Trees in Bamberg and Hallstadt in the radiation field of 65 mobile phone base stations

Examples from a documentation about 700 trees (2006-2016)

A Tree Damages beginning on one side

The trees of the Bamberg-Documentation are numbered from 1 to 700. Those trees which are part of the study „Radiofrequency radiation injures trees around mobile phone base stations“ (Science of the Total Environment 572 (2016) 554-569) have a second, red number.

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On 27 July 2009 the difference between the two sides was striking. The leaves on the left side had brown margins, the leaves on the right side were green.

In 2010 the side difference was visible already on 3 July. Southwards (left) visual contact to phone masts Ludwigstr. 2 (275 m) und Ludwigstr. 25 (190 m). Phone mast Heiliggrabstr. 15 (280 m) westwards was hidden behind trees at that time.

Measurements on 30 May 2012 standing at the top of a ladder: south side 970 µW/m² (0.60 V/m), north side 130 µW/m² (0.22 V/m). On 5 Aug. 2013 the maple had already lost leaves on the left side.
On 8 June 2008 it was noticed, that the northern side of a group of maples (on the right) was damaged. It was the side facing the mobile phone antennas situated on the building. Side beams of the sector antennas reach the maples.

In May 2012 the damage had increased on the left side. The right side showed no damage.

On 30 May 2012 measurements were carried out with the EMF-broadband analyzer HF 59B (27 MHz – 3300 MHz), UBB27_G3, from Gigahertz Solutions (measurement of the sum, peak values of power flux density in μW/m²). Value left side: 680 μW/m², value right side: 80 μW/m². This difference can be explained by attenuation within the tree. A part of the RF-EMF is absorbed from the leaves, a part is reflected, scattered and diffracted.
Maple, Berliner Ring (2013-2015)

View from the east
On 13 May 2013 crown transparency was observed in the upper left section. Phone mast Pödeldorfer Straße 144 (height 23 m, 18 sector antennas) in a distance of 77 m.

On 7 June 14 dead branches were seen in the upper left section. Leaves on the left side were brown.

On 4 June 15 the damage had increased. Measurements were carried out on 14 June 2015.
Maple at the Cathedral square (2010-2011)

Postcard: View from St. Martin to the Cathedral, the New Residence, Altenburg and the maple

Since 2008 early browning on the eastside.

Since 2011 severe crown damage.

Visual contact to phonemast Grüner Markt 23 (440 m).

Broken branches besides passing tourists.
On 29 August 2008 crown transparency in the upper right section was remarked. Visual contact to phone mast Heinrichsdamm 33 a (height 17 m, 6 sector antennas) in a distance of 177 m was given.

On 25 September 2009 the maple had lost its leaves in the upper right section too early in the year.

On 25 August 2010 some little branches were dead.
On 23 July 2014 more branches died off. Birch with crown transparency in the background.

On 30 July 2015 dead branches on the south side had been cut. The birch had already lost leaves. The phone mast had been enlarged (12 antennas). Measurements with the help of a telescopic rod.

On 1 July 2016 the dead birch had been felled. The injury to the maple will go on.

The lime tree on the left is shielded, the maple on the right is exposed. Damage on the exposed side.

In May 2011 the situation was similar. Dead twigs and branches on the top.

In September 2015 the lime tree has dense, green foliage but the maple is brown and has lost leaves.
In May 2011 dead twigs and branches on treetop and on the northeast side, facing the antenna.

On 14 September 2015 the difference between the northeast side and the southwest side is considerable. The measurements were done with the help of a telescopic rod.
Maple, Hallstadt, cemetery (2008-2016)

142 m

View from the southeast

On 27 June 2008 dead branches were observed on the left side of the maple. Visual contact was given to phone mast Landsknechtstr. 23 (height 14-17 m, 6 sector antennas) in a distance of 142 m.

View from the west

On 5 October 2015 parts of the left side had been cut off. In the middle the tree was transparent and brown. The right side had dense, green foliage. Measurements with the help of a telescopic rod.

Numerous trees in and around the cemetery have been felled in the last years - again in winter 2015.
Hornbeam, Hauptsanorstr. 85 (2011-2012)

Mobile phone site Hauptsanorstr. 26 a with 18 sector antennas

View from the northeast

On 8 July 2011 leaves on the left (southeast) side of the hornbeam had brown margins. Visual contact was given to phonemast Hauptsanorstr. 26a in a distance of 450 m.

View from the northwest

Scale mW/m²
Measurement on the southeast side, visual contact to the phonemast.
On 23 May 2012 measurements were carried out
Measured value southeast side: 1100 µW/m², northwest side: 0 µW/m².
Lime tree, Hotel Residenzschloss (2010-2015)

View from northeast over lime to the former Monastery St. Michael with phonemast

On 20 August 2014 the left side was green. The right side and the top were brown or leafless.

Looking from northwest the difference between the left and the right side was sharp.

In 2015 the situation was similar.
Measurements were done on 25.09.15.
On 26 September 2009 the lime tree was brown on its right (east) side.

On 24 September 2015 the right side was brown and had already lost leaves.

On 9 October 2015 the right side was leafless.

The phone mast had now 18 sector antennas.
In August 2008 the first chestnut was brown and on treetop leafless; the second chestnut was green.

In 2010 the first chestnut had lost already many leaves. The browning began at the leaf margins.

Measurements on 30 July 2015 in front (west) of chestnut 1: 400 µW/m², behind (east): 20 µW/m². Visual contact from the first chestnut to phone mast Grüner Markt 23 (height 35 m, 23 antennas).
Locust tree, Gutenbergstraße (2008-2015)

View from northeast

On 29 August 2008 the beginning difference between the left (southeast) and the right side (northwest) was observed. Visual contact to phone mast Gutenbergstraße (height 39-46 m, 22 antennas).

On 1 August 2012 branches in the upper part of the right side were dead

On 14 July 2015 measurements in a height of 3 m had been carried out with the help of a ladder.
In August 2010 the remarkable side difference was noticed. Visual contact to the Altenburg Castle in the north was given (distance 555 m). 17 sector antennas.

In 2012 the side difference was seen already in May. The left (southern) half had dense foliage. The right (northern) half showed defoliation. Measurements were carried out on 29 May 2012.

In 2014 the whole mountain ash was transparent and partly leafless already in July. Damages at other trees in this southwestern part of Bamberg had increased also.

In May 2016 the tree had been cut down.
This Box elder maple in the garden of Kindergarten St. Heinrich had severe damage on the left side. In summer and in autumn 2013 the gardener had cut off several branches. Visual contact was given to phonemast Pödeldorfer Str. 144 in a distance of 125 m.
Walnut tree, Garden of the former Benedictine monastery of Michelsberg (2012-2015)

On 12 July 2012 the walnut tree showed severe crown transparency.

On 6 June 2014 many branches on the north and on the east side were dead.

On 25 September 2015 the walnut tree had leaves only on its southwest side.

On the Concert and Congress Hall the number of sector antennas had increased from 6 up to 21.
On 25 August 2009 the unilateral damage of the tree of life was observed. From the right side visual contact is given to phone mast Breitäckerstr. 9 (height 27 m, 12 antennas).

On 25 April 2012 the power flux density on the left side was in the range between 30 and 130 µW/m², on the right side between 360 and 1600 µW/m². The tree attenuates the radiation.

On 13 August 2010 the damage was similar. On the cemetery and in the surrounding gardens numerous trees and shrubs with severe crown damage were found.
View from the southwest to pine tree, tree of life and maple. On 16 June 2011 the leaves on the south side of the maple had brown margins, the south side of the tree of life was leafless and the south side of the pine tree had lost many needles.

Visual contact was given to phone mast Hainstr. 39 (height 18 m, 6 antennas) in a distance of 395 m.

On 13 September 2013 the damages of the tree of life and of the maple had increased. The phone mast had been enlarged up to 21 sector antennas. Measurements were carried out at the tree of life in 2015. South side: 120 µW/m², north side 10 µW/m².
Douglas fir, B22/Strullendorfer Straße (2007-2014)

View from the south to the Douglas fir and phone mast Gutenbergstr. 20. On 24 July 2007 an unusual distribution of damage was seen. The tree had lost its needles in the upper part and on the right side.

Lime tree, Am Kranen (2006-2011)

In Sept. 2006 a difference between left and right side was noticed. The right side was brown and partly leafless; the left side green with dense foliage.

On 5 September 2007 the difference between left and right had increased.

On 26 Sept. 2009 branches on the right were dead. On 17 Sept. 2011 dead parts had been cut off.

RF-EMF from phone mast Grüner Markt 23 (height 28-35 m, 23 sector antennas) reach the tree.
Lime tree, Michelsberg Monastery (2007-2012)

View from the west

On 12 Sept. 2007 beginning crown transparency was seen. Some leaves turned yellow too early. A phone mast is situated in the roof of the former monastery. The RF-EMF hit the lime tree. The chestnut in the background, which is located in a radio shadow, is still green.

On 19 August 2012 holes were noticed in the upper crown. The chestnut was healthy.
On 12 September 2007 the view from the south showed a difference between the left and the right side in the upper part. The leaves on the right side on top were already brown.

On 2 October 2009 the differences between left and right and top and down were more pronounced.

On 19 October 2011 it was visible that branches had been cut. There were no construction works which could have injured the roots. In the year 2005 three sector antennas were added to the existing Nondirectional antenna. The Lime tree stands in the radiation field of the 230°-sector antenna.
Chestnuts, Altenburg (2007-2009)

On 12 Sept. 2007 the difference between the two chestnuts was noticed and directional antennas

On 30 August 2008 chestnut left was green, chestnut right yellowish brown (leaf margins brown).

On 20 Oct. 2009 chestnut left still had leaves. Chestnut right was leafless. The chestnut on the right is probably hit by side beams. She attenuated radiation and protected the chestnut left from RF-EMF.
Lime tree, Am Hahnenweg/Würzburger Straße (2007-2013)

View from the north
The early loss of leaves on the west side was noticed. From the west (Altenburg) RF-EMF reach the tree. Additionally directional radio link crosses here.

On 14 August 2011 it was noticed, that dead twigs and branches had again been cut off.

View from the south
In the year 2010 the brown colouring and the loss of leaves on the west side were observed already on August 22.
On the west side branches hat been cut

On 30 Sept.2013 left side leafless, right side leafy.
Nearby a further phonemast was installed in 2014.
On 18 September 2007 the birch had already lost many leaves.

In February 2011 dead parts on the top had been removed. The tree on the northwest side had been cut down. The tower of the Altenburg is visible. The conifer had lost needles on the exposed side.

In the following years damage in the upper part of the birch was observed.

This perspective shows that the damage has begun on the side which is oriented towards the Altenburg (distance 1040 m) with 17 sector antennas.
In May 2008 the chestnut had grown no leaves on its left side. Visual contact was given to phone mast Hainstr. 39, which started operating in 2007.

In July some leaves were already brown. One dead branch had been cut off.

In August 2008 the whole chestnut was brown.

In October 2008 the chestnut had been felled.
Mountain ashes, Breitäckerstraße (2008-2014)

View from the northwest

On 7 June 2008 the difference between the two mountain ashes in a garden was noticed. On 13 August 2010 the difference had increased. Many branches of the ash on the right were dead. The ash was felled.

As a result the ash on the left was not shielded anymore. On 31 August 2013 the left ash had died back also.

In the summer 2014 the second mountain ash had been felled too.
This difference between the two mountain ashes in 2008 can be explained by the attenuation of radiation through leaves. In the year 2008 a great amount of the RF-EMF was absorbed from the ash on the right and reflected, scattered or diffracted. Therefore the exposure of the ash on the left was initially much lower than the exposure of the ash on the right. However, after the ash on the right had been felled, the radiation increased considerably.

In the garden numerous other deciduous trees and conifers showing damage were found. In the southern property line which is close to phonemast Breitäckerstr. 9, a gap in the tree population had occurred already in 2007. Measurement in the garden on 22 November 2004: 1400 µW/m². The phonemast is situated in a distance of 110 m from house and garden of a family with four children. The whole family suffered since 2000 from unexplainable symptoms.

Phone mast Breitäckerstraße 9 (07.07.10): height 25.7 m – 26.8 m, 12 sector antennas (2 x 30°, 60°, 95°, 2 x 150°, 180°, 215°, 2 x 270°, 300°, 335°) und directional radio.

View from southwest to the cemetery of Gaustadt and the phone mast Breitäckerstr. 9 (yellow). The effects on trees could already be recognized through the early yellowing in the year 2004. The mountain ashes, which have been cut down meanwhile, are marked red.
Spruce trees and birch, Zollnerstraße (2008-2016)

In June 2008, the spruce, which was closer to the phone mast (distance of 55 m), lost many needles in the upper part. The birch did not grow upwards.

In July 2011 the loss of needles had increased. The birch did not prosper.

In August 2013 most needles had gone. The phone mast was enlarged. Measurement: 3280 µW/m².
In April 2014 the situation was similar.

In April 2015 the spruce on the right had been felled.

In May 2016 the birch had died off. The spruce on the left began to lose needles.
Maple, Robert-Bosch-Straße (2008-2013)

In June 2009 the damage on the right (east) side and on the top was noticed. The distance to the phone mast was 320 m.

In 2009 the damage had increased. Later in 2012 the maple was felled.

In 2011 further decline. In July 2012 the dead branch broke during a storm. Measurement on 21.07.12: 1680µW/m².

Later in 2012 the maple was felled. Large parts of the Virginia Creeper on the east side of the house died off.
In July 2008 the unilateral damage of the maple tree was seen. Visual contact was given to the mobile phone site Haupts Moorstr. 26a. The maple tree showed even without leaves that damage had taken place. The dead branches had been cut off. On 7 August 2010 the leaves on the left side were brown.

Road safety was not ensured anymore because of the asymmetrical shape. In spring 2011 the maple tree was felled.
View from the crossing Haupts Moorstraβe/ Seehofstraβe on the damaged maple tree to the right, mobile phone site Haupts Moorstr. 26 a and two conifers with growth disturbance on the top. Mounting height: 26.6 m – 31.1 m, eighteen sector antennas (3 x 0°, 2 x 60°, 95°, 3 x 120°, 140°, 180°, 215°, 3 x 240°, 270°, 300°, 335°).

Around this mobile phone site numerous tree damages in gardens often beginning on the side, which was facing the antennas, were documented since 2008. All existing trees were affected: pear, cherry, walnut, birch, lime tree, beech, oak, hornbeam, field maple, tree of life, yew, sugarloaf spruce and various conifers. Only in the radio shadow of buildings one could see healthy trees.

More trees around this site: pages 80, 81, 195, 222, 252, 371-380, 498, 499, 569, 608, 623, 636.

View from the west
Unilateral damaged cherry tree in Benkertstraβe with visual contact to the phone mast.

Phone mast Haupts Moorstr.(H), sites of exposed trees (green), of trees in radio shadow (white).
On 8 July 2008 this unilateral damage pattern of a conifer was perplexing.

Over eight years only a slight increase of the damage appeared.

From the conifer on the left visual contact to the phone mast Haupstsmoorstr. 26a is given.
Lime tree, Residenzstraße/Ottoplatz (2008-2013)

On 18 August 2008 loss of leaves and brown colouring was noticed. Only on the left green leaves were seen. In the following time the asymmetrical damage pattern in the crown increased.

In 2011 dead branches on the eastside had been cut off. On 7 July the tree had already lost many leaves. From the east RF-EMF of several phone masts reach the tree (see map).

In 2013 the situation was similar.
Detail from City map Bamberg with Cathedral square, Michelsberg, Concert Hall, Center, Schranne, Wilhelmsplatz and a part of the Haingebiet. The sites of the phone masts (yellow), the main beam directions of the sector antennas (black), sites of exposed trees (green) and sites of trees in the radio shadow of buildings were added (base of the map: City map Bamberg, 23. edition, Städte-Verlag E. v. Wagner & J. Mitterhuber).

View from the southwest
View from the Rosengarten over the lime tree to phone mast Grüner Markt 23.
On its westside the lime tree was still green.
Measurement on 12 July 2010: 3830 µW/m²

On 21 Sept. 2008 the lime tree in the court of the former Dominican Monastery (now Schlenkerla) had still dense foliage. The tree is shielded by the surrounding buildings.
View from the north to poplar and elder. On 18 August 08 the poplar was yellow on the left side. Poplar had lost many leaves on the left side. Visual contact is given to phonemast Gutenbergstr. 20 in a distance of around 2 km, because of the asymmetrical shape road safety was not ensured anymore. In winter 2015 the poplar was felled.

On the left side branches had been cut. In the following years the crown grew asymmetrically. On 22.09.13 the elder had already lost most leaves.
Oak, Brigde in Bamberg-Bug (2008-2014)

View from the northwest

In Oct. 2008 differences concerning defoliation between left and right side and between upper and lower part of the oak were noticed. From left (northeast) radiation of phone mast Gutenbergstr. 20.

In May 2010 crown transparency on the left side and on the top

In July 2014 some branches on the left side and on the top had died off.
In June 2009 the unilaterally damaged birch was seen. More birches had already been felled.

On 06 August 2014 the leaves had turned brown - probably as a result of putting into operation 4 G (LTE Long-Term Evolution).

In winter 2014/2015 the birch had been felled.
Birches, Am Hahnenweg (2009-2016)

View from the east
On 14 June 2009 a slight difference between the south and the north side of the birches was visible. The growth of the conifer was disturbed.

View from the southeast
On 29 May 2012 the unilateral damage and the damage of the treetop had increased.

On 22 June 2010 the difference between the two sides was clearer. Visual contact was given to the phone mast Altenburg (810 m).

From year to year it became worse. In 2016 the birches had been felled.
Walnut, Schoolyard of the Gangolfschool (2009-2014)

In June 2009 crown damage and a difference between the left and the right side was seen. Branches on the right had died off. RF-EMF from northeast (Ludwigstr. 25).

In August 2013 dead parts on the right and on top had been cut off. But the right side was leafless. Phone mast Ludwigstr. 25: height 37 m, 3 (now 12) antennas.

In July 2014 the walnut was felled. Phone mast Ludwigstr. 25: height 37 m, 3 (now 12) antennas.
Lime trees, Heidelsteigschool (2009-2013)

View from the southeast

In June 2009 the difference between the two lime trees on a meadow was perplexing because they stood under largely identical site conditions.

However, there is one difference: from the right RF-EMF from the phone masts Kantstr. 33 (height 43 m, 9 sector antennas) and An der Breitenau 2 (height 28 m, 21 sector antennas) reach the trees. A great amount of the electromagnetic waves is absorbed from the lime tree on the right and reflected, scattered or diffracted. Therefore the exposure of the lime tree on the left is much lower.

On 17 Sept. 13 the lime tree on the right had already lost many leaves. Measurements on 1 Nov. 15.
Birch trees on the bank of the river Regnitz (2009-2013)

View from the southwest to the eastbank of Regnitz. Crown transparency at both birches. The upper half of the left birch had severe damage. From the left side (northwest) RF-EMF (main beams of two 130°-sector antennas) hit the left birch. Phone mast Concert and Congress Hall: height 25 m, 6 sector antennas.

In August 2013 the left birch was felled. Crown transparency at the right birch. In 2014 the phone mast on the Concert hall had been enlarged to 21 sector antennas. In April 2016 it was shocking to see that more trees along the river had been cut down.
In 2007 the phone mast Hainstr. 39 started transmission.

In October 2009 a side difference at the hornbeam was seen: left side almost leafless, right side with dense foliage.

In May 2013 the tree had grown only few leaves on the left.

In 2014 the mobile phone site had been enlarged from 6 to 21 sector antennas. Measured value: 2940 µW/m².
In October 2009 two alders on the eastern side of a larger group of alders had died. The dead alders (marked black) were felled in winter 2009/2010. From east RF-EMF are coming from the phone masts Gutenbergstr. (2,3 km) and A 73 at Strullendorf (4 km), from the television station (also DVB-T) Kälberberg (10 km) and from the radio station (DAB) Geisberg (11 km).

In the following period the next alders died (purple). In winter 2012/13 these were felled also. Since 2004 severe tree damages occurred on the campsite. The damages increased rapidly. All tree species were affected. Numerous trees were felled (p. 170, 367, 570, 585, 605, 629).
Maple trees, Playground at the Hospital (2010-2014)

Maple trees at the playground of the hospital. On 1 July 2010 the difference between the maple trees on the right and on the left was noticed. Visual contact is given to the phone mast Altenburg Castle in a distance of 2 km.

On 2 August 2013 the maple tree on the right side was brown and had already lost leaves.

On 29 Aug. 2014 the situation was similar. Additionally, new planted trees nearby did not grow well.
Silver maple trees, Hospital (2010-2014)

Main beam and side beams, reflection on a building. Detail from „Mobilfunk“ STMUGV (2007)

View from the northeast

Silver maples on the left of the playground above. On 1 July 10 crown transparency at the two trees on the right, whereas the tree in the middle had dense foliage. The silver maple on the left had in turn sparse leaves. The reflections of the RF-EMF on the facade could be the cause (see figure).

On 23 August 2012 the impression was similar. Only the tree in the middle was in full leaf.

On 29 August 2014 furthermore, the trees don't develop well except the tree in the middle.
Locust trees, Don-Bosco-Straße (2010-2013)

In Oct. 2010 considerable difference between the two trees. Locust tree on the right leafless; visual contact to phone mast. View from the southeast

In 2011 the locust tree on the right died off and was felled.

The second locust tree was felled in winter 2012/2013. Numerous trees in the radiation field of this phone mast are damaged or already felled.

Phone mast Margaretendamm 28 (height 26 m, 6 sector antennas)

Measurement: 2920 µW/m²

The phone mast was enlarged.
View from the southwest
On 12 Oct. 2010 the great contrast between the right and the left lime tree was noticed. From the east RF-EMF are coming from the phone masts Gutenbergstr. (2,3 km) and A 73 at Strullendorf (4 km), from the television station (also DVB-T) Kälberberg (10 km) and from the radio station (DAB) Geisberg (11 km).

On 3 Oct. 2011 the lime on the right was not brown, as in the year before, but transparent.

In 2013 branches had died and broke off.

It is dangerous under the trees
In February 2011 loss of needles on the left side. On the right side many needles were brown. Visual contact to phone mast Altenburg (632m).

In May 2012 the loss of needles had increased. In August 2012 only a few brown needles were left. Measurement: 250 µW/m²

In 2013 the pine was felled.
On 3 June 2011 the two chestnuts on the westside of the Beer Garden were brown. RF-EMF from the three phone masts Wilhelmsplatz, Theresienstraße and Erlichstraße interfere at this place.

On 20 Sept. 2012 the two chestnuts were leafless; the other chestnuts and a lime tree still had leaves.

On 25 August 2014 the stem of one chestnut was cut; the second chestnut was leafless. The third chestnut began to turn brown. RF-EMF come not only from the west but also from the southeast through gaps between the buildings (distances 432 m, 622 m, 633 m).
On 27 August 2012, during the horticultural show, the crown transparency on the left side was observed. From this perspective the difference between the north and the south side is better recognizable. RF-EMF from the northwest and the north (three phone masts in the port) reach the tree.

In June 2015 crown transparency had increased. In 2014/15 LTE (4 G) was added to many phone masts. A further phone mast started transmission.

In July 2016 the beech was almost leafless.
Lime tree, Lange Straße/Südliche Promenade (July 2013 - April 2014)

View from the southwest
On 15 July 2013 leaves turned yellow top left.  On 14 August 2013 the section top left was leafless.

On 7 Sept. 2013 the whole left side had turned brown. On 30 Sept. 13 the lime had lost many leaves.
View from the south

View from the road intersection at the Schönleinsplatz to the lime tree behind the advertising pillar. In the background on the left a gap between buildings is visible.

View from the southeast
Looking from the southern end of the green area at the Schönleinsplatz to the lime tree, a part of the phone mast Grüner Markt 23 is visible.

View from the southwest
In winter 2013/2014 branches had been cut.
Maple, Babenbergerring (2014-2016)

View from the southeast
In July 2014 the upper right section showed damage. In September 2014 many leaves had fallen.

In August 2015 the damage was similar. In July 2016 the damage had increased.

Visual contact is given to the phone mast Altenburg in a distance of 630 m.