# DELTA Test Report

DANAK
TEST Reg. no. 19

## Emission tests to FCC requirements of TrackMan II

## Performed for Interactive Sports Games A/S

DANAK-198415 Rev. A
Project no.: A503808-1
Page 1 of 47
including 6 annexes

03 August 2006

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| | |
|---|---|
| Title | Emission tests to FCC requirements of TrackMan II |
| Test object | TrackMan II<br>10500 - 10550 MHz Field Disturbance Sensor |
| FCC ID | SFX-TMAN |
| Report no. | DANAK-198415 Rev. A |
| Project no. | A503808-1 |
| Test period | 05 May 2006 to 14 June 2006 |
| Client | Interactive Sports Games A/S<br>Staktoften 2<br>2950 Vedbaek<br>Denmark<br><br>Telephone: +45 45 57 08 50<br>Fax: +45 45 74 00 39 |
| Contact person | Mr. Bjørn Andersen<br>bva@isg.dk |
| Manufacturer | Interactive Sports Games A/S |
| Specifications | 47 CFR Part 15, Subpart C - Intentional Radiators |
| Results | The equipment was in compliance with the requirements. |
| Test personnel | Henrik Egeberg Nielsen<br>Claus Rømer Andersen |
| Date | 03 August 2006 |

Responsible

Claus Rømer Andersen
Project Manager - EMC
DELTA

This report is a revision of the original test report DANAK-198415 dated 30 June 2006. The revision has been made due to the following corrections:

On page 13 MHz has been corrected to GHz in the first column
On page 15 mV/m has been corrected to V/m in the third column.

Table of contents Page


| | | |
|---|---|---|
| **1.** | **Summaries** | **4** |
| 1.1 | Technical report summary | 4 |
| 1.1.1 | Applicable FCC rules for test | 4 |
| 1.2 | Summary of tests | 5 |
| **2.** | **Test objects and auxiliary equipment** | **6** |
| 2.1 | Test object - Field Disturbance Sensor (Tx & Rx) | 7 |
| 2.2 | Test object - Field Disturbance Sensor (Tx & Rx) | 7 |
| 2.3 | Test object - Field Disturbance Sensor (Tx & Rx) | 7 |
| 2.4 | Test object - Power adapter for Field Disturbance Sensor | 7 |
| 2.5 | Auxiliary equipment - PC | 8 |
| 2.6 | Auxiliary equipment - Power adapter for PC | 8 |
| **3.** | **General test conditions** | **9** |
| 3.1 | Test setup during test | 9 |
| 3.2 | Modifications before test | 9 |
| **4.** | **Tests and results** | **10** |
| 4.1 | Conducted emission, AC mains (FCC Part 15, Subpart C) | 10 |
| 4.2 | Radiated electromagnetic field (FCC Part 15, Subpart C) | 11 |
| 4.3 | Occupied bandwidth | 14 |
| 4.4 | Peak output field strength | 15 |
| | Annex 1 List of instruments | 16 |
| | Annex 2 Photos | 18 |
| | Annex 3 Test record sheets regarding conducted emission, AC mains | 23 |
| | Annex 4 Test record sheets regarding radiated electromagnetic field | 28 |
| | Annex 5 Test record sheet regarding occupied bandwidth | 42 |
| | Annex 6 Test record sheets regarding peak output field strength | 44 |

# 1. Summaries

## 1.1 Technical report summary

The tests reported in this document have been performed to demonstrate compliance with the requirements of 47 CFR Part 15, Section 15.245 Operation within the bands 902-928 MHz, 2435-2465 MHz, 5785-5815 MHz, 10500-10550 MHz and 24075-24175 MHz.

This report contains measurement data from tests performed at DELTA, Hørsholm, Denmark. DELTA is a FCC listed (Reg. no.: 90529) and DANAK accredited test laboratory.

### 1.1.1 Applicable FCC rules for test

47 CFR, Part 15, Subpart C - Intentional Radiators:

- 15.205 Emission in restricted bands
- 15.207 Conducted limits
- 15.209 Radiated emission limits, general requirements
- 15.215 Additional provisions to the general radiated emission limitations
- 15.245 Operation within the bands 902-928 MHz, 2435-2465 MHz, 5785-5815 MHz, 10500-10550 MHz and 24075-24175 MHz.

The methods and procedures have been applied as specified in:

- 15.31 Measurement standards.

The following procedure has been used during the measurements reported in this document:

- ANSI C63.4: Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

Furthermore, the requirements of the following have been applied:

- 15.33 Frequency range of radiated measurements
- 15.35 Measurement detector functions and bandwidths.

## 1.2 Summary of tests

The results of the tests can be summarized as follows:

| **Tests** | **Reference (47 CFR Part 15)** | **Results** |
|---|---|---|
| Conducted emission, AC mains | 15.207 | Passed |
| Radiated electromagnetic field emission | 15.209 | Passed |
| Radiated emission limits, additional provisions | 15.215<br>15.245 | Passed |
| Emission in restricted bands | 15.205 | Passed |

Abbreviations

| | | |
|---|---|---|
| Failed | : | The requirements are not met. |
| Passed | : | The requirements are met. |
| Not done | : | No test was performed. |
| N/A | : | Not applicable. |
| Not relevant | : | The test was not relevant for the test object. |

The given results are based on a shared risk principle with respect to the measurement uncertainty.

**Conclusion**

The test objects mentioned in this report meet the requirements of the standard stated below as to the test phenomena mentioned above:

- Title 47 of the Code of Federal Regulations, Part 15, Subpart C - Intentional Radiators.

The test results relate only to the objects tested.

## 2. Test objects and auxiliary equipment

The test object is a field disturbance sensor installed in a cabinet. Information from the field disturbance sensor is transmitted to a PC using an USB2 connection.

The field disturbance sensor can be set to any frequency within the frequency band 10.50 to 10.55 GHz. The change of frequency is performed by the manufacturer and can not be performed by the user.

Tests are performed using three test objects: one set to the lowest used frequency, one set to the centre frequency and one set to the highest frequency.

The field disturbance sensor is designed for the purpose of measuring properties of sport balls and will only be used at sport facilities or at sport equipment manufacturers test facilities.

## 2.1 Test object - Field Disturbance Sensor (Tx & Rx)

| | |
|---|---|
| Category | Field Disturbance Sensor |
| Manufacturer | Interactive Sports Games A/S |
| Model / type | TrackMan II |
| Part no. | - |
| Serial no. | 0604 3 007 |
| FCC ID | SFX-TMAN |
| Supply voltage | 12 VDC |
| Operational mode | Tx at 10.5005 GHz |

## 2.2 Test object - Field Disturbance Sensor (Tx & Rx)

| | |
|---|---|
| Category | Field Disturbance Sensor |
| Manufacturer | Interactive Sports Games A/S |
| Model / type | TrackMan II |
| Part no. | - |
| Serial no. | 0604 3 008 |
| FCC ID | SFX-TMAN |
| Supply voltage | 12 VDC |
| Operational mode | Tx at 10.5250 GHz |

## 2.3 Test object - Field Disturbance Sensor (Tx & Rx)

| | |
|---|---|
| Category | Field Disturbance Sensor |
| Manufacturer | Interactive Sports Games A/S |
| Model / type | TrackMan II |
| Part no. | - |
| Serial no. | 0604 3 009 |
| FCC ID | SFX-TMAN |
| Supply voltage | 12 VDC |
| Operational mode | Tx at 10.5495 GHz |

## 2.4 Test object - Power adapter for Field Disturbance Sensor

| | |
|---|---|
| Category | AC/DC Converter |
| Manufacturer | GlobTek Inc. |
| Model / type | GT-21148-3012-T2 |
| Part no. | TR9KE2500LTW-Y |
| Serial no. | 04096330/05 |
| FCC ID | - |
| Supply voltage | 115 VAC |
| Operational mode | Supplying 12 VDC |

## 2.5 Auxiliary equipment - PC

| | |
|---|---|
| Manufacturer | Panasonic |
| Model / type | Toughbook, CF-29 |
| Part no. | CF-29LTQGZL2 |
| Serial no. | 6CKCB16129 |
| FCC ID | - |

## 2.6 Auxiliary equipment - Power adapter for PC

| | |
|---|---|
| Manufacturer | Panasonic |
| Model / type | CF-AA1653A M4 |
| Part no. | SEB100P3-15.6C |
| Serial no. | 1653AM405Z26872D |
| FCC ID | - |

# 3. General test conditions

## 3.1 Test setup during test

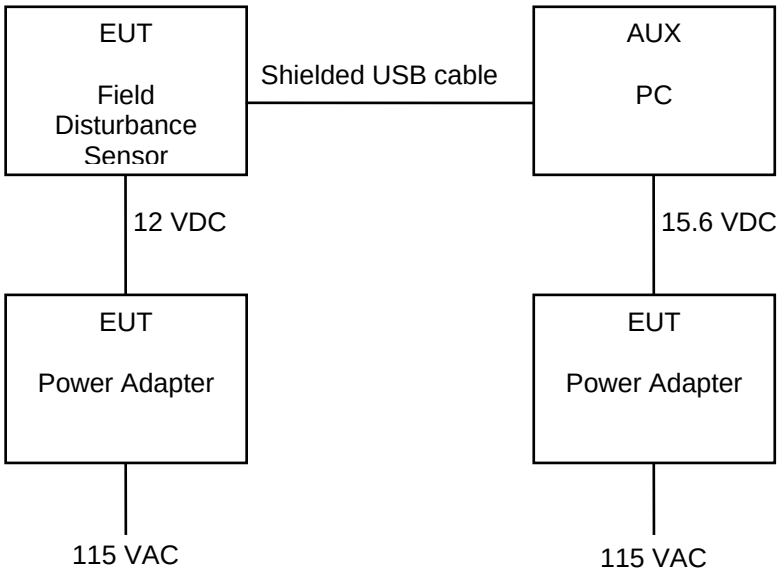



Figure 3.1 Test setup during test.

The antenna of the field disturbance sensor is mounted internally and behind a cover.

The test object will transmit un-modulated carrier. Reflected signals will produce a Doppler signal that is converted and transmitted to the PC for calculation. In the test object a camera is installed, too. Images are captured continuously and transmitted to the PC, where they are displayed.

## 3.2 Modifications before test

The following modifications were performed before test:

- The controller PCB was grounded, using existing spacers.
- A ferrite was inserted on the internal USB cable connected to the controller PCB.
- The USB and DC cables were fixated.

# 4. Tests and results

## 4.1 Conducted emission, AC mains (FCC Part 15, Subpart C)

| | **Requirements** | |
|---|---|---|
| Specification | FCC Rules and Regulations Part 15, Subpart C | |
| Test set-up | ANSI C63.4:2003 | |
| Frequency range | 0.15-30 MHz | |
| Limit: (quasi-peak) | Quasi-peak | Average |
| 0.15-0.5 MHz | 66-56<br>Decreases with log of freq. | 56-46<br>Decreases with log of freq. |
| 0.5-5 MHz | 56 | 46 |
| 5-30 MHz | 60 | 50 |
| | | |
| Photos<br>Test record sheets | | Annex 2<br>Annex 3 |

**Results**

The test object is in compliance with the requirements.

**Comments**

The field disturbance sensor was supplied from the power adapter.

Measurements were performed on the 10.5005 GHz and the 10.5250 GHz field disturbance sensors.

## 4.2 Radiated electromagnetic field (FCC Part 15, Subpart C)

| | **Requirements** | |
|---|---|---|
| Specification | FCC Rules and Regulations Part 15, Subpart C | |
| Test set-up | ANSI C63.4:2003 | |
| Measuring distance | 3 m | |
| Frequency range | 30-40.000 MHz | |
| Limits:<br>As specified in<br>15.209(a) | 30-88 MHz:<br>88-216 MHz:<br>216-960 MHz:<br>Above 960 MHz: | 40 dBµV/m<br>43.5 dBµV/m<br>46 dBµV/m<br>54 dBµV/m |
| Measurement uncertainty (k = 2) <1 GHz<br>Measurement uncertainty (k = 2) >1 GHz | | 2.6 dB<br>4.9 dB |
| Below 1 GHz the limits apply to measurements performed using a quasi-peak detector.<br>Above 1 GHz the limits apply to measurements of spurious emission performed with an average detector.<br>Furthermore, the peak level must be no higher than 20 dB above the average limit. | | |
| Photos<br>Test record sheets | | Annex 2<br>Annex 4 |

In the frequency range 30 MHz - 2.75 GHz measurements were performed on the 10.5250 GHz field disturbance sensor.
In the frequency range 2.75 - 40 GHz measurements were performed on the 10.5005 GHz, 10.5250 GHz and the 10.4950 GHz field disturbance sensors.

On plots from the R&S receiver, found as A4-portrait plots, statements like "Ant 1 m vertical" or "4 m horizontal" indicate the elevation of the antenna during exploratory measurements.

Measurements 30 - 1000 MHz were performed using a test receiver with quasi peak detector.

Measurements 1 - 2.75 GHz were performed using a test receiver with average detector. The tabulated values on the plot are the measured average values using a resolution bandwidth of 1 MHz.

Measurements 2.75 - 18 GHz are shown as spectrum analyser plots in peak-hold mode, where all heights and polarities are maximized together to produce one plot. Peak-to-Average factor is established to be 0 dB, because un-modulated carrier is transmitted.

Therefore, average emission values are 0 dB lower than indicated on the spectrum analyser plots.

This is as a worst-case situation also assumed for possible harmonics from the digital processor.

Measurements from 18 - 40 GHz showed only harmonics from the transmitter.
The measurements were performed in a laboratory and recorded using a spectrum analyser. The test object was scanned with hand-held standard gain horn antennas at a distance of approximately 0.2 m. During the scans the bandwidth was lowered in order to lower the noise floor. In the band 18 - 26.5 GHz the bandwidth was 100 kHz. In the band 26.5 - 40 GHz the bandwidth was 10 kHz.
The maximum position and polarity was found and final measurements made there with the horn antenna placed at a distance of 1 meter. This optimisation was made on each significant frequency.

**Results**

The emission was within the specified limits.

Spurious emission 30 - 1000 MHz in tabular form:
(For spectral plots, see Annex 4).

| Tx freq. [MHz] | Spurious freq. [MHz] | Polarisation | Field strength QP [dBµV/m] | Margin [dB] | Note |
|---|---|---|---|---|---|
| 10.5250 | 86.25 | V | 30.8 | 9.2 | - |
| 10.5250 | 336.02 | H | 41.8 | 4.2 | - |
| 10.5250 | 432.04 | H | 44.1 | 1.9 | - |
| 10.5250 | 480.04 | H | 38.4 | 7.6 | - |
| 10.5250 | 528.04 | H | 37.5 | 8.5 | - |
| 10.5250 | 624.05 | H | 42.2 | 3.8 | - |
| 10.5250 | 960.00 | V | 38.7 | 7.3 | (R) |

(R) means frequency in restricted band, as defined in 15.205.

Spurious emission 1 - 40 GHz in tabular form:
(For spectral plots, see Annex 4)

| Tx freq. [GHz] | Spurious freq. [MHz] | Polarisation | Field strength Peak [dBµV/m] | Field strength Average [dBµV/m] | Margin Av [dB] | Note |
|---|---|---|---|---|---|---|
| 10.5250 | 1200.10 | V | 43.0 | 43.0 | 10.9 | (R) |
| 10.5250 | 1296.17 | V | 47.9 | 47.9 | 6.0 | - |
| 10.5250 | 1695.68 | H | 43.6 | 43.6 | 10.3 | - |
| 10.5250 | 21003 | - | 62.0 | 62.0 | 15.5 | 2nd har. |
| 10.5250 | 31501 | - | 62.8 | 62.8 | 14.7 | 3rd har. |
| 10.5005 | 21050 | - | 64.1 | 64.1 | 13.4 | 2nd har. |
| 10.5005 | 31575 | - | 67.0 | 67.0 | 10.3 | 3rd har. |
| 10.5495 | 21099 | - | 63.8 | 63.8 | 13.7 | 2nd har. |
| 10.5495 | 31648 | - | 64.6 | 64.6 | 12.9 | 3rd har. |

(R) means frequency in restricted band, as defined in 15.205.
The limit on all harmonics is 7.5 mV/m or 77.5 dBµV/m. Peak limit is 20 dB above average limit or 74 dBµV/m.

**Comments**

Measurements of spurious emission were performed with CW carrier.

## 4.3 Occupied bandwidth

With reference to 15.215(c), the 20 dB bandwidth of the emission shall be contained within the designated frequency band (10.50 - 10.55 GHz).

The occupied bandwidth was measured in 10 kHz resolution bandwidth.

Measurements were performed on the lowest and the highest Tx frequency, including frequency drift during warm-up.

**Occupied bandwidth**

(For spectral plots, see Annex 5)

| Tx frequency | Lower band edge | Upper band edge | Occupied bandwidth |
|---|---|---|---|
| 10.5005 | 10.5003240 | 10.5003777 | 0.0537 MHz |
| 10.5495 | 10.5491903 | 10.5492497 | 0.0594 MHz |

The occupied bandwidth is within the specifications.

## 4.4 Peak output field strength

With reference to 15.245(b), the peak output field strength is limited to 2500 mV/m or 128 dBµV/m at a distance of 3 m.

Measurements were performed on the lowest, middle and the highest Tx frequency

**Peak output field strength**

(For spectral plots, see Annex 6)

| Tx frequency | Field strength, at 3 m [dBµV/m] | Field strength, at 3 m [V/m] | Margin [dB] |
|---|---|---|---|
| 10.5005 | 120.9 | 1.109 | 7.1 |
| 10.5250 | 120.6 | 1.075 | 7.4 |
| 10.5495 | 121.0 | 1.122 | 7.0 |

The peak output field strength is within the specifications.

# Annex 1

# List of instruments

| NO. | DESCRIPTION | MANUFACTURER | TYPE NO. |
|---|---|---|---|
| 29461 | ARTIFICIAL MAINS NETWORK | ROHDE & SCHWARZ | ESH2/Z5 |
| 29494 | MICROWAVE CABLE, FIXED ROOM 1 CABLE | SUHNER | SUCOFLEX 104 |
| 29797 | BILOG ANTENNA, 30-2000 MHz | CHASE ELECTRICS LTD | CBL 6111A |
| 29861 | EMI-SOFTWARE Ver. 1.60 | ROHDE & SCHWARZ | ES-K1, PART: 1026.6790.02 |
| 29876 | RIDGED GUIDE HORN ANTENNA, 1-12.75 (18) GHz | EMCO | 3115 |
| 29916 | AUTOMATIC TEST RECEIVER, 9 kHz - 2.75 GHz | ROHDE & SCHWARZ | ESCS 30 1102.4500.30 |
| 49037 | BROADBAND MICROWAVE PREAMPLIFIER, 1-12.8 GHz | MITEQ / DELTA | AMF-5D-001128-35-11P |
| 49086 | REMI EMISSION SOFTWARE PACKAGE v. 2.133, ROOM 5 | NeWeTec | REMI |
| 49321 | SPECTRUM ANALYZER, 50 GHz WITH OPTION 006 | HEWLETT-PACKARD | 8565E |
| 49326 | STANDARD GAIN HORN, 26.5-40.0GHz | NARDA | V637 |
| 49329 | STANDARD GAIN HORN, 18-26.5GHz | NARDA | 638 |
| 49332 | STANDARD GAIN HORN, 8.20-12.4GHz | NARDA | 640 |
| 49387 | 40 GHz MICROWAVE CABLE, 30 cm | MIDWEST MICRO-WAVE INTERNA-TIONAL LTD | CSY-KMKM-44-001-FS |
| 49388 | 40 GHz MICROWAVE CABLE, 60 cm | MIDWEST MICRO-WAVE INTERNA-TIONAL LTD | CSY-KMKM-44-002-FS |
| 49421 | IMPULSE VOLTAGE LIMITER | ROHDE & SCHWARZ | ESH3/Z2 |

# Annex 2

# Photos

Photo A2.1 Conducted emission, AC mains.

Photo A2.2 Conducted emission, AC mains.

Photo A2.3 Radiated electromagnetic field, 30-1000 MHz.

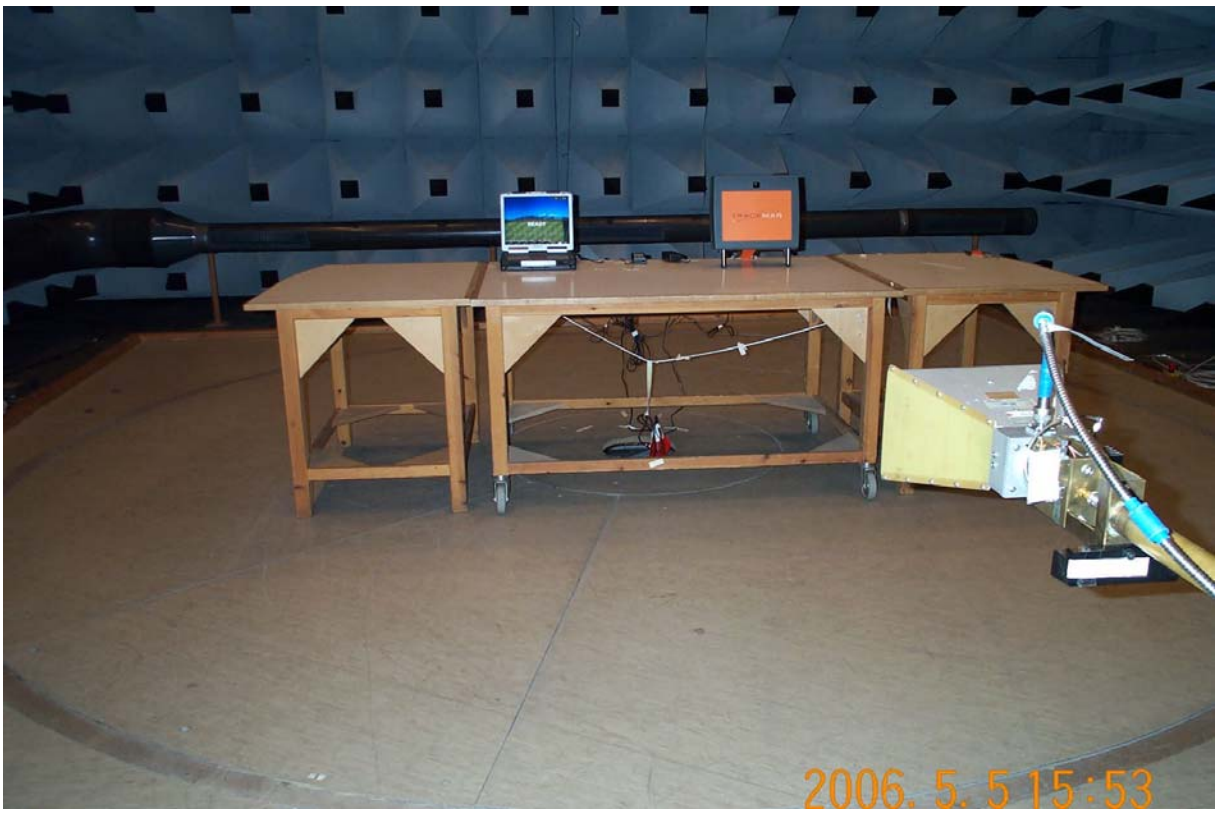



Photo A2.4 Radiated electromagnetic field 1-12.75 GHz and peak output field strength.

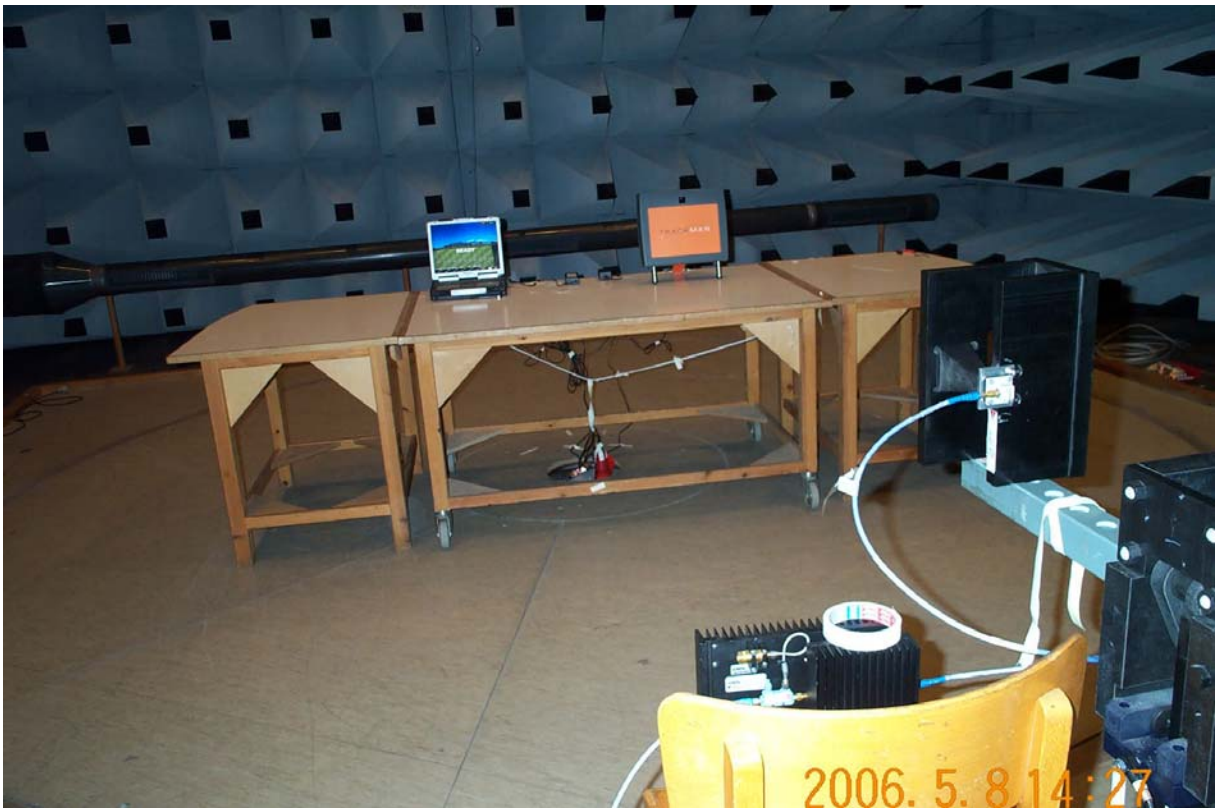



Photo A2.5 Radiated electromagnetic field, 12.75-18 GHz.

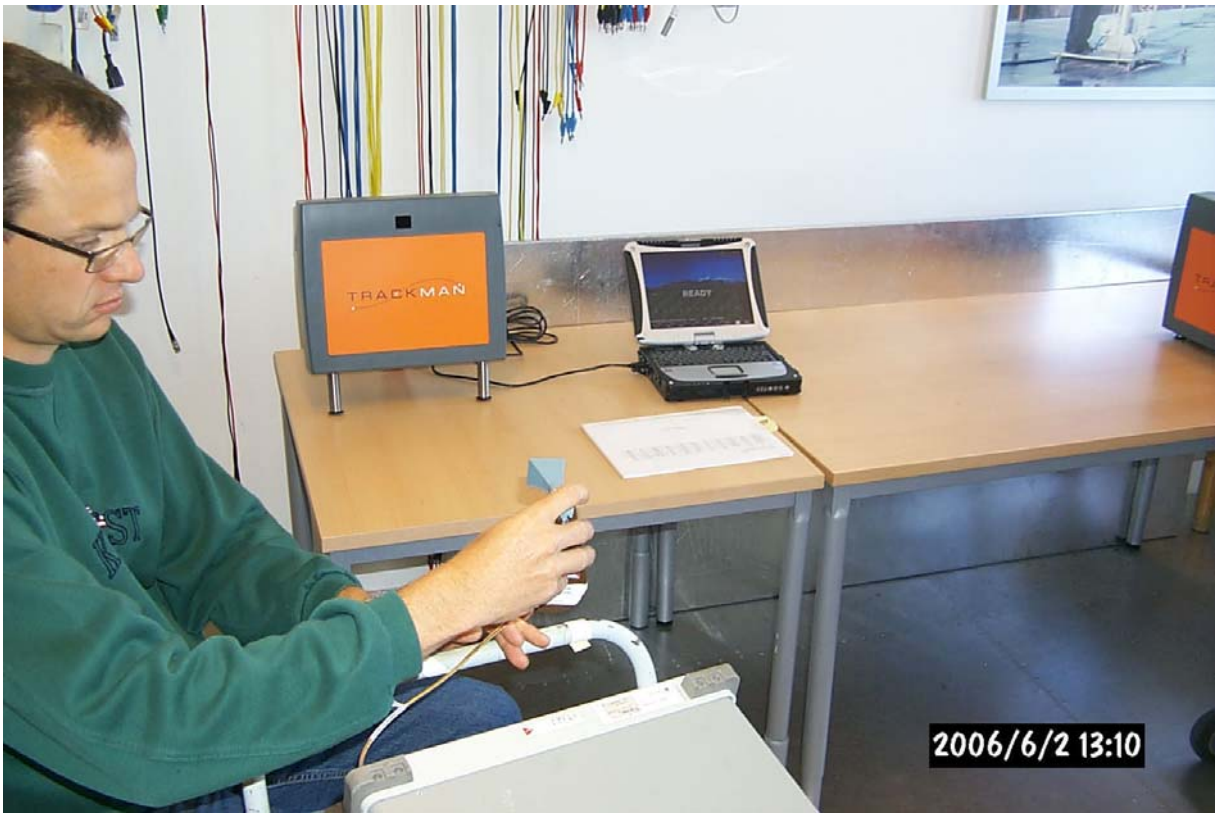



Photo A2.6 Radiated electromagnetic field, 18-40 GHz.

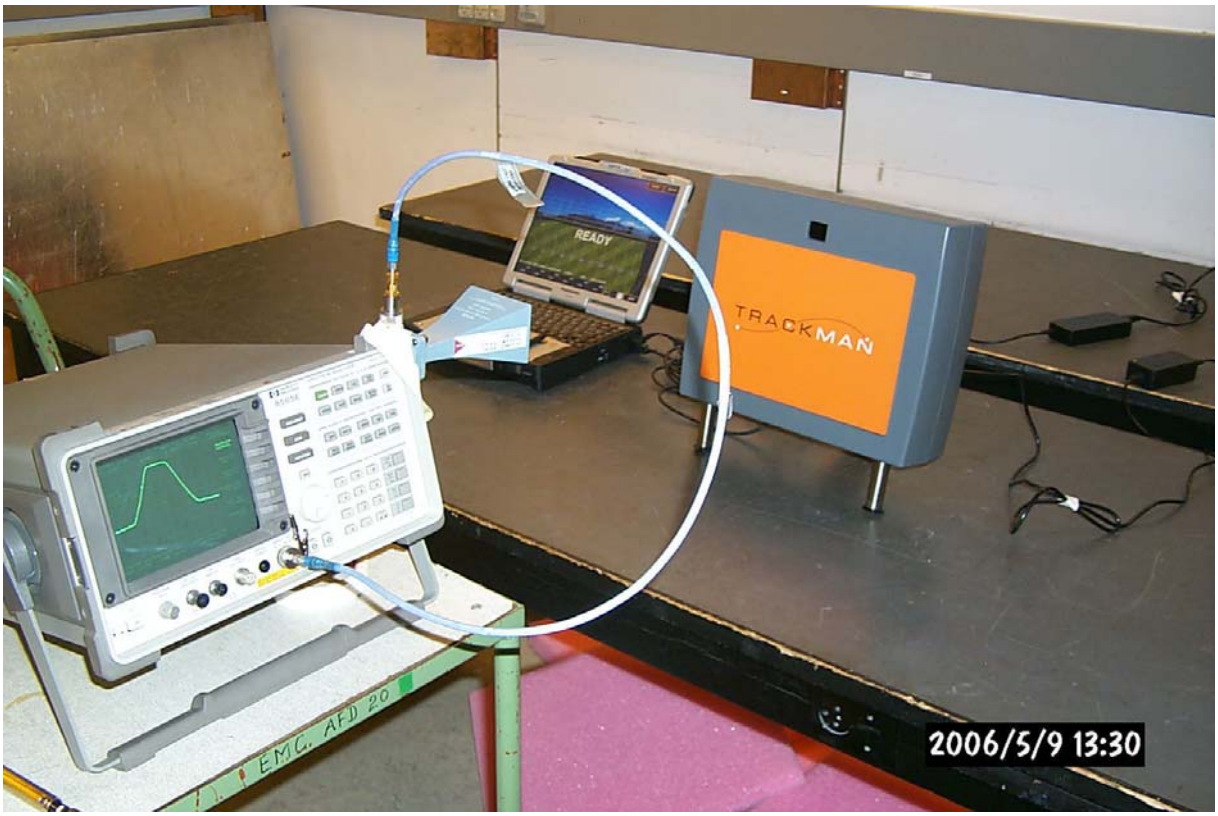
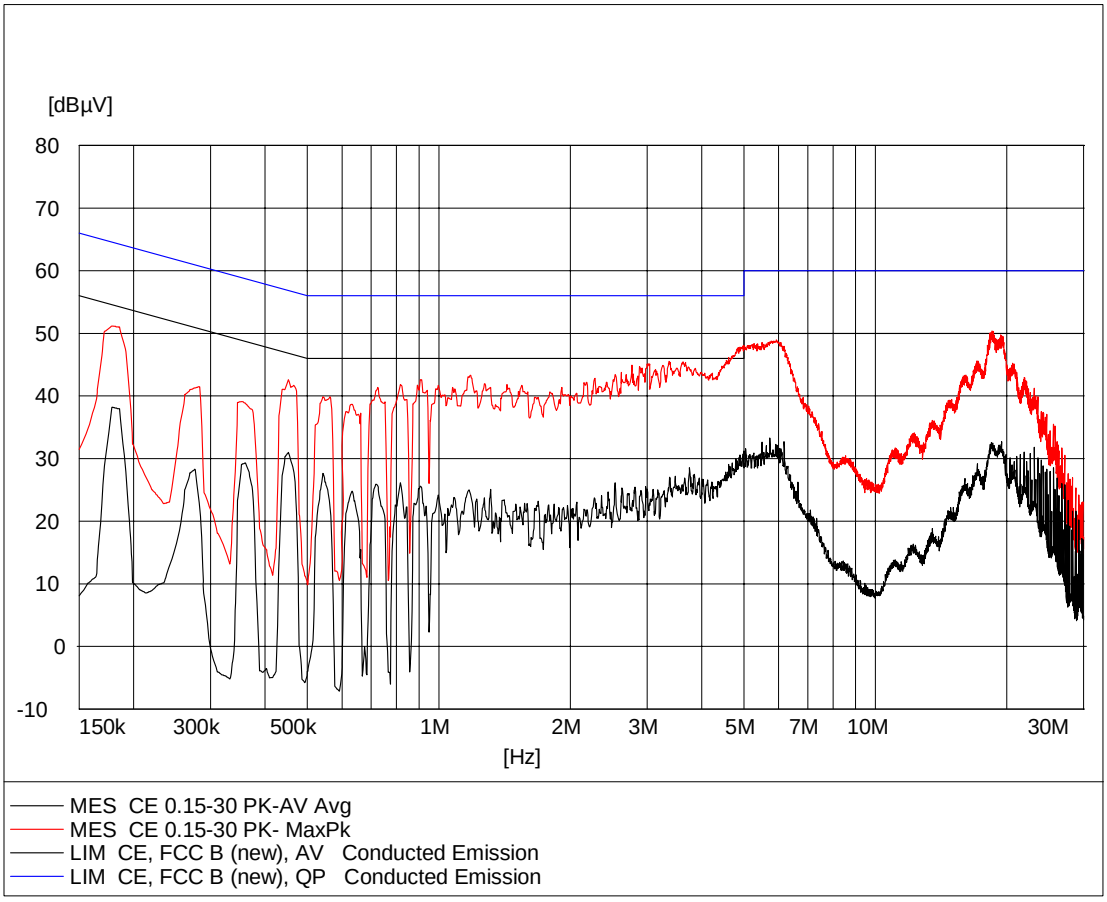



Photo A2.7 Occupied bandwidth.

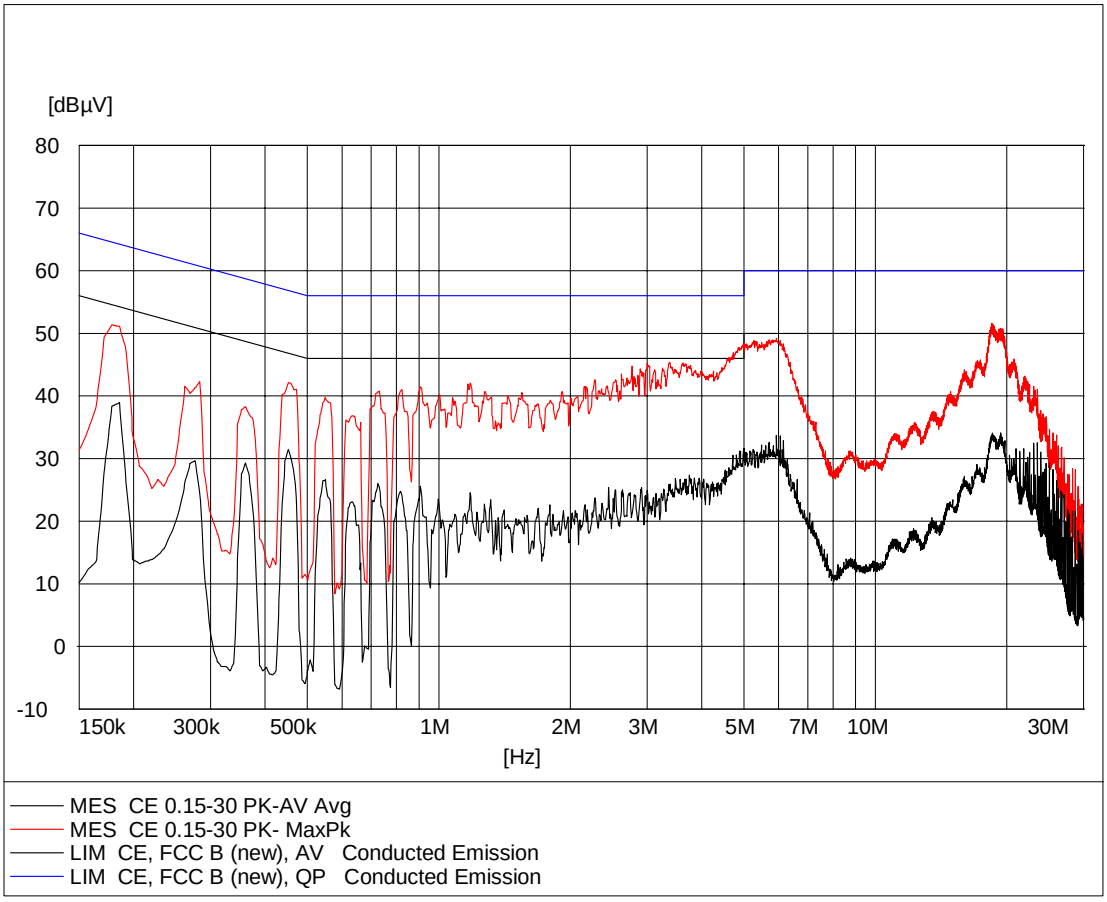
# Annex 3

## Test record sheets regarding conducted emission, AC mains

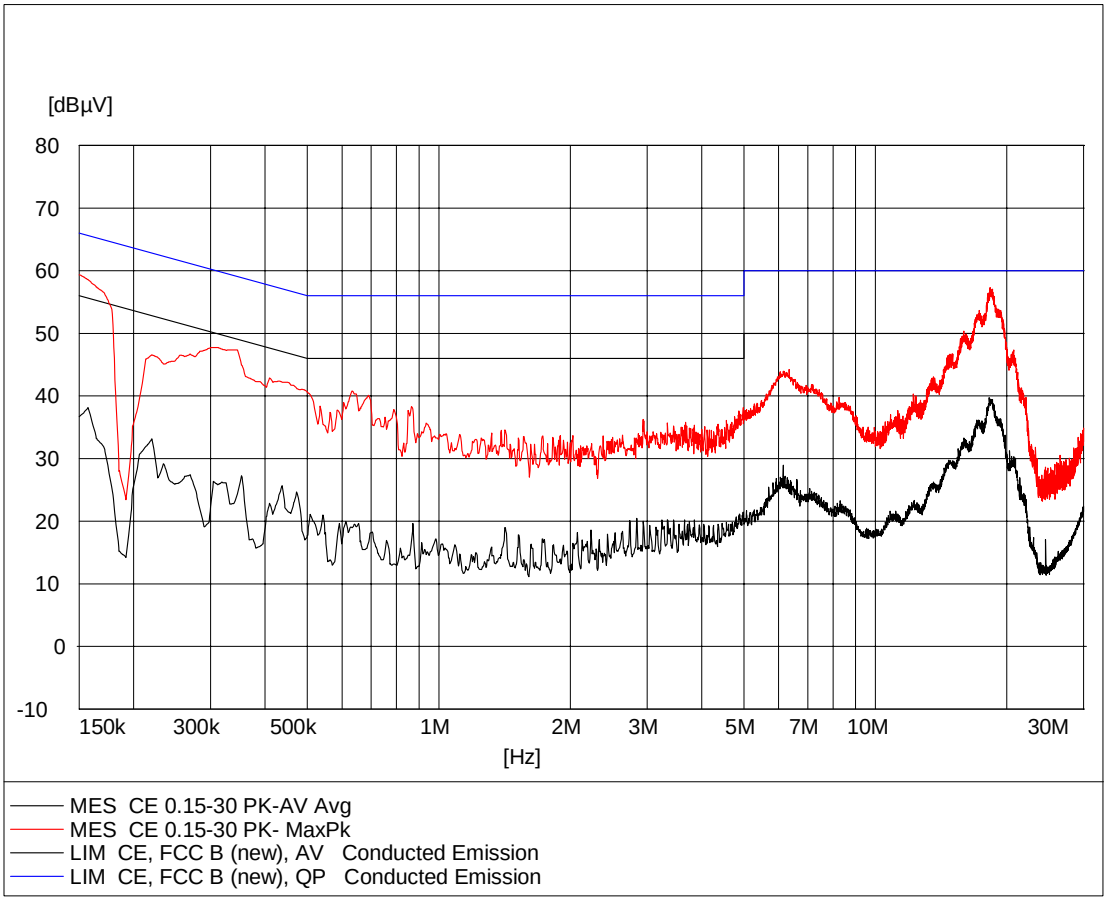
```
EUT:                  Tman II. 10.5495 GHz
Manufacturer:         ISG
Operating Condition:  Line no.: Neutral. 120 VAC
Test Site:            EMC-5
Operator:             HEN - A503808
Test Specification:   FCC part 15 sub C
Comment:              Sheet 28
Start of Test:        2006-05-08
```



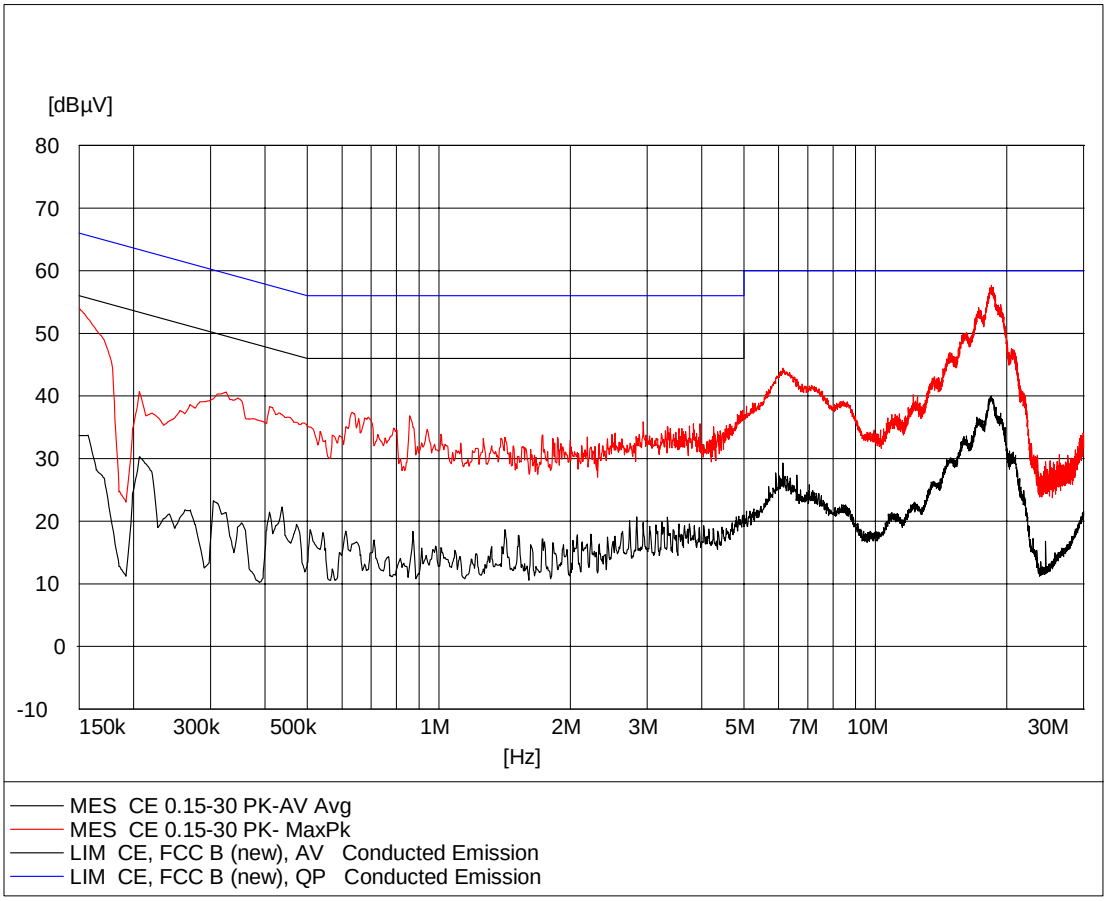
```
EUT:                  Tman II. 10.5495 GHz
Manufacturer:         ISG
Operating Condition:  Line no.: Line 1. 120 VAC
Test Site:            EMC-5
Operator:             HEN - A503808
Test Specification:   FCC part 15 sub C
Comment:              Sheet 29
Start of Test:        2006-05-08
```



```
EUT:                  Panasonic ToughBook CF29
Manufacturer:         ISG
Operating Condition:  Line no.: Neutral. 120 VAC
Test Site:            EMC-5
Operator:             HEN - A503808
Test Specification:   FCC part 15 sub C
Comment:              Sheet 30
Start of Test:        2006-05-08
```



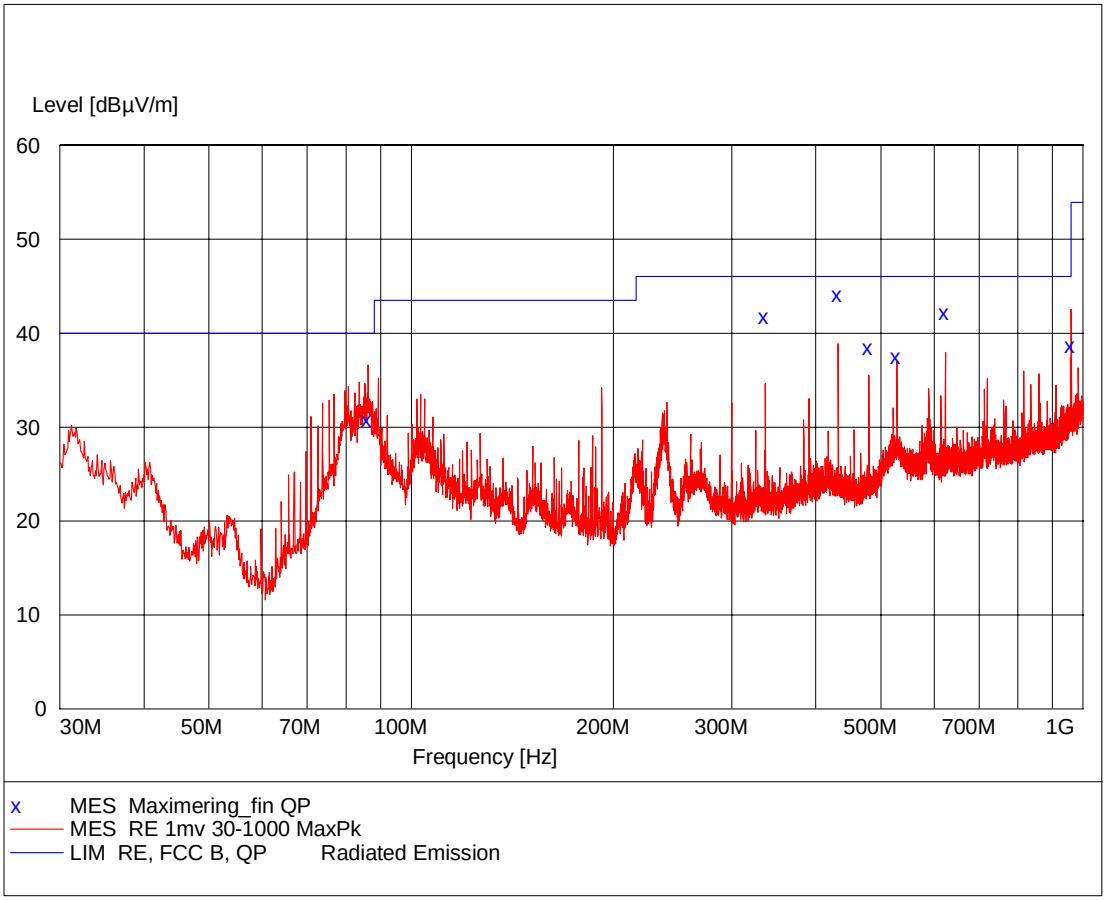
```
EUT:                  Panasonic ToughBook CF29
Manufacturer:         ISG
Operating Condition:  Line no.: Line 1. 120 VAC
Test Site:            EMC-5
Operator:             HEN - A503808
Test Specification:   FCC part 15 sub C
Comment:              Sheet 31
Start of Test:        2006-05-08
```



# Annex 4

## Test record sheets regarding radiated electromagnetic field

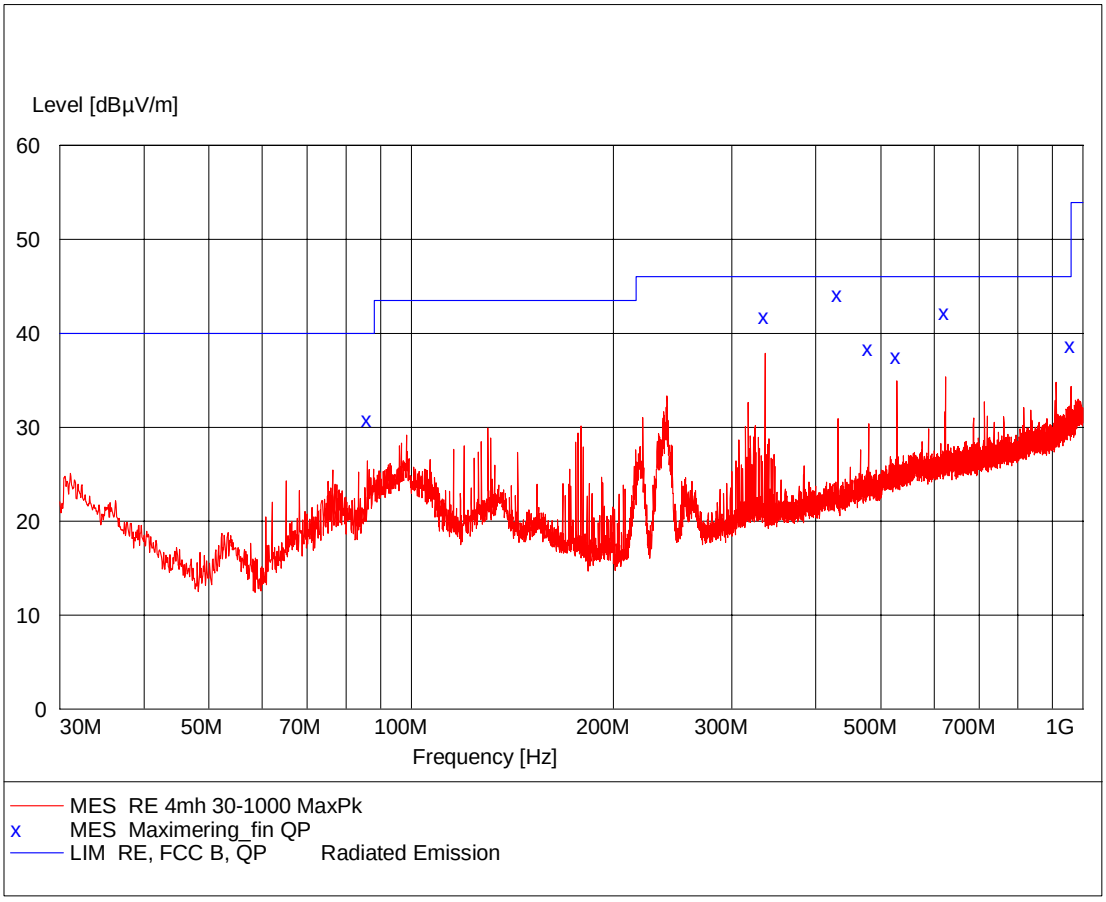
EUT: Tman II. 10.525 GHz
Manufacturer: ISG
Operating Condition: Ant. 1 m vertical. 120 VAC
Test Site: EMC-5
Operator: HEN - A503808
Test Specification: FCC part 15 sub C
Comment: Sheet 12
Start of Test: 2006-05-05



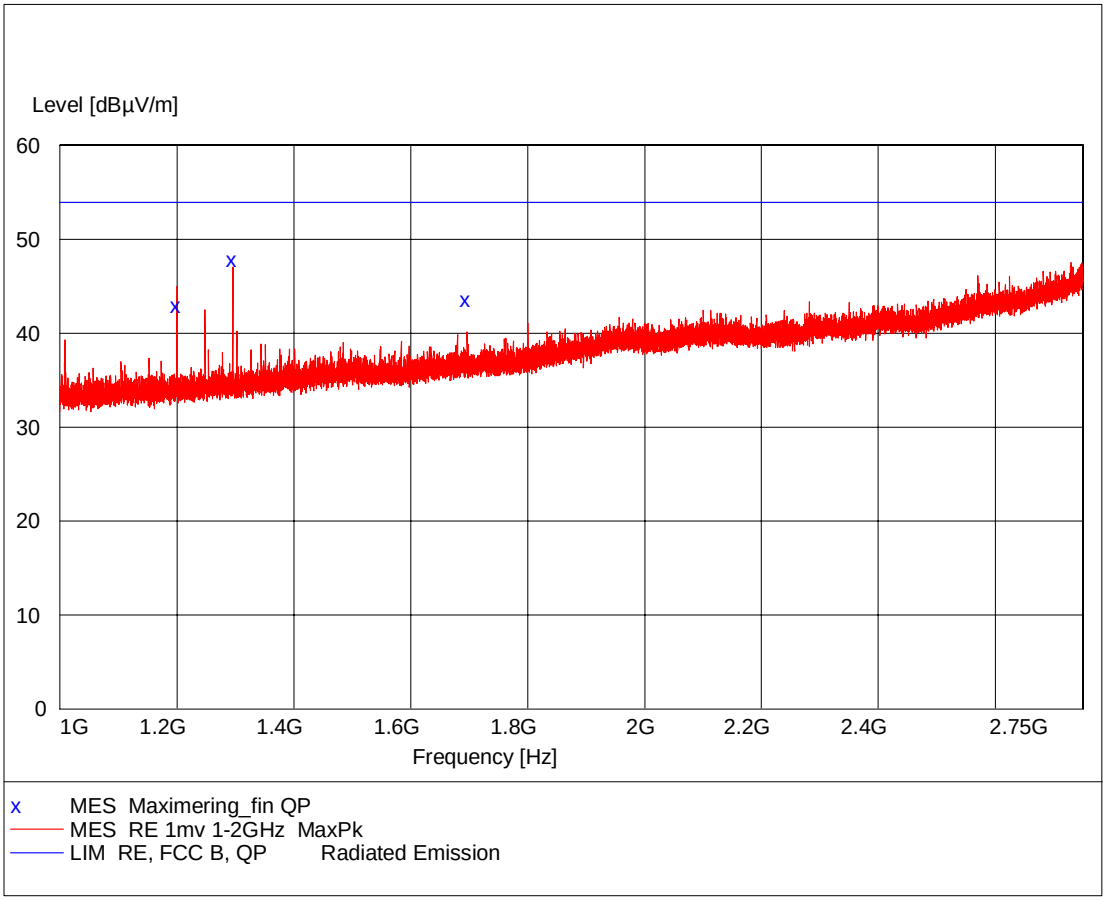

**MEASUREMENT RESULT: "Maximering_fin QP"**
2006-05-05 15:16

| Frequency MHz | Level dBµV/m | Transd dB | Limit dBµV/m | Margin dB | Height cm | Azimuth deg | Polarisation |
|---|---|---|---|---|---|---|---|
| 86.250000 | 30.80 | 10.9 | 40.0 | 9.2 | 123.0 | 61.00 | VERTICAL |
| 336.020000 | 41.80 | 17.4 | 46.0 | 4.2 | 101.0 | 173.00 | HORIZONTAL |
| 432.040000 | 44.10 | 19.6 | 46.0 | 1.9 | 180.0 | 151.00 | HORIZONTAL |
| 480.040000 | 38.40 | 20.5 | 46.0 | 7.6 | 101.0 | 63.00 | HORIZONTAL |
| 528.040000 | 37.50 | 21.7 | 46.0 | 8.5 | 141.0 | 358.00 | HORIZONTAL |
| 624.050000 | 42.20 | 23.7 | 46.0 | 3.8 | 101.0 | 322.00 | HORIZONTAL |
| 960.000000 | 38.70 | 28.2 | 46.0 | 7.3 | 163.0 | 173.00 | VERTICAL |

```
EUT:                  Tman II. 10.525 GHz
Manufacturer:         ISG
Operating Condition:  Ant. 3 m horizontal. 120 VAC
Test Site:            EMC-5
Operator:             HEN - A503808
Test Specification:   FCC part 15 sub C
Comment:              Sheet 13
Start of Test:        2006-05-05
```



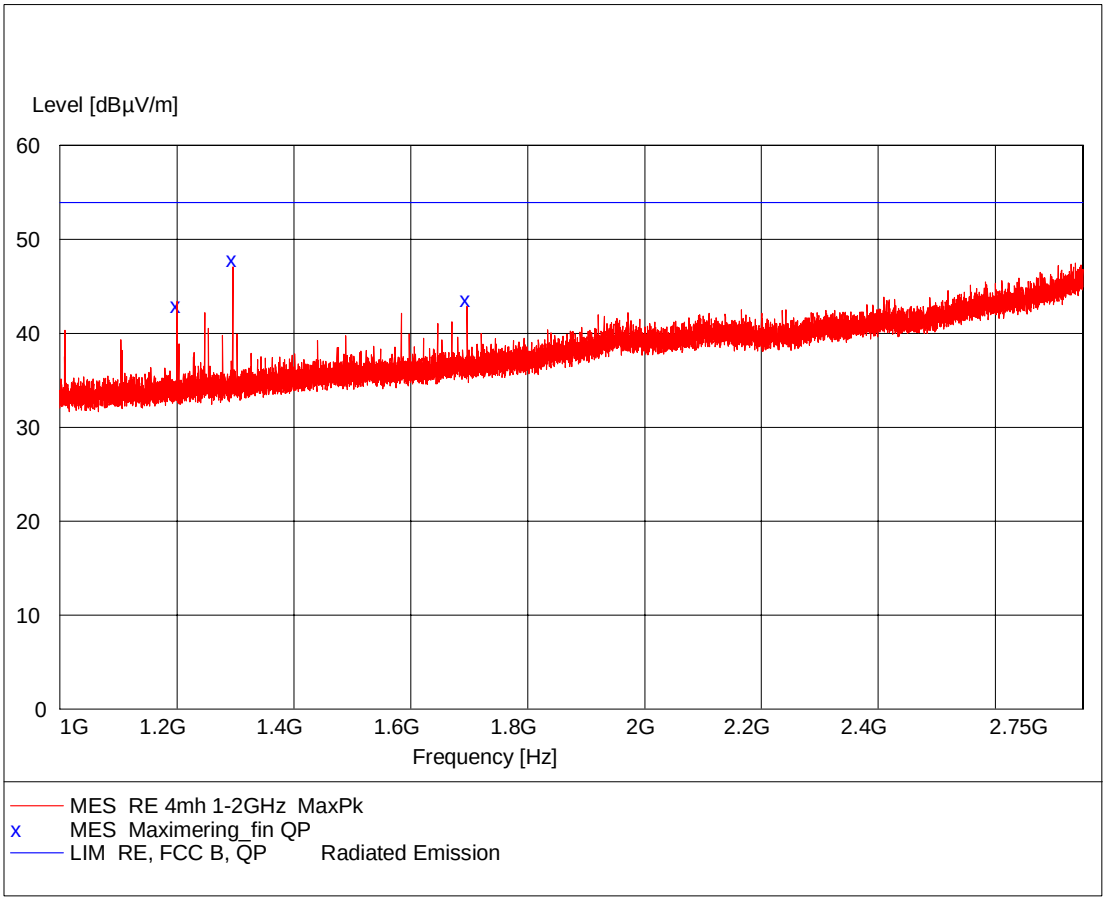
```
EUT:                  Tman II. 10.525 GHz
Manufacturer:         ISG
Operating Condition:  Ant. 1 m vertical. 120 VAC
Test Site:            EMC-5
Operator:             HEN - A503808
Test Specification:   FCC part 15 sub C
Comment:              Sheet 14
Start of Test:        2006-05-05
```

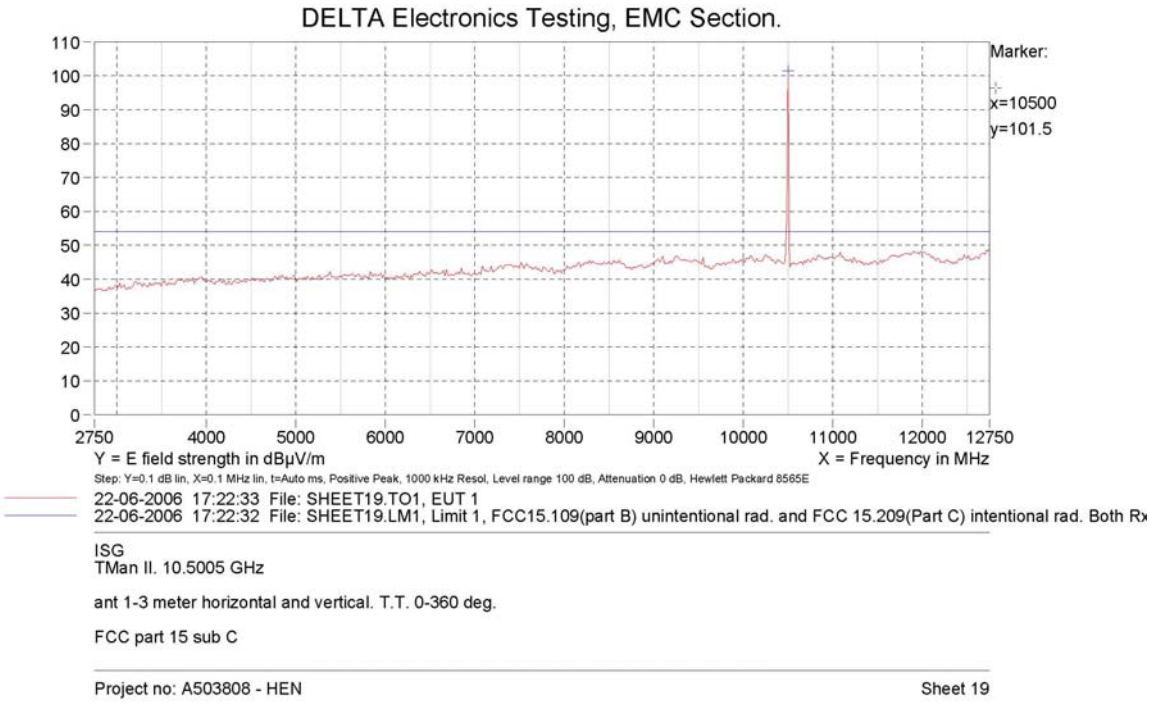


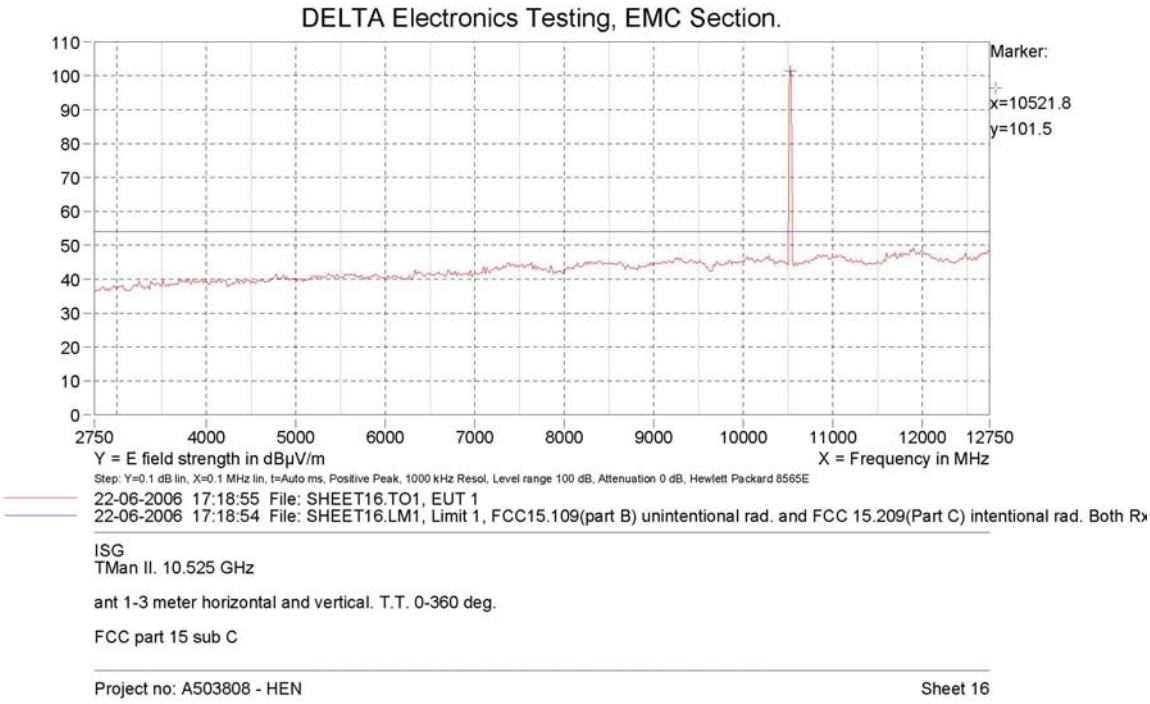

**MEASUREMENT RESULT: "Maximering_fin QP"**
2006-05-05 16:13

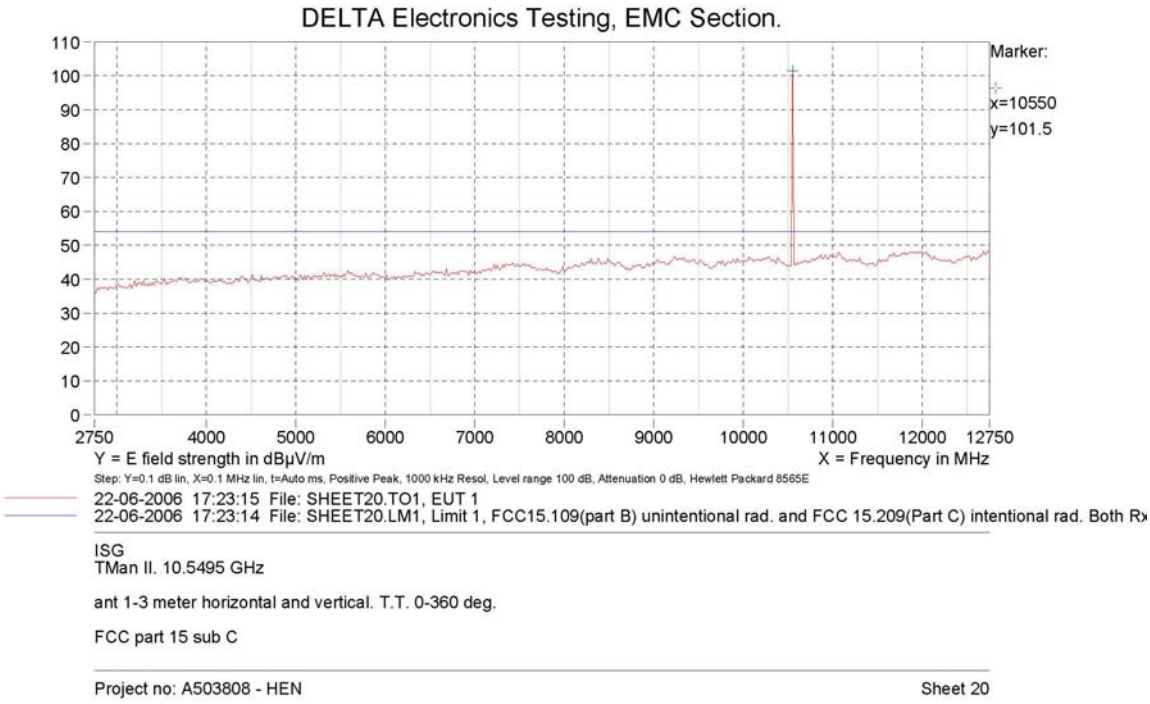
| Frequency MHz | Level dBµV/m | Transd dB | Limit dBµV/m | Margin dB | Height cm | Azimuth deg | Polarisation |
|---|---|---|---|---|---|---|---|
| 1200.100000 | 43.00 | 30.3 | 53.9 | 10.9 | 112.0 | 347.00 | VERTICAL |
| 1296.170000 | 47.90 | 30.7 | 53.9 | 6.0 | 101.0 | 328.00 | VERTICAL |
| 1695.680000 | 43.60 | 33.0 | 53.9 | 10.3 | 119.0 | 148.00 | HORIZONTAL |

EUT: Tman II. 10.525 GHz
Manufacturer: ISG
Operating Condition: Ant. 2 m horizontal. 120 VAC
Test Site: EMC-5
Operator: HEN - A503808
Test Specification: FCC part 15 sub C
Comment: Sheet 15
Start of Test: 2006-05-05

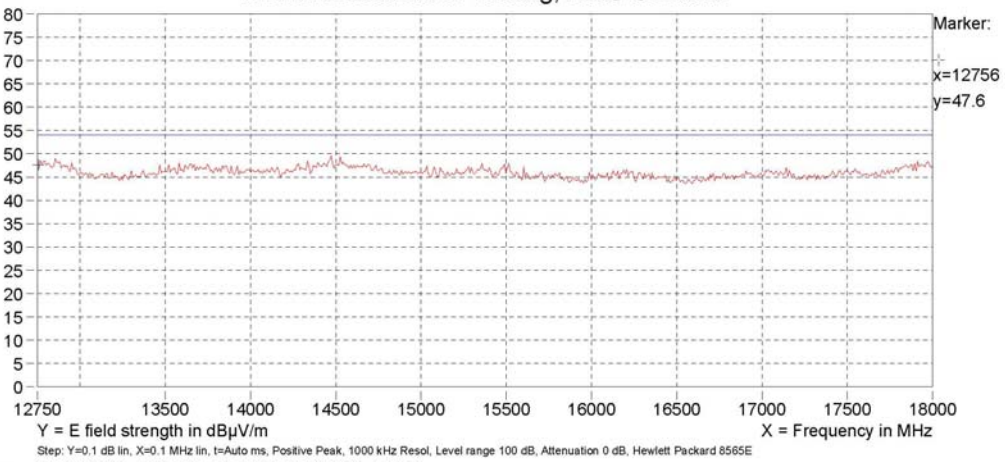



DELTA Electronics Testing, EMC Section.
Marker:
x=10500
y=101.5
110
100
90
80
70
60
50
40
30
20
10
0
2750
4000
5000
6000
7000
8000
9000
10000
11000
12000
12750
Y = E field strength in dBµV/m
X = Frequency in MHz
Step: Y=0.1 dB lin, X=0.1 MHz lin, t=Auto ms, Positive Peak, 1000 kHz Resol, Level range 100 dB, Attenuation 0 dB, Hewlett Packard 8565E
22-06-2006 17:22:33 File: SHEET19.TO1, EUT 1
22-06-2006 17:22:32 File: SHEET19.LM1, Limit 1, FCC15.109(part B) unintentional rad. and FCC 15.209(Part C) intentional rad. Both Rx
ISG
TMan II. 10.5005 GHz
ant 1-3 meter horizontal and vertical. T.T. 0-360 deg.
FCC part 15 sub C
Project no: A503808 - HEN
Sheet 19


DELTA Electronics Testing, EMC Section.
110
100
90
80
70
60
50
40
30
20
10
0
2750
4000
5000
6000
7000
8000
9000
10000
11000
12000
12750
Marker:
x=10521.8
y=101.5
Y = E field strength in dBµV/m
X = Frequency in MHz
Step: Y=0.1 dB lin, X=0.1 MHz lin, t=Auto ms, Positive Peak, 1000 kHz Resol, Level range 100 dB, Attenuation 0 dB, Hewlett Packard 8565E
22-06-2006 17:18:55 File: SHEET16.TO1, EUT 1
22-06-2006 17:18:54 File: SHEET16.LM1, Limit 1, FCC15.109(part B) unintentional rad. and FCC 15.209(Part C) intentional rad. Both Rx
ISG
TMan II. 10.525 GHz
ant 1-3 meter horizontal and vertical. T.T. 0-360 deg.
FCC part 15 sub C
Project no: A503808 - HEN
Sheet 16


DELTA Electronics Testing, EMC Section.
110
100
90
80
70
60
50
40
30
20
10
0
2750
4000
5000
6000
7000
8000
9000
10000
11000
12000
12750
Marker:
x=10550
y=101.5
Y = E field strength in dBµV/m
X = Frequency in MHz
Step: Y=0.1 dB lin, X=0.1 MHz lin, t=Auto ms, Positive Peak, 1000 kHz Resol, Level range 100 dB, Attenuation 0 dB, Hewlett Packard 8565E
22-06-2006 17:23:15 File: SHEET20.TO1, EUT 1
22-06-2006 17:23:14 File: SHEET20.LM1, Limit 1, FCC15.109(part B) unintentional rad. and FCC 15.209(Part C) intentional rad. Both Rx
ISG
TMan II. 10.5495 GHz
ant 1-3 meter horizontal and vertical. T.T. 0-360 deg.
FCC part 15 sub C
Project no: A503808 - HEN
Sheet 20

DELTA Electronics Testing, EMC Section.




Step: Y=0.1 dB lin, X=0.1 MHz lin, t=Auto ms, Positive Peak, 1000 kHz Resol, Level range 100 dB, Attenuation 0 dB, Hewlett Packard 8565E

22-06-2006 17:27:51 File: SHEET26.TO1, EUT 1
22-06-2006 17:27:50 File: SHEET26.LM1, Limit 1, FCC 15.109 part B unint. rad. and FCC 15.209 Part C int. rad. Rx + Tx.

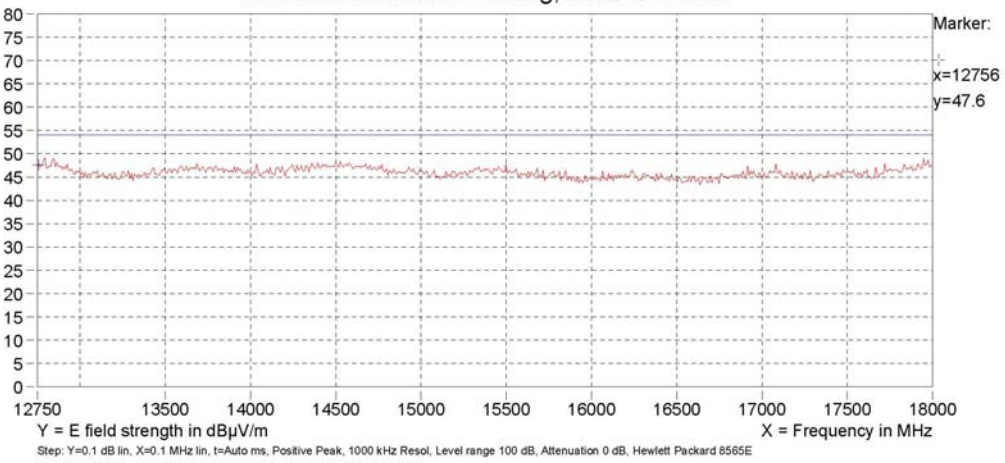
ISG
TMan II. 10.5005 GHz

ant 1 meter vertical. T.T. 0-360 deg.

FCC part 15 sub C

Project no: A503808 - HEN Sheet 26

DELTA Electronics Testing, EMC Section.




Step: Y=0.1 dB lin, X=0.1 MHz lin, t=Auto ms, Positive Peak, 1000 kHz Resol, Level range 100 dB, Attenuation 0 dB, Hewlett Packard 8565E

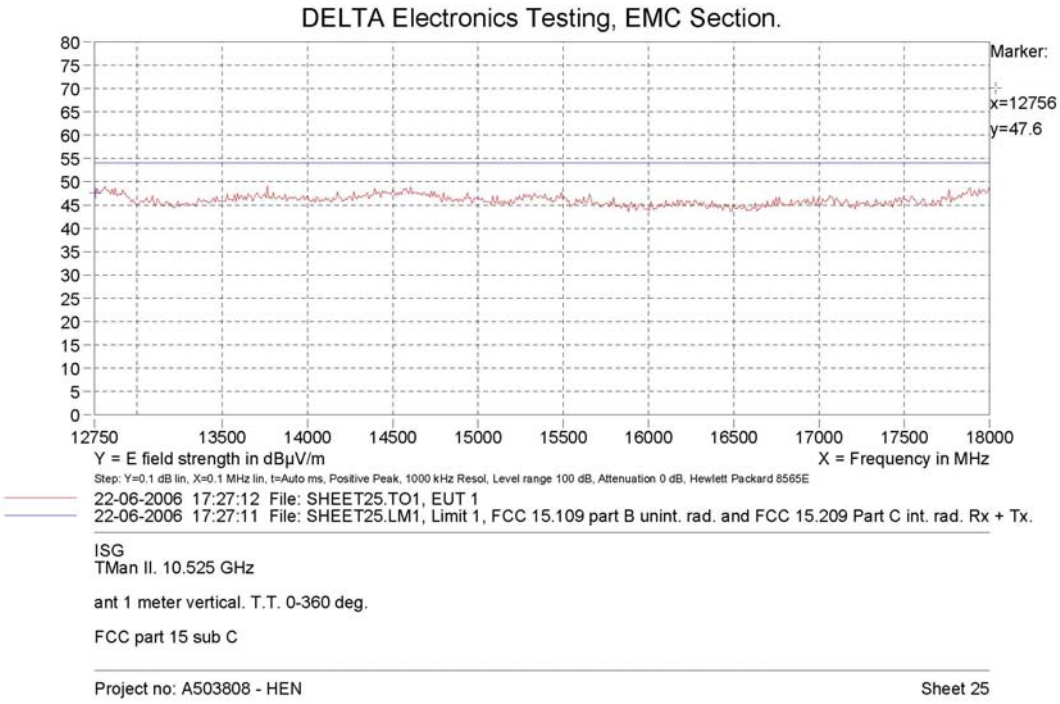
22-06-2006 17:28:35 File: SHEET27.TO1, EUT 1
22-06-2006 17:28:34 File: SHEET27.LM1, Limit 1, FCC 15.109 part B unint. rad. and FCC 15.209 Part C int. rad. Rx + Tx.

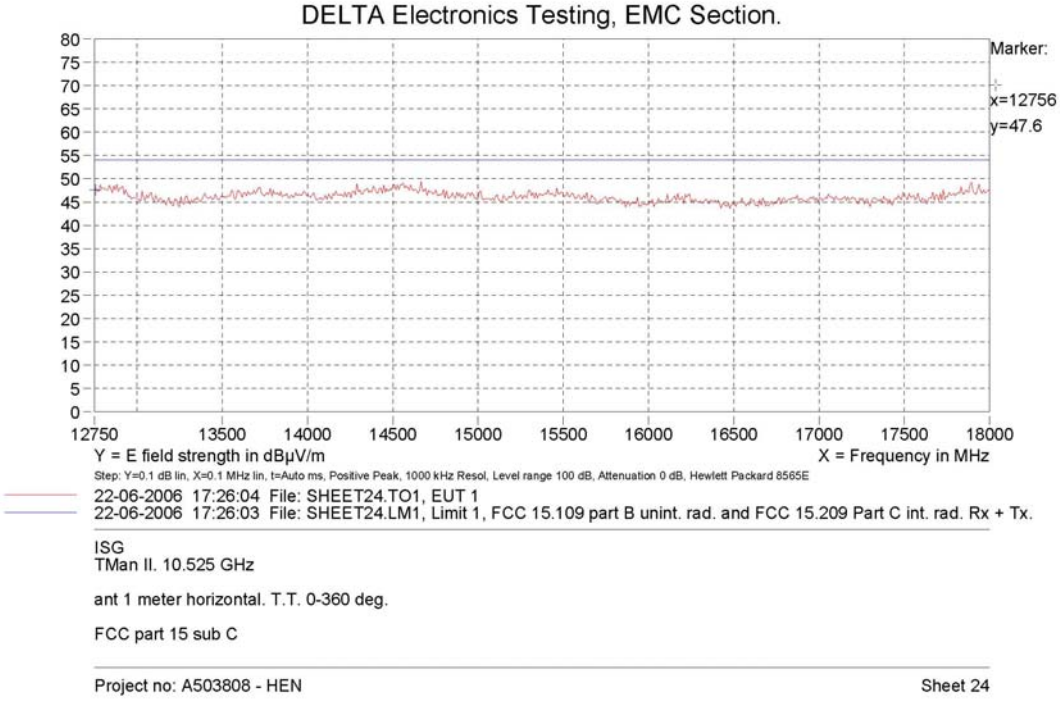
ISG
TMan II. 10.5005 GHz

ant 1 meter horizontal. T.T. 0-360 deg.

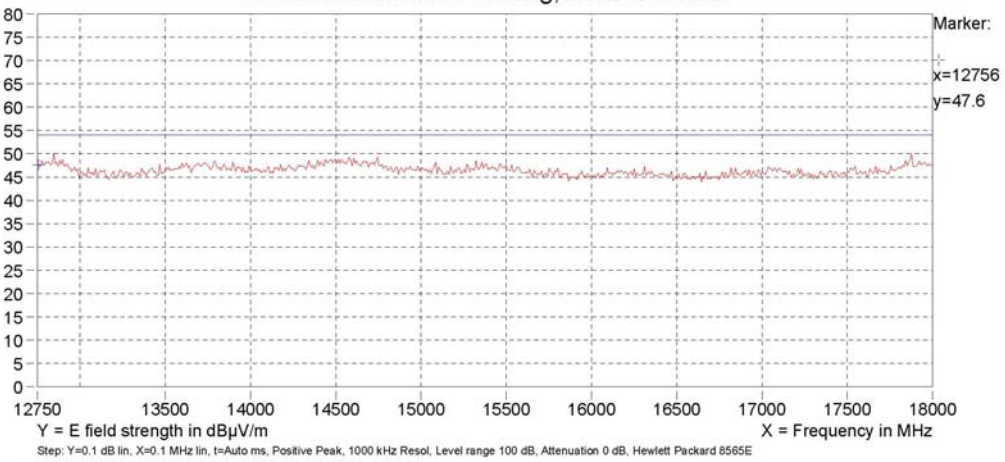
FCC part 15 sub C

Project no: A503808 - HEN Sheet 27


DELTA Electronics Testing, EMC Section.
Marker:
x=12756
y=47.6
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
12750
13500
14000
14500
15000
15500
16000
16500
17000
17500
18000
Y = E field strength in dBµV/m
X = Frequency in MHz
Step: Y=0.1 dB lin, X=0.1 MHz lin, t=Auto ms, Positive Peak, 1000 kHz Resol, Level range 100 dB, Attenuation 0 dB, Hewlett Packard 8565E
22-06-2006 17:27:12 File: SHEET25.TO1, EUT 1
22-06-2006 17:27:11 File: SHEET25.LM1, Limit 1, FCC 15.109 part B unint. rad. and FCC 15.209 Part C int. rad. Rx + Tx.
ISG
TMan II. 10.525 GHz
ant 1 meter vertical. T.T. 0-360 deg.
FCC part 15 sub C
Project no: A503808 - HEN
Sheet 25


DELTA Electronics Testing, EMC Section.
Marker:
x=12756
y=47.6
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
12750
13500
14000
14500
15000
15500
16000
16500
17000
17500
18000
Y = E field strength in dBµV/m
X = Frequency in MHz
Step: Y=0.1 dB lin, X=0.1 MHz lin, t=Auto ms, Positive Peak, 1000 kHz Resol, Level range 100 dB, Attenuation 0 dB, Hewlett Packard 8565E
22-06-2006 17:26:04 File: SHEET24.TO1, EUT 1
22-06-2006 17:26:03 File: SHEET24.LM1, Limit 1, FCC 15.109 part B unint. rad. and FCC 15.209 Part C int. rad. Rx + Tx.
ISG
TMan II. 10.525 GHz
ant 1 meter horizontal. T.T. 0-360 deg.
FCC part 15 sub C
Project no: A503808 - HEN
Sheet 24

DELTA Electronics Testing, EMC Section.




Step: Y=0.1 dB lin, X=0.1 MHz lin, t=Auto ms, Positive Peak, 1000 kHz Resol, Level range 100 dB, Attenuation 0 dB, Hewlett Packard 8565E

22-06-2006 17:24:24 File: SHEET22.TO1, EUT 1
22-06-2006 17:24:23 File: SHEET22.LM1, Limit 1, FCC 15.109 part B unint. rad. and FCC 15.209 Part C int. rad. Rx + Tx.

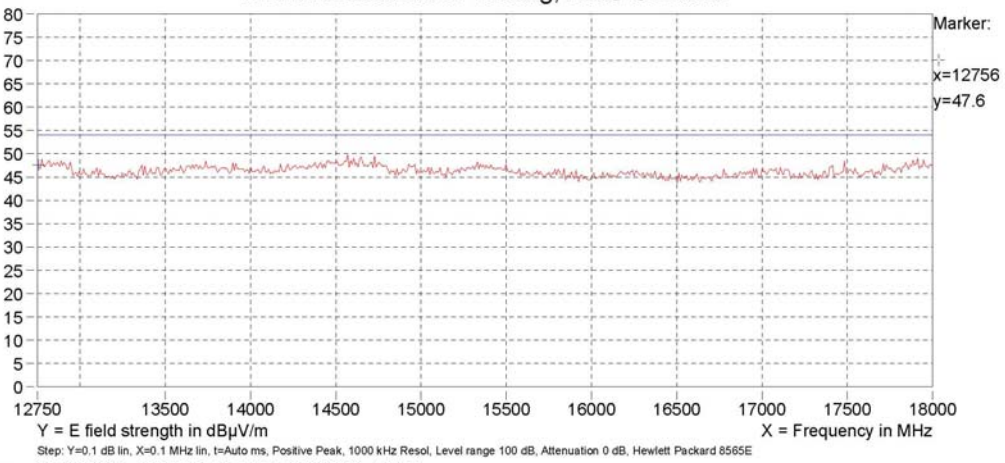
ISG
TMan II. 10.5495 GHz

ant 1 meter vertical. T.T. 0-360 deg.

FCC part 15 sub C

Project no: A503808 - HEN Sheet 22

DELTA Electronics Testing, EMC Section.




Step: Y=0.1 dB lin, X=0.1 MHz lin, t=Auto ms, Positive Peak, 1000 kHz Resol, Level range 100 dB, Attenuation 0 dB, Hewlett Packard 8565E

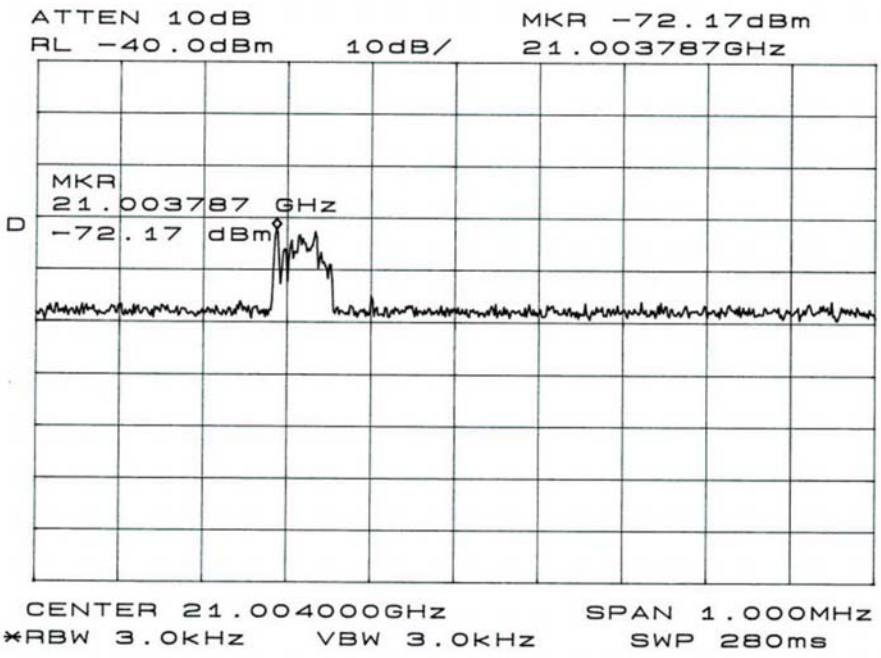
22-06-2006 17:25:00 File: SHEET23.TO1, EUT 1
22-06-2006 17:25:00 File: SHEET23.LM1, Limit 1, FCC 15.109 part B unint. rad. and FCC 15.209 Part C int. rad. Rx + Tx.

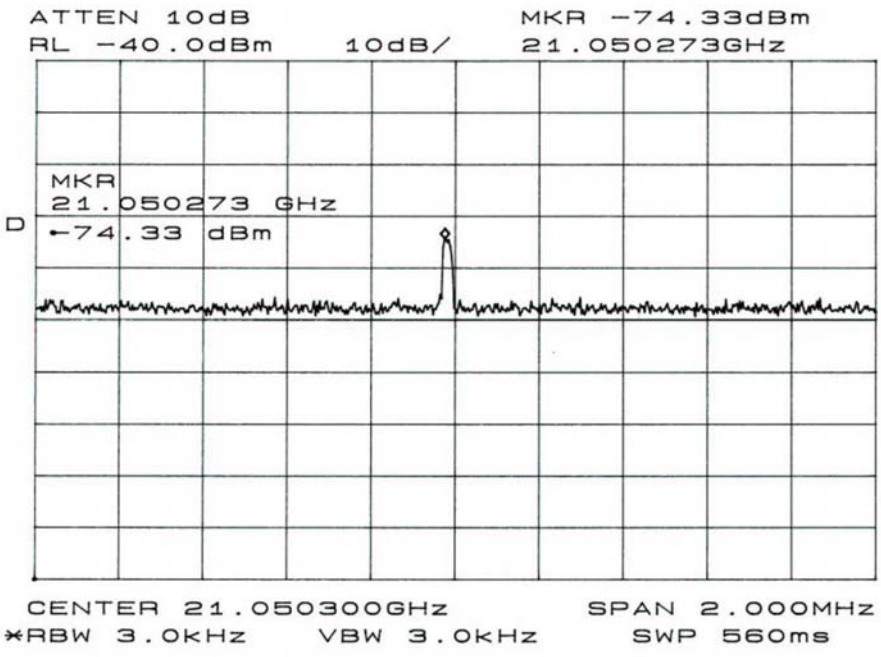
ISG
TMan II. 10.5495 GHz

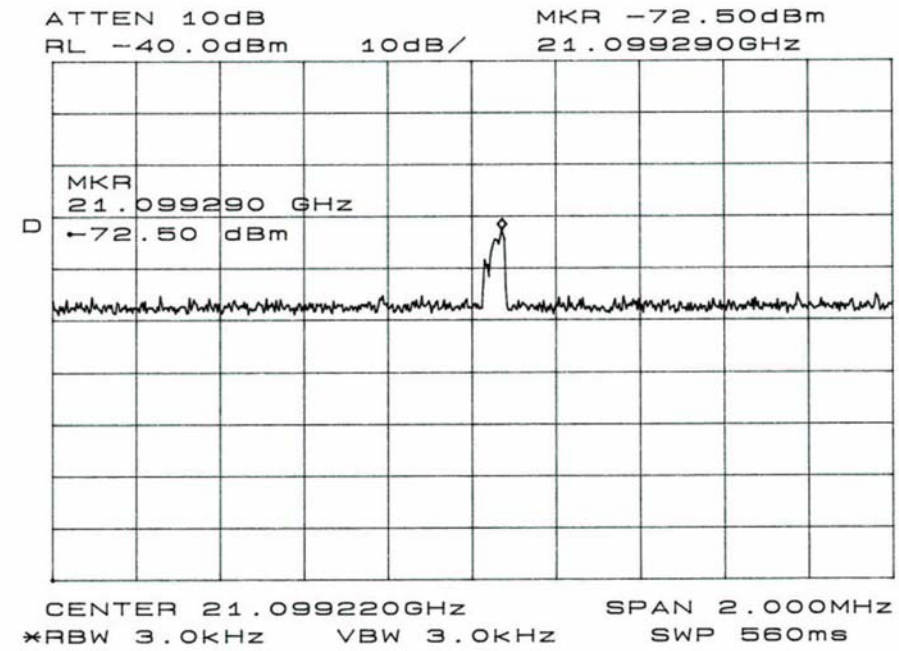
ant 1 meter horizontal. T.T. 0-360 deg.

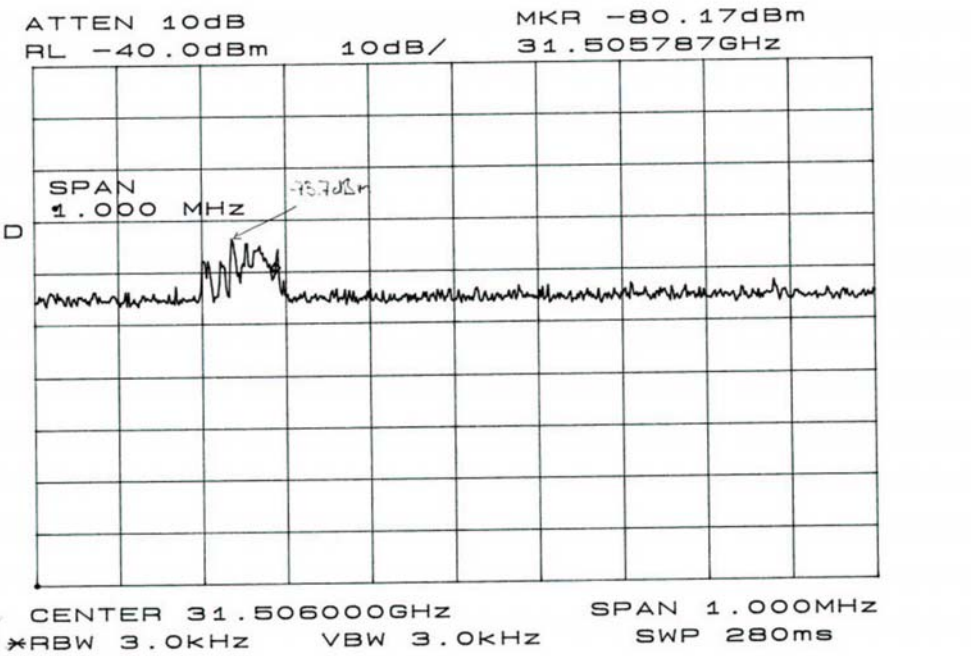
FCC part 15 sub C

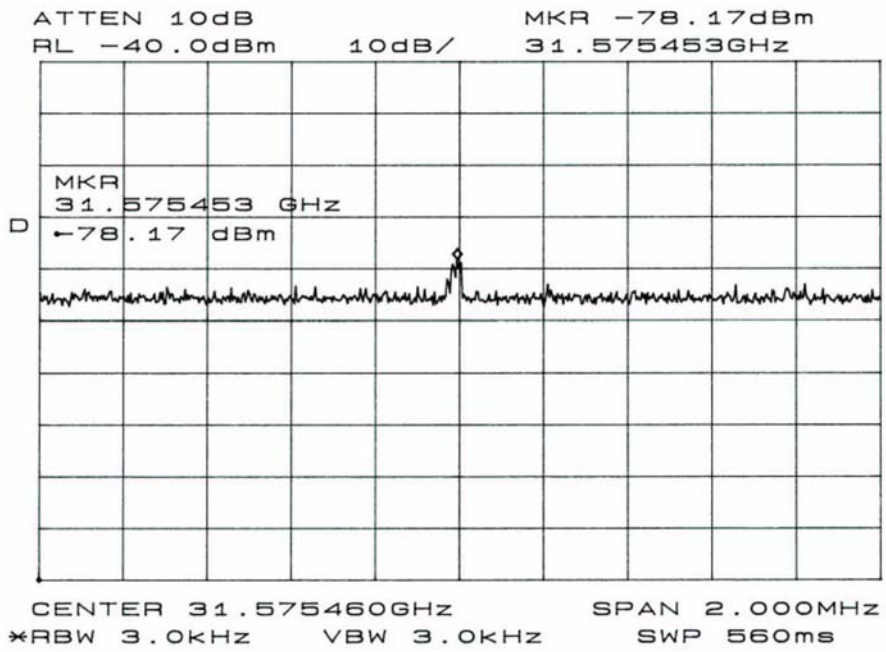
Project no: A503808 - HEN Sheet 23

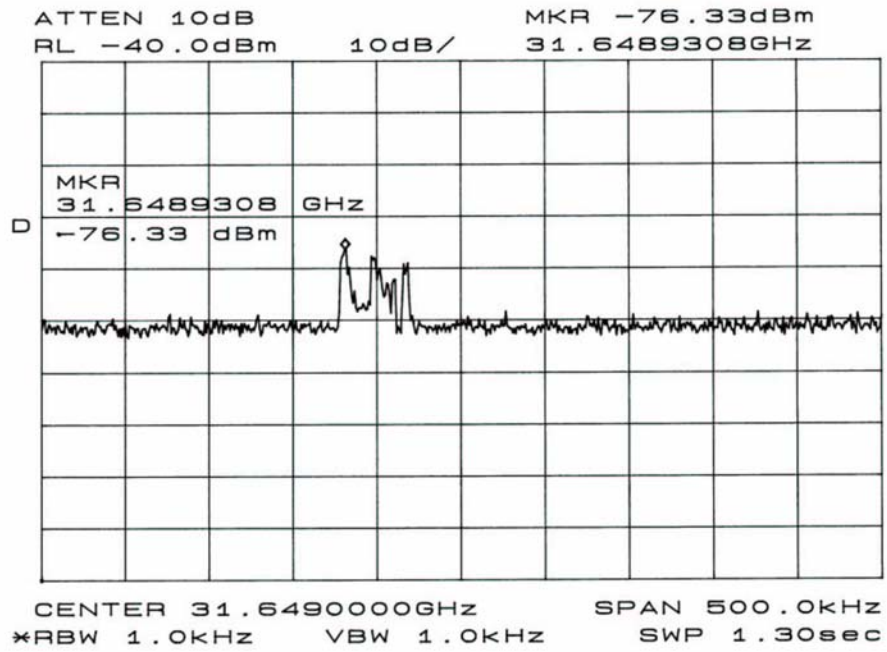

ATTEN 10dB
RL -40.0dBm
10dB/
MKR -72.17dBm
21.003787GHz
MKR
21.003787 GHz
-72.17 dBm
D
CENTER 21.004000GHz
SPAN 1.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 280ms


ATTEN 10dB
RL -40.0dBm
10dB/
MKR -74.33dBm
21.050273GHz
MKR
21.050273 GHz
-74.33 dBm
D
CENTER 21.050300GHz
SPAN 2.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 560ms


ATTEN 10dB
RL -40.0dBm
10dB/
MKR -72.50dBm
21.099290GHz
MKR
21.099290 GHz
-72.50 dBm
D
CENTER 21.099220GHz
SPAN 2.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 560ms

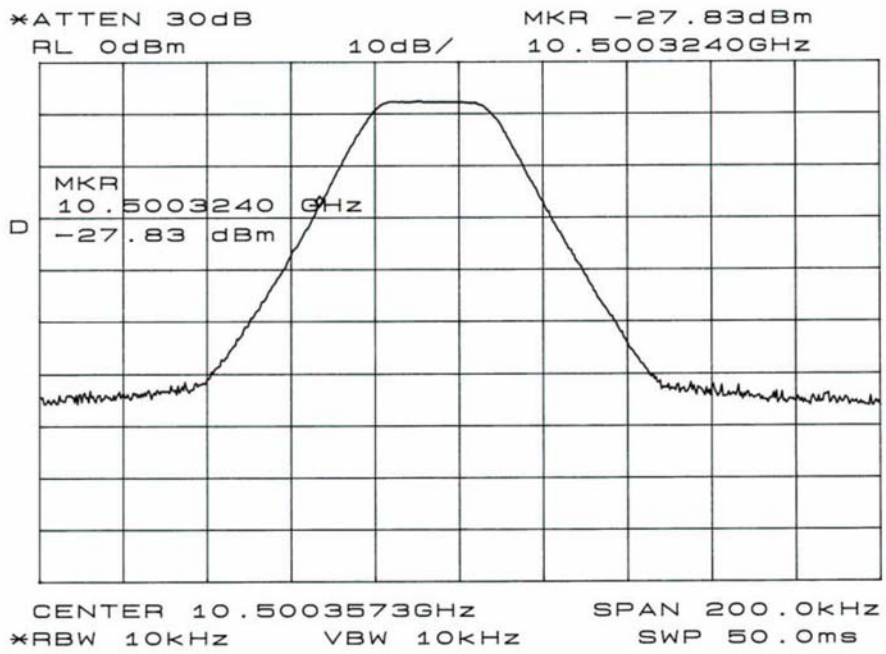

ATTEN 10dB
RL -40.0dBm
10dB/
MKR -80.17dBm
31.505787GHz
SPAN
1.000 MHz
D
CENTER 31.506000GHz
SPAN 1.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 280ms

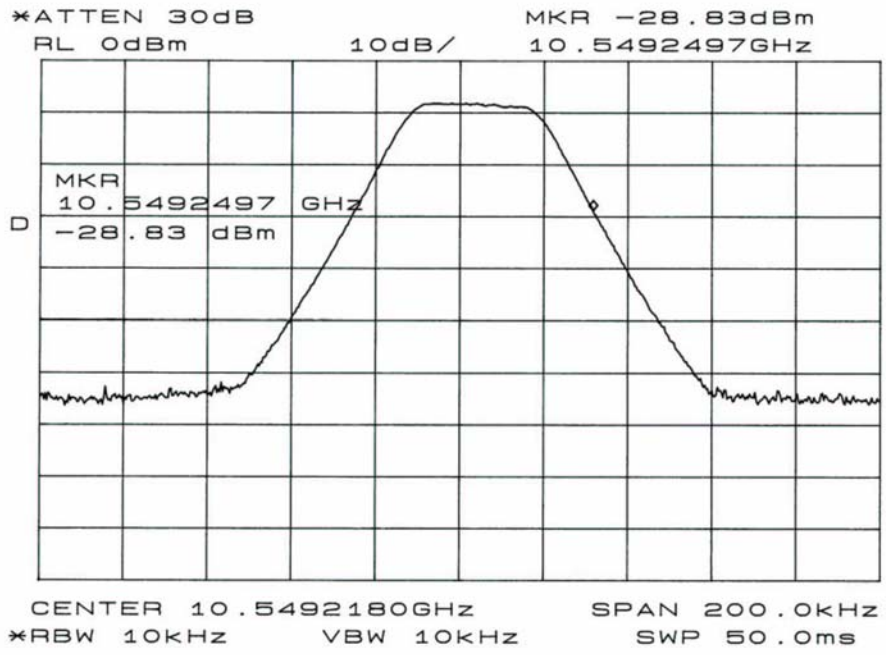

ATTEN 10dB
RL -40.0dBm
10dB/
MKR -78.17dBm
31.575453GHz
MKR
31.575453 GHz
-78.17 dBm
D
CENTER 31.575460GHz
SPAN 2.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 560ms


ATTEN 10dB
RL -40.0dBm
10dB/
MKR -76.33dBm
31.6489308GHz
MKR
31.6489308 GHz
-76.33 dBm
D
CENTER 31.6490000GHz
SPAN 500.0kHz
*RBW 1.0kHz
VBW 1.0kHz
SWP 1.30sec

# Annex 5

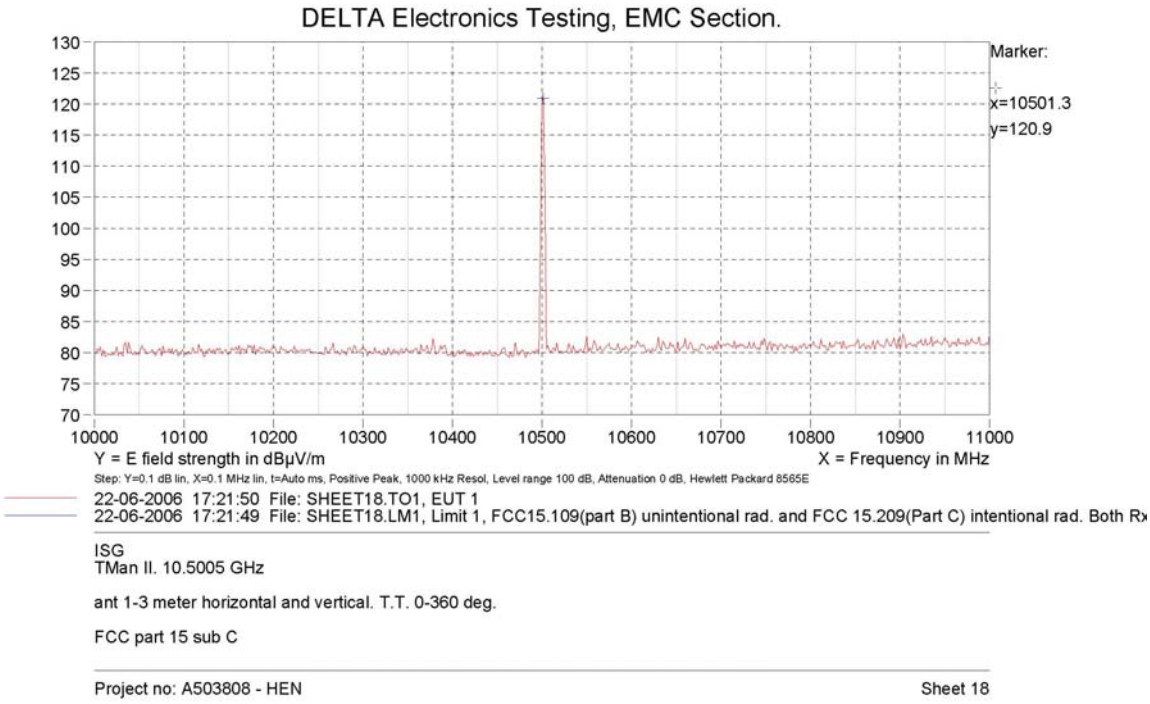
## Test record sheet regarding occupied bandwidth

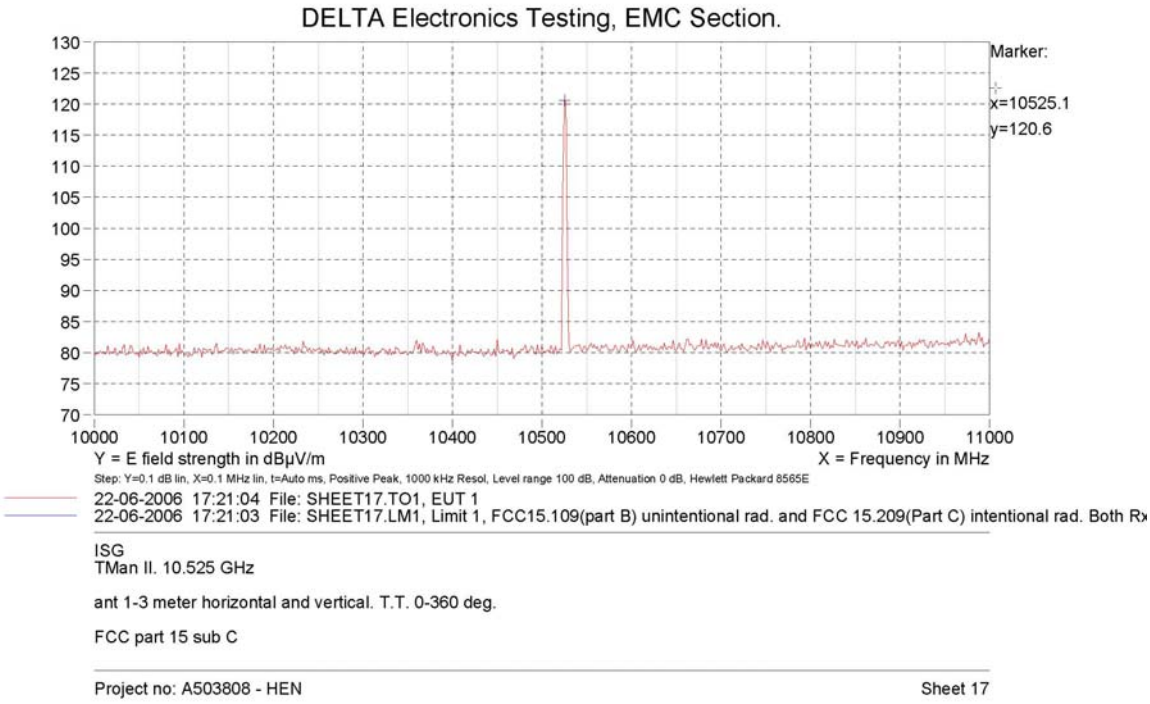

*ATTEN 30dB
RL 0dBm
10dB/
MKR -27.83dBm
10.5003240GHz
MKR
10.5003240 GHz
-27.83 dBm
D
CENTER 10.5003573GHz
SPAN 200.0kHz
*RBW 10kHz
VBW 10kHz
SWP 50.0ms

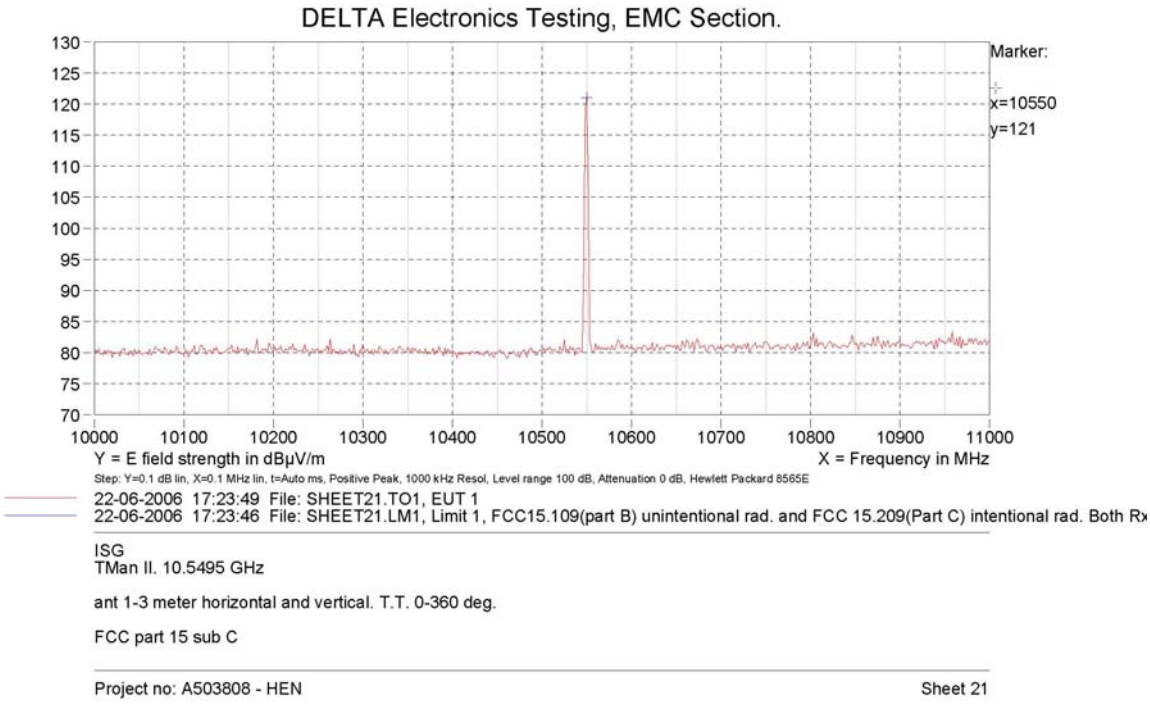

*ATTEN 30dB
RL 0dBm
10dB/
MKR -28.83dBm
10.5492497GHz
MKR
10.5492497 GHz
-28.83 dBm
D
CENTER 10.5492180GHz
SPAN 200.0kHz
*RBW 10kHz
VBW 10kHz
SWP 50.0ms

# Annex 6

## Test record sheets regarding peak output field strength


DELTA Electronics Testing, EMC Section.
Marker:
x=10501.3
y=120.9
130
125
120
115
110
105
100
95
90
85
80
75
70
10000
10100
10200
10300
10400
10500
10600
10700
10800
10900
11000
Y = E field strength in dBµV/m
X = Frequency in MHz
Step: Y=0.1 dB lin, X=0.1 MHz lin, t=Auto ms, Positive Peak, 1000 kHz Resol, Level range 100 dB, Attenuation 0 dB, Hewlett Packard 8565E
22-06-2006 17:21:50 File: SHEET18.TO1, EUT 1
22-06-2006 17:21:49 File: SHEET18.LM1, Limit 1, FCC15.109(part B) unintentional rad. and FCC 15.209(Part C) intentional rad. Both Rx
ISG
TMan II. 10.5005 GHz
ant 1-3 meter horizontal and vertical. T.T. 0-360 deg.
FCC part 15 sub C
Project no: A503808 - HEN
Sheet 18


DELTA Electronics Testing, EMC Section.
130
125
120
115
110
105
100
95
90
85
80
75
70
10000
10100
10200
10300
10400
10500
10600
10700
10800
10900
11000
Marker:
x=10525.1
y=120.6
Y = E field strength in dBµV/m
X = Frequency in MHz
Step: Y=0.1 dB lin, X=0.1 MHz lin, t=Auto ms, Positive Peak, 1000 kHz Resol, Level range 100 dB, Attenuation 0 dB, Hewlett Packard 8565E
22-06-2006 17:21:04 File: SHEET17.TO1, EUT 1
22-06-2006 17:21:03 File: SHEET17.LM1, Limit 1, FCC15.109(part B) unintentional rad. and FCC 15.209(Part C) intentional rad. Both Rx
ISG
TMan II. 10.525 GHz
ant 1-3 meter horizontal and vertical. T.T. 0-360 deg.
FCC part 15 sub C
Project no: A503808 - HEN
Sheet 17


DELTA Electronics Testing, EMC Section.
Marker:
x=10550
y=121
130
125
120
115
110
105
100
95
90
85
80
75
70
10000
10100
10200
10300
10400
10500
10600
10700
10800
10900
11000
Y = E field strength in dBµV/m
X = Frequency in MHz
Step: Y=0.1 dB lin, X=0.1 MHz lin, t=Auto ms, Positive Peak, 1000 kHz Resol, Level range 100 dB, Attenuation 0 dB, Hewlett Packard 8565E
22-06-2006 17:23:49 File: SHEET21.TO1, EUT 1
22-06-2006 17:23:46 File: SHEET21.LM1, Limit 1, FCC15.109(part B) unintentional rad. and FCC 15.209(Part C) intentional rad. Both Rx
ISG
TMan II. 10.5495 GHz
ant 1-3 meter horizontal and vertical. T.T. 0-360 deg.
FCC part 15 sub C
Project no: A503808 - HEN
Sheet 21