# TEST RESULT SUMMARY

## FCC Part 15 Subpart C Section 15.247

| | |
|---|---|
| MANUFACTURER'S NAME | ClimateMinder Incorporated |
| MANUFACTURER'S ADDRESS | 9444 Haines Canyon Avenue<br>Tujunga CA  91042 |
| NAME OF EQUIPMENT | NodeRF V2.1.90 – Wireless Sensor Network RF Node |
| MODEL NUMBER(S) TESTED | V2.1.90 |
| TEST REPORT NUMBER | WC909614 Rev C |
| TEST DATE(S) | 30 March – 08 July 2010 |

TÜV SÜD America Inc, as an independent testing laboratory, declares that the equipment tested as specified above conforms to the applicable EMC requirements of FCC Part 15 Subpart C Section 15.247 *"Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz; General requirements."*

It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics.  Any modifications necessary for compliance made during testing on the above mentioned date(s) must be implemented in all production units for compliance to be maintained.

Date:     09 July 2010
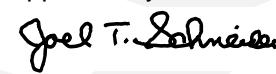
Location:     Taylors Falls MN
              USA

Tested by:

Greg Jakubowski
Senior EMC Technician

**Not Transferable**

Approved by:

Joel T Schneider
Senior EMC Engineer

# EMC TEST REPORT

| | | |
|---|---|---|
| Test Report No. | **WC909614 Rev C** | Date of issue:  09 July 2010 |

Model / Serial No(s) Tested     V2.1.90 / N/A

Product Type     NodeRF V2.1.90 – Wireless Sensor Network RF Node

Manufacturer     ClimateMinder Incorporated

Address     9444 Haines Canyon Avenue

Tujunga CA  91042

Test Result     ■ **Positive**          ☐ **Negative**

**REVISION RECORD**

| REVISION | TOTAL NUMBER OF PAGES | DATE | DESCRIPTION |
|---|---|---|---|
| | 48 | 27 May 2010 | Initial Release |
| A | 50 | 28 June 2010 | ▪ Revisions include additional test data. |
| B | 57 | 09 July 2010 | ▪ Revisions include additional conducted AC power line test data. |
| C | 50 | 09 July 2010 | ▪ Revisions include removal of external antenna data |

**TEST REPORT CONTENTS**                                                                 **Page(s)**

**STATEMENT OF MEASUREMENT UNCERTAINTY**
The data and results referenced in this document are accurate. The reader is cautioned that there is some measurement variability due to the tolerances of the test equipment that can contribute to a nominal product measurement uncertainty. Furthermore, component differences and manufacturing process variability of production units similar to that tested may result in additional product uncertainty. If necessary, refer to the test lab for the actual measurement uncertainty for specific tests.

**TEST EQUIPMENT**
All measurement instrumentation is traceable to the National Institute of Standards and Technology and is calibrated according to internal procedure.

**EMC TEST REGULATIONS:**
**The tests were performed according to the following regulations:**

■ - FCC Part 15 Subpart C Section 15.247

**ENVIRONMENTAL CONDITIONS IN THE LAB**

|  | Actual |
|---|---|
| Temperature: | : 20 – 23°C |
| Atmospheric pressure | : 98 – 99.5kPa |
| Relative Humidity | : 26 – 69% |

**POWER SUPPLY UTILIZED**

| Power supply system | : 3.6VDC Battery Powered |
|---|---|
|  | 110 VAC, 60 Hz from bench power supply |

**SIGN EXPLANATIONS**
□ - not applicable
■ - applicable

## 6 dB Bandwidth
**FCC 15.247(a)(2)**

**Test summary**
The requirements are:  ■ - MET  □ - NOT MET
Test was performed in accordance with the test procedure of FCC KDB Publication 558074
The minimum 6 dB bandwidth = 1.56 MHz

**Test location**
□ - Wild River Lab Large Test Site (Open Area Test Site)
□ - Wild River Lab Small Test Site (Open Area Test Site)
■ - Wild River Lab Tech Area, conducted measurement

**Test equipment**

| TUV ID | Model Number | Manufacturer | Description | Serial Number | Cal Due |
|--------|--------------|--------------|-------------|---------------|---------|
| WRLE03371 | E4440A | Agilent | Spectrum Analyzer | MY43362222 | 11-Aug-10 |

**Test limit**
500 kHz minimum

**Test data**
See following pages

## 6 dB Bandwidth Low Channel



```
    Agilent 11:15:42  Mar 30, 2010

                                                    Δ Mkr2  1.60 MHz
Ref 15 dBm                  #Atten 30 dB                  -0.20 dB
#Peak
Log
10
dB/
Offst
0.5
dB

DI
-1.1
dBm

LgAv

V1 S2
Center 2.450 00 GHz                          Span 10 MHz
#Res BW 100 kHz             VBW 300 kHz       Sweep 1 ms (1001 pts)
```
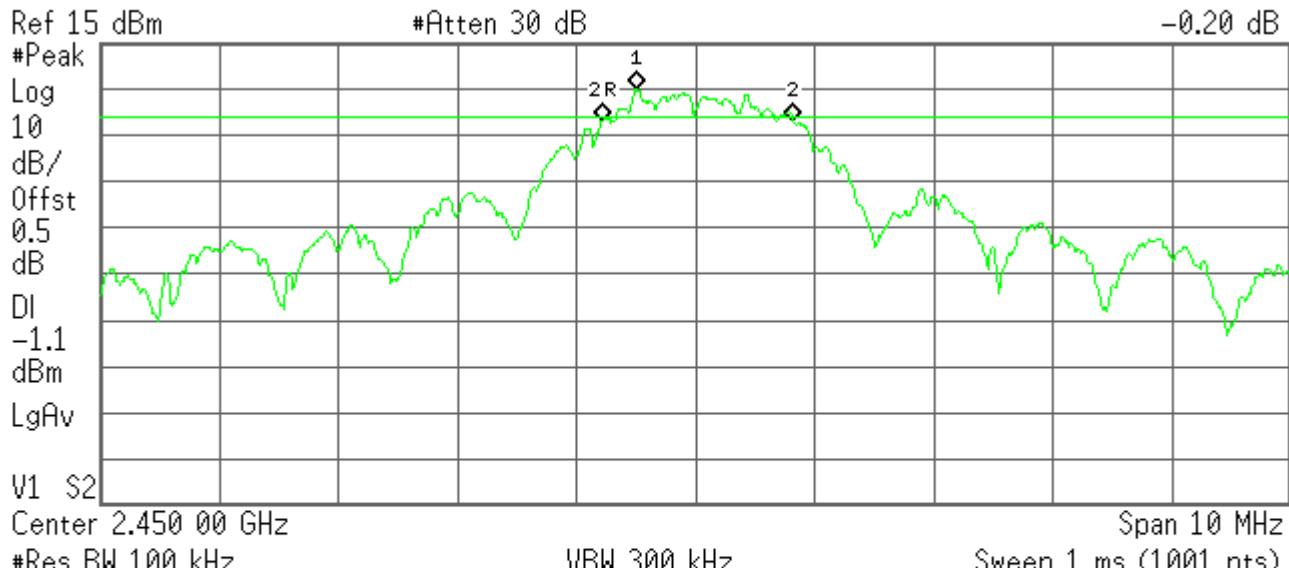
| Marker | Trace | Type | X Axis | Amplitude |
|--------|-------|------|--------|-----------|
| 1 | (1) | Freq | 2.449 50 GHz | 4.86 dBm |
| 2R | (1) | Freq | 2.449 22 GHz | -1.82 dBm |
| 2Δ | (1) | Freq | 1.60 MHz | -0.20 dB |

# 6 dB Bandwidth Mid Channel



Agilent 10:19:46 Mar 30, 2010

Δ Mkr2 1.58 MHz
−0.59 dB

Ref 15 dBm          #Atten 30 dB

#Peak
Log
10
dB/
Offst
0.5
dB

DI
−2.2
dBm

LgAv

V1 S2

Center 2.465 00 GHz                                    Span 10 MHz
#Res BW 100 kHz          VBW 300 kHz          Sweep 1 ms (1001 pts)
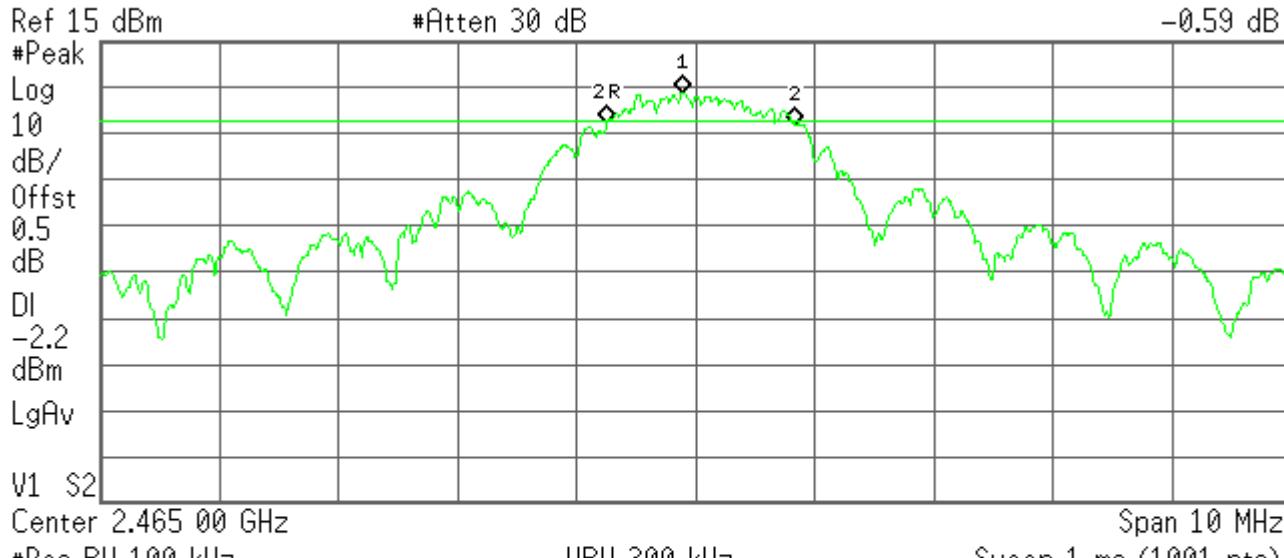
| Marker | Trace | Type | X Axis | Amplitude |
|--------|-------|------|--------|-----------|
| 1 | (1) | Freq | 2.464 89 GHz | 3.81 dBm |
| 2R | (1) | Freq | 2.464 26 GHz | −2.65 dBm |
| 2Δ | (1) | Freq | 1.58 MHz | −0.59 dB |

## 6 dB Bandwidth High Channel

Test Report WC909614 Rev C
TÜV SÜD AMERICA INC     19333 Wild Mountain Road     Taylors Falls MN 55084-1786     Tel: 651 638 0297     Fax: 651 638 0298     Rev. 071107

## Maximum peak output power
**FCC 15.247(b)(3), IC RSS-210 A8.4(4)**

**Test summary**
The requirements are:  ■ - MET  □ - NOT MET
Test was performed in accordance with the test procedure of FCC KDB Publication 558074
Maximum peak output power is 9.26 dBm or 8.45 mW

**Test location**
□ - Wild River Lab Large Test Site (Open Area Test Site)
□ - Wild River Lab Small Test Site (Open Area Test Site)
■ - Wild River Lab Tech Area, conducted measurement

**Test equipment**

| TUV ID | Model Number | Manufacturer | Description | Serial Number | Cal Due |
|--------|-------------|--------------|-------------|---------------|---------|
| WRLE03371 | E4440A | Agilent | Spectrum Analyzer | MY43362222 | 11-Aug-10 |

**Test limit**
1 watt

**Test data**
See following pages

**Peak output power Low Channel**

```
    ☀ Agilent  11:17:50  Mar 30, 2010

                                          Mkr1  2.449 55 GHz
 Ref 15 dBm            #Atten 30 dB            9.26 dBm
 #Peak
 Log
 10
 dB/
 Offst
 0.5
 dB

 DI
 -1.1
 dBm

 LgAv


 V1  S2
 Center 2.450 00 GHz                      Span 10 MHz
 #Res BW 2 MHz           VBW 6 MHz       Sweep 1 ms (1001 pts)
```

| Marker | Trace | Type | X Axis | Amplitude |
|--------|-------|------|--------|-----------|
| 1 | (1) | Freq | 2.449 55 GHz | 9.26 dBm |
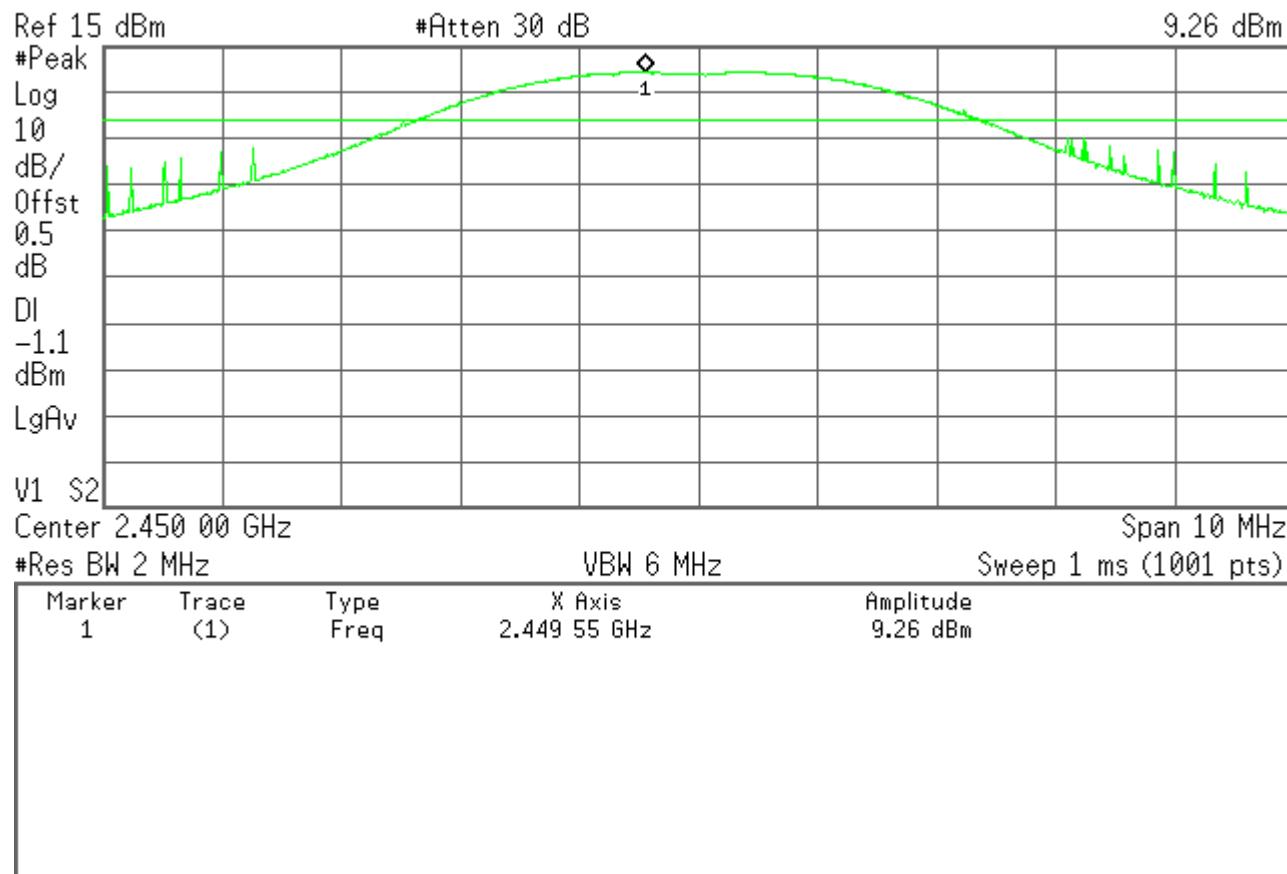
**Peak output power Mid Channel**

※ **Agilent** 10:14:38 Mar 30, 2010

Mkr1  2.465 40 GHz

Ref 15 dBm          #Atten 30 dB                    8.42 dBm

#Peak
Log
10
dB/
Offst
0.5
dB

LgAv

V1 S2

Center 2.465 00 GHz                              Span 10 MHz
#Res BW 2 MHz               VBW 6 MHz        Sweep 1 ms (1001 pts)

| Marker | Trace | Type | X Axis | Amplitude |
|--------|-------|------|--------|-----------|
| 1 | (1) | Freq | 2.465 40 GHz | 8.42 dBm |
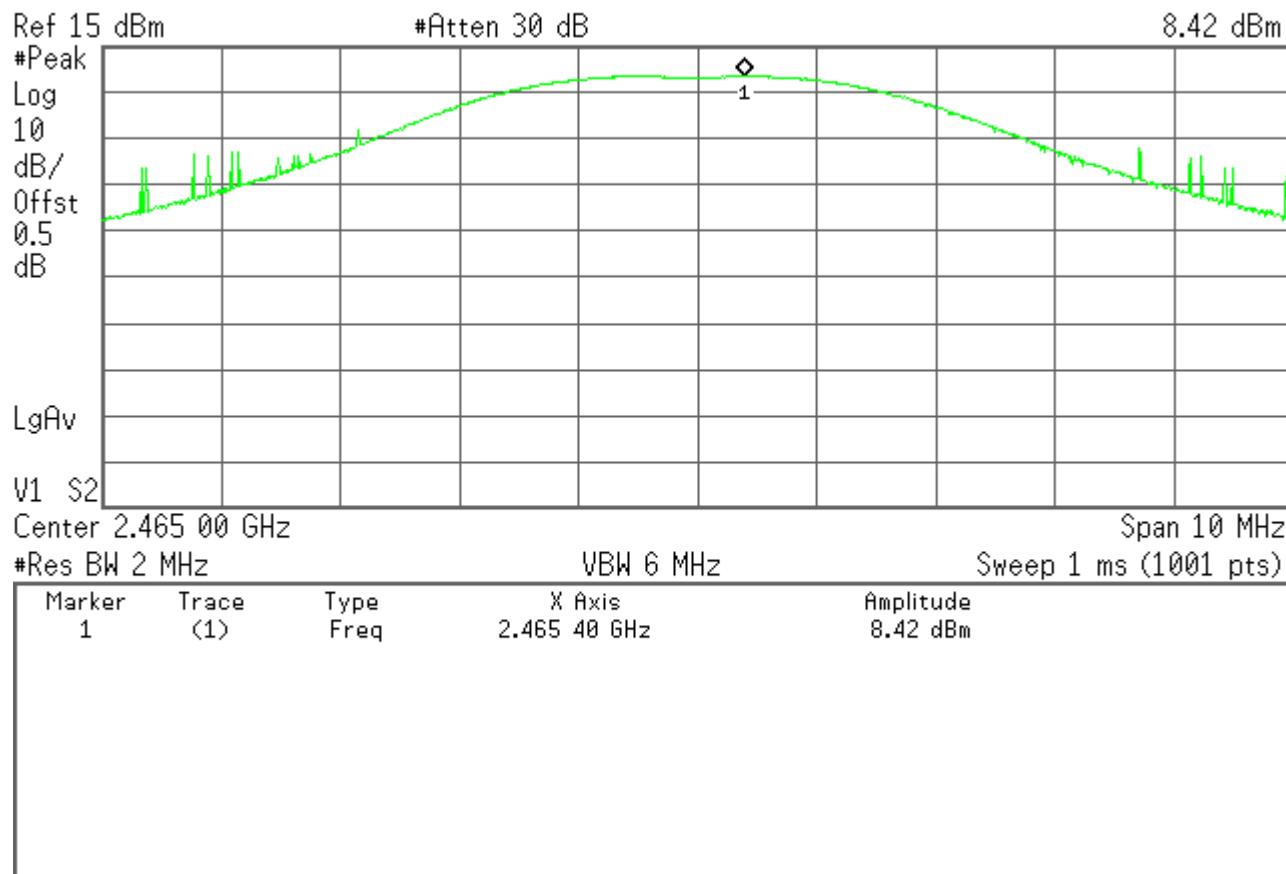
# Peak output power High Channel



Agilent 11:27:17 Mar 30, 2010

Mkr1 2.479 51 GHz
8.32 dBm

Ref 15 dBm          #Atten 30 dB

#Peak
Log
10
dB/
Offst
0.5
dB

LgAv

V1 S2

Center 2.480 00 GHz                    Span 10 MHz
#Res BW 2 MHz          VBW 6 MHz        Sweep 1 ms (1001 pts)

| Marker | Trace | Type | X Axis | Amplitude |
|--------|-------|------|--------|-----------|
| 1 | (1) | Freq | 2.479 51 GHz | 8.32 dBm |
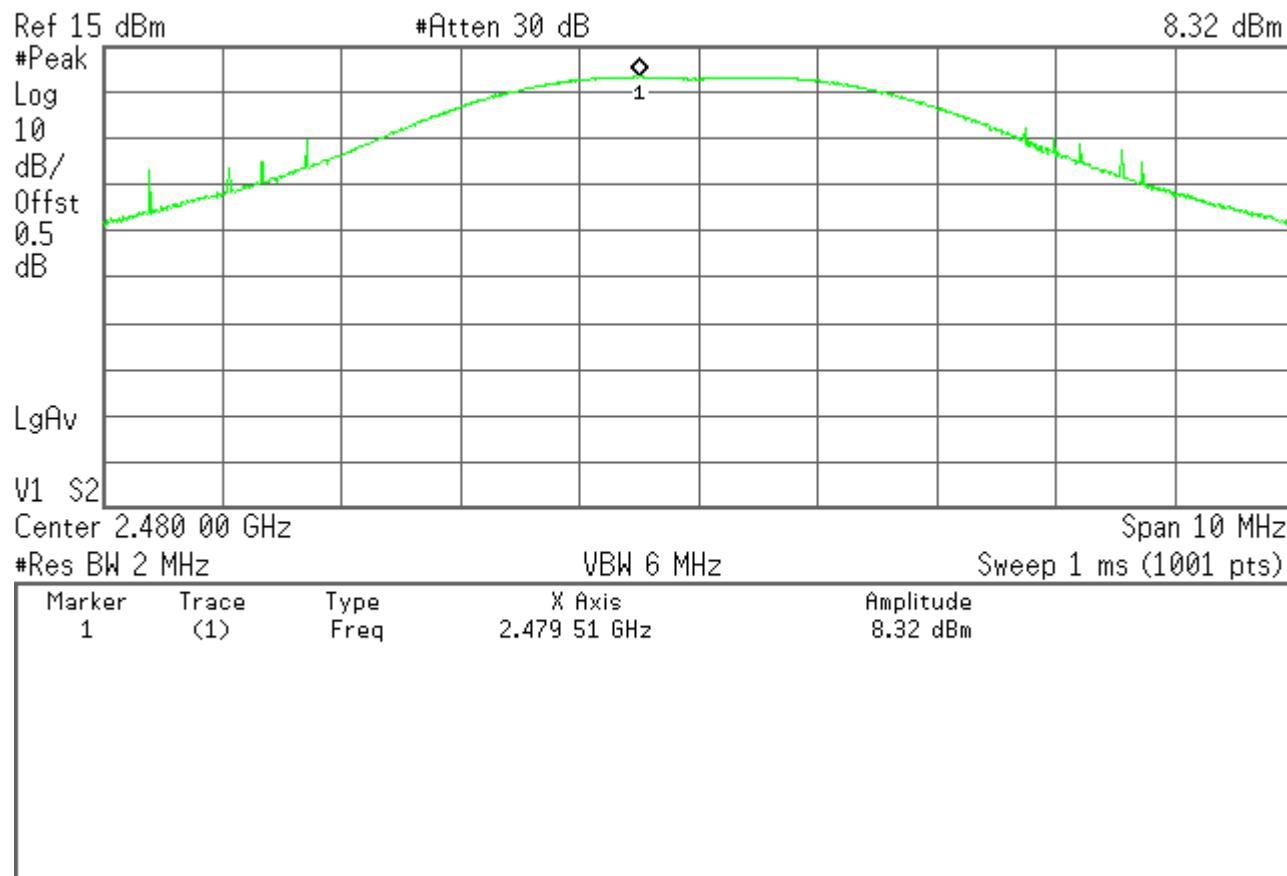
## Spurious emissions
**FCC 15.247(d), IC RSS-210 A8.5**

### Test summary
The requirements are:  □ - MET   ■ - NOT MET
Test was performed in accordance with ANSI C63.4 2003, clause 8.3 and FCC KDB Publication 558074
Maximum conducted spurious emission is -54.10dBc (-54.10dBm) at 2.632 GHz
Maximum radiated spurious emissions in the restricted bands below 1 GHz >10dBm since no significant emissions detected from 30 – 1000 MHz on all 3 channels in the Vertical and Horizontal polarization.
Maximum radiated spurious emissions in the restricted bands below 1 GHz >10dBm since no significant emissions detected from 1000 – 26000 MHz on all 3 channels in the Vertical and Horizontal polarization.

### Test location
■ - Wild River Lab Large Test Site (Open Area Test Site)
□ - Wild River Lab Small Test Site (Open Area Test Site)
■ - Wild River Lab Tech Area, conducted measurement

### Test equipment

| TUV ID | Model Number | Manufacturer | Description | Serial Number | Cal Due |
|---|---|---|---|---|---|
| WRLE03371 | E4440A | Agilent | Spectrum Analyzer | MY43362222 | 11-Aug-10 |
| WRLE02681 | 85650A | Hewlett-Packard | Quasi-Peak Adapter | 2430A00562 | 12-May-11 |
| WRLE02690 | 8566B | Hewlett-Packard | Spectrum Analyzer | 2430A00930 | 28-Oct-10 |
| WRLE02674 | 85662A | Hewlett-Packard | Analyzer Display | 2050A02007 | 28-Oct-10 |
| WRLE03995 | EM-6917B | Electro-Metrics | Biconicalog Periodic | 151 | 07-May-11 |
| WRLE10617 | ZHL-1042J | Mini-Circuits | Preamplifier 30 MHz-5 GHz | QA0746004 | Code B 25-Sep-10 |
| WRLE02075 | 3115 | EMCO | Ridge Guide Ant. 1-18 GHz | 9001-3275 | 18-Jan-11 |
| WRLE10527 | SL18B4020 | Phase One Microwave | Preamplifier 1 – 18 GHz | 0001 | Code B 28-Sep-10 |
| WRLE06717 | 3116 | EMCO | Ridge Guide Ant 18-40 GHz | 2005 | 03-Jun-10 |
| WRLE03978 | SL26-3010 | Phase One Microwave | Amplifier 18-26.5 GHz | 0005 | Code B 14-Jun-10 |
| WRLE03997 | EWT-14-0066 | EWT | 2.4 GHz Notch filter | E2 | Code B 26-Feb-11 |

Code B = Calibration verification performed internally. Code Y = Calibration not required when used with other calibrated equipment.

### Test limit - conducted
-20 dBc

### Test limit within restricted bands per 15.205 - radiated

| Frequency (MHz) | Field strength ($\mu$V/meter) | Field strength (dB$\mu$V/meter) |
|---|---|---|
| 30 - 88 | 100, QP | 40.0 |
| 88 - 216 | 150, QP | 43.5 |
| 216 - 960 | 200, QP | 46.0 |
| Above 960 | 500, QP | 54.0 |
| > 1000 | 500, AV | 54.0 |
|  | 5000, PK | 74.0 |

### Test data
See following pages

Radiated Spurious emissions

# List of measurements for run #: 4

| FREQ | LEVEL (dBuV) | CABLE / ANT / PREAMP / ATTEN (dB) | FINAL (dBuV / m) | POL / HGT / AZ (m)(DEG) | DELTA1 FCC 15.247 restricted bands >1GHz 3m av | DELTA2 FCC 15.247 restricted bands >1GHz 3m pk |
|---|---|---|---|---|---|---|
| | | | | | | |
| Begin scan 1 - 18 GHz | | | | | | |
| | | | | | | |
| Low channel, internal antenna, board upright, standing on narrow edge, antenna at top | | | | | | |
| Device rotated 360 degrees, measurement antenna 1 - 4 meters high, vertical and horizontal | | | | | | |
| No significant emissions detected | | | | | | |
| | | | | | | |
| measured both mid and high channel versions,  internal antenna | | | | | | |
| No significant emissions detected | | | | | | |
| | | | | | | |
| End scan 1 - 18 GHz | | | | | | |
| 2.485 GHz | 59.8 Pk | 4.25 / 28.4 / 29.25 / 0.0 | 63.2 | V / 1.00 / 0 | | -10.8 |
| 2.486 GHz | 53.5 Pk | 4.25 / 28.41 / 29.25 / 0.0 | 56.9 | V / 1.00 / 0 | | -17.1 |
| 2.487 GHz | 49.0 Pk | 4.25 / 28.41 / 29.25 / 0.0 | 52.4 | V / 1.00 / 0 | | -21.6 |
| 2.489 GHz | 43.3 Pk | 4.25 / 28.42 / 29.26 / 0.0 | 46.71 | V / 1.00 / 0 | | -27.29 |
| 2.49 GHz | 44.6 Pk | 4.25 / 28.42 / 29.26 / 0.0 | 48.01 | V / 1.00 / 0 | | -25.99 |
| 2.5 GHz | 43.0 Pk | 4.26 / 28.45 / 29.27 / 0.0 | 46.44 | V / 1.00 / 0 | | -27.56 |
| The duty cycle correction factor for average reading is -41.4 dB, so average levels are >20 dB below the average limit. | | | | | | |
| Begin spurious scan 30 - 1000 MHz | | | | | | |
| High channel internal antenna | | | | | | |
| Device rotated 360 degrees, measurement antenna 1 - 4 meters high, vertical and horizontal | | | | | | |
| No significant emissions detected | | | | | | |
| | | | | | | |
| measured both low and mid channel versions, internal antenna | | | | | | |
| No significant emissions detected | | | | | | |
| | | | | | | |
| end scan 30 - 1000 MHz | | | | | | |
| | | | | | | |
| | | | | | | |
| Begin scan 18 - 26 GHz | | | | | | |
| | | | | | | |
| Low channel | | | | | | |
| No significant emissions detected | | | | | | |
| with internal antenna version | | | | | | |
| No significant emissions detected | | | | | | |
| Repeat all previous testing with both mid and high channel versions, internal antenna | | | | | | |
| No significant emissions detected | | | | | | |
| | | | | | | |
| End scan 18 - 26 GHz | | | | | | |

Test Report WC909614 Rev C
TÜV SÜD AMERICA INC     19333 Wild Mountain Road     Taylors Falls MN  55084-1786     Tel: 651 638 0297     Fax: 651 638 0298

14 of 50
Rev. 071107

## Conducted spurious emissions Low Channel



Agilent 11:05:57 Mar 30, 2010

Mkr2 2.603 GHz
-58.83 dBm

Ref 15 dBm    #Atten 30 dB
#Peak
Log
10
dB/
Offst
0.5
dB
DI
-16.4
dBm
LgAv

V1 S2
Start 30 MHz                                      Stop 3.000 GHz
#Res BW 100 kHz        VBW 300 kHz        Sweep 283.9 ms (1001 pts)

| Marker | Trace | Type | X Axis | Amplitude |
|--------|-------|------|--------|-----------|
| 1 | (1) | Freq | 2.451 GHz | 3.59 dBm |
| 2 | (1) | Freq | 2.603 GHz | -58.83 dBm |
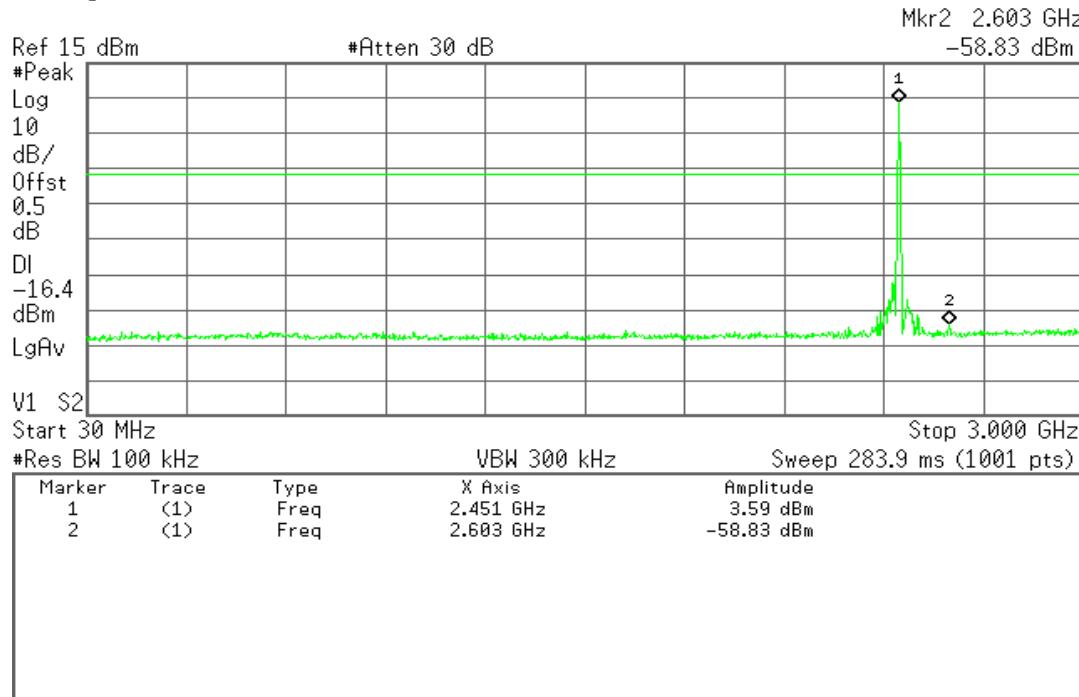
Agilent 11:08:59 Mar 30, 2010

Mkr1 2.450 GHz
3.93 dBm

Ref 15 dBm    #Atten 30 dB
#Peak
Log
10
dB/
Offst
0.5
dB
DI
-16.1
dBm
LgAv

V1 S2
Start 2.000 GHz                                    Stop 5.000 GHz
#Res BW 100 kHz        VBW 300 kHz        Sweep 286.7 ms (1001 pts)

| Marker | Trace | Type | X Axis | Amplitude |
|--------|-------|------|--------|-----------|
| 1 | (1) | Freq | 2.450 GHz | 3.93 dBm |
| 2 | (1) | Freq | 4.900 GHz | -59.91 dBm |
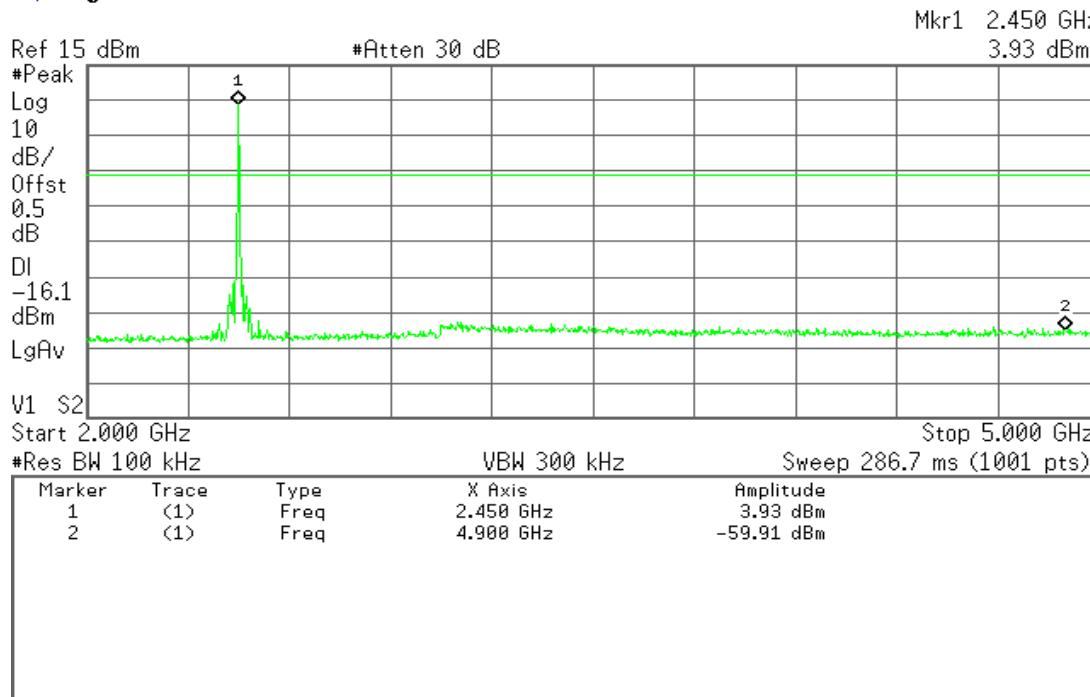
Agilent 11:10:24 Mar 30, 2010

Mkr1  7.35 GHz
−59.04 dBm

Ref 15 dBm                    #Atten 30 dB

#Peak
Log
10
dB/
Offst
0.5
dB

DI
−16.1
dBm

LgAv

V1 S2

Center 15.75 GHz                                    Span 21.5 GHz
#Res BW 100 kHz          VBW 300 kHz      Sweep 2.055 s (1001 pts)

| Marker | Trace | Type | X Axis | Amplitude |
|--------|-------|------|--------|-----------|
| 1 | (1) | Freq | 7.35 GHz | −59.04 dBm |
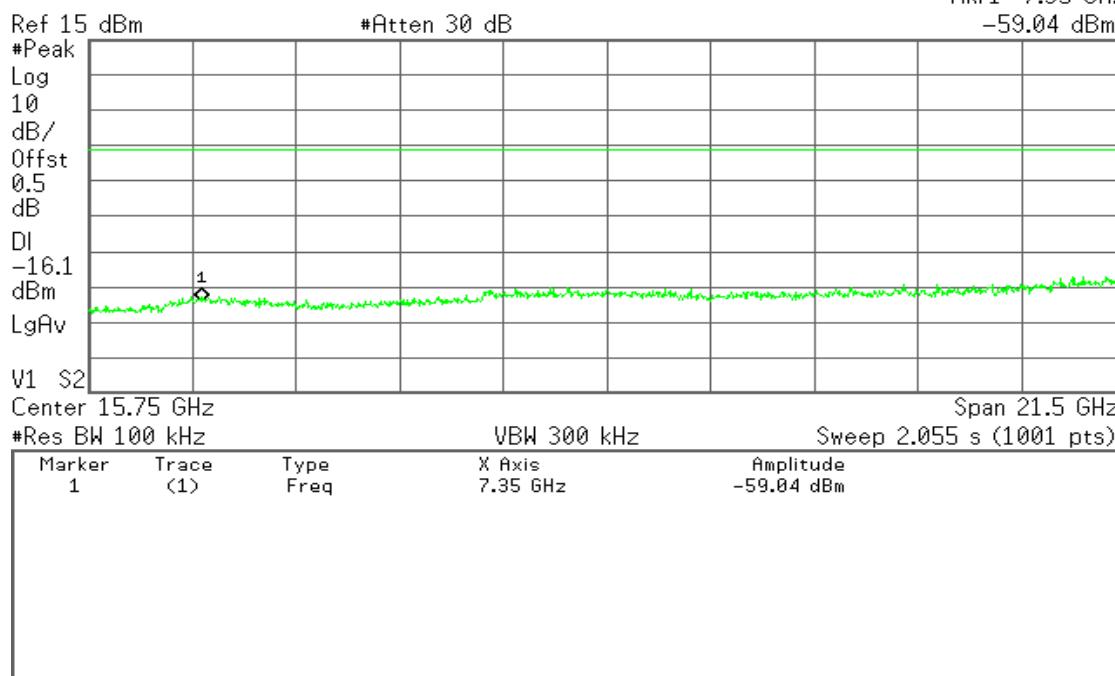
**Conducted spurious emissions Mid Channel**

Agilent 10:24:44 Mar 30, 2010

Mkr2  2.614 GHz
−55.93 dBm

Ref 15 dBm                    #Atten 30 dB

#Peak
Log
10
dB/
Offst
0.5
dB

DI
−18.6
dBm

LgAv

V1 S2

Start 30 MHz                                       Stop 3.000 GHz
#Res BW 100 kHz          VBW 300 kHz      Sweep 283.9 ms (1001 pts)

| Marker | Trace | Type | X Axis | Amplitude |
|--------|-------|------|--------|-----------|
| 1 | (1) | Freq | 2.465 GHz | 2.22 dBm |
| 2 | (1) | Freq | 2.614 GHz | −55.93 dBm |

Mkr1 2.465 GHz
1.38 dBm

Ref 15 dBm          #Atten 30 dB
#Peak
Log
10
dB/
Offst
0.5
dB

DI
−18.6
:dBm
LgAv

V1 S2

Start 2.000 GHz                                    Stop 5.000 GHz
#Res BW 100 kHz          VBW 300 kHz          Sweep 286.7 ms (1001 pts)

| Marker | Trace | Type | X Axis | Amplitude |
|--------|-------|------|--------|-----------|
| 1 | (1) | Freq | 2.465 GHz | 1.38 dBm |
| 2 | (1) | Freq | 4.993 GHz | −61.86 dBm |

Mkr1 7.39 GHz
−58.05 dBm

Ref 15 dBm          #Atten 30 dB
#Peak
Log
10
dB/
Offst
0.5
dB

DI
−18.6
dBm
LgAv

V1 S2

Start 5.00 GHz                                    Stop 26.50 GHz
#Res BW 100 kHz          VBW 300 kHz          Sweep 2.055 s (1001 pts)

| Marker | Trace | Type | X Axis | Amplitude |
|--------|-------|------|--------|-----------|
| 1 | (1) | Freq | 7.39 GHz | −58.05 dBm |

## Conducted spurious emissions High Channel



✳ **Agilent** 11:33:47 Mar 30, 2010

Mkr1 2.480 GHz
1.75 dBm

Ref 15 dBm          #Atten 30 dB

#Peak
Log
10
dB/
Offst
0.5
dB

DI
−18.2
dBm

LgAv

V1 S2

Start 30 MHz                                           Stop 3.000 GHz
#Res BW 100 kHz          VBW 300 kHz          Sweep 283.9 ms (1001 pts)

| Marker | Trace | Type | X Axis | Amplitude |
|--------|-------|------|--------|-----------|
| 1 | (1) | Freq | 2.480 GHz | 1.75 dBm |
| 2 | (1) | Freq | 2.632 GHz | −54.10 dBm |
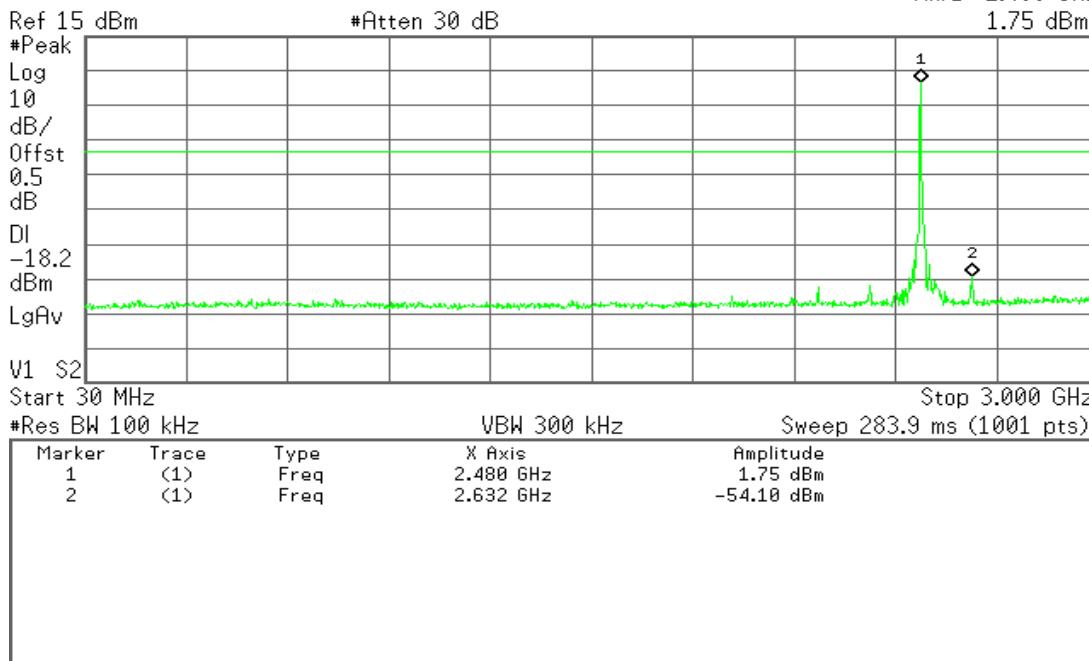


✳ **Agilent** 11:38:14 Mar 30, 2010

Mkr3 2.633 GHz
−54.81 dBm

Ref 15 dBm          #Atten 30 dB

#Peak
Log
10
dB/
Offst
0.5
dB

DI
−17.1
dBm

LgAv

V1 S2

Start 2.000 GHz                                        Stop 5.000 GHz
#Res BW 100 kHz          VBW 300 kHz          Sweep 286.7 ms (1001 pts)

| Marker | Trace | Type | X Axis | Amplitude |
|--------|-------|------|--------|-----------|
| 1 | (1) | Freq | 2.480 GHz | 3.00 dBm |
| 2 | (1) | Freq | 4.960 GHz | −60.42 dBm |
| 3 | (1) | Freq | 2.633 GHz | −54.81 dBm |

Test Report WC909614 Rev C
TÜV SÜD AMERICA INC      19333 Wild Mountain Road      Taylors Falls MN  55084-1786      Tel: 651 638 0297      Fax: 651 638 0298

19 of 50
Rev. 071107
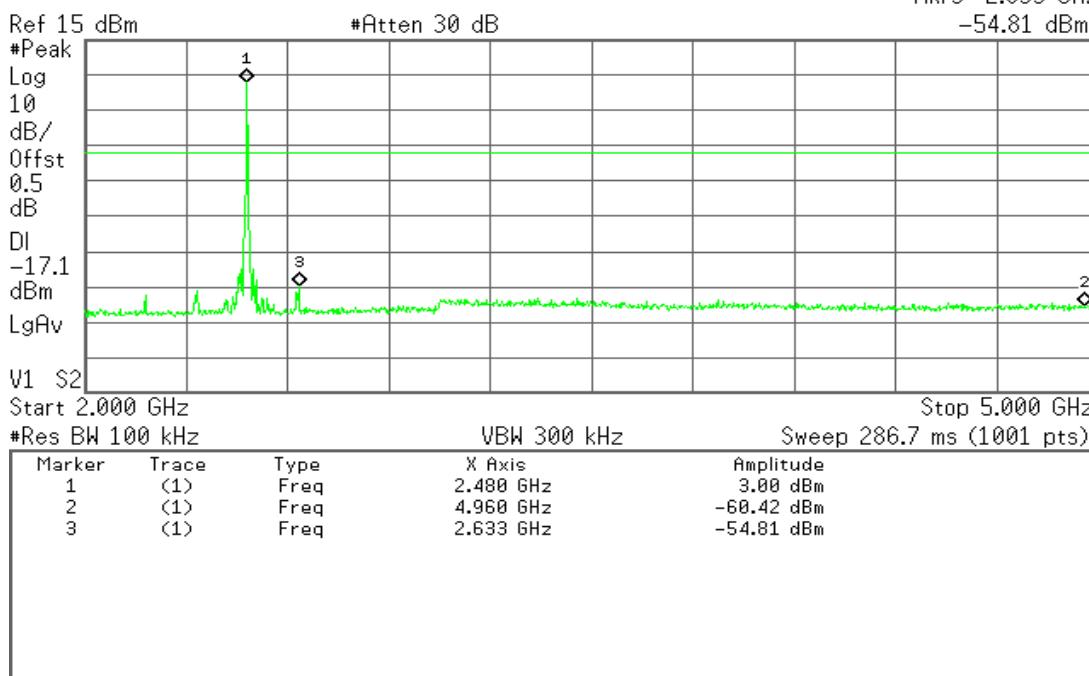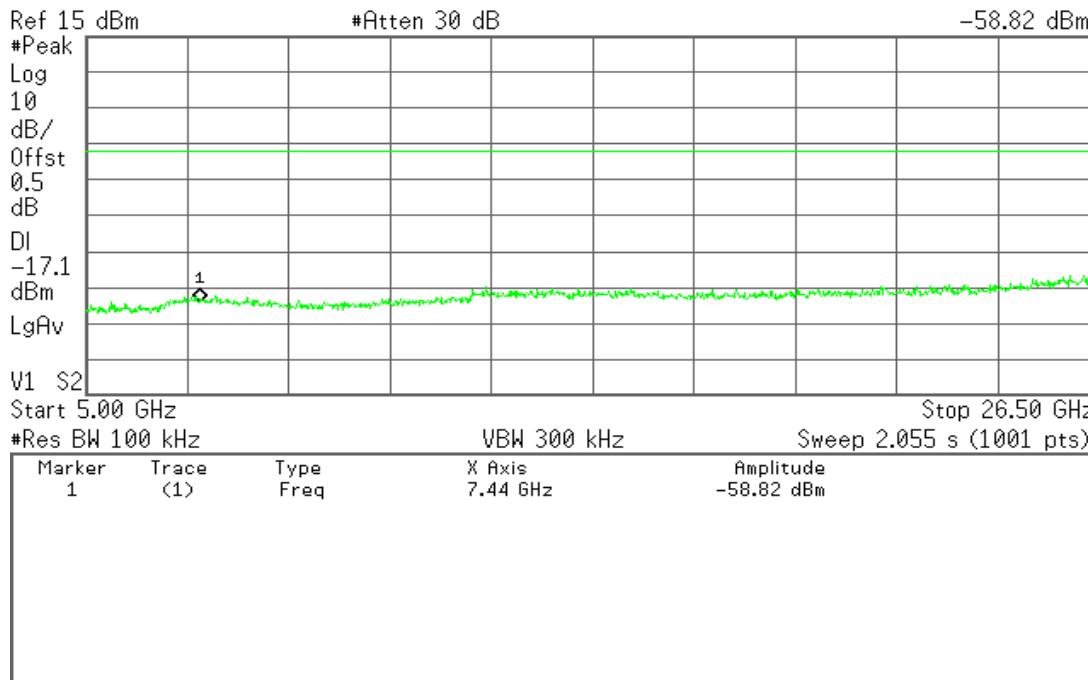
## Conducted band edge Low Channel

❄ **Agilent** 11:00:31 Mar 30, 2010

Mkr1 2.450 12 GHz

Ref 15 dBm          #Atten 30 dB                    3.87 dBm

#Peak
Log
10
dB/

Offst
0.5
dB

DI
−16.1
dBm

LgAv

V1 S2

Start 2.380 00 GHz                              Stop 2.455 00 GHz
#Res BW 100 kHz          VBW 300 kHz          Sweep 7.2 ms (1001 pts)

| Marker | Trace | Type | X Axis | Amplitude |
|--------|-------|------|--------|-----------|
| 1 | (1) | Freq | 2.450 12 GHz | 3.87 dBm |
| 2 | (1) | Freq | 2.390 00 GHz | −63.35 dBm |
| 3 | (1) | Freq | 2.400 00 GHz | −62.91 dBm |
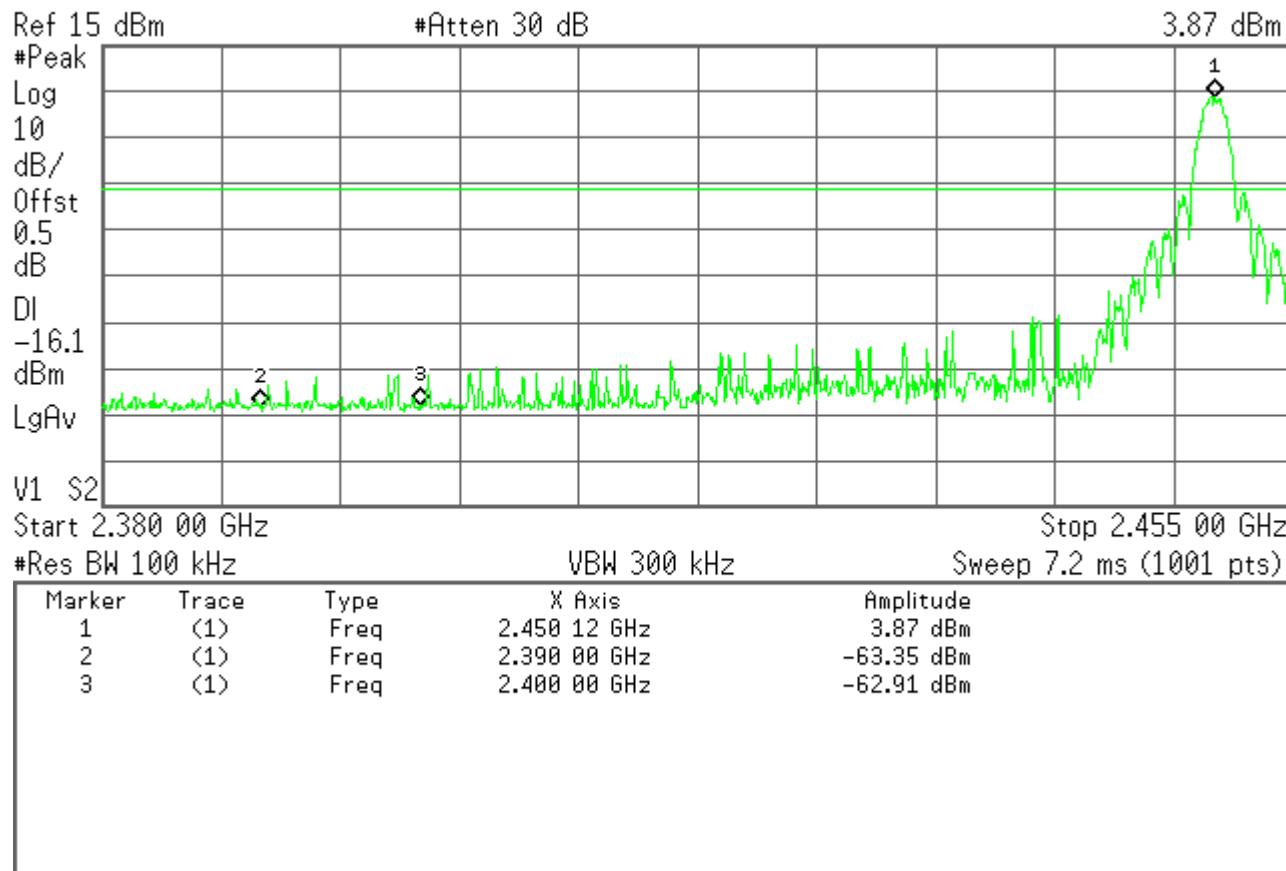
## Conducted band edge High Channel



Agilent 11:45:36 Mar 30, 2010

Mkr2 2.483 50 GHz
-29.84 dBm

Ref 15 dBm          #Atten 30 dB

#Peak
Log
10
dB/
Offst
0.5
dB

DI
-16.7
dBm

LgAv

V1 S2

Start 2.479 00 GHz                    Stop 2.500 00 GHz
#Res BW 100 kHz          VBW 300 kHz          Sweep 2.067 ms (1001 pts)

| Marker | Trace | Type | X Axis | Amplitude |
|--------|-------|------|--------|-----------|
| 1 | (1) | Freq | 2.480 39 GHz | 3.29 dBm |
| 2 | (1) | Freq | 2.483 50 GHz | -29.84 dBm |

Δ Mkr1    846 µs
0.81 dB

Ref 115.5 dBµV          #Atten 10 dB

#Peak
Log
10
dB/
Offst
8.5
dB

LgAv

S1 S2
V3 FC
AA

£(f):
FTun

Center 2.480 047 GHz                          Span 0 Hz
Res BW 1 MHz              VBW 3 MHz        Sweep 2 ms (1001 pts)

**Duty cycle correction = 20 log (846 us/100 ms) = -41.4 dB**

Δ Mkr1    241.8 ms
-0.05 dB

Ref 115.5 dBµV          #Atten 10 dB

#Peak
Log
10
dB/
Offst
8.5
dB

LgAv

S1 S2
V3 VC
AA

£(f):
FTun

Center 2.480 047 GHz                          Span 0 Hz
Res BW 1 MHz              VBW 3 MHz        Sweep 300 ms (1001 pts)

# Radiated band edge Low Channel

## Peak Internal Antenna



```
    ※ Agilent 12:25:29  Mar 30, 2010
                                              Mkr1  2.450 42 GHz
    Ref 112.8 dBµV          #Atten 30 dB        109.21 dBµV
    #Peak
    Log
    10
    dB/
    Offst
    -11.2
    dB
    DI
    74.0
    dBµV
    LgAv

    V1 S2
    Start 2.380 00 GHz                  Stop 2.455 00 GHz
    #Res BW 1 MHz        #VBW 3 MHz      Sweep 1 ms (1001 pts)
```
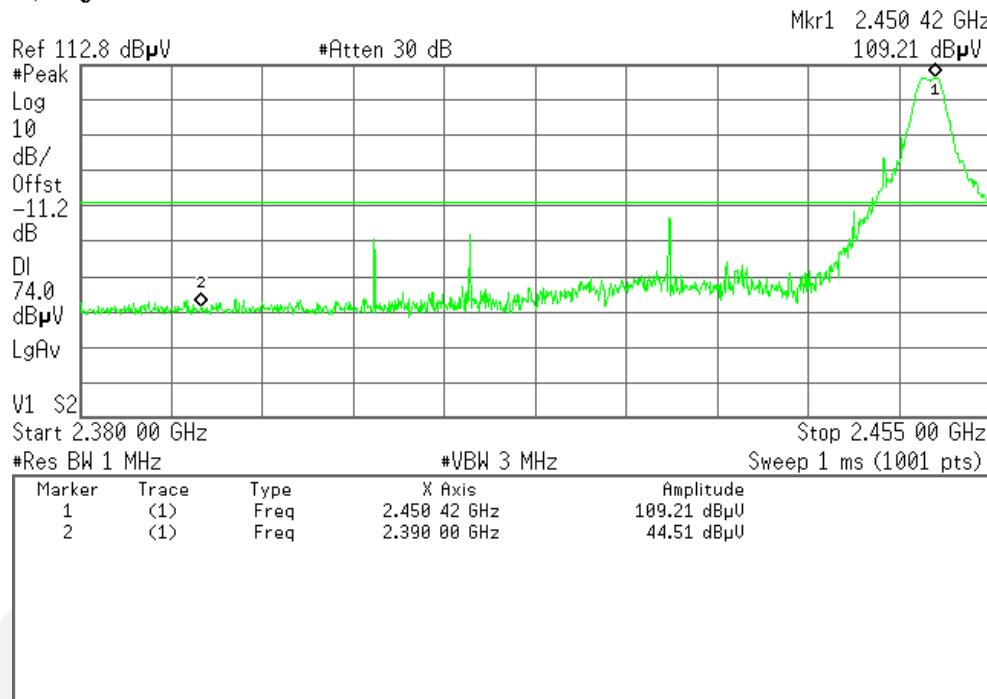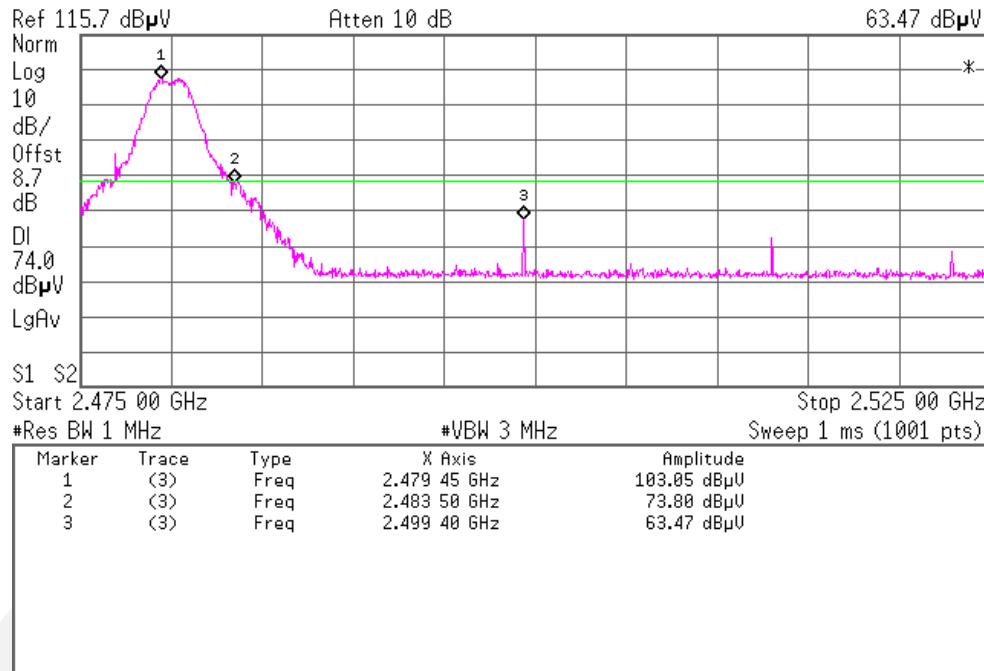
| Marker | Trace | Type | X Axis | Amplitude |
|--------|-------|------|--------|-----------|
| 1 | (1) | Freq | 2.450 42 GHz | 109.21 dBµV |
| 2 | (1) | Freq | 2.390 00 GHz | 44.51 dBµV |

## Average Internal Antenna

The duty cycle correction factor for average reading is -41.4 dB, so band edge compliance is maintained.

## Radiated band edge High Channel

**Peak Internal Antenna**



**Average Internal Antenna**

The duty cycle correction factor for average reading is -41.4 dB, so band edge compliance is maintained.

## Power spectral density
**FCC 15.247(e), IC RSS-210 A8.2(b)**

**Test summary**

The requirements are:  ■ - MET  □ - NOT MET

Test was performed in accordance with the test procedure of FCC KDB Publication 558074

Maximum power spectral density is -5.17dBm / 3 kHz

**Test location**

□ - Wild River Lab Large Test Site (Open Area Test Site)

□ - Wild River Lab Small Test Site (Open Area Test Site)

■ - Wild River Lab Tech Area, conducted measurement

**Test equipment**

| TUV ID | Model Number | Manufacturer | Description | Serial Number | Cal Due |
|---|---|---|---|---|---|
| WRLE03371 | E4440A | Agilent | Spectrum Analyzer | MY43362222 | 11-Aug-10 |

**Test limit**

No greater than 8 dBm in any 3 kHz band

**Test data**

See following pages.

Test Report WC909614 Rev C
TÜV SÜD AMERICA INC    19333 Wild Mountain Road    Taylors Falls MN 55084-1786    Tel: 651 638 0297    Fax: 651 638 0298

25 of 50
Rev. 071107

## Power spectral density Low Channel



Agilent 10:58:01 Mar 30, 2010

Mkr1 2.450 436 GHz

Ref 15 dBm        #Atten 30 dB        −5.17 dBm

#Peak
Log
10
dB/
Offst
0.5
dB

DI
8.0
dBm

LgAv

V1 S2
S3 FS
  AA
£(f):
f>50k
#Swp

Center 2.450 000 GHz        Span 2 MHz
#Res BW 3 kHz_____VBW 9.1 kHz_____#Sweep 666.7 s (1001 pts)_

## Power spectral density Mid Channel

**Agilent** 10:41:54 Mar 30, 2010

Mkr1  2.465 120 GHz
−6.88 dBm

Ref 15 dBm          #Atten 30 dB

#Peak
Log
10
dB/
Offst
0.5
dB

DI
8.0
dBm

LgAv

V1  S2
S3  FS
   AA
£(f):
f>50k
#Swp

Center 2.465 000 GHz                          Span 2 MHz
#Res BW 3 kHz_____VBW 9.1 kHz_____#Sweep 666.7 s (1001 pts)_
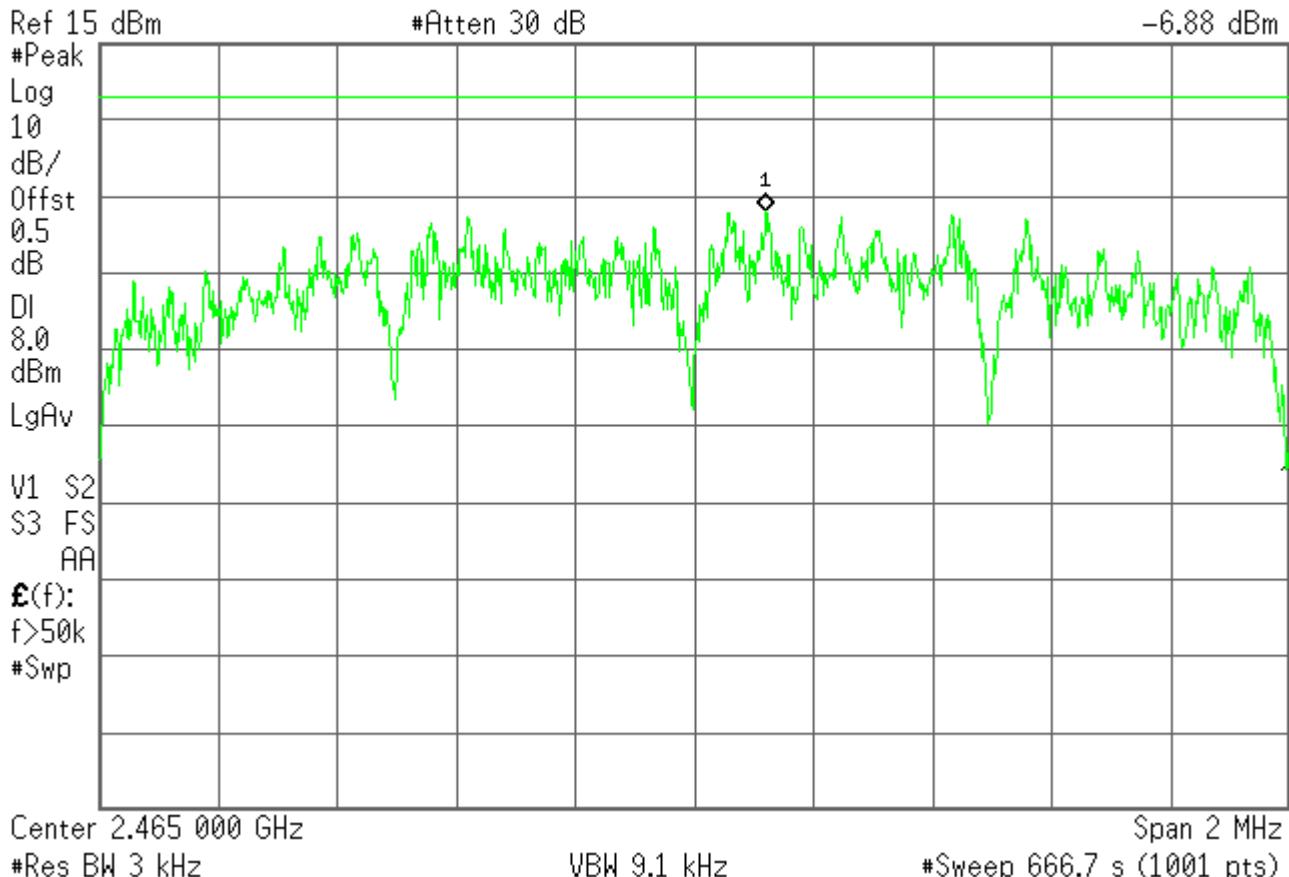
## Power spectral density High Channel



✳ **Agilent** 11:58:59 Mar 30, 2010

Mkr1 2.480 440 GHz
−7.24 dBm

Ref 15 dBm
#Peak
Log
10
dB/
Offst
0.5
dB

DI
8.0
dBm

LgAv

V1 S2
S3 FC
AA
£(f):
f>50k
#Swp

#Atten 30 dB

Center 2.480 000 GHz
#Res BW 3 kHz

VBW 9.1 kHz

Span 2 MHz
#Sweep 666.7 s (1001 pts)

Test Report WC909614 Rev C
TÜV SÜD AMERICA INC     19333 Wild Mountain Road     Taylors Falls MN 55084-1786     Tel: 651 638 0297     Fax: 651 638 0298

28 of 50
Rev. 071107
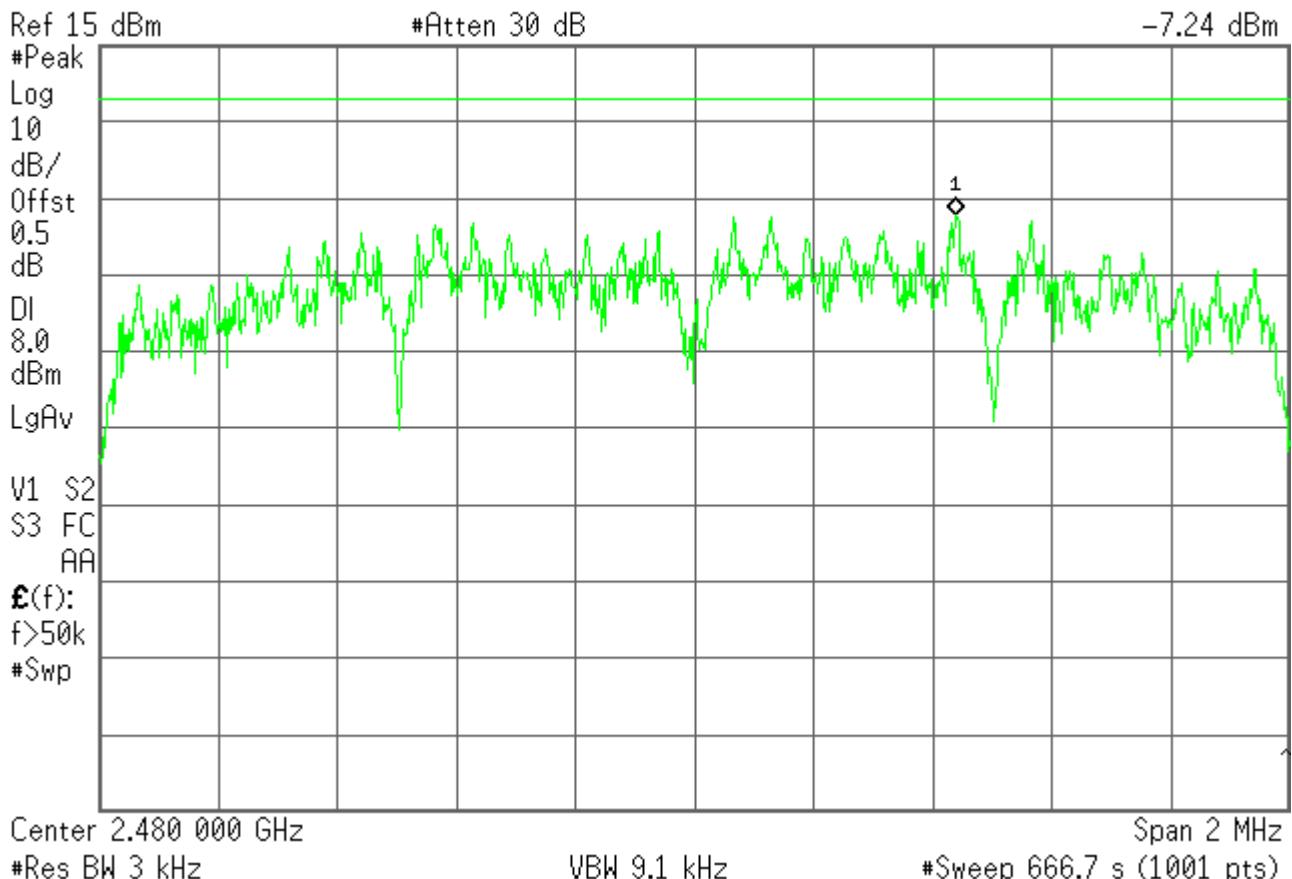
## CONDUCTED EMISSIONS (Interference Voltage) AC Power Lines

| The measurements were performed at the following TÜV SÜD America test location: |
|---|

| ☐ - Test not applicable |
|---|

■ - Wild River Shield Room 2 - Shielded room (3.7m x 3.5m x 2.4m) or (12' x 11.5' x 8')

■ - Tabletop equipment is placed on a non-conducting table 80 centimeters above the floor, 40 centimeters from a vertical ground plane.

**Test equipment used:**

| TUV ID | Model | Manufacturer | Description | Serial | Cal Due |
|---|---|---|---|---|---|
| WRLE02417 | 3825/2 | Electro-Mechanics (EMCO) | 50 Ω LISN | 8812-1439 | Code B 23-Mar-11 |
| WRLE | ESCS-30 | Rohde & Schwarz | EMI Receiver | | |

Cal Code B = Calibration verification performed internally. Cal Code Y = Calibration not required when used with other calibrated equipment.

All measurement instrumentation is traceable to the National Institute of Standards and Technology and is calibrated according to internal procedure. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak/average detection, and a Line Impedance Stabilization Network (LISN), with 50 Ω/50 μH (CISPR 16-1-1) characteristics.

**Test specification:**

Frequency - range:  ■ - 150 kHz to 30 MHz

EUT Power:  ■ - 60 Hz    ■ - 110 VAC

| Test Results - Conducted emissions 150 kHz - 30 MHz |
|---|

| The requirements are | ☐ - N/A | ■ - MET | ☐ - NOT MET | |
|---|---|---|---|---|

Minimum margin of compliance (Average)  <u>35</u> dB  at  <u>24.35</u> MHz

Minimum margin of compliance (Quasi-peak)  <u>40</u> dB  at  <u>19.55</u> MHz

Remarks:  A BK Precision 1646 Bench Power Supply was used to provide 3.6 VDC to the units under test. It does not contain any special line filtering, so representative source to demonstrate compliance of EUT.

See the following pages for test set-up photos and data.

# CONDUCTED EMISSIONS

**TÜV**
PRODUCT SERVICE

| | | | |
|---|---|---|---|
| Test Report #: | WC909614 Run 11 | Test Area: | SCREENROOM |
| EUT Model #: | V2.1.90 | Date: | 7/8/2010 |
| EUT Serial #: | N/A | EUT Power: | 60 Hz 110 VAC |
| Test Method: | FCC 15.247 | | |
| Customer: | Climate Minder | | |

Temperature: 21.0 °C
Air Pressure: 98.0 kPa
Rel. Humidity: 69.0 %

EUT Description: Wireless Sensor Network RF Node.

Notes:

Data File Name: 9614.dat

Page: 1 of 5

## List of measurements for run #: 11

| FREQ | LEVEL (dBuV) | CABLE / ANT / PREAMP / ATTEN (dB) | FINAL (dBuV) | EUT Lead | DELTA1 FCC B Qp | DELTA2 FCC B Avg |
|---|---|---|---|---|---|---|
| 150.0 kHz | 1.8 Qp | 0.12 / 0.2 / 0.0 / 0.0 | 2.12 | N | -63.88 | n/a |
| 225.0 kHz | -1.81 Qp | 0.14 / 0.1 / 0.0 / 0.0 | -1.57 | N | -64.21 | n/a |
| 300.0 kHz | -2.17 Qp | 0.15 / 0.1 / 0.0 / 0.0 | -1.92 | N | -62.16 | n/a |
| 450.0 kHz | -2.71 Qp | 0.17 / 0.1 / 0.0 / 0.0 | -2.44 | N | -59.31 | n/a |
| 750.0 kHz | -2.77 Qp | 0.21 / 0.2 / 0.0 / 0.0 | -2.36 | N | -58.36 | n/a |
| 1.0 MHz | -2.36 Qp | 0.22 / 0.2 / 0.0 / 0.0 | -1.94 | N | -57.94 | n/a |
| 1.5 MHz | -2.68 Qp | 0.26 / 0.1 / 0.0 / 0.0 | -2.32 | N | -58.32 | n/a |
| 2.0 MHz | -2.19 Qp | 0.29 / 0.1 / 0.0 / 0.0 | -1.8 | N | -57.8 | n/a |
| 3.0 MHz | -1.05 Qp | 0.33 / 0.1 / 0.0 / 0.0 | -0.62 | N | -56.62 | n/a |
| 4.0 MHz | -1.79 Qp | 0.37 / 0.1 / 0.0 / 0.0 | -1.32 | N | -57.32 | n/a |
| 5.6 MHz | 16.97 Qp | 0.42 / 0.1 / 0.0 / 0.0 | 17.49 | N | -42.51 | n/a |
| 8.0 MHz | 3.87 Qp | 0.48 / 0.2 / 0.0 / 0.0 | 4.55 | N | -55.45 | n/a |
| 12.0 MHz | 8.92 Qp | 0.63 / 0.4 / 0.0 / 0.0 | 9.95 | N | -50.05 | n/a |
| 13.3 MHz | 15.42 Qp | 0.66 / 0.47 / 0.0 / 0.0 | 16.54 | N | -43.46 | n/a |
| 19.55 MHz | 17.45 Qp | 0.78 / 0.78 / 0.0 / 0.0 | 19.01 | N | -40.99 | n/a |
| 24.35 MHz | 14.71 Qp | 0.86 / 0.99 / 0.0 / 0.0 | 16.56 | N | -43.44 | n/a |
| 150.0 kHz | -2.12 Av | 0.12 / 0.2 / 0.0 / 0.0 | -1.8 | N | n/a | -57.8 |
| 225.0 kHz | -5.44 Av | 0.14 / 0.1 / 0.0 / 0.0 | -5.2 | N | n/a | -57.84 |
| 300.0 kHz | -5.93 Av | 0.15 / 0.1 / 0.0 / 0.0 | -5.68 | N | n/a | -55.92 |
| 450.0 kHz | -6.17 Av | 0.17 / 0.1 / 0.0 / 0.0 | -5.9 | N | n/a | -52.77 |
| 750.0 kHz | -6.38 Av | 0.21 / 0.2 / 0.0 / 0.0 | -5.97 | N | n/a | -51.97 |
| 1.0 MHz | -6.31 Av | 0.22 / 0.2 / 0.0 / 0.0 | -5.89 | N | n/a | -51.89 |
| 1.5 MHz | -6.28 Av | 0.26 / 0.1 / 0.0 / 0.0 | -5.92 | N | n/a | -51.92 |
| 2.0 MHz | -6.28 Av | 0.29 / 0.1 / 0.0 / 0.0 | -5.89 | N | n/a | -51.89 |
| 3.0 MHz | -4.95 Av | 0.33 / 0.1 / 0.0 / 0.0 | -4.52 | N | n/a | -50.52 |
| 4.0 MHz | -5.66 Av | 0.37 / 0.1 / 0.0 / 0.0 | -5.19 | N | n/a | -51.19 |
| 5.6 MHz | 8.82 Av | 0.42 / 0.1 / 0.0 / 0.0 | 9.34 | N | n/a | -40.66 |
| 8.0 MHz | -1.64 Av | 0.48 / 0.2 / 0.0 / 0.0 | -0.96 | N | n/a | -50.96 |
| 12.0 MHz | 3.02 Av | 0.63 / 0.4 / 0.0 / 0.0 | 4.05 | N | n/a | -45.95 |
| 13.3 MHz | 5.1 Av | 0.66 / 0.47 / 0.0 / 0.0 | 6.22 | N | n/a | -43.78 |

Tested by: J. T. Schneider
Printed          Signature

Reviewed by: Robert J Behringer
Printed          Signature

# CONDUCTED EMISSIONS

**TÜV PRODUCT SERVICE**

| | | | |
|---|---|---|---|
| Test Report #: | WC909614 Run 11 | Test Area: | SCREENROOM |
| EUT Model #: | V2.1.90 | Date: | 7/8/2010 |
| EUT Serial #: | N/A | EUT Power: | 60 Hz 110 VAC |
| Test Method: | FCC 15.247 | | |
| Customer: | Climate Minder | | |
| EUT Description: | Wireless Sensor Network RF Node. | | |
| Notes: | | | |
| Data File Name: | 9614.dat | | |

Temperature: 21.0 °C
Air Pressure: 98.0 kPa
Rel. Humidity: 69.0 %

Page: 2 of 5

## List of measurements for run #: 11

| FREQ | LEVEL (dBuV) | CABLE / ANT / PREAMP / ATTEN (dB) | FINAL (dBuV) | EUT Lead | DELTA1 FCC B Qp | DELTA2 FCC B Avg |
|---|---|---|---|---|---|---|
| 19.55 MHz | 7.77 Av | 0.78 / 0.78 / 0.0 / 0.0 | 9.33 | N | n/a | -40.67 |
| 24.35 MHz | 12.26 Av | 0.86 / 0.99 / 0.0 / 0.0 | 14.11 | N | n/a | -35.89 |
| 150.0 kHz | 9.56 Qp | 0.12 / 0.2 / 0.0 / 0.0 | 9.88 | L1 | -56.12 | n/a |
| 150.0 kHz | -2.53 Av | 0.12 / 0.2 / 0.0 / 0.0 | -2.21 | L1 | n/a | -58.21 |

Tested by: J. T. Schneider
Printed                    Signature

Reviewed by: Robert J Behringer
Printed                    Signature

Test Report WC909614 Rev C

# CONDUCTED EMISSIONS

**TÜV**
PRODUCT SERVICE

| | | | |
|---|---|---|---|
| Test Report #: | WC909614 Run 11 | Test Area: | SCREENROOM |
| EUT Model #: | V2.1.90 | Date: | 7/8/2010 |
| EUT Serial #: | N/A | EUT Power: | 60 Hz 110 VAC |

Temperature: 21.0 °C

Air Pressure: 98.0 kPa

Rel. Humidity: 69.0 %

| | |
|---|---|
| Test Method: | FCC 15.247 |
| Customer: | Climate Minder |
| EUT Description: | Wireless Sensor Network RF Node. |
| Notes: | |
| Data File Name: | 9614.dat |

Page: 3 of 5

## Measurement summary for limit1: FCC B Qp (Qp)

| FREQ | LEVEL (dBuV) | CABLE / ANT / PREAMP / ATTEN (dB) | FINAL (dBuV) | EUT Lead | DELTA1 EN55022 B Qp |
|---|---|---|---|---|---|
| 19.55 MHz | 17.45 Qp | 0.78 / 0.78 / 0.0 / 0.0 | 19.01 | N | -40.99 |
| 5.6 MHz | 16.97 Qp | 0.42 / 0.1 / 0.0 / 0.0 | 17.49 | N | -42.51 |
| 24.35 MHz | 14.71 Qp | 0.86 / 0.99 / 0.0 / 0.0 | 16.56 | N | -43.44 |
| 13.3 MHz | 15.42 Qp | 0.66 / 0.47 / 0.0 / 0.0 | 16.54 | N | -43.46 |
| 12.0 MHz | 8.92 Qp | 0.63 / 0.4 / 0.0 / 0.0 | 9.95 | N | -50.05 |
| 8.0 MHz | 3.87 Qp | 0.48 / 0.2 / 0.0 / 0.0 | 4.55 | N | -55.45 |
| 150.0 kHz | 9.56 Qp | 0.12 / 0.2 / 0.0 / 0.0 | 9.88 | L1 | -56.12 |
| 3.0 MHz | -1.05 Qp | 0.33 / 0.1 / 0.0 / 0.0 | -0.62 | N | -56.62 |
| 4.0 MHz | -1.79 Qp | 0.37 / 0.1 / 0.0 / 0.0 | -1.32 | N | -57.32 |
| 2.0 MHz | -2.19 Qp | 0.29 / 0.1 / 0.0 / 0.0 | -1.8 | N | -57.8 |
| 1.0 MHz | -2.36 Qp | 0.22 / 0.2 / 0.0 / 0.0 | -1.94 | N | -57.94 |
| 1.5 MHz | -2.68 Qp | 0.26 / 0.1 / 0.0 / 0.0 | -2.32 | N | -58.32 |
| 750.0 kHz | -2.77 Qp | 0.21 / 0.2 / 0.0 / 0.0 | -2.36 | N | -58.36 |
| 450.0 kHz | -2.71 Qp | 0.17 / 0.1 / 0.0 / 0.0 | -2.44 | N | -59.31 |
| 300.0 kHz | -2.17 Qp | 0.15 / 0.1 / 0.0 / 0.0 | -1.92 | N | -62.16 |
| 225.0 kHz | -1.81 Qp | 0.14 / 0.1 / 0.0 / 0.0 | -1.57 | N | -64.21 |

| | | |
|---|---|---|
| Tested by: | J. T. Schneider | |
| | Printed | Signature |
| Reviewed by: | Robert J Behringer | |
| | Printed | Signature |

# CONDUCTED EMISSIONS

**TÜV**
PRODUCT SERVICE

| | | | |
|---|---|---|---|
| Test Report #: | WC909614 Run 11 | Test Area: | SCREENROOM |
| EUT Model #: | V2.1.90 | Date: | 7/8/2010 |
| EUT Serial #: | N/A | EUT Power: | 60 Hz 110 VAC |
| Test Method: | FCC 15.247 | | |
| Customer: | Climate Minder | | |
| EUT Description: | Wireless Sensor Network RF Node. | | |
| Notes: | | | |
| Data File Name: | 9614.dat | | |

Temperature: 21.0 °C
Air Pressure: 98.0 kPa
Rel. Humidity: 69.0 %

Page: 4 of 5

## Measurement summary for limit2: FCC B Avg (Av)

| FREQ | LEVEL (dBuV) | CABLE / ANT / PREAMP / ATTEN (dB) | FINAL (dBuV) | EUT Lead | DELTA2 EN55022 B Avg |
|---|---|---|---|---|---|
| 24.35 MHz | 12.26 Av | 0.86 / 0.99 / 0.0 / 0.0 | 14.11 | N | -35.89 |
| 5.6 MHz | 8.82 Av | 0.42 / 0.1 / 0.0 / 0.0 | 9.34 | N | -40.66 |
| 19.55 MHz | 7.77 Av | 0.78 / 0.78 / 0.0 / 0.0 | 9.33 | N | -40.67 |
| 13.3 MHz | 5.1 Av | 0.66 / 0.47 / 0.0 / 0.0 | 6.22 | N | -43.78 |
| 12.0 MHz | 3.02 Av | 0.63 / 0.4 / 0.0 / 0.0 | 4.05 | N | -45.95 |
| 3.0 MHz | -4.95 Av | 0.33 / 0.1 / 0.0 / 0.0 | -4.52 | N | -50.52 |
| 8.0 MHz | -1.64 Av | 0.48 / 0.2 / 0.0 / 0.0 | -0.96 | N | -50.96 |
| 4.0 MHz | -5.66 Av | 0.37 / 0.1 / 0.0 / 0.0 | -5.19 | N | -51.19 |
| 1.0 MHz | -6.31 Av | 0.22 / 0.2 / 0.0 / 0.0 | -5.89 | N | -51.89 |
| 2.0 MHz | -6.28 Av | 0.29 / 0.1 / 0.0 / 0.0 | -5.89 | N | -51.89 |
| 1.5 MHz | -6.28 Av | 0.26 / 0.1 / 0.0 / 0.0 | -5.92 | N | -51.92 |
| 750.0 kHz | -6.38 Av | 0.21 / 0.2 / 0.0 / 0.0 | -5.97 | N | -51.97 |
| 450.0 kHz | -6.17 Av | 0.17 / 0.1 / 0.0 / 0.0 | -5.9 | N | -52.77 |
| 300.0 kHz | -5.93 Av | 0.15 / 0.1 / 0.0 / 0.0 | -5.68 | N | -55.92 |
| 150.0 kHz | -2.12 Av | 0.12 / 0.2 / 0.0 / 0.0 | -1.8 | N | -57.8 |
| 225.0 kHz | -5.44 Av | 0.14 / 0.1 / 0.0 / 0.0 | -5.2 | N | -57.84 |

| | | | |
|---|---|---|---|
| Tested by: | J. T. Schneider | | _Joel T. Schneider_ |
| | Printed | | Signature |
| Reviewed by: | Robert J Behringer | | _Behringer_ |
| | Printed | | Signature |

# CONDUCTED EMISSIONS

**TÜV**
PRODUCT SERVICE

| | | | | |
|---|---|---|---|---|
| Test Report #: | WC909614 Run 11 | Test Area: | SCREENROOM | |
| EUT Model #: | V2.1.90 | Date: | 7/8/2010 | |
| EUT Serial #: | N/A | EUT Power: | 60 Hz 110 VAC | Temperature: 21.0 °C |
| Test Method: | FCC 15.247 | | | Air Pressure: 98.0 kPa |
| Customer: | Climate Minder | | | Rel. Humidity: 69.0 % |
| EUT Description: | Wireless Sensor Network RF Node. | | | |
| Notes: | | | | |
| Data File Name: | 9614.dat | | Page: | 5 of 5 |

## Graph:
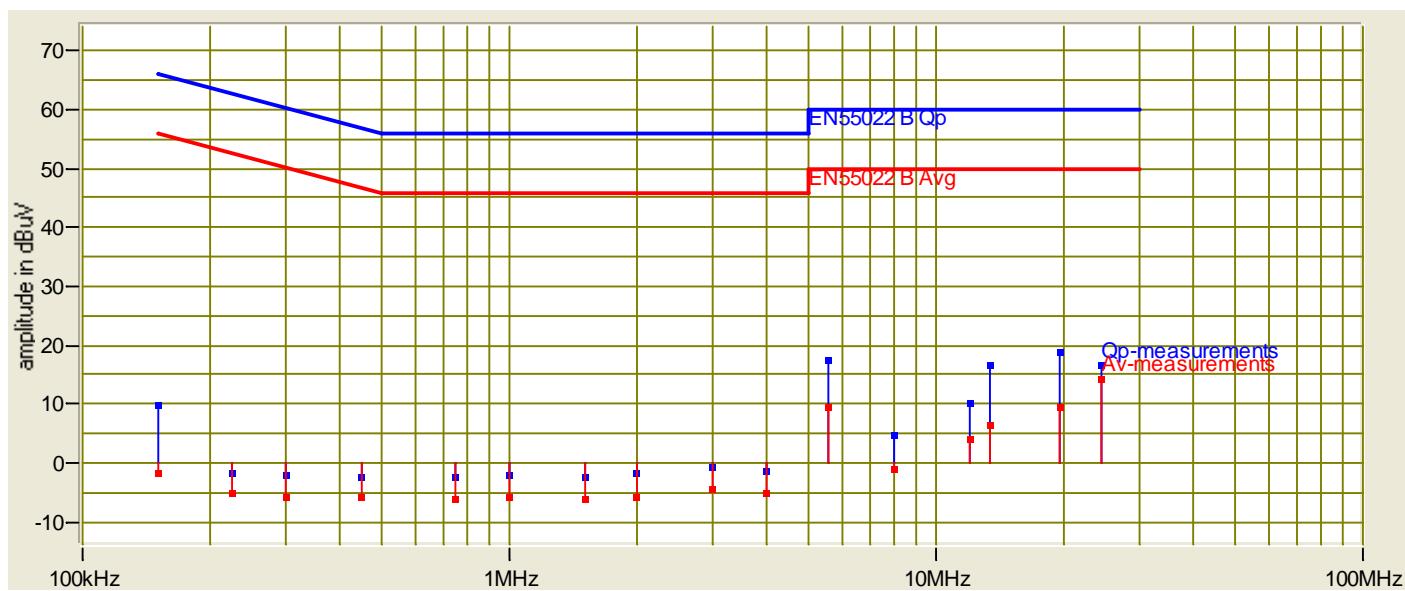


Tested by: J. T. Schneider
Printed          Signature

Reviewed by: Robert J Behringer
Printed          Signature

# TEST SETUP FOR EMISSIONS TESTING

WILD RIVER LAB
Large Test Site

Notes:
1. Items shown in dotted lines are located on the floor below the test area. It is 5 meters vertically from the ground floor to the test area.

2. 50 Hz, 60 Hz, and 400 Hz are power panels for alternating current.

3. The antenna may be positioned horizontally 3, 10 or 30 meters from the center of the turntable.

4. The circle is a 6.7 meter diameter turntable.

5. A ground plane is in the plane of this sheet.

6. The test sample is shown in the azimuthal position representing zero degrees.
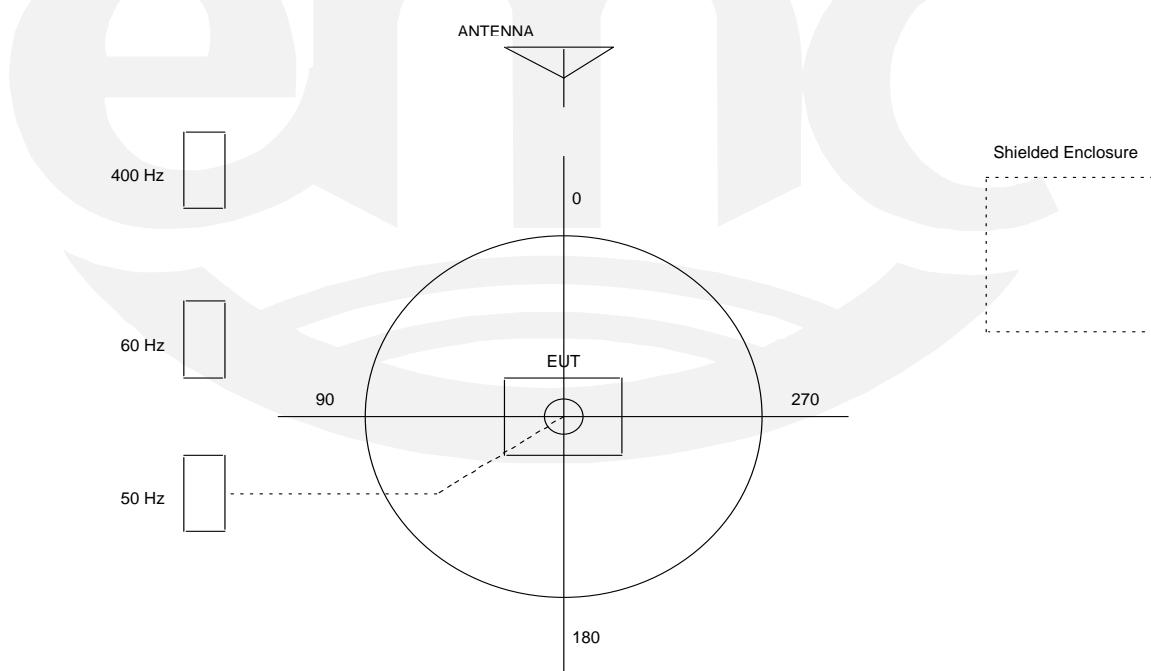
**Test-setup photo(s):**
**Conducted measurements**
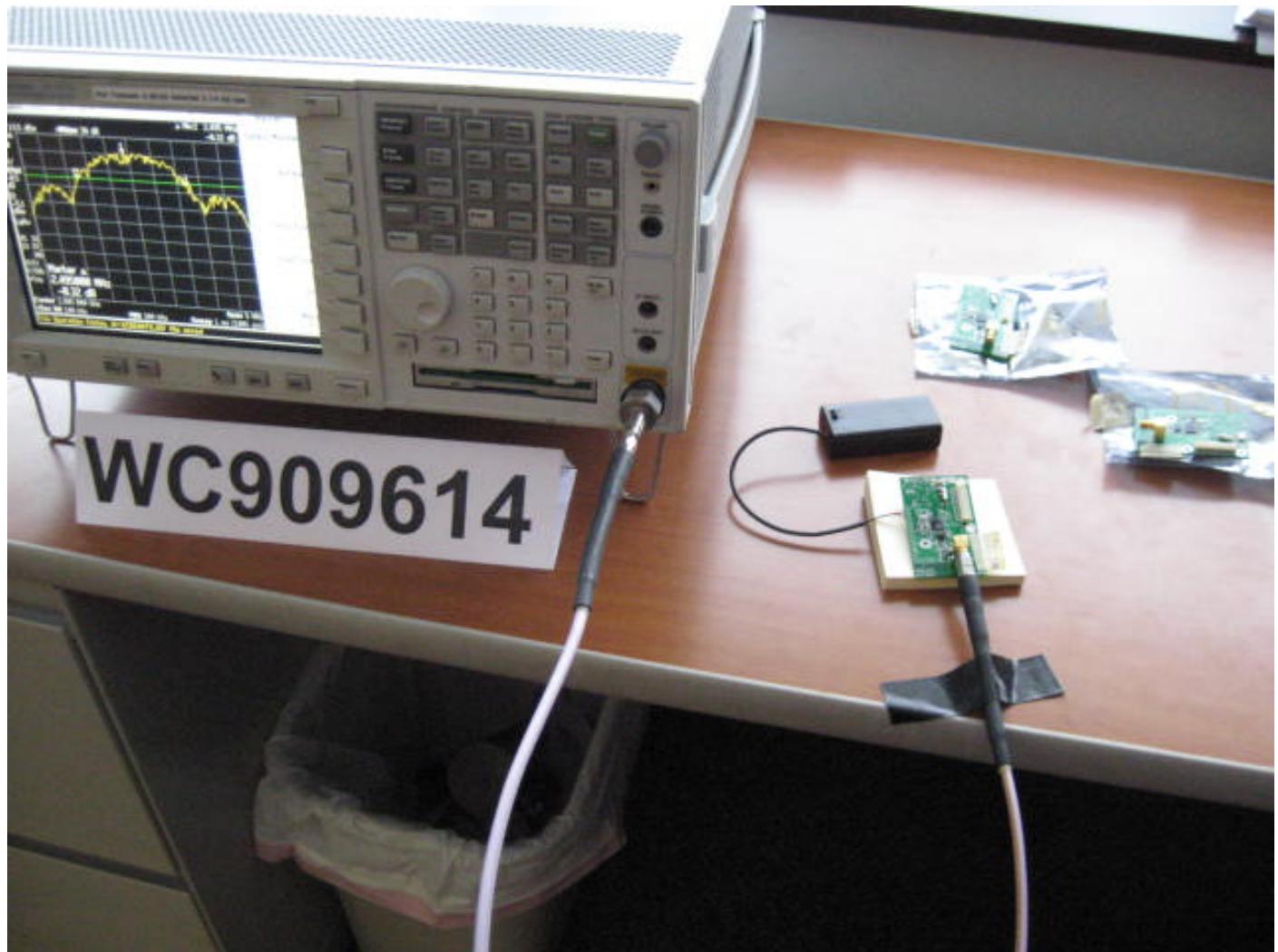
**Test-setup photo(s):**
**Conducted AC power line measurements**

Test Report WC909614 Rev C
TÜV SÜD AMERICA INC          19333 Wild Mountain Road          Taylors Falls MN  55084-1786          Tel: 651 638 0297          Fax: 651 638 0298

37 of 50
Rev. 071107

**Test-setup photo(s):**
**Radiated measurements**

## Equipment Under Test (EUT) Test Operation Mode:

**The device under test was operated under the following conditions during immunity testing :**

☐ - Standby

☐ - Test program (H - Pattern)

☐ - Test program (color bar)

☐ - Test program (customer specific)

☐ - Practice operation

■ - Normal operating mode

■ - _____


**Configuration of the device under test:**

■ - See Constructional Data Form in Appendix B

☐ - See Product Information Form(s) in Appendix B

**The following peripheral devices and interface cables were connected during the measurement:**

☐ - _____    Type : _____

☐ - _____    Type : _____

☐ - _____    Type : _____

☐ - _____    Type : _____

☐ - _____    Type : _____

☐ - _____    Type : _____

☐ - _____    Type : _____

☐ - _____    Type : _____

☐ - unshielded power cable

☐ - unshielded cables

☐ - shielded cables     MPS.No.: _____

☐ - customer specific cables

☐ - _____

☐ - _____

## GENERAL REMARKS:

Modifications required to pass:
☐ None
■ As indicated on the data sheet(s)

Test Specification Deviations:  Additions to or Exclusions from:
■ None
☐ As indicated in the Test Plan
☐

## SUMMARY:

The requirements according to the technical regulations are
■ - **met** and the equipment under test does fulfill the general approval requirements.
☐ - not met and the equipment under test does not fulfill the general approval requirements.

| | |
|---|---|
| EUT Received Date: | 26 March 2010 |
| Condition of EUT: | Normal |
| Testing Start Date: | 30 March 2010 |
| Testing End Date: | 08 July 2010 |

## TÜV SÜD AMERICA INC

Tested by:

*G. Jakubowski*

Greg Jakubowski
Senior EMC Technician

Approved by:

*Joel T. Schneider*

Joel T Schneider
Senior EMC Engineer

Test Report WC909614 Rev C
TÜV SÜD AMERICA INC        19333 Wild Mountain Road        Taylors Falls MN  55084-1786        Tel: 651 638 0297        Fax: 651 638 0298

40 of 50
Rev. 071107
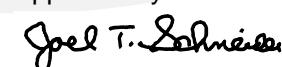
# Appendix A

Constructional Data Form

**Form**



# EMC Test Plan and Constructional Data Form

PLEASE COMPLETE THIS DOCUMENT IN FULL, ENTERING N/A IF THE FIELD IS NOT APPLICABLE.  IF TESTING RESULTS IN MODIFICATIONS TO THE EQUIPMENT, PLEASE SUBMIT A REVISED TP/CDF INDICATING THOSE MODIFICATIONS.
*NOTE:  This information will be input into your test report as shown below.  Press the F1 key at any time to get HELP for the current field selected.*

| | |
|---|---|
| Company: | ClimateMinder, Inc. |
| Address: | 9444 Haines Canyon Ave. |
| | Tujunga, CA, 91042 |
| | ÿ FORMTEXT |

| | | | |
|---|---|---|---|
| Contact: | Bulut F. Ersavas | Position: | CEO |
| Phone: | 1-818-482-3711 | Fax: | |
| E-mail Address: | bulut@climateminder.com | | |

---

**General Equipment Description --** *NOTE:  This information will be input into your test report as shown below.*

| | | | |
|---|---|---|---|
| EUT Description | Wireless Sensor Network RF Node | | |
| EUT Name | NodeRF V2.1.90 | | |
| Model No.: | V2.1.90 | Serial No.: | |
| Product Options: | Modulated Communication | | |
| Configurations to be tested: | Modulated Radiation | | |

---

**Equipment Modification (***If applicable, indicate modifications since EUT was last tested.  If modifications are made during this  testing, submit revised TP/CDF after testing is complete.***)**

| | |
|---|---|
| Modifications since last test: | N/A |
| Modifications made during test: | N/A |

---

**Test Objective(s):** *Please indicate the tests to be performed, entering the applicable standard(s) where noted.*

☐ EMC Directive 2004/108/EC (EMC)       ☒ FCC:   Class ☐ A ☐ B   Part   15
    Std: _____      ☐ VCCI:   Class ☐ A ☐ B
☐ Machinery Directive 89/392/EEC (EMC)      ☐ BSMI:   Class ☐ A ☐ B   (Separate Report)
    Std: _____      ☐ Canada:   Class ☐ A ☐ B
☐ Medical Device Directive 93/42/EEC (EMC)      ☐ Australia:   Class ☐ A ☐ B
    Std: _____      ☐ Other: _____
☐ Vehicle Directive:   ☐ 2001/3/EC (EMC)     ☐ 2004/104/EC (EMC)
    ☐ Other Vehicle Std: _____
☐ FDA Reviewers Guidance for Premarket
    Notification Submissions (EMC)

---

**Third Party Certification, if applicable (*Signature on Page 6 Required)**

☐ Attestation of Conformity (AoC)*      ☐ EMC Certification (used with Octagon Mark)*
☐ Certificate of Conformity (CoC)*      ☐ Compliance Document*
    Protection Class   (N/A for vehicles)     ☐ Class I      ☐ Class II      ☐ Class III
    (Press **F1** when field is selected to show additional information on Protection Class.)
☒ FCC / TCB Certification      ☐ Industry Canada / FCB Certification
☐ E-Mark Certification      ☐ Taiwan Certification

---

**Form**

## EMC Test Plan and Constructional Data Form

| **Attendance** |
Test will be:  ☐ Attended by the customer  ☒ Unattended by the customer

| **Failure  - *Complete this section if testing will not be attended by the customer.*** |
If a failure occurs, TÜV SÜD America should:
☒ Call contact listed above, if not available then stop testing.   (After hrs phone):  818-482-3711
☐ Continue testing to complete test series.
☐ Continue testing to define corrective action.
☐ Stop testing.

| **EUT Specifications and Requirements** |
Length:  52mm          Width:  29mm          Height:  9mm          Weight:  12gr

| **Power Requirements** |
*Regulations require testing to be performed at typical  power ratings in the countries of intended use.  (i.e., European power is typically 230 VAC 50 Hz or 400 VAC 50 Hz, single and three phase, respectively)*

Voltage:          3.6V          (If battery powered, make sure battery life is sufficient to complete testing.)

# of Phases:     N/A

Current
(Amps/phase(max)):   80mA     Current
(Amps/phase(nominal)):    30 mA

Other

| **Other Special Requirements** |
1 x D Size Battery Holder with Proper Connector Provided for testing.

| **Typical Installation and/or Operating Environment** |
(ie. Hospital, Small Business, Industrial/Factory, etc.)
Agriculture (Open Field, Greenhouses) and Industrial

| **EUT Power Cable** |
☐ Permanent   OR   ☒ Removable          Length (in meters):  0.3 ( Battery DC battery cable)

☐ Shielded    OR   ☒ Unshielded
☐ Not Applicable

# EMC Test Plan and Constructional Data Form

## EUT Interface Ports and Cables

| Type | Analog | Digital | Active | Passive | Qty | Yes | No | Shielding Type | Termination | Connector Type | Port Termination | Length tested (in meters) | Removable | Permanent |
|------|--------|---------|--------|---------|-----|-----|-----|------|-------------|----------------|------------------|--------------------------|-----------|-----------|
| ***EXAMPLE:*** *RS232* | ☐ | ☒ | ☒ | ☐ | *2* | ☒ | ☐ | *Foil over braid* | *Coaxial* | *Metallized 9-pin D-Sub* | *Characteristic Impedance* | *6* | ☒ | ☐ |
| SMA Connector for conducted emissions measurements | ☒ | ☐ | ☒ | ☐ | 1 | ☐ | ☒ | | Coaxial | SMA | 50 ohm | | ☒ | ☐ |
| | ☐ | ☐ | ☐ | ☐ | | ☐ | ☐ | | | | | | ☐ | ☐ |
| | ☐ | ☐ | ☐ | ☐ | | ☐ | ☐ | | | | | | ☐ | ☐ |
| | ☐ | ☐ | ☐ | ☐ | | ☐ | ☐ | | | | | | ☐ | ☐ |
| | ☐ | ☐ | ☐ | ☐ | | ☐ | ☐ | | | | | | ☐ | ☐ |
| | ☐ | ☐ | ☐ | ☐ | | ☐ | ☐ | | | | | | ☐ | ☐ |
| | ☐ | ☐ | ☒ | ☐ | | ☐ | ☐ | | | | | | ☐ | ☐ |
| | ☐ | ☐ | ☐ | ☐ | | ☐ | ☐ | | | | | | ☐ | ☐ |
| | ☐ | ☐ | ☐ | ☐ | | ☐ | ☐ | | | | | | ☐ | ☐ |
| | ☐ | ☐ | ☐ | ☐ | | ☐ | ☐ | | | | | | ☐ | ☐ |
| | ☐ | ☐ | ☐ | ☐ | | ☐ | ☐ | | | | | | ☐ | ☐ |
| | ☐ | ☐ | ☒ | ☐ | | ☐ | ☐ | | | | | | ☐ | ☐ |

## EMC Test Plan and Constructional Data Form

| **EUT Software**. |
|---|

Revision Level:    FCCTest v1

Description:        uC(MSP430F1611) software loaded and ready in order to control data transmission
                   through RF Module

| **Equipment Under Test (EUT) Operating Modes to be Tested --** list the operating modes to be used during test. It is recommended the equipment be tested while operating in a typical operation mode. FCC testing of personal computers and/or peripherals requires that a simple program generate a complete line of upper case H's. Provide a general description of all software, firmware, and PLD algorithms used in the equipment.  List all code modules as described above, with the revision level used during testing.  Consult with your TÜV Product Service Representative if additional assistance is required. |
|---|

1.   -
     High Power Data Transmission Mode at low channel (2450 MHz).

     Max duty cycle is 30%, which means in the worst condition transmission is no more than 30
     miliseconds for a 100 miliseconds period.

2.   High Power Data Transmission Mode at high channel (2485 MHz)

     Max duty cycle is 30%, which means in the worst condition transmission is no more than 30
     miliseconds for a 100 miliseconds period.

3.   High Power Data Transmission Mode at mid channel (2445 MHz)

     Max duty cycle is 30%, which means in the worst condition transmission is no more than 30
     miliseconds for a 100 miliseconds period.

Please note that our RF chip can operate in one of the 16 channels available between 2405 to 2485.
However, since the end users can not change the channels we want to certificate our product only on 2450
– 2485 band.

| **Equipment Under Test (EUT) System Components --** List and describe all components which are part of the EUT. For FCC & Taiwan testing a minimum configuration is required. (ie. Mouse, Printer, Monitor, External Disk Drive, Motherboard, etc) | | | |
|---|---|---|---|
| **Description** | **Model #** | **Serial #** | **FCC ID #** |
| Wireless Sensor Node | NodeRF V2.1.90 | | |

**Form**

# EMC Test Plan and Constructional Data Form

**Support Equipment --** List and describe all support equipment which is not part of the EUT. (i.e. peripherals, simulators, etc) This information is required for FCC & Taiwan testing.

| Description | Model # | Serial # | FCC ID # |
|---|---|---|---|
|  |  |  |  |

## Oscillator Frequencies

| Manufacturer | Frequency | Derived Frequency | Component # / Location | Description of Use |
|---|---|---|---|---|
| Abracomm | 16MHz | 2.4-2.485 GHz | X3/26-9.8mm | RF Modem Clock |
| Abracomm | 8MHz | 4 MHz | X1/1.53-18.7 mm | uC Module Clock-1 |
| Abracomm | 32.768 KHz | 32.768 KHz | X2/18.4-25mm | uC Module Clock-2 |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

## Power Supply

| Manufacturer | Model # | Serial # | Type |
|---|---|---|---|
| Standard Type | D size Tadiran |  | ☐ Switched-mode:   (Frequency) _____ <br> ☐ Linear   ☒ Other:   Battery _____ |
|  |  |  | ☐ Switched-mode:   (Frequency) _____ <br> ☐ Linear   ☐ Other: _____ |

## Power Line Filters

| Manufacturer | Model # | Location in EUT |
|---|---|---|
|  |  |  |
|  |  |  |

**Form**

## EMC Test Plan and Constructional Data Form

| Critical EMI Components (Capacitors, ferrites, etc.) | | | | |
|---|---|---|---|---|
| *Description* | *Manufacturer* | *Part # or Value* | *Qty* | *Component # / Location* |
| On Board PCB Antenna | Genetlab | 2dBi- Inverted F | 1 | 62.9-17.8mm |
| RF Modem | TI | CC2420-cc2590 | 1 | U2/37.8-18.6mm |
| SMA OPTIONAL | ANTENNOVA | TITANIS | 1 | 62.9-17.8mm |
| | | | | |

**EMC Critical Detail --** Describe other EMC Design details used to reduce high frequency noise.

4-Layer PCB Design with adiquate vias
Separate DC and RF Grounds
By-Pass Capacitors near DC Power pins on each IC

PLEASE ENTER NAMES BELOW (INSERT ELECTRONIC SIGNATURE IF POSSIBLE)

**Authorization (Signature Required if a Third Party Certification is checked on pg 1)**

Customer authorization to perform tests
according to this test plan.                                    Date

Test Plan/CDF Prepared By (please print)                        Date

**Form**

## EMC Block Diagram Form

---

**System Configuration Block Diagram --** Provide a line drawing identifying the EUT, simulators, support equipment, I/O cables, power cables, and any other pertinent components to be used during testing.   Use a dashed line to separate the equipment in the testing field versus equipment outside testing field.
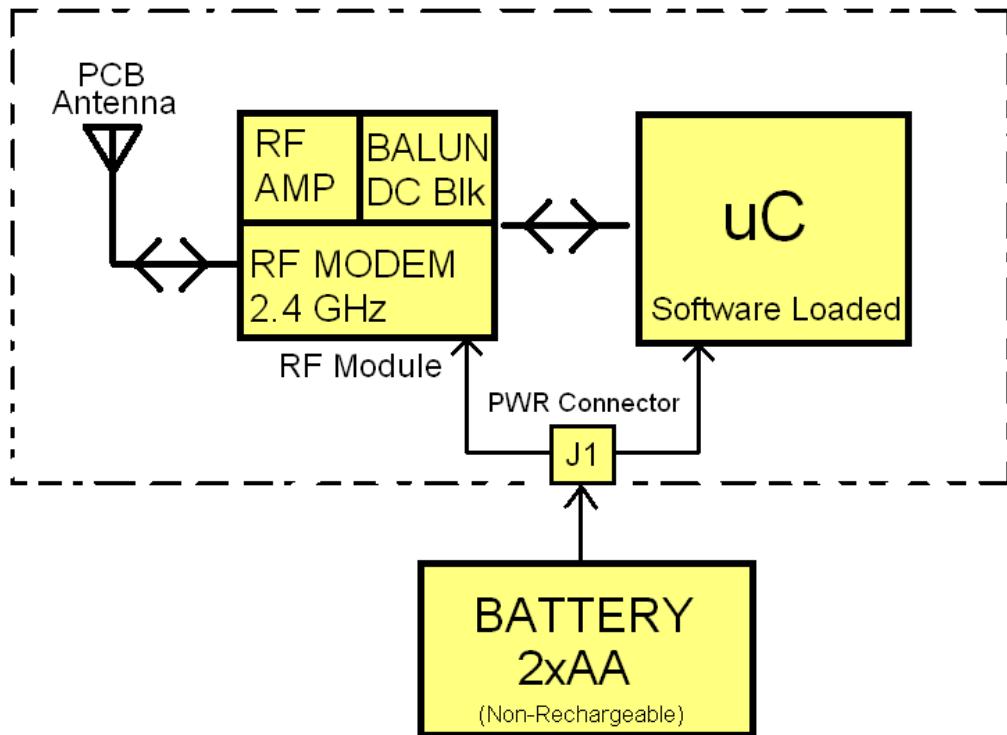


| | |
|---|---|
| uC Module: | Texas Instruments MSP430F1611 ultra-low power MCU |
| RF Communication: | 2400-2485 MHz |
| RF Module: | Texas Instruments CC2420 RF IC and CC2590 front end amp. |
| | +8dBm maximum output power. |
| Battery: | 2 Units of  standard AA type non-rechargeable with proper connector and housing |
| | Provided. Alternatively, 1 D-size 3.6V lithium primary battery can be used as well. |
| Oscilators: | 16Mhz Crystall Oscilator(RF) ; 8MHZ Crystall Oscilator (MCU); 32KHz(MCU) |

---

**Authorization Signatures**

Customer authorization to perform tests
according to this test plan.                                    Date

Test Plan/CDF Prepared By (please print)                        Date

# Appendix B

Measurement Protocol

# MEASUREMENT PROTOCOL
## GENERAL INFORMATION

### Test Methodology
Emissions testing is performed according to the procedures in ANSI C63.4-2003.

### Measurement Uncertainty
The test system for conducted emissions is defined as the LISN, tuned receiver or spectrum analyzer, and coaxial cable. The test system has a measurement uncertainty of ±1.8 dB. The test system for radiated emissions is defined as the antenna, the pre-amplifier, the spectrum analyzer and the coaxial cable. The test system has a measurement uncertainty of ±4.8 dB. The equipment comprising the test systems is calibrated on an annual basis.

### Justification
The Equipment Under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral into its characteristic impedance or left unterminated. When appropriate, the cables are manually manipulated with respect to each other to obtain maximum emissions from the unit.

### Conducted Emissions
The final level, in dBμV, equals the EMI receiver level plus the cable loss and LISN factor.

### Radiated Emissions
The final level, in dBμV/m, equals the reading from the spectrum analyzer (Level dBμV), adding the antenna correction factor and cable loss factor (Factor dB) to it, and subtracting the preamp gain (and duty cycle correction factor, if applicable). This result then has the limit subtracted from it to provide the Delta, which gives the tabular data as shown in the data sheets in Attachment A. Intentional radiators are rotated through 3 orthogonal axes to determine the test position yielding the maximum emission levels.

Example:

| FREQ (MHz) | LEVEL (dBuV) | CABLE/ANT/PREAMP (dB) (dB/m) (dB) | FINAL (dBuV/m) | POL/HGT/AZ (m) (deg) | DELTA1 |
|---|---|---|---|---|---|
| 60.80 | 42.5Qp + | 1.2 + 10.9 - 25.5 = | 29.1 | V   1.0   0.0 | -10.9 |

### Test Equipment
All measurement instrumentation is traceable to the National Institute of Standards and Technology and is calibrated according to internal procedure.

Test Report WC909614 Rev C
TÜV SÜD AMERICA INC     19333 Wild Mountain Road     Taylors Falls MN  55084-1786     Tel: 651 638 0297     Fax: 651 638 0298

50 of 50
Rev. 071107