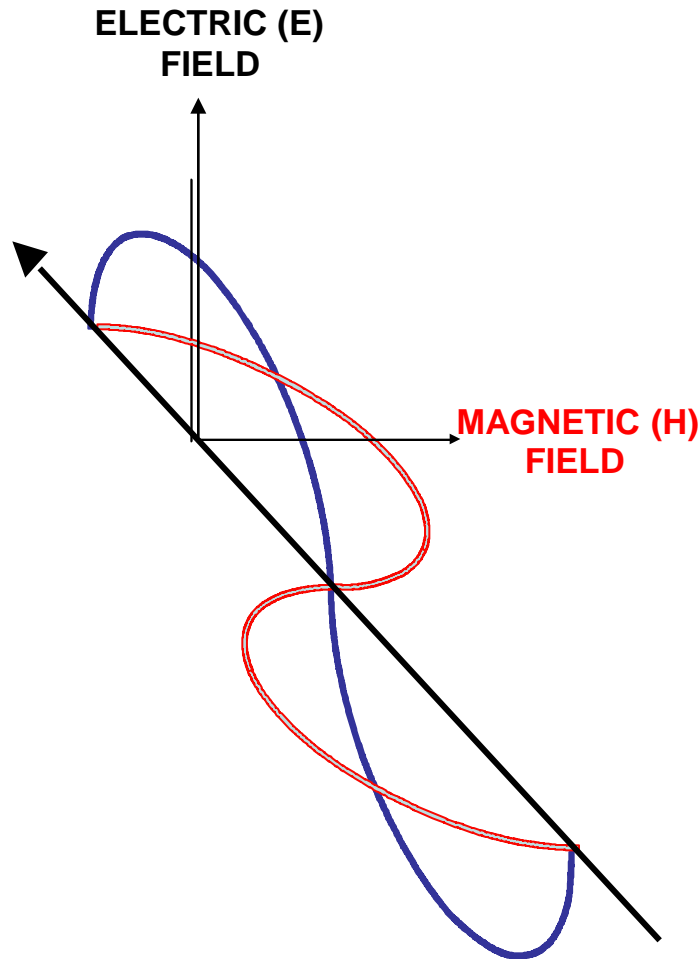


Technology Selection RFID

LF/HF/UHF



Quick Physics Lesson (Reminder)

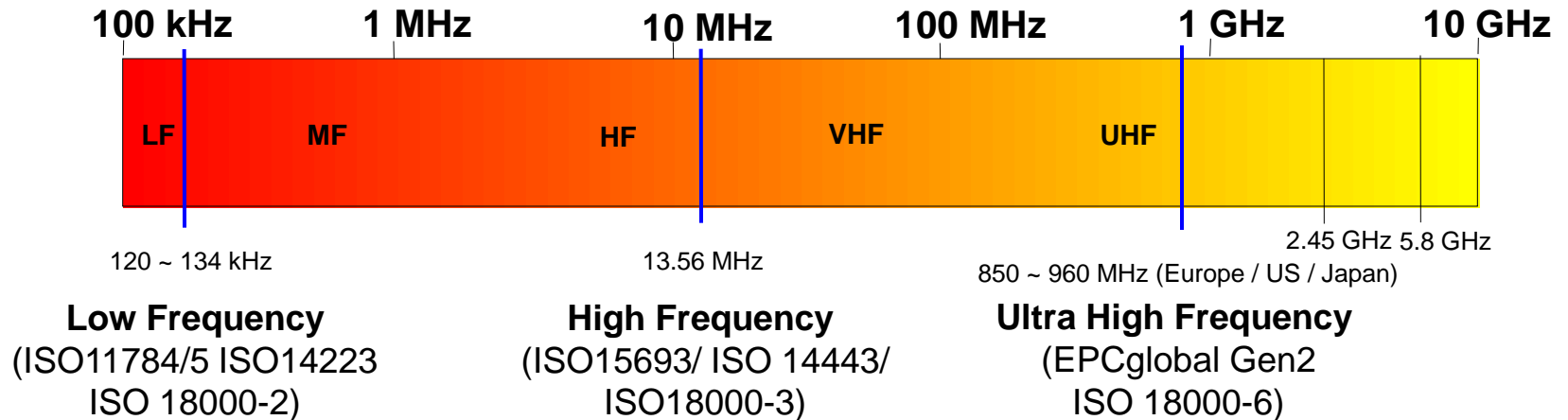


- Radio signals are electromagnetic waves, having a magnetic component (H-Field) and an electric component (E-Field)
- LF & HF systems use the **Magnetic field only** to transfer power and information by induction and coil antennas
 - Strength of this field falls off quickly
 - Liquids have less of an effect on H-Field
- UHF systems use the **Electromagnetic field** to transfer power and information by capacitive coupling with dipole antennas
 - Strength of this field doesn't fall off as quickly which provides for a potentially longer read distances
 - Liquids absorb this field and reduce performance
 - Metals either shield signals or detune the tags
 - ◆ Special metal mount tags are typically required

Frequency of Operation

RFID tags exhibit different characteristics at different frequencies:

RADIO FREQUENCY SPECTRUM



Low Frequency < 135 kHz

ADVANTAGES

Relative freedom from regulatory limitations

Best performance because of the high max. regulatory field strength level (1.3m, button tag)

Freedom to design different tag antenna form factors (compared to HF and UHF) gives best performance with small tag designs

Penetrates materials well e.g. water, tissue, wood, body

Excellent non-line-of-sight communications

Very well defined read zone

No limitation using ferrite antenna for improved performance

Simple and low cost readers and antennae

DISADVANTAGES

Does not penetrate or transmit around metals e.g. iron, steel

Slow read speeds: Can only read ~ 20 tags per second (4k Bit/second)
Relatively large reader antennae

Inlay construction

- Is thicker than 13.56MHz and 900MHz
- Inlay may be more expensive i.e. application dependent
- Requires wire antenna, typically > 100 turns

High Frequency 13.56 MHz

ADVANTAGES

Simpler antenna design and lower manufacturing cost for paper label inlay (typical design: IC glued to etched antenna on plastic foil)

Higher data rates: Can read up to 50 tags/second

Good non-line-of-sight communication

Controlled read zone

Thinner tag construction i.e. foil antenna

Penetrates wood/tissue

DISADVANTAGES

Does not penetrate or transmit around metals

Medium read range (50cm, button tag)

For same read range compared to LF, bigger tag size is required

Constraints in designing different antenna form factors for readers and tags (low performance for small sized antennae)

Limitations on use of ferrite antennae e.g. higher cost

For animal applications, a more rigid construction is needed compared to usual plastic foil inlays to withstand the very tough environmental condition. This will increase the cost of the final Tag.

Ultra High Frequency 868 - 956 MHz

ADVANTAGES

High data rate: Can read up to 1500 tags per second (dependent on regional regulations)

Thinner tag construction i.e. foil antenna

Lower manufacture cost for inlay only (secondary packaging of inlay most likely required for livestock tag)

Large read range with line-of-sight communication (up to 8 meters)

Penetrates wood

DISADVANTAGES

Does not penetrate or transmit around metals
The performance is badly affected by tissue, water absorption
= Not suitable for implants and Bolus

Sensitive to nearly any material around
Reflexions may disturb the application

Different performance worldwide due to local regulations

Complex readers and antennas and set up required for gate applications

For animal applications, a more rigid construction is needed compared to usual plastic foil inlays to withstand the very tough environmental condition. This will increase the cost of the final Tag

For same performance compared to LF, larger tag size is required (<1m, button tag)

Frequency Selection

Parameter		Capability of Frequency Options		
		< 135 kHz	13.56 MHz	2.45 GHz/UHF
Cost	<i>Transponder Chip Antenna Reader</i>	<i>medium/low medium medium low</i>	<i>low lowest lowest medium</i>	<i>medium/low lowest lowest high</i>
Range	<i>Passive</i>	<i>high</i>	<i>medium</i>	<i>medium / high</i>
Form Factor flexibility		<i>high</i>	<i>low</i>	<i>medium</i>
Data Rate	<i>Down-Link (Reader to Transp.) UP-Link (Transp. to reader)</i>	<i>low low</i>	<i>medium medium</i>	<i>high high</i>
Cost of Reader /Antennas		<i>low</i>	<i>medium</i>	<i>high</i>
Complexity (set up)		<i>low</i>	<i>medium</i>	<i>high</i>
Environment / Noise (EMI / Broadband Discrete - in Band)		<i>Medium</i>	<i>Low</i>	<i>Medium</i>
Environment,	<i>- Tissue/Human Body - Metal</i>	<i>NO absorption controllable</i>	<i>Lim. absorption controllable</i>	<i>Strong absorption reflection</i>