



L C I E

Rapport d'essai / Test report

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: GEMALTO
Avenue du Pic de Bertagne
13881 GEMENOS - 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 USB de carte contact & sans contact
Dual Interface Contact & Contactless USB Smart Card Reader
- Marque / Trade mark : GEMALTO
- Constructeur / Manufacturer : GEMALTO
- Type / Model : PROX DU & PROX SU
- Type Sous Test / Model Under Test : PROX-DU
- N° de série / serial number : PROTO
- FCC ID : MESPROXDUB

Date des essais / Test date

: Du 7 au 9 Décembre 2010 / From December 7th to 9th, 2010

Lieu d'essai / Test location

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

Test réalisé par / Test performed by

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Ce document comporte / Composition of document : 29 pages.

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MOIRANS, LE 17 JANVIER 2011 / JANUARY 17th, 2011

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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-12.5GHz	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-12.5GHz*	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).

Justification of choice tested model:

- PROX DU:
 - o Contact less reader
 - o Contact reader
- PROX SU:
 - o Contact less reader

It's the same electronic, for the PROX SU, opening for contact card is closed. Worst configuration is PROX DU.

2.2. HARDWARE IDENTIFICATION

- **Equipment under test (EUT):**

PROX-DU

Serial number: PROTO
FCC ID: **MESPROXDUB**

- Internal max frequencies: 27.12MHz

- **Input/output:**

- 1 x USB port

- **Auxiliaries used for testing:**

- 1 x Laptop DELL n°51495 Model: PP11L
- 1 x Power supply unit for laptop DELL PA-12 Model: AA22850-L
- 1 x Contact less card GEMPLUS (00501001)
- 1 x Contact card GEMPLUS (GemSAFE Logon)

Sn: 423- 546-849-19
Sn: CN-OU7088-16293-548-02BW

- **I/O cables used for testing:**

- 1 x USB cable of EUT, shielded, length: 1.8m (attached on equipment)



2.3. EUT CONFIGURATION

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 card and a contact card not together, it isn't possible in typical use.

PC Software used: CE&FCC EMC Tester for Prox-DU V1.0.0

Running mode:

- Contact less card: RF field is ON / Contact less card is place above the reader in the landing zone
- Contact card: RF field is OFF / Smartcard is inserted in the reader's slot

2.4. EQUIPMENT MODIFICATIONS

None

2.5. SPECIAL ACCESSORIES

None

3. RADIATED EMISSION DATA

3.1. CLIMATIC CONDITIONS

Date of test	: December 7 th , 2010	and	December 9 th , 2010
Test performed by	: A.MERLIN		A.MERLIN
Atmospheric pressure	: 979mb		981mb
Relative humidity	: 33%		35%
Ambient temperature	: 21°C		20°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.



Radiated emission test setup



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.

3.3.2. Pre-characterization [30MHz-1GHz]

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.

See graphs for 30MHz-1GHz:

Polarisation H:	graph Emr#1	<i>Contactless Mode – Axis XY</i>	(see annex 1)
Polarisation V:	graph Emr#2	<i>Contactless Mode – Axis XY</i>	(see annex 1)
Polarisation H:	graph Emr#3	<i>Contactless Mode – Axis Z</i>	(see annex 1)
Polarisation V:	graph Emr#4	<i>Contactless Mode – Axis Z</i>	(see annex 1)
Polarisation H:	graph Emr#5	<i>Contact Mode – Axis XY</i>	(see annex 1)
Polarisation V:	graph Emr#6	<i>Contact Mode – Axis XY</i>	(see annex 1)
Polarisation H:	graph Emr#7	<i>Contact Mode – Axis Z</i>	(see annex 1)
Polarisation V:	graph Emr#8	<i>Contact Mode – Axis Z</i>	(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.

Frequency (MHz)	QPeak Limit (dBμV/m) @ 30m	Qpeak (dBμV/m)	Qpeak-Limit (Margin dB)	Turntable Angle (deg)	Ant. Pol./ Angle (deg)	Tot Corr (dB)
13.56 ^{*1}	84.0	40.9	-43.1	90	0	35.3
27.12 ^{*1}	29.5	No Frequency Observed				39.3

^{*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 1GHz

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.

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:

Contactless Mode

No	Frequency (MHz)	QPeak Limit (dBµV/m)	Qpeak * (dBµV/m)	Qpeak-Limit (Margin, dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)	Comments
1	38.416	40.0	32.60	-7.4	165	V	150	12.3	AXIS XY
2	40.679	40.0	34.70	-5.3	125	V	100	12.1	AXIS XY
3	43.999	40.0	39.70	-0.3	185	V	100	11.7	AXIS XY
4	47.983	40.0	37.70	-2.3	90	V	100	11.5	AXIS XY
5	52.019	40.0	36.30	-3.7	80	V	100	11.5	AXIS XY
6	54.239	40.0	36.80	-3.2	190	V	100	11.6	AXIS XY
7	59.945	40.0	28.60	-11.4	170	V	150	11.7	AXIS XY
8	67.797	40.0	35.00	-5.0	210	V	150	10.6	AXIS XY
9	81.278	40.0	31.60	-8.4	155	H	300	7.9	AXIS Z
10	110.035	43.5	37.70	-5.8	50	V	150	15.4	AXIS XY
11	120.092	43.5	30.90	-12.6	45	H	250	17.5	AXIS Z
12	143.827	43.5	32.60	-10.9	170	V	150	14.9	AXIS XY
13	154.231	43.5	31.70	-11.8	0	H	200	16.5	AXIS XY
14	199.995	43.5	33.70	-9.8	105	H	200	19.7	AXIS XY
15	366.129	46.0	35.10	-10.9	65	V	300	19.2	AXIS XY
16	516.042	46.0	37.20	-8.8	50	H	300	22.4	AXIS XY
17	599.957	46.0	36.80	-9.2	50	V	250	23.4	AXIS XY
18	823.317	46.0	38.80	-7.2	170	H	250	27.2	AXIS XY

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

(M@3m = M@10m+10.5dB)

Contact Mode

No	Frequency (MHz)	QPeak Limit (dBµV/m)	Qpeak * (dBµV/m)	Qpeak-Limit (Margin, dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)	Comments
1	43.971	40.0	37.1	-2.9	190	V	100	11.7	AXIS XY
2	48.051	40.0	32.4	-7.6	180	V	100	11.5	AXIS XY
3	51.966	40.0	39.6	-0.4	140	V	150	11.5	AXIS XY
4	56.052	40.0	37.3	-2.7	260	V	200	11.6	AXIS XY
5	59.949	40.0	33.8	-6.2	235	V	200	11.7	AXIS XY
6	114.204	43.5	37.7	-5.8	130	V	200	16.2	AXIS XY
7	141.496	43.5	33.9	-9.6	90	V	150	14.8	AXIS XY
8	159.118	43.5	33.4	-10.1	110	H	350	15.6	AXIS XY
9	215.436	43.5	28.1	-15.4	200	V	200	15.7	AXIS XY
10	399.991	46.0	32.7	-13.3	45	H	350	19.6	AXIS Z
11	499.923	46.0	33.6	-12.4	90	V	300	22.2	AXIS XY

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

(M@3m = M@10m+10.5dB)

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 52.5dB μ V 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 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.

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

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

Date of test : December 9th, 2010
Test performed by : A.MERLIN
Atmospheric pressure : 981mb
Relative humidity : 35%
Ambient temperature : 20°C

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°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°C, -20°C and +50°C.
Voltage is varied from 93.5V/60Hz to 126V/60Hz (Power supply of PC)
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.

Temperature	-20°C	20°C	+50°C
Voltage			
Mains voltage: 110V/60Hz			
Frequency Drift (MHz)	+ 0.000006	REF	+ 0.000051
Carrier level (dBc)	- 0.20	REF	- 1.10
Mains voltage: 93,5V/60Hz			
Frequency Drift (MHz)	+ 0.000005	+ 0.000001	+ 0.000051
Carrier level (dBc)	- 0.10	+ 0.00	- 1.00
Mains voltage: 126V/60Hz			
Frequency Drift (MHz)	+ 0.000005	+ 0.000001	+ 0.000050
Carrier level (dBc)	- 0.20	+ 0.00	- 1.00

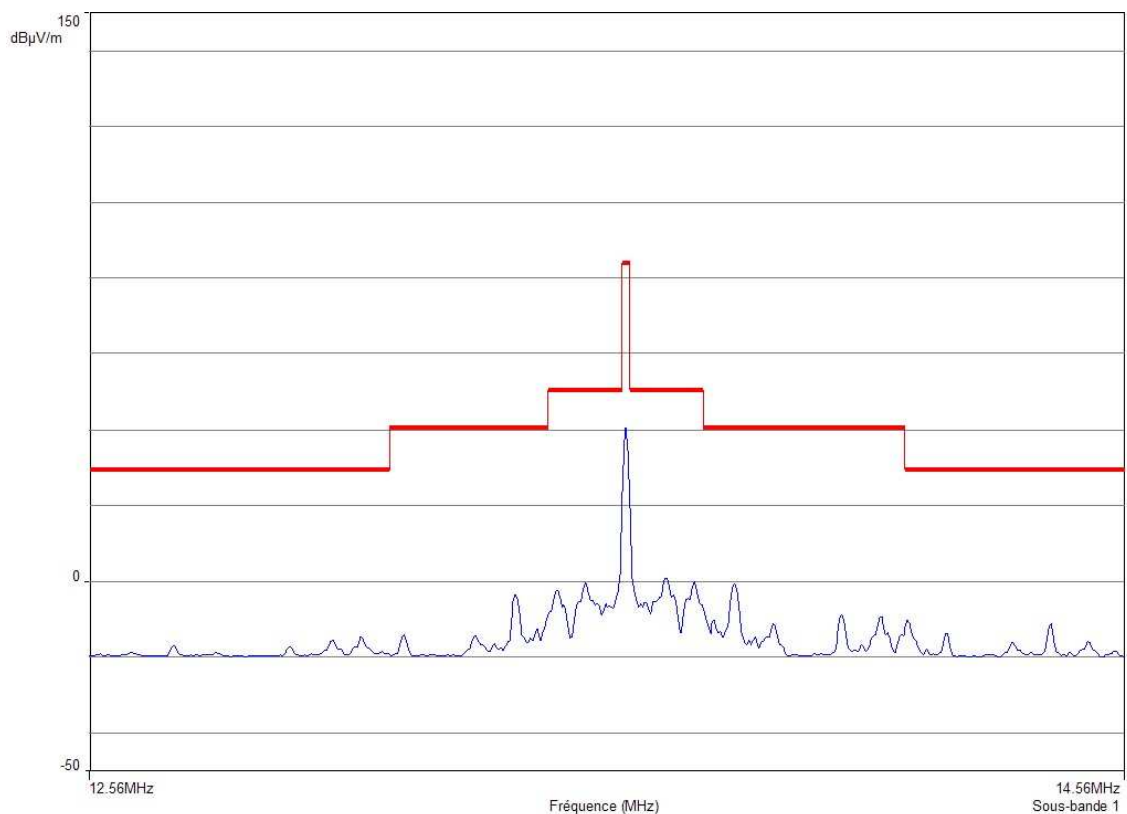
Frequency drift measured is **51 Hz** when the temperature is varied from -20°C to +50°C and voltage is varied from 120V/60Hz $\pm 15\%$.

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

Date of test : December 7th, 2010
Test performed by : A.MERLIN
Atmospheric pressure : 979mb
Relative humidity : 33%
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.



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

Date of test : December 7th, 2010
Test performed by : A.MERLIN
Atmospheric pressure : 979mb
Relative humidity : 33%
Ambient temperature : 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 120V/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.

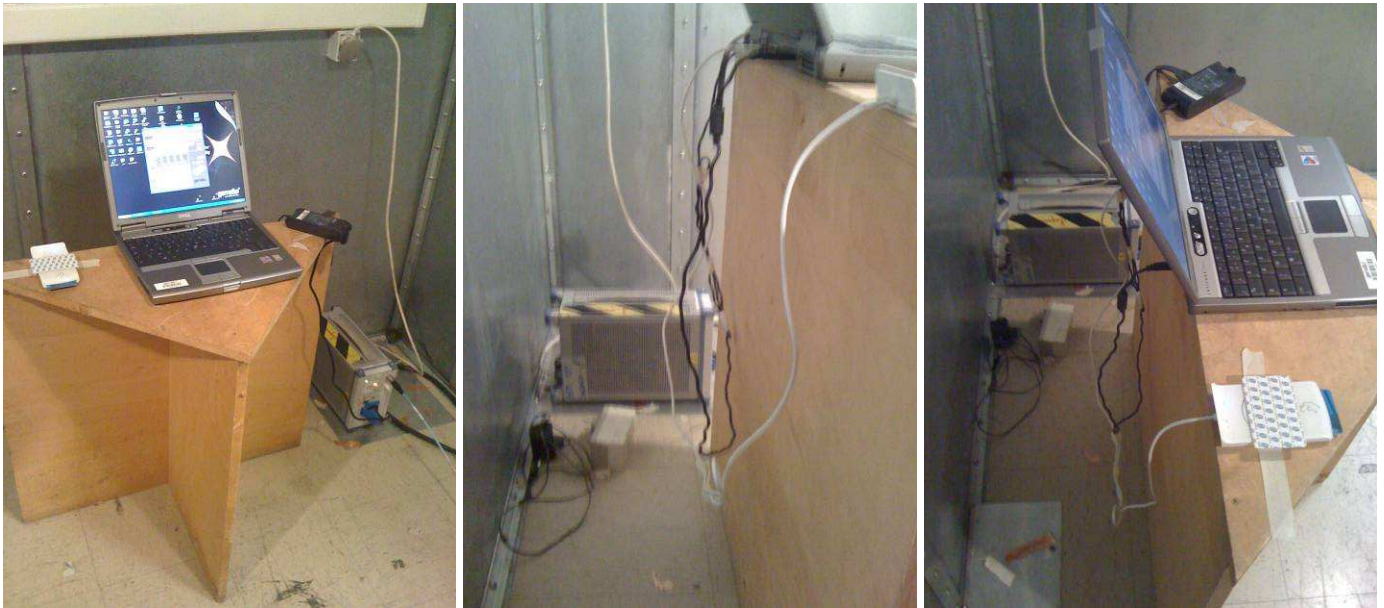
Interconnecting cables and equipment's were moved to position that maximized emission. A summary of the worst case emissions found in all test configurations and modes is shown on the following page.

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).



Conducted emission test setup

**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.

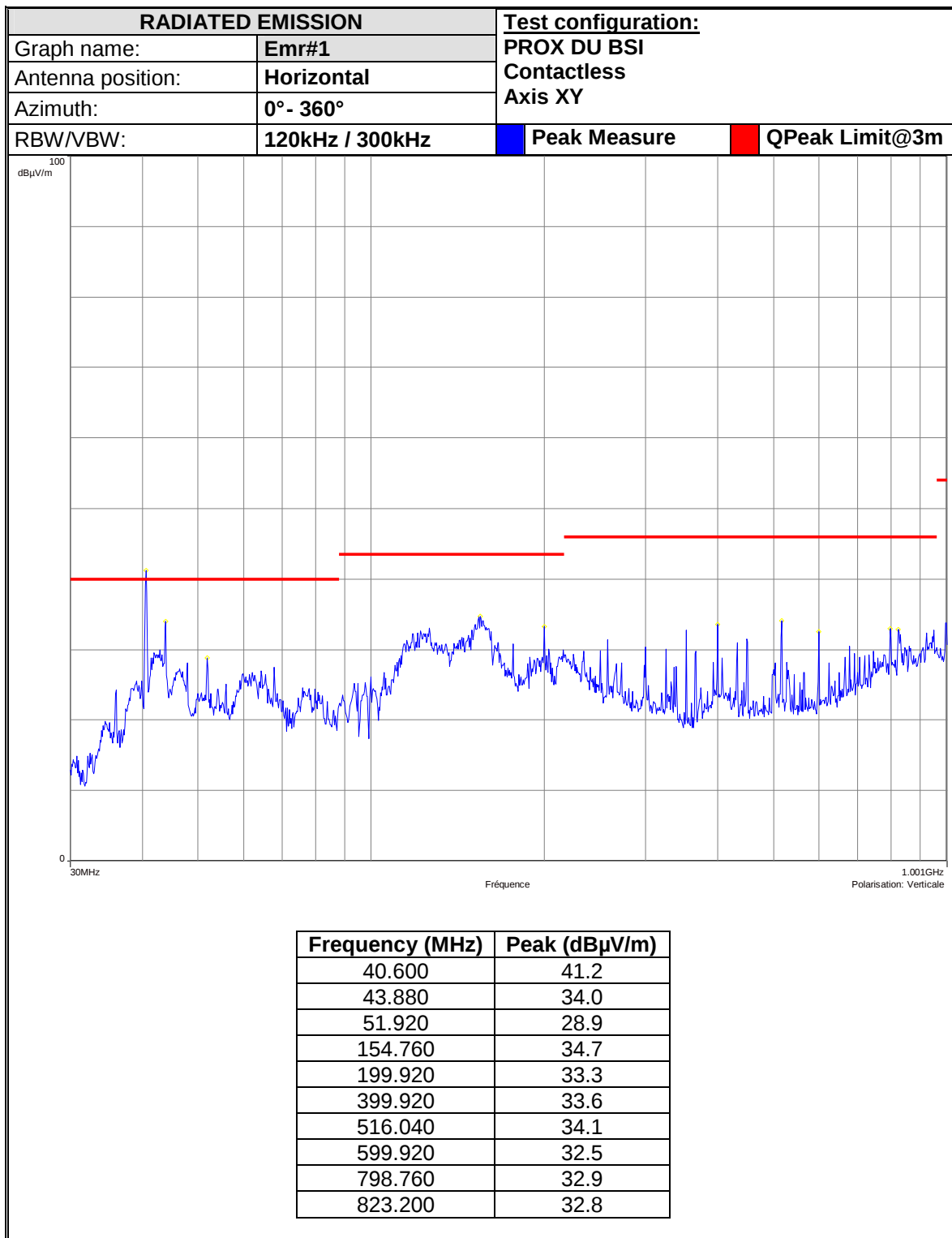
Graphs are obtained in PEAK detection.

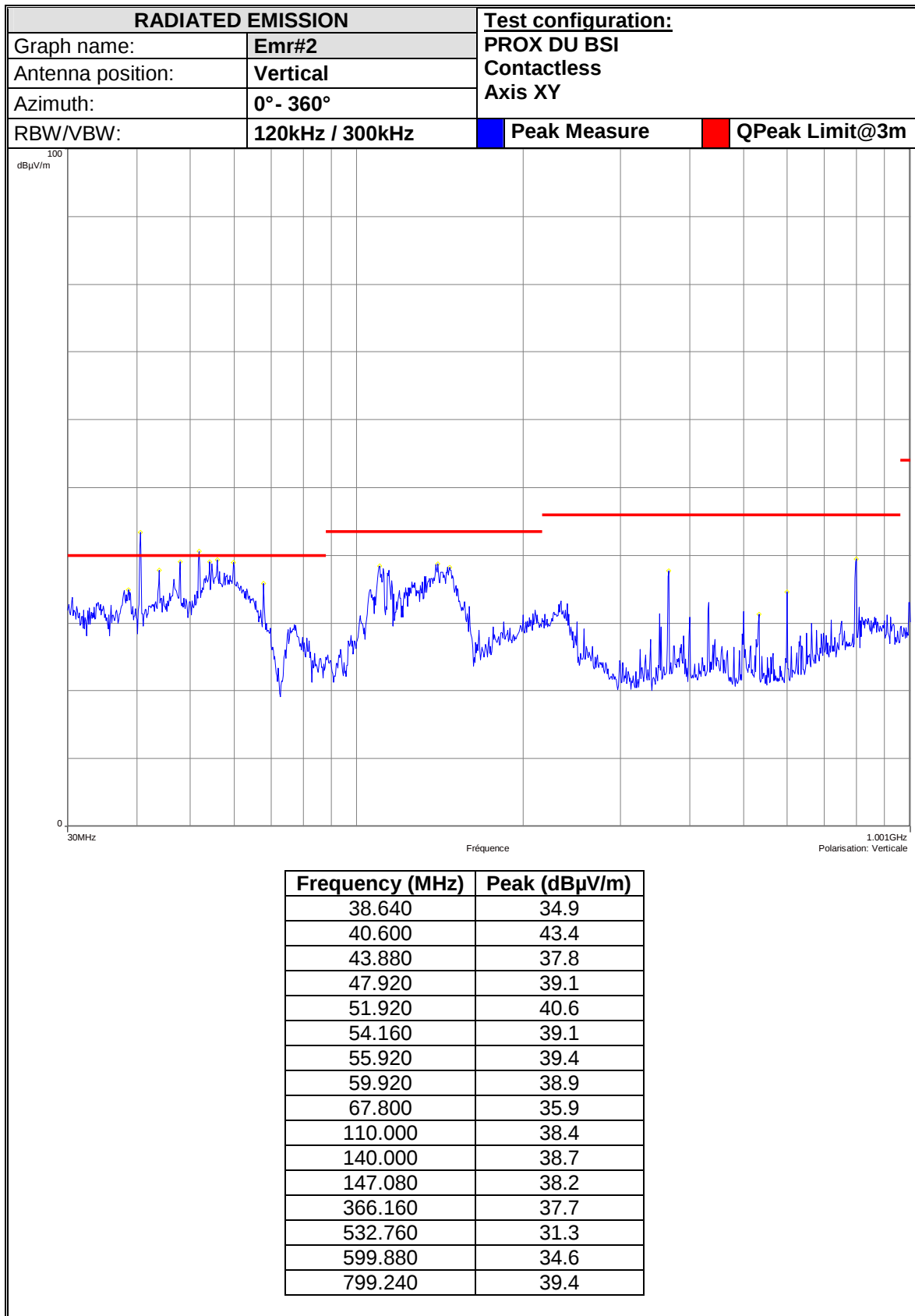
Measures are also performed in Quasi-Peak and Average for any strong signal.

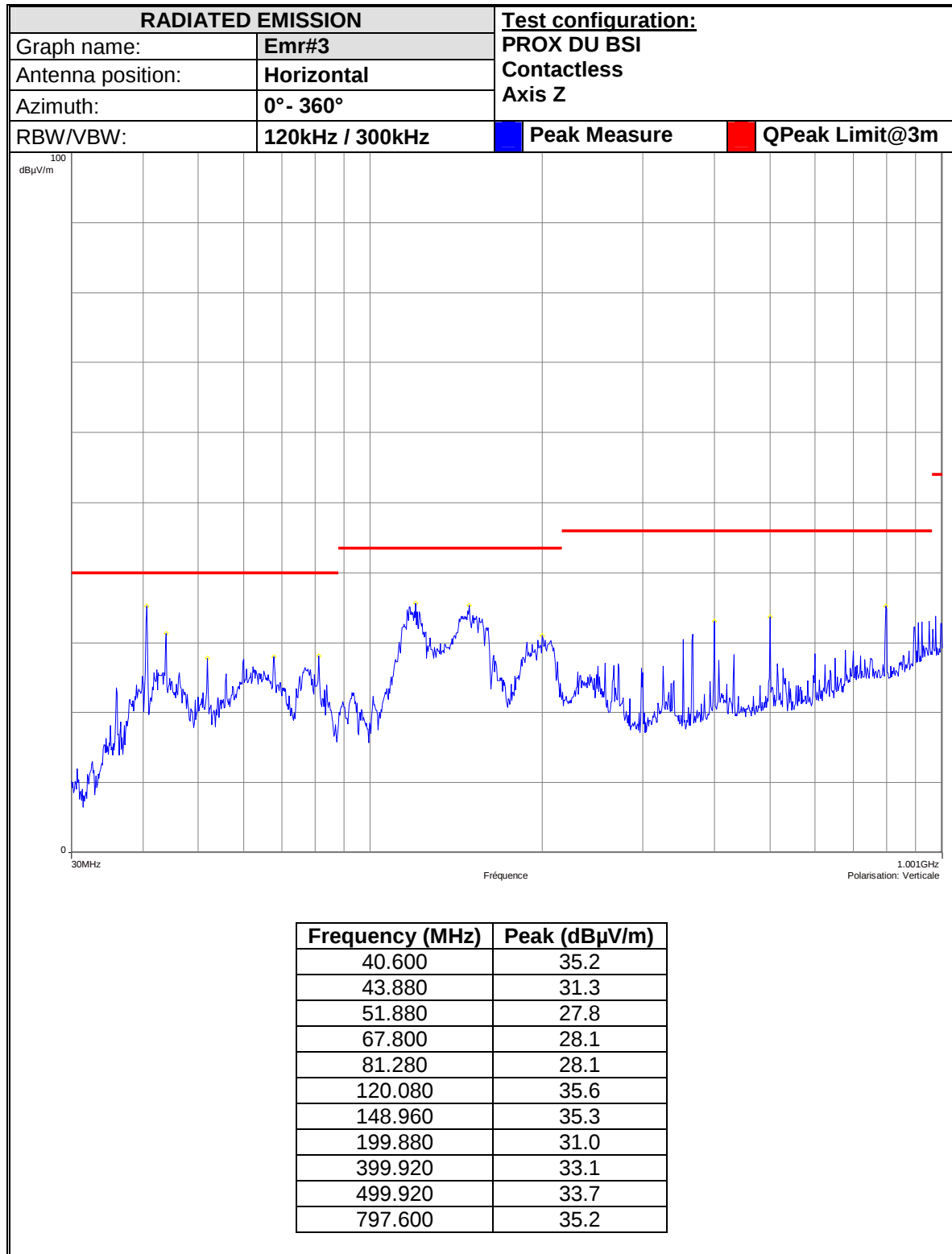
Measure on L1:	graph Emc#1	<i>Contact Mode and Contactless Mode</i>	(see annex 1)
Measure on N:	graph Emc#2	<i>Contact Mode and Contactless Mode</i>	(see annex 1)
Measure on L1:	graph Emc#3	<i>Dummy Load</i>	(see annex 1)
Measure on N:	graph Emc#4	<i>Dummy Load</i>	(see annex 1)

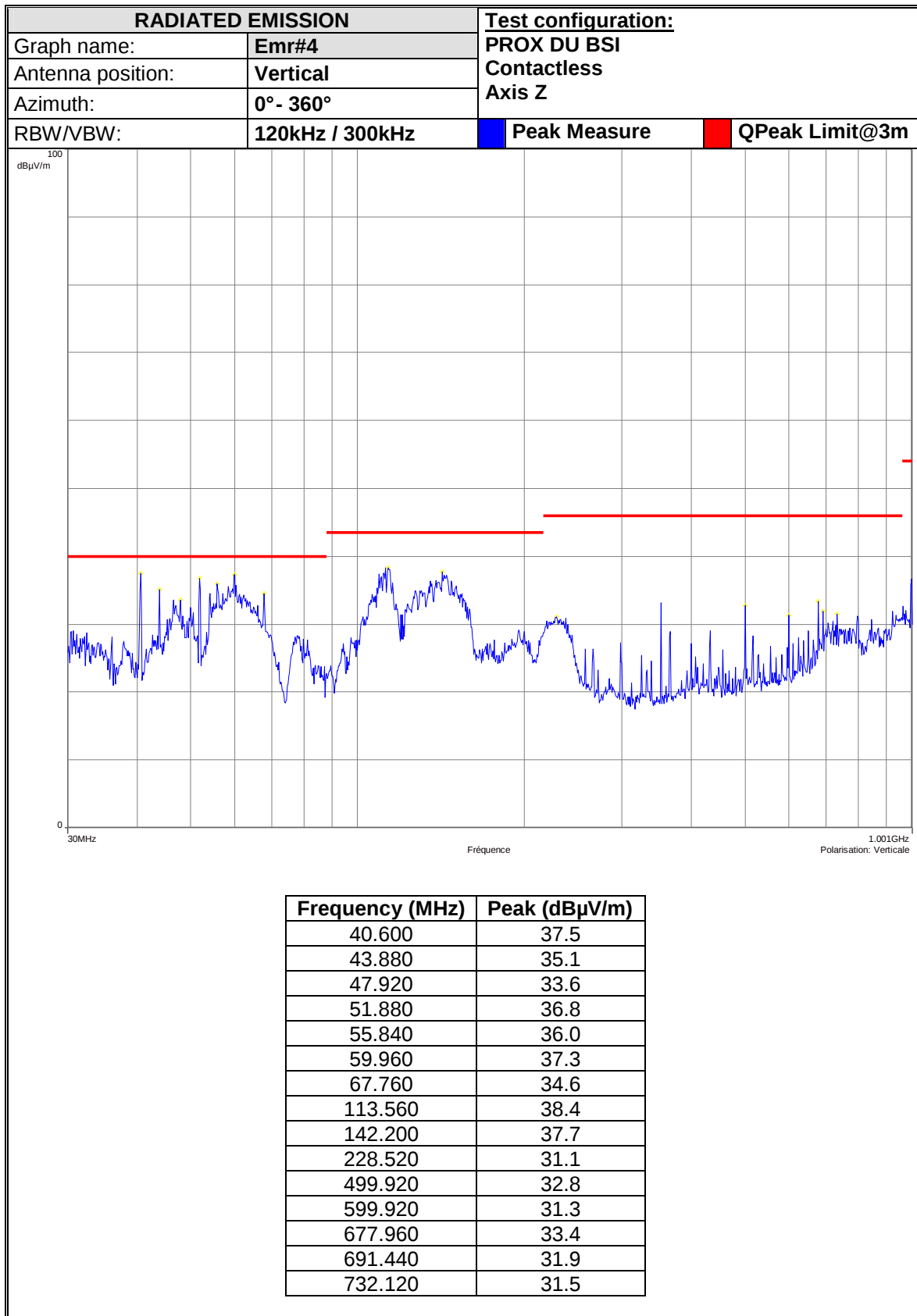
RESULT: PASS

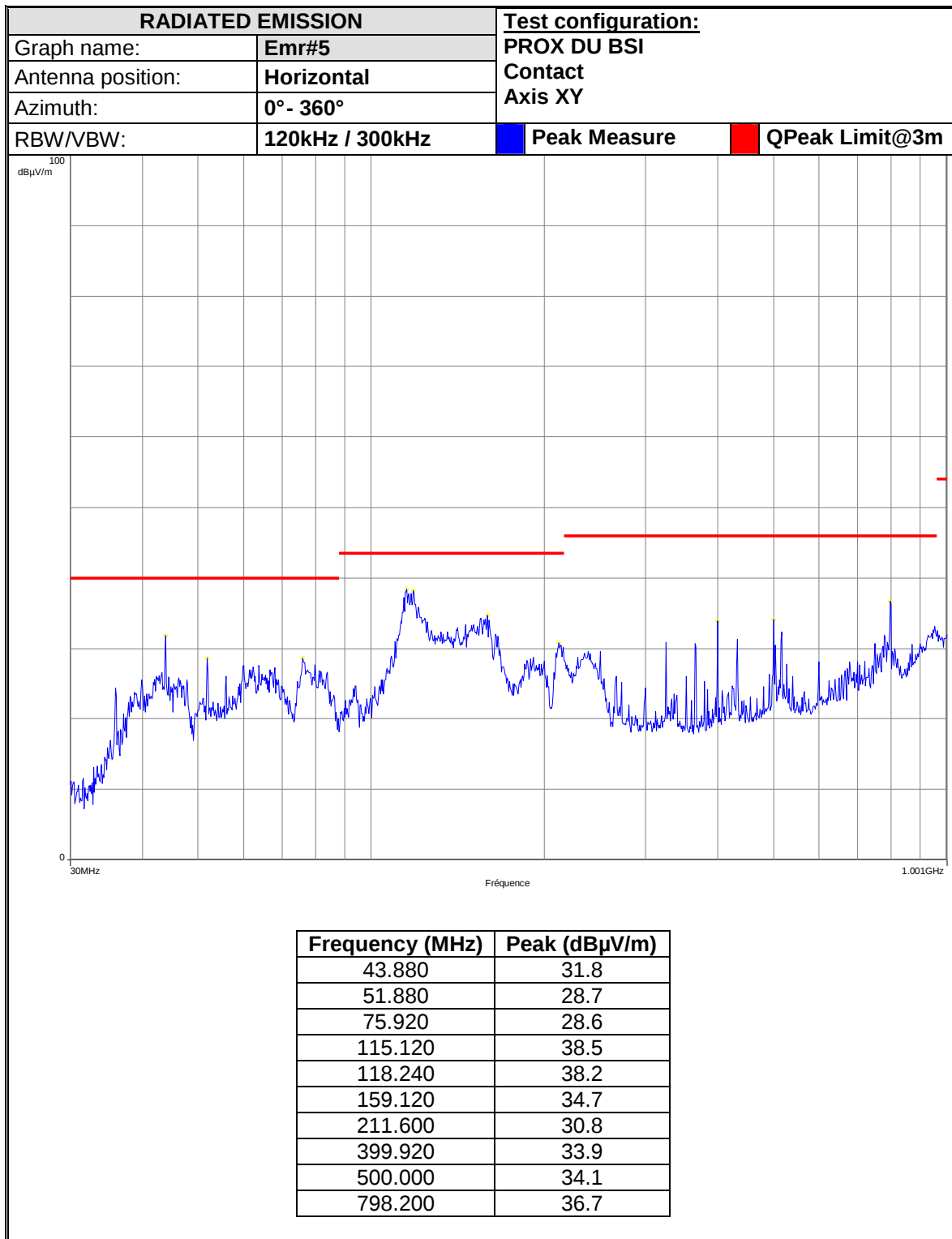
7. ANNEX 1 (GRAPHS)

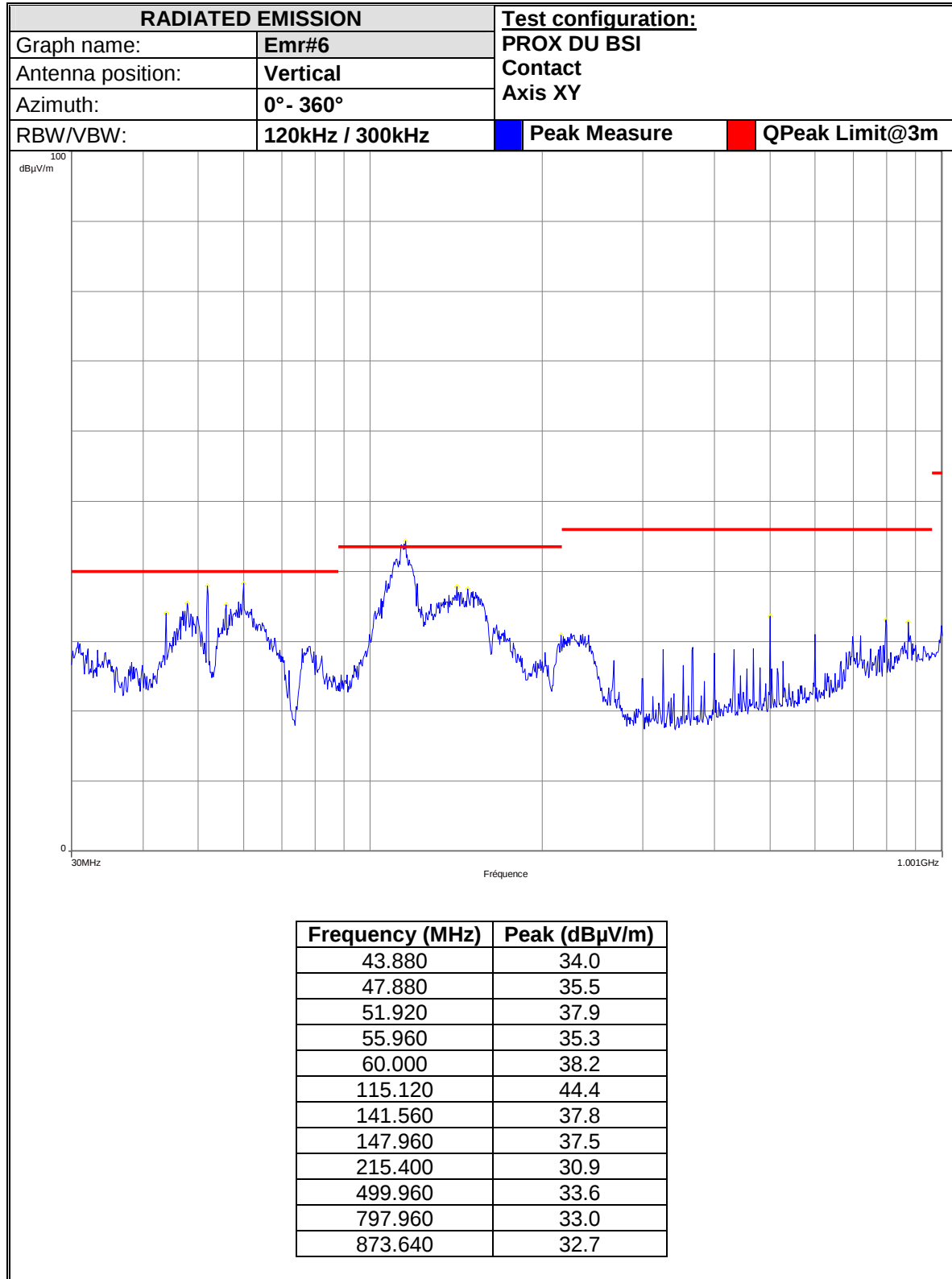


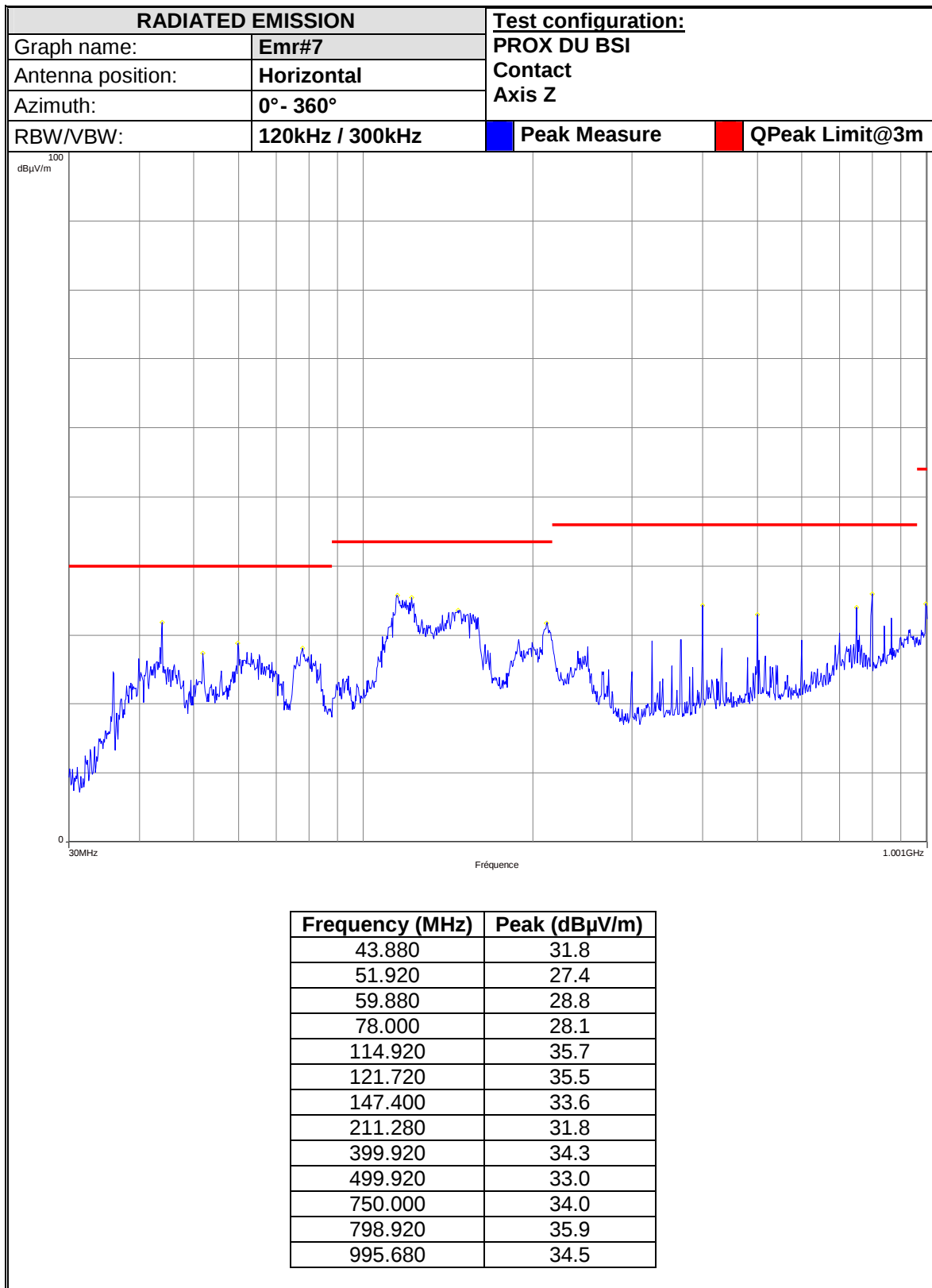


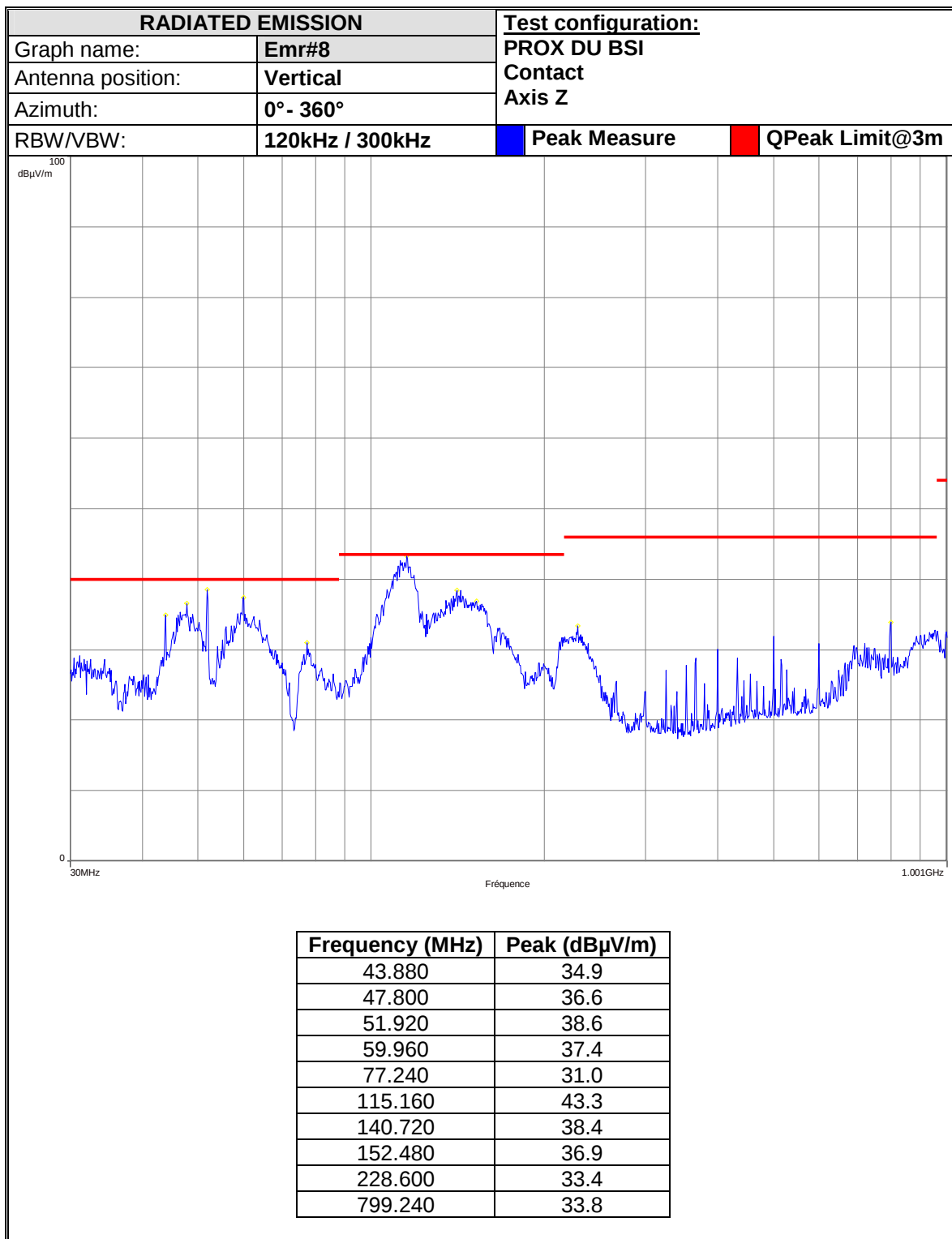


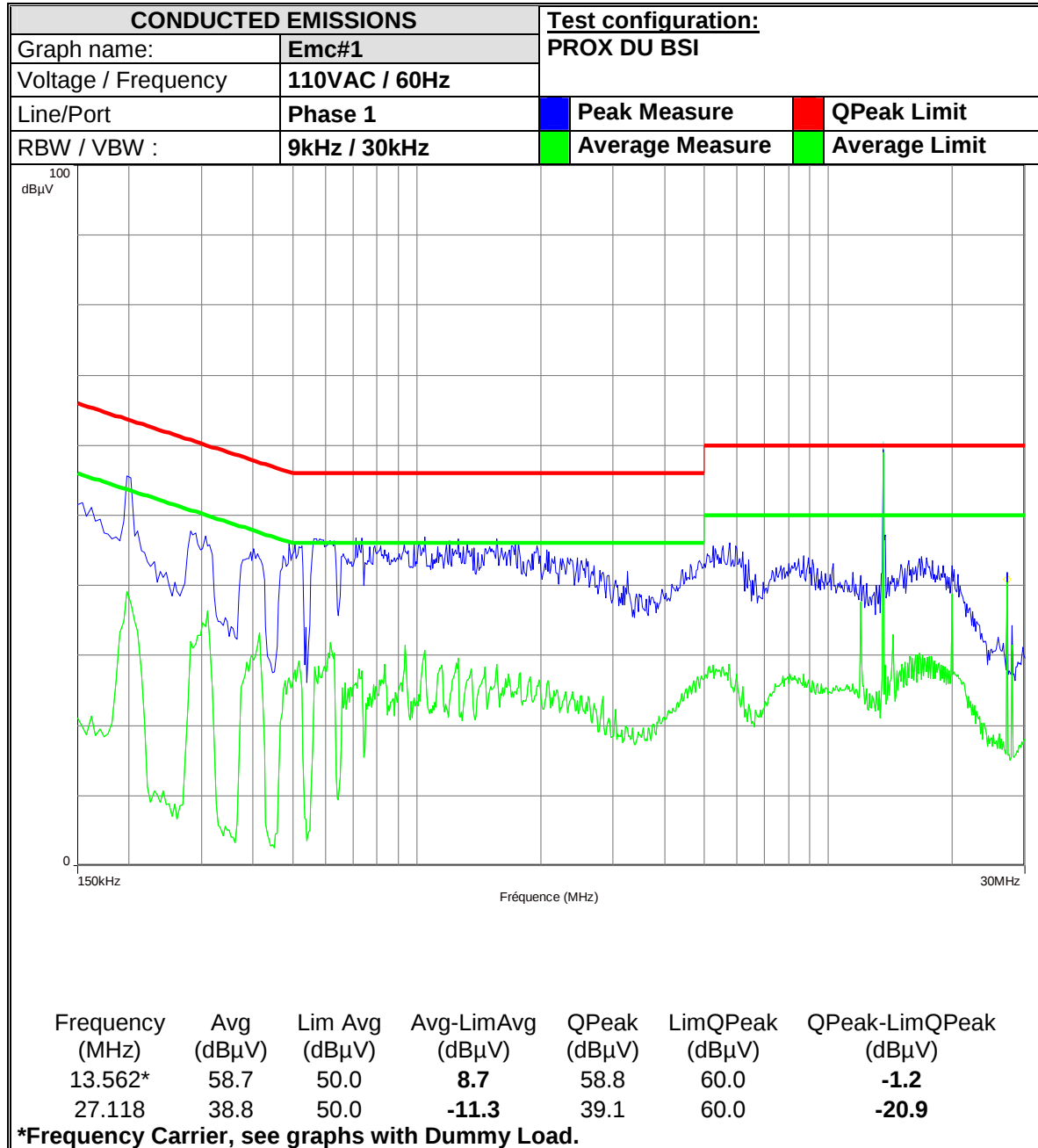


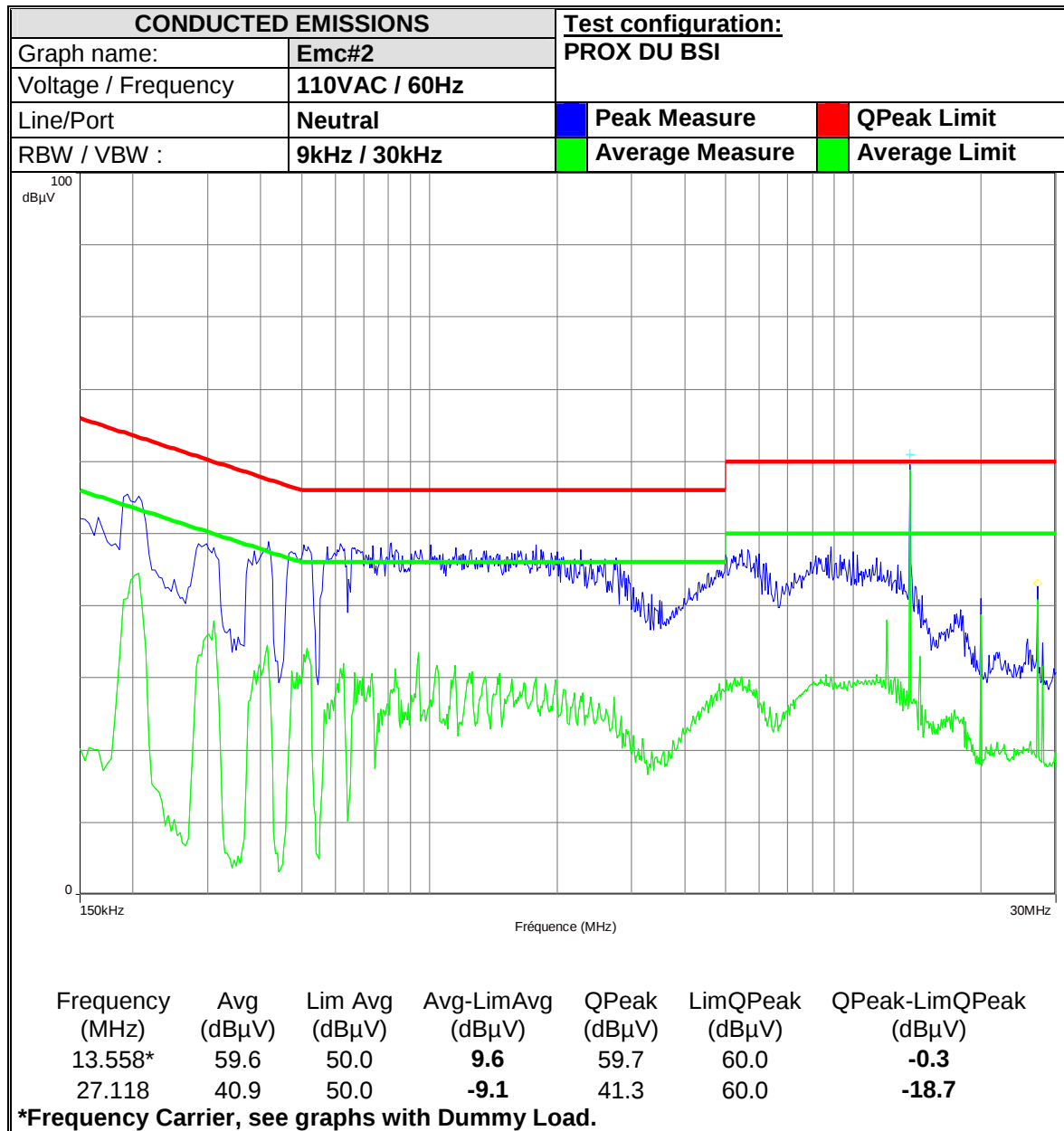


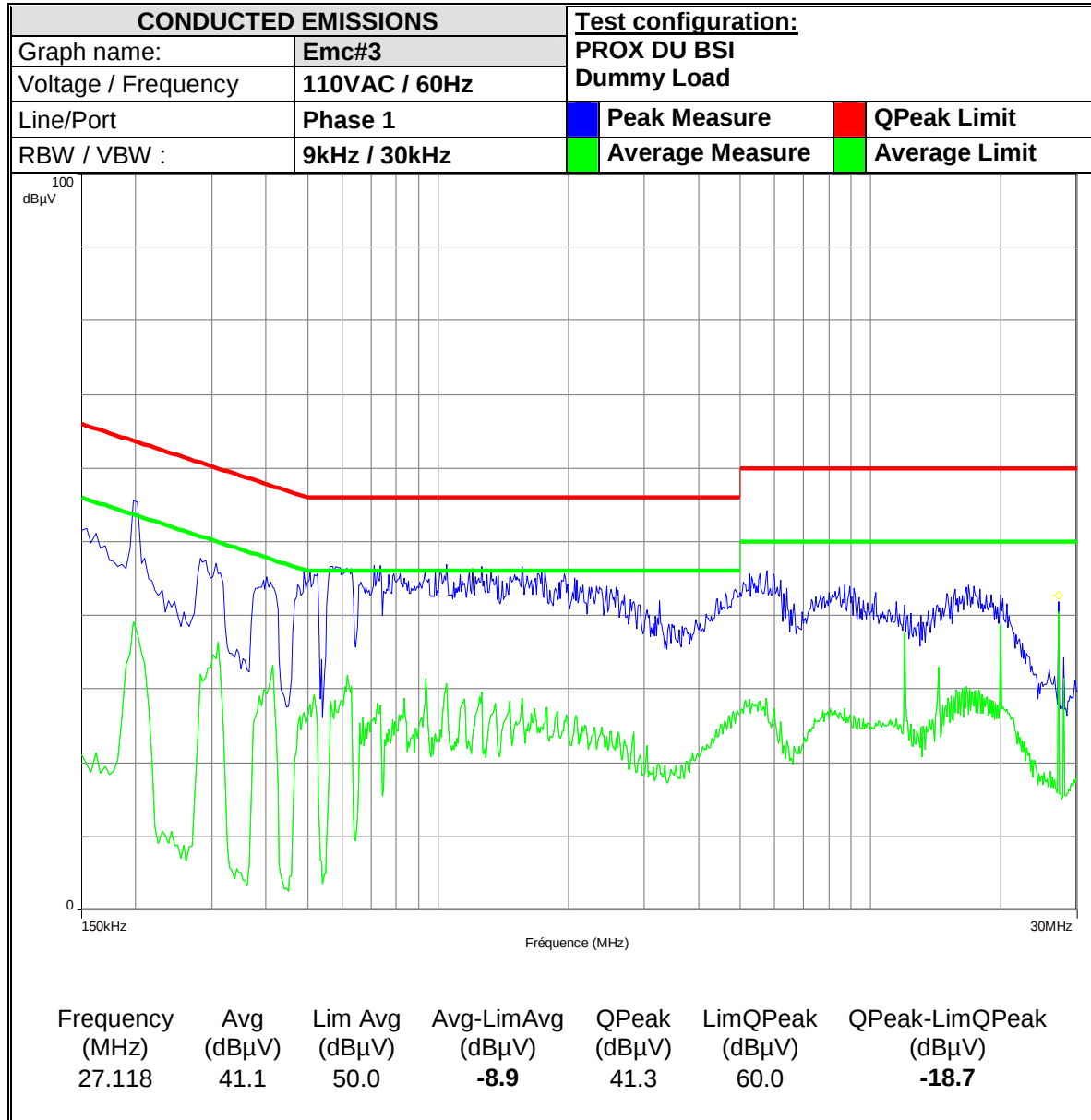


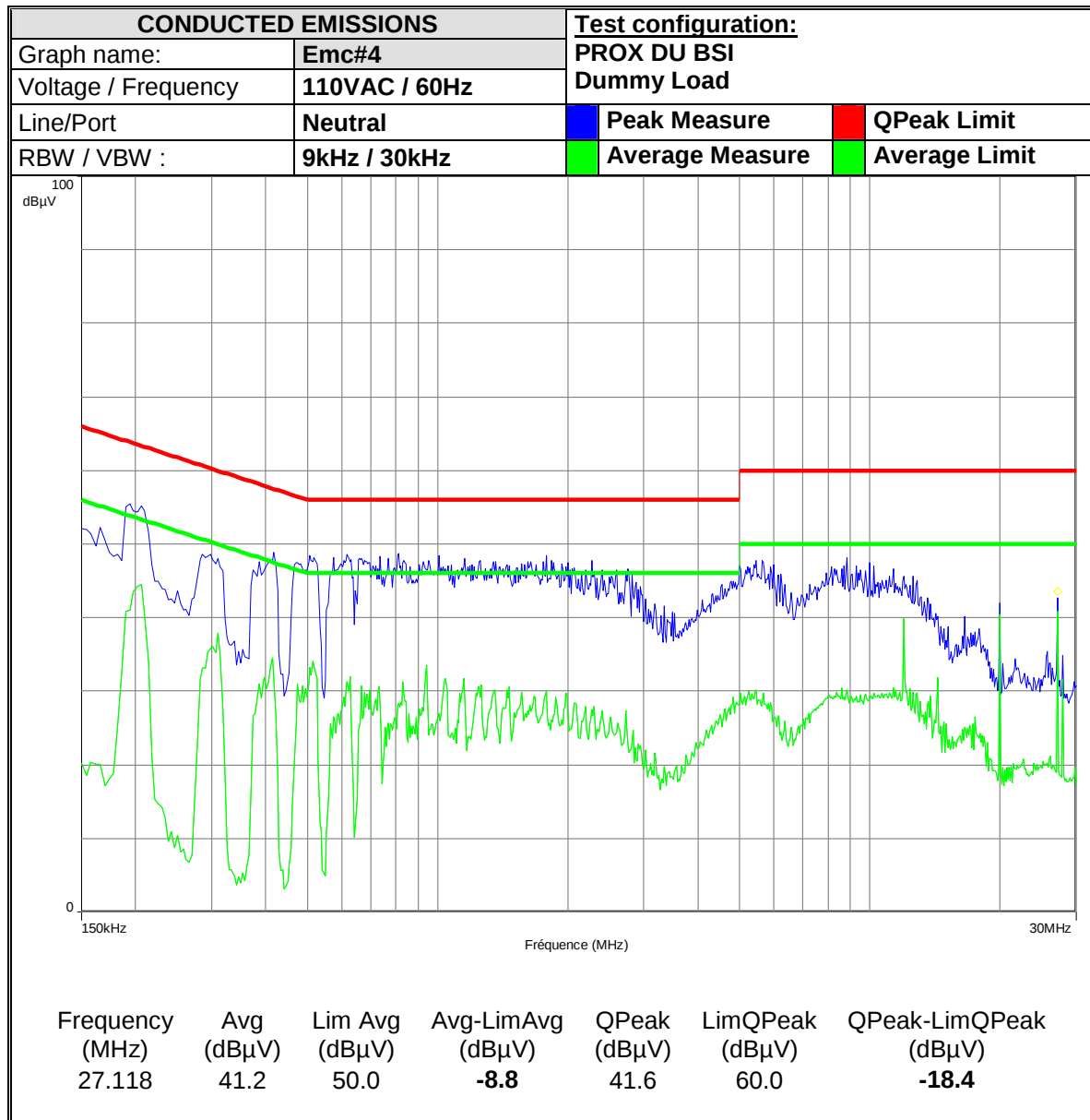














8. TEST EQUIPMENT LIST

USED	N°LCIE	TYPE	COMPANY	REF	CAL DATE	CAL DUE
RADIATED EMISSION MEASUREMENT (PRE-SCAN SEMI-ANECHOIC CHAMBER)						
x	A7486006	Amplifier 9kHz – 1300 MHz	HEWLETT PACKARD	8447F	04/10	04/11
x	C2040052	Antenna Loop	ELECTRO-METRICS	EM-6879	12/09	12/10
x	C2040146	Antenna Bi-Log XWing	TESEQ	CBL6144	03/10	03/12
x	A5329045	Cable N/N	-	-	12/09	12/10
x	A5329056	Cable N/N	-	-	02/10	02/11
x	A5329057	Cable N/N	-	-	02/10	02/11
x	D3044015	Semi-Anechoic chamber #2	SIEPEL	-	08/09	08/10
x	A3169050	Radiated emission comb generator	BARDET	-	-	-
x	A4060017	Spectrum analyzer	HEWLETT PACKARD	HP8568B	06/10	06/12
x	A4060019	Spectrum analyzer display	HEWLETT PACKARD	HP85662A	06/10	06/12
x	B4204052	Thermo-hygrometer	HUGER	-	04/10	04/12
x	F2000393	Turntable controller (Cage#2-3)	ETS Lingren	Model 2066	-	-
x	F2000404	Turntable chamber (Cage#2)	ETS Lingren	Model 2165	-	-
RADIATED EMISSION MEASUREMENT (OPEN AREA TEST SITE)						
x	C2040050	Antenna biconic	EMCO	3104C	01/10	01/11
x	C2040052	Antenna Loop	ELECTRO-METRICS	EM-6879	12/09	12/10
x	C2040056	Antenna log-periodic	EMCO	3146	01/10	01/11
x	A5329061	Cable N/N	SUCOFLEX	106G	12/09	12/10
x	A5329188	Cable N/N OATS (Mast at 10m)	UTIFLEX	-	05/10	05/11
x	A5329199	Cable N/N OATS (Mast at 10m)	UTIFLEX	-	05/10	05/11
x	A3169050	Radiated emission comb generator	BARDET	-	-	-
x	F2000409	OATS	-	-	08/10	08/11
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	-	-
BAND-EDGE COMPLIANCE						
x	C2040052	Antenna Loop	ELECTRO-METRICS	EM-6879	12/09	12/10
x	A5329061	Cable N/N	SUCOFLEX	106G	12/09	12/10
x	A2642019	Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	10/10	10/11
FREQUENCY TOLERANCE						
x	C2040052	Antenna Loop	ELECTRO-METRICS	EM-6879	12/09	12/10
x	A5329061	Cable N/N	SUCOFLEX	106G	12/09	12/10
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
CONDUCTED MEASUREMENT EMISSION						
x	A5329415	Cable	-	-	03/10	03/11
x	D3044010	Faraday Cage	RAY PROOF	-	01/10	01/11
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	12/09	12/10

**9. UNCERTAINTIES CHART**

Type de mesure / Kind of measurement	Incertitude élargie laboratoire / Wide uncertainty laboratory (k=2) ± x	Incertitude limite du CISPR / CISPR uncertainty limit ± 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