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EMC test of SC 645 (3 appendices)

Test object

IR Camera SC 645 (article nr: T197 715, serial no: 549 00 647),
powered by AC/DC adaptor CMP S024EM1200200 (article nr: T910750).

Summary

Standard	Compliant	Appendix
FCC 47 CFR part 15 B	Yes	
15.107 Conducted emission, class B	Yes	2
15.109 Radiated emission, class B	Yes	3

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Appendix 1

Purpose of test

The tests were performed to verify that the electromagnetic emission from the test object meet the requirements of FCC Part 15 B.

Test facility

The used anechoic chamber is compliant with the requirements of section 2.948 of the FCC rules and listed, registration number 96866, as a facility accepted for certification under parts 15 and 18. The site complies with RSS Gen, Issue 2 and is accepted by Industry Canada for the performance of radiated measurements, file number IC 3482A-2.

Measurement equipment

Measurement equipment	Calibration Due	SP number
Test site Tesla	2010-10	503 881
Test site Edison	2009-07	504 114
R&S EMI test receiver ESIB 26	2009-07	503 292
R&S EMI test receiver ESIB 26	2009-07	503 885
LISN Schwarzbeck NNLA 8120	2011-04	500 574
LISN Schwarzbeck NNLK 8121	2011-02	502 112
LISN Schwarzbeck NSLK 8126	2011-04	503 114
Chase Bilog antenna CBL 6111A	2011-11	503 182
Antenna Schaffner CBL 6143	2010-03	504 079
EMCO Horn Antenna 3115	2011-02	501 548
EMCO Horn Antenna 3115	2011-01	502 175
EMCO Horn Antenna 3115	2012-03	504 194
Flann Standard gain horn 16240-25	-	503 939
Flann Standard gain horn 18240-25	-	503 900
Flann Standard gain horn 20240-20	-	503 674
MITEQ Low Noise Amplifier	2009-06	503 277
MITEQ Low Noise Amplifier	2009-06	503 285
MITEQ Low Noise Amplifier	2009-08	504 160
Temperature and humidity meter Testo 615	2009-11	503 505
Temperature and humidity meter Testo 625	2009-08	504 117

Appendix 1

Operational test mode

The EUT was set in normal operational mode during the emission measurements. It was exercised by the FLIR Research IR application during the conducted emission measurements and by FLIR camera player application during the radiated emission measurements. The applications were running on the minimal system PC.

Cabling during conducted emission test:

I/O port	Cable type	Cable length	Termination
120 V AC input	Unshielded	-	Connected to LISN with 1m cable
Ethernet	Cat 6, shielded	1 m	Connected to gigabit router through ISN. The cable length between EUT and ISN was 1m
USB	Shielded USB (art nr. 1919423)	2 m	No termination, bundled
Digital I/O	Unshielded ribbon cable	2 m	No termination, bundled

Cabling during radiated emission test:

EUT port	Cable type	Cable length	Termination
120 V AC input	Unshielded	-	Connected to power outlet
Ethernet	Cat 6, shielded	1.5 m	No termination, bundled
USB	Shielded USB (art nr. 1919423)	2 m	Test PC
Digital I/O	Unshielded ribbon cable	2 m	No termination, bundled

The highest frequency generated in the EUT was 240 MHz.

Connected equipment during the test (“minimum system”)

PC, Siemens-Fujitsu Espiro C5910 IQ963, s/n YKUE007869	Client equipment
PC Monitor, Dell 1907FPc, s/n CN-0CC300-64180-68U-278S	Client equipment
PC Mouse, M-UAE96931737-0000	Client equipment
PC Keyboard, Fujitsu-Siemens KBPCSXUSB	Client equipment
Gigabit Router, Cisco RVS 4000	Client equipment

Uncertainties

Measurement and test instrument uncertainties are described in the quality assurance documentation ”EL-QD 8.2”. The measurement uncertainties can be found in the table below. The uncertainties are calculated with a coverage factor k=2 (95% level of confidence).

The measurement uncertainties can be found in the table below:

Method	Uncertainty
Radiated emission, 30 – 1000 MHz	4.8/5.6 dB (V/H-pol)
Radiated emission, 1 – 40 GHz	2.6 dB
Conducted emission	3.5 dB



Appendix 1

Reservation

The test results in this report apply only to the particular test object as declared in the report.

Delivery of test object

The client delivered the test object at the date of the test.

Test participant

Göran Skedung, Flir Systems AB

Test engineers

Martin Forsberg

Appendix 2

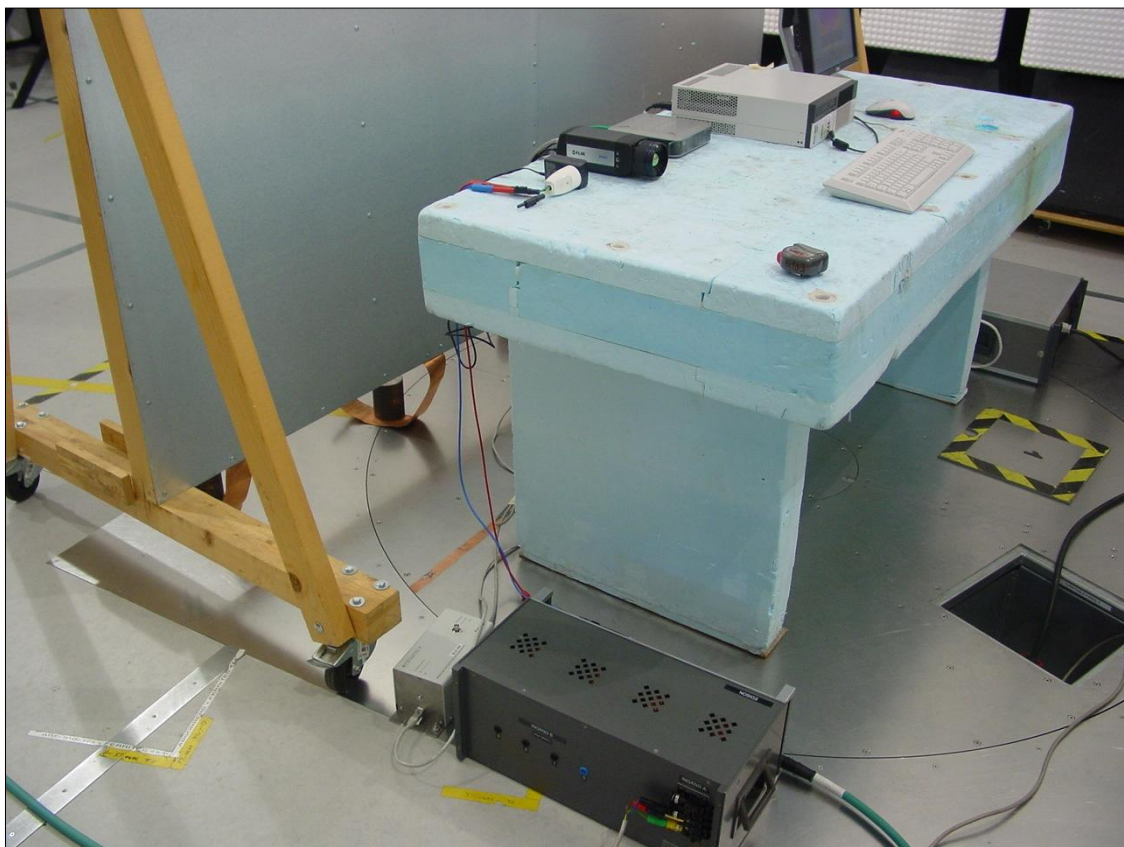
Conducted emission measurements according to FCC 47 CFR part 15.107, class B

Date 2010-05-04	Temperature 20 °C ± 3 °C	Humidity 27 % ± 5 %
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Test set-up and procedure

Measurements were performed on the 120 V AC/60 Hz, phase and neutral conductors.

Test set-up during the tests can be found below.



Measurement equipment	SP number
Semi anechoic chamber, Edison	504 114
EMI measurement computer	-
R&S EMI test receiver ESIB 26	503 885
Software: R&S EMC32, ver. 6.10.10	503 897
LISN Schwarzbeck NNLA 8120	500 574
Temperature and humidity meter Testo 625	504 117



Appendix 2

Result

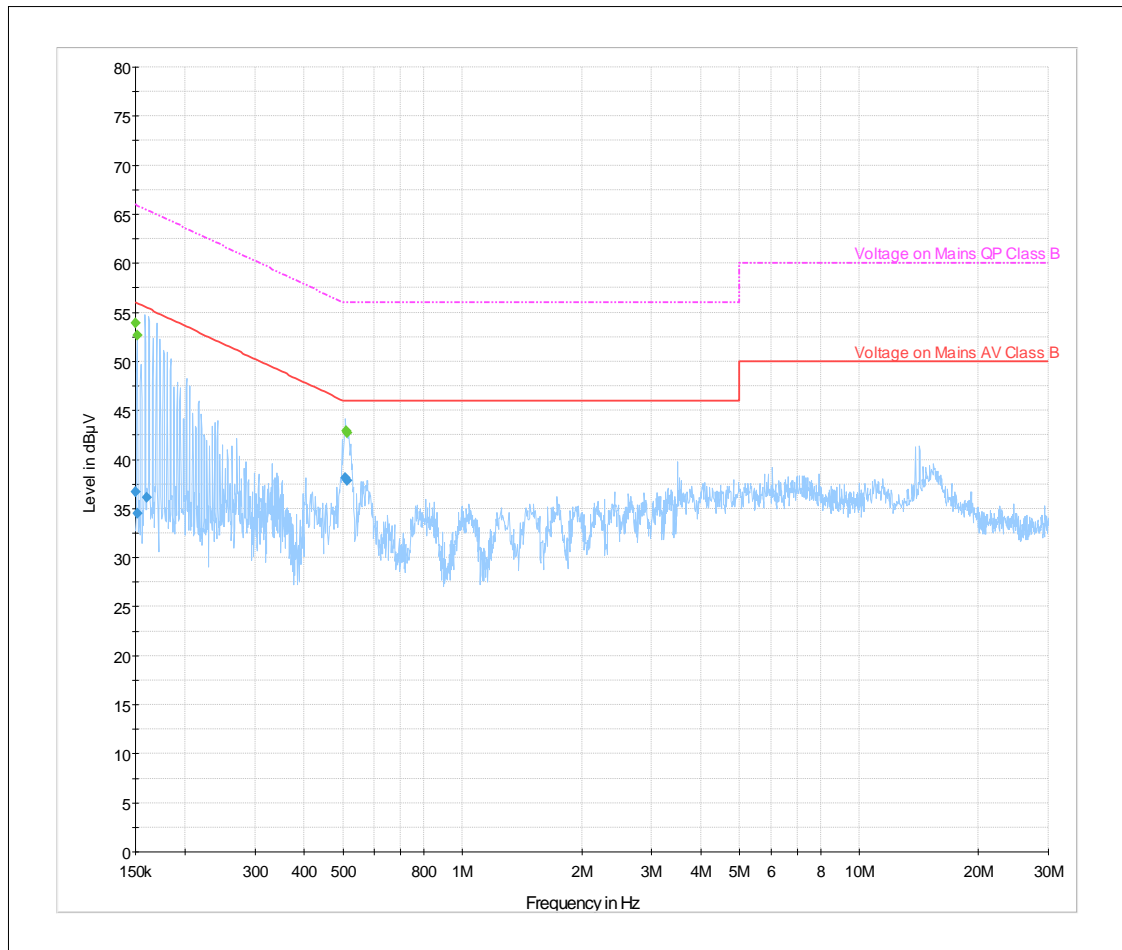
The conducted emission spectra can be found in appendix 2.1.

Diagram 1:	Phase conductor
Diagram 2:	Neutral conductor

Emission below limit?	Yes
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Appendix 2.1

Diagram 1: Phase conductor

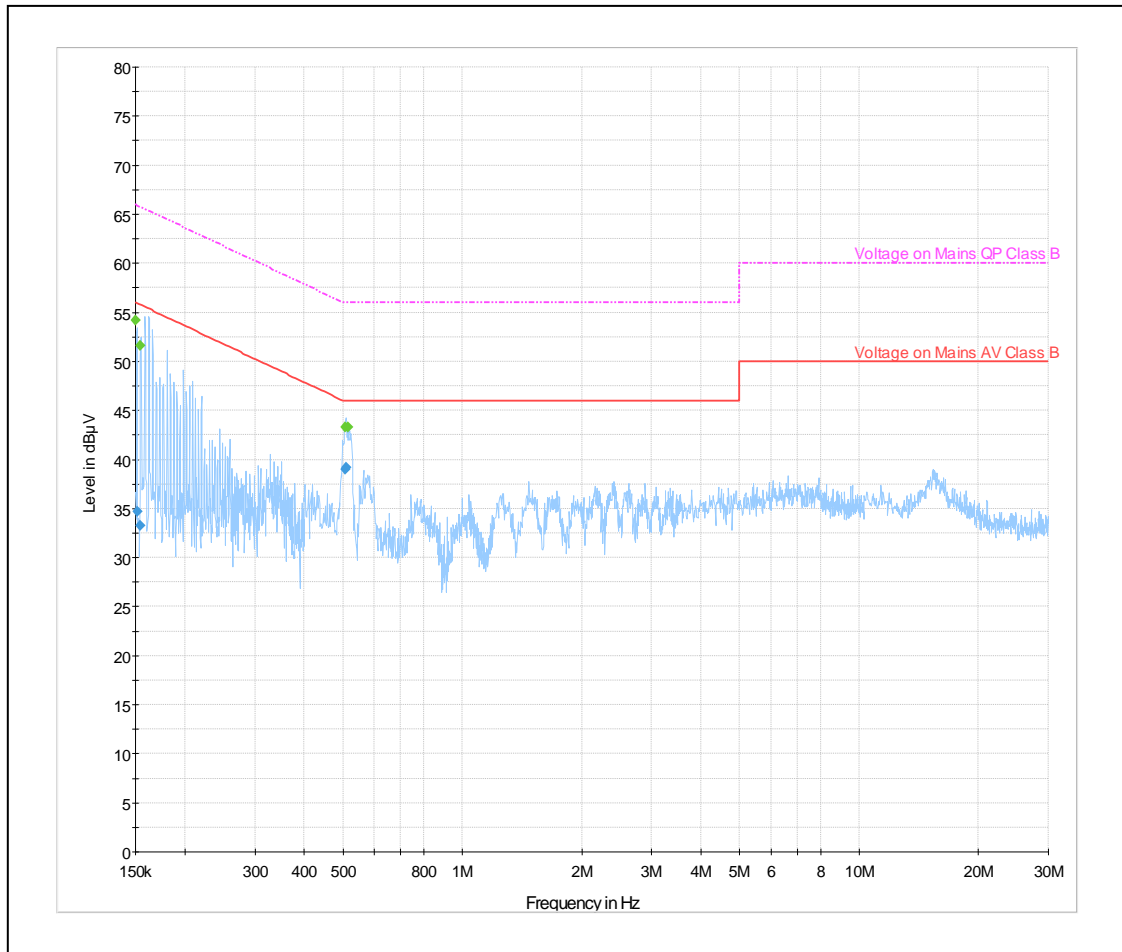


Frequency MHz	Average dBµV	Meas. Time ms	Bandwidth kHz	Margin dB	Limit dBµV
0.150	36.66	5000	9	19.30	56.00
0.152	34.53	5000	9	21.40	55.89
0.160	36.16	5000	9	19.30	55.46
0.507	38.13	5000	9	7.90	46.00
0.511	37.82	5000	9	8.20	46.00

Frequency MHz	QuasiPeak dBµV	Meas. Time ms	Bandwidth kHz	Margin dB	Limit dBµV
0.150	53.91	5000	9	12.10	66.00
0.152	52.63	5000	9	13.30	65.89
0.509	42.93	5000	9	13.10	56.00
0.513	42.72	5000	9	13.30	56.00

Appendix 2.1

Diagram 2: Neutral conductor



Frequency MHz	Average dBµV	Meas. Time ms	Bandwidth kHz	Margin dB	Limit dBµV
0.152	34.72	5000	9	21.20	55.89
0.154	33.29	5000	9	22.50	55.78
0.507	39.04	5000	9	7.00	46.00
0.508	39.16	5000	9	6.80	46.00

Frequency MHz	QuasiPeak dBµV	Meas. Time ms	Bandwidth kHz	Margin dB	Limit dBµV
0.150	54.16	5000	9	11.80	66.00
0.154	51.63	5000	9	14.20	65.78
0.507	43.27	5000	9	12.70	56.00
0.514	43.29	5000	9	12.70	56.00

Appendix 3

Radiated emission measurements according to FCC 47 CFR part 15.109, class B

Date 2010-05-04	Temperature 20 °C ± 3 °C	Humidity 27 % ± 5 %
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Test set-up and procedure

The measurements were performed according to ANSI C63.4-2003.

The test of radiated emission was performed in a semi anechoic chamber. The measurements were performed with both horizontal and vertical polarization of the antenna. The antenna distance was 3 m.

The measurement procedure is as the following:

1. A pre-measurement is performed with peak detector. The test object is measured in eight directions with the antenna at three heights, 1.0 m, 1.5 m and 2.0 m.
2. If the emission is close or above the limit during the pre-measurement, the test object is scanned 360 degrees and the antenna height scanned from 1 to 4 m for maximum response. Then the emission is measured with the quasi-peak detector on frequencies below 1 GHz and with the average detector above 1 GHz.

Test set-up during the tests can be seen below.



Appendix 3

Measurement equipment	SP number
Anechoic chamber, Edison	504 114
R&S EMI test receiver ESIB 26	503 885
Control computer, Fujitsu Siemens	-
Software: R&S EMC32, ver. 6.10.10	503 899
Antenna Schaffner CBL 6143	504 079
Horn antenna EMCO 3115	501 548
MITEQ Low Noise Amplifier	504 160
Temperature and humidity meter Testo 615	503 505

Result

The emission spectra can be found in appendix 3.1.

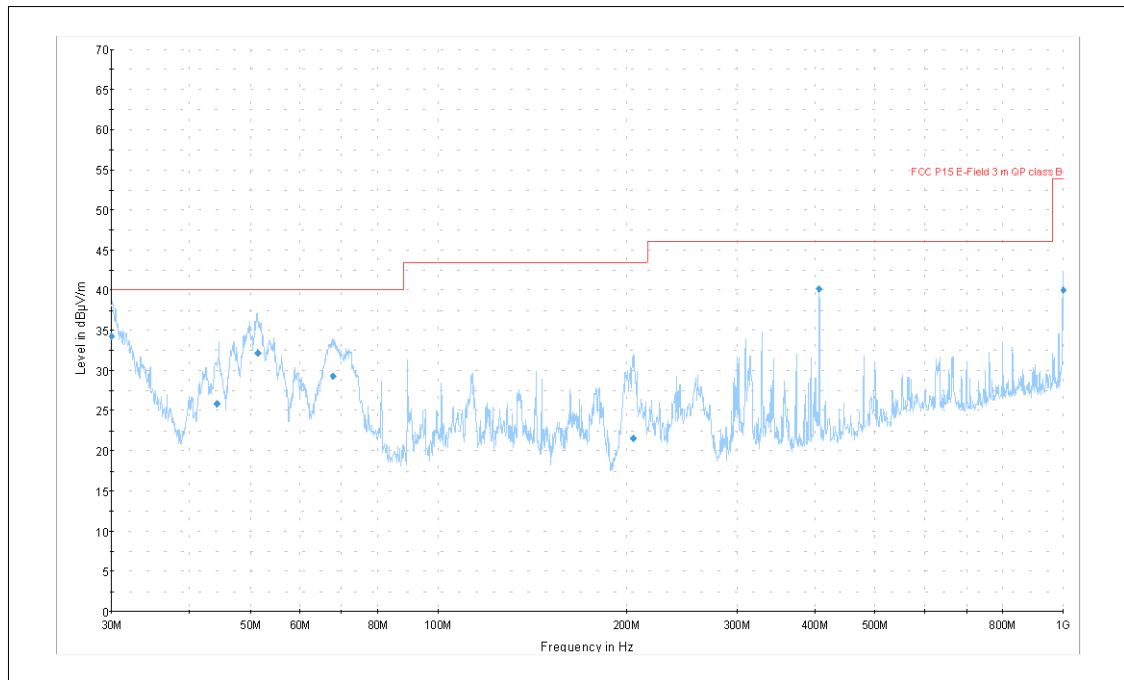
Diagram 1: Radiated emission 30-1000 MHz vertical and horizontal polarization.

Diagram 2: Radiated emission 1-2 GHz vertical and horizontal polarization.

Emission below limit?	Yes
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Appendix 3.1

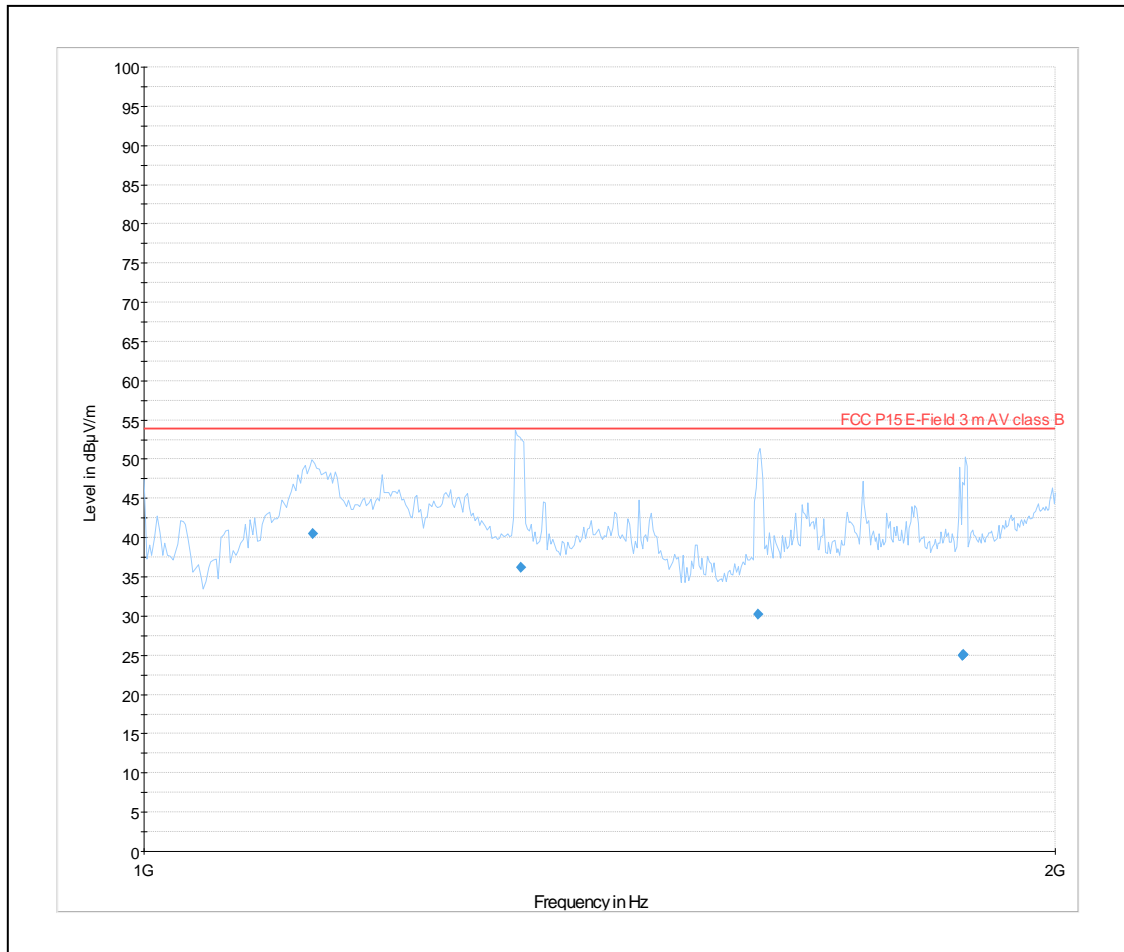
Diagram 1: Radiated emission 30-1000 MHz vertical and horizontal polarization



Frequency MHz	QuasiPeak dBµV/m	Antenna height cm	Polarity	Turntable position deg	Margin dB	Limit dBµV/m
30.01	34.3	109	V	10	5.7	40.0
44.18	25.9	109	V	97	14.1	40.0
51.45	32.2	109	V	174	7.8	40.0
67.86	29.4	189	V	88	10.6	40.0
204.82	21.6	100	V	0	21.9	43.5
406.25	40.2	100	H	318	5.8	46.0
999.74	40.0	108	V	352	13.9	53.9

Appendix 3.1

Diagram 2: Radiated emission 1-2 GHz vertical and horizontal polarization



v	Average	Antenna height	Polarity	Turntable position	Margin	Limit
MHz	dBµV/m	cm		deg	dB	dBµV/m
1137.30	40.5	108	V	10	13.4	53.9
1331.51	36.2	137	V	5	17.7	53.9
1595.74	30.2	119	V	5	23.7	53.9
1863.62	25.0	131	V	340	28.9	53.9
1864.58	25.1	137	V	24	28.8	53.9