



RF EXPOSURE TEST REPORT



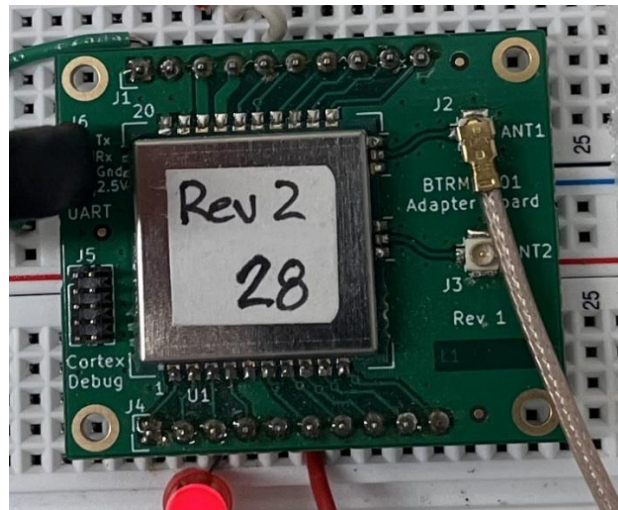
Report Reference Number: E10992-2401_CastGroup_BTRM-001_Rev1.0
Total Number of Pages: 22
Date of Issue: January 23, 2025
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Laboratory Accreditations (per ISO/IEC 17025:2017)



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Manufacturer: Cast Group of Companies Inc.
Address: 35 Ripley Avenue a Unit 1
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Equipment Tested: BTRM-001
Model Number(s): BTRM-001
FCC ID: RKT-BTRM001
ISED ID: 10858A-BTRM001



REVISION HISTORY

Date	Report Number	Details	Author's Initials
March 5, 2025	E10992-2401_CastGroup_BTRM-001_RF Exposure_FCC_ISED_CE_Rev0.0	Initial draft	DJ
March 6, 2025	E10992-2401_CastGroup_BTRM-001_RF Exposure_FCC_ISED_CE_Rev1.0	Final Release	DJ
All previous versions of this report have been superseded by the latest dated revision as listed in the above table. Please dispose of all previous electronic and paper printed revisions accordingly.			

REPORT AUTHORIZATION

The data documented in this report is for the test equipment provided by the manufacturer. The tests were conducted on the sample equipment as requested by the manufacturer for the purpose of demonstrating compliance with the standards outlined in Section I of this report as agreed upon by the Manufacturer under the quote 23RH02073R2.

The Manufacturer is responsible for the tested product configurations, continued product compliance, and for the appropriate auditing of subsequent products as required.

This report may comprise a partial list of tests that are required for FCC, ISED, CE, RCM and UKCA conformity. A Declaration of Conformity can only be produced by the manufacturer. This is to certify that the following report is true and correct to the best of our knowledge.

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QAI EMC ACCREDITATION

QAI EMC is your one-stop regulatory compliance partner for electromagnetic compatibility (EMC) and electromagnetic interference (EMI). Products are tested to the latest and applicable EMC/EMI requirements for domestic and international markets. QAI EMC goes above and beyond being a testing facility—we are your regulatory compliance partner. QAI EMC has the capability to perform RF Emissions and Immunity for all types of electronics manufacturing including Industrial, Scientific, Medical, Information Technology, Telecom, Wireless, Automotive, Marine and Avionics.

EMC Laboratory Location	FCC Designation (3m SAC)	IC Registration (3m SAC)	A2LA Certificate
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1 EXECUTIVE SUMMARY

1.1 Purpose

The purpose of this report is to demonstrate and document the compliance of the Cast Group of Companies Wireless Transmitter Module as per Sections 1.2 and 1.3.

1.2 Scope

The information documented in this report is based on the test methods and levels as per Quote 23RH02073R2:

- **FCC KDB 447498 D04: v01 – General RF Exposure Guidance**
- **47 CFR FCC Part 2 Subpart J, section 2.1091**
- **47 CFR Part 1.1307**
- **47 CFR Part 1.1310**
- **RSS-102 Issue 6** – Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
- **EN 62479:2010** – Assessment of the compliance of low power electronic and electrical equipment with the basic restrictions related to human exposure to electromagnetic fields

1.3 Summary of Results

No.	Test	Applicable Standard	Description	Result
1	RF Exposure Evaluation	FCC 47 CFR 2.1093 FCC 47 CFR 1.1310 RSS-102 Issue 6 (6.6) EN 62479	RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm	Complies

Table 1: Applicable Test Standards and Descriptions

Note: The gain of the antenna(s) is provided by the client to measure or calculate test results and is not independently measured by QAI.

1.4 Sample Calculations of Emissions Data

Radiated and conducted emissions were performed using EMC32 software developed by Rohde & Schwarz. Transducer factors like Antenna factors, Cable Losses and Amplifier gains were stored in the test templates which are used to perform the emissions measurements. After test is finished, data is generated from the EMC32 consisting of product details, emission plots and final data tables as shown below.

Frequency (MHz)	Quasi Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Band width (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
31.0064	25.67	40.00	14.33	1000	120	315.0	H	161	4.0

Quasi-Peak reading shown in the table above is already corrected by the software using correction factor shown in column “Corr.” The correction factor listed under “Corr.” table calculated as:

$$\text{Corr. (dB)} = \text{Antenna factor} + \text{Cable loss}$$

Or

$$\text{Corr. (dB)} = \text{Antenna factor} + \text{Cable Loss} - \text{Amp gain (if pre-amplifier was used)}$$

The final Quasi peak reading shown in the data is calculated by the software using following equation:

$$\text{Corrected Quasi-Peak (dBµV/m)} = \text{Raw Quasi-Peak Reading} + \text{Antenna factor} + \text{Cable loss}$$

To obtain the final Quasi-Peak or Average reading during power line conducted emissions, transducer factors are included in the final measurement as shown below.

Frequency (MHz)	Quasi Peak (dBµV)	Average (dBµV)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)
0.2410	---	23.71	52.06	28.35	1000.0	9.0	L1	GND	10.0
0.2411	38.98	---	62.06	23.08	1000.0	9.0	L1	GND	10.0

Quasi Peak or Average reading shown in above table is already corrected by the software using the correction factor shown in column “Corr.” The correction factor listed under “Corr.” table calculated as:

$$\text{Corr. (dB)} = \text{Antenna factor} + \text{Cable loss}$$

The final Quasi-peak or Average reading shown in the data is calculated by the software using following equation:

$$\text{Corr. Quasi-Peak/Average Reading (dBµV)} = \text{Raw Quasi-Peak/Average Reading} + \text{Antenna factor} + \text{Cable loss}$$

The allowable margin from the limits, as per the standards, were calculated for both radiated and conducted emissions:

$$\text{Margin (dB)} = \text{Limit} - \text{Quasi-Peak or Average reading}$$

1.5 Test Equipment List

The tables below contain all the equipment used by ‘QAI Laboratories’ in conducting all tests on the Equipment Under Test (EUT) as per Section I.

Emissions Test Equipment

	Manufacturer	Model	Description	Serial No.	S/W Version	Calibration Due Date
1	Com-Power Corporation	LI-220C	Line Impedance Stabilization Network (9kHz-30MHz)	20070025	N/A	2026-Jan-23
2	ETS Lindgren	2165	Turntable	00043677	N/A	N/A
3	Maturo GmbH	BAM 4.0-P	Boresight Antenna Mast	365	3382.01	N/A
4	ETS Lindgren	S201	5-meter Semi-Anechoic Chamber	1030	N/A	N/A
5	Hewlett Packard	8449B	Preamplifier (1-26 GHz)	3008A00982	N/A	2025-Feb-15
6	Keysight Technologies	N9038B	MXE EMI Receiver, Multi-touch	MY60180014	N/A	2024-Aug-22
7	ETS-Lindgren	3117	Horn, Double-Ridge Guide Ant, 1.0 - 18 GHz	75944	N/A	2026-Jan-25
8	Sunol Sciences	JB1	Biconilog Antenna 30MHz – 2GHz	A070209	N/A	2026-Jan-04
9	TESEQ	ISN T800	Impedance Stabilization Network (150kHz – 30MHz)	27133	N/A	2026-Feb-08
10	Hewlett Packard	8447F	Preamplifier (0.1-1300MHz)	1726A00566	N/A	N/A

Note: Equipment listed above have 3 years calibration interval.

Measurement Software List

	Manufacturer	Model	Version	Description
1	Rohde & Schwarz	EMC 32	10.35.10	Emissions Test Software

2 GENERAL INFORMATION

2.1 Product Description

The information provided in this section is for the Equipment Under Test (EUT) and the corresponding Auxiliary Equipment needed to perform the tests as a complete system.

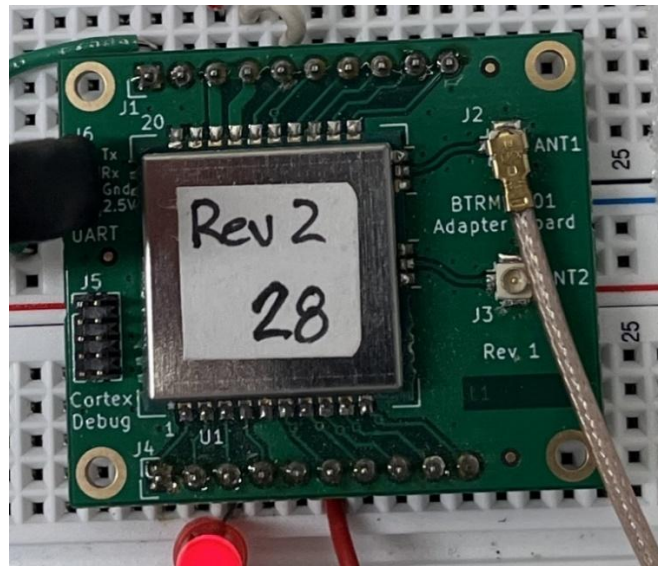


Figure 1: BTRM-001

Equipment Under Test (EUT) – General Information

Equipment	2400 MHz Radio
Description	Short range radio transceiver module, 802.15.4
Manufacturer	Cast Group of Companies Inc.
Model No.	BTRM-001
Serial No.	28
Clock frequencies tuned upon within the EUT:	16MHz, 48 MHz
Highest frequency generated within the EUT:	2483.5 MHz



Equipment Under Test (EUT) – RF Information

RF device type	DTS
Model No. (HVIN)	BTRM-001
Operating frequency	2405 - 2480 MHz
Number of available	16
Channel separation	5 MHz
Channel bandwidth	2 MHz
Output Power/Transmitter	10 dBm
Modulation type	O-QPSK DSSS
Test Channels (L, M, H)	2405 MHz, 2445 MHz, 2480 MHz
Data Rate	250 kbps
Adaptive	No
Geo-location-capable	No
Number of antennas	2
Antenna type	Flexible printed circuit stick-on dipole with UF.L Connector
Antenna gain	4.0 dBi

Notes: None.

Equipment Under Test (EUT) – General Information

Tested as	Table top
Dimensions	20 x 20 x 3.4 mm
Declared operating temperature range:	-30 to +70 °C
Input power	3V, 40mA, 120 mW
Grounded	No
Device use	Mobile or portable

Notes: None.

2.2 Environmental Conditions

The equipment under test was operated and tested under the following environmental conditions:

Parameter	Conditions
Location	Indoors
Temperature	20.1 °C
Relative Humidity	43.5%
Atmospheric Pressure	101.2 kPa

2.3 Measurement Uncertainty

Parameter	Uncertainty
Radiated Emissions, 30MHz-1GHz	± 2.40 dB
Radiated Emissions, 1GHz-40GHz	± 2.48 dB
Radio Frequency	±1.5 x 10 ⁻⁵ MHz
Total RF Power Conducted	±1.36 dB
Spurious Emissions, Conducted	±1.36 dB
RF Power Density, Conducted	±1.36 dB
Temperature	±1°C
Humidity	±5 %
DC and low frequency voltages	±3 %

Test Modes

Test Mode	Transmitter State	Power
1	ON – O-QPSK DSSS	Bench power supply
5	OFF – Rx only	Bench power supply

Auxiliary Manufacturer Supplied Equipment

Equipment	Manufacturer	Product Description	Model No.
Aux 1	Lenovo	Laptop with Python script for controlling EUT	Model No
Aux 2	FTDI	USB serial port adapter cable	TTL-232RG

3 DATA & TEST RESULTS

3.1 RF Exposure Evaluation – Federal Communications Commission (FCC)

Date Performed:	04-Mar-25
Test Standard:	FCC 47 CFR 1.1307 FCC 47 CFR 1.1310 FCC 47 CFR 2.1091
Test Method:	FCC OET Bulletin 65 Ed 97-01 FCC KDB 477498 D01: v06
Modifications:	None
Final Result:	Complies

3.1.1 Applicable Regulations

3.1.1.1 FCC – KDB 447498: General RF Exposure Guidance

7. RF EXPOSURE EVALUATION GUIDANCE FOR MOBILE CONDITIONS

7.1 Transmitters used in mobile device exposure conditions for standalone operations.

A minimum test separation distance ≥ 20 cm is required between the antenna and radiating structures of the device and nearby persons to apply mobile device exposure limits. The minimum test separation distance required for a device to comply with mobile device exposure conditions must be clearly identified in the installation and operating instructions, for all installation and exposure conditions, to enable users and installers to comply with RF exposure requirements.

When a device qualifies for the categorical exclusion provision of 2.1091 (c), the minimum test separation distance may be estimated, when applicable, by simple calculations according to plane-wave equivalent conditions, to ensure the transmitter and its antenna(s) can operate in manners that meet or exceed the estimated distance.

When a device does not qualify for the categorical exclusion provision of 2.1091 (c), routine evaluation using MPE measurement or computational modeling is required to determine compliance. For mobile devices operating in mostly stationary configurations MPE estimated instead of measurements or numerical simulation may be acceptable.

7.2 Transmitters used in mobile device exposure conditions for simultaneous transmission operations.

For mobile exposure host platform devices to qualify for simultaneous transmission MPE test exclusion, all transmitters and antennas in the host must either be evaluated for MPE compliance, by measurement or computational modeling, or qualify for the standalone MPE test exclusion in 7.1. When modular transmitters are used, the minimum test separation distance required for each simultaneously transmitting antenna installed in the host device must satisfy MPE compliance for both standalone and simultaneous transmission operations. When simultaneous transmission MPE test exclusion applies, transmitter modules may be incorporated in host devices according to Class I permissive change requirements to document the test exclusion conditions.

Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneously transmitting antennas incorporated in a host device is ≤ 1.0 , according to calculated/estimated, numerically modeled, or measured field strengths or power density. The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to the MPE limit at the test frequency. Either the maximum peak or spatially averaged results from measurements or numerical simulations may be used to determine the MPE ratios. Spatial averaging should not be applied when MPE is estimated using simple calculations based on far-field plane-wave equivalent conditions. The antenna installation and operating

requirements for the host device must meet the minimum test separation distances required for all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.

3.1.1.2 FCC 47 CFR 1.1307: Actions that may have a significant environmental effect, for which Environmental Assessments (EAs) must be prepared.

(b)(3)(i)(B) A single RF source is exempt if the available maximum time-averaged power or effective radiated power (ERP), whichever is greater is less than or equal to the threshold P_{th} (mW) described in the following formula:

$$P_{th}(mW) = \begin{cases} ERP_{20cm}(d/20cm)^x & d \leq 20cm \\ ERP_{20cm} & 20cm \leq d \leq 40cm \end{cases}$$

Where

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

And

$$ERP_{20cm} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f \leq 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

(b)(3)(i)(C) Table 1 – Single RF Sources Subject to Routine Environmental Evaluation:

RF Source Frequency (MHz)	Threshold ERP (W)
0.3 – 1.34	1,920 R ²
1.34 – 30	3,450 R ² /f ²
30 – 300	3.83 R ²
300 – 1,500	0.0128 R ² f
1,500 – 100,000	19.2 R ²

R is the separation distance in meters

Table 2: Single RF Sources Subject to Routine Evaluation

(b)(3)(ii)(B) in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation:

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1$$

Where:

a = number of fixed, mobile, or portable RF sources claiming exemption using (b)(3)(i)(B) for P_{th}

b = number of fixed, mobile, or portable RF sources claiming exemption using (b)(3)(i)(C) for ERP_{th}

c = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance.

P_i = the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source i at a distance between 0.5 cm and 40 cm

$P_{th,i}$ = the exemption threshold power (P_{th}) according to (b)(3)(i)(B) for fixed, mobile, or portable RF source i

ERP_j = the ERP of fixed, mobile, or portable RF source j .

$ERP_{th,j}$ = exemption threshold ERP for fixed, mobile, or portable RF source j , at a distance of at least $\lambda/2\pi$ according to the applicable formula of (b)(3)(i)(C)

$Evaluated_k$ = the maximum reported SAR or MPE of fixed, mobile, or portable RF source k either in the device or at the transmitter site from an existing evaluation at the location of exposure.

$Exposure Limit_k$ = either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable RF source k , as applicable from 1.1310

3.1.1.3 FCC 47 CFR 1.1310: Radiofrequency radiation exposure limits

(e)(1) Table 1 – Limits for Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
(i) Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	*(100)	≤ 6
3.0 – 30	1842/f	4.89/f	*(900/f ²)	< 6
30 – 300	61.4	0.163	1.0	< 6
300 – 1,500			f/300	< 6
1,500 – 100,000			5	< 6
(ii) Limits for General Population/Uncontrolled Exposure				
0.3 – 3.0	614	1.63	*(100)	< 30
3.0 – 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

Table 3: Limits for Maximum Permissible Exposure (MPE)

(e)(2) Occupational/controlled exposure limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure.

3.1.1.4 FCC 47 CFR 2.1091: Radiofrequency radiation exposure evaluation: mobile devices

(c) (1): Evaluation of compliance with the exposure limits in 1.1310 of this chapter, and preparation of an EA if the limits are exceeded, is necessary for mobile devices with single RF sources having either more than an available maximum time averaged power of 1 mW or more than the ERP listed in table 1 of 1.1307(b)(3)(i)(C), whichever is greater.

3.1.2 FCC Measurement Data and Results:

Date Performed: 10-Jan-2025
Measurements: refer to measurements from Test Report:
E10992-2401_CastGroup_BTRM-001_FCC-ISED_Rev1.0
Peak Output Power: 10.33 dBm, 10.79 mW – Conducted
(refer to measurements from Test Report:
E10992-2401_CastGroup_BTRM-001_FCC-ISED_Rev1.0)
Duty Cycle Corr.: 3.41ms ON; 64.84ms OFF (10log On/Off) = - 12.79dB
Peak Output Corr'd: -2.46dBm = 0.57mw
Antenna Gain: 4.0 dBi
Antenna Type: Flexible printed circuit stick-on dipole with U.F.L Connector
Frequency Range: 2405 – 2480 MHz
Exposure Distance: 0.5 cm

Using the Maximum Permissible Exposure (MPE) threshold table above in section 3.1.1.3, taken from FCC 47 CFR 1.1310(e)(1), the limit for occupational/uncontrolled exposure at 2400 MHz is:

$$MPE_{2400MHz} = 1 \text{ mW/cm}^2$$

The plane-wave power density calculation for the transmitter is:

$$S = \frac{P_{mW} * G_{ant}}{4\pi * R_{cm}^2} \text{ mW/cm}^2$$

Where,

S = power density
 P_{mW} = conducted output power in mW
 G_{ant} = linear antenna gain
 R_{cm} = the separation distance in cm

$$S_{Tx1_BLE} = \frac{0.57 \text{ mW} * \left(10^{4.0 \text{ dBi}/10}\right)}{4\pi * 0.5^2} = 0.46 \text{ mW/cm}^2$$

Transmitter	Detail	Power Density (mW/cm ²)	Power Density Limit (mW/cm ²)	Result
Tx ₁	2.4 GHz BLE	0.46	1	Complies

Table 4: FCC RF Exposure Evaluation Results

3.2 RF Exposure Evaluation – Innovation, Science and Economic Development Canada (ISED)

Date Performed:	25-Mar-4
Test Standard:	RSS-102 Issue 6
Test Method:	KDB 447498 D01
Modifications:	None
Final Result:	Complies

3.2.1 Applicable Regulations

3.2.1.1 ISED – RSS-102

Section 6.6 Exemption Limits for Routine Evaluation – RF Exposure Evaluation:

4 6.1 General

All transmitters are exempt from routine NS, SAR, APD, IPD and/or FRL exposure evaluations provided that they comply with the appropriate requirements specified in the following sections. If the equipment under test (EUT) meets the appropriate requirements outlined in the following sections, applicants are required to submit a properly signed declaration of compliance (refer to annex B).

In addition, the following information, where applicable, shall also be part of the RF exposure technical brief:

- the root mean square (RMS) current
- the number of turns of the coil
- the maximum output power
- the information that demonstrates how the maximum output power of the transmitter was derived
- the rationale for the separation distances applied (see table 10, table 11 and table 12), which must be based on the most conservative exposure condition for the applicable radio apparatus module or host platform test procedure requirements

For an EUT that overlaps a frequency range with 2 types of evaluation (e.g. below 6 GHz and above 6 GHz), both exemption limits (e.g. SAR exemption limit and the APD exemption limit) shall be met to be exempt from the routine evaluation(s).

If the EUT does not meet the appropriate exemption limit, a complete NS, SAR, APD, IPD and/or FRL evaluation shall be performed. However, the exemption limits in table 10, table 11 and table 12, may be applied to reduce the number of test configurations (e.g. possibly eliminating the need for testing of a tablet edge). The RF exposure technical brief (refer to section 4.3) shall include a rationale for the separation distances applied, based on the applicable radio apparatus module or host platform test procedure requirements.

- It is emphasized that exemption from routine evaluation is **not** an exemption from compliance with the applicable exposure limit(s) and the other relevant requirements.

Section 3.2 RF Exposure Evaluation of Devices:

A device requiring an RF exposure evaluation shall be made in accordance with the latest version of IEEE C95.3.



If the device is designed such that more than one antenna can functionally transmit at the same time, the RF exposure evaluation shall be conducted while all antennas are transmitting. The individual exposure level ratios shall be totalled and used for compliance purposes.

If the device has more than one antenna but is not designed to have more than one antenna functionally transmit at the same time, the RF exposure evaluation of the device shall be performed for each of the individually transmitting antennas. The maximum RF field strength value shall be recorded and used for compliance purposes.

If the device combines groups of simultaneous and non-simultaneous transmitting antennas, the worst-case of the above scenarios applies.

Section 4 Exposure Limits:

RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)				
Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (Minutes)
0.003 – 10	83	90	-	Instantaneous*
0.1 – 10	-	0.73 / f	-	6**
1.1 – 10	87 / f ^{0.5}	-	-	6**
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^{0.25}	0.008335 f^{0.25}	0.02619 f^{0.5}	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 x 10 ⁻⁴ f ^{0.5}	6.67 x 10 ⁻⁵ f	616000 / f ^{1.2}

Note: f is frequency in MHz.

* Based on nerve stimulation (NS).

** Based on specific absorption rate (SAR).

Table 5: ISED Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

RF Field Strength Limits for Controlled Use Devices (Controlled Environment)				
Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (Minutes)
0.003 – 10	170	180	-	Instantaneous*
0.1 – 10	-	1.6 / f	-	6**
1.1 – 10	193 / f ^{0.5}	-	-	6**
10 – 20	61.4	0.163	10	6
20 – 48	129.8 / f ^{0.25}	0.3444 / f ^{0.25}	44.72 / f ^{0.5}	6
48 – 300	49.33	0.1309	6.455	6
300 – 6000	15.60 f ^{0.25}	0.04138 f ^{0.25}	0.6455 f ^{0.5}	6
6000 – 15000	137	0.364	50	6
15000 – 150000	137	0.364	50	616000 / f ^{1.2}
150000 – 300000	0.354 f ^{0.5}	9.4 x 10 ⁻⁴ f ^{0.5}	3.33 x 10 ⁻⁴ f	616000 / f ^{1.2}

Note: f is frequency in MHz.

* Based on nerve stimulation (NS).

** Based on specific absorption rate (SAR).

Table 6: ISED Field Strength Limits for Controlled Use Devices (Controlled Environments)

4.1.1 ISED Measurement Data and Results:

From the RSS-102 limits for RF field strength limits in uncontrolled environments, the maximum power density at 2400 MHz is **0.02619 f^{0.5}** (1.284 W/m²) and which is 12.84 mW/cm².

Transmitter	Detail	Power Density (mW/cm ²) ^{Note 1}	Power Density Limit (mW/cm ²) ^{Note 2}	Result
Tx ₁	2.4 GHz BLE	0.54	12.84	Complies

Note 1: See section 3.1.1 for calculation of transmitter power density

Note 2: Power density limit converted from W/m² to mW/cm²

Table 7: RSS-102 Exposure Evaluation

4.2 RF Exposure Evaluation – European Standard EN 62479:2010

Date Performed:	25-Jan-20
Test Standard:	EN 62479:2010 IEEE C95.1
Test Method:	IEEE C95.1 KDB 447498 D01
Modifications:	None
Final Result:	Complies

4.2.1 Applicable Regulations

4.2.1.1 EN 62479:2010

4.1 General Considerations:

Compliance of electromagnetic emissions from electronic and electrical equipment with the basic restrictions usually is determined by measurements and, in some cases, calculation of the exposure level. If the electrical power used by or radiated by the equipment is sufficiently low, the electromagnetic fields emitted will be incapable of producing exposures that exceed the basic restrictions. This standard provides simple EMF assessment procedures for this low power equipment.

Any relevant compliance assessment procedure which is consistent with the state of the art, reproducible and gives valid results can be used.

For transmitters intended for use with more than one antenna configuration option, the combination of transmitter and antenna(s) which generates the highest available antenna power and/or average total radiated power shall be assessed.

4.2 Low Power Exclusion Level ($P_{\max}$)

Low-power electronic and electrical equipment is deemed to comply with the provisions of this standard if it can be demonstrated that the average total radiated power is less than or equal to the applicable low-power exclusion level $P_{\max}$.

4.3 Exposure to Multiple Transmitting Sources

If an equipment under test (EUT) is equipped with multiple intentional radiators, the overall conformity assessment might require more than just the assessment of conformity of each one of the radiators separately. The effect of multiple intentional radiators should be considered in the conformity assessment process.

4.2.1.2 IEEE C95.1-2019

4.3.2 Whole-body exposure ERLs (100 kHz to 300 GHz)

The ERLs are provided in the subclause for convenience in exposure assessments. For human exposure to electromagnetic energy at radio frequencies from 100 kHz to 300 GHz, the ERLs, in terms of rms electric (E) and magnetic (H) field strengths, the power density (S) and plane wave-equivalent power densities (S_E , S_H) are presented as a function of frequency in the following table. For uncorrelated (in time) fields, such as multiple field

exposure situations (e.g., different frequency field sources), compliance is determined by summing the percentages of the applicable ERLs in terms of E^2 , H^2 , or power density that each frequency field represents and ensuring that this sum does not exceed 100 %

ERLs for whole-body exposure of persons permitted in unrestricted environments				
Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	
			S _E	S _H
0.1 – 1	614	16.3 / f	1000	100 000 / f ²
1 – 30	823.8 / f	16.3 / f ^{1.668}	1800 / f ²	100 000 / f ²
30 – 100	27.5	158.3 / f	2	9 400 000 / f ^{3.336}
100 – 400	27.5	0.0729	2	
400 - 2000	-	-	f / 200	
2000 – 300 000	-	-	10	

Note: f is frequency in MHz.

Table 8: IEEE ERLs for whole-body exposure of persons permitted in unrestricted environments

ERLs for whole-body exposure of persons permitted in restricted environments (Controlled Environment)				
Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	
			S _E	S _H
0.1 – 1	1842	16.3 / f	9000	100 000 / f ²
1 – 30	1842 / f	16.3 / f	9000 / f ²	100 000 / f ²
30 – 100	61.4	16.3 / f	10	100 000 / f ²
100 – 400	61.4	0.163	10	
400 - 2000	-	-	f / 40	
2000 – 300 000	-	-	50	

Note: f is frequency in MHz.

Table 9: IEEE ERLs for whole-body exposure of persons permitted in restricted environments

4.2.1 EN 62479 RF Exposure Evaluation

From the IEEE C95.1 table of ERLs for whole-body exposure in uncontrolled environments, the maximum power density in the 2000 – 300 000 MHz range is 10 W/m². (100 mW/cm²)

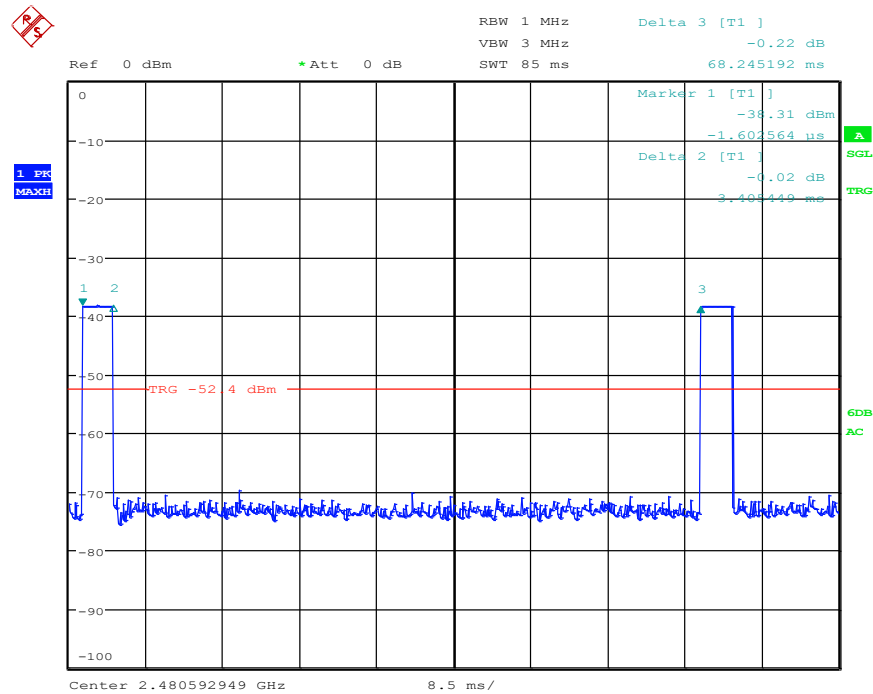
Transmitter	Detail	Power Density (mW/cm ²) ^{Note 1}	Power Density Limit (mW/cm ²) ^{Note 2}	Result
Tx ₁	2.4 GHz BLE	0.54	100	Complies

Note 1: See section 3.1.1 for calculation of transmitter power density

Note 2: Power density limit converted from W/m² to mW/cm² are multiplied by 10

Table 10: EN 62479 RF Exposure Evaluation

4.3 Dwell Time



Date: 1.JAN.2003 22:20:44

Marker 1 to 2 - Pulse "ON" Duration: 3.41ms
Marker 2 to 3 - Pulse "OFF" Duration: 64.84ms

Duty Factor reduction: $10\log(\text{On/Off}) = -12.79\text{dB}$

Peak Output Power: 10.33 dBm, 10.79 mW – Conducted

Peak Output Corrected: -2.46dBm = 0.57mw

Note - Due to low transmitting power dwell time exception was not used in the RF and MPE calculations.



Appendix A: ABBREVIATIONS

Abbreviation	Definition
AC	Alternating Current
AM	Amplitude Modulation
CE	European Conformity
CISPR	Comité International Spécial des Perturbations Radioélectriques (International Special Committee on Radio Interference)
DC	Direct Current
EFT	Electrical Fast Transient
EMC	Electro Magnetic Compatibility
EMI	Electro Magnetic Interference
ESD	Electrostatic Discharge
EUT	Equipment Under Test
FCC	Federal Communications Commission
FVIN	Firmware Version Identification Number FVIN
ICES	Interference Causing Equipment Standard
IEC	International Electrotechnical Commission
ISED	Innovation, Science and Economic Development (Canada)
LISN	Line Impedance Stabilizing Network
OATS	Open Area Test Site
RCM	Regulatory Compliance Mark
RF	Radio Frequency
RMS	Root-Mean-Square
SAC	Semi-Anechoic Chamber
UKCA	UK Conformity Assessed



END OF REPORT