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Signal Sampling and its Characterization as Electromagnetic Wave During Rain & storm And Dry Weather Between 50Mhz-3.5Ghz .

N. Sinha

(Research Scholar) University Department Of Physics BRA Bihar University, Muzaffarpur-842001 .

Abstract: *Electromagnetic Wave Propagation follows Poynting Vector Theorem . Here we have carried out the Investigation with three axial Co-ordinate System for Electric Field(E), Magnetic Field(H) & Poynting Vector(S) .The investigation on paper is to choose sample of wave between 50 Mhz-3.5 GHz during rain & Storm and in open sky signal. Data had been taken into consideration using field measuring Devices and its comparison has been done to show the its effect during rainstorm .*

Key Word: Electric field (E); Magnetic field(H); Poynting Vector Theorem(H); EM field Measuring Devices.

Introduction: **Signal Sampling During Rainstorm obeys Maxwell Equation using Poynting vector theorem. Signal sample has been chosen in three axial coordinate system for Electric Field Magnetic Field and Propagation Vector . If chosen sample of wave Follows Pointing Vector Theorem the wave has been supposed to be Electromagnetic .** An Electromagnetic Wave is Maxwell Equation in differential form has been studied for its investigation in free space and in dielectrics like water.

Maxwell Electromagnetic Wave in Free Space is defined as:

$$divD = \nabla . D = \rho$$
$$divB = \nabla . B = 0$$
$$curlE = -\frac{\partial B}{\partial t} \qquad \ldots\ldots.(1)$$
$$curlH = J + \frac{\partial D}{\partial t}$$

For Free Space the

$$\rho = 0, \sigma = o, \mu = \mu_o and \varepsilon = \varepsilon_0 .....(2)$$

Therefore Maxwell Equation (1) reduces to,

$$divE = 0$$
$$divH = 0$$
$$curlE = -\mu_o \frac{\partial H}{\partial t} \qquad \ldots\ldots(3)$$
$$and$$
$$curlH = \varepsilon_0 \frac{\partial E}{\partial t}$$

Taking Curl for Curl E in Equation (3) we get,

$$curlcurlE = -\mu_0 \frac{\partial}{\partial}(curlH) \qquad \ldots.(4)$$

Substituting Curl H from Eq (3) We get:

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$$curlcurlE = -\mu_0 \frac{\partial}{\partial t}\left(\varepsilon_0 \frac{\partial E}{\partial t}\right)$$

i.e

$$curlcurlE = -\mu_0 \varepsilon_0 \frac{\partial^2 E}{\partial t^2}$$

Now ,

$$curlcurlE = graddivE - \nabla^2 E$$
$$= -\nabla^2 E....(4)$$

$\because divE = 0$ from Eq(3)

Equation (4) becomes

$$\nabla^2 E - \mu_0 \varepsilon_0 \frac{\partial^2 E}{\partial t^2} = 0....(5)$$

Same way We Can Take Curl Of Eq.3d, We get

$$curlcurlH = \varepsilon_0 \frac{\partial}{\partial t}\left(-\mu_0 \frac{\partial H}{\partial t}\right) = -\mu_0 \varepsilon_0 \frac{\partial^2 H}{\partial t^2}....(6)$$

Using the identity and noting div H=0 from Eq3b, we get

Curl Curl H = $-\nabla^2 H$.

Making this substituting in Equation (6) ,we get

$$\nabla^2 H - \mu_0 \varepsilon_0 \frac{\partial^2 H}{\partial t^2} = 0 \qquad (7)$$

Equation (5) and (7) represents wave equation governing electric and magnetic fields in free space:

It may be noted that these equations may be obtained by using Eq(2) in Eq(5) and Eq(7) are vector equations of identical form ,which means that each of six components of E and H Separately satisfies the same wave equation of the form

$$\nabla^2 \phi - \mu_0 \varepsilon_0 \frac{\partial^2 \phi}{\partial t^2} = 0 \quad .....(8)$$

Where ϕ is a scalar and can stand for one of the components of E and H .It is obvious that (8) Resembles with general wave equation:

$$\nabla^2 \phi = \frac{1}{v^2} \frac{\partial^2 \phi}{\partial t^2}.....(9)$$

Comparing Equation (7) and Equation(9) ,we see that the field E and H are propagated in Free space as wave at speed equal to

$$v = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$$

Substituting the value $\mu_0 = 4\pi \times 10^{-7} wb / A.m$ and $\varepsilon_0 = 8.542 \times 10^{-12} F / m$

We reach $v = 3 \times 10^8 m / s$ =c

Speed of light in vacuum]

The same way we may reach the velocity of electromagnetic wave

As $v = \frac{1}{\sqrt{\mu\varepsilon}} = \frac{1}{\sqrt{\mu_r \mu_0 \varepsilon_r \varepsilon_o}}$ (9)

Solving it $v = \frac{c}{\sqrt{\mu_r \varepsilon_r}}$ This shows that velocity of light in an isotropic dielectric media is less than speed of electromagnetic wave and it obeys pointing vector theorem $E \times H = S$,where E ,is electric field vector ,H is magnetic field vector and S is propagation vector.

Obviously from the above equation (9) it may be reached to the conclusion that when an electromagnetic wave travels in rain & storm it suffers to many dielectric media and conducting media. Conclusively when an electromagnetic wave travels in Rain & Storm its components vector is measured using emf devices and its Electric field(E) , Magnetic field(H) and Propagation vector(S) has been recorded between 50 Mhz-3.5 Ghz during rain & Storm and its characteristics property has been investigated to choose the real sample of electromagnetic wave using pointing vector theorem .

When an electromagnetic wave travels in free space its three component should must be observed to have perpendicular to each other otherwise if any of the components had been observed in different phase from each other ,it may be said to be attenuated or polarized signal. It maybe sinusoidal in one of them by being independent with other component of waves.

In dry weather or before rain it may be found to have its all component in same phase and follows pointing vector theorem . Before rain fall the EM wave has been observed to have 109^0 in phase ,shows the presence of water molecules it encounter on its way. In general weather an electromagnetic wave may be observed to have 90^0 in phase and follows pointing vector theorem .

Here are the data record of an electromagnetic wave between 50Mhz-3.5 Ghz ,where we have recorded electric field(E) ,Magnetic field(H) and Propagation vector(S) and compared the result with power received in the device.

The area of observation of electromagnetic wave in rainstorm had been chosen between 50MHz-3.5GHz the size of raindrop had not been considered for any effect on electromagnetic waves. The electric field strength had been chosen to come into effect within this range .The frequency parameter had not been taken into account for showing any significant change in signal strength.Creteria for study of electromagnetic wave had been chosen using pointing vector theorem ,for the study of electric field(E) , magnetic field(H) and pointing vector(S) to follow its validations using these components of electromagnetic wave .The observation has been done during rain and dry weather and its three components vectors strength variations had been studied using pointing vector theorem .If it has been found to follow the above equation the three components are perpendicular to each that may not be the case during rain and hence these two conditions had been studied to observe its effect time to time .The reason of choosing this range is its wide area of uses in day to day life since its validations in the following area had been widely accepted for the cases to study storm and had been studied using wind profile for weather radar .

The comparative graph between this two cases had been studied and may possibly be seen that during Rains & Storm it does not follows pointing vector equation .The dry weather data had been recorded half an hour before rainfall therefore moisture profile may be noticed by watching the graphical inclination of 109^0 rather than 90^0 as cases may be followed in dry weather conditions. Here we have chosen the purely electromagnetic signal whose characteristic property is that in dry weather condition it should be isotropic in nature i.e. its X, Y and Z component have approximately same value and are mutually perpendicular to each other as defined by pointing vector theorem.

Therefore it should be emphasized to study those signal which is electromagnetic in character during rain & storm .As it has been found that during Rain & Storm its component are sinusoidal and random as well as some time we are not receiving some of them. This changes the character of electromagnetic wave due to which receiving appliances may observe unique and random behavior .

So our purpose it is to select purely electromagnetic wave during rain & storm if any of them receives a characteristics pattern on Poynting Vector Theorem then we compare it with signal without rain & storm .To justify these two cases is not by any mathematical analysis or theoretical study but to see its effect may be compared with its characteristics pattern Using Graphical Study. The range of study with frequency and electric filed strength is as follow.

FREQUENCY(Hz)	E-FIELD STRENGTH (mV/m)
50 MHz .	3.16
100 MHz.	2.46
200 MHz .	2.01
300 MHz.	2.01
300 MHz	1.91
433 MHz	0.55
500 MHz	0.37
600 MHz	2.41
700 Mhz	4.63
800 Mhz	4.21
900 Mhz	4.47
1.0 GHz	1.38
1.2 GHz	3.26
1.6 GHz	1.25
1.8 Ghz	1.87
2.0 Ghz	1.67
2.2 Ghz	1.95
2.45 GHz	1.93
3.0 GHz	**

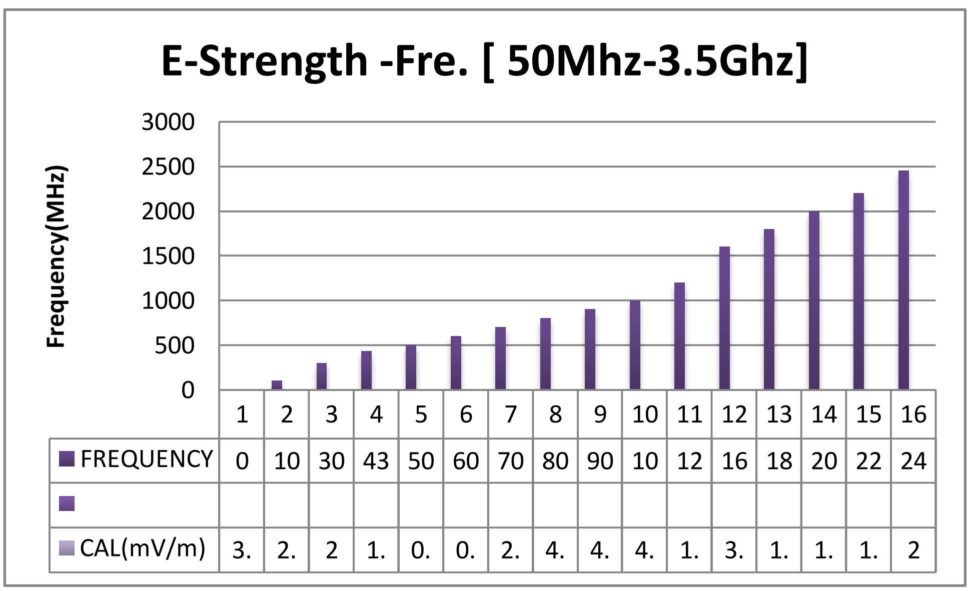

Figure 1: The above plot may be used as reference to study the frequency and the E-field Strength received by the EMF – devices .

The study of signal frequency in dry weather is recorded using an observable data record in this chapter that may follow this frequency range in dry weather condition only .

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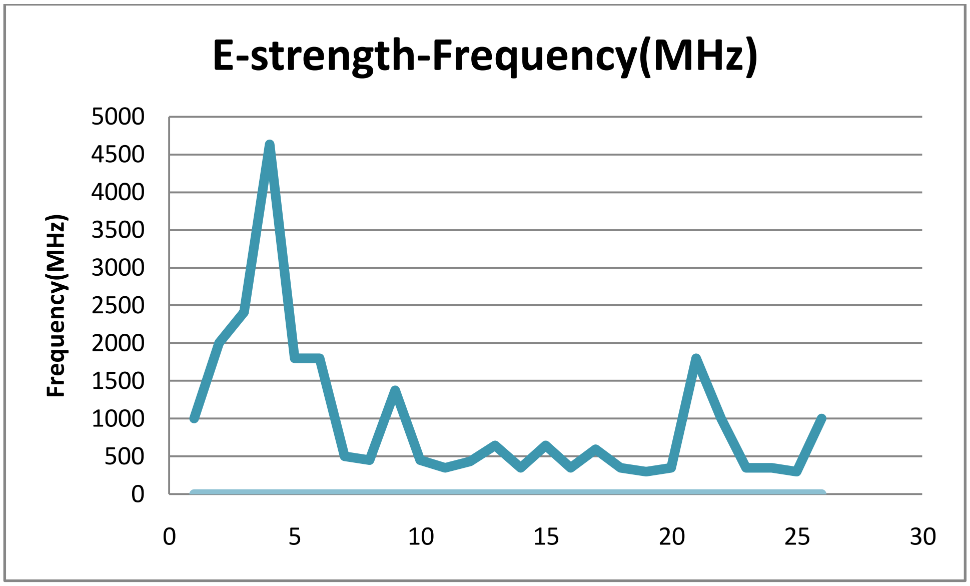

Figure 2: The general characteristics observation of Electric Field Strength Versus Frequency Range in which it may be justified to consider the range of study.

As may be mentioned in this table of E-field pattern may not distinguish between MHz-GHz correctly is not due to E-Strength but it may be the appliance characteristics observation pattern so it is liable to study using pointing vector Theorem to check the signal characteristics during rain & storm and without rain . Further study has been carried out using total electron content in ionosphere that may be best suitable study by observing irregularities of TEC.

Now if may be needed to plot the graph between frequency and electric field strength during rain, it cannot be reported for any purposeful reason and therefore to study theoretically we have used pointing vector theorem to justify the points under consideration.

Data and Methodology : The work has been carried out using EMF devices during rainstorm in open wave signal range between 50Mhz-3.5Ghz. The general study had been carried out for an electromagnetic wave in rain & Storm An Electromagnetic Wave propagation in vacuum is defined by Maxwell equation and may be studied in dielectric and conducting media . So Studies had been carried out in rain & storm where water is dielectric media during thunder also suffers through conducting media .As the recent studies has to be carried out we have to investigate the effect of rain & storm on electromagnetic wave propagation .Therefore it is quite difficult to study using any of the mathematical model or theoretical framework for different range of electromagnetic wave since signal always suffers adverse atmospheric condition from one region to another and is time dependent. So Justification had been made to carry the work using observations received by devices in the applicable range of frequency to develop model or equation as permissible using theoretical study. The reason for chosing this frequency range is to distinguish the wave character may not be possible in the other range affected by bad weather condition or adverse atmospheric conditions . It can be justified under the following range of observation as raindrop size distribution and attenuation calculation which follows minimum interference for study and signal validation in applicable range .Studying Attenuation in different range of frequency shows its validity is maximum in the above mentioned range of study.

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(1) Attenuation Due To Rain & Storm in the month of June 2012 at different wavelength (10 , 5, 3.2cm) .

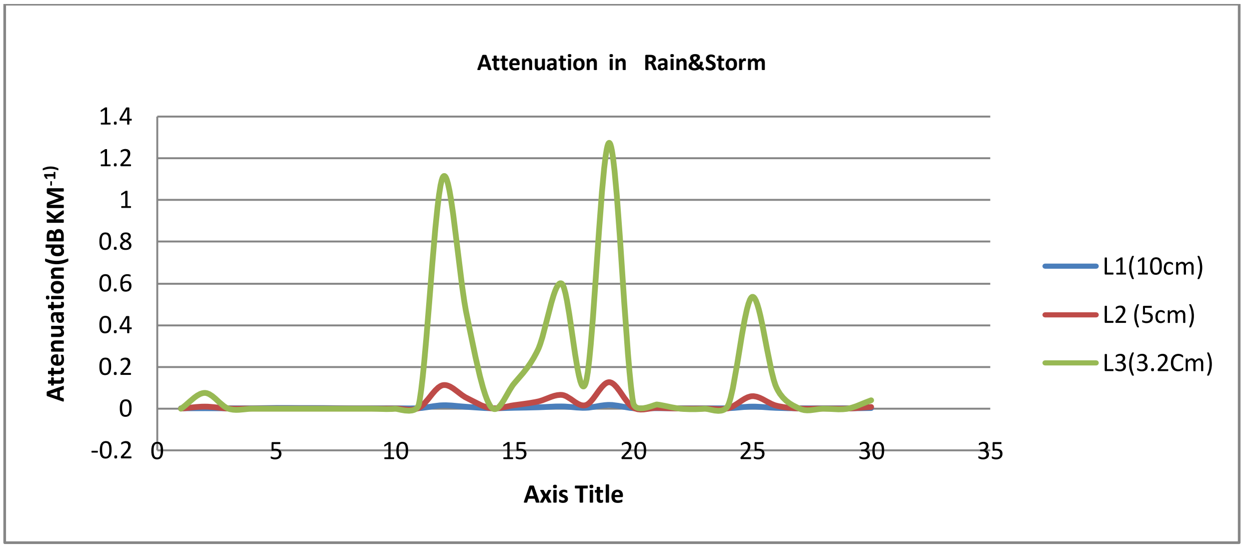

Fig (a): Shows attenuation in Rain & Storm by Signal Wavelength 3.2 cm is reporting maximum and least by 10cm (S-Band Radar) recorded directly by RF Rate .

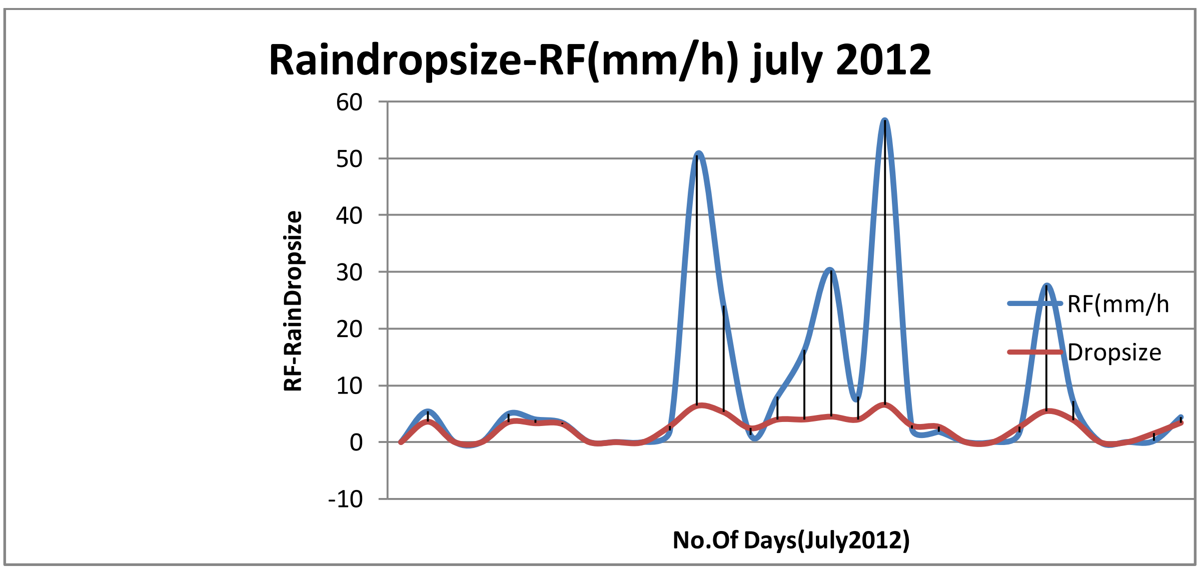

Figure 2. Dropsize Distribution using RF chart had been studied maximum of 5 mm with heavy Rainfall And Storm .From the above two observation it can be justified that the range of choosing sample of wave in the range 50 Mhz- 3.5 Ghz is due to its validity for receiving minimum attenuation and dropsize of 5mm range.

The data record of an electromagnetic wave between 50Mhz-3.5 Ghz where we have recorded electric field(E) ,Magnetic field(H) and Propagation vector(S) and compared the result with power received in the device.

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DATA SHEET

1.Data Recorded For Electric , Magnetic And Propagation Vector(S) of an Electromagnetic Waves in Rain & storm By an EMF device in the month of 12 Sept 2014 within an hour.

AXIS -	X	Y	Z
ELE(E) mV/m	60.6	16.6	25.5
MAG(H) mA/m	1.2459	160.4	0
PRO(S) mW/m^2	0.744	0.74	0
RESULT	75.50	26.62	0
% Loss /Gain	99	0.0277	0

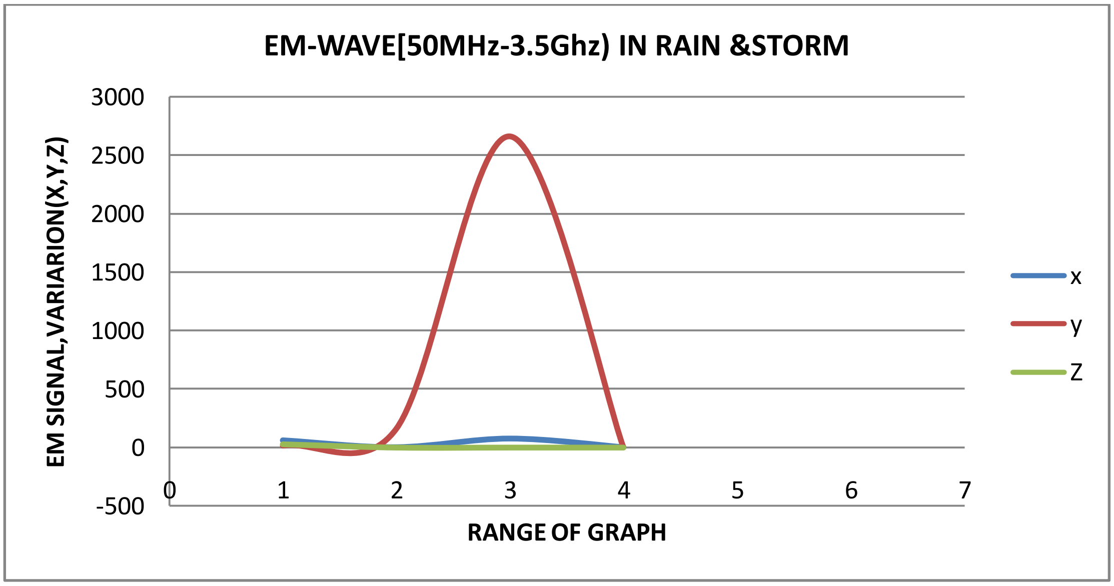

Fig 1: The Signal Variation (sinusoidal) In Rain & Storm . The EM-wave is inclined with different component of E H and S for X , Y and Z axis with same sample of waves and hence is not Electromagnetic in Rain & Storm .

DATA-SHEET

2.Data Recorded For Electric , Magnetic And Propagation Vector(S) of an Electromagnetic Waves in Rain & storm By EMF device dated 12 Sept 2014 within an hour .

AXIS	X	Y	Z
EL(mV/m)	15.5	17.7	123.3
Mag (mA/m)	14.4	46.6	0
Pro (mW/m^2)	0.709	19.3	0.064
Result	218.705	824.82	0
% Loss	8.8246	0.0077	0

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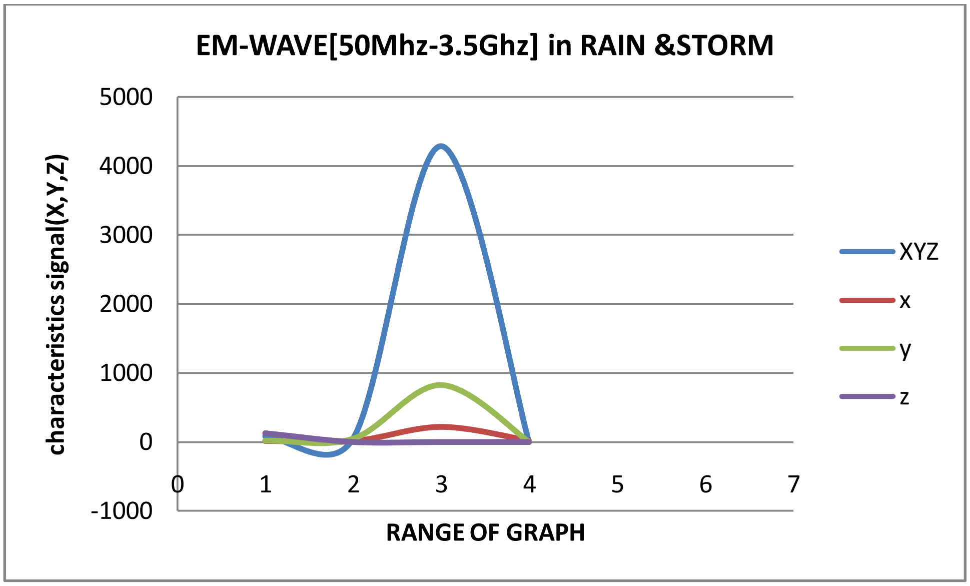

Fig 2: The Signal Variation (Sinusoidal) in rain & storm . The EM-wave is inclined for different component of E H and S in X Y and Z with same sample of wave and hence it is not Electromagnetic in Rain & Storm .

DATA SHEET

3.Data Recorded For Electric , Magnetic And Propagation Vector(S) of an Electromagnetic Waves during Rain & storm By EMF device dated 12 sep 2014 within 1 hour .

AXIS	X	Y	Z
EL(mV/m)	22.2	36.6	106.6
Mag(mA/m)	0.64	0.06	0.53
Pro (mW/m^2)	0	0.064	19.3
Result	14.208	2.196	56.6
% Loss	0	2.914	34.160

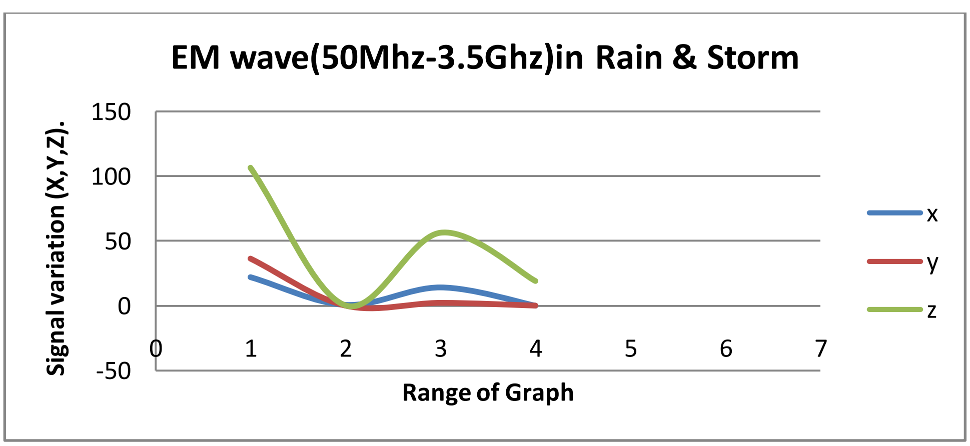

Fig3: Signal variation(Random-sinusoidal) due to rain & storm . The EM-wave is inclined with different component of E H and S for X , Y and Z axis with same sample of waves and hence is not Electromagnetic in Rain & Storm .

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DATA SHEET

4.Data Recorded For Electric , Magnetic And Propagation Vector(S) of an Electromagnetic Waves during Rain & Storm By EMF device dated 12 Sept 2014 within an hour.

AXIS	X	Y	Z
EL(mV/m)	43.3	13.3	83.3
Mag(mA/m)	0.633	0.063	2.92
Pro (mW/m^2)	0.633	0.063	2.92
Result	27.4089	0.8379	243.236
% Loss	0.22	7.5187	1.200

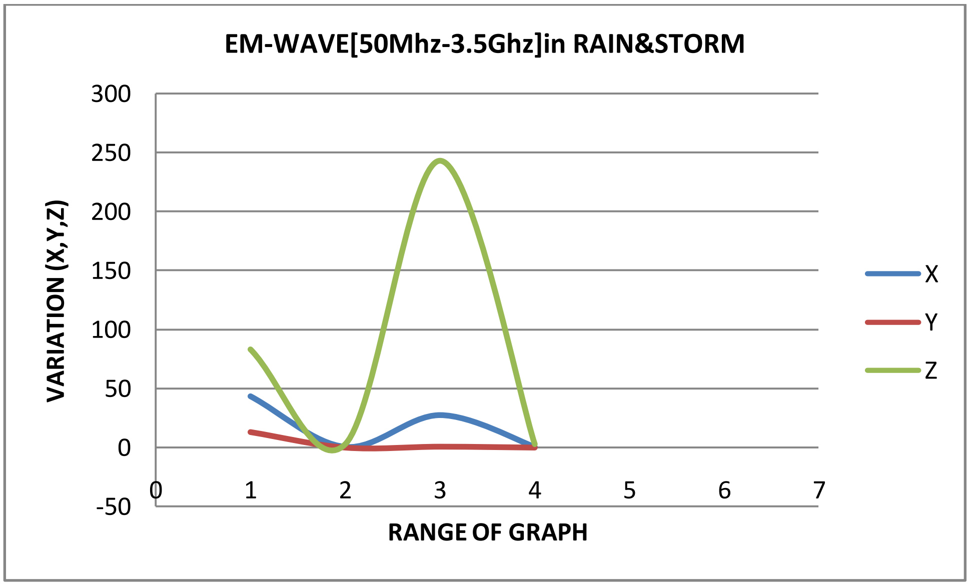

Fig 4. Signal Variation(Random-Sinusoidal) in rain & storm . The EM-wave is inclined with different component of E H and S for X , Y and Z axis with same sample of waves and hence is not Electromagnetic in Rain & Storm .

DATA SHEET

5.Data Recorded For Electric Magnetic And Propagation Vector(S) of an Electromagnetic Waves in Rain & storm By EMF device dated 12 Sept within an hour .

AXIS	X	Y	Z
EL(mV/m)	12.4	12.4	0
Mag(mA/m)	32.1	32.5	0
Pro (mW/m^2)	0	0.388	0.096277
Result	398.04	403	0
% Loss	0	0.096277	0

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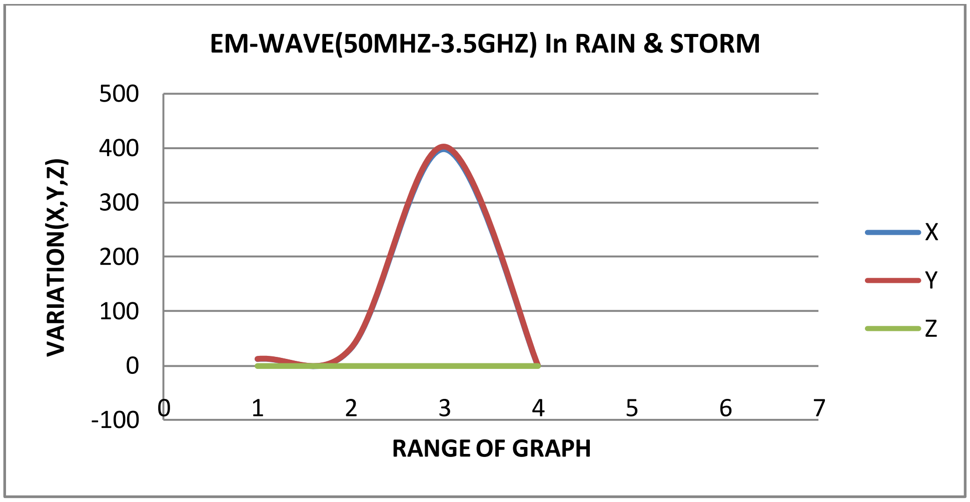

Fig5: Signal Variation (Sinusoidal XY) in Rain & Storm. The EM-wave is inclined with different component of E H and S for X , Y and Z axis with same sample of waves and hence is not Electromagnetic in Rain & Storm .

DATA SHEET

6.Data Recorded For Electric , Magnetic And Propagation Vector(S) of an Electromagnetic Waves in Rains & Storm in EMF device dated 12 Sept 2014 within an hour .

AXIS	X	Y	Z
EL(mV/m)	0	11.9	18.3
Mag(mA/m)	0	32.58	12.28
Pro (mW/m^2)	0	0.378	0.002
Result	0	387.702	224.724
% Loss	0	0.0974	0.0008899

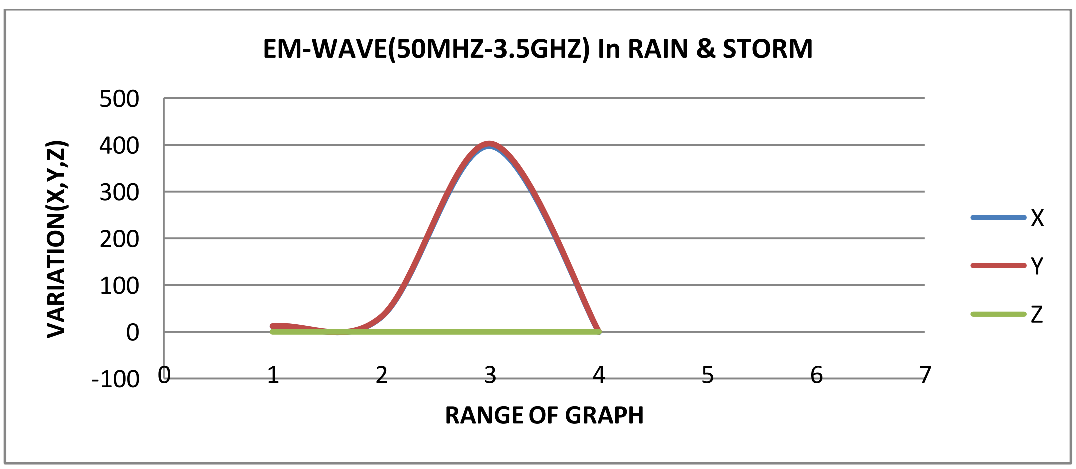

Fig 6: .The Signal Variation (Sinusoidal, XY) in rain & storm. The EM-wave is inclined with different component of E H and S for X , Y and Z axis with same sample of waves and hence is not Electromagnetic in Rain & Storm .

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DATA SHEET

7.Data Recorded For Electric , Magnetic And Propagation Vector(S) of an Electromagnetic Waves in Rain & storm By EMF device dated 12 Sept within an hour .

AXIS	X	Y	Z
EL(mV/m)	178.4	3.8	14.4
Mag(mA/m)	140.85	13.5	160.26
Pro (mW/m^2)	0.43	0	0
Result	25127.64	51.3	2307.744
% Loss	1.711	0	0

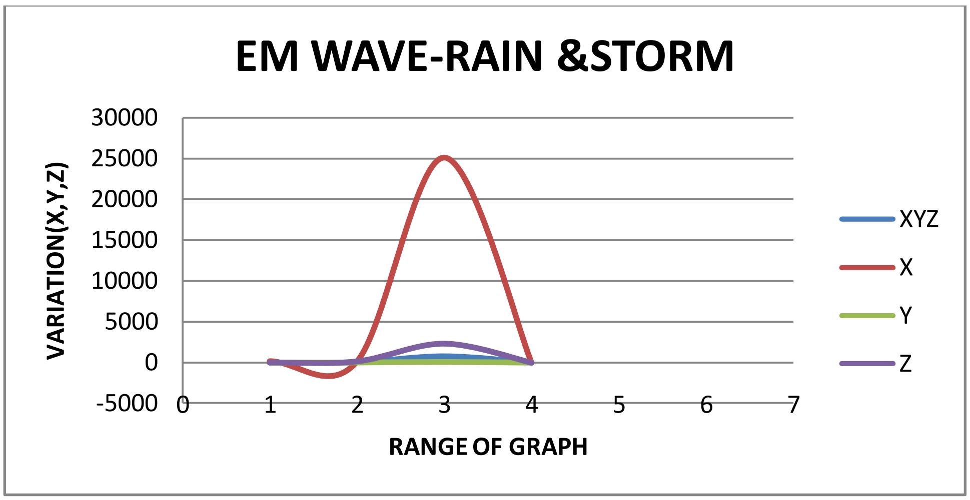

Fig 7: The signal variation (Sinusoidal ,XYZ) in rain & storm. The EM-wave is inclined with different component of E H and S for X , Y and Z axis with same sample of waves and hence is not Electromagnetic in Rain & Storm .

DATA SHEET

8.Data Recorded For Electric , Magnetic And Propagation Vector(S) of an Electromagnetic Waves in Rain & storm By EMF device between 50 Mhz-3.5Ghz dated 12 Sept 2014 .

AXIS	X	Y	Z
EL(mV/m)	121.5	30.3	14
Mag(mA/m)	6.72	12.46	2.42
Pro (mW/m^2)	0.415	0	0
Result	816.48	377.538	33.88
% Loss	0	50.82	0

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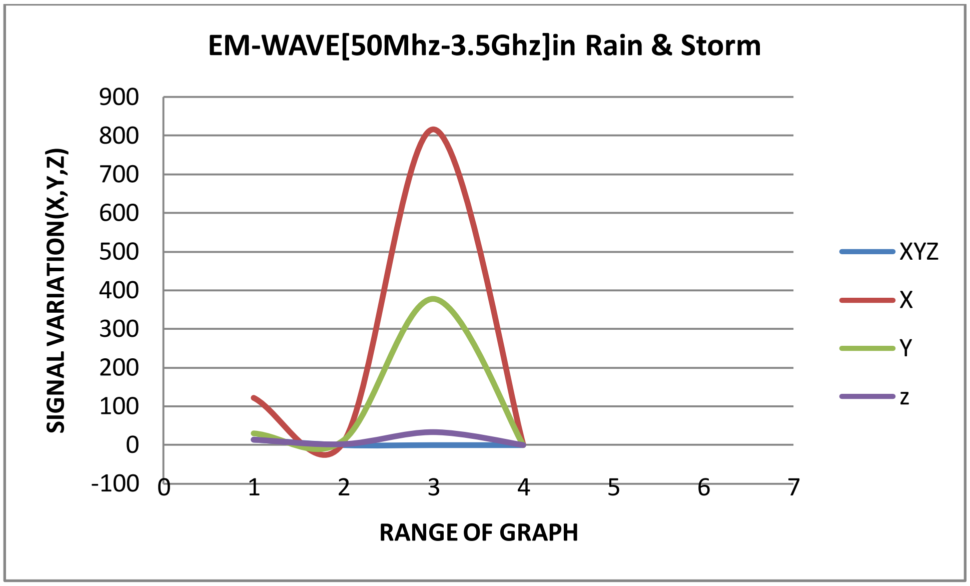

Fig 8: The signal Variation (Sinusoidal X,Y,Z) in rain & storm. The EM-wave is inclined with different component of E H and S for X , Y and Z axis with same sample of waves and hence is not Electromagnetic in Rain & Storm .

DATA SHEET

9.Data Recorded For Electric , Magnetic And Propagation Vector(S) of an Electromagnetic Waves in Rain & storm By EMF device between 50 Mhz-3.5Ghz dated 12 Sept 2014 within an hour .

AXIS	X	Y	Z
EL(mV/m)	14.3	16.6	10
Mag(mA/m)	8.27	4.2	2.39
Pro (mW/m^2)	0.42	0	0
Result	118.261	6673.2	23.9
% Loss	0.355	0	0

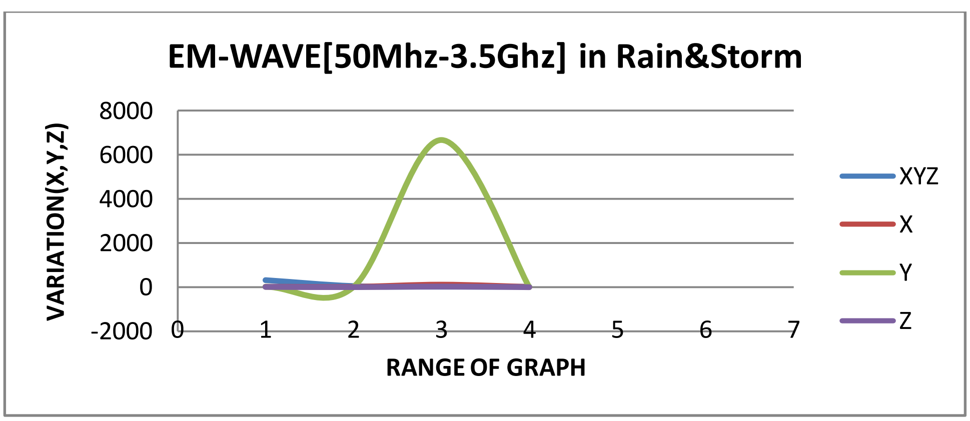

Fig 9: The signal variation (sinusoidal Y) in rain & storm. The EM-wave is inclined with different component of E H and S for X , Y and Z axis with same sample of waves and hence is not Electromagnetic in Rain & Storm .

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DATA SHEET

10.Data Recorded For Electric(E) , Magnetic (H) And Propagation Vector(S) of an Electromagnetic Waves dated 12 Sep 2014 in Rain & storm within an hour.

AXIS -	X	Y	Z
ELE(E) mV/m	14.3	16.6	10
MAG(H) mA/m	8.27	4.2	2.39
PRO(S) mW/m^2	0.42	0.0	0.0
RESULT	118.261	6673.2	23.9
% Loss /Gain	0.355	0.00	0.0

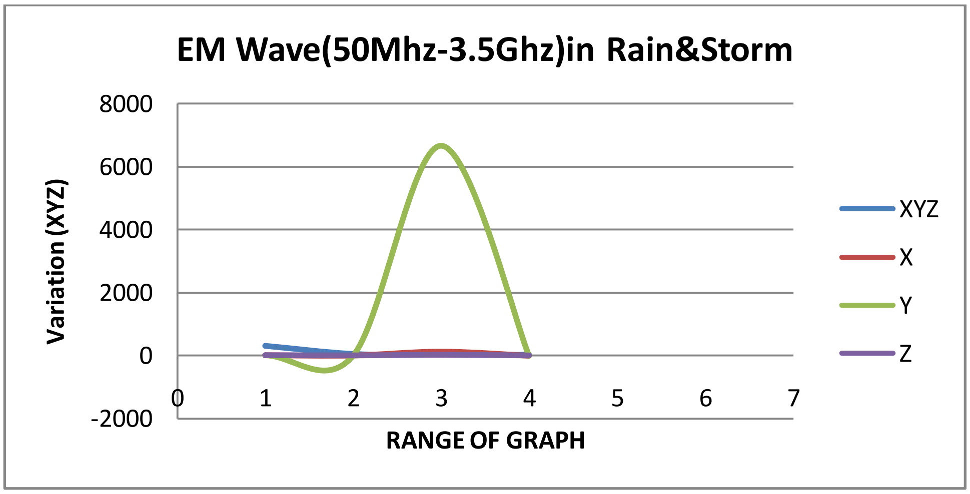

Fig 10 : The signal variation(Sinusoidal Y) in rain & storm. The EM-wave is inclined with different component of E H and S for X , Y and Z axis with same sample of waves and hence is not Electromagnetic in Rain & Storm .

Observation of Signal In Dry Weather

In dry weather or before rain it may be found to have its all component in same phase and follows pointing vector theorem . Before rain fall the EM wave has been observed to have 109^0 in phase ,shows the presence of water molecules it encounter on its way. In general weather an electromagnetic wave may be observed to have 90^0 in phase and follows pointing vector theorem .

Here are the data record of an electromagnetic wave between 50Mhz-3.5 Ghz where we have recorded electric field(E) ,Magnetic field(H) and Propagation vector(S) and compared the result with power received in the device.

The range of observation of electromagnetic wave in rain & storm had been chosen between 50MHz-3.5GHz the size of raindrop had not been considered for any effect on electromagnetic waves. The electric field strength had been chosen to come into effect within this range .The frequency parameter had not been taken into account for showing any significant change in signal strength. Criteria for study of electromagnetic wave had been verified using pointing vector theorem ,for the study of electric field(E) , magnetic field(H) and pointing vector(S) to follow its validations using these components of electromagnetic wave .The observation has been done during dry weather and its three components vectors strength variations had been studied using pointing vector theorem .The reason of choosing this range is its wide area of uses in day to day life since its validations in the following area had been widely accepted for the cases to study storm and had been studied using wind profile for weather radar .

Observation has been Recorded for Electric field , Magnetic field And Propagation Vector(S) for an Electromagnetic Waves in dry weather half an hour before Rain & Storm by EMF device in the month of 29 Sept 2014.

DATA SHEET

1.Data Recorded For Electric Field ,Magnetic Field And Propagation Vector(S) of an Electromagnetic Waves in dry weather half an hour before Rain & Storm by EMF device in the month of 29 Sept 2014.

AXIS	X	Y	Z
EL(mV/m)	1.646	0.5429	0.6794
Mag(mA/m)	4.366	1.4401	1.8021
Pro (mW/m^2)	7.187	0.7818	1.2244
Result	7.186	0.78183	1.2243
% Loss	100.0	99 .0	100.0

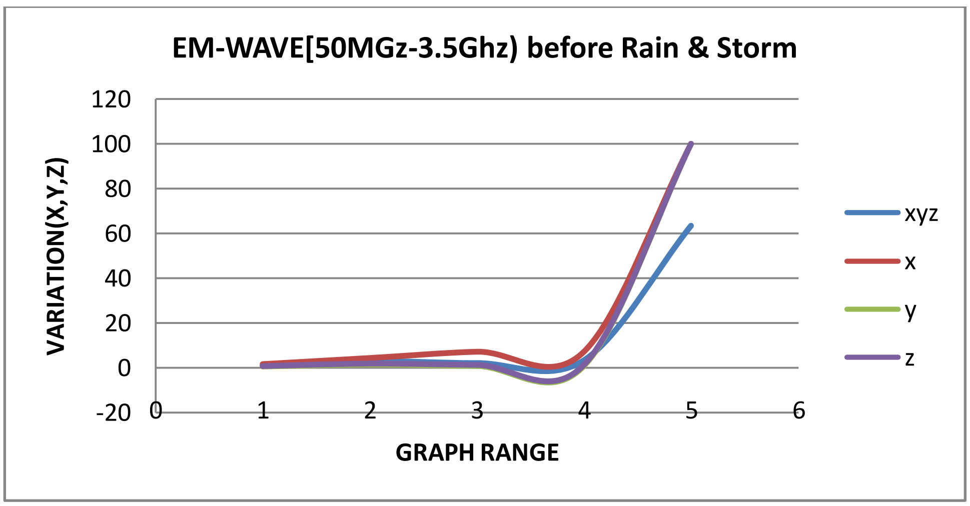

Figure 1: The signal variation (Mutually Perpendicular) in E, H & S component for X,Y,Z half an hour before rain & storm and is electromagnetic in nature.

DATA SHEET

2.Data Recorded For Electric , Magnetic And Propagation Vector(S) of an Electromagnetic Waves half an hour before Rain storm & By EMF device between 50 Mhz-3.5Ghz dated on 29 Sept 2014 .

AXIS	X	Y	Z
EL(mV/m)	1.718	0.3461	0.66
Mag(mA/m)	4.557	0.918	1.7507
Pro (mW/m^2)	7.829	0.3177	1.1554
Result	7.82	0.31772	1.155462
% Loss	100	99	99

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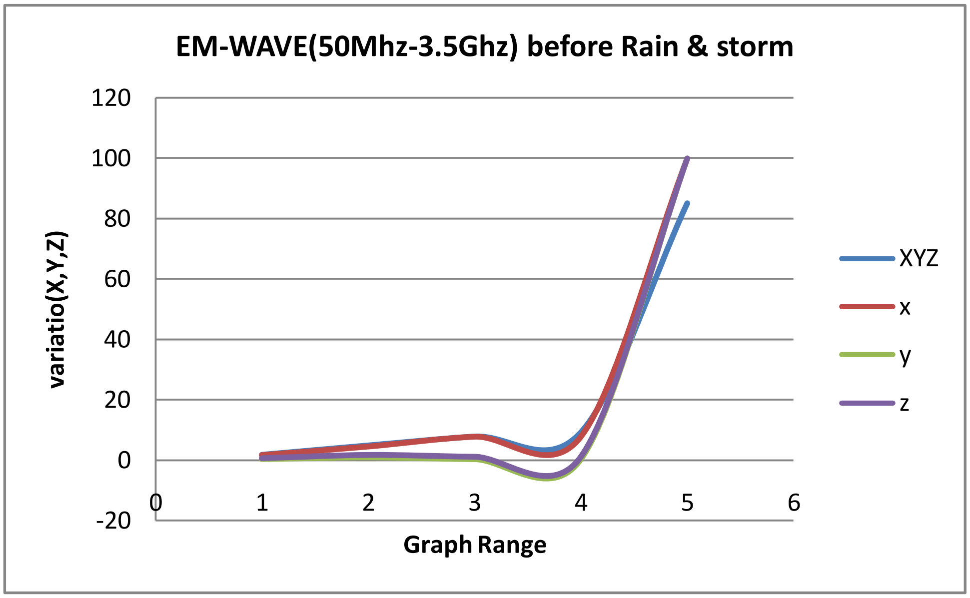

Figure 2: The signal variation (Mutually Perpendicular) in E H & S component for X,Y,Z half an hour before rain & storm and is electromagnetic in nature.

DATA SHEET

3.Data Recorded For Electric , Magnetic And Propagation Vector(S) of an Electromagnetic Waves half an hour before Rain & storm By EMF device between 50 Mhz-3.5Ghz dated 29 Sept 2014.

AXIS	X	Y	Z
EL(mV/m)	0.6665	0.751	0.4689
Mag(mA/m)	1.7679	1.992	1.2438
Pro (mW/m^2)	1.1783	1.496	0.909
Result	1.1783	1.4959	0.5782
% Loss	100	100	157

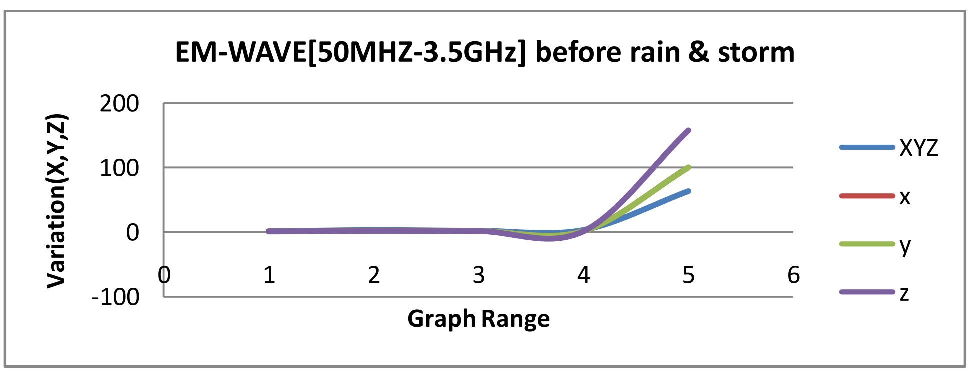

Figure 3: The signal variation (Mutually Perpendicular) in E H & S component for X,Y,Z half an hour before rain & storm and is electromagnetic in nature.

DATA SHEET

4.Data Recorded For Electric , Magnetic And Propagation Vector(S) of an Electromagnetic Waves half an hour before Rain & storm By EMF device between 50 Mhz-3.5Ghz dated 29 Sept 2014 .

AXIS	X	Y	Z
EL(mV/m)	0.8552	3.004	0.8367
Mag(mA/m)	2.2668	7.968	2.219
Pro (mW/m^2)	1.94	23.94	1.8569
Result	1.938567	23.93	1.8566
% Loss	99	99	99

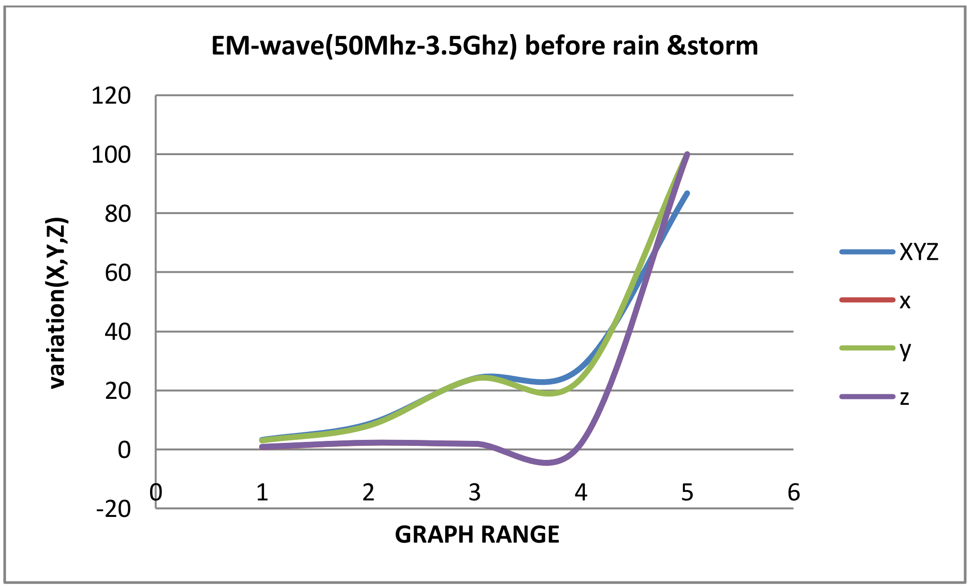

Fig 4: The signal variation (Polarized) with E, H & S component for X Y Z half an hour before rain & storm and is electromagnetic in nature.

DATA SHEET

5.Data Recorded For Electric , Magnetic And Propagation Vector(S) of an Electromagnetic Waves half an before Rain & storm By EMF device between 50 Mhz-3.5Ghz dated 29 Sept 2014 .

AXIS	X	Y	Z
EL(mV/m)	0.8986	1.996	0.714
Mag(mA/m)	2.384	5.294	1.8942
Pro (mW/m^2)	2.142	10.568	1.352
Result	2.1422	55.94	1.352
% Loss	99.98	18.88	100.01

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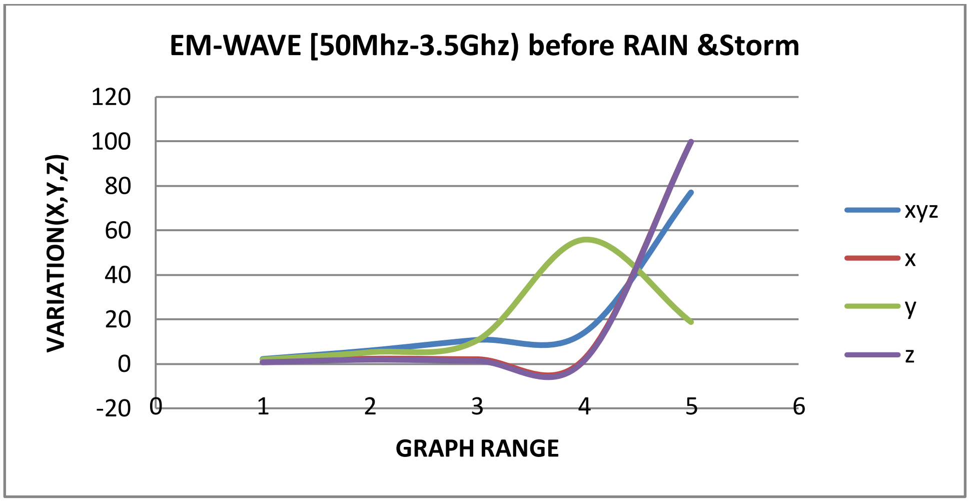

Figure 5: The signal variation (Mutually Perpendicular) in E H & S component for X,Y,Z half an hour before rain & storm and is electromagnetic in nature.

DATA SHEET

6.Data Recorded For Electric , Magnetic And Propagation Vector(S) of an Electromagnetic Waves half an hour before storm Rain & By EMF device between 50 Mhz-3.5Ghz in the month of 29 Sept 2014 .

AXIS	X	Y	Z
EL(mV/m)	1.377	0.9282	0.7413
Mag(mA/m)	3.653	2.462	1.4371
Pro (mW/m^2)	5.03	2.285	0.7786
Result	5.0	2.28	1.06
% Loss	99	99	73

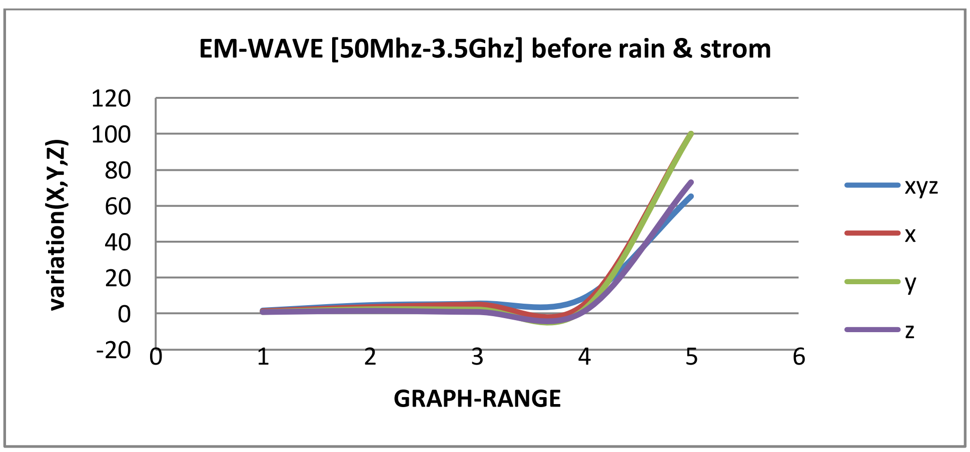

Figure:6 The signal variation (Mutually Perpendicular) with E H & S component for X Y Z half an hour before rain & storm and is electromagnetic in nature.

DATA SHEET

7.Data Recorded For Electric, Magnetic And Propagation Vector(S) of an Electromagnetic Waves half an hour before Rain & storm By EMF device between 50 Mhz-3.5Ghz dated 29 Sept 2014 .

AXIS	X	Y	Z
EL(mV/m)	0.5872	2.081	0.5798
Mag(mA/m)	1.55	5.52	1.5374
Pro (mW/m^2)	0.9146	11.487	0.8917
Result	0.914	11.48	0.8909
% Loss	99	99	100

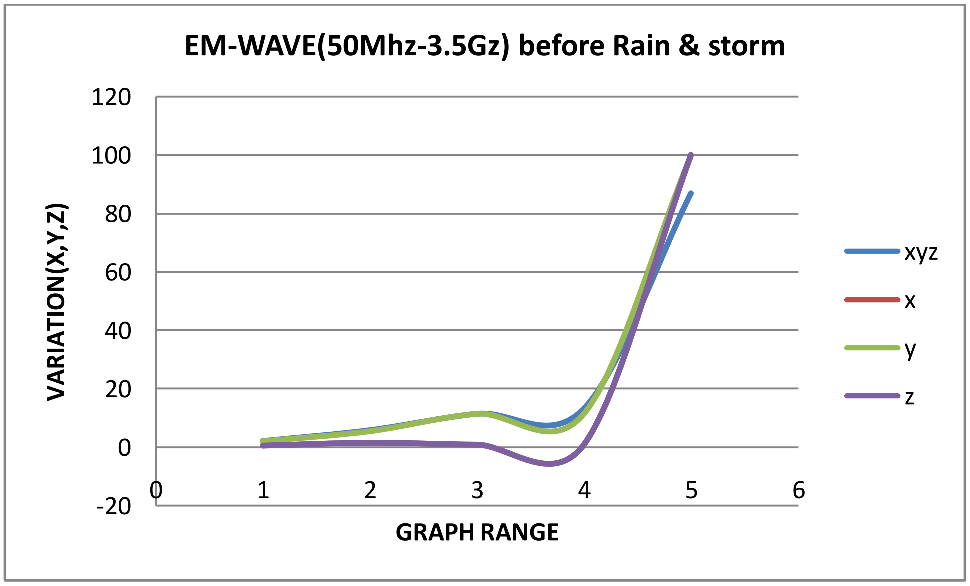

Fig 7: The signal variation (Mutually Perpendicular) with E H & S component for X Y Z half an hour before rain & storm and is electromagnetic in nature.

DATA SHEET

8.Data Recorded For Electric , Magnetic And Propagation Vector(S) of an Electromagnetic Waves half an hour before Rain & storm By EMF device between 50 Mhz-3.5Ghz dated 29 sep 2014.

AXIS	X	Y	Z
EL(mV/m)	2.911	4.553	0.8412
Mag(mA/m)	7.721	12.077	2.231
Pro (mW/m^2)	22.48	54.99	1.877
Result	22.47	55.04	1.87
% Loss	100	99	100

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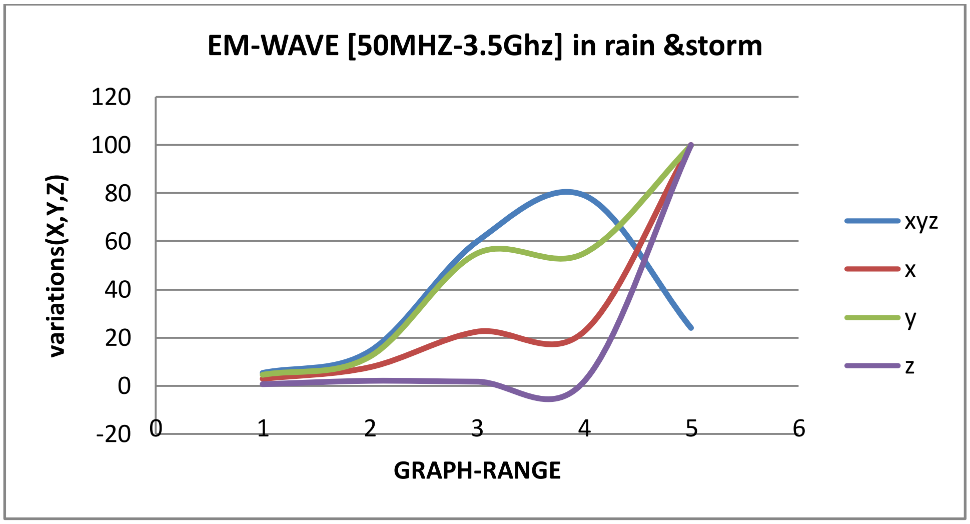

Figure 8 The signal variation (Polarised) in E H & S component for X Y Z half an hour before rain & storm and is electromagnetic in nature.

DATA SHEET

9.Data Recorded For Electric , Magnetic And Propagation Vector(S) of an Electromagnetic Waves half an hour before Rain & storm By EMF device between 50 Mhz-3.5Ghz dated 29 Sept 2014 .

AXIS	X	Y	Z
EL(mV/m)	3.254	4.461	0.595
Mag(mA/m)	8.631	11.83	1.5732
Pro (mW/m^2)	28.09	52.79	0.931
Result	28.08	52.77	0.933
% Loss	100.33	100.33	100.33

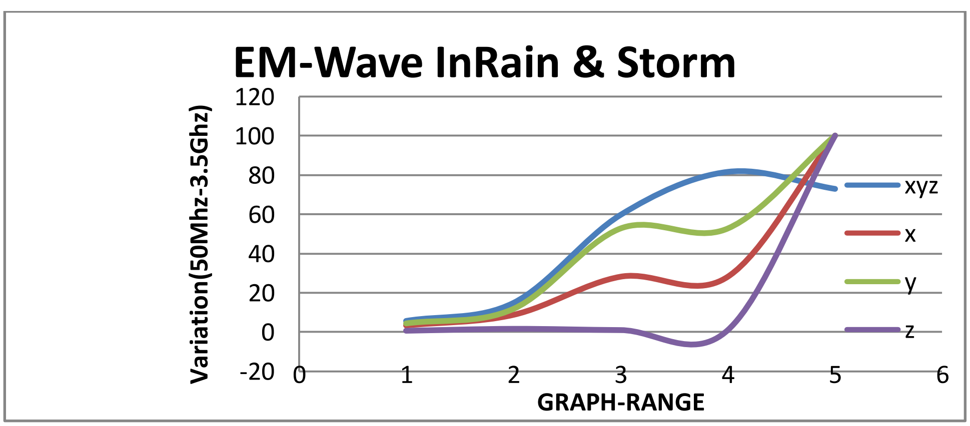

Fig 9: The signal variation (Polarised) in E H & S component for X Y Z half an hour before rain & storm and is electromagnetic in nature.

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DATA SHEET

10.Data Recorded For Electric , Magnetic And Propagation Vector(S) of an Electromagnetic Waves half an hour before Rain & storm By EMF device between 50 Mhz-3.5Ghz dated 29 Sept 2014 .

AXIS	X	Y	Z
EL(mV/m)	2.83	0.9756	0.9942
Mag(mA/m)	7.5007	7.586	2.637
Pro (mW/m^2)	21.24	21.7	2.622
Result	28.08	52.77	0.93
% Loss	100	100	100.

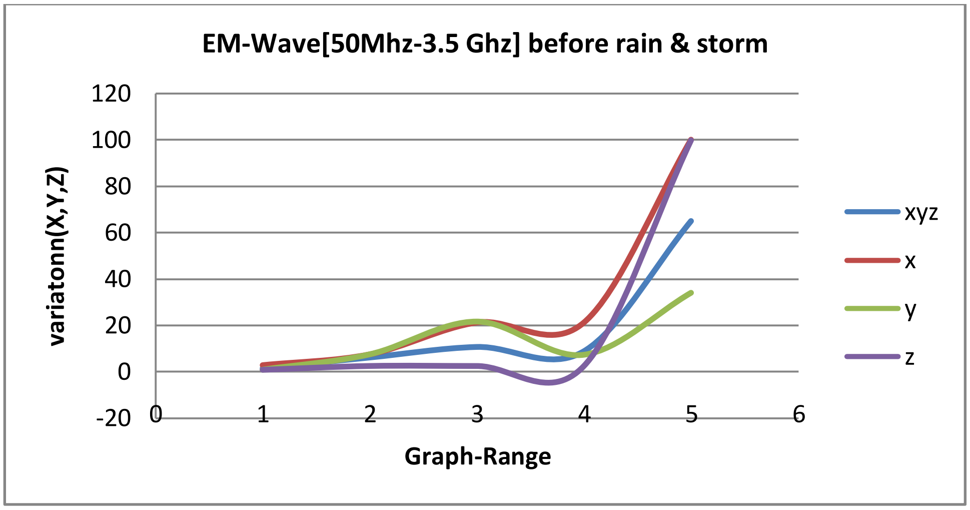

Figure10: The signal variation (Polarised) with E H & S component for X Y Z half an hour before rain & storm and is electromagnetic in nature.

DATA SHEET

11.Data Recorded For Electric , Magnetic And Propagation Vector(S) of an Electromagnetic Waves half an hour before Rain & storm By EMF device between 50 Mhz-3.5Ghz dated 29 Sept 2014 .

AXIS	X	Y	Z
EL(mV/m)	3.479	2.405	0.9679
Mag(mA/m)	9.732	6.37	2.567
Pro (mW/m^2)	35.71	31.85	2.479
Result	33.85	15.34	2.48
% Loss	94	100	100

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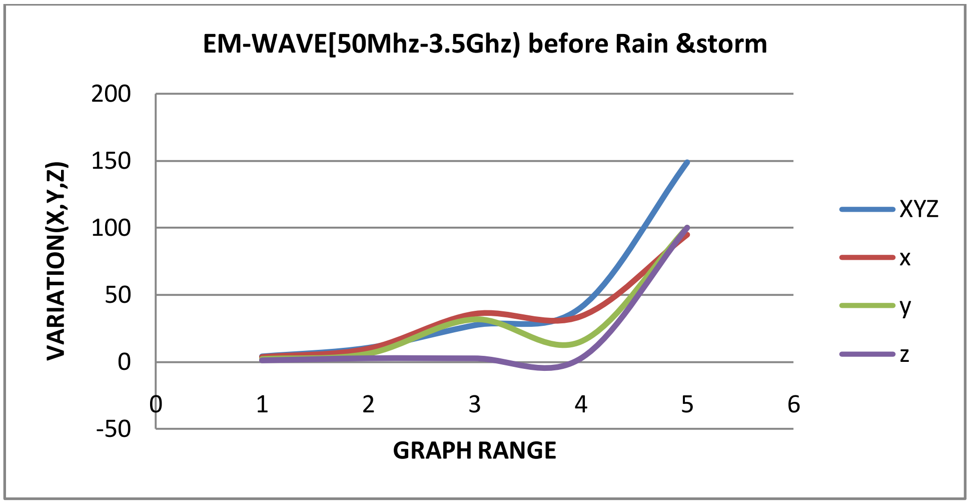

Figure 11: The signal variation (Polarised) in E H & S component for X Y Z half an hour before rain & storm and is electromagnetic in nature.

DATA SHEET

12.Data Recorded For Electric , Magnetic And Propagation Vector(S) of an Electromagnetic Waves half an hour before Rain & storm By EMF device between(50 Mhz-3.5Ghz)dated 29 Sept 2014 .

AXIS	X	Y	Z
EL(mV/m)	4.197	4.127	2.83
Mag(mA/m)	11.133	10.947	7.507
Pro (mW/m^2)	45.941	45.18	21.24
Result	46.752	45.17	21.24
% Loss	101.707	99	100

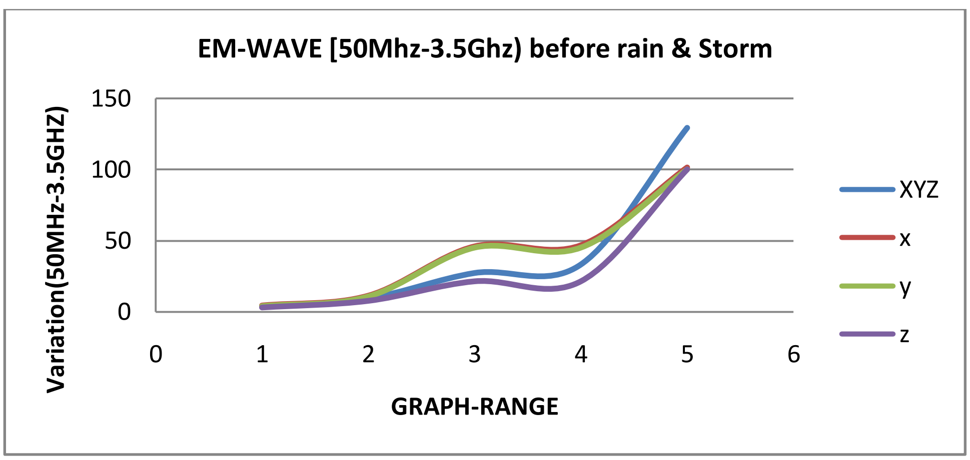

Figure 12: The signal variation (Polarised) in E H & S component for X Y Z half an hour before rain & storm and is electromagnetic in nature.

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13.Data Recorded For Electric , Magnetic And Propagation Vector(S) of an Electromagnetic Waves half an hour before Rain & storm By EMF device between 50 Mhz-3.5Ghz in dated 29 Sept 2014 .

AXIS	X	Y	Z
EL(mV/m)	5.041	4.127	2.83
Mag(mA/m)	13.371	10.947	7.507
Pro (mW/m^2)	67.4	45.18	21.24
Result	67.40	45.17	21
% Loss	100	100	100

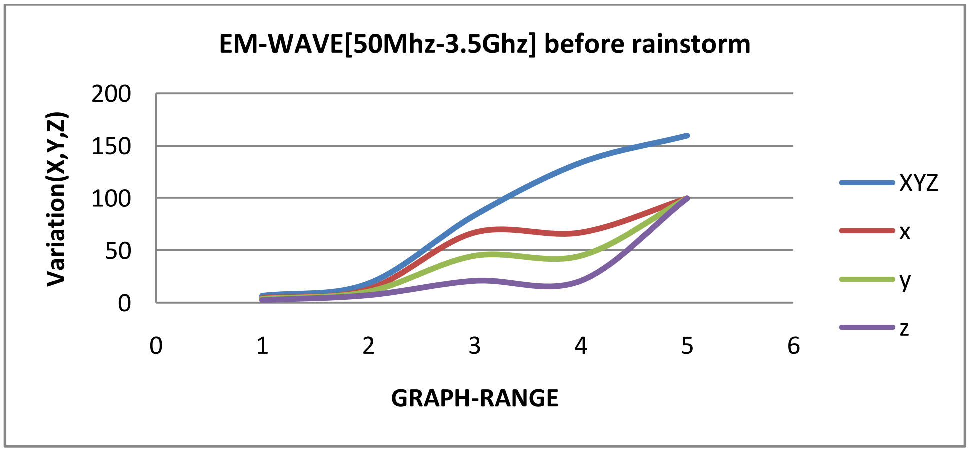

Figure 13 : The signal variation (Polarised) in E H & S component for X Y Z half an hour before rain & storm and is electromagnetic in nature.

Results and dissections:

For the purpose of Investigation of an electromagnetic wave comparative study of the above two observation has been recorded and compared using pointing vector theorem .

1.Data Recorded For Electric , Magnetic And Propagation Vector(S) of an Electromagnetic Waves half an hour before Rain & storm By EMF device between 50 Mhz-3.5Ghz in the month of 29 Sept 2014 .

AXIS	X	Y	Z
EL(mV/m)	1.377	0.9282	0.7413
Mag(mA/m)	3.653	2.462	1.4371
Pro (mW/m^2)	5.03	2.285	0.7786
Result	5.0	2.28	1.06
% Loss	99	99	73

In the above sample of Waves :

Ex=1.377 mV/m Ey = 0.9282 mV/m and Ez = 0.7413 mV/m. Electric polarization angle = 0 (x y)

Likewise:

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Hx = 3.653 mA/m Hy= 2.462 mA/m and Hz= 1.4371 mA/m. Magnetic Polarization Angle=33^0
And
Propagation Vector:
Sx =5.03mW/m^2 Sy=2.285 mW/m^2 and Sz = 1.06mW/m^2. Propagation Angle=21^0 (x , y).
The above chosen sample of wave had been found to have some inclination in XY plane for E ,H and S and little polarization had been observed due in rain & Storm half an hour before rainfall.

The same way let us investigate an another sample of wave dated 29 sep 2014.

AXIS	X	Y	Z
EL(mV/m)	1.718	0.3461	0.66
Mag(mA/m)	4.557	0.918	1.7507
Pro (mW/m^2)	7.829	0.3177	1.1554
Result	7.82	0.31772	1.155462
% Loss	100	99	99

Ex=1.718 mV/m Ey = 0.3461 mV/m and Ez = 0.66 mV/m. Electric polarization angle = 0 Rad (x y)

Likewise .

Hx = 4.557 mA/m Hy= 0.918 mA/m and Hz= 1.7507 mA/m. Magnetic Polarization Angle=0.0 (x,y)

And Propagation Vector Sx =7.829mW/m^2 Sy =0.3177 mW/m^2 and Sz = 1.155462 mW/m^2. Propagation Angle= 0 Rad (x,y)

The above chosen sample of wave had been found no inclination in XY plane for E ,H and S and no polarization had been observed in rain & Storm for half an hour before rainfall.

Two another sample of wave had been chosen that have been recorded in Rain & Storm :

AXIS	X(mV/m)	Y(mA/m)	Z(mW/m^2)
EL(mV/m)	1164	712.6	788.3
Mag(mA/m)	1.8902	1.8902	2.091
Pro (mW/m^2)	1.3469	1.3469	1.6483
Result	2200.193	1346.957	1648.335
% Loss	0.06121	0.099	0.0999

In the above sample of Waves :
Ex=1164 mV/m Ey = 712.6 mV/m and Ez = 788.3 mV/m. Electric polarization angle = 31^0(x y)
Likewise (H)
Hx = 1.8902 mA/m Hy= 1.8902 mA/m and Hz=2.092 mA/m. Magnetic Polarization Angle= 45^0 .
And
Propagation Vector(S)
Sx =1.3469mW/m^2 Sy=1.3469 mW/m^2 and Sz =1.6483 mW/m^2. Propagation Angle= 45^0(x,y).
The above chosen sample of wave had been found to have some inclination in XY plane for E ,H and S and polarization had been observed in rain & Storm .

AXIS	X(mV/m)	Y(mA/m)	Z(mW/m^2)

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EL(mV/m)	195.7	330.4	138.3
Mag(mA/m)	0.514	0.8764	0.1437
Pro (mW/m^2)	0.101	0.2896	0.3812
Result	100	289.56	19.87
% Loss	0.100	0.1000	1.9181

Ex=195.7mV/m Ey = 330.4 mV/m and Ez = 138.3 mV/m. Electric polarization angle = 59^0(x y).

Likewise (H)

Hx = 0.514 mA/m Hy= 0.8764mA/m and Hz=0.1437 mA/m. Magnetic Polarization Angle=Absurd result .

And

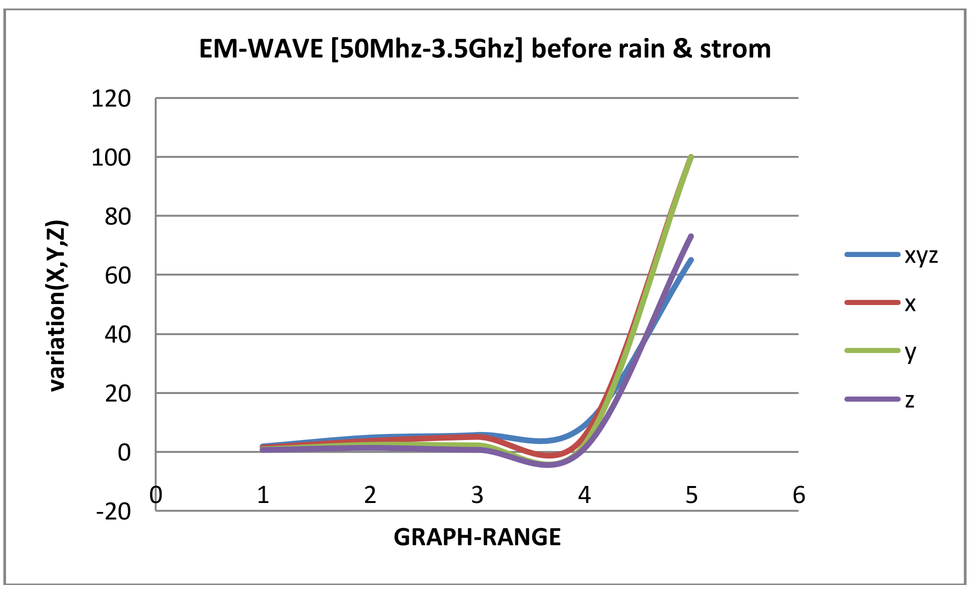
Propagation Vector(S)

Sx =0.101mW/m^2 Sy=0.28956 mW/m^2 and Sz =0.3812 mW/m^2. Propagation Angle=Absurd (x,y).

The above chosen sample of wave had been found to have some inclination for electric field as 31^0 and 60^0 and rest of data gives absurd result for H and S . Here only electric polarization had been observed in rain & Storm .

The investigation of the above study shows that during rain & storm electromagnetic wave suffers polarization due to adverse atmospheric conditions whereas in another sample of wave before rain & storm the EM wave had been found not to have polarization and hence propagates without any attenuation .

The comparative graph may be studied as shown the behavior of electromagnetic wave during rain & Storm between 50MHz-3.5Ghz .



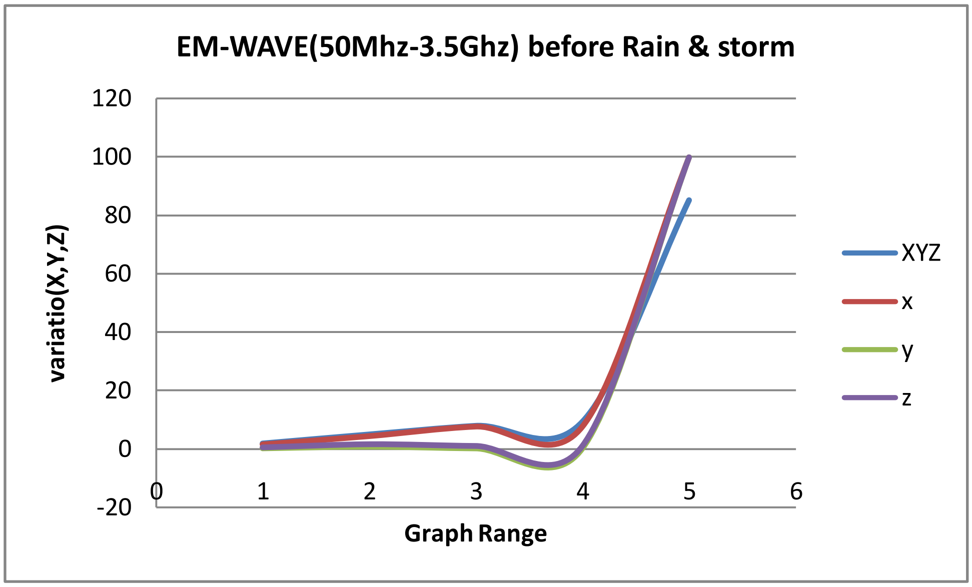
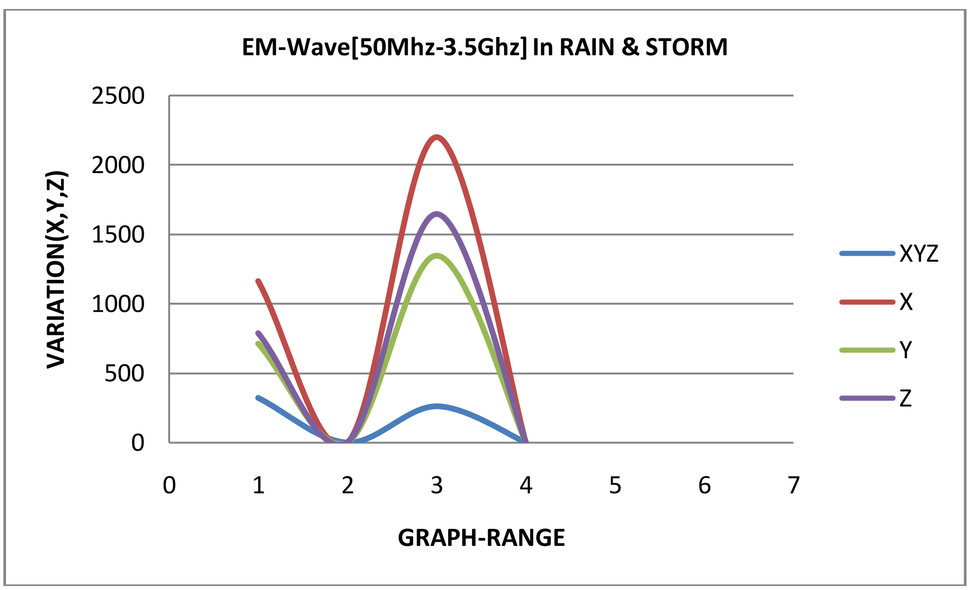


Figure 1 & 2 :The above chosen sample of wave had been found no inclination in XY plane for E ,H and S and no polarization had been observed in rain & Storm for signals half an hour before rainfall .

The Signal During Rain & Storm :



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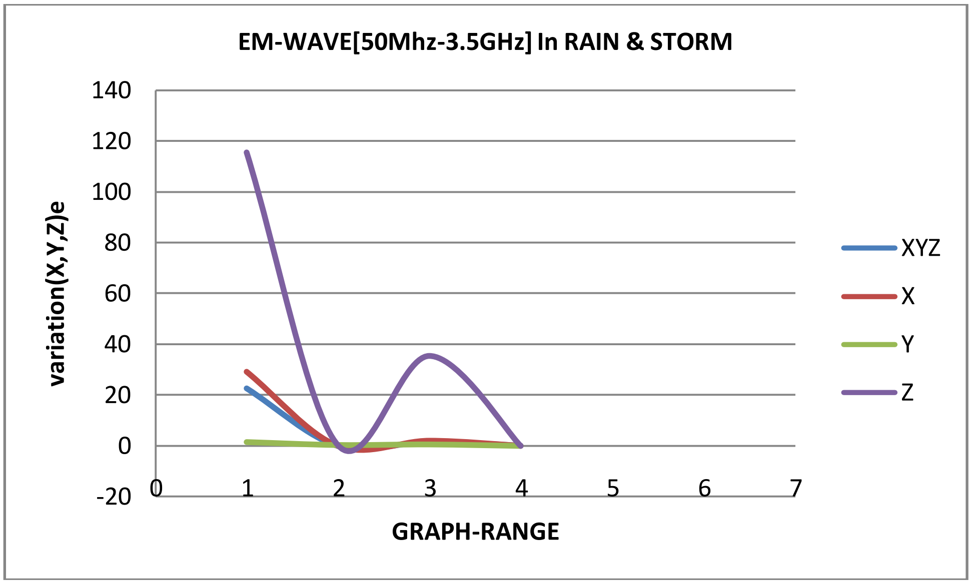

Fig 1 & 2 : The above chosen sample of wave had been found to have some inclination for electric field of 60^0 and 31^0 of data gives absurd result for H and S and hence only electric polarization had been observed in rain & Storm .

Concluding Remarks:

Signal sampling had been done for the purpose of choosing Its characteristics property wave as electromagnetic Wave . Next observation had been done for the wave characteristics in Rain & Storm and had not been found to have its validation of proving Poynting Vector Theorem .Although In the case of open sky wave observation has been found to be correct.

Acknowledgements:

The author is grateful to institute of radio-physics university of Calcutta and IMD –Patna where we have carried out this work independently to justify the result theoretically and experimentally .