Device

Highly Efficient and Compact Leaky Wave Antenna Using Non-Reciprocal Metamaterials

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Non-reciprocal Metamaterial Technology :

A new concept that combines the non-reciprocal circuit with different transmission characteristics by the propagation direction and the metamaterial technology.

1. Utilization of Non-Reciprocal Metamaterial Technology to Antennas

Non-reciprocal CRLHTL(*)

Backward Wave   **Forward Wave**

LH → **Flow of Electric Power** ← RH

Non-reciprocal CRLHTL

Flow of Phase

(*)Composite Right/Left Handed Transmission Lines

Forward: Positive refractive index (RH)
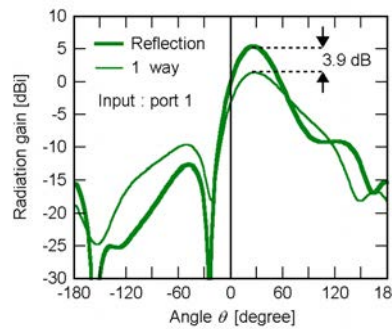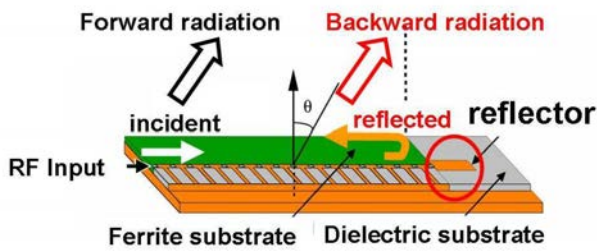Backward: Negative refractive index (LH) → *metamaterial*

Wave vector is the same direction regardless of the direction of transmitted power

→ The new technology applied to antenna

-1 Application to the leaky wave antenna [Non-reciprocal leaky wave antenna]

・It can be reused the radio waves by having reflecting at the end.

→ Radiation efficiency and directivity are improved

Non-reciprocal Leaky Wave Antenna

Improvement of
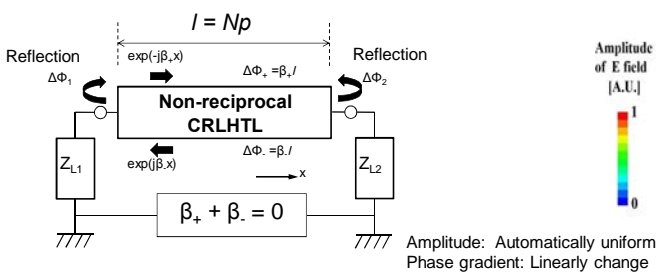 Radiation Efficiency (calculated result)

-2 Application to the travelling-wave resonator and the beam-scan antenna

・The resonance condition is automatically satisfied not depending on the resonator size by connecting reflector on both ends.
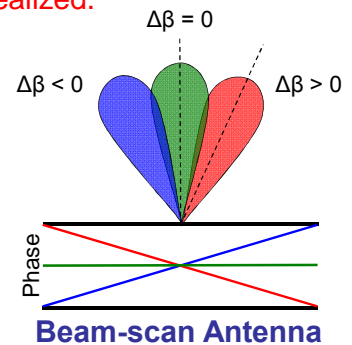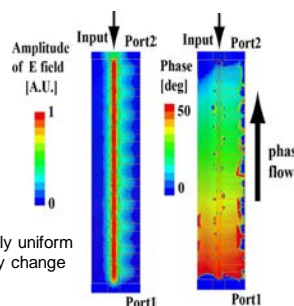
→ Possible to change the size of resonator, keeping fixing the resonance frequency. Reduced size of antenna is possible.

・Phase gradient of the electromagnetic field distribution on the resonator is continuously controllable by an externally applied magnetic field.

→ Small and high radiation efficiency beam-scan antenna is realized.

Pseudo-Traveling-Wave Resonator

Amplitude: Automatically uniform
Phase gradient: Linearly change

Beam-scan Antenna

2. Potential Applications

■ Beam-scanning antennas for microwave and/or millimeter wave radar
■ Beam-scanning antennas for compact wireless communication in which highly-directivity is not required
■ Antennas for wireless power transmission

Patent Licensing Available

Patent : WO2008/111460, WO2011/024575, WO2012/014984, WO2012/115245
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