

Test Report C-3867 F

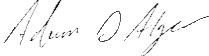
Equipment Under Test:	Lyra 24P
Requirement(s):	FCC: 1.1307, 1.1310 ISED: RSS-102
Test Date(s):	1/8/2025-2/19/2025
Prepared for:	Trimble Attn: Stefan Andersson Rinkebyvagen 17 182 36 Danderyd, Sweden

Report Issued by: Anthony Smith, EMC Engineering Specialist

Signature: 

Date: 05/01/2025

Report Reviewed by: Adam Alger, Sr. Manager, EMC Laboratory

Signature: 

Date: 05/01/2025

Report Constructed by: Anthony Smith, EMC Engineering Specialist

Signature: 

Date: 02/19/2025

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Company: Trimble	Page 1 of 19	Name: Lyra 24P
Report: TR 3867 F		Model: Lyra 24P
Job: C-3867		Serial: Engineering Sample

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Ezurio Test Services in Review

The Ezurio 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: Trimble	Page 3 of 19	Name: Lyra 24P
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1 TEST REPORT SUMMARY

During **January 14th, 2025 through February 19th, 2025** the Equipment Under Test (EUT), **Lyra 24P**, as provided by **Trimble** was tested to the following requirements:

FCC 15.247 | RSS-247 – DTS Bluetooth Low Energy | FHSS Bluetooth Low Energy

Requirements	Description	Method	Compliant
FCC Part 1.1310, 2.1093	Radio Frequency Radiation Exposure Evaluation	ANSI C63.10	Yes
ISED RSS-102	Radio Frequency Exposure Compliance of Radiocommunication Apparatus	RSS-102	Yes

Note: Class 2 permissive change testing to add SAW Filter + RF Switch with Antenna.

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	Trimble
Contact Person	Stefan Andersson
Address	Rinkebyvagen 17 182 36 Danderyd, Sweden

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	Lyra 24P
Model Number	Lyra 24P
Serial Number	Engineering Sample
FCC ID	S9E-LYRA24P
IC ID	5817A-LYRA24P

2.2 Product Description

Bluetooth Low Energy module

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

EUT undergoing testing to add a SAW Filter + RF Switch with 2 dBi dipole antenna. Performed on Mintaka variant.

3 REFERENCES

Publication	Edition	Date	AMD 1	AMD 2
eCFR	-	2025	-	-
RSS-102	6	2023	-	-
KDB 447498 D04*	v01	2021	-	-
ANSI C63.10	-	2020	-	-

**KDB 447498 D04 not on Scope of Accreditation*

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

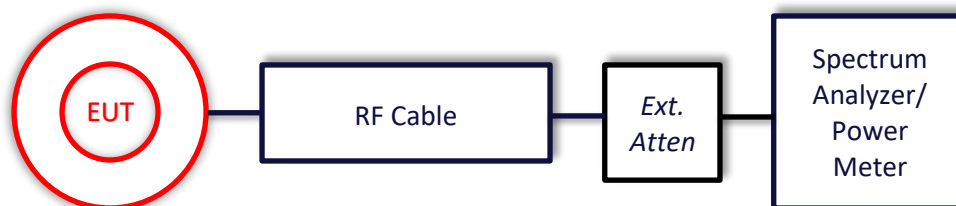
Parameter	ETSI U.C. $\pm$	U.C. $\pm$
Radio Frequency, from F0	1×10^{-7}	0.55×10^{-7}
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9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

5 TEST DATA

5.1 Antenna Port Conducted Emissions

Description of Measurement	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 Antenna Port Conducted Emissions

Operator	Anthony Smith	QA	Dylan Rosenfeldt
Temperature	23.4°C	R.H. %	26.4
Test Date	1/16/2025	Location	Chamber 3
Requirement	FCC 15.247	Method	ANSI C63.10

Limits: 30 dBm

Test Parameters

Frequency	2402, 2440, 2478, 2480 MHz	Setup	Antenna port
RBW	3 MHz	VBW	50 MHz
Detector(s)	Peak	Settings	Peak, max hold

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960172	Cable	A.H. Systems, Inc.	SAC-26G-1	387	1/28/2025	1/28/2026	Active Verification
EE 960085	Analyzer - EMI Receiver	Agilent	N9038A	MY51210148	4/9/2024	4/9/2025	Active Calibration
EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	4/10/2024	4/10/2025	Active Calibration

EUT Parameters

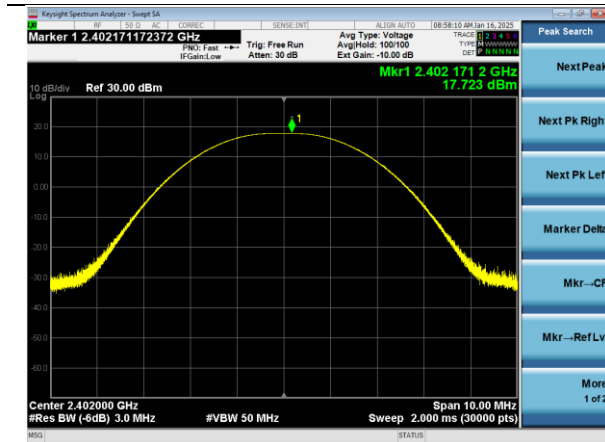
Input Power	USB – 5VDC	Mode	Continuous Transmit Modulated
Frequency	2402, 2440, 2478, 2480 MHz	Channel	Low, Mid, High

Table

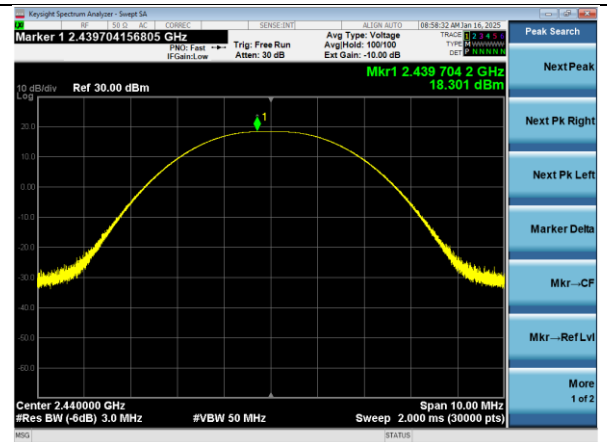
Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)	Data Rate	Channel	Power Index Setting
2402.0	11.2	30.0	18.8	125k	0	12
2440.0	11.7	30.0	18.3	125k	19	12
2478.0	10.5	30.0	19.5	125k	38	12
2480.0	10.3	30.0	19.7	125k	39	12
2402.0	17.7	30.0	12.3	500k	0	20
2440.0	18.3	30.0	11.7	500k	19	20
2478.0	15.6	30.0	14.4	500k	38	18
2480.0	13.3	30.0	16.7	500k	39	15
2402.0	17.7	30.0	12.3	1M	0	20
2440.0	18.3	30.0	11.7	1M	19	20
2478.0	15.6	30.0	14.4	1M	38	18
2480.0	13.3	30.0	16.7	1M	39	15
2404.0	17.8	30.0	12.2	2M	1	20
2440.0	18.3	30.0	11.7	2M	38	20
2478.0	15.2	30.0	14.8	2M	38	17

Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)	Data Rate	Channel	Power Index Setting
2402.0	8.8	30.0	21.2	125k	0	10
2440.0	9.2	30.0	20.8	125k	19	10
2478.0	8.0	30.0	22.0	125k	38	10
2480.0	7.8	30.0	22.2	125k	39	10
2402.0	8.8	30.0	21.2	500k	0	10
2440.0	9.3	30.0	20.7	500k	19	10
2478.0	8.1	30.0	21.9	500k	38	10
2480.0	7.9	30.0	22.1	500k	39	10
2402.0	8.8	30.0	21.2	1M	0	10
2440.0	9.3	30.0	20.7	1M	19	10
2478.0	8.1	30.0	21.9	1M	38	10
2480.0	7.9	30.0	22.1	1M	39	10
2404.0	8.9	30.0	21.1	2M	1	10
2440.0	9.3	30.0	20.7	2M	38	10
2478.0	8.1	30.0	21.9	2M	38	10

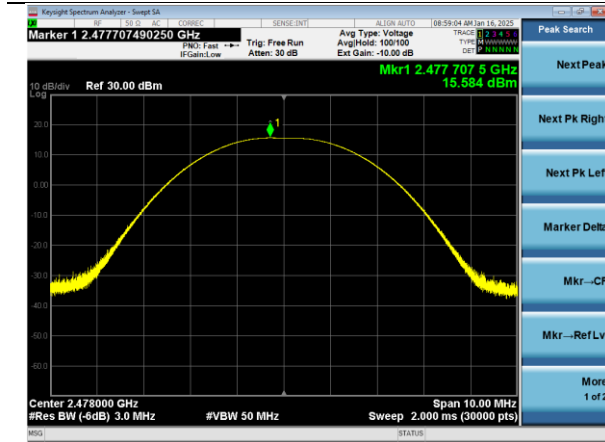
Plots (Worst Case)



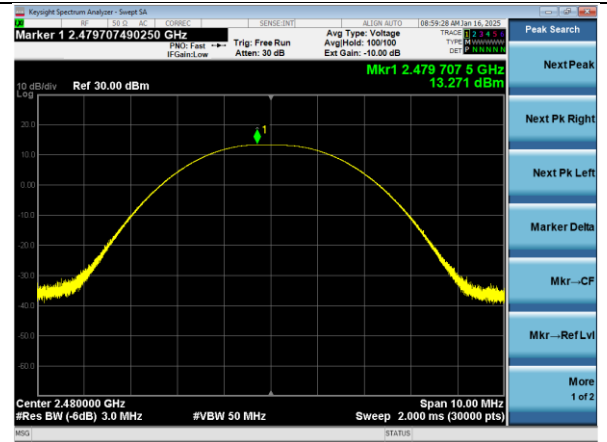
2402 1M Power Set 20



2440 1M Power Set 20



2478 1M Power Set 17



2480 1M Power Set 15

5.1.2 Antenna Port Conducted Emissions

Operator	Anthony Smith	QA	Dylan Rosenfeldt
Temperature	23.4, 19.6°C	R.H. %	26.4, 29.8
Test Date	1/16/2025, 2/19/2025	Location	Chamber 3
Requirement	FCC 15.247	Method	ANSI C63.10

Limits: 21 dBm

Test Parameters

Frequency	2402, 2440, 2478, 2480 MHz	Setup	Antenna port
RBW	3 MHz	VBW	50 MHz
Detector(s)	Peak	Settings	Peak, max hold

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960172	Cable	A.H. Systems, Inc.	SAC-26G-1	387	1/28/2025	1/28/2026	Active Verification
EE 960085	Analyzer - EMI Receiver	Agilent	N9038A	MY51210148	4/9/2024	4/9/2025	Active Calibration
EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	4/10/2024	4/10/2025	Active Calibration

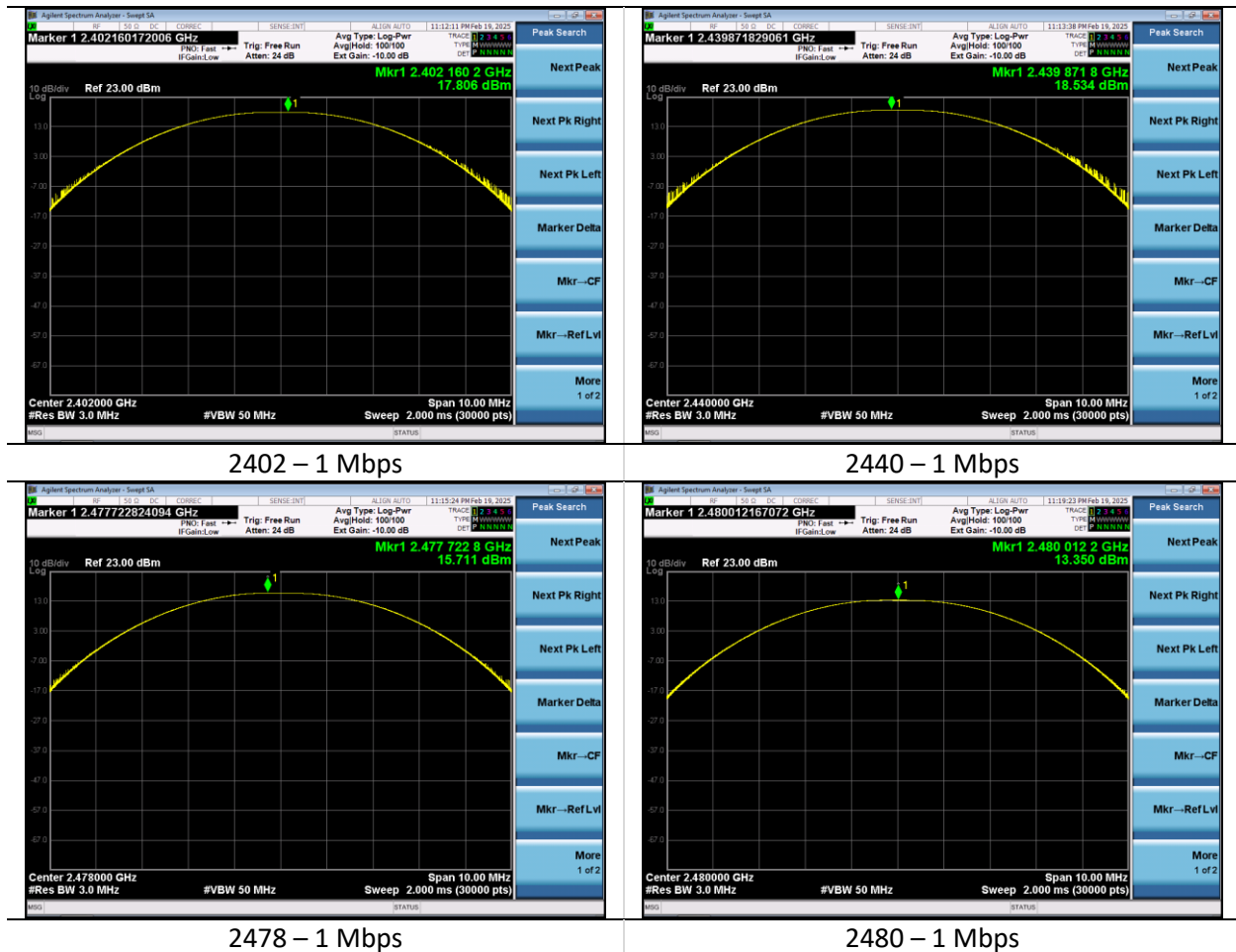
EUT Parameters

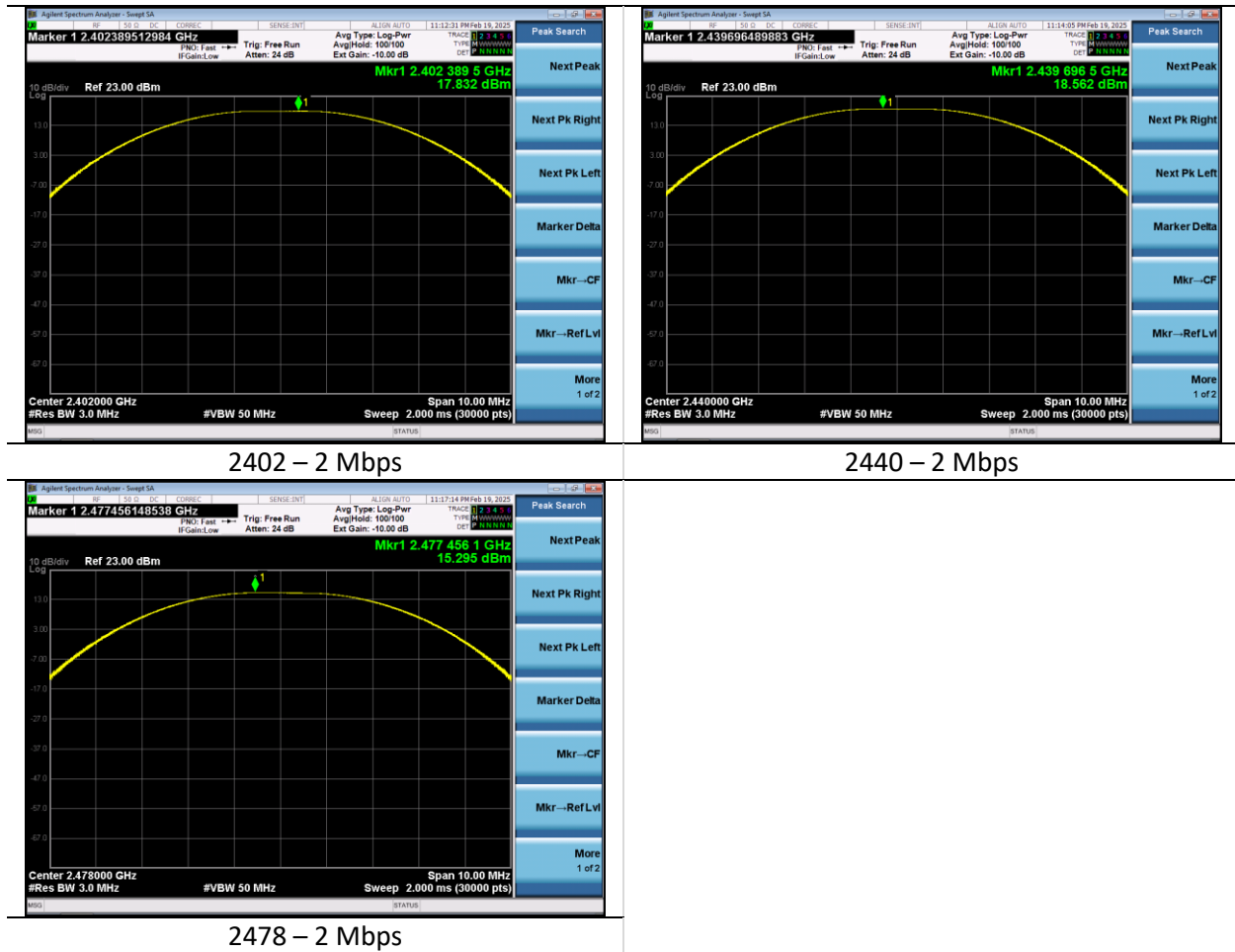
Input Power	USB 5V DC	Mode	Continuous Transmit Modulated
Frequency	2402, 2440, 2478, 2480 MHz	Channel	Low, Mid, High

Table

Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)	Data Rate	Channel	Power Index Setting
2402.0	17.8	21.0	3.2	125k	0	20
2440.0	18.5	21.0	2.5	125k	19	20
2478.0	15.7	21.0	5.3	125k	38	18
2480.0	13.4	21.0	7.6	125k	39	15
2402.0	17.8	21.0	3.2	500k	0	20
2440.0	18.5	21.0	2.5	500k	19	20
2478.0	15.7	21.0	5.3	500k	38	18
2480.0	13.4	21.0	7.6	500k	39	15
2402.0	17.8	21.0	3.2	1M	0	20
2440.0	18.5	21.0	2.5	1M	19	20
2478.0	15.7	21.0	5.3	1M	38	18
2480.0	13.4	21.0	7.6	1M	39	15
2402.0	17.8	21.0	3.2	2M	0	20
2440.0	18.6	21.0	2.4	2M	38	20
2478.0	15.3	21.0	5.7	2M	38	17

Plots





6 FCC SAR EXCLUSION CALCULATION

FCC SAR Exclusion Limit

$$P_{th} \text{ (mW)} = ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases} \quad (\text{B. 1})$$

SAR-based thresholds are derived based on frequency, power, and separation distance of the RF source. The formula defines the thresholds in general for either available maximum time-averaged power or maximum time-averaged ERP, whichever is greater.

If the ERP of a device is not easily determined, such as for a portable device with a small form factor, the applicant may use the available maximum time-averaged power exclusively if the device antenna or radiating structure does not exceed an electrical length of $\lambda/4$.

As for devices with antennas of length greater than $\lambda/4$ where the gain is not well defined, but always less than that of a half-wave dipole (length $\lambda/2$), the available maximum time-averaged power generated by the device may be used in place of the maximum time-averaged ERP, where that value is not known.

The separation distance is the smallest distance from any part of the antenna or radiating structure for all persons, during operation at the applicable ERP. In the case of mobile or portable devices, the separation distance is from the outer housing of the device where it is closest to the antenna.

The SAR-based exemption formula of § 1.1307(b)(3)(i)(B), repeated here as Formula (B.2), applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power or effective radiated power (ERP), whichever is greater, of less than or equal to the threshold P_{th} (mW).

This method shall only be used at separation distances from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by Formula (B.2).

11/29/2021

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}}(d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases} \quad (\text{B. 2})$$

where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right)$$

and f is in GHz, d is the separation distance (cm), and $ERP_{20 \text{ cm}}$ is per Formula (B.1).

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Distance

≥40 mm

Power Calculation

Max Power of Channel = 18.6 dBm

Tune-up Tolerance = 1.0 dB

Total Power = dBm + Tune-up Tolerance = 19.6 dBm + Antenna Gain -0.1 dBd = 89.1 mW

SAR Test Exclusion Calculation

Frequency Range	Maximum Conducted Power (dBm)	Maximum Tune Up Limit (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP (mW)	SAR-Based Exemption Thresholds (mW)	Pass/Fail
2402-2480 (DTS)	18.6	19.6	-0.1	19.5	89.1	143.2	Pass
2402-2480 (FHSS)	18.6	19.6	-0.1	19.5	89.1	143.2	Pass

Result

The EUT is excluded from SAR testing at ≥40 mm for BLE in the 2.4GHz band.

7 ISED SAR EXEMPTION

SAR Exemption Limit

Frequency (MHz)	≤ 5 mm (mW)	10 mm (mW)	15 mm (mW)	20 mm (mW)	25 mm (mW)	30 mm (mW)	35 mm (mW)	40 mm (mW)	45 mm (mW)	> 50 mm (mW)
≤ 300	45	116	139	163	189	216	246	280	319	362
450	32	71	87	104	124	147	175	208	248	296
835	21	32	41	54	72	96	129	172	228	298
1900	6	10	18	33	57	92	138	194	257	323
2450	3	7	16	32	56	89	128	170	209	245
3500	2	6	15	29	50	72	94	114	134	158
5800	1	5	13	23	32	41	54	74	102	128

Power Limits for exemption from SAR evaluation RSS-102

Distance

≥40 mm

Power Calculation

Max Power of Channel = 18.6 dBm

Tune-up Tolerance = 1.00 dB

Antenna Gain = 2.0 dBi

Total Power = 18.6 dBm + Tune-up Tolerance + Gain = 21.6 dBm = 144.5 mW

SAR Test Exemption Calculation

The exemption limit at 40 mm is 170 mW. The total power of the EUT is 144.5 mW rounded up to 145 mW.

$145 \text{ mW} \leq 170 \text{ mW}$.

Result

The EUT is exempt from routine SAR testing at ≥40 mm as 145 mW is less than 170 mW.

8 REVISION HISTORY

Version	Date	Notes	Person
0.0	2/19/2025	Initial Draft	Anthony Smith
0.1	5/1/2025	Comments addressed	Anthony Smith

END OF REPORT