

# 屋外PLCの不要電磁界および電流分布の数値計算結果

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1

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## 目次

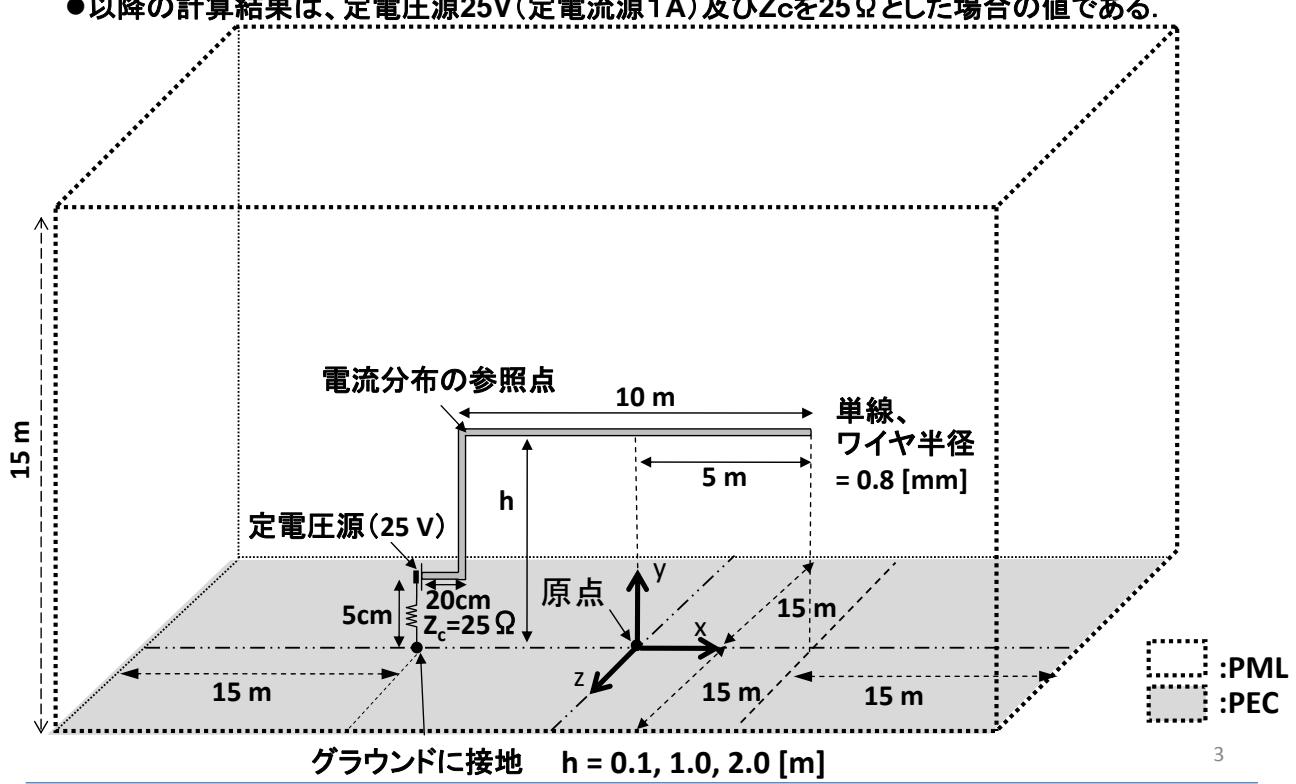


1. 解析モデル
2. 電流分布の数値計算
3. 電磁界強度の数値計算(周波数特性)
4. 磁界分布の数値計算
5. まとめ

2

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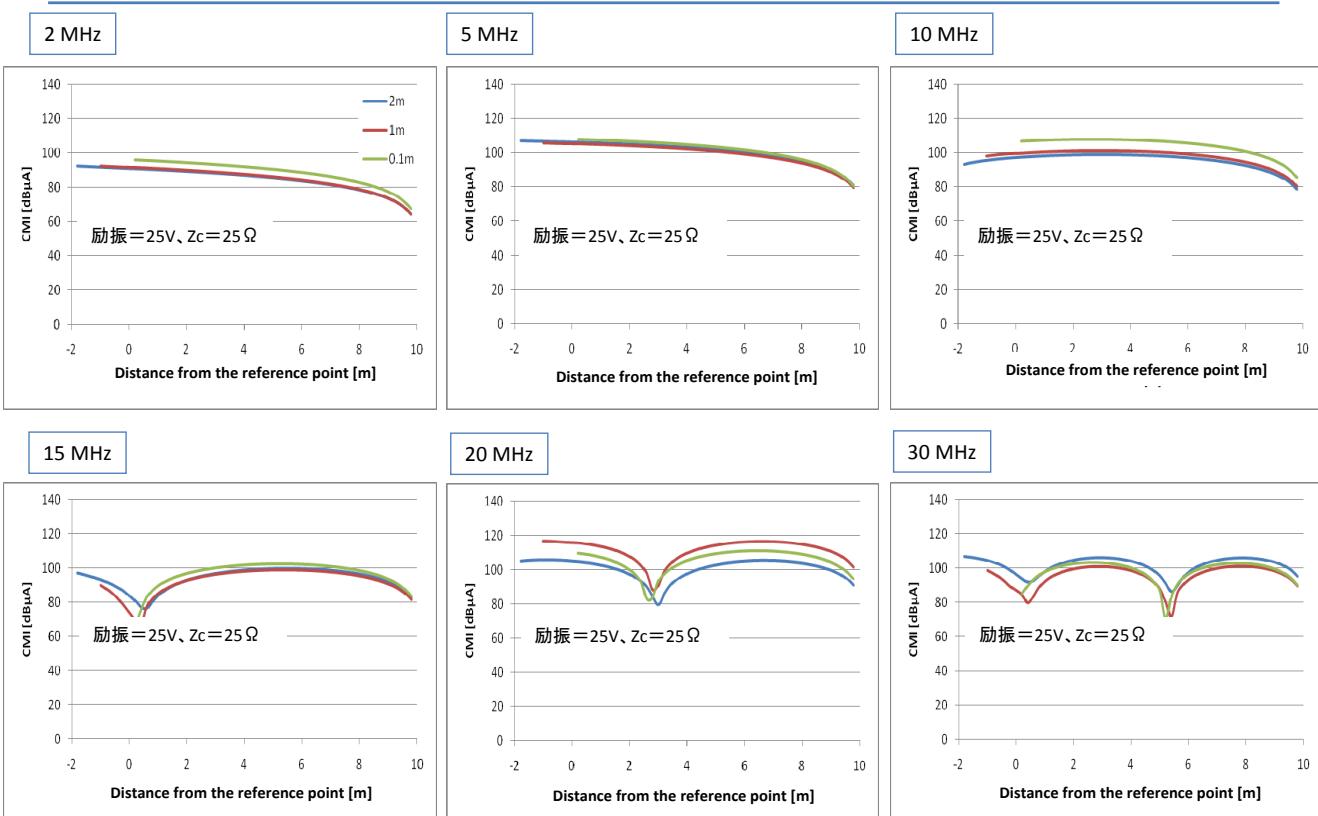
- 第2回作業班資料2-6記載の試験環境をモデル化
  - 以降の計算結果は、定電圧源25V(定電流源1A)及び $Z_c$ を $25\Omega$ とした場合の値である。

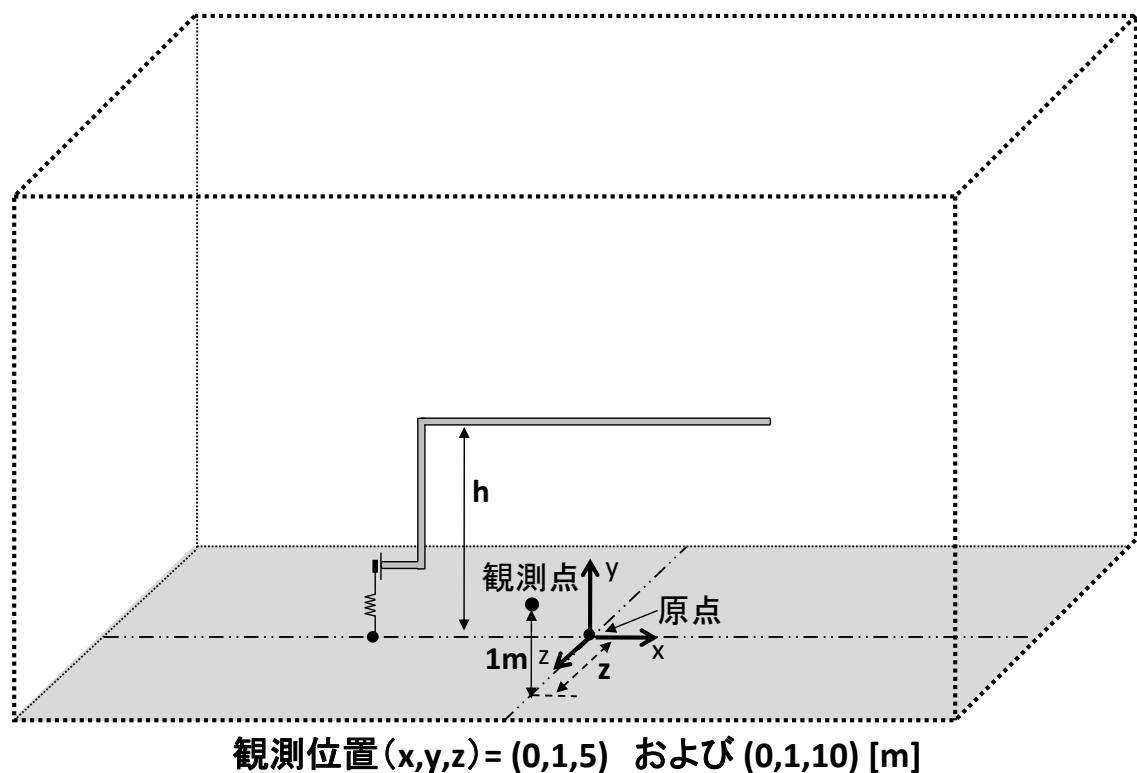


3

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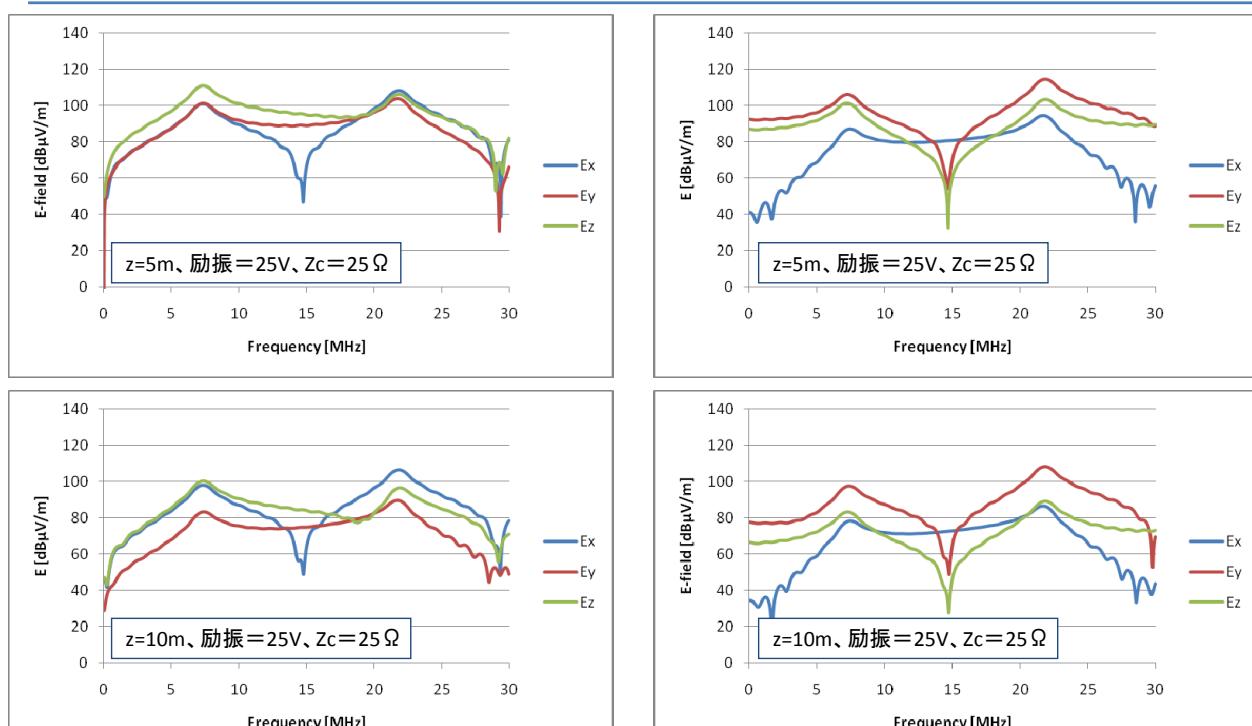
電流分布





5

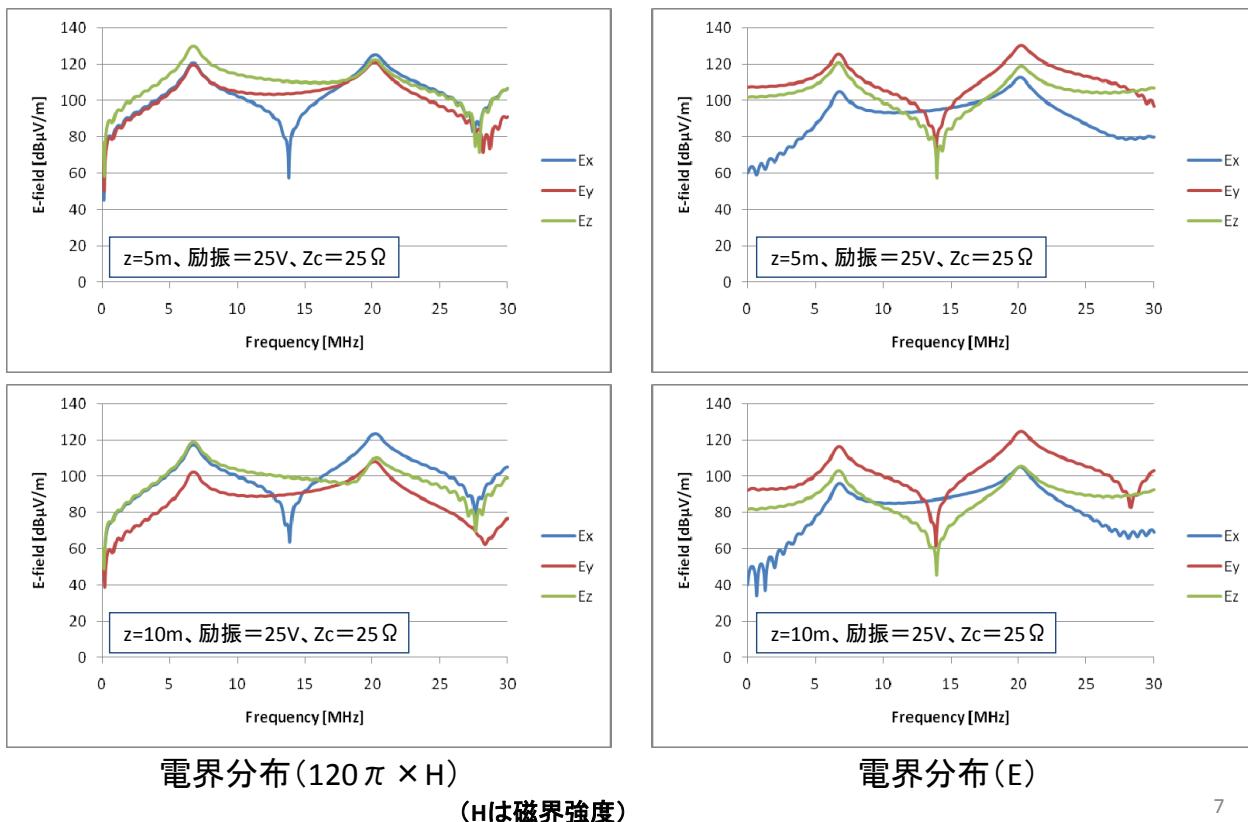
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電界分布(周波数依存性、電力線高さ $h=0.1\text{m}$ )電界分布( $120\pi \times H$ )  
( $H$ は磁界強度)電界分布( $E$ )

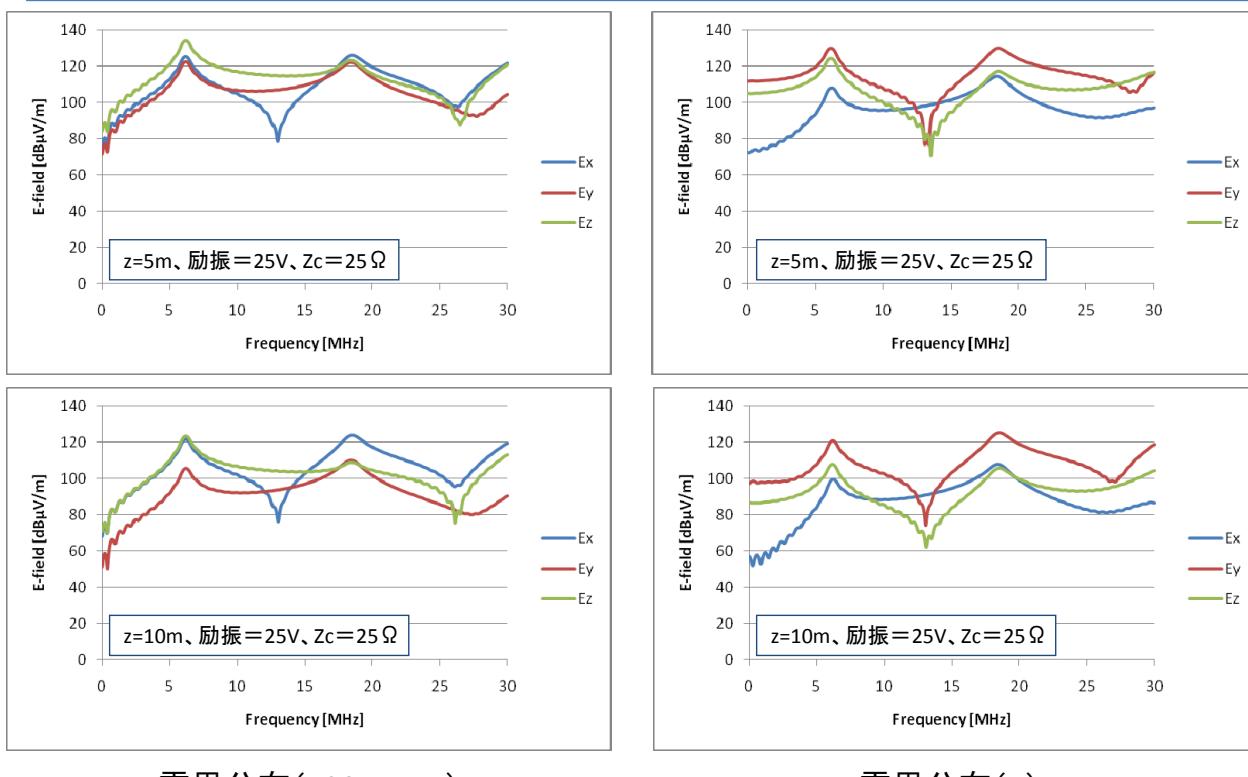
6

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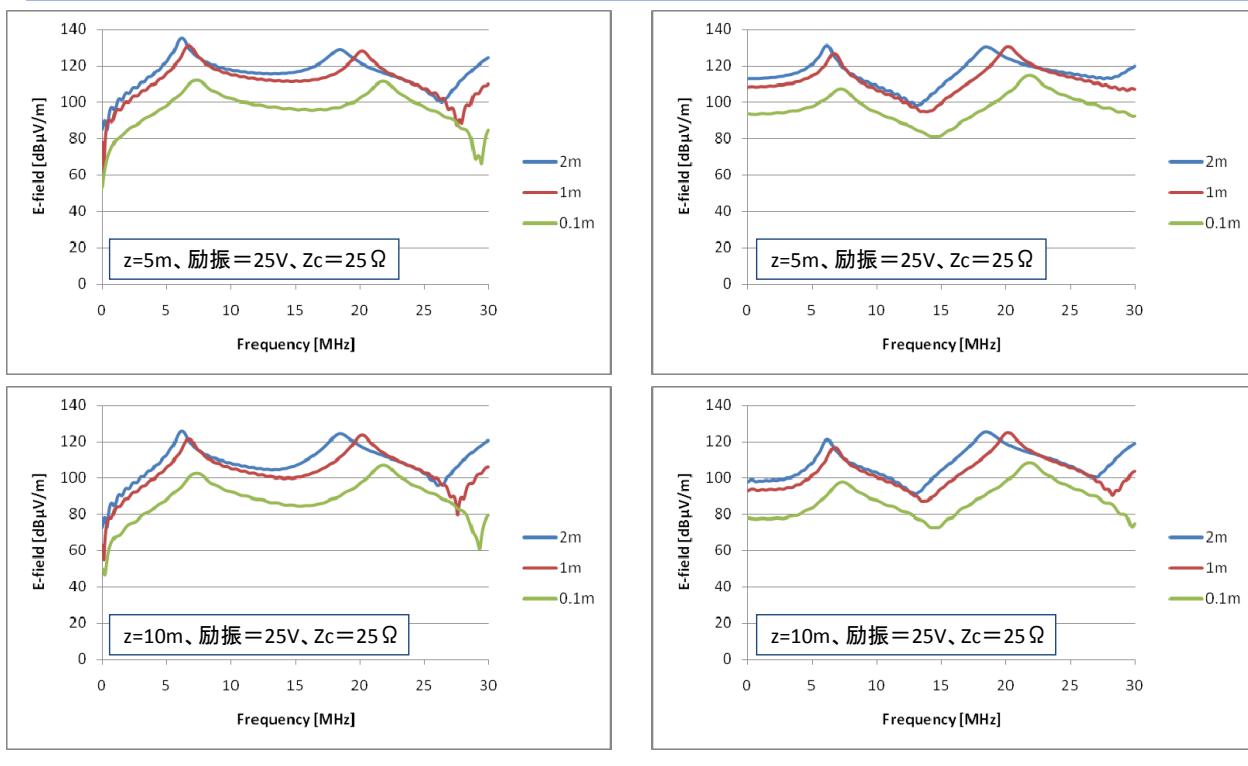
## 電界分布(周波数依存性、電力線高さh=1m)



## 電界分布(周波数依存性、電力線高さh=2m)



## 電界分布(周波数依存性、3成分合成)



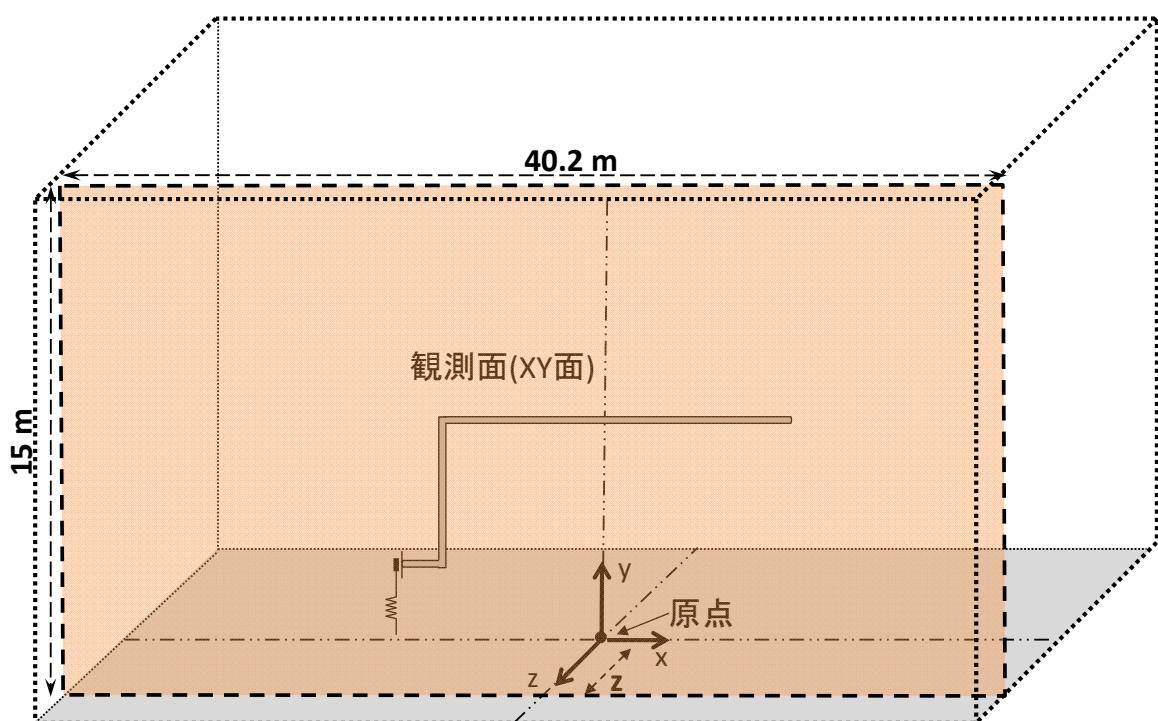
電界分布(120  $\pi \times H$ )  
(Hは磁界強度)

電界分布(E)

9

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## 磁界分布(観測面:XY面, 電力線からの水平距離 5m および10m)



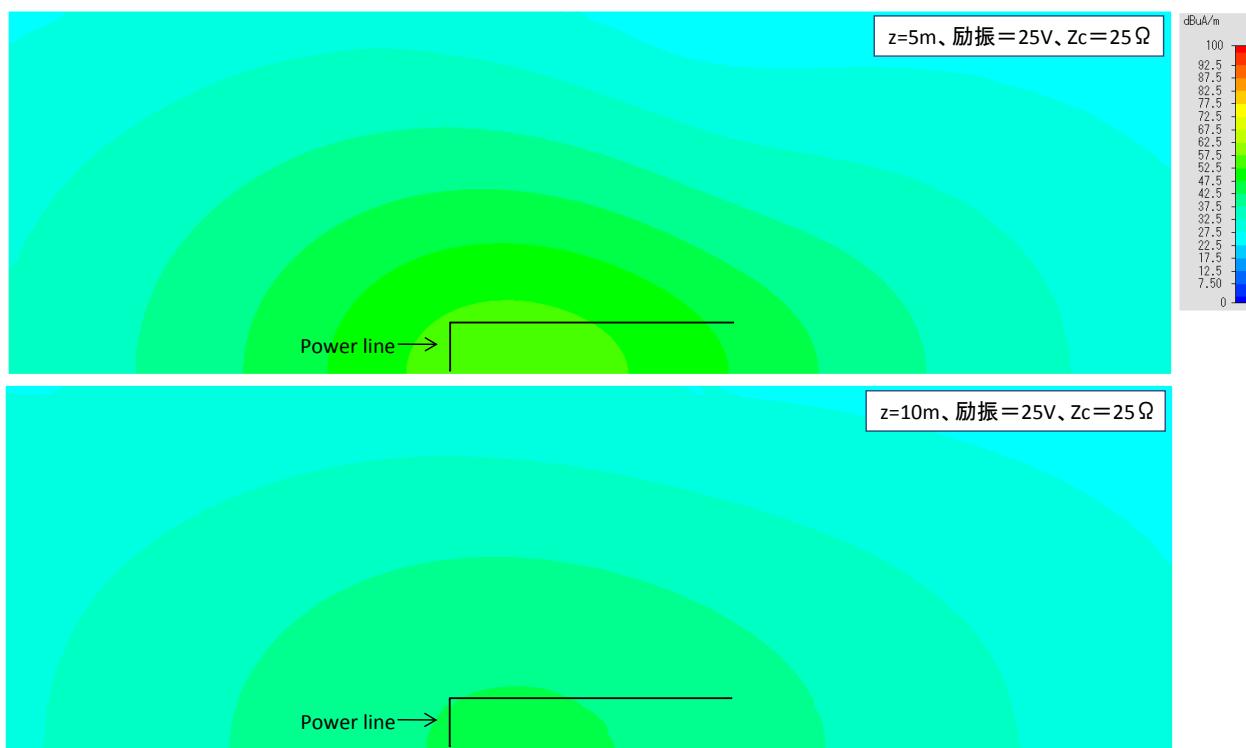
$z = 5, 10 [m]$

周波数= 2,5,10,15,20,30 [MHz]

10

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## 磁界分布 (水平距離 $z = 5$ mと10 mの比較, 電力線高さ $h = 2$ m, $f = 2$ MHz)

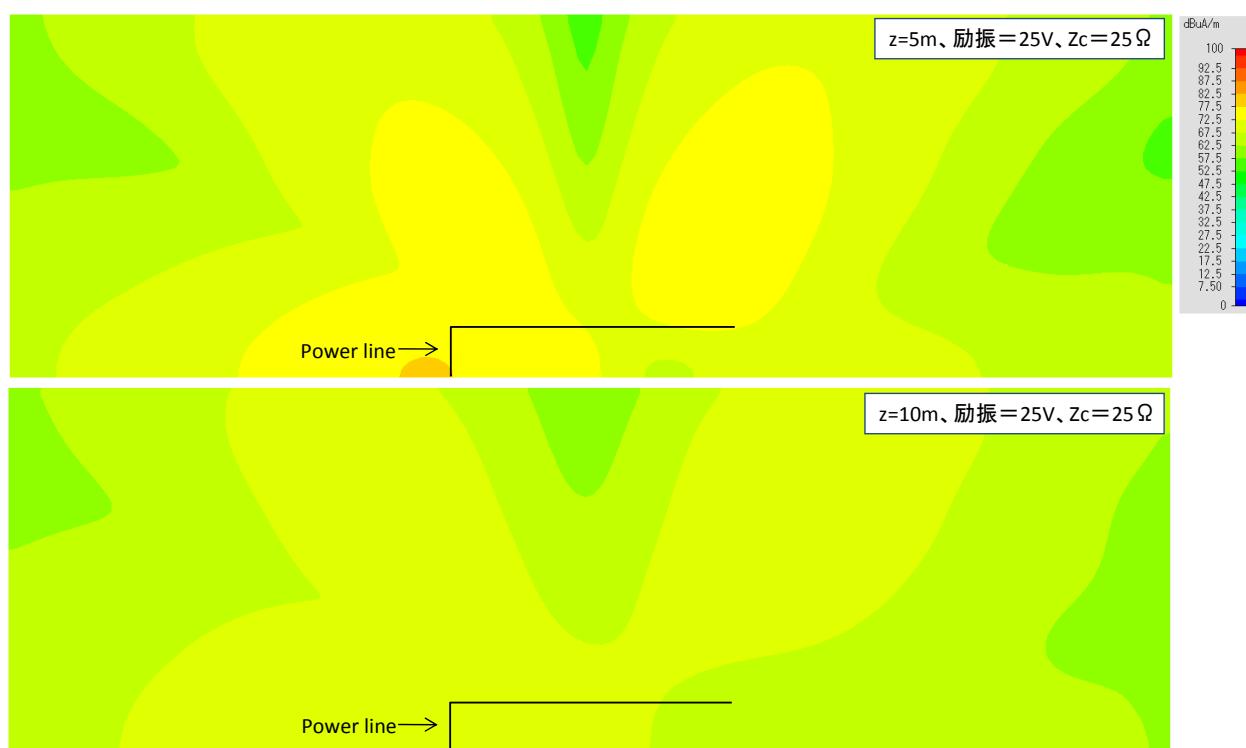


\* 電界強度 [ $\mu$ V/m] =  $120\pi \times$  磁界強度 [ $\mu$ A/m]

11

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## 磁界分布 (水平距離 $z = 5$ mと10 mの比較, 電力線高さ $h = 2$ m, $f = 30$ MHz)

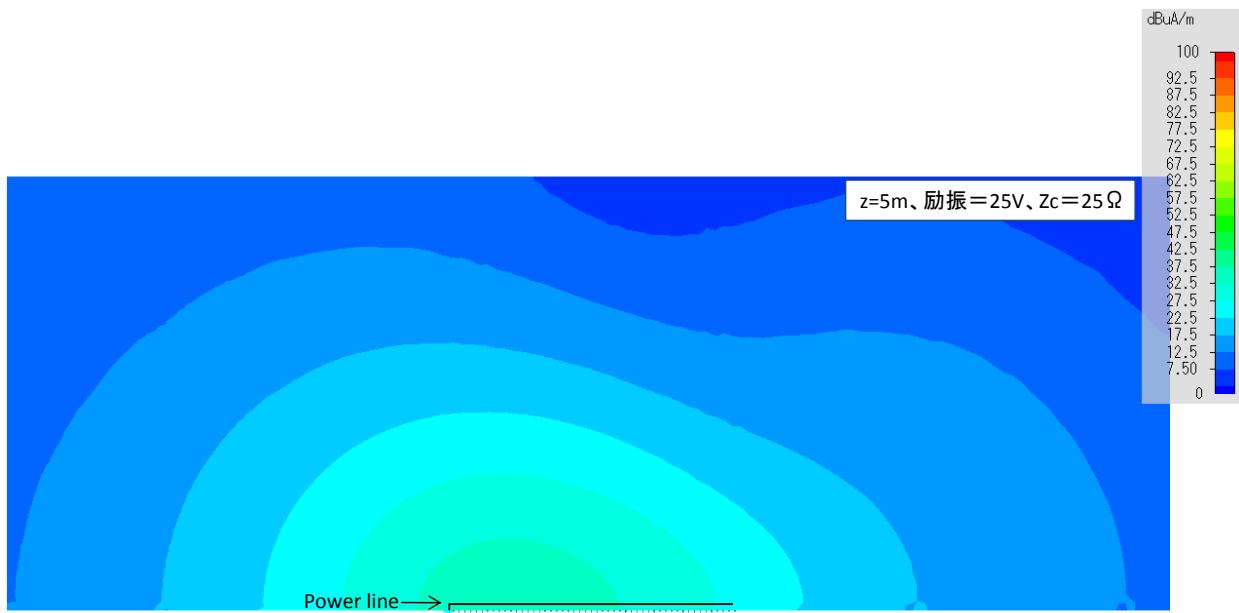


\* 電界強度 [ $\mu$ V/m] =  $120\pi \times$  磁界強度 [ $\mu$ A/m]

12

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## 磁界分布 (電力線高さh = 0.1 m, f = 2 MHz, z = 5 m)

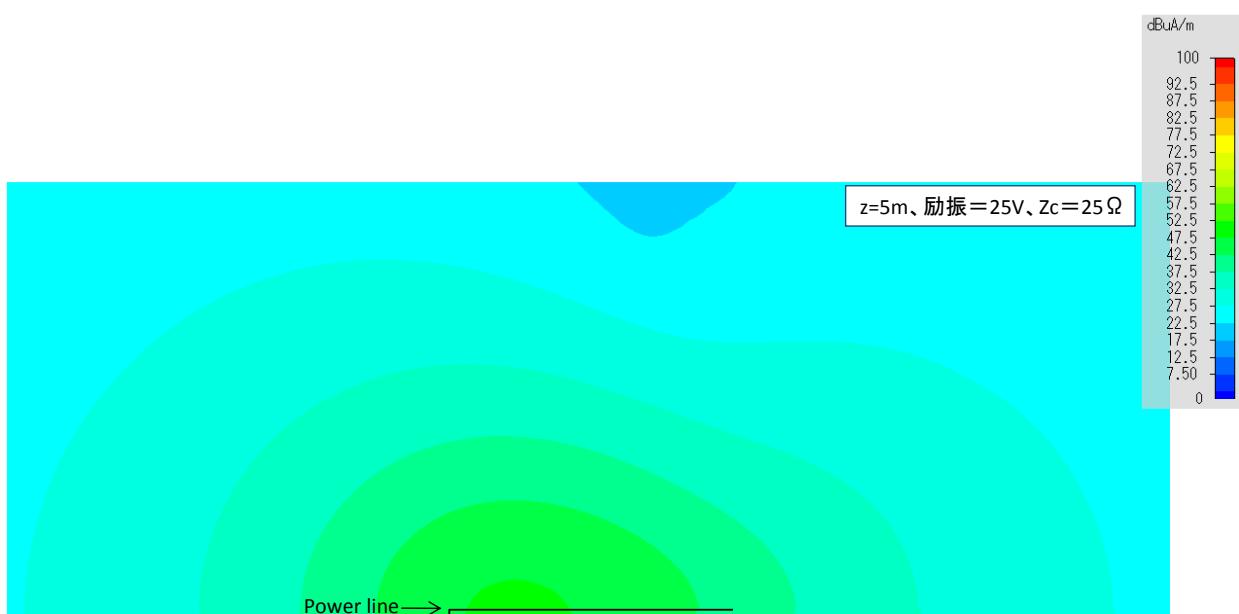


\* 電界強度 [ $\mu\text{V}/\text{m}$ ] =  $120\pi \times$  磁界強度 [ $\mu\text{A}/\text{m}$ ]

13

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## 磁界分布 (電力線高さh = 0.1 m, f = 5 MHz, z = 5 m)

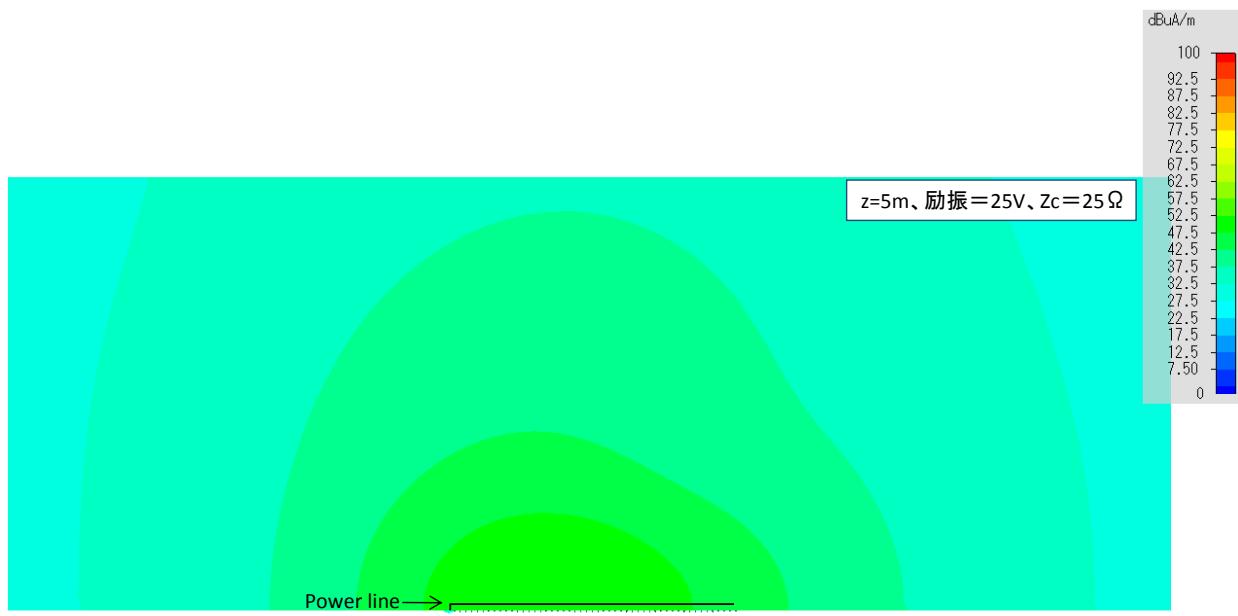


\* 電界強度 [ $\mu\text{V}/\text{m}$ ] =  $120\pi \times$  磁界強度 [ $\mu\text{A}/\text{m}$ ]

14

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## 磁界分布 (電力線高さ $h = 0.1$ m, $f = 10$ MHz, $z = 5$ m)

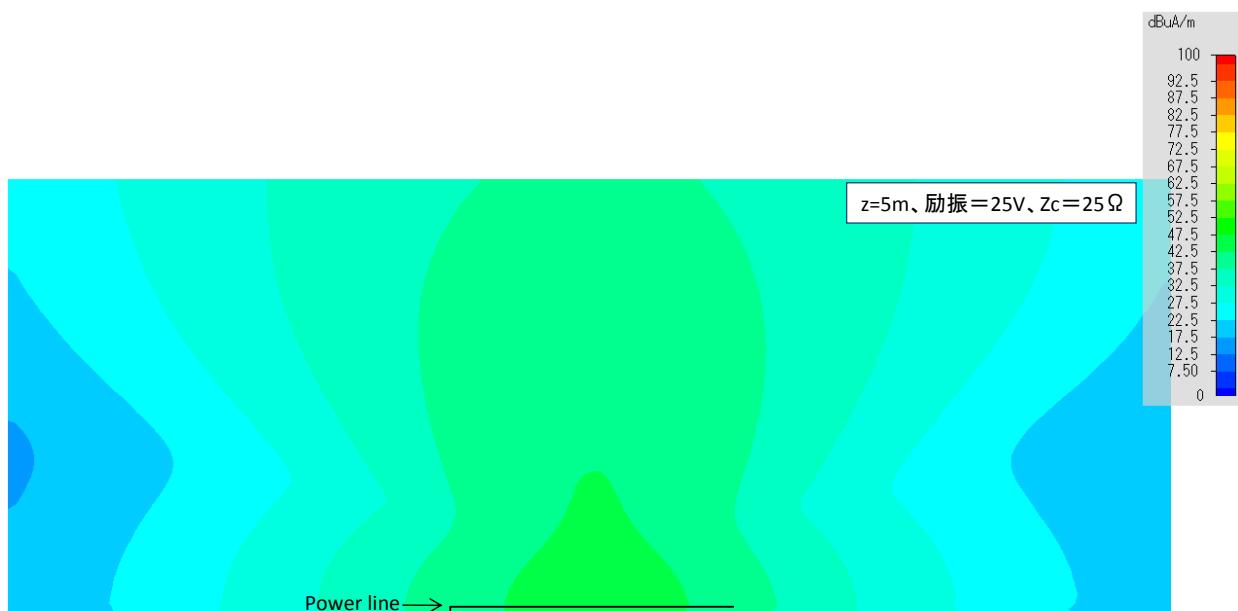


\* 電界強度 [ $\mu$ V/m] =  $120\pi \times$  磁界強度 [ $\mu$ A/m]

15

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## 磁界分布 (電力線高さ $h = 0.1$ m, $f = 15$ MHz, $z = 5$ m)

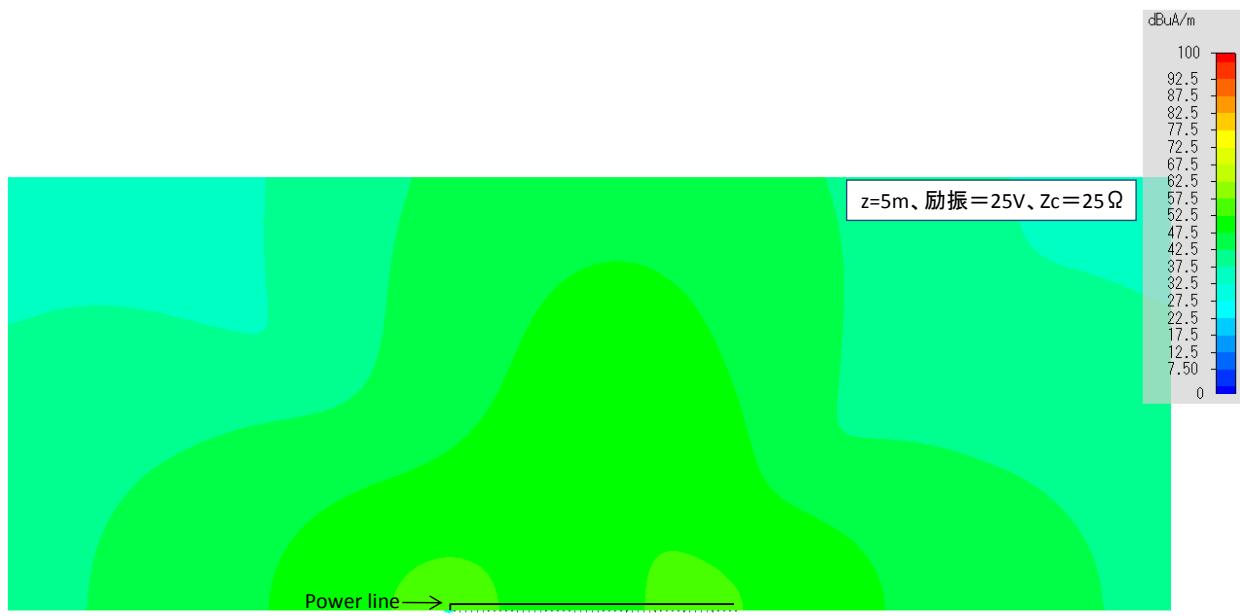


\* 電界強度 [ $\mu$ V/m] =  $120\pi \times$  磁界強度 [ $\mu$ A/m]

16

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## 磁界分布 (電力線高さ $h = 0.1$ m, $f = 20$ MHz, $z = 5$ m)

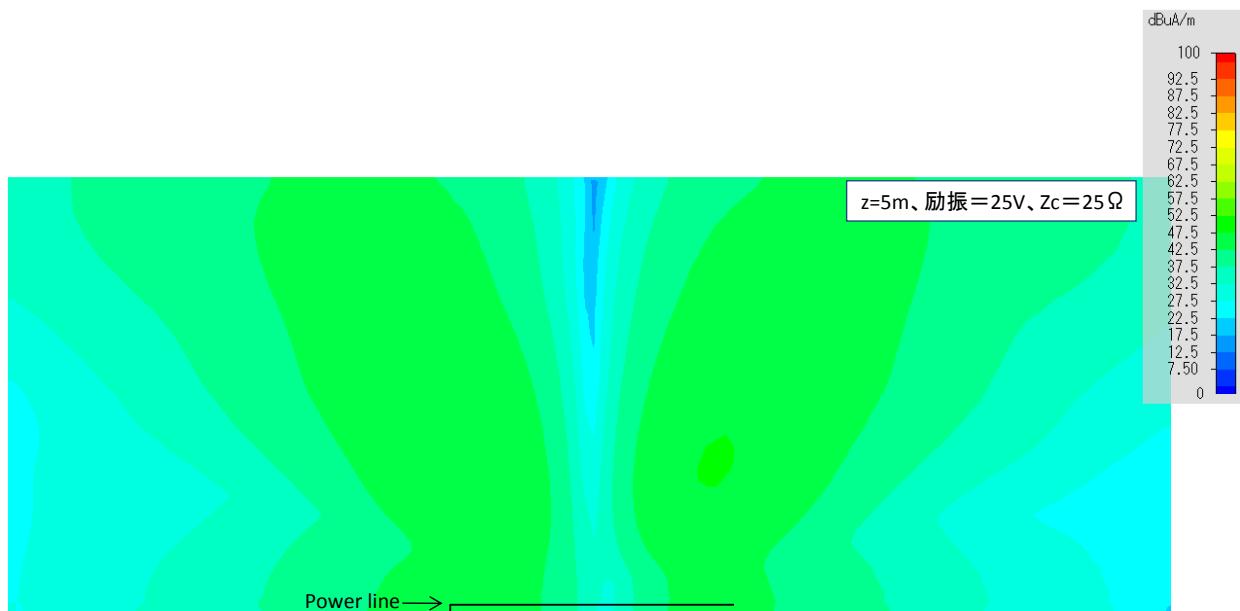


\* 電界強度 [ $\mu\text{V}/\text{m}$ ] =  $120\pi \times$  磁界強度 [ $\mu\text{A}/\text{m}$ ]

17

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## 磁界分布 (電力線高さ $h = 0.1$ m, $f = 30$ MHz, $z = 5$ m)

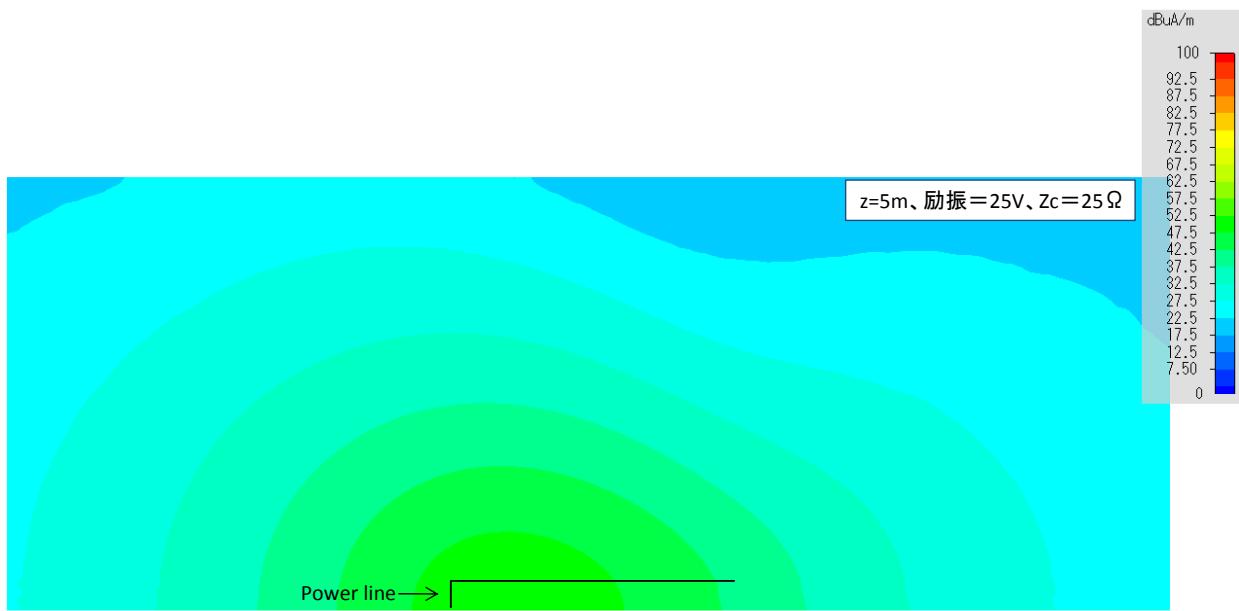


\* 電界強度 [ $\mu\text{V}/\text{m}$ ] =  $120\pi \times$  磁界強度 [ $\mu\text{A}/\text{m}$ ]

18

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## 磁界分布 (電力線高さh = 1 m, f = 2 MHz, z = 5 m)

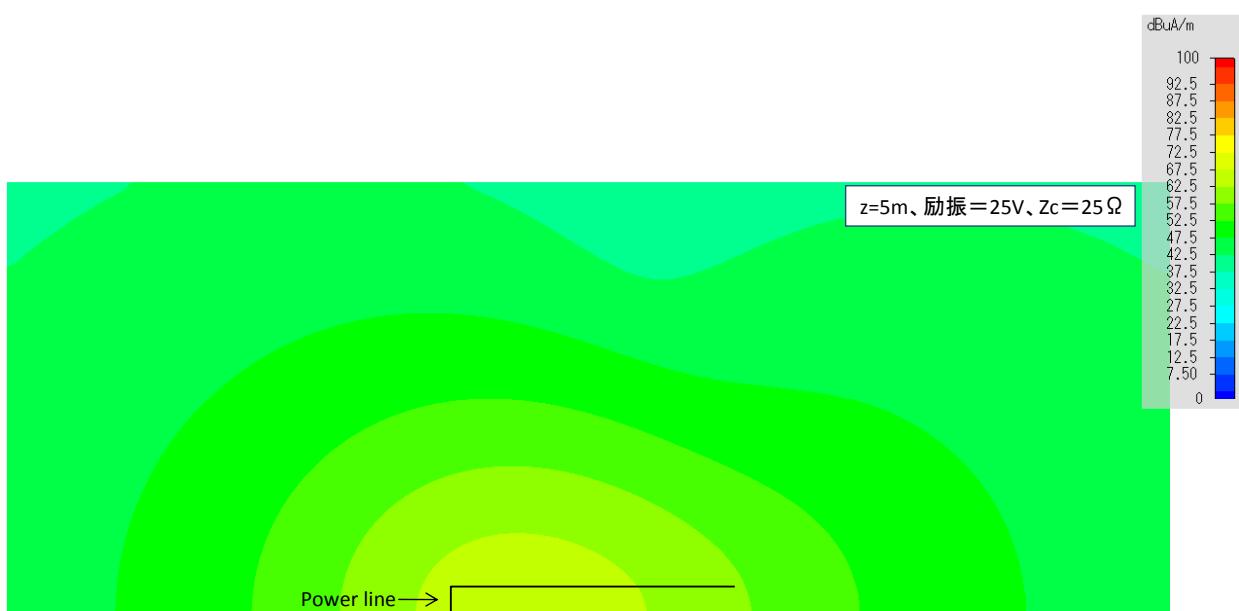


\* 電界強度 [ $\mu\text{V}/\text{m}$ ] =  $120\pi \times$  磁界強度 [ $\mu\text{A}/\text{m}$ ]

19

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## 磁界分布 (電力線高さh = 1 m, f = 5 MHz, z = 5 m)

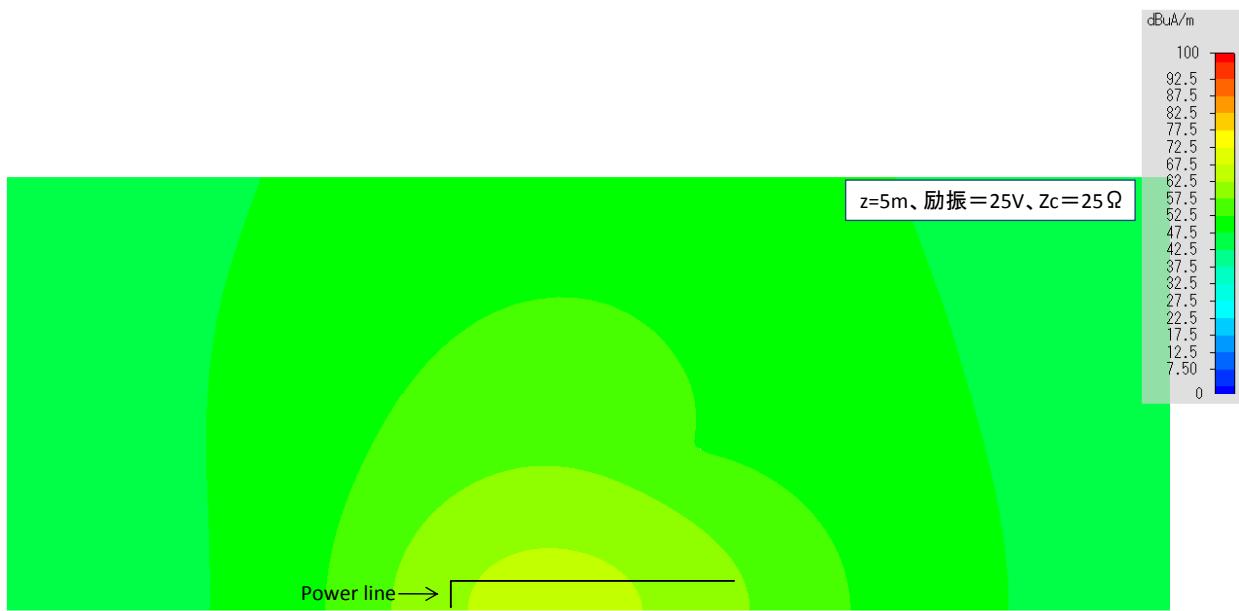


\* 電界強度 [ $\mu\text{V}/\text{m}$ ] =  $120\pi \times$  磁界強度 [ $\mu\text{A}/\text{m}$ ]

20

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## 磁界分布 (電力線高さ $h = 1$ m, $f = 10$ MHz, $z = 5$ m)

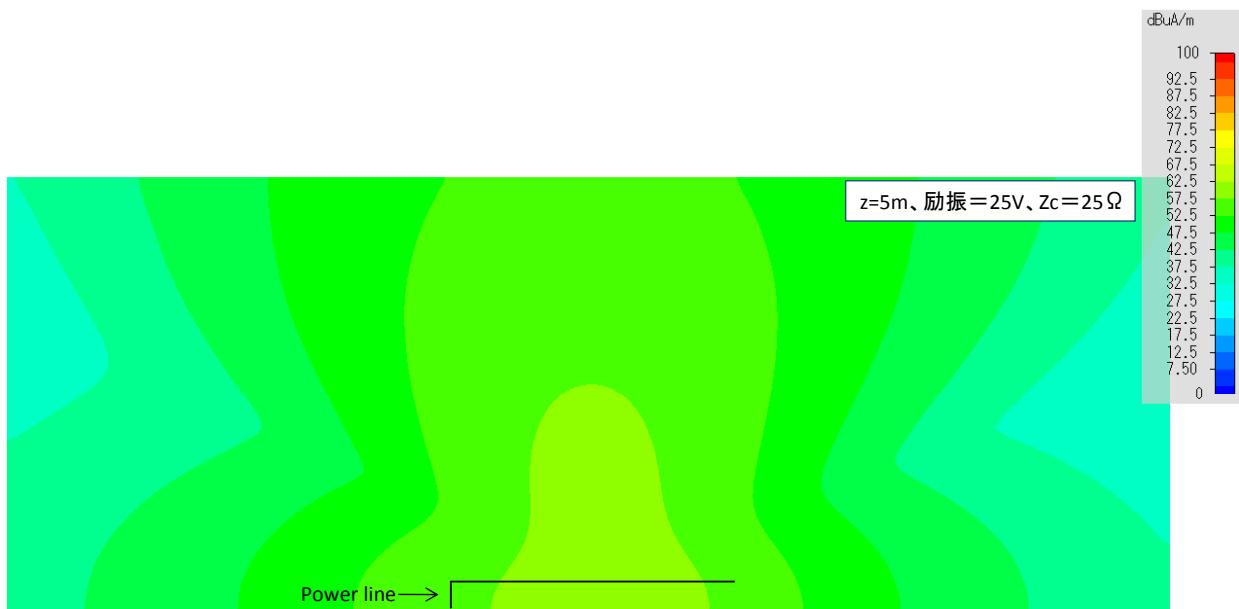


\* 電界強度 [ $\mu\text{V}/\text{m}$ ] =  $120\pi \times$  磁界強度 [ $\mu\text{A}/\text{m}$ ]

21

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## 磁界分布 (電力線高さ $h = 1$ m, $f = 15$ MHz, $z = 5$ m)

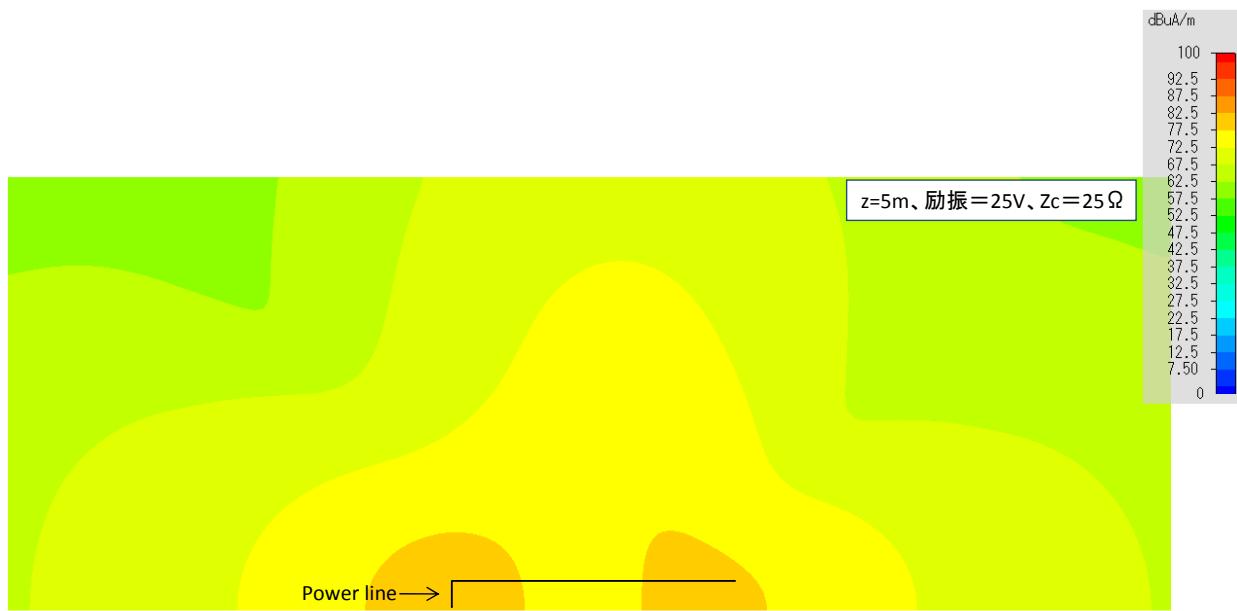


\* 電界強度 [ $\mu\text{V}/\text{m}$ ] =  $120\pi \times$  磁界強度 [ $\mu\text{A}/\text{m}$ ]

22

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## 磁界分布 (電力線高さh = 1 m, f = 20 MHz, z = 5 m)

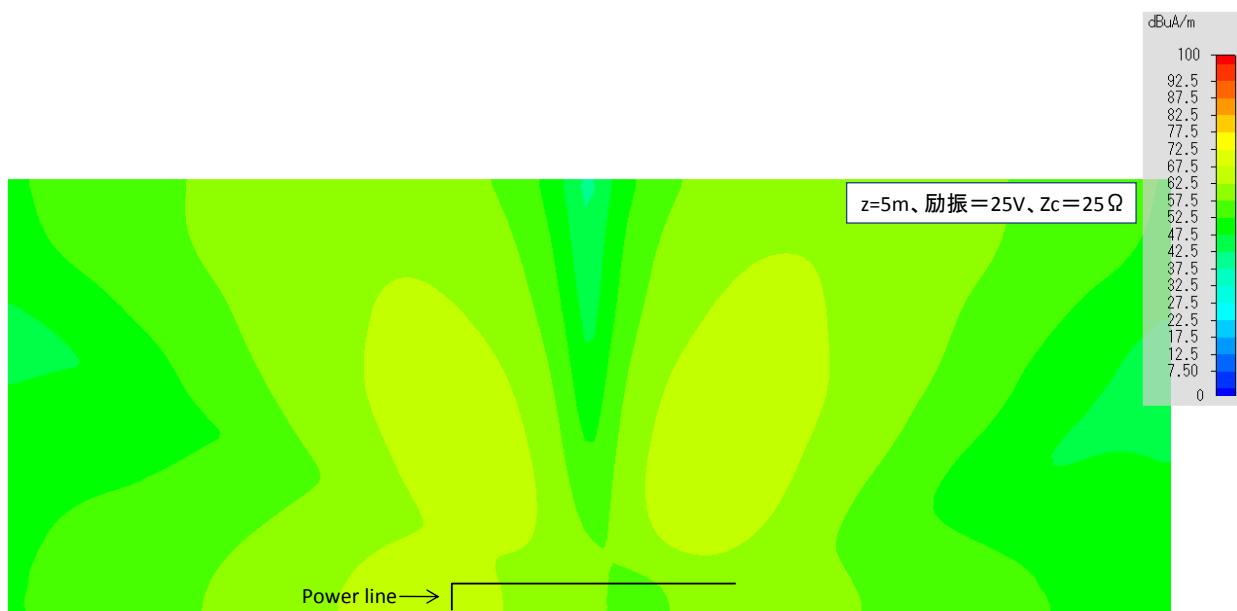


\* 電界強度 [ $\mu\text{V}/\text{m}$ ] =  $120\pi \times$  磁界強度 [ $\mu\text{A}/\text{m}$ ]

23

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## 磁界分布 (電力線高さh = 1 m, f = 30 MHz, z = 5 m)

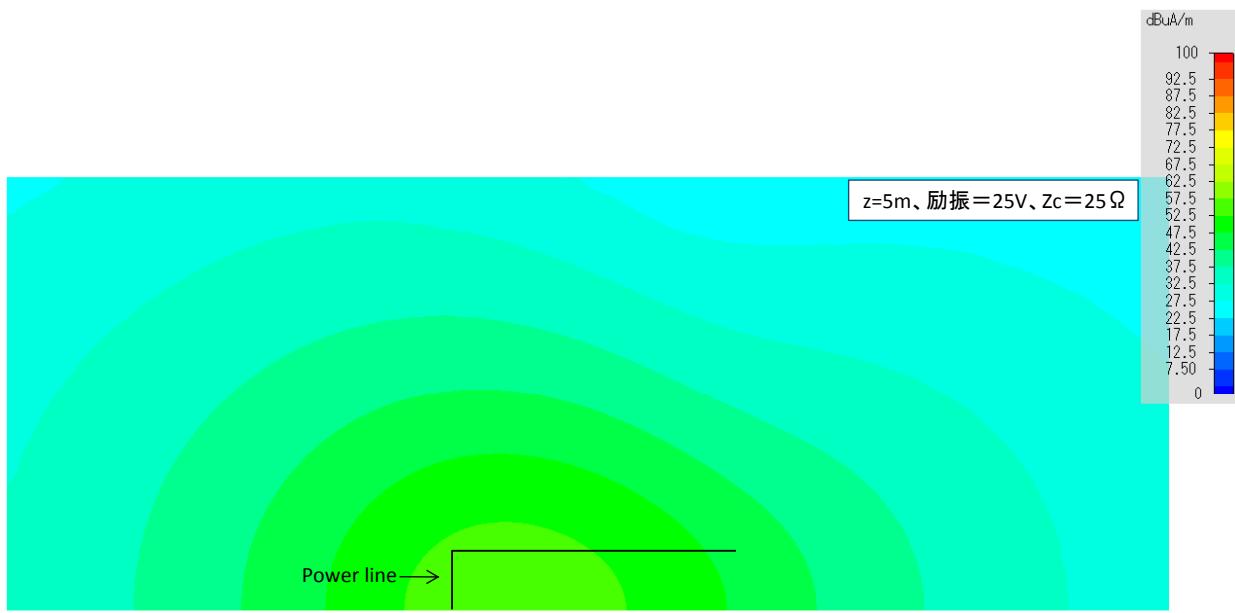


\* 電界強度 [ $\mu\text{V}/\text{m}$ ] =  $120\pi \times$  磁界強度 [ $\mu\text{A}/\text{m}$ ]

24

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## 磁界分布 (電力線高さh = 2 m, f = 2 MHz, z = 5 m)

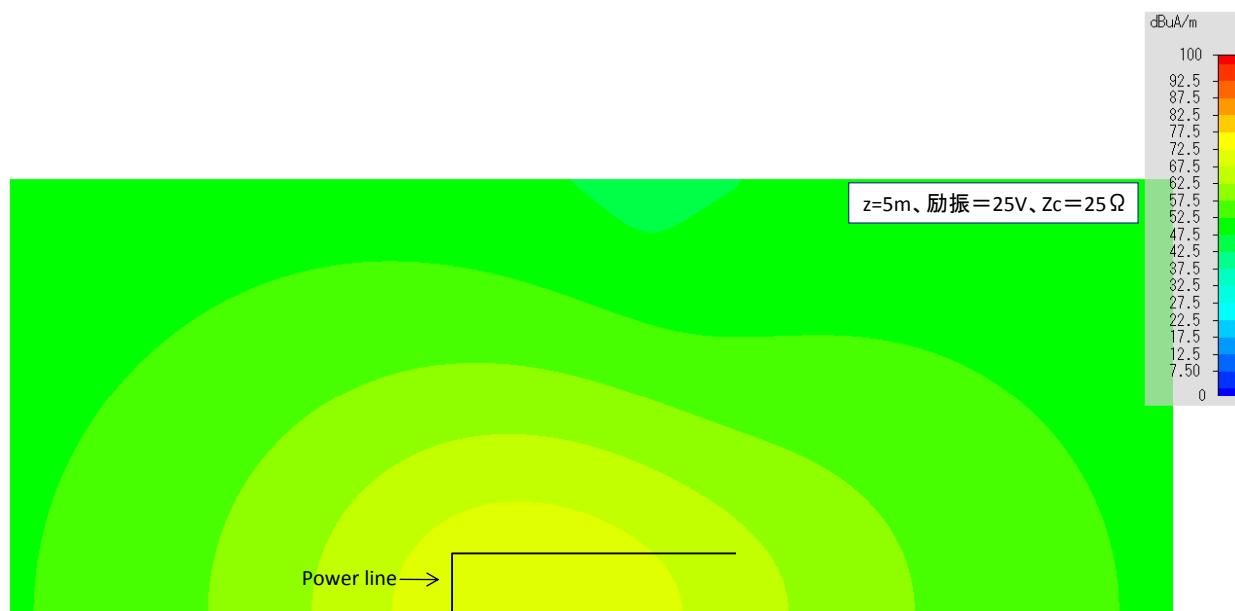


\* 電界強度 [ $\mu\text{V}/\text{m}$ ] =  $120\pi \times$  磁界強度 [ $\mu\text{A}/\text{m}$ ]

25

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## 磁界分布 (電力線高さh = 2 m, f = 5 MHz, z = 5 m)

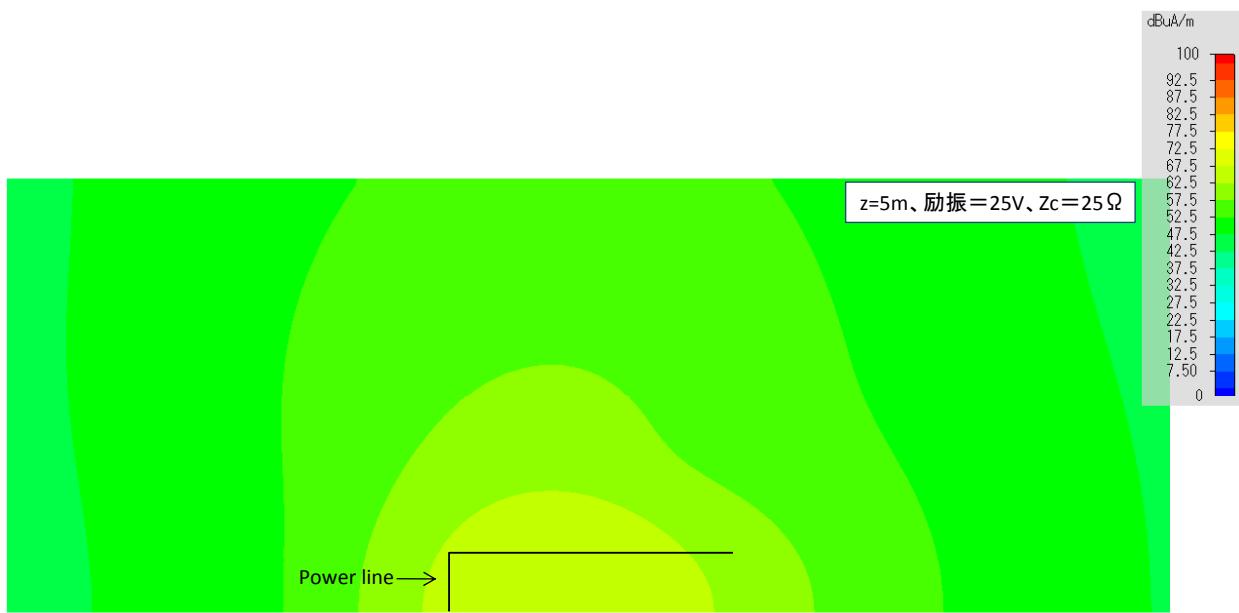


\* 電界強度 [ $\mu\text{V}/\text{m}$ ] =  $120\pi \times$  磁界強度 [ $\mu\text{A}/\text{m}$ ]

26

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## 磁界分布 (電力線高さ $h = 2$ m, $f = 10$ MHz, $z = 5$ m)

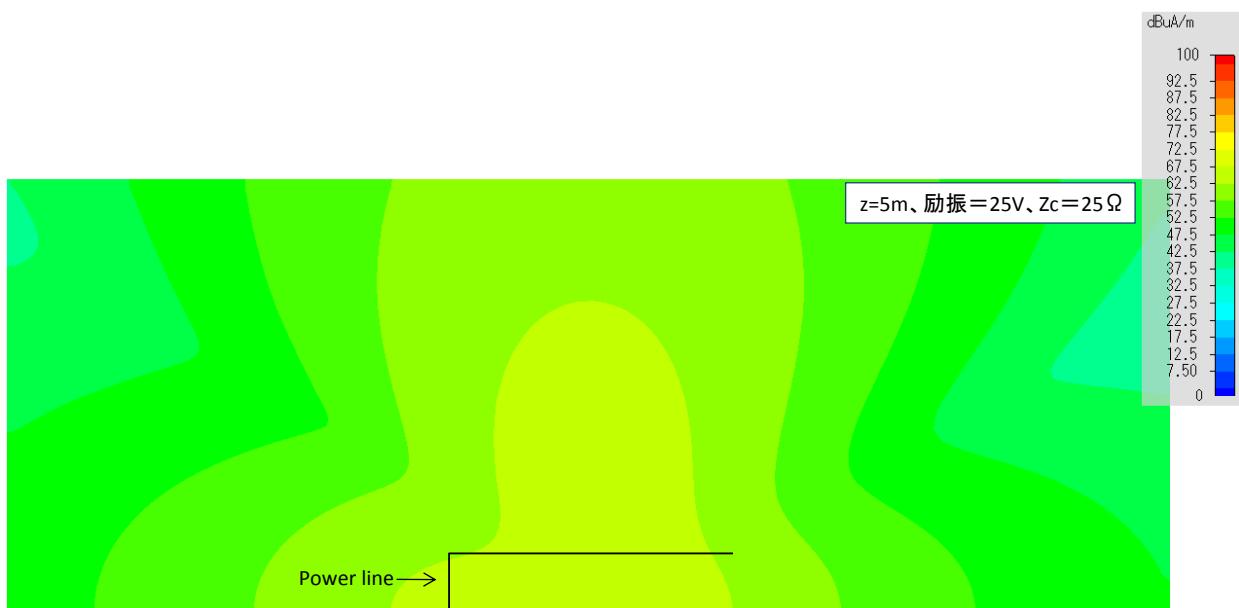


\* 電界強度 [ $\mu$ V/m] =  $120\pi \times$  磁界強度 [ $\mu$ A/m]

27

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## 磁界分布 (電力線高さ $h = 2$ m, $f = 15$ MHz, $z = 5$ m)

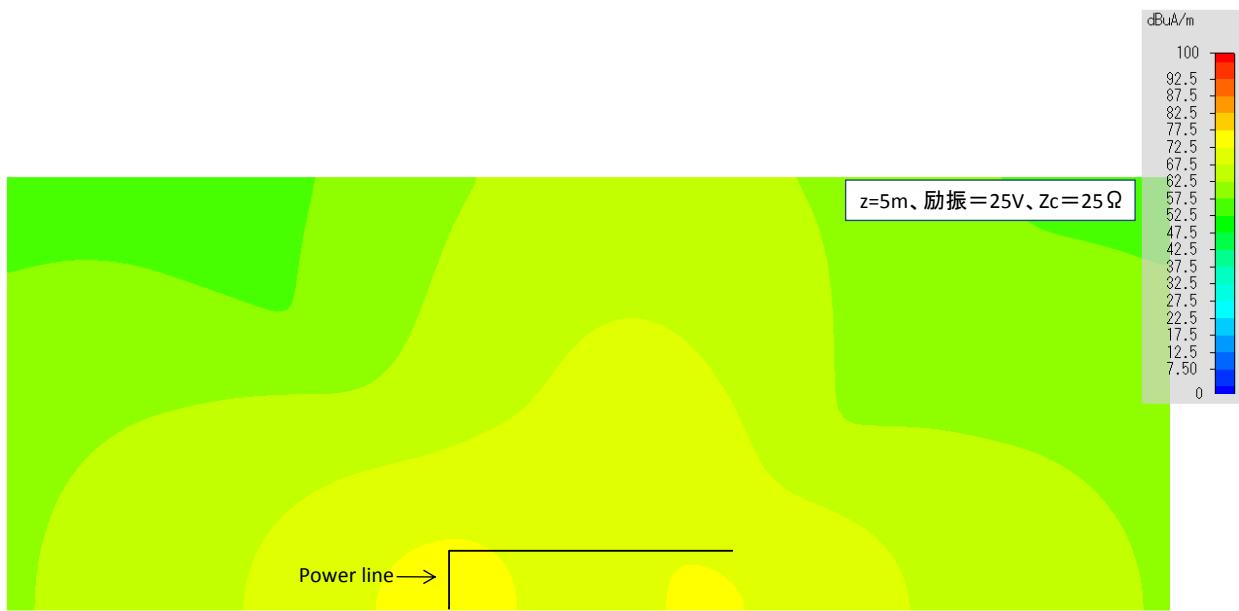


\* 電界強度 [ $\mu$ V/m] =  $120\pi \times$  磁界強度 [ $\mu$ A/m]

28

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## 磁界分布 (電力線高さh = 2 m, f = 20 MHz, z = 5 m)

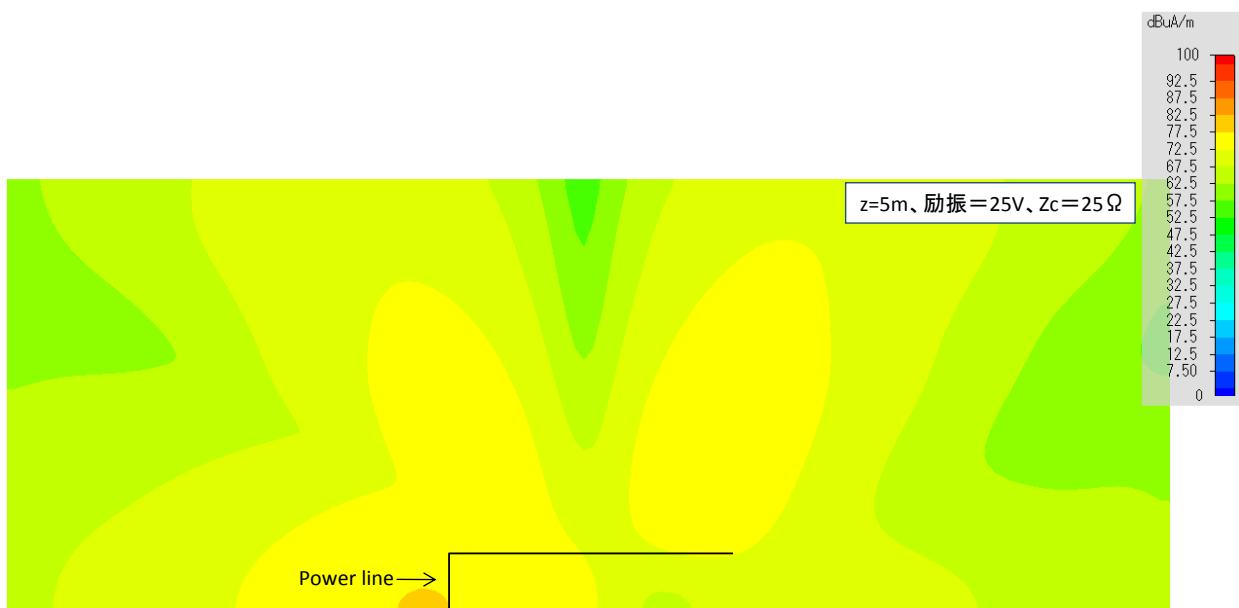


\* 電界強度 [ $\mu\text{V/m}$ ] =  $120\pi \times$  磁界強度 [ $\mu\text{A/m}$ ]

29

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## 磁界分布 (電力線高さh = 2 m, f = 30 MHz, z = 5 m)



\* 電界強度 [ $\mu\text{V/m}$ ] =  $120\pi \times$  磁界強度 [ $\mu\text{A/m}$ ]

30

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屋外PLCにより発生する電磁界と電流分布について数値計算を行った。  
( 単線でモデル化した電力線の一方(屋外コンセント側)を  
定電圧源で励振 , 励振源インピーダンス $25\Omega$  )  
得られた結果を以下に示す .

- 電界分布と磁界からの換算値 ( $120 \times H$ ) の分布は異なる .
- 線路の総延長 ( 垂直部分含む ) が , おおむね  $/4$  、  $3/4$  に相当する周波数において , 電流および周囲電磁界強度が増大する .
- 電磁界強度の分布や最大となる位置は , 周波数によって大きく異なる .