

Analysis of The Effect of Thunder And Lightning Strike on Television Signal Transmission (A Case Study of Nta Enugu.)

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Abstract: The lightning strike and thunder and its effect on television signal transmission in Nigerian Television, NTA Enugu Nigeria was analyzed. From the analyses, it was observed that lightning and thunder strike affects television transmissions. This occurs at the beginning and end of the raining seasons of every year. The result showed that the lightning strike and thunder effect causes image fading lost of signal, breaking of images and sometimes causes the station to be out of broadcast. National Communication Commission, NCC should ensure that all television stations in Nigeria be digitalized and powerful/modern lightning arrester and surge protection device be installed to avert the effects of lightning strike and thunder on their stations to keep transmitter "ON" during transmission.

Keyword: *Television, Transmission, Transmitter, Lightning strike, Thunder strike, Lightning arrester and Broadcast*

I. INTRODUCTION

Lightning is a harsh weather phenomenon which occurs mostly during seasons. Its effect cannot be neglected in telecommunication and radio signal transmission, especially breaking networks. It is essentially a very high transient that can cause destruction if it occurs directly on conducting systems such as transmitter, antenna, computer, radio and television sets etc [Encyclopedia Britannica]. Lightning is an atmospheric electrostatic discharge (or spark) accompanied by thunder which typically occur during thunderstorms, and sometimes during volcanic eruption. [Encyclopedia Britannica]. Lightning strike is an electric discharge on a massive scale between the atmosphere and the earth bound object. The mostly originates on the ground and terminates in the thunder cloud, called ground to cloud lightning. Also upwards propagating lightning is initiated from a fall ground object and reaches into the clouds. Lightning occurs with both positive and negative polarity. An average bolt of negative lightning carries an electric current of 30 kA, and transfers 15 C of electric charge and 50 MJ of energy. Large bolt of lightning can carry up to 120 kA of electric current and 350 C of electric charge. [Martin, 1986]. Average bolt of positive lightning current and electric current of about 300 kA is about 10 times that of negative lightning. [Rakov and Uman, 2003]. Lightning rapidly heats the air in its immediate vicinity to about 20,000C which is about three times the temperature of the surface of the sun. The sudden heating effect and the expansion of the heated air giving rise to a supersonic shock wave in the surrounding clear air. This shock wave once it decays to acoustic wave is heard as thunder [Encyclopedia Britannica]. Lightning strike damages electronics devices like telephone, modems, computers etc as it produces over current which can get to these devices through phone jack, Ethernet cable, or electricity outlets. Also the lightning strike can generates electromagnetic pulse, especially during positive lightning strike. Lightning current have very fast rise time of order of 40kA per microseconds. The conductor of such current can exhibit marked skin effect causing most of the current to flow through the outer surface of the conductor . Also lightning interferes with AM radio signals more than FM signals [Joni et al., 2007]

Thunder Thunder is the sound caused by lightning [Rakov and Uman, 2007). However, depending on the nature of the lightning, thunder can range from sharp, loud crack to long, low rumble. Then the sudden increase in pressure and temperature produces rapid expansion of the air surrounding and within a bolt of lightning. This expansion of air in turn causes a sonic shock wave, which is the same to sonic boom, which produces the sound of thunder that is referred to as clap, crack, or peal of thunder [Encyclopedia Britannica, Granean, 1989]

Lightning effect on Transmitter Damaging power surges or transient occurs when lightning strikes transmitter, metallic plant equipments. Lightning damage to transmitter depends on the access route of itsstrike. A direct hit generally destroys a transmitter while a nearby strike can induce damaging current in piping or

wiring. On the process, piping will usually damage the sensor module and may damage the electronic components of the transmitter [Technical data sheet, 2002].

Fig 1 Show a thunder strike on a transmitter tower



Rain Attenuation Heavy lightning mostly results during the beginning and the end of rain. Rain along the transmission path is the major effect for satellite communication at frequencies above 10 GHz. Rain attenuations is the weakening of the satellite signal as it passes through rain drops. Rain drops absorb and scatter radio wave energy; which degrades the reliability and performance of the communication link. Rain effects are dependent on frequency, rain rate, drop size distribution and drop shapes which are determined by the type of rain [Adami et al., 2002] This research work x-ray the lightning and thunder effect on television signal transmission and its possible way it can be reduced.

Data Collection

Lightning logged data were collected from Nigerian Television Authority, NTA Enugu Network Centre, Nigeria from 2014 and 2015 at the beginning and ending of the raining seasons

II. RESULTS

Table 1: Lightning strike/thunder logged data from NTA, Enugu Nigeria for 2014

Date	Time	Status of the transmitter	Effect on the transmitter
10/03/14	12.00pm	Switched off	Nil
13/03/14	8.05pm	ON	Fading / breaking of images
18/03/14	3.00pm	ON	Fading / breaking of images
02/04/14	4.28pm	Switched off	NIL
08/04/14	10.30am	ON	Fading/ breaking of images
29/04/14	6.30pm	ON	Fading/ breaking of images
01/05/14	8.00pm	Switched off	NIL
09/05/14	10.55pm	ON	Transmitter Damaged
04/06/14	10.35pm	ON	Fading/ breaking of images
11/06/14	8.53PM	ON	Fading/ breaking of images
05/08/14	1.00PM	Switched off	NIL
18/08/14	6.15PM	ON	Fading/ breaking of images
21/08/14	4.00am	ON	Fading/ breaking of images
25/08/14	7.44am	Switched off	NIL
21/09/14	3.10pm	ON	Fading/ breaking of images

26/09/14	3.50pm	Switched off	NIL
04/10/14	1.10pm	Switched off	NIL
09/10/14	2.10pm	Switched off	NIL

Table 2: Lightning strike/thunder logged data from NTA, Enugu Network center, Nigeria for 2015

Date	Time	Status of the transmitter	Effect on the transmitter
12/02/15	1.15PM	ON	Fading/ breaking of images
15/02/15	7.30PM	Switched off	NIL
21/02/15	9.00PM	ON	Fading/ breaking of images
28/02/15	11.15PM	Switched off	NIL
04/03/15	8.40PM	ON	Fading/ breaking of images
18/03/15	6.45PM	Switched off	NIL
21/03/15	1.15PM	ON	Fading/ breaking of images
03/04/15	7.48PM	Switched off	NIL
10/04/15	2.18PM	Switched off	NIL
23/04/15	1.28PM	ON	Fading/ breaking of images
26/04/15	9.48PM	ON	Fading/ breaking of images
04/05/15	10.00am	Switched off	NIL
18/05/15	3.58pm	ON	Fading/ breaking of images
26/05/15	8.04pm	ON	Fading/ breaking of images
08/06/15	6.45pm	Switched off	Transmitter Damaged
24/06/15	10.00PM	Switched off	NIL
28/06/15	11.57am	Switched off	NIL
10/07/15	4.58pm	Switched off	NIL
19/08/15	5.45am	Switched off	NIL
29/08/15	10.40am	Switched off	NIL
02/09/15	10.32am	Switched off	NIL
06/09/15	10.15am	ON	Fading/ breaking of images
10/09/15	1.28pm	ON	Fading/ breaking of images
21/09/15	2.08pm	ON	Fading/ breaking of images
03/10/15	12pm	ON	Fading/ breaking of images
06/10/15	6.03pm	Switched off	NIL
13/10/15	10.15pm	Switched off	NIL
24/10/15	8.10am	ON	Fading/ breaking of images
27/10/15	10.16pm	ON	Fading/ breaking of images

III. DISCUSSION

From Table 1 and Table 2, it was observed that heavy lightning and thunder strike comes at the beginning and the end of the raining season which is towards the beginning and end of the year respectively in Nigeria. This disturbs the transmission which results to fading and breaking of images, cracking noise and in most cases switching off the transmitter of the television station. Hence, program (i.e. news, information, messages etc) transmitted by the station to the people is highly affected and sometimes vital and urgent information it cannot be broadcasted. Television stations should be digitalized to reduce the problems of fading and breaking .

Moreover, in some cases the transmitter was badly damage by the strike because it was on. The following parts were affected; exciter, power unit, modulator and encoder. This type of incidence usually keeps the station off air for some weeks or months before it is put in place, hence activities of the station were paralyzed. Lightening is a natural occurrence that must take place; effort should be taken to install a powerful/modern lightning arrester and surge protection device also good earthing should be done around the transmitting environment to prevent the effect on the transmission even when the station is on air.

IV. CONCLUSION

The effect of lightning on television transmission was analyzed. From the analysis, it was discovered that lightning is a problem to television transmission and this is mostly observed during the raining season. National Communication Commission NCC should ensure that proper lightning arresters are installed on television station and most importantly enforce digitalization of television stations in Nigeria.

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