note 1)	Test Condition
15.407(h)	Dynamic Frequency Selection (DFS)	C	Conducted
<i>Note 1:</i> C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable			
<i>Note 2:</i> The data in this test report are traceable to the national or international standards.			
<i>Note 3:</i> The sample was tested according to the following specification: FCC Part 15.407, ANSI C63.10-2013			
<i>Note 4:</i> The tests were performed according to the method of measurements prescribed in KDB No.905462.			

3.2 Mode of operation during the test

The EUT is operated in a manner representative of the typical of the equipments. During at testing, system components were manipulated within the confines of typical usage to maximize each emission.

For WLAN function, the engineering test program was provided and enabled to make EUT continuous transmit.

All modulation modes were tests. The results are only attached worst cases.

Test Frequency & Test mode

- 802.11ac_VHT80

	Lowest channel	Middle channel	Highest channel
UNII 2C	5 530 MHz	-	-

3.3 Technical Requirements for DFS

3.3.1 Applicability of DFS Requirements

A U-NII network will employ a DFS function to detect signals from radar systems and to avoid co-channel operation with these systems. This applies to the 5250-5350 MHz and/or 5470-5725 MHz bands.

3.3.1.1 Applicability of DFS Requirements Prior to Use of a Channel

Requirement	Operational Mode		
	Master	Client Without Radar Detection	Client With Radar Detection
<i>Non-Occupancy Period</i>	Yes	Not required	Yes
<i>DFS Detection Threshold</i>	Yes	Not required	Yes
<i>Channel Availability Check Time</i>	Yes	Not required	Not required
<i>U-NII Detection Bandwidth</i>	Yes	Not required	Yes

3.3.1.2 Applicability of DFS requirements during normal operation

Requirement	Operational Mode	
	Master Device or Client with Radar Detection	Client Without Radar Detection
<i>DFS Detection Threshold</i>	Yes	Not required
<i>Channel Closing Transmission Time</i>	Yes	Yes
<i>Channel Move Time</i>	Yes	Yes
<i>U-NII Detection Bandwidth</i>	Yes	Not required

3.3.1.3 Additional requirements for devices

Additional requirements for devices with multiple bandwidth modes	Master Device or Client with Radar Detection	Client Without Radar Detection
<i>U-NII Detection Bandwidth and Statistical Performance Check</i>	All BW modes must be tested	Not required
<i>Channel Move Time and Channel Closing Transmission Time</i>	Test using widest BW mode available	Test using the widest BW mode available for the link
<i>All other tests</i>	Any single BW mode	Not required
<p>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.</p>		

3.3.2 DFS Detection Thresholds and Response Requirements

3.3.2.1 DFS Detection Thresholds

below provides the DFS Detection Thresholds for Master Devices as well as Client Devices incorporating In-Service Monitoring.

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

3.3.2.2 Response Requirements

provides the response requirements for Master and Client Devices incorporating DFS.

Parameter	Value
<i>Non-occupancy period</i>	Minimum 30 minutes
<i>Channel Availability Check Time</i>	60 seconds
<i>Channel Move Time</i>	10 seconds See Note 1.
<i>Channel Closing Transmission Time</i>	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.
<i>U-NII Detection Bandwidth</i>	Minimum 100% of the U-NII 99% transmission power bandwidth. See Note 3.
<p>Note 1: <i>Channel Move Time</i> and the <i>Channel Closing Transmission Time</i> should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst. Note 2: The <i>Channel Closing Transmission Time</i> is comprised of 200 milliseconds starting at the beginning of the <i>Channel Move Time</i> plus any additional intermittent control signals required to facilitate a <i>Channel move</i> (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 <i>U-NII Detection Bandwidth</i> 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.</p>	



3.3.3 RADAR TEST WAVEFORMS

3.3.3.1 Short Pulse Radar Test Waveforms

Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (μsec)	PRI (μsec)	Number of 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	Roundup $\left\{ \left(\frac{1}{360} \right) \cdot \left(\frac{19 \cdot 10^6}{\text{PRI}_{\mu\text{sec}}} \right) \right\}$	60%	30
		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			
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.					



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Pulse Repetition Intervals Values for Test A

Pulse Repetition Frequency Number	Pulse Repetition Frequency (Pulses Per Second)	Pulse Repetition Interval (Microseconds)
1	1930.5	518
2	1858.7	538
3	1792.1	558
4	1730.1	578
5	1672.2	598
6	1618.1	618
7	1567.4	638
8	1519.8	658
9	1474.9	678
10	1432.7	698
11	1392.8	718
12	1355	738
13	1319.3	758
14	1285.3	778
15	1253.1	798
16	1222.5	818
17	1193.3	838
18	1165.6	858
19	1139	878
20	1113.6	898
21	1089.3	918
22	1066.1	938
23	326.2	3066



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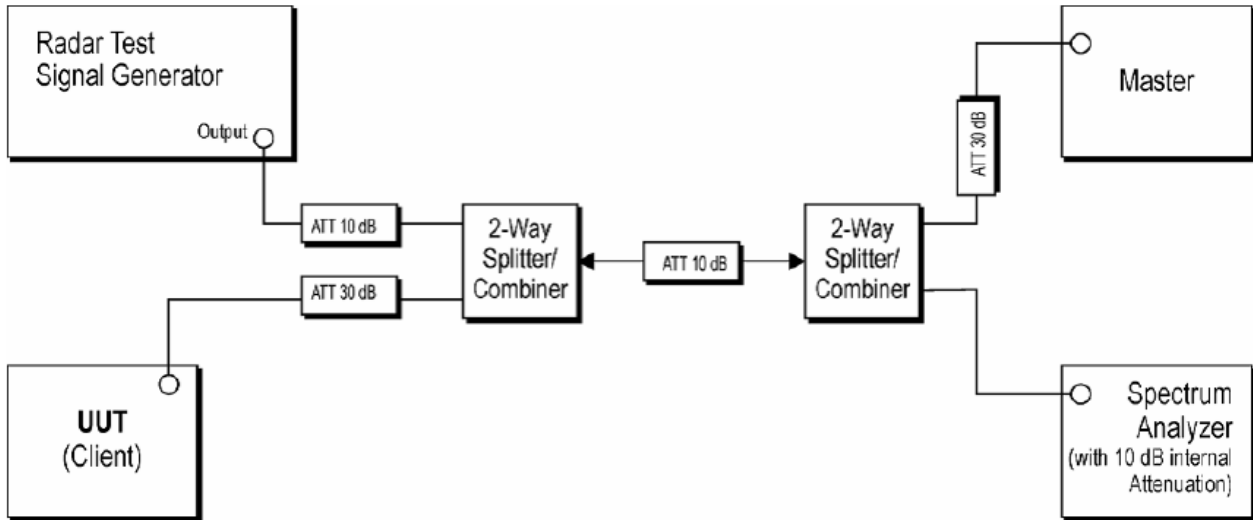
3.3.3.2 Pulse Repetition Intervals Values for Test A

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

3.3.3.3 Frequency Hopping Radar Test Waveform

Radar Type	Pulse Width (μsec)	PRI (μsec)	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

3.4 Measuring Systematic diagram



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3.5 Maximum Measurement Uncertainty

The value of the measurement uncertainty for the measurement of each parameter.
Coverage factor $k = 2$, Confidence levels of 95 %

Description	Uncertainty
DFS Detection Thresholds	1.5 dB (C.L.: Approx. 95 %, $k = 2$)



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4. Technical Characteristic Test

4.1 DFS Requirements(Channel Closing Transmission Time & Channel Move Time)

Test Procedures

KDB 905462
 ANSI C63.10-2013

Limit

Parameter	Value
<i>Non-occupancy period</i>	Minimum 30 minutes
<i>Channel Availability Check Time</i>	60 seconds
<i>Channel Move Time</i>	10 seconds See Note 1.
<i>Channel Closing Transmission Time</i>	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.
<i>U-NII Detection Bandwidth</i>	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.

Test Data Result:

Channel Closing Transmission Time

Modulation Mode	Freq [MHz]	Radar Type	Result [ms]	Limit [ms]
802.11ac-VHT80	5 530	0	4.5	260

Note

-Result[ms]: Sample bin for measurement (9)bin * Dwell time per bin (0.5)ms

Channel Move Time

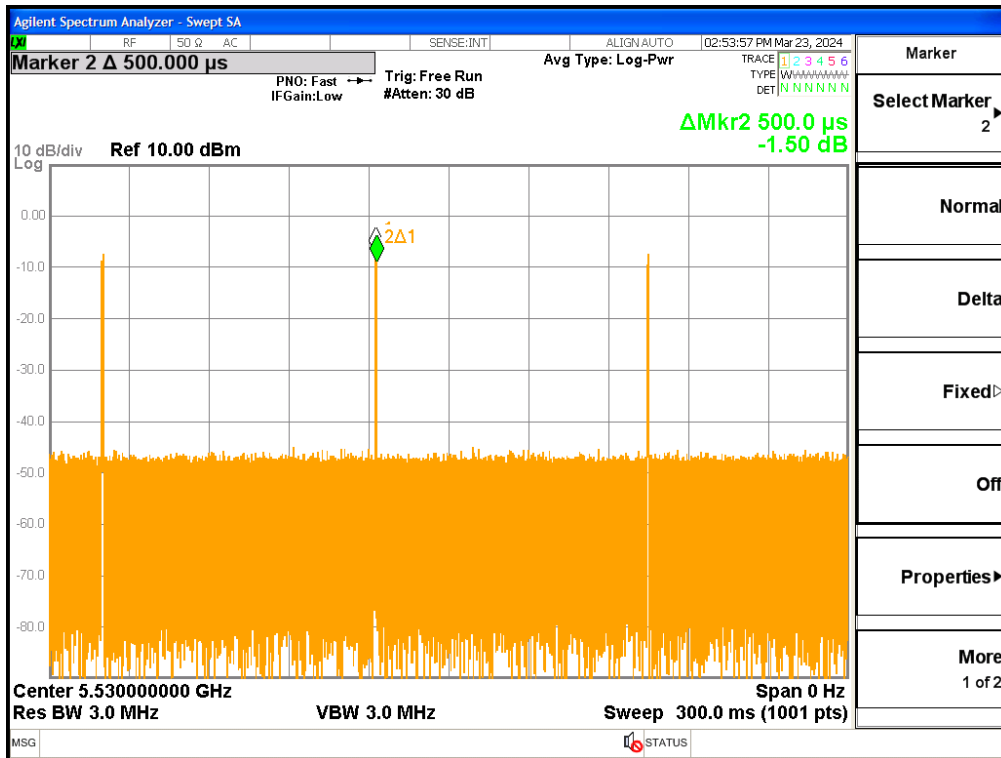
Modulation Mode	Freq [MHz]	Radar Type	Result [s]	Limit [s]
802.11ac-VHT80	5 530	0	1.65	10

See next pages for actual measured spectrum plots.

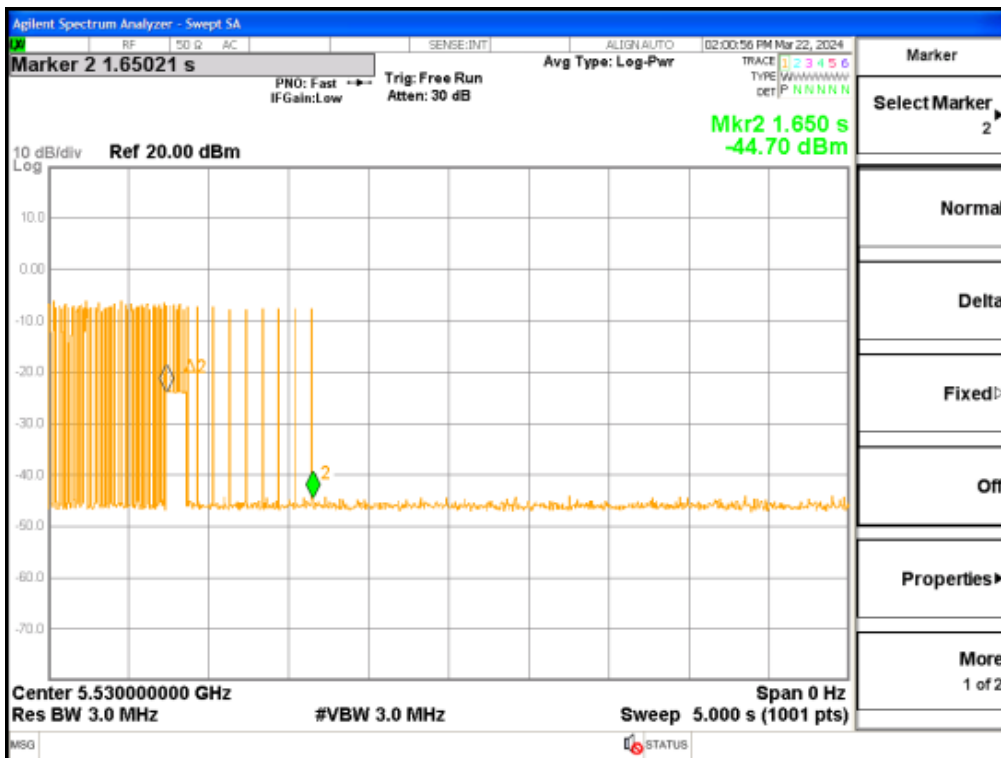


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Channel Closing Transmission Time(Dwell time per)

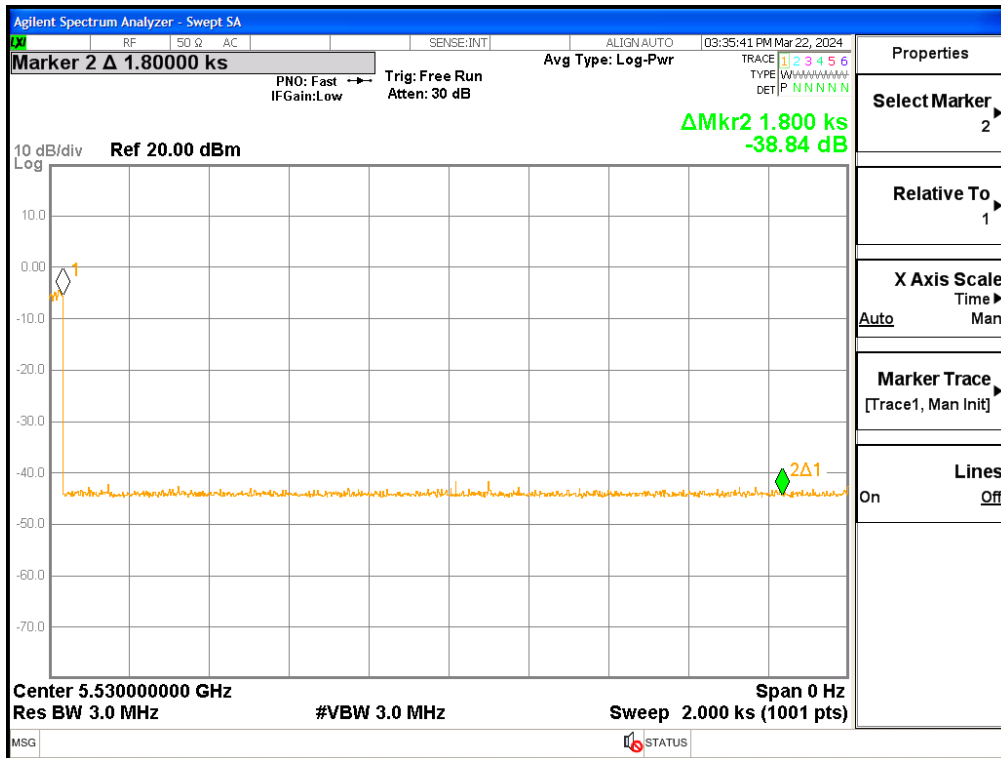


Channel Move Time



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Non-Occupancy period

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APPENDIX A – Test Equipment Used For Tests

No.	Name of Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	Signal Analyzer	Agilent	N9020A	MY48011598	2023-09-25	2024-09-25
2	Combiner/Divider	Weinschel	1594	717	2024-09-26	2024-09-26
3	VECTOR SIGNAL GENERATOR	Rohde & Schwarz	SMBV100A	258008	2023-12-04	2024-12-04

No.	Cable	Manufacturer	Model No.	Serial No.	Check Date
1	RF Cable (Conducted)	Junkosha Inc.	MWX221	2008S245	2023-08-21
2	RF Cable (Conducted)	Junkosha Inc.	MWX221	2005S318	2023-08-21
3	RF Cable (Conducted)	Junkosha Inc.	MWX221	J0970758	2023-08-23
4	RF Cable (Conducted)	Junkosha Inc.	MWX221	J12J102248-00-5	2023-08-23

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