CALCULATING RADIOFREQUENCY FIELD STRENGTH

SAFETY CODE 6 SITE VALIDATION

FOR SITE: W2352

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RF Designer: Henry Phan, P.Eng

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Department: Radio Engineering / Central Region

Bell

1 DESCRIPTION OF BELL MOBILITY CELL SITE

1.1 General information:

Site name:	W2352 Lakeshore Rd. / West St.		
Address:	3135 Lakeshore Rd. West, Oakville, ON		
Location code:	**W2352**	**Site coordinates: LAT / LONG (NAD83 / degrees. decimal)**	**43° 23' 15.864" / 79° 43' 0.66"**

1.2 Identification of radio operators located in the vicinity of the Bell Mobility site (*note1):

LAND MOBILE SERVICE-type cellular sites located less than 100 m from the Bell Mobility site:	☐ ROGERS	☐ TELUS	☐ Other	☑ None
BROADCAST stations located less than 1 km from the Bell Mobility site:				☑ None

Note 1: Industry Canada's Assignment and Licensing System (ALS) database is used to locate transmitting radio base stations. The database can be accessed from the Strategis site of Industry Canada via the following link:
https://sd.ic.gc.ca/pls/engdoc_anon/sd_pages.main

1.3 Description of Bell Mobility site location:

1.3.1 Base station equipment installed on **NEW** telecommunications structure?

☐ YES	☑ NO

1.3.2 Telecommunications structure type:

☑ Monopole	☐ Guyed tower	☐ Building	☐ Tower on top of building
☐ Tripole	☐ Water tower	☐ Hydro Ontario wooden pole (low voltage power line)	☐ In-building system
☐ Self-supporting tower	☐ Church	☐ Hydro Ontario pylon (high voltage power line)	

1.3.3 Owner of telecommunications structure:

☑ Bell Mobility	☐ ROGERS	☐ TELUS
☐ Other		

1.4 Summary of installation

Bell Mobility will provide 1900/850 MHz HSPA and 2100/2600 MHz LTE services. Installation consist of

1. 1 x CYL-X7CAP-465-00-00-00-i for HSPA 850 and 1900 MHz,
2. 3 x HWXX-6516DS-VTM antennas for LTE 2100 and 2600 MHz

Each set of antennas will have installed its corresponding Remote Radio Unit (RRU) and other necessary equipment and cabling for full commissioning. Safety Code 6 analysis and calculations will be done for this site based on current site info and RF Design specifications.

2.0 RESULTS OF THE ANALYSIS OF SAFETY CODE 6

☑	Cumulative RF field levels relating to the site's antenna facilities **are compliant with** the limits of maximum RF exposure established in Health Canada's Safety Code 6, with reference to **Uncontrolled** exposure criteria.
☑	Cumulative RF field levels relating to the site's antenna facilities **are compliant with** the limits of maximum RF exposure established in Health Canada's Safety Code 6, with reference to **Controlled** exposure criteria.

Notes:

The Safety Code 6 study carried out on the cell site facilities in question takes the following aspects into account:

a) References in the study to Safety Code 6 are based on the Health Canada document titled "Technical Guide for Interpretation and Compliance Assessment of Health Canada's Radiofrequency Exposure Guidelines" in the Frequency Range from 3 kHz to 300 GHz" (last version published in 2009).

- The calculations included in the study reflect the maximum exposure limits set forth in Safety Code 6.

b) **EMF Visual** electromagnetic field calculation software is used to assess RF field levels.

- The software assesses electromagnetic field levels using an approach based on decomposing the antenna being studied into smaller radiant elements and superposing the effects.
- This approach, which has been published and standardized (CENELEC EN50383 European standard), evaluates the electromagnetic field in both the far field and near field of the antenna.
- The approach used by EMF Visual software was published in an article titled, "Optimal modeling of real radio base station antennas for human exposure assessment using spherical-mode decomposition" which appeared in the magazine *IEEE Antennas and Wireless Propagation Letters*, Vol. 1, pp. 215-218, 2002. (Y. Adane, A. Gati.).

c) Sound engineering practices:

- The parameters relating to transmitter output power and number of radio carriers considered for the study exceed actual parameters at the initial site in-service date to allow for future capacity growth at the site.
- Different antenna orientations (azimuth and tilt) are considered in the study in order to take into account future changes in antenna orientation and tilt.
- Analyses of RF field levels are conducted at a height of 2.0 m (the estimated height of a person) with respect to the main horizontal surfaces (roof, ground level).
- The analysis also takes into account the electromagnetic fields of existing radio operators located in proximity to the site being studied (i.e. land mobile service type radio operators located less than 100 m from the site and broadcast station operators located less than 1 km away).

2.1 Conclusion

Based on a cumulative analysis of all antenna systems installed at this location; the maximum radio frequency exposure at 2m above the ground level is 100 times less than (or 1%) the maximum allowed by Safety Code 6 (standard for general public).

Note:
As indicated by Industry Canada, the maximum limit for the frequencies emitted are 5.7W/m2 for 850MHz, and 10 W/m2 for 1900MHz, 2100MHz and 2600MHz, respectively.

The analysis of Safety Code 6 shows that the site is compliant.

2.2 Details of Analysis

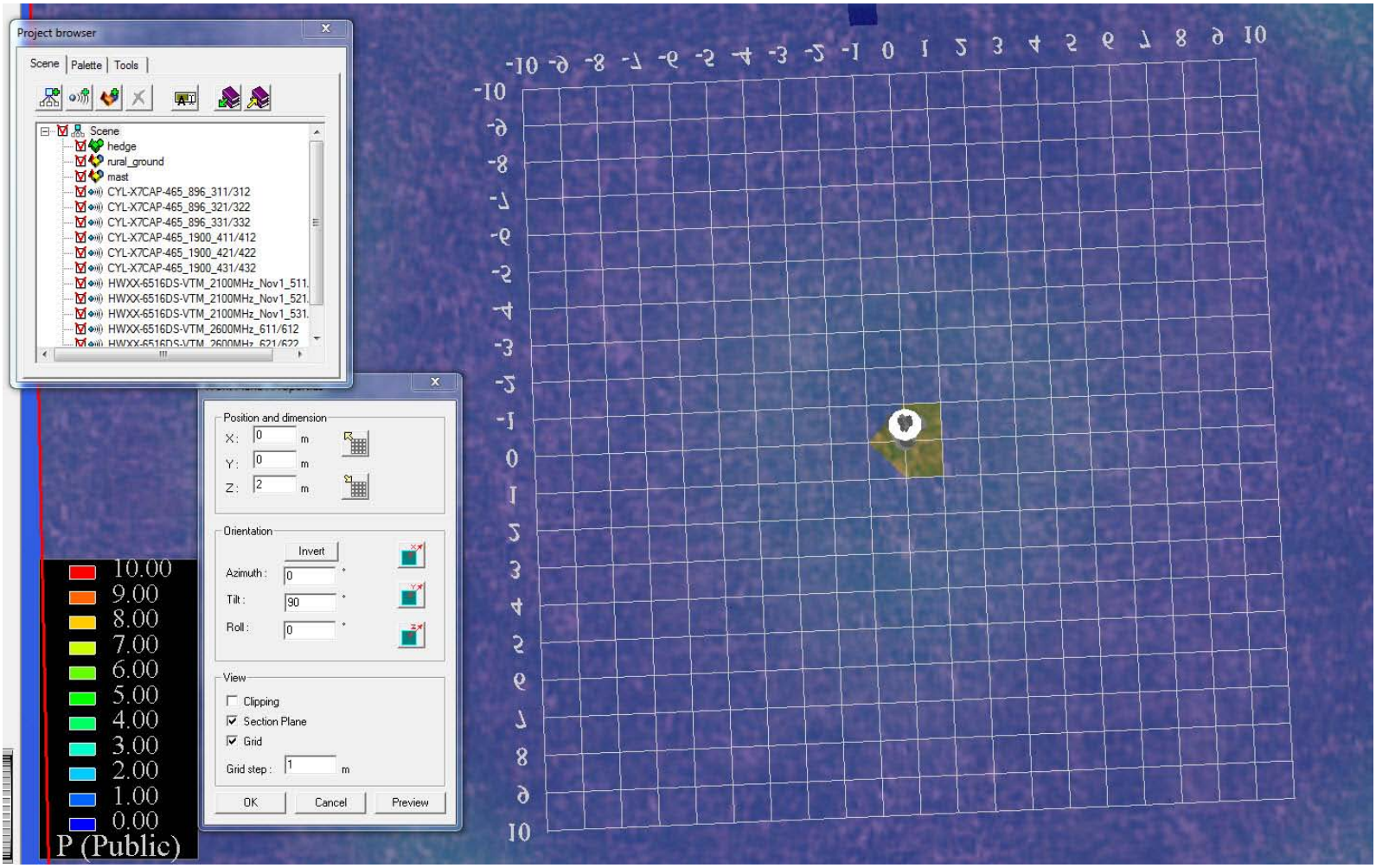

Fig. 1 Distribution of antennas power density **at a height of 2m above ground** (horizontal cross-section) Range Scale: 0% to 10% of the Safety Code 6 limit: General Public Standard.

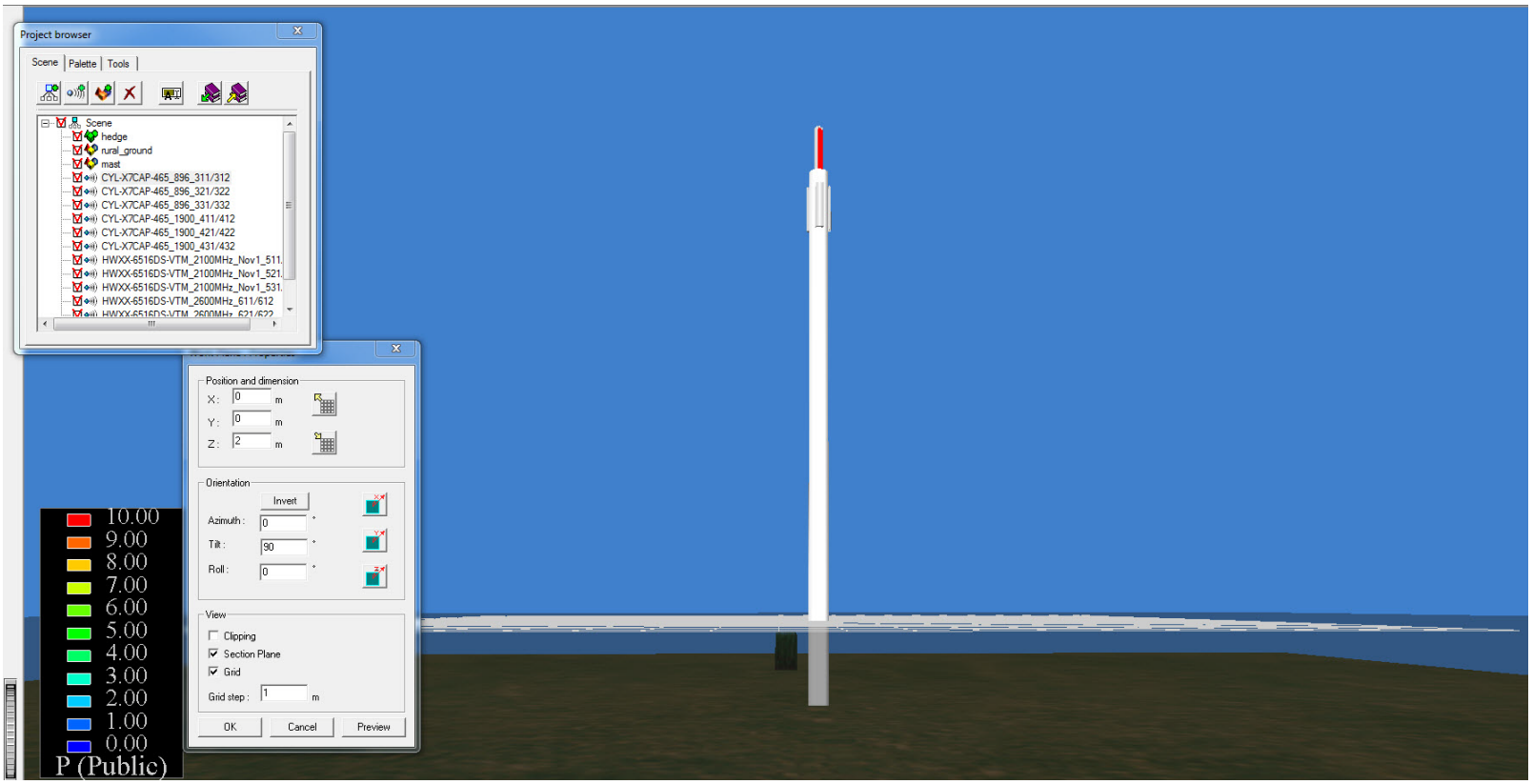

Fig. 2 Distribution of antennas power density **<u>at a height of 2m above ground</u>** (vertical cross-section) Range Scale: 0% to 10% of the Safety Code 6 limit: General Public Standard.

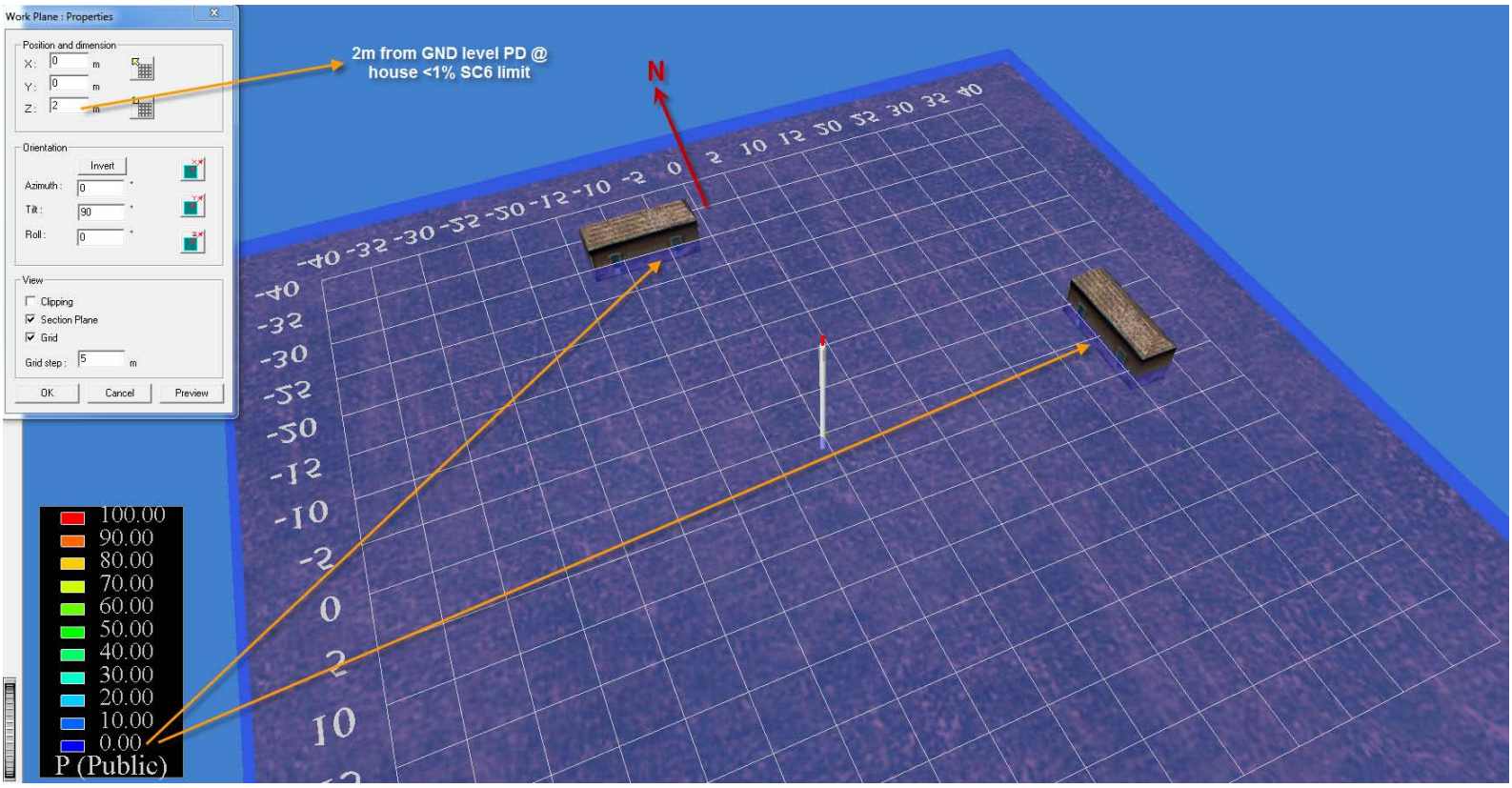

Fig. 3 Power Density distribution **<u>at a height of 2m above ground</u>** with proximity to nearby structures. Range Scale: 0% to 100% of the Safety Code 6 limit: General Public Standard

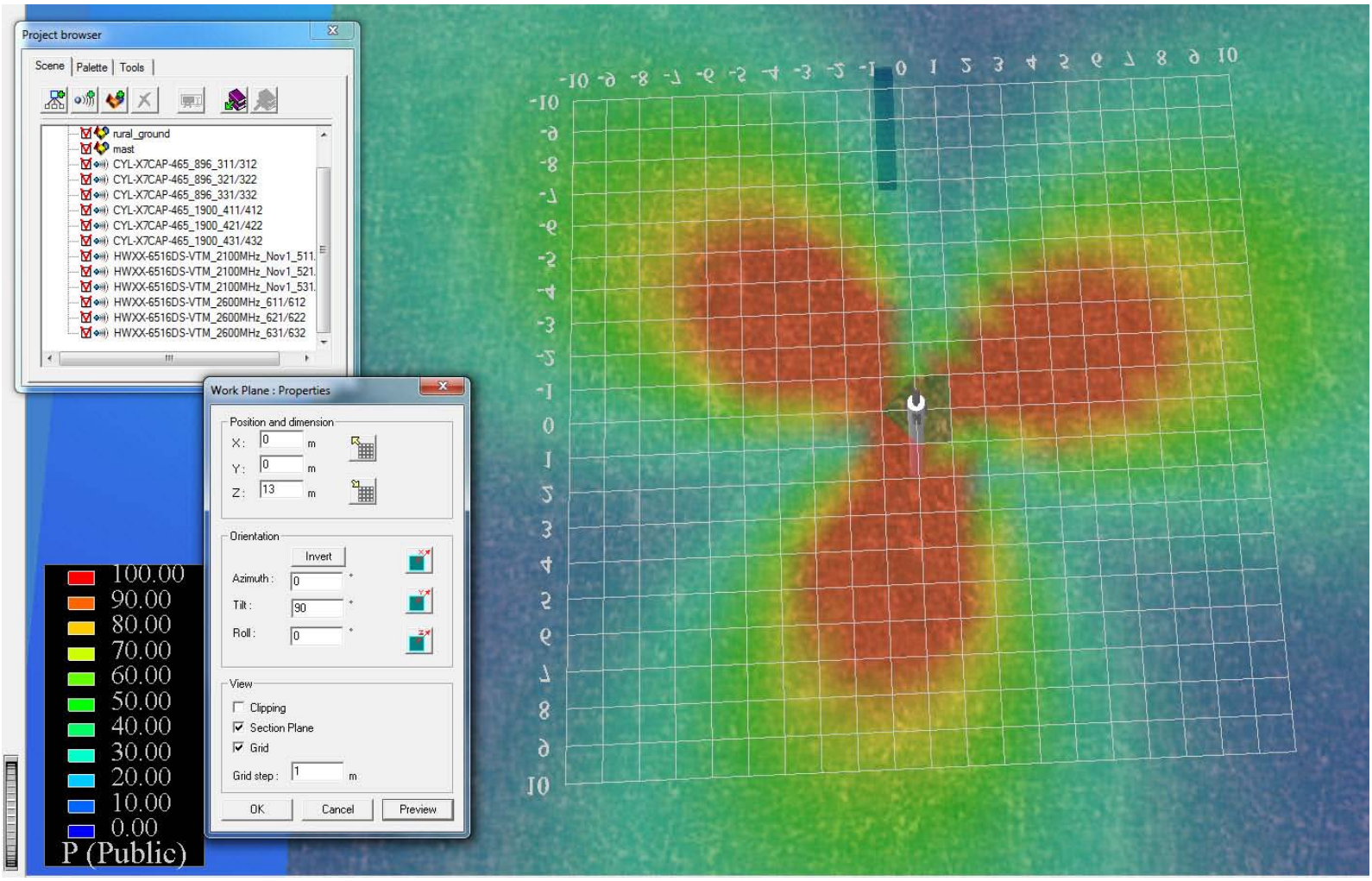

Fig. 4 Distribution of antennas power density **at a height of 13m above ground** (horizontal cross-section at the midpoint of the antenna height) Range Scale: 0% to 100% of the Safety Code 6 limit: General Public Standard.

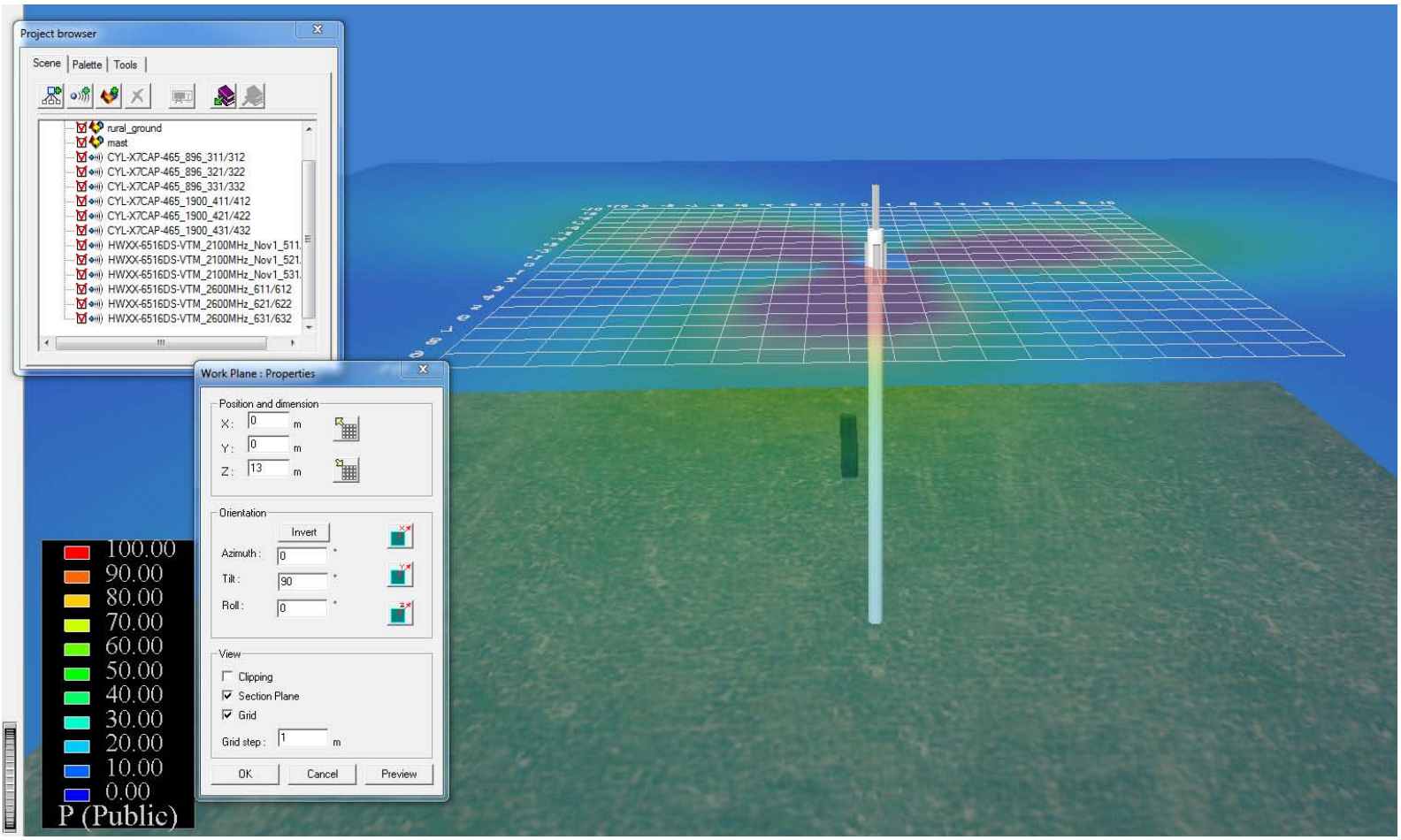

Fig. 5 Distribution of antennas power density **<u>at a height of 13m above ground</u>** (vertical cross-section at the midpoint of the lower antenna elevations) Range Scale: 0% to 100% of the Safety Code 6 limit: General Public Standard

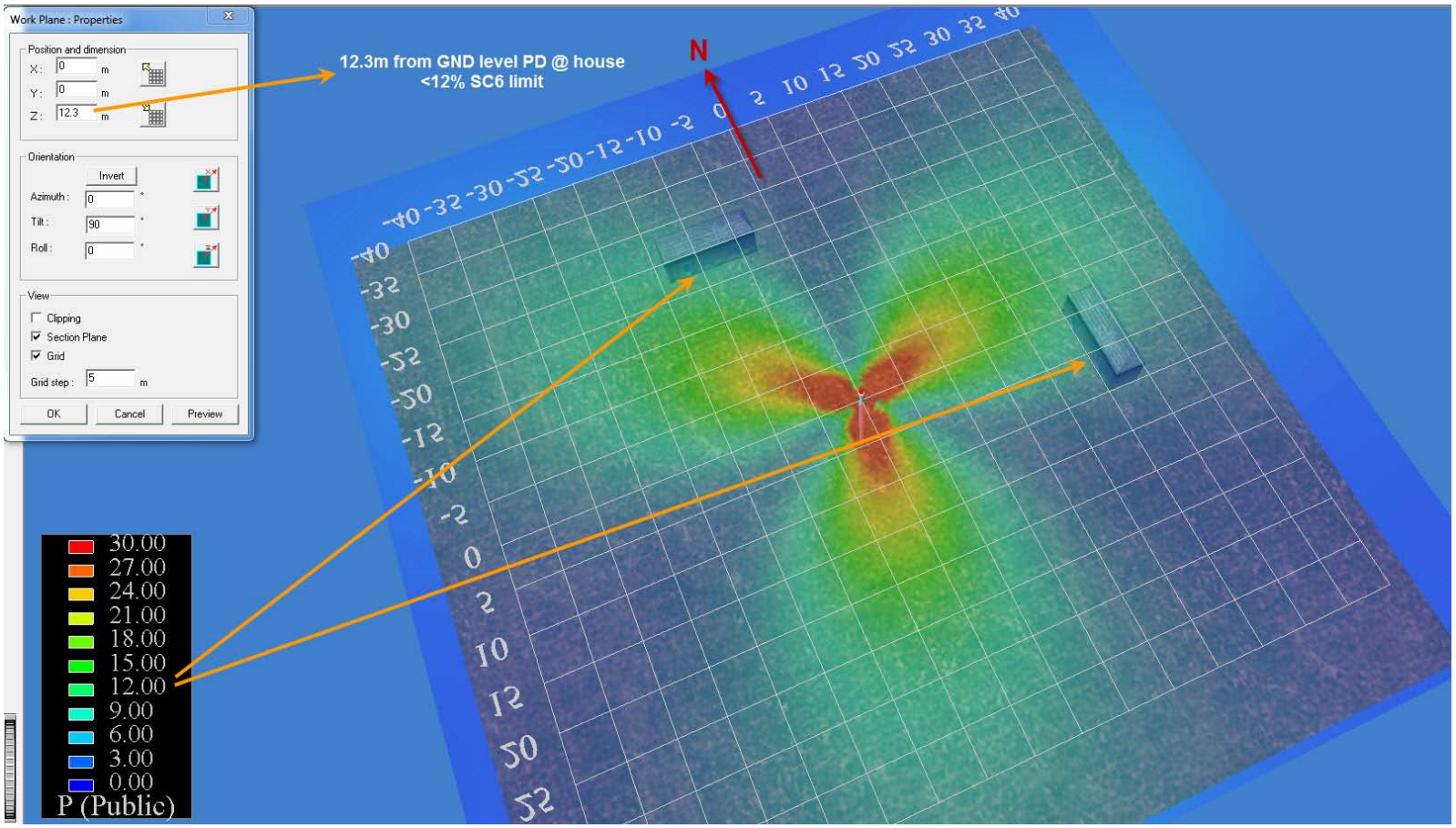

Fig. 6 Power Density distribution @ 12.3m above GND level with proximity to nearby structures. Range Scale: 0% to 30% of the Safety Code 6 limit: General Public Standard

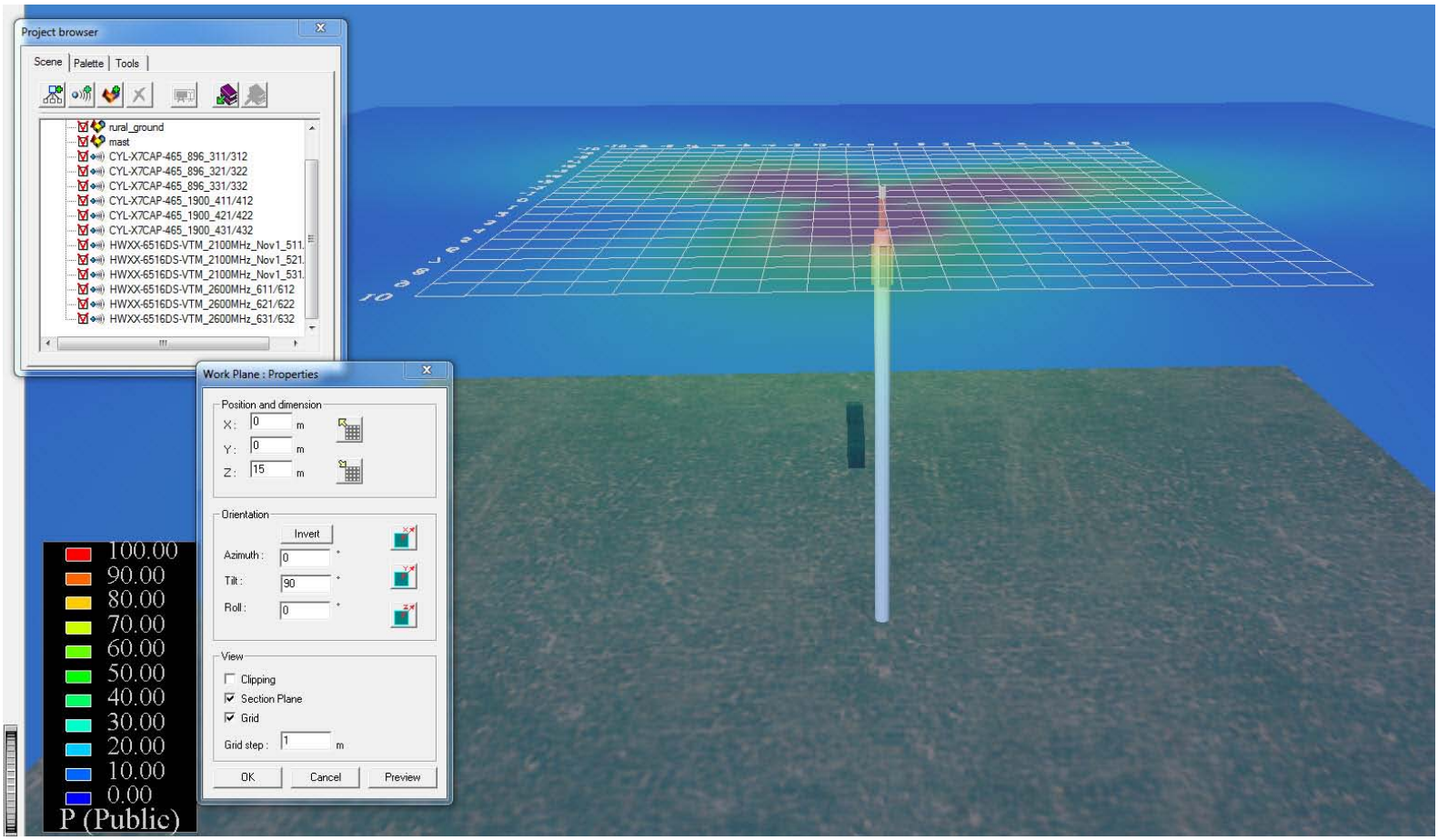

Fig. 7 Distribution of antennas power density **at a height of 15m above ground** (vertical cross-section at the midpoint of the upper antenna elevation) Range Scale: 0% to 100% of the Safety Code 6 limit: General Public Standard

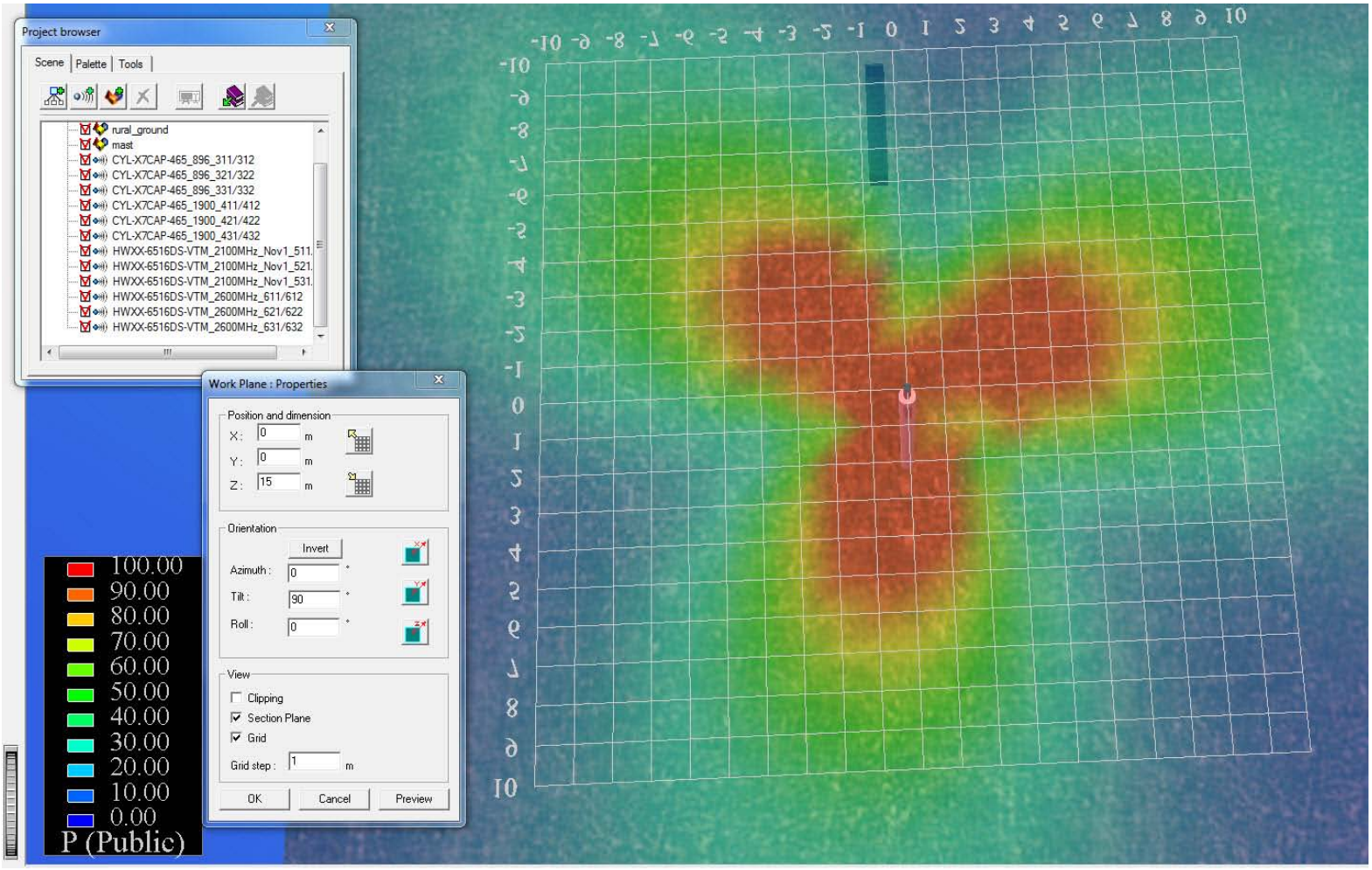

Fig. 8 Power Density distribution @ 12.3m above GND level with proximity to nearby structures. Range Scale: 0% to 30% of the Safety Code 6 limit: General Public Standard

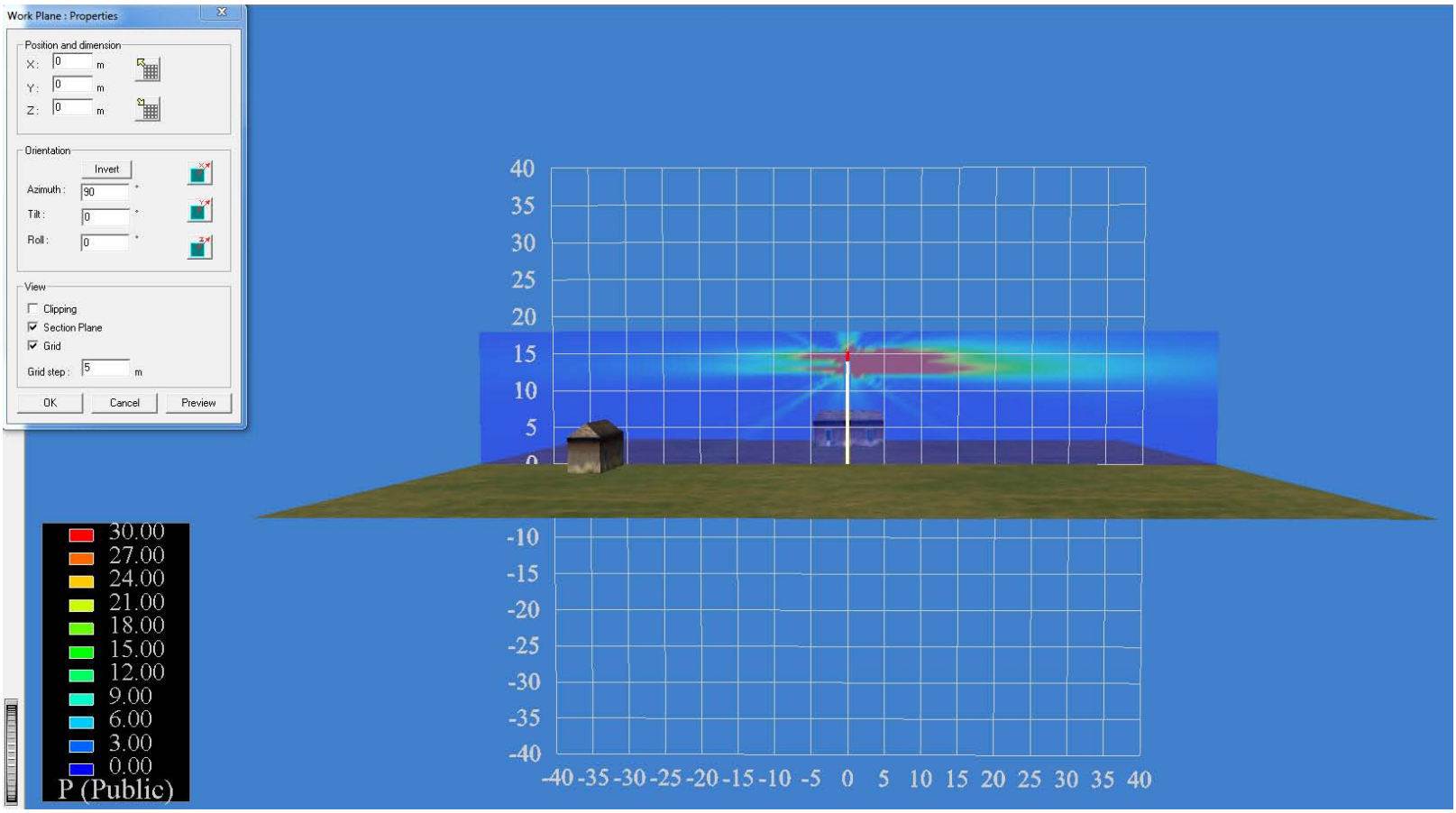

Fig. 9 Power Density distribution cross-section of tower with proximity to nearby structures. Range Scale: 0% to 30% of the Safety Code 6 limit: General Public Standard

2.3 Hardware Data, Applied Knowledge and Assumptions

HSPA Layer:

HSPA 850MHz will operate with 2 carriers
HSPA 1900MHz will operate with up to 5 carriers

LTE Layer:

LTE 2100MHz will operate on 1 carrier.
LTE 2600MHz will operate with 1 carrier.

Fibre optic cables/jumpers are approx. 1m in length to respective antennas from each RRU on the ground. DIN connectors used for all coax cable LDF4 connections between antenna ports and its RRU

Industry Canada's website indicated that there are no transmitters within 100m of this site at 3515 Lakeshore Rd. West
http://sd.ic.gc.ca/pls/engdoc_anon/web_search.geographical_input?warning_msg=No+records+were+found+that+matched+your+search+criteria

Antenna	Sector	Technology	Operator	Antenna Model	Height	Az.	Tilt	Freq.	$P_{TRANSMITTER\ Per\ CARRIER}$	Number of carriers	Jumper Type	Jumper Length	Jumper Loss	Splitter/ Connector Loss	$P_{TOTAL\_ANT\_INPUT}$	Ant. gain	EIRP
					[m] *	[deg]	[deg]	[MHz]	[Watts/dBmW]	Total Power	LDF/AVA	[m]	[dB]	[dB]	[Watts/dBm]	[dBi]	[Watts/dBm]
311/312	Alpha	HSPA	Bell Mobility	CYL-X7CAP-465_850MHz	14	70	0,0	850	20.0 W	3 Ch	LDF-4	20	1.34	0	43.2 W	14.75	1289.3 W
									43.0 dBm	47.8 dBm				0.09	46.4 dBm		61.1 dBm
321/322	Beta	HSPA	Bell Mobility	CYL-X7CAP-465_850MHz	14	190	0,0	850	20.0 W	3 Ch	LDF-4	20	1.34	0	43.2 W	14.75	1289.3 W
									43.0 dBm	47.8 dBm				0.09	46.4 dBm		61.1 dBm
331/332	Gamma	HSPA	Bell Mobility	CYL-X7CAP-465_850MHz	14	310	0,0	850	20.0 W	3 Ch	LDF-4	20	1.34	0	43.2 W	14.75	1289.3 W
									43.0 dBm	47.8 dBm				0.09	46.4 dBm		61.1 dBm
411/412	Alpha	HSPA	Bell Mobility	CYL-X7CAP-465_1900MHz	14	70	0,0	1900	20.0 W	3 Ch	LDF-4	20	2.11	0	36.2 W	17.05	1833.0 W
									43.0 dBm	47.8 dBm				0.09	45.6 dBm		62.6 dBm
421/422	Beta	HSPA	Bell Mobility	CYL-X7CAP-465_1900MHz	14	190	0,0	1900	20.0 W	3 Ch	LDF-4	20	2.11	0	36.2 W	17.05	1833.0 W
									43.0 dBm	47.8 dBm				0.09	45.6 dBm		62.6 dBm
431/432	Gamma	HSPA	Bell Mobility	CYL-X7CAP-465_1900MHz	14	310	0,0	1900	20.0 W	3 Ch	LDF-4	20	2.11	0	36.2 W	17.05	1833.0 W
									43.0 dBm	47.8 dBm				0.09	45.6 dBm		62.6 dBm
511/512	Alpha	LTE	Bell Mobility	HWXX-6516DS-VTM_2100MHz	12.3	70	0,0	2100	20.0 W	3 Ch	LDF-4	20	2.20	0	35.4 W	17.7	2085.2 W
									43.0 dBm	47.8 dBm				0.09	45.5 dBm		63.2 dBm
521/522	Beta	LTE	Bell Mobility	HWXX-6516DS-VTM_2100MHz	12.3	190	0,0	2100	20.0 W	3 Ch	LDF-4	20	2.20	0	35.4 W	17.7	2085.2 W
									43.0 dBm	47.8 dBm				0.09	45.5 dBm		63.2 dBm
531/532	Gamma	LTE	Bell Mobility	HWXX-6516DS-VTM_2100MHz	12.3	310	0,0	2100	20.0 W	3 Ch	LDF-4	20	2.20	0	35.4 W	17.7	2085.2 W
									43.0 dBm	47.8 dBm				0.09	45.5 dBm		63.2 dBm
611/612	Alpha	LTE	Bell Mobility	HWXX-6516DS-VTM_2600MHz	12.3	70	0,0	2600	20.0 W	3 Ch	LDF-4	20	2.50	0	33.0 W	18.2	2183.5 W
									43.0 dBm	47.8 dBm				0.09	45.2 dBm		63.4 dBm
621/622	Beta	LTE	Bell Mobility	HWXX-6516DS-VTM_2600MHz	12.3	190	0,0	2600	20.0 W	3 Ch	LDF-4	20	2.50	0	33.0 W	18.2	2183.5 W
									43.0 dBm	47.8 dBm				0.09	45.2 dBm		63.4 dBm
631/632	Gamma	LTE	Bell Mobility	HWXX-6516DS-VTM_2600MHz	12.3	310	0,0	2600	20.0 W	3 Ch	LDF-4	20	2.50	0	33.0 W	18.2	2183.5 W
									43.0 dBm	47.8 dBm				0.09	45.2 dBm		63.4 dBm

Fig. 10 Antenna and Radio Configuration. All cable losses is calculated separately from their connector loss. Antenna elevations/heights listed in table and are to each antenna centre line

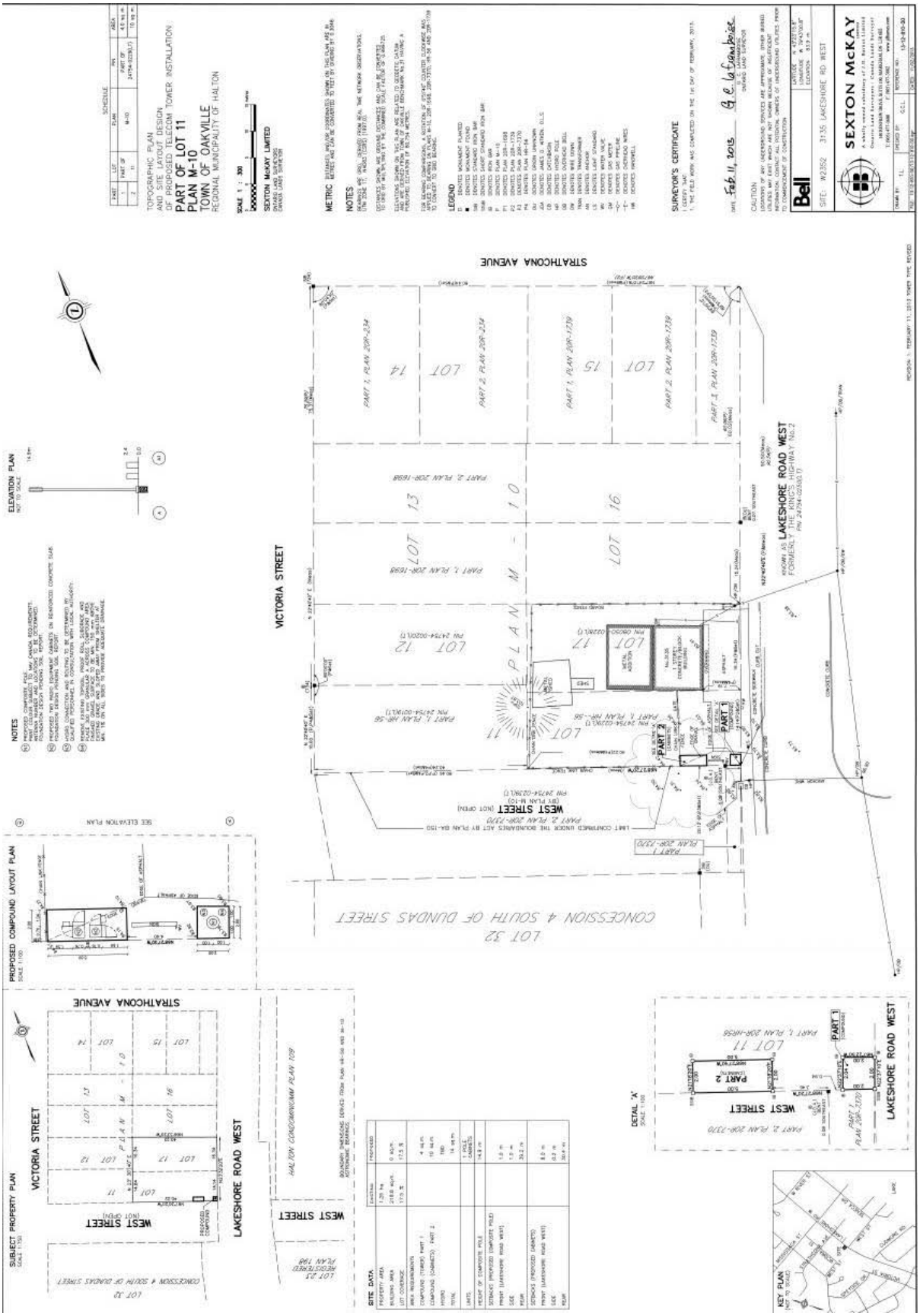

Fig. 11 Site Survey