

UHF Tag Performance Survey



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The UHF Tag Performance Survey

- The UTPS is a global usability performance report of UHF RFID-tags
- The UTPS is covering most of the important tags on the market
- The report contains several tests for different characteristics
- The tests include measurements between 800-1000 MHz – all global UHF Gen2 bands of interest are covered
- First release is available now



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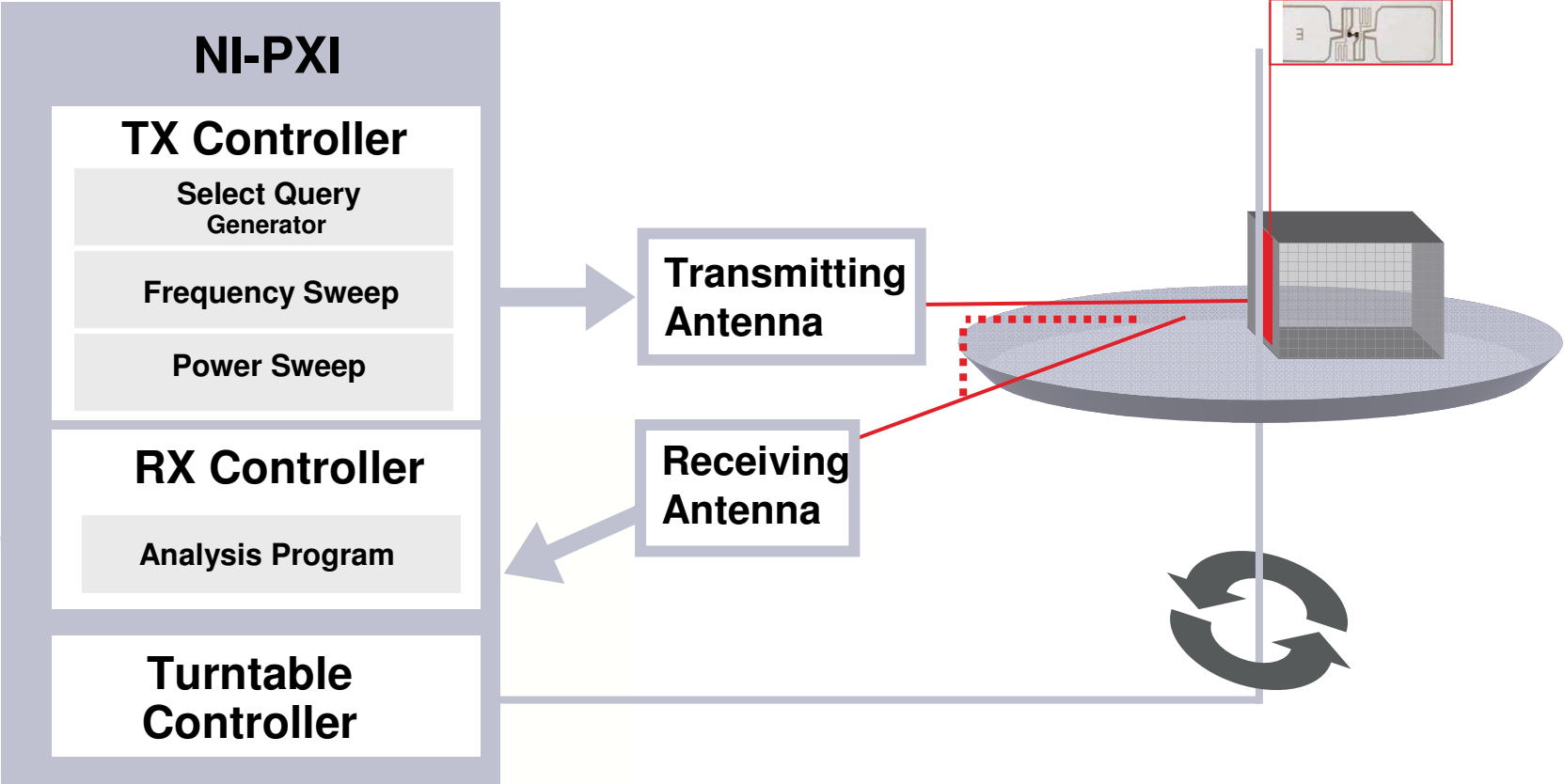
Why do companies need an UHF Tag Performance Survey?

- Quick Overview of commercially available transponders
- The UTPS results in a variety of suitable transponders for a special application
- Estimation of the achievable read range, the customer don't get unwanted surprises
- Base information for a cost-benefit analysis
- The UTPS is faster, cheaper and more reliable than self-made performance tests

The following tags were measured

Alien Squiggle (Monza)	Omron Wave
Alien Squiggle Higgs	RSI 633 Spyder
Avery Dennison 222	RSI Thin Propeller
Avery Dennison 421	Symbol 4x4 (Double T)
Avery Dennison 612	UPM Dogbone
Avery Dennison 821	UPM Dogbone Monza 2
CheckPoint Smiley	UPM Frog
KSW Excalibur	UPM Short Dipole II
KSW Templar	UPM Short Dipole Monza 2
Omron Loop	UPM Web

Standard Measurement Setup



Standard Measurement Setup



View inside of the anechoic chamber

RX antenna

Tag on reference-material

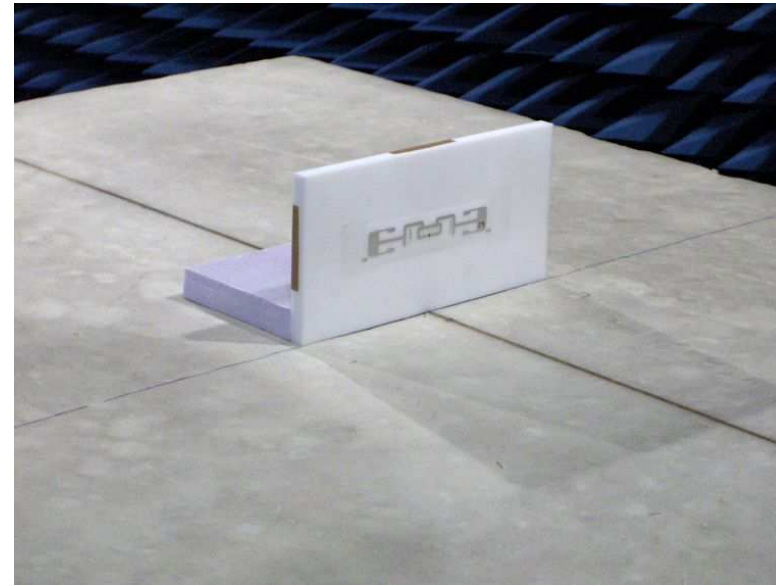
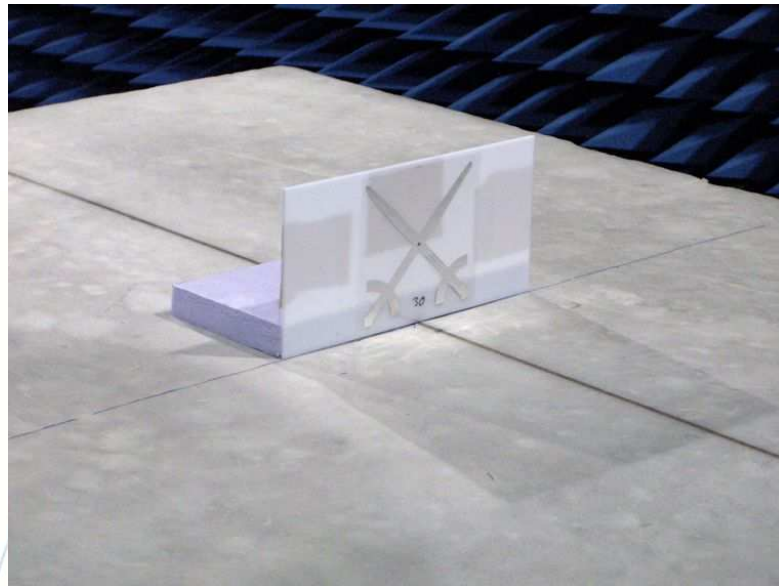
TX antenna

Reference Materials

- ⊙ Free Air
For example: Apparel hanger
- ⊙ Teflon 2 mm
Reproducible substitute for paper or boxes with relatively high air content.
For example: diapers, disposable paper, large detergent boxes.
- ⊙ Teflon 10 mm
Reproducible substitute for different plastic containers.
For example: Beverage cases (if distance case to bottle is > 3cm)
- ⊙ Plastic-bottles (PET) AquaDest with a spacer of 2 mm
Reproducible substitute for different products made of liquid contents
For example: Ketchup, dressings, or milk
- ⊙ Metallic reflector with size of 200 mm * 100 mm, with a spacer of 4 mm
Reproducible substitute for products having metallic surfaces.
For example: Chocolate bars, Tetra-packs, or coffee

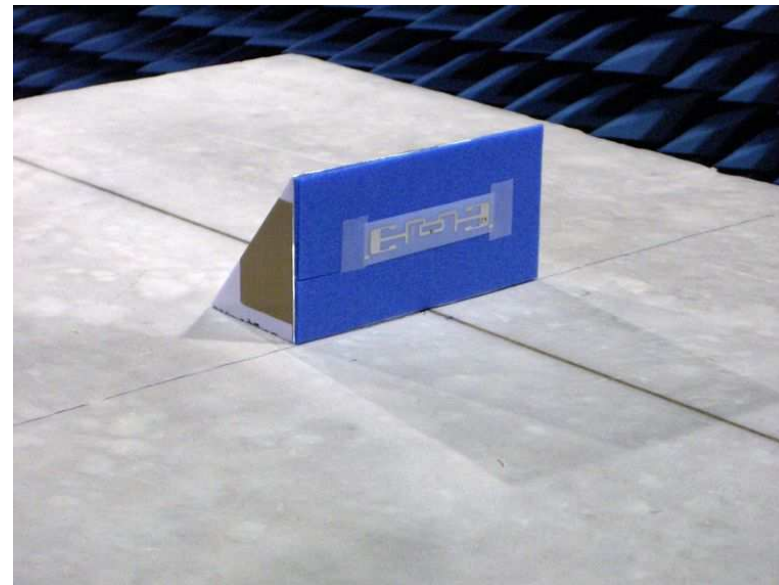
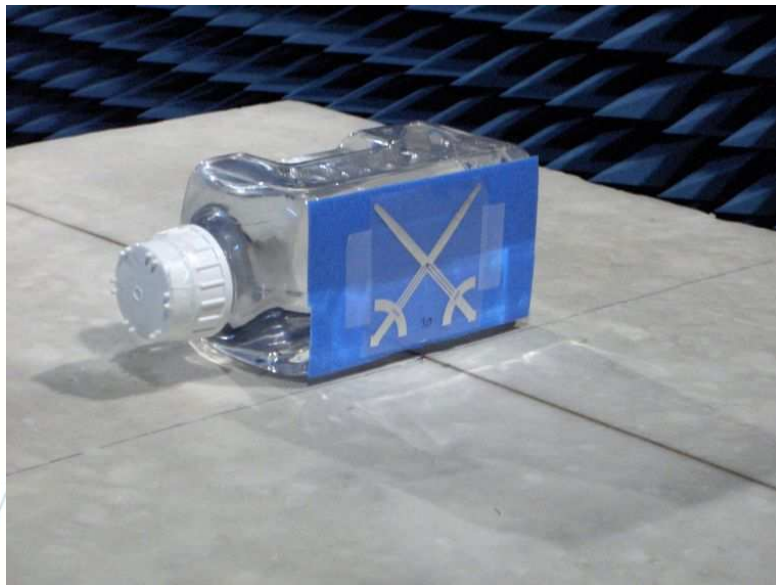
Reference Materials

Two different tags on Teflon 2 mm and Teflon 10 mm



Reference Materials

Two different tags on water with a spacer of 2 mm and metal with a spacer of 4 mm



Comparison between UTPS and existing Tag Benchmark Reports

- ⊙ Measurements follow ISO 18046 Part 3 and EPC TLRPP guidelines
- ⊙ Tag performance is measured without a vendor specific reader implementation
- ⊙ Results comparable with other test-labs
- ⊙ Most reliable test setup is used
- ⊙ Four different chips were included in the measurement
- ⊙ Higher accuracy due to higher resolution in power levels and angles
- ⊙ Representative and reproducible reference products instead of real products

Summary of findings

- ⦿ Dramatic differences between different ICs
- ⦿ Large variances on production consistency
- ⦿ Not all tags are good performing at global operations
- ⦿ Large differences according to orientation sensitivity
- ⦿ Read Range of 10 m and more was measured
- ⦿ Read Range always limited by forward link at typical applications (Backscatter Range > forward link range)

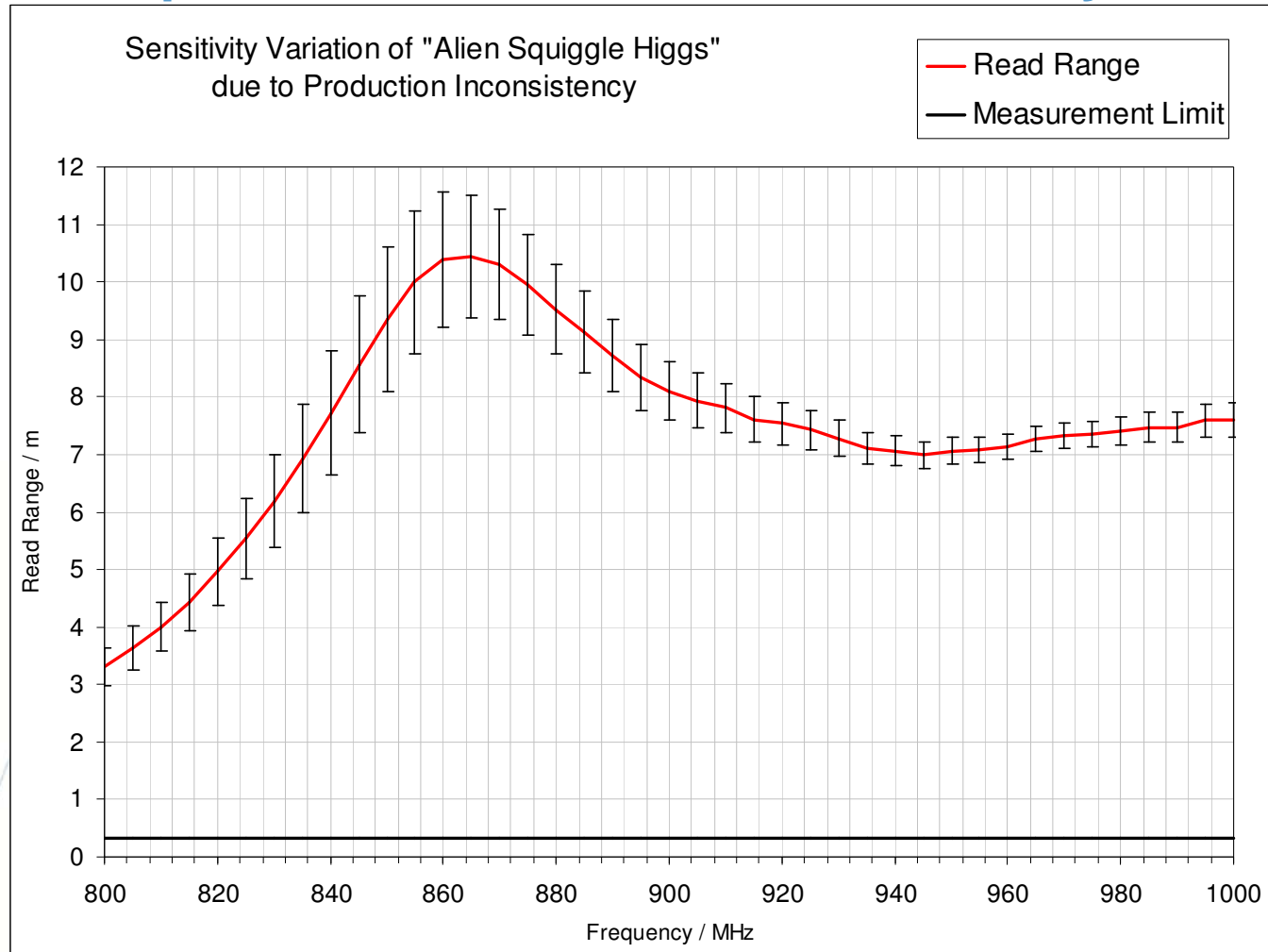
Four tests have been carried out

- ⊙ Production consistency
- ⊙ Orientation dependent sensitivity and read range
- ⊙ Frequency dependent sensitivity and read range on five reference materials
- ⊙ Backscatter Range on five reference materials

Production Consistency

Objective	Analyze the production quality and reliability of tags
End User relevance	Reliable performance is mandatory for most applications
Measurement	Frequency sweep on 30 randomly selected tags Standard deviation is included in an average graph
Benchmark	Read range and standard deviation for EU, US and JPN frequencies

Example Results Production Consistency



866 MHz / 2 Werp	
Read Range	Standard Dev.
10,42	1,04

910 MHz / 4 Weirp	
Read Range	Standard Dev.
8,63	0,47

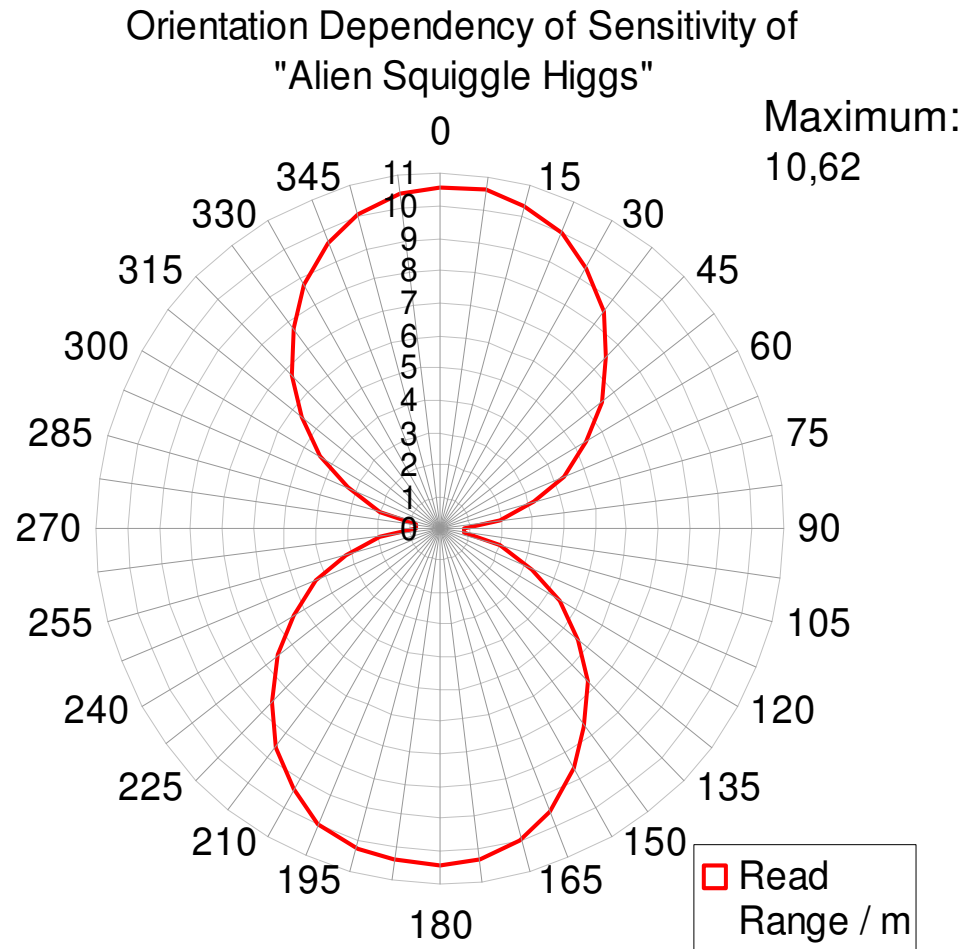
922MHz / 4 Weirp	
Read Range	Standard Dev.
8,28	0,39

953 MHz / 4 Weirp	
Read Range	Standard Dev.
7,81	0,25

Orientation Dependent Sensitivity and Read Range

Objective	Evaluation of orientation dependent Read Range
End User relevance	Normally end users can not predict the tag orientation inside the interrogation zone
Measurement	Orientation sweep on one tag with typical behavior
Benchmark	No benchmark table or graph

Example Results

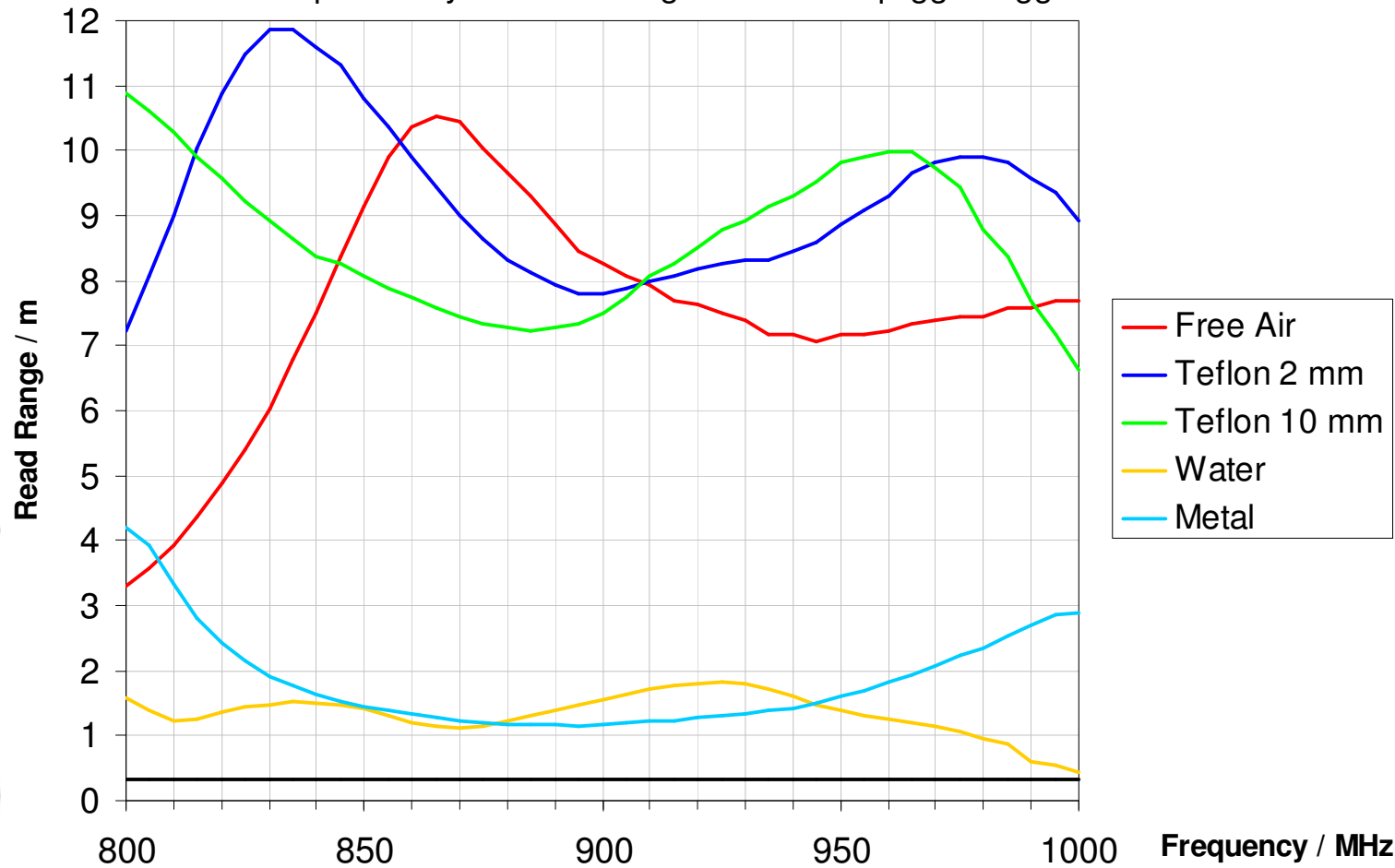


Frequency Dependent Sensitivity and Read Range

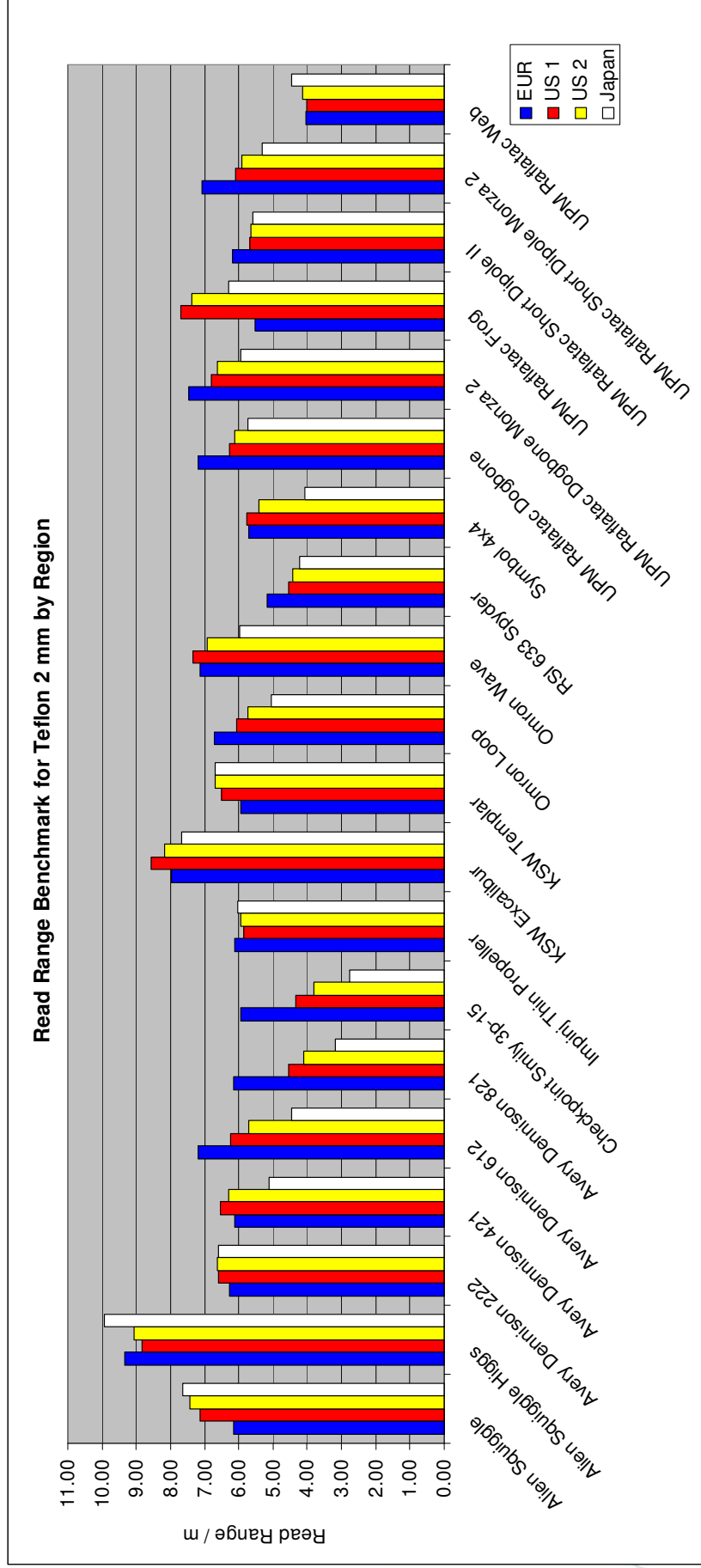
Objective	Evaluate the read range dependency on different frequencies and different products
End User relevance	Read Range is the key performance parameter for tag selection and may vary in different applications
Measurement	Frequency sweep of a typical tag on five different materials
Benchmark	Best Read Range per reference material on frequencies of interest

Example Results

Material Dependency of Read Range of "Alien Squiggle Higgs"



Example Results, ReadRange benchmark



Backscatter Range

Objective	Verify that the Read Range is limited by the forward link
End User relevance	In some applications the Backscatter Range can be lower than the measured forward Read Range
Measurement	Frequency sweep of a typical tag on five different materials, measuring the received power
Benchmark	No benchmark table or graph

Example Results



Backscatter Range of "Alien Squiggle Higgs"
at -70 dBm, 4 dBi Antenna Gain

