Test Report C-3625C

Equipment Under Test:	3350 ADV Series Auto-Darkening Filter Bluetooth Module
Requirement(s):	FCC 1.1310 ISED RSS-102
Test Date(s):	10/4/2022-10/5/2022
Prepared for:	Lincoln Electric Attn: Hank Rumpke 22801 St. Clair Avenue Cleveland, OH 44117

Report Issued by: Anthony Smith, EMC Engineering Specialist

Signature:  Date: 12/7/2022

Report Reviewed by: Adam Alger, Laboratory Manager

Signature:  Date: 12/7/2022

Report Constructed by: Anthony Smith, EMC Engineering Specialist

Signature:  Date: 12/7/2022

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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:

Certificate #1255.01

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

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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

1 TEST REPORT SUMMARY

During **10/4/2022-10/5/2022** the Equipment Under Test (EUT), **3350 ADV Series Auto-Darkening Filter Bluetooth Module**, as provided by **Lincoln Electric** was tested to the following requirements:

Portable Device

Requirements	Description	Method	Compliant
FCC: 1.1310 IC: RSS-102	Radiofrequency Radiation Exposure Limits	Distance ≤ 5mm 1g-SAR	Reported

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	Lincoln Electric
Contact Person	Hank Rumpke
Address	22801 St. Clair Avenue Cleveland, OH 44117

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	3350 ADV Series Auto-Darkening Filter Bluetooth Module
Model Number	M29670
Serial Number	Engineering Sample
Additional Information	FCC ID: 2AJY8-LEB00030451 IC ID: 22017-LEB00030451

2.2 Product Description

The 3350 ADV Series Auto-Darkening Filter Bluetooth Module gives fifth generation VIKING™ welding helmets modern communication capabilities for data collection and connection to the Internet-of-Things. It also provides a simple display and user interface. Antenna is a Yageo 2.4 GHz ceramic chip antenna.

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

Program device with a Laptop via USB to a translator board to the EUT. Test software used is Silicon Labs Direct Test Mode Tool version 0.10.2. Channels tested were 37 (2402 MHz), 17 (2440 MHz), and 39 (2480 MHz) with a 1M and 2M Data Rate.

3 REFERENCES

Publication	Edition	Date	AMD 1
FCC eCFR	-	2022	-
RSS-102	5	2015	2021
KDB 447498	-	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 ±
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

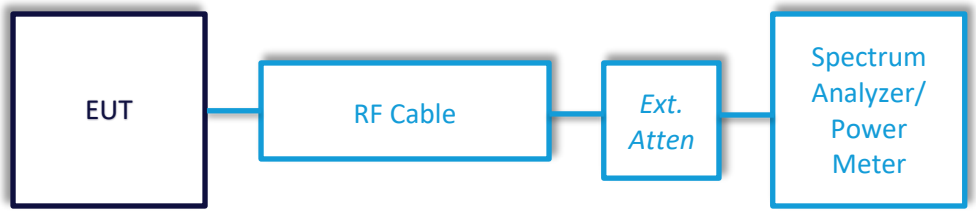
Parameter	ETSI U.C. ±	U.C. ±
Radio Frequency, from F0	$1x10^{-7}$	$0.55x10^{-7}$
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %
Supply voltages	3 %	1 %

5 TEST DATA

5.1 Antenna Port Conducted Emissions

Description of Measurement	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. The cable and attenuator factors are loaded into the analyzer or power meter allowing for direct measurement readings without the need for further corrections.
Example Calculations	Measurement (dBm) + Cable factor (dB) + External Attenuator (dB) = Corrected Reading (dBm) Margin (dB) = Limit (dBm) – Corrected Reading (dBm)

Block Diagram



5.1.1 Peak Output Power

Operator	Anthony Smith	**QA**	Adam Alger
Temperature	22.2°C, 22.8°C	**R.H. %**	44%, 42.8%
Test Date	10/4/2022, 10/5/2022	**Location**	Bench
Requirement	FCC 15.247, RSS-247	**Method**	ANSI C63.10

Limits: 30 dBm

Test Parameters

Frequency	2402, 2440, 2480 MHz	**Setup**	Conducted
RBW	3 MHz	**VBW**	50 MHz
Detector(s)	Max Peak Hold	**Sweep Time**	Auto

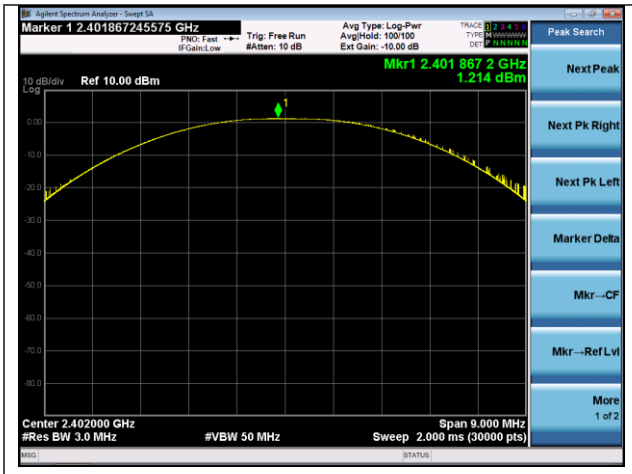
EUT Parameters

Input Power	USB	**Mode**	BLE Transmit
Frequency	2402, 2440, 2480 MHz	**Channel**	37, 17, 39
Data Rate/Modulation	BLE: 1M and 2M		

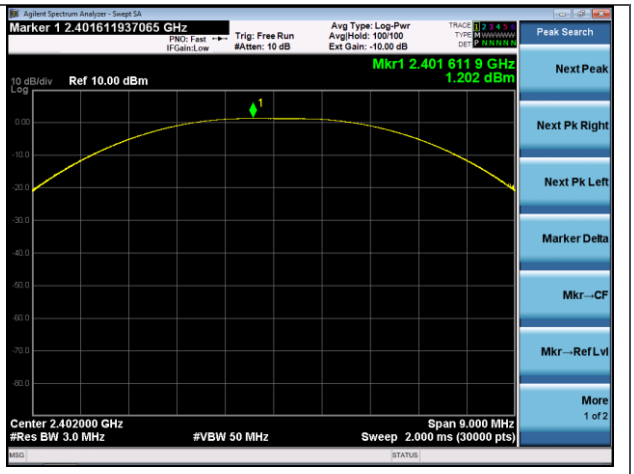
Data Table

Channel	Data Rate	Transmit Power Setting	Peak Output Power (dBm)	Limit (dBm)	Margin (dB)
37	1M	4	1.2	30	28.8
17	1M	4	0.6	30	29.4
39	1M	4	0.0	30	30.0
37	2M	4	1.2	30	28.8
17	2M	4	0.6	30	29.4
39	2M	4	0.0	30	30.0

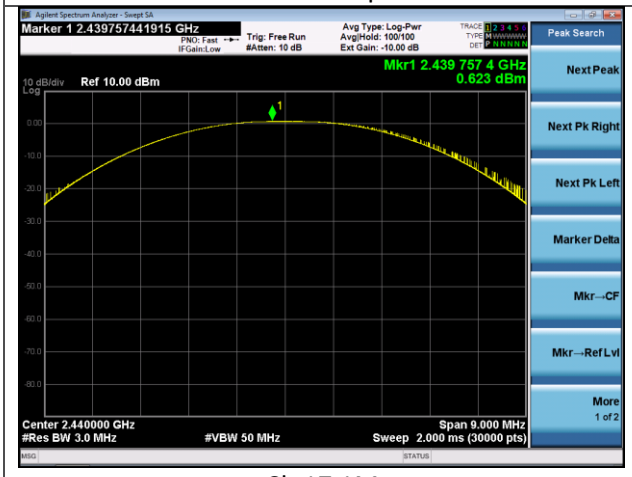
Plots



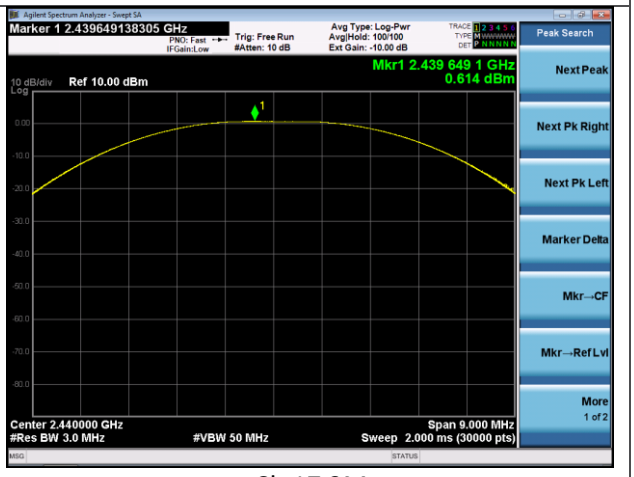
Ch 37 1M
1.2 dBm Peak Output Power



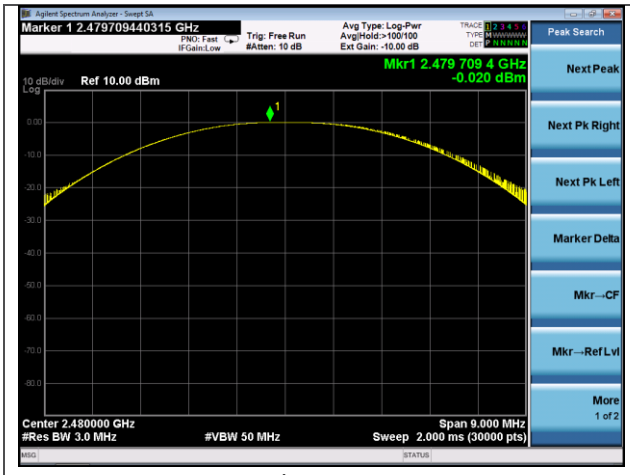
Ch 37 2M
1.2 dBm



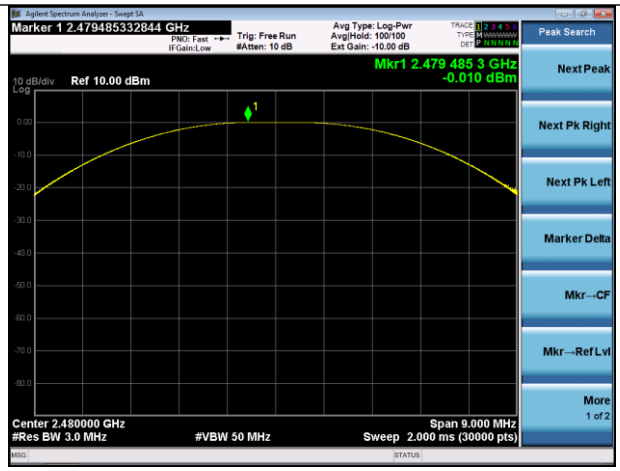
Ch 17 1M
0.6 dBm Peak Output Power



Ch 17 2M
0.6 dBm Peak Output Power



Ch 39 1M
0 dBm Peak Output Power



Ch 39 2M
0 dBm Peak Output Power

6 FCC 1-G SAR Test Exclusion Calculations

6.1 Power Calculations

Max Power of Channel = 1.2 dBm

Tune Up Tolerance = 1 dB

Total Channel Power = 2.2 dBm = 1.7 mW = 2 mW

6.2 Distance

≤5 mm

6.3 SAR Test Exclusion Calculation

[(Maximum power of channel, including tune-up tolerance, mW) / (Minimum test separation distance, mm)] * [√f(GHz)] ≤ 3 for 1-g SAR

Where:

- F(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- The value 3.0 is referred to as numeric thresholds

$$\left(\frac{\mathbf{2\ mW}}{\mathbf{5\ mm}}\right) \boldsymbol{x} \left(\sqrt{\mathbf{2}}\mathbf{.48}\right) \leq \mathbf{3.0}$$

$$\mathbf{0.4}\ \boldsymbol{x}\ \mathbf{1.562} \leq \mathbf{3.0}$$

$$\mathbf{0.6} \leq \mathbf{3.0}$$

6.4 Result

The EUT is excluded from routine SAR testing as 0.6 is less than 3.0.

7 IC Exemption Calculation for Routine SAR Evaluation

7.1 Power Calculations

Max Power of Channel = 1.2 dBm

Tune Up Tolerance = 1 dB

Peak Antenna Gain = 2.7 dBi

Total Channel Power = 4.7 dBm = 3.0 mW

7.2 Distance

≤5 mm

7.3 Exemption Limits

Table 1: SAR evaluation — Exemption limits for routine evaluation based on frequency and separation distance[4,5]

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

Interpolated Limit at 2480 MHz

$$4 + (2480 - 2450)\, x \left(\frac{2 - 4}{3500 - 2450}\right) = 3.9$$

At 2480 and ≤5 mm the exemption limit is 3.9 mW.

7.4 SAR Test Exclusion Limit

3.0 mW ≤ 3.9 mW

7.5 Result

The EUT is excluded from routine SAR testing as 3.0 mW is less than 3.9 mW.

8 REVISION HISTORY

Version	Date	Notes	Person
0.0	10/20/2022	Initial Draft	Anthony Smith
1.0	12/7/2022	Revised	Anthony Smith

END OF REPORT