Review Paper on Broadband Antenna Design Techniques for Wireless Application System

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Abstract— **In this paper presented review about the broadband antenna design. The broad band antenna has been using since many past decades. The broad band antenna would be design by many numbers of techniques like shorting pin and shorting post, slotting technique, by using different shape of patch and ground plane, using via hole technique, the broad band antenna has been using simultaneously in multiband application. The broad band antenna has been using in many application like GSM, WLAN, GPS, Blutooth, Wi-Max and Satellite & radar application. In this paper discussed history of broad band antenna and discussed about the work of past decades and future aspects**

I. Brief Historical Review

The microstrip antenna was inventive by Des-champs in 1953 [3] and later in 1955, Gutton and Baissinot patented in France [1-2], the first practical antenna took 20 years to come up. In the early of 1970's, Howell and Munson developed the first most practical microstrip antenna and this set the platform for the research. A researchers meeting held in 1979 in Las Cruces, Mexico marked the beginning of an international interest in microstrip antennas with the extensive research and development on microstrip antennas and arrays, many advantages like light weight, and multiple feeding were fully discussed and used in many applications.

II. REVIEW DIFFERENT TECHNIQUES

A. Slotted technique:

The strip types of antennas have been versatile used in the microstrip antenna designing. For given impedance matching in a strip the slotting technique has been used. The slotting technique would be done in form of U-Slot, L-Slot and square slot etc.

B. Shorting pin & Shorting post:

The modern technology is versatile demanding the compact broad band antenna for various applications
like WLAN, Bluetooth, Mobile communication, GSM and GPS, All such application could be need compactness, for providing the compactness shorting pin and shorting post technique could be suggested. In this technique used shorting pin and post at the corner of antenna geometry.

C. Via hole technique:

The theory of antenna, via hole connections are an integral part of the process. The holes are punched in each green ceramic sheet and subsequently filled with a metal paste consisting of tungsten or molybdenum, which makes interconnections from layer to layer. Computer-controlled step and repeat equipment is used to punch holes with high precision. The minimum diameter used is about 6 mils. In multilayer MMICs and digital ICs, the interconnection between different level metals is made by using via holes in the separating dielectric layer or a via hole ground is an opening in the dielectric substrate made either by dry or wet etching or punching techniques or by using laser drilling. In thin-film technology whereas in LTCC multilayer ceramic technology, numeric precision controlled punching is used, via hole walls are then metalized to make a connection between the top and bottom sides, MMICs, the ground connection for active devices and passive components operating above L-band frequencies is traditionally achieved by backside via hole technology, they provide low-inductance grounding for transistors, diodes, capacitors, resistors, inductors, and transmission lines, provide great flexibility in the physical layout of the circuit otherwise, all of the circuit elements that need RF grounding have to be placed near the edge of the circuit or use open-circuited radial line stubs to realize effective RF grounds, the former approach adds uncertainty in the inductance value in addition to extra processing steps, whereas the latter approach requires more space and makes the circuit size larger. However, at millimeter-wave frequencies the latter technique is quite effective.

- In MMICs, via holes are etched through the backside of the substrate. Via Hole etching is usually performed by using dry etching employing reactive gases. This technique is also known as plasma etching and is a well-controlled process leading to vertical sidewalls and excellent yield, via hole walls are then metalized using thick gold, which also completely fills the backside, making good connections with the via pads located on the front side of the locations of via holes, thus, gold-filled via holes make good low-resistance and low-inductance connections between the front side pads and the backside wherever RF or dc grounding is desired.
- Via holes require additional backside processing steps, including wafer thinning, via etching, and metallization, that increase fabrication time and wafer cost. Also backside processing lowers the yield because now one has to remount wafers with the front side, which has most of the circuitry, down, because most of the present wireless applications are below 3 GHz, where bond wire parasitic effects are

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not significant, almost all MIMC for such applications are produced without via hole technology, in order to compete with hybrid and printed circuit technologies. Salient features of via hole grounds can be summarized as follows:

a. Low-inductance grounds: Low-inductance grounds result in good RF ground returns. an inductance in the source lead manifests itself as a resistive loss in the gate circuit and, hence, results in a reduction in power gain, low-inductance grounds improve significantly the device performance at millimeter-wave frequencies, via hole connections also provide good short circuits for microwave passive circuits.

b. Excellent thermal paths: Excellent thermal connections and improve their reliability, which results in low-noise performance due to low thermal resistance, thus via holes play an important role in low-noise.

Compatible with MIC technology: Although via holes require two more level of processing steps the processing is compatible with MIC technology, other methods of grounding, namely, wrap-around, sheet grounding, transformers, and so on, consume a large portion of the available area, via holes require minimal substrate area resulting in much better real estate utilization.

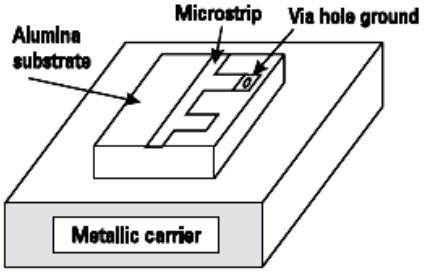

Fig 1 Ground connection techniques in MICs: via hole

a) Via Hole Models

Several different techniques have been applied to develop via hole models, these include analytical methods, full-wave analysis and *S*-parameter measurement based models, analytical models have limited accuracy quasi-static models are valid for dimensions much smaller than the operating wavelengths, full wave techniques provide accurate results but require long computational times and measurement-based models are valid for only those geometries used in the characterization, these methods are briefly discussed in this section

b) Meta material technique :

The meta-material is an artificial material and it has used for reconfigure the radiation property of antenna, reconfigure the permeability, permittivity and intrinsic impedance of antenna. The meta-material is more demanded in modern technology, large number of antennas are preparing by metamertial

Review of broadband antenna concludes that compact broadband antenna is versatile used in modern applications such as radars, Satellite communication system, ultra-wideband application, and GSM etc, compactness and broadband techniques of antennas have been reviewed from origin and discuss development and come across different technologies are used for implementing the designing. Table-1 shows different technology used in past decades such as appropriate patch shape, appropriate ground shape, meander's technique, thick and thin substrate, shorting pins technique, Inverted shape patch, folded shape, shorting pin, inverted U-shaped or folded patch, stack patch, many number of impedance matching network .

III. RESEARCH GAP

The technology demand day by day, but research not fulfill this requirement and exists research gap in many aspects like multi-notches antenna design, antenna versatile used in recent wireless communication due to compactness and Broadband characteristics, it also provides dual band and multi band.

IV. PROBLEM STATEMENT

From review of all technique, concluded that more modification and enhancement required in compactness, broadness, gain, efficiency, so further discussion and invention will be require for portable and handheld devices like laptop, mobiles, etc, in professional and industrial application, recent years communication systems require smaller antenna size in order to meet the compactness requirements for mobile system.

The reviews of some previous technique have given table-1, in this table given technique has been using for broadband since past decades.

V. MOTIVATION

- Multi-notch antenna is strongly needed to operate at specified frequencies of application.
- In survey geometry design is found by thick substrate, thin substrate or combination of both, by controlling the characteristic of ground plane as per as theory, ground plane is effective role to generate impedance matching of design antenna and controlling reflection of geometry.

Table 1 Reviewed of Techniques

Used techniques	Bandwidth	Gain	Compactness
Optimum Patch shape	≤10%	≤ 6dBi	≤5%
Optmum Ground shape	≤20%	≤ 7.5dBi	≤10%
Meander's Slotting Ground plane technique	≤ 40%	≤ 9dBi	≤20%
Using Thick substrate	≤ 30%	≤ 7dBi	≤10%
Using Thin substrate	≤ 35	≤ 9dBi	≤25%
Shorting pins & Shorting Post technique	≤ 60%	≤ 9dBi	≤60%
Slotting technique	≤ 60%	≤ 10dBi	≤55%
Using Metamaterial	≤ 80%	≤ 10dBi	≤60%

- Work on substrate materials for achieving compactness at specified frequency. The use of a high-permittivity substrate like HTCC, Si, Ceramics etc.
- Recent growing technology, many work and scope is possible in compact broadband so that more motivation to be a part of modern technology in form to provide useful antenna for system.

CONCLUSION

This paper has successfully reviewed the work of past decades and techniques to be used to gives the broad bandwidth. This paper has concluded in past decades broad band techniques were used like shorting pin and shorting post , slotting technique, cut slots in the patch and ground plane and slotting were done by impedance matching, Meta-material and via hole technique also used for gives the broadband width and compactness. In this reviewed concluded that this broadband antenna has been using in modern wireless communication, GSM,Wi-Max, WLAN etc.

REFERENCES

[1] Delaveaud, P. Leveque, and B. Jecko, "New kind of Microstrip Antenna: The monopolar wire-patch antenna," Electron. Lett, vol. 30, no.1, pp. 1–2, 1994.
[2] L. Economou and R. J. Langley, "Patch antenna equivalent to simple monopole," Electron. Lett., vol. 33, no. 9, pp. 727–728, Apr. 1997.
[3] C. Shen, S. A. Long, M. R. Allerding, and M. D. Walton, "Resonant frequency of a circular disk, printed circuit antenna," IEEE Trans. Antennas Propagate., vol. AP-25, no. 4, pp. 595–596, Jul. 1997.
[4] K Ahmed Khidre.et.al, "Wide Band Dual-Beam U-Slot Microstrip Antenna" IEEE Transactions on Antennas and Propagation, Vol. 61, NO.3, March 2013 1415.
[5] U. Chakraborty.et.al, "Compact Dual-Band Microstrip Antenna for IEEE 802.11a WLAN Application" IEEE Antennas And Wireless Propagation Letters, Vol. 13, 2014 407.
[6] Chawanonphithak. et.al, "Compact dual-band I-shaped patch antenna with longitudinal strip on inverted-T ground plane " Information and Communication Technology, Electronic and Electrical Engineering (JICTEE), 2014 4th IEEE, Page(s): 1 – 4.
[7] Kachare,Rupali.et.al, "Compact dual band planar monopole antenna for WLAN/WiMAX " Communications and Signal Processing (ICCSP), 2014 IEEE Conference 2014 , Page(s): 391 - 394 .
[8] R. Collin, "Field theory of guided waves ", 2nd Ed. New York, IEEE PRESS 1991 Publication Year: 1991.
[9] James, J. R., and P. S. Hall, Handbook of Microstrip Antennas, Vol. 1, London: Peter Peregrinus Ltd., 1989. Publication Year: 1989.
[10] Girish Kumar, K.P.Roy, Broadband Microstrip Antenna year 2006.
[11] John D Kraus, Antenna and Wave Propagation Fourth Edition, ISBN NO: 10:0-07-067155-9.
[12] Uniaxial anisotropic substrate effects on the resonance of an equi-triangular Microstrip Patch Antenna. Progress in Electromagnetic Research(PIER) M, Vol.24, pp 45-56, 2012.
[13] Manish Kumar Gupta and Monika Singh "Comparison between metamaterial based circular patch antenna and Microstrip Patch Antenna" International Journal of Engineering Research and Applications(IJERA), Vol.2, Issue 3, pp 574-579, May-June 2012.
[14] Ms. Dipika S. Sagne, Dr. N.K. Choudhry, Mr. Prasanna L. Zade. "Broadband equilateral triangular Microstrip Antenna for wi-max application". International conference on communication systems and network technologies, 2012.
[15] Md. Shaad Mahmud, "Design and performance analysis of a compact and conformal super wide band textile antenna for wearable body area applications" EuCAP 2012.
[16] Singh, I .et.al, "Compact circularly-polarized Microstrip Patch Antenna on Reactive Impedance Substrates" Computers and Devices for Communication (CODEC), 2012 5th IEEE conference publications 2012 , Page(s): 1 – 4.