

Test report no. : 104353-16

Item tested : Bluetooth RF part of DH4

Type of equipment : DECT PP supporting Bluetooth

Client : Ascom Sweden A/S

Parts of FCC Part 15.247
Frequency Hopping Transmitters /
Digital Transmission System

Parts of RSS-210, Issue 7
Low Power Licence-Exempt
Radiocommunication Devices

2 June 2008

Authorized by : 

Frode Sveinsen
Technical Verificator

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1 GENERAL INFORMATION

1.1 Testhouse Info

Name : Nemko AS
Address : Nemko Comlab
Gåsevikkveien 8, Box 96
N-2027 Kjeller, NORWAY
Telephone : +47 64 84 57 00
Fax : +47 64 84 57 05
E-mail: comlab@nemko.com
FCC test firm
registration # : 994405
IC OATS
registration # : 2040D-1
Total Number of Pages: 29

1.2 Client Information

Name : Ascom Sweden AB
Address : P.O.Box 8783, SE-040276 Göteborg, Sweden
Contact:
Name : Tania Ottebrink
E-mail : Tania.Ottebrink@ascom.se

1.3 Factory (if other than client)

Name : Flextronics Doumen Industrial Park
Address : P Xin Qing Science & Technology Industrial Park Jing An, Doumen, Zhuhai
P.R. China Postal Code: 519180

2 Test Information

2.1 Tested Item

| | |
|------------------------------------|---------------------------|
| Name : | Ascom DH4 |
| Model/version : | DH4 |
| Serial number : | T26103JA56 |
| Hardware identity and/or version: | DUT # 2 |
| Software identity and/or version : | 2.4.4 |
| Frequency Range : | 2.4 - 2.4835 GHz |
| Number of Channels : | 79 |
| Type of Modulation : | FHSS |
| Channel Spacing : | 1MHz |
| User Frequency Adjustment : | None |
| Rated Output Power : | 10mW |
| Power Adaptor : | Battery operated 3.7 V DC |
| Antenna Connector : | Integral |
| Antenna Diversity Supported : | None |
| Desktop Charger : | Yes |

Description of Tested Device(s)

The DH4 is a DECT PP with Bluetooth communication facility.

Exposure Evaluation

HANDSET: The EUT is a portable device and is designed to be held to ear or worn in a belt clip when used. A test reports with the measured SAR values for both configurations are submitted with the application. The SAR values are also included in the user manual.

The EUT is exempted from RF Exposure Evaluation to Industry Canada SAR requirements since the output power is below the limit in RSS-102 Issue 2, clause 2.5.1 for General Public Use.

2.2 Test Environment

2.2.1 Normal test condition

| | |
|----------------------|------------|
| Temperature: | 20 - 24 °C |
| Relative humidity: | 20 - 50 % |
| Normal test voltage: | 3.7 V DC |

The values are the limit registered during the test period.

2.3 Test Period

| | |
|---------------------|-------------------------------|
| Item received date: | 2008-04-29 |
| Test period : | from 2008-05-02 to 2008-05-06 |

3 TEST REPORT SUMMARY

3.1 General

Manufacturer: Ascom
Model No.: DH4
Serial No.: T26103JA56

All measurements are traceable to national standards.

The tests were conducted for the purpose of demonstrating compliance with FCC CFR 47 Part 15, paragraph 15.247 and Industry Canada RSS-210 Issue 7.

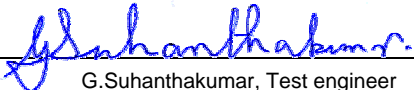
Radiated tests were conducted in accordance with ANSI C63.4-2003. The radiated tests were made in a semi-anechoic chamber at measuring distances of 3m and 10m.

- | | |
|---|---|
| <input checked="" type="checkbox"/> New Submission | <input checked="" type="checkbox"/> Production Unit |
| <input type="checkbox"/> Class II Permissive Change | <input type="checkbox"/> Pre-production Unit |
| DSS Equipment Code | <input type="checkbox"/> Family Listing |

THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.
Deviations from, additions to, or exclusions from the test specifications are described in "Summary of Test Data".



TEST REPORT #: 104353-16

TESTED BY:  DATE: 06 May 2008
G.Suhanthakumar, Test engineer

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3.2 Test Summary

| Name of test | FCC Part 15 reference | RSS-210 Issue 7 reference | Result |
|--|-------------------------------------|---------------------------|------------------|
| Supply Voltage Variations | 15.31(e) | 8 (RSS-GEN) | P |
| Number of Operating Frequencies | 15.31(m) | A8.1 | P |
| Antenna Requirement | 15.203 | 7.1.4 (RSS-GEN) | ¹ |
| Power Line Conducted Emission | 15.107(a) 15.207(a) | 7.2.2 (RSS-GEN) | NT |
| Channel Separation | 15.247(a)(1) | A8.1 | NT |
| Pseudorandom Hopping Algorithm | 15.247(a)(1) | A8.1 | NT |
| Time of Occupancy | 15.247(a)(1)(iii) | A8.1 | NT |
| Occupied Bandwidth | 15.247(a)(1) | A8.1 | NT |
| Minimum 20 dB Bandwidth | 15.247(a)(2) | A8.2 | NT |
| Peak Power Output | 15.247(b) | A8.4 | P |
| Power Spectral Density | 15.247(d) | A8.2 | NA |
| Spurious Emissions (Antenna Conducted) | 15.247(c) | A8.5 | N/A ¹ |
| Spurious Emissions (Radiated) | 15.247(c) 15.109(a) 15.209(a) | A8.5 | P |

¹ The tested equipment has integrated antennas only.

3.3 Description of modification for Modification Filing

Not applicable.

3.4 Comments

The measurements were done with the fully charged batteries.

All ports were populated during spurious emission measurements.

3.5 Family List Rational

Not Applicable.

4 TEST RESULTS

4.1 Radiated Power Output

Para. No.: 15.247 (b)

| | |
|-----------------------------------|--------------------------|
| Test Performed By: G.Suinthakumar | Date of Test: 02.05.2008 |
|-----------------------------------|--------------------------|

Test Results: Complies

Measurement Data:

Maximum field strength

| RF channel | 2402MHz | 2442MHz | 2480MHz |
|-------------------------------|---------|---------|---------|
| Measured value (dB μ V/m) | 98.39 | 99.52 | 96.93 |

See attached graph.

Detachable antenna?

Yes No

If detachable, is the antenna connector non-standard?

Yes No

Type of antenna connector: >

Requirements:

The maximum peak output power shall not exceed the following limits:

For frequency hopping systems employing at least 75 hopping channels: 1 Watt

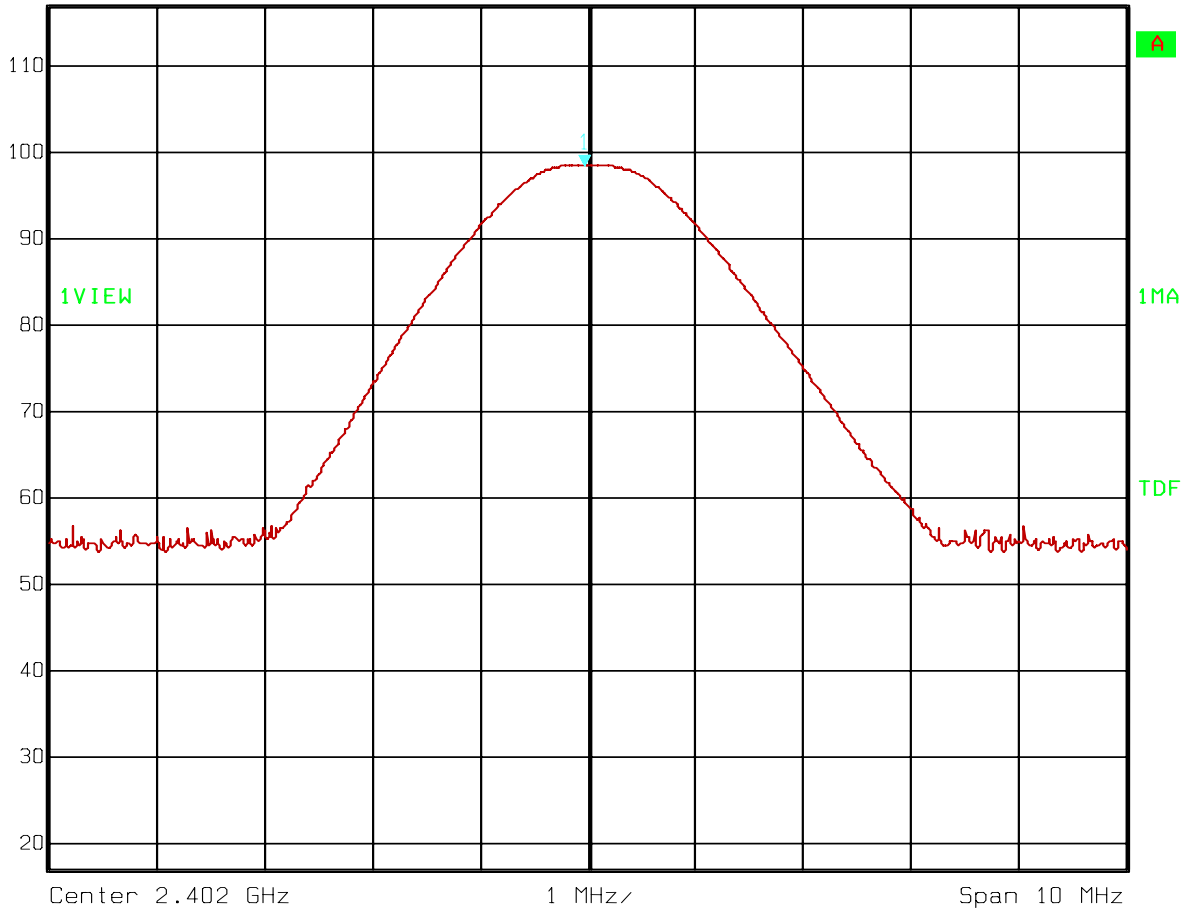
For all other frequency hopping systems in the 2400 - 2483.5 MHz band: 0.125 Watts

For Digital Transmission Systems in the 2400 - 2483.5 MHz band: 1 Watt

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced below the stated value above by the amount in dB that the directional gain of the antenna exceeds 6 dBi.



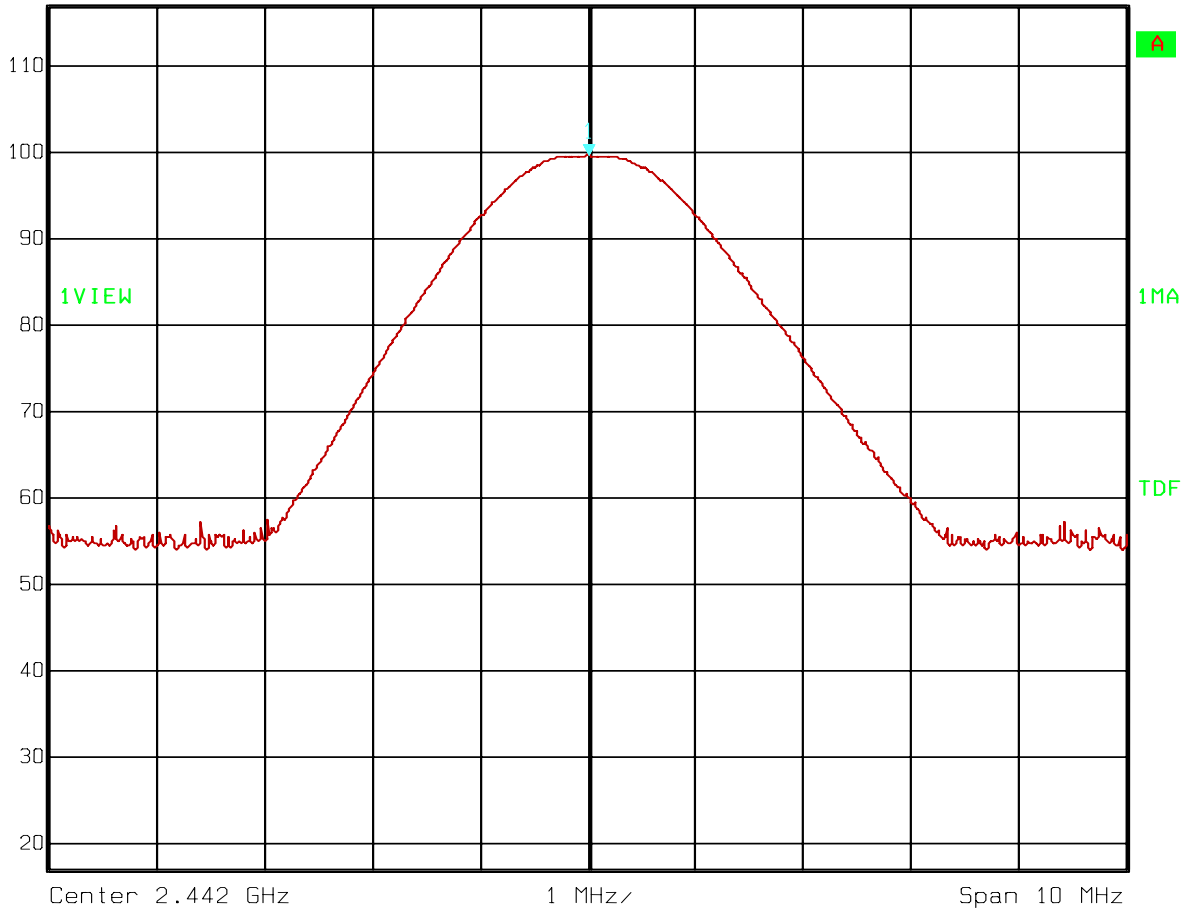
| | | | | | |
|---------|--------------------|-----|-------|--------|--------------|
| Ref Lvl | Marker 1 [T1] | RBW | 1 MHz | RF Att | 30 dB |
| 117 dB* | 98.39 dB μ V/m | VBW | 1 MHz | | |
| | 2.40196994 GHz | SWT | 5 ms | Unit | dB μ V/m |



Date: 2.MAY.2008 9:14:16

Field strength – Lower Frequency, 2.402GHz

| | | | | | | |
|---|---------|--------------------|-----|-------|--------|--------------|
|  | Ref Lvl | Marker 1 [T1] | RBW | 1 MHz | RF Att | 30 dB |
| | 117 dB* | 99.52 dB μ V/m | VBW | 1 MHz | | |
| | | 2.44201002 GHz | SWT | 5 ms | Unit | dB μ V/m |

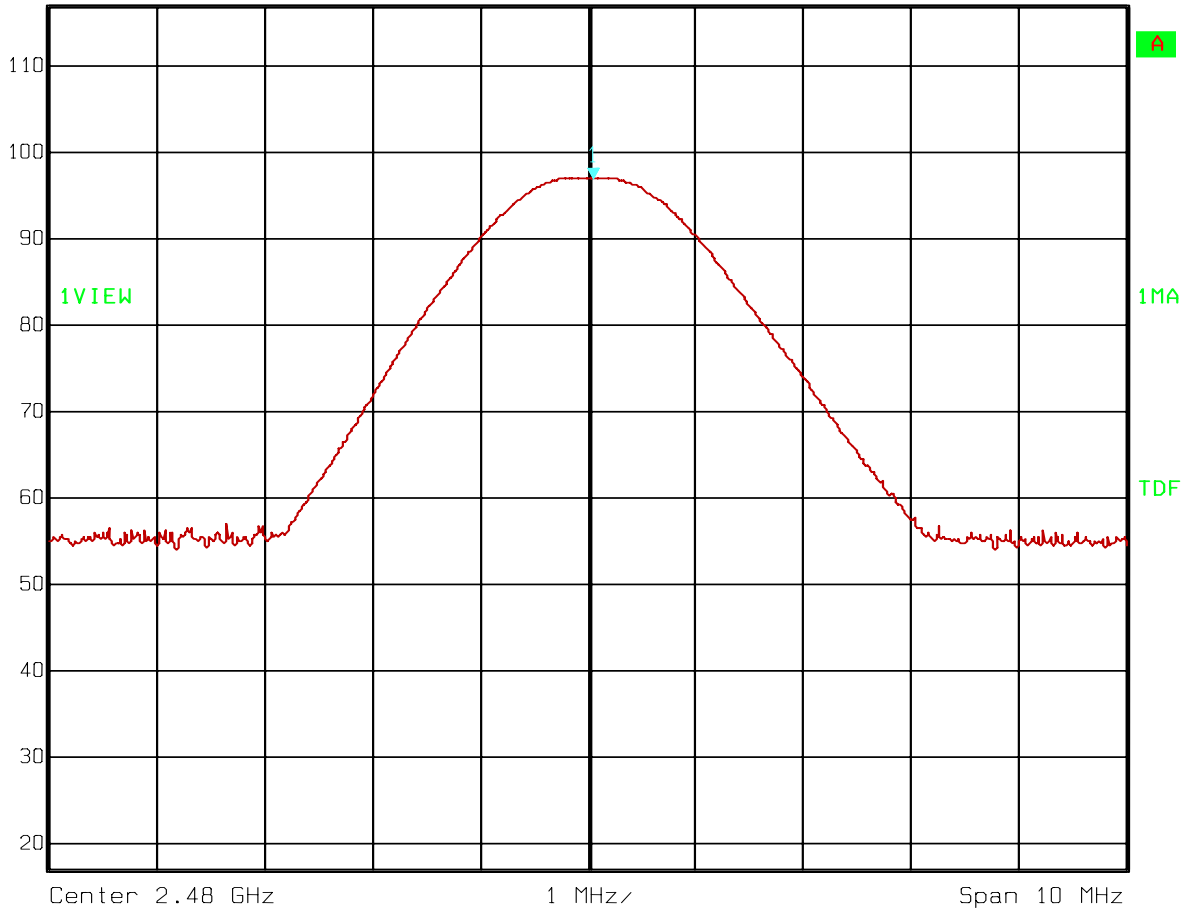


Date: 2.MAY.2008 9:38:20

Field strength – Middle Frequency, 2.442GHz



| | | | | | |
|---------|--------------------|-----|-------|--------|--------------|
| Ref Lvl | Marker 1 [T1] | RBW | 1 MHz | RF Att | 30 dB |
| 117 dB* | 96.93 dB μ V/m | VBW | 1 MHz | | |
| | 2.48005010 GHz | SWT | 5 ms | Unit | dB μ V/m |



Date: 2.MAY.2008 9:55:36

Field strength – Upper Frequency, 2.48GHz

4.2 Spurious Emissions (Radiated)

Para. No.: 15.247 (c)

Test Performed By: G.Suwanthakumar

Date of Test: 02.05.2008

Test Results: Complies

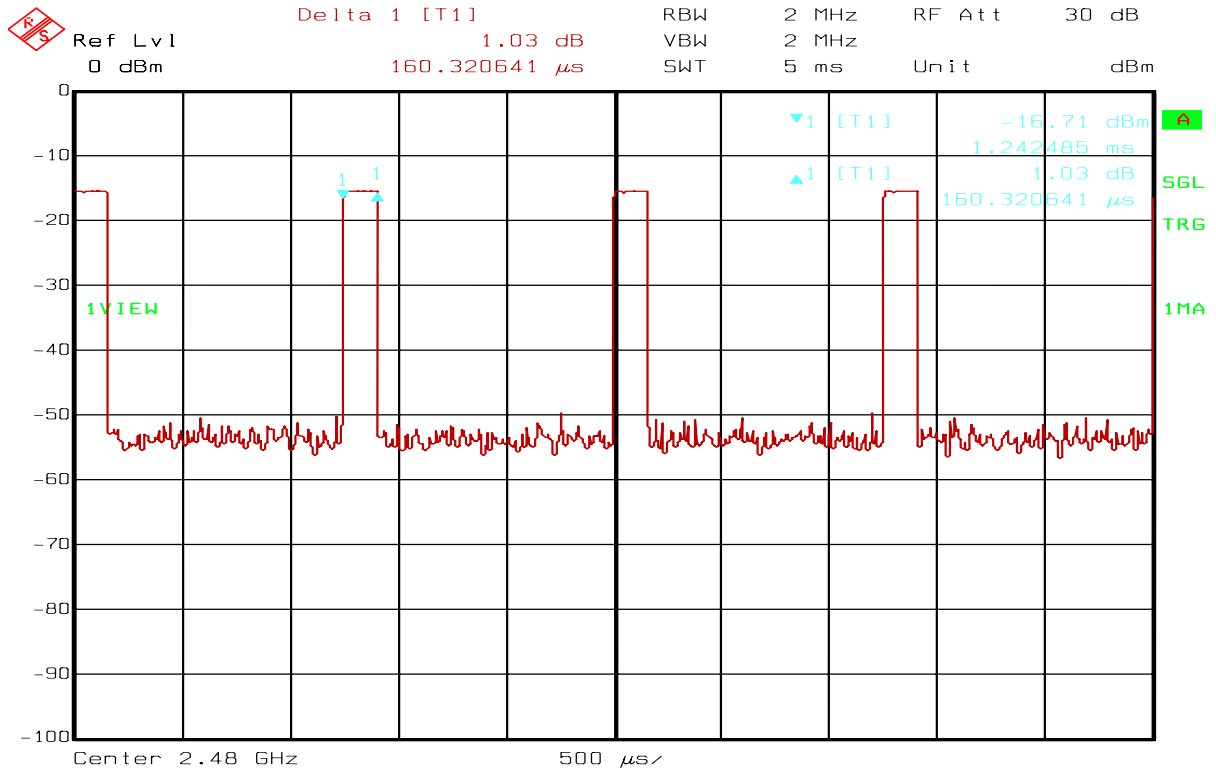
Measurement Data:

Duty Cycle Calculation:

RF duty cycle: Calculation according to RF burst Para 15.35 (c)

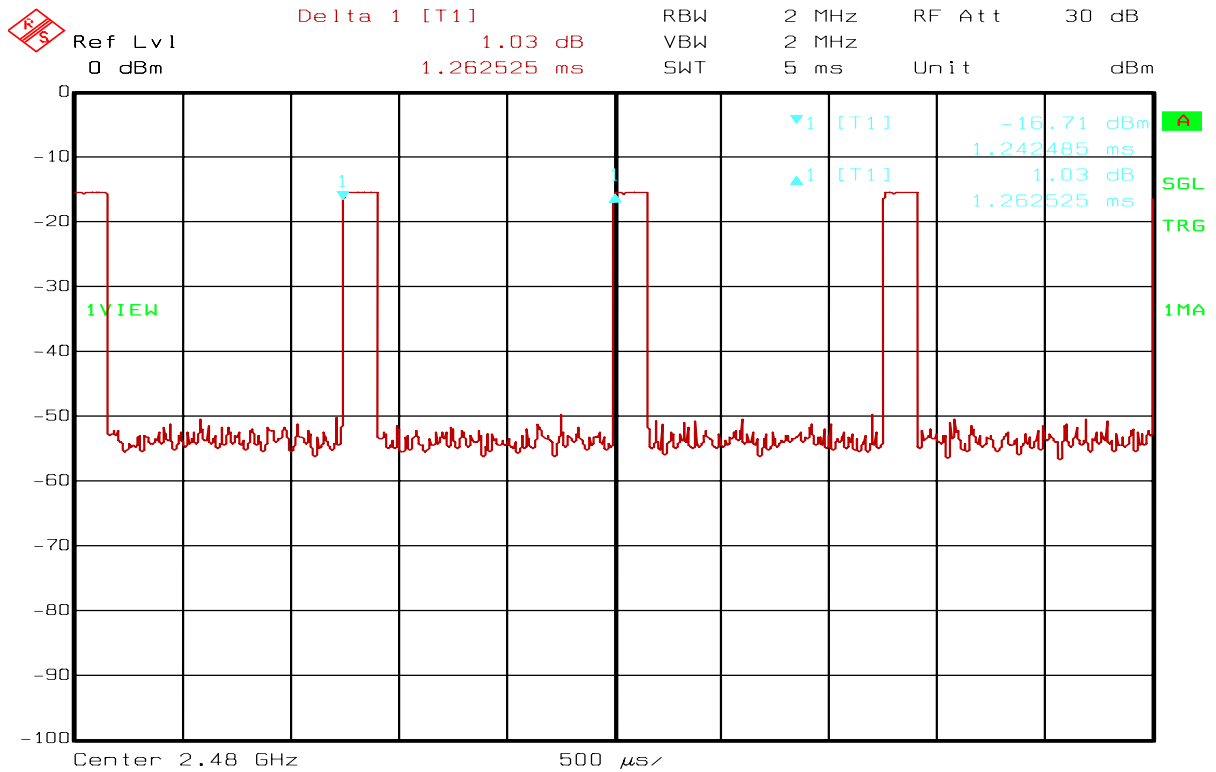
$$-20 \cdot \log(0.169\text{ms}/1.10\text{ms}) = 16.2 \text{ dB}$$

This value is used to calculate average field strength above 1 GHz from the measured Peak value.



Date: 30.APR.2008 15:40:27

Duty cycle ON time



Date: 30.APR.2008 15:41:08

Duty cycle ON+OFF time

Radiated Emissions, 1-25 GHz, peak

1-18 GHz measured at a distance of 3m, 18-25 GHz measured at 1m.

The worst case spurious emission is observed in VP and in XZ plane.

Measured with Peak Detector

| Frequency | RF channel | Dist. corr. factor | Field strength, Peak, 3m | Duty cycle corr. factor | Limit | Margin |
|-----------|------------|--------------------|--------------------------|-------------------------|--------------|--------|
| GHz | L,M,H | dB | dB μ V/m | dB | dB μ V/m | dB |
| 4.809 | L | 0 | 47.85 | - | 74 | 26.15 |
| 4.889 | M | 0 | 44.31 | - | 74 | 29.69 |
| 4.958 | H | 0 | 44.31 | - | 74 | 29.69 |
| 5 - 25 | L,M,H | 0 | None detected | - | - | - |

Radiated emission 1- 25 GHz, Average

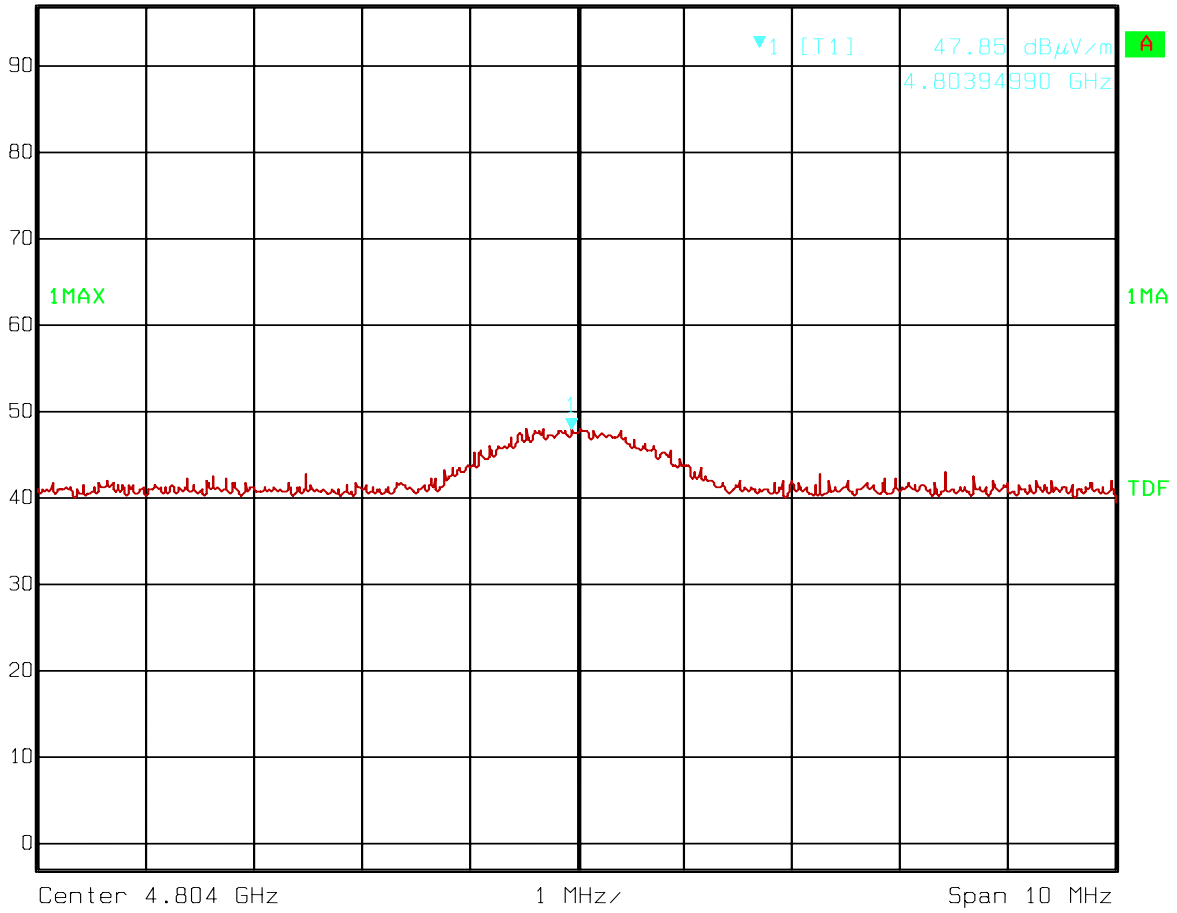
Calculated value from Peak Detector

| Frequency | RF channel | Dist. corr. factor | Field strength, Peak, 3 meters | Duty Cycle correction factor | Limit | Margin |
|-----------|------------|--------------------|--------------------------------|------------------------------|--------------|--------|
| GHz | L,M,H | dB | dB μ V/m | dB | dB μ V/m | dB |
| 4.809 | L | 0 | 47.85 | 16,2 | 54 | 22.35 |
| 4.889 | M | 0 | 44.31 | 16,2 | 54 | 25.89 |
| 4.958 | H | 0 | 44.31 | 16,2 | 54 | 25.89 |
| 5 - 25 | L,M,H | 0 | None detected | - | - | - |

See attached graphs

Antenna factor, amplifier gain and cable loss are included in spectrum analyzer "Transducer factor".

| | | | | | | |
|---|---------|--------------------|-----|-------|--------|--------------|
|  | Ref Lvl | Marker 1 [T1] | RBW | 1 MHz | RF Att | 0 dB |
| | 97 dB* | 47.85 dB μ V/m | VBW | 1 MHz | | |
| | | 4.80394990 GHz | SWT | 5 ms | Unit | dB μ V/m |

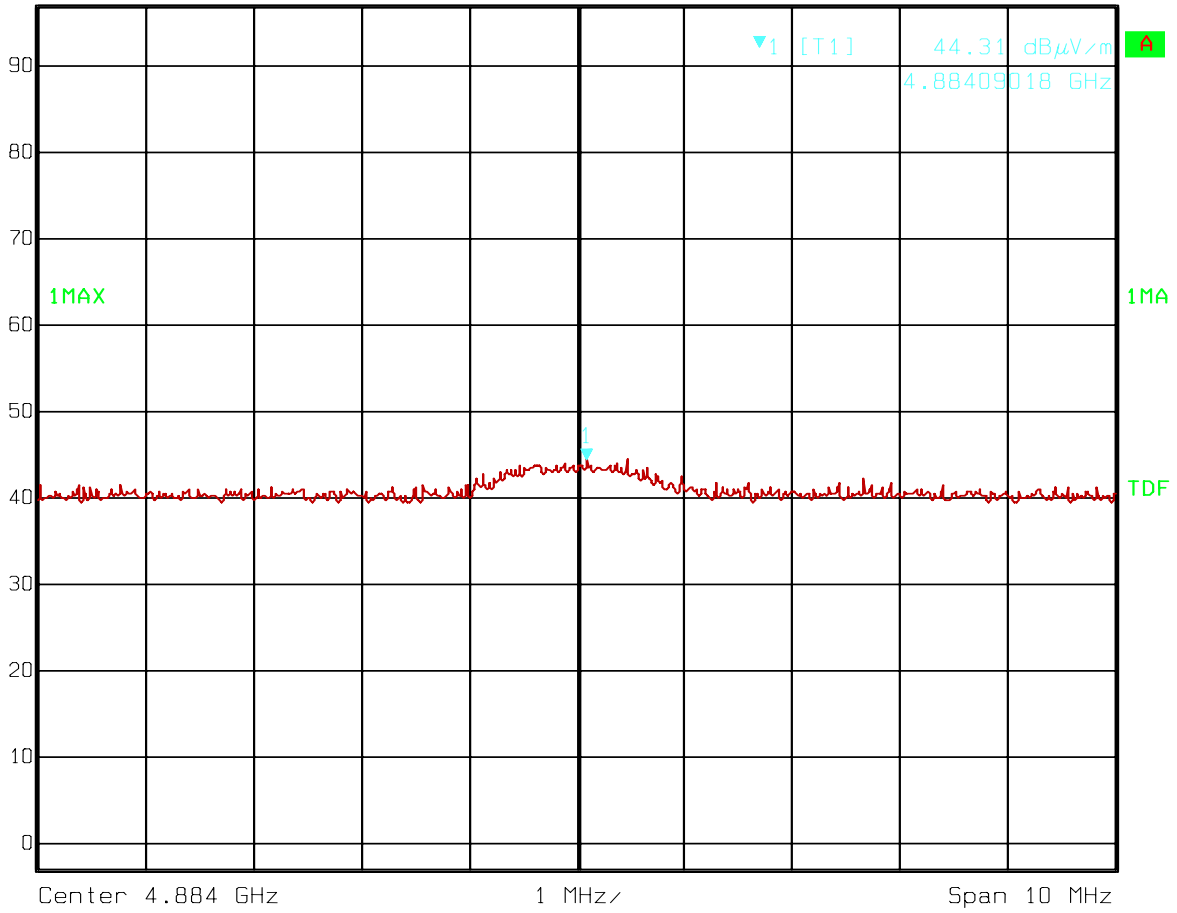


Date: 30.APR.2008 16:40:47

2nd harmonic, Lower Channel



| | | | | | |
|---------|--------------------|-----|-------|--------|--------------|
| Ref Lvl | Marker 1 [T1] | RBW | 1 MHz | RF Att | 0 dB |
| 97 dB* | 44.31 dB μ V/m | VBW | 1 MHz | | |
| | 4.88409018 GHz | SWT | 5 ms | Unit | dB μ V/m |

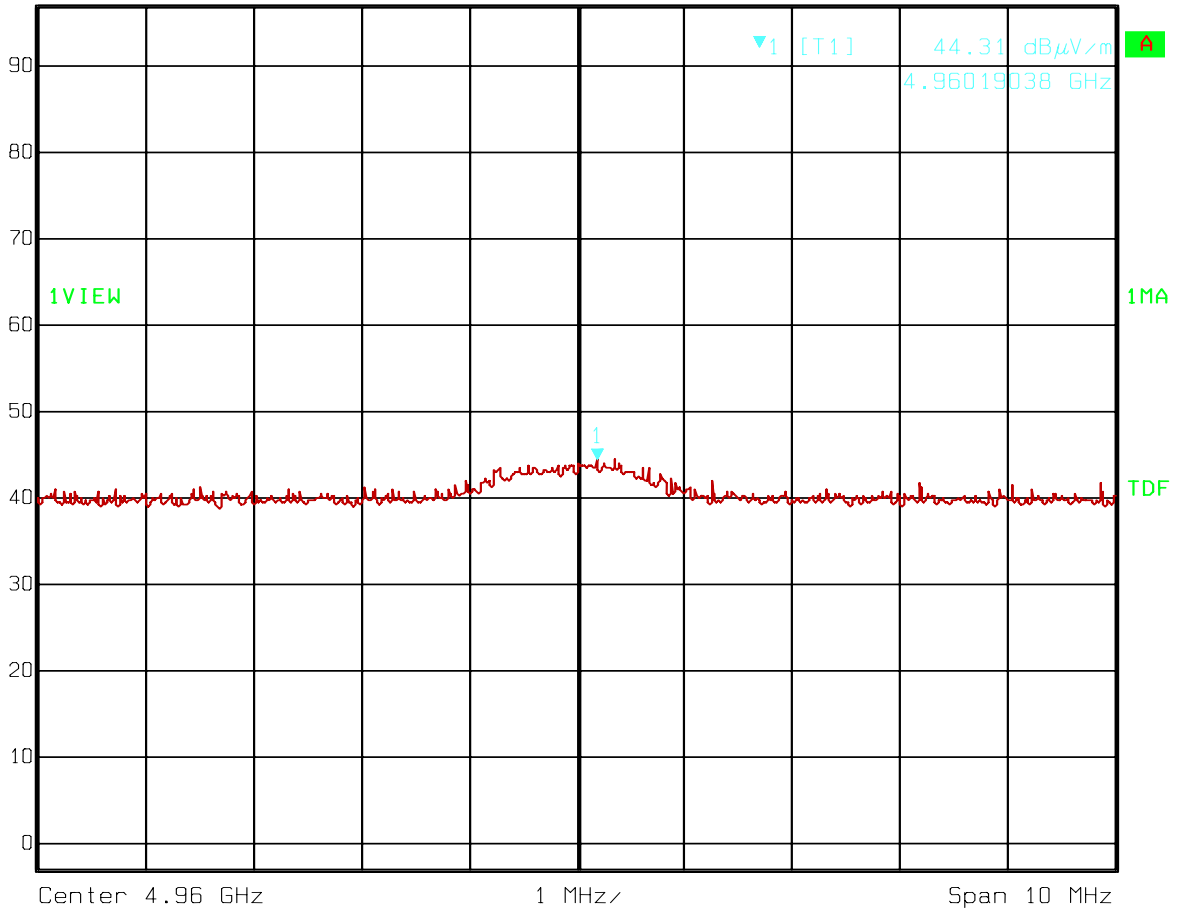


Date: 30.APR.2008 16:44:05

2nd harmonic, Middle Channel



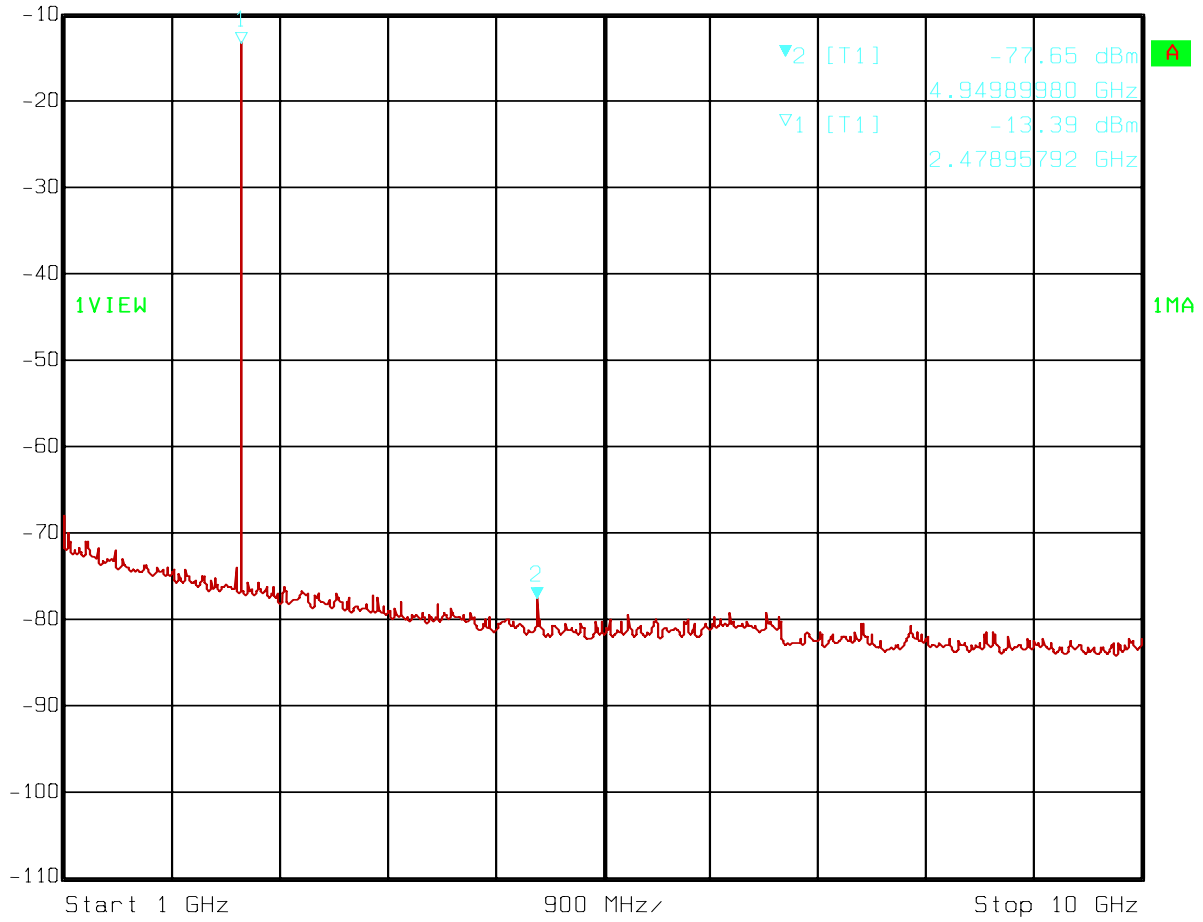
| | | | | | |
|---------|--------------------|-----|-------|--------|--------------|
| Ref Lvl | Marker 1 [T1] | RBW | 1 MHz | RF Att | 0 dB |
| 97 dB* | 44.31 dB μ V/m | VBW | 1 MHz | | |
| | 4.96019038 GHz | SWT | 5 ms | Unit | dB μ V/m |



Date: 30.APR.2008 16:37:01

2nd harmonic, Upper channel

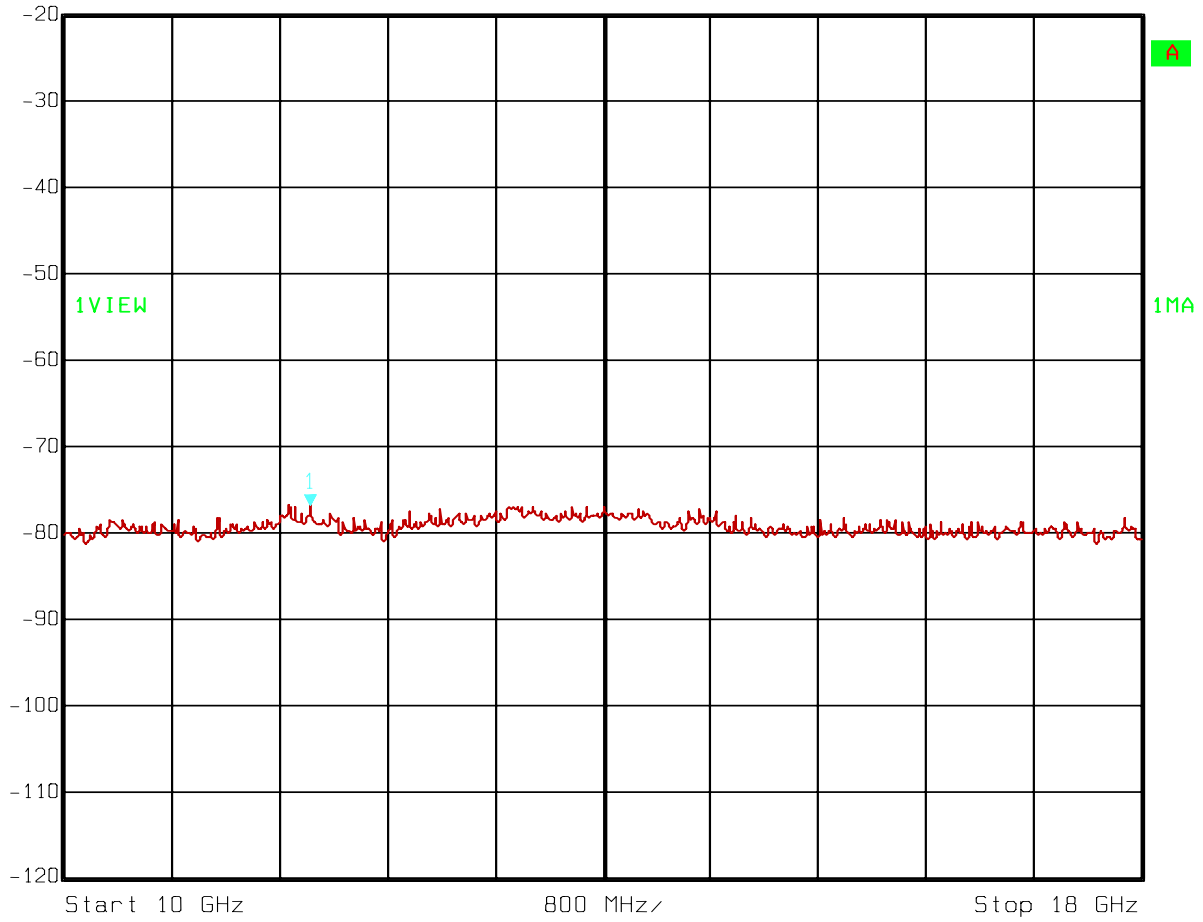
◆ Marker 2 [T1] RBW 100 kHz RF Att 0 dB
 Ref Lvl -10 dBm -77.65 dBm VBW 100 kHz
4.94989980 GHz SWT 2.25 s Unit dBm



Date: 30.APR.2008 16:27:19

Spurious emissions, pre-scan 1 – 10GHz

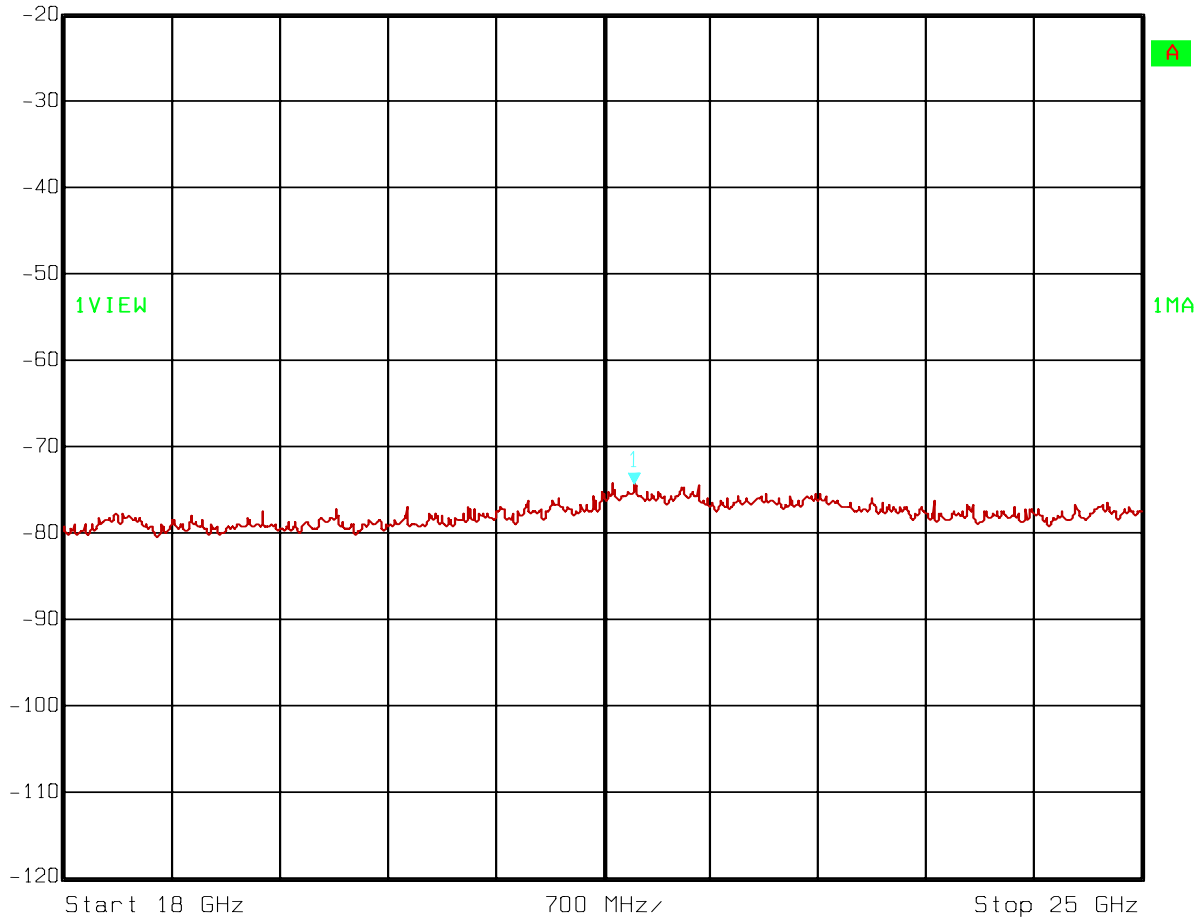
 Ref Lvl -20 dBm Marker 1 [T1] -76.91 dBm RBW 1 MHz RF Att 0 dB
11.82765531 GHz VBW 1 MHz Unit dBm
SWT 46 ms



Date: 2.MAY.2008 8:16:09

Spurious emissions, pre-scan 10 – 18GHz

| | | | | | |
|---|---------------|-----------------|-------|--------|------|
|  | Marker 1 [T1] | RBW | 1 MHz | RF Att | 0 dB |
| | Ref Lvl | -74.31 dBm | VBW | 1 MHz | |
| | -20 dBm | 21.70340681 GHz | SWT | 40 ms | Unit |



Date: 2.MAY.2008 8:15:01

Spurious emissions, pre-scan 18 – 25GHz

Radiated emission 30 – 1000 MHz.

Detector: Quasi-Peak

Measuring distance 10 m according to CISPR 22.

Tested in test mode

The worst case spurious emission is observed in VP and in XZ plane.

| Frequency | Operational condition | Field strength | Measuring distance | Limit FCC15.209 | Margin |
|-----------|-----------------------|----------------|--------------------|--------------------|--------|
| MHz | | dB μ V/m | metres | dB μ V/m | dB |
| 601.35 | TX on | 24.9 | 3 | 45 | 20.1 |

See attached graphs.

Nemko
Peak

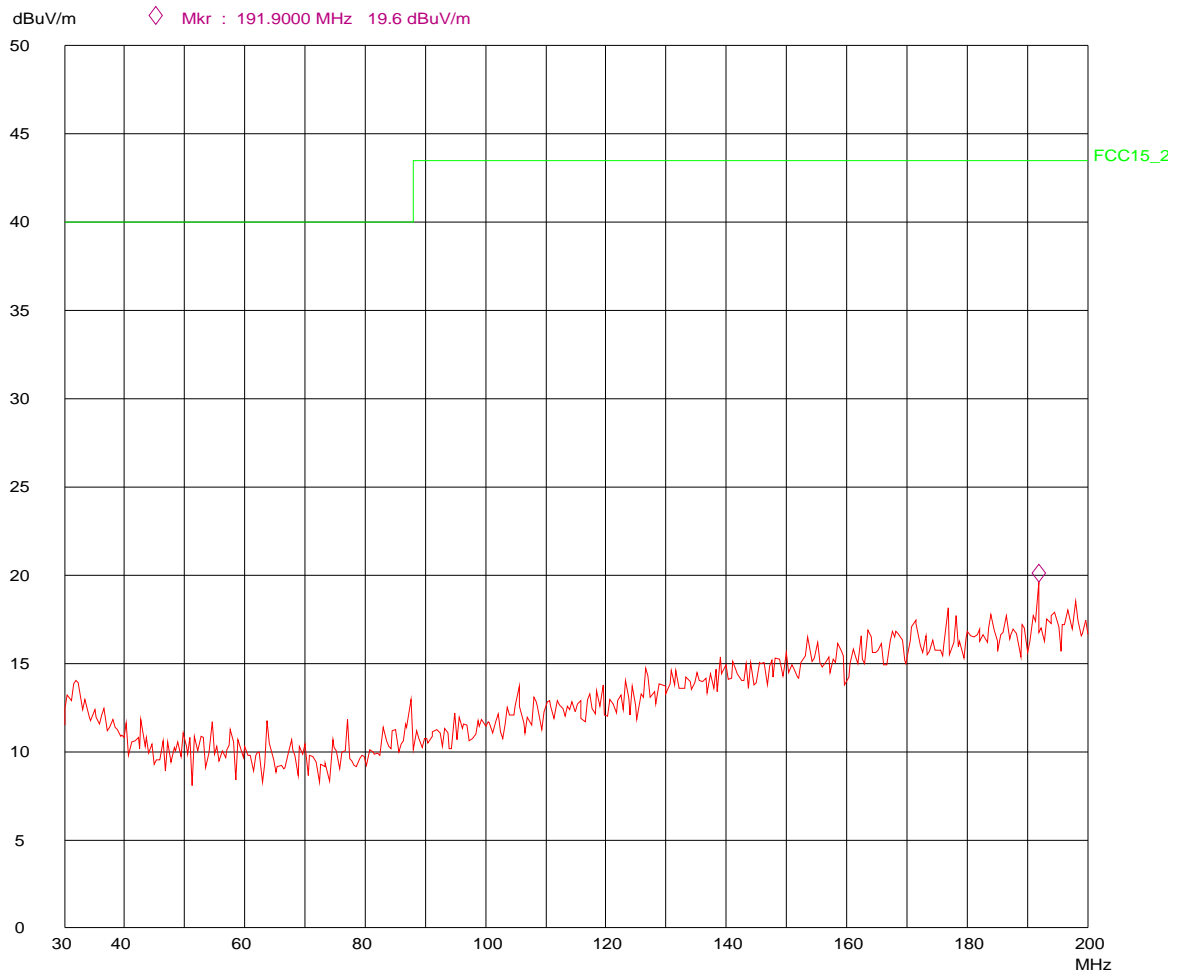
02. May 08 07:44

EUT: Amayon
 Manuf: Ascom
 Op Cond: 1m Vp 3m dist
 Operator: gns
 Test Spec: Fcc part 15
 Comment: tx mode

Scan Settings (1 Range)

| Frequencies | | | | Receiver Settings | | | | |
|-------------|------|------|-------|-------------------|--------|-------|--------|-------|
| Start | Stop | Step | IF BW | Detector | M-Time | Atten | Preamp | OpRge |
| 30M | 200M | 50k | 120k | PK | 50ms | 0dB | LN ON | 60dB |

| Transducer No. | Start | Stop | Name |
|----------------|-------|------|-------|
| 20 | 30M | 200M | HK116 |



VP, 30 - 200MHz

Nemko
Peak

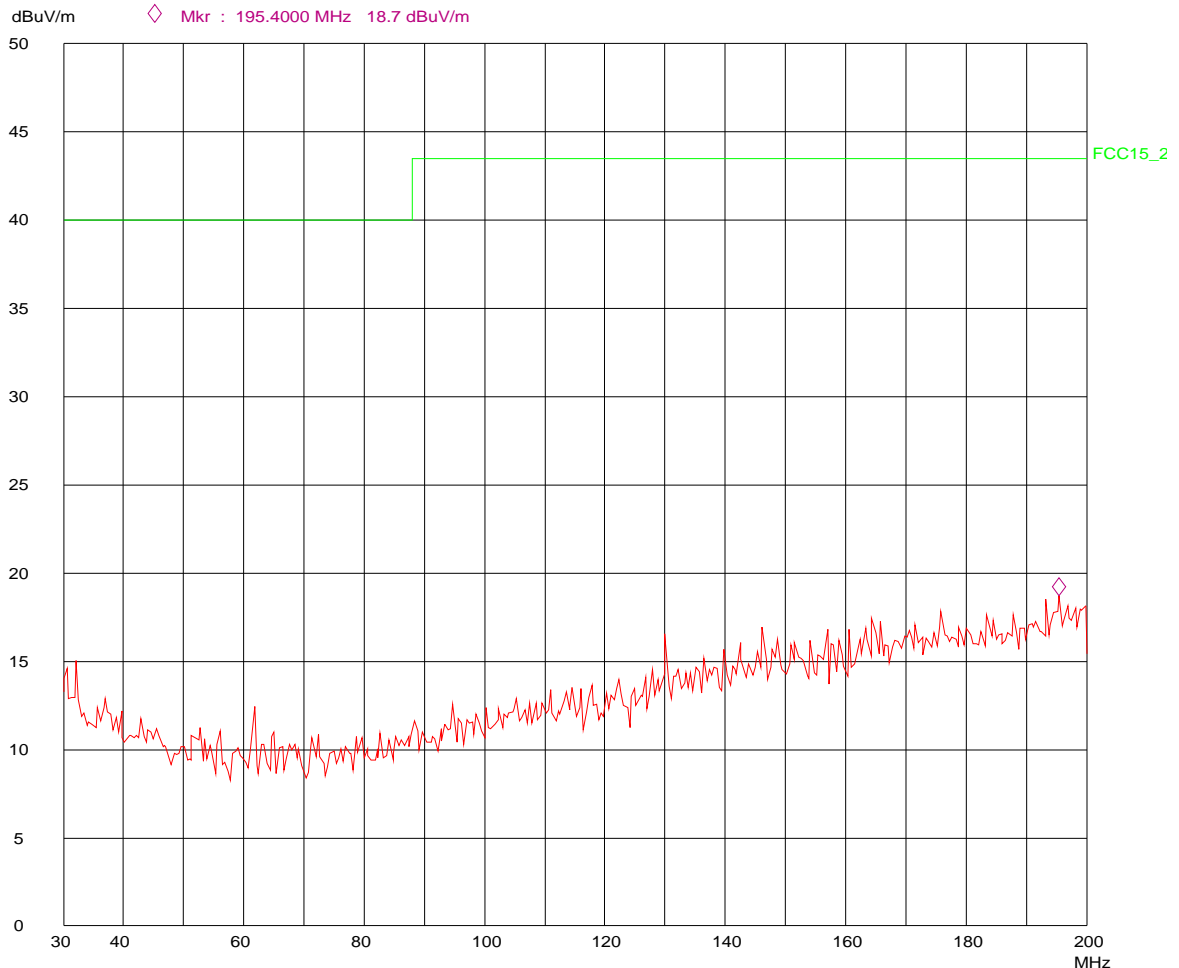
02. May 08 07:52

EUT: Amayon
 Manuf: Ascom
 Op Cond: 3m hp 3m dist
 Operator: gns
 Test Spec: Fcc part 15
 Comment: tx mode

Scan Settings (1 Range)

| Frequencies | | | Receiver Settings | | | | | |
|-------------|------|------|-------------------|----------|--------|-------|--------|-------|
| Start | Stop | Step | IF BW | Detector | M-Time | Atten | Preamp | OpRge |
| 30M | 200M | 50k | 120k | PK | 50ms | 0dBLN | ON | 60dB |

| Transducer No. | Start | Stop | Name |
|----------------|-------|------|-------|
| 20 | 30M | 200M | HK116 |



HP, 30 - 200MHz

Nemko
Peak

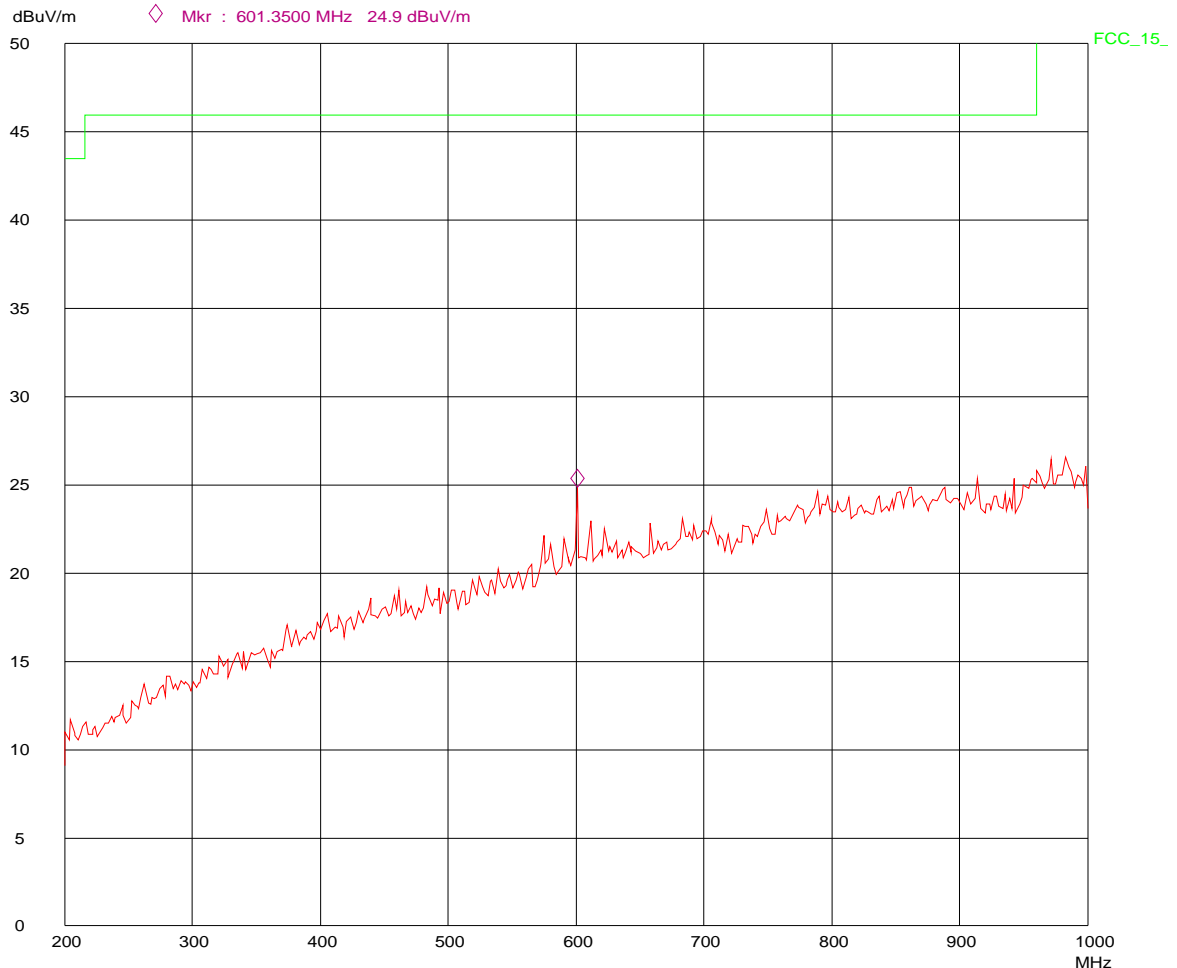
02. May 08 08:09

EUT: Amayon
 Manuf: Ascom
 Op Cond: 1m vp 3m dist
 Operator: gns
 Test Spec: Fcc part 15

Scan Settings (1 Range)

| Frequencies | | | Receiver Settings | | | | | |
|-------------|-------|------|-------------------|----------|--------|-------|--------|-------|
| Start | Stop | Step | IF BW | Detector | M-Time | Atten | Preamp | OpRge |
| 200M | 1000M | 50k | 120k | PK | 50ms | AUTO | LN ON | 60dB |

| Transducer No. | Start | Stop | Name |
|----------------|-------|-------|---------|
| 22 | 200M | 1000M | HL223HP |



VP, 200 - 1000MHz

Nemko
Peak

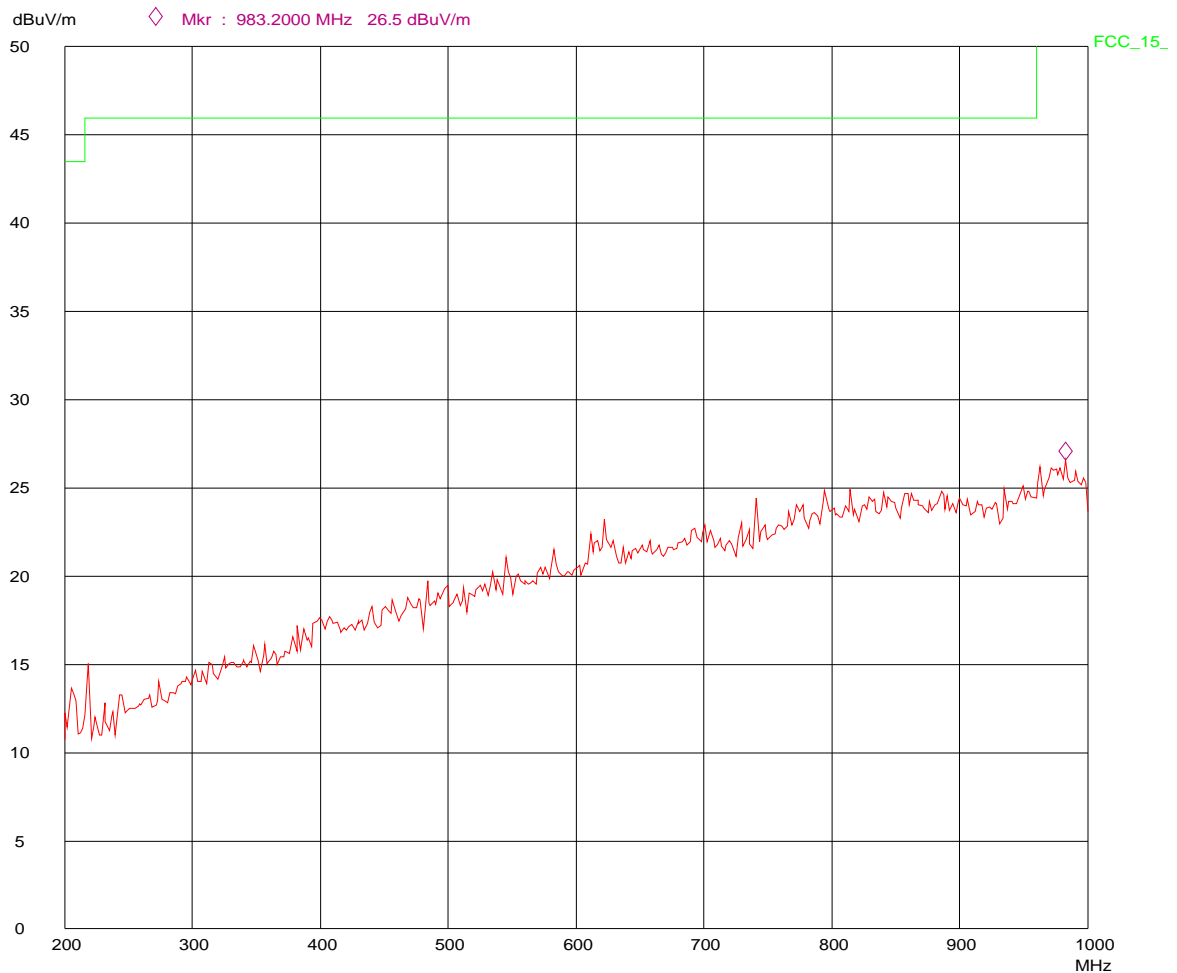
02. May 08 08:38

EUT: Amayon
 Manuf: Ascom
 Op Cond: 3m hp 3m dist
 Operator: gns
 Test Spec: Fcc part 15

Scan Settings (1 Range)

| Frequencies | | | Receiver Settings | | | | | |
|-------------|-------|------|-------------------|----------|--------|-------|--------|-------|
| Start | Stop | Step | IF BW | Detector | M-Time | Atten | Preamp | OpRge |
| 200M | 1000M | 50k | 120k | PK | 50ms | AUTO | LN ON | 60dB |

| Transducer No. | Start | Stop | Name |
|----------------|-------|-------|---------|
| 22 | 200M | 1000M | HL223HP |



HP, 200 - 1000MHz

Radiated emission 10 kHz-30 MHz.

Measuring distance 10 m, measured with Peak detector.

No component detected, see attached graph.

Limit is converted to 10m using 40 dB/decade according to 15.31 (f) (2).

NEMKO Comlab

02. May 08 18:47

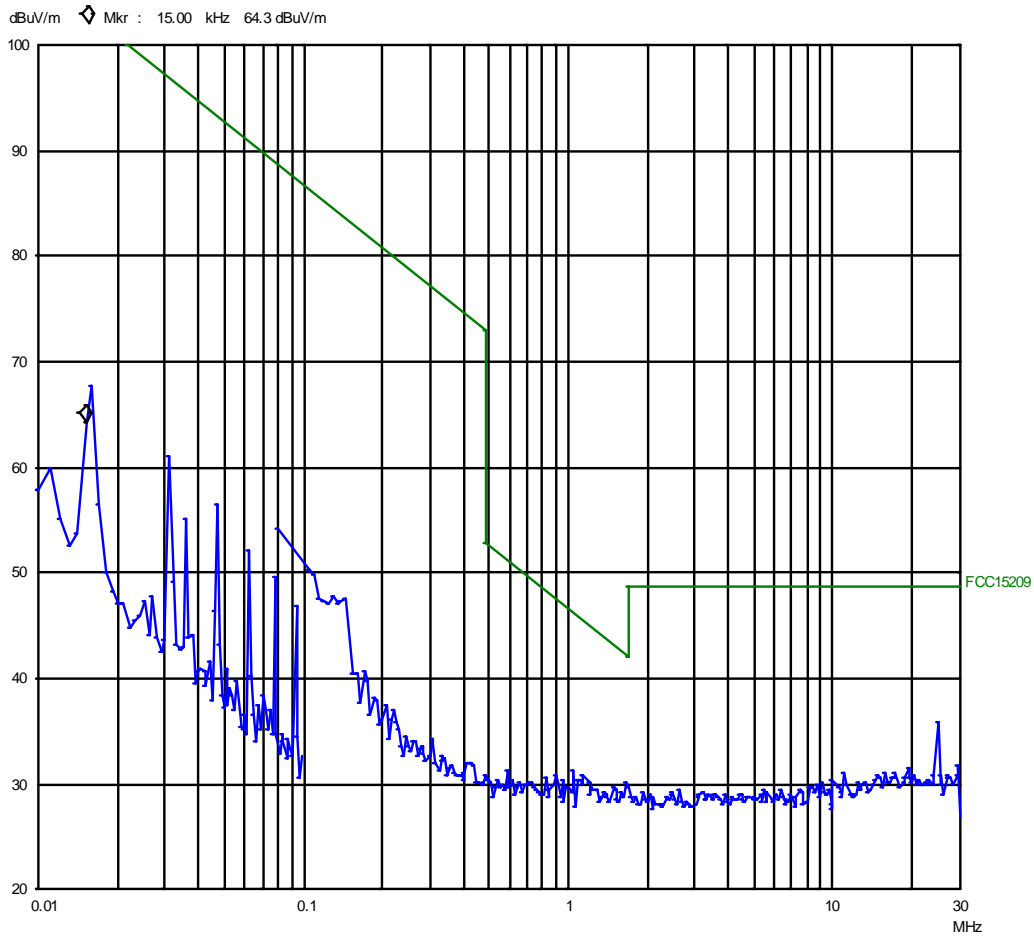
Peak

Operator: gns
 Comment: ASCOM
 Bluetooth
 tx mode
 FCC part 15

Scan Settings (4 Ranges)

| Frequencies | | | Receiver Settings | | | | | |
|-------------|------|------|-------------------|----------|--------|-------|--------|-------|
| Start | Stop | Step | IF BW | Detector | M-Time | Atten | Preamp | OpRge |
| 10k | 100k | 1k | 1k | PK | 20ms | 0dB | LN OFF | 60dB |
| 20k | 20k | 5k | 9k | PK | 20ms | AUTO | LN ON | 60dB |
| 20k | 10M | 5k | 9k | PK | 20ms | AUTO | LN OFF | 60dB |
| 10M | 30M | 5k | 9k | PK | 20ms | AUTO | LN OFF | 60dB |

| Transducer No. | Start | Stop | Name |
|----------------|-------|------|--------|
| 13 | 10k | 30M | HFH222 |



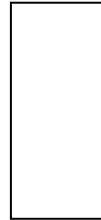
5 LIST OF TEST EQUIPMENT

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

| No | Description | Manufactur | Type |
|------|--------------------------|------------|-------------------|
| 1410 | Shielded room | ETS | Semi-anechoic |
| 1434 | Climate Chamber | Vøtsch | VC 7057 |
| 1337 | Spektrum Analyzer | R&S | FSEK 1088,3494,30 |
| 1330 | Antenna Horn | EMCO | 3115 |
| 1332 | Antenna Dipole | R&S | HZ-12 633,0886,00 |
| 1123 | Spektrum Analyzer | Advantest | R3271 |
| 1260 | Antenna, biconical | R&S | HK 116 |
| 1261 | Antenna Log-periodic | R&S | HL 223 |
| 1020 | Multimeter, Digital | Fluke | 87 |
| 1143 | Attenuator | Suhner | 6810.17.A |
| 1101 | EMI-Receiver | R&S | ESVS30 |
| 589 | Power Supply | Oltronix | B60-15R |
| 1322 | Amplifier RF | HP | 8449B |
| 285 | Antenna, loop | R&S | HFH2-Z2 |
| 1518 | Test Fixture 2440MHz | Comlab | SRD 2440 |
| 1515 | AC power source/Analyzer | Agilent | 6812B |
| 93 | Antenna Horn | Narda | 643 |
| 100 | Antenna Horn | Systron | DBF-520-20 |
| 103 | Antenna Horn | Sivers | PM 7320X |

6 BLOCK DIAGRAM

6.1 System set up



Portable part

6.2 Test Site Radiated Emission

