

ASMTower 2018.4

Job No. 30m Monopole
Client VM
Project GSM Network

Rev. No. A
Date 5/11/2017
Designed by M.Joe
Checked by A.S.M

ASMTower 2018.4

Structure Design For 30m Monopole

Client: VF
Project: GSM Network

A	5/11/2017	First issue	M.Joe	A.S.M
Rev.	Date	Description	Designed by	Reviewed by

Design Basics

The design is according to ANSI/TIA-222-H, the following is the main design parameters:

- 3-Sec gust wind speed (50 year interval) 36.11 m/s.
- Service wind speed is 25 m/s.
- Exposure category is C.
- Risk category is II.
- Topographic category is 1.
- Elevation at bottom of tower is 0 m.
- Wind directions applied on tower in the analysis are generated automatically.
- Wind directions applied on tower in the analysis are 0, 45, 90, 135, 180, 225, 270, 315 Deg.
- Wind load on each panel antenna are based on actual direction.
- Wind load on each microwave are based on actual direction.

Executive Summary

The structure is Safe with maximum members rating are as following:

- Pole parts rating is 0.36
- Base connection rating is 0.97

Antenna Loading Configuration

The tower is designed to carry the following:

ID	Antenna Name	Elev. m	Qty.	Type	Width mm	Thick. mm	Height mm	Mount Name
1	Quad Band Antenna	28	1	Flat	548	135	2555	Mount 76x3000
2	Quad Band Antenna	28	1	Flat	548	135	2555	Mount 76x3000
3	Quad Band Antenna	28	1	Flat	548	135	2555	Mount 76x3000
4	Quad Band Antenna	25	1	Flat	548	135	2555	Mount 76x3000
5	Quad Band Antenna	25	1	Flat	548	135	2555	Mount 76x3000
6	Quad Band Antenna	25	1	Flat	548	135	2555	Mount 76x3000

Microwave antennas

ID	MW Name	Elev. m	Qty.	Type	Diameter mm	Mount Name
1	HP 1.2m	27	1	HP	1200	Mount 114x1500
2	HP 1.2m	29	1	HP	1200	Mount 114x1500

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Pole Parts Geometry

Part No.	Bottom Elev. m	Top Elev. m	Length m	Bottom Diam. mm	Top Diam. mm	Thick. mm	No. Of Sides	Bottom Overlap m	Material Name	Weight kg
3	19	30	11	760	550	6	ROUND	1.5	S355J0	1077.2
2	9.5	20.5	11	970	760	6	ROUND	1.5	S355J0	1425.7
1	0	11	11	1180	970	8	ROUND	0	S355J0	2361.3
Total										4864.2

Section Properties

ID	Name	Area mm ²	ey mm	ez mm	q Deg	rmin mm	rmax mm	ry mm	rz mm
1	L60x5	582	16.8	16.8	45	11.8	23.5	18.6	18.6
2	Rod 6	28.3	3	3	0	1.5	1.5	1.5	1.5
3	Rod 20	314.2	10	10	0	5	5	5	5

List of used profiles in the tower

ID	Type	Name	Grade	Length m	Weight kg	Paint Area m ²
1	EqualAngle	L60x5	S235J0	60.001	279.5	13.8
2	SolidRound	Rod 6	S235J0	30.001	6.8	0.565
3	SolidRound	Rod 20	S235J0	35.35	88.9	2.221
Total					375.2	16.587

Wind Calculation Of Basic Design Wind Speed 45.5 m/s Dir. 0Gust effect factor $G_h = 1.1$ Direction probability $K_d = 0.95$ **Wind forces on pole parts**

Part No.	Wind slice No.	Mean Elev. m	L m	D_{av} m	Area m ²	t_{iz} mm	R_w	R_L	C	C_f	EPA m ²	q_z N/m ²	Force KN
1	1	27.5	5	0.598	2.989	0	0	0	30.27	0.6	1.793	1493.4	2.95
	2	22	6	0.703	4.216	0	0	0	34.76	0.6	2.53	1424.9	3.97
2	1	16.625	4.75	0.834	3.961	0	0	0	40.05	0.6	2.377	1343.3	3.51
	2	11.875	4.75	0.925	4.392	0	0	0	42.86	0.6	2.635	1251.4	3.63
3	1	7.125	4.75	1.044	4.959	0	0.11	0	45.86	0.6	2.975	1123.8	3.68
	2	2.375	4.75	1.135	5.39	0	0.11	0	47.6	0.6	3.234	1024.7	3.65
Total											15.544	---	21.37

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Wind force from ladder

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	25 To 30	27.5	1	1.357	1.236	1.357	0	1493.4	0	2.23
2	19 To 25	22	1	1.628	1.483	1.628	0	1424.9	0	2.55
3	14.25 To 19	16.625	1	1.289	1.174	1.282	0	1343.3	0	1.89
4	9.5 To 14.25	11.875	1	1.289	1.174	1.167	0	1251.4	0	1.61
5	4.75 To 9.5	7.125	1	1.289	1.174	0.055	0	1123.8	0	0.07
6	0 To 4.75	2.375	1	1.289	1.174	0	0	1024.7	0	0
Total						5.489	---	---	---	8.35

Wind vector from ladder

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27.5	-2.23	0	0	0	61.28	0
2	22	-2.55	0	0	0	56.13	0
3	16.625	-1.89	0	0	0	31.49	0
4	11.875	-1.61	0	0	0	19.08	0
5	7.125	-0.07	0	0	0	0.49	0
6	2.375	0	0	0	0	0	0
Total		-8.35	0	0	0	168.47	0

Wind forces from transmission line clusters

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	19 To 25	22	1	2.412	0.684	0	0	1424.9	0	0
2	14.25 To 19	16.625	1	1.91	0.542	0	0	1343.3	0	0
3	9.5 To 14.25	11.875	1	1.91	0.542	0	0	1251.4	0	0
4	4.75 To 9.5	7.125	1	1.91	0.542	0	0	1123.8	0	0
5	0 To 4.75	2.375	1	1.91	0.542	0	0	1024.7	0	0
Total						0	---	---	---	0

Wind vector from transmission line clusters

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	22	0	0	0	0	0	0
2	16.625	0	0	0	0	0	0
3	11.875	0	0	0	0	0	0
4	7.125	0	0	0	0	0	0
5	2.375	0	0	0	0	0	0

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#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
Total		0	0	0	0	0	0

Wind forces from panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	28	28	1	1.815	0.62	1.516	0	1499.1	30	2.5
2	28	28	1	1.815	0.62	1.516	0	1499.1	150	2.5
3	28	28	1	1.815	0.62	0.62	0	1499.1	90	1.02
4	25	25	1	1.815	0.62	1.516	0	1463.8	30	2.44
5	25	25	1	1.815	0.62	1.516	0	1463.8	150	2.44
6	25	25	1	1.815	0.62	0.62	0	1463.8	90	1
Total						7.304	---	---	---	11.9

Wind vector from panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	-2.5	0	0	0	70	-2.01
2	28	-2.5	0	0	0	70	-2.01
3	28	-1.02	0	0	0	28.63	1.65
4	25	-2.44	0	0	0	61.03	-2
5	25	-2.44	0	0	0	61.03	-2
6	25	-1	0	0	0	24.96	1.64
Total		-11.9	0	0	0	315.64	-4.75

Wind forces from mounts of panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	28	28	1	0.034	0.358	0.115	0	1499.1	30	0.19
2	28	28	1	0.034	0.358	0.115	0	1499.1	150	0.19
3	28	28	1	0.034	0.358	0.358	0	1499.1	90	0.59
4	25	25	1	0.034	0.358	0.115	0	1463.8	30	0.18
5	25	25	1	0.034	0.358	0.115	0	1463.8	150	0.18
6	25	25	1	0.034	0.358	0.358	0	1463.8	90	0.58
Total						1.174	---	---	---	1.91

Wind vector from mounts of panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
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#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	-0.19	0	0	0	5.3	-0.13
2	28	-0.19	0	0	0	5.3	-0.13
3	28	-0.59	0	0	0	16.51	0.83
4	25	-0.18	0	0	0	4.62	-0.13
5	25	-0.18	0	0	0	4.62	-0.13
6	25	-0.58	0	0	0	14.39	0.83
Total		-1.91	0	0	0	50.73	1.12

Wind forces from MW dishes

#	Elev. m	Z m	O.D. mm	Area m ²	t _{iz} mm	q _z N/m ²	q Deg	C _a	C _s	C _m	F _a KN	F _s KN	M _m KN
1	27	27	1200	1.131	0	1487.7	330	1.21	-0.23	0.05	2.24	-0.43	0.12
2	29	29	1200	1.131	0	1510.2	330	1.21	-0.23	0.05	2.28	-0.44	0.12

Wind vectors from MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	M _x KN.m	M _y KN.m	M _z KN.m	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	-2.16	0	-0.74	0	0.12	0	-20.11	58.26	-2.43
2	29	-2.19	0	-0.76	0	0.12	0	-21.93	63.52	-2.46
Total		-4.35	0	-1.5	---	---	---	-42.04	121.78	-4.89

Wind forces from mounts Of MW dishes

#	Elev. m	Z m	K _a	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	27	27	1	0.034	0.236	0.085	0	1487.7	30	0.14
2	29	29	1	0.034	0.235	0.084	0	1510.2	30	0.14
Total							0.169	---	---	0.28

Wind vectors from mounts Of MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	-0.14	0	0	0	3.73	-0.16
2	29	-0.14	0	0	0	4.06	-0.16
Total		-0.28	0	0	0	7.8	-0.32

Wind Calculation Of Basic Design Wind Speed 45.5 m/s Dir. 45

Gust effect factor $G_h = 1.1$

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Direction probability $K_d = 0.95$ **Wind forces on pole parts**

Part No.	Wind slice No.	Mean Elev. m	L m	D_{av} m	Area m^2	t_{iz} mm	R_W	R_L	C	C_f	EPA m^2	q_z N/m^2	Force KN
1	1	27.5	5	0.598	2.989	0	0	0	30.27	0.6	1.793	1493.4	2.95
	2	22	6	0.703	4.216	0	0	0	34.76	0.6	2.53	1424.9	3.97
2	1	16.625	4.75	0.834	3.961	0	0	0	40.05	0.6	2.377	1343.3	3.51
	2	11.875	4.75	0.925	4.392	0	0	0.03	42.86	0.6	2.635	1251.4	3.63
3	1	7.125	4.75	1.044	4.959	0	0.04	0.08	45.86	0.6	2.975	1123.8	3.68
	2	2.375	4.75	1.135	5.39	0	0.04	0.08	47.6	0.6	3.234	1024.7	3.65
Total											15.544	---	21.37

Wind force from ladder

#	Elev. m	Z m	Ka	EPA _n m^2	EPA _t m^2	EPA _a m^2	t_{iz} mm	q_z N/m^2	q Deg	Force KN
1	25 To 30	27.5	1	1.357	1.236	1.296	0	1493.4	45	2.13
2	19 To 25	22	1	1.628	1.483	1.556	0	1424.9	45	2.44
3	14.25 To 19	16.625	1	1.289	1.174	1.209	0	1343.3	45	1.79
4	9.5 To 14.25	11.875	1	1.289	1.174	1.025	0	1251.4	45	1.41
5	4.75 To 9.5	7.125	1	1.289	1.174	0.04	0	1123.8	45	0.05
6	0 To 4.75	2.375	1	1.289	1.174	0	0	1024.7	45	0
Total						5.127	---	---	---	7.82

Wind vector from ladder

#	Elev. m	F_x KN	F_y KN	F_z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27.5	-1.51	0	-1.51	-41.41	41.41	0.78
2	22	-1.72	0	-1.72	-37.93	37.93	0.95
3	16.625	-1.26	0	-1.26	-21.01	21.01	0.74
4	11.875	-1	0	-1	-11.85	11.85	0.62
5	7.125	-0.04	0	-0.04	-0.25	0.25	0.02
6	2.375	0	0	0	0	0	0
Total		-5.53	0	-5.53	-112.45	112.45	3.12

Wind forces from transmission line clusters

#	Elev. m	Z m	Ka	EPA _n m^2	EPA _t m^2	EPA _a m^2	t_{iz} mm	q_z N/m^2	q Deg	Force KN
1	19 To 25	22	1	2.412	0.684	0	0	1424.9	45	0
2	14.25 To 19	16.625	1	1.91	0.542	0	0	1343.3	45	0

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#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
3	9.5 To 14.25	11.875	1	1.91	0.542	0	0	1251.4	45	0
4	4.75 To 9.5	7.125	1	1.91	0.542	0	0	1123.8	45	0
5	0 To 4.75	2.375	1	1.91	0.542	0	0	1024.7	45	0
Total							0	---	---	0

Wind vector from transmission line clusters

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	22	0	0	0	0	0	0
2	16.625	0	0	0	0	0	0
3	11.875	0	0	0	0	0	0
4	7.125	0	0	0	0	0	0
5	2.375	0	0	0	0	0	0
Total		0	0	0	0	0	0

Wind forces from panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	28	28	1	1.815	0.62	1.735	0	1499.1	15	2.86
2	28	28	1	1.815	0.62	0.7	0	1499.1	105	1.15
3	28	28	1	1.815	0.62	1.217	0	1499.1	135	2.01
4	25	25	1	1.815	0.62	1.735	0	1463.8	15	2.79
5	25	25	1	1.815	0.62	0.7	0	1463.8	105	1.13
6	25	25	1	1.815	0.62	1.217	0	1463.8	135	1.96
Total						7.304	---	---	---	11.9

Wind vector from panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	-2.02	0	-2.02	-56.64	56.64	1.19
2	28	-0.82	0	-0.82	-22.86	22.86	-1.8
3	28	-1.42	0	-1.42	-39.75	39.75	2.29
4	25	-1.98	0	-1.98	-49.38	49.38	1.19
5	25	-0.8	0	-0.8	-19.93	19.93	-1.79
6	25	-1.39	0	-1.39	-34.65	34.65	2.27
Total		-8.42	0	-8.42	-223.19	223.19	3.36

Wind forces from mounts of panel antenna

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#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN	
1	28	28	1	0.034	0.358	0.056	0	1499.1	15	0.09	
2	28	28	1	0.034	0.358	0.336	0	1499.1	105	0.55	
3	28	28	1	0.034	0.358	0.196	0	1499.1	135	0.32	
4	25	25	1	0.034	0.358	0.056	0	1463.8	15	0.09	
5	25	25	1	0.034	0.358	0.336	0	1463.8	105	0.54	
6	25	25	1	0.034	0.358	0.196	0	1463.8	135	0.32	
Total							1.174	---	---	---	1.91

Wind vector from mounts of panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	-0.06	0	-0.06	-1.81	1.81	0.03
2	28	-0.39	0	-0.39	-10.96	10.96	-0.75
3	28	-0.23	0	-0.23	-6.39	6.39	0.32
4	25	-0.06	0	-0.06	-1.58	1.58	0.03
5	25	-0.38	0	-0.38	-9.56	9.56	-0.75
6	25	-0.22	0	-0.22	-5.57	5.57	0.32
Total		-1.35	0	-1.35	-35.87	35.87	-0.79

Wind forces from MW dishes

#	Elev. m	Z m	O.D. mm	Area m ²	t _{iz} mm	q _z N/m ²	q Deg	C _a	C _s	C _m	F _a KN	F _s KN	M _m KN
1	27	27	1200	1.131	0	1487.7	15	1.26	0.14	-0.04	2.32	0.25	-0.08
2	29	29	1200	1.131	0	1510.2	15	1.26	0.14	-0.04	2.36	0.26	-0.08

Wind vectors from MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	M _x KN.m	M _y KN.m	M _z KN.m	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	-1.89	0	-1.38	0	-0.08	0	-37.3	50.93	-2.23
2	29	-1.91	0	-1.4	0	-0.08	0	-40.67	55.53	-2.27
Total		-3.8	0	-2.78	---	---	---	-77.96	106.46	-4.49

Wind forces from mounts Of MW dishes

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	27	27	1	0.034	0.236	0.048	0	1487.7	15	0.08
2	29	29	1	0.034	0.235	0.048	0	1510.2	15	0.08
Total							0.095	---	---	0.16

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Wind vectors from mounts Of MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	-0.06	0	-0.06	-1.49	1.49	-0.06
2	29	-0.06	0	-0.06	-1.62	1.62	-0.07
Total		-0.11	0	-0.11	-3.11	3.11	-0.13

Wind Calculation Of Basic Design Wind Speed 45.5 m/s Dir. 90

Gust effect factor G_n = 1.1
 Direction probability K_d = 0.95

Wind forces on pole parts

Part No.	Wind slice No.	Mean Elev. m	L m	D _{av} m	Area m ²	t _{iz} mm	R _w	R _L	C	C _f	EPA m ²	q _z N/m ²	Force KN
1	1	27.5	5	0.598	2.989	0	0	0	30.27	0.6	1.793	1493.4	2.95
	2	22	6	0.703	4.216	0	0	0	34.76	0.6	2.53	1424.9	3.97
2	1	16.625	4.75	0.834	3.961	0	0	0.01	40.05	0.6	2.377	1343.3	3.51
	2	11.875	4.75	0.925	4.392	0	0	0.06	42.86	0.6	2.635	1251.4	3.63
3	1	7.125	4.75	1.044	4.959	0	0	0.12	45.86	0.64	3.166	1123.8	3.91
	2	2.375	4.75	1.135	5.39	0	0	0.11	47.6	0.62	3.353	1024.7	3.78
Total											15.854	---	21.74

Wind force from ladder

#	Elev. m	Z m	K _a	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	25 To 30	27.5	1	1.357	1.236	1.236	0	1493.4	90	2.03
2	19 To 25	22	1	1.628	1.483	1.483	0	1424.9	90	2.32
3	14.25 To 19	16.625	1	1.289	1.174	1.121	0	1343.3	90	1.66
4	9.5 To 14.25	11.875	1	1.289	1.174	0.662	0	1251.4	90	0.91
5	4.75 To 9.5	7.125	1	1.289	1.174	0.007	0	1123.8	90	0.01
6	0 To 4.75	2.375	1	1.289	1.174	0	0	1024.7	90	0
Total						4.509	---	---	---	6.93

Wind vector from ladder

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27.5	0	0	-2.03	-55.84	0	1.05
2	22	0	0	-2.32	-51.15	0	1.29

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#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
3	16.625	0	0	-1.66	-27.54	0	0.98
4	11.875	0	0	-0.91	-10.82	0	0.57
5	7.125	0	0	-0.01	-0.06	0	0.01
6	2.375	0	0	0	0	0	0
Total		0	0	-6.93	-145.41	0	3.88

Wind forces from transmission line clusters

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN	
1	19 To 25	22	1	2.412	0.684	0	0	1424.9	90	0	
2	14.25 To 19	16.625	1	1.91	0.542	0	0	1343.3	90	0	
3	9.5 To 14.25	11.875	1	1.91	0.542	0	0	1251.4	90	0	
4	4.75 To 9.5	7.125	1	1.91	0.542	0	0	1123.8	90	0	
5	0 To 4.75	2.375	1	1.91	0.542	0	0	1024.7	90	0	
Total							0	---	---	---	0

Wind vector from transmission line clusters

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	22	0	0	0	0	0	0
2	16.625	0	0	0	0	0	0
3	11.875	0	0	0	0	0	0
4	7.125	0	0	0	0	0	0
5	2.375	0	0	0	0	0	0
Total		0	0	0	0	0	0

Wind forces from panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN	
1	28	28	1	1.815	0.62	0.919	0	1499.1	60	1.51	
2	28	28	1	1.815	0.62	0.919	0	1499.1	60	1.51	
3	28	28	1	1.815	0.62	1.815	0	1499.1	180	2.99	
4	25	25	1	1.815	0.62	0.919	0	1463.8	60	1.48	
5	25	25	1	1.815	0.62	0.919	0	1463.8	60	1.48	
6	25	25	1	1.815	0.62	1.815	0	1463.8	180	2.92	
Total							7.304	---	---	---	11.9

Wind vector from panel antenna

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#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	0	0	-1.51	-42.42	0	2.11
2	28	0	0	-1.51	-42.42	0	-2.11
3	28	0	0	-2.99	-83.79	0	0
4	25	0	0	-1.48	-36.98	0	2.1
5	25	0	0	-1.48	-36.98	0	-2.1
6	25	0	0	-2.92	-73.05	0	0
Total		0	0	-11.9	-315.64	0	0

Wind forces from mounts of panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN	
1	28	28	1	0.034	0.358	0.277	0	1499.1	60	0.46	
2	28	28	1	0.034	0.358	0.277	0	1499.1	60	0.46	
3	28	28	1	0.034	0.358	0.034	0	1499.1	180	0.06	
4	25	25	1	0.034	0.358	0.277	0	1463.8	60	0.45	
5	25	25	1	0.034	0.358	0.277	0	1463.8	60	0.45	
6	25	25	1	0.034	0.358	0.034	0	1463.8	180	0.05	
Total							1.174	---	---	---	1.91

Wind vector from mounts of panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	0	0	-0.46	-12.77	0	0.56
2	28	0	0	-0.46	-12.77	0	-0.56
3	28	0	0	-0.06	-1.56	0	0
4	25	0	0	-0.45	-11.13	0	0.55
5	25	0	0	-0.45	-11.13	0	-0.55
6	25	0	0	-0.05	-1.36	0	0
Total		0	0	-1.91	-50.73	0	0

Wind forces from MW dishes

#	Elev. m	Z m	O.D. mm	Area m ²	t _{iz} mm	q _z N/m ²	q Deg	C _a	C _s	C _m	F _a KN	F _s KN	M _m KN
1	27	27	1200	1.131	0	1487.7	60	0.95	0.37	-0.01	1.75	0.68	-0.02
2	29	29	1200	1.131	0	1510.2	60	0.95	0.37	-0.01	1.78	0.69	-0.02

Wind vectors from MW dishes

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#	Elev. m	F _x KN	F _y KN	F _z KN	M _x KN.m	M _y KN.m	M _z KN.m	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	-1.18	0	-1.46	0	-0.02	0	-39.51	31.73	-1.29
2	29	-1.19	0	-1.49	0	-0.02	0	-43.08	34.6	-1.32
Total		-2.37	0	-2.95	---	---	---	-82.59	66.34	-2.61

Wind forces from mounts Of MW dishes

#	Elev. m	Z m	K _a	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	27	27	1	0.034	0.236	0.185	0	1487.7	60	0.3
2	29	29	1	0.034	0.235	0.185	0	1510.2	60	0.31
Total							0.37	---	---	0.61

Wind vectors from mounts Of MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	0	0	-0.3	-8.18	0	-0.01
2	29	0	0	-0.31	-8.89	0	-0.01
Total		0	0	-0.61	-17.08	0	-0.02

Wind Calculation Of Basic Design Wind Speed 45.5 m/s Dir. 135Gust effect factor $G_h = 1.1$ Direction probability $K_d = 0.95$ **Wind forces on pole parts**

Part No.	Wind slice No.	Mean Elev. m	L m	D _{av} m	Area m ²	t _{iz} mm	R _w	R _L	C	C _f	EPA m ²	q _z N/m ²	Force KN
1	1	27.5	5	0.598	2.989	0	0	0	30.27	0.6	1.793	1493.4	2.95
	2	22	6	0.703	4.216	0	0	0	34.76	0.6	2.53	1424.9	3.97
2	1	16.625	4.75	0.834	3.961	0	0	0.01	40.05	0.6	2.377	1343.3	3.51
	2	11.875	4.75	0.925	4.392	0	0	0.04	42.86	0.6	2.635	1251.4	3.63
3	1	7.125	4.75	1.044	4.959	0	0	0.08	45.86	0.6	2.975	1123.8	3.68
	2	2.375	4.75	1.135	5.39	0	0	0.08	47.6	0.6	3.234	1024.7	3.65
Total											15.544	---	21.37

Wind force from ladder

#	Elev. m	Z m	K _a	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
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#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	25 To 30	27.5	1	1.357	1.236	1.296	0	1493.4	135	2.13
2	19 To 25	22	1	1.628	1.483	1.556	0	1424.9	135	2.44
3	14.25 To 19	16.625	1	1.289	1.174	1.148	0	1343.3	135	1.7
4	9.5 To 14.25	11.875	1	1.289	1.174	0.637	0	1251.4	135	0.88
5	4.75 To 9.5	7.125	1	1.289	1.174	0.007	0	1123.8	135	0.01
6	0 To 4.75	2.375	1	1.289	1.174	0	0	1024.7	135	0
Total						4.643	---	---	---	7.15

Wind vector from ladder

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27.5	1.51	0	-1.51	-41.41	-41.41	0.78
2	22	1.72	0	-1.72	-37.93	-37.93	0.95
3	16.625	1.2	0	-1.2	-19.93	-19.93	0.71
4	11.875	0.62	0	-0.62	-7.36	-7.36	0.38
5	7.125	0.01	0	-0.01	-0.04	-0.04	0
6	2.375	0	0	0	0	0	0
Total		5.05	0	-5.05	-106.67	-106.67	2.83

Wind forces from transmission line clusters

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	19 To 25	22	1	2.412	0.684	0	0	1424.9	135	0
2	14.25 To 19	16.625	1	1.91	0.542	0	0	1343.3	135	0
3	9.5 To 14.25	11.875	1	1.91	0.542	0	0	1251.4	135	0
4	4.75 To 9.5	7.125	1	1.91	0.542	0	0	1123.8	135	0
5	0 To 4.75	2.375	1	1.91	0.542	0	0	1024.7	135	0
Total						0	---	---	---	0

Wind vector from transmission line clusters

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	22	0	0	0	0	0	0
2	16.625	0	0	0	0	0	0
3	11.875	0	0	0	0	0	0
4	7.125	0	0	0	0	0	0
5	2.375	0	0	0	0	0	0
Total		0	0	0	0	0	0

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Wind forces from panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN	
1	28	28	1	1.815	0.62	0.7	0	1499.1	105	1.15	
2	28	28	1	1.815	0.62	1.735	0	1499.1	15	2.86	
3	28	28	1	1.815	0.62	1.217	0	1499.1	135	2.01	
4	25	25	1	1.815	0.62	0.7	0	1463.8	105	1.13	
5	25	25	1	1.815	0.62	1.735	0	1463.8	15	2.79	
6	25	25	1	1.815	0.62	1.217	0	1463.8	135	1.96	
Total							7.304	---	---	---	11.9

Wind vector from panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	0.82	0	-0.82	-22.86	-22.86	1.8
2	28	2.02	0	-2.02	-56.64	-56.64	-1.19
3	28	1.42	0	-1.42	-39.75	-39.75	-2.29
4	25	0.8	0	-0.8	-19.93	-19.93	1.79
5	25	1.98	0	-1.98	-49.38	-49.38	-1.19
6	25	1.39	0	-1.39	-34.65	-34.65	-2.27
Total		8.42	0	-8.42	-223.19	-223.19	-3.36

Wind forces from mounts of panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN	
1	28	28	1	0.034	0.358	0.336	0	1499.1	105	0.55	
2	28	28	1	0.034	0.358	0.056	0	1499.1	15	0.09	
3	28	28	1	0.034	0.358	0.196	0	1499.1	135	0.32	
4	25	25	1	0.034	0.358	0.336	0	1463.8	105	0.54	
5	25	25	1	0.034	0.358	0.056	0	1463.8	15	0.09	
6	25	25	1	0.034	0.358	0.196	0	1463.8	135	0.32	
Total							1.174	---	---	---	1.91

Wind vector from mounts of panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	0.39	0	-0.39	-10.96	-10.96	0.75
2	28	0.06	0	-0.06	-1.81	-1.81	-0.03
3	28	0.23	0	-0.23	-6.39	-6.39	-0.32
4	25	0.38	0	-0.38	-9.56	-9.56	0.75
5	25	0.06	0	-0.06	-1.58	-1.58	-0.03

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#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
6	25	0.22	0	-0.22	-5.57	-5.57	-0.32
Total		1.35	0	-1.35	-35.87	-35.87	0.79

Wind forces from MW dishes

#	Elev. m	Z m	O.D. mm	Area m ²	t _{iz} mm	q _z N/m ²	q Deg	C _a	C _s	C _m	F _a KN	F _s KN	M _m KN
1	27	27	1200	1.131	0	1487.7	105	-0.44	0.57	0.11	-0.82	1.05	0.25
2	29	29	1200	1.131	0	1510.2	105	-0.44	0.57	0.11	-0.83	1.06	0.26

Wind vectors from MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	M _x KN.m	M _y KN.m	M _z KN.m	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	1.23	0	-0.5	0	0.25	0	-13.48	-33.26	1.81
2	29	1.25	0	-0.51	0	0.26	0	-14.7	-36.26	1.81
Total		2.48	0	-1.01	---	---	---	-28.19	-69.52	3.62

Wind forces from mounts Of MW dishes

#	Elev. m	Z m	K _a	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	27	27	1	0.034	0.236	0.222	0	1487.7	105	0.36
2	29	29	1	0.034	0.235	0.221	0	1510.2	105	0.37
Total							0.443	---	---	0.73

Wind vectors from mounts Of MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	0.26	0	-0.26	-6.94	-6.94	0.29
2	29	0.26	0	-0.26	-7.54	-7.54	0.28
Total		0.52	0	-0.52	-14.48	-14.48	0.57

Wind Calculation Of Basic Design Wind Speed 45.5 m/s Dir. 180

Gust effect factor G_h = 1.1
 Direction probability K_d = 0.95

Wind forces on pole parts

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Part No.	Wind slice No.	Mean Elev. m	L m	D_{av} m	Area m^2	t_{iz} mm	R_w	R_L	C	C_f	EPA m^2	q_z N/m ²	Force KN
1	1	27.5	5	0.598	2.989	0	0	0	30.27	0.6	1.793	1493.4	2.95
	2	22	6	0.703	4.216	0	0	0	34.76	0.6	2.53	1424.9	3.97
2	1	16.625	4.75	0.834	3.961	0	0	0	40.05	0.6	2.377	1343.3	3.51
	2	11.875	4.75	0.925	4.392	0	0	0	42.86	0.6	2.635	1251.4	3.63
3	1	7.125	4.75	1.044	4.959	0	0	0	45.86	0.6	2.975	1123.8	3.68
	2	2.375	4.75	1.135	5.39	0	0	0	47.6	0.6	3.234	1024.7	3.65
Total											15.544	---	21.37

Wind force from ladder

#	Elev. m	Z m	Ka	EPA _n m^2	EPA _t m^2	EPA _a m^2	t_{iz} mm	q_z N/m ²	q Deg	Force KN
1	25 To 30	27.5	1	1.357	1.236	1.357	0	1493.4	180	2.23
2	19 To 25	22	1	1.628	1.483	1.628	0	1424.9	180	2.55
3	14.25 To 19	16.625	1	1.289	1.174	1.187	0	1343.3	180	1.75
4	9.5 To 14.25	11.875	1	1.289	1.174	0.672	0	1251.4	180	0.92
5	4.75 To 9.5	7.125	1	1.289	1.174	0.014	0	1123.8	180	0.02
6	0 To 4.75	2.375	1	1.289	1.174	0	0	1024.7	180	0
Total						4.857	---	---	---	7.48

Wind vector from ladder

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27.5	2.23	0	0	0	-61.28	0
2	22	2.55	0	0	0	-56.13	0
3	16.625	1.75	0	0	0	-29.16	0
4	11.875	0.92	0	0	0	-10.98	0
5	7.125	0.02	0	0	0	-0.12	0
6	2.375	0	0	0	0	0	0
Total		7.48	0	0	0	-157.68	0

Wind forces from transmission line clusters

#	Elev. m	Z m	Ka	EPA _n m^2	EPA _t m^2	EPA _a m^2	t_{iz} mm	q_z N/m ²	q Deg	Force KN
1	19 To 25	22	1	2.412	0.684	0	0	1424.9	180	0
2	14.25 To 19	16.625	1	1.91	0.542	0	0	1343.3	180	0
3	9.5 To 14.25	11.875	1	1.91	0.542	0	0	1251.4	180	0
4	4.75 To 9.5	7.125	1	1.91	0.542	0	0	1123.8	180	0
5	0 To 4.75	2.375	1	1.91	0.542	0	0	1024.7	180	0
Total						0	---	---	---	0

Wind vector from transmission line clusters

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	22	0	0	0	0	0	0
2	16.625	0	0	0	0	0	0
3	11.875	0	0	0	0	0	0
4	7.125	0	0	0	0	0	0
5	2.375	0	0	0	0	0	0
Total		0	0	0	0	0	0

Wind forces from panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN	
1	28	28	1	1.815	0.62	1.516	0	1499.1	150	2.5	
2	28	28	1	1.815	0.62	1.516	0	1499.1	30	2.5	
3	28	28	1	1.815	0.62	0.62	0	1499.1	90	1.02	
4	25	25	1	1.815	0.62	1.516	0	1463.8	150	2.44	
5	25	25	1	1.815	0.62	1.516	0	1463.8	30	2.44	
6	25	25	1	1.815	0.62	0.62	0	1463.8	90	1	
Total							7.304	---	---	---	11.9

Wind vector from panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	2.5	0	0	0	-70	2.01
2	28	2.5	0	0	0	-70	2.01
3	28	1.02	0	0	0	-28.63	-1.65
4	25	2.44	0	0	0	-61.03	2
5	25	2.44	0	0	0	-61.03	2
6	25	1	0	0	0	-24.96	-1.64
Total		11.9	0	0	0	-315.64	4.75

Wind forces from mounts of panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	28	28	1	0.034	0.358	0.115	0	1499.1	150	0.19
2	28	28	1	0.034	0.358	0.115	0	1499.1	30	0.19
3	28	28	1	0.034	0.358	0.358	0	1499.1	90	0.59
4	25	25	1	0.034	0.358	0.115	0	1463.8	150	0.18
5	25	25	1	0.034	0.358	0.115	0	1463.8	30	0.18

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#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
6	25	25	1	0.034	0.358	0.358	0	1463.8	90	0.58
Total						1.174	---	---	---	1.91

Wind vector from mounts of panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	0.19	0	0	0	-5.3	0.13
2	28	0.19	0	0	0	-5.3	0.13
3	28	0.59	0	0	0	-16.51	-0.83
4	25	0.18	0	0	0	-4.62	0.13
5	25	0.18	0	0	0	-4.62	0.13
6	25	0.58	0	0	0	-14.39	-0.83
Total		1.91	0	0	0	-50.73	-1.12

Wind forces from MW dishes

#	Elev. m	Z m	O.D. mm	Area m ²	t _{iz} mm	q _z N/m ²	q Deg	C _a	C _s	C _m	F _a KN	F _s KN	M _m KN
1	27	27	1200	1.131	0	1487.7	150	-0.96	0.18	0.06	-1.77	0.33	0.14
2	29	29	1200	1.131	0	1510.2	150	-0.96	0.18	0.06	-1.8	0.33	0.14

Wind vectors from MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	M _x KN.m	M _y KN.m	M _z KN.m	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	1.7	0	0.6	0	0.14	0	16.3	-45.81	2.14
2	29	1.72	0	0.61	0	0.14	0	17.78	-49.95	2.16
Total		3.42	0	1.22	---	---	---	34.08	-95.75	4.3

Wind forces from mounts Of MW dishes

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	27	27	1	0.034	0.236	0.085	0	1487.7	150	0.14
2	29	29	1	0.034	0.235	0.084	0	1510.2	150	0.14
Total						0.169	---	---	---	0.28

Wind vectors from mounts Of MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
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#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	0.14	0	0	0	-3.73	0.16
2	29	0.14	0	0	0	-4.06	0.16
Total		0.28	0	0	0	-7.8	0.32

Wind Calculation Of Basic Design Wind Speed 45.5 m/s Dir. 225

Gust effect factor G_h = 1.1
 Direction probability K_d = 0.95

Wind forces on pole parts

Part No.	Wind slice No.	Mean Elev. m	L m	D _{av} m	Area m ²	t _{iz} mm	R _w	R _L	C	C _f	EPA m ²	q _z N/m ²	Force KN
1	1	27.5	5	0.598	2.989	0	0	0	30.27	0.6	1.793	1493.4	2.95
	2	22	6	0.703	4.216	0	0	0	34.76	0.6	2.53	1424.9	3.97
2	1	16.625	4.75	0.834	3.961	0	0	0.01	40.05	0.6	2.377	1343.3	3.51
	2	11.875	4.75	0.925	4.392	0	0	0.04	42.86	0.6	2.635	1251.4	3.63
3	1	7.125	4.75	1.044	4.959	0	0	0.08	45.86	0.6	2.975	1123.8	3.68
	2	2.375	4.75	1.135	5.39	0	0	0.08	47.6	0.6	3.234	1024.7	3.65
Total											15.544	---	21.37

Wind force from ladder

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	25 To 30	27.5	1	1.357	1.236	1.296	0	1493.4	135	2.13
2	19 To 25	22	1	1.628	1.483	1.556	0	1424.9	135	2.44
3	14.25 To 19	16.625	1	1.289	1.174	1.169	0	1343.3	135	1.73
4	9.5 To 14.25	11.875	1	1.289	1.174	0.637	0	1251.4	135	0.88
5	4.75 To 9.5	7.125	1	1.289	1.174	0.007	0	1123.8	135	0.01
6	0 To 4.75	2.375	1	1.289	1.174	0	0	1024.7	135	0
Total						4.665	---	---	---	7.18

Wind vector from ladder

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27.5	1.51	0	1.51	41.41	-41.41	-0.78
2	22	1.72	0	1.72	37.93	-37.93	-0.95
3	16.625	1.22	0	1.22	20.31	-20.31	-0.72
4	11.875	0.62	0	0.62	7.36	-7.36	-0.38
5	7.125	0.01	0	0.01	0.04	-0.04	0

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#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
6	2.375	0	0	0	0	0	0
Total		5.08	0	5.08	107.05	-107.05	-2.84

Wind forces from transmission line clusters

#	Elev. m	Z m	K _a	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	19 To 25	22	1	2.412	0.684	0	0	1424.9	135	0
2	14.25 To 19	16.625	1	1.91	0.542	0	0	1343.3	135	0
3	9.5 To 14.25	11.875	1	1.91	0.542	0	0	1251.4	135	0
4	4.75 To 9.5	7.125	1	1.91	0.542	0	0	1123.8	135	0
5	0 To 4.75	2.375	1	1.91	0.542	0	0	1024.7	135	0
Total							0	---	---	0

Wind vector from transmission line clusters

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	22	0	0	0	0	0	0
2	16.625	0	0	0	0	0	0
3	11.875	0	0	0	0	0	0
4	7.125	0	0	0	0	0	0
5	2.375	0	0	0	0	0	0
Total		0	0	0	0	0	0

Wind forces from panel antenna

#	Elev. m	Z m	K _a	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	28	28	1	1.815	0.62	1.735	0	1499.1	165	2.86
2	28	28	1	1.815	0.62	0.7	0	1499.1	75	1.15
3	28	28	1	1.815	0.62	1.217	0	1499.1	45	2.01
4	25	25	1	1.815	0.62	1.735	0	1463.8	165	2.79
5	25	25	1	1.815	0.62	0.7	0	1463.8	75	1.13
6	25	25	1	1.815	0.62	1.217	0	1463.8	45	1.96
Total						7.304	---	---	---	11.9

Wind vector from panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	2.02	0	2.02	56.64	-56.64	-1.19

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#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
2	28	0.82	0	0.82	22.86	-22.86	1.8
3	28	1.42	0	1.42	39.75	-39.75	-2.29
4	25	1.98	0	1.98	49.38	-49.38	-1.19
5	25	0.8	0	0.8	19.93	-19.93	1.79
6	25	1.39	0	1.39	34.65	-34.65	-2.27
Total		8.42	0	8.42	223.19	-223.19	-3.36

Wind forces from mounts of panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	28	28	1	0.034	0.358	0.056	0	1499.1	165	0.09
2	28	28	1	0.034	0.358	0.336	0	1499.1	75	0.55
3	28	28	1	0.034	0.358	0.196	0	1499.1	45	0.32
4	25	25	1	0.034	0.358	0.056	0	1463.8	165	0.09
5	25	25	1	0.034	0.358	0.336	0	1463.8	75	0.54
6	25	25	1	0.034	0.358	0.196	0	1463.8	45	0.32
Total							1.174	---	---	1.91

Wind vector from mounts of panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	0.06	0	0.06	1.81	-1.81	-0.03
2	28	0.39	0	0.39	10.96	-10.96	0.75
3	28	0.23	0	0.23	6.39	-6.39	-0.32
4	25	0.06	0	0.06	1.58	-1.58	-0.03
5	25	0.38	0	0.38	9.56	-9.56	0.75
6	25	0.22	0	0.22	5.57	-5.57	-0.32
Total		1.35	0	1.35	35.87	-35.87	0.79

Wind forces from MW dishes

#	Elev. m	Z m	O.D. mm	Area m ²	t _{iz} mm	q _z N/m ²	q Deg	C _a	C _s	C _m	F _a KN	F _s KN	M _m KN
1	27	27	1200	1.131	0	1487.7	195	-0.98	-0.12	-0.03	-1.82	-0.23	-0.07
2	29	29	1200	1.131	0	1510.2	195	-0.98	-0.12	-0.03	-1.85	-0.23	-0.08

Wind vectors from MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	M _x KN.m	M _y KN.m	M _z KN.m	OTM _x KN.m	OTM _z KN.m	Torque KN.m
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#	Elev. m	F _x KN	F _y KN	F _z KN	M _x KN.m	M _y KN.m	M _z KN.m	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	1.46	0	1.11	0	-0.07	0	29.92	-39.53	1.59
2	29	1.49	0	1.12	0	-0.08	0	32.62	-43.1	1.62
Total		2.95	0	2.23	---	---	---	62.54	-82.62	3.2

Wind forces from mounts Of MW dishes

#	Elev. m	Z m	K _a	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	27	27	1	0.034	0.236	0.048	0	1487.7	165	0.08
2	29	29	1	0.034	0.235	0.048	0	1510.2	165	0.08
Total							0.095	---	---	0.16

Wind vectors from mounts Of MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	0.06	0	0.06	1.49	-1.49	0.06
2	29	0.06	0	0.06	1.62	-1.62	0.07
Total		0.11	0	0.11	3.11	-3.11	0.13

Wind Calculation Of Basic Design Wind Speed 45.5 m/s Dir. 270

Gust effect factor $G_h = 1.1$
 Direction probability $K_d = 0.95$

Wind forces on pole parts

Part No.	Wind slice No.	Mean Elev. m	L m	D _{av} m	Area m ²	t _{iz} mm	R _w	R _L	C	C _f	EPA m ²	q _z N/m ²	Force KN
1	1	27.5	5	0.598	2.989	0	0	0	30.27	0.6	1.793	1493.4	2.95
	2	22	6	0.703	4.216	0	0	0	34.76	0.6	2.53	1424.9	3.97
2	1	16.625	4.75	0.834	3.961	0	0	0.01	40.05	0.6	2.377	1343.3	3.51
	2	11.875	4.75	0.925	4.392	0	0	0.06	42.86	0.6	2.635	1251.4	3.63
3	1	7.125	4.75	1.044	4.959	0	0	0.12	45.86	0.64	3.166	1123.8	3.91
	2	2.375	4.75	1.135	5.39	0	0	0.11	47.6	0.62	3.353	1024.7	3.78
Total											15.854	---	21.74

Wind force from ladder

#	Elev. m	Z m	K _a	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
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#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	25 To 30	27.5	1	1.357	1.236	1.236	0	1493.4	90	2.03
2	19 To 25	22	1	1.628	1.483	1.483	0	1424.9	90	2.32
3	14.25 To 19	16.625	1	1.289	1.174	1.112	0	1343.3	90	1.64
4	9.5 To 14.25	11.875	1	1.289	1.174	0.675	0	1251.4	90	0.93
5	4.75 To 9.5	7.125	1	1.289	1.174	0.007	0	1123.8	90	0.01
6	0 To 4.75	2.375	1	1.289	1.174	0	0	1024.7	90	0
Total						4.513	---	---	---	6.94

Wind vector from ladder

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27.5	0	0	2.03	55.84	0	-1.05
2	22	0	0	2.32	51.15	0	-1.29
3	16.625	0	0	1.64	27.32	0	-0.97
4	11.875	0	0	0.93	11.03	0	-0.58
5	7.125	0	0	0.01	0.06	0	-0.01
6	2.375	0	0	0	0	0	0
Total		0	0	6.94	145.4	0	-3.89

Wind forces from transmission line clusters

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	19 To 25	22	1	2.412	0.684	0	0	1424.9	90	0
2	14.25 To 19	16.625	1	1.91	0.542	0	0	1343.3	90	0
3	9.5 To 14.25	11.875	1	1.91	0.542	0	0	1251.4	90	0
4	4.75 To 9.5	7.125	1	1.91	0.542	0	0	1123.8	90	0
5	0 To 4.75	2.375	1	1.91	0.542	0	0	1024.7	90	0
Total						0	---	---	---	0

Wind vector from transmission line clusters

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	22	0	0	0	0	0	0
2	16.625	0	0	0	0	0	0
3	11.875	0	0	0	0	0	0
4	7.125	0	0	0	0	0	0
5	2.375	0	0	0	0	0	0
Total		0	0	0	0	0	0

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Wind forces from panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	28	28	1	1.815	0.62	0.919	0	1499.1	120	1.51
2	28	28	1	1.815	0.62	0.919	0	1499.1	120	1.51
3	28	28	1	1.815	0.62	1.815	0	1499.1	0	2.99
4	25	25	1	1.815	0.62	0.919	0	1463.8	120	1.48
5	25	25	1	1.815	0.62	0.919	0	1463.8	120	1.48
6	25	25	1	1.815	0.62	1.815	0	1463.8	0	2.92
Total						7.304	---	---	---	11.9

Wind vector from panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	0	0	1.51	42.42	0	-2.11
2	28	0	0	1.51	42.42	0	2.11
3	28	0	0	2.99	83.79	0	0
4	25	0	0	1.48	36.98	0	-2.1
5	25	0	0	1.48	36.98	0	2.1
6	25	0	0	2.92	73.05	0	0
Total		0	0	11.9	315.64	0	0

Wind forces from mounts of panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	28	28	1	0.034	0.358	0.277	0	1499.1	120	0.46
2	28	28	1	0.034	0.358	0.277	0	1499.1	120	0.46
3	28	28	1	0.034	0.358	0.034	0	1499.1	0	0.06
4	25	25	1	0.034	0.358	0.277	0	1463.8	120	0.45
5	25	25	1	0.034	0.358	0.277	0	1463.8	120	0.45
6	25	25	1	0.034	0.358	0.034	0	1463.8	0	0.05
Total						1.174	---	---	---	1.91

Wind vector from mounts of panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	0	0	0.46	12.77	0	-0.56
2	28	0	0	0.46	12.77	0	0.56
3	28	0	0	0.06	1.56	0	0
4	25	0	0	0.45	11.13	0	-0.55
5	25	0	0	0.45	11.13	0	0.55

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#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
6	25	0	0	0.05	1.36	0	0
Total		0	0	1.91	50.73	0	0

Wind forces from MW dishes

#	Elev. m	Z m	O.D. mm	Area m ²	t _{iz} mm	q _z N/m ²	q Deg	C _a	C _s	C _m	F _a KN	F _s KN	M _m KN
1	27	27	1200	1.131	0	1487.7	240	-0.71	-0.44	-0.1	-1.32	-0.81	-0.23
2	29	29	1200	1.131	0	1510.2	240	-0.71	-0.44	-0.1	-1.34	-0.82	-0.23

Wind vectors from MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	M _x KN.m	M _y KN.m	M _z KN.m	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	0.73	0	1.36	0	-0.23	0	36.7	-19.83	0.52
2	29	0.75	0	1.38	0	-0.23	0	40.01	-21.63	0.54
Total		1.48	0	2.74	---	---	---	76.71	-41.46	1.05

Wind forces from mounts Of MW dishes

#	Elev. m	Z m	K _a	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	27	27	1	0.034	0.236	0.185	0	1487.7	120	0.3
2	29	29	1	0.034	0.235	0.185	0	1510.2	120	0.31
Total							0.37	---	---	0.61

Wind vectors from mounts Of MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	0	0	0.3	8.18	0	0.01
2	29	0	0	0.31	8.89	0	0.01
Total		0	0	0.61	17.08	0	0.02

Wind Calculation Of Basic Design Wind Speed 45.5 m/s Dir. 315Gust effect factor $G_h = 1.1$ Direction probability $K_d = 0.95$ **Wind forces on pole parts**

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Part No.	Wind slice No.	Mean Elev. m	L m	D _{av} m	Area m ²	t _{iz} mm	R _w	R _L	C	C _f	EPA m ²	q _z N/m ²	Force KN
1	1	27.5	5	0.598	2.989	0	0	0	30.27	0.6	1.793	1493.4	2.95
	2	22	6	0.703	4.216	0	0	0	34.76	0.6	2.53	1424.9	3.97
2	1	16.625	4.75	0.834	3.961	0	0	0	40.05	0.6	2.377	1343.3	3.51
	2	11.875	4.75	0.925	4.392	0	0	0.03	42.86	0.6	2.635	1251.4	3.63
3	1	7.125	4.75	1.044	4.959	0	0.04	0.08	45.86	0.6	2.975	1123.8	3.68
	2	2.375	4.75	1.135	5.39	0	0.04	0.08	47.6	0.6	3.234	1024.7	3.65
Total											15.544	---	21.37

Wind force from ladder

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	25 To 30	27.5	1	1.357	1.236	1.296	0	1493.4	45	2.13
2	19 To 25	22	1	1.628	1.483	1.556	0	1424.9	45	2.44
3	14.25 To 19	16.625	1	1.289	1.174	1.209	0	1343.3	45	1.79
4	9.5 To 14.25	11.875	1	1.289	1.174	1.001	0	1251.4	45	1.38
5	4.75 To 9.5	7.125	1	1.289	1.174	0.04	0	1123.8	45	0.05
6	0 To 4.75	2.375	1	1.289	1.174	0	0	1024.7	45	0
Total						5.103	---	---	---	7.78

Wind vector from ladder

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27.5	-1.51	0	1.51	41.41	41.41	-0.78
2	22	-1.72	0	1.72	37.93	37.93	-0.95
3	16.625	-1.26	0	1.26	21.01	21.01	-0.74
4	11.875	-0.97	0	0.97	11.57	11.57	-0.61
5	7.125	-0.04	0	0.04	0.25	0.25	-0.02
6	2.375	0	0	0	0	0	0
Total		-5.5	0	5.5	112.17	112.17	-3.1

Wind forces from transmission line clusters

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	19 To 25	22	1	2.412	0.684	0	0	1424.9	45	0
2	14.25 To 19	16.625	1	1.91	0.542	0	0	1343.3	45	0
3	9.5 To 14.25	11.875	1	1.91	0.542	0	0	1251.4	45	0
4	4.75 To 9.5	7.125	1	1.91	0.542	0	0	1123.8	45	0
5	0 To 4.75	2.375	1	1.91	0.542	0	0	1024.7	45	0
Total						0	---	---	---	0

Wind vector from transmission line clusters

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	22	0	0	0	0	0	0
2	16.625	0	0	0	0	0	0
3	11.875	0	0	0	0	0	0
4	7.125	0	0	0	0	0	0
5	2.375	0	0	0	0	0	0
Total		0	0	0	0	0	0

Wind forces from panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN	
1	28	28	1	1.815	0.62	0.7	0	1499.1	75	1.15	
2	28	28	1	1.815	0.62	1.735	0	1499.1	165	2.86	
3	28	28	1	1.815	0.62	1.217	0	1499.1	45	2.01	
4	25	25	1	1.815	0.62	0.7	0	1463.8	75	1.13	
5	25	25	1	1.815	0.62	1.735	0	1463.8	165	2.79	
6	25	25	1	1.815	0.62	1.217	0	1463.8	45	1.96	
Total							7.304	---	---	---	11.9

Wind vector from panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	-0.82	0	0.82	22.86	22.86	-1.8
2	28	-2.02	0	2.02	56.64	56.64	1.19
3	28	-1.42	0	1.42	39.75	39.75	2.29
4	25	-0.8	0	0.8	19.93	19.93	-1.79
5	25	-1.98	0	1.98	49.38	49.38	1.19
6	25	-1.39	0	1.39	34.65	34.65	2.27
Total		-8.42	0	8.42	223.19	223.19	3.36

Wind forces from mounts of panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	28	28	1	0.034	0.358	0.336	0	1499.1	75	0.55
2	28	28	1	0.034	0.358	0.056	0	1499.1	165	0.09
3	28	28	1	0.034	0.358	0.196	0	1499.1	45	0.32
4	25	25	1	0.034	0.358	0.336	0	1463.8	75	0.54
5	25	25	1	0.034	0.358	0.056	0	1463.8	165	0.09

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#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
6	25	25	1	0.034	0.358	0.196	0	1463.8	45	0.32
Total						1.174	---	---	---	1.91

Wind vector from mounts of panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	-0.39	0	0.39	10.96	10.96	-0.75
2	28	-0.06	0	0.06	1.81	1.81	0.03
3	28	-0.23	0	0.23	6.39	6.39	0.32
4	25	-0.38	0	0.38	9.56	9.56	-0.75
5	25	-0.06	0	0.06	1.58	1.58	0.03
6	25	-0.22	0	0.22	5.57	5.57	0.32
Total		-1.35	0	1.35	35.87	35.87	-0.79

Wind forces from MW dishes

#	Elev. m	Z m	O.D. mm	Area m ²	t _{iz} mm	q _z N/m ²	q Deg	C _a	C _s	C _m	F _a KN	F _s KN	M _m KN
1	27	27	1200	1.131	0	1487.7	285	0.47	-0.53	-0.05	0.87	-0.98	-0.1
2	29	29	1200	1.131	0	1510.2	285	0.47	-0.53	-0.05	0.89	-0.99	-0.1

Wind vectors from MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	M _x KN.m	M _y KN.m	M _z KN.m	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	-1.25	0	0.41	0	-0.1	0	11.1	33.68	-1.67
2	29	-1.27	0	0.42	0	-0.1	0	12.1	36.72	-1.67
Total		-2.51	0	0.83	---	---	---	23.2	70.4	-3.34

Wind forces from mounts Of MW dishes

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	27	27	1	0.034	0.236	0.222	0	1487.7	75	0.36
2	29	29	1	0.034	0.235	0.221	0	1510.2	75	0.37
Total						0.443	---	---	---	0.73

Wind vectors from mounts Of MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
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#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	-0.26	0	0.26	6.94	6.94	-0.29
2	29	-0.26	0	0.26	7.54	7.54	-0.28
Total		-0.52	0	0.52	14.48	14.48	-0.57

Wind Calculation Of Basic Service Wind Speed 25 m/s Dir. 0

Gust effect factor $G_h = 1.1$
 Direction probability $K_d = 0.85$

Wind forces on pole parts

Part No.	Wind slice No.	Mean Elev. m	L m	D _{av} m	Area m ²	t _{iz} mm	R _w	R _L	C	C _f	EPA m ²	q _z N/m ²	Force KN
1	1	27.5	5	0.598	2.989	0	0	0	16.63	0.6	1.793	403.4	0.8
	2	22	6	0.703	4.216	0	0	0	19.1	0.6	2.53	384.9	1.07
2	1	16.625	4.75	0.834	3.961	0	0	0	22.01	0.6	2.377	362.9	0.95
	2	11.875	4.75	0.925	4.392	0	0	0	23.55	0.6	2.635	338.1	0.98
3	1	7.125	4.75	1.044	4.959	0	0.11	0	25.2	0.6	2.975	303.6	0.99
	2	2.375	4.75	1.135	5.39	0	0.11	0	26.15	0.6	3.234	276.8	0.98
Total											15.544	---	5.77

Wind force from ladder

#	Elev. m	Z m	K _a	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	25 To 30	27.5	1	1.357	1.236	1.357	0	403.4	0	0.6
2	19 To 25	22	1	1.628	1.483	1.628	0	384.9	0	0.69
3	14.25 To 19	16.625	1	1.289	1.174	1.282	0	362.9	0	0.51
4	9.5 To 14.25	11.875	1	1.289	1.174	1.167	0	338.1	0	0.43
5	4.75 To 9.5	7.125	1	1.289	1.174	0.055	0	303.6	0	0.02
6	0 To 4.75	2.375	1	1.289	1.174	0	0	276.8	0	0
Total							5.489	---	---	2.26

Wind vector from ladder

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27.5	-0.6	0	0	0	16.55	0
2	22	-0.69	0	0	0	15.16	0
3	16.625	-0.51	0	0	0	8.51	0
4	11.875	-0.43	0	0	0	5.15	0
5	7.125	-0.02	0	0	0	0.13	0

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#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
6	2.375	0	0	0	0	0	0
Total		-2.26	0	0	0	45.51	0

Wind forces from transmission line clusters

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN	
1	19 To 25	22	1	2.412	0.684	0	0	384.9	0	0	
2	14.25 To 19	16.625	1	1.91	0.542	0	0	362.9	0	0	
3	9.5 To 14.25	11.875	1	1.91	0.542	0	0	338.1	0	0	
4	4.75 To 9.5	7.125	1	1.91	0.542	0	0	303.6	0	0	
5	0 To 4.75	2.375	1	1.91	0.542	0	0	276.8	0	0	
Total							0	---	---	---	0

Wind vector from transmission line clusters

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	22	0	0	0	0	0	0
2	16.625	0	0	0	0	0	0
3	11.875	0	0	0	0	0	0
4	7.125	0	0	0	0	0	0
5	2.375	0	0	0	0	0	0
Total		0	0	0	0	0	0

Wind forces from panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	28	28	1	1.815	0.62	1.516	0	405	30	0.68
2	28	28	1	1.815	0.62	1.516	0	405	150	0.68
3	28	28	1	1.815	0.62	0.62	0	405	90	0.28
4	25	25	1	1.815	0.62	1.516	0	395.4	30	0.66
5	25	25	1	1.815	0.62	1.516	0	395.4	150	0.66
6	25	25	1	1.815	0.62	0.62	0	395.4	90	0.27
Total						7.304	---	---	---	3.22

Wind vector from panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	-0.68	0	0	0	18.91	-0.54

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#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
2	28	-0.68	0	0	0	18.91	-0.54
3	28	-0.28	0	0	0	7.73	0.45
4	25	-0.66	0	0	0	16.49	-0.54
5	25	-0.66	0	0	0	16.49	-0.54
6	25	-0.27	0	0	0	6.74	0.44
Total		-3.22	0	0	0	85.26	-1.28

Wind forces from mounts of panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	28	28	1	0.034	0.358	0.115	0	405	30	0.05
2	28	28	1	0.034	0.358	0.115	0	405	150	0.05
3	28	28	1	0.034	0.358	0.358	0	405	90	0.16
4	25	25	1	0.034	0.358	0.115	0	395.4	30	0.05
5	25	25	1	0.034	0.358	0.115	0	395.4	150	0.05
6	25	25	1	0.034	0.358	0.358	0	395.4	90	0.16
Total						1.174	---	---	---	0.52

Wind vector from mounts of panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	-0.05	0	0	0	1.43	-0.04
2	28	-0.05	0	0	0	1.43	-0.04
3	28	-0.16	0	0	0	4.46	0.22
4	25	-0.05	0	0	0	1.25	-0.04
5	25	-0.05	0	0	0	1.25	-0.04
6	25	-0.16	0	0	0	3.89	0.22
Total		-0.52	0	0	0	13.7	0.3

Wind forces from MW dishes

#	Elev. m	Z m	O.D. mm	Area m ²	t _{iz} mm	q _z N/m ²	q Deg	C _a	C _s	C _m	F _a KN	F _s KN	M _m KN
1	27	27	1200	1.131	0	401.9	330	1.21	-0.23	0.05	0.61	-0.12	0.03
2	29	29	1200	1.131	0	408	330	1.21	-0.23	0.05	0.61	-0.12	0.03

Wind vectors from MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	M _x KN.m	M _y KN.m	M _z KN.m	OTM _x KN.m	OTM _z KN.m	Torque KN.m
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#	Elev. m	F _x KN	F _y KN	F _z KN	M _x KN.m	M _y KN.m	M _z KN.m	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	-0.58	0	-0.2	0	0.03	0	-5.43	15.74	-0.66
2	29	-0.59	0	-0.2	0	0.03	0	-5.92	17.16	-0.66
Total		-1.17	0	-0.41	---	---	---	-11.36	32.9	-1.32

Wind forces from mounts Of MW dishes

#	Elev. m	Z m	K _a	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	27	27	1	0.034	0.244	0.087	0	401.9	30	0.04
2	29	29	1	0.034	0.244	0.087	0	408	30	0.04
Total							0.173	---	---	0.08

Wind vectors from mounts Of MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	-0.04	0	0	0	1.03	-0.04
2	29	-0.04	0	0	0	1.13	-0.04
Total		-0.08	0	0	0	2.16	-0.09

Wind Calculation Of Basic Service Wind Speed 25 m/s Dir. 45Gust effect factor $G_h = 1.1$ Direction probability $K_d = 0.85$ **Wind forces on pole parts**

Part No.	Wind slice No.	Mean Elev. m	L m	D _{av} m	Area m ²	t _{iz} mm	R _w	R _L	C	C _f	EPA m ²	q _z N/m ²	Force KN
1	1	27.5	5	0.598	2.989	0	0	0	16.63	0.6	1.793	403.4	0.8
	2	22	6	0.703	4.216	0	0	0	19.1	0.6	2.53	384.9	1.07
2	1	16.625	4.75	0.834	3.961	0	0	0	22.01	0.6	2.377	362.9	0.95
	2	11.875	4.75	0.925	4.392	0	0	0.03	23.55	0.6	2.635	338.1	0.98
3	1	7.125	4.75	1.044	4.959	0	0.04	0.08	25.2	0.6	2.975	303.6	0.99
	2	2.375	4.75	1.135	5.39	0	0.04	0.08	26.15	0.6	3.234	276.8	0.98
Total											15.544	---	5.77

Wind force from ladder

#	Elev. m	Z m	K _a	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
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#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	25 To 30	27.5	1	1.357	1.236	1.296	0	403.4	45	0.58
2	19 To 25	22	1	1.628	1.483	1.556	0	384.9	45	0.66
3	14.25 To 19	16.625	1	1.289	1.174	1.209	0	362.9	45	0.48
4	9.5 To 14.25	11.875	1	1.289	1.174	1.025	0	338.1	45	0.38
5	4.75 To 9.5	7.125	1	1.289	1.174	0.04	0	303.6	45	0.01
6	0 To 4.75	2.375	1	1.289	1.174	0	0	276.8	45	0
Total						5.127	---	---	---	2.11

Wind vector from ladder

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27.5	-0.41	0	-0.41	-11.19	11.19	0.21
2	22	-0.47	0	-0.47	-10.25	10.25	0.26
3	16.625	-0.34	0	-0.34	-5.68	5.68	0.2
4	11.875	-0.27	0	-0.27	-3.2	3.2	0.17
5	7.125	-0.01	0	-0.01	-0.07	0.07	0.01
6	2.375	0	0	0	0	0	0
Total		-1.49	0	-1.49	-30.38	30.38	0.84

Wind forces from transmission line clusters

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	19 To 25	22	1	2.412	0.684	0	0	384.9	45	0
2	14.25 To 19	16.625	1	1.91	0.542	0	0	362.9	45	0
3	9.5 To 14.25	11.875	1	1.91	0.542	0	0	338.1	45	0
4	4.75 To 9.5	7.125	1	1.91	0.542	0	0	303.6	45	0
5	0 To 4.75	2.375	1	1.91	0.542	0	0	276.8	45	0
Total						0	---	---	---	0

Wind vector from transmission line clusters

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	22	0	0	0	0	0	0
2	16.625	0	0	0	0	0	0
3	11.875	0	0	0	0	0	0
4	7.125	0	0	0	0	0	0
5	2.375	0	0	0	0	0	0
Total		0	0	0	0	0	0

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Wind forces from panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	28	28	1	1.815	0.62	1.735	0	405	15	0.77
2	28	28	1	1.815	0.62	0.7	0	405	105	0.31
3	28	28	1	1.815	0.62	1.217	0	405	135	0.54
4	25	25	1	1.815	0.62	1.735	0	395.4	15	0.75
5	25	25	1	1.815	0.62	0.7	0	395.4	105	0.3
6	25	25	1	1.815	0.62	1.217	0	395.4	135	0.53
Total						7.304	---	---	---	3.22

Wind vector from panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	-0.55	0	-0.55	-15.3	15.3	0.32
2	28	-0.22	0	-0.22	-6.17	6.17	-0.49
3	28	-0.38	0	-0.38	-10.74	10.74	0.62
4	25	-0.53	0	-0.53	-13.34	13.34	0.32
5	25	-0.22	0	-0.22	-5.38	5.38	-0.48
6	25	-0.37	0	-0.37	-9.36	9.36	0.61
Total		-2.27	0	-2.27	-60.29	60.29	0.91

Wind forces from mounts of panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	28	28	1	0.034	0.358	0.056	0	405	15	0.02
2	28	28	1	0.034	0.358	0.336	0	405	105	0.15
3	28	28	1	0.034	0.358	0.196	0	405	135	0.09
4	25	25	1	0.034	0.358	0.056	0	395.4	15	0.02
5	25	25	1	0.034	0.358	0.336	0	395.4	105	0.15
6	25	25	1	0.034	0.358	0.196	0	395.4	135	0.09
Total						1.174	---	---	---	0.52

Wind vector from mounts of panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	-0.02	0	-0.02	-0.49	0.49	0.01
2	28	-0.11	0	-0.11	-2.96	2.96	-0.2
3	28	-0.06	0	-0.06	-1.73	1.73	0.09
4	25	-0.02	0	-0.02	-0.43	0.43	0.01
5	25	-0.1	0	-0.1	-2.58	2.58	-0.2

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#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
6	25	-0.06	0	-0.06	-1.5	1.5	0.09
Total		-0.37	0	-0.37	-9.69	9.69	-0.21

Wind forces from MW dishes

#	Elev. m	Z m	O.D. mm	Area m ²	t _{iz} mm	q _z N/m ²	q Deg	C _a	C _s	C _m	F _a KN	F _s KN	M _m KN
1	27	27	1200	1.131	0	401.9	15	1.26	0.14	-0.04	0.63	0.07	-0.02
2	29	29	1200	1.131	0	408	15	1.26	0.14	-0.04	0.64	0.07	-0.02

Wind vectors from MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	M _x KN.m	M _y KN.m	M _z KN.m	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	-0.51	0	-0.37	0	-0.02	0	-10.07	13.76	-0.6
2	29	-0.52	0	-0.38	0	-0.02	0	-10.99	15	-0.61
Total		-1.03	0	-0.75	---	---	---	-21.06	28.76	-1.21

Wind forces from mounts Of MW dishes

#	Elev. m	Z m	K _a	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	27	27	1	0.034	0.244	0.048	0	401.9	15	0.02
2	29	29	1	0.034	0.244	0.048	0	408	15	0.02
Total							0.097	---	---	0.04

Wind vectors from mounts Of MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	-0.02	0	-0.02	-0.41	0.41	-0.02
2	29	-0.02	0	-0.02	-0.44	0.44	-0.02
Total		-0.03	0	-0.03	-0.85	0.85	-0.04

Wind Calculation Of Basic Service Wind Speed 25 m/s Dir. 90Gust effect factor $G_h = 1.1$ Direction probability $K_d = 0.85$

Wind forces on pole parts

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Part No.	Wind slice No.	Mean Elev. m	L m	D_{av} m	Area m^2	t_{iz} mm	R_w	R_L	C	C_f	EPA m^2	q_z N/m 2	Force KN
1	1	27.5	5	0.598	2.989	0	0	0	16.63	0.6	1.793	403.4	0.8
	2	22	6	0.703	4.216	0	0	0	19.1	0.6	2.53	384.9	1.07
2	1	16.625	4.75	0.834	3.961	0	0	0.01	22.01	0.6	2.377	362.9	0.95
	2	11.875	4.75	0.925	4.392	0	0	0.06	23.55	0.6	2.635	338.1	0.98
3	1	7.125	4.75	1.044	4.959	0	0	0.12	25.2	0.64	3.166	303.6	1.06
	2	2.375	4.75	1.135	5.39	0	0	0.11	26.15	0.62	3.353	276.8	1.02
Total											15.854	---	5.87

Wind force from ladder

#	Elev. m	Z m	Ka	EPA _n m^2	EPA _t m^2	EPA _a m^2	t_{iz} mm	q_z N/m 2	q Deg	Force KN
1	25 To 30	27.5	1	1.357	1.236	1.236	0	403.4	90	0.55
2	19 To 25	22	1	1.628	1.483	1.483	0	384.9	90	0.63
3	14.25 To 19	16.625	1	1.289	1.174	1.121	0	362.9	90	0.45
4	9.5 To 14.25	11.875	1	1.289	1.174	0.662	0	338.1	90	0.25
5	4.75 To 9.5	7.125	1	1.289	1.174	0.007	0	303.6	90	0
6	0 To 4.75	2.375	1	1.289	1.174	0	0	276.8	90	0
Total						4.509	---	---	---	1.87

Wind vector from ladder

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27.5	0	0	-0.55	-15.08	0	0.28
2	22	0	0	-0.63	-13.82	0	0.35
3	16.625	0	0	-0.45	-7.44	0	0.26
4	11.875	0	0	-0.25	-2.92	0	0.15
5	7.125	0	0	0	-0.02	0	0
6	2.375	0	0	0	0	0	0
Total		0	0	-1.87	-39.28	0	1.05

Wind forces from transmission line clusters

#	Elev. m	Z m	Ka	EPA _n m^2	EPA _t m^2	EPA _a m^2	t_{iz} mm	q_z N/m 2	q Deg	Force KN
1	19 To 25	22	1	2.412	0.684	0	0	384.9	90	0
2	14.25 To 19	16.625	1	1.91	0.542	0	0	362.9	90	0
3	9.5 To 14.25	11.875	1	1.91	0.542	0	0	338.1	90	0
4	4.75 To 9.5	7.125	1	1.91	0.542	0	0	303.6	90	0
5	0 To 4.75	2.375	1	1.91	0.542	0	0	276.8	90	0
Total						0	---	---	---	0

Wind vector from transmission line clusters

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	22	0	0	0	0	0	0
2	16.625	0	0	0	0	0	0
3	11.875	0	0	0	0	0	0
4	7.125	0	0	0	0	0	0
5	2.375	0	0	0	0	0	0
Total		0	0	0	0	0	0

Wind forces from panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN	
1	28	28	1	1.815	0.62	0.919	0	405	60	0.41	
2	28	28	1	1.815	0.62	0.919	0	405	60	0.41	
3	28	28	1	1.815	0.62	1.815	0	405	180	0.81	
4	25	25	1	1.815	0.62	0.919	0	395.4	60	0.4	
5	25	25	1	1.815	0.62	0.919	0	395.4	60	0.4	
6	25	25	1	1.815	0.62	1.815	0	395.4	180	0.79	
Total							7.304	---	---	---	3.22

Wind vector from panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	0	0	-0.41	-11.46	0	0.57
2	28	0	0	-0.41	-11.46	0	-0.57
3	28	0	0	-0.81	-22.63	0	0
4	25	0	0	-0.4	-9.99	0	0.57
5	25	0	0	-0.4	-9.99	0	-0.57
6	25	0	0	-0.79	-19.73	0	0
Total		0	0	-3.22	-85.26	0	0

Wind forces from mounts of panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	28	28	1	0.034	0.358	0.277	0	405	60	0.12
2	28	28	1	0.034	0.358	0.277	0	405	60	0.12
3	28	28	1	0.034	0.358	0.034	0	405	180	0.02
4	25	25	1	0.034	0.358	0.277	0	395.4	60	0.12
5	25	25	1	0.034	0.358	0.277	0	395.4	60	0.12

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#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
6	25	25	1	0.034	0.358	0.034	0	395.4	180	0.01
Total						1.174	---	---	---	0.52

Wind vector from mounts of panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	0	0	-0.12	-3.45	0	0.15
2	28	0	0	-0.12	-3.45	0	-0.15
3	28	0	0	-0.02	-0.42	0	0
4	25	0	0	-0.12	-3.01	0	0.15
5	25	0	0	-0.12	-3.01	0	-0.15
6	25	0	0	-0.01	-0.37	0	0
Total		0	0	-0.52	-13.7	0	0

Wind forces from MW dishes

#	Elev. m	Z m	O.D. mm	Area m ²	t _{iz} mm	q _z N/m ²	q Deg	C _a	C _s	C _m	F _a KN	F _s KN	M _m KN
1	27	27	1200	1.131	0	401.9	60	0.95	0.37	-0.01	0.47	0.18	-0.01
2	29	29	1200	1.131	0	408	60	0.95	0.37	-0.01	0.48	0.19	-0.01

Wind vectors from MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	M _x KN.m	M _y KN.m	M _z KN.m	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	-0.32	0	-0.4	0	-0.01	0	-10.67	8.57	-0.35
2	29	-0.32	0	-0.4	0	-0.01	0	-11.64	9.35	-0.36
Total		-0.64	0	-0.8	---	---	---	-22.31	17.92	-0.71

Wind forces from mounts Of MW dishes

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	27	27	1	0.034	0.244	0.192	0	401.9	60	0.08
2	29	29	1	0.034	0.244	0.192	0	408	60	0.09
Total						0.383	---	---	---	0.17

Wind vectors from mounts Of MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
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#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	0	0	-0.08	-2.29	0	0
2	29	0	0	-0.09	-2.49	0	0
Total		0	0	-0.17	-4.78	0	-0.01

Wind Calculation Of Basic Service Wind Speed 25 m/s Dir. 135

Gust effect factor $G_h = 1.1$ Direction probability $K_d = 0.85$

Wind forces on pole parts

Part No.	Wind slice No.	Mean Elev. m	L m	D _{av} m	Area m ²	t _{iz} mm	R _w	R _L	C	C _f	EPA m ²	q _z N/m ²	Force KN
1	1	27.5	5	0.598	2.989	0	0	0	16.63	0.6	1.793	403.4	0.8
	2	22	6	0.703	4.216	0	0	0	19.1	0.6	2.53	384.9	1.07
2	1	16.625	4.75	0.834	3.961	0	0	0.01	22.01	0.6	2.377	362.9	0.95
	2	11.875	4.75	0.925	4.392	0	0	0.04	23.55	0.6	2.635	338.1	0.98
3	1	7.125	4.75	1.044	4.959	0	0	0.08	25.2	0.6	2.975	303.6	0.99
	2	2.375	4.75	1.135	5.39	0	0	0.08	26.15	0.6	3.234	276.8	0.98
Total											15.544	---	5.77

Wind force from ladder

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	25 To 30	27.5	1	1.357	1.236	1.296	0	403.4	135	0.58
2	19 To 25	22	1	1.628	1.483	1.556	0	384.9	135	0.66
3	14.25 To 19	16.625	1	1.289	1.174	1.148	0	362.9	135	0.46
4	9.5 To 14.25	11.875	1	1.289	1.174	0.637	0	338.1	135	0.24
5	4.75 To 9.5	7.125	1	1.289	1.174	0.007	0	303.6	135	0
6	0 To 4.75	2.375	1	1.289	1.174	0	0	276.8	135	0
Total						4.643	---	---	---	1.93

Wind vector from ladder

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27.5	0.41	0	-0.41	-11.19	-11.19	0.21
2	22	0.47	0	-0.47	-10.25	-10.25	0.26
3	16.625	0.32	0	-0.32	-5.38	-5.38	0.19
4	11.875	0.17	0	-0.17	-1.99	-1.99	0.1
5	7.125	0	0	0	-0.01	-0.01	0

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#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
6	2.375	0	0	0	0	0	0
Total		1.37	0	-1.37	-28.82	-28.82	0.76

Wind forces from transmission line clusters

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN	
1	19 To 25	22	1	2.412	0.684	0	0	384.9	135	0	
2	14.25 To 19	16.625	1	1.91	0.542	0	0	362.9	135	0	
3	9.5 To 14.25	11.875	1	1.91	0.542	0	0	338.1	135	0	
4	4.75 To 9.5	7.125	1	1.91	0.542	0	0	303.6	135	0	
5	0 To 4.75	2.375	1	1.91	0.542	0	0	276.8	135	0	
Total							0	---	---	---	0

Wind vector from transmission line clusters

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	22	0	0	0	0	0	0
2	16.625	0	0	0	0	0	0
3	11.875	0	0	0	0	0	0
4	7.125	0	0	0	0	0	0
5	2.375	0	0	0	0	0	0
Total		0	0	0	0	0	0

Wind forces from panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	28	28	1	1.815	0.62	0.7	0	405	105	0.31
2	28	28	1	1.815	0.62	1.735	0	405	15	0.77
3	28	28	1	1.815	0.62	1.217	0	405	135	0.54
4	25	25	1	1.815	0.62	0.7	0	395.4	105	0.3
5	25	25	1	1.815	0.62	1.735	0	395.4	15	0.75
6	25	25	1	1.815	0.62	1.217	0	395.4	135	0.53
Total						7.304	---	---	---	3.22

Wind vector from panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	0.22	0	-0.22	-6.17	-6.17	0.49

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#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
2	28	0.55	0	-0.55	-15.3	-15.3	-0.32
3	28	0.38	0	-0.38	-10.74	-10.74	-0.62
4	25	0.22	0	-0.22	-5.38	-5.38	0.48
5	25	0.53	0	-0.53	-13.34	-13.34	-0.32
6	25	0.37	0	-0.37	-9.36	-9.36	-0.61
Total		2.27	0	-2.27	-60.29	-60.29	-0.91

Wind forces from mounts of panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	28	28	1	0.034	0.358	0.336	0	405	105	0.15
2	28	28	1	0.034	0.358	0.056	0	405	15	0.02
3	28	28	1	0.034	0.358	0.196	0	405	135	0.09
4	25	25	1	0.034	0.358	0.336	0	395.4	105	0.15
5	25	25	1	0.034	0.358	0.056	0	395.4	15	0.02
6	25	25	1	0.034	0.358	0.196	0	395.4	135	0.09
Total						1.174	---	---	---	0.52

Wind vector from mounts of panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	0.11	0	-0.11	-2.96	-2.96	0.2
2	28	0.02	0	-0.02	-0.49	-0.49	-0.01
3	28	0.06	0	-0.06	-1.73	-1.73	-0.09
4	25	0.1	0	-0.1	-2.58	-2.58	0.2
5	25	0.02	0	-0.02	-0.43	-0.43	-0.01
6	25	0.06	0	-0.06	-1.5	-1.5	-0.09
Total		0.37	0	-0.37	-9.69	-9.69	0.21

Wind forces from MW dishes

#	Elev. m	Z m	O.D. mm	Area m ²	t _{iz} mm	q _z N/m ²	q Deg	C _a	C _s	C _m	F _a KN	F _s KN	M _m KN
1	27	27	1200	1.131	0	401.9	105	-0.44	0.57	0.11	-0.22	0.28	0.07
2	29	29	1200	1.131	0	408	105	-0.44	0.57	0.11	-0.22	0.29	0.07

Wind vectors from MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	M _x KN.m	M _y KN.m	M _z KN.m	OTM _x KN.m	OTM _z KN.m	Torque KN.m
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Job No. 30m Monopole

Rev. No. A

Client VM

Date 5/11/2017

Project GSM Network

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#	Elev. m	F _x KN	F _y KN	F _z KN	M _x KN.m	M _y KN.m	M _z KN.m	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	0.33	0	-0.13	0	0.07	0	-3.64	-8.98	0.49
2	29	0.34	0	-0.14	0	0.07	0	-3.97	-9.8	0.49
Total		0.67	0	-0.27	---	---	---	-7.61	-18.78	0.98

Wind forces from mounts Of MW dishes

#	Elev. m	Z m	K _a	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	27	27	1	0.034	0.244	0.23	0	401.9	105	0.1
2	29	29	1	0.034	0.244	0.23	0	408	105	0.1
Total							0.46	---	---	0.2

Wind vectors from mounts Of MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	0.07	0	-0.07	-1.94	-1.94	0.08
2	29	0.07	0	-0.07	-2.12	-2.12	0.08
Total		0.14	0	-0.14	-4.06	-4.06	0.16

Wind Calculation Of Basic Service Wind Speed 25 m/s Dir. 180Gust effect factor $G_h = 1.1$ Direction probability $K_d = 0.85$ **Wind forces on pole parts**

Part No.	Wind slice No.	Mean Elev. m	L m	D _{av} m	Area m ²	t _{iz} mm	R _w	R _L	C	C _f	EPA m ²	q _z N/m ²	Force KN
1	1	27.5	5	0.598	2.989	0	0	0	16.63	0.6	1.793	403.4	0.8
	2	22	6	0.703	4.216	0	0	0	19.1	0.6	2.53	384.9	1.07
2	1	16.625	4.75	0.834	3.961	0	0	0	22.01	0.6	2.377	362.9	0.95
	2	11.875	4.75	0.925	4.392	0	0	0	23.55	0.6	2.635	338.1	0.98
3	1	7.125	4.75	1.044	4.959	0	0	0	25.2	0.6	2.975	303.6	0.99
	2	2.375	4.75	1.135	5.39	0	0	0	26.15	0.6	3.234	276.8	0.98
Total											15.544	---	5.77

Wind force from ladder

#	Elev. m	Z m	K _a	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
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#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	25 To 30	27.5	1	1.357	1.236	1.357	0	403.4	180	0.6
2	19 To 25	22	1	1.628	1.483	1.628	0	384.9	180	0.69
3	14.25 To 19	16.625	1	1.289	1.174	1.187	0	362.9	180	0.47
4	9.5 To 14.25	11.875	1	1.289	1.174	0.672	0	338.1	180	0.25
5	4.75 To 9.5	7.125	1	1.289	1.174	0.014	0	303.6	180	0
6	0 To 4.75	2.375	1	1.289	1.174	0	0	276.8	180	0
Total						4.857	---	---	---	2.02

Wind vector from ladder

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27.5	0.6	0	0	0	-16.55	0
2	22	0.69	0	0	0	-15.16	0
3	16.625	0.47	0	0	0	-7.88	0
4	11.875	0.25	0	0	0	-2.97	0
5	7.125	0	0	0	0	-0.03	0
6	2.375	0	0	0	0	0	0
Total		2.02	0	0	0	-42.6	0

Wind forces from transmission line clusters

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	19 To 25	22	1	2.412	0.684	0	0	384.9	180	0
2	14.25 To 19	16.625	1	1.91	0.542	0	0	362.9	180	0
3	9.5 To 14.25	11.875	1	1.91	0.542	0	0	338.1	180	0
4	4.75 To 9.5	7.125	1	1.91	0.542	0	0	303.6	180	0
5	0 To 4.75	2.375	1	1.91	0.542	0	0	276.8	180	0
Total						0	---	---	---	0

Wind vector from transmission line clusters

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	22	0	0	0	0	0	0
2	16.625	0	0	0	0	0	0
3	11.875	0	0	0	0	0	0
4	7.125	0	0	0	0	0	0
5	2.375	0	0	0	0	0	0
Total		0	0	0	0	0	0

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Wind forces from panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	28	28	1	1.815	0.62	1.516	0	405	150	0.68
2	28	28	1	1.815	0.62	1.516	0	405	30	0.68
3	28	28	1	1.815	0.62	0.62	0	405	90	0.28
4	25	25	1	1.815	0.62	1.516	0	395.4	150	0.66
5	25	25	1	1.815	0.62	1.516	0	395.4	30	0.66
6	25	25	1	1.815	0.62	0.62	0	395.4	90	0.27
Total						7.304	---	---	---	3.22

Wind vector from panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	0.68	0	0	0	-18.91	0.54
2	28	0.68	0	0	0	-18.91	0.54
3	28	0.28	0	0	0	-7.73	-0.45
4	25	0.66	0	0	0	-16.49	0.54
5	25	0.66	0	0	0	-16.49	0.54
6	25	0.27	0	0	0	-6.74	-0.44
Total		3.22	0	0	0	-85.26	1.28

Wind forces from mounts of panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	28	28	1	0.034	0.358	0.115	0	405	150	0.05
2	28	28	1	0.034	0.358	0.115	0	405	30	0.05
3	28	28	1	0.034	0.358	0.358	0	405	90	0.16
4	25	25	1	0.034	0.358	0.115	0	395.4	150	0.05
5	25	25	1	0.034	0.358	0.115	0	395.4	30	0.05
6	25	25	1	0.034	0.358	0.358	0	395.4	90	0.16
Total						1.174	---	---	---	0.52

Wind vector from mounts of panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	0.05	0	0	0	-1.43	0.04
2	28	0.05	0	0	0	-1.43	0.04
3	28	0.16	0	0	0	-4.46	-0.22
4	25	0.05	0	0	0	-1.25	0.04
5	25	0.05	0	0	0	-1.25	0.04

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#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
6	25	0.16	0	0	0	-3.89	-0.22
Total		0.52	0	0	0	-13.7	-0.3

Wind forces from MW dishes

#	Elev. m	Z m	O.D. mm	Area m ²	t _{iz} mm	q _z N/m ²	q Deg	C _a	C _s	C _m	F _a KN	F _s KN	M _m KN
1	27	27	1200	1.131	0	401.9	150	-0.96	0.18	0.06	-0.48	0.09	0.04
2	29	29	1200	1.131	0	408	150	-0.96	0.18	0.06	-0.49	0.09	0.04

Wind vectors from MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	M _x KN.m	M _y KN.m	M _z KN.m	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	0.46	0	0.16	0	0.04	0	4.4	-12.37	0.58
2	29	0.47	0	0.17	0	0.04	0	4.8	-13.49	0.58
Total		0.92	0	0.33	---	---	---	9.21	-25.87	1.16

Wind forces from mounts Of MW dishes

#	Elev. m	Z m	K _a	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN	
1	27	27	1	0.034	0.244	0.087	0	401.9	150	0.04	
2	29	29	1	0.034	0.244	0.087	0	408	150	0.04	
Total								0.173	---	---	0.08

Wind vectors from mounts Of MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	0.04	0	0	0	-1.03	0.04
2	29	0.04	0	0	0	-1.13	0.04
Total		0.08	0	0	0	-2.16	0.09

Wind Calculation Of Basic Service Wind Speed 25 m/s Dir. 225

Gust effect factor $G_h = 1.1$
Direction probability $K_d = 0.85$

Wind forces on pole parts

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 Project GSM Network

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Part No.	Wind slice No.	Mean Elev. m	L m	D _{av} m	Area m ²	t _{iz} mm	R _w	R _L	C	C _f	EPA m ²	q _z N/m ²	Force KN
1	1	27.5	5	0.598	2.989	0	0	0	16.63	0.6	1.793	403.4	0.8
	2	22	6	0.703	4.216	0	0	0	19.1	0.6	2.53	384.9	1.07
2	1	16.625	4.75	0.834	3.961	0	0	0.01	22.01	0.6	2.377	362.9	0.95
	2	11.875	4.75	0.925	4.392	0	0	0.04	23.55	0.6	2.635	338.1	0.98
3	1	7.125	4.75	1.044	4.959	0	0	0.08	25.2	0.6	2.975	303.6	0.99
	2	2.375	4.75	1.135	5.39	0	0	0.08	26.15	0.6	3.234	276.8	0.98
Total											15.544	---	5.77

Wind force from ladder

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	25 To 30	27.5	1	1.357	1.236	1.296	0	403.4	135	0.58
2	19 To 25	22	1	1.628	1.483	1.556	0	384.9	135	0.66
3	14.25 To 19	16.625	1	1.289	1.174	1.169	0	362.9	135	0.47
4	9.5 To 14.25	11.875	1	1.289	1.174	0.637	0	338.1	135	0.24
5	4.75 To 9.5	7.125	1	1.289	1.174	0.007	0	303.6	135	0
6	0 To 4.75	2.375	1	1.289	1.174	0	0	276.8	135	0
Total						4.665	---	---	---	1.94

Wind vector from ladder

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27.5	0.41	0	0.41	11.19	-11.19	-0.21
2	22	0.47	0	0.47	10.25	-10.25	-0.26
3	16.625	0.33	0	0.33	5.49	-5.49	-0.19
4	11.875	0.17	0	0.17	1.99	-1.99	-0.1
5	7.125	0	0	0	0.01	-0.01	0
6	2.375	0	0	0	0	0	0
Total		1.37	0	1.37	28.92	-28.92	-0.77

Wind forces from transmission line clusters

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	19 To 25	22	1	2.412	0.684	0	0	384.9	135	0
2	14.25 To 19	16.625	1	1.91	0.542	0	0	362.9	135	0
3	9.5 To 14.25	11.875	1	1.91	0.542	0	0	338.1	135	0
4	4.75 To 9.5	7.125	1	1.91	0.542	0	0	303.6	135	0
5	0 To 4.75	2.375	1	1.91	0.542	0	0	276.8	135	0
Total						0	---	---	---	0

Wind vector from transmission line clusters

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	22	0	0	0	0	0	0
2	16.625	0	0	0	0	0	0
3	11.875	0	0	0	0	0	0
4	7.125	0	0	0	0	0	0
5	2.375	0	0	0	0	0	0
Total		0	0	0	0	0	0

Wind forces from panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN	
1	28	28	1	1.815	0.62	1.735	0	405	165	0.77	
2	28	28	1	1.815	0.62	0.7	0	405	75	0.31	
3	28	28	1	1.815	0.62	1.217	0	405	45	0.54	
4	25	25	1	1.815	0.62	1.735	0	395.4	165	0.75	
5	25	25	1	1.815	0.62	0.7	0	395.4	75	0.3	
6	25	25	1	1.815	0.62	1.217	0	395.4	45	0.53	
Total							7.304	---	---	---	3.22

Wind vector from panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	0.55	0	0.55	15.3	-15.3	-0.32
2	28	0.22	0	0.22	6.17	-6.17	0.49
3	28	0.38	0	0.38	10.74	-10.74	-0.62
4	25	0.53	0	0.53	13.34	-13.34	-0.32
5	25	0.22	0	0.22	5.38	-5.38	0.48
6	25	0.37	0	0.37	9.36	-9.36	-0.61
Total		2.27	0	2.27	60.29	-60.29	-0.91

Wind forces from mounts of panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	28	28	1	0.034	0.358	0.056	0	405	165	0.02
2	28	28	1	0.034	0.358	0.336	0	405	75	0.15
3	28	28	1	0.034	0.358	0.196	0	405	45	0.09
4	25	25	1	0.034	0.358	0.056	0	395.4	165	0.02
5	25	25	1	0.034	0.358	0.336	0	395.4	75	0.15

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Job No. 30m Monopole

Rev. No. A

Client VM

Date 5/11/2017

Project GSM Network

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#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
6	25	25	1	0.034	0.358	0.196	0	395.4	45	0.09
Total						1.174	---	---	---	0.52

Wind vector from mounts of panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	0.02	0	0.02	0.49	-0.49	-0.01
2	28	0.11	0	0.11	2.96	-2.96	0.2
3	28	0.06	0	0.06	1.73	-1.73	-0.09
4	25	0.02	0	0.02	0.43	-0.43	-0.01
5	25	0.1	0	0.1	2.58	-2.58	0.2
6	25	0.06	0	0.06	1.5	-1.5	-0.09
Total		0.37	0	0.37	9.69	-9.69	0.21

Wind forces from MW dishes

#	Elev. m	Z m	O.D. mm	Area m ²	t _{iz} mm	q _z N/m ²	q Deg	C _a	C _s	C _m	F _a KN	F _s KN	M _m KN
1	27	27	1200	1.131	0	401.9	195	-0.98	-0.12	-0.03	-0.49	-0.06	-0.02
2	29	29	1200	1.131	0	408	195	-0.98	-0.12	-0.03	-0.5	-0.06	-0.02

Wind vectors from MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	M _x KN.m	M _y KN.m	M _z KN.m	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	0.4	0	0.3	0	-0.02	0	8.08	-10.68	0.43
2	29	0.4	0	0.3	0	-0.02	0	8.81	-11.64	0.44
Total		0.8	0	0.6	---	---	---	16.9	-22.32	0.87

Wind forces from mounts Of MW dishes

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	27	27	1	0.034	0.244	0.048	0	401.9	165	0.02
2	29	29	1	0.034	0.244	0.048	0	408	165	0.02
Total						0.097	---	---	---	0.04

Wind vectors from mounts Of MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
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#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	0.02	0	0.02	0.41	-0.41	0.02
2	29	0.02	0	0.02	0.44	-0.44	0.02
Total		0.03	0	0.03	0.85	-0.85	0.04

Wind Calculation Of Basic Service Wind Speed 25 m/s Dir. 270

Gust effect factor $G_h = 1.1$ Direction probability $K_d = 0.85$

Wind forces on pole parts

Part No.	Wind slice No.	Mean Elev. m	L m	D _{av} m	Area m ²	t _{iz} mm	R _w	R _L	C	C _f	EPA m ²	q _z N/m ²	Force KN
1	1	27.5	5	0.598	2.989	0	0	0	16.63	0.6	1.793	403.4	0.8
	2	22	6	0.703	4.216	0	0	0	19.1	0.6	2.53	384.9	1.07
2	1	16.625	4.75	0.834	3.961	0	0	0.01	22.01	0.6	2.377	362.9	0.95
	2	11.875	4.75	0.925	4.392	0	0	0.06	23.55	0.6	2.635	338.1	0.98
3	1	7.125	4.75	1.044	4.959	0	0	0.12	25.2	0.64	3.166	303.6	1.06
	2	2.375	4.75	1.135	5.39	0	0	0.11	26.15	0.62	3.353	276.8	1.02
Total											15.854	---	5.87

Wind force from ladder

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	25 To 30	27.5	1	1.357	1.236	1.236	0	403.4	90	0.55
2	19 To 25	22	1	1.628	1.483	1.483	0	384.9	90	0.63
3	14.25 To 19	16.625	1	1.289	1.174	1.112	0	362.9	90	0.44
4	9.5 To 14.25	11.875	1	1.289	1.174	0.675	0	338.1	90	0.25
5	4.75 To 9.5	7.125	1	1.289	1.174	0.007	0	303.6	90	0
6	0 To 4.75	2.375	1	1.289	1.174	0	0	276.8	90	0
Total						4.513	---	---	---	1.87

Wind vector from ladder

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27.5	0	0	0.55	15.08	0	-0.28
2	22	0	0	0.63	13.82	0	-0.35
3	16.625	0	0	0.44	7.38	0	-0.26
4	11.875	0	0	0.25	2.98	0	-0.16
5	7.125	0	0	0	0.02	0	0

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#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
6	2.375	0	0	0	0	0	0
Total		0	0	1.87	39.28	0	-1.05

Wind forces from transmission line clusters

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN	
1	19 To 25	22	1	2.412	0.684	0	0	384.9	90	0	
2	14.25 To 19	16.625	1	1.91	0.542	0	0	362.9	90	0	
3	9.5 To 14.25	11.875	1	1.91	0.542	0	0	338.1	90	0	
4	4.75 To 9.5	7.125	1	1.91	0.542	0	0	303.6	90	0	
5	0 To 4.75	2.375	1	1.91	0.542	0	0	276.8	90	0	
Total							0	---	---	---	0

Wind vector from transmission line clusters

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	22	0	0	0	0	0	0
2	16.625	0	0	0	0	0	0
3	11.875	0	0	0	0	0	0
4	7.125	0	0	0	0	0	0
5	2.375	0	0	0	0	0	0
Total		0	0	0	0	0	0

Wind forces from panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	28	28	1	1.815	0.62	0.919	0	405	120	0.41
2	28	28	1	1.815	0.62	0.919	0	405	120	0.41
3	28	28	1	1.815	0.62	1.815	0	405	0	0.81
4	25	25	1	1.815	0.62	0.919	0	395.4	120	0.4
5	25	25	1	1.815	0.62	0.919	0	395.4	120	0.4
6	25	25	1	1.815	0.62	1.815	0	395.4	0	0.79
Total						7.304	---	---	---	3.22

Wind vector from panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	0	0	0.41	11.46	0	-0.57

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#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
2	28	0	0	0.41	11.46	0	0.57
3	28	0	0	0.81	22.63	0	0
4	25	0	0	0.4	9.99	0	-0.57
5	25	0	0	0.4	9.99	0	0.57
6	25	0	0	0.79	19.73	0	0
Total		0	0	3.22	85.26	0	0

Wind forces from mounts of panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	28	28	1	0.034	0.358	0.277	0	405	120	0.12
2	28	28	1	0.034	0.358	0.277	0	405	120	0.12
3	28	28	1	0.034	0.358	0.034	0	405	0	0.02
4	25	25	1	0.034	0.358	0.277	0	395.4	120	0.12
5	25	25	1	0.034	0.358	0.277	0	395.4	120	0.12
6	25	25	1	0.034	0.358	0.034	0	395.4	0	0.01
Total							1.174	---	---	0.52

Wind vector from mounts of panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	0	0	0.12	3.45	0	-0.15
2	28	0	0	0.12	3.45	0	0.15
3	28	0	0	0.02	0.42	0	0
4	25	0	0	0.12	3.01	0	-0.15
5	25	0	0	0.12	3.01	0	0.15
6	25	0	0	0.01	0.37	0	0
Total		0	0	0.52	13.7	0	0

Wind forces from MW dishes

#	Elev. m	Z m	O.D. mm	Area m ²	t _{iz} mm	q _z N/m ²	q Deg	C _a	C _s	C _m	F _a KN	F _s KN	M _m KN
1	27	27	1200	1.131	0	401.9	240	-0.71	-0.44	-0.1	-0.36	-0.22	-0.06
2	29	29	1200	1.131	0	408	240	-0.71	-0.44	-0.1	-0.36	-0.22	-0.06

Wind vectors from MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	M _x KN.m	M _y KN.m	M _z KN.m	OTM _x KN.m	OTM _z KN.m	Torque KN.m
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#	Elev. m	F _x KN	F _y KN	F _z KN	M _x KN.m	M _y KN.m	M _z KN.m	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	0.2	0	0.37	0	-0.06	0	9.91	-5.36	0.14
2	29	0.2	0	0.37	0	-0.06	0	10.81	-5.84	0.15
Total		0.4	0	0.74	---	---	---	20.72	-11.2	0.28

Wind forces from mounts Of MW dishes

#	Elev. m	Z m	K _a	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	27	27	1	0.034	0.244	0.192	0	401.9	120	0.08
2	29	29	1	0.034	0.244	0.192	0	408	120	0.09
Total							0.383	---	---	0.17

Wind vectors from mounts Of MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	0	0	0.08	2.29	0	0
2	29	0	0	0.09	2.49	0	0
Total		0	0	0.17	4.78	0	0.01

Wind Calculation Of Basic Service Wind Speed 25 m/s Dir. 315Gust effect factor $G_h = 1.1$ Direction probability $K_d = 0.85$ **Wind forces on pole parts**

Part No.	Wind slice No.	Mean Elev. m	L m	D _{av} m	Area m ²	t _{iz} mm	R _w	R _L	C	C _f	EPA m ²	q _z N/m ²	Force KN
1	1	27.5	5	0.598	2.989	0	0	0	16.63	0.6	1.793	403.4	0.8
	2	22	6	0.703	4.216	0	0	0	19.1	0.6	2.53	384.9	1.07
2	1	16.625	4.75	0.834	3.961	0	0	0	22.01	0.6	2.377	362.9	0.95
	2	11.875	4.75	0.925	4.392	0	0	0.03	23.55	0.6	2.635	338.1	0.98
3	1	7.125	4.75	1.044	4.959	0	0.04	0.08	25.2	0.6	2.975	303.6	0.99
	2	2.375	4.75	1.135	5.39	0	0.04	0.08	26.15	0.6	3.234	276.8	0.98
Total											15.544	---	5.77

Wind force from ladder

#	Elev. m	Z m	K _a	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
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#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	25 To 30	27.5	1	1.357	1.236	1.296	0	403.4	45	0.58
2	19 To 25	22	1	1.628	1.483	1.556	0	384.9	45	0.66
3	14.25 To 19	16.625	1	1.289	1.174	1.209	0	362.9	45	0.48
4	9.5 To 14.25	11.875	1	1.289	1.174	1.001	0	338.1	45	0.37
5	4.75 To 9.5	7.125	1	1.289	1.174	0.04	0	303.6	45	0.01
6	0 To 4.75	2.375	1	1.289	1.174	0	0	276.8	45	0
Total						5.103	---	---	---	2.1

Wind vector from ladder

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27.5	-0.41	0	0.41	11.19	11.19	-0.21
2	22	-0.47	0	0.47	10.25	10.25	-0.26
3	16.625	-0.34	0	0.34	5.68	5.68	-0.2
4	11.875	-0.26	0	0.26	3.13	3.13	-0.16
5	7.125	-0.01	0	0.01	0.07	0.07	-0.01
6	2.375	0	0	0	0	0	0
Total		-1.49	0	1.49	30.3	30.3	-0.84

Wind forces from transmission line clusters

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	19 To 25	22	1	2.412	0.684	0	0	384.9	45	0
2	14.25 To 19	16.625	1	1.91	0.542	0	0	362.9	45	0
3	9.5 To 14.25	11.875	1	1.91	0.542	0	0	338.1	45	0
4	4.75 To 9.5	7.125	1	1.91	0.542	0	0	303.6	45	0
5	0 To 4.75	2.375	1	1.91	0.542	0	0	276.8	45	0
Total						0	---	---	---	0

Wind vector from transmission line clusters

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	22	0	0	0	0	0	0
2	16.625	0	0	0	0	0	0
3	11.875	0	0	0	0	0	0
4	7.125	0	0	0	0	0	0
5	2.375	0	0	0	0	0	0
Total		0	0	0	0	0	0

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Wind forces from panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	28	28	1	1.815	0.62	0.7	0	405	75	0.31
2	28	28	1	1.815	0.62	1.735	0	405	165	0.77
3	28	28	1	1.815	0.62	1.217	0	405	45	0.54
4	25	25	1	1.815	0.62	0.7	0	395.4	75	0.3
5	25	25	1	1.815	0.62	1.735	0	395.4	165	0.75
6	25	25	1	1.815	0.62	1.217	0	395.4	45	0.53
Total						7.304	---	---	---	3.22

Wind vector from panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	-0.22	0	0.22	6.17	6.17	-0.49
2	28	-0.55	0	0.55	15.3	15.3	0.32
3	28	-0.38	0	0.38	10.74	10.74	0.62
4	25	-0.22	0	0.22	5.38	5.38	-0.48
5	25	-0.53	0	0.53	13.34	13.34	0.32
6	25	-0.37	0	0.37	9.36	9.36	0.61
Total		-2.27	0	2.27	60.29	60.29	0.91

Wind forces from mounts of panel antenna

#	Elev. m	Z m	Ka	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	28	28	1	0.034	0.358	0.336	0	405	75	0.15
2	28	28	1	0.034	0.358	0.056	0	405	165	0.02
3	28	28	1	0.034	0.358	0.196	0	405	45	0.09
4	25	25	1	0.034	0.358	0.336	0	395.4	75	0.15
5	25	25	1	0.034	0.358	0.056	0	395.4	165	0.02
6	25	25	1	0.034	0.358	0.196	0	395.4	45	0.09
Total						1.174	---	---	---	0.52

Wind vector from mounts of panel antenna

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	28	-0.11	0	0.11	2.96	2.96	-0.2
2	28	-0.02	0	0.02	0.49	0.49	0.01
3	28	-0.06	0	0.06	1.73	1.73	0.09
4	25	-0.1	0	0.1	2.58	2.58	-0.2
5	25	-0.02	0	0.02	0.43	0.43	0.01

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#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
6	25	-0.06	0	0.06	1.5	1.5	0.09
Total		-0.37	0	0.37	9.69	9.69	-0.21

Wind forces from MW dishes

#	Elev. m	Z m	O.D. mm	Area m ²	t _{iz} mm	q _z N/m ²	q Deg	C _a	C _s	C _m	F _a KN	F _s KN	M _m KN
1	27	27	1200	1.131	0	401.9	285	0.47	-0.53	-0.05	0.24	-0.26	-0.03
2	29	29	1200	1.131	0	408	285	0.47	-0.53	-0.05	0.24	-0.27	-0.03

Wind vectors from MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	M _x KN.m	M _y KN.m	M _z KN.m	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	-0.34	0	0.11	0	-0.03	0	3	9.1	-0.45
2	29	-0.34	0	0.11	0	-0.03	0	3.27	9.92	-0.45
Total		-0.68	0	0.22	---	---	---	6.27	19.02	-0.9

Wind forces from mounts Of MW dishes

#	Elev. m	Z m	K _a	EPA _n m ²	EPA _t m ²	EPA _a m ²	t _{iz} mm	q _z N/m ²	q Deg	Force KN
1	27	27	1	0.034	0.244	0.23	0	401.9	75	0.1
2	29	29	1	0.034	0.244	0.23	0	408	75	0.1
Total							0.46	---	---	0.2

Wind vectors from mounts Of MW dishes

#	Elev. m	F _x KN	F _y KN	F _z KN	OTM _x KN.m	OTM _z KN.m	Torque KN.m
1	27	-0.07	0	0.07	1.94	1.94	-0.08
2	29	-0.07	0	0.07	2.12	2.12	-0.08
Total		-0.14	0	0.14	4.06	4.06	-0.16

Combination

Comb. No.	Description
1	1.2D.L.+1DesignWL_0Deg_45.5m/s
2	1.2D.L.+1DesignWL_45Deg_45.5m/s
3	1.2D.L.+1DesignWL_90Deg_45.5m/s
4	1.2D.L.+1DesignWL_135Deg_45.5m/s

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Comb. No.	Description
5	1.2D.L.+1DesignWL_180Deg_45.5m/s
6	1.2D.L.+1DesignWL_225Deg_45.5m/s
7	1.2D.L.+1DesignWL_270Deg_45.5m/s
8	1.2D.L.+1DesignWL_315Deg_45.5m/s
9	0.9D.L.+1DesignWL_0Deg_45.5m/s
10	0.9D.L.+1DesignWL_45Deg_45.5m/s
11	0.9D.L.+1DesignWL_90Deg_45.5m/s
12	0.9D.L.+1DesignWL_135Deg_45.5m/s
13	0.9D.L.+1DesignWL_180Deg_45.5m/s
14	0.9D.L.+1DesignWL_225Deg_45.5m/s
15	0.9D.L.+1DesignWL_270Deg_45.5m/s
16	0.9D.L.+1DesignWL_315Deg_45.5m/s
17	1D.L.+1ServiceWL_0Deg_25m/s
18	1D.L.+1ServiceWL_45Deg_25m/s
19	1D.L.+1ServiceWL_90Deg_25m/s
20	1D.L.+1ServiceWL_135Deg_25m/s
21	1D.L.+1ServiceWL_180Deg_25m/s
22	1D.L.+1ServiceWL_225Deg_25m/s
23	1D.L.+1ServiceWL_270Deg_25m/s
24	1D.L.+1ServiceWL_315Deg_25m/s

Pole Section Properties

Sec. No.	Elev. m	Diameter mm	Thick. mm	Area mm ²	Inertia mm ⁴	Elastic Modulus mm ³	Plastic Modulus mm ³
1	30	550	6	10254.2	379367972	1379520	1775688
2	28.643	575.9	6	10742.5	436190321	1514789	1948850
3	28.643	575.9	6	10742.5	436190321	1514789	1948850
4	27.286	601.8	6	11230.9	498421113	1656384	2130068
5	27.286	601.8	6	11230.9	498421113	1656384	2130068
6	25.929	627.7	6	11719.3	566306227	1804307	2319341
7	25.929	627.7	6	11719.3	566306227	1804307	2319341
8	24.571	653.6	6	12207.7	640091540	1958555	2516669
9	24.571	653.6	6	12207.7	640091540	1958555	2516669
10	23.214	679.5	6	12696	720022929	2119131	2722053
11	23.214	679.5	6	12696	720022929	2119131	2722053
12	21.857	705.5	6	13184.4	806346272	2286033	2935492
13	21.857	705.5	6	13184.4	806346272	2286033	2935492
14	20.5	731.4	6	13672.8	899307447	2459262	3156986
15	20.5	731.4	12	27119.4	1754718309	4798484	6210384
16	19	760	12	28198.9	1972684743	5191276	6714624
17	19	788.6	6	14752.3	1129579308	2864639	3675190
18	17.667	814.1	6	15232.2	1243413966	3054730	3918138

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Sec. No.	Elev. m	Diameter mm	Thick. mm	Area mm ²	Inertia mm ⁴	Elastic Modulus mm ³	Plastic Modulus mm ³
19	17.667	814.1	6	15232.2	1243413966	3054730	3918138
20	16.333	839.5	6	15712	1364650695	3250927	4168860
21	16.333	839.5	6	15712	1364650695	3250927	4168860
22	15	865	6	16191.8	1493522658	3453232	4427358
23	15	865	6	16191.8	1493522658	3453232	4427358
24	13.667	890.5	6	16671.6	1630263018	3661642	4693631
25	13.667	890.5	6	16671.6	1630263018	3661642	4693631
26	12.333	915.9	6	17151.4	1775104937	3876160	4967679
27	12.333	915.9	6	17151.4	1775104937	3876160	4967679
28	11	941.4	6	17631.2	1928281577	4096784	5249503
29	11	941.4	14	40787.6	4385681367	9317720	12040961
30	9.5	970	14	42047.1	4804572218	9906334	12796019
31	9.5	998.6	8	24897.4	3054365403	6117072	7851054
32	7.917	1028.9	8	25657.1	3342564106	6497584	8337471
33	7.917	1028.9	8	25657.1	3342564106	6497584	8337471
34	6.333	1059.1	8	26416.8	3648344749	6889578	8838507
35	6.333	1059.1	8	26416.8	3648344749	6889578	8838507
36	4.75	1089.3	8	27176.5	3972227924	7293054	9354163
37	4.75	1089.3	8	27176.5	3972227924	7293054	9354163
38	3.167	1119.5	8	27936.2	4314734224	7708011	9884437
39	3.167	1119.5	8	27936.2	4314734224	7708011	9884437
40	1.583	1149.8	8	28695.9	4676384242	8134450	10429330
41	1.583	1149.8	8	28695.9	4676384242	8134450	10429330
42	0	1180	8	29455.6	5057698569	8572370	10988843

Pole capacity details

Sec. No.	Elev. m	W/t or D/t	Fy' MPa	fPn KN	fMn KN.m	fVn KN.m	fTn KN.m	Comment
1	30	91.67	319.4	2947.27	496.83	982.86	534.41	
2	28.643	95.98	315.6	3051.67	542.78	1029.67	586.52	
3	28.643	95.98	315.6	3051.67	542.78	1029.67	586.52	
4	27.286	100.3	312.2	3156.04	590.75	1076.48	641.06	
5	27.286	100.3	312.2	3156.04	590.75	1076.48	641.06	
6	25.929	104.62	309.1	3260.38	640.73	1123.29	698.03	
7	25.929	104.62	309.1	3260.38	640.73	1123.29	698.03	
8	24.571	108.94	306.2	3364.7	692.75	1170.1	757.42	
9	24.571	108.94	306.2	3364.7	692.75	1170.1	757.42	
10	23.214	113.26	303.6	3468.99	746.78	1216.91	819.23	
11	23.214	113.26	303.6	3468.99	746.78	1216.91	819.23	
12	21.857	117.58	301.1	3573.27	802.83	1263.73	883.47	
13	21.857	117.58	301.1	3573.27	802.83	1263.73	883.47	
14	20.5	121.89	298.9	3677.52	860.91	1310.54	950.13	

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Sec. No.	Elev. m	W/t or D/t	Fy' MPa	fPn KN	fMn KN.m	fVn KN.m	fTn KN.m	Comment
15	20.5	60.95	355	8664.64	1826.47	2599.39	1868.96	
16	19	63.33	355	9009.56	1964.02	2702.87	2020.72	
17	19	131.44	294.3	3907.93	996.46	1414.01	1106.1	
18	17.667	135.68	292.5	4010.31	1059.87	1460	1179.22	
19	17.667	135.68	292.5	4010.31	1059.87	1460	1179.22	
20	16.333	139.92	290.8	4112.68	1125.24	1505.99	1254.68	
21	16.333	139.92	290.8	4112.68	1125.24	1505.99	1254.68	
22	15	144.17	289.2	4215.04	1192.56	1551.98	1332.48	
23	15	144.17	289.2	4215.04	1192.56	1551.98	1332.48	
24	13.667	148.41	287.7	4317.4	1261.82	1597.97	1412.62	
25	13.667	148.41	287.7	4317.4	1261.82	1597.97	1412.62	
26	12.333	152.65	286.3	4419.74	1333.04	1643.96	1495.1	
27	12.333	152.65	286.3	4419.74	1333.04	1643.96	1495.1	
28	11	156.89	285	4522.08	1406.21	1689.95	1579.92	
29	11	67.24	349.4	12825.94	3493.34	3909.49	3623.68	
30	9.5	69.29	346.1	13096.06	3697.81	4030.21	3850.93	
31	9.5	124.83	297.4	6663.8	2136.99	2386.42	2362.87	
32	7.917	128.61	295.6	6825.94	2264.22	2459.23	2509.27	
33	7.917	128.61	295.6	6825.94	2264.22	2459.23	2509.27	
34	6.333	132.39	293.9	6988.06	2395.13	2532.05	2660.07	
35	6.333	132.39	293.9	6988.06	2395.13	2532.05	2660.07	
36	4.75	136.16	292.3	7150.16	2529.7	2604.87	2815.26	
37	4.75	136.16	292.3	7150.16	2529.7	2604.87	2815.26	
38	3.167	139.94	290.8	7312.25	2667.94	2677.68	2974.86	
39	3.167	139.94	290.8	7312.25	2667.94	2677.68	2974.86	
40	1.583	143.72	289.4	7474.32	2809.84	2750.5	3138.85	
41	1.583	143.72	289.4	7474.32	2809.84	2750.5	3138.85	
42	0	147.5	288.1	7636.38	2955.42	2823.32	3307.25	

Pole Sections Check

Sec. No.	Elev. m	Pu KN	Mu KN.m	Vu KN	Tu KN.m	Comb . No.	Pu / fPn	Mu / fMn	Vu / fVn	Tu / fTn	Comb. Stress Ratio	Check
1	30	0	0	0	0	11	0	0	0	0	0	Safe
2	28.643	3.98	3.84	5.78	-0.14	7	0	0.01	0.01	0	0.01	Safe
3	28.643	3.98	3.84	5.78	-0.14	7	0	0.01	0.01	0	0.01	Safe
4	27.286	7.01	15.55	8.87	-0.4	7	0	0.03	0.01	0	0.03	Safe
5	27.286	7.01	15.55	8.87	-0.4	7	0	0.03	0.01	0	0.03	Safe
6	25.929	12.83	34.34	18.37	-0.78	6	0	0.05	0.02	0	0.06	Safe
7	25.929	12.83	34.34	18.37	-0.78	6	0	0.05	0.02	0	0.06	Safe
8	24.571	14.59	60.41	20.72	7.93	1	0	0.09	0.02	0.01	0.09	Safe
9	24.571	14.59	60.41	20.72	7.93	1	0	0.09	0.02	0.01	0.09	Safe
10	23.214	18.2	92.59	25.6	8.83	1	0.01	0.12	0.02	0.01	0.13	Safe

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Sec. No.	Elev. m	Pu KN	Mu KN.m	Vu KN	Tu KN.m	Comb. No.	Pu / fPn	Mu / fMn	Vu / fVn	Tu / fTn	Comb. Stress Ratio	Check
11	23.214	18.2	92.59	25.6	8.83	1	0.01	0.12	0.02	0.01	0.13	Safe
12	21.857	20.15	128.78	27.07	8.83	1	0.01	0.16	0.02	0.01	0.17	Safe
13	21.857	20.15	128.78	27.07	8.83	1	0.01	0.16	0.02	0.01	0.17	Safe
14	20.5	22.16	166.99	28.54	8.83	1	0.01	0.19	0.02	0.01	0.2	Safe
15	20.5	22.16	166.99	28.54	8.83	1	0	0.09	0.01	0	0.09	Safe
16	19	26.39	211.6	30.17	8.83	1	0	0.11	0.01	0	0.11	Safe
17	19	26.39	211.6	30.17	8.83	1	0.01	0.21	0.02	0.01	0.22	Safe
18	17.667	28.57	253.4	31.69	8.83	1	0.01	0.24	0.02	0.01	0.25	Safe
19	17.667	28.57	253.4	31.69	8.83	1	0.01	0.24	0.02	0.01	0.25	Safe
20	16.333	30.8	297.21	33.2	8.83	1	0.01	0.26	0.02	0.01	0.27	Safe
21	16.333	30.8	297.21	33.2	8.83	1	0.01	0.26	0.02	0.01	0.27	Safe
22	15	33.09	343.04	34.72	8.83	1	0.01	0.29	0.02	0.01	0.3	Safe
23	15	33.09	343.04	34.72	8.83	1	0.01	0.29	0.02	0.01	0.3	Safe
24	13.667	35.45	390.85	36.21	8.83	1	0.01	0.31	0.02	0.01	0.32	Safe
25	13.667	35.45	390.85	36.21	8.83	1	0.01	0.31	0.02	0.01	0.32	Safe
26	12.333	37.86	440.6	37.68	8.83	1	0.01	0.33	0.02	0.01	0.34	Safe
27	12.333	37.86	440.6	37.68	8.83	1	0.01	0.33	0.02	0.01	0.34	Safe
28	11	40.34	492.25	39.15	8.83	1	0.01	0.35	0.02	0.01	0.36	Safe
29	11	40.34	492.25	39.15	8.83	1	0	0.14	0.01	0	0.14	Safe
30	9.5	46.51	552.69	40.8	8.83	1	0	0.15	0.01	0	0.15	Safe
31	9.5	46.51	552.69	40.8	8.83	1	0.01	0.26	0.02	0	0.27	Safe
32	7.917	50.63	618.77	42.05	8.83	1	0.01	0.27	0.02	0	0.28	Safe
33	7.917	50.63	618.77	42.05	8.83	1	0.01	0.27	0.02	0	0.28	Safe
34	6.333	54.86	686.75	43.3	8.83	1	0.01	0.29	0.02	0	0.29	Safe
35	6.333	54.86	686.75	43.3	8.83	1	0.01	0.29	0.02	0	0.29	Safe
36	4.75	59.2	756.62	44.55	8.83	1	0.01	0.3	0.02	0	0.31	Safe
37	4.75	59.2	756.62	44.55	8.83	1	0.01	0.3	0.02	0	0.31	Safe
38	3.167	63.65	828.32	45.76	8.83	1	0.01	0.31	0.02	0	0.32	Safe
39	3.167	63.65	828.32	45.76	8.83	1	0.01	0.31	0.02	0	0.32	Safe
40	1.583	68.22	901.82	46.97	8.83	1	0.01	0.32	0.02	0	0.33	Safe
41	1.583	68.22	901.82	46.97	8.83	1	0.01	0.32	0.02	0	0.33	Safe
42	0	72.9	977.08	48.19	8.83	1	0.01	0.33	0.02	0	0.34	Safe

Reactions From The Tower

Total reaction on foundation

Comb No.	Shear X KN	Vertical KN	Shear Z KN	Horiz. Shear KN	Moment Mx KN.m	Torque My KN.m	Moment Mz KN.m	Horiz. Moment KN.m
1	48.17	72.9	1.5	48.19	39.09	8.83	-976.29	977.08
2	34.32	72.9	33.3	47.82	671.47	-1.06	-700.94	970.66
3	2.37	72.9	46.05	46.11	924.13	-1.25	-64.31	926.36

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Comb No.	Shear X KN	Vertical KN	Shear Z KN	Horiz. Shear KN	Moment Mx KN.m	Torque My KN.m	Moment Mz KN.m	Horiz. Moment KN.m
4	-32.94	72.9	31.46	45.55	626.78	-4.45	674.9	921.05
5	-46.36	72.9	-1.22	46.38	-37.95	-8.24	944.75	945.51
6	-33.02	72.9	-32.3	46.2	-657.35	2.07	677.04	943.66
7	-1.48	72.9	-45.84	45.87	-925.08	2.81	44.79	926.16
8	33.42	72.9	-31.73	46.08	-634.17	4.45	-675.66	926.65
9	48.17	54.67	1.5	48.19	39.84	8.83	-974.45	975.26
10	34.32	54.67	33.3	47.82	670.58	-1.06	-699.81	969.23
11	2.37	54.67	46.05	46.11	922.59	-1.25	-64.82	924.86
12	-32.94	54.67	31.46	45.55	626.02	-4.45	672.42	918.73
13	-46.36	54.67	-1.22	46.38	-36.96	-8.24	941.58	942.3
14	-33.02	54.67	-32.3	46.2	-654.76	2.07	674.56	940.08
15	-1.48	54.67	-45.84	45.87	-921.8	2.81	43.95	922.85
16	33.42	54.67	-31.73	46.08	-631.66	4.45	-674.6	924.17
17	13.01	60.75	0.41	13.02	8.6	2.39	-261.74	261.88
18	9.27	60.75	9	12.92	179.14	-0.29	-187.44	259.28
19	0.64	60.75	12.45	12.46	247.44	-0.34	-15.75	247.94
20	-8.9	60.75	8.5	12.31	167.23	-1.21	183.73	248.45
21	-12.53	60.75	-0.33	12.53	-12.17	-2.23	256.41	256.7
22	-8.92	60.75	-8.73	12.48	-179.21	0.56	184.17	256.97
23	-0.4	60.75	-12.39	12.4	-251.57	0.76	13.67	251.94
24	9.03	60.75	-8.58	12.46	-173.1	1.21	-180.76	250.28
Max.	48.17	72.9	46.05	48.19	-925.08	8.83	-976.29	977.08

Individual support reaction

Joint No.	Comb No.	Rx KN	Ry KN	Rz KN	RMx KN.m	RMy KN.m	RMz KN.m
Pole	1	48.17	72.9	1.5	39.09	8.83	-976.29
	2	34.32	72.9	33.3	671.47	-1.06	-700.94
	3	2.37	72.9	46.05	924.13	-1.25	-64.31
	4	-32.94	72.9	31.46	626.78	-4.45	674.9
	5	-46.36	72.9	-1.22	-37.95	-8.24	944.75
	6	-33.02	72.9	-32.3	-657.35	2.07	677.04
	7	-1.48	72.9	-45.84	-925.08	2.81	44.79
	8	33.42	72.9	-31.73	-634.17	4.45	-675.66
	9	48.17	54.67	1.5	39.84	8.83	-974.45
	10	34.32	54.67	33.3	670.58	-1.06	-699.81
	11	2.37	54.67	46.05	922.59	-1.25	-64.82
	12	-32.94	54.67	31.46	626.02	-4.45	672.42
	13	-46.36	54.67	-1.22	-36.96	-8.24	941.58
	14	-33.02	54.67	-32.3	-654.76	2.07	674.56
	15	-1.48	54.67	-45.84	-921.8	2.81	43.95
	16	33.42	54.67	-31.73	-631.66	4.45	-674.6

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Joint No.	Comb No.	Rx KN	Ry KN	Rz KN	RMx KN.m	RMy KN.m	RMz KN.m
	17	13.01	60.75	0.41	8.6	2.39	-261.74
	18	9.27	60.75	9	179.14	-0.29	-187.44
	19	0.64	60.75	12.45	247.44	-0.34	-15.75
	20	-8.9	60.75	8.5	167.23	-1.21	183.73
	21	-12.53	60.75	-0.33	-12.17	-2.23	256.41
	22	-8.92	60.75	-8.73	-179.21	0.56	184.17
	23	-0.4	60.75	-12.39	-251.57	0.76	13.67
	24	9.03	60.75	-8.58	-173.1	1.21	-180.76
	Max	48.17	72.9	46.05	-925.08	8.83	-976.29

Comparison of Reaction Force Vs. Applied Loads

Base moment reaction Vs. applied base moment

Comb No.	Reaction OTM X KN.m	Reaction Torque KN.m	Reaction OTM Z KN.m	Applied OTM X KN.m	Applied Torque KN.m	Applied OTM Z KN.m	Change %
1	39.09	8.83	-976.29	-38.65	-8.83	966.2	1.0447
2	671.47	-1.06	-700.94	-664.56	1.06	693.66	1.0448
3	924.13	-1.25	-64.31	-914.62	1.25	63.54	1.0407
4	626.78	-4.45	674.9	-620.37	4.45	-667.89	1.0417
5	-37.95	-8.24	944.75	37.46	8.24	-934.97	1.0467
6	-657.35	2.07	677.04	650.52	-2.07	-670.01	1.0494
7	-925.08	2.81	44.79	915.5	-2.81	-44.25	1.0464
8	-634.17	4.45	-675.66	627.65	-4.45	668.68	1.0415
9	39.84	8.83	-974.45	-39.5	-8.83	966.9	0.7811
10	670.58	-1.06	-699.81	-665.41	1.06	694.36	0.7815
11	922.59	-1.25	-64.82	-915.47	1.25	64.24	0.7786
12	626.02	-4.45	672.42	-621.22	4.45	-667.19	0.7791
13	-36.96	-8.24	941.58	36.62	8.24	-934.27	0.7823
14	-654.76	2.07	674.56	649.67	-2.07	-669.31	0.7839
15	-921.8	2.81	43.95	914.66	-2.81	-43.56	0.7815
16	-631.66	4.45	-674.6	626.81	-4.45	669.38	0.7782
17	8.6	2.39	-261.74	-8.53	-2.39	259.49	0.8675
18	179.14	-0.29	-187.44	-177.62	0.29	185.82	0.8638
19	247.44	-0.34	-15.75	-245.33	0.34	15.59	0.8589
20	167.23	-1.21	183.73	-165.83	1.21	-182.14	0.863
21	-12.17	-2.23	256.41	12.03	2.23	-254.2	0.8718
22	-179.21	0.56	184.17	177.65	-0.56	-182.58	0.8776
23	-251.57	0.76	13.67	249.38	-0.76	-13.53	0.8765
24	-173.1	1.21	-180.76	171.61	-1.21	179.21	0.8697

Force reaction Vs. applied forces

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Comb No.	Reaction Shear X KN	Reaction Vertical KN	Reaction Shear Z KN	Applied Shear X KN	Applied Vertical KN	Applied Shear Z KN	Error %
1	48.17	72.9	1.5	-48.17	-72.9	-1.5	0
2	34.32	72.9	33.3	-34.32	-72.9	-33.3	0
3	2.37	72.9	46.05	-2.37	-72.9	-46.05	0
4	-32.94	72.9	31.46	32.94	-72.9	-31.46	0
5	-46.36	72.9	-1.22	46.36	-72.9	1.22	0
6	-33.02	72.9	-32.3	33.02	-72.9	32.3	0
7	-1.48	72.9	-45.84	1.48	-72.9	45.84	0
8	33.42	72.9	-31.73	-33.42	-72.9	31.73	0
9	48.17	54.67	1.5	-48.17	-54.67	-1.5	0
10	34.32	54.67	33.3	-34.32	-54.67	-33.3	0
11	2.37	54.67	46.05	-2.37	-54.67	-46.05	0
12	-32.94	54.67	31.46	32.94	-54.67	-31.46	0
13	-46.36	54.67	-1.22	46.36	-54.67	1.22	0
14	-33.02	54.67	-32.3	33.02	-54.67	32.3	0
15	-1.48	54.67	-45.84	1.48	-54.67	45.84	0
16	33.42	54.67	-31.73	-33.42	-54.67	31.73	0
17	13.01	60.75	0.41	-13.01	-60.75	-0.41	0
18	9.27	60.75	9	-9.27	-60.75	-9	0
19	0.64	60.75	12.45	-0.64	-60.75	-12.45	0
20	-8.9	60.75	8.5	8.9	-60.75	-8.5	0
21	-12.53	60.75	-0.33	12.53	-60.75	0.33	0
22	-8.92	60.75	-8.73	8.92	-60.75	8.73	0
23	-0.4	60.75	-12.39	0.4	-60.75	12.39	0
24	9.03	60.75	-8.58	-9.03	-60.75	8.58	0

Displacement at non service condition

Elevation m	Deflection X mm	Down mm	Deflection Z mm	Horiz. Deflection mm	Tilt Deg	Twist My Deg
30	-416.3 (1)	-0.2 (1)	395.6 (7)	416.7 (1)	1.35 (1)	0.06 (9)
19	-174.3 (1)	-0.2 (1)	165.2 (7)	174.4 (1)	1.08 (1)	0.03 (1)
9.5	-43.2 (1)	-0.1 (1)	40.9 (7)	43.3 (1)	0.52 (1)	0.01 (1)

Displacement at service condition

Elevation m	Deflection X mm	Down mm	Deflection Z mm	Horiz. Deflection mm	Tilt Deg	Twist My Deg
30	-111.4 (17)	-0.2 (17)	108.8 (23)	111.4 (17)	0.37 (22)	0.02 (17)
19	-46.7 (17)	-0.2 (17)	45.1 (23)	46.7 (17)	0.29 (17)	0.01 (17)
9.5	-11.6 (17)	-0.1 (17)	11.1 (23)	11.6 (17)	0.14 (17)	0 (17)

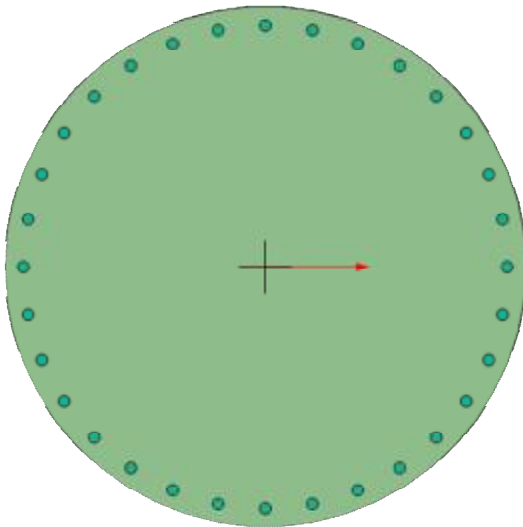
DESIGN OF ANCHOR ROD

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Name: Base Conn**Design is safe with usage ratio 0.97****Connection Parameters**

Located at: Pole.

Design code		=	ANSI/TIA-222-H
Diameter of base plate		=	1380 mm
Type of bolt analysis		=	Elastic
Dist. above concrete to bottom of leveling nut		=	75 mm
Orientation of the connection		=	0 Deg
Location of support reaction	X	=	0 mm
	Z	=	0 mm
Use of grout under base plate		=	YES
Use of leveling nut under base plate		=	NO
Total length of anchor rod		=	1150 mm

**Bolt Specification**

#	Diam mm	X-Coord. mm	Z-Coord. mm	Material Name
1	30	640	0	A572-50
2	30	627.7	124.9	A572-50
3	30	591.3	244.9	A572-50

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Job No. 30m Monopole
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 Project GSM Network

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#	Diam mm	X-Coord. mm	Z-Coord. mm	Material Name
4	30	532.1	355.6	A572-50
5	30	452.5	452.5	A572-50
6	30	355.6	532.1	A572-50
7	30	244.9	591.3	A572-50
8	30	124.9	627.7	A572-50
9	30	0	640	A572-50
10	30	-124.9	627.7	A572-50
11	30	-244.9	591.3	A572-50
12	30	-355.6	532.1	A572-50
13	30	-452.5	452.5	A572-50
14	30	-532.1	355.6	A572-50
15	30	-591.3	244.9	A572-50
16	30	-627.7	124.9	A572-50
17	30	-640	0	A572-50
18	30	-627.7	-124.9	A572-50
19	30	-591.3	-244.9	A572-50
20	30	-532.1	-355.6	A572-50
21	30	-452.5	-452.5	A572-50
22	30	-355.6	-532.1	A572-50
23	30	-244.9	-591.3	A572-50
24	30	-124.9	-627.7	A572-50
25	30	0	-640	A572-50
26	30	124.9	-627.7	A572-50
27	30	244.9	-591.3	A572-50
28	30	355.6	-532.1	A572-50
29	30	452.5	-452.5	A572-50
30	30	532.1	-355.6	A572-50
31	30	591.3	-244.9	A572-50
32	30	627.7	-124.9	A572-50

Critical Reaction in Global Coordinate System

#	Support	Load Com.	F _x KN	F _y KN	F _z KN	Horiz. Force KN	M _x KN.m	M _y KN.m	M _z KN.m	Horiz. Moment KN.m
1	Pole	9	48.17	54.67	1.5	48.19	39.84	8.83	-974.45	975.26

ASMTower 2018.4

Job No. 30m Monopole

Rev. No. A

Client VM

Date 5/11/2017

Project GSM Network

Designed by M.Joe

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#	Support	Load Com.	F _x KN	F _y KN	F _z KN	Horiz. Force KN	M _x KN.m	M _y KN.m	M _z KN.m	Horiz. Moment KN.m
2	Pole	1	48.17	72.9	1.5	48.19	39.09	8.83	-976.29	977.08

Critical Action in Local Coordinates of Connection

#	Support	Load Com.	F _x KN	F _y KN	F _z KN	Horiz. Force KN	M _x KN.m	M _y KN.m	M _z KN.m	Horiz. Moment KN.m
1	Pole	9	-48.17	-54.67	-1.5	48.19	-39.84	-8.83	974.45	975.26
2	Pole	1	-48.17	-72.9	-1.5	48.19	-39.09	-8.83	976.29	977.08

Force distribution in anchor rods

#	Diam mm	F _x #1 KN	F _y #1 KN	F _z #1 KN	F _x #2 KN	F _y #2 KN	F _z #2 KN
1	30	-1.51	93.46	0.38	-1.51	93.07	0.38
2	30	-1.59	92.39	0.38	-1.59	91.98	0.38
3	30	-1.67	87.7	0.35	-1.67	87.27	0.35
4	30	-1.74	79.57	0.31	-1.74	79.11	0.31
5	30	-1.81	68.33	0.26	-1.81	67.83	0.26
6	30	-1.86	54.4	0.19	-1.86	53.87	0.19
7	30	-1.9	38.3	0.12	-1.9	37.73	0.12
8	30	-1.93	20.68	0.04	-1.93	20.07	0.04
9	30	-1.94	2.18	-0.05	-1.94	1.54	-0.05
10	30	-1.93	-16.46	-0.13	-1.93	-17.14	-0.13
11	30	-1.9	-34.53	-0.21	-1.9	-35.23	-0.21
12	30	-1.86	-51.35	-0.29	-1.86	-52.08	-0.29
13	30	-1.81	-66.24	-0.35	-1.81	-66.99	-0.35
14	30	-1.74	-78.67	-0.41	-1.74	-79.43	-0.41
15	30	-1.67	-88.14	-0.45	-1.67	-88.91	-0.45
16	30	-1.59	-94.28	-0.47	-1.59	-95.04	-0.47
17	30	-1.51	-96.87	-0.48	-1.51	-97.62	-0.48
18	30	-1.42	-95.8	-0.47	-1.42	-96.53	-0.47
19	30	-1.34	-91.12	-0.45	-1.34	-91.83	-0.45
20	30	-1.27	-82.99	-0.41	-1.27	-83.67	-0.41
21	30	-1.2	-71.74	-0.35	-1.2	-72.39	-0.35
22	30	-1.15	-57.82	-0.29	-1.15	-58.43	-0.29
23	30	-1.11	-41.72	-0.21	-1.11	-42.29	-0.21

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#	Diam mm	F _x #1 KN	F _y #1 KN	F _z #1 KN	F _x #2 KN	F _y #2 KN	F _z #2 KN
24	30	-1.08	-24.1	-0.13	-1.08	-24.63	-0.13
25	30	-1.07	-5.6	-0.05	-1.07	-6.1	-0.05
26	30	-1.08	13.05	0.04	-1.08	12.58	0.04
27	30	-1.11	31.11	0.12	-1.11	30.68	0.12
28	30	-1.15	47.93	0.19	-1.15	47.52	0.19
29	30	-1.2	62.82	0.26	-1.2	62.43	0.26
30	30	-1.27	75.25	0.31	-1.27	74.87	0.31
31	30	-1.34	84.72	0.35	-1.34	84.35	0.35
32	30	-1.42	90.87	0.38	-1.42	90.49	0.38

Bolt Design

Anchor rod diameter	d	=	30	mm
Material of anchor rod		=	A572-50	
Gross area of anchor rod	A _g	=	706.9	mm ²
Net area of anchor rod	A _n	=	530.1	mm ²
Minimum tensile strength of anchor rod	F _u	=	448.2	MPa
Minimum yield strength of anchor rod	F _y	=	344.7	MPa
Maximum compression	P _{uc}	=	97.62	KN
Maximum tension	P _{ut}	=	93.46	KN
Shear force occurring with tension	V _{ut}	=	1.55	KN
Shear force occurring with compression	V _{uc}	=	1.58	KN
Length from concrete to bottom leveling nut	l _{ar}	=	75	mm
Bending moment occurring with tension	M _{ut}	=	0.65 x l _{ar} x V _{ut}	
		=	0.08	KN.m
Bending moment occurring with compression	M _{uc}	=	0.65 x l _{ar} x V _{uc}	
		=	0.08	KN.m
Nominal tensile strength of anchor rod	R _{nt}	=	F _u A _n	
		=	237.59	KN
	φ _t	=	0.75	
Nominal compression yield strength of anchor rod	R _{nc}	=	F _y A _n	

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Job No.
Client
Project30m Monopole
VM
GSM Network

Rev. No.

A

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		=	182.76	KN
	ϕ_c	=	1	
Nominal shear rupture strength of anchor rod	Rnv	=	0.5 Fu Ag	
		=	158.39	KN
Nominal shear yield strength of anchor rod	Rnvc	=	0.6 Fy An / 2	
		=	54.83	KN
	ϕ_v	=	0.75	
Tensile root diameter	dn	=	26	mm
Plastic section modulus based on dn	Z	=	2923	mm ³
Nominal flexural strength of anchor rod	Mn	=	Fy Z	
		=	1.01	KN.m
	ϕ_f	=	0.9	
Interaction equation at tension		=	$[P_{ut}/\phi_t R_{nt} + M_{ut}/\phi_f M_n]^2 + [V_{ut}/\phi_v R_{nv}]^2$	
		=	0.37	
Interaction equation at compression		=	$[P_{uc}/\phi_c R_{nc} + M_{uc}/\phi_f M_n] + [V_{uc}/\phi_c R_{nvc}]^2$	
		=	0.62	

Bolt status**Safe as 0.62 < 1.0****Check the Pullout Resistance of Anchor**

Type of anchor rod head		=	Hex Nut	
Maximum tension in anchor	T	=	93.46	KN
Bearing area of anchor head	Abrg	=	1046.8	mm ²
Concrete compressive strength	F'c	=	21	MPa
Modification factor for pullout resistance	Ψ_{cp}	=	1	
The pullout resistance of anchor	Np	=	$\Psi 8 Abrg F'c$	
		=	175.86	KN
Strength reduction factor	ϕ	=	0.7	
Available pullout resistance	ϕNp	=	123.1	KN
Utilization ratio	T / ϕNp	=	0.76	

Safety status**Safe as 0.76 < 1.0**

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Check the Development Length of Anchor

Assumption:

The tension forces are transferred to the longitudinal rebars, which will restrain the concrete failure prism. Therefore, concrete breakout strength in tension is not checked. The longitudinal reinforcement shall be developed on either sides of the breakout surface. This development length is calculated to estimate the minimum embedment length of the anchor.

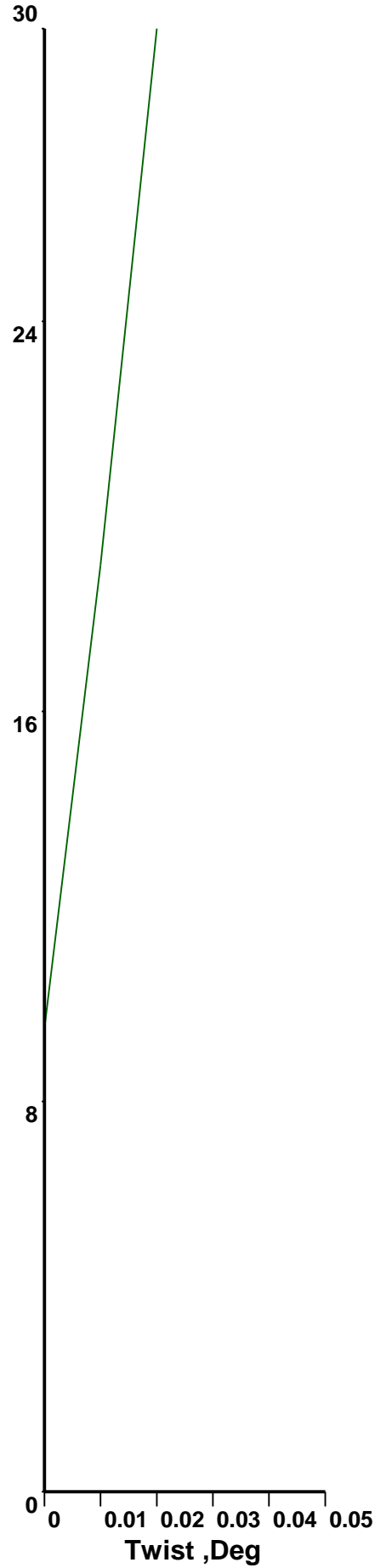
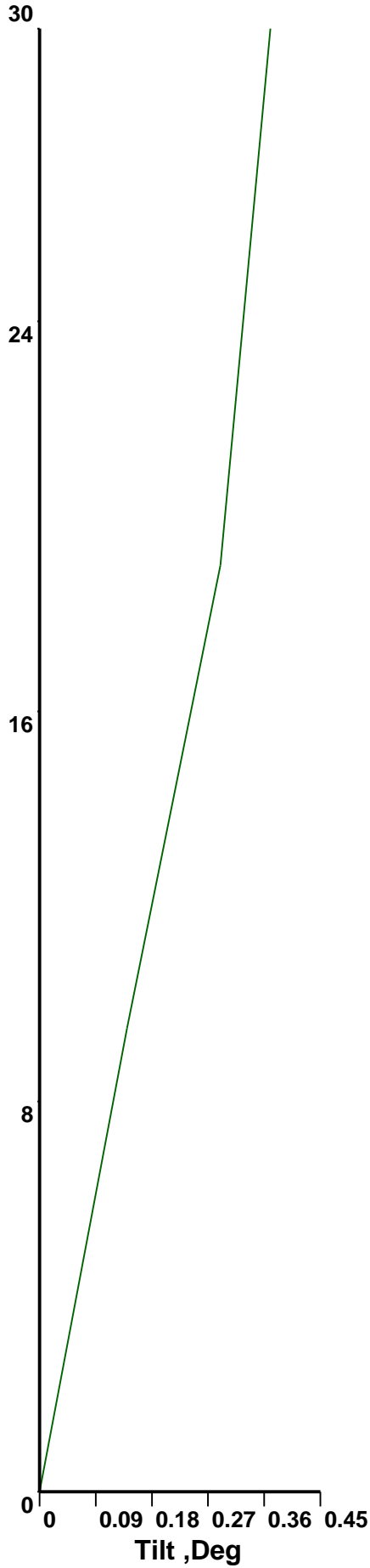
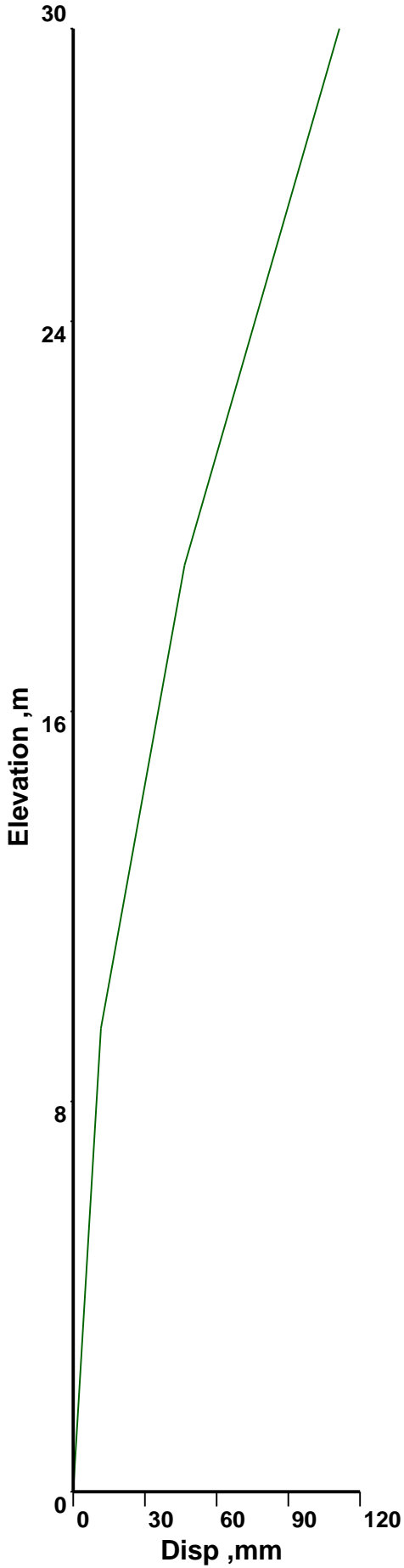
The reinforcement bars are deformed bars without hook

Diameter of reinforcement bars	db	= 25	mm
Side cover for reinforcement bars		= 75	mm
Top cover for reinforcement bars	Ct	= 50	mm
Minimum spacing between reinforcement bars		= 150	mm
Maximum spacing between reinforcement and anchor	Sa	= 300	mm
Concrete compressive strength	F'c	= 21	MPa
Yielding strength of reinforcement bars	Fy	= 360	MPa
Lesser of one-half the spacing between anchors and distance from bar to nearest concrete surface	cb	= 75	mm
Epoxy coated factor	Ψe	= 1	
Size factor	Ψs	= 1	
Casting position factor	Ψt	= 1	
Light weight concrete factor	λ	= 1	
Transverse reinforcement index	ktr	= 0	mm
Reinforcement bars development length	ldr	= $F_y \Psi_t \Psi_e \Psi_s / [1.1 \lambda \text{ Sqrt}(F_c) (cb + Ktr)/db]$ db	
		= not less 300	mm
		= 714.2	mm
Length of anchor above top of concrete surface	O	= 80	mm
Required embeded length for anchor rod	Lan	= ldr + Ct + Sa / 1.5 + a	
		= 1034.2	mm
Required total length for anchor rod	Ltr	= Lan + O	
		= 1114.2	mm
Supplied total length for anchor rod	Lts	= 1150	mm
Utilization ratiofor embeded length		= 0.97	

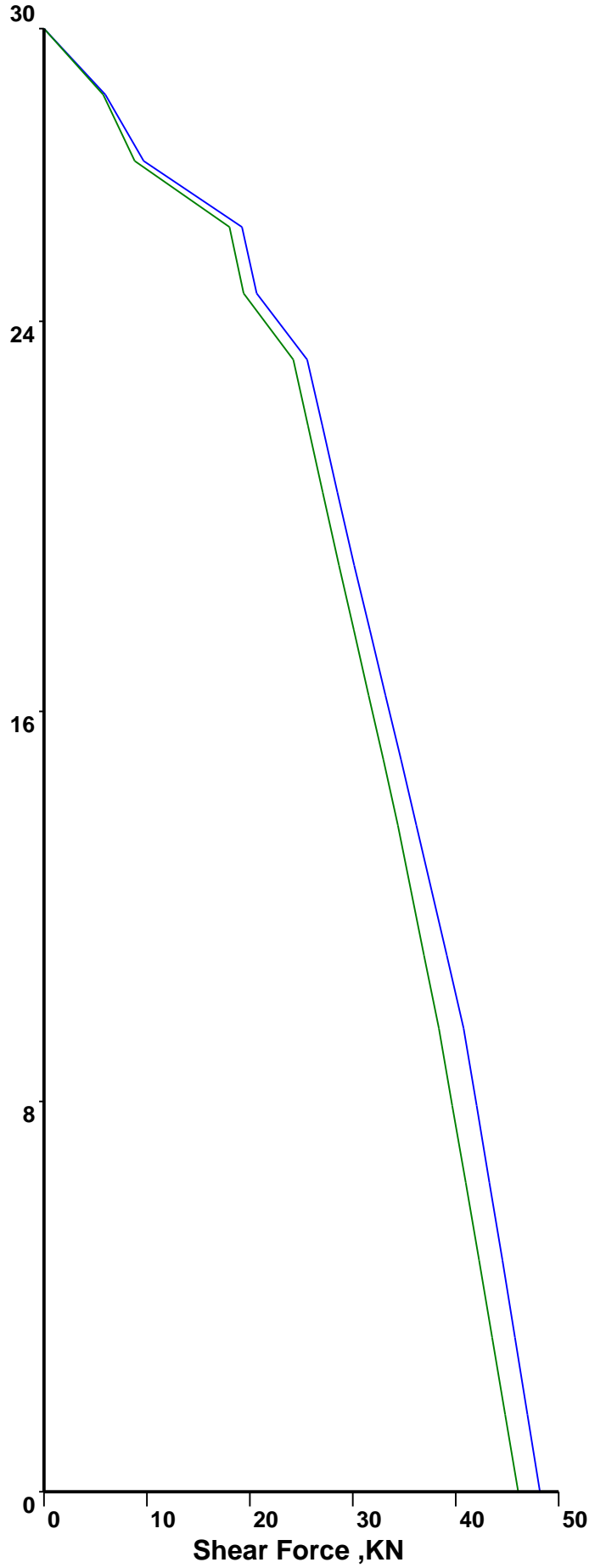
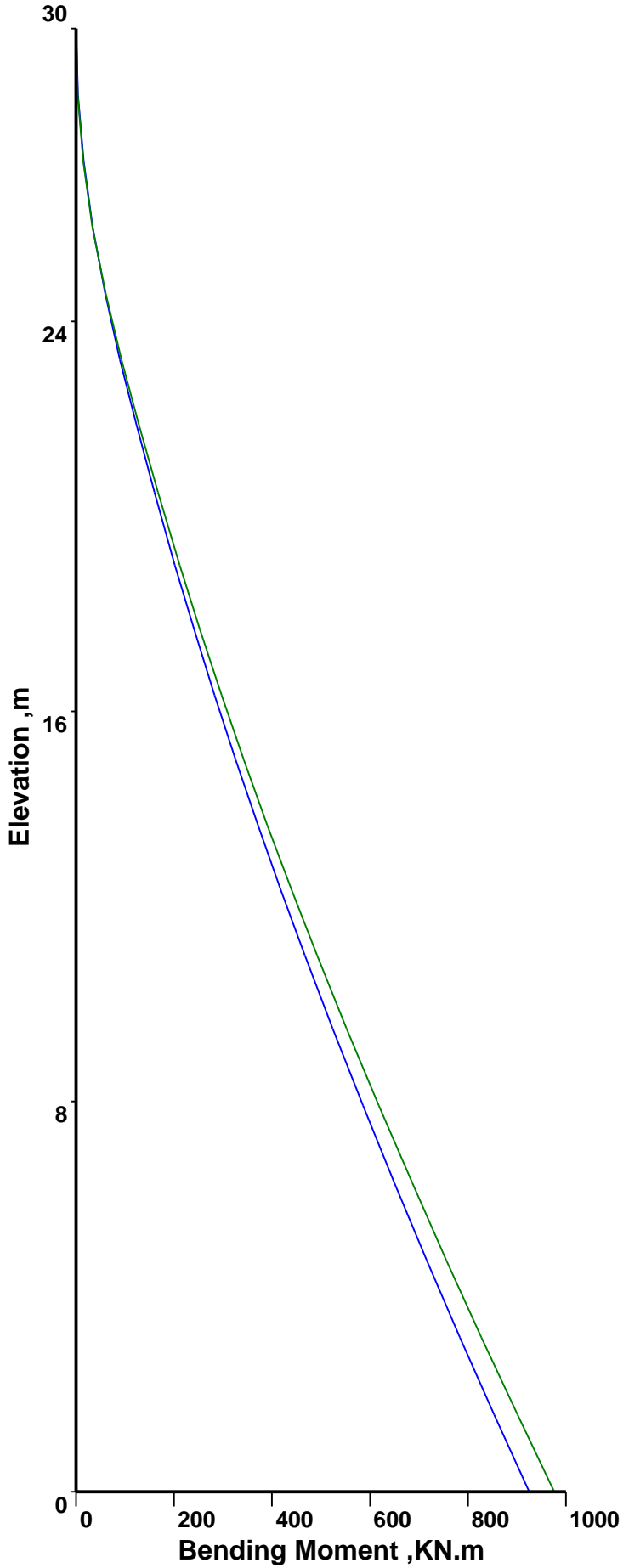
Safety status

Safe as 0.97 < 1.0

Deformation Chart Of 30m Monopole Max Service Wind



Global Moment and Shear Chart Of 30m Monopole Max Design Wind



PANEL NO.	ELEVATION (m)	TOWER WIDTH (m)	MAIN LEGS	LEG GRADE	DIAGONALS	DIAGONAL GRADE	PANELS HEIGHT (m)
1	30	0.55	TP 760x550x6mm	S355J0	ROUND	N.A.	N.A.
	20.5	19					
2	19	0.76	TP 970x760x6mm	S355J0	ROUND	N.A.	N.A.
	19	0.789					
3	11	0.97	TP 1180x970x8mm	S355J0	ROUND	N.A.	N.A.
	9.5	0.999					
0	1.18						



A	5/11/2017	First issue	M.Joe	M.Joe	A.S.M	
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REVISIONS						
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