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Schweizerischer Prüfstellendienst
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 Swiss testing service

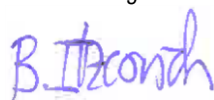


Report:	Electromagnetic compatibility and Radio spectrum Matters		Report no:	14-MO-0235.R22
Product name:	Roger EasyPen		Mandate no:	14-MO-0235
Serial no:	---	Model number:	TX22	
Customer:	Phonak Communications AG Länggasse 17 3280 Murten Switzerland		Date of test:	October 15 – 27, 2014 December 22, 2014

Standards		Result
47 CFR, Part 15	(Subpart C, Intentional radiators: §§ 207/209/247)	Pass
	(Subpart B, Intentional radiators: § 15.109)	Pass
Industry Canada	(RSS-210, Licence-exempt Radio Apparatus: Category I Equipment)	Pass

These results were achieved without modifications of the EUT.

Test performed by
 Mr B. Itzcovich
 EMC Test Engineer



Report prepared by
 Mr B. Itzcovich
 EMC Test Engineer



Report controlled and approved by
 Mr J. Ding
 EMC Test Engineer



Rossens, January 13, 2015

(Issue Date)

2014-10-15

Main language : English

The present document results from tests on one specimen and does not prejudice to the conformity of all the manufactured products.
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1. Summary of test results

- ✓ Pass
- ✗ Fail
- Ø Not applicable to this product
- Not tested
- # No requirements

§	Test Type	Result
6	Emission	CFR 47 Part 15 Industry Canada
6.1	Channel 20dB-bandwidth CFR 47 § 15.247 (a)(1) RSS-210 § A8.1 (b)	1.52 MHz
6.2	Carrier frequency separation CFR 47 § 15.247 (a)(1) RSS-210 § A8.1 (b)	✓
6.3	Number of hopping channels CFR 47 § 15.247 (a)(1)(iii) RSS-210 § A8.1 (d)	✓
6.4	Time of occupancy (dwell time) CFR 47 § 15.247 (a)(1)(iii) RSS-210 § A8.1 (d)	✓
6.5	Antenna gain & effective radiated power CFR 47 § 15.247 (b)(4) RSS-210 § A8.4 (1)	< -2.26 dBi
6.6	Maximum output power (conducted) CFR 47 § 15.247 (b)(1) RSS-210 § A8.4 (1)	✓
6.7	Band-edge emission (conducted) CFR 47 § 15.247 (d) RSS-210 § A8.5	✓
-	Band-edge emission (radiated) CFR 47 § 15.247 (d) CFR 47 § 15.205 RSS-210 § A8.5	# ¹
6.8	Spurious emissions – conducted (transmitter) CFR 47 § 15.247 (d) RSS-210 § A8.5	✓
6.9	Spurious emissions – radiated (transmitter) CFR 47 § 15.247 (d) CFR 47 § 15.209 (a) CFR 47 § 15.205 RSS-210 § A8.5	✓
6.10	Radiated emission – receiver CFR 47 § 15.109 RSS-Gen	✓
6.11	Conducted emission CFR 47 § 15.207	✓
6	Emission	CFR 47 Part 2
6.12	Designation of emission FCC 47 §2.201 FCC 47 §2.202	1M96FXD

1. Conducted tests could be successfully performed on the EUT

2. Applied standards

47 CFR Part 15 Subpart C	Code of Federal Regulations - Title 47 - Telecommunication, Part 15, Subpart C: "Intentional Radiators"
47 CFR Part 15 Subpart B	Code of Federal Regulations - Title 47 - Telecommunication, Part 15, Subpart B: "Unintentional Radiators"
RSS-Gen issue 3, December 2010	Spectrum Management and Telecommunications - Radio Standards Specification General Requirements and Information for the Certification of Radio Apparatus
RSS-210 issue 8, December 2010	Spectrum Management and Telecommunications - Radio Standards Specification Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

3. Client

Client name and address	<i>Phonak Communications AG Länggasse 17 3280 Murten Switzerland</i>
Contact Person	<i>Mr Antoine Ribordy</i>
Telephone	<i>+41 26 672 96 45</i>
Fax	<i>+41 26 672 93 80</i>
E-mail	<i>antoine.ribordy@phonak.com</i>
Mandate no	<i>14-MO-0235</i>

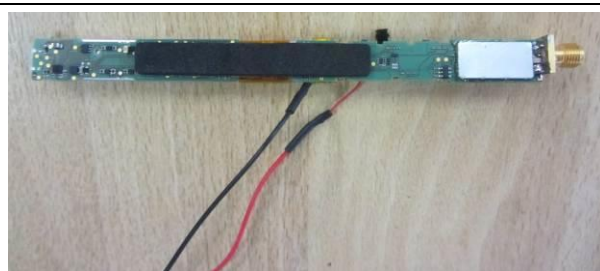
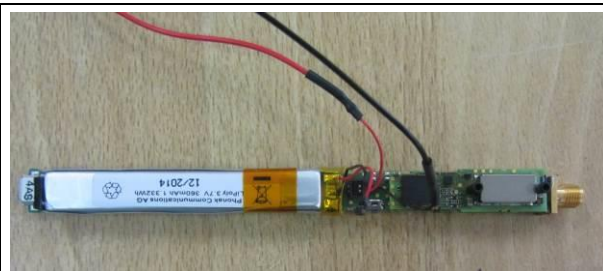
4. Equipment under test

4.1 Identification

Manufacturer name and address	<i>Phonak Communications AG Länggasse 17 3280 Murten Switzerland</i>
Production country	<i>Vietnam</i>
Brand name	<i>Phonak</i>
Product name	<i>Roger EasyPen</i>
Product description	<i>Wireless microphone 2.4 GHz</i>
Model number	<i>TX22</i>
Serial no	<i>- - -</i>
FCC ID IC ID	<i>FCC: KWCTX22 IC: 2262A-TX22</i>
Software version	<i>SVN 4993</i>
Highest frequency	<i>38.4 MHz (DSP) / 2.48 GHz (Transmitter)</i>
Supply	<i>$U = 3.7 V_{DC} / P_{max} = 0.25 W$ (Lithium Polymer Battery) or $U = 5 V_{DC} / P_{max} = 2 W$ (DC In USB) *</i>
Dimension / Weight	<i>~145 mm x Ø ~15 mm (l x d) / ~ 28 g</i>
Technical	<i>None. The equipment is completely identified by the above-mentioned information. Phonak Communications AG assures the traceability of the documentation and is responsible for the product identification.</i>

* When the external 5 V_{DC} supply is connected to the EUT, the battery is disconnected from the RF module.

4.2 Pictures of the EUT



Electronic board with temporary antenna & supply connectors



Front



Rear



Connectors on cradle (USB + audio)

4.3 Classification

CFR 47 Part 15	☒ Unintentional radiator (Subpart B), Receive mode ☐ Class A digital device ☒ Class B digital device ☐ The highest frequency of the internal sources of the EUT is less than 108 MHz (measurement shall be made up to 1 GHz). ☐ The highest frequency of the internal sources of the EUT is between 108 MHz and 500 MHz (measurement shall be made up to 2 GHz). ☐ The highest frequency of the internal sources of the EUT is between 500 MHz and 1 GHz (measurement shall be made up to 5 GHz). ☒ The highest frequency of the internal sources of the EUT is above 1 GHz (measurement shall be made up to 5 times the highest frequency or 40 GHz, whichever is lower). ☒ Intentional radiator (Subpart C), Transmit mode ☒ The highest fundamental frequency of the EUT is less than 10 GHz (measurement shall be made up to the tenth harmonic or 40 GHz, whichever is lower). ☐ The highest fundamental frequency of the EUT is between 10 GHz and 30 GHz (measurement shall be made up to the fifth harmonic or 100 GHz, whichever is lower). ☐ The highest fundamental frequency of the EUT is above 30 GHz (measurement shall be made up to the fifth harmonic or 200 GHz, whichever is lower).
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4.4 Transmitter characteristics (according to Phonak Communications AG)

Method of frequency generation	☒ Crystal ☐ Synthesizer ☐
Transmitter operating frequency range (OFR) The OFR is the total range of frequencies covered by one type, or by a family of equipment. It is noted that a family of equipment may be capable of covering a wider frequency range than the alignment frequency range of one type of equipment.	2.402 GHz to 2.480 GHz.
Channel separation (if applicable)	2 MHz
Number of channels	40
Maximum rated output power	57.5 mW (at transmitter RF output connector)
Modulation	☐ Amplitude ☐ Frequency: Deviation kHz ☐ Phase ☐ Pulse Pulse repetition frequency Duty cycle ☒ Other FHSS, GFSK
	☐ Transmitter can be operated without modulation ☒ Transmitter can only be operated with modulation

4.5 Receiver characteristics (according to Phonak Communications AG)

Receiver operating frequency range	2.402 GHz to 2.480 GHz
Channel separation (if applicable)	2 MHz
Number of channels	40

4.6 Ports

Port	Cable			Remark
	Max. length	Type	Screen	
DC 5V in (USB charger)	1.5 m (≤ 3 m)	Micro USB	Yes	Connected to Power supply
Audio in	≤ 3 m	Jack 3.5 mm stereo	Yes	External audio input port

4.7 Modifications

None

5. Test conditions

5.1 Climatic conditions, location and date

Location	Date	Temp.	Pressure	Rel. humidity
Montena EMC 1728 Rossens Switzerland	October 15 – 27, 2014	23 – 25 °C	1010 – 1030 hPa	35 – 55 %
Montena EMC 1728 Rossens Switzerland	December 22, 2014	23 – 25 °C	1027 – 1035 hPa	45 – 50 %

5.2 Test facility and methodology

*The alternate test site (ferrite chamber) is accepted by FCC (Reg. No. 90808) and by Industry Canada (Site number 3625A-2).
Conducted and radiated measurements are performed according to the ANSI C63.4 (2003) procedure.*

5.3 Attendant persons

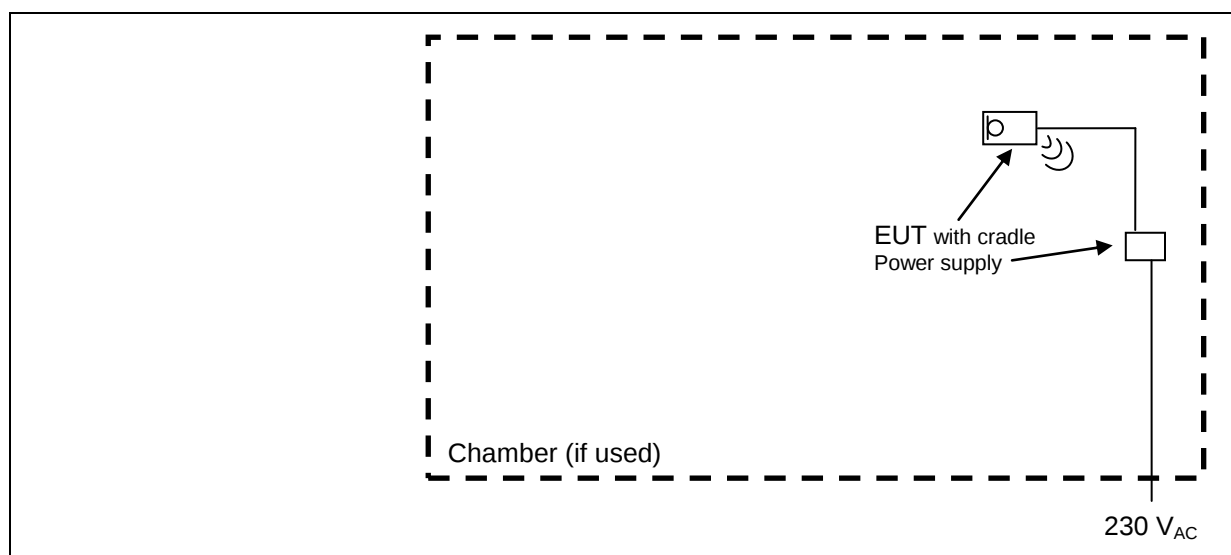
Test Engineer(s):

Mr B. Itzcovich
EMC Test Engineer

Other(s):

Name	Company
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5.4 Test configuration



5.5 Operating conditions

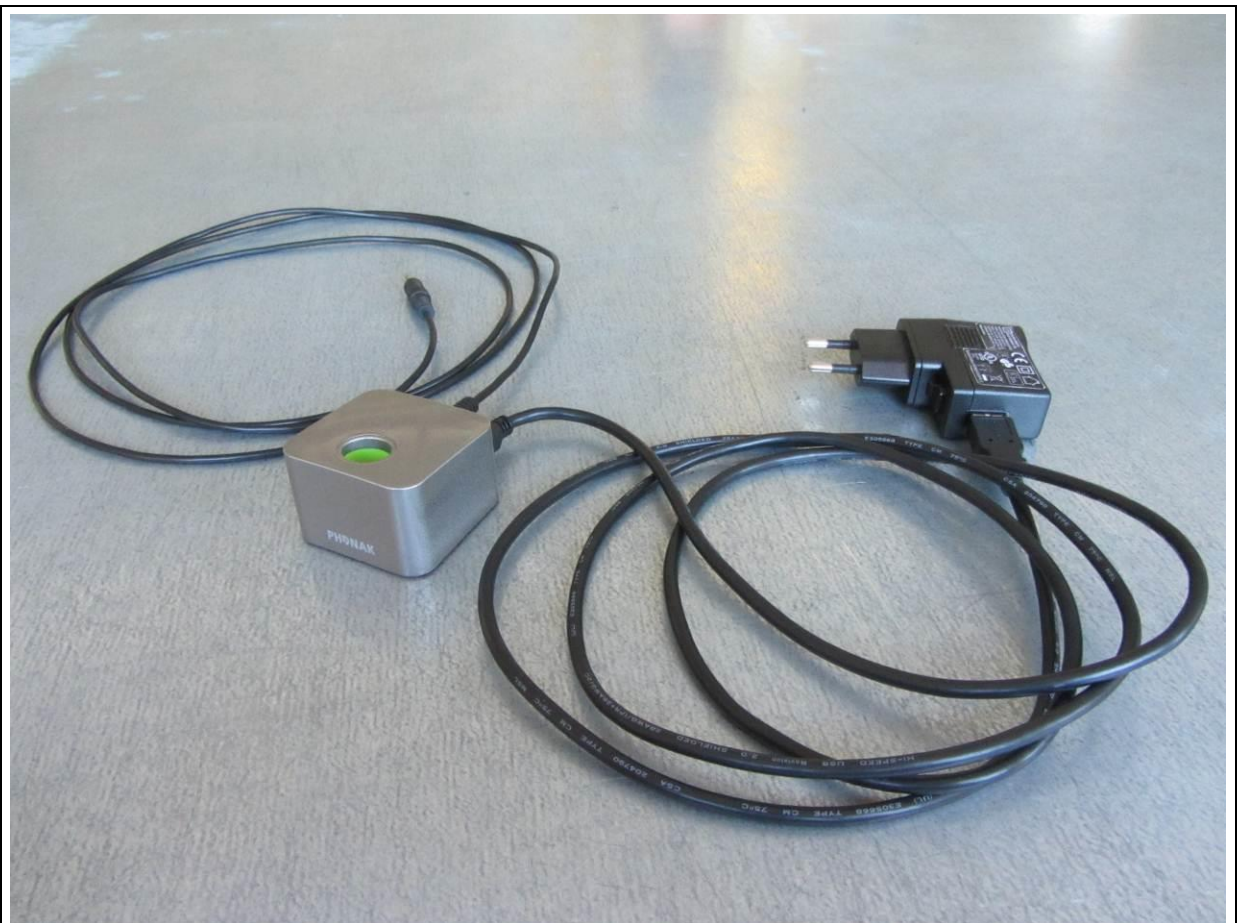
Power supply during tests if not stated otherwise in § 6 : 5 V_{DC} (USB)

- Continuous transmission of random data with single frequencies (2.402, 2.440 and 2.480 GHz)
- Normal operation: transmission of random data with hopping sequence
- Standby: DSP & controller running, RF module disabled

5.6 Auxiliary equipment

The following pieces of equipment are used for the monitoring of the EUT or are necessary for the EUT but they are not part of the EUT

Product	Brand	Model No.	ID	Remark
Cradle	Phonak	Roger Pen	- - -	Portable device holder
Power supply	Phonak	GPE0538-050100-Z	- - -	AC adapter (5 V _{DC} output)



Cradle with power supply & audio cable

6. Test results

6.1 Channel 20dB-bandwidth

Introduction: Channel-bandwidth measured at -20 dBc.

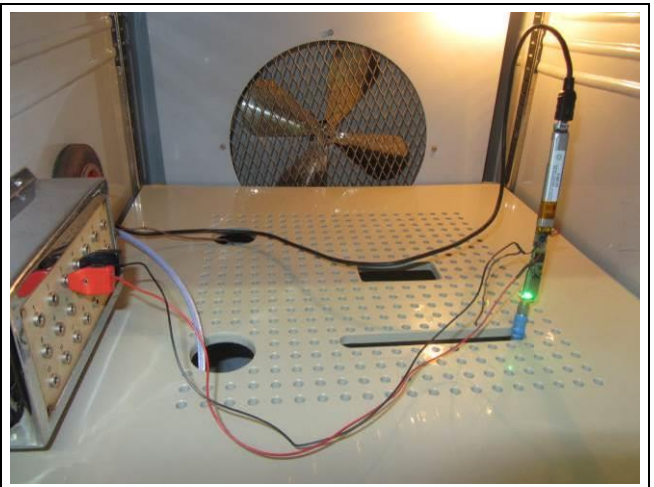
Test site: ☐ semi-anechoic chamber (foam) ☐ open test site
☐ semi-anechoic chamber (ferrites) ☒ laboratory

Meas. uncertainty: 9kHz – 3GHz: ± 1 dB
 3GHz – 6.7GHz: ± 2.1 dB
 6.7GHz – 13.2GHz: ± 2.6 dB
 13.2GHz – 19GHz: ± 2.8 dB
 19GHz – 26.5GHz: ± 3 dB

Method: Measurement of the conducted power on the antenna connector or a test fixture.

Limit: This measurement gives the limit for § 6.2 test.

Test set-up:



Remarks: ---

Test equipment:

Spectrum analyser	☐ 88-14	☐ 94-24	☐ 02-06	☐ 03-45	☐ 05-39	☒ 07-53
Power supply	☒ 99-07	☐ 04-31				
Cables	☒ 11-13					

Results of the test

Client: *Phonak Communications AG*

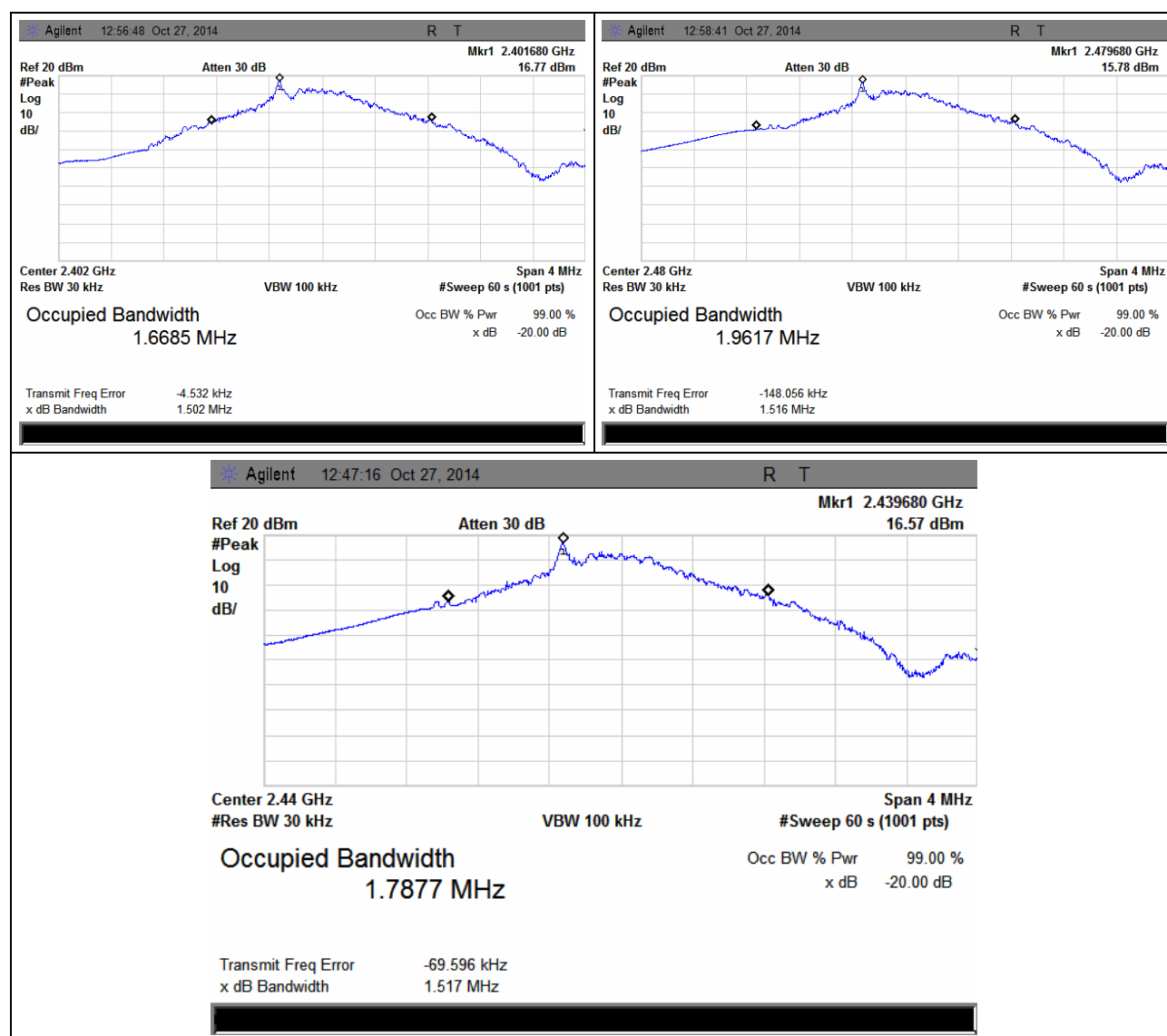
Apparatus: *Roger EasyPen*

Operating mode: *Continuous emission (f = 2.402 / 2.440 / 2.480 GHz), reduced power, modulated*

Cables connected to the EUT: *Temporary supply & antenna cables*

Remarks: *Measured on temporary antenna connector*

frequency [GHz]	20 dB bandwidth [MHz]	Remarks
2.402	1.502	---
2.440	1.517	---
2.480	1.516	---



Place and date of test:
Operator:

Rossens, October 27, 2014
B. Itzcovich

6.2 Carrier frequency separation

Introduction: Determination of the frequency separation of two adjacent channels.

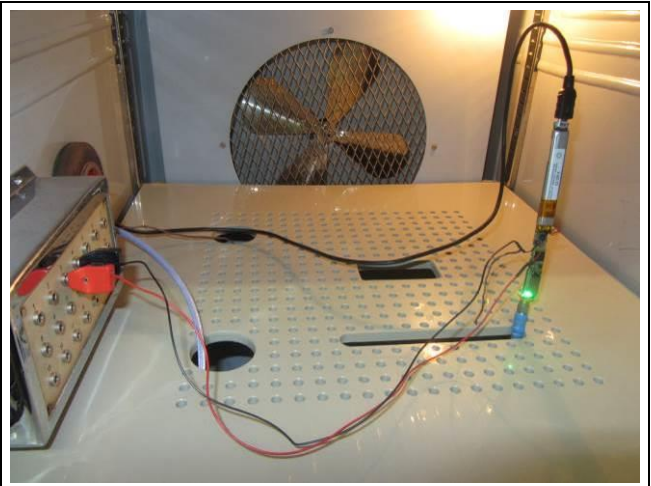
Test site: ☐ semi-anechoic chamber (foam) ☐ open test site
☐ semi-anechoic chamber (ferrites) ☒ laboratory

Meas. uncertainty: $\pm 2.6 \mu\text{Hz/Hz}$

Method: Measurement of the frequency separation on the antenna connector or a test fixture.

Limit: 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel (see § 6.1), whichever is greater, provided the system operates with an output power no greater than 125 mW (see § 6.6).

Test set-up:



Remarks: ---

Test equipment:

Spectrum analyser	☐ 88-14	☐ 94-24	☐ 02-06	☐ 03-45	☐ 05-39	☒ 07-53
Power supply	☒ 99-07	☐ 04-31				
Cables	☒ 11-13					

Result:	☒ pass	☐ fail	☐ not applicable	☐ not tested
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Results of the test

Client: *Phonak Communications AG*

Apparatus: *Roger EasyPen*

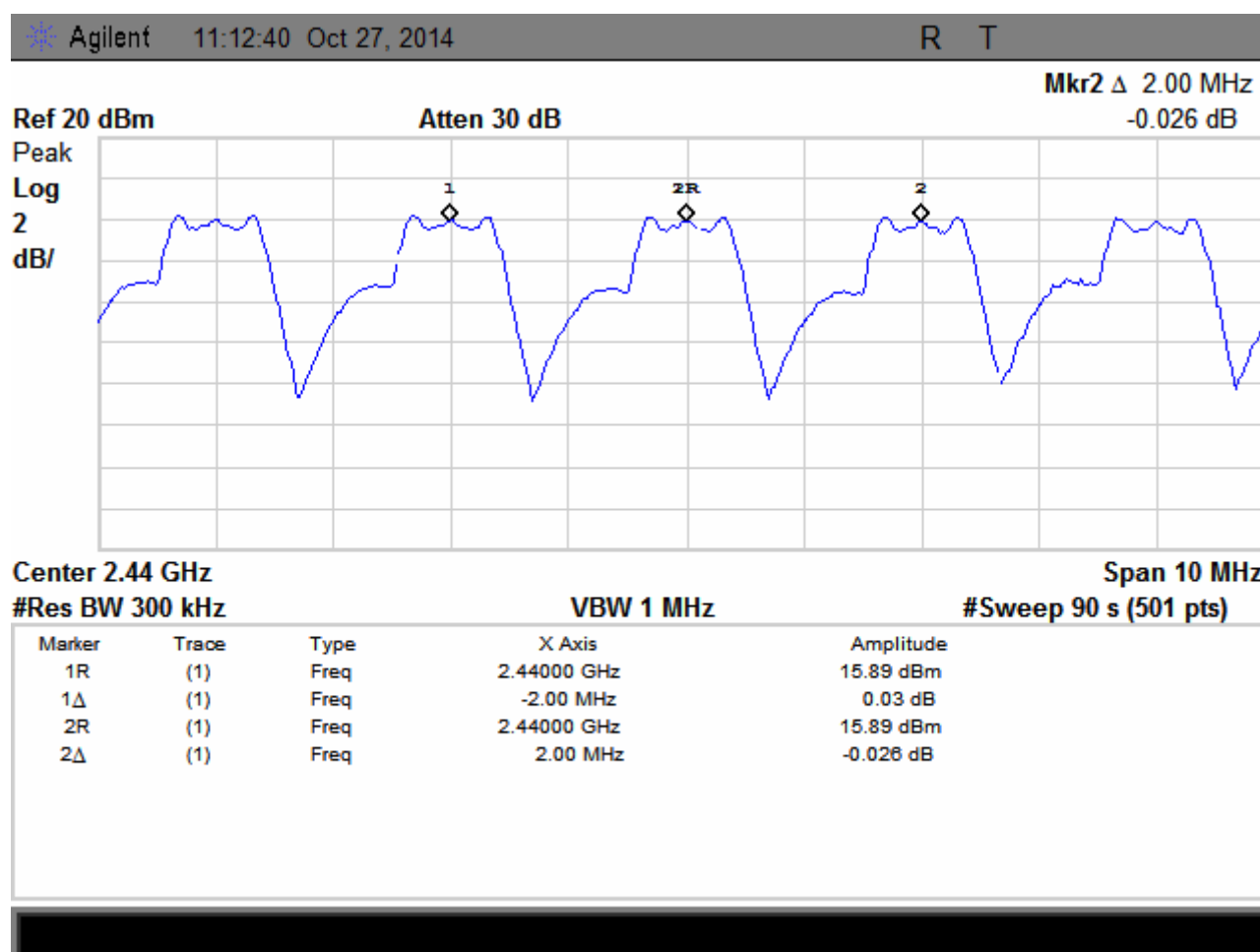
Operating mode: *Continuously hopping on all channels, max. power, modulated*

Cables connected to the EUT: *Temporary supply & antenna cables*

Remarks: *Measured on temporary antenna connector*

RESULT

Carrier frequency separation = 2.0 MHz < (2/3 x 1.52) → Pass



Place and date of test:
Operator:

Rossens, October 27, 2014
B. Itzcovich

6.3 Number of hopping channels

Introduction: Number of hopping channels used in the frequency hopping system.

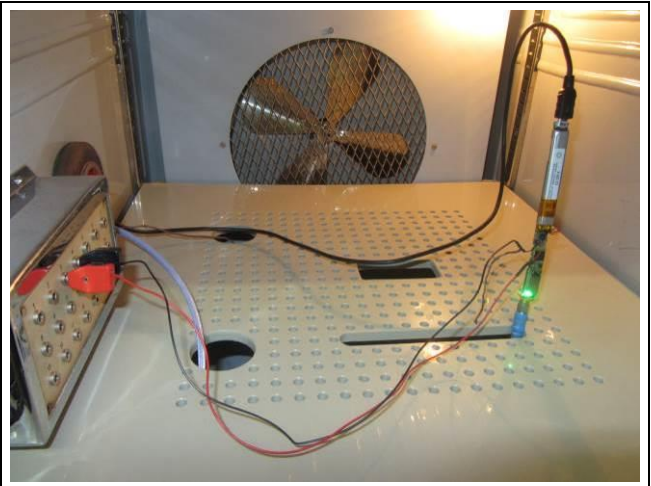
Test site: ☐ semi-anechoic chamber (foam) ☐ open test site
☐ semi-anechoic chamber (ferrites) ☒ laboratory

Meas. uncertainty: $\pm 2.6 \mu\text{Hz/Hz}$

Method: Measurement of the frequency separation on the antenna connector or a test fixture.

Limit: At least 15 channels

Test set-up:



Remarks: ---

Test equipment:

Spectrum analyser	☐ 88-14	☐ 94-24	☐ 02-06	☐ 03-45	☐ 05-39	☒ 07-53
Power supply	☒ 99-07	☐ 04-31				
Cables	☒ 11-45					

Result:	☒ pass	☐ fail	☐ not applicable	☐ not tested
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Results of the test

Client: *Phonak Communications AG*

Apparatus: *Roger EasyPen*

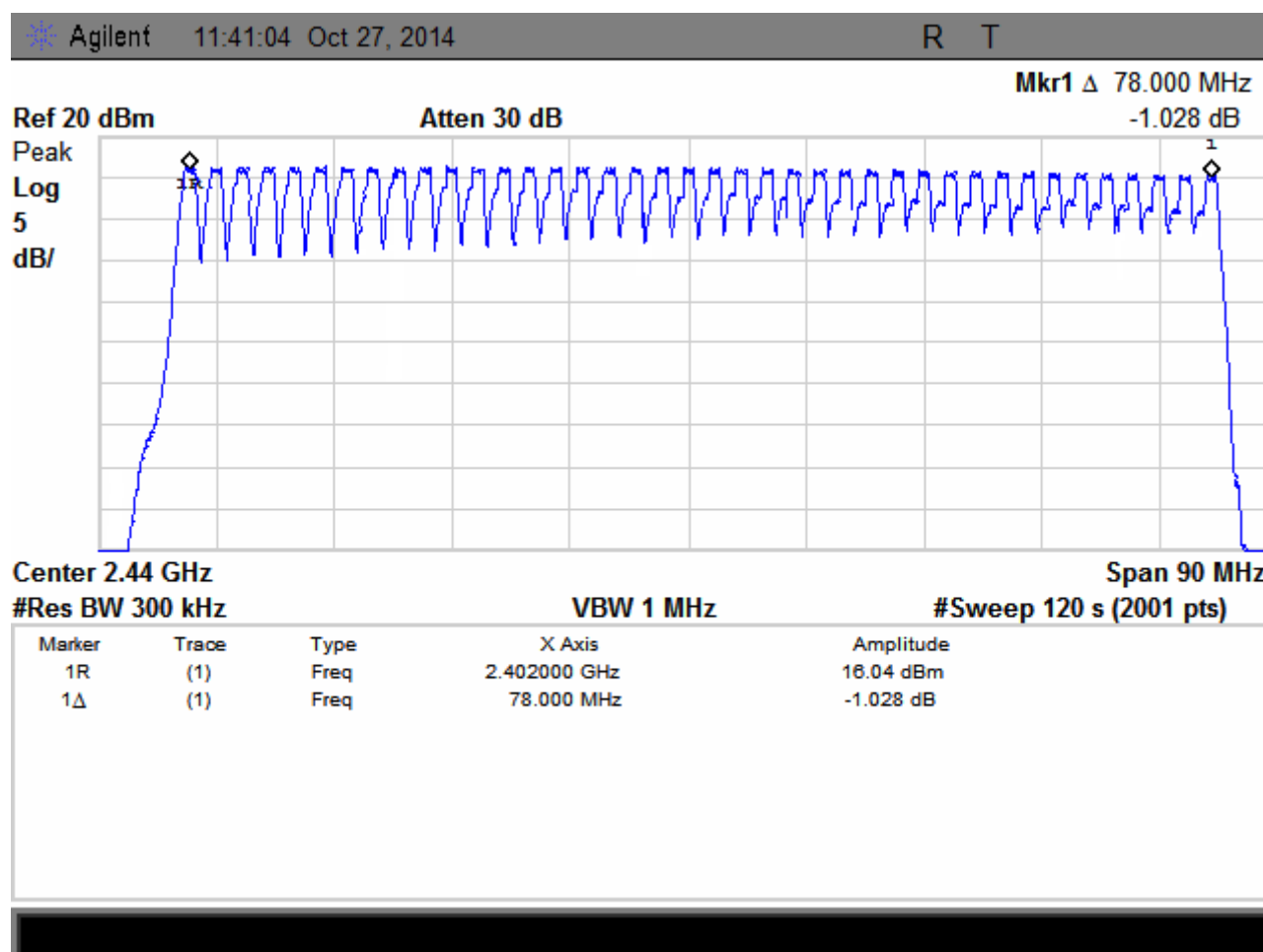
Operating mode: *Continuously hopping on all channels, max. power, modulated*

Cables connected to the EUT: *Temporary supply & antenna cables*

Remarks: *Measured on temporary antenna connector*

RESULT

Number of hopping channels = 40 > 15 → Pass



Place and date of test: *Rossens, October 27, 2014*

Operator: *B. Itzcovich*

6.4 Time of occupancy (dwell time)

Introduction: Average duration during which the system stays on one channel.

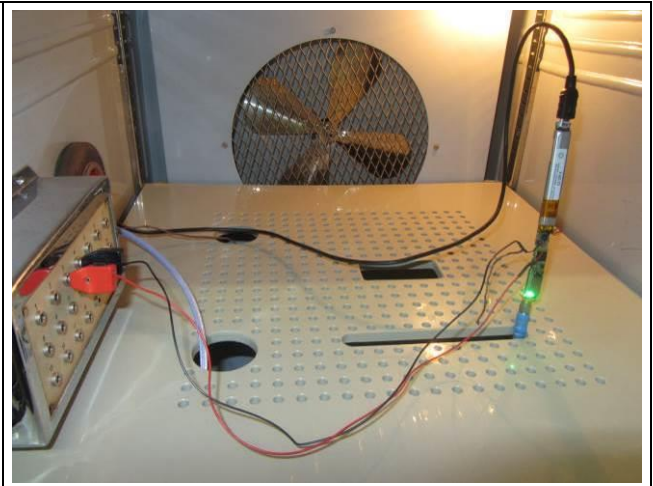
Test site: ☐ semi-anechoic chamber (foam) ☐ open test site
☐ semi-anechoic chamber (ferrites) ☒ laboratory

Meas. uncertainty: $\pm 2.6 \mu\text{s/s}$

Method: Measurement on the antenna connector or a test fixture.

Limit: The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Test set-up:



Remarks: ---

Test equipment:

Spectrum analyser	☐ 88-14	☐ 94-24	☐ 02-06	☐ 03-45	☐ 05-39	☒ 07-53
Power supply	☒ 99-07	☐ 04-31				
Cables	☒ 11-13					

Result: ☒ pass ☐ fail ☐ not applicable ☐ not tested

Results of the test

Client: *Phonak Communications AG*

Apparatus: *Roger EasyPen*

Operating mode: *Continuously hopping*

Cables connected to the EUT: *Temporary supply & antenna cables*

Remarks: *Measured on temporary antenna connector*

Calculation based on information from Phonak Communications AG and measurement of the pulse duration

Number of channels: 40

Period of observation: $\text{Number of channels} \times 0.4 \text{ s} = 40 \times 0.4 \text{ s} = 16 \text{ s}$

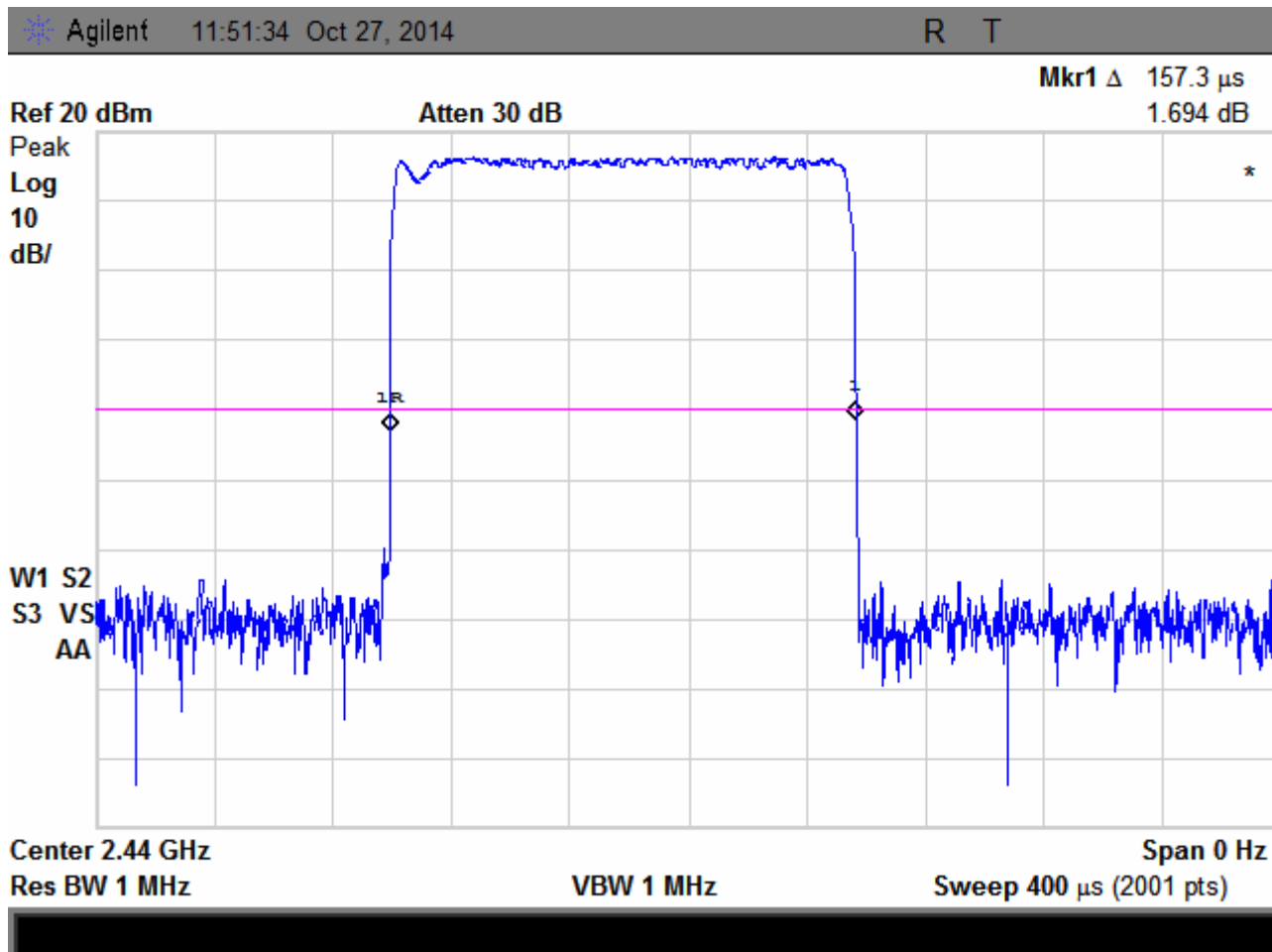
Single occupancy time during one hop (measured): 157.3 μs

Pulses in 2.9h: $2^{16} \times 40 \times 10 = 26214400$

Pulses in 16 s: $(\text{Pulses in 2.9h} / 2.9) / 3600 \times 16 \text{ s} = 40175.3$

Pulse in 16 s of one channel: $\text{Pulses in 16 s} / \text{Number of channels} = 1004.4$

Time of occupancy: $\text{Pulse in 16 s of one channel} \times \text{occupancy time} = 1004.4 \times 157.3 \mu\text{s} = 0.158 \text{ s}$

RESULT**Time of occupancy = 0.158 s < 0.4 s → Pass****Example of pulse duration at frequency 2.44 GHz**

Place and date of test: *Rossens, October 27, 2014*

Operator: *B. Itzcovich*

6.5 Antenna gain & effective isotropic radiated power

- Introduction:** The effective radiated power is the power radiated by the antenna of an interrogator in its direction of maximum gain under specified conditions of measurement.
- Test site:** ☐ semi-anechoic chamber (ferrites) ☒ semi-anechoic chamber (foam)
- Distance:** ☐ 1 m ☒ 3 m ☐ 10 m ☐ 30 m
- Position of EUT:** 0.8 m (height of the equipment under test above floor)
- Meas. uncertainty:** ± 1.34 dB ($f < 300$ MHz) / ± 1.61 dB ($f > 300$ MHz)
- Test method:** The electromagnetic disturbance radiated by the equipment is measured using a spectrum analyser and a wide band antenna. The ERP / EIRP values are determined replacing the EUT by a substitution antenna (dipole or other). The limits on the plots represent the equivalent field levels for the required power limits.
- Limit:** Antenna gain 6 dBi (for a maximum conducted power of 125 mW = 21 dBm). If antennas with directional gains exceeding 6 dBi are used, the maximum peak output power shall be reduced as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Test set-up:



Remarks: ---

Test equipment:

Spectrum analyser	☐ 88-14	☐ 94-24	☐ 02-06	☐ 03-45	☐ 05-39	☒ 07-53
Receiver	☐ 85-04	☐ 90-43	☐ 94-35	☐ 04-29		
Preamplifier	☐ 11-29	☐ 95-86	☐ 05-56	☐ 05-59	☐ 05-62	☐ 05-87
Antenna (horn)	☒ 90-24	☐ 98-12	☐ 98-13	☐ 07-31		
HF-wattmeter	☐ 95-97	☐ 01-15	☐ 01-17	☐ 03-07	☐ 04-96	☒ 05-20
Thermocouple detector	☐ 92-03	☐ 05-74	☐ 05-88	☐ 07-03	☐ 10-27	☒ 03-14
Substitution antenna	☐ 89-01	☒ 00-52				
Oscilloscope	☐ 90-14	☐ 93-85	☐ 93-86	☐ 01-20	☐ 04-06	☐ 04-50
Multimeter	☐ 03-22	☐ 04-47	☐ 04-104	☐ 04-105	☐ 06-51	☐ 06-52
Frequency generator	☐ 88-23	☐ 00-42	☐ 03-39	☒ 07-02	☐ 04-89	☐ 05-78
Cables	☒ 06-00	☐ 06-01	☒ 10-49	☐ SMK		
Attenuator 10dB	☐ 11-36					

Result: ☒ pass ☐ fail ☐ not applicable ☐ not tested

Results of the test

Client: *Phonak Communications AG*

Apparatus: *Roger EasyPen*

Operating mode: *Hopping f = 2.402/2.440/2.480 GHz, modulated, Pmax*

Cables connected to the EUT: *All (see § 4.6 and § 5.4)*

Remarks: *RBW = 5 MHz, VBW = 3 MHz; Peak detector*

f [GHz]	Measurement with EUT		Power at substitution ant.		Meas. with subst. ant.	Parameters of substitution ant.		Result			Remarks
	E [dBuV/m]	preamp [dB]	P [dBm]	factor [dB]	E [dBuV/m]	gain [dB]	att. Cable [dB]	corr. [dB]	P EIRP [dBm]	P EIRP [W]	
2.402	110.6	0.0	11.0	0	111.5	2.15	0	-98.35	12.21	16.63 mW	Vertical
2.402	103.9	0.0	11.0	0	109.1	2.15	0	-95.95	7.96	6.25 mW	Horizontal
2.440	110.5	0.0	11.0	0	109.7	2.15	0	-96.55	13.93	24.75 mW	Vertical
2.440	104.8	0.0	11.0	0	108.2	2.15	0	-95.05	9.70	9.34 mW	Horizontal
2.480	109.7	0.0	11.0	0	108.4	2.15	0	-95.25	14.41	27.62 mW	Vertical
2.480	103.9	0.0	11.0	0	107.7	2.15	0	-94.55	9.38	8.68 mW	Horizontal

The antenna gain is the difference (in dB) of the radiated EIRP power and the conducted power of § 6.6 :

frequency [GHz]	Conducted power [dBm]	Radiated power EIRP [dBm]	Antenna gain [dBi]	Remarks
2.402	17.60	12.21	-5.39	---
2.440	17.54	13.93	-3.61	---
2.480	16.67	14.41	-2.26	---

Place and date of test: *Rossens, October 15 and 27, 2014*
 Operator: *B. Itzcovich*

6.6 Maximum output power (conducted)

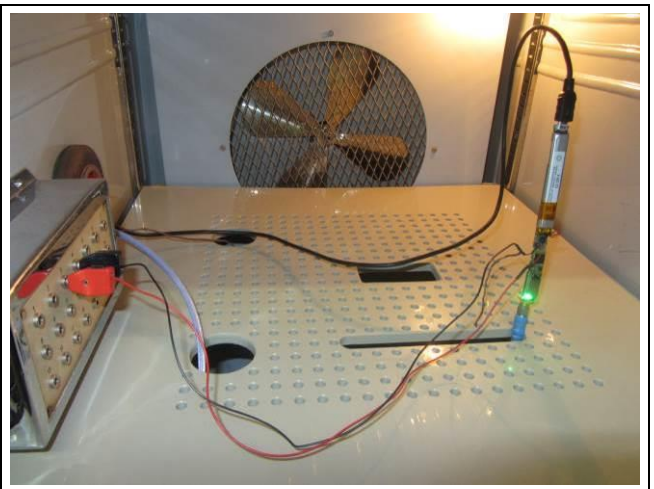
Test site: ☐ semi-anechoic chamber (foam) ☐ open test site
☐ semi-anechoic chamber (ferrites) ☒ laboratory

Meas. uncertainty: 9kHz – 3GHz: ± 1 dB
 3GHz – 6.7GHz: ± 2.1 dB
 6.7GHz – 13.2GHz: ± 2.6 dB
 13.2GHz – 19GHz: ± 2.8 dB
 19GHz – 26.5GHz: ± 3 dB

Test method: Measurement of the conducted power on the antenna connector or a test fixture.

Limit: Maximum 0.125 Watt (= 21.0 dBm) for systems using antennas with directional gains that do not exceed 6 dBi. If antennas with directional gains exceeding 6 dBi are used, the maximum peak output power shall be reduced as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Test set-up:



Remarks: ---

Test equipment:

Spectrum analyser	☐ 88-14	☐ 94-24	☐ 02-06	☐ 03-45	☐ 05-39	☒ 07-53
Power supply	☒ 99-07	☐ 04-31				
Cables	☒ 11-13					

Result: ☒ pass ☐ fail ☐ not applicable ☐ not tested

Results of the test

Client: *Phonak Communications AG*

Apparatus: *Roger EasyPen*

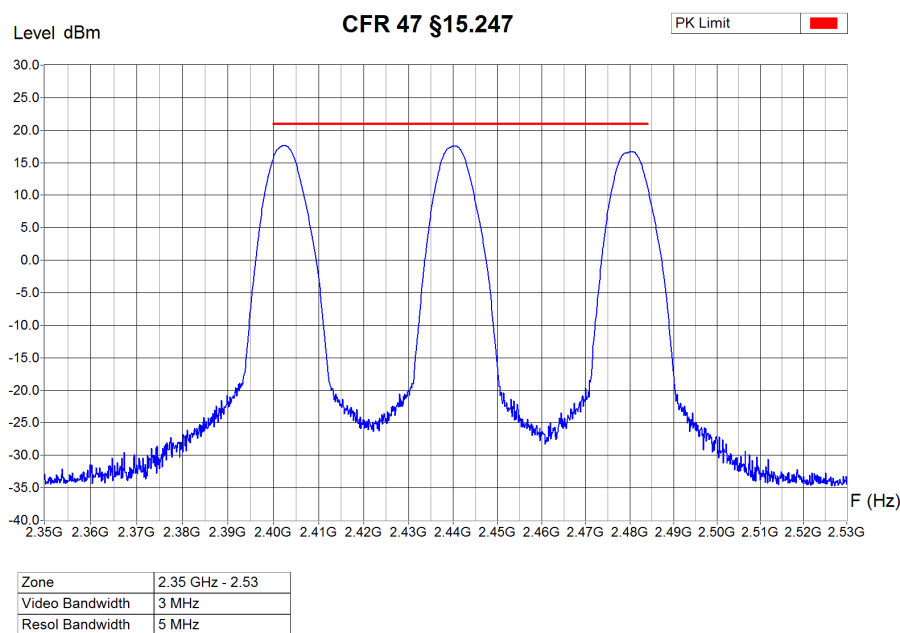
Operating mode: *Hopping f = 2.402/2.440/2.480 GHz, modulated, Pmax*

Cables connected to the EUT: *Temporary supply & antenna cables*

Remarks: *Measured on temporary antenna connector*

f normal [GHz]	Temp [°C]	U [V]	P [dBm]	P [mW]	Limit [mW]	Remarks	Pass	
							Yes	No
2.402	25	5	17.60	57.53	125	---	☒	☐
2.440	25	5	17.54	56.75	125	---	☒	☐
2.480	25	5	16.67	46.46	125	---	☒	☐

Equipment Under Test : TX22 Roger EasyPen
 Set-Up : See photos
 Operating Conditions : Hopping emission (f = 2.402, 2.440 and 2.480 GHz), modulated, Pmax
 Remarks : Peak detector, 2 sweeps, ST = 15 s, 1501 Pts
 Ton = 2x 0.184 ms, T = 3.04 ms
 Supply = 5.0 VDC, Temp. = 25°C



Operator: B. Itzcovich
 Date/Time: 27.10.2014 13:21
 Filename:
 51_CE_2G44_carrier_TX3f_5V_25
 °C.png/.txt

Place and date of test: *Rossens, October 27, 2014*
 Operator: *B. Itzcovich*

6.7 Band-edge emission (conducted)

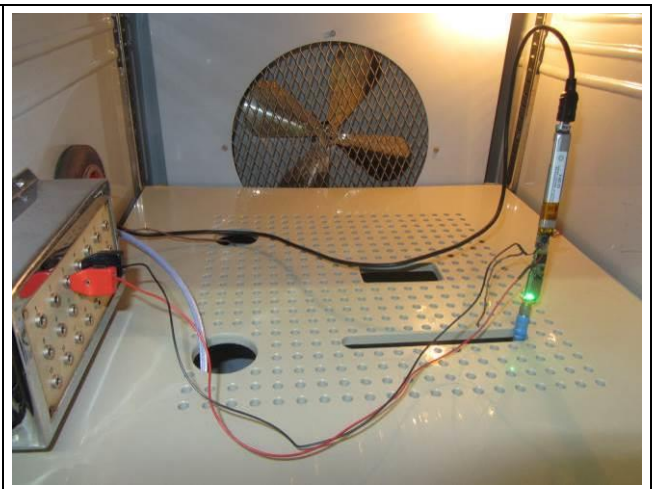
Test site: ☐ semi-anechoic chamber (foam) ☐ open test site
☐ semi-anechoic chamber (ferrites) ☒ laboratory

Meas. uncertainty: 9kHz – 3GHz: ± 1 dB
 3GHz – 6.7GHz: ± 2.1 dB
 6.7GHz – 13.2GHz: ± 2.6 dB
 13.2GHz – 19GHz: ± 2.8 dB
 19GHz – 26.5GHz: ± 3 dB

Test method: Measurement of the conducted power on the antenna connector or a test fixture.

Limit: In any 100 kHz bandwidth outside the frequency band, the radio frequency power 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.

Test set-up:



Remarks: ---

Test equipment:

Spectrum analyser	☐ 88-14	☐ 94-24	☐ 02-06	☐ 03-45	☐ 05-39	☒ 07-53
Power supply	☒ 99-07	☐ 04-31				
Cables	☒ 11-13					

Result: ☒ pass ☐ fail ☐ not applicable ☐ not tested

Results of the test

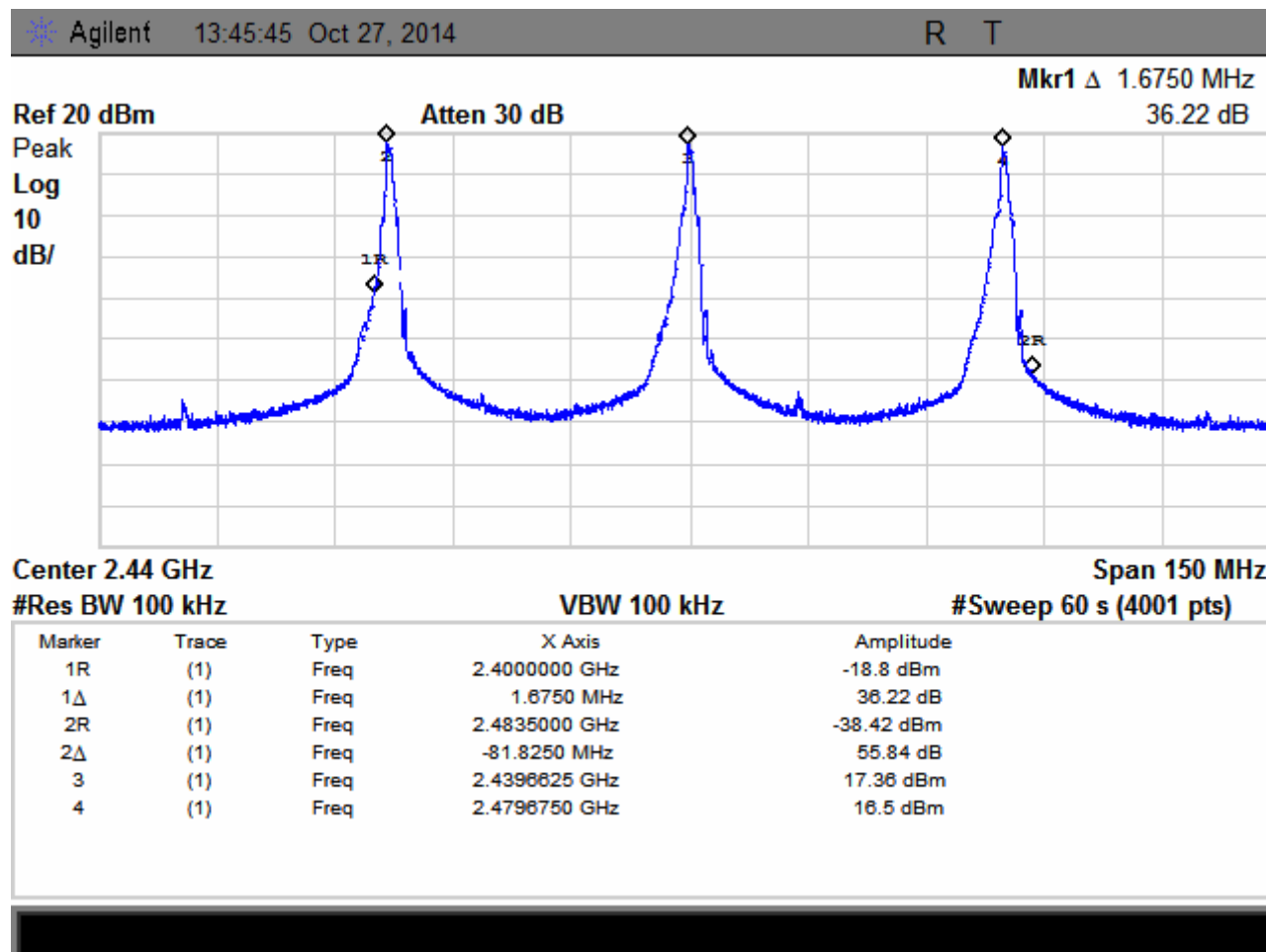
Client: *Phonak Communications AG*

Apparatus: *Roger EasyPen*

Operating mode: *Hopping f = 2.402/2.440/2.480 GHz, modulated, Pmax*

Cables connected to the EUT: *Temporary supply & antenna cables*

Remarks: *Measured on temporary antenna connector*



Place and date of test: *Rossens, October 27, 2014*
Operator: *B. Itzcovich*

6.8 Spurious emission (conducted – 15 MHz to 26.5 GHz)

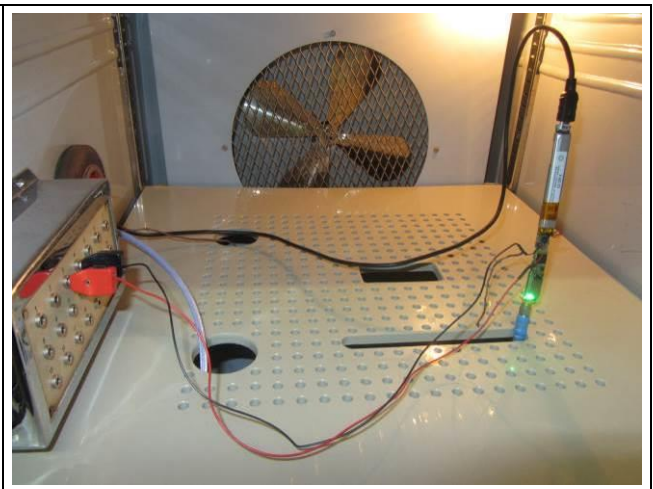
Test site: ☐ semi-anechoic chamber (foam) ☐ open test site
☐ semi-anechoic chamber (ferrites) ☒ laboratory

Meas. uncertainty: 9kHz – 3GHz: ± 1 dB
 3GHz – 6.7GHz: ± 2.1 dB
 6.7GHz – 13.2GHz: ± 2.6 dB
 13.2GHz – 19GHz: ± 2.8 dB
 19GHz – 26.5GHz: ± 3 dB

Test method: Measurement of the conducted power on the antenna connector or a test fixture.

Limit: In any 100 kHz bandwidth outside the frequency band, the radio frequency power 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

Test set-up:



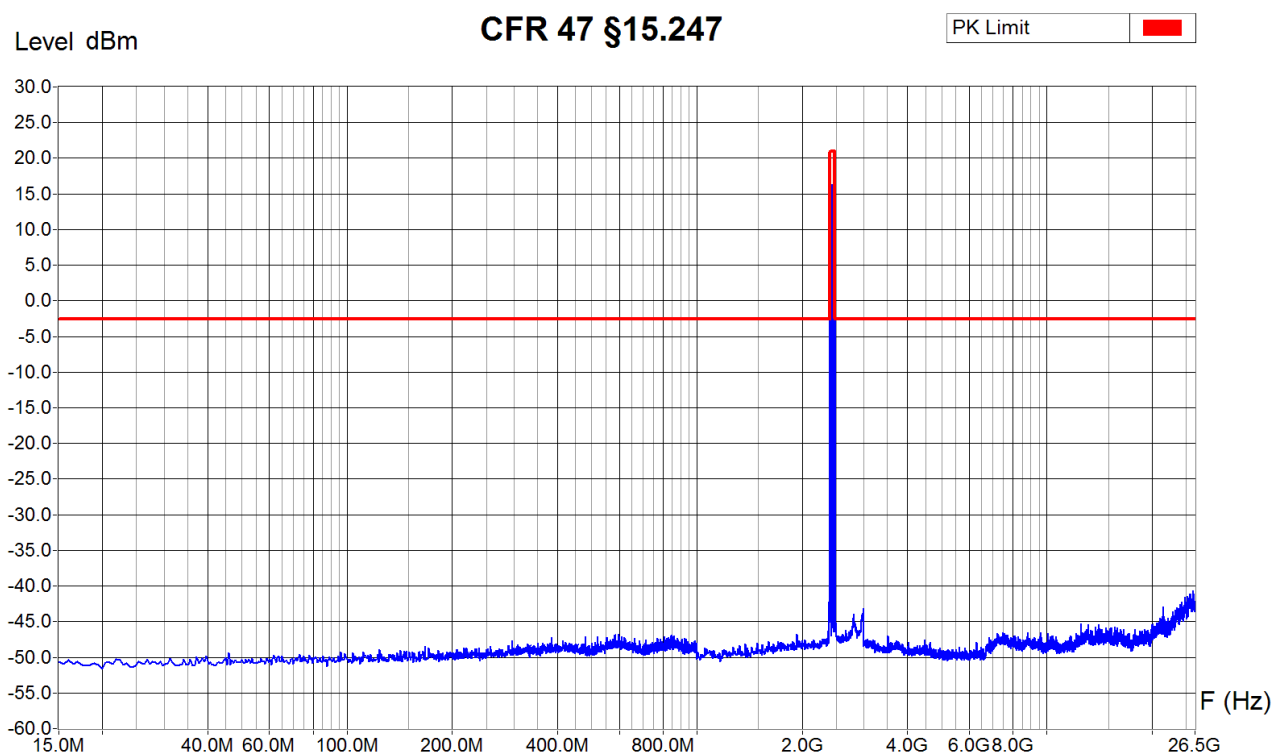
Remarks: ---

Test equipment:

Spectrum analyser	☐ 88-14	☐ 94-24	☐ 02-06	☐ 03-45	☐ 05-39	☒ 07-53
Power supply	☒ 99-07	☐ 04-31				
Cables	☒ 11-13					

Result: ☒ pass ☐ fail ☐ not applicable ☐ not tested

Equipment Under Test : TX22 Roger EasyPen
 Set-Up : See photos
 Operating Conditions : Continuously hopping TX, modulated, Pmax
 Remarks : Supply = 5.0 VDC, Temp = 25 °C
 Peak detector sweep, ST = 60s, 2001 pts



Zone	15 MHz - 1 GHz	1 GHz - 9 GHz	9 GHz - 18 GHz	18 GHz - 26.50 GHz
Video Bandwidth	100 KHz	100 KHz	100 KHz	100 KHz
Resol Bandwidth	100 KHz	100 KHz	100 KHz	100 KHz

Operator: B. Itzcovich
 Date/Time: 27.10.2014 13:03
 Filename:
 45_CE_15M-
 26G5_TX3f_17dBm.png/.txt

6.9 Spurious emission transmit mode - radiated**6.9.1 9 kHz to 30 MHz**

Test site: ☐ semi-anechoic chamber (foam) ☐ open test site
☒ semi-anechoic chamber (ferrites) ☐

Distance: ☐ 3 m ☒ 10 m ☐ 30 m

Position of EUT: 0.8 m (height of the equipment under test above floor)

Meas. uncertainty: ± 2.8 dB (10 m)

Test method: The magnetic disturbance radiated by the equipment under test is measured using a spectrum analyser and a wide band magnetic antenna. The center of the antenna is placed at 1.4 m of height, first in the direction of the apparatus under test, then at 90° to the apparatus and if required also horizontally. If possible the turning table is operated through 360° during the measurement. The recording is carried out taking into account the maximum value of the disturbance appearing during the functioning of the apparatus under test. The peak values are recorded continuously on a graph. The values exceeding the limits are remeasured using a measuring receiver.

Modifications: ☒ None ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Test set-up:



Perpendicular



Parallel

Remarks: Limit values expressed in dB μ V/m and transformed to a measuring distance of 10 m
(factor used = 40 dB/decade) if necessary
e.g.: for $f = 10$ MHz the limit is 30 μ V/m at 30 m;

$$20 \log \left(\frac{30 \frac{\mu V}{m}}{1 \frac{\mu V}{m}} \right) + 40 \log \left(\frac{30 m}{10 m} \right) = 48.6 \frac{dB\mu V}{m} \text{ at } 10 m$$

Test equipment:

Spectrum analyser	☐ 88-14	☐ 94-24	☐ 02-06	☐ 03-45	☐ 05-39	☒ 10-70
Receiver	☐ 85-04	☐ 90-43	☐ 94-35	☒ 10-70		
Preamplifier	☐ 90-01	☐ 95-86	☐ 05-56	☐ 05-59	☐ 05-62	
Antenna (type: magnetic)	☒ 90-25	☐ 90-28	☐ 99-32	☐ 04-79		
Cables	☒ 06-01	☒ 06-236				

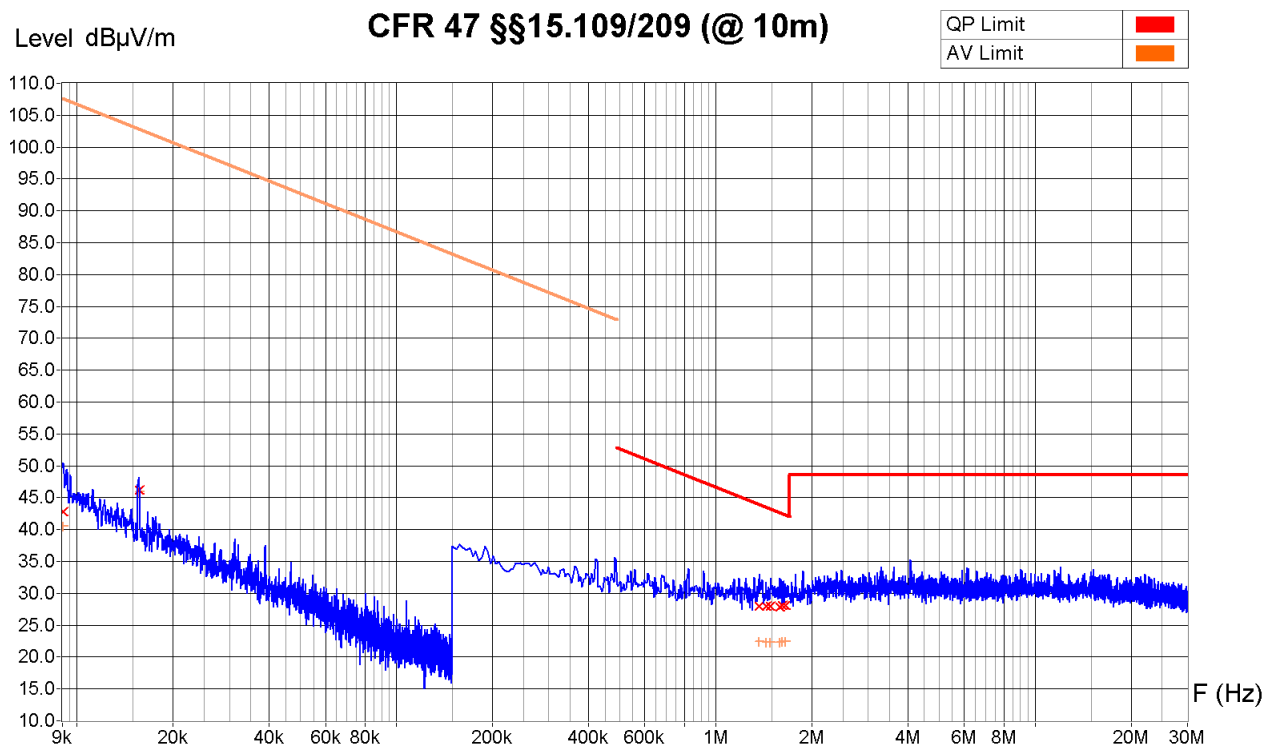
Result: ☒ pass ☐ fail ☐ not applicable ☐ not tested

Measurement Type : Radiated Field
 Polarisation : Perpendicular
 Table Angle : 0 - 360°
 Antenna Height : 1.4 m



Equipment Under Test : TX22 Roger EasyPen
 Set-Up : With cradle, charger and audio cable connected, see photos
 Operating Conditions : Hopping emission, modulated, Pmax
 Remarks :

Cage 06-01



Zone	9 KHz - 60 KHz	60 KHz - 105 KHz	105 KHz - 150 KHz	150 KHz - 8 MHz	8 MHz - 30 MHz
Video Bandwidth	500 Hz	500 Hz	500 Hz	30 KHz	30 KHz
Resol Bandwidth	200 Hz	200 Hz	200 Hz	9 KHz	9 KHz

Receiver Measures

Frequency	Peak	QuasiPeak (x)	Average (+)	QP Margin
9.05 KHz	51.9 dBμV/m	42.7 dBμV/m	40.5 dBμV/m	
15.63 KHz	49.9 dBμV/m	46.2 dBμV/m	45.9 dBμV/m	
1.37 MHz	34.1 dBμV/m	28.0 dBμV/m	22.4 dBμV/m	16.0 dB
1.44 MHz	34.3 dBμV/m	28.0 dBμV/m	22.3 dBμV/m	15.5 dB
1.49 MHz	34.3 dBμV/m	28.0 dBμV/m	22.3 dBμV/m	15.2 dB
1.59 MHz	33.9 dBμV/m	27.9 dBμV/m	22.3 dBμV/m	14.8 dB
1.62 MHz	34.6 dBμV/m	28.1 dBμV/m	22.4 dBμV/m	14.4 dB
1.65 MHz	34.5 dBμV/m	28.0 dBμV/m	22.4 dBμV/m	14.3 dB

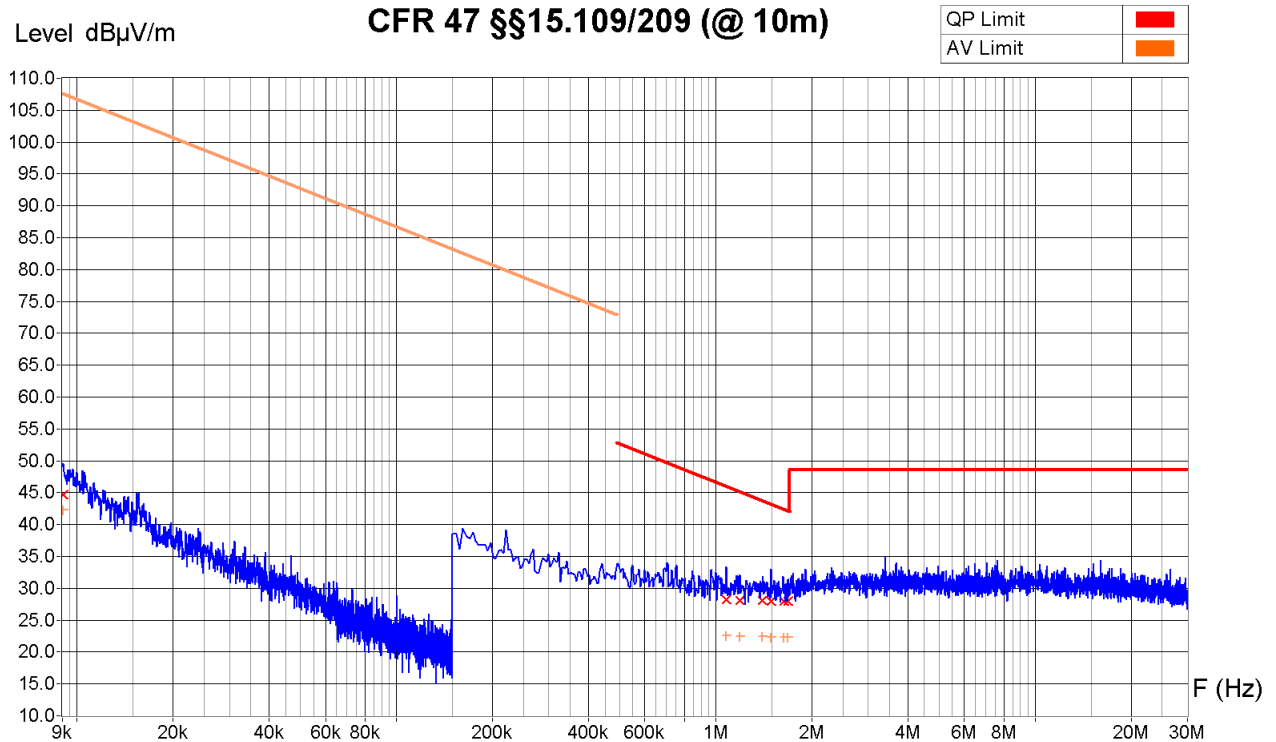
Operator: B. Itzcovich
 Date/Time: 22.12.2014 15:37
 Filename:
 75_RE_9k-30M_TX_Per.png/.txt

Measurement Type : Radiated Field
Polarisation : Parallel
Table Angle : 0 - 360°
Antenna Height : 1.4 m



Equipment Under Test : TX22 Roger EasyPen
Set-Up : With cradle, charger and audio cable connected, see photos
Operating Conditions : Hopping emission, modulated, Pmax
Remarks :

Cage 06-01



Zone	9 KHz - 60 KHz	60 KHz - 105 KHz	105 KHz - 150 KHz	150 KHz - 8 MHz	8 MHz - 30 MHz
Video Bandwidth	500 Hz	500 Hz	500 Hz	30 KHz	30 KHz
Resol Bandwidth	200 Hz	200 Hz	200 Hz	9 KHz	9 KHz

Receiver Measures

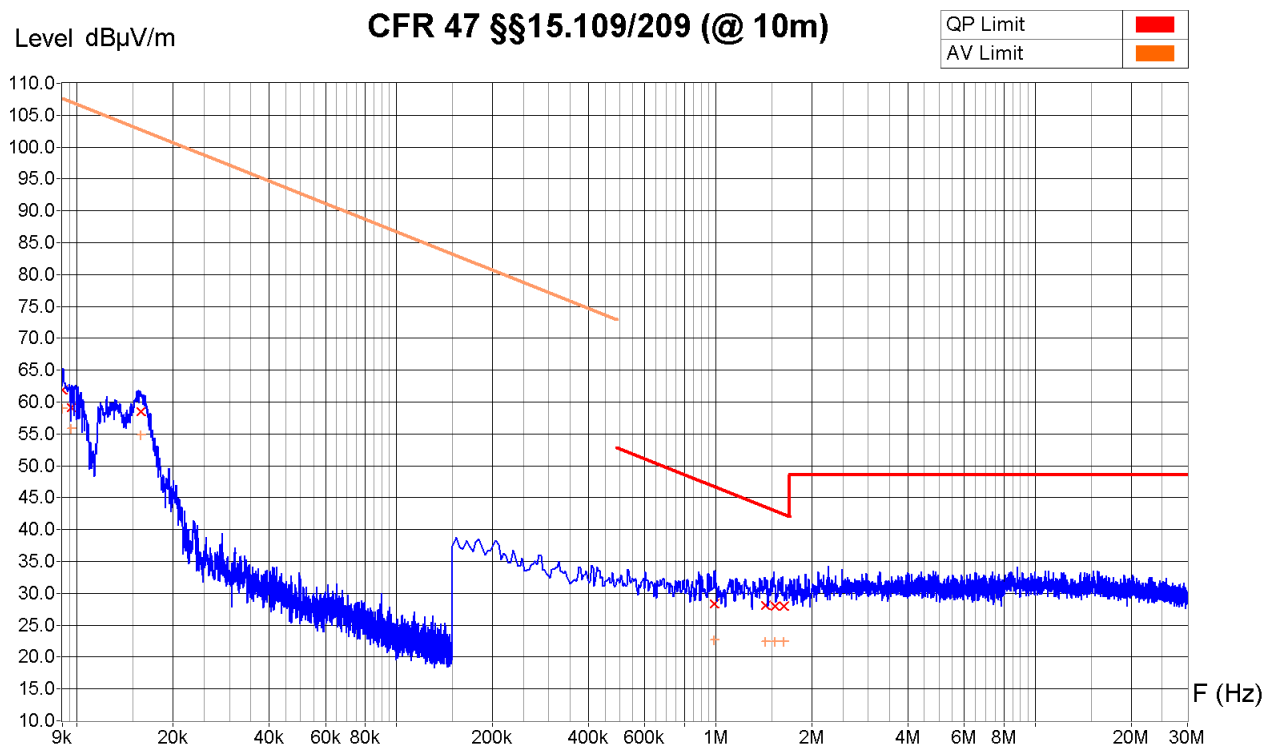
Frequency	Peak	QuasiPeak (x)	Average (+)	QP Margin
9.05 KHz	53.2 dB μ V/m	44.6 dB μ V/m	42.3 dB μ V/m	
1.08 MHz	34.6 dB μ V/m	28.2 dB μ V/m	22.5 dB μ V/m	17.9 dB
1.19 MHz	35.1 dB μ V/m	28.0 dB μ V/m	22.4 dB μ V/m	17.1 dB
1.40 MHz	35.0 dB μ V/m	28.1 dB μ V/m	22.5 dB μ V/m	15.7 dB
1.49 MHz	34.4 dB μ V/m	28.0 dB μ V/m	22.3 dB μ V/m	15.2 dB
1.63 MHz	34.7 dB μ V/m	28.0 dB μ V/m	22.4 dB μ V/m	14.4 dB
1.68 MHz	33.9 dB μ V/m	28.0 dB μ V/m	22.4 dB μ V/m	14.2 dB

Operator: B. Itzcovich
Date/Time: 22.12.2014 15:51
Filename:
76_RE_9k-30M_TX_Par.png/.txt

Measurement Type : Radiated Field
Polarisation : Horizontal
Table Angle : 0 - 360°
Antenna Height : 1.4 m



Equipment Under Test : TX22 Roger EasyPen
Set-Up : With cradle, charger and audio cable connected, see photos
Operating Conditions : Hopping emission, modulated, Pmax
Remarks : Antenna Ground-parallel
Cage 06-01



Zone	9 KHz - 60 KHz	60 KHz - 105 KHz	105 KHz - 150 KHz	150 KHz - 8 MHz	8 MHz - 30 MHz
Video Bandwidth	500 Hz	500 Hz	500 Hz	30 KHz	30 KHz
Resol Bandwidth	200 Hz	200 Hz	200 Hz	9 KHz	9 KHz

Receiver Measures

Frequency	Peak	QuasiPeak (x)	Average (+)	QP Margin
9 KHz	66.8 dBμV/m	61.9 dBμV/m	59.0 dBμV/m	
9.58 KHz	64.2 dBμV/m	59.1 dBμV/m	55.8 dBμV/m	
15.83 KHz	63.8 dBμV/m	58.5 dBμV/m	54.9 dBμV/m	
990 KHz	34.5 dBμV/m	28.3 dBμV/m	22.7 dBμV/m	18.5 dB
1.43 MHz	34.3 dBμV/m	28.0 dBμV/m	22.4 dBμV/m	15.5 dB
1.53 MHz	34.2 dBμV/m	28.0 dBμV/m	22.4 dBμV/m	15.0 dB
1.63 MHz	33.8 dBμV/m	28.0 dBμV/m	22.4 dBμV/m	14.4 dB

Operator: B. Itzcovich
Date/Time: 22.12.2014 16:09
Filename:
77_RE_9k-30M_TX_Hor.png/.txt

6.9.2 30 MHz to 1 GHz

Test site: ☐ semi-anechoic chamber (foam) ☒ semi-anechoic chamber (ferrites)

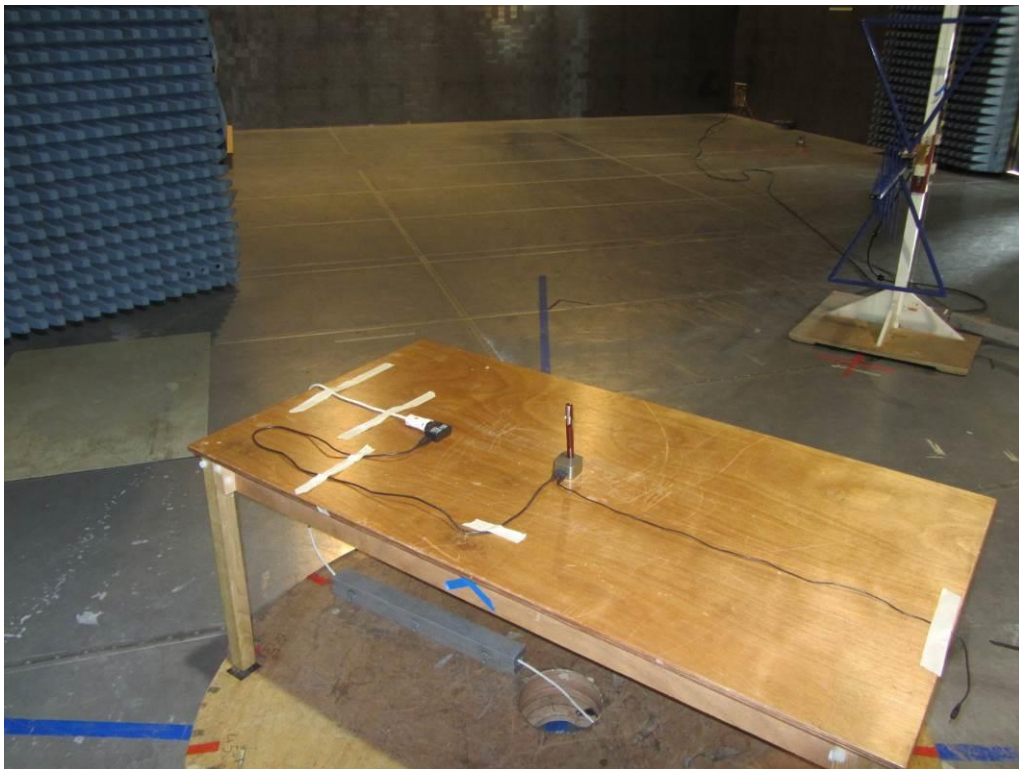
Distance: ☒ 3 m ☐ 10 m ☐ 30 m

Position of EUT: 0.8 m (height of the equipment under test above floor)

Meas. uncertainty: ± 4.6 dB (30 - 300 MHz) / ± 3.7 dB (300 - 1000 MHz)

Test method: The electromagnetic disturbance radiated by the equipment is measured using a spectrum analyser and a wide band antenna. The antenna is moved from 1 to 4 m in height successively with horizontal and vertical polarisations. The turning table is operated through 360° during the measurements. The recordings are carried out taking into account the maximum value of all the disturbances appearing while the apparatus is under test. The peak values are recorded continuously on the graph. The values exceeding a limit are remeasured manually using a receiver.

Test set-up:



Remarks: Limit values expressed in dB μ V/m and transformed to a measuring distance of 3 m (factor used = 20 dB/decade) if necessary
e.g.: for $f = 40$ MHz the limit is 100 μ V/m at 3 m;

$$20 \log \left(\frac{100 \frac{\mu V}{m}}{1 \frac{\mu V}{m}} \right) = 40 \frac{dB \mu V}{m} \text{ at } 3m$$

Test equipment:

Spectrum analyser	☐ 88-14	☐ 94-24	☐ 02-06	☐ 03-45	☐ 05-39	☒ 10-70
Receiver	☐ 85-04	☐ 90-43	☐ 94-35	☒ 10-70		
Preamplifier	☐ 90-01	☐ 95-86	☐ 05-56	☒ 05-59	☐ 05-62	
Antenna (bilog)	☒ 94-03	☐ 05-38				
Cables	☒ 06-01					

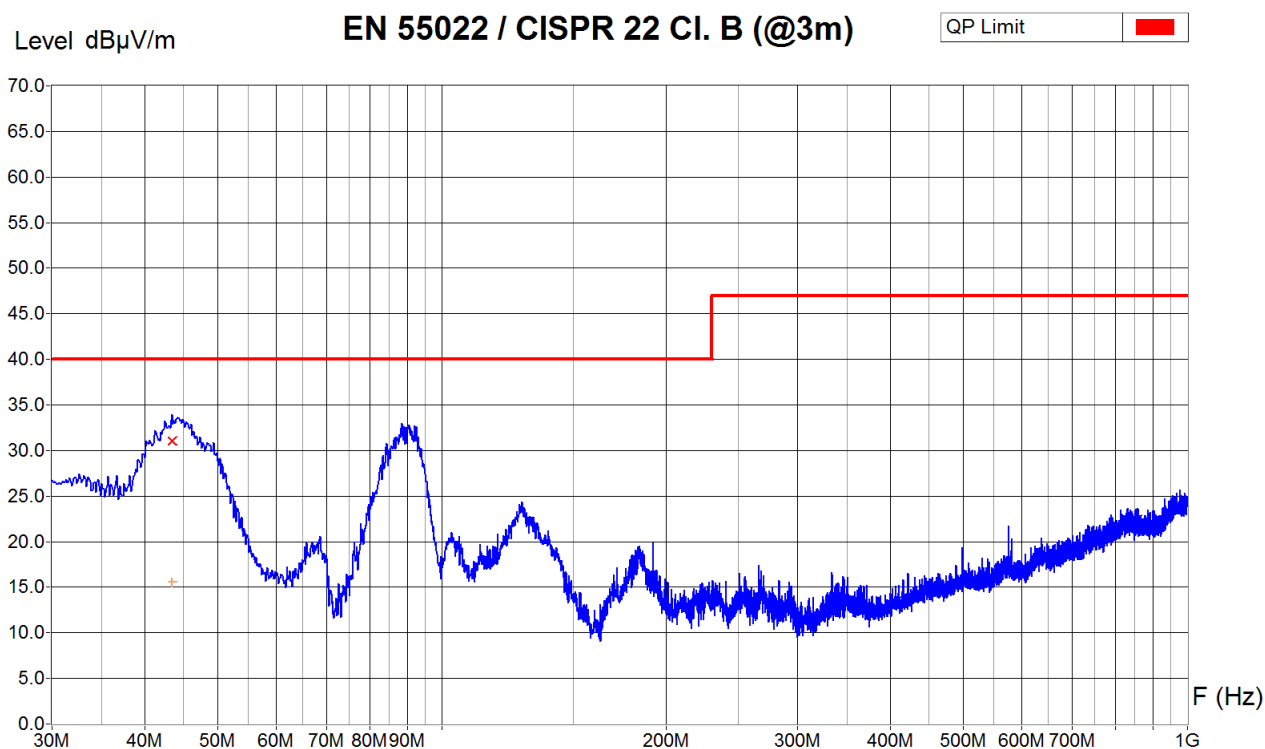
Result: ☒ pass ☐ fail ☐ not applicable ☐ not tested

Measurement Type : Radiated Field
Polarisation : Vertical
Table Angle : 0 - 360°
Antenna Height : 1 - 4m



Equipment Under Test : TX22 Roger EasyPen
Set-Up : With cradle, charger and audio cable connected. See photos
Operating Conditions : DM Hopping emission ($f = 2.402, 2.440 / 2.480$ GHz), modulated, Pmax
Remarks :

Cage 06-01



Zone	30 MHz - 1 GHz
Video Bandwidth	300 KHz
Resol Bandwidth	120 KHz

Receiver Measures

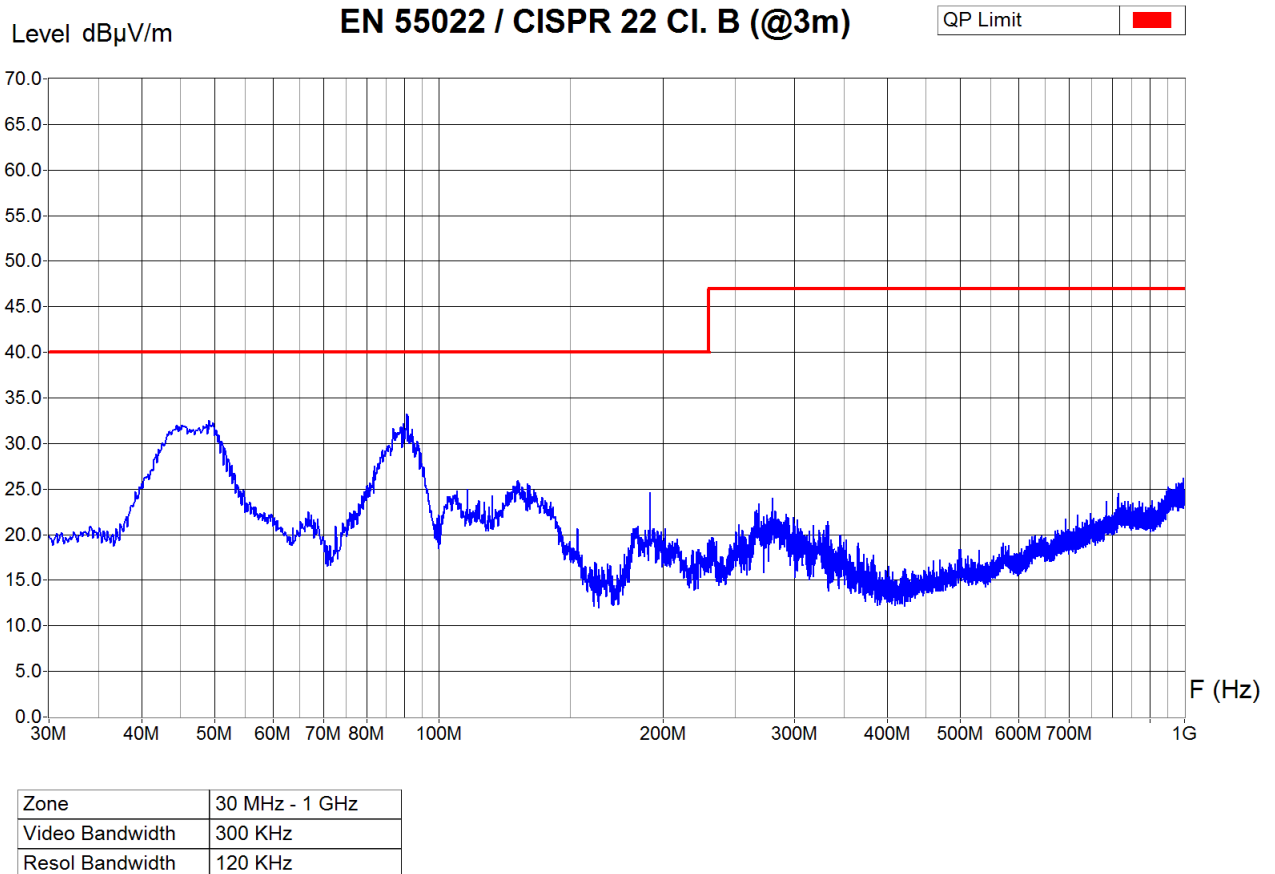
Frequency	Peak	QuasiPeak (x)	Average (+)	QP Margin
43.46 MHz	36.4 dB μ V/m	31.0 dB μ V/m	15.5 dB μ V/m	9.0 dB

Operator: B. Itzcovich
Date/Time: 20.10.2014 14:01
Filename:
05_RE_30M-
1G_TX3f_V_C22_R.png/.txt

Measurement Type : Radiated Field
Polarisation : Horizontal
Table Angle : 0 - 360°
Antenna Height : 1 - 4m



Equipment Under Test : TX22 Roger EasyPen
Set-Up : With cradle, charger and audio cable connected. See photos
Operating Conditions : DM Hopping emission (f = 2.402, 2.440 / 2.480 GHz), modulated, Pmax
Remarks :
Cage 06-01



Operator: B. Itzcovich
Date/Time: 20.10.2014 14:10
Filename:
06_RE_30M-
1G_TX3f_H_C22.png/.txt

6.9.3 1 GHz to 18 GHz

Test site: ☐ semi-anechoic chamber (ferrites) ☒ semi-anechoic chamber (foam)

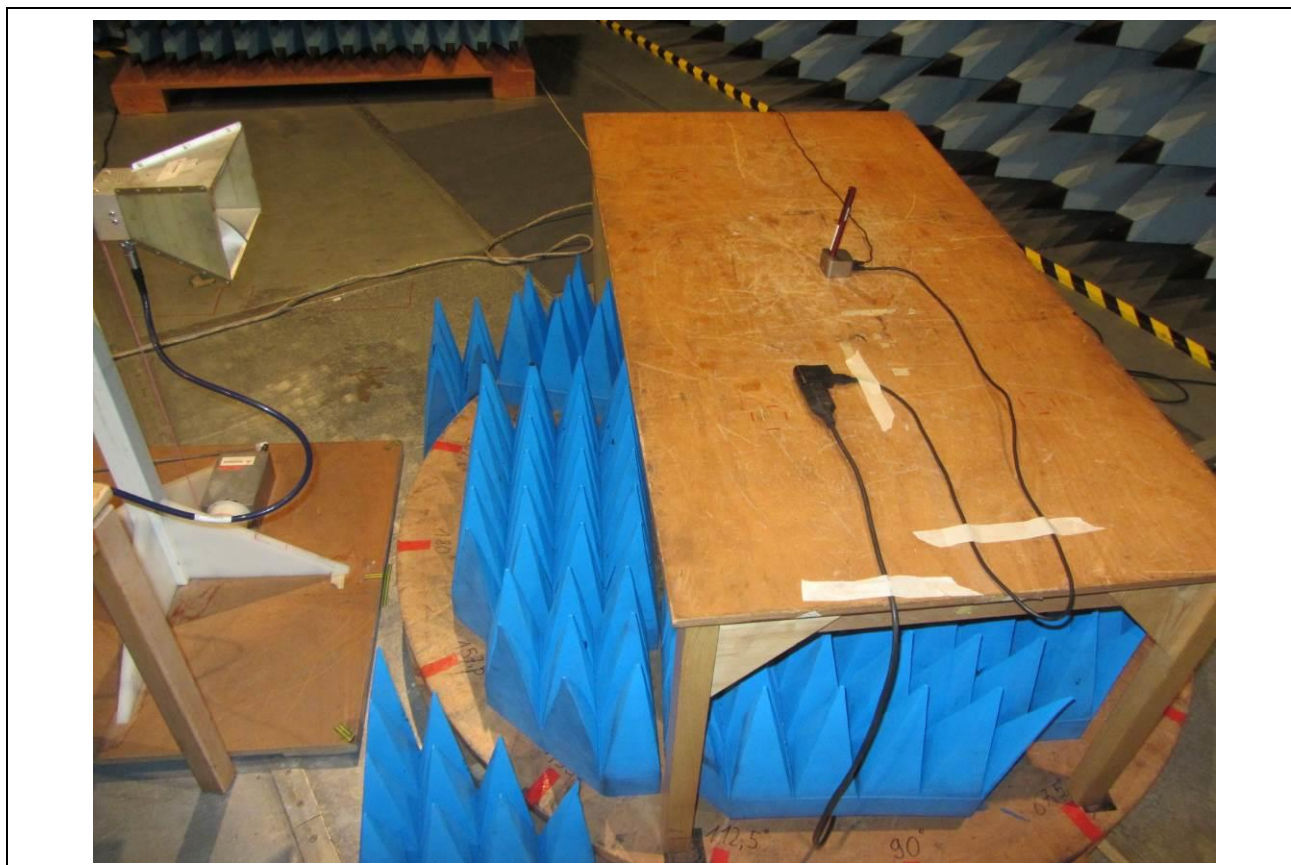
Distance: ☒ 1 m ☐ 3 m ☐ 10 m ☐ 30 m

Position of EUT: 0.8 m (height of the equipment under test above floor)

Meas. uncertainty: ± 4.7 dB

Test method: The electromagnetic disturbance radiated by the equipment is measured using a spectrum analyser and a wide band antenna. The antenna is placed at the same height as the EUT successively with horizontal and vertical polarisations. The turning table is operated through 360° during the measurements. The recordings are carried out taking into account the maximum value (peak) of all the disturbances appearing while the apparatus is under test.

Test set-up:



Remarks: Limit values expressed in dB μ V/m and transformed to a measuring distance of 1 m (factor used = 20 dB/decade) if necessary
e.g.: for $f = 1$ GHz the limit is 500 μ V/m at 3 m;

$$20 \log \left(\frac{500 \frac{\mu V}{m}}{1 \frac{\mu V}{m}} \right) + 20 \log \left(\frac{3m}{1m} \right) = 63.5 \frac{dB\mu V}{m} \text{ at } 1m$$

Test equipment:

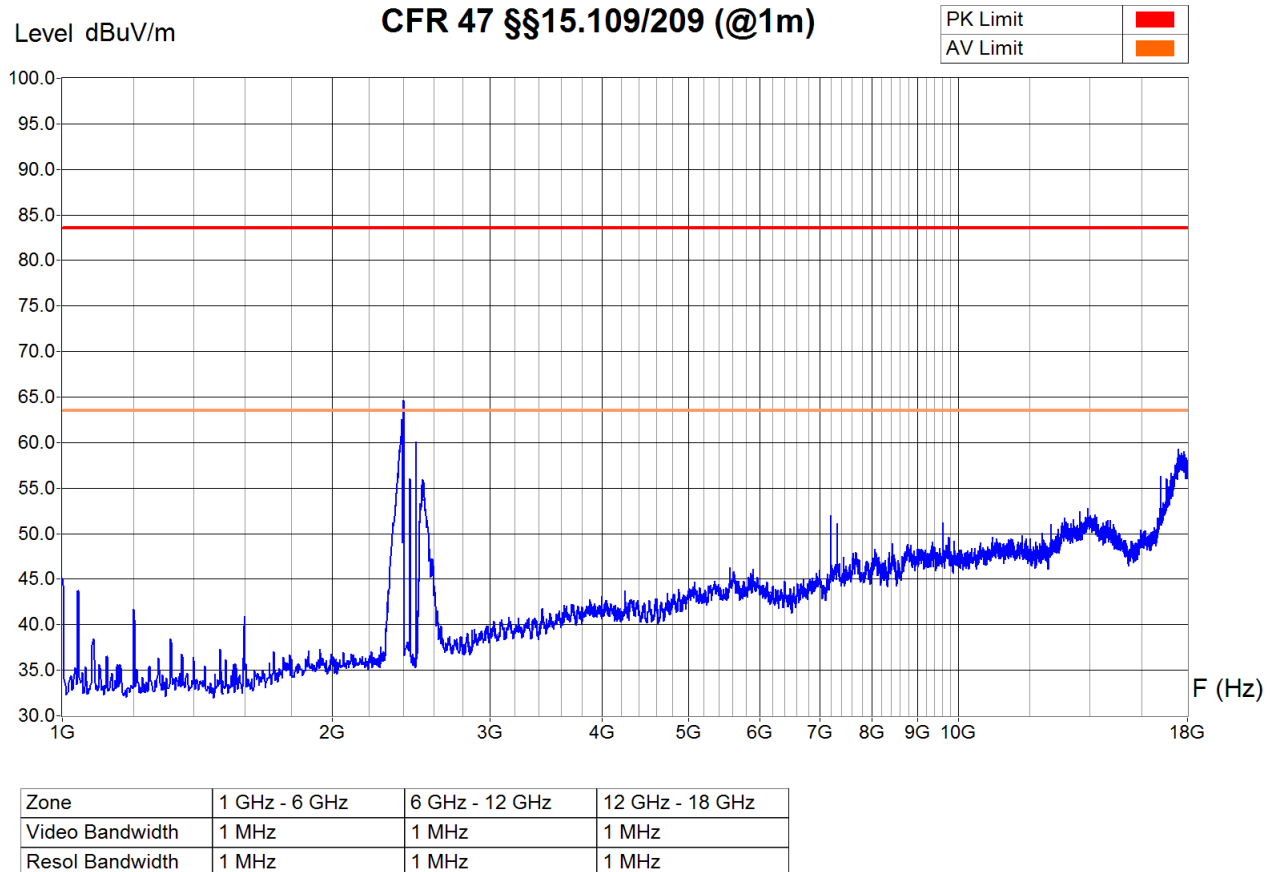
Spectrum analyser	☐ 88-14	☐ 94-24	☐ 02-06	☐ 03-45	☐ 05-39	☒ 07-53
Preamplifier	☐ 05-56	☐ 05-87	☒ 11-29			
Antenna (horn)	☒ 90-24	☐ 07-31				
Cables	☒ 10-75	☒ 11-61				
Filters	☐ 10-65	☐ 10-66	☒ 13-14	☒ 12-06		

Result: ☒ pass ☐ fail ☐ not applicable ☐ not tested

Measurement Type : Radiated Field
Polarisation : Vertical
Table Angle : 0 - 360°
Antenna Height : 1 - 2m



Equipment Under Test : TX22 Roger EasyPen
Set-Up : With cradle, charger and audio cable connected, see photos
Operating Conditions : Hopping emission (f = 2.402 / 2.440 / 2.480 GHz), modulated, Pmax (15dBm)
Remarks : Zone 1-6 GHz with notch filter, with preamp.
Zone 6-18 GHz with HP filter, with preamp.
Cage 06-00

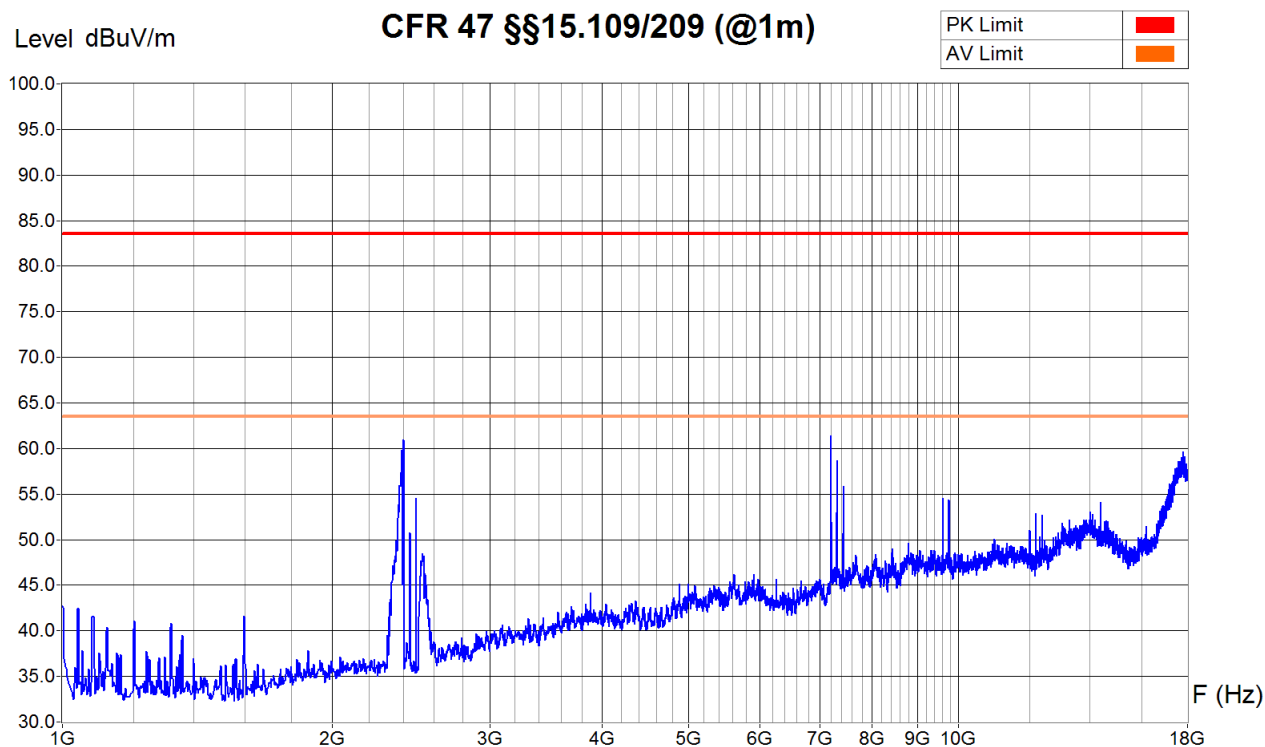


Operator: B. Itzcovich
Date/Time: 22.10.2014 11:50
Filename:
21_RE_1-
18G_TX3f_V_0m8_FCC.png/.txt

Measurement Type : Radiated Field
Polarisation : Horizontal
Table Angle : 0 - 360°
Antenna Height : 1 - 2m



Equipment Under Test : TX22 Roger EasyPen
Set-Up : With cradle, charger and audio cable connected, see photos
Operating Conditions : Hopping emission (f = 2.402 / 2.440 / 2.480 GHz), modulated, Pmax (15dBm)
Remarks : Zone 1-6 GHz with notch filter, with preamp.
Zone 6-18 GHz with HP filter, with preamp.
Cage 06-00



Zone	1 GHz - 6 GHz	6 GHz - 12 GHz	12 GHz - 18 GHz
Video Bandwidth	1 MHz	1 MHz	1 MHz
Resol Bandwidth	1 MHz	1 MHz	1 MHz

Frequency	Average RMS detector meas.
7.206 GHz	51.1 dBuV/m

Operator: B. Itzcovich
Date/Time: 22.10.2014 11:57
Filename:
22_RE_1-
18G_TX3f_H_0m8_FCC.png/.txt

6.9.4 18 GHz to 26.5 GHz

Test site: ☒ semi-anechoic chamber (foam) ☐ semi-anechoic chamber (ferrites)

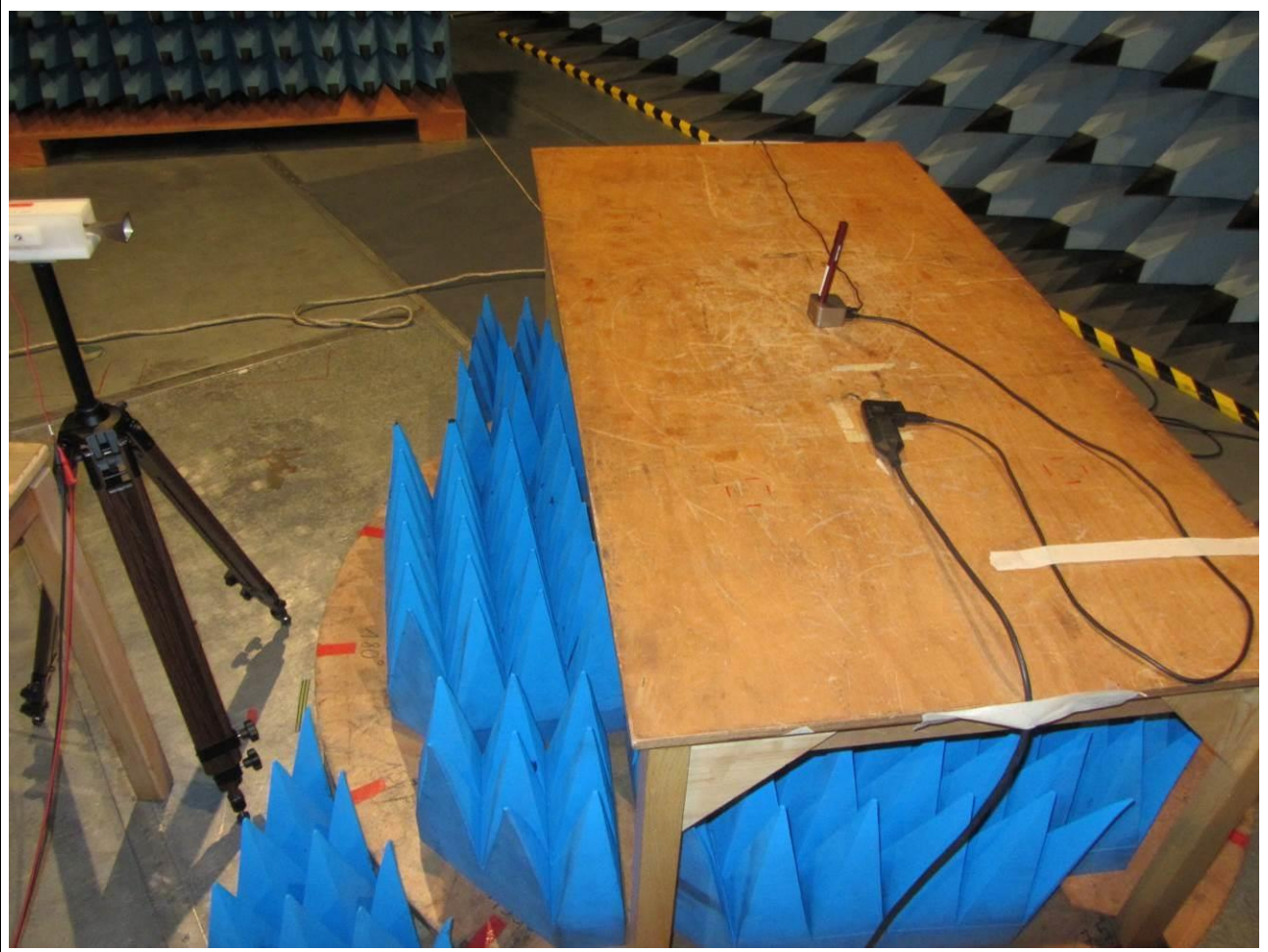
Distance: ☒ 1 m ☐ 3 m ☐ 10 m ☐ 30 m

Position of EUT: 0.8 m (height of the equipment under test above floor)

Meas. uncertainty: ± 4.7 dB

Test method: The electromagnetic disturbance radiated by the equipment is measured using a spectrum analyser and a wide band antenna. The antenna is placed at the same height as the EUT successively with horizontal and vertical polarisations. The turning table is operated through 360° during the measurements. The recordings are carried out taking into account the maximum value (peak) of all the disturbances appearing while the apparatus is under test.

Test set-up:



Remarks: Limit values expressed in dB μ V/m and transformed to a measuring distance of 1 m (factor used = 20 dB/decade) if necessary
e.g.: for $f = 18$ GHz the limit is 500 μ V/m at 3 m;

$$20 \log \left(\frac{500 \frac{\mu V}{m}}{1 \frac{\mu V}{m}} \right) + 20 \log \left(\frac{3m}{1m} \right) = 63.5 \frac{dB\mu V}{m} \text{ at } 1m$$

Test equipment:

Spectrum analyser	☐ 88-14	☐ 94-24	☐ 02-06	☐ 03-45	☐ 05-39	☒ 07-53
Antenna with mixer & preamp.	☒ 98-12					
Cables	☒ 11-62	☒ 10-81				
Power supply	☒ 06-62					

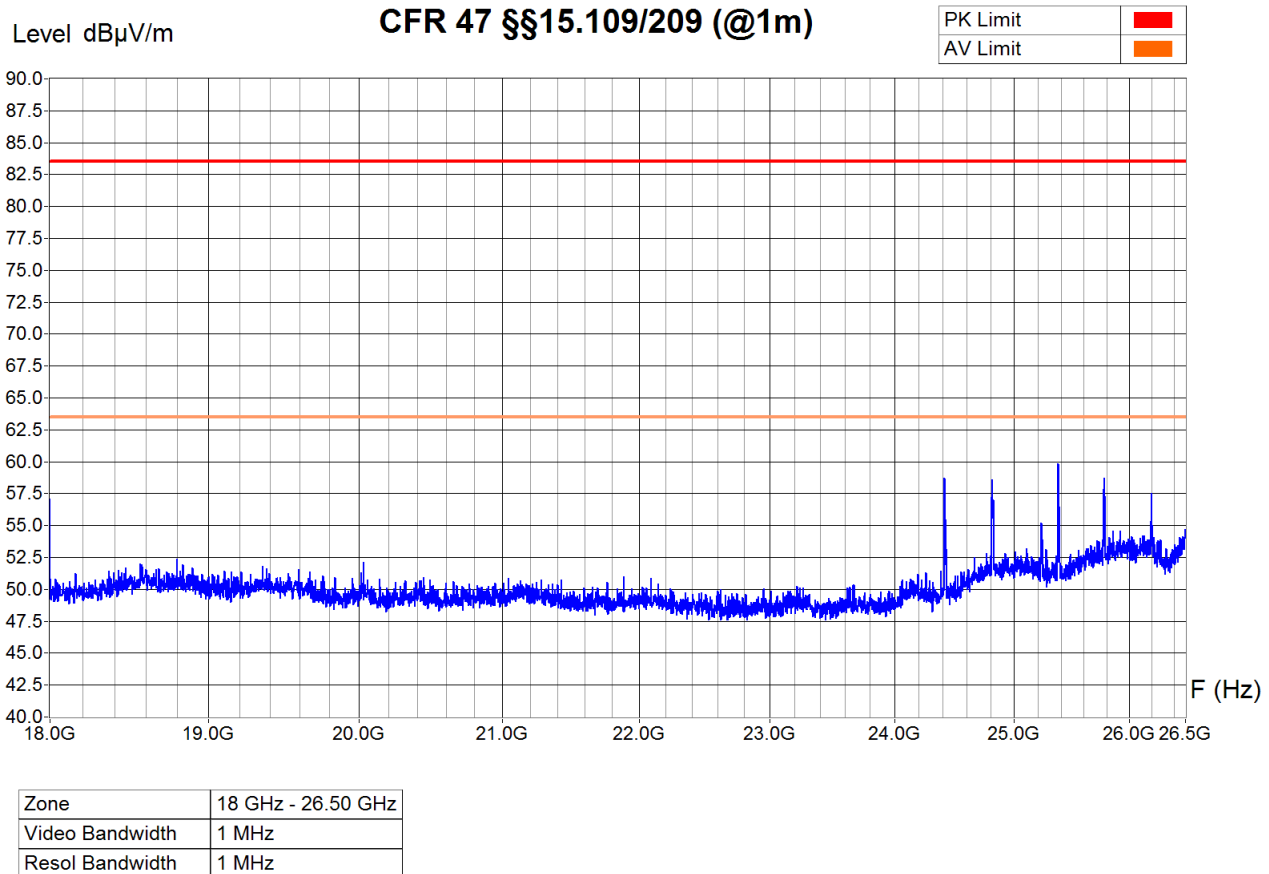
Result: ☒ pass ☐ fail ☐ not applicable ☐ not tested

Measurement Type : Radiated Field
Polarisation : Vertical
Table Angle : 0 - 360°
Antenna Height : 1m



Equipment Under Test : TX22 Roger EasyPen
Set-Up : With cradle, charger and audio cable connected, see photos
Operating Conditions : Hopping emission (f = 2.402 / 2.440 / 2.480 GHz), modulated, Pmax (15dBm)
Remarks :

Cage 06-00



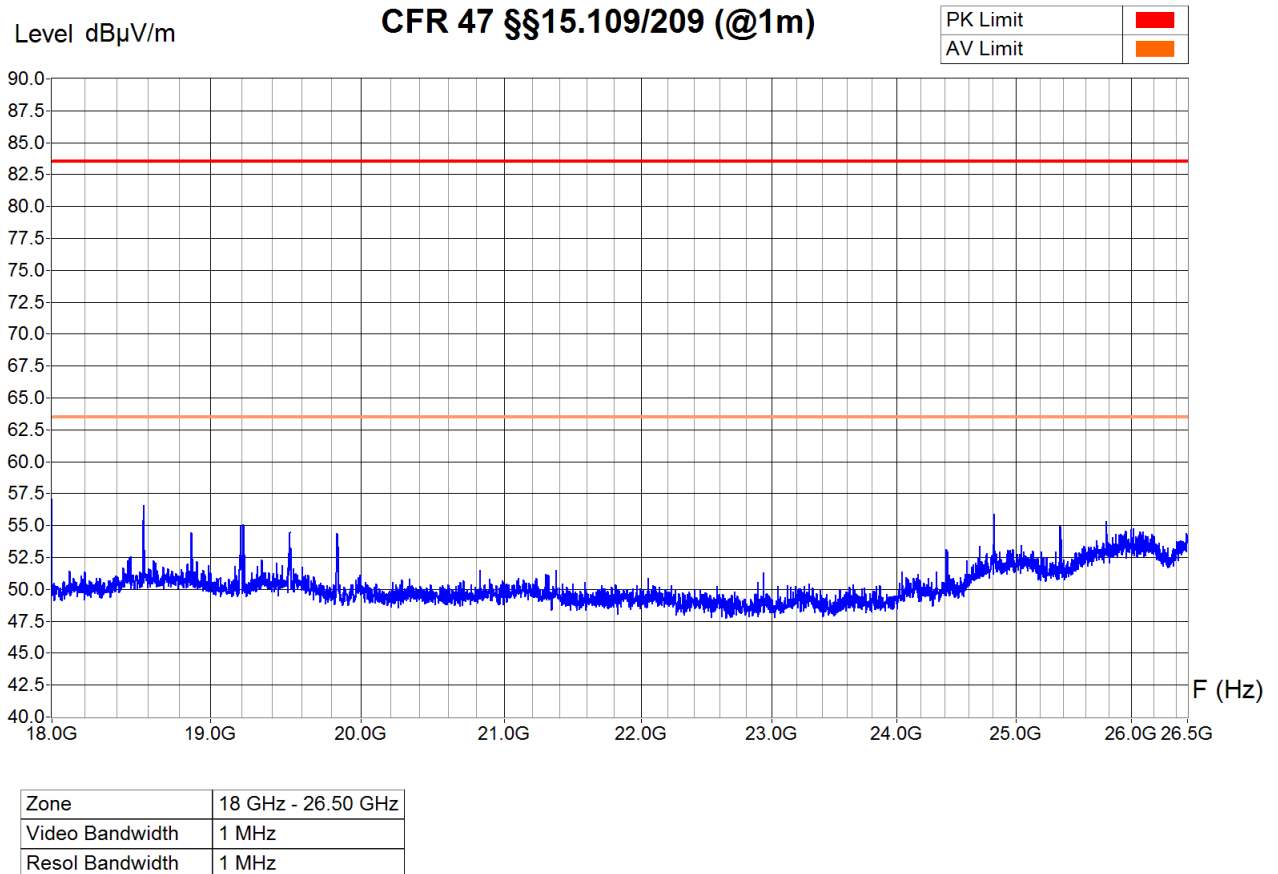
Operator: B. Itzcovichm
Date/Time: 23.10.2014 09:07
Filename:
31_RE_18-
26G5_TX3f_V_0m8_FCC.png/.txt

Measurement Type : Radiated Field
Polarisation : Horizontal
Table Angle : 0 - 360°
Antenna Height : 1m



Equipment Under Test : TX22 Roger EasyPen
Set-Up : With cradle, charger and audio cable connected, see photos
Operating Conditions : Hopping emission (f = 2.402 / 2.440 / 2.480 GHz), modulated, Pmax (15dBm)
Remarks :

Cage 06-00



Operator: B. Itzcovichm
Date/Time: 23.10.2014 09:15
Filename:
32_RE_18-
26G5_TX3f_H_0m8_FCC.png/.txt

6.10 Spurious emission receive mode - radiated**6.10.1 9 kHz to 30 MHz**

Test site: ☐ semi-anechoic chamber (foam) ☐ open test site
☒ semi-anechoic chamber (ferrites) ☐

Distance: ☐ 3 m ☒ 10 m ☐ 30 m

Position of EUT: 0.8 m (height of the equipment under test above floor)

Meas. uncertainty: ± 2.8 dB (10 m)

Test method: The magnetic disturbance radiated by the equipment under test is measured using a spectrum analyser and a wide band magnetic antenna. The center of the antenna is placed at 1.4 m of height, first in the direction of the apparatus under test, then at 90° to the apparatus and if required also horizontally. If possible the turning table is operated through 360° during the measurement. The recording is carried out taking into account the maximum value of the disturbance appearing during the functioning of the apparatus under test. The peak values are recorded continuously on a graph. The values exceeding the limits are remeasured using a measuring receiver.

Modifications: ☒ None ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Test set-up:



Perpendicular



Parallel

Remarks:

Limit values expressed in dBμV/m and transformed to a measuring distance of 10 m
 (factor used = 40 dB/decade) if necessary
 e.g.: for f = 10 MHz the limit is 30 μV/m at 30 m;

$$20 \log \left(\frac{30 \frac{\mu V}{m}}{1 \frac{\mu V}{m}} \right) + 40 \log \left(\frac{30 m}{10 m} \right) = 48.6 \frac{dB\mu V}{m} \text{ at } 10 m$$

Test equipment:

Spectrum analyser	☐ 88-14	☐ 94-24	☐ 02-06	☐ 03-45	☐ 05-39	☒ 10-70
Receiver	☐ 85-04	☐ 90-43	☐ 94-35	☒ 10-70		
Preamplifier	☐ 90-01	☐ 95-86	☐ 05-56	☐ 05-59	☐ 05-62	
Antenna (type: magnetic)	☒ 90-25	☐ 90-28	☐ 99-32	☐ 04-79		
Cables	☒ 06-01	☒ 06-236				

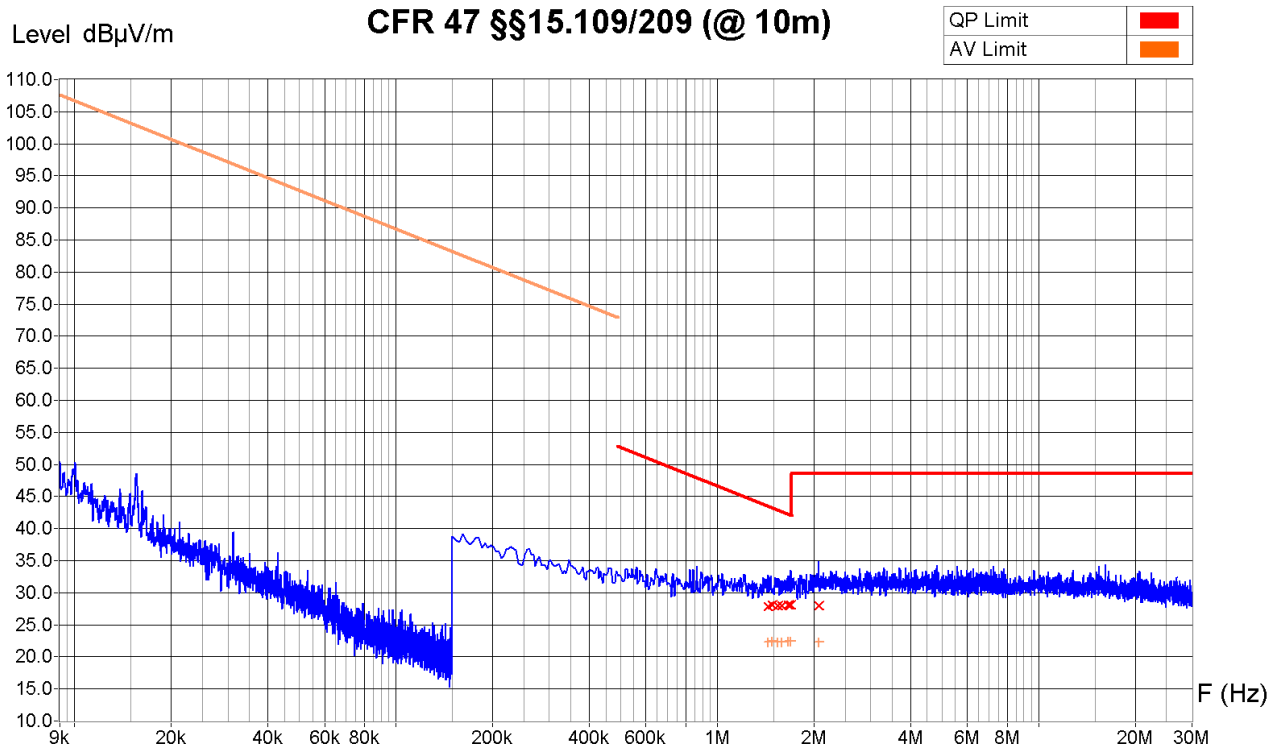
Result: ☒ pass ☐ fail ☐ not applicable ☐ not tested

Measurement Type : Radiated Field
Polarisation : Perpendicular
Table Angle : 0 - 360°
Antenna Height : 1.4 m



Equipment Under Test : TX22 Roger EasyPen
Set-Up : With cradle, charger and audio cable connected, see photos
Operating Conditions : Standby mode, charging
Remarks :

Cage 06-01



Zone	9 KHz - 60 KHz	60 KHz - 105 KHz	105 KHz - 150 KHz	150 KHz - 8 MHz	8 MHz - 30 MHz
Video Bandwidth	500 Hz	500 Hz	500 Hz	30 KHz	30 KHz
Resol Bandwidth	200 Hz	200 Hz	200 Hz	9 KHz	9 KHz

Receiver Measures

Frequency	Peak	QuasiPeak (x)	Average (+)	QP Margin
1.44 MHz	34.7 dB μ V/m	27.9 dB μ V/m	22.3 dB μ V/m	15.6 dB
1.48 MHz	34.7 dB μ V/m	28.1 dB μ V/m	22.4 dB μ V/m	15.2 dB
1.54 MHz	34.4 dB μ V/m	27.9 dB μ V/m	22.3 dB μ V/m	15.0 dB
1.59 MHz	34.6 dB μ V/m	28.0 dB μ V/m	22.3 dB μ V/m	14.7 dB
1.66 MHz	34.7 dB μ V/m	28.1 dB μ V/m	22.4 dB μ V/m	14.2 dB
1.69 MHz	34.5 dB μ V/m	28.1 dB μ V/m	22.4 dB μ V/m	14.1 dB
2.07 MHz	35.9 dB μ V/m	28.0 dB μ V/m	22.3 dB μ V/m	20.7 dB

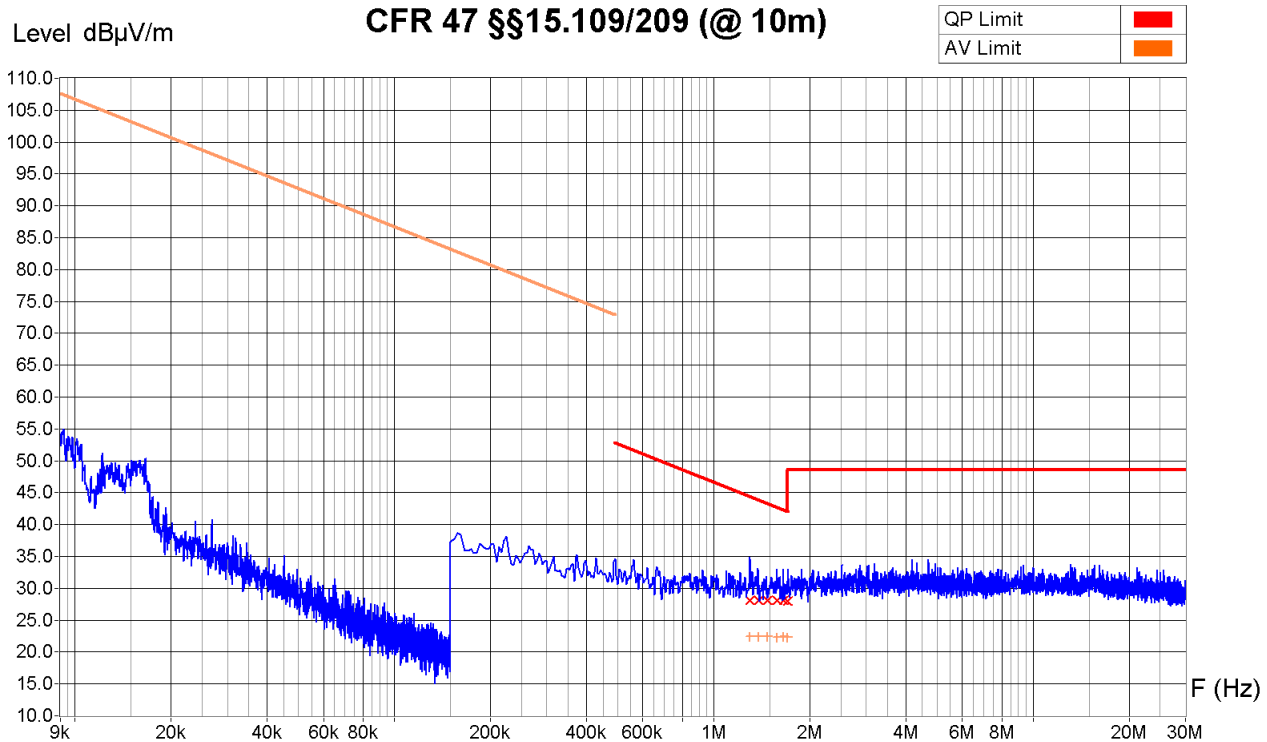
Operator: B. Itzcovich
Date/Time: 22.12.2014 16:44
Filename:
78_RE_9k-30M_Stby_Per.png/.txt

Measurement Type : Radiated Field
 Polarisation : Parallel
 Table Angle : 0 - 360°
 Antenna Height : 1.4 m



Equipment Under Test : TX22 Roger EasyPen
 Set-Up : With cradle, charger and audio cable connected, see photos
 Operating Conditions : Standby mode, charging
 Remarks :

Cage 06-01



Zone	9 KHz - 60 KHz	60 KHz - 105 KHz	105 KHz - 150 KHz	150 KHz - 8 MHz	8 MHz - 30 MHz
Video Bandwidth	500 Hz	500 Hz	500 Hz	30 KHz	30 KHz
Resol Bandwidth	200 Hz	200 Hz	200 Hz	9 KHz	9 KHz

Receiver Measures

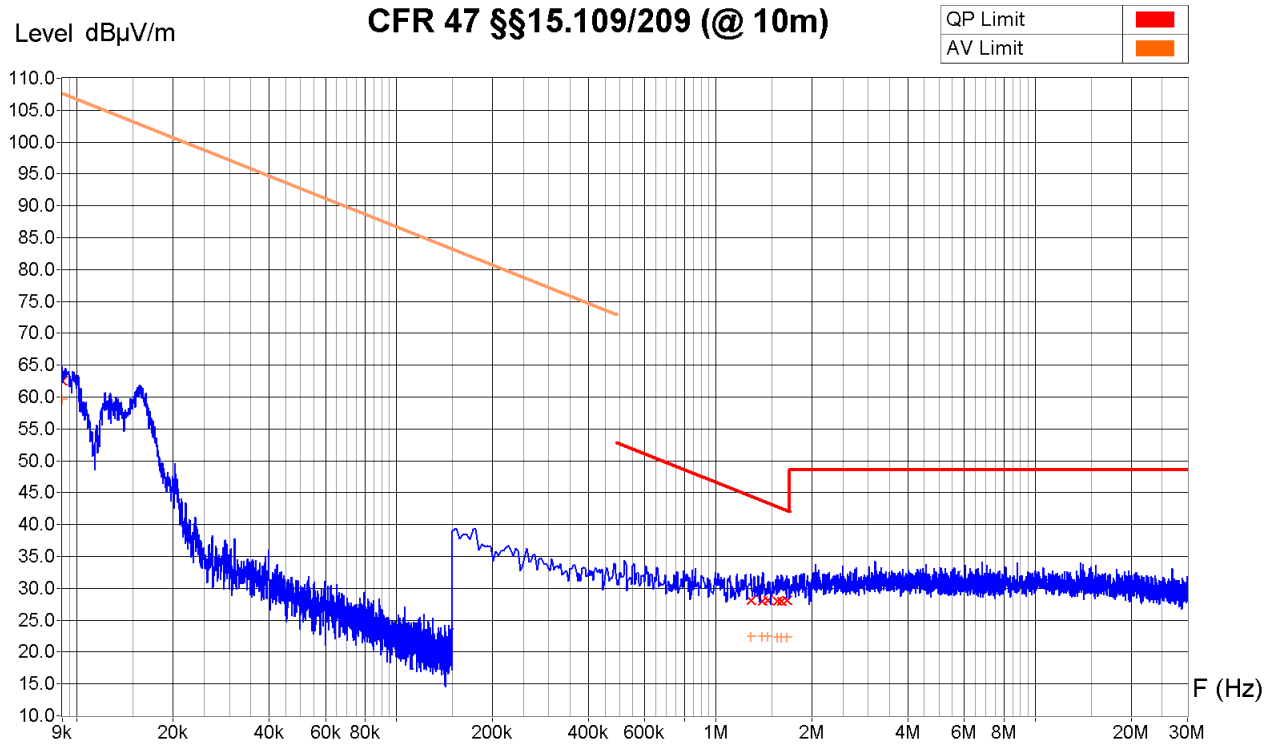
Frequency	Peak	QuasiPeak (x)	Average (+)	QP Margin
1.30 MHz	34.8 dBμV/m	28.1 dBμV/m	22.4 dBμV/m	16.3 dB
1.38 MHz	35.4 dBμV/m	28.1 dBμV/m	22.4 dBμV/m	15.8 dB
1.47 MHz	35.0 dBμV/m	28.1 dBμV/m	22.4 dBμV/m	15.3 dB
1.58 MHz	34.1 dBμV/m	28.1 dBμV/m	22.4 dBμV/m	14.7 dB
1.65 MHz	34.6 dBμV/m	28.1 dBμV/m	22.4 dBμV/m	14.2 dB
1.70 MHz	34.4 dBμV/m	28.0 dBμV/m	22.3 dBμV/m	14.1 dB

Operator: B. Itzcovich
 Date/Time: 22.12.2014 16:30
 Filename:
 79_RE_9k-30M_Stby_Par.png/.txt

Measurement Type : Radiated Field
Polarisation : Horizontal
Table Angle : 0 - 360°
Antenna Height : 1.4 m



Equipment Under Test : TX22 Roger EasyPen
Set-Up : With cradle, charger and audio cable connected, see photos
Operating Conditions : Standby mode, charging
Remarks : Antenna Ground-parallel
Cage 06-01



Zone	9 KHz - 60 KHz	60 KHz - 105 KHz	105 KHz - 150 KHz	150 KHz - 8 MHz	8 MHz - 30 MHz
Video Bandwidth	500 Hz	500 Hz	500 Hz	30 KHz	30 KHz
Resol Bandwidth	200 Hz	200 Hz	200 Hz	9 KHz	9 KHz

Receiver Measures

Frequency	Peak	QuasiPeak (x)	Average (+)	QP Margin
9 KHz	67.8 dB μ V/m	62.5 dB μ V/m	59.7 dB μ V/m	
1.29 MHz	34.2 dB μ V/m	28.1 dB μ V/m	22.4 dB μ V/m	16.4 dB
1.40 MHz	34.5 dB μ V/m	28.0 dB μ V/m	22.4 dB μ V/m	15.8 dB
1.46 MHz	34.0 dB μ V/m	28.1 dB μ V/m	22.4 dB μ V/m	15.3 dB
1.56 MHz	33.9 dB μ V/m	27.9 dB μ V/m	22.3 dB μ V/m	14.9 dB
1.61 MHz	34.3 dB μ V/m	27.9 dB μ V/m	22.3 dB μ V/m	14.6 dB
1.67 MHz	34.2 dB μ V/m	28.0 dB μ V/m	22.3 dB μ V/m	14.2 dB

Operator: B. Itzcovich
Date/Time: 22.12.2014 16:22
Filename:
80_RE_9k-30M_Stby_Hor.png/.txt

6.10.2 30 MHz to 1 GHz

Test site: ☐ semi-anechoic chamber (foam) ☒ semi-anechoic chamber (ferrites)

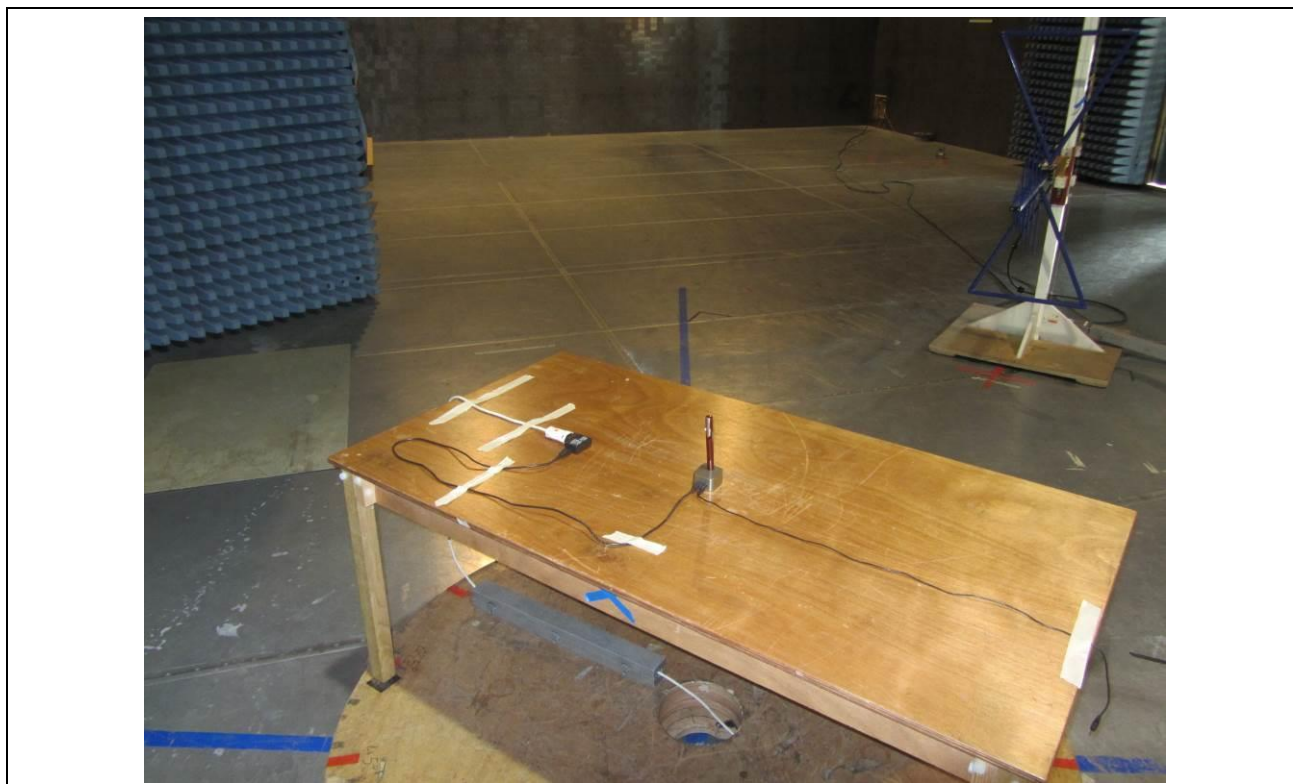
Distance: ☒ 3 m ☐ 10 m ☐ 30 m

Position of EUT: 0.8 m (height of the equipment under test above floor)

Meas. uncertainty: ± 4.6 dB (30 - 300 MHz) / ± 3.7 dB (300 - 1000 MHz)

Test method: The electromagnetic disturbance radiated by the equipment is measured using a spectrum analyser and a wide band antenna. The antenna is moved from 1 to 4 m in height successively with horizontal and vertical polarisations. The turning table is operated through 360° during the measurements. The recordings are carried out taking into account the maximum value of all the disturbances appearing while the apparatus is under test. The peak values are recorded continuously on the graph. The values exceeding a limit are remeasured manually using a receiver.

Test set-up:



Remarks: Limit values expressed in dB μ V/m and transformed to a measuring distance of 3 m (factor used = 20 dB/decade) if necessary
e.g.: for $f = 40$ MHz the limit is 100 μ V/m at 3 m;

$$20 \log \left(\frac{100 \frac{\mu V}{m}}{1 \frac{\mu V}{m}} \right) = 40 \frac{dB \mu V}{m} \text{ at } 3m$$

Test equipment:

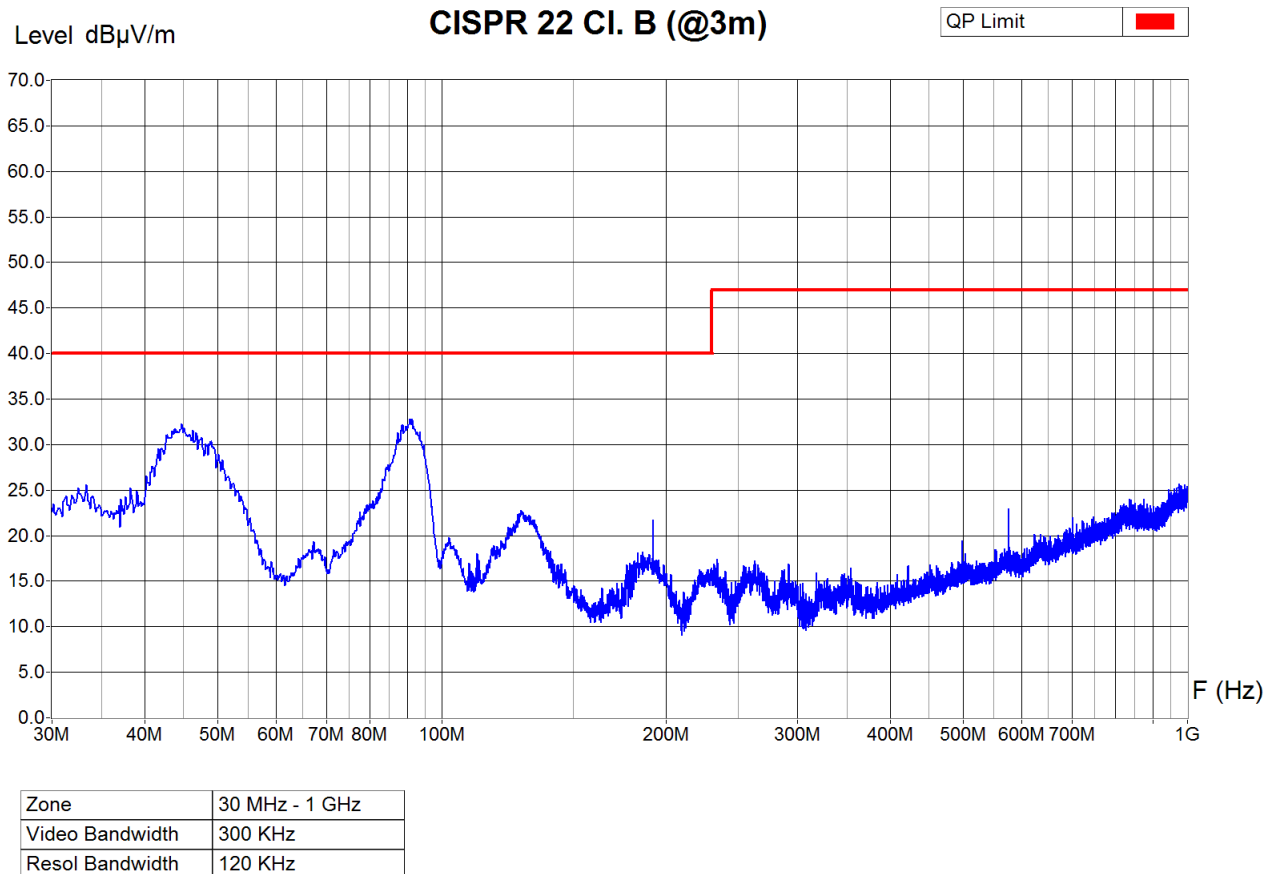
Spectrum analyser	☐ 88-14	☐ 94-24	☐ 02-06	☐ 03-45	☐ 05-39	☒ 10-70
Receiver	☐ 85-04	☐ 90-43	☐ 94-35	☒ 10-70		
Preamplifier	☐ 90-01	☐ 95-86	☐ 05-56	☒ 05-59	☐ 05-62	
Antenna (bilog)	☒ 94-03	☐ 05-38				
Cables	☒ 06-01					

Result: ☒ pass ☐ fail ☐ not applicable ☐ not tested

Measurement Type : Radiated Field
Polarisation : Vertical
Table Angle : 0 - 360°
Antenna Height : 1 - 4m



Equipment Under Test : TX22 Roger EasyPen
Set-Up : With cradle, charger and audio cable connected. See photos
Operating Conditions : RX (f = 2.440 GHz)
Remarks :
Cage 06-01



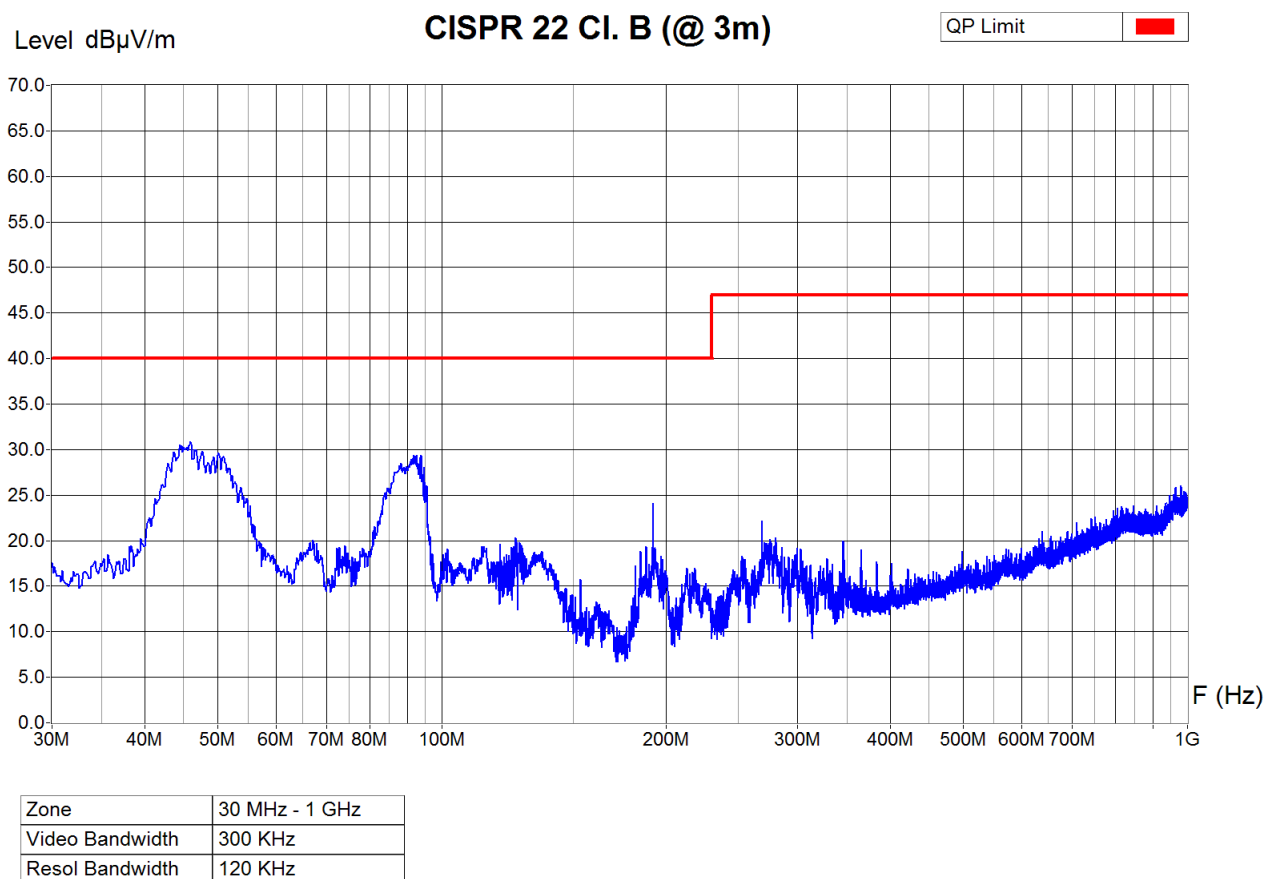
Operator: B. Itzcovich
Date/Time: 20.10.2014 14:38
Filename:
09_RE_30M-1G_RX_V_C22.png/
.txt

Measurement Type : Radiated Field
 Polarisation : Horizontal
 Table Angle : 0 - 360°
 Antenna Height : 1 - 4m



Equipment Under Test : TX22 Roger EasyPen
 Set-Up : With cradle, charger and audio cable connected. See photos
 Operating Conditions : RX (f = 2.440 GHz)
 Remarks :

Cage 06-01

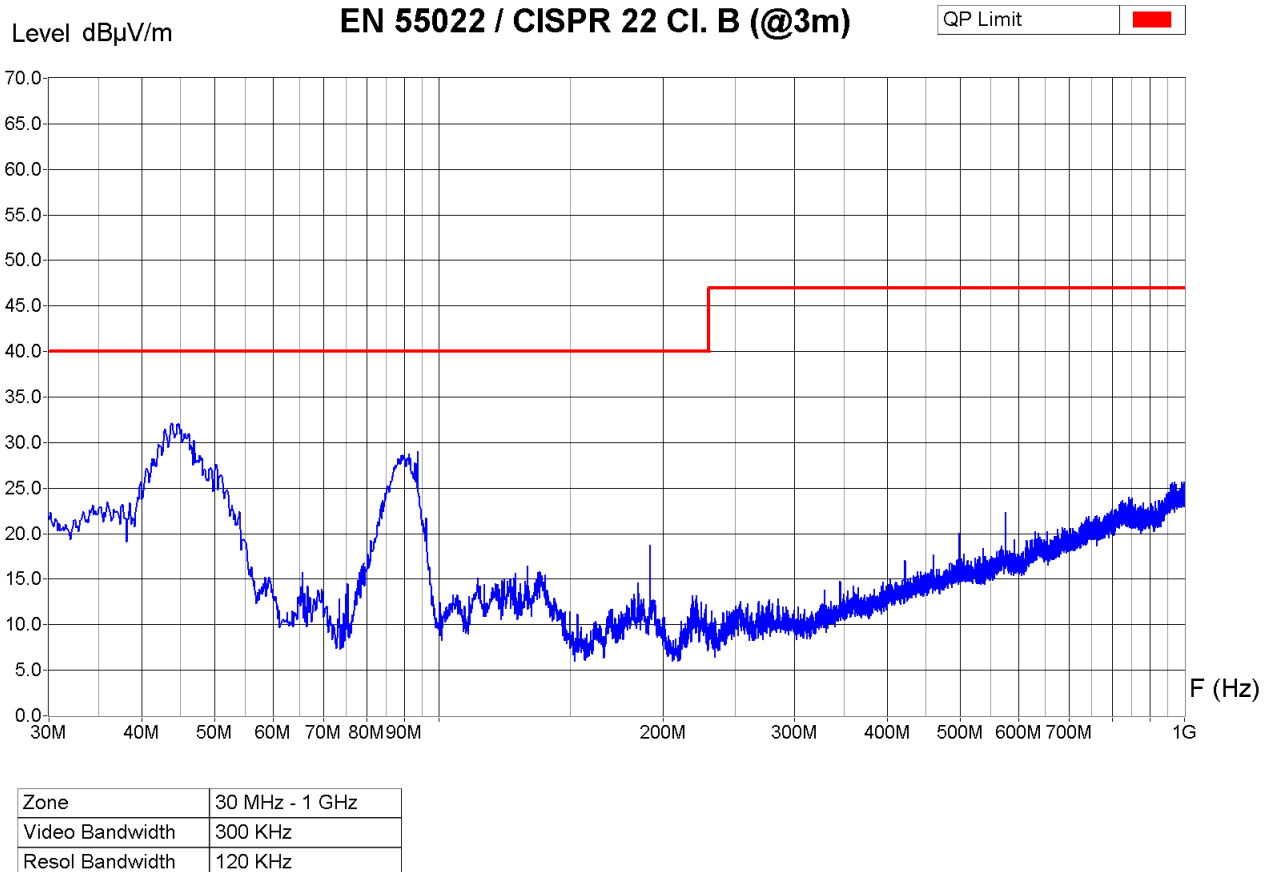


Operator: B. Itzcovich
 Date/Time: 20.10.2014 14:46
 Filename:
 10_RE_30M-1G_RX_H_C22.png/
 .txt

Measurement Type : Radiated Field
Polarisation : Vertical
Table Angle : 0 - 360°
Antenna Height : 1 - 4m



Equipment Under Test : TX22 Roger EasyPen
Set-Up : With cradle, charger and audio cable connected. See photos
Operating Conditions : Standby mode, charging
Remarks :
Cage 06-01



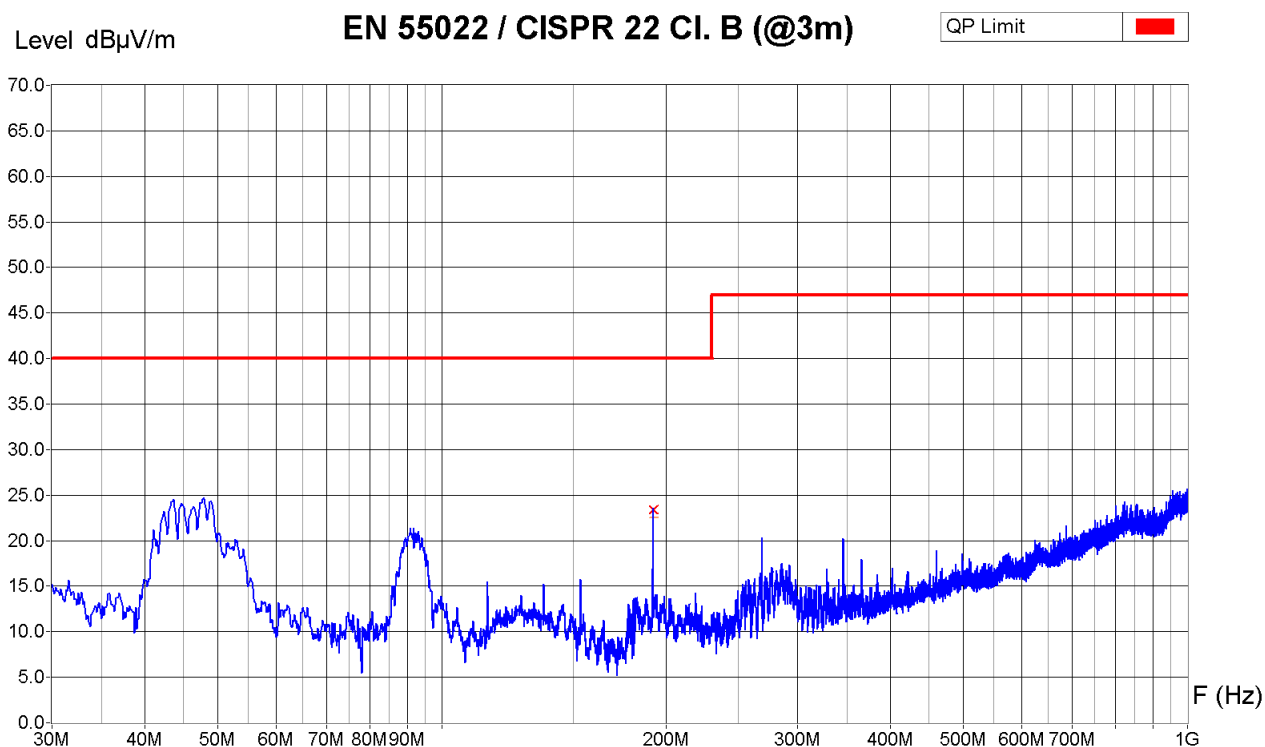
Operator: B. Itzcovich
Date/Time: 20.10.2014 15:00
Filename:
11_RE_30M-1G_Stby_V.png/.txt

Measurement Type : Radiated Field
 Polarisation : Horizontal
 Table Angle : 0 - 360°
 Antenna Height : 1 - 4m



Equipment Under Test : TX22 Roger EasyPen
 Set-Up : With cradle, charger and audio cable connected. See photos
 Operating Conditions : Standby mode, charging
 Remarks :

Cage 06-01



Zone	30 MHz - 1 GHz
Video Bandwidth	300 KHz
Resol Bandwidth	120 KHz

Receiver Measures

Frequency	Peak	QuasiPeak (x)	Average (+)	QP Margin
192 MHz	25.7 dBμV/m	23.4 dBμV/m	22.6 dBμV/m	16.6 dB

Operator: B. Itzcovich
 Date/Time: 20.10.2014 15:09
 Filename:
 12_RE_30M-1G_Stby_H.png/.txt

6.10.3 1 GHz to 18 GHz

Test site: ☐ semi-anechoic chamber (ferrites) ☒ semi-anechoic chamber (foam)

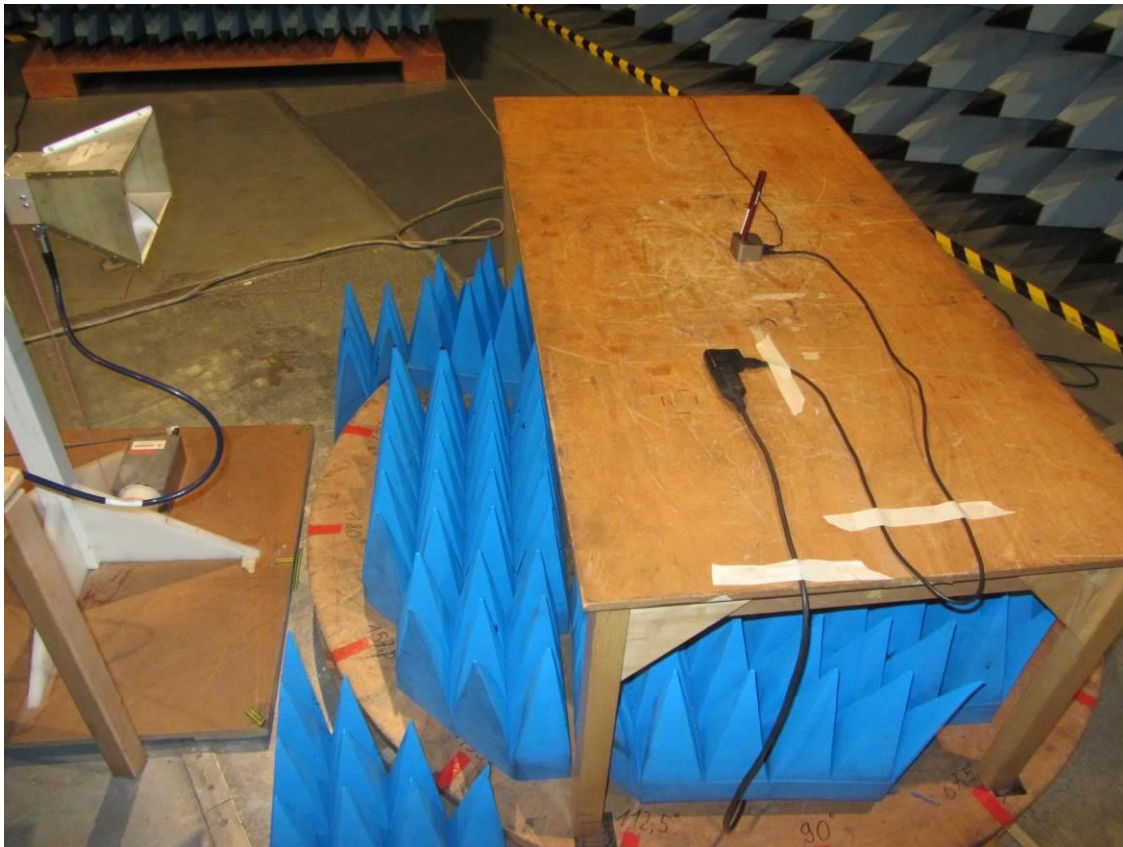
Distance: ☒ 1 m ☐ 3 m ☐ 10 m ☐ 30 m

Position of EUT: 0.8 m (height of the equipment under test above floor)

Meas. uncertainty: ± 4.7 dB

Test method: The electromagnetic disturbance radiated by the equipment is measured using a spectrum analyser and a wide band antenna. The antenna is placed at the same height as the EUT successively with horizontal and vertical polarisations. The turning table is operated through 360° during the measurements. The recordings are carried out taking into account the maximum value (peak) of all the disturbances appearing while the apparatus is under test.

Test set-up:



Remarks: Limit values expressed in dB μ V/m and transformed to a measuring distance of 1 m (factor used = 20 dB/decade) if necessary
e.g.: for $f = 1$ GHz the limit is 500 μ V/m at 3 m;

$$20 \log \left(\frac{500 \frac{\mu V}{m}}{1 \frac{\mu V}{m}} \right) + 20 \log \left(\frac{3m}{1m} \right) = 63.5 \frac{dB\mu V}{m} \text{ at } 1m$$

Test equipment:

Spectrum analyser	☐ 88-14	☐ 94-24	☐ 02-06	☐ 03-45	☐ 05-39	☒ 07-53
Preamplifier	☐ 05-56	☐ 05-87	☒ 11-29			
Antenna (horn)	☒ 90-24	☐ 07-31				
Cables	☒ 10-75	☒ 11-61				
Filters	☐ 10-65	☐ 10-66	☐ 13-14	☐ 12-06		

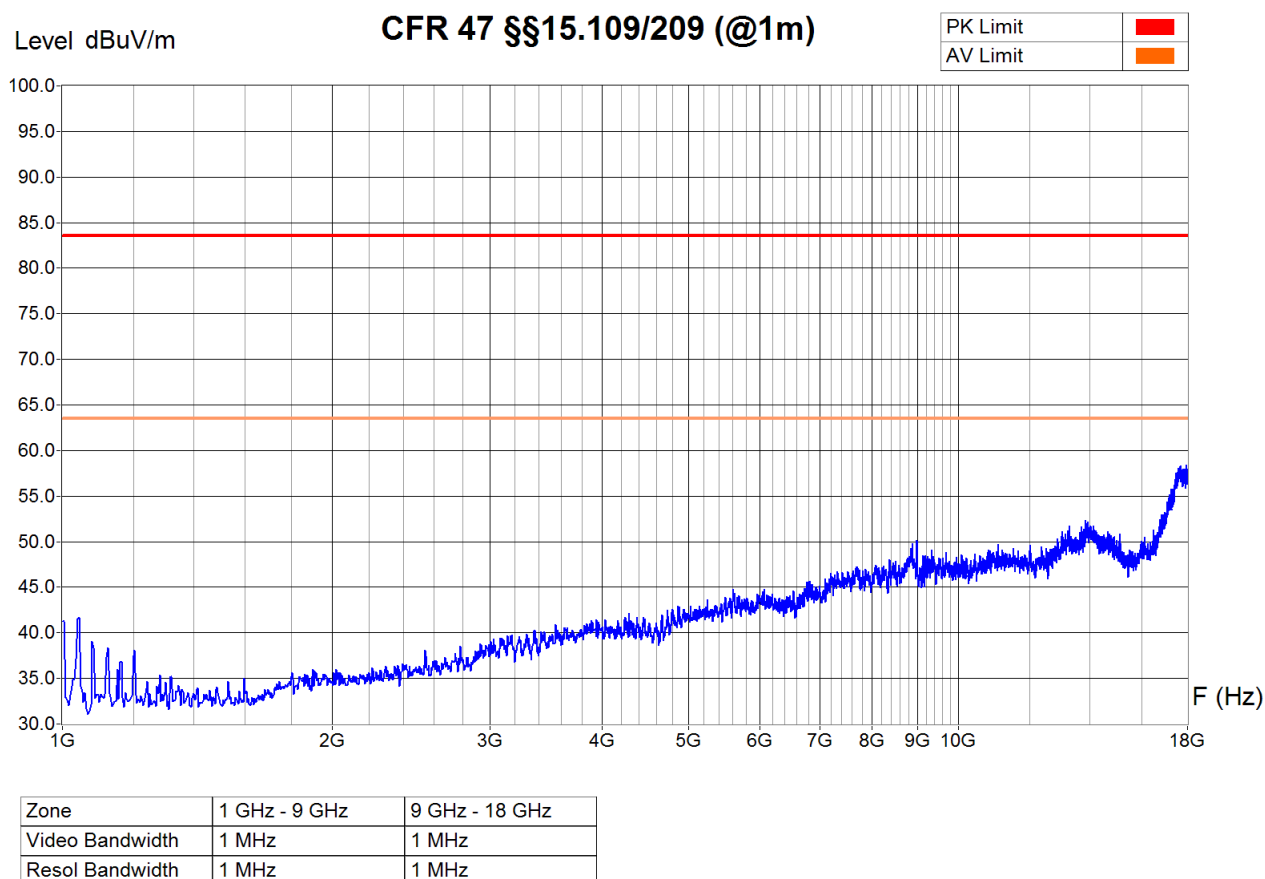
Result: ☒ pass ☐ fail ☐ not applicable ☐ not tested

Measurement Type : Radiated Field
 Polarisation : Vertical
 Table Angle : 0 - 360°
 Antenna Height : 1 - 2m



Equipment Under Test : TX22 Roger EasyPen
 Set-Up : With cradle, charger and audio cable connected, see photos
 Operating Conditions : RX (f = 2.440 GHz)
 Remarks :

Cage 06-00

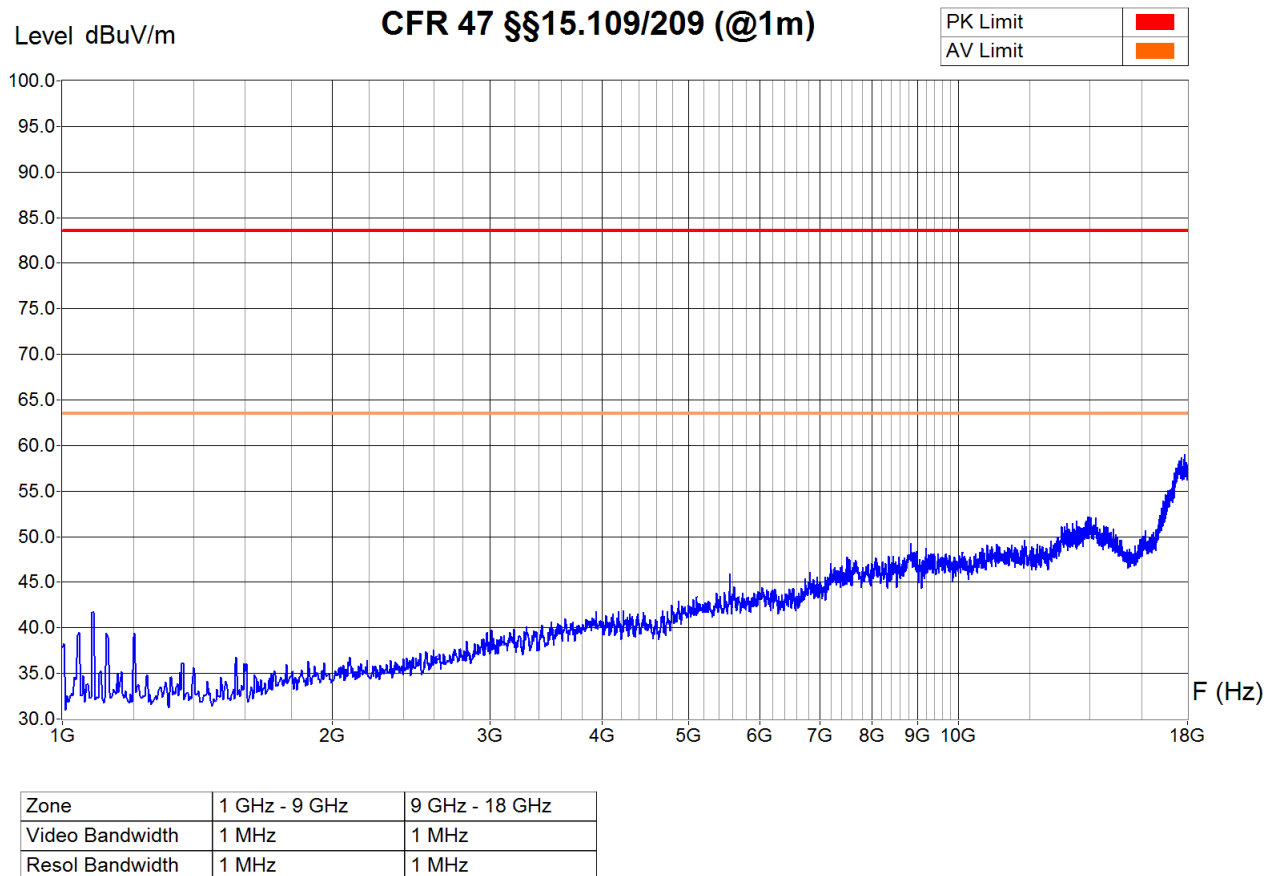


Operator: B. Itzcovich
 Date/Time: 22.10.2014 12:10
 Filename:
 23_RE_1-
 18G_RX_V_0m8_FCC.png/.txt

Measurement Type : Radiated Field
Polarisation : Horizontal
Table Angle : 0 - 360°
Antenna Height : 1 - 2m



Equipment Under Test : TX22 Roger EasyPen
Set-Up : With cradle, charger and audio cable connected, see photos
Operating Conditions : RX (f = 2.440 GHz)
Remarks :
Cage 06-00



Operator: B. Itzcovich
Date/Time: 22.10.2014 12:06
Filename:
24_RE_1-
18G_RX_H_0m8_FCC.png/.txt

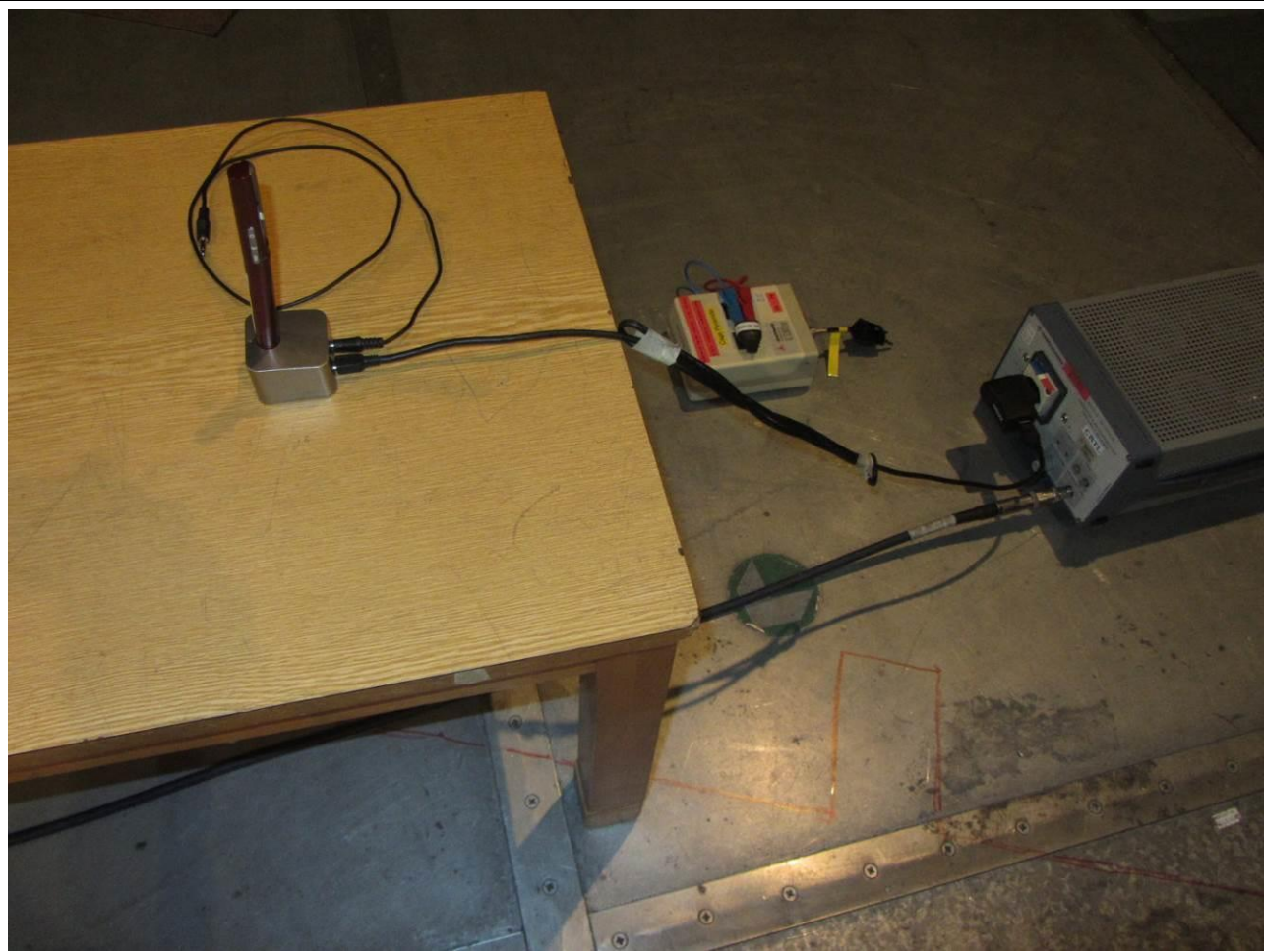
6.11 Conducted emission - Interference voltage

Test site: ☐ semi-anechoic chamber (foam) ☐ shielded room
☒ semi-anechoic chamber (ferrites) ☐ laboratory

Meas. uncertainty: ± 3.6 dB

Measuring method: The conducted disturbance is measured using a spectrum analyser and a line impedance substitution network (LISN). The measurement of the voltage against the earth is carried out successively. The peak values are recorded continuously on the graph. The values that exceed the limit are remeasured with a measuring receiver.

Test set-up:



Remarks: No narrowband emissions above limits were found

Test equipment:

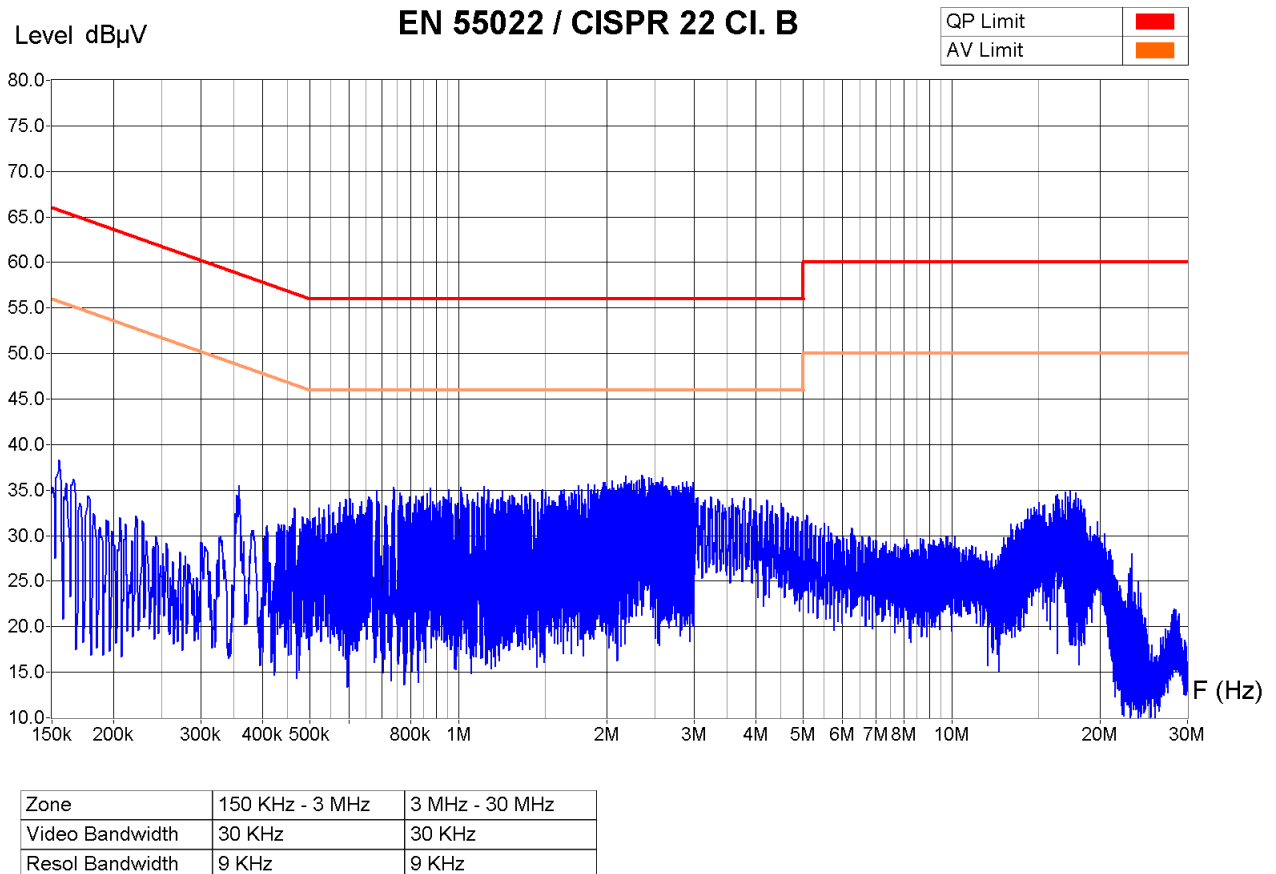
Spectrum analyser	☐ 10-70	☐ 94-24	☐ 02-06	☐ 03-45	☐ 05-39	☒ 07-53
Receiver	☐ 10-70	☐ 90-11	☒ 94-34	☐ 04-28	☐ 06-29	
LISN	☐ 85-13	☐ 90-08	☐ 94-36	☐ 94-40	☐ 95-12	☒ 00-43
Protection 10 dB	☐ 95-33	☐ 95-35	☐ 95-36	☐ 96-38	☐ included in LISN	
Protection 20 dB	☐ 91-46	☐ 95-33	☐ 95-38	☐ included in LISN		
Cables	☒ 06-00	☐ 06-01	☐ 06-206			

Result: ☒ pass ☐ fail ☐ not applicable ☐ not tested

Measurement Type : Voltage Interference
 Supply : Line 1
 Other : Powered with 100 V / 50 Hz



Equipment Under Test : TX22 Roger EasyPen
 Set-Up : With cradle, charger and audio cable connected. See photos
 Operating Conditions : Hopping TX, modulated, Pmax, charging
 Remarks :
 Cage 06-00



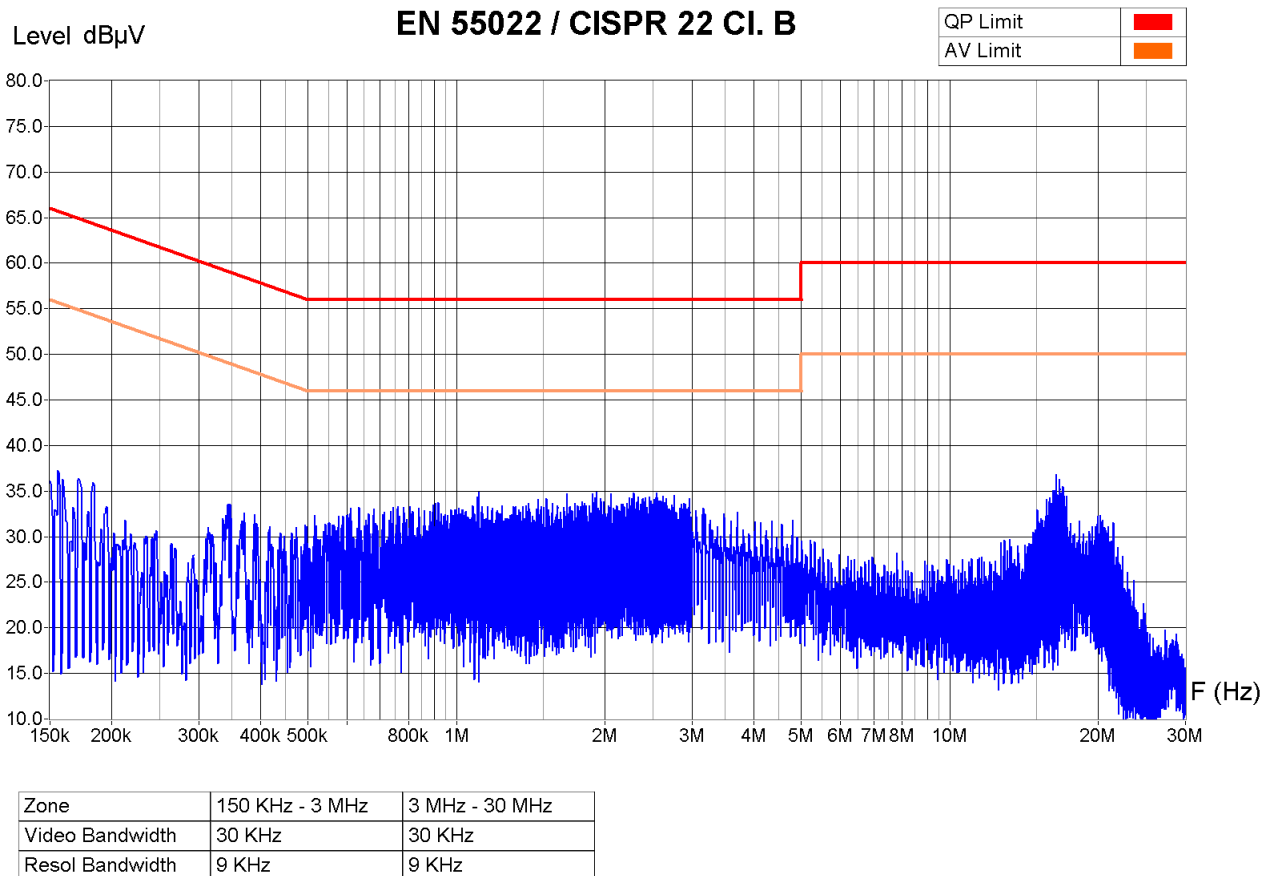
Operator: B. Itzcovich
 Date/Time: 23.10.2014 16:47
 Filename:
 43_CV_150k-
 30M_TX_Charging_L1_100.png/

Measurement Type : Voltage Interference
 Supply : Neutral
 Other : Powered with 100 V / 50 Hz



Equipment Under Test : TX22 Roger EasyPen
 Set-Up : With cradle, charger and audio cable connected. See photos
 Operating Conditions : Hopping TX, modulated, Pmax, charging
 Remarks :

Cage 06-00

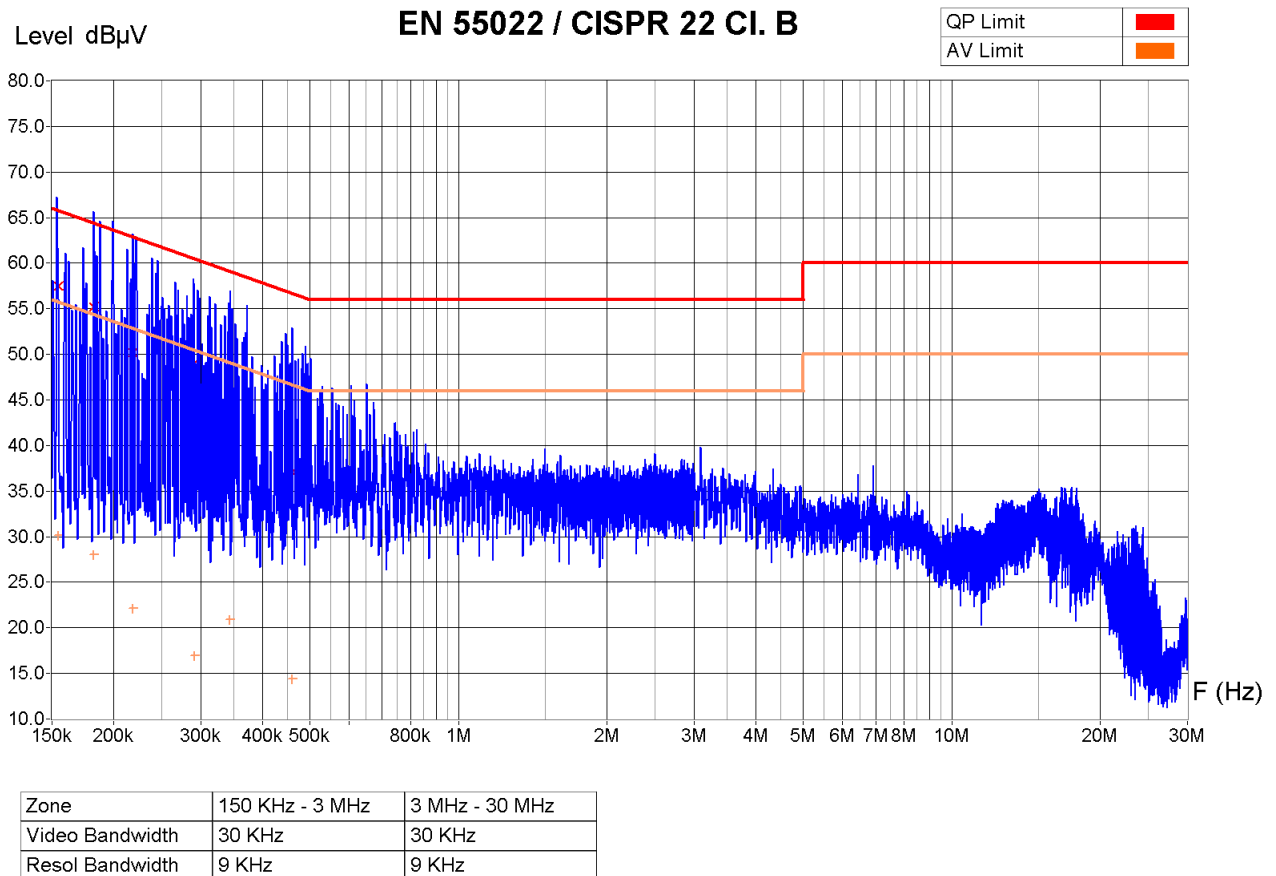


Operator: B. Itzcovich
 Date/Time: 23.10.2014 16:49
 Filename:
 44_CV_150k-
 30M_TX_Charging_N_100.png/

Measurement Type : Voltage Interference
 Supply : Line 1
 Other : Powered with 230 V / 50 Hz



Equipment Under Test : TX22 Roger EasyPen
 Set-Up : With cradle, charger and audio cable connected. See photos
 Operating Conditions : Hopping TX, modulated, Pmax, charging
 Remarks :
 Cage 06-00



Receiver Measures

Frequency	Peak	QuasiPeak (x)	Average (+)	QP Margin
154.27 KHz	69.1 dBμV	57.4 dBμV	30.1 dBμV	8.3 dB
181.95 KHz	68.5 dBμV	55.2 dBμV	28.1 dBμV	9.2 dB
219.08 KHz	64.6 dBμV	50.2 dBμV	22.1 dBμV	12.6 dB
291.34 KHz	60.3 dBμV	49.1 dBμV	17.0 dBμV	11.4 dB
344.43 KHz	57.5 dBμV	44.6 dBμV	20.9 dBμV	14.5 dB
460.39 KHz	51.8 dBμV	37.1 dBμV	14.4 dBμV	19.6 dB

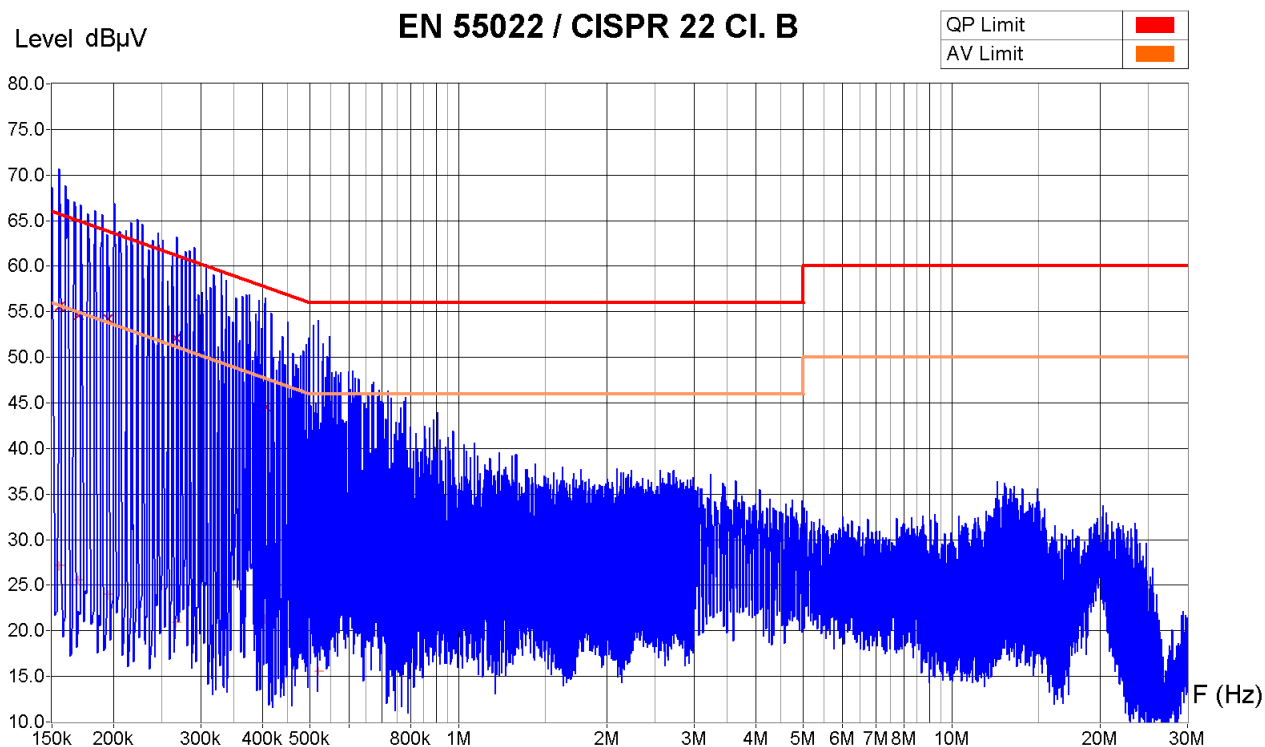
Operator: B. Itzcovich
 Date/Time: 23.10.2014 16:17
 Filename:
 41_CV_150k-
 30M_TX_Charging_L1_230.png/

Measurement Type : Voltage Interference
 Supply : Neutral
 Other : Powered with 230 V / 50 Hz



Equipment Under Test : TX22 Roger EasyPen
 Set-Up : With cradle, charger and audio cable connected. See photos
 Operating Conditions : Hopping TX, modulated, Pmax, charging
 Remarks :

Cage 06-00



Zone	150 KHz - 3 MHz	3 MHz - 30 MHz
Video Bandwidth	30 KHz	30 KHz
Resol Bandwidth	9 KHz	9 KHz

Receiver Measures

Frequency	Peak	QuasiPeak (x)	Average (+)	QP Margin
155 KHz	67.9 dBμV	55.6 dBμV	27.1 dBμV	10.2 dB
170 KHz	67.2 dBμV	54.6 dBμV	25.6 dBμV	10.3 dB
195 KHz	66.8 dBμV	54.2 dBμV	24.0 dBμV	9.6 dB
267.93 KHz	63.6 dBμV	52.2 dBμV	20.9 dBμV	9.0 dB
407 KHz	57.1 dBμV	44.5 dBμV	21.4 dBμV	13.2 dB
520.58 KHz	53.2 dBμV	40.5 dBμV	15.6 dBμV	15.5 dB

Operator: B. Itzcovich
 Date/Time: 23.10.2014 16:35
 Filename:
 42_CV_150k-
 30M_TX_Charging_N_230.png/

6.12 Designation of emission

Standard: United States: 47 CFR "Code of Federal Regulations" – Telecommunication
☒ FCC Part 2, Subpart C: Emission: §2.201 and §2.202

Introduction: A system of designating emission, modulation and transmission characteristics shall be employed.

(a) Emissions are designated according to their classification and their necessary bandwidth.

(b) A minimum of three symbols are used to describe the basic characteristics of radio waves.

(c) Four symbols are used to describe the necessary bandwidth.

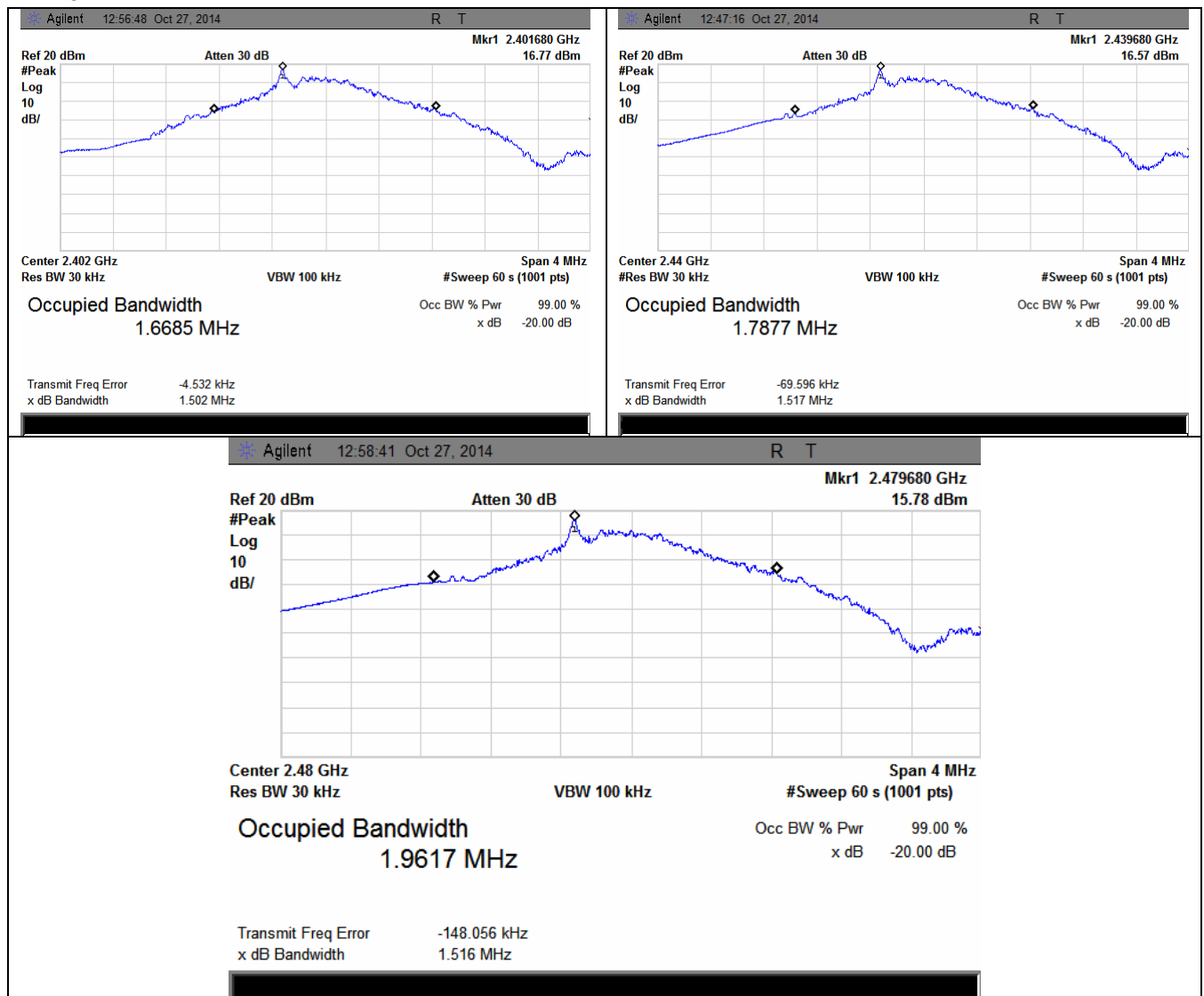
Necessary bandwidth: For a given class of emission, the minimum value of the occupied bandwidth sufficient to ensure the transmission of information at the rate and with the quality required for the system employed, under specified conditions.

$$B_n = 1.96 \text{ MHz (occupied bandwidth)}$$

Basic characteristics:

	FXD	F : frequency modulation
		X : Cases not otherwise covered
		D : data transmission

Designation of emission: 1M96FXD



Place and date of test: *Rossens, October 27, 2014*
Operator: *B. Itzcovich*