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TCB ID: DE 0001



Accredited by the
German Accreditation Council
DAR-Registration Number
DAT-P-176/94-D1



Independent ETSI
compliance test house



Accredited Bluetooth® Test Facility (BQTF)

Test report no.: 2-4556-01-02_07_Ant2_5G

LANCOM XAP-40-2
Hirschmann BAT54-Rail
FCC ID: U4Y-SE1I2
IC: 7049A-SE1I2

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1. Administrative data

1.1. Administrative data of the test facility

1.1.1 Identification of the testing laboratory


| | |
|-------------------------------------|---|
| Company name: | Cetecom ICT Services GmbH |
| Address: | Untertürkheimerstr. 6-10 D-66117 Saarbruecken Germany |
| Laboratory accreditation: | DAR-Registration No. DAT-P-176/94-D1 Bluetooth Qualification Test Facility (BQTF) |
| Responsible for testing laboratory: | Harro Ames, Stefan Bös Phone: +49 681 598 0 Fax: +49 681 598 9075 email: info@ict.cetecom.de |


..... /

Responsible for testing laboratory
(Harro Ames, Stefan Bös)

1.1.2 Organizational items

| | |
|---|--------------------------|
| Reference No.: | |
| Order No.: | |
| Responsible for test report and project leader: | Harro Ames, Stefan Bös |
| Receipt of EUT: | 2007-03-22 |
| Date(s) of test: | 2007-03-25 to 2007-04-20 |
| Date of report: | 2007-05-11 |
| Number of report pages: | 30 |
| Number of diagram pages (annex): | |
| ----- | |
| Version of template: | 1.6 |


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Responsible for test report
(Harro Ames, Stefan Bös)

Note:

The test results of this test report relate exclusively to the item tested as specified in this report. The CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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During the test no hardware and software changes are allowed to be performed at the EUT.

1.1.3 Applicant's details

| | |
|-------------------|---|
| Applicant's name: | LANCOM Systems GmbH |
| Address: | Adenauerstr. 20/B2 D-52146 Würselen Germany |
| Contact person: | Mr. Andre Krautschick Tel: +49 (0)2405 49936-443 Fax: +49(0)2405 49936-99 email: Andre.Krautschick@lancom.de |

1.2 Administrative data of manufacturer / member

| | |
|----------------------|---------------|
| Manufacturer's name: | - applicant - |
| Address: | |

1.3 Description of the Equipment under test (EUT)

1.3.1 EUT: Type, S/N etc.

| Product name | Product ID | Description | S/N serial number | HW hardware status | SW software status |
|------------------------|--------------------|--------------------|-----------------------|--------------------------|--------------------|
| XAP-40-2 BAT54-Rail | | Dual WLAN AP | - | - | - |
| Frequency Band [MHz] | Type of Modulation | Number of channels | Antenna | Power Supply | Temperature Range |
| 5.180 – 5.240 | OFDM | 4 | 2*2 external antennas | External AC power supply | -20°C - +55°C |
| ISM 5.745 – 5.825 | OFDM | 5 | 2*2 external antennas | External AC power supply | -20°C - +55°C |

1.3.2 If RF component testing only, description of additional used HW/SW

| | Product name | Product ID | Description | S/N serial number | HW hardware status | SW software status |
|---|--------------|------------|-------------|-------------------|--------------------|--------------------|
| 1 | | | | | | |
| 2 | | | | | | |

1.3.3 Additional EUT information

The sample is a dual access point for dualband use. (2.4 and 5 GHz).

Inside the AP there are two identical RF parts, both are able to work on 2.4 and 5 GHz.

In this report we test the radiated emissions of the AP with external antenna **Ant2 (BAT-ANT-8A) at the 5 GHz ranges.**

We tested spurious emissions for each antenna type.

The maximal output power can be calculated by the conducted output power and the attached pattern of the antenna.

Other antennas and frequency ranges are tested in separate reports.

The complete test report for the AP at **5.2 GHz** is **2-4556-01-06/07** from our house.

The complete test report for the AP at **5.8 GHz** is **2-4556-01-05/07** from our house.

Antenna types: (gain according data sheet)

| | | | |
|--------|-------------------|------------------|----------|
| Ant2: | BAT-ANT-8A | 5.15 – 5.35 GHz | 5.0 dBi |
| | | 5.35 – 5.875 GHz | 8.0 dBi |
| Ant6: | BAT-ANT-N-12A | 5.15 – 5.35 GHz | 12.0 dBi |
| | | 5.35 – 5.875 GHz | 14.0 dBi |
| Ant7: | BAT-ANT-TNC-10ADS | 5.15 – 5.875 GHz | 10.0 dBi |
| Ant8: | BAT-ANT-N-23/9a | 5.15 – 5.875 GHz | 23.0 dBi |
| Ant9: | Extender I-60AG | 5.15 – 5.875 GHz | 8.0 dBi |
| Ant11: | Extender 0-9a | 5.15 – 5.35 GHz | 23.0 dBi |
| | | 5.47 – 5.875 GHz | 23.0 dBi |
| Ant12: | Extender 0-D60a | 5.15 – 5.875 GHz | 10.0 dBi |
| Ant14: | Extender 0-360ag | 5.x GHz | 7.0 dBi |
| Ant15: | BAT-ANT-N-6ABG | 4.90 – 5.935 GHz | 8.0 dBi |
| Ant17: | Extender 0-18a | 5.25 – 5.875 GHz | 18.0 dBi |

To simplify reading the report we use inside the short name of the antennas, ANT1, ANT2 etc.

1.3.4 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. 3 | | low temperature, high power source conditions |
| Op. 4 | | high temperature, low power source conditions |
| Op. 5 | | high temperature, high power source conditions |

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

1.3.5 Extreme conditions testing values

| Description | Shortcut | Unit | Value |
|--------------------------------|-------------------|--------|------------|
| Nominal Temperature / humidity | T _{nom} | °C / % | 22°C / 33% |
| Low Temperature | T _{low} | °C | -20°C |
| High Temperature | T _{high} | °C | 55°C |
| Nominal Power Source | V _{nom} | V | 115V AC |
| Low Power Source | V _{low} | V | 100V AC |
| High Power Source | V _{high} | V | 130V AC |

Type of powersource: External AC power supply with 12V DC output, delivered by the customer

2 Test standard & summary list of all performed test cases

| TC identifier | Description | verdict | date | Remark |
|---------------|--|---------|------------|--------|
| RF-Testing | FCC Part 15 §15.247/15.407 - CANADA RSS-210 | pass | 2007-05-11 | |

| Test Specification Clause | Test Case | Pass | Fail | Not applicable | Not performed |
|-------------------------------|--|------|------|----------------|---------------|
| None | Antenna Gain | Yes | | | |
| § 15.247(b)(3) / 15.407(a)(1) | Maximum output power (conducted) | Yes | | | |
| § 15.247(b)(4) / 15.407(a)(1) | Max. peak output power (radiated) | Yes | | | |
| § 15.209 / 15.407(b)(1) | Spurious Emission -radiated (Transmitter) | Yes | | | |
| § 15.247 (i) | Radio frequency energy level (Transmitter) | Yes | | | |

3 RF measurement testing

3.1 Description of test set-up

3.1.1 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 conform 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 conform with ANSI C63.2-1996 item 15.

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

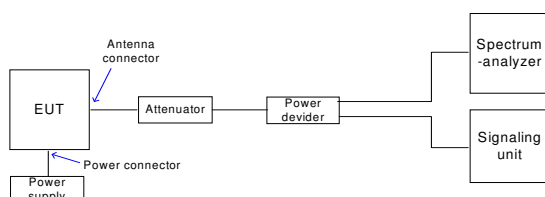
30 MHz - 200 MHz: Quasi Peak measurement, 120KHz Bandwidth, biconical antenna

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

>1GHz: Average, RBW 1MHz, VBW 10 MHz, waveguide horn with lownoise preamp

3.1.2 Conducted measurements

The EUT's RF signal is coupled out by the antenna connector which is supplied by the manufacturer. The signal is connected to the spectrum analyzer. The specific losses for signal paths are first checked within a calibration. The measurement readings on the spectrum analyzer are corrected by the specific test set-up loss. The attenuator, power divider, signaling unit and the spectrum analyzer are impedance matched on 50 Ohm.



3.1.3 AC-conducted measurements

We used the dedicated power supply delivered by the customer.

3.2 Referenced Documents

none

3.3 Additional comments

none

3.4 Antenna gain

according to data sheets of the antennas

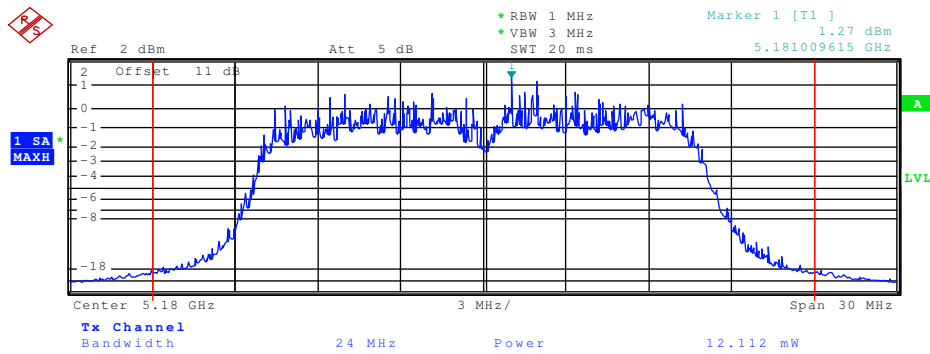
The real gain of the antennas may be lower.

| | Ant2 | Ant6 | Ant7 | Ant8 | Ant9 | Ant11 | Ant12 | Ant14 | Ant15 | Ant17 |
|-------------------|-------------|------|------|------|------|-------|-------|-------|-------|-------|
| gain(dBi) 5.2 GHz | 5.0 | 12.0 | 10.0 | 23.0 | 8.0 | 23.0 | 10.0 | 7.0 | 8.0 | - |
| gain(dBi) 5.8 GHz | 8.0 | 14.0 | 10.0 | 23.0 | 8.0 | 23.0 | 10.0 | 7.0 | 8.0 | 18.0 |

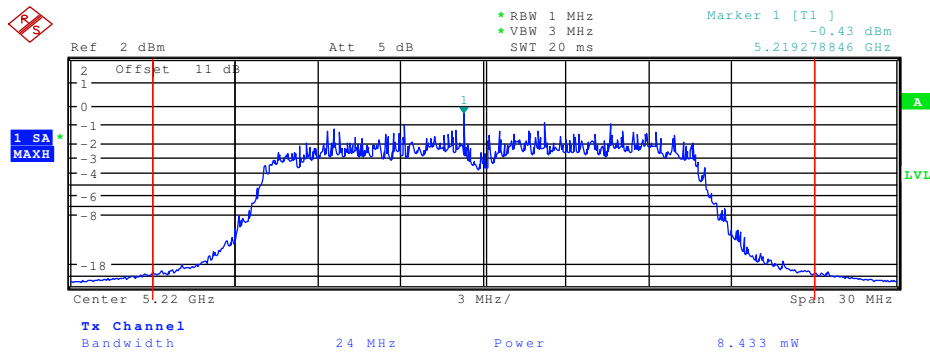
3.5 Maximum output power (conducted) (OFDM)

§ 15.247(b)(3) / 15.407(a)(1)

Plot 1:



Plot 2:



SRD-Testreport

CETECOM ICT Services GmbH Saarbruecken, Germany

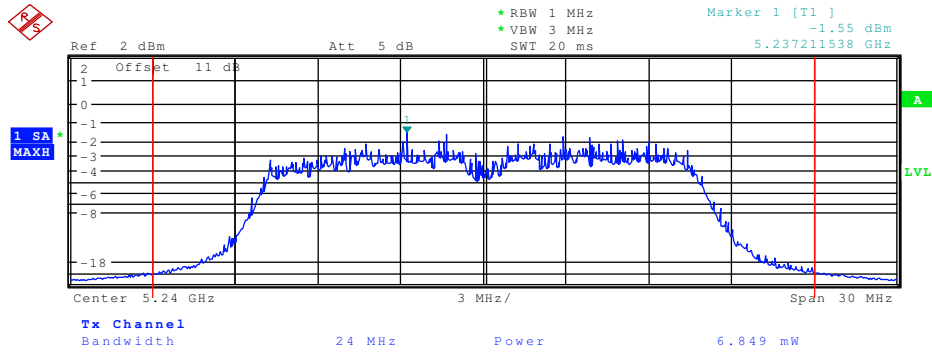


Test report No.: 2-4556-01-02_07_Ant2_5G

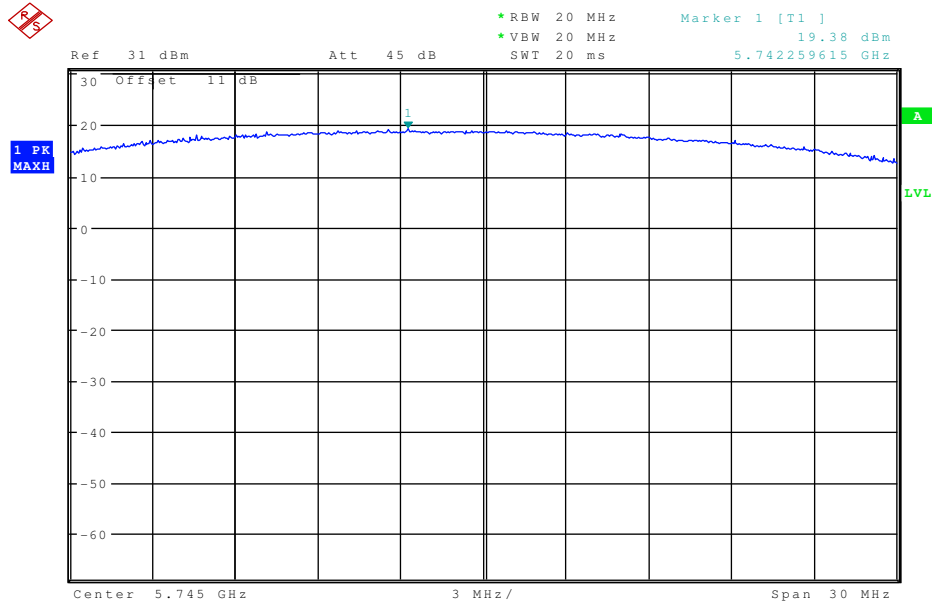
Date: 2007-05-11

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Plot 3:



Plot 4:



SRD-Testreport

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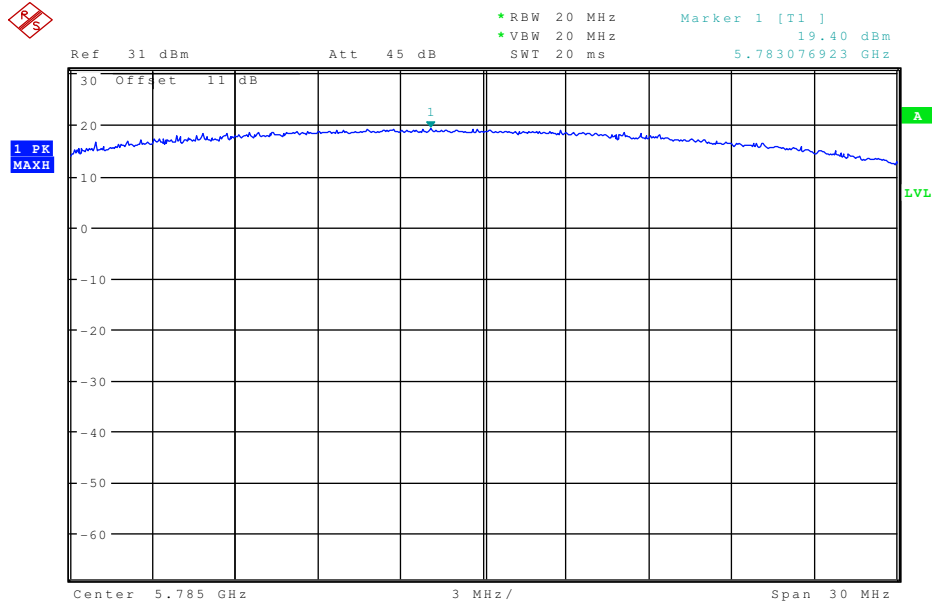


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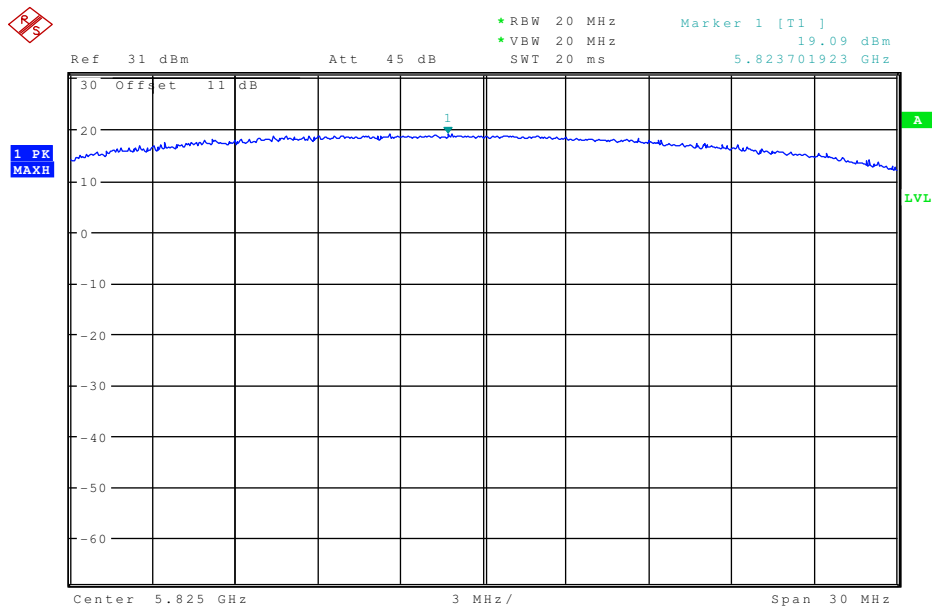
Date: 2007-05-11

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Plot 5:



Plot 6:



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Results:

| Test conditions | | Max. peak output power [dBm] | | |
|-------------------------|------------------|------------------------------|------|------|
| Frequency [MHz] | | 5180 | 5220 | 5240 |
| T _{nom} | V _{nom} | 10.8 | 9.26 | 8.36 |
| Measurement uncertainty | | ±3dB | | |

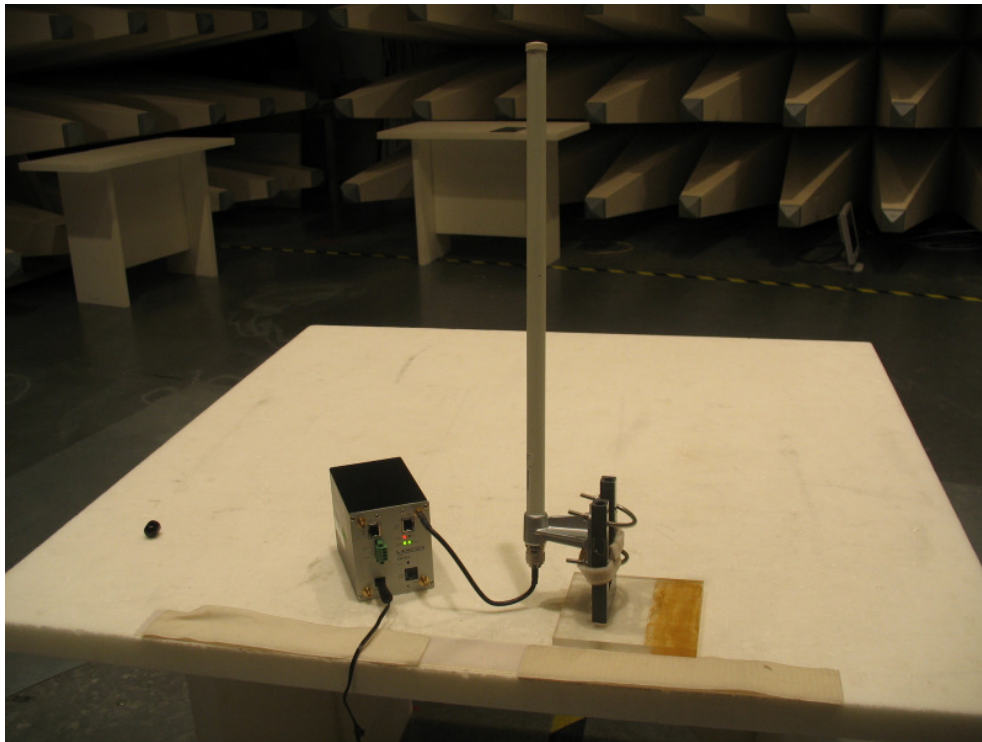
| Test conditions | | Max. peak output power [dBm] | | | |
|-------------------------|------------------|------------------------------|-------|-------|-------|
| Frequency [MHz] | | 5745 | | 5785 | 5825 |
| T _{nom} | V _{nom} | PK | 19.38 | 19.40 | 19.09 |
| Measurement uncertainty | | ±3dB | | | |

Limits:

| | |
|--|---|
| Under normal test conditions only, for frequency range 5.15 – 5.25 GHz | Max. 50 mW (17 dBm) or 4 dBm + 10logB where B is the 26dB-Emission-bandwidth in MHz – whichever is lesser |
| Under normal test conditions only, for frequency range 5.725 – 5.850 GHz | Max. 1 W (30 dBm) or 17 dBm + 10logB where B is the 26dB-Emission-bandwidth in MHz – whichever is lesser |

3.6 Ant 2: BAT-ANT-8A

Max. peak output power (radiated) § 15.247 (b) (4) / § 15.407 (a) (1)



Results: calculated with specified antenna gain (5.0 dBi)

| Test conditions | | Max. peak output power EIRP [dBm] | | |
|-------------------------|------------------|-----------------------------------|-------|-------|
| | | 5180 | 5220 | 5240 |
| Frequency [MHz] | | 5180 | 5220 | 5240 |
| T _{nom} | OFDM - Conducted | 10.8 | 9.26 | 8.36 |
| T _{nom} | OFDM - Radiated | 15.8 | 14.26 | 13.36 |
| Measurement uncertainty | | ±3dB | | |

Limits:

| | |
|--|--|
| Under normal test conditions only, for frequency range 5.15 – 5.25 GHz | Radiated: Max. 17 dBm + directional gain of the antenna If the directional gain of the antenna exceeds 6 dBi the maximum conducted output power (17 dBm) shall be reduced by the amount in dB that the gain exceeds 6 dBi |
|--|--|

SRD-Testreport

CETECOM ICT Services GmbH Saarbruecken, Germany



Test report No.: 2-4556-01-02_07_Ant2_5G

Date: 2007-05-11

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Results: calculated with specified antenna gain (8.0 dBi)

| Test conditions | | Max. peak output power EIRP [dBm] | | |
|-------------------------|------------------|-----------------------------------|-------|-------|
| Frequency [MHz] | | 5745 | 5785 | 5825 |
| T _{nom} | OFDM - Conducted | 19.38 | 19.40 | 19.09 |
| T _{nom} | OFDM - Radiated | 27.38 | 27.40 | 27.09 |
| Measurement uncertainty | | ±3dB | | |

Limits:

| | |
|--|---|
| Under normal test conditions only, for frequency range 5.725 – 5.850 GHz | Radiated: Max. 30 dBm + directional gain of the antenna If the directional gain of the antenna exceeds 6 dBi the maximum conducted output power (30 dBm) shall be reduced by the amount in dB that the gain exceeds 6 dBi |
| Under normal test conditions only, for frequency range 5.725 – 5.850 GHz (Fixed point to point U-NII devices) | Radiated: Max. 30 dBm + directional gain of the antenna (max. gain 23 dBi) If the directional gain of the antenna exceeds 6 dBi the maximum conducted output power (30 dBm) shall be reduced by the amount in dB that the gain exceeds 6 dBi |

SRD-Testreport

CETECOM ICT Services GmbH Saarbruecken, Germany



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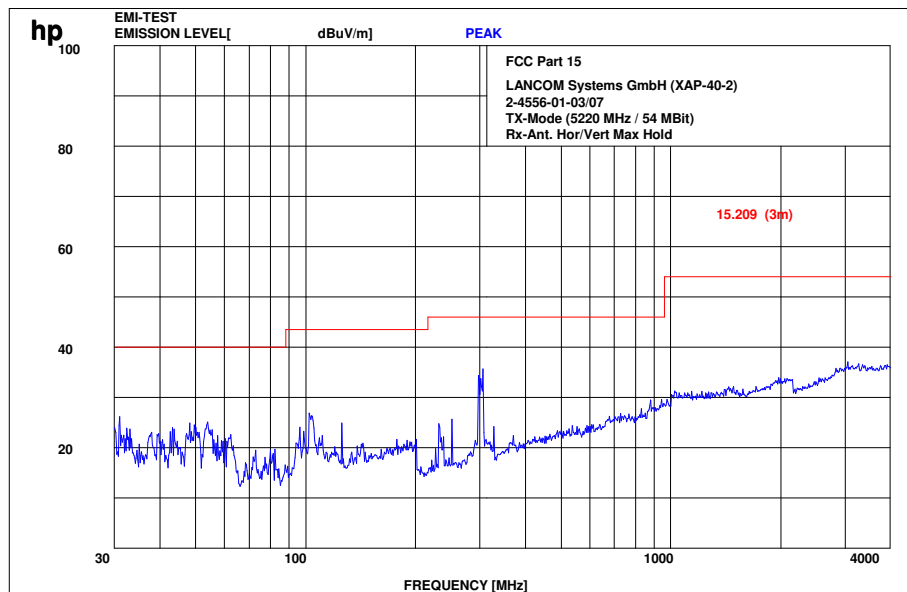
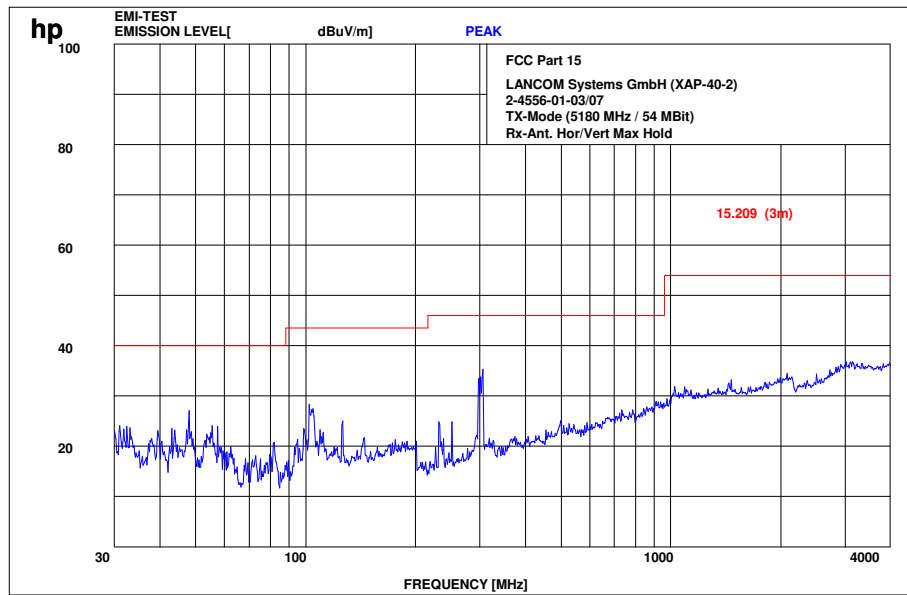
Spurious Emissions - radiated

Transmitter

§ 15.209 / 15.247 / 15.407(b)(1)

OFDM mode

0.03 - 12 GHz vertical / horizontal



SRD-Testreport

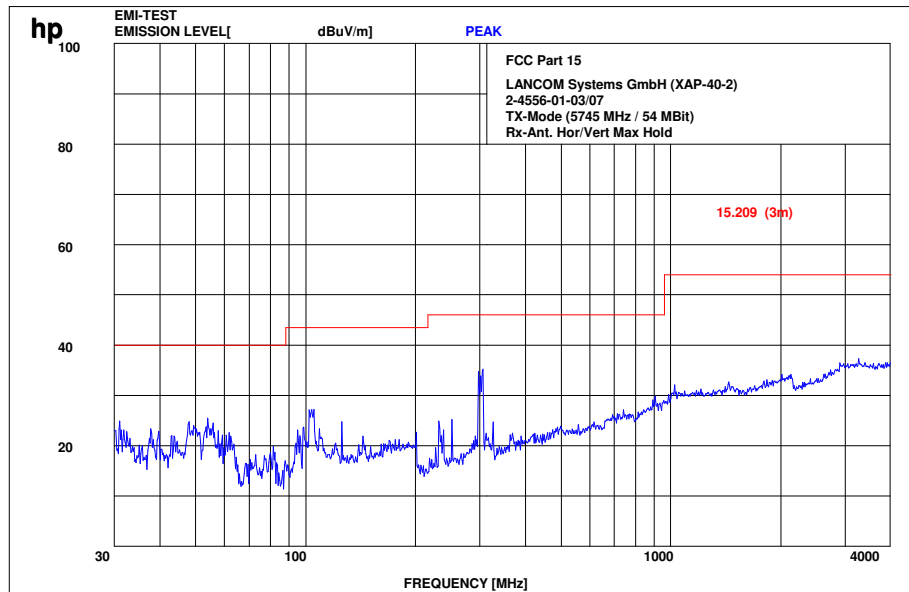
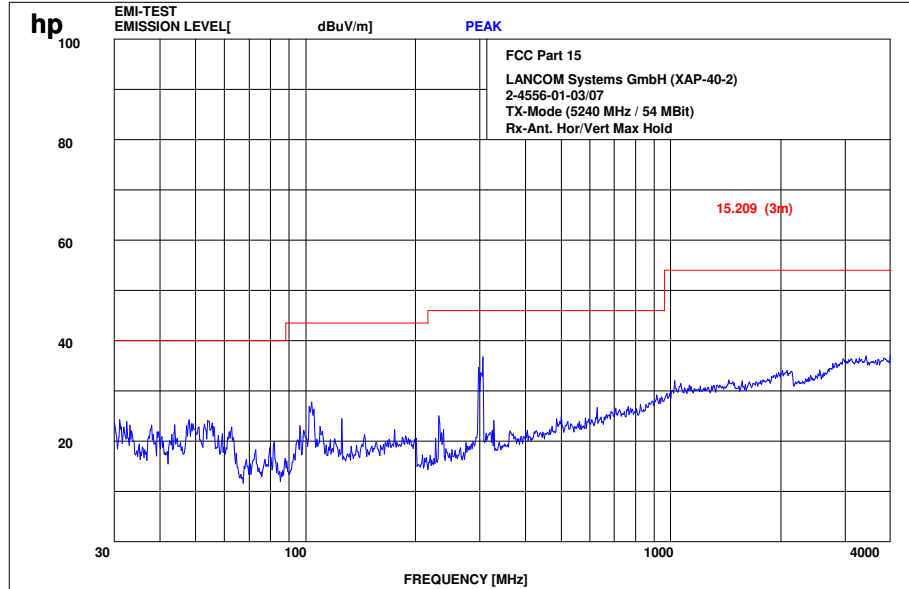
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SRD-Testreport

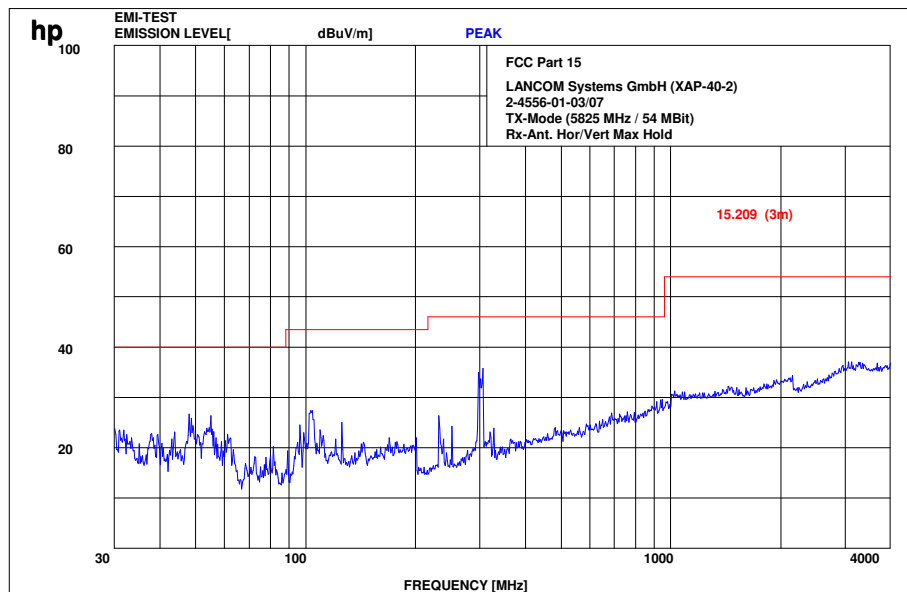
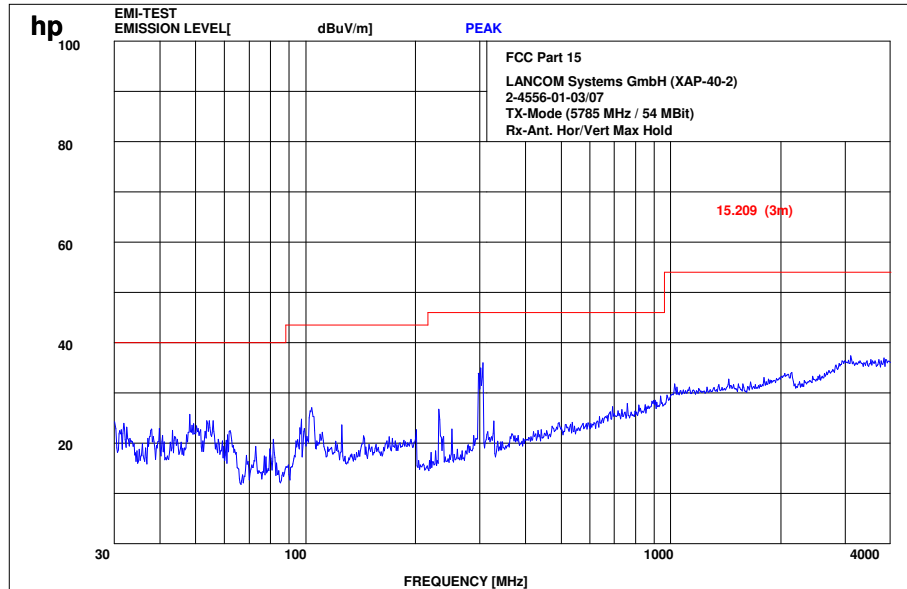
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SRD-Testreport

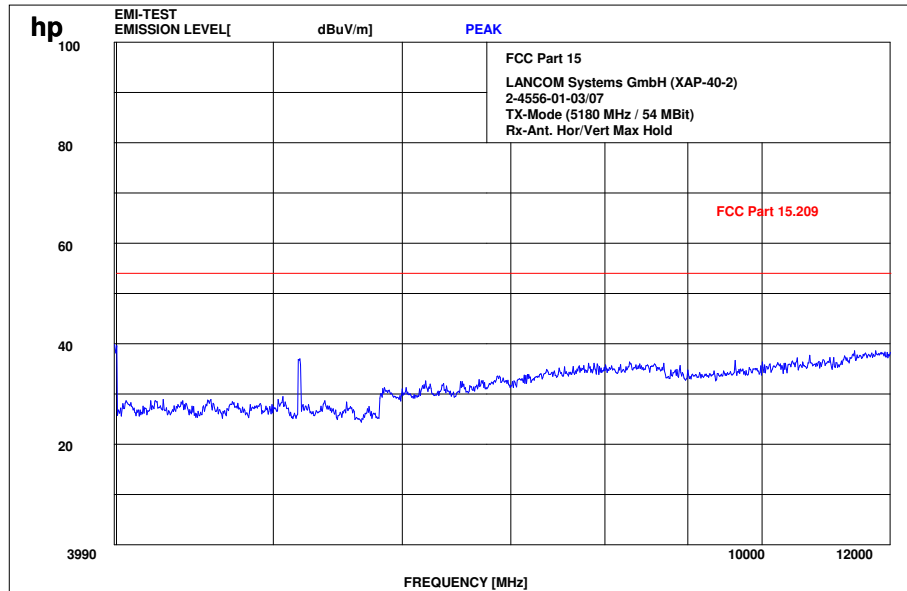
CETECOM ICT Services GmbH Saarbruecken, Germany



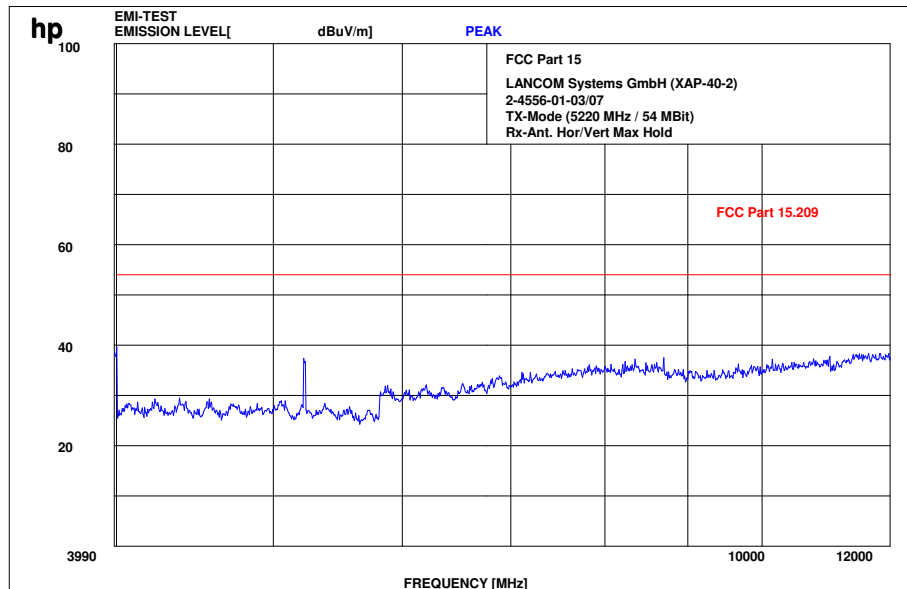
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Carrier suppressed with a rejection filter



Carrier suppressed with a rejection filter

SRD-Testreport

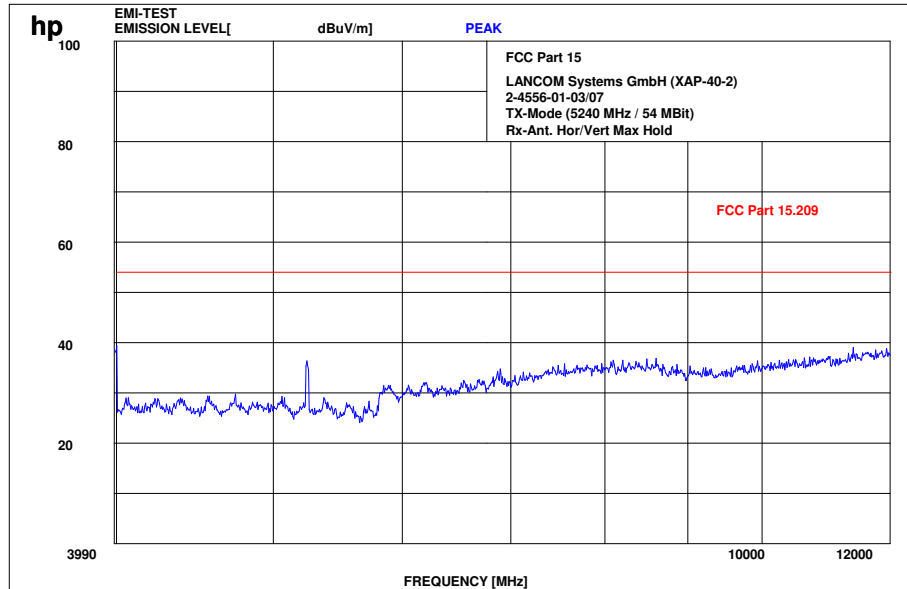
CETECOM ICT Services GmbH Saarbruecken, Germany



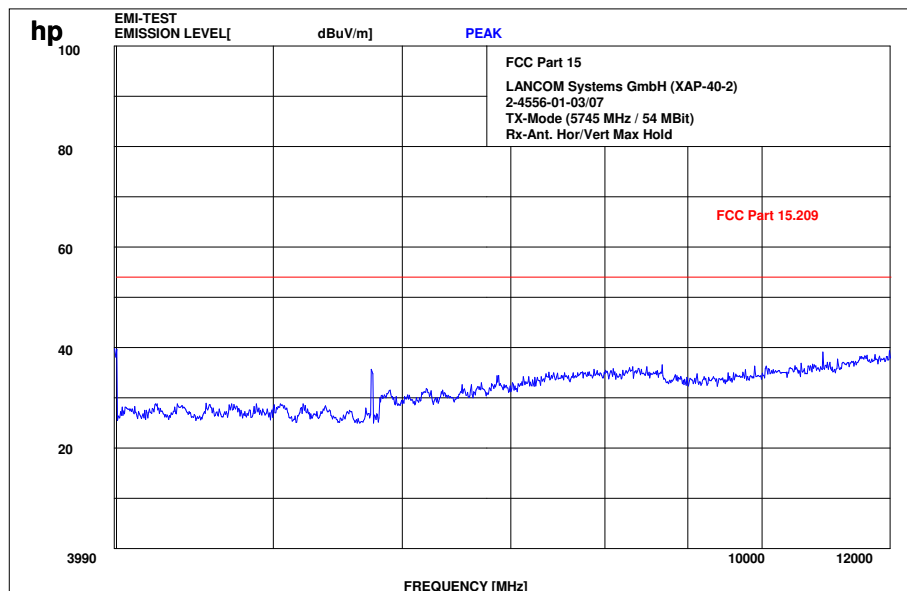
Test report No.: 2-4556-01-02_07_Ant2_5G

Date: 2007-05-11

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Carrier suppressed with a rejection filter



Carrier suppressed with a rejection filter

SRD-Testreport

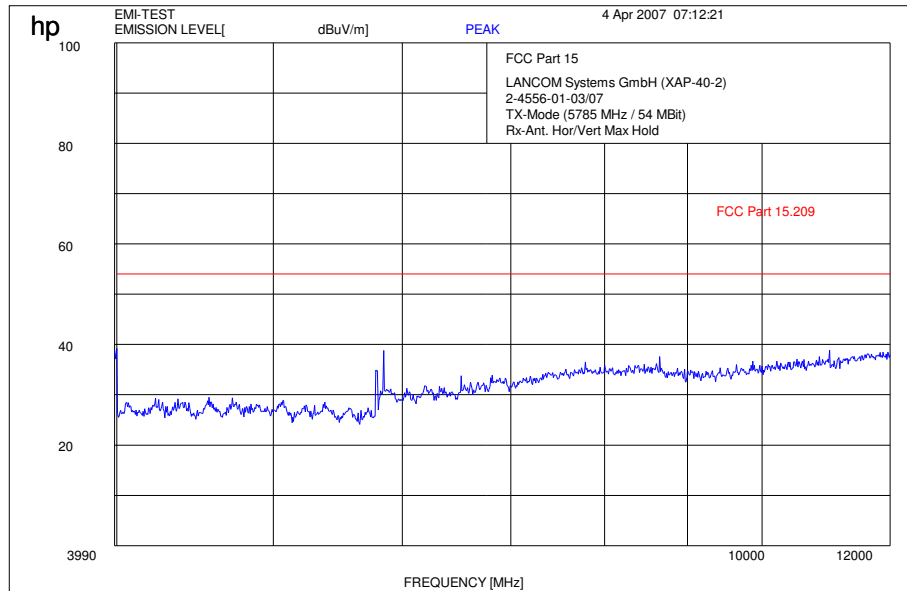
CETECOM ICT Services GmbH Saarbruecken, Germany



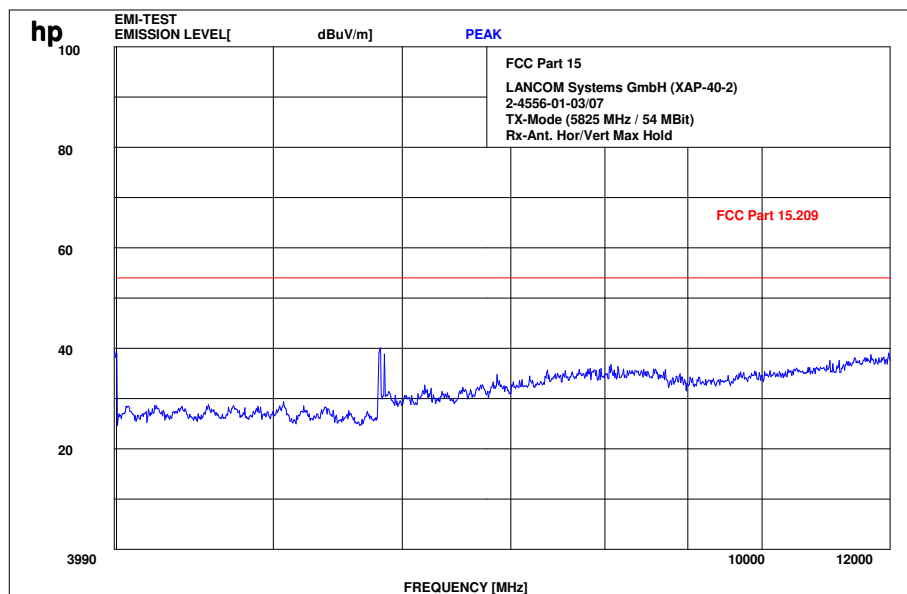
Test report No.: 2-4556-01-02_07_Ant2_5G

Date: 2007-05-11

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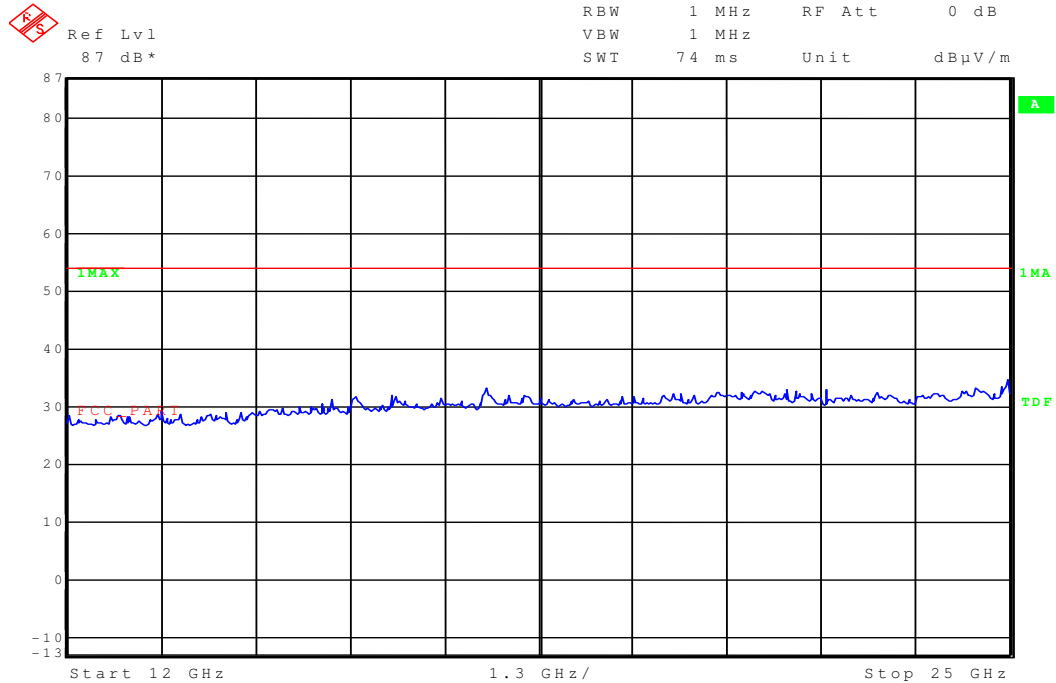


Carrier suppressed with a rejection filter



Carrier suppressed with a rejection filter

12- 25 GHz (valid for all channels, worst case)



Results:

| Spurious Emissions level [$\mu\text{V/m}$] | | | | | | | | | |
|--|----------|---------------------------|--------|------------|---------------------------|----------|----------|---------------------------|--|
| 5180 MHz | | 5220 MHz | | 5240 MHz | | 5745 MHz | | 5785 MHz | |
| f[MHz] | Detector | Level [$\mu\text{V/m}$] | f[MHz] | Detector | Level [$\mu\text{V/m}$] | f[MHz] | Detector | Level [$\mu\text{V/m}$] | |
| No critical peaks found < 10 dB below limit line | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| 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 / 209

| Frequency (MHz) | Field strength ($\mu\text{V/m}$) | Measurement distance (m) |
|-----------------|------------------------------------|--------------------------|
| 30 - 88 | 100 (40 dB $\mu\text{V/m}$) | 3 |
| 88 - 216 | 150 (43.5 dB $\mu\text{V/m}$) | 3 |
| 216 - 960 | 200 (46 dB $\mu\text{V/m}$) | 3 |
| above 960 | 500 (54 dB $\mu\text{V/m}$) | 3 |

3.7 MPE

These equations are generally accurate in the far field of an antenna but will over predict power density in the near field, where they could be used for making a “worst case” prediction.

$$S = PG/4\pi R^2$$

where S = power density (in appropriate units, e.g. mW/cm²)

P = power input to the antenna (in appropriate units e.g. mW)

G = power gain of the antenna in the direction of interest relative to the isotropic radiator

R = distance to the center of radiation of the antenna (appropriate units e.g. cm)

Or

$$S = EIRP/4\pi R^2$$

where EIRP = equivalent isotropically radiated power

Calculation:

| 5.2 GHz band | 5.8 GHz band |
|---|--|
| (Calculated for max. EIRP) | (Calculated for max. EIRP) |
| EIRP: 15.8 dBm = 38 mW | EIRP: 27.40 dBm = 550 mW |
| calculated at distance of 20 cm: | calculated at distance of 20 cm: |
| power density = $38 / 4\pi 20^2 = 0.008 \text{ mW/ cm}^2$ | power density = $550 / 4\pi 20^2 = 0.109 \text{ mW/ cm}^2$ |

Measurement:

| 5.2 GHz band |
|---|
| measured at a distance of 20 cm: |
| power density = 0.003 mW/ cm ² |

Limit:

| |
|--|
| 1mW/ cm ² is the reference level for general public exposure according to the OET Bulletin 65, Edition 97-01 Table 1. |
|--|

3.8 Datasheet antenna

Omni-Directional Antenna for 5.8 GHz

BAT- ANT- 8A

Order Number: 943 903 301

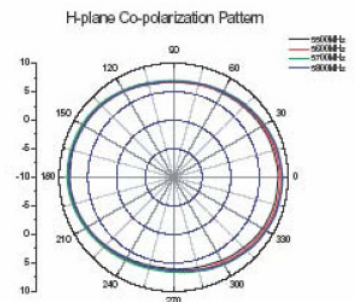
Electrical Specification

| | | |
|-----------------|---------------------|---------------------|
| Frequency range | 5150 MHz - 5350 MHz | 5350 MHz - 5875 MHz |
| Gain | 5 dBi | 8 dBi |
| VSWR | 2.0 : 1 Max. | |
| Polarization | Linear, vertical | |
| HPBW / | horizontal 360° | |
| HPBW / | vertical 12° | |
| Power handling | 5 W (CW) | |
| Impedance | 50 Ω | |
| Connector | N female | |
| Down tilt | 0° | |



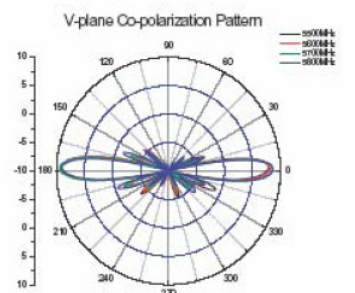
Environmental & Mechanical Characteristics

| | |
|---------------------|------------------|
| Survival wind speed | 216 km/hr |
| Temperature | - 40°C to +80°C |
| Humidity | 95% @ 55°C |
| Radome color | Gray-white |
| Radome material | Fiber glass |
| Weight | 227 g |
| Dimension | 78 x 80 x 373 mm |
| IP | IP65 |



Cable

1m with N connectors at both sides.
Attenuation at 5.8 GHz 1dB



Usable system for BAT54M and BAT54-Rail.
Please order cable for BAT54-Rail additionally.

3.9 Testequipment

Anechoic chamber C:

| Device | Manufacturer | Type | S/N Number | Inv. No. Cetecom |
|---------------------------|--------------|-----------|------------|------------------|
| Spektrum Analyser | HP | 8566B | 2747A05306 | 300001000 |
| Spektrum Analyser Display | HP | 85662A | 2816A16541 | 300002297 |
| Quasi-Peak-Adapter | HP | 85650A | 2811A01131 | 300000999 |
| Power Dupply | HP | 6032A | 2818A03450 | 300001040 |
| Power Attenuator | Byrd | 8325 | 1530 | 300001595 |
| Biconical Antenna | EMCO | 3104 | 3758 | 300001602 |
| Log. Period. Antenna | EMCO | 3146 | 2130 | 300001603 |
| Double Ridged Antenna | EMCO | HP 3115P | 3088 | 300001032 |
| Active Loop Antenna | EMCO | 6502 | 2210 | 300001015 |
| Antenna VDE/FCC | | HP11965B | | 300002298 |
| SRM-Drive | HP | 9144A | 2823e46556 | 300001044 |
| Software | HP | EMI | | 300000983 |
| Busisolator | Kontron | | | 300001056 |
| Absorberhalle | MWB | | 87400/02 | 300000996 |
| Salzsäule | Kontron | | | 300001055 |
| Antenna | R&S | HMO20 | 832211/003 | 300002243 |
| Indukt.Tast Antenna | R&S | HFH 2 Z4 | 881468/026 | 300001464 |
| System-Rack | HP I.V. | 85900 | * | 300000222 |
| Spectrum Analyzer | HP | 8566B | 2747A05275 | 300000219 |
| Quasi-Peak-Adapter | HP | 85650A | 2811A01135 | 300000216 |
| RF-Preselector | HP | 85685A | 2837A00779 | 300000218 |
| Rahmen Antenne | R&S | HFH2-Z2 | 891847-35 | 300001169 |
| Leitungsteiler | HP | 11850C | | 300000997 |
| Breitband-Hornantenne EMI | HP | 35155P | | 300002300 |
| PC | HP | Vectra VL | | 300001688 |
| VHF Meßantenne | Schwarzbeck | VHA 9103 | | 300001778 |
| Spectrum Analyzer Display | HP | 85662A | 2816A16497 | 300001690 |
| VHF Meßantenna | Schwarzbeck | VHA 9103 | | 300001780 |
| Biconical Antenna | EMCO | 3104 C | 9909-4868 | 300002590 |

SRD Laboratory:

| Device | 300001207 | Type | S/N Number | Inv. No. Cetecom |
|---------------------------------|-----------|----------------|------------|------------------|
| Spectrum Analyzer | 300001208 | 494AP | B010241 | 300000863 |
| Spectrum Analyzer | HP | 71210A (70000) | 2731A02347 | 300000321 |
| Spectrum Analyzer Display | HP | 70206A | 2840A01553 | 300002017 |
| Reference Frequency | HP | 70310A | 2736A00707 | 300002018 |
| Local Oscillator | HP | 70900A | 2842A02221 | 300002019 |
| ZF-Modul 10Hz-300 kHz | HP | 70902A | 2840A02145 | 300002020 |
| ZF-Modul 100 kHz-3 MHz | HP | 70903A | 2835A01069 | 300002021 |
| HF-Teil für 71210A 100Hz- 22GHz | HP | 70908A | | 300002022 |
| Spectrum Analyzer 2 | HP | 85660B | 3138A07614 | |
| Spectrum Analyzer Display 2 | HP | 85662A | 3144A20627 | |

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| | | | | |
|--------------------------------|-----------------|-----------|------------|-----------|
| Signal Generator DC-600 KHz | HP | 8904A | 2822A01213 | 300001157 |
| Signal Generator DC-600 KHz | HP | 8904A | 2822A01214 | 300001158 |
| Powersupply | HP | 6038A | 3122A11097 | 300001204 |
| Netznachbildung | R&S | ESH3-Z5 | 828576/020 | 300001210 |
| Amplituden Controller | R&S | SMDU-Z2 | 871829/051 | 300002309 |
| Trenntrafo | Erfi | 913501 | | 300001205 |
| Trenntrafo | Grundig | RT5A | 9242 | 300001627 |
| Relais Matrix | HP | 3488A | 2719A15013 | 300001156 |
| Multimeter | Siemens | Multizet | | 300001102 |
| Peak Power Calibrator | HP | 8900B | | 300001084 |
| Schallgeber | Schomandl | SG 1 | 10159 | 300001209 |
| Schallgeber | Schomandl | SG 2 | 10176 | 300002473 |
| Filter | FSY Microwave | | | 300001206 |
| Attenuatorer | Pro Nova | | | 300002476 |
| Klimaschrank | Heraeus Voetsch | VUK04/500 | | 300001012 |
| Spectrum Analyzer 3 | HP | 8566A | 1925A00257 | 300001098 |
| Spectrum Analyzer Display 3 | HP | 85662 | 1925A00860 | 300002306 |
| Oszilloscope | Tektronix | 2432 | 110261 | 300001165 |
| Radiocom. Analyzer | R&S | CMTA 54 | 894043/010 | 300001175 |
| Powersupply | HP | 6038A | 2848A07027 | 300001174 |
| Signal Generator 0.01-1280 MHz | HP | 8662A | 2224A01012 | 300001110 |
| Signal Generator (Funktionen) | R&S | AFGU | 862490/032 | 300001201 |
| Trenntrafo | Erfi | MPL | 91350 | 300001155 |
| Relais Matrix | R&S | PSU | 893285/020 | 300001173 |
| Power Meter | HP | 436A | 2101A12378 | 300001136 |
| Powersensor | HP | 8484A | 2237A10156 | 300001140 |
| Powersensor | HP | 8482A | 2237A06016 | 300001139 |
| Relais Matrix | R&S | PSU | 282628/004 | 300001214 |
| Powersupply | Zentro | | 2007 | 300001109 |
| Oszilloscope | Tektronix | 7633 | | 300001111 |
| Klimaschrank | Heraeus Voetsch | VUK04/500 | 32926 | 300001500 |
| Quasi-Peak Adapter | HP | 85650A | 2811A01204 | 300002308 |
| Radiocom. Analyzer | R&S | CMTA 84 | 894199/012 | 300001176 |
| Oszilloscope | HP | 54510A | 3022A02062 | 300001202 |
| Funkmeßplatz | Schomandl | FD1000 | 34982 | 300001115 |
| Signal Generator | R&S | SMPC | 882416/019 | 300001162 |
| Frequency counter | HP | 5340A | 2116A08138 | 300001104 |
| Power Meter | HP | 436A | 2031U01461 | 300001105 |
| Powersensor | HP | 8482A | | 300001106 |
| Powersensor | HP | 8484A | | 300001107 |
| Powersensor | HP | 8485A | | 300001108 |
| Powersupply | HP | 6038A | 2752A04866 | 300001161 |
| Reflectionsmeter | R&S | NAP | 879191 | 300001132 |
| Signal Generator NF | R&S | SPN | 880139/068 | 300001142 |
| Trenntrafo | Erfi | MPL | 91350 | 300001151 |
| Attenuator | JFW | 30 db | 1350h/104 | 300001703 |
| Attenuator | JFW | 10 db | 1350h/103 | 300001704 |
| Attenuator | JFW | 20 db | 1350h/106 | 300001705 |
| Attenuator | JFW | 20 db | 1350h/105 | 300001766 |
| Filter | Spinner | 153755 | | 300001791 |

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|--------------------------------|-----------------|-----------|------------|-----------|
| Powersensor | HP | 8484A | 2237A10494 | 300001666 |
| Powersupply | HP | 6038A | 3122A11097 | 300001204 |
| Netznachbildung | R&S | ESH3-Z5 | 828576/020 | 300001210 |
| Amplituden Controller | R&S | SMDU-Z2 | 871829/051 | 300002309 |
| Trenntrafo | Erfi | 913501 | | 300001205 |
| Trenntrafo | Grundig | RT5A | 9242 | 300001627 |
| Relais Matrix | HP | 3488A | 2719A15013 | 300001156 |
| Multimeter | Siemens | Multizet | | 300001102 |
| Peak Power Calibrator | HP | 8900B | | 300001084 |
| Schallgeber | Schomandl | SG 1 | 10159 | 300001209 |
| Schallgeber | Schomandl | SG 2 | 10176 | 300002473 |
| Filter | FSY Microwave | | | 300001206 |
| Attenuatorer | Pro Nova | | | 300002476 |
| Klimaschrank | Heraeus Voetsch | VUK04/500 | | 300001012 |
| Spectrum Analyzer 3 | HP | 8566A | 1925A00257 | 300001098 |
| Spectrum Analyzer Display 3 | HP | 85662 | 1925A00860 | 300002306 |
| Oszilloscope | Tektronix | 2432 | 110261 | 300001165 |
| Radiocom. Analyzer | R&S | CMTA 54 | 894043/010 | 300001175 |
| Powersupply | HP | 6038A | 2848A07027 | 300001174 |
| Signal Generator 0.01-1280 MHz | HP | 8662A | 2224A01012 | 300001110 |
| Signal Generator (Funkions) | R&S | AFGU | 862490/032 | 300001201 |
| Trenntrafo | Erfi | MPL | 91350 | 300001155 |
| Relais Matrix | R&S | PSU | 893285/020 | 300001173 |
| Power Meter | HP | 436A | 2101A12378 | 300001136 |
| Powersensor | HP | 8484A | 2237A10156 | 300001140 |
| Powersensor | HP | 8482A | 2237A06016 | 300001139 |
| Relais Matrix | R&S | PSU | 282628/004 | 300001214 |
| Powersupply | Zentro | | 2007 | 300001109 |
| Oszilloscope | Tektronix | 7633 | | 300001111 |
| Klimaschrank | Heraeus Voetsch | VUK04/500 | 32926 | 300001500 |
| Quasi-Peak Adapter | HP | 85650A | 2811A01204 | 300002308 |
| Radiocom. Analyzer | R&S | CMTA 84 | 894199/012 | 300001176 |
| Oszilloscope | HP | 54510A | 3022A02062 | 300001202 |
| Funkmeßplatz | Schomandl | FD1000 | 34982 | 300001115 |
| Signal Generator | R&S | SMPC | 882416/019 | 300001162 |
| Frequency counter | HP | 5340A | 2116A08138 | 300001104 |
| Power Meter | HP | 436A | 2031U01461 | 300001105 |
| Powersensor | HP | 8482A | | 300001106 |
| Powersensor | HP | 8484A | | 300001107 |
| Powersensor | HP | 8485A | | 300001108 |
| Powersupply | HP | 6038A | 2752A04866 | 300001161 |
| Reflectionsmeter | R&S | NAP | 879191 | 300001132 |
| Signal Generator NF | R&S | SPN | 880139/068 | 300001142 |
| Trenntrafo | Erfi | MPL | 91350 | 300001151 |
| Attenuator | JFW | 30 db | 1350h/104 | 300001703 |
| Attenuator | JFW | 10 db | 1350h/103 | 300001704 |
| Attenuator | JFW | 20 db | 1350h/106 | 300001705 |
| Attenuator | JFW | 20 db | 1350h/105 | 300001766 |
| Filter | Spinner | 153755 | | 300001791 |
| Powersensor | HP | 8484A | 2237A10494 | 300001666 |

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|-------------------------------|--------------------|--------------------------|------------|-----------|
| Powersensor | HP | 8485A | 2238A00849 | 300001668 |
| Bandfilter | Telonic | TTF7255EE | 20293-11 | 300001300 |
| Bandfilter | Telonic | TTF12555EE | 20292-6 | 300001302 |
| Bandfilter | Telonic | TTF25055EE | 20291-8 | 300001304 |
| Bandfilter | Telonic | TTF50055EE | 20290-7 | 300001305 |
| Bandfilter | Telonic | TTF100055EE | 20289-7 | 300001307 |
| Bandfilter | Telonic | TTA300055EESN | 20370-2 | 300001312 |
| Bandstop | Telonic | TTR3753EE1 | 30013-1 | 300001314 |
| Bandstop | Telonic | TTR723EE | 20417-2 | 300001316 |
| Bandstop | Telonic | TTR95-3EE | 20372-4 | 300001318 |
| Bandstop | Telonic | TTR1903EE | 30036-4 | 300001320 |
| Bandstop | Telonic | TTR3753EE | 20369-5 | 300001321 |
| Bandstop | Telonic | TTR750-3EE1 | 90177-1 | 300002387 |
| Highpass | Pro Nova | HDP120-6GG | ohne | 300001348 |
| Highpass | Pro Nova | HMC500-6AA | HJ67-01? | 300001350 |
| Highpass | Narda | NHP 9000 | 0004 | 300001362 |
| Highpass | Narda | HDP16-6GH | JV70-01 | 300001364 |
| Highpass | RSD | HDP50-6GH, HDP200-6GG | | 300001371 |
| Highpass | RSD | 2099-02-01 | | 300000370 |
| Signal Generator 0.1-2060 MHz | HP | 8657A | 2838U00736 | 300001009 |
| Radio Code Analyzer | Schlumberger | SL4922 | | 300001038 |
| Signal Analyzer | B&K | 2033 | | 300001047 |
| Frequency counter | HP | 5386A | 2704A01243 | 300000998 |
| Laufzeitelement | WR-Elektronik | | | 300001036 |
| Powersupply Stromversorgung | Systron | M5P 40/15A | 828233 | 300001291 |
| Powersupply | Heiden | 1108-32 | 1701 | 300001392 |
| Powersupply | Heiden | 1108-32 | 1802 | 300001383 |
| Powersupply | Heiden | 1108-32 | 003202 | 300001187 |
| Powersupply | Zentro | LA 2x30/5GB1 | 2011 | 300001276 |
| Powersupply | Zentro | LA 2x30/5GB2 | 2012 | 300001275 |
| Powersupply | Zentro | LA 30/5GA | 2041,2042 | 300001287 |
| Trenntrafo | Grundig | RT5A | 8781 | 300001277 |
| Trenntrafo | Grundig | RT5A | 9242 | 300001263 |
| Multimeter | Goerz Elektro | Unigor 6e P | 911 355 | 300001625 |
| Multimeter | Goerz Elektro | Unigor 6e P | 911 391 | 300001281 |
| Climatic Box | Heraeus Voetsch | VUK04/500 | 32679 | 300000299 |
| Powersensor + Att. | HP | 8482B | 2703A02586 | 300001492 |
| Attenuator 30 dB | HP | 8498A | 1801A02445 | 300001475 |
| Signal Generator NF | HP | | 2822A01203 | 300001004 |
| Attenuator | Spinner | BN 534171 D | 51881 | 300001516 |
| Attenuator coaxial | Bird | 8325 | 2429 | 300001513 |
| Impulsbegrenzer | R&S | ESH 3 Z2 | | 300001460 |
| 4Port Box | R&S | 4Port Box | 860457/005 | 300001472 |
| Signal Generator 0.1-4200 MHz | HP | 8665A | 2833A0011 | 300002299 |
| Spektrumanalyzer | R&S | FSU50 | 200012 | 300003443 |
| Swissphone Freifeld-Messbox | Swissphone Schweiz | | | 300002302 |
| Trenntrafo regelbar | Grundig | RT5H | 9242 | 300001628 |
| Signal Generator | HP | 8111A | 2215G00867 | 300001117 |

4 Photographs

Test site:

