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The Netherlands
Chamber of Commerce
09076358
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Radio Test Report: 99604230

Applicant: Miele & Cie KG
Miele Strasse 2
33611 Bielefeld
Germany

Equipment Under Test: TX915; RX915, Remote Control Transmitter and Receiver

FCC ID: SYNTX915; SYNRX915

IC ID: 5669A-TX915; 5669A-RX915

In Accordance With: **FCC Part 15, Subpart B, 15.109 (10-01-04 edition)**
For receivers operating within the frequency range of 30-960 MHz.

FCC Part 15, Subpart C, 15.231 (10-01-04 edition)
For low power transmitters operating periodically in the band 40.66 - 40.77 MHz and above 70 MHz

RSS-210, issue 5 (November 2001 edition)

Tested By: Telefication bv
Edisonstraat 12a
6902 PK Zevenaar
The Netherlands

Test Engineer: _____
ing. P.A. Suringa, Senior Engineer Radio/EMC

Reviewed by: _____
ing. J.C. le Clercq, Test Engineer

Authorized by: _____
J.P. van de Poll, Co-ordinator Test Group

Date: 3 February 2005

Total Number of Pages: 25

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Section 1. Summary of Test Results

Manufacturer: Miele & Cie KG

Model No.: TX915; RX915

Serial No.: --

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart B Paragraphs 15.107, 15.109 and Subpart C, Paragraph 15.231. All tests were conducted using measurement procedure ANSI C63.4-2003. Radiated emissions are made on an open area test site.
A description of the test facility is on file with the FCC (FCC listed 90828, IC listed 3501).

☒ New Submission ☒ Production Unit

☐ Class II Permissive Change ☐ Pre-Production Unit

D	S	C

Equipment Code

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.
See " Summary of Test Data".

Summary of Test Data

Receiver:

Name of test	Paragraph number	Results
Power line conducted emissions	15.107	Complies
Radiated emissions	15.109	Complies
Antenna power conducted limits for receivers	15.111	N/A

Transmitter:

Name of test	Paragraph number	Results
Antenna requirement	15.203	N/A
External radio frequency power amplifiers and antenna modifications	15.204	N/A
Conducted emissions	15.207	N/A
Transmission requirements	15.231(a)	Complies
Radiated emissions	15.231(b)	Complies
Occupied bandwidth	15.231(c)	Complies
Frequency tolerance	15.231(d)	N/A
Periodic alternate field strength requirements	15.231(e)	N/A

Footnotes for N/A's:

§ 15.203 is not applicable because the transmitter is provided with an integral antenna.

§ 15.204 is not applicable because the transmitter is provided with an integral antenna.

§ 15.207 is not applicable because the transmitter is wireless.

§ 15.111 is not applicable because no terminals for external receiving antennas exist.

§ 15.231(d) has not been tested, because the Equipment Under Test does not operate within the frequency band 40.66-40.70 MHz.

§ 15.231(e) has not been tested, because the Equipment Under Test complies with § 15.231(a)

Test Conditions:

Indoor Temperature: 22 °C
Humidity: 45 %

Outdoor Temperature: 3.5 °C
Humidity: 6 %

Section 2. Equipment under Test (E.U.T.)

General Equipment Information

Frequency range:	915 MHz
Operating frequency of sample:	915 MHz
Type of emission:	ON/OFF keying of RF carrier
Emission designator:	4K50A1D
Supply power requirement:	Transmitter: 3.0 V_{dc} Receiver: 3.0 V_{dc}
Duty cycle calculation:	(0.2 msec/0.4 msec) ∗ 100 = 50 %

Description of E.U.T.

The transmitter serves as a remote control for a vacuum cleaner and is located in the handle of the vacuum cleaner's tube.
The accompanying receiver is located in the vacuum cleaner's housing. The system uses a frequency of 915 MHz.

Modifications incorporated in E.U.T.

None.

Theory of operation

The transmitter's IC 2 is designed for applications with carrier frequencies from 850 to 930 MHz, e.g. the US 915 MHz ISM band.
IC 2 contains an integrated PLL synthesizer of which the VCO output feeds the integrated power amplifier (PA). The PA can be ASK modulated. This turns the internal current sources of the PA on and off and therefore leads to an ASK signal at the RF output.
The RF output drives a loop antenna.

The receiver consists of IC 1, which is a single conversion super heterodyne receiver designed for applications with carrier frequencies ranging from 800 to 930 MHz. The receiver features received signal strength indication (RSSI), which for ASK reception, feeds to an ASK detector. The ASK detector is constituted by an integrated operational amplifier which precedes the IF demodulator.
RF front-end filtering is realized by using a SAW filtering in front of the LNA.

Section 3. Radiated emissions for receivers

NAME OF TEST: Radiated emissions	PARA. NO.: 15.109
TESTED BY: P.A. Suringa	DATE: 26 January 2005

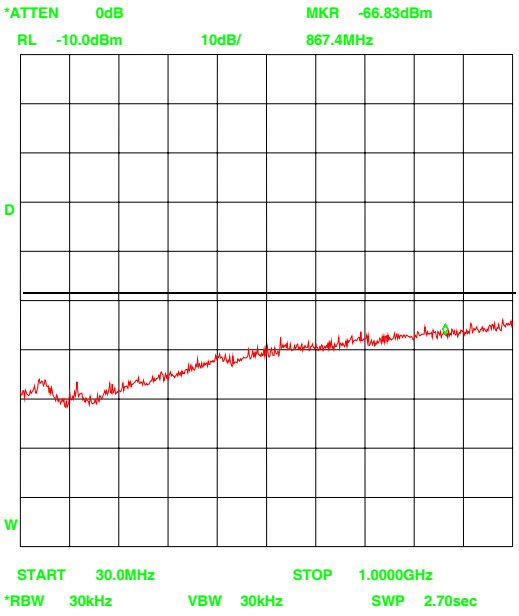
The field strength of radiated emissions from unintentional radiators at a distance of 3 metres shall not exceed the following values:

Frequency of emission (MHz)	Field strength (µV/m)
30-88	100
88-216	150
216-960	200
Above 960	500

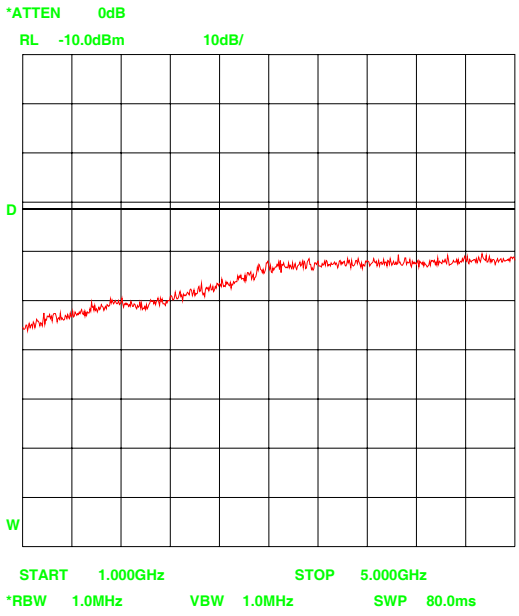
Test Results: Complies.

Test Data: See plots (units in dBm E.(I.)R.P.)

Horizontal polarization

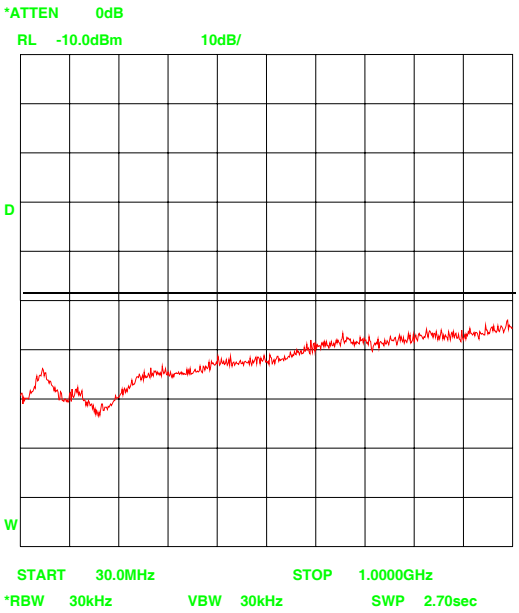


Limit line: -57.4 dBm

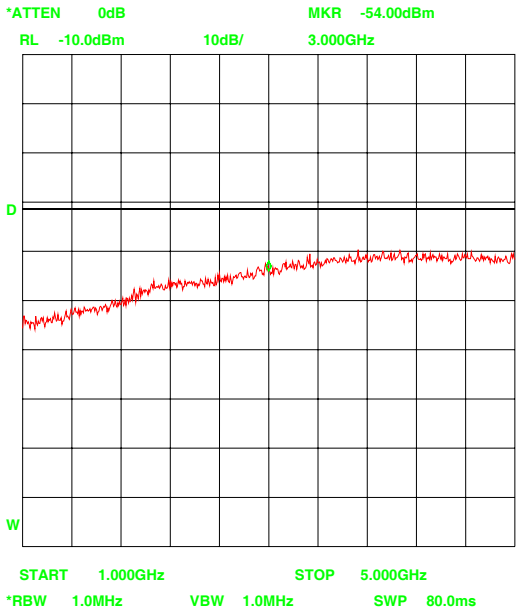


Limit line: -41.4 dBm

Vertical polarization



Limit line: -57.4 dBm



Limit line: -41.4 dBm

Note:
The (worst case) limit in dBµV/m at 3 meters has been converted to E.R.P.(E.I.R.P.), in terms of dBm, by subtracting 97.4 (95.4)dB.

Section 4. Power line conducted emissions

NAME OF TEST: Power line conducted emissions	PARA. NO.: 15.107
TESTED BY: P.A. Suringa	DATE: 26 January 2005

Minimum Standard:

Frequency (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56*	56 to 46*
0.5 - 5	56	46
5 - 30.0	60	50

* Decreases with the logarithm of the frequency.

Test Results: Complies.

Test Data: See tables.

Measurement Data:

Time: 16:50:43 Date: 26-01-2005

Signal measured on "Neutral".

Measurement =>	QPeak			Av		
Range	Frequency (MHz)	Level dB (uV)	Limit dB (uV)	Frequency (MHz)	Level dB (uV)	Limit dB (uV)
01	Below	30.0	64.9	Below	30.0	54.9
02	Below	30.0	62.7	Below	30.0	52.7
03	Below	30.0	60.5	Below	30.0	50.5
04	Below	30.0	58.3	Below	30.0	48.3
05	Below	30.0	56.1	Below	30.0	46.1
06	Below	30.0	56	Below	30.0	46
07	Below	30.0	56	Below	30.0	46
08	Below	30.0	56	Below	30.0	46
09	Below	30.0	56	Below	30.0	46
10	Below	30.0	56	Below	30.0	46
11	Below	30.0	56	Below	30.0	46
12	Below	30.0	56	Below	30.0	46
13	Below	30.0	56	Below	30.0	46
14	Below	30.0	60	Below	30.0	50
15	Below	30.0	60	Below	30.0	50
16	Below	30.0	60	Below	30.0	50
17	Below	30.0	60	Below	30.0	50
18	Below	30.0	60	Below	30.0	50
19	Below	30.0	60	Below	30.0	50
20	Below	30.0	60	Below	30.0	50

This product is in compliance with § 15.107

* ==> exceeding the limit

The frequency range 0.15 - 30 MHz is divided into 20 subranges.
For every subrange the highest emission component is given in the table.

In ranges marked "Below" the maximum level of the components measured,
is below 30 dBuV. For this evaluation, peak detection is used.

Time: 16:53:48 Date: 26-01-2005

Signal measured on "Live".

Measurement =>	QPeak			Av		
Range	Frequency (MHz)	Level dB (uV)	Limit dB (uV)	Frequency (MHz)	Level dB (uV)	Limit dB (uV)
01	Below	30.0	64.9	Below	30.0	54.9
02	Below	30.0	62.7	Below	30.0	52.7
03	Below	30.0	60.5	Below	30.0	50.5
04	Below	30.0	58.3	Below	30.0	48.3
05	Below	30.0	56.1	Below	30.0	46.1
06	Below	30.0	56	Below	30.0	46
07	Below	30.0	56	Below	30.0	46
08	Below	30.0	56	Below	30.0	46
09	Below	30.0	56	Below	30.0	46
10	Below	30.0	56	Below	30.0	46
11	Below	30.0	56	Below	30.0	46
12	Below	30.0	56	Below	30.0	46
13	Below	30.0	56	Below	30.0	46
14	Below	30.0	60	Below	30.0	50
15	Below	30.0	60	Below	30.0	50
16	Below	30.0	60	Below	30.0	50
17	Below	30.0	60	Below	30.0	50
18	Below	30.0	60	Below	30.0	50
19	Below	30.0	60	Below	30.0	50
20	Below	30.0	60	Below	30.0	50

This product is in compliance with § 15.107

* ==> exceeding the limit

The frequency range 0.15 - 30 MHz is divided into 20 subranges.
For every subrange the highest emission component is given in the table.

In ranges marked "Below" the maximum level of the components measured,
is below 30 dBuV. For this evaluation, peak detection is used.

Section 5. Transmission requirements

NAME OF TEST: Transmission requirements	PARA. NO.: 15.231(a)
TESTED BY: P.A. Suringa	DATE: 26 January 2005

Minimum Standard:

15.231(a) Continuous transmissions such as voice, video or data transmissions are not permitted.

15.231(a)(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds after being released.

15.231(a)(2) A transmitter activated automatically shall cease transmission within 5 seconds of activation.

15.231(a)(3) Periodic transmissions at regular pre-determined intervals are not permitted. However polling or supervisory transmissions to determine system integrity of transmitters used in security or safety applications are allowed if the periodic rate of transmission does not exceed one transmission of not more than one second duration per hour for each transmitter.

15.231(a)(4) Intentional radiators, which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm.

Test Results: Complies

Test Data: Compliance was determined by verification of technical specifications and a functional test on the equipment.

Rationale for compliance with transmission requirements

15.231(a) : complies

15.231(a)(1) : complies, deactivation within 5 seconds after release

15.231(a)(2) : not applicable

15.231(a)(3) : not applicable

15.231(a)(4) : not applicable

Section 6. Radiated Emissions

NAME OF TEST: Radiated Emissions	PARA. NO.: 15.231(b)
TESTED BY: P.A. Suringa	DATE: 26 January 2005

Minimum standard:

Permissible field strength limits (Momentarily operated devices

Fundamental Frequency (MHz)	Field Strength of Fundamental Microvolts/Meter at 3 meters	Field Strength of Unwanted Emissions Microvolts/Meter at 3 meters
40.66 - 40.70	2,250	225
70-130	1, 250	125
130-174	1,250 to 3,750[#]	125 to 375
174-260	3,750	375
260-470	3,750 to 12,500*	375 to 1,250
Above 470	12,500	1,250

Notes:

Use quasi-peak or averaging meter.
Linear interpolation with frequency F in MHz
[#]For 130 - 174 MHz: FS (microvolts/m) = (56.82 x F) - 6136
[*]For 260 - 470 MHz: FS (microvolts/m) = (41.67 x F) - 7083

Any emissions that fall within the restricted bands of 15.205 shall not exceed the following limits:

Frequency (MHz)	Field Strength (µV/m @ 3m)	Field Strength (dBµV/m @ 3m)
30 – 88	100	40.0
88 – 216	150	43.5
216 – 960	200	46.0
Above 960	500	54.0

Test Results: Complies. The worst-case emission level is 73.0 dBµV/m @ 3m at 915 MHz.
This is 9 dB below the specification limit.

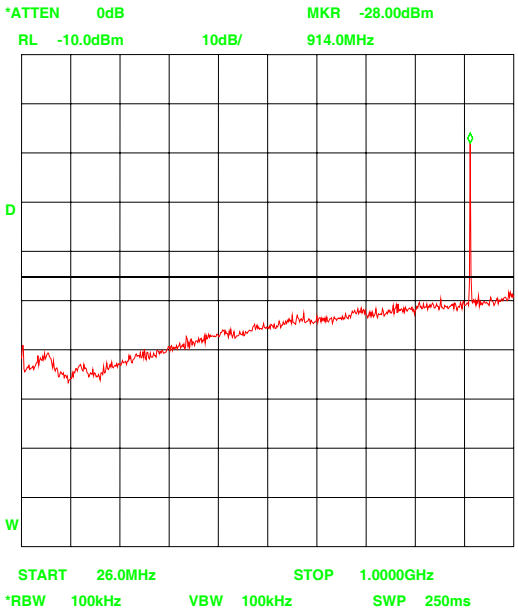
Test Data: See attached graphs and table.

Above 1 GHz a spectrum analyzer and low noise amplifier are used to measure emission levels. The spectrum analyzer resolution bandwidth was set to 1 MHz and video bandwidth was 1 MHz.

Test Data – Radiated Emissions

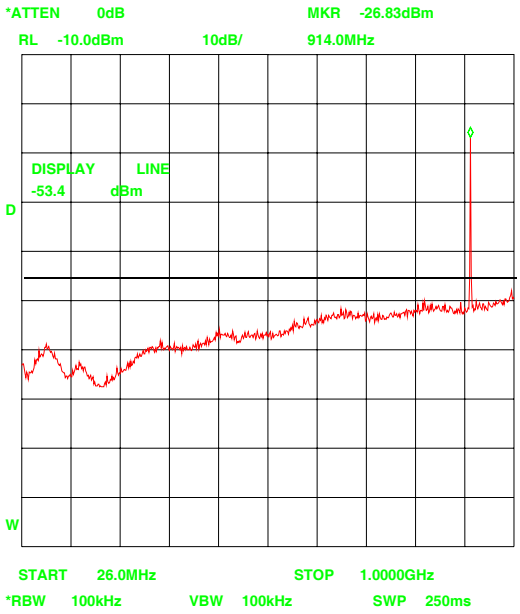
Pre scan graphs 30 MHz to 1 GHz

Horizontal polarization



Limit line: -55.5 dBm

Vertical polarization



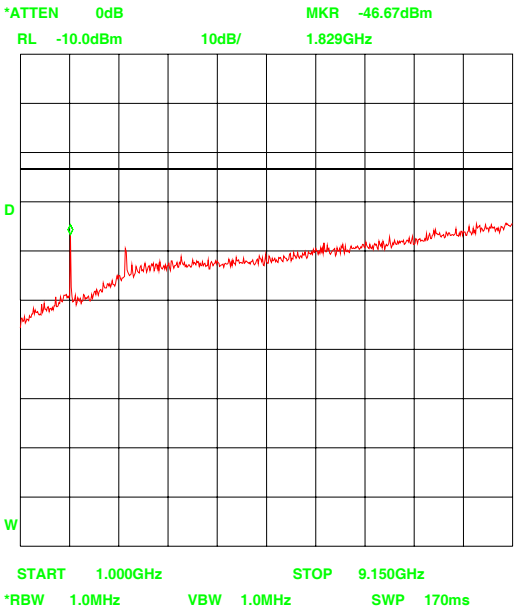
Limit line: -55.5 dBm

Note: units in dBm E.R.P.

The (worst case) limit in dBµV/m at 3 meters has been converted to E.R.P., in terms of dBm, by subtracting 97.4 dB.

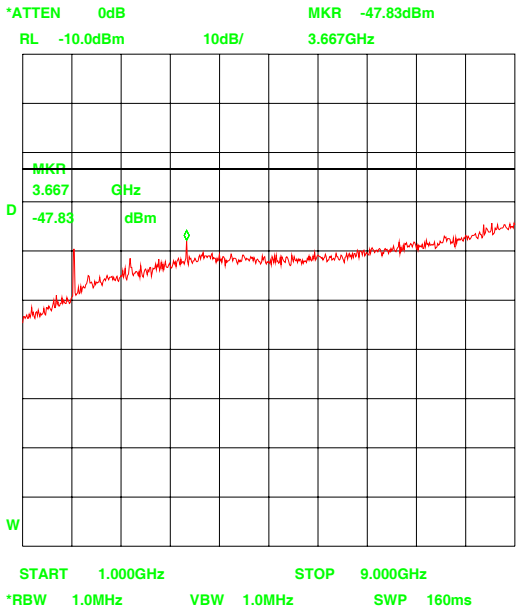
Graphs 1 GHz and above

Horizontal polarization



Limit line: -33.5 dBm

Vertical polarization



Limit line: -33.5 dBm

Note: units in dBm E.I.R.P.
The limit in dBµV/m at 3 meters has been converted to E.I.R.P., in terms of dBm, by subtracting 95.4 dB.

Note: The sample was in continuous unmodulated transmitting mode.

Test Distance (meters) : 3		**Range: 1-4 m**		**Receiver: R&S ECCS 30**		**RBW (kHz): 120**		**Detector: Quasi peak**			
Freq. (MHz)	**Ant.**	**Pol. (V/H)**	**Ant. HGT. (m)**	**Table (deg.)**	**RCVD Signal (dBµV)**	**Ant. Factor (dB)****	**Amp. Gain (dB)*****	**Dist. Corr. (dB)**	**Field Strength (dBµV/m)**	**Limit (dBµV/m)**	**Margin (dB)**
915	B/L	V	--	--	39.6	33.3	--	--	73.0	82.0	9.0
915	B/L	H	--	--	39.7	33.3	--	--	72.9	82.0	9.1

Notes:
B/C = Biconical, B/L = Biconilog, L/P = Log-Periodic, H = Horn, D/P = Dipole
* Re-measured using dipole antenna.
** Includes cable loss when amplifier is not used.
*** Includes cable loss.
( ) Denotes failing emission level.

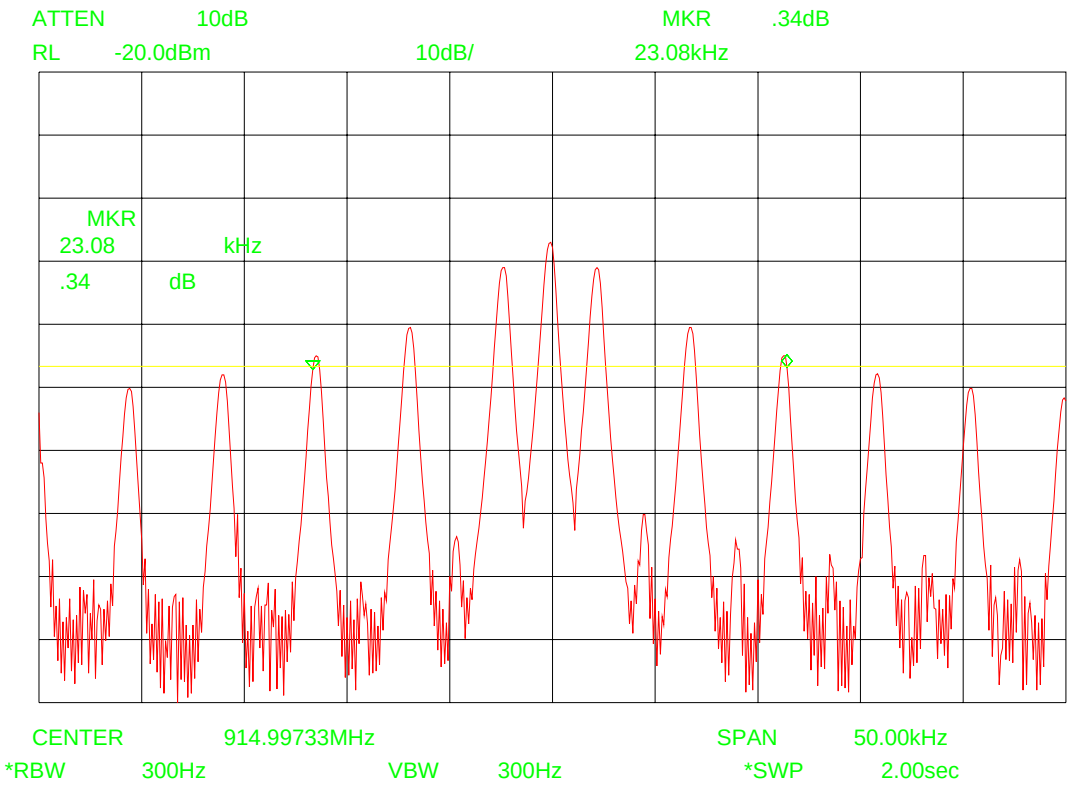
Section 7. Occupied bandwidth

NAME OF TEST: Occupied bandwidth	PARA. NO.: 15.231(c)
TESTED BY: P.A. Suringa	DATE: 26 January 2005

Minimum Standard: 15.231(c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Test Results: Complies.

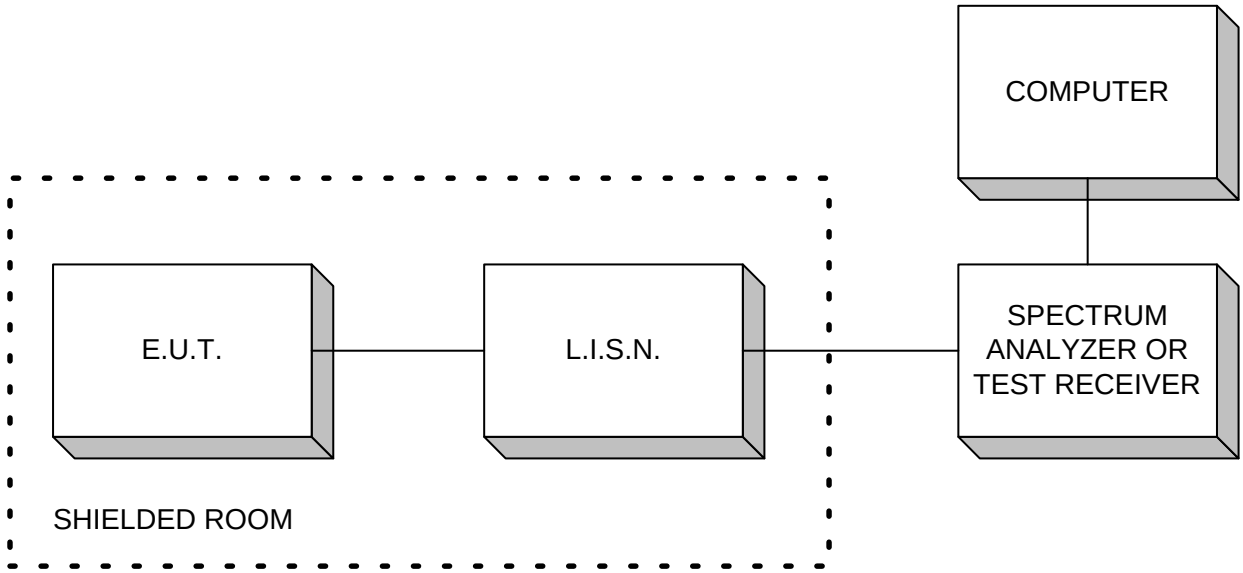
Test Data: See graph.



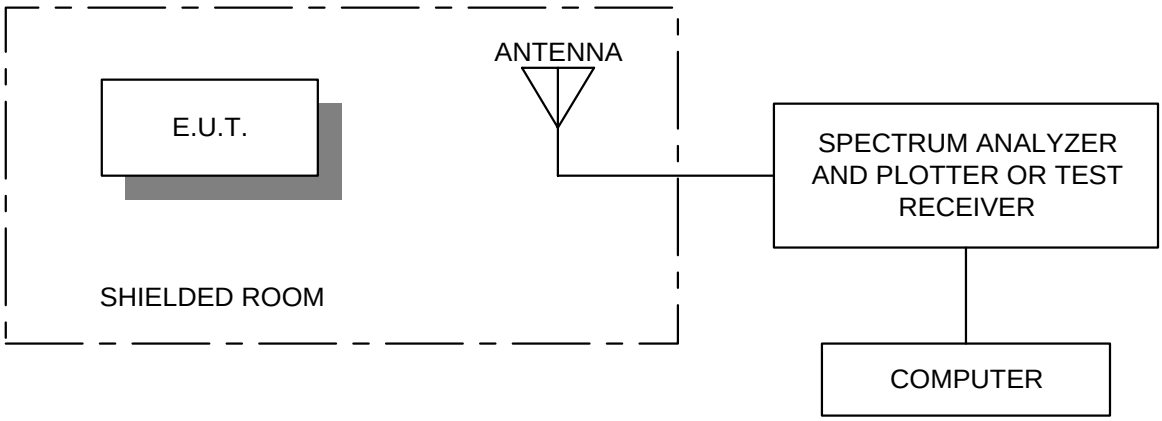
Measured bandwidth: 23.08 kHz

Section 8. Block Diagrams

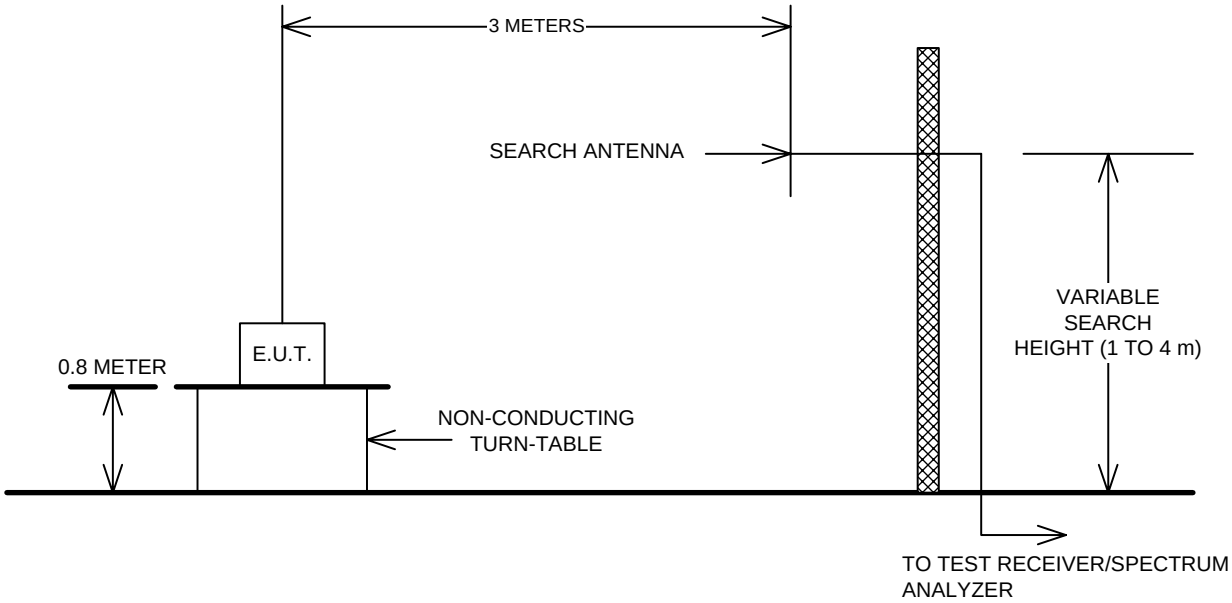
Conducted Emissions



Radiated Prescan

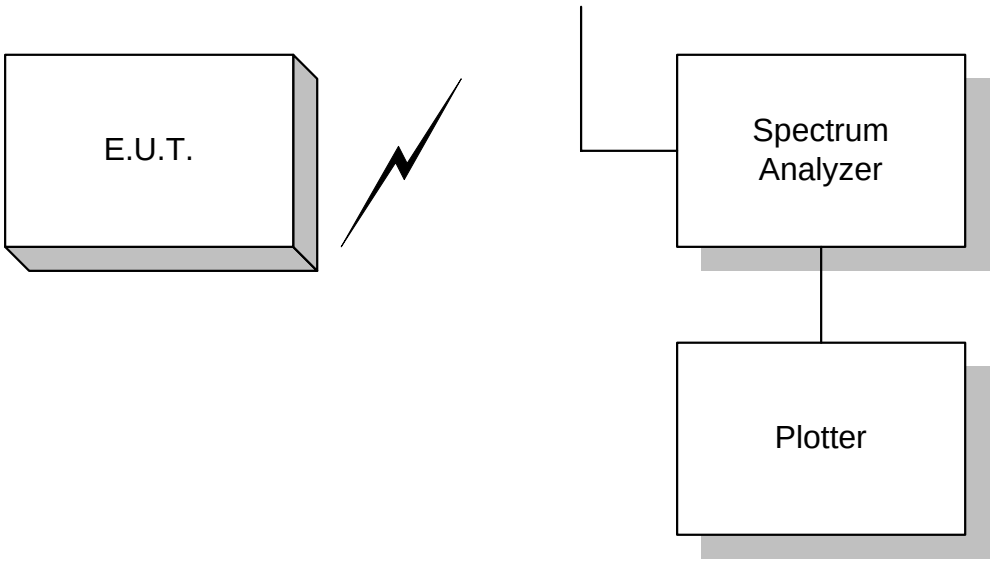


Outdoor Test Site For Radiated Emissions



The spectrum was searched up to the 10th harmonic of the fundamental frequency of operation.

Occupied Bandwidth



Section 9. Test Equipment List

Description	Manufacturer	Model	Identification	Used at
Anechoic chamber	Euroshield	RFD-F-100	--	15.109, 15.205, 15.231
Open Area Test Site	Comtest	TNO EPS	13886	15.109, 15.205, 15.231
Spectrum analyzer	Hewlett Packard	8563E	TE 00481	15.109, 15.111, 15.205, 15.231
Test receiver	Rohde & Schwarz	ESVP	TE 00091	15.231
Test receiver	Rohde & Schwarz	ESH3	TE 00205	15.207
Test receiver	Rohde & Schwarz	ESCS 30	S/n 15667	15.109, 15.205, 15.231
Biconilog antenna	EMCO	3143	TE 00744	15.109, 15.205, 15.231
Biconilog antenna	Chase	CBL6111B	S/n 15633	15.109, 15.205, 15.231
Double ridged guide horn antenna	EMCO	3115	TE 00531	15.109, 15.205, 15.231
Pre-amplifier	Hewlett Packard	8449B	TE 00092	15.109, 15.111, 15.205, 15.231
Pre-amplifier	Rohde & Schwarz	ESV-Z3	TE 00098	15.109, 15.111, 15.205, 15.231
Pulse limiter	Rohde & Schwarz	ESH3-Z2	TE 00027	15.207
Artificial Mains Network	Rohde & Schwarz	ESH3-Z5	TE 00208	15.207

ANNEX A

RESTRICTED BANDS

Section A Restricted bands of operation

NAME OF TEST: restricted bands of operation	PARA. NO.: 15.205
TESTED BY: psuringa	DATE: 18 November 2003

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42-16.423	399.9-410	4.5-5.15
0.49 - 0.51	16.69475-16.69525	608-614	5.35-5.46
2.1735 - 2.1905	16.80425-16.80475	960-1240	7.25-7.75
3.020 - 3.026	25.5-25.67	1300-1427	8.025-8.5
4.125 - 4.128	37.5-38.25	1435-1626.6	9.0-9.2
4.17725 - 4.17775	73-74.6	1645.5-1646.5	9.3-9.5
4.20725 - 4.20775	74.8-75.2	1660-1710	10.6-12.7
6.215 - 6.218	108-121.94	1718.8-1722.2	13.25-13.4
6.31175 - 6.31225	123-138	2220-2300	14.47-14.5
8.291 - 8.294	149.9-150.05	2310-2390	15.35-16.2
8.362 - 8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625 - 8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425 - 8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29 - 12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975 - 12.52025	240-285	3345.8-3358	36.43-36.5
12.57675 - 12.57725	322-335.4	3600-4400	Above 38.6
13.36 - 13.41			

No signals in the restricted bands emitted by the transmitter have been found.

No signals in the restricted bands emitted by the receiver have been found.

Section B IC - FCC cross reference table

Cross reference table

Transmitter		
CNR RSS-210 Issue 5		**FCC 47 CFR Ch. 1 part 15, subpart C (10-1-04 Edition)**
par. 6.1.1 (a)		§ 15.231 (a)
Par. 6.1.1 (b)		§ 15.231 (b)
par. 6.1.1 (c)		§ 15.231 (c)
par. 6.1.1 (d)		§ 15.231 (d)
Par. 6.1.1 (e)		§ 15.231 (e)
Par. 6.1.1 (f)	Par. 6.3	§ 15.205
	Par. 6.4	§ 15.231 (d)
	Par. 6.5	§ 15.35 (b), (c)
	Par. 6.6	§ 15.207

Category I non - scanning receiver	
CNR RSS-210 Issue 5	**FCC 47 CFR Ch. 1 part 15 subpart B (10-1-04 Edition)**
Par. 7.2	§ 15.111 (a)
Par. 7.3	§ 15.109
Par. 7.4	§ 15.107