

Test Report TR3664A BL5340


Equipment Under Test: BL5340

Requirement(s): FCC 15.247
RSS-247

Test Date(s): 3/9/2023-3/21/2023


Prepared for: Laird Connectivity
Attn: Jonathan Kaye
W66 N220 Commerce Ct.
Cedarburg, WI 53012

Report Issued by: Anthony Smith, EMC Engineering Specialist

Signature: 


Date: 7/12/2023

Report Reviewed by: Adam Alger, Laboratory Manager

Signature: 

Date: 06/16/2023

Report Constructed by: Anthony Smith, EMC Engineering Specialist

Signature: 

Date: 7/12/2023

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Company: Laird Connectivity	Page 1 of 27	Name: BL5340
Report: TR3664A BL5340		Model: BL5340
Quote: NBO-12-2022-005678		Serial: 00068

CONTENTS

Contents.....	2
Laird Connectivity Test Services in Review	3
1 Test Report Summary	4
2 Client Information.....	5
2.1 Equipment Under Test (EUT) Information	5
2.2 Product Description	5
2.3 Modifications Incorporated for Compliance.....	5
2.4 Deviations and Exclusions from Test Specifications	5
2.5 Additional Information.....	5
2.6 Additional Information.....	5
3 References	6
4 Uncertainty Summary	7
5 Test Data	8
5.1 Antenna Port Conducted Emissions.....	8
6 Revision History	27

Laird Connectivity Test Services in Review

The Laird Connectivity LLC laboratory located at W66 N220 Commerce Court Cedarburg, Wisconsin, 53012 USA is recognized through the following organizations:



A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025:2017 with Electrical (EMC) Scope

A2LA Certificate Number: 1255.01

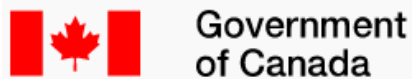
Scope of accreditation includes all test methods listed herein unless otherwise noted



Federal Communications Commission (FCC) – USA

Accredited Test Firm Registration Number: 953492

Recognition of two 3 meter Semi-Anechoic Chambers



Innovation, Science and Economic Development Canada

Accredited U.S. Identification Number: US0218

Recognition of two 3 meter Semi-Anechoic Chambers

Company: Laird Connectivity	Page 3 of 27	Name: BL5340
Report: TR3664A BL5340		Model: BL5340
Quote: NBO-12-2022-005678		Serial: 00068

1 TEST REPORT SUMMARY

During **March 9th, 2023 to March 21st, 2023** the Equipment Under Test (EUT), **BL5340**, as provided by **Laird Connectivity** was tested to the following requirements for the purpose of a Class 2 Permissive Change to add an antenna:

FCC 15.247/RSS-247

Requirements	Description	Specification	Method	Compliant
FCC: 15.247 (b)(3) ISED: RSS-247 5.4 (d)	Maximum Conducted Output Power	30 dBm	ANSI C63.10	Yes
FCC: 15.247 (d) ISED: RSS-GEN 8.10	Spurious Emissions in Restricted Frequency Bands	FCC 15.209 RSS-GEN 8.9	ANSI C63.10	Yes

Notice:

The results relate only to the item tested as configured and described in this report. Any additional configurations, modes of operation, or modifications made to the equipment under test after the specified test date(s) are at the decision of the client and may not apply to the data seen in this test report.

The decision rule for Pass / Fail assessment to the specification or standard listed in this test report has been agreed upon by the client and laboratory to be as follows:

Measurement Type	Rule
Emissions – Amplitude	1 dB below specified limit
Emissions – Frequency	1% less than the specification
Immunity	Tested at specified level

2 CLIENT INFORMATION

Company Name	Laird Connectivity
Contact Person	Jonathan Kaye
Address	W66N220 Commerce Court Cedarburg, WI, 53012

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	BL5340
Model Number	BL5340
Serial Number	00068
FCC ID	SQGBL5340
IC ID	3147A-BL5340

2.2 Product Description

Bluetooth and 802.15.4 Module operating in the 2.4 GHz range.

2.3 Modifications Incorporated for Compliance

None noted at time of test

2.4 Deviations and Exclusions from Test Specifications

None noted at time of test

2.5 Additional Information

nRF Connect for Desktop v4.0.0 – Direct Test Mode v2.0.4 used to program EUT. Bluetooth LE (Low Energy) 125k, 500k, 1Mbps, 2Mbps. Channels tested: 37 (2402 MHz), 17 (2440 MHz), and 39 (2480 MHz). Dell Latitude 5480 Laptop used to program radio.

2.6 Additional Information

This testing is for a permissive change to add the iFlex-Pifa Antenna, with an antenna gain of 3.1 dBi, to the list of antennas usable by the BL5340. EUT tested via Cabinet Radiation method.

Company: Laird Connectivity	Page 5 of 27	Name: BL5340
Report: TR3664A BL5340		Model: BL5340
Quote: NBO-12-2022-005678		Serial: 00068

3 REFERENCES

Publication	Edition	Date	AMD 1
eCFR	-	2023	-
RSS-247	2	2017	-
RSS-GEN	5	2018	2019
ANSI C63.10	-	2013	-
KDB 178919 D01	6	2015	-

4 UNCERTAINTY SUMMARY

Using the guidance of the following publications the calculated measurement uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of $k = 2$.

References
CISPR 16-4-1
CISPR 16-4-2
CISPR 32
ANSI C63.23
A2LA P103
A2LA P103c
ETSI TR 100-028

Measurement Type	Configuration	Uncertainty \pm
Radiated Emissions	Biconical Antenna	5.0 dB
Radiated Emissions	Log Periodic Antenna	5.3 dB
Radiated Emissions	Horn Antenna	4.7 dB
AC Line Conducted Emissions	Artificial Mains Network	3.4 dB
Telecom Conducted Emissions	Asymmetric Artificial Network	4.9 dB
Disturbance Power Emissions	Absorbing Clamp	4.1 dB
Radiated Immunity	3 Volts/meter	2.2 dB
Conducted Immunity	CDN/EM/BCI	2.4/3.5/3.4 dB
EFT Burst/Surge	Peak pulse voltage	164 volts
ESD Immunity	15 kV level	1377 Volts

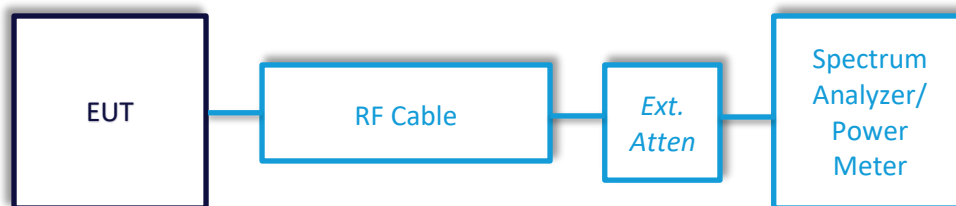
Parameter	ETSI U.C. \pm	U.C. \pm
Radio Frequency, from F0	1×10^{-7}	0.55×10^{-7}
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %
Supply voltages	3 %	1 %

5 TEST DATA

5.1 Antenna Port Conducted Emissions

Description of Measurement	<p>The direct measurement of emissions at the antenna port of the EUT is achieved by use of a RF connection to a spectrum analyzer or power meter.</p> <p>The cable and attenuator factors are loaded into the analyzer or power meter allowing for direct measurement readings without the need for further corrections.</p>
Example Calculations	<p>Measurement (dBm) + Cable factor (dB) + External Attenuator (dB) = Corrected Reading (dBm)</p> <p>Margin (dB) = Limit (dBm) – Corrected Reading (dBm)</p>

Block Diagram



5.1.1 Antenna Port Conducted Emissions – RF Output Power

Operator	Anthony Smith	QA	Adam Alger
Temperature	20.6°C	R.H. %	29.60%
Test Date	3/9/2023	Location	RF Conducted Bench
Requirement	FCC 15.247	Method	ANSI C63.10

Limits: <30 dBm

Test Parameters

Frequency	2400-2483.5 MHz	Setup	Conducted
RBW	3 MHz	VBW	50 MHz
Detector(s)	Peak	Settings	Trace Max Hold

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960172	Cable	A.H. Systems, Inc.	SAC-26G-1	387	3/22/2022	3/22/2023	Active Verification
EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	4/12/2022	4/12/2023	Active Calibration

EUT Parameters

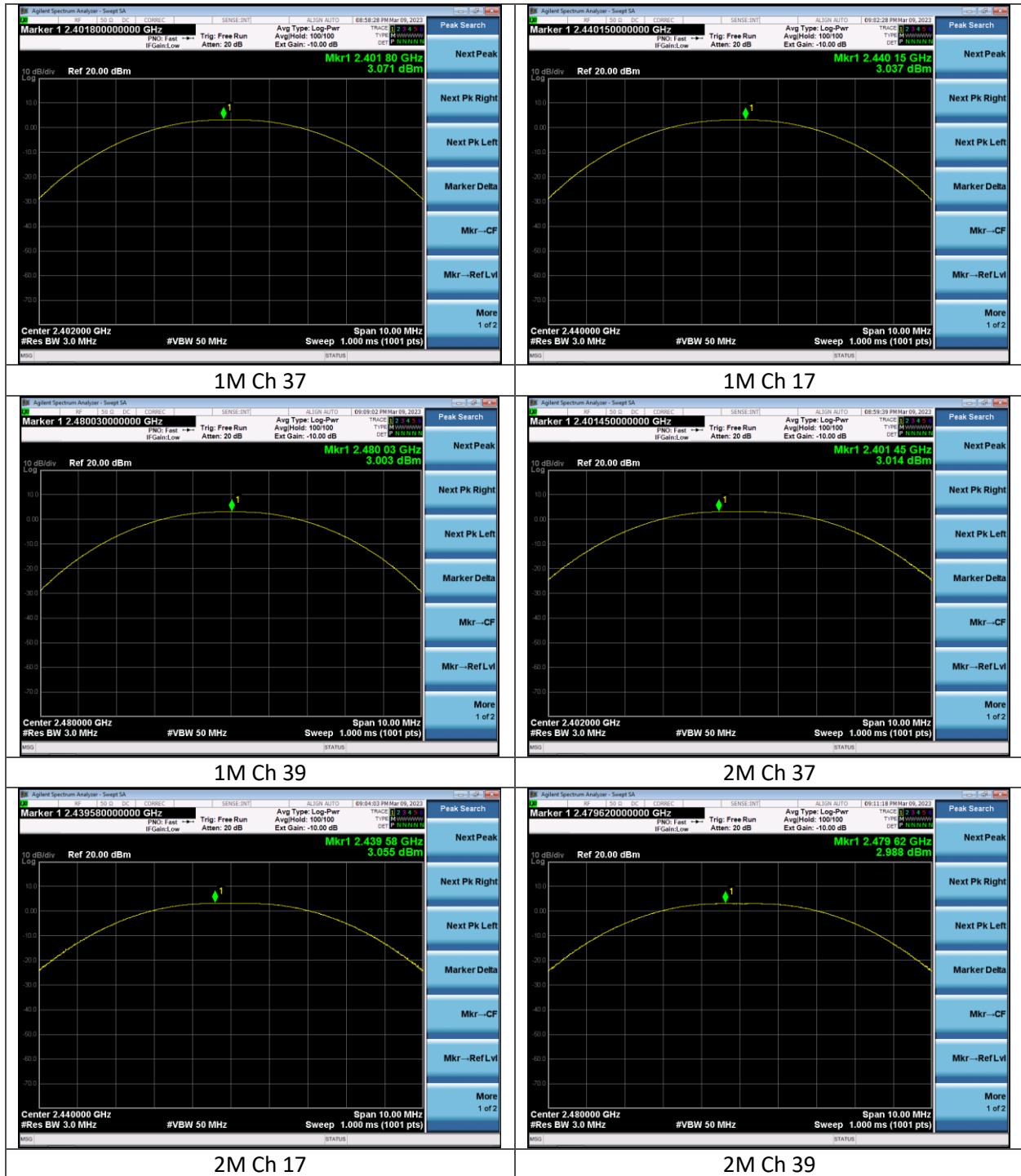
Input Power	USB	Mode	BLE
Frequency	2402, 2440, 2480 MHz	Channel	37, 17, 39
Data Rates	125k, 500k, 1M, 2M	Transmit Power Setting	0

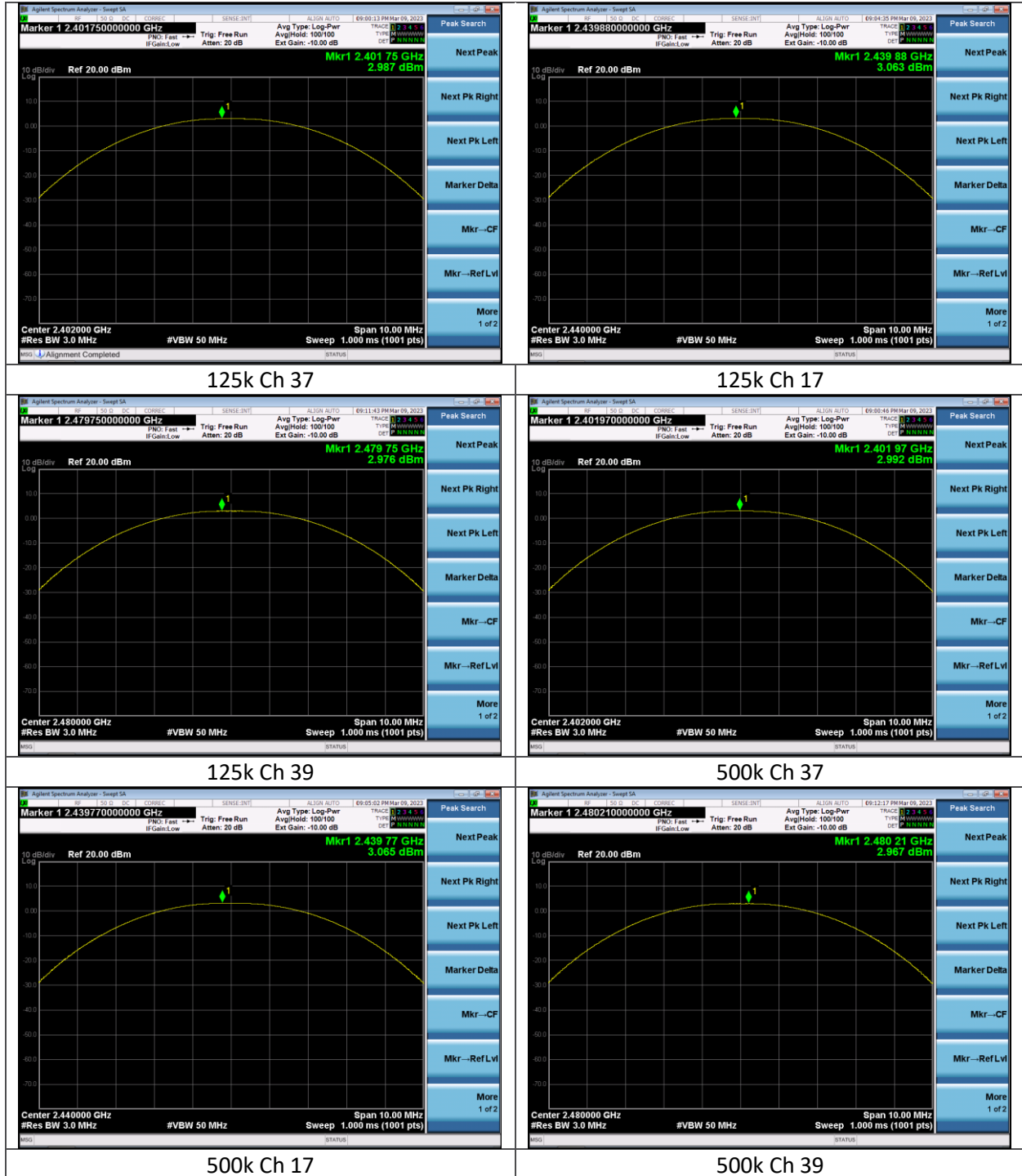
Data

Table

Channel	Mode	Peak Conducted Power (dBm)	Limit (dBm)	Margin (dB)
37	1M	3.1	30.0	26.9
17	1M	3.0	30.0	27.0
39	1M	3.0	30.0	27.0
37	2M	3.0	30.0	27.0
17	2M	3.1	30.0	26.9
39	2M	3.0	30.0	27.0
37	125k	3.0	30.0	27.0
17	125k	3.1	30.0	26.9
39	125k	3.0	30.0	27.0
37	500k	3.0	30.0	27.0
17	500k	3.1	30.0	26.9
39	500k	3.0	30.0	27.0

Plots





5.1.2 Antenna Port Conducted Emissions – Emissions in Restricted Frequency Bands

Operator	Anthony Smith	QA	Adam Alger
Temperature	22.3, 22.0°C	R.H. %	21.2%, 25.7%
Test Date	3/20/2023, 3/21/2023	Location	Bench
Requirement	FCC 15.247 RSS-247	Method	ANSI C63.10

Limits:

Frequency (MHz)	Quasi Peak Limit (dBµV/m)	Average Limit (dBµV/m)	Peak Limit (dBµV/m)
30-88	40.0	-	-
88-216	43.5	-	-
216-960	46.0	-	-
960-1000	54.0	-	-
1000-25000	-	54.0	74.0

Test Parameters

Frequency	1-25 GHz	Setup	Conducted
RBW	1 MHz	VBW	3 MHz
Detector(s)	Peak, Average	Settings	Max Hold - Peak, Trace Average - Average

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960173	Cable	A.H. Systems, Inc.	SAC-26G-1	388	3/22/2022	3/22/2023	Active Verification
EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	4/12/2022	4/12/2023	Active Calibration

EUT Parameters

Input Power	USB	Mode	BLE Packet Length 255 bytes
Frequency	2402, 2440, 2480 MHz	Channel	37, 17, 39
Data Rates	1M, 2M	Settings	

Data Tables

Duty Cycle

Mode	On Time (ms)	Period (ms)	Duty Cycle (%)	Avg VBW (Hz)	DC Correction (dB)
1M	2.138	2.5	85.5	468	0.7
2M	1.08	1.875	57.6	926	2.4

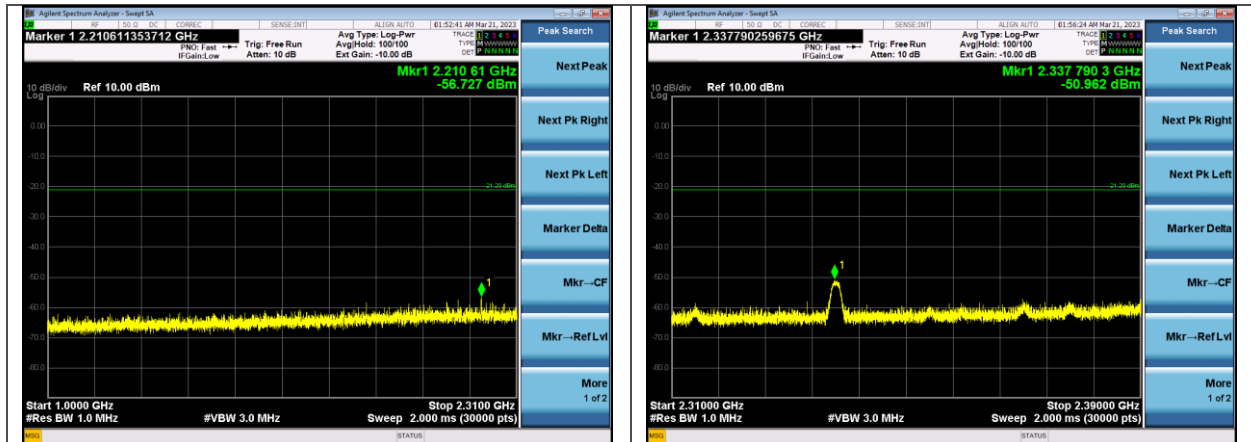
Peak Measurements

Mode/Channel	Freq (MHz)	Meas. (dBm)	Ant. Gain (dBi)	Corrected Meas. (dBm)	Limit (dBm)	Margin (dB)
1M/Low	2337.8	-50.9	3.1	-47.8	-21.2	26.6
1M/Mid	2375.8	-51.0	3.1	-47.9	-21.2	26.7
1M/High	2351.9	-56.5	3.1	-53.4	-21.2	32.2
2M/Low	2337.8	-51.3	3.1	-48.2	-21.2	27.0
2M/Mid	2375.7	-51.0	3.1	-47.9	-21.2	26.7
2M/High	2351.9	-55.6	3.1	-52.5	-21.2	31.3
1M/Low	2490.3	-57.5	3.1	-54.4	-21.2	33.2
1M/Mid	2487.9	-57.3	3.1	-54.2	-21.2	33.0
1M/High	2483.6	-48.1	3.1	-45.0	-21.2	23.8
2M/Low	2489.9	-57.7	3.1	-54.6	-21.2	33.4
2M/Mid	2487.4	-57.8	3.1	-54.7	-21.2	33.5
2M/High	2483.5	-38.5	3.1	-35.4	-21.2	14.2
1M/Low	4804.1	-43.5	3.1	-40.4	-21.2	19.2
1M/Mid	4879.8	-44.6	3.1	-41.5	-21.2	20.3
1M/High	4960.8	-45.4	3.1	-42.3	-21.2	21.1
2M/Low	4803.3	-44.5	3.1	-41.4	-21.2	20.2
2M/Mid	4881.3	-45.8	3.1	-42.7	-21.2	21.5
2M/High	4959.3	-45.9	3.1	-42.8	-21.2	21.6

Average Measurements

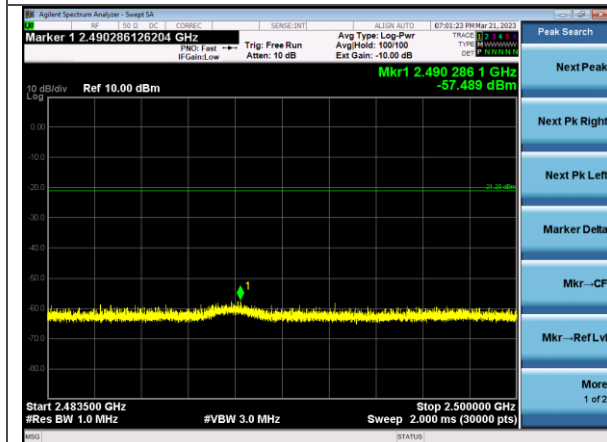
Mode/Channel	Freq (MHz)	Meas. (dBm)	Ant. Gain (dBi)	Duty Cycle Correction	Corrected Meas. (dBm)	Limit (dBm)	Margin (dB)
1M/Low	2338	-54.6	3.1	0.7	-50.8	-41.2	9.6
1M/Mid	2376.1	-54.9	3.1	0.7	-51.1	-41.2	9.9
1M/High	2352.1	-61.6	3.1	0.7	-57.8	-41.2	16.6
2M/Low	2337.9	-57.1	3.1	2.4	-51.6	-41.2	10.4
2M/Mid	2375.9	-57.2	3.1	2.4	-51.7	-41.2	10.5
2M/High	2352.1	-63.6	3.1	2.4	-58.1	-41.2	16.9
1M/Low	2490	-66.4	3.1	0.7	-62.6	-41.2	21.4
1M/Mid	2488.2	-66.7	3.1	0.7	-62.9	-41.2	21.7
1M/High	2483.5	-57.4	3.1	0.7	-53.6	-41.2	12.4
2M/Low	2489.8	-67.2	3.1	2.4	-61.7	-41.2	20.5
2M/Mid	2487.6	-67.9	3.1	2.4	-62.4	-41.2	21.2
2M/High	2483.5	-49.3	3.1	2.4	-43.8	-41.2	2.6
1M/Low	4804.3	-47.9	3.1	0.7	-44.1	-41.2	2.9
1M/Mid	4880.2	-48.9	3.1	0.7	-45.1	-41.2	3.9
1M/High	4960.3	-50.2	3.1	0.7	-46.4	-41.2	5.2
2M/Low	4805.1	-52.3	3.1	2.4	-46.8	-41.2	5.6
2M/Mid	4879.4	-52.9	3.1	2.4	-47.4	-41.2	6.2
2M/High	4959.9	-54.2	3.1	2.4	-48.7	-41.2	7.5

Plots

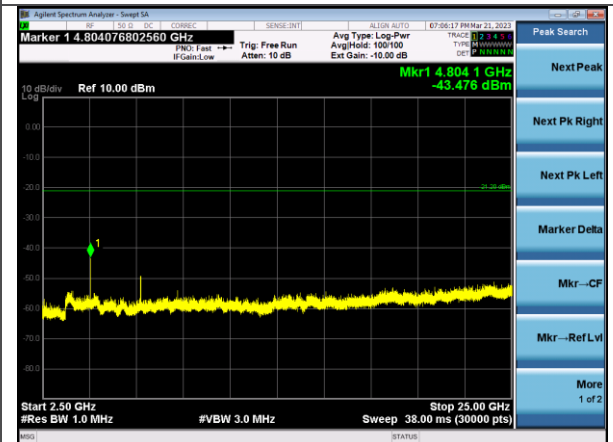


1-2.31 GHz Peak
Ch 37 1M

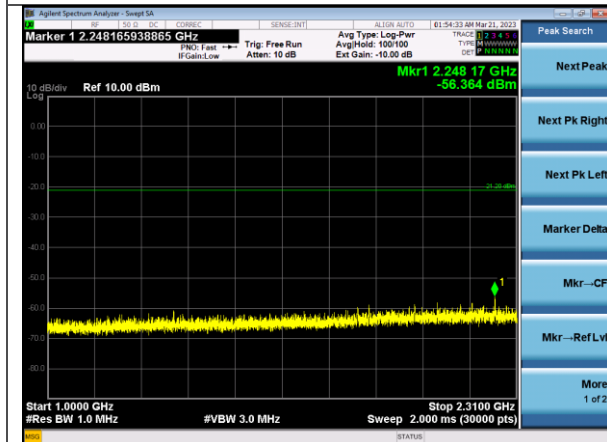
2.31-2.39 GHz Peak
Ch 37 1M



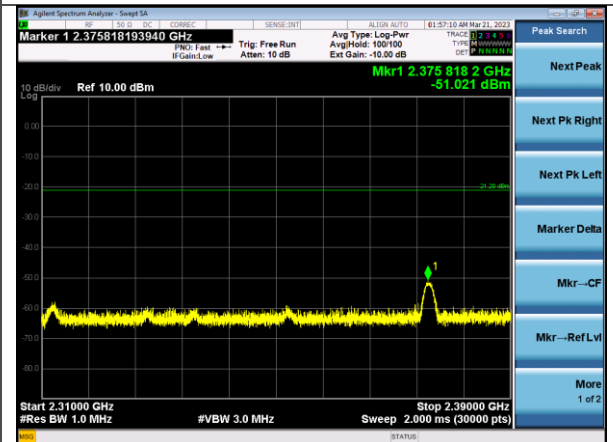
2.4835-2.5 GHz Peak
Ch 37 1M



2.5-25 GHz Peak
Ch 37 1M

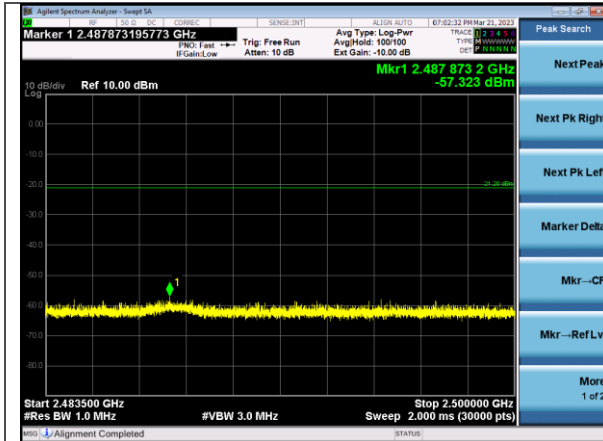


1-2.31 GHz Peak
Ch 17 1M

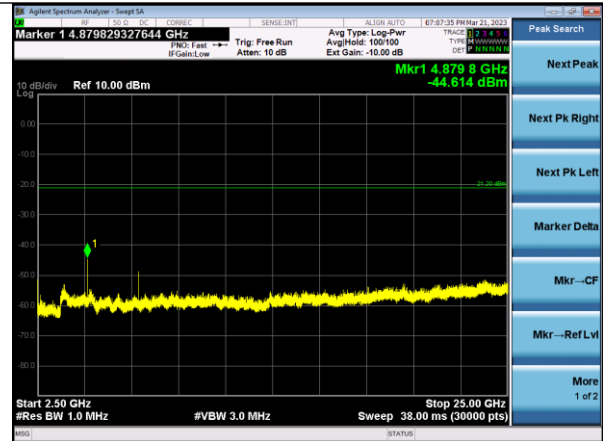


2.31-2.39 GHz Peak
Ch 17 1M

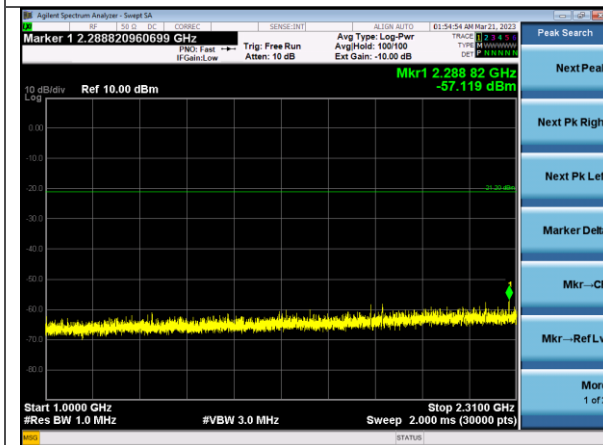
Company: Laird Connectivity		Name: BL5340
Report: TR3664A BL5340	Page 16 of 27	Model: BL5340
Quote: NBO-12-2022-005678		Serial: 00068



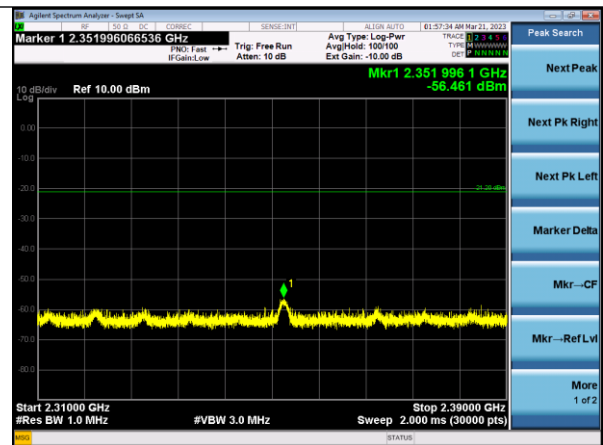
2.4835-2.5 GHz Peak
Ch 17 1M



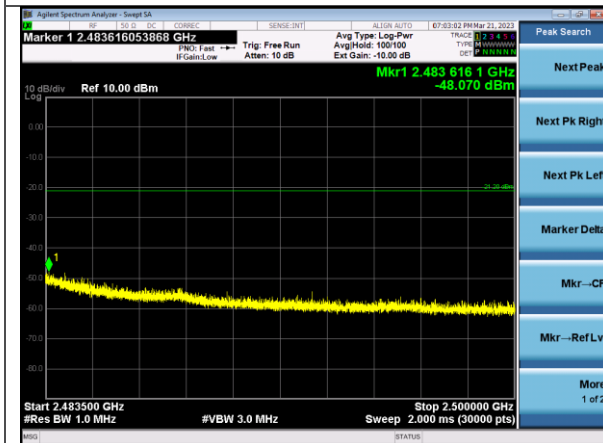
2.5-25 GHz Peak
Ch 17 1M



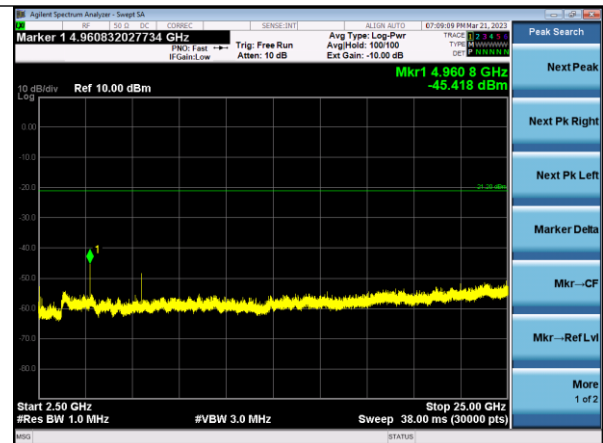
1-2.31 GHz Peak
Ch 39 1M



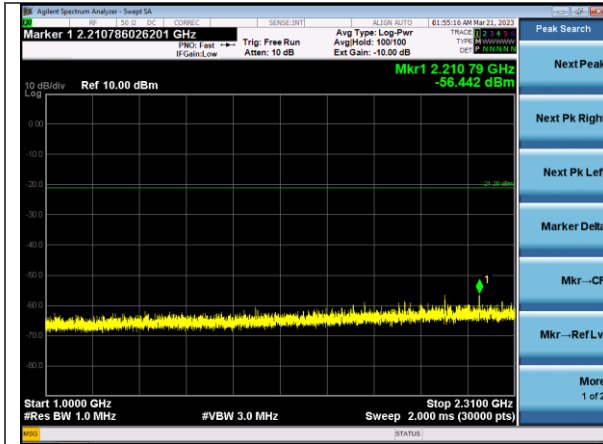
2.31-2.39 GHz Peak
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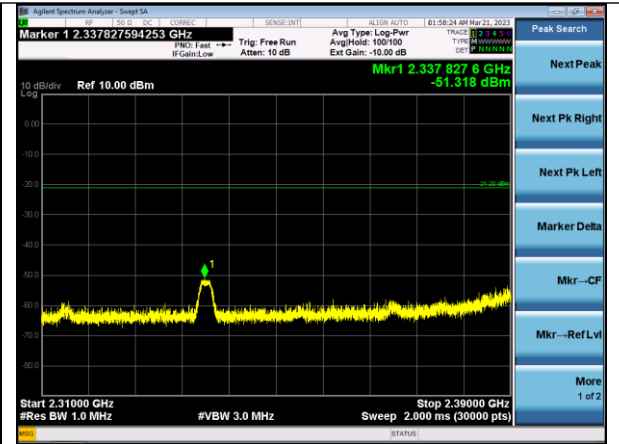
2.4835-2.5 GHz Peak
Ch 39 1M



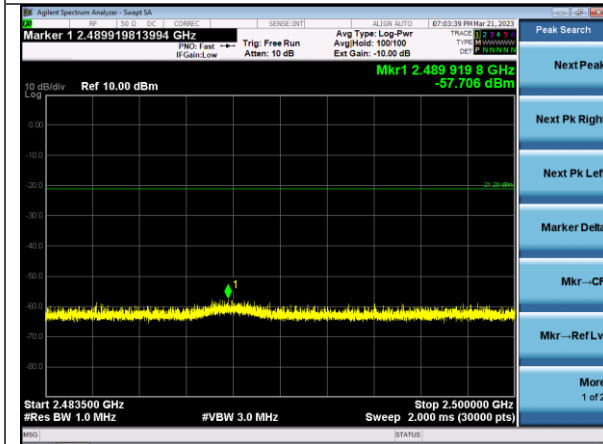
2.5-25 GHz Peak
Ch 39 1M



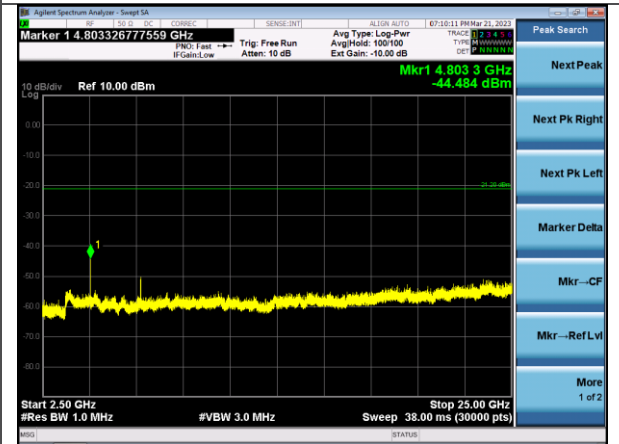
1-2.31 GHz Peak
Ch 37 2M



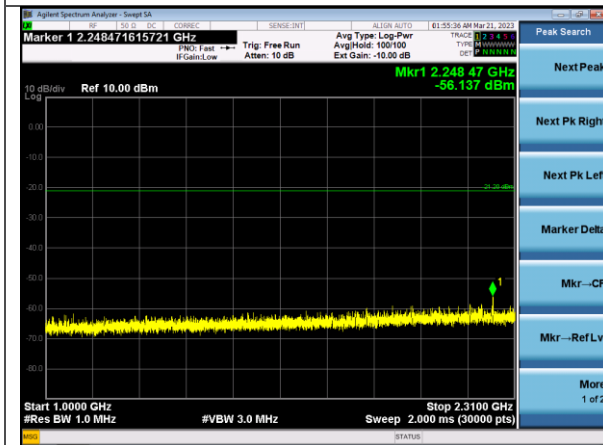
2.31-2.39 GHz Peak
Ch 37 2M



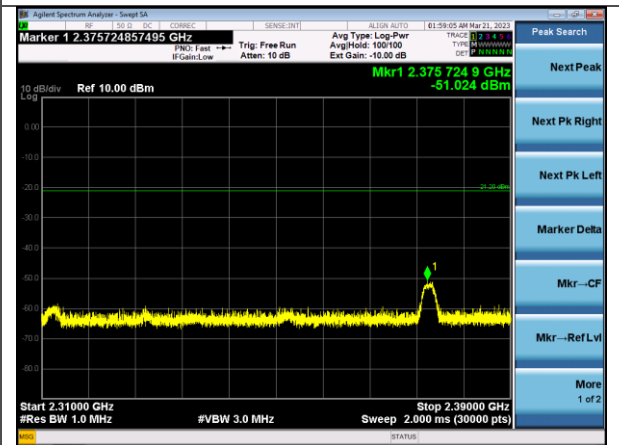
2.4835-2.5 GHz Peak
Ch 37 2M



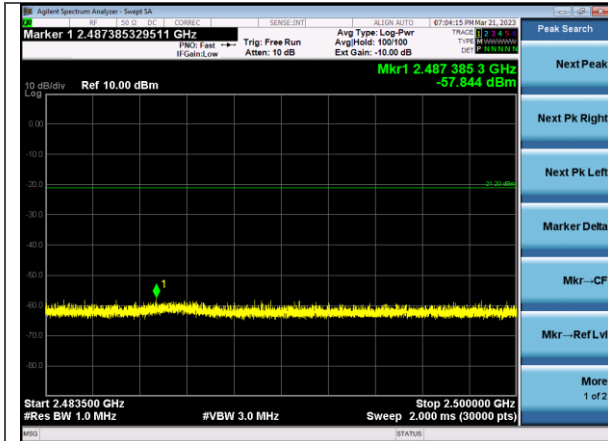
2.5-25 GHz Peak
Ch 37 2M



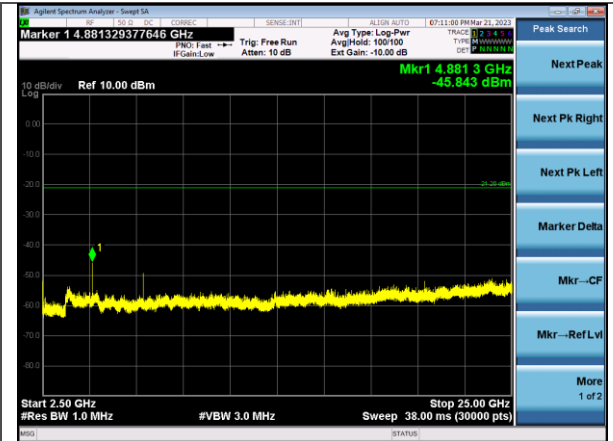
1-2.31 GHz Peak
Ch 17 2M



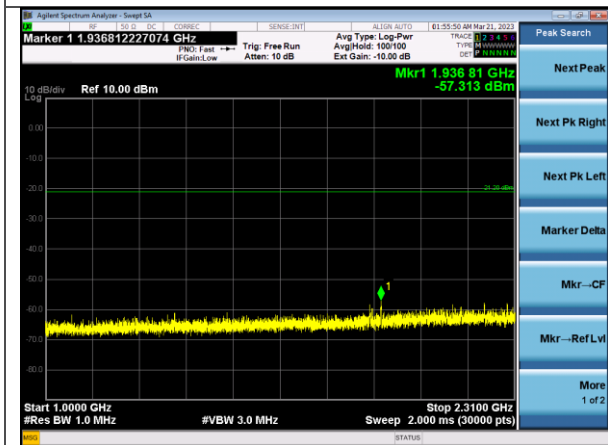
2.31-2.39 GHz Peak
Ch 17 2M



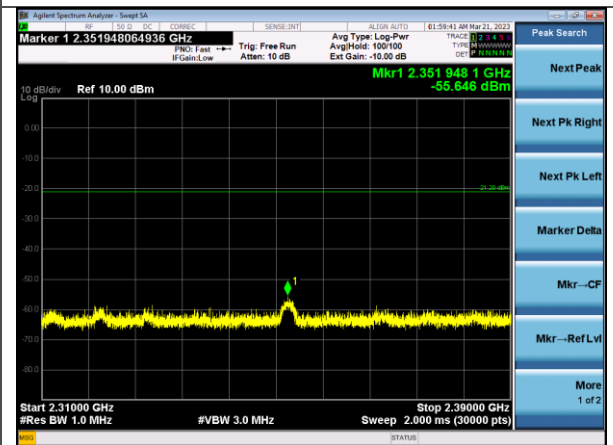
2.4835-2.5 GHz Peak
Ch 17 2M



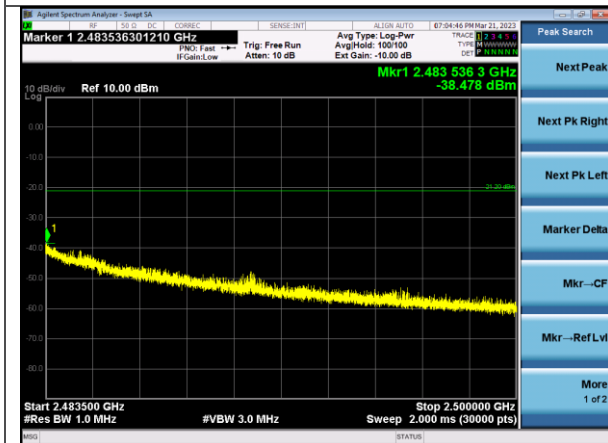
2.5-25 GHz Peak
Ch 17 2M



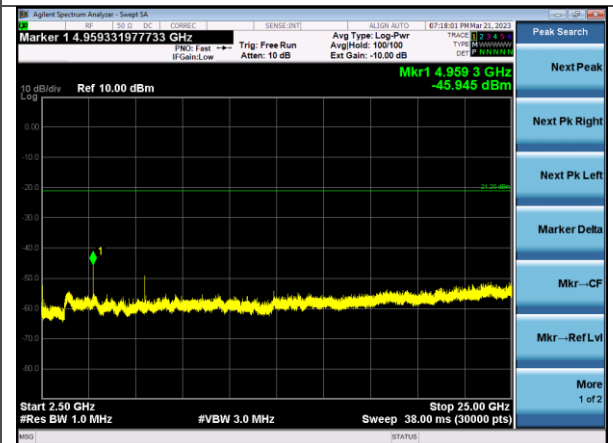
1-2.31 GHz Peak
Ch 39 2M



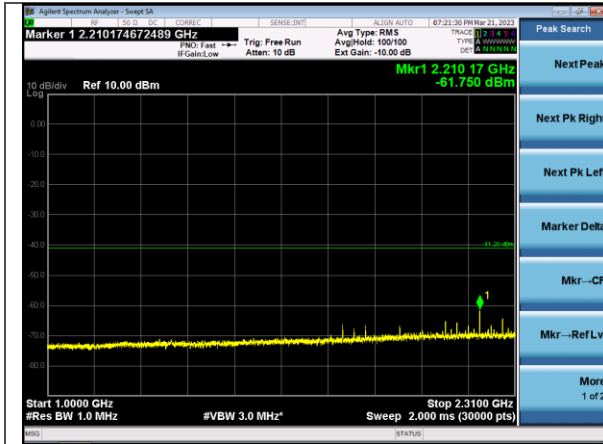
2.31-2.39 GHz Peak
Ch 39 2M



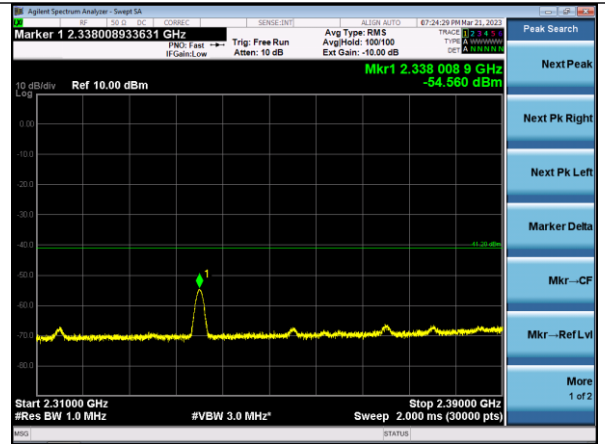
2.4835-2.5 GHz Peak
Ch 39 2M



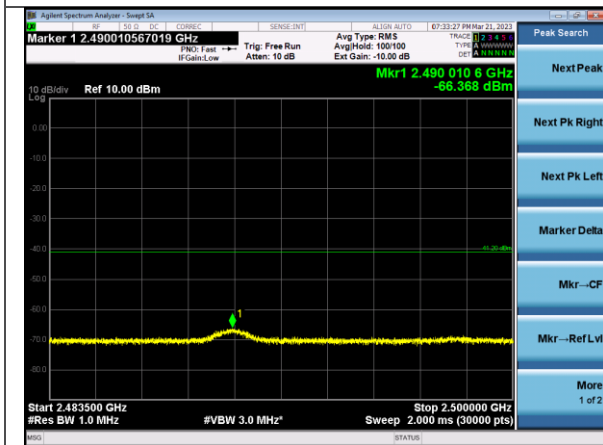
2.5-25 GHz Peak
Ch 39 2M



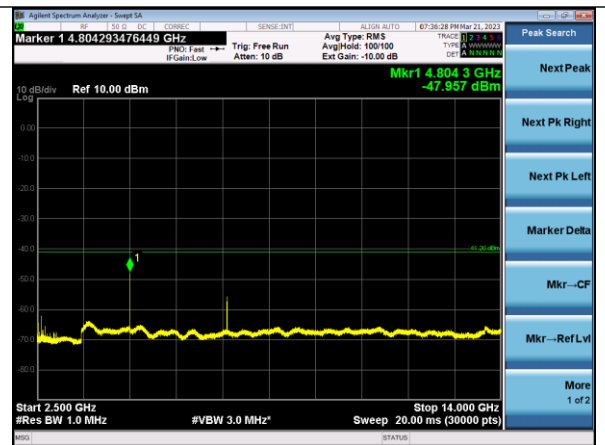
1-2.31 GHz Average
Ch 37 1M



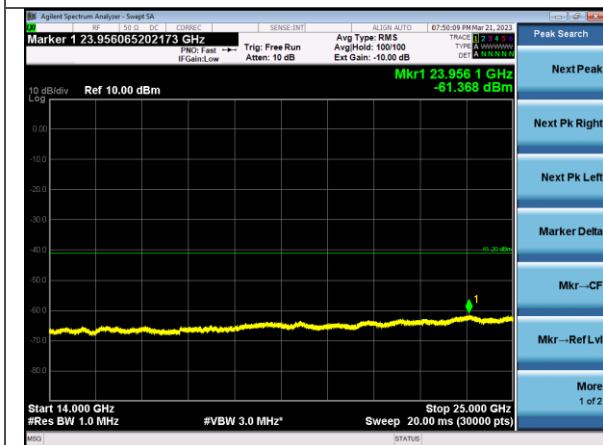
2.31-2.39 GHz Average
Ch 37 1M



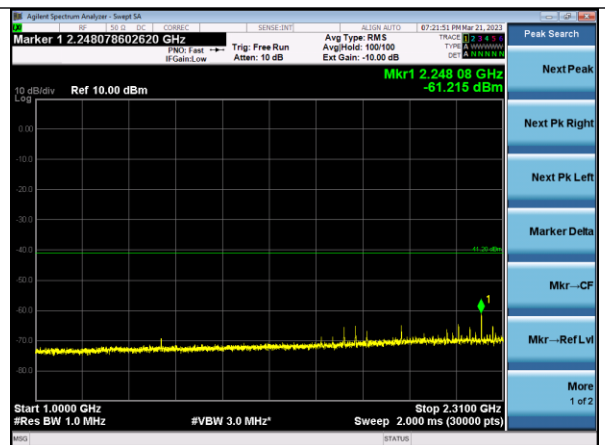
2.4835-2.5 GHz Average
Ch 37 1M



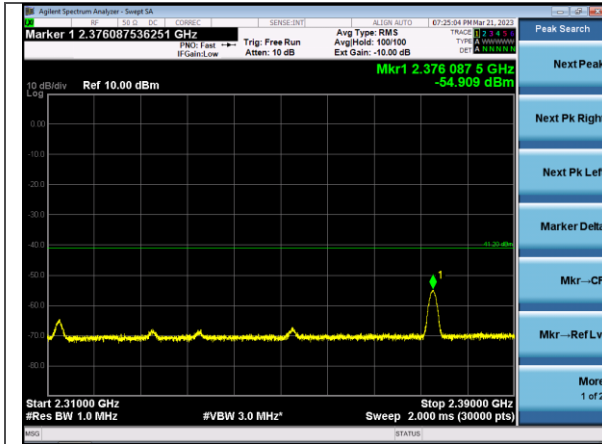
2.5-14 GHz Average
Ch 37 1M



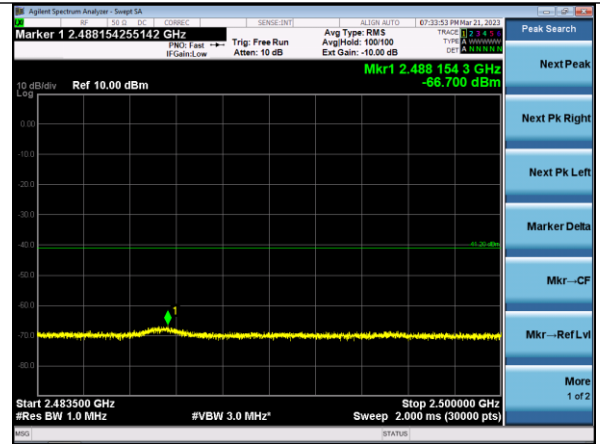
14-25 GHz Average
Ch 37 1M



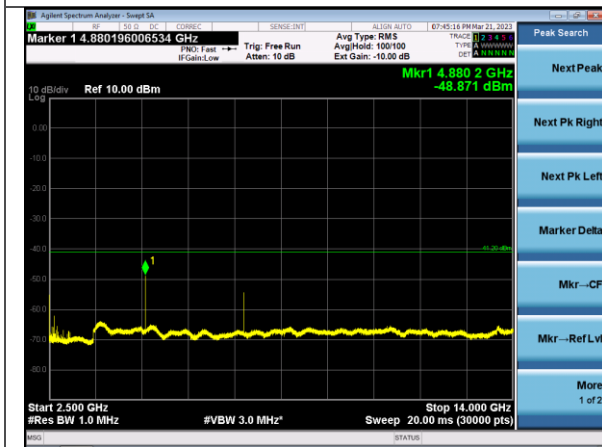
1-2.31 GHz Average
Ch 17 1M



2.31-2.39 GHz Average
Ch 17 1M



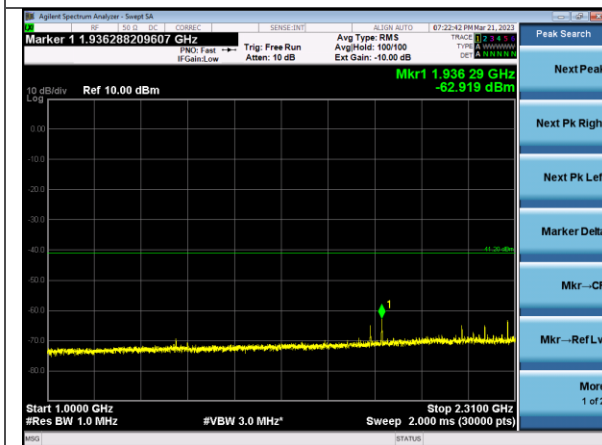
2.4835-2.5 GHz Average
Ch 17 1M



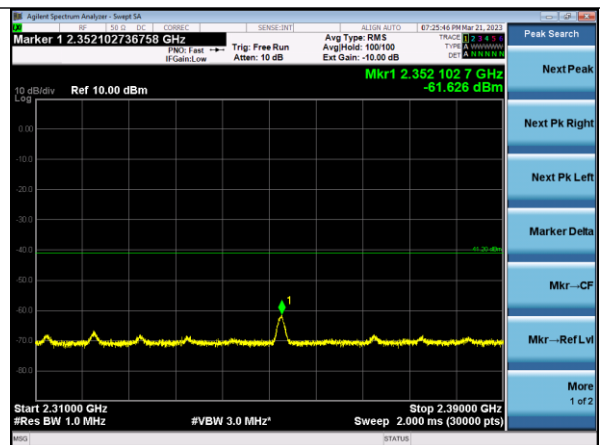
2.5-14 GHz Average
Ch 17 1M



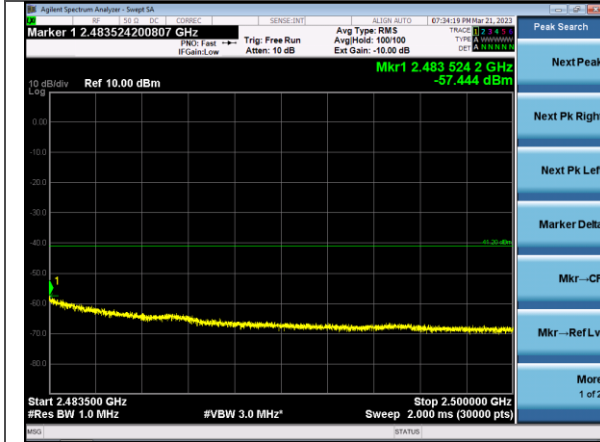
14-25 GHz Average
Ch 39 1M



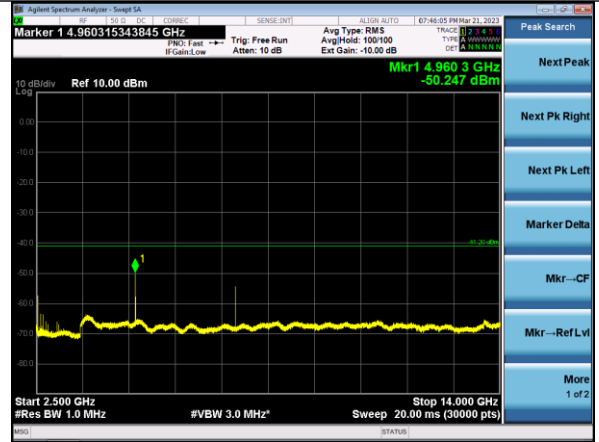
1-2.31 GHz Average
Ch 39 1M



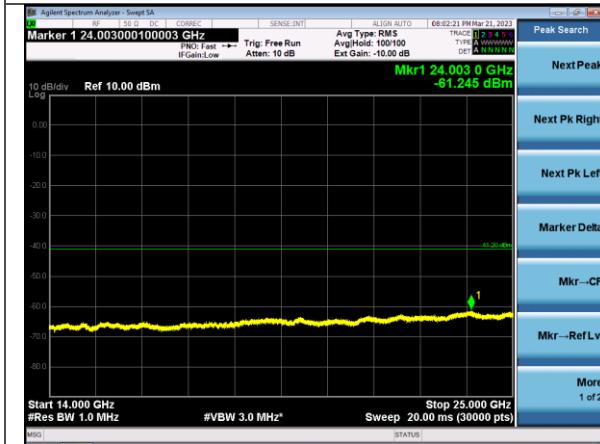
2.31-2.39 GHz Average
Ch 39 1M



2.4835-2.5 GHz Average
Ch 39 1M

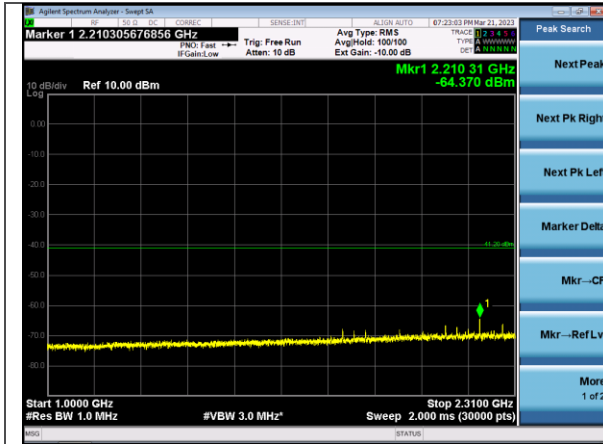


2.5-14 GHz Average
Ch 39 1M

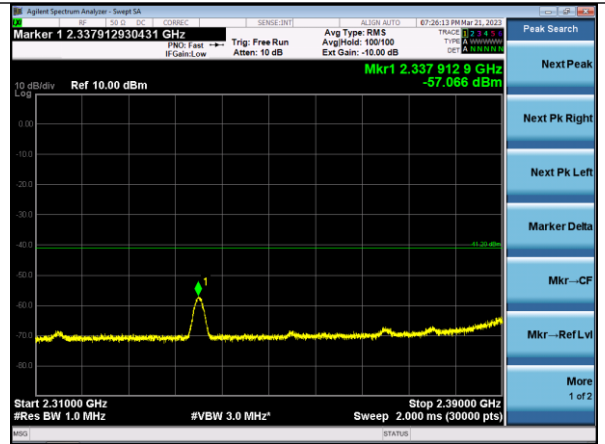


14-25 GHz Average
Ch 39 1M

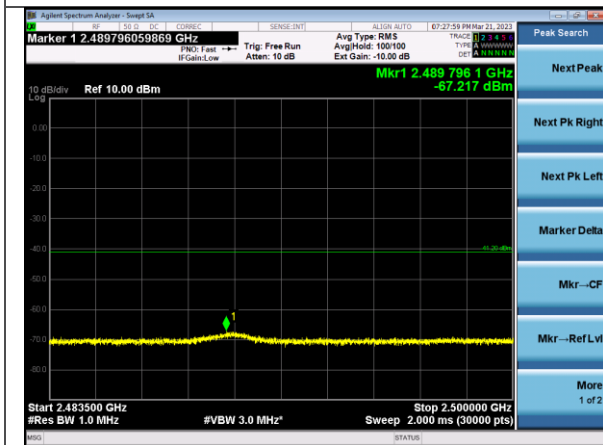
Company: Laird Connectivity	Page 22 of 27	Name: BL5340
Report: TR3664A BL5340		Model: BL5340
Quote: NBO-12-2022-005678		Serial: 00068



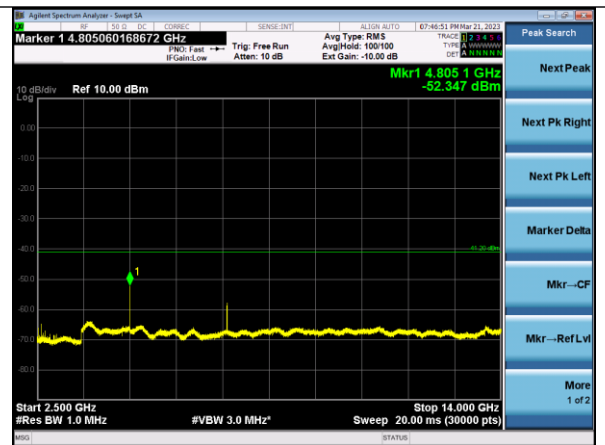
1-2.31 GHz Average
Ch 37 2M



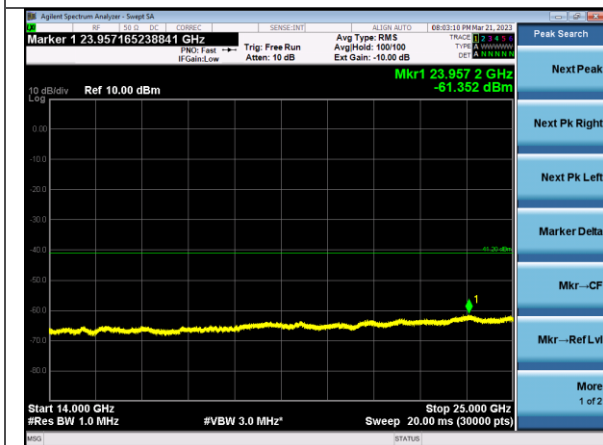
2.31-2.39 GHz Average
Ch 37 2M



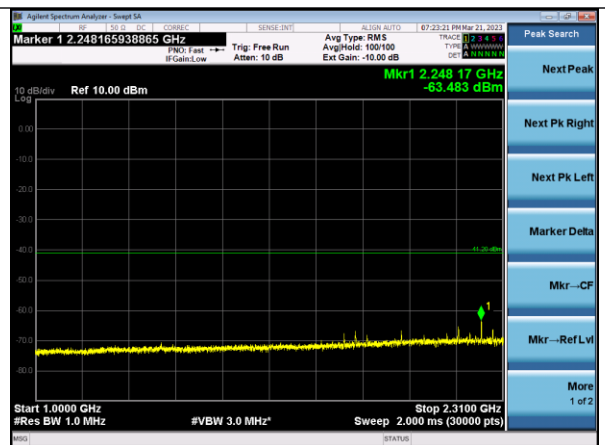
2.4835-2.5 GHz Average
Ch 37 2M



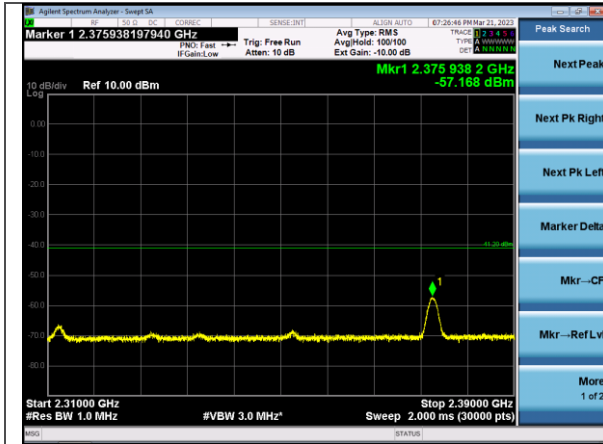
2.5-14 GHz Average
Ch 37 2M



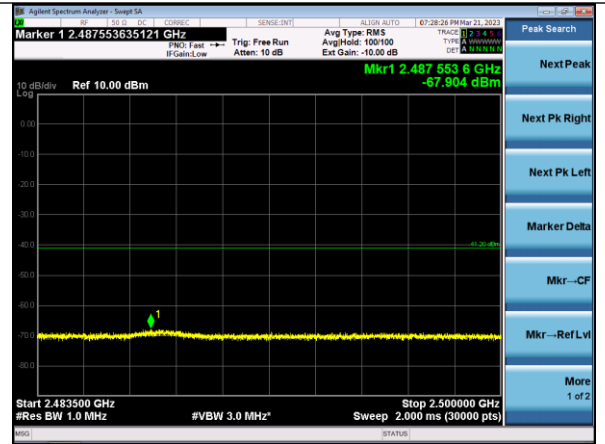
14-25 GHz Average
Ch 37 2M



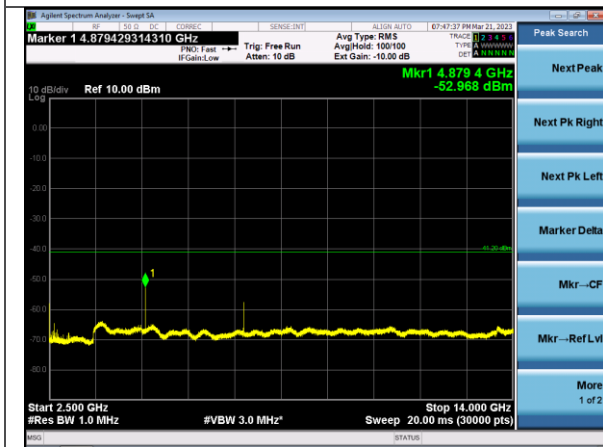
1-2.31 GHz Average
Ch 17 2M



2.31-2.39 GHz Average
Ch 17 2M



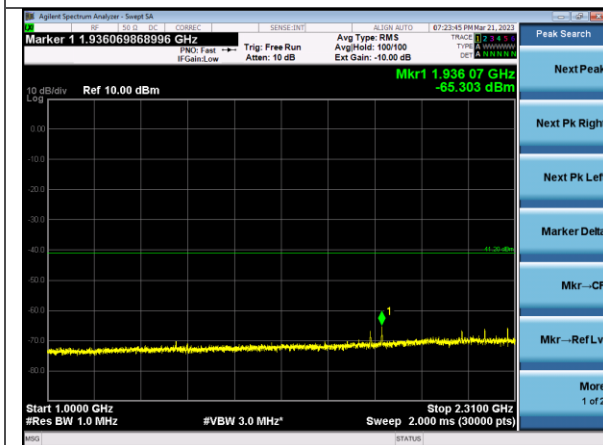
2.4835-2.5 GHz Average
Ch 17 2M



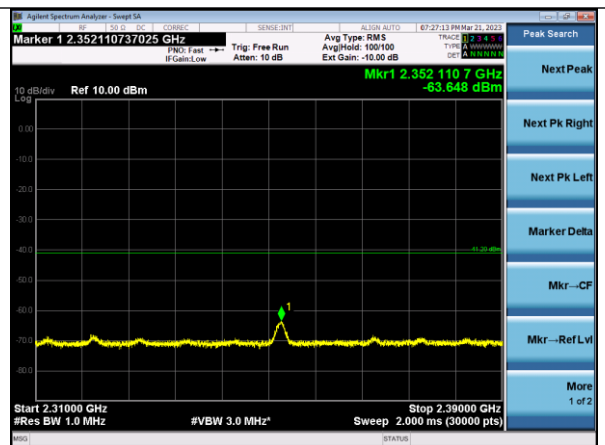
2.5-14 GHz Average
Ch 17 2M



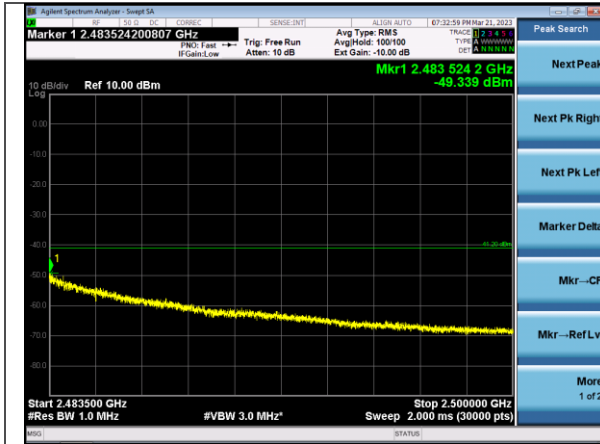
14-25 GHz Average
Ch 17 2M



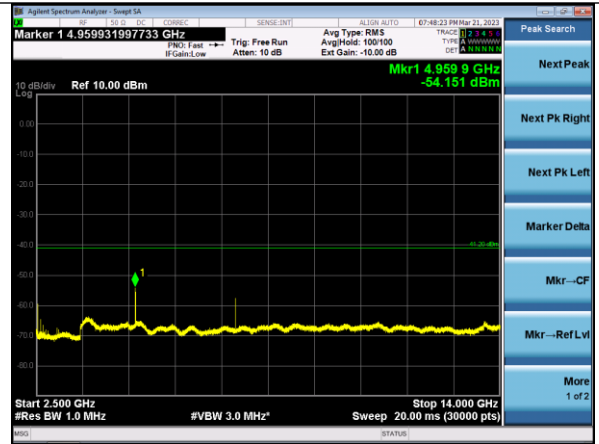
1-2.31 GHz Average
Ch 39 2M



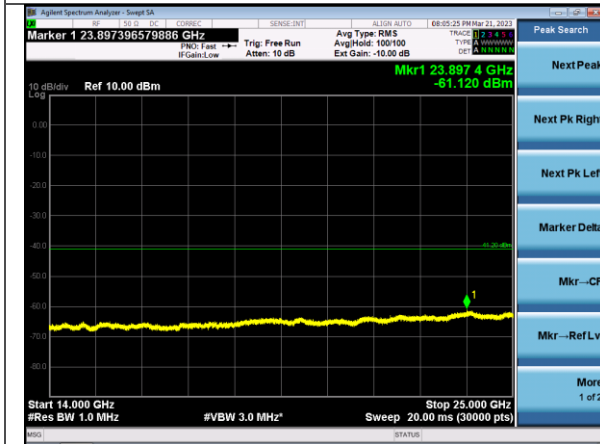
2.31-2.39 GHz Average
Ch 39 2M



2.4835-2.5 GHz Average
Ch 39 2M



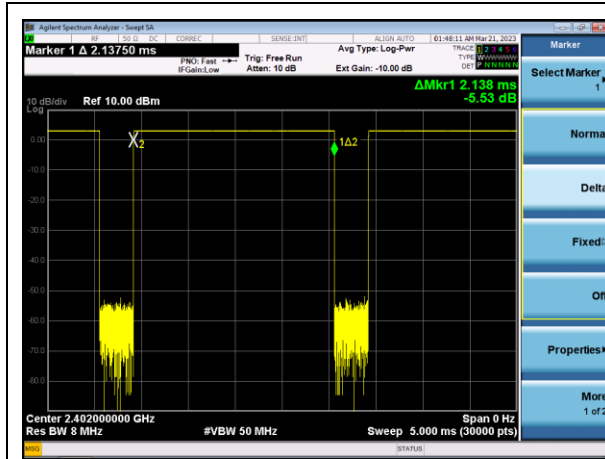
2.5-14 GHz Average
Ch 39 2M



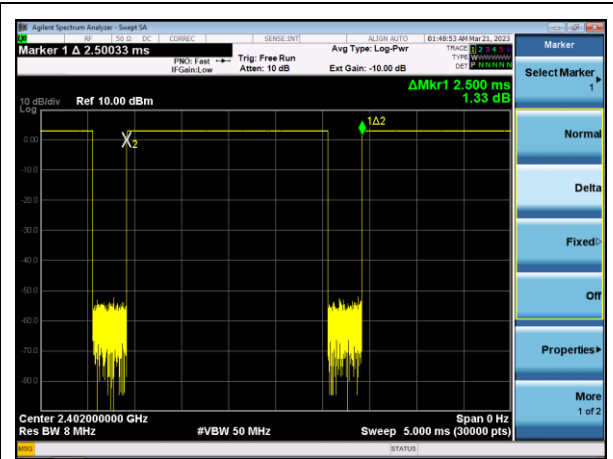
14-25 GHz Average
Ch 39 2M

Company: Laird Connectivity	Page 25 of 27	Name: BL5340
Report: TR3664A BL5340		Model: BL5340
Quote: NBO-12-2022-005678		Serial: 00068

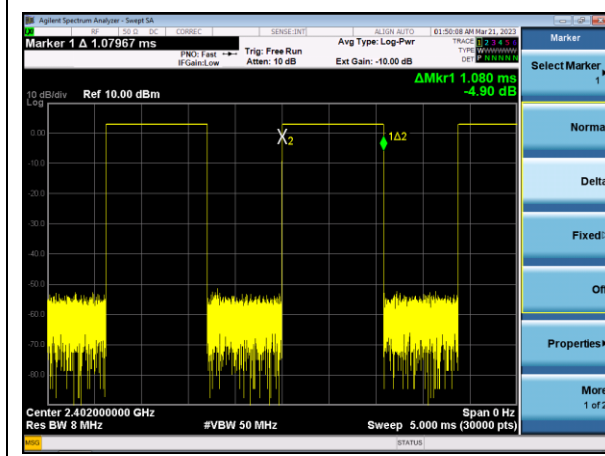
Duty Cycle Plots



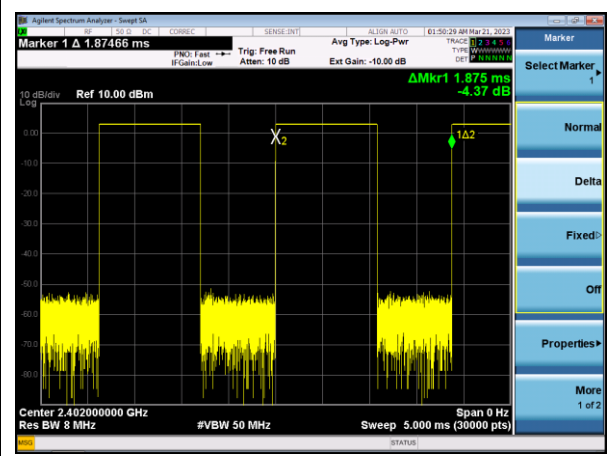
1M On Time 2.138ms



1M Period 2.5ms



2M On Time 1.08ms



2M Period 1.875ms

6 REVISION HISTORY

Version	Date	Notes	Person
0	3/23/2023	Initial Draft	Anthony Smith
1	7/12/2023	Revised Draft	Anthony Smith

END OF REPORT