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CC-D: Claim Chart Comparing claims 1, 12-14, and 30 of the '431 Patent to Misra under 35 U.S.C. § 103

Prior art cited in this chart:

- Misra, Ita *et al.*, "Experimental Investigations on the Impedance and Radiation Properties of a Three-Element Concentric Microstrip Antenna," Microwave and Optical Technology Letters, Vol. 11, No. 2, February 5, 1996 ("Misra")

Claims of the '431 Patent	Disclosure of the Prior Art
Claim 1	
1. A multi-band antenna comprising:	"Experimental investigation on an electromagnetically coupled concentric microstrip square-ring antenna (CMSRA) has been presented. Our previous work on concentric microstrip annular-ring resonators revealed that the impedance and radiation bandwidth can be improved considerably. A three-element CMSRA has been designed and its measured impedance and radiation patterns have been compared with those of a single square-ring antenna having a dimension equal to the largest element of the CMSRA. The effect of change of feed location has also been studied. Results show that the total percent bandwidth (BW) for the concentric microstrip square ring antenna is larger with respect to the single-ring antenna, and this effect is very much prominent at a particular feed location. © 1996 John Wiley & Sons, Inc." **Misra at pg. 66.** "One of the most important aspects of any antenna is its bandwidth. The main drawback of microstrip antennas (MA) is their narrow bandwidth. The bandwidth of an antenna can be increased proportionately either by increasing the substrate thickness or by reducing the dielectric constant [1]. However, the increase in substrate thickness is generally limited by excitation of surface waves, and there are practical limitations in decreasing the value of the dielectric constant. Thus, the BW obtained from conventional MA is not sufficient for many purposes. Another important aspect of MA is a variety of feeding techniques that can be applied to them. Electromagnetic coupling is an attractive one, due to its multilayered structure,

which allows the antenna to be integrated with its feed circuitry [2]. Another reason for electromagnetic coupling is that it has been used in configurations that significantly enhance the BW of a patch antenna [3].

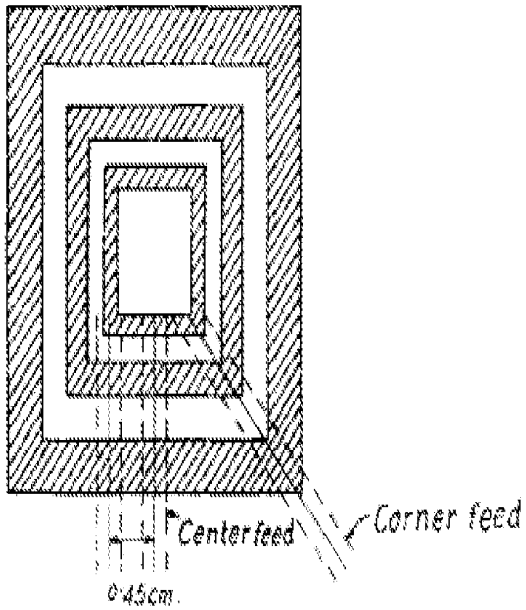
Our previous works on electromagnetically coupled concentric microstrip ring antennas [4, 5] show that these structures give wide bandwidth. The present article deals with a concentric microstrip square-ring antenna (CMSRA) containing three elements. The variation of input impedance at different bands of frequencies have been measured by an HP 8410B network analyzer and compared with those of an electromagnetically coupled microstrip single square-ring antenna."

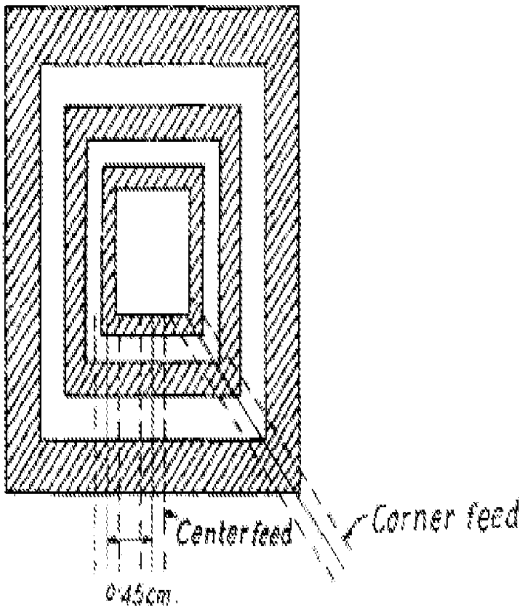
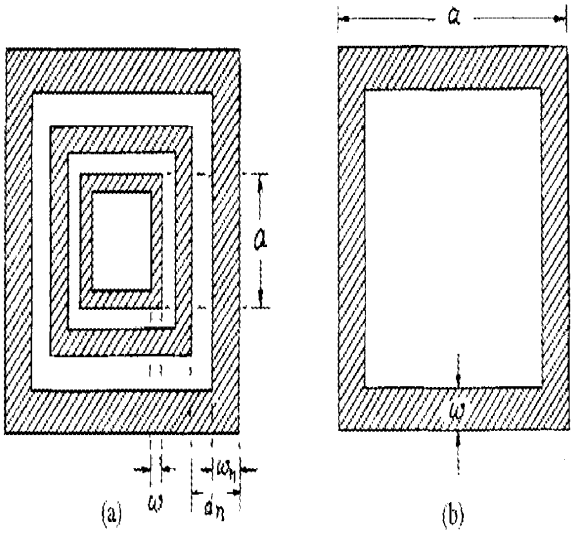
Misra at pgs. 66-67.

TABLE 1 Comparison of Percent BW Between Single Square-Ring and Concentric Square-Ring Antennas

	Single Square Ring		Concentric Square Ring	
Feed location	Frequency range in GHz	% Bandwidth	Frequency range in GHz	% Bandwidth
Center feed	2.7 – 2.74 = 0.04	1.47	2.655 – 2.685 = 0.03	1.12
			5.31 – 5.435 = 0.125	2.32
			6.55 – 6.85 = 0.30	4.47
0.45 cm away from center	2.698 – 2.76 = 0.068	2.49	2.654 – 2.694 = 0.04	1.49
			6.64 – 7.5 = 0.86	12.16
Corner feed	2.638 – 2.692 = 0.054	2.02	2.612 – 2.65 = 0.038	1.44
			2.74 – 2.773 = 0.033	1.19
	2.805 – 2.852 = 0.047	1.66	6.74 – 7.2 = 0.46	6.6
			7.33 – 7.53 = 0.20	2.69

Misra at Table 1.

	 **Misra at FIG 1.**
a conductive radiating element including at least one multilevel structure, said at least one multilevel structure comprising a plurality of electromagnetically coupled geometric elements,	"From the above investigations it may be said that the concentric microstrip square-ring antenna has a multiple band effect with increase in total percent bandwidth with respect to the single square ring having the largest physical dimension of the CMSRA." **Misra at pg. 68.** "The three-element CMSRA is shown in Figure 2(a). We have first chosen the innermost square-ring antenna with side a = 1.0 cm and width w = 0.2 cm." **Misra at pg. 68.**

	 Misra at FIG 1.  **Figure 2** (a) Three-element concentric microstrip square-ring antenna (b) single square-ring antenna Misra at FIG 2.
said plurality of geometric elements including at least two portions, a first portion being associated with a first selected frequency band	"From the above investigations it may be said that the concentric microstrip square-ring antenna has a multiple band effect with increase in total percent bandwidth with respect to the single square ring having the largest physical dimension of the

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