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Schweizerischer Prüfstellendienst
Service suisse d'essai
Swiss testing service

Report no:
Rapport no: **14'159A**
Bericht Nr:

Title: **Type acceptance measurements for a 216-217 MHz transmitter « EasyLink » 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: **April to October, 2005**
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 Emmanuel de Raemy
Mr Erich Staub

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

Mr Emmanuel de Raemy
Mr Erich Staub

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

Mr François Trotti

Rossens, October 31, 2005 (Issue Date / Date d'édition / Ausstelldatum)

V0111

Main language / Langue principale / Hauptsprache: english / français / deutsch

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Total number of pages

Nombre total de pages du rapport: 18

Total Anzahl Seiten

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	References/ Références / Referenzen	Result / Résultat / Ergebnis
Designation of emission Désignation d'émission Bezeichnung der Emission	FCC 47 §2.201 FCC 47 §2.202	✓
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)	✓
Mains terminal interference voltage Tension perturbatrice aux bornes d'alimentation Störspannung auf den Energieversorgungsleitungen	FCC 47 §15.207	Ø ¹⁾
Radiated electromagnetic field Champ perturbateur Störfeldstärke	FCC 47 §15.209	✓

1. Powered with internal batteries

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)
FCC Part 15: Subpart C, Intentional radiator

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 Stefan Gysins</i>
Telephone / Téléphone / Telefon	<i>+41 (0)26 672 96 72</i>
Fax / Télécopieur / Telefax	<i>+41 (0)26 672 93 80</i>
Mandate no / Mandat no / Auftrag Nr.	<i>2005-6516</i>

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>EasyLink</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 antenna consists of a "Lavalier cord". An inductive remote control (40 kHz) allows configuring the receiver.</i>
Production country / Pays de fabrication / Ursprungsland	<i>Switzerland</i>
Product type / Type du produit / Typ des Produktes	<i>EasyLink</i>
Serial no / No. de série / Seriennummer	<i>N#2 / N#3</i>
Highest frequency / Frequence plus élevée / Höchste Frequenz	<i>217 MHz (FM carrier)</i>
Modifications before the tests Modifications apportées avant les essais Vor den Prüfungen angebrachte Änderungen	<i>None</i>

4. Test instrumentation and procedures

The list of the test equipment (stock list number) is provided for each test given in the appendices. The equipment is calibrated at defined intervals with traceability.

The test procedures used are in accordance with ANSI C63.4 "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, Part 15 and Part 95.

6. Test conditions / Conditions d'essai / Testbedingungen

Temperature / Température / Temperatur:	20 - 24 °C
Pressure / Pression / Druck:	1005 - 1020 hPa
Relative humidity / Humidité relative / Relative Luftfeuchtigkeit:	38 - 45 %
Test period / Date des essais / Datum der Prüfungen:	April to October, 2005

7. Persons present / Personnes présentes / Anwesende Personen

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

Mr Emmanuel de Raemy
Mr Erich Staub

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

Name / Nom / Name

Company / Société / Firma

Mr François Callias
Mr Stefan Gysin

Phonak Communications AG
Phonak Communications AG

8. Emission Tests / Essais d'émission / Störaussendungsmessungen

8.1. Designiation of emission / Désignation d'émission / Bezeichnung der 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. $B_n = 2M + 2D$ B_n = necessary bandwidth M = maximum modulation frequency in hertz = 7 kHz D = Peak frequency deviation = 5 kHz $B_n = 24 \text{ kHz}$	
Basic characteristics:	F3E	F : frequency modulation 3 : a single channel containing analogue information E : telephony (including sound broadcasting)
Designation of emission:	24K0F3E	

8.2. 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

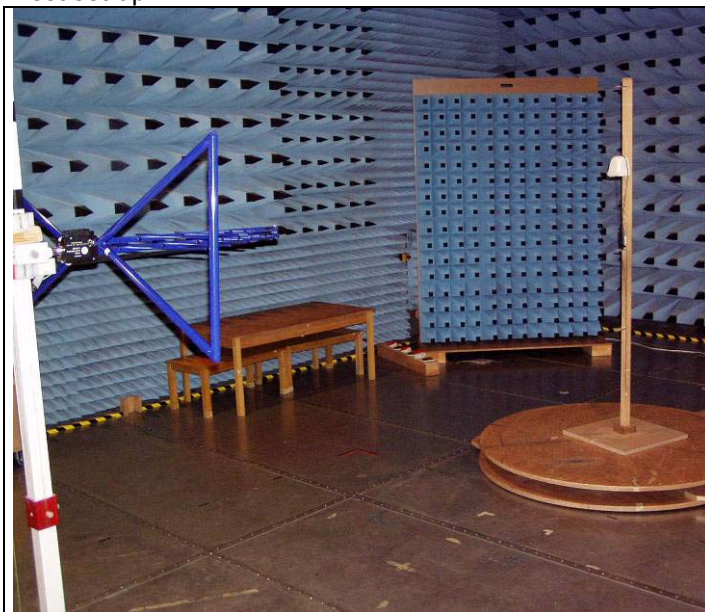
Position of EUT: 1.5 m (Height of equipment under test above floor)

Test method: The radiated field strength of the device under test has been measured at 3 m for horizontal and vertical polarization. The effective radiated power (ERP) was measured by the substitution of the EUT by a dipole.

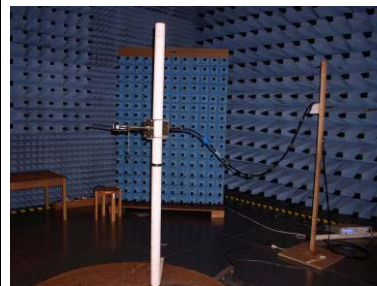
Test results: Test frequency: 216.4375 MHz

 $P_{ERP} = +10$ dBm / 10 mW

Test set-up:



EUT



Substitution

Test equipment:

☒ Spectrum analyzer	☐ 88-14	☐ 90-26	☐ 94-24	☒ 02-06		
☐ 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 (dipole)	☐ 94-03	☒ 90-01				
☐ Antenna (horn)	☐ 90-24	☐ 90-29	☐ 98-12	☐ 98-13	☐	
☒ Antenna (bilog)	☐ 94-03	☒ 05-38				

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

8.3. 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: (Mic input) An audio signal at 1 kHz was adjusted for a 100 % rated FM deviation (= 20 mV rms). While maintaining the same amplitude, the frequency was varied. The FM deviation was measured and recorded at several frequencies in order to determine the frequency response.

Audio [kHz]	Dev. [kHz]	Audio [kHz]	Dev. [kHz]	Audio [kHz]	Dev. [kHz]	Audio [kHz]	Dev. [kHz]
0.1	5.2	0.9	3.9	4.0	3.4	8.0	0
0.2	3.9	1.0	3.9	4.5	3.4	9.0	0
0.3	3.9	1.2	3.8	5.0	3.3		
0.4	3.9	1.5	3.7	5.5	3.2		
0.5	3.9	2.0	3.7	6.0	3.2		
0.6	3.9	2.5	3.6	6.5	2.5		
0.7	3.9	3.0	3.6	7.0	0.7		
0.8	3.9	3.5	3.4	7.5	0		

Modulation limiting: (Mic input) An audio signal at 1 kHz was adjusted for a 100 % rated FM deviation (= 20 mV rms). While maintaining the same frequency, the audio level was varied. The FM deviation was measured and recorded at different audio levels in order to determine the modulation limiting.

Audio signal level [mV rms]	FM Deviation (kHz)
0.5	1.3
1	2.6
2	3.7
3	3.7
4	3.7
5	3.7
20	3.9
50	3.9
100	3.7

Audio Input: The sensitivity of the audio input is 26 dB above the sensitivity of the microphone input; the adjustment is made with resistors.

The characteristics of the microphone is: 75 dBPSL $\Rightarrow$ 1 mVrms

Test equipment:

☒ HF-generator	☐ 88-23	☒ 94-06	☐ 00-42	☐ 00-47	☐ 03-39
☒ LF-generator	☒ 02-04				
☒ Oscilloscope	☒ 01-20				
☒ FM discriminator					

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

**8.4. 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:

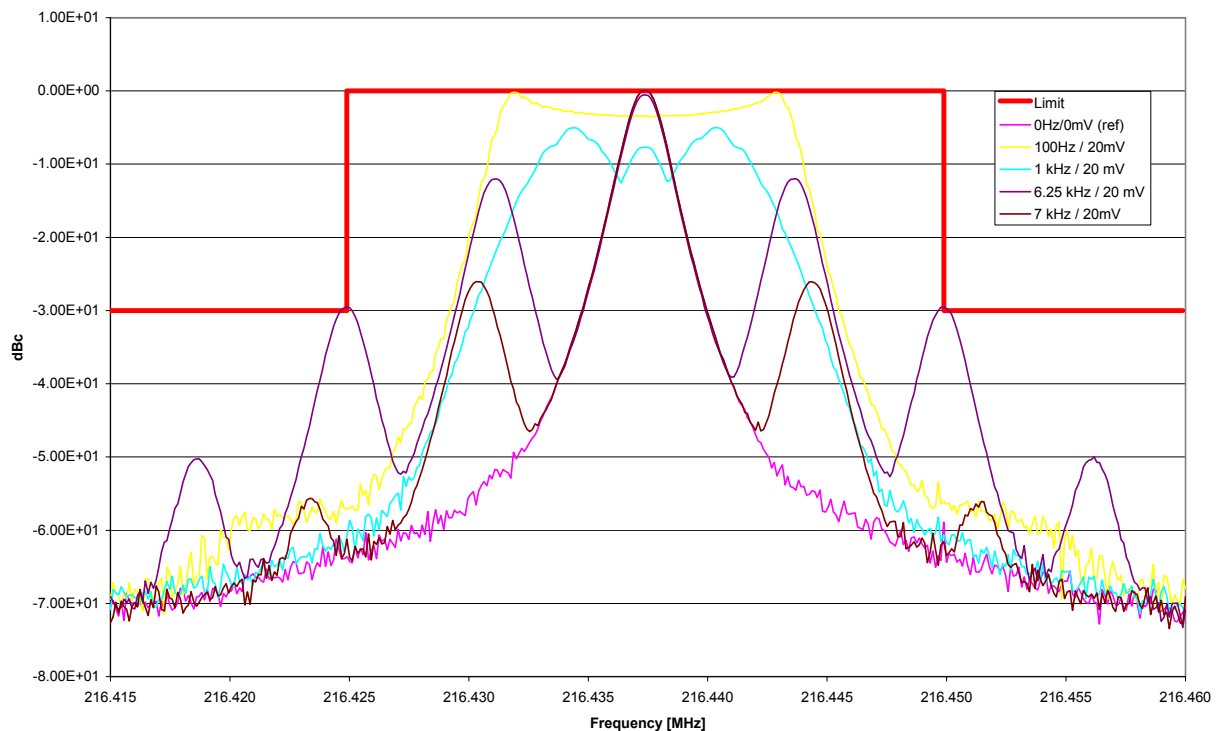
- Emissions 12.5 kHz to 22.5 kHz away from the channel centre frequency:
at least 30 dB
- Emissions more than 22.5 kHz away from the channel centre frequency:
at least $43 + 10 \log$ (carrier power in watts) dB

Test method: The audio signal input was set to 20 mV rms (= FM deviation max). For different input frequencies the fundamental frequency was plotted.

Test equipment:

☒ Spectrum analyzer	☐ 88-14	☐ 90-26	☐ 94-24	☒ 02-06
☒ LF-generator	☒ 02-04			
☐				

Results:	☒ complies	☐ does not comply	☐ not applicable	☐ not done
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**Measurement Type:** Power interference**Equipment under test:** EasyLink**Set-Up:****Operating conditions:** Faudio= 100 Hz, 1 kHz, 6.25 kHz, 7 kHz - Level = 20 mV**Remarks:** Mic Input; measurement with Max Hold

* Agilent 11:05:15 May 30, 2005

Ref 5 dBm

Atten 15 dB

Mkr1 Δ 7.09 kHz
-26.23 dBPeak
Log
10
dB/
Marker Δ
7.087 kHz
-26.23 dBV1 S2
S3 FC
AA

Center 216.4 MHz

#Res BW 1 kHz

VBW 1 kHz

Span 45 kHz

#Sweep 1 s (401 pts)

Plot of the screen of the
spectrum analyzer
(audio signal 7 kHz /
20 mV)

**8.5. Radiated magnetic field**

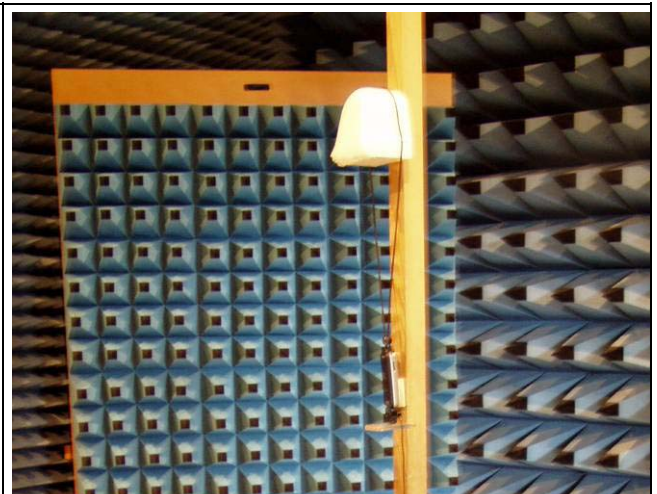
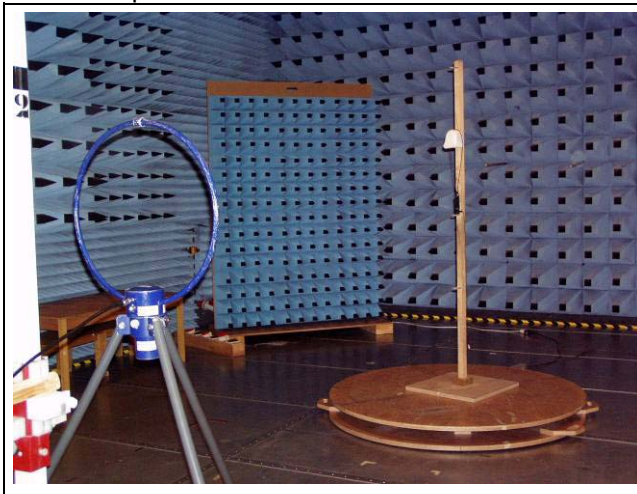
Standard: United States: 47 CFR "Code of Federal Regulations" - Telecommunication

☒ FCC Part 15, Subpart C: Intentional radiator §15.209Test site: ☐ anechoic chamber (ferrites) ☐ open test site☒ anechoic chamber (foam) ☐Meas. distance: ☒ 3 m ☐ 10 m ☐ 30 m ☐ mTest precision: ± 2.8 dB (10 m)

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

Measuring method: The magnetic disturbance radiated by the equipment under test is measured using a spectrum analyser and a wide band magnetic antenna. The bottom of the antenna is placed at 1 m of height, first in the direction of the apparatus under test and then at 90° to the apparatus. 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.

Test set-up:



Remarks: ---

Test equipment:

Spectrum analyser	☐ 88-14	☐ 90-26	☐ 94-24	☒ 02-06	☐ 03-45	☐ 03-57
Receiver	☐ 85-12	☐ 90-11	☐ 94-34	☐ 04-28	☐	
Preamplifier	☐ 88-05	☒ 90-01	☐ 90-42	☐ 95-86		
Antenna (typ: magnetic)	☐ 90-25	☒ 90-28	☐ 99-32	☐		

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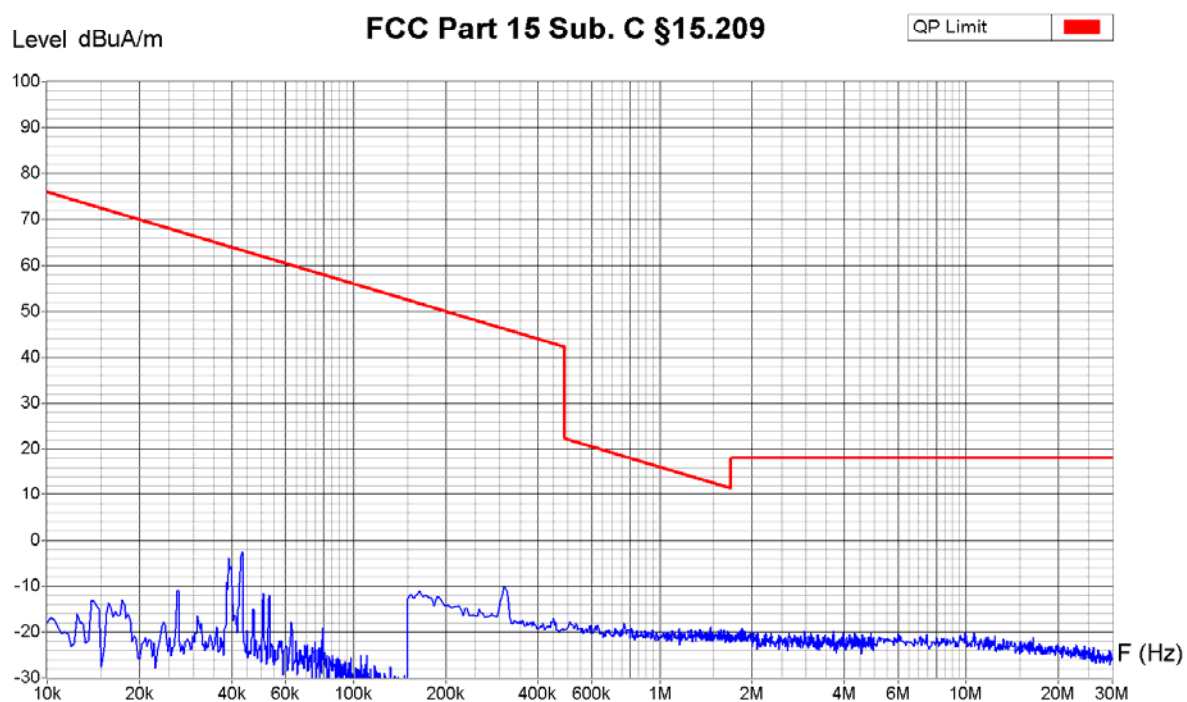


Measurement Type : Radiated Field
 Polarisation : Perpendicular
 Table Angle : 0 - 360°
 Antenna Height : 1.5 m



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Equipment Under Test : EasyLink (TX7) SN N#2
 Set-Up : With audio input cable
 Operating Conditions : permanent pressing frequency change button (40 kHz)
 Remarks :



Zone	10 KHz - 150 KHz	150 KHz - 2 MHz	2 MHz - 5 MHz	5 MHz - 30 MHz
Video Bandwidth	300 Hz	10 KHz	10 KHz	10 KHz
Resol Bandwidth	300 Hz	10 KHz	10 KHz	10 KHz

Operator: E. de Raemy
 Date/Time: 08.04.05 15:07
 Filename:
 FCC_N04.png/.txt

No. / No. / Nr. : **14'159A**

Date/Date/Datum : **April to October, 2005**



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Measurement Type : Radiated Field

Polarisation : Parallel

Table Angle : 0 - 360°

Antenna Height : 1.5 m



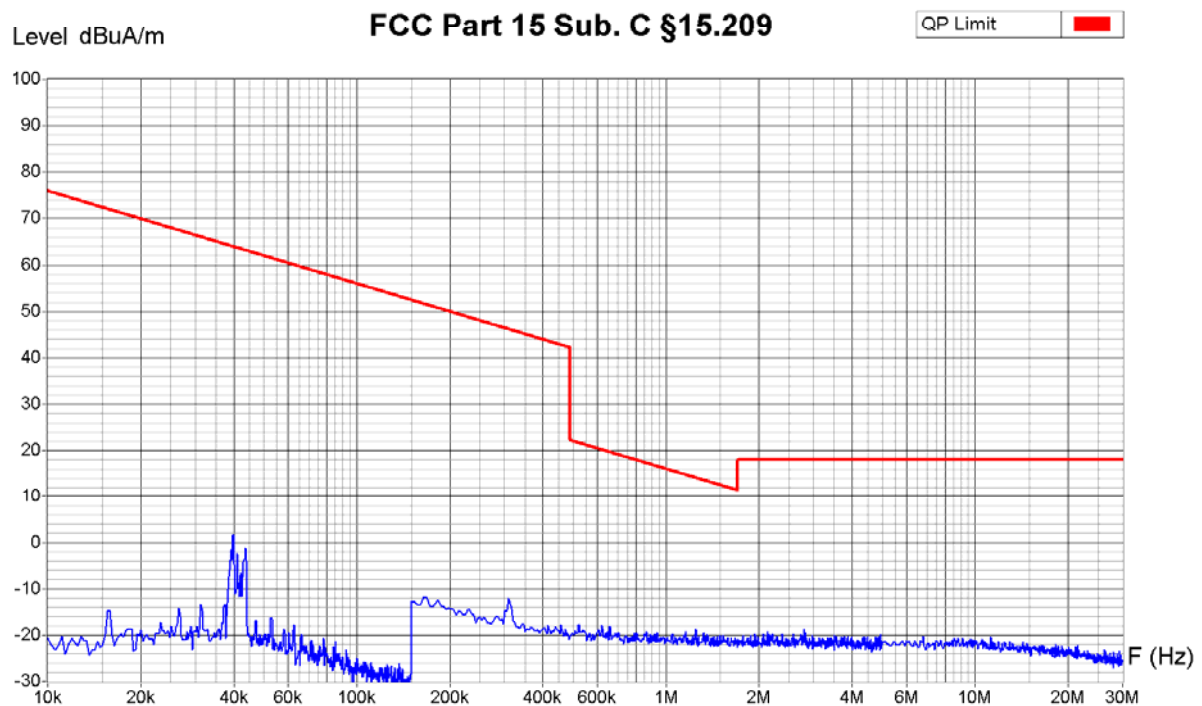
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Equipment Under Test : EasyLink (TX7) SN N#2

Set-Up : With audio input cable

Operating Conditions : permanent pressing frequency change button (40 kHz)

Remarks :



Zone	10 KHz - 150 KHz	150 KHz - 2 MHz	2 MHz - 5 MHz	5 MHz - 30 MHz
Video Bandwidth	300 Hz	10 KHz	10 KHz	10 KHz
Resol Bandwidth	300 Hz	10 KHz	10 KHz	10 KHz

Operator: E. de Raemy
Date/Time: 08.04.05 14:56
Filename:
FCC_N03.png/.txt

**8.6. Unwanted 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)Test site: ☐ anechoic chamber (foam) ☐ open test site☒ anechoic chamber (ferrites) ☐Distance: ☐ 30 m ☐ 10 m ☒ 3 m ☐

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

Test precision: ± 6 dB (30 - 300 MHz) / ± 5.4 dB (300 - 1000 MHz)

Test method: According to ANSI TIA-603-C-2004

Test set-up:



Remarks:

Test equipment:

Spectrum analyser	☒ 88-14	☐ 90-26	☐ 94-24	☐ 02-06	☐ 03-45	☐ 03-57
Receiver	☐ 85-04	☐ 90-43	☐ 94-35			
Preamplifier	☐ 88-05	☐ 90-01	☐ 90-42	☐ 97-08	☒ 05-87	
Antenna (biconical)	☐ 82-02	☐ 87-05	☐ 87-16	☐ 91-05	☒ 05-00	
Antenna (dipole)	☒ 89-01					
Antenna (bilog)	☒ 94-03	☐ 05-38				
Antenna (horn)	☒ 90-24	☐ 90-29	☐ 98-12	☐ 98-13	☐	

Result:	☒ pass	☐ fail	☐ not applicable	☐ not tested
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f [MHz]	Polaris. Hor Vert		P ERP [dBm]	Limit -13 dBm
216.44	☐	☒	8.10	Carrier
432.88	☐	☒	-50.52	Pass
649.31	☐	☒	-42.40	Pass
1'515.06	☐	☒	-57.90	Pass
216.44	☒	☐	-8.40	Carrier
432.88	☒	☐	-59.32	Pass
1'515.06	☒	☐	-59.57	Pass

Date of test: *October, 2005*
Operator: *Erich Staub*

**8.7. 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. Variation with the temperature
 requirement: $\Delta f < 50$ ppm with temperature varied from -30° to $+50^\circ$ in steps of 10 degrees.

Temperature [°C]	Frequency [MHz]	Difference [ppm]	Limit [ppm]
-30	216.437207	0.89	50
-20	216.437300	0.46	50
-10	216.437335	0.30	50
0	216.437349	0.23	50
10	216.437357	0.19	50
20	216.437399	reference	reference
22	216.437379	reference	reference
30	216.437348	0.14	50
40	216.437327	0.24	50
50	216.437316	0.29	50

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

Rated voltage	Frequency [MHz]	Change [ppm]	Limit [ppm]
85%	216.437367	0.00	50
Nominal	216.437366	reference	reference
115%	216.437366	0.00	50

Test equipment:

☒ Frequency counter	☒ 03-21
☒ Spectrum analyzer	☐ 88-14 ☒ 02-06 ☐ 94-24
☐	

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



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



Photo 1

Frequency stability

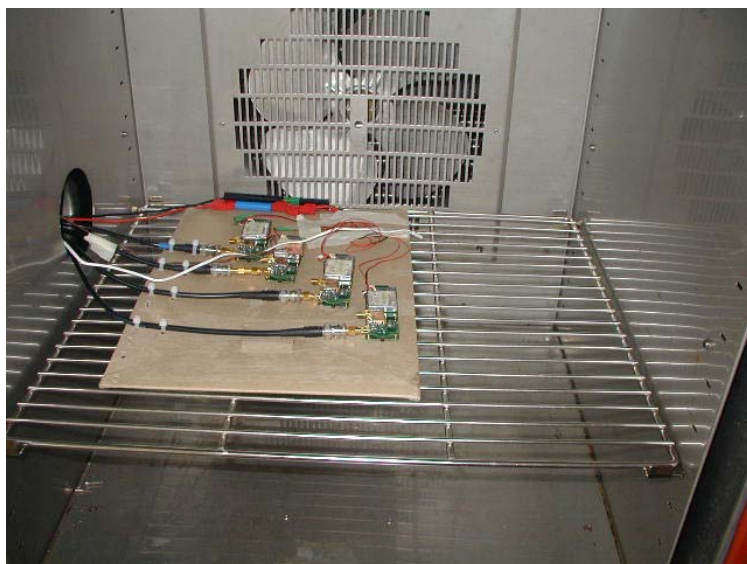


Photo 2

Frequency stability



Photo 3

Occupied bandwidth

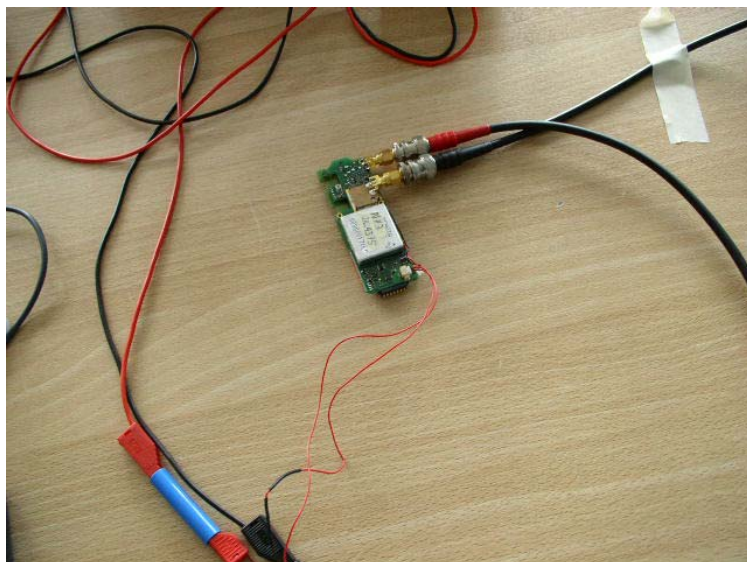


Photo 4

Occupied bandwidth



Photo 5

Modulation characteristics