

8 CONDUCTED EMISSION DATA

8.1 Test procedure

In accordance with § 15.207 the conducted radio frequency disturbance voltages between each of the power lines (live, neutral) and the ground terminal were determined over the frequency range from 450 kHz to 30 MHz. The AC power line conducted emission measurements were performed at the line voltage of 120 Vac and at the power frequency of 60 Hz. Measurements were performed at the AC powerport of the adapter.

The measurement shall show compliance of this (class B) intentional radiator with the conducted limit of 250 μ V (48 dB μ V).

The (floor standing) test set-up was in accordance with the requirements of ANSI C63.4-1992.

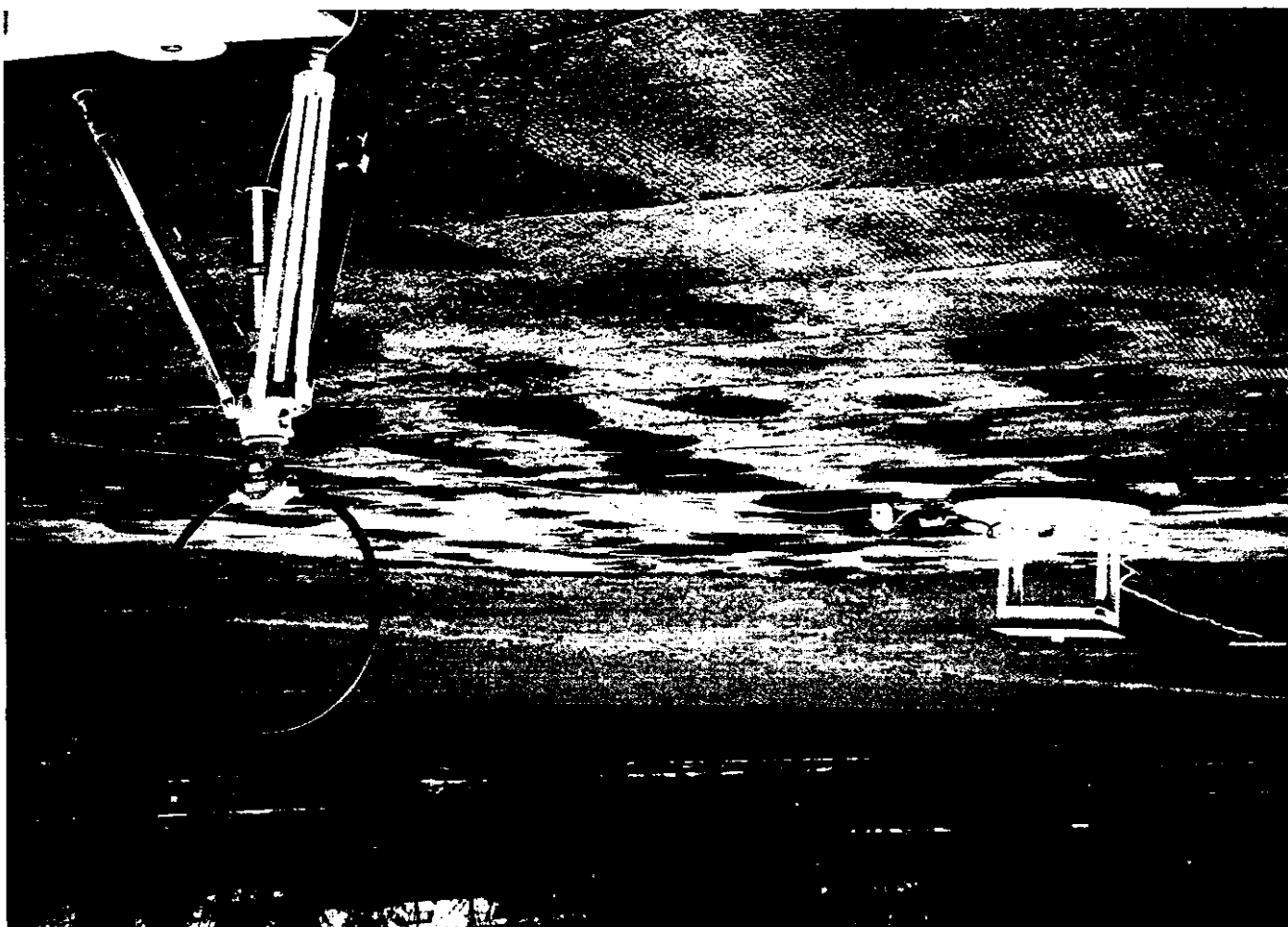
The initial step in collecting conducted data is a peak scan measurement over the frequency range of interest. Significant peaks are then marked, and these signals are then quasi-peaked. This procedure is implemented in the utilised test receiver by the incorporated EMI software. The test receiver used also meets the requirement as mentioned in § 15.35 "Measurement detector functions and bandwidths". The test receiver employs a CISPR quasi-peak detector function with a bandwidth of 9 - 10 kHz.

8.2 Test Instrumentation Used for Conducted Measurements

EMI Equipment	Type	Manufacturer	Serial no.	ORS No.	Cal interval
Spectrum analyzer	R3381A	Adventest		078274	yearly (08-98)
LISN (4 x 10 A)	NSLK 8127	Schwarzbeck	8127128	078086	yearly (05-98)
EMI test receiver	ESHS 10	Rohde & Schwarz	840048/008	077988	yearly (07-98)

Note : The Object Registration Number (ORS) is a unique number within the KEMA quality system, which identifies the equipment.

photo 4, measurement setup during the H-field measurements at 10 meter



8.3 Measured data (mains conducted disturbance voltage)

Standard : FCC part 15 Subpart B
 Port : 120V_{ac}/60Hz mains adapter
 Limits :

Frequency [MHz]	Limit Qp [dB(μV)]
0,45 - 30	48

Operation mode: detection mode

Results :

Frequency [MHz]	Line/Neutral	Level Qp [dB(μV)]
0,51	N	44
0,54	N	44
0,74	N	38
0,87	N	45
0,89	L	44
1,12	L	43
1,35	N	39
1,66	N	38
1,89	N	39
2,60	L	33
3,90	L	30
10,00	L	33
20,24	N	27
24,58	N	34

Measurement uncertainty: ± 2 dB

Note 1 : "Qp" are levels and limits referring to measurements with the quasi-peak detector.

Note 2 : The class A emission limits (section 15.107) are (also) allowed for any digital circuitry in the EUT wich does not directly enable the transmitter.

Conclusion : Pass (margin 3 dB)

Test personnel:

Tester Signature :



9 RADIATED EMISSION DATA (E-field > 30 MHz)**9.1 Test Procedure**

In accordance with § 15.209 the field strength levels of radiated emissions above 30 MHz from this intentional radiator at a distance of 3 meters were determined over the frequency range from 30 MHz up to 1000 MHz. The measurement shall show compliance of this intentional radiator. The test set-up was in accordance with the requirements of ANSI C63.4-1992.

Preliminary radiation measurements were performed in a compact anechoic room at a 3 meter test distance. The investigated frequency range from 30 MHz to 1000 MHz was scanned with the aid of the automatic test receiver ESVS10. This receiver automatically calculates the resulting field strength using the entered correction factor for cable loss and antenna factor. The resulting radiation levels are plotted. Radiation scans were made for various angles of the set-up with respect to the antenna and also for vertical as well as for horizontal antenna polarizations. As a result of the preliminary scans a list remains with frequencies at which relevant spurious radiation levels were detected.

The final measurements in the frequency range 30 - 1000 MHz were performed on the open area test site (OATS) as authorized by the FCC. At those frequencies where significant levels were detected in the compact anechoic room measurements were made on the open field to determine the actual field strength levels. At the open area test site the test receiver, type ESV make Rohde & Schwarz, is used for determining the levels. This receiver automatically selects the quasi-peak detector function with a bandwidth of 120 kHz when switched to the CISPR weighing mode. Signals in the frequency range 30 - 300 MHz were measured using the biconical antenna and signal levels in the frequency range 300 - 1000 MHz were determined with aid of the logperiodic antenna.

The antennas were oriented both for vertical and horizontal polarizations. At each frequency at which a spurious component is present the receiving antenna is raised and lowered through the range of heights of 1 to 4 meter and the table with the test set-up is rotated through 360° in the horizontal plane to ensure maximum signal reception by the receiver.

The data presented in clause 9.4 lists the significant emission frequencies, measured levels, correction factor (includes cable correction and antenna factors), the corrected reading, plus the limit. An explanation of the Correction Factor is given in paragraph 9.2.

9.2 Field Strength Calculation

The final field strength is calculated by adding the Antenna Factor and Cable Factor to the reading on the test receiver. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - (G)$$

where:

FS = Field strength

RA = Receiver amplitude

AF = Antenna factor

CF = Cable attenuation factor

G = Pre-amplifier gain (used in frequency range 1 - 2 GHz)

Example of calculating the field strength level:

Assume the receiver reading of 26.0 dBuV at a frequency of 113.6 MHz as obtained for the system with the bus-clock set at 66 MHz:

Measuring value, RA: 26.0 dB(μV)

Antenna factor, AF: 13.0 (dB/m)

Cable factor, CF: 1.1 (dB)

Thus resulting in a

Field strength, FS: 40.1 dB(μV/m)

The Correction Factor mentioned in the result tables of clause 9.4 comprises the Antenna factor AF and the Cable attenuation factor CF.

9.3 Test Instruments Used for Radiated Measurements

EMI Equipment	Type	Manufacturer	Serial no.	ORS No.	Cal interval
EMI Test receiver	ESV	Rohde & Schwarz	872148/016	087254	yearly (05-98)
EMI test receiver	ESVS 10	Rohde & Schwarz	827864/001	078088	yearly (09-98)
Biconical antenna	3110	EMCO	1076	078268	yearly (09-98)
Logper antenna	3146	EMCO	9111-3294	074850	yearly (09-98)

9.4 Radiated electromagnetic field strength results

Standard : FCC part 15 Subpart C

Limits : Measurement distance of 3 m

Frequency [MHz]	Limit Qp [μV/m]	Limit Qp [dBμV/m]
30 - 88	100	40
88 - 216	150	43,5
216 - 960	200	46
> 960	500	54

Final Results: No significant emission levels could be measured above > 30 MHz.

Note 1 : All readings are quasi-peak values using a quasi-peak bandwidth of 120 kHz

Note 2 : The class A emission limits (section 15.109) are (also) allowed for any digital circuitry in the EUT which does not directly enable the transmitter.

Conclusion : Pass

Test personnel:
Tester Signature:
Name : A.J. Werner

10 RADIATED EMISSION DATA (H-field <30 MHz)

10.1 Test Procedure

In accordance with section 15.209 the magnetic field strength levels of radiated emissions < 30 MHz from this intentional radiator at a distance of 3 and 10 meters were determined over the frequency range from 0,009 MHz up to 30 MHz. The measurement shall show compliance of this intentional radiator. The test set-up was in accordance with the requirements of section 13 of ANSI C63.4-1992.

Preliminary radiation measurements were performed in a compact anechoic room using the active loop antenna, in accordance with section 8.2.1 of ANSI C63-4, at a 3 meter test distance. First a bandwidth plot using the peak-detector was drawn of the fundamental and spurious frequencies. See annex A for results.

The results of the preliminary measurements were used for the final measurements at the OATS. A conducting ground plane was present. Both the fundamental and the spurious emissions were measured.

In accordance with section 15.209, measurements in band 110 - 490 kHz were performed employing both the Average- and the peak- detector. The peak limit is calculated by adding 20 dB to the average limit (section 15.35(b) of 47CFR part 15).

The RF output power of the transmitter was adjusted by the manufacturer at the nominal working power.

The data presented in clause 10.4 lists the significant emission frequencies and measured levels.

10.2 Field Strength Calculation

The field strength is calculated automatically by the EMI-receiver in combination with the active loop antenna by means of a hardware plug (20 dB linear over the range 0,15 - 30 MHz).

10.3 Test Instruments Used for H-field Radiated Measurements

EMI Equipment	Type	Manufacturer	Serial no.	ORS No.	Cal interval
EMI Test receiver	ESHS 10	Rhode & Schwarz	840046/008	077969	yearly (07-98)
EMI Test receiver	ESH2	Rhode & Schwarz	872316/018	067222	yearly (05-98)
Active loop antenna	HFH-Z2	Rhode & Schwarz	335471152	067219	yearly (09-98)

10.4 Radiated magnetic field strength

Standard : FCC part 15 Subpart C section 15.209

Limits : Distance of 30 m

frequency [MHz] ¹⁾	Limit [μV/m] Quasi-peak	Limit [μV/m] Average	Limit [μV/m] Peak	Limit [dB(μV/m)] Quasi-peak	Limit [dB(μV/m)] Average	Limit [dB(μV/m)] Peak
0,09 - 0,49	2400/f for 300m	-	-	calculation	-	-
0,49 - 1,705	24000/f for 30m	-	-	calculation	-	-
1,705-10,0	-	100	1000	-	40	60
10,0 -30,0	30	-	-	29,5	-	-

¹⁾ See section 15.221, 15.225 and section 15.227 of 47CFR for specific emission requirements within the bands 225-1705 kHz, 13.553-13.567 MHz and 26.96-27.28 MHz.

Limits : Distance of 10 m

In accordance with section 15.31 f(2) of 47CFR part 15 the square of an inverse linear distance extrapolation factor (40 dB/decade) was used to calculate the limit at 10 meter measuring distance.

According to section 15.209 (d) measurements within the frequency band 110-490 KHz are based on measurements employing an average detector.

frequency [MHz]	Limit [dB(μV/m)] Quasi-peak	Limit [dB(μV/m)] Average	Limit [dB(μV/m)] Peak
0,150	-	84,1	104,1
0,1536	-	83,9	103,9
1,705-10,0	-	60,0	80,0
10,0 -30,0	49,5	-	-

10.4.1 Final Results at 3 meter

frequency [MHz]	Result QP [dB μ V/m]	Result AV [dB μ V/m]	Result Peak [dB μ V/m]
0,150	78	76	86
0,1536	78,5	76,5	87
> 0,1536	below noise level	below noise level	below noise level

Final Results : at 10 meter

frequency	Result QP [dB μ V/m]	Result AV [dB μ V/m]	Result Peak [dB μ V/m]	Limit QP [dB μ V/m]	Limit AV [dB μ V/m]	limit Peak [dB μ V/m]
0,150	40	38	48	-	84,1	104,1
0,1536	40,5	38,5	49	-	83,9	103,9
> 0,1536	below noise level	below noise level	below noise level	-	-	-

Conclusion : Pass

Test personnel:

Tester Signature:



Name : H.T. Jonker

BANDWIDTH PLOTS

The next first page shows bandwidth plots of the operating ZAPLOC. The second page of annex A shows the ambient levels while the ZAPLOC is switched off.

dBV/m

80

70

60

50

40

30

20

10

0

0.15

0.2

0.3

0.4

0.5

0.6

0.7

0.8

0.9

MHz

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