



LCIE

Rapport d'essai / Test report

N° 96350-A1-R2-E

JDE : 105566

DELIVRE A / ISSUED TO

: TAGSYS RFID
785 Voie Antiope
Athélia III
13600 LA CIOTAT - FRANCE

Objet / Subject

: Essais de compatibilité électromagnétique conformément aux normes
FCC CFR 47 Part 15, Subpart B et C.
*Electromagnetic compatibility tests according to the standards
FCC CFR 47 Part 15, Subpart B and C*

Matériel testé / Apparatus under test :

- Produit / Product : Lecteur RFID / RFID Reader
- Marque / Trade mark : TAGSYS RFID
- Constructeur / Manufacturer : TAGSYS RFID
- Type / Model : MEDIO L40 + ANTENNAS
- N° de série / serial number : T1111002A0
- Type d'antenne / Antenna Model : AERO LB / AERO LC / MAT / LSA3 / LSA4
- N° de série / serial number : See configuration page 5
- FCC ID : QHKMEDIOL40

Date des essais / Test date

: Du 21 au 29 Mars 2011 / From March 21st to 29th, 2011

Lieu d'essai / Test location

: LCIE SUD-EST
ZI Centr'Alp – 170 rue de Chatagnon
38430 MOIRANS - FRANCE

Test réalisé par / Test performed by

: Anthony MERLIN

Ce document comporte / Composition of document : 73 pages.

Ecrit par / Written by
Anthony MERLIN

MOIRANS, LE 5 MAI 2011 / MAY 5TH, 2011

LABORATOIRE CENTRAL DES
INDUSTRIES ELECTRIQUES
LCIE SUD-EST
ZI Centr'Alp
170, Rue de Chatagnon
38430 MOIRANS
Tél : +33 4 76 07 36 36
Fax : +33 4 76 55 90 88

La reproduction de ce document n'est autorisée que sous sa forme intégrale. Toute reproduction partielle ou toute insertion de résultats dans un texte d'accompagnement en vue de leur diffusion doit recevoir un accord préalable et formel du LCIE. Ce document résulte d'essais effectués sur un spécimen, un échantillon ou une éprouvette. Il ne préjuge pas de la conformité de l'ensemble des produits fabriqués à l'objet essayé. Sauf indication contraire, la décision de conformité prend en compte l'incertitude de mesures. Il ne préjuge en aucun cas d'une décision de certification.

This document shall not be reproduced, except in full, without the written approval of the LCIE. This document contains results related only to the item tested. It does not imply the conformity of the whole production to the item tested. Unless otherwise specified, the decision of conformity takes into account the uncertainty of measures. This document does not anticipate any certification decision.



SUMMARY

1. TEST PROGRAM	3
2. SYSTEM TEST CONFIGURATION	4
3. RADIATED EMISSION DATA	6
4. FUNDAMENTAL FREQUENCY TOLERANCE (15.225E)	15
5. BAND-EDGE COMPLIANCE §15.209	17
6. CONDUCTED EMISSION DATA	23
7. ANNEX 1 (GRAPHS)	31
8. TEST EQUIPMENT LIST	72
9. UNCERTAINTIES CHART	73



1. TEST PROGRAM

Standard: - FCC Part 15, Subpart B (Digital Devices)
- ANSI C63.4 (2009)

EMISSION TEST	LIMITS			RESULTS (Comments)
Limits for conducted disturbance at mains ports 150kHz-30MHz	Frequency	Quasi-peak value (dBμV)	Average value (dBμV)	PASS
	150-500kHz	66 to 56	56 to 46	
	0.5-5MHz	56	46	
	5-30MHz	60	50	
Radiated emissions 30MHz-2GHz*	Measure at 3m 30MHz-88MHz : 40 dBμV/m 88MHz-216MHz : 43.5 dBμV/m 216MHz-960MHz : 46.0 dBμV/m Above 960MHz : 54.0 dBμV/m			PASS

Standard: - FCC Part 15, Subpart C
- ANSI C63.4 (2009)

EMISSION TEST	LIMITS			RESULTS (Comments)
Limits for conducted disturbance at mains ports 150kHz-30MHz	Frequency	Quasi-peak value (dBμV)	Average value (dBμV)	PASS
	150-500kHz	66 to 56	56 to 46	
	0.5-5MHz	56	46	
	5-30MHz	60	50	
Radiated emissions 9kHz-30MHz	Measure at 300m 9kHz-490kHz : 67.6dBμV/m /F(kHz) Measure at 30m 490kHz-1.705MHz : 87.6dBμV/m /F(kHz) 1.705MHz-30MHz : 29.5 dBμV/m			PASS
Radiated emissions 30MHz-2GHz*	Measure at 3m 30MHz-88MHz : 40 dBμV/m 88MHz-216MHz : 43.5 dBμV/m 216MHz-960MHz : 46.0 dBμV/m Above 960MHz : 54.0 dBμV/m			PASS
Fundamental frequency tolerance	Operation within the band 13.110-14.010 MHz §15.225			PASS
Bandedge compliance	Operation within the band 13.110-14.010 MHz §15.225			PASS

*§15.33: The highest internal source of a testing device is defined like more the highest frequency generated or used in the testing device or on which the testing device works or agrees.

- If the highest frequency of the internal sources of the testing device is lower than 108 MHz, measurement must be only performed until 1GHz.
- If the highest frequency of the internal sources of the testing device ranges between 108 MHz and 500 MHz, measurement must be only performed until 2GHz.
- If the highest frequency of the internal sources of the testing device ranges between 500 MHz and 1 GHz, measurement must be only performed until 5GHz.

If the highest frequency of the internal sources of the testing device is above 1 GHz, measurement must be only performed until 5 times the highest frequency or 40 GHz, while taking smallest of both.



2. SYSTEM TEST CONFIGURATION

2.1. JUSTIFICATION

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

Different configuration of antennas with RFID reader MEDIO L40 are presented and tested in this test report:

- MEDIO L40 + 1 x AERO LB (Not tested, see results of worst case, 4 x AERO LB)
- MEDIO L40 + 4 x AERO LB
- MEDIO L40 + 1 x AERO LC (Not tested, see results of worst case, 4 x AERO LC)
- MEDIO L40 + 4 x AERO LC
- MEDIO L40 + 1 x MAT (Not tested, see results of worst case, 4 x MAT)
- MEDIO L40 + 4 x MAT
- MEDIO L40 + 1 x LSA3
- MEDIO L40 + 4 x LSA4

Reader may be used with 1 until 4 antennas (see different configurations), but not emitted together; so only worst configuration tested.

Maximum Power Output: 5W.

2.2. HARDWARE IDENTIFICATION

• Equipment under test (EUT):

MEDIO L40 + ANTENNAS

Serial number: T1111002A0
FCC ID: QHKMEDIOL40

Antenna:

- | | |
|-----------|------------------|
| ○ AERO LB | Sn: L1048001C0-R |
| ○ AERO LB | Sn: L1048002C0-R |
| ○ AERO LB | Sn: L1048003C0-R |
| ○ AERO LB | Sn: L1048007C0-R |
| ○ AERO LC | Sn: L1029148C1-R |
| ○ AERO LC | Sn: L1023007C1-R |
| ○ AERO LC | Sn: L1023022C1-R |
| ○ AERO LC | Sn: L1023028C1-R |
| ○ MAT | Sn: L1036004A0 |
| ○ MAT | Sn: L1040028A0 |
| ○ MAT | Sn: L1040032A0 |
| ○ MAT | Sn: L1040039A0 |
| ○ LSA3 | Sn: L1038956F1-R |
| ○ LSA4 | Sn: M103S019-B0 |

Internal max frequencies: 300MHz

Power supply:

- AC/DC adapter Switchbox, FDF0453-A 100-240VAC, 1.2A, 50-60Hz, 18-24VDC, 2.50-1.88A, sn: none.
- AC/DC adapter VPELECTRONIC, A2-50S18R-V 100-240VAC, 1.5A, 50-60Hz, 24VDC, 2.08A, sn: none.
- AC/DC adapter MEANWELL, GS40A24-P1J 100-240VAC, 1.0A, 50-60Hz, 24VDC, 1.67A, sn: none.

Measurement performed with three power supplies, worst case presented followings tests in this report.



- **Input/output:**

- 1 x Power supply 24VDC
- 1 x Synchro
- 1 x LAN
- 1 x USB
- 1 x RS-232
- 1 x GPIO
- 1 x Extension
- 4 x RF output SMA

- **Cables:**

- 1 x Power supply 2 wires unshielded, length: 1m until adapter.
- 1 x Synchro, 2 wires unshielded, length: 1m
- 1 x LAN, shielded cable, length: 5m connected to laptop by switch.
- 1 x USB, shielded cable, length: 2m
- 1 x RS-232, LAN cable shielded with adaptor, length: 3m
- 1 x GPIO, 8 wires unshielded, length: 1m
- 1 x Extension, 10 wires unshielded, length: 1m
- 4 x RF output SMA, BNC cable with 6 ferrites reader side shielded, length: 3m
- 1 x RF output LSA3 antenna, BNC cable with 6 ferrites reader side shielded, length: 6m
- 1 x RF output LSA4 antenna, BNC cable with 6 ferrites reader side shielded, length: 3m

- **Auxiliaries equipment used during test:**

- 1 x Laptop DELL Vostro 1500 with its power supply
- 1 x LAN switch with its power supply
- 1 x TAGSYS - RFID tag (ISO 15693)

2.3. EUT EXERCISE SOFTWARE

The EUT exercise program used during radiated and conducted testing was exercised the reader in a manner similar to a typical use.

The test program permits the continuous reading of a RFID tag.

Software: TAGSYS Explorer v1.4.018880

Power output: 5W

Multiplexer: YES (Each RF channel ON independently, never 4 together)

2.4. SPECIAL ACCESSORIES

None

2.5. EQUIPMENT MODIFICATIONS

No equipment modification has been necessary during testing.

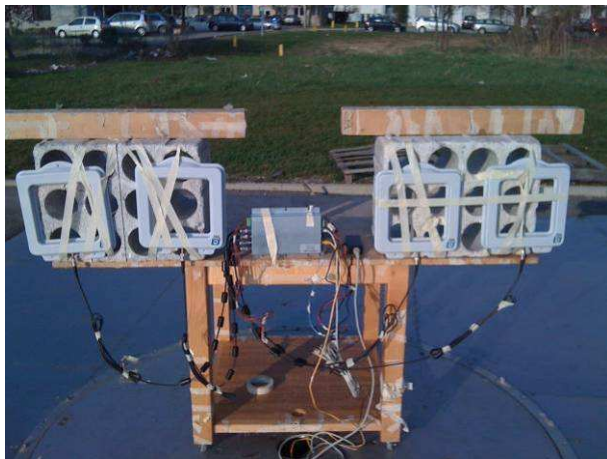
3. RADIATED EMISSION DATA

3.1. CLIMATIC CONDITIONS

Date of test : March 21st, 2011
Test performed by : A.MERLIN
Atmospheric pressure : 998mb
Relative humidity : 37%
Ambient temperature : 21°C

3.2. TEST SETUP

The installation of EUT is identical for pre-characterization measurement in a 3 meters semi anechoic chamber and for measures on a 10 meters Open site. Setup is same with three power supplies.
Difference between three power supplies measured with one configuration, worst case configuration (4xAERO LC antennas). All antenna configurations tested with SWITCHBOX power supply.

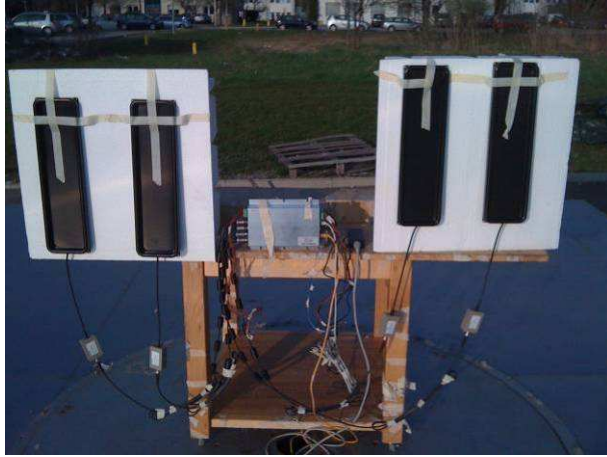


AERO LB Configuration



AERO LC Configuration





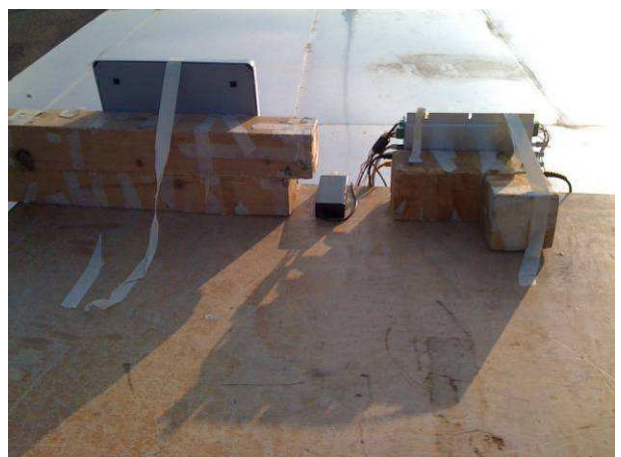
MAT Configuration

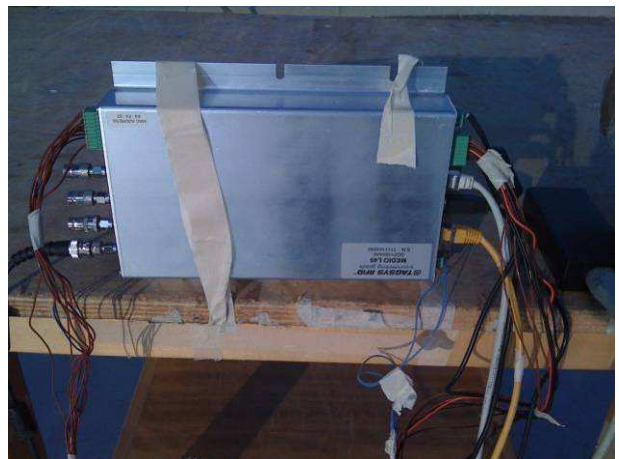
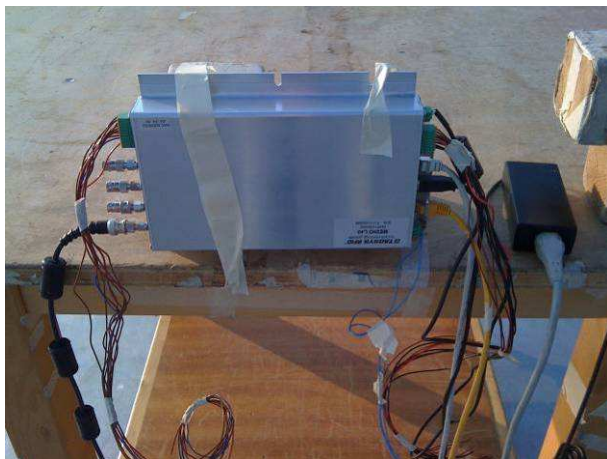
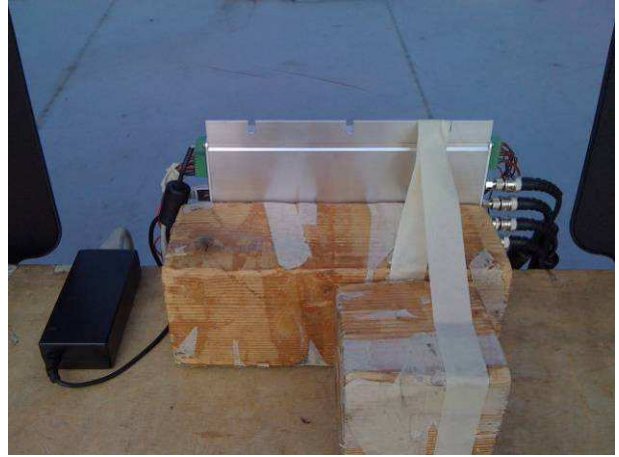
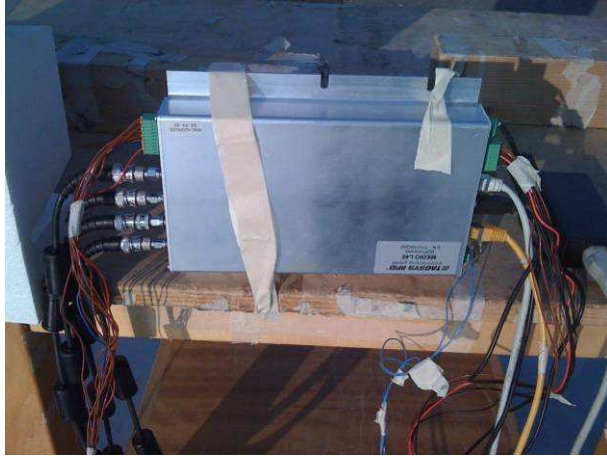


LSA3 Configuration



LSA4 Configuration





Reader configuration (1 or 4 antennas)



3.3. TEST SEQUENCE AND RESULTS

3.3.1. Pre-characterization at 3 meters [9kHz-30MHz]

A pre-scan of all the setup has been performed in a 3 meters semi anechoic chamber.
The distance between EUT and antenna is 3 meters. For Pre-characterization, the loop antenna was rotated during the test for maximized the emission measurement. Measurement performed on 3 axis of EUT.
Frequency band investigated is 9kHz to 30MHz.
The pre-characterization graphs are obtained in PEAK detection.

See graph for 9kHz-30MHz band:

AERO LB	Emr#1	(See annex 1)
AERO LC	Emr#2	(See annex 1)
MAT	Emr#3	(See annex 1)
LSA3	Emr#4	(See annex 1)
LSA4	Emr#5	(See annex 1)
AERO LC + VPELECTRONIQUE	Emr#6	(See annex 1)
AERO LC + MEANWELL	Emr#7	(See annex 1)

3.3.2. Pre-characterization [30MHz-2GHz]

For frequency band 30MHz to 1GHz, a pre-scan of all the setup has been performed in a 3 meters semi anechoic chamber.

The distance between EUT and antenna is 3 meters. Test is performed in horizontal (H) and vertical (V) polarization with a log-periodic antenna. The EUT is being rotated on 360° and on 3 axis during the measurement. The pre-characterization graphs are obtained in PEAK detection.

For frequency band 1GHz to 2GHz, a search is performed in the semi-anechoic chamber in order to determine frequencies radiated by the EUT (Measuring distance reduced to 1m).

See graphs for 30MHz-1GHz:

H polarization	Emr#8	AERO LB	(See annex 1)
V polarization	Emr#9	AERO LB	(See annex 1)
H polarization	Emr#10	AERO LC	(See annex 1)
V polarization	Emr#11	AERO LC	(See annex 1)
H polarization	Emr#12	MAT	(See annex 1)
V polarization	Emr#13	MAT	(See annex 1)
H polarization	Emr#14	LSA3	(See annex 1)
V polarization	Emr#15	LSA3	(See annex 1)
H polarization	Emr#16	LSA4	(See annex 1)
V polarization	Emr#17	LSA4	(See annex 1)
H polarization	Emr#18	AERO LC+VPELECTRONIQUE	(See annex 1)
V polarization	Emr#19	AERO LC+VPELECTRONIQUE	(See annex 1)
H polarization	Emr#20	AERO LC+MEANWELL	(See annex 1)
V polarization	Emr#21	AERO LC+MEANWELL	(See annex 1)



3.3.3. Characterization on 10 meters open site below 30 MHz

The product has been tested according to ANSI C63.4 (2009), FCC part 15 subpart C. Radiated Emissions were measured on an open area test site. A description of the facility is on file with the FCC.

The product has been tested at a distance of **10 meters** from the antenna and compared to the FCC part 15 subpart C §15.225 limits in the frequency range 13.553MHz 13.567MHz. Measurement bandwidth was 9kHz.

Antenna height was 1m for both horizontal and vertical polarization.

Antenna was rotated around its vertical axis.

Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on 3 axis of EUT. A summary of the worst case emissions found in all test configurations and modes is shown on clauses 3.2.

Same results with three power supplies, results with SWITCHBOX presented.

Frequency (MHz)	QPeak Limit (dBμV/m) @ 30m	Qpeak (dBμV/m)	Qpeak-Limit (Margin dB)	Turntable angle (deg)	Ant. Pol./ Angle (deg)	Tot Corr (dB)	Antenna
13.56 ^{*1}	84.0	73.2	-10.8	110	0	35.3	AERO LB
13.56 ^{*1}	84.0	81.0	-3.0	110	0	35.3	AERO LC
13.56 ^{*1}	84.0	75.7	-8.3	110	0	35.3	MAT
13.56 ^{*1}	84.0	60.3	-23.7	110	0	35.3	LSA3
13.56 ^{*1}	84.0	64.0	-20.0	110	0	35.3	LSA4

^{*1}: Measure have been done at 10m distance and corrected according to requirements of 15.209.e)
(M@30m = M@10m-19.1dB)

Limits Sub clause §15.225

Frequency (MHz)	Field strength (μV/m)	Measurement distance (m)
13.553-13.567	15 848 84 dBμV/m	30
13.410-13.553 13.567-13.710	334 50.5 dBμV/m	30
13.110-13.410 13.710-14.010	106 40.5 dBμV/m	30

See chapter 5 of this test report for band edge measurements.

3.3.4. Characterization on 10 meters open site from 30MHz to 2GHz

The product has been tested at a distance of **10 meters** from the antenna and compared to the FCC part 15 subpart B §15.109 limits and C §15.209 limits. Measurement bandwidth was 120kHz from 30 MHz to 1GHz and 1MHz from 1GHz to 2GHz.

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. Measurement performed on 3 axis of EUT.

A summary of the worst case emissions found in all test configurations and modes is shown on clause 3.2

**Worst case final data result:****AERO LB:**

No	Frequency (MHz)	QPeak Limit (dBµV/m)	Qpeak * (dBµV/m)	Qpeak-Limit (Margin, dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)	Comments
1	40.679	40.0	35.5	-4.5	0	V	100	13.3	/
2	718.656	46.0	43.3	-2.7	70	H	150	24.9	/
3	786.456	46.0	37.9	-8.1	60	V	200	25.9	/
4	799.294	46.0	38.6	-7.4	30	H	100	26.2	/
5	813.573	46.0	42.5	-3.5	80	H	100	26.3	/
6	827.593	46.0	40.3	-5.7	85	V	150	26.5	/

*: Measure have been done at 10m distance and corrected according to requirements of 15.209.e)
(M@3m = M@10m+10.5dB)

Frequency band 1GHz to 2GHz

Measurements are performed using a PEAK and Average detection. (RBW = 1MHz)

No	Frequency (GHz)	Limit Average (dBµV/m)	Measure Average (dBµV/m)	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. factor (dB)	Comments
----	-----------------	------------------------	--------------------------	-----------------------	-------------------	----------	--------------	---------------------	----------

No Significant Frequency observed

Note: Measures have been done at 3m distance.

RESULTS: PASS

AERO LC:

No	Frequency (MHz)	QPeak Limit (dBµV/m)	Qpeak * (dBµV/m)	Qpeak-Limit (Margin, dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)	Comments
1	40.679	40.0	36.6	-3.4	0	V	100	13.3	/
2	209.678	43.5	38.6	-4.9	195	V	130	12.7	/
3	718.656	46.0	43.5	-2.5	70	H	150	24.9	/
4	786.456	46.0	37.3	-8.7	60	V	200	25.9	/
5	799.294	46.0	38.1	-7.9	30	H	100	26.2	/
6	813.573	46.0	42.1	-3.9	80	H	100	26.3	/
7	827.593	46.0	39.6	-6.4	85	V	150	26.5	/

*: Measure have been done at 10m distance and corrected according to requirements of 15.209.e)
(M@3m = M@10m+10.5dB)

Frequency band 1GHz to 2GHz

Measurements are performed using a PEAK and Average detection. (RBW = 1MHz)

No	Frequency (GHz)	Limit Average (dBµV/m)	Measure Average (dBµV/m)	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. factor (dB)	Comments
----	-----------------	------------------------	--------------------------	-----------------------	-------------------	----------	--------------	---------------------	----------

No Significant Frequency observed

Note: Measures have been done at 3m distance.

RESULTS: PASS

**MAT:**

No	Frequency (MHz)	QPeak Limit (dBµV/m)	Qpeak * (dBµV/m)	Qpeak-Limit (Margin, dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)	Comments
1	40.679	40.0	36.3	-3.7	0	V	100	13.3	/
2	718.656	46.0	44.6	-1.4	70	H	150	24.9	/
3	786.456	46.0	39.5	-6.5	60	V	200	25.9	/
4	799.294	46.0	38.9	-7.1	30	H	100	26.2	/
5	813.573	46.0	42.9	-3.1	80	H	100	26.3	/
6	827.593	46.0	39.1	-6.9	85	V	150	26.5	/

*: Measure have been done at 10m distance and corrected according to requirements of 15.209.e)
(M@3m = M@10m+10.5dB)

Frequency band 1GHz to 2GHz

Measurements are performed using a PEAK and Average detection. (RBW = 1MHz)

No	Frequency (GHz)	Limit Average (dBµV/m)	Measure Average (dBµV/m)	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. factor (dB)	Comments
----	-----------------	------------------------	--------------------------	-----------------------	-------------------	----------	--------------	---------------------	----------

No Significant Frequency observed

Note: Measures have been done at 3m distance.

RESULTS: PASS

LSA3:

No	Frequency (MHz)	QPeak Limit (dBµV/m)	Qpeak * (dBµV/m)	Qpeak-Limit (Margin, dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)	Comments
1	40.679	40.0	36.1	-3.9	0	V	100	13.3	/
2	718.656	46.0	44.5	-1.5	70	H	150	24.9	/
3	786.456	46.0	39.4	-6.6	60	V	200	25.9	/
4	799.294	46.0	39.4	-6.6	30	H	100	26.2	/
5	813.573	46.0	43.9	-2.1	80	H	100	26.3	/
6	827.593	46.0	40.4	-5.6	85	V	150	26.5	/

*: Measure have been done at 10m distance and corrected according to requirements of 15.209.e)
(M@3m = M@10m+10.5dB)

Frequency band 1GHz to 2GHz

Measurements are performed using a PEAK and Average detection. (RBW = 1MHz)

No	Frequency (GHz)	Limit Average (dBµV/m)	Measure Average (dBµV/m)	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. factor (dB)	Comments
----	-----------------	------------------------	--------------------------	-----------------------	-------------------	----------	--------------	---------------------	----------

No Significant Frequency observed

Note: Measures have been done at 3m distance.

RESULTS: PASS



LSA4:

No	Frequency (MHz)	QPeak Limit (dBμV/m)	Qpeak * (dBμV/m)	Qpeak-Limit (Margin, dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)	Comments
1	40.679	40.0	36.9	-3.1	0	V	100	13.3	/
2	718.656	46.0	43.2	-2.8	70	H	150	24.9	/
3	786.456	46.0	38.5	-7.5	60	V	200	25.9	/
4	799.294	46.0	38.9	-7.1	30	H	100	26.2	/
5	813.573	46.0	44.7	-1.3	80	H	100	26.3	/
6	827.593	46.0	39.5	-6.5	85	V	150	26.5	/

*: Measure have been done at 10m distance and corrected according to requirements of 15.209.e)
(M@3m = M@10m+10.5dB)

Frequency band 1GHz to 2GHz

Measurements are performed using a PEAK and Average detection. (RBW = 1MHz)

No	Frequency (GHz)	Limit Average (dBμV/m)	Measure Average (dBμV/m)	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. factor (dB)	Comments
----	-----------------	------------------------	--------------------------	-----------------------	-------------------	----------	--------------	---------------------	----------

No Significant Frequency observed

Note: Measures have been done at 3m distance.

RESULTS: PASS

AERO LC + VPELECTRONIQUE:

No	Frequency (MHz)	QPeak Limit (dBμV/m)	Qpeak * (dBμV/m)	Qpeak-Limit (Margin, dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)	Comments
1	40.679	40.0	36.5	-3.5	10	V	100	13.3	/
2	112.548	46.0	33.1	-12.9	95	V	150	13.5	/
3	759.352	46.0	37.1	-8.9	60	V	200	25.9	/
4	813.573	46.0	42.1	-3.9	110	H	100	26.3	/
5	827.593	46.0	39.6	-6.4	90	V	150	26.5	/
6	840.698	46.0	37.4	-8.6	85	V	150	26.5	/

*: Measure have been done at 10m distance and corrected according to requirements of 15.209.e)
(M@3m = M@10m+10.5dB)

Frequency band 1GHz to 2GHz

Measurements are performed using a PEAK and Average detection. (RBW = 1MHz)

No	Frequency (GHz)	Limit Average (dBμV/m)	Measure Average (dBμV/m)	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. factor (dB)	Comments
----	-----------------	------------------------	--------------------------	-----------------------	-------------------	----------	--------------	---------------------	----------

No Significant Frequency observed

Note: Measures have been done at 3m distance.

RESULTS: PASS



AERO LC + MEANWELL:

No	Frequency (MHz)	QPeak Limit (dBμV/m)	Qpeak * (dBμV/m)	Qpeak-Limit (Margin, dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)	Comments
1	40.679	40.0	36.5	-3.5	0	V	100	13.3	/
2	46.679	40.0	30.1	-9.9	275	V	100	10.8	/
3	51.894	40.0	28.1	-11.9	155	V	120	8.6	/
4	54.247	40.0	26.7	-13.3	110	V	100	7.9	/
5	203.387	43.5	33.1	-10.4	190	H	250	12.7	/
6	786.456	46.0	37.3	-8.7	60	V	200	25.9	/
7	799.294	46.0	37.8	-8.2	30	H	100	26.2	/
8	813.573	46.0	42.2	-3.8	80	H	100	26.3	/
9	827.593	46.0	39.8	-6.2	85	V	150	26.5	/
1	40.679	40.0	36.5	-3.5	0	V	100	13.3	/
2	46.679	40.0	30.1	-9.9	275	V	100	10.8	/
3	51.894	40.0	28.1	-11.9	155	V	120	8.6	/

*: Measure have been done at 10m distance and corrected according to requirements of 15.209.e)
(M@3m = M@10m+10.5dB)

Frequency band 1GHz to 2GHz

Measurements are performed using a PEAK and Average detection. (RBW = 1MHz)

No	Frequency (GHz)	Limit Average (dBμV/m)	Measure Average (dBμV/m)	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. factor (dB)	Comments
----	-----------------	------------------------	--------------------------	-----------------------	-------------------	----------	--------------	---------------------	----------

No Significant Frequency observed

Note: Measures have been done at 3m distance.

RESULTS: PASS

3.4. 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 are 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.

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

**4. FUNDAMENTAL FREQUENCY TOLERANCE (15.225E)****4.1. TEST CONDITIONS**

Date of test : March 23rd, 2011 and April 7th, 2011
Test performed by : A.MERLIN

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency when the temperature is varied from -20°C to $+50^{\circ}\text{C}$ at the nominal power voltage and the primary power voltage is varied from 85% to 115% of the rated supply voltage at 20°C .

4.2. Temperature and voltage fluctuation

Temperature has been set at $+20^{\circ}\text{C}$, -20°C and $+50^{\circ}\text{C}$.

Voltage is varied from 93.5V/60Hz to 126V/60Hz

Frequency of carrier: 13.56 MHz

Upper limit: 13.561356 MHz

Lower limit: 13.558644 MHz

The equipment (RF box) is set in a climatic chamber. Measure is performed on one channel of RF module.

SWITCHBOX power supply:

Temperature	-20°C	20°C	+50°C
Voltage			
Mains voltage: 110V/60Hz			
Frequency Drift (MHz)	+ 0.000052	REF	- 0.000072
Carrier level (dBc)	+ 0.00	REF	- 0.10
Mains voltage: 93,5V/60Hz			
Frequency Drift (MHz)	+ 0.000052	- 0.000001	- 0.000072
Carrier level (dBc)	- 0.20	+ 0.00	- 0.20
Mains voltage: 126V/60Hz			
Frequency Drift (MHz)	+ 0.000052	+ 0.000001	- 0.000072
Carrier level (dBc)	- 0.10	- 0.40	- 0.10

Frequency drift measured is **72 Hz** when the temperature is varied from -20°C to $+50^{\circ}\text{C}$ and voltage is varied from 110V/60Hz $\pm 15\%$.

VPELECTRONIC power supply:

Temperature	-20°C	20°C	+50°C
Voltage			
Mains voltage: 110V/60Hz			
Frequency Drift (MHz)	- 0.000059	REF	- 0.000074
Carrier level (dBc)	- 0.10	REF	- 0.20
Mains voltage: 93,5V/60Hz			
Frequency Drift (MHz)	- 0.000059	+ 0.000002	- 0.000074
Carrier level (dBc)	- 0.10	+ 0.00	- 0.20
Mains voltage: 126V/60Hz			
Frequency Drift (MHz)	- 0.000059	+ 0.000002	- 0.000074
Carrier level (dBc)	- 0.10	+ 0.00	- 0.20

Frequency drift measured is **74 Hz** when the temperature is varied from -20°C to $+50^{\circ}\text{C}$ and voltage is varied from 110V/60Hz $\pm 15\%$.



MEANWELL power supply:

Temperature	-20°C	20°C	+50°C
Voltage			
Mains voltage: 110V/60Hz			
Frequency Drift (MHz)	- 0.000072	REF	- 0.000076
Carrier level (dBc)	- 0.10	REF	- 0.20
Mains voltage: 93,5V/60Hz			
Frequency Drift (MHz)	- 0.000073	+ 0.000000	- 0.000076
Carrier level (dBc)	- 0.10	+ 0.00	- 0.10
Mains voltage: 126V/60Hz			
Frequency Drift (MHz)	- 0.000072	+ 0.000000	- 0.000076
Carrier level (dBc)	- 0.10	+ 0.00	- 0.10

Frequency drift measured is **76 Hz** when the temperature is varied from -20°C to +50°C and voltage is varied from 110V/60Hz ± 15%.

**5. BAND-EDGE COMPLIANCE §15.209****5.1. CLIMATIC CONDITIONS**

Date of test : March 22nd; 2011
Test performed by : A.MERLIN
Atmospheric pressure : 999mb
Relative humidity : 37%
Ambient temperature : 21°C

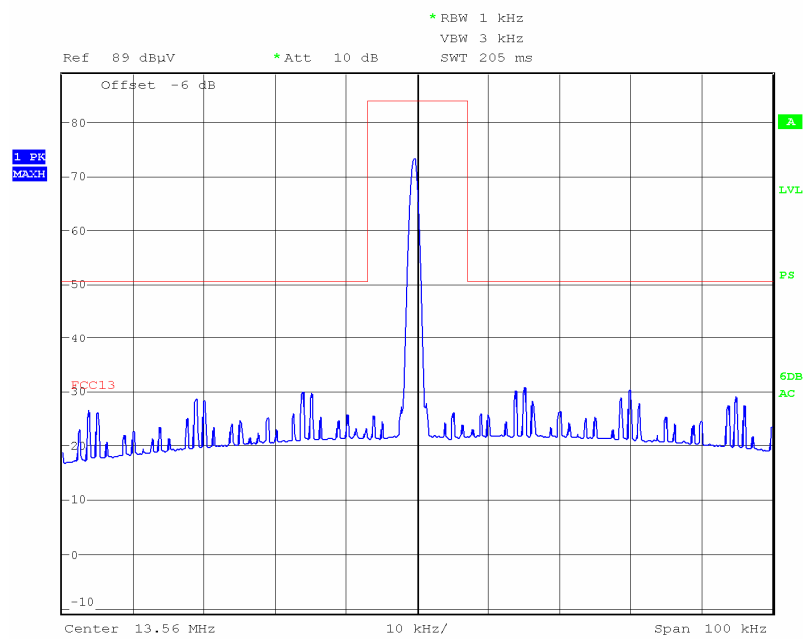
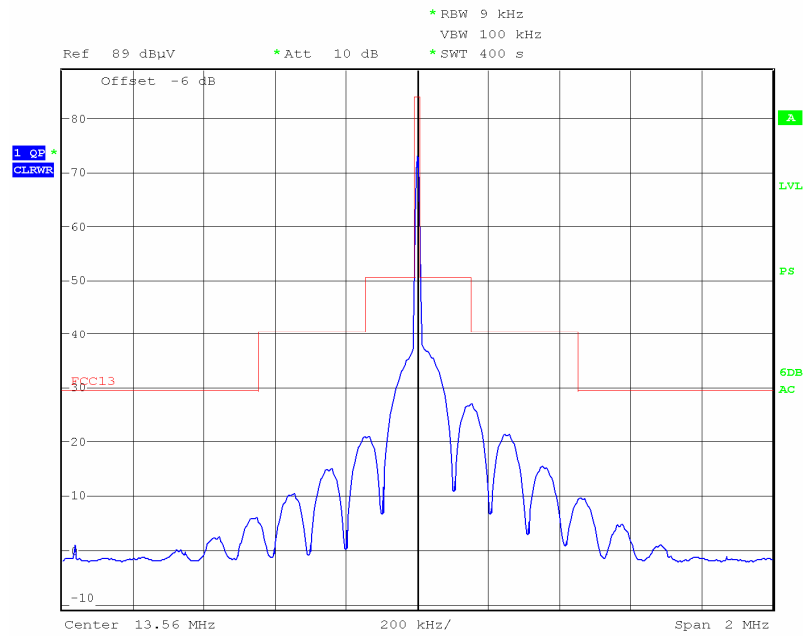
5.2. Frequency band 13.110-14.010MHz

Following plots show radiated emission level in the frequency band 13.110-14.010MHz with a RBW of 9kHz and a quasi-peak detector. The graphs are obtained with a measuring receiver ESU8.
Same results with three power supplies, results with SWITCHBOX presented.

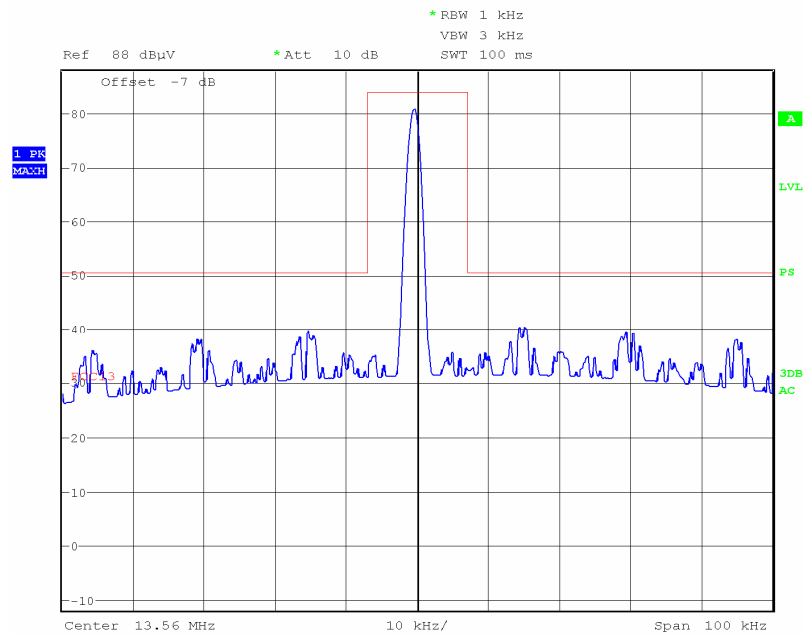
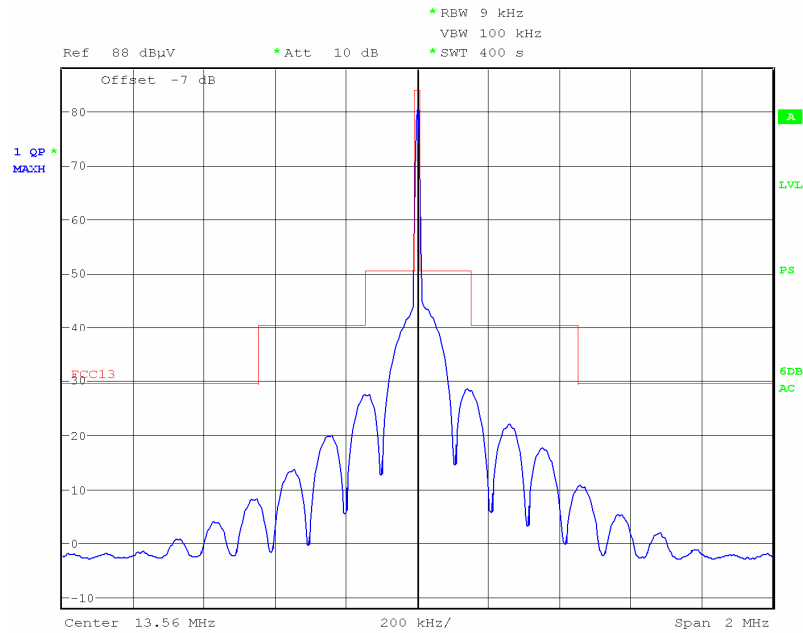
5.3. Frequency band 13.553-13.567MHz

Following plots show radiated emission level in the frequency band 13.55.-13.567MHz with a RBW of 1kHz. The graphs are obtained with a measuring receiver ESU8.
Same results with three power supplies, results with SWITCHBOX presented.

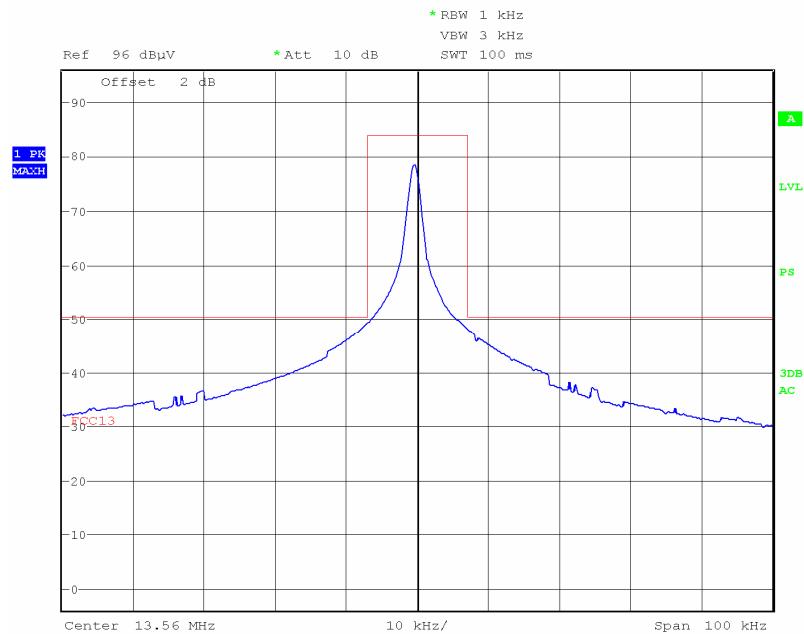
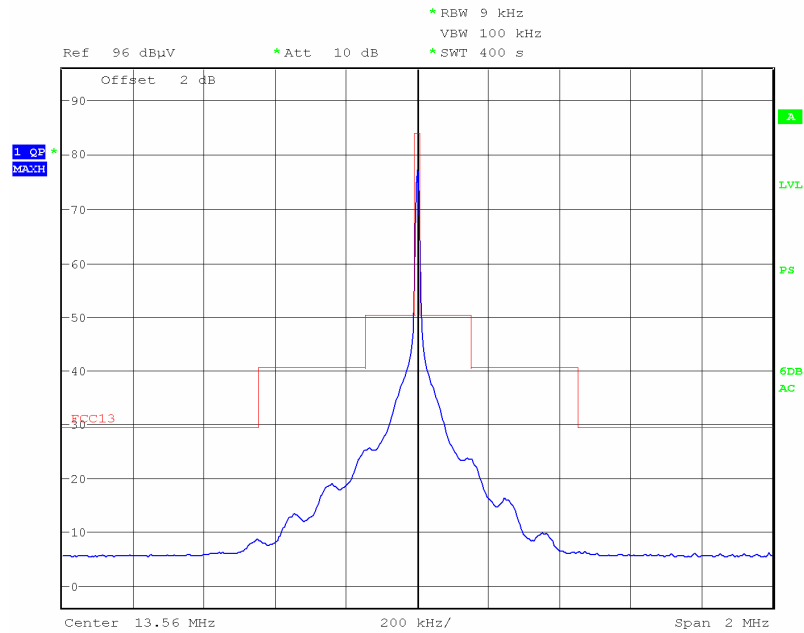
AERO LB:



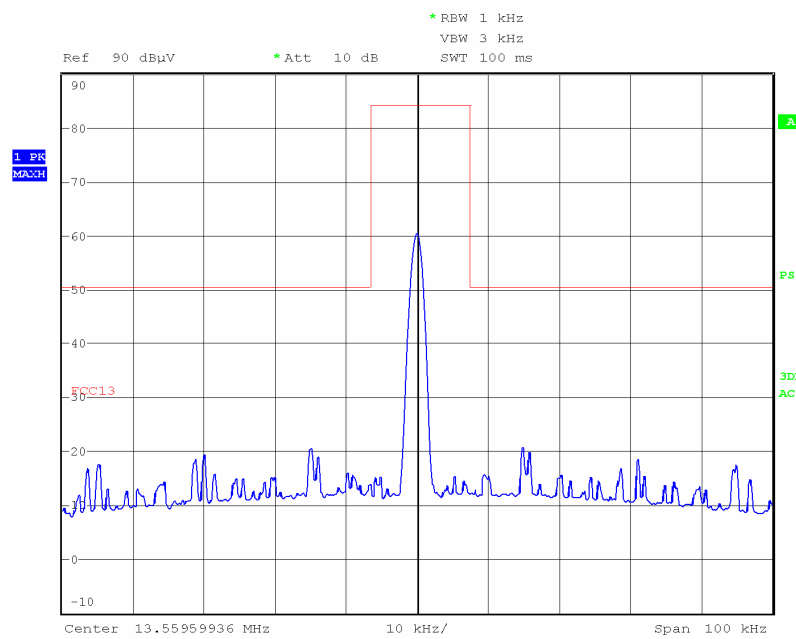
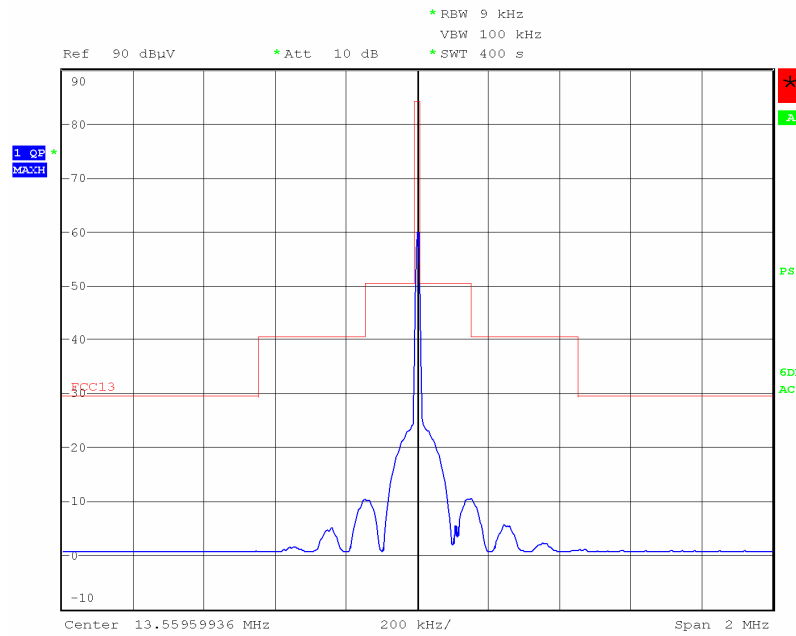
AERO LC:



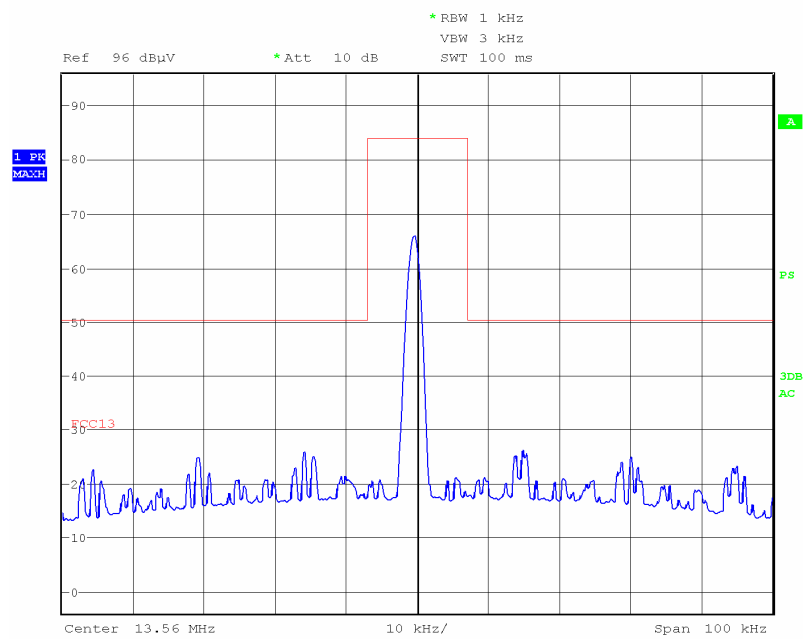
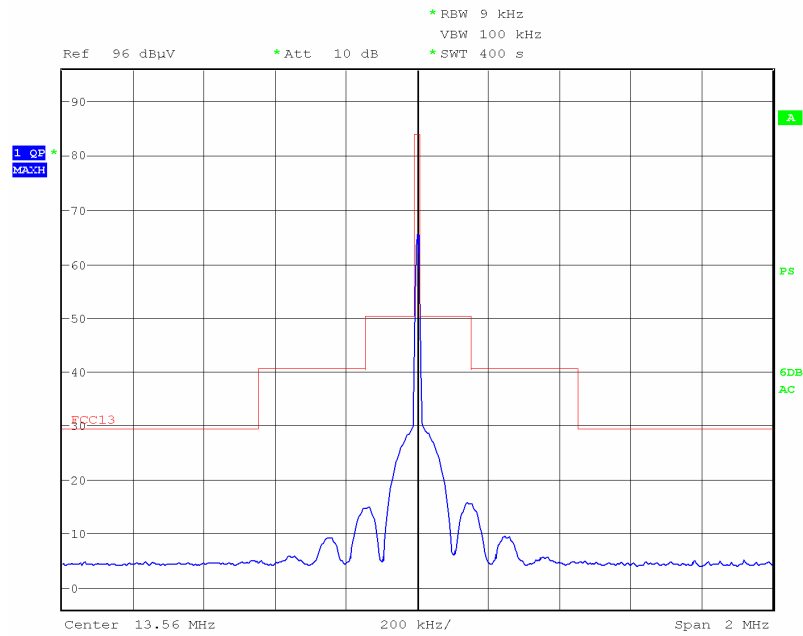
MAT:



LSA3:



LSA4:



**6. CONDUCTED EMISSION DATA****6.1. CLIMATIC CONDITIONS**

Date of test	: March 22 nd , 2011	and	April 4 th , 2011
Test performed by	: A.MERLIN		
Atmospheric pressure	: 999mb		991mb
Relative humidity	: 31%		46%
Ambient temperature	: 21°C		21°C

6.2. SETUP FOR CONDUCTED EMISSIONS MEASUREMENT

The product has been tested according to ANSI C63.4-(2009) and FCC Part 15 subpart B and C.

The product has been tested with 110V/60Hz power line voltage and compared to the FCC Part 15 subpart B §15.107 and C §15.207 limits. Measurement bandwidth was 9kHz from 150 kHz to 30 MHz.

Measurement is made with a Rohde & Schwarz ESU8 receiver in peak mode. This was followed by a Quasi-Peak, i.e. CISPR measurement 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 LISN (measure) is 50Ω / 50μH.

The Peak data are shown on plots in annex 1. 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.

6.3. TEST SETUP

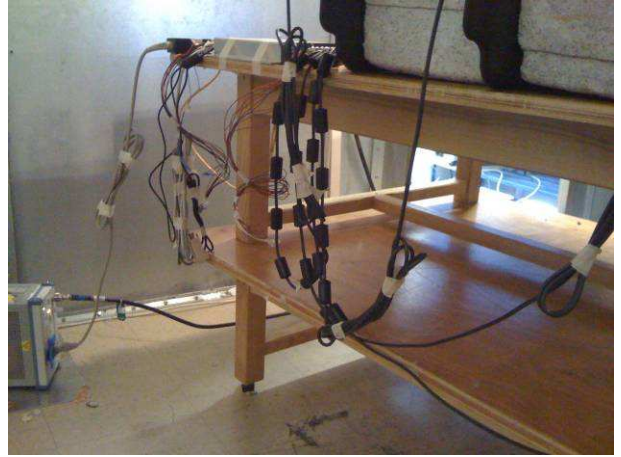
The EUT is placed on the ground reference plane, at 80cm from the LISN. The distance between the EUT and the vertical ground plane is 40cm.

Auxiliaries are powered by another LISN.

The cable has been shorted to 1meter length. The EUT is powered trough the LISN (measure).



AERO LB configuration



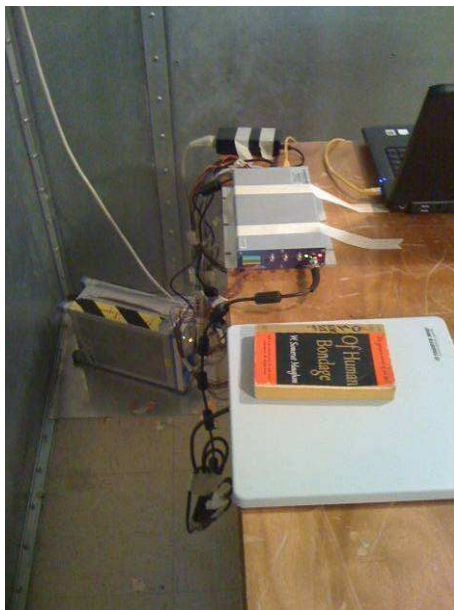
AERO LC configuration



MAT configuration



LSA3 configuration



LSA4 configuration



AERO LC + VPELECTRONIC configuration



AERO LC + MEANWELL configuration



**6.4. TEST SEQUENCE AND RESULTS**

Measurements are performed on the phase (L1) and neutral (N) of power line voltage.

A measurement is also performed with a 50Ω dummy load replacing the transmitter antenna in order to demonstrate that some 13.56MHz may be cross-coupled to AC line connection.

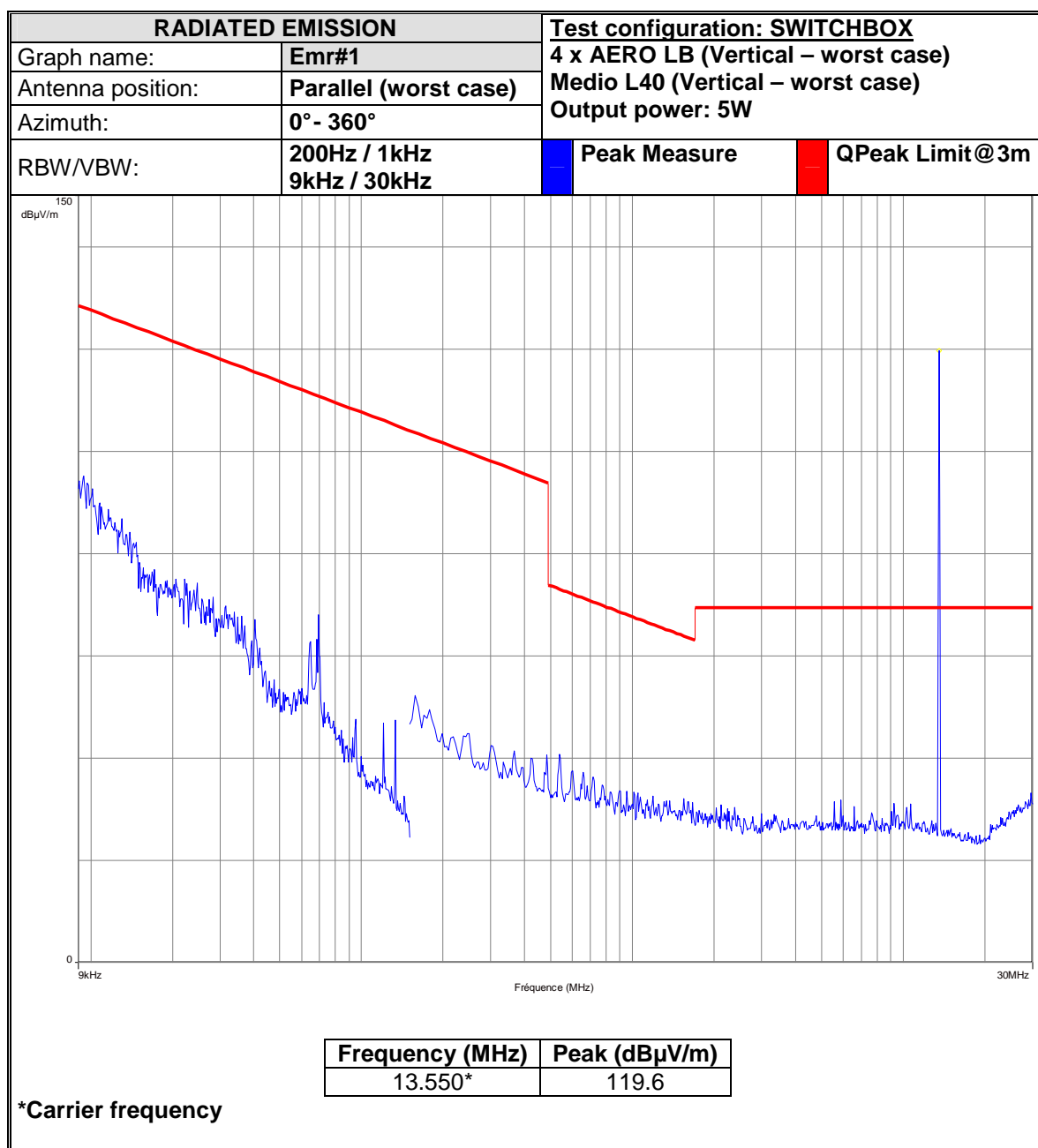
Graphs are obtained in PEAK detection.

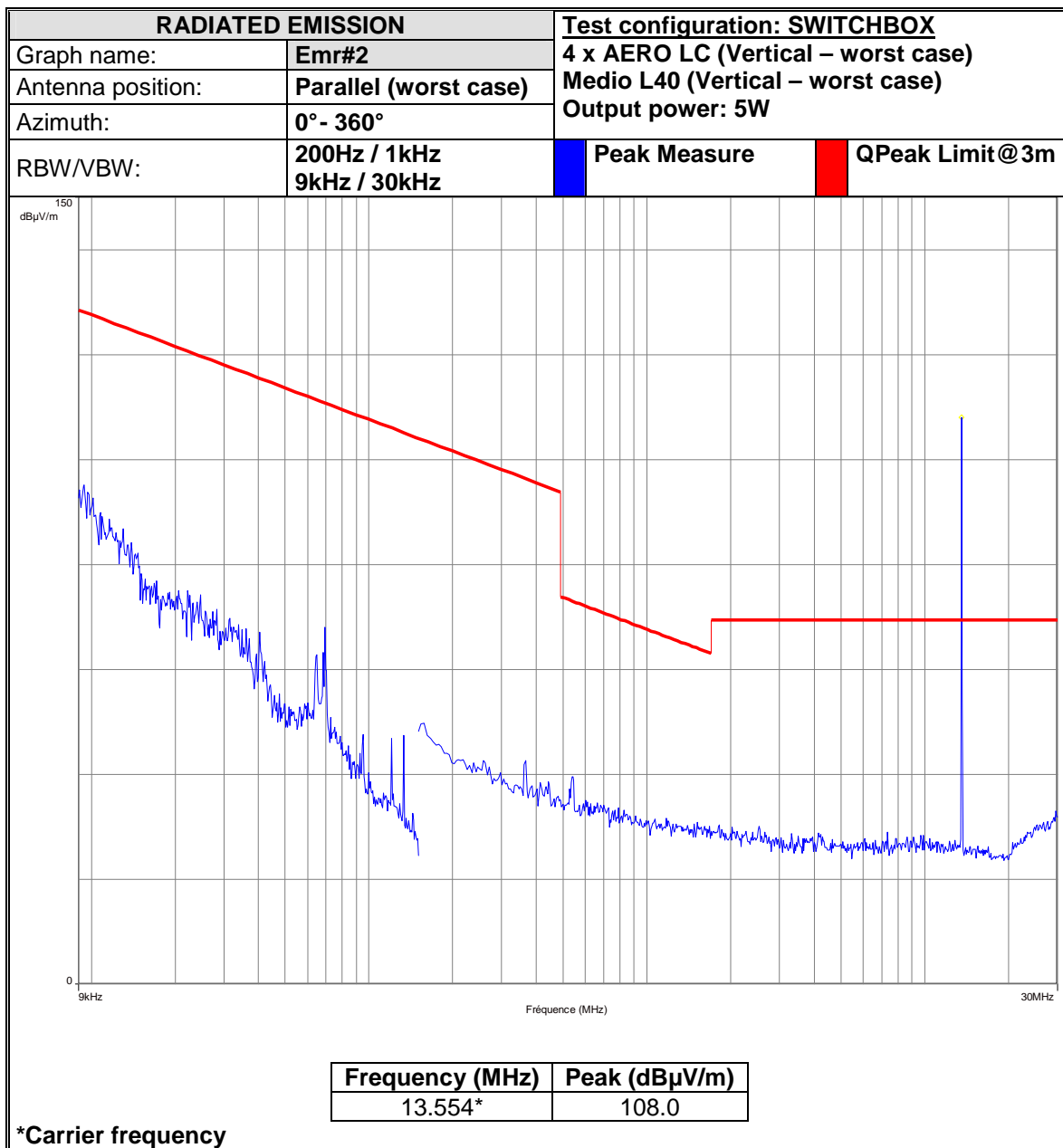
Measures are also performed in Quasi-Peak and Average for any strong signal.

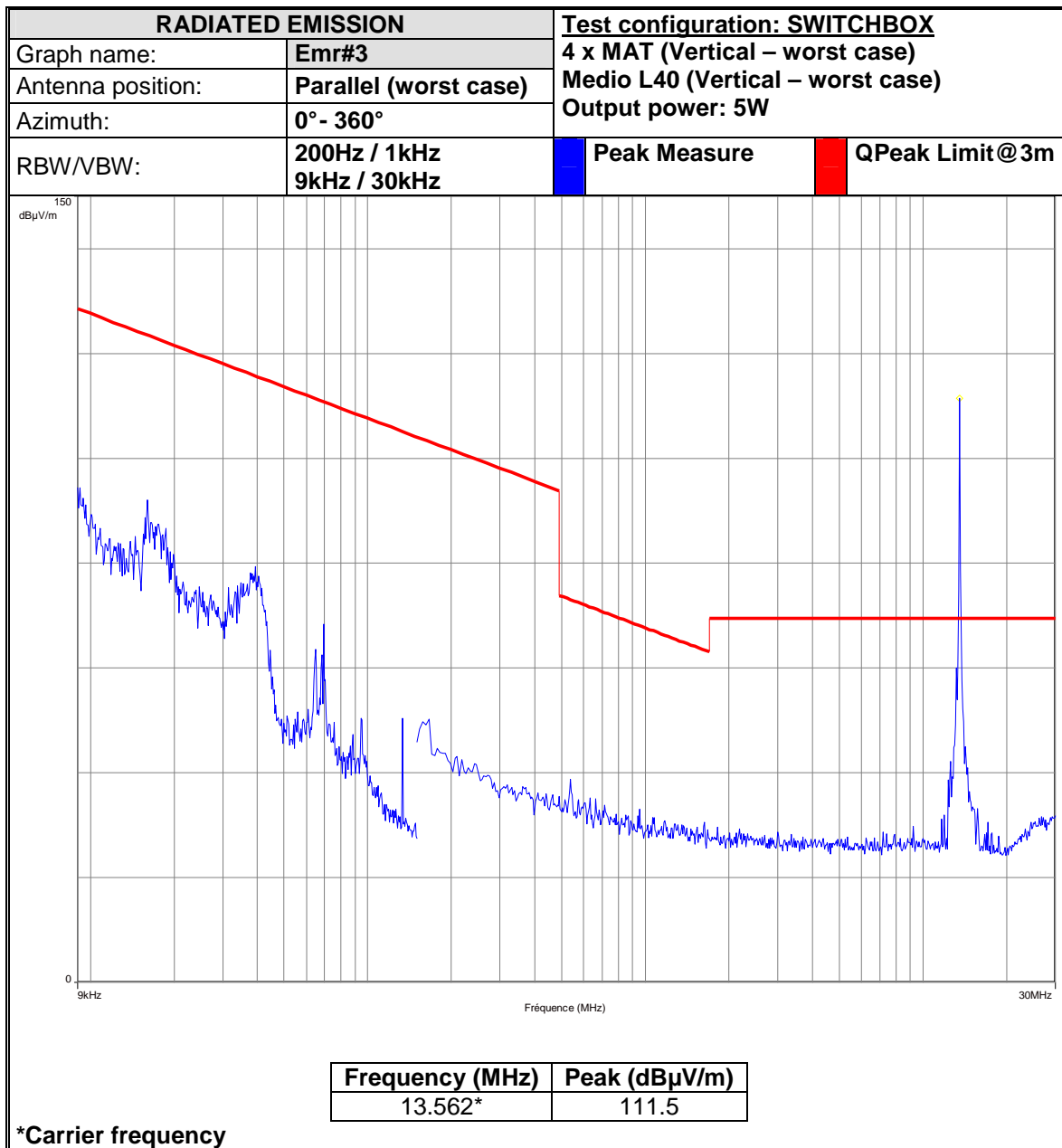
Measure on L1:	graph Emc#1	AERO LB	(see annex 1)
Measure on N:	graph Emc#2	AERO LB	(see annex 1)
Measure on L1:	graph Emc#3	AERO LC	(see annex 1)
Measure on N:	graph Emc#4	AERO LC	(see annex 1)
Measure on L1:	graph Emc#5	MAT	(see annex 1)
Measure on N:	graph Emc#6	MAT	(see annex 1)
Measure on L1:	graph Emc#7	LSA3	(see annex 1)
Measure on N:	graph Emc#8	LSA3	(see annex 1)
Measure on L1:	graph Emc#9	LSA4	(see annex 1)
Measure on N:	graph Emc#10	LSA4	(see annex 1)
Measure on L1:	graph Emc#11	With Dummy Load	(see annex 1)
Measure on N:	graph Emc#12	With Dummy Load	(see annex 1)
Measure on L1:	graph Emc#13	AERO LC + VPELECTRONIQUE	(see annex 1)
Measure on N:	graph Emc#14	AERO LC + VPELECTRONIQUE	(see annex 1)
Measure on L1:	graph Emc#15	Dummy Load + VPELECTRONIQUE	(see annex 1)
Measure on N:	graph Emc#16	Dummy Load + VPELECTRONIQUE	(see annex 1)
Measure on L1:	graph Emc#17	AERO LC + MEANWELL	(see annex 1)
Measure on N:	graph Emc#18	AERO LC + MEANWELL	(see annex 1)
Measure on L1:	graph Emc#19	Dummy Load + MEANWELL	(see annex 1)
Measure on N:	graph Emc#20	Dummy Load + MEANWELL	(see annex 1)

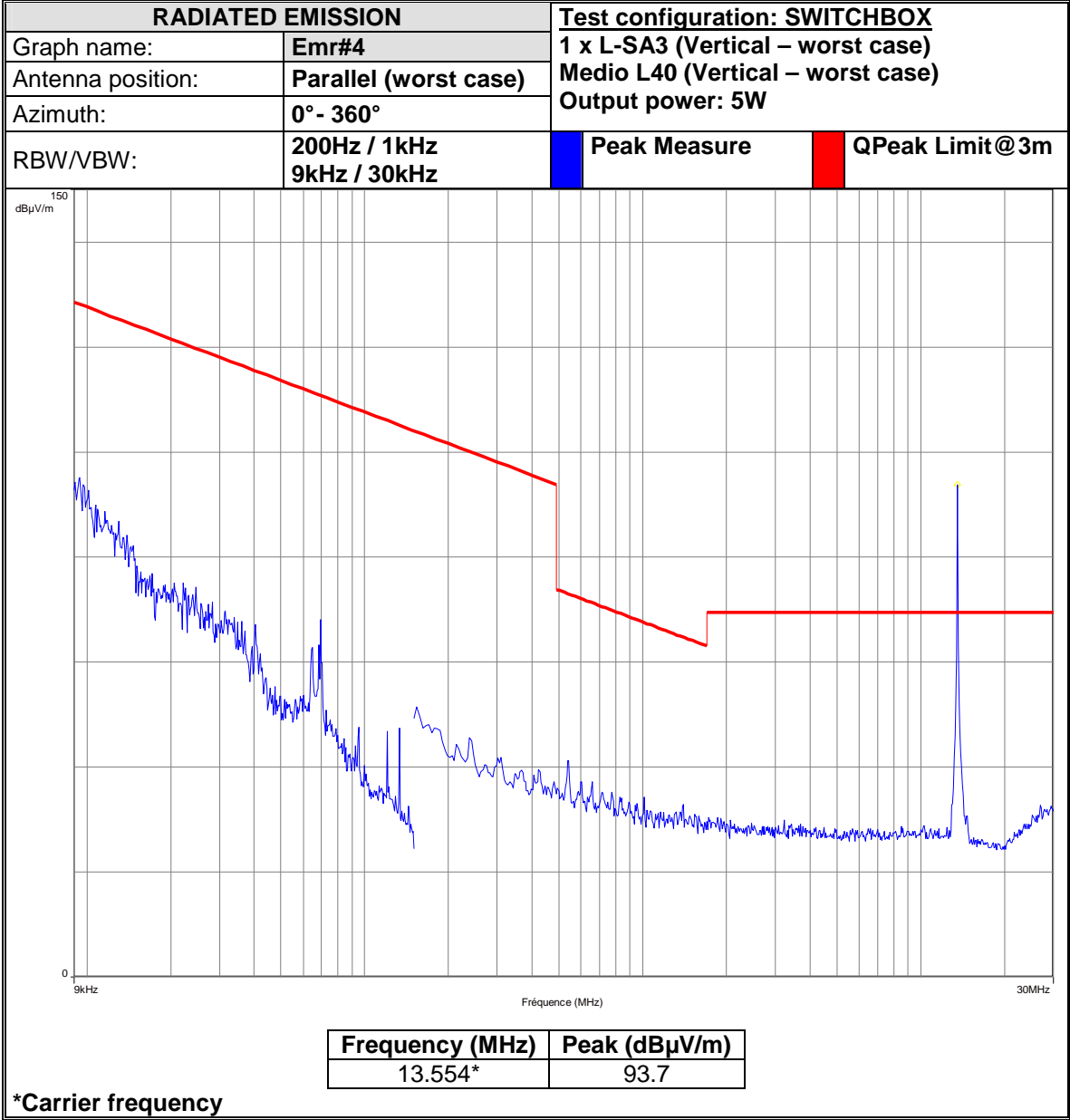
RESULT: PASS

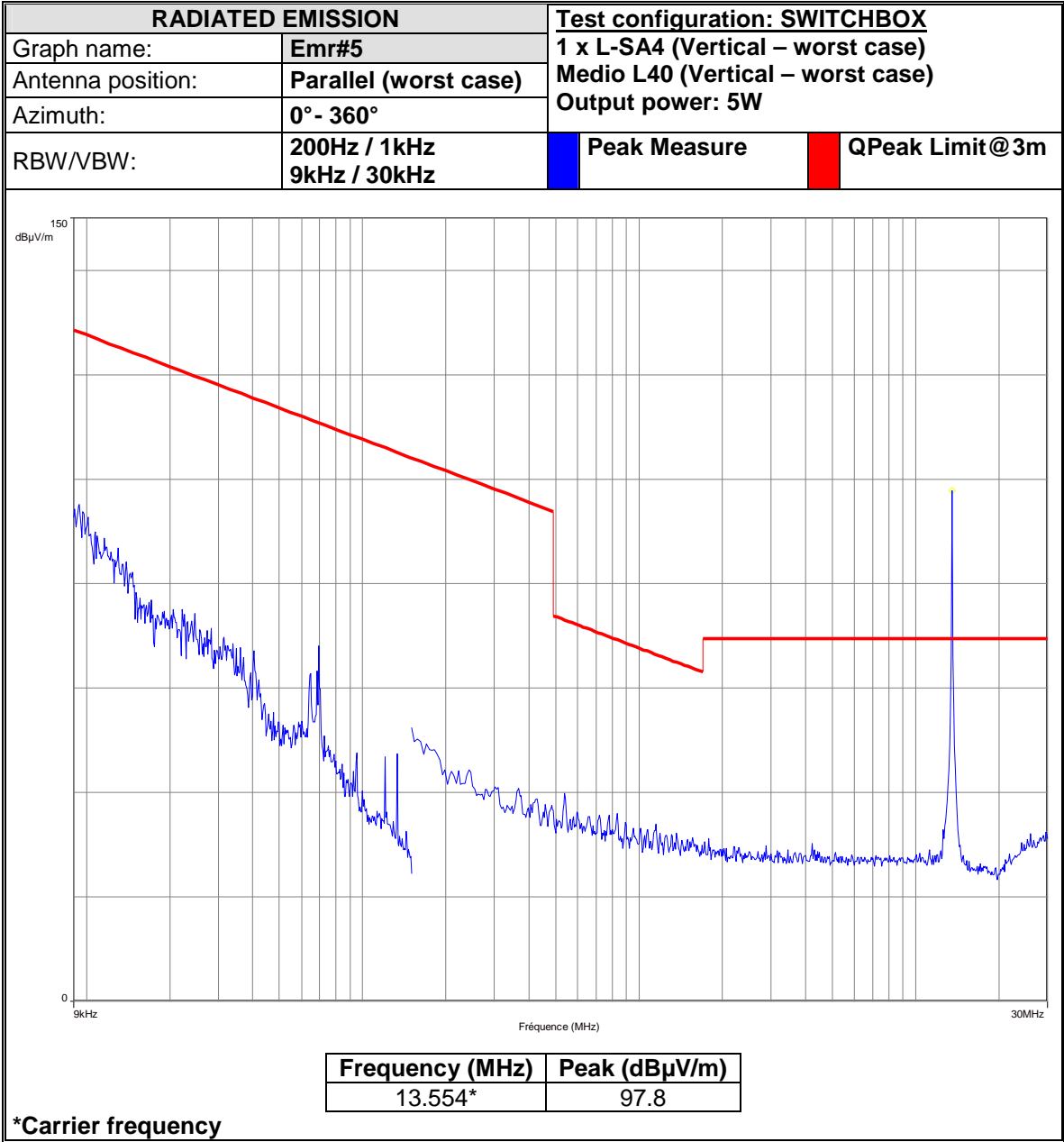
7. ANNEX 1 (GRAPHS)

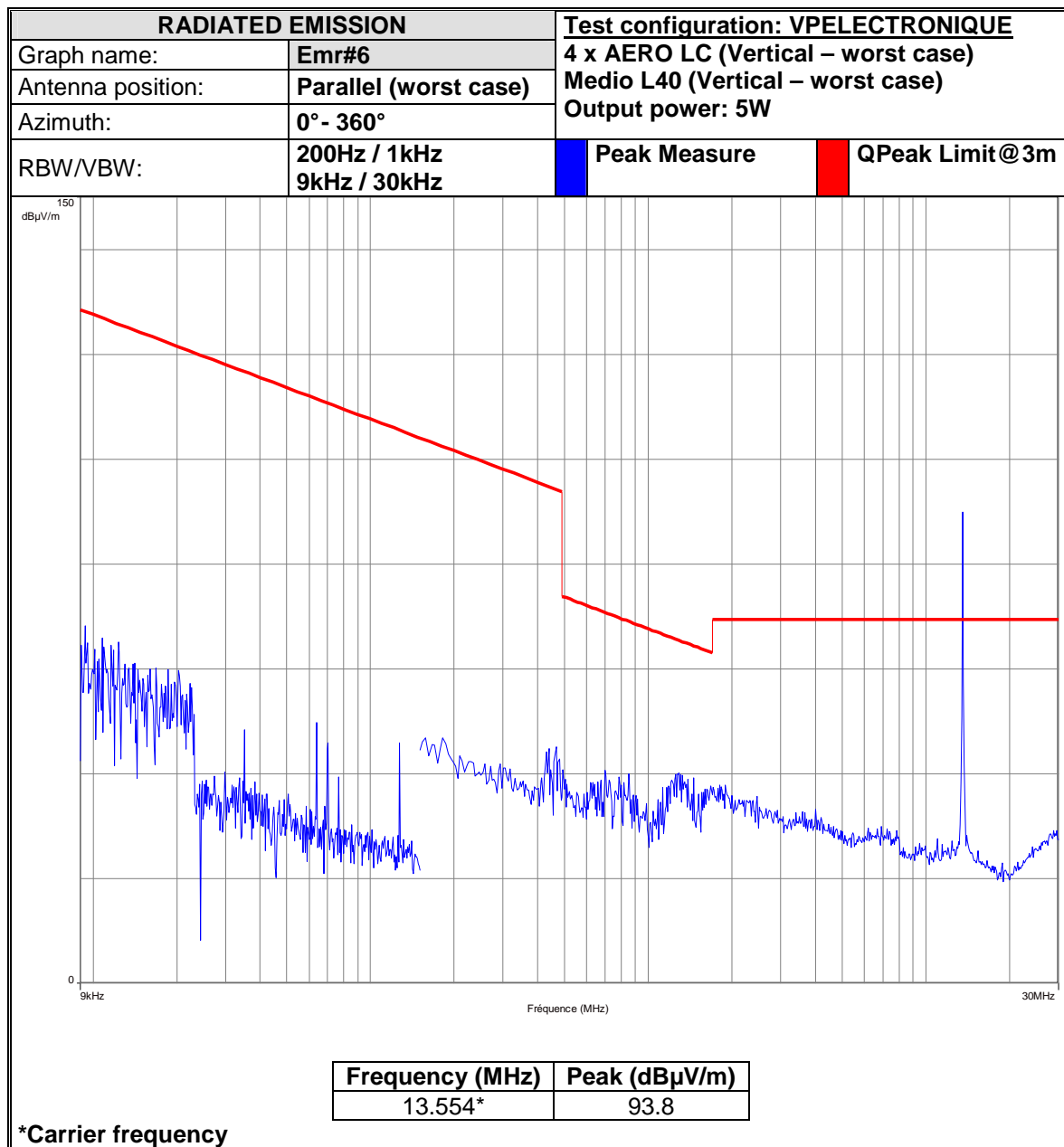


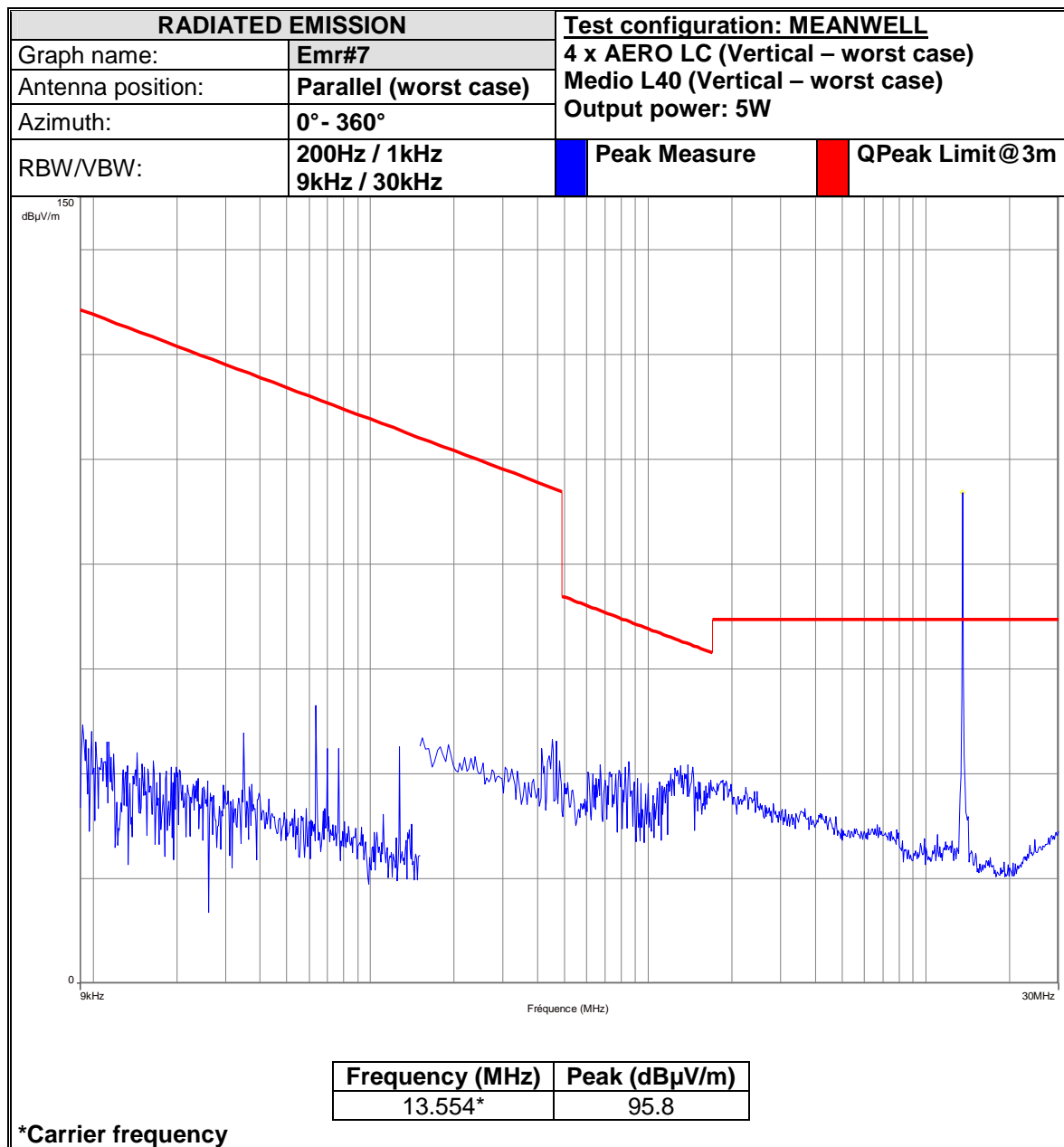


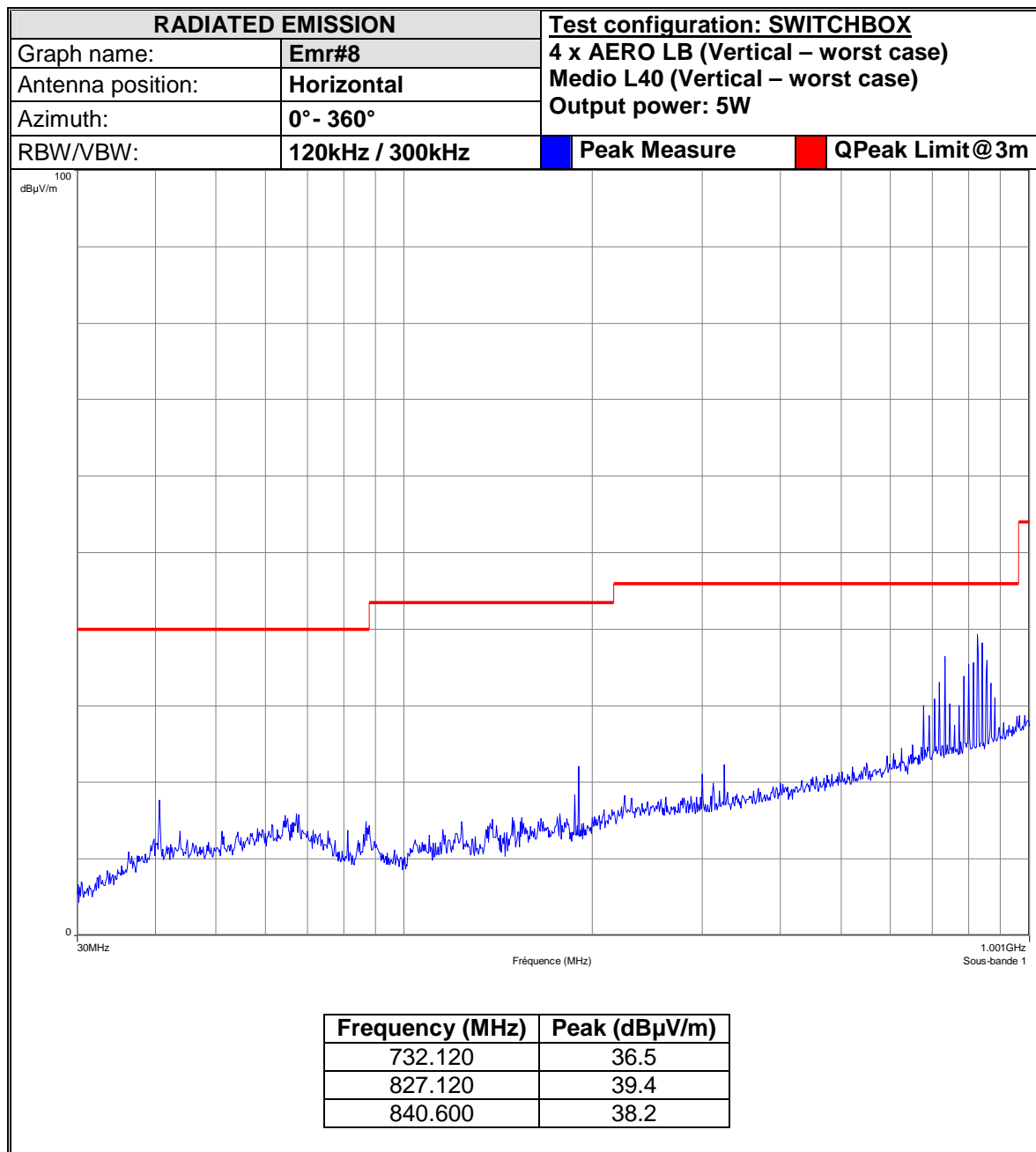


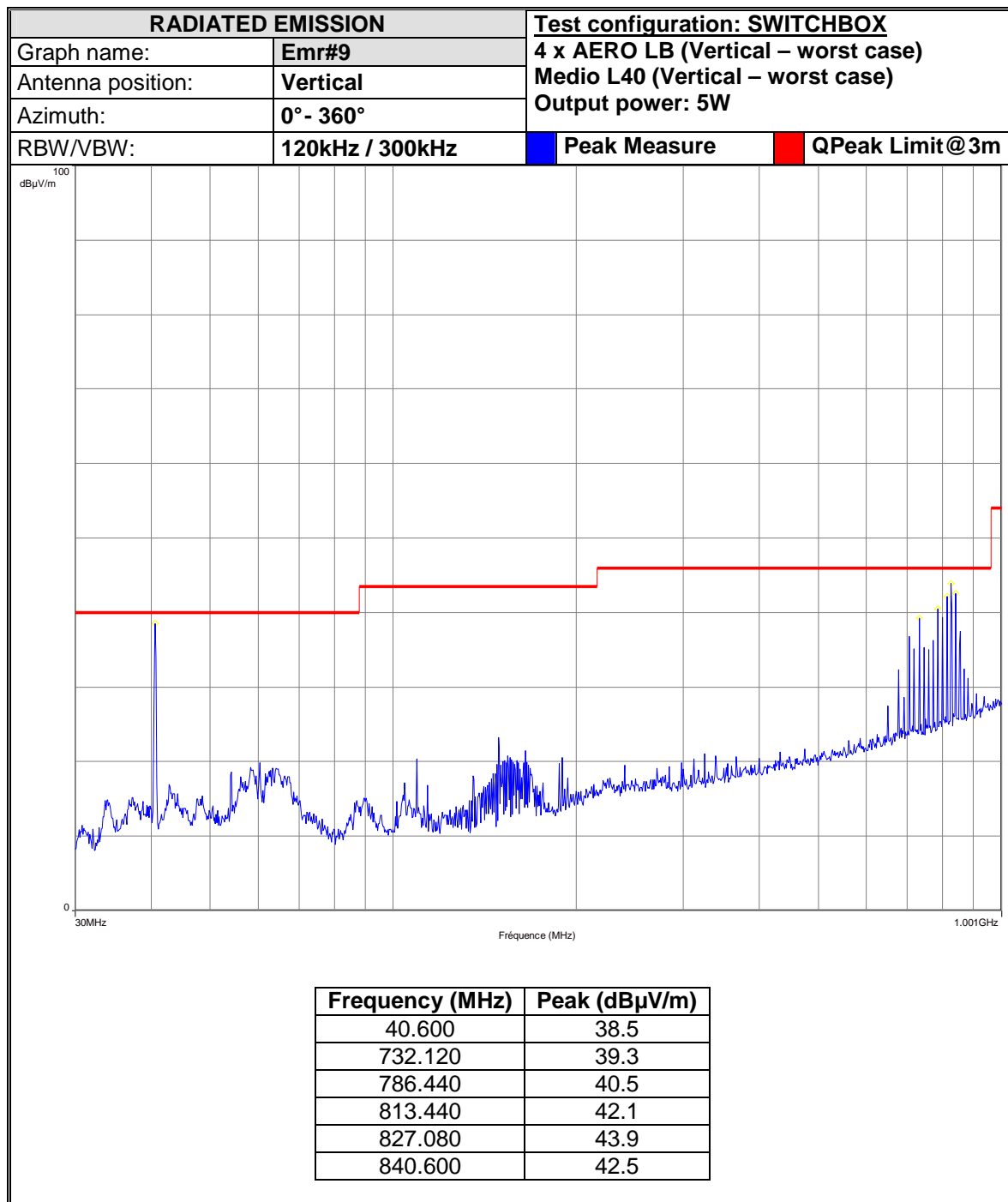


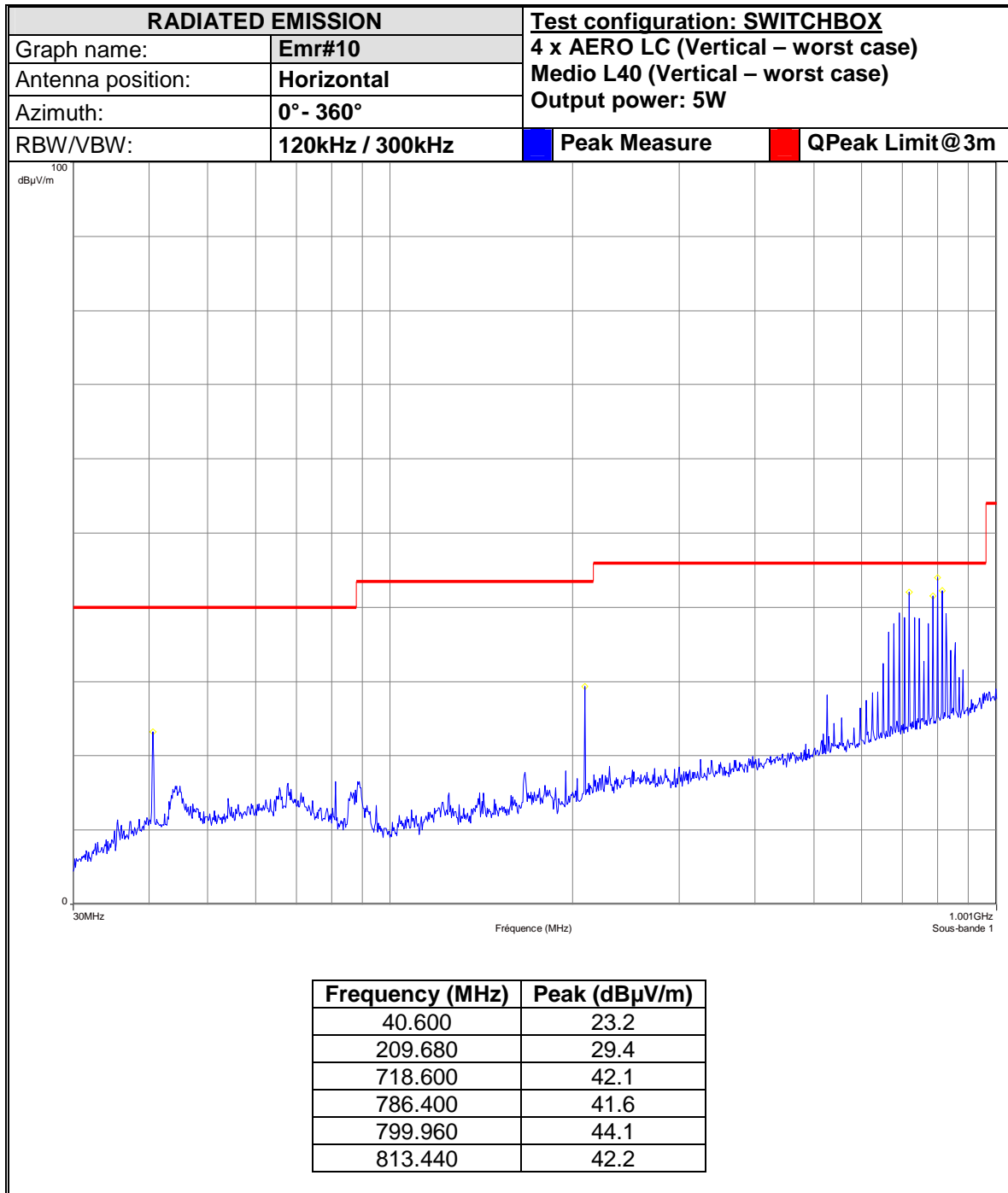


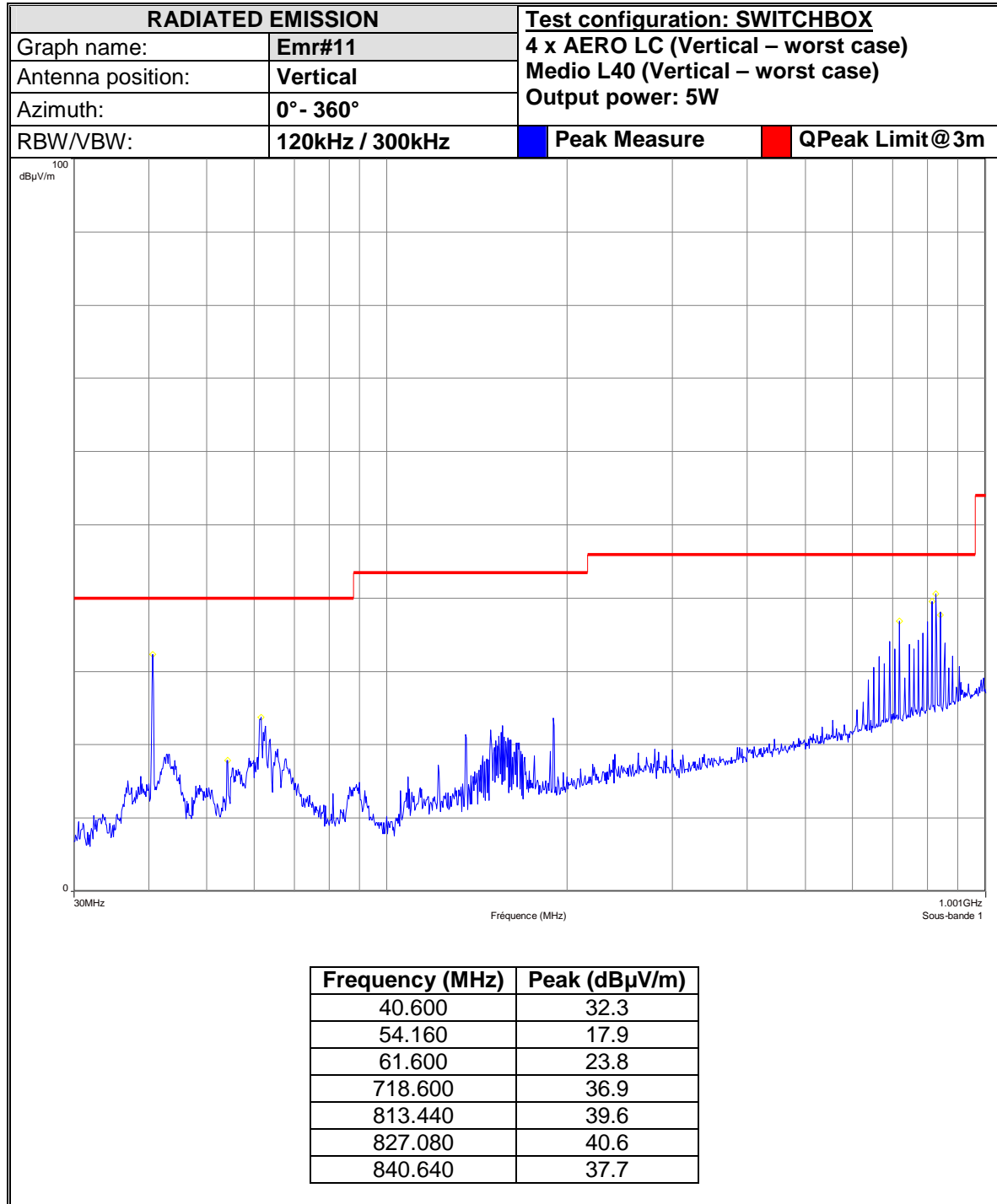


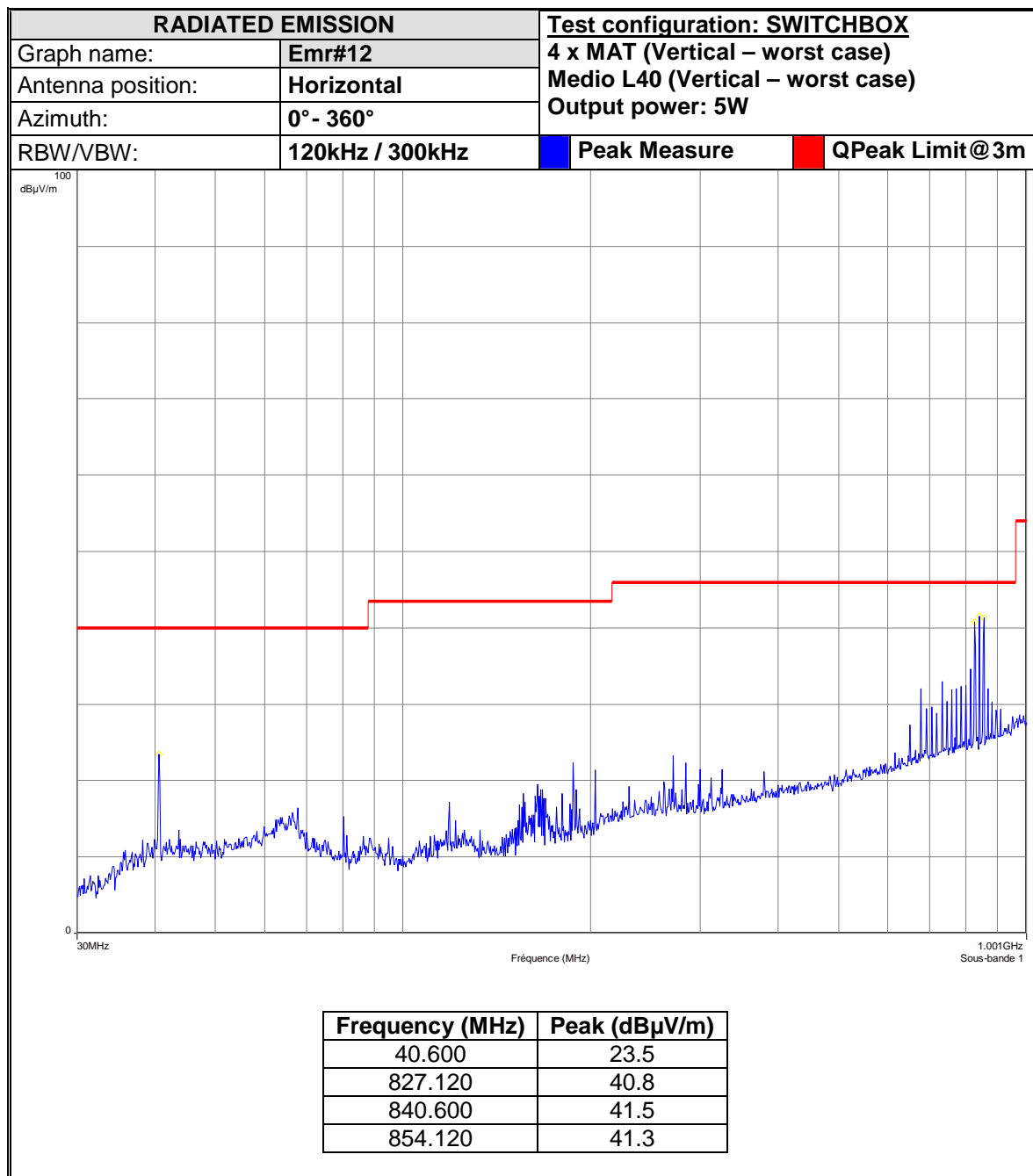


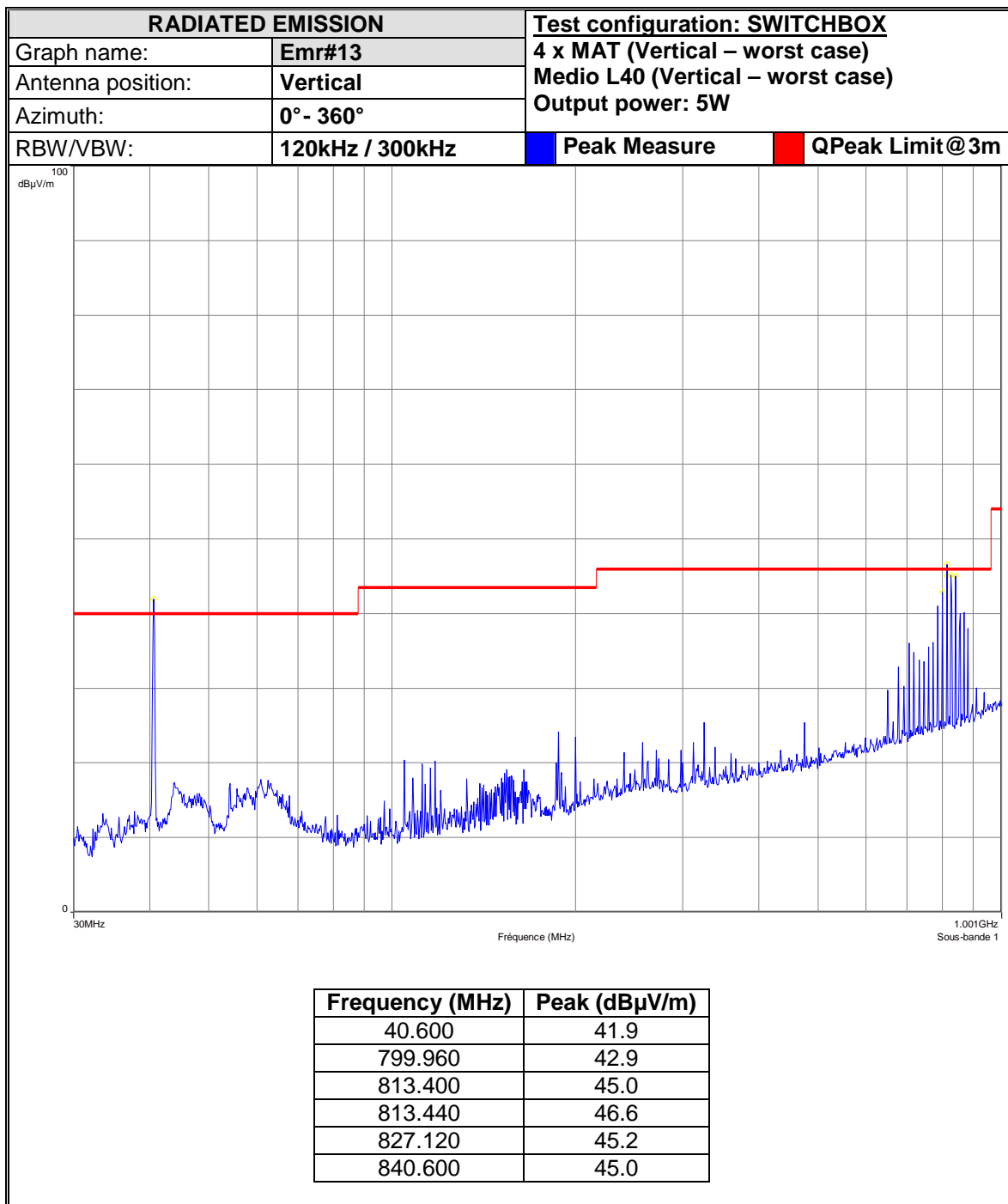


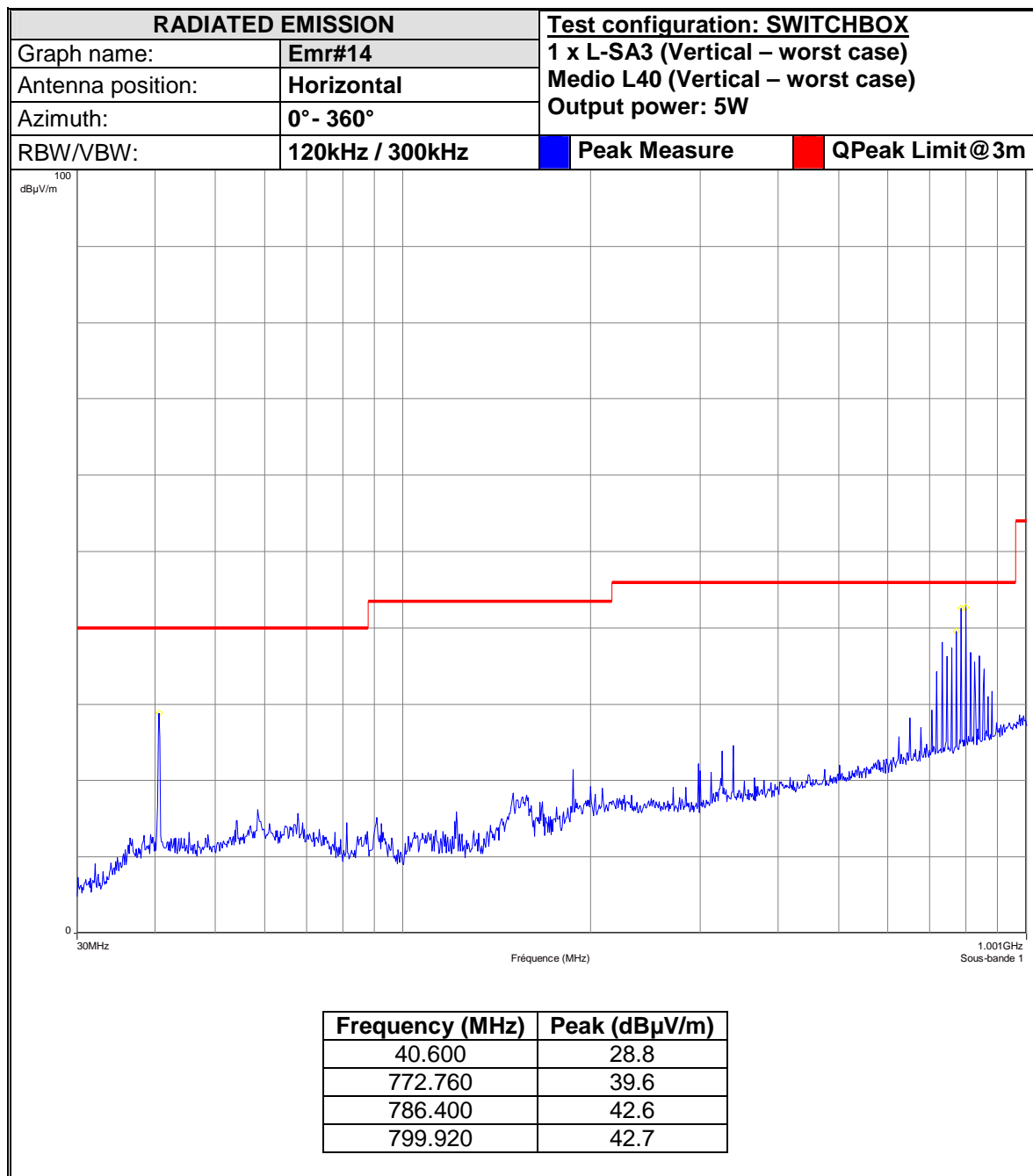


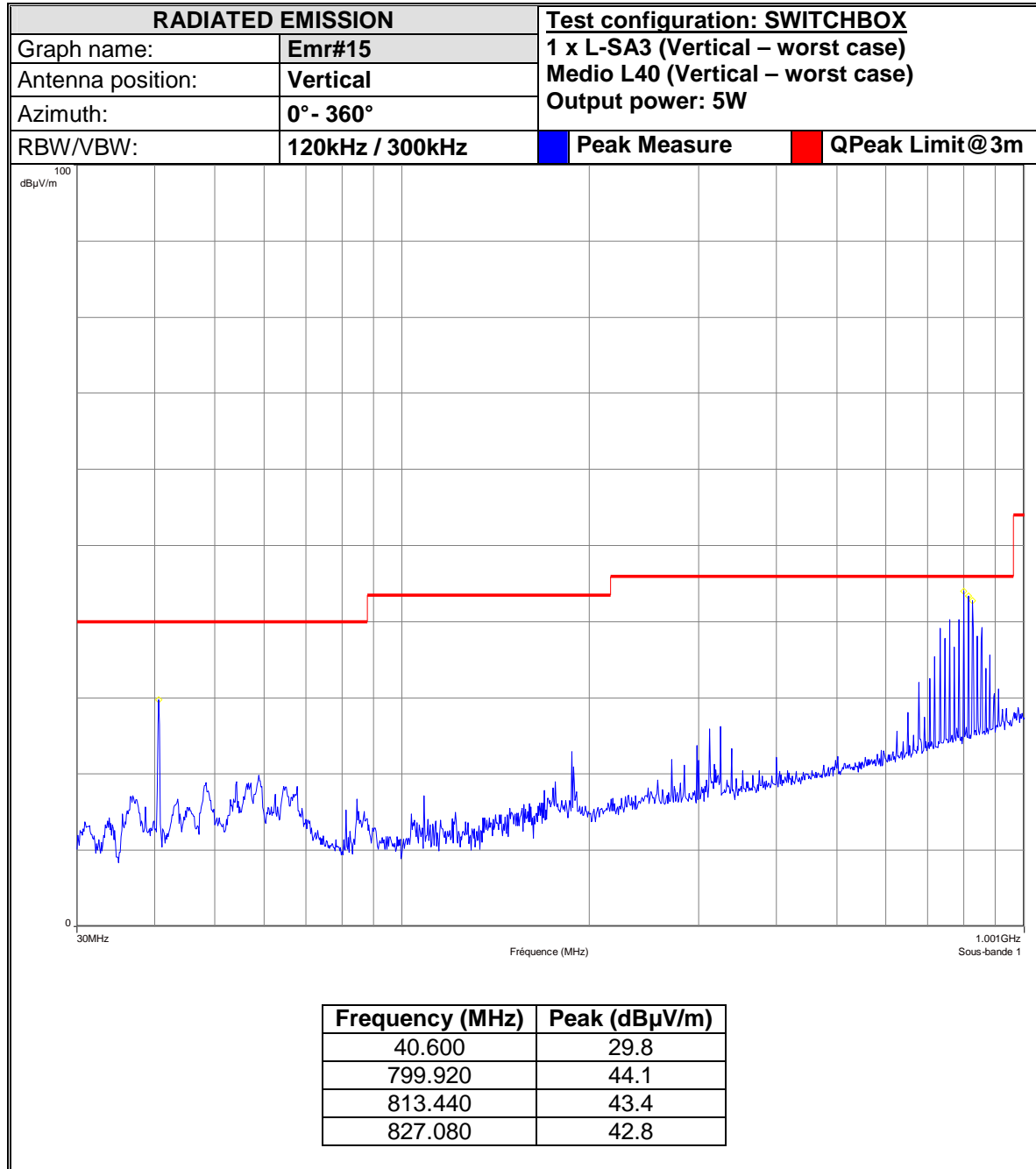


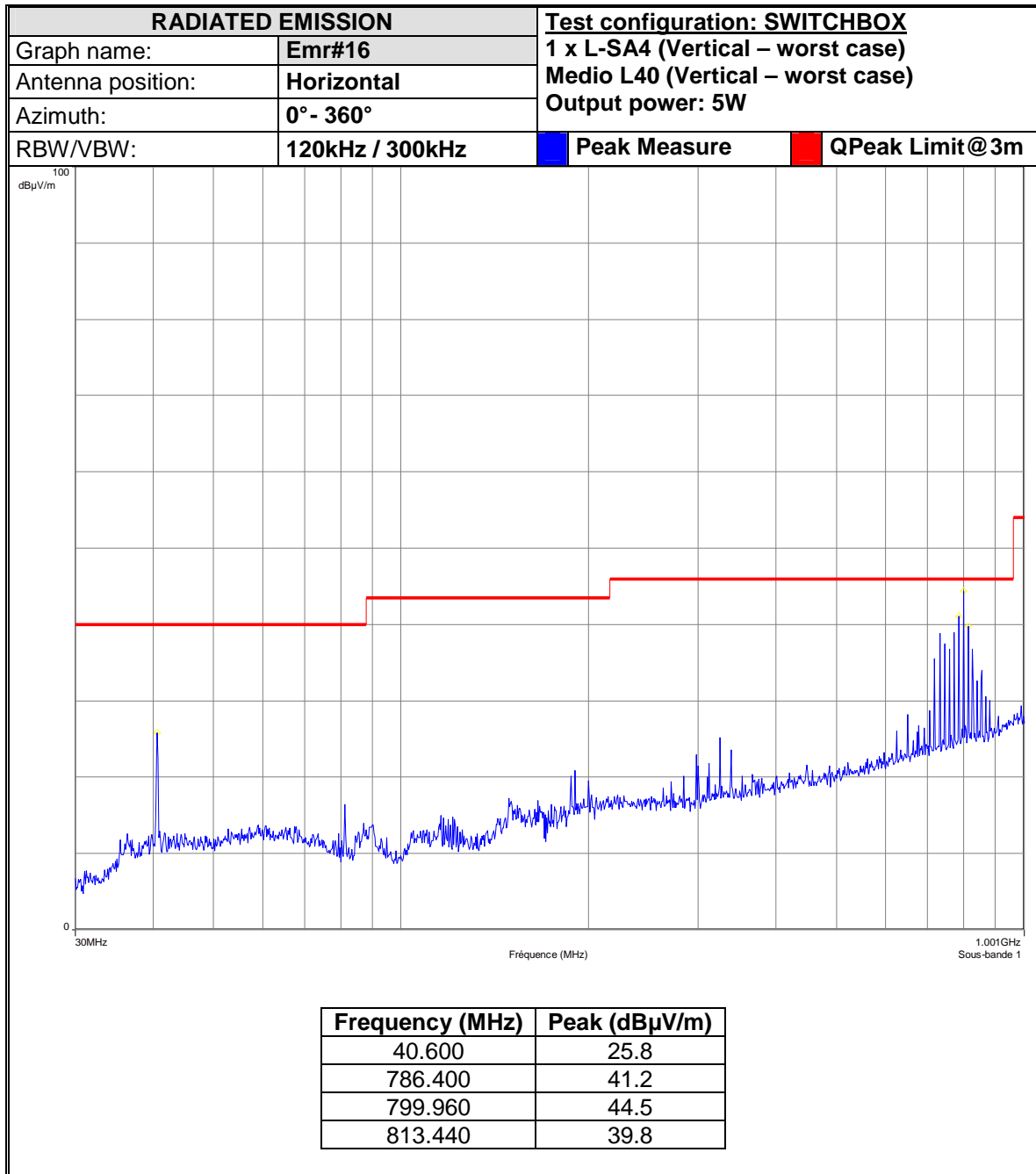


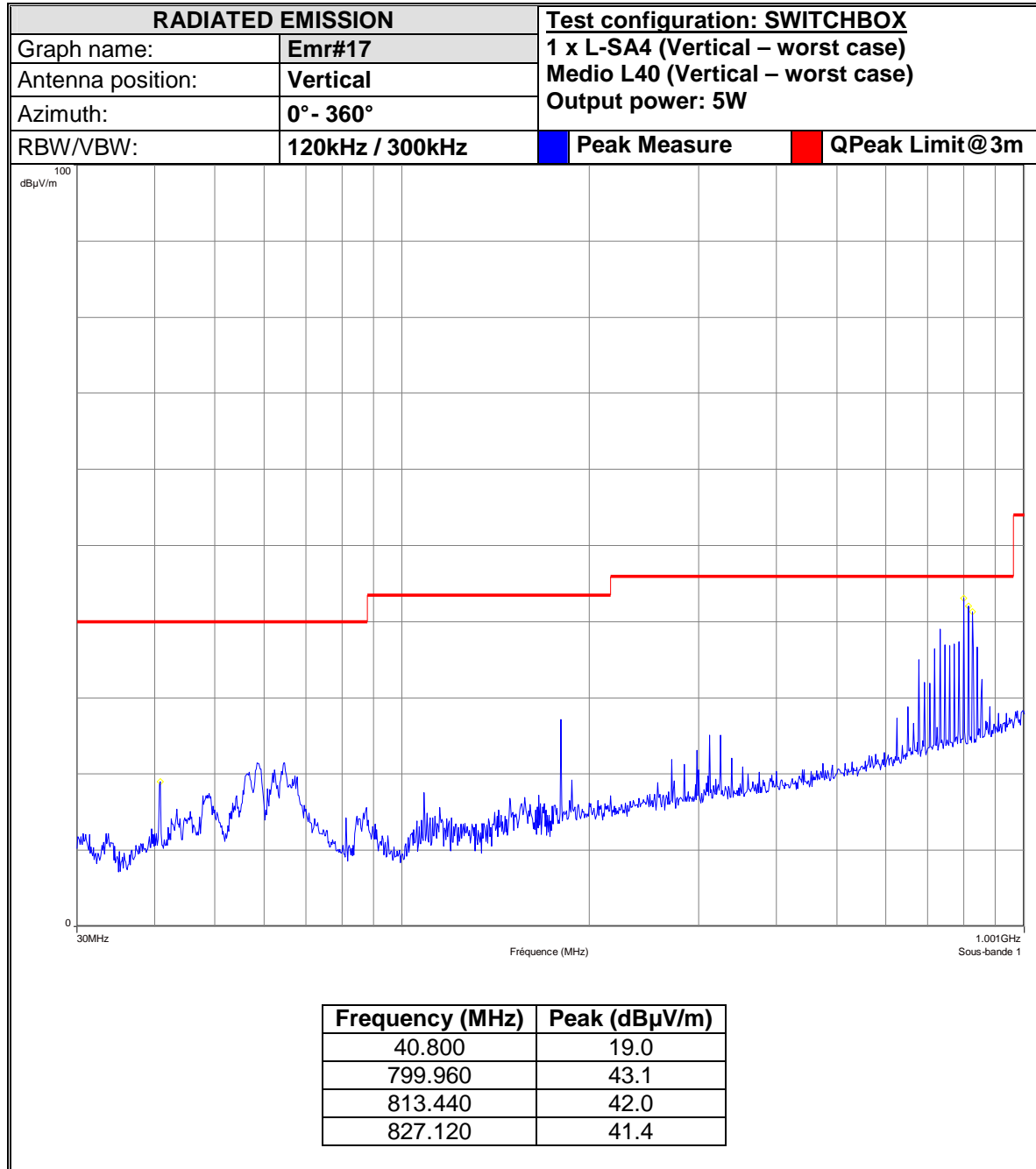


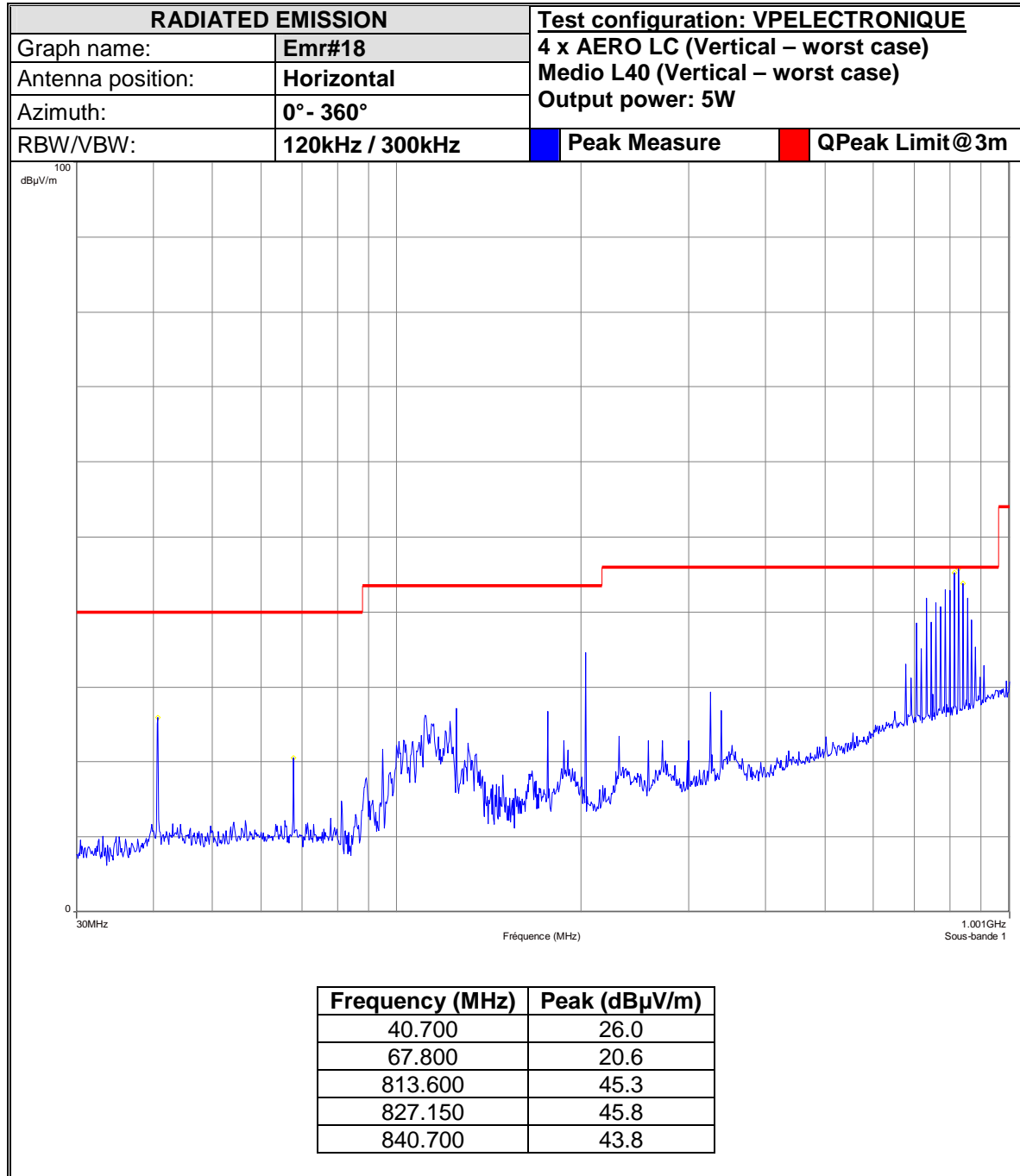


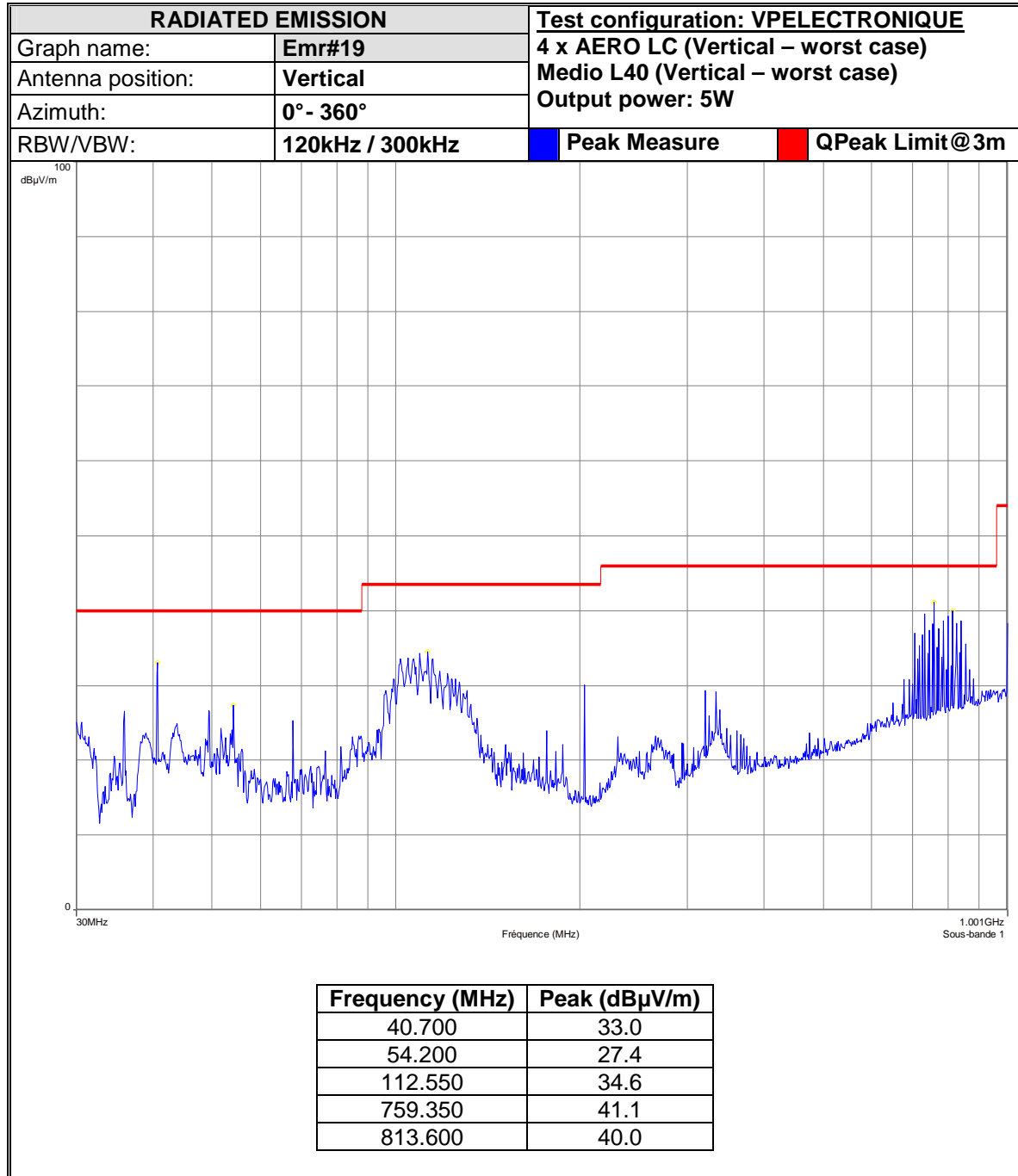


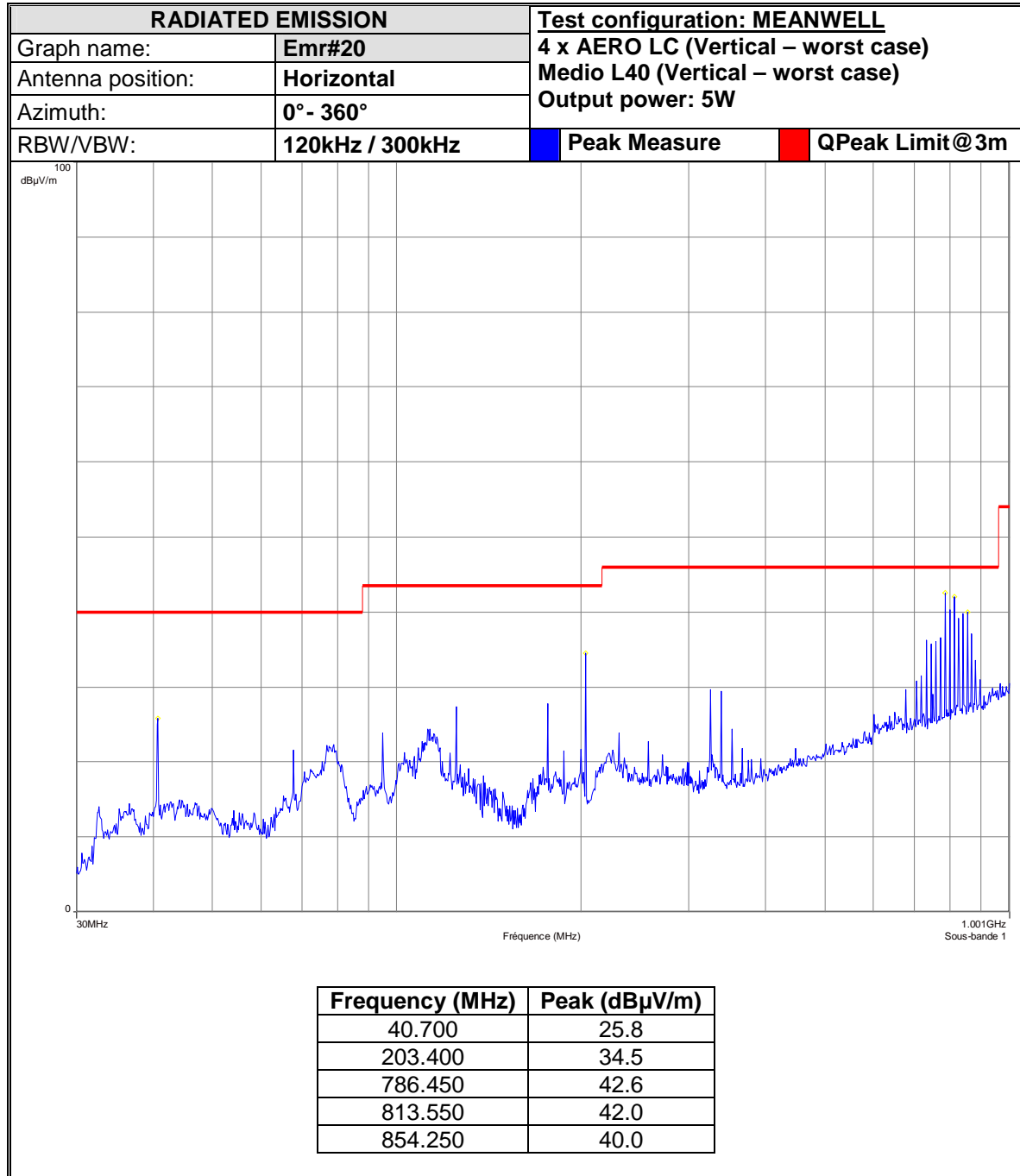


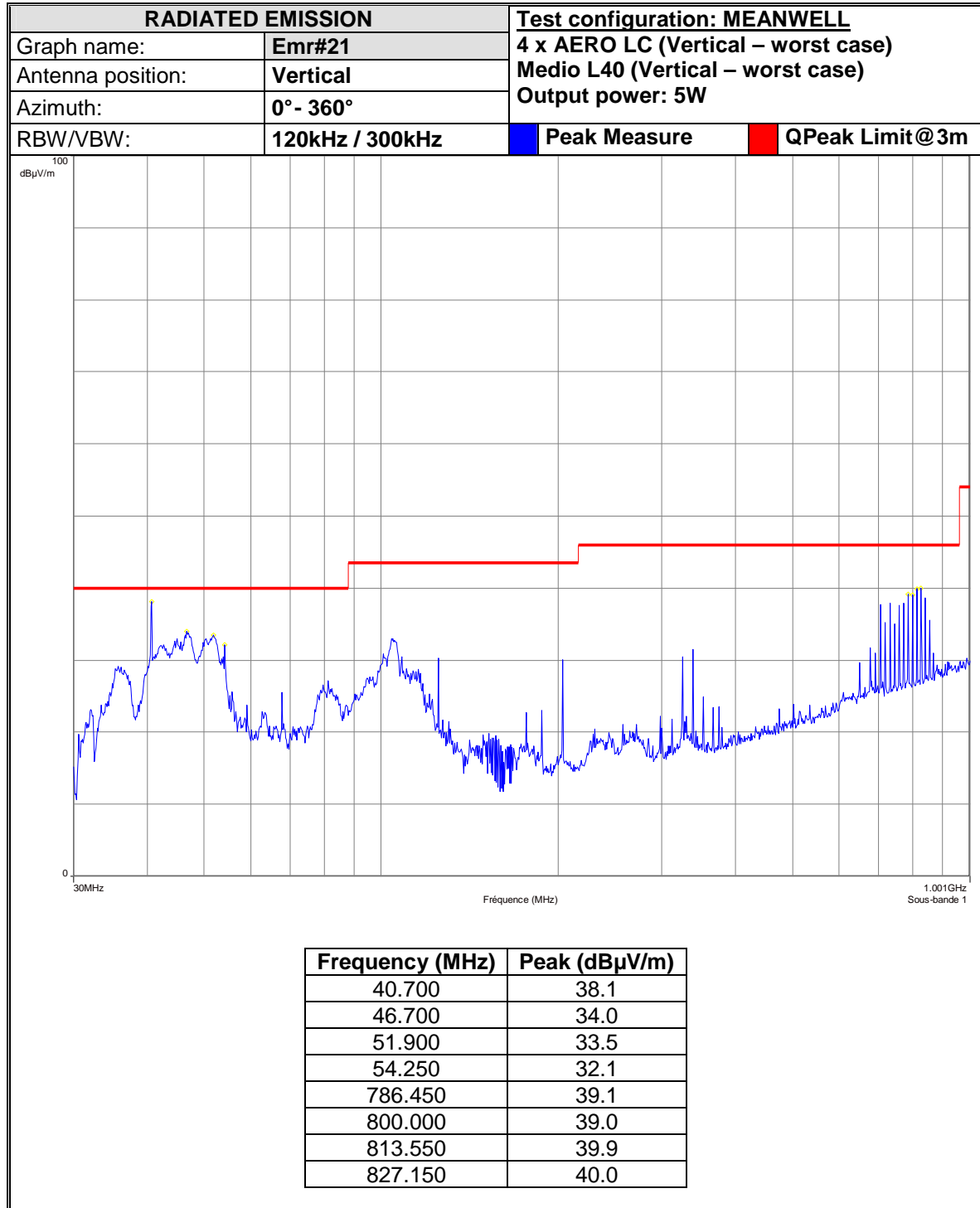


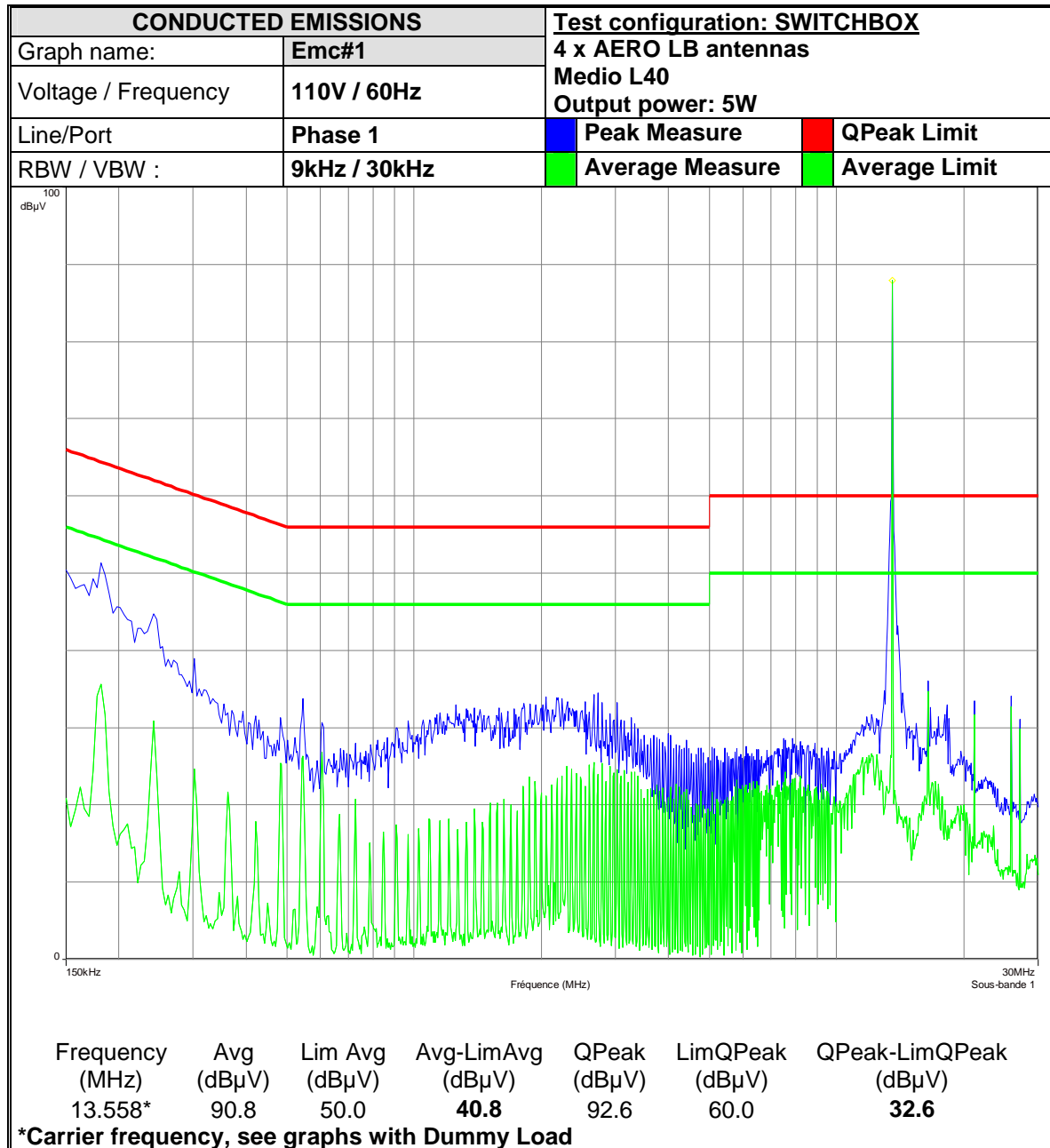


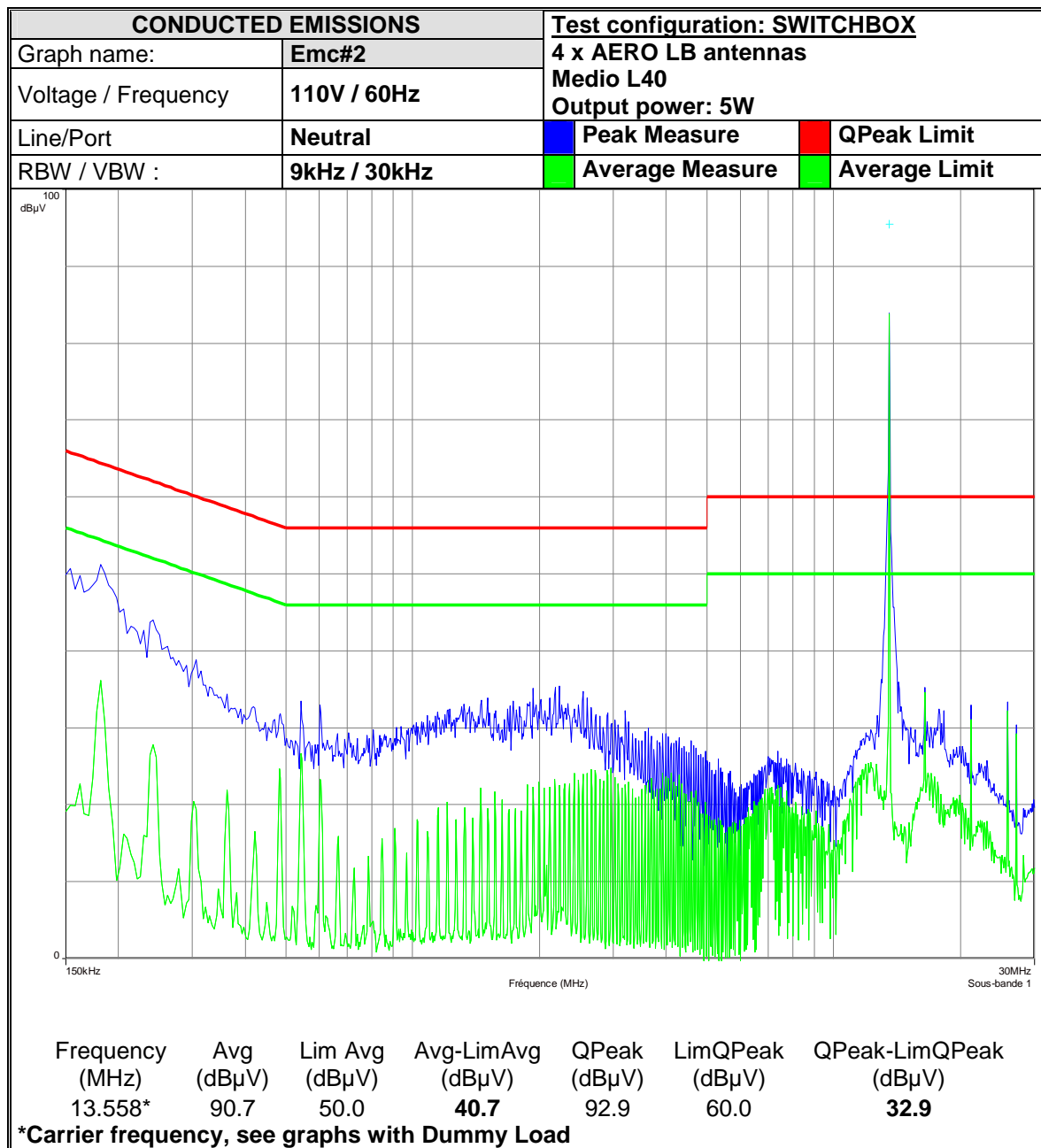


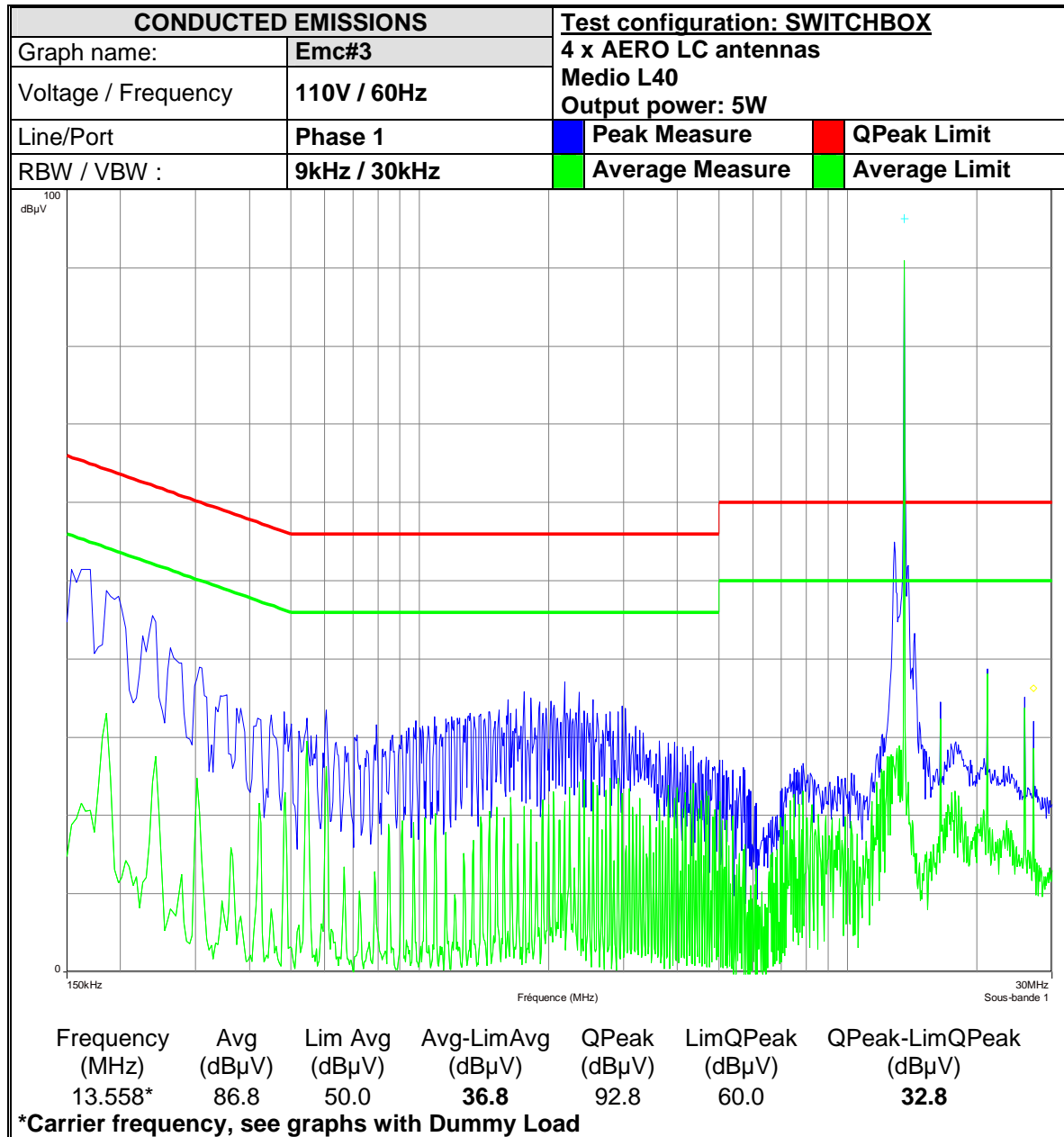


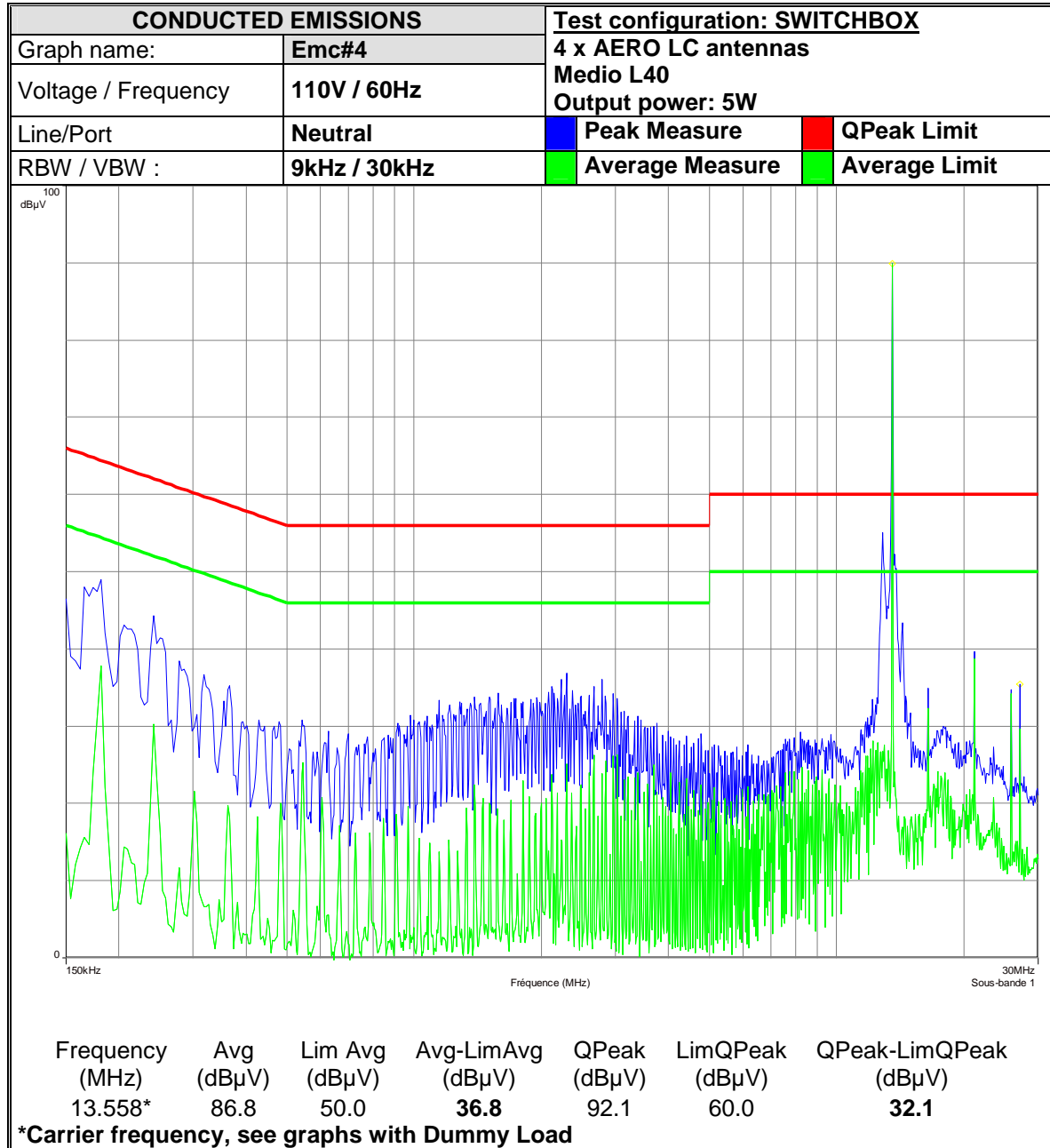


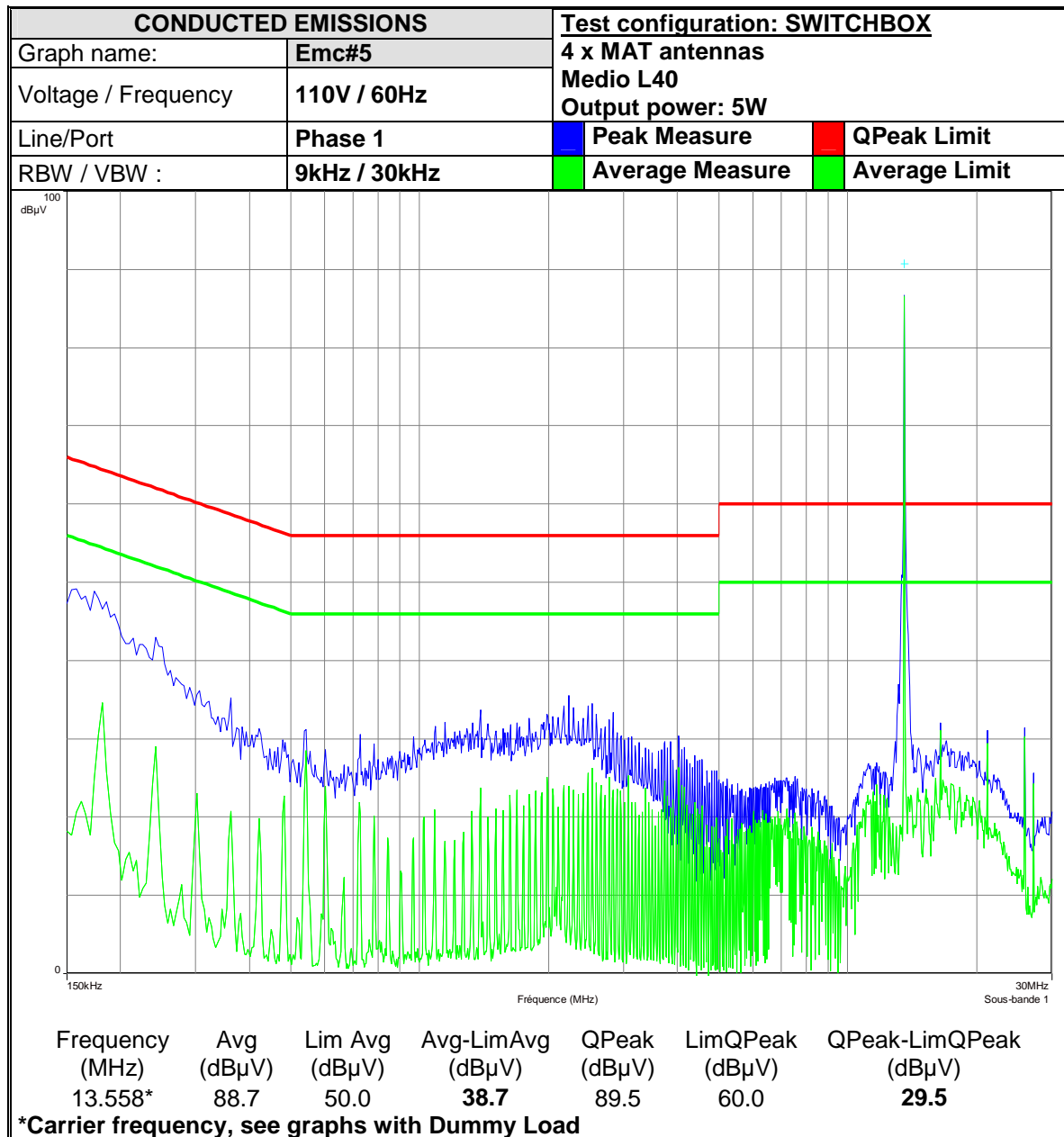


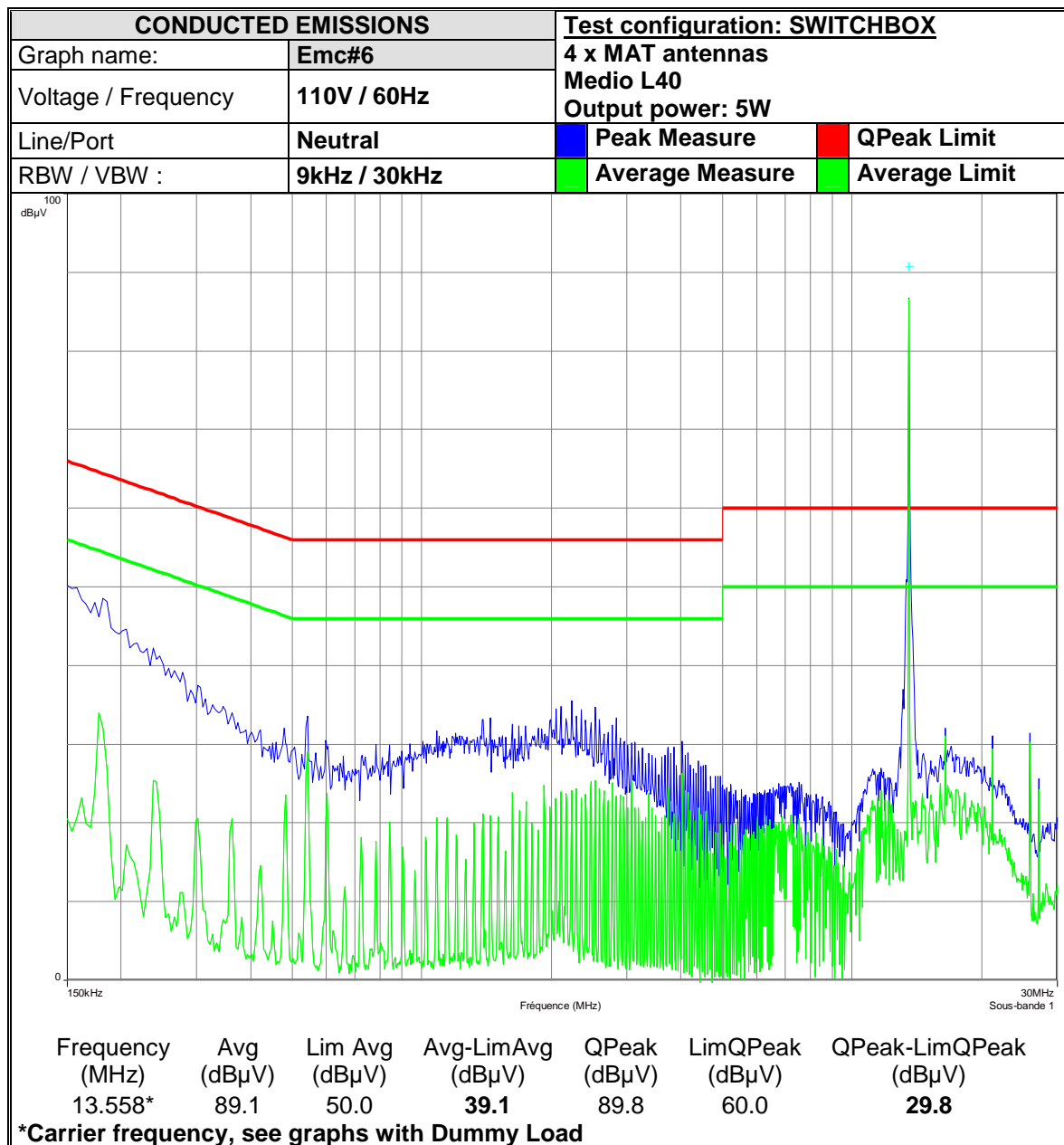


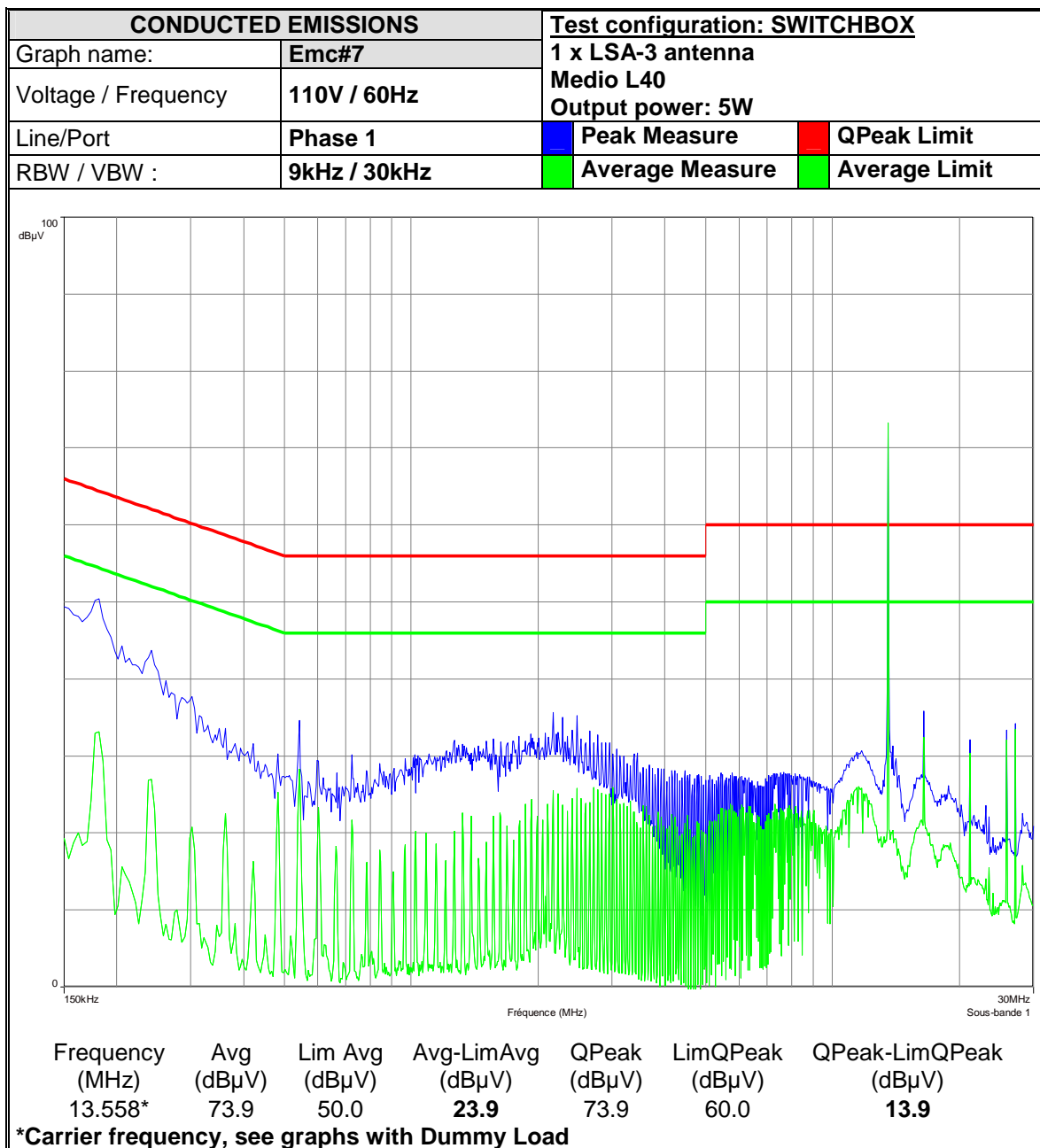


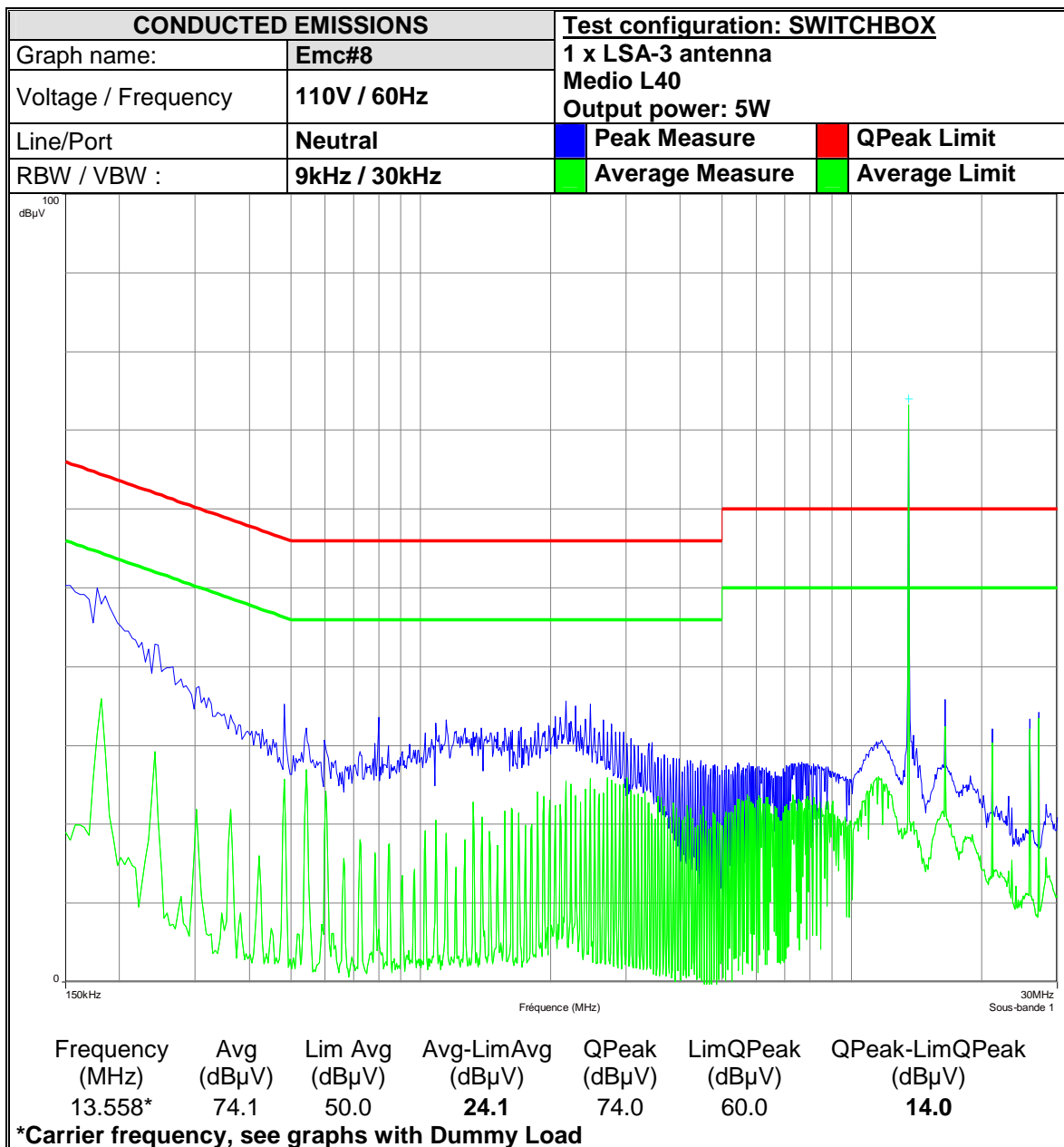


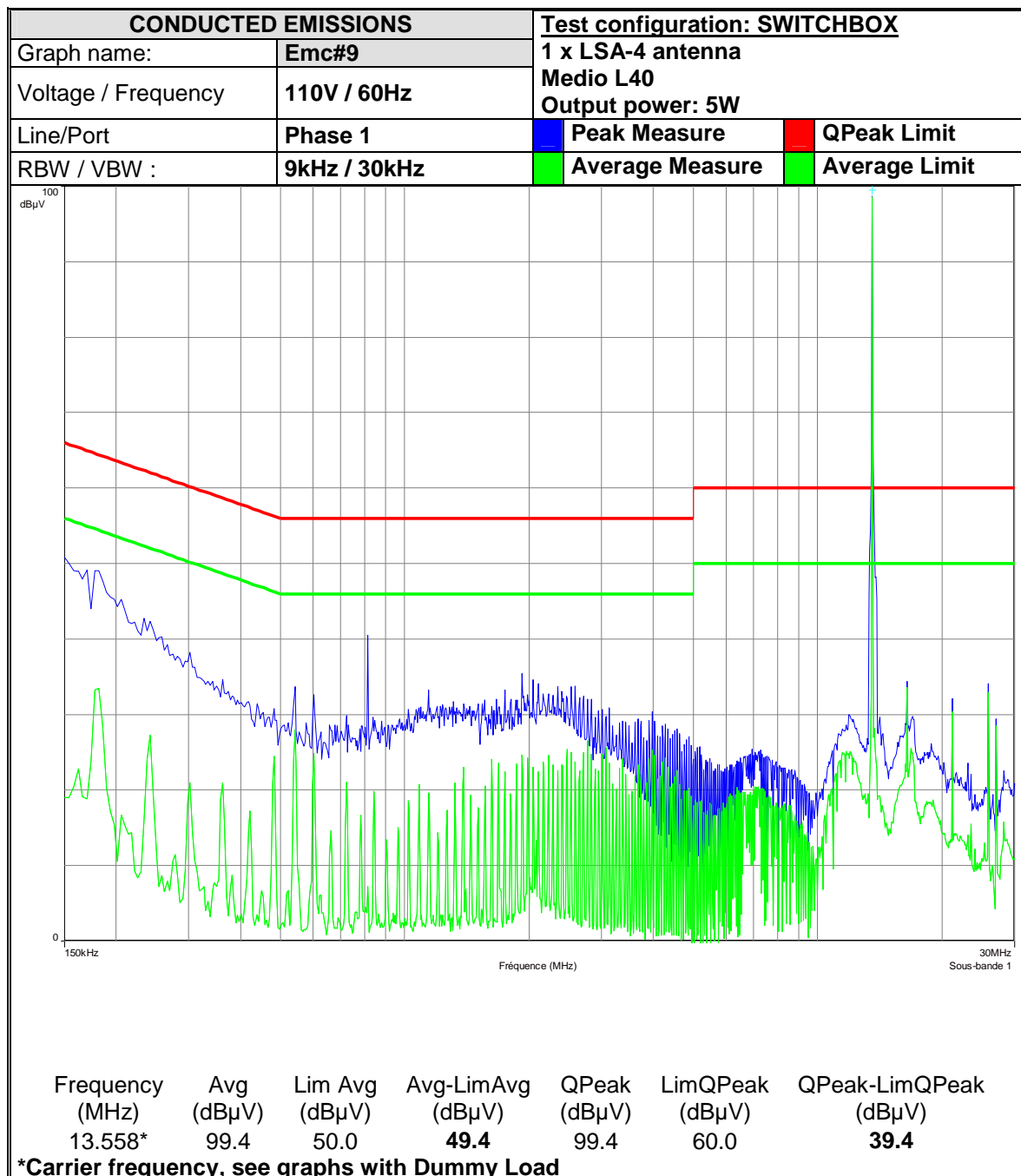


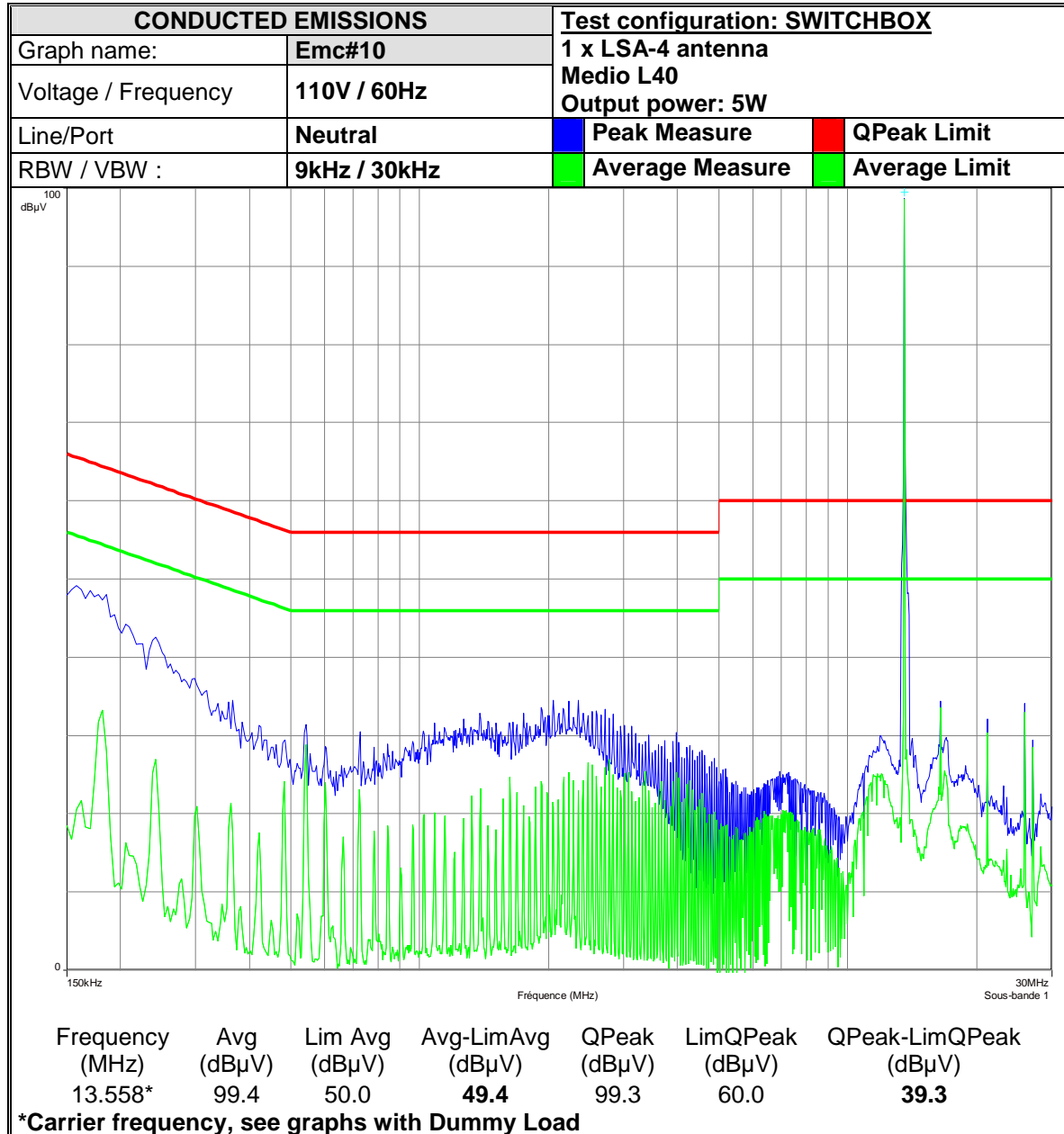


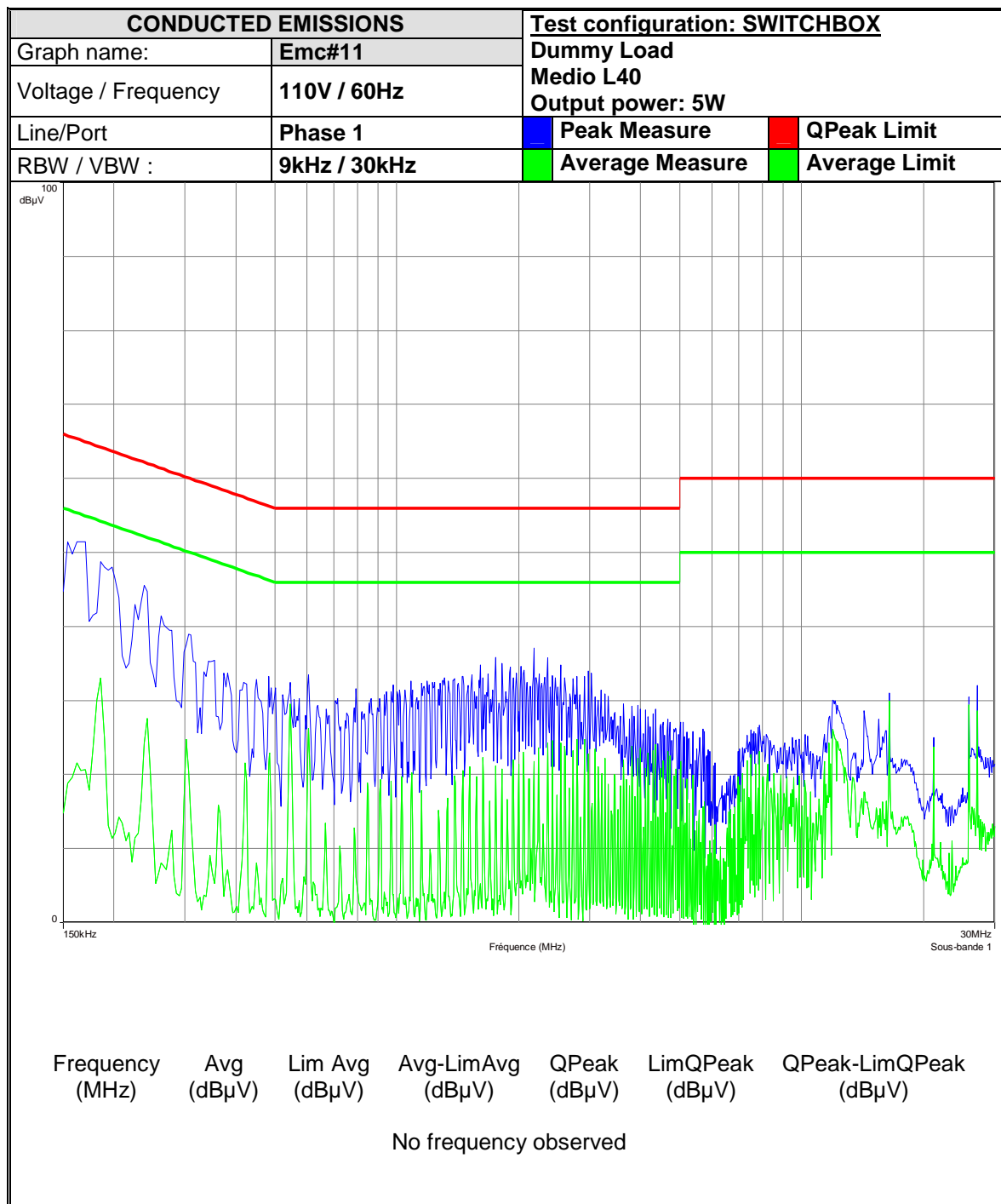


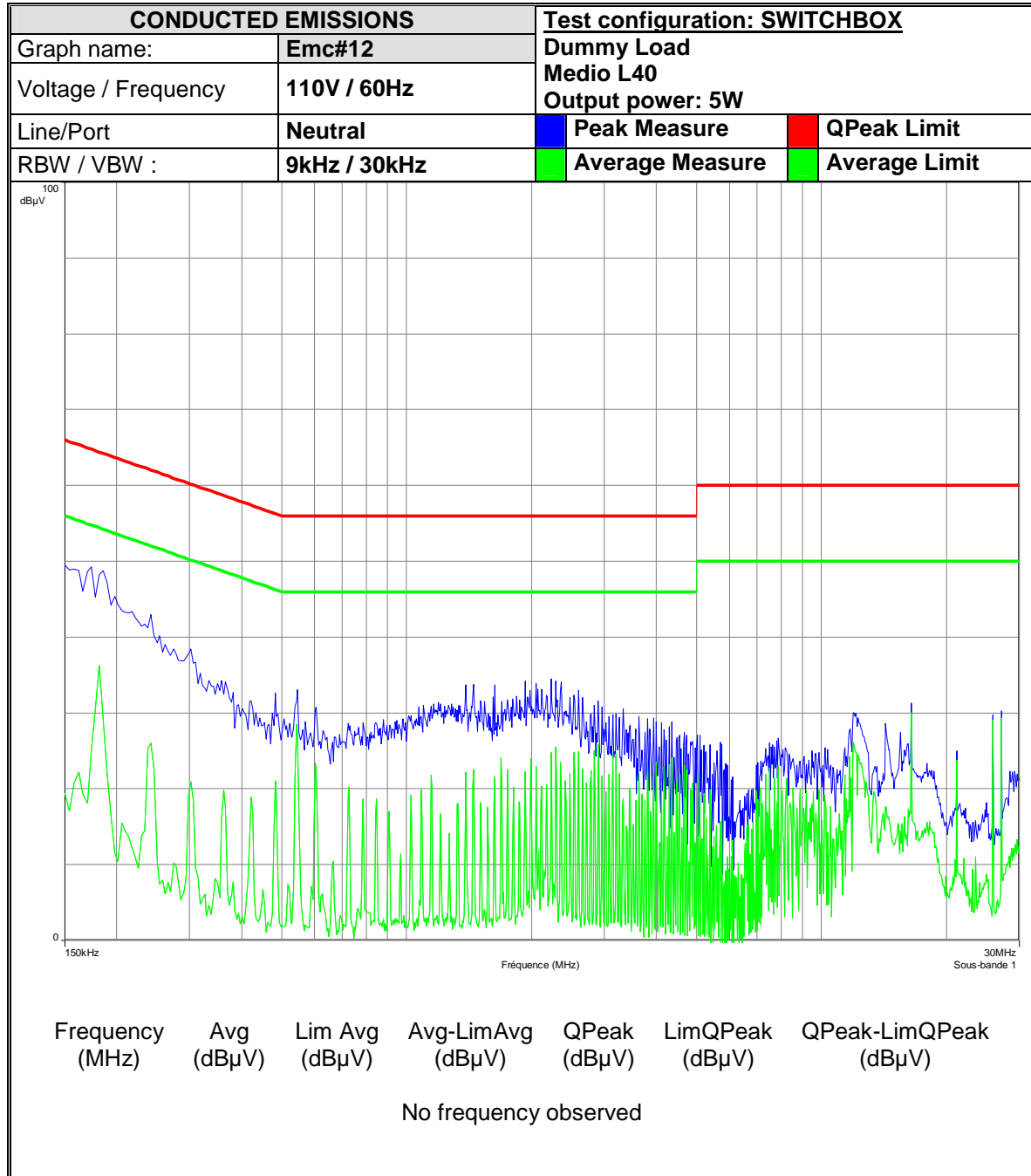


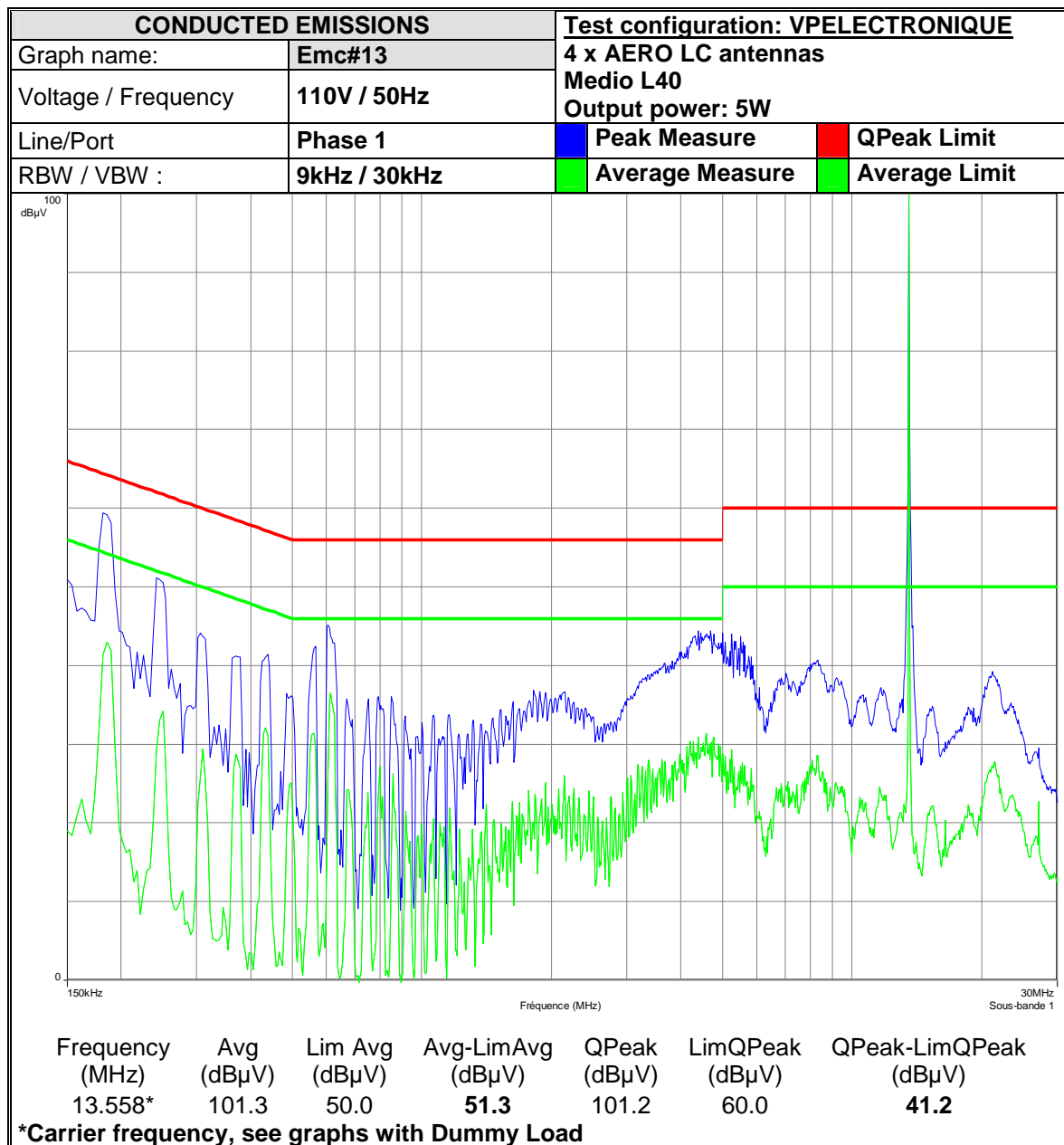


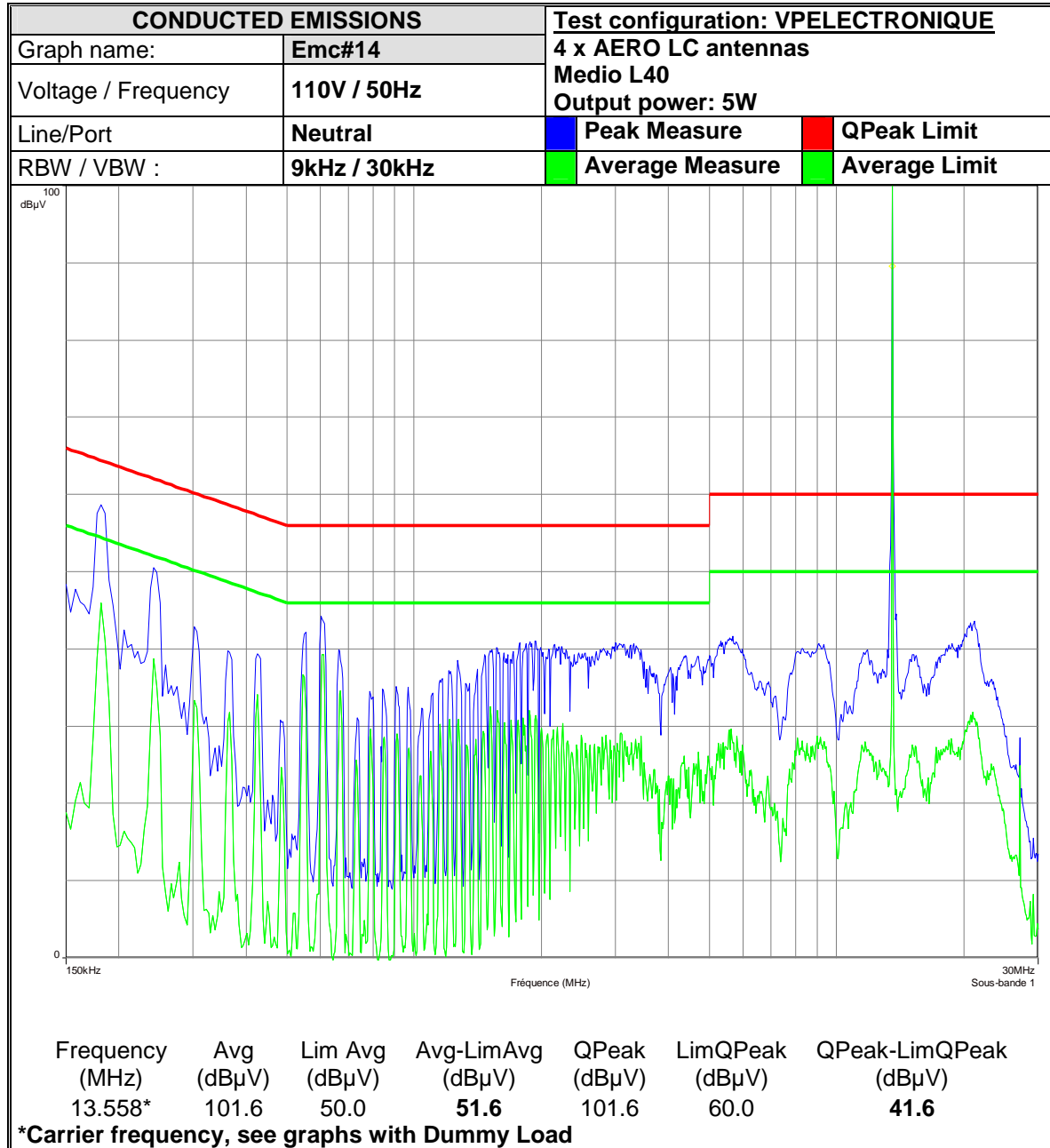


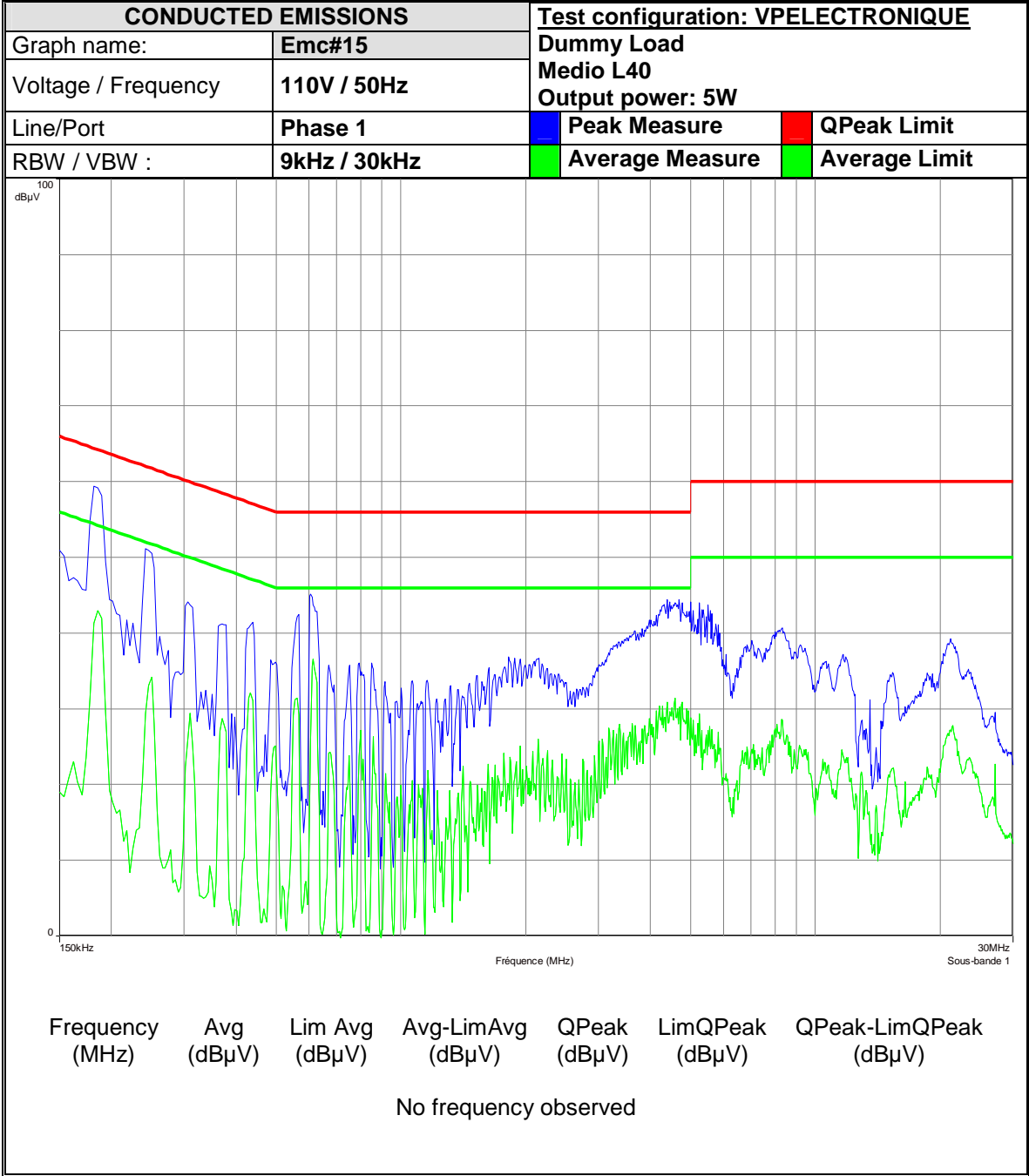


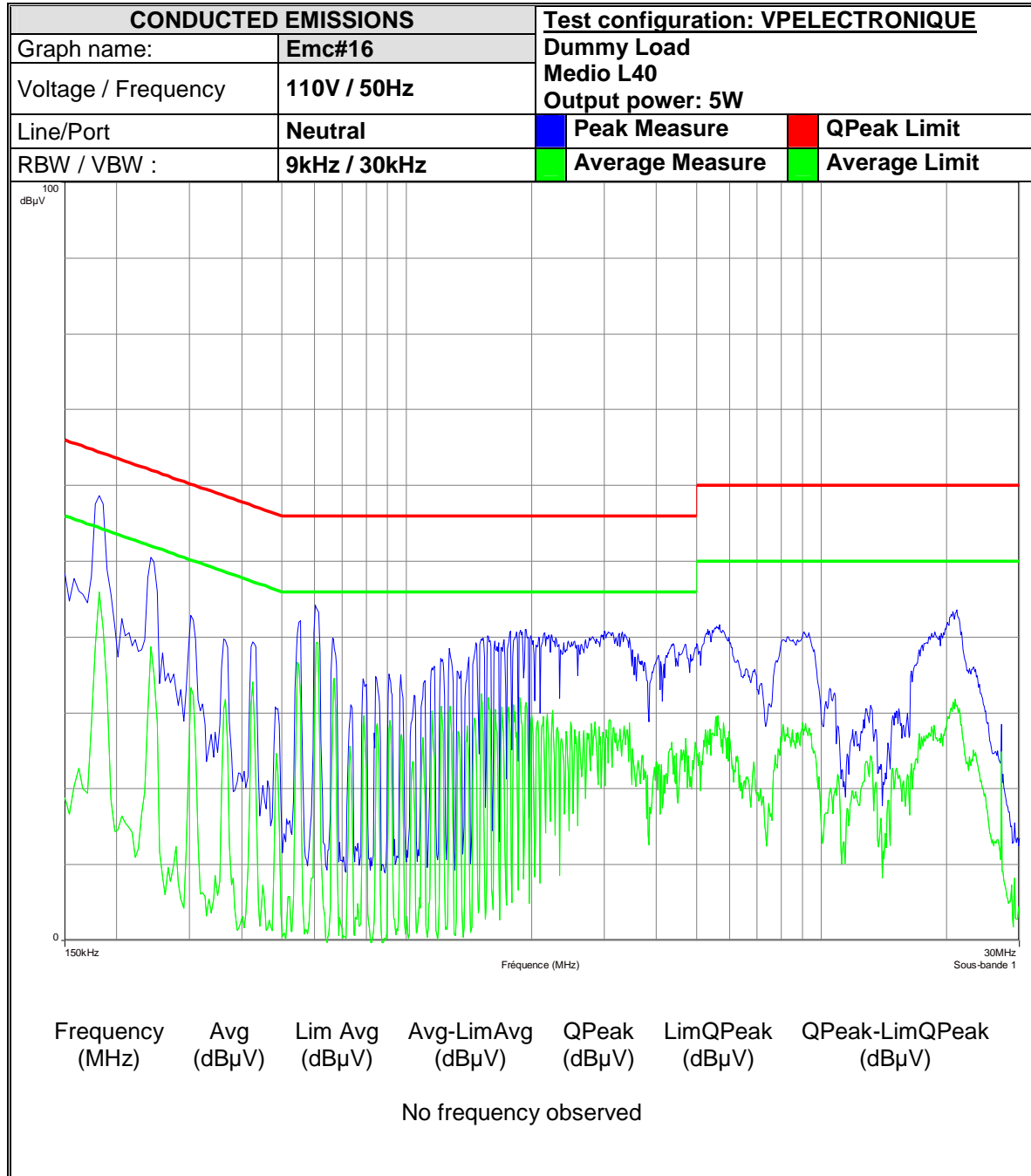


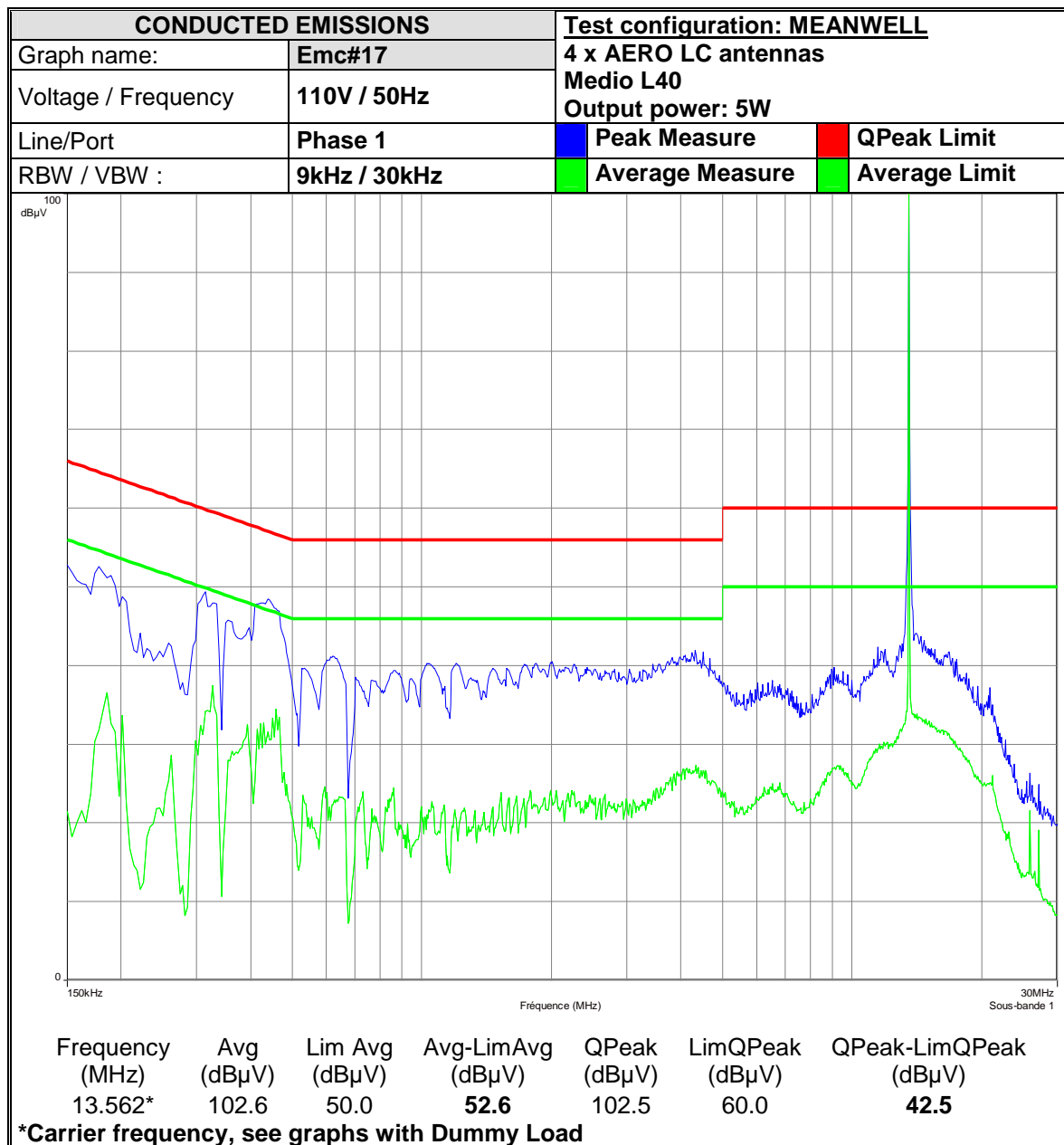


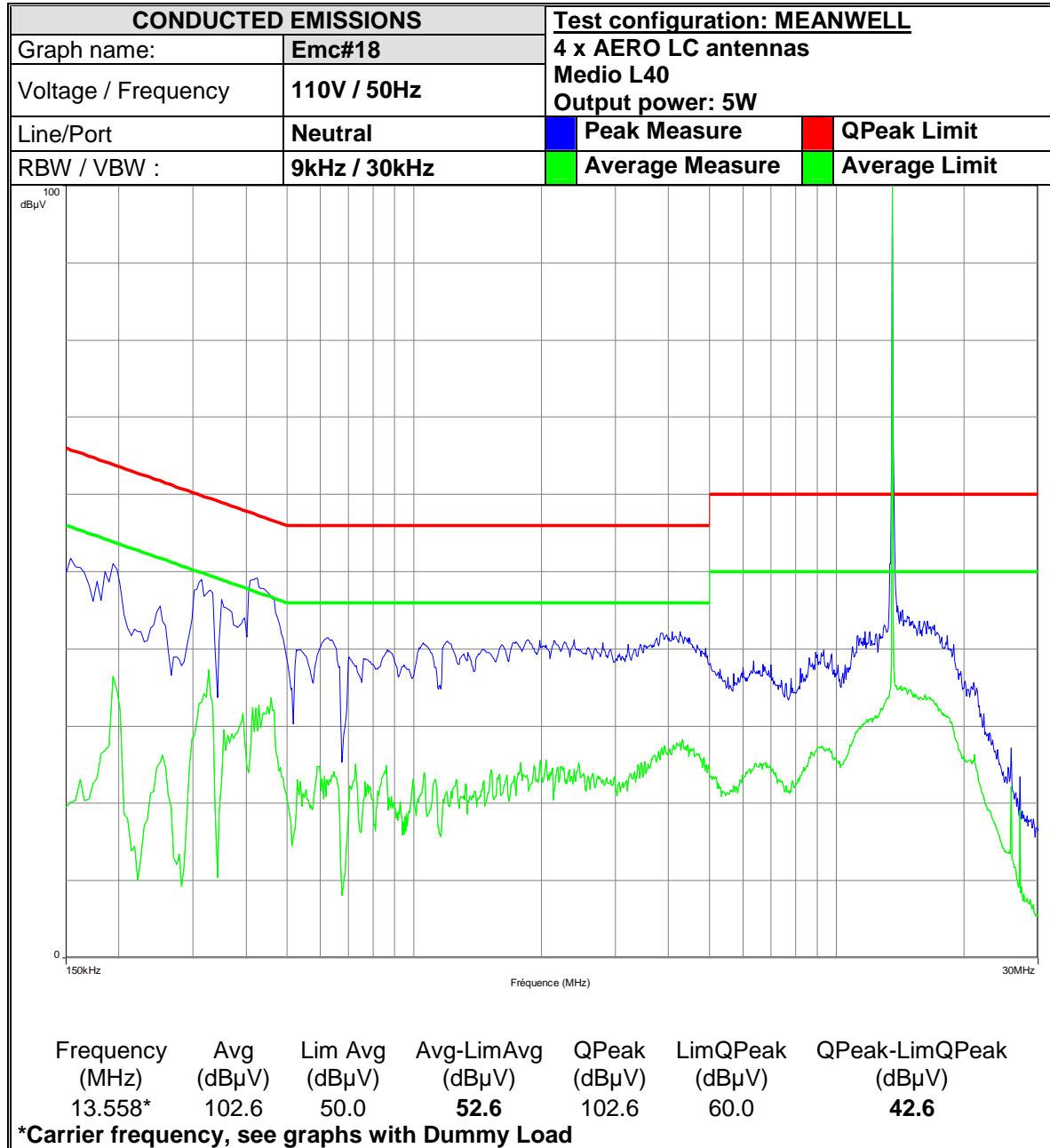


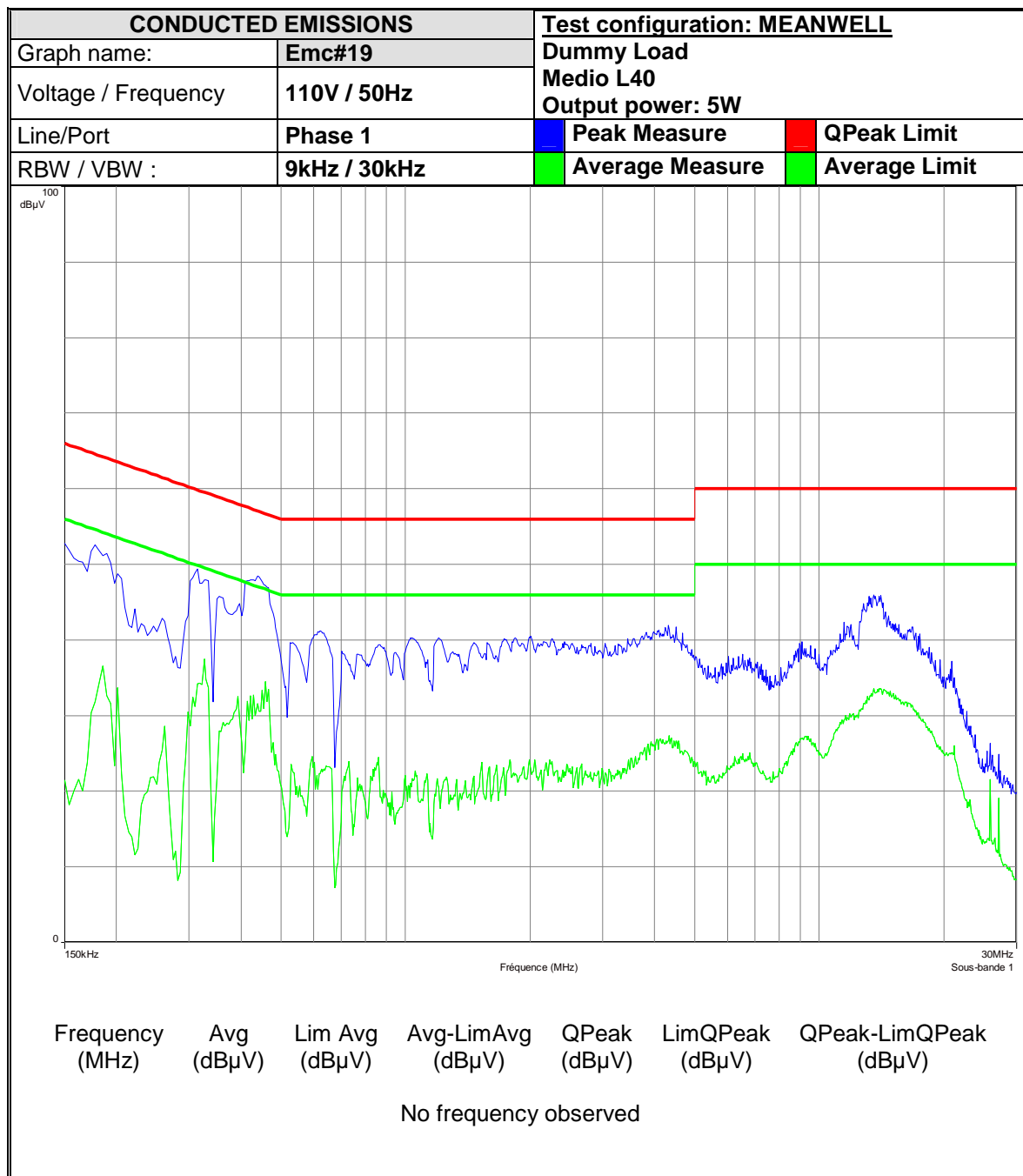


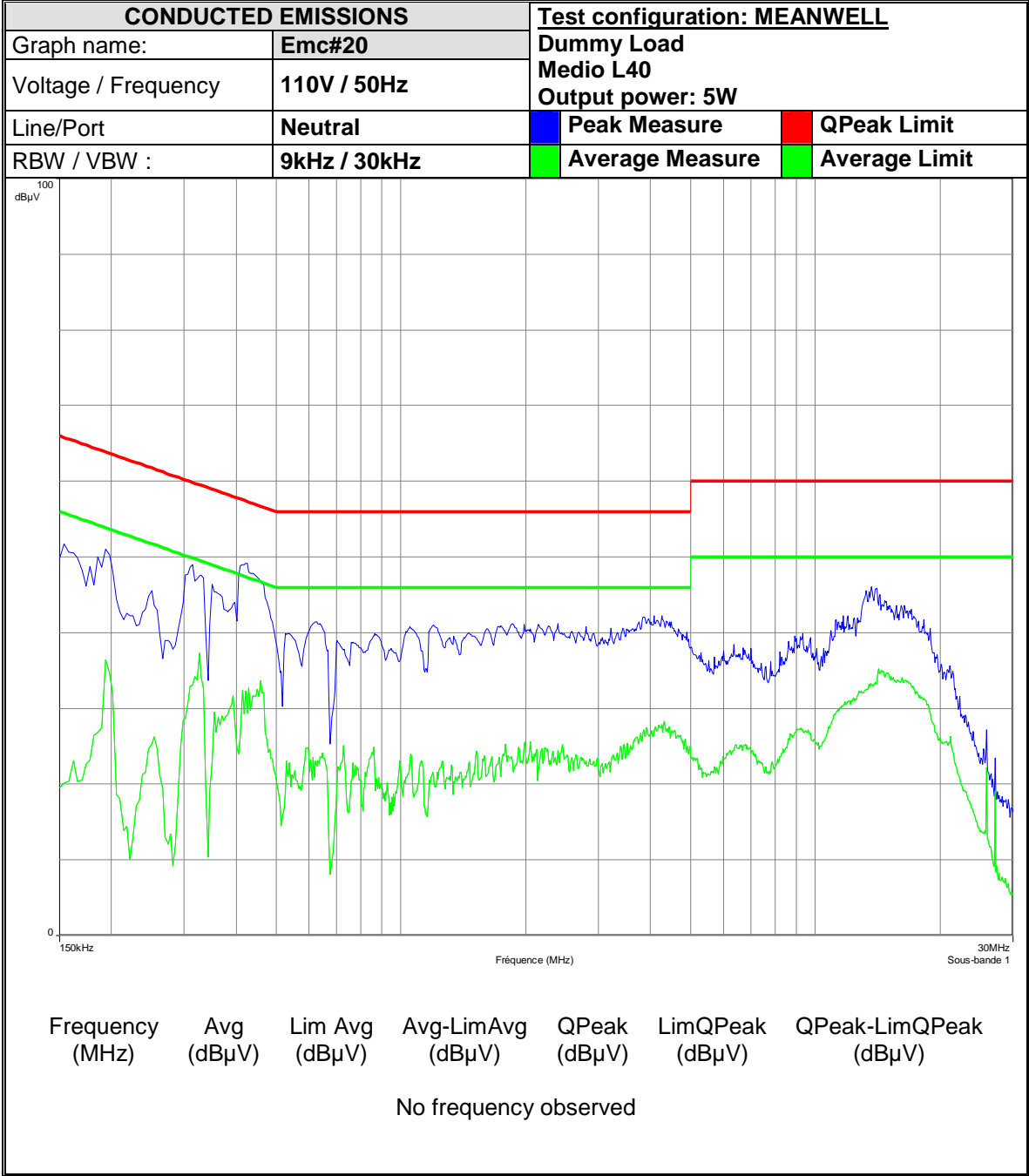














8. TEST EQUIPMENT LIST

USED	N° LCIE	TYPE	COMPANY	REF	CAL DATE	CAL DUE
RADIATED EMISSION DATA						
X	C2040051	Antenna Bi-log	CHASE	CBL6111A	08/10	08/12
X	C2040052	Antenna Loop	ELECTRO-METRICS	EM-6879	12/09	12/10
X	C2040075	Antenna Dipole precision	SCHWARZBECK	UHAP	10/10	10/11
X	C2040146	Antenna Bi-Log XWing	TESEQ	CBL6144	03/10	03/12
X	A7122167	Attenuator 10dB 18GHz 2W	JFW	-	02/10	02/11
X	A5329038	Cable N/N	-	-	02/10	02/11
X	A5329061	Cable	SUCOFLEX	106G	01/11	01/12
X	A5329187	Cable OATS (Turntable)	UTIFLEX	-	05/10	05/11
X	A5329188	Cable OATS (Mast at 10m)	UTIFLEX	-	05/10	05/11
X	A5329196	Cable OATS (Turntable)	UTIFLEX	-	05/10	05/11
X	A5329199	Cable OATS (Mast at 10m)	UTIFLEX	-	05/10	05/11
X	D3044015	Semi-Anechoic chamber #2	SIEPEL	-	01/11	01/12
X	A3169050	Radiated emission comb generator	BARDET	-	-	-
X	A5442025	Frequency generator 0.1-2060MHz	HEWLETT PACKARD	8657B	08/10	08/11
X	F2000409	OATS	-	-	08/10	08/11
X	A1500019	Power meter	RHODE & SCHWARZ	NRVD	04/10	04/11
X	A1509048	Power meter sensor	RHODE & SCHWARZ	NRV-Z4	04/10	04/11
X	A2642019	Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	10/10	10/11
X	B4204052	Thermo-hygrometer	HUGER	-	04/10	04/12
X	F2000372	Turntable / Mast controller (OATS)	ETS Lindgren	Model 2066	-	-
X	F2000392	Antenna mast (OATS)	ETS Lindgren	2071-2	-	-
X	F2000403	Turntable (OATS)	ETS Lindgren	Model 2187	-	-
FUNDAMENTAL FREQUENCY TOLERANCE						
X	C2040052	Antenna Loop	ELECTRO-METRICS	EM-6879	12/09	12/10
X	A5329061	Cable	SUCOFLEX	106G	01/11	01/12
X	A2642019	Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	10/10	10/11
X	A7043026	CALIFORNIA System: 5kVA PSU	SCHAFFNER	NSG 1007	11/09	11/11
X	D1022117	Climatic chamber	BIA CLIMATIC	CL 6-25	02/09	02/11
X	B4204052	Thermo-hygrometer	HUGER	-	04/10	04/12
BANDEDGE COMPLIANCE						
X	C2040052	Antenna Loop	ELECTRO-METRICS	EM-6879	12/09	12/10
X	A5329061	Cable	SUCOFLEX	106G	01/11	01/12
X	A2642019	Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	10/10	10/11
CONDUCTED EMISSION DATA						
x	A5329415	Cable	-	-	03/10	03/11
x	D3044010	Faraday Cage	RAY PROOF	-	01/11	01/12
x	A3169049	Conducted emission comb generator	BARDET	-	-	-
x	C2320123	LISN	RHODE & SCHWARZ	ENV216	05/10	05/11
x	A2642019	Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	10/10	10/11
x	A4049061	Transient limiter	HEWLETT PACKARD	11947A	01/11	01/12

**9. UNCERTAINTIES CHART**

Type de mesure / Kind of measurement	Incertitude élargie laboratoire / Wide uncertainty laboratory (k=2) $\pm x$	Incertitude limite du CISPR / CISPR uncertainty limit $\pm y$
Mesure des perturbations conduites en tension sur le réseau d'énergie <i>Measurement of conducted disturbances in voltage on the power port</i>	3.57 dB	3.6 dB
Mesure des perturbations conduites en tension sur le réseau de télécommunication <i>Measurement of conducted disturbances in voltage on the telecommunication port.</i>	3.28 dB	A l'étude / Under consid.
Mesure des perturbations discontinues conduites en tension <i>Measurement of discontinuous conducted disturbances in voltage</i>	3.47 dB	3.6 dB
Mesure des perturbations conduites en courant <i>Measurement of conducted disturbances in current</i>	2.90 dB	A l'étude / Under consid.
Mesure du champ électrique rayonné sur le site en espace libre de Moirans <i>Measurement of radiated electric field on the Moirans open area test site</i>	5.07 dB	5.2 dB