



**montena emc**

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 Prüflabor akkreditiert nach ISO 17025 durch die Schweizerische Akkreditierungsstelle SAS

Registration number  
 Numéro d'accréditation  
 Akkreditierungsnummer

**STS 024**

Schweizerischer Prüfstellendienst  
 Service suisse d'essai  
 Swiss testing service



Report:	<b>Electromagnetic compatibility and Radio spectrum Matters</b>		Report no:	13-MO-0047.11
Product name:	<b>TLC Twin</b>		Mandate no:	13-MO-0047
Serial no:	6F001		Model number:	04760180
Customer:	<b>TESA SA</b> <b>Rte du Bugnon 38</b> <b>1020 Renens</b> <b>Switzerland</b>		Date of test:	<b>January 25, 2013</b> <b>May 16 &amp; 21, 2013</b>

<b>Standards</b>		<b>Result</b>
<b>47 CFR, Part 15</b> (Subpart C, Intentional radiator : §§ 15.207; 15.209, 15.227)		<b>Pass</b>
<b>47 CFR, Part 2</b> (General rules and regulations : §§ 2.201, 2.202)		<b>Pass</b>
<b>Industry Canada</b> RSS-Gen, General Requirements and Information for the Certification of Radio Apparatus		<b>Pass</b>
RSS-210, License-exempt Radio Apparatus: Category I Equipment		<b>Pass</b>

These tests passed without modifications.

Test performed by

Mr B. Itzcovich

Mr E. de Raemy

EMC test engineers

Report prepared by

Mr B. Itzcovich

EMC test engineer

Report controlled and approved by

Mr J. Ding

EMC test engineer

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Rossens, May 29, 2013

(Issue Date)

REV20130422

Main language : English

The present document results from tests on one specimen and does not prejudge to the conformity of all the manufactured products.

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**SEV** Association for Electrical Engineering, Power and Information Technologies

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VALID

## 1. Summary of test results

- ✓ Pass
- ✗ Fail
- ∅ Not applicable to this product
- Not tested
- █ No requirements

§	Test Type	Result
<b>6</b>	<b>Emission</b>	<b>CFR 47 Part 15 Sub C / Industry Canada</b>
-	Conducted emission	∅ <sup>1</sup>
6.1	Radiated emission – Carrier	✓
6.2		
6.3	Radiated emission – EM-field	✓
6.4		
6.2		
6.3	Radiated emission – receiver	✓
6.4		
-	<b>Emission, modulation, and transmission characteristics</b>	<b>CFR 47 Part 2 Sub C</b>
6.5	Designation of emission	2M03F1D

1. Powered with 3 VDC

## 2. Applied standards

47 CFR Part 2	Code of Federal Regulations - Title 47 - Telecommunication, Part 2 – Frequency allocations and radio treaty matters; General rules and regulations
47 CFR Part 15 Subpart C	Code of Federal Regulations - Title 47 - Telecommunication, Part 15, Subpart C: "Intentional Radiators"
RSS-Gen issue 3, December 2010	Spectrum Management and Telecommunications - Radio Standards Specification General Requirements and Information for the Certification of Radio Apparatus
RSS-210 issue 8, December 2010	Spectrum Management and Telecommunications - Radio Standards Specification License-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

VALID

### 3. Client

Client name and address	TESA SA Rte du Bugnon 38 1020 Renens Switzerland
Contact Person	Mr Serge Mariller
Telephone	+41 21 633 17 20
Fax	+41 21 635 75 35
E-mail	Serge.mariller@hexagonmetrology.com
Mandate no	13-MO-0047

### 4. Equipment under test

#### 4.1. Identification

Manufacturer name and address	TESA SA Rte du Bugnon 38 1020 Renens Switzerland
Production country	Switzerland
Brand name	TESA
Product name	TLC Twin <i>(also referred to as "TWIN-CAP" on the measurement plots)</i>
Product description	Wireless interface
Model number	04760180
Serial no	6F001
Software version	V1.3
Highest frequency	16 MHz (Transmitter: 2.48 GHz)
Supply	$U = 3 \text{ VDC}$ (Battery) / $I = 0.1 \text{ mA}$ / $P = 0.3 \text{ mW}$
Dimension	3 cm x 3 cm x 0.8 cm (l x w x h)
Weight	80 g
Technical documentation	<i>None. The equipment is completely identified by the numbers and references listed above. Documentation traceability and product identification are under the responsibility of and assured by TESA SA.</i>

VALID

#### 4.2. Pictures of the EUT



#### 4.3. Classification

CFR 47 Part 15	<ul style="list-style-type: none"> <li><input type="checkbox"/> Unintentional radiator (Subpart B)           <ul style="list-style-type: none"> <li><input type="checkbox"/> Class A digital device</li> <li><input type="checkbox"/> Class B digital device</li> <li><input type="checkbox"/> The highest frequency of the internal sources of the EUT is less than 108 MHz (measurement shall be made up to 1 GHz).</li> <li><input type="checkbox"/> The highest frequency of the internal sources of the EUT is between 108 MHz and 500 MHz (measurement shall be made up to 2 GHz).</li> <li><input type="checkbox"/> The highest frequency of the internal sources of the EUT is between 500 MHz and 1 GHz (measurement shall be made up to 5 GHz).</li> <li><input type="checkbox"/> The highest frequency of the internal sources of the EUT is above 1 GHz (measurement shall be made up to 5 times the highest frequency or 40 GHz, whichever is lower).</li> </ul> </li> <li><input checked="" type="checkbox"/> Intentional radiator (Subpart C)           <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> The highest fundamental frequency of the EUT is less than 10 GHz (measurement shall be made up to the tenth harmonic or 40 GHz, whichever is lower).</li> <li><input type="checkbox"/> The highest fundamental frequency of the EUT is between 10 GHz and 30 GHz (measurement shall be made up to the fifth harmonic or 100 GHz, whichever is lower).</li> <li><input type="checkbox"/> The highest fundamental frequency of the EUT is above 30 GHz (measurement shall be made up to the fifth harmonic or 200 GHz, whichever is lower).</li> </ul> </li> </ul>
----------------	--

#### 4.4. Ports

None

#### 4.5. Modifications

None

Validé

## 5. Test conditions

### 5.1. Climatic conditions, location and date

Location	Date	Temp.	Pressure	Rel. humidity
montena emc sa 1728 Rossens - Switzerland	January 25, 2013	22 - 24 °C	1010 - 1040 hPa	20 - 50 %
	May 16 & 21, 2013	23 - 25 °C	1010 - 1040 hPa	20 - 50 %

### 5.2. Test facility and methodology

*The alternate test site (ferrite chamber) is accepted by FCC (Reg. No. 90808).  
Conducted and radiated measurements are performed according to the ANSI C63.4 (2003) procedure.*

*The open area test site is accepted by Industry Canada (Site number 3625A-1).*

### 5.3. Attendant persons

#### Test Engineer(s)

*Mr B. Itzcovich*

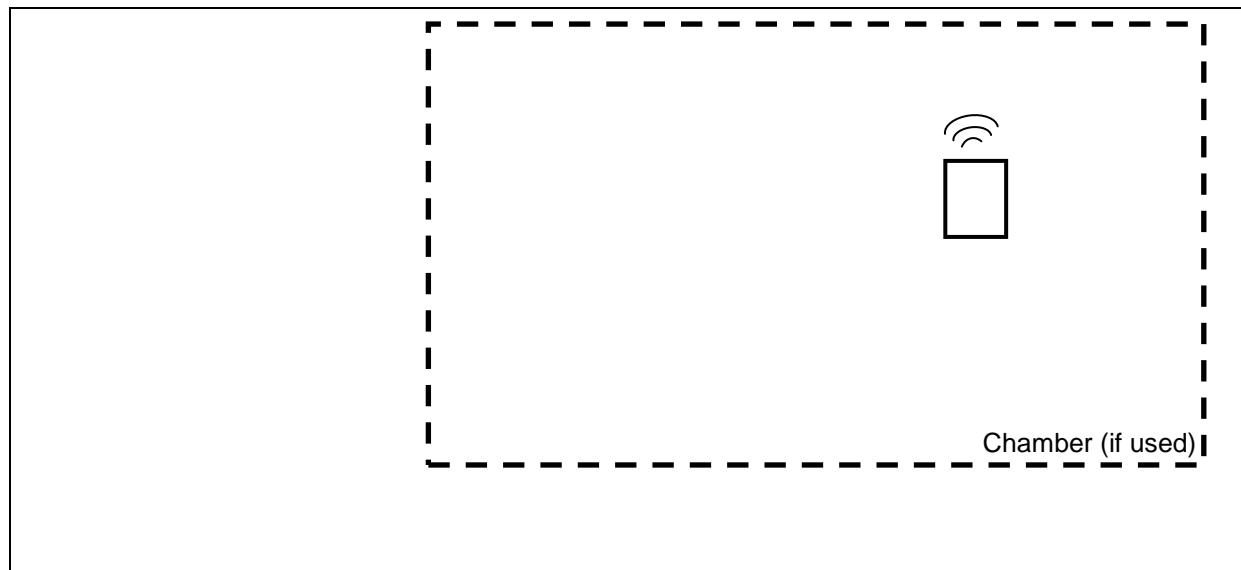
*Mr E. de Raemy*

*EMC test engineers*

#### Other(s)

Name	Company
<i>Mr Serge Mariller (partially)</i>	<i>TESA SA</i>

### 5.4. Test configuration



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## 5.5. Operating conditions

- For emission test, the output power has been set to the maximum (0dBm), modulation and frequency have been set according the requirements of the different measurements.

## 5.6. Auxiliary equipment

The following pieces of equipment are used for the monitoring of the EUT or are necessary for the EUT but they are not part of the EUT

None

Validé

## 6. Emission tests

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## 6.1. Carrier - Radiated emission

Test site:  anechoic chamber (ferrites)  open test site  
 anechoic chamber (foam)  .....

Meas. distance:  3 m  10 m  30 m  1 m

Meas. uncertainty:  $\pm 4.7$  dB

Position of EUT: 1.5 m (height above floor of equipment under test)

Measuring method: The carrier radiated by the equipment is measured using a spectrum analyzer and a wide band antenna. The antenna is placed at the same height as the EUT successively with horizontal and vertical polarizations. The turning table is operated through 360° during the measurements. The recordings are carried out taking into account the maximum value of all the disturbances appearing while the apparatus is under test. The peak values are recorded continuously on the graph. The values exceeding a limit are re-measured manually using a receiver.

Test set-up:



Remarks: Limit values expressed in  $\text{dB}\mu\text{V}/\text{m}$  at 3m:

$$20 \log \left( \frac{50 \frac{\text{mV}}{\text{m}}}{1 \frac{\mu\text{V}}{\text{m}}} \right) = 94 \frac{\text{dB}\mu\text{V}}{\text{m}} \text{ at 3m}$$

For some measurements, the RBW has been reduced to 100 kHz to compensate the lack of selectivity of the analyzer's 1MHz BP filter

Test equipment:

Spectrum analyzer	<input type="checkbox"/> 88-14	<input type="checkbox"/> 90-26	<input type="checkbox"/> 94-24	<input checked="" type="checkbox"/> 02-06	<input type="checkbox"/> 05-39	<input type="checkbox"/> 07-53
Receiver	<input type="checkbox"/> 85-04	<input type="checkbox"/> 90-43	<input type="checkbox"/> 04-29			
Preamplifier	<input type="checkbox"/> 90-01	<input type="checkbox"/> 95-86	<input type="checkbox"/> 05-56	<input type="checkbox"/> 05-59	<input type="checkbox"/> 05-62	<input checked="" type="checkbox"/> 11-29
Antenna (horn)	<input type="checkbox"/> 90-24	<input type="checkbox"/> 90-29	<input type="checkbox"/> 98-12	<input type="checkbox"/> 98-13	<input checked="" type="checkbox"/> 07-31	
Cables	<input checked="" type="checkbox"/> 10-75	<input checked="" type="checkbox"/> 11-61				

Result:  pass  fail  not applicable  not tested

Measurement Type : Radiated Field  
 Polarisation : Horizontal  
 Table Angle : 0° - 360° (max @ 30°)  
 Antenna Height : 1m - 2m (max @ 1m)

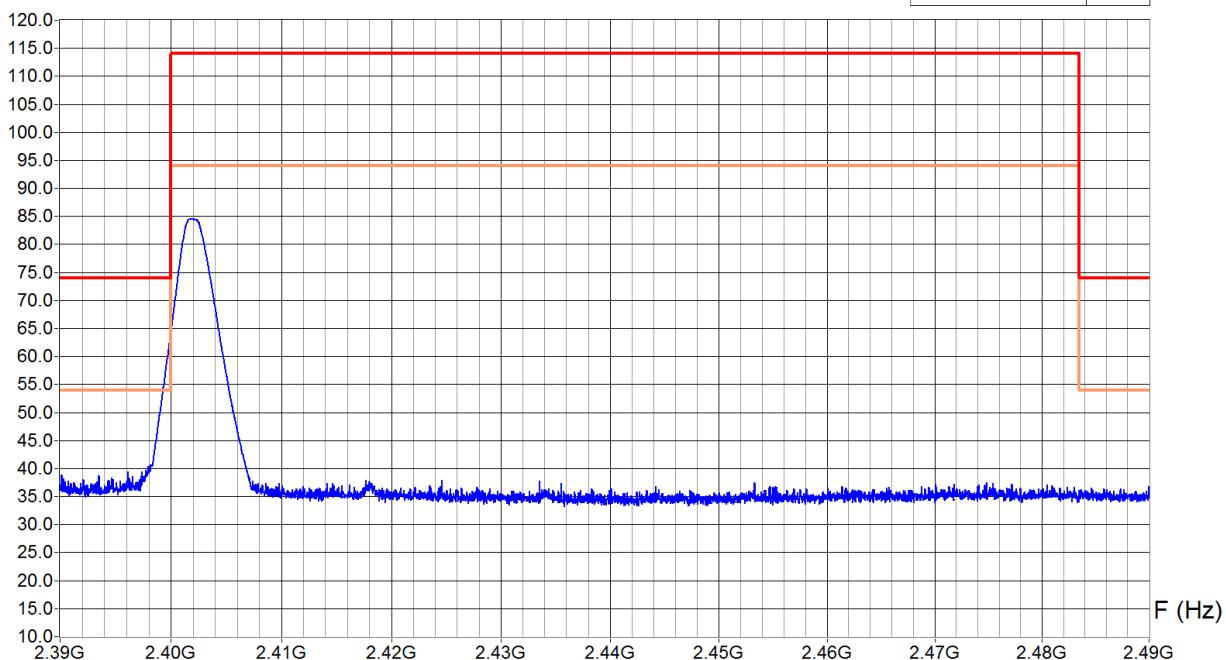


Equipment Under Test : TWIN-CAP  
 Set-Up : Cage 06-00, see photos  
 Operating Conditions : TX 0dBm modulated @ 2402 MHz  
 Remarks : Peak detector sweep (ST = 10s, 4001 pts, Ton=100%)

Level dB $\mu$ V/m

## CFR 47 §15.249 (@3m)

PK Limit	
AV Limit	



Zone	2.39 GHz - 2.49
Video Bandwidth	1 MHz
Resol Bandwidth	1 MHz

VALID

Operator: B. Itzcovich  
 Date/Time: 16.05.2013 11:11  
 Filename:  
 01\_Carrier\_TX2402\_H.png.txt

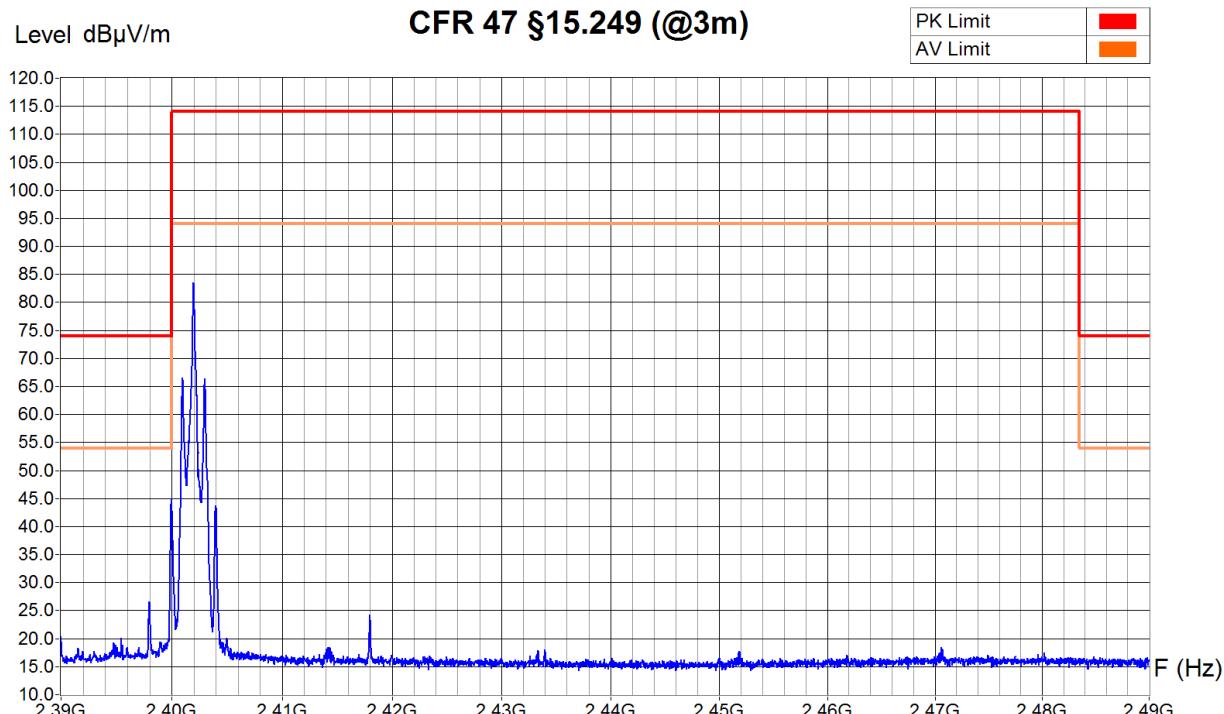
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Measurement Type : Radiated Field  
 Polarisation : Horizontal  
 Table Angle : 0° - 360° (max @ 30°)  
 Antenna Height : 1m - 2m (max @ 1m)



Equipment Under Test : TWIN-CAP  
 Set-Up : Cage 06-00, see photos  
 Operating Conditions : TX 0dBm modulated @ 2402 MHz  
 Remarks : Average RMS detector sweep (ST = 10s, 4001 pts, Ton=100%)



Zone	2.39 GHz - 2.49
Video Bandwidth	100 KHz
Resol Bandwidth	100 KHz

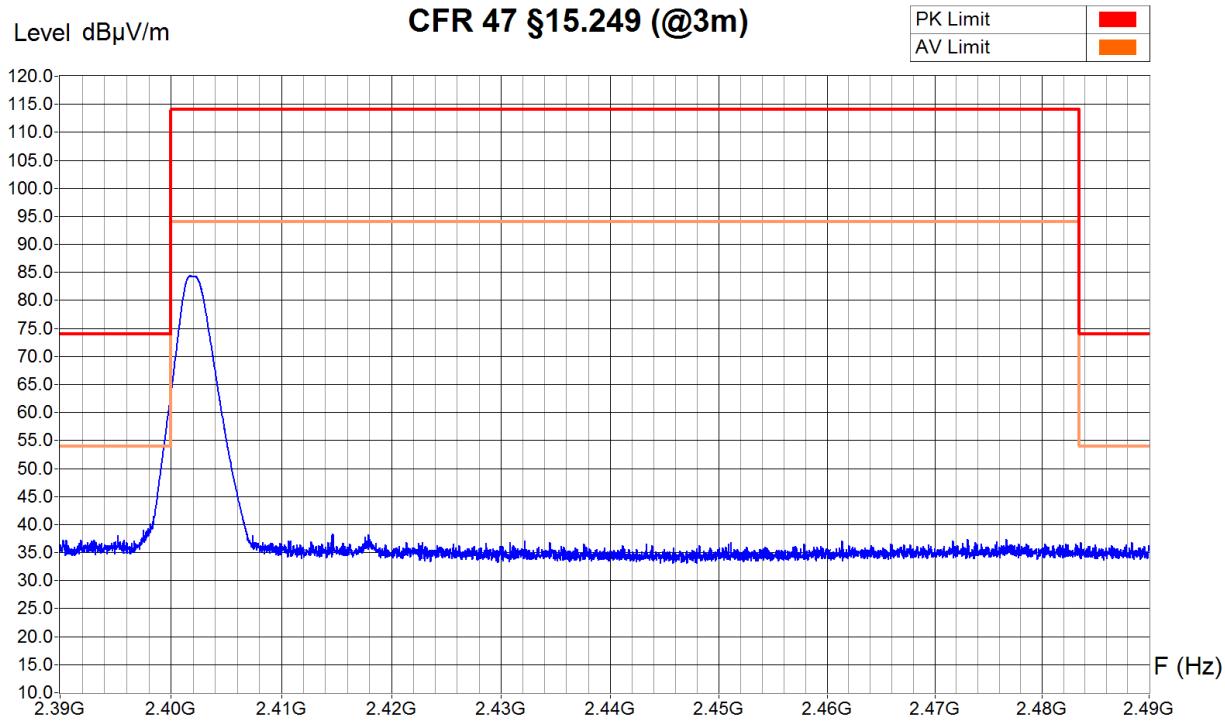
VALID

Operator: B. Itzcovich  
 Date/Time: 16.05.2013 11:14  
 Filename:  
 03\_Carrier\_TX2402\_H\_AVG\_100k  
 .png/.txt

Measurement Type : Radiated Field  
 Polarisation : Vertical  
 Table Angle : 0° - 360° (max @ 160°)  
 Antenna Height : 1m - 2.5m (max @ 2.1m)



Equipment Under Test : TWIN-CAP  
 Set-Up : Cage 06-00, see photos  
 Operating Conditions : TX 0dBm modulated @ 2402 MHz  
 Remarks : Peak detector sweep (ST = 10s, 4001 pts, Ton=100%)



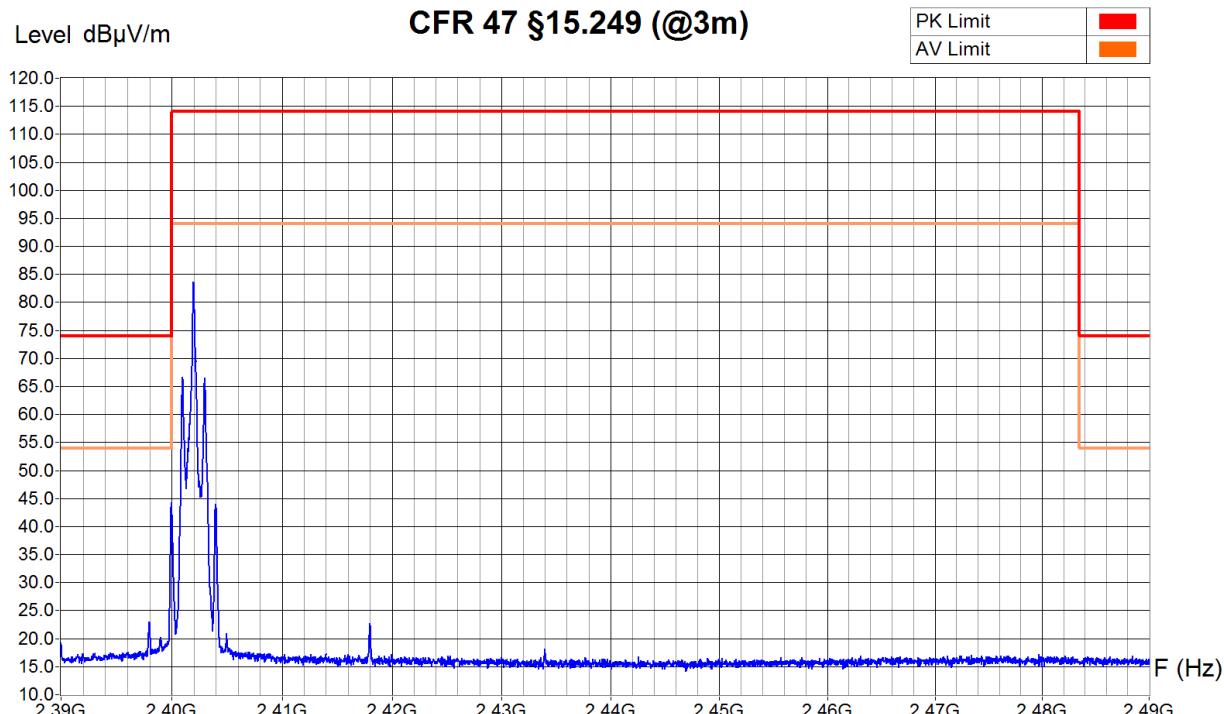
Validé

Operator: B. Itzcovich  
 Date/Time: 16.05.2013 12:08  
 Filename:  
 11\_Carrier\_TX2402\_V.png.txt

Measurement Type : Radiated Field  
 Polarisation : Vertical  
 Table Angle : 0° - 360° (max @ 160°)  
 Antenna Height : 1m - 2.5m (max @ 2.1m)



Equipment Under Test : TWIN-CAP  
 Set-Up : Cage 06-00, see photos  
 Operating Conditions : TX 0dBm modulated @ 2402 MHz  
 Remarks : Average RMS detector sweep (ST = 10s, 4001 pts, Ton=100%)



Zone	2.39 GHz - 2.49
Video Bandwidth	100 KHz
Resol Bandwidth	100 KHz

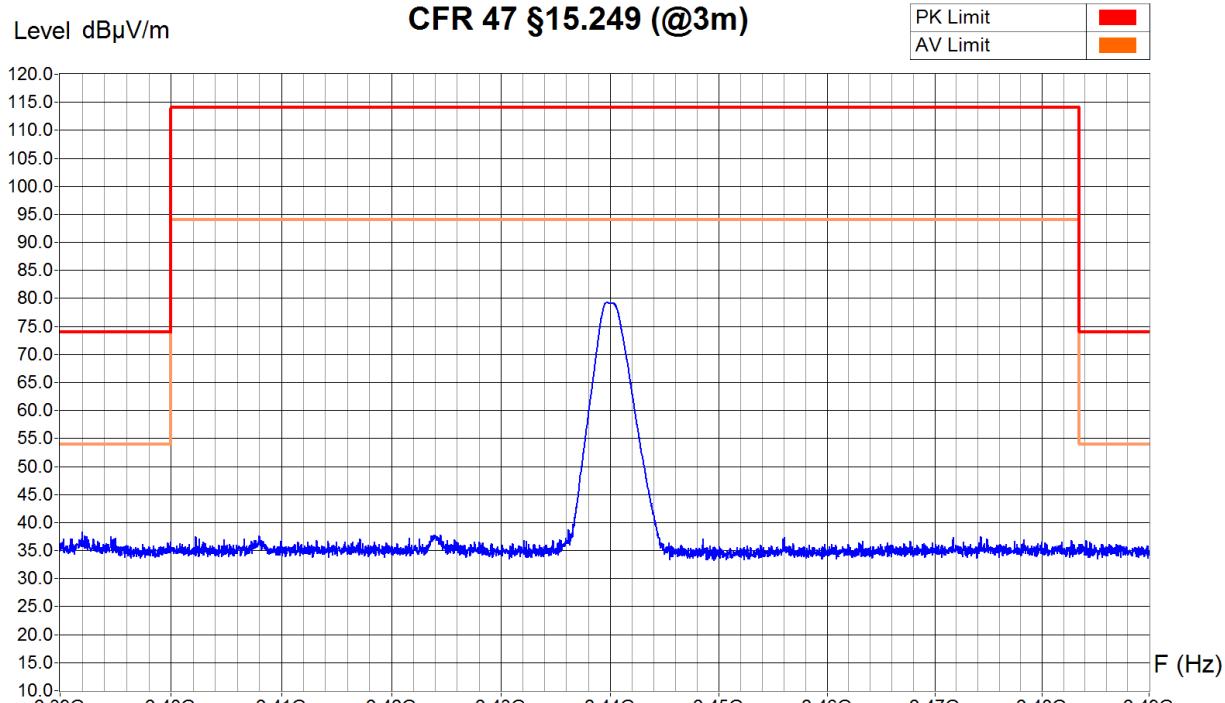
VALID

Operator: B. Itzcovich  
 Date/Time: 16.05.2013 12:12  
 Filename:  
 13\_Carrier\_TX2402\_V\_AVG\_100k.  
 png/.txt

Measurement Type : Radiated Field  
 Polarisation : Horizontal  
 Table Angle : 0° - 360° (max @ 30°)  
 Antenna Height : 1m - 2m (max @ 1m)



Equipment Under Test : TWIN-CAP  
 Set-Up : Cage 06-00, see photos  
 Operating Conditions : TX 0dBm modulated @ 2440 MHz  
 Remarks : Peak detector sweep (ST = 10s, 4001 pts, Ton=100%)



Zone	2.39 GHz - 2.49
Video Bandwidth	1 MHz
Resol Bandwidth	1 MHz

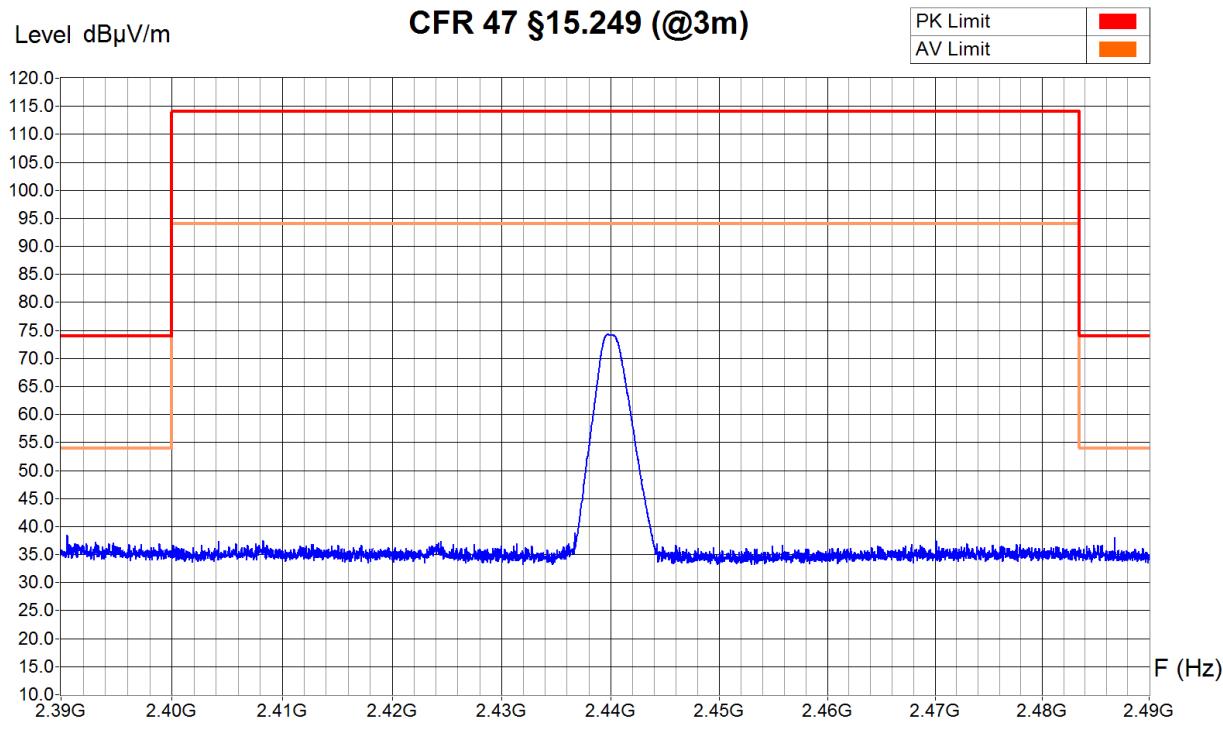
Validé

Operator: B. Itzovich  
 Date/Time: 16.05.2013 11:38  
 Filename:  
 09\_Carrier\_TX2440\_H.png/.txt

Measurement Type : Radiated Field  
 Polarisation : Vertical  
 Table Angle : 0° - 360° (max @ 160°)  
 Antenna Height : 1m - 2.5m (max @ 2.1m)



Equipment Under Test : TWIN-CAP  
 Set-Up : Cage 06-00, see photos  
 Operating Conditions : TX 0dBm modulated @ 2440 MHz  
 Remarks : Peak detector sweep (ST = 10s, 4001 pts, Ton=100%)



Zone	2.39 GHz - 2.49
Video Bandwidth	1 MHz
Resol Bandwidth	1 MHz

VALID

Operator: B. Itzcovich  
 Date/Time: 16.05.2013 11:51  
 Filename:  
 10\_Carrier\_TX2440\_V.png/.txt

Measurement Type : Radiated Field  
 Polarisation : Horizontal  
 Table Angle : 0° - 360° (max @ 30°)  
 Antenna Height : 1m - 2m (max @ 1m)

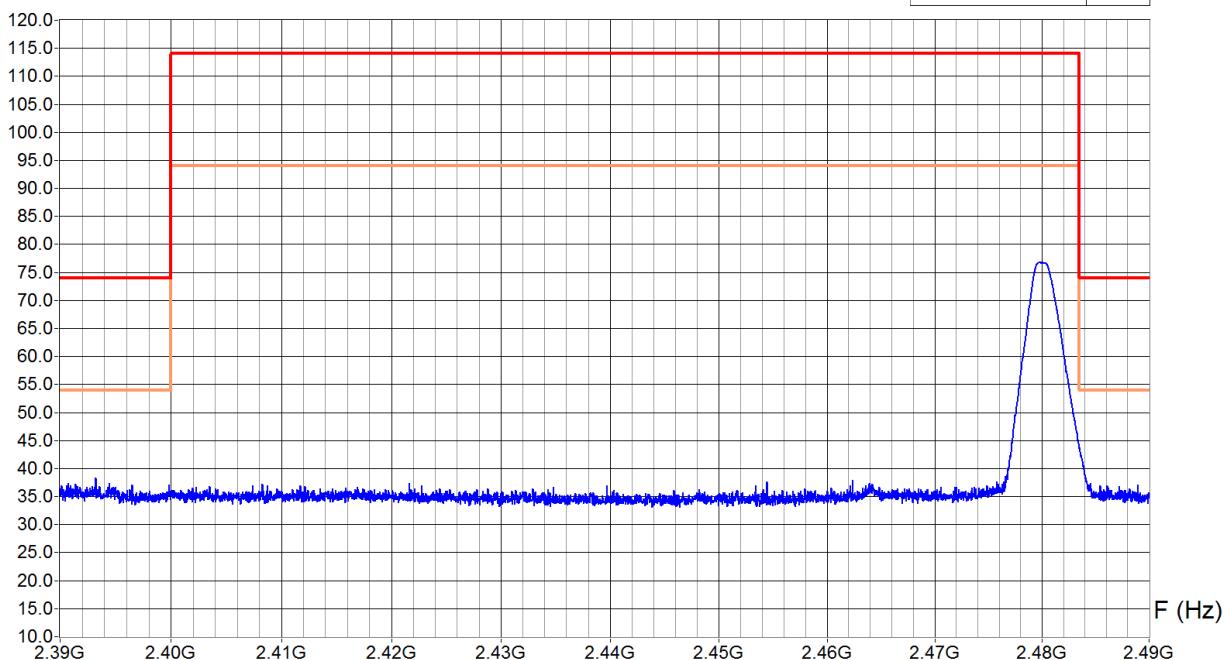


Equipment Under Test : TWIN-CAP  
 Set-Up : Cage 06-00, see photos  
 Operating Conditions : TX 0dBm modulated @ 2480 MHz  
 Remarks : Peak detector sweep (ST = 10s, 4001 pts, Ton=100%)

Level dB $\mu$ V/m

## CFR 47 §15.249 (@3m)

PK Limit	
AV Limit	



Zone	2.39 GHz - 2.49
Video Bandwidth	1 MHz
Resol Bandwidth	1 MHz

VALID

Operator: B. Itzcovich  
 Date/Time: 16.05.2013 11:36  
 Filename:  
 08\_Carrier\_TX2480\_H.png/.txt

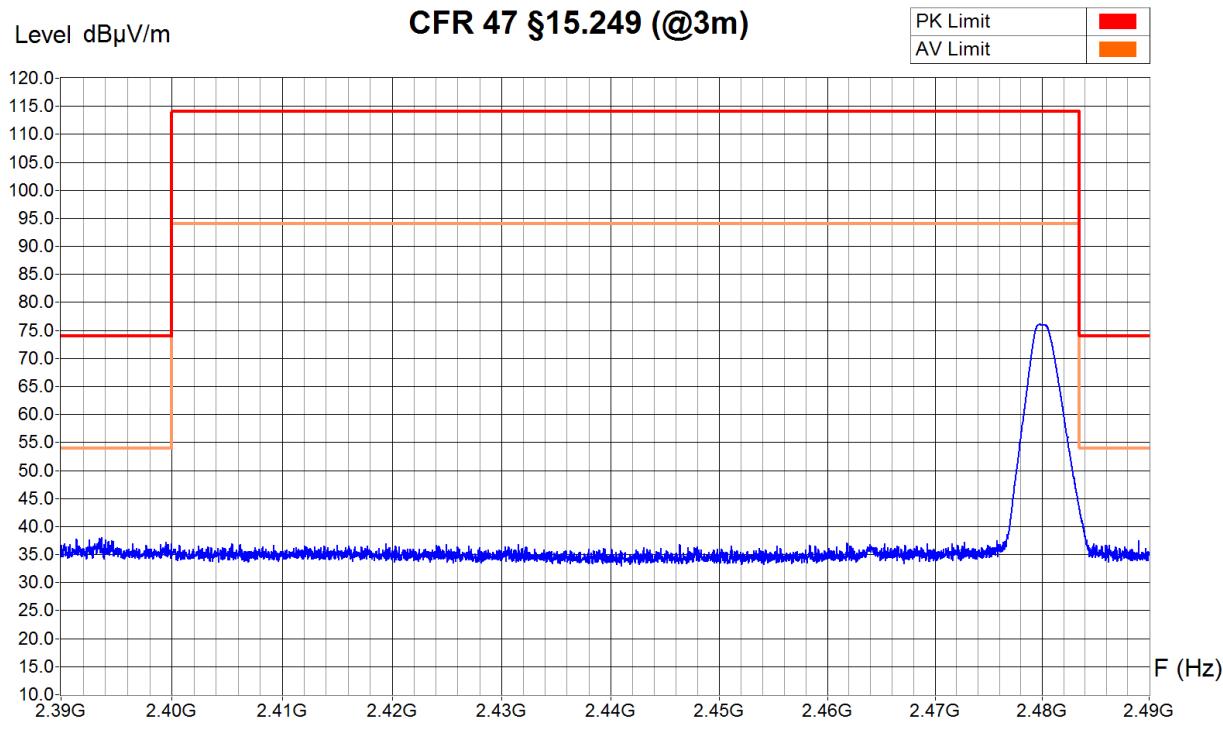
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Measurement Type : Radiated Field  
 Polarisation : Vertical  
 Table Angle : 0° - 360° (max @ 160°)  
 Antenna Height : 1m - 2.5m (max @ 2.1m)



Equipment Under Test : TWIN-CAP  
 Set-Up : Cage 06-00, see photos  
 Operating Conditions : TX 0dBm modulated @ 2480 MHz  
 Remarks : Peak detector sweep (ST = 10s, 4001 pts, Ton=100%)



Zone	2.39 GHz - 2.49
Video Bandwidth	1 MHz
Resol Bandwidth	1 MHz

VALID

Operator: B. Itzcovich  
 Date/Time: 16.05.2013 12:00  
 Filename:  
 12\_Carrier\_TX2480\_V.png/.txt

## 6.2. Radiated emission - Electromagnetic field (radiated – 30 MHz to 1 GHz)

Test site:  anechoic chamber (foam)  open test site  
 anechoic chamber (ferrites)  .....

Distance:  30 m  10 m  3 m  .....

Position of EUT: 1.5 m (height of the equipment under test above floor)

Meas. uncertainty:  $\pm 4.6$  dB (30 - 300 MHz) /  $\pm 3.7$  dB (300 - 1000 MHz)

Test method: The electromagnetic disturbance radiated by the equipment is measured using a spectrum analyzer and a wide band antenna. The antenna is moved from 1 to 4 m in height successively with horizontal and vertical polarizations. The turning table is operated through 360° during the measurements. The recordings are carried out taking into account the maximum value of all the disturbances appearing while the apparatus is under test. The peak values are recorded continuously on the graph. The values exceeding a limit are re-measured manually using a receiver.

Test set-up:



Remarks: Limit values expressed in  $\text{dB}\mu\text{V/m}$  and transformed to a measuring distance of 3m

(factor used = 20 dB/decade) if necessary

e.g.: for  $f = 40\text{MHz}$  the limit is  $100\mu\text{V/m}$  at 3m;

$$20 \log \left( \frac{100 \frac{\mu\text{V}}{\text{m}}}{1 \frac{\mu\text{V}}{\text{m}}} \right) = 40 \frac{\text{dB}\mu\text{V}}{\text{m}} \text{ at 3m}$$

Test equipment:

Spectrum analyzer	<input checked="" type="checkbox"/> 10-70	<input type="checkbox"/> 94-24	<input type="checkbox"/> 02-06	<input type="checkbox"/> 03-45	<input type="checkbox"/> 05-39	<input type="checkbox"/> 07-53
Receiver	<input checked="" type="checkbox"/> 10-70	<input type="checkbox"/> 90-43	<input type="checkbox"/> 94-35	<input type="checkbox"/> 04-29		
Preamplifier	<input type="checkbox"/> 90-01	<input type="checkbox"/> 95-86	<input type="checkbox"/> 05-56	<input checked="" type="checkbox"/> 05-59	<input type="checkbox"/> 05-62	
Antenna (biconical)	<input type="checkbox"/> 82-02	<input type="checkbox"/> 87-05	<input type="checkbox"/> 87-16	<input type="checkbox"/> 91-05	<input type="checkbox"/> 94-37	
Antenna (log-per)	<input type="checkbox"/> 88-20	<input type="checkbox"/> 90-30	<input type="checkbox"/> 91-35	<input type="checkbox"/> 94-64		
Antenna (bilog)	<input checked="" type="checkbox"/> 94-03	<input type="checkbox"/> 05-38				
Antenna (horn)	<input type="checkbox"/> 90-24	<input type="checkbox"/> 98-12	<input type="checkbox"/> 98-13			
Cables	<input type="checkbox"/> 06-00	<input checked="" type="checkbox"/> 06-01	<input type="checkbox"/> .....	<input type="checkbox"/> .....	<input type="checkbox"/> .....	

Result:	<input checked="" type="checkbox"/> pass	<input type="checkbox"/> fail	<input type="checkbox"/> not applicable	<input type="checkbox"/> not tested
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### 6.2.1. Transmit mode

Measurement Type : Radiated Field

Polarisation : Vertical

Table Angle : 0° - 360°

Antenna Height : 1m - 4m



Equipment Under Test : TWIN-CAP

Set-Up : Cage 06-01, see photos

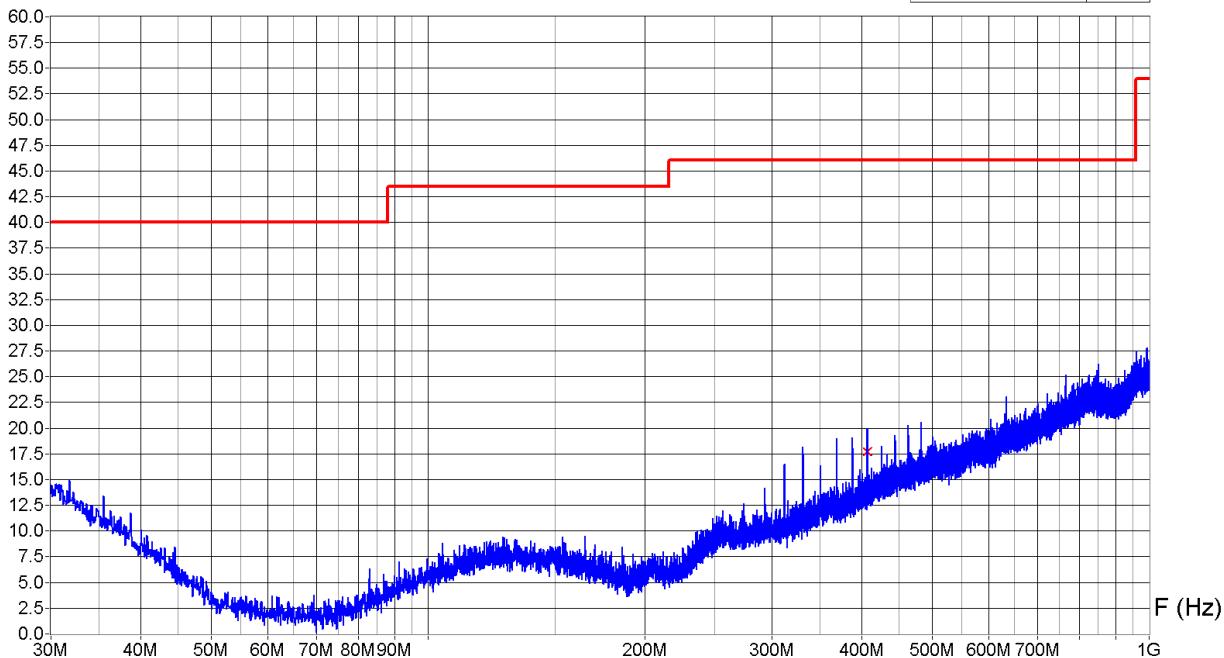
Operating Conditions : TX 0dBm modulated @ 2440 MHz

Remarks : Peak detector sweep

Level dB $\mu$ V/m

CFR 47 §§15.209/109 (@3m)

QP Limit	
AV Limit	



Zone	25 MHz - 1 GHz
Video Bandwidth	300 KHz
Resol Bandwidth	100 KHz

#### Receiver Measures

Frequency	Peak	QuasiPeak (x)	Average (+)	QP Margin
406.95 MHz	21.0 dB $\mu$ V/m	17.7 dB $\mu$ V/m	13.2 dB $\mu$ V/m	28.3 dB

VALID

Operator: B. Itzcovich  
 Date/Time: 21.05.2013 10:58  
 Filename:  
 25\_RE\_25M-1G\_TX2440\_V.png/  
 .txt

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Measurement Type : Radiated Field  
 Polarisation : Horizontal  
 Table Angle : 0° - 360°  
 Antenna Height : 1m - 4m

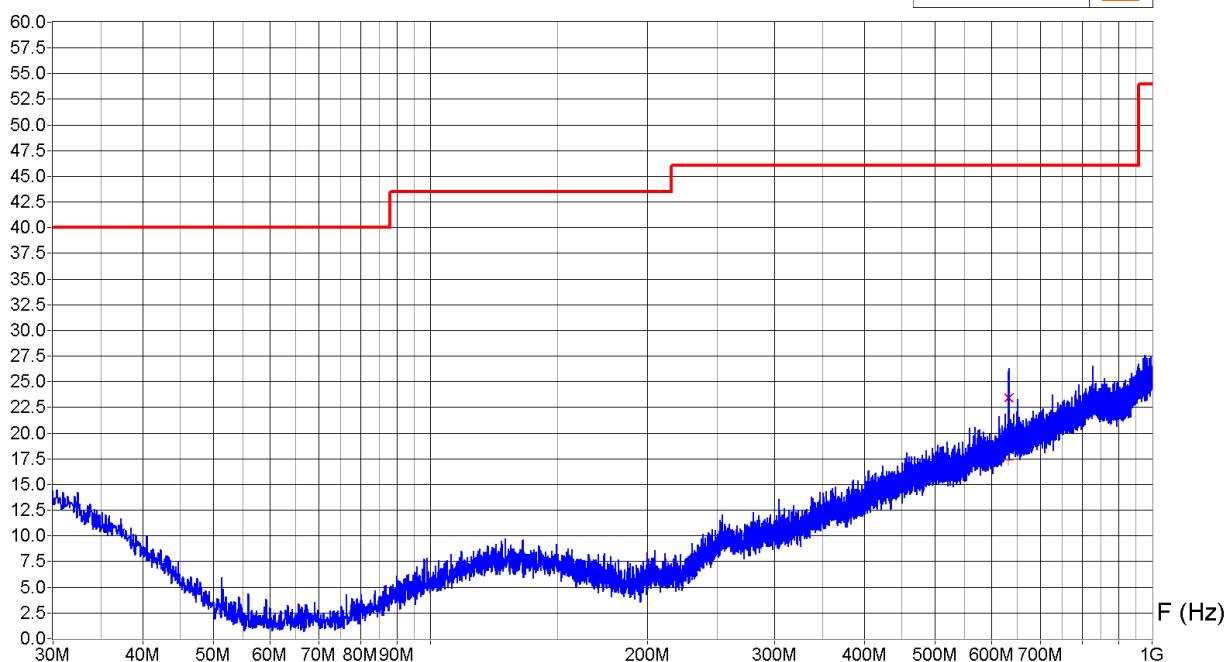


Equipment Under Test : TWIN-CAP  
 Set-Up : Cage 06-01, see photos  
 Operating Conditions : TX 0dBm modulated @ 2440 MHz  
 Remarks : Peak detector sweep

Level dB $\mu$ V/m

## CFR 47 §§15.209/109 (@3m)

QP Limit	
AV Limit	



Zone	25 MHz - 1 GHz
Video Bandwidth	300 KHz
Resol Bandwidth	100 KHz

## Receiver Measures

Frequency	Peak	QuasiPeak (x)	Average (+)	QP Margin
633.60 MHz	27.4 dB $\mu$ V/m	23.4 dB $\mu$ V/m	17.3 dB $\mu$ V/m	22.6 dB

VALID

Operator: B. Itzcovich  
 Date/Time: 21.05.2013 11:18  
 Filename: 26\_RE\_25M-1G\_TX2440\_H.png/.txt

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### 6.2.2. Receive mode

Measurement Type : Radiated Field

Polarisation : Horizontal

Table Angle : 0° - 360°

Antenna Height : 1m - 4m



Equipment Under Test : TWIN-CAP

Set-Up : Cage 06-01, see photos

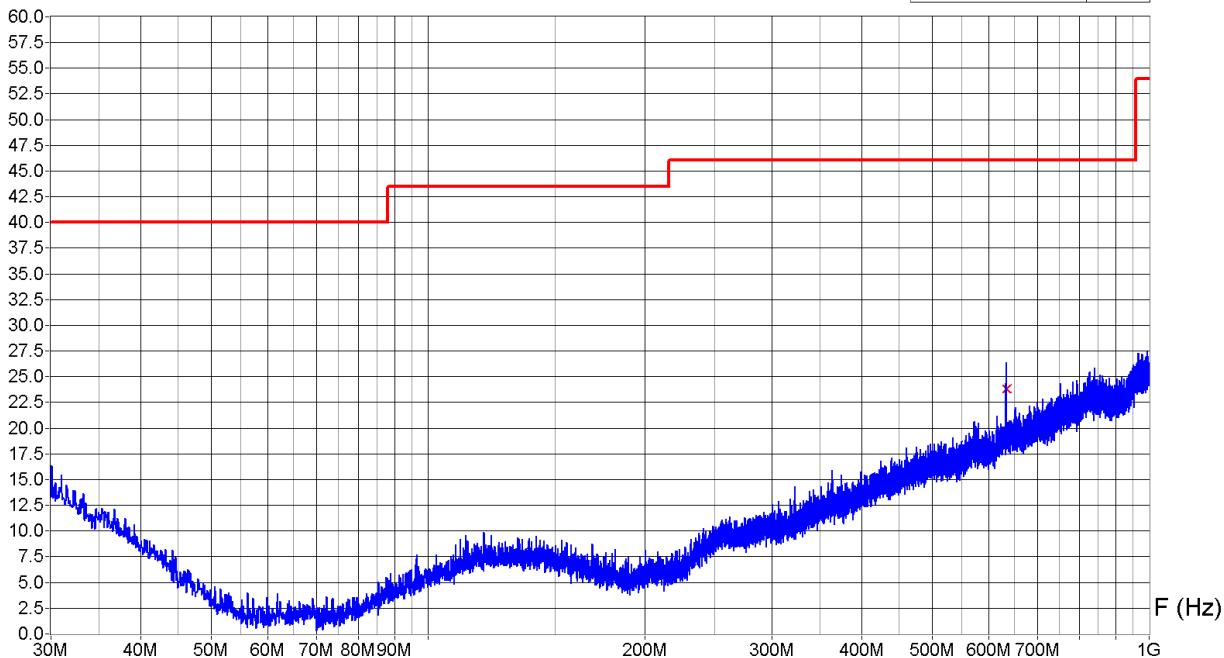
Operating Conditions : RX @ 2440 MHz

Remarks : Peak detector sweep

Level dB $\mu$ V/m

CFR 47 §§15.209/109 (@3m)

QP Limit	
AV Limit	



Zone	25 MHz - 1 GHz
Video Bandwidth	300 KHz
Resol Bandwidth	100 KHz

#### Receiver Measures

Frequency	Peak	QuasiPeak (x)	Average (+)	QP Margin
634 MHz	27.2 dB $\mu$ V/m	23.8 dB $\mu$ V/m	18.3 dB $\mu$ V/m	22.2 dB

VALID

Operator: B. Itzcovich  
 Date/Time: 21.05.2013 11:42  
 Filename:  
 27\_RE\_25M-1G\_RX2440\_H.png/  
 .txt

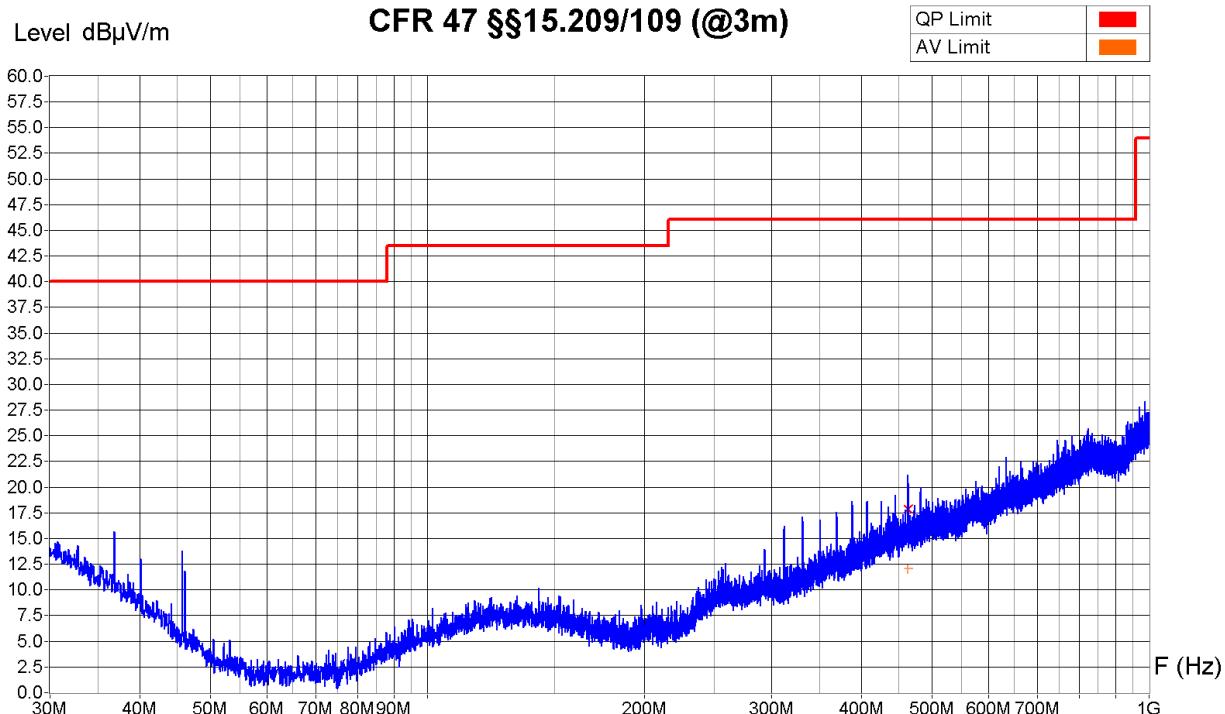
montena emc

CH-1728 Rossens - Switzerland / phone +41 26 411 93 33 / fax +41 26 411 93 30 / www.montenaemc.ch / office@montenaemc.ch

Measurement Type : Radiated Field  
 Polarisation : Vertical  
 Table Angle : 0° - 360°  
 Antenna Height : 1m - 4m



Equipment Under Test : TWIN-CAP  
 Set-Up : Cage 06-01, see photos  
 Operating Conditions : RX @ 2440 MHz  
 Remarks : Peak detector sweep



Zone	25 MHz - 1 GHz
Video Bandwidth	300 KHz
Resol Bandwidth	100 KHz

## Receiver Measures

Frequency	Peak	QuasiPeak (x)	Average (+)	QP Margin
463.35 MHz	21.5 dB $\mu$ V/m	17.9 dB $\mu$ V/m	12.0 dB $\mu$ V/m	28.2 dB

Validé

Operator: B. Itzcovich  
 Date/Time: 21.05.2013 11:50  
 Filename:  
 28\_RE\_25M-1G\_RX2440\_V.png/.txt

### 6.3. Radiated emission - Electromagnetic field (radiated – 1 GHz to 18 GHz)

Test site:  anechoic chamber (foam)  open test site  
 anechoic chamber (ferrites)  .....

Distance:  30 m  10 m  3 m  1 m

Position of EUT: 1.5 m (height of the equipment under test above floor)

Meas. uncertainty: ± 4.7 dB

Test method: The electromagnetic disturbance radiated by the equipment is measured using a spectrum analyzer and a wide band antenna. The antenna is placed at the same height as the EUT successively with horizontal and vertical polarizations. The turning table is operated through 360° during the measurements. The recordings are carried out taking into account the maximum value of all the disturbances appearing while the apparatus is under test.

Test set-up:



Remarks: Limit values expressed in dB $\mu$ V/m. The limit is 500 $\mu$ V/m at 3m;

$$20 \log \left( \frac{500 \frac{\mu V}{m}}{1 \frac{\mu V}{m}} \right) = 54 \frac{dB\mu V}{m} \text{ at 3m}$$

Test equipment:

Spectrum analyzer	<input type="checkbox"/> 88-14	<input type="checkbox"/> 94-24	<input checked="" type="checkbox"/> 02-06	<input type="checkbox"/> 03-45	<input type="checkbox"/> 05-39	<input type="checkbox"/> 07-53
Receiver	<input type="checkbox"/> 85-04	<input type="checkbox"/> 90-43	<input type="checkbox"/> 94-35	<input type="checkbox"/> 04-29		
Preamplifier	<input type="checkbox"/> 05-56	<input type="checkbox"/> 05-87	<input checked="" type="checkbox"/> 11-29			
Antenna (horn)	<input type="checkbox"/> 90-24	<input type="checkbox"/> 98-10	<input type="checkbox"/> 98-12	<input checked="" type="checkbox"/> 07-31	.....	
Band pass filter	<input type="checkbox"/> 10-65	<input type="checkbox"/> 10-66	<input type="checkbox"/> 10-68	<input type="checkbox"/> 11-08		
Cables	<input checked="" type="checkbox"/> 10-75	<input checked="" type="checkbox"/> 11-61				

Result:  pass  fail  not applicable  not tested

### 6.3.1. Transmit mode

Measurement Type : Radiated Field

Polarisation : Vertical

Table Angle : 0° - 360°

Antenna Height : 1m - 2m



Equipment Under Test : TWIN-CAP

Set-Up : Cage 06-00, see photos

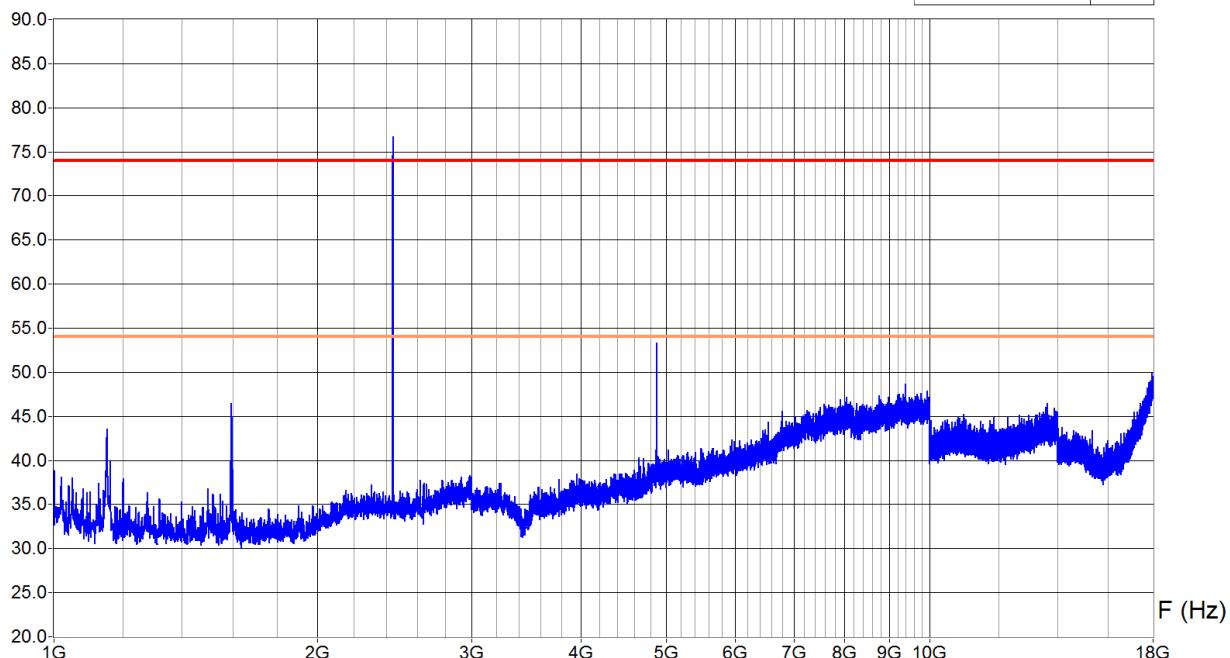
Operating Conditions : TX 0dBm modulated @ 2440 MHz

Remarks : Peak detector sweep

Level dBuV/m

### CFR 47 §§15.209/109 (@3m)

PK Limit	
AV Limit	



Zone	1 GHz - 6 GHz	6 GHz - 10 GHz	10 GHz - 14 GHz	14 GHz - 18 GHz
Video Bandwidth	1 MHz	1 MHz	1 MHz	1 MHz
Resol Bandwidth	1 MHz	1 MHz	300 KHz	100 KHz

Validé

Operator: B. Itzcovich  
Date/Time: 16.05.2013 13:43  
Filename:  
16\_RE\_1G-18G\_TX2440\_V.png/.txt

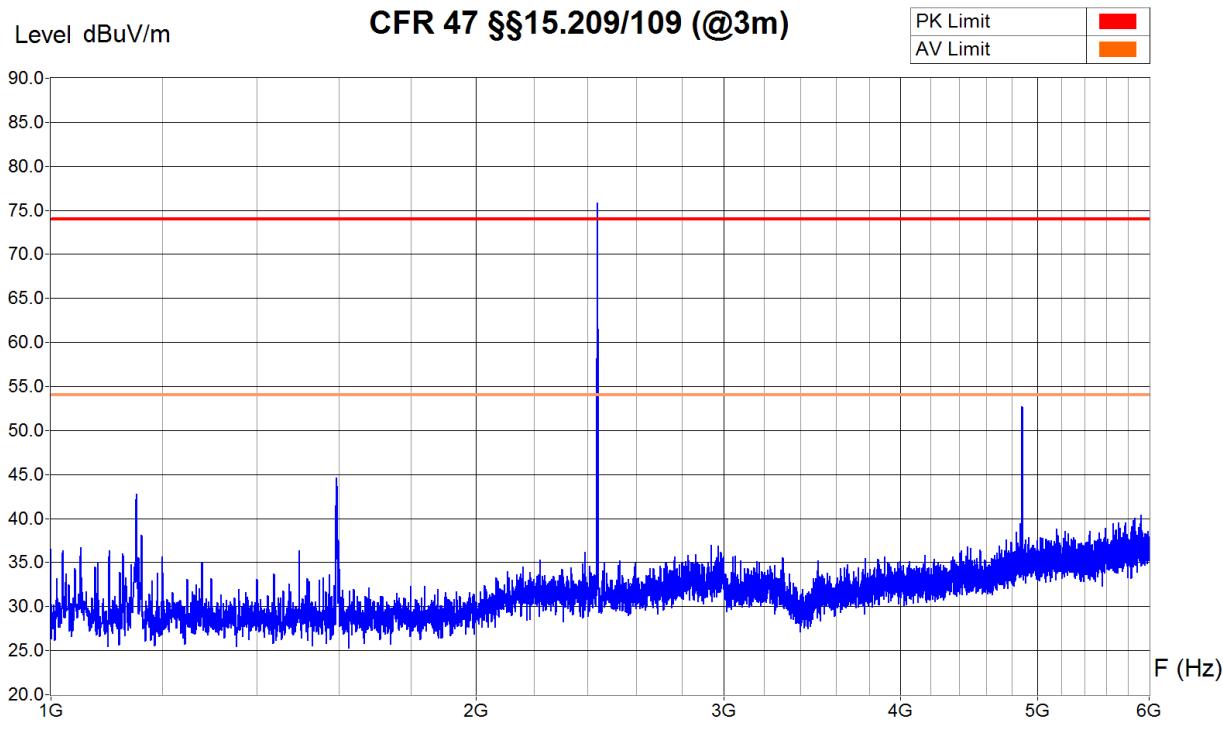
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Measurement Type : Radiated Field  
 Polarisation : Vertical  
 Table Angle : 0° - 360°  
 Antenna Height : 1m - 2m



Equipment Under Test : TWIN-CAP  
 Set-Up : Cage 06-00, see photos  
 Operating Conditions : TX 0dBm modulated @ 2440 MHz  
 Remarks : Average RMS detector sweep



Zone	1 GHz - 6 GHz
Video Bandwidth	1 MHz
Resol Bandwidth	1 MHz

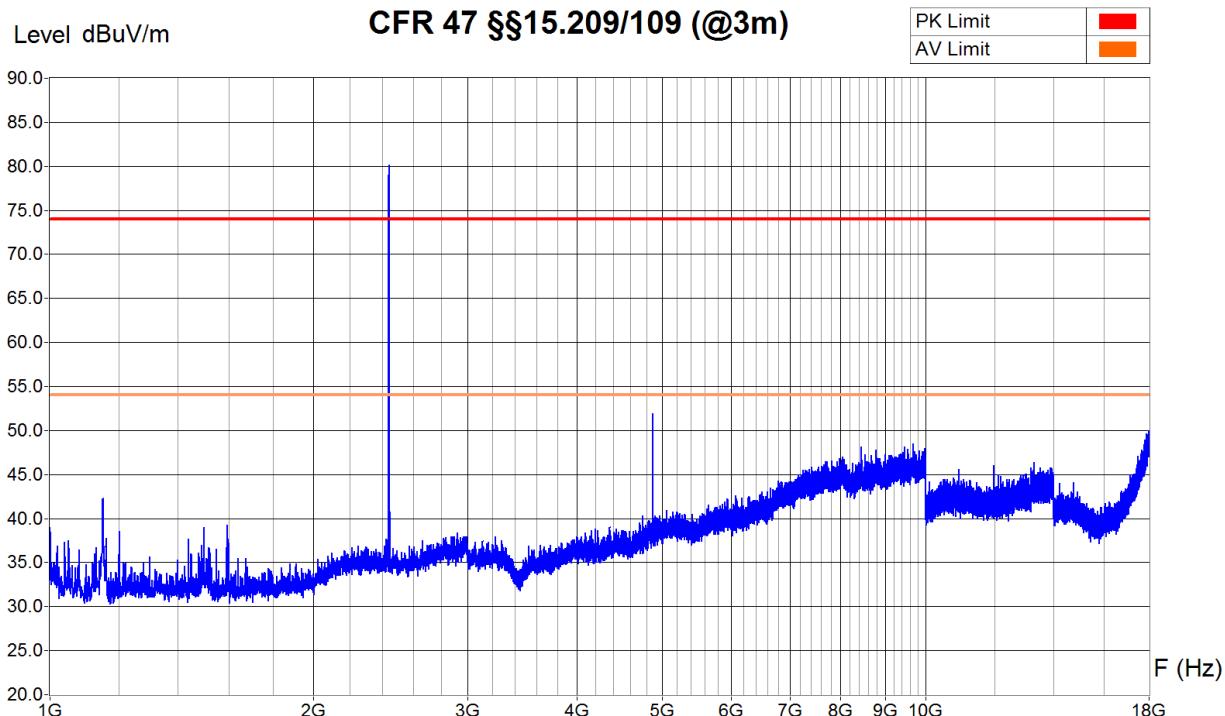
VALID

Operator: B. Itzcovich  
 Date/Time: 16.05.2013 13:49  
 Filename:  
 17\_RE\_1G-  
 6G\_TX2440\_V\_AVG.png/.txt

Measurement Type : Radiated Field  
 Polarisation : Horizontal  
 Table Angle : 0° - 360°  
 Antenna Height : 1m - 2m



Equipment Under Test : TWIN-CAP  
 Set-Up : Cage 06-00, see photos  
 Operating Conditions : TX 0dBm modulated @ 2440 MHz  
 Remarks : Peak detector sweep



Zone	1 GHz - 6 GHz	6 GHz - 10 GHz	10 GHz - 14 GHz	14 GHz - 18 GHz
Video Bandwidth	1 MHz	1 MHz	1 MHz	1 MHz
Resol Bandwidth	1 MHz	1 MHz	300 KHz	100 KHz

Validé

Operator: B. Itzcovich  
 Date/Time: 16.05.2013 14:00  
 Filename:  
 18\_RE\_1G-18G\_TX2440\_H.png/.txt

### 6.3.2. Receive mode

Measurement Type : Radiated Field

Polarisation : Horizontal

Table Angle : 0° - 360°

Antenna Height : 1m - 2m



Equipment Under Test : TWIN-CAP

Set-Up : Cage 06-00, see photos

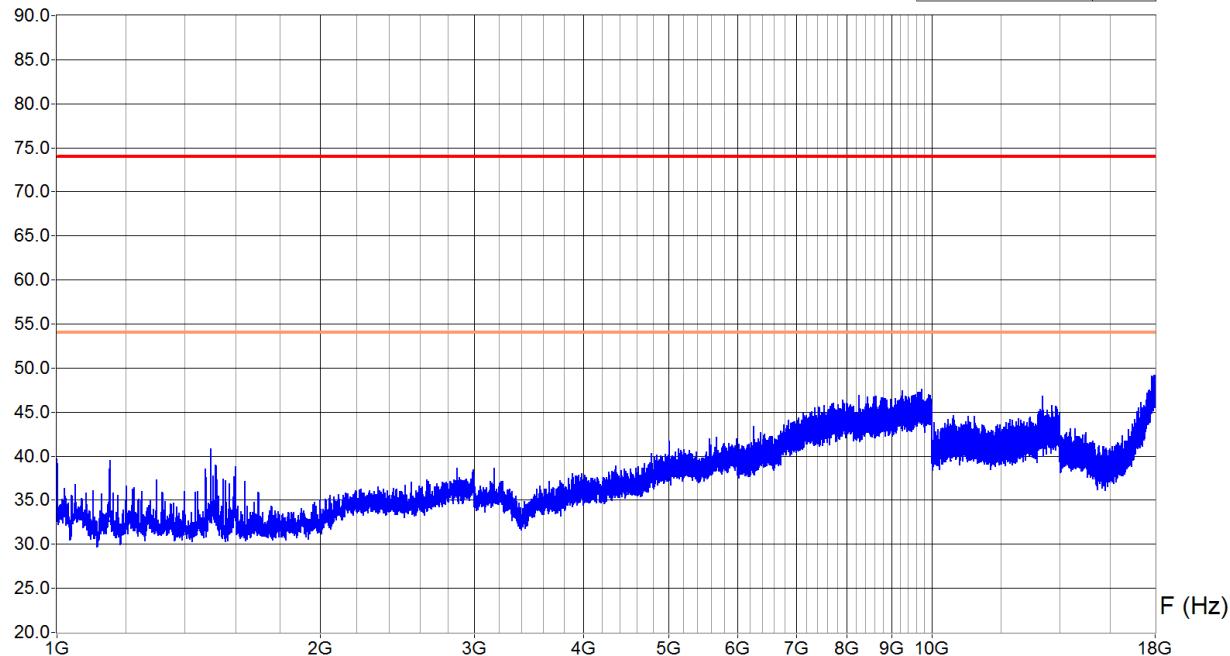
Operating Conditions : RX @ 2440 MHz

Remarks : Peak detector sweep

Level dBuV/m

CFR 47 §§15.209/109 (@3m)

PK Limit	
AV Limit	



Zone	1 GHz - 6 GHz	6 GHz - 10 GHz	10 GHz - 14 GHz	14 GHz - 18 GHz
Video Bandwidth	1 MHz	1 MHz	1 MHz	1 MHz
Resol Bandwidth	1 MHz	1 MHz	300 KHz	100 KHz

VALID

Operator: B. Itzcovich
Date/Time: 16.05.2013 14:11
Filename:
19_RE_1G-18G_RX2440_H.png/.txt

Measurement Type : Radiated Field

Polarisation : Vertical

Table Angle : 0° - 360°

Antenna Height : 1m - 2m



Equipment Under Test : TWIN-CAP

Set-Up : Cage 06-00, see photos

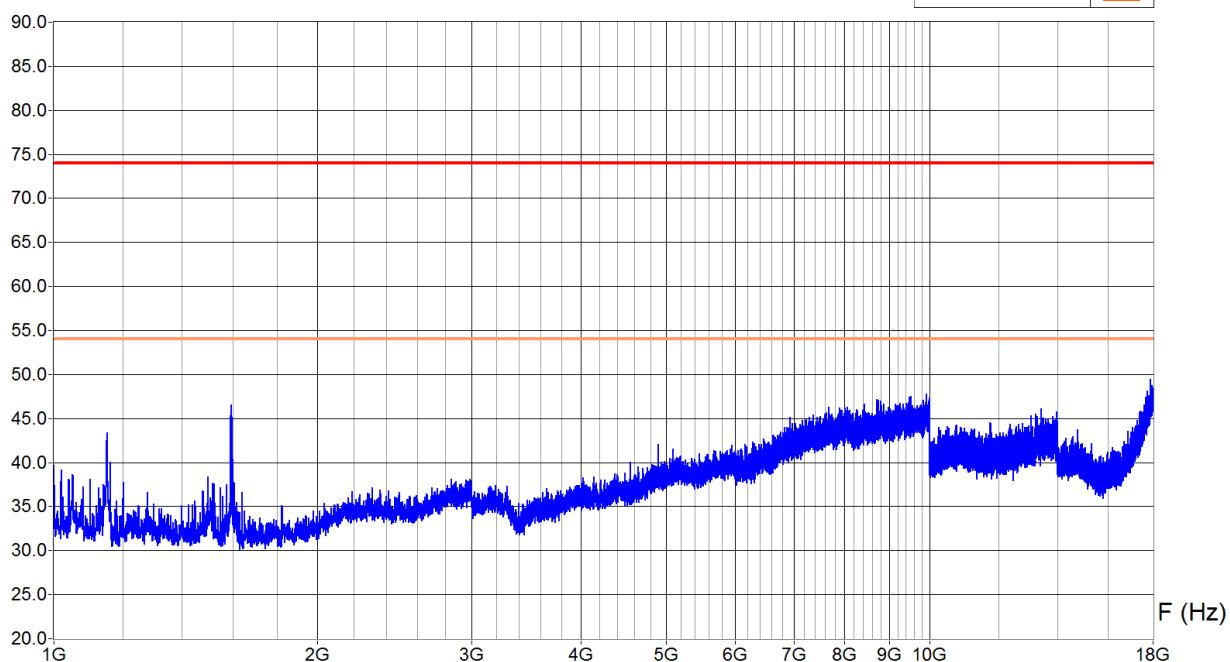
Operating Conditions : RX @ 2440 MHz

Remarks : Peak detector sweep

Level dBuV/m

**CFR 47 §§15.209/109 (@3m)**

PK Limit	
AV Limit	



Zone	1 GHz - 6 GHz	6 GHz - 10 GHz	10 GHz - 14 GHz	14 GHz - 18 GHz
Video Bandwidth	1 MHz	1 MHz	1 MHz	1 MHz
Resol Bandwidth	1 MHz	1 MHz	300 KHz	100 KHz

Validé

Operator: B. Itzcovich  
Date/Time: 16.05.2013 14:15  
Filename:  
20\_RE\_1G-18G\_RX2440\_V.png/.txt

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#### 6.4. Radiated emission - Electromagnetic field (radiated – 18 GHz to 26.5 GHz)

Test site:  anechoic chamber (foam)  anechoic chamber (ferrites)  
 Distance:  10 m  3 m  1 m  0.3 m  
 Position of EUT: 1.5 m (height of the equipment under test above floor)  
 Meas. uncertainty:  $\pm 4.7$  dB  
 Test method: The electromagnetic disturbance radiated by the equipment is measured using a spectrum analyzer and a wide band antenna. The antenna is placed at the same height as the EUT successively with horizontal and vertical polarizations. The turning table is operated through 360° during the measurements. The recordings are carried out taking into account the maximum value (peak) of all the disturbances appearing while the apparatus is under test.

Test set-up:



Remarks: Limit values expressed in  $dB\mu V/m$  and transformed to a measuring distance of 1m  
 (factor used = 20 dB/decade) if necessary  
 e.g.: for  $f = 18GHz$  the limit is  $500\mu V/m$  at 3m;

$$20 \log\left(\frac{500 \frac{\mu V}{m}}{1 \frac{\mu V}{m}}\right) + 20 \log\left(\frac{3m}{1m}\right) = 63.5 \frac{dB\mu V}{m} \text{ at 1m}$$

Test equipment:

Spectrum analyzer	<input type="checkbox"/> 88-14	<input type="checkbox"/> 94-24	<input checked="" type="checkbox"/> 02-06	<input type="checkbox"/> 03-45	<input type="checkbox"/> 05-39	<input type="checkbox"/> 07-53
Antenna with mixer & preamplifier	<input checked="" type="checkbox"/> 98-12					
Cables	<input checked="" type="checkbox"/> 10-81	<input checked="" type="checkbox"/> 11-62				

<b>Result:</b>	<input checked="" type="checkbox"/> <b>pass</b>	<input type="checkbox"/> <b>fail</b>	<input type="checkbox"/> <b>not applicable</b>	<input type="checkbox"/> <b>not tested</b>
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VALID

#### 6.4.1. Transmit mode

Measurement Type : Radiated Field

Polarisation : Horizontal

Table Angle : 0° - 360°

Antenna Height : 1.5 m



Equipment Under Test : TWIN-CAP

Set-Up : Cage 06-00, see photos

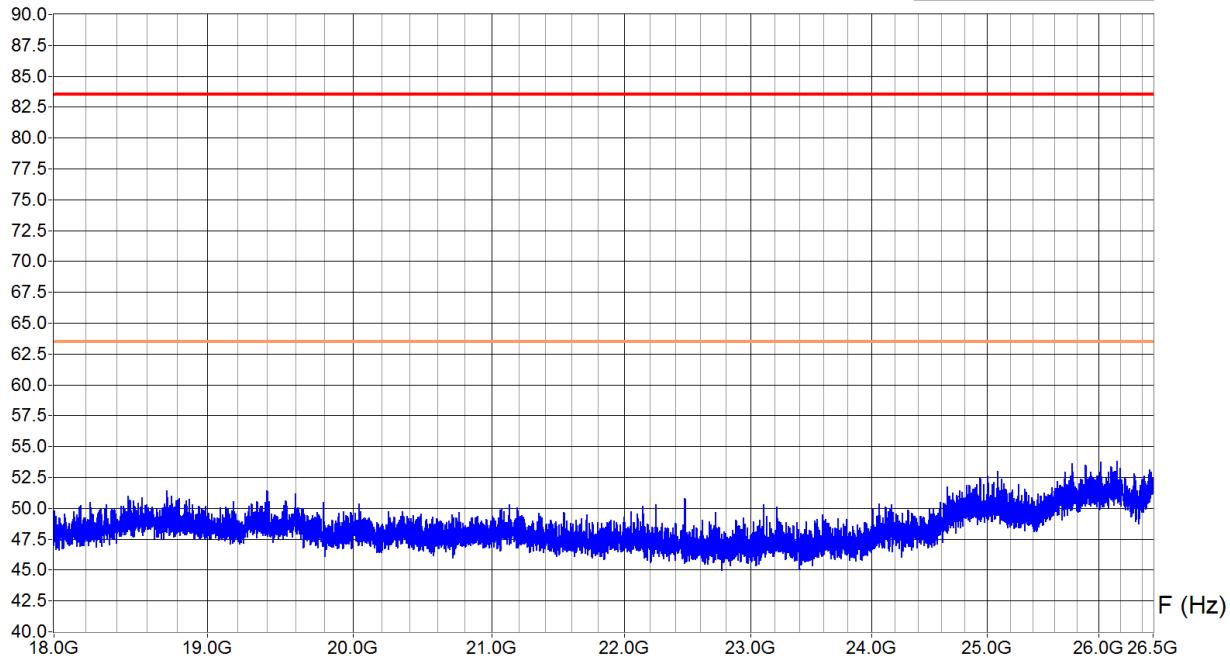
Operating Conditions : TX 0dBm modulated @ 2440 MHz

Remarks : Peak detector sweep

Level dB $\mu$ V/m

#### CFR 47 §§15.209/109 (@1m)

PK Limit	
AV Limit	



Zone	18 GHz - 26.50 GHz
Video Bandwidth	1 MHz
Resol Bandwidth	1 MHz

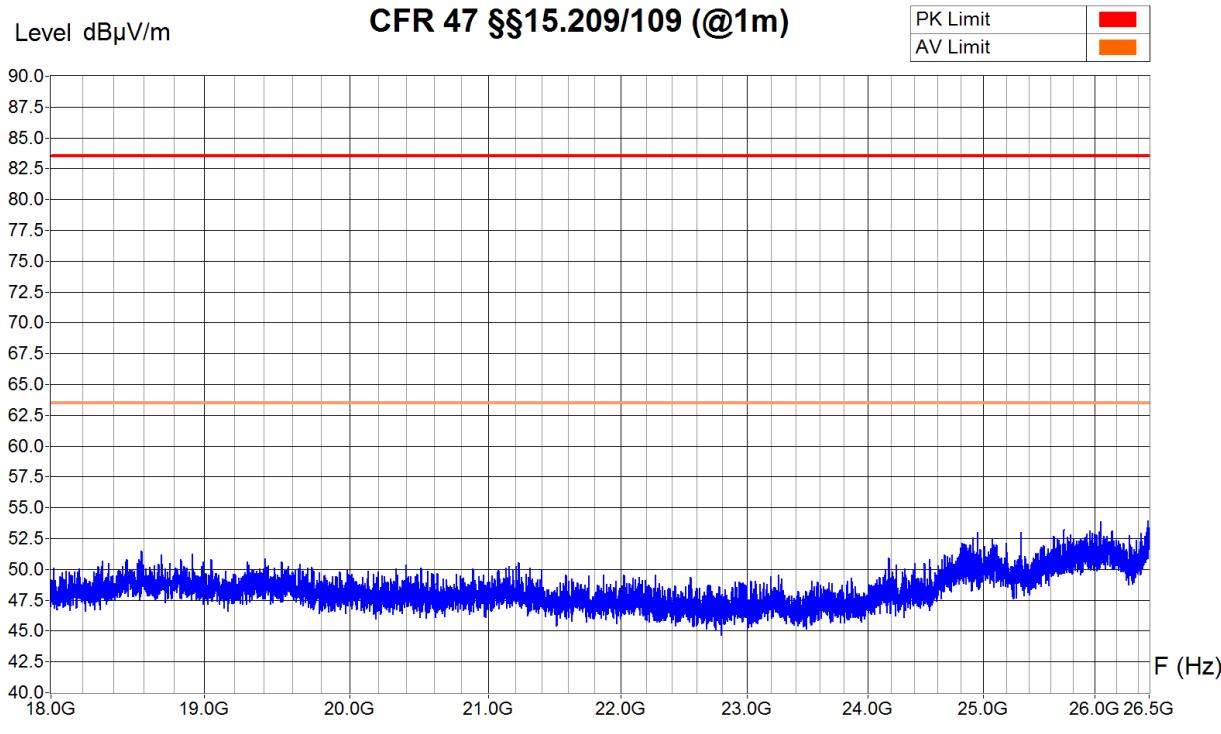
VALID

Operator: B. Itzcovich  
Date/Time: 16.05.2013 15:09  
Filename:  
23\_RE\_18G-  
26G5\_TX2440\_H.png/.txt

Measurement Type : Radiated Field  
 Polarisation : Vertical  
 Table Angle : 0° - 360°  
 Antenna Height : 1.5 m



Equipment Under Test : TWIN-CAP  
 Set-Up : Cage 06-00, see photos  
 Operating Conditions : TX 0dBm modulated @ 2440 MHz  
 Remarks : Peak detector sweep



Zone	18 GHz - 26.50 GHz
Video Bandwidth	1 MHz
Resol Bandwidth	1 MHz

VALID

Operator: B. Itzcovich  
 Date/Time: 16.05.2013 15:13  
 Filename:  
 24\_RE\_18G-  
 26G5\_TX2440\_V.png/.txt

#### 6.4.2. Receive mode

Measurement Type : Radiated Field

Polarisation : Vertical

Table Angle : 0° - 360°

Antenna Height : 1.5 m



Equipment Under Test : TWIN-CAP

Set-Up : Cage 06-00, see photos

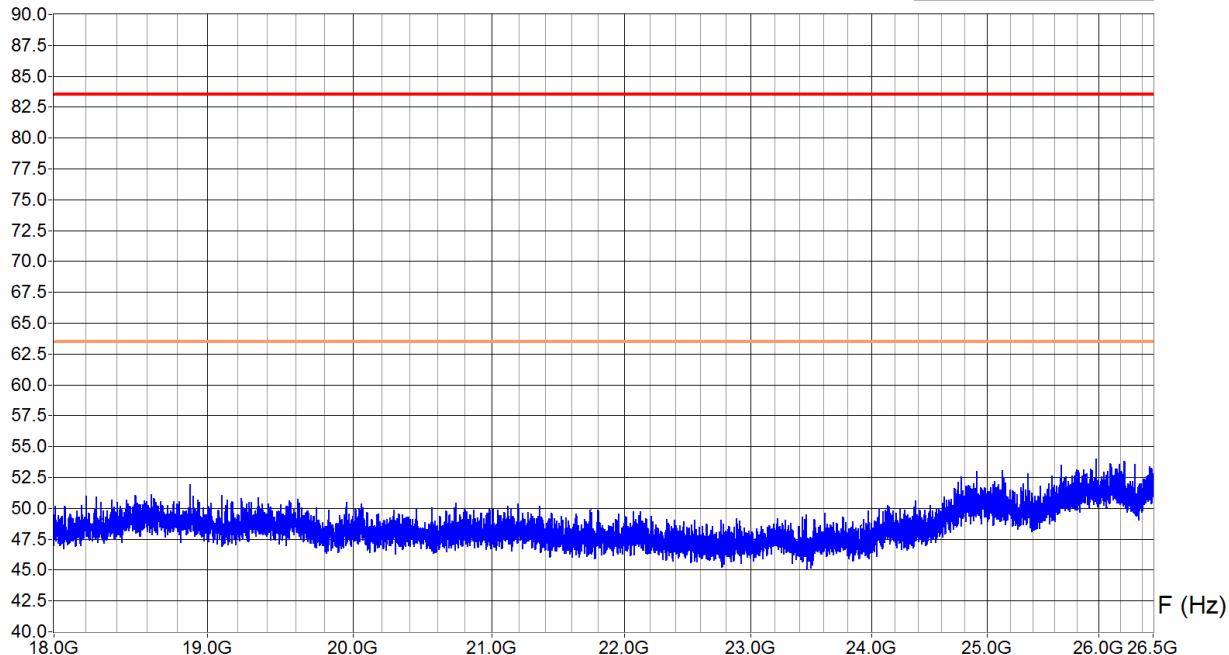
Operating Conditions : RX @ 2440 MHz

Remarks : Peak detector sweep

Level dB $\mu$ V/m

#### CFR 47 §§15.209/109 (@1m)

PK Limit	
AV Limit	



Zone	18 GHz - 26.50 GHz
Video Bandwidth	1 MHz
Resol Bandwidth	1 MHz

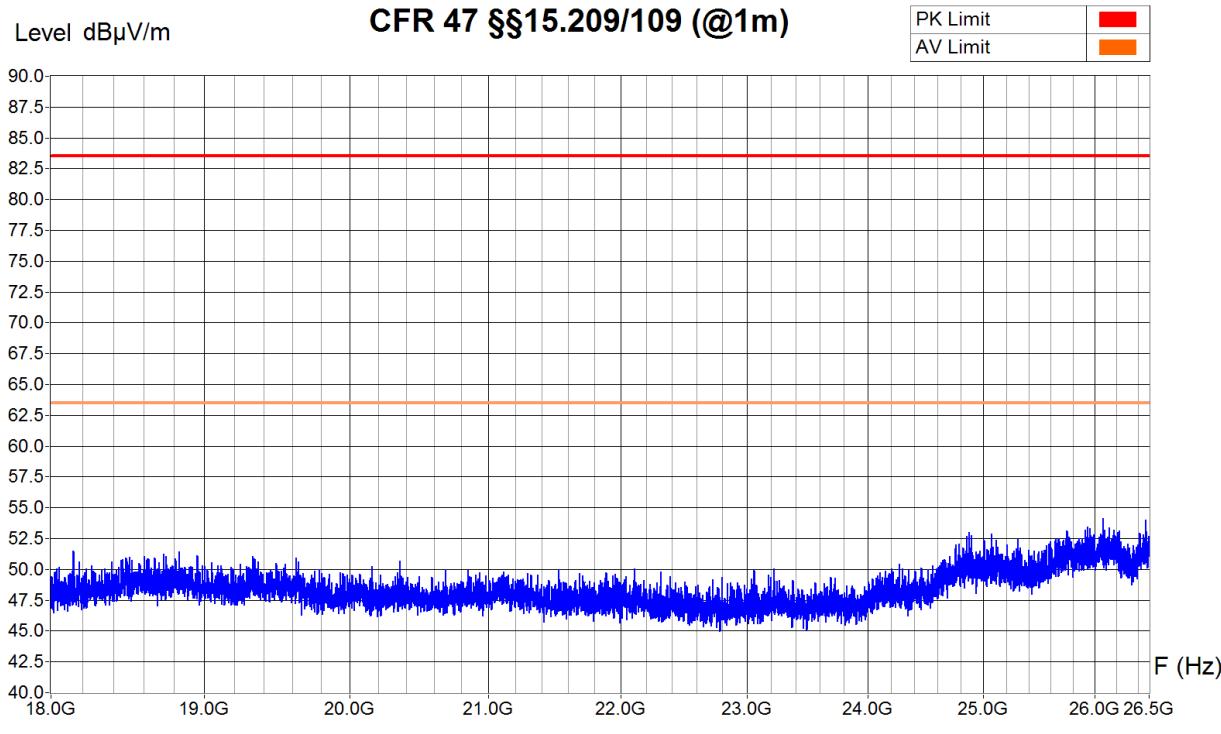
Validé

Operator: B. Itzcovich  
 Date/Time: 16.05.2013 14:54  
 Filename:  
 21\_RE\_18G-  
 26G5\_RX2440\_V.png/.txt

Measurement Type : Radiated Field  
 Polarisation : Horizontal  
 Table Angle : 0° - 360°  
 Antenna Height : 1.5 m



Equipment Under Test : TWIN-CAP  
 Set-Up : Cage 06-00, see photos  
 Operating Conditions : RX @ 2440 MHz  
 Remarks : Peak detector sweep



Zone	18 GHz - 26.50 GHz
Video Bandwidth	1 MHz
Resol Bandwidth	1 MHz

VALID

Operator: B. Itzcovich  
 Date/Time: 16.05.2013 14:59  
 Filename:  
 22\_RE\_18G-  
 26G5\_RX2440\_H.png/.txt

## 6.5. Designation of emission

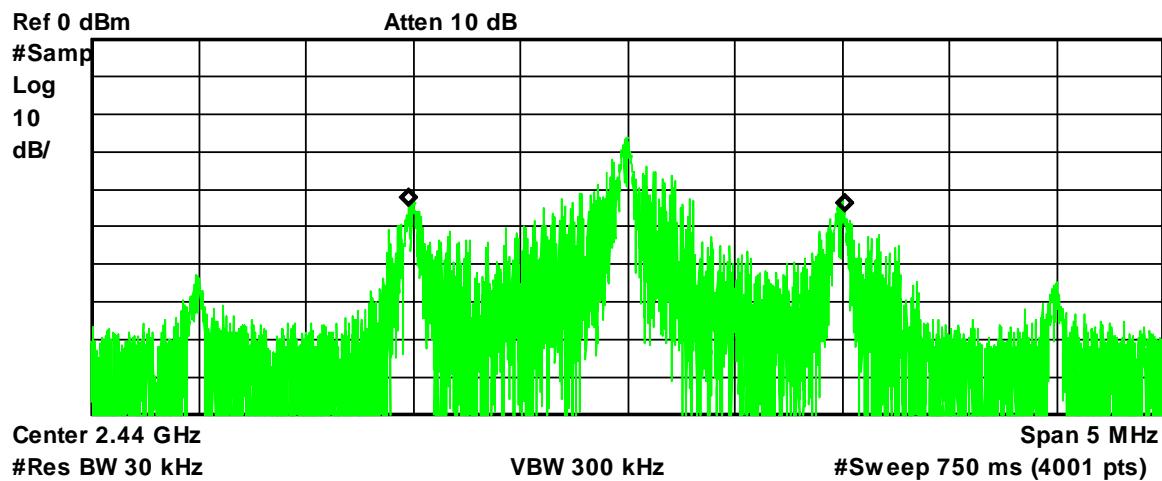
Standard:	United States: 47 CFR "Code of Federal Regulations" – Telecommunication ☒ FCC Part 2, Subpart C: Emission: §2.201 and §2.202
Introduction:	A system of designating emission, modulation and transmission characteristics shall be employed.  (a) Emissions are designated according to their classification and their necessary bandwidth.  (b) A minimum of three symbols are used to describe the basic characteristics of radio waves.  (c) Four symbols are used to describe the necessary bandwidth.
Necessary bandwidth:	For a given class of emission, the minimum value of the occupied bandwidth is sufficient to ensure the transmission of information at the rate and with the quality required for the system employed, under specified conditions.

$B_n = 2.03$  MHz (occupied bandwidth)

Basic characteristics: F1D F : frequency modulation  
1 : a single channel containing digital information without the use of a modulating sub-carrier  
D : data transmission

Designation of emission: 2M03F1D

Agilent 15:33:51 Jan 25, 2013



Occupied Bandwidth  
2.0273 MHz

Occ BW % Pwr 99.00 %  
x dB -26.00 dB

-4.969 kHz  
2.284 MHz\*

Place and date of test: Rossens, January 25, 2013  
Operator: E. de Raemy