



Accredited testing-laboratory

DAR registration number: DAT-P-176/94-D1

**Federal Motor Transport Authority (KBA)
DAR registration number: KBA-P 00070-97**

Recognized by the Federal Communications Commission

Anechoic chamber registration no.: 90462 (FCC)

Anechoic chamber registration no.: 3463A-1 (IC)

Certification ID: DE 0001

Accreditation ID: DE 0002

Accredited Bluetooth® Test Facility (BQTF)

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Test report no. : 2-4576-10-03/07
Type identification : AAD-3022101-BV
Applicant : Sony Ericsson Mobile Communications AB
FCC ID : PY7A3022101
IC Certification No : 4170B-A3022101
Test standards : 47 CFR Part 15
RSS - 210 Issue 7

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1 General information

1.1 Notes

The test results of this test report relate exclusively to the test item specified in 1.5. The CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM ICT Services GmbH.

Test laboratory manager:

2007-09-03

Jakob Reschke

Date

Name

Signature



Technical responsibility for area of testing:

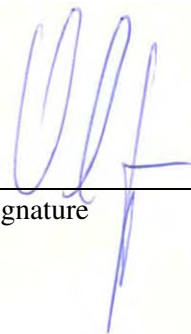
2007-09-03

Jörg Warken

Date

Name

Signature



1.2 Testing laboratory

CETECOM ICT Services GmbH

Untertürkheimer Straße 6 - 10
66117 Saarbrücken
Germany

Phone: + 49 681 5 98 - 0

Fax: + 49 681 5 98 - 9075

e-mail: info@ICT.cetecom.de

Internet: http://www.cetecom-ict.de

State of accreditation: The test laboratory (area of testing) is accredited according to
DIN EN ISO/IEC 17025
DAR registration number: DAT-P-176/94-D1

Accredited by: Federal Motor Transport Authority (KBA)
DAR registration number: KBA-P 00070-97

Testing location, if different from CETECOM ICT Services GmbH:

Name :
Street :
Town :
Country :
Phone :
Fax :

1.3 Details of applicant

| | |
|-------------------|---|
| Name: | Sony Ericsson Mobile Communications AB |
| Street: | Nya Vattentornet |
| Town: | 22188 Lund |
| Country: | Sweden |
| Telephone: | +46-46-19-3000 |
| Fax: | +46-46-19-3295 |
| Contact: | Peter Lindeborg |
| E-mail: | peter.lindeborg@sonyericsson.com |
| Telephone: | +46-46-212-6180 |

1.4 Application details

| | |
|--|-------------------|
| Date of receipt of order: | 2007-03-14 |
| Date of receipt of test item: | 2007-08-24 |
| Date of start test: | 2007-08-27 |
| Date of end test | 2007-09-03 |
| Persons(s) who have been present during the test: | |

2 Test standard/s:

| | | |
|-------------------|---------|---|
| 47 CFR Part 15 | 2006-08 | Title 47 of the Code of Federal Regulations; Chapter I- Federal Communications Commission subchapter A - general, Part 15-Radio frequency devices |
| RSS - 210 Issue 7 | 2007-06 | Spectrum Management and Telecommunications - Radio Standards Specification Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment |

3 Technical tests

3.1 Details of manufacturer

| | |
|----------|--|
| Name: | Sony Ericsson Mobile Communications AB |
| Street: | Nya Vattentornet |
| Town: | 22188 Lund |
| Country: | Sweden |

3.1.1 Test item

| | |
|------------------------|---|
| Kind of test item : | GSM Mobile Phone 900/1800/1900/UMTS/BT2.0+EDR |
| Type identification : | AAD-3022101-BV |
| S/N serial number : | Radiated Sample: CB510Q5DJU Conducted Sample: CB510PQ8RU |
| HW hardware status : | A |
| SW software status : | -.- |
| Frequency Band [MHz] : | ISM 2.400 - 2.483,5 |
| Type of Modulation : | FHSS |
| Number of channels : | 79 |
| Antenna : | Integrated antenna |
| Power Supply : | 4.0 V DC by Li-Polymer battery |
| Temperature Range : | -20°C to +55°C |

Max. power radiated: 0.89 dBm

Max. power conducted: 3.67 dBm

FCC ID: PY7A3022101

IC: 4170B-A3022101

3.1.2 Additional EUT information For IC Canada (appendix 2)

| | |
|---|--|
| IC Registration Number: | 4170B-A3022101 |
| Model Name: | AAD-3022101-BV |
| Manufacturer (complete Address): | Sony Ericsson Mobile Communications AB Nya Vattentorget 22188 Lund Sweden |
| Tested to Radio Standards Specification (RSS) No.: | RSS-210 Issue 7 |
| Open Area Test Site Industry Canada Number: | IC 3463A-1 |
| Frequency Range (or fixed frequency) [MHz]: | 2400 – 2483.5 MHz |
| RF: Power [W] (max): | Rad. EIRP: 1.23 mW Conducted : 2.33 mW |
| Antenna Type: | Integrated antenna |
| Occupied Bandwidth (99% BW) [kHz]: | 1323 (Pi/4 DQPSK) |
| Type of Modulation: | FSK |
| Emission Designator (TRC-43): | IM00FXD / 79M0FXD (FHSS) |
| Transmitter Spurious (worst case) [μ V/m in 3m]: | Nothing found |
| Receiver Spurious (worst case) [μ V/m in 3m]: | Nothing found |

ATTESTATION: I attest that the testing was performed or supervised by me; that the test measurements were made in accordance with the above-mentioned departmental standard(s), and that the radio equipment identified in this application has been subject to all applicable test conditions specified in the departmental standards and all of the requirements of the standards have been met.

Signature:



Date: 2007-09-03

Test engineer: Jakob Reschke

3.1.3 RF Technical Brief Cover Sheet acc. To RSS-102

All Fields must be completed with the requested information or the following codes: N/A for Not Applicable, N/P for Not Performed or N/V for Not Available. Where applicable, check appropriate box.

- 1. COMPANY NUMBER: **4170B-A3022101**
- 2. MODEL NUMBER: **AAD-3022101-BV**
- 3. MANUFACTURER: **Sony Ericsson Mobile Communications AB**
- 4. TYPE OF EVALUATION:

(c) RF Evaluation

- Evaluated against exposure limits: General Public Use Controlled Use
- Duty cycle used in evaluation: 99 %
- Standard used for evaluation: RSS-102 Issue 2 (2005-11)
- Measurement distance: 0.5 m
- RF value: 0.89 dBm V/m A/m W/m²
- Measured Computed Calculated

Declaration of RF Exposure Compliance

ATTESTATION: I attest that the information provided in this testreport are correct; that a Technical Brief was prepared and the information it contains is correct; that the device evaluation was performed or supervised by me; that applicable measurement methods and evaluation methodologies have been followed and that the device meets the SAR and/or RF exposure limits of RSS-102.

Name: Jakob Reschke
Title: Engineer
Company: Cetecom ICT Services GmbH



3.1.4 EUT operating modes

| EUT operating mode no. *) | Description of operating modes | Additional information |
|---------------------------|--------------------------------|--|
| Op. 0 | Normal mode | Normal temperature and power source conditions |
| Op. 1 | | low temperature, low power source conditions |
| Op. 2 | | low temperature, high power source conditions |
| Op. 3 | | high temperature, low power source conditions |
| Op. 4 | | high temperature, high power source conditions |

*) EUT operating mode no. is used to simplify the test plan

3.1.5 Extreme conditions testing values

| Description | Shortcut | Unit | Value |
|----------------------|------------------|------|-------|
| Nominal Temperature | T _{nom} | °C | 22 |
| Nominal Humidity | H _{nom} | % | 44 |
| Nominal Power Source | V _{nom} | V | 4.0 |

Type of power source: **DC by Li-Polymer battery**

Deviations from these values are reported in chapter 2

4 Summary of Measurement Results and list of all performed test cases

- No deviations from the technical specifications were ascertained
- There were deviations from the technical specifications ascertained

| TC identifier | Description | verdict | date | Remark |
|---------------|--------------------------------------|---------|------------|--------|
| RF-Testing | FCC Part 15 §15.247 - CANADA RSS-210 | PASS | 2007-09-03 | PASS |

| Test Specification Clause | Test Case | Modulation | Pass | Fail | N/A | Not performed |
|---------------------------|--|------------------------------|-------------------|------|-----|---------------|
| None | Antenna Gain | GFSK | Yes | | | |
| §15.247(a1) | Carrier frequency separation | GFSK | Yes | | | |
| §15.247(a1) | Number of hopping channels | GFSK | Yes | | | |
| §15.247(a)(1)(iii) | Time of occupancy (dwell time) | -- | Yes | | | |
| §15.247(e) | Power Spectral density (Hybrid system in Inquiry mode/Page scan) | -- | | | Yes | |
| §15.247(a)(1) | Spectrum Bandwidth of a FHSS System / 20dB Bandwith | GFSK Pi/4 DQPSK 8 DPSK | Yes Yes Yes | | | |
| § 15.247 (b)(1) | Maximum output power (conducted) | GFSK Pi/4 DQPSK 8 DPSK | Yes Yes Yes | | | |
| § 15.247 (b)(1) | Max. peak output power (radiated) | GFSK | Yes | | | |
| § 15.247 (d) | Band-edge compliance of conducted emissions | Widest modulation | Yes | | | |
| § 15.205 | Band-edge compliance of radiated emissions | Widest modulation | Yes | | | |
| § 15.247 (d) | Spurious Emission - conducted (Transmitter) | GFSK | Yes | | | |
| § 15.247 (d) | Spurious Emission - radiated (Transmitter) >30 MHz | GFSK | Yes | | | |
| § 15.109 | Spurious Emissions - radiated (Receiver) | GFSK | Yes | | | |
| § 15.209 | Spurious Emissions - radiated (Transmitter) <30 MHz | GFSK | Yes | | | |
| § 15.107/207 | Conducted Emissions <30 MHz | GFSK | Yes | | | |

5 RF measurement testing

5.1 Description of test set-up

5.1.1 Radiated measurements

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 25 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are confirmed with specifications ANSI C63.2-1996 clause 15 and ANSI C63.4-2003 clause 4.1.5. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analysers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63-4-2003 clause 4.2.

Antennas are confirmed with ANSI C63.2-1996 item 15.

9 kHz - 150 kHz: Quasi Peak measurement, 200 Hz Bandwidth, passive loop antenna.

150 kHz - 30 MHz: Quasi Peak measurement, 9 kHz Bandwidth, passive loop antenna.

30 MHz - 200 MHz: Quasi Peak measurement, 120 kHz Bandwidth, biconical antenna

200MHz - 1GHz: Quasi Peak measurement, 120 kHz Bandwidth, log periodic antenna

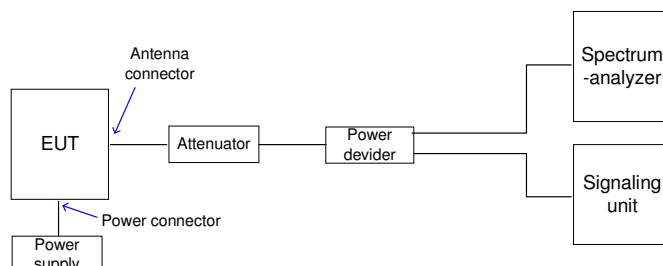
>1GHz: Average, RBW 1MHz, VBW 10 Hz, waveguide horn

All measurements are done in accordance with the Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems DA 00-705 and Appendix A "BLUETOOTH APPROVALS"

The EUT is powered by an external power supply with nominal voltage. The signalling is performed from outside the chamber with a signalling unit (CMU200 or other) by air link using signalling antenna.

5.1.2 Conducted measurements

The EUT's RF signal is coupled out by the antenna connector which is supplied by the manufacturer. The signal is first 10dB attenuated before it is power divided (~6dB loss per branch). One of the signal path is connected to the communication base Station (CMU200 or other), the other one is connected to the spectrum analyzer. The specific losses for both signal paths are first checked within a calibration. The measurement readings on the signalling unit/spectrum analyzer are corrected by the specific test set-up loss. The attenuator, power divider, signalling unit and the spectrum analyzer are impedance matched on 50 Ohm.



5.2 Referenced documents

None

5.3 Additional comments

--

5.4 Antenna gain

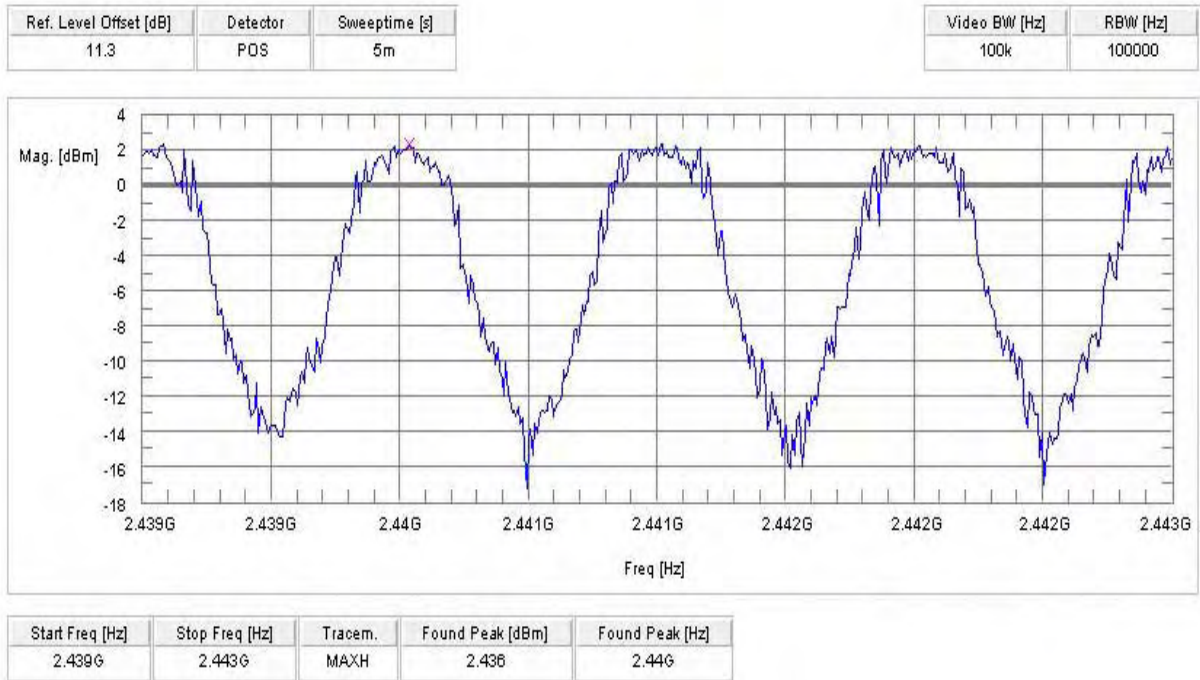
The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module.

| | low channel | mid channel | high channel |
|---------------------------------|-------------|-------------|--------------|
| Conducted power [dBm] (GFSK) | 1.88 | 3.13 | 3.67 |
| Radiated power [dBm] | -0.10 | 0.89 | 0.43 |
| Gain [dBi] | -1.98 | -2.24 | -3.24 |

5.5 Carrier frequency separation §15.247(a)(1)

Modulation: GFSK

Plot 1 of 1:



Result: Channel separation is: ~ 1 MHz

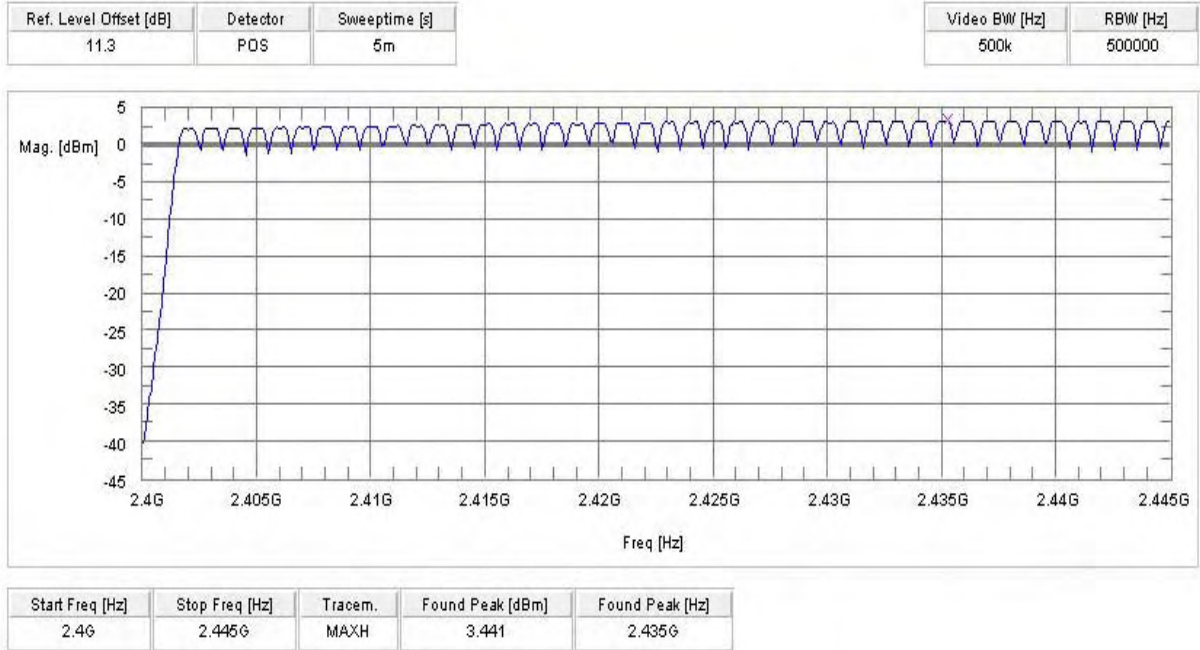
Limits:

| | |
|-----------------------------------|---|
| Under normal test conditions only | Minimum 25 kHz or 20 dB Bandwidth of the hopping system |
|-----------------------------------|---|

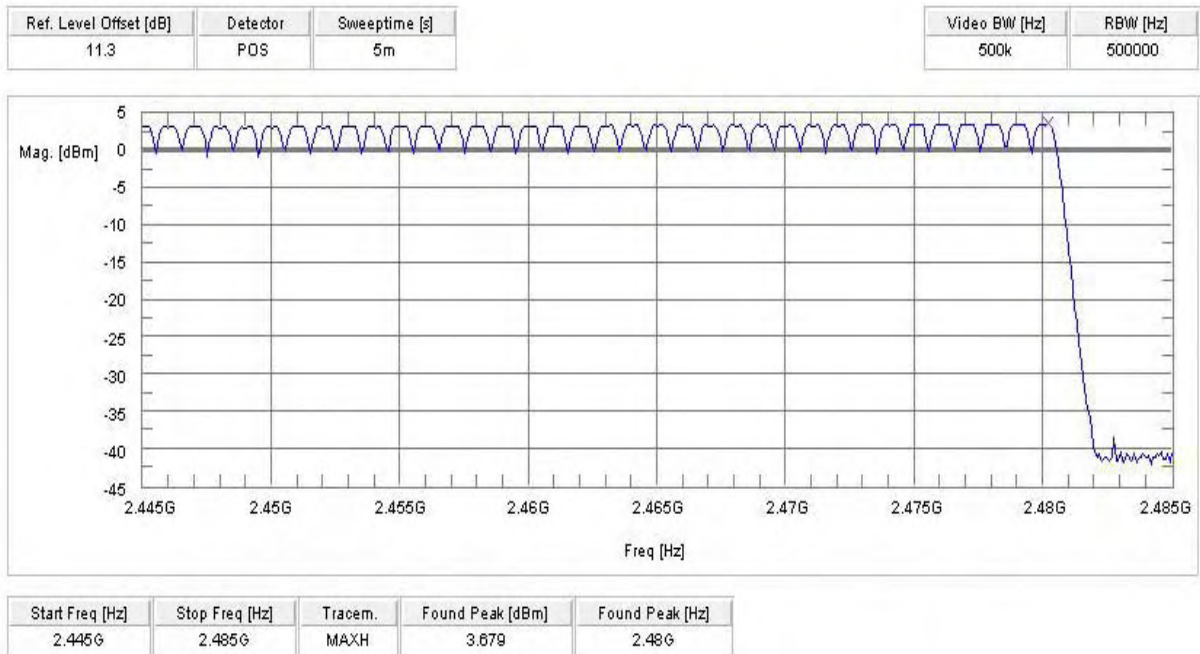
5.6 Number of hopping channels §15.247(a)(1)

Modulation: GFSK

Plot 1 of 2:



Plot 2 of 2:



Result : The number of hopping channels is: 79

Limits :

| | |
|-----------------------------------|--------------------------------------|
| Under normal test conditions only | at least 15 non-overlapping channels |
|-----------------------------------|--------------------------------------|

5.7 Time of occupancy (dwell time) §15.247(a)(1)(iii)

For Bluetooth devices:

The dwell time of 0.4 s within a 31.6 second period in data mode is independent from the packet type (packet length). The calculation for a 31.6 second period is as follows:

Dwell time = time slot length * hop rate / number of hopping channels * 31.6 s

Example for a DH1 packet (with a maximum length of one time slot)

Dwell time = $625 \mu\text{s} * 1600 \text{ 1/s} / 79 * 31.6 \text{ s} = 0.4 \text{ s}$ (in a 31.6 s period)

For multi-slot packet the hopping is reduced according to the length of the packet.

Example for a DH5 packet (with a maximum length of five time slots)

Dwell time = $5 * 625 \mu\text{s} * 1600 * 1/5 * 1/s / 79 * 31.6 \text{ s} = 0.4 \text{ s}$ (in a 31.6 s period)

This is according to the Bluetooth Core Specification V 1.1 & V 1.2 & V2.0 (+ critical errata) for all Bluetooth devices.

Therefore, all Bluetooth devices comply with the FCC dwell time requirement in the data mode.

This was checked during the Bluetooth Qualification tests.

The Dwell time in hybrid mode is approximately 2.6 ms (in a 12.8s period)

**5.8 Power Spectral density (Hybrid system in Inquiry mode/Page scan)
§15.247(e)**

Plot 1 of 1:

Not applicable

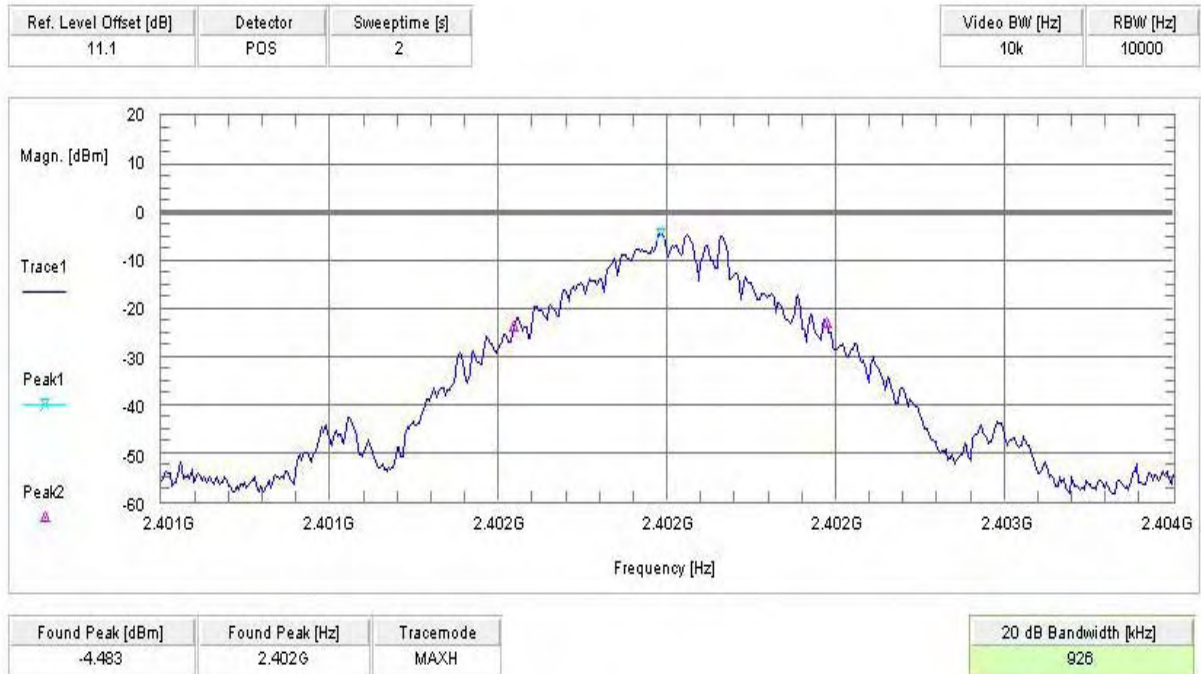
Result: Power density: - dBm/Hz = - dBm / 3 kHz
Correction factor from dBm/Hz to dBm / 3 kHz is +34,8 dB

Limits :

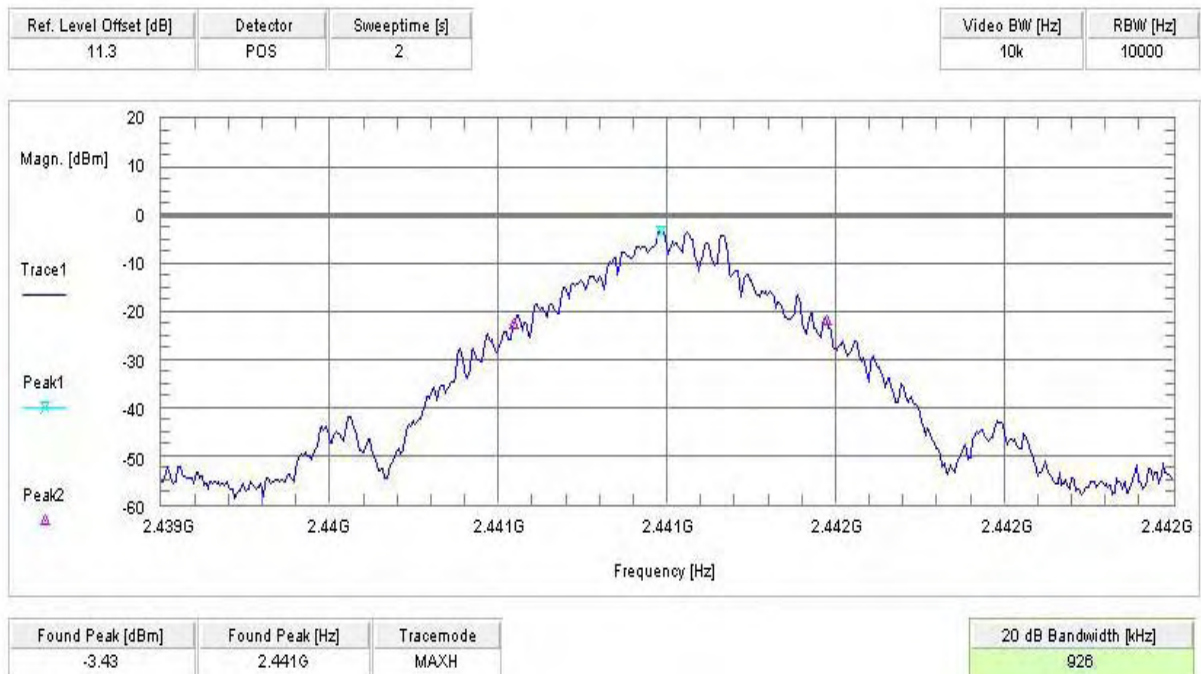
| | |
|-----------------------------------|---|
| Under normal test conditions only | For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission |
|-----------------------------------|---|

5.9 Spectrum Bandwidth of a FHSS System / 20dB Bandwidth §15.247(a)(1)

Plot 1 GFSK



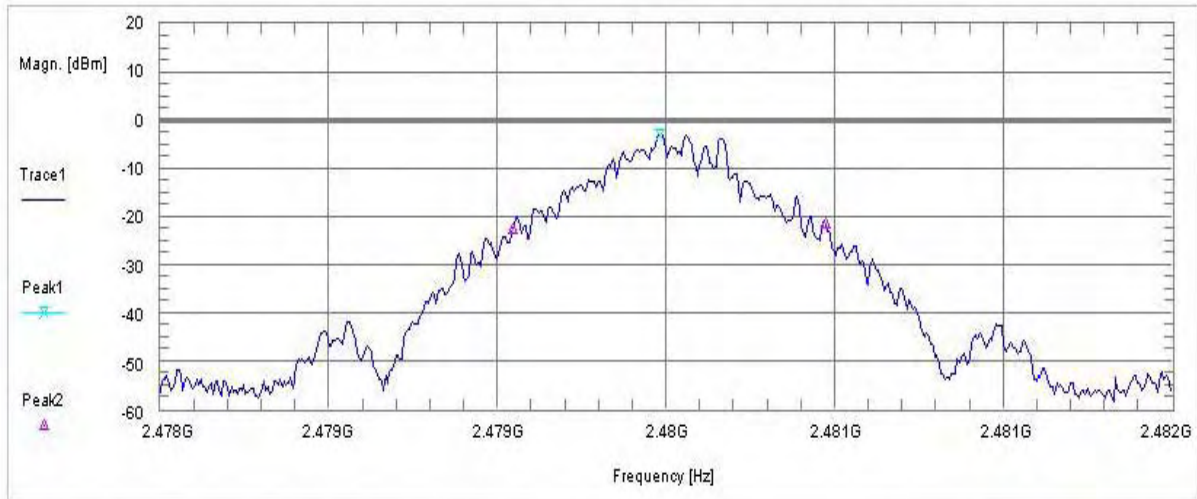
Plot 2 GFSK



Plot 3 GFSK

| Ref. Level Offset [dB] | Detector | Sweeptime [s] |
|------------------------|----------|---------------|
| 11.4 | POS | 2 |

| Video BW [Hz] | RBW [Hz] |
|---------------|----------|
| 10k | 10000 |



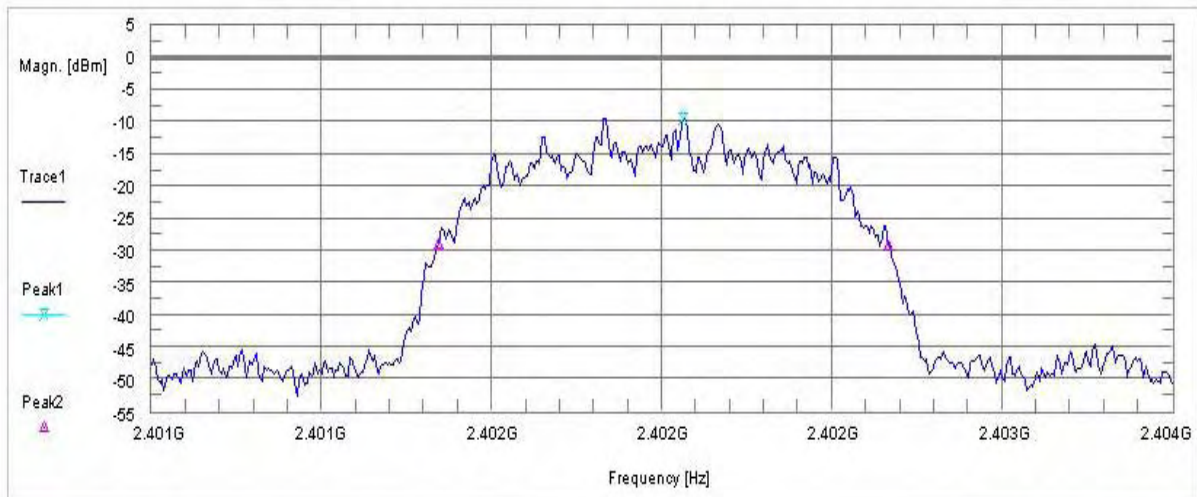
| Found Peak [dBm] | Found Peak [Hz] | Tracemode |
|------------------|-----------------|-----------|
| -3.084 | 2.48G | MAXH |

| 20 dB Bandwidth [kHz] |
|-----------------------|
| 926 |

Plot 4 Pi/4 DQPSK

| Ref. Level Offset [dB] | Detector | Sweeptime [s] |
|------------------------|----------|---------------|
| 11.1 | POS | 2 |

| Video BW [Hz] | RBW [Hz] |
|---------------|----------|
| 10k | 10000 |



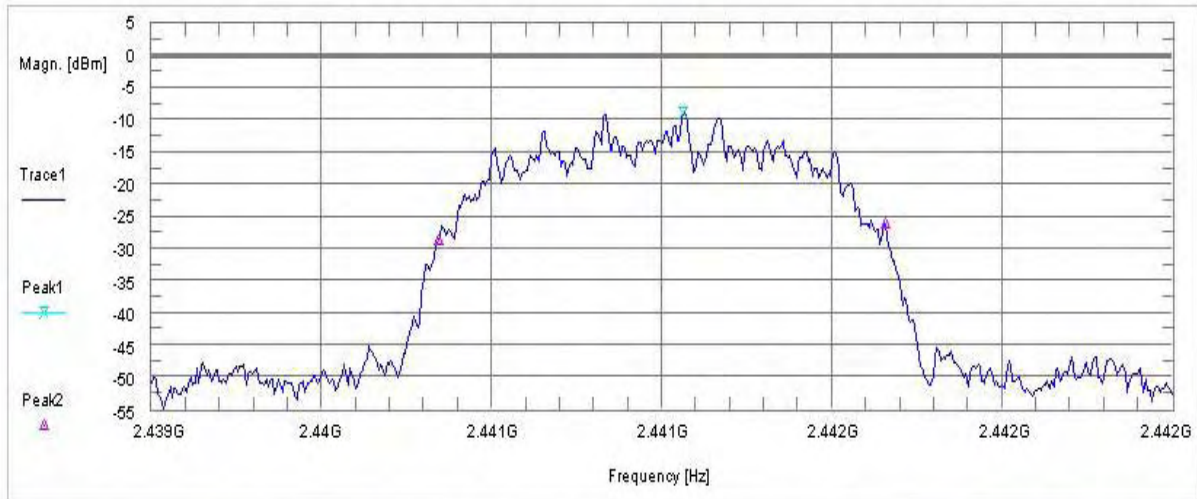
| Found Peak [dBm] | Found Peak [Hz] | Tracemode |
|------------------|-----------------|-----------|
| -9.352 | 2.402G | MAXH |

| 20 dB Bandwidth [kHz] |
|-----------------------|
| 1323 |

Plot 5 Pi/4 DQPSK

| Ref. Level Offset [dB] | Detector | Sweeptime [s] |
|------------------------|----------|---------------|
| 11.3 | POS | 2 |

| Video BW [Hz] | RBW [Hz] |
|---------------|----------|
| 10k | 10000 |



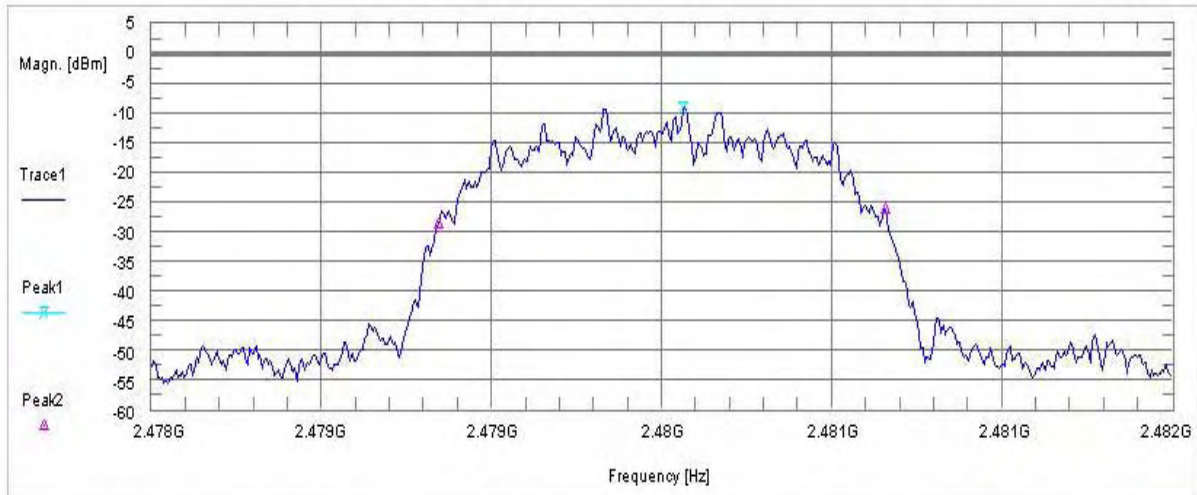
| Found Peak [dBm] | Found Peak [Hz] | Tracemode |
|------------------|-----------------|-----------|
| -8.966 | 2.441 G | MAXH |

| 20 dB Bandwidth [kHz] |
|-----------------------|
| 1317 |

Plot 6 Pi/4 DQPSK

| Ref. Level Offset [dB] | Detector | Sweeptime [s] |
|------------------------|----------|---------------|
| 11.4 | POS | 2 |

| Video BW [Hz] | RBW [Hz] |
|---------------|----------|
| 10k | 10000 |



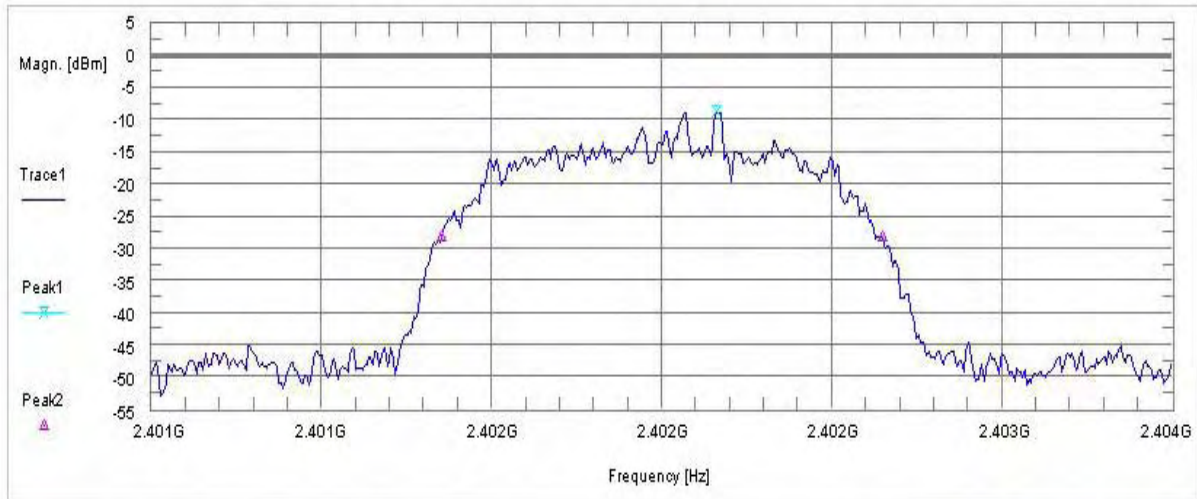
| Found Peak [dBm] | Found Peak [Hz] | Tracemode |
|------------------|-----------------|-----------|
| -9.092 | 2.48 G | MAXH |

| 20 dB Bandwidth [kHz] |
|-----------------------|
| 1317 |

Plot 7 8DPSK

| Ref. Level Offset [dB] | Detector | Sweeptime [s] |
|------------------------|----------|---------------|
| 11.1 | POS | 2 |

| Video BW [Hz] | RBW [Hz] |
|---------------|----------|
| 10k | 10000 |



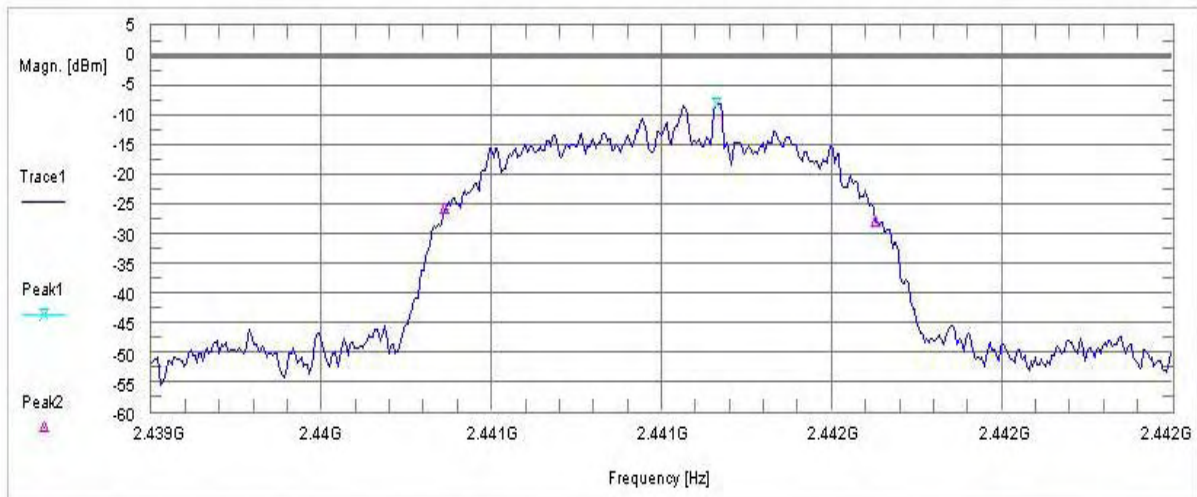
| Found Peak [dBm] | Found Peak [Hz] | Tracemode |
|------------------|-----------------|-----------|
| -8.535 | 2.402G | MAXH |

| 20 dB Bandwidth [kHz] |
|-----------------------|
| 1293 |

Plot 8 8DPSK

| Ref. Level Offset [dB] | Detector | Sweeptime [s] |
|------------------------|----------|---------------|
| 11.3 | POS | 2 |

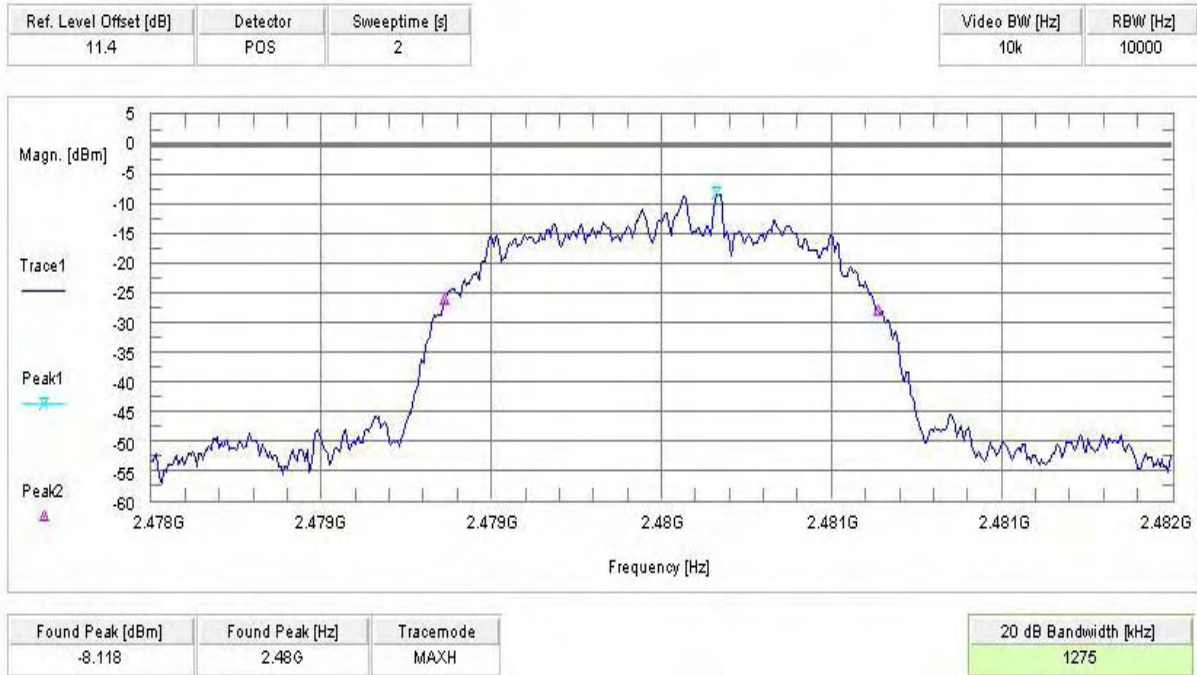
| Video BW [Hz] | RBW [Hz] |
|---------------|----------|
| 10k | 10000 |



| Found Peak [dBm] | Found Peak [Hz] | Tracemode |
|------------------|-----------------|-----------|
| -8.008 | 2.441G | MAXH |

| 20 dB Bandwidth [kHz] |
|-----------------------|
| 1269 |

Plot 9 8DPSK



RESULTS:

| Modulation | 20 dB BANDWIDTH [kHz] | | |
|-------------------------|-----------------------|------|------|
| | 2402 | 2441 | 2480 |
| Frequency [MHz] | | | |
| GFSK | 926 | 926 | 926 |
| Pi/4 DQPSK | 1323 | 1317 | 1317 |
| 8DPSK | 1293 | 1269 | 1275 |
| Measurement uncertainty | ±1kHz | | |

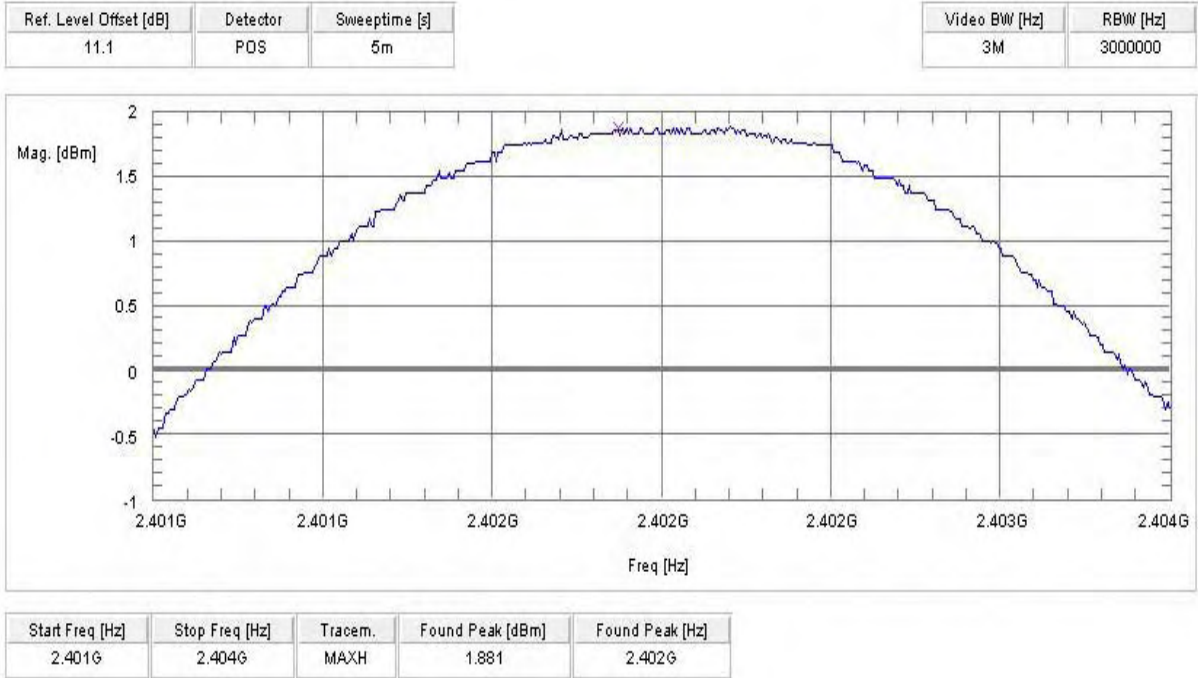
RBW / VBW as provided in the „Measurement Guidelines“ (DA 00-705, March 30, 2000)
 RBW: 10 kHz / VBW 10 kHz

Limits:

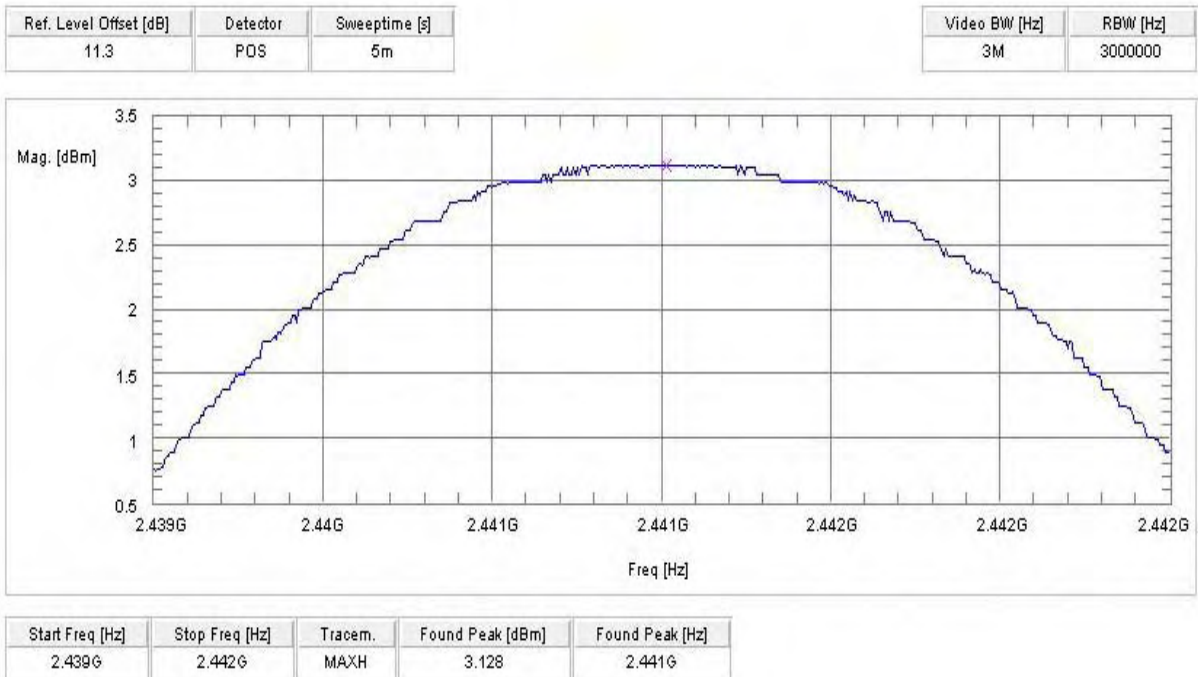
| | |
|-----------------------------------|--|
| Under normal test conditions only | GFSK < 1000 kHz Pi/4 DQPSK < 1500 8DPSK < 1500 |
|-----------------------------------|--|

5.10 Maximum output power (conducted) § 15.247 (b)(1)

Plot 1 GFSK



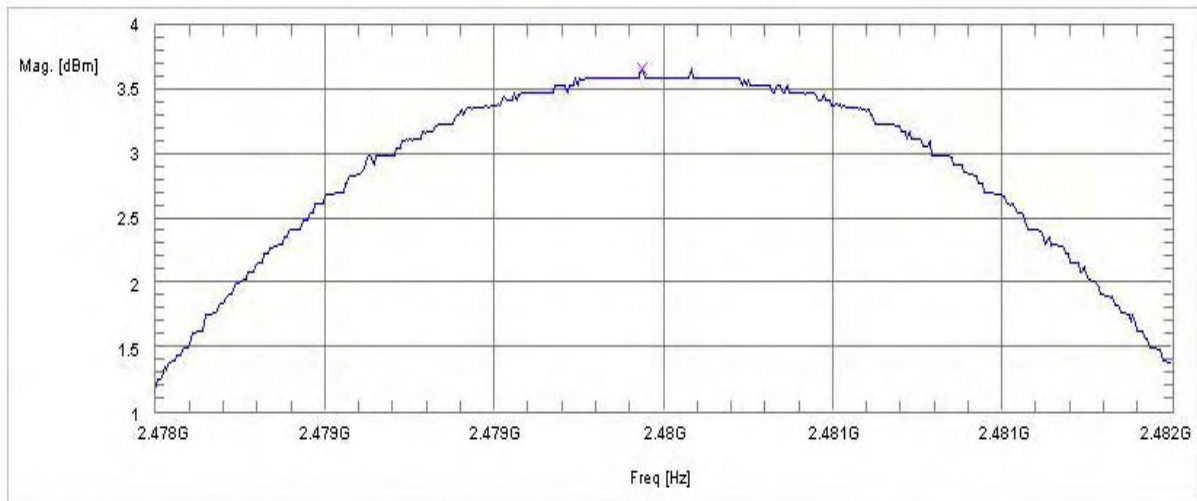
Plot 2 GFSK



Plot 3 GFSK

| Ref. Level Offset [dB] | Detector | Sweeptime [s] |
|------------------------|----------|---------------|
| 11.4 | POS | 5m |

| Video BW [Hz] | RBW [Hz] |
|---------------|----------|
| 3M | 3000000 |

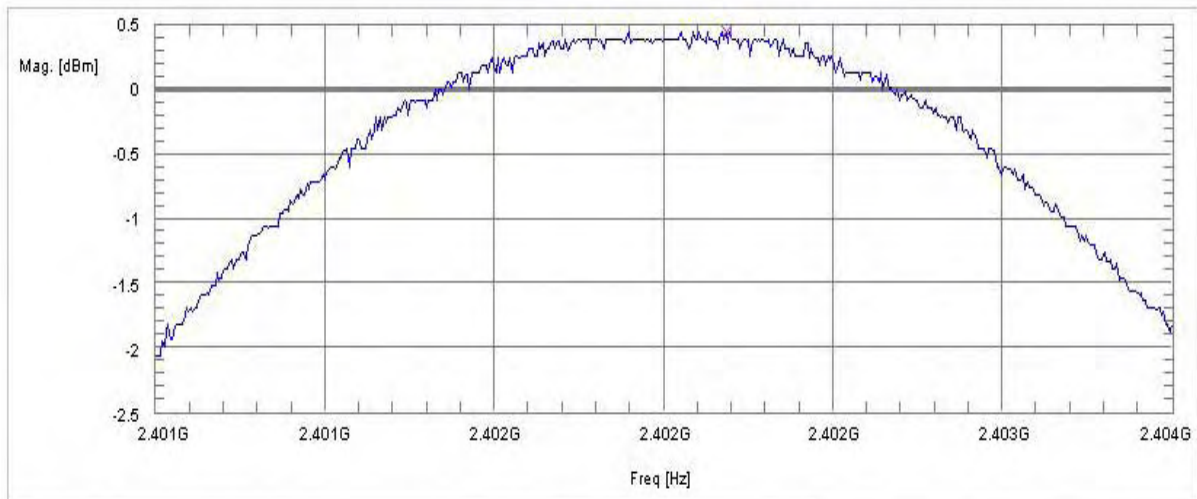


| Start Freq [Hz] | Stop Freq [Hz] | Tracem. | Found Peak [dBm] | Found Peak [Hz] |
|-----------------|----------------|---------|------------------|-----------------|
| 2.478G | 2.482G | MAXH | 3.673 | 2.48G |

Plot 4 Pi/4 DQPSK

| Ref. Level Offset [dB] | Detector | Sweeptime [s] |
|------------------------|----------|---------------|
| 11.1 | POS | 5m |

| Video BW [Hz] | RBW [Hz] |
|---------------|----------|
| 3M | 3000000 |

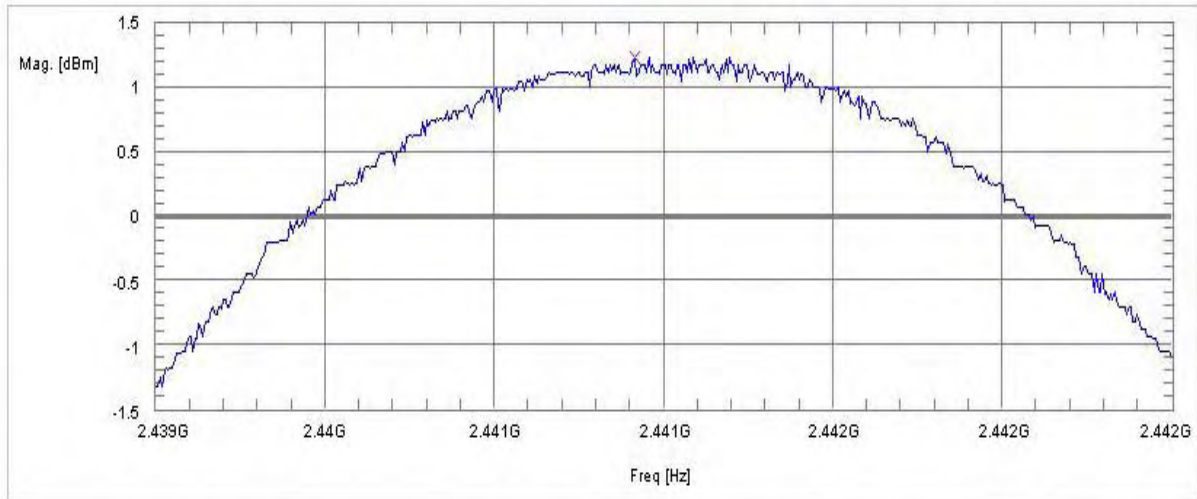


| Start Freq [Hz] | Stop Freq [Hz] | Tracem. | Found Peak [dBm] | Found Peak [Hz] |
|-----------------|----------------|---------|------------------|-----------------|
| 2.401G | 2.404G | MAXH | 0.4536 | 2.402G |

Plot 5 Pi/4 DQPSK

| Ref. Level Offset [dB] | Detector | Sweeptime [s] |
|------------------------|----------|---------------|
| 11.3 | POS | 5m |

| Video BW [Hz] | RBW [Hz] |
|---------------|----------|
| 3M | 3000000 |

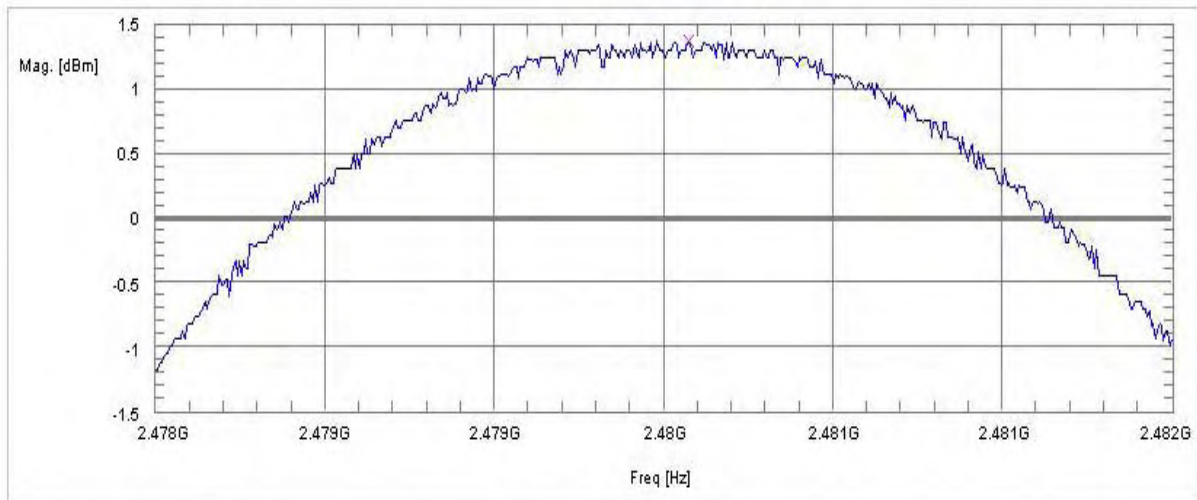


| Start Freq [Hz] | Stop Freq [Hz] | TraceM. | Found Peak [dBm] | Found Peak [Hz] |
|-----------------|----------------|---------|------------------|-----------------|
| 2.439G | 2.442G | MAXH | 1.235 | 2.441G |

Plot 6 Pi/4 DQPSK

| Ref. Level Offset [dB] | Detector | Sweeptime [s] |
|------------------------|----------|---------------|
| 11.4 | POS | 5m |

| Video BW [Hz] | RBW [Hz] |
|---------------|----------|
| 3M | 3000000 |

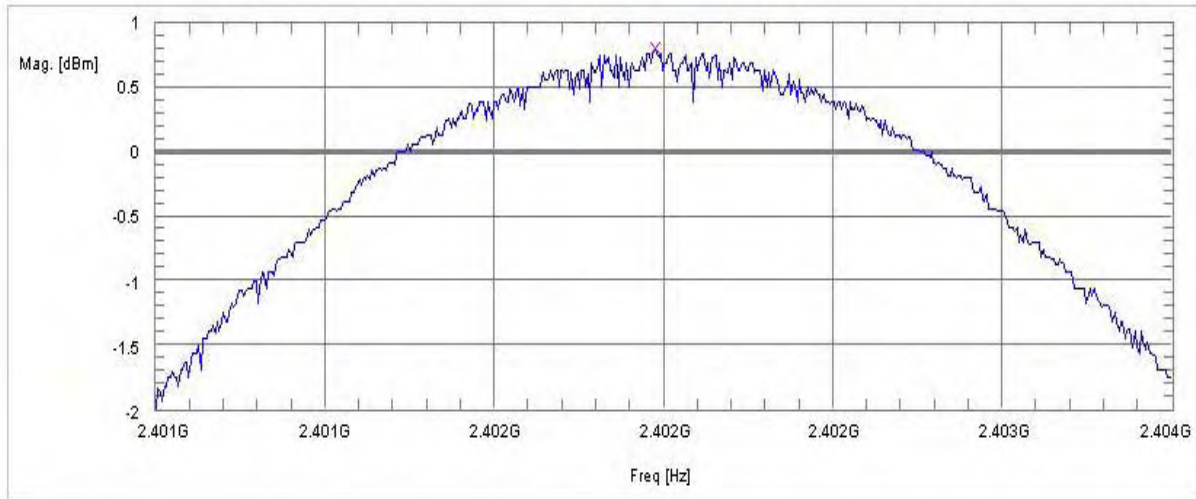


| Start Freq [Hz] | Stop Freq [Hz] | TraceM. | Found Peak [dBm] | Found Peak [Hz] |
|-----------------|----------------|---------|------------------|-----------------|
| 2.478G | 2.482G | MAXH | 1.381 | 2.48G |

Plot 7 8DPSK

| Ref. Level Offset [dB] | Detector | Sweeptime [s] |
|------------------------|----------|---------------|
| 11.1 | POS | 5m |

| Video BW [Hz] | RBW [Hz] |
|---------------|----------|
| 3M | 3000000 |

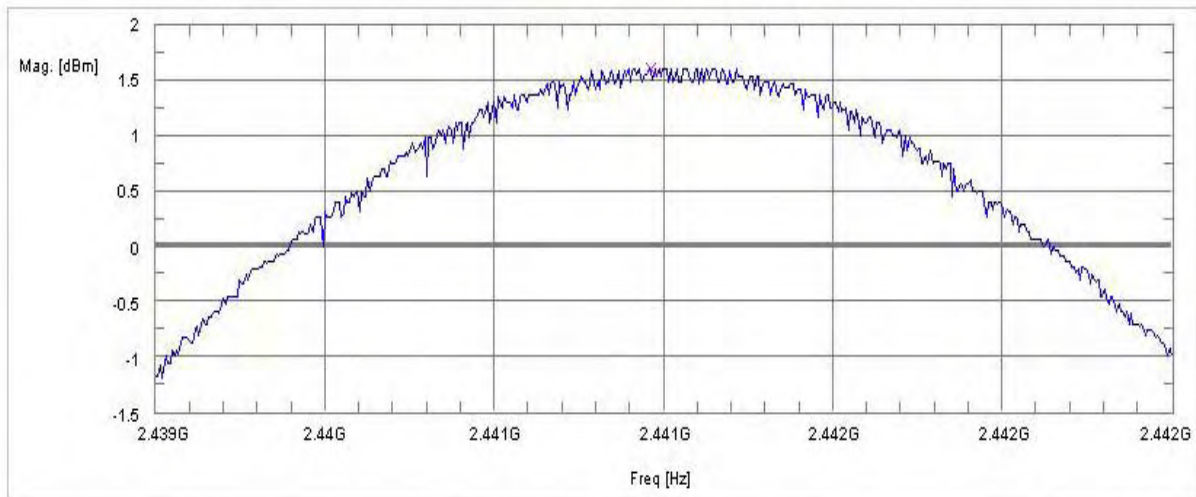


| Start Freq [Hz] | Stop Freq [Hz] | Tracem. | Found Peak [dBm] | Found Peak [Hz] |
|-----------------|----------------|---------|------------------|-----------------|
| 2.401G | 2.404G | MAXH | 0.8197 | 2.402G |

Plot 8 8DPSK

| Ref. Level Offset [dB] | Detector | Sweeptime [s] |
|------------------------|----------|---------------|
| 11.3 | POS | 5m |

| Video BW [Hz] | RBW [Hz] |
|---------------|----------|
| 3M | 3000000 |

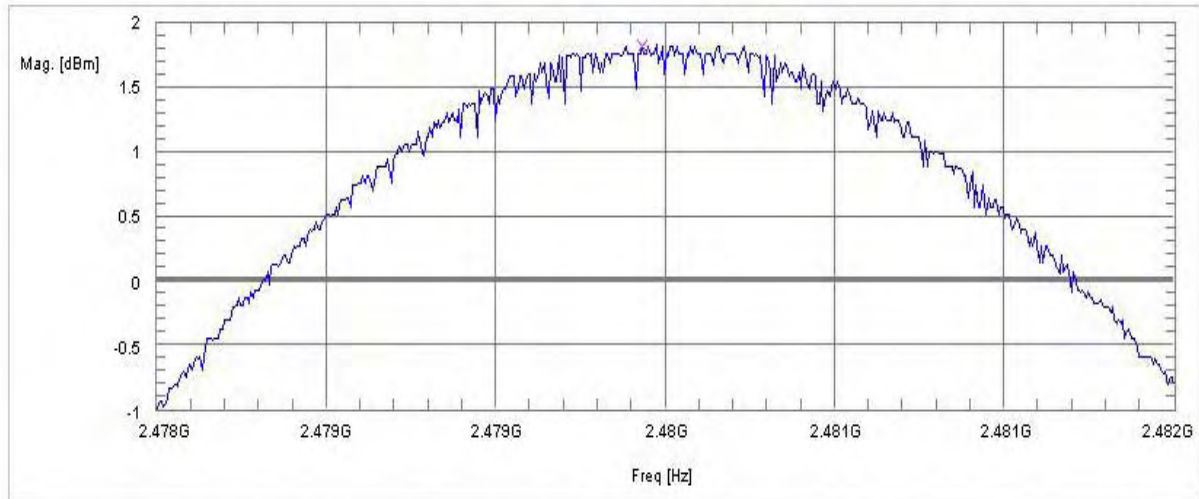


| Start Freq [Hz] | Stop Freq [Hz] | Tracem. | Found Peak [dBm] | Found Peak [Hz] |
|-----------------|----------------|---------|------------------|-----------------|
| 2.439G | 2.442G | MAXH | 1.621 | 2.441G |

Plot 9 8DPSK

| | | |
|------------------------|----------|---------------|
| Ref. Level Offset [dB] | Detector | Sweeptime [s] |
| 11.4 | PDS | 5m |

| | |
|---------------|----------|
| Video BW [Hz] | RBW [Hz] |
| 3M | 3000000 |



| | | | | |
|-----------------|----------------|---------|------------------|-----------------|
| Start Freq [Hz] | Stop Freq [Hz] | Tracem. | Found Peak [dBm] | Found Peak [Hz] |
| 2.478G | 2.482G | MAXH | 1.832 | 2.48G |

Results:

| Modulation | Max. peak output power [dBm] | | |
|-------------------------|------------------------------|------|------|
| | 2402 | 2441 | 2480 |
| Frequency [MHz] | | | |
| <i>GFSK</i> | 1.88 | 3.13 | 3.67 |
| <i>Pi/4 DQPSK</i> | 0.45 | 1.24 | 1.38 |
| <i>8DPSK</i> | 0.82 | 1.62 | 1.83 |
| Measurement uncertainty | ±2dB | | |

RBW / VBW: 3 MHz

Limits:

| | |
|--|---------------|
| Under normal test conditions only, for frequency range 2400-2483.5 MHz | Max. 1.0 Watt |
|--|---------------|

5.11 Max. peak output power (radiated) § 15.247 (b)(1)

Modulation: GFSK

Results:

| Test conditions | | Max. peak output power EIRP [dBm] | | |
|-------------------------|------------------|-----------------------------------|------|------|
| Frequency [MHz] | | 2402 | 2442 | 2480 |
| T _{nom} | V _{nom} | -0.10 | 0.89 | 0.43 |
| Measurement uncertainty | | ±3dB | | |

RBW / VBW: 3 MHz

Measured at a distance of 3m

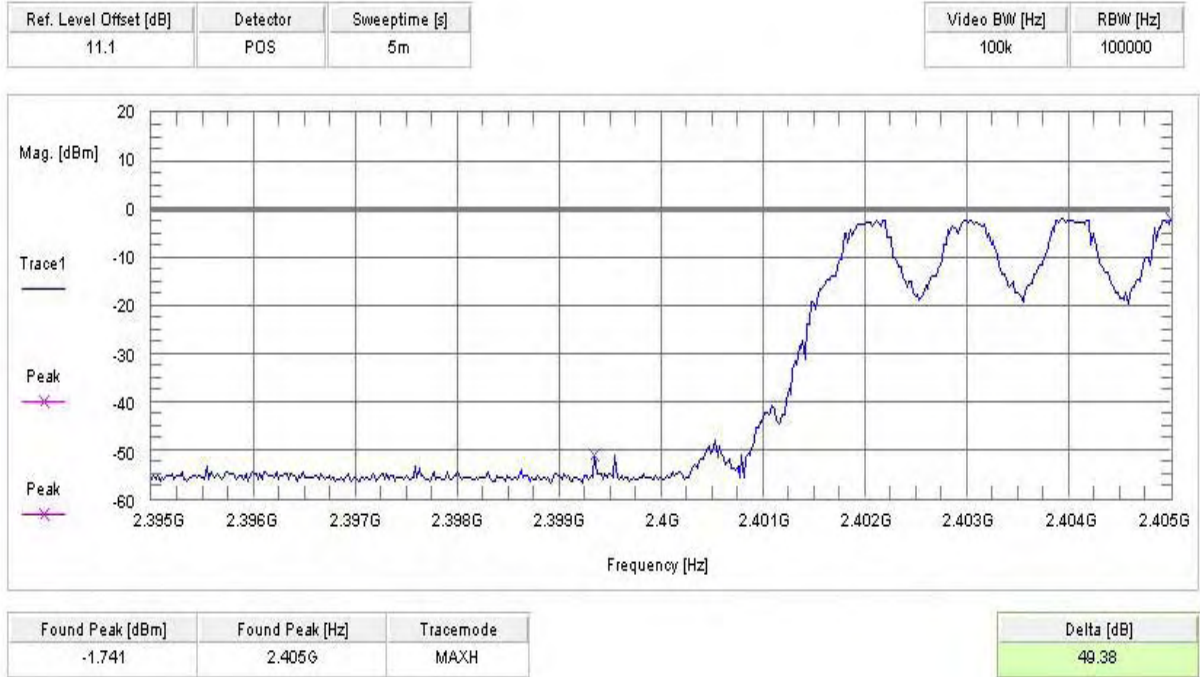
Limits:

| | |
|--|---------------|
| Under normal test conditions only, for frequency range 2400-2483.5 MHz | Max. 1.0 Watt |
|--|---------------|

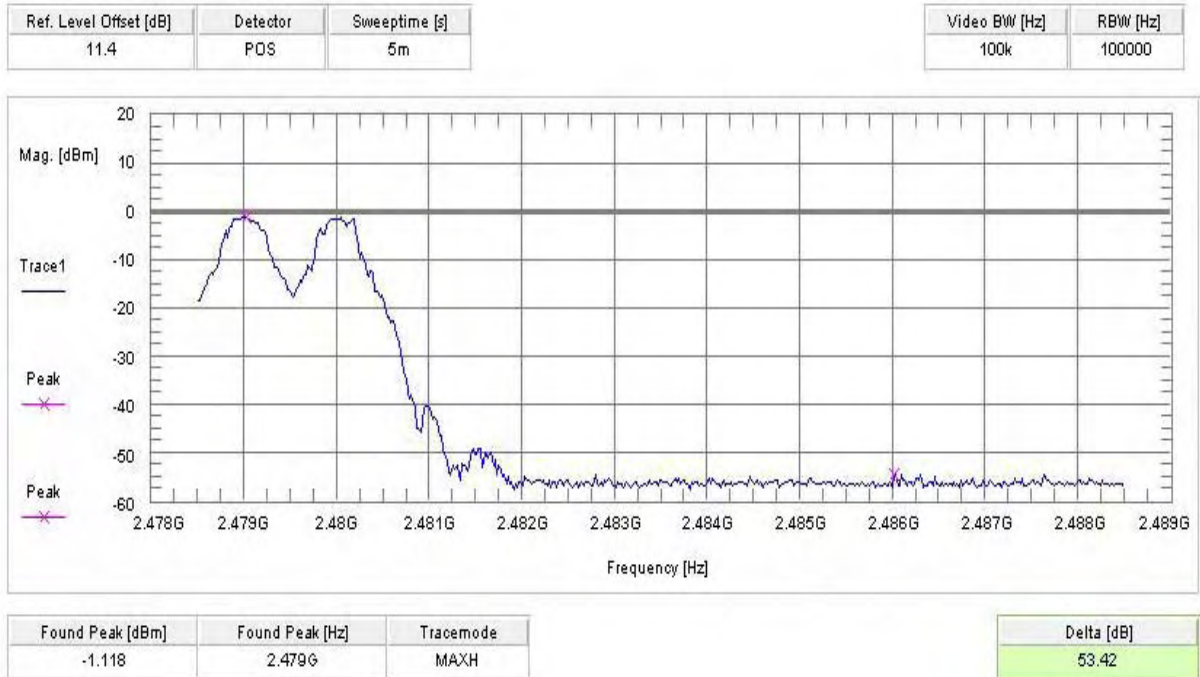
5.12 Band-edge compliance of conducted emissions §15.247 (d)

Modulation: GFSK

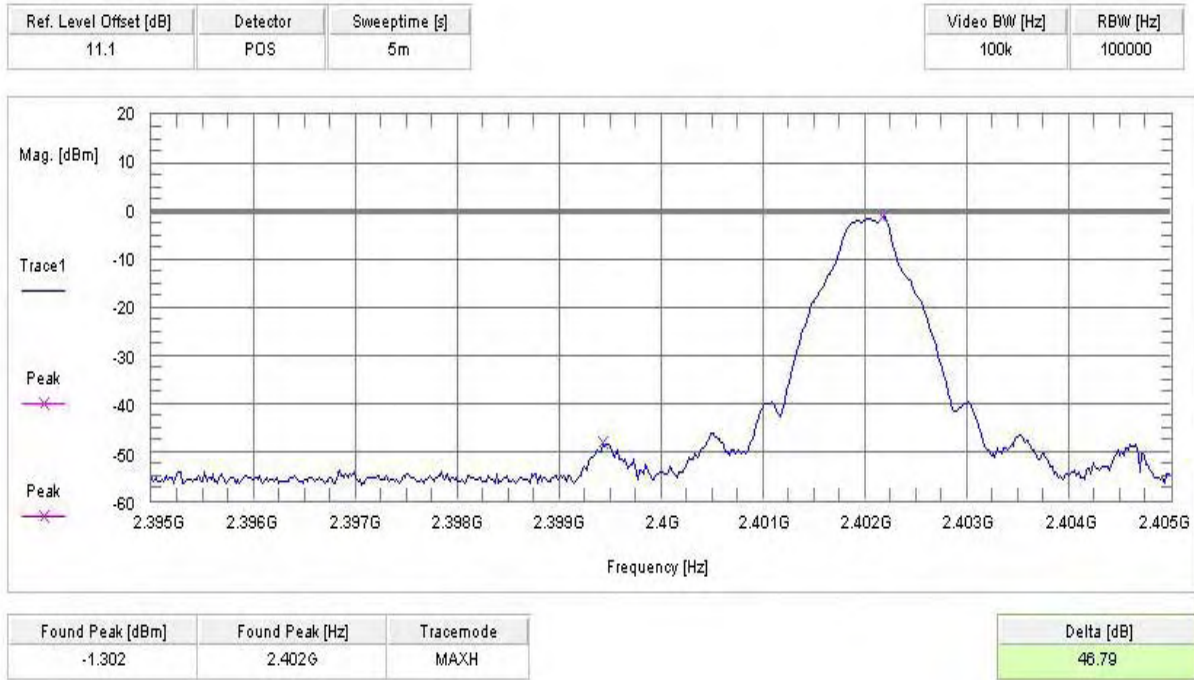
Plot 1 of 4 (hopping off, lowest frequency):



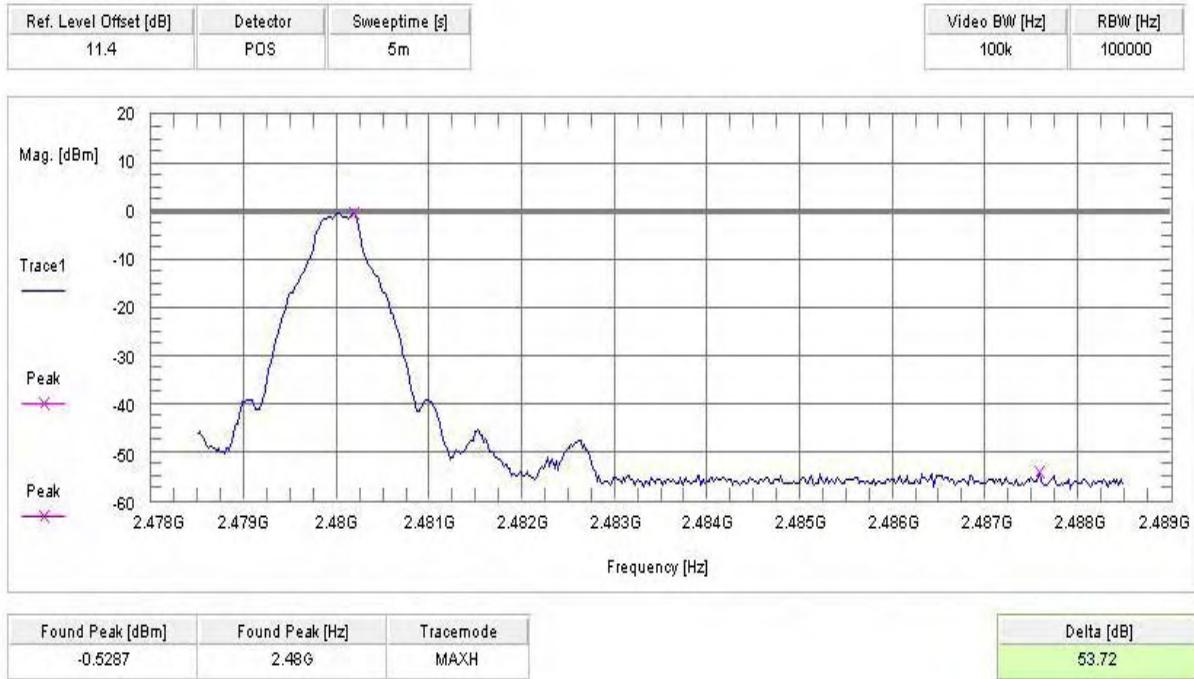
Plot 2 of 4 (hopping on, lowest frequency):



Plot 3 of 4 (hopping off, highest frequency):



Plot 4 of 4 (hopping on, highest frequency):

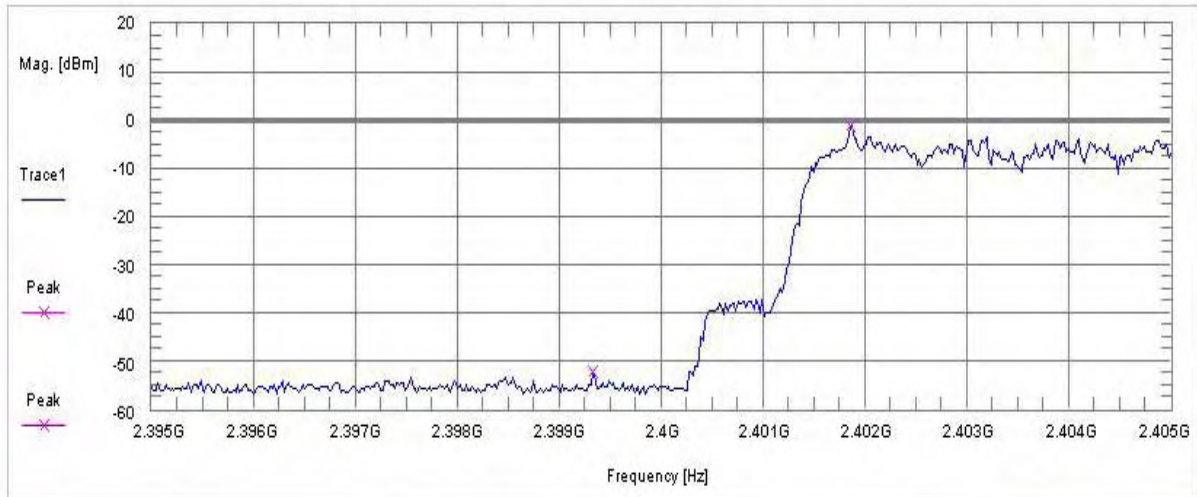


Modulation: Pi/4 DQPSK

Plot 1 of 4 (hopping off, lowest frequency):

| Ref. Level Offset [dB] | Detector | Sweeptime [s] |
|------------------------|----------|---------------|
| 11.1 | POS | 5m |

| Video BW [Hz] | RBW [Hz] |
|---------------|----------|
| 100k | 100000 |



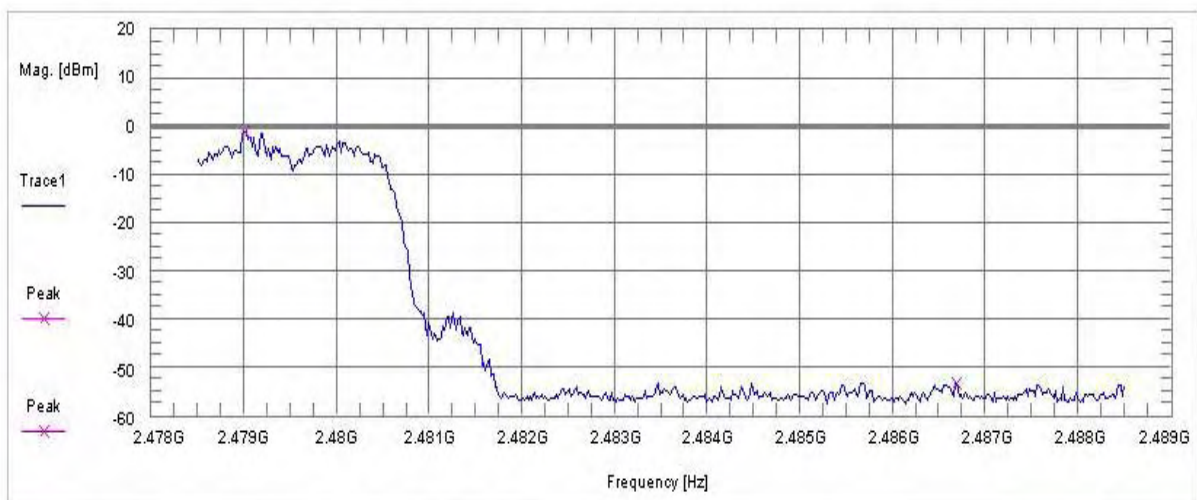
| Found Peak [dBm] | Found Peak [Hz] | Tracemode |
|------------------|-----------------|-----------|
| -1.306 | 2.402G | MAXH |

| Delta [dB] |
|------------|
| 51.07 |

Plot 2 of 4 (hopping on, lowest frequency):

| Ref. Level Offset [dB] | Detector | Sweeptime [s] |
|------------------------|----------|---------------|
| 11.4 | POS | 5m |

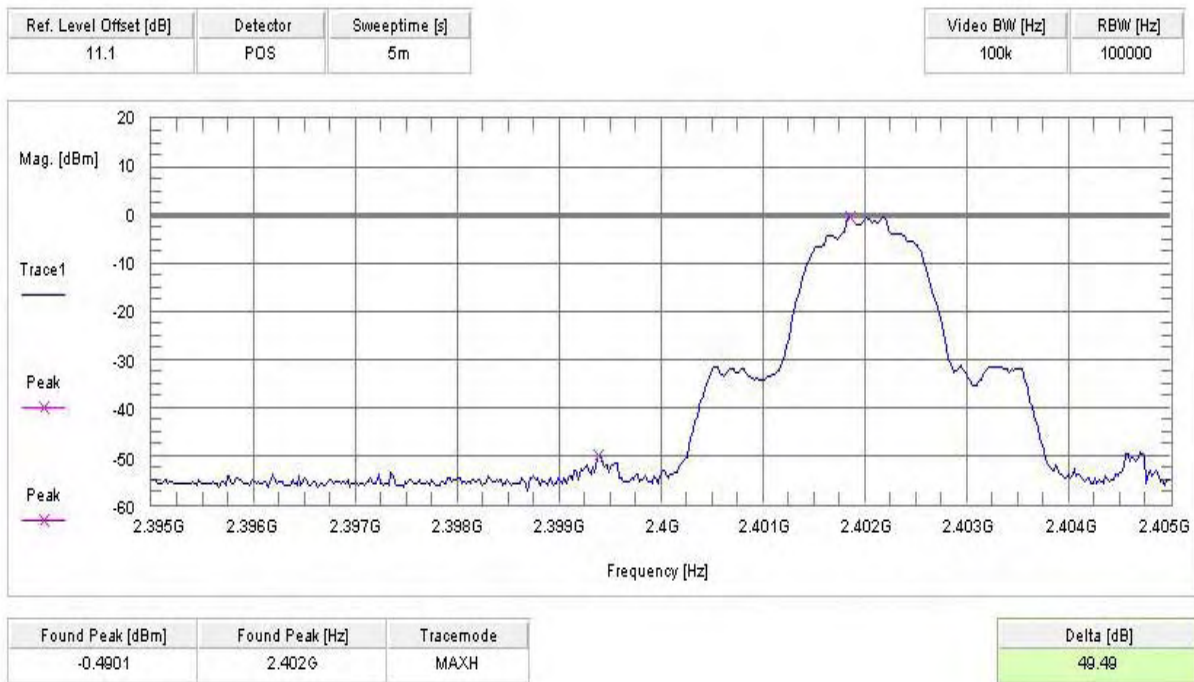
| Video BW [Hz] | RBW [Hz] |
|---------------|----------|
| 100k | 100000 |



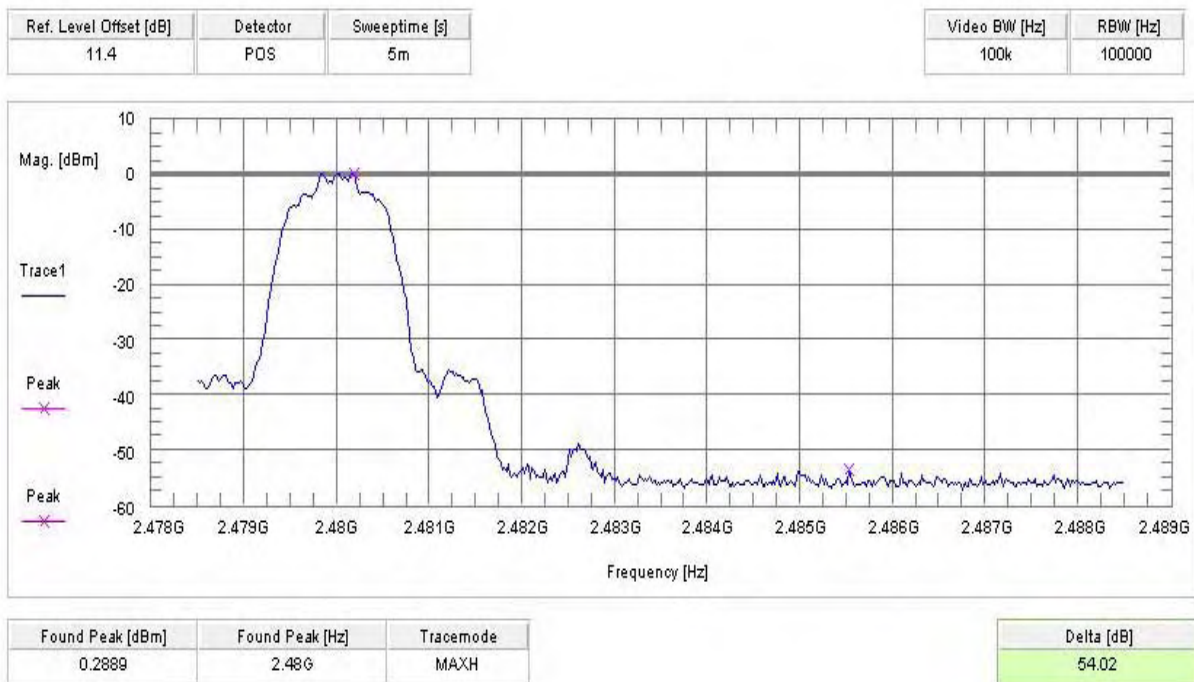
| Found Peak [dBm] | Found Peak [Hz] | Tracemode |
|------------------|-----------------|-----------|
| -1.007 | 2.479G | MAXH |

| Delta [dB] |
|------------|
| 52.28 |

Plot 3 of 4 (hopping off, highest frequency):

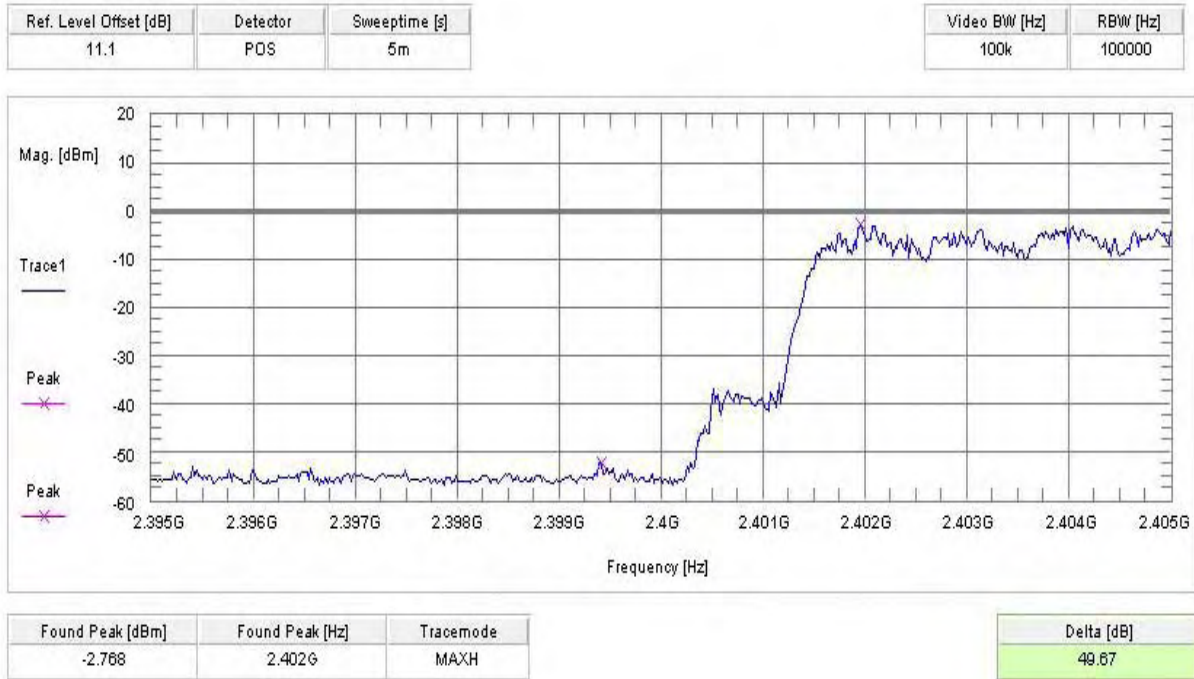


Plot 4 of 4 (hopping on, highest frequency):

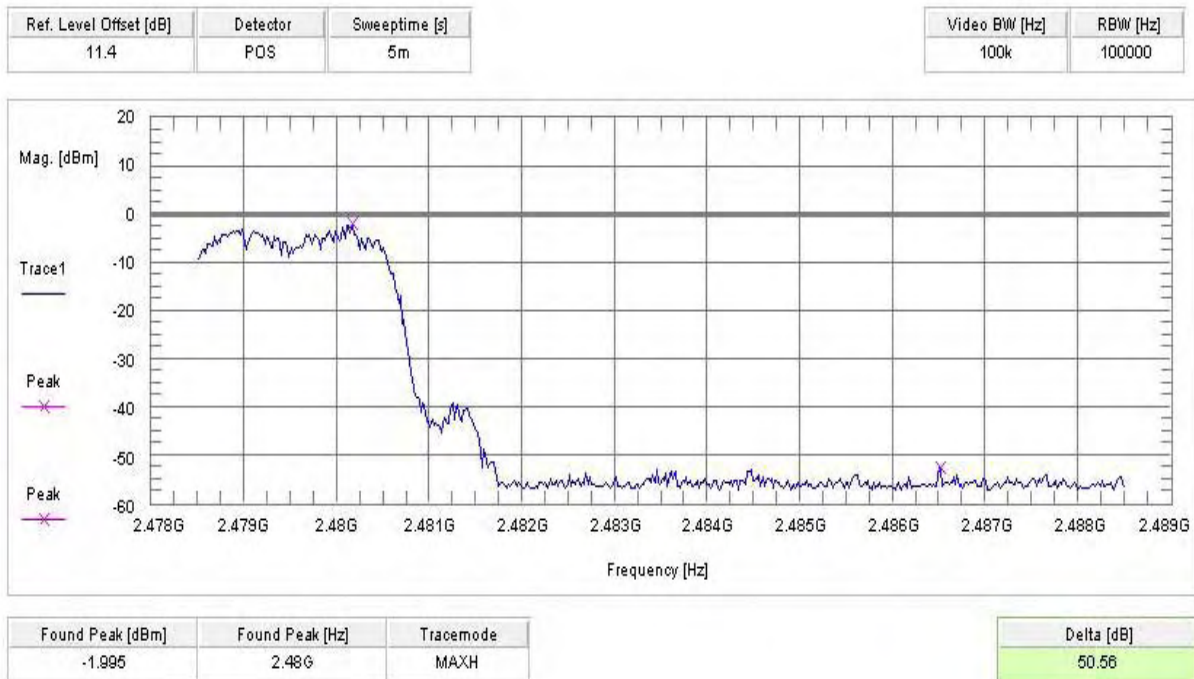


Modulation: 8 DPSK

Plot 1 of 4 (hopping off, lowest frequency):



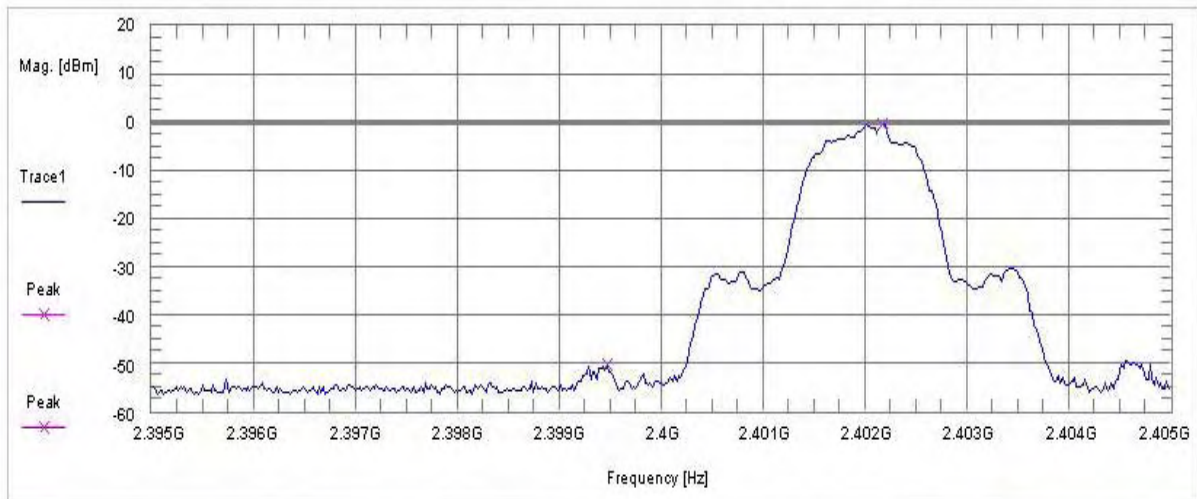
Plot 2 of 4 (hopping on, lowest frequency):



Plot 3 of 4 (hopping off, highest frequency):

| Ref. Level Offset [dB] | Detector | Sweeptime [s] |
|------------------------|----------|---------------|
| 11.1 | POS | 5m |

| Video BW [Hz] | RBW [Hz] |
|---------------|----------|
| 100k | 100000 |



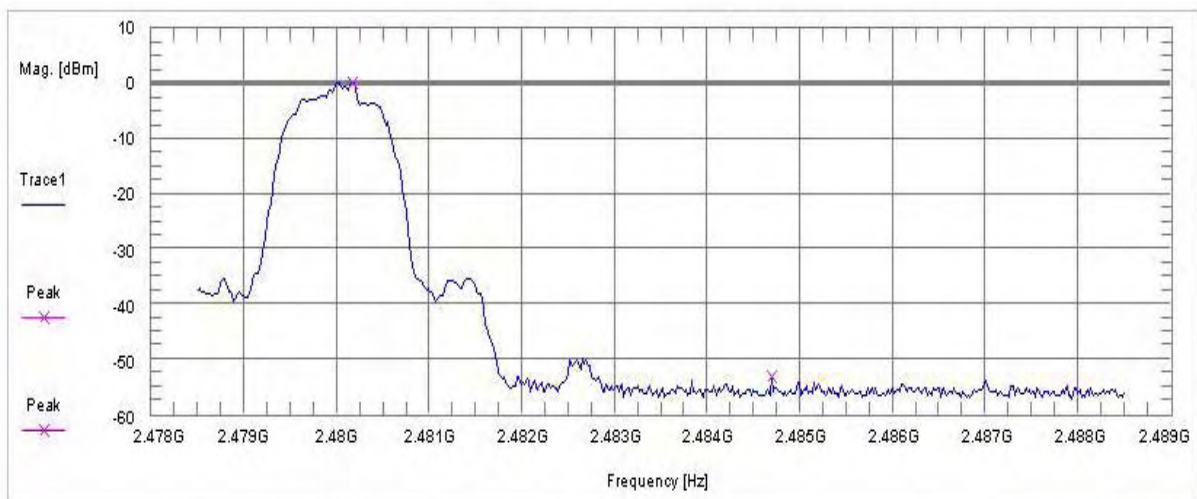
| Found Peak [dBm] | Found Peak [Hz] | Tracemode |
|------------------|-----------------|-----------|
| -0.4758 | 2.402G | MAXH |

| Delta [dB] |
|------------|
| 50 |

Plot 4 of 4 (hopping on, highest frequency):

| Ref. Level Offset [dB] | Detector | Sweeptime [s] |
|------------------------|----------|---------------|
| 11.4 | POS | 5m |

| Video BW [Hz] | RBW [Hz] |
|---------------|----------|
| 100k | 100000 |



| Found Peak [dBm] | Found Peak [Hz] | Tracemode |
|------------------|-----------------|-----------|
| 0.2767 | 2.48G | MAXH |

| Delta [dB] |
|------------|
| 53.63 |

Results:

| SZENARIO | DELTA VALUE [DB] |
|--------------------------------|------------------|
| hopping off, lowest frequency | > 20 dB |
| hopping on, lowest frequency | > 20 dB |
| hopping off, highest frequency | > 20 dB |
| hopping on, highest frequency | > 20 dB |
| Measurement uncertainty | ±1,5dB |

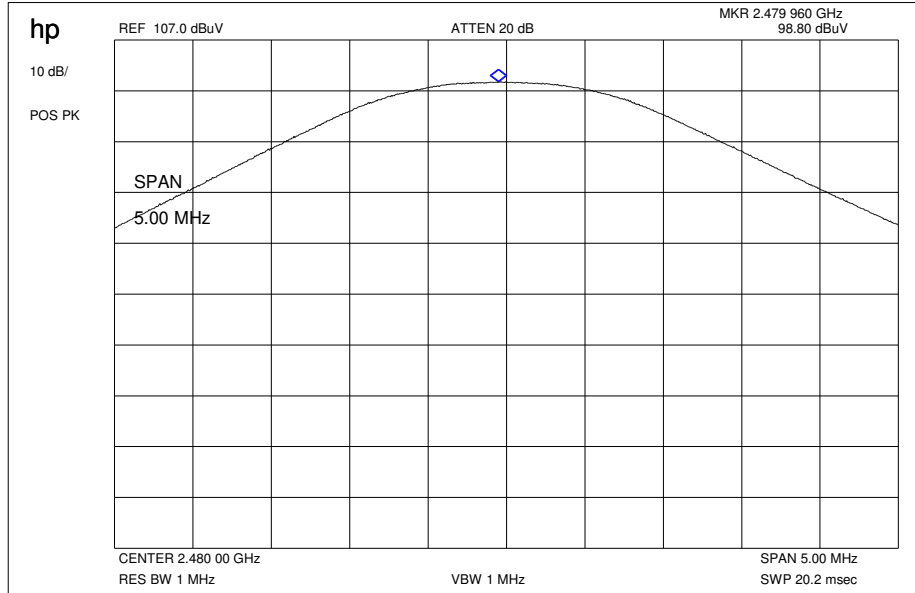
Limits:

| | |
|-----------------------------------|--|
| Under normal test conditions only | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 5.205(c)). |
|-----------------------------------|--|

5.13 Band-edge compliance of radiated emissions §15.205

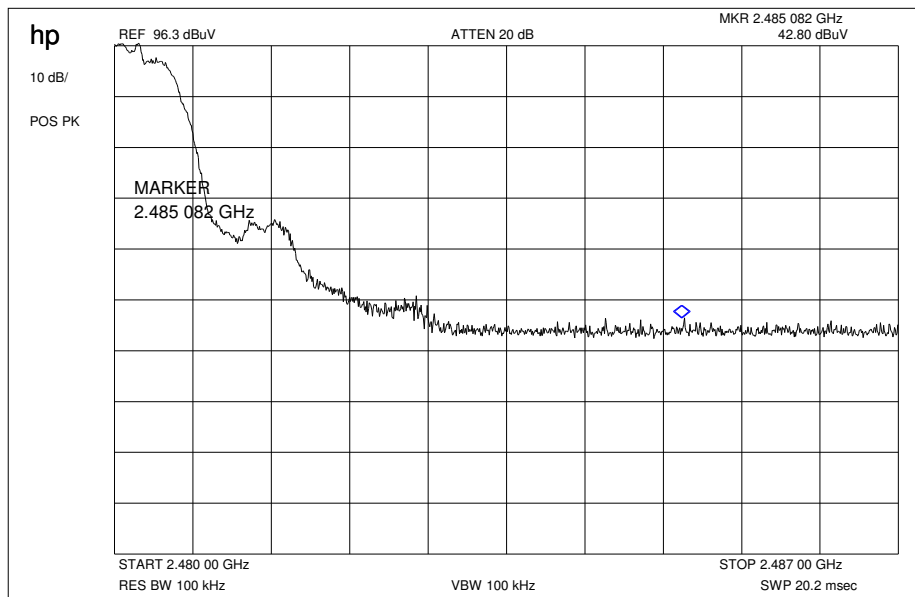
Modulation: widest

Plot 1: Max field strength in 3m distance (single frequency)



Result: 98.8 dB μ V/m

Plot 2: Marker-Delta Method (single carrier)

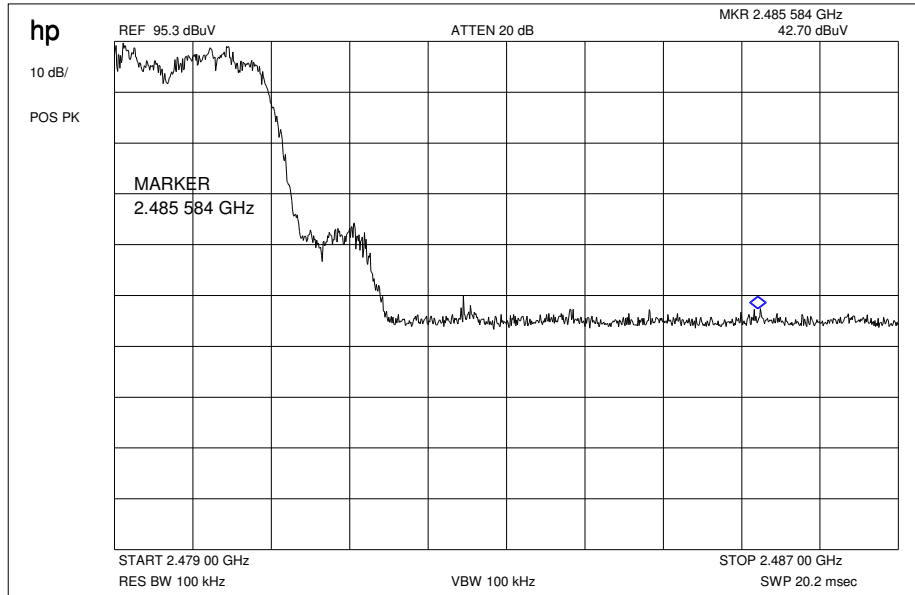


Result:

Marker-Delta-Value: 53.5 dB

This measurement was made to show that the behaviour of the system is conform to FCC 15.205 (restricted bands)

Plot 3: Marker-Delta Method (hopping)

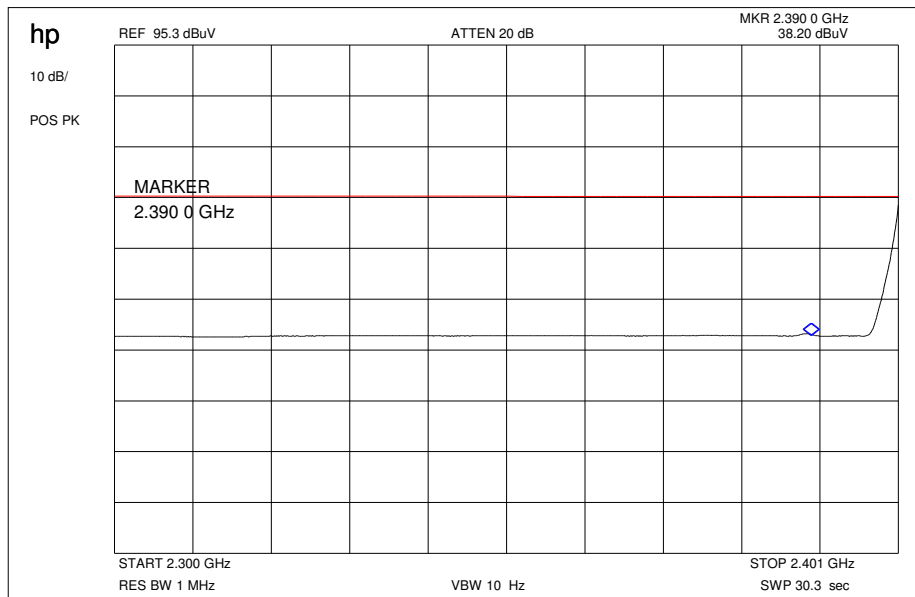


Result:

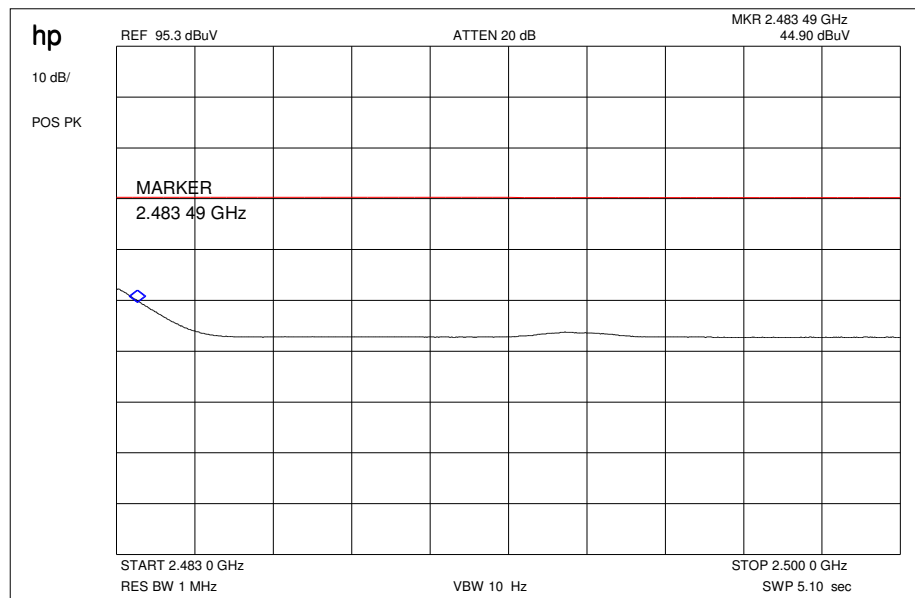
Marker-Delta-Value: 52.6 dB

This measurement was made to show that the behaviour of the system is conform to FCC 15.205 (restricted bands)

Plot 4: Restricted Bands low



Plot 5: Restricted Bands high



Results & Limits:

Radiated field strength

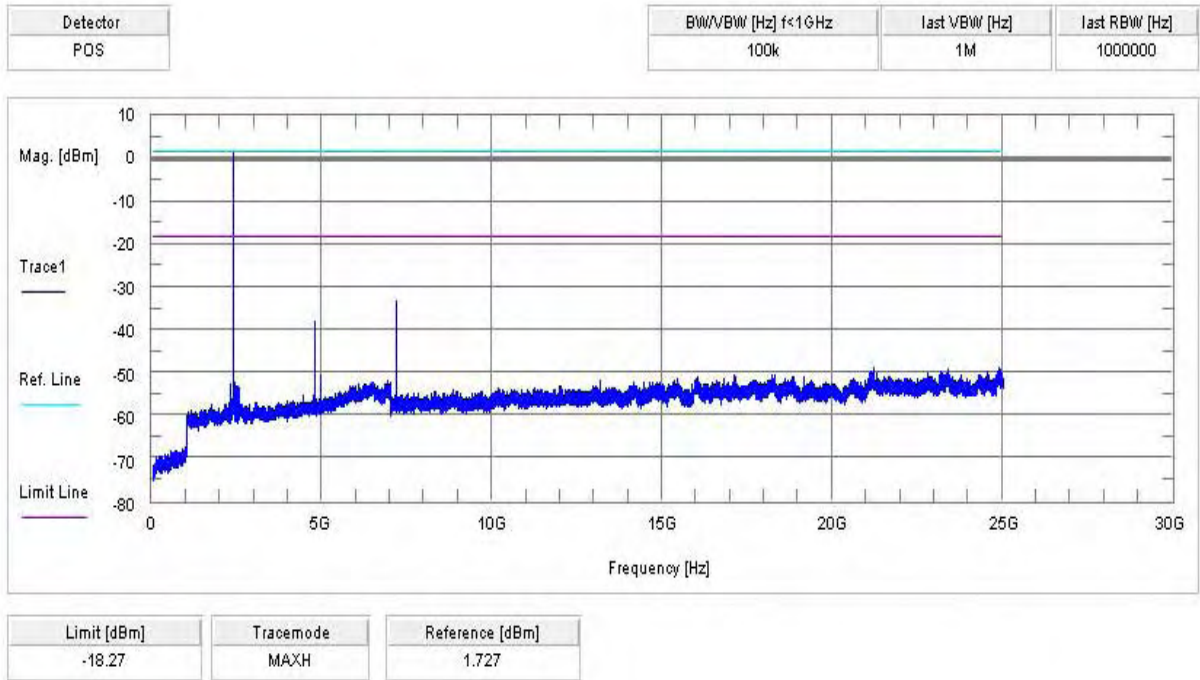
The field strength was measured with an EMI measuring receiver and 1 MHz RBW / VBW for peak and with 1MHz RBW / 10Hz VBW for average at a distance of 3m.

| high channel | setup | measured value (3m) | correction factor (3m) | calculated value (3m) |
|--------------------|--|--|---|--|
| Max. peak value | 1 MHz RBW 1 MHz VBW | 98.80 dB μ V/m | -3.20 | 95.70 dB μ V/m |
| Max. average value | Calculated with duty cycle correction factor | 95.70 dB μ V/m peak | -1,07dB duty cycle correction factor (worst case DH5) | 94.63 dB μ V/m |
| Delta value | Peak 100 kHz RBW/VBW | 53.5 dB (single carrier) 52.6 dB (hopping mode) | - | - |
| Value at band edge | limit 54 dB μ V/m | | | 41.13 dB μ V/m (single carrier) 42.03 dB μ V/m (hopping mode) |
| Statement: | | | | Complies |

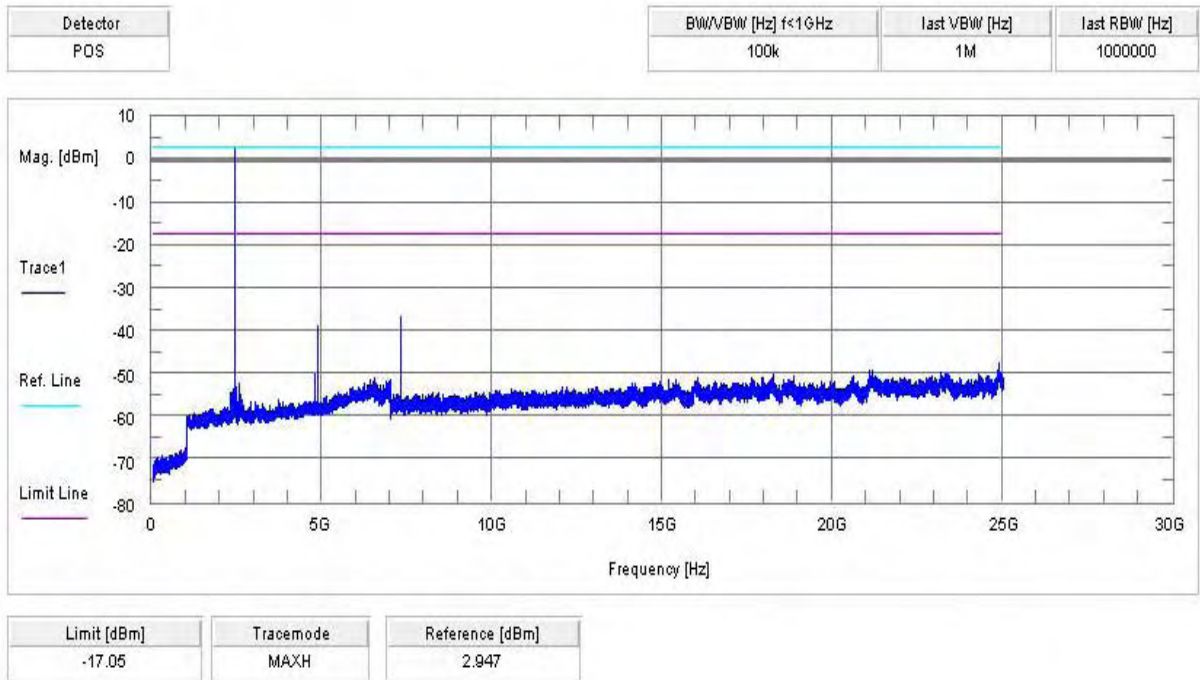
5.14 Spurious Emissions - conducted (Transmitter) § 15.247 (c)(1)

Modulation: GFSK

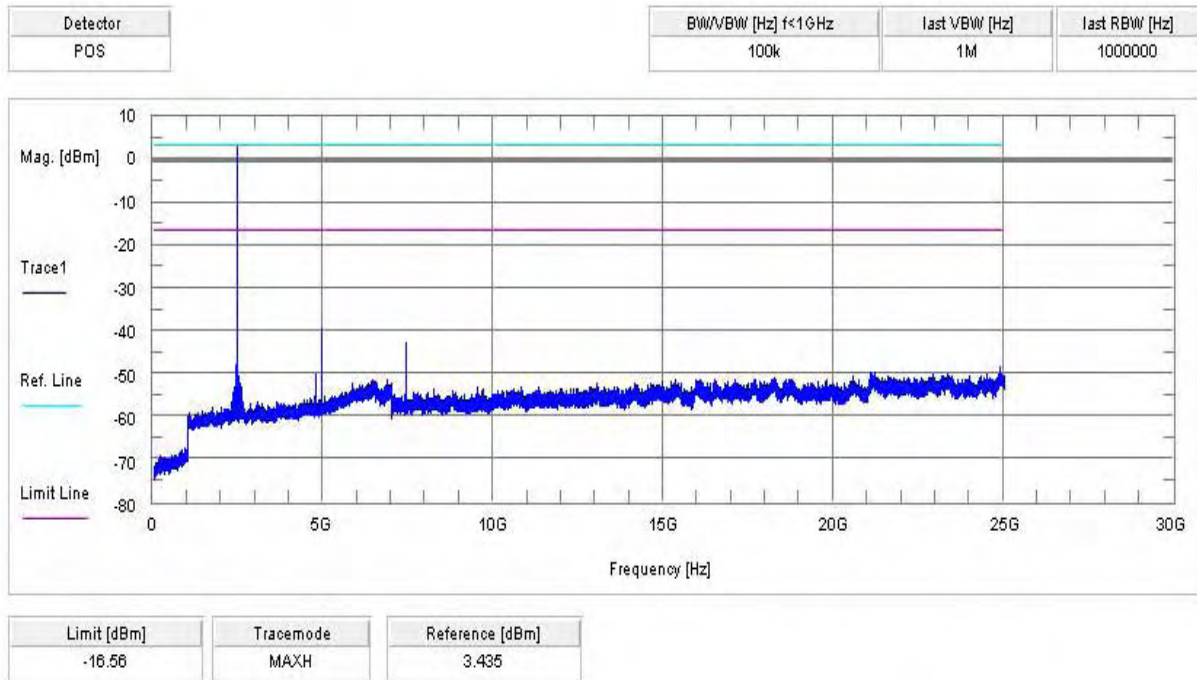
Plot 1 of 3: lowest channel



Plot 2 of 3: middle channel



Plot 3 of 3: highest channel



Result & Limits:

| Emission Limitation | | | | | |
|-------------------------|--|-----------------------------|-----------------------------------|--|---------------------|
| f [MHz] | | amplitude of emission [dBm] | limit max. allowed emission power | actual attenuation below frequency of operation [dB] | results |
| 2402 | | 1.73 | 30 dBm | | Operating frequency |
| 4804 | | -37.9 | -20 dBc | 39.63 | complies |
| 7206 | | -32.4 | | 34.13 | complies |
| 2441 | | 2.95 | 30 dBm | | Operating frequency |
| 4882 | | -39.6 | -20 dBc | 42.55 | complies |
| 7323 | | -36.8 | | 39.75 | complies |
| 2480 | | 3.44 | 30 dBm | | Operating frequency |
| 4960 | | -39.7 | -20 dBc | 43.14 | complies |
| 7440 | | -42.3 | | 45.74 | complies |
| Measurement uncertainty | | ± 3dB | | | |

RBW: 100 kHz VBW: 100 MHz

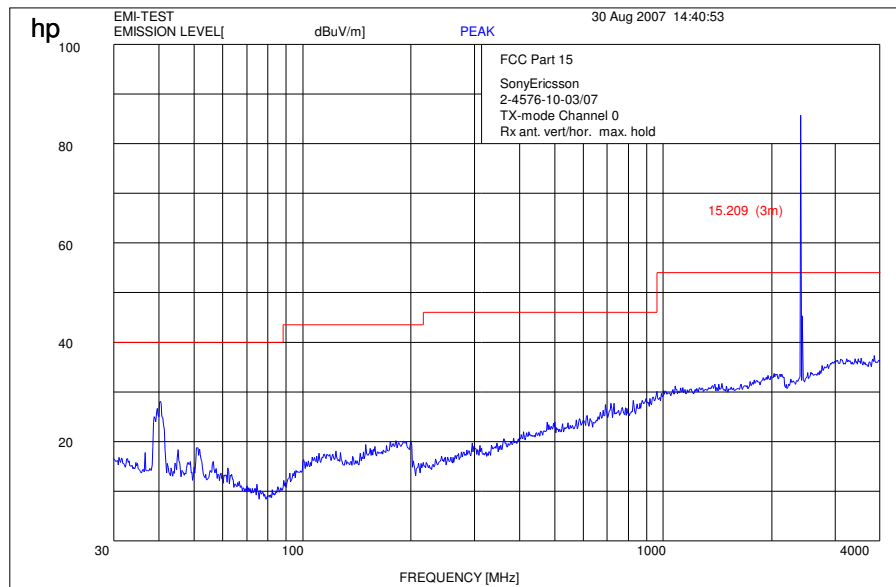
| | |
|-----------------------------------|--|
| Under normal test conditions only | In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)). |
|-----------------------------------|--|

Note: For emissions that fall into restricted bands you find the radiated emissions later in the report.

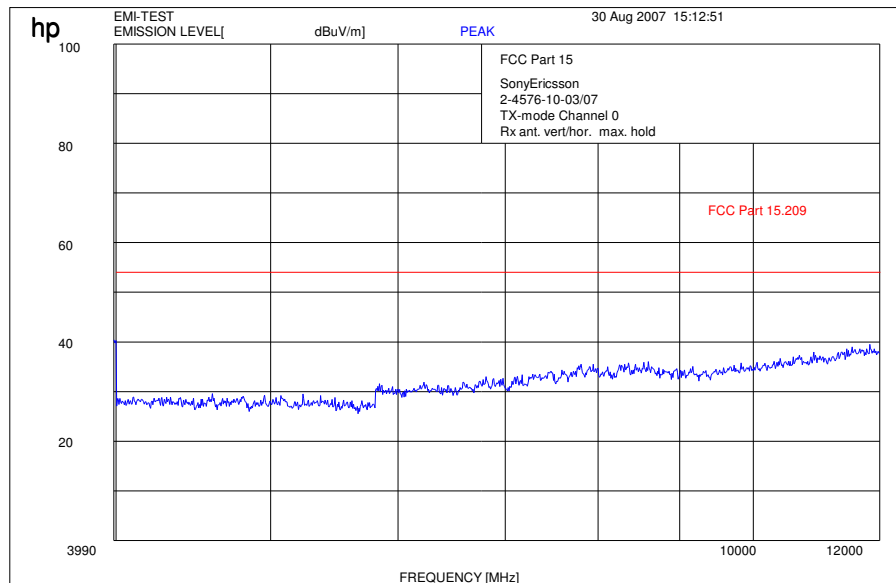
5.15 Spurious Emissions > 30 MHz- radiated (Transmitter) § 15.247 (c)(1)

Modulation: GFSK

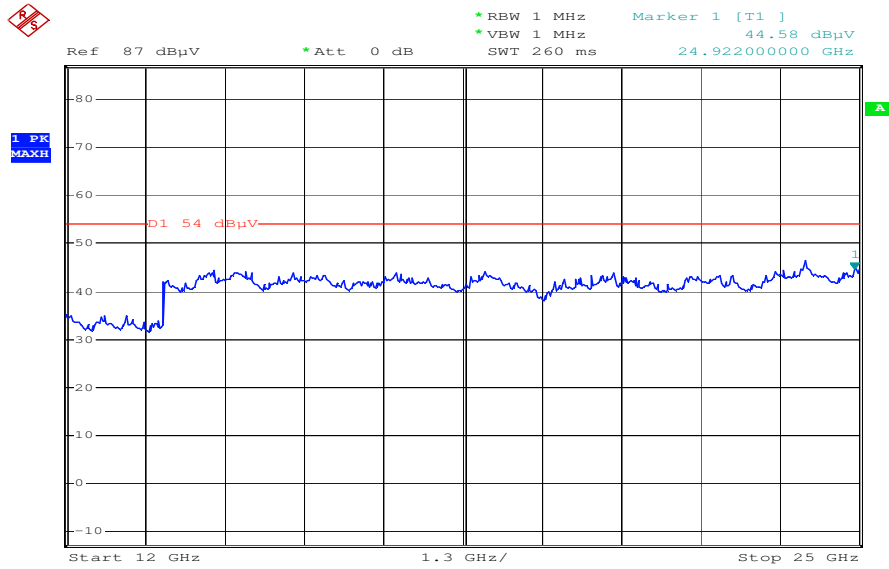
Plot: 0.03 - 4 GHz vertical/horizontal (lowest channel)



Plot: 4- 12 GHz vertical/horizontal (lowest channel)

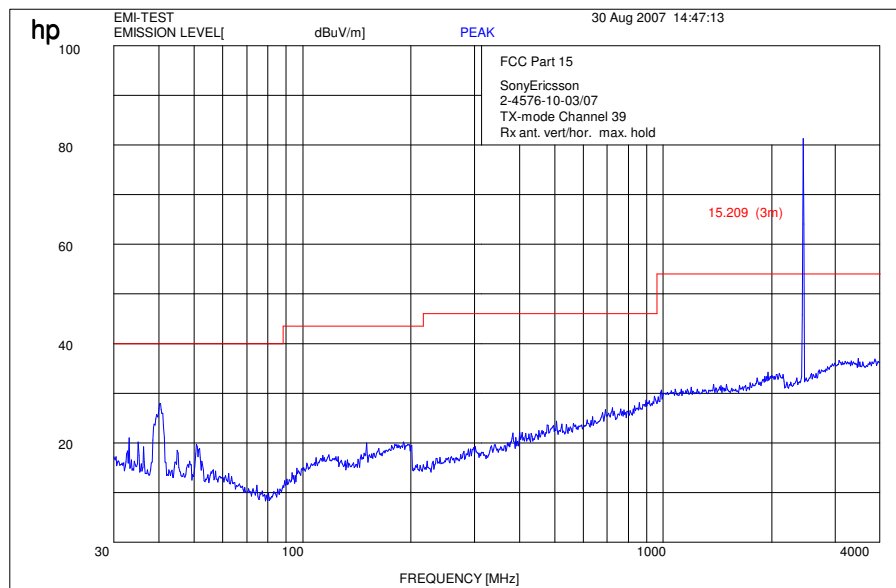


Plot: 12- 25 GHz vertical/horizontal (valid for all channels)

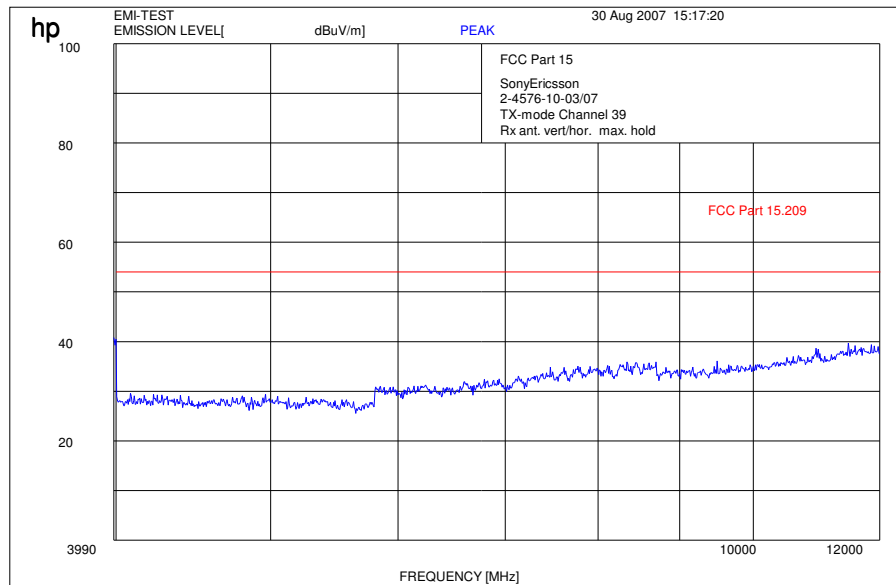


Date: 3.SEP.2007 11:15:24

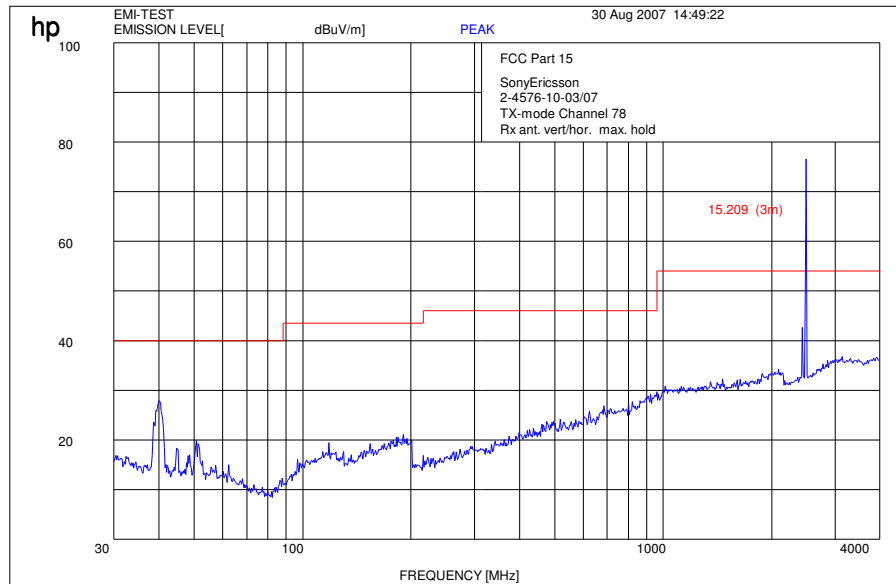
Plot: 0.03 - 4 GHz vertical/horizontal (middle channel)



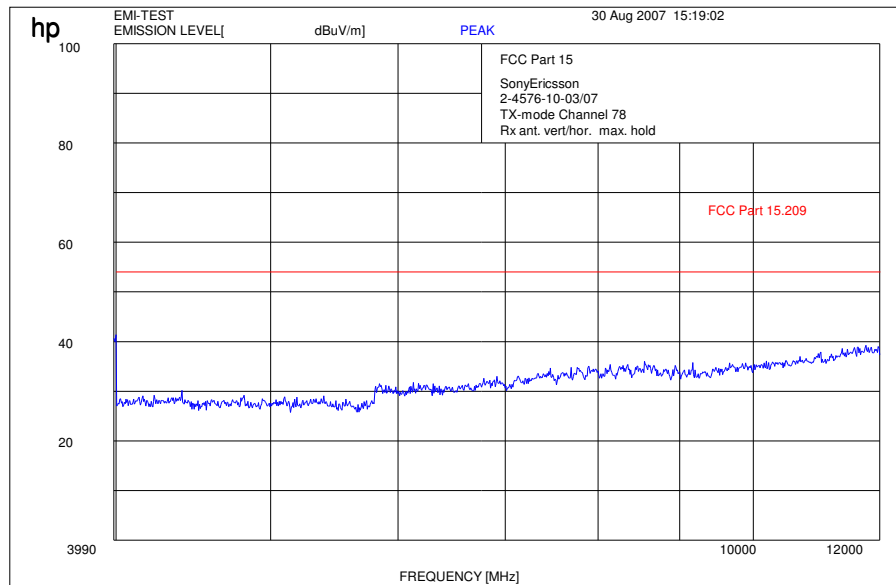
Plot: 4- 12 GHz vertical/horizontal (middle channel)



Plot: 0.03 - 4 GHz vertical/horizontal (highest channel)



Plot: 4- 12 GHz vertical/horizontal (highest channel)



Results:

| SPURIOUS EMISSIONS LEVEL (dB μ V/m) | | | | | | | | |
|---|----------|----------------------|-------------------------|----------|----------------------|-------------------------|----------|----------------------|
| 2402 MHz | | | 2441 MHz | | | 2480 MHz | | |
| F [MHz] | Detector | Level [dB μ V/m] | F [MHz] | Detector | Level [dB μ V/m] | F [MHz] | Detector | Level [dB μ V/m] |
| No critical peaks found | | | No critical peaks found | | | No critical peaks found | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| Measurement uncertainty | | | ±3 dB | | | | | |

f < 1 GHz : RBW/VBW: 100 kHz

f ≥ 1GHz : RBW/VBW: 1 MHz

Limits: § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

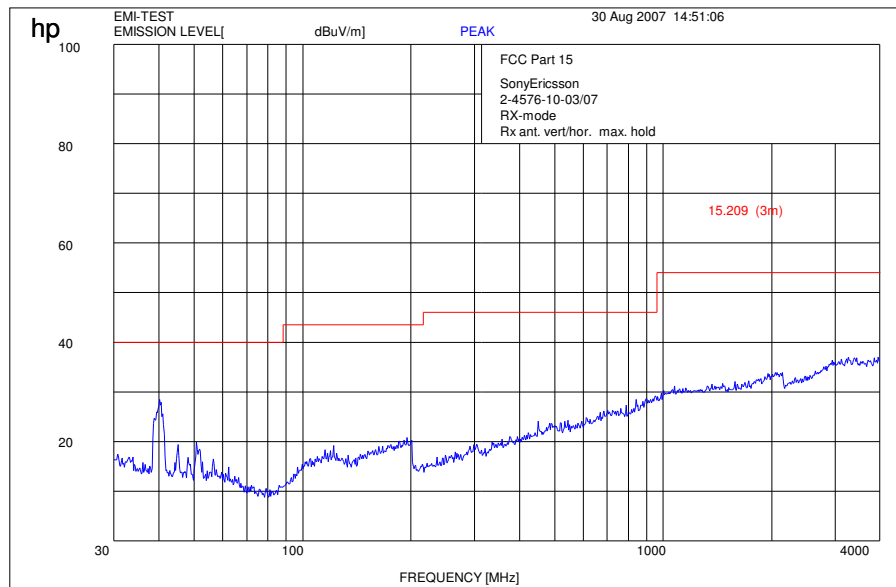
Limits: § 15.209

| Frequency [MHz] | Field strength [μ V/m] | Measurement distance (m) |
|-----------------|-----------------------------|--------------------------|
| 30 - 88 | 100 (40 dB μ V/m) | 3 |
| 88 - 216 | 150 (43.5 dB μ V/m) | 3 |
| 216 - 960 | 200 (46 dB μ V/m) | 3 |
| above 960 | 500 (54 dB μ V/m) | 3 |

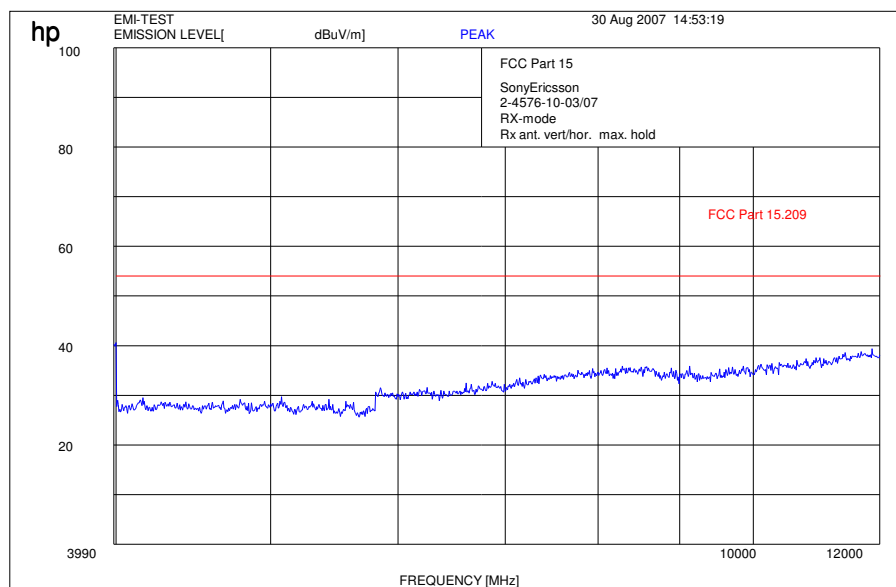
5.16 Spurious Emissions - radiated (Receiver) § 15.109

Modulation: GFSK

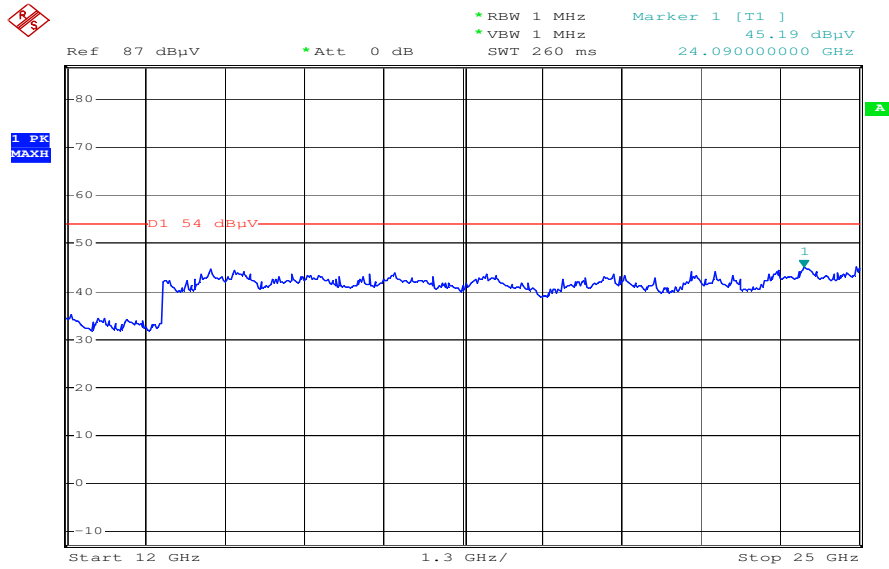
Plot: 0.03 - 4 GHz vertical/horizontal (receiver)



Plot: 4- 12 GHz vertical/horizontal (receiver)



Plot: 12- 25 GHz vertical/horizontal (receiver)



Date: 3.SEP.2007 11:15:43

| Spurious Emissions level [dBμV/m] | | |
|-----------------------------------|----------|----------------|
| f[MHz] | Detector | Level [dBμV/m] |
| No critical peaks found | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| Measurement uncertainty | | ±3 dB |

f < 1 GHz: RBW/VBW: 100 kHz f ≥ 1GHz : RBW/VBW: 1 MHz
 See above plots

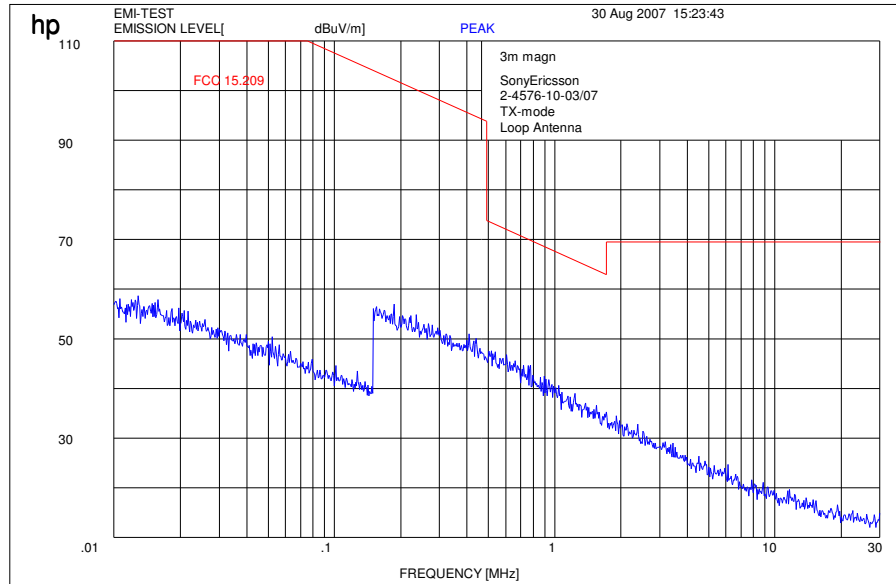
Measurement distance see table

Limits: § 15.109

| Frequency (MHz) | Field strength (μV/m) | Measurement distance (m) |
|-----------------|-----------------------|--------------------------|
| 30 - 88 | 100 (40 dBμV/m) | 3 |
| 88 - 216 | 150 (43.5 dBμV/m) | 3 |
| 216 - 960 | 200 (46 dBμV/m) | 3 |
| above 960 | 500 (54 dBμV/m) | 3 |

5.17 Spurious Emissions < 30 MHz - Transmitter radiated § 15.209

Modulation: GFSK



Measured at 10 m distance.
 Values recalculated with 40 dB/decade according to FCC rules.

Plot 1:

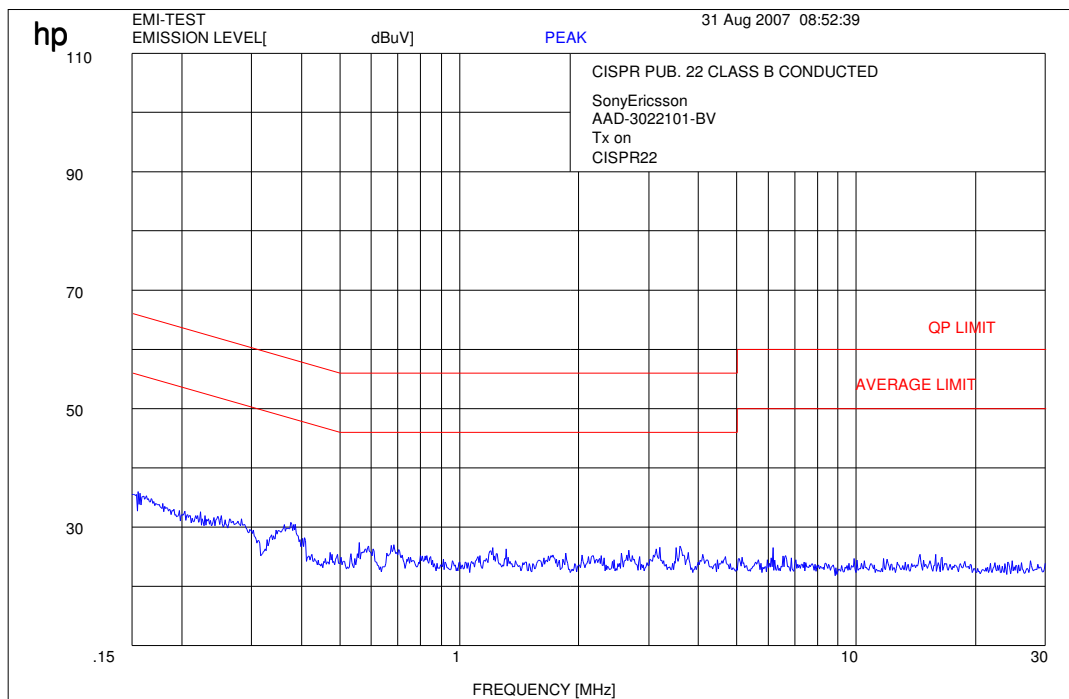
Limits:

| Frequency (MHz) | Field strength ($\mu\text{V/m}$) | Measurement distance (m) |
|-----------------|------------------------------------|--------------------------|
| 0.009 – 0.490 | 2400/F(kHz) | 300 |
| 0.490 – 1.705 | 24000/F(kHz) | 30 |
| 1.705 – 30.0 | 30 / 29.5 dB $\mu\text{V/m}$ | 30 |

5.18 Conducted Emissions <30 MHz § 15.107/207

Modulation: GFSK

Plot 1:



Limits :

| | |
|-----------------------------------|-----------|
| Under normal test conditions only | See plots |
|-----------------------------------|-----------|

6 Test equipment and ancillaries used for tests

To simplify the identification on each page of the test equipment used, on each page of the test report, each item of test equipment and ancillaries such as cables are identified (numbered) by the Test Laboratory, below.

Anechoic chamber C:

| No | Equipment/Type | Manuf. | Serial Nr. | Inv. No. Cetecom | Last Calibration | Frequency (months) | Next Calibration |
|----|----------------------------------|------------|------------------|------------------|------------------------------------|--------------------|------------------|
| 1 | Anechoic chamber | MWB | 87400/02 | 300000996 | Monthly verification | | |
| 2 | System-Rack 85900 | HP I.V. | * | 300000222 | n.a. | | |
| 3 | Measurement System 1 | | | | | | |
| 4 | Spektrum Analyzer 8566B | HP | 2747A05306 | 300001000 | 05.10.2006 | 24 | 05.10.2008 |
| 5 | Spektrum Analyzer Display 85662A | HP | 2816A16541 | 300002297 | 05.10.2006 | 24 | 05.10.2008 |
| 6 | Quasi-Peak-Adapter 85650A | HP | 2811A01131 | 300000999 | 05.10.2006 | 24 | 05.10.2008 |
| 7 | RF-Preselector 85685A | HP | 2837A00779 | 300000218 | 08.11.2006 | 24 | 08.11.2008 |
| 8 | PC Vectra VL | HP | | 300001688 | n.a. | | |
| 9 | Software EMI | HP | | 300000983 | n.a. | | |
| 10 | Measurement System 2 | | | | | | |
| 11 | FSP 30 | R&S | 100623 | ICT 300003464 | 26.10.2006 | 12 | 26.10.2007 |
| 12 | PC | F+W | | | n.a. | | |
| 13 | TILE | TILE | | | n.a. | | |
| 14 | Biconical antenna | EMCO | S/N: 860 942/003 | | Monthly verification (System cal.) | | |
| 15 | Log. Period. Antenna 3146 | EMCO | 2130 | 300001603 | Monthly verification (System cal.) | | |
| 16 | Double Ridged Antenna HP 3115P | EMCO | 3088 | 300001032 | Monthly verification (System cal.) | | |
| 17 | Active Loop Antenna 6502 | EMCO | 2210 | 300001015 | Monthly verification (System cal.) | | |
| 18 | Power Supply 6032A | HP | 2818A03450 | 300001040 | 12.05.2007 | 36 | 12.05.2010 |
| 19 | Busisolator | Kontron | | 300001056 | n.a. | | |
| 20 | Leitungsteiler 11850C | HP | | 300000997 | Monthly verification (System cal.) | | |
| 21 | Power attenuator 8325 | Byrd | 1530 | 300001595 | Monthly verification (System cal.) | | |
| 22 | Band reject filter WRCG1855/1910 | Wainwright | 7 | 300003350 | Monthly verification (System cal.) | | |
| 23 | Band reject filter WRCG2400/2483 | Wainwright | 11 | 300003351 | Monthly verification (System cal.) | | |
| | | | | | | | |

Bluetooth Rack:

| No | Equipment/Type | Manuf. | Serial Nr. | Inv. No. Cetecom | Last Calibration | Frequency (months) | Next Calibration |
|----|------------------|--------|-------------|------------------|------------------|--------------------|------------------|
| 1 | FSP 30 | R&S | | 300003575 | 02.04.2007 | 24 | 02.04.2009 |
| 2 | CBT | R&S | 100313 | 300003516 | 24.10.2006 | 24 | 24.10.2008 |
| 3 | Switch Matrix | HP | | 300000929 | n.a. | | |
| 4 | Power Supply | HP | 3041A00544 | 300002270 | 13.05.2007 | 36 | 13.05.2010 |
| 5 | Signal Generator | R&S | 836206/0092 | 300002680 | 30.05.2007 | 36 | 30.05.2010 |
| | | | | | | | |
| | | | | | | | |

SRD Laboratory Room 005:

| No | Equipment/Type | Manuf. | Serial Nr. | Inv. No. Cetecom | Last Calibration | Frequency (months) | Next Calibration |
|----|----------------------------------|--------|------------|------------------|------------------|--------------------|------------------|
| 1 | Spektrum Analyzer 8566B | HP | 2747A05275 | 300000219 | 08.11.2006 | 24 | 08.11.2008 |
| 2 | Spektrum Analyzer Display 85662A | HP | 2816A16497 | 300001690 | 08.11.2006 | 24 | 08.11.2008 |
| 3 | Quasi-Peak-Adapter 85650A | HP | 2811A01135 | 300000216 | 08.11.2006 | 24 | 08.11.2008 |
| 4 | Power Supply | Heiden | 003202 | 300001187 | 12.05.2007 | 36 | 12.05.2010 |
| 5 | Power Supply | Heiden | 1701 | 300001392 | 12.05.2007 | 36 | 12.05.2010 |
| | | | | | | | |