Sure Cross® Wireless Q45PS All-in-One Pressure Sensor

BANNER®
more sensors, more solutions

Datasheet

Sure Cross® Wireless Q45 Sensors combine the best of Banner's flexible Q45 sensor family with its reliable, field-proven, Sure Cross wireless architecture to solve new classes of applications limited only by the user's imagination. Containing a variety of sensor models, a radio, and internal battery supply, this product line is truly plug and play.

The Q45PS All-in-One Pressure Sensor combines a media isolated pressure sensor with the reliable, field-proven, Sure Cross wireless architecture into one package, eliminating the need for ordering multiple components and reducing the physical size of the device. This solution monitors pressurized systems in remote locations without human intervention. The industrial grade, battery-powered device can be used to wirelessly transmit pressure levels to a wireless controller/gateway for remote monitoring of critical systems.
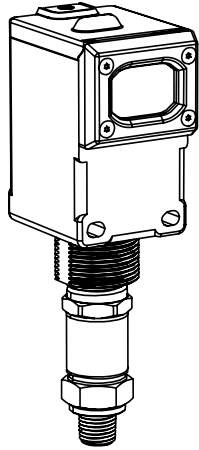
Benefits

- Provides for the ability to deliver factory automation and IIoT solutions for many applications including, but not limited to monitoring:
  ◦ Water pressure
  ◦ HVAC systems
  ◦ Pneumatic systems
  ◦ Cooling systems/compressors/chillers fluid pressure
  ◦ Hydraulic system pressure
  ◦ Supply tank level via the head pressure
- **Eliminate control wires**—The Sure Cross wireless system is a radio frequency network with integrated I/O that removes the need for power and control wires
- **Reduce complexity**—Machine or process reconfiguration made easier; great for retrofit applications
- **Deploy easily**—Simplify installation on existing equipment to enable deployment in remote and hard-to-access locations where implementing a wired solution would be difficult, impractical, or not cost-effective
- Selectable transmit power levels of 250 mW or 1 Watt for 900 MHz models
- DIP switches for user configuration
- Frequency Hopping Spread Spectrum (FHSS) technology ensures reliable data delivery
- Transceivers provide bidirectional communication between the Gateway and Node, including fully acknowledged data transmission
- Diagnostics allow user defined output settings in the unlikely event of lost RF signal

Models

Model	Radio Frequency	Inputs and Outputs
DX80N9Q45PS15G	900 MHz ISM Band	Q45 with integrated 0-15 psi gauge pressure sensor
DX80N9Q45PS50G		Q45 with integrated 0-50 psi gauge pressure sensor
DX80N9Q45PS150G		Q45 with integrated 0-150 psi gauge pressure sensor
DX80N9Q45PS250G		Q45 with integrated 0-250 psi gauge pressure sensor
DX80N9Q45PS500S		Q45 with integrated 0-500 psi sealed gauge pressure sensor
DX80N9Q45PS1000S		Q45 with integrated 0-1000 psi sealed gauge pressure sensor
DX80N9Q45PS3000S		Q45 with integrated 0-3000 psi sealed gauge pressure sensor
DX80N2Q45PS500S	2.4 GHz ISM Band	Q45 with integrated 0-500 psi sealed gauge pressure sensor
DX80N2Q45PS3000S		Q45 with integrated 0-3000 psi sealed gauge pressure sensor

To order an integrated battery model without the battery, add an **NB** to the model number (for example, **DX80N9Q45PS50G NB**). If you purchase a model without the battery, Banner Engineering recommends battery model **BWA-BATT-006**.

Storage Mode

While in **storage mode**, the device's radio does not operate, to conserve the battery. To put any device into storage mode, press and hold the binding button for five seconds. The device is in storage mode when the LEDs stop blinking. To wake the device, press and hold the binding button (inside the housing on the radio board) for five seconds.

Configuration Instructions

Button and LEDs
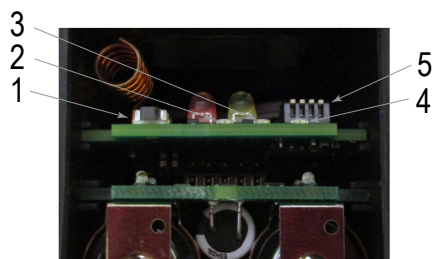
1 Binding button
2 Red LED (flashing) indicates a radio link error with the Gateway.
3 Green LED (flashing) indicates a good radio link with the Gateway.
4 Amber LED is not used.
5 DIP switches

DIP Switches

After making any changes to any DIP switch position, reboot the Wireless Q45 Sensor by triple-clicking the button, waiting a second, then double-clicking the button.

The DIP switches are in the OFF position. To turn a DIP switch on, push the switch toward the battery pack. DIP switches one through four are numbered from left to right.

	DIP Switches							
	1	2	3	4	5	6	7	8
900 MHz transmit power level: 1 Watt (30 dBm)	OFF *							
900 MHz transmit power level: 250 mW (24 dBm), DX80 compatibility mode	ON							
Temperature in Fahrenheit		OFF *						
Temperature in Celsius		ON						
Reserved			OFF *					
Reserved				OFF *				
Reserved					OFF *			
Modbus or software configured (overrides DIP switches)						OFF *	OFF *	OFF *
Sample/report rate of 15 minutes						OFF	OFF	ON
Sample/report rate of 5 minutes						OFF	ON	OFF
Sample/report rate of 64 seconds						OFF	ON	ON
Sample/report rate of 16 seconds						ON	OFF	OFF
Sample/report rate of 4 seconds						ON	OFF	ON
Sample/report rate of 2 seconds						ON	ON	OFF
Sample/report rate of 1 seconds						ON	ON	ON

The factory default sample and report rate is 5 minutes.

Transmit Power Levels

The 900 MHz radios transmit at 1 Watt (30 dBm) or 250 mW (24 dBm). The 250 mW mode reduces the radio's range but improves the battery life in short range applications. For 2.4 GHz models, this DIP switch is disabled. The transmit power for 2.4 GHz is fixed at about 65 mW EIRP (18 dBm).

Sample and Report Rates

The sample interval, or rate, defines how often the Sure Cross device samples the input. For battery-powered applications, setting a slower rate extends the battery life.

The report rate defines how often the Node communicates the I/O status to the Gateway. For battery-powered applications, setting the report rate to a slower rate extends the battery life.

What is Sampling on Demand?

Sample on demand allows a host system to send a Modbus command to a register and require the inputs to immediately sample the sensor and report readings back to the host system and/or Gateway. Sampling on demand can be used between the normal periodic reporting.

The sample on demand feature requires using a host-controlled system capable of sending Modbus commands to the master radio.

Sample an Input Using a Host System

To sample the input, have the Host System write to the Node's register 15. To calculate which register this is for your Node, use this equation: 15 + (Node # × 16).

1. From the host system, write 0x13xx to the Node's register 15, where xx defines the input you want to sample.

| For Input	Write Value (in hex)	Write Value (in decimal)
1	0x1301	4865
2	0x1302	4866
3	0x1304	4868
4	0x1308	4872
5	0x1310	4880
6	0x1320	4896
All Inputs	0x133F	4927

2. To send the Sample on Demand command to more than one input, add together the binary representation values.

   For example, to demand a sampling of inputs 1, 2, and 3, the Hex command is 0x1307.

Apply Power to the Q45

Follow these instructions to install or replace the lithium "AA" cell batteries.

As with all batteries, these are a fire, explosion, and severe burn hazard. Do not burn or expose them to high temperatures. Do not recharge, crush, disassemble, or expose the contents to water. Properly dispose of used batteries according to local regulations by taking it to a hazardous waste collection site, an e-waste disposal center, or other facility qualified to accept lithium batteries.

Figure 1. Q45 battery board
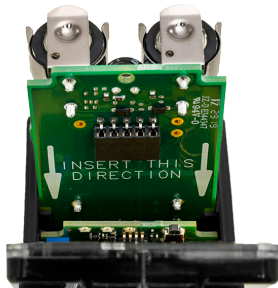
1. Loosen the clamp plate with a small Phillips screwdriver and lift the cover.
2. Slide the battery board out of the Q45 housing.
3. If applicable, remove the discharged batteries.
4. Install the new batteries. Use Banner's **BWA-BATT-006** replacement batteries or an equivalent 3.6 V AA lithium batteries, such as Xeno's XL-60F.
5. Verify the battery's positive and negative terminals align to the positive and negative terminals of the battery holder mounted within the case. Caution: There is a risk of explosion if the battery is replaced incorrectly.
6. Slide the board containing the new batteries back into the Q45 housing.
7. Close the cover and gently tighten the clamp plate with the small Phillips screwdriver.

Bind to the Gateway and Assign the Node Address

Before beginning the binding procedure, apply power to all the devices. Separate the devices by two meters when running binding procedure. Put only one Gateway into binding at a time to prevent binding to the wrong Gateway.

1. On the Gateway: Enter binding mode.
   - For housed DX80 Gateways, triple-click button 2 on the Gateway. Both LEDs flash red.
   - For Gateway board modules, triple-click the button. The green and red LED flashes.
2. Assign the Q45 a Node address using the Gateway's rotary dials. Use the left rotary dial for the left digit and the right rotary dial for the right digit. For example, to assign your Q45 to Node 10, set the Gateway's left dial to 1 and the right dial to 0. Valid Node addresses are 01 through 47.

3. On the Q45: Loosen the clamp plate on the top of the Q45 and lift the cover.
4. Enter binding mode on the Q45 by triple-clicking the Q45's button.
   The red and green LEDs flash alternately and the sensor searches for a Gateway in binding mode. After the Q45 is bound, the LEDs stay solid momentarily, then they flash together four times. The Q45 exits binding mode.
5. Label the sensor with the Q45's Node address number for future reference.
6. Repeat steps 2 through 5 for as many Q45s as are needed for your network.
7. On the Gateway: After binding all Q45s, exit binding mode.
   - For housed DX80 Gateways, double-click button 2.
   - For board-level DX80 Gateways, double-click the button.

For Gateways with single-line LCDs: After binding your Q45 to the Gateway, make note of the binding code displayed under the Gateway's *DVCFG menu, XADR submenu on the LCD. Knowing the binding code prevents having to re-bind all Q45s if your Gateway is ever replaced.

Bind to a DXM and Assign the Node Address

Before beginning the binding procedure, apply power to all the devices. Separate the radios by two meters when running the binding procedure. Put only one DXM into binding mode at a time to prevent the Q45 from binding to the wrong Gateway.

1. On the DXM: Use the arrow keys to select the **ISM Radio** menu on the LCD and click **ENTER**.
2. Highlight the **Binding** menu and click **ENTER**.
3. Use the arrow keys to select the Node address to bind the Q45 to.
4. On the Q45: Loosen the top clamp plate and lift the cover.
5. Enter binding mode by triple-clicking the binding button.
   The red and green LEDs flash alternately and the sensor searches for a Gateway in binding mode. After the Node binds, the LEDs stay solid momentarily, then they flash together four times. The Node exits binding mode.
6. Label the sensor with the Node address number for future reference.
7. On the DXM: Click **BACK** to exit binding for that specific Node address.
8. Repeat steps 3 through 7 and change the Node address for as many Q45s as are needed for your network.
9. On the DXM: After you have finished forming your network, click **BACK** until you reach the main menu.

Modbus Registers

Table 1: Modbus holding registers

I/O #	Modbus Holding Register		I/O Type	I/O Range		Holding Register Representation	
	Gateway	Any Node		Min.	Max.	Min.	Max.
1	1	1 + (Node# × 16)	Temperature	-1638.3	1638.4	-32768	32767
2	2	2 + (Node# × 16)	Pressure (unscaled)	0	65535	0	65535
		...					
7	7	7 + (Node# × 16)	Reserved				
8	8	8 + (Node# × 16)	Device Message				
		...					
15	15	15 + (Node# × 16)	Control Message				
16	16	16 + (Node# × 16)	Reserved				

For temperature values: Temperature = (Modbus register value) ÷ 20.

For pressure values: The Q45PS is equipped with a 0-5 V DC pressure sensor. The Node's register 2 reports this output as a raw value. Use the following equations to interpret the raw value in PSIG or PSIS.

Table 2: Example pressure calculations

Model	Divide the Value in Register 2 by	Example
0-15 PSIG	2184.5	PSI = 13265 (holding register 2 in decimal) ÷ 2184.5 = 6.07 PSIG
0-50 PSIG	655.35	PSI = 13265 (holding register 2 in decimal) ÷ 655.35 = 20.2 PSIG
0-150 PSIG	218.45	PSI = 13265 (holding register 2 in decimal) ÷ 218.45 = 60.7 PSIG
0-250 PSIG	131.07	PSI = 13265 (holding register 2 in decimal) ÷ 131.07 = 101.2 PSIG
0-500 PSIS	65.535	PSI = 13265 (holding register 2 in decimal) ÷ 65.535 = 202 PSIS
0-1000 PSIS	32.7675	PSI = 13265 (holding register 2 in decimal) ÷ 32.7675 = 404 PSIS
0-3000 PSIS	10.9225	PSI = 13265 (holding register 2 in decimal) ÷ 10.9225= 1214 PSIS

Specifications

Performance Radio with Internal Antenna Specifications

Radio Range [1]
900 MHz, 1 Watt: Up to 3.2 km (2 miles) with line of sight (internal antenna)
2.4 GHz, 65 mW: Up to 1000 m (3280 ft) with line of sight (internal antenna)

Antenna Minimum Separation Distance
900 MHz, 150 mW and 250 mW: 2 m (6 ft)
900 MHz, 1 Watt: 4.57 m (15 ft)
2.4 GHz, 65 mW: 0.3 m (1 ft)

Radio Transmit Power
900 MHz, 1 Watt: 30 dBm (1 W) conducted (up to 36 dBm EIRP)
2.4 GHz, 65 mW: 18 dBm (65 mW) conducted, less than or equal to 20 dBm (100 mW) EIRP

Link Timeout (Performance)
Gateway: Configurable via User Configuration Software
Node: Defined by Gateway

Spread Spectrum Technology
FHSS (Frequency Hopping Spread Spectrum)

900 MHz Compliance (1 Watt)
FCC ID UE3RM1809: FCC Part 15, Subpart C, 15.247
IC: 7044A-RM1809
IFT: RCPBARM13-2283

(NOM approval only applies to 900 MHz models)

2.4 GHz Compliance
FCC ID UE300DX80-2400: FCC Part 15, Subpart C, 15.247
Radio Equipment Directive (RED) 2014/53/EU
IC: 7044A-DX8024
ANATEL: 15966-21-04042 Este equipamento não tem direito à proteção contra interferência prejudicial e não pode causar interferência em sistemas devidamente autorizados. Para maiores informações, consulte o site da ANATEL www.gov.br/anatel/pt-br/

Wireless Q45PS Sensor Node Specifications

Pressure Sensor
Range: 0–15 PSIG, 0–50 PSIG, 0–150 PSIG, 0–250 PSIG, 0–500 PSIS, 0–1000 PSIS, 0–3000 PSIS
Proof Pressure: 2× FS
Burst Pressure: 3× FS
Fatigue Life: > 4 million cycles
Output: 0-5 V DC
Accuracy: ± 1.4% FS

Pressure Sensor Mechanical
Pressure fitting: 1/4"-18NPT
Rating: IP65
Housing: 304 stainless steel
Wetted material for the 0–15 PSIG model: 316 stainless steel
Wetted material for all other models: 17-4PH stainless steel

Housing
Molded reinforced thermoplastic polyester housing, oring-sealed transparent Lexan® cover, molded acrylic lenses, and stainless steel hardware.
Designed to withstand 1200 psi washdown.

Indicators
Red and green LEDs (radio function)

Default Sensing Interval
5 minutes

Typical Battery Life
See chart

Environmental Specifications

Operating Conditions
–40 °C to +70 °C (–40 °F to +158 °F); 90% at +50 °C maximum relative humidity (non-condensing)
Radiated Immunity: 10 V/m (EN 61000-4-3)

Environmental Rating
NEMA 6P, IP67

Operating the devices at the maximum operating conditions for extended periods can shorten the life of the device.

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[1] Range depends on the environment and decreases significantly without line of sight. Always verify your wireless network's range by performing a Site Survey.
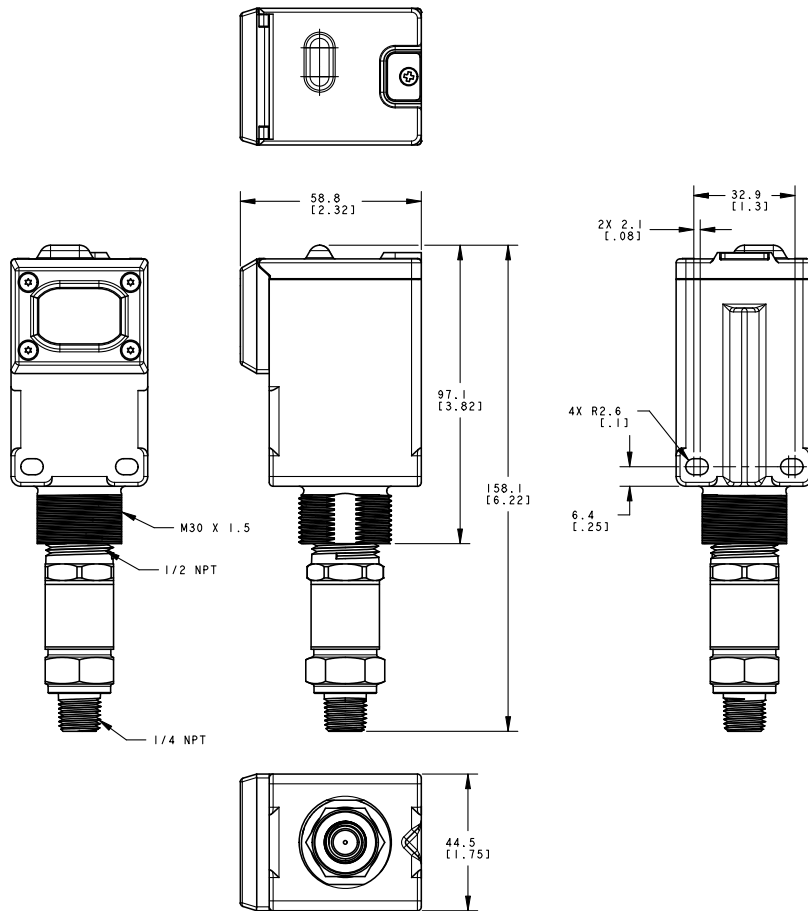
Battery Life Performance Curve

Figure 2. Battery Life for the Q45PS Sensor Node
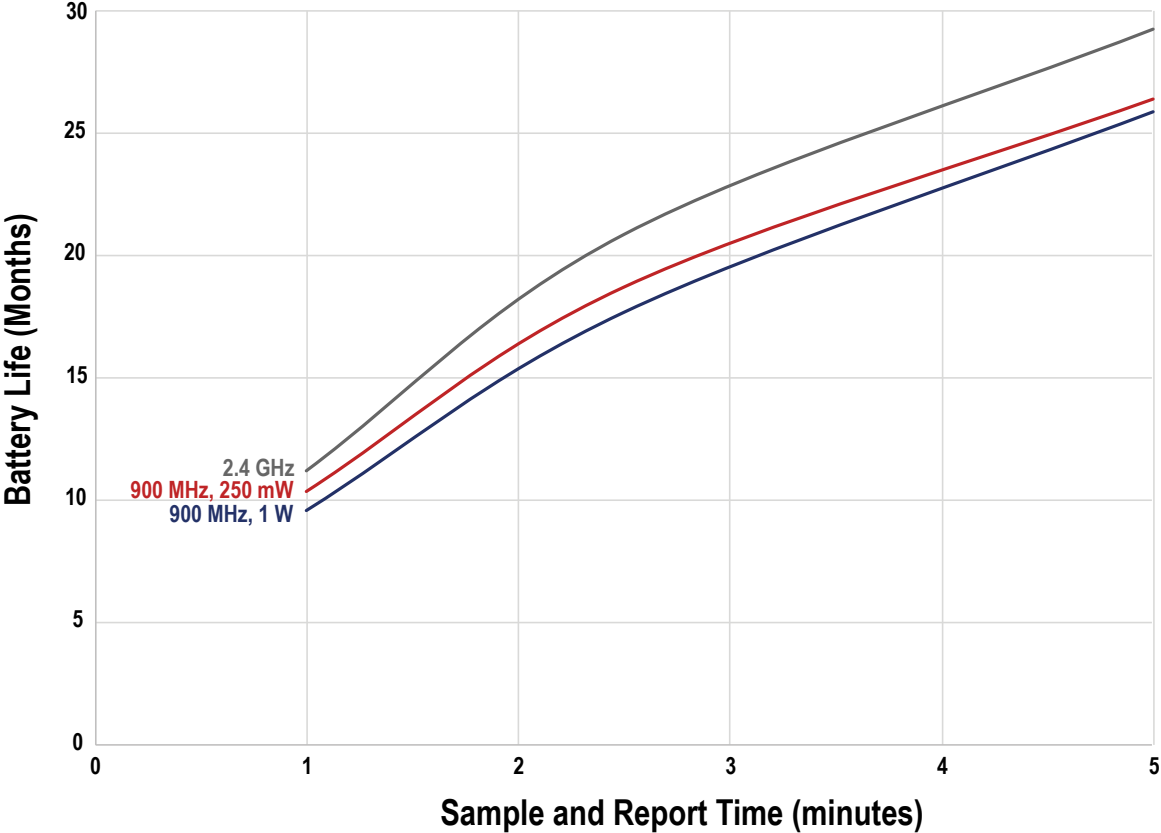
Dimensions

All measurements are listed in millimeters, unless noted otherwise.

M30 X 1.5
1/2 NPT
1/4 NPT

58.8
[2.32]

97.1
[3.82]

158.1
[6.22]

32.9
[1.3]

2X 2.1
[.08]

4X R2.6
[.1]

6.4
[.25]

44.5
[1.75]

Replacement Batteries

BWA-BATT-006

- 3.6 V Lithium AA cell
- Two batteries

Warnings

Exporting Sure Cross® Radios. It is our intent to fully comply with all national and regional regulations regarding radio frequency emissions. **Customers who want to re-export this product to a country other than that to which it was sold must ensure the device is approved in the destination country.** The Sure Cross wireless products were certified for use in these countries using the antenna that ships with the product. When using other antennas, verify you are not exceeding the transmit power levels allowed by local governing agencies. This device has been designed to operate with the antennas listed on Banner Engineering's website and having a maximum gain of 9 dBm. Antennas not included in this list or having a gain greater that 9 dBm are strictly prohibited for use with this device. The required antenna impedance is 50 ohms. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen such that the equivalent isotropically radiated power (EIRP) is not more than that permitted for successful communication. Consult with Banner Engineering Corp. if the destination country is not on this list.

Important: Please download the complete Wireless Q45 Sensor Node technical documentation, available in multiple languages, from www.bannerengineering.com for details on the proper use, applications, Warnings, and installation instructions of this device.

Important: Por favor descargue desde www.bannerengineering.com toda la documentación técnica de los Wireless Q45 Sensor Node, disponibles en múltiples idiomas, para detalles del uso adecuado, aplicaciones, advertencias, y las instrucciones de instalación de estos dispositivos.

Important: Veuillez télécharger la documentation technique complète des Wireless Q45 Sensor Node sur notre site www.bannerengineering.com pour les détails sur leur utilisation correcte, les applications, les notes de sécurité et les instructions de montage.

WARNING:
- **Do not use this device for personnel protection**
- Using this device for personnel protection could result in serious injury or death.
- This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A device failure or malfunction can cause either an energized (on) or de-energized (off) output condition.

Important:
- **Electrostatic discharge (ESD) sensitive device**
- ESD can damage the device. Damage from inappropriate handling is not covered by warranty.
- Use proper handling procedures to prevent ESD damage. Proper handling procedures include leaving devices in their anti-static packaging until ready for use; wearing anti-static wrist straps; and assembling units on a grounded, static-dissipative surface.

Banner Engineering Corp. Limited Warranty

Banner Engineering Corp. warrants its products to be free from defects in material and workmanship for one year following the date of shipment. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture which, at the time it is returned to the factory, is found to have been defective during the warranty period. This warranty does not cover damage or liability for misuse, abuse, or the improper application or installation of the Banner product.

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For patent information, see www.bannerengineering.com/patents.

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Información México: La operación de este equipo está sujeta a las siguientes dos condiciones: 1) es posible que este equipo o dispositivo no cause interferencia perjudicial y 2) este equipo debe aceptar cualquier interferencia, incluyendo la que pueda causar su operación no deseada.

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Antenas SMA	Modelo	Antenas Tipo-N	Modelo
Antena, Omni 902-928 MHz, 2 dBd, junta de caucho, RP-SMA Macho	BWA-9O2-C	Antena, Omni 902-928 MHz, 6 dBd, fibra de vidrio, 1800mm, N Hembra	BWA-9O6-A
Antena, Omni 902-928 MHz, 5 dBd, junta de caucho, RP-SMA Macho	BWA-9O5-C	Antena, Yagi, 900 MHz, 10 dBd, N Hembra	BWA-9Y10-A

Mexican Importer

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San Pedro Garza Garcia Nuevo Leòn, C. P. 66269

81 8363.2714

ANATEL

Modelo (Model): DX80-2400—Este equipamento não tem direito à proteção contra interferência prejudicial e não pode causar interferência em sistemas devidamente autorizados. Para maiores informações, consulte o site da ANATEL www.gov.br/anatel/pt-br/

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Agência Nacional de Telecomunicações
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more sensors, more solutions