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Report no:
Rapport no: **12715**
Bericht Nr:

Title: **Type acceptance measurements for a 216-217 MHz transmitter « TelCom » according to the Code of federal regulations 47 : Parts 2 (General rules and regulations) and 95 (LPRS transmitters)**
Titre:
Titel:

Date of test:
Date de l'essai: **2000-11-21, 2001-05-10, 2001-05-14**
Prüfdatum:

Customer:
Client: **Phonak Communications AG**
Kunde:

Test place: **montena emc sa**
Lieu de l'essai: **CH-1728 Rossens**
Prüfört: **Switzerland**

Test performed by
Essai effectué par :
Prüfer

Mr. Erich Staub

Test report prepared by
Rapport d'essai préparé par :
Berichterstatter

Mr. Erich Staub

Test report controlled and approved by
Rapport d'essai contrôlé et approuvé par :
Prüfbescheinigung

Mr. Jacques Ding

Rossens, 2001-05-10

(Issue Date / Date d'édition / Ausstelldatum)

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No. / No. / Nr. : **12'715**

Date/Date/Datum : **2000-11-21, 2001-05-10, 2001-05-14**



Title/Titre/Titel : **Type acceptance measurements for a 216-217 MHz transmitter « TelCom » according to the Code of federal regulations 47 : Parts 2 (General rules and regulations) and 95 (LPRS transmitters)**

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Total Anzahl Seiten

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1. Summary of test results / Résumé des résultats d'essais / Zusammenfassung der Prüfergebnisse

- ✓ Pass / Réussi / Bestanden
- X Fail / Pas réussi / Nicht bestanden
- Not applicable to this type of product / Pas applicable à ce type de produit / Nicht anwendbar für diese Produktart
- No test / Pas d'essai / Nicht geprüft

Test Type / Type d'essai / Art der Prüfung		Result / Résultat / Ergebnis
RF power output Puissance RF HF Leistung	FCC 47 §2.1046 FCC 47 §95.639 (e)	✓
Modulation characteristics Caractéristiques de la modulation Modulationscharakteristiken	FCC 47 §2.1047	✓
Occupied bandwidth Bande passante Bandbreite	FCC 47 §2.1049 FCC 47 §95.635 (c)(1)	✓
Field strength of spurious radiation Champ émis Feldstärke der Nebenaussendung	FCC 47 §2.1053 FCC 47 §95.635 (c)(1)	✓
Frequency stability Stabilité de fréquence Frequenzstabilität	FCC 47 §2.1055 FCC 47 §95.629 (d)(2)	✓

United States: 47 CFR "Code of Federal Regulations" - Telecommunication
FCC Part 2: Frequency allocations and radio treaty matters; General rules and regulations
FCC Part 95: Low power radio service (LPRS)

No. / No. / Nr. : **12'715**

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Title/Titre/Titel : **Type acceptance measurements for a 216-217 MHz transmitter « TelCom » according to the Code of federal regulations 47 : Parts 2 (General rules and regulations) and 95 (LPRS transmitters)**

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2. Client / Client / Kunde

Client name and address Nom et adresse du client Name und Adresse des Kunden	<i>Phonak Communications AG Länggasse 17 CH-3280 Murten Switzerland</i>
--	---

Contact Person / Responsable / Kontaktperson	<i>Mr Frank Riedo</i>
--	-----------------------

Telephone / Téléphone / Telefon	<i>+41 (0)26 672 96 74</i>
---------------------------------	----------------------------

Fax / Télécopieur / Telefax	<i>+41 (0)26 672 96 77</i>
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Mandate no / Mandat no / Auftrag Nr.	<i>20014820</i>
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3. Equipment under test / Equipement à l'essai / Prüfling

Manufacturer name and address Nom et adresse du fabricant Name und Adresse des Herstellers	<i>Phonak Communications AG Länggasse 17 CH-3280 Murten Switzerland</i>
--	---

Product name / Nom du produit / Produktname	<i>TelCom</i>
---	---------------

Product description / Description du produit / Produktbeschreibung	<i>One channel FM-transmitter for use as an auditory assistance device in the low power radio service (LPRS) band. The device contains an audio input which is also used as antenna socket.</i>
---	---

Production country / Pays de fabrication / Ursprungsland	<i>Switzerland</i>
---	--------------------

Product type / Type du produit / Typ des Produktes	<i>TelCom</i>
--	---------------

Serial no / No. de série / Seriennummer	<i>012C01202</i>
---	------------------

Highest frequency / Frequence plus élevée / Höchste Frequenz	<i>217 MHz</i>
---	----------------

Modifications before the tests Modifications apportées avant les essais Vor den Prüfungen angebrachte Änderungen	<i>none</i>
--	-------------

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4. Test instrumentation and procedures

The list of the test equipment (stocklist number) is provided for each test in the appendix. The equipment is calibrated annually with traceability.

The test procedures used are in accordance with ANSI C63.4-1992 "Method of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz".

5. Test specification requirements

The EUT must comply with the requirements of 47 CFR "Code of Federal Regulations" - Telecommunication, FCC Part 2 and Part 95.

6. Test conditions / Conditions d'essai / Testbedingungen

Temperature / Température / Temperatur:

21 - 23 °C

Pressure / Pression / Druck:

1008 - 1015 hPa

Relative humidity / Humidité relative / Relative Luftfeuchtigkeit:

40 - 45 %

Test period / Date des essais / Datum der Prüfungen:

2000-11-21, 2001-05-10,
2001-05-14

7. Persons present / Personnes présentes / Anwesende Personen

Test Engineer(s) / Ingénieur(s) d'essai / Prüflingenieur(e) :

Mr. Erich Staub

Other(s) / Autre(s) / Andere :

Name / Nom / Name

Company / Société / Firma

Mr. Frank Riedo

Phonak Communications AG

8. Emission Tests / Essais d'émission / Störaussendungsmessungen

8.1. RF power output / Puissance RF / HF Leistung

Standard: United States: 47 CFR "Code of Federal Regulations" - Telecommunication
☒ FCC Part 2, Subpart J: Certification: §2.1046
☒ FCC Part 95, Subpart E: Technical regulations: §95.639(e)
 Limit for LPRS = 100 mW = 20 dBm

Distance: ☐ 30 m ☐ 10 m ☒ 3 m ☐

Test site: ☐ anechoic chamber (foam) ☐ open test site
☒ anechoic chamber (ferrite) ☐

Test precision: ± 4.6 dB

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

Test method: Since the test item is equipped with an integral antenna, the effective radiated power (ERP) was measured instead of the output power. The ERP into a dipole antenna was calculated.

$$P = \frac{E^2 4\pi d^2}{120\pi g} = \frac{E^2 d^2}{30g}$$

with

P = power in watts

g = numeric gain

E = field strength in volts/meter

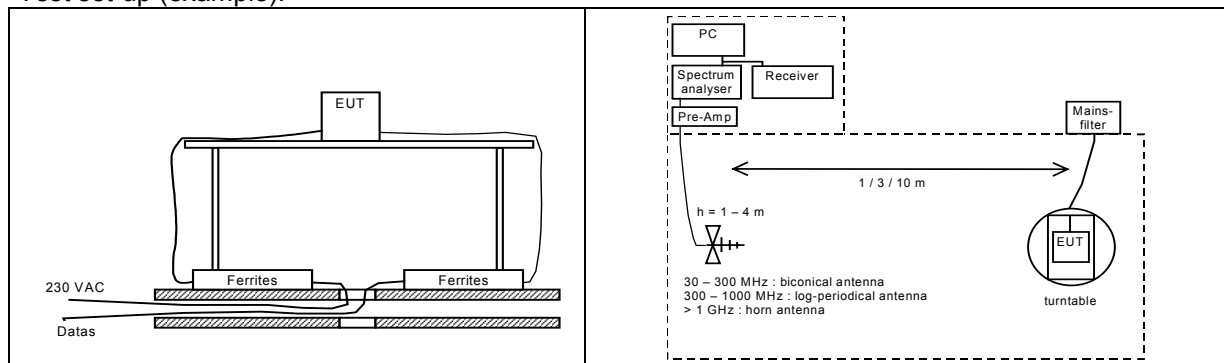
d = measurement distance in meter

Test results: With E = 105.5 dBμV/m ; g = 1.25 dB ; d = 3 m

The equation reduces to :

$$P(\text{dBm}) = E(\text{dB}\mu\text{V/m}) - 96.2 \text{ dB} = 9.3 \text{ dBm} = 8.51 \text{ mW}$$

Test set-up (example):



Test equipment:

☒ Spectrum analyser	☐ 88-14	☐ 90-26	☒ 94-24			
☒ Receiver (CISPR 16)	☐ 85-04	☐ 90-43	☒ 94-35			
☐ Preamplifier	☐ 88-05	☐ 90-01	☐ 90-42	☐ 92-39	☐ 95-86	☐ 97-08
☐ Antenna (biconical)	☐ 82-02	☐ 87-05	☐ 87-16	☐ 91-05	☐ 94-37	
☐ Antenna (log-per)	☐ 88-20	☐ 90-30	☐ 91-35	☐ 94-64	☐	
☒ Antenna (bilog)	☒ 94-03	☐				
☐ Antenna (horn)	☐ 90-24	☐ 90-29	☐ 98-12	☐ 98-13	☐	
☒ Printer	☒ 99-33	☐				

Results: ☒ complies ☐ does not comply ☐ not applicable ☐ not done

**8.2. Modulation characteristics / Caractéristiques de modulation / Modulationscharakteristiken**

Standard: United States: 47 CFR "Code of Federal Regulations" - Telecommunication
☒ FCC Part 2, Subpart J: Certification: §2.1047

Test site: ☐ anechoic chamber (foam) ☐ open test site
☐ anechoic chamber (ferrite) ☒ laboratory

Frequency response of audio circuit: An audio signal at 1 kHz was adjusted for a 100 % rated FM deviation (= 400 mV rms). While maintaining the same audio signal, the frequency was varied. The FM deviation was measured and recorded at several frequencies in order to determine the frequency response.

Frequency [kHz]	Dev [kHz]	Frequency [kHz]	Dev [kHz]	Frequency [kHz]	Dev [kHz]	Frequency [kHz]	Dev [kHz]
0.1	2.1	0.8	3	3.0	2.9	6.5	2.9
0.2	3.2	0.9	2.9	3.5	2.9	7.0	2.9
0.3	3.1	1.0	2.9	4.0	2.9	7.8	2.9
0.4	3	1.2	2.9	4.5	2.9	8.0	2.9
0.5	3	1.5	2.9	5.0	2.9	8.5	2.9
0.6	3	2.0	2.9	5.5	2.9	9.0	2.9
0.7	3	2.5	2.9	6.0	2.9	9.5	2.9

Modulation limiting: An audio signal at 1 kHz was adjusted for a 100 % rated FM deviation (= 400 mV rms). While maintaining the same frequency, the audio level was varied. The FM deviation was measured and recorded at audio levels in order to determine the modulation limiting.

Audio signal level [mV rms]	FM Deviation [kHz]			
	200 Hz	1000 Hz	3500 Hz	8000 Hz
20	0.8	0.9	0.9	0.9
50	1.3	1.3	1.4	1.3
100	1.8	1.7	1.8	1.8
200	2.5	2.4	2.4	2.4
300	3	2.8	2.9	2.8
400	3.2	3	3	3
500	3.5	3	3	3
700	3.6	3.1	3.1	3.1
1000	3.6	3.2	3.1	3.1
1500	3.7	3.2	3.2	3.2
2000	3.9	3.3	3.3	3.3
2500	4	3.4	3.4	3.4

Test equipment:

☒ Analyzer ☒ HP 8920B
☐

Results: ☒ complies ☐ does not comply ☐ not applicable ☐ not done

**8.3. Occupied bandwidth / Bande passante / Bandbreite**

Standard: United States: 47 CFR "Code of Federal Regulations" - Telecommunication

☒ FCC Part 2, Subpart J: Certification: §2.1049☒ FCC Part 95, Subpart E: Technical regulations: §95.635(c)(1)Test site: ☐ anechoic chamber (foam) ☐ open test site
☐ anechoic chamber (ferrite) ☒ laboratoryTest precision: ± 4.6 dB

Test requirements: Emissions for transmitters operating on standard band channels (25 kHz) shall be attenuated below the unmodulated carrier in accordance with the following:

- Emissions 12.5 kHz to 22.5 kHz away from the channel center frequency: at least 30 dB
- Emissions more than 22.5 kHz away from the channel center frequency: at least $43 + 10 \log$ (carrier power in watts) dB

Test method: The audio signal input was set to 2.5 V rms (= FM deviation max of 3.5 kHz). For different input frequencies the fundamental frequency was plotted.

Test equipment:

☒ Spectrum analyzer ☐ 88-14 ☒ 90-26 ☐ 94-24☐Results: ☒ complies ☐ does not comply ☐ not applicable ☐ not done

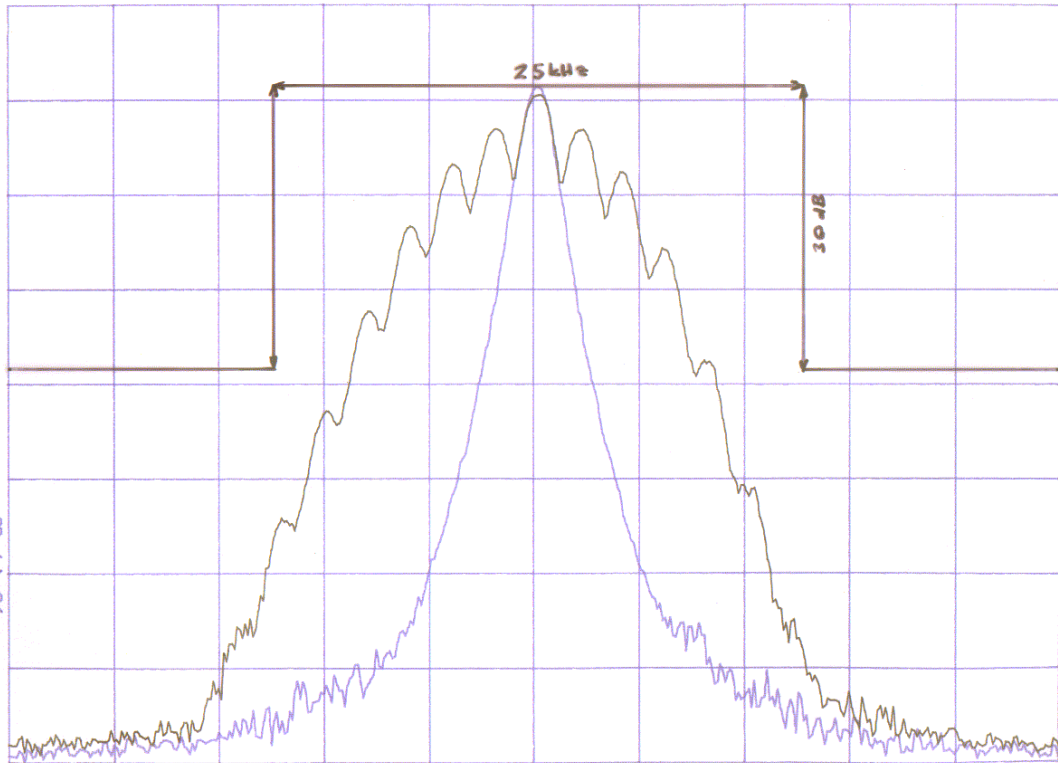


09:33:00 MAY 10, 2001

REF .0 dBm ATTEN 10 dB

PEAK
LOG
10
dB/

VA VB
SC FC
CORR



CENTER 216.01250 MHz
#RES BW 1.0 kHz

VBW 1 kHz

SPAN 50.00 kHz
SWP 300 msec

Audio input = 2.5 Vrms
f = 2 kHz



09:36:12 MAY 10, 2001

hp

REF .0 dBm

ATTEN 10 dB

PEAK

LOG

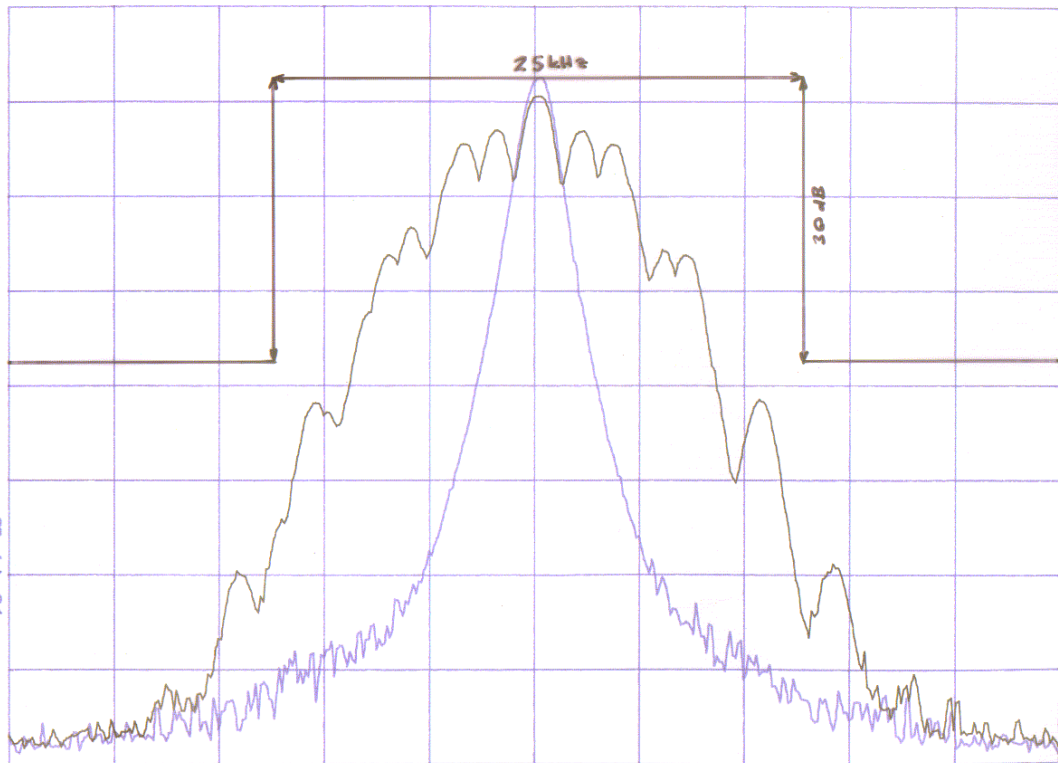
10

dB/

VA VB

SC FC

CORR



CENTER 216.01250 MHz

#RES BW 1.0 kHz

VBW 1 kHz

SPAN 50.00 kHz

SWP 300 msec

Audio input = 2.5 Vrms

f = 3.5 kHz



09:38:34 MAY 10, 2001

/P

REF .0 dBm

ATTEN 10 dB

PEAK

LOG

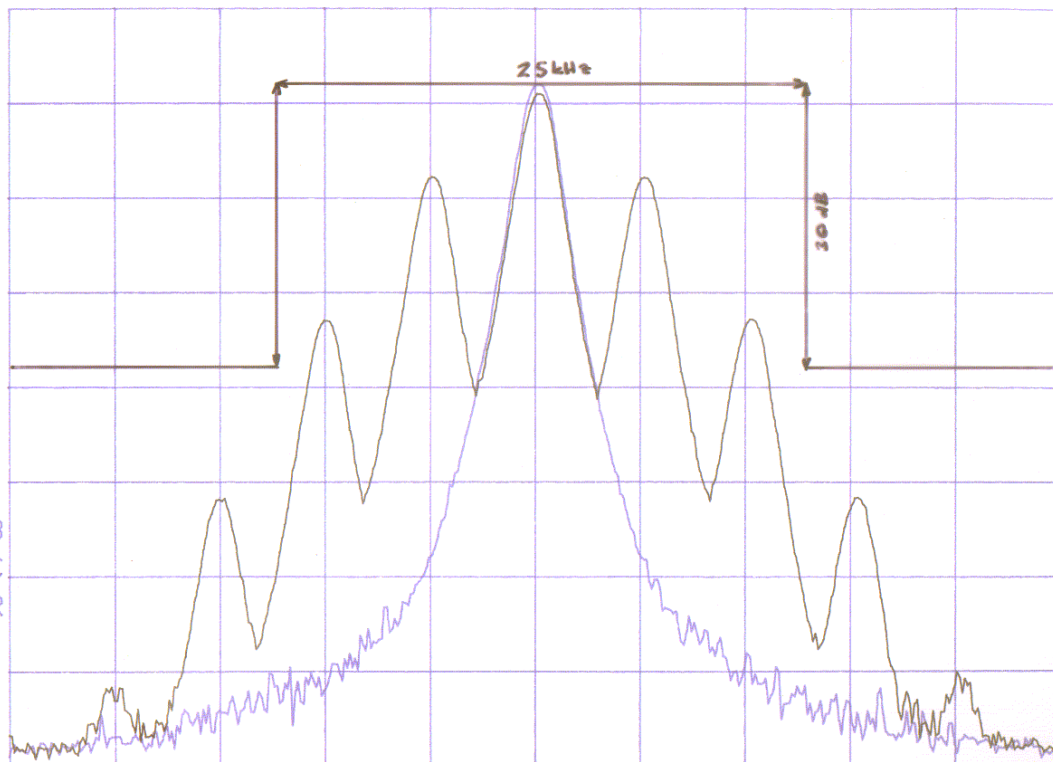
10

dB/

VA VB

SC FC

CORR



CENTER 216.01250 MHz

#RES BW 1.0 kHz

VBW 1 kHz

SPAN 50.00 kHz

SWP 300 msec

Audio input = 2.5 Vrms

f = 5 kHz



10:01:30 MAY 10, 2001

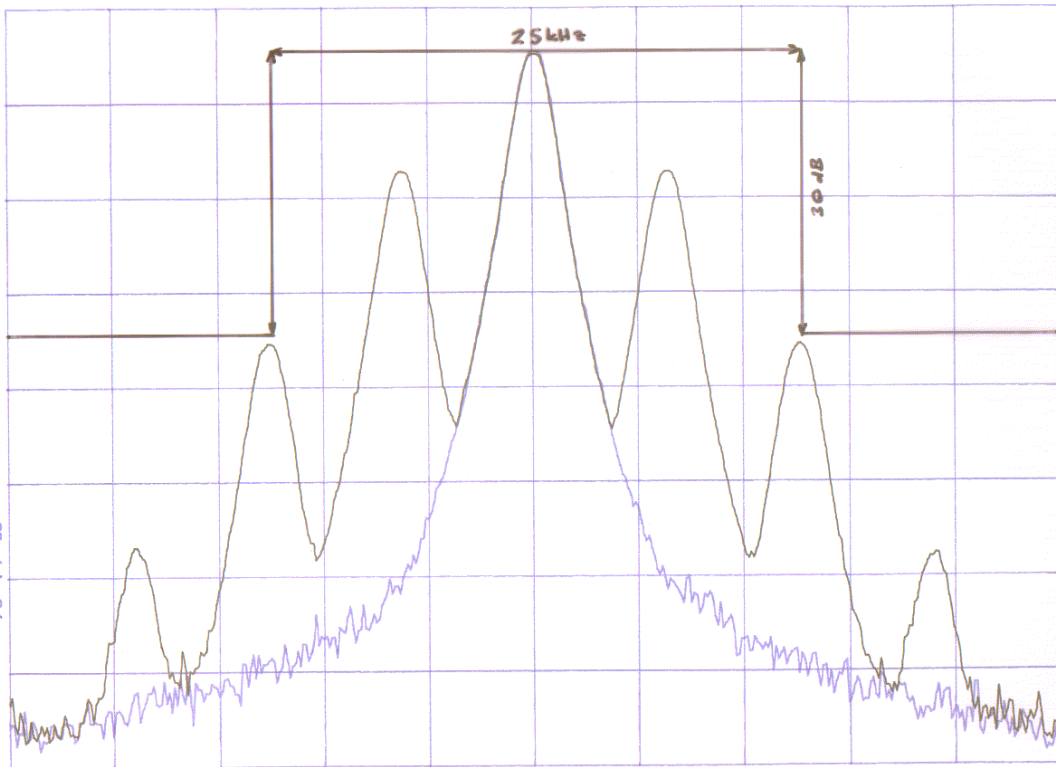
HP

REF . 0 dBm

ATTEN 10 dB

PEAK
LOG
10
dB/

VA VB
SC FC
CORR



CENTER 216.01275 MHz

#RES BW 1.0 kHz

VBW 1 kHz

SPAN 50.00 kHz

SWP 300 msec

Audio input = 2.5 Vrms
f = 6.25 kHz



09:41:10 MAY 10, 2001

hp

REF .0 dBm

ATTEN 10 dB

PEAK

LOG

10

dB/

VA VB

SC FC

CORR

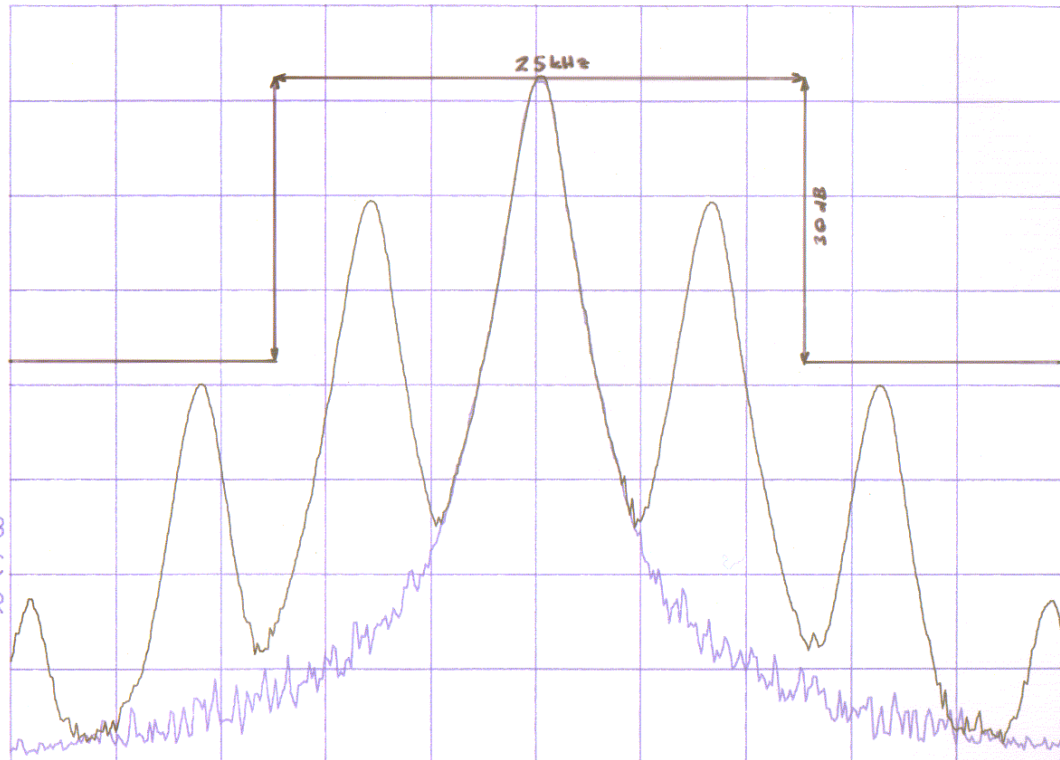
CENTER 216.01250 MHz

#RES BW 1.0 kHz

VBW 1 kHz

SPAN 50.00 kHz

SWP 300 msec



Audio input = 2.5 Vrms
f = 8 kHz



8.4. Field strength of spurious radiation / Champ rayonné / Störfeldstärke

Standard: United States: 47 CFR "Code of Federal Regulations" - Telecommunication
☒ FCC Part 2, Subpart J: Certification: §2.1053
☒ FCC Part 2 §2.1047: Frequency range: up to tenth harmonic or 40 GHz
☒ FCC Part 95, Subpart E: Technical regulations: §95.635(c)(1)

Distance: ☐ 30 m ☐ 10 m ☒ 3 m ☐

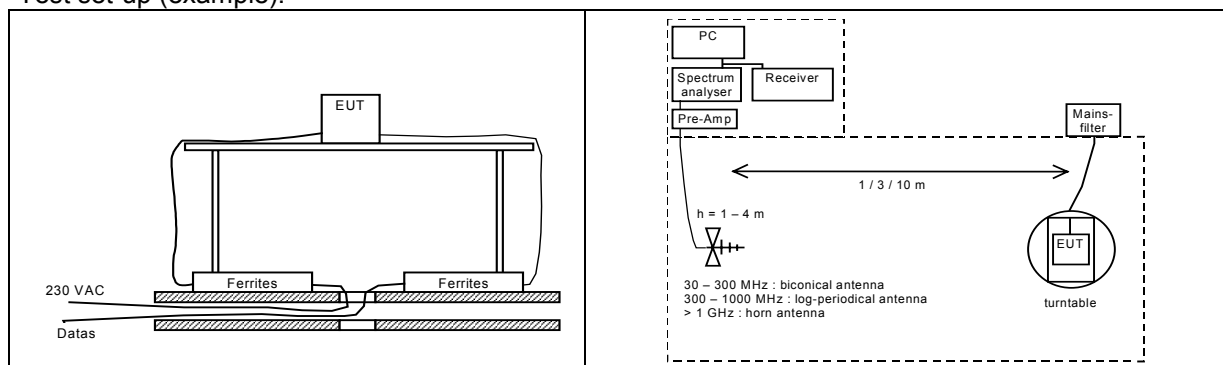
Test site: ☒ anechoic chamber (foam): 1 – 2.8 GHz
☒ anechoic chamber (ferrite): 30 MHz – 1 GHz

Test precision: ± 4.6 dB

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

Test method: The electromagnetic disturbance radiated by the equipment is measured using a spectrum analyzer and an antenna. The equipment is placed on a wooden table at 80 cm. The turning table is operated through 360° during the measurements. The recordings are carried out taking into account the maximum value of all the disturbance appearing while the apparatus is under test. The peak values are recorded continuously on the graph. The limit must be respected in quasi-peak values (QP) up to 1 GHz and in average values (AV) above 1 GHz. The 6 dB bandwidth of the spectrum analyzer is adjusted to 120 kHz from 30 to 1000 MHz and 1 MHz above 1 GHz.

Test set-up (example):



Test equipment:

☒ Spectrum analyzer	☒ 88-14	☐ 90-26	☒ 94-24			
☐ Receiver (CISPR 16)	☐ 85-04	☐ 90-43	☒ 94-35			
☒ Preamplifier	☐ 88-05	☒ 90-01	☐ 90-42	☐ 92-39	☐ 95-86	☒ 97-08
☐ Antenna (biconical)	☐ 82-02	☐ 87-05	☐ 87-16	☐ 91-05	☐ 94-37	
☐ Antenna (log-per)	☐ 88-20	☐ 90-30	☐ 91-35	☐ 94-64	☐	
☒ Antenna (bilog)	☒ 94-03	☐				
☒ Antenna (horn)	☒ 90-24	☐ 90-29	☐ 98-12	☐ 98-13	☐	
☒ Printer	☒ 99-33	☐				
☐						

Results: ☒ complies ☐ does not comply ☐ not applicable ☐ not done

**Explanations :**

Two measurements have been realized.

1. Table of the fundamental and the harmonics measured point by point with a measuring receiver.
The preamplifier was not used up to 1 GHz to avoid wrong measurements due to the saturation of the preamplifier at the harmonics. Above 1 GHz the horn antenna garnets an attenuation of the 216 MHz peak and therefore a preamplifier could be used. The measured values are not derived from the plots on the following pages.

Frequency [MHz]	RDG Hor [dBuV]	RDG Vert [dBuV]	BW [kHz]	Ant. Fac. [dB]	Cable loss [dB]	Pre-Amp [dB]	Isotrop. [dB]	ERP Hor [dBm]	ERP Vert [dBm]	Limit [dBm]
216.0125	93.5	89.7	120	11.0	1.0		-96.2	9.3	5.5	20
432.0250	23.3	31.4	120	16.2	2.0		-96.2	-54.7	-46.6	-13.0
648.0375	17.5	14.7	120	20.6	4.0		-96.2	-54.1	-56.9	-13.0
864.0500	17.0	11.2	120	22.6	8.0		-96.2	-48.6	-54.4	-13.0
1080.0625	8.3	14.5	3	24.2	1.4	20.2	-96.2	-82.5	-76.3	-13.0
1296.0750	6.5	6.6	3	24.6	1.7	19.6	-96.2	-83.0	-82.9	-13.0
1512.0875	7.6	11.4	3	25.2	2.0	18.9	-96.2	-80.3	-76.5	-13.0
1728.1000	4.0	8.7	3	26.3	2.3	18.6	-96.2	-82.2	-77.5	-13.0
1944.1125	5.0	9.0	3	27.8	2.6	18.0	-96.2	-78.8	-74.8	-13.0
2160.1250	13.4	11.0	3	28.1	3.0	17.2	-96.2	-68.9	-71.3	-13.0

The limit at the fundamental is 100 mW = 20 dBm

The limit at the harmonics is 43 + 10 log (carrier power in watts) lower than the fundamental.

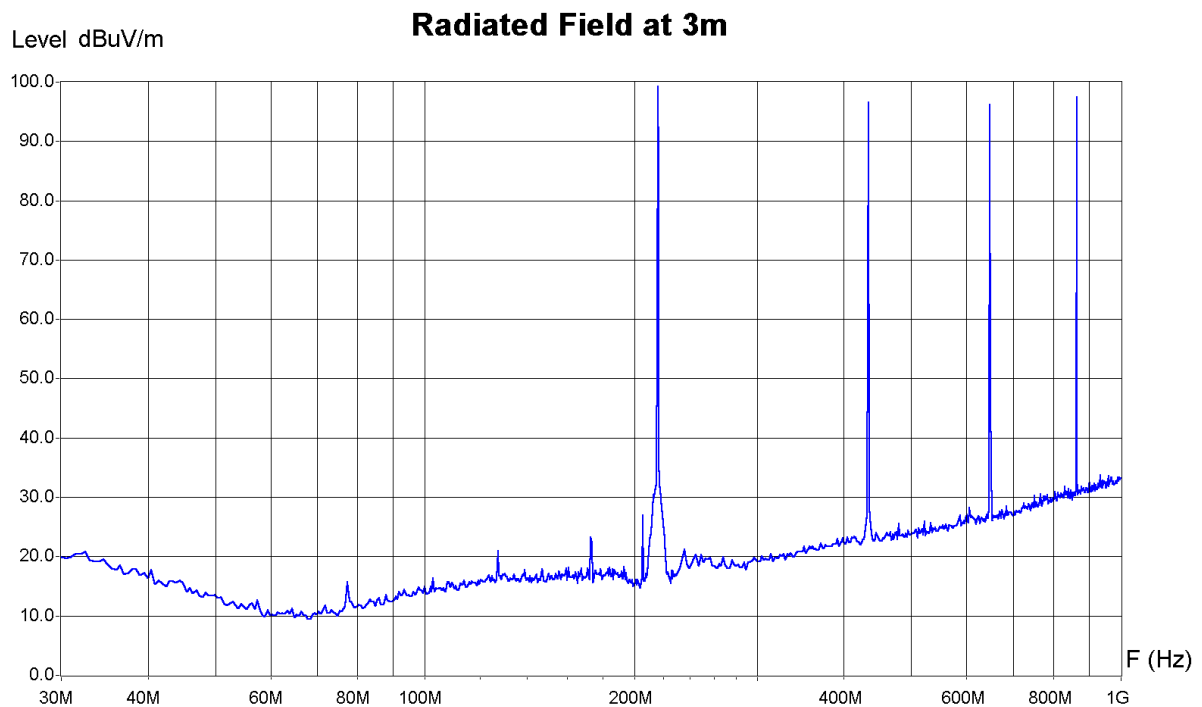
With 9.3 dBm at the fundamental the limit is = 9.3 – (43 + 10 log (carrier power in watts)) = - 13 dBm.

2. A measurement with preamplifier shows the spurious emission in the rest of the frequency band (for the values at the fundamental and the harmonics see table above) from 30 MHz to 2.8 GHz.
See following pages.

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



Equipment Under Test : TelCom
Set-Up : Cables connected: Audio, Tel, Supply
Operating Conditions : with audio signal
Remarks :



Zone	30 MHz - 230 MHz	230 MHz - 1 GHz
Video Bandwidth	300 KHz	300 KHz
Resol Bandwidth	120 KHz	120 KHz
Sweep Time	0 s	0 s

The plot is showing the spurious emission of the equipment under test. The values at the fundamental and the harmonics are not correct due to the preamplifier and should not be considered. The measurements for these frequencies can be found on a previous page.

Operator:
Date/Time: 14.05.2001 09.29 h
Filename:
telcom 008.png/.txt

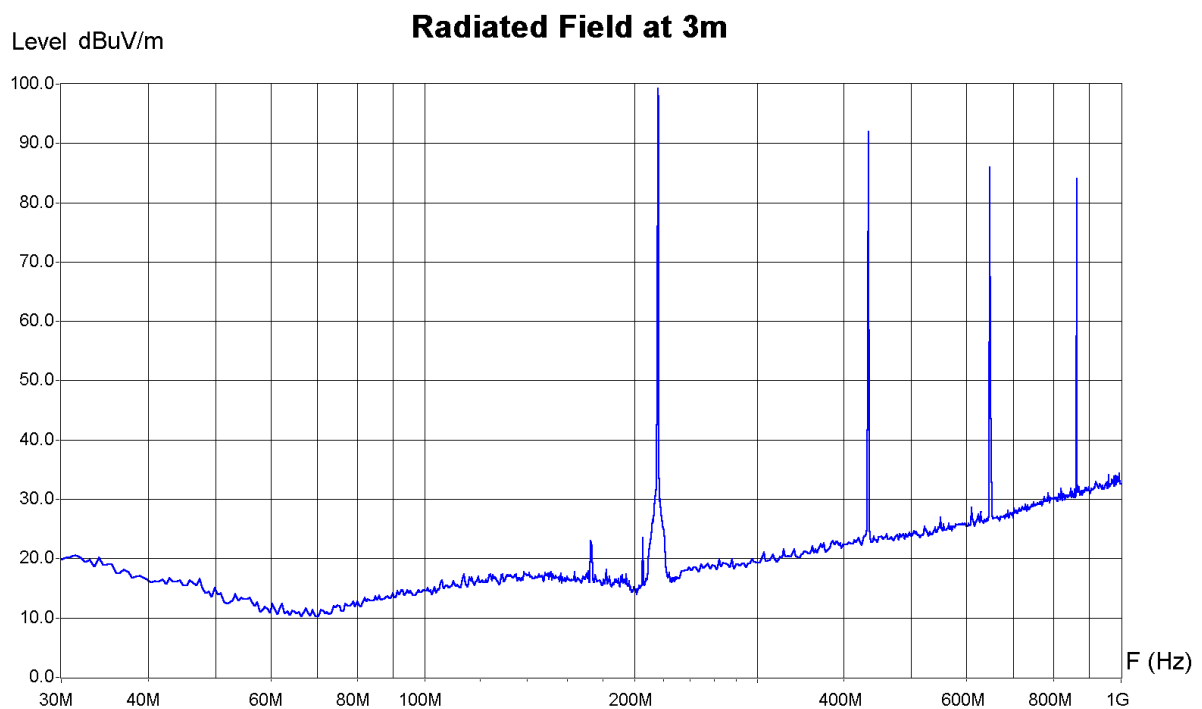


Measurement Type : Radiated Field
Polarisation : Vertical
Table Angle : 0 - 360°
Antenna Height : 1m



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Equipment Under Test : TelCom
Set-Up : Cables connected: Audio, Tel, Supply
Operating Conditions : with audio signal
Remarks :



Zone	30 MHz - 230 MHz	230 MHz - 1 GHz
Video Bandwidth	300 KHz	300 KHz
Resol Bandwidth	120 KHz	120 KHz
Sweep Time	0 s	0 s

The plot is showing the spurious emission of the equipment under test. The values at the fundamental and the harmonics are not correct due to the preamplifier and should not be considered. The measurements for these frequencies can be found on a previous page.

Operator: E. Staub
 Date/Time: 14.05.2001 09.05 h
 Filename:
 telcom 007.png/.txt

No. / No. / Nr. : 12715

Date/Date/Datum : 2000-11-21, 2001-05-10, 2001-05-14



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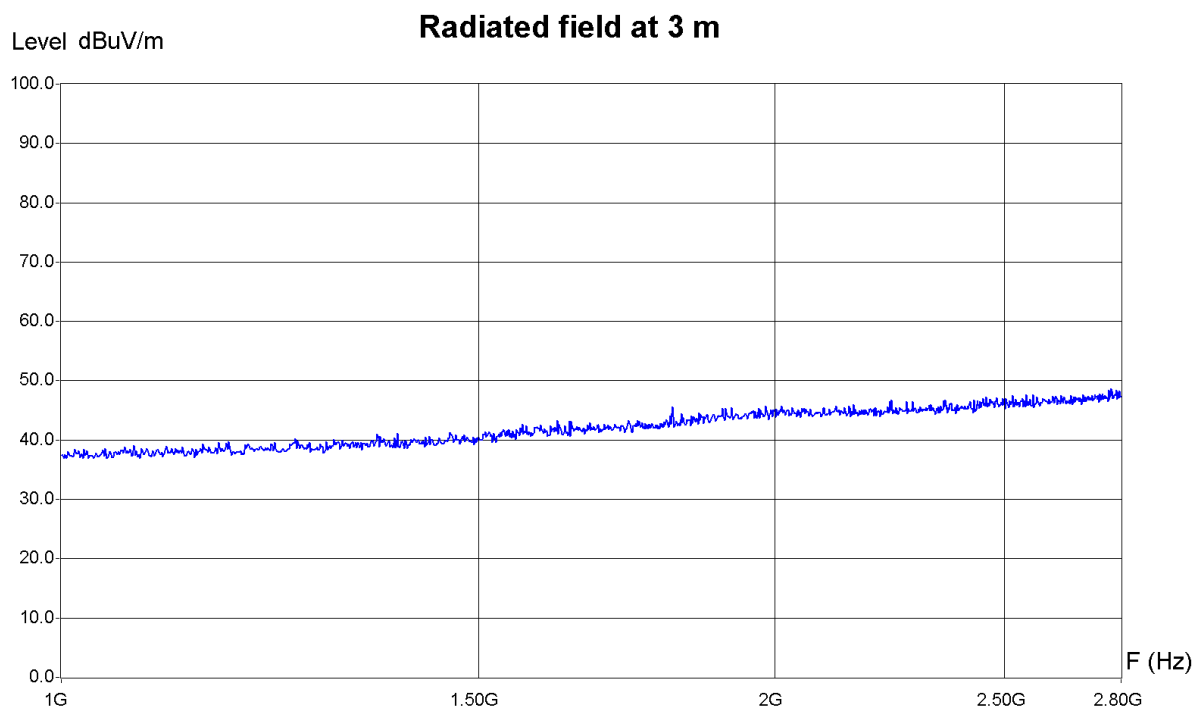
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Measurement Type : Radiated Field
Polarisation : Horizontal
Table Angle : 0 - 360°
Antenna Height : 1 m



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Equipment Under Test : TelCom
Set-Up : Cables connected: audio, tel, supply
Operating Conditions : with audio signal
Remarks :



Zone	1 GHz - 1.80 GHz	1.80 GHz - 2.80
Video Bandwidth	1 MHz	1 MHz
Resol Bandwidth	1 MHz	1 MHz
Sweep Time	0 s	0 s

Operator: E. Staub
Date/Time: 11.05.01 16:45
Filename:
telcom 006.png/.txt

No. / No. / Nr. : **12715**

Date/Date/Datum : **2000-11-21, 2001-05-10, 2001-05-14**



montena

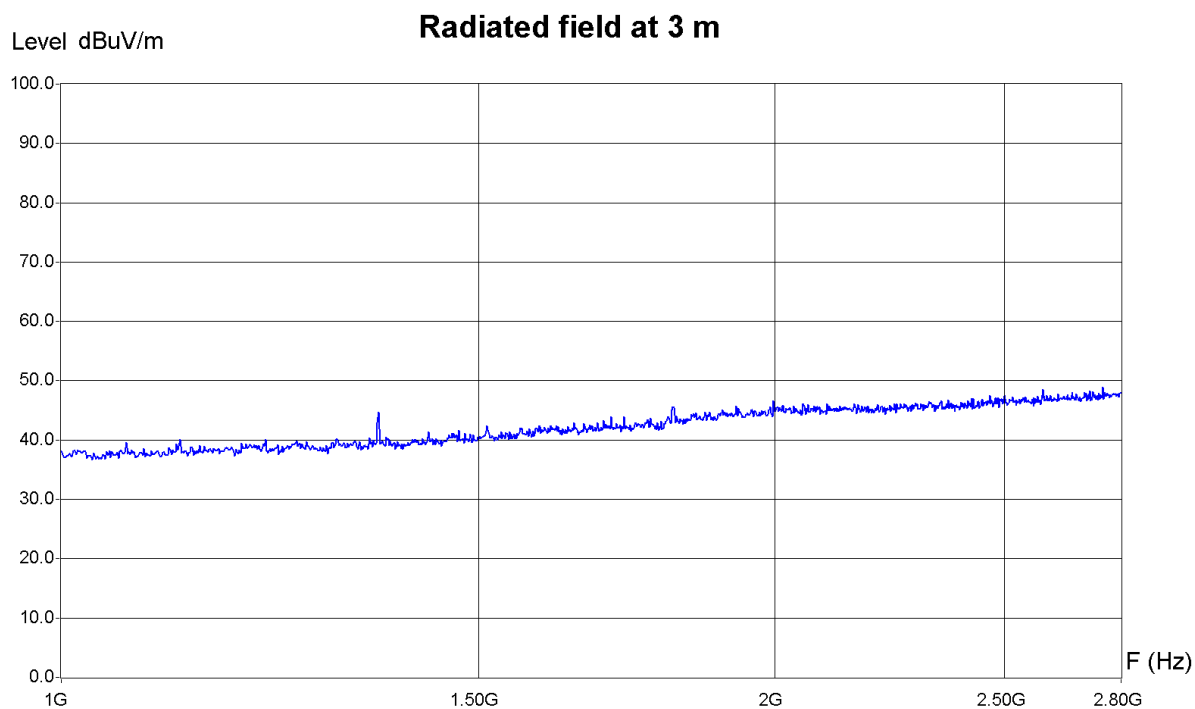
Page/Page/Seite 19 / 21

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



montena
montena emc sa

Equipment Under Test : TelCom
Set-Up : Cables connected: audio, tel, supply
Operating Conditions : with audio signal
Remarks :



Zone	1 GHz - 1.80 GHz	1.80 GHz - 2.80
Video Bandwidth	1 MHz	1 MHz
Resol Bandwidth	1 MHz	1 MHz
Sweep Time	0 s	0 s

Operator: **E. Staub**
Date/Time: **11.05.01 16:20**
Filename:
telcom 005.png/.txt

**8.5. Frequency stability / Stabilité de fréquence / Frequenzstabilität**

Standard: United States: 47 CFR "Code of Federal Regulations" - Telecommunication
☒ FCC Part 2, Subpart J: Certification: §2.1055
☒ FCC Part 95, Subpart E: Technical regulations: §95.629(d)(2)

Test site: ☐ anechoic chamber (foam) ☐ open test site
☐ anechoic chamber (ferrite) ☒ laboratory

Test requirements and results: 1. $\Delta f < 50$ ppm with temperature varied from -30° to $+50^{\circ}$ in steps of 10 degrees.

Temperature in Degrees	Frequency [MHz]	Change ppm	Limit ppm
-30	216.010900	5.92	50
-20	216.012168	0.05	50
-10	216.012415	1.10	50
0	216.012477	1.38	50
10	216.012351	0.80	50
20	216.012178	ref	ref
30	216.012059	0.55	50
40	216.012140	0.18	50
50	216.012587	1.89	50
60	216.013263	5.02	50
70	216.014903	12.62	50

2. $\Delta f < 50$ ppm with supply voltage varied from 85% to 115%

Voltage [VAC]	Rated voltage	Frequency [MHz]	Change ppm	Limit ppm
7.65	85%	216.01259	0.00	50
9	Nominal	216.01259	ref	ref
10.35	115%	216.01254	0.23	50

Test equipment:

☒ Analyzer	HP 8920B
☒ Spectrum analyzer	☐ 88-14 ☒ 90-26 ☐ 94-24
☐	

Results: ☒ complies ☐ does not comply ☐ not applicable ☐ not done



9. Test set-up photos / Photos des essais / Fotos der Prüfungen

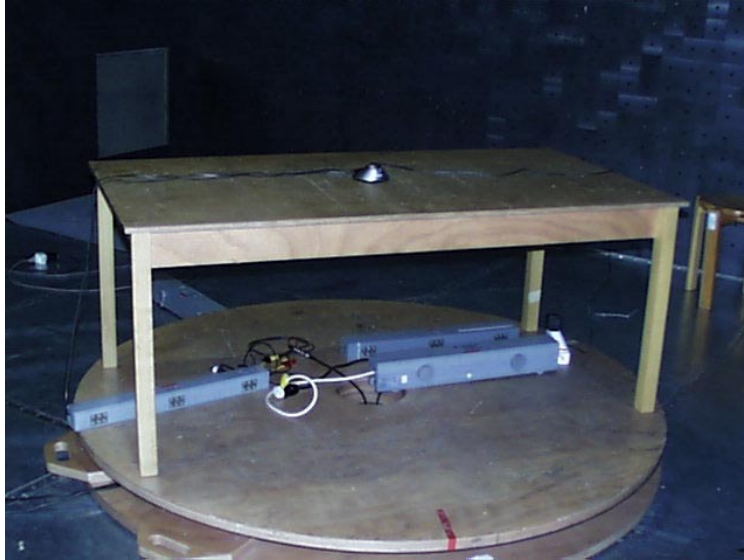


Photo 1

Spurious emission