

# Project Completion Report

**1. Title of the project:** “Miniaturized flexible planar antennas for body worn applications as health monitoring systems in L and S band (ISM band) using nano magneto-dielectric composite as substrate”

**2. Principal Investigator:** Dr. Nidhi S. Bhattacharyya

Microwave Engineering Lab, Department of Physics, Tezpur University, Napaam, Sonitpur, Assam-784028, India

Email: nidhisbhatta@gmail.com

**3. Co-Investigator(s):** Dr. Satyajib Bhattacharyya

Dept. of Electronics and Comm. Engg., Tezpur University, Napaam, Sonitpur, Assam-784028, India

Email: sb@tezu.ernet.in

**4. Implementing Institution:** Tezpur University, Napaam, Sonitpur, Assam-784028, India.

**5. Date of commencement:** 21.11.2017

**6. Planned Date of completion:** 17.10.2020

**7. Actual Date of completion:** 31.03.2022

**8. Objectives as stated in the project proposal:**

- Development of sensing and trans-receiving planar antennas on nano-composite flexible substrates, to be mounted on the human body for the wireless health monitoring system.
- Manipulations of the antenna geometry and nanofiller concentrations in the substrate for size reduction and achieving consistency of performance over the bending limit in L and S-band (ISM band).
- Optimization of operational performance over the human phantom.

**9. Deviation made from original objectives if any, while implementing the project and reasons thereof:**

**10. Experimental work:**

**10.1 Design and fabrication of flexible antenna for wearable applications**

- Linear low-density polyethylene (LLDPE) was taken as flexible material to develop as substrate for Microstrip Patch Antenna (MPA). In addition, LLDPE is nontoxic and easy to process.
- Testing of physical properties and microwave characterization of the developed substrate was carried out.
- MPA was designed and fabricated on the flexible LLDPE substrate
- Performance study of the developed antenna with different bending angles was conducted.

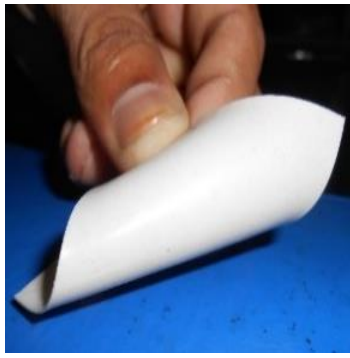


Figure 1: LLDPE substrate

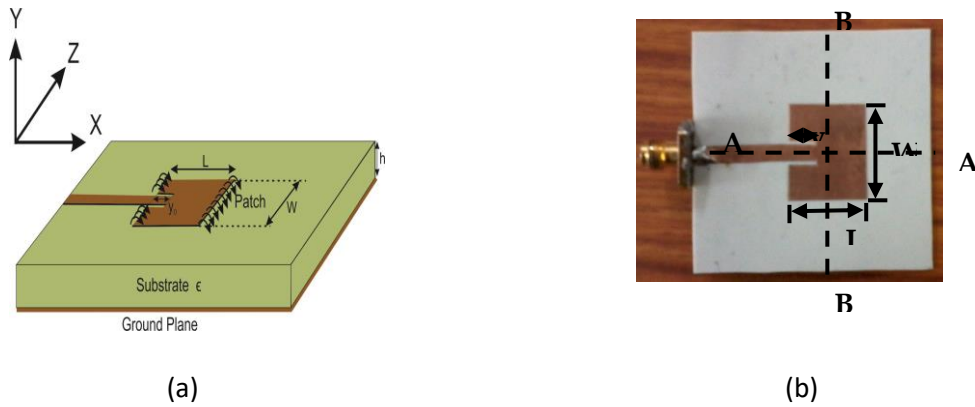


Figure 2: (a) Structure of microstrip patch antenna (b) Rectangular patch antenna fabricated on LLDPE substrate

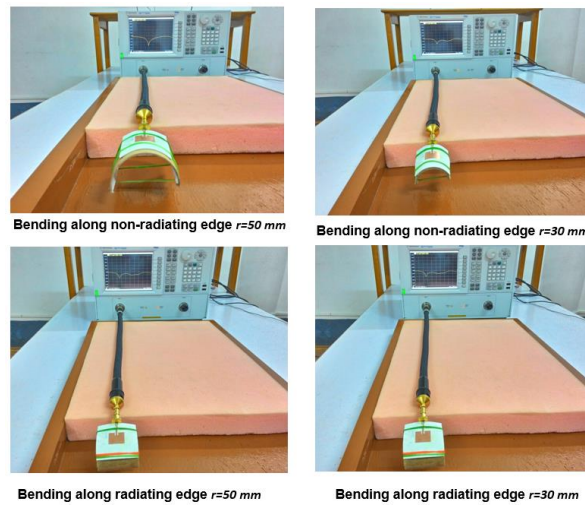


Figure 3: Performance study with bending

## 10.2 Miniaturization of wearable antenna

- Magneto Dielectric Nano Material was used as filler in LLDPE to reduce the size
- Magneto-dielectric composite (nano-sized Nickel Zinc Ferrite-LLDPE) was synthesized to be used as substrate.
- Microstructural Studies (X-Ray Diffraction, Transmission electron microscopy of nickel-zinc ferrite) were carried out.
- Tensile properties, density, water absorbance, and thermogravimetric analysis of the nickel-zinc ferrite-LLDPE composite were studied.
- Microwave characterization of the composite substrate was carried out.

- Rectangular patch antenna was designed and fabricated on nanosized Nickel Zinc Ferrite-LLDPE composite substrate

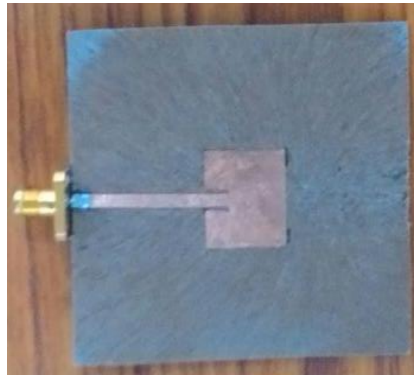


Figure 1: Fabricated antenna Nickel Zinc Ferrite- LLDPE composite substrate

### 10.3 Development of human hand phantom and testing of the antenna

- A human arm model was developed in CST.
- A solid phantom was developed using graphite powder (Make - Merck) mixed with silicone rubber (Make - Moldsil) in the weight ratio 1:1 to mimic the average dielectric properties of a human hand.
- The fabricated MPA was tested in the developed model.

Table 1: Parameters of the human arm model developed in CST

Tissue Name	Density (kg/m <sup>3</sup> )	Thickness (mm)
Skin (dry)	1109	1.5
Fat	911	1.5
Nerve	1075	1
Blood	1050	4
Muscle	1090	15
Bone Marrow	1908	17

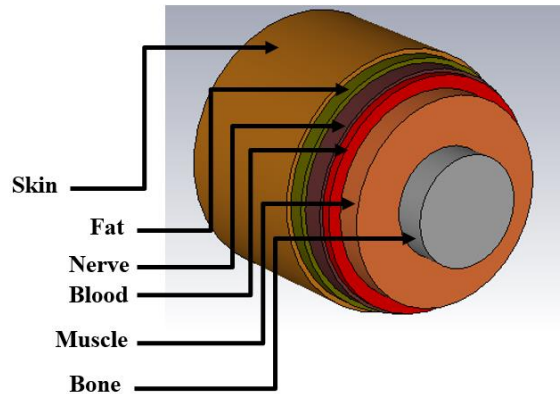


Figure 2: Cross section of the human arm model developed in CST



Figure 3: Hand phantom developed using graphite powder (Make - Merck) mixed with silicone rubber (Make - Moldsil) in the weight ratio 1:1.

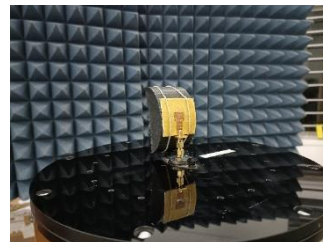


Figure 4: MPA testing on the developed phantom

## 10.4

- A flexible conducting lossy shield is developed and demonstrated for reduction in back radiation of linearly polarized X-band patch antenna for Wireless Body Area Network (WBAN) applications.
- The proposed structure comprises of a flexible patch antenna backed by a laminated sheet of Expanded Graphite (EG). The EG sheet is used as a protective shield to prevent back radiation emanating out of the WBAN antenna from propagating toward the human body.
- The antenna performance is tested over human wrist phantoms experimentally and through full wave simulation studies. The results indicate marginal variation in the -10 dB impedance bandwidth with slight increase in the gain and directivity values.
- A maximum measured on-body gain of 6.7 dBi is exhibited by the antenna backed by the EG shield. Electric field and SAR studies reveals reduction in wave penetration by the EG shield antenna inside the wrist phantom with a decrease of SAR by a maximum of 5%. Measured front-to-back ratio (FBR) values indicates lowering of back radiation with a maximum average increase by 76% exhibited by backed antenna which signifies the effectiveness of the EG shield employed in the study

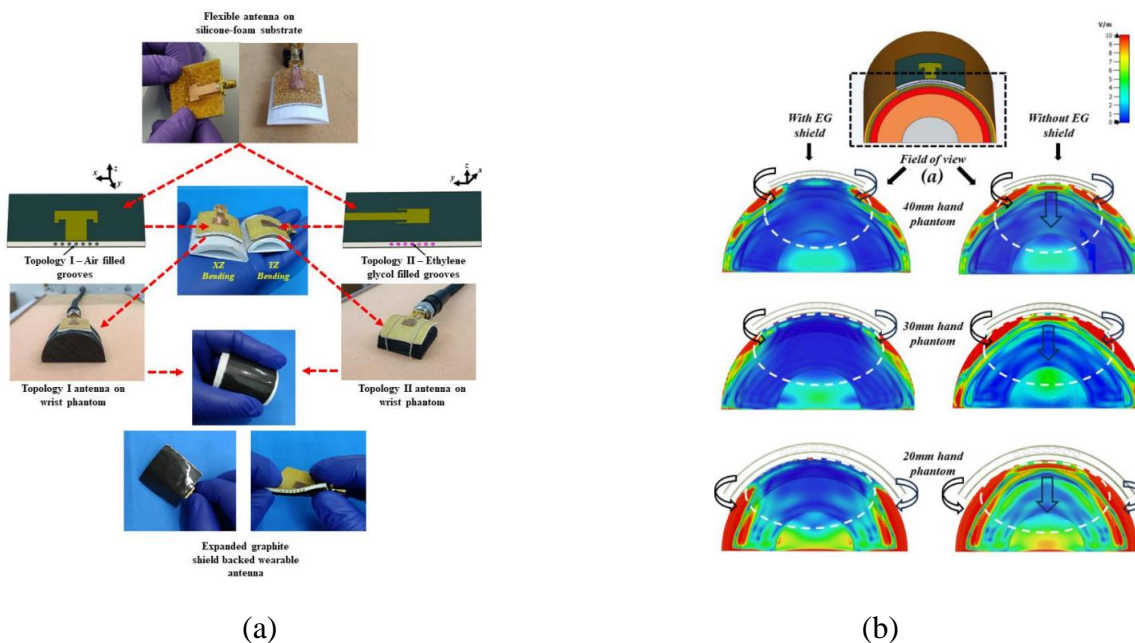


Figure 5: (a) Fabricated EG shield and its application on developed wrist phantom, (b) Simulated E field strength with and without EG shields with different bending radii.

## 10.5 Development of metastructure based microwave blood glucose sensor

- Circular, Hexagonal, and square-shaped Split Ring Resonator based designs were simulated in CST microwave studio and optimized to get a narrow and sharp response in transmission coefficient ( $S_{21}$ ) in a two-port network.
- The optimized structures were then fabricated for fast, accurate, and non-invasive monitoring of the blood glucose level.
- The performance of the developed sensor was studied.

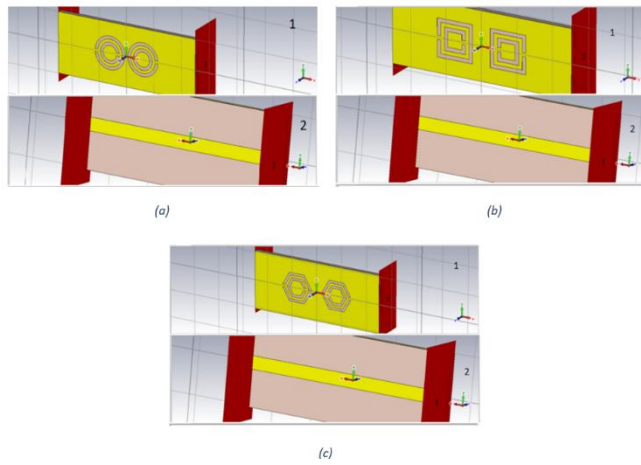


Figure 6: Simulation designs of the Split Ring Resonators, (a) Circular, (b) Square Shaped, (c) Hexagonal

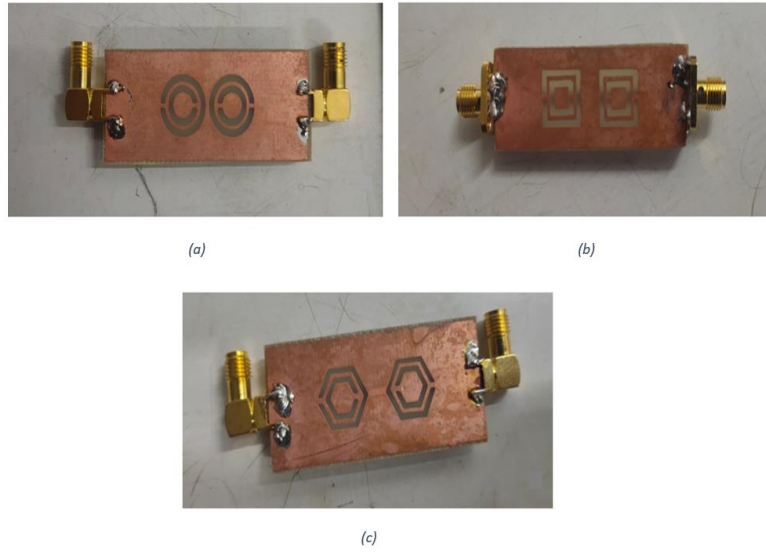
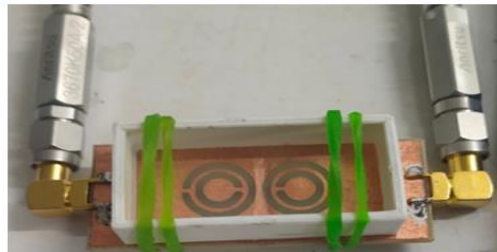
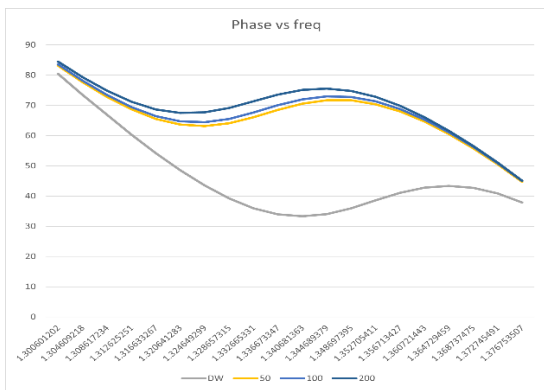


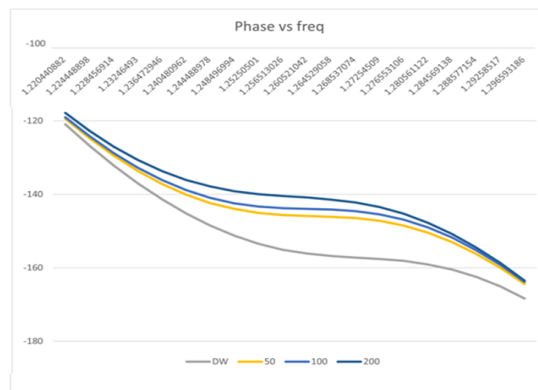
Figure 7: Fabricated Split Ring Resonator based sensors, (a) Circular, (b) Square Shaped, (c) Hexagonal



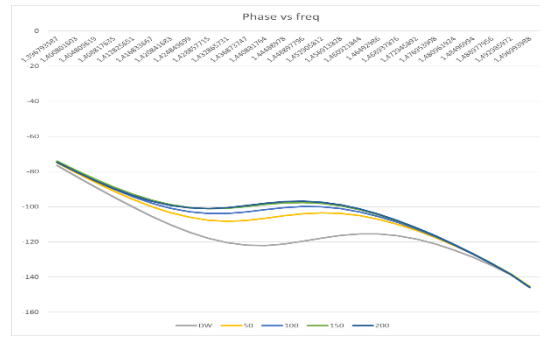
(a)



(c)



(b)



(d)

Figure 8: (a) Measurement setup of sensor, Experimental result of phase shifts of the developed sensor (b) Circular CSRR, (c) Square CSRR, (d) Hexagonal CSRR, upon different glucose concentration (50-200 mg/dL)

## 11. Analysis of the results:

MPA designed and fabricated on the flexible LLDPE substrate shows reliable performance within the designed band. The shift of frequency concerning flat profile geometry for bending along the non-radiating edge is only 0.33 % while radiating edge bending shows a shift of 0.66 % for  $r=10$  mm.

Miniaturization of antenna is carried out using nano sized magneto-dielectric material as substrate. 7 wt % of  $x=0.50$  NZF-LLDPE composite shows the maximum miniaturization factor 1.85 and percentage of miniaturization 27.09 % and hence are used as substrate for designing MPA and further study.

The phantom is first characterized for the microwave dielectric properties in the working frequency band regime and the results closely match with the average dielectric values of human hand.

The MPA fabricated on the NZF-LLDPE is found to radiate with low reflection loss. The measured values of  $S_{11}$  are -31 dB in free space, -29 dB on the solid phantom and -27dB on human hand. The MPAs on the Nickel Zinc Ferrite-LLDPE substrate also showed improved values of -10 dB bandwidth, and directivity as compared to the MPA on the LLDPE substrate.

Silicone-foam substrate is synthesized that is flexible, water resistant, exhibits low permittivity and loss. A technique based on mechanical interlocking is developed for strong adherence of copper with the substrate making it suitable for the design of wearable antennas exhibiting gain  $\sim 7.0$  dBi.

A technique of self-compensating nature is demonstrated by etching grooves in the substrate to mitigate the detuning effects of bending which is sustainable without the requirement of any external aid. A minimum frequency compensation of  $\sim 35-50\%$  is exhibited by the self-compensating antennas.

Simulation of expanded graphite-based shield demonstrated reduction in back radiations of the wearable antenna along with SAR compliance. The fabricated shield post integration to the antenna structure has hardly any detrimental effect on the antenna performance and hence exterminating the requirement of modification of the radiating elements.

Three different sensors were designed and fabricated made with three different shapes of CSRRs on the front face and a microstrip line on the back.

Analysis of the performance of the glucose sensor shows that the phase shift is a more reliable measure than the  $S_{11}$  and  $S_{21}$  parameters. The phase shift is more pronounced in lower concentrations of glucose solutions making the sensor more responsive in sensing concentrations below 150mg/dL making it suitable for application in human body.

## 12. Conclusion

A Microstrip Patch Antenna was fabricated on flexible LLDPE substrate. Miniaturization of the antenna was achieved through filling of nano sized Nickel Zinc Ferrite into the LLDPE substrate which has also helped in reducing reflection losses, obtaining broad -10 dB bandwidth and improvement in directivity. The performance of the developed antenna has been found to be consistent over repeated bending making it a suitable candidate for mounting in small non-planer surfaces.

A solid human hand phantom was developed using graphite powder (Make - Merck) mixed with silicone rubber that excellently mimics the behaviour of real human tissues.

A Split Ring Resonator based microwave sensor has been developed for continuous non-invasive monitoring of the blood glucose levels in the human body. The sensing relies on the phase shift and displays reliable performance in glucose concentrations below 150mg/dL.

The MPA fabricated on flexible Nickel Zinc Ferrite-LLDPE substrate has huge application potential in development of flexible miniaturized trans-receiving systems to for wearable applications on human body. The metal adhesion technique demonstrated in the study can also be used for other applications like developing flexible EMI shielding materials.

The metastructure based microwave glucose sensor can potentially address the challenges in detection of low concentrations of blood glucose (70 to 130 mg/dL in normal human) and offer reliable, fast, accurate and most importantly, non-invasive and painless solutions.

## 13. S&T benefits accrued:

### i. List of research publications:

S No	Authors	Title of paper	Name of the Journal	Volume	Pages	Year
1.	Pragyan Jyoti Gogoi, Satyajib Bhattacharyya, Nidhi S. Bhattacharyya	CPW-Fed Body Worn Monopole Antenna on Magneto-Dielectric Substrate in C-Band	Progress in electromagnetic Research	84	201-213	2018
2.	Phukan, Arunav, and Nidhi S. Bhattacharyya	Low-density foam as an adhesion facilitator between silicone rubber and copper sheet for use in flexible microwave antennas	Materials Research Express	6	12	2020

### ii. Manpower trained on the project

a) Research Scientists or Research Associates – N/A

b) No. of Ph.D. produced - One

c) Other Technical Personal trained - Three

iii. Patents taken, if any – N/A

#### 14. Financial Position:

No	Financial Position/Budget Head	Funds Sanctioned	Expenditure	% of Total cost
I	Salaries/ Manpower costs	20,44,669	20,44,669	23.99
II	Equipment	54,22,000	54,22,000	63.62
III	Consumables	5,33,686	5,33,686	6.26
IV	Contingencies	1,49,900	1,49,900	1.76
V	Travel	55,684	55,684	0.65
VI	Overhead Expenses	3,16,061	3,16,061	3.71
VII	Others, if any	Nil	Nil	Nil
	<b>Total</b>	<b>85,22,000</b>	<b>85,22,000</b>	<b>100%</b>

#### 15. Procurement/ Usage of Equipment

a)

S No	Name of Equipment	Make/Model	Cost (FE/Rs)	Date of Installation	Utilisation Rate (%)	Remarks regarding maintenance/ breakdown
1.	EM Human Phantom		34,50,189.75 (Including GST)	19-03-2019	Fully	
2.	Speag Exposure Acquisition System	SPEAG	16,43,386.00 (Including GST)	15-06-2021	Fully	
3.	Microwave Absorber Foam 2 X 2 Pyramidal 10 MHz – 20 GHz		1,30,242.00 (Including GST)	25-03-2022	Fully	
4.	MATLAB Software		3,62,477.00 (Including GST)	19-05-2021	Fully	

b) **Plans for utilising the equipment facilities in future**

the equipment facilities acquired through the DST Nano Mission represent a valuable asset for our research endeavours. it's imperative that we maximize the utility of these resources to fuel our research initiatives. To this end, we have devised a comprehensive plan:



**Ph.D. Research Integration:**

Our foremost priority is to integrate these equipment facilities into the research projects of our Ph.D. scholars. Each student will be allocated dedicated time slots to utilize the equipment for their experiments and analyses. This approach ensures equitable access and fosters a collaborative research environment.

**Skill Development Workshops:**

We will organize regular workshops and training sessions to familiarize all lab members, including Ph.D. students, with the operation and maintenance of the equipment. By empowering everyone with the requisite skills, we aim to promote self-sufficiency and encourage independent utilization of the facilities.

**Cross-disciplinary Collaboration:**

We encourage interdisciplinary collaboration wherein Ph.D. students from different research domains can leverage the equipment for their projects. This cross-pollination of ideas not only expands the scope of research but also promotes knowledge exchange and innovation.

**FINAL STATEMENT OF EXPENDITURE (Two copies)**

1. **SERB sanction Order No and date** (First Sanction Order): **SR/NM/NT-1032/2016(C)** and date: **17.10.2017**
2. **Project Title** : Miniaturized flexible planar antennas for body-worn applications as health monitoring systems in L and S band (ISM band) using nano magneto-dielectric composite as substrate
3. **PI Name & Address** : Prof. Nidhi S. Bhattacharyya, Department of Physics Tezpur University
4. **Total Sanctioned Project Cost** : **86,96,200**
5. **Revised Project Cost** : **N/A**  
(if applicable)
6. **Date of Commencement/start of the project:** **21.11.2017**
7. **Date of Completion of the project:** **31.03.2022**
8. **Grant received in each year:**
  - a. 1<sup>st</sup> Financial Year : 49,000/-
  - b. 2<sup>nd</sup> Financial Year : 7,31,000/-
  - c. 3<sup>rd</sup> Financial Year : 36,71,895/-
  - d. 4<sup>th</sup> Financial Year : 7,99,761/-
  - e. 5<sup>th</sup> Financial Year : 27,43,652/-
  - f. Interest accrued, if any : 3,42,134/-
  - g. Total (a+b+c+d+e+f) : 88,64,134/-

**Statement of Expenditure (as of 31<sup>st</sup> March, 2022)**

Sr	Sanctioned Heads	Funds sanctioned	1 <sup>st</sup> year DOS to 31 <sup>st</sup> March,2018	2 <sup>nd</sup> year 1 <sup>st</sup> April 2018 to 31 <sup>st</sup> March 2019	3 <sup>rd</sup> year 1 <sup>st</sup> April 2019 to 31 <sup>st</sup> March 2020	4 <sup>th</sup> year 1 <sup>st</sup> April 2020 to 31 <sup>st</sup> March 2021	5 <sup>th</sup> year 1 <sup>st</sup> April 2021 to 31 <sup>st</sup> March 2022	Total	Balance, as of 31 <sup>st</sup> Mar, 2022	Remarks
(I)	(II)	(III)								
1.	Manpower costs	20,44,669	49,000	4,59,482	3,10,800	6,17,840	6,07,547	20,44,669	Nil	
2.	Consumables	5,33,686	Nil	1,20,072	59,850	1,03,796	2,49,968	5,33,686	Nil	
3.	Travel	55,684	Nil	24,476	16,334	Nil	14,874	55,684	Nil	
4.	Contingencies	1,49,900	Nil	49,818	Nil	Nil	1,00,082	1,49,900	Nil	
5.	Equipment	54,22,000	Nil	Nil	32,85,895	Nil	21,36,105	54,22,000	Nil	
6.	Overhead expenses	3,16,061	Nil	78,125	Nil	78,125	1,59,811	3,16,061	Nil	
7.	Interest	3,42,134 (generated)	69,948	1,70,669	65,603	35,473	441	3,42,134	Nil	Interest returned
8.	<b>Total</b>	88,64,134	1,18,948	9,02,642	37,38,482	8,35,234	32,68,828	88,64,134	Nil	
9.	<b>Total Fund</b> (Total - Interest)	85,22,000	49,000	7,31,973	36,72,879	7,99,761	32,68,387	85,22,000	Nil	

Amount to be refunded/reimbursed (whichever is appropriate): Rs

*Nick*

(Nick S. Bhattacharya)

Name and Signature of Principal Investigator:

Date: 12.12.2022

DOS : Date of Start of Project

*[Signature]*

Signature of Competent financial audit authority: \_\_\_\_\_  
(with seal) Date: \_\_\_\_\_

*Finance Officer  
Tezpur University*

GFR 12-A  
[Rule 238]

**FORM OF UTILIZATION CERTIFICATE**

Utilization certificate for the year **2021-2022** in respect

Of recurring/~~non-recurring~~

GRANTS-IN-AID/SALARIES/CREATION OF CAPITAL ASSETS

1. Name of the Scheme:- **Miniaturized flexible planar antennas for body worn applications as health monitoring system in L and S band using nano magneto-dielectric composite substrate**
2. Whether recurring or non-recurring grants:- **Recurring grants**
3. Grants position at the beginning of the Financial year
  - i. Cash in Hand/Bank :- **2,32,282**
  - ii. Unadjusted advances :- **Nil**
  - iii. Total :- **2,32,282**
4. Details of grants received, expenditure incurred and closing balances: (Actuals)

Unspent Balances of Grants received years [figure as at Sl. No. 3 (iii)]	Interest earned thereon	Interest deposited back to the Govt.	Grant received during the year			Total Available funds (1+2+3+4)	Expenditure incurred	Closing Balances (5-6)
			Sanction No. (i)	Date (ii)	Amount (iii)			
1	2	3	4			5	6	7
			Sanction No. (i)	Date (ii)	Amount (iii)			
2,32,282	188	188	SR/NM/NT-1032/2016(G)	20.12.2021	9,00,000	11,32,282	11,32,282	Nil

Component wise utilization of grants:-

Grant-in-aid-General	Grant-in-aid-Salary	Grant-in-aid-creation of capital assets	Total
5,24,735	6,07,547	Nil	11,32,282

Details of grants position at the end of the year


- i. Cash in Hand/Bank: **Nil**
- ii. Unadjusted Advances: **Nil**
- iii. Total: **Nil**

Certified that I have satisfied myself that the candidates on which grants were sanctioned have been dully fulfilled/are being fulfilled and that I have exercised following checks to see that the money has been actually utilized for the purpose for which it was sanctioned:

- i. The main accounts and other subsidiary accounts and registers (including assets registers) are maintained as prescribed in the relevant Act/Rules/Standing instruction (mentioned the Act/Rules) and have been duly audited by designated auditors. The figure depicted above tally with the audited figure mentioned in financial statements/accounts.
- ii. There exist internal controls for safeguarding public funds/assets, watching outcomes and achievements of physical targets against the financial inputs, ensuring quality in asset creation etc. & the periodic evaluation of internal controls is exercised to ensure their effectiveness.
- iii. To the best of our knowledge and belief, no transaction has been entered that are in violation of relevant Act/Rules/Standing instructions and scheme guidelines.
- iv. The responsibilities among the key functionaries for execution of the scheme have been assigned in clear terms and are not general in nature.
- v. The benefits were extended to the intended beneficiaries and only such areas/districts were covered where the scheme was intended to operate.
- vi. The expenditure on various components of the scheme was in proportions authorized as per the scheme guidelines and terms and conditions of the grants-in-aid.
- vii. It has been ensured that the physical and financial performance under (name of the scheme) has been according to the requirements, as prescribed in the guidelines issued by Govt. of India and the performance/targets achieved statement for the year to which the utilization of the fund resulted in the outcomes given at Annexure-I duly enclosed.
- viii. The utilization of the fund resulted in outcomes given at Annexure-II duly enclosed (to be formulated by the Ministry/Department concerned as per their requirements/specifications)
- ix. Details of various schemes executed by the agency through grants-in-aid received from the same Ministry or from other Ministries is enclosed at Annexure-II (to be formulated by the Ministry/Department concerned as per their requirements/specifications).

Date:

Place:

Signature   
Name.....

Chief Finance Officer  
(Head of the Finance)  
**Finance Officer**  
**Tezpur University**

Signature   
Name.....

Head of the Organisation  
**Registrar**  
**Tezpur University**

(Strike out inapplicable terms)

GFR 12-A

[Rule 238]

**FORM OF UTILIZATION CERTIFICATE**

Utilization certificate for the year **2020-2021** in respect

Of recurring/~~non-recurring~~

**GRANTS-IN-AID/SALARIES/CREATION OF CAPITAL ASSETS**

1. Name of the Scheme :- **Miniaturized flexible planar antennas for body worn applications as health monitoring system in L and S band using nano magnetodielectric composite substrate**
2. Whether recurring or non-recurring grants:- **Recurring grants**
3. Grants position at the beginning of the Financial year
  - i. Cash in Hand/Bank :- **Rs. -1,89,957**
  - ii. Unadjusted advances :- **Nil**
  - iii. Total :- **Rs. -1,89,957**
4. Details of grants received, expenditure incurred and closing balances: (Actuals)

Unspent Balances of Grants received years [figure as at Sl. No. 3 (iii)]	Interest earned thereon	Interest deposited back to the Govt.	Grant received during the year			Total Available funds (1+2-3+4)	Expenditure incurred	Closing Balances (5-6)
			Sanction No. (i)	Date (ii)	Amount (iii)			
1	2	3	4			5	6	7
-1,89,957	Nil	Nil	SR/NM/NT-1032/2016(G)	11.12.2020	12,22,000	10,32,043	7,99,761	2,32,282

**Component wise utilization of grants:-**

Grant-in-aid-General	Grant-in-aid-Salary	Grant-in-aid-creation of capital assets	Total
1,81,921	6,17,840	Nil	7,99,761

**Details of grants position at the end of the year**


- i. Cash in Hand/Bank: **Rs. 2,32,282**
- ii. Unadjusted Advances: **Nil**
- iii. Total: **Rs. 2,32,282**

Certified that I have satisfied myself that the candidates on which grants were sanctioned have been dully fulfilled/are being fulfilled and that I have exercised following checks to see that the money has been actually utilized for the purpose for which it was sanctioned:

- i. The main accounts and other subsidiary accounts and registers (including assets registers) are maintained as prescribed in the relevant Act/Rules/Standing instruction (mentioned the Act/Rules) and have been duly audited by designated auditors. The figure depicted above tally with the audited figure mentioned in financial statements/accounts.
- ii. There exist internal controls for safeguarding public funds/assets, watching outcomes and achievements of physical targets against the financial inputs, ensuring quality in asset creation etc. & the periodic evaluation of internal controls is exercised to ensure their effectiveness.
- iii. To the best of our knowledge and belief, no transaction has been entered that are in violation of relevant Act/Rules/Standing instructions and scheme guidelines.
- iv. The responsibilities among the key functionaries for execution of the scheme have been assigned in clear terms and arc not general in nature.
- v. The benefits were extended to the intended beneficiaries and only such areas/districts were covered where the scheme was intended to operate.
- vi. The expenditure on various components of the scheme was in proportions authorized as per the scheme guidelines and terms and conditions of the grants-in-aid.
- vii. It has been ensured that the physical and financial performance under (name of the scheme) has been according to the requirements, as prescribed in the guidelines issued by Govt. of India and the performance/targets achieved statement for the year to which the utilization of the fund resulted in outcomes given at Annexure-I duly enclosed.
- viii. The utilization of the fund resulted in outcomes given at Annexure-II duly enclosed (to be formulated by the Ministry/Department concerned as per their requirements/specifications )
- ix. Details of various schemes executed by the agency through grants-in-aid received from the same Ministry or from other Ministries is enclosed at Annexure-II (to be formulated by the Ministry/Department concerned as per their requirements/specifications).


Date:

Place:

Signature   
Name.....

Chief Finance Officer  
(Head of the Finance)

*Finance Officer*  
*Tezpur University*

Signature   
Name.....

Head of the Organisation

*Registrar*  
*Tezpur University*

(Strike out inapplicable terms)

GFR 12-A

[Rule 238]

**FORM OF UTILIZATION CERTIFICATE**

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Of ~~recurring~~/non-recurring

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1. Name of the Scheme :- **Miniaturized flexible planar antennas for body worn applications as health monitoring system in L and S band using nano magnetodielectric composite substrate**
2. Whether recurring or non-recurring grants:- **Non-recurring grants**
3. Grants position at the beginning of the Financial year
  - i. Cash in Hand/Bank :- **Rs. 21,36,105**
  - ii. Unadjusted advances :- **Nil**
  - iii. Total :- **Rs. 21,36,105**
4. Details of grants received, expenditure incurred and closing balances: (Actuals)

Unspent Balances of Grants received years [figure as at Sl. No. 3 (iii)]	Interest earned thereon	Interest deposited back to the Govt.	Grant received during the year			Total Available funds (1+2-3+4)	Expenditure incurred	Closing Balances (5-6)
			Sanction No. (i)	Date (ii)	Amount (iii)			
1	2	3	4			5	6	7
21,36,105	35,473	35,473	Nil			21,36,105	Nil	21,36,105

Component wise utilization of grants:-

Grant-in-aid-General	Grant-in-aid-Salary	Grant-in-aid-creation of capital assets	Total
Nil	Nil	Nil	Nil

Details of grants position at the end of the year

- i. Cash in Hand/Bank: **Rs. 21,36,105**
- ii. Unadjusted Advances: **Nil**
- iii. Total: **Rs. 21,36,105**




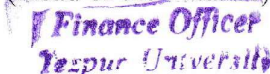
Certified that I have satisfied myself that the candidates on which grants were sanctioned have been dully fulfilled/are being fulfilled and that I have exercised following checks to see that the money has been actually utilized for the purpose for which it was sanctioned:


- i. The main accounts and other subsidiary accounts and registers (including assets registers) are maintained as prescribed in the relevant Act/Rules/Standing instruction (mentioned the Act/Rules) and have been duly audited by designated auditors. The figure depicted above tally with the audited figure mentioned in financial statements/accounts.
- ii. There exist internal controls for safeguarding public funds/assets, watching outcomes and achievements of physical targets against the financial inputs, ensuring quality in asset creation etc. & the periodic evaluation of internal controls is exercised to ensure their effectiveness.
- iii. To the best of our knowledge and belief, no transaction has been entered that are in violation of relevant Act/Rules/Standing instructions and scheme guidelines.
- iv. The responsibilities among the key functionaries for execution of the scheme have been assigned in clear terms and are not general in nature.
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- vi. The expenditure on various components of the scheme was in proportions authorized as per the scheme guidelines and terms and conditions of the grants-in-aid.
- vii. It has been ensured that the physical and financial performance under (name of the scheme) has been according to the requirements, as prescribed in the guidelines issued by Govt. of India and the performance/targets achieved statement for the year to which the utilization of the fund resulted in outcomes given at Annexure-I duly enclosed.
- viii. The utilization of the fund resulted in outcomes given at Annexure-II duly enclosed (to be formulated by the Ministry/Department concerned as per their requirements/specifications )
- ix. Details of various schemes executed by the agency through grants-in-aid received from the same Ministry or from other Ministries is enclosed at Annexure-II (to be formulated by the Ministry/Department concerned as per their requirements/specifications).


Date:

Place:

Signature   
Name..... 13.9.2024

Chief Finance Officer  
(Head of the Finance)  


Signature   
Name.....

Head of the Organisation  


(Strike out inapplicable terms)

## GFR 12-A

[Rule 238]

**FORM OF UTILIZATION CERTIFICATE**Utilization certificate for the year **2017-2018** in respectOf ~~recurring~~/non-recurring**GRANTS-IN-AID/SALARIES/CREATION OF CAPITAL ASSETS**

1. Name of the Scheme :- **Miniaturized flexible planar antennas for body worn applications as health monitoring system in L and S band using nano magnetodielectric composite substrate**
2. Whether recurring or non-recurring grants:- **Non-recurring grants**
3. Grants position at the beginning of the Financial year
  - i. Cash in Hand/Bank :- **Nil**
  - ii. Unadjusted advances :- **Nil**
  - iii. Total :- **Nil**
4. Details of grants received, expenditure incurred and closing balances: (Actuals)

Unspent Balances of Grants received years [figure as at Sl. No. 3 (iii)]	Interest earned thereon	Interest deposited back to the Govt.	Grant received during the year			Total Available funds (1+2-3+4)	Expenditure incurred	Closing Balances (5-6)
			Sanction No. (i)	Date (ii)	Amount (iii)			
1	2	3	4			5	6	7
Nil	59,716	59,716	SR/NM/NT-1032/2016(C)	17.10.17	54,22,000	54,22,000	Nil	54,22,000

**Component wise utilization of grants:-**

Grant-in-aid-General	Grant-in-aid-Salary	Grant-in-aid-creation of capital assets	Total
Nil	Nil	Nil	Nil

**Details of grants position at the end of the year**

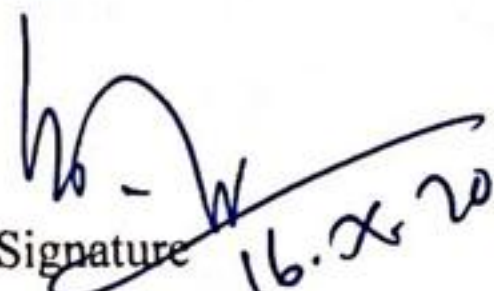
- i. Cash in Hand/Bank: **Rs 54,22,000**
- ii. Unadjusted Advances: **Nil**
- iii. Total: **Rs 54,22,000**

Certified that I have satisfied myself that the candidates on which grants were sanctioned have been dully fulfilled/are being fulfilled and that I have exercised following checks to see that the money has been actually utilized for the purpose for which it was sanctioned:

- i. The main accounts and other subsidiary accounts and registers (including assets registers) are maintained as prescribed in the relevant Act/Rules/Standing instruction (mentioned the Act/Rules) and have been duly audited by designated auditors. The figure depicted above tally with the audited figure mentioned in financial statements/accounts.
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- iii. To the best of our knowledge and belief, no transaction has been entered that are in violation of relevant Act/Rules/Standing instructions and scheme guidelines.
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- viii. The utilization of the fund resulted in outcomes given at Annexure-II duly enclosed (to be formulated by the Ministry/Department concerned as per their requirements/specifications )
- ix. Details of various schemes executed by the agency through grants-in-aid received from the same Ministry or from other Ministries is enclosed at Annexure-II (to be formulated by the Ministry/Department concerned as per their requirements/specifications).


Date:

Place:

  
Signature  
16.2.20  
Name.....

Chief Finance Officer  
(Head of the Finance)

*Finance Officer*  
*Tezpur University*

  
Signature  
Name.....

Head of the Organisation  
*Registrar*  
*Tezpur University*

(Strike out inapplicable terms)

GFR 12-A

[Rule 238]

**FORM OF UTILIZATION CERTIFICATE**

Utilization certificate for the year 2018-2019 in respect

Of ~~recurring~~/non-recurring

GRANTS-IN-AID/SALARIES/CREATION OF CAPITAL ASSETS

1. Name of the Scheme :- **Miniaturized flexible planar antennas for body worn applications as health monitoring system in L and S band using nano magnetodielectric composite substrate**
2. Whether recurring or non-recurring grants:- **Non-recurring grants**
3. Grants position at the beginning of the Financial year
  - i. Cash in Hand/Bank :- **Rs 54,22,000**
  - ii. Unadjusted advances :- **Nil**
  - iii. Total :- **Rs 54,22,000**
4. Details of grants received, expenditure incurred and closing balances: (Actuals)

Unspent Balances of Grants received years [figure as at Sl. No. 3 (iii)]	Interest earned thereon	Interest deposited back to the Govt.	Grant received during the year			Total Available funds (1+2-3+4)	Expenditure incurred	Closing Balances (5-6)
			Sanction No. (i)	Date (ii)	Amount (iii)			
1	2	3	4			5	6	7
54,22,000	1,64,451	1,64,451		Nil		54,22,000	Nil	54,22,000

Component wise utilization of grants:-

Grant-in-aid-General	Grant-in-aid-Salary	Grant-in-aid-creation of capital assets	Total
Nil	Nil	Nil	Nil

Details of grants position at the end of the year

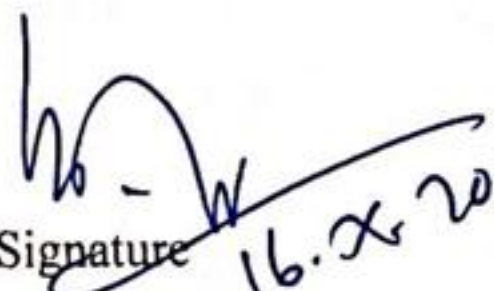
- i. Cash in Hand/Bank: **Rs 54,22,000**
- ii. Unadjusted Advances: **Nil**
- iii. Total: **Rs 54,22,000**

Certified that I have satisfied myself that the candidates on which grants were sanctioned have been dully fulfilled/are being fulfilled and that I have exercised following checks to see that the money has been actually utilized for the purpose for which it was sanctioned:

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- ix. Details of various schemes executed by the agency through grants-in-aid received from the same Ministry or from other Ministries is enclosed at Annexure-II (to be formulated by the Ministry/Department concerned as per their requirements/specifications).


Date:

Place:

  
Signature  
16.2.20  
Name.....

Chief Finance Officer  
(Head of the Finance)

*Finance Officer*  
*Tezpur University*

  
Signature  
Name.....

Head of the Organisation  
*Registrar*  
*Tezpur University*

(Strike out inapplicable terms)

## GFR 12-A

[Rule 238]

**FORM OF UTILIZATION CERTIFICATE**Utilization certificate for the year **2019-2020** in respectOf ~~recurring~~/non-recurring**GRANTS-IN-AID/SALARIES/CREATION OF CAPITAL ASSETS**

1. Name of the Scheme :- **Miniaturized flexible planar antennas for body worn applications as health monitoring system in L and S band using nano magnetodielectric composite substrate**
2. Whether recurring or non-recurring grants:- **Non-recurring grants**
3. Grants position at the beginning of the Financial year
  - i. Cash in Hand/Bank :- **Rs 54,22,000**
  - ii. Unadjusted advances :- **Nil**
  - iii. Total :- **Rs 54,22,000**
4. Details of grants received, expenditure incurred and closing balances: (Actuals)

Unspent Balances of Grants received years [figure as at Sl. No. 3 (iii)]	Interest earned thereon	Interest deposited back to the Govt.	Grant received during the year			Total Available funds (1+2-3+4)	Expenditure incurred	Closing Balances (5-6)
			Sanction No. (i)	Date (ii)	Amount (iii)			
1	2	3	4			5	6	7
54,22,000/	65,603/	65,603	Nil			54,22,000	32,85,895	21,36,105/

**Component wise utilization of grants:-**

Grant-in-aid-General	Grant-in-aid-Salary	Grant-in-aid-creation of capital assets	Total
Nil	Nil	32,85,895	32,85,895

**Details of grants position at the end of the year**

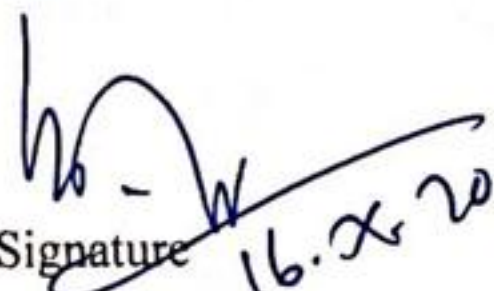
- i. Cash in Hand/Bank: **Rs 21,36,105**
- ii. Unadjusted Advances: **Nil**
- iii. Total: **Rs 21,36,105**

Certified that I have satisfied myself that the candidates on which grants were sanctioned have been dully fulfilled/are being fulfilled and that I have exercised following checks to see that the money has been actually utilized for the purpose for which it was sanctioned:

- i. The main accounts and other subsidiary accounts and registers (including assets registers) are maintained as prescribed in the relevant Act/Rules/Standing instruction (mentioned the Act/Rules) and have been duly audited by designated auditors. The figure depicted above tally with the audited figure mentioned in financial statements/accounts.
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Date:

Place:

  
Signature  
16.2.20  
Name.....

Chief Finance Officer  
(Head of the Finance)

*Finance Officer*  
*Tezpur University*

  
Signature  
Name.....

Head of the Organisation  
*Registrar*  
*Tezpur University*

(Strike out inapplicable terms)

GFR 12-A  
[Rule 238]

**FORM OF UTILIZATION CERTIFICATE**

Utilization certificate for the year **2017-2018** in respect

Of recurring/~~non-recurring~~

**GRANTS-IN-AID/SALARIES/CREATION OF CAPITAL ASSETS**

1. Name of the Scheme :- **Miniaturized flexible planar antennas for body worn applications as health monitoring system in L and S band using nano magnetodielectric composite substrate**
2. Whether recurring or non-recurring grants:- **Recurring grants**
3. Grants position at the beginning of the Financial year
  - i. Cash in Hand/Bank :- **Nil**
  - ii. Unadjusted advances :- **Nil**
  - iii. Total :- **Nil**
4. Details of grants received, expenditure incurred and closing balances: (Actuals)

Unspent Balances of Grants received years [figure as at Sl. No. 3 (iii)]	Interest earned thereon	Interest deposited back to the Govt.	Grant received during the year			Total Available funds (1+2-3+4)	Expenditure incurred	Closing Balances (5-6)
			Sanction No. (i)	Date (ii)	Amount (iii)			
1	2	3	4			5	6	7
Nil	10,232	10,232	SR/NM/NT-1032/2016(C)	17.10.17	9,78,000	9,78,000	49,000	9,29,000

**Component wise utilization of grants:-**

Grant-in-aid-General	Grant-in-aid-Salary	Grant-in-aid-creation of capital assets	Total
Nil	49,000	Nil	49,000

**Details of grants position at the end of the year**

- i. Cash in Hand/Bank: **Rs 9,29,000**
- ii. Unadjusted Advances: **Nil**
- iii. Total: **Rs 9,29,000**

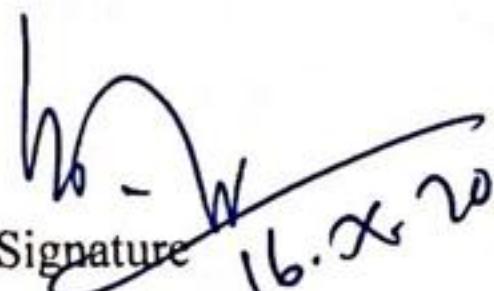


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Date:

Place:

  
Signature  
16.2.20  
Name.....

Chief Finance Officer  
(Head of the Finance)

*Finance Officer*  
*Tezpur University*

  
Signature  
Name.....

Head of the Organisation  
*Registrar*  
*Tezpur University*

(Strike out inapplicable terms)

GFR 12-A  
[Rule 238]

**FORM OF UTILIZATION CERTIFICATE**

Utilization certificate for the year 2018-2019 in respect

Of recurring/~~non-recurring~~

**GRANTS-IN-AID/SALARIES/CREATION OF CAPITAL ASSETS**

1. Name of the Scheme :- **Miniaturized flexible planar antennas for body worn applications as health monitoring system in L and S band using nano magnetodielectric composite substrate**
2. Whether recurring or non-recurring grants:- **Recurring grants**
3. Grants position at the beginning of the Financial year
  - i. Cash in Hand/Bank :- **Rs 9,29,000**
  - ii. Unadjusted advances :- **Nil**
  - iii. Total :- **Rs 9,29,000**
4. Details of grants received, expenditure incurred and closing balances: (Actuals)

Unspent Balances of Grants received years [figure as at Sl. No. 3 (iii)]	Interest earned thereon	Interest deposited back to the Govt.	Grant received during the year			Total Available funds (1+2-3+4)	Expenditure incurred	Closing Balances (5-6)
			Sanction No. (i)	Date (ii)	Amount (iii)			
1	2	3	4			5	6	7
9,29,000/	6,218 ✓	6,218	Nil			9,29,000	7,31,973	1,97,027 ✓

**Component wise utilization of grants:-**

Grant-in-aid-General	Grant-in-aid-Salary	Grant-in-aid-creation of capital assets	Total
2,72,491	4,59,482	Nil	7,31,973

**Details of grants position at the end of the year**

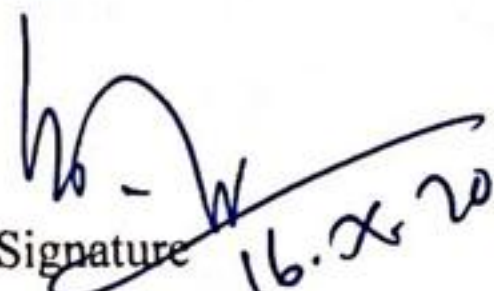
- i. Cash in Hand/Bank: **Rs 1,97,027**
- ii. Unadjusted Advances: **Nil**
- iii. Total: **Rs 1,97,027**

Certified that I have satisfied myself that the candidates on which grants were sanctioned have been dully fulfilled/are being fulfilled and that I have exercised following checks to see that the money has been actually utilized for the purpose for which it was sanctioned:

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Date:

Place:

  
Signature  
16.2.20  
Name.....

Chief Finance Officer  
(Head of the Finance)

*Finance Officer*  
*Tezpur University*

  
Signature  
Name.....

Head of the Organisation  
*Registrar*  
*Tezpur University*

(Strike out inapplicable terms)

GFR 12-A  
[Rule 238]

**FORM OF UTILIZATION CERTIFICATE**

Utilization certificate for the year 2019-2020 in respect

Of recurring/~~non-recurring~~

**GRANTS-IN-AID/SALARIES/CREATION OF CAPITAL ASSETS**

1. Name of the Scheme :- **Miniaturized flexible planar antennas for body worn applications as health monitoring system in L and S band using nano magnetodielectric composite substrate**
2. Whether recurring or non-recurring grants:- **Recurring grants**
3. Grants position at the beginning of the Financial year
  - i. Cash in Hand/Bank :- **Rs 2,13,477**
  - ii. Unadjusted advances :- **Nil**
  - iii. Total :- **Rs 2,13,477**
4. Details of grants received, expenditure incurred and closing balances: (Actuals)

Unspent Balances of Grants received years [figure as at Sl. No. 3 (iii)]	Interest earned thereon	Interest deposited back to the Govt.	Grant received during the year			Total Available funds (1+2-3+4)	Expenditure incurred	Closing Balances (5-6)
			Sanction No. (i)	Date (ii)	Amount (iii)			
1	2	3	4			5	6	7
1,97,027	0	0		Nil		1,97,027	3,86,984	-1,89,957

**Component wise utilization of grants:-**

Grant-in-aid-General	Grant-in-aid-Salary	Grant-in-aid-creation of capital assets	Total
76,184,00	3,10,800	Nil	3,86,984

**Details of grants position at the end of the year**

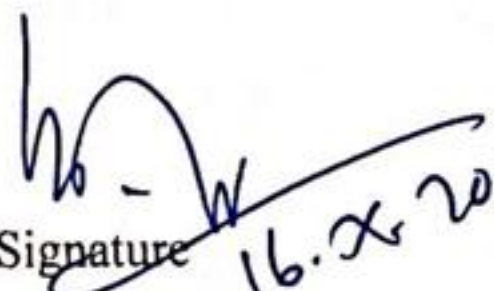
- i. Cash in Hand/Bank: **Rs -1,89,957**
- ii. Unadjusted Advances: **Nil**
- iii. Total: **Rs -1,89,957**

Certified that I have satisfied myself that the candidates on which grants were sanctioned have been dully fulfilled/are being fulfilled and that I have exercised following checks to see that the money has been actually utilized for the purpose for which it was sanctioned:

- i. The main accounts and other subsidiary accounts and registers (including assets registers) are maintained as prescribed in the relevant Act/Rules/Standing instruction (mentioned the Act/Rules) and have been duly audited by designated auditors. The figure depicted above tally with the audited figure mentioned in financial statements/accounts.
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Date:

Place:

  
Signature  
16.2.20  
Name.....

Chief Finance Officer  
(Head of the Finance)

*Finance Officer*  
*Tezpur University*

  
Signature  
Name.....

Head of the Organisation  
*Registrar*  
*Tezpur University*

(Strike out inapplicable terms)