



Actions Mesures

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EMC TEST REPORT

Nr 2685-FCC

This test report applies only on equipment described hereafter.

Proposal number: 200302-2252

Date..... : February 11th & 31st , 2003

Location..... : SMEE Actions Mesures Laboratory - 38 VOIRON

Performed by : Jacques LORQUIN

Customer : **TAGSYS S.A. (M. D'ANNUNZIO)**
180, Chemin de Saint Lambert
13821 La PENNE SUR HUVEAUNE
FRANCE

Product..... : **Library Stack Antenna L-SA1 with L-L100**

Type of test..... : **Radiated and Conducted Emission Test**

Applied standards..... : ANSI C63-4 (1992+2000)
47 CFR Part 15 Subpart C

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

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Written by : Jacques LORQUIN

Approved by : Jacques LORQUIN



FCCID : QHKLSA1ANT

1. System test configuration

1.1. Justification

The system was configured for testing in a typical fashion (as a customer would normally use it). The LSA1 is connected to L-L100, which was connected to a Personnel computer. It has been tested with a laptop Dell model latitude CPi PPL.

1.2. HARDWARE IDENTIFICATION:

• Equipment under test (EUT):

➤ L-SAL sn:proto FCCID: QHKLSA1ANT

- Input/output: 2x I/O BNC connector
- Size : 600x400x10mm

Tested with:

➤ L-L100 pn: SE10120B0 sn:M029010004

- Input/output:

- * 1x serial connector (DB9)
- * 1x parallel connector
- * Ch1 BNC antenna connector
- * Ch2 BNC antenna connector
- * Syn IN/OUT BNC connector
- * I/O ports (1,2,3,4, gnd, Vin, Vout, gnd)
- * power supply

- Size : 250x300x75mm

- Frequencies: crystal 32.768kHz and 14.7456MHz
oscillator 27.12MHz; (no clock or signal higher than 108Mhz)

- output power : Ch1: 1W; Ch2: 1W.

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
FOLIO 20 D6 (sn: none)	None	Smart label	
DELL latitude CPi model PPL (sn:0006692D-12800-031-2130)	Doc of Conf	laptop	All data cables are shielded
Dell model PA-6 pn:9364U	Doc of Conf	adapter	Power cable unshielded.

1.4. Equipment modifications

No equipment modification has been necessary during testing to achieve compliance to FCC part 15 Subpart C requirements. The unit tested was representative to a production unit.



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1.5. EUT Exercise software

The EUT exercise program (Tagsyslibrary_test.exe, running under Windows 95) used during radiated and conducted testing was designed to exercise the L-SA1 in a manner similar to a typical use :

- Carrier on,
- Reading the tag's number,
- Display the number of the tag on the monitor.
- Write ES bit onto tag

Parameter: normal skipping 770ms

1.6. Special accessories

The serial and parallel interfaces cables used for compliance testing is shielded as normally supplied. All these cables are normally recommended to be used with the product.

1.7. I/O cables

- 2x Standard power cord Length:1.8m (PC and L-L100)
- 1x video cable with 2 integrated ferrite (shielded cable, length: 1.8m)
- 1x Parallel cable #174-8747 (shielded cable, length: 2m)
- 1x serial cable #174-8545 (Shielded cable, length:4.5m)
- 2x Coaxial cable with 6 ferrites (length: 3m) provided with LSA1

2. Radiated emission data

2.1. SET-UP

The EUT is placed on a non-conducting table of 80cm height. A smart label is set on the Unlarge library antenna LSA1.





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Equipment configuration and running mode:

- The L-L100 is plug on serial and parallel connectors;
- The L-L100 is powered by 230V/50Hz;
- Power output of L-L100: Ch1=1W & Ch2=1W;
- The Antenna (L-SA1) is connected to the Ch1 & CH2 of the L-L100;
- PC and EUT are ON;
- software is running;

The installation of EUT is identical for pre-characterization measurement in a 3 meters full anechoic chamber and for measures on a 10 meters Open site.

2.2. TEST EQUIPMENT

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

Equipment	Company	Model	Serial	Calibration Due
Spectrum Analyzer	HP	8568B	2732A04140	March 22 nd , 2003
Quasi-Peak adapter	HP	85650A	2811A01136	March 22 nd , 2003
RF Pre-selector	HP	85685A	2833A00773	March 22 nd , 2003
Biconical Antenna	EMCO	3104C	9401-4636	April 4 th , 2003
Log Periodic Antenna	EMCO	3146	2178	April 4 th , 2003
Spectrum Analyzer	HP	8593E	3409u00537	June 29 th , 2003
Loop antenna	Electro-metrics	EM-6879	690234	February 10 th , 2004
Amplifier	HP	8447F H64	3113A06394	March 28 th , 2003
OATS				April 9 th , 2003

EMCO-1050, 6 meters height antenna mast & EMCO-1060, 3 meters diameter Turntable.

A 10 meters Open site located in SMEE Actions Mesures - Voiron (FRANCE) .

Pre-scan, test Equipment up to 1GHz:

Equipment	Company	Model	Serial	Calibration Due
EMC Analyzer	HP	8591EM	3536A00384	March 29 th , 2003
Amplifier	HP	8447F H64	3113A06394	March 28 th , 2003
Antenna (30MHz-1GHz)	CHASE	CBL6111A	1628	March 29 th , 2003
Loop antenna	Electro-metrics	EM-6879	690234	February 10 th , 2004

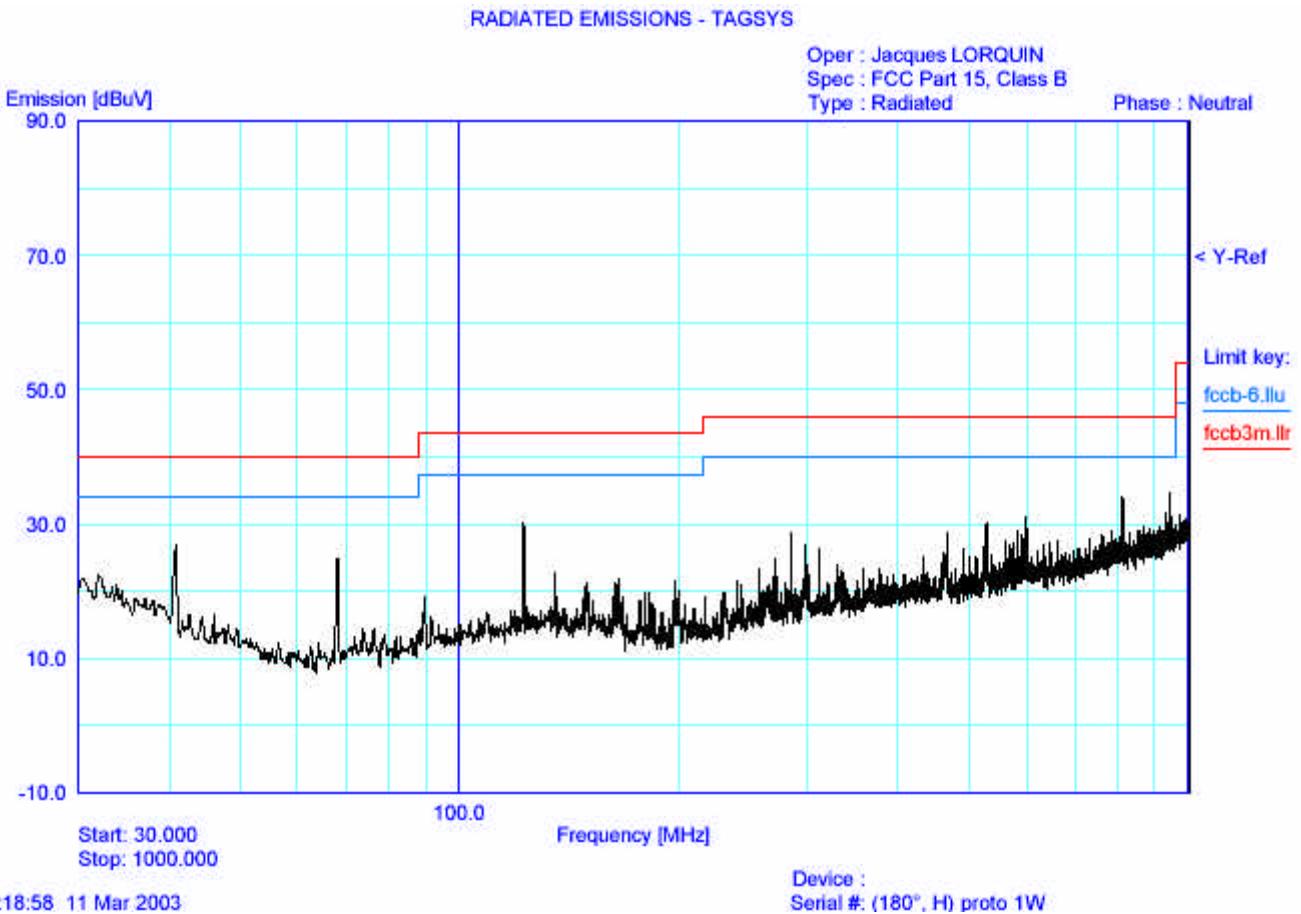


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2.3. TEST SEQUENCE AND RESULTS

2.3.1. Pre-characterization at 3 meters

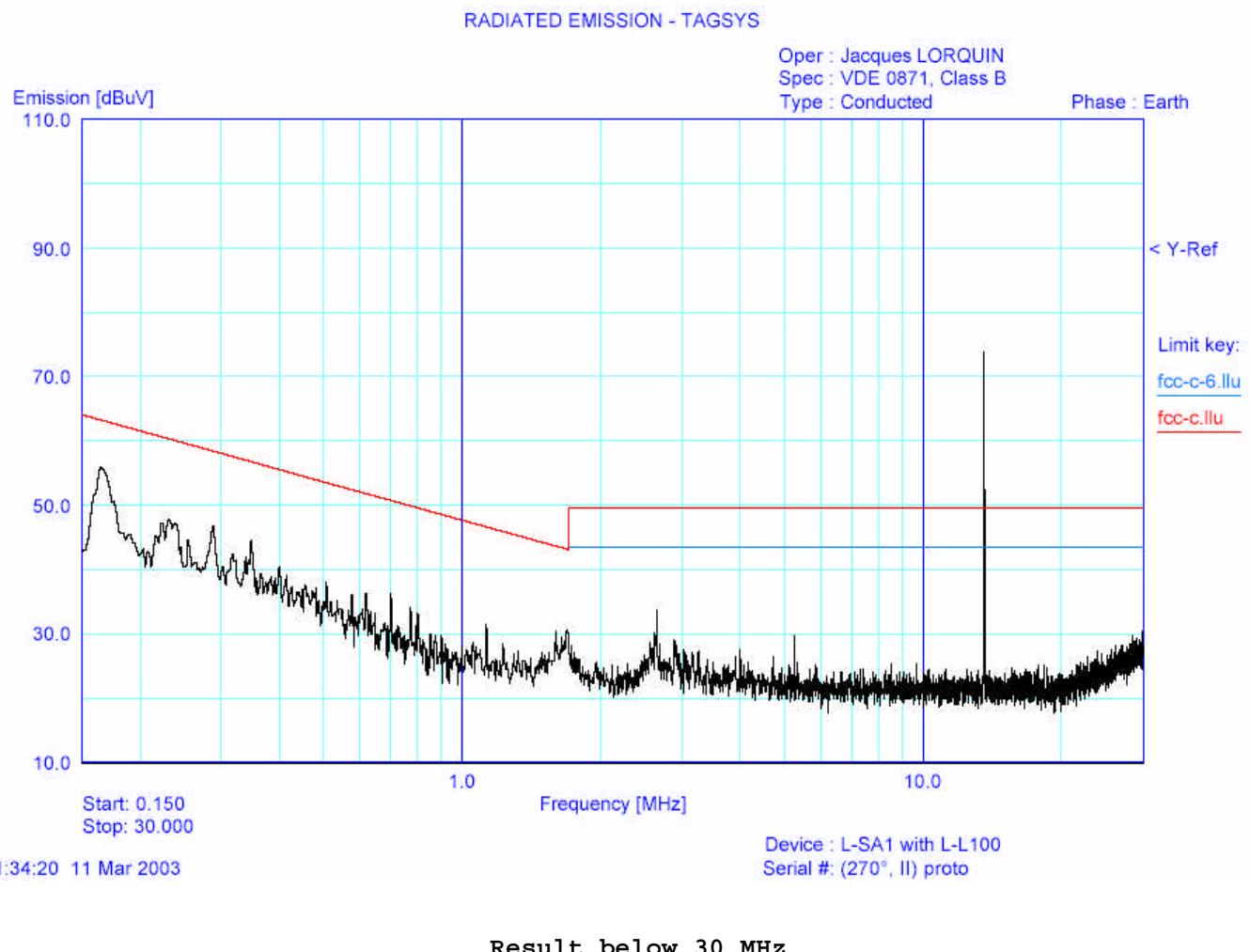
A pre-scan of all the setup has been performed in a 3 meters full anechoic chamber. The distance between EUT and antenna is 3 meters. Test is performed in horizontal (H) and vertical (V) polarization, and on 4 faces of the EUT. See below for a graph example:





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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:





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

The product has been tested according to ANSI C63.4-(1992), FCC part 15 subpart C. Radiated Emission were 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.

No	Frequency (MHz)	QPeak Lmt (dB μ V/m)	QPeak (dB μ V/m)	QPeak-Lmt (dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)	Comments
1	40.679	40.0	39.4	-0.6	255	H	344	11.6	*
2	67.794	40.0	30.7	-9.3	156	V	101	10.0	*
3	122.792	43.5	35.1	-8.4	264	H	382	16.0	*
4	132.733	43.5	29.6	-13.9	287	V	262	14.9	*
5	284.743	46	37.4	-8.6	52	H	277	17.1	*
6	298.310	46	33.3	-12.7	59	H	349	17.7	*
7	813.609	46	40.6	-5.4	157	H	291	26.8	*

*: The results are extrapolated with §15.31 requirement.

2.3.3.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.

Frequency (MHz)	QPeak Lmt (dB μ V/m)	QPeak (dB μ V/m)	QPeak-Lmt (dB)	Angle EUT (deg)	Pol	Angle Ant. (deg)	Tot Corr (dB)
13.56* ¹	80	50.6	-29.4	166	vertical	0	35.4
27.12				Not traceable signal			

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



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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 52.5dB μ V 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 dB μ V/m.

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

The 32 dB μ V/m value can be mathematically converted to its corresponding level in μ V/m.

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



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3. Conducted emission data

The product has been tested according to ANSI C63.4-(1992) 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 non-conducting table of 80cm height. The cable of the power supply has been shorted to 1meter length. The MEDIO L100 is powered through the LISN.





FCCID : QHKLSA1ANT

Equipment configuration and running mode:

- The L-L100 is plug on serial and parallel connectors;
- The L-L100 is powered by 110V/60Hz;
- The Antenna is connected to the Ch1 & Ch2 of the L-L100;
- PC and EUT are ON;
- software is running;

3.2. TEST EQUIPMENT

Equipment	Company	Model	Serial	Calibration Due
EMC Analyzer	HP	8591EM	3536A00384	March 29 th ,2003
test receiver	Rohde&Schwarz	ESH3	872079/117	March 21 st ,2003
	z			
Transient Limiter	HP	11947A	3107A01596	March 28 th ,2003
LISN(auxiliary)	EMCO	3810/2SH	9511-11821628	December 12 th ,2003
LISN(measure)	Telemeter	TGmbH	NNB 9511-11821628	September 13 th
50Ω / 50µH	Electronis	2/16		,2003
Faraday room	Rayproof		4854	none

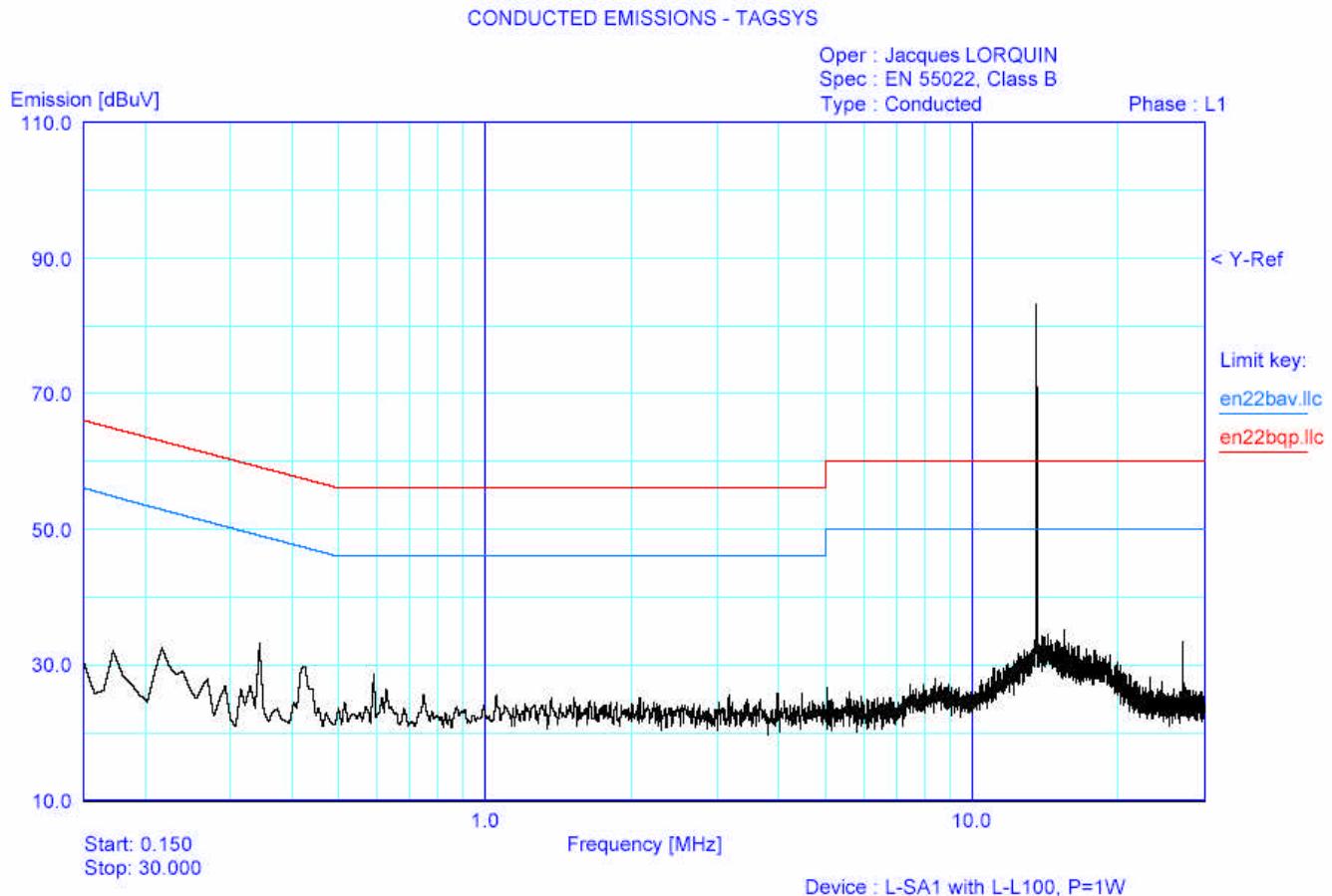


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3.3. TEST SEQUENCE AND RESULTS

Measures are performed on line 1 and line 2 of the power supply of the L-L100,

3.3.1. Line conducted emission data on L-L100



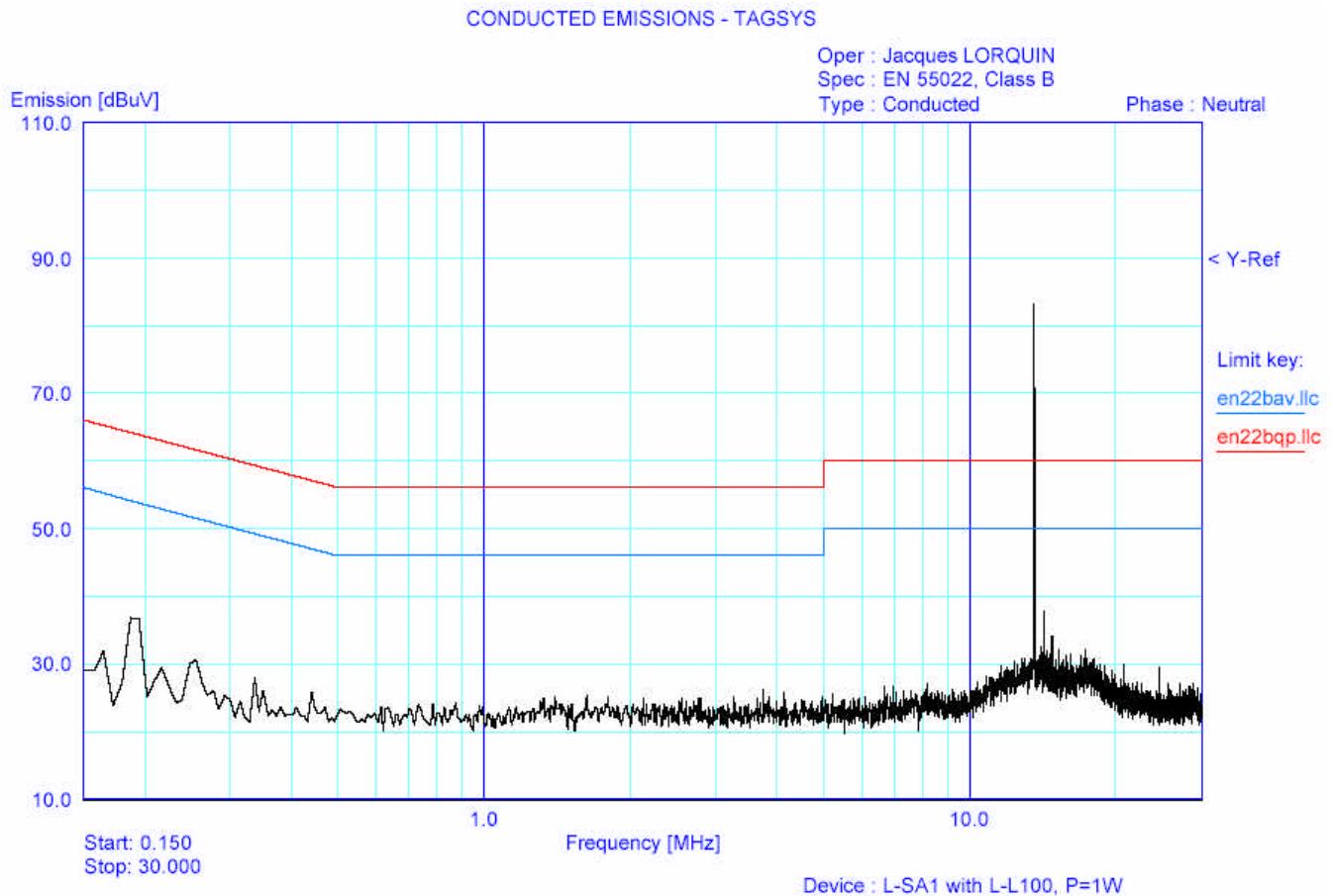
Num.	Freq. [MHz]	Peak [dB μ V]	Q-Peak [dB μ V]	QP limit [dB μ V]	QP delta [dB μ V]	Average [dB μ V]	AVG Limit [dB μ V]	AVG Delta [dB μ V]	Comment.
1	0.340	25.27	19.96	58.0	-38.04	13.86	48.0	-34.14	
2	0.420	24.44	19.82	56.0	-36.18	13.51	46.0	-32.49	
3	0.590	23.78	19.54	56.0	-36.46	13.43	46.0	-32.57	
4	13.56	83.71	-	60.0	-	-	50.0	-	Carrier*
5	14.52	32.37	27.25	60.0	-32.75	20.57	50.0	-29.43	
6	15.44	31.60	25.56	60.0	-34.44	18.63	50.0	-31.37	
7	27.13	34.96	33.15	60.0	-26.85	31.65	50.0	-18.35	

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



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3.3.2. Neutral conducted emission data on L-L100



Num.	Freq. [MHz]	Peak [dB μ V]	QP-peak [dB μ V]	QP limit [dB μ V]	QP delta [dB μ V]	Average [dB μ V]	AVG Limit [dB μ V]	AVG Delta [dB μ V]	Comment.
1	0.190	41.82	34.19	62.0	-27.81	14.30	52.0	-37.7	
2	13.55	30.56	25.14	60.0	-34.86	18.89	50.0	-31.11	
3	13.56	80.58	-	60.0		-	50.0		Carrier*
4	14.23	30.60	24.88	60.0	-35.12	18.54	50.0	-31.46	
5	14.76	35.03	31.57	60.0	-28.43	29.04	50.0	-20.96	
6	17.26	30.06	25.02	60.0	-34.98	18.91	50.0	-31.09	

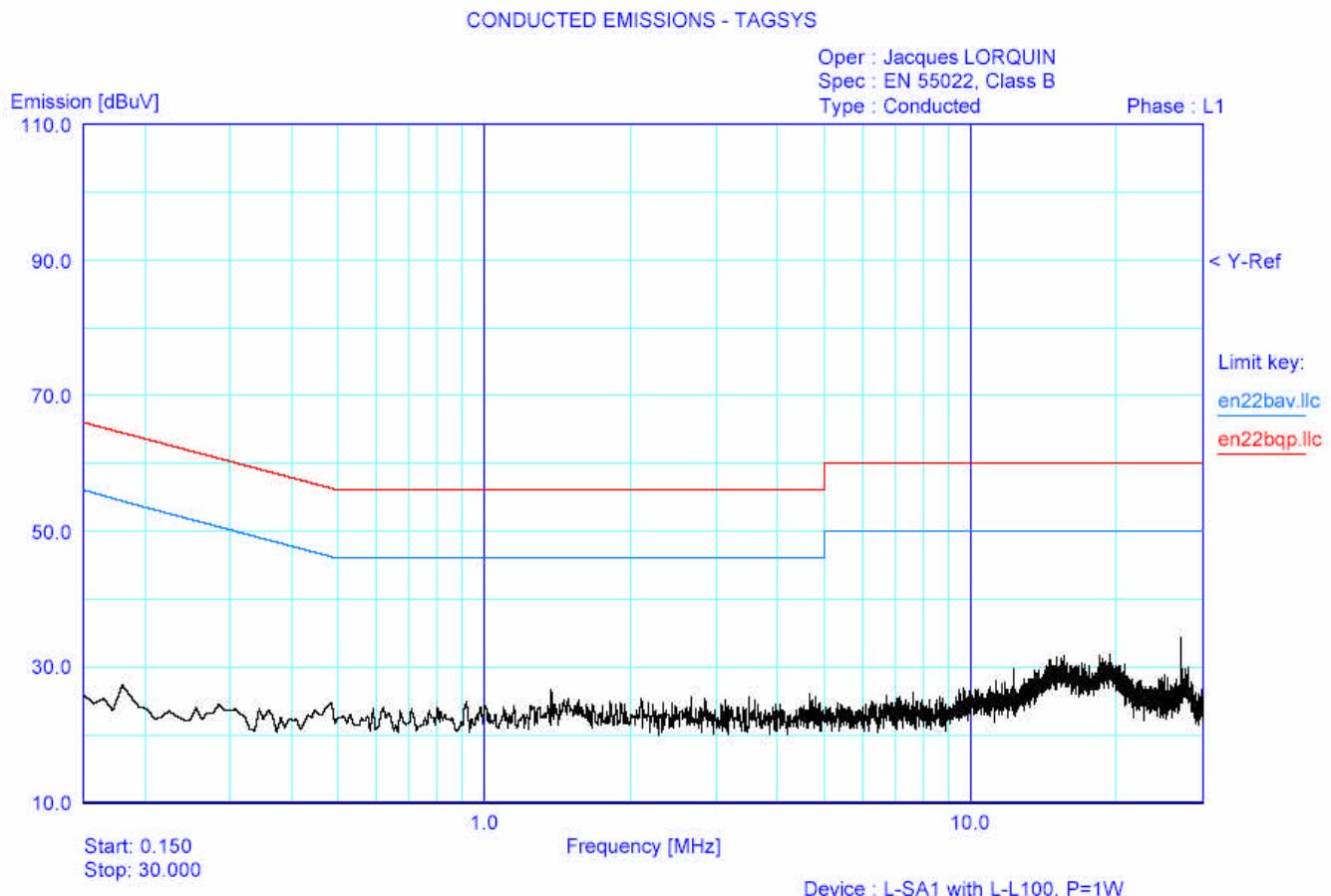
*: Carrier - §15.207(b): Limits shall not apply to carrier current systems operating as intentional radiators on frequencies below 30MHz.



FCCID : QHKLSA1ANT

3.3.3. Line conducted emission data on L-L100 with dummy load

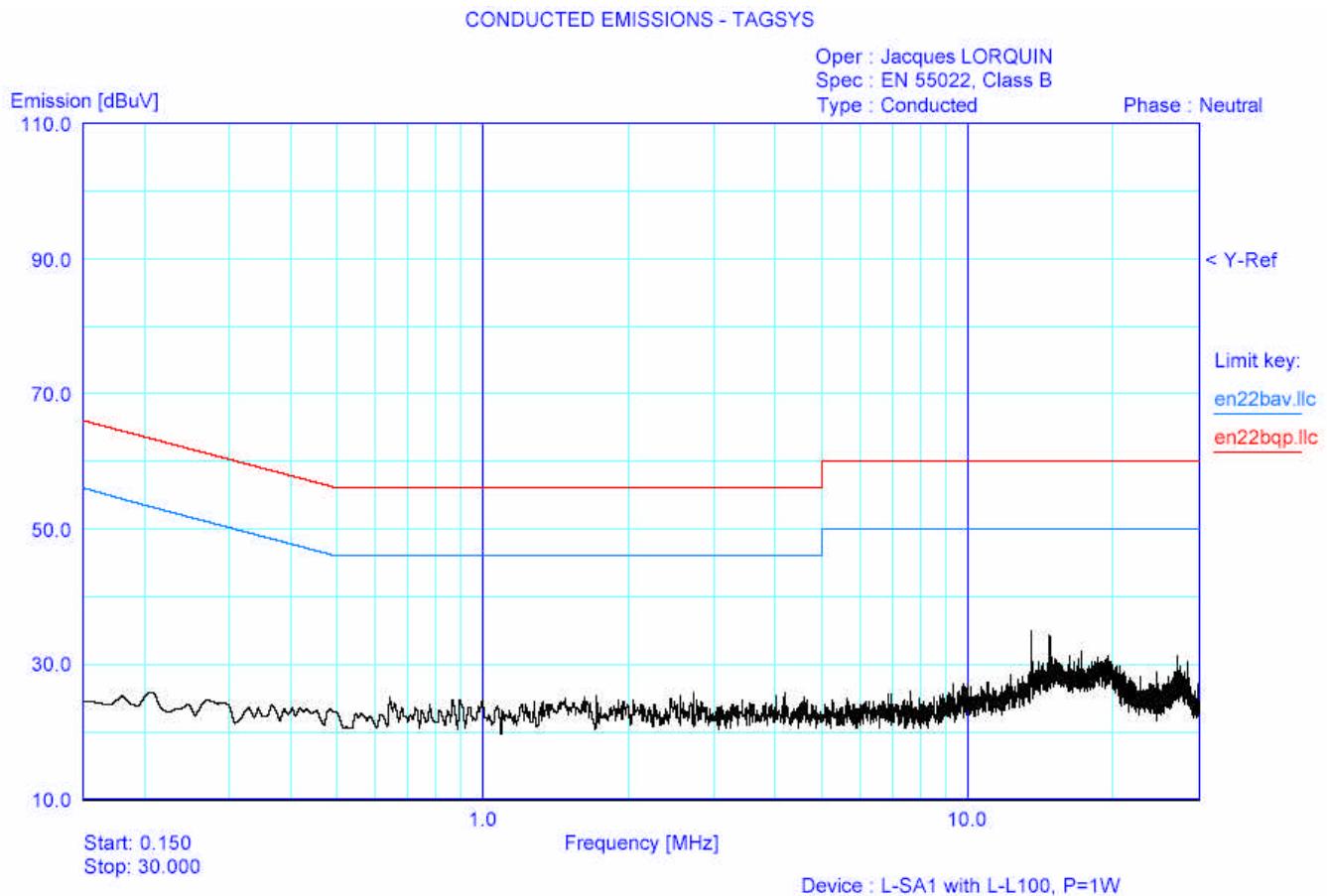
Antennas are replaced by dummy loads.





FCCID : QHKLSA1ANT

3.3.4. Neutral conducted emission data on Medio L100 with dummy load
Antennas are replaced by dummy loads.





FCCID : QHKLSA1ANT

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.)

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

Frequency	QPeak	Lmt	QPeak	QPeak-Lmt	Angle	Pol	Angle Ant.	Tot	
(MHz)	(dB μ V/m)	(dB μ V/m)	(dB)	(dB)	EUT	(deg)	(deg)	Corr	(dB)
13.56	80	50.6	-29.4	166	vertical	0	35.4		

No significant 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%): 0.2dBc

Limits Subclause §15.225(a)

Frequency (MHz)	Field strength (μ V/m)	Measurement distance (m)
13.56	10 000 80dB μ V/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

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

Nominal voltage : 110-230V/60Hz

Frequency of carrier: 13.56 MHz

Upper limit: 13.561356 MHz

Lower limit: 13.558644 MHz

Voltage	85V	230V	276V
Frequency (MHz)	13.560000	13.559960	13.560025
Result	Pass	-	Pass



FCCID : QHKL5A1ANT

5.2. *temperature*

Temperature has been set at -20°C and +50°C at nominal voltage 230V/50Hz.

Frequency of carrier: 13.56 MHz

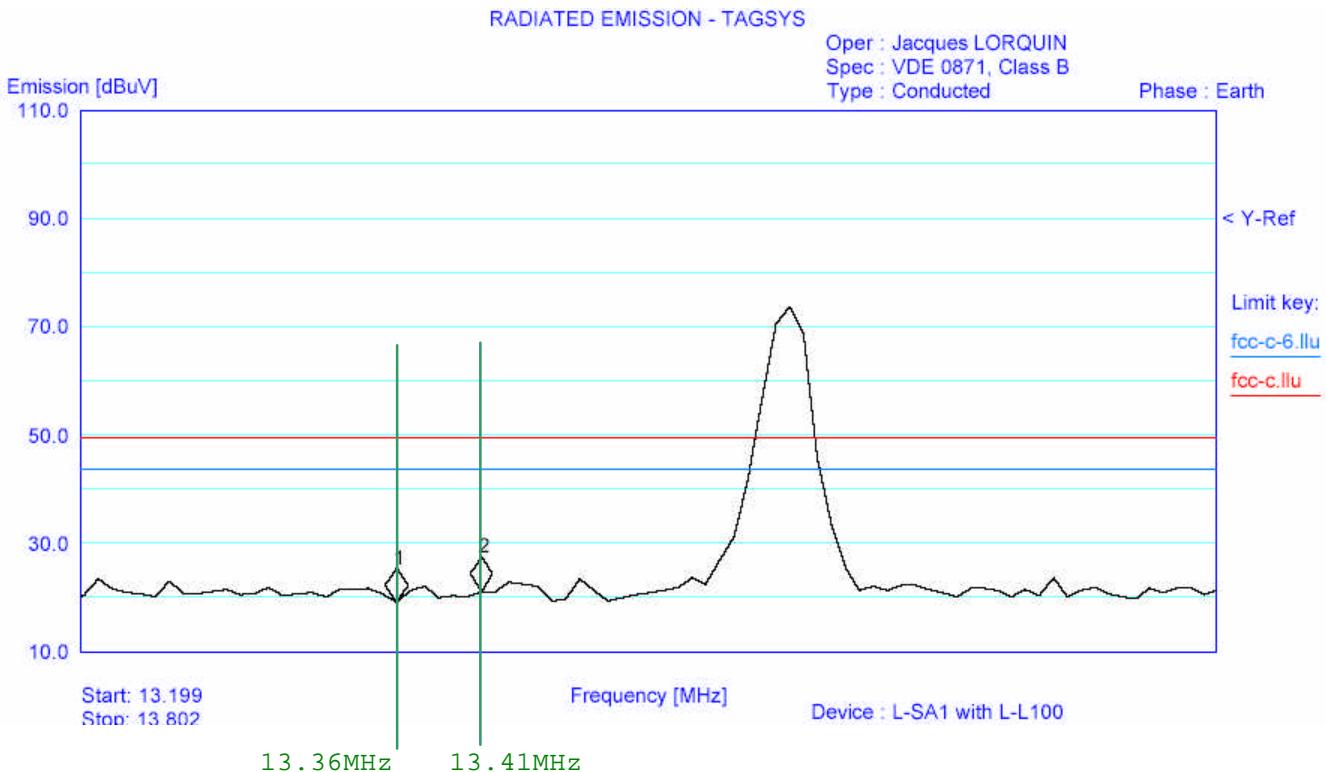
Upper limit: 13.561356 MHz

Lower limit: 13.558644 MHz

	-20 °C	20 °C	+50 °C
Voltage			
Frequency (MHz)	13.559925	13.559960	13.560015
Result	Pass	-	Pass

6. Occupied bandwidth

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

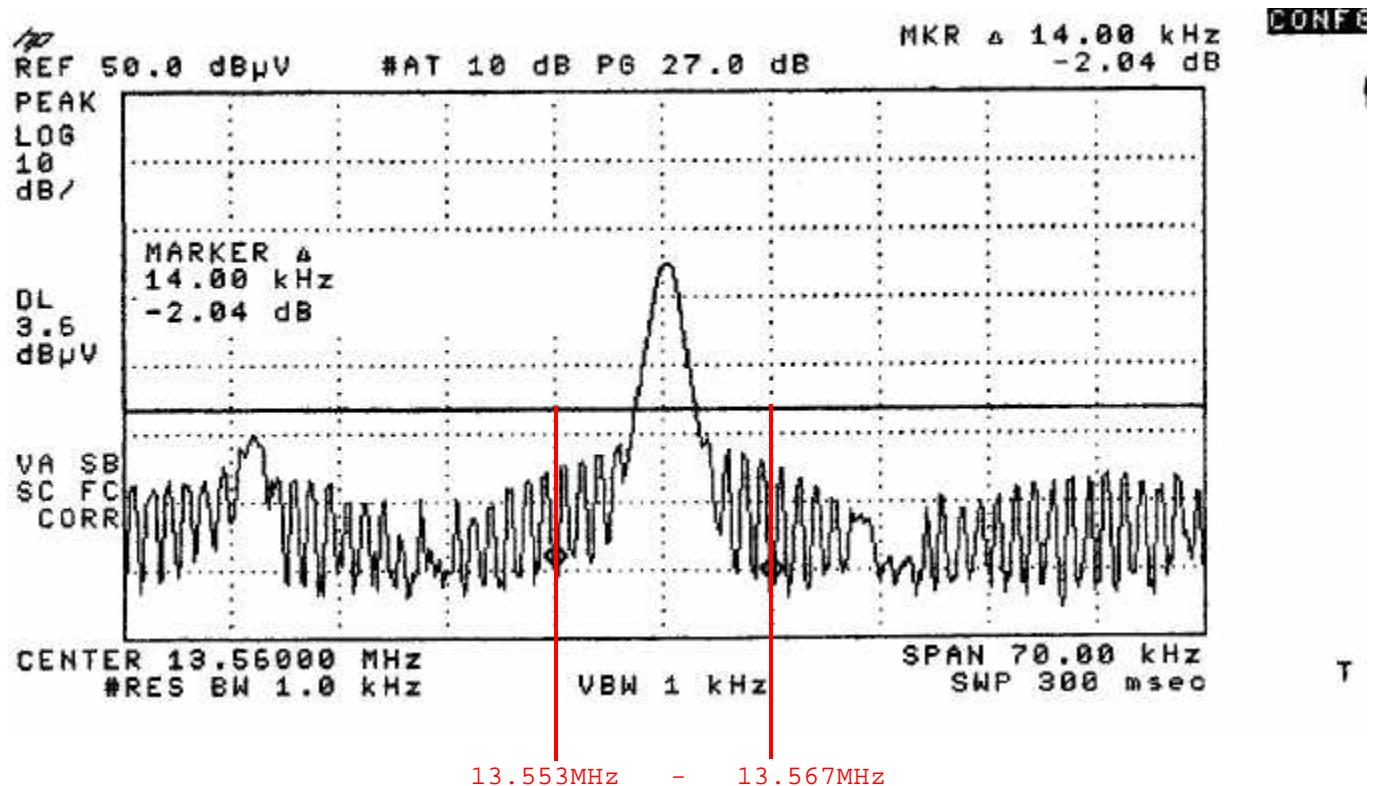




FCCID : QHKLSA1ANT

7. Band-edge compliance §15.209

Write time : 770ms



End of Tests