Why do I care?

Antenna Polarization

SensThys, Inc

November 12, 2021 (V1.2)

Legal Notices

FCC Compliance

This equipment has been tested and found to comply with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Any change or modification to this product voids the user’s authority to operate per FCC Part 15 Subpart A. Section 15.21 regulations.

Industry Canada Compliance

This device complies with Industry Canada License-exempt RSS standards. Operation is subject to the following two conditions: (1) this device may not cause interference and (2) this device must accept any interference, including interference that may cause undesired operation of the device. This device has been designed to operate with a variety of different gain (dBi). The reader maximum output power is set by the gain of the antenna. Using an antenna having a higher gain is strictly prohibited per regulations of Industry Canada. In addition, using the reader at a power exceeding the maximum output power for a given antenna is also strictly prohibited. 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 that the equivalent isotropically radiated power (EIRP) is not more than that required for successful communication.

Conformité d'Industrie Canada

Cet appareil est conforme aux normes RSS exemptées de licence d'Industrie Canada. L'opération est soumise aux deux conditions suivantes: (1) cet appareil ne doit pas provoquer d'interférence et (2) cet appareil doit accepter toute interférence, y compris les interférences susceptibles de provoquer un fonctionnement indésirable de l'appareil. Cet appareil a été conçu pour fonctionner avec une variété de gains différents (dBi). La puissance de sortie maximale du lecteur est définie par le gain de l'antenne. L'utilisation d'une antenne ayant un gain plus élevé est strictement interdite par règlement d'Industrie Canada. En outre, l'utilisation du lecteur à une puissance supérieure à la puissance de sortie maximale pour une antenne donnée est également strictement interdite. L'impédance d'antenne requise est de 50 ohms. Afin de réduire les interférences radio potentielles avec d'autres utilisateurs, le type d'antenne et son gain devraient être choisis de manière à ce que la puissance éloignée isotropiquement (EIRP) équivalente soit supérieure à celle requise pour une communication réussie.

Safety Recommendations

Reader antennas should be positioned so that personnel in the area for prolonged periods may safely remain at least 31 cm (12.2 in) in an uncontrolled environment from the antenna’s surface. See FCC OET Bulletin 56 “Hazards of radio frequency and electromagnetic fields” and Bulletin 65 “Human exposure to radio frequency electromagnetic fields.”

Sicherheitsempfehlungen

Reader Antennen sollten so positioniert werden, dass das Personal im Bereich über einen längeren Zeitraum kann sicher bleiben mindestens 31 cm (12.2 Zoll) entfernt von der Antenne Oberfläche, in einer unkontrollierten Umgebung. Siehe FCC OET Bulletin 56 "Gefahren der Radiofrequenz und elektromagnetische Felder" und Bulletin 65 "Human Exposition gegenüber hochfrequenten elektromagnetischen Feldern."

Revision History

Version	Author	Date	Changes
1.1	N. Mitchell	August 2019	Initial Released Document
1.2	N. Mitchell	November 2021	Updated Copyright

What is polarization?

This describes the plane (the up and down movement) the electromagnetic waves leave the antenna.

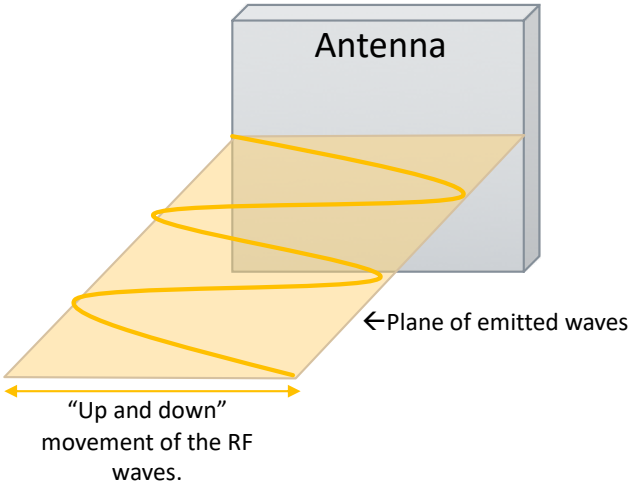

Figure 1 - Simple Antenna Linear Polarization

Why do I care?

RFID tags have orientations they work well in, some orientations less so and two they really don't read at all (small end on). See the next page.

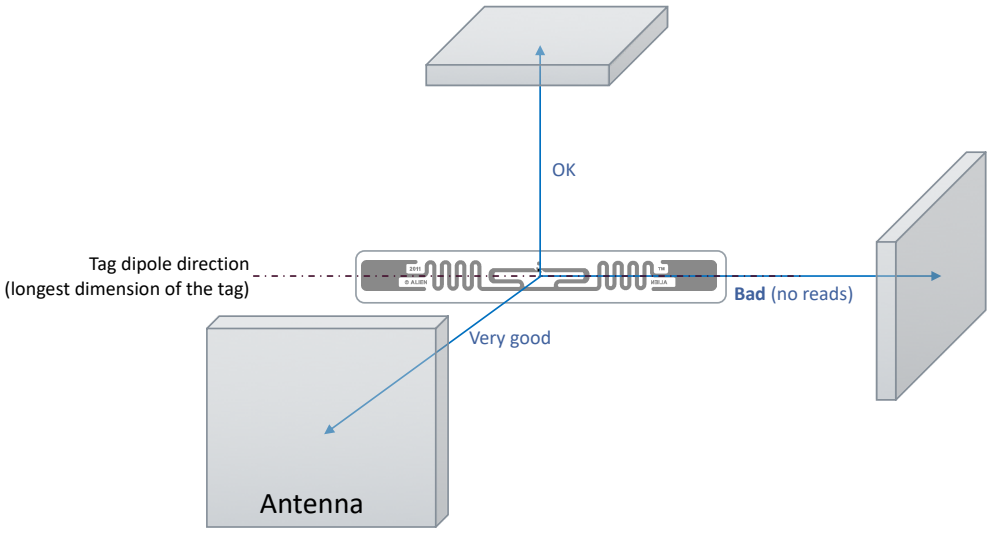

Figure 2 - RFID Tags Have Orientation Too

Ideally, we want the plane of the tag to be parallel to the plane of the antenna and aligned between the angle of the dipole of the tag and the pane of the antenna's polarization.

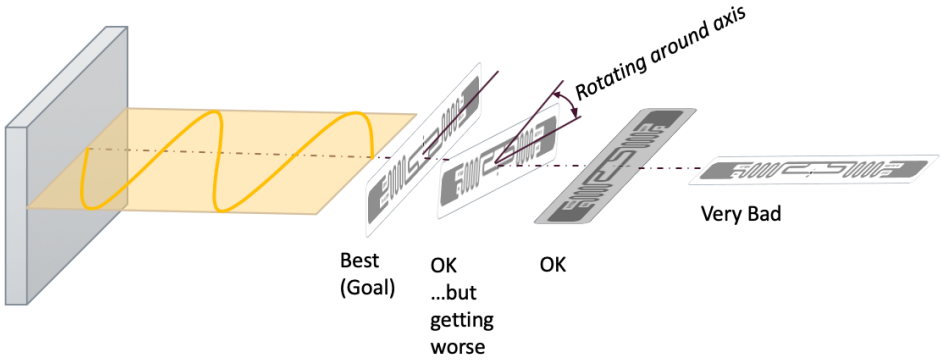

Figure 3 - Tag Orientation with Respect to a Linear Antenna

What are the key types of polarization?

There are linear and circular polarized antenna.

Linear antenna

Linear are the most simple and seen above. The up and down motion of the plane does not change over time. The direction of the linear plane needs to be matched to the dipole direction of the tags being read by the antenna (for example, may require the antenna mounting rotated 90°).

Linear antenna work well only when the orientation of the antenna with respect to the tags being read can be guaranteed. When this is the case, this antenna is ideal as it ensures the best-read performance.

Linear antennas must be mounted at the appropriate rotation to align with the tags passing them. However, if the tag orientation is not known or not always in the same orientation, we need another antenna type. This is actually the most common case.

Another way of looking at a linear waveform:

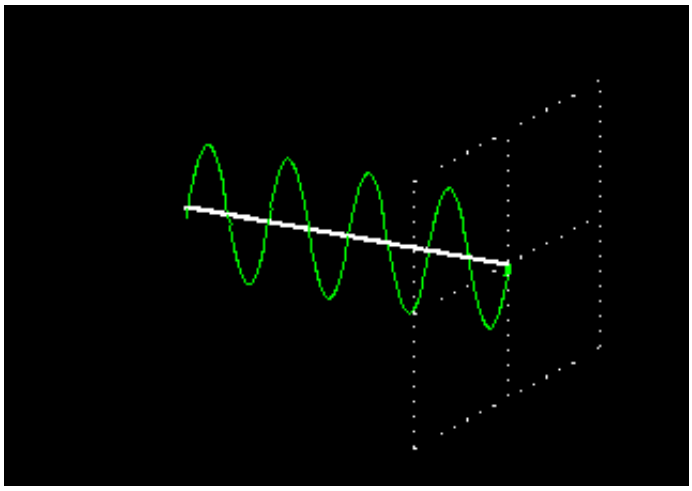

Figure 4 - Linear (vertical shown) Polarization

Circular polarization?

A circular polarized antenna rotates the plane of the RF waves coming out of the antenna over time. This ensures a tag rotating in the same plane will now easily be visible. See below.

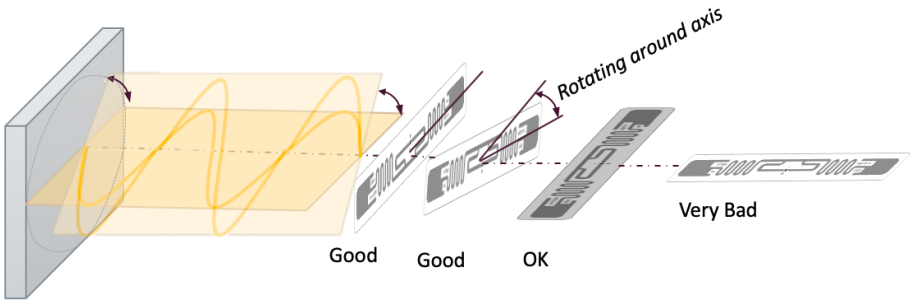

Figure 5 - Tag Orientation with Respect to a Circular Antenna

You can think of the radiation pattern being stirred uniformly in one direction:

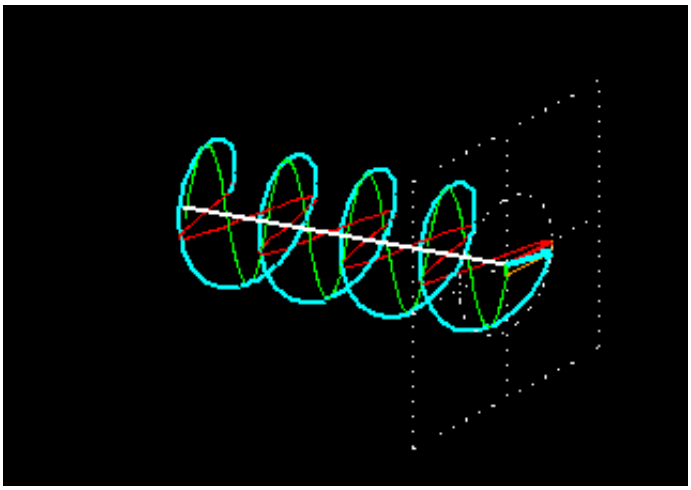

Figure 6 - Circular (right-hand shown) Polarization

This is the best solution when tags are in random or unknown orientations.

Linear vs Circular

Why not always use circular? The production of the circular pattern requires two linear RF patterns to be combined (inside the antenna). The circular motion is the result of the interaction between these two linear fields each splitting the available power. So, a circular antenna delivers 3dB less or ½ the power to any one place than a linear. The majority of the time this trade-off is fine unless you can be absolutely certain of the tag orientation in your application.

Circular Antenna Types

Yep…there are two type of circular antenna. Left Hand and Right Hand Circular Polarization (analogous to anticlockwise and clockwise, respectively). LHCP is used to denote Left Hand Circular Polarization and RHCP for right-hand.

Why do you care about Left- or Right-Hand Polarization?

Normally you don't, unless you have two antenna facing each other and active at the same time. In this case (e.g. portals), two circular antenna of the same polarization direction would interfere with other and may reduce the chances of reading a tag. It is therefore desirable to have the opposing antenna have different circular polarizations. So, a LHCP would be positioned opposite a RHCP antenna.

If your application does not require different polarized antenna, you can use either LHCP or RHCP (the default is usually RHCP but LHCP would be fine too).

SensRF-101

This antenna is a high-performance circular antenna which is environmentally resilient (IP67) and can be used indoors or outdoors. Its polycarbonate radome is stronger than many competitors ABS plastic radomes and has been designed for highly efficient manufacturing leading to an industry leading price positioning. It was first introduced as a RHCP antenna but now also available as a LHCP variant.

Information on the SensRF-101 can be found here: https://www.sensthys.com/sensrf-101/

Model (All models 865-928 MHz)	**Circular Polarizarion Type**	**Mounting Option**	**Part Number**
SensRF-101 Flush Mount	Right-Hand (RHCP) (if in doubt, RHCP is good for most applications)	Flush/Flat with through hole	**A0101-RWF**
SensRF-101 VESA Mount		Studded 100mm VESA	**A0101-RWV**
SensRF-101 Flush Mount	Left-Hand (LHCP)	Flush/Flat with through hole	**A0101-LWF**
SensRF-101 VESA Mount		Studded 100mm VESA	**A0101-LWV**

ORDERING INFORMATION - Order at https://www.sensthys.com/shop/