



*FCC PART 15, SUBPART B and C; and FCC SECTION 15.247*  
*TEST REPORT*

*for*

**HOPPER**

**Model: FTW000123**

Prepared for

FTW LLC  
 7016 MOTZ STREET  
 PARAMOUNT, CALIFORNIA 90723

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DATE: OCTOBER 31, 2023

REPORT BODY	APPENDICES	TOTAL				
		A	B	C	D	E
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

*Hopper  
Model: FTW000123*

## LIST OF APPENDICES

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## GENERAL REPORT SUMMARY

This electromagnetic emission test report is generated by Compatible Electronics Inc., which is an independent testing and consulting firm. The test report is based on testing performed by Compatible Electronics personnel according to the measurement procedures described in the test specifications given below and in the "Test Procedures" section of this report.

The measurement data and conclusions appearing herein relate only to the sample tested and this report may not be reproduced without the written permission of Compatible Electronics, unless done so in full.

This report must not be used by the client to claim product certification, approval or endorsement by NVLAP, NIST or any agency of the U.S. Government.

Device Tested:                    Hopper  
     Model: FTW000123  
     S/N: N/A

Product Description:            The equipment under test is a Hopper wireless controlled drone utilizing BLE and WiFi connectivity. Crystal oscillator frequencies: 32 MHz and 40 MHz. Highest frequency generated: 2480 MHz.

Dimensions: 176 mm (L) x 176 mm (W) x 48 mm (H). It utilizes internal LiPO 3.7V battery and it comes with an external AC adapter used as a battery charger only.

Modifications:                    The EUT was not modified in order to meet the specifications.

Customer:                        FTW LLC  
     7016 Motz Street  
     Paramount, California 90723

Test Dates:                        July 26, 29 and 31; and August 1 and 2, 2023



Test Specification covered by accreditation:

Test Specifications:            Emissions requirements  
     CFR Title 47, Part 15, Subpart B; and Subpart C, sections 15.205, 15.207, 15.209, and 15.247

Test Procedures:                ANSI C63.4 and ANSI C63.10

Test Deviations:                The test procedure was not deviated from during the testing.

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## SUMMARY OF TEST RESULTS

TEST	DESCRIPTION	RESULTS
1	Conducted RF Emissions, 150 kHz - 30 MHz	Complies with the <b>Class B</b> limits of CFR Title 47, Part 15 Subpart B See section 6.3 for Measurement Uncertainty
2	Radiated RF Emissions, 9 kHz – 25000 MHz	Complies with the <b>Class B</b> limits of CFR Title 47, Part 15, Subpart B; and the limits of CFR Title 47, Part 15 Subpart C, 15.205, 15.209 and 15.247 (d) See section 6.3 for Measurement Uncertainty
3	DTS Bandwidth	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (a)(2)
4	Peak Output Power	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (b)(3)
5	RF Band Edges	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (d)
6	Spectral Density	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (e)

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## 1. PURPOSE

This document is a qualification test report based on the emissions tests performed on the Hopper, Model: FTW000123 (EUT). The emissions measurements were performed according to the measurement procedure described in ANSI C 63.4 and ANSI C 63.10. The tests were performed in order to determine whether the electromagnetic emissions from the equipment under test, referred to as EUT hereafter, are within the Class B specification limits defined by CFR Title 47, Part 15, Subpart B; and Subpart C, sections 15.205, 15.207, 15.209, and 15.247.

### 1.1 Decision rule & risk

If a measured value exceeds a specification limit it implies non-compliance. If the value is below a specification limit it implies compliance. Measurement uncertainty of the laboratory is reported with all measurement results but generally not taken into consideration unless a standard, rule or law requires it to be considered.

Qualification test reports are only produced for products that are in compliance with the test requirements, therefore results are always in conformity. Otherwise, an engineering report or just the data is provided to the customer.

When performing a measurement and making a statement of conformity, in or out-of-specification to manufacturer's specifications or Pass/Fail against a requirement, there are two possible outcomes:

- The result is reported as conforming with the specification
- The result is reported as not conforming with the specification

The decision rule is defined below.

When the test result is found to be below the limit but within our measurement uncertainty of the limit, it is our policy that the final acceptance decision is left to the customer, after discussing the implications and potential risks of the decision.

When the test result is found to be exactly on the specification, it is our policy, in the case of unwanted emissions measurements to consider the result non-compliant; however, the final decision is left to the customer, after discussing the implications and potential risks of the decision.

When the test result is found to be over the specification limit under any condition, it is our policy to consider the result non-compliant.

In terms of uncertainty of measurement, the laboratory is a calibrated and tightly controlled environment and generally exceptionally stable, the measurement uncertainties are evaluated without the consideration of the test sample. When it comes to the test sample however, as most testing is performed on a single sample rather than a sample population, and that sample is often a pre-production representation of the final product that test sample represents a significantly higher source of measurement uncertainty. We advise our customers of this and that when in doubt (small test to limit margins), they may wish to perform statistical sampling on a population to gain a higher confidence in the results. All lab reported results are that of a single sample in any event.

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## 2. ADMINISTRATIVE DATA

### 2.1 Location of Testing

The emissions tests described herein were performed at the test facility of Compatible Electronics, 114 Olinda Drive, Brea, California 92823.

### 2.2 Traceability Statement

The calibration certificates of all test equipment used during the test are on file at the location of the test. The calibration is traceable to the National Institute of Standards and Technology (NIST).

### 2.3 Cognizant Personnel

FTW LLC

Rob Harvey, Executive Chairman + Cofounder  
 Robert Ganton

Compatible Electronics Inc.

Kyle Fujimoto Sr. Test Engineer  
 James Ross Sr. Test Engineer

### 2.4 Date Test Sample was Received

The test sample was received prior to initial date of testing. Received as defined in product description.

### 2.5 Disposition of the Test Sample

The test sample has been returned to FTW LLC prior to the date of this report.

### 2.6 Abbreviations and Acronyms

The following abbreviations and acronyms may be used in this document.

EMI	Electromagnetic Interference
EUT	Equipment Under Test
P/N	Part Number
S/N	Serial Number
ITE	Information Technology Equipment
DoC	Declaration of Conformity
FCC	Federal Communications Commission
N/A	Not Applicable
Tx	Transmit
Rx	Receive
Inc.	Incorporated
RF	Radio Frequency
BLE	Bluetooth Low Energy
WiFi	Wireless Fidelity

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### 3. APPLICABLE DOCUMENTS

The following documents are referenced or used in the preparation of this emissions Test Report.

SPEC	TITLE
FCC Title 47, Part 15 Subpart C	FCC Rules – Radio frequency devices (including digital devices) – Intentional Radiators
FCC Title 47, Part 15 Subpart B	FCC Rules – Radio frequency devices (including digital devices) – Unintentional Radiators
558074 D01 DTS Meas Guidance v05r02	Guidance for Performing Compliance Measurements on Digital Transmissions Systems (DTS) Operating Under Section 15.247
EN 50147-2: 1997	Anechoic chambers. Alternative test site suitability with respect to site attenuation
ANSI C63.4: 2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10: 2013	American National Standard for Testing Unlicensed Wireless Devices



## 4. DESCRIPTION OF TEST CONFIGURATION

The Hopper, Model: FTW000123 (EUT) was tested and connected as shown in the two modes below:

- Battery Powered Mode

The EUT was tested as a stand-alone device and was powered by an internal LiPO 3.7V battery.

- AC Charging Mode

The EUT was tested while connected to an accessory AC charging adapter that delivered DC voltage to the EUT via a USB Type 'A' to USB Type 'C' cable that charges the EUT's internal battery when connected to the AC adapter.

The EUT was continuously transmitting at 2402 MHz (BLE mode) and 2412 MHz (WiFi mode), respectively, in battery powered, flight mode and was continuously charging only when connected to its AC adapter during spurious emissions testing.

The EUT was tested for emissions while in the X, Y, and Z axis. The X orientation is when the EUT is parallel to the ground mounted horizontally. The Y orientation is when the EUT is perpendicular to the ground mounted vertically. The Z orientation is when the EUT is perpendicular to the ground mounted horizontally.

The firmware inside the EUT to continuously transmit at the low, middle, and high during the intentional radiator tests.

The firmware is stored on the company's servers.

The radiated and conducted data was taken in the continuously exercising mode of operation. All initial investigations were performed with the EMI Receiver in manual mode scanning the frequency range continuously. The cables were bundled and routed as shown in the photographs in Appendix D.

### 4.1.1 Cable Construction and Termination

#### Cable 1

This is a 2-meter braid shielded cable connecting the EUT to the accessory AC Charging Adapter. The cable has a USB Type 'C' connector at the EUT end and a USB Type 'A' connector at the AC Charging Adapter end. The shield of the cable was grounded to the chassis via the USB connectors.

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## 5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT

### 5.1 EUT and Accessory List

EQUIPMENT	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID
HOPPER (EUT)	FTW LLC	FTW000123	N/A	2BB9E-0123A
AC CHARGING ADAPTER (EUT)	INSIGNIA	NS-PW372AC1W22	N/A	N/A
FIRMWARE*	FTW LLC	EspRFTestTool	N/A	N/A

\*Only used to program the EUT to continuously transmit at the low, middle, and high channels (not used during testing)

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## 5.2 Emissions Test Equipment

EQUIPMENT TYPE	MANU-FACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. DUE DATE
<b>RF RADIATED AND AC CONDUCTED EMISSIONS TEST EQUIPMENT</b>					
TDK TestLab	TDK RF Solutions, Inc.	9.22	700145	N/A	N/A
Power Sensor	ETS Lindgren	7002-0067	00160367	June 1, 2022	June 1, 2024
Loop Antenna	Com-Power	AL-130R	121090	February 10, 2022	February 10, 2025
EMI Receiver, 3 Hz – 44 GHz	Keysight Technologies, Inc.	N9038A	MY59050117	July 14, 2023	July 14, 2024
CombiLog Antenna	Com-Power	AC-220	61093	December 14, 2021	December 14, 2023
Horn Antenna	Com-Power	AH-118	10050113	December 16, 2021	December 16, 2023
Horn Antenna	Com-Power	AH-826	0071957	NCR	NCR
Preamplifier	Com-Power	PA-118	181653	March 7, 2022	March 7, 2024
Preamplifier	Com-Power	PA-840	711013	April 8, 2022	April 8, 2024
System Controller	Sunol Sciences Corporation	SC110V	112213-1	N/A	N/A
Turntable	Sunol Sciences Corporation	2011VS	N/A	N/A	N/A
Antenna-Mast	Sunol Sciences Corporation	TWR95-4	112213-3	N/A	N/A
LISN (EUT)	Com-Power	LI-220C	20070069	July 24, 2023	July 24, 2024
LISN (ACC)	Com-Power	LI-215A	191952	July 21, 2023	July 21, 2024
Attenuator 10 dB	SureCall	SC-ATT-10	17100174	December 2, 2022	December 2, 2023
Computer	Hewlett Packard	p6716f	MXX1030PX0	N/A	N/A



## 6. TEST SITE DESCRIPTION

### 6.1 Test Facility Description

Please refer to section 2.1 of this report for emissions test location.

### 6.2 EUT Mounting, Bonding and Grounding

**For frequencies 1 GHz and below:** The EUT was mounted on a 0.6 by 1.2 meter non-conductive table 0.8 meters above the ground plane.

**For frequencies above 1 GHz:** The EUT was mounted on a 0.6 by 1.2 meter non-conductive table 1.5 meters above the ground plane.

**For conducted AC emissions:** The EUT was mounted on a 0.6 by 1.2 meter non-conductive table 0.8 meters above the ground plane.

The EUT was not grounded.

### 6.3 Measurement Uncertainty

“Compatible Electronics”  $U_{lab}$  value is less than  $U_{cisp}$ , thus based on this – compliance is deemed to occur if no measured disturbance exceeds the disturbance limit.

The uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level, using a coverage factor of  $k=2$

$$u_c(y) = \sqrt{\sum_i c_i^2 u^2(x_i)}$$

Measurement		$U_{cisp}$	$U_{lab} = 2uc(y)$
Conducted disturbance (mains port)	(150 kHz – 30 MHz)	3.4 dB	2.72 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(30 MHz – 1,000 MHz)	6.3 dB	3.32 dB (Vertical) 3.30 dB (Horizontal)
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(1 GHz – 6 GHz)	5.2 dB	4.06 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(6 GHz – 18 GHz)	5.5 dB	4.06 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(18 GHz – 26 GHz)	N/A	4.43 dB
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(26.5 GHz – 40 GHz)	N/A	4.57 dB



## 7. CHARACTERISTICS OF THE TRANSMITTER

The following sections describe the test methods and the specifications for the tests. Test results are also included in this section.

### 7.1 Channel Number and Frequencies

In BLE mode, the EUT uses a total of 40 channels.

The low channel is 2402 MHz  
 The middle channel is 2440 MHz  
 The high channel is 2480 MHz

In WiFi mode, the EUT uses a total of 11 channels.

The low channel is 2412 MHz  
 The middle channel is 2437 MHz  
 The high channel is 2462 MHz

### 7.2 Antenna

The EUT utilized the following antennas:

Both micro-controllers (WiFi and Bluetooth) utilized a 31 mm monopole, wire antenna.  
 The Peak Gain for each antenna  $\approx$  2.1 dBi



## 8. TEST PROCEDURES

The following sections describe the test methods and the specifications for the tests. Test results are also included in this section.

### 8.1 RF Emissions

#### 8.1.1 Conducted Emissions Test

The EMI Receiver was used as a measuring meter. A quasi-peak and/or average reading was taken only where indicated in the data sheets. A 10 dB attenuator used for the protection of the EMI Receiver input stage, and the offset was adjusted accordingly to read the actual data measured. The LISN output was measured using the EMI Receiver. The output of the second LISN was terminated by a 50-ohm termination. The effective measurement bandwidth used for this test was 9 kHz.

Please see section 6.2 of this report for mounting, bonding, and grounding of the EUT. The EUT was powered through the LISN, which was bonded to the ground plane. The LISN power was filtered and the filter was bonded to the ground plane. The EUT was set up with the minimum distances from any conductive surfaces as specified in ANSI 63:4. The excess power cord was wrapped in a figure eight pattern to form a bundle not exceeding 0.4 meters in length.

The conducted emissions from the EUT were maximized for operating mode as well as cable placement. The final data was collected under program control by computer software.

The six highest emissions are listed in Table 1.

#### Test Results:

The EUT complies with the **Class B** limits of CFR Title 47, Part 15 Subpart B for conducted emissions.

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### 8.1.2 Radiated Emissions Test

The EMI Receiver was used as the measuring meter. Above 1000 MHz, preamplifiers were used to increase the sensitivity of the instrument. The EMI Receiver was initially used with the Analyzer mode feature activated. In this mode, the EMI receiver can then record the actual frequency to be measured. This final reading is then taken accurately in the EMI Receiver mode, which takes into account the cable loss, amplifier gain and antenna factors, so that a true reading is compared to the true limit. The effective measurement bandwidth used for the radiated emissions test was according to the frequency measured.

The frequencies below 1 GHz were quasi-peaked using the quasi-peak detector of the EMI Receiver.

The frequencies above 1 GHz for band edges were averaged using the RMS average function of the EMI Receiver.

The EMI test chamber of Compatible Electronics, Inc. was used for radiated emissions testing. This test site is in full compliance with ANSI C63.4 and ANSI C63.10. Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The turntable supporting the EUT is remote controlled using a motor. The turntable permits EUT rotation of 360 degrees in order to maximize emissions. Also, the antenna mast allows height variation of the antenna from 1 meter to 4 meters. Data was collected in the worst case (highest emission) configuration of the EUT. At each reading, the EUT was rotated 360 degrees and the antenna height was varied from 1 to 4 meters (for E field radiated field strength). The gunsight method was used when measuring with the horn antenna in order to ensure accurate results.

The EUT was tested at a 3-meter test distance. The six highest emissions are listed in Table 2.

The measurement bandwidths and transducers used for the radiated emissions test were:

FREQUENCY RANGE	EFFECTIVE MEASUREMENT BANDWIDTH	TRANSDUCER
9 kHz to 150 kHz	200 Hz	Loop Antenna
150 kHz to 30 MHz	9 kHz	Loop Antenna
30 MHz to 1 GHz	120 kHz	CombiLog Antenna
1 GHz to 25 GHz	1 MHz	Horn Antenna

#### Test Results:

The EUT complies with the **Class B** limits of CFR Title 47, Part 15, Subpart B; the limits of CFR Title 47, Part 15, Subpart C, sections 15.205, 15.209 and 15.247 for radiated emissions.

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### 8.1.3 RF Emissions Test Results

Table 1      Conducted EMISSION RESULTS  
 Hopper, Model: FTW000123

Frequency (MHz)	Average Emission Level* (dB $\mu$ V/m)	Average Specification Limit (dB $\mu$ V/m)	Delta (Emission Level – Spec Limit) (dB)
0.322 (BL) (Internal Battery Charging Mode)	23.89	49.39	-25.50
0.246 (BL) (Internal Battery Charging Mode)	23.17	51.74	-28.57
0.294 (WL) (Internal Battery Charging Mode)	21.64	50.31	-28.67
0.294 (BL) (Internal Battery Charging Mode)	21.87	50.59	-28.71
0.218 (WL) (Internal Battery Charging Mode)	19.22	52.56	-33.34
0.222 (WL) (Internal Battery Charging Mode)	19.11	52.53	-33.42

Table 2      RADIATED EMISSION RESULTS  
 Hopper, Model: FTW000123

Frequency (MHz)	EMI Reading (dB $\mu$ V/m)	Average Specification Limit (dB $\mu$ V/m)	Delta (EMI Reading – Spec. Limit) (dB)
2483.50 (V) (BE, High Chan.) (Y-Axis) (WiFi Mode)	53.57 (AVG)	53.97	-0.40
2390.00 (H) (BE, Low Chan.) (X-Axis) (WiFi Mode)	52.58 (AVG)	53.97	-1.39
2483.50 (H) (BE, High Chan.) (X-Axis) (WiFi Mode)	52.23 (AVG)	53.97	-1.74
12310.00 (H) (High Chan.) (Y-Axis) (WiFi Mode)	47.37	53.97	-6.60
12310.00 (H) (High Chan.) (X-Axis) (WiFi Mode)	47.28	53.97	-6.69
12310.00 (V) (High Chan.) (X-Axis) (WiFi Mode)	47.14	53.97	-6.83

Notes:

- \* The complete emissions data is given in Appendix E of this report.
- (BL) Black Lead
- (WL) White Lead
- (V) Vertical
- (H) Horizontal
- (AVG) Average
- BE Band Edge
- Chan. Channel

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### 8.1.4 Sample Calculations

A correction factor for the antenna, cable and a distance factor (if any) must be applied to the meter reading before a true field strength reading can be obtained. This Corrected Meter Reading is then compared to the specification limit in order to determine compliance with the limits.

Conversion to logarithmic terms: Specification limit ( $\mu\text{V/m}$ )  $\log x 20$  = Specification Limit in dB $\mu\text{V/m}$

To correct for distance when measuring at a distance other than the specification

For measurements below 30 MHz: (Specification distance / test distance)  $\log x 40$  = distance factor

For measurements above 30 MHz: (Specification distance / test distance)  $\log x 20$  = distance factor

Note: When using an Active Antenna, the Antenna factor shall be subtracted due to the combination of the internal amplification and antenna loss.

Corrected Meter Reading = meter reading + F – A + C

where:            F = antenna factor

                  A = amplifier gain

                  C = cable loss

The correction factors for the antenna and the amplifier gain are attached in Appendix D of this report. The data sheets are attached in Appendix E.

The distance factor D is 0 when the test is performed at the required specification distance.



## 8.2 DTS Bandwidth

The DTS Bandwidth was measured using the EMI Receiver. The following steps were performed for measuring the DTS Bandwidth.

1. Set RBW = 100 kHz
2. Set the video bandwidth (VBW) to equal or greater than 3 times the RBW
3. Detector = Peak
4. Trace Mode = Max Hold
5. Sweep = Auto Couple
6. Allow the trace to stabilize
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

### Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a)(2).

## 8.3 Maximum Conducted Output Power

The Conducted Peak Output Power was measured using the Power Meter. The peak output power was measured using the peak power measurement procedure described in section 11.9.1.3 of ANSI C63.10. The Maximum Conducted Output Power was then taken.

### Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (b)(3).

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## 8.4 Emissions in Non-restricted Frequency Bands

The emissions in the non-restricted frequency bands measurements were performed using the EMI receiver directly connected to the EUT. The reference level was established by setting the instrument center frequency to the DTS channel center frequency. The span was set to  $\geq 1.5$  times the DTS bandwidth. The RBW was set to 100 kHz and the VBW was set to 300 kHz. A peak detector was used with sweep set to auto. A max hold trace was used and allowed to fully stabilize. The peak marker function was used to determine the reference level. For emission level measurement, the center frequency and span were set to encompass the frequency range to be measured. The RBW was set to 100 kHz and the VBW was set to 300 kHz. A peak detector was used with a sweep time set to auto. The number of measurement points were greater than the span/RBW. A max hold trace was used and allowed to fully stabilize. The peak marker function was used to determine the maximum amplitude level. The final qualification data sheets are located in Appendix E.

### Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (d).

## 8.5 RF Band Edges

The RF band edges were taken at 2390 MHz when the EUT was on the low channel and 2483.5 MHz when the EUT was on the high channel using the EMI Receiver. A preamplifier was used to boost the signal level, with the plots being taken at a 3 meter test distance. The radiated emissions test procedure as describe in section 8.1.2 of this test report was used to maximize the emission.

### Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (d). The RF power at the restricted bands closest to the band edges at 2390 MHz and 2483.5 MHz also meet the limits of section 15.209. Please see the data sheets located in Appendix E.

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## 8.6 Spectral Density Test

The spectrum density output was measured using the EMI Receiver. The spectral density output was measured using a direct connection from the RF out on the EUT into the input of the EMI Receiver. The following steps were performed for measuring the spectral density.

1. Set analyzer center frequency to DTS channel center frequency
2. Set the span to 1.5 times the OBW.
3. Set the RBW to  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$
4. Set the VBW  $\geq [3 \times \text{RBW}]$
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Allow the trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

### Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (e).

## 8.7 Variation of the Input Power

The variation of the input power test was performed using the EMI Receiver. The EUT input power was varied between 85 % and 115 % of the nominal rated supply voltage. The carrier frequency was monitored for any change in amplitude.

### Test Results:

This test was not performed because the EUT is an internal battery powered device for normal operation, and only connects to the public AC mains while in charging mode (it does not transmit while in charging mode).

## 9. CONCLUSIONS

The Hopper, Model: FTW000123 (EUT), as tested, meets all of the specification limits defined in CFR Title 47, Part 15, Subpart B; and Subpart C, sections 15.205, 15.207, 15.209, and 15.247.

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FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Page A1

Hopper

Model: FTW000123

## APPENDIX A

### ***LABORATORY ACCREDITATIONS AND RECOGNITIONS***

---

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## LABORATORY ACCREDITATIONS AND RECOGNITIONS



For US, Canada, Australia/New Zealand, Japan, Taiwan, Korea, and the European Union,

Compatible Electronics is currently accredited by NVLAP to ISO/IEC 17025.

For the most up-to-date version of our scopes and certificates please visit

<http://celectronics.com/quality/scope/>

Quote from ISO-ILAC-IAF Communiqué on the Management Systems Requirements of ISO/IEC 17025, General Requirements for the competence of testing and calibration laboratories:

"A laboratory's fulfilment of the requirements of ISO/IEC 17025 means the laboratory meets both the technical competence requirements and management system requirements that are necessary for it to consistently deliver technically valid test results and calibrations. The management system requirements in ISO/IEC 17025 are written in language relevant to laboratory operations and operate generally in accordance with the principles of ISO 9001"

ISED Test Site Registration Number: 2154A

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

## APPENDIX B

### ***MODIFICATIONS TO THE EUT***

---

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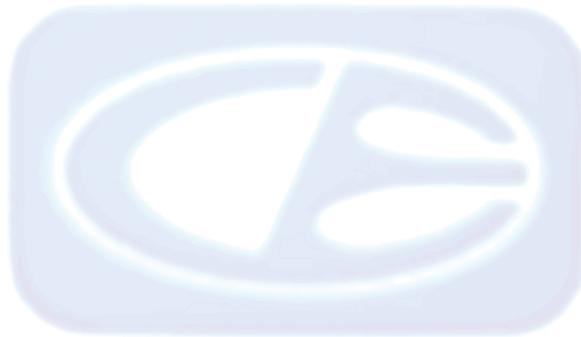


## MODIFICATIONS TO THE EUT

The modifications listed below were made to the EUT to pass FCC Subpart B and FCC 15.247 specifications.

All the rework described below was implemented during the test in a method that could be reproduced in all the units by the manufacturer.

No modifications were made to the EUT during the testing.



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**COMPATIBLE  
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FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper

Model: FTW000123

## APPENDIX C

### ***MODELS COVERED UNDER THIS REPORT***

---

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FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper

Model: FTW000123

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## MODELS COVERED UNDER THIS REPORT

USED FOR THE PRIMARY TEST

Hopper  
Model: FTW000123  
S/N: N/A

There are no additional models covered under this report.



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**COMPATIBLE  
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FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper

Model: FTW000123

## APPENDIX D

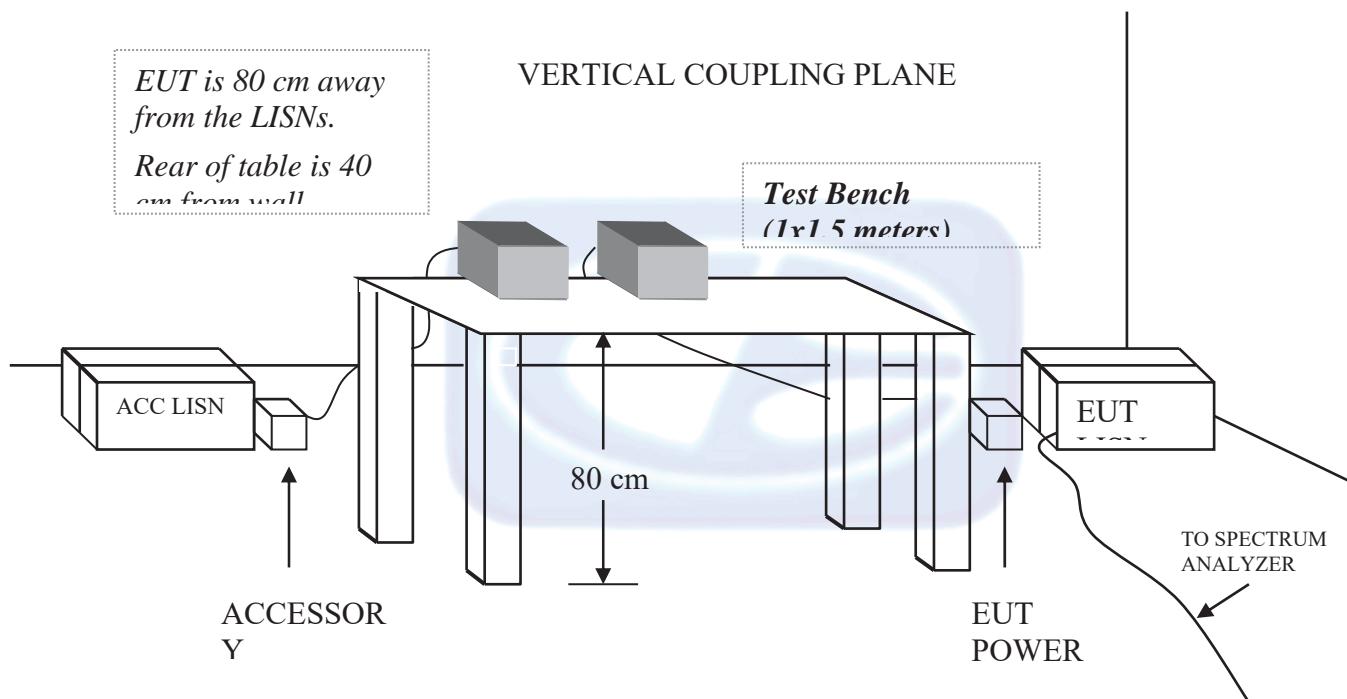
### ***DIAGRAMS AND CHARTS***

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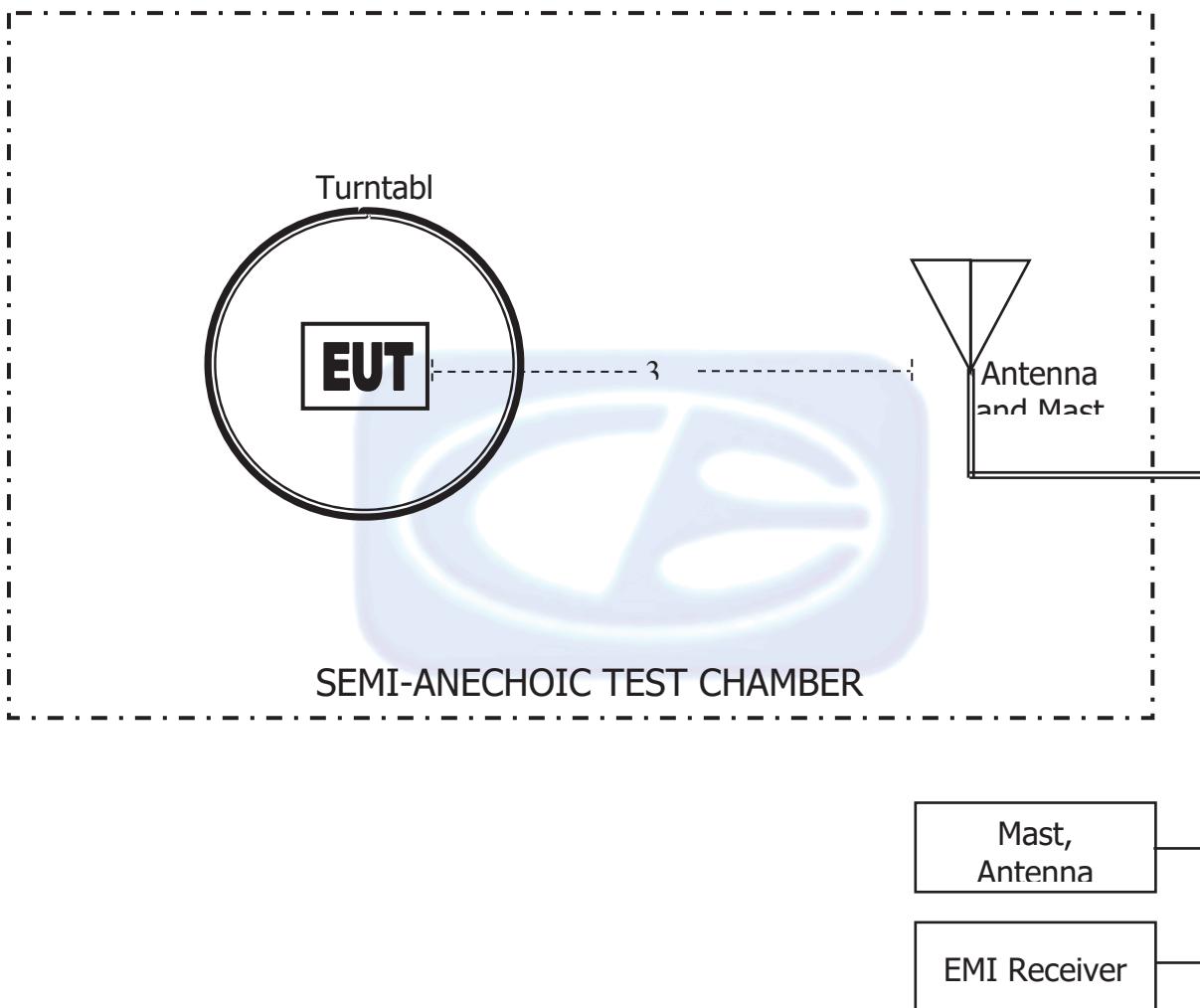
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**FIGURE 1: CONDUCTED EMISSIONS TEST SETUP**


**FIGURE 2: LAYOUT OF THE SEMI-ANECHOIC TEST CHAMBER**





**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

## COM-POWER AL-130R

### LOOP ANTENNA

S/N: 121090

CALIBRATION DATE: FEBRUARY 10, 2022

FREQUENCY (MHz)	MAGNETIC (dB/m)	ELECTRIC (dB/m)
0.009	15.6	-35.8
0.01	15.8	-35.6
0.02	14.8	-36.6
0.03	15.6	-35.9
0.04	15.0	-36.5
0.05	14.4	-37.1
0.06	14.6	-36.9
0.07	14.3	-37.2
0.08	14.3	-37.2
0.09	14.4	-37.0
0.10	14.1	-37.4
0.20	14.1	-37.4
0.30	14.0	-37.5
0.40	13.9	-37.6
0.50	14.1	-37.3
0.60	14.1	-37.3
0.70	14.2	-37.3
0.80	14.2	-37.3
0.90	14.2	-37.2
1.00	14.4	-37.0
2.00	14.6	-36.9
3.00	14.6	-36.8
4.00	14.9	-36.6
5.00	14.9	-36.7
6.00	14.8	-36.7
7.00	14.6	-36.8
8.00	14.5	-37.0
9.00	14.3	-37.2
10.00	14.5	-37.0
11.00	14.6	-36.9
12.00	14.7	-36.7
13.00	14.9	-36.6
14.00	15.0	-36.5
15.00	14.9	-36.6
16.00	14.9	-36.6
17.00	14.6	-36.8
18.00	14.4	-37.1
19.00	14.5	-37.0
20.00	14.5	-37.0
21.00	14.2	-37.3
22.00	13.9	-37.5
23.00	13.9	-37.5
24.00	13.8	-37.7
25.00	13.4	-38.0
26.00	13.2	-38.2
27.00	13.2	-38.3
28.00	12.7	-38.7
29.00	12.7	-38.8
30.00	12.4	-39.0

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

COM-POWER AC-220

COMBILOG ANTENNA

S/N: 61093

CALIBRATION DATE: DECEMBER 14, 2021

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
30	22.50	200	16.00
35	21.40	250	17.40
40	21.00	300	19.70
45	20.60	350	20.00
50	19.70	400	22.20
60	16.10	450	22.40
70	12.80	500	23.10
80	12.50	550	23.40
90	14.20	600	24.90
100	15.40	650	25.30
120	16.50	700	25.40
125	16.80	750	26.40
140	15.90	800	26.70
150	16.60	850	27.10
160	18.50	900	27.90
175	15.90	950	28.00
180	15.50	1000	28.00

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

COM POWER AH-118

HORN ANTENNA

S/N: 10050113

CALIBRATION DATE: DECEMBER 16, 2021

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	23.86	10.0	38.91
1.5	25.67	10.5	39.94
2.0	28.25	11.0	39.10
2.5	29.17	11.5	39.70
3.0	29.78	12.0	40.29
3.5	30.88	12.5	41.93
4.0	31.21	13.0	41.34
4.5	32.96	13.5	40.57
5.0	33.30	14.0	40.23
5.5	34.24	14.5	42.25
6.0	34.57	15.0	43.63
6.5	35.61	15.5	39.96
7.0	36.60	16.0	40.38
7.5	37.49	16.5	40.56
8.0	37.44	17.0	40.93
8.5	37.98	17.5	42.27
9.0	38.01	18.0	43.77
9.5	38.53		

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

COM-POWER AH-826

HORN ANTENNA

S/N: 71957

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
18.0	33.5	22.5	35.5
18.5	33.5	23.0	35.9
19.0	34.0	23.5	35.7
19.5	34.0	24.0	35.6
20.0	34.3	24.5	36.0
20.5	34.9	25.0	36.2
21.0	34.7	25.5	36.1
21.5	35.0	26.0	36.2
22.0	35.0	26.5	35.7

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COM-POWER PA-118

PREAMPLIFIER

S/N: 181653

CALIBRATION DATE: MARCH 7, 2022

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	40.02	6.0	38.84
1.1	39.72	6.5	39.20
1.2	39.93	7.0	39.46
1.3	39.98	7.5	39.67
1.4	39.99	8.0	39.28
1.5	40.20	8.5	38.63
1.6	40.05	9.0	38.96
1.7	40.15	9.5	39.33
1.8	40.20	10.0	39.58
1.9	40.33	11.0	38.25
2.0	40.33	12.0	40.03
2.5	40.60	13.0	40.55
3.0	40.76	14.0	40.36
3.5	40.87	15.0	39.34
4.0	40.39	16.0	37.34
4.5	39.55	17.0	42.14
5.0	40.34	18.0	42.54
5.5	39.45		

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper

Model: FTW000123

**COM-POWER PA-840**

**MICROWAVE PREAMPLIFIER**

**S/N: 711013**

**CALIBRATION DATE: APRIL 8, 2022**

<b>FREQUENCY (GHz)</b>	<b>FACTOR (dB)</b>
18.0	24.85
19.0	24.25
20.0	22.69
21.0	22.17
22.0	22.78
23.0	23.23
24.0	23.72
25.0	24.13
26.0	24.28
26.5	25.06

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper

Model: FTW000123

***DRONE – BATTERY POWERED (FLIGHT MODE)***



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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



#### FRONT VIEW

FTW LLC

HOPPER

MODEL: FTW000123

FCC SUBPART B AND C – RADIATED EMISSIONS – BELOW 1 GHz

#### PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

---

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



#### REAR VIEW

FTW LLC

HOPPER

MODEL: FTW000123

FCC SUBPART B AND C – RADIATED EMISSIONS – BELOW 1 GHz

#### PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

---

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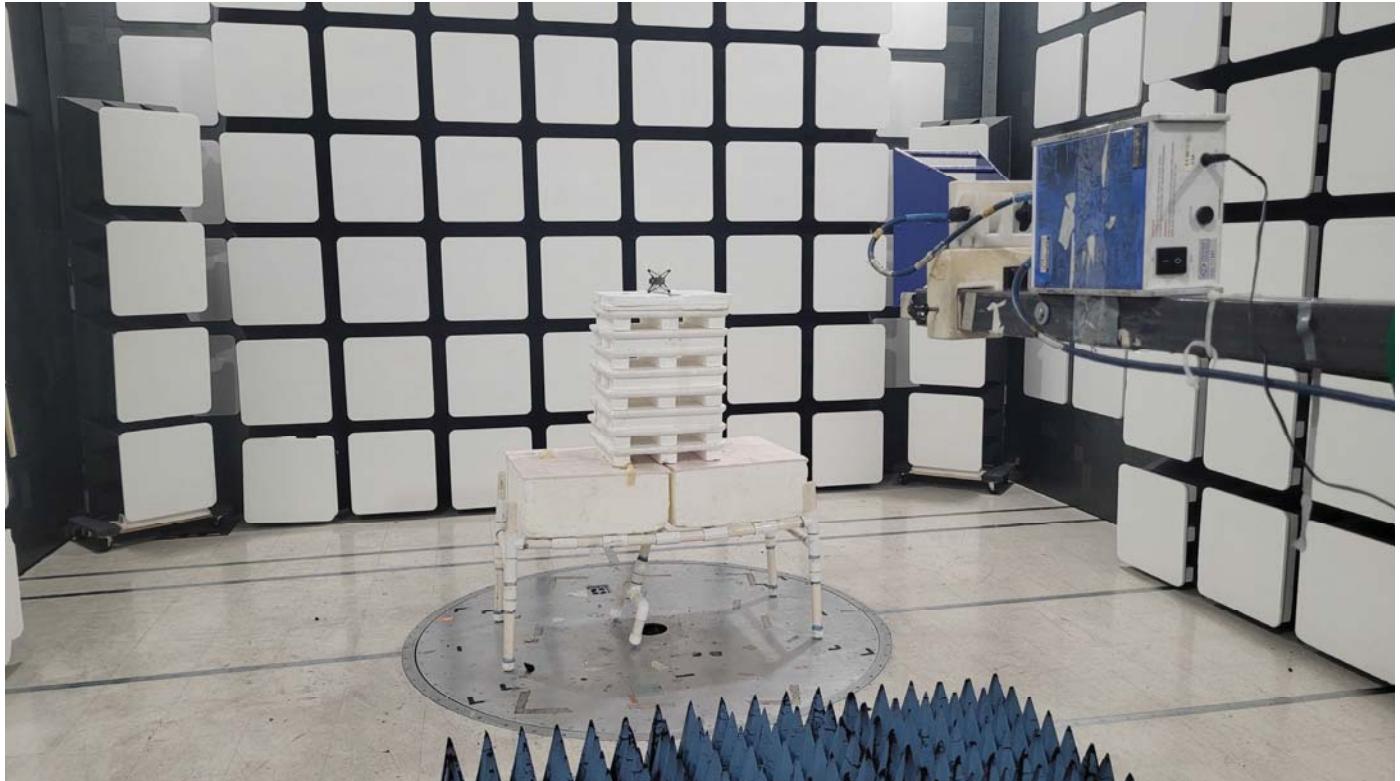
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



#### FRONT VIEW

FTW LLC

HOPPER

MODEL: FTW000123

FCC SUBPART B AND C – RADIATED EMISSIONS – ABOVE 1 GHz

#### PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

---

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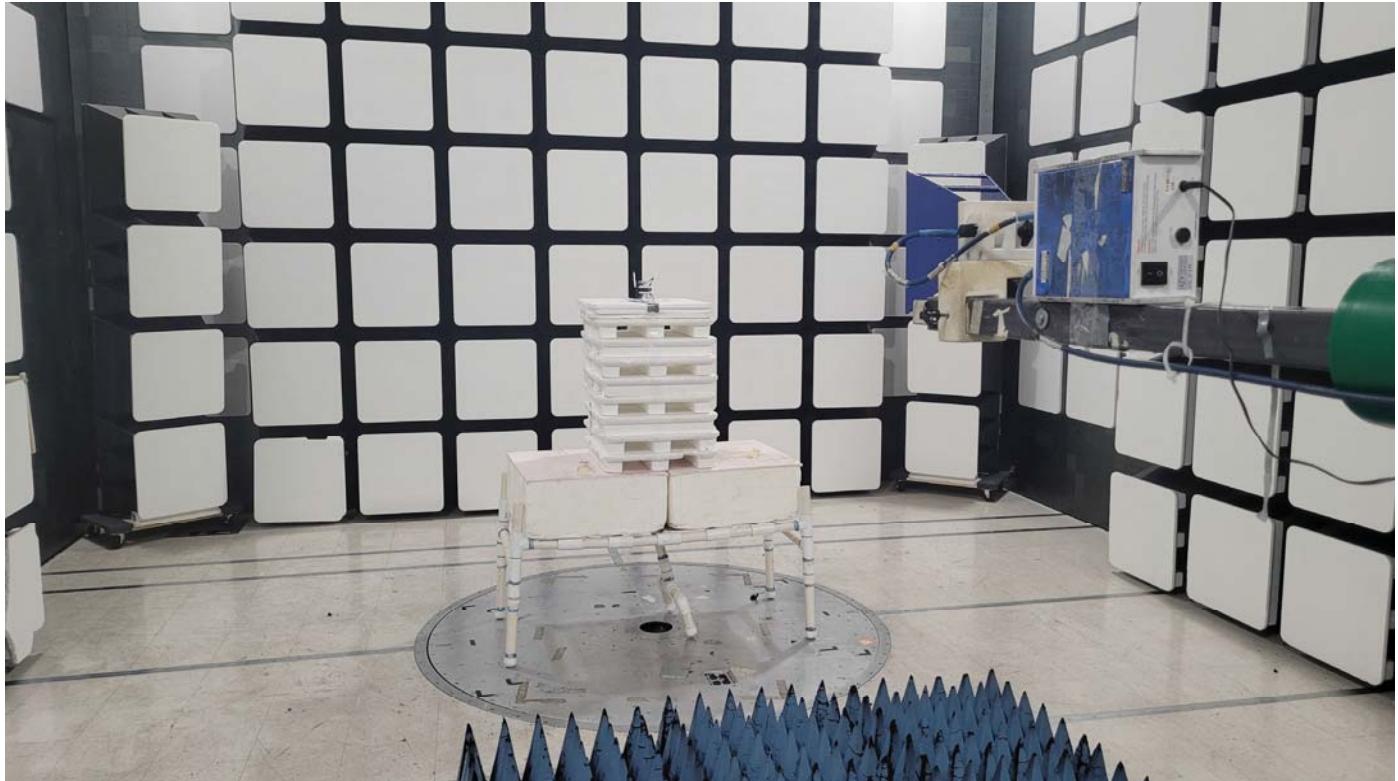
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



#### REAR VIEW

FTW LLC

HOPPER

MODEL: FTW000123

FCC SUBPART B AND C – RADIATED EMISSIONS – ABOVE 1 GHz

#### PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

---

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper

Model: FTW000123

***DRONE – CHARGING MODE (ONLY)***

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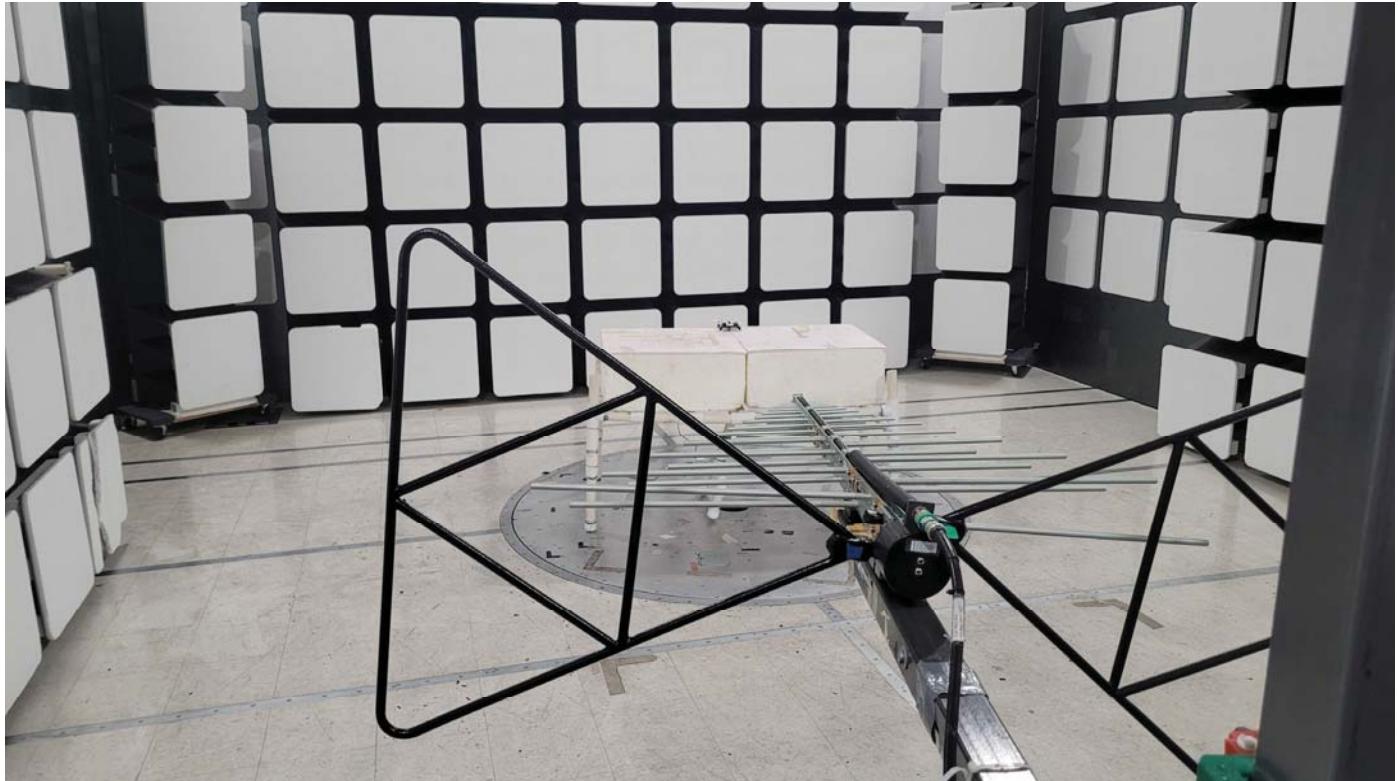
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



#### FRONT VIEW

FTW LLC

HOPPER

MODEL: FTW000123

FCC SUBPART B – RADIATED EMISSIONS – BELOW 1 GHz

#### PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

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**REAR VIEW**

FTW LLC  
HOPPER  
MODEL: FTW000123  
FCC SUBPART B – RADIATED EMISSIONS – BELOW 1 GHz

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION  
FOR MAXIMUM EMISSIONS**

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**Lake Forest Division**  
20621 Pascal Way  
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(949) 587-0400

**Newbury Park Division**  
1050 Lawrence Drive  
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(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



**FRONT VIEW**

**AC POWERED MODE**

FTW LLC  
HOPPER  
MODEL: FTW000123  
FCC SUBPART B  
AC CONDUCTED EMISSIONS

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION  
FOR MAXIMUM EMISSIONS**

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



**REAR VIEW**

**AC POWERED MODE**

FTW LLC  
HOPPER  
MODEL: FTW000123  
FCC SUBPART B  
AC CONDUCTED EMISSIONS

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION  
FOR MAXIMUM EMISSIONS**

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FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Report Number: B30731D1  
Hopper  
Model: FTW000123

Page E1

**APPENDIX E**

***DATA SHEETS***

---

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FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Report Number: B30731D1  
Hopper  
Model: FTW000123

Page E2

## ***SPURIOUS EMISSIONS DATA SHEETS***

---

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

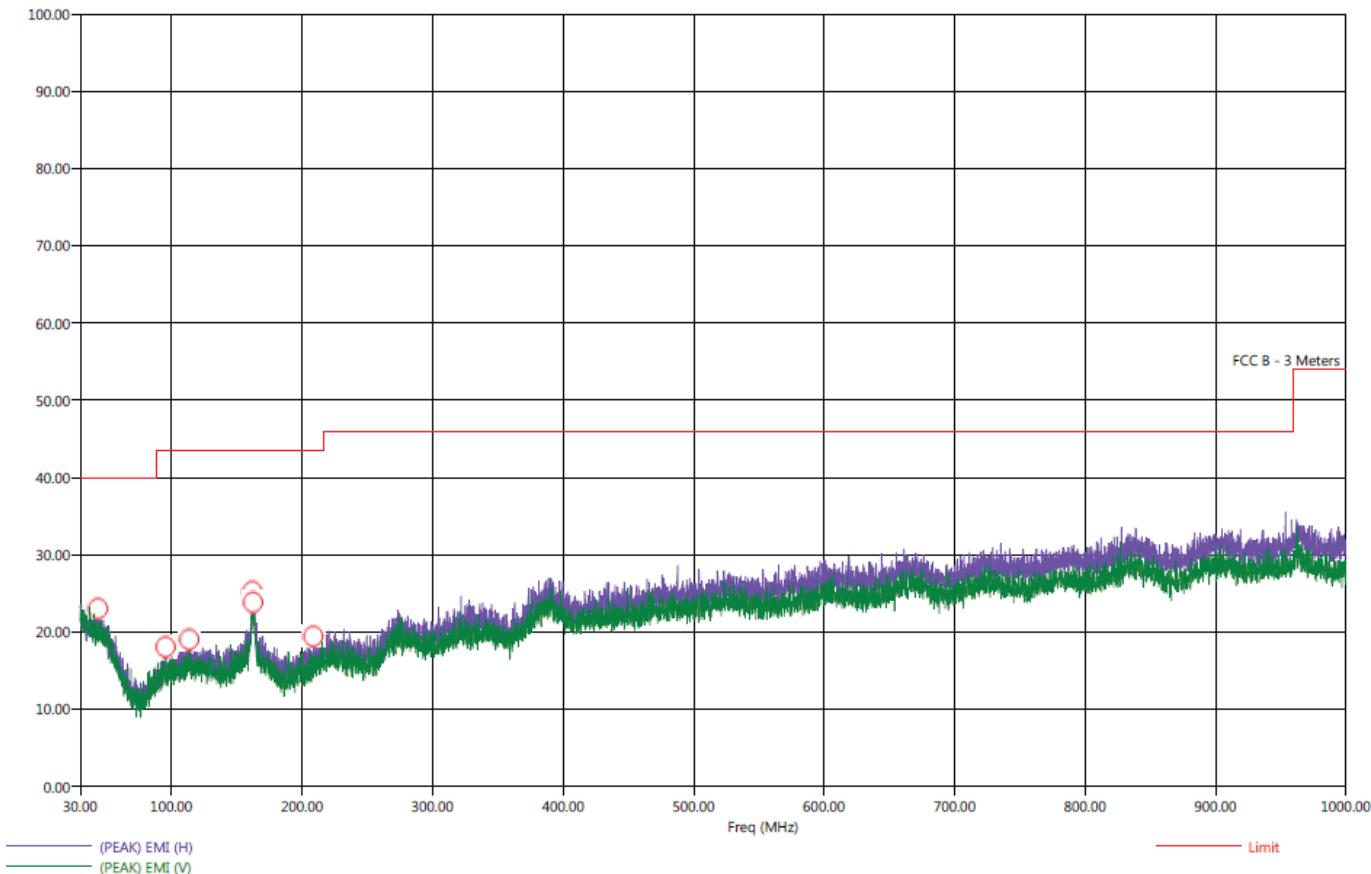
Hopper  
Model: FTW000123

Title: Pre-Scan - FCC Class B  
File: 1 - Pre-Scan - X-Axis - 24102 MHz - 08-01-2023.set  
Operator: Kyle Fujimoto  
EUT Type: Hopper  
EUT Condition: The EUT is continuously transmitting BLE at 2402 MHz  
Company: FTW LLC  
Model: FTW000123  
S/N: N/A  
X-Axis (Worst Case)

8/1/2023 8:31:51 AM  
Sequence: Preliminary Scan

FCC Class B

Electric Field Strength (dB $\mu$ V/m)



(PEAK) EMI (H)

(PEAK) EMI (V)

Limit

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

Title: Radiated Final - FCC Class B  
File: 1 - Final Scan - X-Axis - 2402 MHz - 07-31-2023.set  
Operator: Kyle Fujimoto  
EUT Type: Hopper  
EUT Condition: The EUT is continuously transmitting BLE at 2402 MHz  
Company: FTW LLC  
Model: FTW000123  
S/N: N/A  
X-Axis (Worst Case)

8/1/2023 8:41:55 AM  
Sequence: Final Measurements

FCC Class B

Freq (MHz)	Pol	(PEAK) EMI (dB $\mu$ V/m)	(OP) EMI (dB $\mu$ V/m)	(PEAK) Margin (dB)	(QP) Margin (dB)	Limit (dB $\mu$ V/m)	Transducer (dB)	Cable (dB)	Ttbl Aql (deg)	Twr Ht (cm)
43.90	H	23.29	18.03	-16.71	-21.97	40.00	20.69	0.44	287.75	350.49
95.60	H	18.12	12.55	-25.38	-30.95	43.50	14.95	0.68	272.00	398.25
113.70	H	19.38	13.78	-24.12	-29.72	43.50	16.08	0.76	180.50	350.61
162.10	H	26.25	21.36	-17.25	-22.14	43.50	22.96	0.94	41.25	270.91
162.70	V	25.82	21.04	-17.68	-22.46	43.50	22.64	0.94	261.50	400.16
208.80	H	19.00	13.96	-24.50	-29.54	43.50	15.80	1.10	17.50	270.85



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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

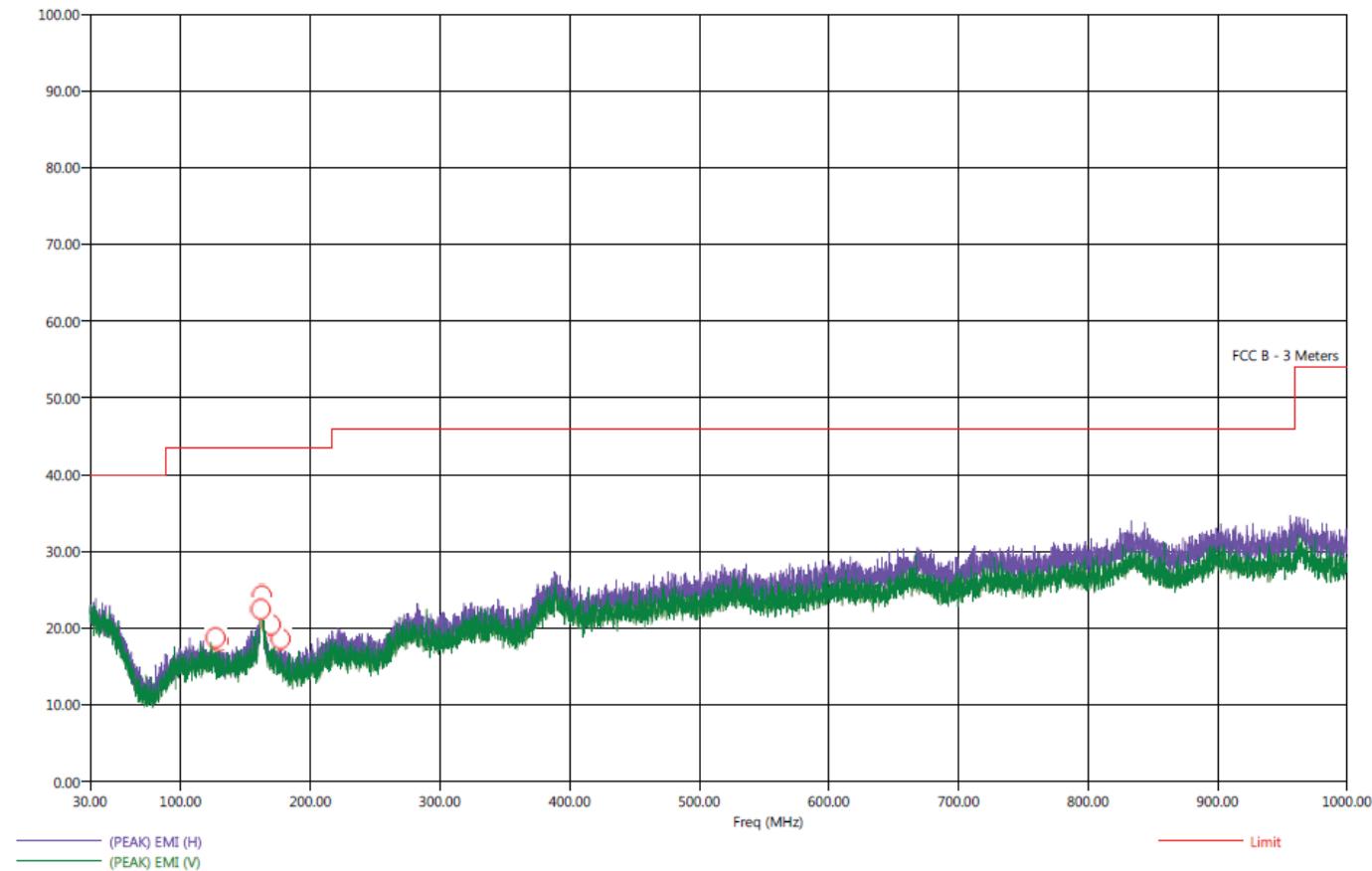
Hopper  
Model: FTW000123

Title: Pre-Scan - FCC Class B  
File: 1 - Pre-Scan - X-Axis - 2412 MHz - 07-31-2023.set  
Operator: Kyle Fujimoto  
EUT Type: Hopper  
EUT Condition: The EUT is continuously transmitting WiFi at 2412 MHz  
Company: FTW LLC  
Model: FTW000123  
S/N: N/A  
X-Axis (Worst Case)

7/31/2023 5:02:31 PM  
Sequence: Preliminary Scan

FCC Class B

Electric Field Strength (dB $\mu$ V/m)



(PEAK) EMI (H)  
(PEAK) EMI (V)

Limit

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

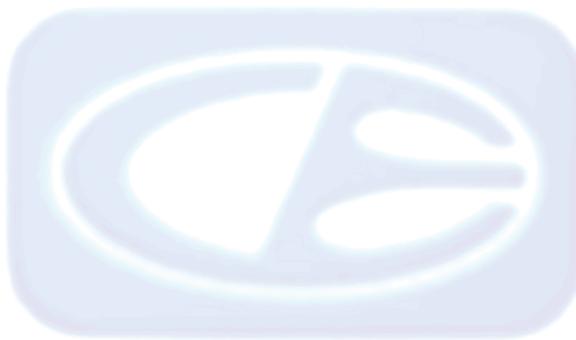
Hopper  
Model: FTW000123

Title: Radiated Final - FCC Class B  
 File: 1 - Final Scan - X-Axis - 2412 MHz - 07-31-2023.set  
 Operator: Kyle Fujimoto  
 EUT Type: Hopper  
 EUT Condition: The EUT is continuously transmitting WiFi at 2412 MHz  
 Company: FTW LLC  
 Model: FTW000123  
 S/N: N/A  
 X-Axis (Worst Case)

7/31/2023 5:27:00 PM  
 Sequence: Final Measurements

FCC Class B

Freq (MHz)	Pol	(PEAK) EMI (dB $\mu$ V/m)	(QP) EMI (dB $\mu$ V/m)	(PEAK) Margin (dB)	(QP) Margin (dB)	Limit (dB $\mu$ V/m)	Transducer (dB)	Cable (dB)	Ttbl Aql (deg)	Twr Ht (cm)
120.00	H	19.07	14.37	-24.43	-29.13	43.50	16.50	0.79	299.75	159.14
120.00	V	18.42	13.79	-25.08	-29.71	43.50	16.51	0.80	74.50	159.14
160.00	V	21.91	16.84	-21.59	-26.66	43.50	18.54	0.93	163.00	319.26
162.20	H	25.86	21.15	-17.64	-22.35	43.50	22.76	0.94	233.50	159.38
376.00	H	25.93	20.78	-20.07	-25.22	46.00	22.50	1.50	311.50	127.56
388.00	H	27.81	22.58	-18.19	-23.42	46.00	23.47	1.53	251.00	399.32



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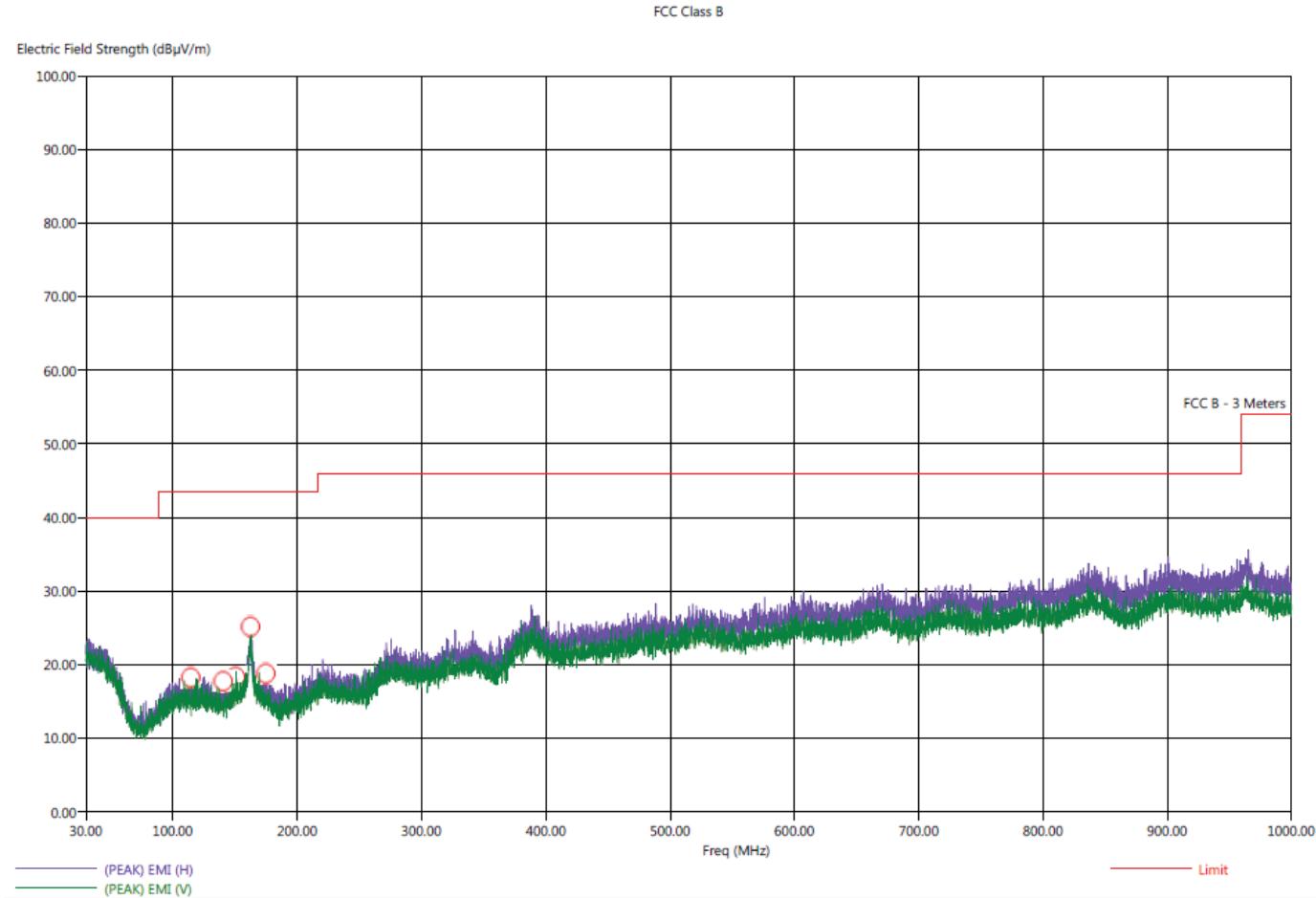
**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

Title: Pre-Scan - FCC Class B  
File: 1 - Pre-Scan - X-Axis - Charging - 08-02-2023.set  
Operator: Kyle Fujimoto  
EUT Type: Hopper  
EUT Condition: The EUT is continuously charging the EUT  
Company: FTW LLC  
Model: FTW000123  
S/N: N/A  
X-Axis (Worst Case)

8/2/2023 1:21:42 PM  
Sequence: Preliminary Scan



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**COMPATIBLE  
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FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

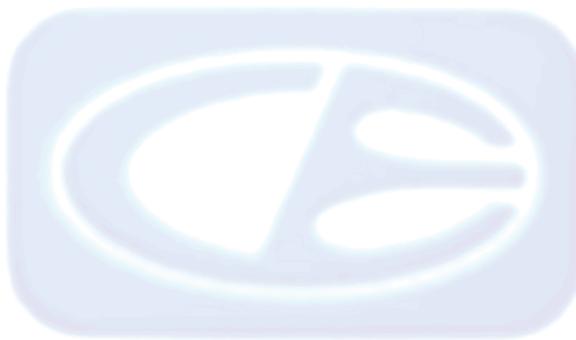
Hopper  
Model: FTW000123

Title: Radiated Final - FCC Class B  
File: 1 - Final Scan - Charging - 08-02-2023.set  
Operator: Kyle Fujimoto  
EUT Type: Hopper  
EUT Condition: The EUT is continuously charging the EUT  
Company: FTW LLC  
Model: FTW000123  
S/N: N/A  
X-Axis (Worst Case)

8/2/2023 1:30:45 PM  
Sequence: Final Measurements

FCC Class B

Freq (MHz)	Pol	(PEAK) EMI (dB $\mu$ V/m)	(QP) EMI (dB $\mu$ V/m)	(PEAK) Margin (dB)	(QP) Margin (dB)	Limit (dB $\mu$ V/m)	Transducer (dB)	Cable (dB)	Ttbl AqI (deg)	Twr Ht (cm)
120.00	H	18.65	13.81	-24.85	-29.69	43.50	16.50	0.79	278.75	127.26
120.00	V	19.01	13.85	-24.49	-29.65	43.50	16.52	0.80	137.00	398.43
160.00	V	22.00	16.72	-21.50	-26.78	43.50	18.40	0.93	53.25	366.49
162.20	H	26.04	21.23	-17.46	-22.27	43.50	22.83	0.94	317.75	350.61
376.00	H	26.05	20.77	-19.95	-25.23	46.00	22.51	1.50	157.50	287.08
388.00	H	27.39	22.63	-18.61	-23.37	46.00	23.51	1.53	241.75	350.49



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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

***TRANSMIT HARMONICS***

***BLE MODE***

---

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
Lab: D  
Tested By: Kyle Fujimoto

**Harmonics - Low Channel**

**Transmit Mode - X-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4804.00	38.56	V	53.97	-15.41	Peak	61.50	191.56	
7206.00								Not in Restricted Band
								Done Via Conducted
9608.00								Not in Restricted Band
								Done Via Conducted
12010.00								No Emission Detected
14412.00								No Emission Detected
16814.00								No Emission Detected
19216.00								No Emission Detected
21618.00								No Emission Detected
24020.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
Lab: D  
Tested By: Kyle Fujimoto

**Harmonics - Low Channel**  
**Transmit Mode - Y-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4804.00	39.01	V	53.97	-14.96	Peak	170.75	249.02	
7206.00								Not in Restricted Band
								Done Via Conducted
9608.00								Not in Restricted Band
								Done Via Conducted
12010.00								No Emission Detected
14412.00								No Emission Detected
16814.00								No Emission Detected
19216.00								No Emission Detected
21618.00								No Emission Detected
24020.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC

Hopper

Model: FTW000123

Date: 07/29/2023

Lab: D

Tested By: Kyle Fujimoto

**Harmonics - Low Channel**

**Transmit Mode - Z-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4804.00	38.21	V	53.97	-15.76	Peak	63.50	192.34	
7206.00								Not in Restricted Band
								Done Via Conducted
9608.00								Not in Restricted Band
								Done Via Conducted
12010.00								No Emission Detected
14412.00								No Emission Detected
16814.00								No Emission Detected
19216.00								No Emission Detected
21618.00								No Emission Detected
24020.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
Lab: D  
Tested By: Kyle Fujimoto

**Harmonics - Low Channel**  
**Transmit Mode - X-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4804.00	38.72	H	53.97	-15.25	Peak	47.75	239.38	
7206.00								Not in Restricted Band
								Done Via Conducted
9608.00								Not in Restricted Band
								Done Via Conducted
12010.00								No Emission Detected
14412.00								No Emission Detected
16814.00								No Emission Detected
19216.00								No Emission Detected
21618.00								No Emission Detected
24020.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
Lab: D  
Tested By: Kyle Fujimoto

**Harmonics - Low Channel**  
**Transmit Mode - Y-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4804.00	38.50	H	53.97	-15.47	Peak	73.00	111.32	
7206.00								Not in Restricted Band
								Done Via Conducted
9608.00								Not in Restricted Band
								Done Via Conducted
12010.00								No Emission Detected
14412.00								No Emission Detected
16814.00								No Emission Detected
19216.00								No Emission Detected
21618.00								No Emission Detected
24020.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC

Hopper

Model: FTW000123

Date: 07/29/2023

Lab: D

Tested By: Kyle Fujimoto

**Harmonics - Low Channel**

**Transmit Mode - Z-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4804.00	39.23	H	53.97	-14.74	Peak	104.75	127.44	
7206.00								Not in Restricted Band
								Done Via Conducted
9608.00								Not in Restricted Band
								Done Via Conducted
12010.00								No Emission Detected
14412.00								No Emission Detected
16814.00								No Emission Detected
19216.00								No Emission Detected
21618.00								No Emission Detected
24020.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC

Hopper

Model: FTW000123

Date: 07/29/2023

Lab: D

Tested By: Kyle Fujimoto

**Harmonics - Middle Channel**

**Transmit Mode - X-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4880.00	38.00	V	53.97	-15.97	Peak	358.25	175.38	
7320.00	44.28	V	53.97	-9.69	Peak	159.75	191.44	
9760.00								Not in Restricted Band
								Done Via Conducted
12200.00								No Emission Detected
14640.00								No Emission Detected
17080.00								No Emission Detected
19520.00								No Emission Detected
21960.00								No Emission Detected
24400.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW  
LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023

Lab: D

Tested By: Kyle Fujimoto

**Harmonics - Middle Channel**  
**Transmit Mode - Y-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4880.00	37.53	V	53.97	-16.44	Peak	30.25	221.26	
7320.00	43.06	V	53.97	-10.91	Peak	97.25	245.21	
9760.00								Not in Restricted Band
								Done Via Conducted
12200.00								No Emission Detected
14640.00								No Emission Detected
17080.00								No Emission Detected
19520.00								No Emission Detected
21960.00								No Emission Detected
24400.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
Lab: D  
Tested By: Kyle Fujimoto

**Harmonics - Middle Channel**

**Transmit Mode - Z-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4880.00	36.98	V	53.97	-16.99	Peak	63.75	239.14	
7320.00	43.28	V	53.97	-10.69	Peak	225.50	174.91	
9760.00								Not in Restricted Band
								Done Via Conducted
12200.00								No Emission Detected
14640.00								No Emission Detected
17080.00								No Emission Detected
19520.00								No Emission Detected
21960.00								No Emission Detected
24400.00								No Emission Detected

**Brea Division**  
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(714) 579-0500

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20621 Pascal Way  
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(949) 587-0400

**Newbury Park Division**  
1050 Lawrence Drive  
Newbury Park, CA 91320  
(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
Lab: D  
Tested By: Kyle Fujimoto

**Harmonics - Middle Channel**

**Transmit Mode - X-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4880.00	37.99	H	53.97	-15.98	Peak	83.75	159.38	
7320.00	43.99	H	53.97	-9.98	Peak	136.50	111.38	
9760.00								Not in Restricted Band
								Done Via Conducted
12200.00								No Emission Detected
14640.00								No Emission Detected
17080.00								No Emission Detected
19520.00								No Emission Detected
21960.00								No Emission Detected
24400.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC

Hopper

Model: FTW000123

Date: 07/29/2023

Lab: D

Tested By: Kyle Fujimoto

**Harmonics - Middle Channel**

**Transmit Mode - Y-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4880.00	37.70	H	53.97	-16.27	Peak	66.50	222.97	
7320.00	44.40	H	53.97	-9.57	Peak	83.75	111.38	
9760.00								Not in Restricted Band
								Done Via Conducted
12200.00								No Emission Detected
14640.00								No Emission Detected
17080.00								No Emission Detected
19520.00								No Emission Detected
21960.00								No Emission Detected
24400.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
Lab: D  
Tested By: Kyle Fujimoto

**Harmonics - Middle Channel**  
**Transmit Mode - Z-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4880.00	37.69	H	53.97	-16.28	Peak	284.00	223.50	
7320.00	44.17	H	53.97	-9.80	Peak	166.50	206.85	
9760.00								Not in Restricted Band
								Done Via Conducted
12200.00								No Emission
								Detected
14640.00								No Emission
								Detected
17080.00								No Emission
								Detected
19520.00								No Emission
								Detected
21960.00								No Emission
								Detected
24400.00								No Emission
								Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC

Hopper

Model: FTW000123

Date: 07/29/2023

Lab: D

Tested By: Kyle Fujimoto

**Harmonics - High Channel**

**Transmit Mode - X-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4960.00	37.86	V	53.97	-16.11	Peak	115.00	175.62	
7440.00	44.64	V	53.97	-9.33	Peak	150.50	112.52	
9920.00								Not in Restricted Band
								Done Via Conducted
12400.00								No Emission Detected
14880.00								No Emission Detected
17360.00								No Emission Detected
19840.00								No Emission Detected
22320.00								No Emission Detected
24800.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
Lab: D  
Tested By: Kyle Fujimoto

**Harmonics - High Channel**  
**Transmit Mode - Y-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4960.00	37.82	V	53.97	-16.15	Peak	188.50	176.34	
7440.00	43.96	V	53.97	-10.01	Peak	52.50	159.44	
9920.00								Not in Restricted Band
								Done Via Conducted
12400.00								No Emission Detected
14880.00								No Emission Detected
17360.00								No Emission Detected
19840.00								No Emission Detected
22320.00								No Emission Detected
24800.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
Lab: D  
Tested By: Kyle Fujimoto

**Harmonics - High Channel**  
**Transmit Mode - Z-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4960.00	37.58	V	53.97	-16.39	Peak	94.25	223.20	
7440.00	43.86	V	53.97	-10.11	Peak	312.75	206.55	
9920.00								Not in Restricted Band
								Done Via Conducted
12400.00								No Emission Detected
14880.00								No Emission Detected
17360.00								No Emission Detected
19840.00								No Emission Detected
22320.00								No Emission Detected
24800.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
Lab: D  
Tested By: Kyle Fujimoto

**Harmonics - High Channel**

**Transmit Mode - X-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4960.00	37.78	H	53.97	-16.19	Peak	334.00	191.32	
7440.00	45.01	H	53.97	-8.96	Peak	128.75	223.26	
9920.00								Not in Restricted Band Done Via Conducted
12400.00								No Emission Detected
14880.00								No Emission Detected
17360.00								No Emission Detected
19840.00								No Emission Detected
22320.00								No Emission Detected
24800.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
Lab: D  
Tested By: Kyle Fujimoto

**Harmonics - High Channel**

**Transmit Mode - Y-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4960.00	38.18	H	53.97	-15.79	Peak	316.00	143.62	
7440.00	43.91	H	53.97	-10.06	Peak	195.00	143.44	
9920.00								Not in Restricted Band
								Done Via Conducted
12400.00								No Emission Detected
14880.00								No Emission Detected
17360.00								No Emission Detected
19840.00								No Emission Detected
22320.00								No Emission Detected
24800.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC

Hopper

Model: FTW000123

Date: 07/29/2023

Lab: D

Tested By: Kyle Fujimoto

**Harmonics - High Channel**

**Transmit Mode - Z-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4960.00	36.29	H	53.97	-17.68	Peak	99.50	221.26	
7440.00	42.16	H	53.97	-11.81	Peak	308.50	201.28	
9920.00								Not in Restricted Band Done Via Conducted
12400.00								No Emission Detected
14880.00								No Emission Detected
17360.00								No Emission Detected
19840.00								No Emission Detected
22320.00								No Emission Detected
24800.00								No Emission Detected

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# COMPATIBLE ELECTRONICS

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

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Hopper  
Model: FTW000123

FCC 15.247

FTW LLC

## Hopper

Model: FTW000123

Date: 07/20/2023

## Lab: D

Tested By: Kyle Fujimoto

## Non Harmonic Emissions from the Tx and Digital Portion - 9 kHz to 30 MHz

## Non Harmonic Emissions from the Tx and Digital Portion - 1 GHz to 25 GHz

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper

Model: FTW000123

***TRANSMIT HARMONICS***

***WiFi MODE***

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
Lab: D  
Tested By: Kyle Fujimoto

**Harmonics - Low Channel**

**Transmit Mode - X-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4824.00	39.48	V	53.97	-14.49	Peak	103.70	143.38	
7236.00								No Emission Detected
9648.00								No Emission Detected
12060.00								No Emission Detected
14472.00								No Emission Detected
16884.00								No Emission Detected
19296.00								No Emission Detected
21708.00								No Emission Detected
24120.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

FCC 15.247

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
Lab: D  
Tested By: Kyle Fujimoto

Harmonics - Low Channel  
Transmit Mode - Y-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4824.00	39.66	V	53.97	-14.31	Peak	52.00	143.32	
7236.00								No Emission Detected
9648.00								No Emission Detected
12060.00								No Emission Detected
14472.00								No Emission Detected
16884.00								No Emission Detected
19296.00								No Emission Detected
21708.00								No Emission Detected
24120.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC

Hopper

Model: FTW000123

Date: 07/29/2023

Lab: D

Tested By: Kyle Fujimoto

**Harmonics - Low Channel**

**Transmit Mode - Z-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4824.00	38.61	V	53.97	-15.36	Peak	310.00	159.56	
7236.00								No Emission Detected
9648.00								No Emission Detected
12060.00								No Emission Detected
14472.00								No Emission Detected
16884.00								No Emission Detected
19296.00								No Emission Detected
21708.00								No Emission Detected
24120.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW  
LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023

Lab: D

Tested By: Kyle Fujimoto

**Harmonics - Low Channel  
Transmit Mode - X-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4824.00	38.95	H	53.97	-15.02	Peak	257.50	127.38	
7236.00								No Emission Detected
9648.00								No Emission Detected
12060.00								No Emission Detected
14472.00								No Emission Detected
16884.00								No Emission Detected
19296.00								No Emission Detected
21708.00								No Emission Detected
24120.00								No Emission Detected

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ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023

Lab: D

Tested By: Kyle Fujimoto

**Harmonics - Low Channel**

**Transmit Mode - Y-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4824.00	38.05	H	53.97	-15.92	Peak	208.00	144.20	
7236.00								No Emission Detected
9648.00								No Emission Detected
12060.00								No Emission Detected
14472.00								No Emission Detected
16884.00								No Emission Detected
19296.00								No Emission Detected
21708.00								No Emission Detected
24120.00								No Emission Detected

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FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

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Model: FTW000123

**FCC 15.247**

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
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Tested By: Kyle Fujimoto

**Harmonics - Low Channel**

**Transmit Mode - Z-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4824.00	39.56	H	53.97	-14.41	Peak	115.00	111.26	
7236.00								No Emission Detected
9648.00								No Emission Detected
12060.00								No Emission Detected
14472.00								No Emission Detected
16884.00								No Emission Detected
19296.00								No Emission Detected
21708.00								No Emission Detected
24120.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
Lab: D  
Tested By: Kyle Fujimoto

**Harmonics - Middle Channel**

**Transmit Mode - X-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4874.00	38.43	V	53.97	-15.54	Peak	112.25	144.59	
7311.00	44.82	V	53.97	-9.15	Peak	326.00	238.79	
9748.00								No Emission
								Detected
12185.00								No Emission
								Detected
14622.00								No Emission
								Detected
17059.00								No Emission
								Detected
19496.00								No Emission
								Detected
21933.00								No Emission
								Detected
24370.00								No Emission
								Detected

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**COMPATIBLE  
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FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

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Model: FTW000123

**FCC 15.247**

FTW  
LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023

Lab: D

Tested By: Kyle Fujimoto

**Harmonics - Middle Channel  
Transmit Mode - Y-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4874.00	38.73	V	53.97	-15.24	Peak	276.25	127.26	
7311.00	44.51	V	53.97	-9.46	Peak	96.50	249.25	
9748.00								No Emission Detected
12185.00								No Emission Detected
14622.00								No Emission Detected
17059.00								No Emission Detected
19496.00								No Emission Detected
21933.00								No Emission Detected
24370.00								No Emission Detected

**Brea Division**  
114 Olinda Drive  
Brea, CA 92823  
(714) 579-0500

**Lake Forest Division**  
20621 Pascal Way  
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(949) 587-0400

**Newbury Park Division**  
1050 Lawrence Drive  
Newbury Park, CA 91320  
(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
Lab: D  
Tested By: Kyle Fujimoto

**Harmonics - Middle Channel**

**Transmit Mode - Z-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4874.00	41.59	V	53.97	-12.38	Peak	350.25	240.46	
7311.00	44.29	V	53.97	-9.68	Peak	206.25	206.85	
9748.00								No Emission
								Detected
12185.00								No Emission
								Detected
14622.00								No Emission
								Detected
17059.00								No Emission
								Detected
19496.00								No Emission
								Detected
21933.00								No Emission
								Detected
24370.00								No Emission
								Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
Lab: D  
Tested By: Kyle Fujimoto

**Harmonics - Middle Channel**

**Transmit Mode - X-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4874.00	38.14	H	53.97	-15.83	Peak	164.75	142.91	
7311.00	40.64	H	53.97	-13.33	Peak	149.25	223.44	
9748.00								No Emission
								Detected
12185.00								No Emission
								Detected
14622.00								No Emission
								Detected
17059.00								No Emission
								Detected
19496.00								No Emission
								Detected
21933.00								No Emission
								Detected
24370.00								No Emission
								Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
Lab: D  
Tested By: Kyle Fujimoto

**Harmonics - Middle Channel**

Transmit Mode - Y-Axis

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4874.00	42.57	H	53.97	-11.40	Peak	0.00	143.20	
7311.00	44.14	H	53.97	-9.83	Peak	161.25	222.91	
9748.00								No Emission Detected
12185.00								No Emission Detected
14622.00								No Emission Detected
17059.00								No Emission Detected
19496.00								No Emission Detected
21933.00								No Emission Detected
24370.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
Lab: D  
Tested By: Kyle Fujimoto

**Harmonics - Middle Channel**

**Transmit Mode - Z-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4874.00	39.07	H	53.97	-14.90	Peak	347.00	158.97	
7311.00	44.03	H	53.97	-9.94	Peak	114.25	111.26	
9748.00								No Emission Detected
12185.00								No Emission Detected
14622.00								No Emission Detected
17059.00								No Emission Detected
19496.00								No Emission Detected
21933.00								No Emission Detected
24370.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
Lab: D  
Tested By: Kyle Fujimoto

**Harmonics - High Channel**  
**Transmit Mode - X-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4924.00	42.10	V	53.97	-11.87	Peak	114.25	143.20	
7386.00	44.36	V	53.97	-9.61	Peak	79.50	223.44	
9848.00								No Emission Detected
12310.00	47.14	V	53.97	-6.83	Peak	351.00	111.32	
14772.00								No Emission Detected
17234.00								No Emission Detected
19696.00								No Emission Detected
22158.00								No Emission Detected
24620.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
Lab: D  
Tested By: Kyle Fujimoto

**Harmonics - High Channel**  
**Transmit Mode - Y-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4924.00	38.28	V	53.97	-15.69	Peak	280.50	249.07	
7386.00	43.83	V	53.97	-10.14	Peak	74.00	111.20	
9848.00								No Emission Detected
12310.00	46.78	V	53.97	-7.19	Peak	176.50	191.44	
14772.00								No Emission Detected
17234.00								No Emission Detected
19696.00								No Emission Detected
22158.00								No Emission Detected
24620.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
Lab: D  
Tested By: Kyle Fujimoto

**Harmonics - High Channel**  
**Transmit Mode - Z-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4924.00	41.49	V	53.97	-12.48	Peak	329.75	111.26	
7386.00	43.93	V	53.97	-10.04	Peak	115.75	159.08	
9848.00								No Emission Detected
12310.00	47.08	V	53.97	-6.89	Peak	140.25	239.14	
14772.00								No Emission Detected
17234.00								No Emission Detected
19696.00								No Emission Detected
22158.00								No Emission Detected
24620.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
Lab: D  
Tested By: Kyle Fujimoto

**Harmonics - High Channel**  
**Transmit Mode - X-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4924.00	39.50	H	53.97	-14.47	Peak	227.75	207.26	
7386.00	44.01	H	53.97	-9.96	Peak	153.00	191.14	
9848.00								No Emission Detected
12310.00	47.28	H	53.97	-6.69	Peak	218.75	127.08	
14772.00								No Emission Detected
17234.00								No Emission Detected
19696.00								No Emission Detected
22158.00								No Emission Detected
24620.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
Lab: D  
Tested By: Kyle Fujimoto

**Harmonics - High Channel**  
**Transmit Mode - Y-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4924.00	43.47	H	53.97	-10.50	Peak	6.25	158.61	
7386.00	42.01	H	53.97	-11.96	Peak	319.50	206.49	
9848.00								No Emission Detected
12310.00	47.37	H	53.97	-6.60	Peak	208.50	249.95	
14772.00								No Emission Detected
17234.00								No Emission Detected
19696.00								No Emission Detected
22158.00								No Emission Detected
24620.00								No Emission Detected

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

**FCC 15.247**

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
Lab: D  
Tested By: Kyle Fujimoto

**Harmonics - High Channel**  
**Transmit Mode - Z-Axis**

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
4924.00	39.88	H	53.97	-14.09	Peak	336.75	175.14	
7386.00	43.86	H	53.97	-10.11	Peak	288.50	127.44	
9848.00								No Emission Detected
12310.00	46.82	H	53.97	-7.15	Peak	0.50	223.20	
14772.00								No Emission Detected
17234.00								No Emission Detected
19696.00								No Emission Detected
22158.00								No Emission Detected
24620.00								No Emission Detected

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# COMPATIBLE ELECTRONICS

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

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Hopper  
Model: FTW000123

FCC 15.247 and FCC Class B

FTW LLC

## Hopper

Model: FTW000123

Date: 07/29/2023

## Lab: D

Tested By: Kyle Fujimoto

## Non Harmonic Emissions from the Tx and Digital Portion - 9 kHz to 30 MHz

## Non Harmonic Emissions from the Tx and Digital Portion - 1 GHz to 25 GHz

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Newbury Park, CA 91320  
(805) 480-4044**



FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Report Number: B30731D1  
Hopper  
Model: FTW000123

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***BAND EDGES – BLE MODE  
DATA SHEETS***

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# COMPATIBLE ELECTRONICS

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Report Number: B30731D1

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Hopper  
Model: FTW000123

FCC 15.247

FTW LLC

## Hopper

Model: FTW000123

Date: 07/29/2023

## Lab: D

Tested By: Kyle Fujimoto

## Band Edges



# COMPATIBLE ELECTRONICS

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Report Number: B30731D1

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## Hopper

Model: FTW000123

FCC 15.247

FTW LLC  
Hopper  
Model: FTW000123

Date: 07/29/2023  
Lab: D  
Tested By: Kyle Fujimoto

## Band Edges

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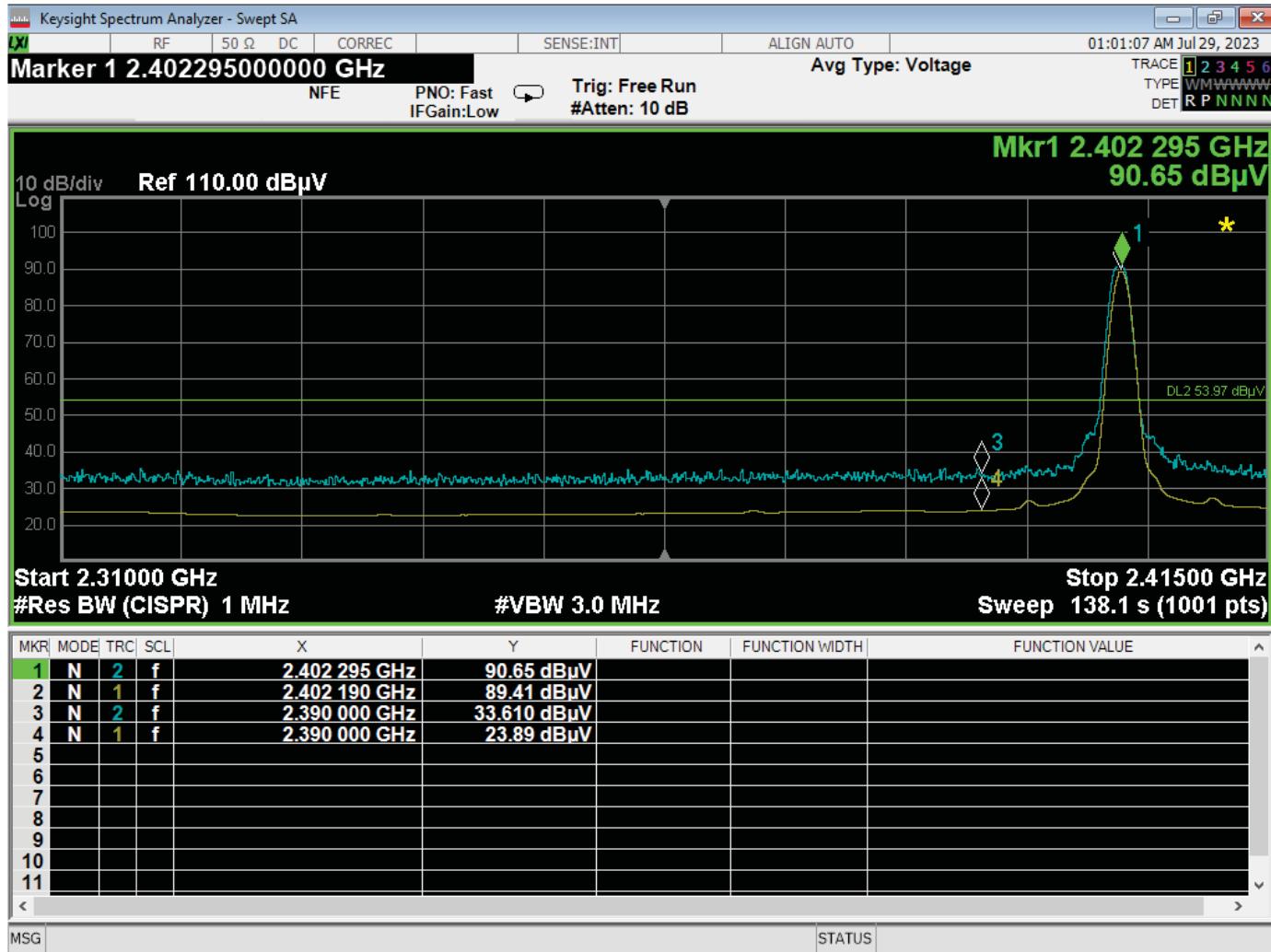
**Newbury Park Division  
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



Band Edge at 2402 MHz - Horizontal - X-Axis - BLE

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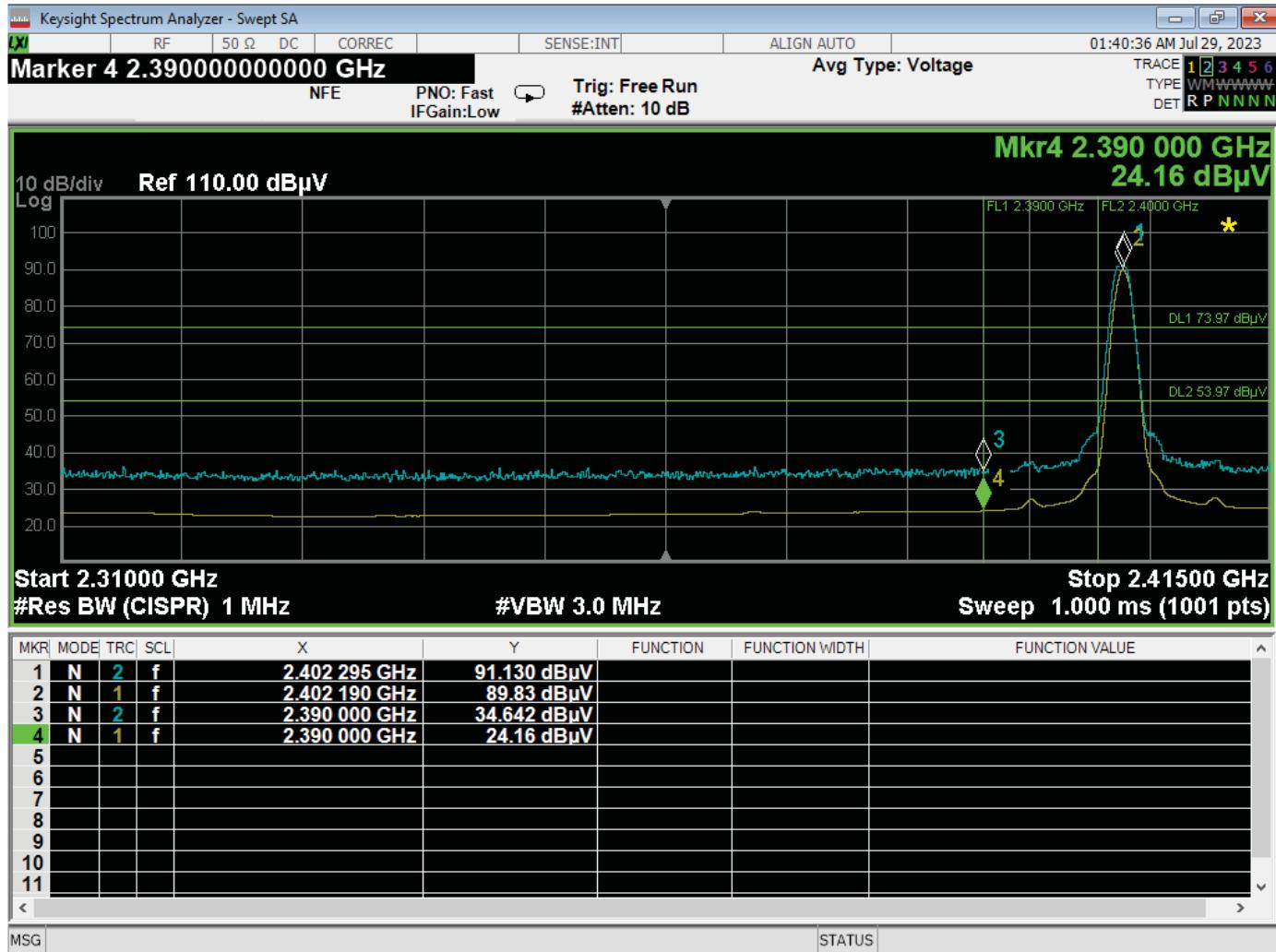
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



Band Edge at 2402 MHz - Vertical - X-Axis - BLE

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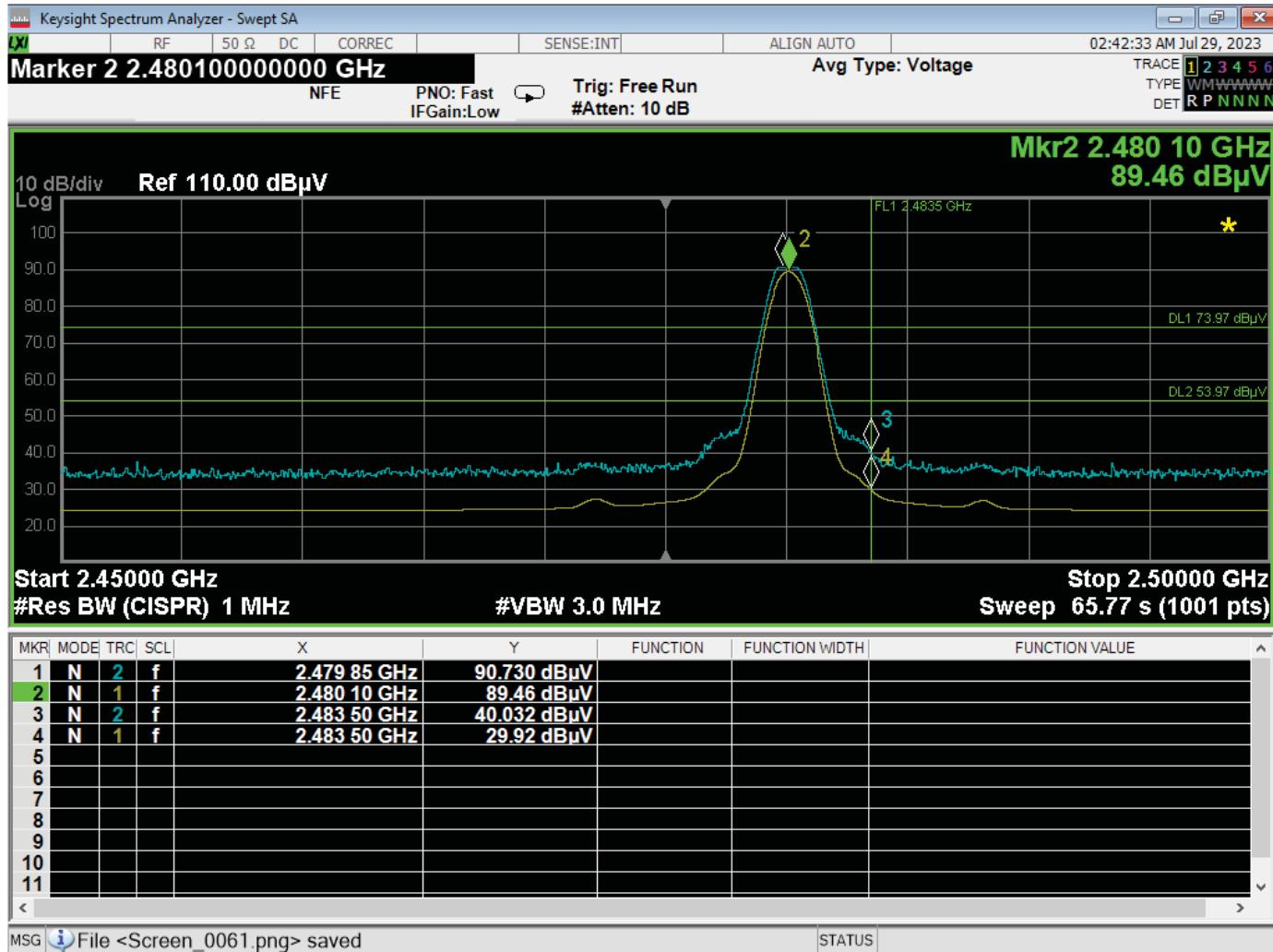
**Newbury Park Division**  
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



Band Edge at 2480 MHz - Horizontal - X-Axis - BLE

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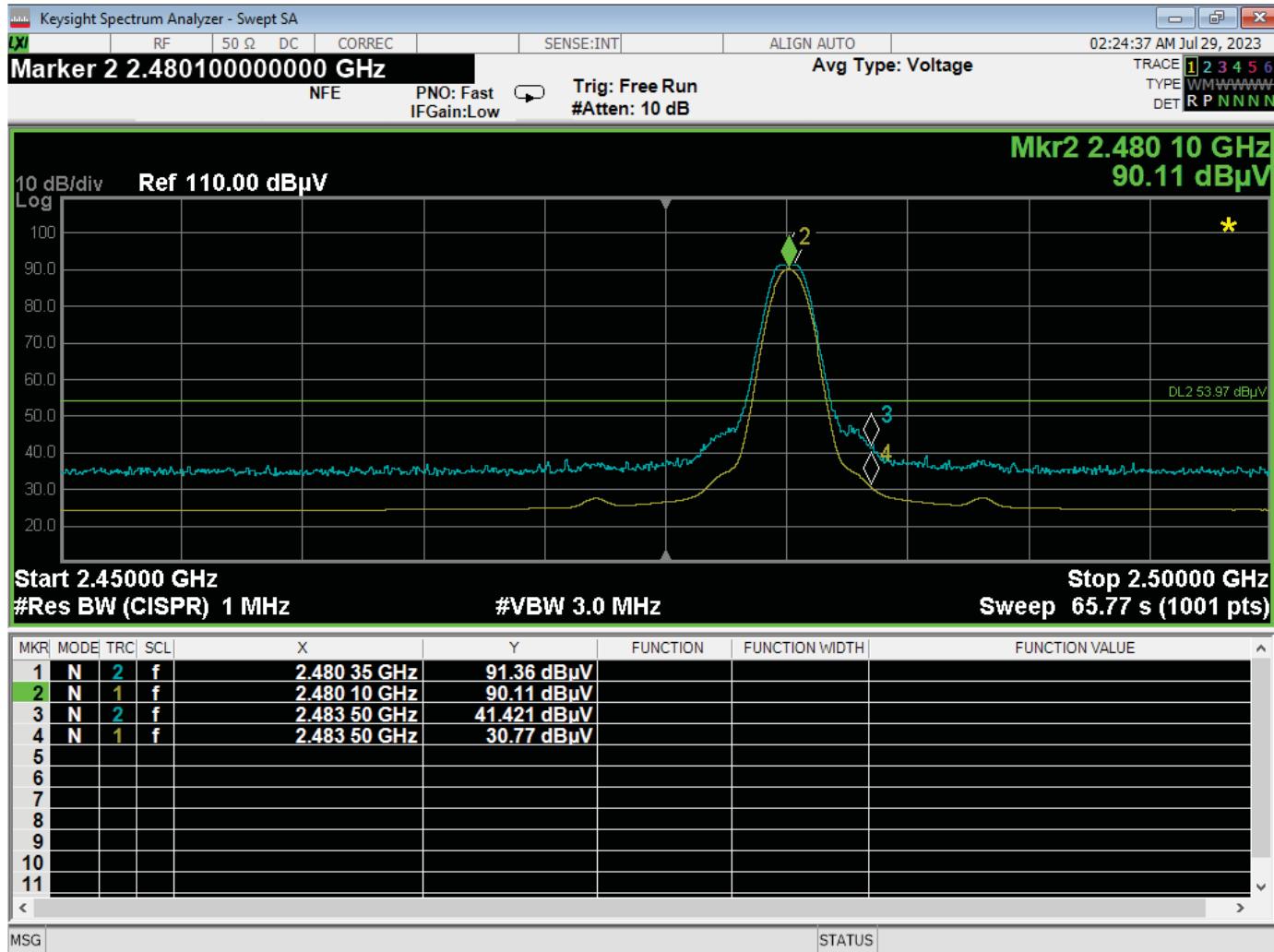
**Newbury Park Division**  
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



Band Edge at 2480 MHz - Vertical - Y-Axis - BLE

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper

Model: FTW000123

***BAND EDGES – WiFi MODE  
DATA SHEETS***

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# COMPATIBLE ELECTRONICS

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Report Number: B30731D1

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# Hopper Model: FTW000123

FCC 15.247

FTW LLC

## Hopper

Model: FTW000123

Date: 07/29/2023

## Lab: D

Tested By: Kyle Fujimoto

## Band Edges



# TEC Part 13 **COMPATIBLE ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Report Number: **B30731D1**

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## Hopper

Model: FTW000123

FCC 15.247

FTW LLC

## Hopper

Model: FTW000123

Date: 07/29/2023

## Lab: D

Tested By: Kyle Fujimoto

## Band Edges

**Brea Division  
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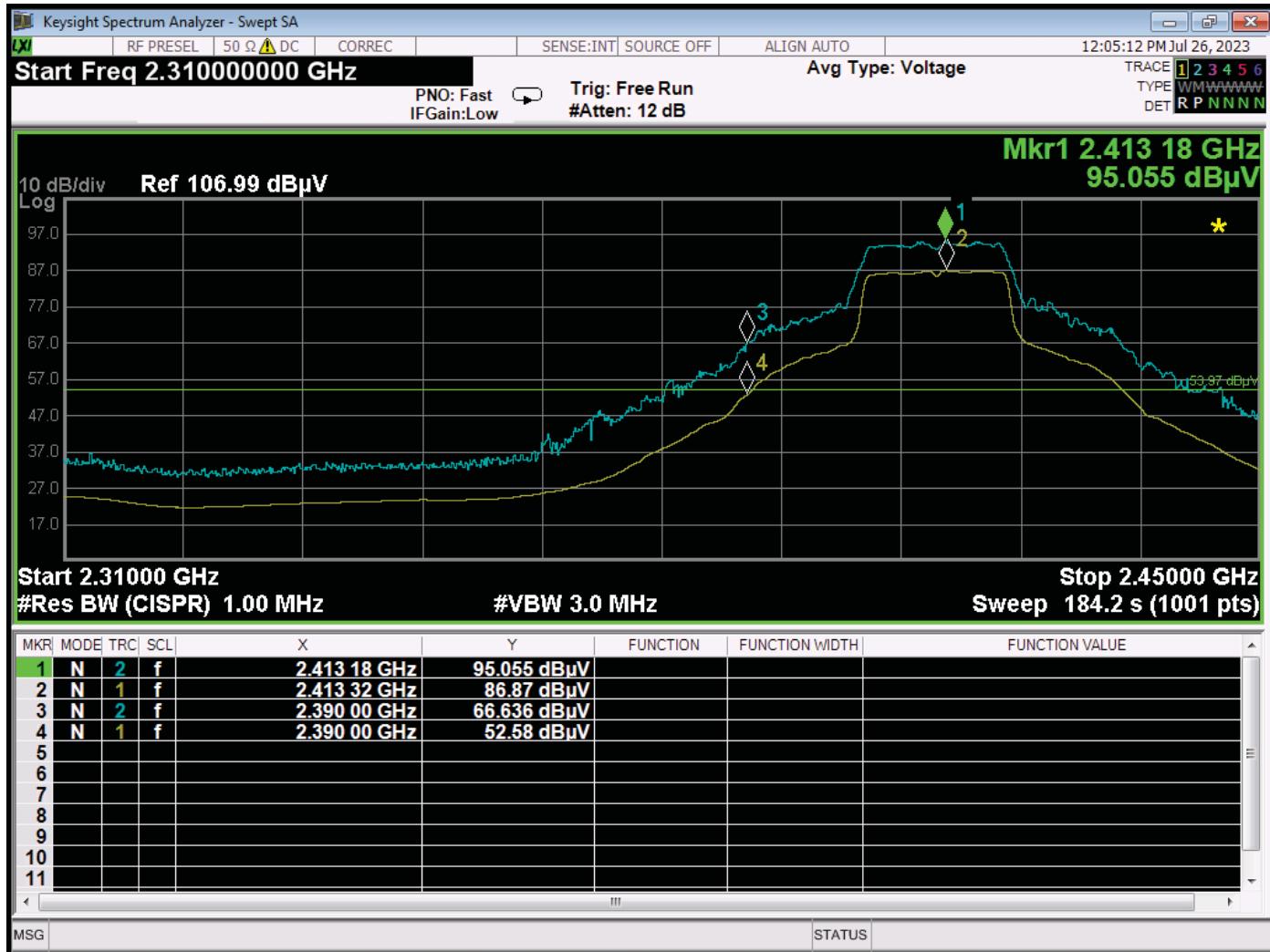
**Newbury Park Division  
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



Band Edge - 2412 MHz - Horizontal - X-Axis - WiFi

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(949) 587-0400

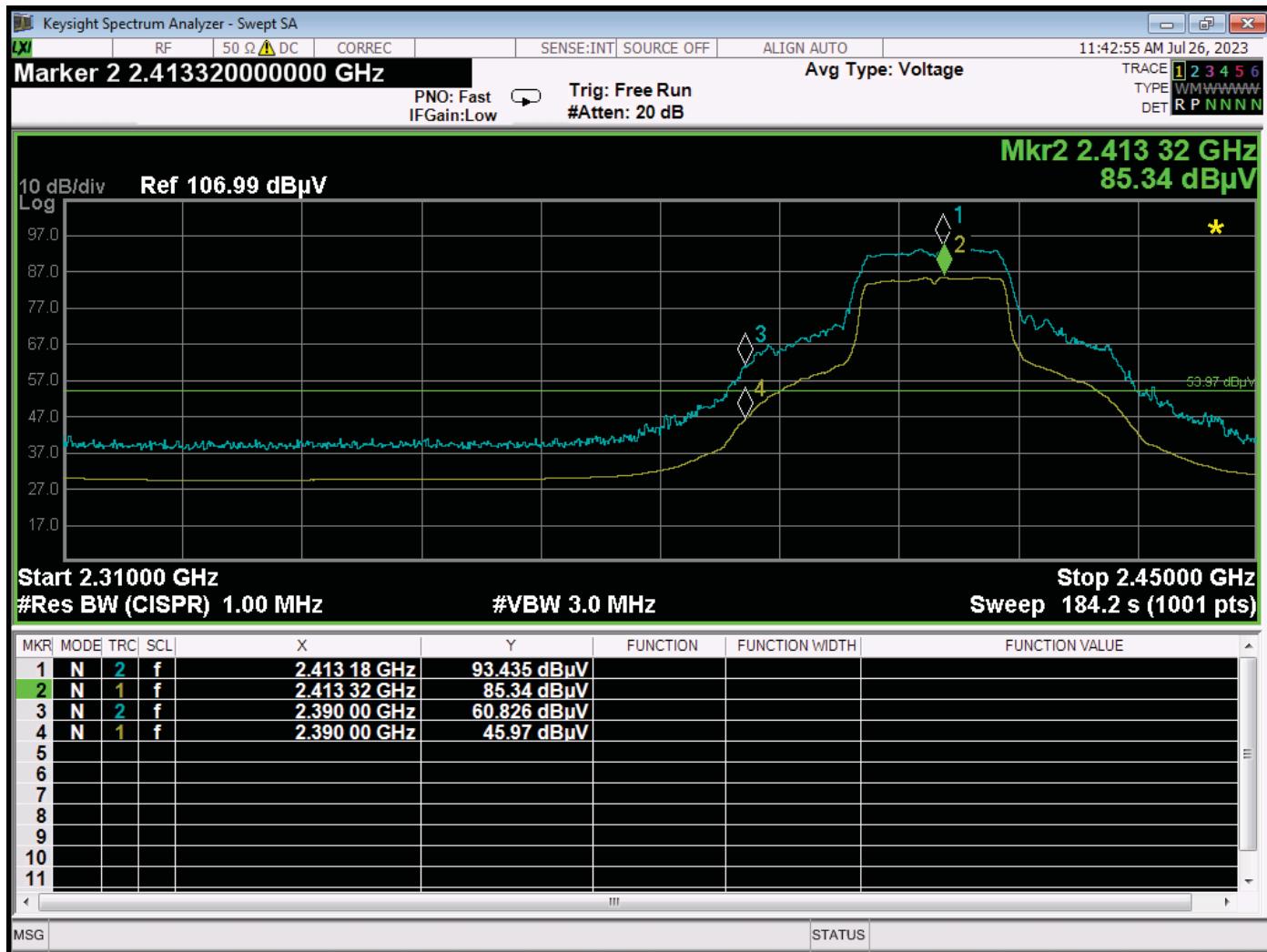
**Newbury Park Division**  
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



Band Edge - 2412 MHz - Vertical - Y-Axis - WiFi

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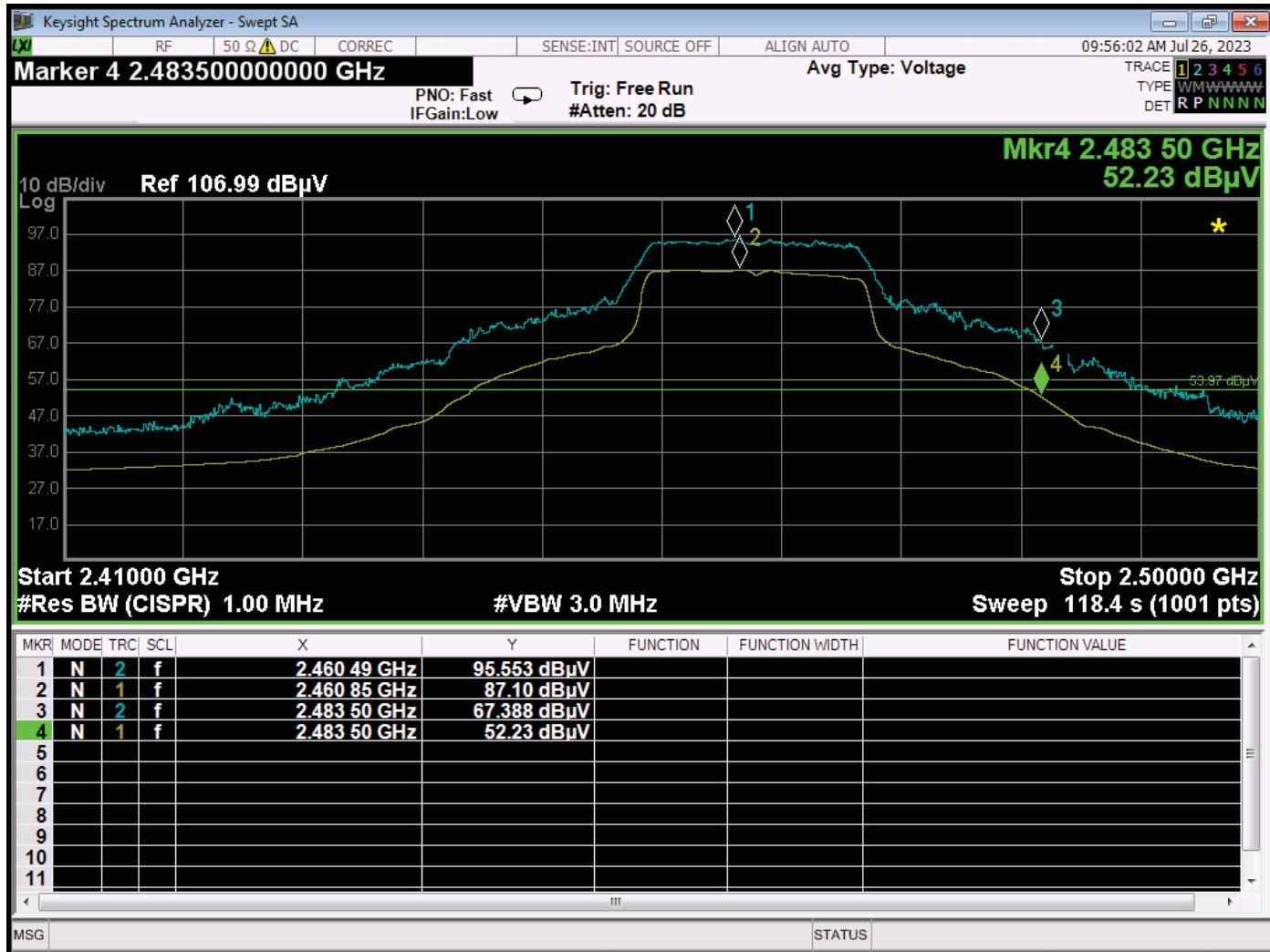
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



Band Edge - 2462 MHz - Horizontal -X-Axis - WiFi

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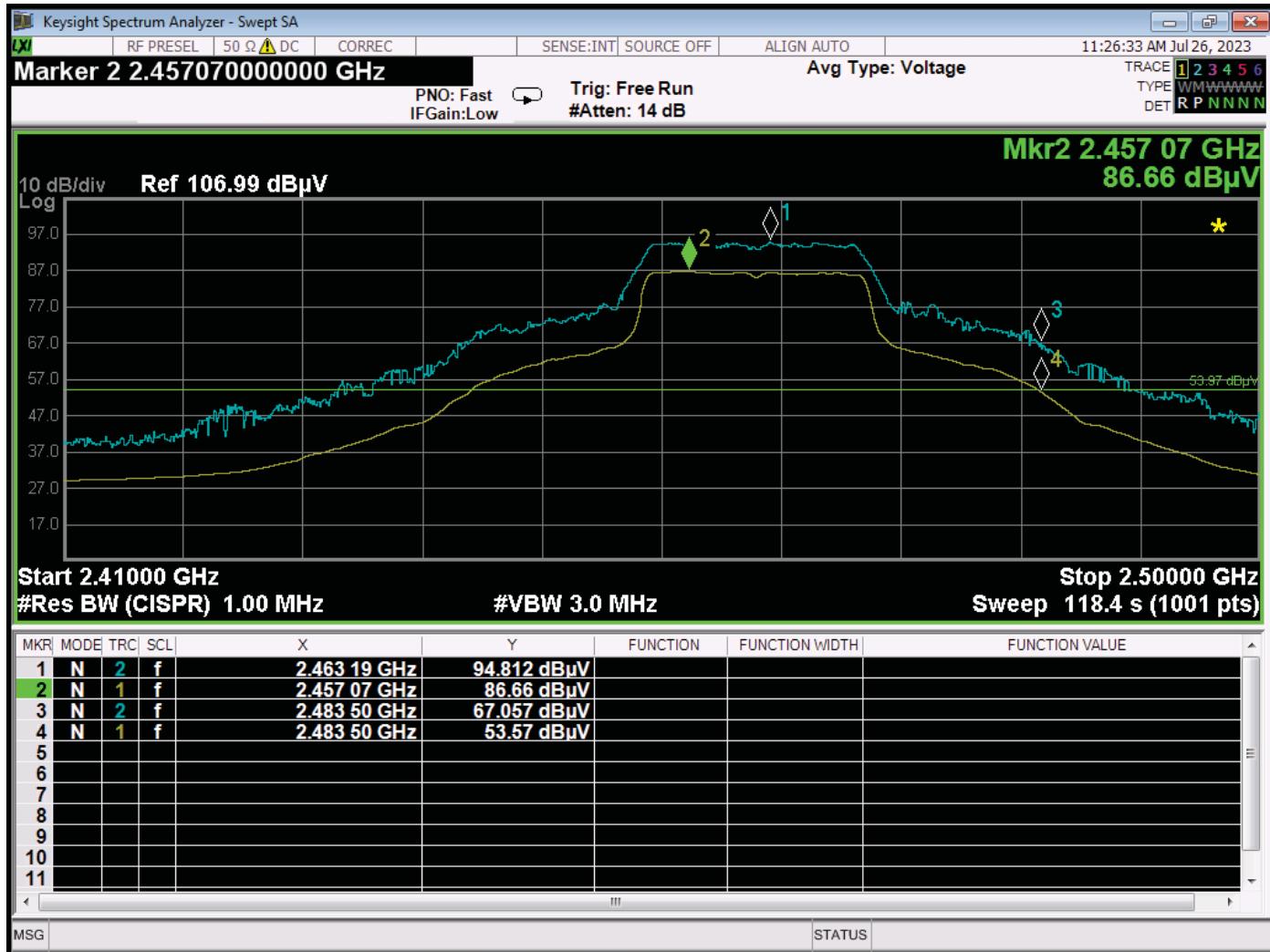
**Newbury Park Division**  
1050 Lawrence Drive  
Newbury Park, CA 91320  
(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



Band Edge - 2462 MHz - Vertical - Y-Axis - WiFi

**Brea Division**  
114 Olinda Drive  
Brea, CA 92823  
(714) 579-0500

**Lake Forest Division**  
20621 Pascal Way  
Lake Forest, CA 92630  
(949) 587-0400

**Newbury Park Division**  
1050 Lawrence Drive  
Newbury Park, CA 91320  
(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper

Model: FTW000123

***BAND EDGES  
CONDUCTED  
2402 MHz at 2400 MHz  
BLE DATA SHEETS***

---

**Brea Division**  
114 Olinda Drive  
Brea, CA 92823  
(714) 579-0500

**Lake Forest Division**  
20621 Pascal Way  
Lake Forest, CA 92630  
(949) 587-0400

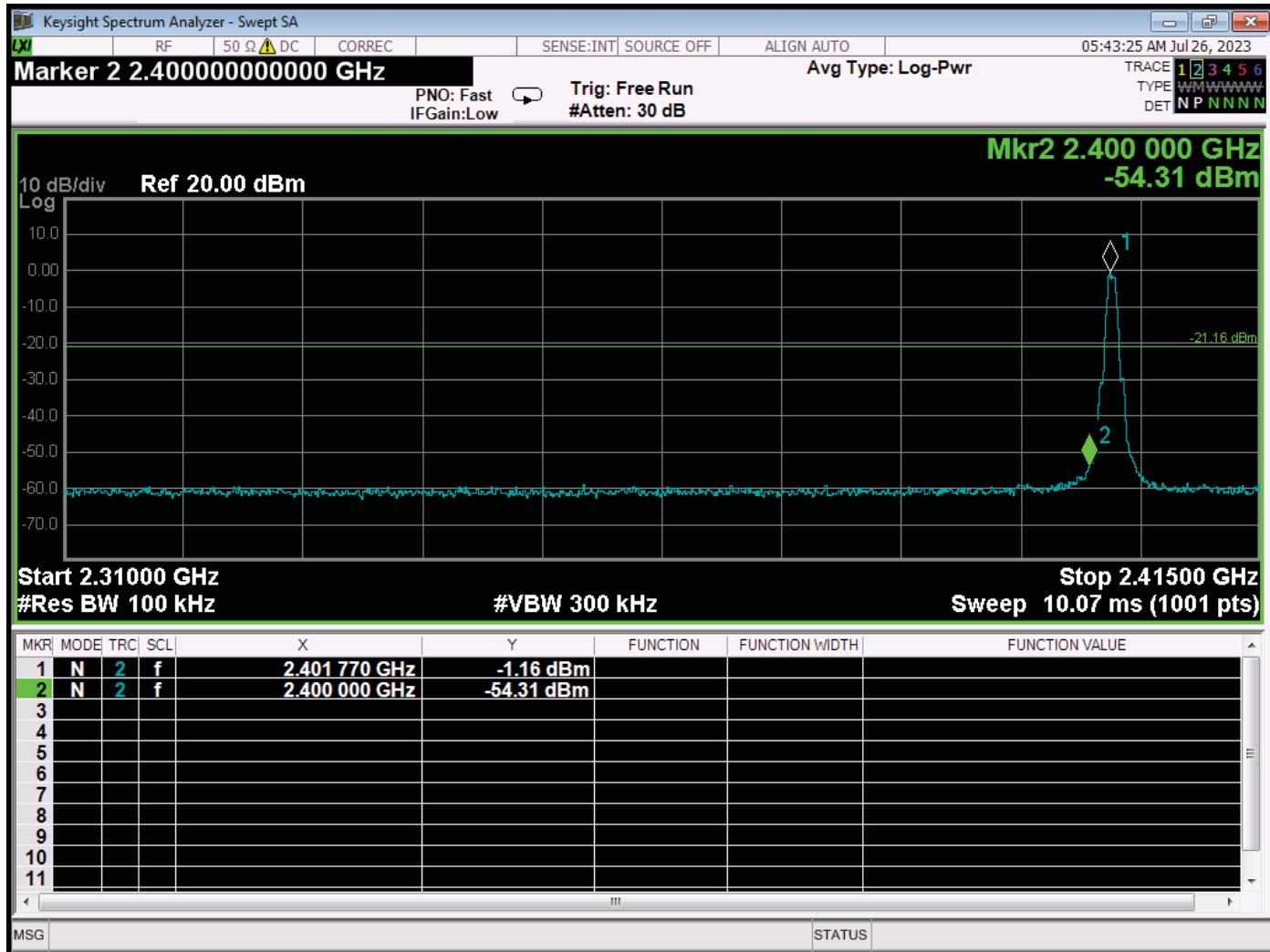
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Newbury Park, CA 91320  
(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



Band Edge at 2400 MHz - 2402 MHz - BLE - Drone - Conducted

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**Lake Forest Division**  
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**Newbury Park Division**  
1050 Lawrence Drive  
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(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper

Model: FTW000123

***BAND EDGES  
CONDUCTED  
2412 MHz at 2400 MHz  
WIFI MODE DATA SHEETS***

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**Lake Forest Division**  
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Lake Forest, CA 92630  
(949) 587-0400

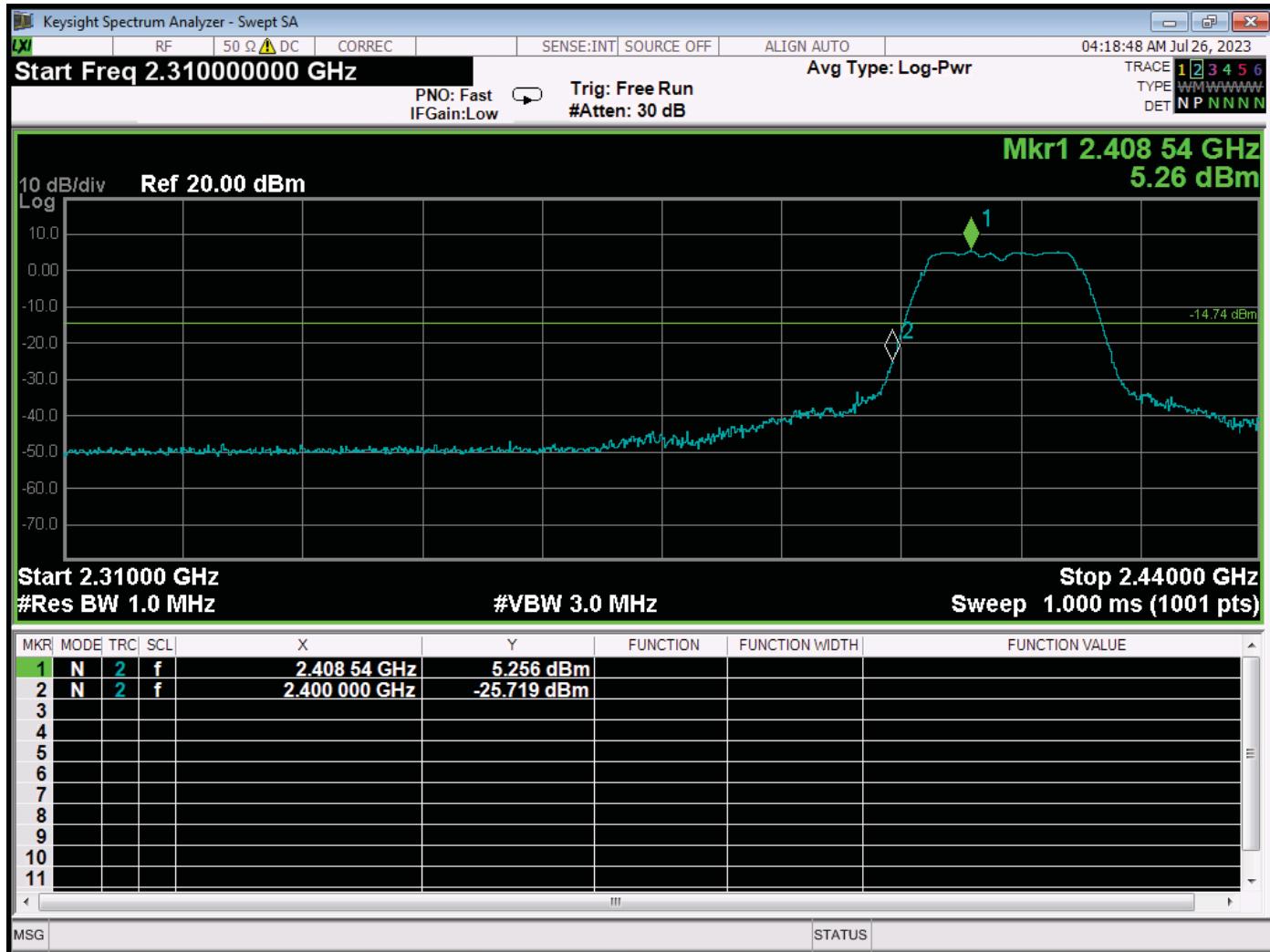
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



Band Edge at 2400 MHz - 2412 MHz - WiFi - Conducted

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**Newbury Park Division**  
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(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper

Model: FTW000123

***DTS BANDWIDTH  
BLE MODE DATA SHEETS***

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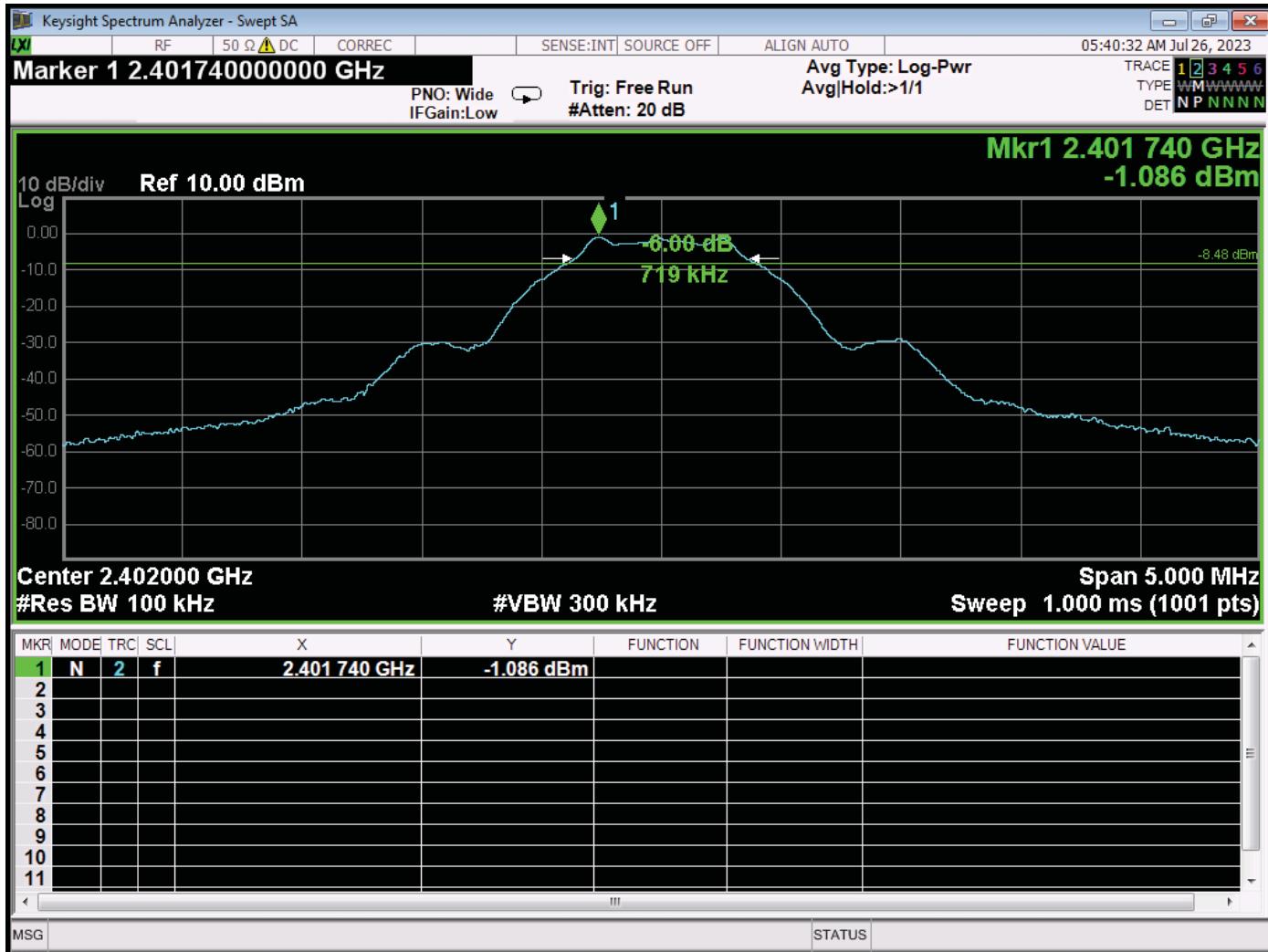
**Newbury Park Division**  
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(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



Bandwidth 6 dB – 2402 MHz – Drone

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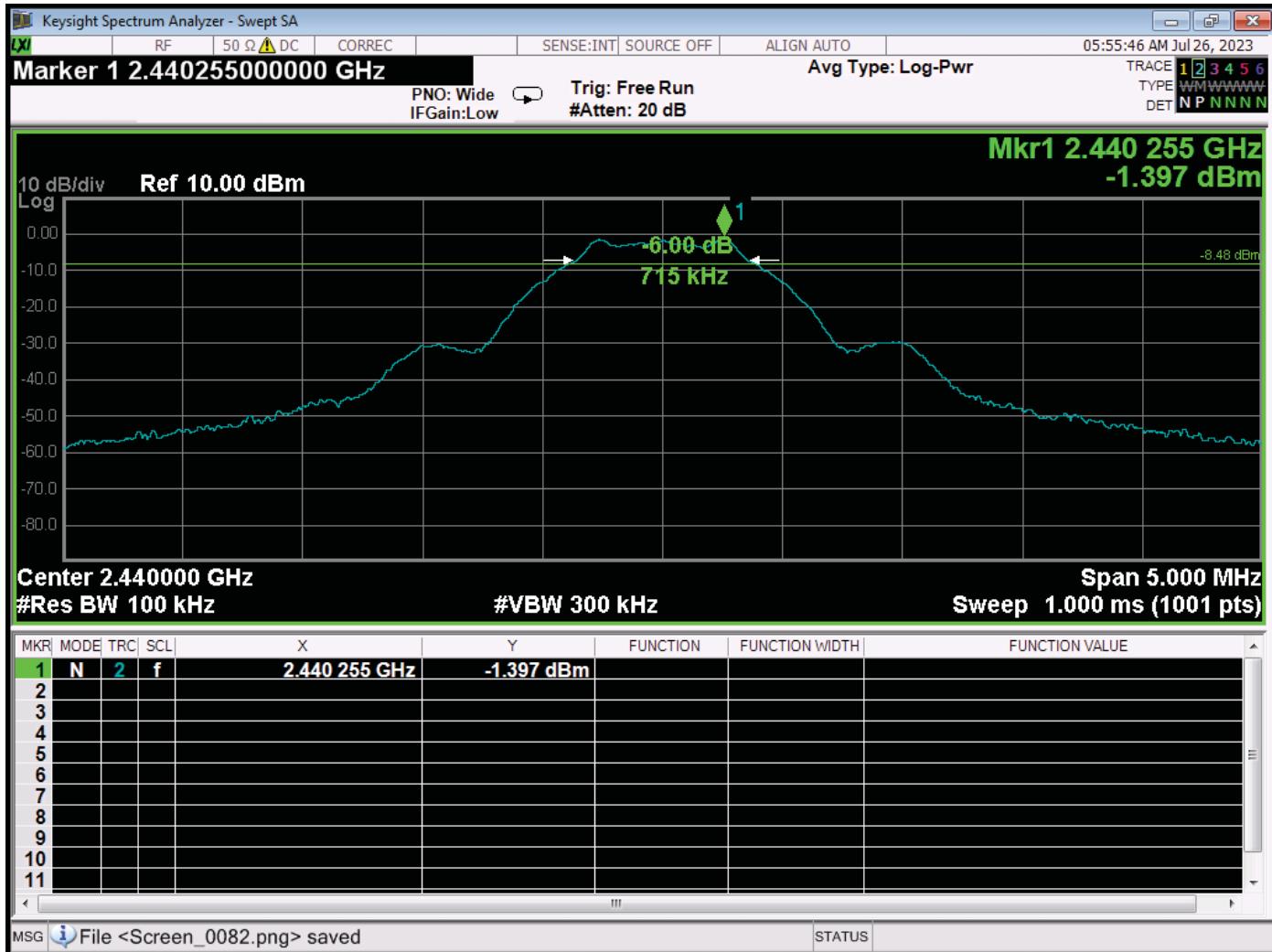
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



Bandwidth 6 dB – 2440 MHz – Drone

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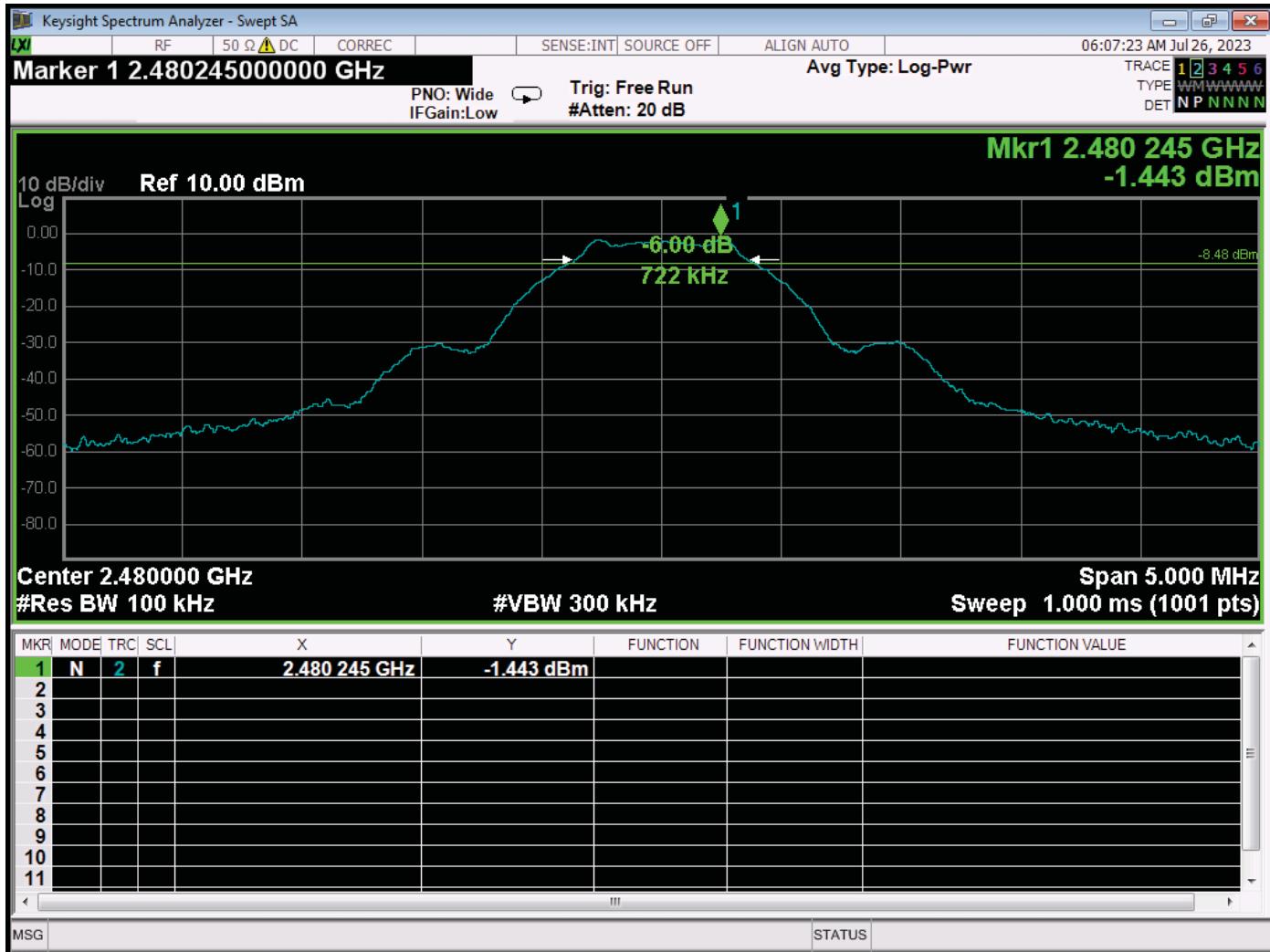
**Newbury Park Division**  
1050 Lawrence Drive  
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(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



Bandwidth 6 dB – 2480 MHz – Drone

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FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Report Number: B30731D1

Hopper  
Model: FTW000123

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*DTS BANDWIDTH*  
*WIFI MODE DATA SHEETS*

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



Bandwidth 6 dB – 2412 MHz – Drone

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(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



Bandwidth 6 dB – 2437 MHz – Drone

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(805) 480-4044



# COMPATIBLE ELECTRONICS



Bandwidth 6 dB = 2462 MHz = Drone



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper

Model: FTW000123

***PEAK OUTPUT POWER  
BLE MODE DATA SHEETS***

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**Lake Forest Division**  
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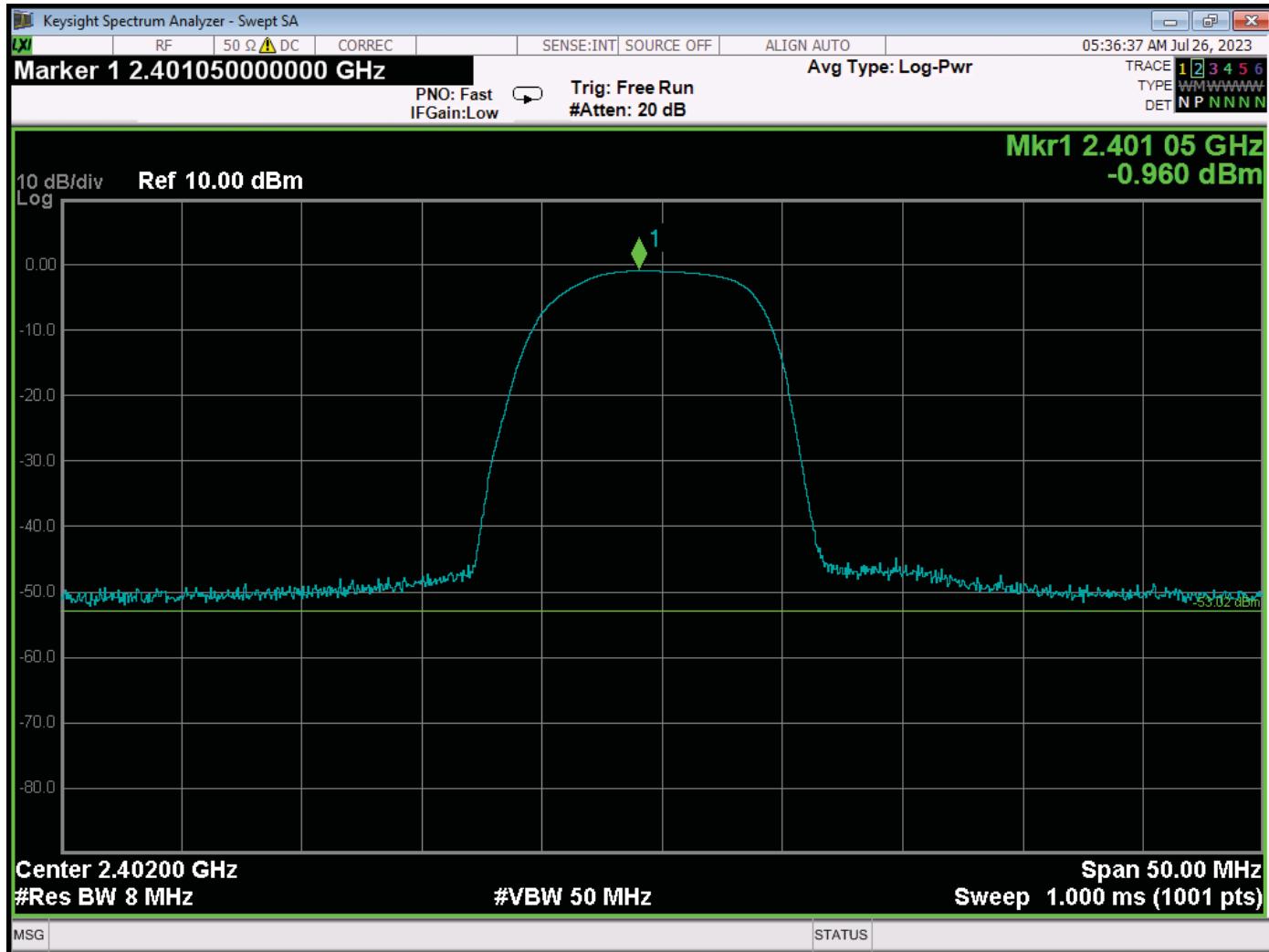
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



Peak Power Output - 2402 MHz - BLE – Drone - -0.960 dBm

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20621 Pascal Way  
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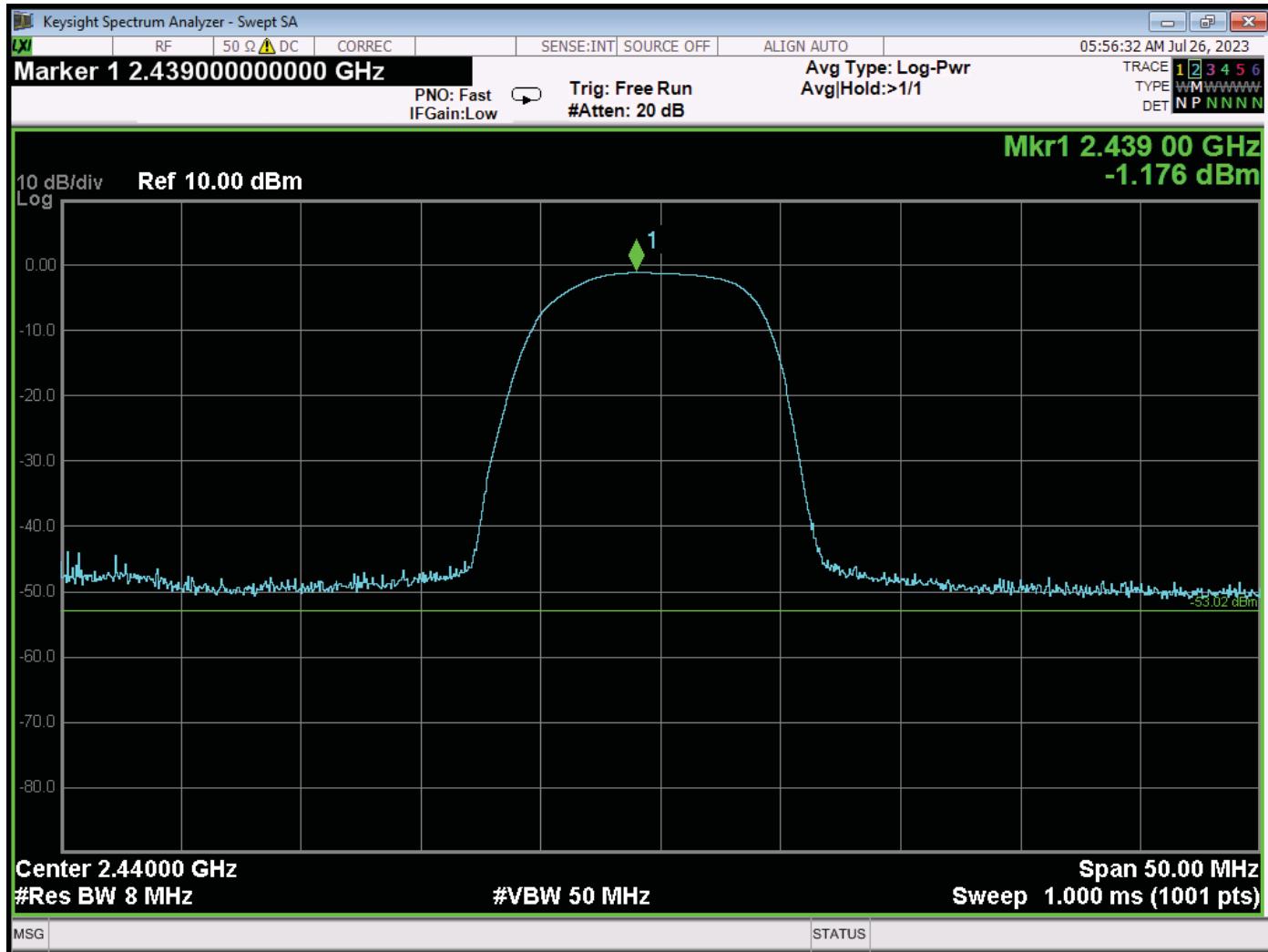
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



Peak Power Output - 2402 MHz - BLE - Drone - -1.176 dBm

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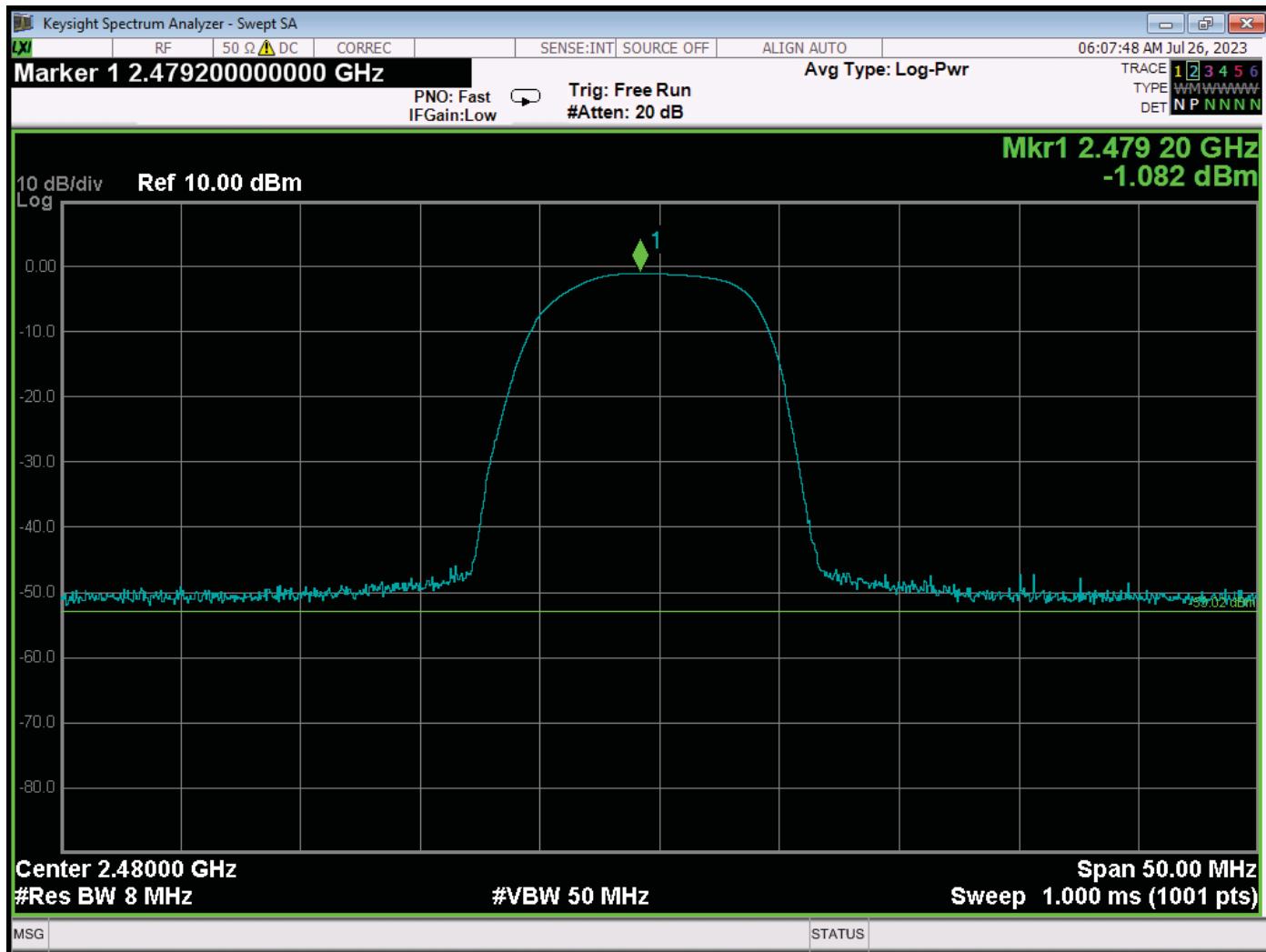
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



Peak Power Output - 2480 MHz - BLE - Drone - -1.0823 dBm

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper

Model: FTW000123

***PEAK OUTPUT POWER  
WIFI DATA SHEETS***

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

## PEAK OUTPUT POWER

FTW LLC

HOPPER

MODEL: FTW000123

## WiFi MODE

FREQUENCY (dBm)	PEAK POWER (dBm)	LIMIT (dB)	MARGIN (dB)
2412	16.67	30.00	-13.33
2437	16.86	30.00	-13.14
2462	17.51	30.00	-12.49

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper

Model: FTW000123

***SPECTRAL DENSITY OUTPUT  
BLE MODE DATA SHEETS***

---

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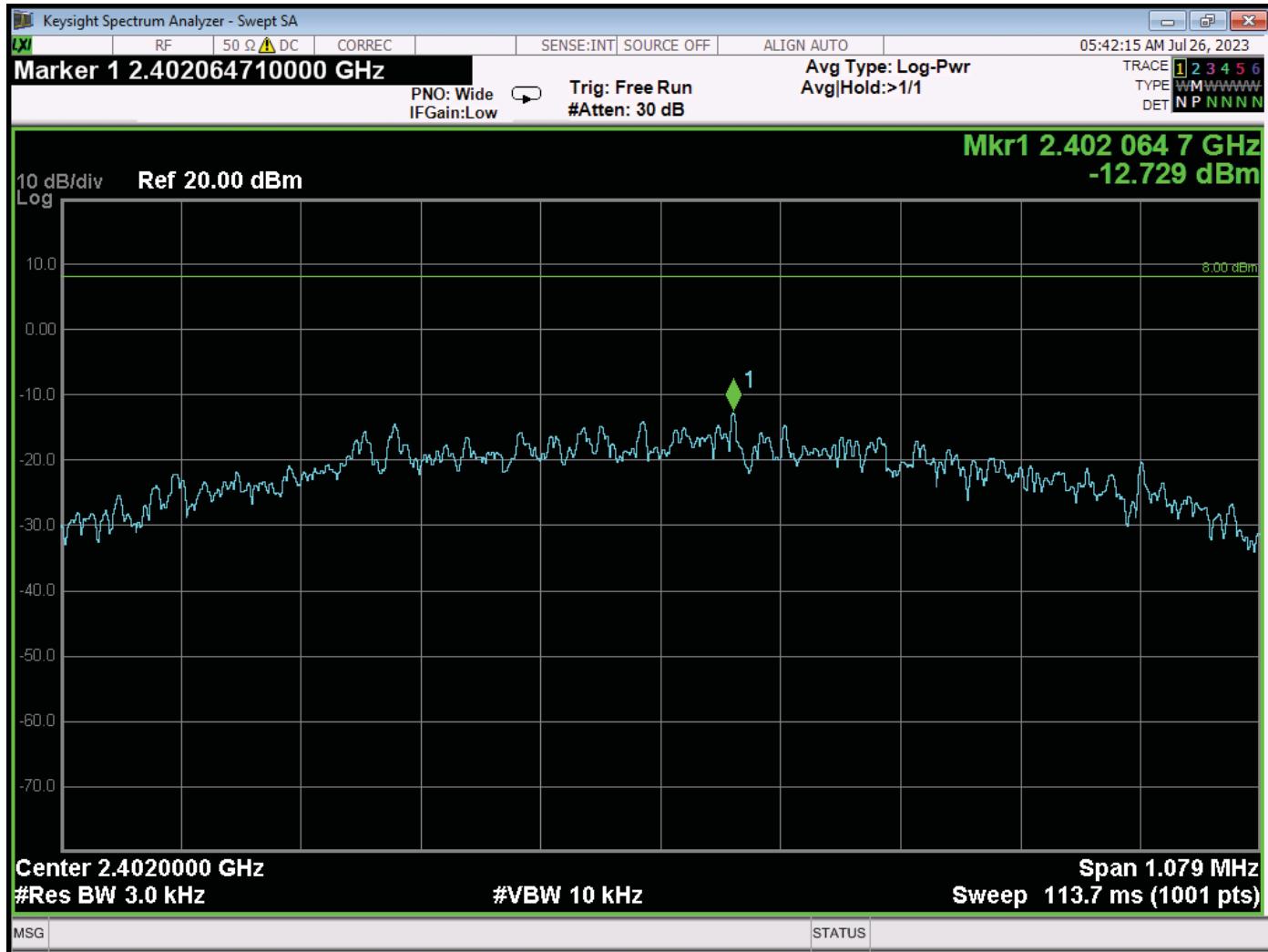
**Newbury Park Division**  
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



Special Density Output - 2402 MHz - BLE - Drone - -12.729 dBm

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(949) 587-0400

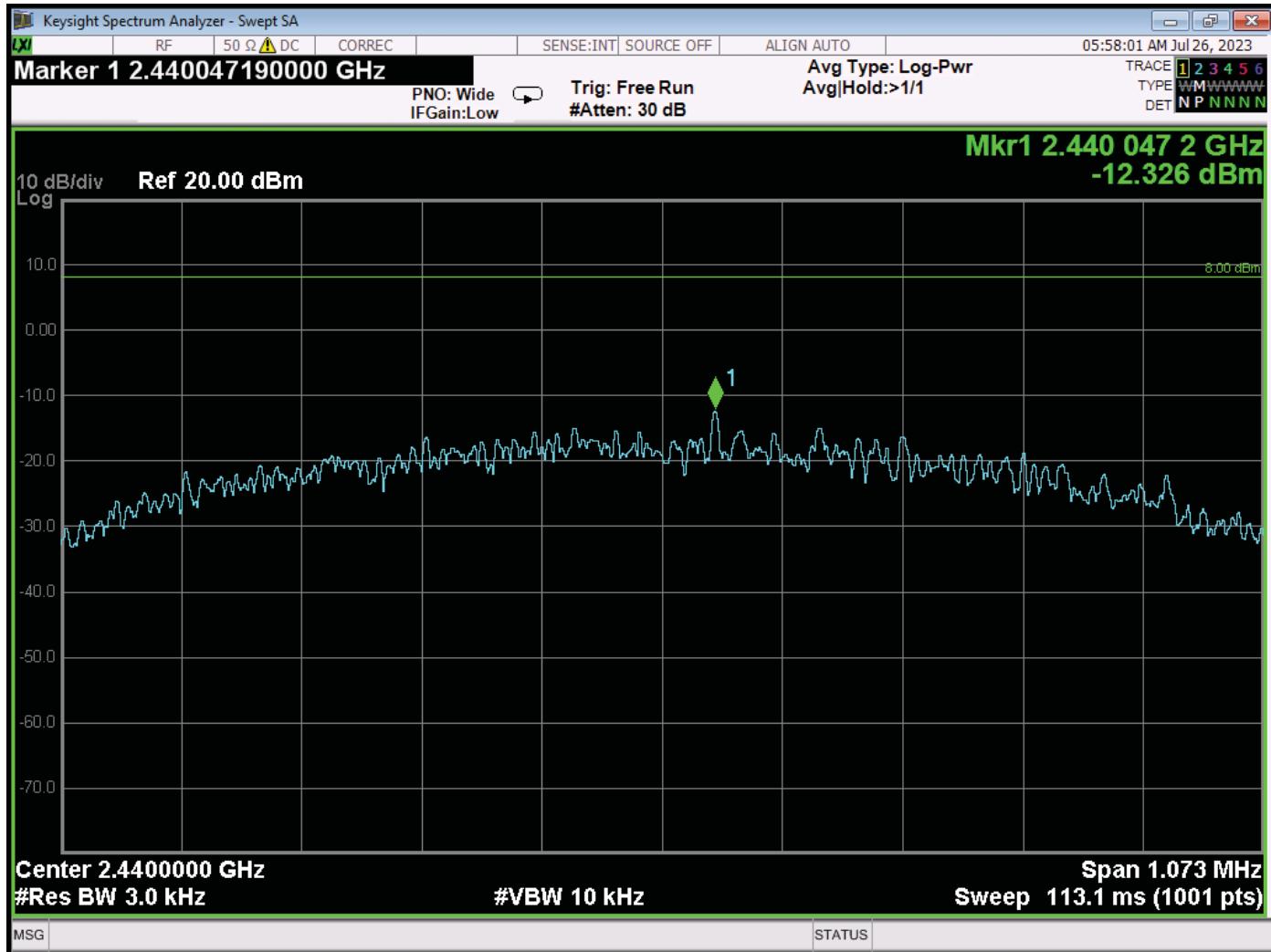
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(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



Special Density Output - 2440 MHz - BLE - Drone - -12.326 dBm

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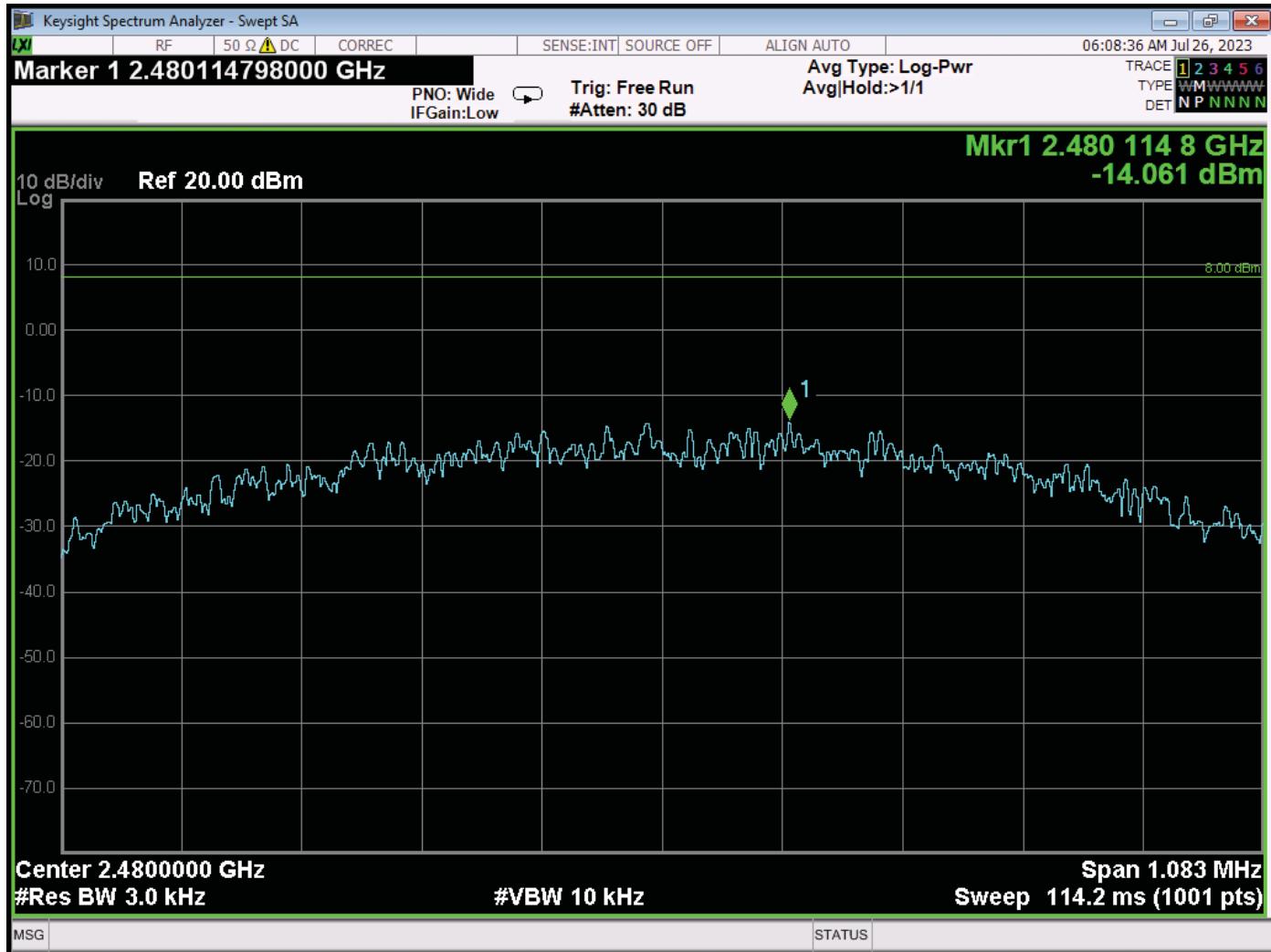
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



Special Density Output - 2480 MHz - BLE - Drone - -14.061 dBm

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper

Model: FTW000123

***SPECTRAL DENSITY OUTPUT  
WIFI MODE DATA SHEETS***

---

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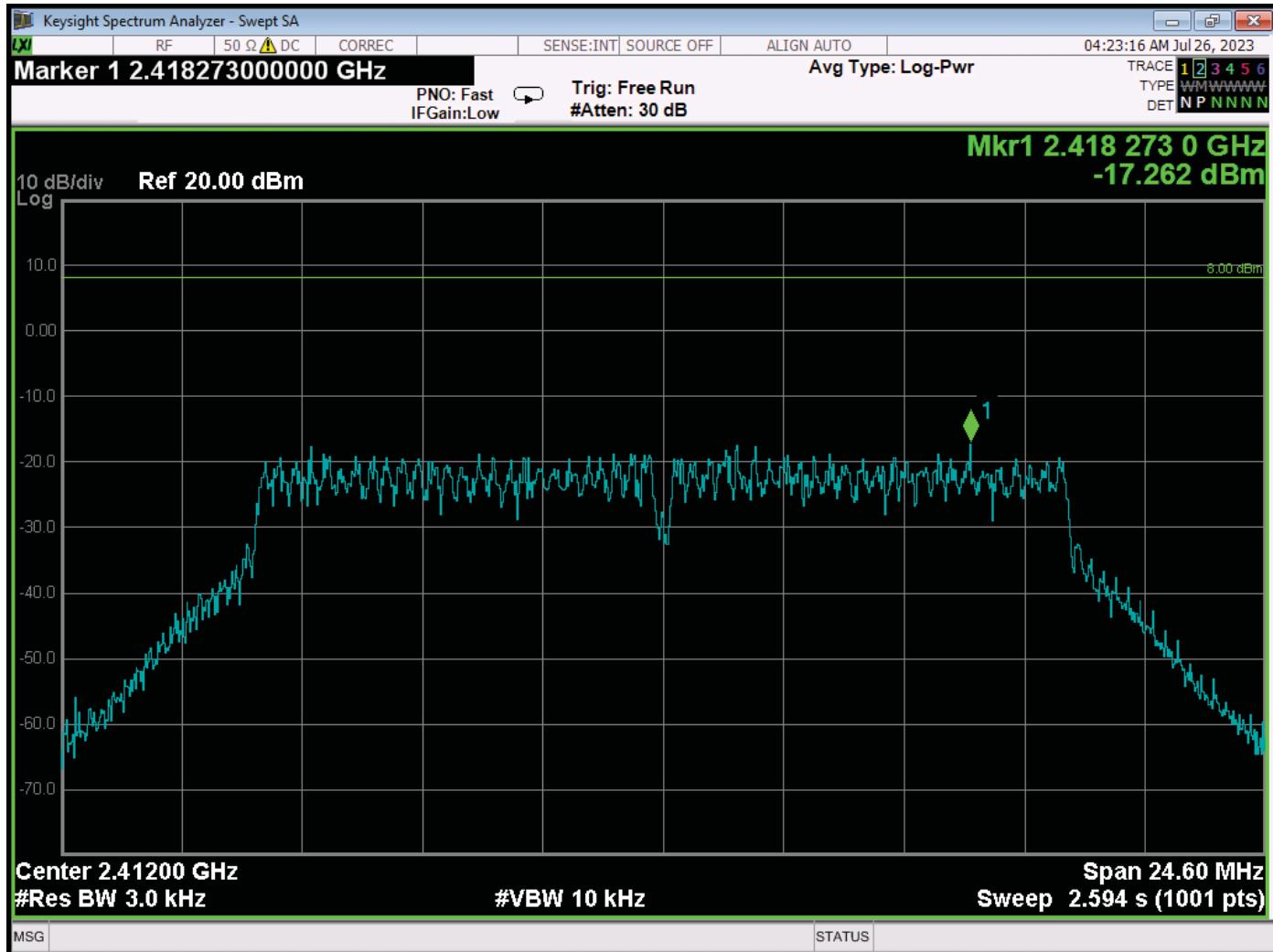
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



Special Density Output - 2412 MHz - WiFi - Drone - -17.262 dBm

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**Lake Forest Division**  
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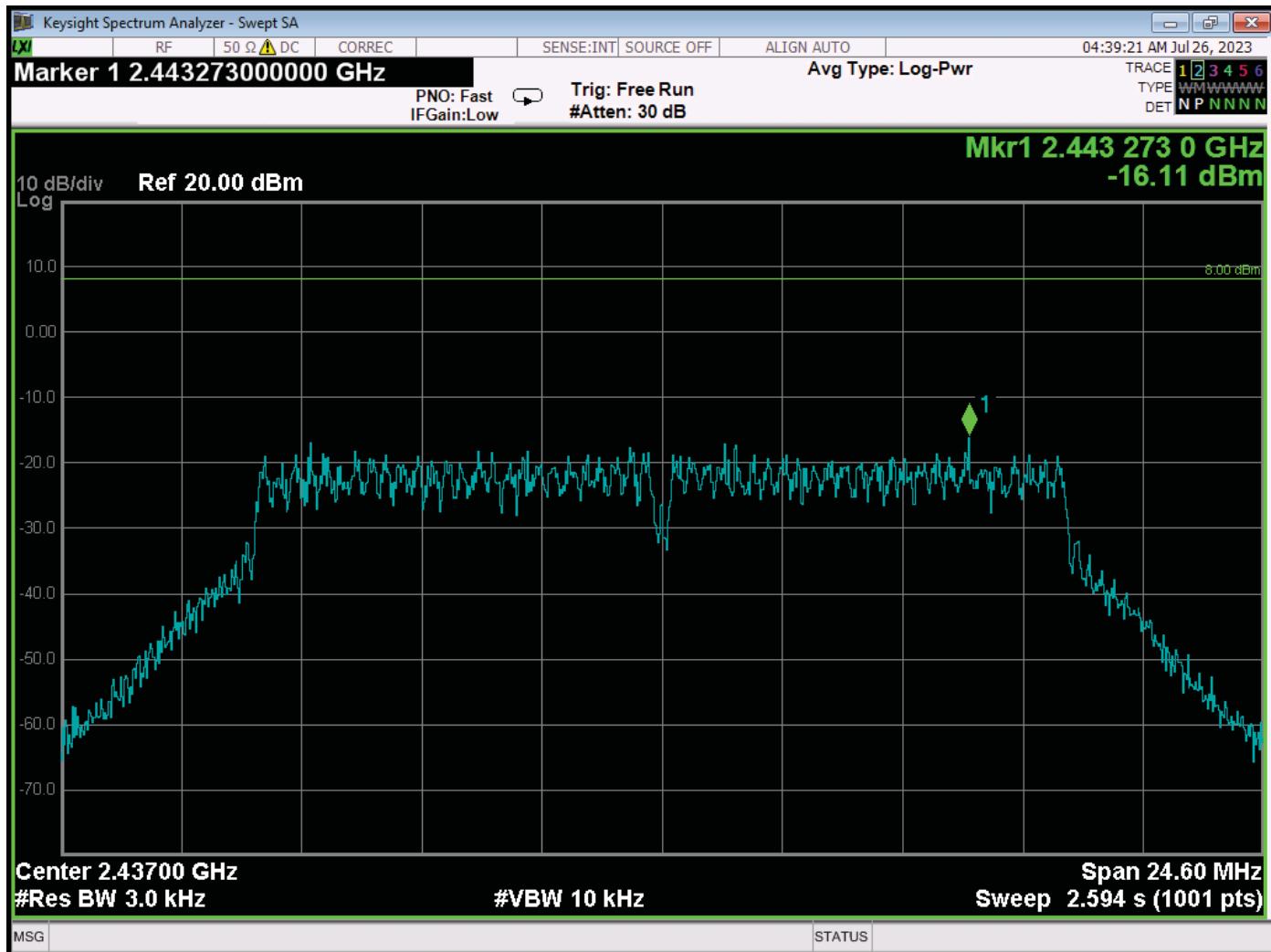
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



Special Density Output - 2437 MHz - WiFi - Drone - -16.110 dBm

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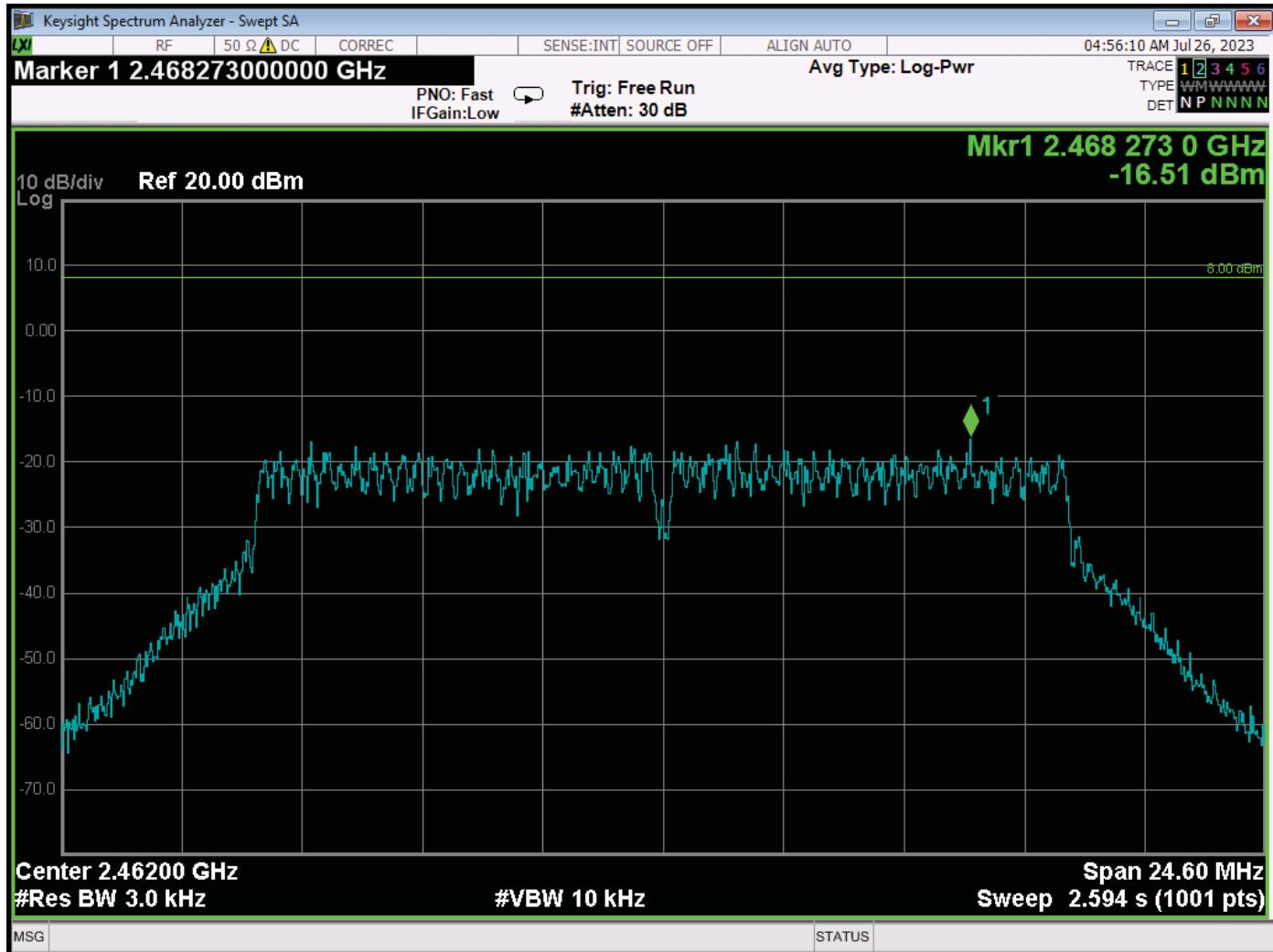
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



Special Density Output - 2462 MHz - WiFi - Drone - -16.510 dBm

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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper

Model: FTW000123

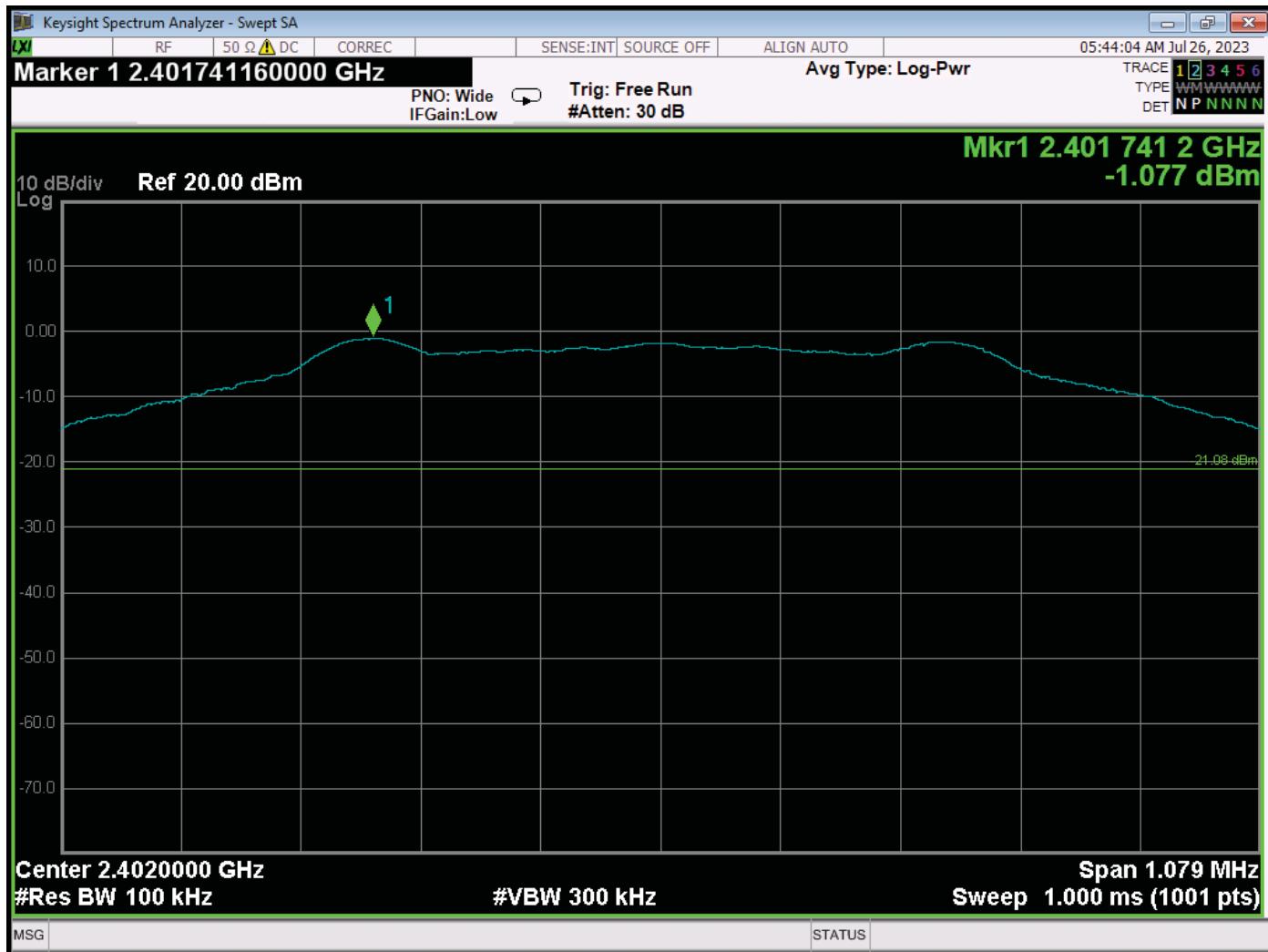
***RF ANTENNA CONDUCTED  
BLE DATA SHEETS***

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RF Antenna Conducted Test – Low Channel – Reference Level – BLE

**Brea Division**  
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**Lake Forest Division**  
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**(949) 587-0400**

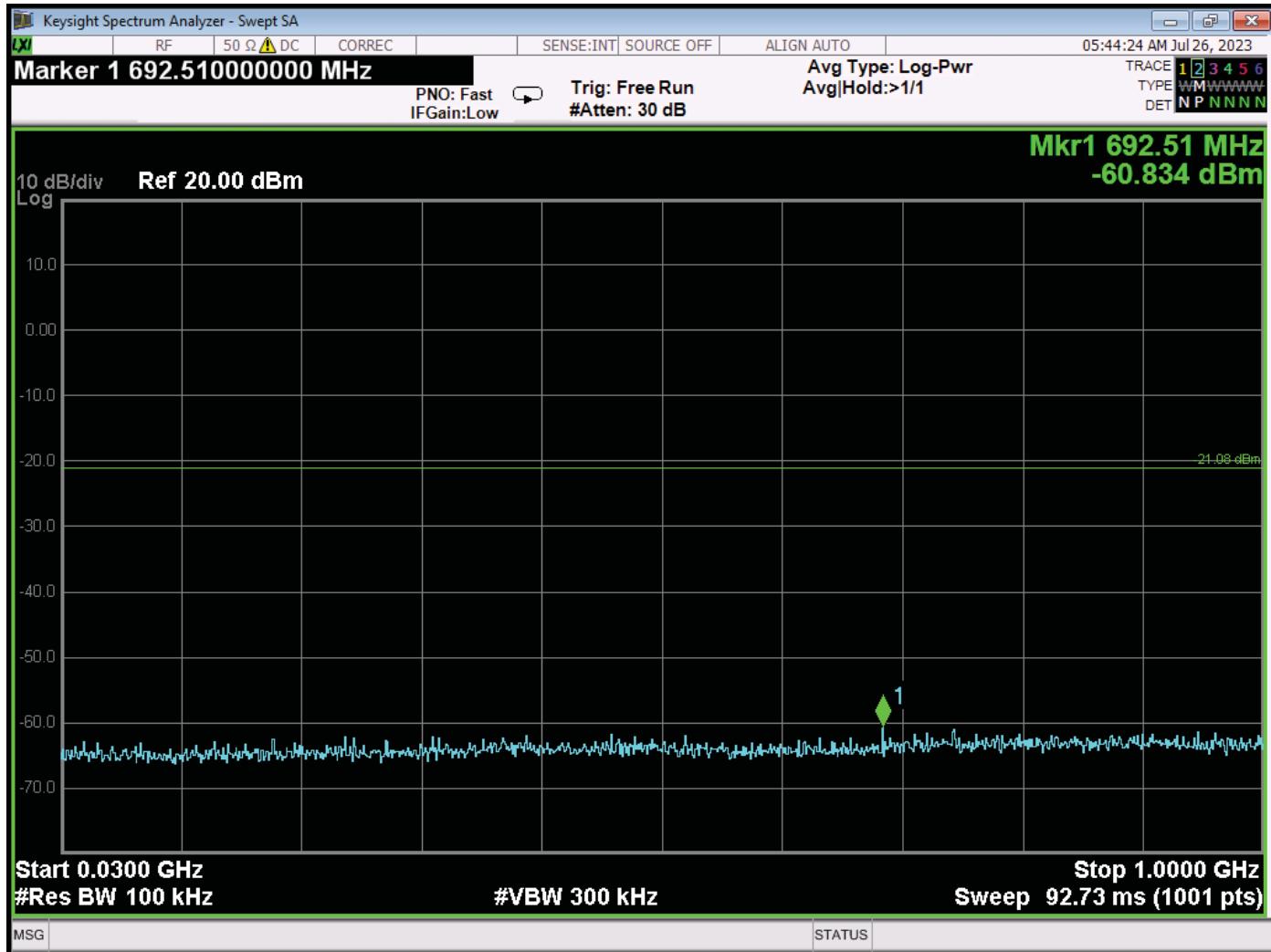
**Newbury Park Division**  
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

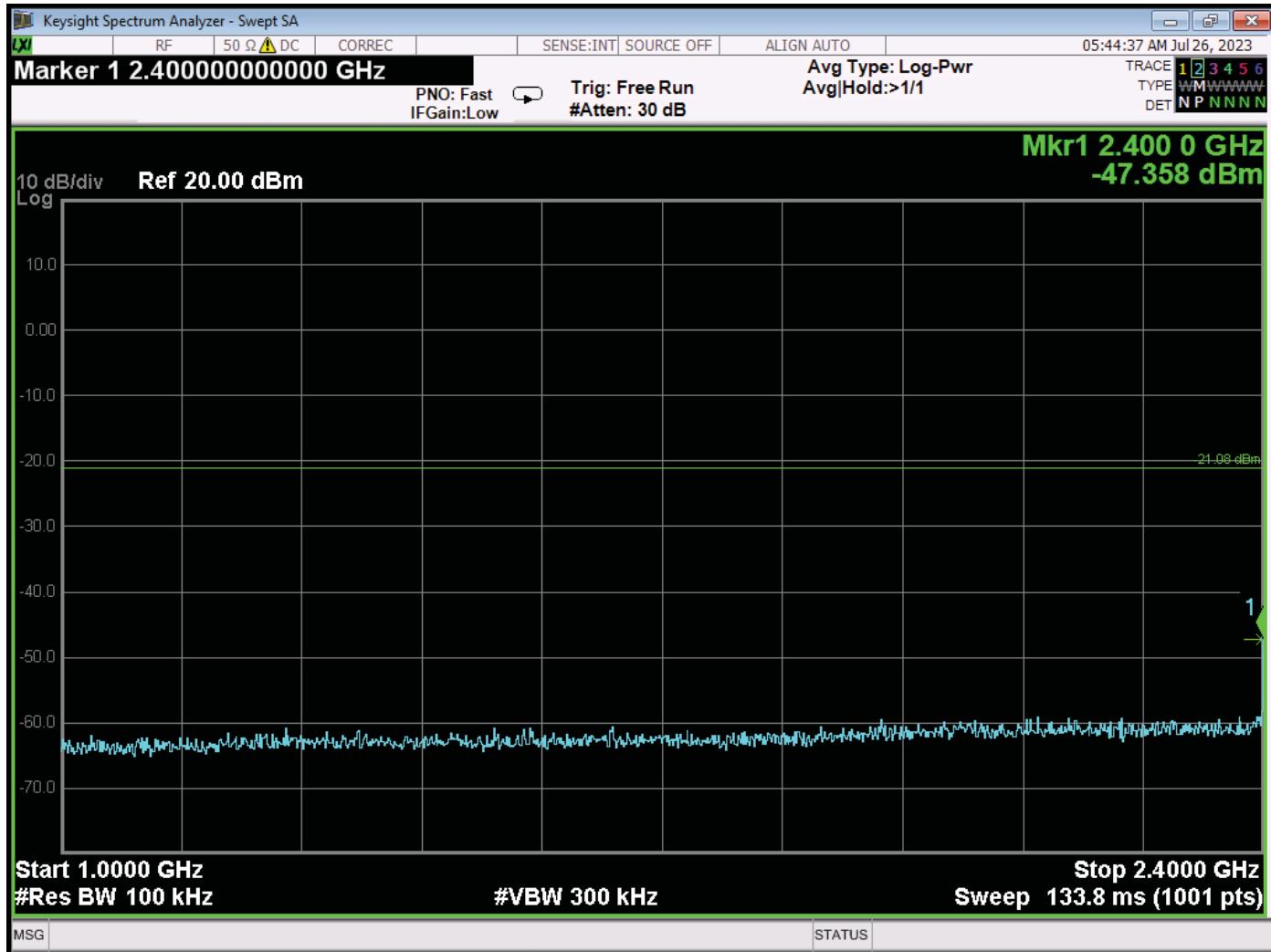


RF Antenna Conducted Test – Low Channel – 30 MHz to 1 GHz – BLE

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RF Antenna Conducted Test – Low Channel – 1 GHz to 2.4 GHz – BLE

**Brea Division**  
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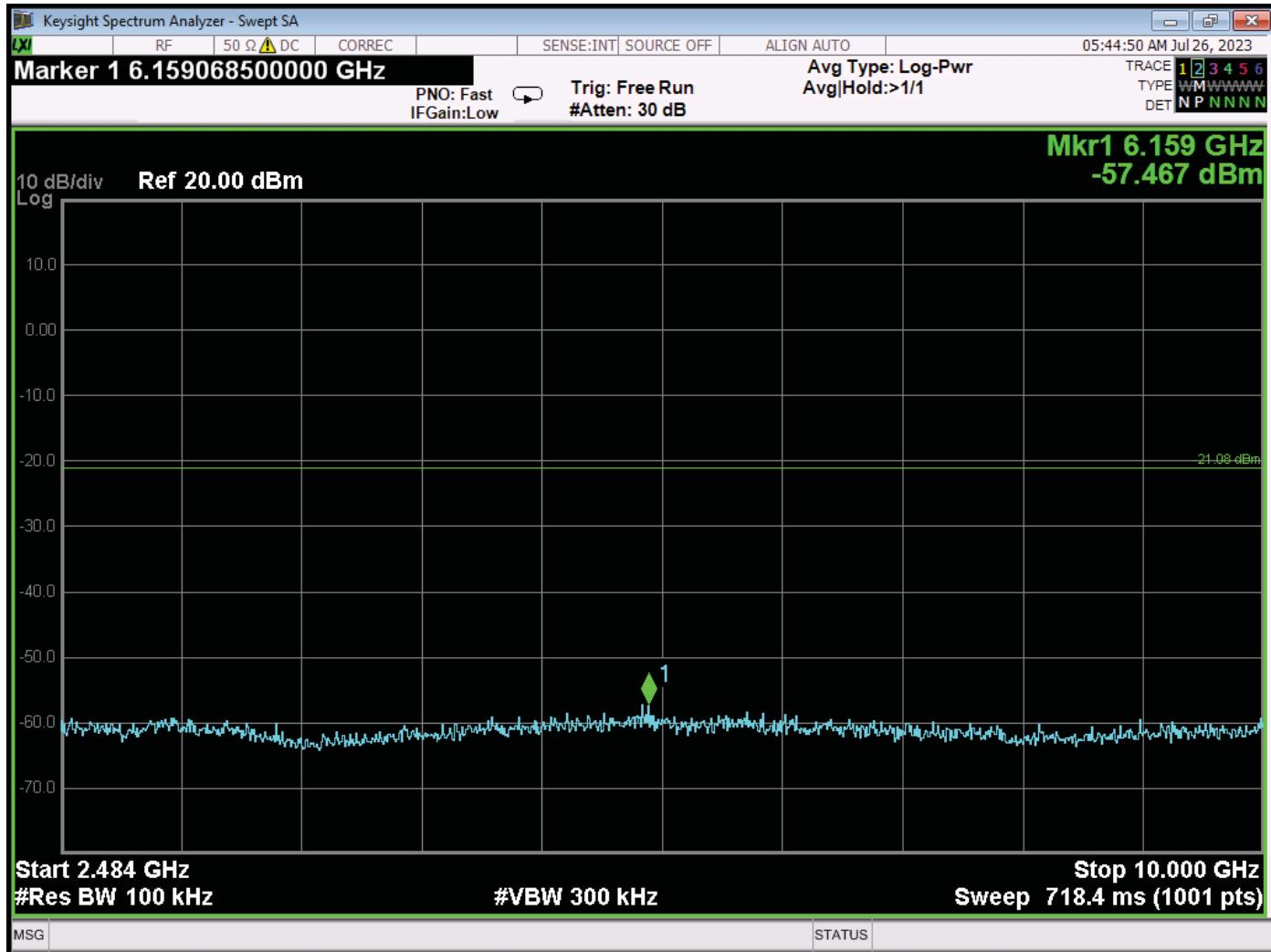
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



RF Antenna Conducted Test – Low Channel – 2483.5 MHz to 10 GHz – BLE

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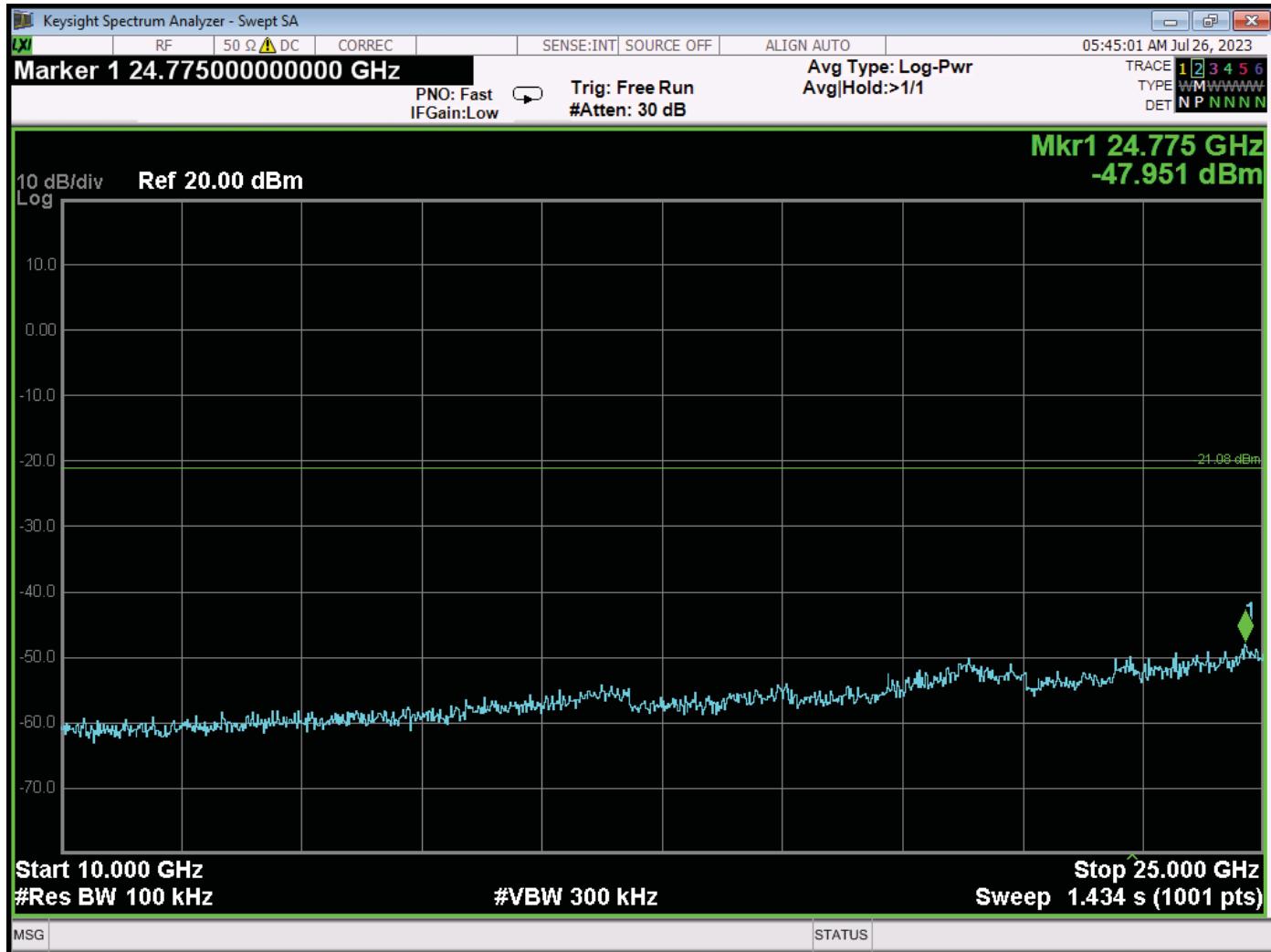
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



RF Antenna Conducted Test – Low Channel – 10 GHz to 25 GHz – BLE

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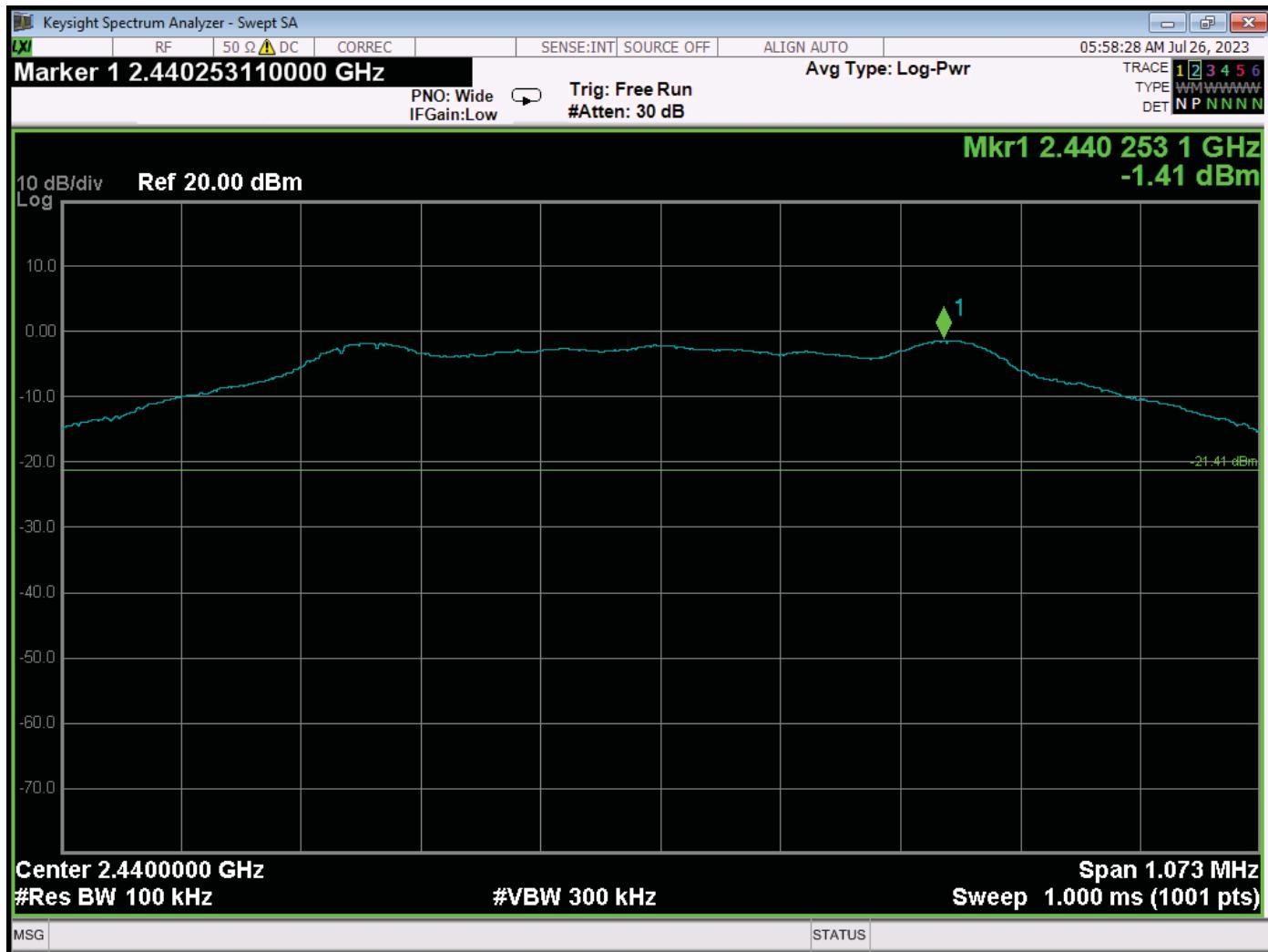
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

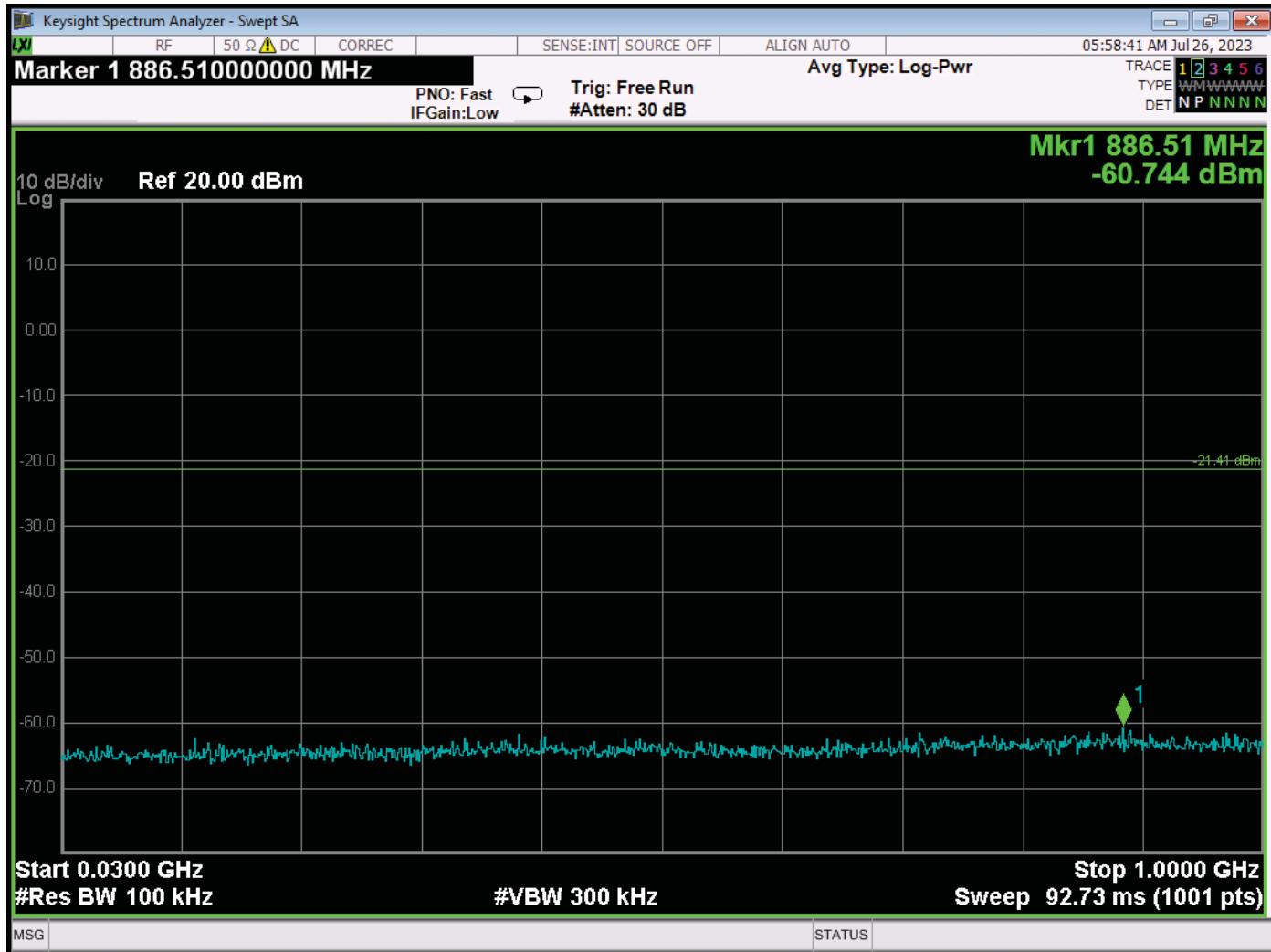


RF Antenna Conducted Test – Mid Channel – Reference Level – BLE

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Lake Forest, CA 92630  
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**Newbury Park Division**  
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(805) 480-4044

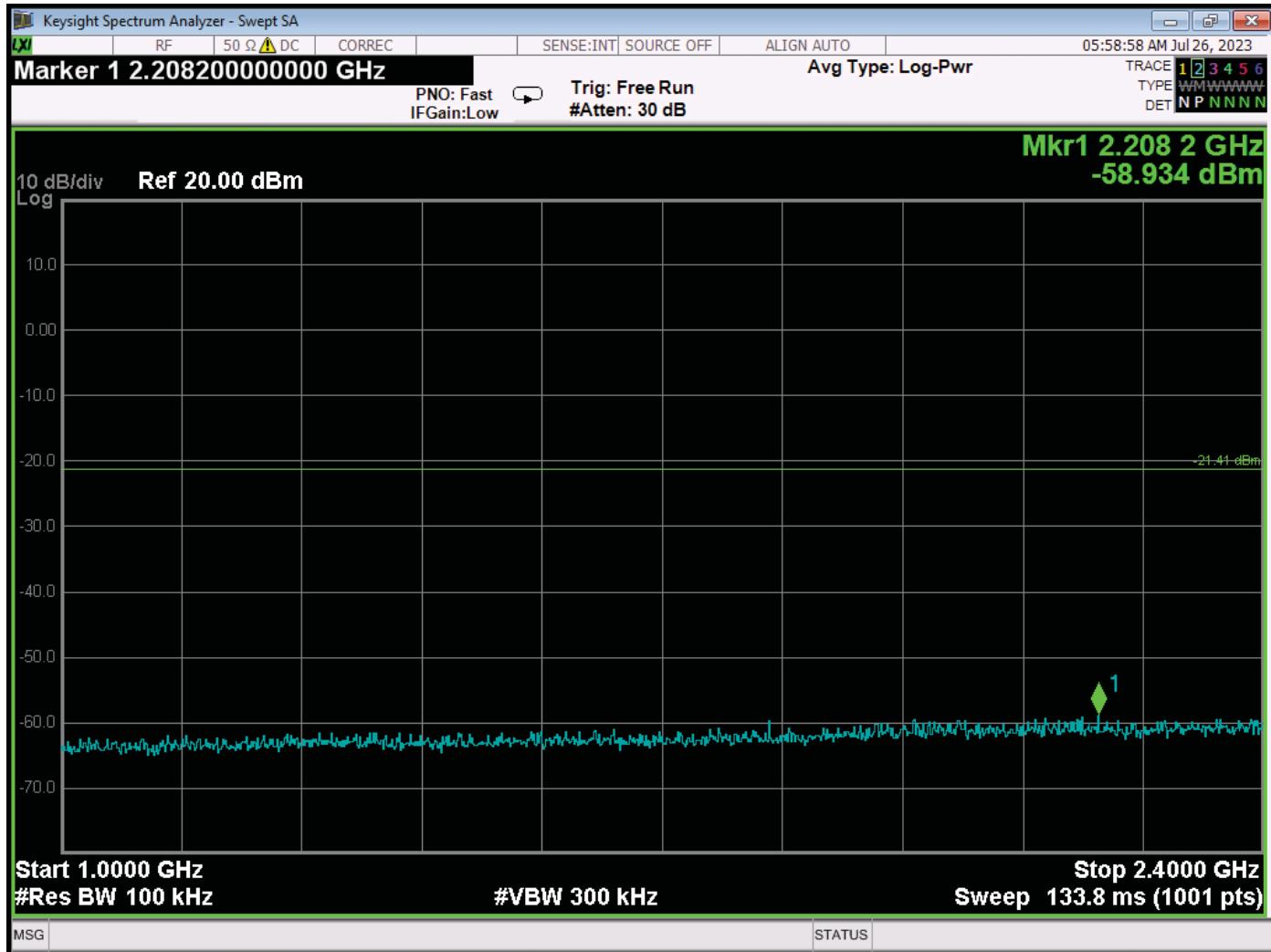


RF Antenna Conducted Test – Mid Channel – 30 MHz to 1 GHz – BLE

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RF Antenna Conducted Test – Mid Channel – 1 GHz to 2.4 GHz – BLE

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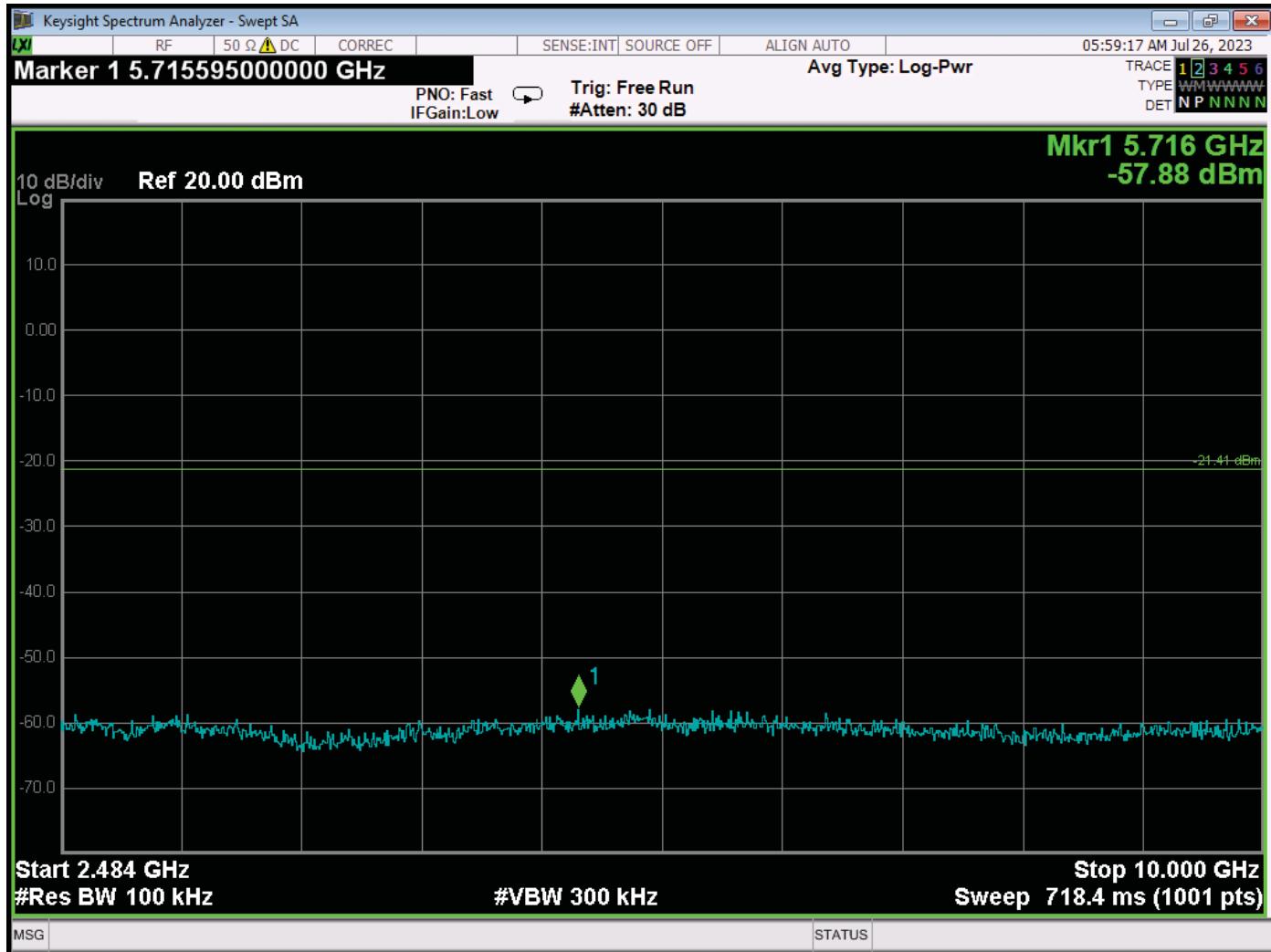
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

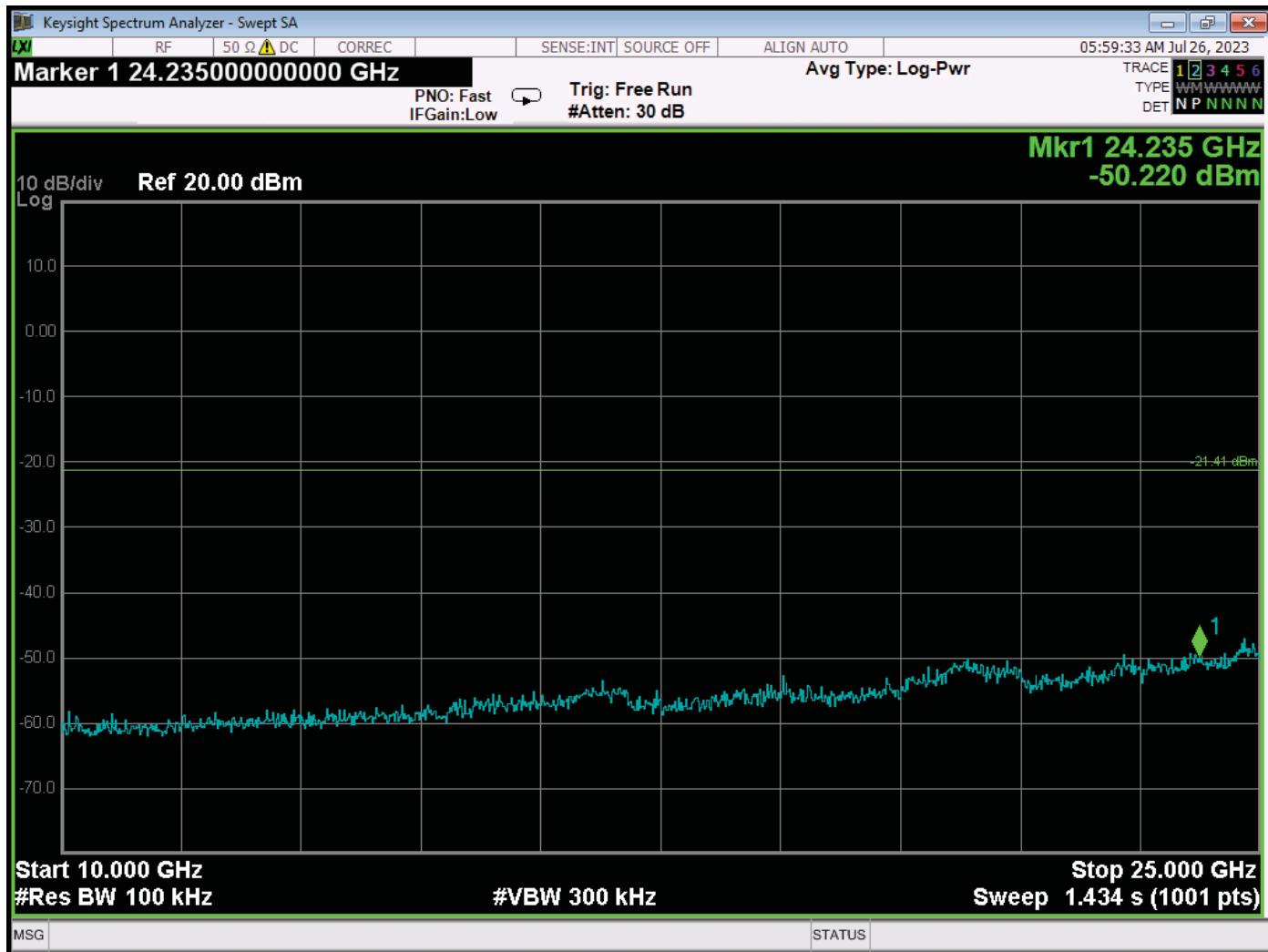


RF Antenna Conducted Test – Mid Channel – 2483.5 MHz to 10 GHz – BLE

**Brea Division**  
114 Olinda Drive  
Brea, CA 92823  
(714) 579-0500

**Lake Forest Division**  
20621 Pascal Way  
Lake Forest, CA 92630  
(949) 587-0400

**Newbury Park Division**  
1050 Lawrence Drive  
Newbury Park, CA 91320  
(805) 480-4044



RF Antenna Conducted Test – Mid Channel – 10 GHz to 25 GHz – BLE

**Brea Division**  
**114 Olinda Drive**  
**Brea, CA 92823**  
**(714) 579-0500**

**Lake Forest Division**  
**20621 Pascal Way**  
**Lake Forest, CA 92630**  
**(949) 587-0400**

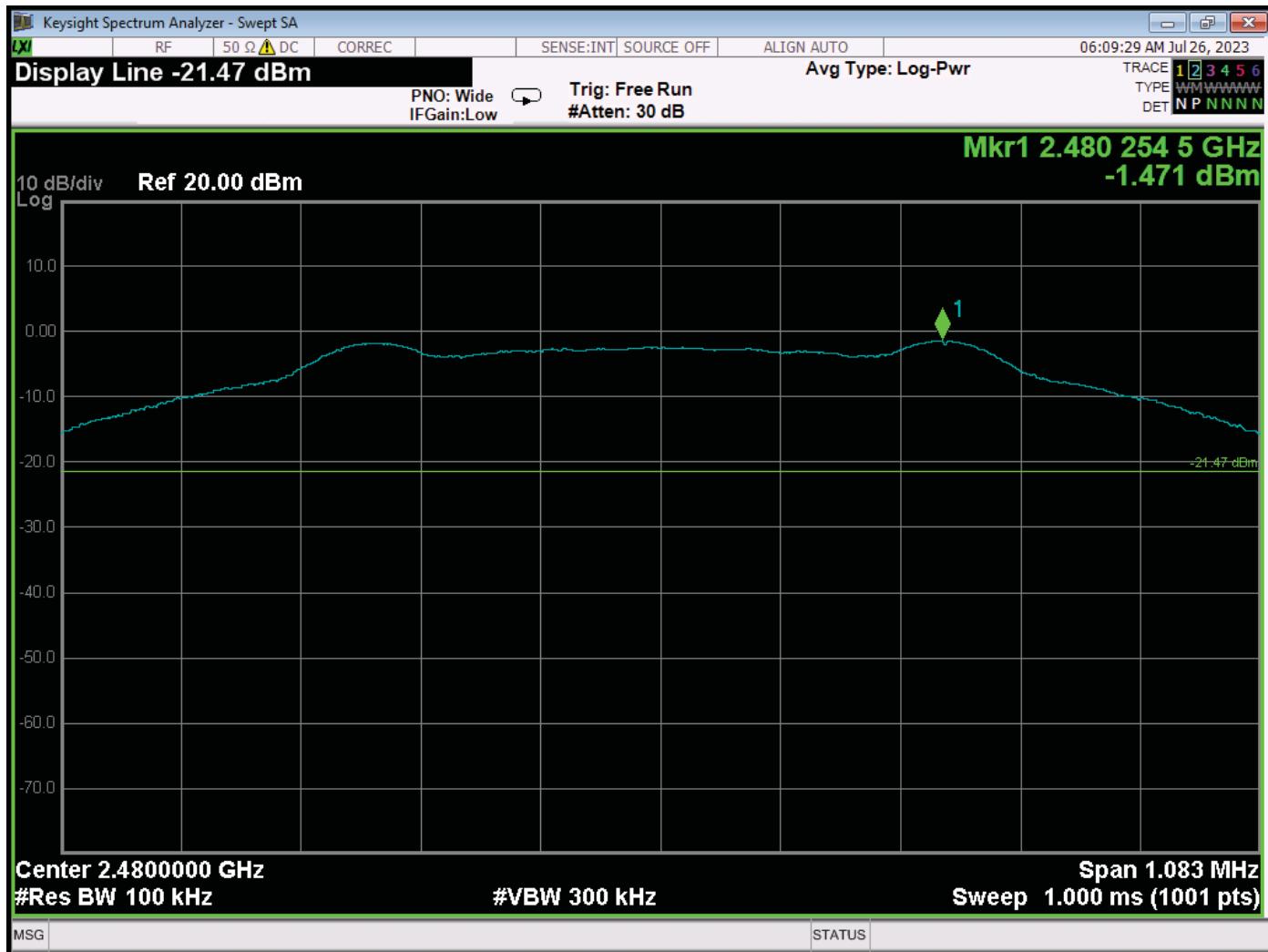
**Newbury Park Division**  
**1050 Lawrence Drive**  
**Newbury Park, CA 91320**  
**(805) 480-4044**



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



RF Antenna Conducted Test – High Channel – Reference Level – BLE

**Brea Division**  
114 Olinda Drive  
Brea, CA 92823  
(714) 579-0500

**Lake Forest Division**  
20621 Pascal Way  
Lake Forest, CA 92630  
(949) 587-0400

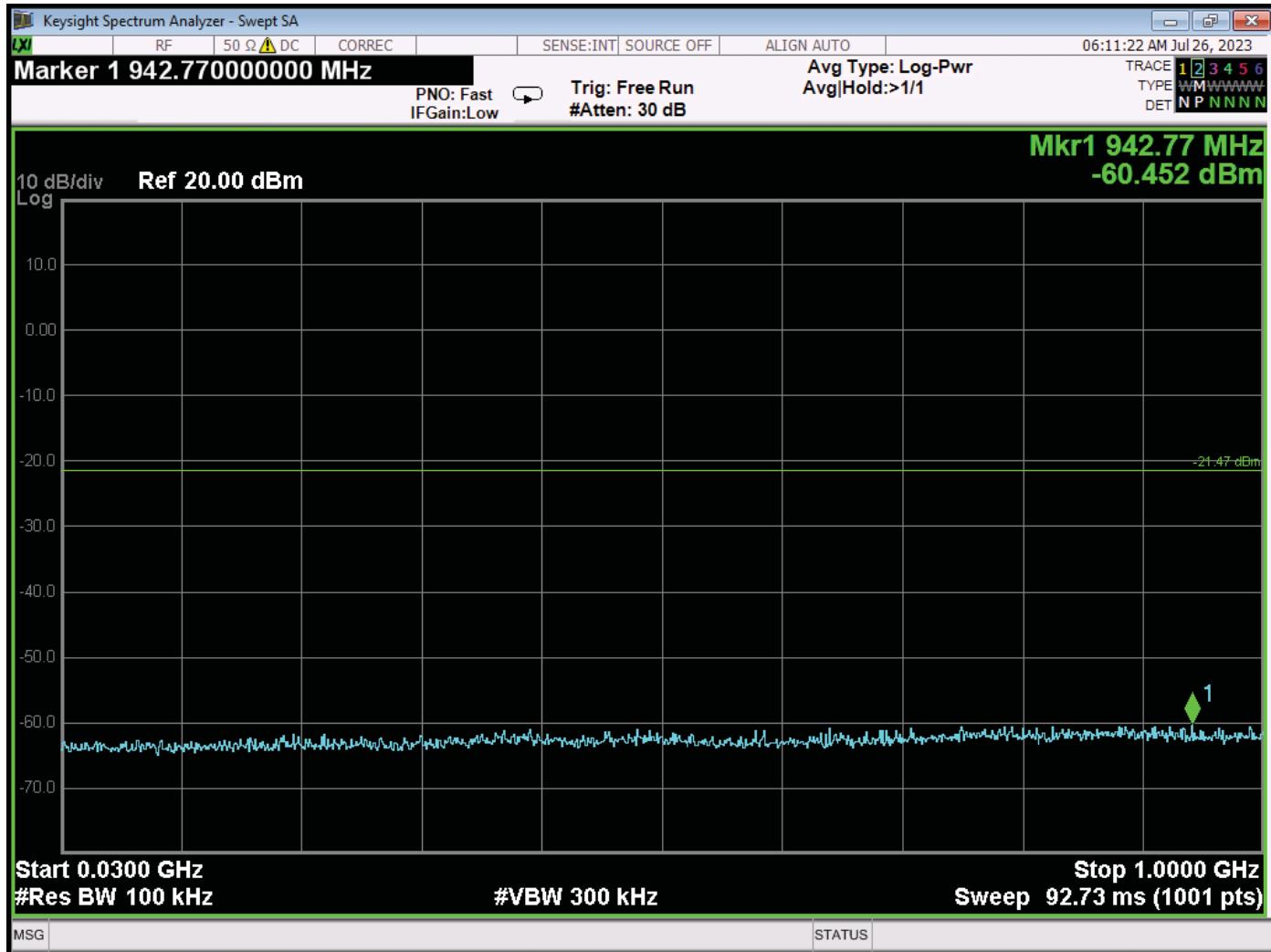
**Newbury Park Division**  
1050 Lawrence Drive  
Newbury Park, CA 91320  
(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



RF Antenna Conducted Test – High Channel – 30 MHz to 1 GHz – BLE

**Brea Division**  
114 Olinda Drive  
Brea, CA 92823  
(714) 579-0500

**Lake Forest Division**  
20621 Pascal Way  
Lake Forest, CA 92630  
(949) 587-0400

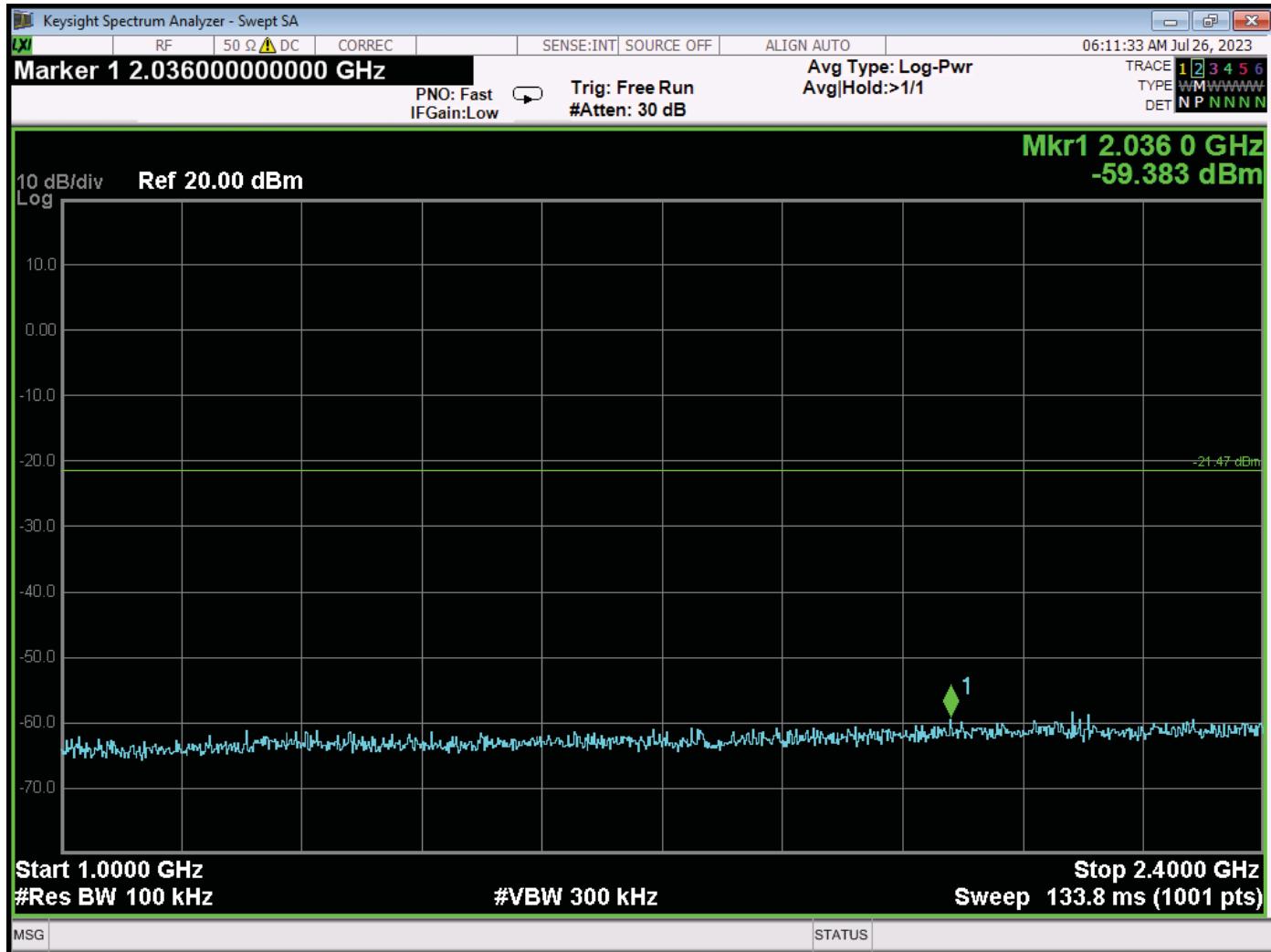
**Newbury Park Division**  
1050 Lawrence Drive  
Newbury Park, CA 91320  
(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



RF Antenna Conducted Test – High Channel – 1 GHz to 2.4 GHz – BLE

**Brea Division**  
114 Olinda Drive  
Brea, CA 92823  
(714) 579-0500

**Lake Forest Division**  
20621 Pascal Way  
Lake Forest, CA 92630  
(949) 587-0400

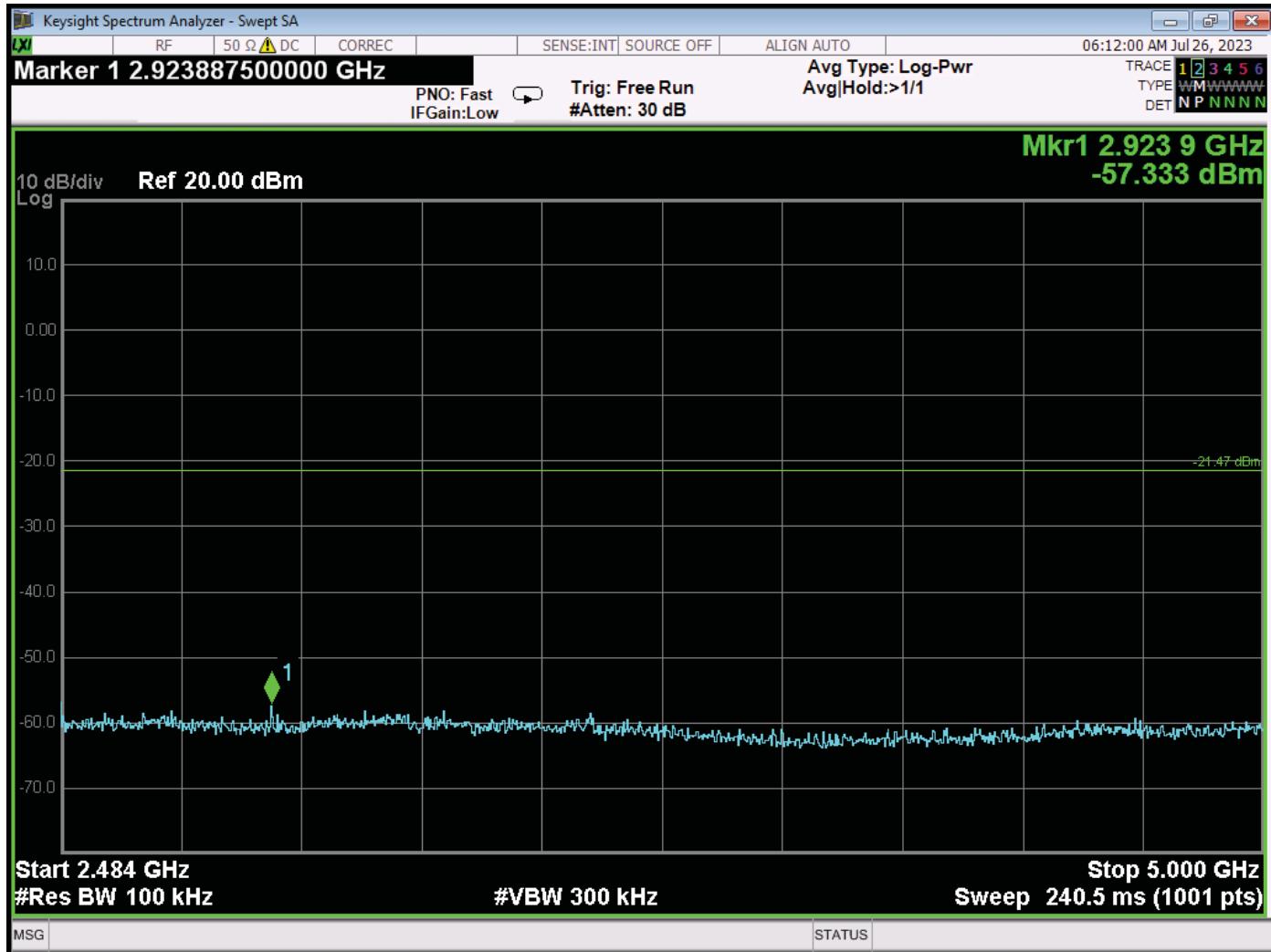
**Newbury Park Division**  
1050 Lawrence Drive  
Newbury Park, CA 91320  
(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



RF Antenna Conducted Test – High Channel – 2483.5 MHz to 5 GHz – BLE

**Brea Division**  
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Brea, CA 92823  
(714) 579-0500

**Lake Forest Division**  
20621 Pascal Way  
Lake Forest, CA 92630  
(949) 587-0400

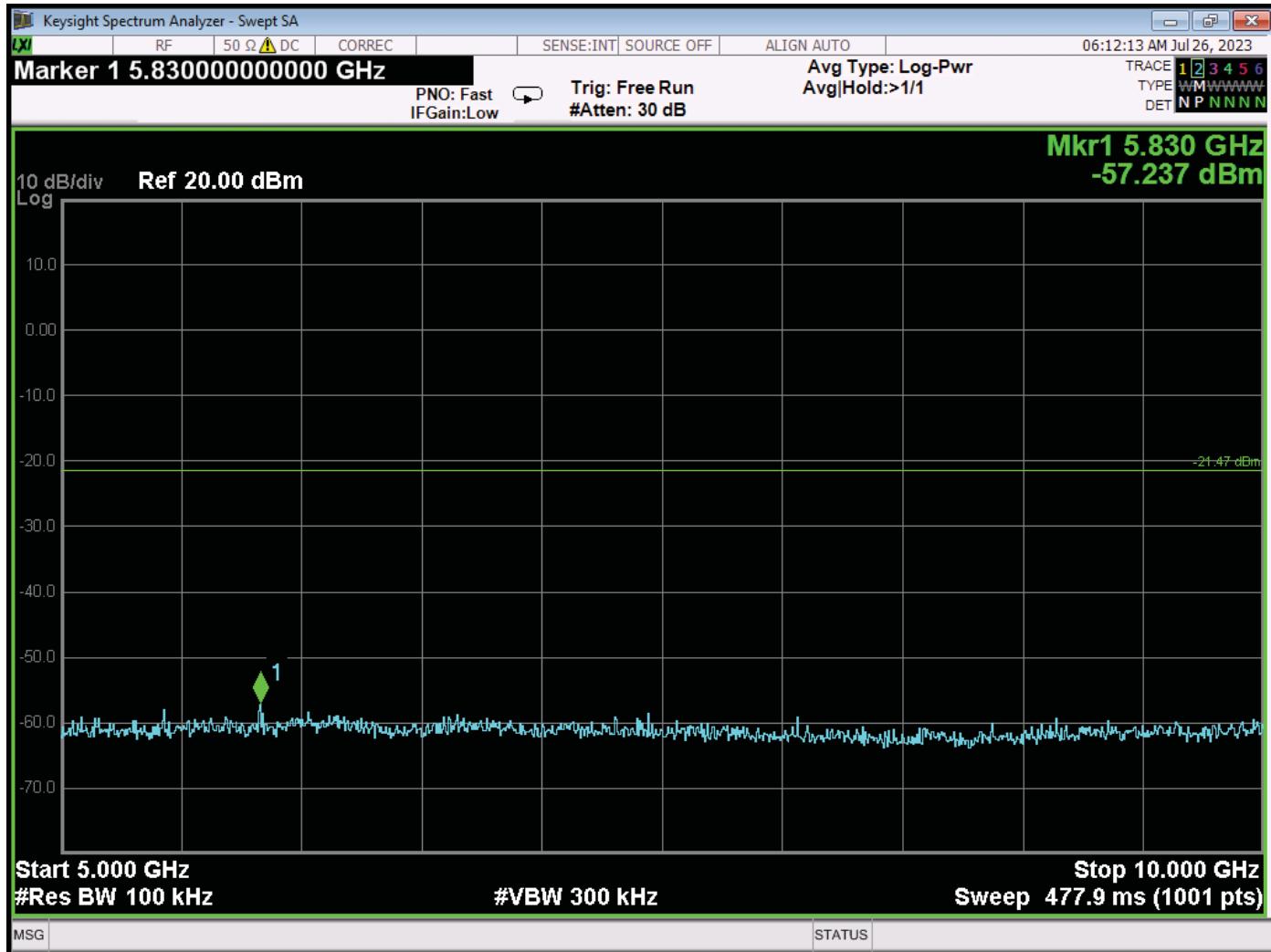
**Newbury Park Division**  
1050 Lawrence Drive  
Newbury Park, CA 91320  
(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



RF Antenna Conducted Test – High Channel – 5 GHz to 10 GHz – BLE

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114 Olinda Drive  
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**Lake Forest Division**  
20621 Pascal Way  
Lake Forest, CA 92630  
(949) 587-0400

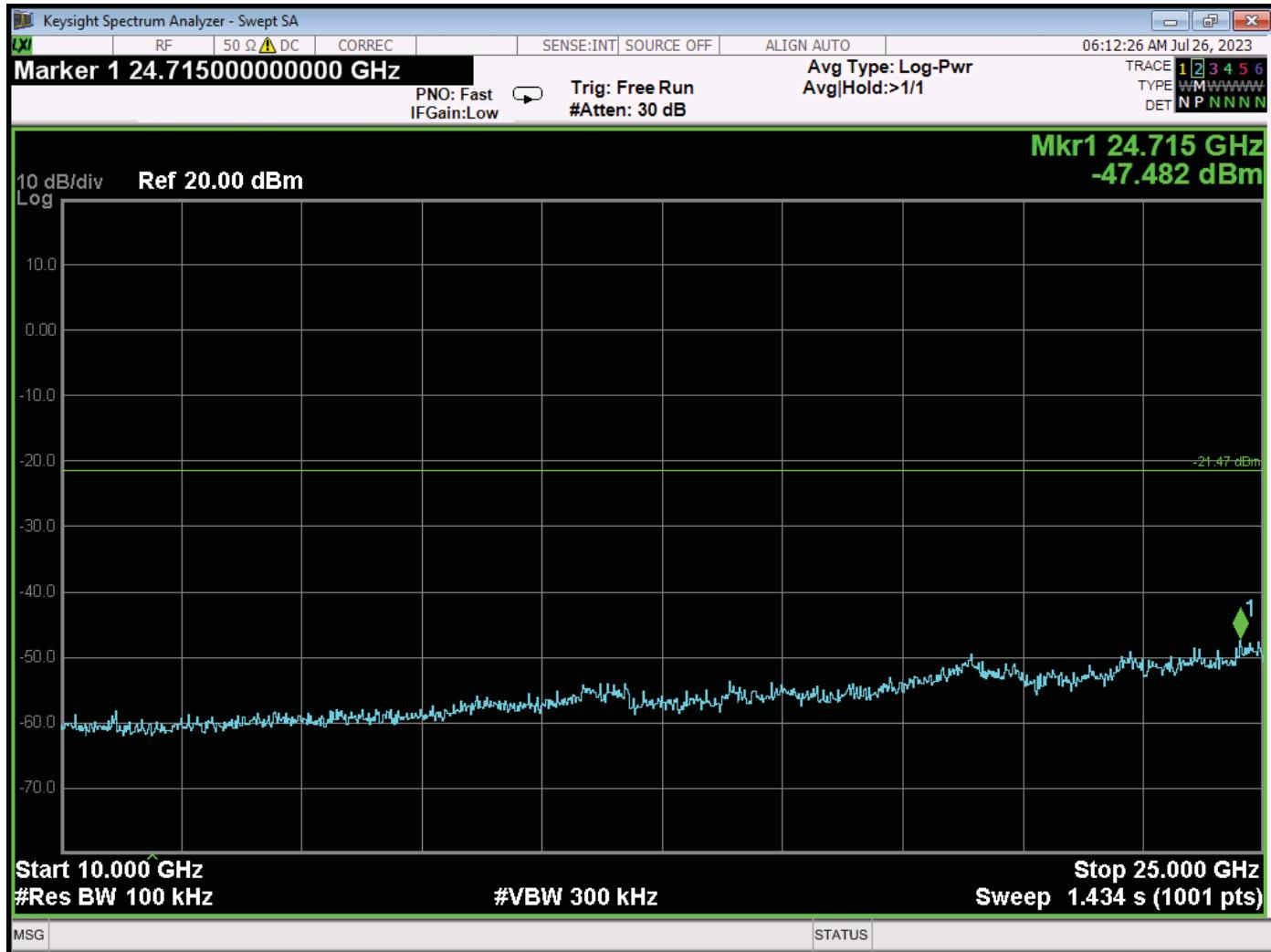
**Newbury Park Division**  
1050 Lawrence Drive  
Newbury Park, CA 91320  
(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



RF Antenna Conducted Test – High Channel – 10 GHz to 25 GHz – BLE

**Brea Division**  
114 Olinda Drive  
Brea, CA 92823  
(714) 579-0500

**Lake Forest Division**  
20621 Pascal Way  
Lake Forest, CA 92630  
(949) 587-0400

**Newbury Park Division**  
1050 Lawrence Drive  
Newbury Park, CA 91320  
(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper

Model: FTW000123

***RF ANTENNA CONDUCTED  
WIFI DATA SHEETS***

---

**Brea Division**  
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Brea, CA 92823  
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**Lake Forest Division**  
20621 Pascal Way  
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(949) 587-0400

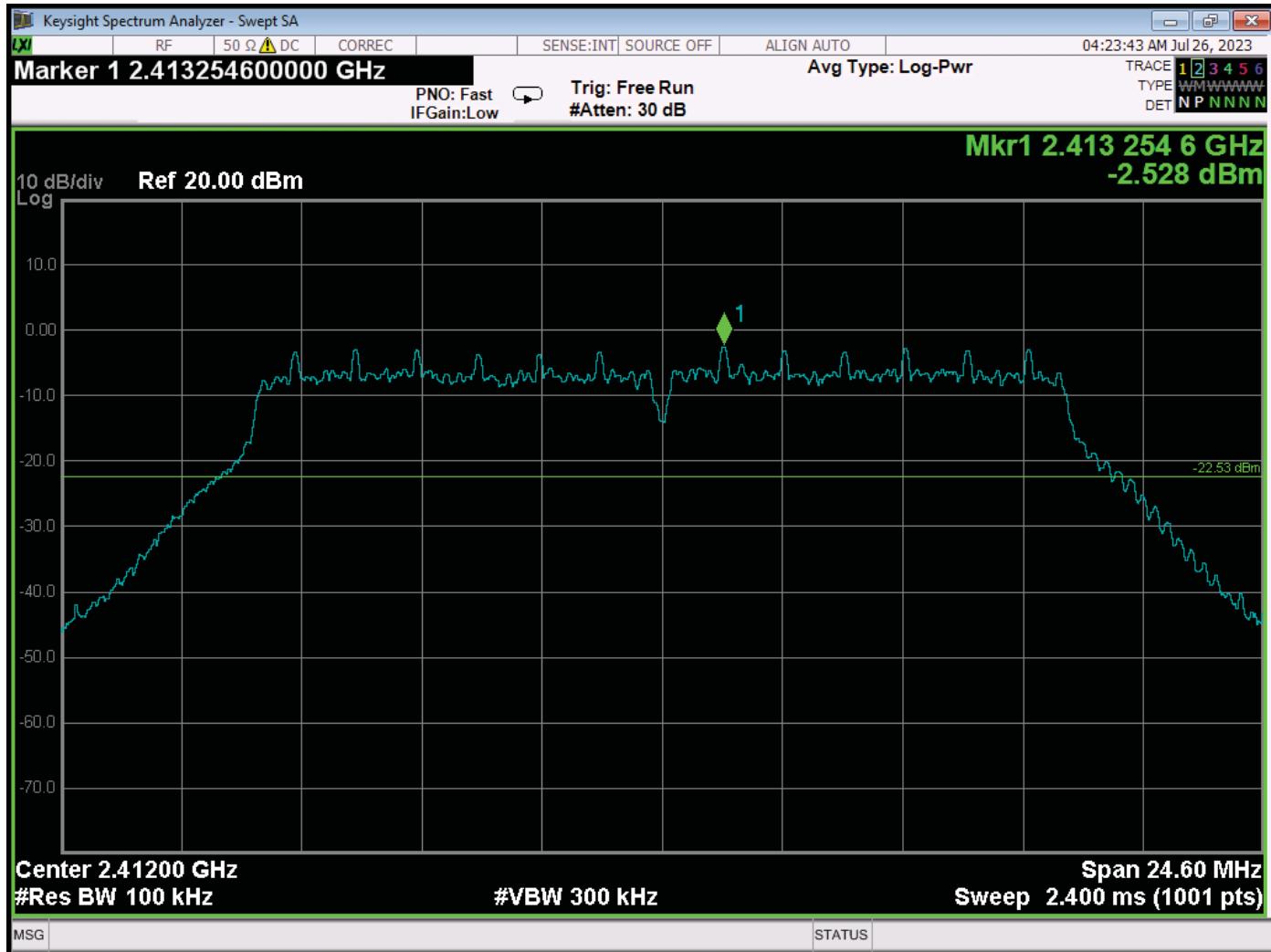
**Newbury Park Division**  
1050 Lawrence Drive  
Newbury Park, CA 91320  
(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



RF Antenna Conducted Test – Low Channel – Reference Level – WiFi

**Brea Division**  
114 Olinda Drive  
Brea, CA 92823  
(714) 579-0500

**Lake Forest Division**  
20621 Pascal Way  
Lake Forest, CA 92630  
(949) 587-0400

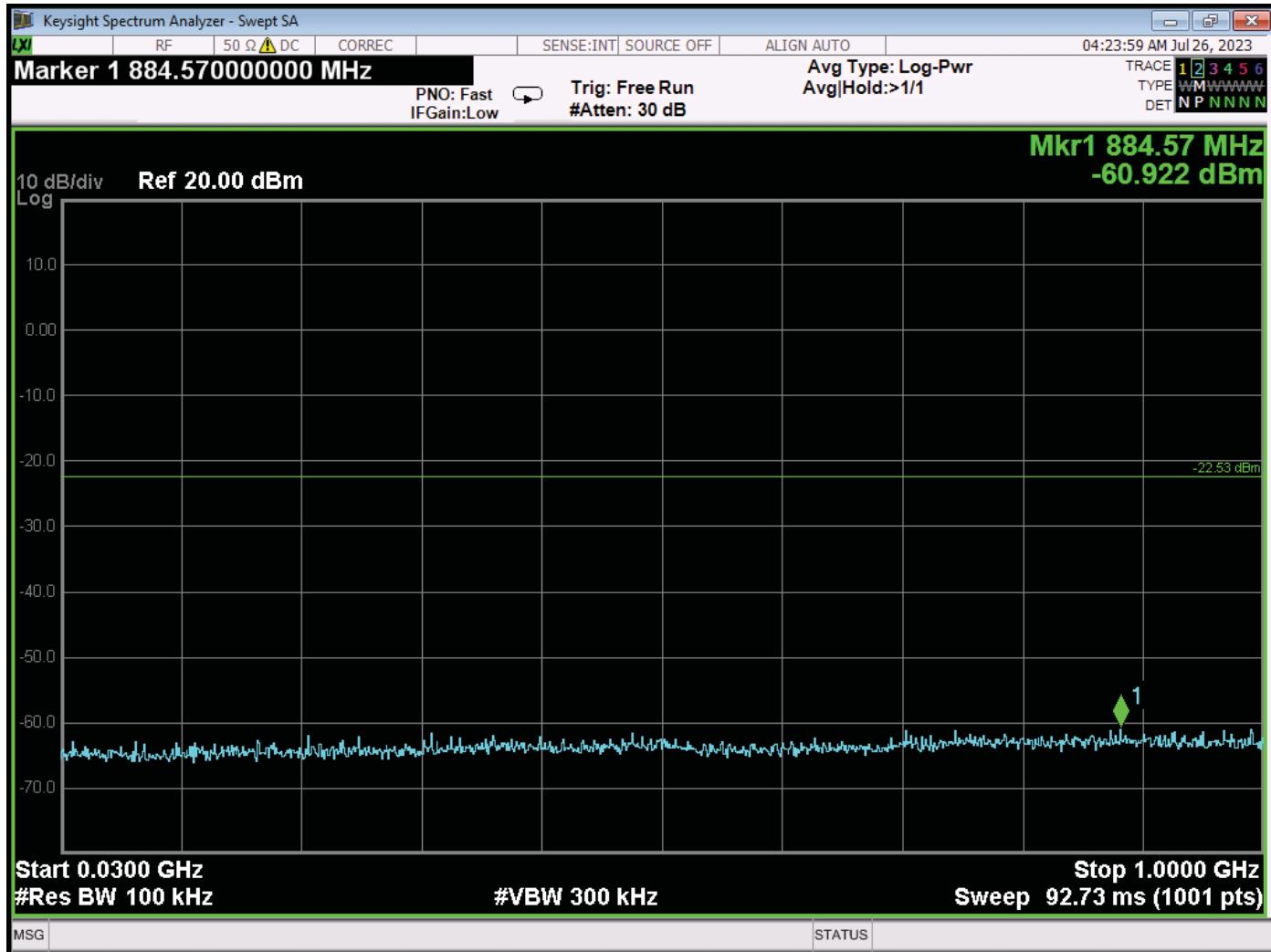
**Newbury Park Division**  
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Newbury Park, CA 91320  
(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



RF Antenna Conducted Test – Low Channel – 30 MHz to 1 GHz – WiFi

**Brea Division**  
114 Olinda Drive  
Brea, CA 92823  
(714) 579-0500

**Lake Forest Division**  
20621 Pascal Way  
Lake Forest, CA 92630  
(949) 587-0400

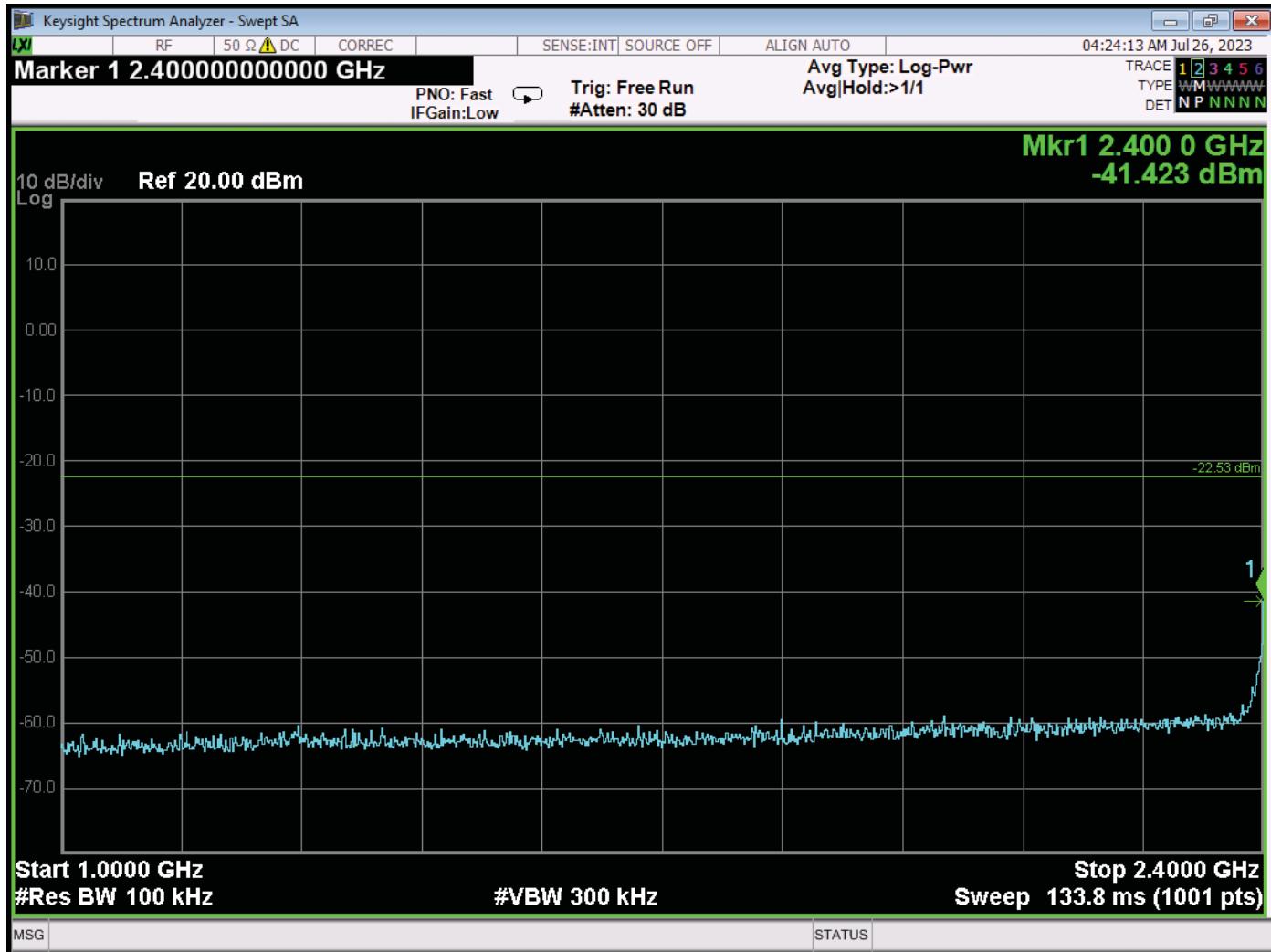
**Newbury Park Division**  
1050 Lawrence Drive  
Newbury Park, CA 91320  
(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



RF Antenna Conducted Test – Low Channel – 1 GHz to 2.4 GHz – WiFi

**Brea Division**  
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(714) 579-0500

**Lake Forest Division**  
20621 Pascal Way  
Lake Forest, CA 92630  
(949) 587-0400

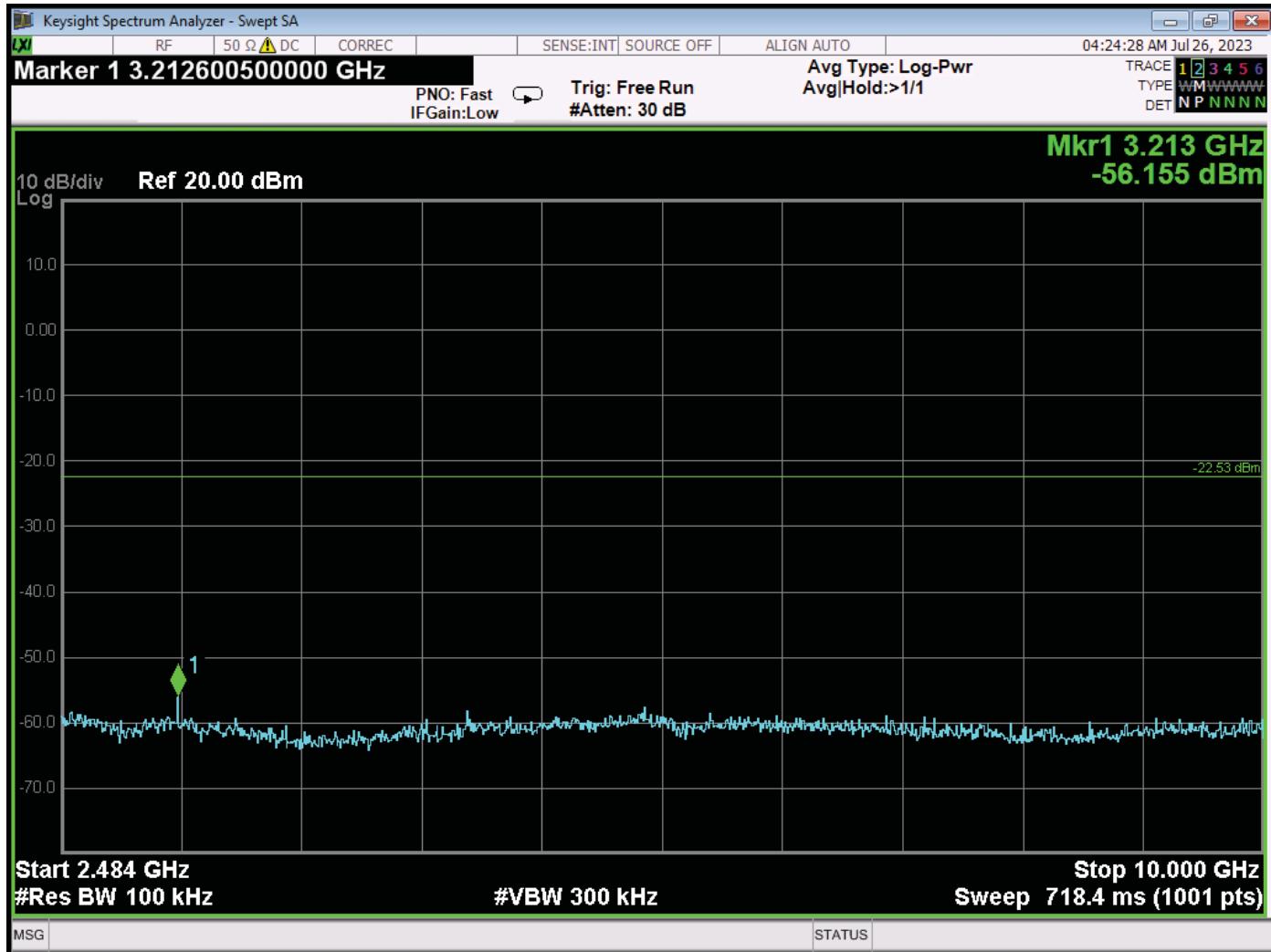
**Newbury Park Division**  
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(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



RF Antenna Conducted Test – Low Channel – 2483.5 MHz to 10 GHz – WiFi

**Brea Division**  
114 Olinda Drive  
Brea, CA 92823  
(714) 579-0500

**Lake Forest Division**  
20621 Pascal Way  
Lake Forest, CA 92630  
(949) 587-0400

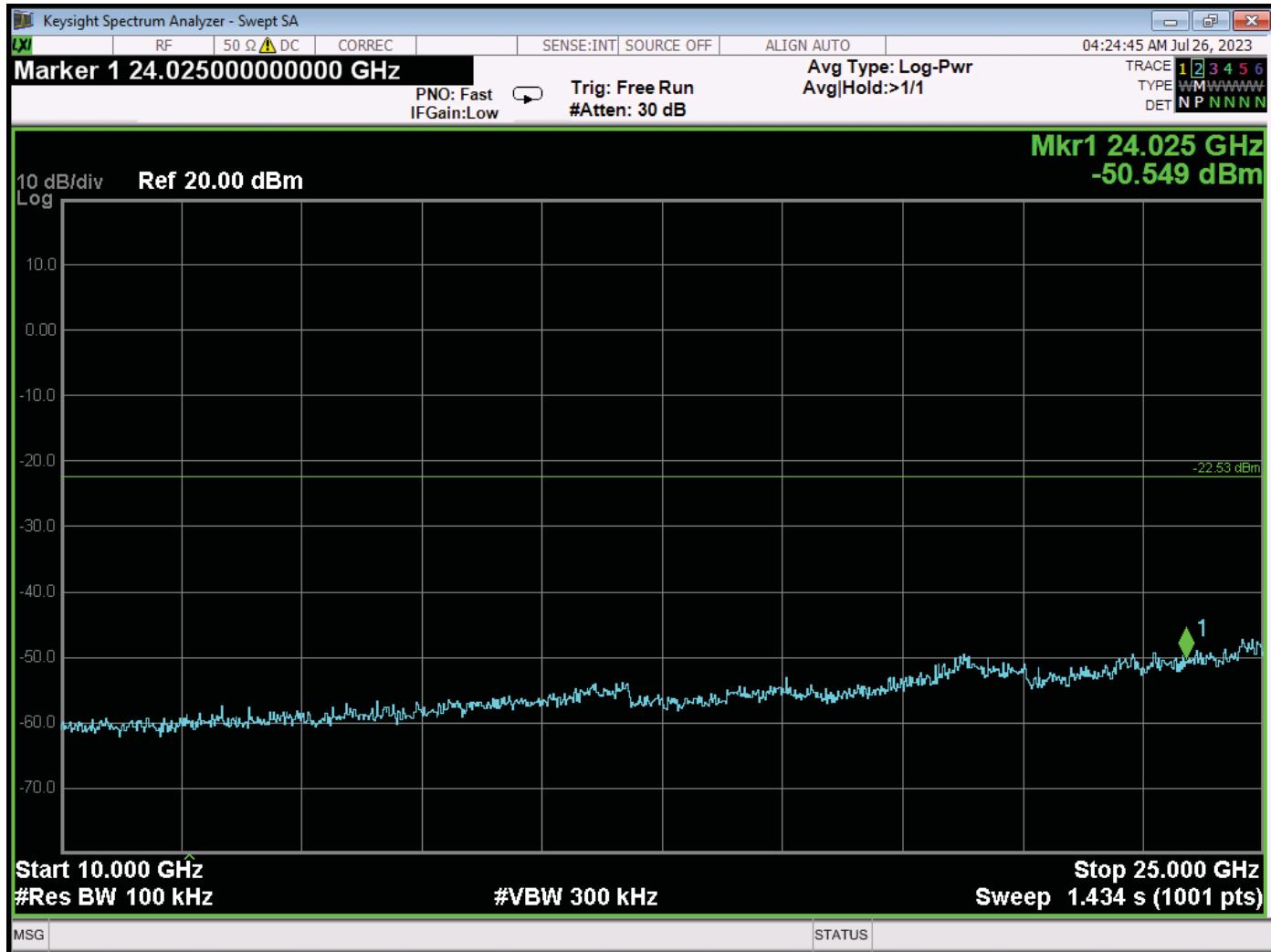
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(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



RF Antenna Conducted Test – Low Channel – 10 GHz to 25 GHz – WiFi

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20621 Pascal Way  
Lake Forest, CA 92630  
(949) 587-0400

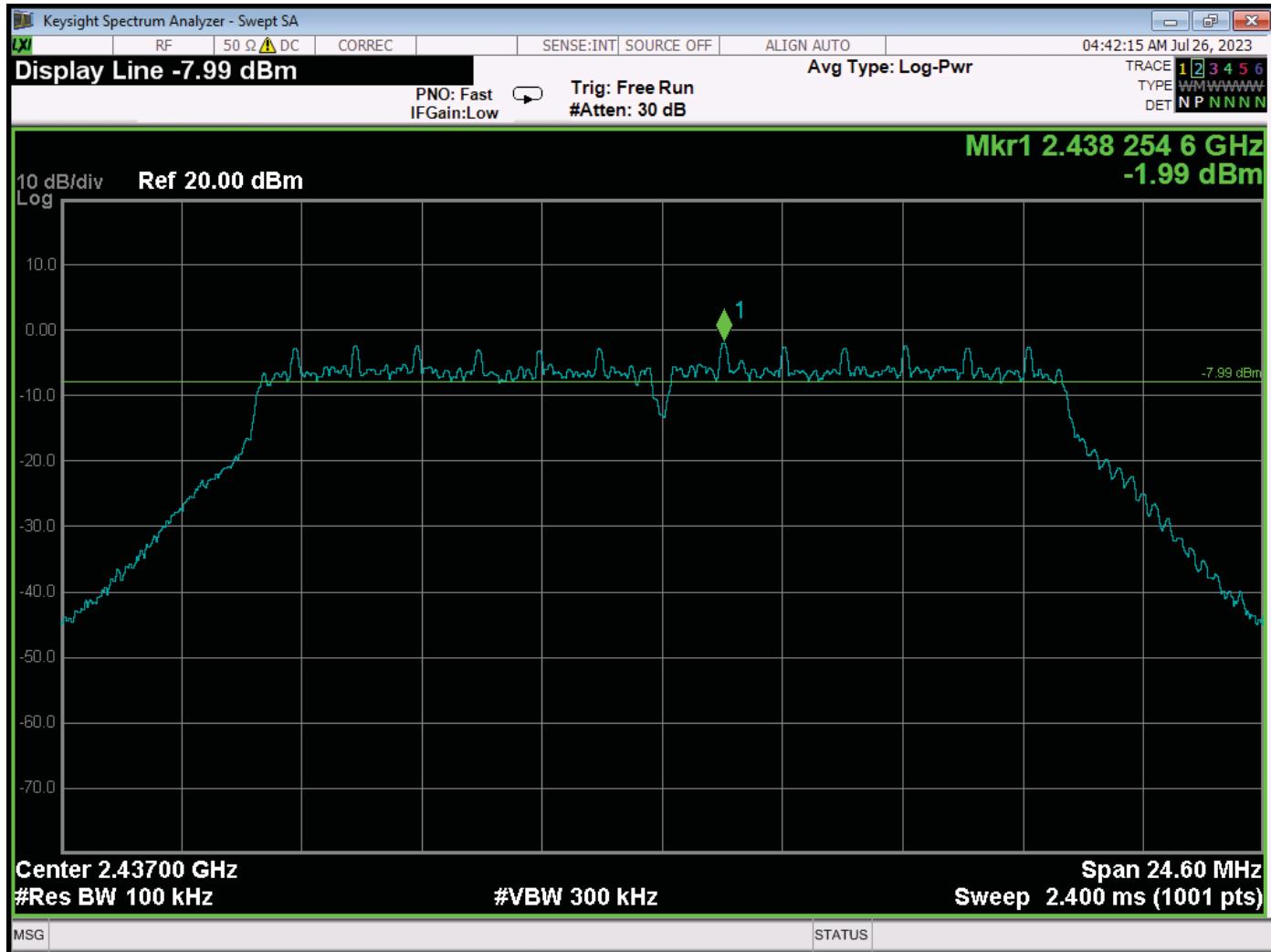
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



RF Antenna Conducted Test – Mid Channel – Reference Level – WiFi

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(949) 587-0400

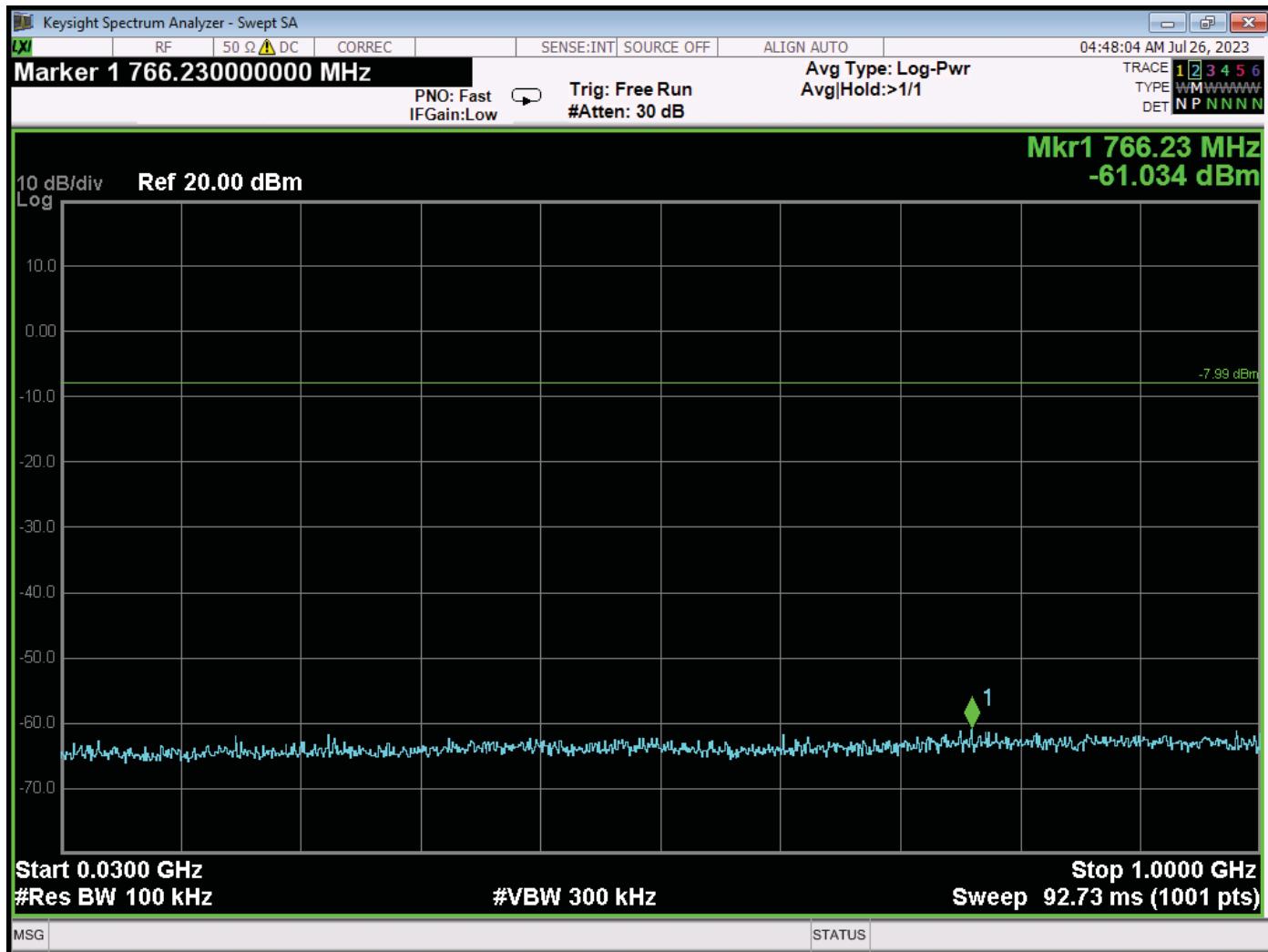
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**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



RF Antenna Conducted Test – Mid Channel – 30 MHz to 1 GHz – WiFi

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**Lake Forest Division**  
20621 Pascal Way  
Lake Forest, CA 92630  
(949) 587-0400

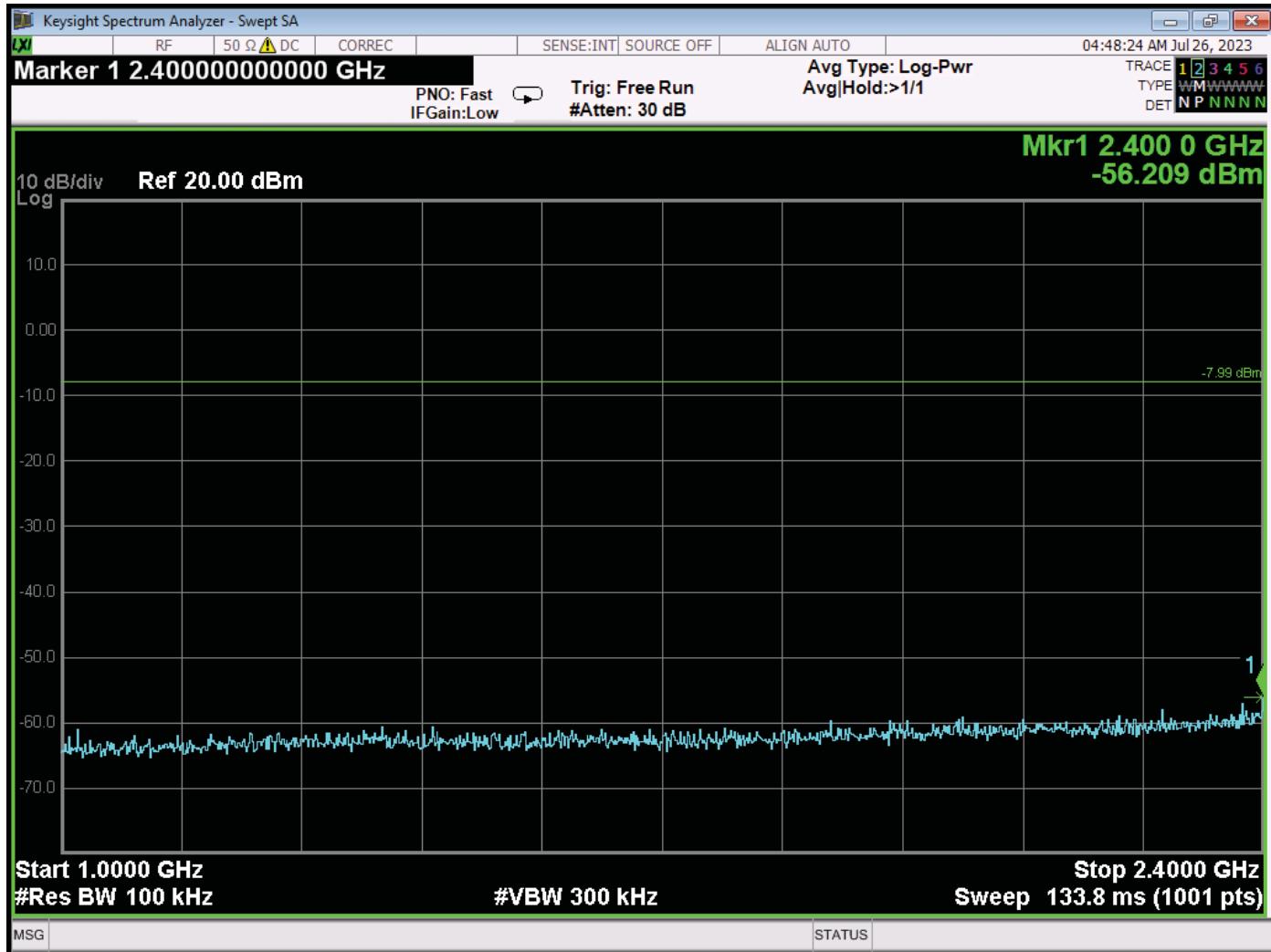
**Newbury Park Division**  
1050 Lawrence Drive  
Newbury Park, CA 91320  
(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



RF Antenna Conducted Test – Mid Channel – 1 GHz to 2.4 GHz – WiFi

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**Lake Forest Division**  
20621 Pascal Way  
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(949) 587-0400

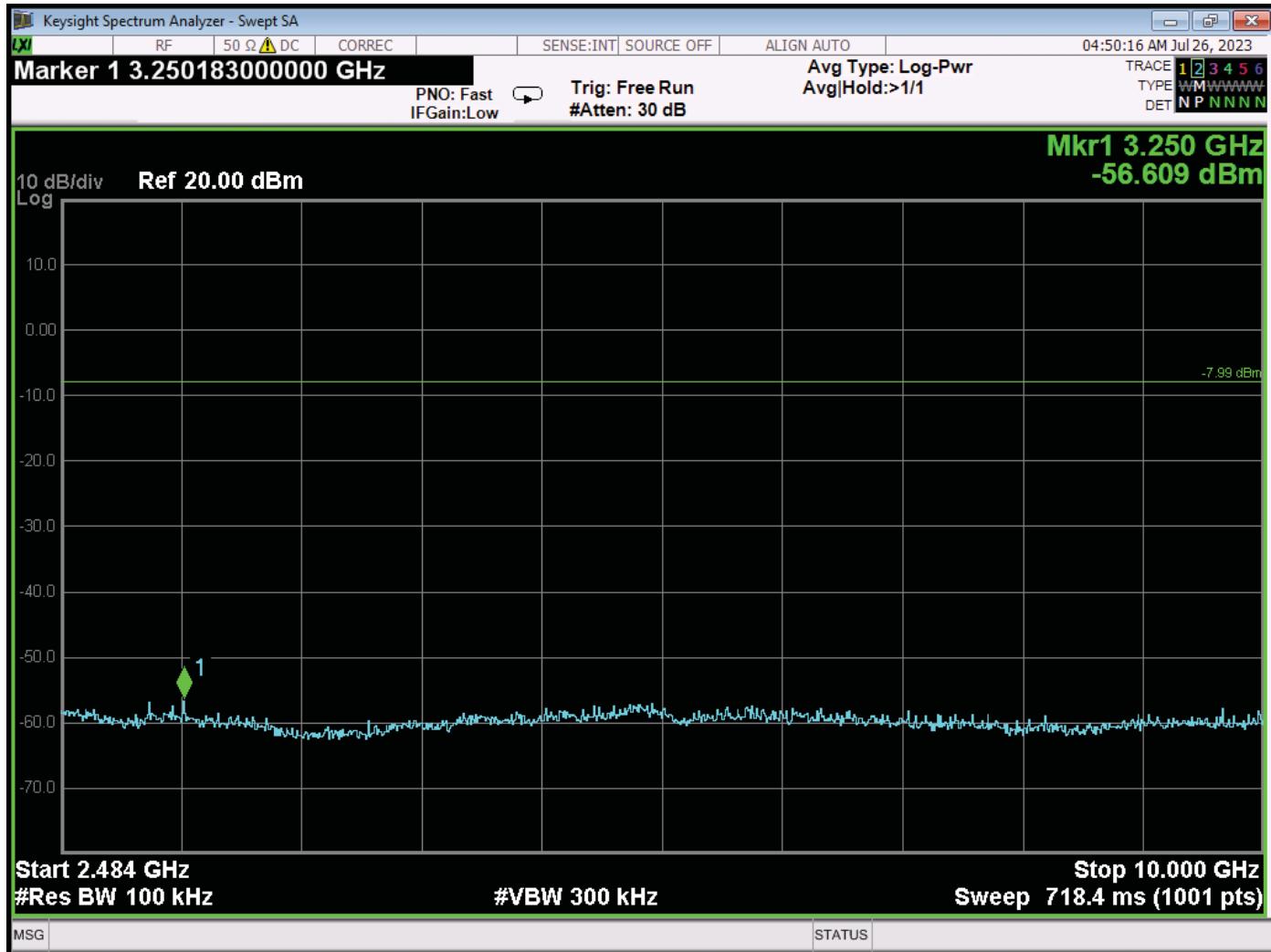
**Newbury Park Division**  
1050 Lawrence Drive  
Newbury Park, CA 91320  
(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



RF Antenna Conducted Test – Mid Channel – 2483.5 MHz to 10 GHz – WiFi

**Brea Division**  
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**Lake Forest Division**  
20621 Pascal Way  
Lake Forest, CA 92630  
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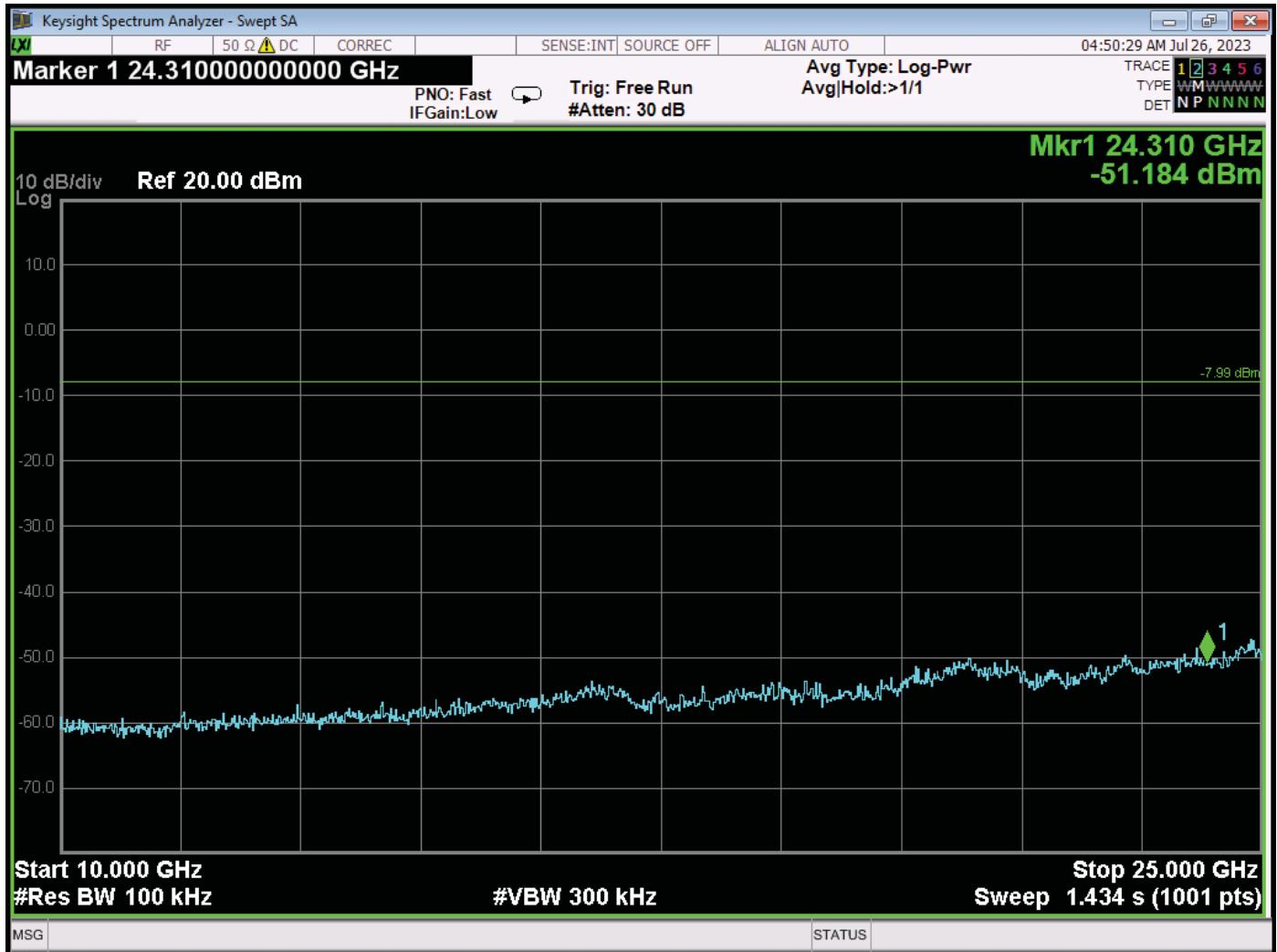
**Newbury Park Division**  
1050 Lawrence Drive  
Newbury Park, CA 91320  
(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



RF Antenna Conducted Test – Mid Channel – 10 GHz to 25 GHz – WiFi

**Brea Division**  
114 Olinda Drive  
Brea, CA 92823  
(714) 579-0500

**Lake Forest Division**  
20621 Pascal Way  
Lake Forest, CA 92630  
(949) 587-0400

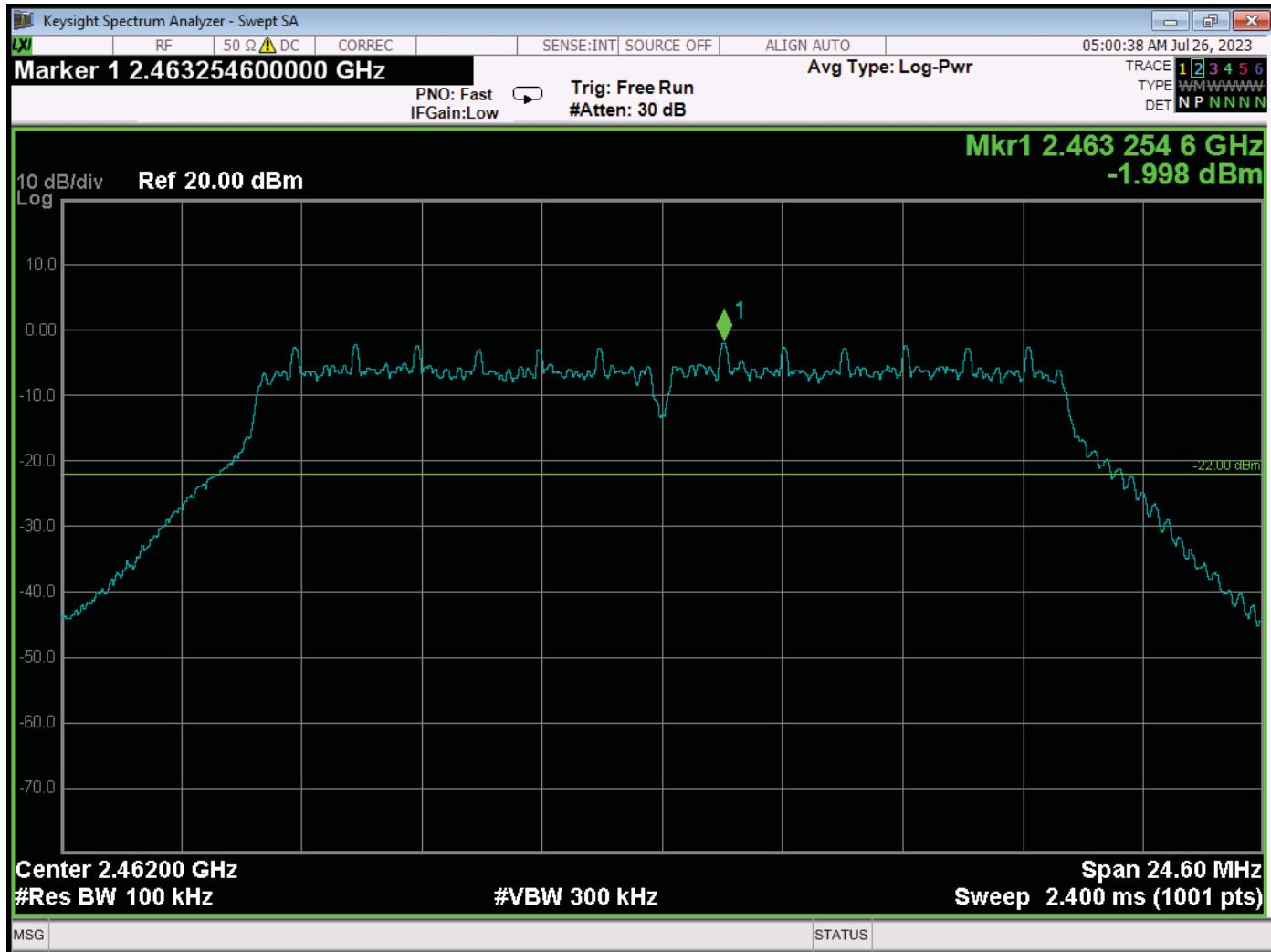
**Newbury Park Division**  
1050 Lawrence Drive  
Newbury Park, CA 91320  
(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



RF Antenna Conducted Test – High Channel – Reference Level – WiFi

**Brea Division**  
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Brea, CA 92823  
(714) 579-0500

**Lake Forest Division**  
20621 Pascal Way  
Lake Forest, CA 92630  
(949) 587-0400

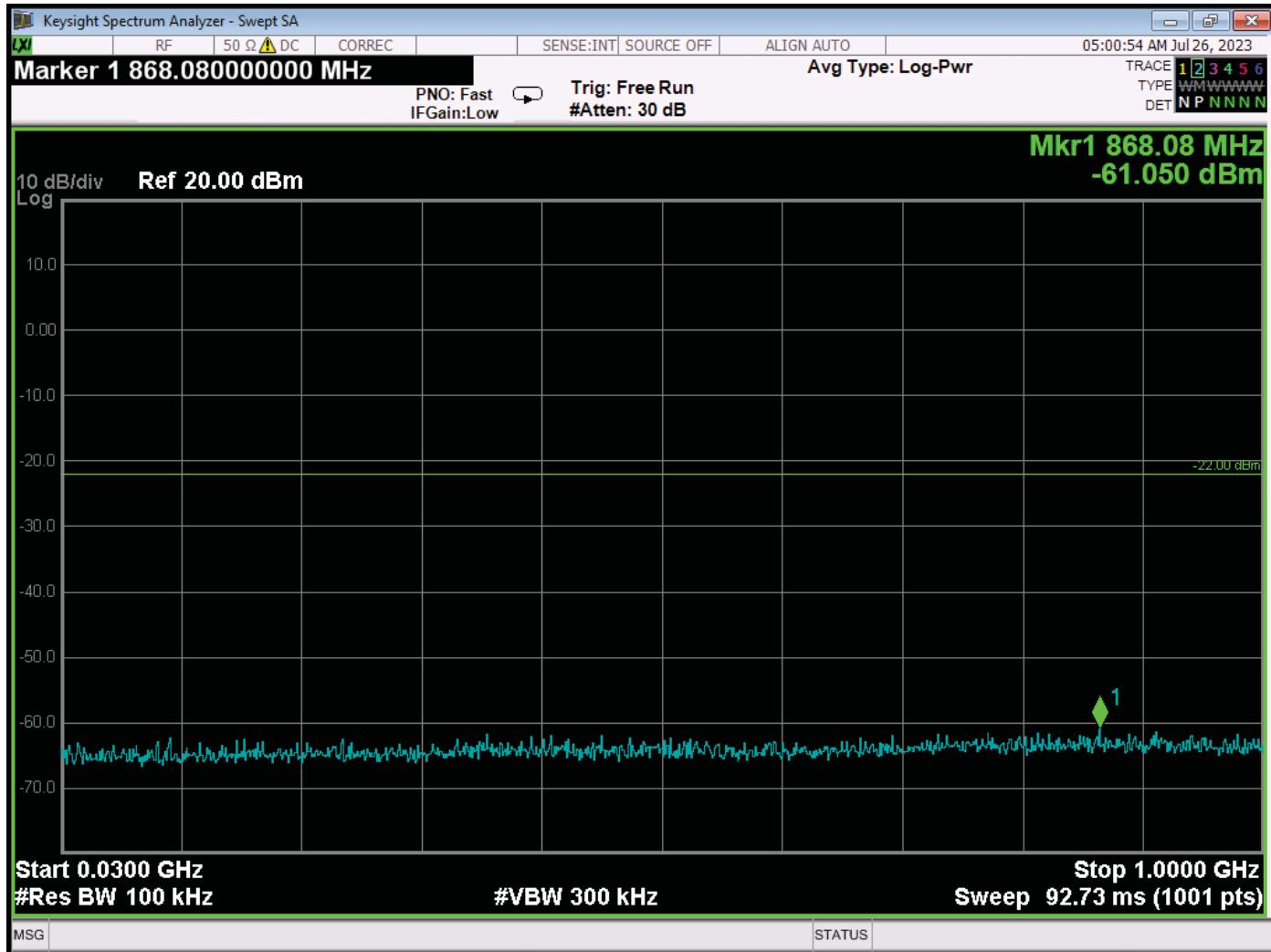
**Newbury Park Division**  
1050 Lawrence Drive  
Newbury Park, CA 91320  
(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



RF Antenna Conducted Test – High Channel – 30 MHz to 1 GHz – WiFi

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Brea, CA 92823  
(714) 579-0500

**Lake Forest Division**  
20621 Pascal Way  
Lake Forest, CA 92630  
(949) 587-0400

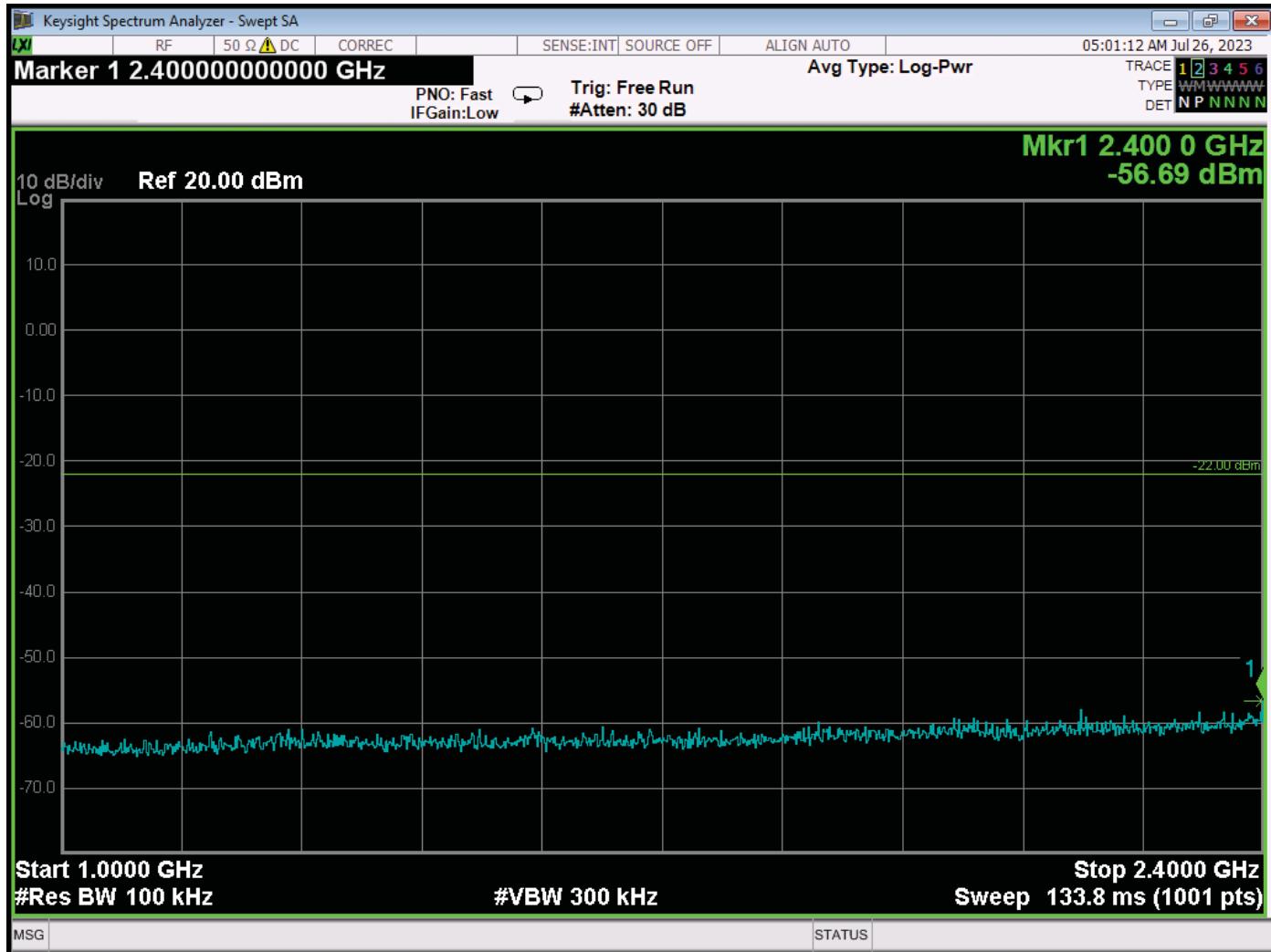
**Newbury Park Division**  
1050 Lawrence Drive  
Newbury Park, CA 91320  
(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



RF Antenna Conducted Test – High Channel – 1 GHz to 2.4 GHz – WiFi

**Brea Division**  
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Brea, CA 92823  
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**Lake Forest Division**  
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Lake Forest, CA 92630  
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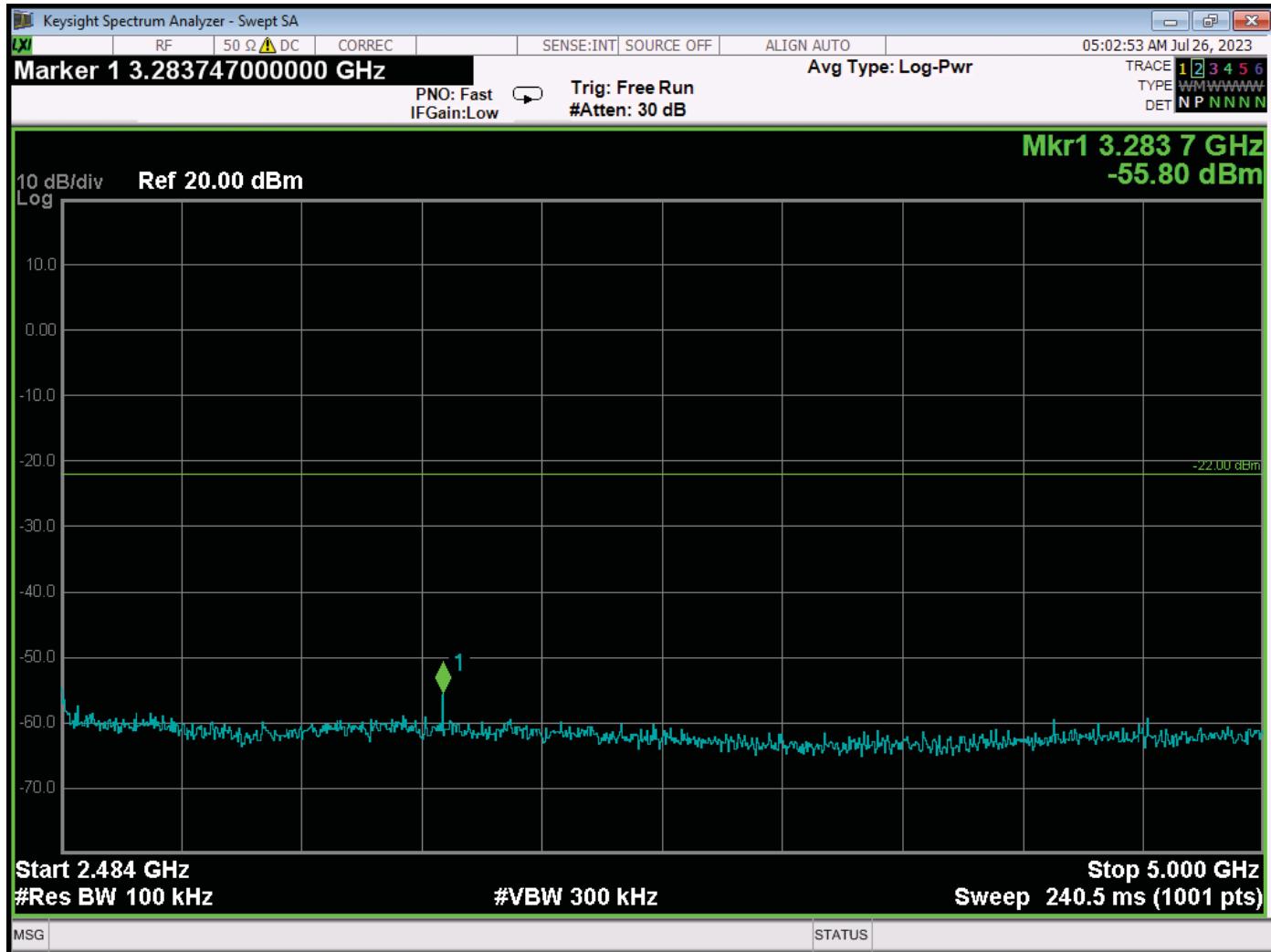
**Newbury Park Division**  
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(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



RF Antenna Conducted Test – High Channel – 2483.5 MHz to 5 GHz – WiFi

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Brea, CA 92823  
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**Lake Forest Division**  
20621 Pascal Way  
Lake Forest, CA 92630  
(949) 587-0400

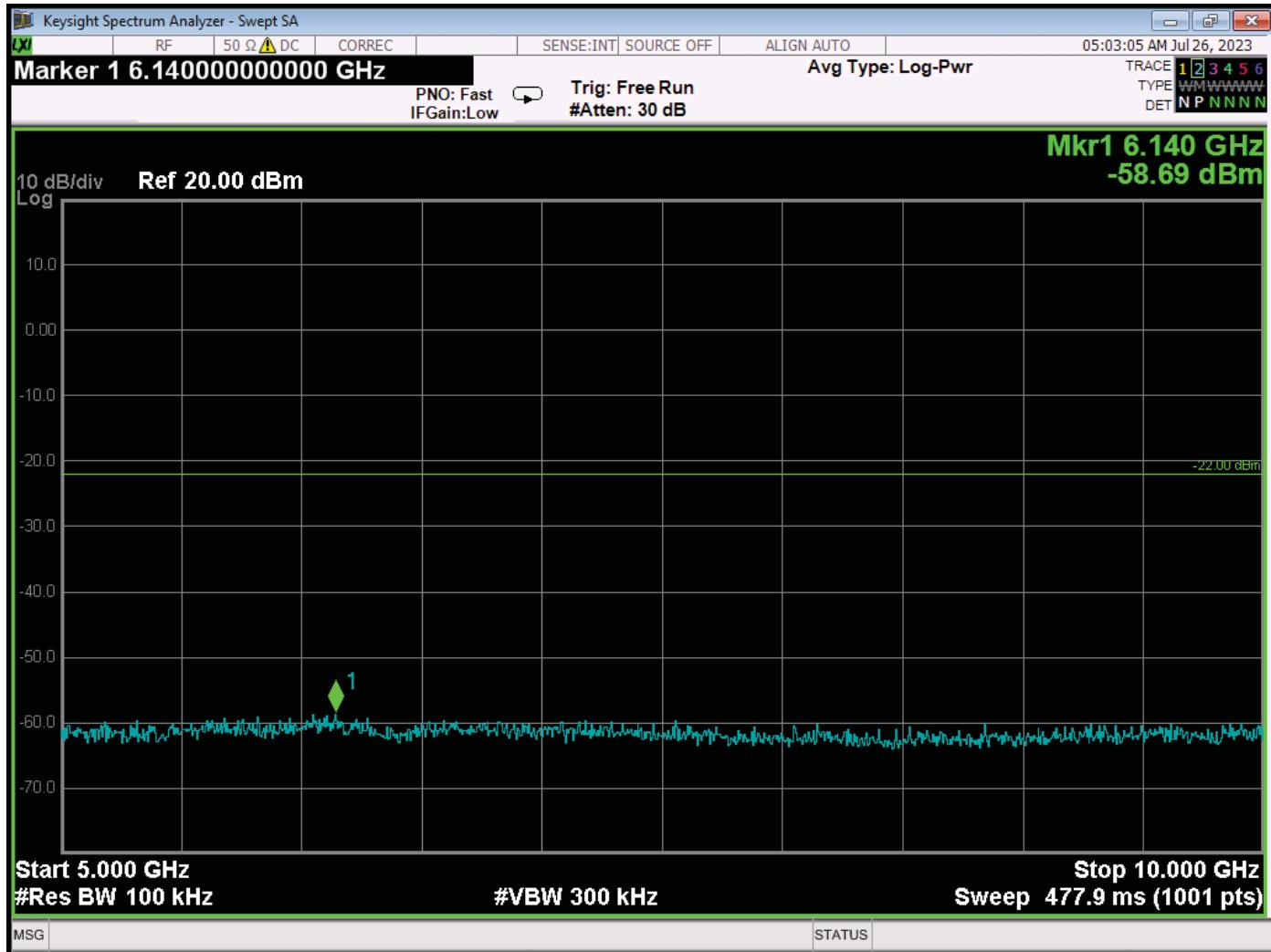
**Newbury Park Division**  
1050 Lawrence Drive  
Newbury Park, CA 91320  
(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



RF Antenna Conducted Test – High Channel – 5 GHz to 10 GHz – WiFi

**Brea Division**  
114 Olinda Drive  
Brea, CA 92823  
(714) 579-0500

**Lake Forest Division**  
20621 Pascal Way  
Lake Forest, CA 92630  
(949) 587-0400

**Newbury Park Division**  
1050 Lawrence Drive  
Newbury Park, CA 91320  
(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123



RF Antenna Conducted Test – High Channel – 10 GHz to 25 GHz – WiFi

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(949) 587-0400

**Newbury Park Division**  
1050 Lawrence Drive  
Newbury Park, CA 91320  
(805) 480-4044



**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

FTW LLC

HOPPER

MODEL: FTW000123

## EMISSIONS IN NON-RESTRICTED BANDS

FREQUENCY (MHz)	LEVEL (dBm)	Limit* (dBm)	Margin (dB)
2400.00	-41.423	-22.53	-18.893
24715.00	-47.482	-21.47	-26.012
2400.00	-47.358	-21.08	-26.278

Note: The three highest non-restricted emissions are reported.

\*The Limit is based on 20 dB below the highest reference level obtained on the previous pages.

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**Newbury Park Division**  
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FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Report Number: B30731D1 Page E124

Hopper

Model: FTW000123

***CONDUCUTED EMISSIONS  
DATA SHEETS***

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**Newbury Park Division**  
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(805) 480-4044



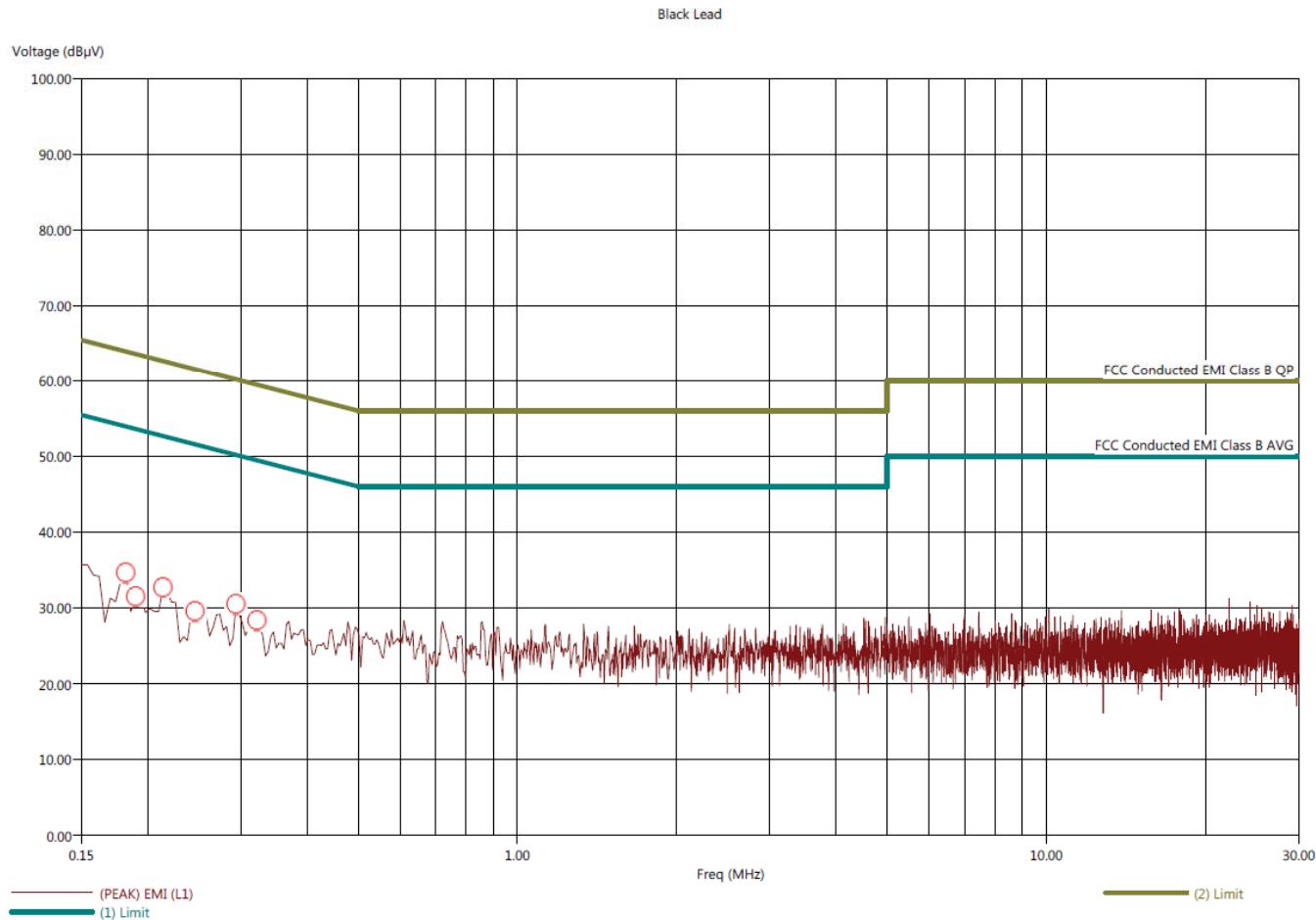
**COMPATIBLE  
ELECTRONICS**

FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

Hopper  
Model: FTW000123

Title: FCC Class B - Black Lead  
File: 2 - Pre-Scan - BL - FCC Class B - 08-02-2023.set  
Operator: Kyle Fujimoto  
EUT Type: Hopper  
EUT Condition: The EUT is continuously charging  
Company: FTW LLC  
Model: FTW000123  
S/N: N/A

8/2/2023 1:59:26 PM  
Sequence: Preliminary Scan



**Brea Division**  
114 Olinda Drive  
Brea, CA 92823  
(714) 579-0500

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20621 Pascal Way  
Lake Forest, CA 92630  
(949) 587-0400

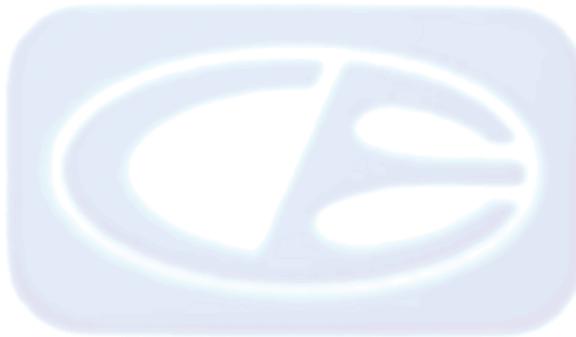
**Newbury Park Division**  
1050 Lawrence Drive  
Newbury Park, CA 91320  
(805) 480-4044



Title: FCC Class B - Black Lead  
 File: 2 - Final Scan - BL - FCC Class B - 08-02-2023.set  
 Operator: Kyle Fujimoto  
 EUT Type: Hopper  
 EUT Condition: The EUT is continuously charging  
 Company: FTW LLC  
 Model: FTW000123  
 S/N: N/A

8/2/2023 2:12:59 PM  
 Sequence: Final Measurements

Black Lead									
Freq (MHz)	(PEAK) EMI (dB $\mu$ V)	(AVG) EMI (dB $\mu$ V)	(PEAK) Margin (dB)	(AVG) Limit (dB $\mu$ V)	(AVG) Margin (AVG) (dB)	Cable (dB)	Transducer (dB)	Filter (dB)	
0.182	31.44	20.83	-23.24	54.68	-33.85	0.01	0.07	10.10	
0.190	30.00	20.00	-23.65	53.66	-33.65	0.01	0.06	10.10	
0.214	29.38	19.55	-23.74	53.11	-33.57	0.01	0.06	10.10	
0.246	33.03	23.17	-18.71	51.74	-28.57	0.01	0.05	10.10	
0.294	32.28	21.87	-18.30	50.59	-28.71	0.01	0.04	10.10	
0.322	32.85	23.89	-16.54	49.39	-25.50	0.01	0.04	10.10	



**Brea Division**  
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**(714) 579-0500**

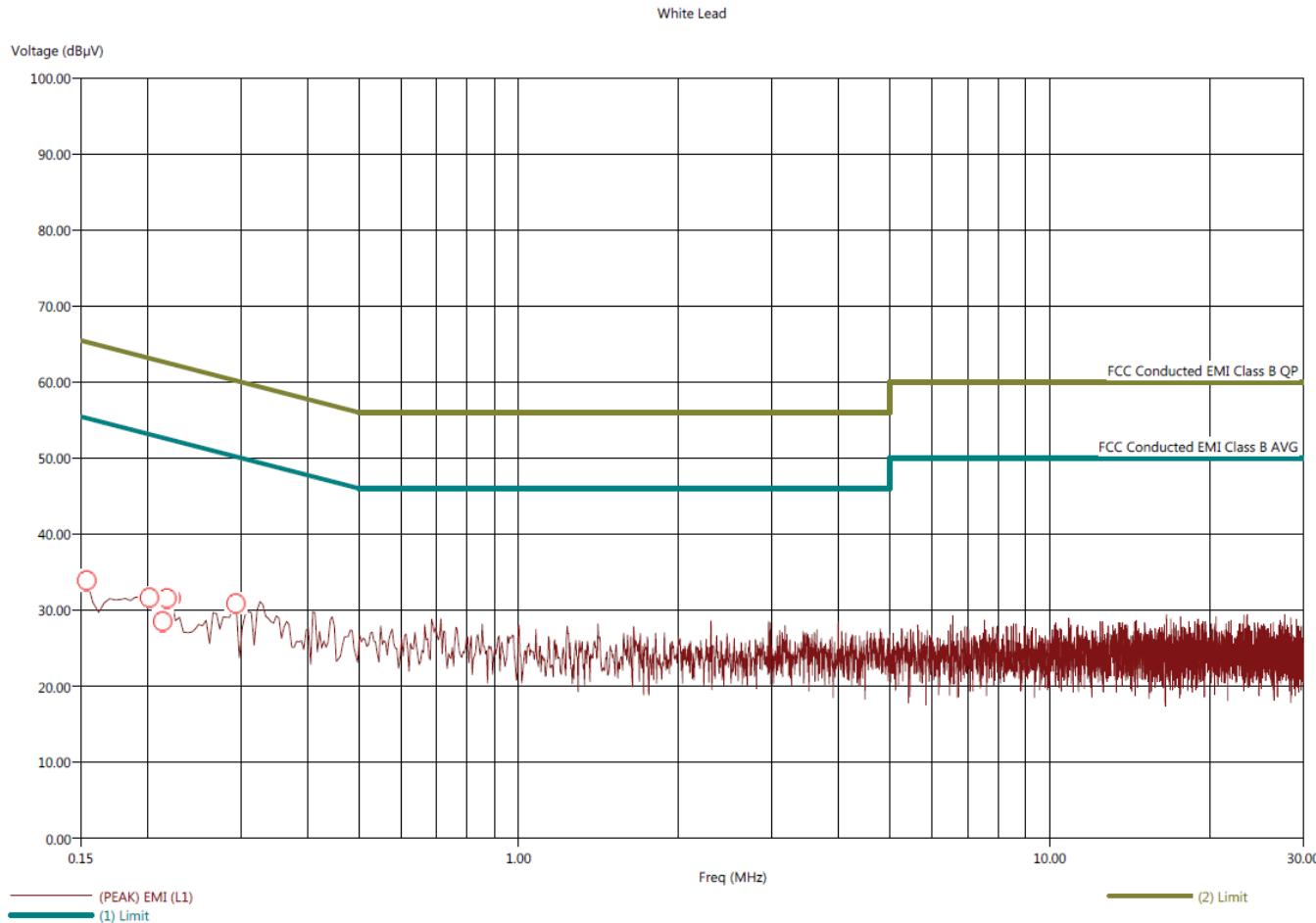
**Lake Forest Division**  
**20621 Pascal Way**  
**Lake Forest, CA 92630**  
**(949) 587-0400**

**Newbury Park Division**  
**1050 Lawrence Drive**  
**Newbury Park, CA 91320**  
**(805) 480-4044**



Title: FCC Class B - White Lead  
 File: 2 - Pre-Scan - WL - FCC Class B - 08-02-2023.set  
 Operator: Kyle Fujimoto  
 EUT Type: Hopper  
 EUT Condition: The EUT is continuously charging  
 Company: FTW LLC  
 Model: FTW000123  
 S/N: N/A

8/2/2023 2:16:18 PM  
 Sequence: Preliminary Scan



**Brea Division**  
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**(805) 480-4044**



## FCC Part 15 Subpart B and C; and FCC Section 15.247 Test Report

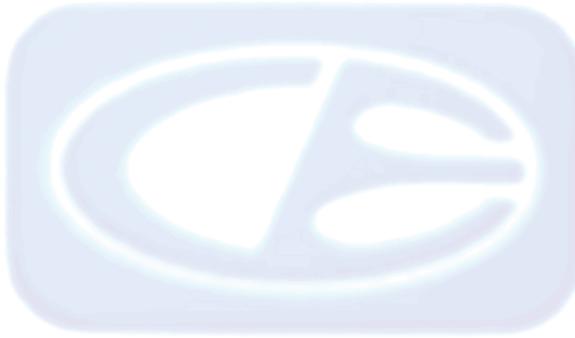
Hopper  
Model: FTW000123

Title: FCC Class B - White Lead  
File: 2 - Final Scan - WL - FCC Class B - 08-02-2023.set  
Operator: Kyle Fujimoto  
EUT Type: Hopper  
EUT Condition: The EUT is continuously charging  
Company: FTW LLC  
Model: FTW000123  
S/N: N/A

8/2/2023 2:18:53 PM  
Sequence: Final Measurements

## White Lead

Freq (MHz)	(PEAK) EMI (dB $\mu$ V)	(AVG) EMI (dB $\mu$ V)	(PEAK) Margin (AVG) (dB)	(AVG) Limit (dB $\mu$ V)	(AVG) Margin (AVG) (dB)	Cable (dB)	Transducer (dB)	Filter (dB)
0.154	32.12	22.06	-23.84	55.96	-33.90	0.01	0.09	10.10
0.202	30.58	19.73	-22.73	53.31	-33.58	0.01	0.06	10.10
0.214	30.86	19.43	-22.09	52.95	-33.52	0.01	0.06	10.10
0.218	29.56	19.22	-23.00	52.56	-33.34	0.01	0.06	10.10
0.222	28.70	19.11	-23.83	52.53	-33.42	0.01	0.06	10.10
0.294	31.41	21.64	-18.90	50.31	-28.67	0.01	0.05	10.10



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