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EMC TEST REPORT

Nr 3597-FCC

This test report applies only on equipment described hereafter.

Proposal number: 200512-2879

Date: December from 20th to 22nd, 2005
Location: **LCIE** Laboratory - 38 VOIRON
Performed by: Jacques LORQUIN
Customer.....: **TAGSYS S.A.**
180, Chemin de Saint Lambert
13821 La PENNE SUR HUVEAUNE
FRANCE

Product.....: **L-P101 with LW1 antenna**
Type of test: **Radiated and Conducted Emission Test**

Applied standards: ANSI C63-4 (2003)
47 CFR Part 15 Subpart C
CISPR 22 (2003)

**Result of tests: Radiated Emission : Comply
Conducted Emission : Comply**

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Written by.....: Jacques LORQUIN

Approved by : Jacques LORQUIN



1. System test configuration

1.1. Justification

The system was configured for testing in a typical fashion (as a customer would normally use it).

1.2. HARDWARE IDENTIFICATION:

* Equipment Under Test (EUT):

MEDIO L-P101 pn:SE11912A1 sn:T0537024A2

* Configuration:

➤ Antenne LW1:

- Taille : 156x120x50mm
- E/S : antenna connector BNC (coaxial cable with 6 ferrites)

➤ RF transmitter :

- Taille : 120x65x30mm
- E/S :
 - * Antenna connector SMA
 - * USB port
 - * power supply 12Vdc

1.3. Auxiliaries

The FCC IDs for all equipment, more description of all cables used in the tested system are :

Trade Mark - Model Number (Serial number)	FCC ID	Description	Cable description
L-P101 pn:SE11912A2* (sn: T0537024A2)	QHKLIBREADERLP101	RFID reader	Power cord unshielded. USB cable shielded Coaxial cable with 6 ferrites.
XP model:MPP6US12-2 (sn: none)	none	AC/DC Power supply	Power cord unshielded.
Hewlett Packard Vli8 (sn: FR94020451)	pn:D763A D.o.C.	Personal computer power supply	with Power cord unshielded. All other cable shielded.
Hewlett Packard (sn: FTW60154310)	pn:D2815A(1) A3KM043	Monitor	Power cord unshielded. Video cable shielded
Hewlett Packard (sn: JP74001000)	pn:D2846(2) A3KM043	Monitor	Power cord unshielded. Video cable shielded
Labtec M-S43 (sn: LZA83406744)	DZL211106	MOUSE	
Hewlett Packard (sn:m971168931)	pn:C4734 GYUR38SK	Keyboard	
HP (sn: MY97619)	pn:C6410A D.O.C.	Parallel printer	Shielded cable
Telex (sn: 700373.000A)	none	microphone	
Labtec LT-100 (sn : none)	pn : D8387A none	Headset	
Hewlett Packard (id83802369)	48GX none	Graphic calculator	Serial cable with ferrite
TAGSYS	none	TAG ISO 15693	

* : Equipment under test.
(1):conducted tests
(2):radiated tests



1.4. Equipment modifications

6 ferrites are set on the coaxial cable inside the LW1 antenna.

1.5. EUT Exercise software

The EUT exercise program used during radiated and conducted testing was designed to exercise the equipment under test in a manner similar to a typical use (Read tag ID):

Px Explorer.exe running under windows 98

1.6. I/O cables

- 2x Standards power cord Length:2m (power supply of the PC and printer)
- Coaxial cable with 6 ferrites at each end, length: 3m
- 1x parallel cable HP#C2950A, shielded, length:2m
- 1x USB cable, shielded, length: 2m
- 1x serial cable with ferrite, shielded, length:1.5m

2. Radiated emission data

2.1. SET-UP

The EUT is placed on a non-conducting table of 80cm height. A Tag is set on the A-MA antenna.

Equipment configuration and running mode:

- EUT is ON;
- software is running;



Setup for LW1 antenna

The installation of EUT is identical for pre-characterization measurement in a 3 meters full anechoic chamber and for measures on a 3 meters Open site.



2.2. TEST EQUIPMENT

Test Equipment up to 1GHz on 10 meters open site:

Equipment	Company	Model	Serial
Spectrum Analyzer	HP	8568B	2732A04155
Quasi-Peak adapter	HP	85650A	2811A01134
RF Pre-selector	HP	85685A	2833A00784
Biconical Antenna	EMCO	3104C	9401-4636
Log Periodic Antenna	EMCO	3146	2178
Spectrum Analyzer	HP	8593E	3409u00537
Loop antenna	Electro-metrics	EM-6879	690234
Amplifier	HP	8447F H64	3113A06394

EMCO-1050, 6 meters height antenna mast & EMCO-1060, 3 meters diameter Turntable.
A 3 meters Open site located in SMEE *Actions Mesures* - Voiron (FRANCE).

Pre-scan, test Equipment up to 1GHz:

Equipment	Company	Model	Serial
EMC Analyzer	HP	8591EM	3536A00384
Amplifier	HP	8447F H64	3113A06394
Antenna (30MHz-1GHz)	CHASE	CBL6111A	1628
Loop antenna	Electro-metrics	EM-6879	690234



2.3. TEST SEQUENCE AND RESULTS

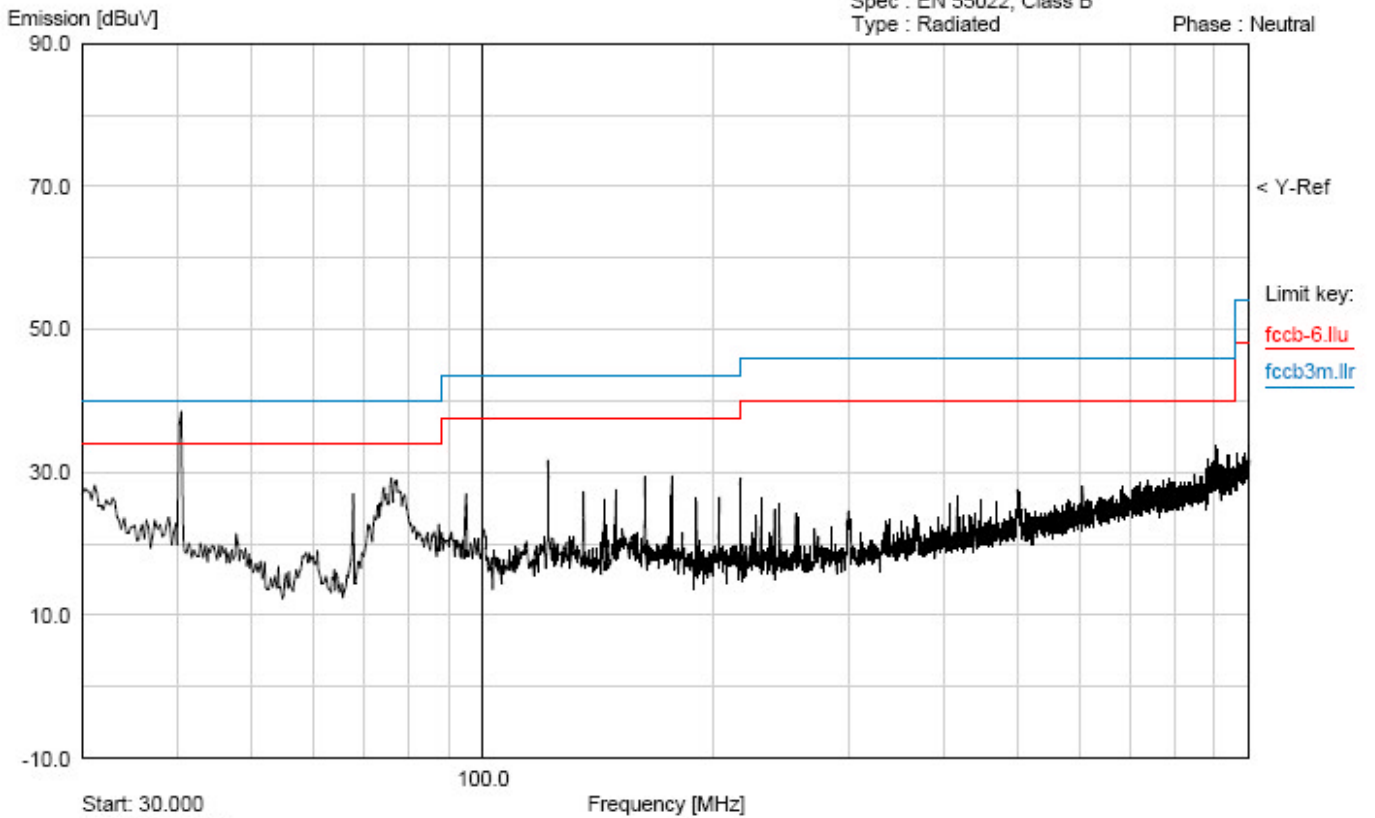
2.3.1. Pre-characterization at 3 meters from 30MHz to 1GHz of LW1 antenna

A pre-scan of all the setup has been performed in a 3 meters full anechoic chamber. The distance between EUT and antenna is 3 meters. Test is performed in horizontal (H) and vertical (V) polarization, and on 4 faces of the EUT. See below for a graph example:

EMISSIONS RAYONNEES - TAGSYS

Oper : Jacques LORQUIN
Spec : EN 55022, Class B
Type : Radiated

Phase : Neutral



Start: 30.000
Stop: 1000.000

Device : LP-101 with LW1 antenna ferrites 6
Serial #: (90°, V) T0537024A2 (R390ohm)

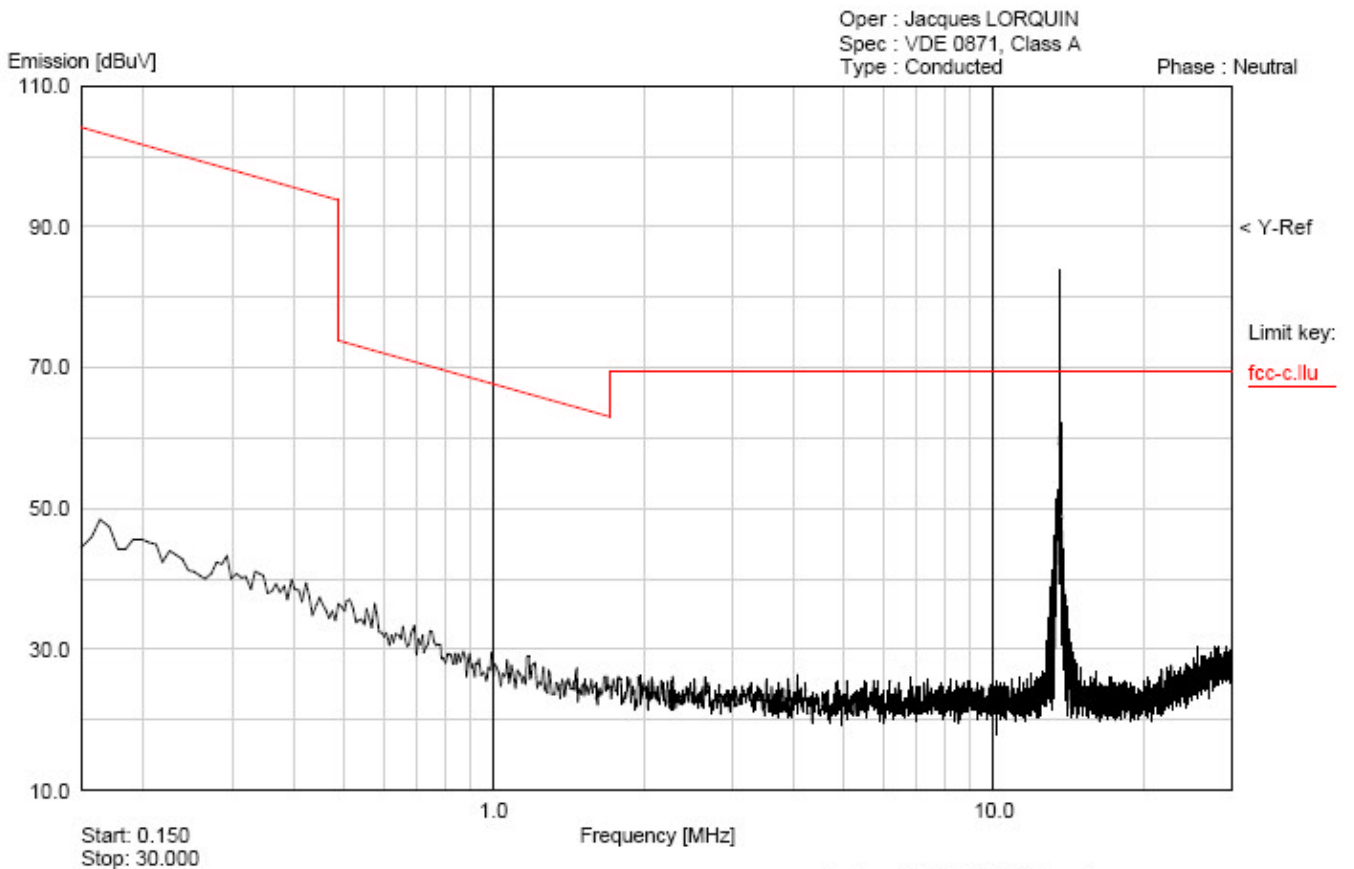
12:01:52 23 Dec 2005



2.3.2.Pre-characterization at 3 meters below 30MHz of LW1 antenna

A pre-scan of all the setup has been performed in a 3 meters full anechoic chamber. The distance between EUT and antenna is 3 meters. Test is performed in horizontal (H) and vertical (V) axis and the loop antenna position was rotated during the test for maximized the emission measurement. See below for a graph example:

RADIATED EMISSIONb - TAGSYS



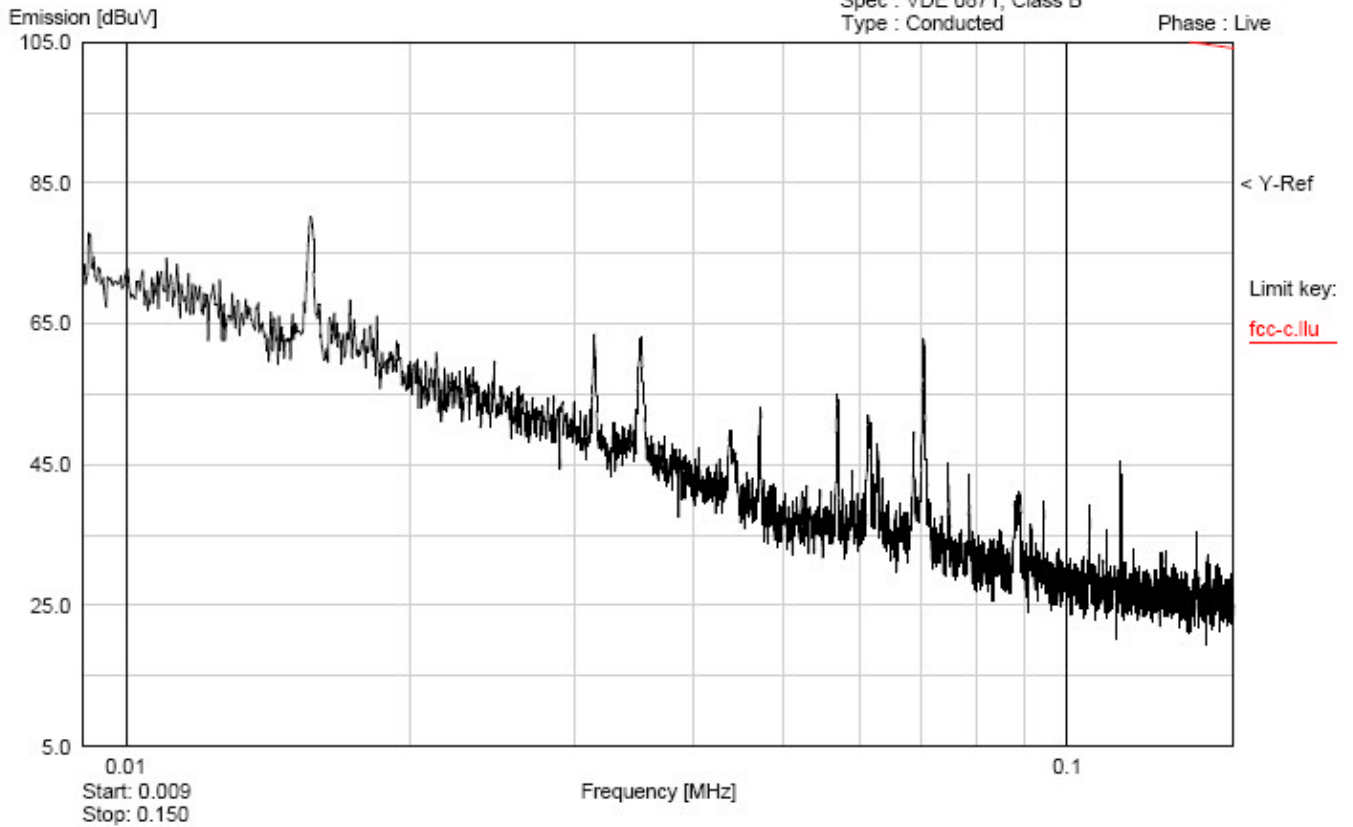
08:55:45 22 Dec 2005



RADIATED EMISSIONb - TAGSYS

Oper : Jacques LORQUIN
Spec : VDE 0871, Class B
Type : Conducted

Phase : Live



0.01
Start: 0.009
Stop: 0.150

Frequency [MHz]

Device : LP101 with LW1 antenna
Serial #: (90, V) ant V90

09:05:38 22 Dec 2005



2.3.3.Characterization on 10 meters open site from 30MHz to 1GHz

The product has been tested according to ANSI C63.4-(2003), FCC part 15 subpart C. Radiated Emission was measured on an open area test site. A description of the facility is on file with the FCC.

The product has been tested with 230V / 50Hz power line voltage, at a distance of 10 meters from the antenna and compared to the FCC part 15 subpart C §15.209 limits. Measurement bandwidth was 120kHz from 30 MHz to 1GHz. 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.

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 clause 2.1.

AERO LW1 Antenna test results:

No	Frequency (MHz)	QPeak Lmt (dBµV/m)	QPeak (dBµV/m)	QPeak-Lmt (dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)	Comments
1	40.668	40.0	39.1	-0.9	75	V	130	11.0	*
2	67.785	40.0	39.2	-0.8	330	V	350	9.5	*
3	122.032	43.5	38.5	-5	115	V	120	15.6	*
4	135.587	43.5	36.9	-6.6	340	V	270	14.4	*
5	149.178	43.5	38.5	-5	20	V	120	14.4	*
6	162.728	43.5	37.4	-6.1	345	V	120	16.9	*
7	176.284	43.5	39.2	-4.3	340	V	120	17.5	*
8	203.428	43.5	35.9	-7.6	10	V	120	15.3	*
9	230.545	46.0	38.4	-7.6	265	V	120	15.0	*

*: Measures have been done at 10m distance and corrected following requirements of 15.31

2.3.4.Characterization on 10 meters open site below 30 MHz

The product has been tested with 230V / 50Hz power line voltage, at a distance of 10 meters from the antenna and compared to the FCC part 15 subpart C §15.209& §15.225 limits. Measurement bandwidth was 9kHz from 150kHz to 30 MHz and 100 Hz from 9 kHz to 150 kHz.

The loop antenna position was rotated to locate the orientation that maximized emission reception during testing. Antenna search was performed for both horizontal and vertical polarization. Continuous linear turntable azimuth search was performed with 360 degrees range.

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 clause 2.1.



LW1 Antenna test results:

Frequency (MHz)	QPeak Lmt (dBµV/m)	QPeak (dBµV/m)	QPeak-Lmt (dB)	Angle EUT (deg)	Pol	Angle Ant. (deg)	Tot Corr (dB)	
13.56*	84	53.5	-30.5	200	vertical	0	35.3	
27.12*	29.5	No traceable signal						

* Measure have been done at 10m distance and corrected following requirements of 15.209.e)

2.4. 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 Amplitude
 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 32 dBµV/m.

$$FS = 52.5 + 7.4 + 1.1 - 29 = 32 \text{ dB}\mu\text{V/m}$$

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

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm} [(32\text{dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}.$$



3. Conducted emission data

The product has been tested according to ANSI C63.4-(2003) and FCC Part 15 subpart C.

The product has been tested with 110V/60Hz power line voltage and compared to the FCC Part 15 subpart C §15.207 limits. Measurement bandwidth was 9kHz from 150 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. If the average limit is met when using a Quasi-Peak detector, the EUT shall be deemed to meet both limits and measurement with the average detector is unnecessary.

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.

3.1. SET-UP

The EUT is placed on a table at 0.8m height. The cable of the power supply of the XP has been shorted to 1meter length. The EUT (L-P101 & XP) is powered through the LISN (measure). The peripherals equipments (PC & parallel printer) is connected to a separate LISN.



Equipment configuration and running mode:

- The equipment under test is powered by 110V/60Hz;
- Auxiliaries are powered by 230V/50Hz;
- L-P101 are ON;
- software is running;



3.2. TEST EQUIPMENT

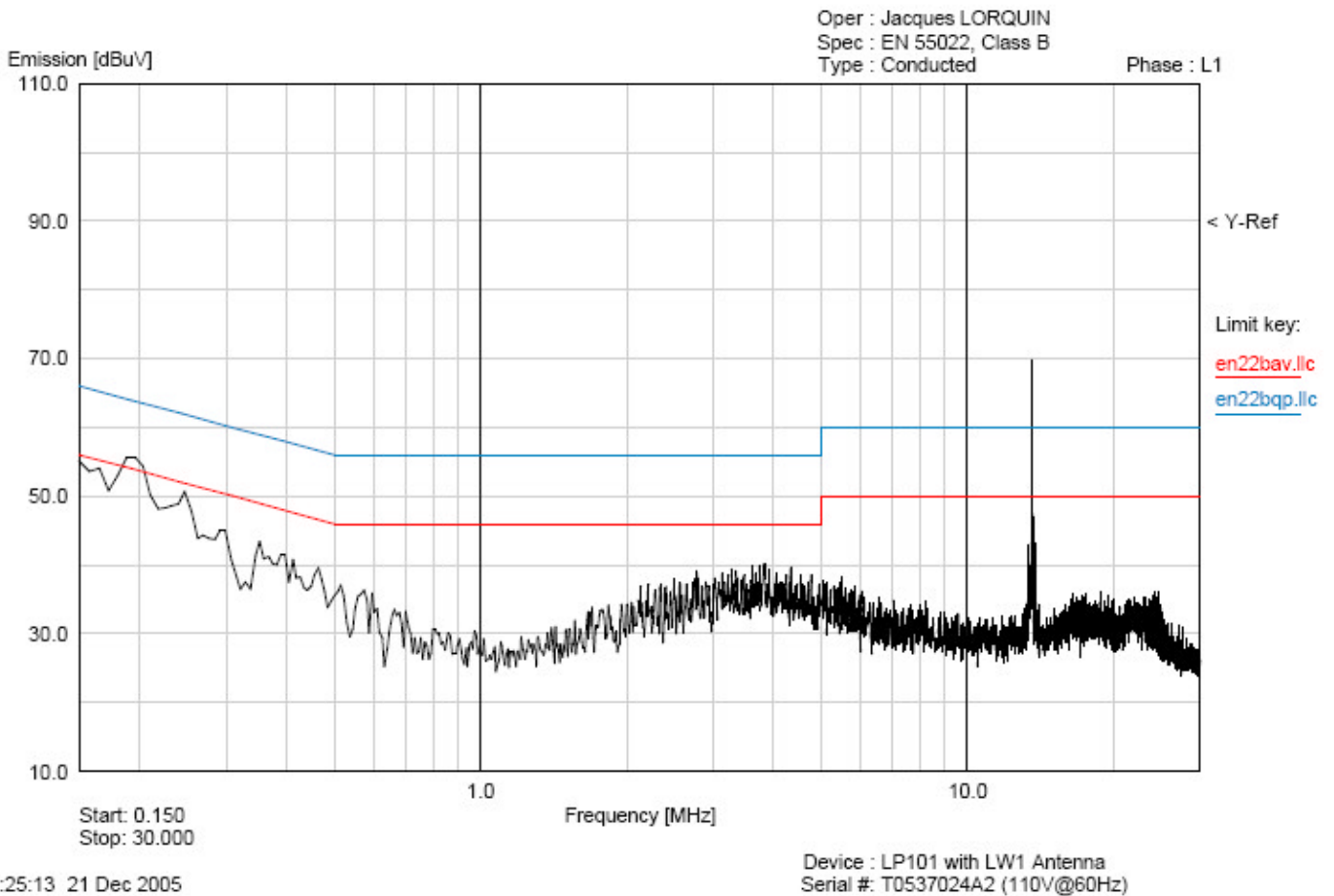
Equipment	Company	Model	Serial
EMC Analyzer	HP	8591EM	3536A00384
test receiver	Rohde&Schwarz	ESH3	872079/117
Transient Limiter	HP	11947A	3107A01596
LISN(auxiliary)	EMCO	3810/2SH	9511-11821628
LISN(measure) 50 Ω / 50 μ H	Telemeter Electronis	TGmbH NNB 2/16	0001300
Faraday room	Rayproof		4854



3.3. TEST SEQUENCE AND RESULTS

Measures are performed on line 1 and line 2 of the power supply of the equipment under test.

3.3.1. Line conducted emission data - LW1 antenna

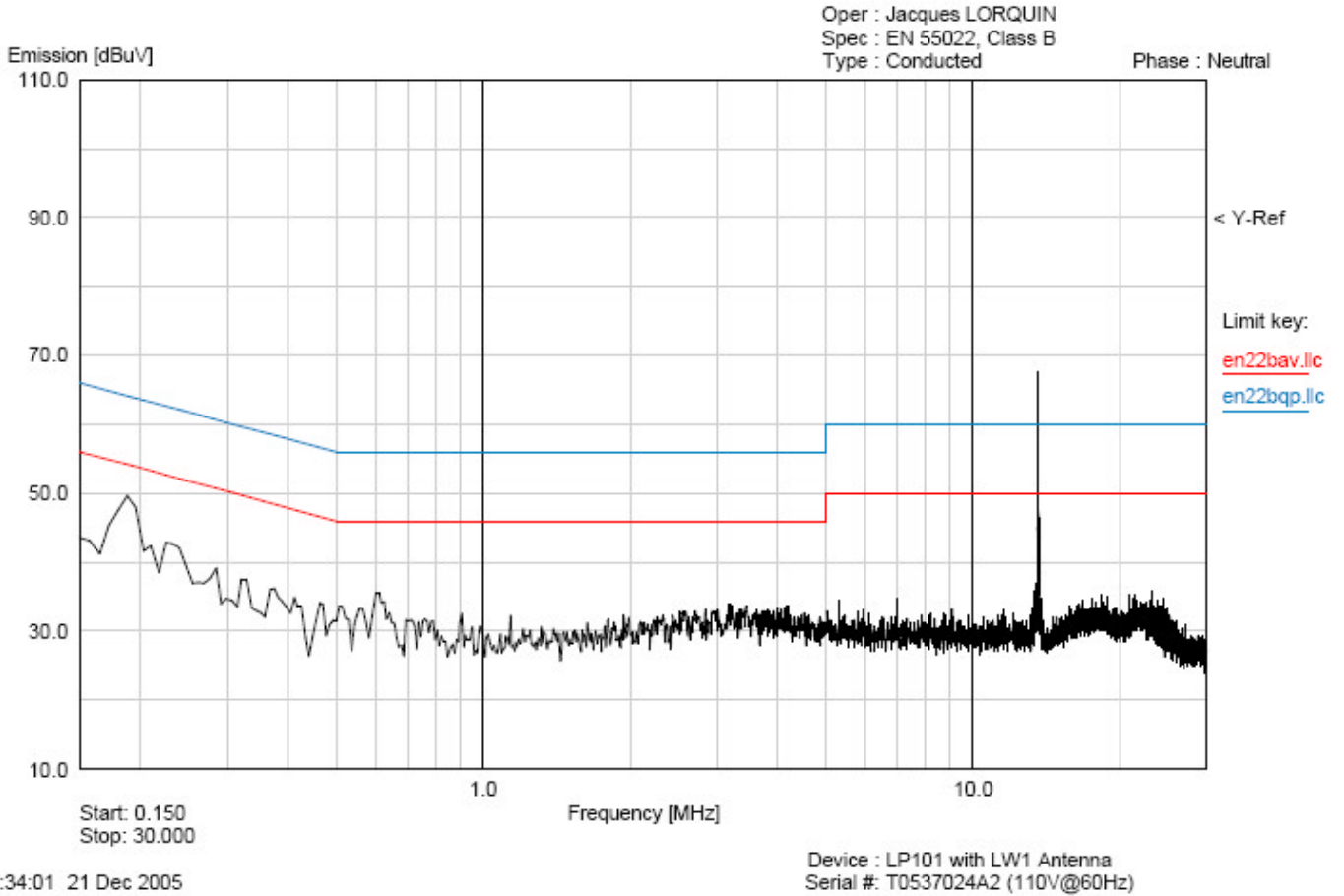


Marker ▽	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.190	54.11 *	50.37	36.92	54.00
2	0.250	49.88	45.37	33.24	50.00
3	0.350	40.81	35.05	24.57	48.00
4	0.470	38.16	33.13	24.24	46.00
5	0.150	57.09 *	54.77 *	42.78	54.00
6	0.300	45.57	40.14	29.46	50.00
7	3.820	40.28	32.40	23.70	46.00
8	13.57	70.47 *	68.87 *	64.98 *	50.00

Carrier - §15.207(b): Limits shall not apply to carrier current systems operating as intentional radiators on frequencies below 30MHz (from 13.110 to 14.010MHz).



3.3.2. Neutral conducted emission data - LW1 antenna



Marker ▽	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.150	52.36	49.09	35.01	54.00
2	0.190	48.87	46.25	32.05	54.00
3	0.230	44.12	40.71	27.56	52.00
4	0.290	39.73	35.89	23.05	50.00
5	0.330	36.24	31.44	19.76	48.00
6	0.370	37.32	32.23	22.59	48.00
7	13.57	68.44 *	67.40 *	66.54 *	50.00

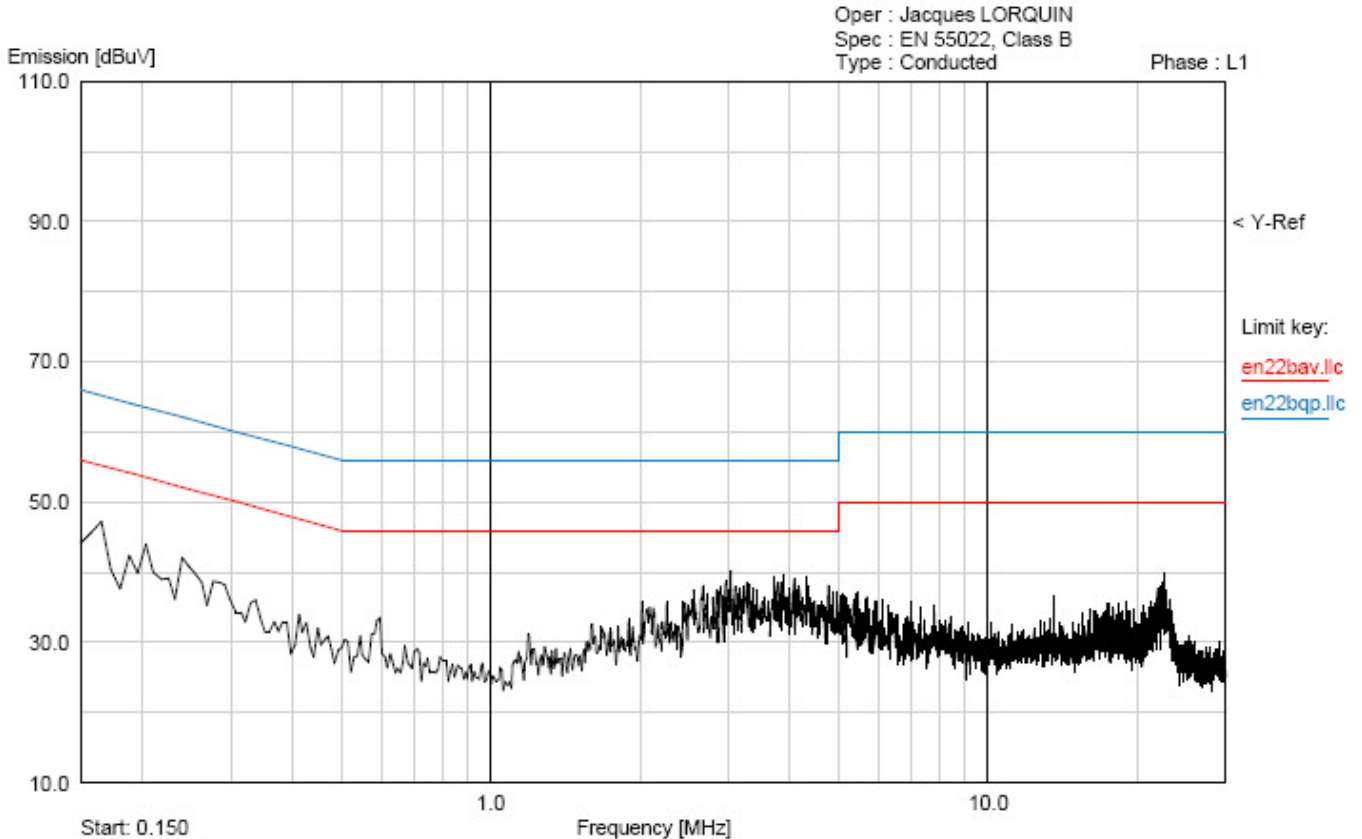
Carrier - §15.207(b): Limits shall not apply to carrier current systems operating as intentional radiators on frequencies below 30MHz (from 13.110 to 14.010MHz).



3.3.3. Line conducted emission data with dummy load

Antenna is replaced by dummy load.

EMISSIONS CONDUITES - Digigram



18:50:36 21 Dec 2005

Device : LP101 with LW1 Antenna
Serial #: T0537024A2 (110V@60Hz)

Marker ▽	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.160	49.21	46.70	35.33	54.00
2	0.200	45.67	42.04	31.12	52.00
3	0.240	41.93	35.78	26.70	50.00
4	0.290	38.82	34.87	27.23	50.00
5	0.340	37.48	31.91	24.72	48.00
6	3.040	38.82	31.32	22.66	46.00
7	22.53	38.99	35.19	27.02	50.00



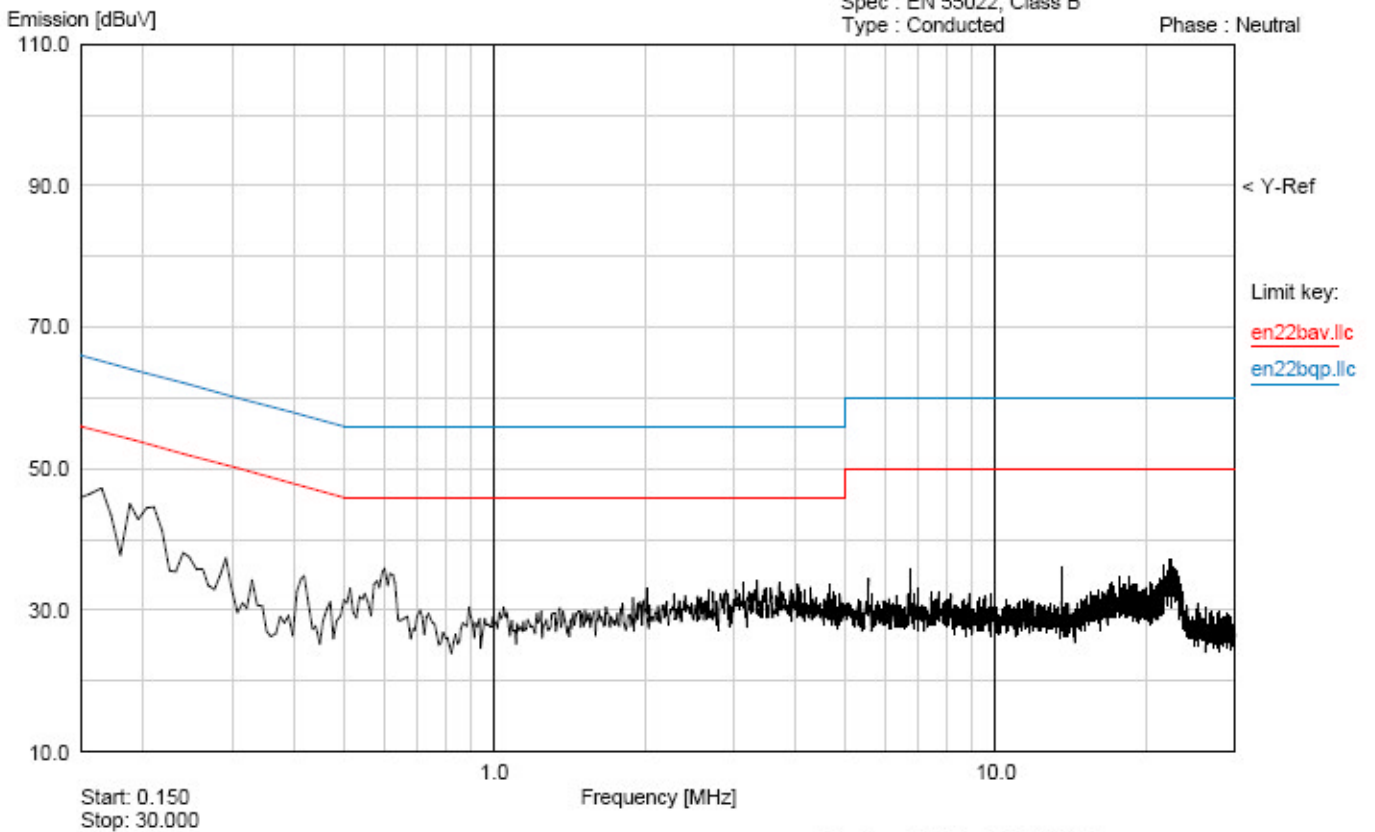
3.3.4. Neutral conducted emission data with dummy load

Antenna is replaced by dummy load.

EMISSIONS CONDUITES - Digigram

Oper : Jacques LORQUIN
Spec : EN 55022, Class B
Type : Conducted

Phase : Neutral



18:46:32 21 Dec 2005

Device : LP101 with LW1 Antenna
Serial #: T0537024A2 (110V@60Hz)

Marker ▽	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.150	48.45	45.30	31.48	54.00
2	0.190	44.64	41.94	28.19	54.00
3	0.230	38.00	32.46	20.19	52.00
4	0.290	37.28	33.10	20.75	50.00
5	0.330	35.03	30.68	19.00	48.00
6	0.370	35.83	30.60	21.53	48.00
7	13.57	35.96	32.98	30.22	50.00



4. Field strength of fundamental §15.225(a)

The polarization of the measurements for the larger power level is vertical (the test is performed for both vertical and horizontal axis, and the loop antenna position was rotated during the test for maximizing the emission measurement.) Measure have been done at 10m distance and corrected following requirements of 15.209.e).

LW1 Antenna test results:

Frequency (MHz)	QPeak Lmt (dBµV/m)	QPeak (dBµV/m)	QPeak-Lmt (dB)	Angle EUT (deg)	Pol	Angle Ant. (deg)	Tot Corr (dB)
13.56*	84	53.5	-30.5	200	vertical	0	35.3
27.12*	29.5			No traceable signal			

* Measure have been done at 10m distance and corrected following requirements of 15.209.e)

No significantly variation of the fundamental amplitude during voltage variation testing per 15.31(e). Maximum deviation under extreme test condition (voltage variation from 85% to 115%):
 +1.6dBc
 -1.5dBc

Limits Subclause §15.225(a): Operation within the band 13.110-14.010MHz

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
13.553-13.567	15 848 84dBµV/m	30
13.410-13.553 13.567-13.710	334 50.5dBµV/m	30
13.110-13.410 13.710-14.010	106 50.5dBµV/m	30

5. Fundamental frequency tolerance (15.225.c)

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

5.1. Voltage fluctuation

See test report N°3420-FCC

5.2. Temperature

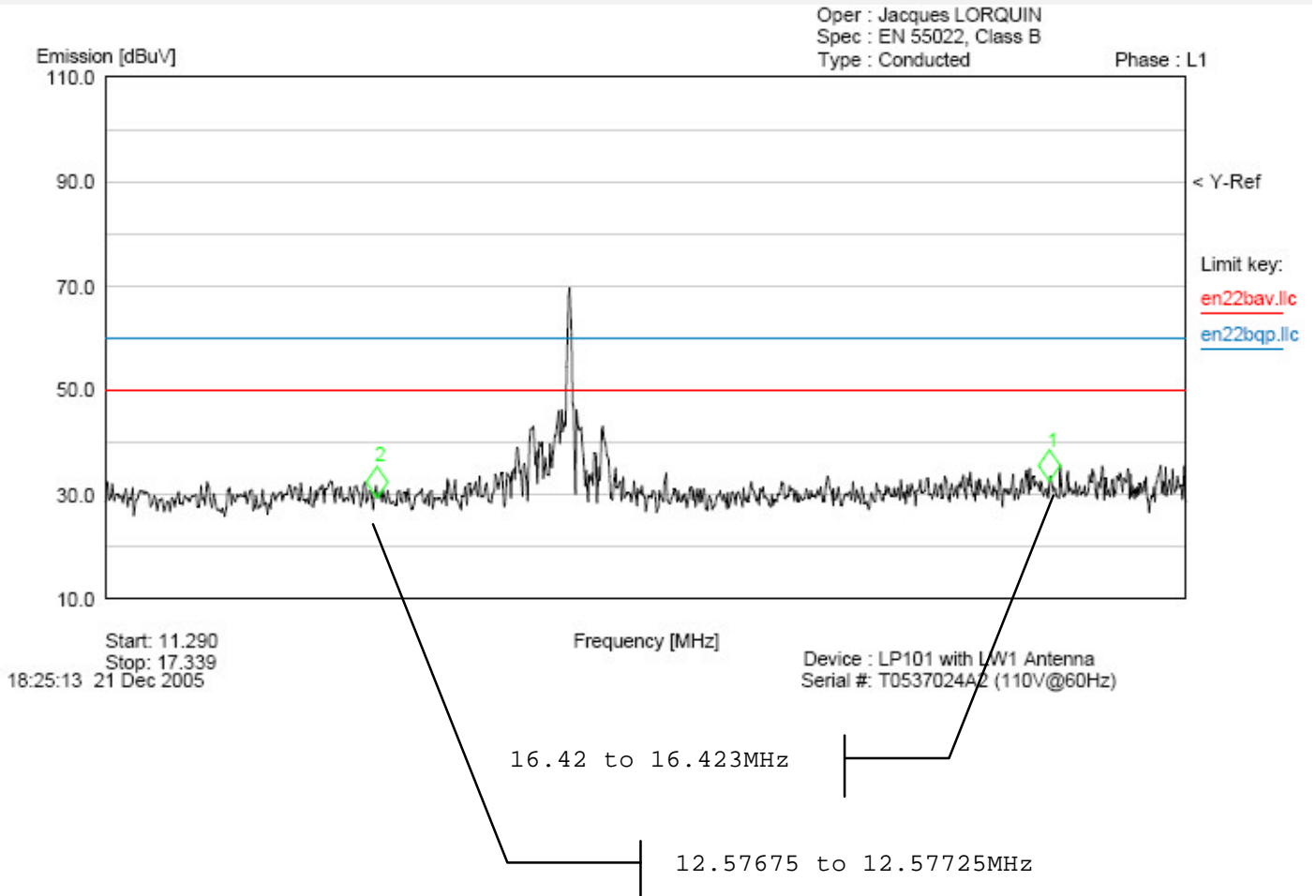
See test report N°3420-FCC



6. Occupied bandwidth §15.205

Here is a plot of the occupied bandwidth, which shows that, 12.57MHz and 16.42MHz restricted bands are free of carrier signal.

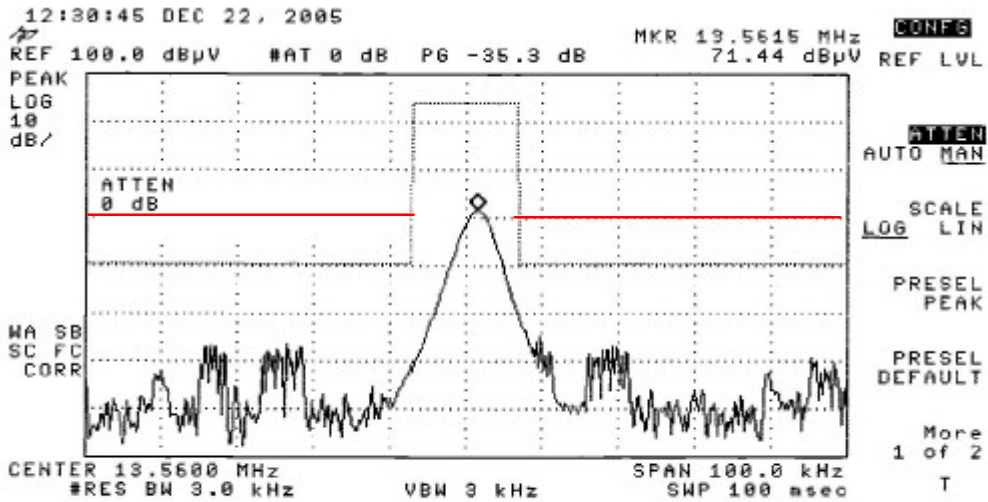
6.1. LW1 antenna





7. Band-edge compliance §15.209

7.1. LW1 antenna



Red line: limits

