

Apéndice E

Código de software de ayuda en Visual Basic 2005

```
Public Class Form1
```

```
    Dim checkcont As Integer = 0, foto = 0
```

```
    Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles Button1.Click
```

```
        Dim d As Double = 0, f As Double = 0, T As Double = 289
```

```
        Dim teta As Double, fp As Double, fs As Double
```

```
        Dim e0 As Double, e1 As Double, e2 As Double, euno As Double, edos As
```

```
Double
```

```
        'Dim n As Double
```

```
        Dim k1 As Double, Yc As Double, M As Double
```

```
        Dim haj1 As Double, hbj1 As Double, hcj1 As Double, haj2 As Double
```

```
        Dim hbj2 As Double, hcj2 As Double, haj3 As Double, hcj3 As Double
```

```
        Dim hbj3 As Double, hai1 As Double, hbi1 As Double, hci1 As Double
```

```
        Dim hai2 As Double, hbi2 As Double, hci2 As Double, hbi4 As Double
```

```
        Dim hai4 As Double, hbi3 As Double, hci3 As Double, hai3 As Double
```

```
        Dim hci4 As Double, hmk As Double, hck As Double, vaj1 As Double
```

```
        Dim vcj1 As Double, vaj2 As Double, vbj2 As Double, vcj2 As Double
```

```
        Dim vbj1 As Double, vaj3 As Double, vbj3 As Double, vcj3 As Double
```

```
        Dim vai1 As Double, vbi1 As Double, vci1 As Double, vai2 As Double
```

```
        Dim vbi2 As Double, vci2 As Double, vbi4 As Double, vai3 As Double
```

```
        Dim vbi3 As Double, vci4 As Double, vci3 As Double, vai4 As Double
```

```
        Dim vmk As Double, vck As Double, vma As Double, vca As Double
```

```
        Dim hlogk As Double, vlogk As Double, ha As Double, hma As Double
```

```
        Dim hca As Double, va As Double, hk As Double, vk As Double
```

```
        Dim hyr As Double, vyr As Double, r As Double
```

```
        Dim p As Double, a As Double, b As Double, g22 As Double, g557 As
```

```
Double
```

```
        Dim lw1 As Double, lw2 As Double, lw3 As Double, lw4 As Double
```

```
        Dim n As Double, n1 As Double, n2 As Double
```

```
        Dim rp As Double, rt As Double, yo As Double, yo154 As Double
```

```
        Dim yw As Double, g752 As Double, lw5 As Double
```

```
        If TextBox1.Text = "" Then
```

```
            TextBox1.Text = 1
```

```
        End If
```

```
        If TextBox2.Text = "" Then
```

```
            TextBox2.Text = 9100
```

```
        End If
```

```
        If TextBox5.Text = "" Then
```

```
            TextBox5.Text = 15
```

```
        End If
```

```
        d = TextBox1.Text
```

```
        f = TextBox2.Text
```

```
        T = TextBox5.Text
```

```
        If CheckBox1.Checked = True Then
```

```
            TextBox3.Text = 32.44 + 20 * Math.Log10(f) + 20 * Math.Log10(d)
```

```
        End If
```

```
        If CheckBox2.Checked = True Then
```

```
            If TextBox4.Text = "" Then
```

```
                TextBox4.Text = "0.2"
```

```
            End If
```

```

M = TextBox4.Text
f = TextBox2.Text / 1000
T = TextBox5.Text + 273.15
teta = 300 / T
fp = 20.09 - 142 * (teta - 1) + 294 * (teta - 1) ^ 2
fs = 590 - 1500 * (teta - 1)
e0 = 77.6 + 103.3 * (teta - 1)
e1 = 5.48
e2 = 3.51
euno = (e0 - e1) / (1 + (f / fp) ^ 2) + (e1 - e2) / (1 + (f / fs)
^ 2) + e2
edos = f * (e0 - e1) / (fp * (1 + (f / fp) ^ 2)) + f * (e1 - e2) /
(fs * (1 + (f / fs) ^ 2))
n = (2 + euno) / edos
k1 = (0.819 * f) / (edos * (1 + n ^ 2))
Yc = M * k1

TextBox6.Text = Yc * d

End If

If CheckBox3.Checked = True Then
  If TextBox8.Text = "" Then
    TextBox8.Text = 0.5 'Rain rate en (mm/H) en promedio varía
de 0 a 2
  End If
  r = TextBox8.Text
  f = TextBox2.Text / 1000
  'DATOS POLARIZACIÓN HORIZONTAL
  haj1 = 0.3364
  hbj1 = 1.1274
  hcj1 = 0.2916
  haj2 = 0.752
  hbj2 = 1.6644
  hcj2 = 0.5175
  haj3 = -0.9466
  hbj3 = 2.8496
  hcj3 = 0.4315

  hai1 = 0.5564
  hbi1 = 0.7741
  hci1 = 0.4011

  hai2 = 0.2237
  hbi2 = 1.4023
  hci2 = 0.3475

  hai3 = -0.1961
  hbi3 = 0.5769
  hci3 = 0.2372

  hai4 = -0.02219
  hbi4 = 2.2959
  hci4 = 0.2801

  hmk = 1.9925
  hck = -4.4125
  hma = -0.08016
  hca = 0.8993
  'DATOS POLARIZACIÓN VERTICAL
  vaj1 = 0.3023
  vbj1 = 1.1402
  vcj1 = 0.2826
  vaj2 = 0.779
  vbj2 = 1.6723
  vcj2 = 0.5694

```

```

vaj3 = -1.0022
vbj3 = 2.94
vcj3 = 0.4823

vai1 = 0.5463
vbi1 = 0.8017
vci1 = 0.3657

vai2 = 0.2158
vbi2 = 1.408
vci2 = 0.3636

vai3 = -0.1693
vbi3 = 0.6353
vci3 = 0.2155

vai4 = -0.01895
vbi4 = 2.3105
vci4 = 0.2938

vmk = 1.971
vck = -4.4535
vma = -0.07059
vca = 0.8756

'log K,
hlogk = (haj1 * Math.Exp(-(((Math.Log10(f) - hb1) / hcj1) ^ 2)))
+ (haj2 * Math.Exp(-(((Math.Log10(f) - hb2) / hcj2) ^ 2))) + (haj3 *
Math.Exp(-(((Math.Log10(f) - hb3) / hcj3) ^ 2))) + hmk * Math.Log10(f) + hck
vlogk = (vaj1 * Math.Exp(-(((Math.Log10(f) - vb1) / vcj1) ^ 2)))
+ (vaj2 * Math.Exp(-(((Math.Log10(f) - vb2) / vcj2) ^ 2))) + (vaj3 *
Math.Exp(-(((Math.Log10(f) - vb3) / vcj3) ^ 2))) + vmk * Math.Log10(f) + vck

ha = (hai1 * Math.Exp(-(((Math.Log10(f) - hbi1) / hci1) ^ 2))) +
(hai2 * Math.Exp(-(((Math.Log10(f) - hbi2) / hci2) ^ 2))) + (hai3 * Math.Exp(-
(((Math.Log10(f) - hbi3) / hci3) ^ 2))) + (hai4 * Math.Exp(-(((Math.Log10(f) -
hbi4) / hci4) ^ 2))) + hma * Math.Log10(f) + hca
va = (vai1 * Math.Exp(-(((Math.Log10(f) - vbi1) / vci1) ^ 2))) +
(vai2 * Math.Exp(-(((Math.Log10(f) - vbi2) / vci2) ^ 2))) + (vai3 * Math.Exp(-
(((Math.Log10(f) - vbi3) / vci3) ^ 2))) + (vai4 * Math.Exp(-(((Math.Log10(f) -
vbi4) / vci4) ^ 2))) + vma * Math.Log10(f) + vca

'ÑCálculo de Hk y Vk

hk = 10 ^ hlogk
vk = 10 ^ vlogk

'Atenuación específica por lluvia Yr:

hyr = hk * r ^ (ha)      'polarización horizontal
vyr = vk * r ^ (va)      'polarización vertical

TextBox7.Text = hyr * d

End If

If CheckBox4.Checked = True Then

If TextBox10.Text = "" Then
    TextBox10.Text = 1018.1
End If

p = TextBox10.Text
'Atenuación específica por aire seco y vapor de agua

```

```

'A=Yo+Yw
f = TextBox2.Text / 1000 'frecuencia en gigahertz

'calculo de atenuación por aire seco Yo
'Datos
p = 1018.1 'presión atmosférica en (hPa)
T = TextBox5.Text ' temperatura en grados centígrados.

rt = 288 / (275 + T)
rp = p / 1013

n = 0 'N es 0 para frecuencias menores a 60ghz y -15 para mayores
a 60ghz

n1 = 6.7665 * (rp ^ (-0.505)) * (rt ^ (0.5106)) * Math.Exp(1.5663
* (1 - rt)) - 1
n2 = 27.8843 * (rp ^ (-0.4908)) * rt ^ (0.8491) * Math.Exp(0.5496
* (1 - rt)) - 1

a = (Math.Log(n2 / n1)) / Math.Log(3.5)
b = (4 ^ a) / n1

yo154 = 2.128 * (rp ^ 1.4954) * (rt ^ -1.6032) * Math.Exp(-2.528 *
(1 - rt))

yo = ((7.34 * rp ^ 2 * rt ^ 3) / (f ^ 2 + 0.36 * rp ^ 2 * rt ^ 2)
+ (0.3429 * b * yo154) / ((54 - f) ^ a + b)) * f ^ 2 * 10 ^ (-3)

'calculo de atnuación por vapor de agua Yw
'datos
p = 7.5 'densidad de vapor de agua 7.5 ejemplo en recomendación.

'calculo de variables necesarias
g752 = 1 + ((f - 752) ^ 2) / ((f + 752) ^ 2)
g557 = 1 + ((f - 557) ^ 2) / ((f + 557) ^ 2)
g22 = 1 + ((f - 22.235) ^ 2) / ((f + 22.235) ^ 2)

lw5 = 0.955 * rp * rt ^ 0.68 + (0.006 * p)
lw4 = 0.9543 * rp * rt ^ 0.68 + (0.0061 * p)
lw3 = 0.9561 * rp * rt ^ 0.67 + (0.0059 * p)
lw2 = 0.95 * rp * rt ^ 0.69 + (0.0061 * p)
lw1 = 0.9544 * rp * rt ^ 0.69 + (0.0061 * p)

'calculo de Yw

yw = ((3.13 * 10 ^ (-2)) * rp * rt ^ 2 + (176 * 10 ^ (-3) * p * rt
^ 8.5) + rt ^ 2.5 * ((3.84 * lw1 * g22 * Math.Exp(2.23 * (1 - rt))) / ((f -
22.235) ^ 2 + 9.42 * lw1 ^ 2) + ((10.48 * lw2 * Math.Exp(0.7 * (1 - rt))) /
((f - 183.31) ^ 2 + 9.48 * lw2 ^ 2)) + ((0.078 * lw3 * Math.Exp(6.4385 * (1 -
rt))) / ((f - 321.226) ^ 2 + 6.9 * lw3 ^ 2)) + ((3.76 * lw4 * Math.Exp(1.6 *
(1 - rt))) / ((f - 325.153) ^ 2 + 9.22 * lw4 ^ 2)) + ((26.36 * lw5 *
Math.Exp(1.09 * (1 - rt))) / ((f - 380) ^ 2)) + ((17.87 * lw5 * Math.Exp(1.46
* (1 - rt))) / ((f - 448) ^ 2)) + ((883.7 * lw5 * g557 * Math.Exp(0.17 * (1 -
rt))) / ((f - 557) ^ 2)) + ((302.6 * lw5 * g752 * Math.Exp(0.41 * (1 - rt))) /
((f - 752) ^ 2)))) * f ^ 2 * p * 10 ^ (-4)

a = yo + yw
TextBox9.Text = a * d

End If

If CheckBox6.Checked Then
    TextBox11.Text = 5.75 * d * 1000
End If

If CheckBox7.Checked Then
    TextBox12.Text = 25.33 * 1000 * d
End If

```

```

        If CheckBox8.Checked Then
            TextBox13.Text = 7.64 * 1000 * d
        End If
    End Sub

    Private Sub CheckBox1_CheckedChanged(ByVal sender As System.Object, ByVal
e As System.EventArgs) Handles CheckBox1.CheckedChanged
        If CheckBox1.Checked = True Then
            Label4.Visible = True
            TextBox3.Visible = True
            TextBox1.Enabled = True
            TextBox2.Enabled = True
            Button1.Enabled = True
            checkcont = checkcont + 1
        Else
            checkcont = checkcont - 1
            TextBox1.Enabled = False
            TextBox2.Enabled = False
            Label4.Visible = False
            TextBox3.Visible = False
            If checkcont = 0 Then
                Button1.Enabled = False
            End If
        End If
    End Sub

    Private Sub CheckBox2_CheckedChanged(ByVal sender As System.Object, ByVal
e As System.EventArgs) Handles CheckBox2.CheckedChanged

        If CheckBox2.Checked = True Then
            checkcont = checkcont + 1
            TextBox1.Enabled = True
            TextBox6.Visible = True
            Label7.Visible = True
            TextBox2.Enabled = True
            TextBox4.Enabled = True
            TextBox5.Enabled = True
            Button1.Enabled = True
            TextBox4.Visible = True
            Label6.Visible = True
            TextBox5.Visible = True
            Label5.Visible = True
        Else
            checkcont = checkcont - 1
            Label7.Visible = False
            TextBox6.Visible = False
            TextBox1.Enabled = False
            TextBox2.Enabled = False
            TextBox4.Enabled = False
            TextBox5.Enabled = False
            TextBox4.Visible = False
            Label6.Visible = False
            TextBox5.Visible = False
            Label5.Visible = False

            If checkcont = 0 Then
                Button1.Enabled = False
            End If
        End If
    End Sub
End Sub

```

```

Private Sub CheckBox3_CheckedChanged(ByVal sender As System.Object, ByVal
e As System.EventArgs) Handles CheckBox3.CheckedChanged
    If CheckBox3.Checked = True Then
        Label8.Visible = True
        TextBox7.Visible = True
        TextBox1.Enabled = True
        TextBox2.Enabled = True
        TextBox8.Enabled = True
        checkcont = checkcont + 1
        Button1.Enabled = True

        TextBox8.Visible = True
        Label9.Visible = True

    Else
        checkcont = checkcont - 1
        Label8.Visible = False
        TextBox7.Visible = False
        TextBox1.Enabled = False
        TextBox2.Enabled = False
        TextBox8.Enabled = False
        TextBox8.Visible = False
        Label9.Visible = False

        If checkcont = 0 Then
            Button1.Enabled = False
        End If
    End If
End Sub

```

```

Private Sub CheckBox4_CheckedChanged(ByVal sender As System.Object, ByVal
e As System.EventArgs) Handles CheckBox4.CheckedChanged
    If CheckBox4.Checked = True Then
        TextBox1.Enabled = True
        Label10.Visible = True
        TextBox9.Visible = True
        TextBox2.Enabled = True
        TextBox10.Enabled = True
        checkcont = checkcont + 1
        Button1.Enabled = True

        TextBox10.Visible = True
        Label11.Visible = True

    Else
        checkcont = checkcont - 1
        Label10.Visible = False
        TextBox9.Visible = False
        TextBox1.Enabled = False
        TextBox2.Enabled = False
        TextBox10.Enabled = False
        TextBox10.Visible = False
        Label11.Visible = False

        If checkcont = 0 Then
            Button1.Enabled = False
        End If
    End If
End Sub

```

```

Private Sub Form1_Load(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles MyBase.Load
    ToolTip1.SetToolTip(Button1, "Presione para Calcular pérdidas")
    ToolTip3.SetToolTip(PictureBox2, "Bienvenido")

```

```

        ToolTip2.SetToolTip(CheckBox1, "Seleccione para Calcular Pérdidas en
el Espacio Libre en DB. ")
        ToolTip2.SetToolTip(CheckBox2, "Seleccione para Calcular Pérdidas por
Neblina y Nubes de Acuerdo a la Recomendación ITU.840-3 de la International
Telecommunications Union")
        ToolTip2.SetToolTip(CheckBox3, "Seleccione para Calcular Pérdidas por
Lluvia en DB de Acuerdo a la Recomendación ITU.838-2")
        ToolTip2.SetToolTip(CheckBox4, "Seleccione para Calcular Pérdidas por
Gases Atmosféricos Secos y Húmedos")
        ToolTip2.SetToolTip(CheckBox5, "Seleccione para Activar Globos de
Ayuda")
    End Sub

    Private Sub CheckBox5_CheckedChanged(ByVal sender As System.Object, ByVal
e As System.EventArgs) Handles CheckBox5.CheckedChanged
        If CheckBox5.Checked = True Then
            ToolTip2.Active = True
            ToolTip1.Active = True
        Else
            ToolTip2.Active = False
            ToolTip1.Active = False
        End If
    End Sub

    Private Sub ToolTip3_Popup(ByVal sender As System.Object, ByVal e As
System.Windows.Forms.PopupEventArgs) Handles ToolTip3.Popup
        If foto = 0 Then
            PictureBox1.Visible = True
            foto = 1
        Else
            PictureBox1.Visible = False
            foto = 0
        End If
    End Sub

    Private Sub CheckBox6_CheckedChanged(ByVal sender As System.Object, ByVal
e As System.EventArgs) Handles CheckBox6.CheckedChanged
        If CheckBox6.Checked Then
            TextBox11.Visible = True
            TextBox11.Enabled = True
            Label18.Visible = True

        Else
            TextBox11.Visible = False
            TextBox11.Enabled = False
            Label18.Visible = False
        End If
    End Sub

    Private Sub CheckBox7_CheckedChanged(ByVal sender As System.Object, ByVal
e As System.EventArgs) Handles CheckBox7.CheckedChanged
        If CheckBox7.Checked Then
            TextBox12.Visible = True
            TextBox12.Enabled = True
            Label20.Visible = True

        Else
            TextBox12.Visible = False
            TextBox12.Enabled = False
            Label20.Visible = False
        End If
    End Sub

    Private Sub CheckBox8_CheckedChanged(ByVal sender As System.Object, ByVal
e As System.EventArgs) Handles CheckBox8.CheckedChanged
        If CheckBox8.Checked Then

```

```
        TextBox13.Visible = True
        TextBox13.Enabled = True
        Label19.Visible = True
    Else
        TextBox13.Visible = False
        TextBox13.Enabled = False
        Label19.Visible = False
    End If
End Sub

Private Sub Button5_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Button5.Click
    PictureBox1.Visible = True
    PictureBoxX.Visible = False
    pictureBoxZ.visible = False
End Sub

Private Sub Button3_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Button3.Click
    PictureBox1.Visible = False
    PictureBoxX.Visible = True
    PictureBoxZ.Visible = False
End Sub

Private Sub Button2_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Button2.Click
    PictureBox1.Visible = False
    PictureBoxX.Visible = False
    PictureBoxZ.Visible = True
End Sub
End Class
```