



Radio Frequency Exposure Evaluation Report

For:
EM Microelectronic

Model:
ABT20

Product Description:
An ultra-compact, wearable BLE Beacon

FCC ID: 2ACQR-EMBT0
IC: 12155A-EMBT0

Applied Rules and Standards:
CFR Part Part1 (1.1307 &1.1310), Part 2 (2.1093),
FCC KDB 447498 D04 Interim General RF Exposure Guidance v01
ISED RSS-102 Issue 5

Report number: EMC_EMMIC_001_23001_SAR_EX_Rev3

DATE: 2023-06-12



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1 Assessment

The following device was evaluated against the limits for general population uncontrolled exposure specified in CFR 47 Part 2.1093 according to SAR evaluation exclusion requirements specified in FCC regulation as listed in KDB 447498, and ISEDC RSS-102 Issue 5.

The device meets the requirements for SAR exclusion as stipulated by the above given FCC/ISEDC rules.

Company	Description	Model #
EM Microelectronic	An ultra-compact, wearable BLE beacon.	ABT20

Responsible for Testing Laboratory:

2023-06-12 Compliance Arndt Stoecker
(Director of Regulatory Services)

Date	Section	Name	Signature
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Responsible for the Report:

2023-06-12 Compliance Art Thammanavarat
(Senior EMC Engineer)

Date	Section	Name	Signature
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The test results of this test report relate exclusively to the test item specified in Section 3.
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2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
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Telephone:	+1 (408) 586 6200
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EMC Lab Manager:	Arndt Stoecker
Responsible Project Leader:	Sangeetha Sivaraman

2.2 Identification of the Client

Client Firm/Name:	EM MICROELECTRONIC
Street Address:	3 Rue des Sors,
City/Zip Code	Marin, 2074
Country	Switzerland

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as Client
Manufacturers Address:	
City/Zip Code	
Country	

3 Equipment under Assessment

3.1 EUT Specifications

Product Description:	An ultra-compact, wearable BLE Beacon
Model Name :	ABT20
Marketing Name	EMBT0
HW Version :	BVPAWS-V4
SW Version :	v2.2rc17
FCC-ID :	2ACQR-EMBT0
IC:	12155A-EMBT0
FVIN:	v2.2rc17
HVIN:	ABT20
PMN:	EMBT0
Bands/Modes Supported	Bluetooth IC Model Name / Model Number : EM9304 Wireless Technologies Bluetooth LE : GFSK
Frequency Range, # of channels	Bluetooth Low Energy: Nominal band: 2400 MHz – 2483.5 MHz; 40 channels
Antenna Gain as declared	-8.4 dBi
Max. Peak Output Power	BLE :-1.09 dBm
Other Radios in the device	None
Power Supply/ Rated Operating Voltage Range	1.1-1.7V
Operating Temperature Range	Low : 0 °C Norm 25 °C High 40 °C
Sample Revision	<input checked="" type="checkbox"/> Production <input type="checkbox"/> Pre-Production
EUT Dimensions	19mm x 19mm x 7.5mm
Weight	3 grams
EUT Diameter	<input checked="" type="checkbox"/> < 60 cm <input type="checkbox"/> Other _____

4 RF Exposure Evaluation Methods

4.1 FCC SAR test exclusions per KDB 447498

KDB 447498 D04 General RF Exposure Guidance v01 Section 2.1; RF Exposure Test Exemptions for Single Source states:

4.1.1 SAR-Based Exemption

A more comprehensive exemption, considering a variable power threshold that depends on both the separation distance and power, is provided in § 1.1307(b)(3)(i)(B). This exemption is applicable to the frequency range between 300 MHz and 6 GHz, with test separation distances between 0.5 cm and 40 cm, and for all RF sources in fixed, mobile, and portable device exposure conditions.

Accordingly, a RF source is considered an RF exempt device if its available maximum time-averaged (matched conducted) power or its effective radiated power (ERP), whichever is greater, are below a specified threshold. This exemption threshold was derived based on general population 1-g SAR requirements and is detailed in Appendix C.

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).

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

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). The example values shown in Table B.2 are for illustration only.

Table B.2—Example Power Thresholds (mW)

Frequency (MHz)	Distance (mm)									
	5	10	15	20	25	30	35	40	45	50
300	39	65	88	110	129	148	166	184	201	217
450	22	44	67	89	112	135	158	180	203	226
835	9	25	44	66	90	116	145	175	207	240
1900	3	12	26	44	66	92	122	157	195	236
2450	3	10	22	38	59	83	111	143	179	219
3600	2	8	18	32	49	71	96	125	158	195
5800	1	6	14	25	40	58	80	106	136	169

4.2 RF Exposure evaluation flow chart

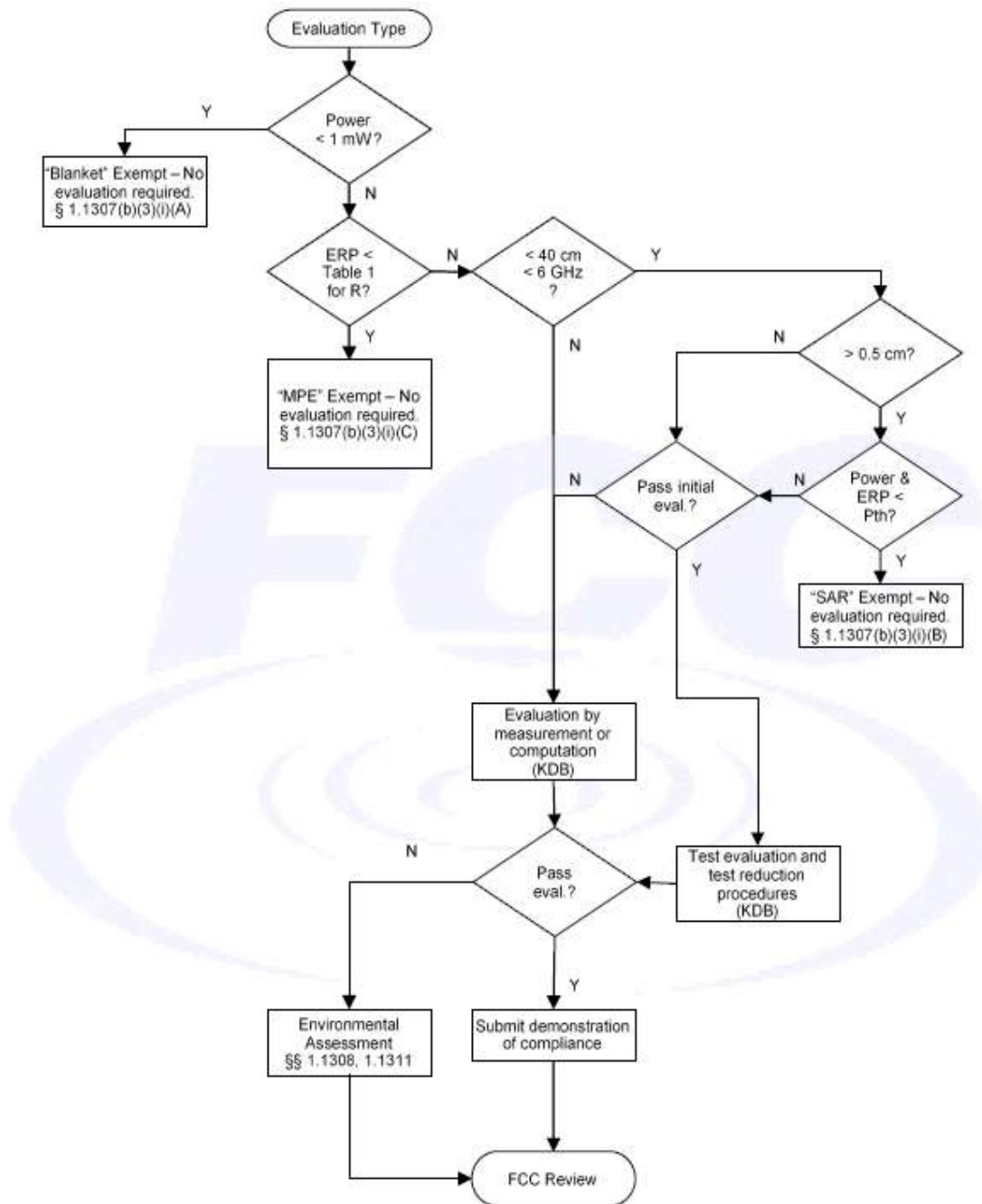


Figure A.1 – General Sequence for Determination of Procedure (exemption or evaluation) to Establish Compliance with Exposure Limits for a Single RF Source³⁹

4.3 ISEDC SAR test exclusions per IC RSS-102 Issue 5

SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1.

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance

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

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of ≥50 mm
≤300	223 mW	254 mW	284 mW	315 mW	345 mW
450	141 mW	159 mW	177 mW	195 mW	213 mW
835	80 mW	92 mW	105 mW	117 mW	130 mW
1900	99 mW	153 mW	225 mW	316 mW	431 mW
2450	83 mW	123 mW	173 mW	235 mW	309 mW
3500	86 mW	124 mW	170 mW	225 mW	290 mW
5800	56 mW	71 mW	85 mW	97 mW	106 mW

5 Stand-alone Transmission SAR Exclusion Evaluation

FCC:

Radio	Tech-Band	Freq-Low _[GHz]	Pwr _[dBm]	Power _[W]	EIRP _[W]	ERP _[W]	Power Threshold Limited at d ≤ 20cm	§ 1.1307(b)(3)(i)(B). ERP < Threshold ERP _[W] SAR Excluded (Y/N)
Bluetooth	LE	2.4020	2.50	0.002	0.0003	0.0002	2.788	Yes

Note: Output power list on the calculation was from customer declaration. Therefore, the Maximum Tune up power was calculated to show the worst case for this evaluation.

IC:

Radio	Tech-Band	Frequency [MHZ]	Distance (mm)	Max. Peak Pwr _[dBm]	Power [W]	Ant-G [dBi]	EIRP [W]	ERP [mW]	SAR	
									RSS-102 2.5.1 D≤20 cm (300 ≤ Freq ≤ 5800 MHz)	
									Exemption limit for Routine Evaluation (mW)	Exemption
BT	LE	2402.0	5	2.5	0.002	-8.4	0.000	0.257	4.26	Exempt

Note: Output power list on the calculation was from customer declaration. Therefore, the Maximum Tune up power was calculated to show the worst case for this evaluation.

Conclusion:

- The maximum RF emissions from this equipment fulfills the SAR exclusion threshold limits for separation distance between the antenna and the human body greater than 5 mm. SAR is not required.

6 Revision History

Date	Report Name	Changes to report	Prepared by
2023-05-18	EMC_EMMIC_001_23001_SAR_EX	Initial Release	Art Thammanavarat
2023-05-31	EMC_EMMIC_001_23001_SAR_EX_Rev1	Section 5: Updated table. Added Scaling SAR to Maximum Tune-up.	Art Thammanavarat
2023-06-09	EMC_EMMIC_001_23001_SAR_EX_Rev2	Updated Standard	Art Thammanavarat
2023-06-12	EMC_EMMIC_001_23001_SAR_EX_Rev3	Section 5: Updated table. Added note.	Art Thammanavarat

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