

Test laboratory accredited according to ISO 17025 by the Swiss Accreditation Service SAS
 Laboratoire d'essai accrédité selon ISO 17025 par le Service d'accréditation suisse SAS
 Prüflabor akkreditiert nach ISO 17025 durch die Schweizerische Akkreditierungsstelle SAS

Registration number
 Numéro d'accréditation
 Akkreditierungsnummer

STS 0024

Schweizerischer Prüfstellendienst
 Service suisse d'essai
 Swiss testing service

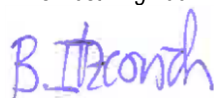


Report:	Electromagnetic compatibility and Radio spectrum Matters		Report no:	16-MO-0231.R03
Product name:	TV Connector		Mandate no:	16-MO-0231
Serial no:	Proto 161 (PCB V2.2)	Model number:	TX25	
Customer:	Phonak Communications AG Länggasse 17 3280 Murten SWITZERLAND	Date of test:	March 20 – 24, 2017	

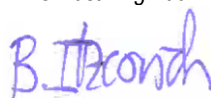
Standards		Result
47 CFR, Part 15	(Subpart C, Intentional radiators: §§ 15.207/209/247)	Pass
	(Subpart B, Class B digital devices: § 15.109)	Pass
Industry Canada	RSS-247, Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices	Pass
	RSS-Gen, General Requirements and Information for the Certification of Radio Apparatus	

These results were achieved with out modifications of EUT

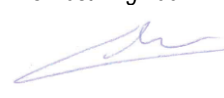
Test performed by
 Mr B. Itzcovich
 EMC Test Engineer



Report prepared by
 Mr B. Itzcovich
 EMC Test Engineer



Report controlled and approved by
 Mr O. Cardou
 EMC Test Engineer



Rossens, July 10, 2017

(Issue Date)

2015-04-10_Rev01

Main language : English

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

t:\auftragsablage pq\auftragsablage ih-mo\2016\0200-0299\16-mo-0231_phonak_tx25\4 prüfberichte\16-mo-0231.r03_phonak_tx25_fcc.doc

Electrosuisse | Association for Electrical Engineering, Power and Information Technologies

Montena EMC
 route de Montena 75
 1728 Rossens
 Switzerland

phone +41 26 411 93 33
 fax +41 26 411 93 30
www.montenaemc.ch
montenaemc@electrosuisse.ch

Montena EMC
 Ostermundigenstrasse 93
 3006 Bern
 Switzerland

phone +41 79 256 21 55
johannes.biner@electrosuisse.ch

Contents

	<i>Page</i>
1. SUMMARY OF TEST RESULTS	3
2. APPLIED STANDARDS	3
3. CLIENT	4
4. EQUIPMENT UNDER TEST	4
4.1 Identification	4
4.2 Pictures of the EUT	5
4.3 Classification	6
4.4 Transmitter characteristics (according to Phonak Communications AG)	7
4.5 Receiver characteristics (according to Phonak Communications AG)	7
4.6 Ports	7
5. TEST CONDITIONS	8
5.1 Climatic conditions, location and date	8
5.2 Test facility and methodology	8
5.3 Attendant persons	8
5.4 Test configuration	8
5.5 Operating conditions	9
5.6 Auxiliary equipment	9
6. TEST RESULTS	10
6.1 Channel 20dB-bandwidth	11
6.2 Carrier frequency separation	13
6.3 Number of hopping channels	15
6.4 Time of occupancy (dwell time)	17
6.5 Antenna gain & effective isotropic radiated power	19
6.6 Maximum output power (conducted)	21
6.7 Band-edge emission (conducted)	23
6.8 Band-edge emission (radiated)	25
6.9 Spurious emission – conducted (transmitter – 9 kHz to 26.5 GHz)	29
6.10 Spurious emission transmit mode – radiated	31
6.10.1 9 kHz to 30 MHz	31
6.10.2 30 MHz to 1 GHz	35
6.10.3 1 GHz to 18 GHz	38
6.10.4 18 GHz to 26.5 GHz	41
6.11 Spurious emission receive & standby mode - radiated	44
6.11.1 30 MHz to 1 GHz	44
6.11.2 1 GHz to 13 GHz	49
6.12 Conducted emission - Interference voltage	52
6.13 Designation of emission	57
7. APPENDIX	58
7.1 Test equipment	59

1. Summary of test results

✓ Pass ✗ Fail Ø Not applicable to this product — Not tested # Not required / 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-247 § 5.1 (1)	1.55 MHz
6.2	Carrier frequency separation CFR 47 § 15.247 (a)(1) RSS-247 § 5.1 (2)	✓
6.3	Number of hopping channels CFR 47 § 15.247 (a)(1)(iii) RSS-247 § 5.1 (4)	✓
6.4	Time of occupancy (dwell time) CFR 47 § 15.247 (a)(1)(iii) RSS-247 § 5.1 (4)	✓
6.5	Antenna gain & effective radiated power CFR 47 § 15.247 (b)(4) RSS-247 § 5.4 (2) and (6)	≤ 5.32 dBi
6.6	Maximum output power (conducted) CFR 47 § 15.247 (b)(1) RSS-247 § 5.4 (2)	✓
6.7	Band-edge emission (conducted) CFR 47 § 15.247 (d) RSS-247 § 5.5	✓
6.8	Band-edge emission (radiated) CFR 47 § 15.247 (d) CFR 47 § 15.205 RSS-Gen Table 6	✓
6.8	Spurious emissions – conducted (transmitter) CFR 47 § 15.247 (d) RSS-247 § 5.5	✓
6.10	Spurious emissions – radiated (transmitter) CFR 47 § 15.247 (d) CFR 47 § 15.209 (a) CFR 47 § 15.205 RSS-247 § 5.5 RSS-Gen Tables 4 and 5	✓
6.11	Radiated emission – receiver CFR 47 § 15.109 RSS-Gen Table 2	✓
6.12	Conducted emission CFR 47 § 15.207 RSS-Gen Table 3	✓
6	Emission	CFR 47 Part 2
6.13	Designation of emission FCC 47 §2.201 FCC 47 §2.202	1M65FXD

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 4, November 2014	Spectrum Management and Telecommunications – Radio Standards Specification General Requirements and Information for the Certification of Radio Apparatus
RSS-247 issue 2, February 2017	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

3. Client

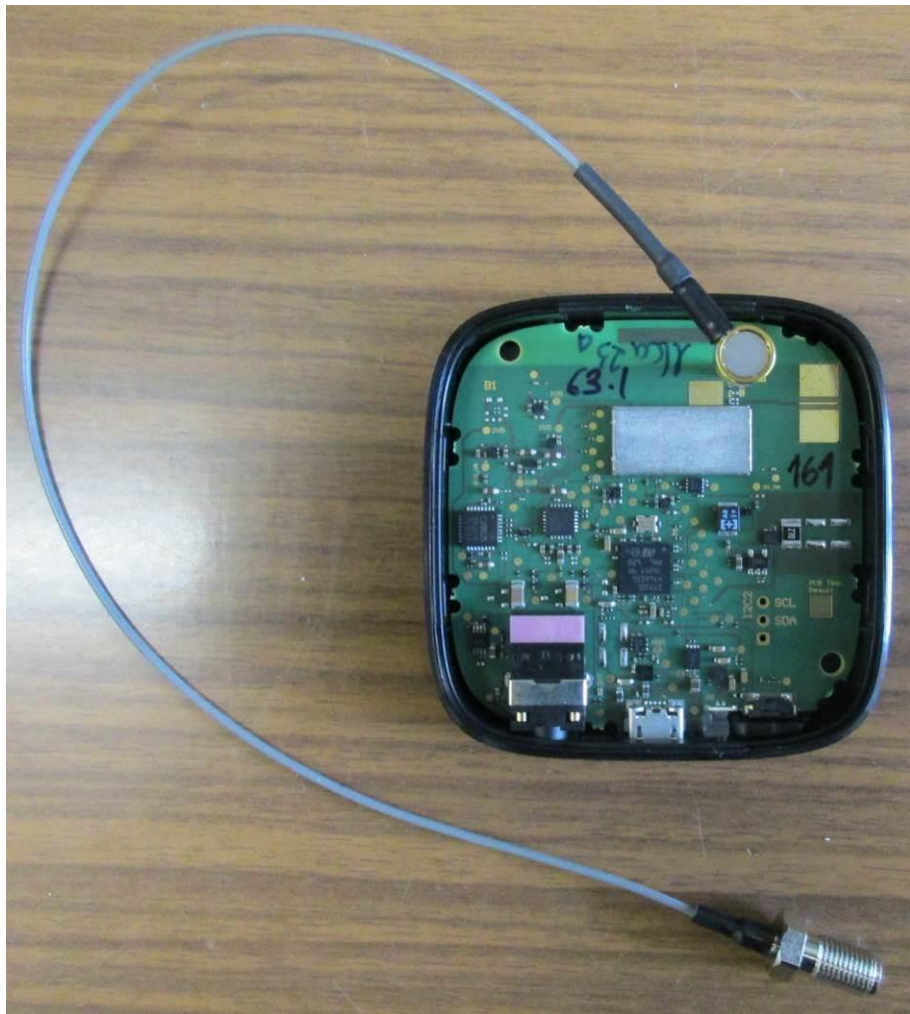
Client name and address	<i>Phonak Communications AG Länggasse 17 3280 Murten SWITZERLAND</i>
Contact Person	<i>Mr Olivier Hautier</i>
Telephone	<i>+41 26 672 92 73</i>
Fax	<i>+41 26 672 93 80</i>
E-mail	<i>olivier.hautier@phonak.com</i>
Mandate no	<i>16-MO-0231</i>

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>TV Connector</i>
Product description	<i>Wireless audio signal transmitter 2.4 GHz</i>
Model number	<i>TX25</i>
Serial no	<i>Proto 161 (PCB V2.2)</i>
FCC ID IC ID	<i>FCC: KWC-TVCONNECTOR IC: 2262A-TVCONNECTOR</i>
Software version	<i>SVN 11643</i>
Lowest Frequency	<i>20 kHz (charge pump for LED driver)</i>
Highest frequency	<i>16 MHz (uC Xtal) / 26 MHz (RF chip) / 2.48 GHz (RF Transmitter carrier)</i>
Supply	<i>$U = 5 V_{DC} / P_{max} = 1 W$ (DC In USB)</i>
Dimension	<i>~63 mm x ~63 mm x ~12 mm (l x w x h)</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>

4.2 Pictures of the EUT



Electronic board with temporary antenna connector



EUT (rear-top view)



EUT (bottom view with marking example)

4.3 Classification

CFR 47 Part 15	☒ Unintentional radiator (Subpart B), Receive and Standby 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).
----------------	--

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	13 dBm (at transmitter RF output connector)
Variable carrier output	☐ Transmitter carrier output is not variable. RF output: $P_{OUT} = \dots mW$ ☒ Transmitter carrier output is variable. Max. RF output: $P_{OUT\ MAX} = 20\ mW$ Min. RF output: $P_{OUT\ MIN} = 2.2\ mW$ ☐ RF output continuously variable ☒ RF output stepped: 9.5 dB per step
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 adaptor)	≤ 3 m	Micro USB	Yes	Connected to AC adaptor
Audio jack	≤ 3 m	Jack 3.5mm 3P	Yes	Analog audio in

5. Test conditions

5.1 Climatic conditions, location and date

Location	Date	Temp.	Pressure [QFE]	Rel. humidity
Electrosuisse Montena EMC 1728 Rossens Switzerland	March 20 – 24, 2017	23 – 25 °C	920 – 940 hPa	30 – 55 %

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 C63.4-2014 and C63.10-2013 procedures.

5.3 Attendant persons

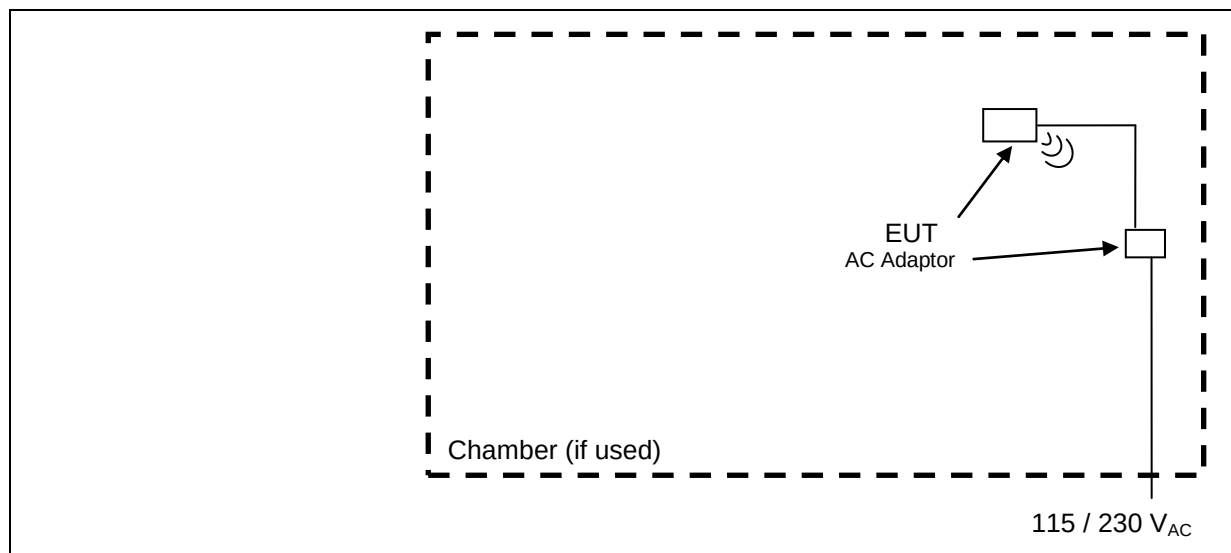
Test Engineer(s):

Mr B. Itzcovich
EMC Test Engineer

Other(s):

Name	Company
Mr Olivier Hautier (partially)	Phonak Communications AG

5.4 Test configuration



5.5 Operating conditions

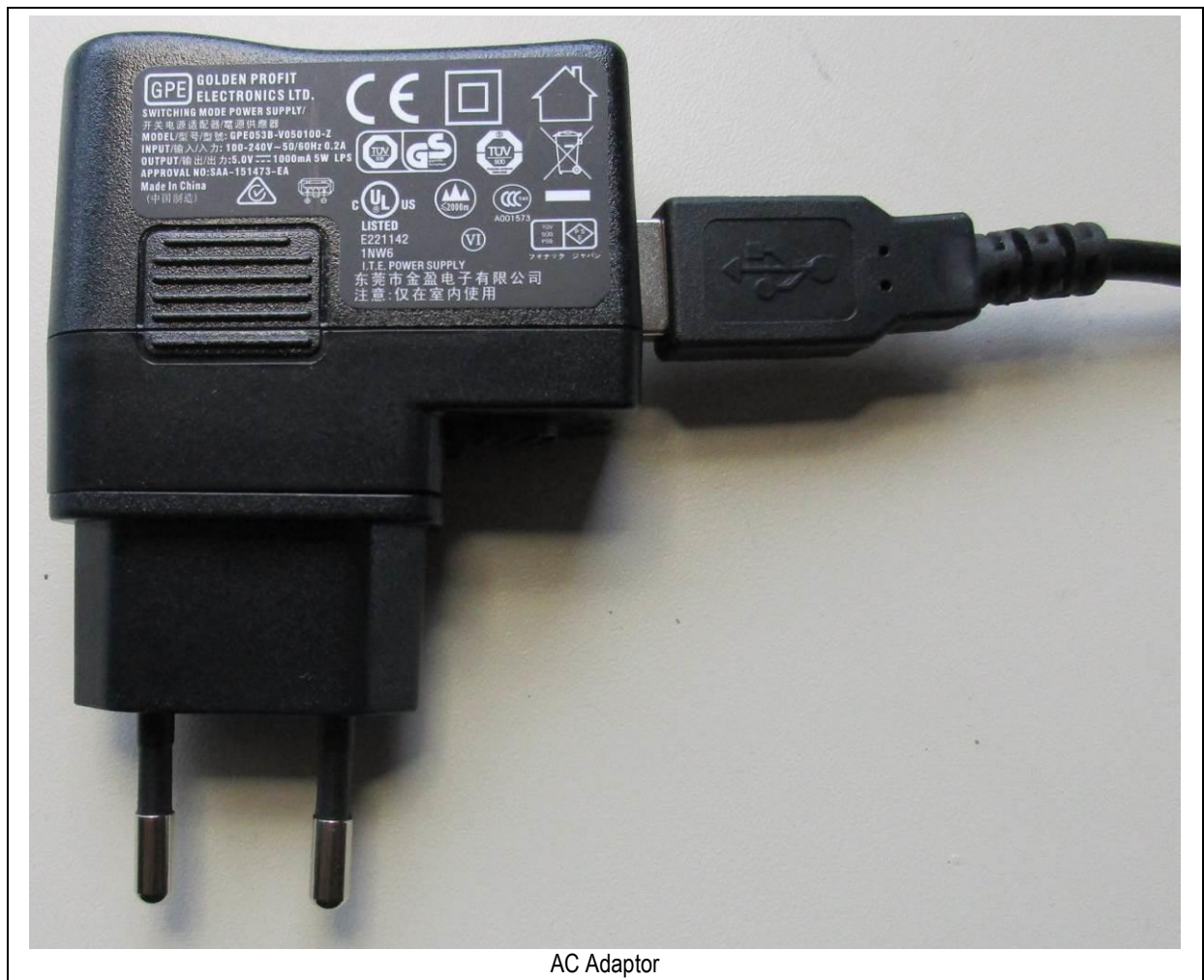
Power supply during tests if not stated otherwise in §6 : 5 V_{DC} (USB)

- Continuous hopping transmission of random data on three frequencies (2.402, 2.440 and GHz and 2.480 GHz)
- Normal operation: transmission of data (audio streaming) with hopping sequence
- Continuous reception on single frequency (2.440 GHz)
- Standby: DSP off, controller running, RF module disabled
- Continuous transmission of random data on one frequency ($f = 2.402/2.480$ GHz), Duty 100%

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
AC adaptor	Phonak	GPE053B-V050100-Z	- - -	100 – 240V _{AC} in / 5 V _{DC} out
Audio source	SanDisk	Clip Sport	- - -	To generate audio signal for streaming



AC Adaptor

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: - - -

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					

Results of the test

Client: *Phonak Communications AG*

Apparatus: *TV Connector*

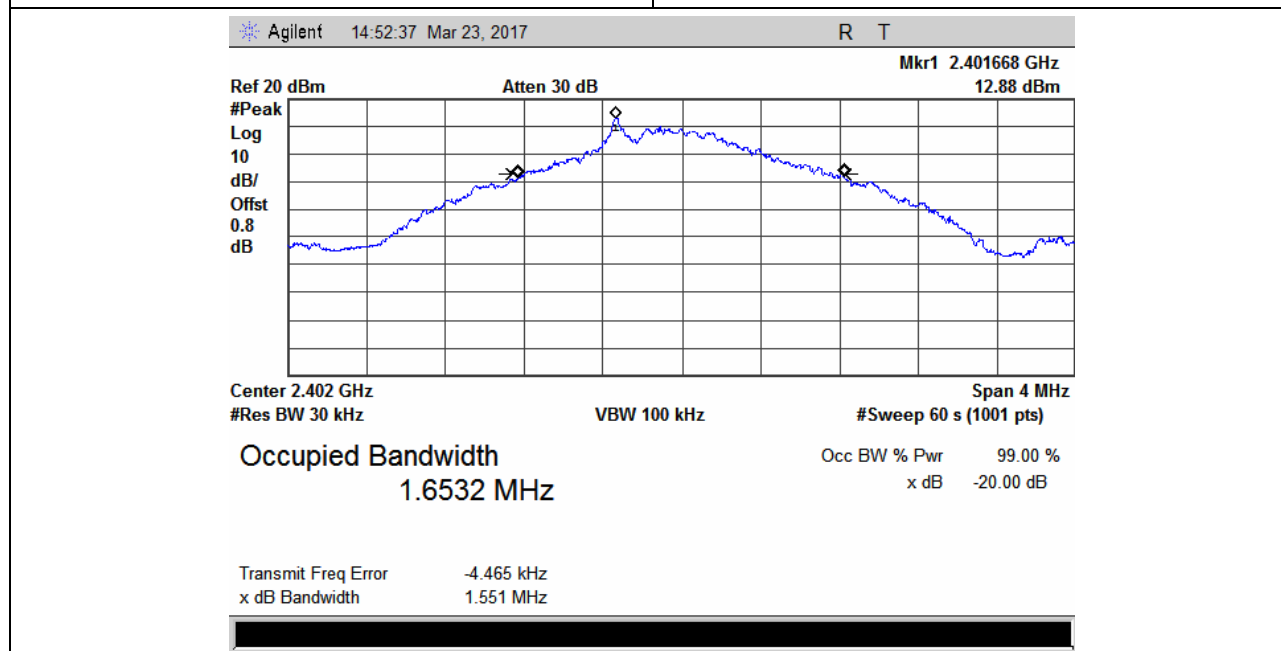
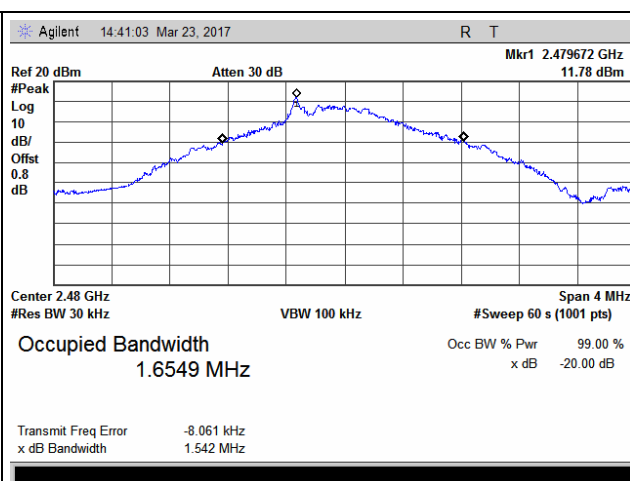
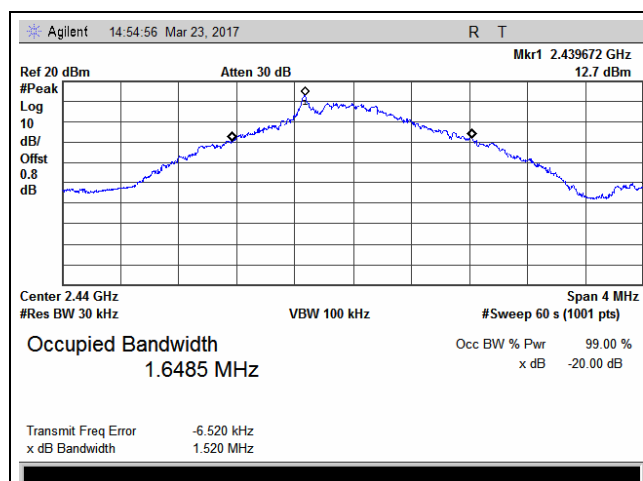
Operating mode: *TX ($f = 2.402 / 2.440 / 2.480$ GHz), modulated, P_{max} (00, 02)*

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

Remarks: *Measured on temporary antenna connector*

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

frequency [GHz]	20 dB bandwidth [MHz]	Remarks
2.402	1.551	- - -
2.440	1.520	- - -
2.480	1.542	- - -



Place and date of test: *Rossens, March 23, 2017*

Operator: *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: Minimum 25 kHz two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

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

Results of the test

Client: *Phonak Communications AG*

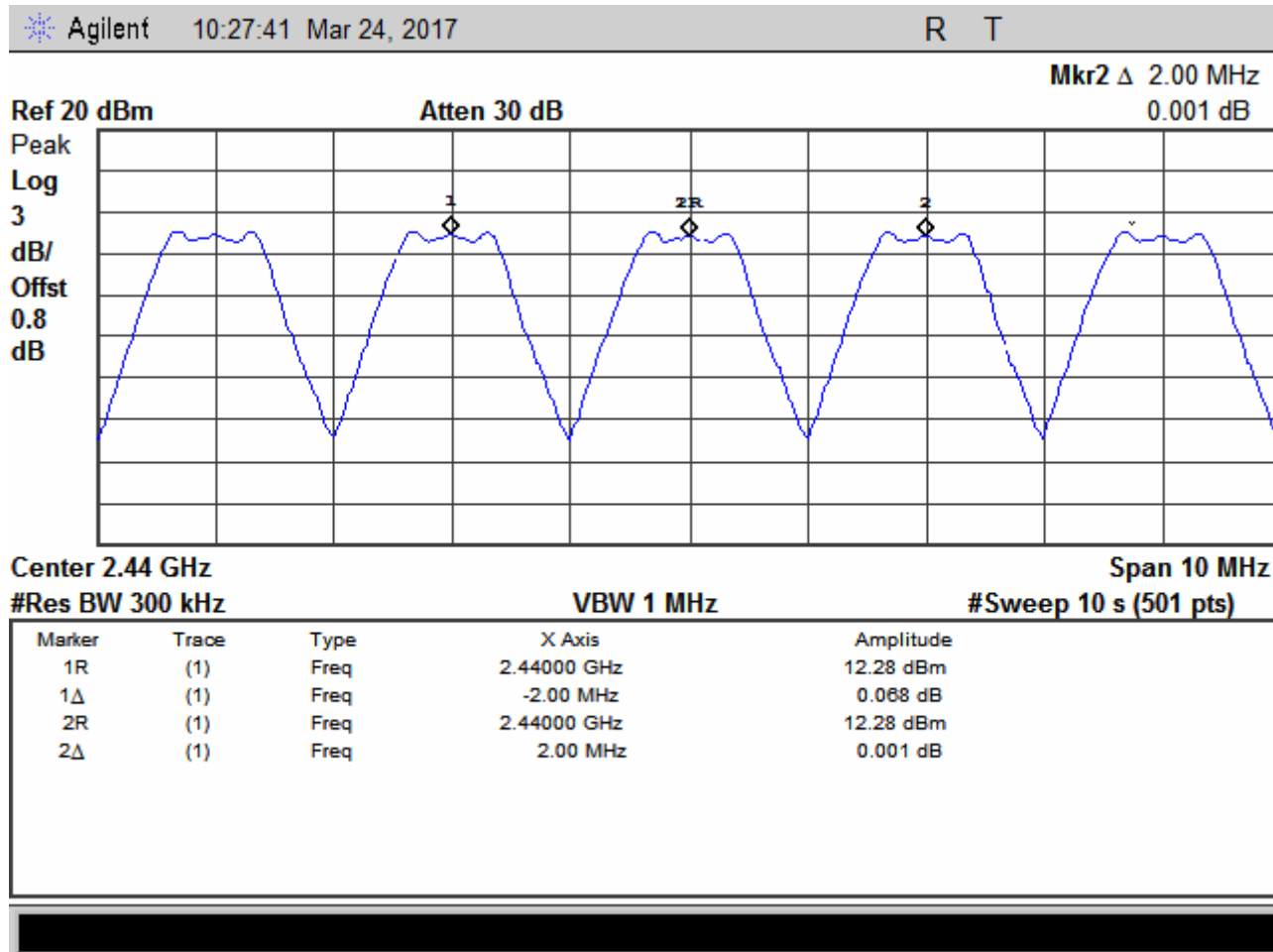
Apparatus: *TV Connector*

Operating mode: *Continuously hopping*

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

Remarks: *Measured on temporary antenna connector*

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



Carrier frequency separation = 2.00 MHz > (2/3) x 1.55 MHz (see § 6.1)

Place and date of test: *Rossens, March 24, 2017*
Operator: *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

Results of the test

Client: *Phonak Communications AG*

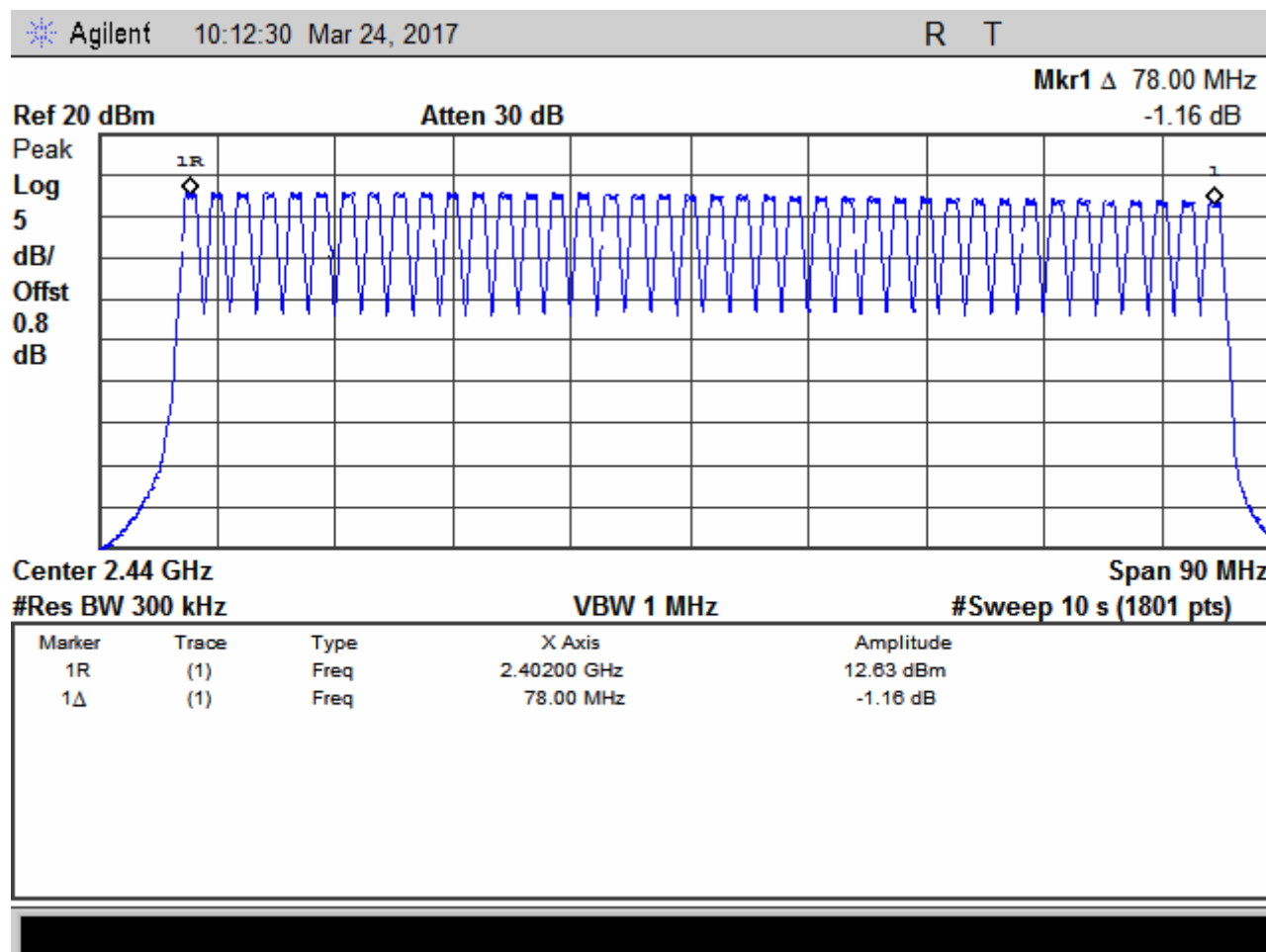
Apparatus: *TV Connector*

Operating mode: *Continuously hopping*

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

Remarks: *Measured on temporary antenna connector*

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



Number of hopping channels = 40

Place and date of test: *Rossens, March 24, 2017*
 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	☒ 11-45					

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

Results of the test

Client: *Phonak Communications AG*

Apparatus: *TV Connector, proto #22*

Operating mode: *Continuously hopping*

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

Remarks: *Measured on temporary antenna connector*

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

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): 173 μs

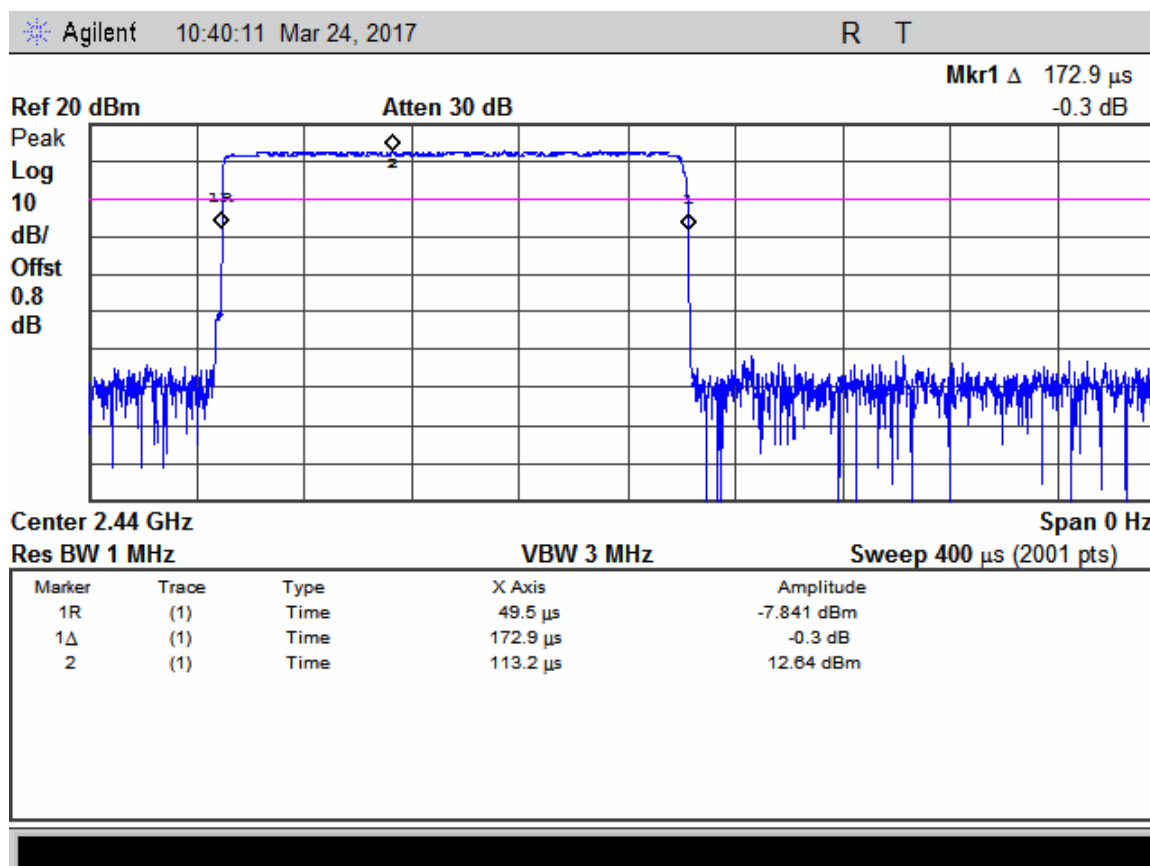
Pulses in 2.9h: $2^{16} \times 40 \times 10 = 26'214'400$

Pulses in 16 s: $(\text{Pulses in 2.9h} / 2.9) / 3'600 \times 16 \text{ s} = 40'175.3$

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

Time of occupancy: $\text{Pulse in 16 s of one channel} \times \text{occupancy time} = 1004.4 \times 173 \mu\text{s} = 0.174 \text{ s}$

RESULT $0.174 \text{ s} < 0.4 \text{ s} \Rightarrow \text{Pass}$

Example of pulse duration at frequency 2.44 GHz

Place and date of test:
Operator:

Rossens, March 24, 2017
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:** 1.5 m (height of the equipment under test above floor)
- Meas. uncertainty:** ± 1.3 dB ($f < 300$ MHz) / ± 1.6 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 6dBi (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: Measurement with EUT in position showing maximum emission at 2.44 GHz

Test equipment:

Spectrum analyser	☒ 10-70	☐ 94-24	☐ 02-06	☐ 03-45	☐ 05-39	☐ 07-53
Receiver	☐ 10-70	☐ 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	☒ 03-07	☐ 05-20
Power sensor	☐ 07-46	☐ 05-74	☐ 05-88	☒ 09-03	☐ 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	☒ 13-16	☐ 00-42	☐ 03-39	☐ 07-02	☐ 04-89	☐ 05-78
Cables	☐ 06-00	☒ 06-01	☒ 10-51	☐ SMK		
Attenuator 10dB	☐ 11-36					

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

Results of the testClient: *Phonak Communications AG*Apparatus: *TV Connector*Operating mode: *Hopping $f = 2.402/2.440/2.480$ GHz, modulated, P_{max} (00, 02)*Cables connected to the EUT: *All (see § 4.6 and § 5.4)*Remarks: *RBW = 3 MHz; Span = 140 MHz; ST = 30 s; RefLev = 20 dBm
Detector = Peak; Trace mode = Max hold; Nb points = 1401*Modifications: ☒ None ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

f [GHz]	Measurement with EUT		Power at substitution ant.		Meas. with subst. ant.	Parameters of substitution ant.		Result			Polarisation
	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	102.0	0.0	10.0	0	108.6	2.15	0	-96.45	5.55	3.59 mW	Vertical
2.402	111.5	0.0	10.0	0	107.8	2.15	0	-95.65	15.85	38.46 mW	Horizontal
2.440	104.8	0.0	10.0	0	107.2	2.15	0	-95.05	9.75	9.44 mW	Vertical
2.440	113.4	0.0	10.0	0	107.5	2.15	0	-95.35	18.05	63.83 mW	Horizontal
2.480	102.1	0.0	10.0	0	106.9	2.15	0	-94.75	7.35	5.43 mW	Vertical
2.480	110.9	0.0	10.0	0	106.3	2.15	0	-94.15	16.75	47.32 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	12.98	15.85	2.87	---
2.440	12.73	18.05	5.32	---
2.480	11.86	16.75	4.89	---

Place and date of test:
Operator:*Rossens, March 20 and 23, 2017
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 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	☒ 11-45					

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

Results of the test

Client: *Phonak Communications AG*

Apparatus: *TV Connector, proto #22*

Operating mode: *Hopping f = 2.402/2.440/2.480 GHz, modulated, max. power (00, 05)*

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

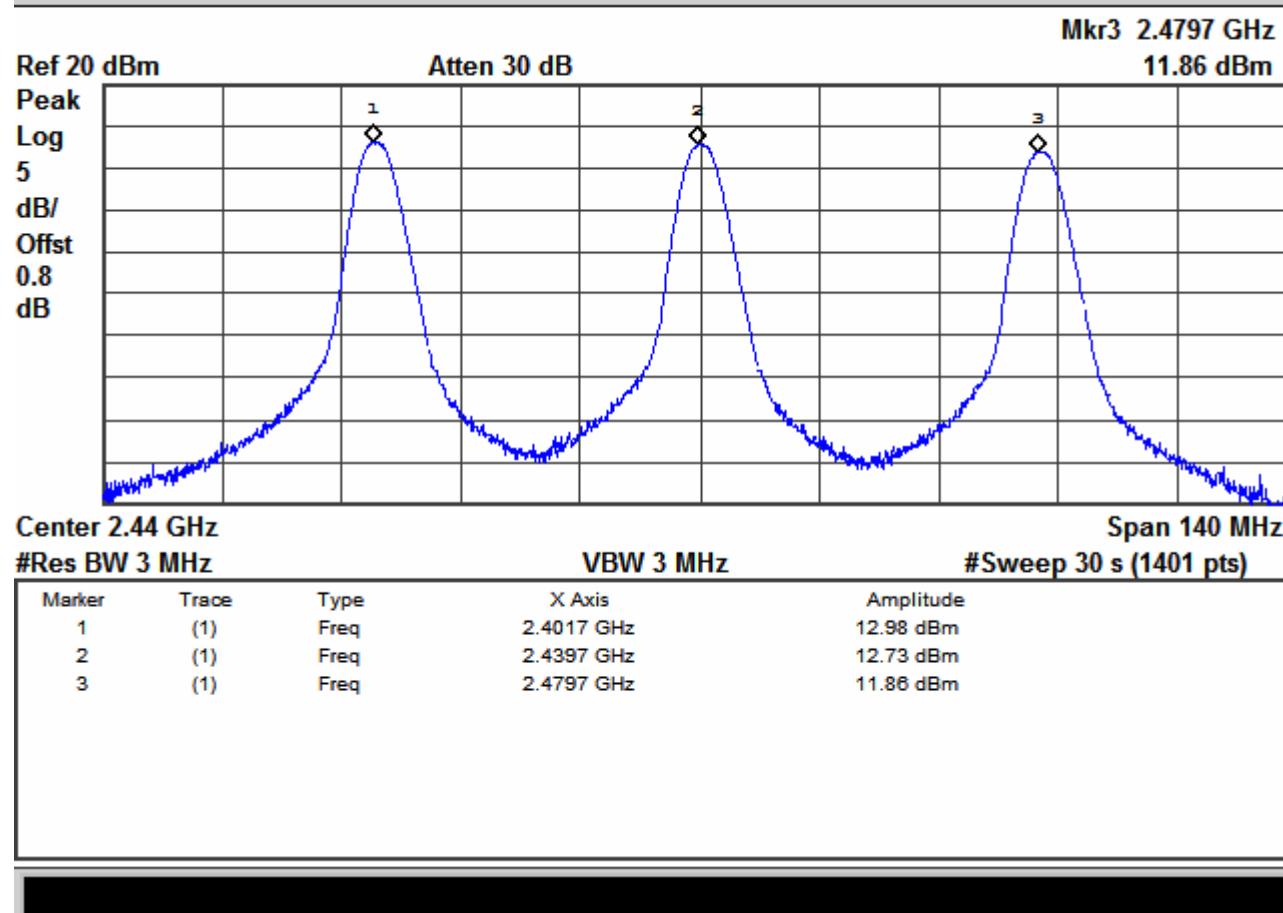
Remarks: *Measured on temporary antenna connector*

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

f normal [GHz]	Temp [°C]	U [V]	P [dBm]	Limit [dBm]	Remarks	Pass	
						Yes	No
2.402	25	5.0	12.98	21	Maximum conducted emission	☒	☐
2.440	25	5.0	12.73	21	---	☒	☐
2.480	25	5.0	11.86	21	---	☒	☐

* Agilent 15:36:55 Mar 23, 2017

R T



Place and date of test:
Operator:

Rossens, March 23, 2017
B. Itzcovich

6.7 Band-edge emission (conducted)

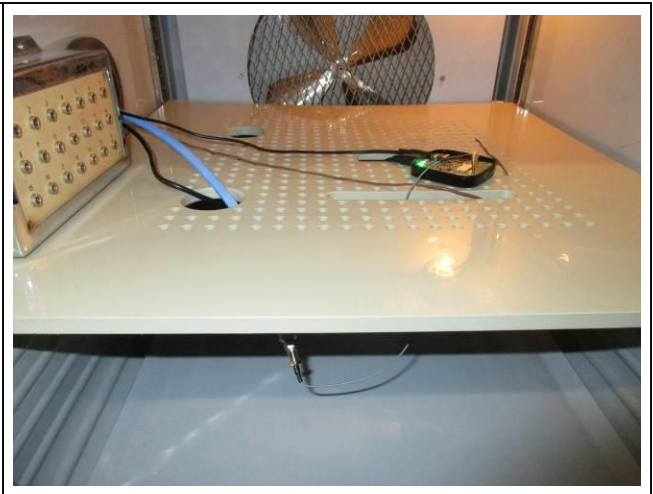
Test site: ☐ semi-anechoic chamber (foam) ☐ open test site
☐ semi-anechoic chamber (ferrites) ☒ laboratory

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 in which the intentional radiator is operating, 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:

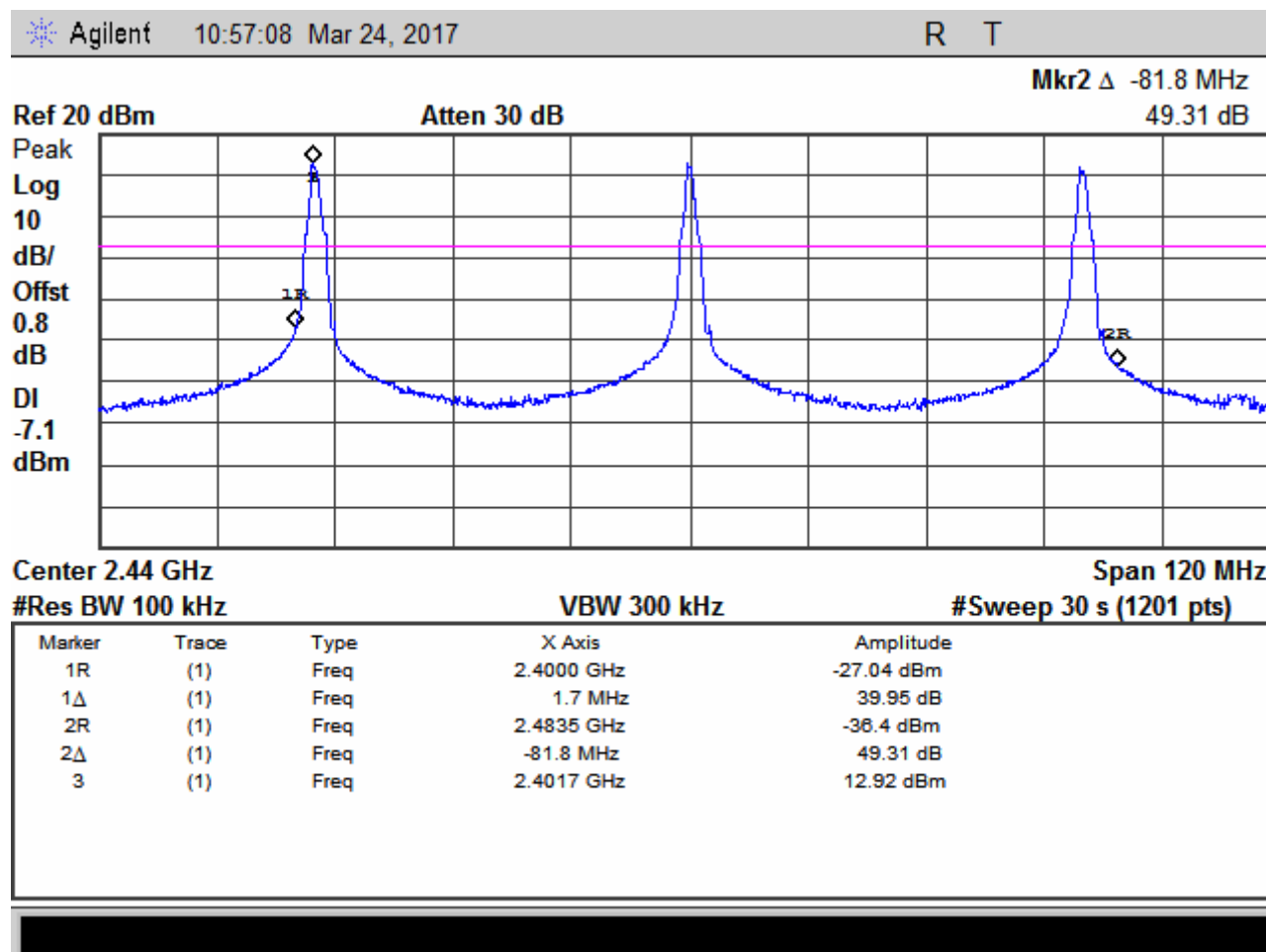


Remarks: - - -

Test equipment:

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

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

Results of the testClient: *Phonak Communications AG*Apparatus: *TV Connector, proto #22*Operating mode: *Hopping f = 2.402/2.440/2.480 GHz, modulated, max. power (00, 02)*Cables connected to the EUT: *All (see § 4.6 and § 5.4)*Remarks: *Measured on temporary antenna connector*Modifications: ☒ None ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5Place and date of test:
Operator:*Rossens, March 24, 2017
B. Itzcovich*

6.8 Band-edge emission (radiated)

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

Distance: ☐ 1 m ☒ 3 m ☐ 10 m ☐ 30 m

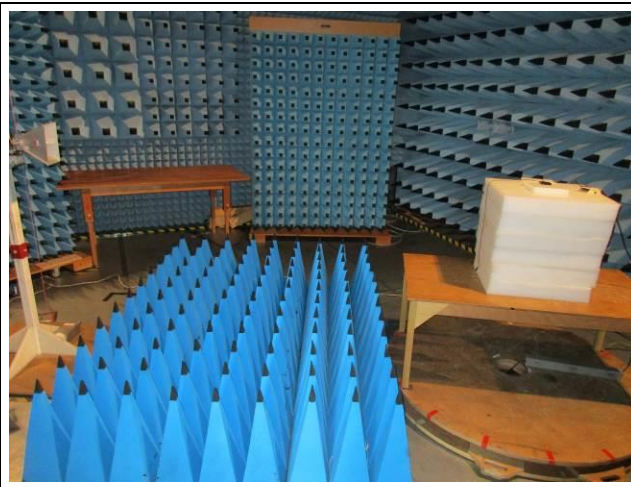
Position of EUT: 1.5 m (height of the equipment under test above floor)

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 EUT is under test.

Limit: Radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)

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 500 μ V/m at 3 m;

$$20 \log \left(\frac{500 \frac{\mu V}{m}}{1 \frac{\mu V}{m}} \right) = 54 \frac{dB\mu V}{m} \text{ at } 3m$$

Test equipment:

Spectrum analyser	☐ 88-14	☐ 94-24	☐ 02-06	☐ 03-45	☒ 16-03	☐ 07-53
Preamplifier	☐ 05-56	☐ 05-87	☐ 14-27			
Antenna (horn)	☒ 90-24	☐ 07-31				
Cables	☐ 06-00	☐ 11-61	☒ 10-75			

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

Results of the test

Client: *Phonak Communications AG*

EUT: *TV Connector*

Operating mode: *TX (f = 2.402/2.480 GHz), modulated, Pmax (00, 02), Duty 100%*

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

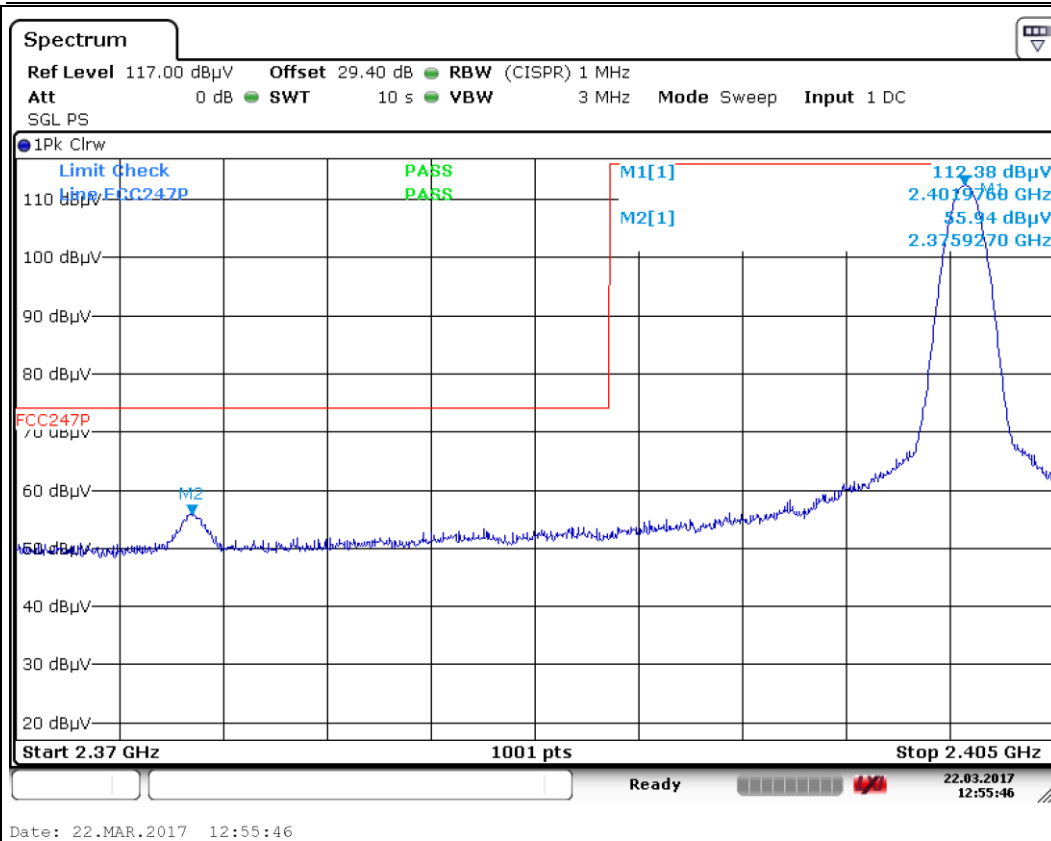
Remarks: *1001 Sweep Points*

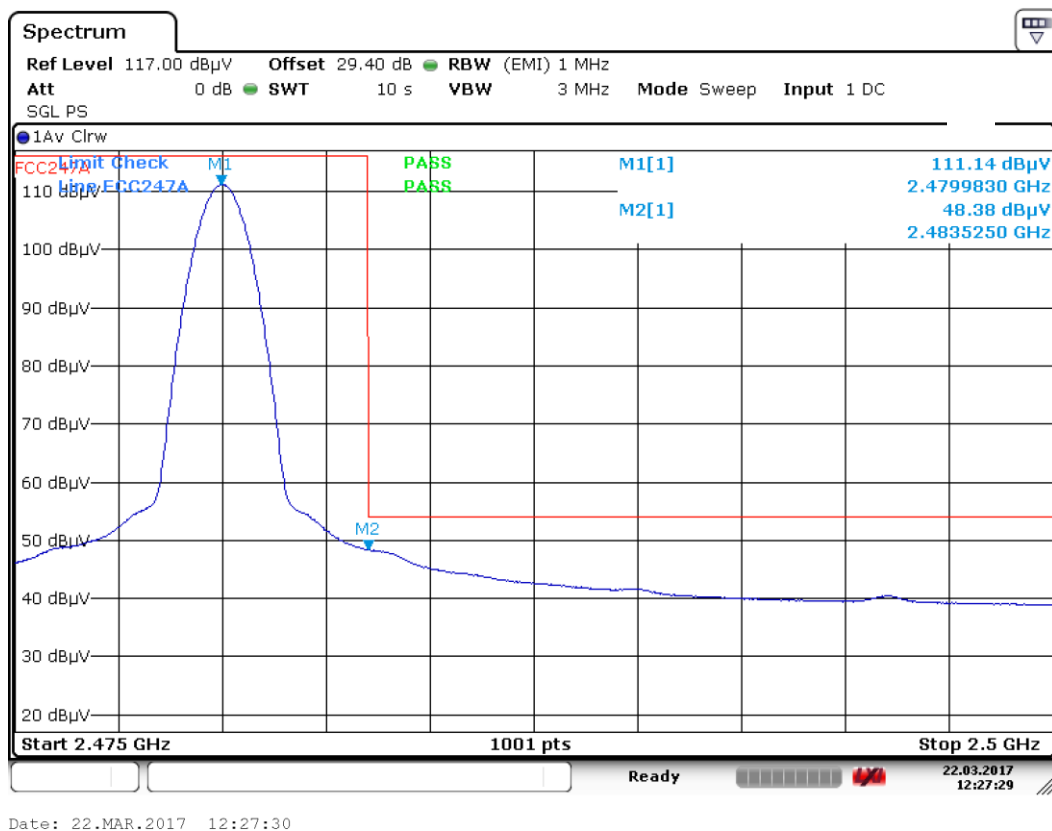
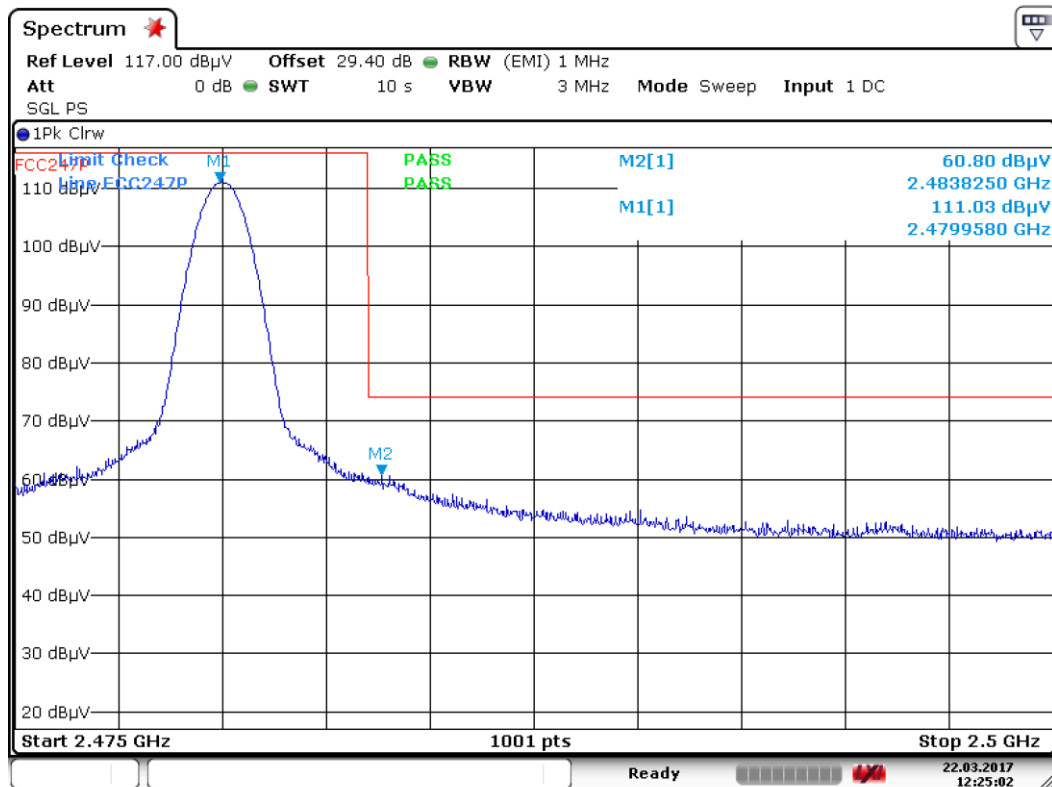
Modifications: ☒ None ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

	Measured field strength [dBμV/m]		Limit [dBμV/m]	Margin [dB]		Pass	
	≤2390.0 MHz	≥2483.5 MHz		≤2390.0 MHz	≥2483.5 MHz	Yes	No
Peak detector	55.94	60.80	74	18.06	13.20	☒	☐
Average RMS detector	51.05	48.38	54	2.95	5.62	☒	☐

Place and date of test: *Rossens, March 22, 2017*

Operator: *B. Itzcovich*





6.9 Spurious emission – conducted (transmitter – 9 kHz 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

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

Test set-up:



Remarks: *Emissions near band-edges are checked under § 6.7*

Test equipment:

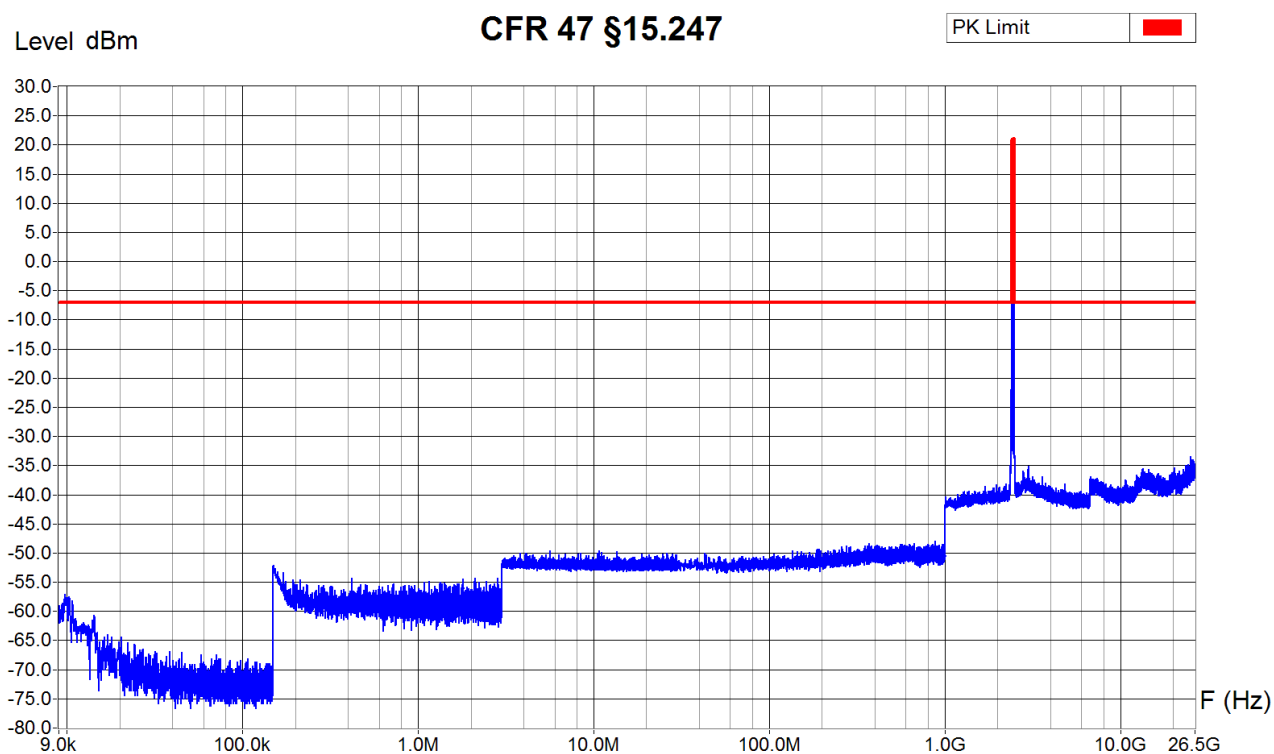
Spectrum analyser	☐ 88-14	☐ 94-24	☒ 02-06	☐ 03-45	☐ 05-39	☐ 07-53
Power supply	☐ 99-07	☐ 04-31				
Cables	☒ 11-45					

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

Measurement Type : Power Interference
Port : Temporary antenna connector
Clamp position : -



Equipment Under Test : TV Connector (TX25), Proto 161
Set-Up : See photos
Operating Conditions : Hopping TX, modulated, Pmax (00, 02)
Remarks : Peak detector sweep, 8001 Pts



Operator: B. Itzcovich
Date/Time: 24.03.2017 11:18
Filename:
22_CE_9k-
26G5_TXmax_FCC.png/.txt

6.10 Spurious emission transmit 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

Test method: The magnetic disturbance radiated by the equipment under test is measured using a spectrum analyser and a wide band magnetic antenna. The antenna is placed at 1 m 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:



Parallel

Remarks: Limit values expressed in dB μ V/m and transformed to a measuring distance of 3 m (factor used = 40 dB/decade) if necessary
 e.g.: for $f = 10$ MHz the limit is 30 μ V/m at 30 m;

$$20 \log \left(\frac{30 \frac{\mu V}{m}}{1 \frac{\mu V}{m}} \right) + 40 \log \left(\frac{30 m}{3 m} \right) = 69.5 \frac{dB \mu V}{m} \text{ at } 3m$$

Test equipment:

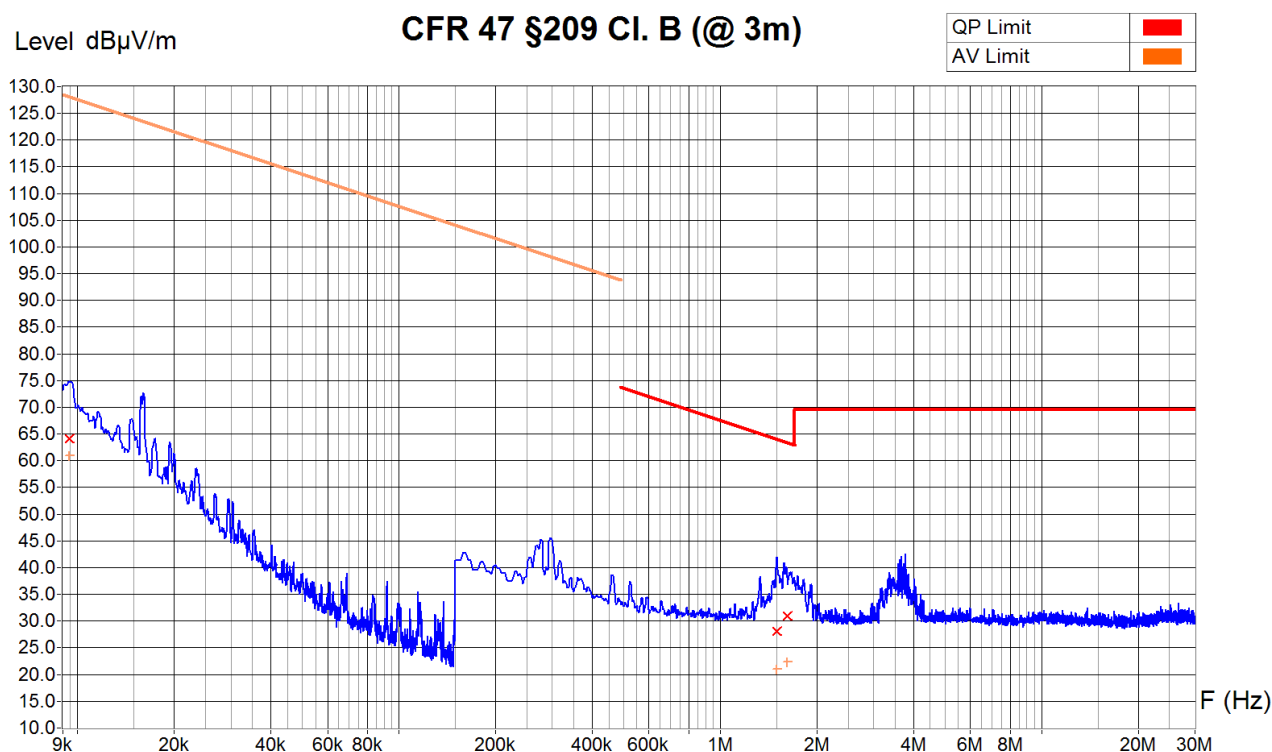
Spectrum analyser	☐ 88-14	☐ 94-24	☐ 02-06	☐ 03-45	☐ 05-39	☒ 16-03
Receiver	☐ 85-04	☐ 90-43	☐ 94-35	☒ 16-03		
Preamplifier	☐ 90-01	☐ 95-86	☐ 05-56	☐ 05-59	☐ 05-62	
Antenna (type: magnetic)	☐ 90-25	☐ 90-28	☐ 99-32	☒ 04-79		
Cables	☒ 06-00	☒ 06-206				

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

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



Equipment Under Test : TV Connector (TX25), Proto 161
 Set-Up : With AC Adapter, USB and audio cables connected; see photos
 Operating Conditions : Hopping TX (f = 2.402 / 2.440 / 2.480 GHz), modulated, Pmax (00, 02)
 Remarks : Peak detector sweep. Chamber 06-00



Zone	9 KHz - 150 KHz	150 KHz - 6 MHz	6 MHz - 30 MHz
Video Bandwidth	500 Hz	30 KHz	30 KHz
Resol Bandwidth	200 Hz	9 KHz	9 KHz

Receiver Measures

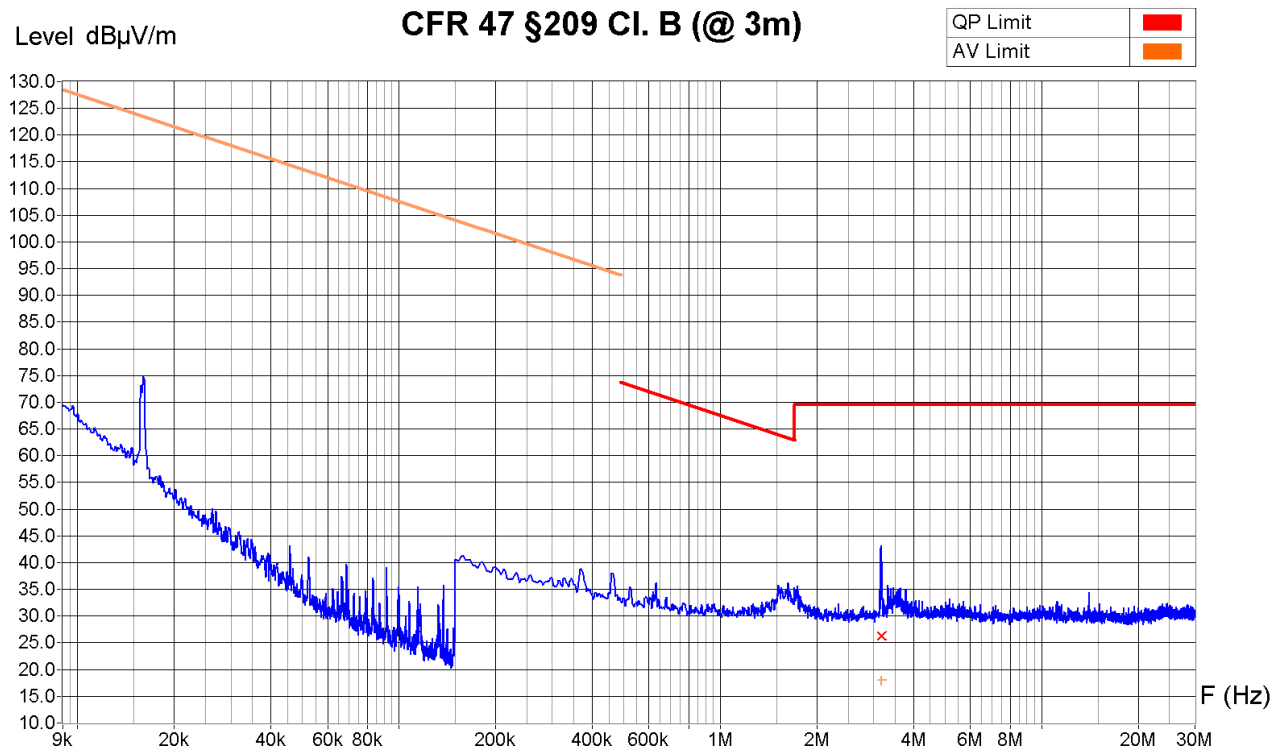
Frequency	Peak	QuasiPeak (x)	Average (+)	QP Margin
9.42 KHz	74.8 dBμV/m	64.1 dBμV/m	61.0 dBμV/m	NaN dB
1.50 MHz	41.5 dBμV/m	28.1 dBμV/m	21.0 dBμV/m	36.0 dB
1.62 MHz	38.8 dBμV/m	31.0 dBμV/m	22.4 dBμV/m	32.4 dB

Operator: B. Itzcovich
 Date/Time: 23.03.2017 10:35
 Filename:
 19_RE_9k-
 30M_TXmax_Par_FCC.png/.txt

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



Equipment Under Test : TV Connector (TX25), Proto 161
Set-Up : With AC Adapter, USB and audio cables connected; see photos
Operating Conditions : Hopping TX (f = 2.402 / 2.440 / 2.480 GHz), modulated, Pmax (00, 02)
Remarks : Peak detector sweep. Chamber 06-00



Zone	9 KHz - 150 KHz	150 KHz - 6 MHz	6 MHz - 30 MHz
Video Bandwidth	500 Hz	30 KHz	30 KHz
Resol Bandwidth	200 Hz	9 KHz	9 KHz

Receiver Measures

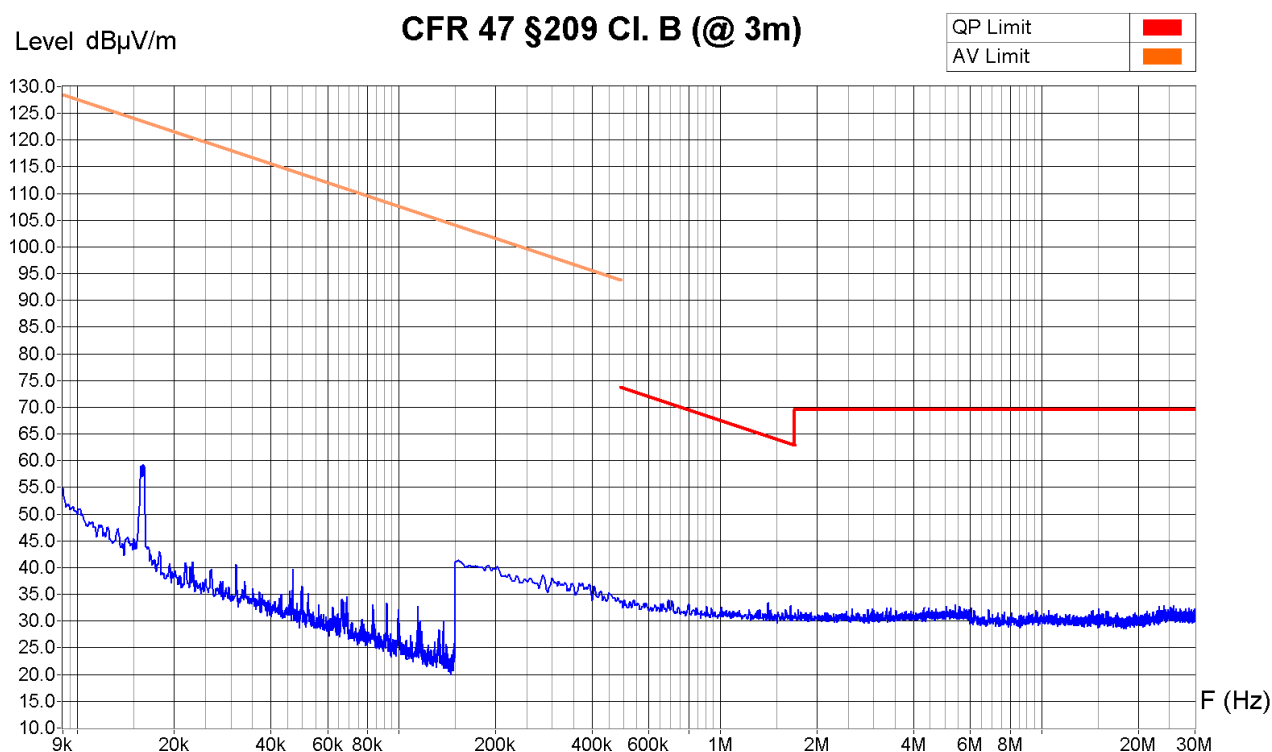
Frequency	Peak	QuasiPeak (x)	Average (+)	QP Margin
3.17 MHz	51.7 dB μ V/m	26.2 dB μ V/m	17.9 dB μ V/m	43.3 dB

Operator: B. Itzcovich
Date/Time: 23.03.2017 10:57
Filename:
20_RE_9k-
30M_TXmax_Per_FCC.png/.txt

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



Equipment Under Test : TV Connector (TX25), Proto 161
 Set-Up : With AC Adapter, USB and audio cables connected; see photos
 Operating Conditions : Hopping TX (f = 2.402 / 2.440 / 2.480 GHz), modulated, Pmax (00, 02)
 Remarks : Peak detector sweep. Chamber 06-00



Zone	9 KHz - 150 KHz	150 KHz - 6 MHz	6 MHz - 30 MHz
Video Bandwidth	500 Hz	30 KHz	30 KHz
Resol Bandwidth	200 Hz	9 KHz	9 KHz

Operator: B. Itzcovich
 Date/Time: 23.03.2017 11:25
 Filename:
 21_RE_9k-
 30M_TXmax_Hor_FCC.png/.txt

6.10.2 30 MHz to 1 GHz

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: ± 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 re-measured manually using a receiver.

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

Test set-up:



Remarks: Limit values expressed in dB μ V/m and transformed to a measuring distance of 3m
(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:

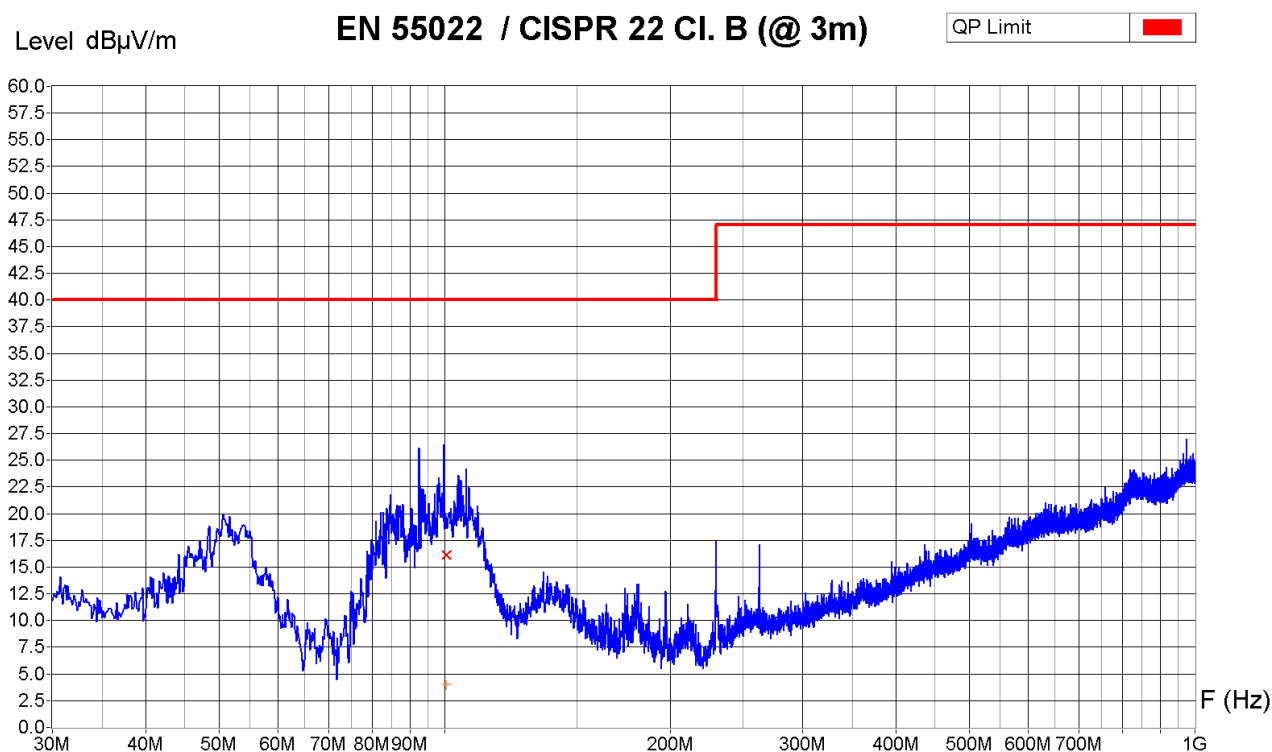
Spectrum analyser	☐ 88-14	☐ 94-24	☐ 02-06	☐ 03-45	☐ 05-39	☒ 10-70
Receiver	☐ 85-04	☐ 90-43	☐ 94-35	☒ 10-70		
Preamplifier	☐ 90-01	☐ 95-86	☐ 05-56	☒ 05-59	☐ 05-62	
Antenna (bilog)	☒ 94-03	☐ 05-38				
Cables	☒ 06-01					

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

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



Equipment Under Test : TV Connector (TX25), Proto 161
 Set-Up : With AC Adapter, USB and audio cables connected; see photos
 Operating Conditions : Hopping TX (f = 2.402 / 2.440 / 2.480 GHz), modulated, Pmax (00, 02)
 Remarks : Cage 06-01



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

Receiver Measures

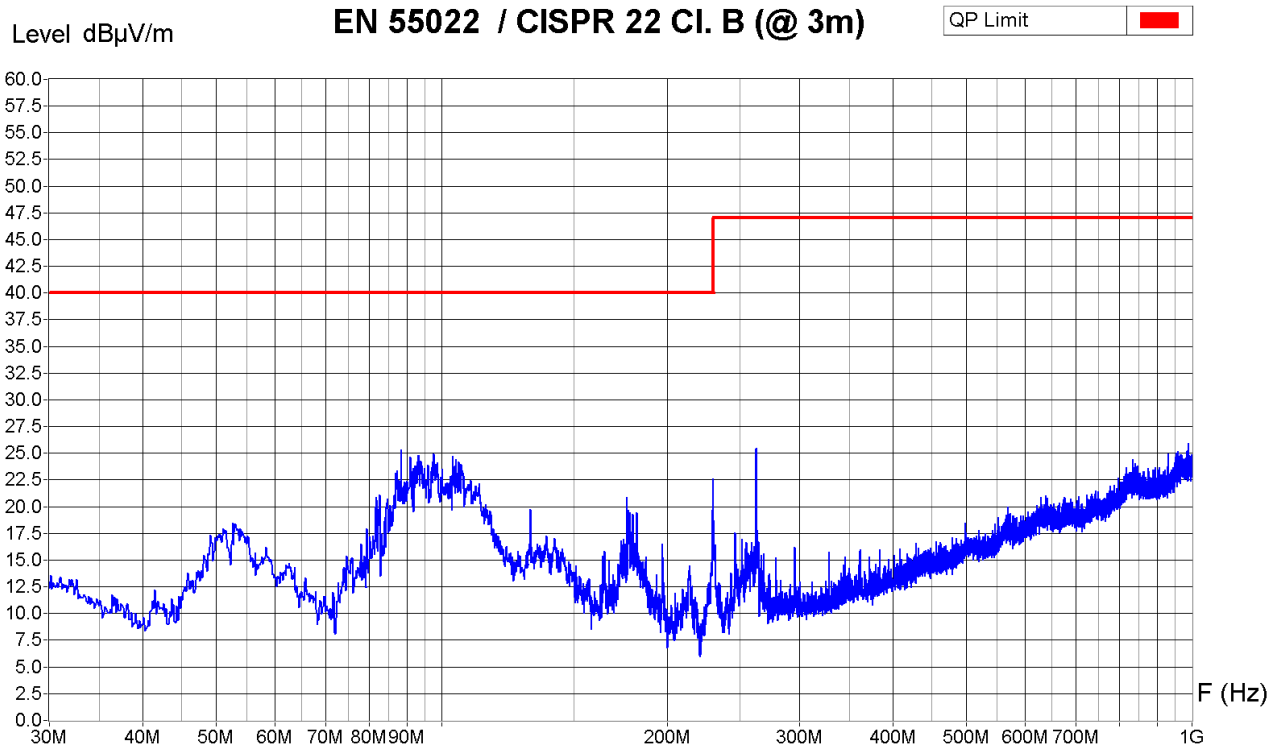
Frequency	Peak	QuasiPeak (x)	Average (+)	QP Margin
100.50 MHz	31.0 dB μ V/m	16.1 dB μ V/m	4.0 dB μ V/m	23.9 dB

Operator: B. Itzcovich
 Date/Time: 20.03.2017 14:53
 Filename:
 01_RE_30M-
 1G_TXmax_V_C22.png/.txt

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



Equipment Under Test : TV Connector (TX25), Proto 161
Set-Up : With AC Adapter, USB and audio cables connected; see photos
Operating Conditions : Hopping TX (f = 2.402 / 2.440 / 2.480 GHz), modulated, Pmax (00, 02)
Remarks : Cage 06-01



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

Operator: B. Itzcovich
Date/Time: 20.03.2017 15:20
Filename:
02_RE_30M-
1G_TXmax_H_C22.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: 1.5 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.

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

Test set-up:



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

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

- Emissions near band-edges may seem over limits due to poor selectivity of 02-06 Analyser at 1 MHz RBW. They are checked under §§ 6.7 and 6.8

Test equipment:

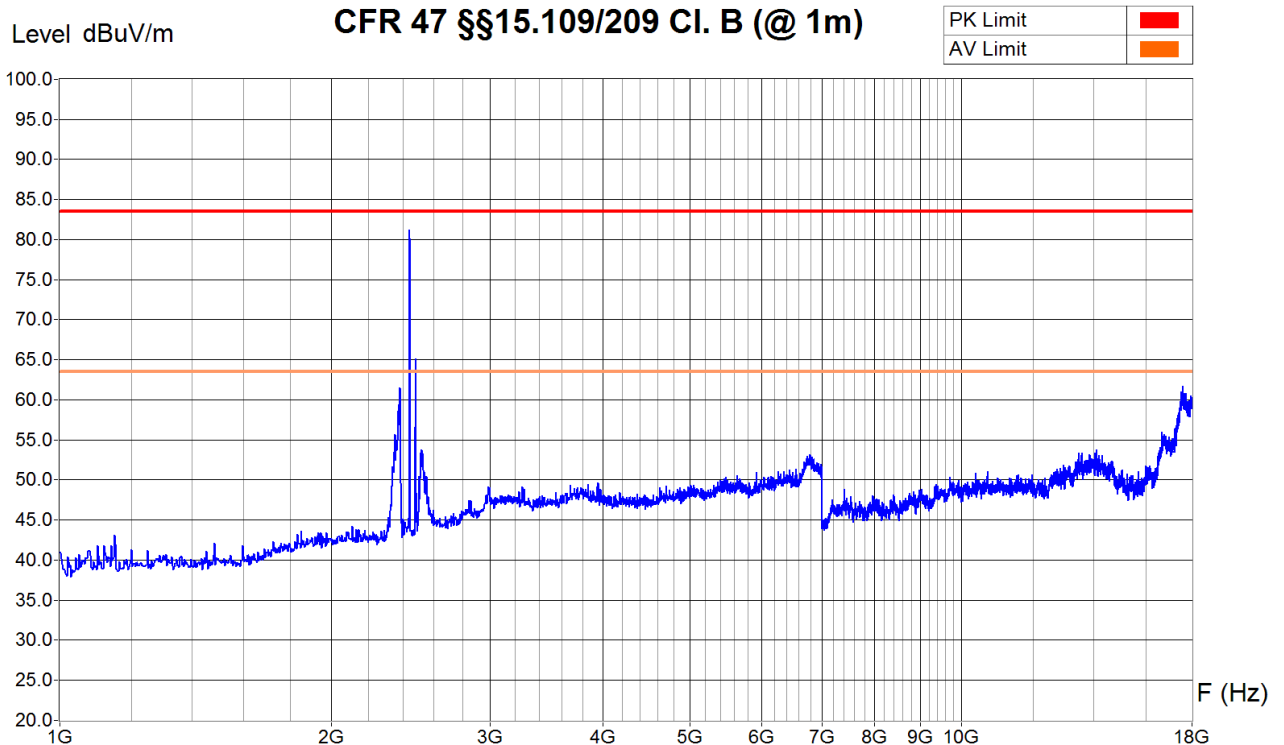
Spectrum analyser	☐ 88-14	☐ 94-24	☒ 02-06	☐ 03-45	☐ 05-39	☐ 07-53
Preamplifier	☐ 05-56	☐ 05-87	☒ 14-27			
Antenna (horn)	☒ 90-24	☐ 07-31				
Cables	☒ 10-75	☒ 11-61				
Filters	☒ 13-14	☒ 12-06	☐ 13-05			

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

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



Equipment Under Test : TV Connector (TX25), Proto 161
Set-Up : With AC Adapter, USB and audio cables connected; see photos
Operating Conditions : Hopping TX (f = 2.402 / 2.440 / 2.480 GHz), modulated, Pmax (00, 02)
Remarks : Measurement up to 7 GHz with notch filter and preamp
Measurement above 7 GHz with HP filter and preamp
Peak detector sweep. Chamber 06-00



Zone	1 GHz - 7 GHz	7 GHz - 13 GHz	13 GHz - 18 GHz
Video Bandwidth	3 MHz	3 MHz	1 MHz
Resol Bandwidth	1 MHz	1 MHz	1 MHz

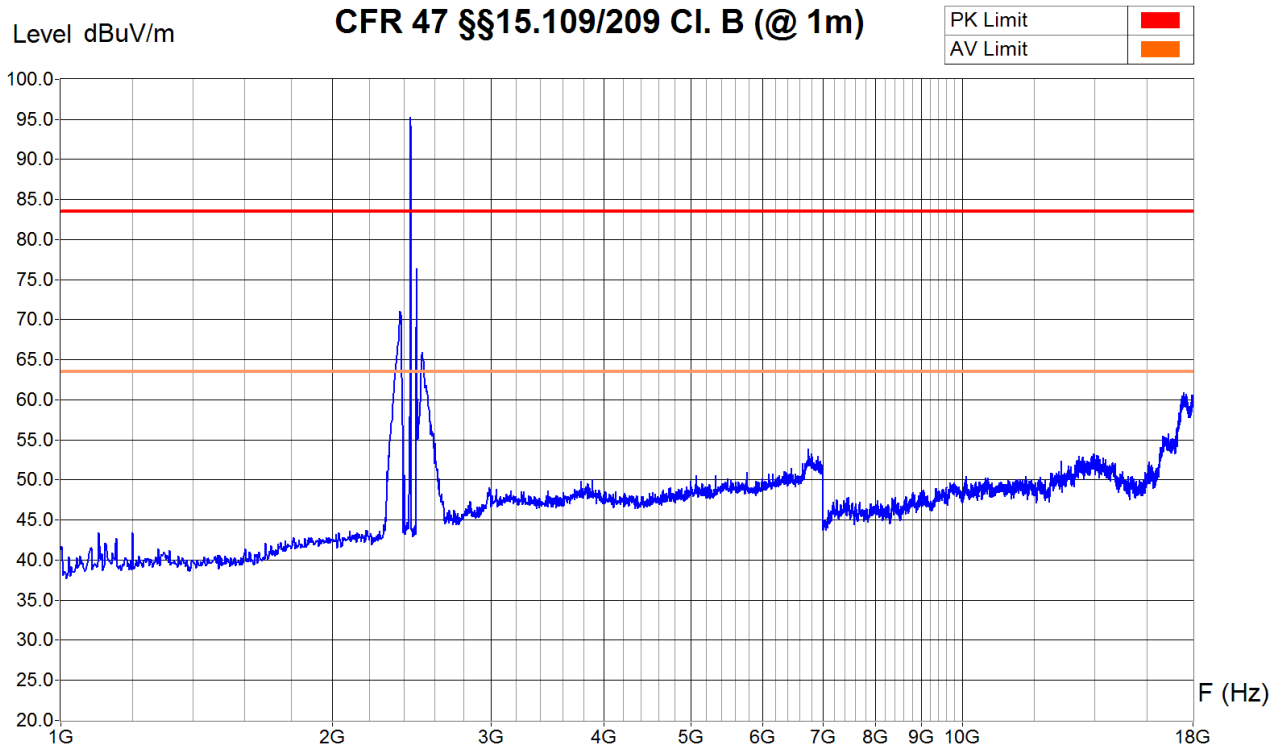
Frequency	Average RMS detector meas.
17.6725 GHz	54.2 dBuV/m

Operator: B. Itzcovich
Date/Time: 22.03.2017 15:27
Filename:
11_RE_1-
18G_TXmax_V_FCC.png/.txt

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



Equipment Under Test : TV Connector (TX25), Proto 161
 Set-Up : With AC Adapter, USB and audio cables connected; see photos
 Operating Conditions : Hopping TX (f = 2.402 / 2.440 / 2.480 GHz), modulated, Pmax (00, 02)
 Remarks : Measurement up to 7 GHz with notch filter and preamp
 Measurement above 7 GHz with HP filter and preamp
 Peak detector sweep. Chamber 06-00



Zone	1 GHz - 7 GHz	7 GHz - 13 GHz	13 GHz - 18 GHz
Video Bandwidth	3 MHz	3 MHz	1 MHz
Resol Bandwidth	1 MHz	1 MHz	1 MHz

Operator: B. Itzcovich
 Date/Time: 22.03.2017 15:48
 Filename:
 12_RE_1-
 18G_TXmax_H_FCC.png/.txt

6.10.4 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

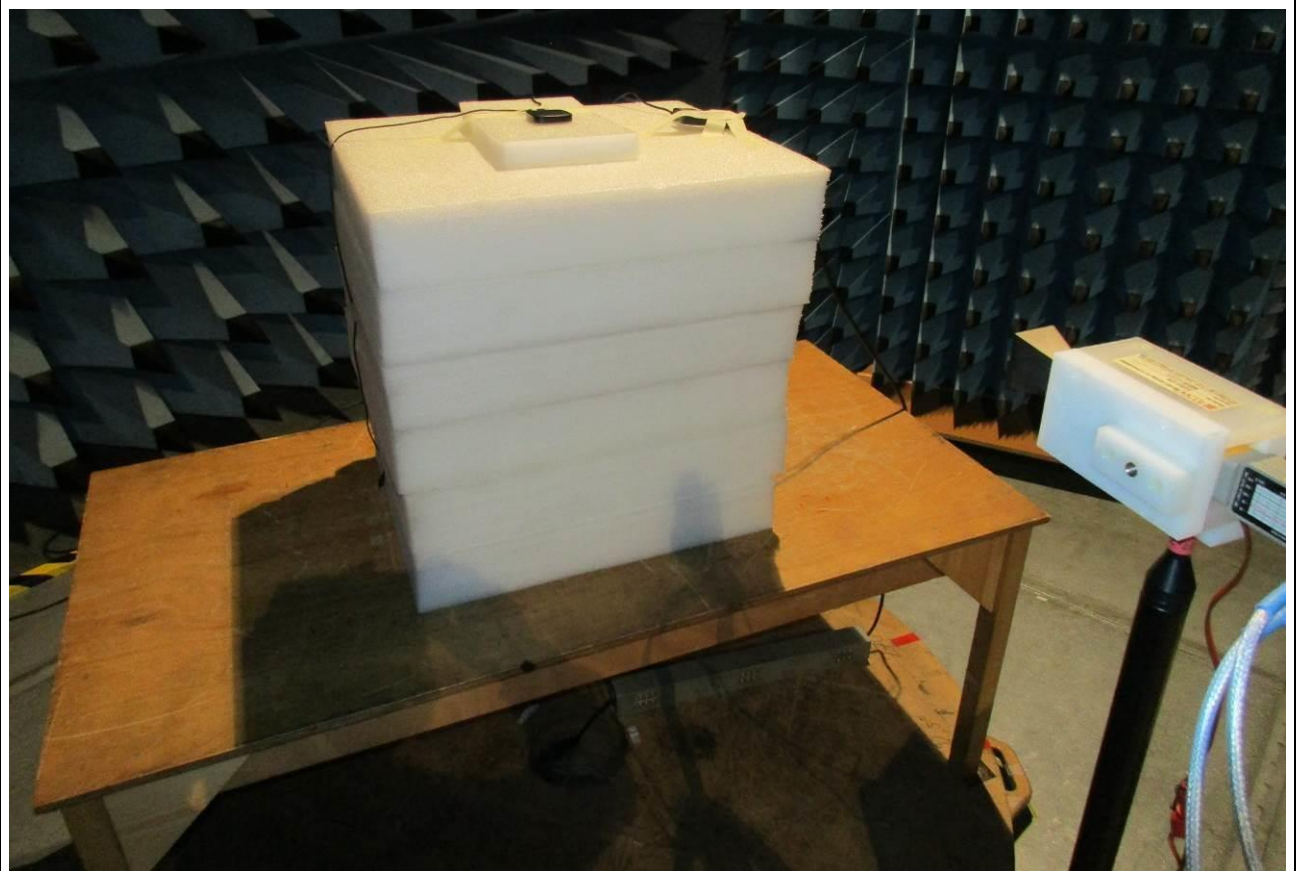
Position of EUT: 1.5 m (height of the equipment under test above floor)

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.

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

Test set-up:



Remarks: Limit values expressed in dB μ V/m and transformed to a measuring distance of 1m (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					

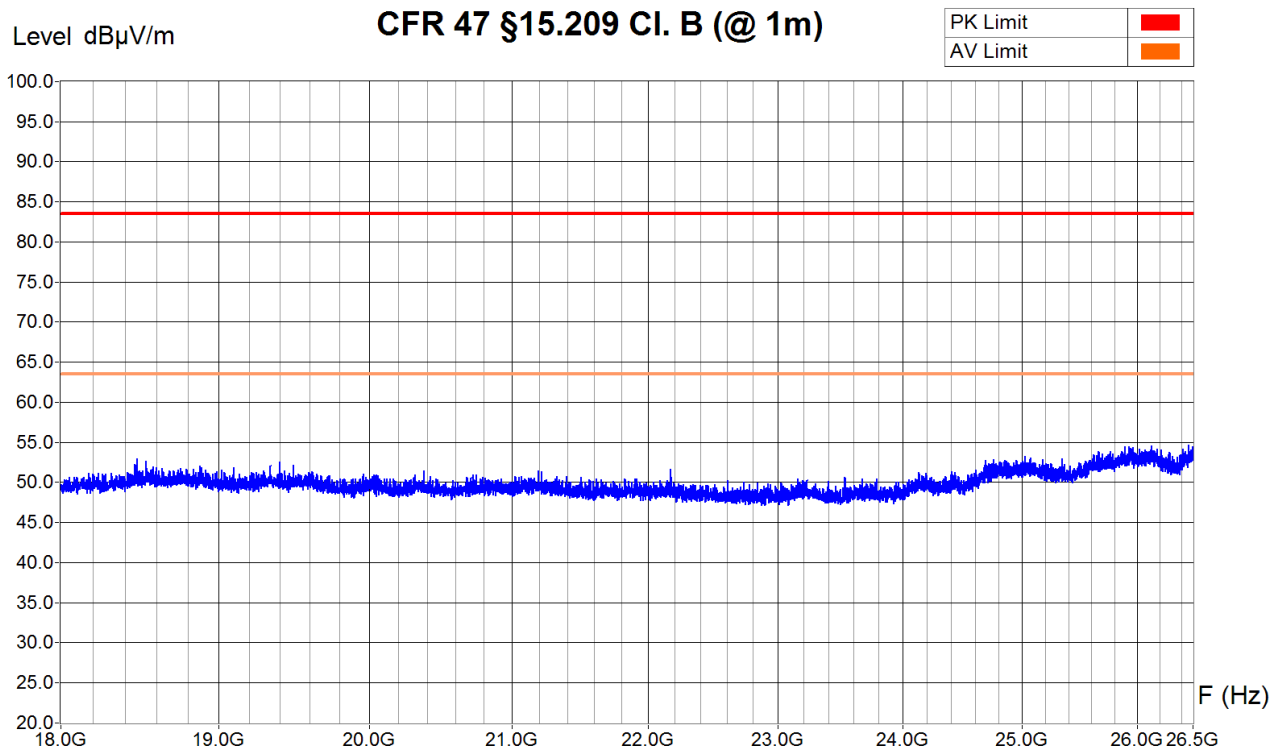
Result: ☒ pass ☐ fail ☐ not applicable ☐ not tested

Measurement Type : Radiated Field
 Polarisation : Vertical
 Table Angle : 0 - 360°
 Antenna Height : 1.5 m



Equipment Under Test : TV Connector (TX25), Proto 161
 Set-Up : With AC Adapter, USB and audio cables connected; see photos
 Operating Conditions : Hopping TX (f = 2.402 / 2.440 / 2.480 GHz), modulated, Pmax (00, 02)
 Remarks :

Peak detector sweep. Chamber 06-00



Zone	18 GHz - 26.50 GHz
Video Bandwidth	1 MHz
Resol Bandwidth	1 MHz

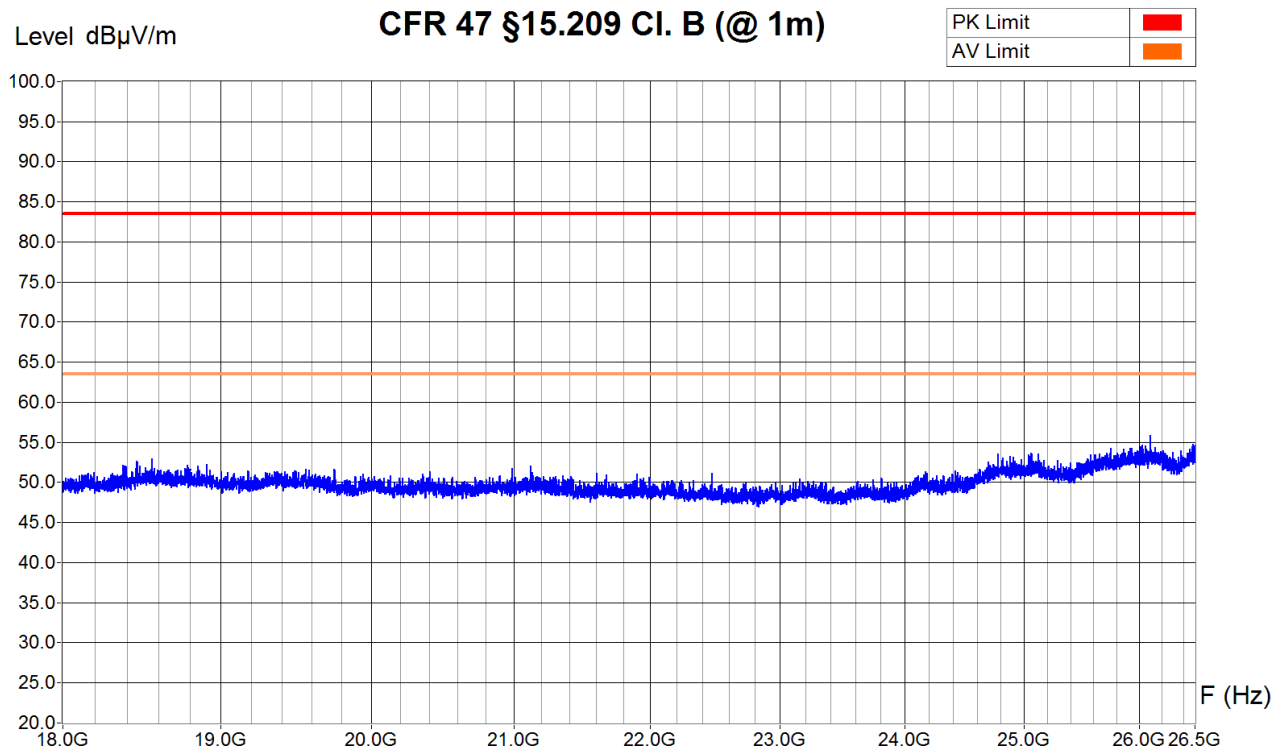
Operator: B. Itzcovich
 Date/Time: 22.03.2017 17:56
 Filename:
 17_RE_18-
 26G5_TXmax_V_FCC.png/.txt

Measurement Type : Radiated Field
Polarisation : Horizontal
Table Angle : 0 - 360°
Antenna Height : 1.5 m



Equipment Under Test : TV Connector (TX25), Proto 161
Set-Up : With AC Adapter, USB and audio cables connected; see photos
Operating Conditions : Hopping TX (f = 2.402 / 2.440 / 2.480 GHz), modulated, Pmax (00, 02)
Remarks :

Peak detector sweep. Chamber 06-00



Zone	18 GHz - 26.50 GHz
Video Bandwidth	1 MHz
Resol Bandwidth	1 MHz

Operator: B. Itzcovich
Date/Time: 22.03.2017 17:52
Filename:
18_RE_18-
26G5_TXmax_H_FCC.png/.txt

6.11 Spurious emission receive & standby mode - radiated**6.11.1 30 MHz to 1 GHz**

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: ± 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 re-measured manually using a receiver.

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

Test set-up:



Remarks: - Limit values expressed in dB μ V/m and transformed to a measuring distance of 3m (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:

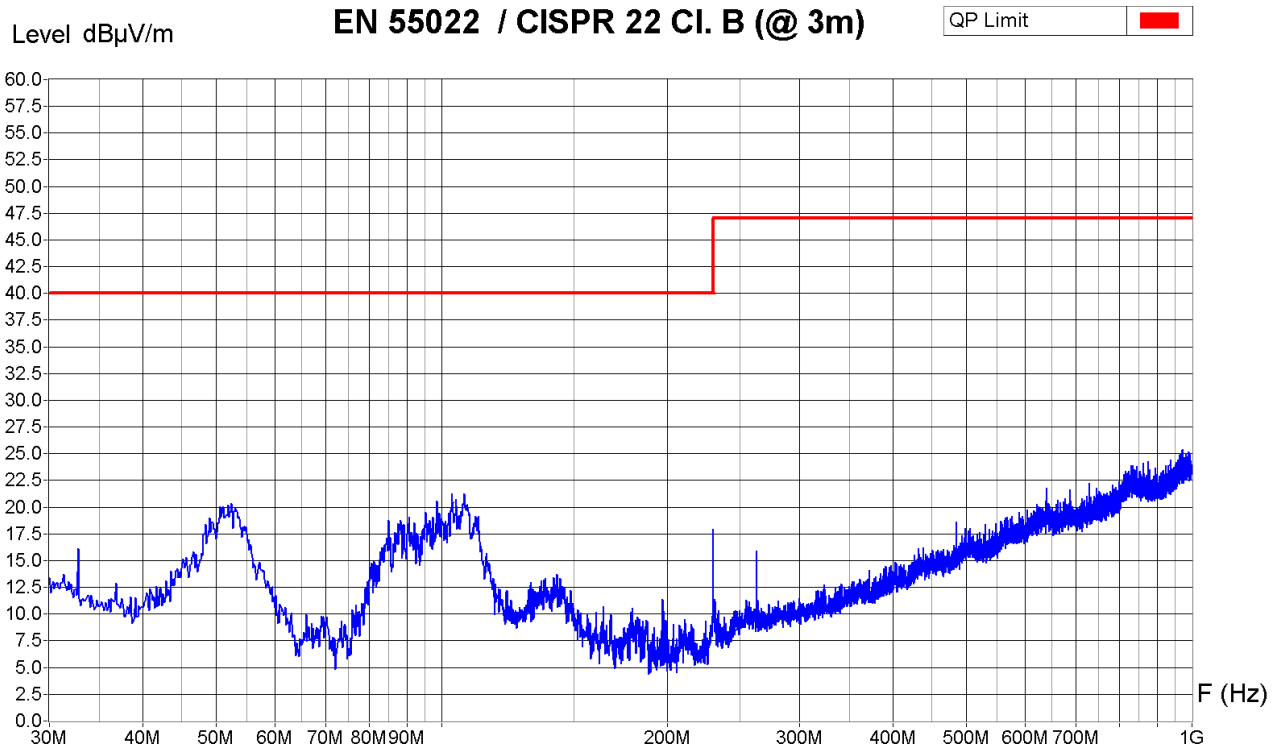
Spectrum analyser	☐ 88-14	☐ 94-24	☐ 02-06	☐ 03-45	☐ 05-39	☒ 10-70
Receiver	☐ 85-04	☐ 90-43	☐ 94-35	☒ 10-70		
Preamplifier	☐ 90-01	☐ 95-86	☐ 05-56	☒ 05-59	☐ 05-62	
Antenna (bilog)	☒ 94-03	☐ 05-38				
Cables	☒ 06-01					

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

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



Equipment Under Test : TV Connector (TX25), Proto 161
Set-Up : With AC Adapter, USB and audio cables connected; see photos
Operating Conditions : RX (f = 2.440 GHz)
Remarks : Cage 06-01



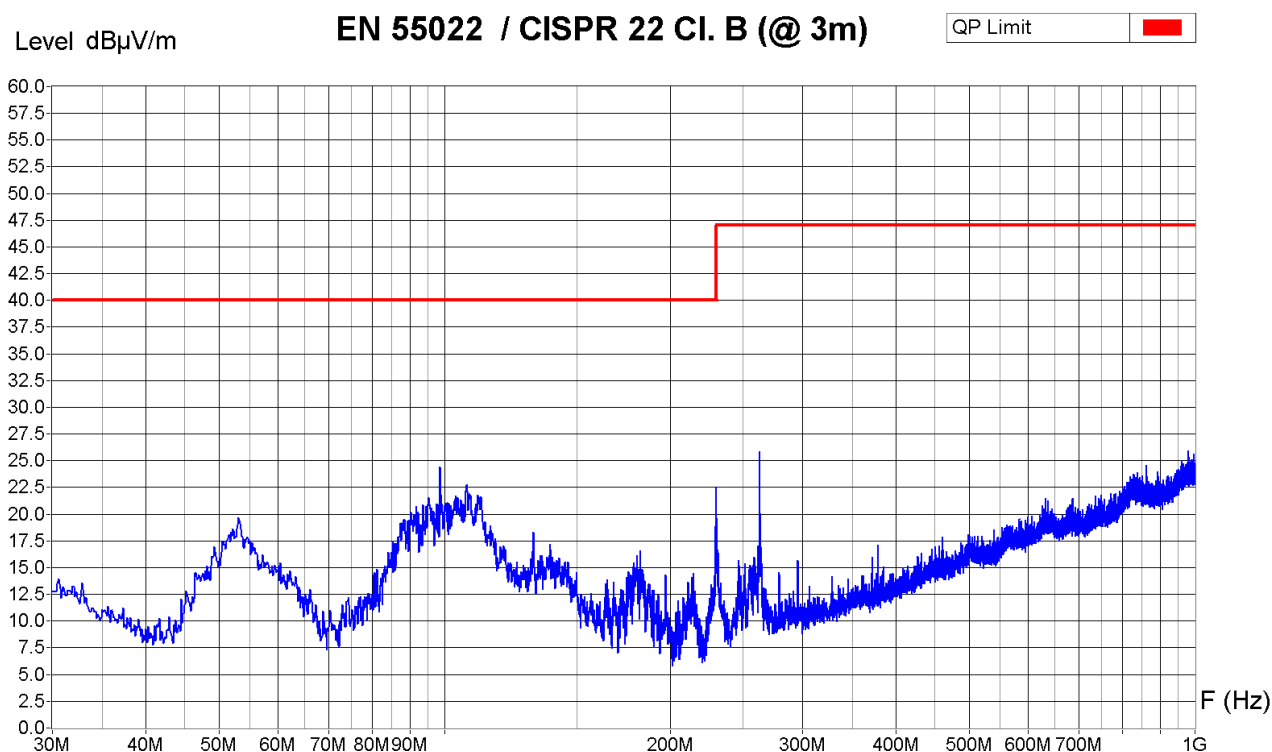
Zone	30 MHz - 1 GHz
Video Bandwidth	300 KHz
Resol Bandwidth	120 KHz

Operator: B. Itzcovich
Date/Time: 20.03.2017 15:33
Filename:
03_RE_30M-1G_RX_V_C22.png/
.txt

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



Equipment Under Test : TV Connector (TX25), Proto 161
 Set-Up : With AC Adapter, USB and audio cables connected; see photos
 Operating Conditions : RX (f = 2.440 GHz)
 Remarks : Cage 06-01



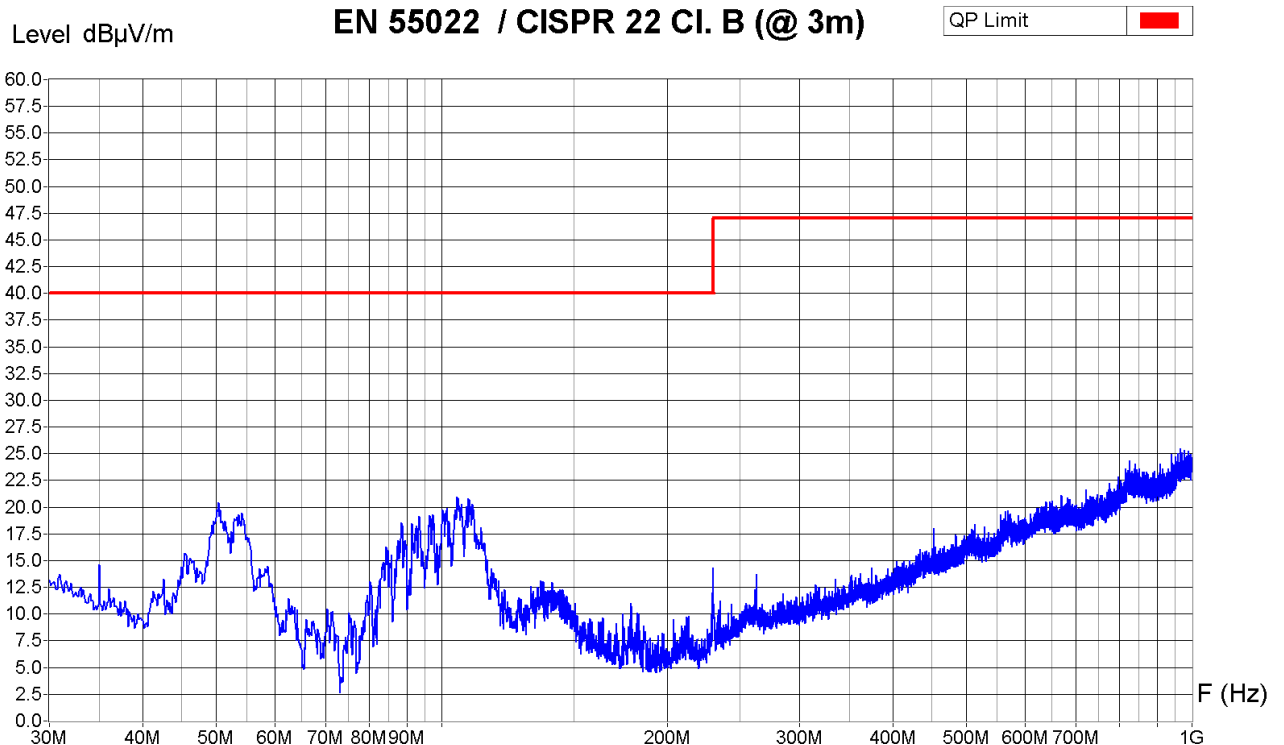
Zone	30 MHz - 1 GHz
Video Bandwidth	300 KHz
Resol Bandwidth	120 KHz

Operator: B. Itzcovich
 Date/Time: 20.03.2017 15:48
 Filename:
 04_RE_30M-1G_RX_H_C22.png/
 .txt

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



Equipment Under Test : TV Connector (TX25), Proto 161
Set-Up : With AC Adapter, USB and audio cables connected; see photos
Operating Conditions : Standby
Remarks : Cage 06-01



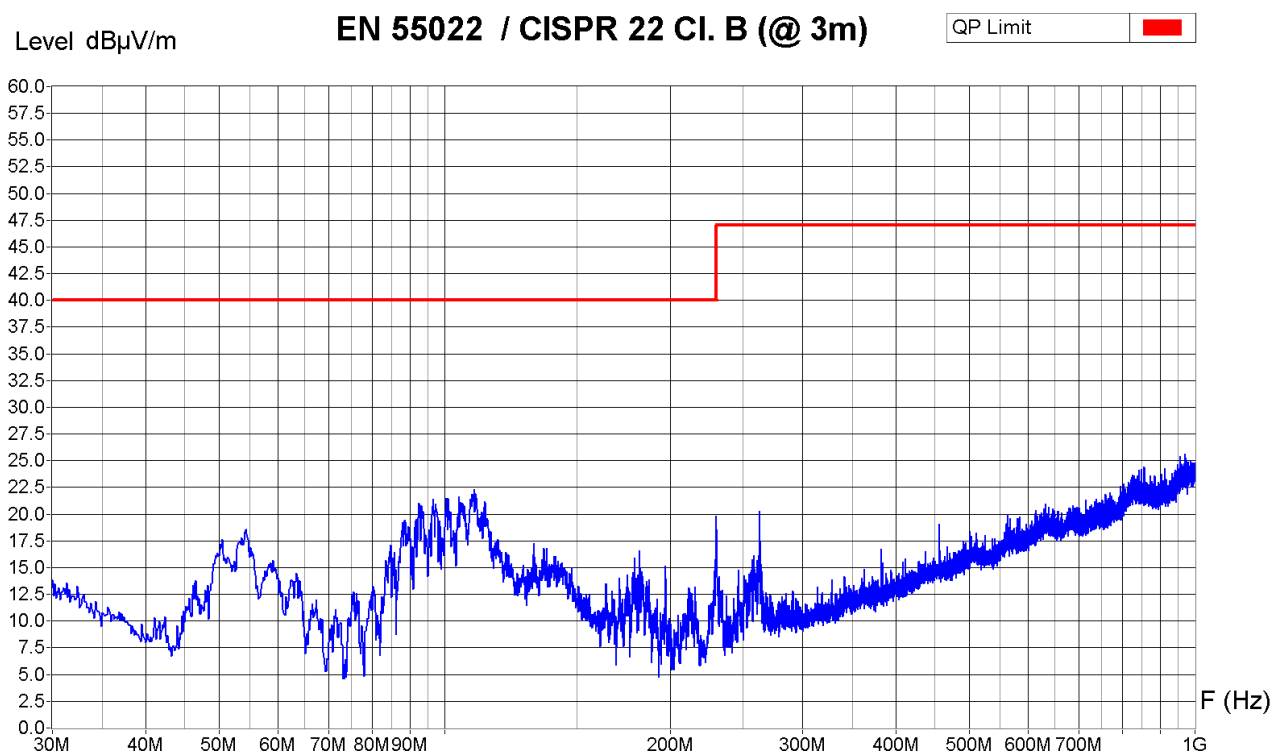
Zone	30 MHz - 1 GHz
Video Bandwidth	300 KHz
Resol Bandwidth	120 KHz

Operator: B. Itzcovich
Date/Time: 20.03.2017 16:04
Filename:
05_RE_30M-
1G_Stby_V_C22.png/.txt

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



Equipment Under Test : TV Connector (TX25), Proto 161
 Set-Up : With AC Adapter, USB and audio cables connected; see photos
 Operating Conditions : Standby
 Remarks : Cage 06-01



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

Operator: B. Itzcovich
 Date/Time: 20.03.2017 16:12
 Filename:
 06_RE_30M-
 1G_Stby_H_C22.png/.txt

6.11.2 1 GHz to 13 GHzTest site: ☐ semi-anechoic chamber (ferrites) ☒ semi-anechoic chamber (foam)Distance: ☒ 1 m ☐ 3 m ☐ 10 m ☐ 30 m

Position of EUT: 1.5 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.

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

Test set-up:



Remarks: Limit values expressed in dB μ V/m and transformed to a measuring distance of 1m (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:

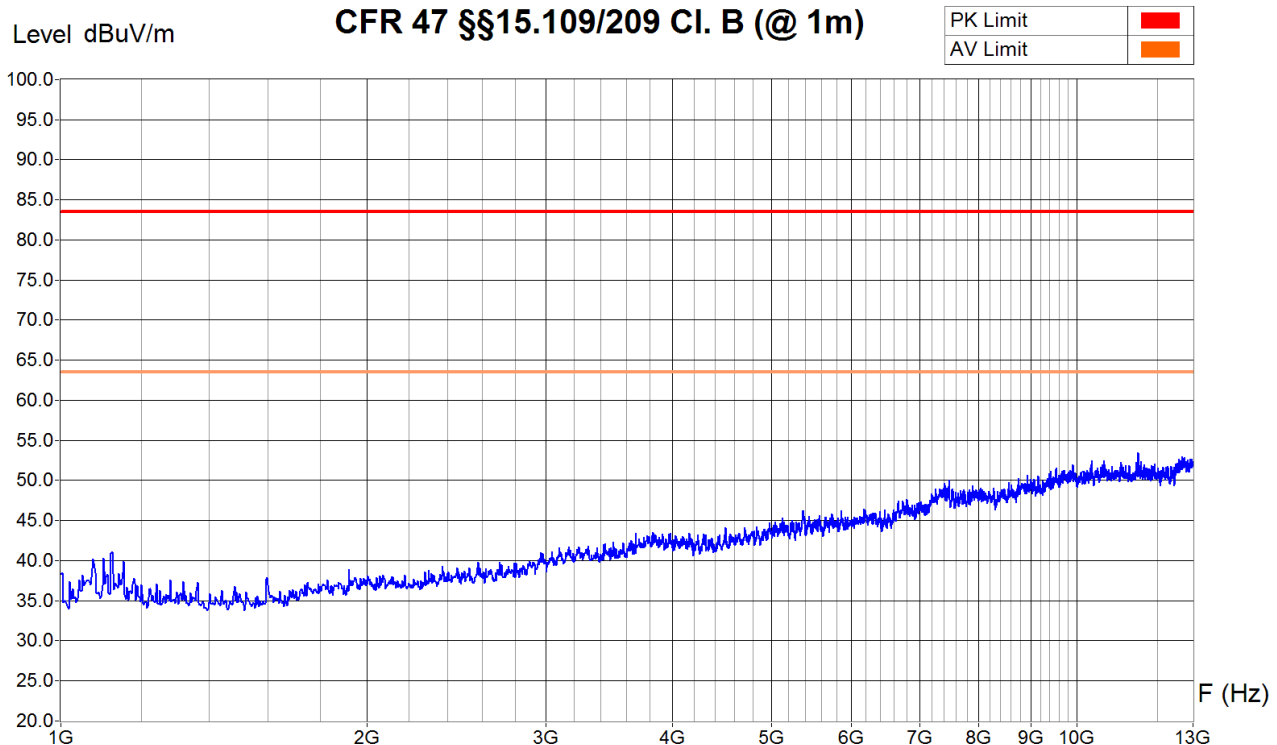
Spectrum analyser	☐ 88-14	☐ 94-24	☒ 02-06	☐ 03-45	☐ 05-39	☐ 07-53
Preamplifier	☐ 05-56	☐ 05-87	☒ 14-27			
Antenna (horn)	☒ 90-24	☐ 07-31				
Cables	☒ 10-75	☒ 11-61				
Filters	☐ 13-14	☐ 10-66	☐ 11-08	☐ 12-06		

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

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



Equipment Under Test : TV Connector (TX25), Proto 161
Set-Up : With AC Adapter, USB and audio cables connected; see photos
Operating Conditions : RX (f = 2.440 GHz)
Remarks : Measurement without filter, with preamp
Peak detector sweep. Chamber 06-00



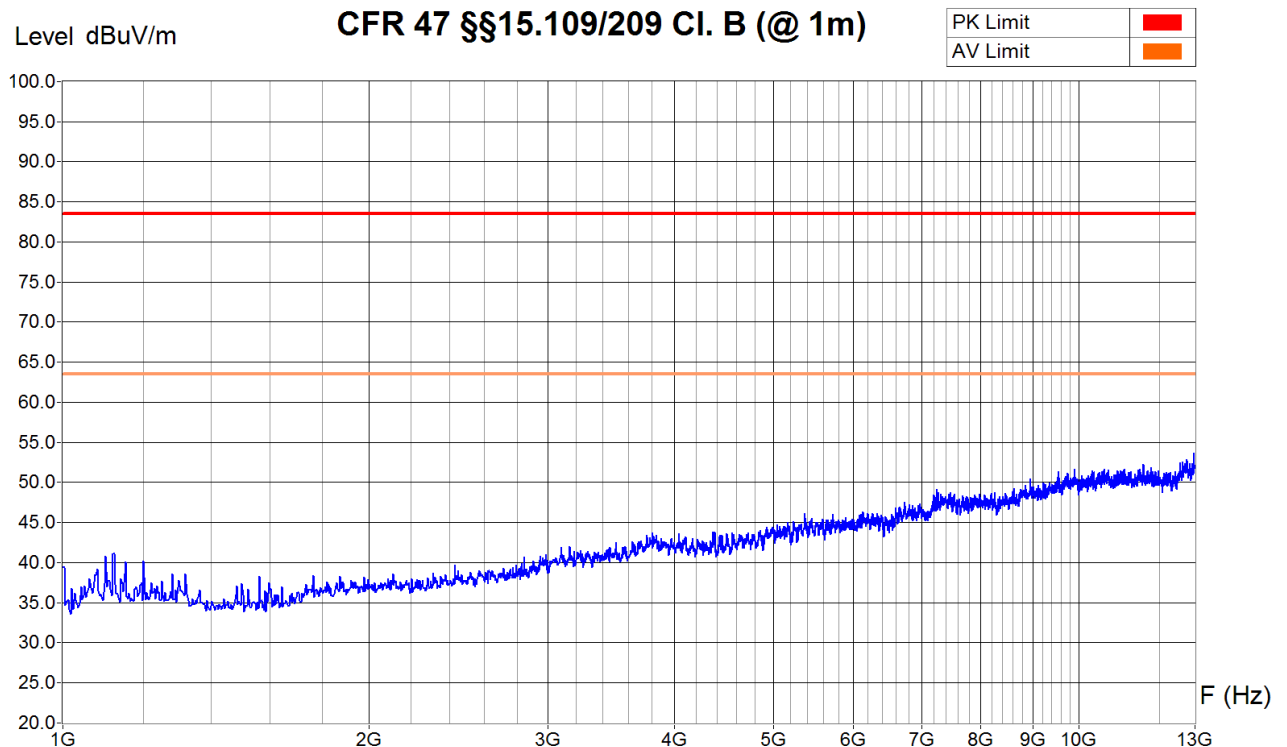
Zone	1 GHz - 7 GHz	7 GHz - 13 GHz
Video Bandwidth	3 MHz	3 MHz
Resol Bandwidth	1 MHz	1 MHz

Operator: B. Itzcovich
Date/Time: 22.03.2017 16:28
Filename:
13_RE_1-13G_RX_V_FCC.png/
.txt

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



Equipment Under Test : TV Connector (TX25), Proto 161
Set-Up : With AC Adapter, USB and audio cables connected; see photos
Operating Conditions : RX (f = 2.440 GHz)
Remarks : Measurement without filter, with preamp
Peak detector sweep. Chamber 06-00



Zone	1 GHz - 7 GHz	7 GHz - 13 GHz
Video Bandwidth	3 MHz	3 MHz
Resol Bandwidth	1 MHz	1 MHz

Operator: B. Itzcovich
Date/Time: 22.03.2017 16:07
Filename:
14_RE_1-13G_RX_H_FCC.png/
.txt

6.12 Conducted emission - Interference voltage

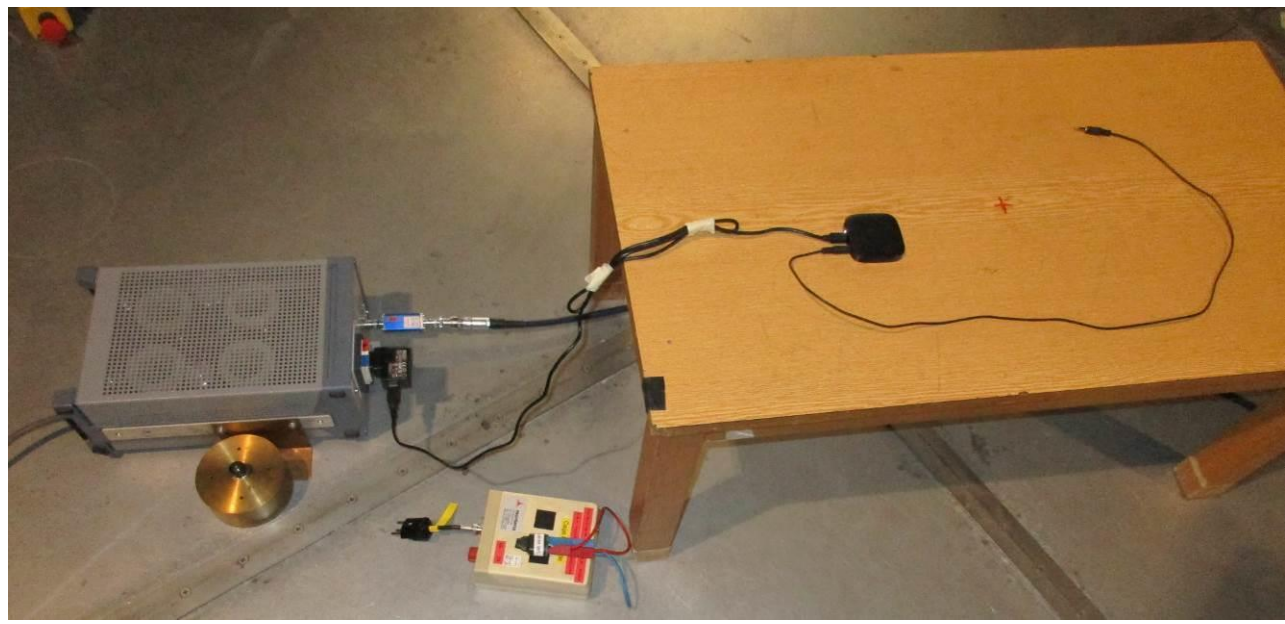
Test site: ☒ semi-anechoic chamber (foam) ☐ shielded room
☐ Semi-anechoic chamber (ferrites) ☐ laboratory

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 re-measured with a measuring receiver.

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

Test set-up:



Remarks: ---

Test equipment:

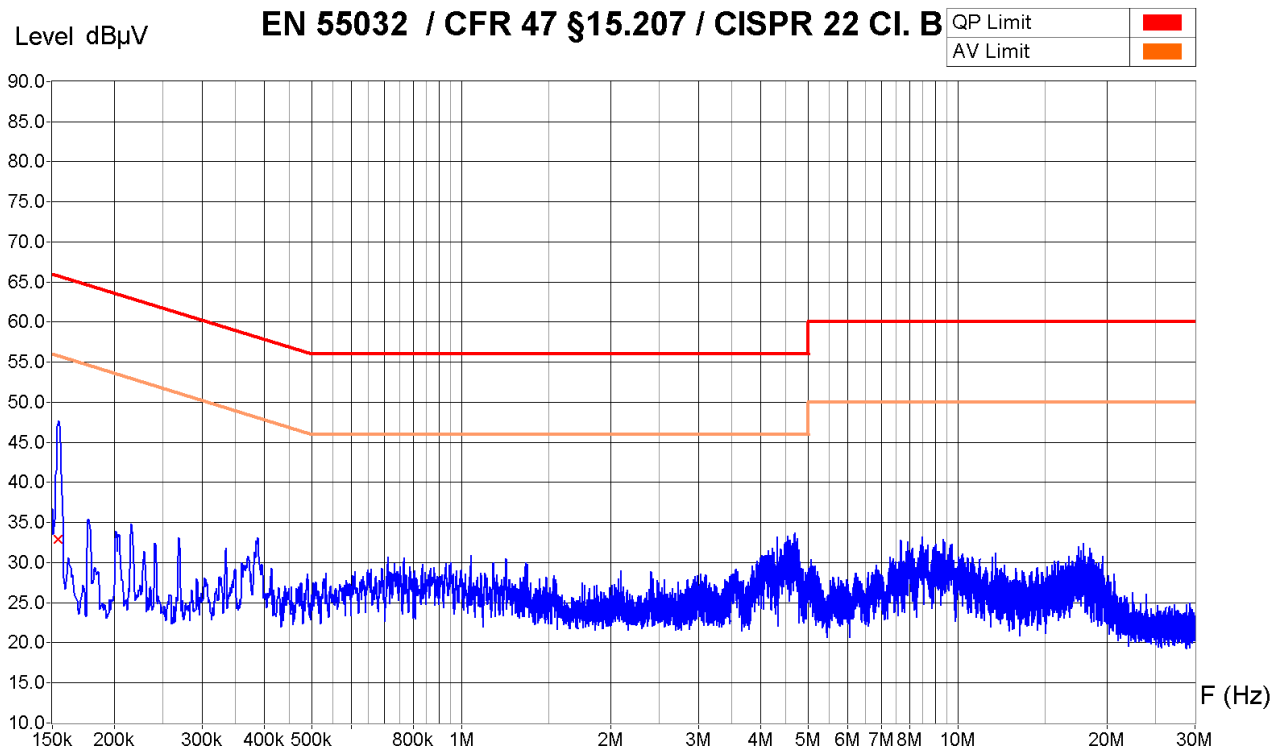
Spectrum analyser	☐ 88-14	☐ 94-24	☐ 02-06	☐ 03-45	☐ 05-39	☒ 02-06
Receiver	☐ 85-12	☐ 90-11	☒ 94-34	☐ 04-28	☐ 06-29	
LISN	☐ 85-13	☐ 90-08	☐ 94-36	☐ 94-40	☐ 95-12	☒ 00-43
Protection 10 dB	☒ 95-30	☐ 95-35	☐ 95-36	☐ 96-38	☐ included in LISN	
Protection 20 dB	☐ 91-46	☐ 95-33	☐ 95-38	☐ included in LISN		
Variable transformer	☒ 04-32					
Multimeter	☒ 05-47					
Cables	☒ 06-00	☒ 10-41	☐ 06-206			

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

Measurement Type : Voltage Interference
 Supply : Line 1
 Other : 115 V / 50 Hz



Equipment Under Test : TV Connector (TX25), Proto 161
 Set-Up : With AC Adapter, USB and audio cables connected; see photos
 Operating Conditions : Hopping TX (f = 2.402 / 2.440 / 2.480 GHz), modulated, Pmax (00, 02)
 Remarks : Cage 06-00



Zone	150 KHz - 6 MHz	6 MHz - 30 MHz
Video Bandwidth	30 KHz	30 KHz
Resol Bandwidth	9 KHz	9 KHz

Receiver Measures

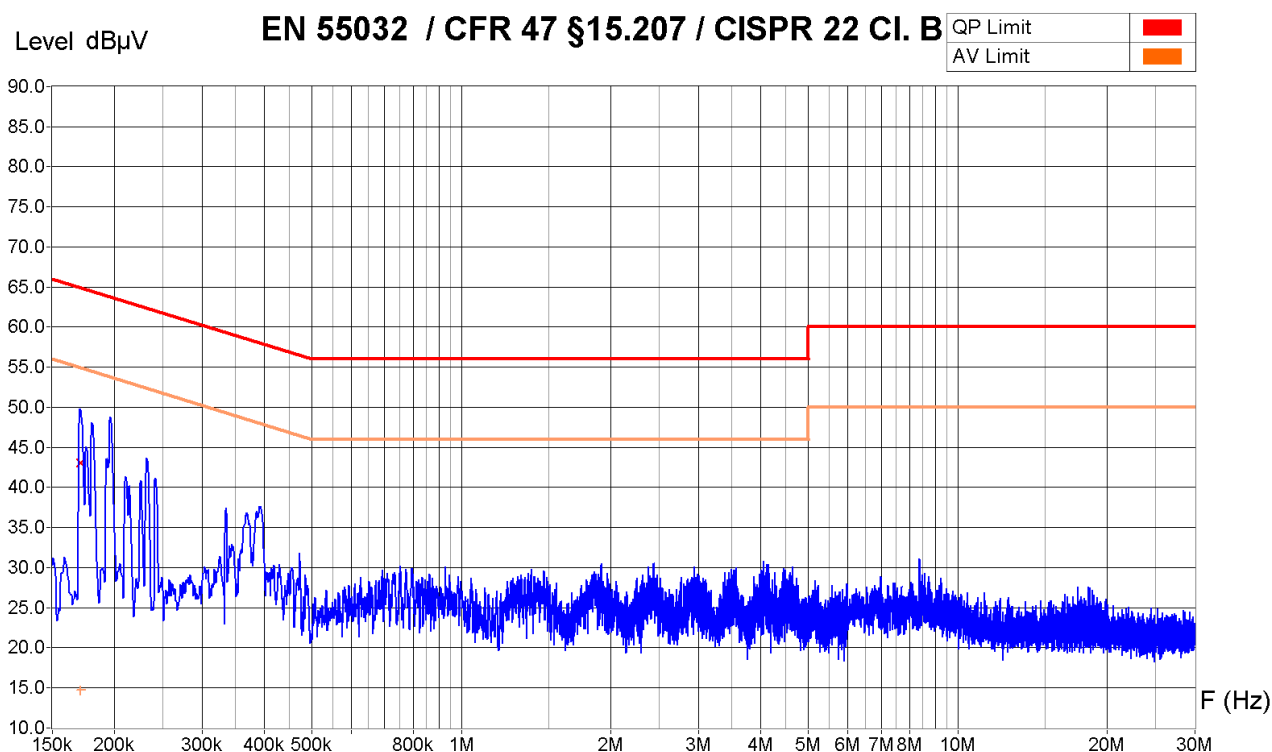
Frequency	Peak	QuasiPeak (x)	Average (+)	QP Margin
154 KHz	47.7 dB μ V	32.9 dB μ V	6.6 dB μ V	32.9 dB

Operator: B. Itzcovich
 Date/Time: 21.03.2017 17:12
 Filename:
 09_CV_150k-
 30M_TXmax_115V_L.png/.txt

Measurement Type : Voltage Interference
 Supply : Neutral
 Other : 115 V / 50 Hz



Equipment Under Test : TV Connector (TX25), Proto 161
 Set-Up : With AC Adapter, USB and audio cables connected; see photos
 Operating Conditions : Hopping TX (f = 2.402 / 2.440 / 2.480 GHz), modulated, Pmax (00, 02)
 Remarks : Cage 06-00



Zone	150 KHz - 6 MHz	6 MHz - 30 MHz
Video Bandwidth	30 KHz	30 KHz
Resol Bandwidth	9 KHz	9 KHz

Receiver Measures

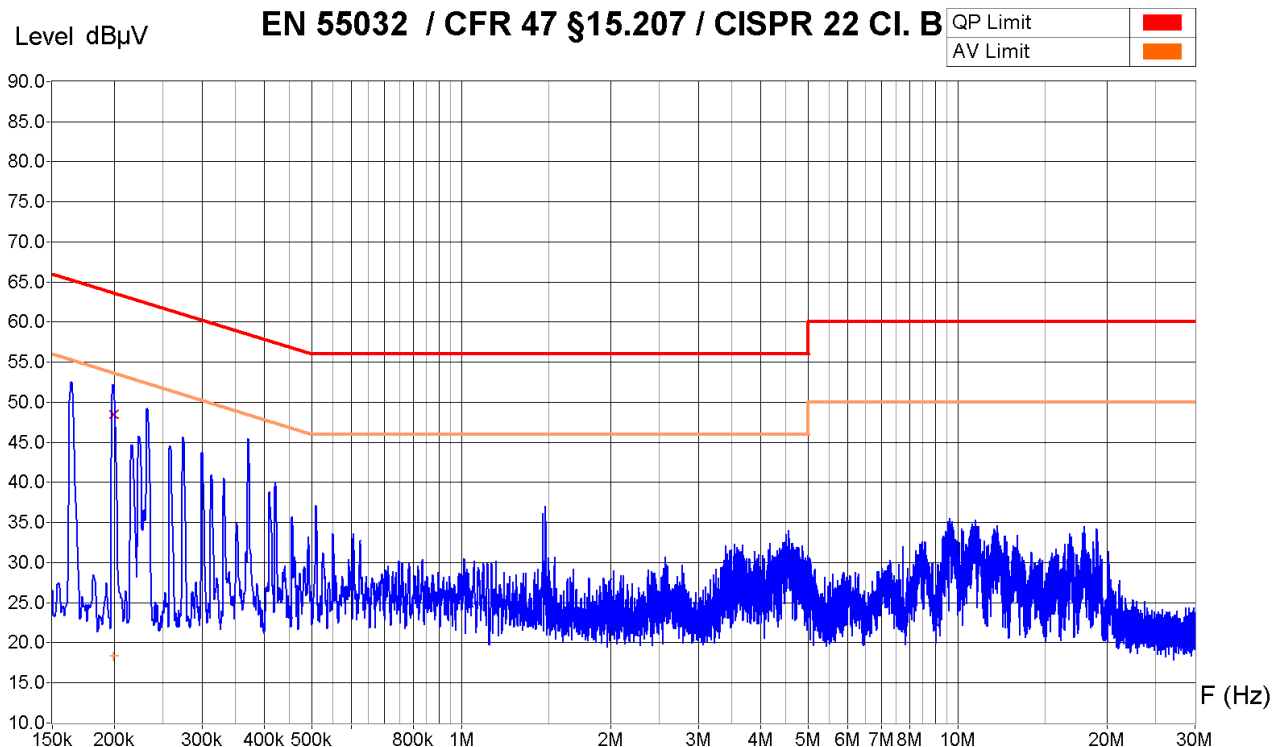
Frequency	Peak	QuasiPeak (x)	Average (+)	QP Margin
171 KHz	61.0 dBμV	43.0 dBμV	14.7 dBμV	21.9 dB

Operator: B. Itzcovich
 Date/Time: 21.03.2017 17:06
 Filename:
 10_CV_150k-
 30M_TXmax_115V_N.png/.txt

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



Equipment Under Test : TV Connector (TX25), Proto 161
 Set-Up : With AC Adapter, USB and audio cables connected; see photos
 Operating Conditions : Hopping TX (f = 2.402 / 2.440 / 2.480 GHz), modulated, Pmax (00, 02)
 Remarks : Cage 06-00



Zone	150 KHz - 6 MHz	6 MHz - 30 MHz
Video Bandwidth	30 KHz	30 KHz
Resol Bandwidth	9 KHz	9 KHz

Receiver Measures

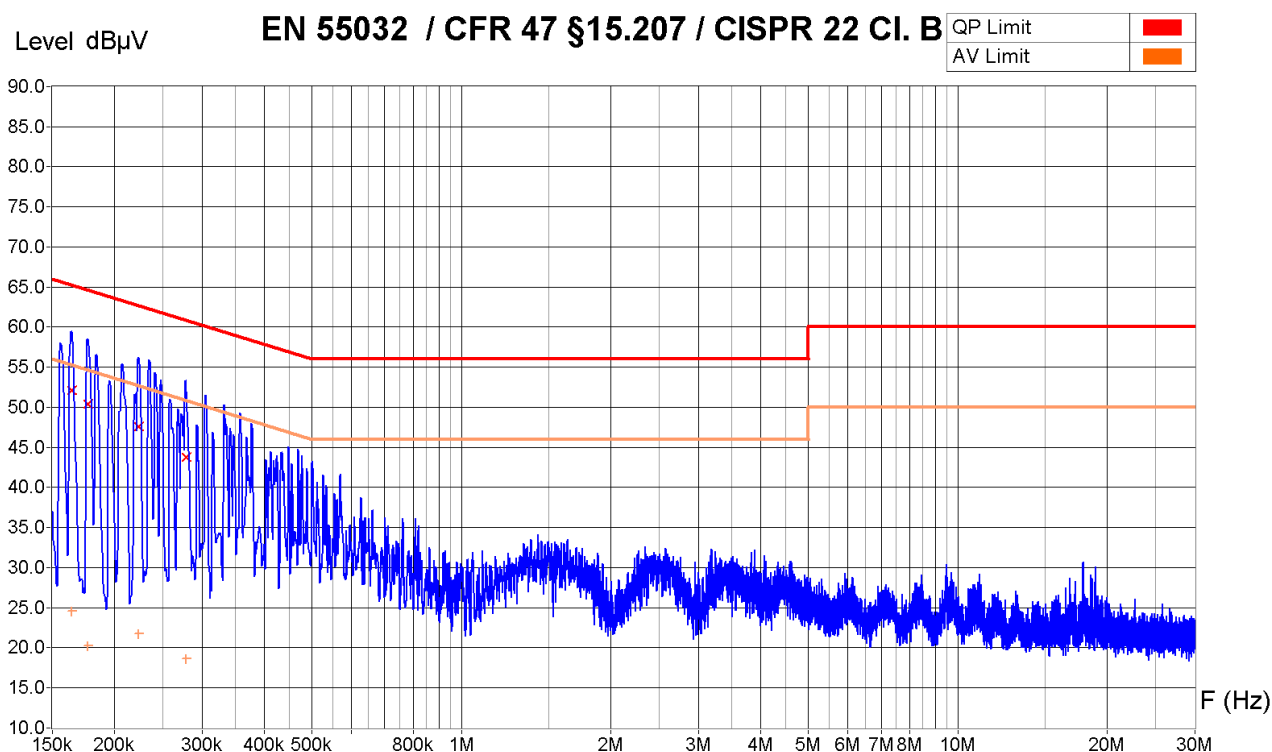
Frequency	Peak	QuasiPeak (x)	Average (+)	QP Margin
199 KHz	68.2 dBμV	48.5 dBμV	18.3 dBμV	15.1 dB

Operator: B. Itzcovich
 Date/Time: 21.03.2017 16:53
 Filename:
 07_CV_150k-
 30M_TXmax_230V_L.png/.txt

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



Equipment Under Test : TV Connector (TX25), Proto 161
 Set-Up : With AC Adapter, USB and audio cables connected; see photos
 Operating Conditions : Hopping TX (f = 2.402 / 2.440 / 2.480 GHz), modulated, Pmax (00, 02)
 Remarks : Cage 06-00



Zone	150 KHz - 6 MHz	6 MHz - 30 MHz
Video Bandwidth	30 KHz	30 KHz
Resol Bandwidth	9 KHz	9 KHz

Receiver Measures

Frequency	Peak	QuasiPeak (x)	Average (+)	QP Margin
164 KHz	60.9 dBμV	52.2 dBμV	24.6 dBμV	13.1 dB
177 KHz	60.4 dBμV	50.5 dBμV	20.3 dBμV	14.2 dB
224 KHz	56.9 dBμV	47.6 dBμV	21.8 dBμV	15.1 dB
279 KHz	54.2 dBμV	43.8 dBμV	18.6 dBμV	17.0 dB

Operator: B. Itzcovich
 Date/Time: 21.03.2017 17:01
 Filename:
 08_CV_150k-
 30M_TXmax_230V_N.png/.txt

6.13 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.

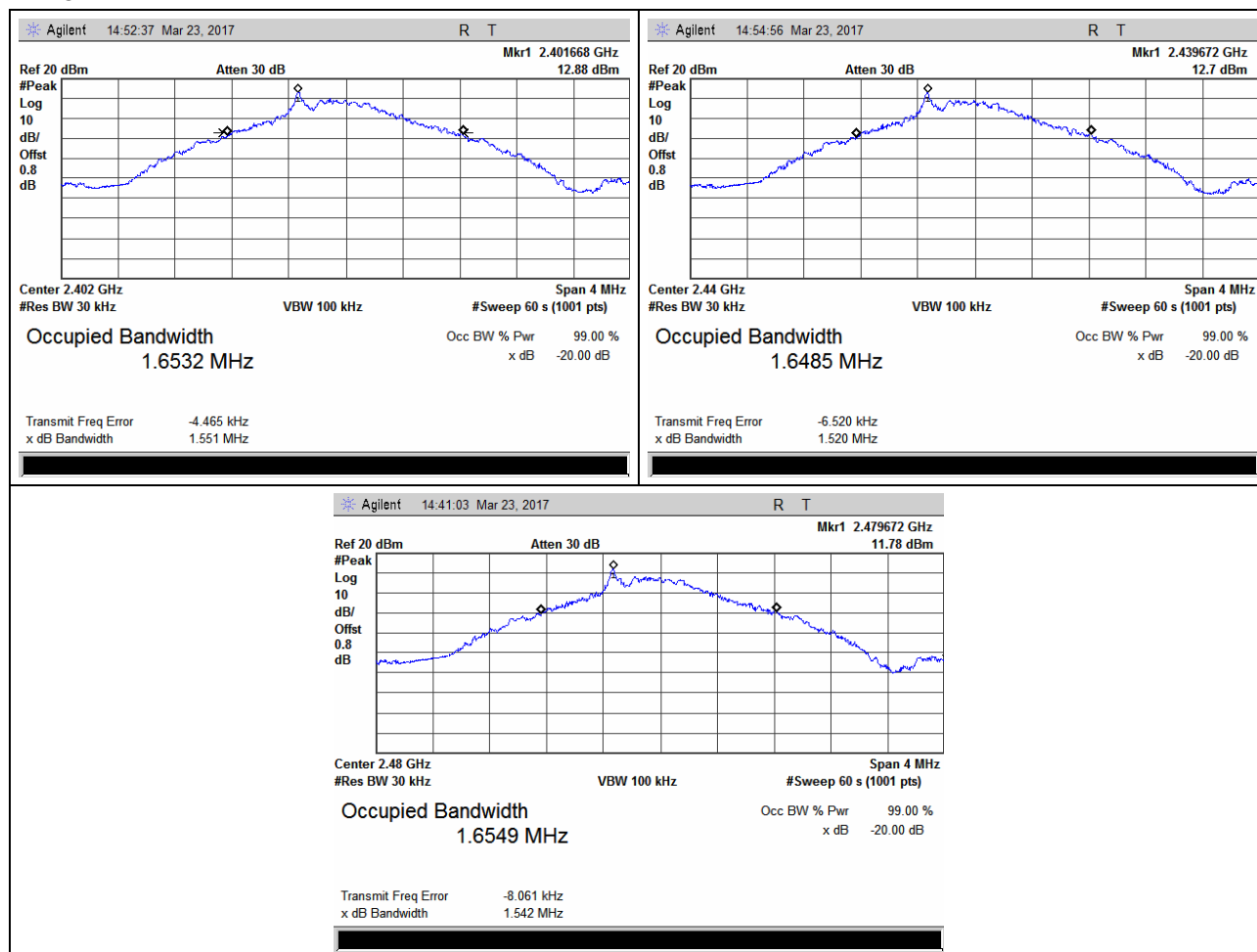
Modifications: ☒ None ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

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.

$B_n = 1.65 \text{ MHz}$ (occupied bandwidth)

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

Designation of emission: 1M65FXD



Place and date of test:
 Operator:

Rossens, March 23, 2017
 B. Itzcovich

7. Appendix

7.1 Test equipment

Inventory No.	Designation	Manufacturer	Type	Serial No.	Cal. date	Next calibr.	Cal. period [year]
04-79	Loop antenna	Rohde&Schwarz	HFH2-Z2	872 177/39	22 Sep. 2015	22 Sep. 2017	2
94-03	Bi-Log antenna	Chase	CBL6111	1056	14 Sep. 2016	14 Sep. 2018	2
90-24	Horn antenna	Emco	3115	9008-3514	07 Jul. 2016	07 Jul. 2018	2
07-31	Horn antenna	Schwarzbeck	BBHA 9120 D	9120D-632	07 Jul. 2016	07 Jul. 2018	2
98-12	Horn Antenna + Preamp. + Mixer	Emco + Miteq + Hewlett Packard	3160-09 + JDM2W-18002650-27-10P-R + 11970K	9809-1121 + 1707479 + 2332A01295	17 Aug. 2012	17 Aug. 2017	5
00-52	Dipole antenna	Schwarzbeck	UHA 9125 D	112	28 Feb. 2013	28 Feb. 2018	5
95-30	Attenuator	Montena EMC	10 dB	EMC Fribourg 1	09 Mar. 2017	09 Mar. 2019	2
12-06	HP Filter	SH 6472	SH 6472	2304801	26 Mar. 2015	26 Mar. 2017	2
13-14	Notch Filter	A-INFOMW	Cavity Band Reject Filter	J10811304070 02	19 Apr. 2016	19 Apr. 2018	2
05-59	Preamplifier	Montena EMC	AM-1300	432972	22 Mar. 2017	22 Mar. 2019	2
14-27	Preamplifier	Montena EMC	AFS42-00101800-25-S-42	1876512	06 Nov. 2015	06 Nov. 2017	2
13-16	Signal Generator	AnaPico AG	APSIN20G-HC	121-21... 0-0096	2 Sep. 2015	2 Sep. 2017	2
06-00	Cable	Huber&Suhner	ST18A ST18A SF106PA	6224/18A 8399/18A 463/6PA	06 Apr. 2016	06 Apr. 2018	2
06-01	Cable	Huber&Suhner	SF106PA SF106PA SF106PA	415/6PA 414/6PA 412/6PA	05 Apr. 2016	05 Apr. 2018	2
06-206	Cable	Huber&Suhner	RG223U	-	05 Oct. 2015	05 Oct. 2017	2
10-41	Cable	Huber&Suhner	RG214U	-	02 Oct. 2015	02 Oct. 2017	2
10-75	Cable	Huber&Suhner	ST18A	8385/18A	02 Oct. 2015	02 Oct. 2017	2
10-81	Cable	Huber&Suhner	SF104P	44159/4P	02 Oct. 2015	02 Oct. 2017	2
10-51	Cable	Huber&Suhner	SF104	222093/4	02 Oct. 2015	02 Oct. 2017	2
11-45	Cable	Huber&Suhner	SF106P	3729/6P	02 Oct. 2015	02 Oct. 2017	2
11-61	Cable	Huber&Suhner	SF106PA	413/6PA	02 Oct. 2015	02 Oct. 2017	2
11-62	Cable	Huber&Suhner	SF104P	51338/4P	02 Oct. 2015	02 Oct. 2017	2
00-43	LISN	Rohde&Schwarz	ESH3-Z5	890 604/026	12 Oct. 2016	12 Oct. 2018	2
02-06	Spectr. Analyzer	Hewlett Packard	E4407B	US39010188	29 Mar. 2016	29 Mar. 2018	2
10-70	Receiver + Spectr. Analyzer	Rohde&Schwarz	ESU8 1302.6005K08	100231	10 Sep. 2016	10 Sep. 2018	2
16-03	Receiver + Spectr. Analyzer	Rohde&Schwarz	ESR7 1316.3003K07	101497	28 Sep. 2016	28 Sep. 2018	2
94-34	Receiver	Rohde&Schwarz	ESHS10	835 499/002-94	17 Jan. 2014	17 Jan. 2017	3
09-03	Power sensor	Hewlett Packard	E9304A H19	MY41498790	12 Dec. 2016	12 Dec. 2018	2
03-07	Wattmeter	Hewlett Packard	E4418B	US39401917	04 Nov. 2016	04 Nov. 2018	2
05-47	Multimeter	Meterman	37XR	050412269	18 Nov. 2015	18 Nov. 2017	2
06-62	Power supply	Elektro-Automatik	EA-PS 2016-050	2006100338	NO CAL	NO CAL	-
04-32	Variable Transformer	REO	REOLINE - AC	-	NO CAL	NO CAL	-

Remark: The test equipment for which no calibration date is defined, is controlled during the test by another calibrated equipment. E.g. the output of a power supply with variable transformer is verified by a calibrated multimeter.