

EMC TEST REPORT

Nr 3420-FCC

This test report applies only on equipment described hereafter.

Proposal number: 200505-2686

Date: May 18th, 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 AERO LI antenna**
L-P101 with LSA3 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 : Jæ





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:SE11912A0

sn:T0519010A0

* Configuration:

➤ Antenne AEROLI:

- Taille : 280x280x20mm
- E/S : antenna connector BNC (coaxial cable with 6 ferrites)

➤ Antenne LSA3:

- Taille : 440x360x25mm
- 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 FCC ID (Serial number)		Description	Cable description
L-P101 pn:SE11912A0* (sn: none)		RFID reader	Power cord unshielded. USB cable shielded Coaxial cable with 6 ferrites.
XP model:MPP6US12-2 (sn: 0605)	none	AC/DC Power supply	Power cord unshielded.
RDI model C151-15 (sn: 0450203)	none	Personal computer with power supply	Power cord unshielded. All other cable shielded.
HP pn:C6410A (sn: MY97619)	D.O.C.	Parallel printer	Shielded cable
TAGSYS	none	TAG ISO 15693	

* : Equipment under test.

1.4. Equipment modifications

No modifications are necessary for performed test.

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 ferrite near equipment, length: 3m
- 1x LAN cable, shielded, length:2m
- 1x parallel cable HP#C2950A, shielded, length:2m
- 1x USB cable, shielded, length: 2m

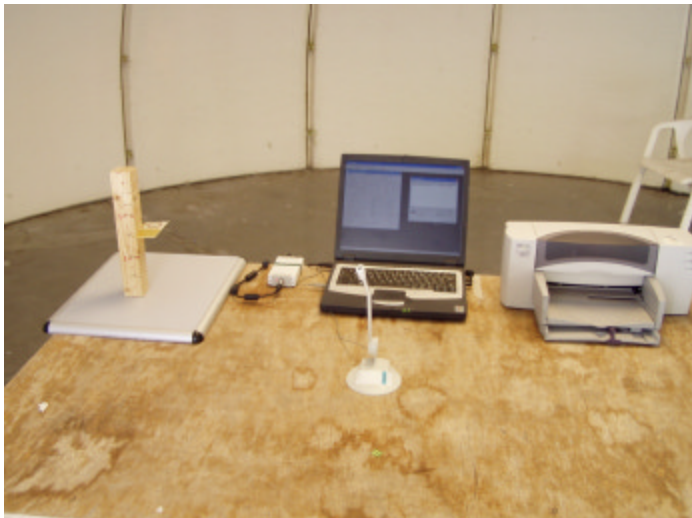
2. Radiated emission data

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 LSA3 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	2732A04140
Quasi-Peak adapter	HP	85650A	2811A01136
RF Pre-selector	HP	85685A	2833A00773
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:

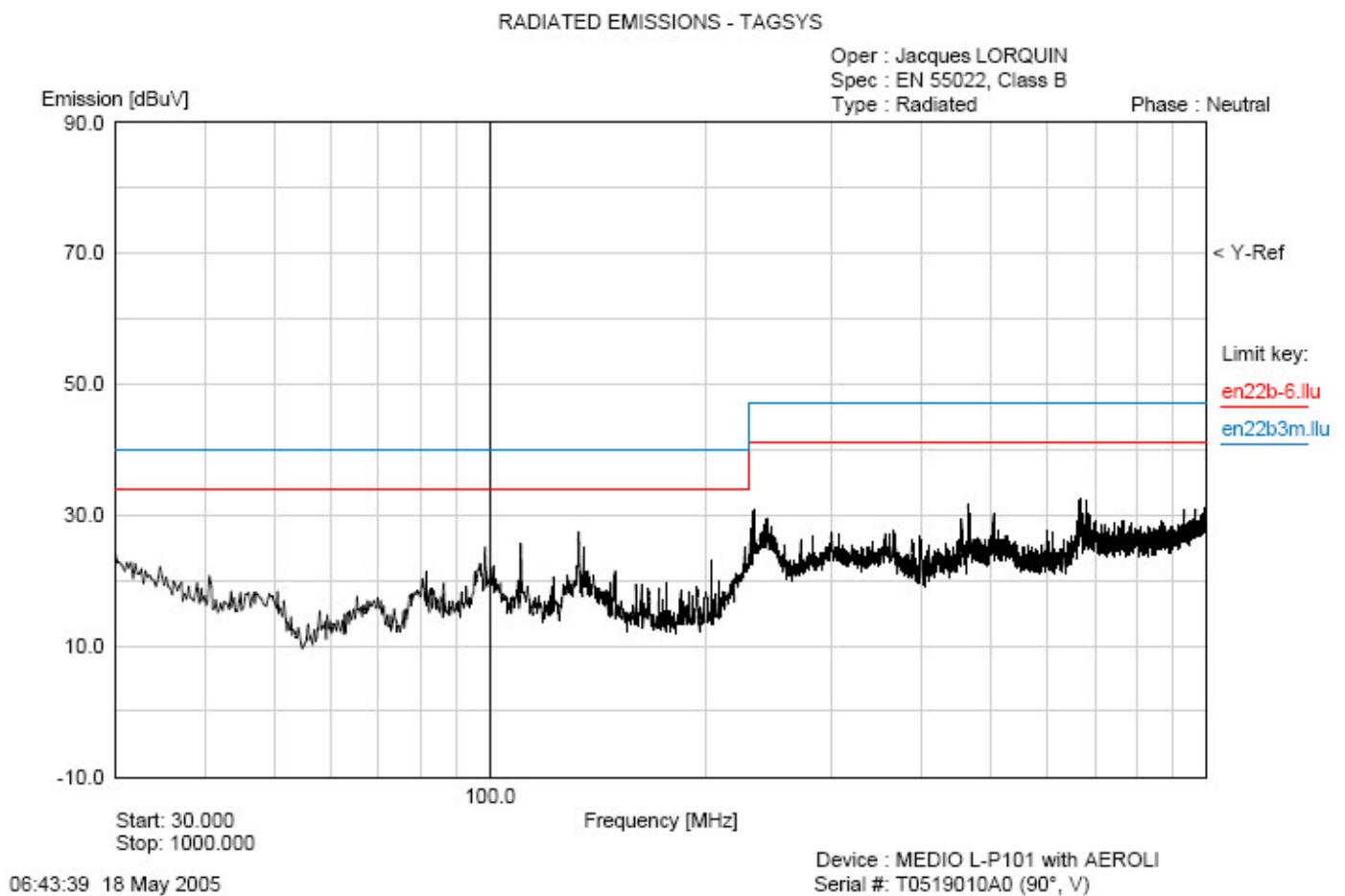
Equipment	Company	Model	Serial
EMC Analyzer	HP	8591EM	3536A00384
Amplifier	HP	8447F H64	3113A06394
Antenna (30MHz-1GHz)	CHASE	CBL6111A	1628
Loop antenna	Electro-metrics	EM-6879	690234



2.3. TEST SEQUENCE AND RESULTS

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

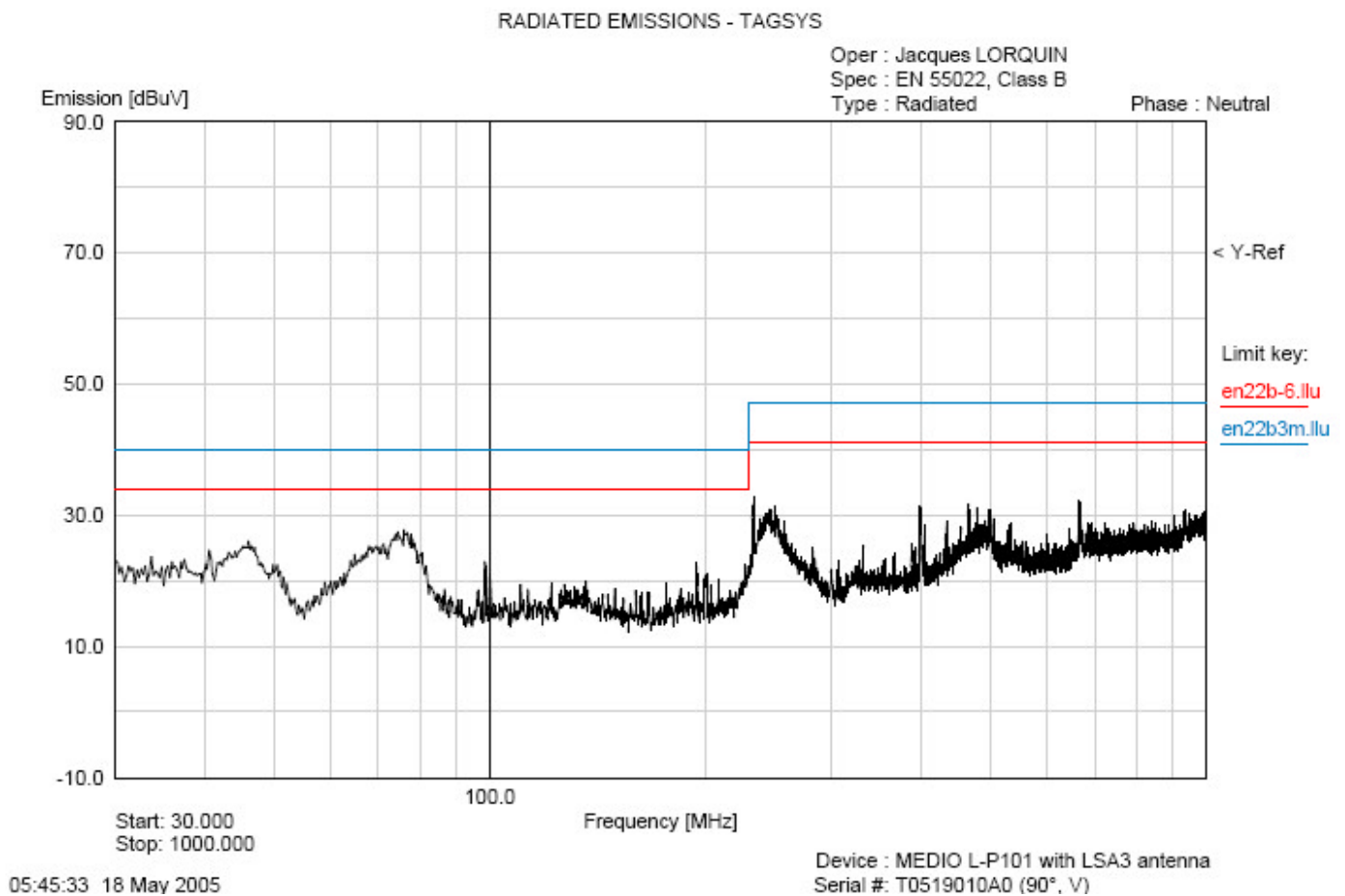
A pre-scan of all the setup has been performed in a 3 meters full anechoic chamber. The distance between EUT and antenna is 3 meters. Test is performed in horizontal (H) and vertical (V) polarization, and on 4 faces of the EUT. See below for a graph example:





2.3.2.Pre-characterization at 3 meters from 30MHz to 1GHz of LSA3 antenna

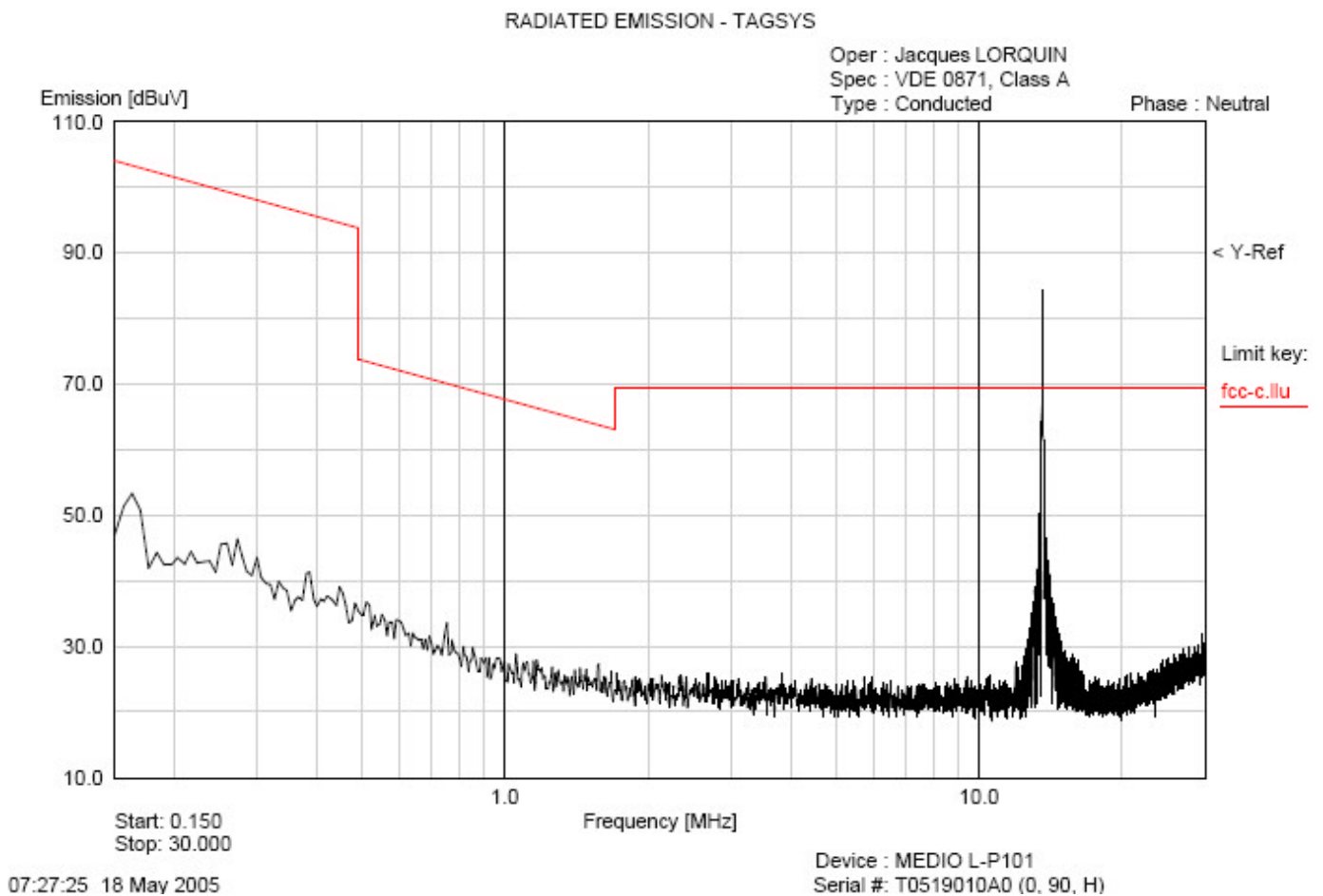
A pre-scan of all the setup has been performed in a 3 meters full anechoic chamber. The distance between EUT and antenna is 3 meters. Test is performed in horizontal (H) and vertical (V) polarization, and on 4 faces of the EUT. See below for a graph example:





2.3.3.Pre-characterization at 3 meters below 30MHz of AERO LI 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:

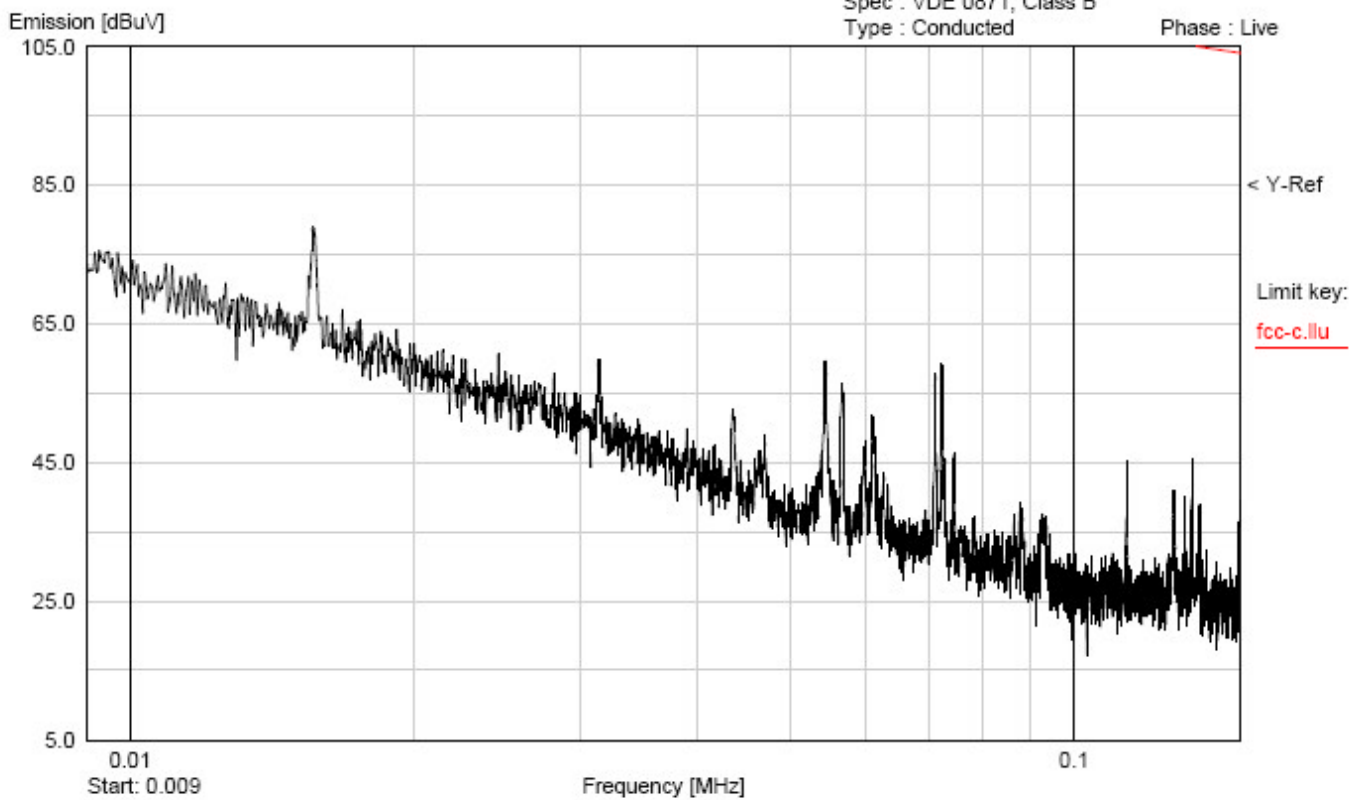




RADIATED EMISSION - TAGSYS

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

Phase : Live



Device : MEDIO L-P101
Serial #: T0519010A0 (0, 90, H)

07:34:28 18 May 2005

Result below 30 MHz



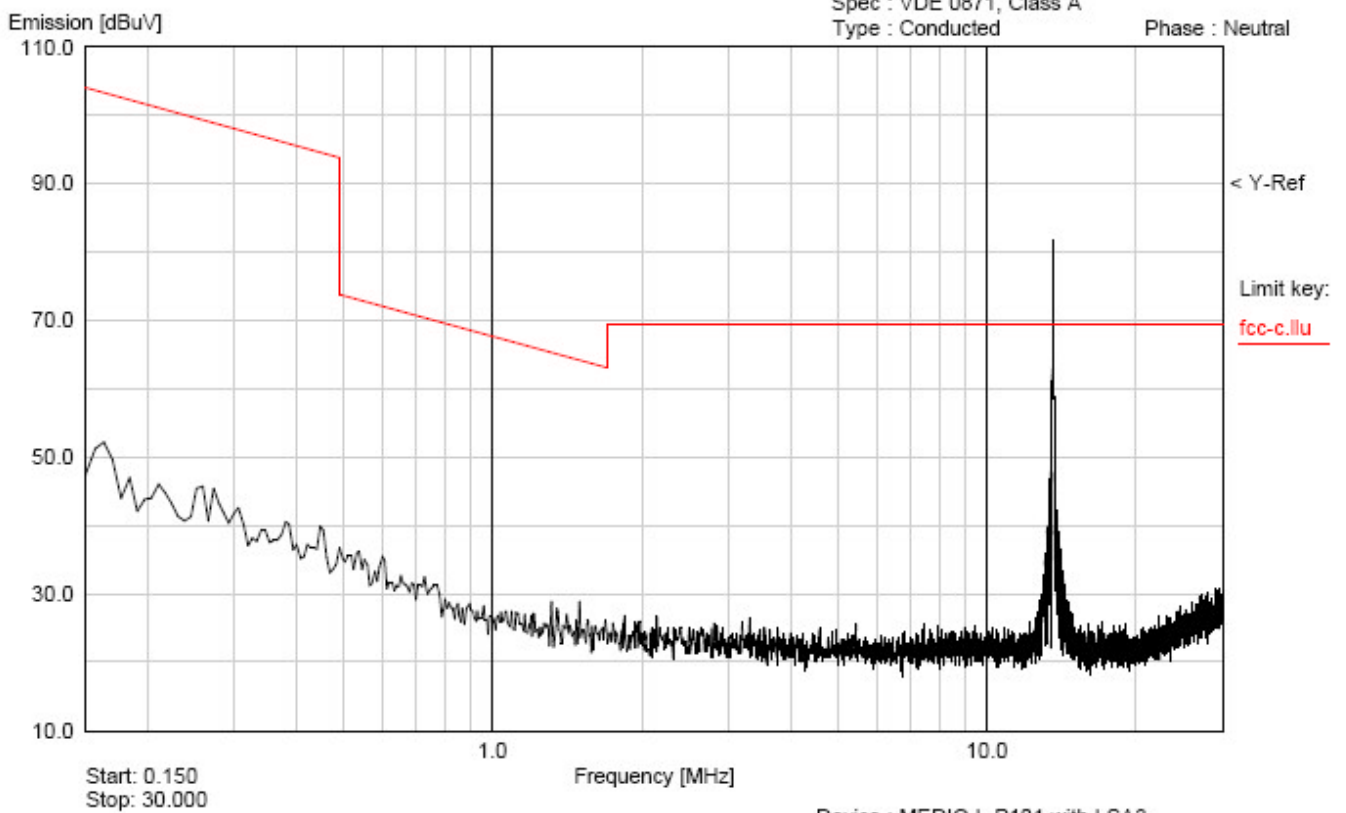
2.3.4.Pre-characterization at 3 meters below 30MHz of LSA3 antenna

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 EMISSION -TAGSYS

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

Phase : Neutral



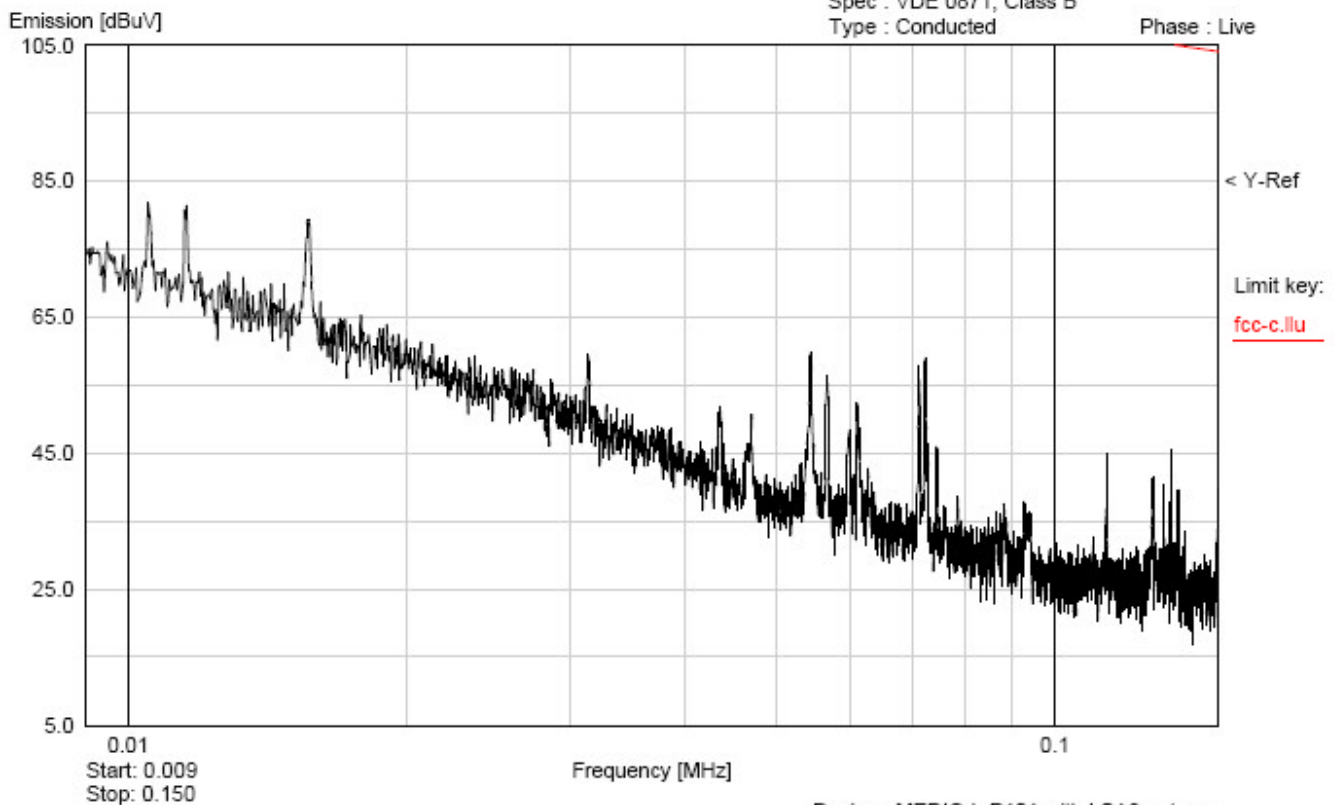
07:49:38 18 May 2005



RADIATED EMISSION - TAGSYS

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

Phase : Live



07:45:43 18 May 2005

Device : MEDIO L-P101 with LSA3 antenna
Serial #: T0519010A0 (0, 90, V)

Result below 30 MHz



2.3.5.Characterization on 3 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 LI 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	159.752	43.5	32.8	-10.7	310	V	310	16.8	*
2	172.049	43.5	30.6	-12.9	330	V	310	17.4	*
3	233.467	46.0	31.6	-14.4	160	V	120	13.9	*
4	380.919	46.0	37.7	-8.3	135	V	120	18.2	*
5	399.456	46.0	35.4	-10.6	20	H	210	18.4	*

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

LSA3 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	71.143	40.0	29.6	-10.4	330	H	300	9.7	*
2	159.735	43.5	30.3	-13.2	320	V	120	16.8	*
3	203.428	43.5	31.6	-11.9	155	V	100	13.2	*
4	234.000	46.0	29.8	-16.2	105	H	290	13.9	*
5	356.345	46.0	35.3	-10.7	165	V	120	17.9	*
6	380.930	46.0	36.1	-9.9	125	V	120	18.2	*
7	405.493	46.0	37.3	-8.7	345	H	210	18.6	*

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

2.3.6.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.

AERO LI 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	46.3	-37.7	80	vertical	0	8.5
27.12*	29.5	No traceable signal					

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

LSA3 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	36.0	-48	180	vertical	0	8.5
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.

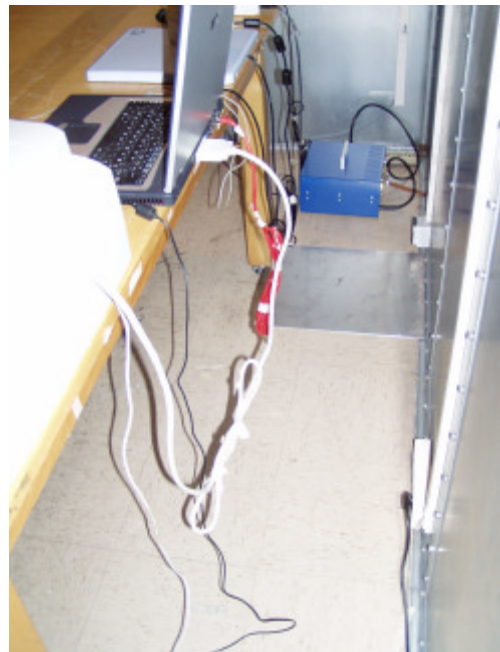
Measurement was initially made with an HP-8591EM Spectrum Analyzer in peak mode. This was followed by a Quasi-Peak, i.e. CISPR measurement with the Rohde & Schwarz ESH3 receiver for any strong signal. If the average limit is met when using a Quasi-Peak detector, the EUT shall be deemed to meet both limits 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 (sn: 0605) 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) 50Ω / 50μH	Telemeter Electronis	TGmbH NNB 2/16	0001300
Faraday room	Rayproof		4854



3.3. TEST SEQUENCE AND RESULTS

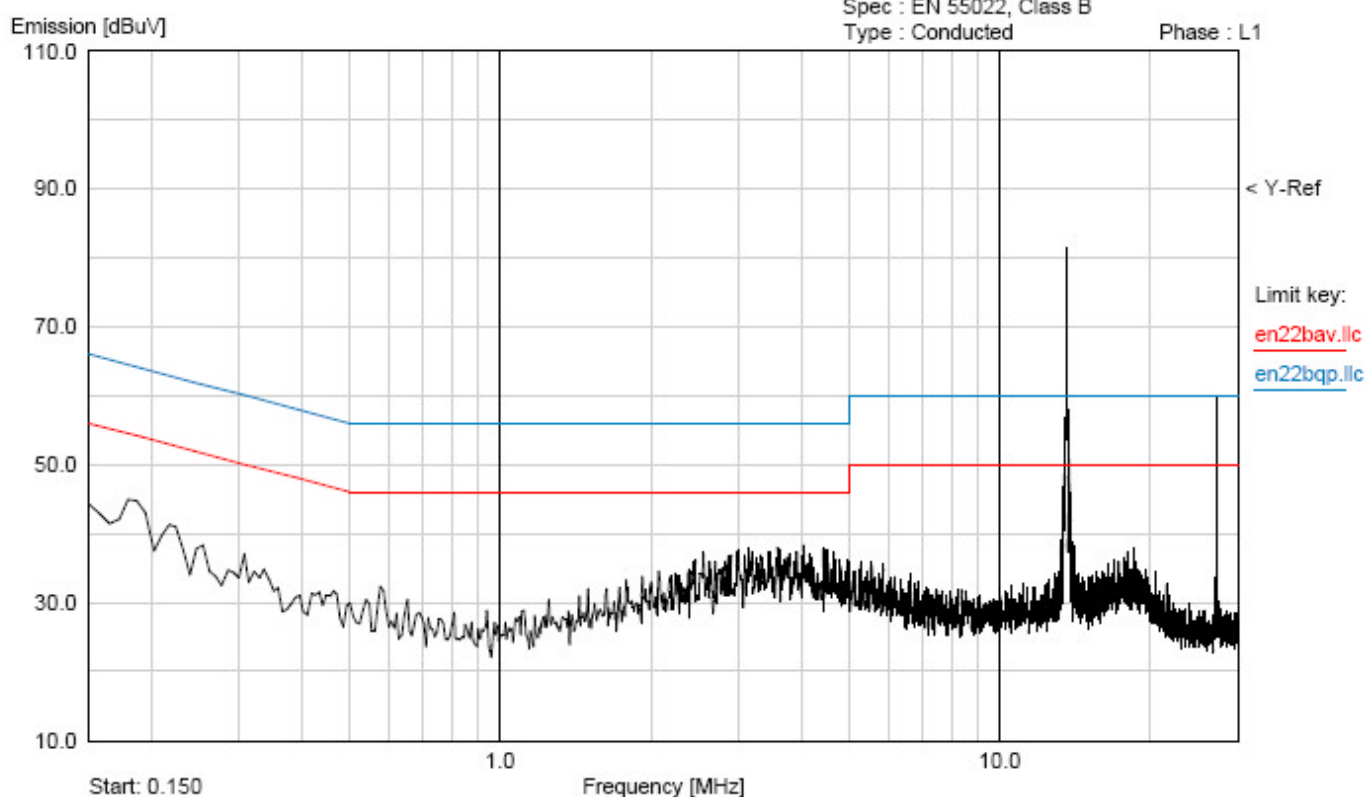
Measures are performed on line 1 and line 2 of the power supply of the equipment under test.

3.3.1. Line conducted emission data - AERO LI antenna

CONDUCTED EMISSIONS - TAGSYS

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

Phase : L1



Device : MEDIO L-P101+ AERO LI
Serial #: T0519010A0 (110V@60Hz)

02:35:16 18 May 2005

Marker ▽	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.190	45.90	42.66	29.63	54.00
2	0.220	42.64	38.89	28.38	52.00
3	0.260	40.30	35.06	27.70	50.00
4	0.290	38.15	33.58	26.29	50.00
5	27.12	60.11	57.77	35.12	50.00
6	13.58	81.45	80.21	76.23	50.00
7	12.54	31.78	26.54	18.79	50.00
8	14.57	32.37	26.67	18.57	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 - AERO LI antenna

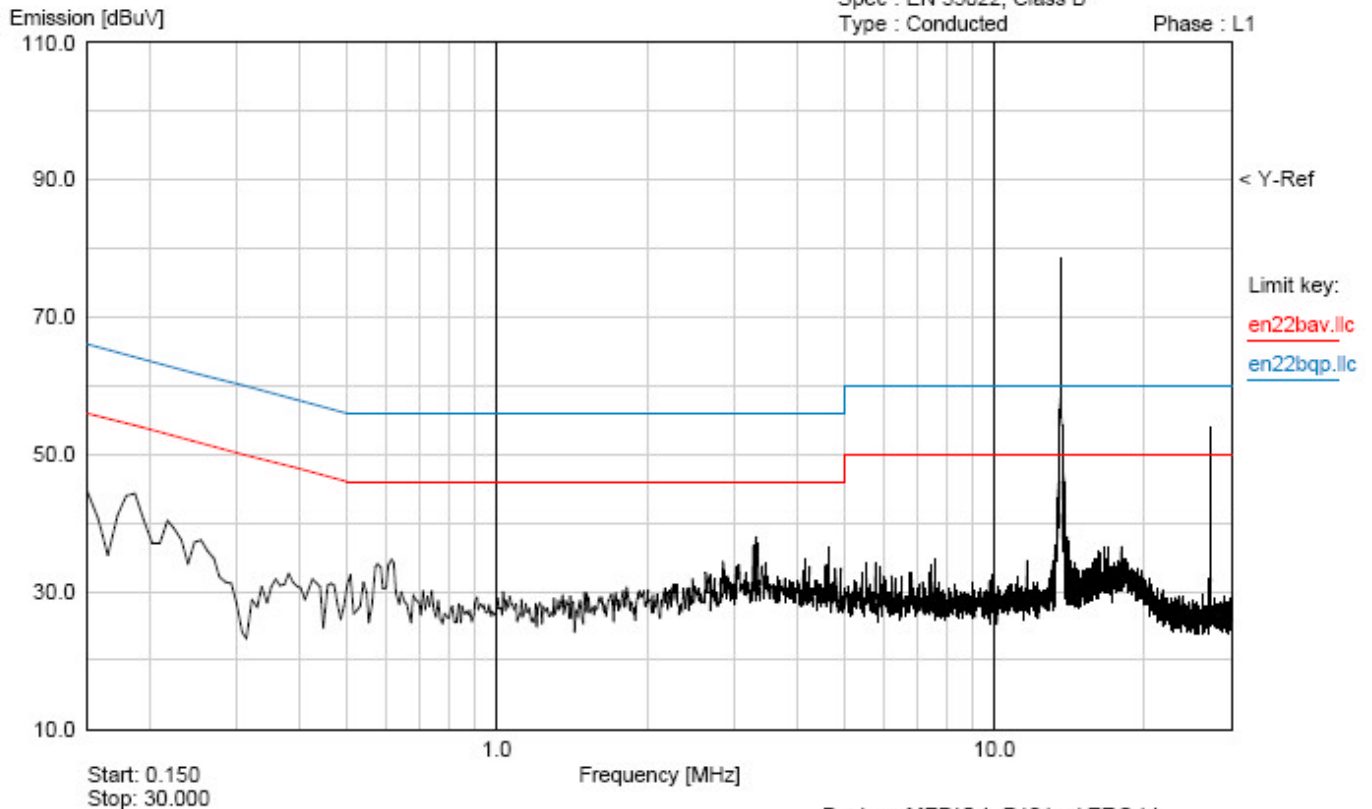
CONDUCTED EMISSIONS - TAGSYS

Oper : Jacques LORQUIN

Spec : EN 55022, Class B

Type : Conducted

Phase : L1



02:44:35 18 May 2005

Device : MEDIO L-P101+ AERO LI
Serial #: T0519010A0 (110V@60Hz)

Marker ▽	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.190	44.35	41.32	26.73	54.00
2	0.220	41.88	37.75	23.58	52.00
3	0.260	37.46	33.58	21.02	50.00
4	0.290	35.62	30.56	19.28	50.00
5	27.12	57.86	53.87	32.38	50.00
6	13.58	81.66 *	77.87 *	76.84 *	50.00
7	12.54	32.25	25.60	19.36	50.00
8	14.57	33.95	26.69	20.06	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 - LSA3 antenna

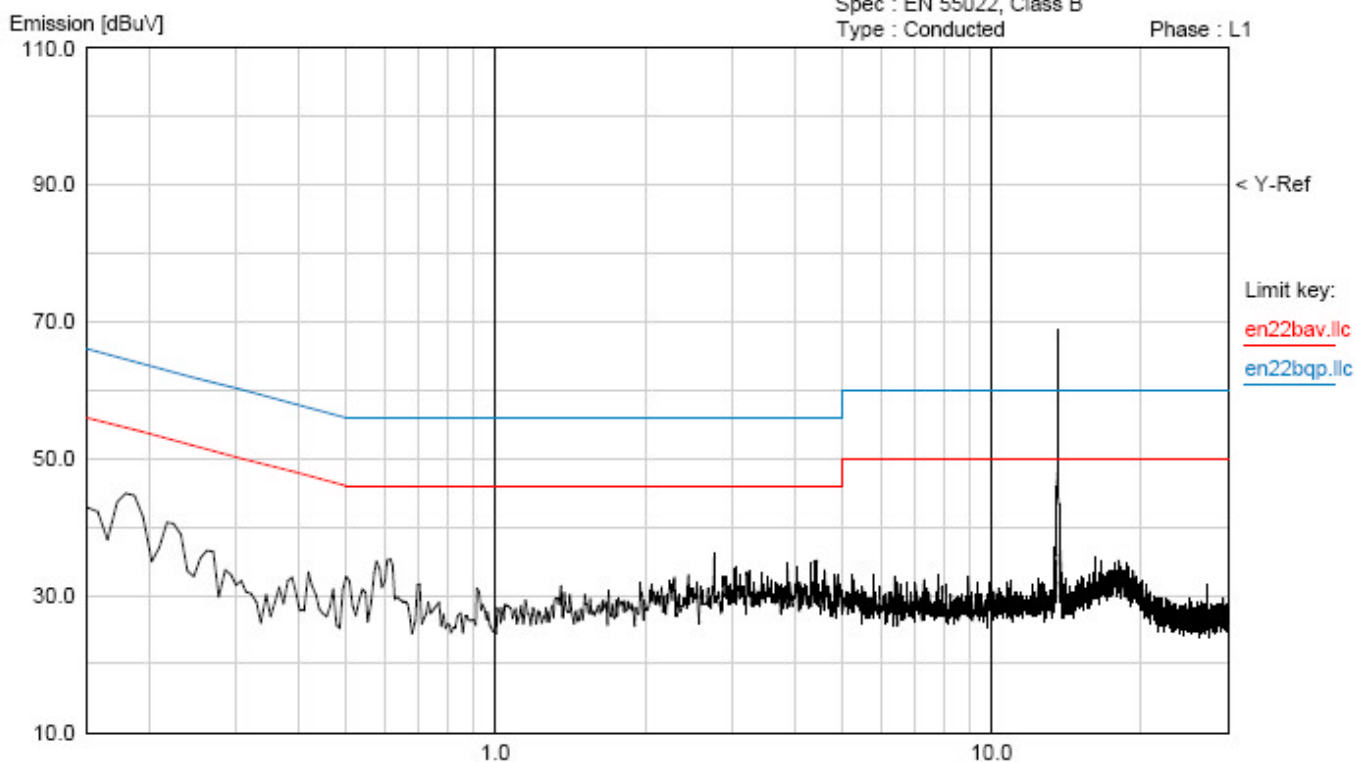
CONDUCTED EMISSIONS - TAGSYS

Oper : Jacques LORQUIN

Spec : EN 55022, Class B

Type : Conducted

Phase : L1



Device : MEDIO L-P101 with LSA3 Antenna
Serial #: T0519010A0 (110V@60Hz)

03:32:36 18 May 2005

Marker ▽	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.180	44.85	40.16	24.77	54.00
2	0.220	40.68	35.28	21.35	52.00
3	0.260	37.09	32.68	19.80	50.00
4	13.57	69.13 *	64.62 *	63.58 *	50.00
5	27.12	36.53	32.62	19.21	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).

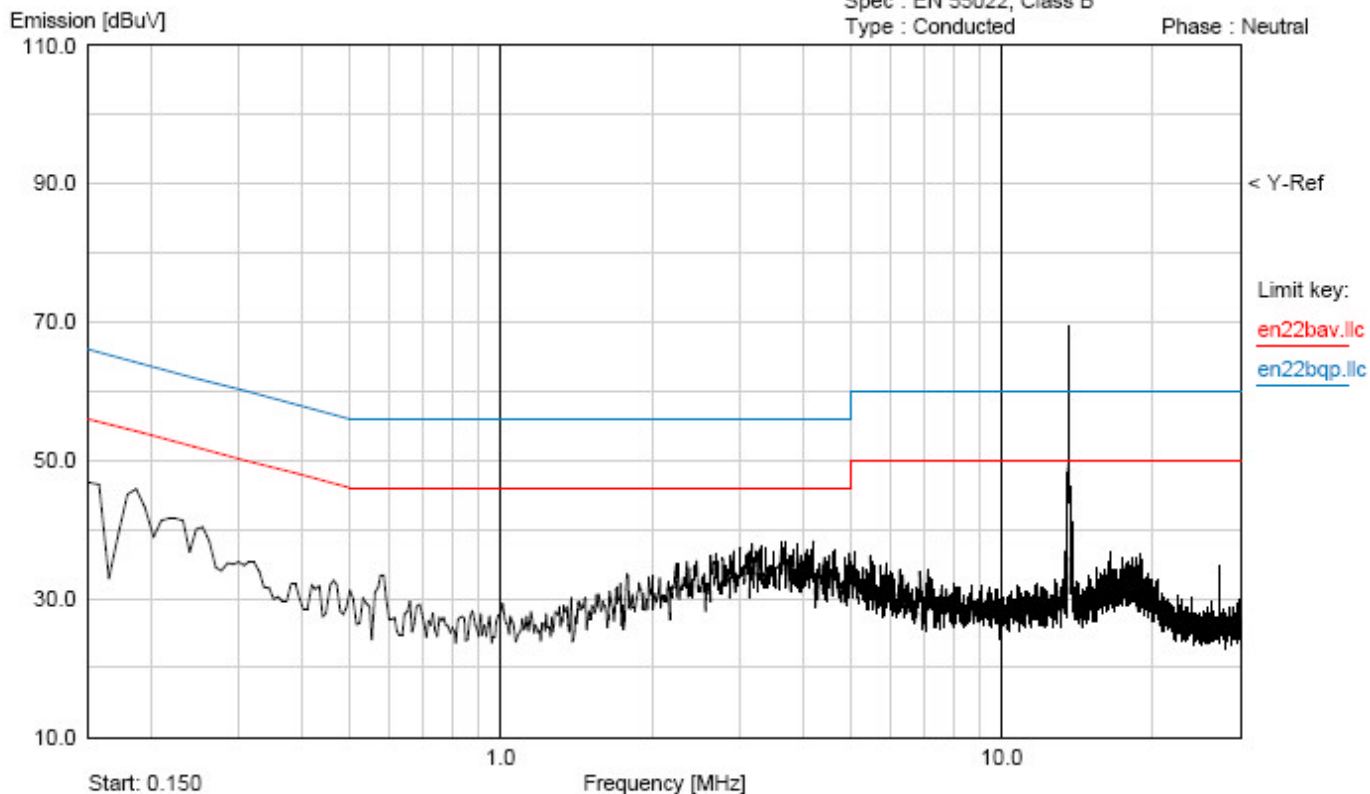


3.3.4. Neutral conducted emission data - LSA3 antenna

CONDUCTED EMISSIONS - TAGSYS

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

Phase : Neutral



Device : MEDIO L-P101 with LSA3 Antenna
Serial #: T0519010A0 (110V@60Hz)

03:25:30 18 May 2005

Marker ▽	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.180	46.08	42.78	29.96	54.00
2	0.210	42.74	38.19	27.39	52.00
3	0.250	40.37	35.92	26.53	50.00
4	13.57	71.03	69.58	65.48	50.00
5	27.12	39.10	36.10	19.71	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).



3.3.5. Line conducted emission data with dummy load

Antenna is replaced by dummy load.

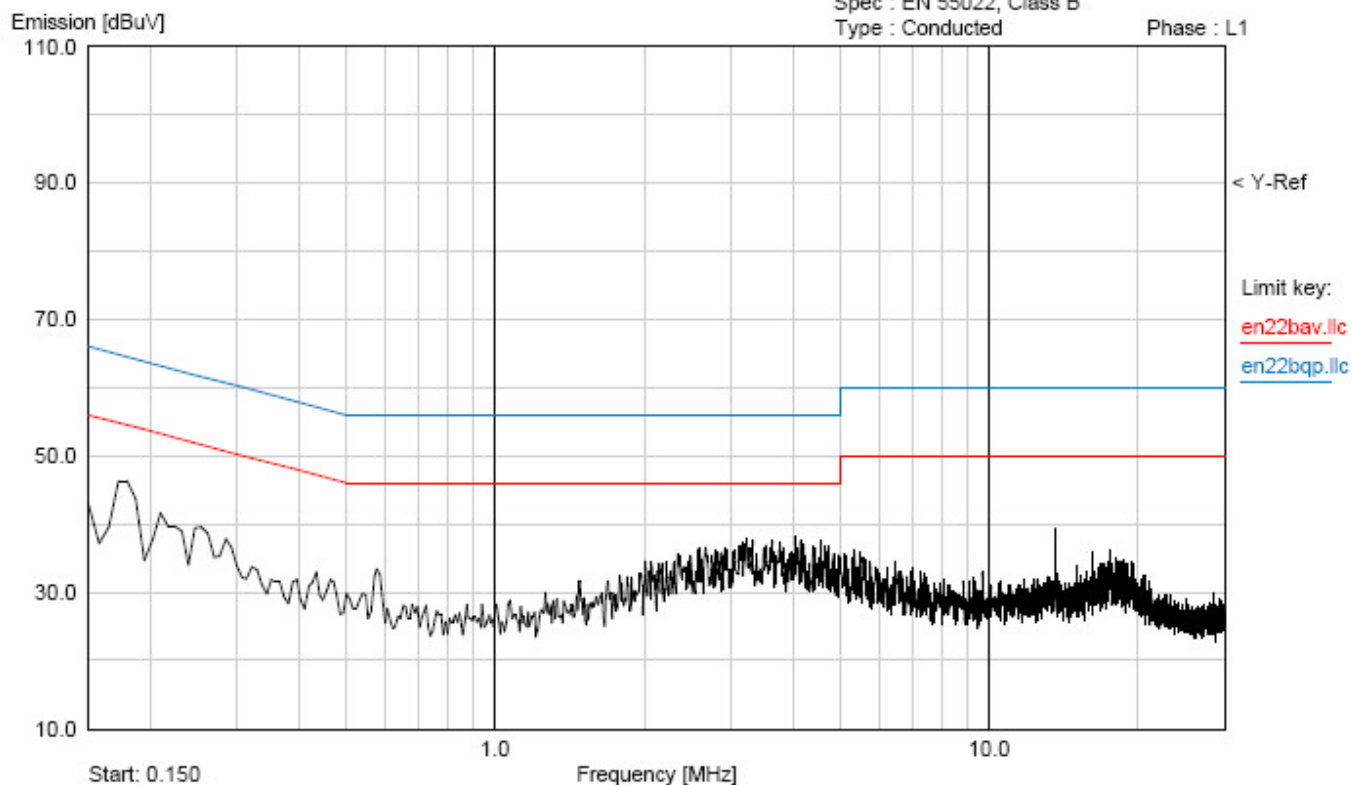
CONDUCTED EMISSIONS - TAGSYS

Oper : Jacques LORQUIN

Spec : EN 55022, Class B

Type : Conducted

Phase : L1



03:13:09 18 May 2005

Device : MEDIO L-P101 with dummy load
Serial #: T0519010A0 (110V@60Hz)

Marker ▽	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.180	46.29	42.92	31.39	54.00
2	13.57	42.48	39.72	35.07	50.00



3.3.6. Neutral conducted emission data with dummy load

Antenna is replaced by dummy load.

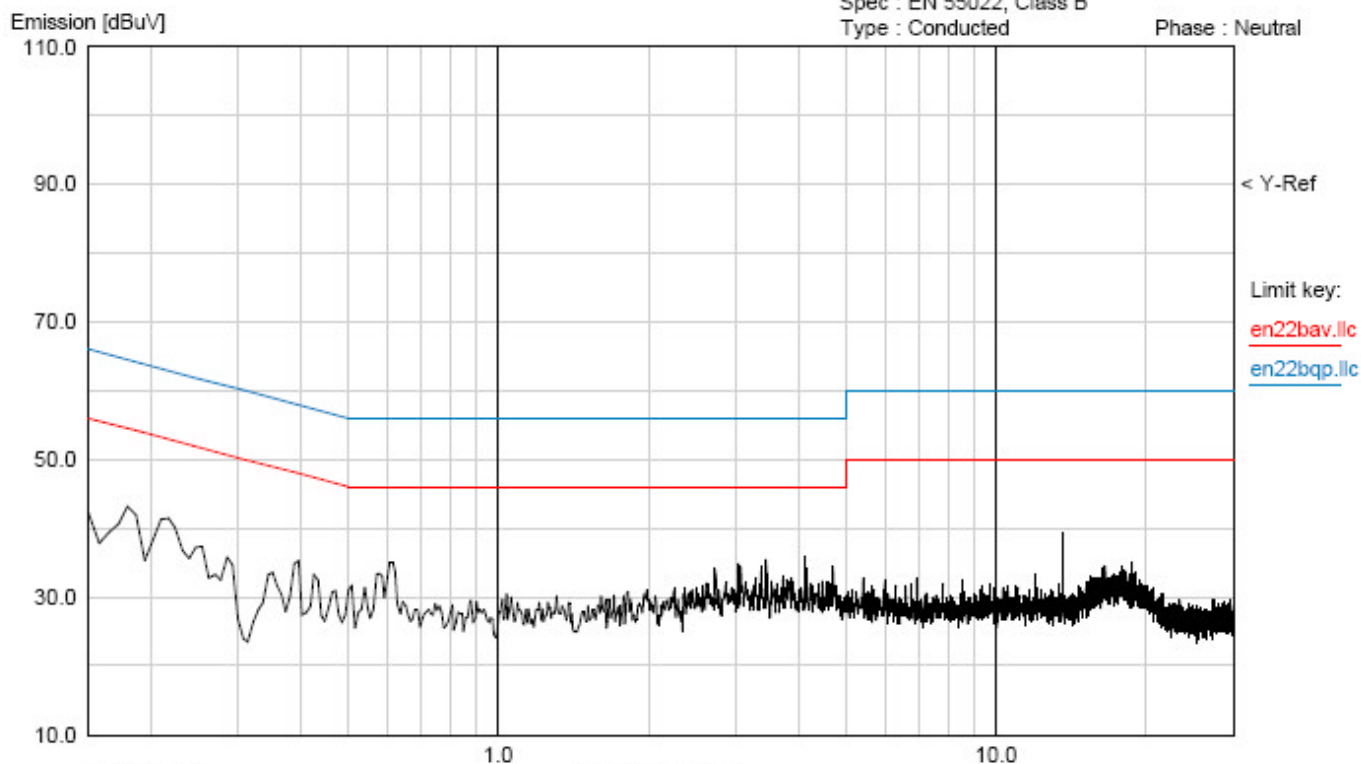
CONDUCTED EMISSIONS - TAGSYS

Oper : Jacques LORQUIN

Spec : EN 55022, Class B

Type : Conducted

Phase : Neutral



Device : MEDIO L-P101 with dummy load
 Serial #: T0519010A0 (110V@60Hz)

Marker ▽	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.180	44.93	42.11	27.62	54.00
2	0.210	41.78	38.23	24.73	52.00
3	0.250	37.82	34.52	21.62	50.00
4	13.57	41.74	37.95	36.24	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 maximized the emission measurement.)

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

AERO LI 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	46.3	-37.7	80	vertical	0	8.5
27.12*	29.5	No traceable signal					

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

LSA3 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	44.4	-39.6	180	vertical	0	8.5
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 $\pm 0.01\%$ of the operating frequency.

5.1. Voltage fluctuation

Power supply has been set at 85% and 115% of nominal voltage, at 20°C.

Nominal voltage: 100-240Vac (AC/CD power supply)

Frequency of carrier: 13.56 MHz

Upper limit: 13.561356 MHz

Lower limit: 13.558644 MHz

Voltage	85V	230V	276V
Frequency (MHz)	13.560462	13.560460	13.560465
Result	Pass	-	Pass

5.2. Temperature

Temperature has been set at -20°C and +50°C at nominal voltage 12Vdc.

Frequency of carrier: 13.56 MHz

Upper limit: 13.561356 MHz

Lower limit: 13.558644 MHz

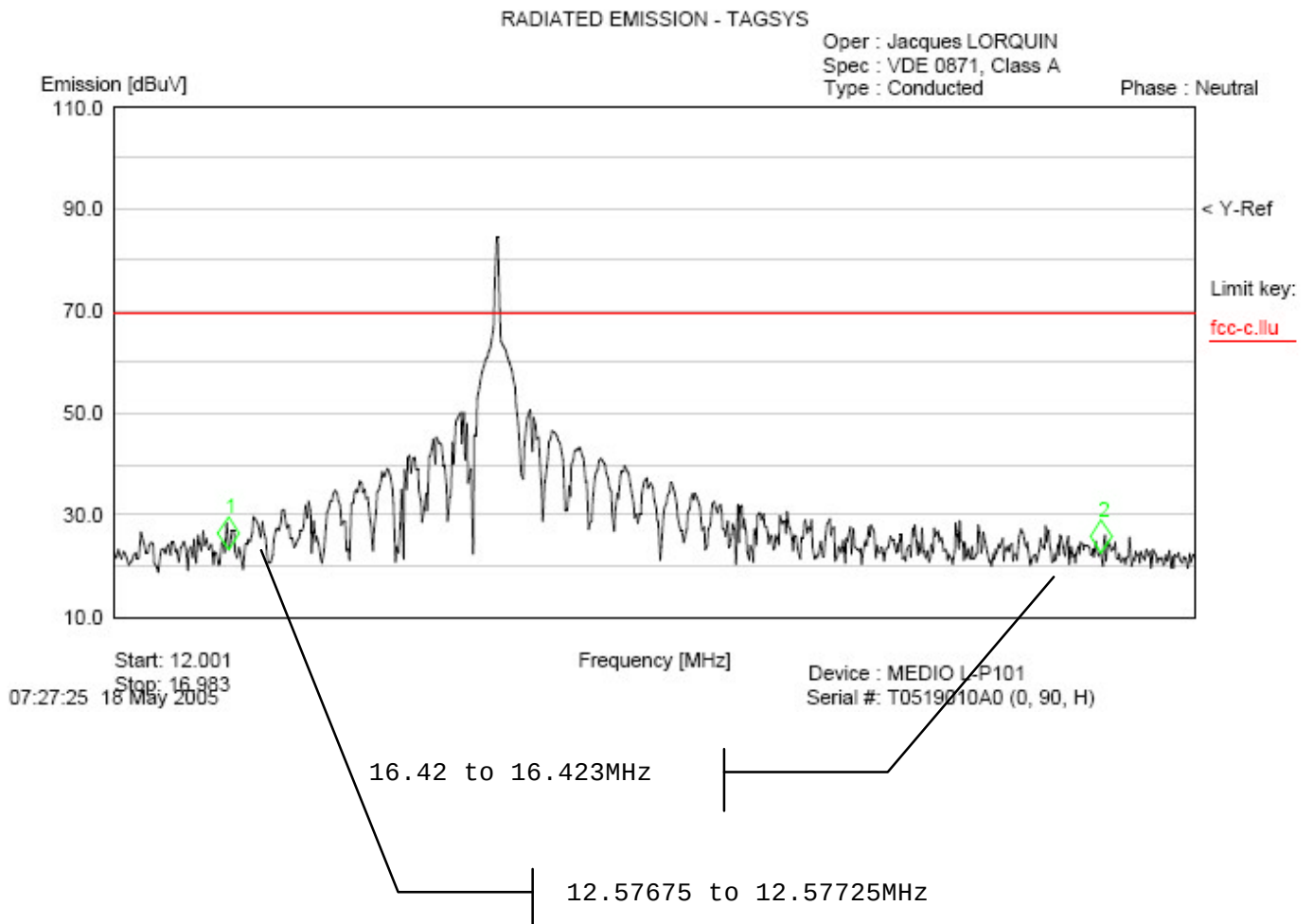
Voltage	-20°C	25°C	+50°C
Frequency (MHz)	13.560682	13.560460	13.560435
Result	Pass	-	Pass



6. Occupied bandwidth §15.205

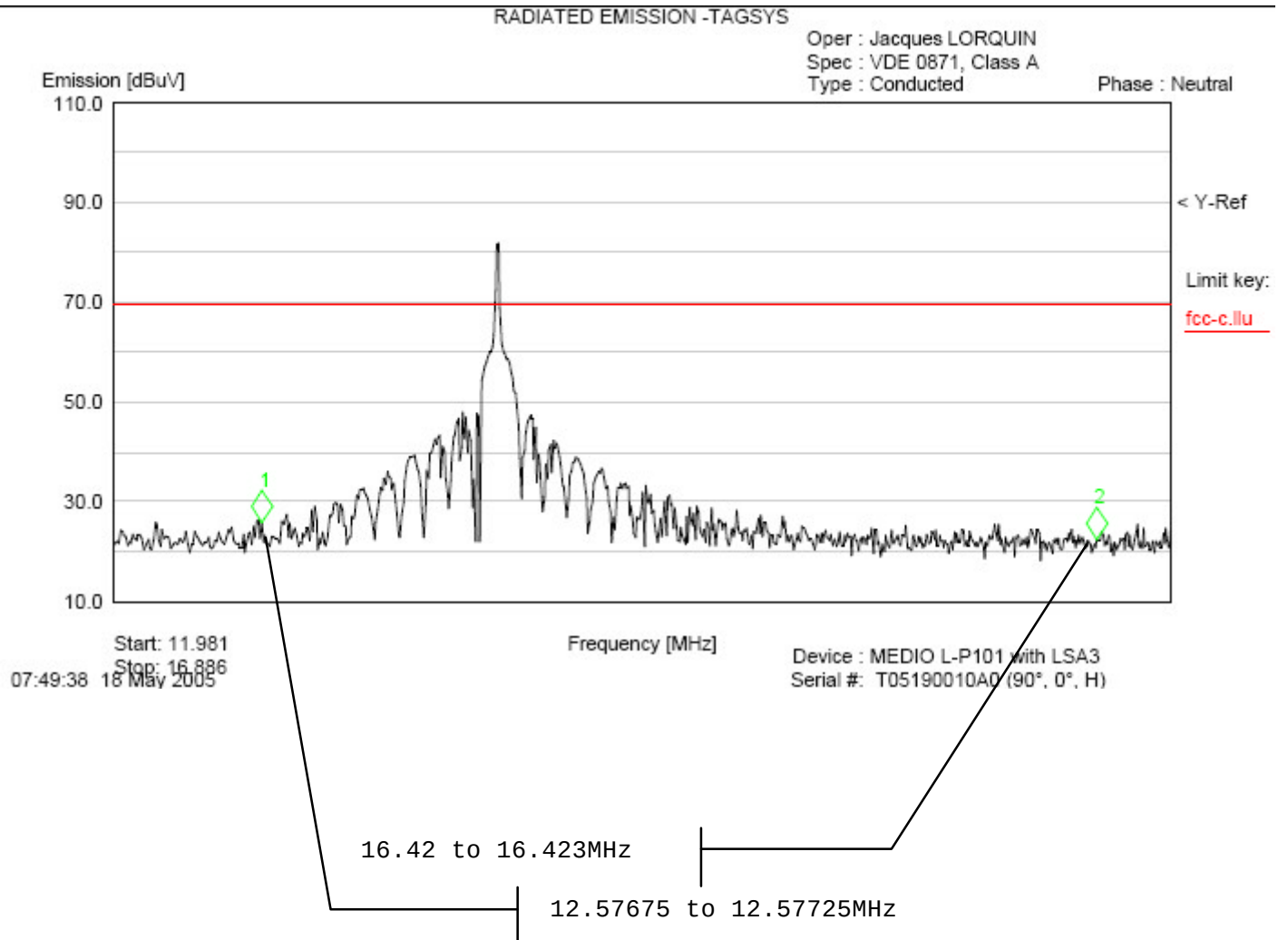
Here is a plot of the occupied bandwidth, which shows that, 12.57MHz and 16.42MHz restricted bands are free of carrier signal.

6.1. AERO LI antenna



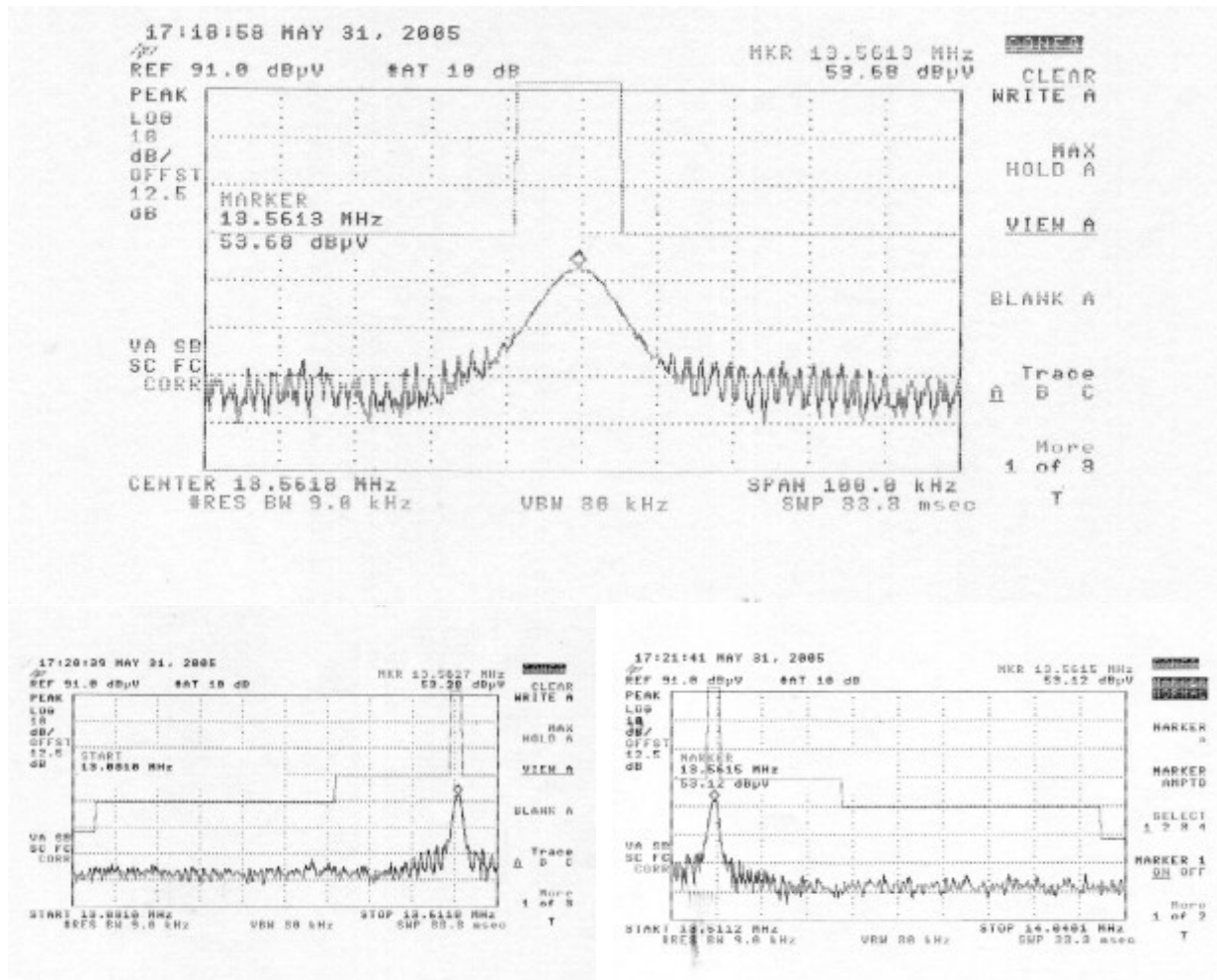


6.2. LSA3 Antenna





7.2. LSA3 Antenna



End of Tests