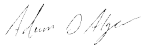
TR3812 D - RFx

Equipment Under Test:	Sentrius™ RS262 Sensor
Requirement(s):	eCFR 47 Part 1.1310, 2.1093 | RSS-102
Test Date(s):	01/14/2025-04/14/2025
Prepared for:	Ezurio Attn: Brian Petted W66 N220 Commerce Ct. Cedarburg, WI 53012

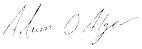
Report Issued by: Adam Alger, Sr. Manager, EMC Laboratory

Signature:  Date: 04/15/2023

Report Reviewed by: Dylan Rosenfeldt, EMC Engineer

Signature:  Date: 04/15/2025

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

Signature:  Date: 04/13/2025

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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

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Federal Communications Commission (FCC) – USA

Accredited Test Firm Registration Number: 953492

Recognition of two 3 meter Semi-Anechoic Chambers

Government of Canada

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 **01/14/2025-04/14/2025** the Equipment Under Test (EUT), **Sentrius™ RS262 Sensor,** as provided by **Ezurio** was tested to the following requirements:

FCC 15.247 | RSS-247

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

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	Ezurio
Contact Person	Brian Petted
Address	W66 N220 Commerce Ct. Cedarburg, WI 53012

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	Sentrius™ RS262 Sensor
Model Number	RS262-EXT, RS262-INT
Serial Number	Eng Sample
FCC ID	SQG-RS262
IC ID	3147A-RS262

2.2 Product Description

The RS262 is a device with LoRa and Bluetooth Low Energy v5.4. Two versions; external sensor temperature / humidity version and internal temperature / humidity sensor version.

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 EUT Information

Battery 3.0 VDC nominal, 3.2 VDC maximum

Device programmed for test modes using Simplicity Studio v5, Bluetooth NCP Commander, RF Regulatory Test and TeraTerm serial AT commands for LoRa. BLE and LoRa can simultaneously transmit.

2.6 Antenna Information

Manufacturer	Frequency Range (MHz)	Dimension (mm)	Type	Peak Gain (dBi)
Ezurio	902-928	85.0 x 42.0 x 1.5	PCBA Monopole Antenna (Loaded Stub "L")	+0.9
Ezurio	2402-2480	85.0 x 42.0 x 1.5	PCB Trace Antenna	+1.8

2.7 Test Channels

LoRa FHSS

Channel	Frequency (MHz)	Power Index	Channel Bandwidth (kHz)	Spreading Factor	Data Rate (bits/sec)
0	902.3	22	125	SF 10	980
31	908.5	22	125	SF 10	980
63	914.9	22	125	SF 10	980

LoRa DTS

Channel	**Frequency (MHz)**	**Power Index**	**Channel Bandwidth (kHz)**	Spreading Factor	Data Rate (bits/sec)
64	903.0	22	500	SF 8	12500
67	907.8	22	500	SF 8	12500
71	914.2	22	500	SF 8	12500

BLE

Channel	Frequency (MHz)	Data Rates
0	2402	125k, 500k, 1M and 2M
19	2440	
39	2480	

3 REFERENCES

Publication	Edition	Date	AMD 1	AMD 2
FCC eCFR 47 Part 1-15	-	2025	-	-
ANSI C63.10	-	2020	-	-
RSS-247	3	2023	-	-
RSS-GEN	5	2018	2019	2021
RSS-102	6	2023	-	-
KDB 447498	D01v06	2015	-	-

Note: KDB 447498 is not on laboratories 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 ±
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

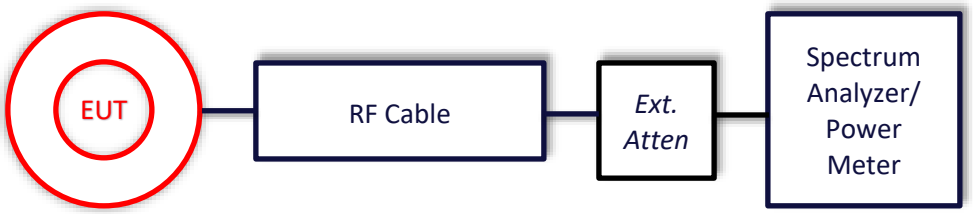
Parameter	ETSI U.C. ±	U.C. ±
Radio Frequency, from F0	$1x10^{-7}$	$0.55x10^{-7}$
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %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



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

5.1.1 RF Output Power – LoRa FHSS

Operator	Dylan Rosenfeldt	**QA**	Anthony Smith
Temperature	21.6°C	**R.H. %**	25.3%
Test Date	4/1/2025	**Location**	RF Bench
Requirement	15.247 (b)(2) RSS-247 Clause 5.4 (a)	**Method**	ANSI C63.10 7.8.5

Limit: The maximum peak conducted output power of the intentional radiator shall not exceed 1 Watt.

Test Parameters

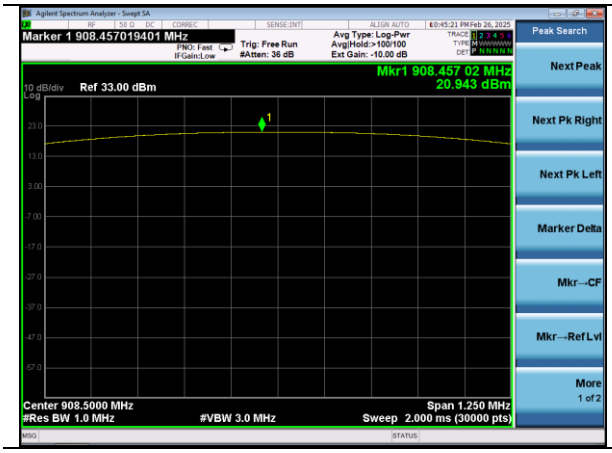
Frequency	902.3-914.9 MHz	**Setup**	Antenna Port
RBW	1 MHz	**VBW**	3 MHz
Detector(s)	Peak	**Settings**	Max Hold

Table

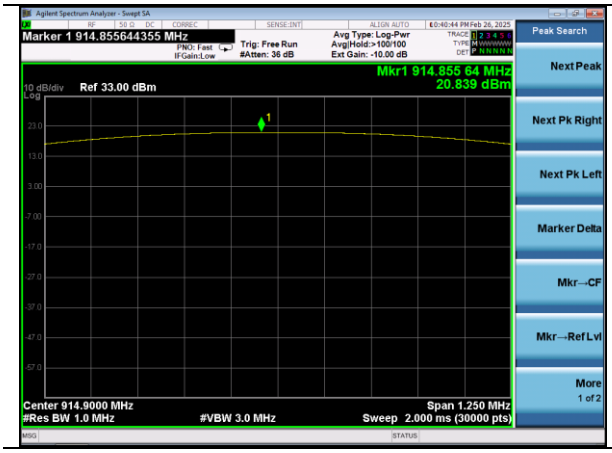
Channel	Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)	Margin (dB)
0	902.3	21.1	30	8.9
31	908.5	20.9	30	9.1
63	914.9	20.8	30	9.2

Plots

Channel 0



Channel 31



Channel 63

5.1.2 RF Output Power – LoRa DTS

Operator	Dylan Rosenfeldt	**QA**	Anthony Smith
Temperature	21.6°C	**R.H. %**	25.3%
Test Date	4/1/2025	**Location**	RF Bench
Requirement	15.247 (b)(3) RSS-247 Clause 5.4 (d)	**Method**	ANSI C63.10 11.9.2.2.4

Limit: The maximum peak conducted output power of the intentional radiator shall not exceed 1 Watt.

Test Parameters

Frequency	903.0-914.2 MHz	**Setup**	Antenna Port
RBW	10 kHz	**VBW**	30 kHz
Detector(s)	RMS Average	**Settings**	Trace Average Span: 1 MHz

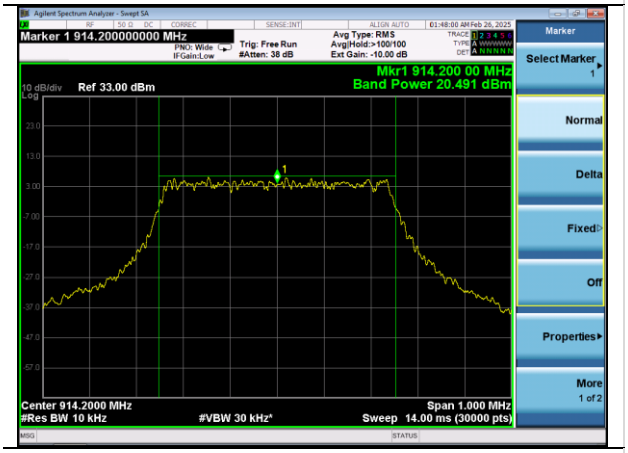
Table

Channel	Frequency (MHz)	Mode	Avg. Output Power (dBm)	DC Correction (dB)	Corrected Measurement (dBm)	Limit (dBm)	Margin (dB)	Power Setting
64	903.0	SF 8	20.7	0.2	20.9	30.0	9.1	22
67	907.8	SF 8	20.6	0.2	20.8	30.0	9.2	22
71	914.2	SF 8	20.5	0.2	20.7	30.0	9.3	22

Plots

Channel 64

Channel 67



Channel 71

5.1.3 RF Output Power - BLE

Operator	Dylan Rosenfeldt	**QA**	Anthony Smith
Temperature	22.1°C	**R.H. %**	24.50%
Test Date	2/24/2025	**Location**	RF Bench
Requirement	15.247 (b)(3) RSS-247 Clause 5.4 (d)	**Method**	ANSI C63.10 11.9.1

Limit: The maximum peak conducted output power of the intentional radiator shall not exceed 1 Watt.

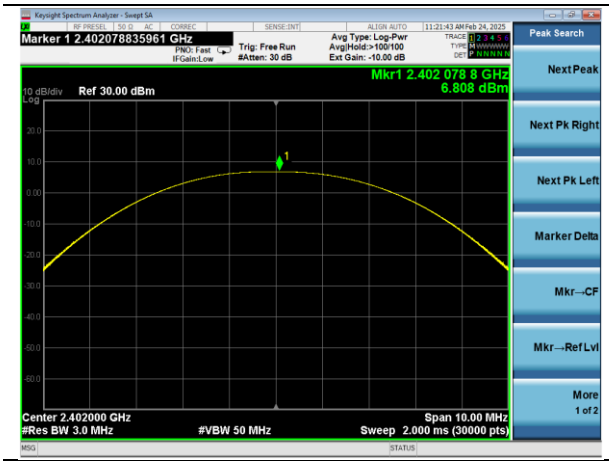
Test Parameters

Frequency	2400-2483.5 MHz	**Setup**	Antenna Port
RBW	3 MHz	**VBW**	50 MHz
Detector(s)	Peak	**Settings**	Max Hold Span: 10 MHz

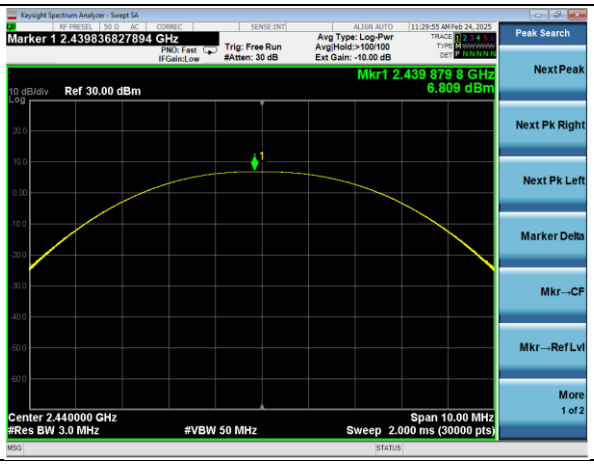
Table

Channel	Mode	Peak Output Power (dBm)	Limit (dBm)	Margin (dB)
0	1M	6.8	30	23.2
19	1M	6.8	30	23.2
39	1M	6.6	30	23.4
0	2M	6.8	30	23.2
19	2M	6.8	30	23.2
39	2M	6.6	30	23.4
0	125k	6.8	30	23.2
19	125k	6.8	30	23.2
39	125k	6.6	30	23.4
0	500k	6.8	30	23.2
19	500k	6.8	30	23.2
39	500k	6.6	30	23.4

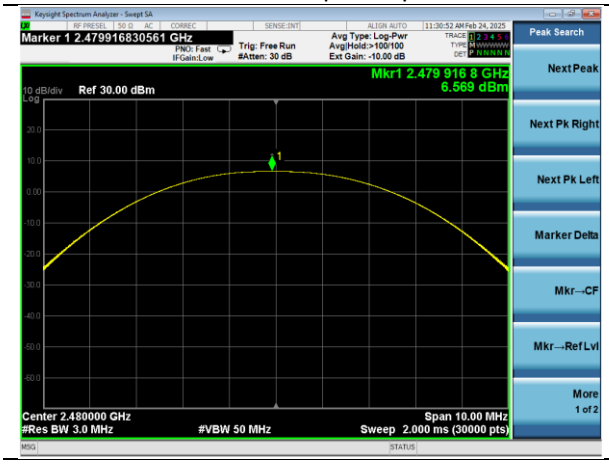
Plots



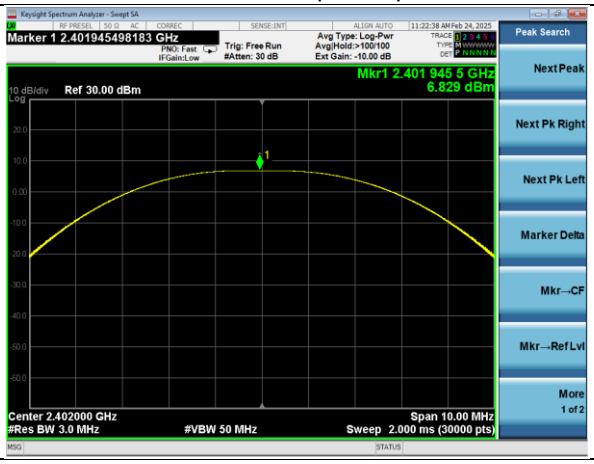
Channel 0 | 1 Mbps



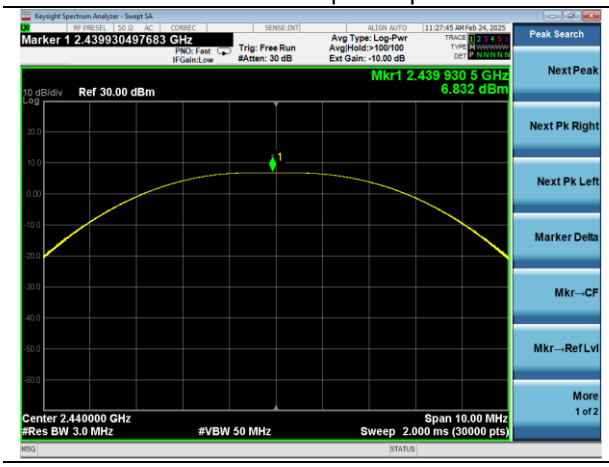
Channel 19 | 1 Mbps



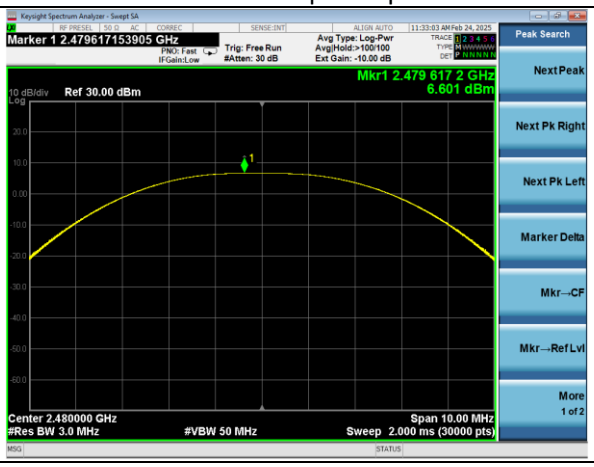
Channel 39 | 1 Mbps



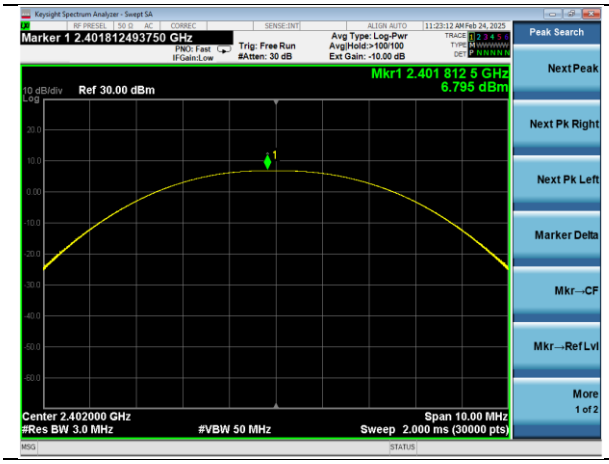
Channel 0 | 2 Mbps



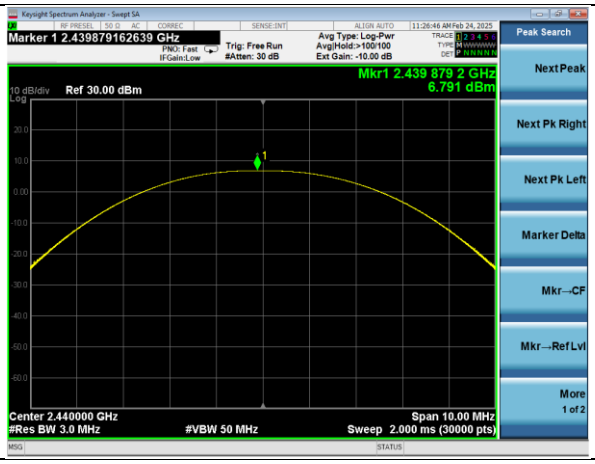
Channel 19 | 2 Mbps



Channel 39 | 2 Mbps

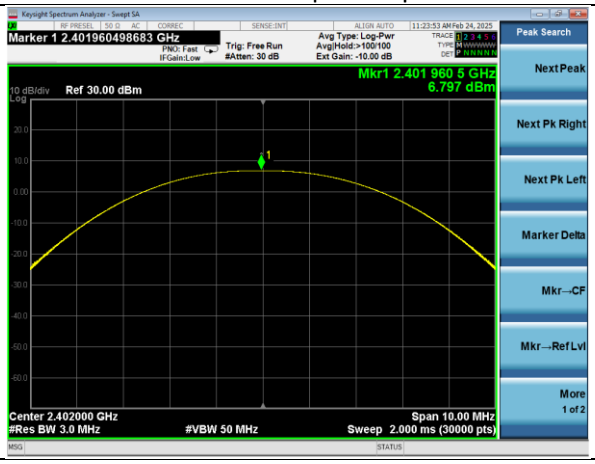


Channel 0 | 125kbps

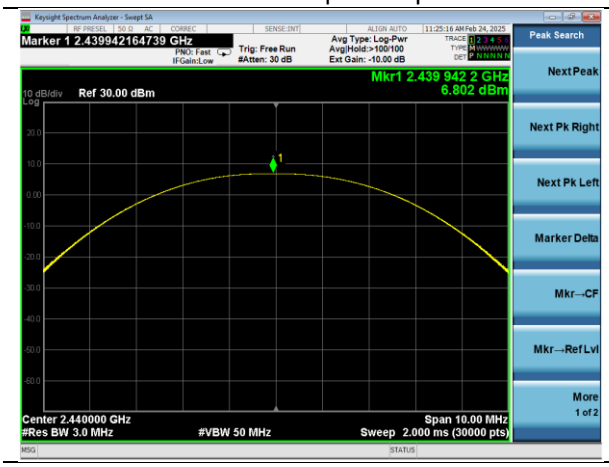


Channel 19 | 125kbps

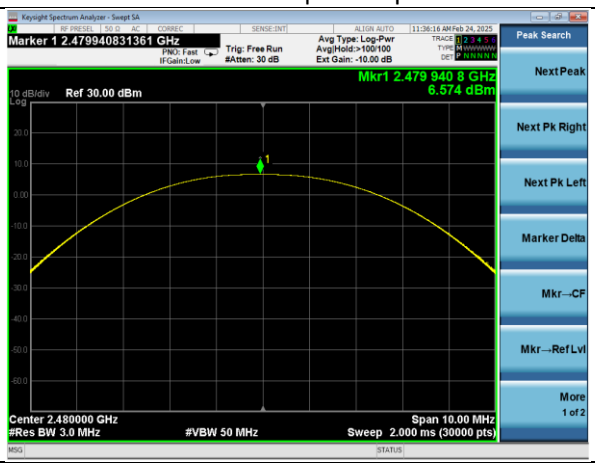
Channel 39 | 125kbps



Channel 0 | 500kbps



Channel 19 | 500kbps



Channel 39 | 500kbps

6 RF Exposure Evaluation – Standalone

FCC SAR Exemption – BLE

SAR Exclusion Limit

For separation distance of 50mm or less

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR

- 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

Distance

≥5 mm

Power Calculation

Max Power of Channel = 6.8 dBm

Tune-up Tolerance = 1.00 dB

Antenna Gain = +1.8 dBi

Total Power = 6.8 dBm + Tune-up Tolerance + Gain = 9.6 dBm = 9.12 mW

SAR Test Exclusion Calculation

$$\left[\frac{(9.12mW)}{(5mm)}\right] \times \sqrt{2.402} = 2.8$$

2.8 ≤ 3.0

Result

The EUT is excluded from SAR testing at ≥5 mm for BLE in the 2.4GHz band as 2.8 is less than the numeric threshold of 3.0.

ISED SAR EXEMPTION – BLE

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

≥15 mm

Power Calculation

Max Power of Channel = 6.8 dBm

Tune-up Tolerance = 1.00 dB

Antenna Gain = +1.8 dBi

Total Power = 6.8 dBm + Tune-up Tolerance + Gain = 9.6 dBm = 9.12 mW

SAR Test Exclusion Calculation

The exemption limit at 15 mm is 16 mW. The total power of the EUT is 9.12 mW.

9.12 mW ≤ 16.0 mW.

Result

The EUT is exempt from routine SAR testing at ≥15 mm as 9.12 mW is less than 16.0 mW.

FCC SAR EXEMPTION – LORA

SAR Exclusion Limit

For separation distance of 50mm or less (step a)

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR

- 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

For separation distance of greater than 50 mm

{[Power allowed at numeric threshold for 50 mm in step a)] + [(test separation distance – 50 mm)·$f_{(MHz)}$/150)]} mW, for 100 MHz to 1500 MHz

KDB 447498 D01

Distance

≥60 mm

Power Calculation

Max Power of Channel = 21.1 dBm

Tune-up Tolerance = 1.00 dB

Antenna Gain = +0.9 dBi

Total Power = 21.1 dBm + Tune-up Tolerance + Gain = 23 dBm = 199.5 mW = 200 mW

SAR Test Exclusion Calculation

Power allowed at numeric threshold for 60mm at 902.3 MHz = 218 mW

Result

The EUT is excluded from SAR testing at ≥60 mm for LoRa in the 900 MHz band as 200 mW is less than 218 mW

ISED SAR EXEMPTION – LORA

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

≥45 mm

Power Calculation

Max Power of Channel = 21.1 dBm

Tune-up Tolerance = 1.00 dB

Antenna Gain = +0.9 dBi

Total Power = 21.1 dBm + Tune-up Tolerance + Gain = 23 dBm = 199.5 mW = 200 mW

SAR Test Exclusion Calculation

The exemption limit at 45 mm is 229 mW. The total power of the EUT is 200 mW.

200 mW $\leq$ 229 mW.

Result

The EUT is exempt from routine SAR testing at ≥45 mm as 200 mW is less than 229 mW.

7 MPE CALCULATION – SIMULTANEOUS TX

FCC MPE Limit

(ii) LIMITS FOR GENERAL POPULATION/UNCONTROLLED EXPOSURE

0.3-1.34	614	1.63	*(100)	<30
1.34-30	824/f	2.19/f	*(180/f^2)	<30
30-300	27.5	0.073	0.2	<30
300-1,500			f/1500	<30
1,500-100,000			1.0	<30

*f = frequency in MHz. * = Plane-wave equivalent power density.*

eCFR 1.1310 (mW/cm^2)

Determining power density for antenna (simple far-field model)

$$S_{FF} = \frac{G_{i(\theta,\phi)} P_{in}}{4\pi d^2}$$

IEEE Std C95.3-2021

where

S_{FF} is the far-field power density (W/m^2)

$G_i(\theta , \phi)$ is the far-field antenna gain in direction (θ,ϕ) spherical coordinates (power ratio with respect to isotropic).

P_{in} is the power into the antenna (W)

d is the distance to the antenna (m)

Distance

≥60 mm

Power Density Limit

The power density limit from 1,500 – 100,000 MHz is 1.0 mw/cm^2

The power density limit from 300-1,500 MHz is f/1500 at 902.3 MHz is 0.6 mW/cm^2

Power Density Calculation BLE

Max Power of Channel = 6.8 dBm

Tune-up Tolerance = 1.00 dB

Antenna Gain = +1.8 dBi

Total Power = 6.8 dBm + Tune-up Tolerance + Gain = 9.6 dBm = 9.12 mW

$$S = \frac{0.00912W}{4\pi(0.060)^2}$$

$$S = 0.202\ W/m^2 = 0.02\ mW/cm^2$$

Power Density Calculation LoRa

Max Power of Channel = 21.1 dBm

Tune-up Tolerance = 1.00 dB

Antenna Gain = +0.9 dBi

Total Power = 21.1 dBm + Tune-up Tolerance + Gain = 23 dBm = 199.5 mW = 200 mW

$$S = \frac{0.200W}{4\pi(0.060)^2}$$

$$S = 4.4\ W/m^2 = 0.44\ mW/cm^2$$

MPE Ratio

MPE ratio = (calculated power density) / (power density limit)

BLE = 0.02

LoRa = 0.73

The sum of the power density ratios must be less than 1 to be exempt from SAR testing.

LoRa + BLE = 0.75

Result

The EUT is exempt from routine SAR testing at ≥60 mm as the MPE ratio is ≤1.0

ISED Canada RF field strength and power density limits for devices used by the general public

Frequency range (MHz)	Electric field (V_{RMS}/m)	Magnetic field (A_{RMS}/m)	Power density (W/m^2)	Reference period (minutes)
10-20	27.46	0.0728	2	6
20-48	$58.07 / f^{0.25}$	$0.1540 / f^{0.25}$	$8.944 / f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142\ f^{0.3417}$	$0.008335\ f^{0.3417}$	$0.02619\ f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158\ f^{0.5}$	$4.21 \times 10^{-4}\ f^{0.5}$	$6.67 \times 10^{-5}\ f$	$616000/f^{1.2}$

Note: f is frequency in MHz.

Determining power density for antenna (simple far-field model)

$$S_{FF} = \frac{G_{i(\theta,\phi)} P_{in}}{4\pi d^2}$$

IEEE Std C95.3-2021

where

S_{FF} is the far-field power density (W/m^2)

$G_i(\theta , \phi)$ is the far-field antenna gain in direction (θ,ϕ) spherical coordinates (power ratio with respect to isotropic).

P_{in} is the power into the antenna (W)

d is the distance to the antenna (m)

Distance

≥80 mm

Power Density Limit

The power density limit from 300 – 6000 MHz is $0.02619*f^{0.6834}$ where f is the frequency in MHz.

Power Density Calculation LoRa

Max Power of Channel = 21.1 dBm

Tune-up Tolerance = 1.00 dB

Antenna Gain = +0.9 dBi

Total Power = 21.1 dBm + Tune-up Tolerance + Gain = 23 dBm = 199.5 mW = 200 mW

$$S = \frac{0.200W}{4\pi(0.080)^2}$$

$$S = 2.49\ W/m^2$$

$$Limit = 2.74\ W/m^2$$

$$Ratio = \frac{2.49}{2.74} = 0.91$$

Power Density Calculation BLE

Max Power of Channel = 6.8 dBm

Tune-up Tolerance = 1.00 dB

Antenna Gain = +1.8 dBi

Total Power = 6.8 dBm + Tune-up Tolerance + Gain = 9.6 dBm = 9.12 mW

$$S = \frac{0.00912W}{4\pi(0.080)^2}$$

$$S = 0.11\ W/m^2$$

$$Limit = 5.35\ W/m^2$$

$$Ratio = \frac{0.11}{5.35} = 0.02$$

MPE Ratio

MPE ratio = (calculated power density) / (power density limit)

LoRa = 0.91

BLE = 0.02

The sum of the power density ratios must be less than 1 to comply with Power Density Exposure Limits.

LoRa + BLE = 0.95

Result

The EUT complies with Power Density Exposure Limits at ≥80 mm as the MPE ratio is ≤ 1.0

8 REVISION HISTORY

Version	Date	Notes	Person
0	04/14/2025	Initial Draft	Adam Alger
1	04/15/2025	Final Draft	Adam Alger

END OF REPORT