



Anexo 7

Ambiente Sonoro



Apêndice 7.1 Relatório de ensaio

RELATÓRIO DE ENSAIO

RE 02/17 – 02/23 – ED01/REV00



MONITAR
engenharia do ambiente

RELATÓRIO DE ENSAIO

RE 02/17 – 02/23 – ED01/REV00

AVALIAÇÃO ACÚSTICA NO ÂMBITO DO ESTUDO DE IMPACTE AMBIENTAL DO PROJETO DA CENTRAL SOLAR FOTOVOLTAICA DE SOPHIA

ENSAIO	MÉTODO
Medição dos níveis de pressão sonora. Determinação do nível médio de longa duração.	NP ISO 1996-1:2021 NP ISO 1996-2:2021 PT 006 Ed05/Rev00



FICHA TÉCNICA DO RELATÓRIO DE ENSAIO

AUTOR DO RELATÓRIO	MONITARLAB - MONITAR, LDA. RUA QUINTA D'EL REI, LOTE 266, FRAÇÕES A/B 3500-612 VISEU
IDENTIFICAÇÃO DO CLIENTE	MATOS, FONSECA & ASSOCIADOS ESTRADA DA ALAGOA, 257 8º DTO 2775-717 CARCAVELOS
TÍTULO DO RELATÓRIO	AVALIAÇÃO ACÚSTICA NO ÂMBITO DO ESTUDO DE IMPACTE AMBIENTAL DO PROJETO DA CENTRAL SOLAR FOTOVOLTAICA DE SOPHIA
N.º DO RELATÓRIO	02/17 – 02/23
EDIÇÃO/REVISÃO	ED01/REV00
NATUREZA DA REVISÃO	---
RELATÓRIOS ANTERIORES	---
ÂMBITO DO RELATÓRIO	ESTUDO DE IMPACTE AMBIENTAL
N.º DA PROPOSTA	02/17 – 02/23
LOCAIS DE MEDIÇÃO	R1 – UNIÃO DE FREGUESIAS DE PEDROGÃO DE SÃO PEDRO E BEMPOSTO, CONCELHO DE PENAMACOR, DISTRITO DE CASTELO BRANCO R2 – FREGUESIA DE ALDEIA DE SANTA MARGARIDA, CONCELHO DE IDANHA-A-NOVA, DISTRITO DE CASTELO BRANCO R3 – FREGUESIA DE PENAMACOR, CONCELHO DE PENAMACOR, DISTRITO DE CASTELO BRANCO R4 E R5 – FREGUESIA DE ORCA, CONCELHO DO FUNDÃO, DISTRITO DE CASTELO BRANCO R6 – UNIÃO DAS FREGUESIAS DE PÓVOA DE ATALAIA E ATALAIA DO CAMPOS, CONCELHO DO FUNDÃO, DISTRITO DE CASTELO BRANCO R7, R8, R9, R10, R11, R12 E R13 – UNIÃO DAS FREGUESIAS DE VALE DE PRAZERES E MATA DA RAINHA, CONCELHO DO FUNDÃO, DISTRITO DE CASTELO BRANCO R14 – FREGUESIA DE ALCAIDE, CONCELHO DO FUNDÃO, DISTRITO DE CASTELO BRANCO R15, R16 E R17 – FREGUESIA DE ENXAMES, CONCELHO DO FUNDÃO, DISTRITO DE CASTELO BRANCO R18 – UNIÃO DAS FREGUESIAS DE FUNDÃO, VALVERDE, DONAS, ALDEIA DE JOANES E ALDEIA NOVA DO CABO, CONCELHO DO FUNDÃO, DISTRITO DE CASTELO BRANCO
DATA DE REALIZAÇÃO DAS MEDIÇÕES	5 A 7 DE JUNHO DE 2024
DIRETOR TÉCNICO	Assinado por: PAULO GABRIEL FERNANDES DE PINHO Num. de Identificação: 09662186 Data: 2024.07.09 10:57:58 +0100
TÉCNICO OPERACIONAL	Assinado por: Nuno Miguel Ribeiro dos Santos Num. de Identificação: 12118822 Data: 2024.07.09 09:47:25+01'00'
DATA DE PUBLICAÇÃO DO RELATÓRIO	9 DE JULHO DE 2024

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INTRODUÇÃO

O presente Relatório de Ensaio é relativo à avaliação acústica realizada no âmbito do Estudo de Impacte Ambiental do Projeto da Central Solar Fotovoltaica (CSF) de Sophia, localizada nos municípios de Penamacor, Idanha-a-Nova e Fundão. A avaliação acústica foi realizada de acordo com o Regulamento Geral do Ruído (RGR) (Decreto-Lei n.º 9/2007, de 17 de Janeiro).

Foram efetuadas medições de ruído em 18 locais que representam os conjuntos de recetores sensíveis previsivelmente mais afetados pelo ruído proveniente da futura CSF de Sophia.

Para verificação do cumprimento do critério de exposição, os indicadores de ruído diurno-entardecer-noturno (L_{den}) e noturno (L_n), obtidos para os locais de medição, foram comparados com os valores limite de exposição definidos no artigo 11.º do RGR e tido em consideração que os concelhos de Penamacor (R1 e R3), Idanha-a-Nova (R2) e Fundão (R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R16, R17 e R18) não atribuem, segundo os seus Planos Diretores Municipais em vigor, classificação de zona aos locais de medição.

METODOLOGIA DE MEDIÇÃO

- NP ISO 1996-1:2021. Acústica. Descrição, medição e avaliação do ruído ambiente. Parte 1: Grandezas fundamentais e métodos de avaliação;
- NP ISO 1996-2:2021. Acústica. Descrição, medição e avaliação do ruído ambiente. Parte 2: Determinação dos níveis de pressão sonora;
- PT 006 Ed05/Rev00. Procedimento Técnico Interno do Laboratório MonitarLab “Determinação do Nível Sonoro Médio de longa Duração”

Observações: Ensaio realizado pelo laboratório de ensaio da Monitar. O anexo técnico de Acreditação pode ser consultado no sítio internet do IPAC através do seguinte link http://www.ipac.pt/pesquisa/ficha_lae.asp?ID=L0558.

EQUIPAMENTO DE MEDIÇÃO

EQUIPAMENTO DE MEDIÇÃO	MARCA/MODELO/N.º DE SÉRIE
Sonómetro integrador da classe de precisão 1	Brüel & Kjaer/2250/2709696
Despacho de aprovação do Sonómetro	245.70.05.3.16
Boletim de Verificação	VACV54/24
Data de verificação	05/02/2024
Sonómetro integrador da classe de precisão 1	Brüel & Kjaer/2260/2604603
Despacho de aprovação do Sonómetro	245.70.98.3.19
Boletim de Verificação	VACV38/24
Data de verificação	02/02/2024
Sonómetro integrador da classe de precisão 1	Norsonic/Nor145/14530068
Despacho de aprovação do Sonómetro	245.71.21.3.38
Boletim de Verificação	VACV163/23
Data de verificação	25/05/2023
Termo-higrómetro-Anemómetro	Kestrel/5500/2748201
Certificados de Calibração	CHUM764/23 (Higrómetro e Termómetro); LAC.2023.0006 (Anemómetro)
Data de calibração	03/03/2023 (Higrómetro e Termómetro); 12/01/2023 (Anemómetro)

LOCAIS DE MEDIÇÃO

LOCAL DE MEDIÇÃO	FREGUESIA	COORDENADAS (PTTM06/ETRS89)	TIPO DE RECETOR	DISTÂNCIA APROXIMADA AO PROJETO (m)	POSIÇÃO DO RECETOR RELATIVAMENTE AO PROJETO
R1	União das freguesias de Pedrógão de São Pedro e Bemposta	M: 77427 P: 44659	Habitação isolada	---	Interior da área da CSF
R2	Aldeia de Santa Margarida	M: 73566 P: 44436	Habitação isolada	---	Interior da área da CSF
R3	Penamacor	M: 70583 P: 45355	Habitação isolada	170	Noroeste da área da CSF
R4	Orca	M: 67033 P: 44342	Habitação isolada	---	Interior da área da CSF
R5		M: 66470 P: 45208	Conjunto de habitações	---	Interior da área da CSF
R6	União das freguesias de Póvoa de Atalaia e Atalaia do Campo	M: 63105 P: 45054	Habitação isolada	10	Este da área da CSF

LOCAL DE MEDIÇÃO	FREGUESIA	COORDENADAS (PTTM06/ETRS89)	TIPO DE RECETOR	DISTÂNCIA APROXIMADA AO PROJETO (m)	POSIÇÃO DO RECETOR RELATIVAMENTE AO PROJETO
R7	União das freguesias de Vale de Prazeres e Mata da Rainha	M: 69867 P: 47277	Habitação isolada	290	Este da área da CSF
R8		M: 68597 P: 48949	Habitação isolada	---	Interior da área da CSF
R9		M: 69864 P: 49912	Habitação isolada	---	Interior da área da CSF
R10		M: 71973 P: 50547	Habitação isolada	---	Interior da área da CSF
R11		M: 70182 P: 51218	Conjunto de habitações	100	Sudeste da alternativa sul da LMAT
R12		M: 70861 P: 51767	Conjunto de habitações	110	Noroeste da alternativa sul da LMAT
R13		M: 66944 P: 51746	Habitação isolada	80	Norte da alternativa sul da LMAT
R14	Alcaide	M: 62753 P: 51724	Habitação isolada	90	Sudoeste da alternativa sul da LMAT
R15	Enxames	M: 62120 P: 53005	Habitação isolada	110	Este da alternativa sul da LMAT
R16		M: 62170 P: 53841	Habitação isolada	75	Oeste da alternativa sul da LMAT
R17		M: 62354 P: 56527	Habitação isolada	55	Noroeste da alternativa norte da LMAT
R18	União das freguesias de Fundão, Valverde, Donas, Aldeia de Joanes e Aldeia Nova do Cabo	M: 58725 P: 56126	Habitação isolada	140	Nordeste da alternativa norte da LMAT

Nota: Os locais de medição estão representados em anexo (ver Carta n.º 1 - Locais de medição de ruído).

REGISTO FOTOGRÁFICO



Local de medição R1



Local de medição R2



Local de medição R3



Local de medição R4



Local de medição R5



Local de medição R6

REGISTO FOTOGRÁFICO



Local de medição R7



Local de medição R8



Local de medição R9



Local de medição R10



Local de medição R11



Local de medição R12

REGISTO FOTOGRÁFICO



Local de medição R13



Local de medição R14



Local de medição R15



Local de medição R16



Local de medição R17



Local de medição R18

RESULTADOS

R1

Observações: Nos períodos diurno, entardecer e noturno, as principais fontes de ruído identificadas na proximidade do recetor sensível caracterizado pelo local de medição R1 estão associadas a fontes naturais de ruído.

Para avaliação do critério de exposição máxima, tendo em consideração os níveis de pressão sonora reduzidos obtidos e a ausência de fontes significativas de origem antropogénica foi considerado apenas um patamar de emissão de ruído em cada período de referência.

Nota: Considera-se que as condições de propagação sonora aquando das medições efetuadas não colocam em causa a comparação com os valores limite definidos no RGR.

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Para verificação do critério de exposição máxima, os resultados obtidos foram analisados comparativamente com os valores limite de exposição definidos no artigo 11.º do Regulamento Geral do Ruído aprovado pelo Decreto-Lei n.º 9/2007, de 17 de Janeiro.

R1

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Com base nos dados meteorológicos são apresentadas as condições de propagação sonora da fonte para o recetor nos períodos em que foram efetuadas as medições (ver anexo Dados meteorológicos).

Período	Fonte sonora predominante		Outras fontes sonoras	Tipo de Solo
	Descrição	Posicionamento da Fonte		
Diurno Entardecer Noturno	-	-	- Naturais	Habitacões dispersas

Período Diurno

Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R1 - Med1	05/06/2024	10:38:32	0:15:00	37,4	37,1
R1 - Med2	05/06/2024	10:53:42	0:15:00	36,8	
R1 - Med3	05/06/2024	11:08:50	0:15:00	37,1	
R1 - Med10	06/06/2024	16:52:57	0:15:00	38,5	38,2
R1 - Med11	06/06/2024	17:10:26	0:15:00	38,0	
R1 - Med12	06/06/2024	17:25:39	0:15:00	38,2	
				Ld	37,7

Período Entardecer					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R1 - Med4	05/06/2024	22:10:04	0:15:00	36,8	
R1 - Med5	05/06/2024	22:27:16	0:15:00	37,3	37,0
R1 - Med6	05/06/2024	22:43:39	0:15:00	36,9	
				Le	37,0

Período Noturno					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R1 - Med7	05/06/2024	23:01:10	0:15:00	35,8	
R1 - Med8	05/06/2024	23:16:59	0:15:00	36,4	36,0
R1 - Med9	05/06/2024	23:32:49	0:15:00	35,9	
				Ln	36,0

Local de Medição	Zona	Valor limite		Valor medido		Resultado da Avaliação
		Lden (dB(A))	Ln (dB(A))	Lden (dB(A))	Ln (dB(A))	
R1	Não definida	63	53	43	36	Inferior ao valor limite

Observações:

Os recetores sensíveis, cujo campo sonoro foi caracterizado pelo local de medição R1, localizam-se no concelho de Penamacor cujo Plano Director Municipal ratificado pela Aviso n.º 14228/2015 de 03 de dezembro, cuja última alteração está publicada na Declaração 137/2021 de 24 de setembro não contempla qualquer definição de zona sensível ou mista em termos de componente acústica para o local em estudo.

Os valores medidos foram considerados representativos da situação de longa duração.

R2

Observações: Nos períodos diurno, entardecer e noturno, as principais fontes de ruído identificadas na proximidade do recetor sensível caracterizado pelo local de medição R2 estão associadas a fontes naturais de ruído.

Para avaliação do critério de exposição máxima, tendo em consideração os níveis de pressão sonora reduzidos obtidos e a ausência de fontes significativas de origem antropogénica foi considerado apenas um patamar de emissão de ruído em cada período de referência.

Nota: Considera-se que as condições de propagação sonora aquando das medições efetuadas não colocam em causa a comparação com os valores limite definidos no RGR.

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Para verificação do critério de exposição máxima, os resultados obtidos foram analisados comparativamente com os valores limite de exposição definidos no artigo 11.º do Regulamento Geral do Ruído aprovado pelo Decreto-Lei n.º 9/2007, de 17 de Janeiro.

R2

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Com base nos dados meteorológicos são apresentadas as condições de propagação sonora da fonte para o recetor nos períodos em que foram efetuadas as medições (ver anexo Dados meteorológicos).

Período	Fonte sonora predominante		Outras fontes sonoras	Tipo de Solo
	Descrição	Posicionamento da Fonte		
Diurno Entardecer Noturno	-	-	- Naturais	Habitacões dispersas

Período Diurno

Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R2 - Med1	05/06/2024	11:45:04	0:15:00	40,6	
R2 - Med2	05/06/2024	12:00:32	0:15:00	41,4	41,2
R2 - Med3	05/06/2024	12:15:59	0:15:00	41,6	
R2 - Med10	06/06/2024	15:49:57	0:15:00	41,1	
R2 - Med11	06/06/2024	16:07:14	0:15:00	40,1	41,1
R2 - Med12	06/06/2024	16:22:57	0:15:00	41,8	
				Ld	41,1

Período Entardecer					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R2 - Med4	05/06/2024	21:07:19	0:15:00	37,7	
R2 - Med5	05/06/2024	21:22:46	0:15:00	38,9	38,5
R2 - Med6	05/06/2024	21:38:48	0:15:00	38,7	
				Le	38,5

Período Noturno					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R2 - Med7	05/06/2024	23:59:21	0:15:00	34,4	
R2 - Med8	06/06/2024	00:14:34	0:15:00	34,9	34,6
R2 - Med9	06/06/2024	00:29:41	0:15:00	34,6	
				Ln	34,6

Local de Medição	Zona	Valor limite		Valor medido		Resultado da Avaliação
		Lden (dB(A))	Ln (dB(A))	Lden (dB(A))	Ln (dB(A))	
R2	Não definida	63	53	43	35	Inferior ao valor limite

Observações:

Os recetores sensíveis, cujo campo sonoro foi caracterizado pelo local de medição R2, localizam-se no concelho de Idanha-a-Nova cujo Plano Director Municipal ratificado pela Resolução do Conselho de Ministros nº 43/94, cuja última alteração está publicada no Aviso nº 908/2023 de 13 de janeiro não contempla qualquer definição de zona sensível ou mista em termos de componente acústica para o local em estudo.

Os valores medidos foram considerados representativos da situação de longa duração.

R3

Observações: Nos períodos diurno, entardecer e noturno, as principais fontes de ruído identificadas na proximidade do recetor sensível caracterizado pelo local de medição R3 estão associadas a fontes naturais de ruído.

Para avaliação do critério de exposição máxima, tendo em consideração os níveis de pressão sonora reduzidos obtidos e a ausência de fontes significativas de origem antropogénica foi considerado apenas um patamar de emissão de ruído em cada período de referência.

Nota: Considera-se que as condições de propagação sonora aquando das medições efetuadas não colocam em causa a comparação com os valores limite definidos no RGR.

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Para verificação do critério de exposição máxima, os resultados obtidos foram analisados comparativamente com os valores limite de exposição definidos no artigo 11.º do Regulamento Geral do Ruído aprovado pelo Decreto-Lei n.º 9/2007, de 17 de Janeiro.

R3

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Com base nos dados meteorológicos são apresentadas as condições de propagação sonora da fonte para o recetor nos períodos em que foram efetuadas as medições (ver anexo Dados meteorológicos).

Período	Fonte sonora predominante		Outras fontes sonoras	Tipo de Solo
	Descrição	Posicionamento da Fonte		
Diurno Entardecer Noturno	-	-	- Naturais	Habitacões dispersas

Período Diurno

Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R3 - Med1	05/06/2024	14:43:21	0:15:00	39,5	39,1
R3 - Med2	05/06/2024	14:59:56	0:15:00	38,3	
R3 - Med3	05/06/2024	15:15:07	0:15:00	39,5	
R3 - Med10	06/06/2024	14:51:27	0:15:00	39,6	40,0
R3 - Med11	06/06/2024	15:06:39	0:15:00	40,6	
R3 - Med12	06/06/2024	15:22:24	0:15:00	39,7	
				Ld	39,6

Período Entardecer					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R3 - Med4	05/06/2024	20:00:07	0:15:00	38,2	
R3 - Med5	05/06/2024	20:15:41	0:15:00	38,9	38,4
R3 - Med6	05/06/2024	20:33:08	0:15:00	38,2	
				Le	38,4

Período Noturno					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R3 - Med7	06/06/2024	00:58:38	0:15:00	34,1	
R3 - Med8	06/06/2024	01:16:01	0:15:00	33,2	33,5
R3 - Med9	06/06/2024	01:31:51	0:15:00	33,2	
				Ln	33,5

Local de Medição	Zona	Valor limite		Valor medido		Resultado da Avaliação
		Lden (dB(A))	Ln (dB(A))	Lden (dB(A))	Ln (dB(A))	
R3	Não definida	63	53	42	34	Inferior ao valor limite

Observações:

Os recetores sensíveis, cujo campo sonoro foi caracterizado pelo local de medição R3, localizam-se no concelho de Penamacor cujo Plano Director Municipal ratificado pela Aviso nº14228/2015, cuja última alteração está publicada na Declaração nº137/2021 de 24 de setembro não contempla qualquer definição de zona sensível ou mista em termos de componente acústica para o local em estudo.

Os valores medidos foram considerados representativos da situação de longa duração.

R4

Observações: Nos períodos diurno, entardecer e noturno, as principais fontes de ruído identificadas na proximidade do recetor sensível caracterizado pelo local de medição R4 estão associadas a fontes naturais de ruído.

Para avaliação do critério de exposição máxima, tendo em consideração os níveis de pressão sonora reduzidos obtidos e a ausência de fontes significativas de origem antropogénica foi considerado apenas um patamar de emissão de ruído em cada período de referência.

Nota: Considera-se que as condições de propagação sonora aquando das medições efetuadas não colocam em causa a comparação com os valores limite definidos no RGR.

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Para verificação do critério de exposição máxima, os resultados obtidos foram analisados comparativamente com os valores limite de exposição definidos no artigo 11.º do Regulamento Geral do Ruído aprovado pelo Decreto-Lei n.º 9/2007, de 17 de Janeiro.

R4

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Com base nos dados meteorológicos são apresentadas as condições de propagação sonora da fonte para o recetor nos períodos em que foram efetuadas as medições (ver anexo Dados meteorológicos).

Período	Fonte sonora predominante		Outras fontes sonoras	Tipo de Solo
	Descrição	Posicionamento da Fonte		
Diurno Entardecer Noturno	-	-	- Naturais	Habitacões dispersas

Período Diurno

Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R4 - Med1	05/06/2024	15:47:20	0:15:00	38,2	37,9
R4 - Med2	05/06/2024	16:11:04	0:15:00	38,1	
R4 - Med3	05/06/2024	16:26:13	0:15:00	37,4	
R4 - Med10	07/06/2024	09:40:52	0:15:00	41,5	41,0
R4 - Med11	07/06/2024	09:56:59	0:15:00	40,8	
R4 - Med12	07/06/2024	10:12:27	0:15:00	40,5	
				Ld	39,7

Período Entardecer					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R4 - Med4	06/06/2024	20:00:13	0:15:00	39,5	
R4 - Med5	06/06/2024	20:20:21	0:15:00	37,4	38,4
R4 - Med6	06/06/2024	20:38:34	0:15:00	37,9	
				Le	38,4

Período Noturno					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R4 - Med7	07/06/2024	01:02:15	0:15:00	34,3	
R4 - Med8	07/06/2024	01:17:25	0:15:00	33,8	34,4
R4 - Med9	07/06/2024	01:35:25	0:15:00	34,9	
				Ln	34,4

Local de Medição	Zona	Valor limite		Valor medido		Resultado da Avaliação
		Lden (dB(A))	Ln (dB(A))	Lden (dB(A))	Ln (dB(A))	
R4	Não definida	63	53	42	34	Inferior ao valor limite

Observações:

Os recetores sensíveis, cujo campo sonoro foi caracterizado pelo local de medição R4, localizam-se no concelho de Fundão cujo Plano Director Municipal ratificado pela Aviso nº20155-I/2023, cuja última alteração está publicada no Aviso nº1578/2024 de 22 de janeiro não contempla qualquer definição de zona sensível ou mista em termos de componente acústica para o local em estudo.

Os valores medidos foram considerados representativos da situação de longa duração.

R5

Observações: Nos períodos diurno, entardecer e noturno, as principais fontes de ruído identificadas na proximidade dos recetores sensíveis caracterizados pelo local de medição R5 estão associadas a fontes naturais de ruído.

Para avaliação do critério de exposição máxima, tendo em consideração os níveis de pressão sonora reduzidos obtidos e a ausência de fontes significativas de origem antropogénica foi considerado apenas um patamar de emissão de ruído em cada período de referência.

Nota: Considera-se que as condições de propagação sonora aquando das medições efetuadas não colocam em causa a comparação com os valores limite definidos no RGR.

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Para verificação do critério de exposição máxima, os resultados obtidos foram analisados comparativamente com os valores limite de exposição definidos no artigo 11.º do Regulamento Geral do Ruído aprovado pelo Decreto-Lei n.º 9/2007, de 17 de Janeiro.

R5

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Com base nos dados meteorológicos são apresentadas as condições de propagação sonora da fonte para o recetor nos períodos em que foram efetuadas as medições (ver anexo Dados meteorológicos).

Período	Fonte sonora predominante		Outras fontes sonoras	Tipo de Solo
	Descrição	Posicionamento da Fonte		
Diurno Entardecer Noturno	-	-	- Naturais	Habitacões dispersas

Período Diurno

Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R5 - Med1	06/06/2024	10:42:56	0:15:00	39,4	
R5 - Med2	06/06/2024	10:58:29	0:15:00	38,4	39,4
R5 - Med3	06/06/2024	11:13:37	0:15:00	40,1	
R5 - Med10	07/06/2024	10:41:08	0:15:00	40,2	
R5 - Med11	07/06/2024	10:57:01	0:15:00	42,0	41,3
R5 - Med12	07/06/2024	11:16:00	0:15:00	41,5	
				Ld	40,4

Período Entardecer					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R5 - Med4	06/06/2024	21:03:47	0:15:00	38,1	
R5 - Med5	06/06/2024	21:19:22	0:15:00	37,2	37,8
R5 - Med6	06/06/2024	21:34:50	0:15:00	37,9	
				Le	37,8

Período Noturno					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R5 - Med7	07/06/2024	00:05:35	0:15:00	33,5	
R5 - Med8	07/06/2024	00:20:43	0:15:00	34,8	34,8
R5 - Med9	07/06/2024	00:36:20	0:15:00	35,7	
				Ln	34,8

Local de Medição	Zona	Valor limite		Valor medido		Resultado da Avaliação
		Lden (dB(A))	Ln (dB(A))	Lden (dB(A))	Ln (dB(A))	
R5	Não definida	63	53	43	35	Inferior ao valor limite

Observações:

Os recetores sensíveis, cujo campo sonoro foi caracterizado pelo local de medição R5, localizam-se no concelho de Fundão cujo Plano Director Municipal ratificado pela Aviso nº20155-I/2023, cuja última alteração está publicada no Aviso nº1578/2024 de 22 de janeiro não contempla qualquer definição de zona sensível ou mista em termos de componente acústica para o local em estudo.

Os valores medidos foram considerados representativos da situação de longa duração.

R6

Observações: Nos períodos diurno, entardecer e noturno, as principais fontes de ruído identificadas na proximidade do recetor sensível caracterizado pelo local de medição R6 estão associadas a fontes naturais de ruído.

Para avaliação do critério de exposição máxima, tendo em consideração os níveis de pressão sonora reduzidos obtidos e a ausência de fontes significativas de origem antropogénica foi considerado apenas um patamar de emissão de ruído em cada período de referência.

Nota: Considera-se que as condições de propagação sonora aquando das medições efetuadas não colocam em causa a comparação com os valores limite definidos no RGR.

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Para verificação do critério de exposição máxima, os resultados obtidos foram analisados comparativamente com os valores limite de exposição definidos no artigo 11.º do Regulamento Geral do Ruído aprovado pelo Decreto-Lei n.º 9/2007, de 17 de Janeiro.

R6

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Com base nos dados meteorológicos são apresentadas as condições de propagação sonora da fonte para o recetor nos períodos em que foram efetuadas as medições (ver anexo Dados meteorológicos).

Período	Fonte sonora predominante		Outras fontes sonoras	Tipo de Solo
	Descrição	Posicionamento da Fonte		
Diurno Entardecer Noturno	-	-	- Naturais	Habitacões dispersas

Período Diurno

Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R6 - Med1	06/06/2024	12:06:01	0:15:00	38,7	
R6 - Med2	06/06/2024	12:21:11	0:15:00	39,4	39,2
R6 - Med3	06/06/2024	12:39:06	0:15:00	39,4	
R6 - Med10	07/06/2024	11:43:33	0:15:00	41,3	
R6 - Med11	07/06/2024	11:58:46	0:15:00	41,5	40,9
R6 - Med12	07/06/2024	12:15:18	0:15:00	39,8	
				Ld	40,1

Período Entardecer					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R6 - Med4	06/06/2024	22:08:12	0:15:00	38,3	
R6 - Med5	06/06/2024	22:23:43	0:15:00	36,5	37,3
R6 - Med6	06/06/2024	22:39:27	0:15:00	37,0	
				Le	37,3

Período Noturno					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R6 - Med7	06/06/2024	23:00:05	0:15:00	36,2	
R6 - Med8	06/06/2024	23:15:55	0:15:00	35,4	35,4
R6 - Med9	06/06/2024	23:31:24	0:15:00	34,6	
				Ln	35,4

Local de Medição	Zona	Valor limite		Valor medido		Resultado da Avaliação
		Lden (dB(A))	Ln (dB(A))	Lden (dB(A))	Ln (dB(A))	
R6	Não definida	63	53	43	35	Inferior ao valor limite

Observações:

Os recetores sensíveis, cujo campo sonoro foi caracterizado pelo local de medição R6, localizam-se no concelho de Fundão cujo Plano Director Municipal ratificado pela Aviso nº20155-I/2023, cuja última alteração está publicada no Aviso nº1578/2024 de 22 de janeiro não contempla qualquer definição de zona sensível ou mista em termos de componente acústica para o local em estudo.

Os valores medidos foram considerados representativos da situação de longa duração.

R7

Observações: Nos períodos diurno, entardecer e noturno, as principais fontes de ruído identificadas na proximidade do recetor sensível caracterizado pelo local de medição R7 estão associadas a fontes naturais de ruído.

Para avaliação do critério de exposição máxima, tendo em consideração os níveis de pressão sonora reduzidos obtidos e a ausência de fontes significativas de origem antropogénica foi considerado apenas um patamar de emissão de ruído em cada período de referência.

Nota: Considera-se que as condições de propagação sonora aquando das medições efetuadas não colocam em causa a comparação com os valores limite definidos no RGR.

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Para verificação do critério de exposição máxima, os resultados obtidos foram analisados comparativamente com os valores limite de exposição definidos no artigo 11.º do Regulamento Geral do Ruído aprovado pelo Decreto-Lei n.º 9/2007, de 17 de Janeiro.

R7

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Com base nos dados meteorológicos são apresentadas as condições de propagação sonora da fonte para o recetor nos períodos em que foram efetuadas as medições (ver anexo Dados meteorológicos).

Período	Fonte sonora predominante		Outras fontes sonoras	Tipo de Solo
	Descrição	Posicionamento da Fonte		
Diurno Entardecer Noturno	-	-	- Naturais	Habitacões dispersas

Período Diurno

Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R7 - Med1	05/06/2024	15:50:51	00:15:00	43,0	
R7 - Med2	05/06/2024	16:11:00	00:15:00	44,1	43,3
R7 - Med3	05/06/2024	16:27:37	00:15:00	42,6	
R7 - Med10	07/06/2024	12:04:58	00:15:00	44,2	
R7 - Med11	07/06/2024	12:20:20	00:15:00	43,7	43,8
R7 - Med12	07/06/2024	12:35:40	00:15:00	43,5	
				Ld	43,6

Período Entardecer					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R7 - Med4	06/06/2024	20:01:37	00:15:00	39,4	
R7 - Med5	06/06/2024	20:26:14	00:15:00	39,0	38,7
R7 - Med6	06/06/2024	20:42:55	00:15:00	37,5	
				Le	38,7

Período Noturno					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R7 - Med7	07/06/2024	01:04:31	00:15:00	35,8	
R7 - Med8	07/06/2024	01:19:50	00:15:00	36,1	35,7
R7 - Med9	07/06/2024	01:35:23	00:15:00	35,3	
				Ln	35,7

Local de Medição	Zona	Valor limite		Valor medido		Resultado da Avaliação
		Lden (dB(A))	Ln (dB(A))	Lden (dB(A))	Ln (dB(A))	
R7	Não definida	63	53	44	36	Inferior ao valor limite

Observações:

Os recetores sensíveis, cujo campo sonoro foi caracterizado pelo local de medição R7, localizam-se no concelho de Fundão cujo Plano Director Municipal ratificado pela Aviso nº20155-I/2023, cuja última alteração está publicada no Aviso nº1578/2024 de 22 de janeiro não contempla qualquer definição de zona sensível ou mista em termos de componente acústica para o local em estudo.

Os valores medidos foram considerados representativos da situação de longa duração.

R8

Observações: Nos períodos diurno, entardecer e noturno, as principais fontes de ruído identificadas na proximidade do recetor sensível caracterizado pelo local de medição R8 estão associadas a fontes naturais de ruído.

Para avaliação do critério de exposição máxima, tendo em consideração os níveis de pressão sonora reduzidos obtidos e a ausência de fontes significativas de origem antropogénica foi considerado apenas um patamar de emissão de ruído em cada período de referência.

Nota: Considera-se que as condições de propagação sonora aquando das medições efetuadas não colocam em causa a comparação com os valores limite definidos no RGR.

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Para verificação do critério de exposição máxima, os resultados obtidos foram analisados comparativamente com os valores limite de exposição definidos no artigo 11.º do Regulamento Geral do Ruído aprovado pelo Decreto-Lei n.º 9/2007, de 17 de Janeiro.

R8

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Com base nos dados meteorológicos são apresentadas as condições de propagação sonora da fonte para o recetor nos períodos em que foram efetuadas as medições (ver anexo Dados meteorológicos).

Período	Fonte sonora predominante		Outras fontes sonoras	Tipo de Solo
	Descrição	Posicionamento da Fonte		
Diurno Entardecer Noturno	-	-	- Naturais	Habitacões dispersas

Período Diurno

Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R8 - Med1	05/06/2024	12:02:05	00:15:00	38,8	
R8 - Med2	05/06/2024	12:17:15	00:15:00	40,7	39,6
R8 - Med3	05/06/2024	12:32:40	00:15:00	38,9	
R8 - Med10	06/06/2024	17:06:56	00:15:00	37,1	
R8 - Med11	06/06/2024	17:22:14	00:15:00	36,9	37,2
R8 - Med12	06/06/2024	17:38:05	00:15:00	37,6	
				Ld	38,5

Período Entardecer					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R8 - Med4	05/06/2024	22:02:26	00:15:00	37,9	
R8 - Med5	05/06/2024	22:18:11	00:15:00	37,3	37,4
R8 - Med6	05/06/2024	22:33:41	00:15:00	37,1	
				Le	37,4

Período Noturno					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R8 - Med7	05/06/2024	23:00:16	00:15:00	37,2	
R8 - Med8	05/06/2024	23:15:29	00:15:00	37,0	37,0
R8 - Med9	05/06/2024	23:33:28	00:15:00	36,7	
				Ln	37,0

Local de Medição	Zona	Valor limite		Valor medido		Resultado da Avaliação
		Lden (dB(A))	Ln (dB(A))	Lden (dB(A))	Ln (dB(A))	
R8	Não definida	63	53	44	37	Inferior ao valor limite

Observações:

Os recetores sensíveis, cujo campo sonoro foi caracterizado pelo local de medição R8, localizam-se no concelho de Fundão cujo Plano Director Municipal ratificado pela Aviso nº20155-I/2023, cuja última alteração está publicada no Aviso nº1578/2024 de 22 de janeiro não contempla qualquer definição de zona sensível ou mista em termos de componente acústica para o local em estudo.

Os valores medidos foram considerados representativos da situação de longa duração.

R9

Observações: Nos períodos diurno, entardecer e noturno, as principais fontes de ruído identificadas na proximidade do recetor sensível caracterizado pelo local de medição R9 estão associadas a fontes naturais de ruído.

Para avaliação do critério de exposição máxima, tendo em consideração os níveis de pressão sonora reduzidos obtidos e a ausência de fontes significativas de origem antropogénica foi considerado apenas um patamar de emissão de ruído em cada período de referência.

Nota: Considera-se que as condições de propagação sonora aquando das medições efetuadas não colocam em causa a comparação com os valores limite definidos no RGR.

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Para verificação do critério de exposição máxima, os resultados obtidos foram analisados comparativamente com os valores limite de exposição definidos no artigo 11.º do Regulamento Geral do Ruído aprovado pelo Decreto-Lei n.º 9/2007, de 17 de Janeiro.

R9

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Com base nos dados meteorológicos são apresentadas as condições de propagação sonora da fonte para o recetor nos períodos em que foram efetuadas as medições (ver anexo Dados meteorológicos).

Período	Fonte sonora predominante		Outras fontes sonoras	Tipo de Solo
	Descrição	Posicionamento da Fonte		
Diurno Entardecer Noturno	-	-	- Naturais	Habitacões dispersas

Período Diurno

Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R9 - Med1	05/06/2024	10:59:39	00:15:00	38,4	
R9 - Med2	05/06/2024	11:14:55	00:15:00	38,7	38,5
R9 - Med3	05/06/2024	11:30:12	00:15:00	38,3	
R9 - Med10	06/06/2024	15:56:45	00:15:00	39,2	
R9 - Med11	06/06/2024	16:13:13	00:15:00	37,3	38,4
R9 - Med12	06/06/2024	16:28:50	00:15:00	38,6	
				Ld	38,5

Período Entardecer					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R9 - Med4	05/06/2024	21:00:02	00:15:00	37,9	
R9 - Med5	05/06/2024	21:15:11	00:15:00	37,4	37,6
R9 - Med6	05/06/2024	21:30:24	00:15:00	37,4	
				Le	37,6

Período Noturno					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R9 - Med7	06/06/2024	00:07:09	00:15:00	37,2	
R9 - Med8	06/06/2024	00:28:38	00:15:00	36,5	36,7
R9 - Med9	06/06/2024	00:44:28	00:15:00	36,4	
				Ln	36,7

Local de Medição	Zona	Valor limite		Valor medido		Resultado da Avaliação
		Lden (dB(A))	Ln (dB(A))	Lden (dB(A))	Ln (dB(A))	
R9	Não definida	63	53	43	37	Inferior ao valor limite

Observações:

Os recetores sensíveis, cujo campo sonoro foi caracterizado pelo local de medição R9, localizam-se no concelho de Fundão cujo Plano Director Municipal ratificado pela Aviso nº20155-I/2023, cuja última alteração está publicada no Aviso nº1578/2024 de 22 de janeiro não contempla qualquer definição de zona sensível ou mista em termos de componente acústica para o local em estudo.

Os valores medidos foram considerados representativos da situação de longa duração.

R10

Observações: Nos períodos diurno, entardecer e noturno, as principais fontes de ruído identificadas na proximidade do recetor sensível caracterizado pelo local de medição R10 estão associadas a fontes naturais de ruído.

Para avaliação do critério de exposição máxima, tendo em consideração os níveis de pressão sonora reduzidos obtidos e a ausência de fontes significativas de origem antropogénica foi considerado apenas um patamar de emissão de ruído em cada período de referência.

Nota: Considera-se que as condições de propagação sonora aquando das medições efetuadas não colocam em causa a comparação com os valores limite definidos no RGR.

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Para verificação do critério de exposição máxima, os resultados obtidos foram analisados comparativamente com os valores limite de exposição definidos no artigo 11.º do Regulamento Geral do Ruído aprovado pelo Decreto-Lei n.º 9/2007, de 17 de Janeiro.

R10

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Com base nos dados meteorológicos são apresentadas as condições de propagação sonora da fonte para o recetor nos períodos em que foram efetuadas as medições (ver anexo Dados meteorológicos).

Período	Fonte sonora predominante		Outras fontes sonoras	Tipo de Solo
	Descrição	Posicionamento da Fonte		
Diurno Entardecer Noturno	-	-	- Naturais	Habitacões dispersas

Período Diurno

Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R10 - Med1	05/06/2024	14:41:14	00:15:00	37,9	
R10 - Med2	05/06/2024	14:56:29	00:15:00	38,4	37,9
R10 - Med3	05/06/2024	15:11:43	00:15:00	37,5	
R10 - Med10	06/06/2024	14:50:46	00:15:00	38,2	
R10 - Med11	06/06/2024	15:06:50	00:15:00	38,8	38,1
R10 - Med12	06/06/2024	15:23:15	00:15:00	37,3	
				Ld	38,0

Período Entardecer					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R10 - Med4	05/06/2024	20:01:06	00:15:00	38,1	
R10 - Med5	05/06/2024	20:16:31	00:15:00	37,5	38,0
R10 - Med6	05/06/2024	20:34:20	00:15:00	38,4	
				Le	38,0

Período Noturno					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R10 - Med7	06/06/2024	01:10:36	00:15:00	35,8	
R10 - Med8	06/06/2024	01:26:06	00:15:00	35,5	36,0
R10 - Med9	06/06/2024	01:41:16	00:15:00	36,7	
				Ln	36,0

Local de Medição	Zona	Valor limite		Valor medido		Resultado da Avaliação
		Lden (dB(A))	Ln (dB(A))	Lden (dB(A))	Ln (dB(A))	
R10	Não definida	63	53	43	36	Inferior ao valor limite

Observações:

Os recetores sensíveis, cujo campo sonoro foi caracterizado pelo local de medição R10, localizam-se no concelho de Fundão cujo Plano Director Municipal ratificado pela Aviso nº20155-I/2023, cuja última alteração está publicada no Aviso nº1578/2024 de 22 de janeiro não contempla qualquer definição de zona sensível ou mista em termos de componente acústica para o local em estudo.

Os valores medidos foram considerados representativos da situação de longa duração.

R11

Observações: Nos períodos diurno, entardecer e noturno, as principais fontes de ruído identificadas na proximidade dos recetores sensíveis caracterizados pelo local de medição R11 estão associadas a fontes naturais de ruído.

Para avaliação do critério de exposição máxima, tendo em consideração os níveis de pressão sonora reduzidos obtidos e a ausência de fontes significativas de origem antropogénica foi considerado apenas um patamar de emissão de ruído em cada período de referência.

Nota: Considera-se que as condições de propagação sonora aquando das medições efetuadas não colocam em causa a comparação com os valores limite definidos no RGR.

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Para verificação do critério de exposição máxima, os resultados obtidos foram analisados comparativamente com os valores limite de exposição definidos no artigo 11.º do Regulamento Geral do Ruído aprovado pelo Decreto-Lei n.º 9/2007, de 17 de Janeiro.

R11

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Com base nos dados meteorológicos são apresentadas as condições de propagação sonora da fonte para o recetor nos períodos em que foram efetuadas as medições (ver anexo Dados meteorológicos).

Período	Fonte sonora predominante		Outras fontes sonoras	Tipo de Solo
	Descrição	Posicionamento da Fonte		
Diurno Entardecer Noturno	-	-	- Naturais	Habitacões dispersas

Período Diurno

Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R11 - Med1	06/06/2024	11:52:23	00:15:00	36,2	
R11 - Med2	06/06/2024	12:08:05	00:15:00	36,0	36,1
R11 - Med3	06/06/2024	12:24:51	00:15:00	36,2	
R11 - Med10	07/06/2024	10:37:33	00:15:00	38,4	
R11 - Med11	07/06/2024	10:56:00	00:15:00	39,6	39,8
R11 - Med12	07/06/2024	11:13:40	00:15:00	41,0	
				Ld	38,3

Período Entardecer					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R11 - Med4	06/06/2024	21:11:39	00:15:00	36,0	
R11 - Med5	06/06/2024	21:27:05	00:15:00	34,8	35,2
R11 - Med6	06/06/2024	21:42:54	00:15:00	34,8	
				Le	35,2

Período Noturno					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R11 - Med7	06/06/2024	23:57:46	00:15:00	33,0	
R11 - Med8	07/06/2024	00:12:58	00:15:00	33,3	33,0
R11 - Med9	07/06/2024	00:28:46	00:15:00	32,7	
				Ln	33,0

Local de Medição	Zona	Valor limite		Valor medido		Resultado da Avaliação
		Lden (dB(A))	Ln (dB(A))	Lden (dB(A))	Ln (dB(A))	
R11	Não definida	63	53	41	33	Inferior ao valor limite

Observações:

Os recetores sensíveis, cujo campo sonoro foi caracterizado pelo local de medição R11, localizam-se no concelho de Fundão cujo Plano Director Municipal ratificado pela Aviso nº20155-I/2023, cuja última alteração está publicada no Aviso nº1578/2024 de 22 de janeiro não contempla qualquer definição de zona sensível ou mista em termos de componente acústica para o local em estudo.

Os valores medidos foram considerados representativos da situação de longa duração.

R12

Observações: Nos períodos diurno, entardecer e noturno, as principais fontes de ruído identificadas na proximidade dos recetores sensíveis caracterizados pelo local de medição R12 estão associadas a fontes naturais de ruído.

Para avaliação do critério de exposição máxima, tendo em consideração os níveis de pressão sonora reduzidos obtidos e a ausência de fontes significativas de origem antropogénica foi considerado apenas um patamar de emissão de ruído em cada período de referência.

Nota: Considera-se que as condições de propagação sonora aquando das medições efetuadas não colocam em causa a comparação com os valores limite definidos no RGR.

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Para verificação do critério de exposição máxima, os resultados obtidos foram analisados comparativamente com os valores limite de exposição definidos no artigo 11.º do Regulamento Geral do Ruído aprovado pelo Decreto-Lei n.º 9/2007, de 17 de Janeiro.

R12

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Com base nos dados meteorológicos são apresentadas as condições de propagação sonora da fonte para o recetor nos períodos em que foram efetuadas as medições (ver anexo Dados meteorológicos).

Período	Fonte sonora predominante		Outras fontes sonoras	Tipo de Solo
	Descrição	Posicionamento da Fonte		
Diurno Entardecer Noturno	-	-	- Naturais	Habitacões dispersas

Período Diurno

Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R12 - Med1	06/06/2024	10:42:59	00:15:00	44,3	
R12 - Med2	06/06/2024	10:58:54	00:15:00	45,4	44,2
R12 - Med3	06/06/2024	11:14:07	00:15:00	42,6	
R12 - Med10	07/06/2024	09:40:52	00:15:00	42,9	
R12 - Med11	07/06/2024	09:56:02	00:15:00	44,2	43,1
R12 - Med12	07/06/2024	10:11:23	00:15:00	41,9	
				Ld	43,7

Período Entardecer					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R12 - Med4	06/06/2024	22:08:58	00:15:00	37,4	
R12 - Med5	06/06/2024	22:24:34	00:15:00	38,2	37,9
R12 - Med6	06/06/2024	22:40:20	00:15:00	38,1	
				Le	37,9

Período Noturno					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R12 - Med7	06/06/2024	23:00:55	00:15:00	36,8	
R12 - Med8	06/06/2024	23:16:13	00:15:00	36,6	36,4
R12 - Med9	06/06/2024	23:31:49	00:15:00	35,6	
				Ln	36,4

Local de Medição	Zona	Valor limite		Valor medido		Resultado da Avaliação
		Lden (dB(A))	Ln (dB(A))	Lden (dB(A))	Ln (dB(A))	
R12	Não definida	63	53	45	36	Inferior ao valor limite

Observações:

Os recetores sensíveis, cujo campo sonoro foi caracterizado pelo local de medição R12, localizam-se no concelho de Fundão cujo Plano Director Municipal ratificado pela Aviso nº20155-I/2023, cuja última alteração está publicada no Aviso nº1578/2024 de 22 de janeiro não contempla qualquer definição de zona sensível ou mista em termos de componente acústica para o local em estudo.

Os valores medidos foram considerados representativos da situação de longa duração.

R13

Observações: Nos períodos diurno, entardecer e noturno, as principais fontes de ruído identificadas na proximidade do recetor sensível caracterizado pelo local de medição R13 estão associadas a fontes naturais de ruído.

Para avaliação do critério de exposição máxima, tendo em consideração os níveis de pressão sonora reduzidos obtidos e a ausência de fontes significativas de origem antropogénica foi considerado apenas um patamar de emissão de ruído em cada período de referência.

Nota: Considera-se que as condições de propagação sonora aquando das medições efetuadas não colocam em causa a comparação com os valores limite definidos no RGR.

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Para verificação do critério de exposição máxima, os resultados obtidos foram analisados comparativamente com os valores limite de exposição definidos no artigo 11.º do Regulamento Geral do Ruído aprovado pelo Decreto-Lei n.º 9/2007, de 17 de Janeiro.

R13

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Com base nos dados meteorológicos são apresentadas as condições de propagação sonora da fonte para o recetor nos períodos em que foram efetuadas as medições (ver anexo Dados meteorológicos).

Período	Fonte sonora predominante		Outras fontes sonoras	Tipo de Solo
	Descrição	Posicionamento da Fonte		
Diurno Entardecer Noturno	-	-	- Naturais	Habitacões dispersas

Período Diurno

Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R13 - Med1	05/06/2024	10:51:46	0:15:00	42,1	
R13 - Med2	05/06/2024	11:07:06	0:15:00	41,1	41,9
R13 - Med3	05/06/2024	11:22:21	0:15:00	42,4	
R13 - Med10	06/06/2024	14:50:25	0:15:00	39,2	
R13 - Med11	06/06/2024	15:06:05	0:15:00	38,7	38,9
R13 - Med12	06/06/2024	15:21:28	0:15:00	38,7	
				Ld	40,6

Período Entardecer					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R13 - Med4	05/06/2024	20:00:22	0:15:00	37,2	
R13 - Med5	05/06/2024	20:15:30	0:15:00	38,9	38,1
R13 - Med6	05/06/2024	20:31:44	0:15:00	38,1	
				Le	38,1

Período Noturno					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R13 - Med7	06/06/2024	01:18:05	0:15:00	33,7	
R13 - Med8	06/06/2024	01:33:12	0:15:00	34,2	34,0
R13 - Med9	06/06/2024	01:52:12	0:15:00	34,2	
				Ln	34,0

Local de Medição	Zona	Valor limite		Valor medido		Resultado da Avaliação
		Lden (dB(A))	Ln (dB(A))	Lden (dB(A))	Ln (dB(A))	
R13	Não definida	63	53	42	34	Inferior ao valor limite

Observações:

Os recetores sensíveis, cujo campo sonoro foi caracterizado pelo local de medição R13, localizam-se no concelho de Fundão cujo Plano Director Municipal ratificado pela Aviso nº20155-I/2023, cuja última alteração está publicada no Aviso nº1578/2024 de 22 de janeiro não contempla qualquer definição de zona sensível ou mista em termos de componente acústica para o local em estudo.

Os valores medidos foram considerados representativos da situação de longa duração.

R14

Observações: Nos períodos diurno, entardecer e noturno, as principais fontes de ruído identificadas na proximidade do recetor sensível caracterizado pelo local de medição R14 estão associadas a fontes naturais de ruído.

Para avaliação do critério de exposição máxima, tendo em consideração os níveis de pressão sonora reduzidos obtidos e a ausência de fontes significativas de origem antropogénica foi considerado apenas um patamar de emissão de ruído em cada período de referência.

Nota: Considera-se que as condições de propagação sonora aquando das medições efetuadas não colocam em causa a comparação com os valores limite definidos no RGR.

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Para verificação do critério de exposição máxima, os resultados obtidos foram analisados comparativamente com os valores limite de exposição definidos no artigo 11.º do Regulamento Geral do Ruído aprovado pelo Decreto-Lei n.º 9/2007, de 17 de Janeiro.

R14

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Com base nos dados meteorológicos são apresentadas as condições de propagação sonora da fonte para o recetor nos períodos em que foram efetuadas as medições (ver anexo Dados meteorológicos).

Período	Fonte sonora predominante		Outras fontes sonoras	Tipo de Solo
	Descrição	Posicionamento da Fonte		
Diurno Entardecer Noturno	-	-	- Naturais	Habitacões dispersas

Período Diurno

Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R14 - Med1	05/06/2024	12:22:57	0:15:00	39,4	39,0
R14 - Med2	05/06/2024	12:38:28	0:15:00	39,4	
R14 - Med3	05/06/2024	12:55:43	0:15:00	37,9	
R14 - Med10	06/06/2024	15:50:56	0:15:00	38,0	37,9
R14 - Med11	06/06/2024	16:06:05	0:15:00	37,6	
R14 - Med12	06/06/2024	16:21:13	0:15:00	38,2	
				Ld	38,5

Período Entardecer					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R14 - Med4	05/06/2024	21:04:49	0:15:00	35,6	
R14 - Med5	05/06/2024	21:21:01	0:15:00	36,2	35,8
R14 - Med6	05/06/2024	21:36:10	0:15:00	35,7	
				Le	35,8

Período Noturno					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R14 - Med7	06/06/2024	00:11:14	0:15:00	34,0	
R14 - Med8	06/06/2024	00:34:28	0:15:00	33,3	33,7
R14 - Med9	06/06/2024	00:50:01	0:15:00	33,9	
				Ln	33,7

Local de Medição	Zona	Valor limite		Valor medido		Resultado da Avaliação
		Lden (dB(A))	Ln (dB(A))	Lden (dB(A))	Ln (dB(A))	
R14	Não definida	63	53	41	34	Inferior ao valor limite

Observações:

Os recetores sensíveis, cujo campo sonoro foi caracterizado pelo local de medição R14, localizam-se no concelho de Fundão cujo Plano Director Municipal ratificado pela Aviso nº20155-I/2023, cuja última alteração está publicada no Aviso nº1578/2024 de 22 de janeiro não contempla qualquer definição de zona sensível ou mista em termos de componente acústica para o local em estudo.

Os valores medidos foram considerados representativos da situação de longa duração.

R15

Observações: Nos períodos diurno, entardecer e noturno, as principais fontes de ruído identificadas na proximidade do recetor sensível caracterizado pelo local de medição R15 estão associadas a fontes naturais de ruído.

Para avaliação do critério de exposição máxima, tendo em consideração os níveis de pressão sonora reduzidos obtidos e a ausência de fontes significativas de origem antropogénica foi considerado apenas um patamar de emissão de ruído em cada período de referência.

Nota: Considera-se que as condições de propagação sonora aquando das medições efetuadas não colocam em causa a comparação com os valores limite definidos no RGR.

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Para verificação do critério de exposição máxima, os resultados obtidos foram analisados comparativamente com os valores limite de exposição definidos no artigo 11.º do Regulamento Geral do Ruído aprovado pelo Decreto-Lei n.º 9/2007, de 17 de Janeiro.

R15

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Com base nos dados meteorológicos são apresentadas as condições de propagação sonora da fonte para o recetor nos períodos em que foram efetuadas as medições (ver anexo Dados meteorológicos).

Período	Fonte sonora predominante		Outras fontes sonoras	Tipo de Solo
	Descrição	Posicionamento da Fonte		
Diurno Entardecer Noturno	-	-	- Naturais	Habitacões dispersas

Período Diurno

Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R15 - Med1	05/06/2024	15:13:49	0:15:00	38,0	
R15 - Med2	05/06/2024	15:29:39	0:15:00	38,8	38,3
R15 - Med3	05/06/2024	15:49:20	0:15:00	38,1	
R15 - Med10	06/06/2024	16:55:10	0:15:00	36,6	
R15 - Med11	06/06/2024	17:10:25	0:15:00	37,1	37,0
R15 - Med12	06/06/2024	17:25:32	0:15:00	37,2	
				Ld	37,7

Período Entardecer					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R15 - Med4	05/06/2024	22:06:12	0:15:00	33,8	
R15 - Med5	05/06/2024	22:21:49	0:15:00	34,3	34,8
R15 - Med6	05/06/2024	22:37:01	0:15:00	35,9	
				Le	34,8

Período Noturno					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R15 - Med7	05/06/2024	23:00:26	0:15:00	34,9	
R15 - Med8	05/06/2024	23:20:31	0:15:00	35,2	34,8
R15 - Med9	05/06/2024	23:38:41	0:15:00	34,2	
				Ln	34,8

Local de Medição	Zona	Valor limite		Valor medido		Resultado da Avaliação
		Lden (dB(A))	Ln (dB(A))	Lden (dB(A))	Ln (dB(A))	
R15	Não definida	63	53	42	35	Inferior ao valor limite

Observações:

Os recetores sensíveis, cujo campo sonoro foi caracterizado pelo local de medição R15, localizam-se no concelho de Fundão cujo Plano Director Municipal ratificado pela Aviso nº20155-I/2023, cuja última alteração está publicada no Aviso nº1578/2024 de 22 de janeiro não contempla qualquer definição de zona sensível ou mista em termos de componente acústica para o local em estudo.

Os valores medidos foram considerados representativos da situação de longa duração.

R16

Observações: Nos períodos diurno, entardecer e noturno, as principais fontes de ruído identificadas na proximidade do recetor sensível caracterizado pelo local de medição R16 estão associadas a fontes naturais de ruído.

Para avaliação do critério de exposição máxima, tendo em consideração os níveis de pressão sonora reduzidos obtidos e a ausência de fontes significativas de origem antropogénica foi considerado apenas um patamar de emissão de ruído em cada período de referência.

Nota: Considera-se que as condições de propagação sonora aquando das medições efetuadas não colocam em causa a comparação com os valores limite definidos no RGR.

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Para verificação do critério de exposição máxima, os resultados obtidos foram analisados comparativamente com os valores limite de exposição definidos no artigo 11.º do Regulamento Geral do Ruído aprovado pelo Decreto-Lei n.º 9/2007, de 17 de Janeiro.

R16

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Com base nos dados meteorológicos são apresentadas as condições de propagação sonora da fonte para o recetor nos períodos em que foram efetuadas as medições (ver anexo Dados meteorológicos).

Período	Fonte sonora predominante		Outras fontes sonoras	Tipo de Solo
	Descrição	Posicionamento da Fonte		
Diurno Entardecer Noturno	-	-	- Naturais	Habitacões dispersas

Período Diurno

Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R16 - Med1	05/06/2024	16:36:42	0:15:00	39,4	
R16 - Med2	05/06/2024	16:51:55	0:15:00	37,7	38,5
R16 - Med3	05/06/2024	17:07:28	0:15:00	38,2	
R16 - Med10	07/06/2024	09:39:33	0:15:00	38,8	
R16 - Med11	07/06/2024	09:54:43	0:15:00	37,3	38,1
R16 - Med12	07/06/2024	10:09:56	0:15:00	38,2	
				Ld	38,3

Período Entardecer					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R16 - Med4	06/06/2024	20:00:23	0:15:00	37,1	
R16 - Med5	06/06/2024	20:16:05	0:15:00	32,9	36,1
R16 - Med6	06/06/2024	20:33:34	0:15:00	37,1	
				Le	36,1

Período Noturno					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R16 - Med7	07/06/2024	01:05:47	0:15:00	33,7	
R16 - Med8	07/06/2024	01:20:59	0:15:00	34,4	33,7
R16 - Med9	07/06/2024	01:36:11	0:15:00	33,0	
				Ln	33,7

Local de Medição	Zona	Valor limite		Valor medido		Resultado da Avaliação
		Lden (dB(A))	Ln (dB(A))	Lden (dB(A))	Ln (dB(A))	
R16	Não definida	63	53	41	34	Inferior ao valor limite

Observações:

Os recetores sensíveis, cujo campo sonoro foi caracterizado pelo local de medição R16, localizam-se no concelho de Fundão cujo Plano Director Municipal ratificado pela Aviso nº20155-I/2023, cuja última alteração está publicada no Aviso nº1578/2024 de 22 de janeiro não contempla qualquer definição de zona sensível ou mista em termos de componente acústica para o local em estudo.

Os valores medidos foram considerados representativos da situação de longa duração.

R17

Observações: Nos períodos diurno, entardecer e noturno, as principais fontes de ruído identificadas na proximidade do recetor sensível caracterizado pelo local de medição R17 estão associadas a fontes naturais de ruído.

Para avaliação do critério de exposição máxima, tendo em consideração os níveis de pressão sonora reduzidos obtidos e a ausência de fontes significativas de origem antropogénica foi considerado apenas um patamar de emissão de ruído em cada período de referência.

Nota: Considera-se que as condições de propagação sonora aquando das medições efetuadas não colocam em causa a comparação com os valores limite definidos no RGR.

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Para verificação do critério de exposição máxima, os resultados obtidos foram analisados comparativamente com os valores limite de exposição definidos no artigo 11.º do Regulamento Geral do Ruído aprovado pelo Decreto-Lei n.º 9/2007, de 17 de Janeiro.

R17

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Com base nos dados meteorológicos são apresentadas as condições de propagação sonora da fonte para o recetor nos períodos em que foram efetuadas as medições (ver anexo Dados meteorológicos).

Período	Fonte sonora predominante		Outras fontes sonoras	Tipo de Solo
	Descrição	Posicionamento da Fonte		
Diurno Entardecer Noturno	-	-	- Naturais	Habitacões dispersas

Período Diurno

Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R17 - Med1	06/06/2024	10:35:29	0:15:00	37,2	
R17 - Med2	06/06/2024	10:50:38	0:15:00	34,8	35,9
R17 - Med3	06/06/2024	11:05:50	0:15:00	35,3	
R17 - Med10	07/06/2024	10:40:52	0:15:00	38,3	
R17 - Med11	07/06/2024	10:56:02	0:15:00	38,9	38,3
R17 - Med12	07/06/2024	11:14:56	0:15:00	37,5	
				Ld	37,2

Período Entardecer					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R17 - Med4	06/06/2024	21:03:24	0:15:00	36,3	
R17 - Med5	06/06/2024	21:18:34	0:15:00	41,3	38,8
R17 - Med6	06/06/2024	21:42:50	0:15:00	37,2	
				Le	38,8

Período Noturno					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R17 - Med7	07/06/2024	00:04:56	0:15:00	35,1	
R17 - Med8	07/06/2024	00:20:06	0:15:00	34,6	34,6
R17 - Med9	07/06/2024	00:35:16	0:15:00	33,9	
				Ln	34,6

Local de Medição	Zona	Valor limite		Valor medido		Resultado da Avaliação
		Lden (dB(A))	Ln (dB(A))	Lden (dB(A))	Ln (dB(A))	
R17	Não definida	63	53	42	35	Inferior ao valor limite

Observações:

Os recetores sensíveis, cujo campo sonoro foi caracterizado pelo local de medição R17, localizam-se no concelho de Fundão cujo Plano Director Municipal ratificado pela Aviso nº20155-I/2023, cuja última alteração está publicada no Aviso nº1578/2024 de 22 de janeiro não contempla qualquer definição de zona sensível ou mista em termos de componente acústica para o local em estudo.

Os valores medidos foram considerados representativos da situação de longa duração.

R18

Observações: Nos períodos diurno, entardecer e noturno, as principais fontes de ruído identificadas na proximidade do recetor sensível caracterizado pelo local de medição R18 estão associadas a fontes naturais de ruído.

Para avaliação do critério de exposição máxima, tendo em consideração os níveis de pressão sonora reduzidos obtidos e a ausência de fontes significativas de origem antropogénica foi considerado apenas um patamar de emissão de ruído em cada período de referência.

Nota: Considera-se que as condições de propagação sonora aquando das medições efetuadas não colocam em causa a comparação com os valores limite definidos no RGR.

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Para verificação do critério de exposição máxima, os resultados obtidos foram analisados comparativamente com os valores limite de exposição definidos no artigo 11.º do Regulamento Geral do Ruído aprovado pelo Decreto-Lei n.º 9/2007, de 17 de Janeiro.

R18

CRITÉRIO DE EXPOSIÇÃO MÁXIMA

Com base nos dados meteorológicos são apresentadas as condições de propagação sonora da fonte para o recetor nos períodos em que foram efetuadas as medições (ver anexo Dados meteorológicos).

Período	Fonte sonora predominante		Outras fontes sonoras	Tipo de Solo
	Descrição	Posicionamento da Fonte		
Diurno Entardecer Noturno	-	-	- Naturais	Habitacões dispersas

Período Diurno

Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R18 - Med1	06/06/2024	12:31:21	0:15:00	41,1	41,0
R18 - Med2	06/06/2024	12:47:47	0:15:00	39,7	
R18 - Med3	06/06/2024	13:04:57	0:15:00	42,0	
R18 - Med10	07/06/2024	11:46:41	0:15:00	38,7	38,8
R18 - Med11	07/06/2024	12:02:33	0:15:00	38,0	
R18 - Med12	07/06/2024	12:18:46	0:15:00	39,5	
				Ld	40,1

Período Entardecer					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R18 - Med4	06/06/2024	22:07:22	0:15:00	37,0	
R18 - Med5	06/06/2024	22:22:33	0:15:00	37,5	37,0
R18 - Med6	06/06/2024	22:37:46	0:15:00	36,4	
				Le	37,0

Período Noturno					
Código de Medição	Data da medição	Início do período de medição	Tempo de medição	L _{Aeq, Fast} (dB(A))	L _{Aeq, Fast} (dB(A))
R18 - Med7	06/06/2024	23:00:26	0:15:00	34,5	
R18 - Med8	06/06/2024	23:15:51	0:15:00	35,7	35,0
R18 - Med9	06/06/2024	23:31:00	0:15:00	34,8	
				Ln	35,0

Local de Medição	Zona	Valor limite		Valor medido		Resultado da Avaliação
		Lden (dB(A))	Ln (dB(A))	Lden (dB(A))	Ln (dB(A))	
R18	Não definida	63	53	43	35	Inferior ao valor limite

Observações:

Os recetores sensíveis, cujo campo sonoro foi caracterizado pelo local de medição R18, localizam-se no concelho de Fundão cujo Plano Director Municipal ratificado pela Aviso nº20155-I/2023, cuja última alteração está publicada no Aviso nº1578/2024 de 22 de janeiro não contempla qualquer definição de zona sensível ou mista em termos de componente acústica para o local em estudo.

Os valores medidos foram considerados representativos da situação de longa duração.

ANÁLISE DOS RESULTADOS

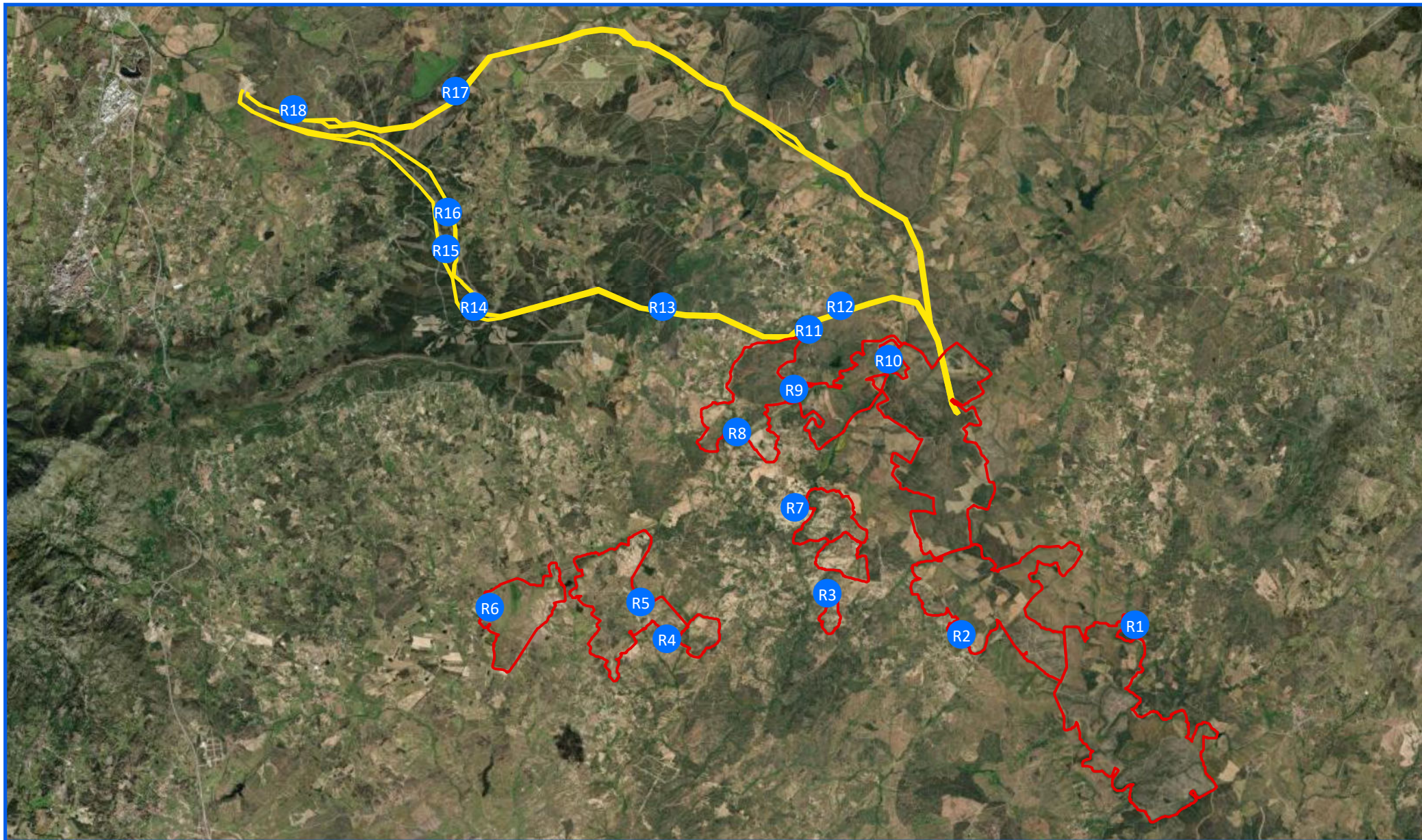
A avaliação acústica efetuada no âmbito do Estudo de Impacte Ambiental do Projeto da CSF de Sophia foi efetuada de acordo com o RGR. A incerteza associada aos ensaios não é apresentada nem é considerada para efeitos de avaliação de conformidade.

Para verificação do cumprimento do critério de exposição foram efetuadas medições nos períodos de referência diurno, entardecer e noturno. Os indicadores de ruído L_{den} e L_n , obtidos junto dos locais avaliados foram comparados com os valores limite de exposição definidos no artigo 11.º do RGR, sendo possível verificar que, nos locais avaliados, os valores encontravam-se abaixo dos valores limite.

ANEXOS

- Carta n.º 1 - Locais de medição de ruído
- Dados meteorológicos

CARTA N.º 1 - LOCAIS DE MEDIÇÃO DE RUÍDO

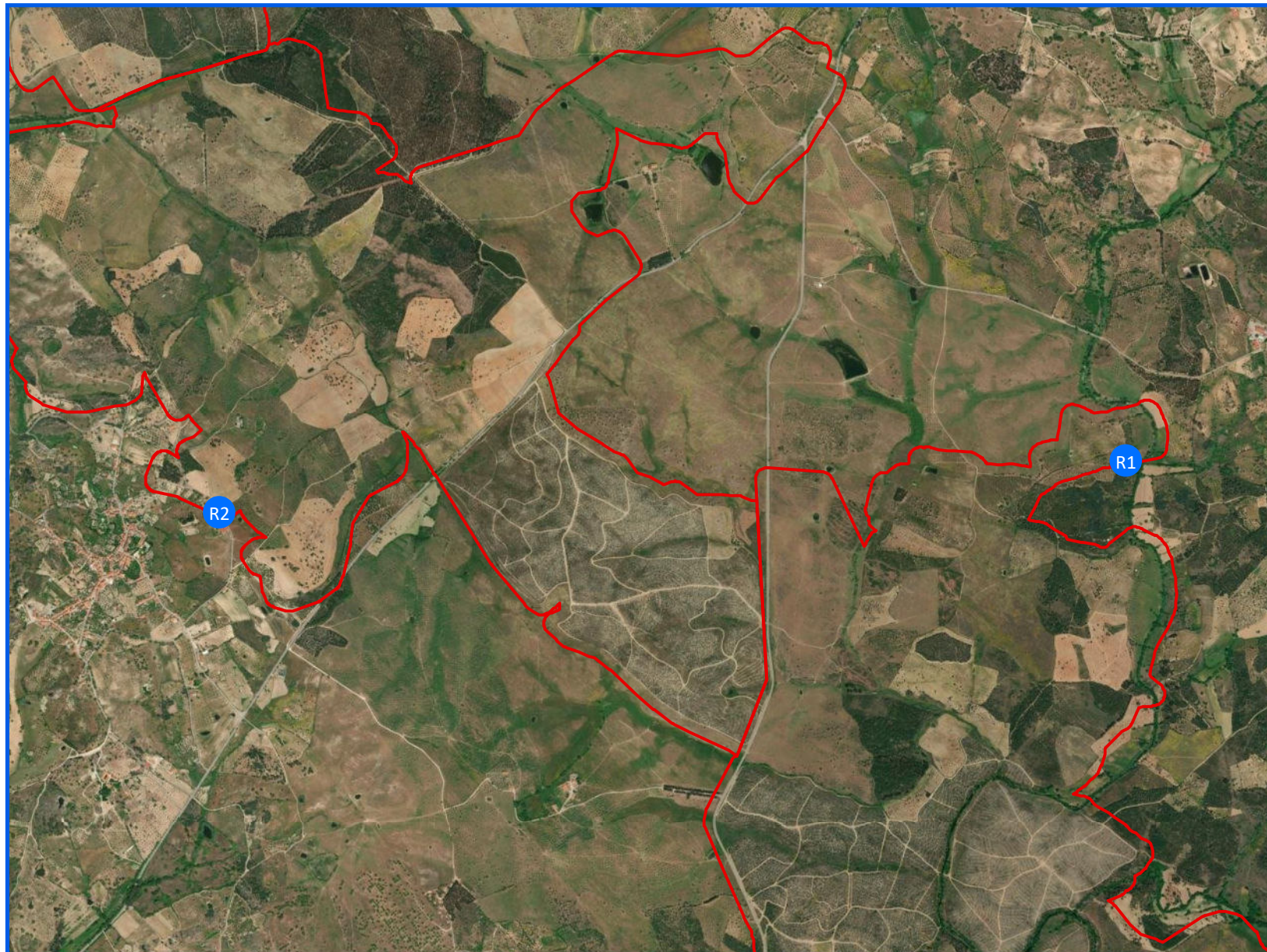




Local de medição R1



Local de medição R2

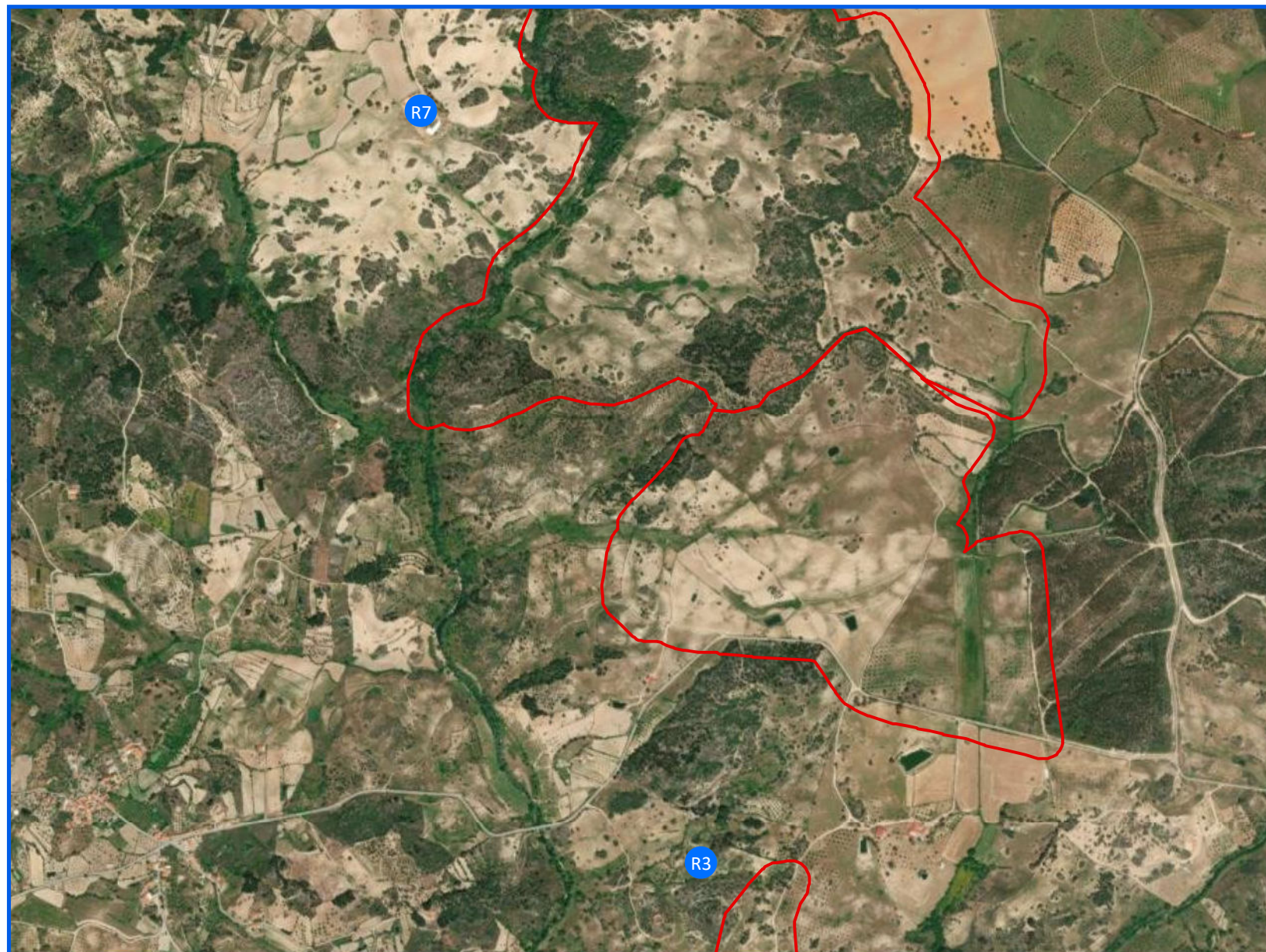




Local de medição R3



Local de medição R7





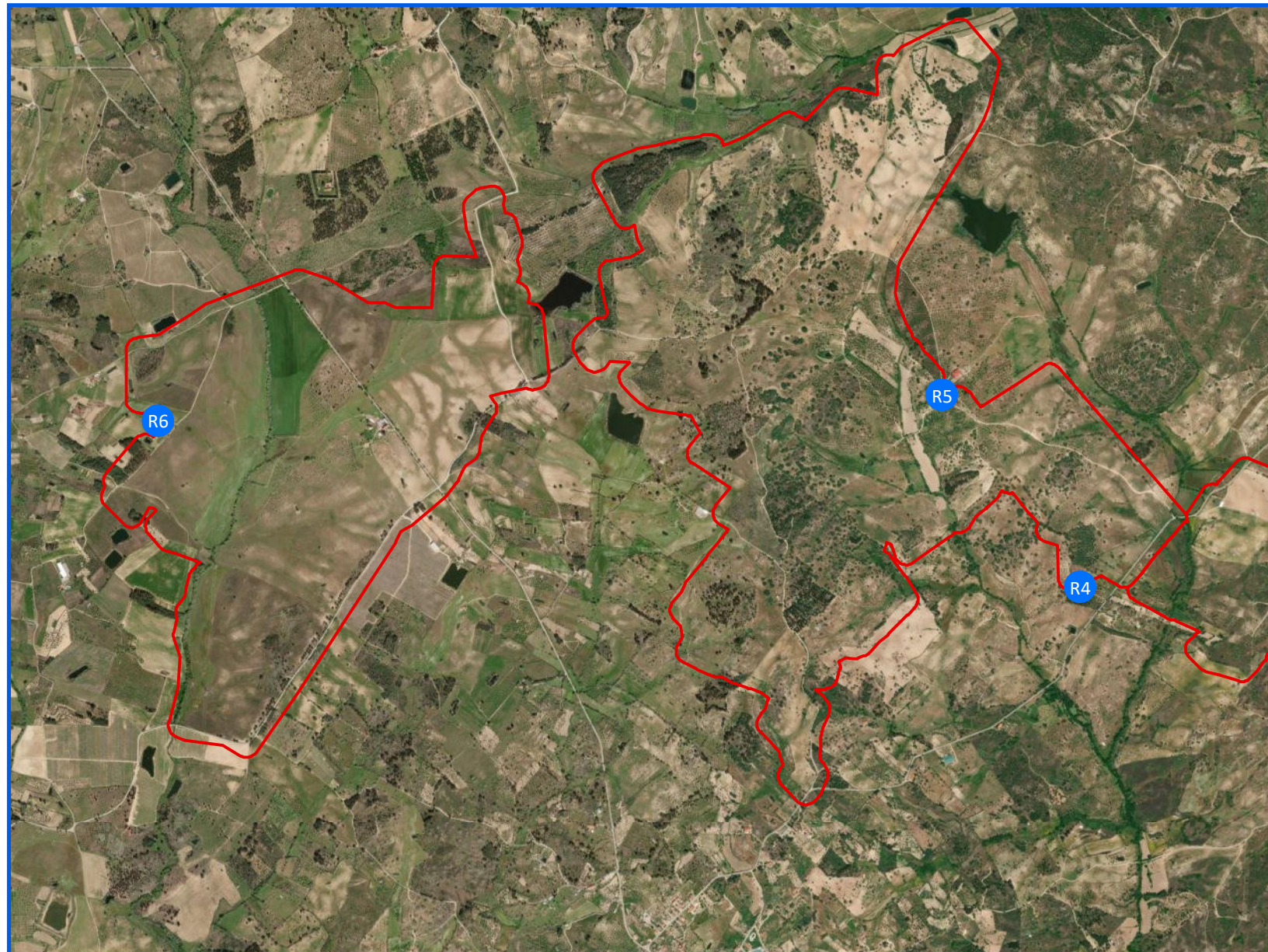
Local de medição R4



Local de medição R5



Local de medição R6





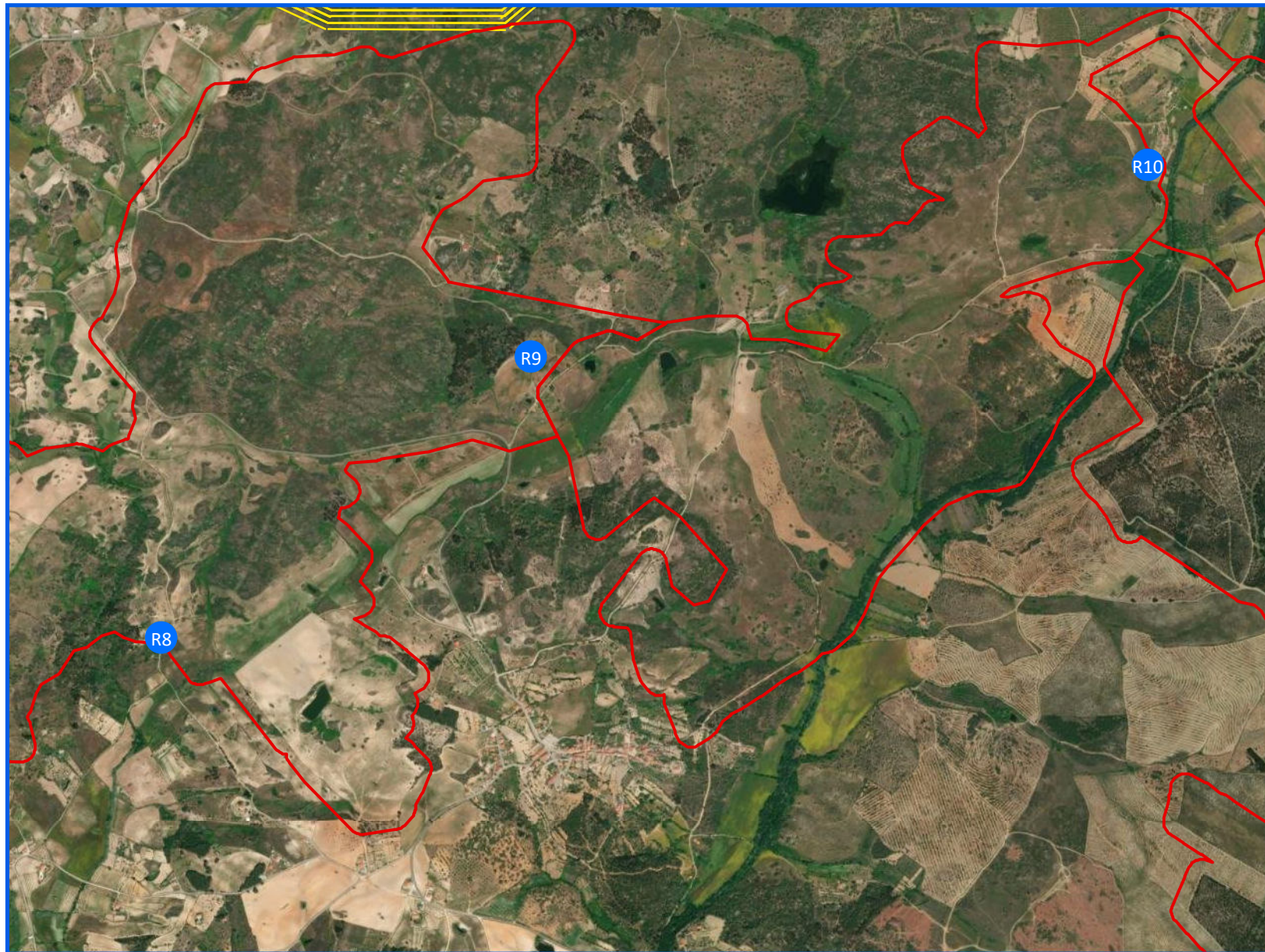
Local de medição R8



Local de medição R9



Local de medição R10





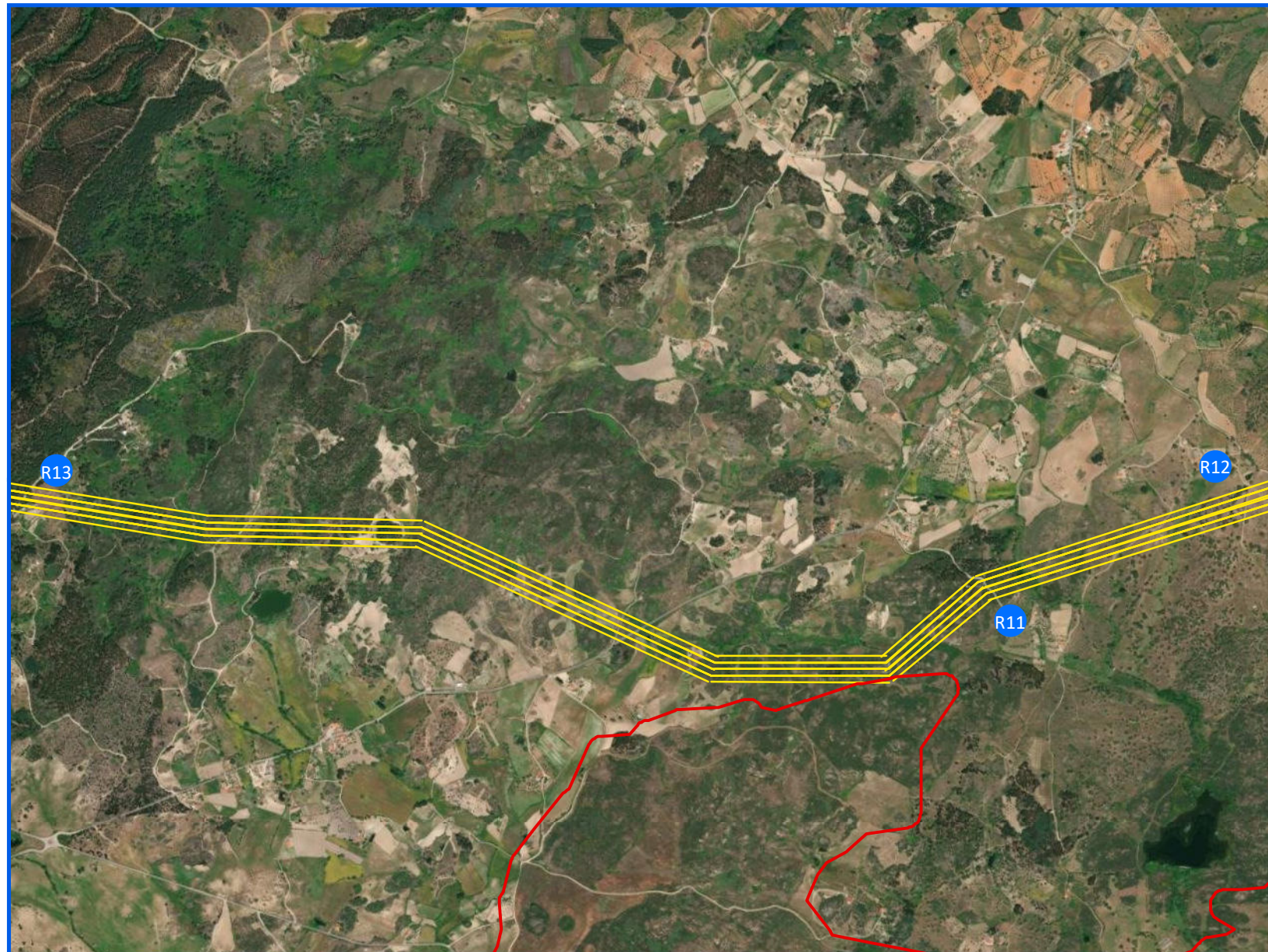
Local de medição R11



Local de medição R12



Local de medição R13





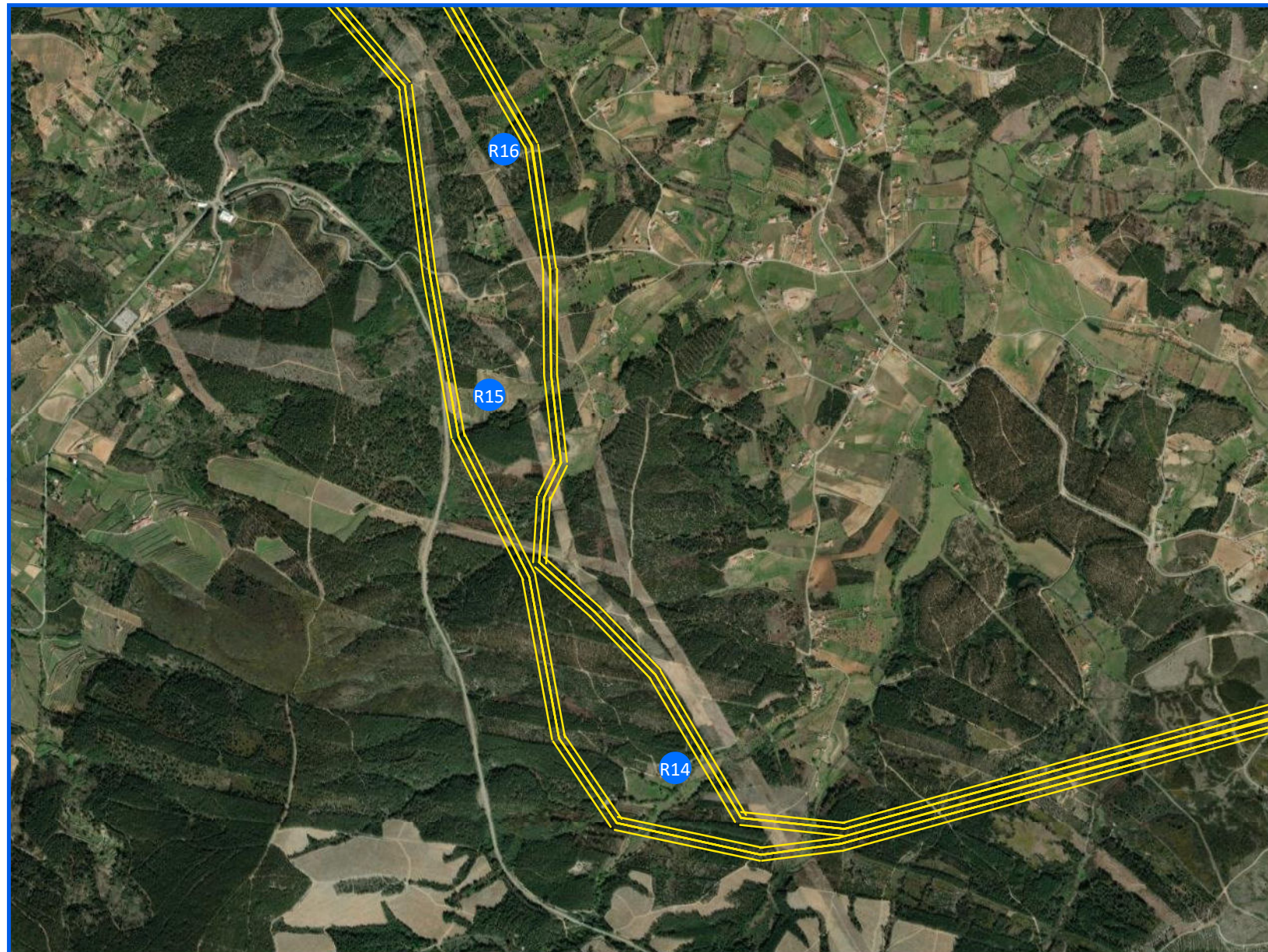
Local de medição R14



Local de medição R15



Local de medição R16





Local de medição R17

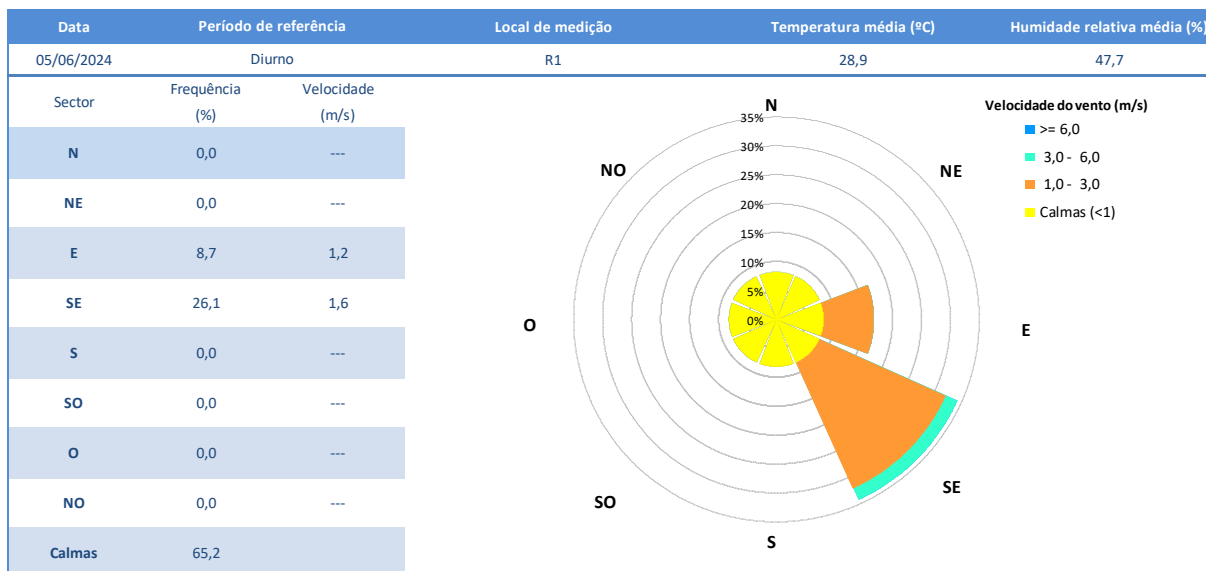


Local de medição R18

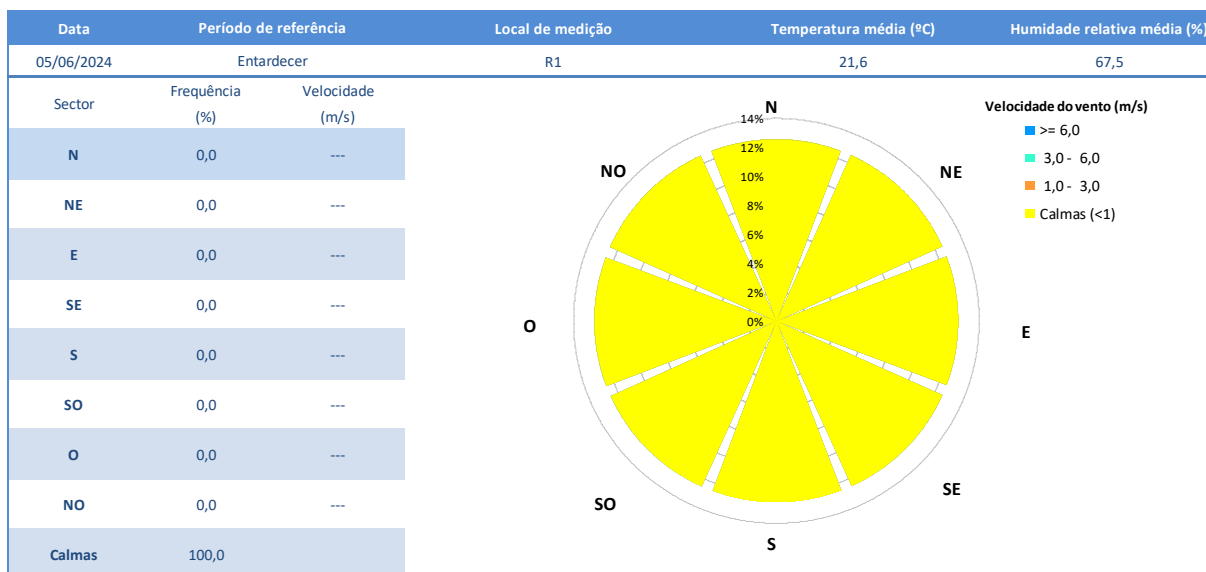


DADOS METEOROLÓGICOS

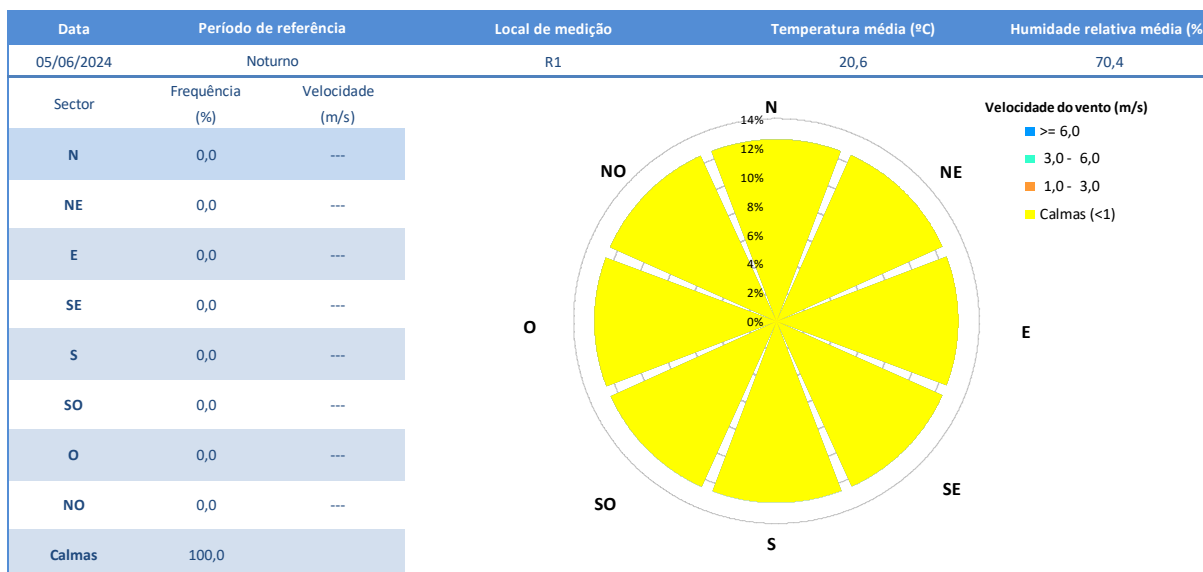
R1



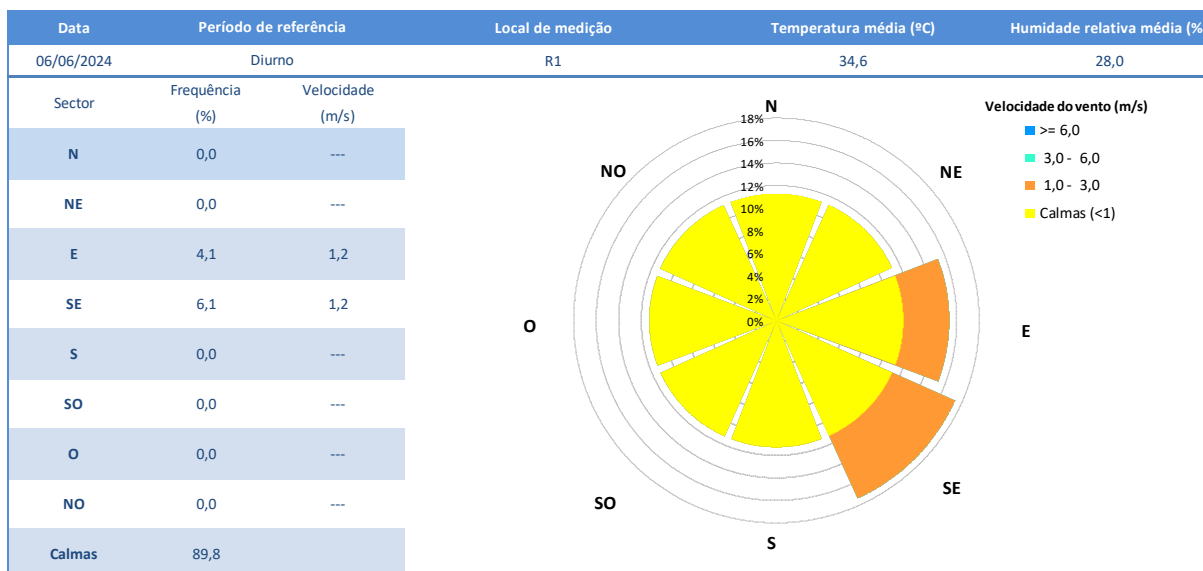
Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.



Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

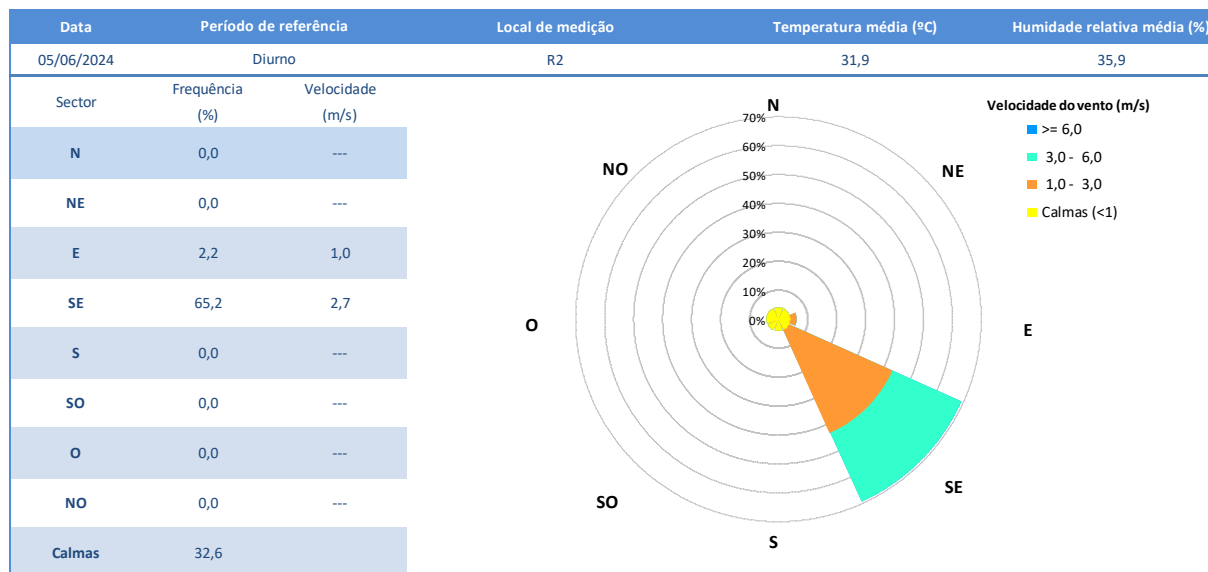


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

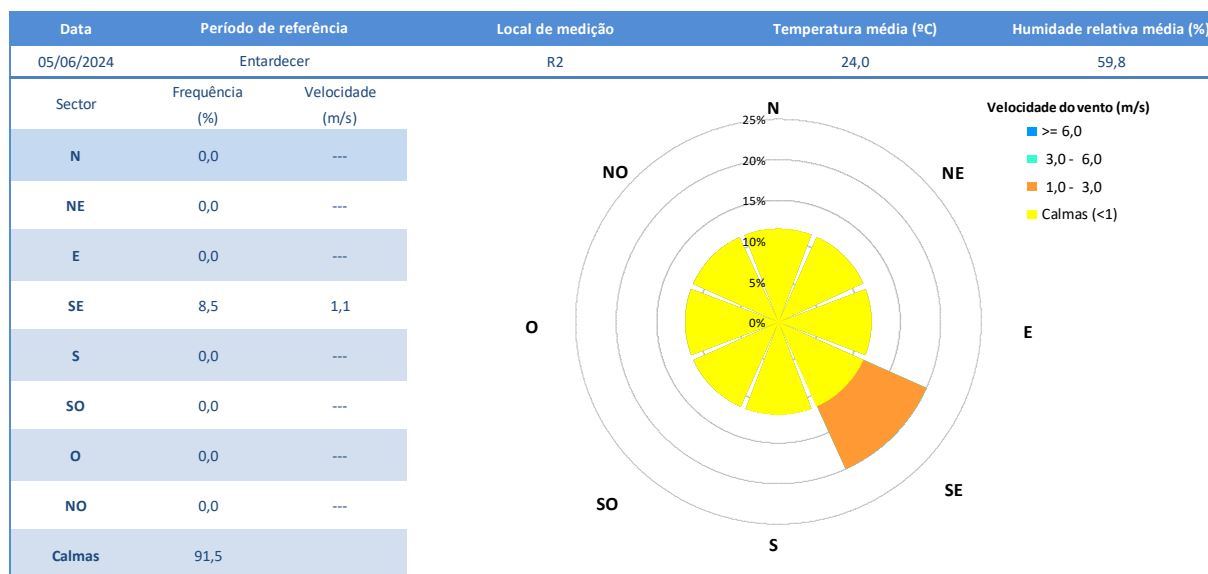


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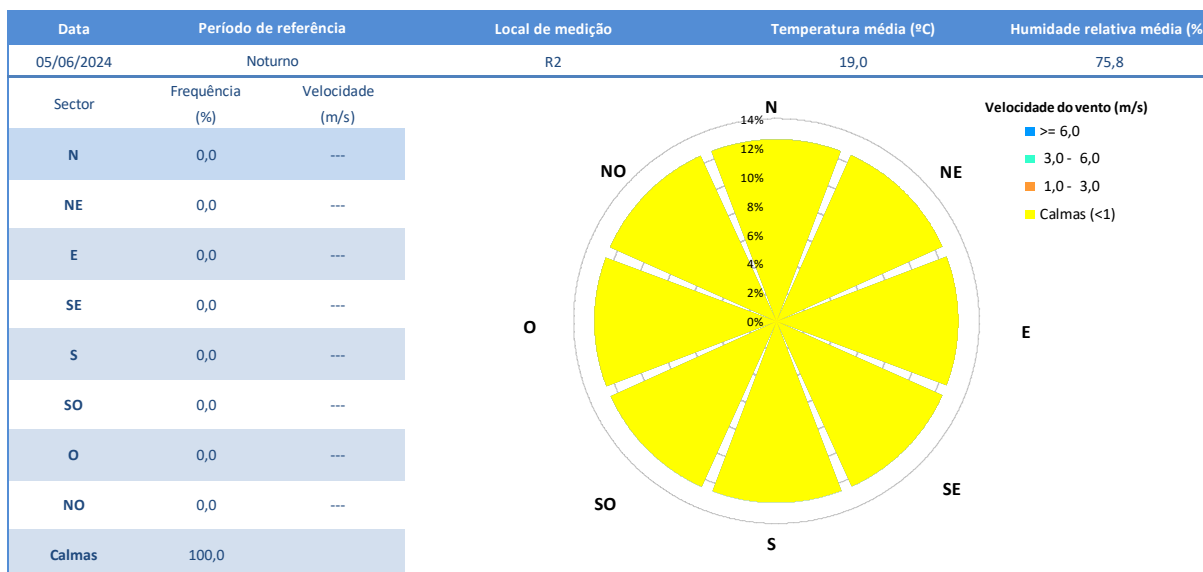
R2



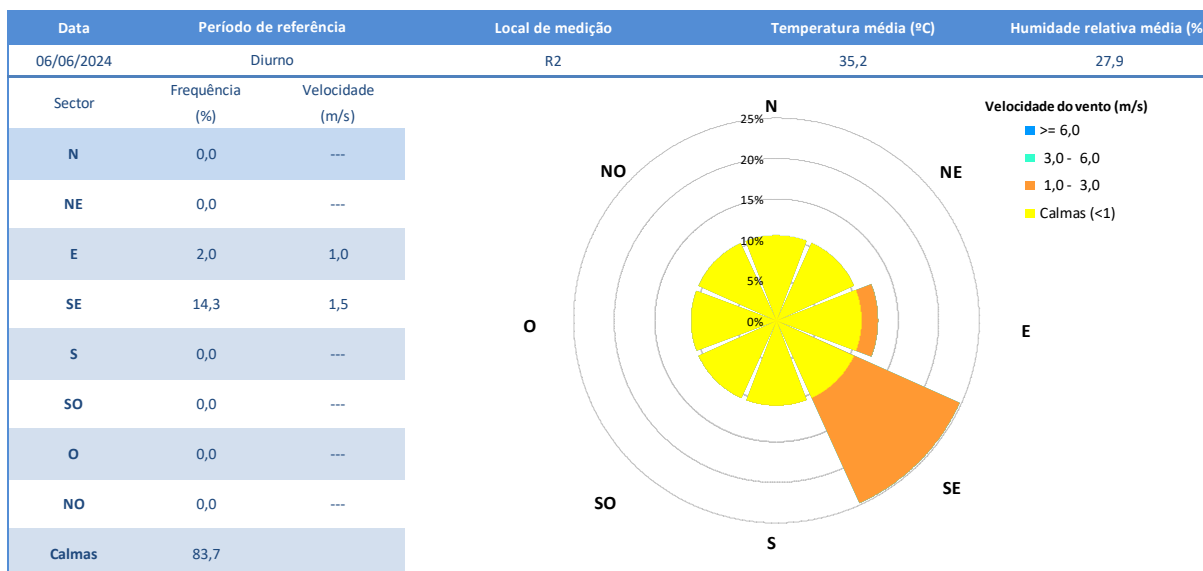
Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.



Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

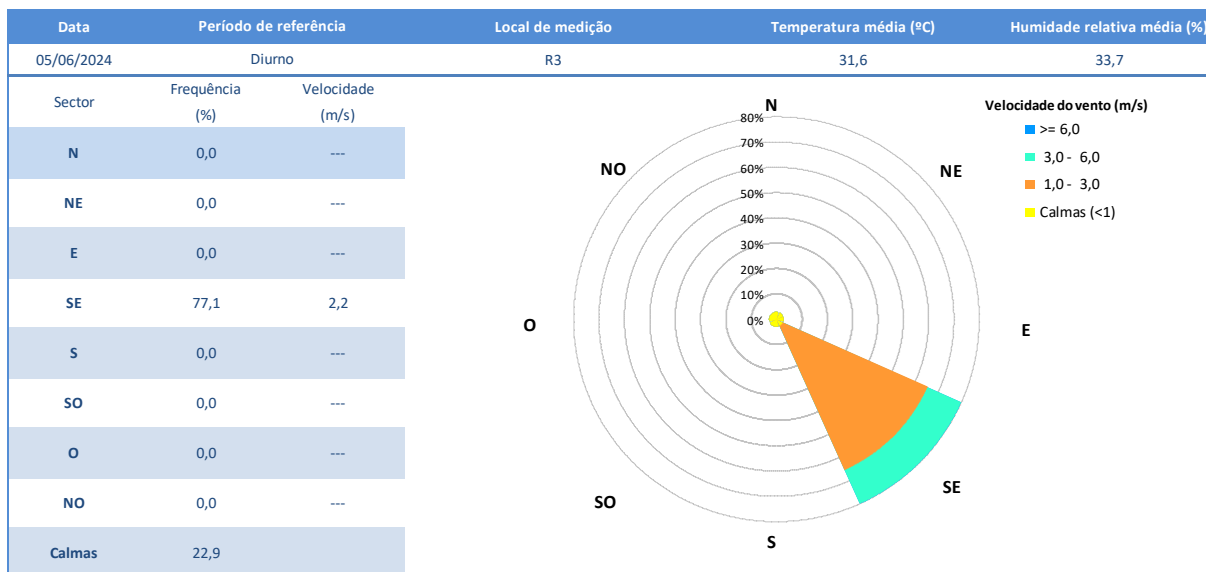


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

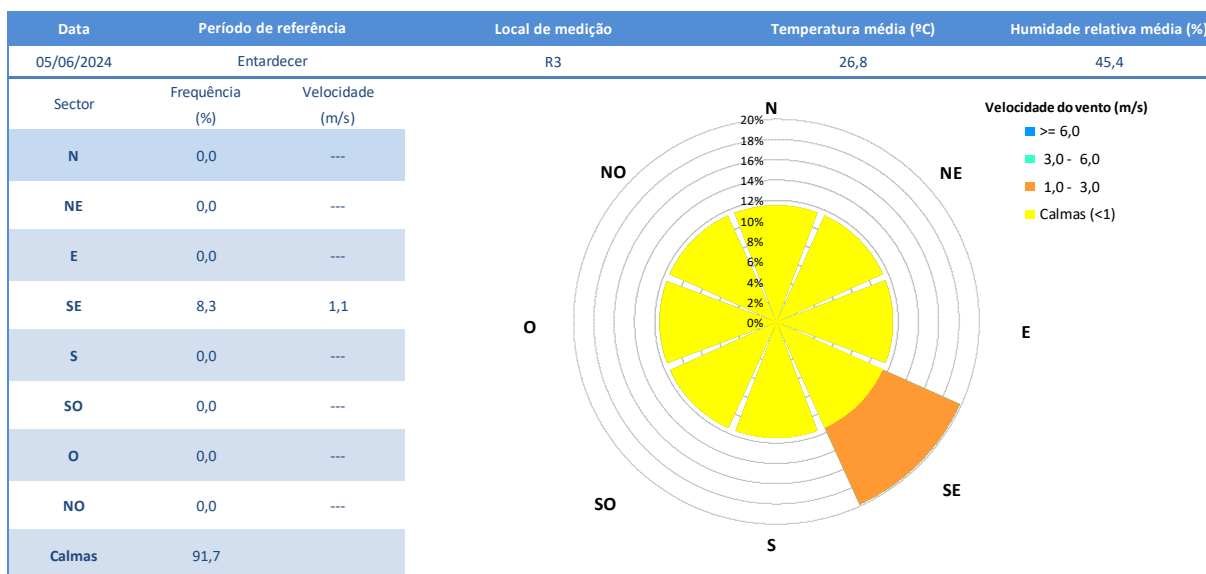


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

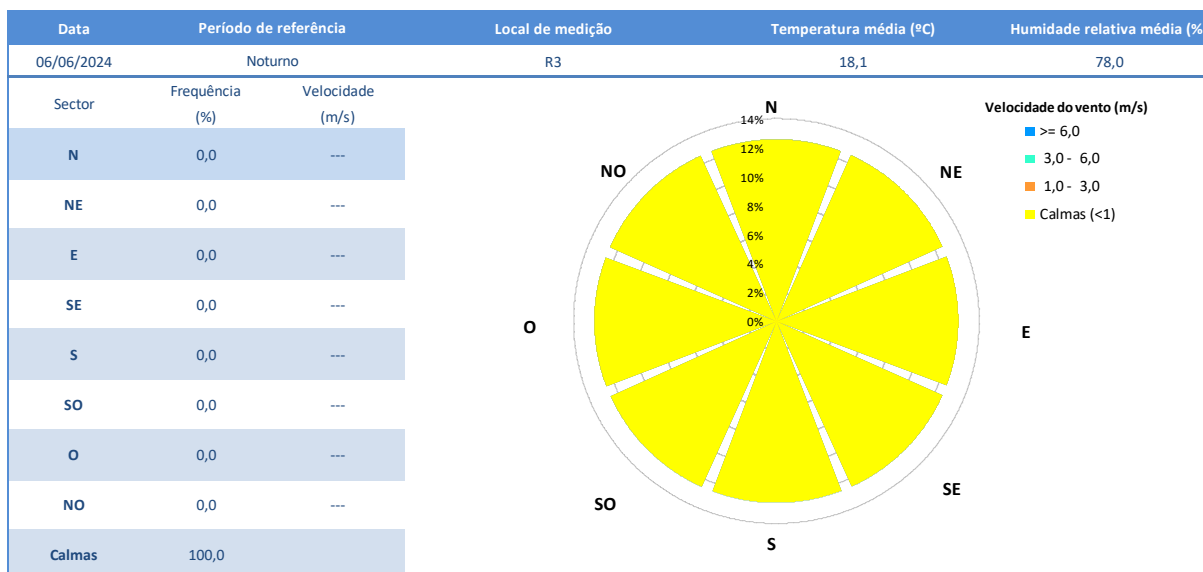
R3



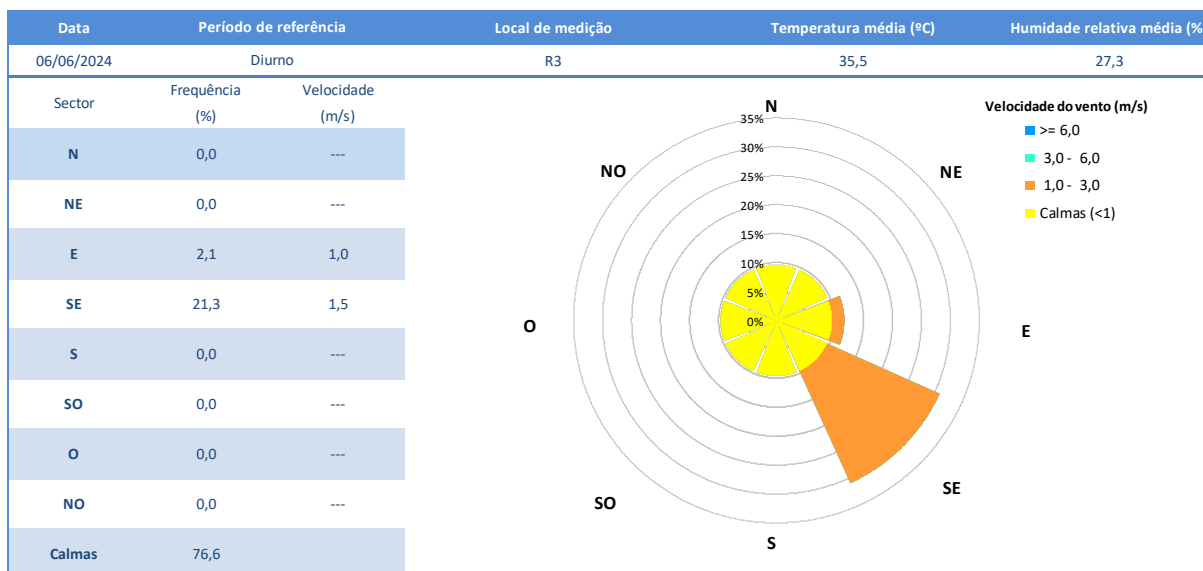
Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.



Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

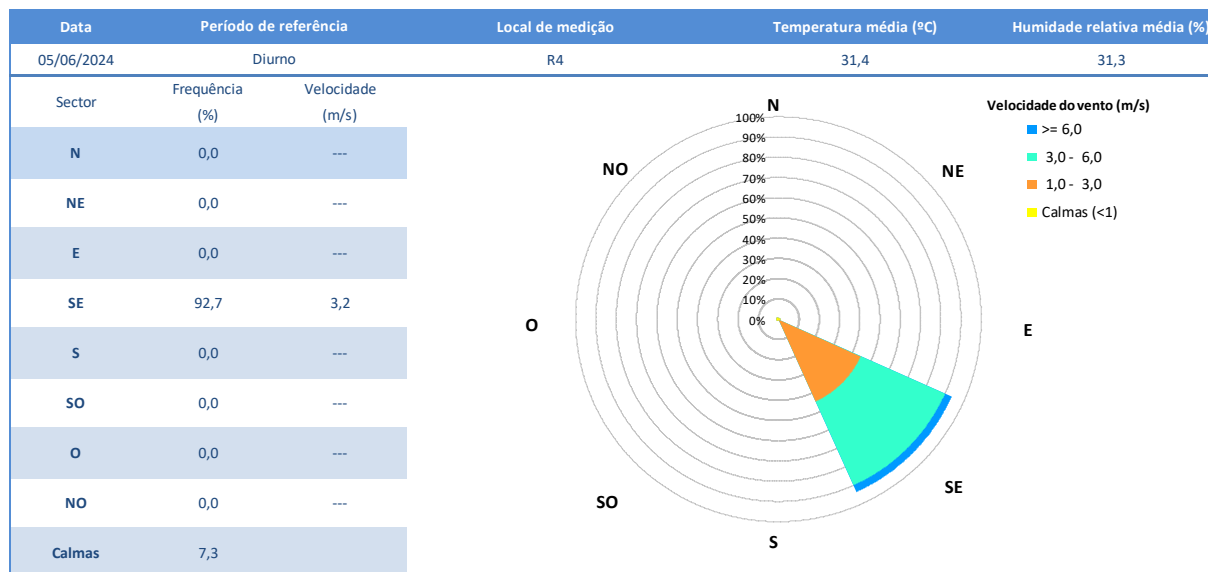


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

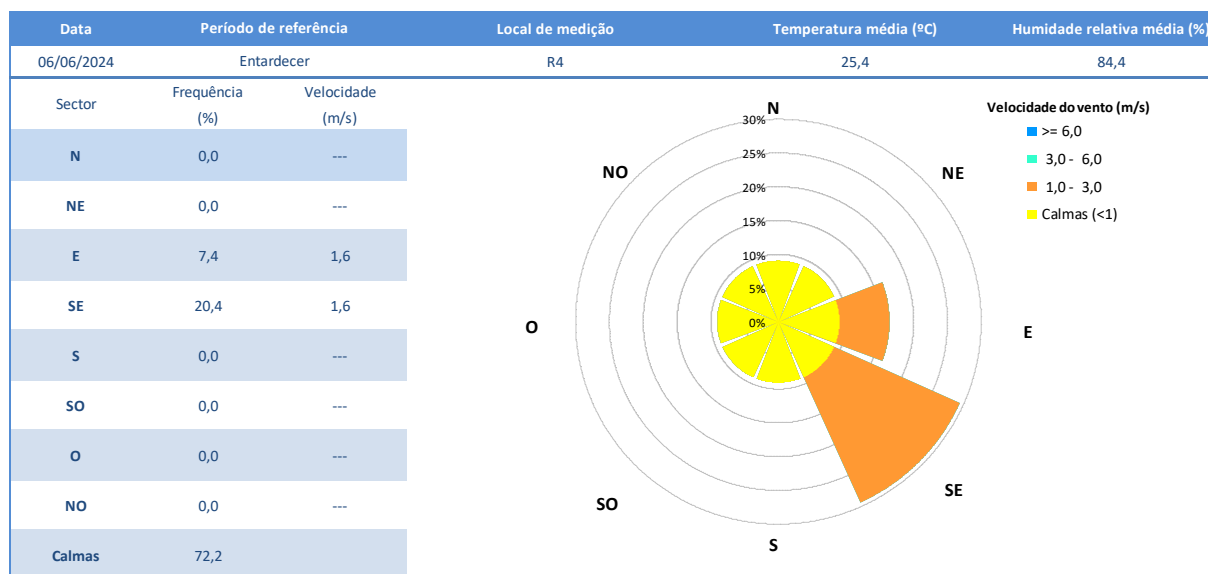


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

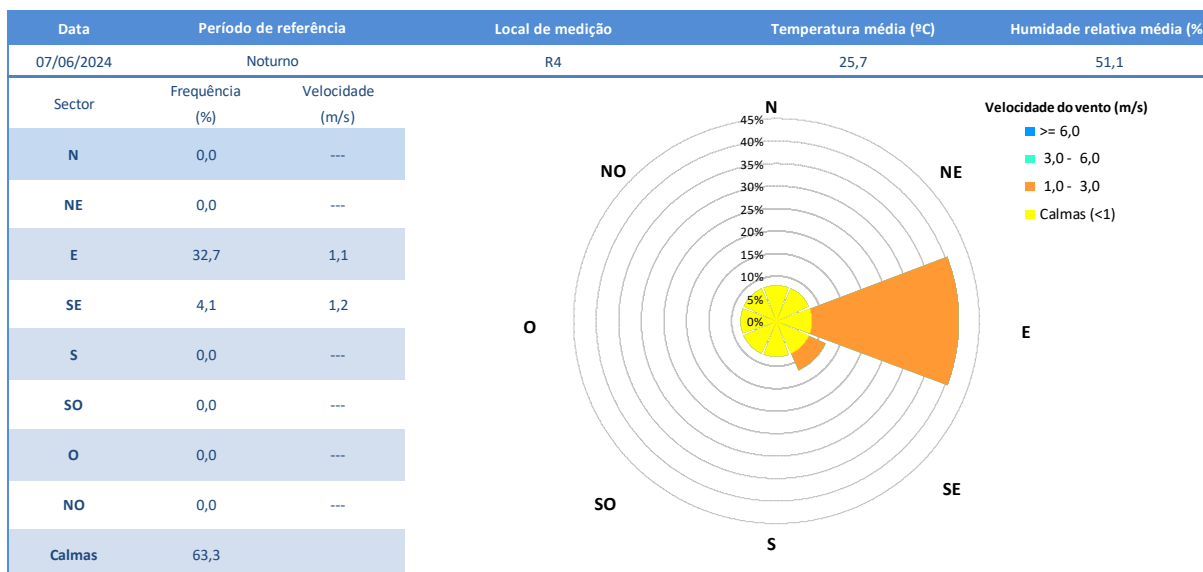
R4



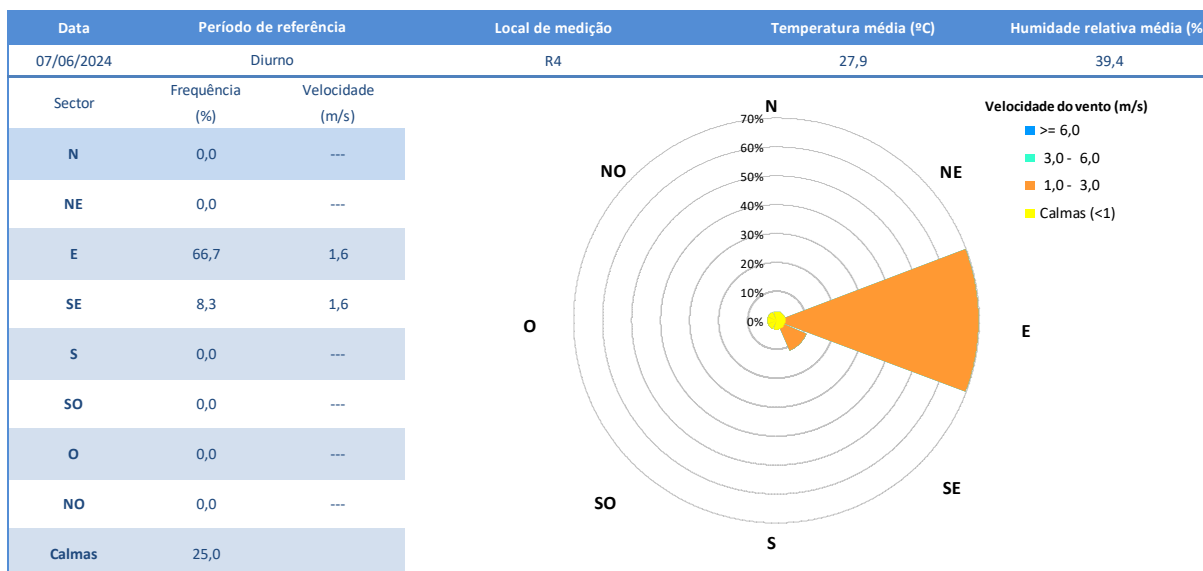
Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.



Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

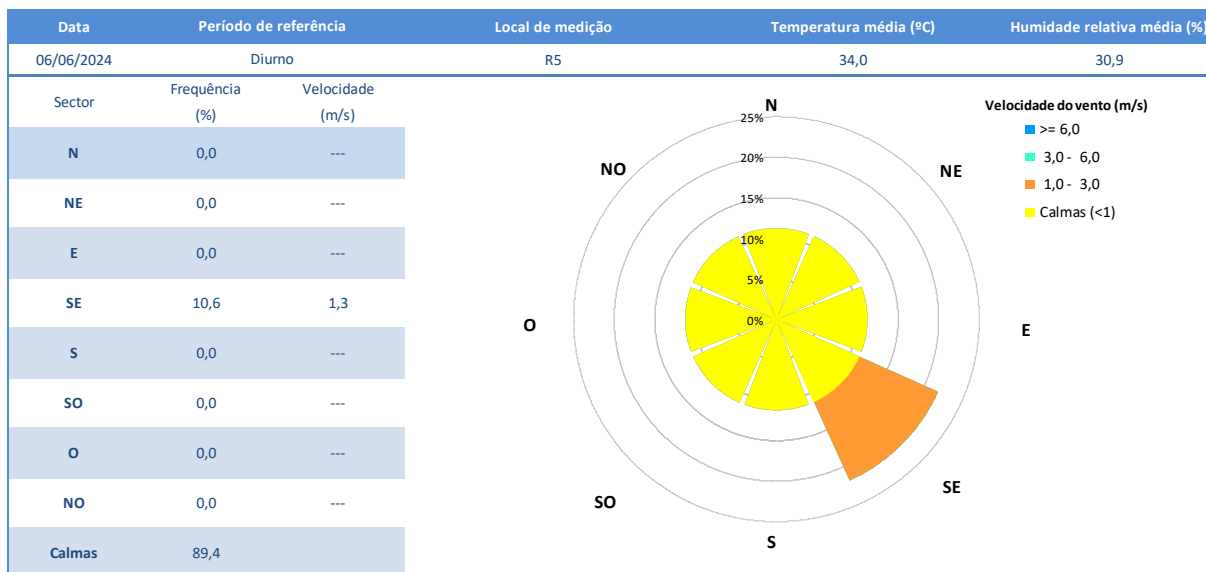


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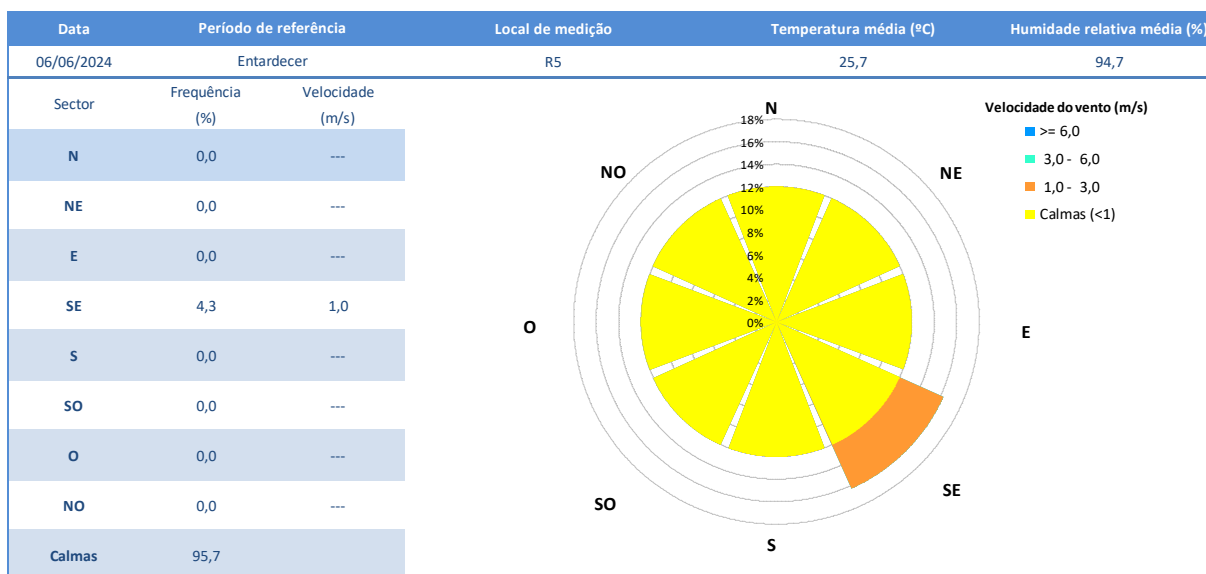


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

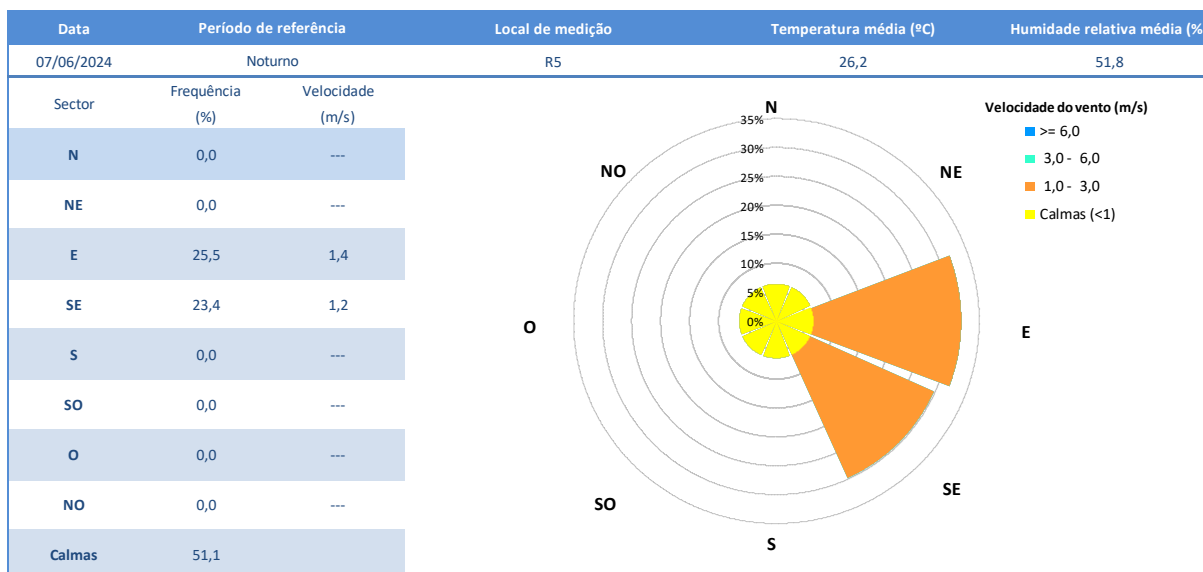
R5



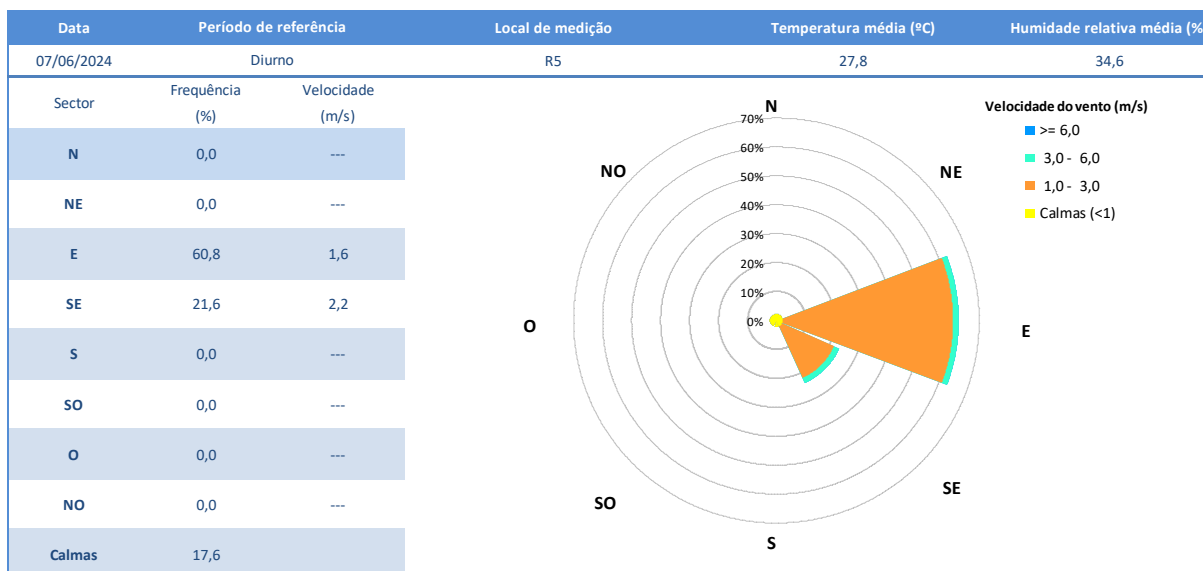
Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.



Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

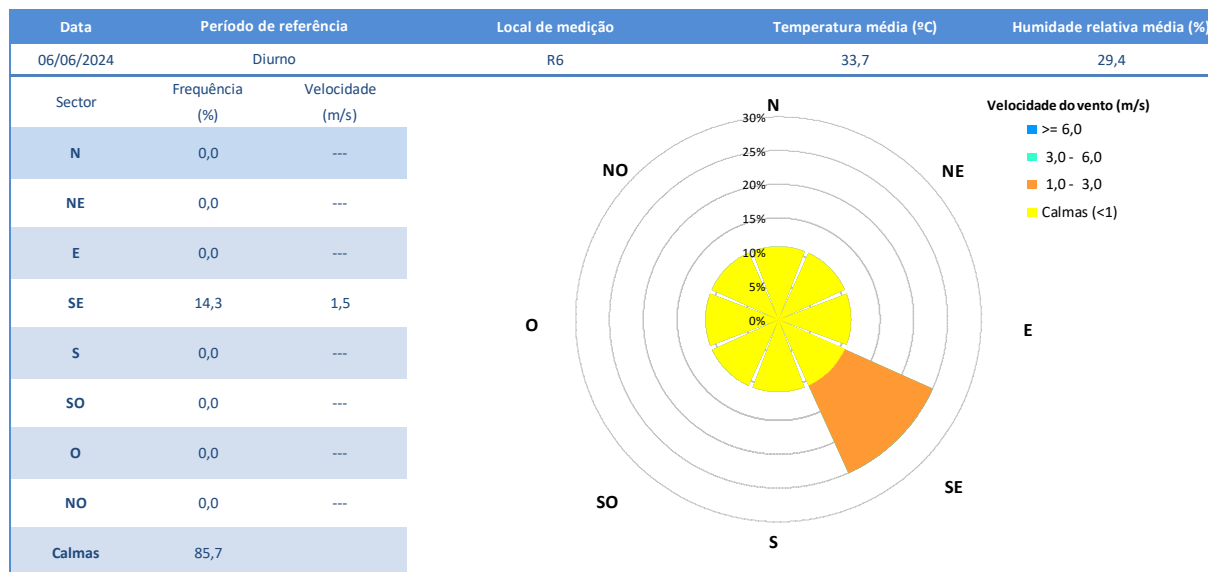


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

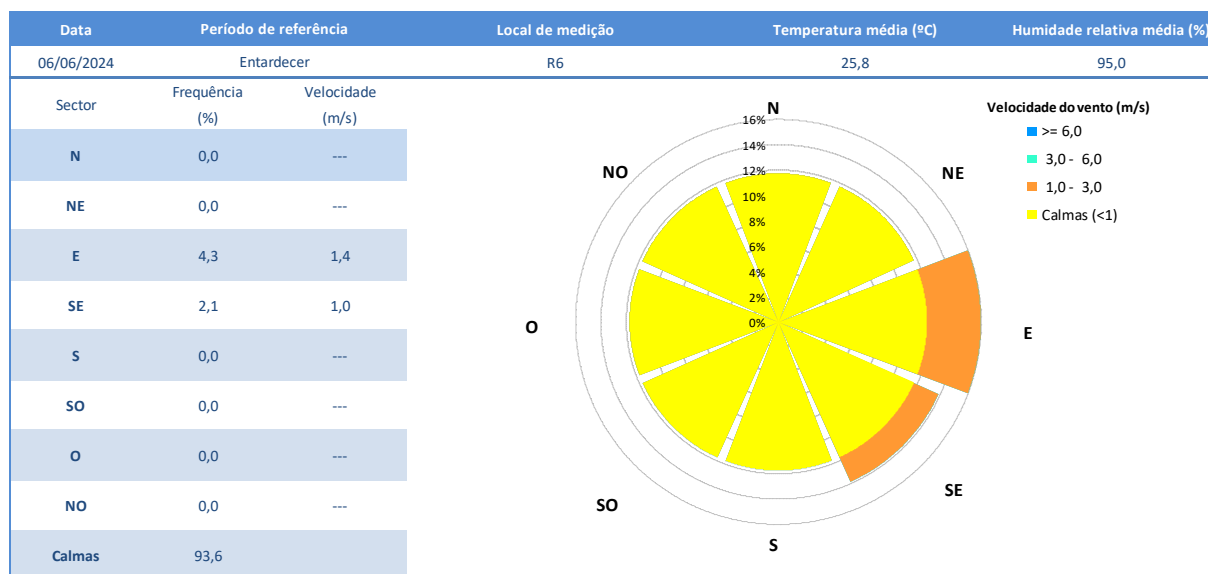


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

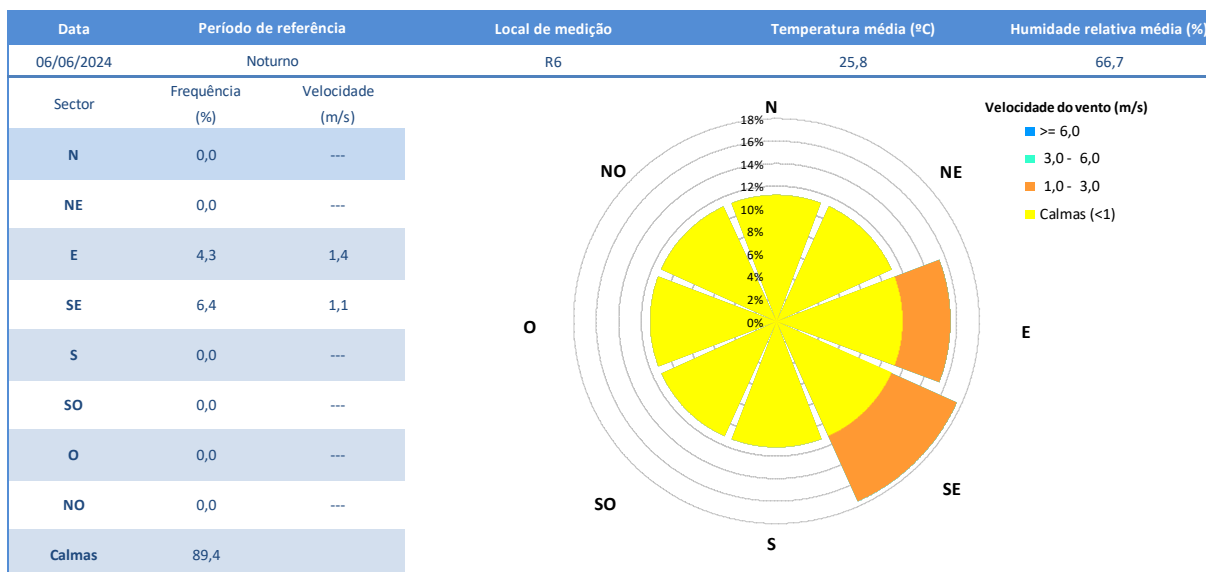
R6



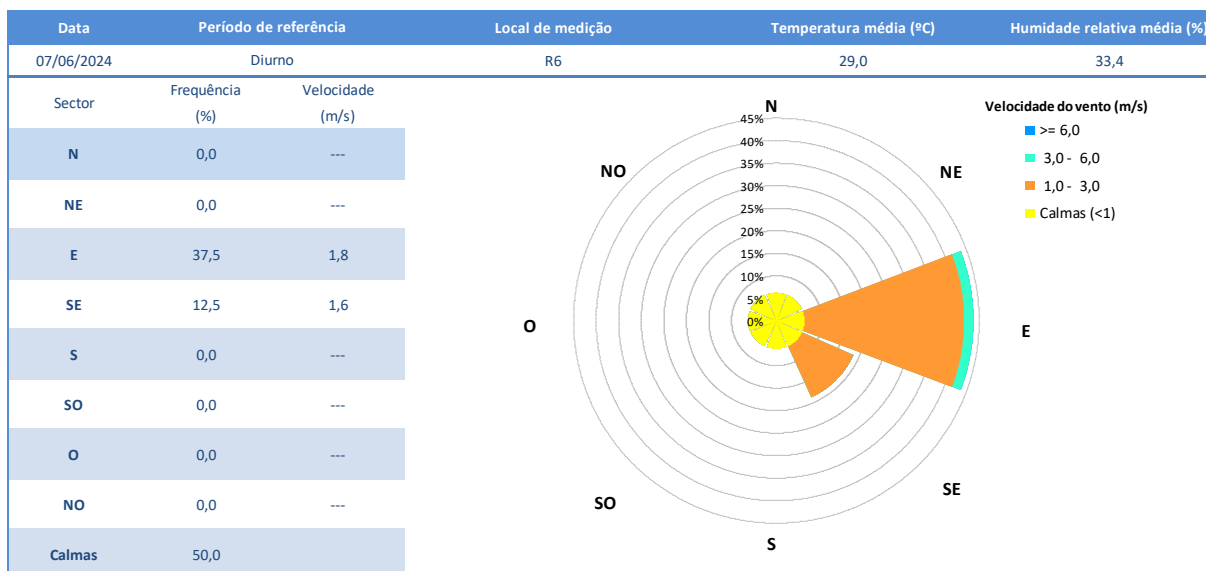
Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.



Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

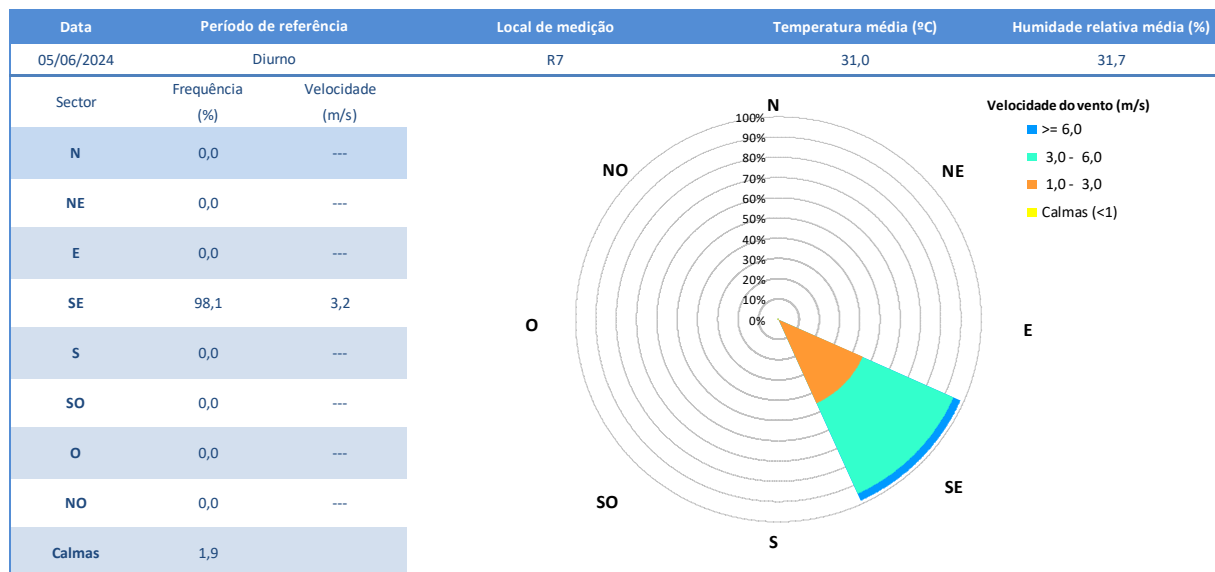


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

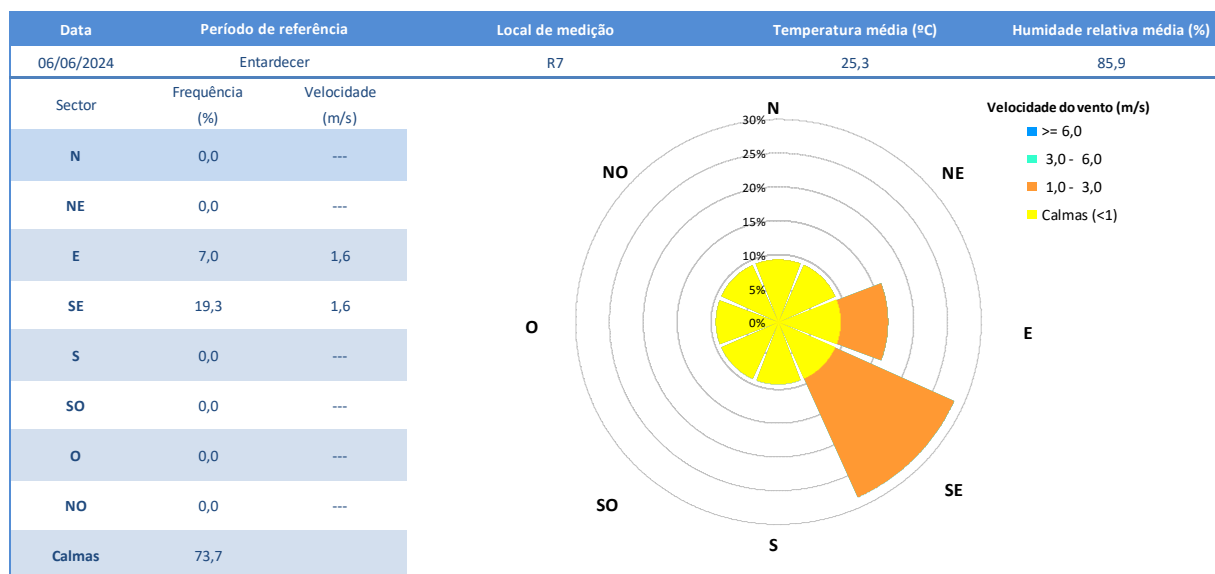


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

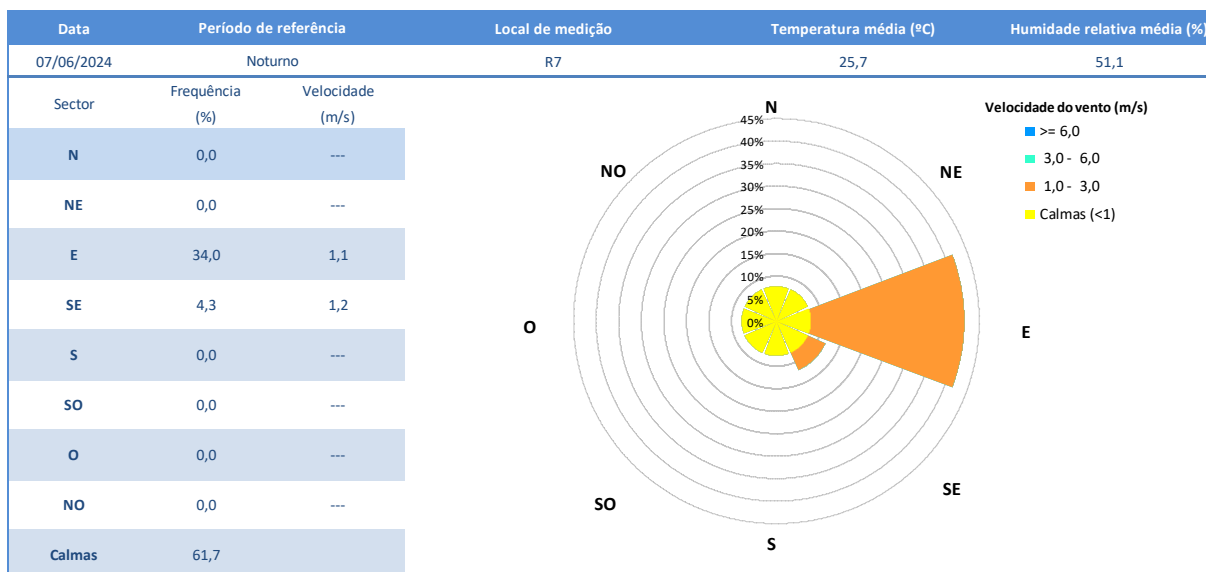
R7



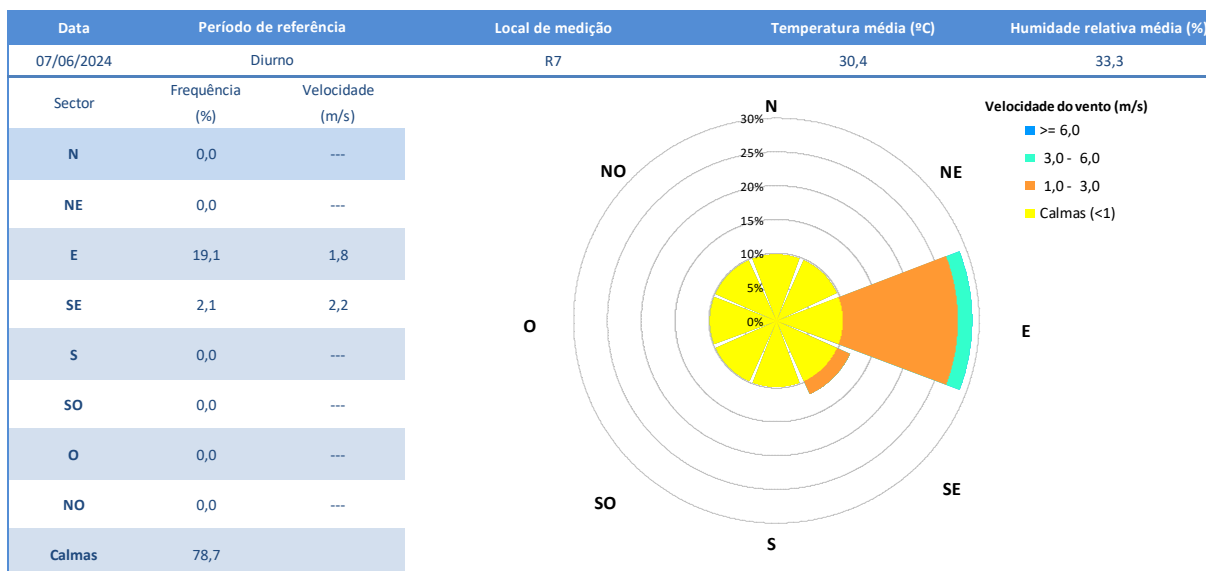
Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.



Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

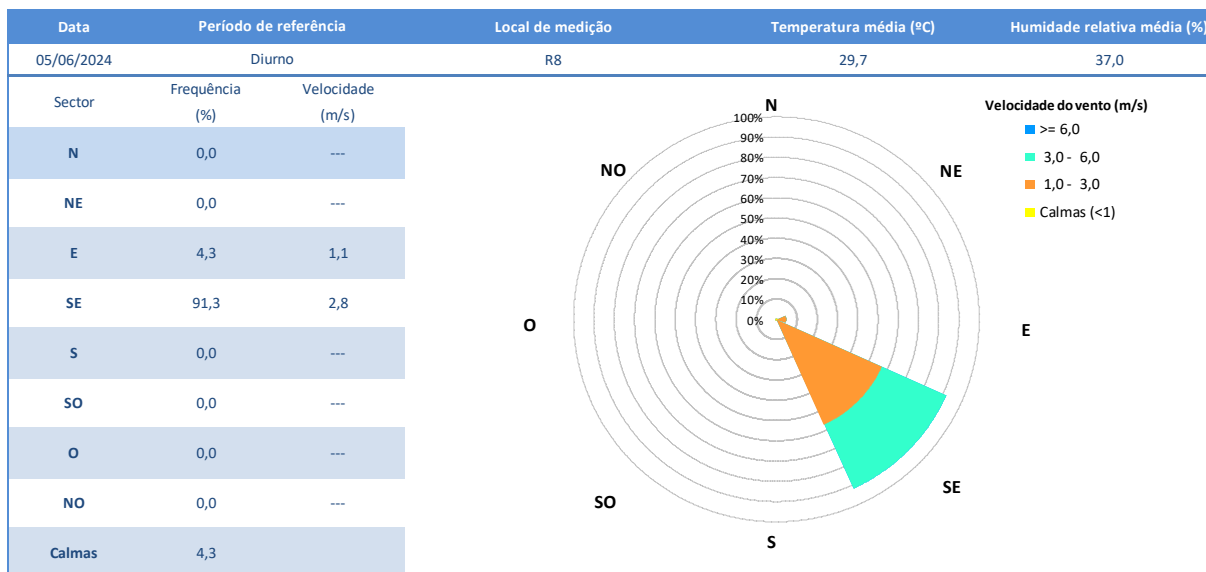


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

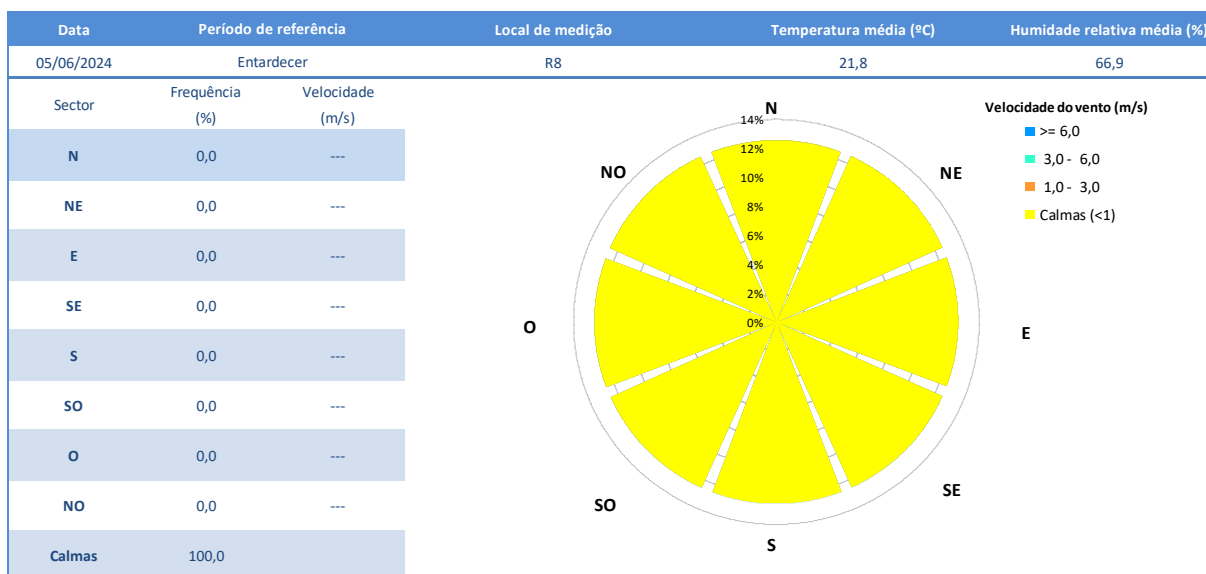


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

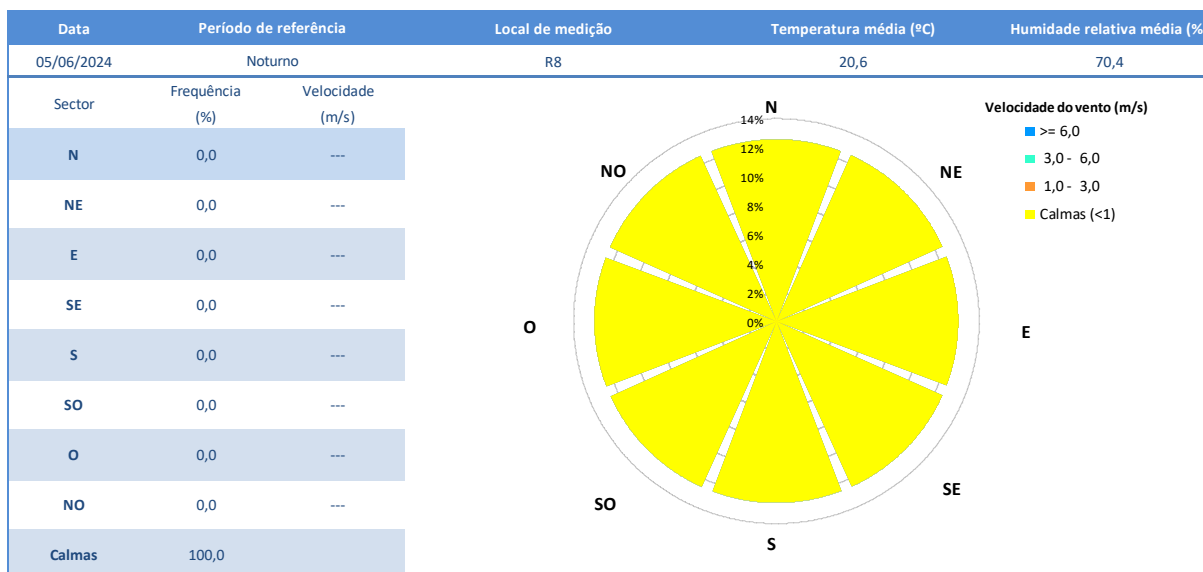
R8



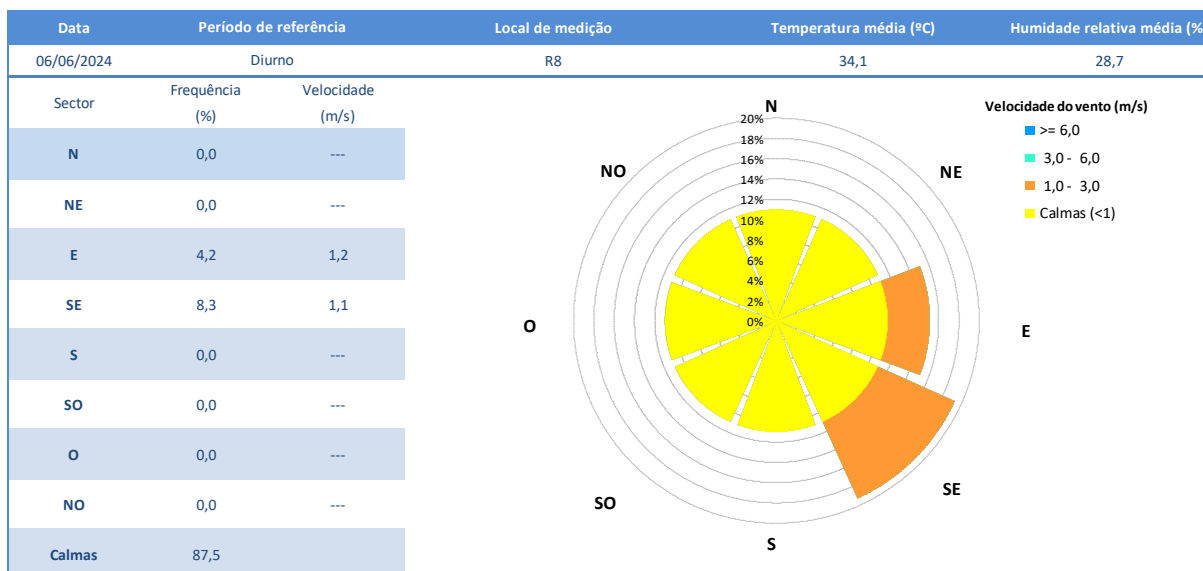
Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.



Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

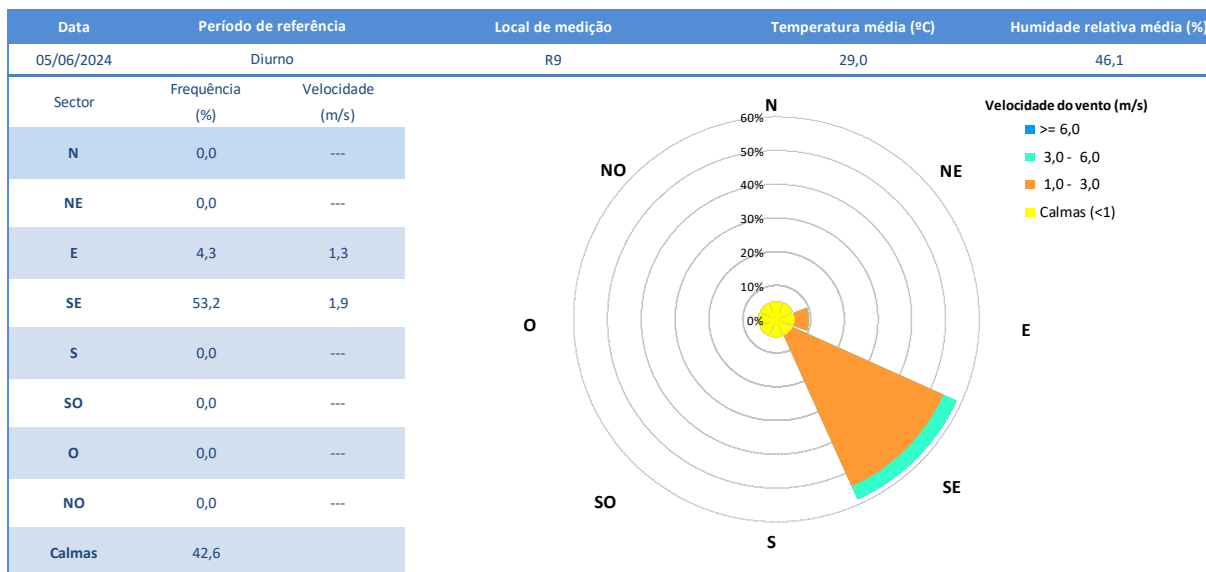


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

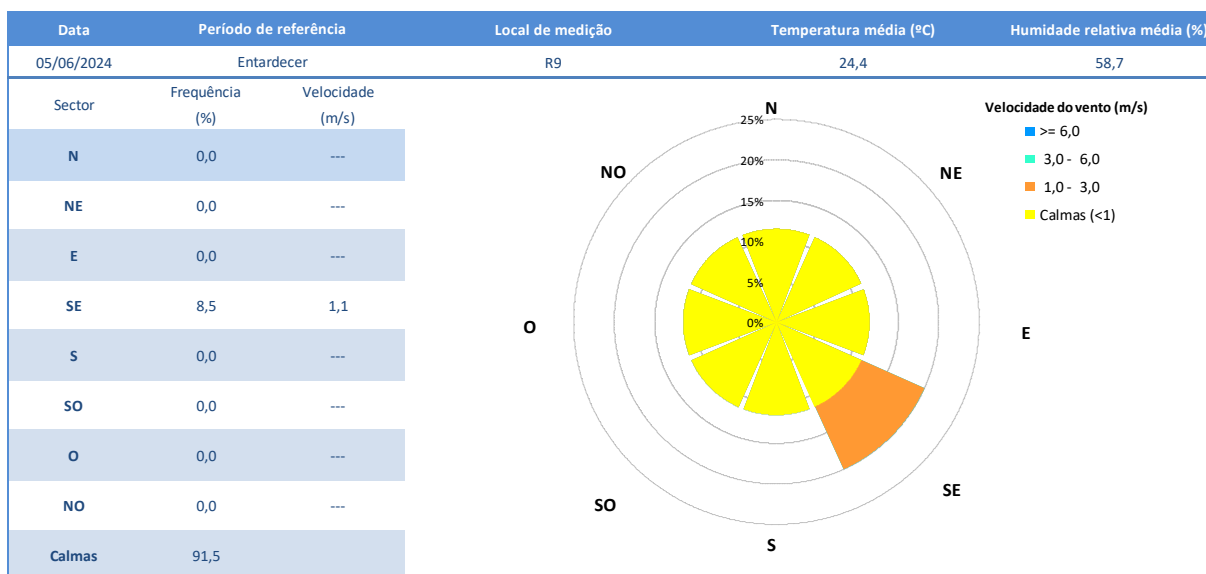


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

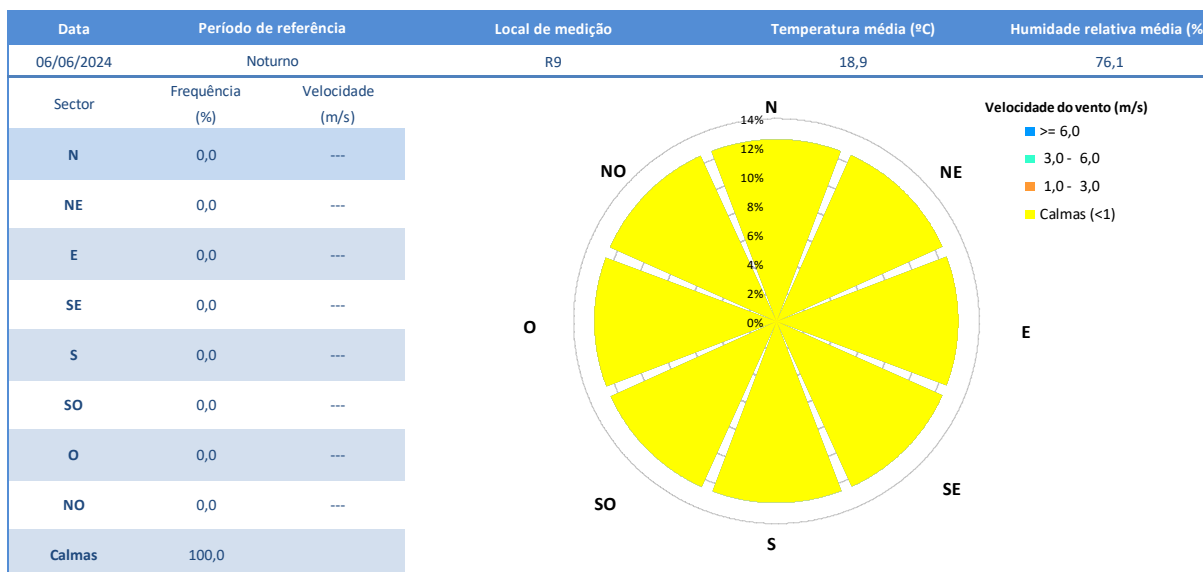
R9



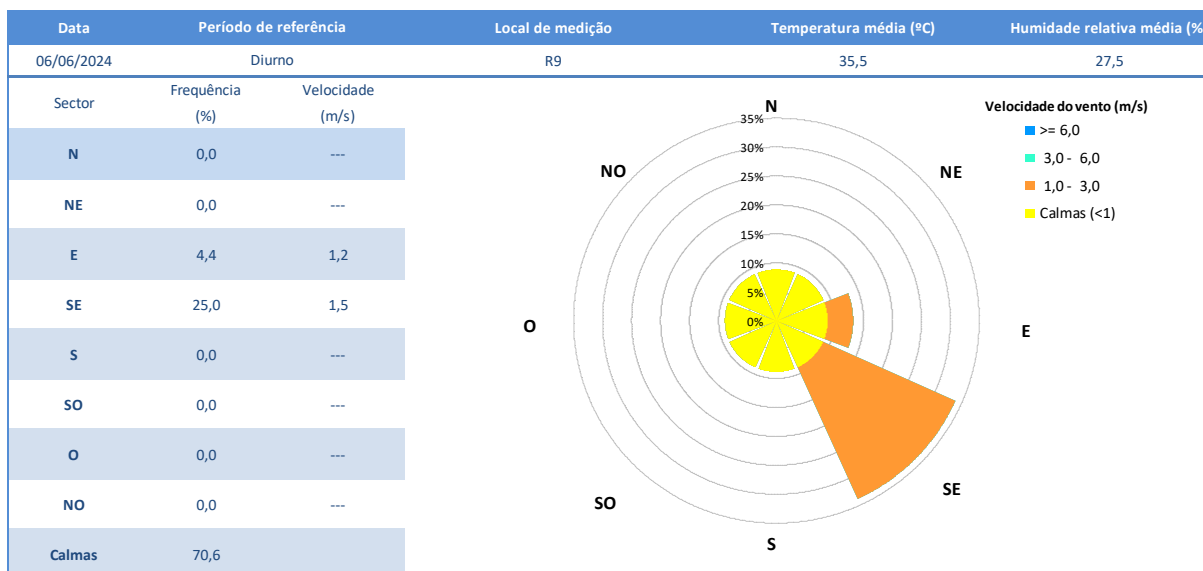
Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.



Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

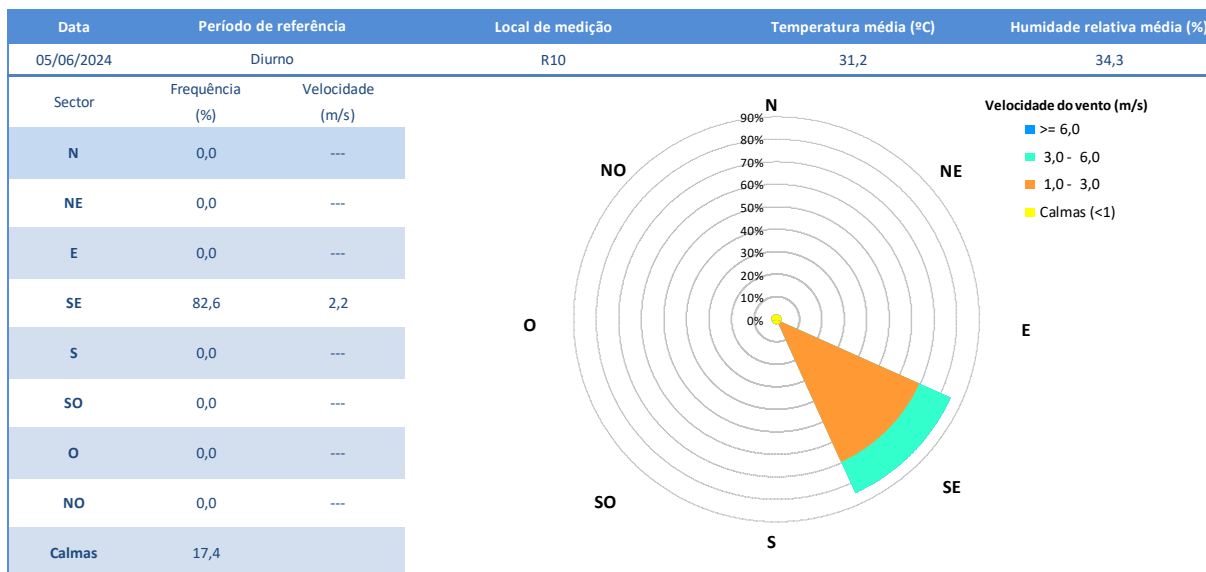


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

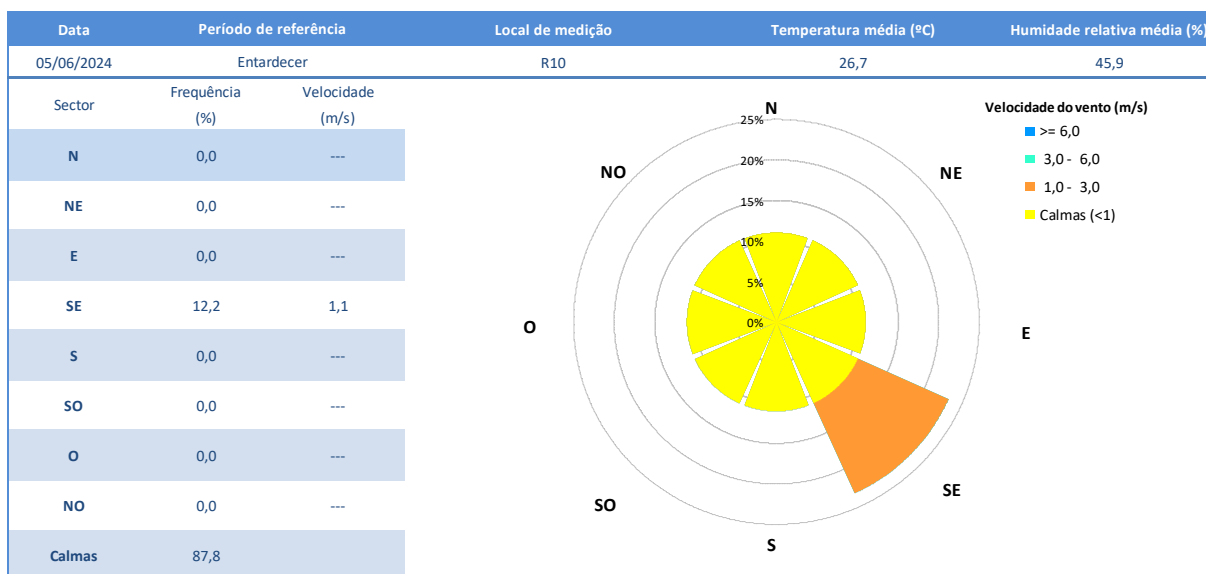


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

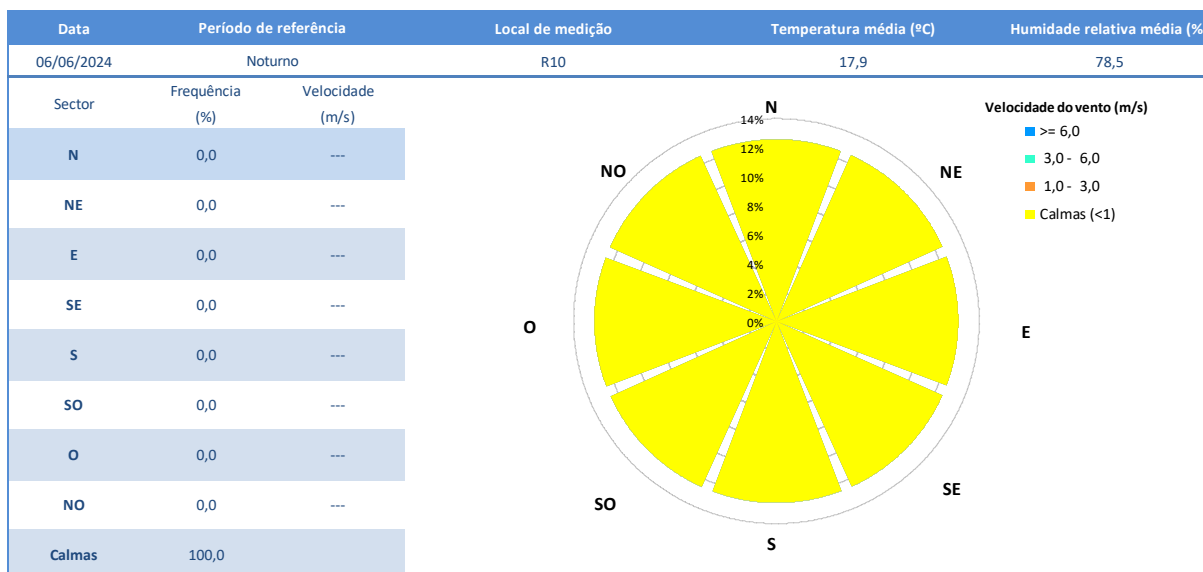
R10



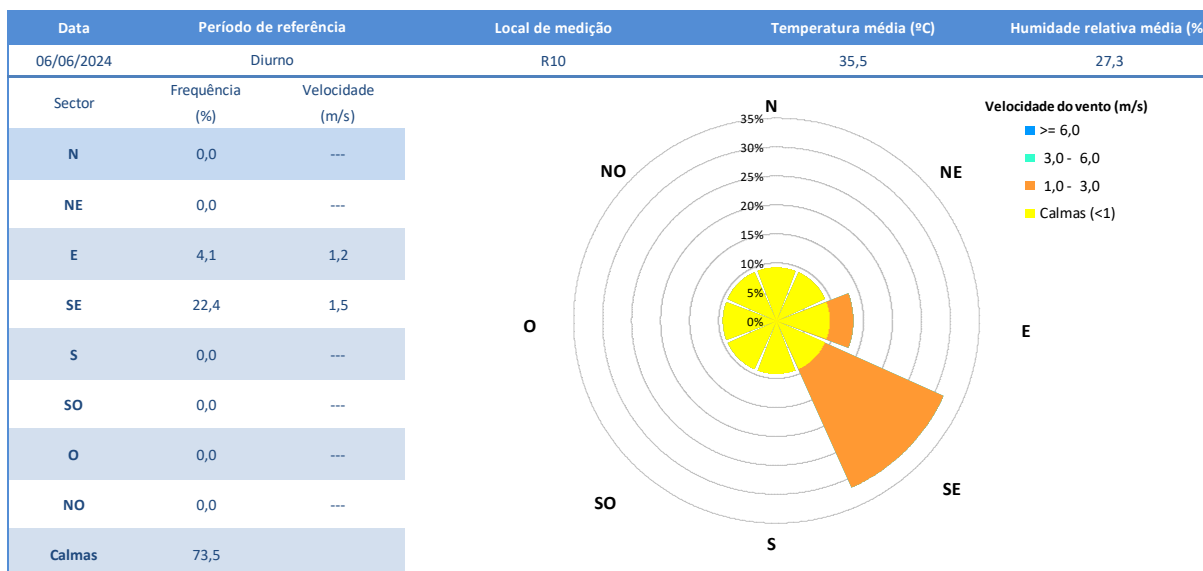
Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.



Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

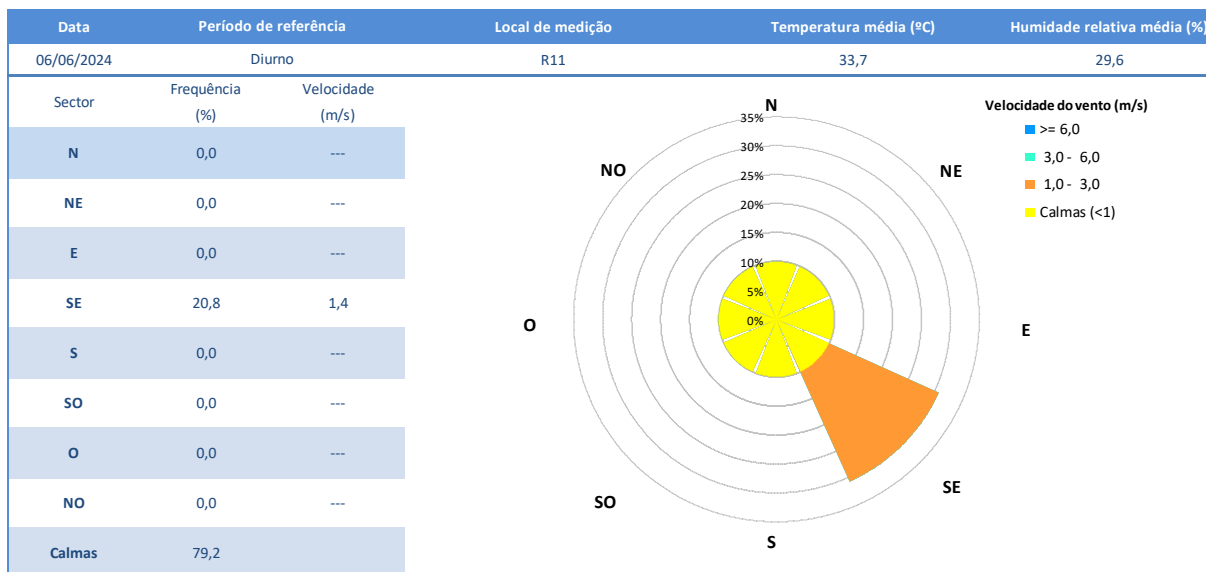


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

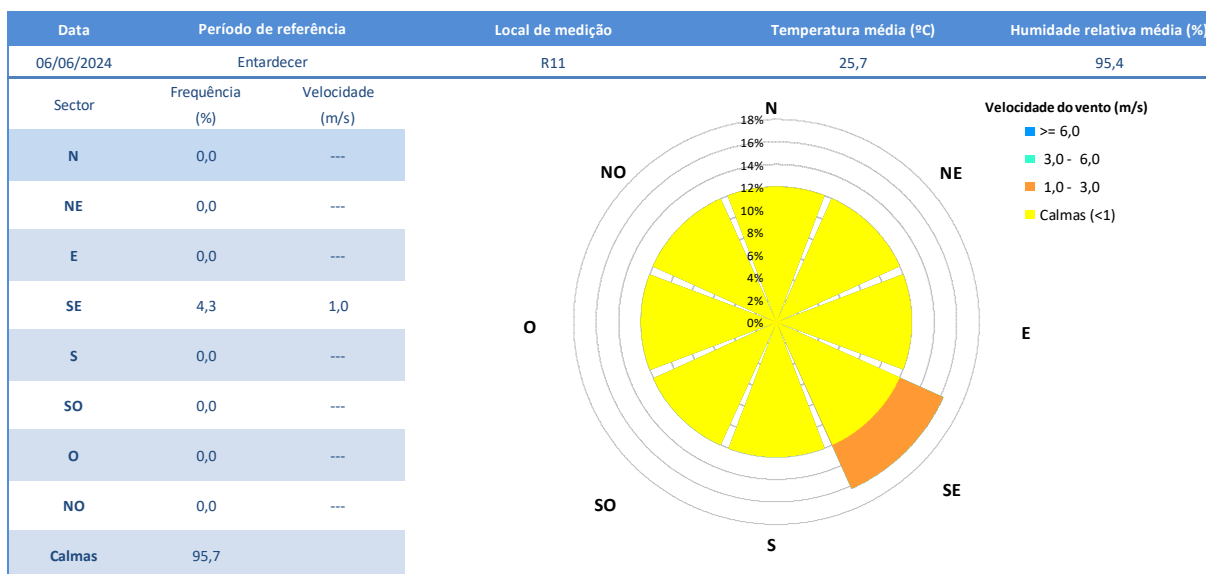


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

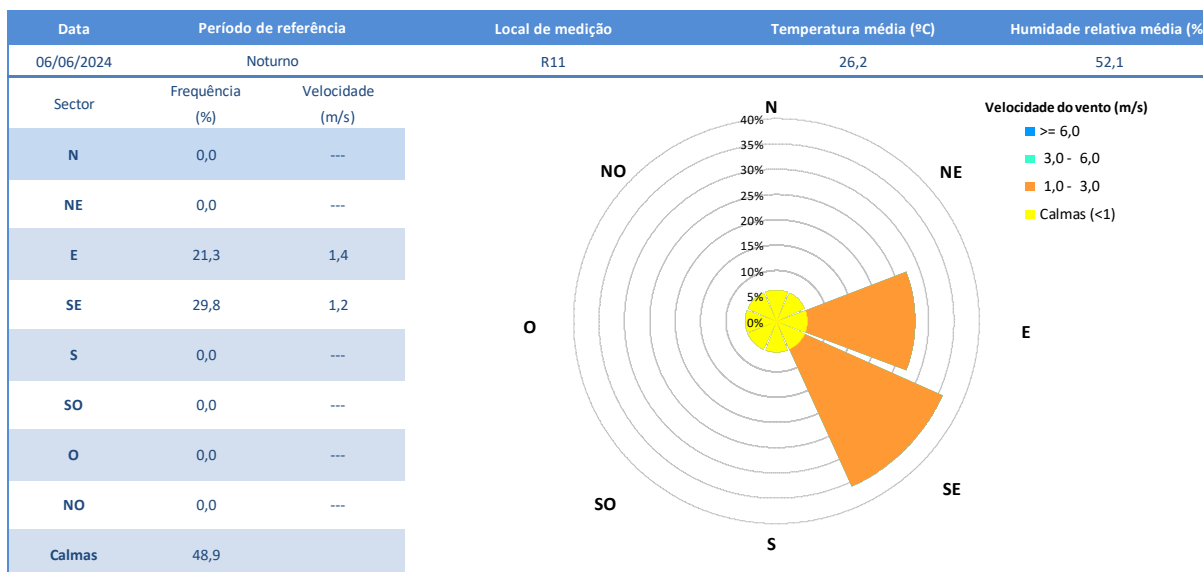
R11



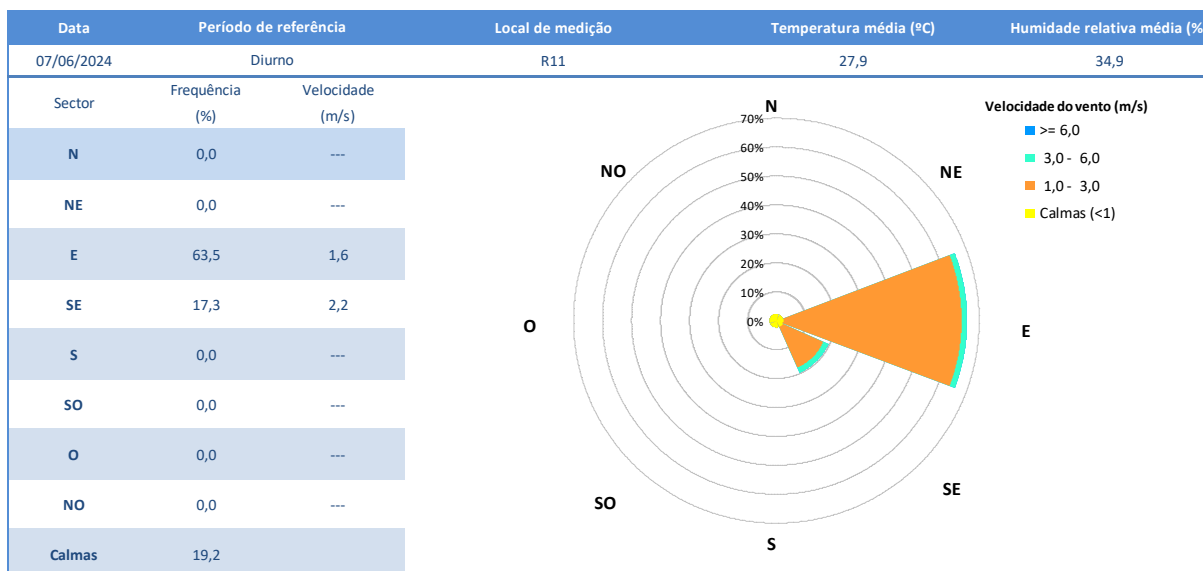
Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.



Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

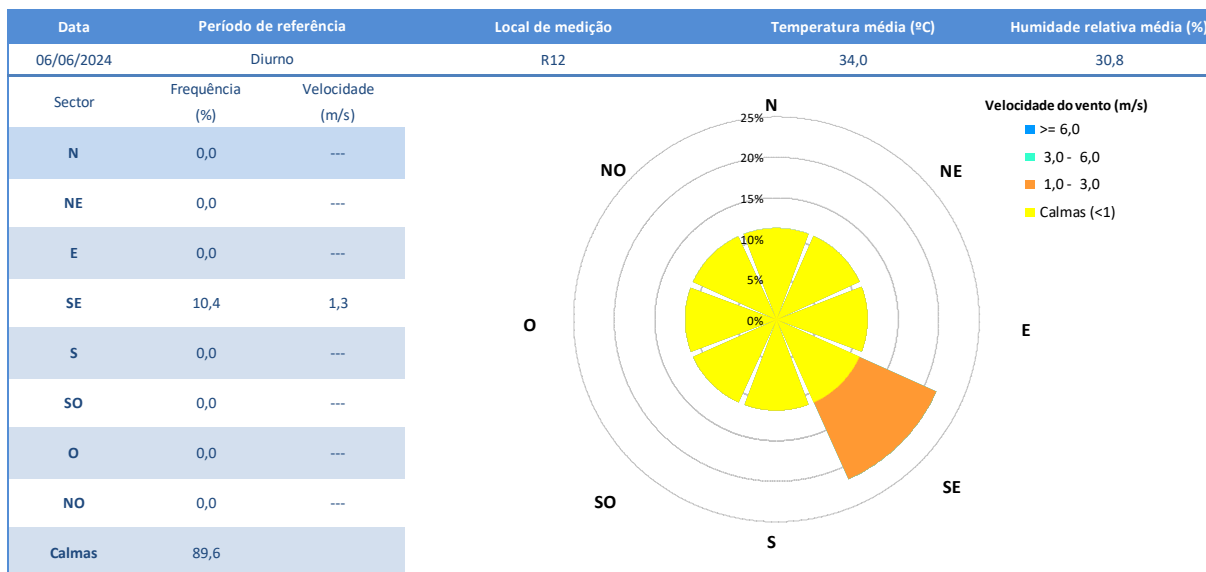


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

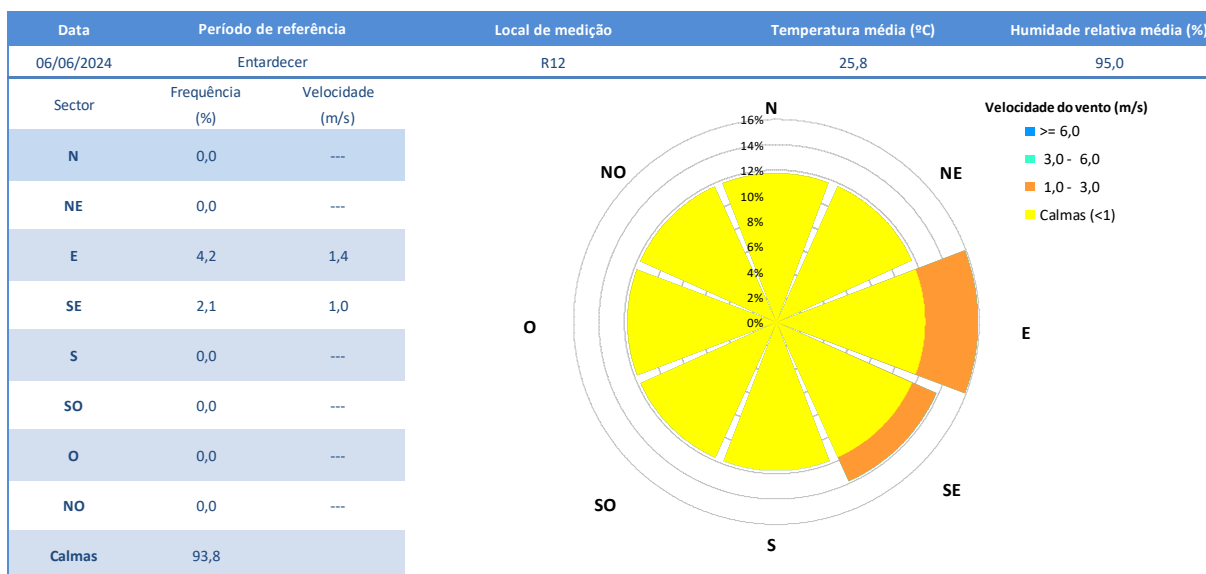


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

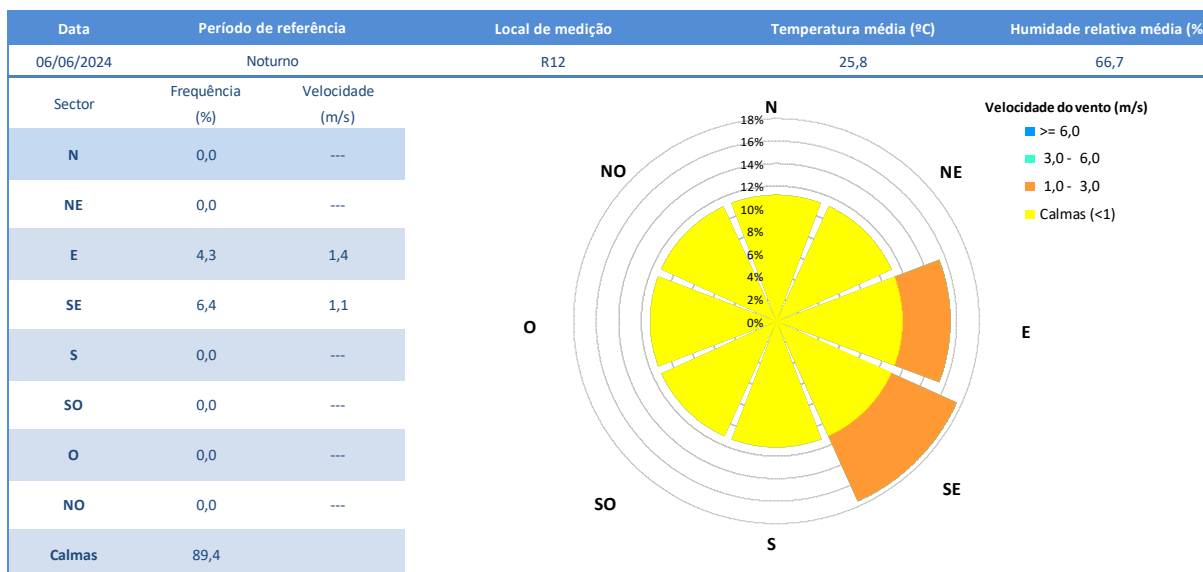
R12



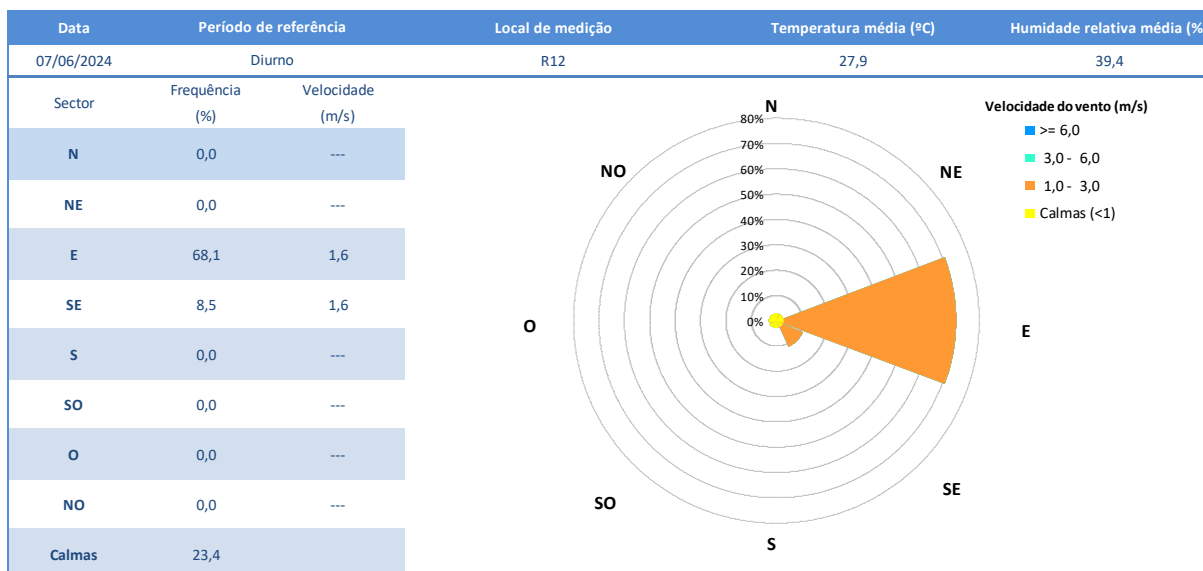
Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.



Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

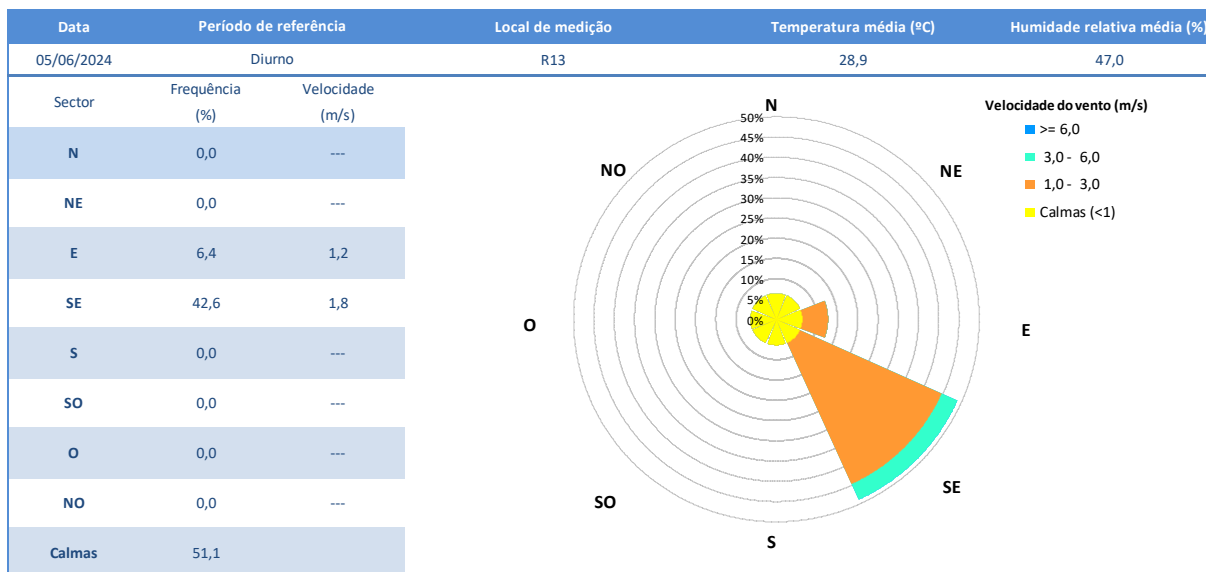


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

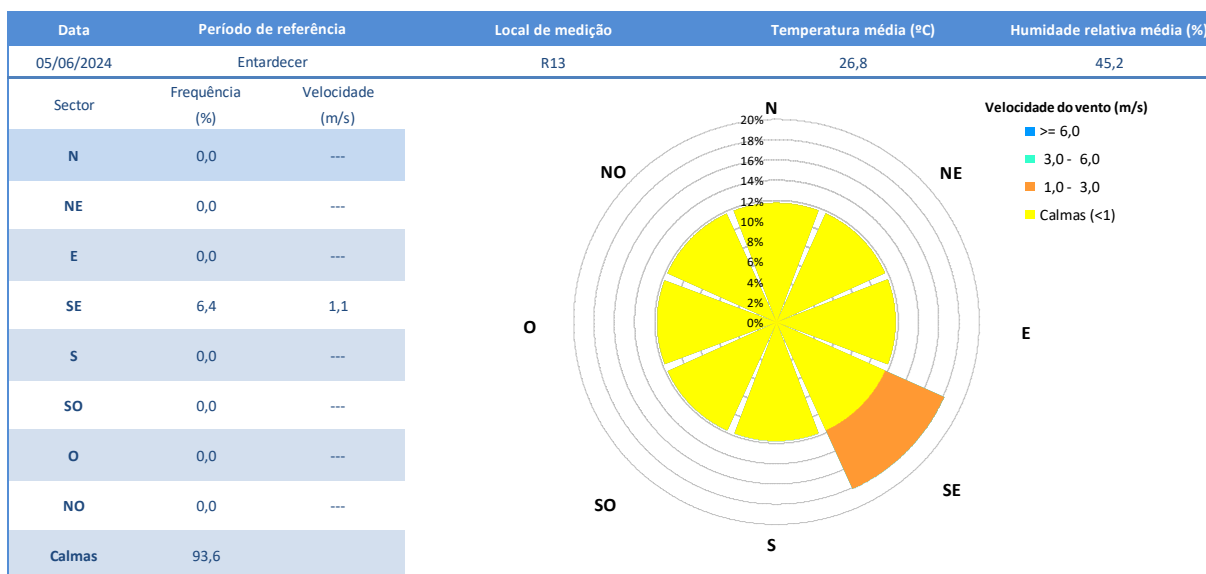


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

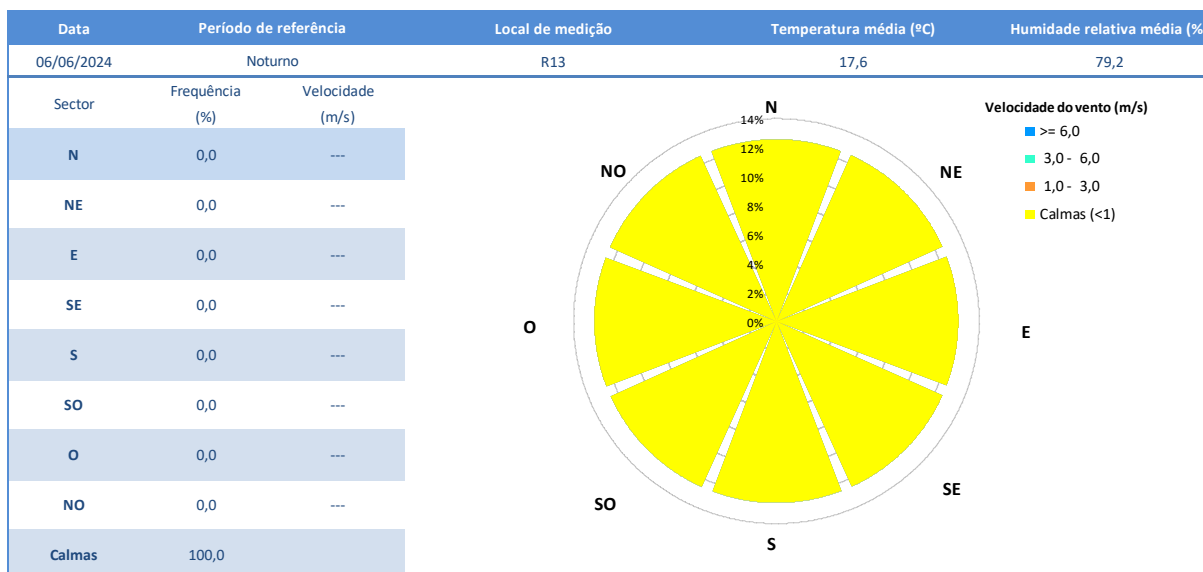
R13



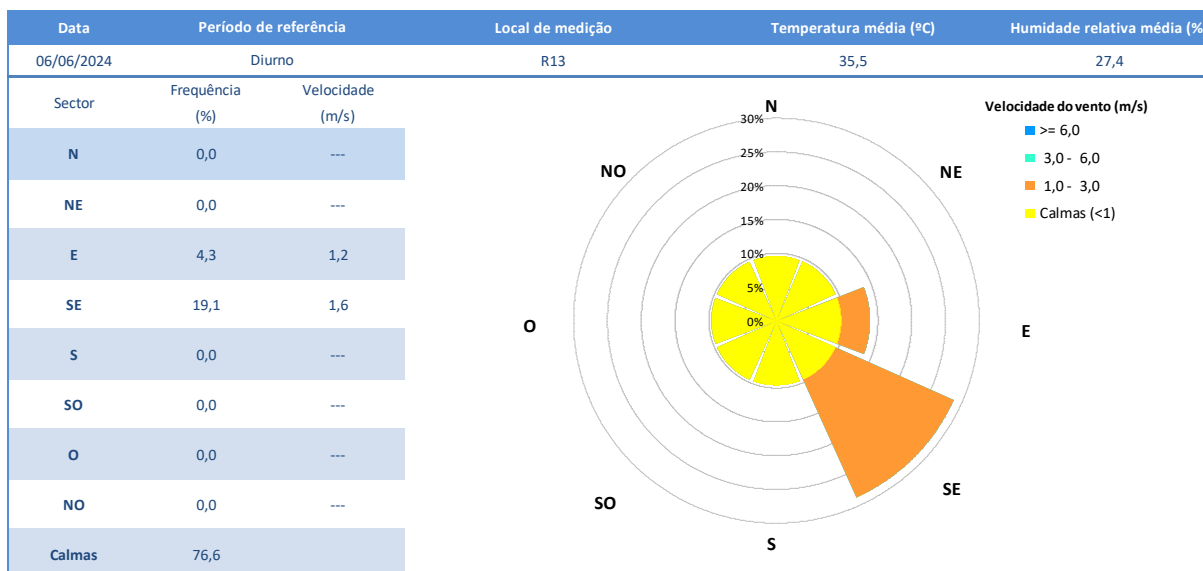
Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.



Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

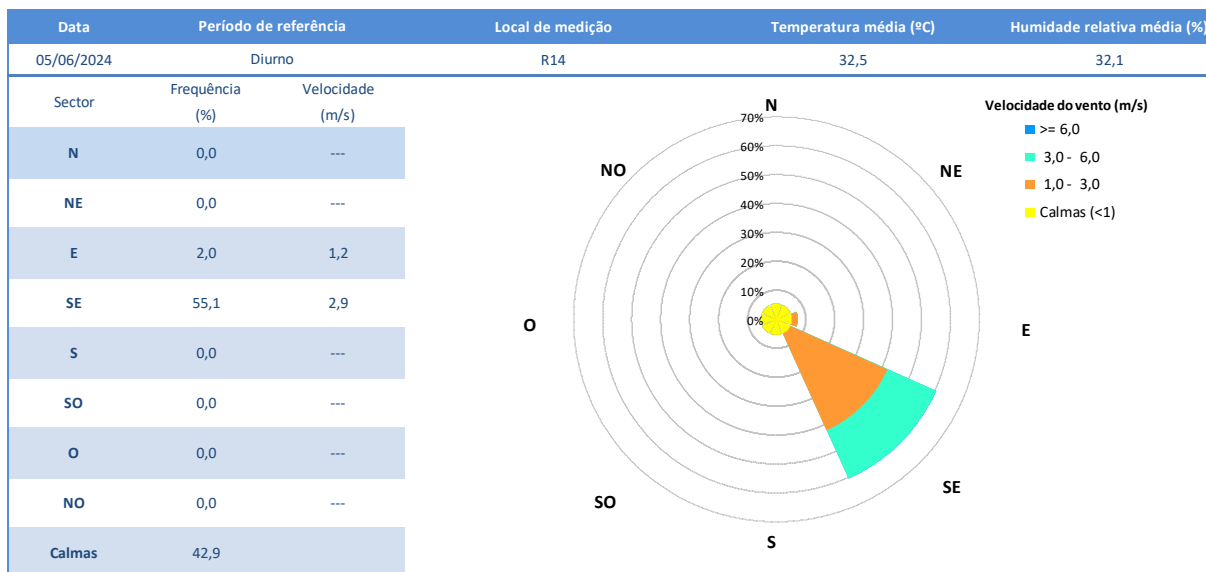


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

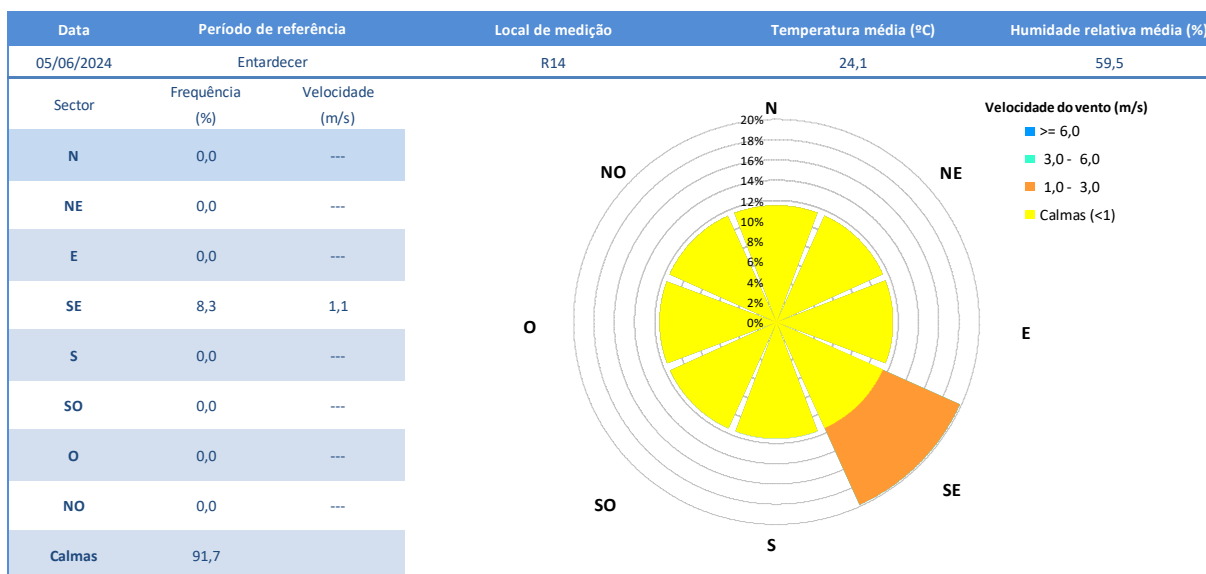


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

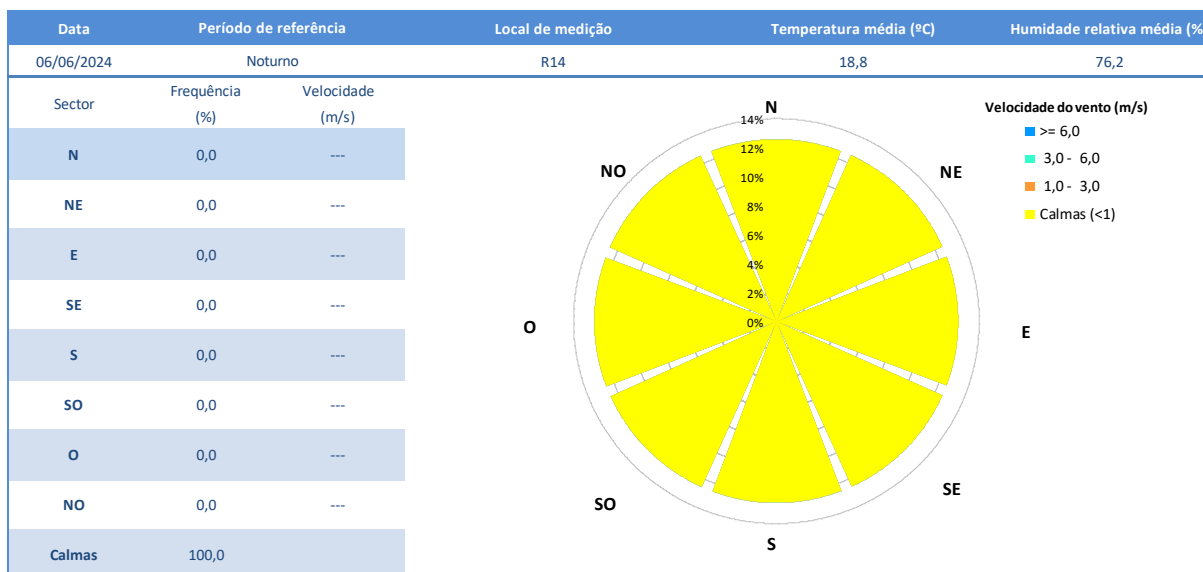
R14



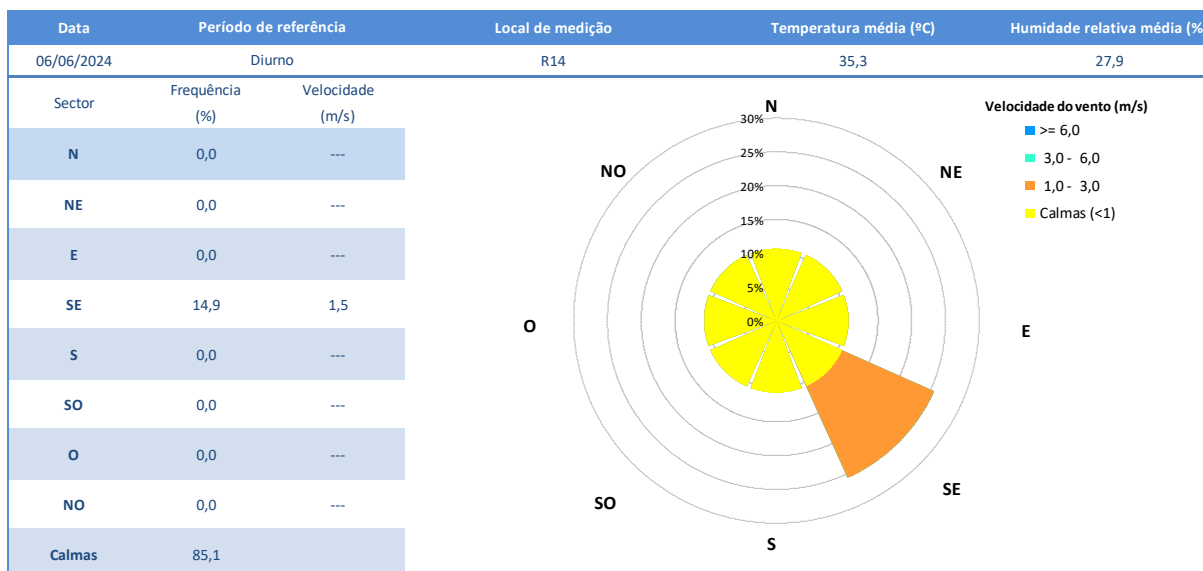
Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.



Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

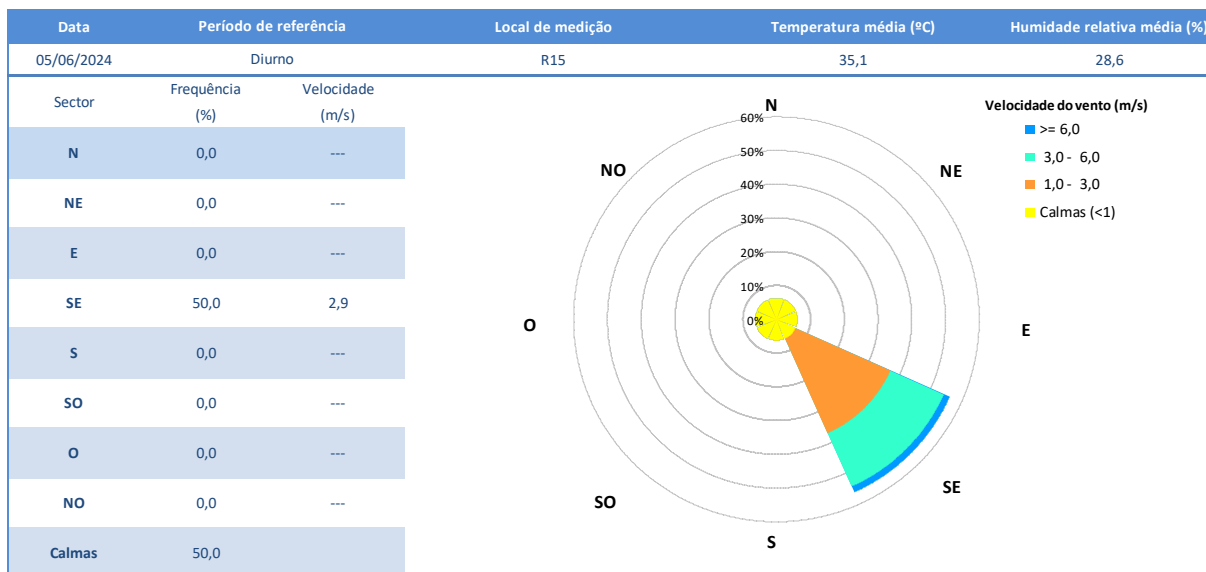


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

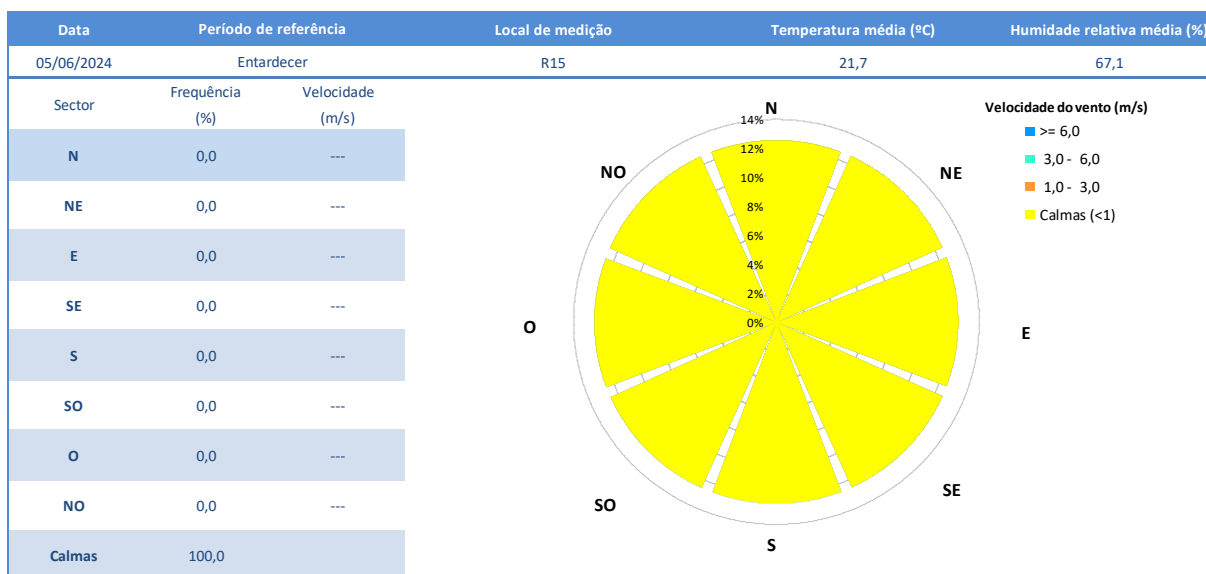


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

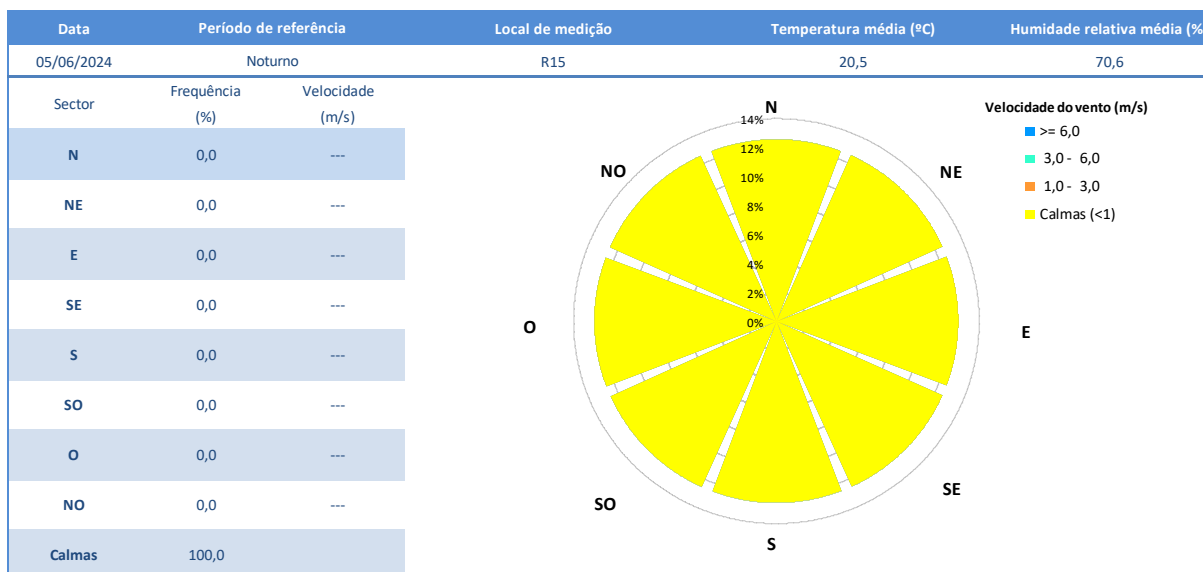
R15



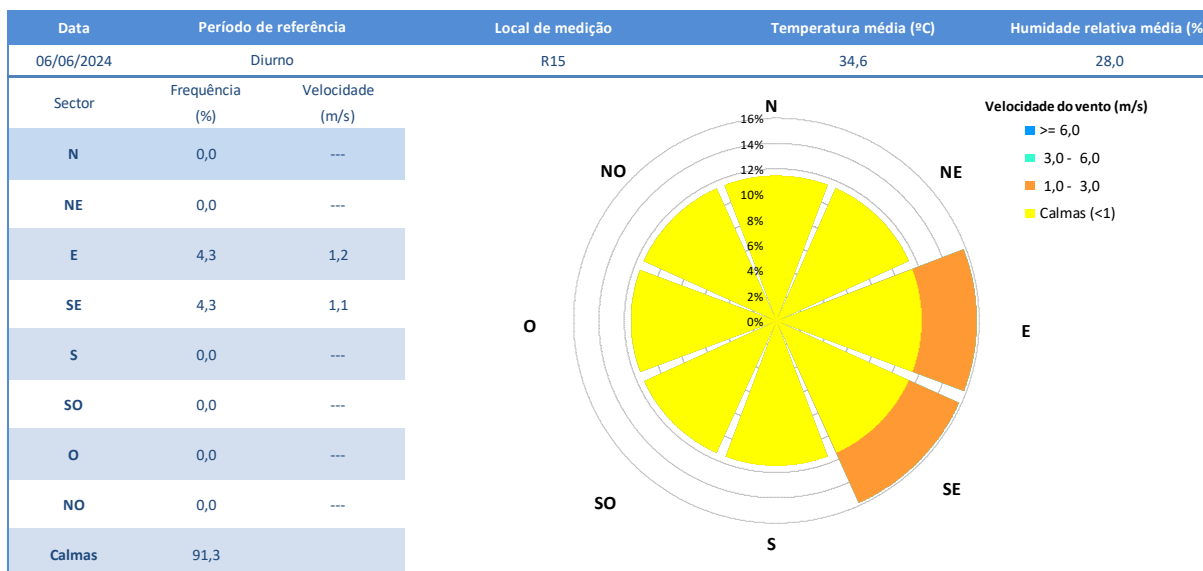
Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.



Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

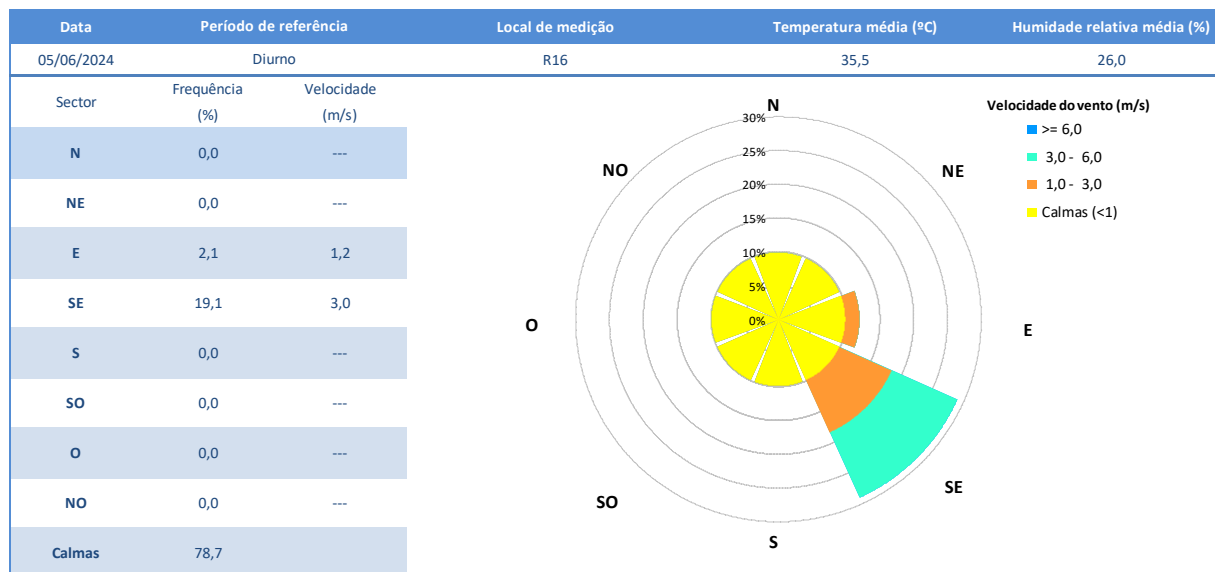


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

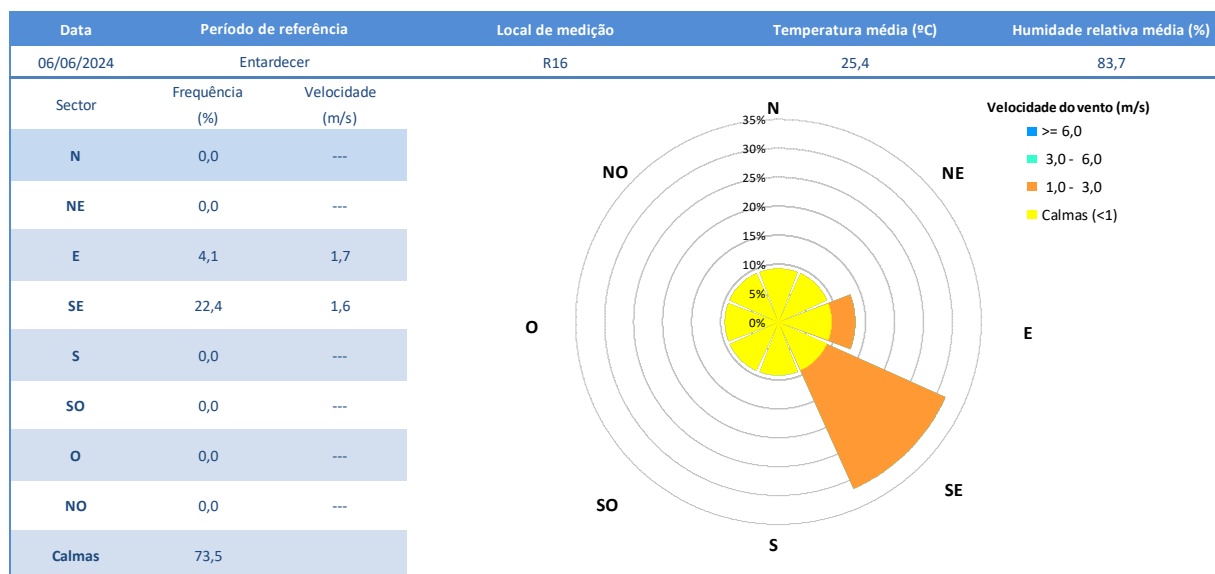


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

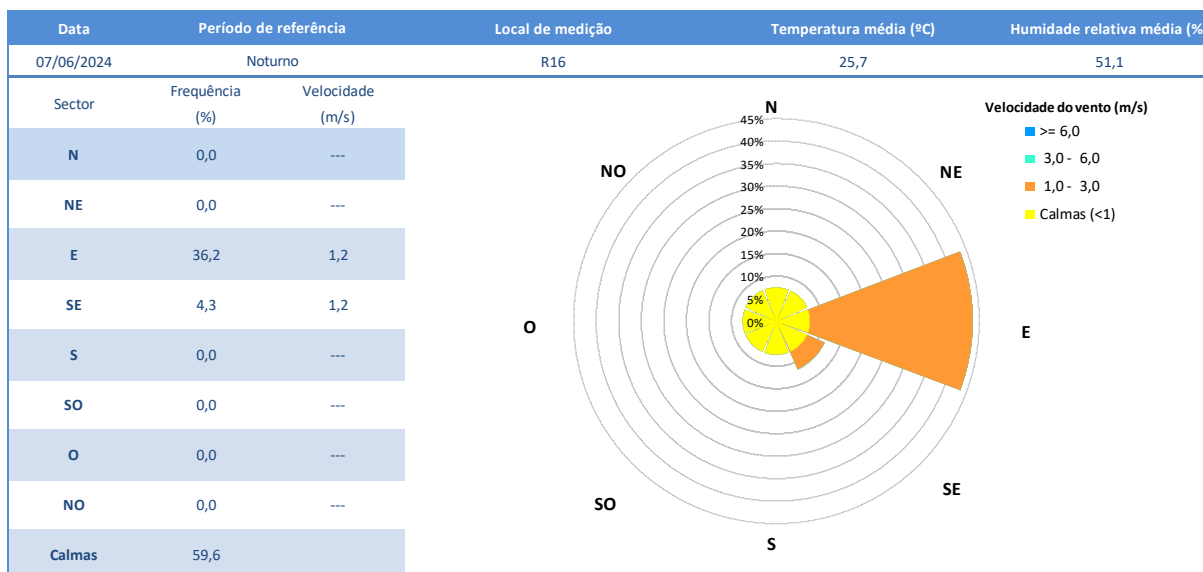
R16



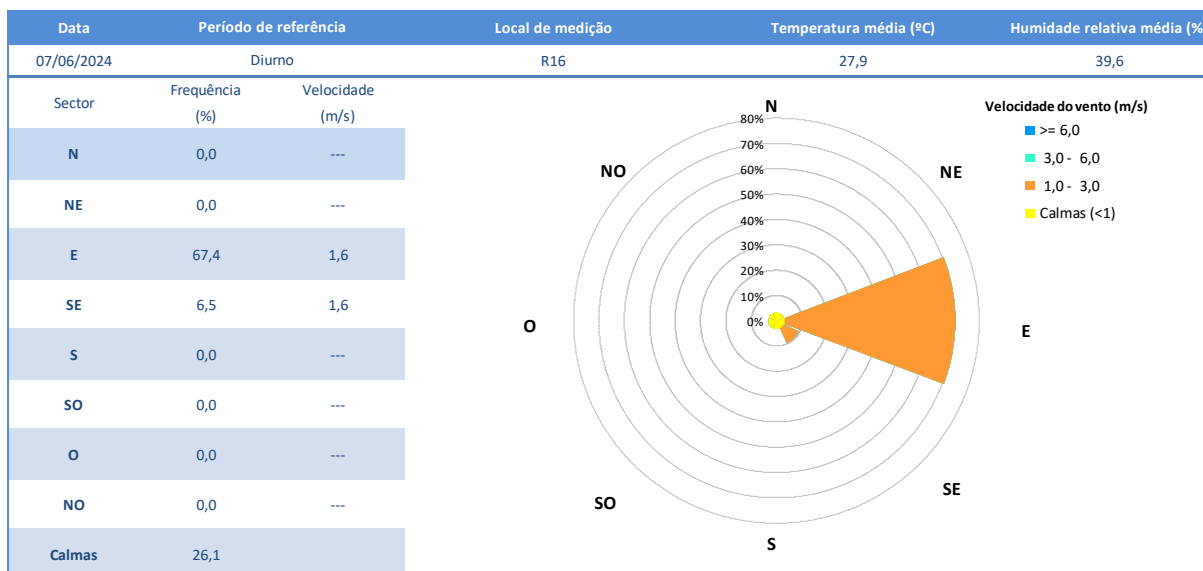
Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.



Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

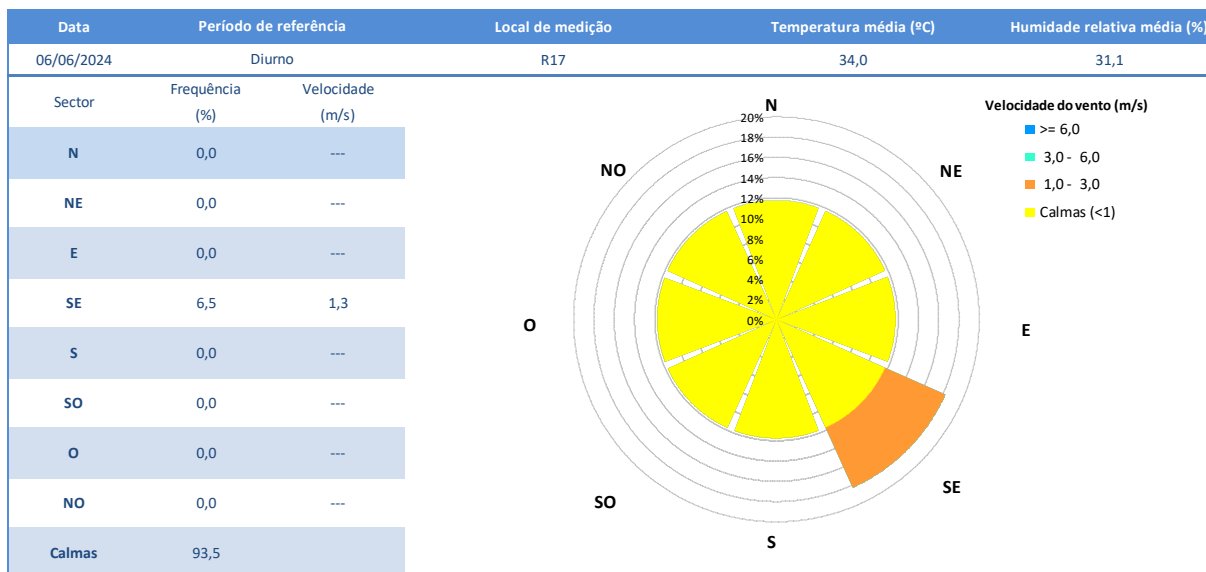


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

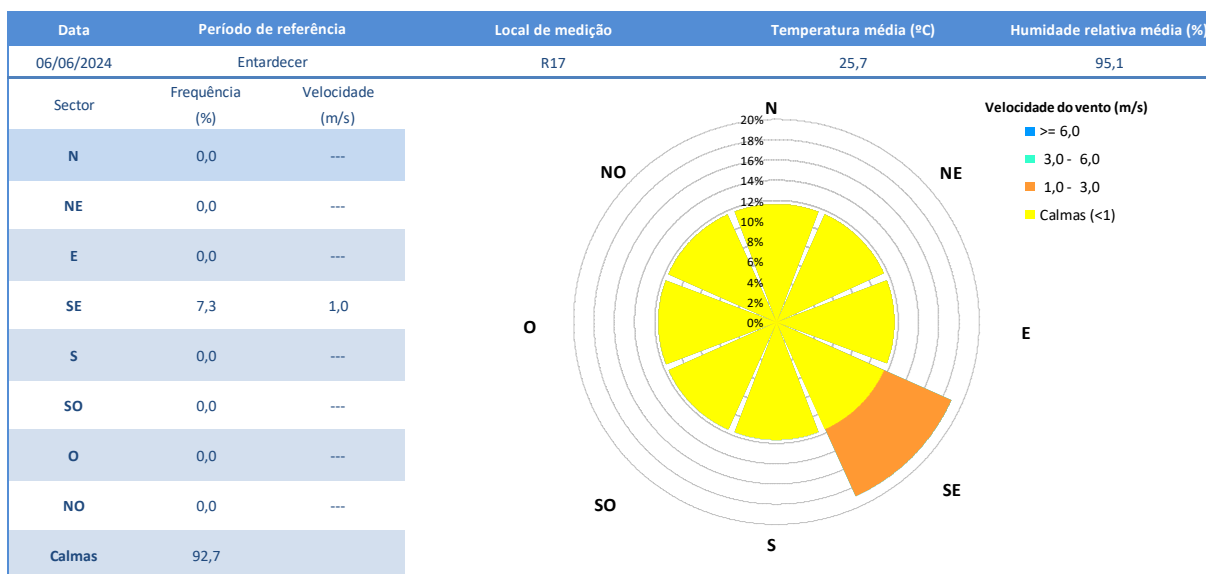


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

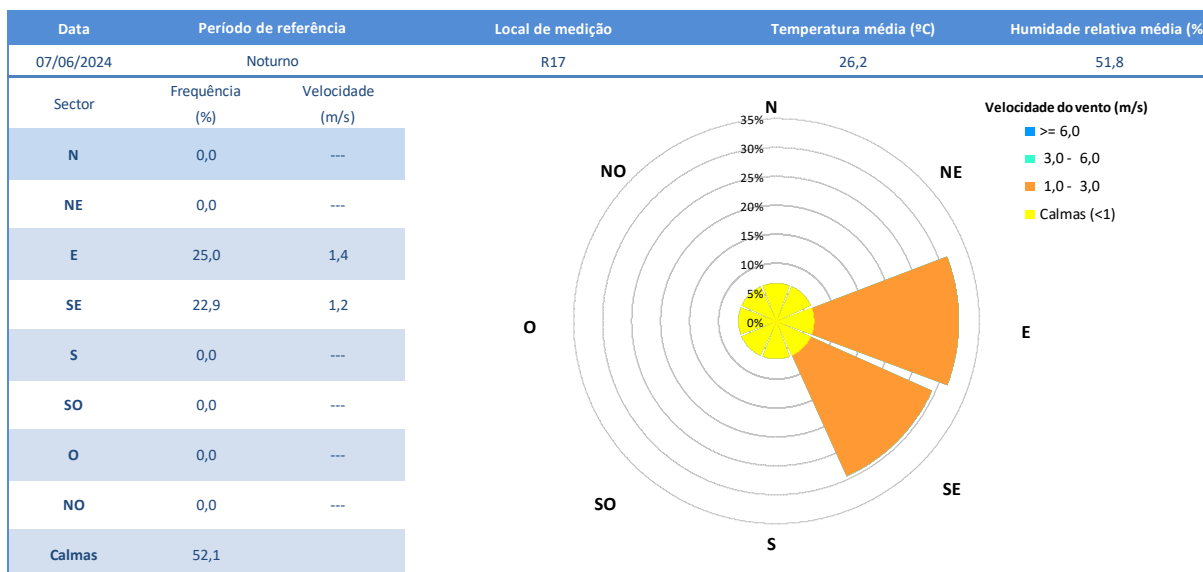
R17



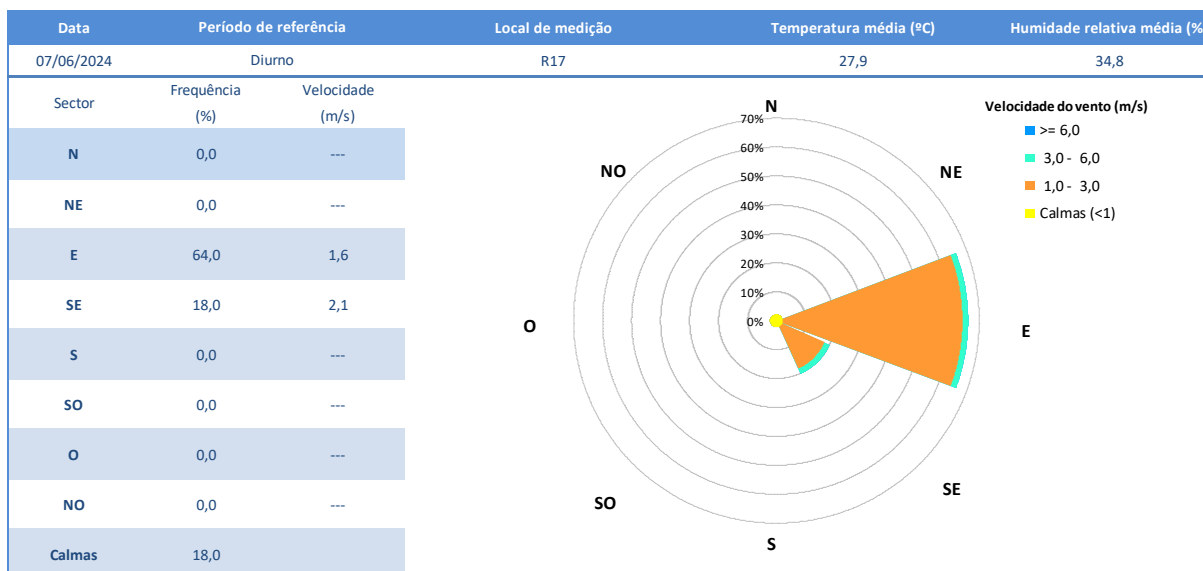
Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.



Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

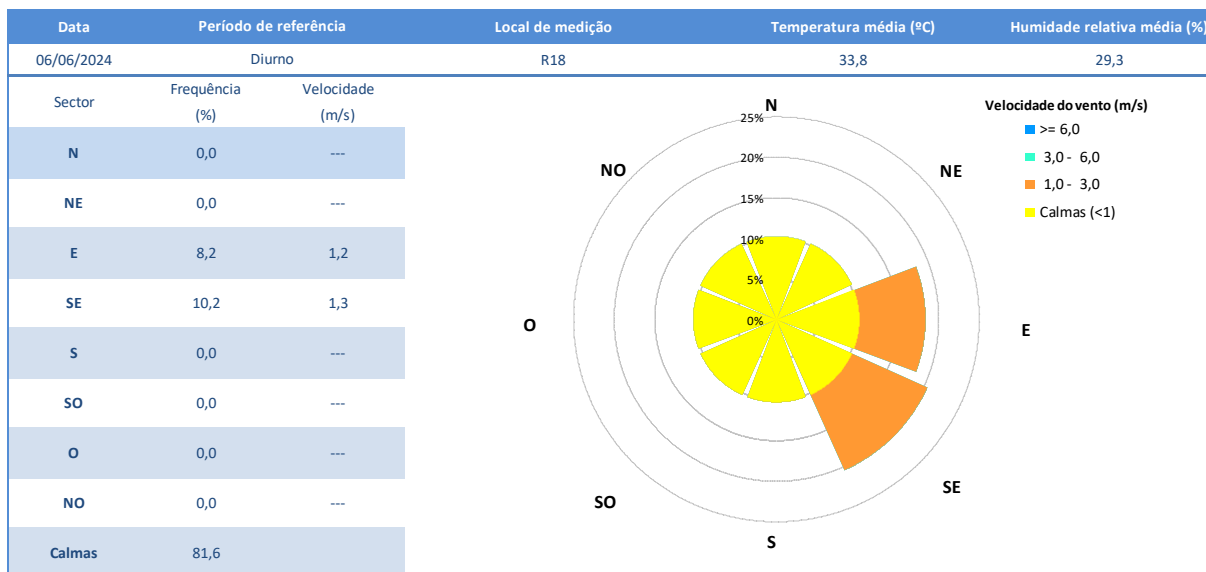


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

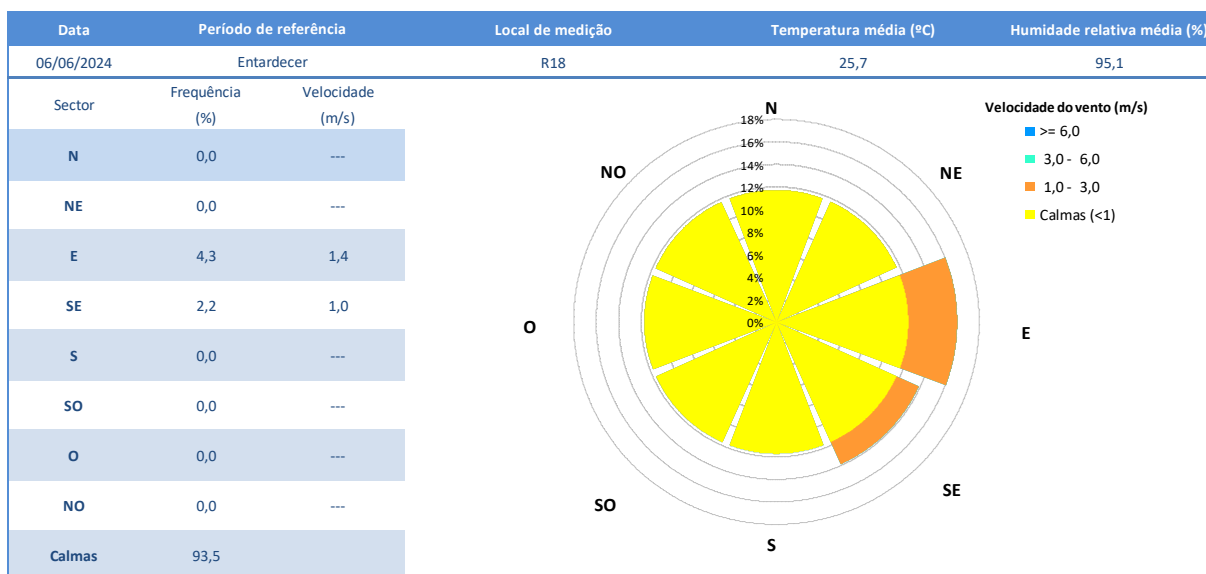


Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

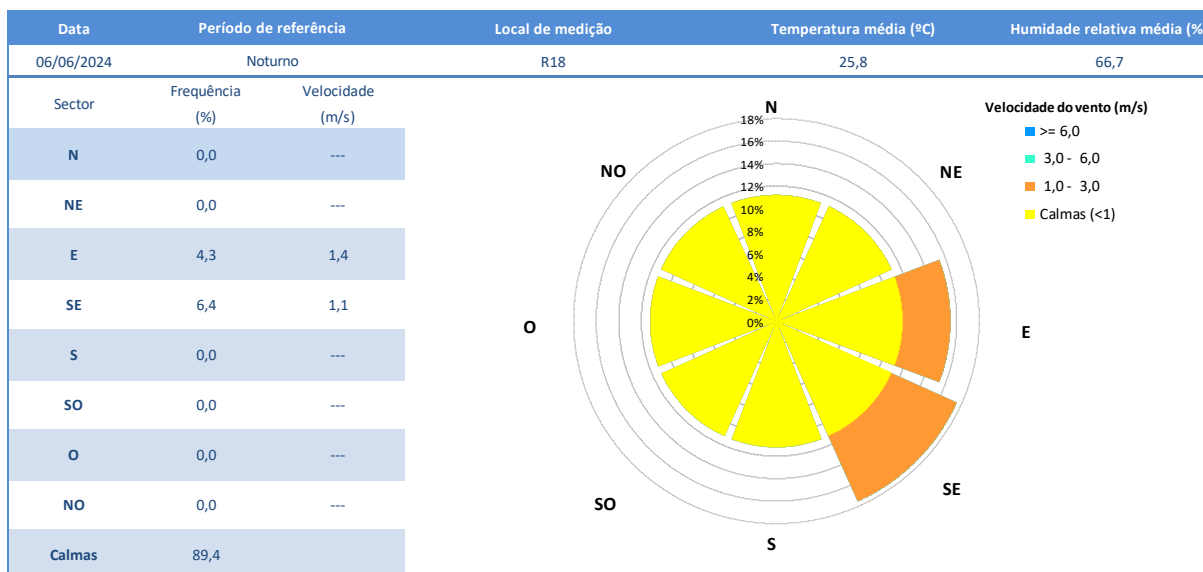
R18



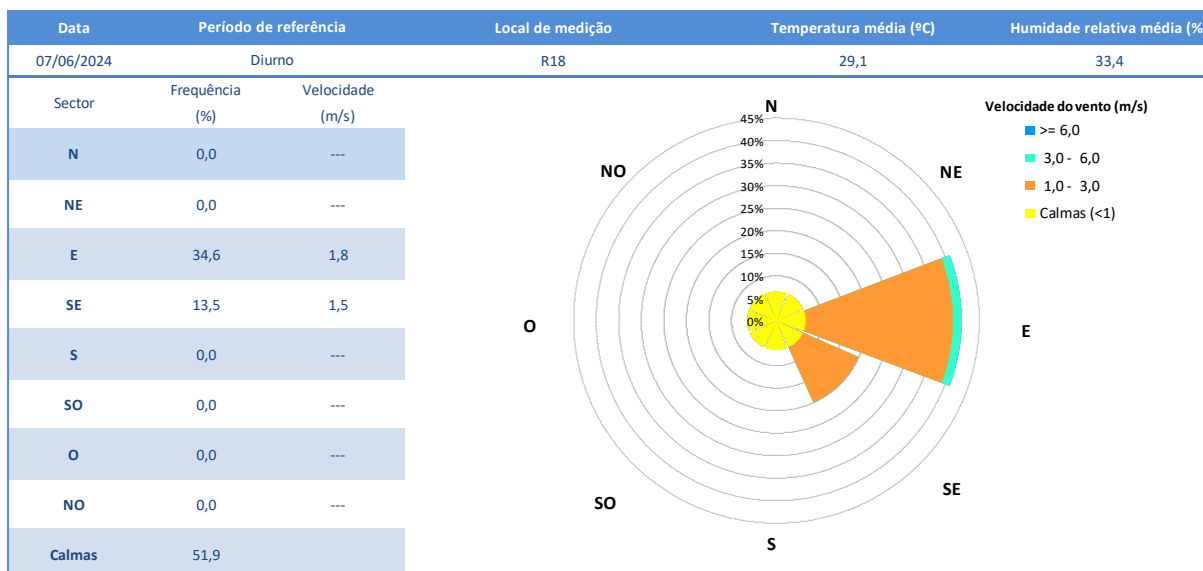
Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.



Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.



Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.



Nota: A “Janela Meteorológica” não é determinada devido à inexistência de uma fonte predominante.

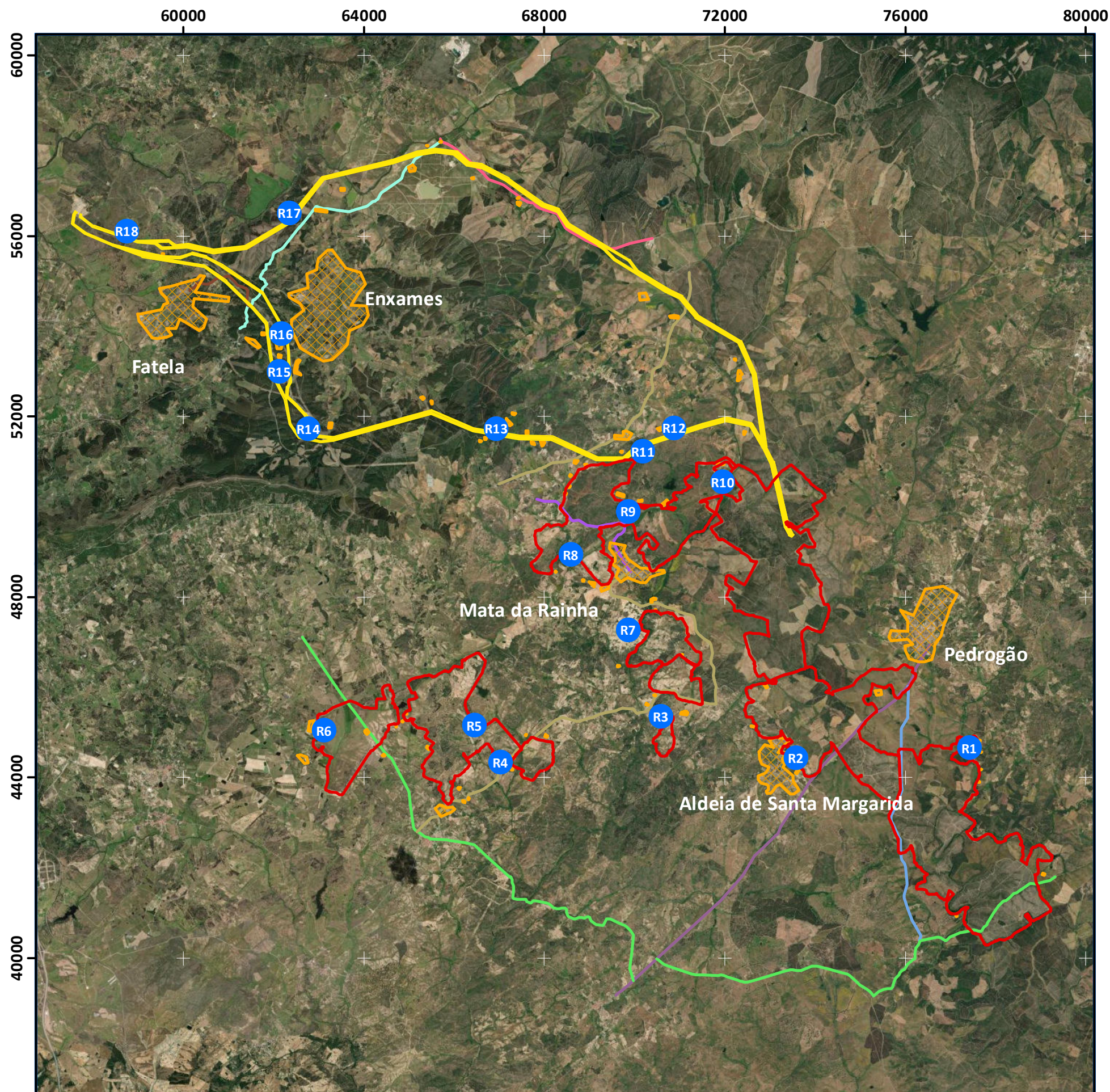
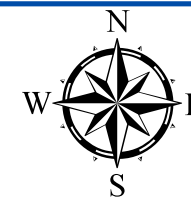


MONITAR

WWW.MONITAR.PT



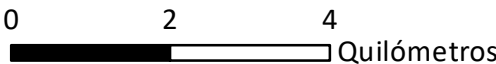
Apêndice 7.2 Cartografia



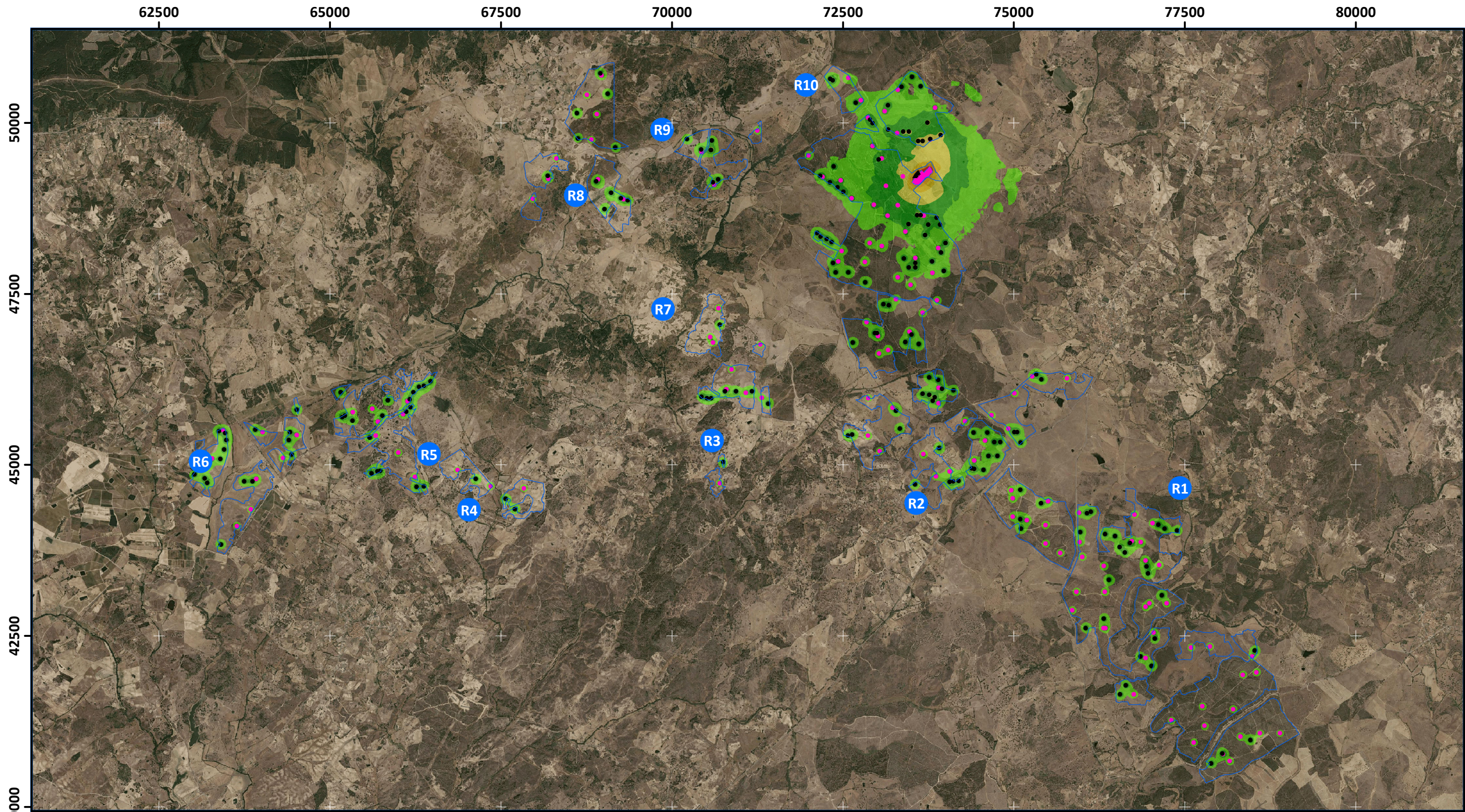
Legenda

- Locais de medição
- CSF de Sophia
- LMAT
- ▨ Recetores sensíveis
- Vias de tráfego rodoviário
 - CM1074
 - EM557
 - EM561
 - EN233
 - EN239
 - EN343
 - EN345
 - EN346

Georeferência: sistema de coordenadas planimétricas (M,P) - PT-TM06/ETRS89



Título: Estudo de Impacte Ambiental Central Solar Fotovoltaica de Sophia	
Carta RA.01 Fontes de ruído e recetores sensíveis na área envolvente ao projeto	ELABORADO POR:  MONITAR engenharia do ambiente
ESCALA: 1:95 000	DATA: julho de 2024

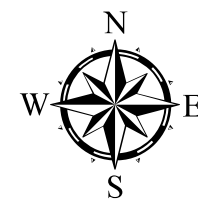


Georreferência: sistema de coordenadas planimétricas (M,P) - PT-TM06/ETRS89; Cartografia de base: OrtoSat 30 cm - Portugal Continental – 2023, DGT

Legenda

- Locais de medição
- Limite de projeto
- Inversores
- Postos de transformação
- Conjunto 2 baterias
- Conversor
- Transformador - Subestação

LAeq [dB(A)] - Período Diurno	
<35	50 - 55
35 - 40	55 - 60
40 - 45	60 - 65
45 - 50	>65



0 0,5 1 2 Km

Título:

Estudo de Impacte Ambiental
Central Solar Fotovoltaica de Sophia

Carta RA.02.01

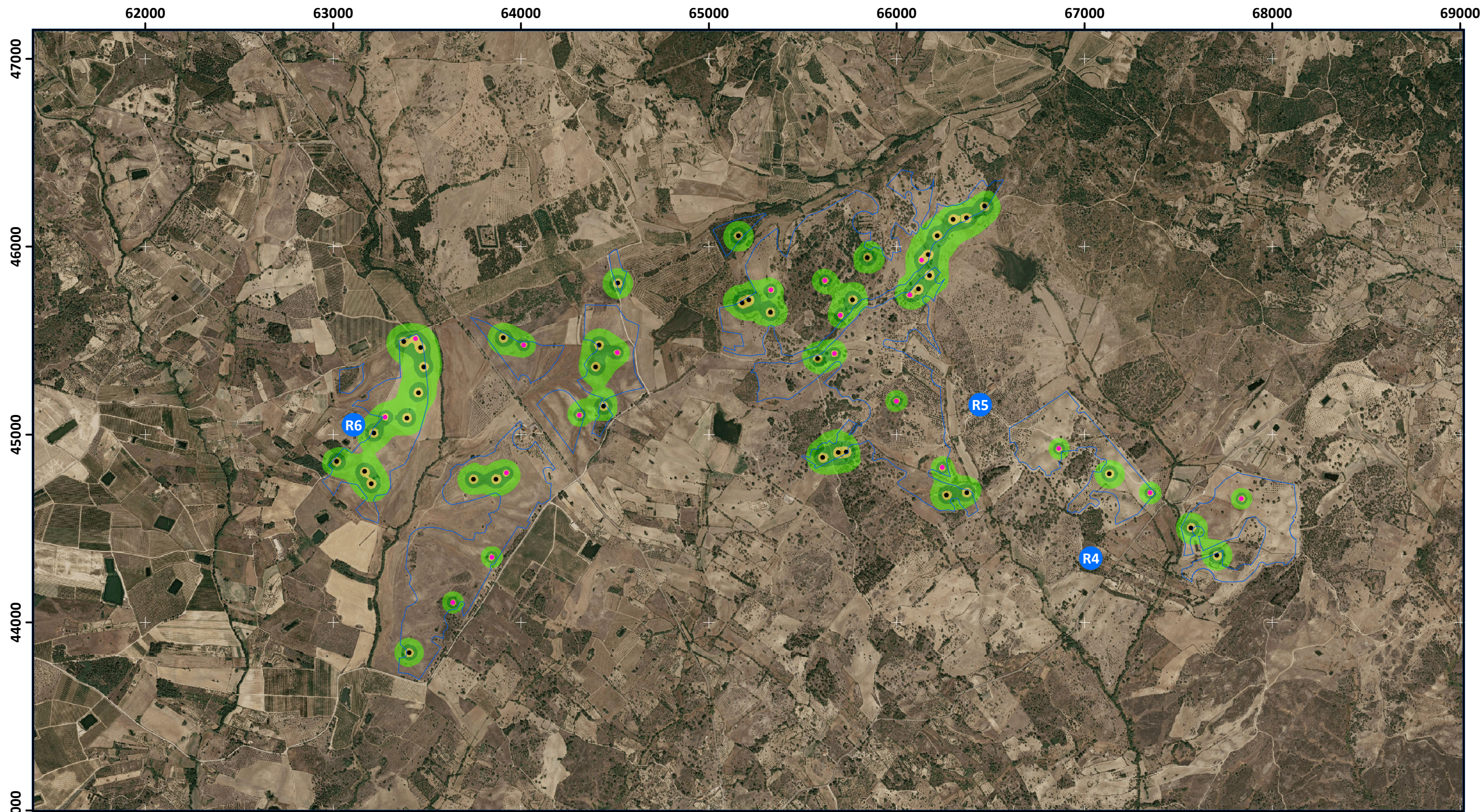
Mapa de Ruído
Nível Sonoro Contínuo Equivalente, LAeq do
Ruído Particular - Período diurno

ESCALA: 1:55 000

DATA: dezembro de 2024

ELABORADO POR:





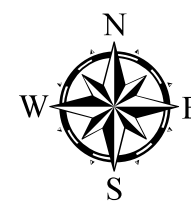
Georreferência: sistema de coordenadas planimétricas (M,P) - PT-TM06/ETRS89; Cartografia de base: OrtoSat 30 cm - Portugal Continental – 2023, DGT

Legenda

- Locais de medição
- Limite de projeto
- Inversores
- Postos de transformação
- ▲ Conjunto 2 baterias
- ▲ Conversor
- ▲ Transformador - Subestação

LAeq [dB(A)] - Período Diurno

<35	50 - 55
35 - 40	55 - 60
40 - 45	60 - 65
45 - 50	>65



0 150 300 600
metros

Título:

Estudo de Impacte Ambiental
Central Solar Fotovoltaica de Sophia

Carta RA.02.02

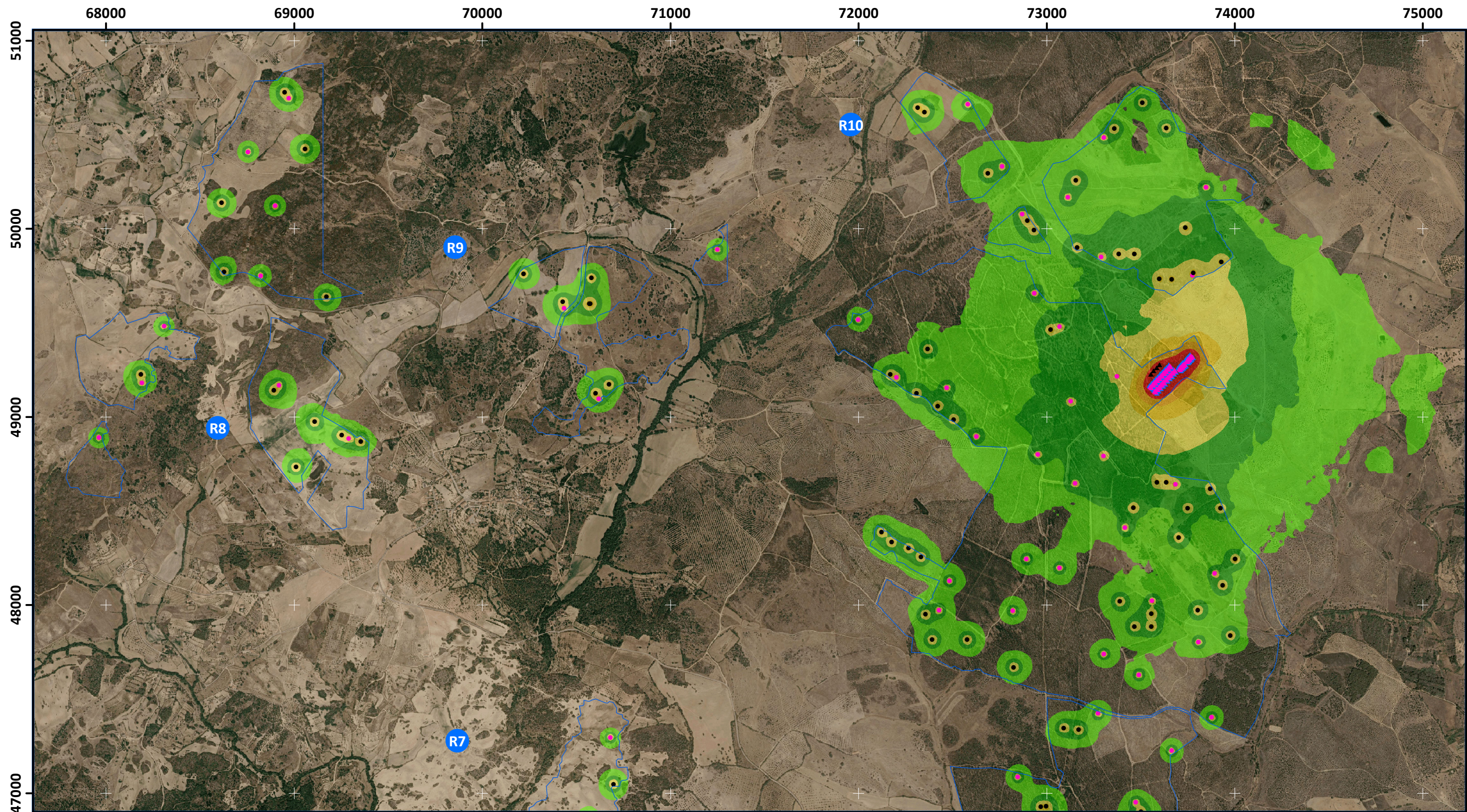
Mapa de Ruído
Nível Sonoro Contínuo Equivalente, LAeq do
Ruído Particular - Período diurno

ESCALA: 1:20 000

DATA: dezembro de 2024

ELABORADO POR:



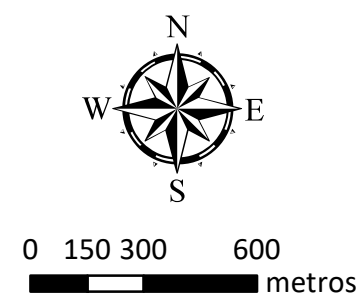


Georreferência: sistema de coordenadas planimétricas (M,P) - PT-TM06/ETRS89; Cartografia de base: OrtoSat 30 cm - Portugal Continental – 2023, DGT

Legenda

- Locais de medição
- Limite de projeto
- Inversores
- Postos de transformação
- ▲ Conjunto 2 baterias
- ▲ Conversor
- ▲ Transformador - Subestação

LAeq [dB(A)] - Período Diurno	
<35	50 - 55
35 - 40	55 - 60
40 - 45	60 - 65
45 - 50	>65



Título:

Estudo de Impacte Ambiental
Central Solar Fotovoltaica de Sophia

Carta RA.02.03

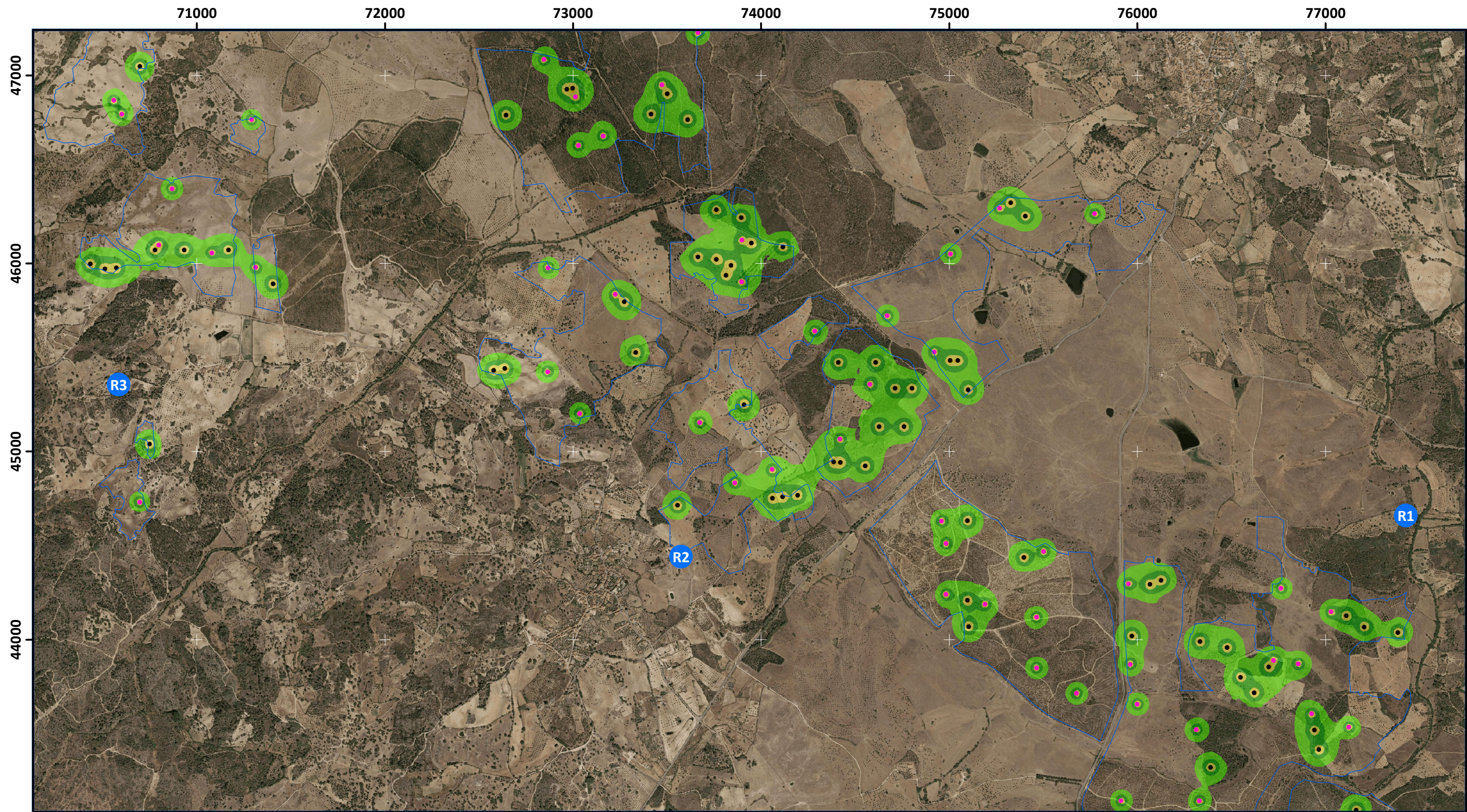
Mapa de Ruído
Nível Sonoro Contínuo Equivalente, LAeq do
Ruído Particular - Período diurno

ESCALA: 1:20 000

DATA: dezembro de 2024

ELABORADO POR:



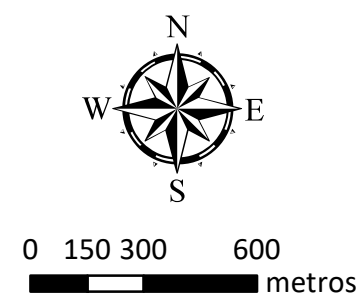


Georreferência: sistema de coordenadas planimétricas (M,P) - PT-TM06/ETRS89; Cartografia de base: OrtoSat 30 cm - Portugal Continental – 2023, DGT

Legenda

- Locais de medição
- Limite de projeto
- Inversores
- Postos de transformação
- Conjunto 2 baterias
- Conversor
- Transformador - Subestação

LAeq [dB(A)] - Período Diurno	
<35	50 - 55
35 - 40	55 - 60
40 - 45	60 - 65
45 - 50	>65



Título:

Estudo de Impacte Ambiental
Central Solar Fotovoltaica de Sophia

Carta RA.02.04

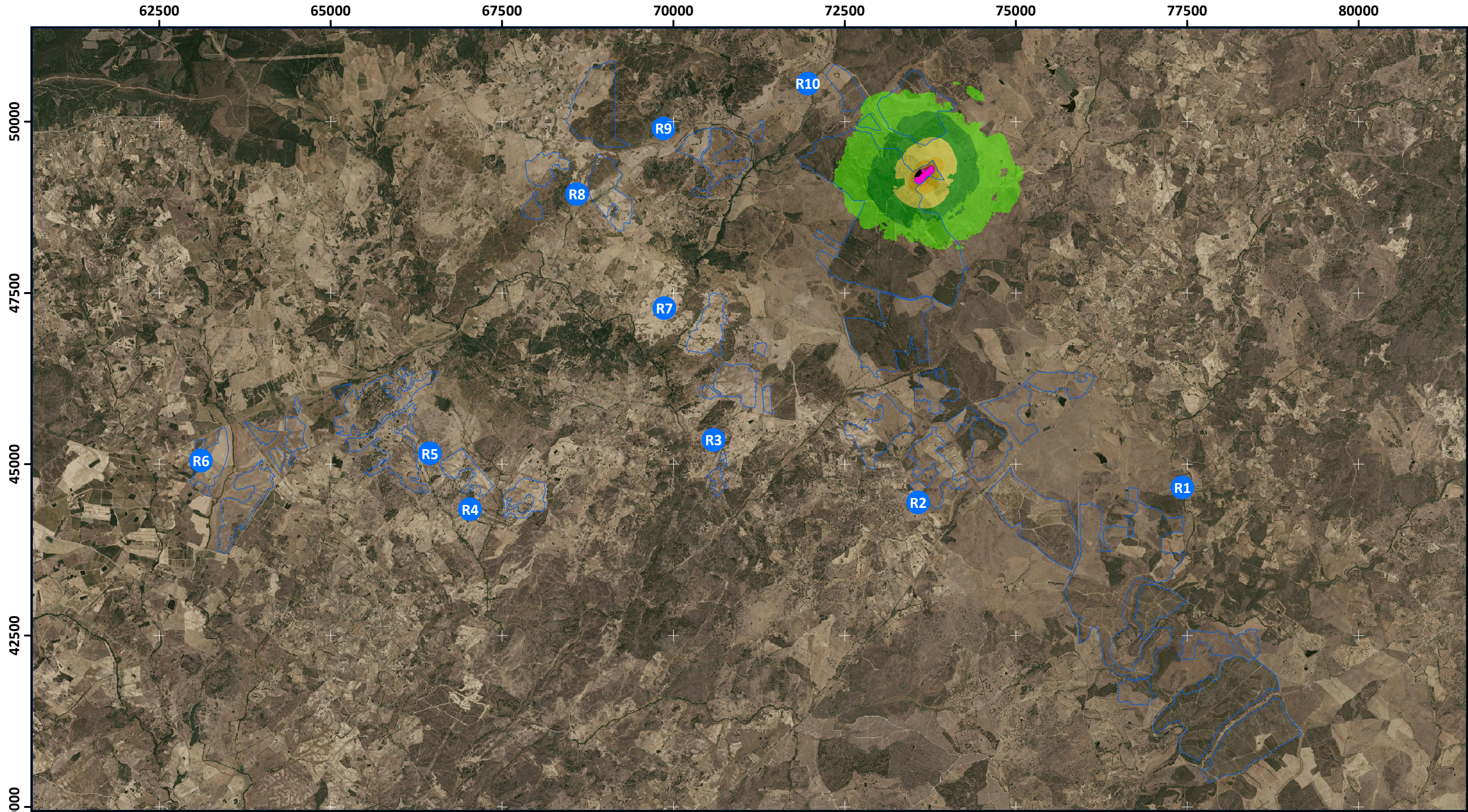
Mapa de Ruído
Nível Sonoro Contínuo Equivalente, LAeq do
Ruído Particular - Período diurno

ESCALA: 1:20 000

DATA: dezembro de 2024

ELABORADO POR:



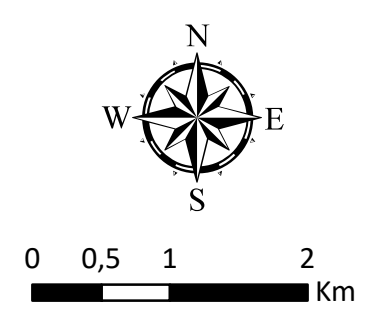


Georreferência: sistema de coordenadas planimétricas (M,P) - PT-TM06/ETRS89; Cartografia de base: OrtoSat 30 cm - Portugal Continental – 2023, DGT

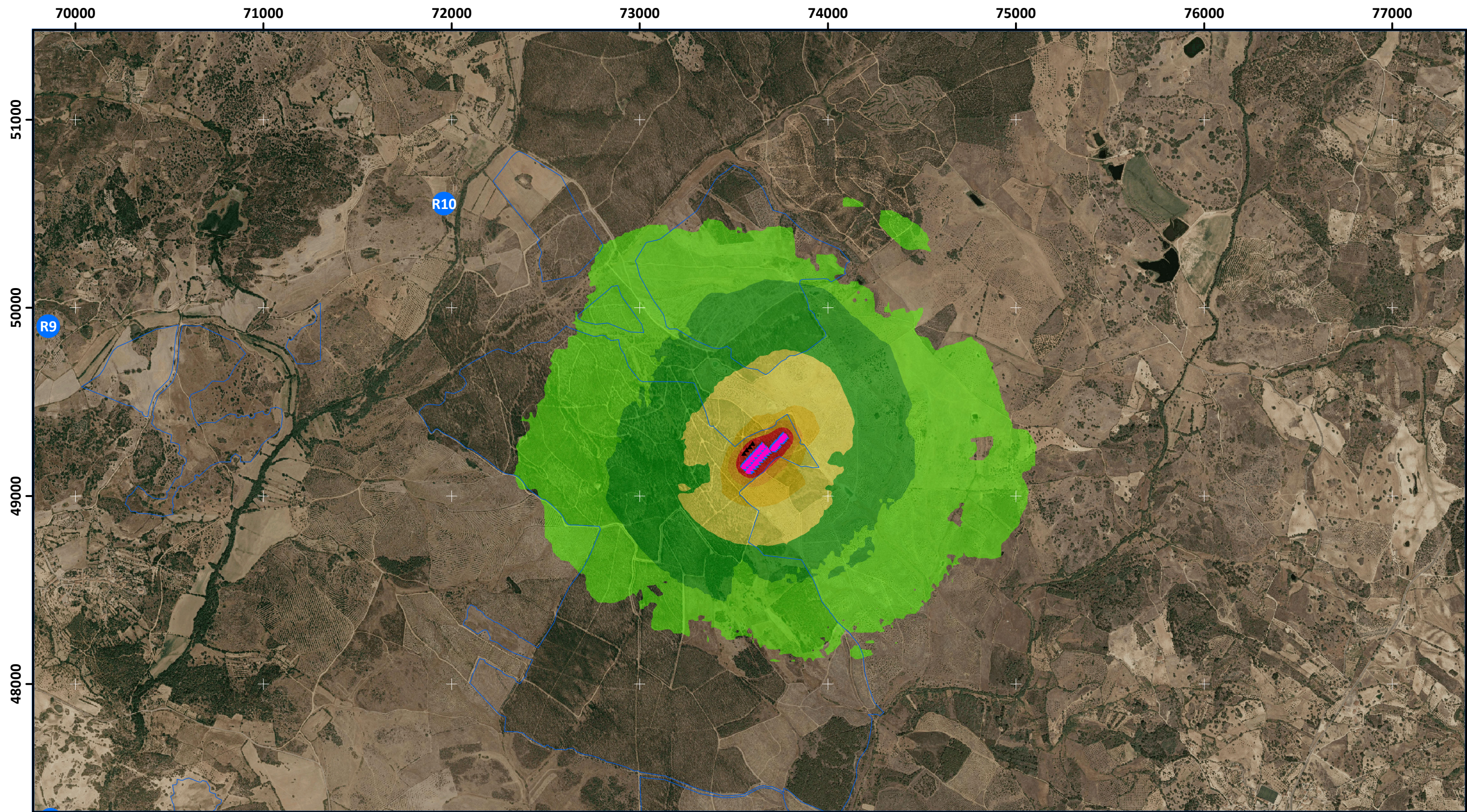
Legenda

- Locais de medição
- Limite de projeto
- ▲ Conjunto 2 baterias
- ▲ Conversor
- ▲ Transformador - Subestação

LAeq [dB(A)] - Período Entardecer	
	<35
	35 - 40
	40 - 45
	45 - 50
	50 - 55
	55 - 60
	60 - 65
	>65



Título: Estudo de Impacte Ambiental Central Solar Fotovoltaica de Sophia	
Carta RA.03.01 Mapa de Ruído Nível Sonoro Contínuo Equivalente, LAeq do Ruído Particular - Período entardecer	ELABORADO POR:  engenharia do ambiente
ESCALA: 1:55 000	DATA: dezembro de 2024



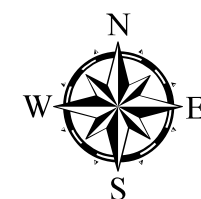
Georreferência: sistema de coordenadas planimétricas (M,P) - PT-TM06/ETRS89; Cartografia de base: OrtoSat 30 cm - Portugal Continental – 2023, DGT

Legenda

-  Locais de medição
-  Limite de projeto
-  Conjunto 2 baterias
-  Conversor
-  Transformador - Subestação

LAeq [dB(A)] - Período Entardecer

	<35		50 - 55
	35 - 40		55 - 60
	40 - 45		60 - 65
	45 - 50		>65



0 150 300 600
metros

Título:

Estudo de Impacte Ambiental
Central Solar Fotovoltaica de Sophia

Carta RA.03.02

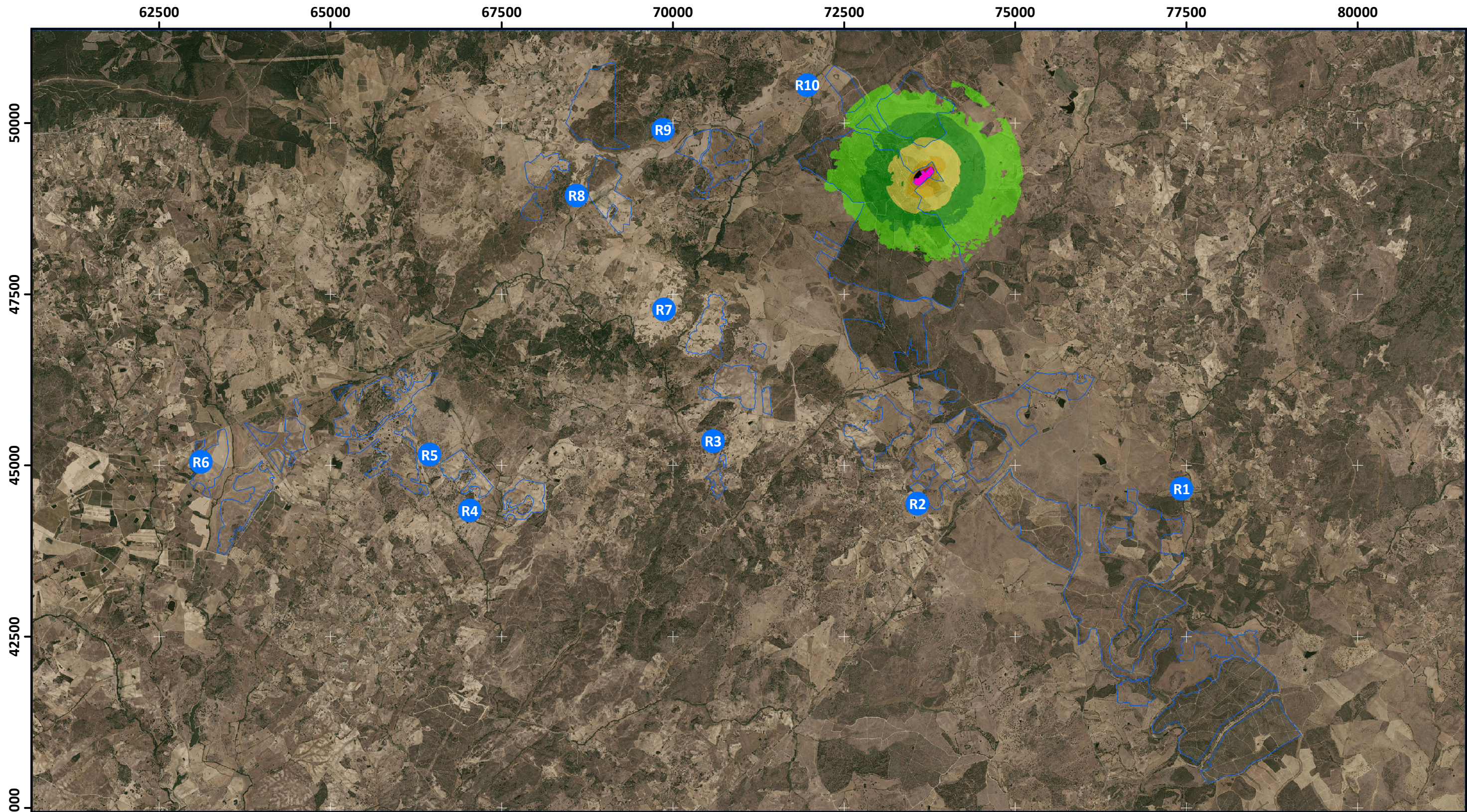
Mapa de Ruído
Nível Sonoro Contínuo Equivalente, LAeq do
Ruído Particular - Período entardecer

ESCALA: 1:20 000

DATA: dezembro de 2024

ELABORADO POR:



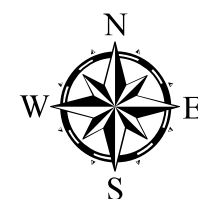


Georreferência: sistema de coordenadas planimétricas (M,P) - PT-TM06/ETRS89; Cartografia de base: OrtoSat 30 cm - Portugal Continental – 2023, DGT

Legenda

- Locais de medição
- Limite de projeto
- ▲ Conjunto 2 baterias
- ▲ Conversor
- ▲ Transformador - Subestação

LAeq [dB(A)] - Período Noturno	
	<35
	35 - 40
	40 - 45
	45 - 50
	50 - 55
	55 - 60
	60 - 65
	>65



0 0,5 1 2
Km

Título:

Estudo de Impacte Ambiental
Central Solar Fotovoltaica de Sophia

Carta RA.04.01

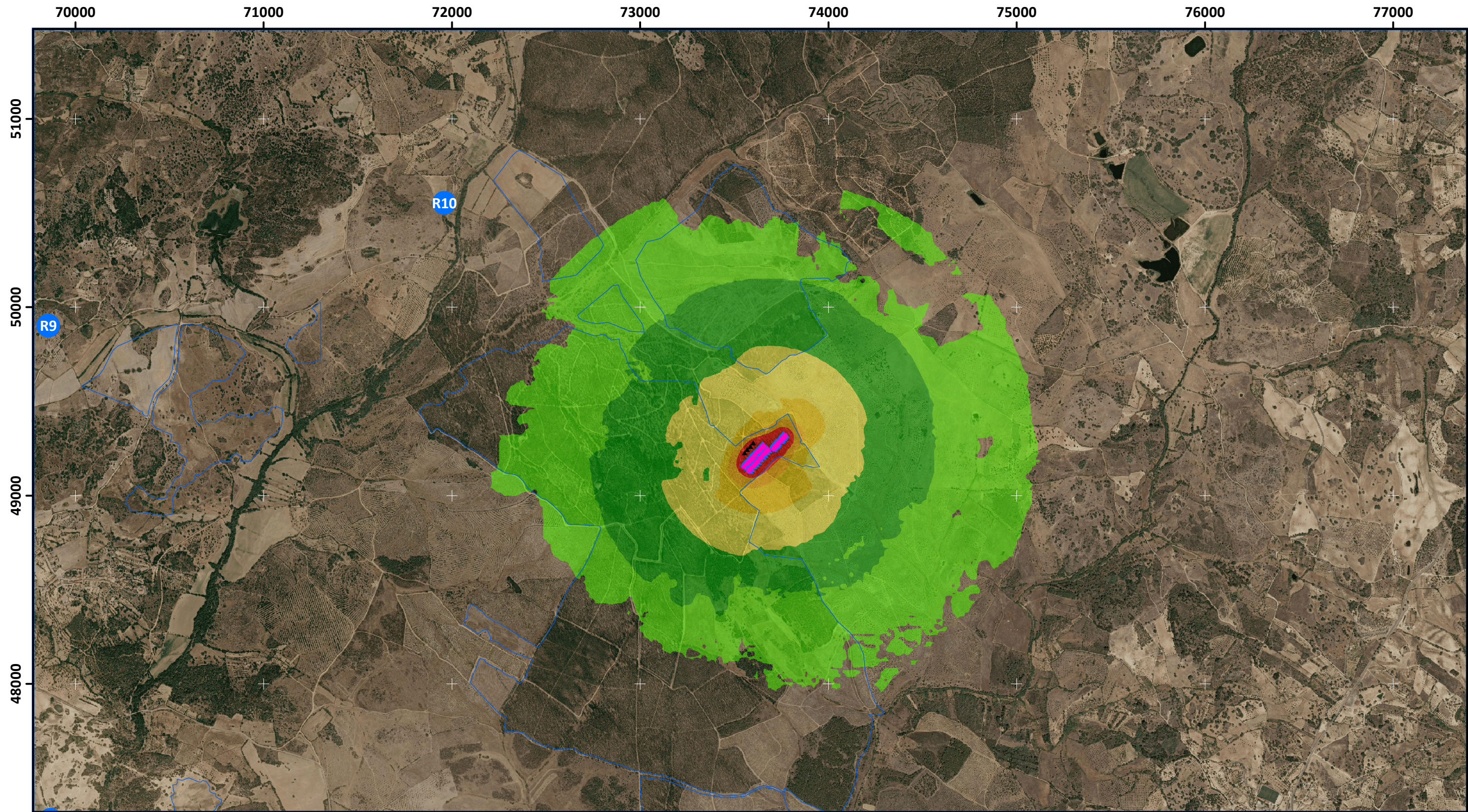
Mapa de Ruído
Nível Sonoro Contínuo Equivalente, LAeq do
Ruído Particular - Período noturno

ESCALA: 1:55 000

DATA: dezembro de 2024

ELABORADO POR:





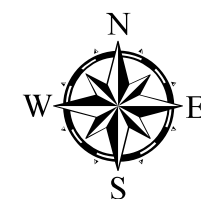
Georreferência: sistema de coordenadas planimétricas (M,P) - PT-TM06/ETRS89; Cartografia de base: OrtoSat 30 cm - Portugal Continental – 2023, DGT

Legenda

- Locais de medição
- ▲ Conjunto 2 baterias
- ▲ Conversor
- ▲ Transformador - Subestação
- Limite de projeto

LAeq [dB(A)] - Período Noturno

<35	50 - 55
35 - 40	55 - 60
40 - 45	60 - 65
45 - 50	>65



0 150 300 600
metros

Título:

Estudo de Impacte Ambiental
Central Solar Fotovoltaica de Sophia

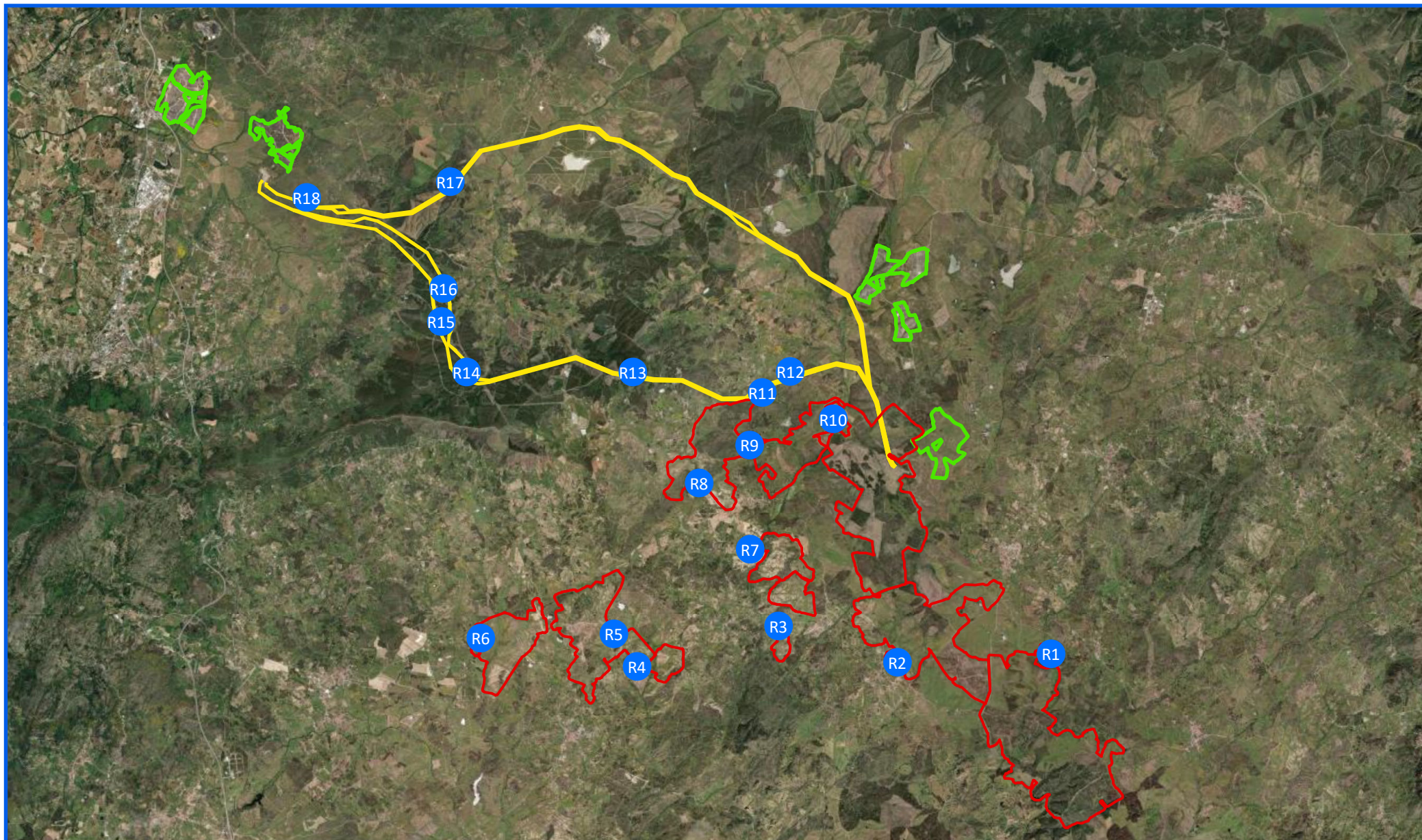
Carta RA.04.02

Mapa de Ruído
Nível Sonoro Contínuo Equivalente, LAeq do
Ruído Particular - Período noturno

ESCALA: 1:20 000 DATA: dezembro de 2024

ELABORADO POR:







Apêndice 7.3 Ruido particular

Ruído Particular

Linha CSF Sophia N - Fundão 1

Local medição R17

Entrada dados previsão

Separação horizontal das fases (m):

-12,05	0,00	12,05
--------	------	-------

centro

Campo eléctrico Emax (kV/cm):

15,2	15,7	15,2
------	------	------

centro

Diâmetro condutores (cm):

3,18	3,18	3,18
------	------	------

centro

Seleccione área geográfica:

Centro (entre Douro e Tejo) ▼

Altura relativa fases (m):

14,00	14,00	14,00
-------	-------	-------

centro

Receptor

Distância à linha MAT:

altura relativa: 1,5 m

Cota terreno da linha MAT: 457,0 m

70,0 m

Cota terreno: 450,0 m

Ruído particular/Linha MAT previsto

	<i>L_d</i>	<i>L_e</i>	<i>L_n</i>	<i>L_{den}</i>
<i>Favorável</i>	39,7	39,7	39,7	46,0 dB(A)
<i>Desfavorável</i>	28,4	28,4	28,4	34,7 dB(A)
<i>L_{Aeq LT}</i>	30,5	30,5	30,5	36,8 dB(A)

Local medição R18

Separação horizontal das fases (m):		Campo Eléctrico Emax (kV/cm):	
-8,00	8,00	16,4	16,4
-8,00	8,00	16,6	16,6
-8,50	8,50	16,3	16,3
Altura relativa fases (m):		Seleccione área geográfica:	
30,50	30,50	Centro (entre Douro e Tejo)	
22,50	22,50		
14,00	14,00		
Diâmetro dos condutores:		Receptor	
3,18	cm	altura relativa:	4,0 m
Distância à linha MAT:			
Cota terreno da linha MAT:	436,0 m	Cota terreno:	437,0 m
	160,0 m		

Ruído particular/Linha MAT previsto				
	<i>Ld</i>	<i>Le</i>	<i>Ln</i>	<i>Lden</i>
<i>Favorável</i>	42,3	42,3	42,3	48,6 dB(A)
<i>Desfavorável</i>	30,3	30,3	30,3	36,6 dB(A)
LAeq LT	32,7	32,7	32,7	39,0 dB(A)

Ruído Particular

Linha CSF Sophia N - Fundão 2

Local medição R17

Entrada dados previsão

Separação horizontal das fases (m):

-12,05	0,00	12,05
--------	------	-------

centro

Campo eléctrico Emax (kV/cm):

15,2	15,7	15,2
------	------	------

centro

Diâmetro condutores (cm):

3,18	3,18	3,18
------	------	------

centro

Seleccione área geográfica:

Centro (entre Douro e Tejo) ▼

Altura relativa fases (m):

14,00	14,00	14,00
-------	-------	-------

centro

Receptor

Distância à linha MAT:

altura relativa: 1,5 m

Cota terreno da linha MAT: 455,0 m

130,0 m

Cota terreno: 450,0 m

Ruído particular/Linha MAT previsto

	<i>L_d</i>	<i>L_e</i>	<i>L_n</i>	<i>L_{den}</i>
<i>Favorável</i>	36,7	36,7	36,7	43,0 dB(A)
<i>Desfavorável</i>	25,4	25,4	25,4	31,7 dB(A)
<i>L_{Aeq LT}</i>	27,5	27,5	27,5	33,8 dB(A)

Ruído Particular

Linha CSF Sophia S - Fundão 1

Local medição R11

Entrada dados previsão

Separação horizontal das fases (m):

-12,00	0,00	12,00
--------	------	-------

centro

Campo eléctrico Emax (kV/cm):

15,2	15,7	15,2
------	------	------

centro

Diâmetro condutores (cm):

3,18	3,18	3,18
------	------	------

centro

Seleccione área geográfica:

Centro (entre Douro e Tejo)

Altura relativa fases (m):

14,00	14,00	14,00
-------	-------	-------

centro

Receptor

Distância à linha MAT:

altura relativa: 1,5 m

Cota terreno da linha MAT: 410,0 m

160,0 m

Cota terreno: 403,0 m

Ruído particular/Linha MAT previsto

	<i>Ld</i>	<i>Le</i>	<i>Ln</i>	<i>Lden</i>
<i>Favorável</i>	35,6	35,6	35,6	41,9 dB(A)
<i>Desfavorável</i>	24,2	24,2	24,2	30,5 dB(A)
<i>LAeq LT</i>	26,4	26,4	26,4	32,7 dB(A)

Local medição R12

Entrada dados previsão

Separação horizontal das fases (m):

-12,00	0,00	12,00
--------	------	-------

centro

Campo eléctrico Emax (kV/cm):

15,2	15,7	15,2
------	------	------

centro

Diâmetro condutores (cm):

3,18	3,18	3,18
------	------	------

centro

Seleccione área geográfica:

Centro (entre Douro e Tejo) ▼

Altura relativa fases (m):

14,00	14,00	14,00
-------	-------	-------

centro

Receptor

Distância à linha MAT:

altura relativa: 1,5 m

Cota terreno da linha MAT: 420,0 m

130,0 m

Cota terreno: 423,0 m

Ruído particular/Linha MAT previsto

	<i>L_d</i>	<i>L_e</i>	<i>L_n</i>	<i>L_{den}</i>
<i>Favorável</i>	36,7	36,7	36,7	43,0 dB(A)
<i>Desfavorável</i>	25,3	25,3	25,3	31,6 dB(A)
<i>L_{Aeq LT}</i>	27,4	27,4	27,4	33,8 dB(A)

Local medição R13

Entrada dados previsão

Separação horizontal das fases (m):

-12,00	0,00	12,00
--------	------	-------

centro

Campo eléctrico Emax (kV/cm):

15,2	15,7	15,2
------	------	------

centro

Diâmetro condutores (cm):

3,18	3,18	3,18
------	------	------

centro

Seleccione área geográfica:

Centro (entre Douro e Tejo) ▼

Altura relativa fases (m):

14,00	14,00	14,00
-------	-------	-------

centro

Receptor

altura
relativa: 4,0 m

**Distância
à linha MAT:**

**Cota terreno
da linha MAT:** 606,0 m

95,0 m

**Cota
terreno:** 627,0 m

Ruído particular/Linha MAT previsto

	<i>L_d</i>	<i>L_e</i>	<i>L_n</i>	<i>L_{den}</i>
<i>Favorável</i>	38,8	38,8	38,8	45,1 dB(A)
<i>Desfavorável</i>	27,5	27,5	27,5	33,8 dB(A)
<i>L_{Aeq LT}</i>	29,6	29,6	29,6	35,9 dB(A)

Local medição R14

Entrada dados previsão

Separação horizontal das fases (m):

-12,00	0,00	12,00
--------	------	-------

centro

Campo eléctrico Emax (kV/cm):

15,2	15,7	15,2
------	------	------

centro

Diâmetro condutores (cm):

3,18	3,18	3,18
------	------	------

centro

Seleccione área geográfica:

Centro (entre Douro e Tejo) ▼

Altura relativa fases (m):

14,00	14,00	14,00
-------	-------	-------

centro

Receptor

Distância à linha MAT:

altura relativa: 1,5 m

Cota terreno da linha MAT: 502,0 m

105,0 m

Cota terreno: 511,0 m

Ruído particular/Linha MAT previsto

	<i>Ld</i>	<i>Le</i>	<i>Ln</i>	<i>Lden</i>
<i>Favorável</i>	42,7	42,7	42,7	49,0 dB(A)
<i>Desfavorável</i>	30,7	30,7	30,7	37,0 dB(A)
LAeq LT	33,1	33,1	33,1	39,4 dB(A)

Local medição R15

Entrada dados previsão

Separação horizontal das fases (m):

-12,00	0,00	12,00
--------	------	-------

centro

Campo eléctrico Emax (kV/cm):

15,2	15,7	15,2
------	------	------

centro

Diâmetro condutores (cm):

3,18	3,18	3,18
------	------	------

centro

Seleccione área geográfica:

Centro (entre Douro e Tejo) ▼

Altura relativa fases (m):

14,00	14,00	14,00
-------	-------	-------

centro

Receptor

altura
relativa: 1,5 m

**Distância
à linha MAT:**

**Cota terreno
da linha MAT:** 500,0 m

205,0 m

**Cota
terreno:** 520,0 m

Ruído particular/Linha MAT previsto

	<i>L_d</i>	<i>L_e</i>	<i>L_n</i>	<i>L_{den}</i>
<i>Favorável</i>	34,7	34,7	34,7	41,0 dB(A)
<i>Desfavorável</i>	23,3	23,3	23,3	29,6 dB(A)
<i>L_{Aeq LT}</i>	25,5	25,5	25,5	31,8 dB(A)

Local medição R16

Entrada dados previsão

Separação horizontal das fases (m):

-12,00	0,00	12,00
--------	------	-------

centro

Campo eléctrico Emax (kV/cm):

15,2	15,7	15,2
------	------	------

centro

Diâmetro condutores (cm):

3,18	3,18	3,18
------	------	------

centro

Seleccione área geográfica:

Centro (entre Douro e Tejo) ▼

Altura relativa fases (m):

14,00	14,00	14,00
-------	-------	-------

centro

Receptor

Distância à linha MAT:

altura relativa: 4,0 m

Cota terreno da linha MAT: 484,0 m

80,0 m

Cota terreno: 486,0 m

Ruído particular/Linha MAT previsto

	<i>Ld</i>	<i>Le</i>	<i>Ln</i>	<i>Lden</i>
<i>Favorável</i>	39,3	39,3	39,3	45,6 dB(A)
<i>Desfavorável</i>	28,0	28,0	28,0	34,3 dB(A)
<i>LAeq LT</i>	30,1	30,1	30,1	36,4 dB(A)

Ruído Particular

Linha CSF Sophia S - Fundão 2

Local medição R11

Entrada dados previsão

Separação horizontal das fases (m):

-12,00	0,00	12,00
--------	------	-------

centro

Campo eléctrico Emax (kV/cm):

15,2	15,7	15,2
------	------	------

centro

Diâmetro condutores (cm):

3,18	3,18	3,18
------	------	------

centro

Seleccione área geográfica:

Centro (entre Douro e Tejo) ▼

Altura relativa fases (m):

14,00	14,00	14,00
-------	-------	-------

centro

Receptor

Distância à linha MAT:

altura relativa: 1,5 m

Cota terreno da linha MAT: 409,0 m

110,0 m

Cota terreno: 403,0 m

Ruído particular/Linha MAT previsto

	<i>L_d</i>	<i>L_e</i>	<i>L_n</i>	<i>L_{den}</i>
<i>Favorável</i>	37,4	37,4	37,4	43,7 dB(A)
<i>Desfavorável</i>	26,1	26,1	26,1	32,4 dB(A)
<i>L_{Aeq LT}</i>	28,2	28,2	28,2	34,5 dB(A)

Local medição R12

Entrada dados previsão

Separação horizontal das fases (m):

-12,00	0,00	12,00
--------	------	-------

centro

Campo eléctrico Emax (kV/cm):

15,2	15,7	15,2
------	------	------

centro

Diâmetro condutores (cm):

3,18	3,18	3,18
------	------	------

centro

Seleccione área geográfica:

Centro (entre Douro e Tejo) ▼

Altura relativa fases (m):

14,00	14,00	14,00
-------	-------	-------

centro

Receptor

Distância à linha MAT:

altura relativa: 1,5 m

Cota terreno da linha MAT: 419,0 m

175,0 m

Cota terreno: 423,0 m

Ruído particular/Linha MAT previsto

	<i>L_d</i>	<i>L_e</i>	<i>L_n</i>	<i>L_{den}</i>
<i>Favorável</i>	35,2	35,2	35,2	41,5 dB(A)
<i>Desfavorável</i>	23,8	23,8	23,8	30,2 dB(A)
<i>L_{Aeq LT}</i>	26,0	26,0	26,0	32,3 dB(A)

Local medição R13

Entrada dados previsão

Separação horizontal das fases (m):

-12,00	0,00	12,00
--------	------	-------

centro

Campo eléctrico Emax (kV/cm):

15,2	15,7	15,2
------	------	------

centro

Diâmetro condutores (cm):

3,18	3,18	3,18
------	------	------

centro

Seleccione área geográfica:

Centro (entre Douro e Tejo) ▼

Altura relativa fases (m):

14,00	14,00	14,00
-------	-------	-------

centro

Receptor

altura
relativa: 4,0 m

**Distância
à linha MAT:**

**Cota terreno
da linha MAT:** 598,0 m

140,0 m

**Cota
terreno:** 627,0 m

Ruído particular/Linha MAT previsto

	<i>L_d</i>	<i>L_e</i>	<i>L_n</i>	<i>L_{den}</i>
<i>Favorável</i>	36,8	36,8	36,8	43,2 dB(A)
<i>Desfavorável</i>	25,5	25,5	25,5	31,8 dB(A)
<i>L_{Aeq LT}</i>	27,6	27,6	27,6	33,9 dB(A)

Local medição R14

Entrada dados previsão

Separação horizontal das fases (m):

-12,00	0,00	12,00
--------	------	-------

centro

Campo eléctrico Emax (kV/cm):

15,2	15,7	15,2
------	------	------

centro

Diâmetro condutores (cm):

3,18	3,18	3,18
------	------	------

centro

Seleccione área geográfica:

Centro (entre Douro e Tejo) ▼

Altura relativa fases (m):

14,00	14,00	14,00
-------	-------	-------

centro

Receptor

Distância à linha MAT:

altura relativa: 1,5 m

Cota terreno da linha MAT: 519,0 m

175,0 m

Cota terreno: 511,0 m

Ruído particular/Linha MAT previsto

	<i>L_d</i>	<i>L_e</i>	<i>L_n</i>	<i>L_{den}</i>
<i>Favorável</i>	35,5	35,5	35,5	41,8 dB(A)
<i>Desfavorável</i>	24,2	24,2	24,2	30,5 dB(A)
<i>L_{Aeq LT}</i>	26,3	26,3	26,3	32,6 dB(A)

Local medição R15

Entrada dados previsão

Separação horizontal das fases (m):

-12,00	0,00	12,00
--------	------	-------

centro

Campo eléctrico Emax (kV/cm):

15,2	15,7	15,2
------	------	------

centro

Diâmetro condutores (cm):

3,18	3,18	3,18
------	------	------

centro

Seleccione área geográfica:

Centro (entre Douro e Tejo) ▼

Altura relativa fases (m):

14,00	14,00	14,00
-------	-------	-------

centro

Receptor

Distância à linha MAT:

altura relativa: 4,0 m

Cota terreno da linha MAT: 547,0 m

115,0 m

Cota terreno: 520,0 m

Ruído particular/Linha MAT previsto

	<i>Ld</i>	<i>Le</i>	<i>Ln</i>	<i>Lden</i>
<i>Favorável</i>	37,5	37,5	37,5	43,8 dB(A)
<i>Desfavorável</i>	26,1	26,1	26,1	32,4 dB(A)
<i>LAeq LT</i>	28,2	28,2	28,2	34,6 dB(A)

Local medição R16

Entrada dados previsão

Separação horizontal das fases (m):

-12,00	0,00	12,00
--------	------	-------

centro

Campo eléctrico Emax (kV/cm):

15,2	15,7	15,2
------	------	------

centro

Diâmetro condutores (cm):

3,18	3,18	3,18
------	------	------

centro

Seleccione área geográfica:

Centro (entre Douro e Tejo) ▼

Altura relativa fases (m):

14,00	14,00	14,00
-------	-------	-------

centro

Receptor

Distância à linha MAT:

altura relativa: 4,0 m

Cota terreno da linha MAT: 510,0 m

300,0 m

Cota terreno: 486,0 m

Ruído particular/Linha MAT previsto

	<i>L_d</i>	<i>L_e</i>	<i>L_n</i>	<i>L_{den}</i>
<i>Favorável</i>	32,8	32,8	32,8	39,1 dB(A)
<i>Desfavorável</i>	21,4	21,4	21,4	27,7 dB(A)
<i>L_{Aeq LT}</i>	23,6	23,6	23,6	29,9 dB(A)



Apêndice 7.4

Fichas técnicas dos equipamentos



Transformers intended for outdoor urban Substations

Country

Zone

Date



Noise level

The sound level of the Transformers operating off-load and at rated voltage shall not be higher than the values prescribed by the relevant laws and standards.

The maximum sound pressure of the Transformer at full load, with all cooling equipment in service, measured according to IEC 60076-10, shall be not greater than the value indicated in the Technical Data Sheets measured at 1 m.

In any case, special attention shall be paid during the design for Transformers intended for outdoor urban Substations. If compliance with the above limits would require a special Transformer design, the bidder shall submit for approval the design that allows a safe optimization of the Transformer, minimizing non-compliance.

Noise level (operating at full load and fans on)		
Guaranteed sound pressure level at 1 m according to According to IEC 60076-10 and UNE-EN 60551	dB(A)	75
Sound Power Spectrum (tolerance ± 2)		
63 Hz	dB(A)	*
125 Hz	dB(A)	*
250 Hz	dB(A)	*
500 Hz	dB(A)	*
1000 Hz	dB(A)	*
2000 Hz	dB(A)	*
4000 Hz	dB(A)	*
8000 Hz	dB(A)	*

Sungrow Power Supply Co., Ltd.
 Add: No. 1699 Xiyou Road, Hefei, China
 Tel: +86 551 6532 7834
 Email: info@sungrow.cn
 Website: www.sungrowpower.com

SUNGROW

Noise Test Report

TYPE TEST SHEET

This Type Test sheet shall be used to record the results of the type testing of Generating Unit			
Type Tested reference number		SG320HX、SG350HX	
Generating Unit technology		Grid-connected PV Inverter	
System supplier name		Sungrow Power Supply Co., Ltd.	
Address		No.1699 Xiyou Rd., New & High Technology Industrial Development Zone, Hefei, P.R. China	
Tel	+86 551 65327834	Fax	+86 551 6532 7800
E:mail	info@sungrow.cn	Web site	www.sungrowpower.com
Maximum export capacity, use separate sheet if more than one connection option.		N/A	kW single phase, single, split or three phase system
		352KW	kW three phase
		N/A	kW two phases in three phase system
		N/A	kW two phases split phase system
Compiled by	张文明	On behalf of	Sungrow Power Supply Co., Ltd.
Approved by		Test Date	2022-08-14
Note that testing can be done by the manufacturer of an individual component, by an external test house, or by the supplier of the complete system, or any combination of them as appropriate. Where parts of the testing are carried out by persons or organisations other than the supplier then the supplier shall keep copies of all test records and results supplied to them to verify that the testing has been carried out by people with sufficient technical competency to carry out the tests.			

The aim of this test is to determine the noise level when the PV Grid inverter in rated working condition.

Used settings of the measurement device for Noise measurement:

Measurement device	Calibration Date	Expire Date
AWA6228+	2022-01-04	2023-01-03

The conditions during testing are specified below:

PGU operation mode	Rated working condition
Voltage range	860-1300V
Grid frequency range	50Hz
Distance	1m、10 m
Date	2022-08-14

The system noise level please check the table below:

1) Rated working condition (1m)

Orientation	Noise (dB)_1m
Front	74.0
Behind	75.4
Left	75.6
Right	74.4
Maximum Noise	75.6

1) Rated working condition (10m)

Orientation	Noise (dB)_10m
Front	66.3
Behind	62.9
Left	68.2
Right	67.4
Maximum Noise	68.2

Photo:
Rated working condition

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Website: www.sungrowpower.com

SUNGROW



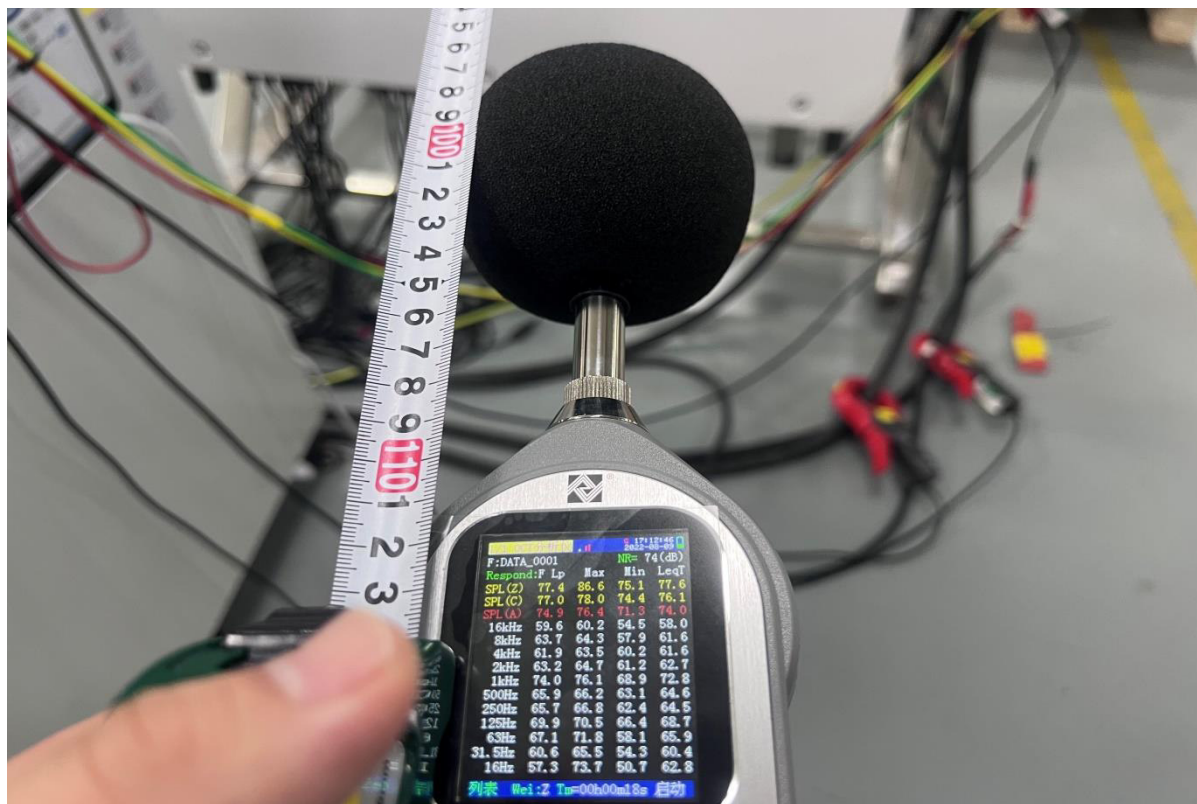
Operation condition



Background noise



1) 1m noise photo





2) 10m noise photo



Front



Behind



Left



Right

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SUNGROW

Additional comments
N/A

Noise Test Report

PowerTitan2.0(4H/35°C)



1 Introduction

This document describes noise test result of SUNGROW PowerTitan2.0 (4H) liquid-cooled energy storage system in the condition of 35°C.

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2 Noise Test

2.1 Test Environment

Installation conditions: Open ground without reflecting planes within 30m around. The interface is shown in the figure below.



Fig. 1 Test Environment

Ambient temperature: 28°C

Ambient humidity: 51%RH

Note: The test conditions are based on the weather of the test site, and the ambient temperature during actual operation of the ESS is different from the value above.

2.2 Test Standards

ISO 3744:2010 *Acoustics—Determination of sound power levels and sound energy*

levels of noise sources using sound pressure—Engineering methods for an essentially free field over a reflecting plane.

2.3 Test Equipment:

Tab. 1 Test Equipment:

Equipment Preparation	Manufacturing Plant	Model	No.	Approved on	Effective Date
Simcenter 12-input Handheld Data Acquisition System	Siemens Industrial Software (Beijing) Co., Ltd.	SCADA S XS	SC-XS12-ACL	2023-02-23	2024-02-22
Acoustic calibrator	B&K	4231	3010773	2023-02-23	2024-02-22

2.4 Test Condition

Tab. 2 Test Condition

No.	Working Conditions
1	Charging/discharging at the rate of 0.25C and the ambient temperature of 35℃, no standing.
2	Charging/discharging at the rate of 0.25C and the ambient temperature of 35℃, 1h standing.
3	Charging/discharging at the rate of 0.25C and the ambient temperature of 35℃, 2h standing.

For other working conditions (with a standing time exceeding 3 hours), please refer to the test report under the working condition of 30 °C

2.5 Test Data

- (1) Background noise: 57.3 dBA
- (2) Average sound pressure level of the tested item $L_{p,T}$ (corrected)
 - 1) Working condition 1: 68.35 dBA
 - 2) Working condition 2: 65.19 dBA

- 3) Working condition 3: 64.08 dBA
- (3) Background noise correction value K1:
- 4) Working condition 1: 0.33 dBA
- 5) Working condition 2: 0.65 dBA
- 6) Working condition 3: 0.83 dBA
- (4) Test environment correction value K2: 0 dBA

2.6 Test Result and Conclusion

2.6.1 Sound Power Level Test Result

Tab. 3 Sound Power Level Test Result

Working Conditions	Sound Power Level/dBA	Expanded Uncertainty U/dBA
Charging/discharging at the rate of 0.25C and the ambient temperature of 35℃, no standing.	90.82	2.4
Charging/discharging at the rate of 0.25C and the ambient temperature of 35℃, 1h standing.	87.66	2.4
Charging/discharging at the rate of 0.25C and the ambient temperature of 35℃, 2h standing.	86.55	2.4

Tab. 4 Sound Power Level 1/3-Octave Spectrum (Working condition 1)

1/3-Octave (Hz)	Average Sound Pressure Level $\overline{L_p A}$, dBA	Sound power level L_{WA} , dBA
50	32.46	54.93
63	33.26	55.73
80	30.72	53.19
100	32.81	55.28
125	34.69	57.16
160	39.49	61.96
200	55.92	78.39

250	54.72	77.19
315	51.34	73.81
400	59.53	82.00
500	54.99	77.46
630	56.20	78.67
800	58.96	81.43
1000	59.76	82.23
1250	60.64	83.11
1600	56.77	79.24
2000	55.71	78.18
2500	55.51	77.98
3150	51.59	74.06
4000	48.20	70.67
5000	45.98	68.45
6300	42.27	64.74
8000	37.23	59.70
10000	32.28	54.75

Tab. 5 Sound Power Level 1/3-Octave Spectrum (Working condition 2)

1/3-Octave (Hz)	Average Sound Pressure Level $\overline{L_p A}$, dBA	Sound power level L_{WA} , dBA
50	31.90	54.37
63	33.82	56.29
80	30.51	52.98
100	33.01	55.48
125	33.00	55.47
160	40.51	62.98
200	52.26	74.73
250	47.27	69.74
315	47.68	70.15

400	52.35	74.82
500	50.70	73.17
630	53.51	75.98
800	55.78	78.25
1000	57.98	80.45
1250	58.86	81.33
1600	53.27	75.74
2000	51.23	73.70
2500	53.24	75.71
3150	49.16	71.63
4000	45.76	68.23
5000	43.92	66.39
6300	39.96	62.43
8000	34.78	57.25
10000	29.79	52.26

Tab. 6 Sound Power Level 1/3-Octave Spectrum (Working condition 3)

1/3-Octave (Hz)	Average Sound Pressure Level $\overline{L_p A}$, dBA	Sound power level L_{WA} , dBA
50	32.84	55.31
63	32.04	54.51
80	31.02	53.49
100	32.64	55.11
125	34.94	57.41
160	43.43	65.90
200	44.16	66.63
250	43.73	66.20
315	46.99	69.46
400	47.98	70.45
500	48.67	71.14

630	51.62	74.09
800	54.82	77.29
1000	57.44	79.91
1250	58.40	80.87
1600	52.29	74.76
2000	49.84	72.31
2500	52.77	75.24
3150	48.69	71.16
4000	45.28	67.75
5000	43.52	65.99
6300	39.43	61.90
8000	34.25	56.72
10000	29.34	51.81

Note: the maximum central frequency of octave can be increased according to the actual demand.

2.6.2 Sound Pressure Level Test Results of Positions 1m Away from the Surface (corrected)

Tab. 7 Sound Pressure Level Test Results of Positions 1m Away from the Surface (corrected)

Working Conditions	Front/dBA	Right/dBA	Back/dBA	Left/dBA	Top/dBA	Expanded Uncertainty/dBA
1	67.6	59.8	59.5	68.2	77.5	2.7
2	67.4	59.6	59.4	68.1	74.0	2.7
3	67.4	59.4	59.1	67.9	69.9	2.7

Tab. 8 Sound Pressure Level 1/3-Octave Spectrum (Working condition 1)

1/3-Octave (Hz)	Front Average Sound Pressure Level	Right Average Sound Pressure Level	Rear Average Sound Pressure Level Lp,T/dBA	Left Average Sound Pressure Level Lp,T/dBA	Right Average Sound Pressure Level Lp,T/dBA
-----------------	------------------------------------	------------------------------------	--	--	---

	Lp,T/dBA	Lp,T/dBA			
50	38.8	30.7	29.2	36.6	32.1
63	39.4	32.6	29.4	36.4	34.4
80	39.2	32.0	28.4	36.7	37.0
100	39.2	33.3	33.1	39.4	44.5
125	44.0	35.1	35.8	43.3	50.4
160	49.1	40.6	39.0	49.0	63.5
200	55.8	47.0	50.0	57.3	71.5
250	54.1	40.9	44.0	52.9	64.0
315	53.3	42.4	45.5	54.1	62.9
400	54.5	45.9	47.0	58.4	66.5
500	54.6	46.1	46.7	56.8	65.7
630	56.1	48.5	46.9	57.3	66.8
800	57.1	51.6	48.6	57.5	66.2
1000	58.3	48.6	49.4	58.0	66.1
1250	61.1	49.2	52.7	60.1	66.2
1600	56.3	50.6	48.6	57.4	65.1
2000	54.5	50.5	47.3	55.9	64.8
2500	53.6	49.4	45.8	55.2	61.6
3150	52.5	45.1	44.9	52.3	58.5
4000	49.0	43.7	41.6	47.8	55.3
5000	43.7	41.1	37.0	42.5	52.5
6300	43.7	39.9	38.1	41.8	50.4
8000	35.1	31.8	30.6	33.4	44.2
10000	28.4	27.1	26.7	26.2	39.1

Tab. 9 Sound Pressure Level 1/3-Octave Spectrum (Working condition 2)

1/3- Octave (Hz)	Front Average Sound Pressure Level Lp,T/dBA	Right Average Sound Pressure Level Lp,T/dBA	Rear Average Sound Pressure Level Lp,T/dBA	Left Average Sound Pressure Level Lp,T/dBA	Right Average Sound Pressure Level Lp,T/dBA
50	38.6	30.5	29.1	36.5	28.6
63	39.2	32.4	29.3	36.3	30.9
80	39.0	31.8	28.3	36.6	33.5
100	39.0	33.1	33.0	39.3	41.0
125	43.8	34.9	35.7	43.2	46.9
160	48.9	40.4	38.9	48.9	60.0
200	55.6	46.8	49.9	57.2	68.0
250	53.9	40.7	43.9	52.8	60.5
315	53.1	42.2	45.4	54.0	59.4
400	54.3	45.7	46.9	58.3	63.0
500	54.4	45.9	46.6	56.7	62.2
630	55.9	48.3	46.8	57.2	63.3
800	56.9	51.4	48.5	57.4	62.7
1000	58.1	48.4	49.3	57.9	62.6
1250	60.9	49.0	52.6	60.0	62.7
1600	56.1	50.4	48.5	57.3	61.6
2000	54.3	50.3	47.2	55.8	61.3
2500	53.4	49.2	45.7	55.1	58.1
3150	52.3	44.9	44.8	52.2	55.0
4000	48.8	43.5	41.5	47.7	51.8
5000	43.5	40.9	36.9	42.4	49.0

6300	43.5	39.7	38.0	41.7	46.9
8000	34.9	31.6	30.5	33.3	40.7
10000	28.2	26.9	26.6	26.1	35.6

Tab. 10 Sound Pressure Level 1/3-Octave Spectrum (Working condition 3)

1/3- Octave (Hz)	Front Average Sound Pressure Level $L_{p,T}/dBA$	Right Average Sound Pressure Level $L_{p,T}/dBA$	Rear Average Sound Pressure Level $L_{p,T}/dBA$	Left Average Sound Pressure Level $L_{p,T}/dBA$	Right Average Sound Pressure Level $L_{p,T}/dBA$
50	38.6	30.3	28.8	36.3	24.5
63	39.2	32.2	29.0	36.1	26.8
80	39.0	31.6	28.0	36.4	29.4
100	39.0	32.8	32.7	39.1	36.9
125	43.8	34.6	35.4	43.0	42.8
160	48.9	40.2	38.6	48.7	55.9
200	55.6	46.6	49.6	57.0	63.9
250	53.9	40.5	43.6	52.6	56.4
315	53.1	42.0	45.1	53.8	55.3
400	54.3	45.5	46.6	58.1	58.9
500	54.4	45.7	46.3	56.5	58.1
630	55.9	48.1	46.5	57.0	59.2
800	56.9	51.2	48.2	57.2	58.6
1000	58.1	48.2	49.0	57.7	58.5
1250	60.9	48.7	52.3	59.8	58.6
1600	56.1	50.2	48.2	57.1	57.5
2000	54.3	50.1	46.9	55.6	57.2
2500	53.4	49.0	45.4	54.9	54.0

3150	52.3	44.6	44.5	52.0	50.9
4000	48.8	43.3	41.2	47.5	47.7
5000	43.5	40.7	36.6	42.2	44.9
6300	43.5	39.5	37.7	41.5	42.8
8000	34.9	31.4	30.2	33.1	36.6
10000	28.2	26.7	26.3	25.9	31.5

Prüfbericht-Nr.: Test report no.:	CN23BNP1 001	Auftrags-Nr.: Order no.:	178176985	Seite 1 von 171 Page 1 of 171
Kunden-Referenz-Nr.: Client reference no.:	2003666	Auftragsdatum: Order date:	2023-01-10	
Auftraggeber: Client:	SUNGROW POWER SUPPLY CO., LTD. No. 1699 Xiyou Rd., New & High Technology Industrial Development Zone, Hefei, Anhui, P. R. China.			
Prüfgegenstand: Test item:	Prefabricated Substation			
Bezeichnung / Typ-Nr.: Identification / Type no.:	MVS7320-LV, MVS7040-LV, MVS6840-LV, MVS6400-LV			
Auftrags-Inhalt: Order content:	AK Certificate			
Prüfgrundlage: Test specification:	IEC 62271-202:2022 subclause 7.2, 7.5, 7.6, 7.7, 7.9, 7.10, 7.101, Annex B IEC62271-212:2022 subclause 7.2, 7.4, 7.6, 7.7, 7.10, 7.101, 7.103, 7.104, 7.106, Annex B			
Wareneingangsdatum: Date of sample receipt:	2023-03-30			
Prüfmuster-Nr.: Test sample no.:	RD180139-002			
Prüfzeitraum: Testing period:	2023-04-17 - 2023-06-12			
Ort der Prüfung: Place of testing:	Shandong Institute for Product Quality Inspection			
Prüflaboratorium: Testing laboratory:	TÜV Rheinland (Shanghai) Co., Ltd.			
Prüfergebnis*: Test result*:	Pass			
geprüft von: reviewed by:			genehmigt von: authorized by:	
Datum: Date:	2023-06-27	Ausstelldatum: Issue date:		2023-06-28
Stellung / Position:	Project Engineer	Stellung / Position:		Authorizer
Sonstiges / Other: MVS7320-LV, MVS7040-LV, MVS6840-LV, MVS6400-LV are with same design, construction and materials, the primary and secondary side voltages are the same- 33kV for input and 800V for output, the only difference is the rated power of the transformer, we choose the MVS7320-LV sample to cover all other models. All test items passed.				
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:		Prüfmuster vollständig und unbeschädigt Test item complete and undamaged		
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet * Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.				

V05

Test report

Report Number: CN23BNP1 001

Test report No.	CN23BNP1 001
Order No.	178176985
Order date	10 th Jan., 2023
Client	Sungrow Power Supply Co., Ltd.
Address	No. 1699 Xiyou Rd., New & High Technology Industrial Development Zone, Hefei, Anhui, P. R. China.
Manufacturer	Sungrow Power Supply Co., Ltd..
Manufacturer address	No. 1699 Xiyou Rd., New & High Technology Industrial Development Zone, Hefei, Anhui, P. R. China.
Trademark	
Manufacture year	2023
Tested samples/ Tested items	Prefabricated substation
Type No. / Identification	MVS7320-LV, MVS7040-LV, MVS6840-LV, MVS6400-LV
Standards / Specifications	IEC 62271-202:2022/IEC 62271-212:2022
Testing period	17 th Apr., 2023 to 12 th Jun., 2023
Test result	Pass
Condition of the test item at delivery	Test item complete and undamaged

This test report only relates to the above mentioned test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.

Number of pages 171 pages

Project Engineer Mr. Ridden Chen
Reviewer Mr. Wencai Zhang

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Test report

Report Number: CN23BNP1 001

Participants

Witness information

Persons attending the test

Mr. Jiancheng Zhang

Shandong Institute for Product Quality Inspection

The inspection test, witnessed by

Mr. Ridden Chen

Commercial department

TÜV Rheinland/CCIC (Qingdao) Co., Ltd.

Test locations

Laboratory information

Testing laboratory Shandong Institute for Product Quality Inspection.

Place of testing No. 1, Chidong Avenue, Chiping District, Liaocheng, Shandong, P.R. China.
No. 31000, Jingshi East Road, Jinan, Shandong, P.R. China.

Testing period 17th Apr., 2023 to 12th Jun., 2023

General remarks

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
"(See Enclosure document)" refers to additional information appended to the report.
"(See appended table)" refers to a table appended to the report.
Throughout this report a ☒ comma / ☐ point is used as the decimal separator.

Possible test case verdicts:

- test case does not apply to the test object : N/A
- test case for reference : R (Reference)
- test object does meet the requirement : P (Pass)
- test object does not meet the requirement : F (Fail)

1. Product information

1.1. Rated characteristics of the tested object assigned by clients

Rating characteristics of the prefabricated substation	
Mode	MVS7320-LV, MVS7040-LV, MVS6840-LV, MVS6400-LV
Rated voltage [kV]	33
Rated frequency [Hz]	50/60
Rated capacity of transformer [kVA]	7320/7040/6840/6400
Power-frequency withstand voltage of HV interconnection [kV]	70
Lighting impulse withstand voltage of HV interconnection [kV]	170
Power-frequency withstand voltage of LV interconnection [kV]	2.5
Lighting impulse withstand voltage of LV interconnection [kV]	12
Rated short-time withstand current of HV main circuit [kA]	20kA/1s (95mm ²), 21kA/1s (120mm ²)
Rated short-time withstand current of LV main circuit [kA]	50 (1s)
Rated short-time withstand current of Earthing circuit [kA]	17.4 (2s)
Rated peak withstand current of HV main circuit [kA]	52kA/0.3s (95mm ²), 54.6kA/0.3s (120mm ²)
Rated peak withstand current of LV main circuit [kA]	105
Rated peak withstand current of Earthing circuit [kA]	45.24
Enclosure protection degree [IK]	IK10
IP level of HV chamber	IP54
IP level of LV chamber	IP65
Sound level [dB]	≤70

Rating characteristics of High voltage switchgear	
Mode	SAFE36
Rated voltage [kV]	36/40.5
Rated frequency [Hz]	50/60
Normal current [A]	630/600
Power frequency withstand voltage To earth and between phases [kV]	95
Power frequency withstand voltage Across the isolating distance [kV]	118
Lighting impulse withstand voltage To earth and between phases [kV]	185
Lighting impulse withstand voltage Across the isolating distance [kV]	215
Short-time withstand current of main circuit [kA]	20/25 (3s)
Short-time withstand current of earthing circuit [kA]	17.4/21.8 (2s)
Peak withstand current of main circuit [kA]	52/65
Peak withstand current of earthing circuit [kA]	45.2/56.6

Rating characteristics of Low voltage switchgear	
Mode	LVS7320, LVS7040, LVS6840, LVS6400
Rated voltage [V]	800 ac
Rated insulation voltage [V]	1000 ac
Rated frequency [Hz]	50/60
Normal current [A]	2*2641.4/2* 2540.3/2*2468.2/2*2309.4
Forms of internal separation	Form 1
Ingress protection	IP65
Short-circuit withstand current of Main busbar	50kA/1s

Test report

Report Number: CN23BNP1 001

Rating characteristics of power transformer	
Mode	SFL-7320/33
Number of phase	3
Rated frequency [Hz]	50/60
Rated power [kVA]	7320
Rated voltage of HV winding [kV]	33
Rated voltage of LV winding [kV]	0.8/0.8
Rated current of HV winding [A]	128.1
Rated current of LV winding [A]	2641.4/2641.4
Vector groups	Dy11y11
Cooling system	ONAN
Voltage adjustment range at the HV side	33±2x2.5%
Power-frequency withstand voltage of HV winding [kV]	70
Power-frequency withstand voltage of LV winding [kV]	3
Lighting impulse withstand voltage of HV winding [kV]	170
Short circuit impedance between HV and LV in reference to the rated power [%]	8.0(±10%)
Load losses at 75°C at rated frequency of 50 Hz [kW]	≤68.217
No-load current at rated voltage and frequency [%]	0.55(+30%)
No-load losses at rated voltage and frequency [kW]	≤4.5
Sound pressure level based on ONAN cooling mode [dB]	70

Test report

Report Number: CN23BNP1 001

Rating characteristics of power transformer	
Mode	SFL-7040/33
Number of phase	3
Rated frequency [Hz]	50/60
Rated power [kVA]	7040
Rated voltage of HV winding [kV]	33
Rated voltage of LV winding [kV]	0.8/0.8
Rated current of HV winding [A]	123.0
Rated current of LV winding [A]	2540.3/2540.3
Vector groups	Dy11y11
Cooling system	ONAN
Voltage adjustment range at the HV side	33±2x2.5%
Power-frequency withstand voltage of HV winding [kV]	70
Power-frequency withstand voltage of LV winding [kV]	3
Lighting impulse withstand voltage of HV winding [kV]	170
Short circuit impedance between HV and LV in reference to the rated power [%]	8.0(±10%)
Load losses at 75°C at rated frequency of 50 Hz [kW]	≤68.217
No-load losses at rated voltage and frequency [kW]	≤4.5
Sound pressure level based on ONAN cooling mode [dB]	70

Test report

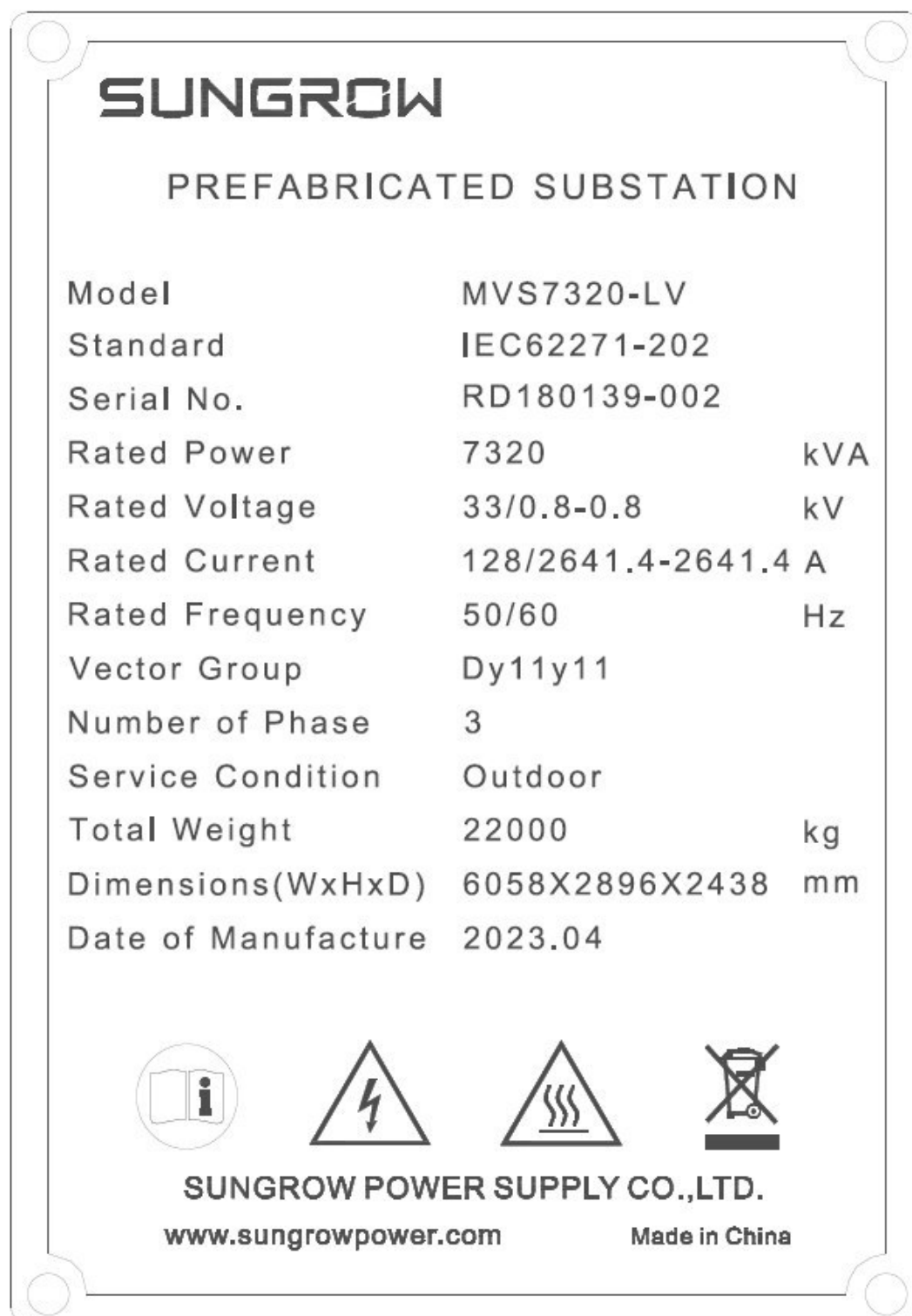
Report Number: CN23BNP1 001

Rating characteristics of power transformer	
Mode	SFL-6840/33
Number of phase	3
Rated frequency [Hz]	50/60
Rated power [kVA]	6840
Rated voltage of HV winding [kV]	33
Rated voltage of LV winding [kV]	0.8/0.8
Rated current of HV winding [A]	120.0
Rated current of LV winding [A]	2468.2/2468.2
Vector groups	Dy11y11
Cooling system	ONAN
Voltage adjustment range at the HV side	33±2x2.5%
Power-frequency withstand voltage of HV winding [kV]	70
Power-frequency withstand voltage of LV winding [kV]	3
Lighting impulse withstand voltage of HV winding [kV]	170
Short circuit impedance between HV and LV in reference to the rated power [%]	8.0(±10%)
Load losses at 75°C at rated frequency of 50 Hz [kW]	≤68.217
No-load losses at rated voltage and frequency [kW]	≤4.5
Sound pressure level based on ONAN cooling mode [dB]	70

Test report

Report Number: CN23BNP1 001

Rating characteristics of power transformer	
Mode	SFL-6400/33
Number of phase	3
Rated frequency [Hz]	50/60
Rated power [kVA]	6400
Rated voltage of HV winding [kV]	33
Rated voltage of LV winding [kV]	0.8/0.8
Rated current of HV winding [A]	112.0
Rated current of LV winding [A]	2309.4/2309.4
Vector groups	Dy11y11
Cooling system	ONAN
Voltage adjustment range at the HV side	33±2x2.5%
Power-frequency withstand voltage of HV winding [kV]	70
Power-frequency withstand voltage of LV winding [kV]	3
Lighting impulse withstand voltage of HV winding [kV]	170
Short circuit impedance between HV and LV in reference to the rated power [%]	8.0(±10%)
Load losses at 75°C at rated frequency of 50 Hz [kW]	≤68.217
No-load losses at rated voltage and frequency [kW]	≤4.5
Sound pressure level based on ONAN cooling mode [dB]	70

1.2. Nameplate

SUNGROW**PREFABRICATED SUBSTATION**

Model	MVS7040-LV	
Standard	IEC62271-202:2022	
Serial No.	RD180139-002	
Rated Power	7040	kVA
Rated Voltage	33/0.8-0.8	kV
Rated Current	123/2540.3-2540.3	A
Rated Frequency	50/60	Hz
Vector Group	Dy11y11	
Number of Phase	3	
Service Condition	Outdoor	
Total Weight	22000	kg
Dimensions(WxHxD)	6058X2896X2438	mm
Date of Manufacture	2023.01	

**SUNGROW POWER SUPPLY CO.,LTD.**www.sungrowpower.com

Made In China

SUNGROW**PREFABRICATED SUBSTATION**

Model	MVS6840-LV	
Standard	IEC62271-202	
Serial No.	RD180139-002	
Rated Power	6840	kVA
Rated Voltage	33/0.8-0.8	kV
Rated Current	120/2468.2-2468.2	A
Rated Frequency	50/60	Hz
Vector Group	Dy11y11	
Number of Phase	3	
Service Condition	Outdoor	
Total Weight	22000	kg
Dimensions(WxHxD)	6058X2896X2438	mm
Date of Manufacture	2023.01	

**SUNGROW POWER SUPPLY CO.,LTD.**www.sungrowpower.com

Made In China

SUNGROW**PREFABRICATED SUBSTATION**

Model	MVS6400-LV	
Standard	IEC62271-202	
Serial No.	RD180139-002	
Rated Power	6400	kVA
Rated Voltage	33/0.8-0.8	kV
Rated Current	112/2309.4-2309.4	A
Rated Frequency	50/60	Hz
Vector Group	Dy11y11	
Number of Phase	3	
Service Condition	Outdoor	
Total Weight	22000	kg
Dimensions(WxHxD)	6058X2896X2438	mm
Date of Manufacture	2023.01	

**SUNGROW POWER SUPPLY CO.,LTD.**www.sungrowpower.com

Made In China

1.3. Major components list of the prefabricated substation (tested)

Component name	Type	Reference standard	Manufacturer	Type test report No.
Transformer	SFL-7320/33	IEC 60076-1	Eaglerise Electric & Electronic (Ji An) Co., Ltd..	CN23N9WX 001 (TUV)
High-voltage switchgear	SAFE36	IEC 62271-200	ABB Beijing Switchgear Limited.	190285G (XIHARI) 190347G (XIHARI) 2485-19 (KEMA) 2043-23 (KEMA)
Low-voltage switchgear	LVS7320	IEC 61439-2	Sungrow Power Supply Co., Ltd.	CN23KW6N 001 (TUV)

1.4. Major components list of the prefabricated substation (Alternative)

Component name	Type	Reference standard	Manufacturer	Type test report No.
Transformer	SFL-7320/33	IEC TR 62271-312	Jiangsu Huapeng Transformer Co., Ltd.	-
Transformer	SFL-7040/33	IEC TR 62271-312	Jiangsu Huapeng Transformer Co., Ltd.	-
			Eaglerise Electric & Electronic (Ji An) Co., Ltd.	
Transformer	SFL-6840/33	IEC TR 62271-312	Jiangsu Huapeng Transformer Co., Ltd.	-
			Eaglerise Electric & Electronic (Ji An) Co., Ltd.	
Transformer	SFL-6400/33	IEC TR 62271-312	Jiangsu Huapeng Transformer Co., Ltd.	-
			Eaglerise Electric & Electronic (Ji An) Co., Ltd.	
Low-voltage switchgear	LVS7040/ LVS 6840/ LVS 6400	IEC 61439-2	Sungrow Power Supply Co., Ltd.	CN23KW6N 001

Summary of tests:

MVS7320-LV, meet the requirements of IEC 62271-202:2022 and IEC 62271-212:2022. For tests, refer to the table below, which covers the type test requirements of both IEC62271-202 and IEC 62271-212. For IEC 62271-212, besides the tests in the table, still four additional tests required:

- 1、 Measurement of the resistance of the main circuit of the high-voltage functional unit
- 2、 Verification of making and breaking capacities of the high-voltage functional unit
- 3、 Mechanical operation tests
- 4、 Pressure withstand tests for gas-filled compartments

These four tests already conducted on the functional unit (high-voltage switchgear and low-voltage switchgear), so just refer to the test results of the test reports, no need to repeat again.

Clause	Tests as per IEC 62271-202	Type test	Remark	Verdict
7.2	Dielectric tests	Power-frequency voltage test : (High voltage interconnection: 70kV/1min Low voltage interconnection: 2.5kV/1min	-	Passed
		Lightning impulse voltage test: (High voltage interconnection: ±170kV/15 times Low voltage interconnection: ±12 kV/3 times)		
		Verification of creepage distance: Low voltage: ≥ 16mm		

Test report

Report Number: CN23BNP1 001

Clause	Tests as per IEC 62271-202	Type test	Remark	Verdict
7.5	Temperature rise tests	High-voltage circuit: apply total loss: 58613W (50Hz); Low-voltage circuit: apply current: 5282.8A (50Hz); High-voltage circuit: apply total loss: 61671W (60Hz); Low-voltage circuit: apply current: 5282.8A (60Hz);	The enclosure class of the prefabricated substation is not declared	Passed
7.6	Short-time withstand current and peak withstand current test	High voltage main circuit: Short-time withstand current: 20kA/1s (95mm ²), 21kA/1s (120mm ²) Peak withstand current: 52kA (95mm ²), 54.6kA (120mm ²) Low voltage main circuit: Short-time withstand current: 50kA/1s; Peak withstand current: 105kA Earthing circuit: Short-time withstand current: 17.4kA/2s; Peak withstand current: 45.24kA	-	Passed
7.7	Verification of the protection	HV chamber: IP54 LV chamber: IP65	-	Passed
	Electromagnetic compatibility tests (HV switchgear)	Electric fast transient test: Test voltage: ± 2 kV Oscillatory wave immunity test: Test voltage: ± 1.0 kV/ ± 2.5 kV Ripple on AC power input voltage drop, short interruptions and voltage change immunity test: Test part: power input port RF radiation emission test: Frequency range: 30~230MHz 230~1000MHz	EMC tests conducted on the high-voltage side and the low-voltage side	Passed

Test report

Report Number: CN23BNP1 001

Clause	Tests as per IEC 62271-202	Type test	Remark	Verdict
7.9	Electromagnetic compatibility tests (LV switchgear)	RF conducted emission test: Frequency range: 0.15~0.50MHz 0.50~30MHz		
		Electrostatic discharge Immunity test: 10 positive and 10 negative discharge for each point, Interval: 1s	EMC tests conducted on the high-voltage side and the low-voltage side	Passed
		Radiated ratio-frequency,electromagnetic field immunity test: 80MHz~1GHz: 10V/m 1.4GHz~6GHz: 3V/m		
		Electrical fast transient test: Power port: 2kV Signal port: 1kV		
		1.2/50us and 8/20us surge immunity test: Test voltage: ±1.0kV/±2kV		
		Immunity test to conducted disturbances Frequency range: 150kHz~80MHz Test voltage: 10V		
		Power-frequency magnetic field immunity test: Magnetic field strength: 30A/m Test time: 5min		
		Voltage dips and short interruptions immunity test: Intervals: 10s		
		Emission test: Frequency range: 0.15~0.50MHz 0.50~30MHz		
		Emission test: Frequency range: 30~230MHz 230~1000MHz		

Test report

Report Number: CN23BNP1 001

Clause	Tests as per IEC 62271-202	Type test	Remark	Verdict
7.10	Additional tests on auxiliary and control circuits	Functional tests	-	Passed
		Power-frequency voltage test: 2kV/1min		
7.101	Calculations and mechanical tests	Roof load: 2500N/m ²	-	Passed
		Impact energy: 20J (IK10)		
Annex B	Test to verify the sound level of a prefabricated substation	Height of measuring device : 1.5m	-	Passed

2. Tests to verify the insulation level of the prefabricated substation

2.1. Reference standards

Clause	Test item	Standard	
	Content	Title	Nr.
7.2	Dielectric tests	AC prefabricated substations for rated voltages above 1kV and up to and including 52kV	IEC 62271-202
7.2	Dielectric tests	High-voltage switchgear and controlgear-Part1: Common specifications	IEC 62271-1

2.2. Measurement

	AC prefabricated substations as per IEC 62271-202		
7.2	Requirements	Remark	Verdict
	Since the high voltage switchgear, power transformer and low voltage switchgear or the CEADS which can be contained in a prefabricated substation have been type-tested according to the relevant standards, this subclause applies only to the interconnection between the components when the installation conditions can affect their dielectric withstand		N/A
	Therefore, the equipment to be subjected to dielectric test is as follows:		P
	- the interconnection between the high-voltage switchgear and the power transformer	Cables	P
	- the interconnection between the power transformer and the low-voltage switchgear	Busbars	P
	- high-voltage switchgear and controlgear without an earthed conductive conductor or layer enclosing all high-voltage parts		N/A
7.2.6	Application of the test voltage and test conditions		P
	Subclause 7.2.6 of IEC 62271-1: 2017 is not applicable. Refer instead to 7.2.101.2		P
7.2.7	Tests of switchgear and controlgear of $U_r \leq 245\text{kV}$		P

	AC prefabricated substations as per IEC 62271-202		
7.2	Requirements	Remark	Verdict
	Subclause 7.2.7 of IEC 62271-1: 2017 is applicable for high voltage components to be type tested with the following modification:		P
	The tests shall be performed with the applicable test voltages given in Table 1a or 1b of IEC 62271-1:2017		P
	For test voltages to earth and between phases, column (2) and (4) shall be used		P
7.2.11	Dielectric tests on auxiliary and control circuits		P
	Subclause 7.2.11 of IEC 62271-1: 2017 is applicable	For the dielectric test of auxiliary and control circuit, refer to clause 7.10	P
7.2.101	Tests on the high-voltage interconnections		P
	The dielectric tests are not required when the high-voltage interconnection is made of high-voltage cables connected by type-tested earth-shielded connectors		N/A
	or by other types of terminations which have been type-tested on both the high-voltage switchgear and the transformer sides in the installation conditions of the prefabricated substation	Conducted the dielectric tests on high-voltage interconnections	N/A
	The dielectric tests are not required on the high-voltage switchgear and controlgear without an earthed conductive enclosure or layer enclosing all high-voltage parts to be tested when it has been previously type tested in the installation conditions of the prefabricated substation		N/A
	or if all the distances between its live parts and the other components of the prefabricated substation, the walls and the ceiling are greater than the minimum clearance values given in Table A.1 of IEC 60071-1:2019 for the rated voltage of the high-voltage switchgear and controlgear		N/A
	In all other cases, the interconnection shall be subjected to dielectric tests according to 7.2.101.2 to 7.2.101.4		P
	The tests may be carried out with the transformer replaced by a replica reproducing the field configuration of the transformer bushings and enclosure near the high-voltage components being tested	No replica needed	N/A

	AC prefabricated substations as per IEC 62271-202		
7.2	Requirements	Remark	Verdict
	If only the high-voltage connection is to be tested, it shall be connected to the test supply through the high-voltage switchgear		P
	Only the switching devices that are in series in the supply circuit are closed		P
	All other swithing devices are open		P
	Voltage-limiting devices shall be disconnected during dielectric tests		P
	Secondary terminals of current transformer shall be short-circuited and connected to earth	No current transformer	N/A
	Voltage transformers shall be disconnected	No voltage transformer	N/A
7.2.101.2	Application of test voltage	On the high-voltage interconnections	P
	The test voltages shall be applied connecting each phase conductor of the main circuit in turn to the high-voltage terminal of the test supply		P
	All other conductors of the main circuit and the auxiliary circuits shall be connected to the earthing conductor of the frame, and to the earth terminal of the test supply		P
	Where non-earth-shielded high-voltage interconnections are used, the non-conductive material shall likewise withstand the test voltages specified in 7.2.101.4		P
	The test methods specified in IEC 60243-1:2013 [18] should be applied to test if the selected material meets the relevant requirements		P
7.2.101.3	Lighting impulse-voltage tests		P
	The high-voltage components to be tested shall be subjected to the lighting impulse-voltage tests according to 7.2.6.3 of IEC 62271-1: 2017 with the following addition	The tests shall be performed with voltages of both polarities using the standard lightning impulse 1.2/50 uS according to IEC 60060-1	P
	To obtain the correct wave shape during the test it is acceptable to disconnect the power transformer or use a mock up instead	Disconnect the power transformer	P

	AC prefabricated substations as per IEC 62271-202		
7.2	Requirements	Remark	Verdict
	During the lightning impulse-voltage tests, the grounded terminal of the impulse generator shall be connected to the earthing conductor of the enclosure of the prefabricated substation		P
7.2.101.4	Power-frequency voltage withstand tests		P
	The high-voltage interconnection shall be subjected to 1min power-frequency voltage withstand tests in dry conditions in accordance with 7.2.7.2 of IEC 62271-1: 2017 with the following addition		P
	During the power-frequency voltage test, one terminal of the test transformer shall be connected to earth and to the earthing conductor of the prefabricated substation		P
	To avoid the saturation of the power transformer during the test it can be necessary to disconnect the power transformer or use a mock up instead	Disconnect the power transformer	P
7.2.102	Test on low-voltage interconnection		P
	When the low-voltage interconnection is partially or totally covered by a non-metallic enclosure, the enclosure shall be covered by a circular or square metal foil having an area as large as possible, but not exceeding 100 cm ² connected to the earth	Metallic enclosure	N/A
	The foil shall be applied to all surface than can be touched by an operator		N/A
	For the tests, the low-voltage interconnection is connected to the test supply through the low-voltage swithgear		P
	Only the switching devices that are in series in the supply circuit are closed		P
	All other switching devices are open		P
7.2.102.2	Lightning impulse-voltage tests		P
	The low-voltage interconnection shall be subjected to lightning impulse-voltage tests		P
	The test voltage is specified in Table F.1 of IEC 60664-1 :2020, where the rated impulse-voltage test is chosen in accordance with 5.3 of this standard	The manufacturer defined the sea level, and the impulse voltage is 14.8kV	P

	AC prefabricated substations as per IEC 62271-202		
7.2	Requirements	Remark	Verdict
	Overvoltage suppressing means shall be disconnected or tests shall be made according to IEC 61180-1:1992		P
	The 1,2/50uS impulse voltage shall be applied three times for each polarity at intervals of 1s minimum		P
	The test voltage shall be applied connecting each phase conductor of the main circuit in turn to the high-voltage terminal of the test supply		P
	All other conductors of the main circuit and the auxiliary circuits shall be connected to the earthing conductor or the frame and to the earth terminal of the test supply		P
	There shall be no disruptive discharge during the tests		P
	To obtain the correct wave shape during the test it can be necessary to disconnect the power transformer or use a mock up instead	Disconnect the power transformer	P
7.2.102.3	Power-frequency voltage withstand tests		P
	The low-voltage interconnections shall be tested in accordance with 10.9.2 of IEC 61439-1:2020		P
	To avoid the saturation of the power transformer during the test, it is acceptable to disconnect the power transformer or use a mock up instead	Disconnect the power transformer	P
7.2.102.4	Verification of creepage distances		P
	The shortest creepage distances between phases, between circuit conductors at different voltages and live and exposed conductive parts shall be measured	The measured values refer to 2.7	P
	The measured creepage distance with respect to material group and pollution degree shall be comply with the requirements in Table F.4 of IEC 60664-1: 2020		P
7.2.4	Test criteria		P
	Subclause 7.2.5 of IEC 62271-1: 2017 is applicable for the high voltage interconnection, with the following modification:		P
	-the second paragraph of item a) that refers to wet test is not applicable		P
	The test is successful if		P
	a) Short- duration power-frequency withstand voltage tests		P

	AC prefabricated substations as per IEC 62271-202		
7.2	Requirements	Remark	Verdict
	– The switchgear and controlgear shall be considered to have passed the if no disruptive discharge occurs		P
	If during a wet test a disruptive discharge on external self-restoring insulation occurs, this test shall be repeated in the same test condition without intermediate cleaning and the test object shall be considered to have passed this test if no further disruptive discharge occurs		N/A
	b) impulse tests		P
	The test procedure B of IEC 60060-1:2010, adapted for test objects that have self-restoring and non-self-restoring insulation, is the preferred test procedure		P
	The test object has passed the impulse tests if the following conditions are fulfilled:		P
	– each series has at least 15 tests;		P
	– the number of disruptive discharges shall not exceed two for each complete series		P
	– no disruptive discharge on non-self restoring insulation shall occur. This is confirmed by 5 consecutive impulse withstands following the last disruptive discharge		N/A
	This procedure leads to a maximum possible number of 25 impulses per series.		P
	Procedure C of IEC 60060-1:2010 may be used when all three poles are tested, refer to 7.2.6.2		N/A

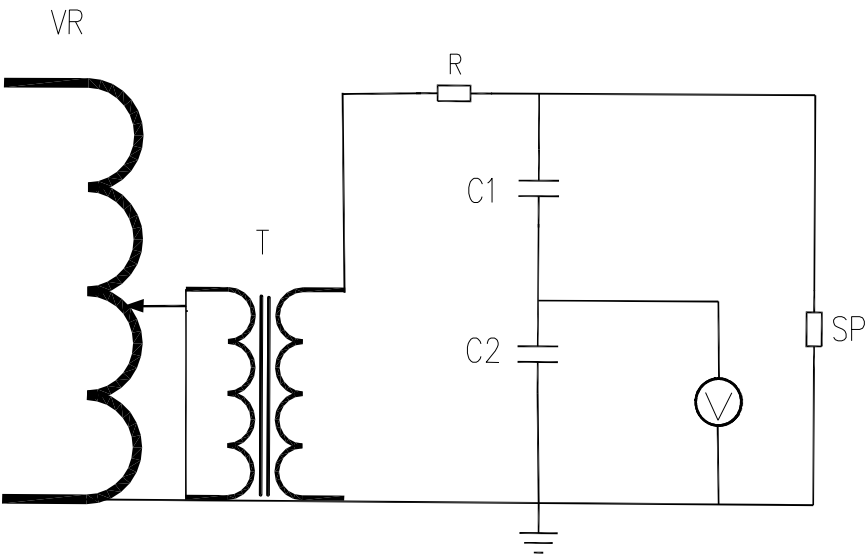
2.3. Measurement condition of test day

Test day	
Measurement date	28 th May., 2023
Ambient condition	22.3°C
Relative humidity	57%
Air pressure	101.2kPa

2.4. Test instrument

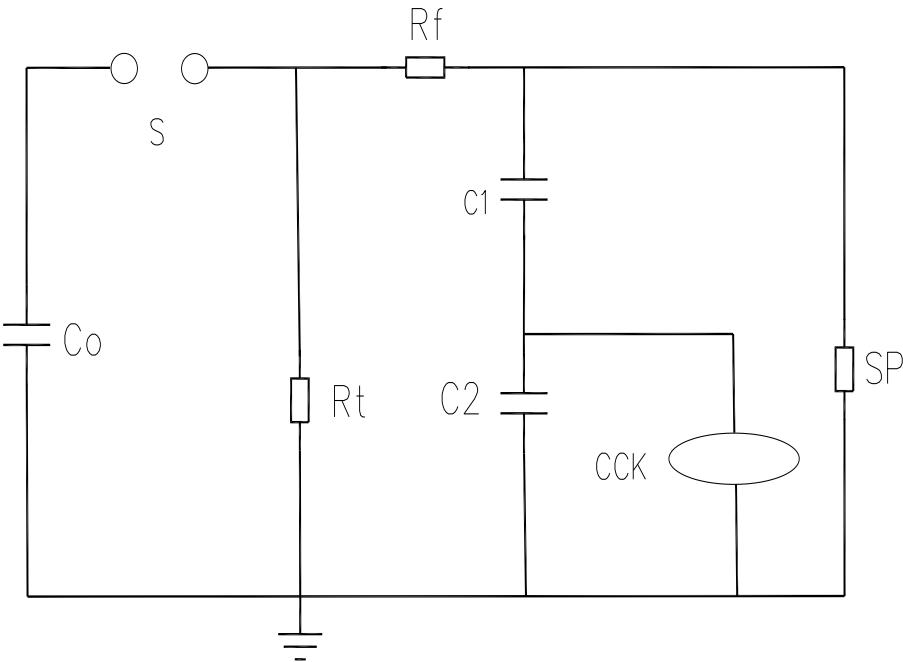
Equipment	Type	Serial number	Scope/accuracy	Next calibration date
Impulse voltage generator sets	CJDY-30kJ/400kV	E6751	Class 3.0	2023-09-07
Empty box barometer	DYM3	E6737	≤2hpa	2023-11-21
Temperature and humidity meter	DT-8892	LJ3111	(±2%~±4%) RH, ±1°C	2023-09-07
Power frequency withstand voltage test device	SKYDC-100/100	E6755	±1%	2023-09-07
Dielcetric test devices	GC-20	E7315	±3%	2023-12-21
AC Withstand Voltage Tester	AN9602M	E6523	±1%	2023-09-07
Vernier caliper	150mm	LJ3047	±0.01mm	2023-11-21

2.5. Test circuit



VR	Voltage regulators	T	Power frequency test transformer
R	Protective resistors	V	Power frequency voltmeter
C1	High-voltage arm capacitor	C2	Low-voltage arm capacitor
SP	Sample		

Figure 2.5.1. Test circuit of power frequency withstand voltage test



Co	Impulse voltage generator main capacitor	S	Impulse voltage generator ignition ball gap
Rf	Wavehead resistor	Rt	Wave tail resistor
C1	High-voltage arm capacitor	C2	Low-voltage arm capacitor
SP	Sample	CCK	Measurement and control system

Figure 2.5.2. Test circuit of lightning impulse test

2.6. Criteria agreed by manufacturer

Table 2.6. Criteria of power-frequency voltage and impulse voltage		
-	Power-frequency voltage	Impulse voltage
High-voltage interconnection	[kV]	[kV]
	70	170

2.7. Measured value

2.7.1. Measured value of Power-frequency voltage test

2.7.1.1. High-voltage interconnection Power frequency voltage test				
Parts of applied voltage	Test voltage	Duration	Frequency	Verdict
	[kV]	[s]	[Hz]	
Between phase A and B,C and earth	70.29	60	50/60	P
Between phase B and A,C and earth	70.36	60	50/60	P
Between phase C and A, B and earth	70.14	60	50/60	P
Supplement information: N/A				

2.7.1.2. Low-voltage interconnection Power frequency voltage test				
Parts of applied voltage	Test voltage	Duration	Frequency	Verdict
	[kV]	[s]	[Hz]	
Between each phase and the other phase connection to the earth conductor	2.50	60	50/60	P
Supplement information: N/A				

2.7.2. Measured value of Lightning impulse voltage test(High-voltage interconnection)

Table 2.7.2.1. LI test between phase- A to phase-B&C and earthing conductor (Positive polarity)

Table 2.7.2.1. LI test between phase- A to phase-B&C and earthing conductor (Positive polarity)										
Phase	% of full Impluse	Applied voltage	Requir- ed voltage	Waveshape						Waveform number
				T_1		T_2		T_c		
		Peak	Peak	Meas.	Req.	Meas.	Req.	Meas.	Req.	Table
		[kV]	[kV]	[μs]	[μs]	[μs]	[μs]	[μs]	[μs]	VD
A	100(FW)	169.5	170±3%	0.997	1.2±30%	47.64	50±20%	-	-	1-1
	100(FW)	170.7	170±3%	0.985	1.2±30%	47.51	50±20%	-	-	1-2
	100(FW)	170.5	170±3%	0.985	1.2±30%	47.48	50±20%	-	-	1-3
	100(FW)	170.3	170±3%	0.991	1.2±30%	47.49	50±20%	-	-	1-4
	100(FW)	170.0	170±3%	0.985	1.2±30%	47.82	50±20%	-	-	1-5
	100(FW)	170.5	170±3%	0.985	1.2±30%	47.66	50±20%	-	-	1-6
	100(FW)	171.6	170±3%	0.985	1.2±30%	47.60	50±20%	-	-	1-7
	100(FW)	171.7	170±3%	0.991	1.2±30%	47.56	50±20%	-	-	1-8
	100(FW)	171.7	170±3%	0.991	1.2±30%	47.58	50±20%	-	-	1-9
	100(FW)	171.7	170±3%	0.985	1.2±30%	47.66	50±20%	-	-	1-10
	100(FW)	170.9	170±3%	0.991	1.2±30%	47.51	50±20%	-	-	1-11
	100(FW)	170.5	170±3%	0.991	1.2±30%	47.69	50±20%	-	-	1-12
	100(FW)	170.4	170±3%	0.997	1.2±30%	47.57	50±20%	-	-	1-13
	100(FW)	170.5	170±3%	0.997	1.2±30%	47.73	50±20%	-	-	1-14
	100(FW)	170.5	170±3%	0.991	1.2±30%	47.75	50±20%	-	-	1-15

Supplementary information:

T_1 Time to peak ±30%

T_2 Time to half ±20%

Meas. Measured value

Req. Required value

VD: Voltage Waveform from Voltage divider

FW: Full wave

Table 2.7.2.2. LI test between phase- A to phase-B&C and earthing conductor (Negative polarity)

Phase	% of full Impluse	Applied voltage	Requir- ed voltage	Waveshape						Waveform number
				T_1		T_2		T_c		
		Peak	Peak	Meas.	Req.	Meas.	Req.	Meas.	Req.	Table
		[kV]	[kV]	[μ s]	[μ s]	[μ s]	[μ s]	[μ s]	[μ s]	VD
A	100(FW)	-171.0	170±3%	0.997	1.2±30%	47.75	50±20%	-	-	1-16
	100(FW)	-170.9	170±3%	0.997	1.2±30%	47.50	50±20%	-	-	1-17
	100(FW)	-171.2	170±3%	0.997	1.2±30%	47.44	50±20%	-	-	1-18
	100(FW)	-170.7	170±3%	0.991	1.2±30%	47.68	50±20%	-	-	1-19
	100(FW)	-170.7	170±3%	0.991	1.2±30%	47.55	50±20%	-	-	1-20
	100(FW)	-171.0	170±3%	0.991	1.2±30%	47.55	50±20%	-	-	1-21
	100(FW)	-170.4	170±3%	0.997	1.2±30%	47.72	50±20%	-	-	1-22
	100(FW)	-170.8	170±3%	0.997	1.2±30%	47.66	50±20%	-	-	1-23
	100(FW)	-170.8	170±3%	0.997	1.2±30%	47.48	50±20%	-	-	1-24
	100(FW)	-170.7	170±3%	0.997	1.2±30%	47.73	50±20%	-	-	1-25
	100(FW)	-171.1	170±3%	0.997	1.2±30%	47.50	50±20%	-	-	1-26
	100(FW)	-171.0	170±3%	0.991	1.2±30%	47.60	50±20%	-	-	1-27
	100(FW)	-170.7	170±3%	0.991	1.2±30%	47.61	50±20%	-	-	1-28
	100(FW)	-170.5	170±3%	0.997	1.2±30%	47.84	50±20%	-	-	1-29
	100(FW)	-170.8	170±3%	1.00	1.2±30%	47.55	50±20%	-	-	1-30
Supplementary information:										
T_1	Time to peak ±30%									
T_2	Time to half ±20%									
Meas.	Measured value									
Req.	Required value									
VD:	Voltage Waveform from Voltage divider									
FW:	Full wave									

Table 2.7.2.3. LI test between phase- B to phase-A&C and earthing conductor (Positive polarity)

Phase	% of full Impluse	Applied voltage	Requir- ed voltage	Waveshape						Waveform number
				T_1		T_2		T_c		
		Peak	Peak	Meas.	Req.	Meas.	Req.	Meas.	Req.	Table
		[kV]	[kV]	[μ s]	[μ s]	[μ s]	[μ s]	[μ s]	[μ s]	VD
B	100(FW)	171.0	170±3%	1.01	1.2±30%	47.62	50±20%	-	-	2-1
	100(FW)	170.6	170±3%	0.991	1.2±30%	47.64	50±20%	-	-	2-2
	100(FW)	170.5	170±3%	0.985	1.2±30%	47.62	50±20%	-	-	2-3
	100(FW)	170.7	170±3%	0.991	1.2±30%	47.68	50±20%	-	-	2-4
	100(FW)	170.8	170±3%	0.991	1.2±30%	47.57	50±20%	-	-	2-5
	100(FW)	170.8	170±3%	0.991	1.2±30%	47.55	50±20%	-	-	2-6
	100(FW)	171.1	170±3%	0.997	1.2±30%	47.49	50±20%	-	-	2-7
	100(FW)	170.6	170±3%	0.997	1.2±30%	47.68	50±20%	-	-	2-8
	100(FW)	171.0	170±3%	0.997	1.2±30%	47.67	50±20%	-	-	2-9
	100(FW)	170.7	170±3%	0.985	1.2±30%	47.71	50±20%	-	-	2-10
	100(FW)	170.9	170±3%	0.997	1.2±30%	47.57	50±20%	-	-	2-11
	100(FW)	170.5	170±3%	0.991	1.2±30%	47.73	50±20%	-	-	2-12
	100(FW)	170.5	170±3%	0.991	1.2±30%	47.82	50±20%	-	-	2-13
	100(FW)	170.5	170±3%	0.985	1.2±30%	47.82	50±20%	-	-	2-14
	100(FW)	170.6	170±3%	0.997	1.2±30%	47.70	50±20%	-	-	2-15
Supplementary information:										
T_1	Time to peak ±30%									
T_2	Time to half ±20%									
Meas.	Measured value									
Req.	Required value									
VD:	Voltage Waveform from Voltage divider									
FW:	Full wave									

Table 2.7.2.4. LI test between phase- B to phase-A&C and earthing conductor (Negative polarity)

Phase	% of full Impluse	Applied voltage	Requir- ed voltage	Waveshape						Waveform number
				T_1		T_2		T_c		
		Peak	Peak	Meas.	Req.	Meas.	Req.	Meas.	Req.	Table
		[kV]	[kV]	[μ s]	[μ s]	[μ s]	[μ s]	[μ s]	[μ s]	VD
B	100(FW)	-170.9	170±3%	0.997	1.2±30%	47.54	50±20%	-	-	2-16
	100(FW)	-171.2	170±3%	1.01	1.2±30%	47.6	50±20%	-	-	2-17
	100(FW)	-171.1	170±3%	1.00	1.2±30%	47.49	50±20%	-	-	2-18
	100(FW)	-171.0	170±3%	1.00	1.2±30%	47.51	50±20%	-	-	2-19
	100(FW)	-171.1	170±3%	0.991	1.2±30%	47.40	50±20%	-	-	2-20
	100(FW)	-171.0	170±3%	0.991	1.2±30%	47.52	50±20%	-	-	2-21
	100(FW)	-171.2	170±3%	0.997	1.2±30%	47.50	50±20%	-	-	2-22
	100(FW)	-171.0	170±3%	0.997	1.2±30%	47.51	50±20%	-	-	2-23
	100(FW)	-171.0	170±3%	0.997	1.2±30%	47.62	50±20%	-	-	2-24
	100(FW)	-170.8	170±3%	0.997	1.2±30%	47.69	50±20%	-	-	2-25
	100(FW)	-170.7	170±3%	0.997	1.2±30%	47.64	50±20%	-	-	2-26
	100(FW)	-171.0	170±3%	0.997	1.2±30%	47.54	50±20%	-	-	2-27
	100(FW)	-171.1	170±3%	0.997	1.2±30%	47.64	50±20%	-	-	2-28
	100(FW)	-170.8	170±3%	1.00	1.2±30%	47.51	50±20%	-	-	2-29
	100(FW)	-170.7	170±3%	0.997	1.2±30%	47.66	50±20%	-	-	2-30
Supplementary information:										
T_1	Time to peak ±30%									
T_2	Time to half ±20%									
Meas.	Measured value									
Req.	Required value									
VD:	Voltage Waveform from Voltage divider									
FW:	Full wave									

Table 2.7.2.5. LI test between phase- C to phase-A&B and earthing conductor (Positive polarity)

Phase	% of full Impluse	Applied voltage	Requir- ed voltage	Waveshape						Waveform number
				T_1		T_2		T_c		
		Peak	Peak	Meas.	Req.	Meas.	Req.	Meas.	Req.	Table
		[kV]	[kV]	[μ s]	[μ s]	[μ s]	[μ s]	[μ s]	[μ s]	VD
C	100(FW)	170.9	170±3%	0.991	1.2±30%	47.56	50±20%	-	-	3-1
	100(FW)	170.6	170±3%	0.991	1.2±30%	47.57	50±20%	-	-	3-2
	100(FW)	170.3	170±3%	0.991	1.2±30%	47.64	50±20%	-	-	3-3
	100(FW)	170.7	170±3%	0.997	1.2±30%	47.74	50±20%	-	-	3-4
	100(FW)	170.6	170±3%	0.985	1.2±30%	47.77	50±20%	-	-	3-5
	100(FW)	170.3	170±3%	0.991	1.2±30%	47.81	50±20%	-	-	3-6
	100(FW)	170.7	170±3%	0.979	1.2±30%	47.57	50±20%	-	-	3-7
	100(FW)	170.8	170±3%	0.991	1.2±30%	47.40	50±20%	-	-	3-8
	100(FW)	170.8	170±3%	0.991	1.2±30%	47.56	50±20%	-	-	3-9
	100(FW)	171.0	170±3%	0.985	1.2±30%	47.50	50±20%	-	-	3-10
	100(FW)	170.8	170±3%	0.991	1.2±30%	47.64	50±20%	-	-	3-11
	100(FW)	170.7	170±3%	0.991	1.2±30%	47.69	50±20%	-	-	3-12
	100(FW)	170.8	170±3%	0.985	1.2±30%	47.65	50±20%	-	-	3-13
	100(FW)	170.8	170±3%	0.991	1.2±30%	47.85	50±20%	-	-	3-14
	100(FW)	170.6	170±3%	0.991	1.2±30%	47.83	50±20%	-	-	3-15
Supplementary information:										
T_1	Time to peak ±30%									
T_2	Time to half ±20%									
Meas.	Measured value									
Req.	Required value									
VD:	Voltage Waveform from Voltage divider									
FW:	Full wave									

Table 2.7.2.6. LI test between phase- C to phase-A&B and earthing conductor (Negative polarity)

Phase	% of full Impluse	Applied voltage	Requir- ed voltage	Waveshape						Waveform number
				T_1		T_2		T_c		
		Peak	Peak	Meas.	Req.	Meas.	Req.	Meas.	Req.	Table
		[kV]	[kV]	[μ s]	[μ s]	[μ s]	[μ s]	[μ s]	[μ s]	VD
C	100(FW)	-170.1	170±3%	0.997	1.2±30%	47.90	50±20%	-	-	3-16
	100(FW)	-170.9	170±3%	0.991	1.2±30%	47.75	50±20%	-	-	3-17
	100(FW)	-170.8	170±3%	1.00	1.2±30%	47.51	50±20%	-	-	3-18
	100(FW)	-170.9	170±3%	0.997	1.2±30%	47.59	50±20%	-	-	3-19
	100(FW)	-170.8	170±3%	0.991	1.2±30%	47.67	50±20%	-	-	3-20
	100(FW)	-170.7	170±3%	0.997	1.2±30%	47.60	50±20%	-	-	3-21
	100(FW)	-171.0	170±3%	0.997	1.2±30%	47.77	50±20%	-	-	3-22
	100(FW)	-170.7	170±3%	1.00	1.2±30%	47.77	50±20%	-	-	3-23
	100(FW)	-171.2	170±3%	0.997	1.2±30%	47.49	50±20%	-	-	3-24
	100(FW)	-171.4	170±3%	0.997	1.2±30%	47.54	50±20%	-	-	3-25
	100(FW)	-170.6	170±3%	0.991	1.2±30%	47.63	50±20%	-	-	3-26
	100(FW)	-170.8	170±3%	0.997	1.2±30%	47.55	50±20%	-	-	3-27
	100(FW)	-171.1	170±3%	0.991	1.2±30%	47.60	50±20%	-	-	3-28
	100(FW)	-171.0	170±3%	0.997	1.2±30%	47.62	50±20%	-	-	3-29
	100(FW)	-170.7	170±3%	1.01	1.2±30%	47.59	50±20%	-	-	3-30
Supplementary information:										
T_1	Time to peak ±30%									
T_2	Time to half ±20%									
Meas.	Measured value									
Req.	Required value									
VD:	Voltage Waveform from Voltage divider									
FW:	Full wave									

Table 2.7.3.1. LI test between phase- a to phase-b&c and earthing conductor										
Phase	% of full Impluse	Applied voltage	Requir- ed voltage	Waveshape						Waveform number
				T_1		T_2		T_c		
		Peak	Peak	Meas.	Req.	Meas.	Req.	Meas.	Req.	Table
		[kV]	[kV]	[μs]	[μs]	[μs]	[μs]	[μs]	[μs]	VD
a	100(FW)	14.8	14.8±3%	1.33	1.2±30%	52.19	50±20%	-	-	4-1
	100(FW)	14.8	14.8±3%	1.35	1.2±30%	52.21	50±20%	-	-	4-2
	100(FW)	14.8	14.8±3%	1.38	1.2±30%	52.39	50±20%	-	-	4-3
	100(FW)	-14.7	14.8±3%	1.30	1.2±30%	50.95	50±20%	-	-	4-4
	100(FW)	-14.7	14.8±3%	1.28	1.2±30%	50.72	50±20%	-	-	4-5
	100(FW)	-14.7	14.8±3%	1.27	1.2±30%	50.53	50±20%	-	-	4-6
Supplementary information: T_1 Time to peak ±30% T_2 Time to half ±20% Meas. Measured value Req. Required value VD: Voltage Waveform from Voltage divider FW: Full wave										

Table 2.7.3.2. LI test between phase- b to phase-a&c and earthing conductor										
Phase	% of full Impluse	Applied voltage	Requir- ed voltage	Waveshape						Waveform number
				T_1		T_2		T_c		
		Peak	Peak	Meas.	Req.	Meas.	Req.	Meas.	Req.	Table
		[kV]	[kV]	[μs]	[μs]	[μs]	[μs]	[μs]	[μs]	VD
b	100(FW)	14.8	14.8±3%	1.35	1.2±30%	51.22	50±20%	-	-	5-1
	100(FW)	14.9	14.8±3%	1.33	1.2±30%	52.12	50±20%	-	-	5-2
	100(FW)	14.7	14.8±3%	1.27	1.2±30%	50.50	50±20%	-	-	5-3
	100(FW)	-14.8	14.8±3%	1.29	1.2±30%	51.14	50±20%	-	-	5-4
	100(FW)	-14.7	14.8±3%	1.39	1.2±30%	53.21	50±20%	-	-	5-5
	100(FW)	-14.7	14.8±3%	1.31	1.2±30%	50.57	50±20%	-	-	5-6
Supplementary information: T_1 Time to peak ±30% T_2 Time to half ±20% Meas. Measured value Req. Required value VD: Voltage Waveform from Voltage divider FW: Full wave										

Table 2.7.3.3. LI test between phase- c to phase-a&b and earthing conductor

Phase	% of full Impluse	Applied voltage	Requir- ed voltage	Waveshape						Waveform number
				T_1		T_2		T_c		
		Peak	Peak	Meas.	Req.	Meas.	Req.	Meas.	Req.	Table
		[kV]	[kV]	[μs]	[μs]	[μs]	[μs]	[μs]	[μs]	VD
c	100(FW)	14.8	14.8±3%	1.27	1.2±30%	51.29	50±20%	-	-	6-1
	100(FW)	14.8	14.8±3%	1.34	1.2±30%	51.11	50±20%	-	-	6-2
	100(FW)	14.9	14.8±3%	1.30	1.2±30%	51.23	50±20%	-	-	6-3
	100(FW)	-14.7	14.8±3%	1.35	1.2±30%	52.24	50±20%	-	-	6-4
	100(FW)	-14.7	14.8±3%	1.32	1.2±30%	51.36	50±20%	-	-	6-5
	100(FW)	-14.8	14.8±3%	1.33	1.2±30%	51.39	50±20%	-	-	6-6
Supplementary information: T_1 Time to peak ±30% T_2 Time to half ±20% Meas. Measured value Req. Required value VD: Voltage Waveform from Voltage divider FW: Full wave										

2.7.4. Measured value of creepage distances of Low voltage interconnections

2.7.4. Creepage distances value of Low voltage interconnections			
Measured parts	Required value	Measured value	Verdict
	[mm]	[mm]	
Between phases	≥ 16	124.42	P
Between live parts and exposed conductive parts	≥ 16	62.21	P
Supplement information: N/A			

2.8. Test waveform

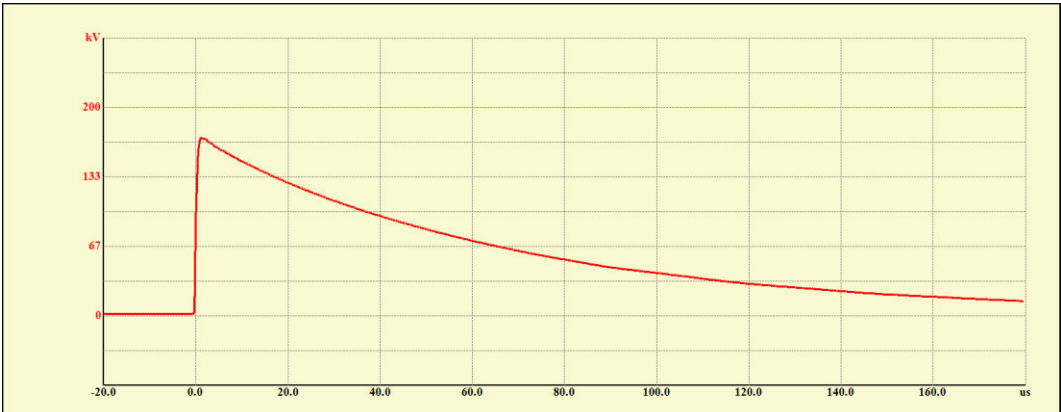
Table 2.8.1.1. Test waveform on HV / Phase: A (Positive polarity)		Nr.
 CH1 Up = 169.5 kV T1 = 997 ns T2 = 47.64 us		1-1
Supplement information: N/A		

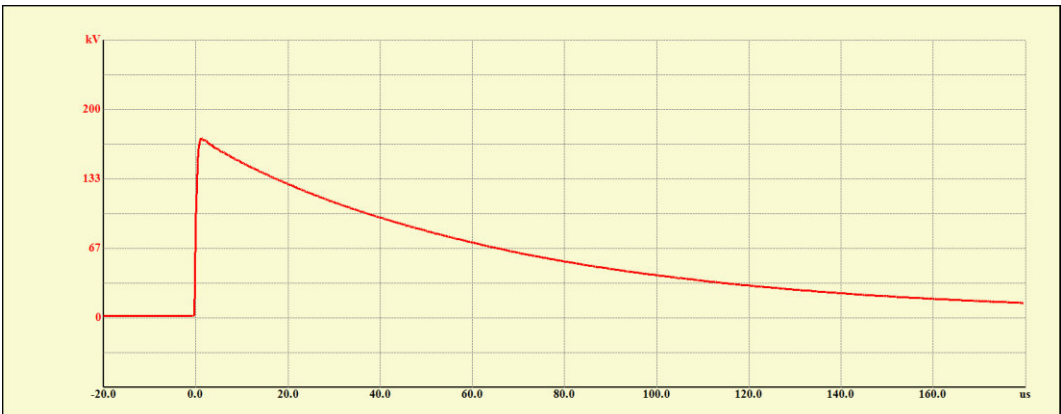
Table 2.8.1.2. Test waveform on HV / Phase: A (Positive polarity)		Nr.
 CH1 Up = 170.7 kV T1 = 985 ns T2 = 47.51 us		1-2
Supplement information: N/A		

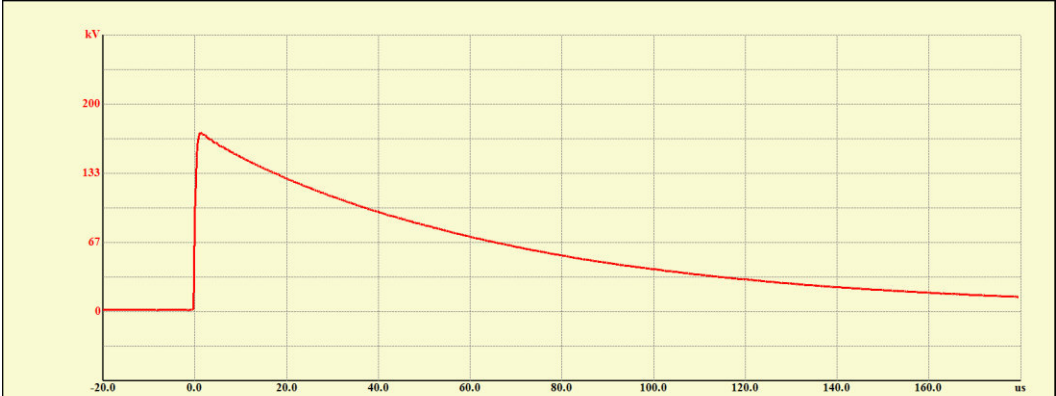
Table 2.8.1.3. Test waveform on HV / Phase: A (Positive polarity)		Nr.
 CHI Up = 170.5 kV T1 = 985 ns T2 = 47.48 us		1-3
Supplement information: N/A		

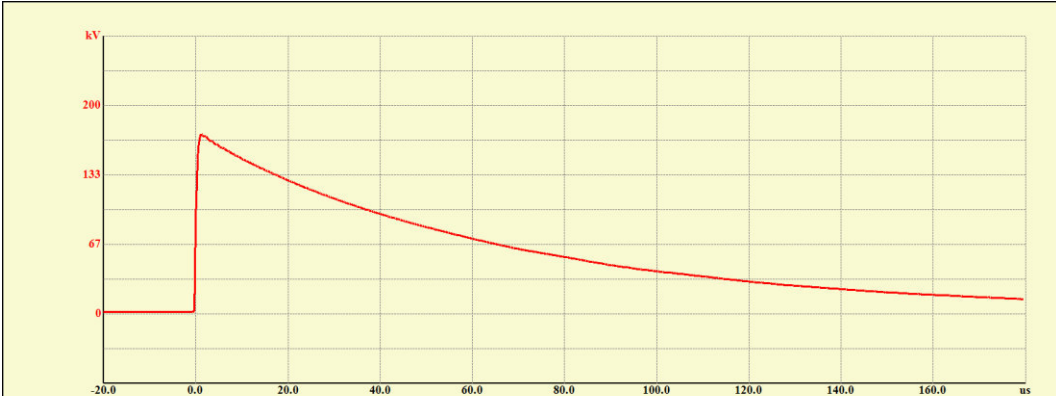
Table 2.8.1.4. Test waveform on HV / Phase: A (Positive polarity)		Nr.
 CHI Up = 170.3 kV T1 = 991 ns T2 = 47.49 us		1-4
Supplement information: N/A		

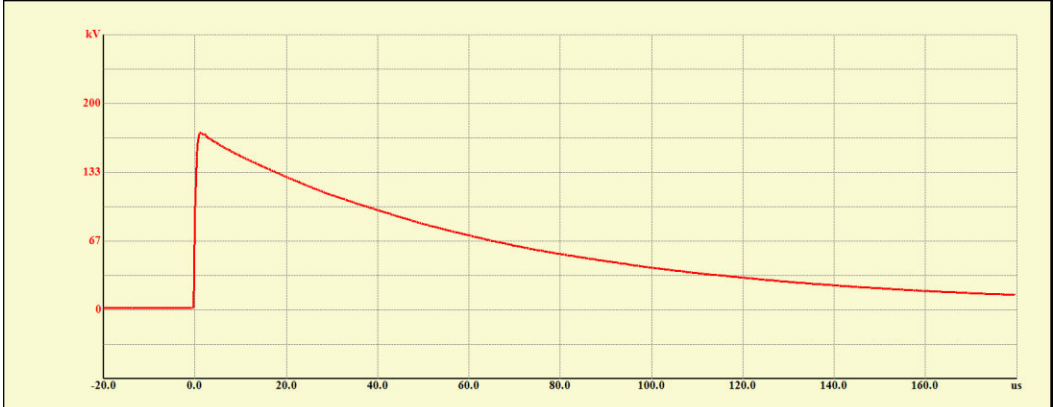
Table 2.8.1.5. Test waveform on HV / Phase: A (Positive polarity)	Nr.
 CH1 Up = 170.0 kV T1 = 985 ns T2 = 47.82 us	1-5
Supplement information: N/A	

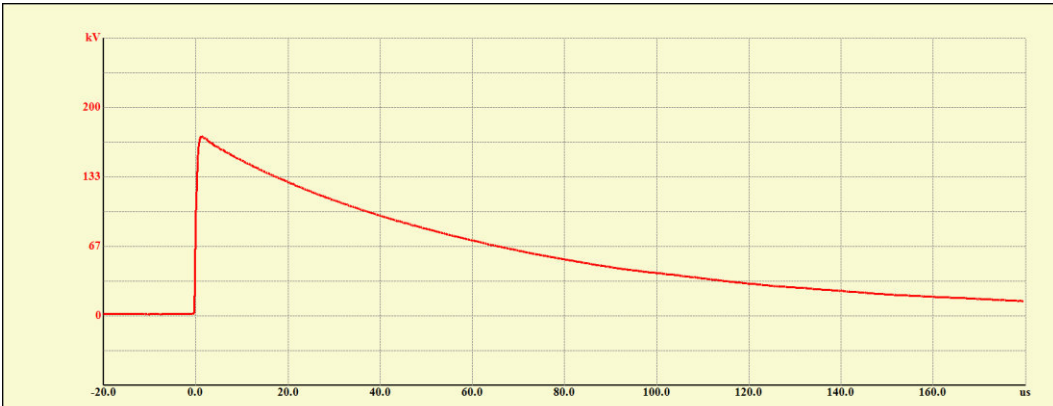
Table 2.8.1.6. Test waveform on HV / Phase: A (Positive polarity)	Nr.
 CH1 Up = 170.5 kV T1 = 985 ns T2 = 47.66 us	1-6
Supplement information: N/A	

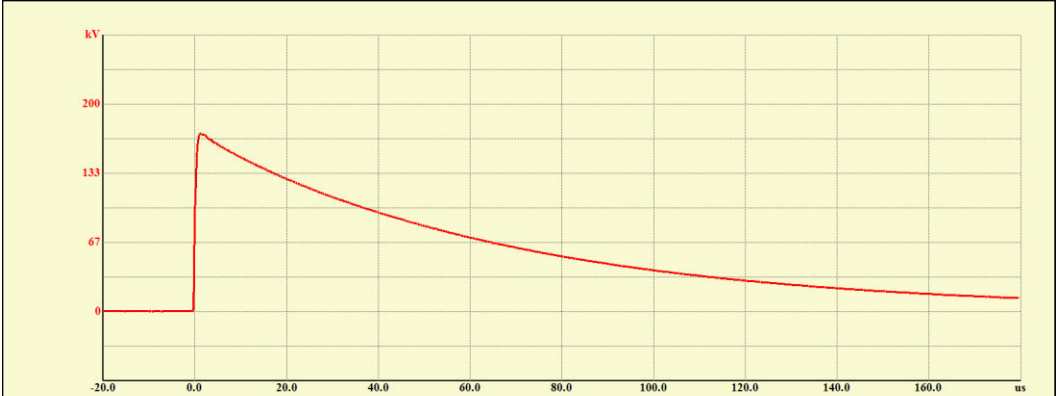
Table 2.8.1.7. Test waveform on HV / Phase: A (Positive polarity)		Nr.
 CHI Up = 171.6 kV T1 = 985 ns T2 = 47.6 us		1-7
Supplement information: N/A		

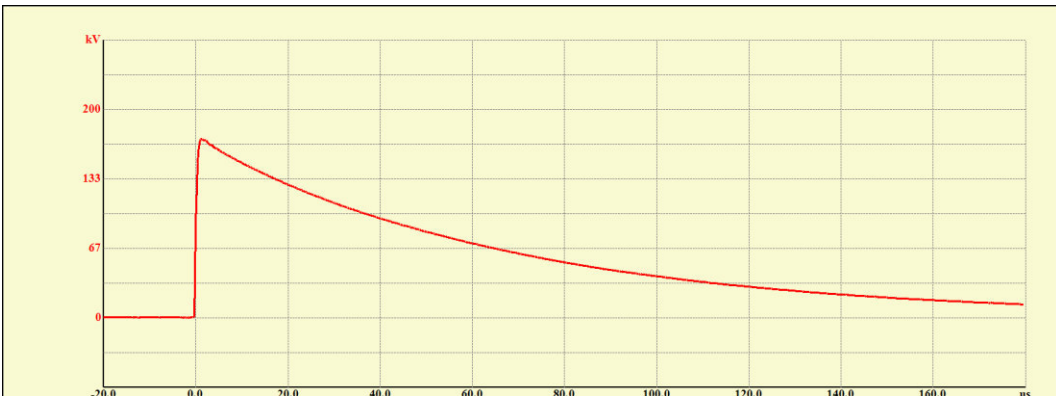
Table 2.8.1.8. Test waveform on HV / Phase: A (Positive polarity)		Nr.
 CHI Up = 171.7 kV T1 = 991 ns T2 = 47.56 us		1-8
Supplement information: N/A		

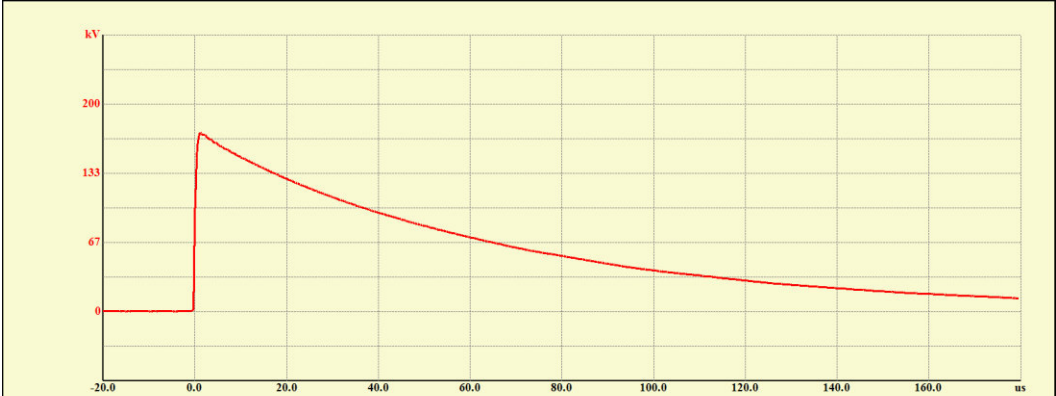
Table 2.8.1.9. Test waveform on HV / Phase: A (Positive polarity)		Nr.
 CHI Up = 171.7 kV T1 = 991 ns T2 = 47.58 us		1-9
Supplement information: N/A		

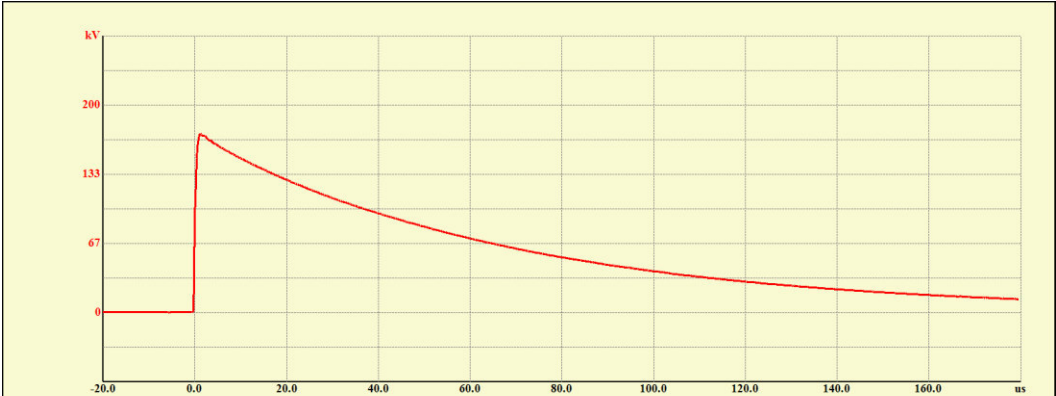
Table 2.8.1.10. Test waveform on HV / Phase: A (Positive polarity)		Nr.
 CHI Up = 171.7 kV T1 = 985 ns T2 = 47.66 us		1-10
Supplement information: N/A		

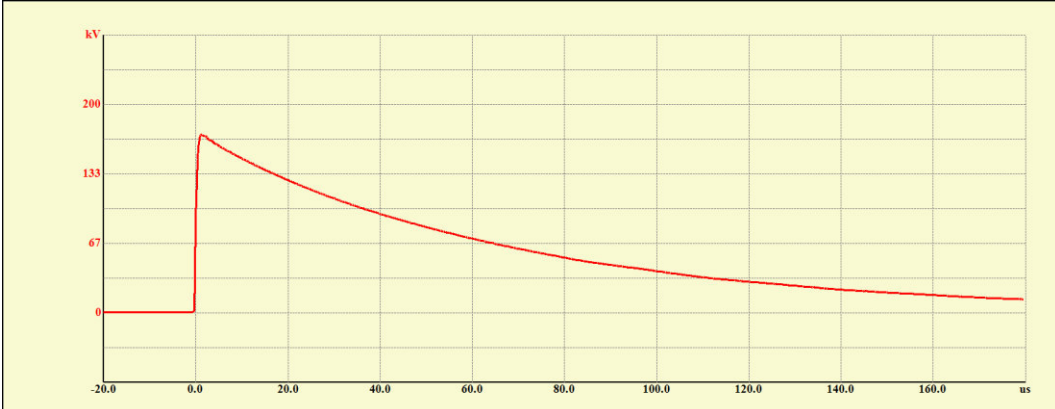
Table 2.8.1.11. Test waveform on HV / Phase: A (Positive polarity)	Nr.
 CHI Up = 170.9 kV T1 = 991 ns T2 = 47.51 us	1-11
Supplement information: N/A	

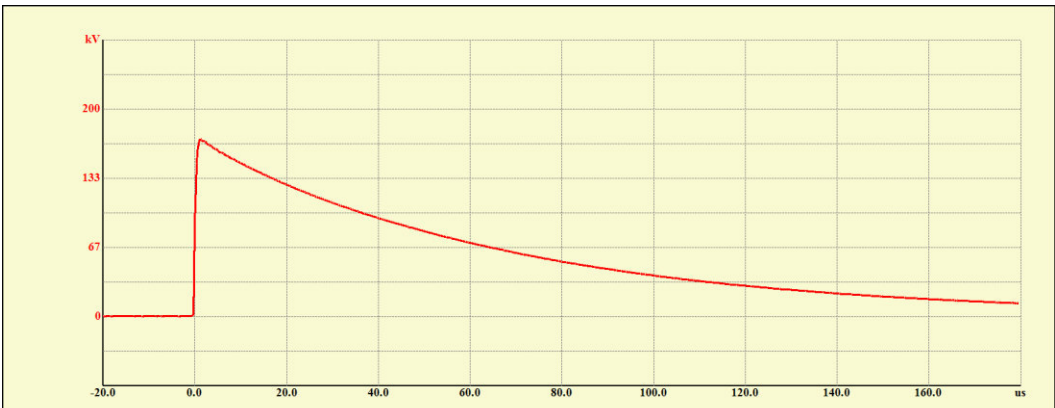
Table 2.8.1.12. Test waveform on HV / Phase: A (Positive polarity)	Nr.
 CHI Up = 170.5 kV T1 = 991 ns T2 = 47.69 us	1-12
Supplement information: N/A	

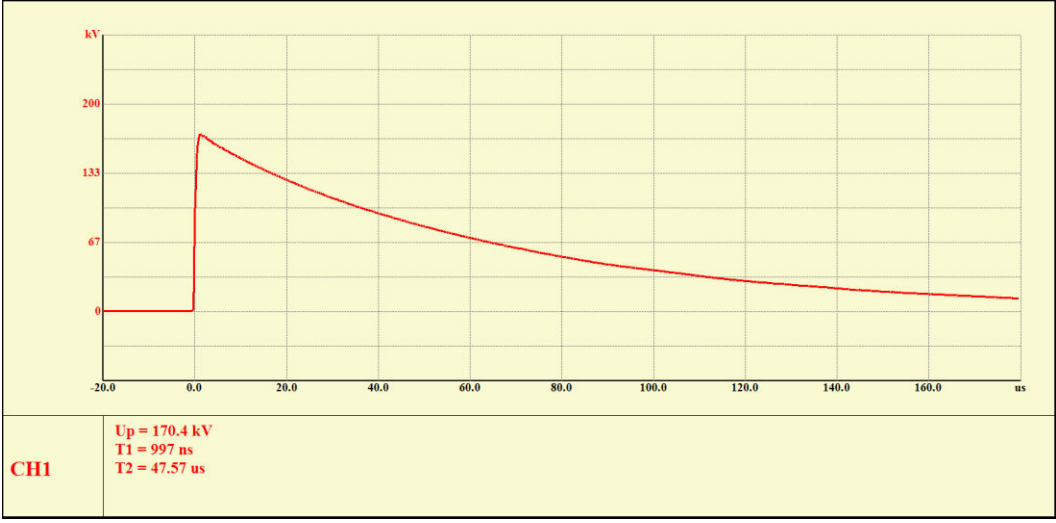
Table 2.8.1.13. Test waveform on HV / Phase: A (Positive polarity)		Nr.
		1-13
Supplement information: N/A		

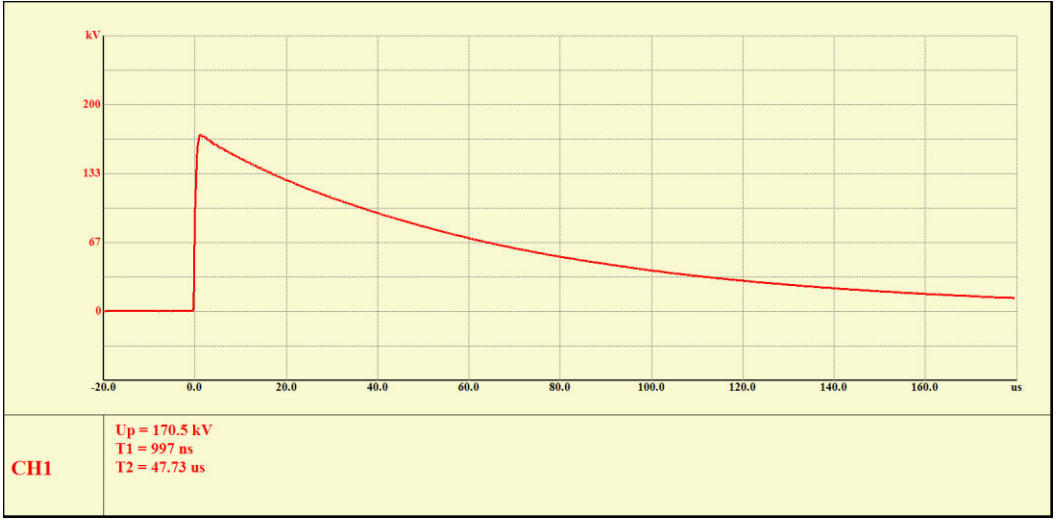
Table 2.8.1.14. Test waveform on HV / Phase: A (Positive polarity)		Nr.
		1-14
Supplement information: N/A		

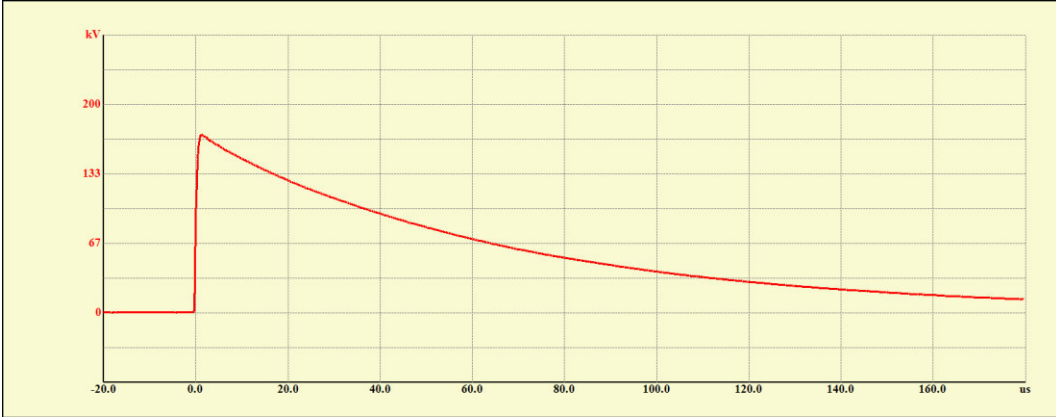
Table 2.8.1.15. Test waveform on HV / Phase: A (Positive polarity)	Nr.
 CH1 Up = 170.5 kV T1 = 991 ns T2 = 47.75 us	1-15
Supplement information: N/A	

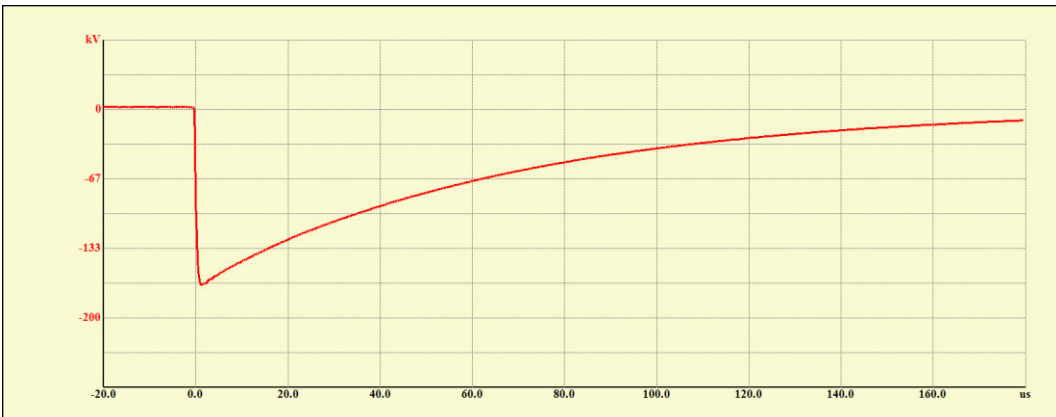
Table 2.8.1.16. Test waveform on HV / Phase: A (Negative polarity)	Nr.
 CH1 Up = -171.0 kV T1 = 997 ns T2 = 47.75 us	1-16
Supplement information: N/A	

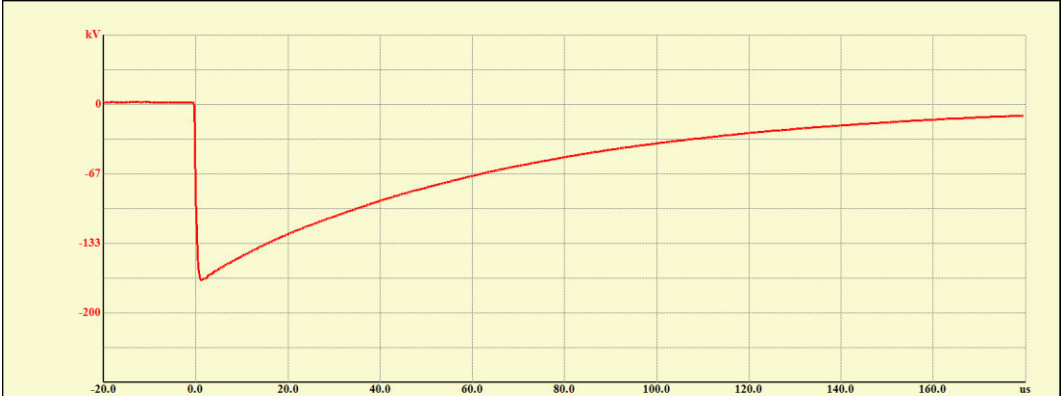
Table 2.8.1.17. Test waveform on HV / Phase: A (Negative polarity)		Nr.
 CH1 Up = -170.9 kV T1 = 997 ns T2 = 47.5 us		1-17
Supplement information: N/A		

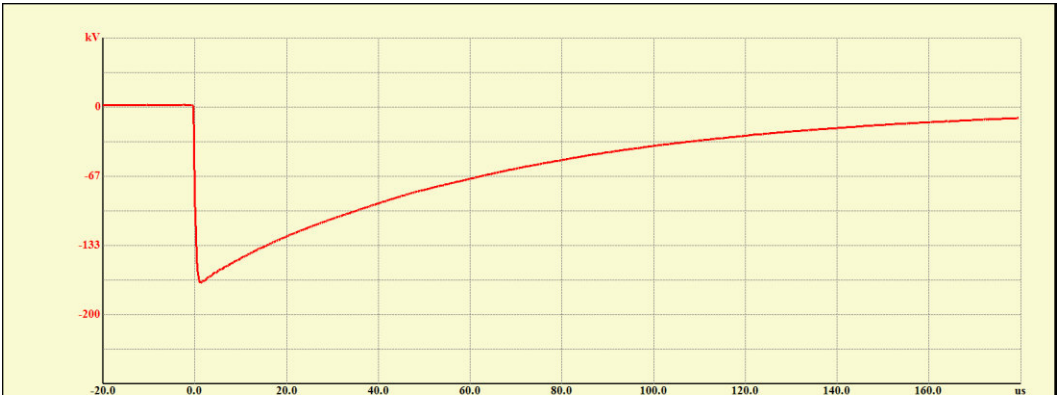
Table 2.8.1.18. Test waveform on HV / Phase: A (Negative polarity)		Nr.
 CH1 Up = -171.2 kV T1 = 997 ns T2 = 47.44 us		1-18
Supplement information: N/A		

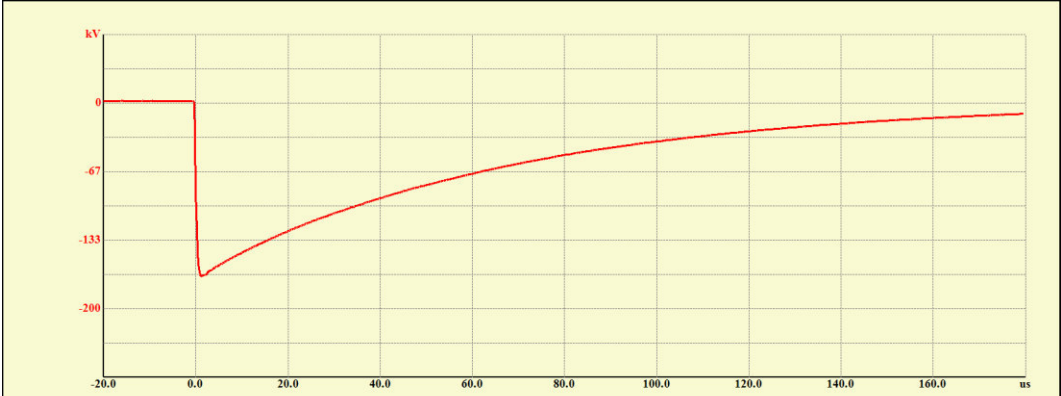
Table 2.8.1.19. Test waveform on HV / Phase: A (Negative polarity)		Nr.
 Up = -170.7 kV T1 = 991 ns T2 = 47.68 us CHI		1-19
Supplement information: N/A		

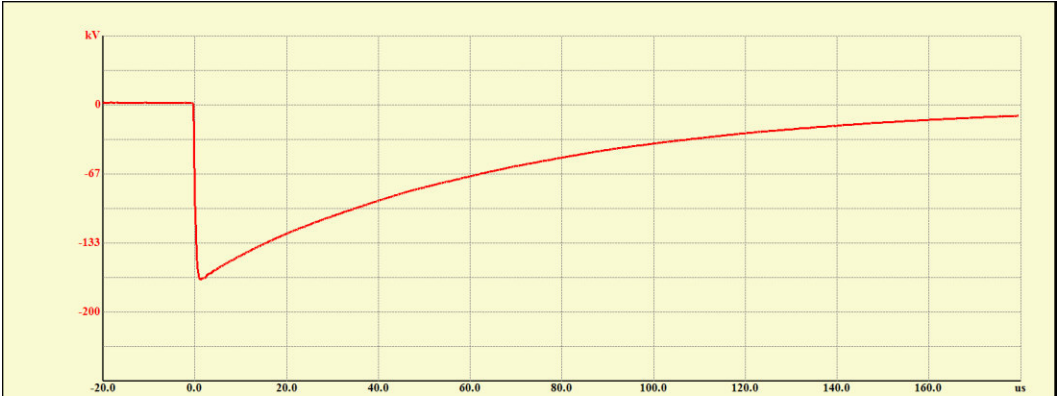
Table 2.8.1.20. Test waveform on HV / Phase: A (Negative polarity)		Nr.
 Up = -170.7 kV T1 = 991 ns T2 = 47.55 us CHI		1-20
Supplement information: N/A		

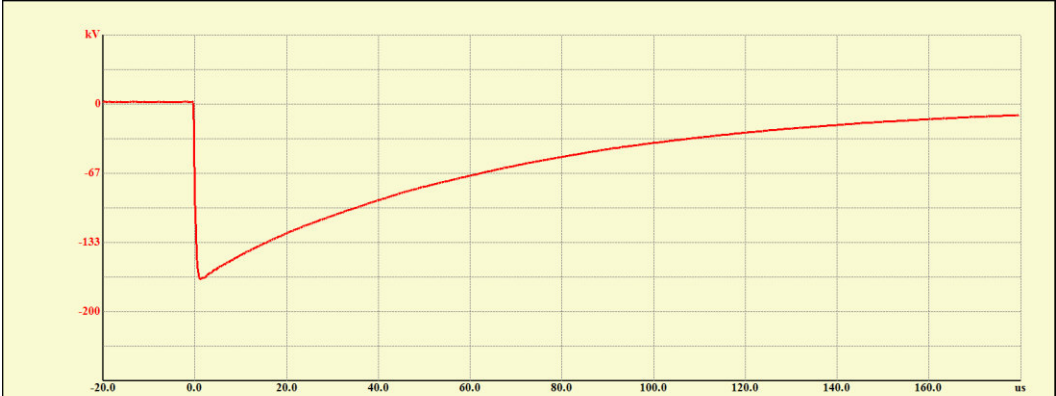
Table 2.8.1.21. Test waveform on HV / Phase: A (Negative polarity)		Nr.
 CHI Up = -171.0 kV T1 = 991 ns T2 = 47.55 us		1-21
Supplement information: N/A		

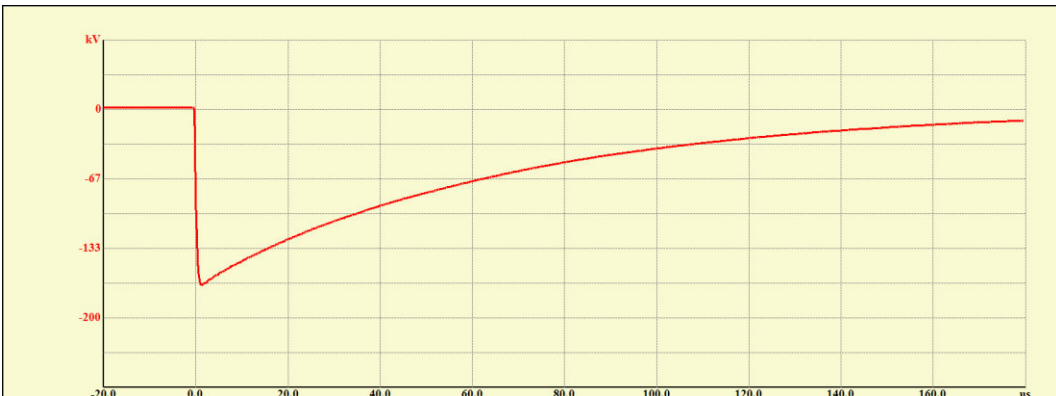
Table 2.8.1.22. Test waveform on HV / Phase: A (Negative polarity)		Nr.
 CHI Up = -170.4 kV T1 = 997 ns T2 = 47.72 us		1-22
Supplement information: N/A		

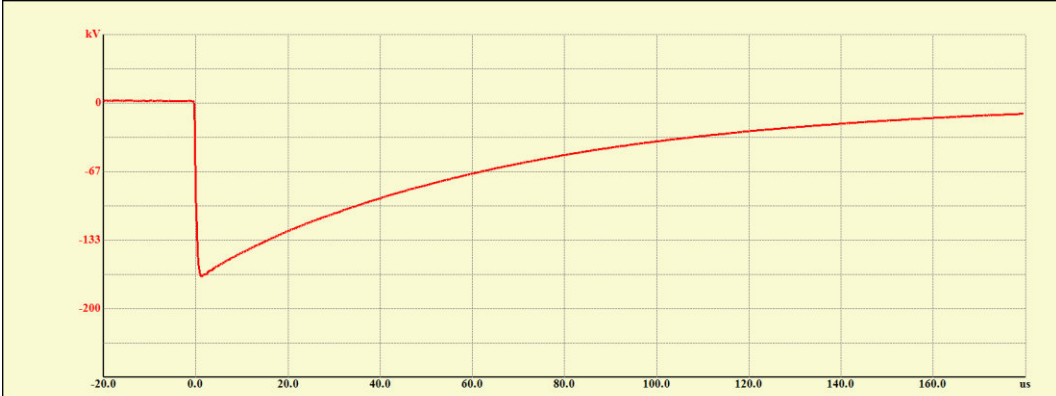
Table 2.8.1.23. Test waveform on HV / Phase: A (Negative polarity)	Nr.
 CHI Up = -170.8 kV T1 = 997 ns T2 = 47.66 us	1-23
Supplement information: N/A	

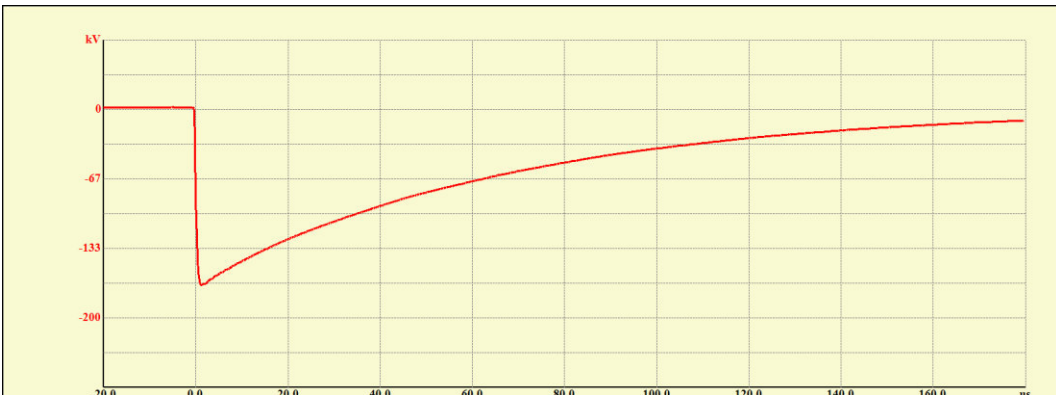
Table 2.8.1.24. Test waveform on HV / Phase: A (Negative polarity)	Nr.
 CHI Up = -170.8 kV T1 = 997 ns T2 = 47.48 us	1-24
Supplement information: N/A	

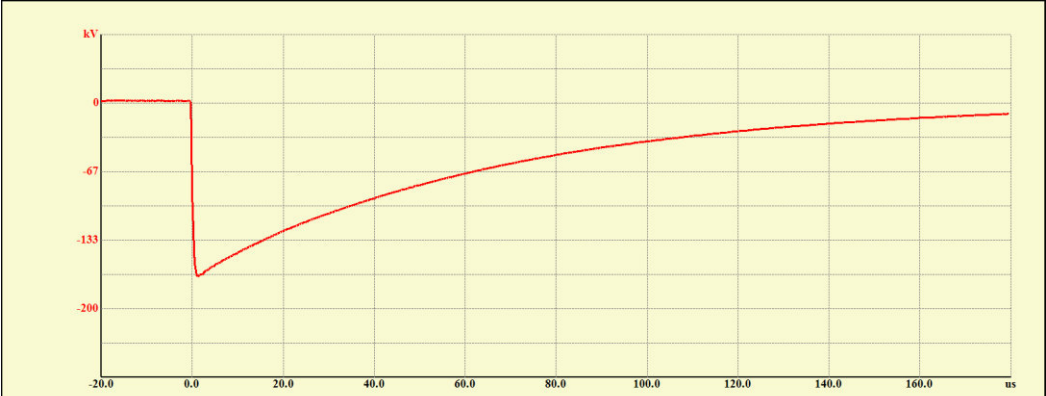
Table 2.8.1.25. Test waveform on HV / Phase: A (Negative polarity)	Nr.
 CH1 Up = -170.7 kV T1 = 997 ns T2 = 47.73 us	1-25
Supplement information: N/A	

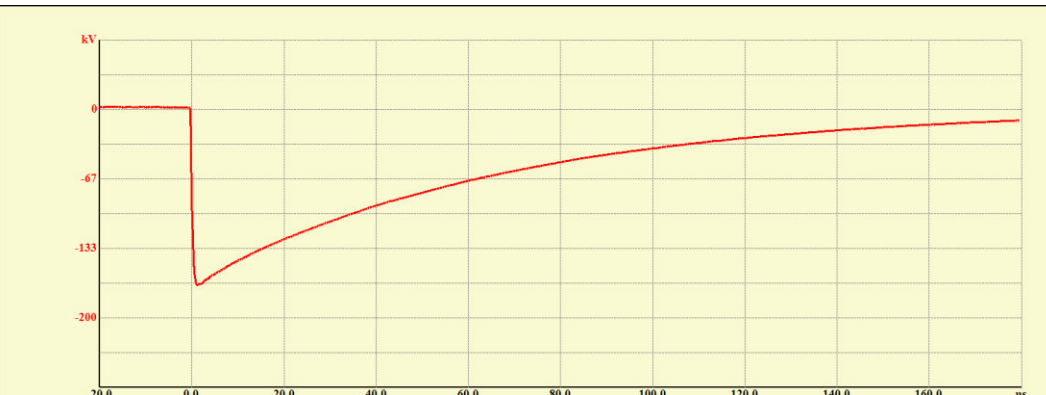
Table 2.8.1.26. Test waveform on HV / Phase: A (Negative polarity)	Nr.
 CH1 Up = -171.1 kV T1 = 997 ns T2 = 47.5 us	1-26
Supplement information: N/A	

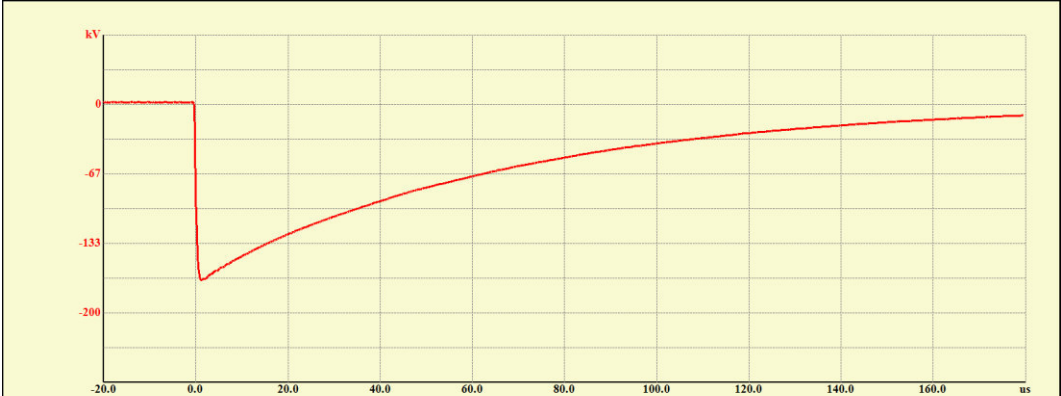
Table 2.8.1.27. Test waveform on HV / Phase: A (Negative polarity)		Nr.
 CHI Up = -171.0 kV T1 = 991 ns T2 = 47.6 us		1-27
Supplement information: N/A		

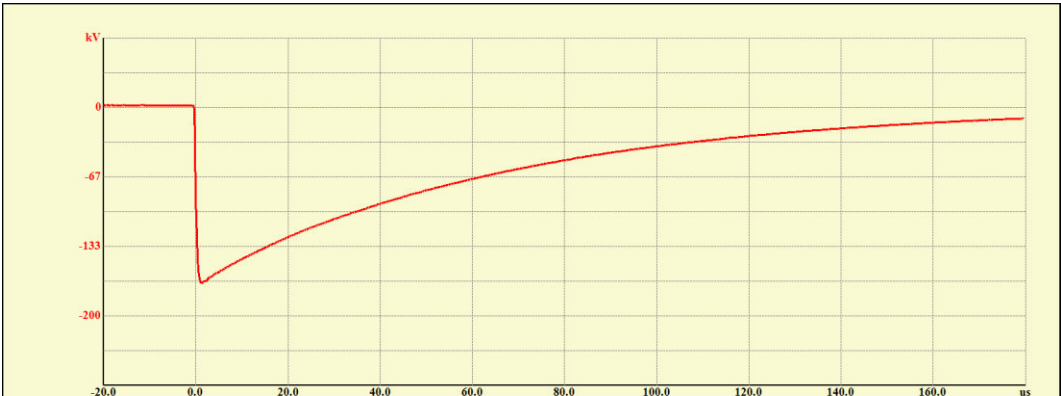
Table 2.8.1.28. Test waveform on HV / Phase: A (Negative polarity)		Nr.
 CHI Up = -170.7 kV T1 = 991 ns T2 = 47.61 us		1-28
Supplement information: N/A		

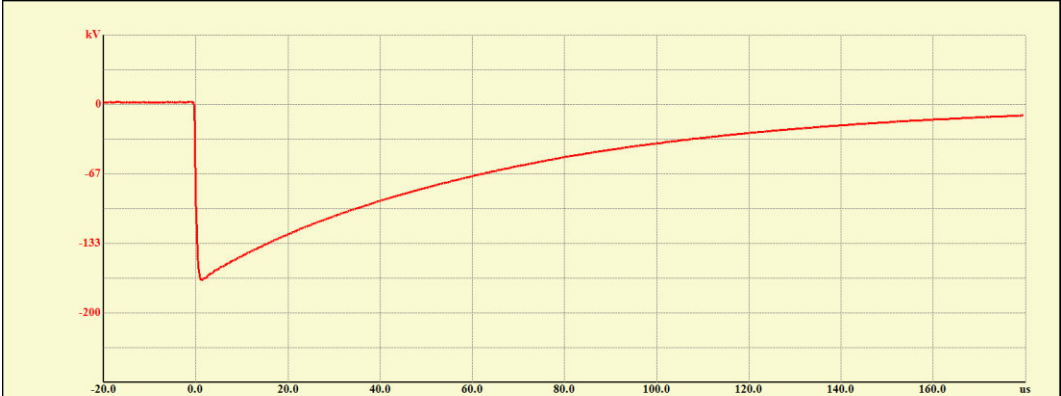
Table 2.8.1.29. Test waveform on HV / Phase: A (Negative polarity)		Nr.
 CH1 Up = -170.5 kV T1 = 997 ns T2 = 47.84 us		1-29
Supplement information: N/A		

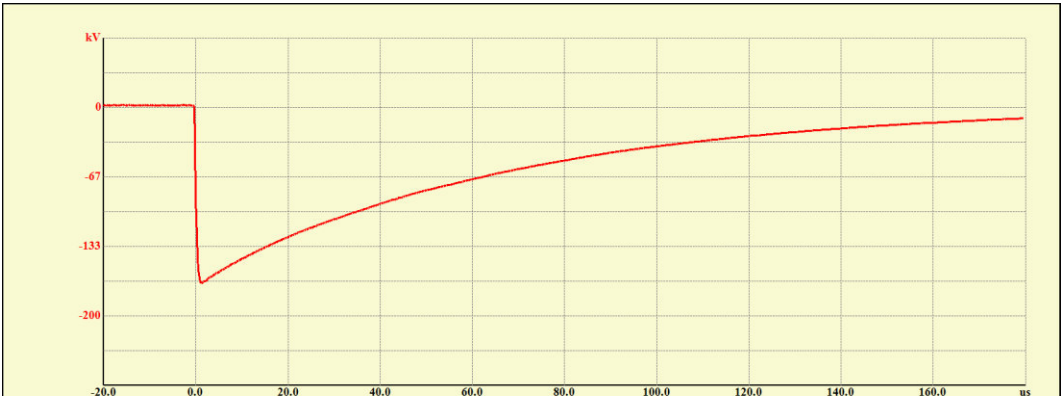
Table 2.8.1.30. Test waveform on HV / Phase: A (Negative polarity)		Nr.
 CH1 Up = -170.8 kV T1 = 1 us T2 = 47.55 us		1-30
Supplement information: N/A		

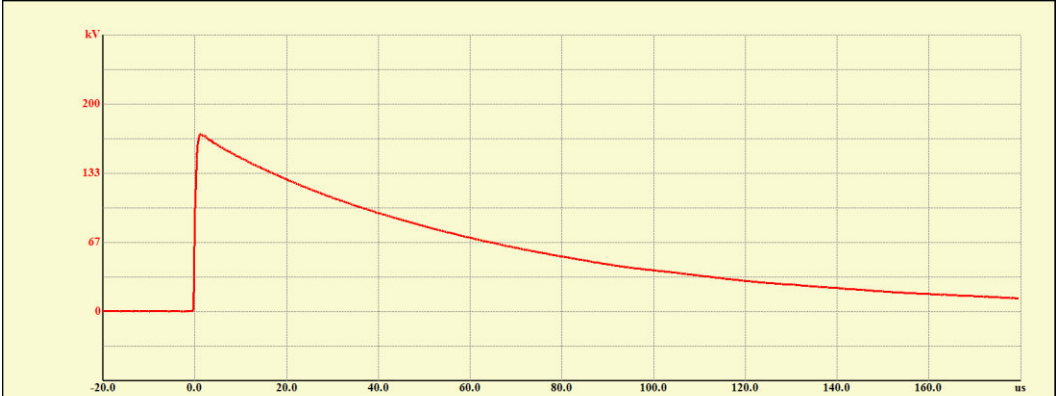
Table 2.8.2.1. Test waveform on HV / Phase: B (Positive polarity)		Nr.
 CH1 Up = 171.0 kV T1 = 1.01 us T2 = 47.62 us		2-1
Supplement information: N/A		

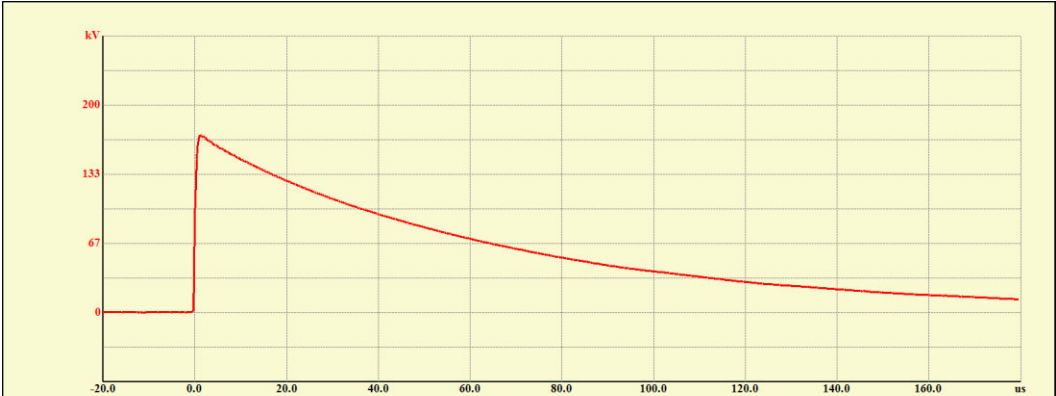
Table 2.8.2.2. Test waveform on HV / Phase: B (Positive polarity)		Nr.
 CH1 Up = 170.6 kV T1 = 991 ns T2 = 47.64 us		2-2
Supplement information: N/A		

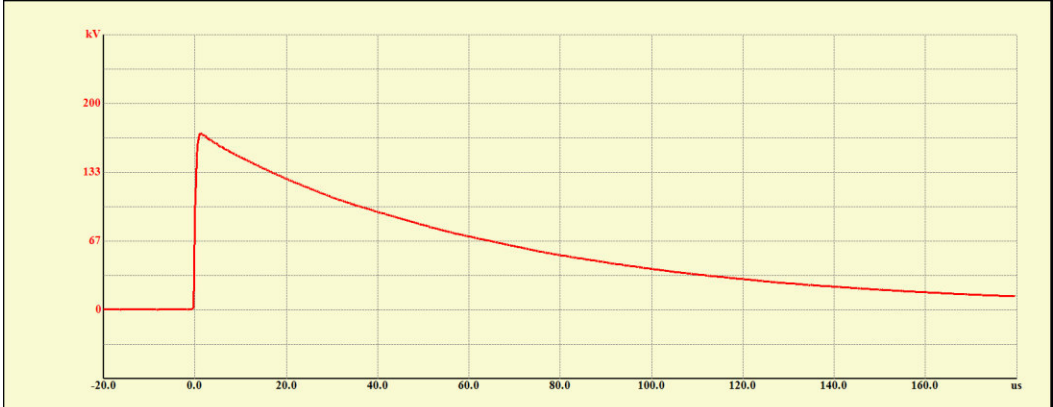
Table 2.8.2.3. Test waveform on HV / Phase: B (Positive polarity)	Nr.
 CH1 Up = 170.5 kV T1 = 985 ns T2 = 47.62 us	2-3
Supplement information: N/A	

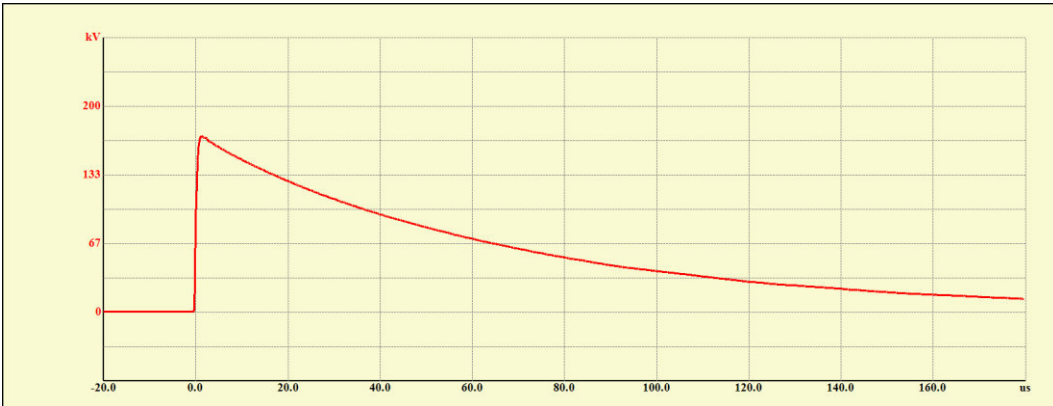
Table 2.8.2.4. Test waveform on HV / Phase: B (Positive polarity)	Nr.
 CH1 Up = 170.7 kV T1 = 991 ns T2 = 47.68 us	2-4
Supplement information: N/A	

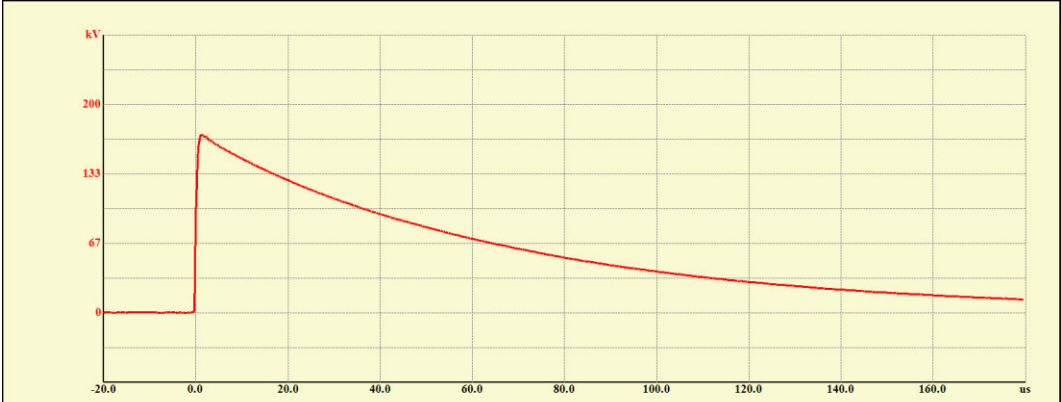
Table 2.8.2.5. Test waveform on HV / Phase: B (Positive polarity)		Nr.
 CHI Up = 170.8 kV T1 = 991 ns T2 = 47.57 us		2-5
Supplement information: N/A		

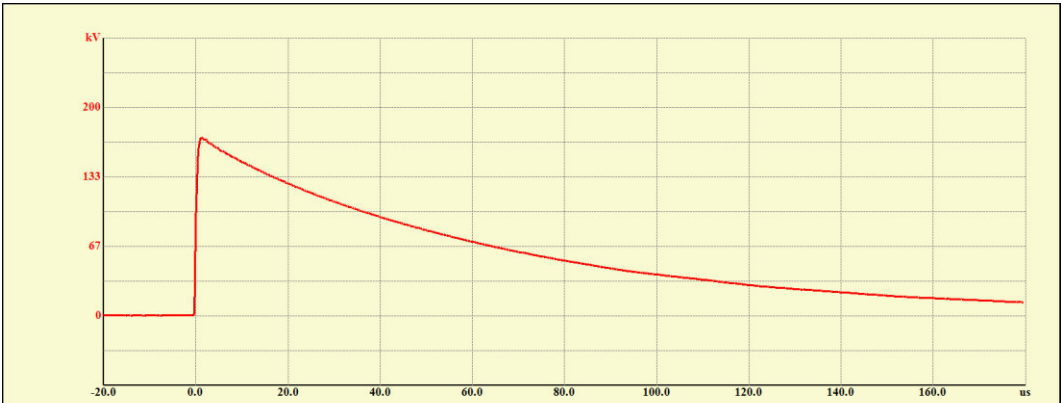
Table 2.8.2.6. Test waveform on HV / Phase: B (Positive polarity)		Nr.
 CHI Up = 170.8 kV T1 = 991 ns T2 = 47.55 us		2-6
Supplement information: N/A		

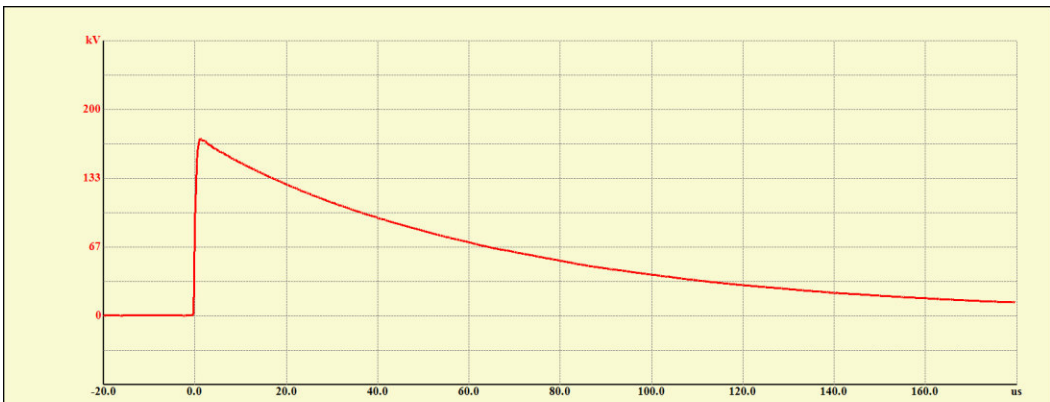
Table 2.8.2.7. Test waveform on HV / Phase: B (Positive polarity)		Nr.
 CH1 Up = 171.1 kV T1 = 997 ns T2 = 47.49 us		2-7
Supplement information: N/A		

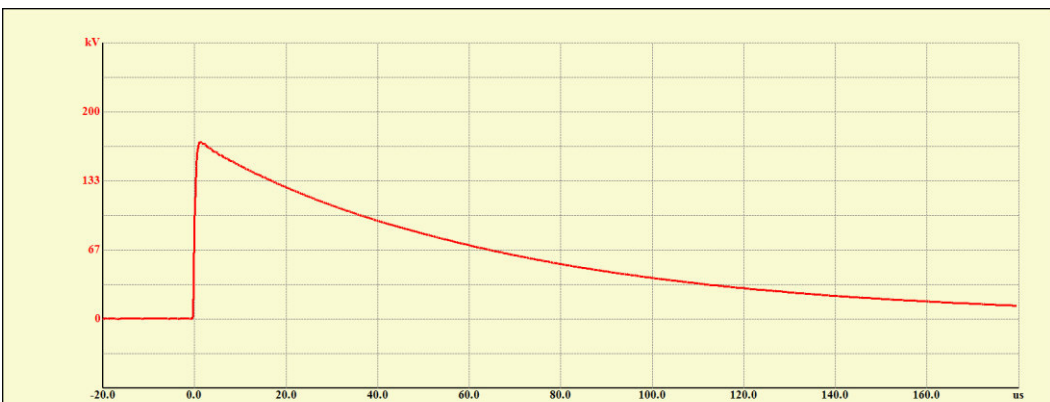
Table 2.8.2.8. Test waveform on HV / Phase: B (Positive polarity)		Nr.
 CH1 Up = 170.6 kV T1 = 997 ns T2 = 47.68 us		2-8
Supplement information: N/A		

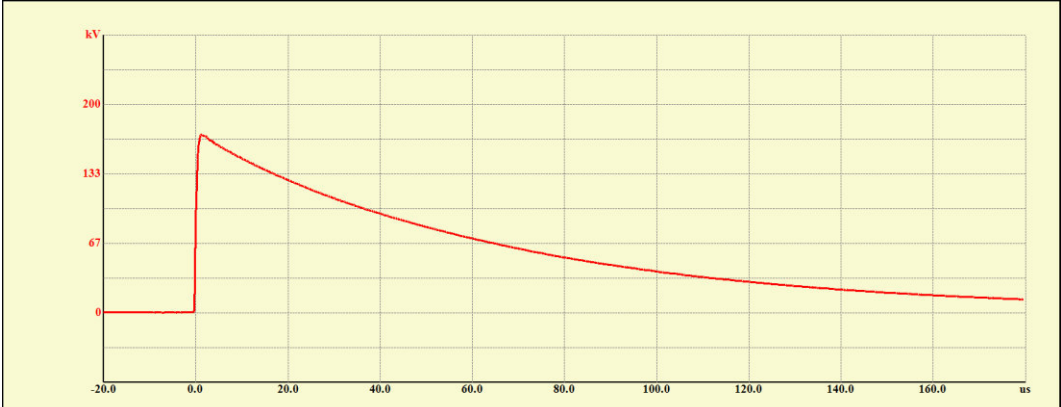
Table 2.8.2.9. Test waveform on HV / Phase: B (Positive polarity)		Nr.
 CH1 Up = 171.0 kV T1 = 997 ns T2 = 47.67 us		2-9
Supplement information: N/A		

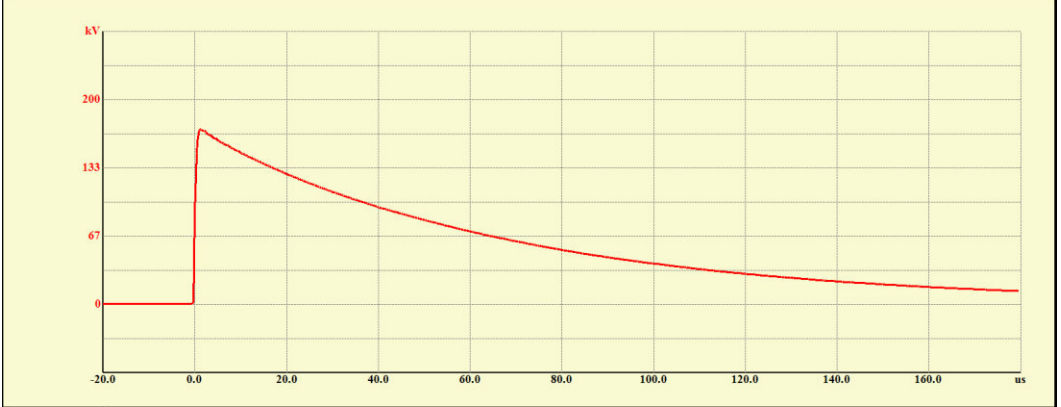
Table 2.8.2.10. Test waveform on HV / Phase: B (Positive polarity)		Nr.
 CH1 Up = 170.7 kV T1 = 985 ns T2 = 47.71 us		2-10
Supplement information: N/A		

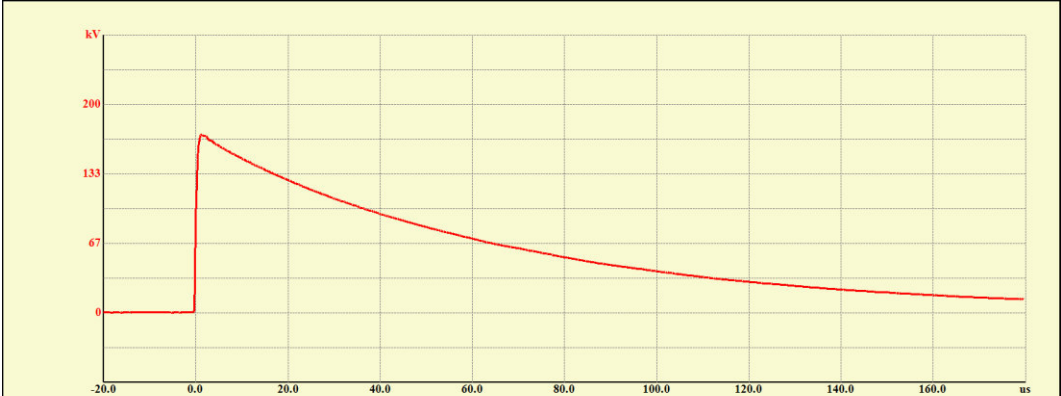
Table 2.8.2.11. Test waveform on HV / Phase: B (Positive polarity)		Nr.
 CH1 Up = 170.9 kV T1 = 997 ns T2 = 47.57 us		2-11
Supplement information: N/A		

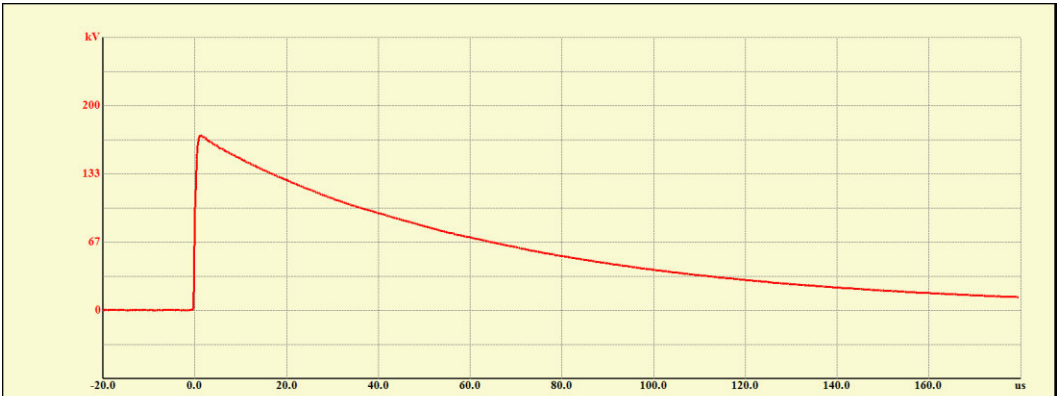
Table 2.8.2.12. Test waveform on HV / Phase: B (Positive polarity)		Nr.
 CH1 Up = 170.5 kV T1 = 991 ns T2 = 47.73 us		2-12
Supplement information: N/A		

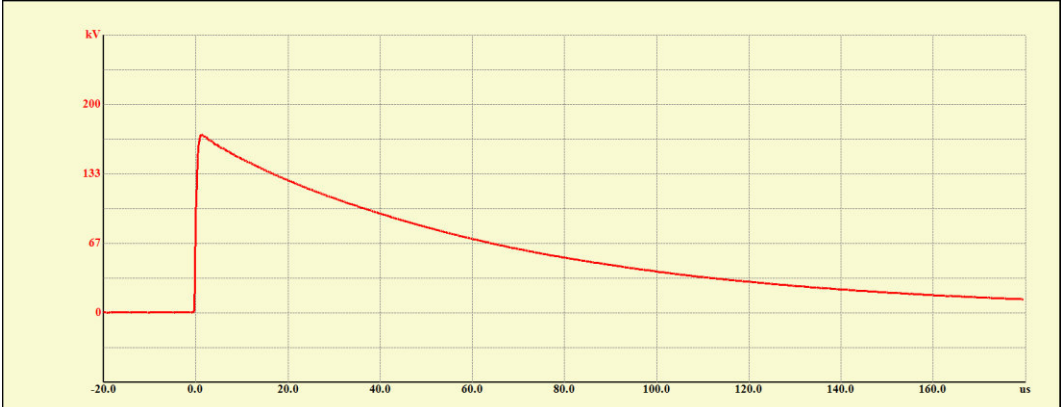
Table 2.8.2.13. Test waveform on HV / Phase: B (Positive polarity)		Nr.
 CHI Up = 170.5 kV T1 = 991 ns T2 = 47.82 us		2-13
Supplement information: N/A		

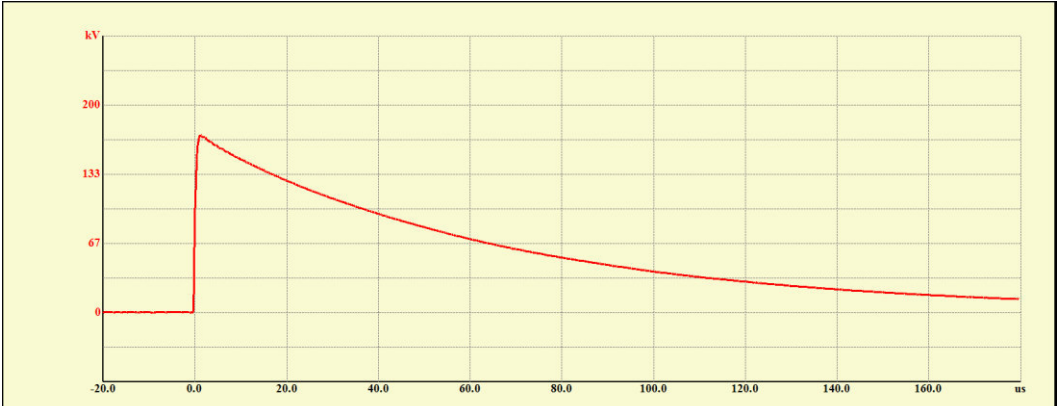
Table 2.8.2.14. Test waveform on HV / Phase: B (Positive polarity)		Nr.
 CHI Up = 170.5 kV T1 = 985 ns T2 = 47.82 us		2-14
Supplement information: N/A		

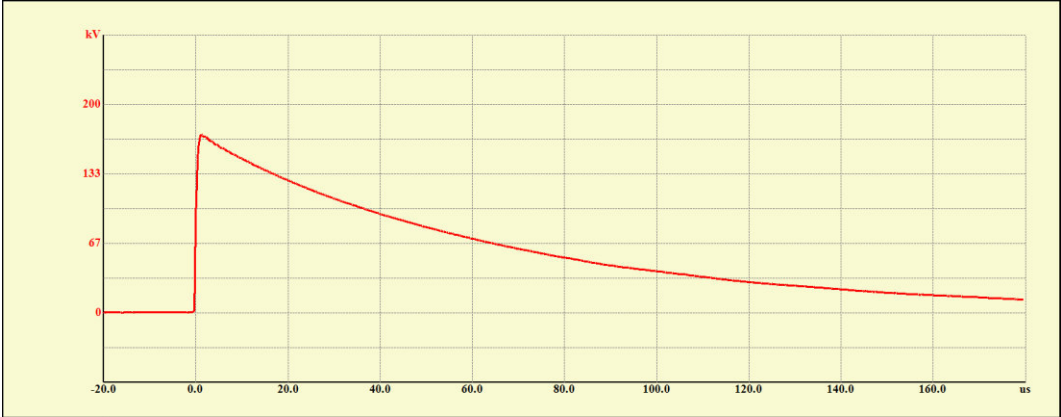
Table 2.8.2.15. Test waveform on HV / Phase: B (Positive polarity)		Nr.
 CH1 Up = 170.6 kV T1 = 997 ns T2 = 47.7 us		2-15
Supplement information: N/A		

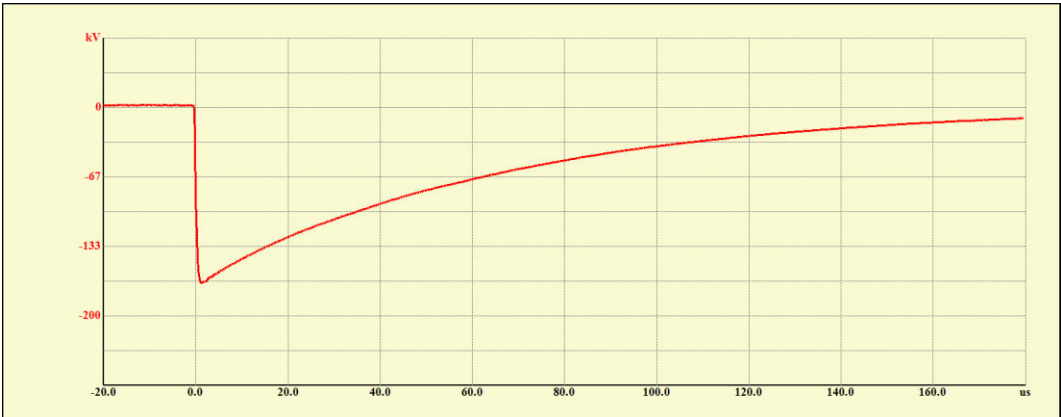
Table 2.8.2.16. Test waveform on HV / Phase: B (Negative polarity)		Nr.
 CH1 Up = -170.9 kV T1 = 997 ns T2 = 47.54 us		2-16
Supplement information: N/A		

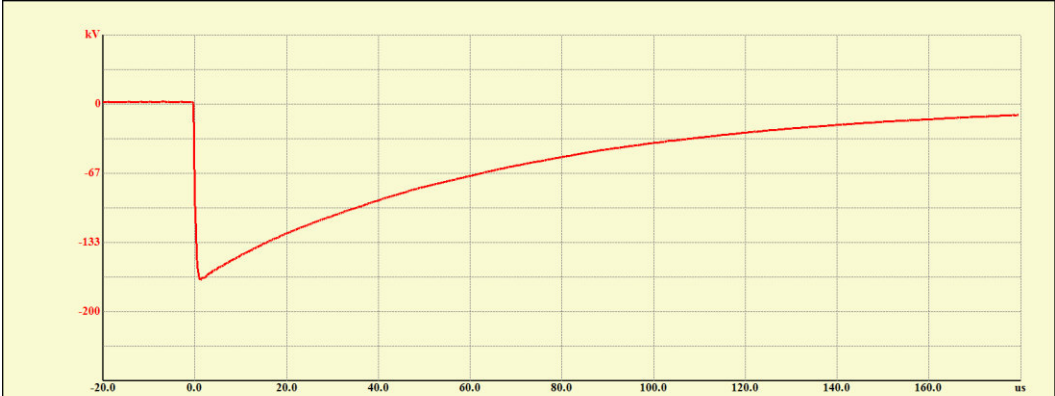
Table 2.8.2.17. Test waveform on HV / Phase: B (Negative polarity)		Nr.
 CHI Up = -171.2 kV T1 = 1.01 us T2 = 47.6 us		2-17
Supplement information: N/A		

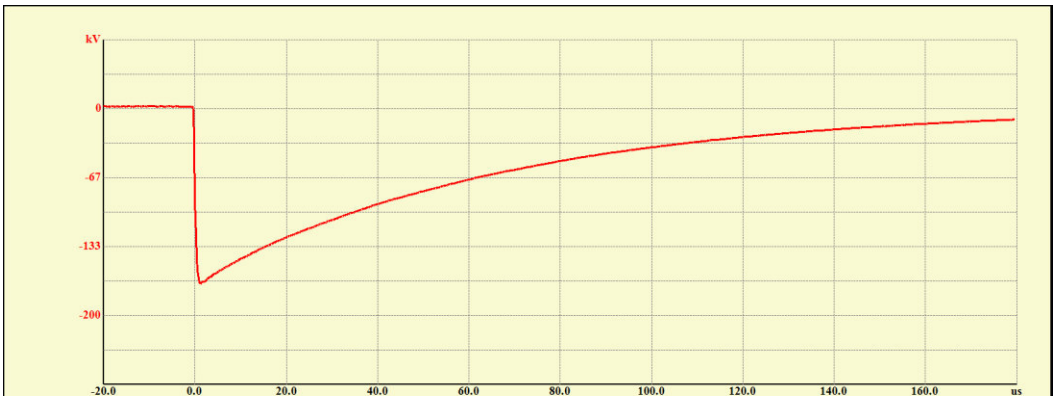
Table 2.8.2.18. Test waveform on HV / Phase: B (Negative polarity)		Nr.
 CHI Up = -171.1 kV T1 = 1 us T2 = 47.49 us		2-18
Supplement information: N/A		

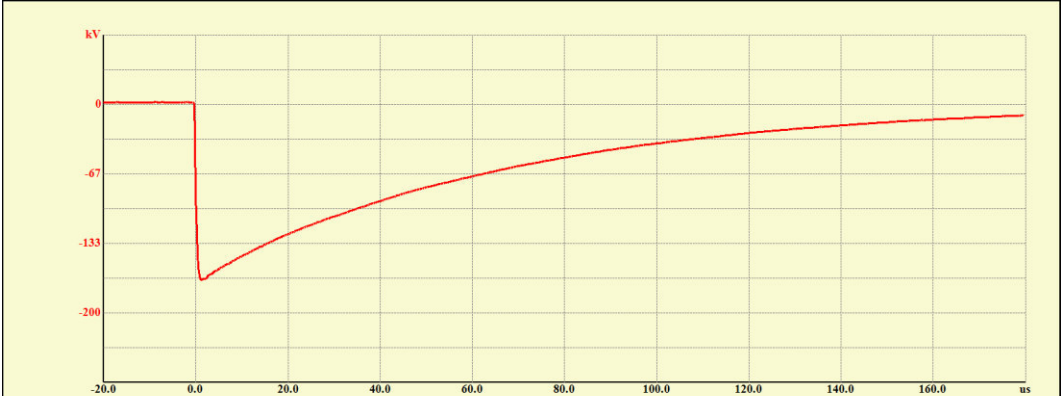
Table 2.8.2.19. Test waveform on HV / Phase: B (Negative polarity)		Nr.
 CHI Up = -171.0 kV T1 = 1 us T2 = 47.51 us		2-19
Supplement information: N/A		

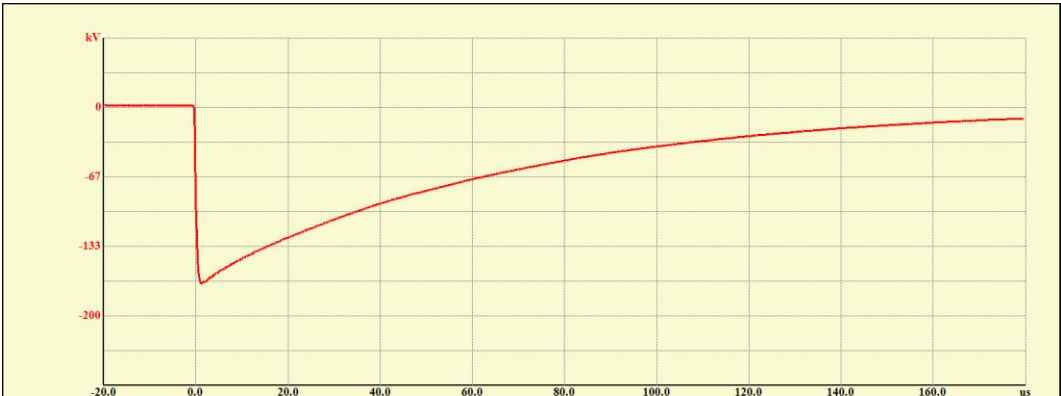
Table 2.8.2.20. Test waveform on HV / Phase: B (Negative polarity)		Nr.
 CHI Up = -171.1 kV T1 = 991 ns T2 = 47.4 us		2-20
Supplement information: N/A		

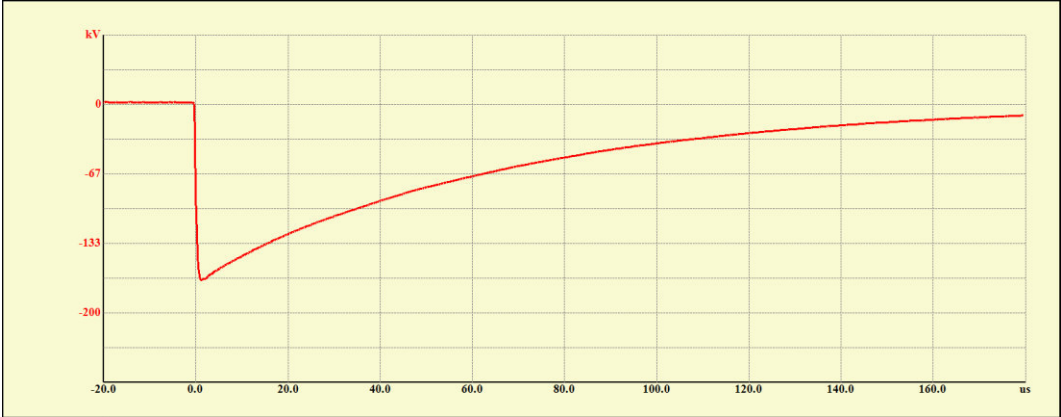
Table 2.8.2.21. Test waveform on HV / Phase: B (Negative polarity)		Nr.
 CH1 Up = -171.0 kV T1 = 991 ns T2 = 47.52 us		2-21
Supplement information: N/A		

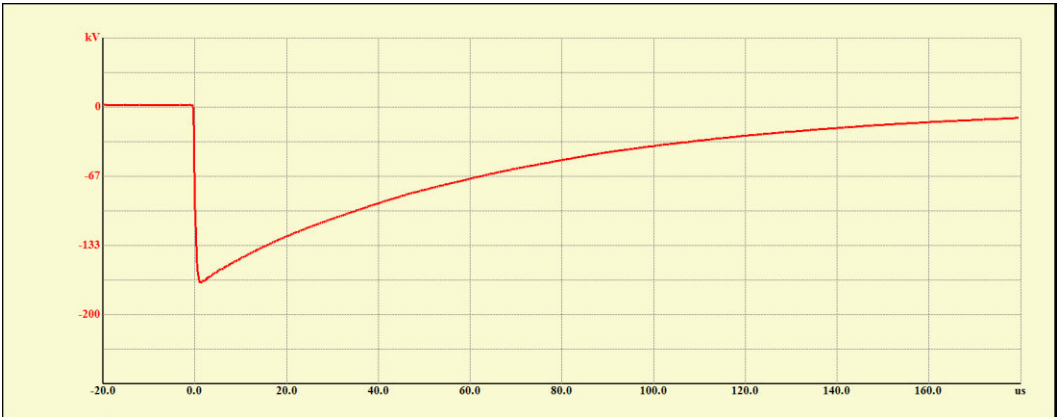
Table 2.8.2.22. Test waveform on HV / Phase: B (Negative polarity)		Nr.
 CH1 Up = -171.2 kV T1 = 997 ns T2 = 47.5 us		2-22
Supplement information: N/A		

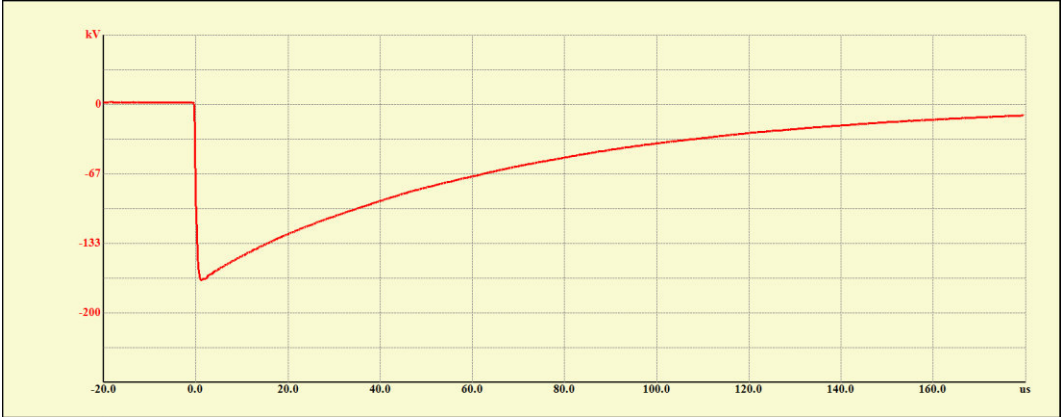
Table 2.8.2.23. Test waveform on HV / Phase: B (Negative polarity)		Nr.
 CHI Up = -171.0 kV T1 = 997 ns T2 = 47.51 us		2-23
Supplement information: N/A		

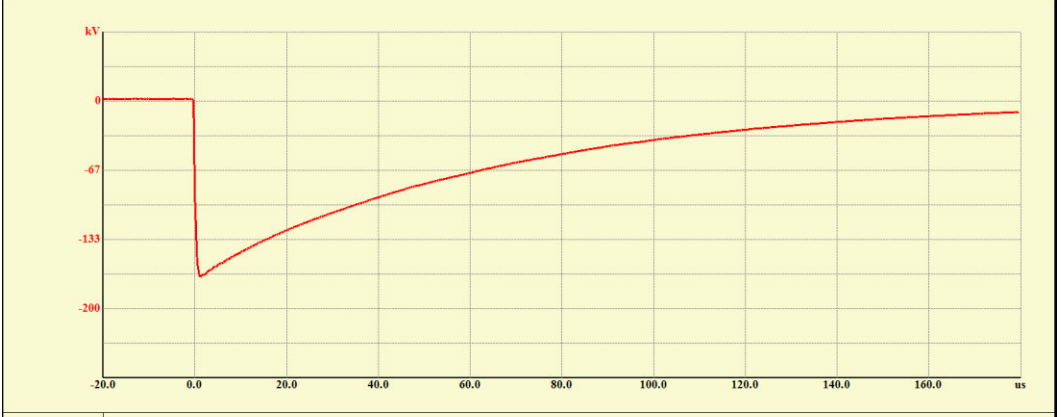
Table 2.8.2.24. Test waveform on HV / Phase: B (Negative polarity)		Nr.
 CHI Up = -171.0 kV T1 = 997 ns T2 = 47.62 us		2-24
Supplement information: N/A		

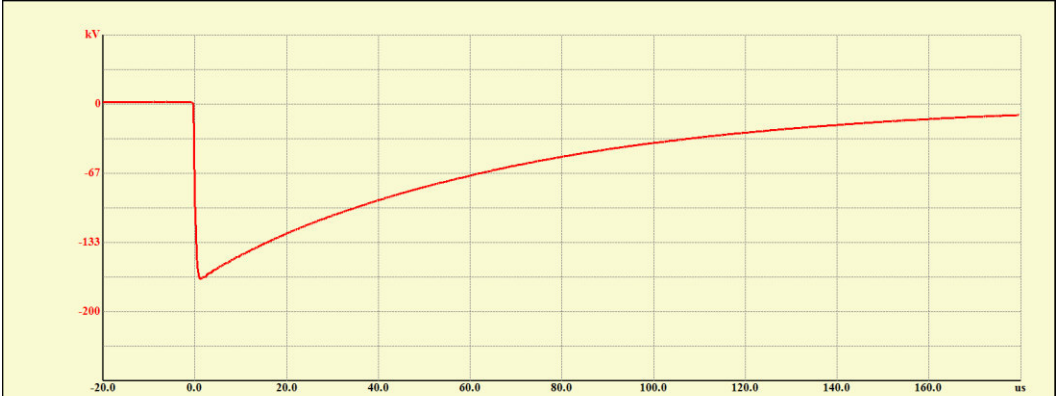
Table 2.8.2.25. Test waveform on HV / Phase: B (Negative polarity)		Nr.
 CHI Up = -170.8 kV T1 = 997 ns T2 = 47.69 us		2-25
Supplement information: N/A		

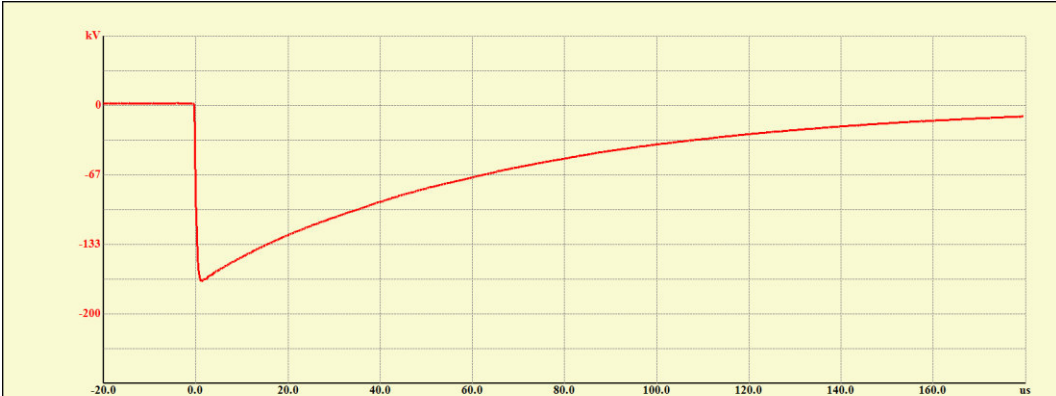
Table 2.8.2.26. Test waveform on HV / Phase: B (Negative polarity)		Nr.
 CHI Up = -170.7 kV T1 = 997 ns T2 = 47.64 us		2-26
Supplement information: N/A		

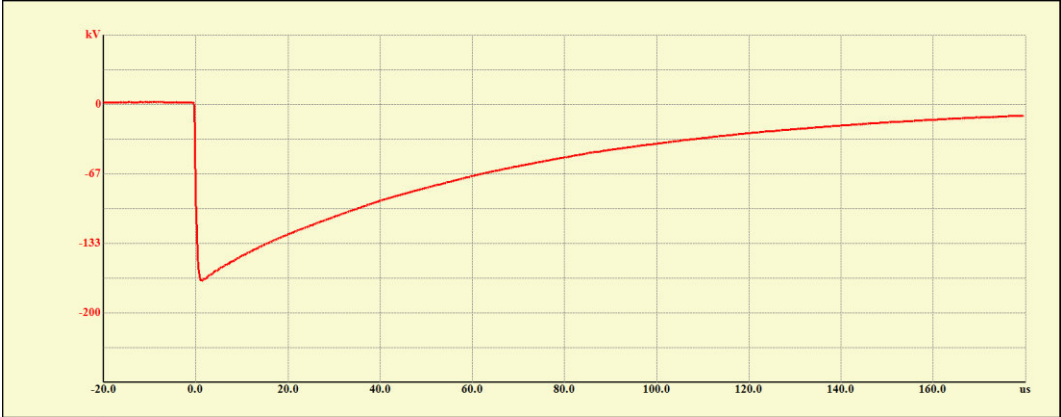
Table 2.8.2.27. Test waveform on HV / Phase: B (Negative polarity)		Nr.
 CH1 Up = -171.0 kV T1 = 997 ns T2 = 47.54 us		2-27
Supplement information: N/A		

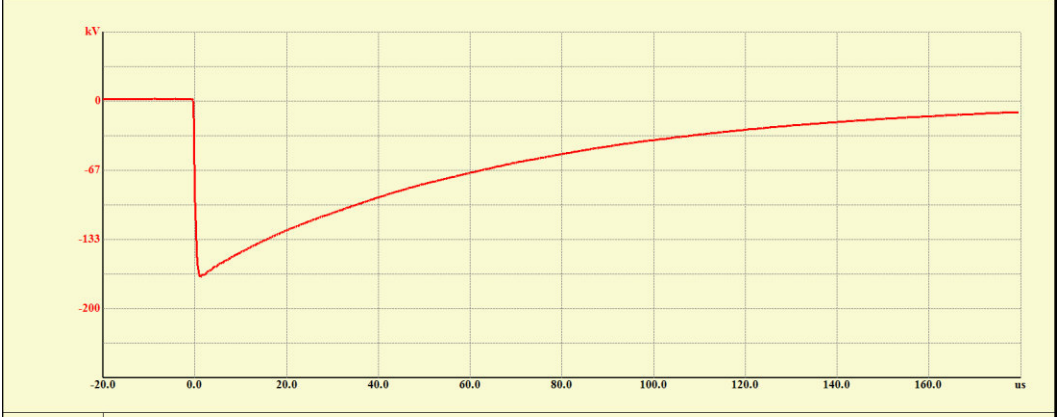
Table 2.8.2.28. Test waveform on HV / Phase: B (Negative polarity)		Nr.
 CH1 Up = -171.1 kV T1 = 997 ns T2 = 47.64 us		2-28
Supplement information: N/A		

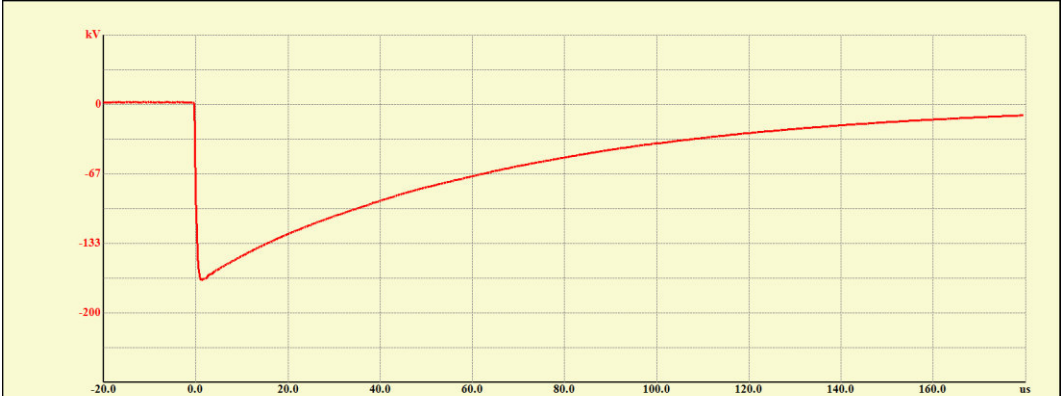
Table 2.8.2.29. Test waveform on HV / Phase: B (Negative polarity)		Nr.
 CHI Up = -170.8 kV T1 = 1 us T2 = 47.51 us		2-29
Supplement information: N/A		

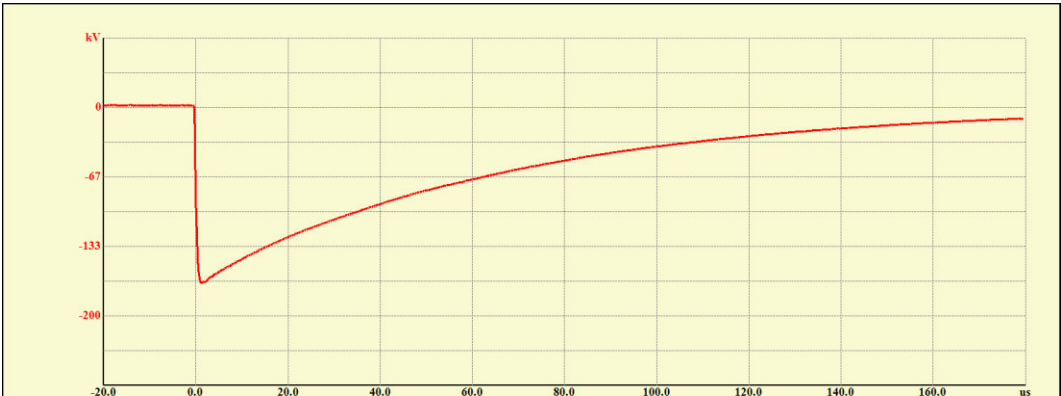
Table 2.8.2.30. Test waveform on HV / Phase: B (Negative polarity)		Nr.
 CHI Up = -170.7 kV T1 = 997 ns T2 = 47.66 us		2-30
Supplement information: N/A		

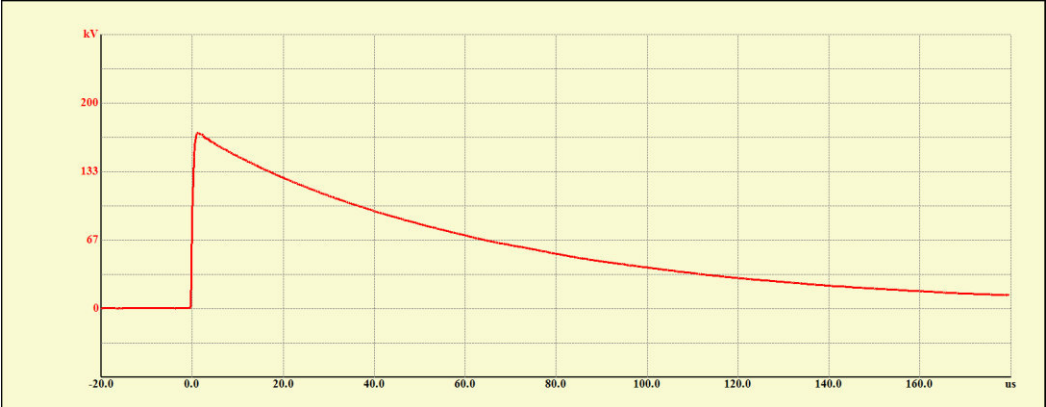
Table 2.8.3.1. Test waveform on HV / Phase: C (Positive polarity)	Nr.
 CHI Up = 170.9 kV T1 = 991 ns T2 = 47.56 us	3-1
Supplement information: N/A	

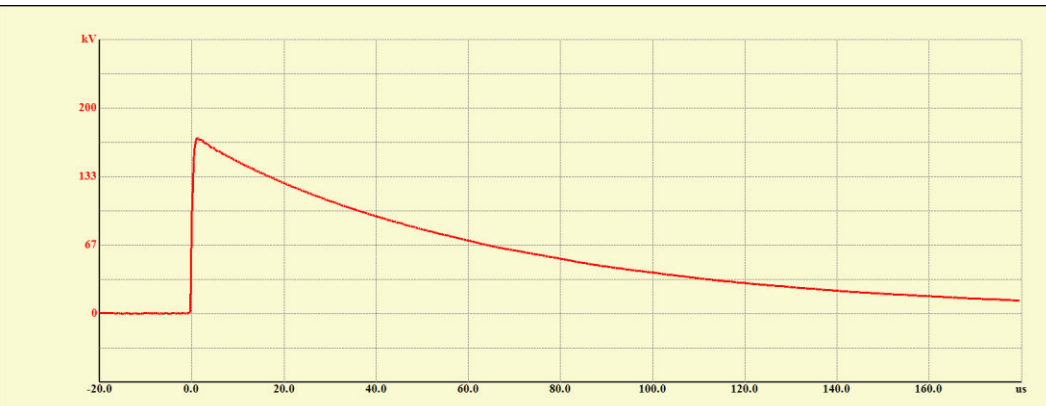
Table 2.8.3.2. Test waveform on HV / Phase: C (Positive polarity)	Nr.
 CHI Up = 170.6 kV T1 = 991 ns T2 = 47.57 us	3-2
Supplement information: N/A	

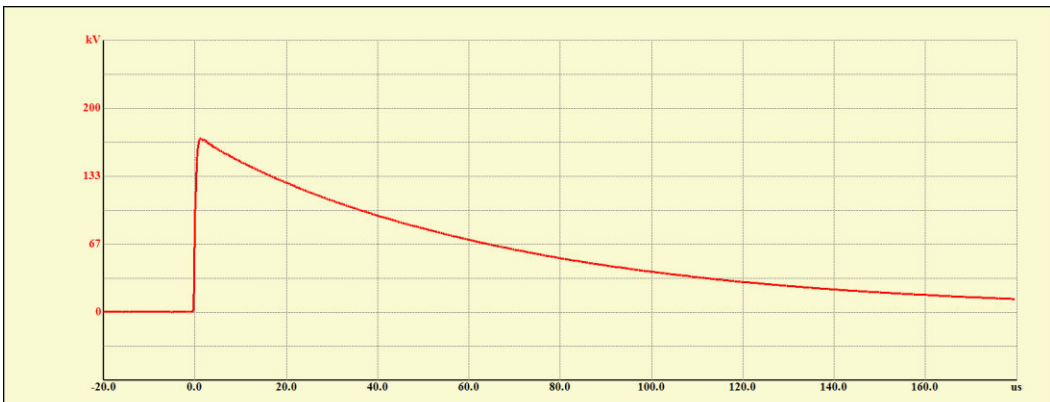
Table 2.8.3.3. Test waveform on HV / Phase: C (Positive polarity)		Nr.
 CHI Up = 170.3 kV T1 = 991 ns T2 = 47.64 us		3-3
Supplement information: N/A		

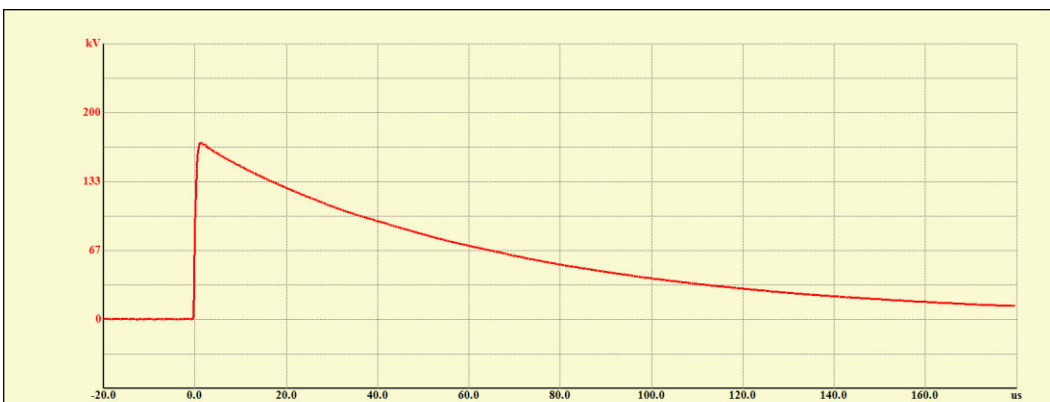
Table 2.8.3.4. Test waveform on HV / Phase: C (Positive polarity)		Nr.
 CHI Up = 170.7 kV T1 = 997 ns T2 = 47.74 us		3-4
Supplement information: N/A		

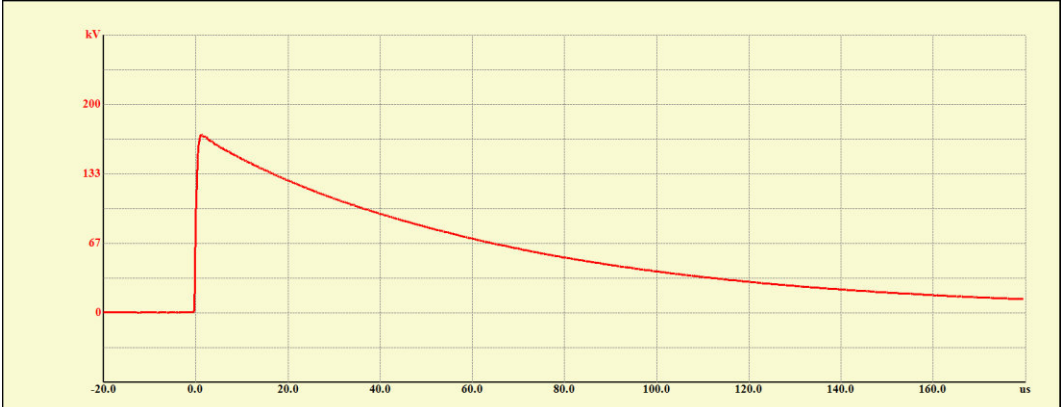
Table 2.8.3.5. Test waveform on HV / Phase: C (Positive polarity)		Nr.
 CHI Up = 170.6 kV T1 = 985 ns T2 = 47.77 us		3-5
Supplement information: N/A		

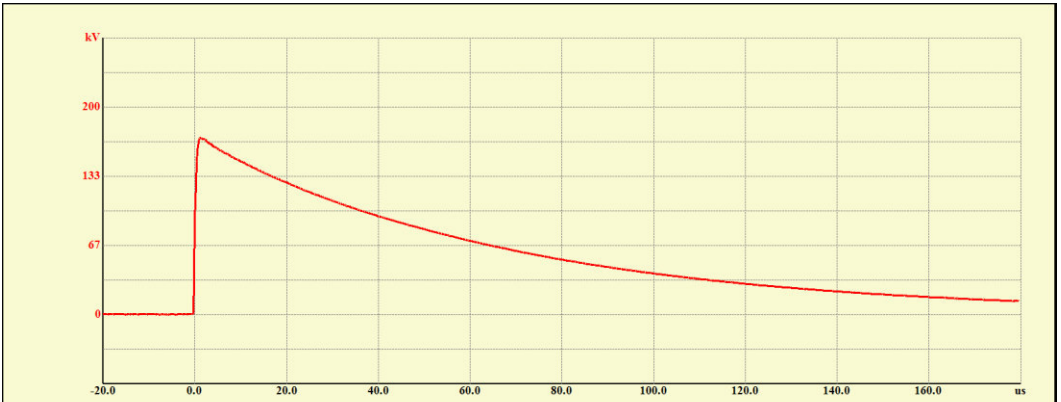
Table 2.8.3.6. Test waveform on HV / Phase: C (Positive polarity)		Nr.
 CHI Up = 170.3 kV T1 = 991 ns T2 = 47.81 us		3-6
Supplement information: N/A		

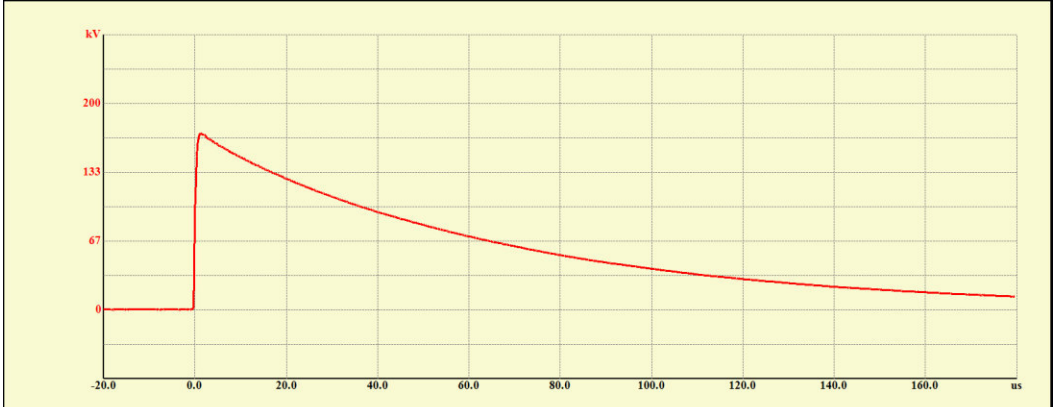
Table 2.8.3.7. Test waveform on HV / Phase: C (Positive polarity)	Nr.
 CH1 Up = 170.7 kV T1 = 979 ns T2 = 47.57 us	3-7
Supplement information: N/A	

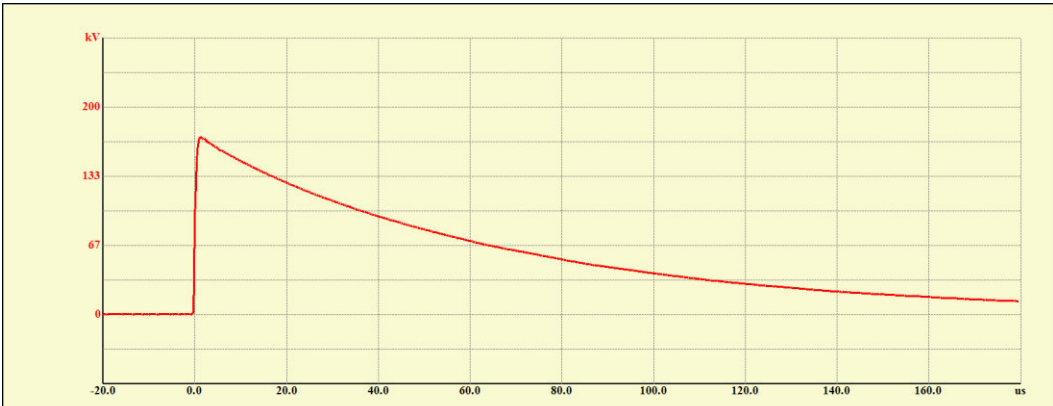
Table 2.8.3.8. Test waveform on HV / Phase: C (Positive polarity)	Nr.
 CH1 Up = 170.8 kV T1 = 991 ns T2 = 47.4 us	3-8
Supplement information: N/A	

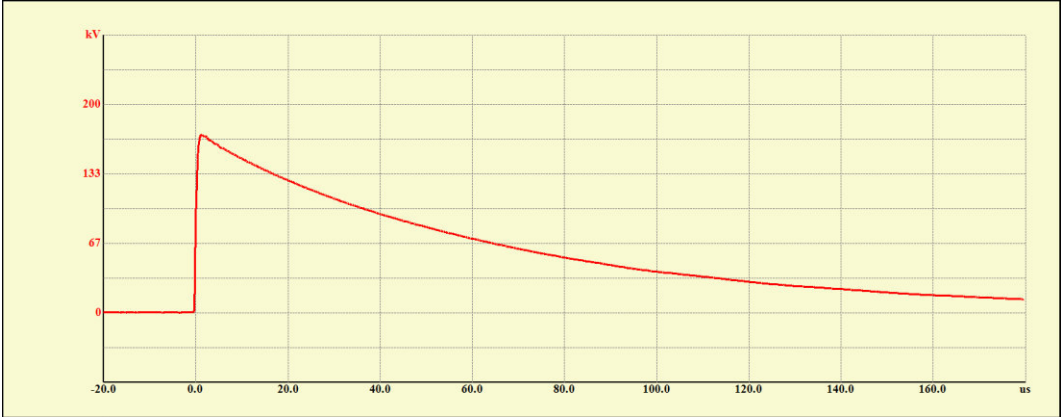
Table 2.8.3.9. Test waveform on HV / Phase: C (Positive polarity)		Nr.
 CHI Up = 170.8 kV T1 = 991 ns T2 = 47.56 us		3-9
Supplement information: N/A		

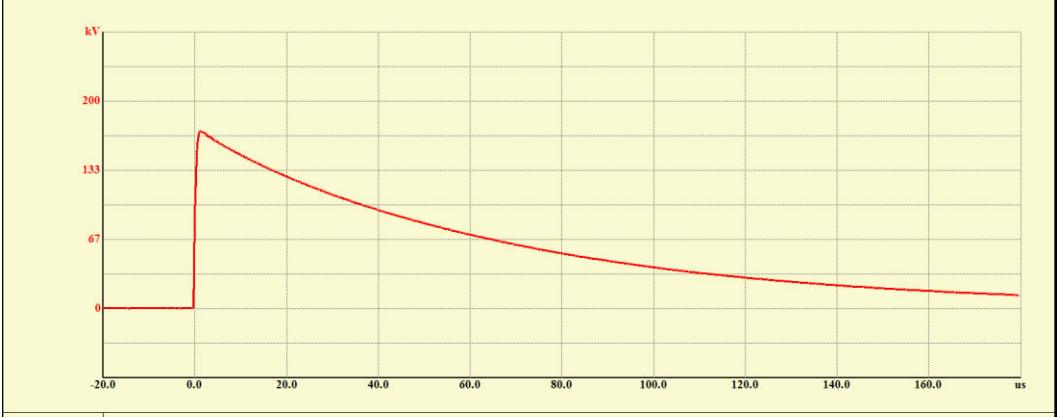
Table 2.8.3.10. Test waveform on HV / Phase: C (Positive polarity)		Nr.
 CHI Up = 171.0 kV T1 = 985 ns T2 = 47.5 us		3-10
Supplement information: N/A		

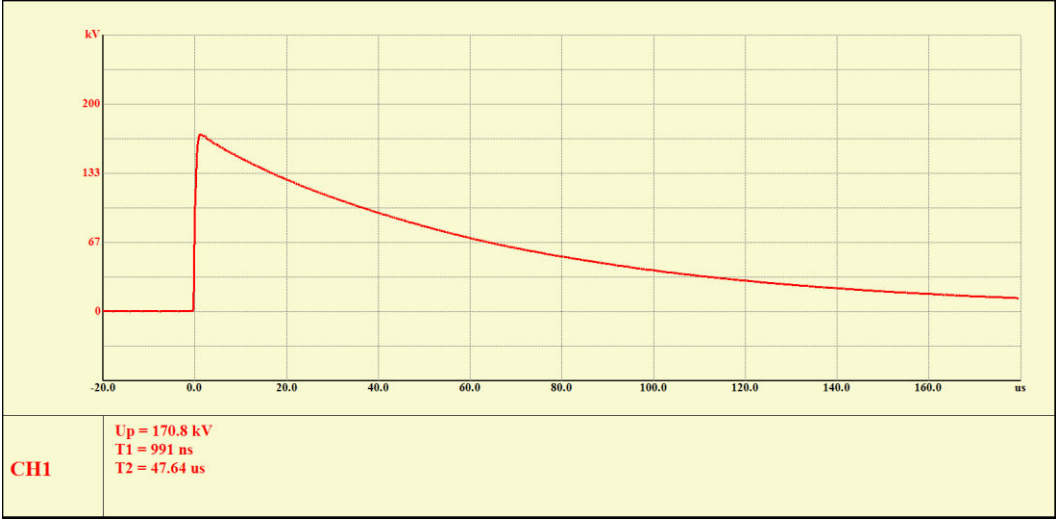
Table 2.8.3.11. Test waveform on HV / Phase: C (Positive polarity)		Nr.
		3-11
Supplement information: N/A		

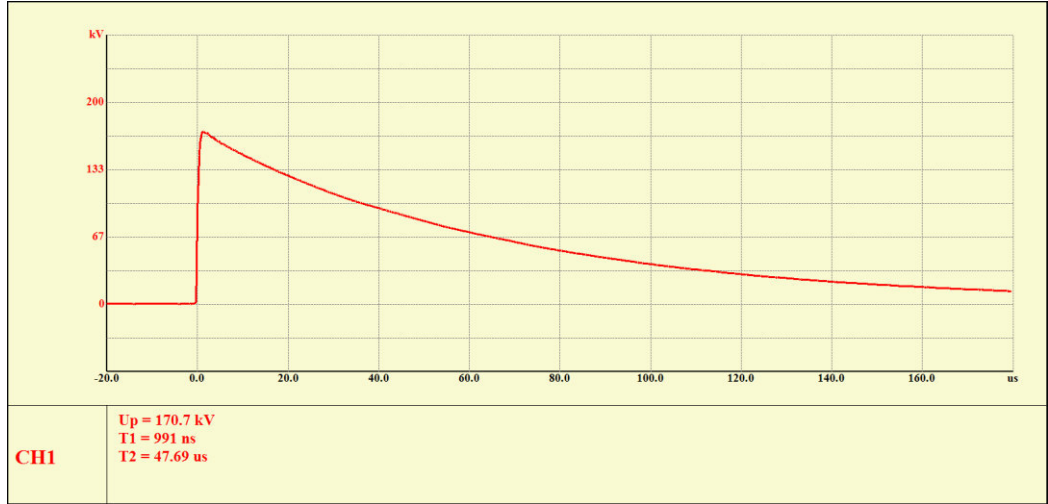
Table 2.8.3.12. Test waveform on HV / Phase: C (Positive polarity)		Nr.
		3-12
Supplement information: N/A		

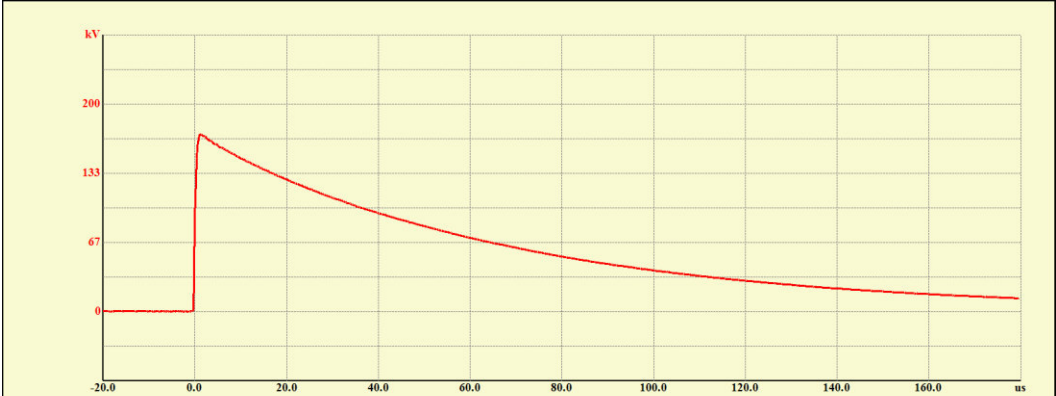
Table 2.8.3.13. Test waveform on HV / Phase: C (Positive polarity)		Nr.
 CHI Up = 170.8 kV T1 = 985 ns T2 = 47.65 us		3-13
Supplement information: N/A		

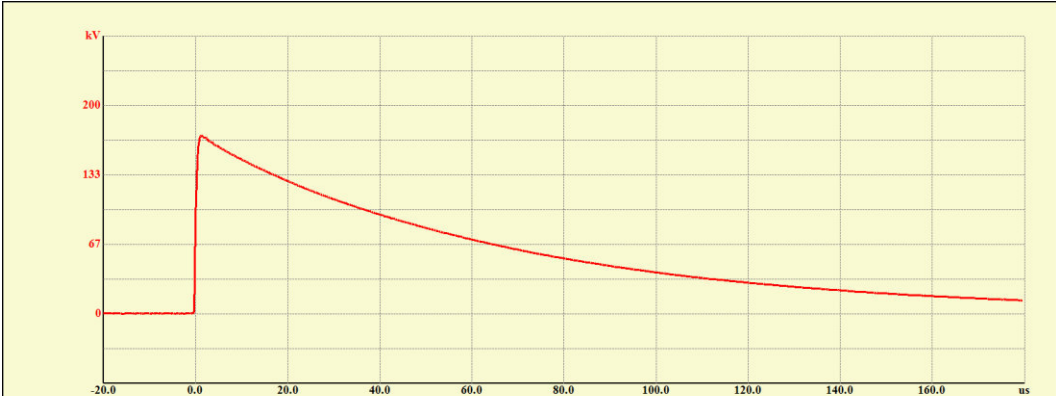
Table 2.8.3.14. Test waveform on HV / Phase: C (Positive polarity)		Nr.
 CHI Up = 170.8 kV T1 = 991 ns T2 = 47.85 us		3-14
Supplement information: N/A		

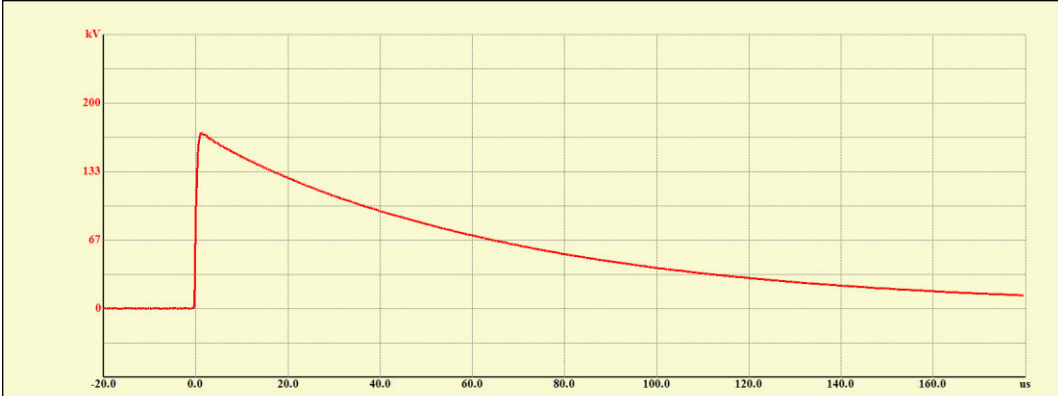
Table 2.8.3.15. Test waveform on HV / Phase: C (Positive polarity)	Nr.
 Up = 170.6 kV T1 = 991 ns T2 = 47.83 us CHI	3-15
Supplement information: N/A	

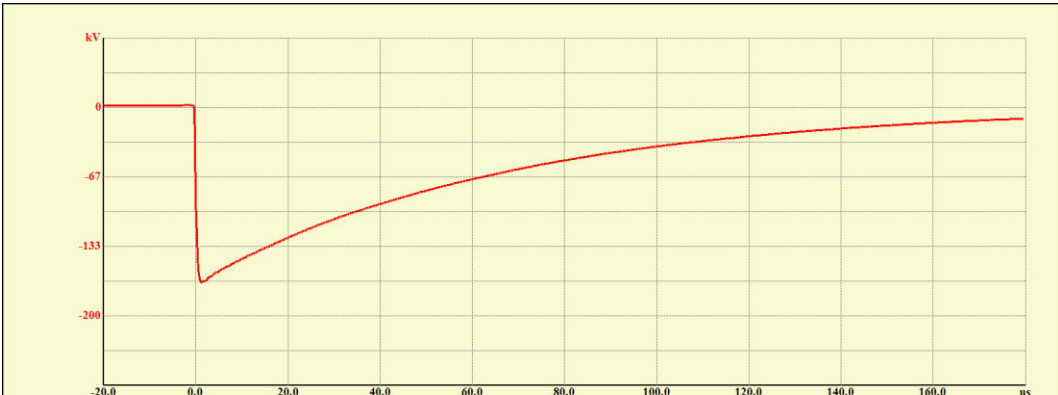
Table 2.8.3.16. Test waveform on HV / Phase: C (Negative polarity)	Nr.
 Up = -170.1 kV T1 = 997 ns T2 = 47.9 us CHI	3-16
Supplement information: N/A	

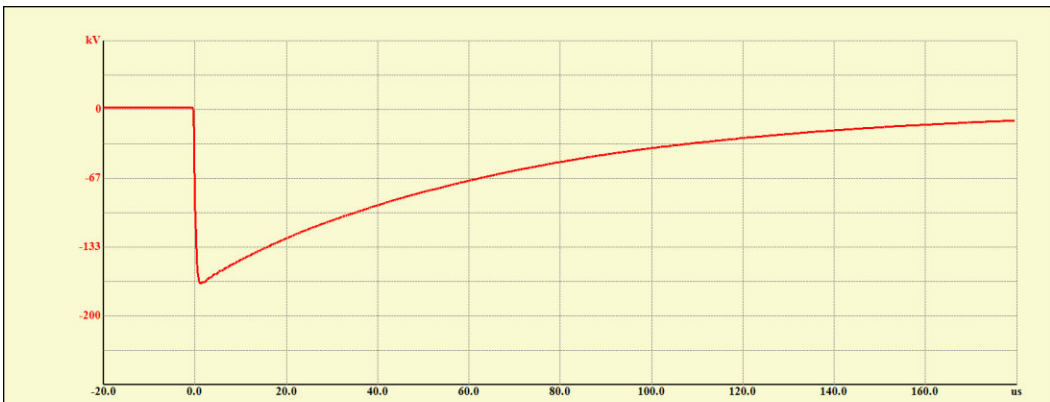
Table 2.8.3.17. Test waveform on HV / Phase: C (Negative polarity)		Nr.
 CH1 Up = -170.9 kV T1 = 991 ns T2 = 47.75 us		3-17
Supplement information: N/A		

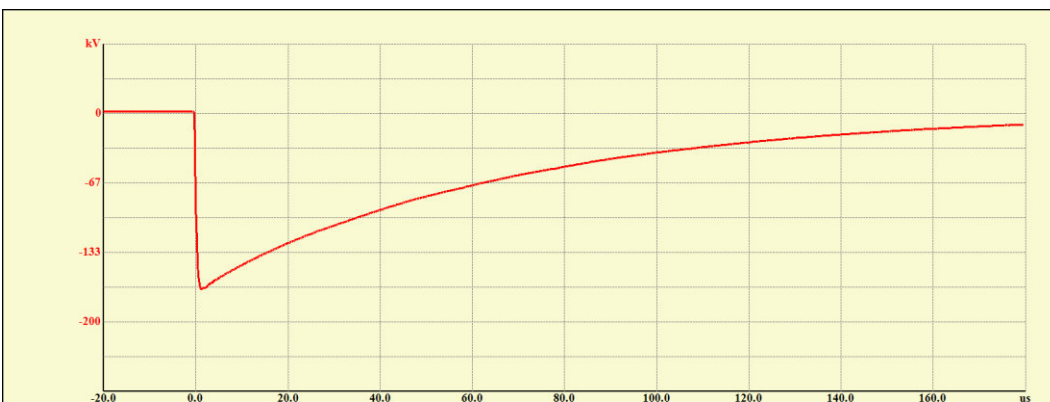
Table 2.8.3.18. Test waveform on HV / Phase: C (Negative polarity)		Nr.
 CH1 Up = -170.8 kV T1 = 1 us T2 = 47.51 us		3-18
Supplement information: N/A		

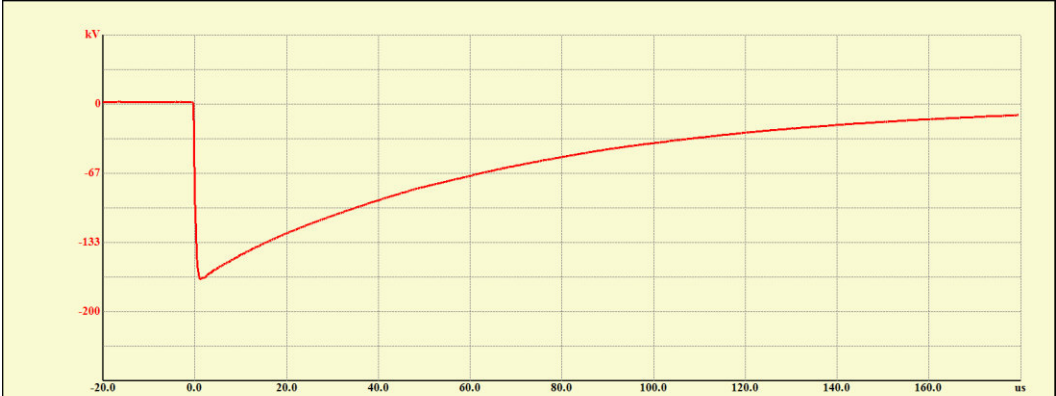
Table 2.8.3.19. Test waveform on HV / Phase: C (Negative polarity)		Nr.
 CH1 Up = -170.9 kV T1 = 997 ns T2 = 47.59 us		3-19
Supplement information: N/A		

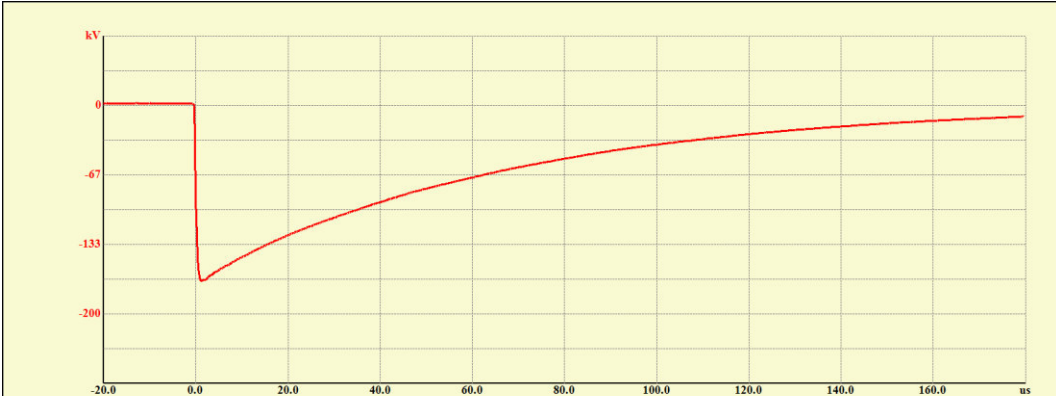
Table 2.8.3.20. Test waveform on HV / Phase: C (Negative polarity)		Nr.
 CH1 Up = -170.8 kV T1 = 991 ns T2 = 47.67 us		3-20
Supplement information: N/A		

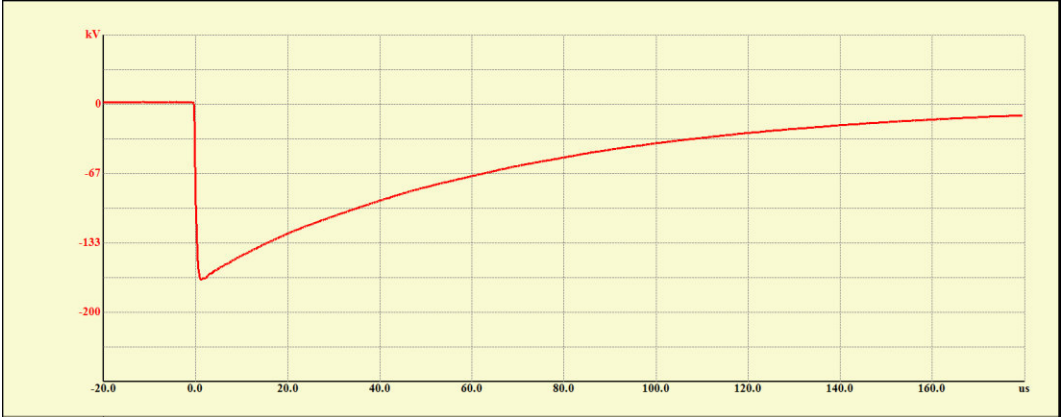
Table 2.8.3.21. Test waveform on HV / Phase: C (Negative polarity)		Nr.
 CH1 Up = -170.7 kV T1 = 997 ns T2 = 47.6 us		3-21
Supplement information: N/A		

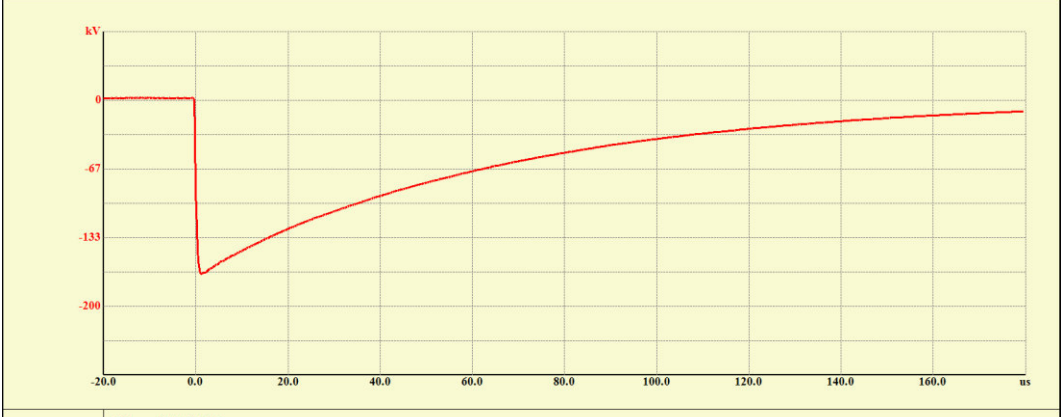
Table 2.8.3.22. Test waveform on HV / Phase: C (Negative polarity)		Nr.
 CH1 Up = -171.0 kV T1 = 997 ns T2 = 47.77 us		3-22
Supplement information: N/A		

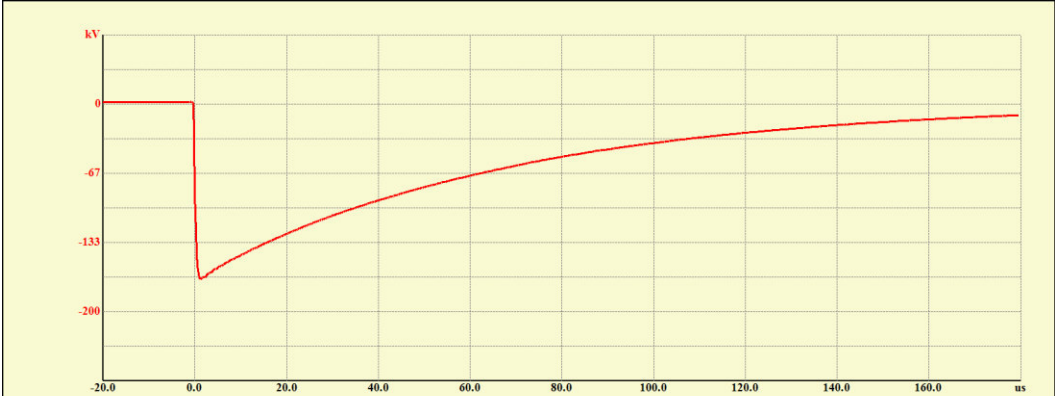
Table 2.8.3.23. Test waveform on HV / Phase: C (Negative polarity)		Nr.
 CH1 Up = -170.7 kV T1 = 1 us T2 = 47.77 us		3-23
Supplement information: N/A		

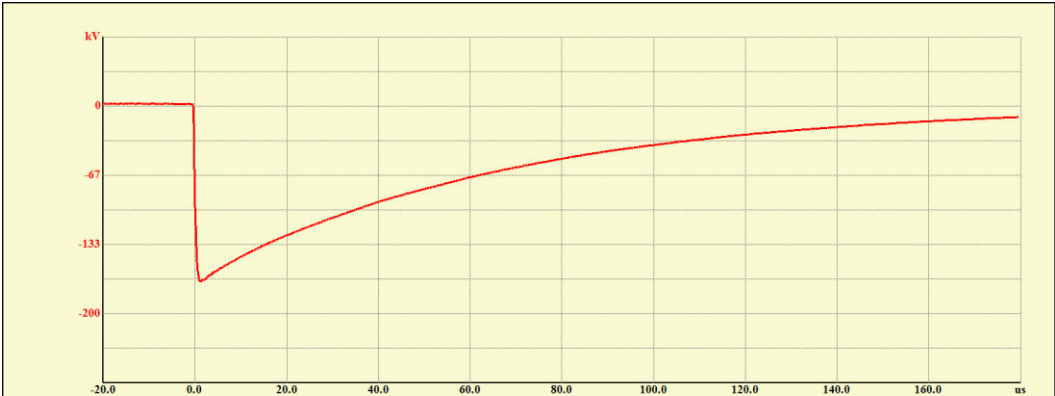
Table 2.8.3.24. Test waveform on HV / Phase: C (P Negative polarity)		Nr.
 CH1 Up = -171.2 kV T1 = 997 ns T2 = 47.49 us		3-24
Supplement information: N/A		

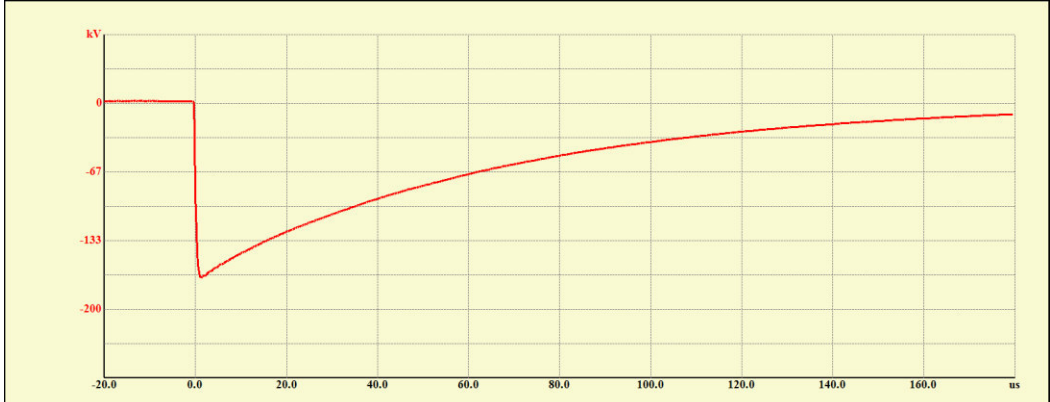
Table 2.8.3.25. Test waveform on HV / Phase: C (Negative polarity)		Nr.
 CHI Up = -171.4 kV T1 = 997 ns T2 = 47.54 us		3-25
Supplement information: N/A		

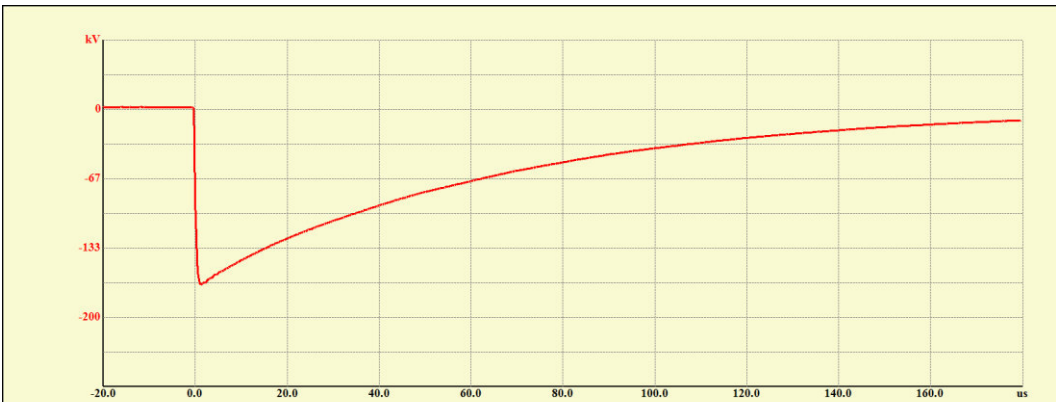
Table 2.8.3.26. Test waveform on HV / Phase: C (Negative polarity)		Nr.
 CHI Up = -170.6 kV T1 = 991 ns T2 = 47.63 us		3-26
Supplement information: N/A		

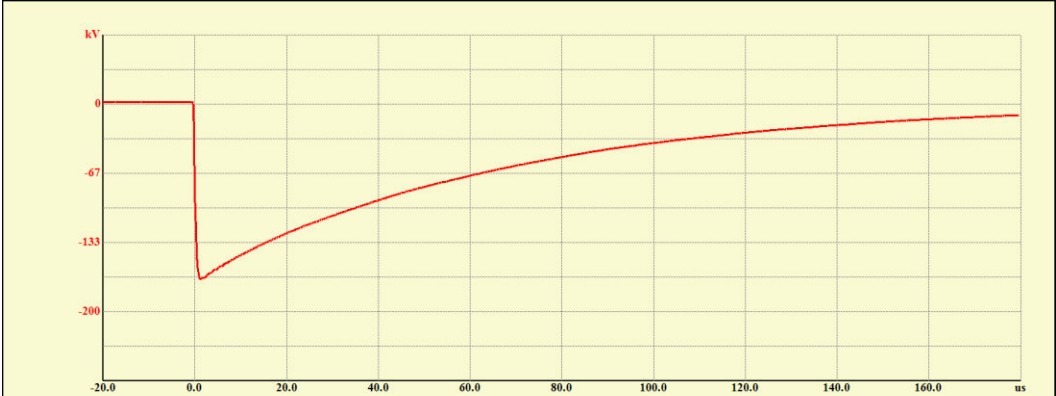
Table 2.8.3.27. Test waveform on HV / Phase: C (Negative polarity)		Nr.
 CHI Up = -170.8 kV T1 = 997 ns T2 = 47.55 us		3-27
Supplement information: N/A		

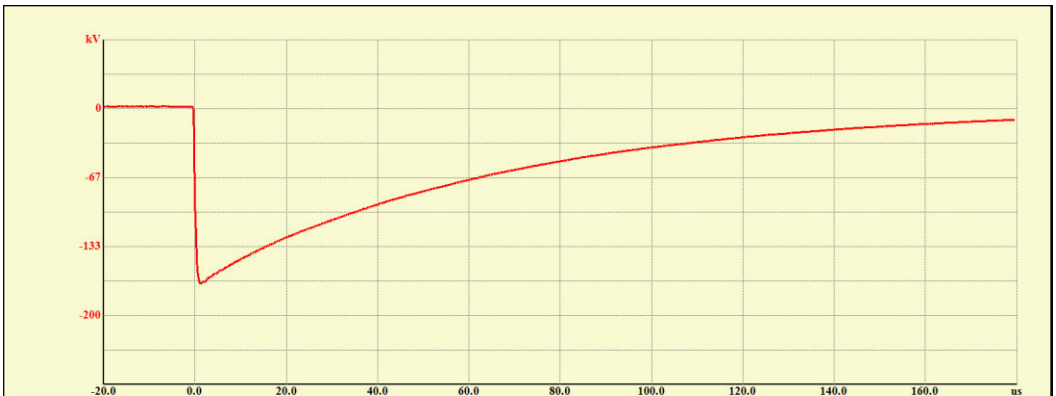
Table 2.8.3.28. Test waveform on HV / Phase: C (Negative polarity)		Nr.
 CHI Up = -171.1 kV T1 = 991 ns T2 = 47.6 us		3-28
Supplement information: N/A		

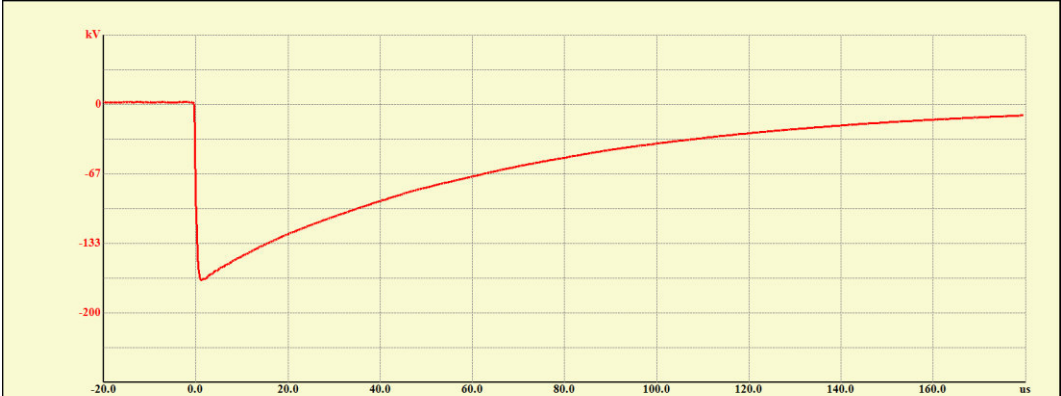
Table 2.8.3.29. Test waveform on HV / Phase: C (Negative polarity)		Nr.
 CH1 Up = -171.0 kV T1 = 997 ns T2 = 47.62 us		3-29
Supplement information: N/A		

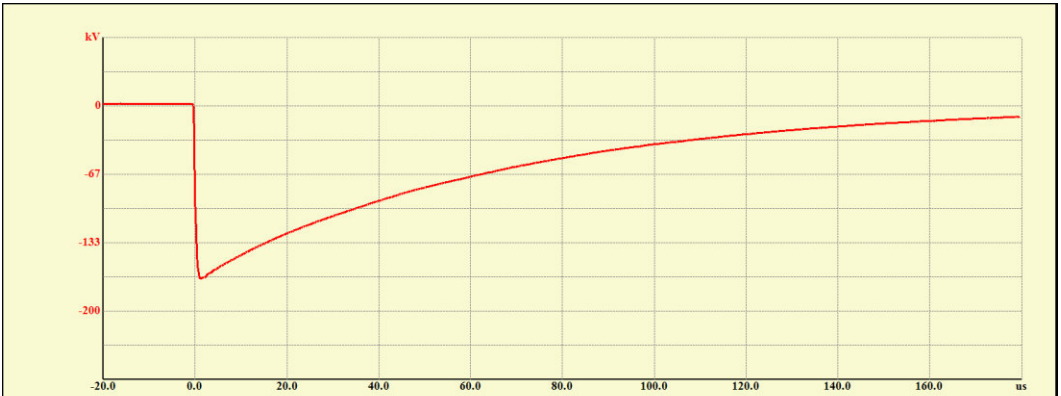
Table 2.8.3.30. Test waveform on HV / Phase: C (Negative polarity)		Nr.
 CH1 Up = -170.7 kV T1 = 1.01 us T2 = 47.59 us		3-30
Supplement information: N/A		

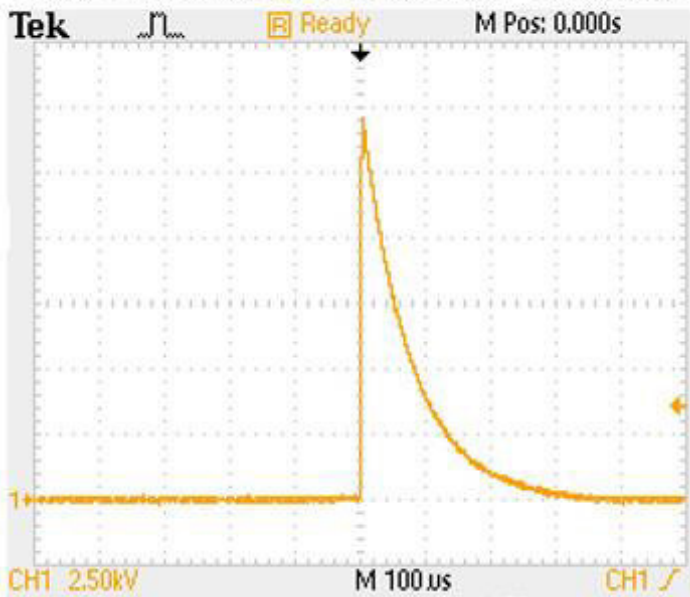
Table 2.8.4.1. Test waveform on LV / Phase: a (Positive polarity)	Nr.
Upk=14.8kV; T1=1.33μs; T2=52.19μs;  CH1 2.50kV M 100.μs CH1 ✓	4-1
Supplement information: N/A	

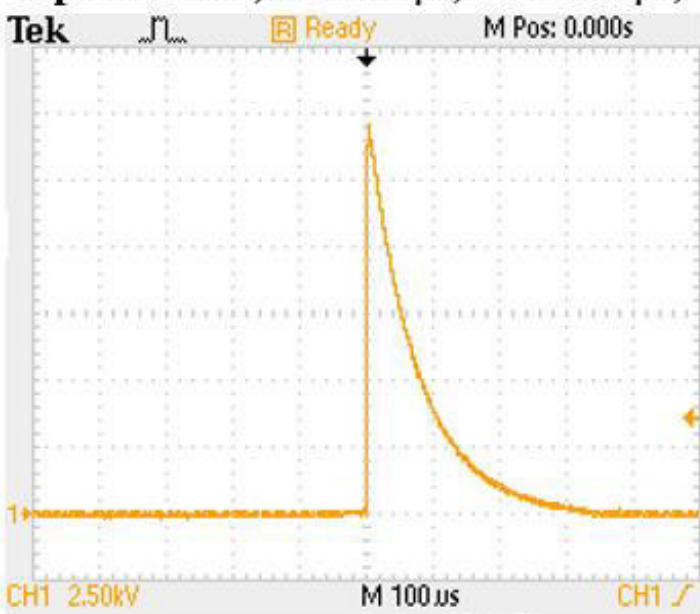
Table 2.8.4.2. Test waveform on LV / Phase: a (Positive polarity)	Nr.
Upk=14.8kV; T1=1.35μs; T2=52.21μs;  CH1 2.50kV M 100.μs CH1 ✓	4-2
Supplement information: N/A	

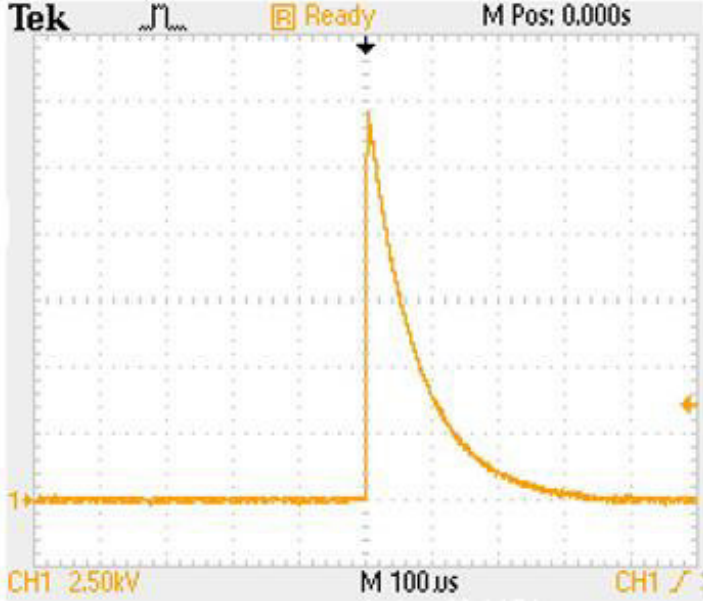
Table 2.8.4.3. Test waveform on LV / Phase: a (Positive polarity)	Nr.
Upk=14.8kV;T1=1.38µs;T2=52.39µs;  CH1 2.50kV M 100µs CH1	4-3
Supplement information: N/A	

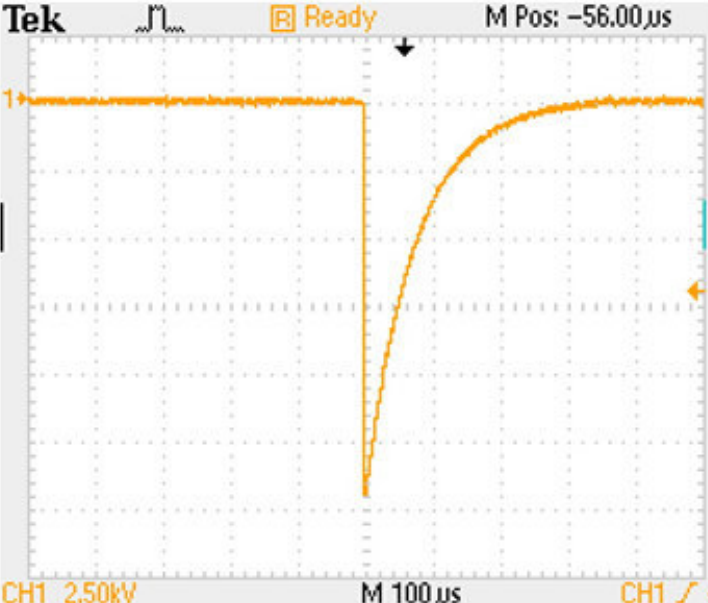
Table 2.8.4.4. Test waveform on LV / Phase: a (Negative polarity)	Nr.
Upk= -14.7kV;T1=1.30µs;T2=50.95µs;  CH1 2.50kV M 100µs CH1	4-4
Supplement information: N/A	

Table 2.8.4.5. Test waveform on LV / Phase: a (Negative polarity)	Nr.
Upk= -14.7kV;T1=1.28μs;T2=50.72μs;  CH1 2.50kV M 100μs CH1 / -	4-5
Supplement information: N/A	

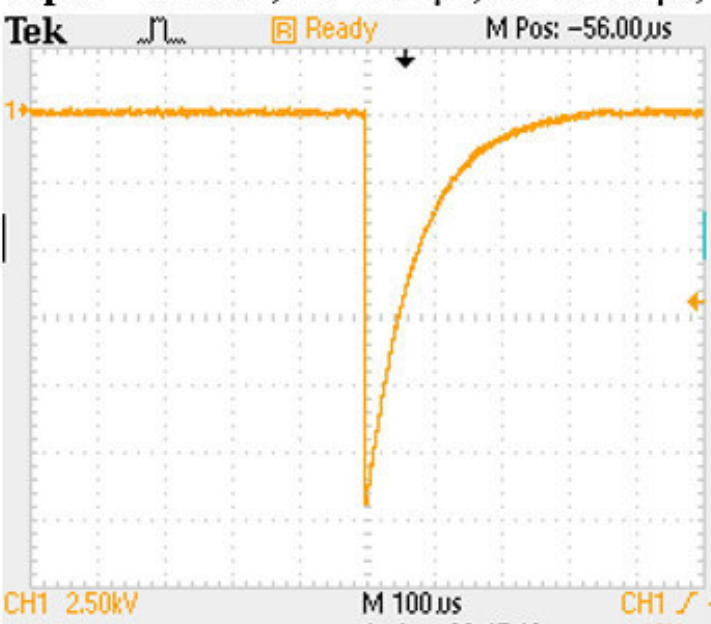
Table 2.8.4.6. Test waveform on LV / Phase: a (Negative polarity)	Nr.
Upk= -14.7kV;T1=1.27μs;T2=50.53μs;  CH1 2.50kV M 100μs CH1 / -	4-6
Supplement information: N/A	

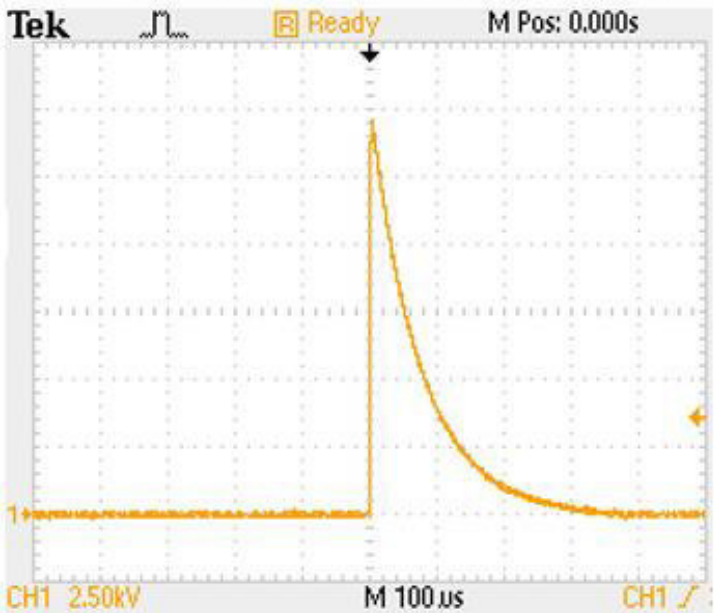
Table 2.8.5.1. Test waveform on LV / Phase: b (Positive polarity)	Nr.
Upk=14.8kV; T1=1.35µs; T2=51.22µs;  Supplement information: N/A	5-1

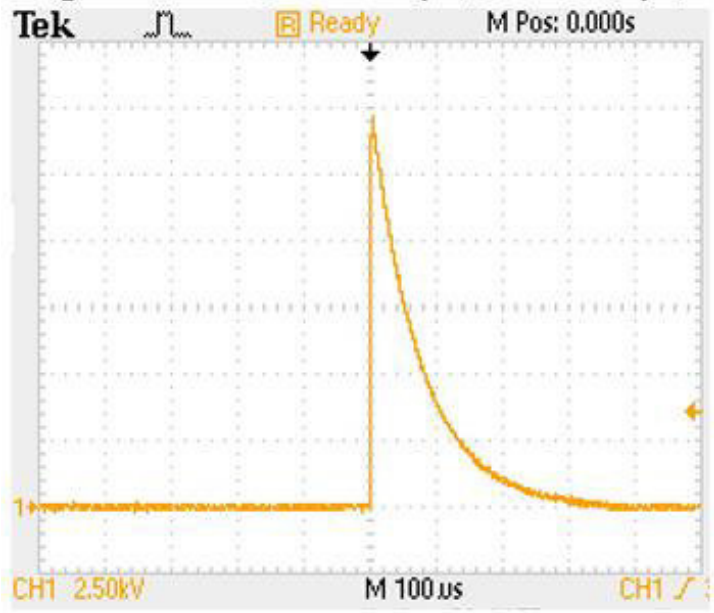
Table 2.8.5.2. Test waveform on LV / Phase: b (Positive polarity)	Nr.
Upk=14.9kV; T1=1.33µs; T2=52.12µs;  Supplement information: N/A	5-2

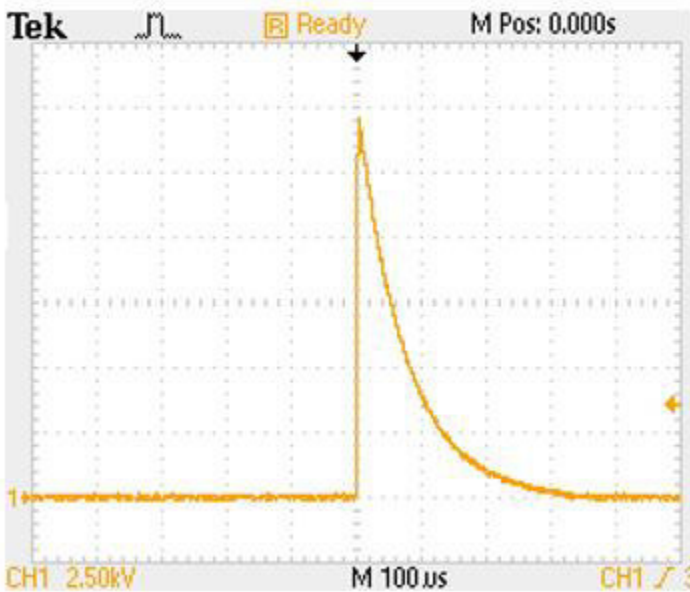
Table 2.8.5.3. Test waveform on LV / Phase: b (Positive polarity)	Nr.
Upk=14.7kV;T1=1.27μs;T2=50.50μs;  CH1 2.50kV M 100μs CH1 / 3	5-3
Supplement information: N/A	

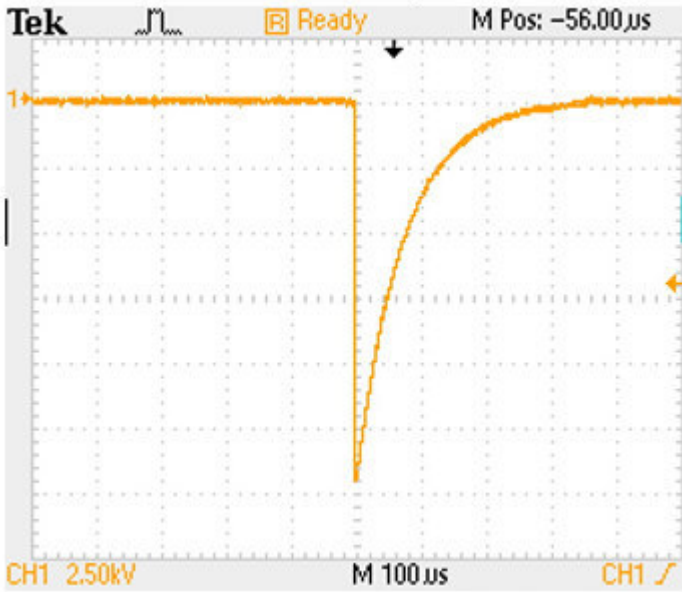
Table 2.8.5.4. Test waveform on LV / Phase: b (Negative polarity)	Nr.
Upk= -14.8kV;T1=1.29μs;T2=51.14μs;  CH1 2.50kV M 100μs CH1 / 3	5-4
Supplement information: N/A	

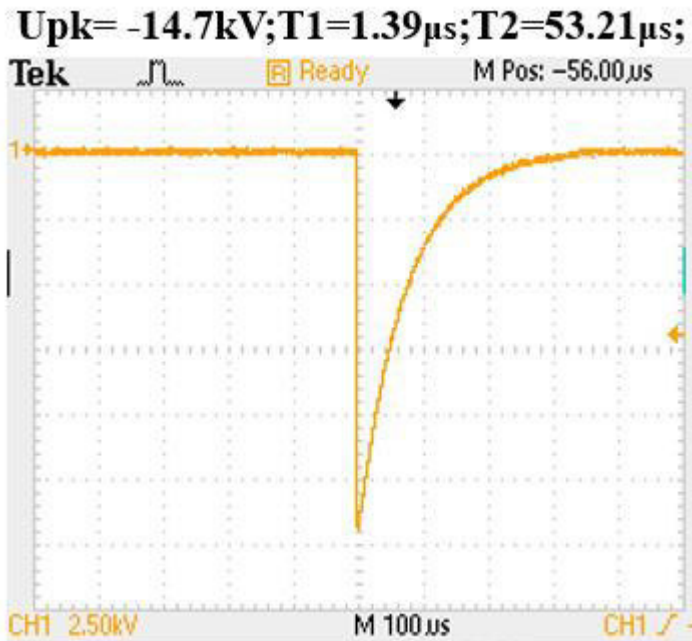
Table 2.8.5.5. Test waveform on LV / Phase: b (Negative polarity)	Nr.
Upk= -14.7kV;T1=1.39μs;T2=53.21μs;  CH1 2.50kV M 100μs CH1 / -	5-5
Supplement information: N/A	

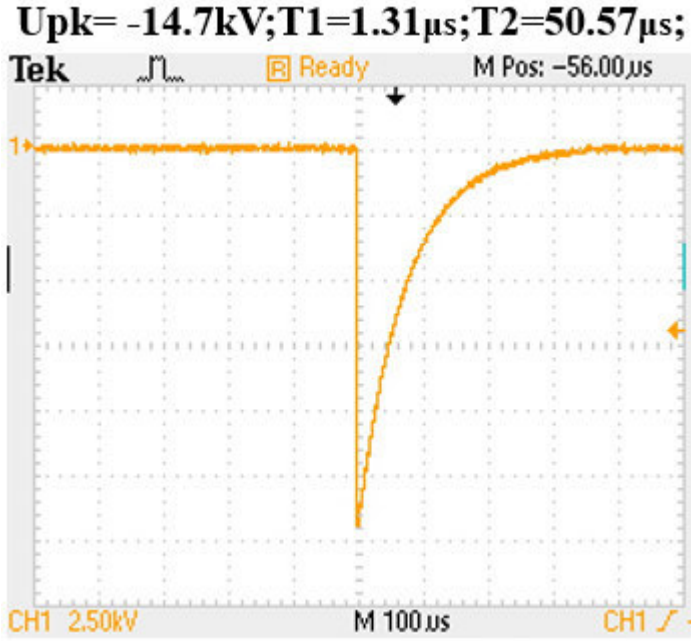
Table 2.8.5.6. Test waveform on LV / Phase: b (Negative polarity)	Nr.
Upk= -14.7kV;T1=1.31μs;T2=50.57μs;  CH1 2.50kV M 100μs CH1 / -	5-6
Supplement information: N/A	

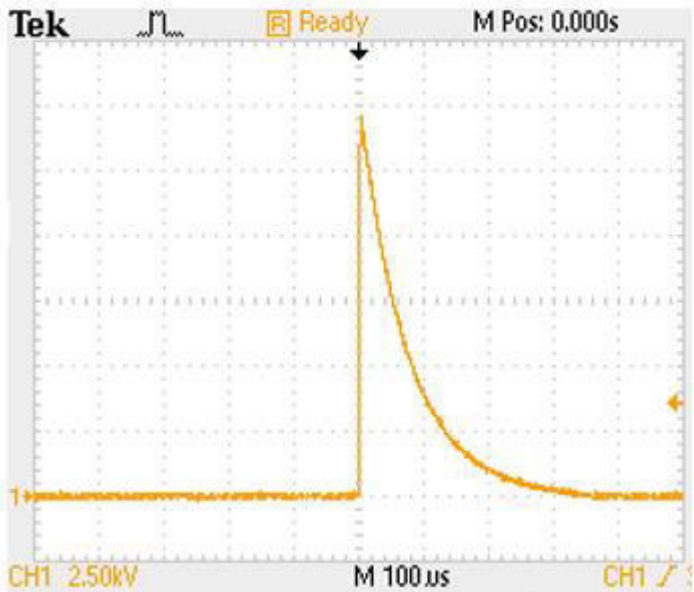
Table 2.8.6.1. Test waveform on LV / Phase: c (Positive polarity)	Nr.
Upk=14.8kV; T1=1.27μs; T2=51.29μs; 	6-1
Supplement information: N/A	

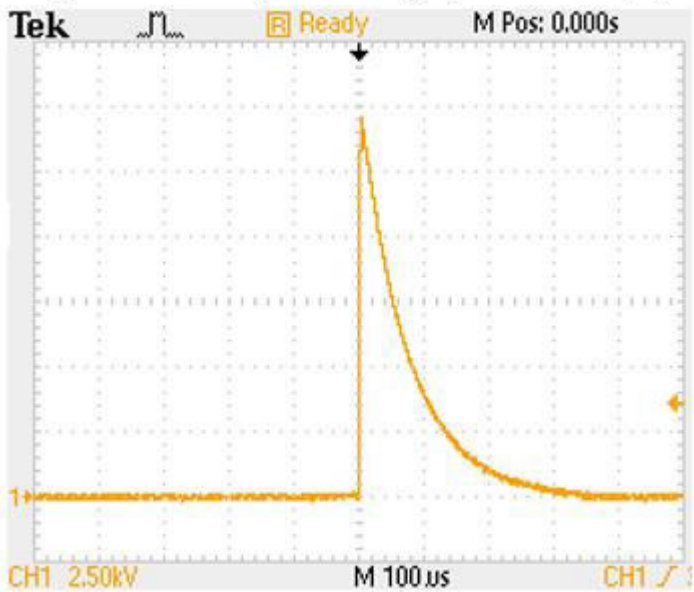
Table 2.8.6.2. Test waveform on LV / Phase: c (Positive polarity)	Nr.
Upk=14.8kV; T1=1.34μs; T2=51.11μs; 	6-2
Supplement information: N/A	

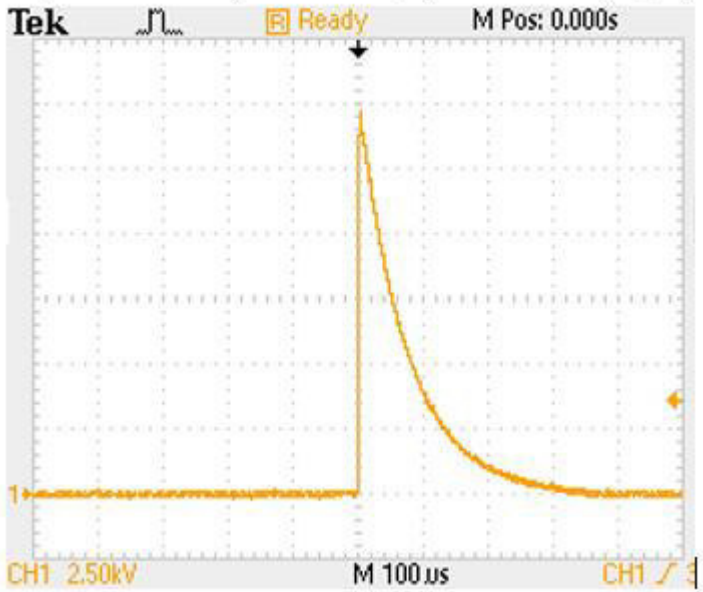
Table 2.8.6.3. Test waveform on LV / Phase: c (Positive polarity)	Nr.
Upk=14.9kV;T1=1.30µs;T2=51.23µsµs;  CH1 2.50kV M 100µs CH1 / 3	6-3
Supplement information: N/A	

Table 2.8.6.4. Test waveform on LV / Phase: c (Negative polarity)	Nr.
Upk= -14.7kV;T1=1.35µs;T2=52.24µsµs;  CH1 2.50kV M 100µs CH1 / 3	6-4
Supplement information: N/A	

Table 2.8.6.5. Test waveform on LV / Phase: c (Negative polarity)	Nr.
Upk= -14.7kV;T1=1.32µs;T2=51.36µs;  CH1 2.50kV M 100µs CH1 /	6-5
Supplement information: N/A	

Table 2.8.6.6. Test waveform on LV / Phase: c (Negative polarity)	Nr.
Upk= -14.8kV;T1=1.33µs;T2=51.39µs;  CH1 2.50kV M 100µs CH1 /	6-6
Supplement information: N/A	

2.9. Conclusion

There is no disruptive discharge during the power-frequency test.

The impulse voltage of the test series and the relevant oscillograms are presented.

There was no sudden collapse of voltage or discontinuity in the voltage indicated on the oscillographic records.

The measured creepage distances of low voltage interconnections fulfill the requirements of IEC 60664-1.

The prefabricated substation has passed the tests.

3. Tests to prove the temperature rise of the components contained in a prefabricated substation**3.1. Reference standards**

Clause	Test item	Standard	
	Content	Title	Nr.
7.5	Continuous current tests	AC prefabricated substations for rated voltages above 1kV and up to and including 52kV	IEC 62271-202

3.2. Measurement

	AC prefabricated substations as per IEC 62271-202		
7.5	Requirements	Remark	Verdict
	Switchgear prefabricated substations are exempt from the continuous current test because the influence of the enclosure is considered negligible with respect to the temperature rise of the high-voltage switchgear and controlgear within the enclosure		N/A
7.5.101	The purpose of this test , among others, is to verify that the temperature rises of the relevant parts of the components when installed in a prefabricated substation do not exceed the limits fixed by the product standards of such components		P
	Their life expectancy of insulating parts will not be unduly influenced by temperature if the specified temperature limits, for example of low-voltage switchgear and controlgear, and/or the specified air temperature, for example of low-voltage switchgear electronic components, are not exceed		P
	The ratings of the components of the prefabricated substation may differ from the rated currents of high-voltage and low-voltage circuits of the prefabricated substation		N/A
	In particular, for the power transformers, the test shall demonstrate that the temperature rises of the transformer inside the enclosure of the prefabricated substation do not exceed those measured on the same transformer outside the enclosure by more than the value which defines the class of enclosure, for example, 5K, 10K, 15K, 20K, 25K, or 30K.	No define for the enclosure class	N/A

	AC prefabricated substations as per IEC 62271-202		
7.5	Requirements	Remark	Verdict
	The two comparative tests shall be carried out with the same transformer unit		N/A
7.5.102	The enclosure shall be complete with its components positioned as designed for service		P
	The doors shall be closed and cable access points sealed to represent service conditions		P
	The power and losses of the transformer should be those corresponding to the rated power of the prefabricated substation, as defined in 5.101.1		P
	The continuous current tests shall be performed simultaneously on power transformer, high voltage and low voltage interconnections, and low-voltage equipment		P
	If the prefabricated substation is designed to work with more than one power transformer simultaneously in service, it shall be tested for such condition and with the applicable load factor for each power transformer as defined by the manufacturer of the prefabricated substation	One transformer in the substation	N/A
	The continuous current test of the high voltage switchgear and controlgear is not required		P
	The test will be executed in a room whose dimension, insulation or air condition will keep the ambient air temperature of the room within the ambient limits specified in 7.5.104.1		P
	The room environment shall be substantially free from air currents, except those generated by heat from the equipment under test		P
	In practice, this condition is reached when the air velocity does not exceed 0.5mm/s		P
7.5.103	Two situations are considered, depending of the type of power transformers installed in the prefabricated substation:		P
	- liquid-filled transformer		P
	- dry-type transformer	The transformer is not dry type	N/A
7.5.103.2	Liquid filled transformers		P

	AC prefabricated substations as per IEC 62271-202		
7.5	Requirements	Remark	Verdict
7.5.103.2.1	If the substation is equipped with liquid filled transformers two test methods can be used to carry out the temperature-rise tests		P
	The preferred one requires the use of independent sources of current to supply the high voltage and the low voltage sides of the substation		P
	An alternative method can be used if the laboratory can provide only one source of current or the design of the substation makes the connection arrangements of the two sources of current impossible		N/A
7.5.103.2	Liquid-immersed power transformer		P
	If the prefabricated substation is equipped with a liquid-immersed power transformer, one of the two following test methods shall be used to carry out the continuous current tests		P
	The preferred method requires the use of independent sources of current to supply the high-voltage and the low-voltage sides of the prefabricated substation		N/A
7.5.103.2.2	Preferred method		P
	This method requires different connections of supply for the high voltage and low voltage sides respectively	Two separate supply for high voltage and low voltage sides	P
	Connection of supplies		P
	High voltage side:		P
	The transformer and high voltage switchgear with its tee-off shall be connected and the low-voltage outgoing terminals of the transformer shall be short-circuited		P
	The supply shall be connected to the incoming high-voltage switchgear terminals		P
	Low-voltage side:		P
	The temperature-rise test on the low-voltage side shall be carried out in accordance with 10.10 of IEC 61439-1:2020 and the following specific requirements		P
	The low-voltage switchgear shall be isolated from the transformer, at a convenient point as close as practicable to the transformer terminals		P

	AC prefabricated substations as per IEC 62271-202		
7.5	Requirements	Remark	Verdict
	At this point adjacent to the transformer terminals, a short-circuit shall be applied to the connection between the transformer and the low-voltage switchgear		P
	The current shall be applied to the low-voltage switchgear via the outgoing feeders		P
	Application of test currents		P
	High-voltage side:		P
	The transformer circuit is supplied with sufficient current to generate the total rated loss of the transformer, at its reference temperature, using the method defined in IEC 60076-2:2011	Total loss: 58613 W (50HZ) Total loss: 61671 W (60Hz)	P
	This test will require a small percentage of current above the rated current flowing through the complete circuit so as to compensate for the transformer no-load loss		P
	Low-voltage side:		P
	The low-voltage circuit is supplied with the rated low-voltage current of the tested transformer	Test current: 5282.8A (50Hz & 60Hz)	P
	The distribution of this supply current at the low voltage outgoing feeders shall be chosen to be the worst case in respect of heat generation		P
	In case of outgoing feeders are equipped with fuses, these fuses shall be present during test and shall represent the service conditions		N/A
	The temperature measurements of ambient air, high-voltage switchgear and controlgear, high-voltage interconnection, power transformer, low-voltage interconnection, low-voltage switchgear and controlgear, and air inside the prefabricated substation shall be made according to 7.5.104		P
7.5.103.2.3	Alternative method		N/A
	This method requires one single supply of current		N/A
	The high voltage switchgear and controlgear with its tee-off, the high voltage/low voltage power transformer and the low voltage switchgear and controlgear shall be connected		N/A

	AC prefabricated substations as per IEC 62271-202		
7.5	Requirements	Remark	Verdict
	Selected outgoing terminals of the low voltage switchgear and controlgear shall be short-circuited in order to distribute the current according to the worst possible case in respect of heat generation		N/A
	In case outgoing feeders are equipped with fuses, these fuses shall be present during test and shall represent the service conditions		N/A
	The supply shall be connected to the incoming terminals of the high voltage switchgear and controlgear		N/A
	The substation is supplied with sufficient current to generate the total rated losses of liquid filled transformer, at its reference temperature, using the method defined in the relevant product standard		N/A
	Application of test currents		N/A
	For a continuous current test on a prefabricated substation equipped with a liquid-immersed power transformer, the application of test currents should follow the method as described in 7.3.2 of IEC 60076-2:2011 consisting of the two following consecutive steps		N/A
	Step 1:		N/A
	Sufficient current shall be supplied to the prefabricated substation such that the power transformer generates its total rated losses, at its reference temperature, using the method defined in IEC 60076-2:2011		N/A
	This step is continued until a steady-state power transformer top oil temperature rise is established		N/A
	The top oil and ambient air temperature measurements shall be made in accordance with 7.5.104.2 and 7.5.104.1, respectively		N/A
	In order for the power transformer to generate its rated total losses inside the enclosure, it is considered sufficient to supply the same magnitude of current that was required for the power transformer to generate its total rated losses outside the enclosure		N/A
	Step 2:		N/A

	AC prefabricated substations as per IEC 62271-202		
7.5	Requirements	Remark	Verdict
	The supply current is reduced so that the high-voltage rated current of the power transformer is injected for 1 h in accordance with IEC 60076-2:2011.		N/A
	At the end of the second step, the low-voltage switchgear and controlgear, low-voltage interconnection, and high-voltage interconnection temperature measurements shall be made in accordance with 7.5.104.3 and 7.5.104.4, respectively		N/A
	The ambient air temperature shall be measured in accordance with 7.5.104.1		N/A
	The measurement of the air temperature inside the prefabricated substation and on the accessible surfaces of high-voltage switchgear and controlgear shall be made in accordance with 7.5.104.5 and 7.5.104.4, respectively		N/A
7.5.103	Dry-type power transformers		N/A
	For a continuous current test on a prefabricated substation equipped with a dry-type power transformer, a three step method is used to accurately measure the temperature rises of the transformer as well as all other components according their respective standards		N/A
	For the transformer, the method for the continuous current test should follow the simulated load method as described in IEC 60076-11:2018 consisting of two consecutive steps		N/A
	For all other components, an additional third test (step 3) is necessary to consider both no load and load losses of the dry-type transformer at the same time		N/A
	Step 1:		N/A
	The open-circuit test shall be performed in such a manner that the rated operating voltage (three-phase) at rated frequency is applied to the low-voltage winding of the power transformer via one of the outgoing feeders of the low-voltage switchgear and controlgear		N/A
	The high-voltage winding is connected to the high-voltage switchgear and controlgear		N/A

	AC prefabricated substations as per IEC 62271-202		
7.5	Requirements	Remark	Verdict
	The high-voltage main circuit is open (see Figure 5). After the steady state condition of the windings and magnetic core has been reached, individual winding temperatures of the power transformer shall then be measured in accordance with 14.3.2.4 of IEC 60076-11:2018. The ambient air temperature shall be measured in accordance with 7.5.104.1		N/A
	Step 2:		N/A
	The connection of supplies is made according to 7.5.103.2.2.2 (Figure 3) or 7.5.103.2.3.2 (Figure 4)		N/A
	The short-circuit test shall be performed in such a manner that the high-voltage side of the prefabricated substation is supplied with the high-voltage rated current of the high-voltage/low-voltage power transformer		N/A
	The low-voltage side of the prefabricated substation is supplied with the low-voltage rated current of the high-voltage/low-voltage power transformer		N/A
	When the steady state condition of the windings and magnetic core is obtained, the temperature measurements of the individual windings shall be made in accordance with 14.3.2.4 of IEC 60076-11:2018		N/A
	After completion of the two steps above, the temperature rise of the power transformer is calculated by the formula given in 14.3.2.2.2 of IEC 60076-11:2018		N/A
	The ambient air temperature shall be measured in accordance with 7.5.104.1		N/A
	Step 3:		N/A
	The test is performed using the preferred test method for the liquid-filled power transformer given in 7.5.103.2.2		N/A
	When the steady state condition of the windings and magnetic core is obtained, the temperature measurements of the individual windings shall be made in accordance with 14.3.2.4 of IEC 60076-11:2018 together with the low-voltage switchgear and controlgear, low-voltage interconnection, and high-voltage interconnection temperature measurements shall be made in accordance with 7.5.104.3 and 7.5.104.4, respectively		N/A

	AC prefabricated substations as per IEC 62271-202		
7.5	Requirements	Remark	Verdict
	The ambient air temperature shall be measured in accordance with 7.5.104.1		N/A
	The measurement of the air temperature inside the prefabricated substation and on the accessible surfaces of high-voltage switchgear and controlgear shall be made in accordance with 7.5.104.5 and 7.5.104.4 respectively		N/A
7.5.104	Measurements		P
7.5.104.1	Measurement ambient air temperature		P
	The ambient air temperature is the average temperature of the air surrounding the prefabricated substation	For an enclosed substation, it is the air outside the enclosure	P
	It shall be measured during the last quarter of the test period by means of at least four thermometers, thermocouples or other temperature-detecting devices equally distributed around the prefabricated substation at about the average height of its current-carrying parts and at a distance of about 1m from the prefabricated substation and at about the average height of its current-carrying parts or,	Four thermocouples, 1m distance from the substation	P
	in case of underground prefabricated substations, at the mid-height of the ventilation openings		N/A
	The thermometers or thermocouples shall be protected against air currents and undue influence of heat		P
	In order to avoid indication errors because of rapid temperature changes, the thermometers or thermocouples may be put into small bottles containing about half a litre of oil		P
	During the last quarter of the test period, the change of ambient air temperature shall not exceed 1K in 1h	Not exceed 1K	P
	If this is not possible because of unfavourable temperature conditions in the test room, the temperature of an identical prefabricated substation under the same conditions, but without current, can be taken as a substitute for the ambient air temperature		N/A
	This additional prefabricated substation shall not be subjected to an undue amount of heat		N/A

	AC prefabricated substations as per IEC 62271-202		
7.5	Requirements	Remark	Verdict
	The ambient air temperature during tests shall be more than +10 °C but less than +40 °C	For details refer to 3.6	P
7.5.104.2	Power transformer		P
	The top oil temperture rise for liquid-filled transformers shall be measured as given in IEC 60076-2:2011		P
	The average winding temperature rises for dry-type transformers shall be measured as given in IEC 60076-11:2018	Liquid-filled transformer	N/A
	The air temperature in the location where electronic equipment may be installed shall be measured. See 7.5.104.5		N/A
7.5.104.3	Low voltage switchgear and controlgear and low-voltage interconnection		P
	The low-voltage switchgear and controlgear temperature rises shall be measured as given in 10.10 of IEC 61439: 2020		P
	The temperature and temperature rise of the low voltage interconnections and their terminals shall be measured	For details, refer to 3.6	P
	The air temperature in the location where electronic equipment may be installed shall be measured		N/A
7.5.104.4	High voltage switchgear and controlgear and high-voltage interconnection		P
	The temperature and temperature rise of the high-voltage switchgear and controlgear accessible parts expected to be touched in normal operation shall be measured as given in 7.5.6 of IEC 62271-1:2017		P
	The temperature and temperature rise of the high voltage interconnections and their terminals shall be measured accroding to 7.5.6 of IEC 62271-1:2017	For details, refer to 3.6	P
	The air temperature in the location where electronic devices may be installed shall be measured	No electronic devices equipped	N/A
7.5.104.5	Air temperature inside the prefabricated substation		P
	The air temperature inside the prefabricated substation shall be measured		P

	AC prefabricated substations as per IEC 62271-202		
7.5	Requirements	Remark	Verdict
	The measurements shall be taken in front of the high-voltage switchgear and controlgear and the low-voltage switchgear, at the vertical middle plane at a distance of 100mm at three different heights equally distributed from the bottom of the component to 2m or to the roof if it is under 2m		P
	The measurements shall also be taken above the power transformer, at the vertical middle axis at 100 mm from the top of the power transformer and at 100 mm below the ceiling. See example in Figure 6		N/A
	In addition, for low-voltage compartments, for example communications box of the prefabricated substation, the air temperature shall be measured at the middle axis at three different heights equally distributed inside that compartment		P
	The average air temperature shall be measured during the last quarter of the test period at each measuring point by means of thermometers, thermocouples or other temperature-measuring devices		P
7.5.105	Acceptance criteria		P
	The prefabricated substation shall be deemed to have passed the temperature-rise test if :		P
	a) the transformer temperature rises do not exceed the corresponding temperature rises measured on the same transformer without an enclosure by more than the temperature class of the prefabricated substation	No enclosure class	N/A
	b) the temperature rises and temperature of the terminals of the high-voltage interconnections do not exceed the requirements of 7.5.6 of IEC 62271-1:2017		P
	c) the temperature rises and temperatures of low-voltage interconnections and low-voltage switchgear and controlgear do not exceed the requirements of 9.2 of IEC 61439-1: 2020		P
	d) the temperature rises and temperatures of the substation enclosure do not exceed the requirements of IEC 62271-1: 2017 for accessible parts excepted to be touched in normal operation		P

	AC prefabricated substations as per IEC 62271-202		
7.5	Requirements	Remark	Verdict
	e) The temperature rise and temperature of any outer accessible part of the enclosure of the substation shall respectively not exceed 30K and 70°C, excluding solar radiation effects		P
	Components in a prefabricated substation which are subject to individual specifications not covered by the scope of IEC 62271-1:2017, IEC 61439-1:2020, IEC 60076-2:2011 and IEC 60076-11:2018 shall not exceed the maximum permissible temperatures and temperature rise limits stated in the relevant standard for each component		N/A
	The air temperature measurements inside the prefabricated substation required in 7.5.104.5 shall be indicated in the test report for information and reference purposes		P
7.5.106	Continuous current test under solar radiation		N/A
	If the effect of solar radiation could affect the performance of the high-voltage/low-voltage transformer prefabricated substation, the high-voltage/low-voltage transformer prefabricated substation may be subjected to a continuous current type test with simulated solar radiation in accordance with Annex G		N/A
	The purpose of the test is to determine, under the conditions of continuous current and solar radiation, the additional temperature rise of the power transformer, the internal components, the air temperature inside the prefabricated substation and the accessible parts expected to be touched in normal operation		N/A
	If necessary, the required derating of the prefabricated substation could then be determined		N/A
	Alternatively, measures to reduce the exposure to and/or effect of solar radiation could be implemented		N/A
	The enclosure colour(s) used for the test should be included in the test report – with reference to the relevant colour standard used		N/A

3.3. Measurement condition of test day

Test day	
Measurement date	31 th May., 2023 ~ 2 nd Jun., 2023
Ambient condition	24.1°C to 24.7 °C
Related humidity	55%
Air pressure	102.1kPa

3.4. Test instrument

Equipment	Type	Serial number	Scope/accuracy	Next calibration date
Voltage transformer or high voltage measuring system	SYBS-3312	E7191	Transformer: Class 0.05 Power analyzer: Class 0.1	2023-09-07
Temperature measuring	LC-R50B	E7082	±0.2°C	2023-12-21
Thermal Imaging	343	E6543	<100°C: ±2°C ≥100°C: ±2%	2023-09-07
Thermal anemometer	HT-9829	LJ3053	±(5%+1d)	2023-10-24
Paperless recorder	GP20	E6731、E6732	<100°C: ±1°C ≥100°C: ±2%	2023-09-07
AC voltage stabilization source	WLATI-1600	E6742, E6743, E7360, E7363	±0.5%	2023-09-07
AC voltage stabilization source	WLATI-2500	E6744	±0.5%	2023-09-07
AC voltage stabilization source	WLATI-630	E6741, E7361, E7362	±0.5%	2023-09-07

3.5. Test circuit

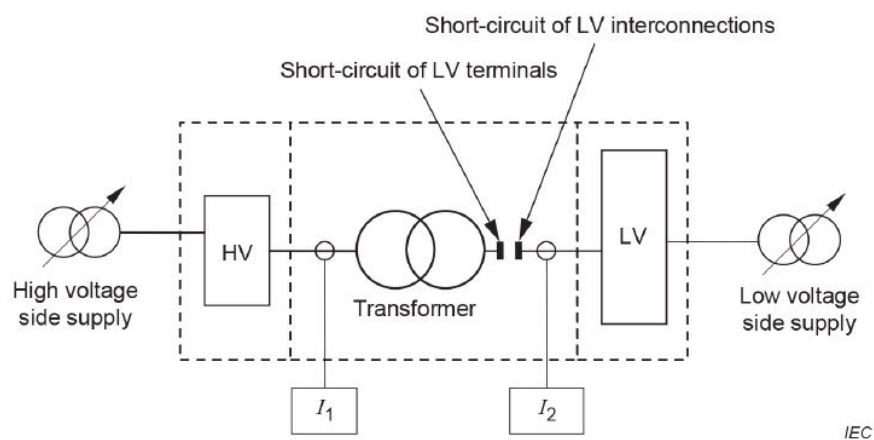
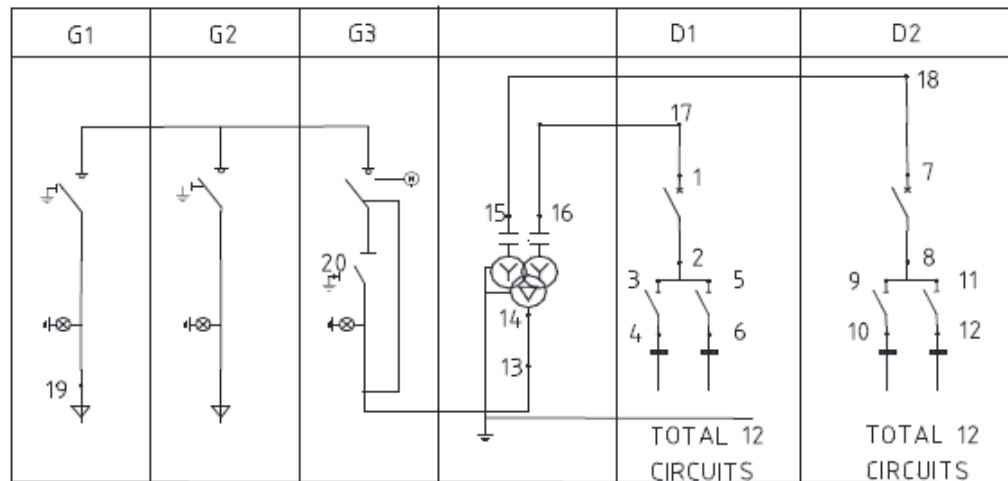


Figure 3.5. Test circuit of Continuous current test



1:D1 Low-voltage universal circuit breaker inlet terminal

2:D1 Low-voltage universal circuit breaker outlet terminal

3:D1 Low-voltage 1st circuit disconnector inlet terminal

4:D1 Low-voltage 1st circuit disconnector outlet terminal

5:D1 Low-voltage 4th circuit disconnector inlet terminal

6:D1 Low-voltage 4th circuit disconnector outlet terminal

7:D2 Low-voltage universal circuit breaker inlet terminal

8:D2 Low-voltage universal circuit breaker outlet terminal

9:D2 Low-voltage 3rd circuit disconnector inlet terminal

10:D2 Low-voltage 3rd circuit disconnector inlet terminal

11: D2 Low-voltage 4th circuit disconnector inlet terminal

12: Low-voltage 4th circuit disconnector outlet terminal

13: HV connection terminal of high voltage interconnection

14: Transformer terminal of high voltage interconnection

Low-voltage interconnection short-circuit withstand current test: D1: 1 terminal connected to the power

D1: 16 terminal short connection

D2: 7 terminal connected to the power

D2: 15 terminal short connection

High-voltage interconnection short time/ peak current test: 19 terminal connected power

14 terminal short connection

PE and 19 terminal of the C-phase bus connected power, 20 terminal of the earthing switches closed

Figure 3.5.2. Diagram of measuring points of Continuous current test on HV and LV main circuits

Table 3.6.2. Continuous current test of transformer at 60Hz						
Top oil temperature-rise and average oil temperature-rise			Ambient temperature [°C]		Calculations of temperature rise [K]	
Top oil temperature [°C]	Average oil temperature [°C]	Total loss injection/specified total loss [W]	Total loss [°C]	Measurement of cold resistance	Top oil temperature-rise	Winding temperature-rise
81.8	-	61671	24.2	-	57.6	-

Supplement information: Tap position of the transformer: Tap 5

The Continuous current test is conducted at rated power (7320kVA)

Table 3.6.3. Continuous current test of High voltage and low voltage circuits at 50Hz

Table 3.6.3. Continuous current test of High voltage and low voltage circuits at 50Hz					
Test parts	Required value	Measured value on three-phase			Verdict
	Temp. rise limits [K]	Temp. rise [K]			
		A	B	C	
Transformer terminal of high-voltage interconnection	50	30.7	31.6	30.1	P
HV connection terminal of high-voltage interconnection	50	32.7	34.1	31.9	P
D1 low-voltage universal circuit breaker intlet terminal	70	60.9	61.7	61.1	P
D1 low-voltage universal circuit breaker outlet terminal	70	57.6	59.1	58.6	P
D1 low-voltage 1 st circuit disconnector intlet terminal	65	55.4	57.1	55.9	P
D1 low-voltage 1 st circuit disconnector outlet terminal	65	50.7	53.1	51.4	P
D1 low-voltage 4 th circuit disconnector intlet terminal	65	54.9	57.2	53.6	P
D1 low-voltage 4 th circuit disconnector outlet terminal	65	53.0	53.8	52.7	P
D2 low-voltage universal circuit breaker intlet terminal	70	60.6	61.4	60.7	P
D2 low-voltage universal circuit breaker outlet terminal	70	57.4	59.2	58.3	P
D2 low-voltage 3 rd circuit disconnector intlet terminal	65	55.7	57.3	56.1	P
D2 low-voltage 3 rd circuit disconnector outlet terminal	65	50.7	52.9	51.1	P
D2 low-voltage 4 th circuit disconnector intlet terminal	65	55.1	56.8	53.4	P
D2 low-voltage 4 th circuit disconnector outlet terminal	65	53.1	53.4	52.4	P
D1 low-voltage side universal circuit breaker operating handle	25	17.9			P
D2 low-voltage side universal circuit breaker operating handle	25	18.2			P

Enclosure		30	11.3	P
Surfaces of manual control components (Non metal)		25	5.1	P
Ambient air temperature in substation	High-Voltage room	-	-	N/A
	Low-voltage room	-	-	N/A
	Transformer room	-	-	N/A
Supplement information: For the measured parts of temperature-rise on HV and LV circuits, refer to the diagram of Figure 3.5.3				

Table 3.6.4. Continuous current test of High voltage and low voltage circuits at 60Hz					
Test parts	Required value	Measured value on three-phase			Verdict
	Temp. rise limits [K]	Temp. rise [K]			
		A	B	C	
Transformer terminal of high-voltage interconnection	50	33.1	33.8	32.0	P
HV connection terminal of high-voltage interconnection	50	35.1	36.2	34.1	P
D1 low-voltage universal circuit breaker intlet terminal	70	63.0	63.5	63.1	P
D1 low-voltage universal circuit breaker outlet terminal	70	59.8	61.4	60.7	P
D1 low-voltage 1 st circuit disconnector intlet terminal	65	57.3	59.3	58.3	P
D1 low-voltage 1 st circuit disconnector outlet terminal	65	52.5	55.4	53.4	P
D1 low-voltage 4 th circuit disconnector intlet terminal	65	56.8	59.4	55.8	P
D1 low-voltage 4 th circuit disconnector outlet terminal	65	55.3	56.0	54.8	P
D2 low-voltage universal circuit breaker intlet terminal	70	62.9	63.7	62.9	P

D2 low-voltage universal circuit breaker outlet terminal		70	59.6	61.4	60.4	P
D2 low-voltage 3 rd circuit disconnecter intlet terminal		65	57.8	59.4	58.0	P
D2 low-voltage 3 rd circuit disconnecter outlet terminal		65	53.1	55.2	53.3	P
D2 low-voltage 4 th circuit disconnecter intlet terminal		65	57.2	59.0	55.3	P
D2 low-voltage 4 th circuit disconnecter outlet terminal		65	55.4	56.0	54.7	P
D1 low-voltage side universal circuit breaker operating handle		25	20.1			P
D2 low-voltage side universal circuit breaker operating handle		25	20.2			P
Enclosure		30	13.6			P
Surfaces of manual control components (Non metal)		25	7.0			P
Ambient air temperature in substation	High-Voltage room	-	-			N/A
	Low-voltage room	-	-			N/A
	Transformer room	-	-			N/A
Supplement information: For the measured parts of temperature-rise on HV and LV circuits, refer to the diagram of Figure 3.5.3						

3.7. Conclusion

The measured temperature value and temperature rise value of Transformer within the range of the standard requirements.

The measured temperature value and temperature rise value of High voltage interconnection and terminal within the range of the standard requirements.

The measured temperature value and temperature rise value of Low voltage interconnection and terminal within the range of the standard requirements.

The measured temperature value and temperature rise value of enclosure and handle within the range of the standard requirements.

The prefabricated substation has passed the tests.

4. Tests to prove the capability of the main and earthing circuits to be subjected to the rated peak and the rated short-time withstand currents

4.1. Reference standards

Clause	Test item	Standard	
	Content	Title	Nr.
7.6	Short-time withstand current and peak withstand current tests	AC prefabricated substations for rated voltages above 1kV and up to and including 52kV	IEC 62271-202

4.2. Measurement

	AC prefabricated substations as per IEC 62271-202		
7.6	Requirements	Remark	Verdict
	Subclause 7.6 of IEC 62271-1:2017 is replaced by the following text		P
	Since the high voltage switchgear and controlgear, Power transformers, and low voltage switchgear and controlgear contained in a prefabricated substation have been type-tested according to the relevant standard, this clause applied only to the high voltage and low voltage interconnections		P
	High-voltage and low-voltage interconnections of type-tested CEADS does not need to be tested again after installed inside the enclosure of a prefabricated substation		N/A
	Non-type-tested high voltage interconnections shall be tested following the procedure described in 7.6 of IEC 62271-1:2017 with the additional of the following paragraph		P
	The test currents will be applied in such a manner that the complete high voltage connection to the power transformer is tested		P
	All parts supporting the interconnection shall be maintained in place, as in service condition, during the test		P
	The test may be performed feeding the interconnection through the high-voltage switchgear and controlgear		P
	In particular, when the high voltage interconnection is protected by current-limiting devices situated in the high voltage switchgear, provision of 7.6.1 a) of IEC 62271-200:2021 are applicable		P

	AC prefabricated substations as per IEC 62271-202		
7.6	Requirements	Remark	Verdict
	Non type-tested low voltage interconnections shall be tested following the procedure described in IEC 61439-1:2020 for low voltage switchgear and controlgear		P
	The test currents will be applied in such a manner that the complete connection to the power transformer is tested		P
	All parts supporting the interconnection shall be maintained in place, as in service condition, during the test		P
	The earthing circuits of the high-voltage switchgear and controlgear and neutral earthing (if any) of the prefabricated substation shall be tested		P
	Test according to 7.6 of IEC 62271-1:2017 shall be performed between the earthing connection point of the high-voltage switchgear and controlgear and the prefabricated substation external earthing connection point		P
	If applicable, an additional test according to 10.11.5.6 of IEC 61439-1:2020 shall be performed between the connecting point to earth of the neutral, i.e. protective conductor, and the prefabricated substation external earthing connection point		P
	It is not required to repeat the type tests on the main earthing circuits of individually type-tested components		P
	After the test, some deformation of the main earthing conductor and of the connection to the components is permissible, but the continuity of the circuit shall be preserved	After the test: The structure of the cabinet have no deformation; The clearance and creepage distance of busbar comply with the specification; Insulation holder of the busbar show no cracking phenomena; The clamping of all connection parts have no loosening; The continuity of the PE is normal;	P

Test report

Report Number: CN23BNP1 001

	AC prefabricated substations as per IEC 62271-202		
7.6	Requirements	Remark	Verdict
	This is verified by using the electrical continuity check of 7.4.3	For electrical continuity check refer to 4.8	P

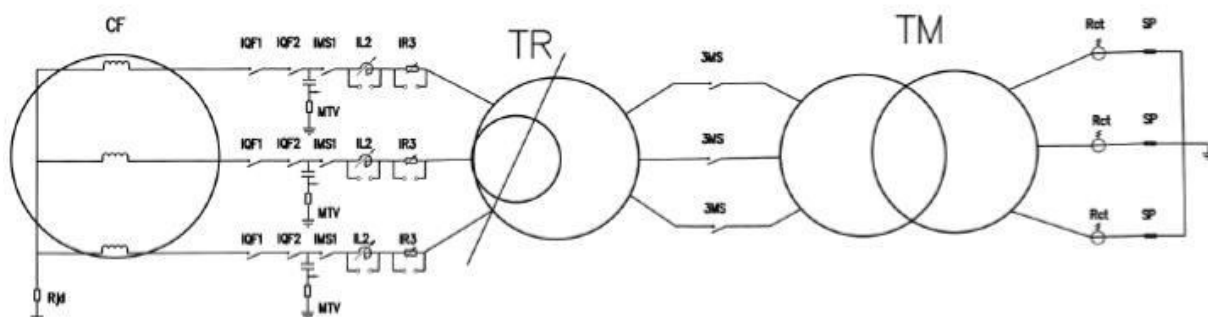
4.3. Measurement condition of test day

Test day	
Measurement date	12 th Jun., 2023
Ambient condition	16.3°C
Related humidity	53%
Air pressure	101.8kPa

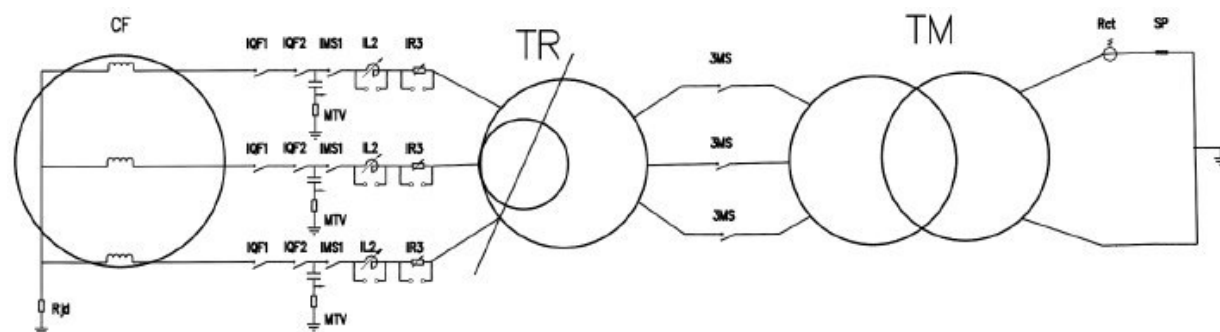
4.4. Test instrument

Equipment	Type	Serial number	Scope/accuracy	Next calibration date
Data acquisition system	1-GEN2tB-2	E6727	±0.3%	2023-09-07
Vernier caliper	150mm	LJ3047	±0.01mm	2023-11-21
Earthed continuity tester	CHT9930A	E7081	±1%	2023-12-21

4.5. Test circuit



Three-phase test diagram (High voltage and low voltage circuit)



Single-phase test diagram (Earthing circuit)

Rjd	Earthed resistance	IMS1	Phase-selective closing switch	3MS	Phase-selector switch
CF	Generators	IR3	Limiting DC component resistors	Rct	Roche coils
IQF1	Protection circuit breaker	IL2	Regulating reactor	SP	Test product
IQF2	Operating circuit breaker	TM	Transformer	MTV	Voltage divider
TR	On-load autotransformer				

Figure 4.5. Test circuit of short-time withstand current and peak withstand current test

4.6. Criteria of test current and test value obtained

4.6.1. Calculation of test current

Table 4.6.1. Criteria of short-time withstand current and peak withstand current				
Test circuit	Peak current		Short-time withstand current	
	Rated current [kA]	Duration [ms]	Rated current [kA]	Duration [s]
High voltage main circuit	52 (95mm ²)/54.6 (120mm ²)	300	20 (95mm ²)/21 (120mm ²)	1
Low voltage main circuit	105	-	50	1
Earthing circuit	45.24	-	17.4	2

4.6.2. Test value obtained

Table 4.6.2.1. Test value of low-voltage interconnection short-time and peak withstand current test (D1 Unit)					
/	Test results				
	Standard value	Measured value			Waveform curve
		Phase A	Phase B	Phase C	
r.m.s. value of short-time withstand current [kA]	50 ⁺⁵ ₀ %	50.01	50.01	50.01	AG1300501-2023-T01
Peak value of short-time withstand current [kA]	105 ⁺⁵ ₀ %	106.43	92.21	93.41	
Joule integral (x10 ⁶ A ² s)	2500	2650.02	2558.82	2558.97	
Frequency	60 ^{start±10%} _{end-20%}	55.83			
Electricity time[s]	1	1.02			
Supplement information: For low voltage main cirtuit, short-time withstand current and Peak withstand current test one time.					

Table 4.6.2.2. Test value of low-voltage interconnection short-time and peak withstand current test (D2 Unit)

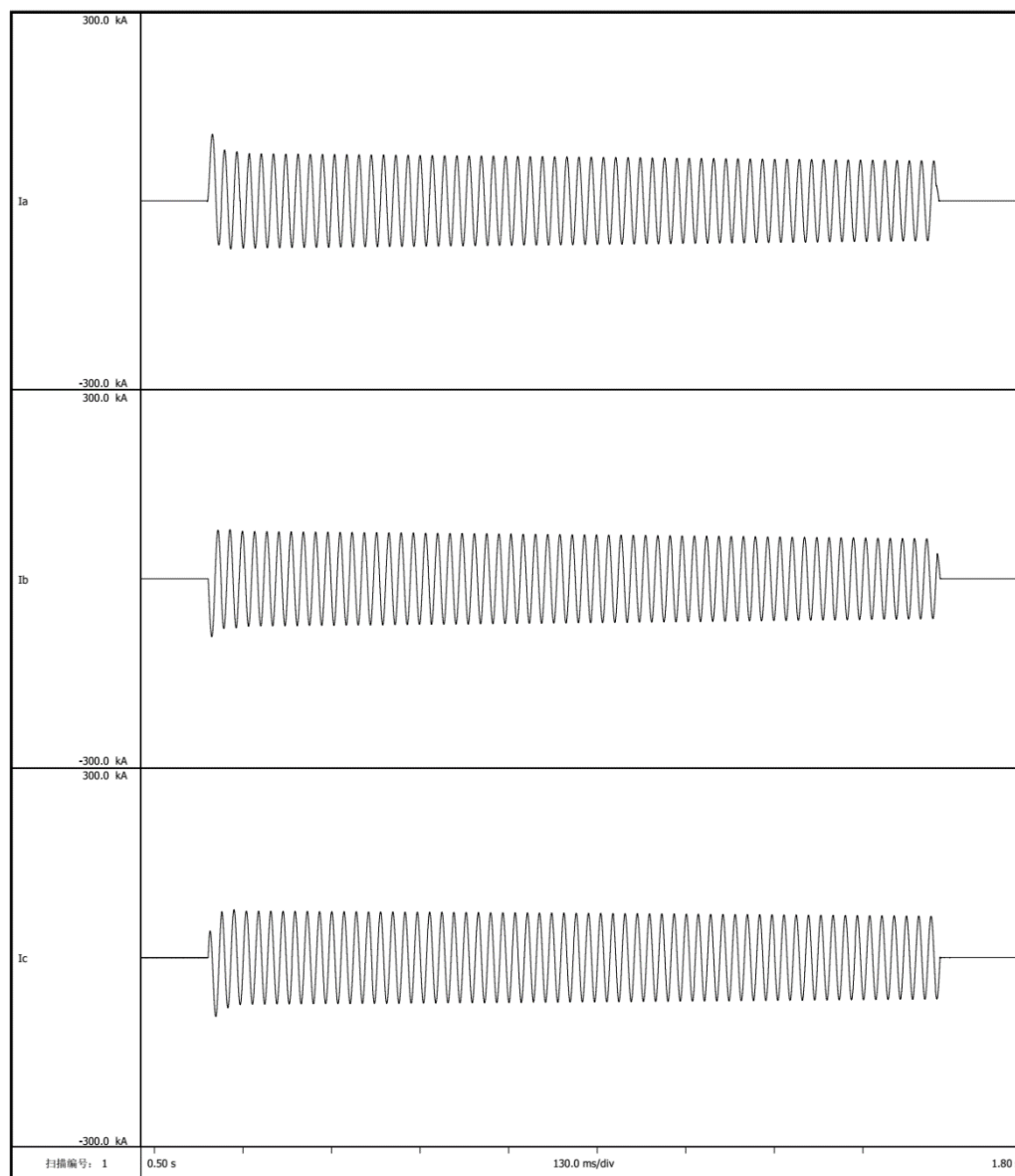
/	Test results				
	Standard value	Measured value			Waveform curve
		Phase A	Phase B	Phase C	
r.m.s. value of short-time withstand current [kA]	50 ₀ ⁺⁵ %	50.03	50.03	50.03	AG1300501-2023-T02
Peak value of short-time withstand current [kA]	105 ₀ ⁺⁵ %	92.63	95.20	107.33	
Joule integral (x10 ⁶ A ² s)	2500	2611.10	2611.78	2612.42	
Frequency	60 ^{start±10%} _{end^{10%}^{-20%}}	55.75			
Electricity time[s]	1	1.04			
Supplement information: For low voltage main cirtuit, short-time withstand current and Peak withstand current test one time.					

Table 4.6.2.3. Test value of earthing circuit short-time and peak withstand current test

/	Test results		
	Standard value	Measured value	Waveform curve
r.m.s. value of short-time withstand current [kA]	17.4 ⁺⁵ ₀ %	17.77	AG1300501-2023-T03~ T04
Peak value of short-time withstand current [kA]	45.24 ⁺⁵ ₀ %	45.40	
Joule integral (x10 ⁶ A ² s)	605.52	643.26	
Frequency	60 ^{start±10%} _{end-20%}	55.91	
Electricity time[s]	2	2.01	
Supplement information: Short-time and peak withstand current tests shall be made one time on earthing circuits. The test frequency is 60Hz, the peak current factor is 2.6.			

Table 4.6.2.4. Test value of high-voltage interconnection short-time and peak withstand current test (High-voltage Cable section: 95mm ² , 120mm ²)					
Section: 95mm ²	Test results				
	Standard value	Measured value			Waveform curve
		Phase A	Phase B	Phase C	
r.m.s. value of short-time withstand current [kA]	20 ⁺⁵ ₀ %	20.36	20.25	20.34	AG1300501-2023-T05~ T06
Peak value of short-time withstand current [kA]	52 ^{+5%}	52.33	39.39	47.91	
Joule integral (x10 ⁶ A ² s)	400	439.25	434.56	438.40	
Frequency	60 ^{start±10%} _{end-20%}	55.69			
Electricity time[s] (RMS)	1	1.05			
Electricity time[ms] (Peak)	300	322.23			
Section: 120mm ²	Test results				
	Standard value	Measured value			Waveform curve
		Phase A	Phase B	Phase C	
r.m.s. value of short-time withstand current [kA]	21 ⁺⁵ ₀ %	21.06	21.19	21.03	AG0500109-2023-T02~T03
Peak value of short-time withstand current [kA]	54.6 ^{+5%}	55.03	38.01	46.47	
Joule integral (x10 ⁶ A ² s)	441	477.58	484.22	476.16	
Frequency	60 ^{start±10%} _{end-20%}	55.86			
Electricity time[s] (RMS)	1	1.07			
Electricity time[ms] (Peak)	300	319.36			

4.7. Waveform

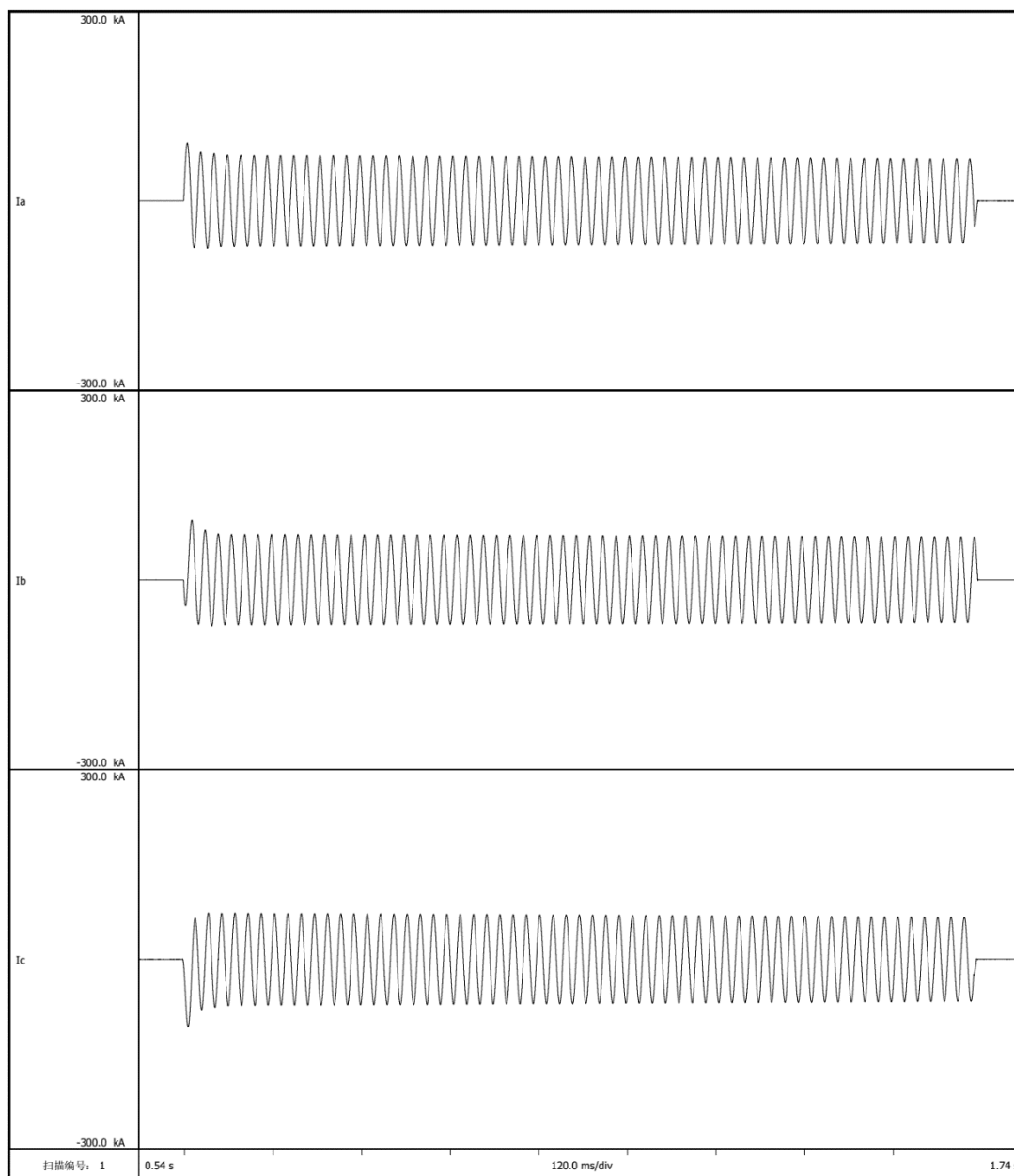


Oscillogram No.	AG1300501-2023-T01		
Phase	A	B	C
Current (RMS) (kA)	50.01	50.01	50.01
Current peak (kA)	106.43	92.21	93.41
Joule Integral (MA ² s)	2560.02	2558.82	2558.97
Frequency (Hz)	55.83		
Time (s)	1.02		

Waveform AG1300501-2023-T01: LV main circuit (D1 Unit) short-time and peak withstand current test

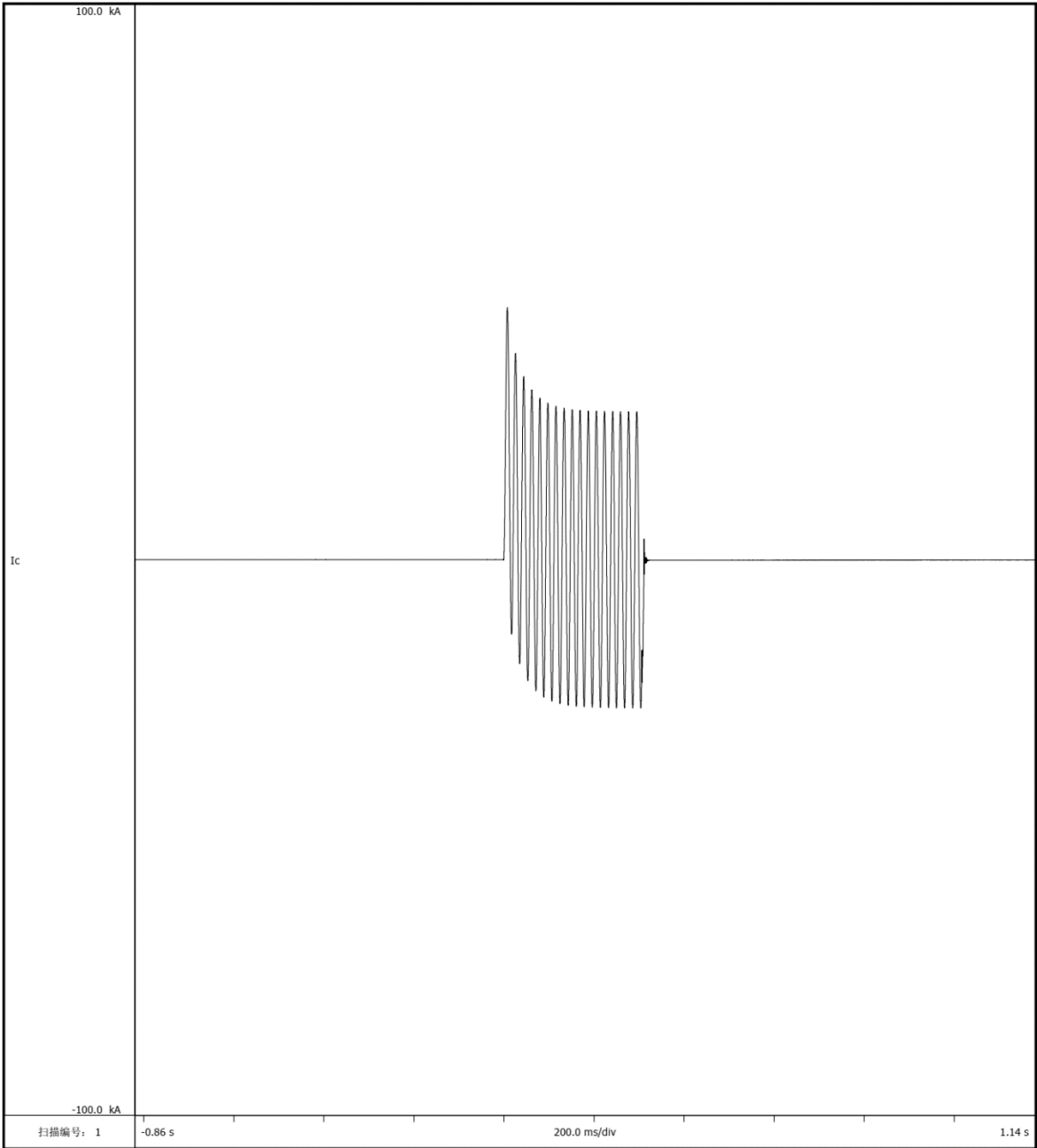
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Oscillogram No.	AG1300501-2023-T02		
Phase	A	B	C
Current (RMS) (kA)	50.03	50.03	50.03
Current peak (kA)	92.63	95.20	107.33
Joule Integral (MA ² s)	2611.10	2611.78	2612.42
Frequency (Hz)	55.75		
Time (s)	1.04		

Waveform AG1300501-2023-T02: LV main circuit (D2 Unit) short-time and peak withstand current test

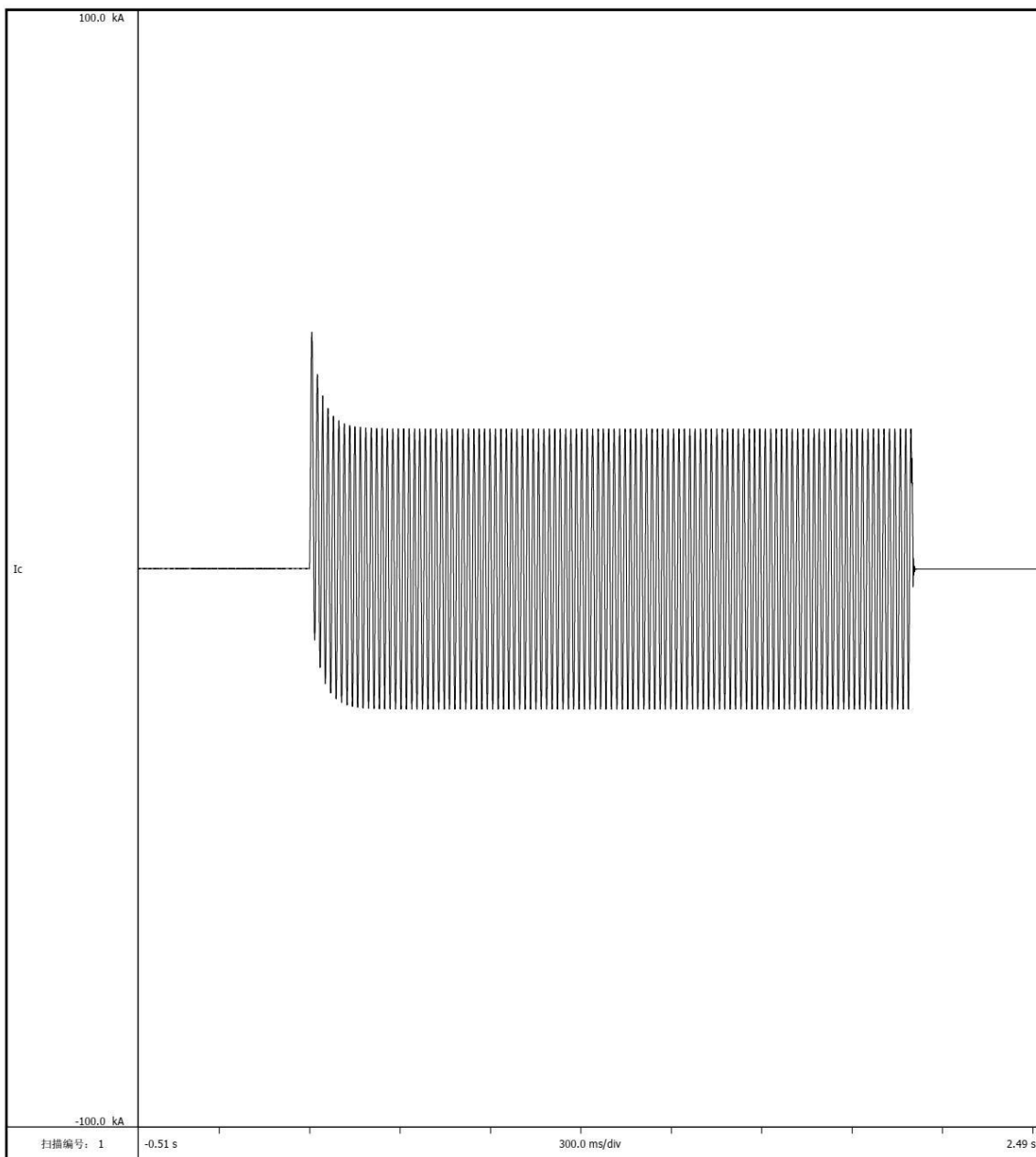


Oscillogram No.	AG1300501-2023-T03
Phase	C
Current peak (kA)	45.40
Frequency (Hz)	55.91
Time (ms)	317.47

Waveform AG1300501-2023-T03: Earthing circuit peak withstand current test

Test report

Report Number: CN23BNP1 001

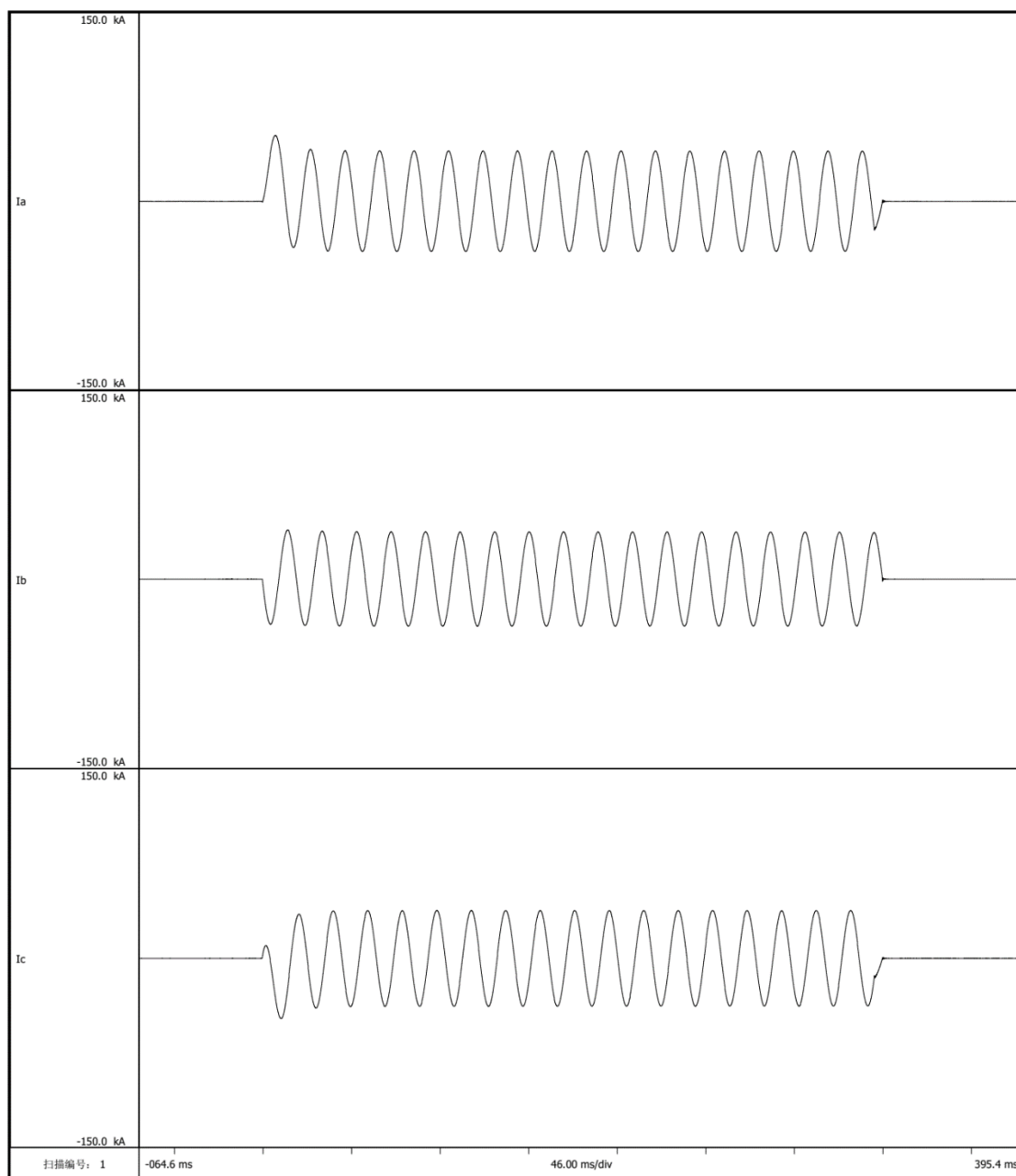


Oscillogram No.	AG1300501-2023-T04
Phase	C
Current (RMS) (kA)	17.77
Joule Integral (MA ² s)	643.26
Frequency (Hz)	55.91
Time (s)	2.01

Waveform AG1300501-2023-T04: Earthing circuit short-time withstand current test

Test report

Report Number: CN23BNP1 001

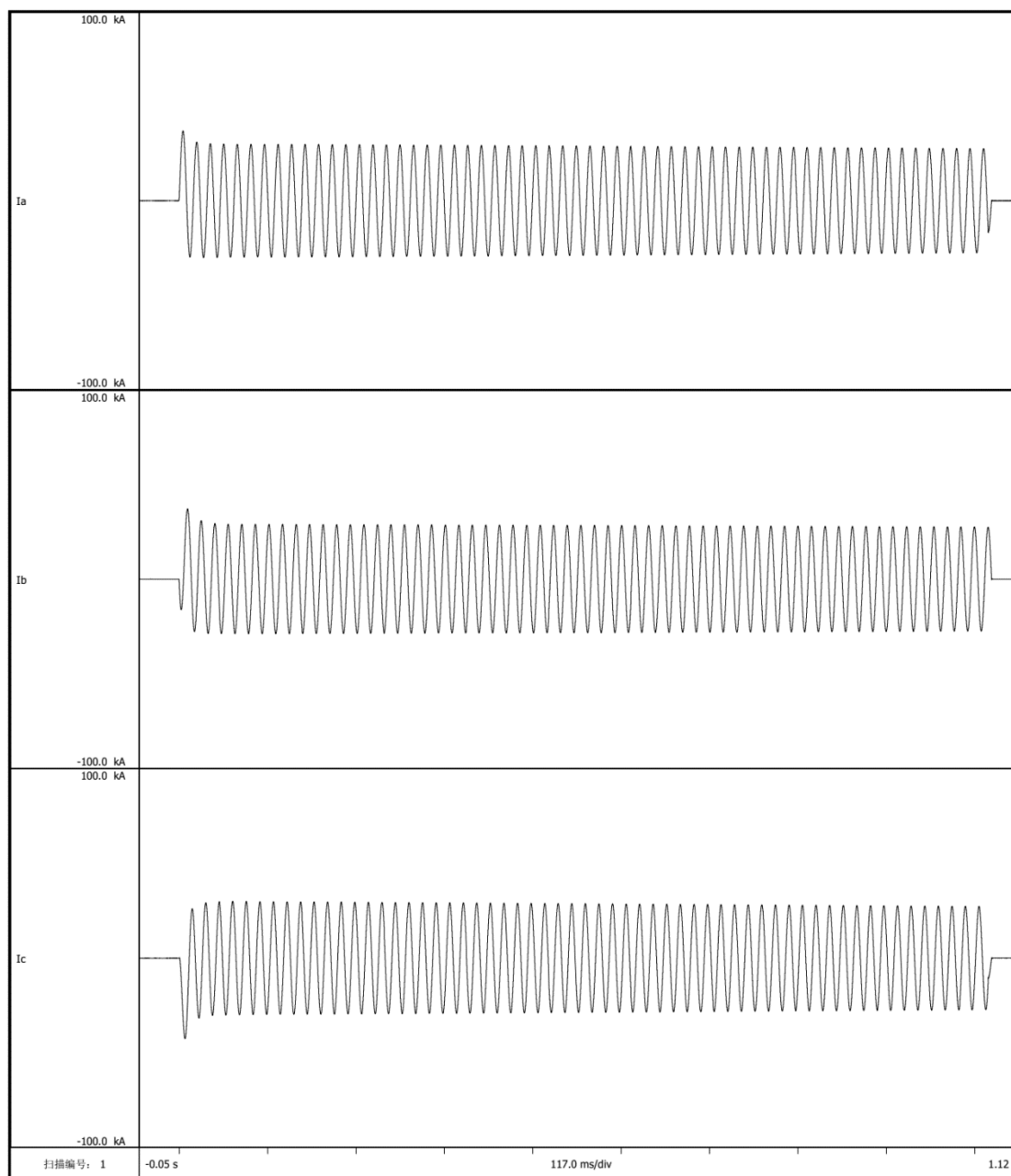


Oscillogram No.	AG1300501-2023-T05		
Phase	A	B	C
Current peak (kA)	52.33	39.39	47.91
Joule Integral (MA ² s)	247.32	238.20	243.70
Frequency (Hz)	55.53		
Time (ms)	322.23		

Waveform AG1300501-2023-T05: HV main circuit peak withstand current test

Test report

Report Number: CN23BNP1 001

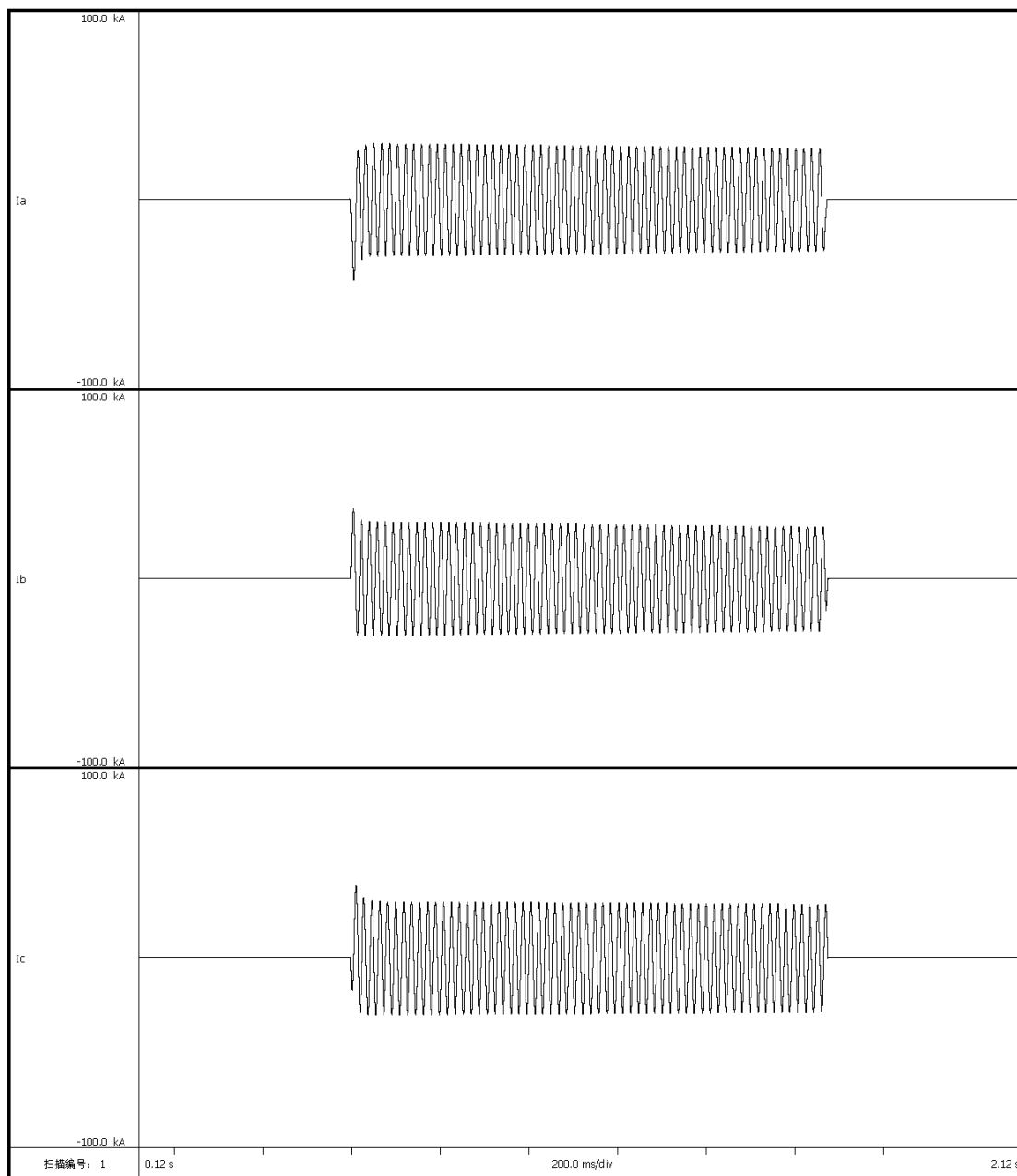


Oscillogram No.	AG1300501-2023-T06		
Phase	A	B	C
Current (RMS) (kA)	20.36	20.25	20.34
Joule Integral (MA ² s)	439.25	434.56	438.40
Frequency (Hz)	55.69		
Time (s)	1.05		

Waveform AG1300501-2023-T06: HV main circuit short-time withstand current test

Test report

Report Number: CN23BNP1 001

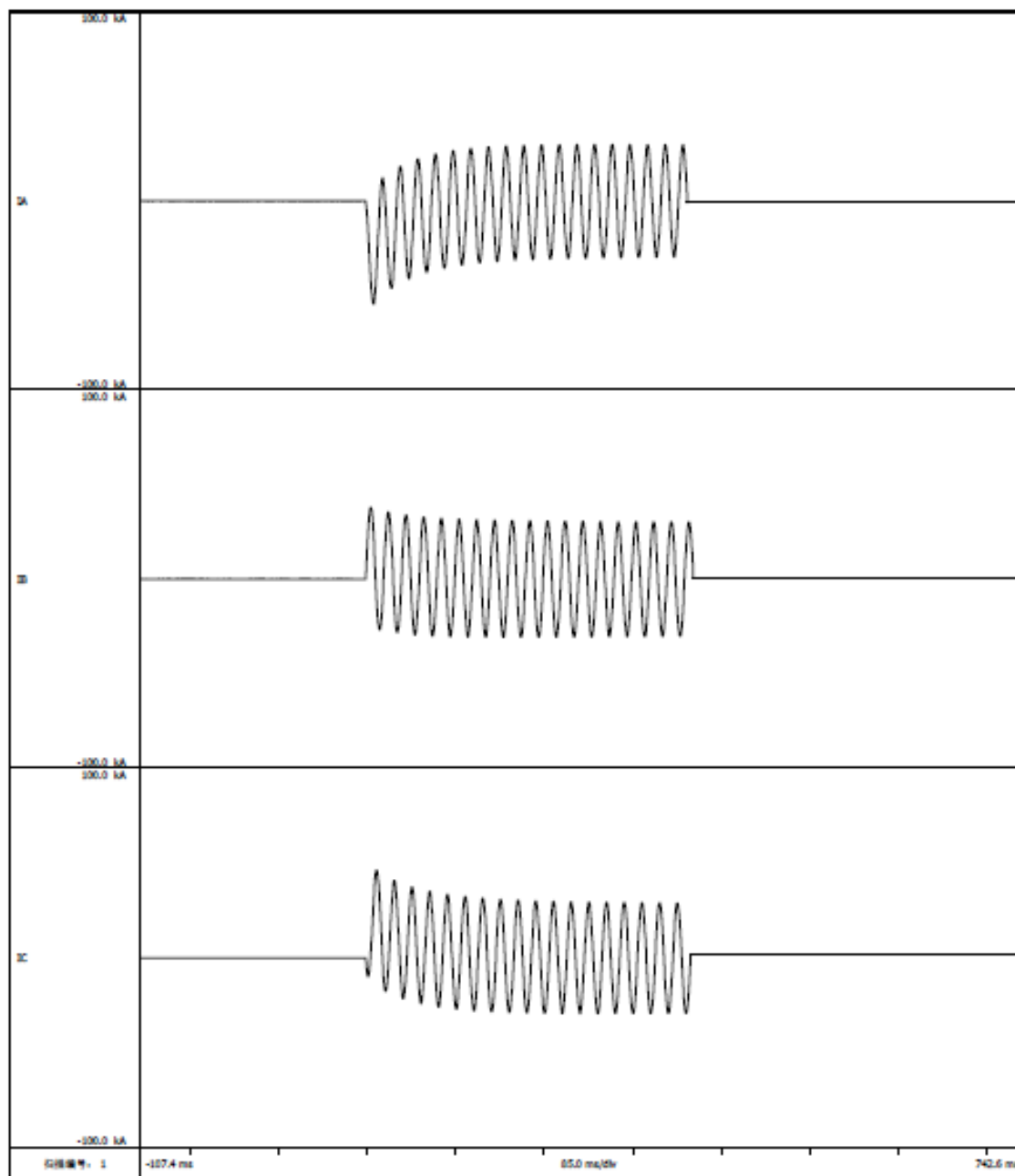


Oscillogram No.	AG0500109-2023-T02		
Phase	A	B	C
Current (RMS) (kA)	21.06	21.19	21.03
Joule Integral (MA ² s)	477.58	484.22	476.16
Frequency (Hz)	55.72		
Time (s)	1.07		

Waveform AG0500109-2023-T02: HV main circuit short-time withstand current test

Test report

Report Number: CN23BNP1 001



Oscillogram No.	AG0500109-2023-T03		
Phase	A	B	C
Current (peak) (kA)	55.03	38.01	46.47
Joule (MA ² s)	188.84	175.33	169.09
Frequency (Hz)	55.86		
Time (ms)	319.36		

Waveform AG0500109-2023-T03: HV main circuit Peak withstand current test

4.8. Earthing continuity test after short-circuit tests

Test part	Prescribed value [V]	Measured value [V]
Between low-voltage room door lock and main earthed conductor	<3	0.39
Between high-voltage switchgear door lock and main earthed conductor	<3	0.40
Between the high-voltage room door lock and main earthed conductor	<3	0.42
Between transformer room door lock and main earthed conductor	<3	0.45
Between the universal circuit breaker frame and main earthed conductor	<3	0.39
Between the low-voltage switchgear door lock and main earthing conductor	<3	0.12
Between the low-voltage disconnecter mounting beam and main earthing conductor	<3	0.06

4.9. Conclusion

The deviations with respect to rated values were within the specified tolerances.

During the test no visible damage could be detected.

The continuity of low voltage main circuit and earthing circuit have no impair after the test.

The prefabricated substation has passed the tests.

5. Tests to verify the degree of protection

5.1. Reference standards

Clause	Test item	Standard	
	Content	Title	Nr.
7.7	Verification of the protection	AC prefabricated substations for rated voltages above 1kV and up to and including 52kV	IEC 62271-202
7.7	Verification of the protection	High-voltage switchgear and controlgear-Part1: Common specifications	IEC 62271-1

5.2. Measurement

AC prefabricated substations as per IEC 62271-202			
7.7	Requirements	Remark	Verdict
	Subclause 7.7 of IEC 62271-1:2007 is applicable	This test mainly for checking the IP code of the substation, for mechanical tests refer to the details showed in clause 7.101	P

High-voltage switchgear and controlgear-Part1: Common specifications as per IEC 62271-1			
7.7	Requirements	Remark	Verdict
	Vefification of the IP coding		P
	In accordance with the requirements specified in Clauses 11, 12, 13 and 15 of IEC 60529, tests shall be performed on the enclosures of switchgear and controlgear fully assembled as under service conditions	The tests performed on the enclosure of the prefabricated substation following the requirements specified in IEC 60529	P
	Transformer chamber checking		N/A
	The diameter of jointed test finger is 12mm and length is 80mm, applying the force of 10N to the sample, and the jointed test finger has adequate clearance form hazardous live parts		N/A

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	High-voltage switchgear and controlgear-Part1: Common specifications as per IEC 62271-1		
7.7	Requirements	Remark	Verdict
	The diameter of rigid sphere without handle or guard is 12.5mm, applying the force of 30N to the sample, and the rigid sphere should not penetrate at all		N/A
	The water pressure is adjusted, the water quantity shall achieve 10L/min, the pressure is 69 kPa, and the duration is 8.2 min, after the test, the surface of the sample shall be wiped up and the interior of the enclosure of the sample is without the water by inspection		N/A
	The diameter of wire is 1.0mm and length is 100mm, applying the force of 1.0N to the sample, and the wire is not access to dangerous live parts		N/A
	High voltage & Low voltage chamber checking	HV chamber : IP54 LV chamber: IP65	P
	Put the sample in the test chamber according to the correct operation place	Testing procedure of the lab	P
	A suitable closed test chamber maintain the talcum powder in suspension, the talcum powder used shall be able to pass through a square-meshed sieve the nominal wire diameter of which 50 um and the nominal width of a gap between wires 75 um		P
	The amount of talcum powder to be used is 2kg per cubic metre of the test chamber volume and it shall not have been used for more than 20 tests		P
	The test is continued for a period of 8h. There is no visible talcum powder accumulated in enclosure and it does not interfere with the correct operation of the equipment after the test		P
	The water pressure is adjusted, the water quantity shall achieve 10L/min, the pressure is 70kPa, and the duration is 14.1 min, after the test, the surface of the sample shall be wiped up and the interior of the enclosure of the sample is without the water by inspection		P
	The diameter of wire is 1.0mm, applying the force of 1.0N to the sample, and the wire is not access to dangerous live parts		P
	As real cable connections entering the enclosures are not normally installed for type tests, corresponding filler pieces shall be used	Filler pieces used	P

	High-voltage switchgear and controlgear-Part1: Common specifications as per IEC 62271-1		
7.7	Requirements	Remark	Verdict
	Transport units of switchgear shall be closed for the tests by covers providing identical protection qualities as for the joints		P
	The tests shall, however, be made only if there are doubts regarding the compliance with these requirements, in each position of the relevant parts as deemed necessary		P
	When the supplementary letter W is used, a recommended test method is given in Annex C	No letter W used	N/A
Annex C	The switchgear and controlgear to be tested shall be fully equipped and complete with all covers, screens, bushings etc., and placed in an area to be subjected to with artificial precipitation		N/A
	For switchgear and controlgear comprising several functional units a minimum of two units shall be used to test the joints between them		N/A
	The artificial precipitation shall be supplied by a sufficient number of nozzles to produce a uniform spray over the surfaces under test		N/A
	The various parts of the switchgear and controlgear may be tested separately, provided that a uniform spray is simultaneously applied also to both of the following:		N/A
	a) the top surfaces from nozzles located at a suitable height		N/A
	b) the floor outside the equipment for a distance of 1m in front of the parts under test with the equipment located at the minimum height above the floor level specified by the manufacturer		N/A
	Where the width of the equipment exceed 3m, the spray may be applied to 3m wide sections in turn.		N/A
	Pressurized enclosures need not be submitted to artificial precipitation		N/A
	Each nozzle used for this test shall deliver a square-shaped spray pattern with uniform spray distribution and shall have a capacity of 30l/min $\pm$ 3l/min at a pressure of 460kPa $\pm$ 46kPa and a spray angle of 60° to 80°		N/A

	High-voltage switchgear and controlgear-Part1: Common specifications as per IEC 62271-1		
7.7	Requirements	Remark	Verdict
	The centre lines of the nozzles shall be inclined downwards so that the top of the spray is horizontal as it is directed towards the surfaces being tested		N/A
	It is convenient to arrange the nozzles on a vertical stand-pipe and to space them about 2m apart		N/A
	The pressure in the feed pipe of the nozzles shall be 460kPa $\pm$ 46kPa under flow conditions		N/A
	The rate at which water is applied to each surface under test shall be about 5mm/min, and each surface so tested receive this rate of artificial precipitation for duration of 5min		N/A
	The spray nozzles shall be at a distance between 2.5m and 3m from the nearest vertical surface under test		N/A
	After the test is completed, the equipment shall be inspected promptly to determine whether the following requirements have been met:		N/A
	a) no water shall be visible on the insulation of the main and auxiliary circuits		N/A
	b) no water shall be visible on any internal electrical components and drive mechanisms of the equipment		N/A
	c) no water accumulation of water shall be retained by the structure or other non-insulating parts		N/A

5.3. Measurement condition of test day

Test day	
Measurement date	18 th Apr., 2023 ~ 19 th Apr., 2023
Ambient condition	16.4°C
Related humidity	55%

5.4. Test instrument

Equipment	Type	Serial number	Scope/accuracy	Next calibration date
Test D probe(ϕ 1.0mm)	SC-I04T	E6514	$\pm 0.3N$	2023-10-23
Empty box barometer	DYM3	E6737	$\leq 2hpa$	2023-11-21
Temperature and humidity meter	DT-8892	LJ3111	($\pm 2\% \sim \pm 4\%$) RH, $\pm 1^{\circ}C$	2023-09-07
Walk-in sand and dust testing chamber	SC-019	4021	-	2024-01-10
Rainfall test equipment	ipx3-6	4928	-	2023-08-15
Test stick	1.0mm	0304012	$0 \sim +0.05mm$	2024-03-09
Cronometro	J9-2II	266	-	2024-01-02
Steel tape	3m	DYZ23	Class 2	2024-01-02
Infrared Thermometer	ST25	3991	$\pm 1\%$	2024-03-26
Power frequency withstand voltage test device	$0 \sim 150kV$	4815	-	2024-01-02

5.5. Test value obtained

Table 5.5. IP test of High-voltage & Low-voltage chamber		
Test unit	Measured value	Verdict
High voltage chamber	IP54	P
Low voltage chamber	IP65	P

5.6. Conclusion

The High voltage chamber meets the requirements of defined IP code.

The Low voltage chamber meets the requirements of defined IP code.

The prefabricated substation has passed the tests.

6. Tests or calculations to verify the withstand of the enclosure of the prefabricated substation against mechanical stress

6.1. Reference standards

Clause	Test item	Standard	
	Content	Title	Nr.
7.101	Calculations and mechanical tests	AC prefabricated substations for rated voltages above 1kV and up to and including 52kV	IEC 62271-202

6.2. Measurement

	AC prefabricated substation as per IEC 62271-202		
7.101	Requirements	Remark	Verdict
	Wind pressure		N/A
	The mechanical effects of the wind pressure on the prefabricated substation may be verified by calculation		N/A
	Refer to 6.101		N/A
	Roof loads		P
	The mechanical effects of loads on the roof of the prefabricated substation may be verified by calculation	Verified by test	N/A
	Refer to 6.101	Minimum 2500N/mm ²	P
	Mechanical impacts		P
	Mechanical impact tests shall be performed on external places of the enclosure that are likely to be weak, for example: doors, covers and ventilation openings		P
	Refer to Annex C for the test procedure		P
	Refer to 6.101		P
6.101	Protection of the prefabricated substation against mechanical stress		P
	The enclosure of a prefabricated substation shall have sufficient mechanical strength and shall withstand the following loads and impacts:		P
	c) external mechanical impacts on covers, doors and ventilation openings:		P

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	AC prefabricated substation as per IEC 62271-202		
7.101	Requirements	Remark	Verdict
	- external mechanical impacts with an energy of 20 J corresponding to a degree of protection IK 10 according to IEC 62262:2002	The defined enclosure IK level: IK10	P
	Accidental mechanical impacts above this value (for example, traffic collisions) are not covered by this document and should be prevented, if necessary, by other means provided external to and around the prefabricated substation		N/A
Annex C	Mechanical impact test		P
C.1	Test for the verification of the resistance to mechanical impact		P
	The tests shall be performed on the weak points of the exposed parts of the enclosure of the prefabricated substation, for example, covers, doors, and ventilation openings		P
	The test shall be performed using the test method described in IEC 62262:2002		P
	The impact energy shall be 20J		P
	For horizontal surfaces, a tube placed vertically may be used to guide the striking element		P
	If a variation in temperature within the normal service conditions significantly affects the mechanical impact strength of the material used for parts of the enclosure, for example, synthetic materials, then an impact test shall be performed on those parts at the minimum service temperature		N/A
	During the test, the enclosure shall be mounted, according to the manufacturer's instructions for use		P
	The maximum number of impacts shall be five on each vertical side or on the roof of the prefabricated substation	Once on each faceplate and doors	P
	Only one impact shall be applied at the same point		P
	To be successful the following criteria shall be met:		P
	- the degree of protection of the enclosure shall be maintained		P
	- operation of control means, handles, etc. shall not be impaired		P

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	AC prefabricated substation as per IEC 62271-202		
7.101	Requirements	Remark	Verdict
	- deterioration of the enclosure or deformations shall neither impair the further use of the equipment or decrease its dielectric withstand (or clearance or creepage distances) according to the specified values	No deterioration	N/A
	- superficial deterioration. For example, removal of paint and small depressions are admissible		P

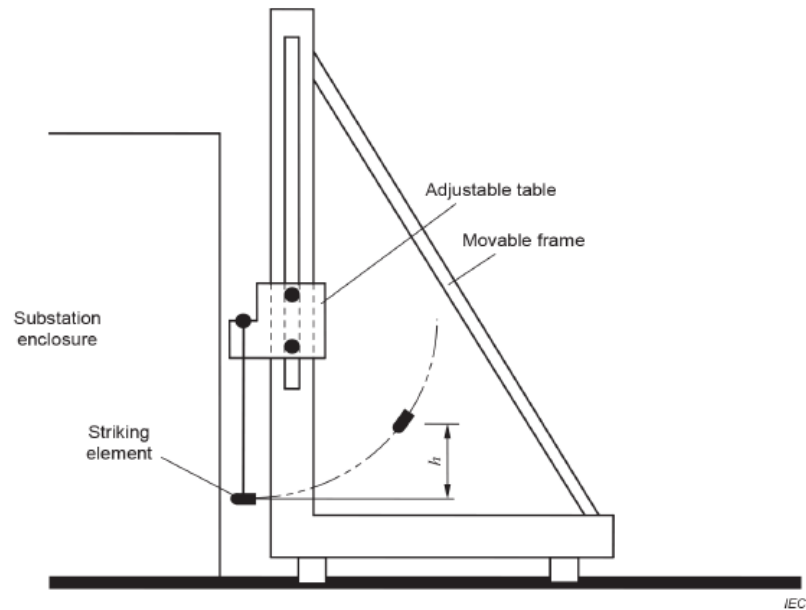
6.3. Measurement condition of test day

Test day	
Measurement date	28 th May., 2023
Ambient condition	22.6 °C
Related humidity	57%
Air pressure	101.2kPa

6.4. Test instrument

Equipment	Type	Serial number	Scope/accuracy	Next calibration date
Mechanical stress-resistant device for enclosure	QH-WKNS-10	E7380	Class 1	2023-12-21
Pendulum test device	SC-BC-IK07-10	E6757	±2%	2023-09-07

6.5. Test arrangement



Where:

impact energy = 20 J;

equivalent mass = 5 kg $\pm$ 0,25kg;

head of striking element: according to IEC 62262:2002;

material of element: E295, steel number 1.0050, according to EN 10025-2:2019 or equivalent, Rockwell hardness HRE 80 to 85 according to ISO 6508-1:2016;

h (nominal height of fall) = 400 mm $\pm$ 4 mm.

Figure 6.5. Test arrangement for mechanical impact test

6.6. Conclusion

The enclosure and the operation panel, door, etc. show no impair after the mechanical impact test.

The prefabricated substation has passed the tests.

7. Tests to verify the auxiliary and control circuits

7.1. Reference standards

Clause	Test item	Standard	
	Content	Title	Nr.
7.10	Additional tests on auxiliary and control circuits	AC prefabricated substations for rated voltages above 1kV and up to and including 52kV	IEC 62271-202
7.10	Additional tests on auxiliary and control circuits	High-voltage switchgear and controlgear-Part1: Common specifications	IEC 62271-1

7.2. Measurement

	AC prefabricated substation as per IEC 62271-202		
7.10	Requirements	Remark	Verdict
	Subclause 7.10.1 of IEC 62271-1:2017 is applicable		P
7.10.2	Functional tests		P
	Subclause 7.10.2 of IEC 62271-1:2017 does not apply and it is replaced as follows		P
	functional test of all low-voltage circuits, including electrical interlocks, shall be made to verify the functionality of auxiliary and control circuits in conjunction with the other parts of the prefabricated substation		P
	The tests shall be performed with the upper and lower value limits of the supply voltage defined in 5.9		P
	For low-voltage circuits, sub-assemblies and components, functional tests may be omitted if they have been fully performed during a test applied to similar prefabricated substation		P
	Mechanical operation, including mechanical interlocks, shall be tested regarding fail safe design aspects		P
7.10.3	Verification of the operational characteristics of auxiliary contacts		N/A
	Subclause 7.10.3 of IEC 62271-1:2017 is applicable		N/A
7.10.4	Environmental tests		N/A
	Subclause 7.10.4 of IEC 62271-1:2017 is applicable with the following limitations:		N/A

	AC prefabricated substation as per IEC 62271-202		
7.10	Requirements	Remark	Verdict
	– tests do not apply for indoor switchgear and controlgear operated under normal service conditions as defined by Clause 4 of IEC 62271-1:2017		N/A
	– when the tests as stated in 7.10.4 of IEC 62271-1:2017 have been performed on the separate components of a representative auxiliary and control circuit, no further environmental tests are needed		N/A
	– when tests are performed, 7.10.4 of IEC 62271-1:2017 is applicable on a typical lay-out of the auxiliary and control circuits		N/A
7.10.5	Dielectric test		P
	Subclause 7.10.5 of IEC 62271: 2017 is applicable		P

	High-voltage switchgear and controlgear-Part1: Common specifications as per IEC 62271-1		
7.10	Requirements	Remark	Verdict
7.10.5	Dielectric test		P
	Auxiliary and control circuits of switchgear and controlgear shall be subjected to short duration power-frequency voltage withstand tests		P
	Each test shall be performed:		P
	a) between the auxiliary and control circuits connected together as a whole and the frame of the switching device		P
	b) if practicable, between each part of the auxiliary and control circuits, which in normal use may be insulated from the other parts, and the other parts connected together and to the frame		P
	The power frequency tests shall be performed according to IEC 61180		P
	The test voltage shall be 2 kV with duration of 1 min	2kV/60s	P
	A DC test is acceptable by agreement of the manufacturer, the test voltage shall be 2,8 kV, with a duration of 1 min		N/A
	The auxiliary and control circuits of switchgear and controlgear shall be considered to have passed the tests if no disruptive discharge occurs during each test	no disruptive discharge occurs	P

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	High-voltage switchgear and controlgear-Part1: Common specifications as per IEC 62271-1		
7.10	Requirements	Remark	Verdict
	If motors and other devices such as electronic equipment used in the auxiliary and control circuits have already been tested in accordance with their own specification, they shall be disconnected for these tests		N/A

7.3. Measurement condition of test day

Test day	
Measurement date	28 th May., 2023
Ambient condition	22.6 °C
Related humidity	57%
Air pressure	101.2kPa

7.4. Test instrument

Equipment	Type	Serial number	Scope/accuracy	Next calibration date
Voltage transformer or high voltage measuring system	SYBS-3312	E7191	Transformer: Class 0.05 Power analyzer: Class 0.1	2023-09-07
AC withstand voltage tester	AN9602M	E6523	±2.5%	2023-09-07
Empty box barometer	DYM3	E6737	≤2hpa	2023-11-21
Temperature and humidity meter	DT-8892	LJ3111	(±2%~±4%) RH, ±1°C	2023-09-07

7.6. Measured value

7.6.1. Measured value of Power-frequency voltage test

7.6.1. Auxiliary and control circuits Power frequency voltage test, rated frequency 50 Hz				
Parts of applied voltage	Test voltage	Duration	Frequency	Verdict
	[kV]	[s]	[Hz]	
Between auxiliary and control circuits and the base frame of the switchgear	2.00	60	50/60	P
Between each part of the auxiliary and control circuits and other parts connected together and connected to the base frame	2.00	60	50/60	P
Supplement information: N/A				

7.6.2. Measured value of Functional tests

Test items	Test voltage [V]	Verdict
All low-voltage circuits are tested for functionality and should operate normally at the upper limit of the supply voltage	242.3	P
All low-voltage circuits are tested for functionality and should operate normally at the lower limit of the supply voltage	187.1	P

7.7. Conclusion

There is no disruptive discharge during the power-frequency test.

The functional tests performed at upper and lower limit of the supply voltage without failure.

The prefabricated substation has passed the tests.

8. EMC compatibility tests

8.1. Reference standards

Clause	Test item	Standard	
	Content	Title	Nr.
7.9	Electromagnetic compatibility tests	AC prefabricated substations for rated voltages above 1kV and up to and including 52kV	IEC 62271-202
7.9	Electromagnetic compatibility tests	High-voltage switchgear and controlgear-Part1: Common specifications	IEC 62271-1

8.2. Measurement

	AC prefabricated substation as per IEC 62271-202		
7.9	Requirements	Remark	Verdict
	For high voltage switchgear and controlgear, 7.9 of IEC 62271-1:2017 is applicable, with the exception of the radio interference voltage test		P
	For low voltage switchgear and controlgear, 10.12 of IEC 61439-1:2020 is applicable	For EMC tests, see J.10.12	P
	A test on a complete substation is not necessary provided that the high voltage switchgear and low voltage switchgear have been tested according to the relevant standards		P
	However, for auxiliary and control circuits of the prefabricated substation neither belonging to high-voltage switchgear and controlgear nor to low-voltage switchgear, 7.9.1.2 of IEC 62271-2:2017 applies		N/A

	High-voltage switchgear and controlgear-Part1: Common specifications as per IEC 62271-1		
7.9	Requirements	Remark	Verdict
7.9.1.1	Emission tests from the main circuits		N/A
	Radio interference voltage tests apply only to switchgear and controlgear having a rated voltage of 245kV and above, when specified in the relevant product standard		N/A
7.9.1.2	Emission tests from auxiliary and control circuits		P

	High-voltage switchgear and controlgear-Part1: Common specifications as per IEC 62271-1		
7.9	Requirements	Remark	Verdict
	Auxiliary and control circuits of switchgear and controlgear shall be subjected to electromagnetic emission tests if they include electronic equipment or components		P
	In other cases no tests are required		N/A
	For auxiliary and control circuits of switchgear and controlgear, the EMC requirements and tests specified in this standard have precedence over other EMC specifications		P
	The test shall be performed only on a representative auxiliary and control circuit, because the single components are tested according to the relevant standards		P
	Electronic equipment, which is part of the auxiliary and control circuits, shall fulfill the requirements with regard to radiated emission, as defined in CISPR 11:2015 of group 1, class A equipment		N/A
	No other tests are specified		P
	A 10m measuring distance may be used instead of 30m, by increasing the limit values by 10dB	Measured distance: 10m	P
7.9.2	Immunity tests on auxiliary and control circuits		P
	Auxiliary and control circuits of switchgear and controlgear shall be subjected to electromagnetic immunity tests if they include electronic equipment or components		P
	In other cases no tests are required		N/A
	The tests shall be performed on a typical auxiliary and control circuit		P
	Components shall comply with their relevant standards, if any		P
	The following immunity tests are specified:		P
	- electric fast transient/burst test, the test simulates the conditions caused by switching in the auxiliary and control circuit		P
	-oscillatory wave immunity test, the test simulates the conditions caused by switching in the main circuit		P
	Electromagnetic immunity tests shall be made on complete auxiliary and control circuits or subassemblies		P

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	High-voltage switchgear and controlgear-Part1: Common specifications as per IEC 62271-1		
7.9	Requirements	Remark	Verdict
	The tests may be made on		P
	- the complete auxiliary and control circuits		P
	- subassemblies, such as central control cubicle, operating mechanism cubicle, etc		N/A
	- subassemblies within a cubicle, such as metering or monitoring system		N/A
	Individual testing of subassemblies is strongly recommended in cases where long lengths of interconnection are needed, or where significant interference are expected between the subassemblies		N/A
	Individual testing is mandatory for each interchangeable subassembly		N/A
	The test voltage shall be applied to the interface of the auxiliary and control circuits or tested subassembly		P
	The interface shall be defined by the manufacturer		P
	The test report shall clearly state what system or subassembly has been tested		P
7.9.2.2	Electrical fast transient/burst test		P
	An electrical fast transient/burst test shall be performed in accordance with IEC 61000-4-4 with a repetition rate of 5 kHz		P
	The ports and interfaces shall be chosen in accordance with IEC 61000-2		P
	The test voltage and coupling shall be chosen according to Table 16	Test voltage: 2kV	P
7.9.2.3	Oscillatory wave immunity test		P
	An oscillatory wave immunity test shall be performed, with shape and duration of the test voltage in accordance with IEC 61000-4-18		P
	The ports and interfaces shall be chosen in accordance with IEC 61000-6-2		P
	Damped oscillatory wave tests shall be made at 100 kHz and 1 MHz, with a relative tolerance of ± 30 %	100kHz and 1MHz made, for details , refer to 8.5	P

	High-voltage switchgear and controlgear-Part1: Common specifications as per IEC 62271-1		
7.9	Requirements	Remark	Verdict
	Tests shall be made for both common and differential mode		P
	The test voltage and coupling method shall be chosen according to Table 17		N/A
7.9.2.4	Behavior of the secondary equipment during and after tests		P
	The auxiliary and control circuits shall withstand each of the tests specified in 7.9.2.2 and 7.9.2.3 without permanent damage	No permanent damage	P
	After the tests it shall still be fully operative	Fully operative	P
	Temporary loss of parts of the functionality is permitted according to Table 18		N/A
7.9.3	Additional EMC tests on auxiliary and control circuits		P
	The objective of the tests described below is to qualify the whole assembly without repeating individual test on components		N/A
	Therefore, tests on components which comply with their relevant IEC standards and with relevant rated values need not be repeated		N/A
7.9.3.2	Ripple on DC input power port immunity test		N/A
	This test shall be performed according to IEC 61000-4-17:2009		N/A
	The test level shall be level 2, and the frequency of the ripple is equal to three times the rated frequency		N/A
	The assessment criterion is: "normal performance within the specification limits"		N/A
7.9.3.3	Voltage dips, short interruptions and voltage variations on input power por immunity tests		P
	Voltage dips, short interruptions and voltage variations tests on AC power ports shall be performed according to IEC 61000-4-11 and on DC power ports according to IEC 6100-4-29		P
	The relevant acceptance criteria are present in 6.4.1		P

8.3. Measurement condition of test day

Test day	
Measurement date	19 th Apr., 2023 ~ 21 th Apr., 2023
Ambient condition	18.3°C
Related humidity	41%
Air pressure	100.90kPa

8.4. Test instrument

Equipment	Type	Serial number	Scope/accuracy	Next calibration date
Comprehensive Simulator	UCS500M4	3058.2	Impulse cluster voltage: U _{re1} =3% Surge voltage: U _{re1} =4%	2023-09-16
Autotransformer	MV2616	3058.3	Voltage: U=0.5V(0%) Remaining voltage: U _{re1} =3% Duration: U _{re1} =3%	2023-09-16
EMI Test Receiver	ESU8	4365.1	Frequency: U _{rel} =3×10 ⁻⁷ ~3×10 ⁻⁵ Voltage: U=0.5dB Adjustment: U=0.8dB FM: U=0.7dB Decay: U=0.3dB 6dB Bandwidth: U _{rel} =0.6%	2023-09-16
Biconical Log Periodic Antenna	VULB9163	3961.2	Antenna factor: U= (0.7~0.8) dB	2023-09-08
Measurement Receiver	FCKL 1528	3060.1	Voltage: U=0.5dB Adjustment: U=0.8dB FM: U=0.7dB Decay: U=0.3dB, 6dB Bandwidth: U _{rel} =1%,	2023-09-16
Artificial power network	NNLK8127	3960.3	Partial pressure factor: U=0.3dB	2023-09-16
10m method electric wave dark room and shielding room	SAC-10m	4370	-	2023-06-14
Combined oscillation wave simulator	OCS 500N6F.3	4369.1	Ring wave voltage: U _{re1} =3% Damping oscillation wave voltage: U _{re1} =4%	2023-09-17

8.5. Test values of High-voltage switchgear

8.5.1.1. Test data of RF radiation emission test								
Frequency	Quasi-Peak	Limit value	capaacity	Measure time	Measure bandwidth	Antenna height	Antenna polarity	Turntable angle
[MHz]	[dBuv/m]	[dBuv/m]	[dB]	[ms]	[min]	[cm]	[H/V]	[deg]
42.513000	14.54	40.00	25.46	1000.0	120.000	100.1	V	-90.0
56.723500	14.15	40.00	25.85	1000.0	120.000	100.1	V	0.0
70.885500	15.44	40.00	24.56	1000.0	120.000	200.0	H	-180.0
196.403500	9.85	40.00	30.15	1000.0	120.000	100.1	V	0.0
201.302000	9.86	40.00	30.14	1000.0	120.000	100.1	V	90.0
931.906000	18.94	47.00	28.06	1000.0	120.000	200.0	V	-180.0
Supplement information: The sample can work normally after the test.								

8.5.1.2. Test result of RF radiation emission test				
Inspection items	Technical requirements		Test result	Single determination
	Frequency range [MHz]	Quasi-peak limit ^b [dB (uV/m)]		
RF radiation emission test	30~230 ^a	40	Meet the restrictions	Qualified
	230~1000	47		
Supplement information: Note a: Lower limits should be used at the transition frequency (230MHz) Note b: The limits value is measured at 10m				

8.5.2.1. Test data of RF conducted emission test					
Test port	Frequency [MHz]	Quasi-Peak QP [dB (uV)]		Average value AV [dB (uV)]	
		Measured value	Limit value	Measured value	Limit value
L phase	0.150	42.84	79	-	-
L phase	0.183	40.15	79	-	-
L phase	0.366	21.16	79	-	-
N phase	0.186	38.82	79	-	-
N phase	0.150	36.82	79	-	-
N phase	0.839	13.46	73	-	-
Supplement information: The sample can work normally after the test.					

8.5.2.2. Test result of RF radiation emission test					
Inspection items	Technical requirements			Test result	Single determination
	Frequency range [MHz]	Quasi-peak limit [dB (uV)]	Average value limit ^a [dB (uV)]		
RF conducted emission test	0.15~0.50	79	66	Meet the restrictions	Qualified
	0.50~30	73	60		
Supplement information: Note a: When measured with a quasi-peak detector receiver, if the limits measured with the average detector are met, the test equipment is considered to be in compliance with both limits and measurement with the average detector receiver is unnecessary					

8.5.3. Test results of Electrical fast transient/burst immunity test

Test port	Test voltage	Duration	Rise time/duration	Repetition rated	Test phenomenon
	[kV]	[min]	[ns]	[kHz]	
Power supply port & chassis grounding interface	±2	1	5/50	5	Normal

Supplement information: The sample can work normally after the test.

8.5.4.1. Test results of Oscillatory wave immunity test

Operating voltage	Coupling mode	Oscillation frequency	Interval	Test Voltage	Duration	Coupling path	Test polarity	Test phenomenon
[V]		[Hz]	[s]	[kV]	[min]			
AC 220	Differential mode	100k	10	1	1	L-N	+	Normal
							-	Normal
	Common mode	100k	10	2.5	1	L,N-PE	+	Normal
							-	Normal

Supplement information: The sample can work normally after the test.

8.5.4.2. Test results of Oscillatory wave immunity test

Operating voltage	Coupling mode	Oscillation frequency	Interval	Test Voltage	Duration	Coupling path	Test polarity	Test phenomenon
[V]		[Hz]	[s]	[kV]	[min]			
AC 220	Differential mode	1M	10	1	1	L-N	+	Normal
							-	Normal
	Common mode	1M	10	2.5	1	L,N-PE	+	Normal
							-	Normal

Supplement information: The sample can work normally after the test.

8.5.5. Test results of Ripple on AC power input voltage dips, short interruptions and voltage change immunity test			
Inspection items	Technical requirements	Test result	Single determination
Ripple on AC power input voltage dips, short interruptions and voltage change immunity test	Test part: Power input port	Meet the criterion A	Qualified
	Test level voltage dips:		
	0% UT, duration 0.5 cycle and 1cycle		
	40% UT, duration 10 cycle		
	70% UT, duration 25 cycle		
	80% UT for 250 cycles		
	Short interruptions: 0% UT for 250 cycles		
Supplement information: UT is rated input voltage			

8.6. Test values of Low-voltage switchgear

8.6.1. Test results of Electrostatic discharge immunity test			
Inspection items	Technical requirements	Test result	Single determination
Electrostatic discharge immunity test	Number of tests: 10 positive and 10 negative	Meet the criteria B	Qualified
	Interval: 1s		
	Location: contact discharge		
	Negative discharges for each pre-selected point		
	Assessibel metallic parts, Horizontal coupling plane, Vertical coupling plane		
	Air discharge: accessible		
	Non-metallic prats and gaps		
Supplement information: ETU works normally without abnormalities			

8.6.2. Test results of Radiated ratio-frequency, electromagnetic field immunity test			
Inspection items	Technical requirements	Test result	Single determination
Radiated ratio-frequency, electromagnetic field immunity test	Frequency range and test field strength: 80MHz ~ 1GHz 10V/m 1.4GHz ~ 6GHz 3V/m	Meet the criteria A	Qualified
	Modulation mode: since wave		
	Amplitude modulation: 80% AM at 1 kHz rate		
	Dwell time: 1s		
	Step size: 1% of the preceding frequency value		
	Polarity: Horizontal/Vertical		
Supplement information: ETU works normally without abnormalities			

8.6.3. Test results of Electrical fast transient/burst immunity test					
Test port	Test voltage	Duration	Rise time/duration	Repetition rated	Test Result
	[kV]	[min]	[ns]	[kHz]	
Power port	2	1	5/50	5	Meet the criteria B
Signal port	1	1	5/50	5	Meet the criteria B
Supplement information: The sample can work normally after the test.					

8.6.4. Test results of 1.2/50 us and 8/20 us surge immunity test					
Test port	Test voltage	Coupling path	Surge	Repetition rate	Test Result
	[kV]				
Power port	±2 (line to earth)	5 positive and 5 negative	1.5/50us	1 per min	Meet the criteria B
	±1 (line to line)				
Signal port	±1 (line to earth)			1.5/50us	1 per min
Supplement information: The sample can work normally after the test.					

8.6.5. Test results of immunity test to conducted disturbances, induced by radio-frequency fields					
Test port	Test voltage level	Duration	Modulation mode	Frequency range	Test Result
	[V]	[min]			
Power port	10	1	80% amplitude modulated with a 1kHz sine wave	150kHz ~ 80MHz	Meet the criteria A
Supplement information: The sample can work normally after the test.					

8.6.6. Test results of power-frequency magnetic field immunity test					
Test port	Field strength	Duration	Orientations	Frequency range	Test Result
	[A/m]	[min]			
Enclosure port	30	5	X, Y, Z	-	Meet the criteria A
Supplement information: The sample can work normally after the test.					

8.6.7. Test results of voltage dips and short interruptions immunity test			
Inspection items	Technical requirements	Test result	Single determination
Voltage dips and short interruptions immunity test	Test part: Power port	Meet the criteria C	Qualified
	Test level voltage dips:		
	0% UT, duration 0.5 cycle and 1cycle		
	40% UT, duration 10 cycle		
	70% UT, duration 25 cycle		
	80% UT for 250 cycles		
	Short interruptions: 0% UT for 250 cycles		
Supplement information: UT is rated input voltage			

8.6.8.1. Test result of emission test (Conducted disturbance test)					
Inspection items	Technical requirements			Test result	Single determination
	Frequency range [MHz]	Quasi-peak limit [dB (uV)]	Average value limit ^a [dB (uV)]		
Emission test	0.15~0.50	79	66	Meet the restrictions	Qualified
	0.50~30	73	60		
Supplement information: At transitional frequency (0.50MHz) , the lower limit applies					

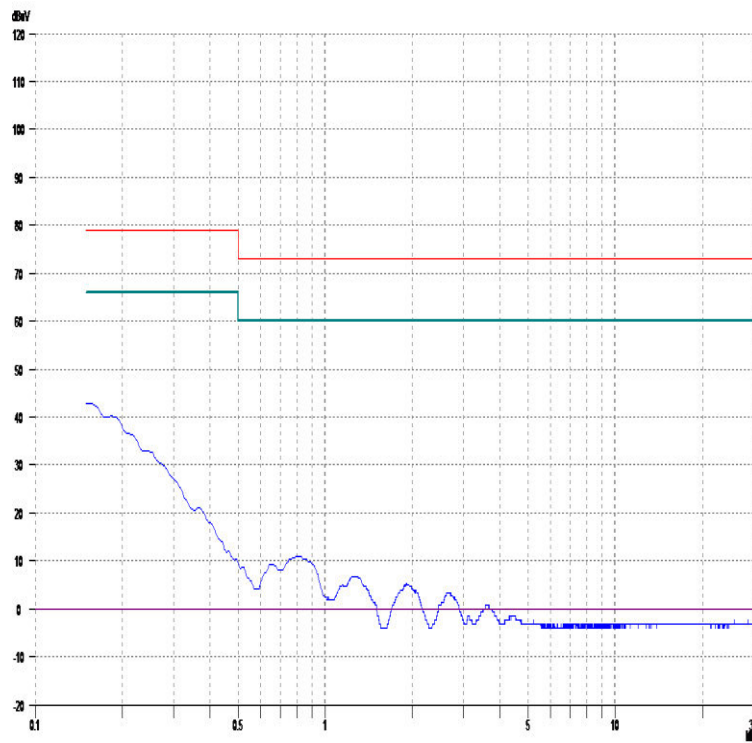
8.6.8.2. Test data of Emission test (Conducted disturbance test)					
Test port	Frequency [MHz]	Quasi-Peak QP [dB (uV)]		Average value AV [dB (uV)]	
		Measured value	Limit value	Measured value	Limit value
L phase	28.857	39.47	73	-	-
L phase	28.569	39.31	73	-	-
L phase	28.800	39.29	73	-	-
L phase	29.205	39.21	73	-	-
L phase	28.743	39.15	73	-	-
L phase	28.626	39.08	73	-	-
N phase	28.572	40.93	73	-	-
N phase	29.208	39.20	73	-	-
N phase	28.860	38.74	73	-	-
N phase	28.803	38.74	73	-	-
N phase	28.746	38.67	73	-	-
N phase	28.920	38.62	73	-	-
Supplement information: The sample can work normally after the test.					

8.6.9.1. Test result of Emission test (Radiated disturbance test)				
Inspection items	Technical requirements		Test result	Single determination
	Frequency range [MHz]	Quasi-peak limit ^b [dB (uV/m)]		
Emission test	30~230	40	Meet the restrictions	Qualified
	230~1000	47		
Supplement information: At transitional frequency (0.50MHz) , the lower limit applies				

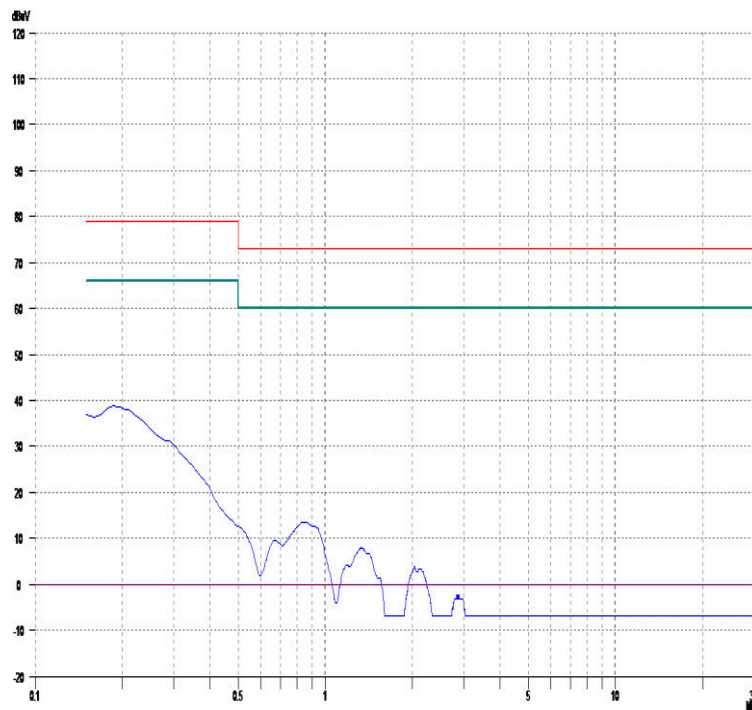
8.6.9.2. Test data of RF radiation emission test								
Frequency	Quasi-Peak	Limit value	Margin	Measure time	Measure bandwidth	Antenna height	Antenna polarity	Azimuth
[MHz]	[dBuv/m]	[dBuv/m]	[dB]	[ms]	[min]	[cm]	[H/V]	[deg]
37.808500	33.04	40.00	6.96	1000.0	120.000	100.1	V	-90.0
39.894000	35.15	40.00	4.85	1000.0	120.000	100.1	V	-90.0
40.524500	35.87	40.00	4.13	1000.0	120.000	100.1	V	-90.0
43.580000	27.93	40.00	12.07	1000.0	120.000	100.1	V	-90.0
199.992500	31.24	40.00	8.76	1000.0	120.000	200.0	V	-180.0
224.970000	31.62	40.00	8.38	1000.0	120.000	200.0	H	90.0
625.046500	35.86	47.00	11.14	1000.0	120.000	100.1	H	-180.0

Supplement information: The sample can work normally after the test.

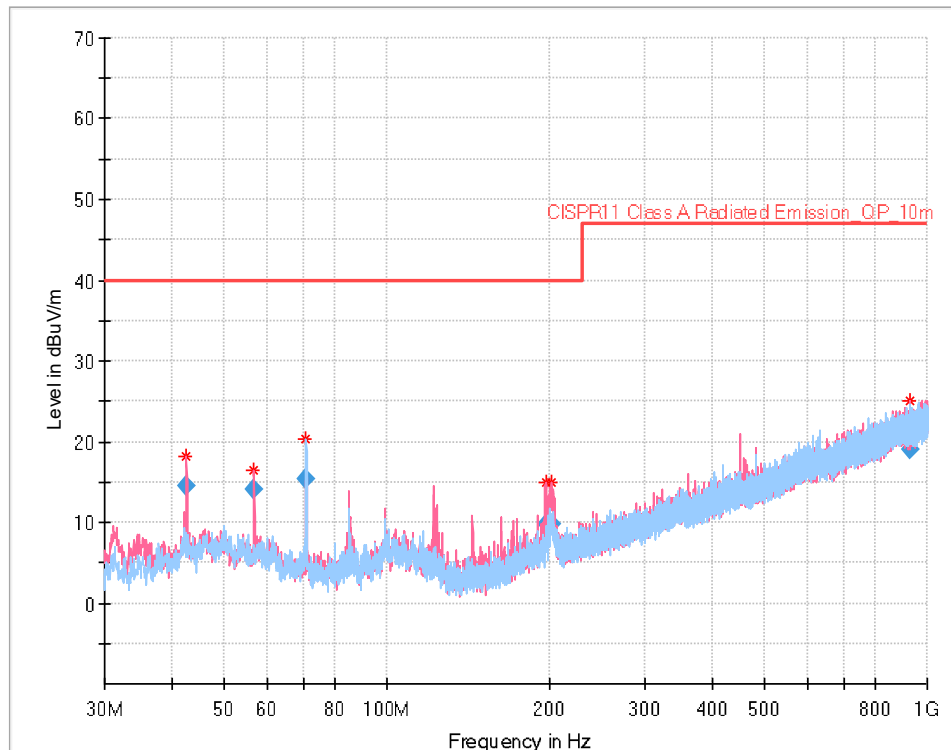
8.7. Test oscillograms



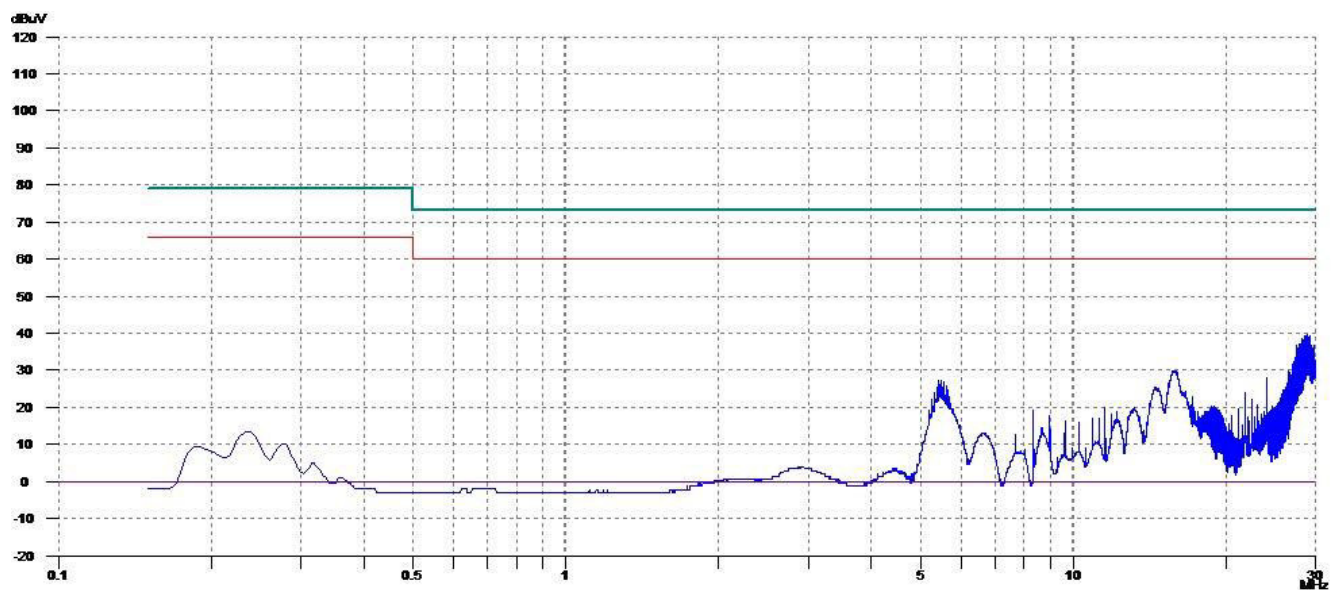
Oscillogram 1: RF conducted emission test QP curve (L) (HV Switchgear)



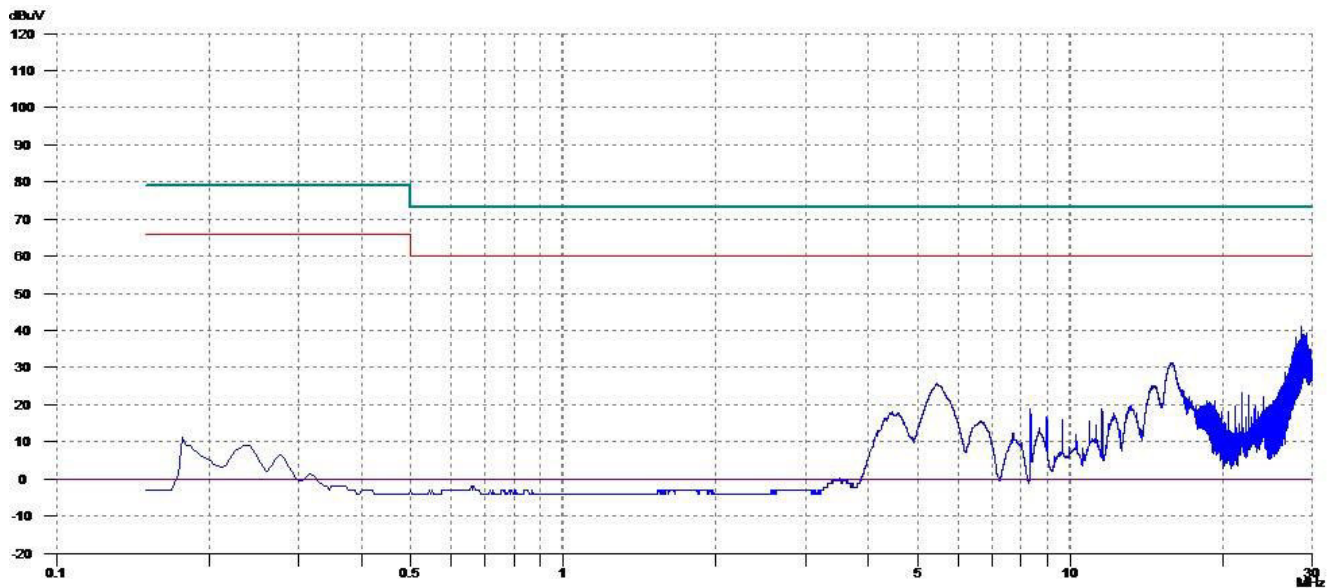
Oscillogram 2: RF conducted emission test QP curve (N) (HV Switchgear)



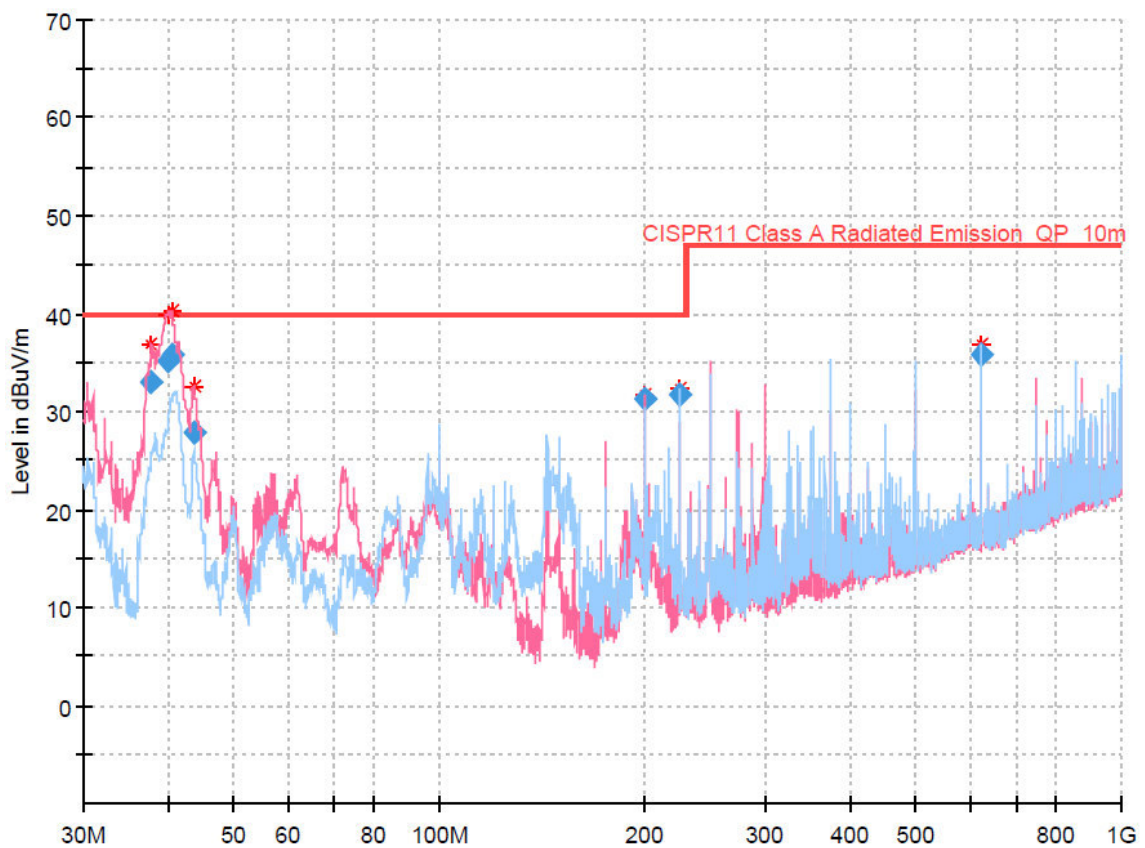
Oscillogram3: RF radiation emission test curve (Horizontal H, Vertical V) (HV Switchgear)



Oscillogram 4: Conducted disturbance test QP curve (L) (LV Switchgear)



Oscillogram 5: Conducted disturbance test QP curve (N) (LV Switchgear)



Oscillogram 6: Radiated disturbance test curve (LV Switchgear)

8.8. Conclusion

The auxiliary and control circuits show no permanent damage after the test.

The sample can be fully operative after the test.

The prefabricated substation has passed the tests.

9. Tests to verify the sound level of high-voltage/low-voltage transformer prefabricated substation

9.1. Reference standards

Clause	Test item	Standard	
	Content	Title	Nr.
Annex B	Test to verify the sound level of a prefabricated substation	AC prefabricated substations for rated voltages above 1kV and up to and including 52kV	IEC 62271-202
-	-	Power transformers - Part 10: Determination of sound levels	IEC 60076-10

9.2. Measurement

	AC prefabricated substation as per IEC 62271-202		
Annex B	Requirements	Remark	Verdict
	The purpose of the test is to calculate the difference between the non-load sound level of a given power transformer alone (see IEC 60076-10:2016) and the non-load sound level of the high-voltage/low-voltage prefabricated substation containing the same power transformer		P
	NOTE 1 Full-load noise level can be considered under special requirement		N/A
	Comparison of the two values is an evaluation of the sound behaviour of the enclosure of the prefabricated substation. It is expected that the enclosure will not increase the sound level of the power transformer		P
	NOTE 2 The enclosure might increase the sound level of the power transformer by resonance phenomena		N/A
	The test values are only valid for the tested assembly at the rated voltage and frequency. If the prefabricated substation to be used contains different components, parts and/or is connected to a network with different supply voltage or frequency, the behaviour of the enclosure may differ		P
	The prefabricated substation tested shall be fully assembled, comprising all fittings and equipment		P
	The test shall be carried out according to IEC 60076-10:2016, which defines the method of test and calculation of an A-weighted sound level along a prescribed contour around the power transformer		P

	AC prefabricated substation as per IEC 62271-202		
Annex B	Requirements	Remark	Verdict
	The same method shall be used for measurements on the prefabricated substation where the enclosure is the sound-emitting boundary		P
	The method of measurement shall comply with IEC 60076-10:2016 with the exception of the requirement for the measuring device, which shall be at 1,5 m above ground level as defined for the prefabricated substation	The height of measured point is 1.5m	P
	These shall be in accordance with IEC 60076-10:2016. For the purpose of positioning the measuring instruments, the enclosure shall be considered as the principal radiating surface of the prefabricated substations		P
B.5	Presentation and calculation of the results		P
	The sound level shall be calculated in accordance with IEC 60076-10: 2016		P
	The report of the test shall include all applicable information as given in IEC 60076-10: 2016 for both configurations: transformer alone and fully assembled prefabricated substation		P
	In addition, for the prefabricated substation configuration, the following information shall also be included:		P
	a) main design characteristics of the enclosure, doors, covers and ventilation grids, including material used	Refer to technical drawings and user manual	P
	b) dimensioned drawing of the internal arrangement of the components inside the enclosure, position and size of doors and ventilation openings, and any other part that may significantly influence the sound propagation	Refer to technical drawings	P
	c) position of the transformer with respect to the enclosure, doors, covers, and ventilation openings	Refer to technical drawings	P

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Power transformers - Part 10: Determination of sound levels as per IEC 60076-10			
	Requirements	Remark	Verdict
	The test object shall be on no-load and excited at rated voltage of sinusoidal and rated frequency.	On no-load Rated frequency: 50Hz and 60Hz	P
	If a transformer is fitted with on-load tap-changer equipment, the measurements shall be made with the transformer on a tapping which involves this condition and which is as near to the principal tapping as possible.	Without OLTC	N/A
	The excitation voltage shall be appropriate to the tapping in use.		P
	For measurements made with forced air cooling auxiliaries out of service, the prescribed contour shall be spaced 0.3m away from the principal radiating surface.	Spaced distance: 0.3m	P
	For measurements made with forced air cooling auxiliaries in service, the prescribed contour shall be spaced 2m away from the principal radiating surface.		N/A
	For transformer with a tank height $\geq 2.5\text{m}$, two prescribed contours shall be used which are on horizontal planes at one-third and two-thirds of the tank height.		N/A
	The microphone positions shall be on the prescribed contours, approximately equally spaced and not more than 1m apart.	The microphones are equally spaced on the prescribed contours Spacing: 0.970m	P
	There shall be a minimum of six microphone positions.	Measuring points: 20	P
	Sound pressure method measurement		P
	Environmental correction K	5.46dB (Transformer outside the substation) 1.80dB (Transformer inside the substation)	-
	The measurements shall be taken when the background noise is approximately constant.		P
	The A-weighted sound pressure level shall be recorded for each measuring position.		-
	Uncorrected average A-weighted sound pressure level determined from the measured value :		P

	Power transformers - Part 10: Determination of sound levels as per IEC 60076-10		
	Requirements	Remark	Verdict
	$\overline{L_{pA0}} = 10 \lg \left\{ \frac{1}{N} \sum_{i=1}^N 10^{0.1 L_{pAi}} \right\}$		-
	N the total number of the measuring positions		-
	Average A-weighted background noise pressure level determined from the measured value before and after the test sequence:		P
	$\overline{L_{bgA}} = 10 \lg \left\{ \frac{1}{M} \sum_{i=1}^M 10^{0.1 L_{bgAi}} \right\}$	For detail refer to 9.6	-
	M the total number of the measuring positions		-
	L_{bgAi} measured A-weighted background noise pressure level at i_{th} measuring position		-
	The corrected average A-weighted sound pressure level calculated by using the following equation:		P
	$\overline{L_{pA}} = 10 \lg \left(10^{0.1 \overline{L_{pA0}}} - 10^{0.1 \overline{L_{bgA}}} \right) - K$	For detail refer to 9.6	-
	$\overline{L_{bgA}}$ the lower of the two calculated average A-weighted background noise pressure levels		-
	A-weighted sound power level calculated from the following equation:		P
	$L_{WA} = \overline{L_{pA}} + 10 \lg \frac{S}{S_0}$		-

9.3. Measurement condition of test day

Test day	
Measurement date	1 st Jun., 2023
Ambient condition	22.6 °C
Related humidity	57%
Air pressure	101.2kPa

9.4. Test instrument

Equipment	Type	Serial number	Scope/accuracy	Next calibration date
Sound level meter	AWA5661	E7095	Class 1	2024-05-15
Voltage transformer or high voltage measuring system	SYBS-3312	E6758	Transformer: Class 0.05 Power analyzer: Class 0.1	2023-09-07
Steel tape measure	5m	LJ3044	Class 2	2023-11-21

9.5. Measured value

9.5.1. Measured value of sound level (transformer without enclosure) at 50Hz				
Total area of the surface of the test room	Average acoustic absorption coefficient	The sound absorption area of the test room	The area of the measuring surface	The measuring distance
Sv [m²]	α [-]	A [m²]	S [m²]	[m]
298	0.15	44.7	28.11	0.3
Sound pressure level of background noise [dB]	Before test	43.12		
	After test	48.43		
Background noise correction factor: K [dB]		5.46		
Average sound pressure level : $\overline{L_{pAO}}$ [dB]		61.40		
Corrected average A-weighted sound level $\overline{L_{pA}}$ [dB]		52.77		
A-weighted sound power level: L_{WA} [dB]		-		
Supplement information: * Tap position: rated tapping				
* Acceptance criteria is given by agreement between purchaser and manufacturer				
* $\overline{L_{pAO}}$: Uncorrected average A-weighted sound level				

9.5.2. Measured value of sound level (transformer without enclosure) at 60Hz					
Total area of the surface of the test room	Average acoustic absorption coefficient		The sound absorption area of the test room	The area of the measuring surface	The measuring distance
Sv [m²]	α [-]		A [m²]	S [m²]	[m]
298	0.15		44.7	28.11	0.3
Sound pressure level of background noise [dB]		Before test	43.06		
		After test	47.93		
Background noise correction factor: K [dB]			5.46		
Average sound pressure level : $\overline{L_{PAO}}$ [dB]			60.50		
Corrected average A-weighted sound level $\overline{L_{pA}}$ [dB]			51.90		
A-weighted sound power level: L_{WA} [dB]			-		
Supplement information: * Tap position: rated tapping					
* Acceptance criteria is given by agreement between purchaser and manufacturer					
* $\overline{L_{PAO}}$: Uncorrected average A-weighted sound level					

9.5.3. Measured value of sound level (prefabricated sustation with transformer inside) at 50Hz					
Total area of the surface of the test room	Average acoustic absorption coefficient		The sound absorption area of the test room	The area of the measuring surface	The measuring distance
Sv [m²]	α [-]		A [m²]	S [m²]	[m]
1562.8	0.35		546.98	70.19904	0.3
Sound pressure level of background noise [dB]	Before test		28.0		
	After test		27.9		
Background noise correction factor: K [dB]			1.80		
Average sound pressure level : $\overline{L_{PAO}}$ [dB]			45.8		
Corrected average A-weighted sound level $\overline{L_{pA}}$ [dB]			43.9		
A-weighted sound power level: L_{WA} [dB]			62.4		
Supplement information: * Tap position: rated tapping					
* Acceptance criteria is given by agreement between purchaser and manufacturer					
* $\overline{L_{PAO}}$: Uncorrected average A-weighted sound level					

9.5.4. Measured value of sound level (prefabricated sustation with transformer inside) at 60Hz					
Total area of the surface of the test room	Average acoustic absorption coefficient		The sound absorption area of the test room	The area of the measuring surface	The measuring distance
Sv [m²]	α [-]		A [m²]	S [m²]	[m]
1562.8	0.35		546.98	70.19904	0.3
Sound pressure level of background noise [dB]		Before test	27.9		
		After test	28.0		
Background noise correction factor: K [dB]			1.80		
Average sound pressure level : $\overline{L_{PAO}}$ [dB]			43.6		
Corrected average A-weighted sound level $\overline{L_{pA}}$ [dB]			41.7		
A-weighted sound power level: L_{WA} [dB]			60.2		
Supplement information: * Tap position: rated tapping					
* Acceptance criteria is given by agreement between purchaser and manufacturer					
* $\overline{L_{PAO}}$: Uncorrected average A-weighted sound level					

9.6. Conclusion

The enclosure of the prefabricated substation does not increase the sound level of the transformer.

The prefabricated substation has passed the tests.

10. Conclusion

This prefabricated substation has been successfully tested, the test procedure and test results are in conformity with standards and specification.

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FIRST ANGLE
PROJECTION

Front view

Top view

Right view

Left view

Back view

Isometric view

The weight weight of the whole machine is about 2500kg.
(Unit: kg) (Weight: 2500kg)

Technical data		Weight data	
Transformer	LV switchgear	Switchgear	Communication box
1000	1000	1000	1000

Item	P/N No.	Description	Specification	Remarks
------	---------	-------------	---------------	---------

Item	P/N No.	Description	Specification	Remarks
Model				
Shape				
Material				
Weight				
Volume				
Power				
Current				
Voltage				
Frequency				
Temperature				
Humidity				
Altitude				
Seismicity				
Corrosion				
Installation				
Operation				
Maintenance				
Storage				
Transportation				
Disposal				

Shunrow Power Supply Co., Ltd.

-End of the test report-