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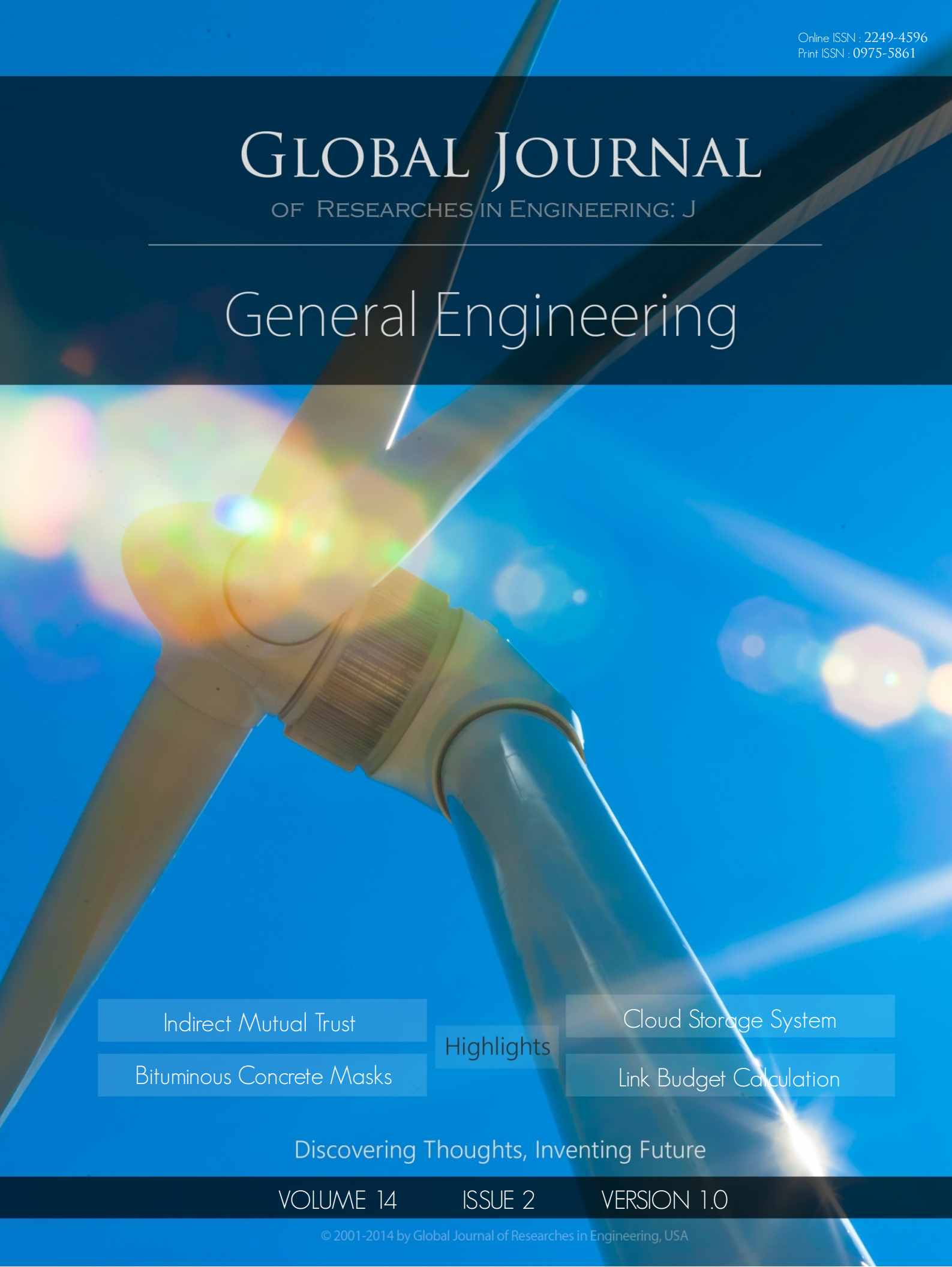

Highlights

Indirect Mutual Trust

Bituminous Concrete Masks

Cloud Storage System

Link Budget Calculation

Discovering Thoughts, Inventing Future

VOLUME 14 ISSUE 2 VERSION 1.0

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The Algerian Experience in the Waterproofness of the Bituminous Concrete Masks Advantages and Inconveniences

By Bounaadja Zoulikha, Dr. Lakhdar Djemili & Pr. Houichi larbi
Badji Mokhtar University, Algeria

Abstract- The experience of the use of bituminous concrete upstream facing is presented in Algeria in the four big dams: Ghrib (1926-1938), Bouhnifia (1930-1941), Sarno (1947-1954) and Ighil Emda, The problem posed in the aroused dams is especially delicate because of the instability of the mask which could become precarious to the temperature. Therefore it was covered with a thermal protection, which demands a periodic renovation. This solution was very expensive. To avoid these costs, one tried to test the stability of the mask without the thermal protection. One prepared a reduced sample of the mask of bouhnifia dam. Then, one put this sample on an inclined facing of 1/1 (slope of the dam); and maintained it in an oven during more than 48 hours under a temperature of 70 C°. This experience permitted to determine that the sample kept its initial shape. The gotten results confirmed that the mask of the Bouhnifia dam can resist the action of the temperature without the necessity of the thermal protection.

Keywords: dam, water barrier, upstream mask, bitumen, bituminous concrete.

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Bounaadja Zoulikha [α], Dr. Lakhdar Djemili [σ] & Pr. Houichi larbi [ρ]

Abstract- The experience of the use of bituminous concrete upstream facing is presented in Algeria in the four big dams: Ghrib (1926-1938), Bouhnifia (1930-1941), Sarno (1947-1954) and Ighil Emda, The problem posed in the aroused dams is especially delicate because of the instability of the mask which could become precarious to the temperature. Therefore it was covered with a thermal protection, which demands a periodic renovation. This solution was very expensive. To avoid these costs, one tried to test the stability of the mask without the thermal protection. One prepared a reduced sample of the mask of bouhnifia dam. Then, one put this sample on an inclined facing of 1/1 (slope of the dam); and maintained it in an oven during more than 48 hours under a temperature of 70 C°. This experience permitted to determine that the sample kept its initial shape. The gotten results confirmed that the mask of the Bouhnifia dam can resist the action of the temperature without the necessity of the thermal protection.

Keywords: dam, water barrier, upstream mask, bitumen, bituminous concrete.

I. Introduction

A bituminous concrete face has been historically a real alternative solution as a water barrier for embankment dam and for other hydraulic works.

Baron Van Asbeck reported the oldest known dam with a sort of primitive bituminous concrete facing to be ASSURE, constructed circa 1300 years BC in Mesopotamia. That is most significant, because it gives testimony to the antiquity of the design concept. Modern construction using bituminous concrete facings starts with CENTRAL dam built in the United States in 1910. In the last sixty years more than 300 dams of height of 30 m and reservoirs of height more 15m; their water barrier were assured by the bituminous concrete. [1]

The continuous progress in conceptions about the construction of masks of this type led us to proceed a study about its characteristics. And to do this, we took the Bouhanifia dam as a model for this study.

The bituminous concrete mask was the water barrier system of Bouhnifia dam "Algeria". It was applied on the upstream slope [2-3]. The mask risked to be unstable because of the effect of sunlight temperatures which can reach (65°C). So, it was covered with a thermal protection, this last is also constituted by a layer of cement concrete of 10 cm thick, armed with a fencing wire of galvanized steel, This layer must be continuously renovated because of cracking. So, the necessity of the renovation of the protective layer influenced on the total cost of the project.

The present work, on the one hand exposes a presentation of the aroused dams, and it is also an analyzed study including an approved results to avoid the setting up of two layers (sealing layer and thermal protective layer) and to minimize the costs of realization. So we studied the mechanical and physical behavior of a reduced sample of the mask seal of the Bouhnifia dam under a temperature of (+ 65 °C) without thermal protection.

II. General Presentation of dams

a) Ghrib Dam

The Ghrib dam is situated on the upper course of Oued Chélif. It accumulates waters of the upper pond with the aim of the irrigation of plains situated in downstream and additionally of the production of the electrical energy. The work is constituted by a dike of fastened rockfill.

Built between 1926 and 1938; the dam of Ghrib was the first work in rockfill realized with an upstream mask in bituminous concrete. This mask performed suitably its role of supple water barrier, in spite of the disappearance of its thermal protection of porous concrete in 1952.

i. *Features of the dam*

- Length in crest: 270 m,
- Width of the base: 148 m,
- Maximum Height: 72 m,
- Slopes upstream bank: vary from 2/3 à 1 / 1,
- Slope bank downstream : 5/4,
- Capacity of the restraint: 300.106 m3.

b) Sarno Dam

The dam of Sarno is built between 1947 and 1954 on the Oued of the same name, streaming of Mekerra which takes its source in the mounts of Daia

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and ends in the swamps of the Macta. The dam of Sarno, is a dike in homogeneous ground with upstream mask in bituminous concrete. The mask gives complete satisfaction because in full restraint, the flights are unimportant. The paint reflection which constitutes the thermal protection of the mask must be redone.

i. *Features of the dam*

- Height above the twig: 28 m,
- Length in crest: 310 m,
- Fruit of the upstream bank: 1/2 in 1/2,5,
- Fruit of the bank downstream: 1/2 in 2/3,
- Width of the massif of the base: 150 m,
- Capacity of the basin: 21.106 m^3.

c) Ighil Emda dam

The dam of Ighil Emda is built on the confluence of adding two Oueds, the Oued Beard and the Oued Embarek which form the Oued Agrioun in 2 km in the South of Kherrata, It is a fixed dam creating a restraint of 160.106 m3 intended to produce some electrical energy.

i. *Features of the dam*

- Length in crest: 710 m,
- Maximum height: 75 m,
- Width of the massif of the base: 265 m,
- Fruit of the upstream bank: 1/1,6,
- Fruit of the bank downstream: 1/1,5,
- Capacity of the basin: 155.106 m^3.

d) Bouhnifia dam

The dam Bouhanifia is built between 1930 and 1941 on Oued Elmmam which takes its source in the mounts of Daia and ends in the swamps of Macta. It is about a work in rockfills with upstream mask in bituminous concrete, widely inspired by the dam of Ghrib. The mask assures without failure its role of the water barrier. [3-4] (Figure 1)

The watershed of the dam has a surface of 7,850 km2 and the annual average flow of the Oued reaches 110.106 m^3.

i. *Features of the dam*

The main features of the dam and the structure of the bituminous concrete facing are given respectively in (Figure 2 and 3).

III. Study of the Mechanical and Physical Behavior of Impervious Facing System of Bouhnifia Dam in Absence of the Thermal Protection

The study of the composition of a bituminous concrete mask consists of choosing among the economically available materials: aggregates with big elements, thin elements, filler as well as a quantity of bitumen to constitute a steady and impervious material after compaction (Table 1). For that to make, it is necessary to determine a correct grading composition in order to reduce to the minimum the percentage of the voids in the compacted mixture to dry Figure 4. The voids must be filled of bitumen to achieve the imposed limits of practical considerations, a specific weight as high as possible [5].

a) Formulation of the bituminous concrete

i. *Features of the used materials*

- *Coarse Aggregations:* We call big aggregations all aggregates retained on the sieve N 10. These aggregates are constituted by rolled gravel, stones or milkmen ground.
- *Fine Aggregates:* We call by fine aggregates all the aggregates passing in the sieve n°10 and retained to the sieve N 200. These aggregates are constituted by natural sand or crushing or by a mixture of these two materials.
- *Filler:* We call filler all materials passing in the sieve °200 and constituted by dry chalky fine grains, or cement, or by all other fine and inert material.
- The aggregations must not be dismayed by the bad weather, to be not frost-susceptible, clean and exempt of dusts in excessive quantity, of homogeneous quality and must not include more than 5% of elementary flat; they must possess a good affinity for the bitumen [1]. The physical characteristics of the aggregates are given in Table 2
- *Bitumen:* The bitumen is gotten by refinement of oils. They must be of homogeneous composition, exempt of water, and must be in conformity with some specifications. The used bitumen is characterized by: The penetration index and Softening point (Table 2)

In view of the previous study of searching the best composition to adopt for the confection of the recommended spoiled, One determines:

The apparent density; the percentage of the voids occupied by the air; the percentage of the voids of the aggregations and the percentage of the voids occupied by the bitumen [6].

a) Mixing and preparation of the samples

- We weigh successively the fixed quantities of different composing aggregates, these quantities must be calculated for a spoiled from 1000 to 1200 g, (binder not included).
- We carry the container and its content in an oven adjusted in 140° C during one hour. In another container, we put the quantity of the binder; we heat it to a temperature between 140 °C and 160 °C during 30 to 45 minutes in order to confer it to the

necessary fluidity of the coating without attending the temperature where the spraying of oils would become excessive.

- Immediately retired from the oven, the aggregations are poured in the binder's container. We add the filler, which doesn't need to be heated, but it must be dry. The mixture is introduced in a normalized mixer and it is homogenized during 30 minutes.
- We fill the molds, while packing every time with the spoon; we adjust the full cylinder and we carry it all between the trays of press. The samples are compacted by 50 strokes. For the aim of letting the samples cool, it is kept during 24 hours in the ambient temperature.
- We measure to the slide gauge, to the 1/10 of mm meadows the diameters and the heights of the samples and we weigh them at 0.5g meadows. (Figure 4)

b) Determinations of the properties of the bituminous Mixing "samples"

After verification of the features of the formulated bituminous concrete, we undertook the following tests: The compression resistance; the percentage of imbibition; the percentage of inflation; the stability following Marshall after immersion during 14 days; the permeability and the stability on the slope. [5-7]

i. *The Compression Resistance*

After confection of the samples, these are immersed in baths under temperatures 0°C, 20°C and 50°C during 3 hours. The samples are withdrawn from the baths and are immediately placed between the trays of the press. The compressive test has been driven on cylindrical samples with a press of capacity 1500 KN.

ii. *Percentage of Imbibition*

Two samples in view of calculation of the imbibition. The percentage of imbibition calculates from the following formula:

$$\left(\frac{P_h - P_o}{P_o}\right).100 \qquad (1)$$

In which:

Ph: Weight of the sample moistened after 14 days,

Po: Weight of the sample before the immersion.

iii. *Percentage of Inflation*

$$\left(\frac{V_h - V_o}{V_o}\right).100 \qquad (2)$$

In which:

V_o and *Vh*: are respectively the volumes of the samples before and after the immersion during 28 days.

iv. *Stability following Marshall after immersion during 14 days*

The stability of the samples is determined after 14 days of conservation under water to the ambient temperature with the Marshall device (Figure 5).

v. *Permeability*

The seal is the fundamental quality of a mask; all samples have been tested under a water pressure of 6 kg. They are all stayed sealed after 24 hours of contact. The value of the favorite permeability must be lower to the recommended value of 5.10^{-8} cm/s [2-5].

The coefficient of permeability is calculated with the following relation:

$$K(cm/s) = \frac{q \times l}{h \times f} \qquad (3)$$

In which :

q: debit of flight of (cm^3/s),

l: the thickness of the plate of (cm),

h: pressure of (cm) of water, measured since the lower face of the plate,,

f: surface of the sample of (cm^2).

vi. *Verification of the stability on the slope*

To verify the stability of the bituminous coatings put on slope, some samples put on an inclined support of 1/1 (slope of the Bouhanifia dam) (Figure 6), and placed in an oven during 48 hours under a temperature of 70°C, the samples must distort during the test [5-7].

The results of the tests are presented in Table 3.

IV. Results and Discussion

According to the (figure 4) we noticed that the grading curve of the mixture was registered in the recommended spindle which gave us a correct composition and allowed to reduce the percentage of the voids in the mixture, this last was the most important characteristic in the bituminous concrete, because it assured its permeability and durability. It also protected the bituminous concrete from the outside effects, that's why we gave a lot of importance for that characteristic (one tried to reduce to the maximum the percentage of the voids occupied by air). The advisable value was between (1, 5% and 2, 3%). For our case one found 1.75 which is in the norms.

For the percentage of the voids between the grains, the advisable value must be superior to (16-19) % and lower to 22%. According to the Table 3, we noticed that the percentage 21.68% respected the advisable norms. Following the found results, one

noticed that all securities levels were in the norms and in the limits of the advisable securities.

Finally, concerning the verification of the stability of the samples on the tilted slope, which is the purpose of this research we found that, After the 48 hours of conservation, the samples kept their initial shapes which allowed us to determine that the bituminous concrete facing resisted indeed the elevated temperatures without risking of deforming. (Figure 6).

V. Conclusion

The gotten results and observations during the exploitation of the four Algerians dams with bituminous concrete masks are:

- Excellent holding of the upstream mask, which followed the massif deformations without losing its qualities, in spite of the slope equals 1/1 and temperatures reach 60-70 ° C.
- Competitive cost price: the mask of Ghrib cost only 1/100th of the cost of the work, that of the Ighil Emda 5/100th. These costs are lower than those of an impervious core or concrete face, taking into account local circumstances.

The bituminous concrete mask is certainly the easiest and the most economical solution that can be designed for perfect sealing of embenkement dams. The complete coating as it was executed in Bouhnifia dam doesn't present hundredth part of the cost of the work, however one takes into account the significant costs of developing the method and the high construction costs of special equipment.

The major problem of such type of masks is the surface temperature due to solar radiation, according to the conducted tests and the obtained results; we can say that the bituminous concrete mask of Bouhnifia dam resists one to one temperature (70 ° C) in spite of the absence of the thermal protection.

VI. Acknowledgments

I address my quick acknowledgment to: the technical Director of the Laboratory of the Public works of Annaba (LTP EST ANNABA), the department of hydraulics and Civil engineering, and to all that brought an efficient help for the preparation of this work, and that they find here our acknowledgments and the expressions of our deep recognition.

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Table 1 : Features of bituminous concrete facing of Bouhanifia dam

Grain diameter	(mm)	percent (%)
Gravel	18/25	20.54
	12/18	14.65
	5/12	19.96
	2.5/5	6.75
Sand	0.63/2.50	10.17
	0.28/0.63	13.90
	0.1/0.28	4.28
Filler	Smaller than 0.1	9.75
Bitumen	Penetration 80/100	8% by weigh of dry materials

Table 2 : Physical features of aggregates "mixing" and bitumen

Number of samples	Specific gravity (t/m^3)	Sand Equivalent (%)
03	2.66	77.33
Number of samples	Index penetration	Softening point
03	84	51°

Table 3 : Results Table For Bouhnifia mask

Studied characteristics	Mean obtained values	Recommended values
Density (g/cm^3)	2.39	Maximal
Creep (mm)	2.72	≤ 8.0
Stability (KN)	8.00	≥ 6.0
% Air voids	1.75	(1.5-2.3)
% Aggregate voids	21.68	> (16-19) %
Compressive strength R20 (kg/cm2)	79.62	> 30
Compressive strength R50 (kg/cm2)	19.90	> 15
Coefficient of thermal stability K_t	4.00	> 2.5
Flexibility coefficient K_e	1.50	< 2.8
Imbibition percentage (%)	0,39	< 1.50
Percentage of swelling Percentage of swelling (%)	0.39	< 0.5
Marshall stability after immersion 28 days.	9.50	> 5.4
Permeability (cm/s)	$4.10.10^{-8}$	5.10^{-8}

Figure 1 : Bouhnifia dam

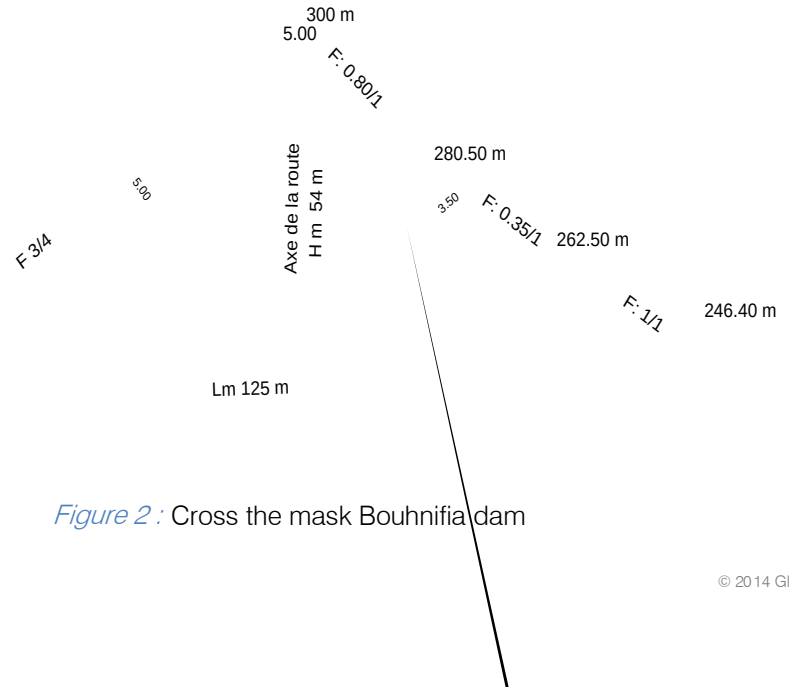

Figure 2 : Cross the mask Bouhnifia dam

Legends

1 - Hold Normal: 295.00 m.
2 - Mask tight.
3 - Masonry hourdée permeable gravel to concrete.
4 - Galleries and drainage work.
5 - Loose stones neatly arranged.
6 - Sitting slightly raised decrease the step.
7 - Rock boulders secured.
8 - Layer masonry.
9 - Berm for listing 248.00m.
10 - Filter.
11 - Drain Bonna.
12 - Pavement.
13 - Filter.
14 - Murette.
15 - Cambre colature of drainage.
16 - Layer Oliocène.

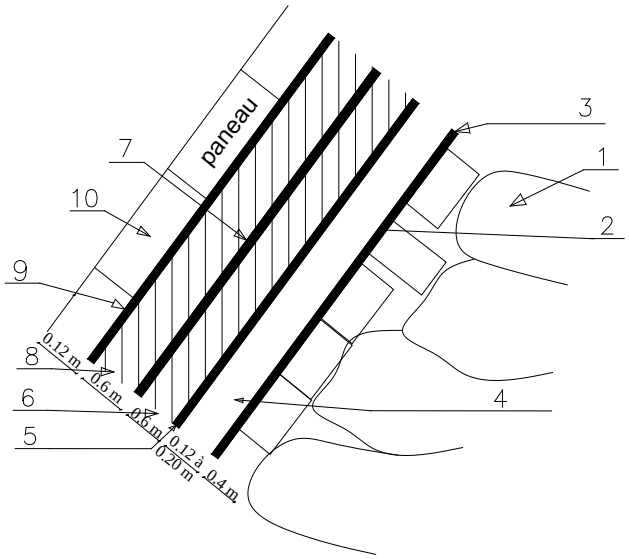

Figure 3 : Structure of the mask seal

Legends

1- Rock.
2 - Reinforcement.
3 - Coating mortar.
4 - Concrete Buidling the drainage layer.
5 - Hinge bitumen dissolved in gasoline.
6 - to 1st layer waterproof asphalt concrete.
7 - Filler bitumen fluxed with gasoline.
8 - 2nd sealed asphalt concrete layer.
9 - Paper interposed to prevent contact between the front mask and the barrier layer.
10 - Signs of the front protective mask made of reinforced concrete.

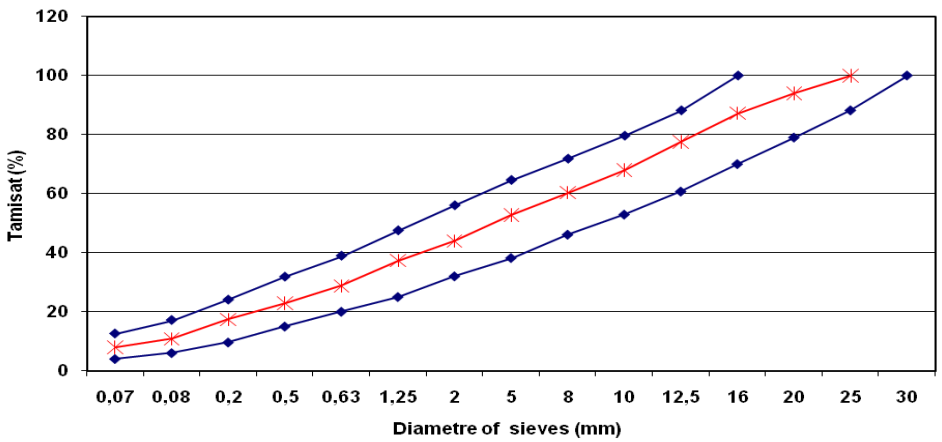

Figure 4 : Grading curve of the mixture (gravel, sand and filler)

Legends

1 - From 0.01 mm to 30 mm diameter of sieve.

2 - 0 to 100%: percentage of underflow.

3 -: Time recommended size.

4 -: Grading curve of the mask seal of Bouhnifia dam.

Figure 4 : Sections of the samples

Figure 5 : Marshall Test

Figure 6 : Specimens after storage 48 h in the oven

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Performances of OFDM/OQPSK Modulation for Optical High Speed Transmission in Long Haul Fiber over 1600 Km

By Serge Roland Sanou, François Zougmoré & Zacharie Koalaga
University of Ouagadougou, Burkina Faso

Abstract- Orthogonal Frequency Division Multiplex (OFDM) is a high-speed transmission technique widely studied in wireless networks. Its potential presents it as an ideal solution for high-speed transmission in optical fiber networks. This study presents the OFDM modulation associated with Offset Quadrature Phase Shift Keying (OQPSK) filtered using a filter banks for an optical transmission at the rate of 10 GB/s over 1600 Km in a single mode fiber (SMF). The simulations are performed in the VPI Photonics software environment. The results show that the filtered OFDM/OQPSK provides better transmission performance than the Classical OFDM/QPSK firstly because it does not require equalization to certain distances; secondly distances are greater than those achieved with the conventional OFDM in similar studies. In this study the bandwidth is maximized because we do not use the cyclic prefix (CP). Moreover the complexity of transmitters and receivers is reduced, which shows OFDM/OQPSK as an effective solution to combat the effects of the chromatic dispersion (CD), the polarization mode dispersion (PMD), the inter-symbol interference (ISI) and nonlinearities.

Keywords: ber, high-speed, OFDM, OQPSK, optical fiber.

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Performances of OFDM/OQPSK Modulation for Optical High Speed Transmission in Long Haul Fiber over 1600 Km

Serge Roland Sanou [α], François Zougmoré [σ] & Zacharie Koalaga [ρ]

Abstract- Orthogonal Frequency Division Multiplex (OFDM) is a high-speed transmission technique widely studied in wireless networks. Its potential presents it as an ideal solution for high-speed transmission in optical fiber networks. This study presents the OFDM modulation associated with Offset Quadrature Phase Shift Keying (OQPSK) filtered using a filter banks for an optical transmission at the rate of 10 GB/s over 1600 Km in a single mode fiber (SMF). The simulations are performed in the VPI Photonics software environment. The results show that the filtered OFDM/OQPSK provides better transmission performance than the Classical OFDM/QPSK firstly because it does not require equalization to certain distances; secondly distances are greater than those achieved with the conventional OFDM in similar studies. In this study the bandwidth is maximized because we do not use the cyclic prefix (CP). Moreover the complexity of transmitters and receivers is reduced, which shows OFDM/OQPSK as an effective solution to combat the effects of the chromatic dispersion (CD), the polarization mode dispersion (PMD), the inter-symbol interference (ISI) and nonlinearities.

Index Terms: ber, high-speed, OFDM, OQPSK, optical fiber.

I. Introduction

OFDM multicarrier modulation techniques have been used to transmit information using various channel transmission networks such as Wi-Fi (IEEE 802.11) or new mobile networks [1], [2]. Application to optical fiber networks is new and raises new issues as the transmission channel has different characteristics [3], [4]. Techniques related to the conventional OFDM like the implementation of an appropriate channel coding (COFDM) is used to improve the performance of OFDM on an optical medium. COFDM has been studied in our previous works [5], [6]. New solutions that can save the cyclic prefix, OFDM/OQPSK, are based on a prototype function which is better localized in time and frequency domain. Another approach is related to the use of OQPSK modulation with a filter banks to perform a good signal processing which can achieve a better performance than the classical OFDM with cyclic prefix.

In fact, the idea of using filtered OFDM/OQPSK by a filter banks is based on the fact that OFDM is a common choice that can now be replaced or supplemented by Filter Bank-based Multicarrier (FBMC) techniques which have some very interesting characteristics, like the results showed by M. Bellanger [7], [8]. Then, it seems to us as a good idea to investigate the combination of the two techniques where an OFDM/OQPSK signal is filtered by a filter banks.

Filter Banks Multicarrier approach can be seen as an evolution and an extension of the FFT approach of the OFDM. In order to keep the same size as the FFT used in OFDM, we implemented a polyphase structure.

In this context, we used to modulate subcarriers by QPSK for the generation of the OFDM baseband signal before applying the OQPSK and filter banks process.

Performance tests of the transmission chain were carried out on the basis of the Error Vector Magnitude (EVM), the Q factor (Qeff) and Bit Error Rate (BER). All these tests were performed according to the Optical Signal to Noise Ratio (OSNR).

II. Material and Methodology

a) OFDM/OQPSK data structure

The principle of the OFDM is based on the division of the transmitted signal into many sub-carriers, which makes it less sensitive to frequency selectivity, and by the extension of the OFDM symbol duration using a Cyclic Prefix (CP) of sufficient length to avoid ISI. The OFDM signal is in baseband time domain [3]:

$$S_{OFDM}(t)=\sum_{i=-\infty}^{+\infty}\sum_{k=-N_{SC}/2+1}^{k=N_{SC}/2} C_{ki}\Pi(t-iT_S)e^{j2\pi f_k(t-iT_S)} \quad (1)$$

$$S_k(t-iT_S)=\Pi(t-iT_S)e^{j2\pi f_k(t-iT_S)} \quad (2)$$

$$f_k=\frac{k-1}{t_S} \quad \Pi(t)=\begin{cases}1, (-\Delta_G \prec t \le t_S)\\ 0, (t \le -\Delta_G, t \succ t_S)\end{cases} \quad (3)$$

where $S_{OFDM}(t)$ is the OFDM signal, Δ_G is the guard interval characterizing the cyclic prefix CP and $\Pi(t)$ the rectangular function taking into account the guard interval. C_{ki} is the *i-th* information symbol of the *k-th* subcarrier, $S_k(t)$ is the waveform of the *k-th* subcarrier, N_{SC} is the number of carriers, f_k is the frequency of the

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k-th subcarrier, T_S is the symbol period, t_s is the observation period of the OFDM symbol.

In the context of OFDM/OQPSK, we don't use the cyclic prefix, so $\Delta_G = 0$. The signal at the output of the optical receiver is:

$$r(t) = e^{j(\omega_{off} t + \Delta\phi)} . r_0(t) \quad (4)$$

$$r_0(t) = S_{OFDM}(t) * h(t) \quad (5)$$

with $\omega_{Off} = \omega_{LD1} - \omega_{LD2}$ and $\Delta\phi = \phi_{LD1} - \phi_{LD2;} \omega_{LD1}$ and ϕ_{LD1} are respectively frequency and phase angular of the transmitter laser. ω_{LD2} and ϕ_{LD2} are respectively frequency and phase angular of the receiver laser. The symbol * represents the convolution product and *h(t)* is the impulse response of the optical fiber channel (SMF fiber).

OFDM has many variants and especially the one where the Cyclic Prefix is suppressed and adding an extension of the FFT approach, like FBMC. There are mainly three FBMC techniques that have been studied in the literature: Offset Quadrature Amplitude Modulation (OQAM), Cosine Modulated multi Tone (CMT), and Filtered Multi Tone (FMT). The term 'offset' refers to the time shift of half the inverse of the sub-channel spacing between the real part and the imaginary part of a complex symbol. Our goal is to address OQPSK which is a variant using QPSK modulation.

Contrary to OFDM, which transmits complex-valued symbols at a given symbol rate, OQPSK transmits real-valued symbols by introducing a half symbol space delay between the in-phase and quadrature components of QPSK symbols, it is possible to achieve a baud-rate spacing between adjacent subcarrier channels and recover the information symbol, free of ISI and Inter-Carrier Interference (ICI). The OQPSK transmitter structure used is the one presented in Figure 1. In the Receiver in Figure 2, the inverted process is achieved using an analysis filter bank.

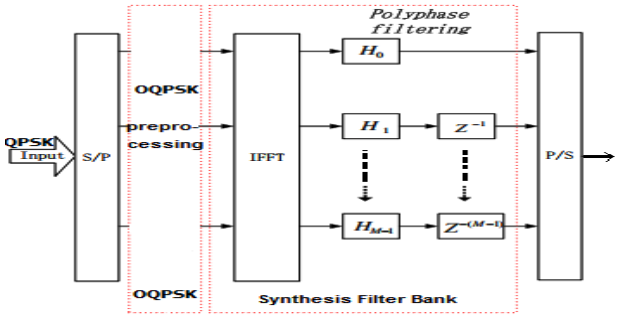

Figure 1 : OQPSK transmitter

H_0, H_1,… H_{M-1} are the prototype filter coefficients. The prototype filter design is based on the Nyquist criterion where the global Nyquist filter is generally split into two parts, a half-Nyquist filter in the transmitter and a half-Nyquist filter in the receiver.

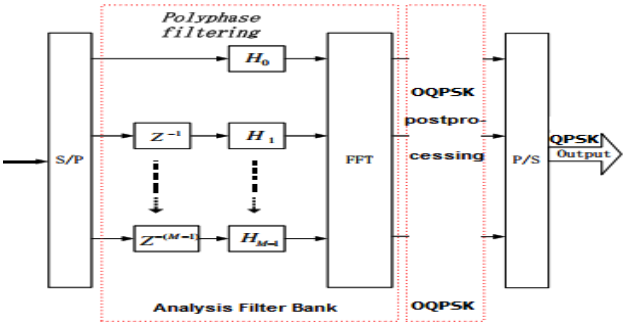

Figure 2 : OQPSK receiver

The analysis and synthesis filter banks can be expressed as functions of the prototype filter *P*[m].The symmetry condition is satisfied by the squares of the frequency coefficients of the filter [9].

$$P[m] = \bar{P}[0] + 2\sum_{k=1}^{K-1} (-1)^k \bar{P}[k] \cos\left(\frac{2\pi k}{KM}(m+1)\right) \quad (6)$$

With m =0,1,…, KM-2, the prototype filter length is L = KM±1 with M the number of subchannels and K the overlapping factor.

The frequency coefficients of the half-Nyquist filter obtained for K=4 are used for the prototype filter in the simulation and are given in Table1.

Table 1: Frequency Domain Prototype Filter Coefficients

K	H0	H1	H2	H3
4	1	0.971960	√2 / 2	0.235147

The *kth* synthesis filter is defined by [10]:

$$g_k[m] = P[m] \exp\left(j\frac{2\pi k}{M}(m - \frac{L_p - 1}{2})\right) \quad (7)$$

The *kth* analysis filter is simply a time-reversed and complex-conjugated version of the corresponding synthesis filter. So it is as follows:

$$f_k[m] = g_k^*[L_p - 1 - m] \quad (8)$$

$$f_k[m] = P[m] \exp\left(j\frac{2\pi k}{M}(m - \frac{L_p - 1}{2})\right) \quad (9)$$

b) Optical transmission chain

The digital optical transmission channel used is illustrated in Figure 3.

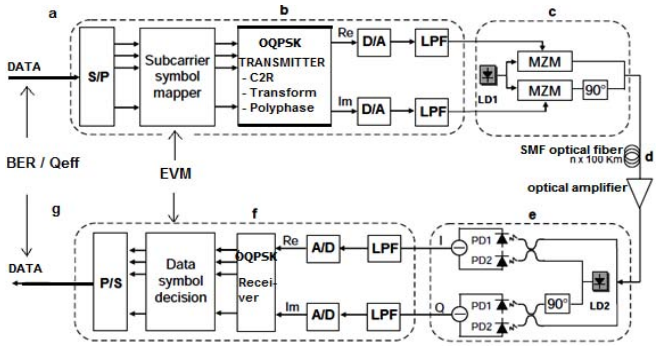

Figure 3 : OFDM/OQPSK optical transmission channel: a- data generation; b-OFDM/OQPSK transmitter; c-RF/Optical converter, d-Optical SMFfiber; e-Optical/RF Converter; f-OFDM/OQPSK Receiver g-data recovering

OFDM optical transmission chain is simulated in VPITransmissionMaker 9.1, [11] and Matlab cosimulation environments. OQPSK modulations are not available in VPITransmissionMaker. So cosimulation with Matlab is used to add specific processing.

The developed processing platform is a universe of interconnected modules where some new galaxies were created. The processing chain used is shown in Figure 4. The simulation model "OFDM for Long-Haul Transmission" available in VPITransmissionMaker was used as a model of inspiration [12].

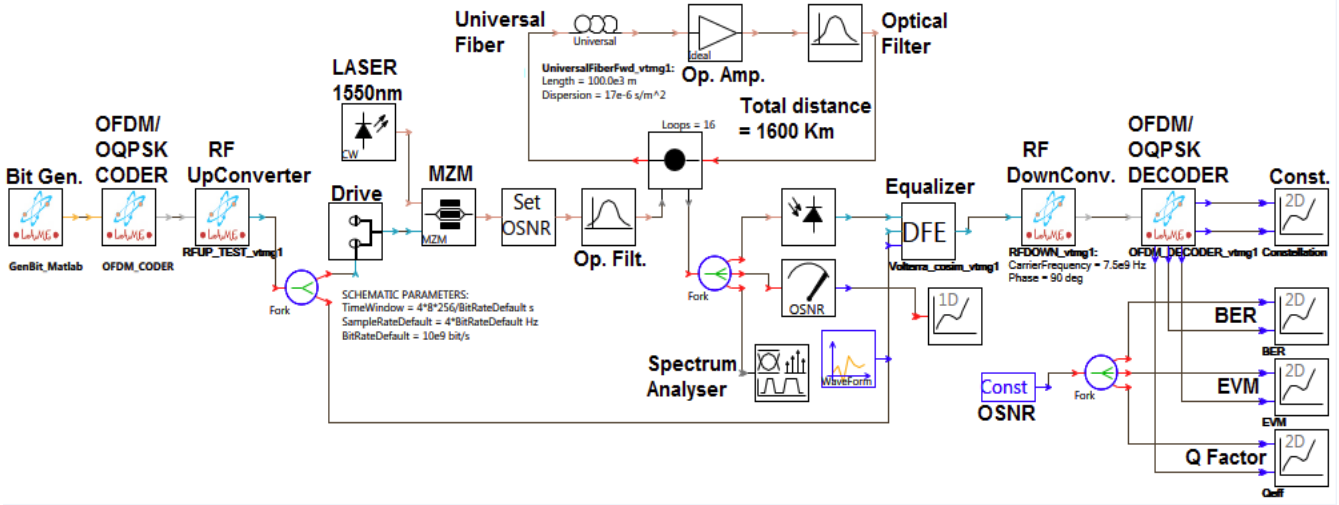

Figure 4 : Scheme of the simulation

New galaxies Bit_Gen for data randomly generation, OFDM_OQPSK_Coder for OFDM/OQPSK coding and RF_Up_Converter for frequency shifts have been implemented in the transmitter side. They have been designed using Matlab in cosimulation with VPITransmissionMaker which provide an interface for that. Figures 5, 6 and 7 show the details galaxies.

Figure 5 : Bit_Gen galaxy

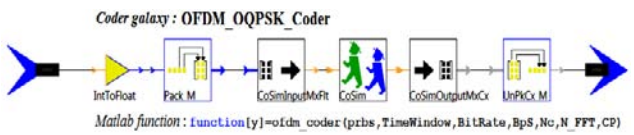

Figure 6 : Coder galaxy

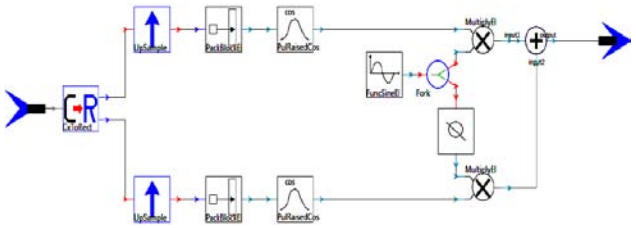

Figure 7 : RF_Up_Converter galaxy

Also new galaxies RF_Down_Converter for frequency shifts and OFDM_OQPSK_Decoder for OFDM/OQPSK decoding have been implemented in the receiver side. They have also been designed using Matlab in cosimulation with VPITransmissionMaker. Figures 8 and 9 show the details galaxies.

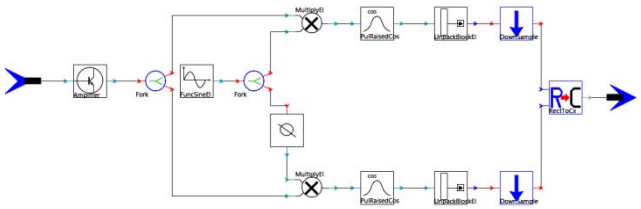

Figure 8 : RF_Down_Converter galaxy

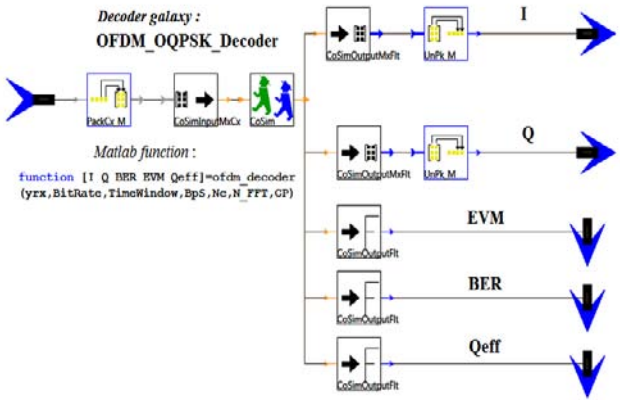

Figure 9 : Decoder galaxy

We monitor the OSNR so as to fix its successive values at the transmitter side which can influence the calculation of BER, modeling the variable effect of imperfections in the optical transmission channel. For this the galaxy Set_OSNR is used. The performances are evaluated using the OSNR measured at the receiver side before the entrance of the signal in the photodiode, by using an OSNR meter.

In order to use the successive values of OSNR in the Decoder galaxy, the OSNR meter uses a variable called OSNR that is also used as the parameter of the Const module in the global transmission chain.

An equalization process is added to the global chain to illustrate the impact of equalization in the calculation of *EVM, BER* and *Qeff* factor. For the simulation, we used the new *DFE* equalizer module which implements a Volterra equalization process available in VPITransmissionMaker 9.1.

c) Estimation of the EVM, BER, Qeff factor and OSNR

The EVM is a measure of the quality of the transmission through the quality of the demodulation.

EVM_{RMS} is the value of the root square (Root Mean Square) of the difference between the received symbols and ideals symbols, normalized. It is given by [13]:

$$EVM_{RMS} = \left[\frac{\frac{1}{N}\sum_{r=1}^{N}\left(\left(I_r - \bar{I}_r\right)^2 + \left(Q_r - \bar{Q}_r\right)^2\right)}{\frac{1}{N}\sum_{r=1}^{N}\left(I_r^2 + Q_r^2\right)} \right]^{1/2} \quad (10)$$

with $\bar{I}_r$ and $\bar{Q}_r$ the real and imaginary part of the *r-th* received symbol. I_r and Q_r are the real and imaginary part of the *r-th* ideal symbol corresponding to the *r-th* received one. The calculation of EVM_{RMS} is performed in the receiver decoding process.

The Bit Error Rate (BER) is the measuring parameter the best known of the quality of a digital transmission, and represents the ratio between the number of erroneous bits and the total number of bits transmitted. The determination of the BER is based on the following definition:

$$BER = \frac{Number\_of\_erroneous\_Bits}{Number\_of\_Transmitted\_Bits} = \frac{N_{err}}{N} \quad (11)$$

For a better estimation of BER, we used a Monte Carlo approach, which consists in a stochastic simulation with a large number of random symbols, to estimate the behavior of the system. Therefore, we can estimate that:

$$BER_{MC} = \lim_{N \to +\infty} \left(\frac{N_{err}}{N}\right) \quad (12)$$

Q factor (*Qeff*) calculation is based on the above *BER* formulas [3]:

$$BER = \frac{1}{2} erfc\left(\frac{Q_{eff}}{\sqrt{2}}\right) \quad (13)$$

$$Q_{eff} = \sqrt{2}.erfcinv(2 * BER) \quad (14)$$

$$erfc(x) = \frac{2}{\sqrt{\pi}} \int_{x}^{+\infty} e^{-t^2} dt \quad (15)$$

with $erfcinv(x)$ the inverted function of the complementary error function $erfc(x)$.

The simulation is performed under the effect of the Chromatic Dispersion (CD) and the Optical Signal to Noise Ratio (OSNR), the ratio of the optical signal power and the noise power:

$$OSNR = \frac{P_S}{P_{Noise}} \quad (16)$$

with *Ps* the power of the optical signal, P_{Noise} the total power of the noise which models the accumulation of all the noises associated with the optical transmission chain.

III. Results

The simulations helped us to plot the evolution curves of EVM as a function of OSNR. Similarly, the estimations of evolution of the BER and Q factor curves were performed according to the OSNR.

a) Received constellations and spectrums

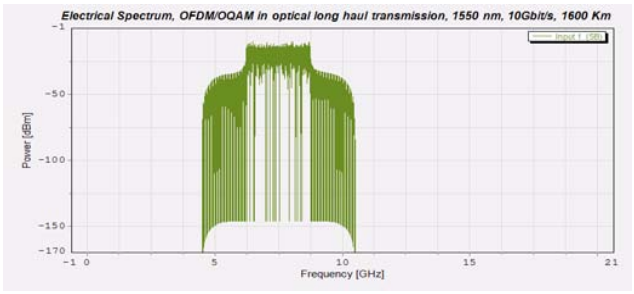

Figure 10 : Electrical spectrum received for OFDM/OQPSK

The electrical spectrum is similar to the one obtained with a OFDM/QPSK transmission

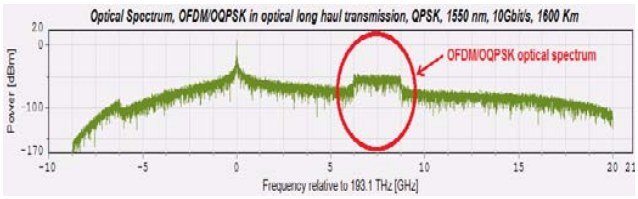

Figure 11 : Optical spectrum received for OFDM/OQPSK

The optical spectrum is also similar to the one obtained with a OFDM/QPSK transmission, due to the use of the same optical components and configuration parameters.

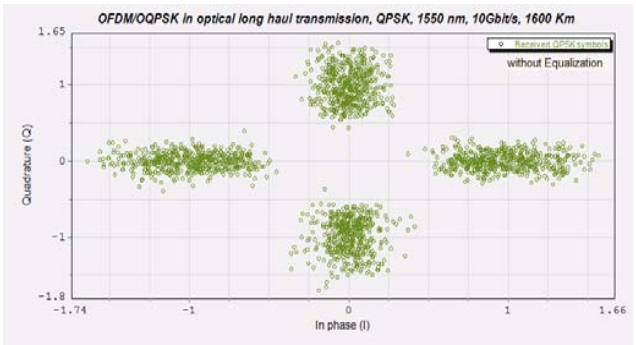

Figure 12 : Constellation received for OFDM/OQSK, without equalization

The constellation received describes the capability of OFDM/OQPSK to be designed for an optical transmission without equalization over a distance of 1600 Km.

b) EVM as a function of OSNR

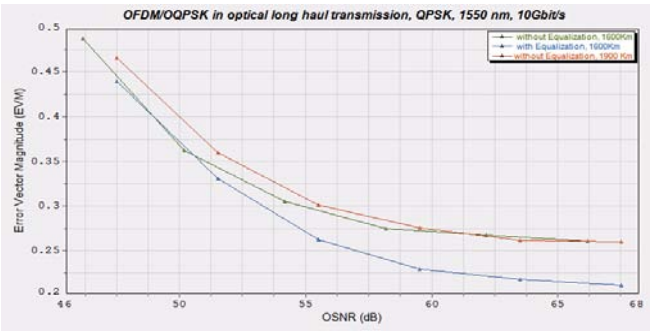

Figure 13 : EVM of OQPSK

Error Vector Magnitude shows the quality of the QPSK demodulation depending on the distance and the equalization process.

c) BER as a function of OSNR

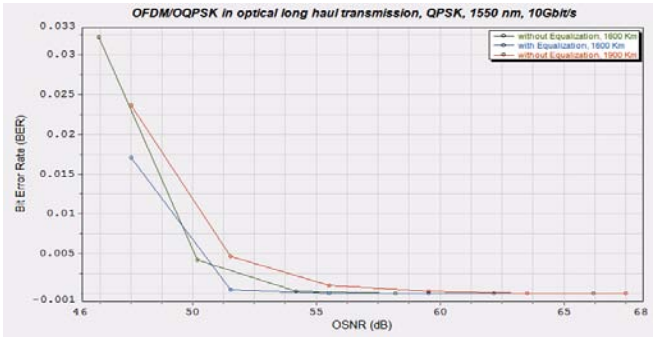

Figure 14 : BER of OQPSK

BER depends on the use of the equalization and also on the distance covered. The simulation gives the better performance over 1600 Km with equalization.

d) Qeff factor as a function of OSNR

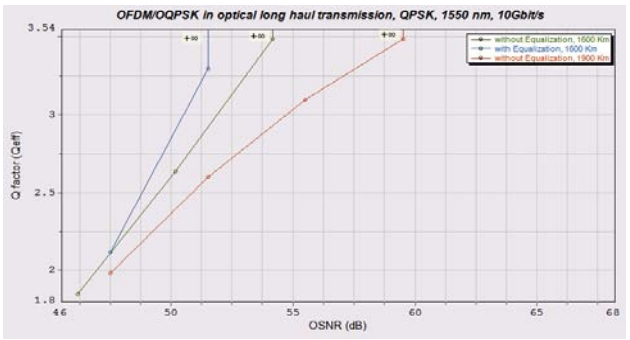

Figure 15 : Qeff of OQPSK

The results show that the Q factor, after some values, became infinite as the better quality is achieved.

IV. Conclusion

OFDM/OQPSK brings a new way of investigation that is being studied in wireless and optical

networks. The idea of using variants of OFDM is influenced by the need to strengthen the transmission capacity and the use of new modulation schemes like OQPSK that can be implemented without the use of a cyclic prefix and equalization in some cases.

The simulations showed the superiority of OFDM/OQPSK than standard OFDM with cyclic prefix for optical communications, in term of covering long distance without the need of an equalization process for modulations like QPSK. This can be useful for simple applications with the use of less complex receivers. The equalization process is mandatory for higher level modulation scheme.

Furthermore, the study of FBMC techniques for optical communication is beginning and it opens new ways of research and applications that can be used to maximize the bandwidth with better qualities of transmission for photonics networks.

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Indirect Mutual Trust and Allowing Dynamic Data for Cloud Storage System

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Abstract- Cloud Computing shifts the databases and application software to the centralized huge data centers, where the organization of the data and services can not be completely truthful. Different organizations generate a huge quantity of responsive data including private information, electronic health report, and economic information. A data owner paid for a desired level of protection and has to get some returns in case of any misbehavior dedicated by the cloud service providers (CSP). This work studies the difficulty of ensuring the reliability of data storage in Cloud Computing. In exacting, we consider the task of allowing a trusted third party (TTP), to confirm the reliability of the dynamic data stored in the cloud. Nearly all universal types of data operation, such as block insertion, deletion and modification, is also a important step toward reasonableness, while services in Cloud Computing are not limited to backup data or archive only. We studied cloud-based storage method so as to let the data owner to advantage from the services offered by the CSP and allows indirect mutual trust between data owner and CSP. It make sure that authoritative users (i.e., persons who have the right to access the owner's data or files) obtain the most recent version of the outsourced data it permits the data owner to grant access or revoke access to the outsourced data.

Keywords: access control, cloud computing, data security, data outsourcing, cloud service provider, mutual trust.

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Index Terms: access control, cloud computing, data security, data outsourcing, cloud service provider, mutual trust.

I. Introduction

Now a day in the existing time of digital world, different organizations generate a huge quantity of responsive data including private information, electronic health report, and economic information.

The local organization of such large quantity of records is challenging and expensive due to the necessities of large storage space capacity and trained personnel. For that reason, Storage-as-a-Service presented by cloud service providers (CSPs) emerged as a resolution to ease the load of huge local records storage space and decrease the preservation price through means of outsourcing data storage space. Since the owner of data physically releases responsive data to a remote Cloud Service Provider, there are a number of concern about, access control, integrity, and confidentiality of the data [2].

The confidentiality feature be able to assured by the owner via encrypting the information previous to outsourcing toward distant servers. For verifying information honesty over cloud servers, researchers have projected provable data possession method to authenticate the intactness of data stored on remote sites. To well confirm the reliability of data A number of PDP protocols have been presented, evidence of retrievability was introduced as a stronger method than PDP in the sense that the complete data file be able to reconstructed from parts of the data that are consistently stored on the servers.

Normally, traditional access control techniques believe the existence of the storage servers and the data owner in the same trust domain. This assumption, on the other hand, no longer grip after the data is outsourced to a remote Cloud Service Provider, which obtain the full charge management of the outsourced data, and The data owner lives in outside of the trust domain. A possible resolution can be obtained to allow the owner to implement right to use control of the data stored on a remote untrusted cloud service providers. Through this resolution, the information is encrypted under a assured key, which is common only with the authoritative client. As they do not have the decryption key, the illegal client, including the cloud service providers, are not capable to use the data.

This common resolution has been broadly incorporated interested in existing schemes, which aspire at providing information storage protection on remote servers which is untrusted. One more class of resolutions makes use of characteristic-based encryption to complete fine-grained retrieve control [3]. Different approaches contain examined that give confidence to the owner of data to outsource the data, and propose some type of assurance interrelated to the access control, integrity, and confidentiality of the outsourced data. These move toward avoid and identify malicious procedures from the cloud service providers side. On the additional, the CSP desires to be defended from a untruthful owner, who efforts to achieve prohibited compensations by untruly arguing data corruption above cloud servers. This concern, if not perfectly handled, can reason the cloud service providers to depart out of business [5]. In this paper, we suggest a design that deals with important concerns associated to outsourcing the storage space of data, specifically *dynamic data, newness, mutual trust,* and *access control.* The remotely accumulated data can be not just accessed by authoritative users, but as well

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updated and ranged by the owner. After modifying, authorized clients should obtain the newest version of the data, a method is essential to identify whether the received data is stale. Mutual trust between the data owner and the CSP is another imperative issue, which is attended to in the projected method. A method is introduced to establish the untruthful party, misbehavior.

Since any side is identified and the dependable party is recognized. Final but not slightest, the access control is measured, which permits the owner to revoke or grant rights of access to the outsourced data.

a) Main Contributions

Our contributions can be summarized in two main points.

i. The completion and plan of a cloud-based storage system that has the following features:

- It allows a data owner to outsource the data to a secluded CSP, and execute full dynamic operations at the block-level, i.e., it chains operations such as block insertion, modification, deletion, as well as append.
- It ensures the freshness property, i.e., the authoritative users receive the mainly fresh translation of the data.
- It establishes not direct common trust between the CSP and the data owner since each social gathering resides in a dissimilar trust domain.
- It enforces the access power for the outsourced data.

b) We talk about the security facial appearance of the future scheme. As well, we give good reason for its presentation through experimental and theoretical analysis evaluation of storage, communication, and computation overheads.

II. Related Work

Existing study work can be establish in the area of honesty verification of outsourced information, data storage security on untrusted remote servers and access control of outsourced information. The name cloud had previously come into profit-making use in the near the beginning 1990s to large Asynchronous Transfer Mode networks. In 21st century, he name ''cloud computing'' had appear, even though major focus at this instant was on Software as a Service (SaaS). They practical many technologies of user web sites like Google and Yahoo! to industry applications. They also provide the concept's like ''on demand'' and ''Software as a Service'' with their real industry and successful clients. Storage as a Service is a significant service of cloud computing referred as Infrastructure as a Service (IaaS). Amazon's Elastic Compute Cloud (EC2) and Amazon Simple Storage Service (S3) are well known examples of cloud data storage. On the other side next to with these benefits' cloud computing faces large challenge i.e. data storage security problem which is an important aspect of Quality of Service .Once client puts data on the cloud rather than locally, he has no power over it i.e. unauthorized users could modify client's data or destroy it and even cloud server plan attacks. Cloud client are mostly concerned about the security and reliability of their data in the Remote Server. Amazon's S3 [1] is such a good example.

a) Integrity Verification of Outsourced Data

For verify data integrity over cloud servers, researchers have planned provable data possession technique to validate the intactness of data stored on remote sites. A amount of PDP protocols have been offered to efficiently validate the honesty of data. Proof of retrievability was introduce as a stronger system than PDP in the logic that the entire data file can be reconstruct from portion of the data that are consistently irretrievability of files on archive service systems. Build irretrievability" (POR) model for ensure the remote data integrity. Their system combines spot-checking and error-correcting code to make sure both possession and stored on the servers. Describe a official "proof of on this model and construct a random linear function based homomorphism authenticator which enable unlimited number of query and requires less communication overhead.

b) Data Storage Security on Untrusted Remote Servers

Normally, usual right to use control techniques imagine the existence of the data owner and the storage servers within the same trust domain. This statement, though, no longer holds when the information is outsourced to a remote cloud server provider, which takes the full accuse of the outsourced data management, and reside exterior the trust area of the data owner. A practical solution can be presented to enable the owner to impose access control of the data store on a remote entrusted CSP. The information is encrypted under a convinced key, which is public only with the authorized users. The unauthorized clients, including the cloud service provider, are incapable to access the information seeing as they do not have the decryption key. This common answer has been widely built-in into existing schemes, which plan at provided that data storage security on entrusted remote servers. A few authorized users of the information have the concession to read and write, while others can only read the information. A data owner encrypts the blocks with same information keys which are encrypted by using a master public key. The data owner keep a master private key to decrypt the same data keys.

c) Access Control of Outsourced Data

The idea of over-encryption to impose access control has also been used by Wang et al. In their system, the owner encrypts the data block-by-block, and construct a binary tree of the block keys. The binary tree enable the owner to decrease the number of keys

given to each client, where different keys in the tree can be generate from one general parent node. The remote storage server performs over-encryption to avoid revoke clients from receiving access to simplified data blocks. Another class of answer utilizes attribute-based encryption to accomplish fine-grained access control. but these system do not implement mutual trust between the data owner and the remote servers. Different approach have been investigate that give confidence the owner to outsource the information, and offer some sort of guarantee related to the privacy, integrity, and access control of the outsourced data. On the another way, the CSP needs to be protected from a untruthful owner, who attempts to get unlawful compensations by falsely claiming data dishonesty over cloud servers. This fear, if not correctly handle, can cause the CSP to go out of industry. In this job, a system is planned that addresses important issue linked to outsourcing the storage of data, namely privacy, integrity and access control. Mutual trust in between the data owner and the CSP is another vital issue, address in the proposed system. A mechanism is introduced to determine the untruthful party, i.e. naughtiness from any side is detected and the answerable party is recognized.

The proposed cloud-based storage system has the following features:

i. It allow a information owner to outsource the data to a cloud service provider, and it ensure that only authorized client (i.e., Those who have the true to access the owner's file) receive the outsourced data i.e. It enforce the right of entry control of the outsourced data.

ii. It establishes indirect mutual trust in between the data owner and the cloud service providers since each party reside in a dissimilar trust field.

III. Our System and Assumptions

a) System components and relations

i. *Data owner*

That can be the group / separate generating complex or sensitive data to be stored in the cloud and made accessible for controlled outside use.

ii. *Cloud Service Provider (CSP)*

Who achieves cloud servers and provides paid storage interplanetary on its substructure to store the holder's or owner's files and make them accessible for approved users.

iii. *Authorized users*

A set of owner's clients who have the right to right of entry the inaccessible information.

iv. *Trusted third party (TTP)*

An entity who is important by all other method components, and has skills to detect/require untruthful parties. The cloud computing storage classic well-thought-out in this work contains of four main components as showed in Figure 1. The relationships between dissimilar method components are characterized by double-sided arrows, where hard and sunk arrows represent belief and disbelief relationships, correspondingly. For example, the data owner, the authorized users i.e. client and the CSP (cloud service provider) trust the TTP (Trusted Third Party). On the further hand, the data owner and the authorized users have shared distrust relationships with the CSP. Therefore, the TTP is used to permit incidental shared trust between these three components. There is a through belief relationship among the data owner and the authorized users.

b) Outsourcing and Accessing

For secrecy, the owner encrypts the information earlier sending to cloud servers. To admittance the data, the approved user sends a data-access invitation to the CSP, and receives the information file in an encrypted form that can be decrypted using a top-secret key created by the approved user. It is supposed that the communication between the owner and the authorized users to validate their individualities has previously been completed, and it is not well-thought-out in this work. The TTP is a self-governing entity, and therefore has no inducement to scheme with any party. Though, any thinkable leakage of data in the way of the TTP must be prohibited to save the outsourced data private. The TTP and the CSP are continuously online, while the owner is spasmodically online. The approved users are able to access the information file from the CSP smooth when the owner is offline [9].

c) Threat Model

The CSP is entrusted, and therefore the concealment and honesty of information in the cloud may be at danger. For financial inducements and keeping a status, the CSP may hide information loss, or regain storage by clearance information that have not been or is infrequently accessed. On the further hand, a data owner and authorized users may scheme and untruthfully accuse the CSP to become a certain amount of recompense. They may untruthfully claim that data honesty over cloud servers has been dishonored [9].

d) Security Requirements

i. *Confidentiality*

Outsourced information must be confined from the trusted third party, the cloud service provider, and clients that are not access.

ii. *Integrity*

Outsourced information is required to remain integral on cloud servers. The data owner and authorized users must be enable to identify data dishonesty over the cloud service provider area.

iii. *Access Control*

Only authorized client are permissible to access the outsourced information.

iv. *CSP's defense*

The cloud service provider must be protected against false accusation that may be claim by dishonest owner/users, and such a hateful behavior is required to be exposed.

IV. Proposed Framework

a) Existing System

A directly promote result to detect corrupted from any side is from end to end digital signatures. For each file owner attaches digital signature earlier than outsourcing. The CSP (cloud service provider) first checked digital signature of owner before storing data on cloud. In case of unsuccessful confirmation, the CSP discards to store data and asks the holder to resend the accurate signature. If the signature is applicable, equally the file and signature are stored on the cloud servers. The digital signature achieves non-repudiation from the holder side. When an authoritative user (or the holder, or the owner) needs to get back the data file, the CSP sends file, CSP's signature and owner's signature on (file || owner's signature). The authorized user first checks the CSP's signature. In case of unsuccessful verification, the user asks CSP to re-perform the communication process. If CSP's signature is applicable, the user then checks owner's signature. If authentication fails, this indicates the dishonesty of data more than the cloud servers. The CSP cannot reject such dishonesty for the owner's signature is before checked and stored by the CSP next to with file. Because CSP's signature is connected with the established data, a dishonest owner cannot wrongly accuse the CSP as regards data reliability. The over explanation increases the storage transparency on cloud as owner's signature is stored next to with the file on cloud servers. Furthermore, there is an improved calculation overhead; CSP has to checked signature of owner earlier than storing file on cloud, and the authorized user checks two signatures for each acknowledged file. If the CSP receives file from trusted person other than the owner, the signature authentication is not needed since the trusted entity has no motivation for negation or agreement. Therefore, delegating minute part of owner's work to the TTP reduces both the computation and storage overheads. But the outsourced information must be kept private and any escape of data toward the TTP must be not permitted.

V. System Preliminaries

a) Lazy Revocation

The future system in this work allows the data owner to cancel the right of some users for accessing the outsourced data. In lazy revocation, it is suitable for users to read (decrypt) unchanged data blocks. However, modernized or new blocks must not be accessed by such cancelled users.

The idea is that allowing cancelled users to read unchanged information blocks is not a important loss in security. This is corresponding to accessing the blocks from cashed copies. Restructured or new blocks following a revocation are encrypted underneath latest keys. Lazy revocation trades re-encryption and data access charge for a degree of protection. However, it causes destruction of encryption keys, which is data blocks could have more than one key [5].

b) Key Rotation

Key rotation is a method in which a sequence of keys can be generated from an primary key and a master top secret key [7].

The progression of keys has two main properties:

- Only the owner of the master top secret key is able to generate the next key in the progression from the recent key, and
- Any authoritative user significant a key in the sequence is able to generate all before versions of that key. In other words, known the i-th key Ki in the sequence, it is computationally infeasible to compute keys Kl for $l > i$ exclusive of having the master top secret key, but it is straightforward to compute keys Kj for $j < i$.

The first property enables the data owner to cancel access to the data by producing latest keys in the progression, which are used to encrypt modernized/new blocks following a revocation (lazy revocation).

It is proposed to avoid a user cancelled during the i-th time from receiving access to data blocks encrypted during the l-th time for $l > i$. The second property allows authoritative users to maintain access to blocks that are encrypted underneath older versions of the recent key.

It enables the data owner to shift only a single key Ki to respected users for accessing all data blocks that are encrypted under keys Kig (rather than transferring a potentially large set of keys fK1;K2; : : : ; Kig). Therefore, the second property reduces the communication overhead on the holder side. The proposed scheme in this work utilizes the key rotation method]. Let N = pq denote the RSA modulus (p&q are prime numbers), a public key = (N; e), and a master top secret key d. The key d is acknowledged only to the data owner, and ed = 1 mod (p- 1) (q - 1).

Whenever a user's access is cancelled, the data owner generates a latest key in the progression (rotating forward). Let ctr point to the index/version number of the recent key in the keys progression.

The owner generates the next key by exponentiation Kctr with the master top secret key d: Kctr+1 = Kdctr mod N. Authoritative users can recursively generate older versions of the current key by exponentiations with the public or unrestricted key component e:Kctr-1 = Kectr mod N (rotating

backward). The RSA encryption is used as a pseudorandom digit generator; it is not likely that frequent encryption consequences in cycling, for if not, it can be used to thing the RSA modulus N [7].

c) Broadcast Encryption

Broadcast encryption (bENC) allows a presenter to encrypt a message for an chance subset of a collection of users. The users in the subset are only acceptable to decrypt the message. However, even if all users outside the subset scheme they cannot access the encrypted message. Such systems have the agreement struggling property, and are used in lots of practical applications as well as TV contribution services and DVD content protection. The proposed method in this work uses bENC to implement access control in outsourced data [9].

The bENC is together of three algorithms: SETUP, ENCRYPT, and DECRYPT.

i. *Setup*

This algorithm takes as contribution the number of system users n. It defines a bilinear group G of major order p with a generator g, a repeated multiplicative group GT, and a bilinear map ê : G×G → GT, which has the properties of bilinearity, computability, and no degeneracy.

The algorithm picks a unsystematic α ϵ Zp, computes gi = g(αi) ϵ G for i = 1,2,...,n,n+2,...,2n, and sets v = gβ ϵ G for β ϵ R Zp. The outputs are a public key PK = (g, g1,...,gn, gn+2,...,g2n,v) ϵ G2n+1, also n private keys {di}1≤i≤n, where di = gi β ϵ G.

ii. *Encrypt*

This algorithm takes as contribution a subset S ϵ {1,2,...,n}, and a public\key PK. It outputs a couple (Hdr, K), where K is a message encryption key And Hdr is called the header (broadcast cipher text). Hdr = (C0, C1) ϵ G2, wherever for t ϵ R Zp, C0 = gtas well as C1 = (v •πj ϵ S gn+1−j)t.

The key K = ê(gn+1, g)t is used to encrypt a message M (symmetric encryption) to be transmit to the subset S.

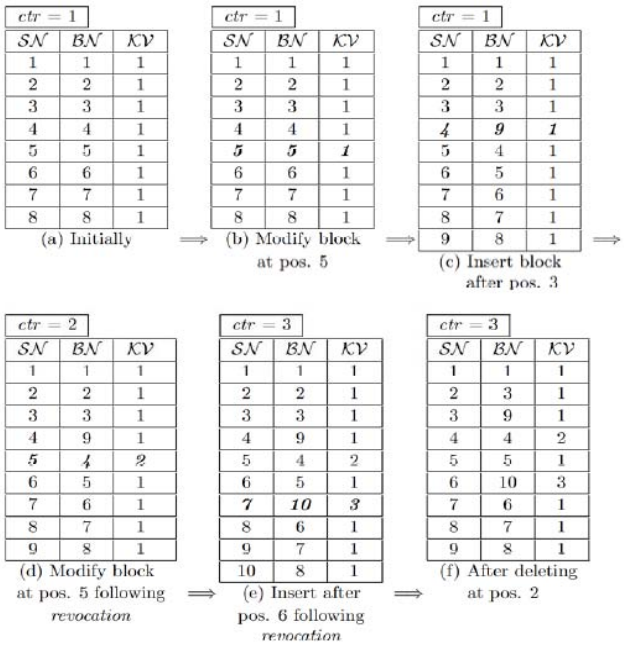
iii. *Decrypt*

This algorithm takes as contribution a subset S ϵ {1,2,...,n}, a user-ID i ϵ {1,2,...,n}, the private key di for user i, the header Hdr = (C0,C1), and the public key PK. If i ϵ S, the algorithm outputs the key K = ê(gi,C1)/ê(di • π j ϵ S ,j≠I gn+1−j+i,C0), which can be used to decrypt the encrypted description of M.

In the above structure of the bENC, a private key contains only one factor of G, and the broadcast cipher text (Hdr) consists of two factors of G. On the further hand, the public key PK is comprised of 2n + 1 factors of G. A second structure, which is a simplification of the first one, was accessible in to trade the PK size for the Hdr size. The main idea is to run several parallel instances of the first structure, where each instance can broadcast to at most B users. Setting B= [√n] results in a system with O(√n) factors of G for each of PK and Hdr. The private key is at a standstill just one factor.

d) Block Status Table

The Block Status Table (BST) is a minute dynamic data structure used to restructure and access file blocks outsourced to the CSP. The BST consists of three columns: Serial Number (SN), Block Number (BN), as well as Key Version (KV). SN is an indexing to the file blocks. It indicates the physical location of each block in the information file. BN is a counter used to build a logical numbering/indexing to the file blocks. Therefore, the relation between BN and SN can be viewed as a mapping between the logical number BN and the physical location SN. KV indicates the report of the key that is used to encrypt every block in the data file [9].



The BST is implemented as a connected list to make things easier the insertion and deletion of table entries. During completion, SN is not required to be store in the table; SN is measured to be the entry/table index. Thus, each table entry contains just two integers BN and KV (8 bytes), i.e., the total table size is 8m bytes, where is the number of file blocks. When a information file is initially created, the owner initializes both ctr and KV of each block to 1. If block alteration or addition operations are to be perform following
a revocation, ctr is incremented by 1 and KV of that customized/new block is set to be equal to ctr.

Fig. 2: change in BST Due to Different active Operation on a File F={bj}1≤j≤8 When a data file is initially created, the data owner initializes both ctr and KV of each block to 1. If block alteration or placing operations are to be performed following a revocation, ctr is incremented by 1 and KV of that customized/new

block is set to be equal to ctr .Figure shows some examples representing the changes in the BST due to dynamic operations on a data file F = {bj}1≤j≤8. When the file blocks are initially formed (Fig.(a)), ctr is initialized to 1, SNj =BNj = j, and KVj = 1: 1≤ j ≤ 8. Fig. (b) Shows no modify for update the block at location 5 since no revocation is performed. To add a new block after location 3 in the file F, Fig. (c) shows that a new entry h4,9,1i is added in the BST after SN3, where 4 is the physical location of the newly added block, 9 is the new logical block number compute by incrementing the maximum of all previous logical block numbers, and 1 is the version of the key used for encryption.

A first revocation in the scheme increments ctr by 1 (ctr = 2). Modifying the block at position 5 following a revocation (Fig.(d)) answers in setting KV5 = ctr. Thus, the table entries at location 5 become h5, 4, 2i. (Fig. (e)) shows that a new block is to be added after position 6 following a second revocation, which Increments ctr to be 3. In Fig. (e), a new table entry h7, 10, 3i is insert after SN6, where KV7 is set to be equal to ctr (the Most recent key version). Deleting a block at position 2 from the Data file requires deleting the table entry at SN2 and shifting all Ensuing entries one position up. Note that during all Dynamic operations, SN indicates the real physical positions of the information blocks in F.

VI. Experimental Evaluation

In this sector we experimentally calculate the computation overhead the planned scheme passes to a cloud storage system that has been commerce with static data with only confidentiality requisite. The experiments are showed using .NET on a method with an Intel(R) Xeon (R) 2-GHz processor and 3GB RAM running Windows XP. We are use algorithms hashing, broadcast encryption and digital signatures are executed using MIRACL library version 5.5.4. For a 128-bit safekeeping level, bENC uses an elliptic curvature with a 256-bit set order. In the experiments, we apply SHA-256, 256-bit BLS mark, and Barreto-Naehrig (BN) curvature defined over major field GF(p) with p = 256 bits and inserting degree = 12 (the BN curve with these limits is provided by the MIRACL library).

To assess the computation overhead on the owner or holder side due to dynamic actions, we execute 100 different block processes from which 50% are executed following cancelations (this percent is higher than an regular value in real applications). Scalability (i.e., how the method performs when more operators are added) is an main feature of cloud storage systems. The access regulator of the proposed scheme be contingent on the square root of the complete number of method users.

In the poorest case, the TTP executes only 4 hashes per dynamic demand to reflect the modification on the outsourced data. Thus, the maximum computation overhead on the TTP side is near 0.08 milliseconds, i.e., the proposed system brings light overhead on the TTP during the ordinary method actions. The computation overhead on the user side due to data access comes from five features separated into two groups.

The first group includes signatures confirmation and hash actions to confirm the acknowledged data (file and table). The second group includes broadcast decryption, backward key replacements, and hash actions to calculate the DEK. The first set costs about 10.77 seconds, which can be simply unknown in the getting time of the data (1GB file and 2MB table). To consider the computation time of the second set, we access the file later running 100 dissimilar block actions (50% of them are done subsequent revocations). Furthermore, we implement the regressive key rotations in the adjusted way. The second set costs around 1.03 seconds, which can be measured as the user's computation overhead due to information access.

As a reply to the information access appeal, the CSP computes two signatures: F and T. Thus, the computation overhead on the CSP lateral due to information access is about 10.75 seconds and can be simply unseen in the broadcast time of the data (1GB file and 2MB table).

To classify the corrupt party in the method in case of disagreements, the TTP authenticates two initials (F and T), computes joint hashes for the information (file and table), and relate the calculates hashes with the reliable values (THTTP and FHTTP). Therefore, the computation overhead on the TTP adjacent is about 10.77 seconds. Finished our experiments, we use individual one desktop computer to fake the TTP and achieve its work. In practice, the TTP may select to divide the work amongst rare devices or use a only device with a multi-core processor which is attractive dominant these days, and therefore the computation time on the TTP lateral is meaningfully reduced in several applications.

VII. Conclusion

Cloud provides a higher security and privacy to our data by maintaining encryption and decryption standards. Our data is provided with better security and data integrity due to cloud and the main aim of our system helps to support features like privacy, integrity, access control of the information. The cloud is planned that allow owner to advantage from facilities offered by the cloud service provider and enable indirect mutual trust in between them. To decide dispute that may occur concerning data honesty, a trusted third party is invoke to determine the untruthful party (owner/users or Cloud Service Provider).

We have some of the safety features into our system which are prior such as data privacy,

recognisation of data integrity, use of Trusted Third Party and finding untruthful owner. Data privacy is based on the safety of underlying encryption algorithm. Recognition of data integrity abuse base on the primate and second-primate confrontation properties of the utilize cryptographic hash function enforcement of right to use control based on Trust third party gives encrypted key to only authorized client and only authorized client can decrypt this key and get the key to study the outsourced data and finding of untruthful owner/user through a TTP.

So all above mentioned feature enhances our system and provide it with features such as privacy, integrity and data control which we have implemented into our system.

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Mobile WiMAX and 3rd Generation Cellular Technology (3G) Link Budget Calculation

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Abstract- In this paper cell range for different region and modulation schemes has been calculated for WiMAX and 3G mobile technologies, considering both as a cellular mobile technology. While resolving the cell range using different propagation models, effect of various parameters like frequency, base station antenna height, transmitting power, maximum allowable path loss and SNR over cell range have also been studied. Analysis has been done for both uplink and downlink. From the study it reveals that for downlink, cell range increases with increasing transmitting power and decreases with frequency and SNR. For uplink, cell range decreases with SNR. When adaptive modulation advances, it affects cell range significantly for parameters such as frequency, base antenna height and SNR.

Keywords: link budget, path loss models, WiMAX, 3G, modulation schemes, cell range.

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Mobile WiMAX and 3rd Generation Cellular Technology (3G) Link Budget Calculation

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Abstract- In this paper cell range for different region and modulation schemes has been calculated for WiMAX and 3G mobile technologies, considering both as a cellular mobile technology. While resolving the cell range using different propagation models, effect of various parameters like frequency, base station antenna height, transmitting power, maximum allowable path loss and SNR over cell range have also been studied. Analysis has been done for both uplink and downlink. From the study it reveals that for downlink, cell range increases with increasing transmitting power and decreases with frequency and SNR. For uplink, cell range decreases with SNR. When adaptive modulation advances, it affects cell range significantly for parameters such as frequency, base antenna height and SNR.

Keywords: link budget, path loss models, WiMAX, 3G, modulation schemes, cell range.

I. Introduction

WiMAX, based on the IEEE 802.16 standard, offers full mobility of cellular networks with high broadband speeds. Both fixed and mobile versions of WiMAX are there to provide broadband wireless services. All these technologies of cellular mobile networks are evolving to meet different user requirements **[1].**

3G mobile technologies support high bandwidth communications in addition to voice. It is based on one of the several standards included under the ITU's IMT-2000. ETSI developed two standards for IMT-2000, one of them is UMTS and other is CDMA2000 **[2].**

This paper calculates the link budget incorporating the various system parameters which leads to evaluate the cell range of mobile WiMAX and 3G network. In calculations system parameters are taken in the allowable range.

II. Link Budget & Path Loss Models

a) Link Budget

A link budget is the accounting of all of the gains and losses from the transmitter, through the medium (free space, cable, waveguide, fiber, etc.) to the receiver in a telecommunication system. It accounts for the attenuation of the transmitted signal due to propagation, as well as the antenna gains, feed-line and miscellaneous losses. A simple link budget equation looks like this:

Received Power (dBm) = Transmitted Power (dBm) + Gains (dB) - Losses (dB). **[3]**

The calculation of link budget of mobile WiMAX and 3rd Generation Cellular Technology incorporates different types of modulation schemes like QPSK, I6QAM, 64QAM etc. Each modulation scheme offers different data rate and as the modulation scheme advances the data rate usually increases. Support for QPSK, 16QAM and 64QAM are mandatory in the DL with Mobile WiMAX. In the UL, 64QAM is optional **[4].**

The Link Budget as well as the cell range that we have calculated here is based on propagation models such as Free Space Path Loss model, COST-231 model (Modified Hata model), Walfish-Ikegami model, Erceg-Greenstein model.

b) Path Loss Models

i. *Free Space Model*

The free space loss (FSL) equation-

$$FSL = 32.45 + 20\log(f_c) + 20\log(d) \text{ dB} \quad (1)$$

Here, d =distance between Base Station (BS) and Mobile Station (MS), f_c = carrier frequency.

ii. *Erceg-Greenstein (E-G) Model (Suburban Areas):*

$$Path\ loss = A + 10\gamma \log\left(\frac{d}{d_0}\right) + \left(\Delta PL_f + \Delta PL_h\right) + s \text{ (dB) [1] [5] [6]} \quad (2)$$

Here,

A = free space path loss, γ = path loss exponent, ΔPL_f = frequency correction term, ΔPL_h = receiver antenna height correction term, s= log normal fading, d = BS to MS distance (Km), d_0 = 0.1Km (Chooses as reference distance).

These parameters can be calculated as –

$$A = 20\log(4\pi d_0/\lambda) \quad (3)$$

$$\gamma = a - bh_b + c/h \quad (4)$$

$$\Delta PL_f = 6\log(f/2000) \quad (5)$$

$$\Delta PL_h = -10.8\log(h_m/2) \text{ ; For terrain A and B} \quad (6)$$

$$= -20.0\log(h_m/2) \text{ ; For terrain C [6]} \quad (7)$$

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We Assume, λ = carrier wavelength (m), h_b = base station (BS) height (m), h_m = mobile station (MS) height (m), f = carrier frequency

The maximum path loss category is hilly terrain with moderate-to-heavy tree densities (Category A). The minimum path loss category is mostly flat terrain with light tree densities (Category C). Intermediate path loss condition is captured in Category B. [6]

a, b, c are constants dependent on the terrain category: [5] [6]

Constant	Terrain A	Terrain B	Terrain C
a	4.6	4.0	3.6
b	.0075	.0065	.005
c	12.6	17.1	20.0

iii. *Cost-231 Model (Modified Hata Model)*

We have used Cost 231 propagation model for Mobile WiMAX and 3G coverage area calculations allowing for urban, rural and open areas.

The Hata formula is being used for many applications but its main disadvantage is that it is developed for frequencies below 2 GHz. In order to use it for the envisioned frequencies of the non line-of-sight systems beyond 3G, the original formula has to be extrapolated to frequencies up to 6 GHz. [7].

The result is provided by the equation:

$$Path\ loss = 46.3 + 33.9\log(f_c) - 13.82log(h_b) - a(h_m) + (44.9 - 6.55\log(h_b))log(d) + C_M \text{ (dB) [7]} \quad (8)$$

Where, C_M = 0 (dB) for medium sized city and sub-urban areas and 3 (dB) for metropolitan centers. $a(h_m)$ = correction factor for effective mobile antenna height, f_c = carrier frequency

$$a(h_m) = (1.1logf_c - 0.7)h_m - (1.56logf_c - 0.8)dB; \text{ For small to medium sized city} \quad (9a)$$

$$= 8.29[\log(1.5h_m)]^2 - 1.1\ dB; \text{ For large city and for } f_c \leq 300 \text{ MHz} \quad (9b)$$

$$= 3.20[\log(11.75h_m)]^2 - 4.97\ dB; \text{ For large city and for } f_c > 300\text{MHz [8]} \quad (9c)$$

According to different locations the path loss (PL) equations are as follows:

$$PL(Sub-Urban) = PL(Urban) - 2[\log(f_c/28)]^2 - 5.4 \text{ (dB)} \quad (10a)$$

$$PL(Rurual) = PL(Urban) - 4.78[\log(f_c)]^2 + 18.33\log(f_c - 35.94) \text{ (dB)} \quad (10b)$$

$$PL(Open) = PL(Urban) - 4.78[\log(f_c)]^2 + 18.33\log(f_c - 40.94) \text{ (dB)} \quad (10c)$$

iv. *Walfish-Ikegami (W-I) Model*

The Walfish-Ikegami model (street canyon model) that includes ground reflections is more realistic than the others as it is based on measurements [7].

$$Path\ loss = 42.64 + 20\log(f_c) + 26\log(d);\ d \leq d_{break} \quad (11a)$$

$$Path\ loss = 42.64 + 20\log(f_c) + 26\log(d_{break}) + 40\log(d/d_{break});\ d > d_{break} \quad (11b)$$

Where, $d_{break} = \frac{4h_b h_m}{\lambda}$ [7] and λ is the carrier wavelength.

Although climate impacts such as rain and fog can result in extra attenuation, they are considered negligible in our calculations for frequencies between 2 and 6 GHz [7].

III. Simulation and Results

Four kinds of regions are selected for link budget calculations and they are open, rural, sub-urban and urban. But in this paper our emphasis is on the large cities.

For downlink frequency range is taken 1900-3500 MHz (WiMAX) and 1800-2100 MHz (3G), base station height range is taken 10-50 m, power per antenna range is taken 5-30 Watts, SNR range is taken from -9 to 9 dB and maximum allowable path loss range is taken from 100 to 200 dB. All these parameters are considered for QPSK 1/8, QPSK 1/2. For uplink frequency, maximum allowable path loss and SNR have the same ranges as downlink. And the modulation schemes are also same.

Figure 1 through Figure 6 demonstrate that the cell range varies with varying different system parameters like power per antenna, carrier frequency, SNR etc both for WiMAX and 3G network.

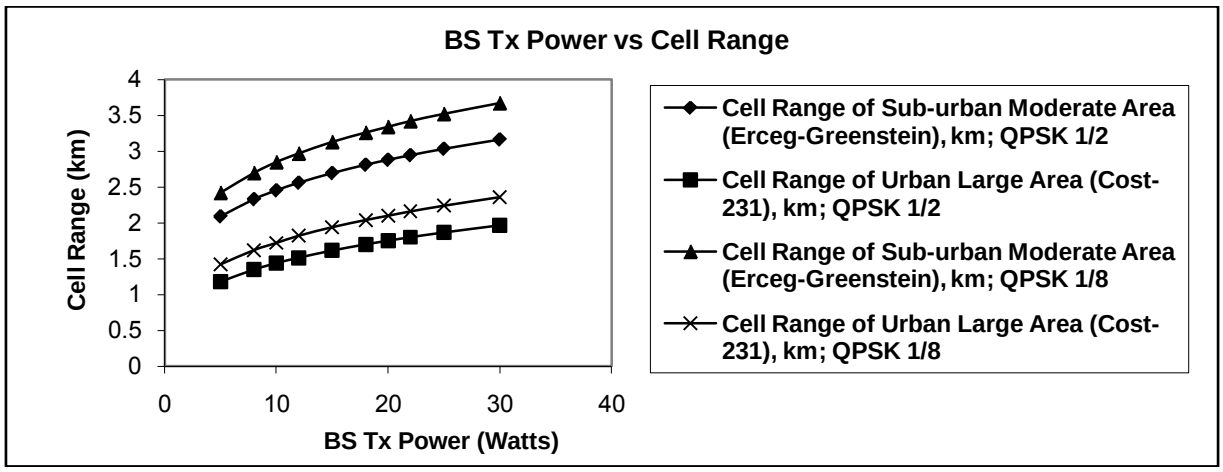

Figure 1 : Graphical representation of BS Tx Power vs Cell Range of WiMAX for downlink

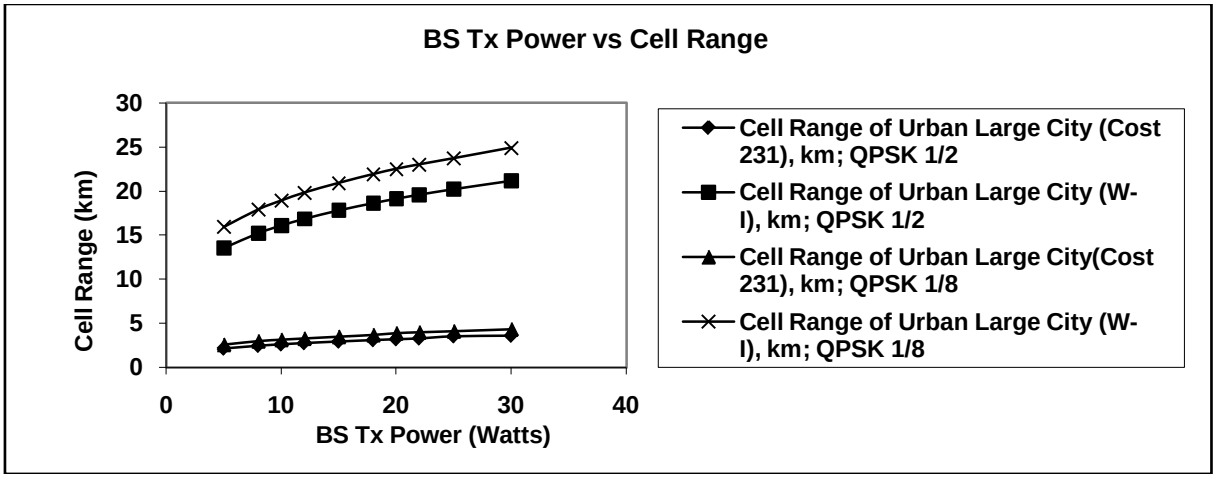

Figure 2 : Graphical representation of BS Tx Power vs Cell Range of 3G for downlink

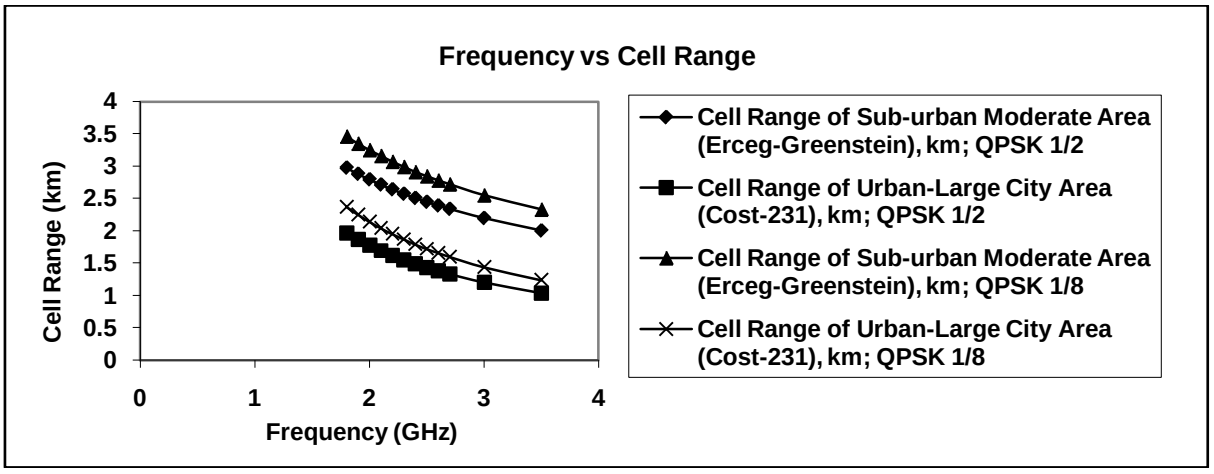

Figure 3 : Graphical representation of Frequency vs Cell Range of WiMAX for downlink

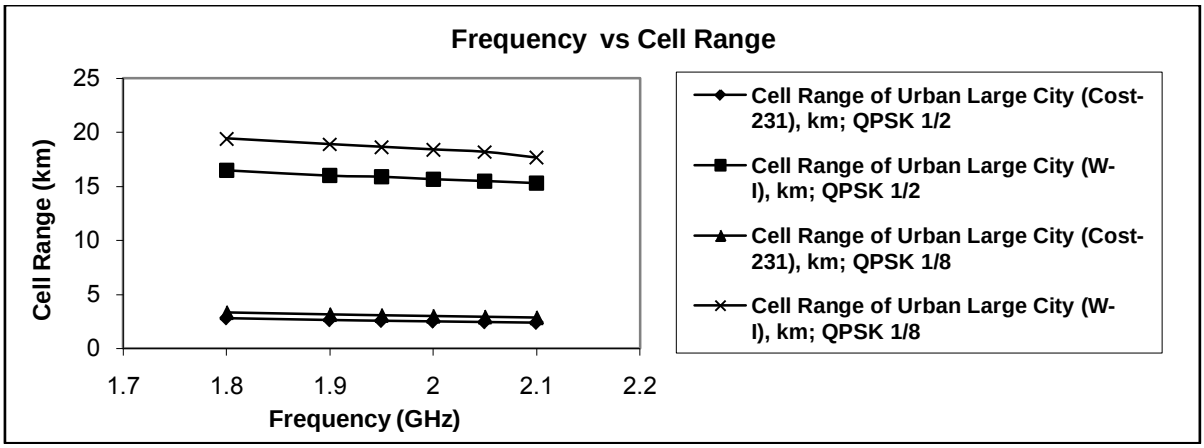

Figure 4 : Graphical representation of Frequency vs Cell Range of of 3G for downlink

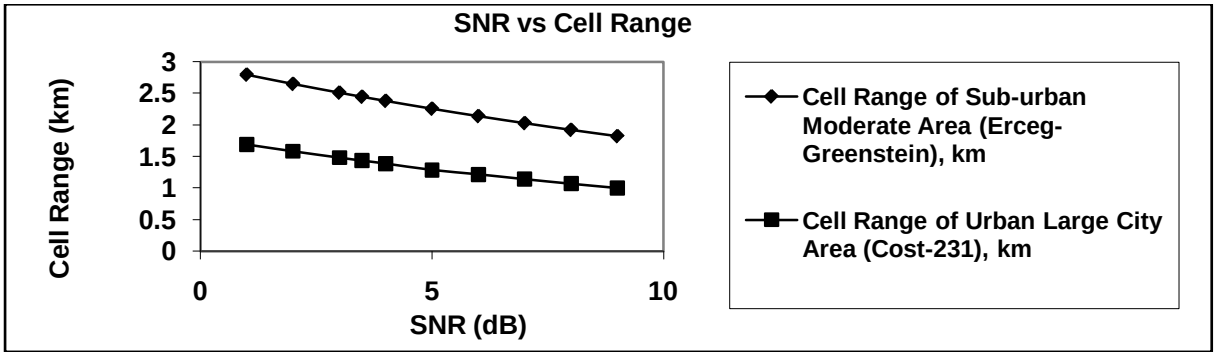

Figure 5 : Graphical representation of SNR vs Cell Range of of WiMAX for downlink

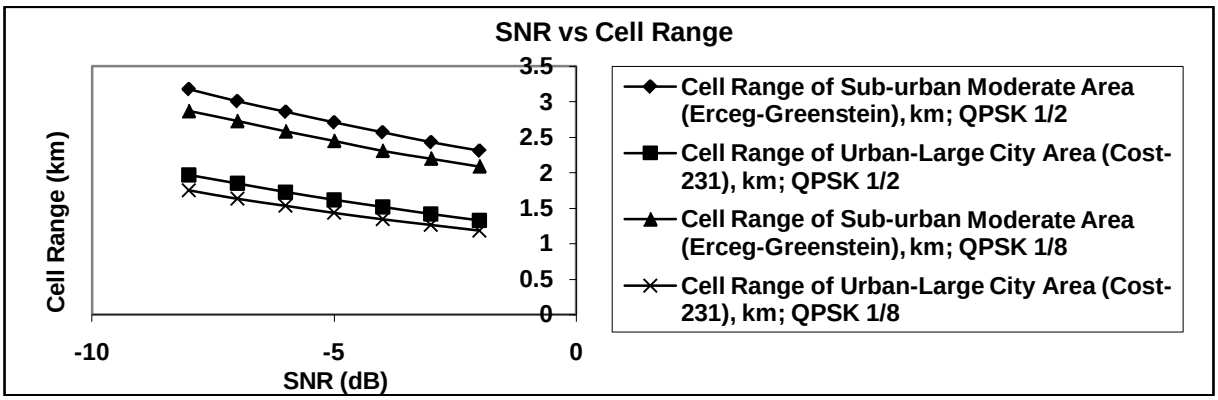

Figure 6 : Grapgical representaion of SNR vs Cell range of WiMAX for uplink

IV. Conclusions

This research work provides numerical facts regarding the WiMAX and 3G cellular network comparison issues, which are only theoretically discussed in literature.

The figure-1, 2 shows that the cell range increases with increasing base station transmitter power for both WiMAX and 3G respectively. Figure-3, 4 shows that cell range decreases with increasing carrier frequency both for WiMAX and 3G respectively. Figure-5 and 6 are both for WiMAX, but for uplink and downlink respectively, and those shows that the cell range decreases with increasing SNR.

The data transfer rate of WiMAX is mostly depends on the channel bandwidth used. The use of the selectable channel bandwidth by WiMAX ranging from 1.25MHz to 20MHz makes the system very flexible. On the other side 3G uses fixed channel bandwidth.

OFDM also makes it easier to exploit frequency diversity and multiuser diversity to improve capacity. Therefore, when compared to 3G, WiMAX offers higher

peak data rates, greater flexibility, and higher average throughput and system capacity and number of user served by WiMAX is four times greater than the 3G cellular networks [1]. Another advantage of WiMAX is its ability to efficiently support more symmetric links. Typically, 3G systems have a fixed asymmetric data rate ratio between downlink and uplink [9].

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Beam Steering of an Array Antenna using Tunable Multi Layer Multi Dielectric-High Impedance Surface Reflector

By Praveen Kumar Kancherla & Dr. Habibulla Khan
JNT University, India

Abstract- Beam scanning have found great demand in the field of wireless communication, satellite communication, radar, etc. [1,2]. These applications are generally covered by phased array antennas [3], where several elements are grouped together in a linear or planar special configuration. The radiated beam is determined by the vector addition of the electromagnetic fields radiated by the individual elements. Present proposal a novel technique of Tunable Multi Layer Multi Dielectric High Impedance Surface (TMMD-HIS) is embedded with array antenna, making it possible to obtain a beam scanning angle of 40 degree (from -20 degree to +20 degree) without the need of expensive active components. The major advantage of proposed concept is that the array have a negligible mutual coupling between radiating element this is happen because of suppression of surface wave. In built phase shifting is provided which reduces the structure size and proportionally cost. simulated results showing the effectiveness and compatibility of proposed concept.

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Keywords: reflection phase, width of patch, gap between patches, height of substrate, operating frequency, band width.

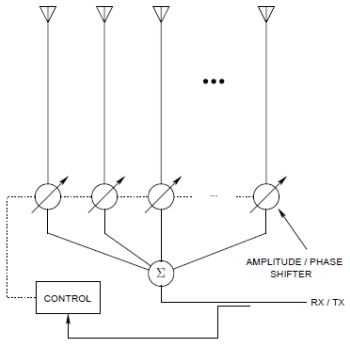
I. Introduction

In RADAR systems beam scanning is necessary to track mobile targets, or to scan the physical area of a targets. In point to point communication links where one or both of a terminals are mobile (especially in satellite communication systems) the beams of both antennas must track with the movement of the terminals so that adequate communication quality is maintained. To have a such adaptability, the antennas are mechanically steered. but this mechanical steering has limitations in terms of tracking speed and flexibility.

Antenna arrays, as the name suggests, consist of a number of antenna elements assembled together to form a larger antenna system. There are two subclasses of antenna arrays.

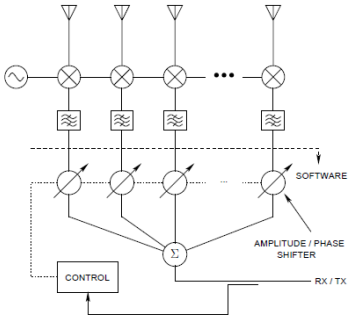
a) Depending on Feed Method

First each element in a array is actively driven by independent radio frequency (RF) sources, and corporate feed method. whereas arrays based on actively driven elements tend to be built such that the elements are separated by a significant distance (typically a half-wavelength or more) to avoid mutual coupling between radiating elements.



(a) RF beam-former

A general diagram of an antenna array utilizing actively driven elements is shown in Figure 1.1(a). It consists of a number of radiators, each driven by a signal whose amplitude and phase are controlled independently [4]. Through manipulating the amplitude weighting and phase shift applied to each of the elements, beams can be formed and steered by the array.



(b) IF beam-former

The diagram in Figure 1.1(b) shows an alternative realization whereby signals from the array are collected at an intermediate frequency (IF). This is done so that phase shifting and amplitude weighting can be done at lower frequencies, which can reduce costs. More frequently, however, this is done so that operations that were traditionally implemented at radio frequencies (namely phase shifting and amplitude weighting) can be performed digitally in software

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through transforming the analog IF signals to digital signals using analog-to-digital converters. The point at which analog-to-digital conversion takes place is denoted by the dashed line in Figure 1.1(b).

Antenna arrays, despite their great potential as reconfigurable antenna platforms, explained above in both the approaches possess a number of major shortcomings that makes the deployment of reconfigurable antennas based on the classic array implementation impractical and inexpensive.

These include the following:

Cost of RF hardware Antenna arrays, regardless of whether they are implemented as shown in Figure 1.1(a) or (b), require a substantial amount of RF hardware. The implementation shown in Figure 1.1(a) requires a separate RF phase shifter for each antenna element, plus an amplitude controller if amplitude weighting is to be used as well. These components tend to be costly and bulky, increasing the size of the array platform and making it more expensive. The implementation of Figure 1.1(b), while eliminating the need for the RF phase shifters and amplitude controllers, nevertheless requires a substantial amount of RF hardware in the form of frequency conversion equipment, filters, and so on. The complexity of these systems increases when they are used in both transmit and receive modes, where additional components such as amplifier chains, RF switches, and other components are required. These components are generally assembled into a unit called a transmit-receive module (TRM). In antenna arrays, TRMs must be duplicated for each of the antenna elements in the system. At high frequencies, these components still tend to be very expensive, especially components designed for use at millimetre-wave frequencies where this project is ultimately targeted. This makes antenna arrays generally a costly proposition. Indeed the cost of the RF hardware in antenna arrays has prevented them from being widely deployed, even at lower RF frequencies.

Feeding difficulties associated with large arrays The scanning angle of antenna main lobe is determined by the feed network. Array antennas require that each element is actively fed by an RF signal. For small arrays, this is usually not a problem, but for large arrays, feeding the array can become a logistical nightmare. However, a serious problematic issue is feed loss in the network itself, which is a particular problem at high frequencies. The large number of feed networks required for large high-gain arrays compounds the loss problem, producing an upper limit on the realizable gain from the array. Additionally, the feed network is often a source of cross-polarization in planar antenna arrays.

Another is to use beam forming networks for multi beam array. Multi beam formers are either the networks [5, 6] (butler matrix, Blass matrix) or quasioptical system lens (Rotman lens).

The input impedance of each radiating element changes from its initial value due to mutual coupling, this variation is unstable when we change the direction of radiated beam. this phenomena causes the mismatching between the output impedance of a beam forming network and input impedance of elements at different given beam directions if BFN is properly designed.

The angle blindness [7] i.e the array can radiate no power in certain angles. 4 and 5 are mainly occurring because of mutual coupling.

b) Proposal of Research work

Antenna arrays are therefore a natural choice as the foundation for any reconfigurable antenna platform. Unfortunately, the design of a large antenna array is complicated by issues of cost, complexity, and loss, as discussed in the previous section. Indeed, shortcomings of traditional array architectures given motivation of this research project. The TMMD-HIS reflector have none of the cost, complexity, and loss of antenna arrays. hence embedding both concepts mutually exclusive way could provide attractive reconfigurability in antenna, with improved performance and reduced cost. several papers on beam steering of antennas based on 2D EBG structures were presented [8,9]. In some papers authors demonstrated 2D EBG structures in reducing the mutual coupling[10][11]. where the suppression of EM wave is done only in two directions. Present paper a novel proposal of TMMD-HIS is a three dimensional Energy Band Gap Structures (EBG). It is going to suppress the EM waves in all three dimensions. This structure has a provision of tuning its surface impedance by varying reactive capacitance in its structure. As the surface impedance is varied interne varies the reflection phase. This inbuilt phase shift operation is utilized to steer the beam of an array antenna.

II. Unit Cel Meodeling

The structure of Multi Layer Multi Dielectric High Impedance Surface consists of an optically planar ground plane, dielectric substrates arranged in ascending order, square metal patches (protrusions) arranged in three dimensionally and metal vias joining the metal protrusions to ground. the arrangement is shown in figure 1.

The unit cell has following dimensions; thickness of lower substrate t =62mil with a relative permittivity of ε_r =2.2 and loss tangent 0.0009, diameter of via d =0.65mm, width of patch w = 41mm, gap g = 2.5mm, hidden layer patch width Hw = 46mm height of TMMD-HIS h = 3mm and an air is considered as another dielectric exist between top and bottom layers. This structure resonates at 1.89GHz.

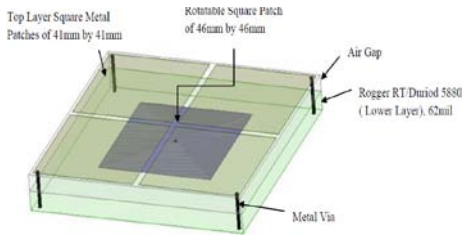

Figure 1 : Description of structural parts unit cell

III. Dispersion Diagram

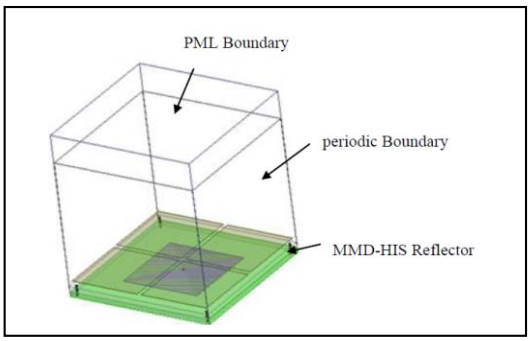

Figure 2 : Unit cell Measurement setup

The Dispersion diagram shown in figure 2 consists of TM wave band bellow the lower line or mode1, this follows the light line up to certain frequency then it becomes very flat suddenly. TE wave band above higher line or mode2 is begins at high frequency and continues upward with a slope and travelled with light line of a speed less than the velocity of light in vacuum. The band gap that spans from the edge of TM band to the point where TE band crosses the light line is called surface wave band gap. During this band gap both TE and TM waves are suppressed.

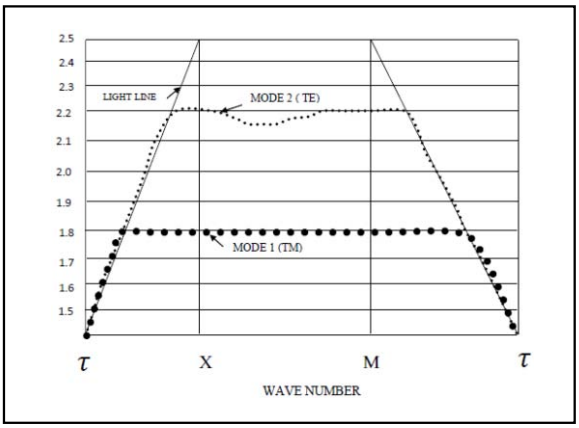

Figure 3 : Dispersion Diagram

IV. Reflection Phase Measurement

A proposed unit cell is designed and executed in Ansoft HFSS software. By placing in a box to which a periodic boundaries are applied and extended to infinity. Finite Element Method is adopted to analyze the proposed unit cell.

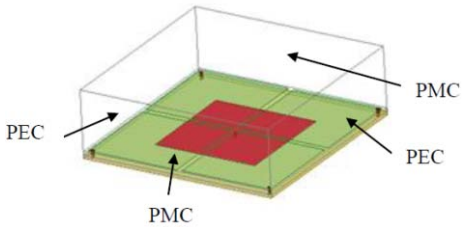

Figure 4 : Reflection Phase

The diagrams in figure 4 is showing perfect electric boundary at opposite walls of unit cell box, and perfect magnetic boundary at opposite walls of remaining unit cell box. The figure 3 is showing the reflection phase of normally incident plane wave on TMMD-HIS structure versus frequency. At low frequencies this structure reflects with a $+180^0$ phase shift as the frequency increases the phase slops downward and crosses through zero degree point and reaches to -180^0 the frequency at this phase is high. The point of intersection of the phase curve with zero degree line, frequency at this point is considered as operating frequency. The region betwee+87.92 degree to–176.08 degree shown in Figure3 with highlighted region reflects the plane waves in phase with transmitted wave. This region functions like Perfect Magnetic Conductor (PMC). This range corresponds to surface wave band gap. The region before and after to highlighted region functions like ordinary reflector.

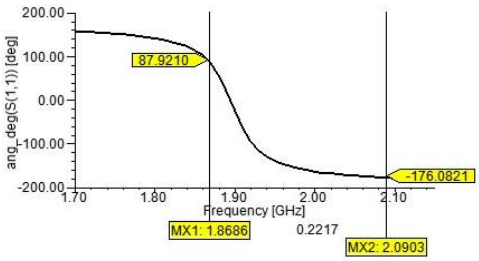

Figure 5 : Reflection Phase

V. Transmission Co-efficient Measurement

Transmission co-efficient indicates how MMD-HIS forbids the propagation of EM waves To demonstrate this two micro strip patch antennas of individually feed with co-axial feed are considered both are operating within the electromagnetic stop band range as described in dispersion diagram. One column of multi Layer Multi Dielectric High Impedance Surface is incorporated between them. during the stop band region A minimum transmission coefficient level of -

60dB is observed indicates MMD-HIS block the transmission of power between antennas. when we carefully observe the minimum transmission co-efficient level range is equal to band gap range obtained in dispersion diagram.

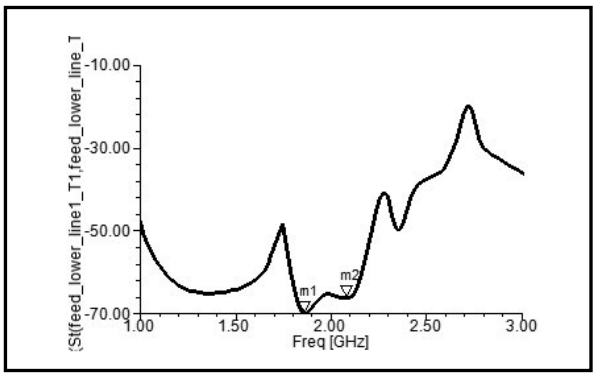

Figure 6 : S21 Characteristics

VI. Array Antenna Over Tmmd-his

MMD-HIS Reflector could be used to improve the efficiency of antennas [12], due to the suppression of surface waves, which are the predominant loss mechanisms in classical designs. Furthermore, the MMD-HIS Reflector can function as an artificial magnetic conductor (AMC) at a certain EM wavelength [13]. A metal surface, as an approximation of a perfect electric conductor (PEC), has a voltage wave reflection coefficient of -1, which causes a reflection and a phase shift of 180 degrees to the incident EM wave. Due to destructive interference, the PEC is undesirable as a ground plane for microstrip antennas. To overcome from this problem offset by a spacing of $\lambda / 4$ between the antenna and the ground plane [9], the problem of surface waves still persist for PEC ground planes. With an artificial magnetic conductor, as an approximation to a perfect magnetic conductor (PMC), there is an in-phase reflection. Having a PMC with a voltage wave reflection coefficient of $+1$ underneath a microstrip antenna increases the antenna's efficiency.

Another advantage of MMD-HIS Reflector is the integration of components. Usually the required high dielectric constant of the substrate needed for a high level of integration would be detrimental for microstrip antennas. However, by using an MMD-HIS Reflector, the antenna could be shielded from the substrate, enabling it to be integrated with other components on the same substrate [14]. similarly, MMD-HIS Reflector can be utilised to reduce crosstalk between neighboring components on a chip [10].

VII. Tuning of mmd-his & Beam Steering Measurement

The structure consists of a group of unit cells arranged in two by two array as a ground plane to 2by2 array of radiating patches. shown in figure.

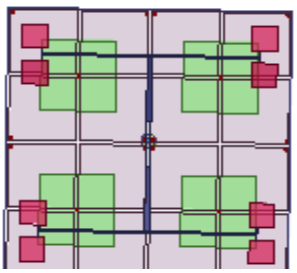

Figure 7 : Array of TMMD-HIS Unit cells

The tunable impedance surface that I used to demonstrate beam steering consists of pair of metal patches in attach with substrate arranged in layers, from the bottom we will give naming convention as layer 1 (contains a substrate of Rogger/RT Duriod 5880 with a permittivity 2.2 and loss tangent 0.0009 consists of an array of four square metal patches (these are made to rotate around it's center position as reference with respect to layer 2 lower patches. in both clock wise and in anti-clock wise. For convenience from now we call them as revolving patches) on its top face, connected to conducting surface lying in other(bottom) face, by means of via which has a height of 62mil. layer 2 consists of Higher substrate of Rogger Ultima 1225 with a permittivity 2.5 and loss tangent 0.0015, contains an array of metal patches (protrusions) on its bottom face which are always fixed in nature) connected to bottom conducting surface of layer 1by means of via positioned at its corner, with a height of 3mm. such that this vias should not be obstacle to revolving patches. here on thing should take care that all the patches in layer 1 and 2 are connected to a common bottom conducting surface of layer 1 to maintain a resonant nature in the structure. Top face of layer 2 is embedded with 2by2 array antenna of square patches of miniature structure of 15.5mm*15.5mm, connected to RF power supply by following transmission line rules so that maximum power can be transferred to patches from RF source. here co-axial feed method is adopted and fed at location (-9.3252mm, 0mm, 2mm). An air gap of 1.4252mm is maintained between layer 1 and layer 2 which functions like air dielectric and develops a parallel plate capacitance. the complete structure is called Tunable Multi Layer Multi Dielectric High Impedance surface.

"The motion that is parallel to applied electric field contributes to change in resonance frequency". keeping this point in mind The beam steering operation is demonstrated here in three stages. Now the revolving square metal patches are made to rotate either in clock wise or anti clock wise direction by making it's center position as reference from it's zero position to ± 45 degree with respect to layer 2 lower patches. The TMMD-HIS reflector embedded with a 2by2 array of square patch antennas shown. Left set of revolving patches are as taken as one unit and right set of

revolving patches are taken as another unit for all stages of execution.

Stage 1: All the patches of layer 1are kept in reference position of zero degree. the radiation pattern obtained at this stage is taken as reference. as shown in above figure the beam is pointing to zero degree in phi direction.

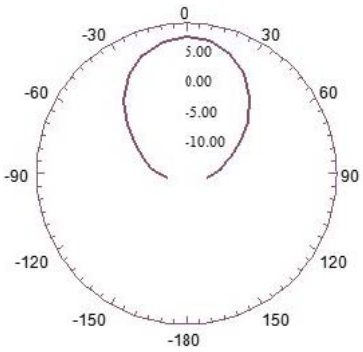

Figure 8 : Reference steer angle

Stage 2: Left set is allowed to revolve right set is kept constant in reference position (zero degree). As the set of plates starts revolving the over lapping area exist between patches of layer 2 and 1varied results change in capacitance reactance exist between parallel plates. since the resonating frequency of individual cavities formed by layer of metal plates and via structures depends on capacitance, so change in over lapping area leads to change in reflection phase results in beam steering to opposite direction. This is demonstrated by orienting left side set anti clock wise direction from zero degree to -45 degree (minus sign here indicates anti clock direction of orientation) with a step size of -15 degree by maintaining right side set is at reference position, the beam is steered to maximum right angle of +20 degree from zero degree when orientation is reaches to -45 degree.

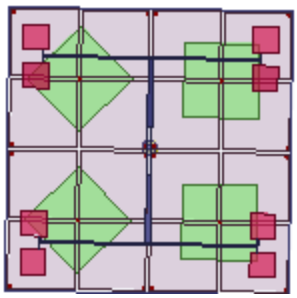

Figure 9 : Left Steer Measurement setup

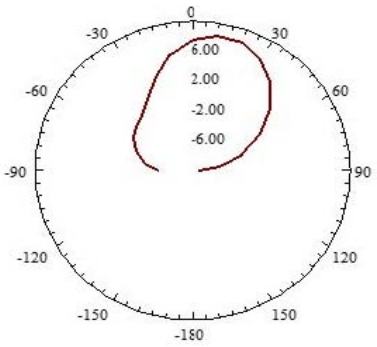

Figure 10 : Beam of patterns steered to +20 degree

Stage 3: Here right set is allowed to revolve left set is kept constant in reference position (zero degree). As the set of plates starts revolving, the over lapping area exist between patches of layer 2 and 1varied results change in capacitance reactance exist between parallel plates. since the resonating frequency of individual cavities formed by layer of metal plates and via structures depends on capacitance, so change in over lapping area leads to change in reflection phase results in beam steering to opposite direction. This is demonstrated by orienting right side set anti clock wise direction from zero degree to -45 degree with a step size of -15 degree by maintaining left side set is at reference position, the beam is steered to maximum right angle of -20 degree from zero degree when orientation is reaches to -45 degree. if the orientation is further increased beyond the -45 degree in both the cases we get repetitive characteristics.

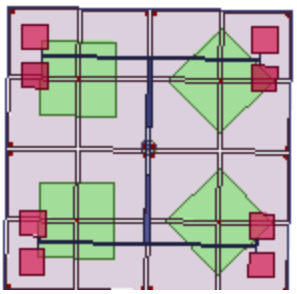

Figure 11 : Right Steer Measurement setup

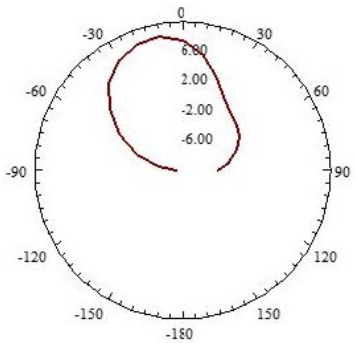

Figure 12 : Beam of patterns steer to -20 degree

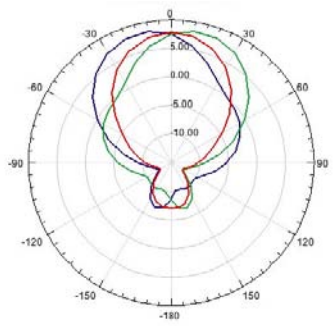

Figure 13 : Steering angles at -20, 0, +20 degrees

VIII. Conclusion

A novel TMMD-HIS embedded array antenna with a reconfigurable beam has been proposed, designed and simulated in Ansoft HFSS software. The simulated results obtained are presented are proving good agreement when compared with designs presented in literature so far.

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27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. Think technically: Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

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Key points to remember:

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Final Points:

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· Present your points in sound order

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- Fundamental goal
- To the point depiction of the research
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- Significant conclusions or questions that track from the research(es)

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- Center on shortening results - bound background information to a verdict or two, if completely necessary
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- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

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- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
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Approach:

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- If use of a definite type of tools.
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- Leave out information that is immaterial to a third party.

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The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

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- Present a background, such as by describing the question that was addressed by creation an exacting study.
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- Give details all of your remarks as much as possible, focus on mechanisms.
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Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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