EUT: Cryptbox FS
FCC ID: QLXCRYPTBOXFS

Date of issue: 2010-12-15

Deutsche Akkreditierungsstelle D-PL-12053-01-01

Test Report acc. to FCC Title 47 CFR Part 15
relating to
TeraTron GmbH
Cryptbox FS

Title 47 - Telecommunication
Part 15 - Radio Frequency Devices
Subpart C – Intentional Radiators
Measurement Procedure:
ANSI C63.4-2003

m. dudde hochfrequenz - technik Rottland 5a D-51429 Bergisch Gladbach Tel. +49 2207-96890 Fax +49 2207 968920

EUT: Cryptbox FS
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Manufacturer's details	
Manufacturer	TeraTron GmbH
Manufacturer's grantee code	**QLX**
Manufacturer's address	TeraTron GmbH
	Bunsenstr. 10
	51647 Gummersbach
	Germany
	Telephone: +49 (0) 2261 8082 0
	Fax: +49 (0) 2261 8082 99
	Email: michael.marquart@teratron.de
Relevant standard used	47 CFR Part 15C - Intentional Radiators
	ANSI C63.4-2003

Test Report prepared by	
Technical engineer	Ralf Trepper
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	Rottland 5a
	51429 Bergisch Gladbach
	Germany
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	Email: m.duddelabor@dudde.com

Equipment **U**nder **T**est **(EUT)**	
Equipment category	Inductive application
Trade name	TeraTron
Type designation	Cryptbox FS
Serial no.	---
Variants	---

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1. Test results

CFR Section	Report Chapter	Requirements Headline	Test result		
15.203	11.1	Antenna Requirement	**Pass**	~~Fail~~	~~N.t.~~
15.205	11.2	Restricted bands of operation	**Pass**	~~Fail~~	~~N.t.~~
15.207	11.3	Conducted limits	**Pass**	~~Fail~~	~~N.t.~~
15.209	11.4	Radiated emission limits	**Pass**	~~Fail~~	~~N.t.~~

The equipment meets the requirements	**Yes**	~~No~~

Signature: ..... (Technician)

Signature: ..... (Manager)

m. dudde hochfrequenz-technik

Andreas Morsbach
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Datum: 2010.12.15 16:39:39 +01'00'

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m. dudde hochfrequenz - technik Rottland 5a D-51429 Bergisch Gladbach Tel. +49 2207-96890 Fax +49 2207 968920

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 May 29, 2008, Registration Number 699717.
Phone	: +49 (0) 2207 9689-0
Fax	: +49 (0) 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	: TeraTron GmbH
Address	: Bunsenstr. 10
Postcode	: 51647
City/town	: Gummersbach
Country	: Germany
Telephone	: +49 (0) 2261 8082 0
Fax	: +49 (0) 2261 8082 99
Email	: michael.marquart@teratron.de
Date of order	: 2010-11-26
References	: Mr. Michael Marquart

4. Product

Samples of the following apparatus were submitted for testing:

Type of equipment	: Inductive application
Trademark	: TeraTron
Type designation	: **Cryptbox FS**
Hardware version	: Cryptbox FS
Serial number	: ---
Software release	: ---
Power used	: 5:0 V DC
Frequency used	: 125.0 kHz
Generated or used frequencies	: 16.00 MHz (crystal), 16.00 MHz (crystal) 125 kHz (carrier)

5. Test schedule

The tests were carried out in accordance with the specifications detailed in chapter 8 of this report at:

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

The test sample was received on:

- 2010-11-25

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

- 2010-11-25 - 2010-11-26

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)	2010-12-15	Annex no. 1
Internal photographs of the **E**quipment **U**nder **T**est (EUT)	2010-12-15	Annex no. 2
Channel occupancy / bandwidth	2010-12-15	Annex no. 3
FCC ID label sample	2010-12-15	Annex no. 4
Functional description / User manual	---	Annex no. 5
Test setup photos	2010-12-15	Annex no. 6
Block diagram	2010-12-15	Annex no. 7
Operational description	2010-12-15	Annex no. 8
Schematics	2010-12-15	Annex no. 9
Parts list	2010-12-15	Annex no. 10
Periodic operation characteristics / Transmission times	---	Annex no. 11

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

Additional equipment for the tests to carry on the Cryptbox FS:

HP Laptop,
Type: compaq nx6325
SN: CNU64907YN

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 15C – Intentional Radiators, ANSI C63.4 - 2003

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9. Conclusions

Samples of the apparatus were found to **CONFORM WITH** the specifications stated in chapter 8 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 8.

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 6. 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 **23.**

Technical inspector:

Date : 2010-12-15

Name : Ralf Trepper

Signature : .....

Technical responsibility for area of testing:

Date : 2010-12-15

Name : Manfried Dudde

Signature : .....

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10. Operation description

10.1 EUT details

Inductive system, cryptical car key programming unit

10.2 EUT configuration

After connection with a power supply the ***Cryptbox FS*** begins to run.

10.3 EUT measurement description

Radiated measurements

The inductive transmitter ***Cryptbox FS*** was tested in a typical fashion. During primary emission tests all orthogonal adjustments of the EUT have been examined. In the final measurement there was chosen the adjustment in which the highest level had been established before.

Conducted measurements

The ***Cryptbox FS*** was connected via USB cable to the USB port from a Laptop and this to the artificial mains network.

11.1 Antenna requirement

11.1.1 Regulation

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 this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, 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**	Page no.

Integrated loop antenna

N.t.* See page no. 22

11.2 Restricted bands of operation

11.2.1 Regulation

(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.

(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).

11.2.2 Result

The equipment meets the requirements	**Yes**	~~No~~	~~N.t.~~

Further test results are attached	~~Yes~~	**No**	Page no.

N.t.* See page no. 22

11.3 Conducted limits

11.3.1 Regulation

(a) For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50µH/50ohms line impedance stabilization network (LISN). Compliance with this provision of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.
The lower limit applies at the boundary between the frequency ranges.

Frequency of emission(MHz)	**Conducted limit (dBµV)**	
	Quasi-peak	**Average**
0.15-0.50	66 to 56*	56 to 46*
0.50-5.0	56	46
5.0-30.0	60	50

* Decreases with the logarithm of the frequency

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provision for, the use of battery chargers which permit operating while charging, AC adaptors or battery eliminators or connected to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

11.3.2 Test equipment

Type	Manufacturer/ Model no.	Serial no.	Last calibration	Next calibration	Remarks
Receiver (9 kHz - 30MHz)	Schwarzbeck FMLK 1518 (428)	1518294 9360	08 / 10	08/13	---
Panorama-Monitor FMLK / VUMA	PAZ1550 (429)				
Protector limiter 9 kHz - 30MHz 10 dB	Rhode & Schwarz ESH 3Z2 (272)	357,881052	03 / 08	02 / 11	---
V-LISN 50 ohms//(50 uH+5 ohms)	RFT NNB 11 (72)	13835240	06 / 08	06 / 11	---
V-LISN 50 ohms//(50 uH+5 ohms)	EMCO (49b)	9512-1227	08 / 08 05/09	08 /11	---
RF- cable	Aircell 1.5m [BNC/N]	K30	2010/01	2011/01	---

11.3.3 Test procedures

The EUT and the additional equipment (if required) are connected to the main power through a line impedance stabilization network (LISN). The LISN must be appropriate to ANSI C63.4: 2003 Section 7.
Additional equipment must also be connected to a second LISN with the same specifications described in the above sentence (if required).

11.3.4 Test results

Tested with a Laptop via USB port with inactive Cryptbox FS

CONDUCTED EMISSIONS (Section 15.207)						
Tested line	Emission frequency [MHz]	Receiver bandwidth [kHz]	Result quasi-peak [dBµV]	Spec. limit (average) [dBµV]	Margin [dB]	Remarks
L1	**0.1829**	**9**	**50.5**	**54.6**	**4.1**	***2**
N	**0.1829**	**9**	**50.5**	**54.6**	**4.1**	***2**
L1	**0.2059**	**9**	**42.0**	**54.5**	**12.5**	***2**
N	**0.2059**	**9**	**42.5**	**54.5**	**12.0**	***2**
L1	0.475	9	-2	47	49.0	*1
N	0.475	9	-2	47	49.0	*1
L1	0.600	9	-2	46	48.0	*1
N	0.600	9	-2	46	48.0	*1
L1	0.775	9	-2	46	48.0	*1
N	0.775	9	-2	46	48.0	*1
L1	0.850	9	-2	46	48.0	*1
N	0.850	9	-2	46	48.0	*1
L1	1.000	9	-2	46	48.0	*1
N	1.000	9	-2	46	48.0	*1
L1	1.250	9	-2	46	48.0	*1
N	1.250	9	-2	46	48.0	*1
L1	2.000	9	-2	46	48.0	*1
N	2.000	9	-2	46	48.0	*1
L1	4.000	9	-2	46	48.0	*1
N	4.000	9	-2	46	48.0	*1
L1	6.7644	9	-2	50	52.0	*1
N	6.7644	9	-2	50	52.0	*1
L1	13.5288	9	-2	50	52.0	*1
N	13.5288	9	-2	50	52.0	*1
L1	20.2931	9	-2	50	52.0	*1
N	20.2931	9	-2	50	52.0	*1
L1	27.0575	9	-2	50	52.0	*1
N	27.0575	9	-2	50	52.0	*1

Remark: *1 Noise level of the measuring instrument ≤ -2dBµV (0.009 – 30MHz)
Remark: *2 Quasi peak measurements lower than "Specified Average Limit"

The equipment meets the requirements	**Yes**	~~No~~	~~N.t.~~

Further test results are attached	~~Yes~~	**No**	Page no.

N.t.* See page no. 22

EUT: Cryptbox FS
FCC ID: QLXCRYPTBOXFS

Date of issue: 2010-12-15

Tested with a Laptop via USB port with active Cryptbox FS

CONDUCTED EMISSIONS (Section 15.207)						
Tested line	Emission frequency [MHz]	Receiver bandwidth [kHz]	Result quasi-peak [dBµV]	Spec. limit (average) [dBµV]	Margin [dB]	Remarks
L1	**0.1829**	**9**	**50.5**	**54.6**	**4.1**	***[2]**
N	**0.1829**	**9**	**50.5**	**54.6**	**4.1**	***[2]**
L1	**0.2059**	**9**	**42.0**	**54.5**	**12.5**	***[2]**
N	**0.2059**	**9**	**42.5**	**54.5**	**12.0**	***[2]**
L1	0.475	9	-2	47	49.0	*[1]
N	0.475	9	-2	47	49.0	*[1]
L1	0.600	9	-2	46	48.0	*[1]
N	0.600	9	-2	46	48.0	*[1]
L1	0.775	9	-2	46	48.0	*[1]
N	0.775	9	-2	46	48.0	*[1]
L1	0.850	9	-2	46	48.0	*[1]
N	0.850	9	-2	46	48.0	*[1]
L1	1.000	9	-2	46	48.0	*[1]
N	1.000	9	-2	46	48.0	*[1]
L1	1.250	9	-2	46	48.0	*[1]
N	1.250	9	-2	46	48.0	*[1]
L1	2.000	9	-2	46	48.0	*[1]
N	2.000	9	-2	46	48.0	*[1]
L1	4.000	9	-2	46	48.0	*[1]
N	4.000	9	-2	46	48.0	*[1]
L1	6.7644	9	-2	50	52.0	*[1]
N	6.7644	9	-2	50	52.0	*[1]
L1	13.5288	9	-2	50	52.0	*[1]
N	13.5288	9	-2	50	52.0	*[1]
L1	20.2931	9	-2	50	52.0	*[1]
N	20.2931	9	-2	50	52.0	*[1]
L1	27.0575	9	-2	50	52.0	*[1]
N	27.0575	9	-2	50	52.0	*[1]

Remark: *[1] Noise level of the measuring instrument ≤ -2dBµV (0.009 – 30MHz)
Remark: *[2] Quasi peak measurements lower than "Specified Average Limit"

The equipment meets the requirements	**Yes**	~~No~~	~~N.t.~~

Further test results are attached	~~Yes~~	**No**	Page no.

N.t.* See page no. 22

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11.4 Radiated emission limits

11.4.1 Regulation

(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

(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 §§ 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. lf 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.

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	2010/11	2012/11
Pre-amplifier (100kHz - 1.3GHz)	Hewlett Packard 8447 E (166a)	1726A00705	2010/02	2012/02
Pre-amplifier (1GHz - 18GHz)	Narda (345)	---	2010/02	2012/02
Magnetic loop antenna (9 kHz - 30 MHz)	Schwarzbeck FMZB 1516 (23)	---	2010/05	2013/05
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	2010/01	2011/01
RF- cable	Aircell 0.5m [BNC]	K40	2010/01	2011/01
RF- cable	Aircell 1m [BNC/N]	K56	2010/01	2011/01
RF- cable	Sucoflex 106 Suhner 6,4m [N]	K74	2010/01	2011/01
RF- cable	Sucoflex 106 Suhner 6,4m [N]	K75	2010/01	2011/01

11.4.3 Test procedure

The EUT and this peripheral (when additional equipment exists) are placed on a turn table which is 0.8 m 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 3m. To find the maximum emission, the polarization of the receiving antenna is 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”

Measurement procedures for electric field radiated emissions above 1 GHz are covered in Clause 8 of ANSI C63.4-2003. The C63.4-2003 measurement procedure consists of both an exploratory test and a final measurement. The exploratory test is critical to determine the frequency of all significant emissions. For each mode of operation required to be tested, the frequency spectrum is monitored. Variations in antenna height, antenna orientation, antenna polarization, EUT azimuth, and cable or wire placement is explored to produce the emission that has the highest amplitude relative to the limit.

The final measurements are made based on the findings in the exploratory testing. When making exploratory and final measurements it is necessary to maximize the measured radiated emission. Subclause 8.3.1.2 of C63.4-2003 states that the measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” We consider the “cone of radiation” to be the 3 dB beam width of the measurement antenna.

While the “bore-sighting” technique is not explicitly mentioned in C63.4-2003, it is a useful technique for measurements using a directional antenna, such as a double-ridged waveguide antenna. Several precautions must be observed, including: knowledge of the beam width of the antenna and the resulting illumination area relative to the size of the EUT, estimation for source of the emission and general location within larger EUTS, measuring system sensitivity, etc.

C63.4-2003 requires that the measurement antenna is kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. That means that if the directional radiation pattern of the EUT results in a maximum emission at an upwards angle from the EUT, when a directional antenna is used to make the measurement it will be necessary for it to be pointed towards the source of the emission within the EUT. This can be done by either pointing the antenna at an angle towards the source of the emission, or by rotating the EUT, in both height and polarization, to maximize the measured emission. The emission must be kept within the illumination area of the 3 dB beamwidth of the antenna so that the maximum emission from the EUT is measured.

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Radiated emissions test characteristics	
Frequency range	30 MHz - 4,000 MHz
Test distance	3 m*
Test instrumentation resolution bandwidth	120 kHz (30 MHz - 1,000 MHz)
	1 MHz (1000 MHz - 4,000 MHz)
Receive antenna scan height	1 m - 4 m
Receive antenna polarization	Vertical/horizontal

* 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).

11.4.4 Calculation of the field strength

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 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).

11.4.5 Result

SPURIOUS RADIATION (Section 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
0.125	**0.2, AV**	**38.9**	**10**	**20.2**	**-59.1**	**0.0**	**26.0- @ 300 m**	**26.0**	**V 0°, 0°**
0.5000	0.2, AV	< 4.0	10	20.2	-19.1	5.1	33.6 @ 30 m	28.5	V, H/0-360°
1.5000	0.2, AV	< 4.0	10	20.2	-19.1	5.1	24.1 @ 30 m	19.00	V, H/0-360°
3.0000	9, AV	< 4.0	10	20.2	-19.1	5.1	29.5 @ 30 m	24.4	V, H/0-360°
5.0000	9, AV	< 4.0	10	20.2	-19.1	5.1	29.5 @ 30 m	24.4	V, H/0-360°
8.0000	9, AV	< 4.0	10	20.2	-19.1	5.1	29.5 @ 30 m	24.4	V, H/0-360°
10.0000	9, AV	< 4.0	10	20.2	-19.1	5.1	29.5 @ 30 m	24.4	V, H/0-360°
20.0000	9, AV	< 4.0	10	20.2	-19.1	5.1	29.5 @ 30 m	24.4	V, H/0-360°
31.3276	**9, AV**	**18.0**	**3**	**13.0*[6]**	**0**	**31.0**	**40.0**	**9.0**	**V60°, V,229cm**
35.0000	100, AV	≤ 3.5	3	-3.1*[6]	0	0	40.0	40.0	H,V/H,V
88.0000	100, AV	≤ 3.5	3	-10.8*[6]	0	-7.3	40.0	47.3	H,V/H,V
216.0000	100, AV	≤ 3.5	3	-10.3*[6]	0	-6.8	43.5	50.3	H,V/H,V
960.0000	100, AV	≤ 3.5	3	8.5*[6]	0	12.0	43.5	31.5	H,V/H,V
1700.0000	1000, AV	≤ 4.5	3	3.8*[7]	0	8.3	54.0	45.7	H,V/H,V
2250.0000	1000, AV	≤ 10	3	8.0*[7]	0	18.0	54.0	36.0	H,V/H,V
4000.0000	1000, AV	≤ 10	3	8.4*[7]	0	18.4	54.0	35.6	H,V/H,V
5000.0000	1000, AV	≤ 10	3	9.1*[7]	0	19.4	54.0	34.6	H,V/H,V
7500.0000	1000, AV	≤ 14	3	12.9*[7]	0	26.9	54.0	27.1	H,V/H,V
8300.0000	1000, AV	≤ 14	3	14.0*[7]	0	28.8	54.0	25.2	H,V/H,V
9400.0000	1000, AV	≤ 14	3	16.0*[7]	0	30.0	54.0	24.0	H,V/H,V
Measurement uncertainty		4 dB							

Blue marked: restricted bands
Bandwidth = the measuring receiver bandwidth

Remark: *[1] noise floor noise level of the measuring instrument ≤ 4.0dBµV @ 10m distance (0.009 MHz –30 MHz)
Remark: *[2] noise floor noise level of the measuring instrument ≤ 3.5dBµV @ 3m distance (30 – 1,000 MHz)
Remark: *[3] noise floor noise level of the measuring instrument ≤ 4.5dBµV @ 3m distance (1,000 – 2,000 MHz)
Remark: *[4] noise floor noise level of the measuring instrument ≤ 10dBµV @ 3m distance (2,000 – 5,500 MHz)
Remark: *[5] noise floor noise level of the measuring instrument ≤ 14dBµV @ 3m distance (5,500 – 14,500 MHz)
Remark: *[6] for using a pre-amplifier in the range between 100 kHz and 1,000 MHz
Remark: *[7] 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.

N.t.* See page no. 22

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
N.t.[3]	Not tested, because not applicable to the EUT
N.t.[4]	Not tested, because not ordered

End of test report

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