EUT: ComFu-E Type 300E
FCC ID: WBNCOMFU300E

Date of issue: 2009-06-29

DAT-P-225/96-02

Test Report
acc. to the relevant standard
47 CFR Part 15 C – Intentional Radiators
Measurement Procedure:
ANSI C63.4 - 2003
relating to
Knick Elektronische Messgeräte GmbH & Co. KG
ComFu-E Type 300E

Measurement of Radio- Noise Emissions
from Low- Voltage Electrical and Electronic Equipment
Technical characteristics and test methods for radio equipment
in the frequency range 9 kHz to 40 GHz

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EUT: ComFu-E Type 300E
FCC ID: WBNCOMFU300E

Date of issue: 2009-06-29

Manufacturer's details	
Manufacturer	Knick Elektronische Meßgeräte GmbH & Co. KG
Manufacturer's grantee code	**WBN**
Manufacturer's address	Beuckestrasse 22
	14163 Berlin
	Germany
	Contact person: Mr. Holger Blaak, Product Management Phone: +49 (30)80191-253 Fax: +49 (30)80191-200 E-mail: blaak@knick.de
Relevant standard used	47 CFR Part 15C - Intentional Radiators
	ANSI C63.4-2003

Test Report prepared by	
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Equipment Under Test (EUT)	
Equipment category	**Wireless Data Transmission**
Trade name	Knick
Type designation	ComFu-E Type 300E
Serial no.	0002762 / 0002763
Variants	---

EUT: ComFu-E Type 300E
FCC ID: WBNCOMFU300E

Date of issue: 2009-06-29

1. Test results

CFR Section	Report Chapter	Requirements Headline	Test result		
15.203	11.1	Antenna requirement	**pass**	~~**fail**~~	~~**n.t.**~~
15.205(a)	11.2	Operation in the restricted bands	**pass**	~~**fail**~~	~~**n.t.**~~
15.209(a)	11.3	Radiated emissions	**pass**	~~**fail**~~	~~**n.t.**~~
15.247(a)(2)	11.4	6 dB bandwidth	**pass**	~~**fail**~~	~~**n.t.**~~
15.247(b)(3)	11.5	Peak output power	**pass**	~~**fail**~~	~~**n.t.**~~
15.247(d)	11.6	Out of band emissions	**pass**	~~**fail**~~	~~**n.t.**~~
15.247(e)	11.7	Power spectral density	**pass**	~~**fail**~~	~~**n.t.**~~

Test requirements kept	**yes**	~~**no**~~

Signature (Technical engineer) Ralf Trepper

Signature (Manager) Manfried Dudde

m. dudde hochfrequenz-technik

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Datum: 2009.06.29 11:17:33 +02'00'

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2. Test laboratory

Company name	: m.dudde hochfrequenz-technik
Street	: Rottland 5a
City	: 51429 Bergisch Gladbach
Country	: Germany
Laboratory	: FCC Registration Number: 699717 This site has been fully described in a report submitted to the FCC, and renewed with letter dated July 12, 2005, Registration Number 699717.
Phone	: +49-2207-9689-0
Fax	: +49-2207-9689-20
E-Mail	: manfred.dudde@t-online.de
Web	: http://www.dudde.com

3. Introduction

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 m. dudde hochfrequenz - technik.

This report contains the result of tests performed by m. dudde hochfrequenz - technik for the purpose of a type approval. The order for carrying out these tests has been placed by:

Manufacturer

Company name	: Knick Elektronische Messgeräte GmbH & Co. KG
Address	: Beuckestrasse 22
Postcode	: D-14163
City/town	: Berlin
Country	: Germany
Telephone	: +49 (30) 80191-253
Fax	: +49 (30) 80191-200
E-mail	: blaak@knick.de
Date of order	: 2009.03.23
References	: Mr. Holger Blaak

4. Product

Samples of the following apparatus were submitted for testing:

Type of equipment	: Wireless Data Transmission
Trademark	: Knick
Type designation	: ComFu-E Type 300E
Hardware version	: ComFu-E Type 300E
Serial number(s)	: 0002762 / 0002763
Software release	: ---
Power used	: 6.0 V DC
Frequency used	: 2.405 MHz to 2.480 MHz Channel 11 to Channel 26 (Zigbee, based on IEEE 802.15.4)
Generated or used frequencies	: 8.00 MHz (crystal), 16.00 MHz (crystal), 2.405 MHz to 2.480 MHz (RF with 5 MHz channel spacing)
FCC ID	: **WBNCOMFU300E**

5. Test schedule

The tests were carried out in accordance with the specifications detailed in chapter 7 “Summary“ of this report at:

- m. dudde hochfrequenz - technik, D-51429 Bergisch Gladbach

The test sample was received on:

- 2009-02-05

The tests were carried out in the following period of time:

- 2009-05-14 - 2009-06-16

6. Product and measurement documentation

For issuing this report the following product documentation was used and the following annexes were created:

Description	Date	Identifications
External photographs of the **E**quipment **U**nder **T**est (EUT)	2009-06-17	Annex no. 1
Internal photographs of the **E**quipment **U**nder **T**est (EUT)	2009-06-17	Annex no. 2
Channel occupancy / bandwidth	2009-06-17	Annex no. 3
FCC ID label sample	2009-06-17	Annex no. 4
Functional description	2009-06-17	Annex no. 5
Test setup photos	2009-06-17	Annex no. 6
Block diagram	2009-06-17	Annex no. 7
Schematics	2009-06-17	Annex no. 8a
Parts list	2009-06-17	Annex no. 8b
Operational description	2009-06-17	Annex no. 9
Antenna description	2009-06-17	Annex no. 10

The above mentioned documentation will be filed at m. dudde hochfrequenz - technik for a period of 10 years following the issue of this report.

7. Observations and comments

8. Summary

The product is intended for the use in the following areas of application:

Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the frequency range of 9 kHz to 40 GHz

The samples were tested according to the following specification:

47 CFR Part 15 – Intentional Radiators, ANSI C63.4 - 2003

9. Conclusions

Samples of the apparatus were found to **CONFORM WITH** the specifications stated in chapter 7 "Summary" of this report.

In the opinion of m. dudde hochfrequenz - technik, the samples satisfied all applicable requirements relating to the network interface types specified in chapter 7 "Summary".

The results of the type tests as stated in this report are exclusively applicable to the product item as identified in this report. m. dudde hochfrequenz - technik does not accept any responsibility for the results stated in this report, with respect to the properties of product items not involved in these tests.

This report consists of a main module, modules with test results and annexes listed in chapter 5:
“Product documentation”. All pages have been numbered consecutively and bear the m. dudde hochfrequenz - technik logo, the report number and sub numbers.
The total number of pages in this report is **40**.

Tester:

Date : 2009-06-29
Name : Ralf Trepper

Signature : 

Technical responsibility for area of testing:

Date : 2009-06-29
Name : Manfried Dudde

Signature : 

10. Operation description

10.1 EUT details

See Annex No. 5 (Users Manual)

10.2 EUT configuration

Testing was carried out using hardware control via dipswitches which allowed the following changes to be made:

- Changes of Channels
- Changes between TX continuous (with and without modulation) and RX continuous operation

10.3 EUT measurement description

Radiated emission test

One configuration will be tested as stand alone device. In order to establish the maximum radiation, firstly, there have been viewed all orthogonal adjustments of the test sample. Secondly the test sample have been rotated at all adjustments around the own axis between 0° and 360°, and thirdly, the antenna polarization between horizontal and vertical has been varied. All generated frequencies, the lowest and the highest frequency of the **ComFu-E Type 300 E,** have been viewed. The device was tested on a stand alone basis.

In all measurement distances the 3 dB beamwidth of the measuring antenna, for measurements above 1 GHz, is greater than the EUT's dimensions.

11.1 Antenna requirement

11.1.1 Regulation

15.203 An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of Part 15C. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31 (d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

11.1.2 Result

The equipment meets the requirements	**yes**	~~**no**~~	~~**n.t.**~~

Further test results are attached	**yes**	~~**no**~~	Annex no: 10

The antenna is integrated in the EUT and can only be replaced by original construction equality antenna.

There is one "½ wave coaxial dipole" with 2 dBi gain. For further descriptions see "Annex no. 10"

11.2 Operation in the restricted bands

11.2.1 Regulation

Section 15.205 Restricted bands of operation

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2] Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

(c) Except as provided in paragraphs (d) and (e), regardless of the field strength limits specified elsewhere in this Subpart, the provisions of this Section apply to emissions from any intentional radiator.

(d) The following devices are exempt from the requirements of this Section:

(1) Swept frequency field disturbance sensors operating between 1.705 and 37 MHz provided their emissions only sweep through the bands listed in paragraph (a), the sweep is never stopped with the fundamental emission within the bands listed in paragraph (a), and the fundamental emission is outside of the bands listed in paragraph (a) more than 99% of the time the device is actively transmitting, without compensation for duty cycle.

(2) Transmitters used to detect buried electronic markers at 101.4 kHz which are employed by telephone companies.

(3) Cable locating equipment operated pursuant to Section 15.213.

(4) Any equipment operated under the provisions of § 15.253, § 15.255 or § 15.257 of this part.

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(5) Biomedical telemetry devices operating under the provisions of Section 15.242 of this part are not subject to the restricted band 608-614 MHz but are subject to compliance within the other restricted bands.

(6) Transmitters operating under the provisions of Subpart D or F of this part.

(7) Devices operated pursuant to § 15.225 are exempt from complying with this section for the 13.36-13.41 MHz band only.

(8) Devices operated in the 24.075-24.175 GHz band under § 15.245 are exempt from complying with the requirements of this section for the 48.15-48.35 GHz and 72.225-72.525 GHz bands only, and shall not exceed the limits specified in § 15.245(b).

(9) Devices operated in the 24.0-24.25 GHz band under § 15.249 are exempt from complying with the requirements of this section for the 48.0-48.5 GHz and 72.0-72.75 GHz bands only, and shall not exceed the limits specified in § 15.249(a).

(e) Harmonic emissions appearing in the restricted bands above 17.7 GHz from field disturbance sensors operating under the provisions of Section 15.245 shall not exceed the limits specified in Section 15.245(b).

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

(c) Except as provided in paragraphs (d) and (e), regardless of the field strength limits specified elsewhere in this Subpart, the provisions of this Section apply to emissions from any intentional radiator. (d) The following devices are exempt from the requirements of this Section:

(1) Swept frequency field disturbance sensors operating between 1.705 and 37 MHz provided their emissions only sweep through the bands listed in paragraph (a), the sweep is never stopped with the fundamental emission within the bands listed in paragraph (a), and the fundamental emission is outside of the bands listed in paragraph (a) more than 99% of the time the device is actively transmitting, without compensation for duty cycle. (2) Transmitters used to detect buried electronic markers at 101.4 kHz which are employed by telephone companies.

(3) Cable locating equipment operated pursuant to Section 15.213.

(4) Any equipment operated under the provisions of § 15.253, § 15.255 or § 15.257 of this part.

(5) Biomedical telemetry devices operating under the provisions of Section 15.242 of this part are not subject to the restricted band 608-614 MHz but are subject to compliance within the other restricted bands.

(6) Transmitters operating under the provisions of Subpart D or F of this part.

(7) Devices operated pursuant to § 15.225 are exempt from complying with this section for the 13.36-13.41 MHz band only.

(8) Devices operated in the 24.075-24.175 GHz band under § 15.245 are exempt from complying with the requirements of this section for the 48.15-48.35 GHz and 72.225-72.525 GHz bands only, and shall not exceed the limits specified in § 15.245(b).

(9) Devices operated in the 24.0-24.25 GHz band under § 15.249 are exempt from 83 complying with the requirements of this section for the 48.0-48.5 GHz and 72.0-72.75 GHz bands only, and shall not exceed the limits specified in § 15.249(a).

(e) Harmonic emissions appearing in the restricted bands above 17.7 GHz from field disturbancesensors operating under the provisions of Section 15.245 shall not exceed the limits specified in Section 15.245(b).

11.2.2 Result

The equipment meets the requirements	**yes**	~~**no**~~	~~**n.t.**~~

Further test results are attached	**yes**	~~**no**~~	page no: **20-25**

11.3 Radiated emissions

11.3.1 Regulation

15.209(a)

Section 15.209 Radiated emission limits, general requirements. (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

(b) In the emission table above, the tighter limit applies at the band edges.
(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other Sections within this Part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

(d) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

(e) The provisions in Sections 15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this Part.

(f) In accordance with Section 15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in Section 15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in Section 15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit. Emissions which must be measured above the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator and which fall within the restricted bands shall comply with the general radiated emission limits in Section 15.109 that are applicable to the incorporated digital device.

(g) Perimeter protection systems may operate in the 54-72 MHz and 76-88 MHz bands under the provisions of this section. The use of such perimeter protection systems is limited to industrial, business and commercial applications.

11.3.2 Test equipment

Type	Manufacturer/ Model no.	Serial no.	Last calibration	Next calibration
Receiver (9 kHz –18.0 GHz)	Rohde & Schwarz Spectrum Analyzer FSL 18 (171a)	100.117	2008/10	2010/10
Receiver (9 kHz –40.0 GHz)	Anritsu Spectrum Analyzer MS2668C (359a)	6200163244	2009/04	2011/04
Pre-amplifier (100kHz - 1.3GHz)	Hewlett Packard 8447 E (166a)	1726A00705	2008/02	2010/02
Pre-amplifier (1GHz - 18GHz)	Narda --- (345)	---	2008/02	2010/02
Bilog antenna (30- 1000 MHz)	Schwarzbeck VULP 9168 (406)		2007/02	2013/02
Horn antenna (0.86-8.5 GHz)	Schwarzbeck BBHA 9120 A (284)	236	2008/01	2013/01
Horn antenna (2.0-14.0 GHz)	Schwarzbeck BBHA 9120 C (169)	305	2008/01	2013/01
RF- cable	Kabelmetal 18m [N]	K1	2009/01	2010/01
RF- cable	Aircell 0.5m [BNC]	K40	2009/01	2010/01
RF- cable	Aircell 1m [BNC/N]	K56	2009/01	2010/01
RF- cable	Sucoflex 106 Suhner 6,4m [N]	K74	2009/01	2010/01
RF- cable	Sucoflex 106 Suhner 6,4m [N]	K75	2009/01	2010/01

11.3.3 Test procedures

The EUT and this peripheral (when additional equipment exists) are placed on a turn table which is 0.8m above the ground. The turn table would be allowed to rotate 360 degrees to determine the position of the maximum emission level. The test distance between the EUT and the receiving antenna are 3 m. To find the maximum emission, the polarization of the receiving antenna are changed in horizontal and vertical polarization, the position of the EUT was changed in different orthogonal determinations.

ANSI C63.4: 2003 Section 8 "Radiated Emissions Testing"

Radiated emissions test characteristics	
Frequency range	0.009 MHz - 10,000 MHz
Test distance	3 m*(for frequencies above 30 MHz)
Test instrumentation resolution bandwidth	9 kHz (0.009 – 30MHz)
	120 kHz (30 MHz - 1,000 MHz)
	1 MHz (1000 MHz - 10,000 MHz)
Receive antenna scan height	1 m (0.009 MHz - 30 MHz)
	1 m - 4 m (30 MHz - 10,000 MHz)
Receive antenna polarization / orientation	0 – 360°
	Vertical / horizontal (30 MHz - 1,000 MHz)

* According to Section 15.31 (f)(1): At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

11.3.4 Calculation of field strength Section 15.209 below 30 MHz

The receiver reading gives not directly the field strength result in (dBµV/m). The antenna factors of the loop antenna and cable losses must be added to find the correct result.

For frequencies below 30 MHz and for a test distance other than what is specified, but fulfilling the requirements of Section 15.31 (f) (2) the field strength is calculated by adding additionally an extrapolation factor of 40 dB/decade (inverse linear distance for field strength measurements).

The field strength is calculated by the following calculation:

Corrected Level = Receiver Level + Correction Factor

Corrected Level = Receiver Level + Correction Factor – Pre-amplifier (with the use of a pre-amplifier)

Receiver Level : Receiver reading without correction factors
Correction Factor : Loop antenna factor + cable loss

FS = 40.7 - 40 = 0.7 [dBµV/m]

Level in µV/m Common Antilogarithm (0.7/20) = 1.1

11.3.5 Calculation of field strength Section 15.209 above 30 MHz

The field strength is calculated by the following calculation:

Corrected Level = Receiver Level + Correction Factor (without the use of a pre-amplifier)

Corrected Level = Receiver Level + Correction Factor – Pre-amplifier (with the use of a pre-amplifier)

Receiver Level : Receiver reading without correction factors
Correction Factor : Antenna factor + cable loss

For test distance other than what is specified, but fulfilling the requirements of Section 15.31 (f) (1) the field strength is calculated by adding additionally an extrapolation factor of 20 dB/decade (inverse linear distance for field strength measurements).

11.3.6 Calculation of average correction factor

The average correction factor is computed by analyzing the "worst case" on time in any 100msec time period and using the formula: Corrections Factor + 20*log (worst case on time/100msec) Analysis of the remote transmitter worst case on time in any 100msec time period is an on time of 50msec, therefore the correction factor is 20*log (50/100) = - 6 dB. The maximum correction factor to be applied is 20 dB per section 15.35 of the FCC rules.

11.3.7 Calculation of the field strength Section 15.247

The field strength is calculated by the following calculation:

Corrected Level = Receiver Level + Correction Factor (without the use of a pre-amplifier)

Corrected Level = Receiver Level + Correction Factor – Pre-amplifier (with the use of a pre-amplifier)

Receiver Level : Receiver reading without correction factors
Correction Factor : Antenna factor + cable loss

For example:

The receiver reading is 32.7 dBµV. The antenna factor for the measured frequency is +2.5 dB (1/m) and the cable factor for the measured frequency is 0.71 dB, giving a field strength of 35.91dBµV/m.
The 35.91dBµV/m value can be mathematically converted to its corresponding level in µV/m.

Level in µV/m = Common Antilogarithm (35.91/20) = 39.8

For a test distance other than what is specified, but fulfilling the requirements of Section 15.31 (f) (1), the field strength is calculated by adding additionally an extrapolation factor of 20dB/decade (inverse linear distance for field strength measurements).

11.3.8 Result

(lowest frequency)(2.405 GHz)

TRANSMITTER SPURIOUS RADIATION BELOW 30 MHz (Section 15.205, 15.209)									
f (MHz)	Bandwidth (kHz) Type of detector	Noted receiver level **dBµV**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	Level corrected **dBµV/m**	Limit **dBµV/m**	Margin **dBµV/m**	Polarisation EUT / antenna orientation
0.1200	*PK/0.2kHz*	*< 4.0*	*10*	20.2	*-59.1*	-34.90	*Pk46.0- @ 300*	80.90	V, H/0-360°
	AV/0.2kHz	*< 4.0*	*10*	20.2	*-59.1*	-34.90	*AV26.0 @ 300*	80.90	V, H/0-360°
0.5000	*AV/0.2kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV33.6 @ 30*	28.5	V, H/0-360°
1.5000	*AV/0.2kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV24.1 @ 30*	19.00	V, H/0-360°
3.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
5.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
8.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
10.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
20.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
30.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
No emissions detected									
Measurement uncertainty		± 4 dB							

(lowest frequency)(2.405 GHz)

TRANSMITTER SPURIOUS RADIATION ABOVE 30 MHz (Section 15.205, 15.209)

f (MHz)	Bandwidth (kHz) Type of detector	Noted receiver level dBµV	Test distance m	Correction factor dB	Distance extrapol. factor dB	AV Correction factor dB	Level corrected dBµV/m	Limit dBµV/m	Margin dBµV/m	Polaris. EUT / antenna	Antenna height cm
30.0000	100, AV	≤ 3.5	3	-2.6*[5]	0	0	0.9	40.0	39.10	H,V/H,V	100-400
88.0000	100, AV	≤ 3.5	3	-10.8*[5]	0	0	-7.3	40.0	47.3	H,V/H,V	100-400
216.0000	100, AV	≤ 3.5	3	-10.3*[5]	0	0	-6.8	43.5	50.3	H,V/H,V	100-400
960.0000	100, AV	≤ 3.5	3	8.5*[5]	0	0	12.0	43.5	31.5	H,V/H,V	100-400
1700.0000	1000, AV	≤ 4.5	3	3.8*[6]	0	0	8.3	54.0	45.7	H,V/H,V	100-400
2800.0000	1000, AV	≤ 10	3	8.1*[6]	0	0	18.1	54.0	35.9	H,V/H,V	100-400
4000.0000	1000, AV	≤ 10	3	8.3*[6]	0	0	18.3	54.0	35.7	H,V/H,V	100-400
4810.0000	**1000, AV**	**29.4**	**3**	**8.9*[6]**	**0**	**0**	**38.3**	**54.0**	**15.7**	**V,180°/V**	**189**
5400.0000	1000, AV	≤ 10	3	9.2*[6]	0	0	19.2	54.0	34.8	H,V/H,V	100-400
7500.0000	1000, AV	≤ 14	3	12.9*[6]	0	0	26.9	54.0	27.1	H,V/H,V	100-400
8250.0000	1000, AV	≤ 14	3	14.8*[6]	0	0	28.8	54.0	25.2	H,V/H,V	100-400
9100.0000	1000, AV	≤ 14	3	15.9*[6]	0	0	29.9	54.0	24.1	H,V/H,V	100-400
11000.000	1000, AV	≤ 14	3	18.3*[6]	0	0	32.3	54.0	21.7	H,V/H,V	100-400
12025.000	**1000, AV**	**≤ 14**	**3**	**19.0*[6]**	**0**	**0**	**33.0**	**54.0**	**21.0**	**H,V/H,V**	**100-400**
14430.000	**1000, AV**	**≤ 14**	**3**	**23.3*[6]**	**0**	**0**	**37.3**	**54.0**	**16.7**	**H,V/H,V**	**100-400**
19240.000	**1000, AV**	**≤ 21**	**1**	**21.5*[7]**	**9.5**	**0**	**42.5**	**54.0**	**11.5**	**H,V/H,V**	**100-300**
Measurement uncertainty	± 4 dB										

Bandwidth = the measuring receiver bandwidth

Remark: *[1] noise floor noise level of the measuring instrument ≤ 3.5 dBµV @ 3m distance (30 – 1,000 MHz)
Remark: *[2] noise floor noise level of the measuring instrument ≤ 4.5 dBµV @ 3m distance (1,000 – 2,000 MHz)
Remark: *[3] noise floor noise level of the measuring instrument ≤ 10 dBµV @ 3m distance (2,000 – 5,500 MHz)
Remark: *[4] noise floor noise level of the measuring instrument ≤ 14 dBµV @ 3m distance (5,500 – 14,500 MHz)
Remark: *[5] for using a pre-amplifier in the range between 100 kHz and 1,000 MHz
Remark: *[6] for using a pre-amplifier in the range between 1.0 GHz and 18.0 GHz
Remark: *[7] for using a pre-amplifier in the range between 18.0 GHz and 27.5 GHz
Remark: *[8] noise floor noise level of the measuring instrument ≤ 21 dBµV @ 3m distance (14,500 – 27,500 MHz)

The equipment meets the requirements	**yes**	~~**no**~~	~~**n.t.**~~

Further test results are attached	~~**yes**~~	**no**	page no:

(middle frequency)(2.445 GHz)

TRANSMITTER SPURIOUS RADIATION BELOW 30 MHz (Section 15.205, 15.209)

f (MHz)	Bandwidth (kHz) Type of detector	Noted receiver level **dBµV**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	Level corrected **dBµV/m**	Limit **dBµV/m**	Margin **dBµV/m**	Polarisation EUT / antenna orientation
0.1200	*PK/0.2kHz*	*< 4.0*	*10*	20.2	*-59.1*	-34.90	*Pk46.0- @ 300*	80.90	V, H/0-360°
	AV/0.2kHz	*< 4.0*	*10*	20.2	*-59.1*	-34.90	*AV26.0 @ 300*	80.90	V, H/0-360°
0.5000	*AV/0.2kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV33.6 @ 30*	28.5	V, H/0-360°
1.5000	*AV/0.2kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV24.1 @ 30*	19.00	V, H/0-360°
3.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
5.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
8.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
10.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
20.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
30.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
No emissions detected									
Measurement uncertainty	± 4 dB								

Remark: *[1] Noise level of the measuring instrument ≤ 4.0dBµV @ 10m distance (0.009 MHz –30 MHz)

(middle frequency)(2.445 GHz)

TRANSMITTER SPURIOUS RADIATION ABOVE 30 MHz (Section 15.205, 15.209)

f (MHz)	Bandwidth (kHz) Type of detector	Noted receiver level **dBµV**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	AV Correction factor **dB**	Level corrected **dBµV/m**	Limit **dBµV/m**	Margin **dBµV/m**	Polaris. EUT / antenna	Antenna height **cm**
30.0000	100, AV	≤ 3.5	3	-2.6*[5]	0	0	0.9	40.0	39.10	H,V/H,V	100-400
88.0000	100, AV	≤ 3.5	3	-10.8*[5]	0	0	-7.3	40.0	47.3	H,V/H,V	100-400
216.0000	100, AV	≤ 3.5	3	-10.3*[5]	0	0	-6.8	43.5	50.3	H,V/H,V	100-400
960.0000	100, AV	≤ 3.5	3	8.5*[5]	0	0	12.0	43.5	31.5	H,V/H,V	100-400
1700.0000	1000, AV	≤ 4.5	3	3.8*[6]	0	0	8.3	54.0	45.7	H,V/H,V	100-400
2800.0000	1000, AV	≤ 10	3	8.1*[6]	0	0	18.1	54.0	35.9	H,V/H,V	100-400
4000.0000	1000, AV	≤ 10	3	8.3*[6]	0	0	18.3	54.0	35.7	H,V/H,V	100-400
4890.0000	**1000, AV**	**28.0**	**3**	**9.0*[6]**	**0**	**0**	**37.0**	**54.0**	**17.0**	**V,180°/V**	**230**
5400.0000	1000, AV	≤ 10	3	9.2*[6]	0	0	19.2	54.0	34.8	H,V/H,V	100-400
7335.0000	**1000, AV**	**16.4**	**3**	**13.1*[6]**	**0**	**0**	**29.5**	**54.0**	**24.5**	**V,180°/V**	**129**
8250.0000	1000, AV	≤ 14	3	14.8*[6]	0	0	28.8	54.0	25.2	H,V/H,V	100-400
9100.0000	1000, AV	≤ 14	3	15.9*[6]	0	0	29.9	54.0	24.1	H,V/H,V	100-400
11000.000	1000, AV	≤ 14	3	18.3*[6]	0	0	32.3	54.0	21.7	H,V/H,V	100-400
12225.000	**1000, AV**	**≤ 14**	**3**	**19.0*[6]**	**0**	**0**	**33.0**	**54.0**	**21.0**	**H,V/H,V**	**100-400**
14490.000	1000, AV	≤ 14	3	23.3*[6]	0	0	37.3	54.0	16.7	H,V/H,V	100-400
19560.000	**1000, AV**	**≤ 21**	**1**	**22.0*[7]**	**-9.5**	**0**	**43.0**	**54.0**	**11.0**	**H,V/H,V**	**100-300**
Measurement uncertainty	± 4 dB										

Bandwidth = the measuring receiver bandwidth

Remark: *[1] noise floor noise level of the measuring instrument ≤ 3.5 dBµV @ 3m distance (30 – 1,000 MHz)
Remark: *[2] noise floor noise level of the measuring instrument ≤ 4.5 dBµV @ 3m distance (1,000 – 2,000 MHz)
Remark: *[3] noise floor noise level of the measuring instrument ≤ 10 dBµV @ 3m distance (2,000 – 5,500 MHz)
Remark: *[4] noise floor noise level of the measuring instrument ≤ 14 dBµV @ 3m distance (5,500 – 14,500 MHz)
Remark: *[5] for using a pre-amplifier in the range between 100 kHz and 1,000 MHz
Remark: *[6] for using a pre-amplifier in the range between 1.0 GHz and 18.0 GHz
Remark: *[7] for using a pre-amplifier in the range between 18.0 GHz and 27.5 GHz
Remark: *[8] noise floor noise level of the measuring instrument ≤ 21 dBµV @ 3m distance (14,500 – 27,500 MHz)

The equipment meets the requirements	**yes**	~~**no**~~	~~**n.t.**~~

Further test results are attached	~~**yes**~~	**no**	page no:

EUT: ComFu-E Type 300E
FCC ID: WBNCOMFU300E

Date of issue: 2009-06-29

(highest frequency)(2.480 GHz)

TRANSMITTER SPURIOUS RADIATION BELOW 30 MHz (Section 15.205, 15.209)

f (MHz)	Bandwidth (kHz) Type of detector	Noted receiver level **dBµV**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	Level corrected **dBµV/m**	Limit **dBµV/m**	Margin **dBµV/m**	Polarisation EUT / antenna orientation
0.1200	*PK/0.2kHz*	*< 4.0*	*10*	20.2	*-59.1*	-34.90	*Pk46.0- @ 300*	80.90	V, H/0-360°
	AV/0.2kHz	*< 4.0*	*10*	20.2	*-59.1*	-34.90	*AV26.0 @ 300*	80.90	V, H/0-360°
0.5000	*AV/0.2kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV33.6 @ 30*	28.5	V, H/0-360°
1.5000	*AV/0.2kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV24.1 @ 30*	19.00	V, H/0-360°
3.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
5.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
8.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
10.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
20.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
30.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
No emissions detected									
Measurement uncertainty			± 4 dB						

Remark: *[1] Noise level of the measuring instrument ≤ 4.0dBµV @ 10m distance (0.009 MHz –30 MHz)

(highest frequency)(2.480 GHz)

TRANSMITTER SPURIOUS RADIATION ABOVE 30 MHz (Section 15.205, 15.209)

f (MHz)	Bandwidth (kHz) Type of detector	Noted receiver level **dBµV**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	AV Correction factor **dB**	Level corrected **dBµV/m**	Limit **dBµV/m**	Margin **dBµV/m**	Polaris. EUT / antenna	Antenna height **cm**
30.0000	100, AV	≤ 3.5	3	-2.6*[5]	0	0	0.9	40.0	39.10	H,V/H,V	100-400
88.0000	100, AV	≤ 3.5	3	-10.8*[5]	0	0	-7.3	40.0	47.3	H,V/H,V	100-400
216.0000	100, AV	≤ 3.5	3	-10.3*[5]	0	0	-6.8	43.5	50.3	H,V/H,V	100-400
960.0000	100, AV	≤ 3.5	3	8.5*[5]	0	0	12.0	43.5	31.5	H,V/H,V	100-400
1700.0000	1000, AV	≤ 4.5	3	3.8*[6]	0	0	8.3	54.0	45.7	H,V/H,V	100-400
2800.0000	1000, AV	≤ 10	3	8.1*[6]	0	0	18.1	54.0	35.9	H,V/H,V	100-400
4000.0000	1000, AV	≤ 10	3	8.3*[6]	0	0	18.3	54.0	35.7	H,V/H,V	100-400
4960.0000	**1000, AV**	**27.6**	**3**	**9.0*[6]**	**0**	**0**	**36.6**	**54.0**	**17.4**	**V,180°/V**	**241**
5400.0000	1000, AV	≤ 10	3	9.2*[6]	0	0	19.2	54.0	34.8	H,V/H,V	100-400
7440.0000	**1000, AV**	**15.7**	**3**	**13.1*[6]**	**0**	**0**	**28.8**	**54.0**	**25.2**	**V,180°/V**	**140**
8250.0000	1000, AV	≤ 14	3	14.8*[6]	0	0	28.8	54.0	25.2	H,V/H,V	100-400
9100.0000	1000, AV	≤ 14	3	15.9*[6]	0	0	29.9	54.0	24.1	H,V/H,V	100-400
11000.000	1000, AV	≤ 14	3	18.3*[6]	0	0	32.3	54.0	21.7	H,V/H,V	100-400
12400.000	**1000, AV**	**≤ 14**	**3**	**19.0*[6]**	**0**	**0**	**33.0**	**54.0**	**21.0**	**H,V/H,V**	**100-400**
14490.000	1000, AV	≤ 14	3	23.3*[6]	0	0	37.3	54.0	16.7	H,V/H,V	100-400
19840.000	**1000, AV**	**≤ 21**	**1**	**22.0*[7]**	**-9.5**	**0**	**43.0**	**54.0**	**11.0**	**H,V/H,V**	**100-300**
Measurement uncertainty	± 4 dB										

Bandwidth = the measuring receiver bandwidth

Remark: *[1] noise floor noise level of the measuring instrument ≤ 3.5 dBµV @ 3m distance (30 – 1,000 MHz)
Remark: *[2] noise floor noise level of the measuring instrument ≤ 4.5 dBµV @ 3m distance (1,000 – 2,000 MHz)
Remark: *[3] noise floor noise level of the measuring instrument ≤ 10 dBµV @ 3m distance (2,000 – 5,500 MHz)
Remark: *[4] noise floor noise level of the measuring instrument ≤ 14 dBµV @ 3m distance (5,500 – 14,500 MHz)
Remark: *[5] for using a pre-amplifier in the range between 100 kHz and 1,000 MHz
Remark: *[6] for using a pre-amplifier in the range between 1.0 GHz and 18.0 GHz
Remark: *[7] for using a pre-amplifier in the range between 18.0 GHz and 27.5 GHz
Remark: *[8] noise floor noise level of the measuring instrument ≤ 21 dBµV @ 3m distance (14,500 – 27,500 MHz)

The equipment meets the requirements	**yes**	~~**no**~~	~~**n.t.**~~

Further test results are attached	~~**yes**~~	**no**	page no:

11.4 6 dB bandwidth

11.4.1 Regulation

15.247(a)(2) Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

11.4.2 Test equipment

Type	Manufacturer/ Model no.	Serial no.	Last calibration	Next calibration
Receiver **(9 kHz –18.0 GHz)**	**Rohde & Schwarz Spectrum Analyzer FSL 18 (171a)**	**100.117**	**2008/10**	**2010/10**
Probe for relative measurement (2.3 – 2.5 GHz)	**Dudde (325)**	**---**	**2009/03**	**2010/03**

11.4.3 Test procedures

Measurements were carried out on lowest and highest single frequencies across the operating range.

11.4.4 Result

The equipment meets the requirements	**yes**	~~**no**~~	~~**n.t.**~~

Further test results are attached	**yes**	~~**no**~~	Annex no. 3

11.5 Peak output power

11.5.1 Regulation

15.247(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

11.5.2 Test equipment

Type	Manufacturer/ Model no.	Serial no.	Last calibration	Next calibration
Receiver (9 kHz –18.0 GHz)	Rohde & Schwarz Spectrum Analyzer FSL 18 (171a)	100.117	2008/10	2010/10
Receiver (9 kHz –40.0 GHz)	Anritsu Spectrum Analyzer MS2668C (359a)	6200163244	2009/04	2011/04
Pre-amplifier (100kHz - 1.3GHz)	Hewlett Packard 8447 E (166a)	1726A00705	2008/02	2010/02
Pre-amplifier (1GHz - 18GHz)	Narda --- (345)	---	2008/02	2010/02
Bilog antenna (30- 1000 MHz)	Schwarzbeck VULP 9168 (406)		2007/02	2013/02
Horn antenna (0.86-8.5 GHz)	Schwarzbeck BBHA 9120 A (284)	236	2008/01	2013/01
Horn antenna (2.0-14.0 GHz)	Schwarzbeck BBHA 9120 C (169)	305	2008/01	2013/01
RF- cable	Kabelmetal 18m [N]	K1	2009/01	2010/01
RF- cable	Aircell 0.5m [BNC]	K40	2009/01	2010/01
RF- cable	Aircell 1m [BNC/N]	K56	2009/01	2010/01
RF- cable	Sucoflex 106 Suhner 6,4m [N]	K74	2009/01	2010/01
RF- cable	Sucoflex 106 Suhner 6,4m [N]	K75	2009/01	2010/01

11.5.3 Test procedures

The EUT and this peripheral (when additional equipment exists) are placed on a turn table which is 0.8m above the ground. The turn table would be allowed to rotate 360 degrees to determine the position of the maximum emission level. The test distance between the EUT and the receiving antenna are 3 m. To find the maximum emission, the polarization of the receiving antenna are changed in horizontal and vertical polarization, the position of the EUT was changed in different orthogonal determinations.
ANSI C63.4: 2003 Section 8 “Radiated Emissions Testing”

Radiated emissions test characteristics	
Frequency range	0.009 MHz - 14,000 MHz
Test distance	3 m*(for frequencies above 30 MHz)
Test instrumentation resolution bandwidth	9 kHz (0.009 – 30MHz)
	120 kHz (30 MHz - 1,000 MHz)
	1 MHz (1000 MHz - 10,000 MHz)
Receive antenna scan height	1 m (0.009 MHz - 30 MHz)
	1 m - 4 m (30 MHz - 14,000 MHz)
Receive antenna polarization / orientation	0 – 360°
	Vertical / horizontal (30 MHz - 14,000 MHz)

11.5.4 Calculation of the radiated power

The radiated power is calculated by the following calculation:

Corrected Level = Receiver Level + Correction Factor (without the use of a pre-amplifier)

Corrected Level = Receiver Level + Correction Factor – Pre-amplifier (with the use of a pre-amplifier)

Receiver Level : Receiver reading without correction factors
Correction Factor : Substituted over the whole frequency band and listed in an correction table

For example:

The receiver reading is -32.7 dBm. The Correction Factor with the use of a pre-amplifier for the measured frequency of 434 MHz is +12.5 dB and the cable factor for the measured frequency is 0.71 dB, giving a power level of -19.49 dBm.
-19.49 dBm = 11.25 µW

11.5.5 Result

Radiated measurement was carried out, because the antennas are integrated types!

(lowest frequency)(2.405 GHz)

PEAK OUTPUT POWER (Section 15.247 (b)(2))											
f (GHz)	Bandwidth (kHz) Type of detector	Noted receiver level **dBm**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	AV Correction factor **dB**	Level corrected **dBm (E.I.R.P)**	Limit **dBm**	Margin **dB**	Polaris. EUT / antenna	Antenna height **cm**
2.405	**1000, PK**	**-14.4**	**3**	**22.8*[6]**	**0**	**0**	**8.4**	**30**	**21.6**	**V,180°/V**	**160**
	1000, PK	**-27.4**	**3**	**22.5*[6]**	**0**	**0**	**-4.9**	**30**	**34.9**	**V, 0°/H**	**260**
	1000, PK	**-28.5**	**3**	**22.8*[6]**	**0**	**0**	**-5.7**	**30**	**35.7**	**H, 270°/V**	**133**
	1000, PK	**-30.1**	**3**	**22.5*[6]**	**0**	**0**	**-7.6**	**30**	**37.6**	**H,240°/H**	**126**
Measurement uncertainty		± 3 dB									

* Bandwidth = the measuring receiver bandwidth

(middle frequency)(2.445 GHz)

PEAK OUTPUT POWER (Section 15.247 (b)(2))											
f (GHz)	Bandwidth (kHz) Type of detector	Noted receiver level **dBm**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	AV Correction factor **dB**	Level corrected **dBm (E.I.R.P)**	Limit **dBm**	Margin **dB**	Polaris. EUT / antenna	Antenna height **cm**
2.445	**1000, PK**	**-14.5**	**3**	**22.8*[6]**	**0**	**0**	**8.3**	**30**	**21.7**	**V,180°/V**	**142**
	1000, PK	**-27.5**	**3**	**22.5*[6]**	**0**	**0**	**-5.0**	**30**	**35.0**	**V, 0°/H**	**245**
	1000, PK	**-28.6**	**3**	**22.8*[6]**	**0**	**0**	**-5.8**	**30**	**35.8**	**H, 270°/V**	**130**
	1000, PK	**-30.3**	**3**	**22.5*[6]**	**0**	**0**	**-7.8**	**30**	**37.8**	**H,240°/H**	**125**
Measurement uncertainty		± 3 dB									

* Bandwidth = the measuring receiver bandwidth

EUT: ComFu-E Type 300E
FCC ID: WBNCOMFU300E

Date of issue: 2009-06-29

(highest frequency)(2.480 GHz)

PEAK OUTPUT POWER (Section 15.247 (b)(2))											
f (GHz)	Bandwidth (kHz) Type of detector	Noted receiver level **dBm**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	AV Correction factor **dB**	Level corrected **dBm (E.I.R.P)**	Limit **dBm**	Margin **dB**	Polaris. EUT / antenna	Antenna height **cm**
2.480	**1000, PK**	**-14.3**	**3**	**22.8*[6]**	**0**	**0**	**8.5**	**30**	**21.5**	**V,180°/V**	**105**
	1000, PK	**-27.7**	**3**	**22.5*[6]**	**0**	**0**	**-5.2**	**30**	**35.2**	**V, 0°/H**	**246**
	1000, PK	**-28.2**	**3**	**22.8*[6]**	**0**	**0**	**-5.4**	**30**	**35.4**	**H, 270°/V**	**137**
	1000, PK	**-30.4**	**3**	**22.5*[6]**	**0**	**0**	**-7.9**	**30**	**37.9**	**H,240°/H**	**120**
Measurement uncertainty	± 3 dB										

* Bandwidth = the measuring receiver bandwidth

Remark: *[1] noise floor noise level of the measuring instrument ≤ -103 dBm @ 3m distance (30 – 1,000 MHz)
Remark: *[2] noise floor noise level of the measuring instrument ≤ -102 dBm @ 3m distance (1,000 – 2,000 MHz)
Remark: *[3] noise floor noise level of the measuring instrument ≤ -96 dBm @ 3m distance (2,000 – 5,500 MHz)
Remark: *[4] noise floor noise level of the measuring instrument ≤ -92 dBm @ 3m distance (5,500 – 14,500 MHz)
Remark: *[5] for using a pre-amplifier in the range between 100 kHz and 1,000 MHz
Remark: *[6] for using a pre-amplifier in the range between 1.0 GHz and 18.0 GHz

The equipment meets the requirements	**yes**	~~**no**~~	~~**n.t.**~~

Further test results are attached	~~**yes**~~	**no**	page no:

11.6 Out of band emissions

11.6.1 Regulation

15.247(d) 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. 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 15.205(c)).

11.6.2 Test equipment

Type	Manufacturer/ Model no.	Serial no.	Last calibration	Next calibration
Receiver (9 kHz –18.0 GHz)	Rohde & Schwarz Spectrum Analyzer FSL 18 (171a)	100.117	2008/10	2010/10
Receiver (9 kHz –40.0 GHz)	Anritsu Spectrum Analyzer MS2668C (359a)	6200163244	2009/04	2011/04
Pre-amplifier (100kHz - 1.3GHz)	Hewlett Packard 8447 E (166a)	1726A00705	2008/02	2010/02
Pre-amplifier (1GHz - 18GHz)	Narda --- (345)	---	2008/02	2010/02
Bilog antenna (30- 1000 MHz)	Schwarzbeck VULP 9168 (406)		2007/02	2013/02
Horn antenna (0.86-8.5 GHz)	Schwarzbeck BBHA 9120 A (284)	236	2008/01	2013/01
Horn antenna (2.0-14.0 GHz)	Schwarzbeck BBHA 9120 C (169)	305	2008/01	2013/01
RF- cable	Kabelmetal 18m [N]	K1	2009/01	2010/01
RF- cable	Aircell 0.5m [BNC]	K40	2009/01	2010/01
RF- cable	Aircell 1m [BNC/N]	K56	2009/01	2010/01
RF- cable	Sucoflex 106 Suhner 6,4m [N]	K74	2009/01	2010/01
RF- cable	Sucoflex 106 Suhner 6,4m [N]	K75	2009/01	2010/01

11.6.3 Test procedures

The EUT and this peripheral (when additional equipment exists) are placed on a turn table which is 0.8m above the ground. The turn table would be allowed to rotate 360 degrees to determine the position of the maximum emission level. The test distance between the EUT and the receiving antenna are 3 m. To find the maximum emission, the polarization of the receiving antenna are changed in horizontal and vertical polarization, the position of the EUT was changed in different orthogonal determinations.
ANSI C63.4: 2003 Section 8 “Radiated Emissions Testing”

Radiated emissions test characteristics	
Frequency range	0.009 MHz - 14,000 MHz
Test distance	3 m*(for frequencies above 30 MHz)
Test instrumentation resolution bandwidth	9 kHz (0.009 – 30MHz)
	120 kHz (30 MHz - 1,000 MHz)
	1 MHz (1000 MHz - 10,000 MHz)
Receive antenna scan height	1 m (0.009 MHz - 30 MHz)
	1 m - 4 m (30 MHz - 14,000 MHz)
Receive antenna polarization / orientation	0 – 360°
	Vertical / horizontal (30 MHz - 14,000 MHz)

11.6.4 Calculation of the radiated power

The radiated power is calculated by the following calculation:

Corrected Level = Receiver Level + Correction Factor (without the use of a pre-amplifier)

Corrected Level = Receiver Level + Correction Factor – Pre-amplifier (with the use of a pre-amplifier)

Receiver Level : Receiver reading without correction factors
Correction Factor : Substituted over the whole frequency band and listed in an correction table

For example:

The receiver reading is -32.7 dBm. The Correction Factor with the use of a pre-amplifier for the measured frequency of 434 MHz is +12.5 dB and the cable factor for the measured frequency is 0.71 dB, giving a power level of -19.49 dBm.
-19.49 dBm = 11.25 µW

11.6.5 Result

(lowest frequency)

OUT OF BAND EMISSION (Section 15.247 (c))											
f (GHz)	Bandwidth (kHz) Type of detector	Noted receiver level **dBm**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	AV Correction factor **dB**	Level corrected **dBm**	Limit **dBm**	Margin **dB**	Polaris. EUT / antenna	Antenna height **cm**
2.3844	100, PK	≤-92	3	16.3*[6]	0	0	-75.7	10	85.7	H,V/H,V	100-400
7.2150	**100, PK**	**-79.5**	**3**	**25.7*[6]**	**0**	**0**	**-53.8**	**10**	**64.2**	**V,180°/V**	**113**
9.6200	100, PK	≤-92	3	29.1*[6]	0	0	-62.9	10	72.9	H,V/H,V	100-400
16.8350	100, PK	≤-70	1	26.0*[6]	-9.5	0	-53.5	10	63.5	H,V/H,V	100-250
21.6450	100, PK	≤-70	1	28.9*[7]	-9.5	0	-50.6	10	60.6	H,V/H,V	100-250
24.0500	100, PK	≤-70	1	28.9*[7]	-9.5	0	-50.6	10	60.6	H,V/H,V	100-250
26.4550	100, PK	≤-70	1	28.5*[7]	-9.5	0	-51.0	10	61.0	H,V/H,V	100-250
All other emissions lower than the ambient noise level of the measurement instruments!											
Measurement uncertainty	± 4 dB										

* Bandwidth = the measuring receiver bandwidth

EUT: ComFu-E Type 300E
FCC ID: WBNCOMFU300E

Date of issue: 2009-06-29

(middle frequency)

OUT OF BAND EMISSION (Section 15.247 (c))

f (GHz)	Bandwidth (kHz) Type of detector	Noted receiver level **dBm**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	AV Correction factor **dB**	Level corrected **dBm**	Limit **dBm**	Margin **dB**	Polaris. EUT / antenna	Antenna height **cm**
9.7800	100, PK	≤-92	3	29.1*[6]	0	0	-62.9	10	72.9	H,V/H,V	100-400
14.6700	100, PK	≤-70	1	25.8*[6]	-9.5	0	-53.7	10	63.7	H,V/H,V	100-250
17.1150	100, PK	≤-70	1	26.0*[6]	-9.5	0	-53.5	10	63.5	H,V/H,V	100-250
22.0050	100, PK	≤-70	1	28.9*[7]	-9.5	0	-50.6	10	60.6	H,V/H,V	100-250
24.4500	100, PK	≤-70	1	28.9*[7]	-9.5	0	-50.6	10	60.6	H,V/H,V	100-250
26.8950	100, PK	≤-70	1	28.5*[7]	-9.5	0	-51.0	10	61.0	H,V/H,V	100-250
All emissions lower than the ambient noise level of the measurement instruments!											
Measurement uncertainty		± 4 dB									

* Bandwidth = the measuring receiver bandwidth

(highest frequency)

OUT OF BAND EMISSION (Section 15.247 (c))

f (GHz)	Bandwidth (kHz) Type of detector	Noted receiver level dBm	Test distance m	Correction factor dB	Distance extrapol. factor dB	AV Correction factor dB	Level corrected dBm	Limit dBm	Margin dB	Polaris. EUT / antenna	Antenna height cm
2.5019	100, PK	≤-92	3	16.3*[6]	0	0	-75.7	10	85.7	H,V/H,V	100-400
9.9200	100, PK	≤-92	3	29.1*[6]	0	0	-62.9	10	72.9	H,V/H,V	100-400
14.8800	100, PK	≤-70	1	25.8*[6]	-9.5	0	-53.7	10	63.7	H,V/H,V	100-250
17.3600	100, PK	≤-70	1	26.0*[6]	-9.5	0	-53.5	10	63.5	H,V/H,V	100-250
22.3200	100, PK	≤-70	1	28.9*[7]	-9.5	0	-50.6	10	60.6	H,V/H,V	100-250
24.8000	100, PK	≤-70	1	28.9*[7]	-9.5	0	-50.6	10	60.6	H,V/H,V	100-250
27.2800	100, PK	≤-70	1	28.5*[7]	-9.5	0	-51.0	10	61.0	H,V/H,V	100-250
All emissions lower than the ambient noise level of the measurement instruments!											
Measurement uncertainty	± 4 dB										

* Bandwidth = the measuring receiver bandwidth

Remark: *[1] noise floor noise level of the measuring instrument ≤ -103 dBm @ 3m distance (30 – 1,000 MHz)
Remark: *[2] noise floor noise level of the measuring instrument ≤ -102 dBm @ 3m distance (1,000 – 2,000 MHz)
Remark: *[3] noise floor noise level of the measuring instrument ≤ -96 dBm @ 3m distance (2,000 – 5,500 MHz)
Remark: *[4] noise floor noise level of the measuring instrument ≤ -92 dBm @ 3m distance (5,500 – 14,500 MHz)
Remark: *[5] for using a pre-amplifier in the range between 100 kHz and 1,000 MHz
Remark: *[6] for using a pre-amplifier in the range between 1.0 GHz and 18.0 GHz
Remark: *[7] for using a pre-amplifier in the range between 18.0 GHz and 27.5 GHz
Remark: *[8] noise floor noise level of the measuring instrument ≤ -70 dBm @ 3m distance (14,500 – 27,500 MHz)

The equipment meets the requirements	**yes**	~~**no**~~	~~**n.t.**~~

Further test results are attached	~~**yes**~~	**no**	page no:

11.7 Power spectral density

11.7.1 Regulation

15.247(e) For digitally modulated systems, the 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. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

11.7.2 Test equipment

Type	Manufacturer/ Model no.	Serial no.	Last calibration	Next calibration
Receiver (9 kHz –18.0 GHz)	Rohde & Schwarz Spectrum Analyzer FSL 18 (171a)	100.117	2008/10	2010/10
Receiver (9 kHz –40.0 GHz)	Anritsu Spectrum Analyzer MS2668C (359a)	6200163244	2009/04	2011/04
Pre-amplifier (100kHz - 1.3GHz)	Hewlett Packard 8447 E (166a)	1726A00705	2008/02	2010/02
Pre-amplifier (1GHz - 18GHz)	Narda --- (345)	---	2008/02	2010/02
Bilog antenna (30- 1000 MHz)	Schwarzbeck VULP 9168 (406)		2007/02	2013/02
Horn antenna (0.86-8.5 GHz)	Schwarzbeck BBHA 9120 A (284)	236	2008/01	2013/01
Horn antenna (2.0-14.0 GHz)	Schwarzbeck BBHA 9120 C (169)	305	2008/01	2013/01
RF- cable	Kabelmetal 18m [N]	K1	2009/01	2010/01
RF- cable	Aircell 0.5m [BNC]	K40	2009/01	2010/01
RF- cable	Aircell 1m [BNC/N]	K56	2009/01	2010/01
RF- cable	Sucoflex 106 Suhner 6,4m [N]	K74	2009/01	2010/01
RF- cable	Sucoflex 106 Suhner 6,4m [N]	K75	2009/01	2010/01

11.7.3 Test procedures

The EUT and this peripheral (when additional equipment exists) are placed on a turn table which is 0.8m above the ground. The turn table would be allowed to rotate 360 degrees to determine the position of the maximum emission level. The test distance between the EUT and the receiving antenna are 3 m. To find the maximum emission, the polarization of the receiving antenna are changed in horizontal and vertical polarization, the position of the EUT was changed in different orthogonal determinations.
ANSI C63.4: 2003 Section 8 “Radiated Emissions Testing”

11.7.4 Calculation of the radiated power spectral density

The radiated power is calculated by the following calculation:

Corrected Level = Receiver Level + Correction Factor (without the use of a pre-amplifier)

Corrected Level = Receiver Level + Correction Factor – Pre-amplifier (with the use of a pre-amplifier)

Receiver Level : Receiver reading without correction factors
Correction Factor : Substituted over the whole frequency band and listed in an correction table

For example:

The receiver peak reading measured with an resolution bandwidth of 3 kHz is -32.7 dBm. The Correction Factor with the use of a pre-amplifier for the measured frequency of 2.413 GHz is +12.5 dB and the cable factor for the measured frequency is 0.71 dB, giving a power level of -19.49 dBm/3kHz.
-19.49 dBm/3kHz = 11.25 µW/3kHz

11.7.5 Result

(lowest frequency)

POWER SPECTRAL DENSITY (Section 15.247 (e))										
f (GHz)	Bandwidth (kHz) Type of detector	Noted receiver level **dBm**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	Level corrected **dBm/3kHz**	Limit **dBm/3kHz**	Margin **dB**	Polaris. EUT / antenna	Antenna height **cm**
2.400013	**3, PK**	**-63.6**	**3**	**22.8*[6]**	**0**	**-40.8**	**8**	**48.8**	**V,180°/V**	**160**
2.401028	**3, PK**	**-59.5**	**3**	**22.8*[6]**	**0**	**-36.7**	**8**	**44.7**	**V,180°/V**	**160**
2.402106	**3, PK**	**-53.7**	**3**	**22.8*[6]**	**0**	**-30.9**	**8**	**38.9**	**V,180°/V**	**160**
2.402904	**3, PK**	**-46.8**	**3**	**22.8*[6]**	**0**	**-24.0**	**8**	**32.0**	**V,180°/V**	**160**
2.404401	**3, PK**	**-24.9**	**3**	**22.8*[6]**	**0**	**-2.1**	**8**	**10.1**	**V,180°/V**	**160**
2.405390	**3, PK**	**-25.2**	**3**	**22.8*[6]**	**0**	**-2.4**	**8**	**10.4**	**V,180°/V**	**160**
2.406916	**3, PK**	**-47.0**	**3**	**22.8*[6]**	**0**	**-24.2**	**8**	**32.2**	**V,180°/V**	**160**
2.407854	**3, PK**	**-54.3**	**3**	**22.8*[6]**	**0**	**-31.5**	**8**	**41.5**	**V,180°/V**	**160**
2.408892	**3, PK**	**-58.0**	**3**	**22.8*[6]**	**0**	**-35.2**	**8**	**43.2**	**V,180°/V**	**160**
2.409850	**3, PK**	**-62.6**	**3**	**22.8*[6]**	**0**	**-39.8**	**8**	**47.8**	**V,180°/V**	**160**
Measurement uncertainty			± 4 dB							

* Bandwidth = the measuring receiver bandwidth

(highest frequency)

POWER SPECTRAL DENSITY (Section 15.247 (e))										
f (GHz)	Bandwidth (kHz) Type of detector	Noted receiver level **dBm**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	Level corrected **dBm/3kHz**	Limit **dBm/3kHz**	Margin **dB**	Polaris. EUT / antenna	Antenna height **cm**
2.475050	**3, PK**	**-62.3**	**3**	**22.8*[6]**	**0**	**-39.5**	**8**	**47.5**	**V,180°/V**	**105**
2.476128	**3, PK**	**-57.5**	**3**	**22.8*[6]**	**0**	**-34.7**	**8**	**42.7**	**V,180°/V**	**105**
2.477046	**3, PK**	**-54.5**	**3**	**22.8*[6]**	**0**	**-31.7**	**8**	**39.7**	**V,180°/V**	**105**
2.478084	**3, PK**	**-46.6**	**3**	**22.8*[6]**	**0**	**-23.8**	**8**	**31.8**	**V,180°/V**	**105**
2.479561	**3, PK**	**-26.2**	**3**	**22.8*[6]**	**0**	**-3.4**	**8**	**11.4**	**V,180°/V**	**105**
2.480319	**3, PK**	**-24.8**	**3**	**22.8*[6]**	**0**	**-2.0**	**8**	**10.0**	**V,180°/V**	**105**
2.482076	**3, PK**	**-46.4**	**3**	**22.8*[6]**	**0**	**-23.6**	**8**	**31.6**	**V,180°/V**	**105**
2.482914	**3, PK**	**-54.1**	**3**	**22.8*[6]**	**0**	**-31.3**	**8**	**39.3**	**V,180°/V**	**105**
2.483832	**3, PK**	**-55.7**	**3**	**22.8*[6]**	**0**	**-32.9**	**8**	**40.9**	**V,180°/V**	**105**
2.484870	**3, PK**	**-62.4**	**3**	**22.8*[6]**	**0**	**-39.6**	**8**	**47.6**	**V,180°/V**	**105**
Measurement uncertainty			± 4 dB							

* Bandwidth = the measuring receiver bandwidth

Remark: *[1] noise floor noise level of the measuring instrument ≤ -103 dBm @ 3m distance (30 – 1,000 MHz)
Remark: *[2] noise floor noise level of the measuring instrument ≤ -102 dBm @ 3m distance (1,000 – 2,000 MHz)
Remark: *[3] noise floor noise level of the measuring instrument ≤ -96 dBm @ 3m distance (2,000 – 5,500 MHz)
Remark: *[4] noise floor noise level of the measuring instrument ≤ -92 dBm @ 3m distance (5,500 – 14,500 MHz)
Remark: *[5] for using a pre-amplifier in the range between 100 kHz and 1,000 MHz
Remark: *[6] for using a pre-amplifier in the range between 1.0 GHz and 18.0 GHz

The equipment meets the requirements	**yes**	~~**no**~~	~~**n.t.**~~

Further test results are attached	~~**yes**~~	**no**	page no:

12. Additional information to the test report

Remarks

n.t.[1] Not tested, because the antenna is part of the PCB

n.t.[2] Not tested, because the EUT is directly battery powered

End of test report