1 TEST REPORT

1.1 System test configuration

1.1.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it). Typical antennas was presented to the Universal Laundry Reading Station, which was itself connected to a personal computer. It has been tested with a laptop Dell Latitude CP mod PPL.

1.1.2 EUT Exercise software

The EUT exercise program (Hyper terminal running under windows 95) used during radiated and conducted testing was designed to exercise the Universal Laundry Reading Station in a manner similar to a typical use (reading the TAG in loop)

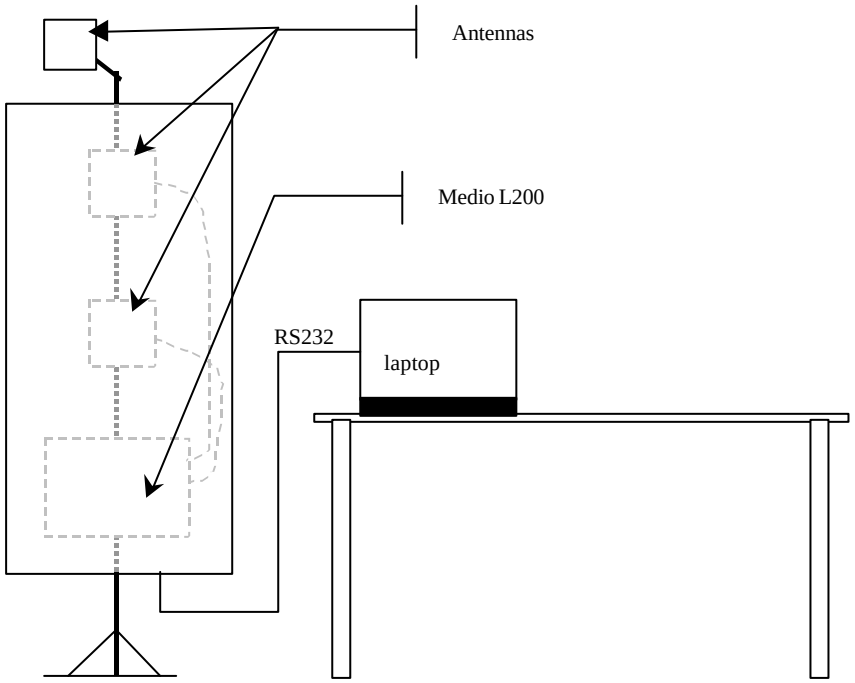
1.1.3 Special accessories

The cable used to connect the Universal Laundry Reading Station, to RS232 ports of the Personal Computer is shielded and attached to the product. It is connected to Com 1.
The TAG use with Generic Sorting Station , is a TAG 210, manufactured by GEMPLUS.
As shown in Figure#1, all interfaces cables used for compliance testing are shielded as normally supplied. All these cables are normally recommended to be used with the Personal Computer.

1.1.4 Equipment modifications

none

1.1.5 Configuration of tested system



1.2 Conducted emission data

1.2.1 Test procedure

The product has been tested according to ANSI C63.4-1992 and FCC PART15, Subpart C, Section 15.207.

The product has been tested with 110V / 60Hz power line voltage and compared to the FCC PART15, Subpart C, Section 15.207 limits. Measurement bandwidth was 9KHz from 450 kHz to 30 MHz.

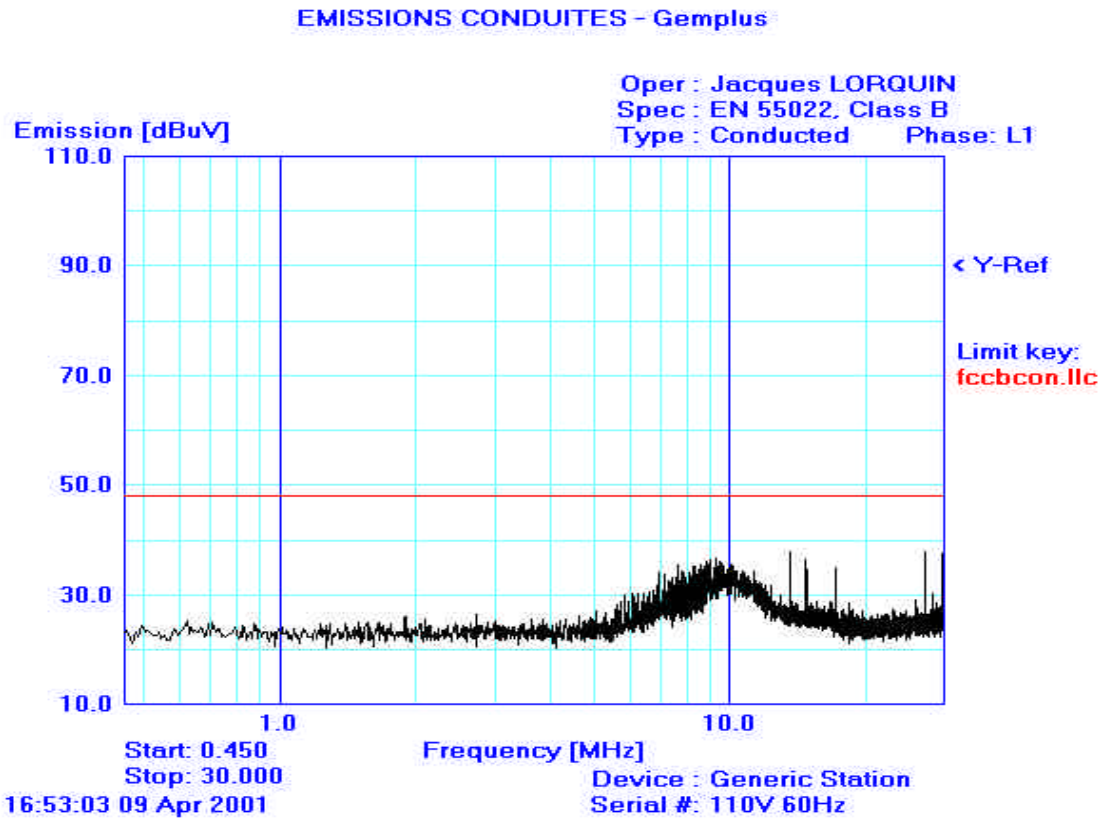
Measurement was initially made with an HP-8591EM Spectrum Analyzer in peak mode. This was followed by a Quasi-Peak, i.e. CISPR measurement with the Rohde & Schwarz ESH3 receiver for any strong signal. An Average measure has also been performed on peak exceeding the limit of 250µV.
The Peak data are shown on the following plots. Quasi-Peak and Average measurements are detailed in a table with frequencies and levels measured.

Interconnecting cables and equipment's were moved to position that maximized emission. A summary of the worst case emissions found in all test configurations and modes is shown on the following page.

The 13.56 MHz frequency, which is the fundamental frequency, exceeds the level when tested in normal configuration. In order to show that the product's electronic isn't the cause, the antenna of the product is replaced by a dummy load. In this configuration, results are FCC compliant; Graphs are shown hereafter.

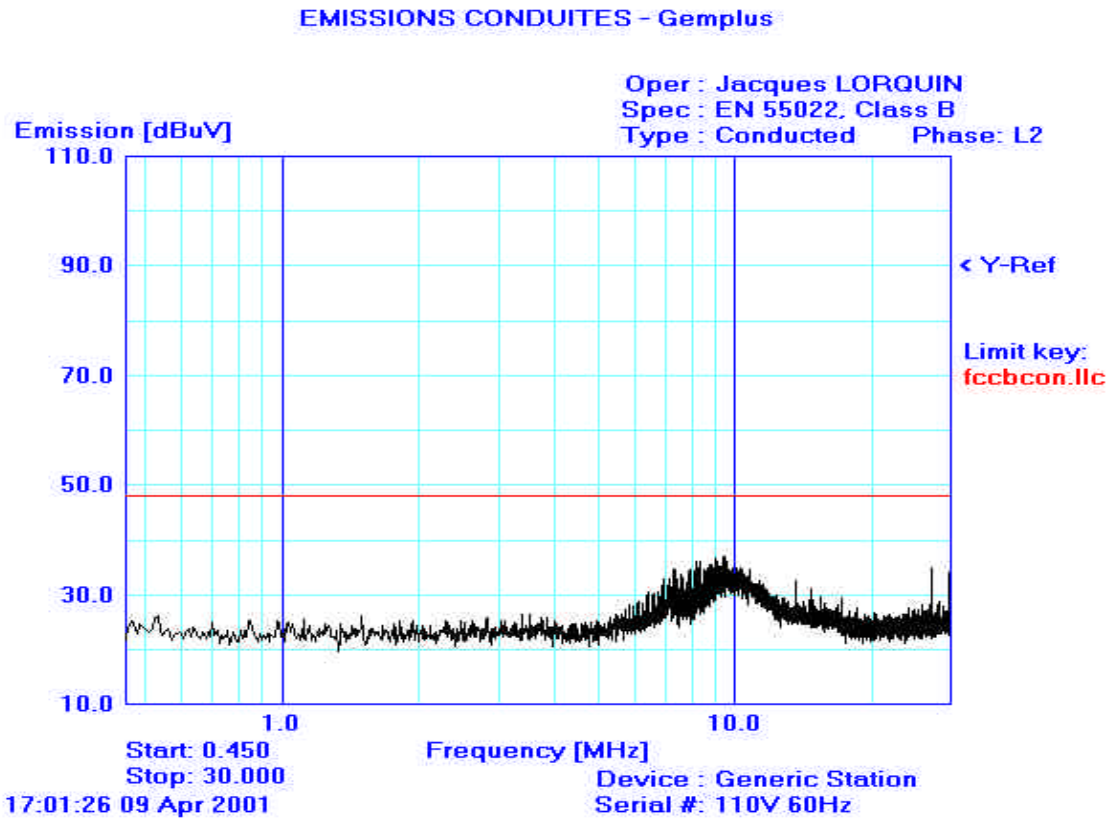
Test equipment :
HP 8591EM Spectrum Analyzer
Rhode & Schwarz ESH3 Receiver
EMCO 3810/2SH LISN N°1 (50Ω/50microhenry LISN measure)
TELEMETER NNB-2/16L LISN N°2

1.2.2 Neutral conducted emission data on Universal Laundry Reading Station



Num.	Freq. [MHz]	Peak [dBµV]	Q-Peak [dBµV]	QP limit [dBµV]	***QP delta [dBµV]***
1	9.01	38.33	34.55	48	**-13.45**
2	13.56	38.66	37.00	48	**-11.00**
3	14.76	37.58	35.52	48	**-12.48**
4	27.12	38.67	36.91	48	**-11.09**
5	29.51	38.79	37.19	48	**-10.81**

1.2.3 Line conducted emission data on Universal Laundry Reading Station



Num.	Freq. [MHz]	Peak [dBµV]	Q-Peak [dBµV]	QP limit [dBµV]	***QP delta [dBµV]***
1	9.50	37.17	32.61	48	**-15.39**
2	27.12	36.93	34.92	48	**-13.08**
3	29.51	32.30	28.75	48	**-19.25**

1.3 RADIATED EMISSION DATA

1.3.1 Test Procedure (15.225)

The product has been tested according to ANSI C63.4-1992 and FCC PART15, Subpart C, Section 15.225.

The product has been tested with 230V / 50Hz power line voltage (requirements of §15.31 (e) are observed for found the worst case), at a distance of 3 meters from the antenna and compared to the FCC PART15, Subpart C, Section 15.225 limits. The radiated power output is 3W for all tests. Measurement bandwidth was 120 kHz from 30 MHz to 1 GHz, and 9kHz below 30 MHz. Requirements of 15.209e) have been observed.
Above 30MHz, antenna height search was performed from 1m to 4m for both horizontal and vertical polarization. Continuous linear turntable azimuth search was performed with 360 degrees range.

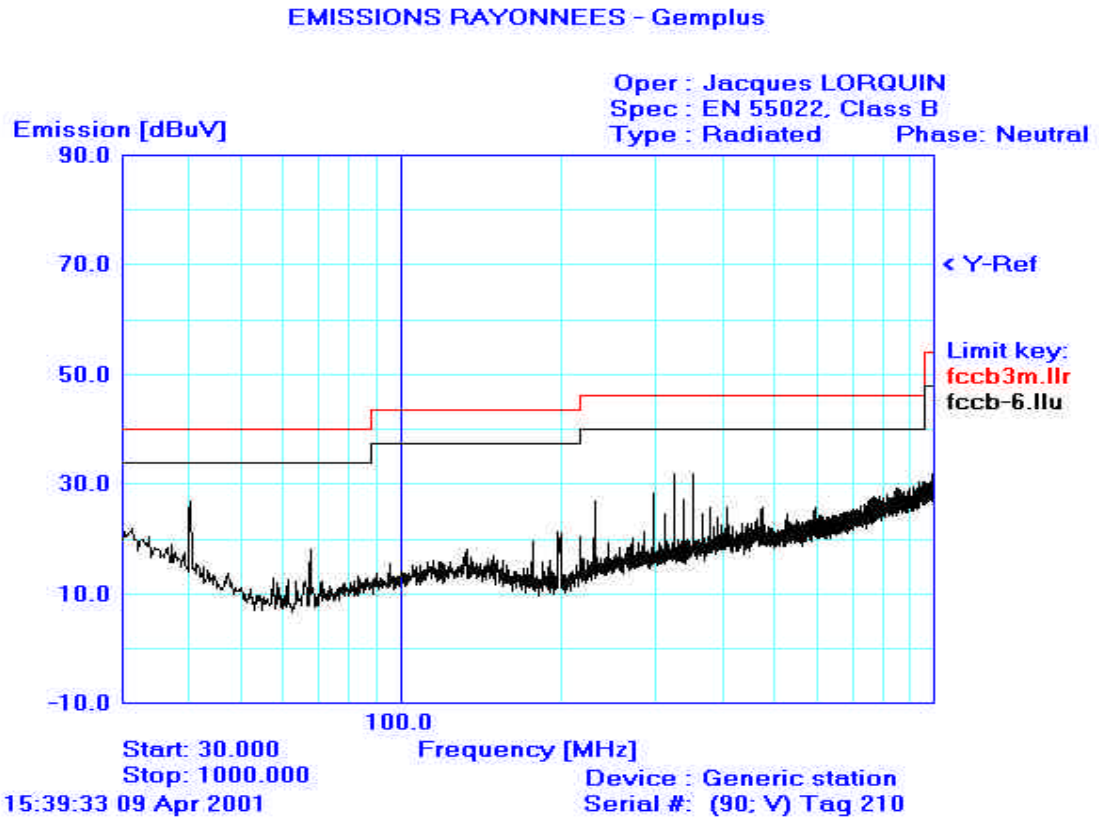
Below 30MHz, a loop antenna has been used in 2 polarization (axial and hortogonal), measurements distance was 10 meters. The average measure was compared to an extrapolated limit to 30 meters (requirement of §15.31)

Interconnecting cables and equipment's were moved to position that maximized emission. A summary of the worst case emissions found in all test configurations and modes is shown on the following page.

Test Equipment: HP-8574A E.M.I Receiver
HP-8568B Analyzer + HP-85650 Quasi-Peak adapter + HP-85685A RF Preselector.
EMCO 3104C Biconical Antenna & EMCO 3146 Log Periodic Antenna
EMCO-1050, 6 meters height antenna mast & EMCO-1060, 3 meters diameter Turntable.
HP-8591EM Spectrum analyser
CHASE CBL6111A Antenna, 30-1000MHz
SIDEN TELEC, Model CT2A, Loop Antenna

1.3.2 Radiated emission data for 200x200 antennas without damping

Final result 30-1000 MHz



Graph example - 30-1000MHz

Frequency (MHz)	QPeak Lmt (dBµV/m)	QPeak (dBµV/m)	QPeak-Lmt (dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)
40.68	40.0	31.8	-8.2	111	V	107	11.8
187.54	43.5	27.7	-15.8	31	H	152	19.2
216.97	46	34.7	-11.3	231	V	106	14.2
230.53	46	39.0	-7	43	V	106	14.4
244.08	46	34.0	-12	236	V	273	14.5
325.44	46	40.9	-5.1	4	H	358	17.3
352.56	46	39.6	-6.4	182	H	356	18
379.69	46	42.7	-3.3	165	H	149	18.6

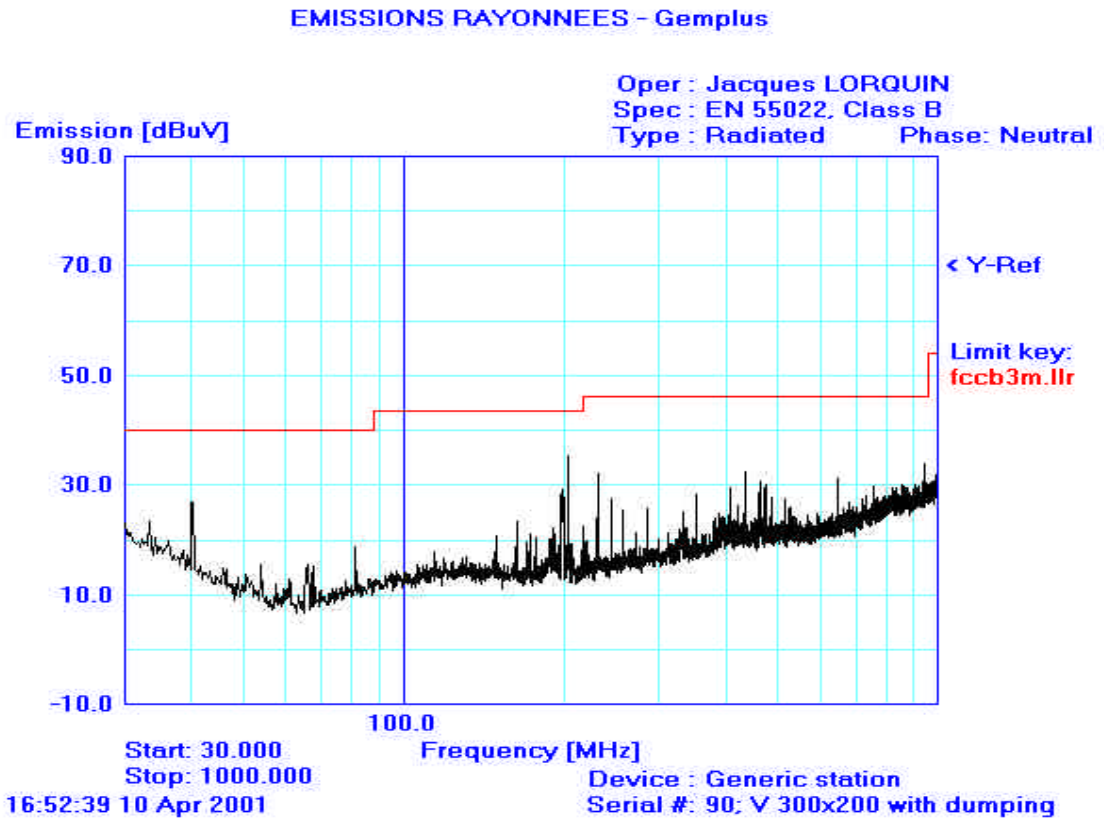
Final result below 30 MHz

Frequency (MHz)	QPeak Lmt (dBµV/m)	QPeak (dBµV/m)	QPeak-Lmt (dB)	Angle (deg)	Pol	Tot Corr (dB)
13.56*[1]	80	63.1	-16.9	130	hortogonal	36.4
27.12	39.5	Not traceable signal				

*[1]: Fundamental – 15.225 limits. Measure have been done at 10m distance and corrected following requirements of 15.209.e)

1.3.3 Radiated emission data for 300x200 antennas with damping

Final result 30-1000 MHz



Graph example - 30-1000MHz

Frequency (MHz)	QPeak Lmt (dBµV/m)	QPeak (dBµV/m)	QPeak-Lmt (dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)
40.66	40	33.8	-6.2	129	V	106	11.8
81.37	40	34.1	-5.9	297	V	169	9.4
108.49	43.5	37.2	-6.3	254	V	119	15.8
162.73	43.5	31.4	-12.1	79	V	112	17.6
199.76	43.5	30.0	-13.5	95	H	278	19.9
203.41	43.5	38.7	-4.8	20	V	106	14
230.51	46	39.3	-6.7	341	V	371	14.4
311.87	46	39.3	-6.7	318	V	273	17
352.54	46	32.9	-13.1	22	V	383	18
442.33	46	37.6	-8.4	241	H	225	20
488.15	46	35.4	-10.6	23	H	191	21
814.42	46	38.0	-8	352	V	209	27

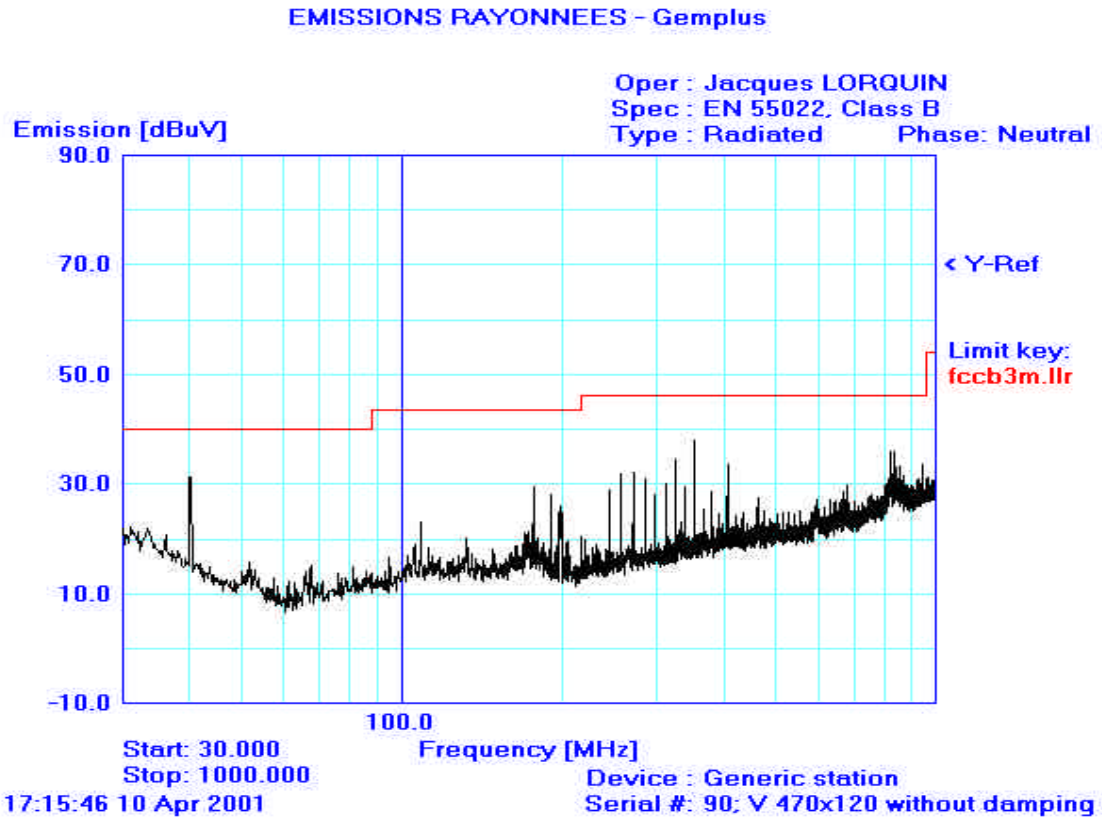
Final result below 30 MHz

Frequency (MHz)	QPeak Lmt (dBµV/m)	QPeak (dBµV/m)	QPeak-Lmt (dB)	Angle (deg)	Pol	Tot Corr (dB)
13.56*[1]	80	64	-16	92	hortogonal	36.4
27.12	39.5	Not traceable signal				

*[1]: Fundamental – 15.225 limits. Measure have been done at 10m distance and corrected following requirements of 15.209.e)

1.3.4 Radiated emission data for 470x120 antennas without damping

Final result 30-1000 MHz



Graph example - 30-1000MHz

Frequency (MHz)	QPeak Lmt (dBµV/m)	QPeak (dBµV/m)	QPeak-Lmt (dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)
40.69	40	31.6	-8.4	123	V	104	11.8
162.71	43.5	27.6	-15.9	6	V	111	17.6
176.27	43.5	33.6	-9.9	31	V	103	18.6
189.85	43.5	34.7	-8.8	286	V	104	19.3
199.74	43.5	33.5	-10	206	H	386	19.9
203.39	43.5	28.6	-14.9	331	V	104	14
216.97	46	34.8	-11.2	191	H	267	14.2
230.54	46	33.5	-12.5	187	H	213	14.4
311.89	46	38.9	-7.1	162	H	193	17
352.56	46	44	-2	5	H	262	18
406.77	46	38.3	-7.7	160	H	168	19.3
442.33	46	37.6	-8.4	241	H	225	20.4
488.15	46	35.4	-10.6	23	H	191	21.7
814.42	46	38	-8	352	V	209	27.3

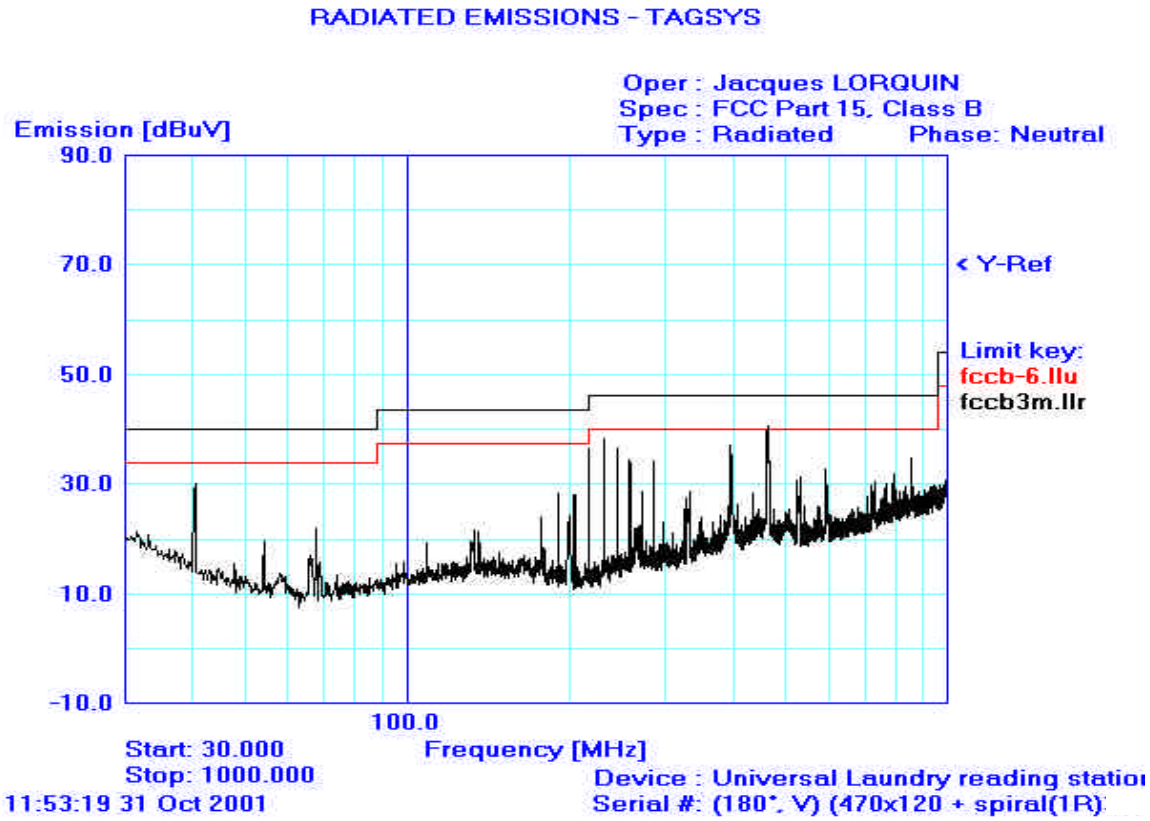
Final result below 30 MHz

Frequency (MHz)	QPeak Lmt (dBµV/m)	QPeak (dBµV/m)	QPeak-Lmt (dB)	Angle (deg)	Pol	Tot Corr (dB)
13.56*[1]	80	74.9	-5.1	87	hortogonal	36.4
27.12	39.5	Not traceable signal				

*[1]: Fundamental – 15.225 limits. Measure have been done at 10m distance and corrected following requirements of 15.209.e)

1.3.5 Radiated emission data for 470x120 antennas with spiral antenna

Final result 30-1000 MHz



Graph example - 30-1000MHz

Frequency (MHz)	QPeak Lmt (dBµV/m)	QPeak (dBµV/m)	QPeak-Lmt (dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)
40.67	40	38.8	-1.2	285	V	104	11.8
135.61	43.5	26.4	-17.1	247	V	168	15.4
189.85	43.5	35.7	-7..8	181	H	107	19.7
203.42	43.5	33.3	-10.2	144	H	303	14.5
216.98	46	42.3	-3.7	72	V	236	14.9
230.54	46	44.9	-1.2	45	V	210	15.3
244.09	46	45.2	-0.8	36	V	178	15.6
257.66	46	43.9	-2.1	66	V	135	16.2
284.78	46	39.8	-6.2	19	H	292	17.5
298.34	46	36.6	-9.4	25	H	283	18.1
406.81	46	38.2	-7.8	78	V	138	20
460.08	46	43.0	-3.0	153	V	145	21.2
732.47	46	38.6	-7.4	144	V	102	27.8

Final result below 30 MHz

Frequency (MHz)	QPeak Lmt (dBµV/m)	QPeak (dBµV/m)	QPeak-Lmt (dB)	Angle (deg)	Pol	Tot Corr (dB)
13.56*[1]	80	77.4	-2.6	10	hortogonal	36.4
27.12	39.5	Not traceable signal				

*[1]: Fundamental – 15.225 limits. Measure have been done at 10m distance and corrected following requirements of 15.209.e)

1.3.6 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follow :

FS = RA + AF + CF – AG

Where FS = Field Strength
RA = Receiver Amp litude
AF = Antenna Factor
CF = Cable Factor
AG = Amplifier Gain

Assume a receiver reading of 52.5dBµV is obtained. The antenna factor of 7.4 and a cable factor of 1.1 is added. The amplifier gain of 29dB is subtracted, giving a field strength of 32dBµV/m.

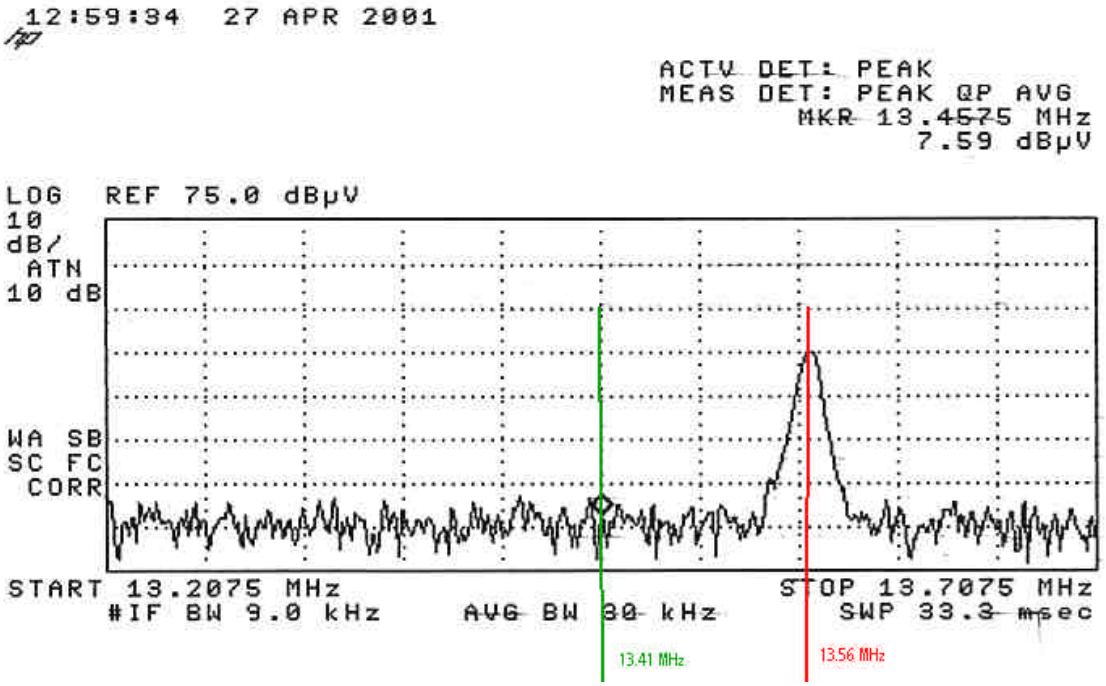
FS = 52.5 + 7.4 + 1.1 – 29 = 32 dBµV/m

The 32 dBµV/m value can be mathematically converted to its corresponding level in µV/m.

Level in µV/m = Common Antilogarithm [(32dBµV/m)/20] = 39.8 µV/m.

1.4 Occupied bandwidth

Here is a plot of the occupied bandwidth, which show that , 13.36MHz - 13.41MHz restricted band is free of spurious emission.



1.5 Fundamental frequency tolerance (15.225.c)

The frequency tolerance of the carrier signal shall be maintained within +/-0.01% of the operating frequency.

1.5.1 Voltage fluctuation

Power supply has been set at 85% and 115% of nominal voltage, at 20°C.
Frequency of carrier: 13.56 MHz
Upper limit: 13.561356 MHz
Lower limit: 13.558644 MHz

Voltage	98V/60Hz	115V/60Hz	132V/60Hz
Frequency (MHz)	13.559812	13.559813	13.559814
Result	Pass	-	Pass

1.5.2 temperature

Teperature has been set at –20°C and +50°C at nominal voltage (115V/60Hz).
Frequency of carrier: 13.56 MHz
Upper limit: 13.561356 MHz
Lower limit: 13.558644 MHz

Voltage	-20°C	20°C	+50°C
Frequency (MHz)	13.5603	13.5605	13.5608
Result	Pass	-	Pass