TAG CORPORATION

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An ISO : 9001 Company

THIRD PARTY TEST REPORT

TEST REPORT NO: CT / 030 / 12-13 Date: 21/05/2012

1. **COMMODITY TESTED** : ACSR BERSIMIS Conductor
   Size- 42 /4.57 mm + 7 / 2.54 mm
2. **CUSTOMER** : Hindustan Vidyut Products Ltd., Guwahati
3. **DATE OF TEST** : 17-05-2012
4. **DETAILS OF TEST AND TEST METHOD** : As given in page 2
5. **RESULTS** : As given in pages 3 to 5
6. **TAG REFERENCE NUMBER** : TSI/12-13/026
7. **ADDITIONAL DETAILS:**

   Buyer's Details

   a) Customer Name : Powergrid Corporation of India Limited

   b) Project Details : Package-P238-CD03 765 KV S/C Bina-Gwalior T/L associated with Transmission System for Phase-I Generation Projects in Orissa (Part-C)

   c) LOA No : CC-CS/111-WR2/CD-996/3/G2/NOA/4005 Dtd: 23-11-2011

This report contains 5 pages including this page, 2 annexure, 3 photographs, and 5 tables. We certify that the information contained in this report is accurate. No part of this report shall be reproduced without written consent of the laboratory.

TESTING ENGINEER

TAG CORPORATION CHENNAI-44

TESTING INCHARGE

TEST REPORT NO: CT / 030 / 12-13

Tests carried out on ACSR BERSIMIS Conductor on 17-05-2012:

S. No.	Test	Test Method	Sample ID / Drum No.	Page Number
1	D.C Resistance Test	IS 398 (Part 5)	AB – 02	3
2	UTS and Surface Condition Test	IS 398 (Part 2)	AB – 02	3

The Results provided pertain to the received samples only, whose sample ID / Drum No. is given above

Details of Samples Received:

One Samples received in good condition. Date of receipt of the sample is 16/05/2012.

The Samples are selected & sealed by,

Mr. M.K. Baruah, Chief Manager (FQA), NER.

TESTING ENGINEER

TAG CORPORATION CHENNAI-44

TESTING INCHARGE

TEST REPORT NO: CT / 030 / 12-13

1. DC Resistance test

Deviation from Procedure: Nil

Results:

Commodity	ACSR Bersimis Conductor *Size- 42 / 4.57 + 7 / 2.54 mm*
Sample Identification / Drum No.	AB-02
Ambient Temperature (°C)	40.2
Average measured resistance at ambient temp. (*Average of 5 readings*) (μΩm)	45.4
Temperature Co-efficient of Resistance	0.00400
Resistance at 20°C (Ω/km)	**0.04200**
Rated DC resistance at 20°C (Ω/km)	*0.04242(Max)*

2. UTS and Surface Condition Test

Deviation from Procedure: Nil

Results:

Commodity	ACSR Bersimis Conductor *Size- 42 / 4.57 + 7 / 2.54 mm*
Sample Identification / Drum No.	AB-02
Length of the conductor (mm)	5530
Surface condition of the conductor at 50% of rated tensile strength	Satisfactory, no distortion of circles
Did the sample withstand rated UTS for 1 minute	**Yes**
Ultimate breaking load achieved (KN)	**155**
Location of breakage	All top layer Aluminium strands broke at clamp mouth in the Non-Tensioning end.
Rated Tensile Strength(KN)	*154.0(Min)*
95 % of Rated UTS(KN)	*146.3(Min)*

TESTING ENGINEER

TAG CORPORATION * CHENNAI-44 *

TESTING INCHARGE

TEST REPORT NO: CT / 030 / 12-13

Annexure I: Equipments Used

S. No.	Equipment	Make/Model	Unique No.	Calibrated on	Calibration Due	Traceability
1	Measuring Tape(3 m)	GIANT	TAG/M/020	12/03/2012	12/03/2013	TCC- 30952
2	Digital Temperature Indicator	UV	TAG/E/053	20/10/2011	19/10/2012	CC No : 6302
3	Digital Micro-ohm meter	ELTEL/DMO100	TAG/E/011	28/07/2011	28/07/2012	CT437-2
4	Measuring Tape (0-30 m)	FREEMANS	TAG/E/046	16/06/2011	15/06/2012	LK 1106/84/02
5	Vernier Caliper	MITUTOYO	TAG/M/013	14/03/2012	14/03/2013	TCC – 210476
6	Horizontal Universal Testing Machine (100T)	FIE	TAG/M/001	08/08/2011	07/08/2012	HIEPL/08/2011/165
7	Digital Stopwatch	RACER	TAG/E/079	03/10/2011	03/10/2012	MNE 0756/11

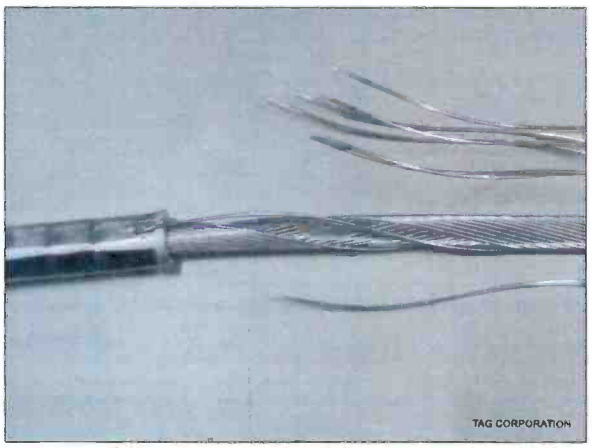
S. No.	Equipment	Unique No.	Used in test	
			Test 1	Test 2
1	Measuring Tape(3 m)	TAG/M/020	✓	✓
2	Digital Temperature Indicator	TAG/E/053	✓	
3	Digital Micro-ohm meter	TAG/E/011	✓	
4	Measuring Tape(0-30 m)	TAG/E/046		✓
5	Vernier Caliper	TAG/M/013		✓
6	Horizontal Universal Testing Machine (100T)	TAG/M/001		✓
7	Digital Stopwatch	TAG/E/079		✓

TAG CORPORATION CHENNAI-44

TEST REPORT NO: CT / 030 / 12-13

Annexure II: Photographs

D.C Resistance Test



UTS & Surface Condition Test

TAG CORPORATION CHENNAI-44

TEST REPORT

SABS

Client	: Hindusthan Vidyut Products Ltd. Plot - 1C, B.C.L., North Guwahati, India
Manufacturer	: Hindusthan Vidyut Products Ltd. North Guwahati, India
Apparatus tested	: ACSR Bersimis conductor (Al 42/4.57 + St 7/2.54 mm)
Voltage rating	: 765 kV
Configuration type	: Quad bundle
Conductor Spacing	: 457 mm
Sample Identification	
Customer	: Powergrid Corporation of India Ltd.
Order No.	: CC-CS/111-WR2/CD-996/3/G2/NOA/4005 Dated 23/11/2011
Project	: Package - P238 - CD03 for 765 kV S/C Bina - Gwalior T/L Associated with Transmission System for Phase - I Generation Project in Orissa (Part - C).
Drum number	: AB-03
Sealed By	: Mr MK Baruah, Chief Manager (FQA), NER.
Tests performed	: Dry RIV and Corona tests

Tests have been carried out in accordance with the client's instruictions:

Test procedures and test parameters were based on:

C.I.S.P.R. Publication 18-2: 2010	*Radio Interference characteristics of overhead power lines and high-voltage equipment Part 2: Methods of measurement and procedure for determining limits* *Clause 4.5.13 Test procedure*

Date of tests : 11 May 2012

Conclusion : **The results are shown in section 4 of this report**

This report consists of the following pages:

Report forms 5

LAJ van den Heever
Manager: High Voltage Laboratory
NETFA

GW Bourn (Technical Signatory)
Specialist: High Voltage Laboratory
NETFA

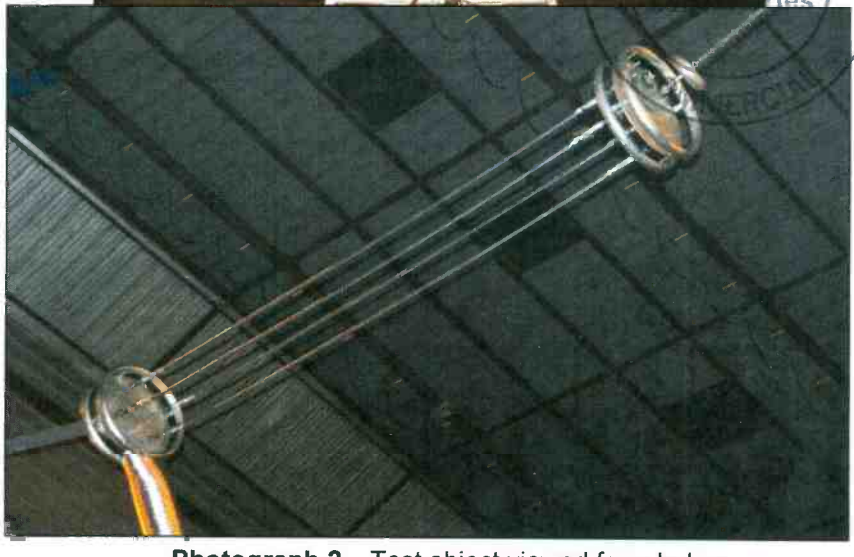
Olifantsfontein, 11 May 2012

1 Test method

The four Bersimis conductors comprising the quad bundle were cut to 6m lengths and provided with crimped dead-ends.
The conductors were then attached to end plates with 457mm spacing between conductors.
The bundle conductor was provided with discharge-free terminations and suspended at a height of 15 m (geometric mean centre to ground).

Photographs of the suspended test sample and environment are shown in photographs 1 and 2 below.

Photograph 1
Test object suspended at 15 m.



Photograph 2 Test object viewed from below

2 Measuring equipment

The following equipment was used for the measurements:

Type	Make and model	SABS number	Calibration expiry date	Accuracy
AC divider	Asea Bushing Tap	SABS 60736	Apr-13	± 1.0%
AC peak voltmeter	Haefely Type 51	SABS 19875	Jul-12	± 1.5%
HF Receiver	Schwarzbeck FSME 1515	SABS 13726	Mar-13	± 5.0%
Atmospheric pressure	Davis 7400	S/N:PE00805A05	Dec-12	± 1.0%
Temperature				± 1.0%
Humidity				± 5.0%

Calibration of the above equipment is traceable to national standards.

2.1 Tolerance on measurements

AC voltage 3%
RIV 5%

3 Test conditions

The tests were conducted at the National Electrical Test Facility of the South African Bureau of Standards.
Test laboratory altitude: 1540 m
Sample condition: The sample arrived wrapped in a protective cover which was removed after the sample was strung up for testing.

The tests were witnessed by Mr PS Malviya of Hindusthan Vidyut Products Ltd.

4 Results

4.1 RIV and visible corona measurements.

Table 1 on the next page shows the sequence of voltage application and the results of RIV and visible corona tests.
The plot of all recorded RIV values is shown in Figure 1.

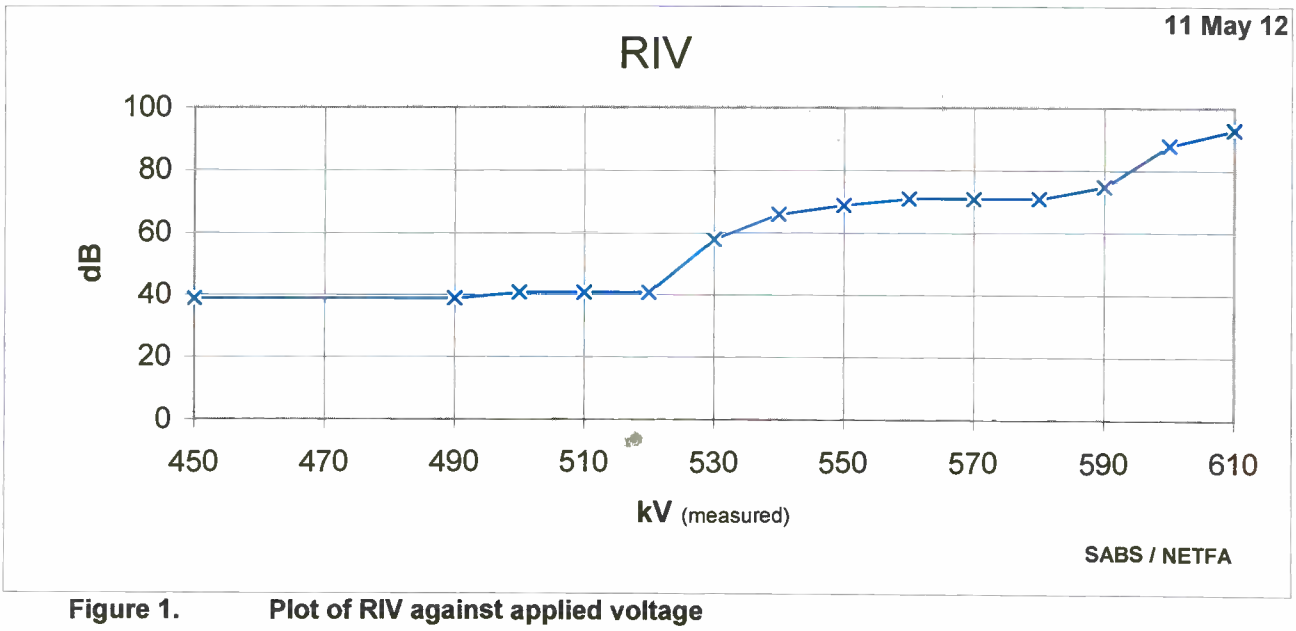


Figure 1. **Plot of RIV against applied voltage**
Sample: ACSR Bersimis conductor (Al 42/4.57 + St 7/2.54 mm)
Manufacturer: Hindusthan Vidyut Products Ltd., North Guwahati

Pressure	85.5	kPa	Temperature	17	°C
Humidity	6.08	g/m^3	Height (GMR)	15	m
Atmospheric correction factor:				**0.81**	
Specified Test voltage U_0				**510**	kV

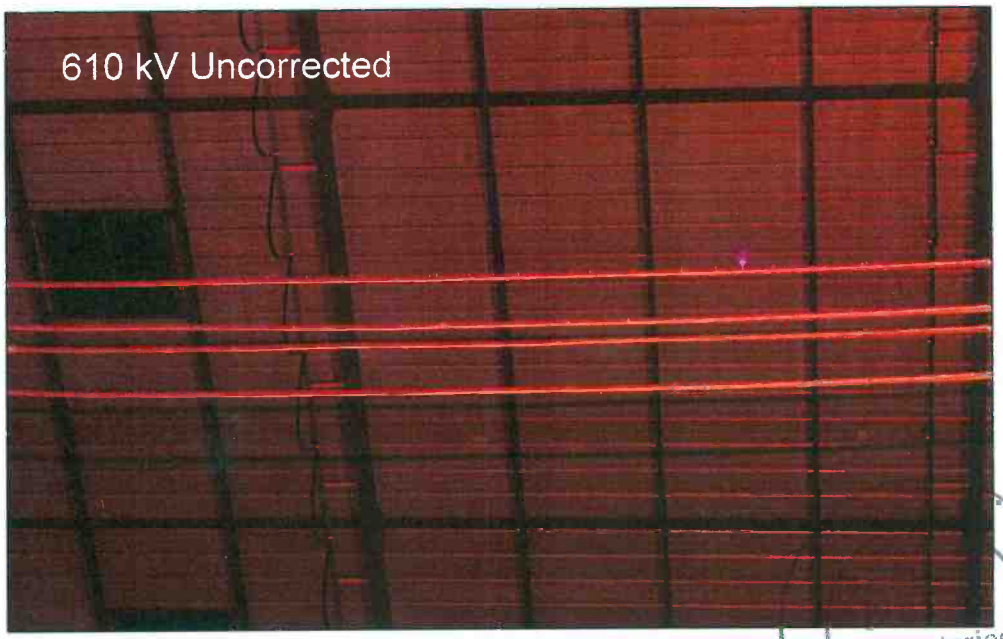
Level	Voltage		Minutes	RIV (1Mhz; 300Ω)			
	measured	corrected*		increasing voltage		decreasing voltage	
	kV	kV		dB	µV	dB	µV
120%	610	*753*	*5*	*96*	*63096*	93	*44668*
100%	510	*630*		*40*	*100*	*41*	*112*
120%	610	*753*	*1*			*93*	*44668*
↓	600	*741*				*88*	*25119*
	590	*728*				*75*	*5623*
	580	*716*				*71*	*3548*
	570	*704*				*71*	*3548*
	560	*691*				*71*	*3548*
	550	*679*				*69*	*2818*
	540	*667*				*66*	*1995*
	530	*654*				*58*	*794*
	520	*642*				*41*	*112*
	510	*630*				*41*	*112*
	500	*617*				*41*	*112*
	490	*605*				*39*	*89*
	450	*556*				*39*	*89*

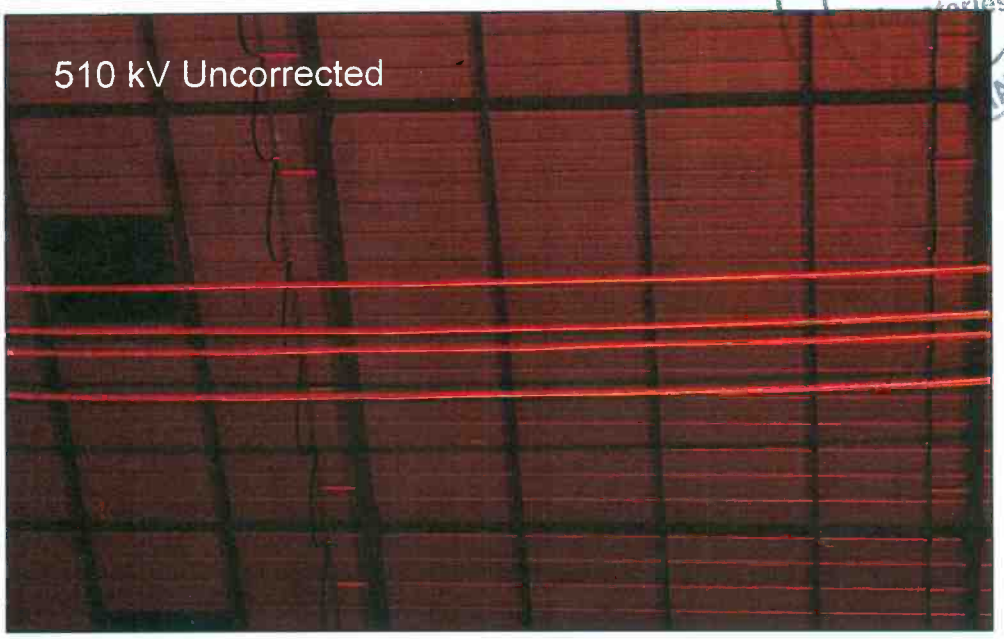
Corona observation	*Inception*			*Extinction*		
	reading kV	mean kV	corrected kV	*reading* kV	mean kV	corrected kV
	535	**536**	**662**	*528*	**527**	***651***
	537			*528*		
	537			*526*		

* corrected to 20°C, 101.3kPa and 11g/m^3 humidity in accordance with IS 731-1971 Appendix A

Table 1. Sequence of voltage application and measurements of RIV and corona.

In a further test, the visible corona inception and extinction voltages (as viewed through a corona camera) were determined 3 times. The photographs below show the corona at the highest uncorrected voltage and at the required uncorrected corona-free voltage.





4.1.1 Summary of Corona tests

Parameter	Measured		Corrected*	
Corona inception (mean of 3)	*536*	kV	*662*	kV
Corona extinction (mean of 3)	*527*	kV	*651*	kV

* to IS: 731 - 1971 (Ed. 3.6)

4.1.2 Summary of RIV tests

Applied voltage		RIV (dry)		
measured	corrected*	frequency	measured	
510 kV	*630* kV	*1.0* MHz	*41* dB	*112* µV

* to IS: 731 - 1971 (Ed. 3.6)