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MACHINERY - COMPONENTS – TECHNOLOGY

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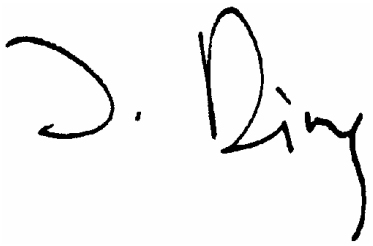
Numéro d'accréditation :
Akkreditierungsnummer

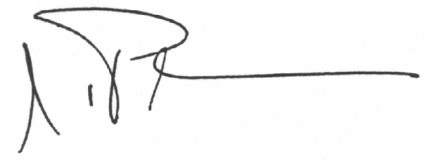
STS 024

Schweizerischer Prüfstellendienst
Service suisse d'essai
Servizio di prova in svizzera
Swiss testing service

Report no: Rapport no: Bericht Nr:	***13'724b***
Title: Titre: Titel:	***Radiocom measurements on « CROS CTX and CRX» according to the ETSI EN 300 330-1 and FCC CFR 47 part 15***
Date of test: Date de l'essai: Prüfdatum:	***April 29 – 30 2004***
Customer: Client: Kunde:	***Phonak AG***
Test place: Lieu de l'essai: Prüfort:	***montena emc sa*** ***CH-1728 Rossens***

Test performed by Essai effectué par : Prüfer	Test report prepared by Rapport d'essai préparé par : Berichterstatter	Test report controlled and approved by Rapport d'essai contrôlé et approuvé par : Prüfbescheinigung
Mr J. Ding	Mr J. Ding	Mr M. Portmann





Rossens, June 22, 2004 (Issue Date / Date d'édition / Ausstelldatum) V0209

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

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Contents / Table des matières / Inhaltsverzeichnis

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Total number of pages
Nombre total de pages du rapport: 28
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 Produkteart
- — Not tested / Pas vérifié / Nicht geprüft

	ETSI EN 300 330-1
Transmitter parameters	
Radiated H-field (carrier)	Chap. 7.2.1.2
RF carrier current	Not applicable
Radiated E-field (carrier)	Not applicable
Frequency range of the modulation bandwidth	Chap. 7.3
Spurios emissions conducted (< 30 MHz)	Not applicable
Spurios emissions conducted (≥ 30 MHz)	Not applicable
Spurios emissions radiated (< 30 MHz)	Chap. 7.4.3
Spurios emissions radiated (≥ 30 MHz)	Chap. 7.4.4
Duty cycle	Chap. 7.5
Receiver parameters	
Adjacent channel selectivity – in band	Not applicable
Blocking or desentizitation	Not applicable
Spurious radiations	Chap. 8.3
	CFR 47 Part 15
Spurious emissions radiated, § 15.209	Pass, s. p. 9 of report

2. 1. Applied standards / Normes appliquées / Verwendete Normen

ETSI EN 300 330-1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Radio equipment in the frequency range 9 kHz to 25 MHz and inductive loop systems in the frequency range 9 kHz to 30 MHz; Part 1: Technical characteristics and test methods
CFR 47	Code of federal regulations Part 15 § 15.209, Radio frequency Devices

3. Client / Client / Kunde

Client name and address Nom et adresse du client Name und Adresse des Kunden	*Phonak AG* *Laubisrütlistrasse 28* *CH-8712 Stäfa*
Contact Person / Responsable / Kontaktperson	*Mr F. Marquis*
Telephone / Téléphone / Telefon	*+41 26 672 96 42*
Fax / Télécopieur / Telefax	*+41 26 672 93 80*
Mandate no / Mandat no / Auftrag Nr.	*2004-6111*

4. Equipment under test / Equipement à l'essai / Prüfling

4.1 Identification / Identification / Identifikation

Manufacturer name and address Nom et adresse du fabricant Name und Adresse des Herstellers	*Phonak Communications SA* *Länggasse 17* *CH-3280 Murten*
Product name / Nom du produit / Produktname	*CROS*
Product description / Description du produit / Produktbeschreibung	*Ear to ear audio transmission for hearing aid*
Production country / Pays de fabrication / Ursprungsland	*Switzerland*
Product type / Type du produit / Typ des Produktes	*Transmitter CROS CTX and receiver CROS CRX*
Serial no / No. de série / Seriennummer	*Id N° CTX N° 11 (only tests § 7.3)* *Id N° CTX N° 12 and CRX N°15 (all other tests)*
Software version / Version du logiciel / Softwareversion	*none*
Highest frequency / Fréquence la plus élevée / Höchste Frequenz	*374 kHz*
Supply / Alimentation / Speisung	*U = 1.2 V Zinc-air battery*
Technical documentation Documentation technique Technische Dokumentation	*See photographs on chap. 7.* *The DUT is identified by its id. no according to ISO 9001.*

4.2 Modifications before the tests / Modifications apportées avant les essais / Vor den Prüfungen angebrachte Änderungen

- none

4.3 Function of the EUT

Ear to ear audio transmission for hearing aid

4.4 Definitions, classifications and test conditions

Definitions	Reference ETSI EN 300 330-1	Classification
Radiated H-field or power level	Table 1	Power class 1
Risk assessment of receiver performance	Table 2	Class 3
Extreme temperature range	Chap 5.4.1.2	Category II (portable)
Product classes (antenna type)	Chap. 7.1.4	Product class 1
Duty cycle classes	Chap. 7.5.3	Duty cycle class 4

Extreme test conditions	Level or range	Remark
Classification	Category II	
Extreme temperatures	-10 °C ÷ +55 °C	
Extreme test source voltages	1.2 V typical	Zinc-air battery

Normal test conditions	Value	Remark
Temperature:	*20 – 22 °C*	
Pression:	*1015 hPa*	
Relative humidity:	*35 – 45 %*	
Test period:	*29 to 30 April 2004*	

Full description of the modulated signal: (only if EUT can not be tested in unmodulated condition)	
Modulation:	*AM*
Transmission frequency	*374 kHz*
FM Deviation:	---
Full Modulation Bandwidth:	---

Conducted tests performed with: (only for equipment with integral antenna)	
Test Fixture	*YES (loop antenna)*
Temporary connector	*NO*
Permanent internal connector	*NO*

Power source for battery operated equipment:	
Internal batteries (normal test conditions)	*Zinc air, 1.2 V*
External test power source (extreme test conditions)	*No*

5. Persons present / Personnes présentes / Anwesende Personen

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

Mr J. Ding

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

Name / Nom / Name	Company / Société / Firma
Mr F. Oberson	Phonak Communications AG

6. Measurement

6.1 H-FIELD STRENGTH SUB-CLAUSE 7.2.1 & CFR 47

(Class 1)

Rated output level: - 30 dBμA/m* at 10m. Antenna size: around Ø 4mm x 18

Test conditions		Transmitter field strength (dBμA/m)		
		CH 1	CH 2	CH 3
T_{nom}(22)°C	V_{nom}(1.2 V)	**≤ -15** (374 kHz)		
Maximum deviation from rated output under normal test conditions (dB)		**+ 15 dBμA/m***		
Measurement uncertainty		± 3.9 dB		

LIMIT SUB-CLAUSE 7.2.1.3

Frequency range (MHz)	H-field field strength limit (Hf) dBμA/m at 10 m
0,009 ≤ f < 0,03	72 *
0,03 ≤ f < 0,07 0,119 ≤ f < 0,135	72 at 0,03 MHz descending 3,0 dB/oct *
0,05975 ≤ f < 0.06025 0,07 ≤ f < 0.119	42
0,135 ≤ f < 1.00	37.7 at 0,135 MHz descending 3,0 dB/oct
1.0 ≤ f < 4.642	29 at 1.0 MHz descending 9,0 dB/oct
4.642 ≤ f < 30	9
6,765 ≤ f ≤ 6,795 (ISM) 13,553 ≤ f ≤ 13,567 (ISM) 26,957 ≤ f ≤ 27,283 (ISM)	42
*For the frequency ranges 9 - 70 kHz and 119 – 135 kHz: – loop area ≥ 0.16 m^2: table values – 0.16 m^2 ≥ loop area ≥ 0.05 m^2: table value + 10 · log (area / 0.16 m^2) – loop area < 0.05 m^2: table values - 10 db	

* The value of rated output declared by the manufacturer is computed. The value measured is the noise level of measurement equipment.

Measured wih 88-14 and 90-28

(The indicated level at 10 m distance does not represent the emission of the EUT, but the noise of the measuring equipment. Another measurement has been performed at 1 m distance)

LIMIT CFR 47 § 15.209 at the carrier frequency (no other emissions found)

Frequency range (MHz)	E-field field strength limit μV/m at 300 m
0,009 ≤ f < 0,490	2400/f with f in kHz
0,374	6.4 ≡ 16.1 dBμV/m

The value of the H field measured at 10 m distance is -15 dBμA/m (it is more the noise of the measuring equipment).

Converted in E field (+51.5 dB) = 36.5 dBμV/m

Reduced from 10 to 300 m (-60 dB) = -23.5 dBμV/m (according to § 15.31 (2))

-23.5 dBμV/m is lower than 16.1 dBμV/m

Complies with the requirements

Measurement Type :	Radiated Field
Polarisation :	Horizontal
Table Angle :	0-360°
Antenna Height :	1-4 m
Equipment Under Test :	CROS CTX
Set-Up :	s. photo
Operating Conditions :	on
Remarks :	receiving antenna in the vertical plan

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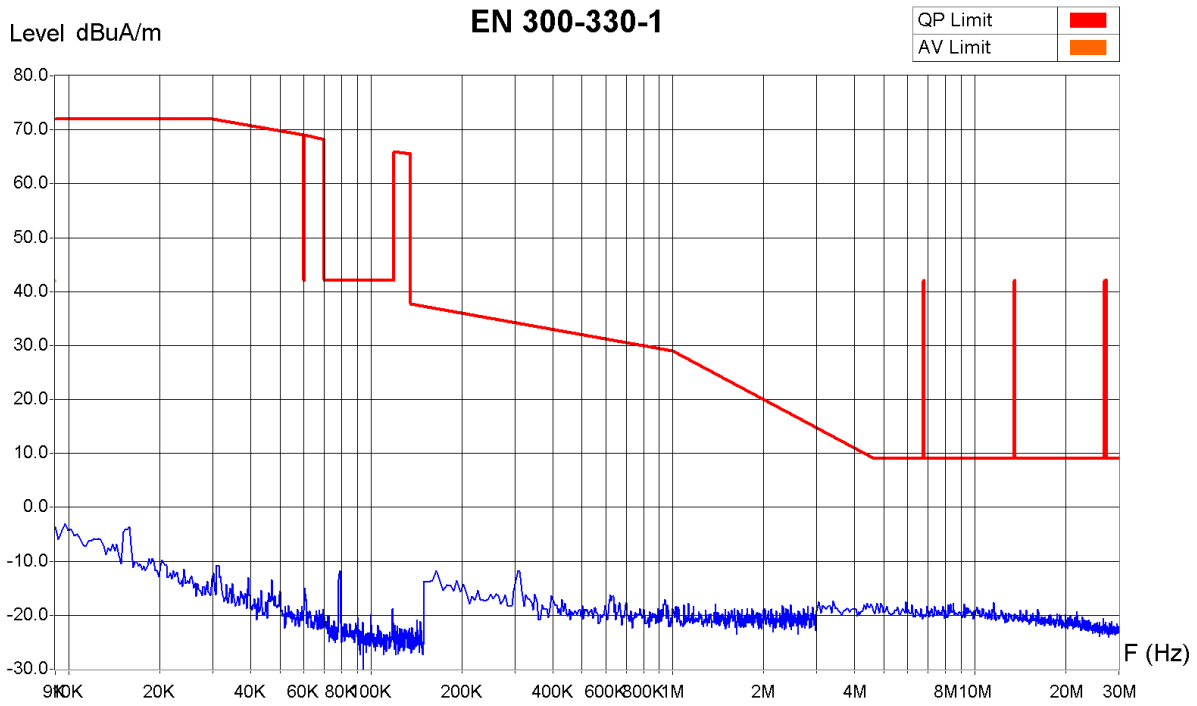

Zone	9 KHz - 150 KHz	150 KHz - 3 MHz	3 MHz - 30 MHz
Video Bandwidth	300 Hz	10 KHz	10 KHz
Resol Bandwidth	300 Hz	10 KHz	10 KHz

Operator: Ding
Date/Time: 30.04.04 08:22
Filename:
CTX_01.png/.txt

Measurement Type :	Radiated Field
Polarisation :	Vertical
Table Angle :	0-360°
Antenna Height :	1-4 m
Equipment Under Test :	CROS CTX
Set-Up :	s. photo
Operating Conditions :	on
Remarks :	receiving antenna in the horizontal plan

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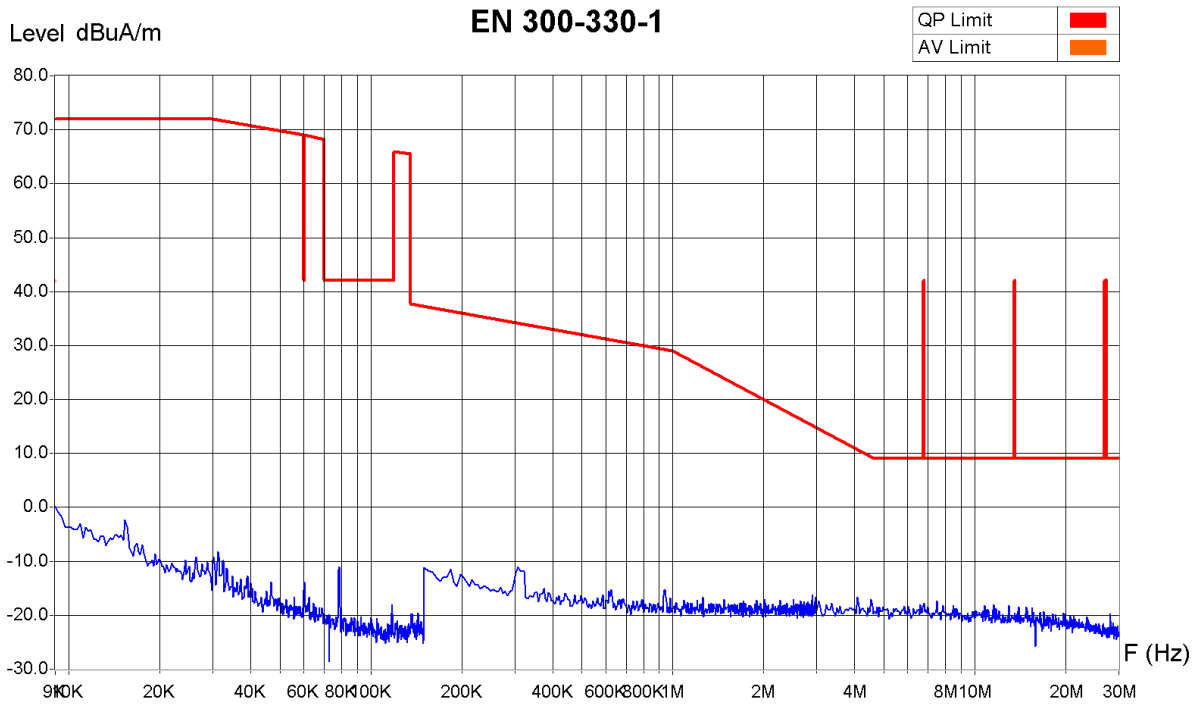

Zone	9 KHz - 150 KHz	150 KHz - 3 MHz	3 MHz - 30 MHz
Video Bandwidth	300 Hz	10 KHz	10 KHz
Resol Bandwidth	300 Hz	10 KHz	10 KHz

Operator: Ding
Date/Time: 30.04.04 08:36
Filename:
CTX_02.png/.txt

Measurement Type :	Radiated Field
Polarisation :	Vertical
Table Angle :	0-360°
Antenna Height :	1-4 m
Equipment Under Test :	CROS CTX
Set-Up :	s. photo
Operating Conditions :	on
Remarks :	receiving antenna in the horizontal plan special measurement at 1 m distance

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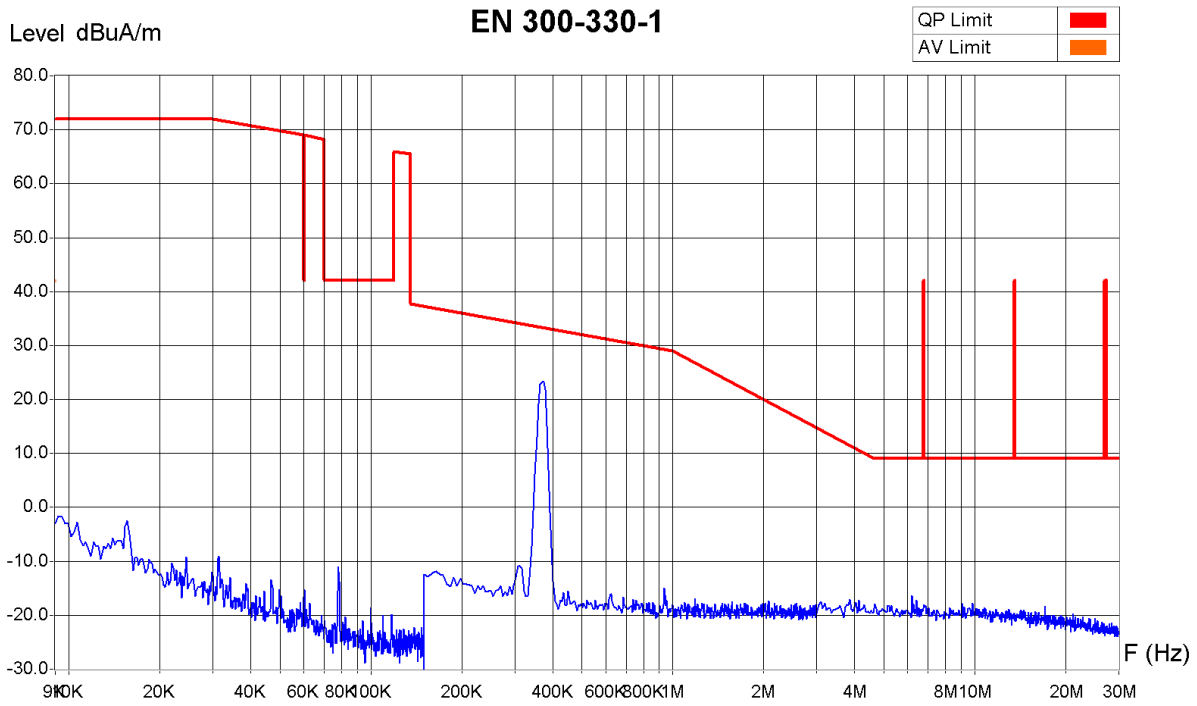

Zone	9 KHz - 150 KHz	150 KHz - 3 MHz	3 MHz - 30 MHz
Video Bandwidth	300 Hz	10 KHz	10 KHz
Resol Bandwidth	300 Hz	10 KHz	10 KHz

Operator: Ding
Date/Time: 30.04.04 08:50
Filename:
CTX_03.png/.txt

6.2 PERMITTED RANGE OF OPERATING FREQUENCIES FOR WIDEBAND EQUIPMENT (>25 kHz) SUB-CLAUSE 7.3

Applicants declared operating frequency band:

Lowest frequency: --- Highest frequency: ---

Test conditions		Limit Frequency MHz	
T_{nom}(20)°C	V_{nom}(1.2)VDC	F_L ---	Reference measurement see page 14
		F_H ---	
T_{min}(-10)°C	V_{min}(1.2)VDC	F_L ---	see page 15
		F_H ---	
	V_{max}(1.2)VDC	F_L ---	not performed
		F_H ---	
T_{max}(55)°C	V_{min}(1.2)VDC	F_L ---	see page 16
		F_H ---	
	V_{max}(1.2)VDC	F_L ---	not performed
		F_H ---	
Measurement uncertainty		1×10^{-7}	

Where F_L = Lowest frequency at the appropriate spurious emission level
F_H = Highest frequency at the appropriate spurious emission level

Band edge limits F_{LM}= Lowest F_L (measured): ---
F_{HM} = Highest F_H (measured): ---

REMARKS: Use of Zinc air battery, no measurement under extreme voltage conditions.

The carrier level is below the limits for spurious emissions, the peak of the carrier corresponds to a value lower than -12 dBµA/ m.

Complies with the requirements!

Measurement Type : Voltage Interference
Supply :
Other : voltage at measuring loop

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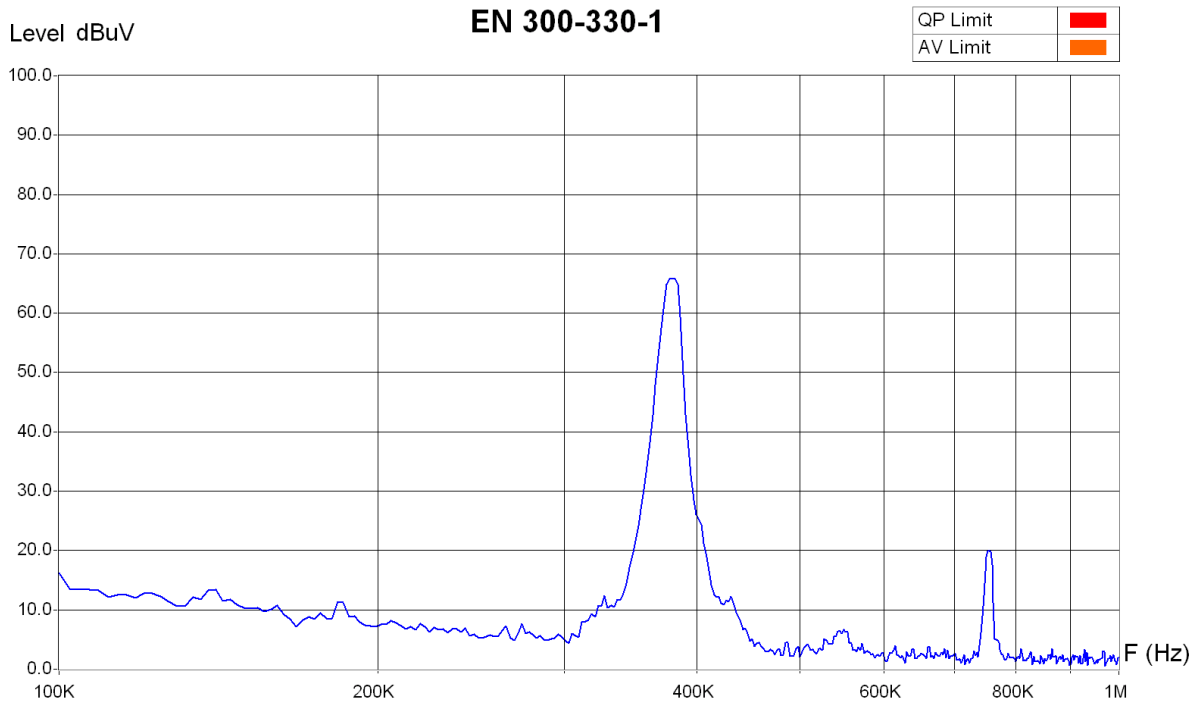
Equipment Under Test : CROS
Set-Up : s. photo
Operating Conditions : only carrier
Remarks : T= 20 °C, U=1.2 V
373.5 kHz, 65.82 dBuV



Zone	100 KHz - 1 MHz
Video Bandwidth	10 KHz
Resol Bandwidth	9 KHz

Operator: Ding
Date/Time: 29.04.2004 09:12
Filename:
cros_01b.png/.txt

Measurement Type : Voltage Interference
Supply :
Other : voltage at measuring loop

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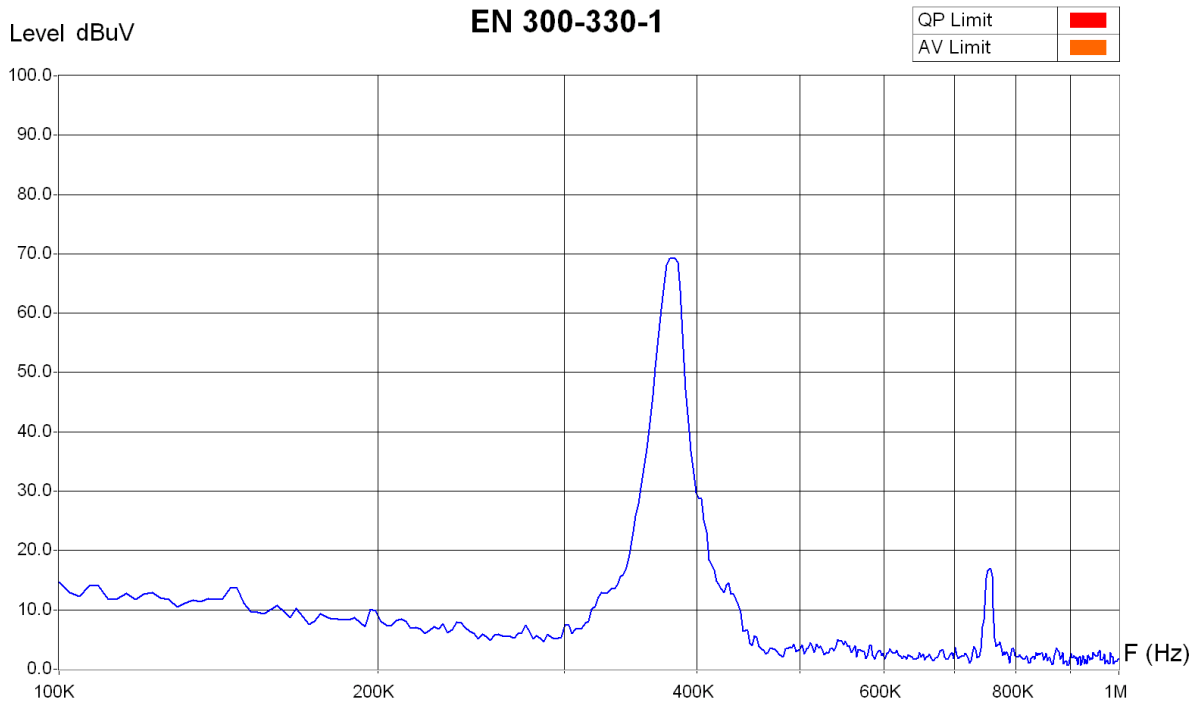
Equipment Under Test : CROS
Set-Up : s. photo
Operating Conditions : only carrier
Remarks : T= -10 °C, U=1.2 V
375.4 kHz, 69.27dBuV



Zone	100 KHz - 1 MHz
Video Bandwidth	10 KHz
Resol Bandwidth	9 KHz

Operator: Ding
Date/Time: 29.04.2004 09:57
Filename:
cros_02b.png/.txt

Measurement Type : Voltage Interference
Supply :
Other : voltage at measuring loop

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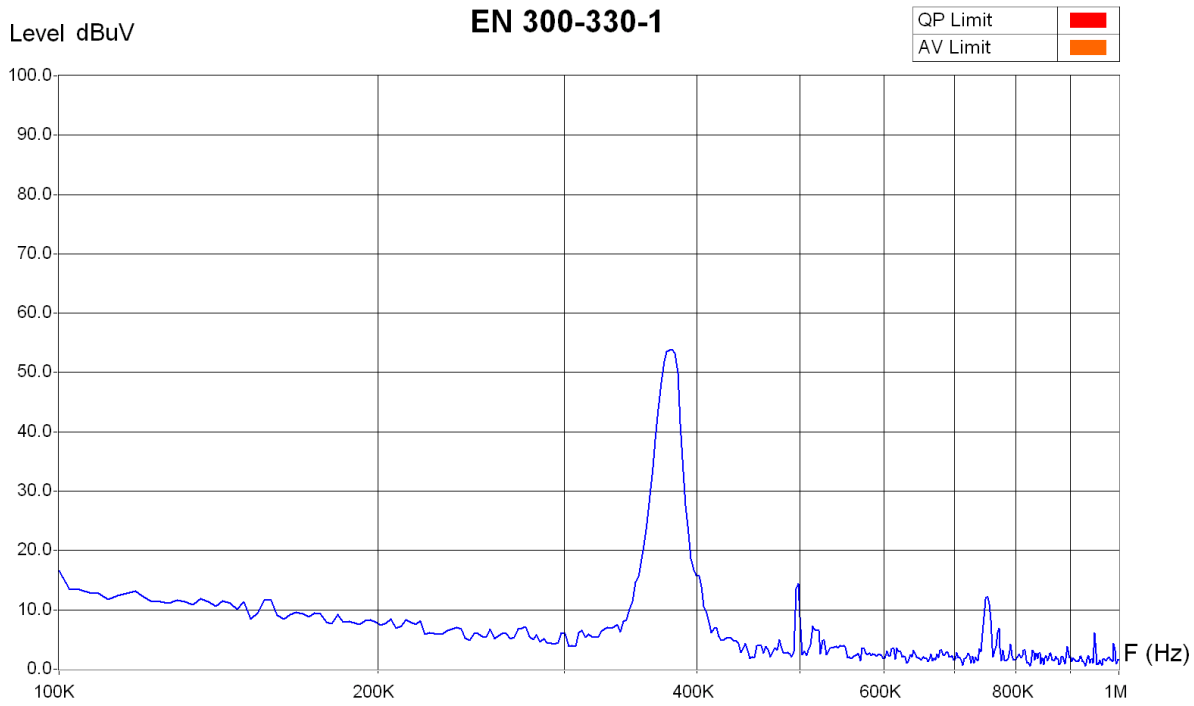
Equipment Under Test : CROS
Set-Up : s. photo
Operating Conditions : only carrier
Remarks : T= +55 °C, U=1.2 V
373.5 kHz, 53 dBuV



Zone	100 KHz - 1 MHz
Video Bandwidth	10 KHz
Resol Bandwidth	9 KHz

Operator: Ding
Date/Time: 29.04.2004 10:26
Filename:
cros_03b.png/.txt

6.3 TRANSMITTER SPURIOUS EMISSIONS RADIATED (<30 MHz) SUB-CLAUSE 7.4.3

Rated carrier output : < -12 dBμA/m (at 10 m)

Transmitter operating — TX ON: Modulated (No stand-by possible)
RX ON (No stand-by possible)

SPURIOUS EMISSIONS LEVEL (dBμA/m)								
CH 1			CH 2			CH 3		
f (MHz)	Band-Width** (kHz)	Level (dBμA/m)	f (MHz)	Band-width** (kHz)	Level (dBμA/m)	f (MHz)	Band-width** (kHz)	Level (dBμA/m)
0.009–0.15	0.3	**OK** *see plots*						
0.15 – 30	9	**OK** *see plots*						
Measurement uncertainty			± 3.9 dB					

** Bandwidth = the measuring receiver bandwidth

LIMIT SUB-CLAUSE 7.4.3.2

State	Frequency 9 kHz ≤ f < 10 MHz	Frequency 10 MHz ≤ f < 30 MHz
Transmit	27 dBμA/m descending 3 dB/oct	-3.5 dBμA/m
Standby	6 dBμA/m descending 3 dB/oct	-24.5 dBμA/m

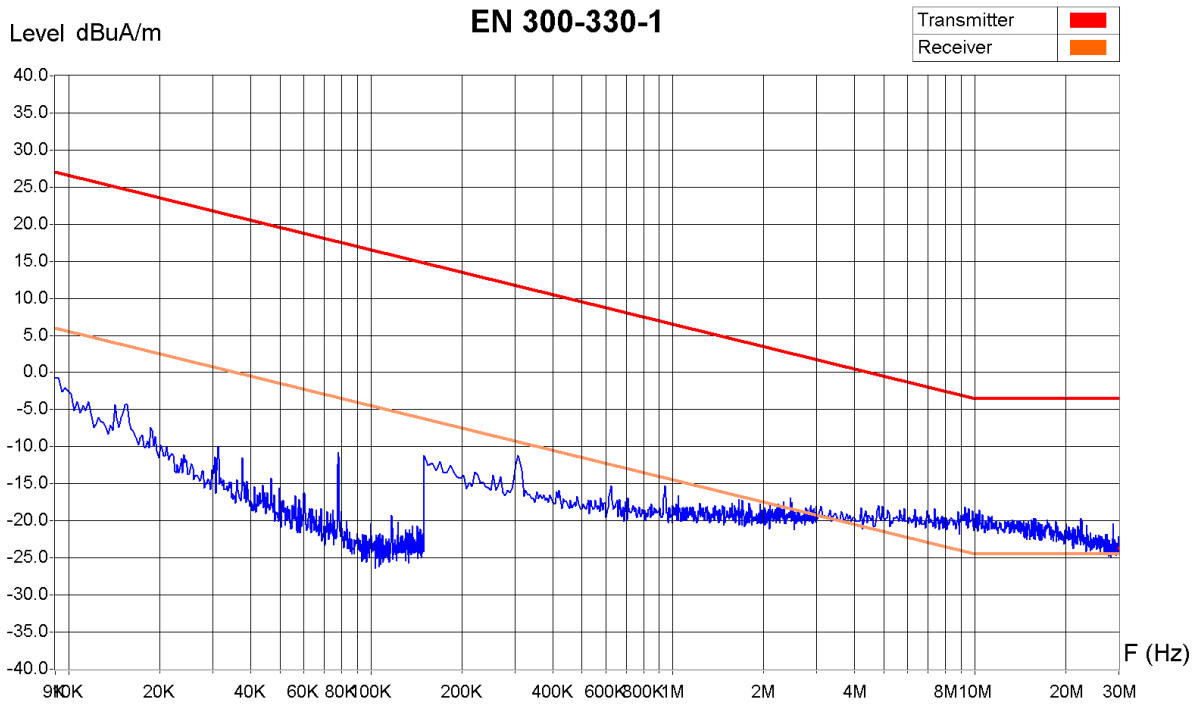
REMARKS:

s. available limit on plots

Complies with the requirements!!!

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

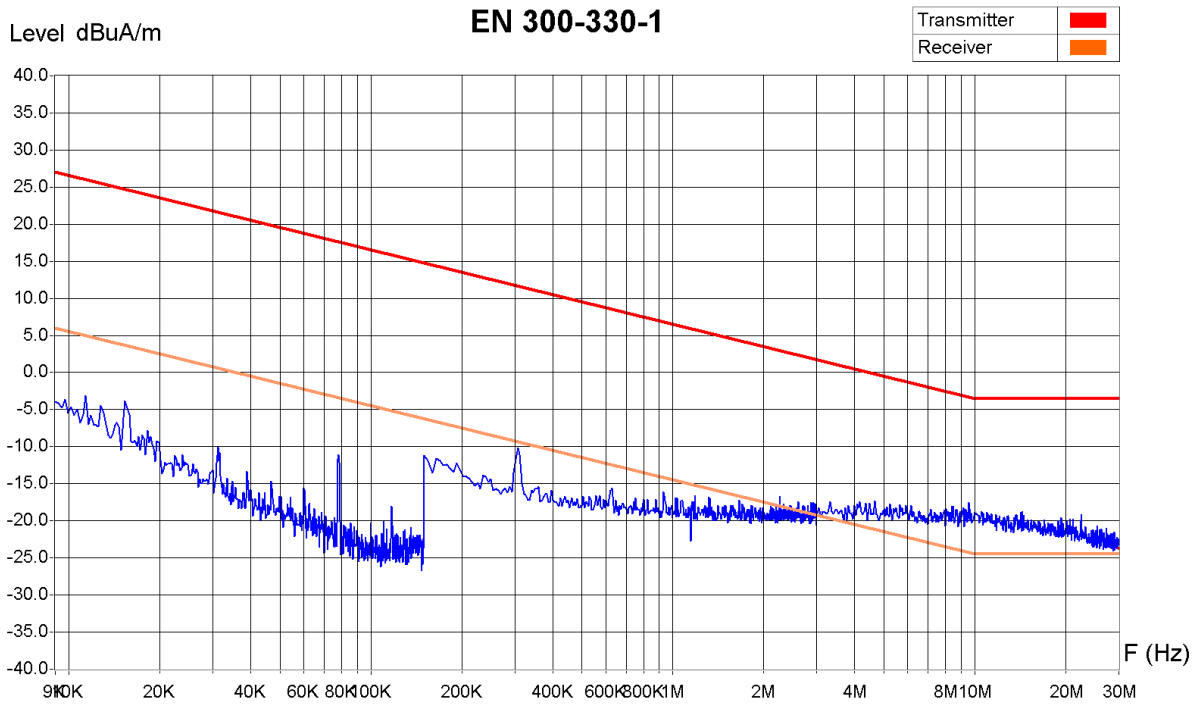
Equipment Under Test : CROS CTX
Set-Up : s. photo
Operating Conditions : transmitting (no stand-by possible)
Remarks :
ONLY UPPER LIMIT AVAILABLE



Zone	9 KHz - 150 KHz	150 KHz - 3 MHz	3 MHz - 30 MHz
Video Bandwidth	300 Hz	10 KHz	10 KHz
Resol Bandwidth	300 Hz	9 KHz	9 KHz

Operator: Ding
Date/Time: 30.04.04 09:26
Filename:
CTX_05.png/.txt

Measurement Type :	Radiated Field
Polarisation :	Horizontal
Table Angle :	0-360°
Antenna Height :	1-4 m
Equipment Under Test :	CROS CTX
Set-Up :	s. photo
Operating Conditions :	transmitting (no stand-by possible)
Remarks :	
	ONLY UPPER LIMIT AVAILABLE



Zone	9 KHz - 150 KHz	150 KHz - 3 MHz	3 MHz - 30 MHz
Video Bandwidth	300 Hz	10 KHz	10 KHz
Resol Bandwidth	300 Hz	9 KHz	9 KHz

Operator: Ding
Date/Time: 30.04.04 09:32
Filename:
CTX_06.png/.txt

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

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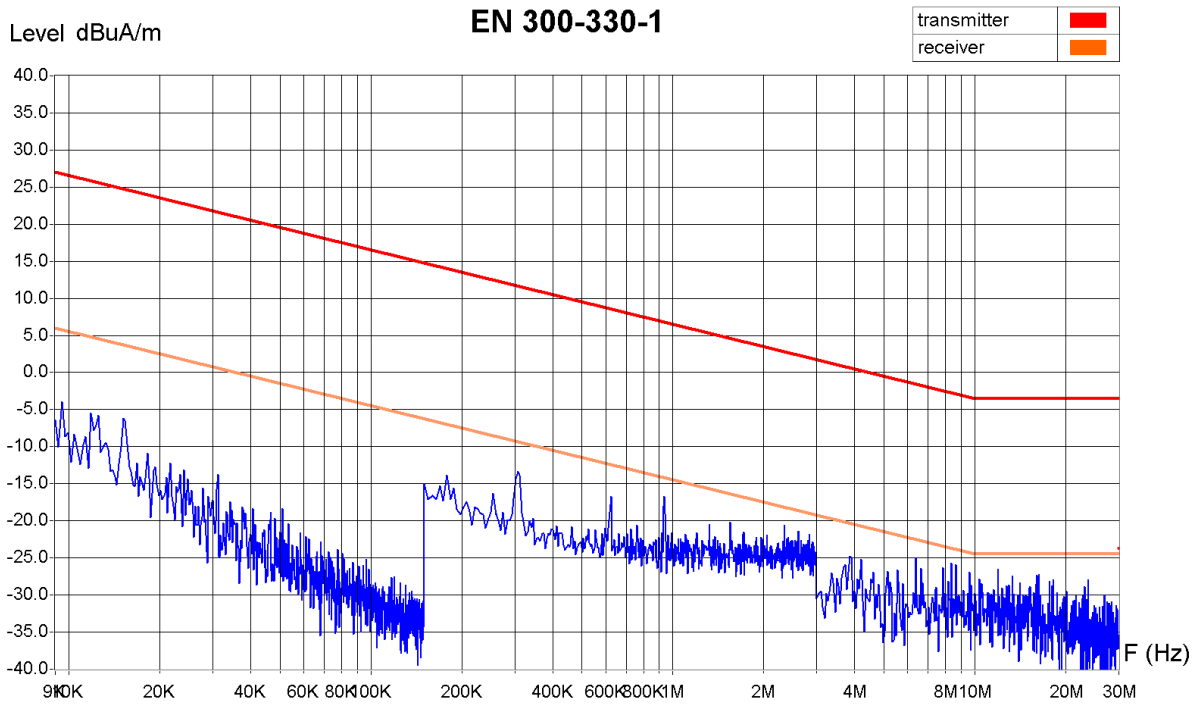
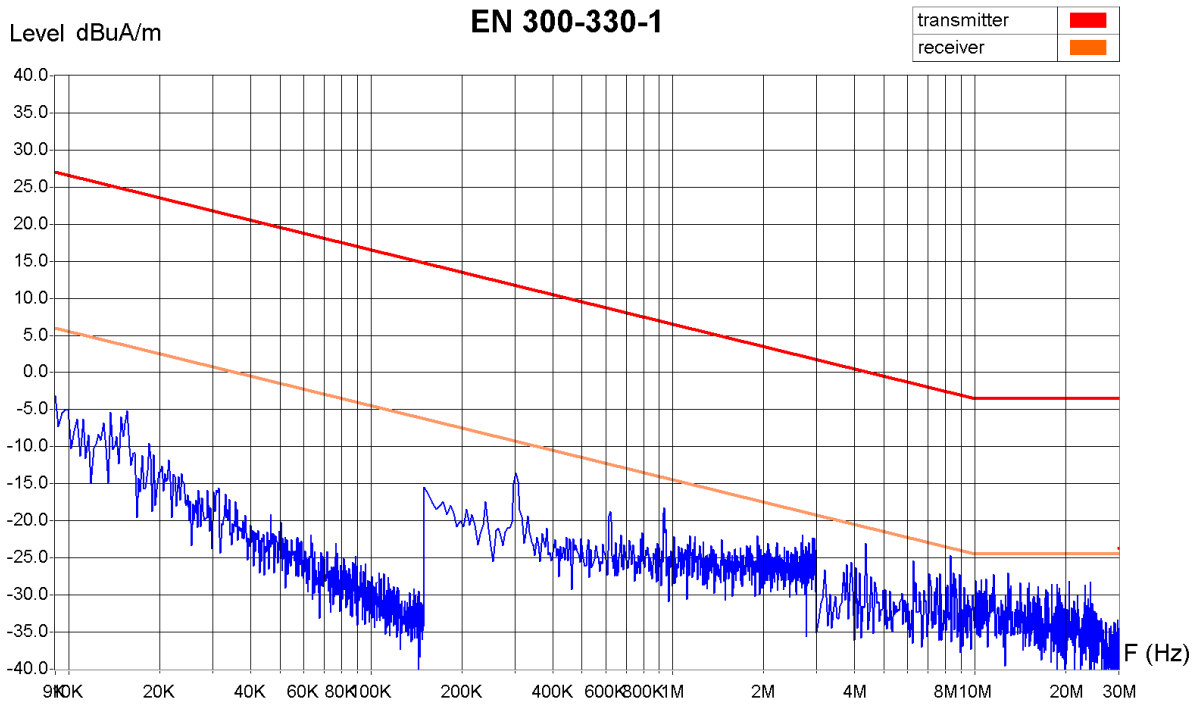
Equipment Under Test :	CROS CRX
Set-Up :	s, photo
Operating Conditions :	active (no stand-by possible)
Remarks :	LOWER LIMIT AVAILABLE
	with measuring pre-amplifier 95-86 (low noise)



Zone	9 KHz - 150 KHz	150 KHz - 3 MHz	3 MHz - 30 MHz
Video Bandwidth	300 Hz	10 KHz	10 KHz
Resol Bandwidth	300 Hz	9 KHz	9 KHz

Operator: Ding
Date/Time: 30.04.04 10:22
Filename:
CTX_07bis.png/.txt

Measurement Type :	Radiated Field
Polarisation :	Vertical
Table Angle :	0-360°
Antenna Height :	1-4 m
Equipment Under Test :	CROS CRX
Set-Up :	s, photo
Operating Conditions :	active (no stand-by possible)
Remarks :	LOWER LIMIT AVAILABLE
	with measuring pre-amplifier 95-86 (low noise)



Zone	9 KHz - 150 KHz	150 KHz - 3 MHz	3 MHz - 30 MHz
Video Bandwidth	300 Hz	10 KHz	10 KHz
Resol Bandwidth	300 Hz	9 KHz	9 KHz

Operator: Ding
Date/Time: 30.04.04 10:33
Filename:
CTX_08.png/.txt

6.4 TRANSMITTER SPURIOUS EMISSIONS RADIATED (>30 MHz) SUB-CLAUSE 7.4.4

Rated carrier output: < -12 dBμA/m

Transmitter operating Modulated

SPURIOUS EMISSIONS LEVEL (nW)								
CH 1 (8.2 MHz)			CH 2			CH 3		
f (MHz)	Band-width** (kHz)	Level (nW)	f (MHz)	Band-width** (kHz)	Level (nW)	f (MHz)	Band-Width** (kHz)	Level (nW)
30 – 300	120	≤ **2**						
300 – 1000	120	≤ **2**						
Measurement uncertainty			± 2 dB					

** Bandwidth = the measuring receiver bandwidth

LIMIT SUB-CLAUSE 7.4.4.2

State	47 MHz to 74 MHz 87,5 MHz to 118 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other Frequencies between 30 to 1000 MHz
Operating	4 nW	250 nW
Standby	2 nW	2 nW

REMARKS:

Complies with the requirements

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

Equipment Under Test : CROS CRX and CTX
Set-Up : s. photo
Operating Conditions : active and transmitting
Remarks :

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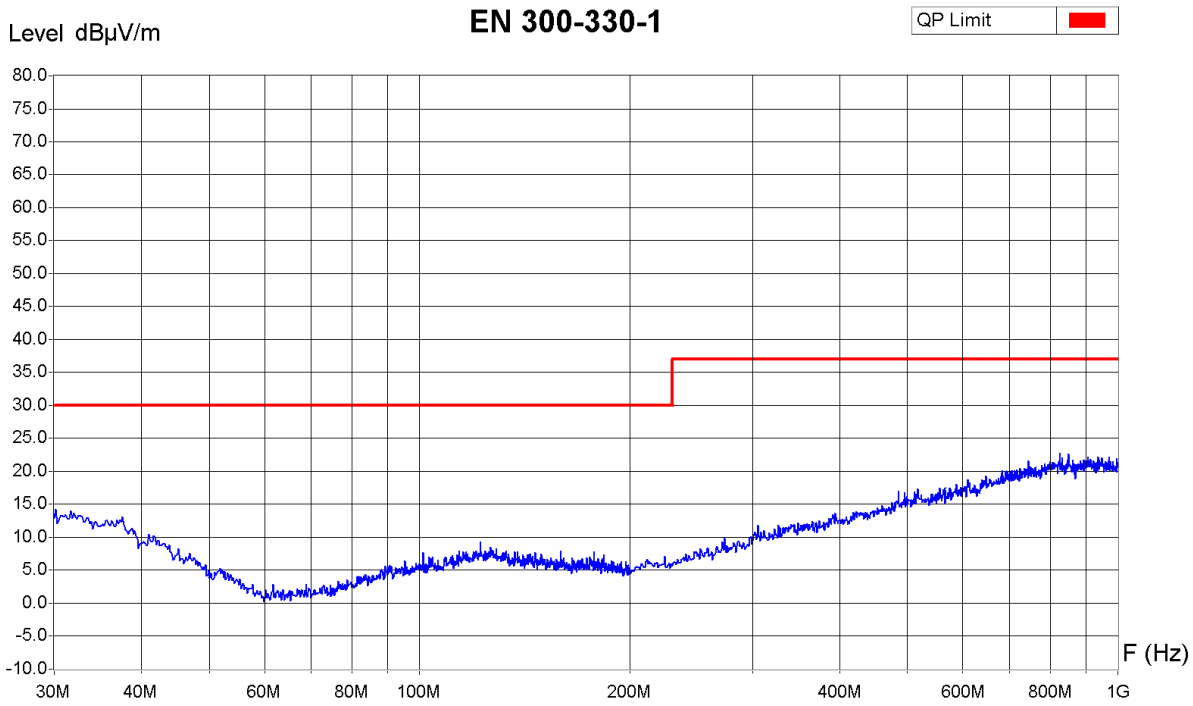

Zone	30 MHz - 199 MHz	199 MHz - 1 GHz
Video Bandwidth	100 KHz	100 KHz
Resol Bandwidth	120 KHz	120 KHz

Operator: Ding
Date/Time: 30.04.04 17:32
Filename:
supercros_01.png/.txt

Measurement Type :	Radiated Field
Polarisation :	Horizontal
Table Angle :	0-360°
Antenna Height :	1-4 m
Equipment Under Test :	CROS CRX and CTX
Set-Up :	s. photo
Operating Conditions :	active and transmitting
Remarks :	

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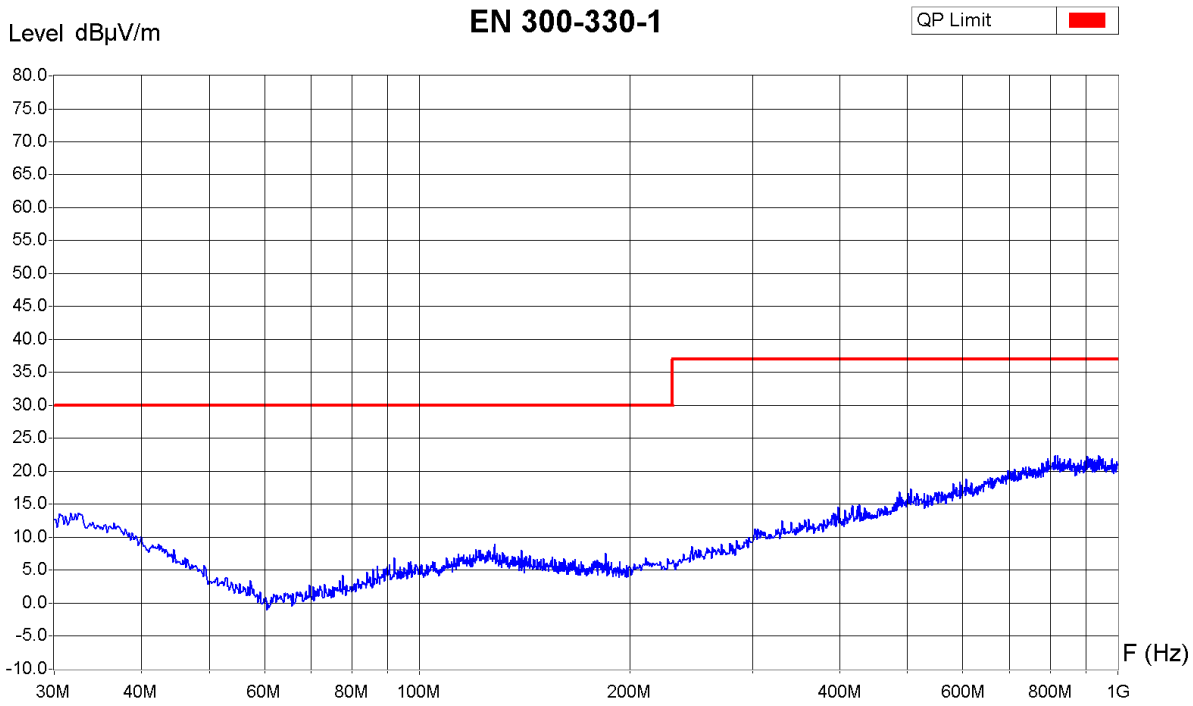

Zone	30 MHz - 199 MHz	199 MHz - 1 GHz
Video Bandwidth	100 KHz	100 KHz
Resol Bandwidth	120 KHz	120 KHz

Operator: Ding
Date/Time: 30.04.04 17:38
Filename:
supercros_02.png/.txt

6.5 DUTY CYCLE SUB-CLAUSE 7.5

The DUT is continuously transmitting.

LIMIT SUB-CLAUSE 7.5.3

Duty cycle Class	Duty cycle ratio
1	< 0.1 %
2	< 1.0 %
3	< 10 %
4	Up to 100%

The duty cycle class is 4.

7. Photos of DUT

Photo 1

Equipment under test

right: Transmitter CROS CTX

left: Receiver CROS CRX

Photo 2

Measurement of carrier and spurious emissions on CTX (f<30MHz)

Photo 3

Measurement of spurious emissions on CRX (f<30MHz)

Photo 4

Measurement of spurious emissions (f>30 MHz)