



Radio Frequency Exposure Evaluation Report

For:

Banner Engineering Corp.

Brand:

Banner Engineering Corp.

Marketing Name:

77 GHz Industrial Radar Presence Detector

Model Name:

Q90R27

Product Description:

Industrial Radar Presence Detector

FCC ID: UE3Q90R2-7

IC: 7044A-Q90R27

Applied Rules and Standards:

CFR Title 47 Part1 (1.1307 & 1.1310), Part 2 (2.1091),
FCC KDB 447498 D04 Interim General RF Exposure Guidance v01
ISED RSS-102 Issue 6

REPORT #: EMC_BANNE_011_24001_RF_Exposure

DATE: 2025-03-14



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1 **Assessment**

This RF Exposure evaluation report provides evidence for compliance of the below identified device with the RF Exposure limits for mobile devices as defined in

- FCC CFR Part 1 (1.1307 & 1.1310), Part 2 (2.1091)
- IC standard RSS-102 issue 6

under worst case conditions (measured or rated RF output power, antenna gain, distance towards human body, multiple transmitter information as presented by the applicant).

In addition, maximum antenna gain or minimum distance towards the human body is calculated respectively, where relevant.

The device meets the limits as stipulated by the above given FCC and IC rule parts based on available specifications for worst case conditions at 20 cm distance to the body.

Company	Description	Model #
Banner Engineering Corp.	Industrial Radar Presence Detector	Q90R27

Responsible for the Report:

2025-03-14	Compliance	Guangcheng Huang (Senior EMC Test Engineer)	
Date	Section	Name	Signature

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
Street Address:	411 Dixon Landing
City/Zip Code	Milpitas, 95035 CA
Country	USA
Telephone:	+ 1 (408) 586 6200
Fax:	+ 1 (408) 586 6299
EMC Lab Manager:	Alvin Ilarina
Project Manager:	Shane Hao

2.2 Identification of the Client

Client's Name:	Banner Engineering Corp.
Street Address:	9714 10th Avenue North
City/Zip Code	Minneapolis, MN 55441
Country	USA

2.3 Identification of the Manufacturer

Manufacturer's Name:	same as client
Manufacturers Address:	same as client
City/Zip Code	same as client
Country	same as client

3 **Equipment Under Test (EUT)**

3.1 EUT Specifications

Model No:	Q90R27
Marketing Name:	77 GHz Industrial Radar Presence Detector
HW Version:	Rev. A
SW Version:	1.0
FCC ID:	UE3Q90R2-7
IC:	7044A-Q90R27
FWIN:	N/A
HVIN:	Q90R2
PMN:	Q90R2
Product Description:	Industrial Radar Presence Detector
Power Supply / Rated operating Voltage Range:	10-30 VDC, Nominal 20 VDC
Operating Temperature Range	-40 °C to +65 °C
Sample Revision	Production
EUT Dimensions	90 x 90 x 25 mm
Note: All information provided by the client.	

3.2 Radio Specifications

Embedded Radio Technologies	77 GHz Radar
Frequency Range / number of channels:	77-78.56 GHz
Rated max. EIRP	20 dBm
Tested radio technology	77 GHz Radar
Antenna Type / Gain	Microstrip patch antenna
Modes of Operation	FMCW continuous
Note: All information provided by the client.	

4 RF Exposure Limits and FCC & IC Basic Rules

4.1 FCC

§ 2.1091(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 to § 1.1307(b)(3)(i)(C), whichever is greater. For mobile devices not exempt by § 1.1307(b)(3)(i)(C) at distances from 20 centimeters to 40 centimeters and frequencies from 0.3 GHz to 6 GHz, evaluation of compliance with the exposure limits in § 1.1310 of this chapter is necessary if the ERP of the device is greater than ERP_{20cm} in the formula below. If the ERP of a single RF source at distances from 20 centimeters to 40 centimeters and frequencies from 0.3 GHz to 6 GHz is not easily obtained, then the available maximum time-averaged power may be used (i.e., without consideration of ERP) in comparison with the following formula only if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

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

§ 1.1307(b)(3)(i)(C)

Using following table and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

RF Source frequency (MHz)	Threshold ERP (watts)
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	$19.2 R^2$.

4.2 IC

According to RSS-102 Issue 6, section 6.6, Field reference level (FRL) 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 (i.e. mobile devices), except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum EIRP. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the EIRP was derived.

5 Evaluations

5.1 FCC

Exemption threshold according to FCC 1.1307(b)(3)(i)(C) for a single RF source

Radio	Freq-Low [GHz]	EIRP [dBm]	EIRP [W]	ERP [W]	Exemption ERP Threshold [W]	Percentage of limit
Radar	77	11.39	0.014	0.0084	0.768	1.09%

Conclusion:

The maximum RF emissions from this equipment is below the SAR exemption ERP threshold for separation distance between the antenna and the human body greater than 20 cm. SAR is not required.

5.2 IC

Exemption threshold according to applied rule part

Radio	Freq-Low [GHz]	EIRP [dBm]	EIRP [W]	Exemption EIRP Threshold [W]
Radar	77	11.39	0.014	5

Conclusion:

The maximum RF emissions from this equipment is below the Field reference level (FRL) exposure evaluation exemption threshold for separation distance between the device's radiating element and the human body greater than 20 cm. Thus, Field reference level (FRL) exposure evaluation is exempt.

6 Revision History

Date	Report name	Changes to report	Prepared by
2025-02-18	EMC_BANNE_011_24001_RF_Exposure	Initial version	Guangcheng Huang
2025-03-14	EMC_BANNE_011_24001_RF_Exposure_Rev1	Update model name	Guangcheng Huang

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