# TEST REPORT

**N°: 847040-R1-E** **JDE : 675397**

| | |
|---|---|
| **Subject** | **Electromagnetic compatibility and Radio spectrum Matters (ERM) tests according to standards: FCC CFR 47 Part 15, Subpart C RSS-247 Issue 1.0** |
| **Issued to** | **SCHNEIDER ELECTRIC INDUSTRIES FRANCE**<br>22 Chemin du Vieux Chêne<br>38240 MEYLAN FRANCE |
| **Apparatus under test** | |
| Product | **HU250** |
| Trade mark | **SCHNEIDER ELECTRIC** |
| Manufacturer | **SCHNEIDER ELECTRIC** |
| Model under test | **EMS59000** |
| Serial number | **MP1-7 & MP1-5** |
| FCCID | **2AHHK-EASERGYHU250** |
| ICID | **21156-EASERGYHU250** |
| **Test date** | From August 11th to 14th, 2015 |
| **Test location** | Moirans |
| **IC Test site** | 6500A-1 & 6500A-3 |
| **Test performed by** | G.Deschamps |
| **Composition of document** | 46 pages |
| **Modification of the last version** | None |
| **Document issued on** | April 15, 2016 |

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## SUMMARY

## 1. TEST PROGRAM

**Standard:**
- **FCC Part 15, Subpart C 15.247**
- **ANSI C63.10 (2013)**
- **558074 D01 DTS Measurement Guidance v03r03**
- **RSS-247 Issue 1.0 – May 2015**
- **RSS-Gen Issue 4 – Nov 2014**

| EMISSION TEST | LIMITS | | | RESULTS |
|---|---|---|---|---|
| **Limits for conducted disturbance at mains ports**<br>150kHz-30MHz | **Frequency** | **Quasi-peak value (dBµV)** | **Average value (dBµV)** | ☑ **PASS**<br>☐ **FAIL**<br>☐ **NA**<br>☐ **NP** |
| | 150-500kHz | 66 to 56 | 56 to 46 | |
| | 0.5-5MHz | 56 | 46 | |
| | 5-30MHz | 60 | 50 | |
| **Radiated emissions**<br>9kHz-30MHz<br>*CFR 47 §15.209 (a)*<br>*CFR 47 §15.247 (d)*<br>*RSS-247 §5.5* | **Measure at 300m**<br>9kHz-490kHz : 67.6dBµV/m /F(kHz)<br>**Measure at 30m**<br>490kHz-1.705MHz : 87.6dBµV/m /F(kHz)<br>1.705MHz-30MHz : 29.5 dBµV/m | | | ☐ **PASS**<br>☐ **FAIL**<br>☑ **NA**<br>☐ **NP** |
| **Radiated emissions**<br>30MHz-25GHz*<br>*CFR 47 §15.209 (a)*<br>*CFR 47 §15.247 (d)*<br>*RSS-247 §5.5*<br>***Highest frequency :***<br>***(Declaration of provider)*** | **Measure at 3m**<br>30MHz-88MHz : 40 dBµV/m<br>88MHz-216MHz : 43.5 dBµV/m<br>216MHz-960MHz : 46.0 dBµV/m<br>Above 960MHz : 54.0 dBµV/m | | | ☑ **PASS**<br>☐ **FAIL**<br>☐ **NA**<br>☐ **NP** |
| **Bandwidth 6dB**<br>*CFR 47 §*15.247 (a) (2)<br>*RSS-247 §5.2.1* | **At least 500kHz** | | | ☑ **PASS**<br>☐ **FAIL**<br>☐ **NA**<br>☐ **NP** |
| **Power spectral Density**<br>*CFR 47 §15.247 (e)*<br>*RSS-247 §5.2.2* | **Limit: 8dBm/3kHz** | | | ☑ **PASS**<br>☐ **FAIL**<br>☐ **NA**<br>☐ **NP** |
| **Maximum Peak Output Power**<br>*CFR 47 §*15.247 (b)<br>*RSS-247 §5.4.4* | **Limit: 30dBm**<br>Conducted or Radiated measurement | | | ☑ **PASS**<br>☐ **FAIL**<br>☐ **NA**<br>☐ **NP** |
| **Band Edge Measurement**<br>*CFR 47 §15.209 (a)*<br>*CFR 47 §15.247 (d)*<br>*RSS-247 §5.5* | **Limit: -20dBc or**<br>**Radiated emissions limits in restricted bands** | | | ☑ **PASS**<br>☐ **FAIL**<br>☐ **NA**<br>☐ **NP** |
| **Occupied bandwidth**<br>*RSS-Gen §4.6.1* | **No limit** | | | ☑ **PASS**<br>☐ **FAIL**<br>☐ **NA**<br>☐ **NP** |
| **Receiver Spurious Emission****<br>*RSS-Gen §4.10* | **See RSS-Gen §4.10** | | | ☐ **PASS**<br>☐ **FAIL**<br>☑ **NA**<br>☐ **NP** |

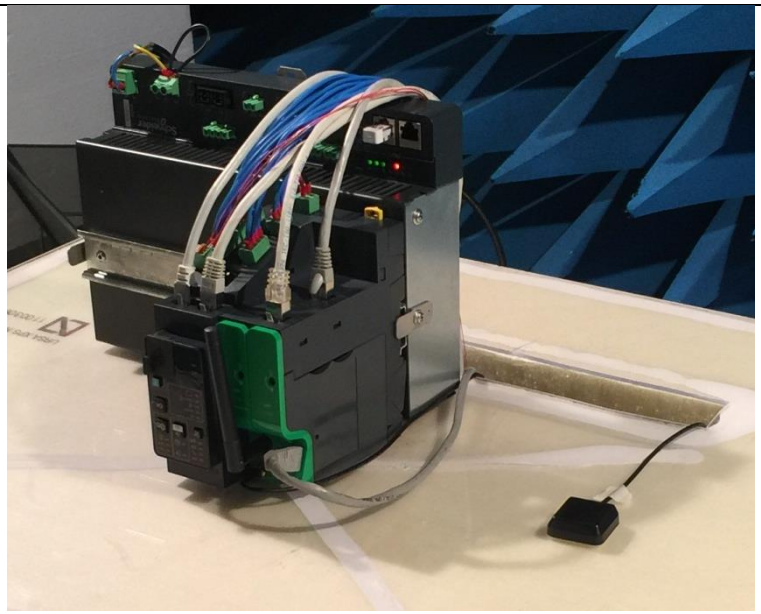
***§15.33:** The highest internal source of a testing device is defined like more the highest frequency generated or used in the testing device or on which the testing device works or agrees.
- If the highest frequency of the internal sources of the testing device is lower than 108 MHz, measurement must 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. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):*

**Equipment under test (EUT):**
**EMS59000**
**Serial Number: MP1-7**



Photography of EUT

**Power supply:**
During all the tests, EUT is supplied by $V_{nom}$: 12VDC
For measurement with different voltage, it will be presented in test method.

| Name | Type | Rating | Reference / Sn | Comments |
|---|---|---|---|---|
| Supply1 | ☐ AC ☑ DC ☐ Battery | 12VDC | - | - |

**Inputs/outputs - Cable:**

| Access | Type | Length used (m) | Declared <3m | Shielded | Under test | Comments |
|---|---|---|---|---|---|---|
| 1 | Power supply (DC) | 0.05 | ☐ | ☐ | ☐ | 12V |
| 2 | WLAN | 1 | ☐ | ☑ | ☐ | |
| 3 | Modbus | 1 | ☐ | ☑ | ☐ | |
| 4 | 3rd Party | 1 | ☐ | ☑ | ☐ | |
| 5 | Lampes BVE | 1 | ☐ | ☑ | ☐ | |
| 6 | Outputs | 1 | ☐ | ☑ | ☐ | |
| 7 | Inputs | 1 | ☐ | ☑ | ☐ | |
| 8 | K7 RS485 | 1 | ☐ | ☐ | ☐ | |
| 9 | LAN1 | 1 | ☐ | ☑ | ☐ | com for test |

**Auxiliary equipment used during test:**

| Type | Reference | Sn | Comments |
|---|---|---|---|
| Power Supply DC | EMS58588 (PS50) | 15260019 | Provided by Schneider |
| Power supply DC | TDK | - | Ref LCIE : A7044055 |
| K7 GSM/GPS | EMS59153 | - | |
| K7 RS485 | EMS59151 | - | |

**Equipment information:**

| Type: | **WIFI** | | | | |
|---|---|---|---|---|---|
| Frequency band: | [2400 – 2483.5] MHz | | | | |
| Standard: | ☑ 802.11b | ☑ 802.11g | ☑ 802.11n HT20 | ☑ 802.11n HT40 | |
| Spectrum Modulation: | ☑ DSSS | | ☑ OFDM | | |
| Number of Channel: | 13 | | | | |
| Spacing channel: | 5MHz | | | | |
| Channel bandwidth: | ☑ 20MHz | | ☑ 40MHz | | |
| Antenna Type: | ☑ Integral | ☐ External | ☐ Dedicated | | |
| Antenna connector: | ☐ Yes | ☑ No | ☑ Temporary for test | | |
| Transmit chains: | ☑ 1 | ☐ 2 | ☐ 3 | ☐ 4 | |
| | ☑ Single antenna | ☐ Symmetrical | ☐ Asymmetrical | | |
| | Gain 1: 2.27dBi | Gain 2: dBi | Gain 3: dBi | Gain 4: dBi | Accumuled Gain: dBi |
| Beam forming gain: | ☐ Yes: dB | | ☑ No | | |
| Receiver chains | ☑ 1 | ☐ 2 | ☐ 3 | ☐ 4 | |
| Type of equipment: | ☑ Stand-alone | ☐ Plug-in | ☐ Combined | | |
| Ad-Hoc mode: | ☐ Yes | | ☑ No | | |
| Adaptivity mode: | ☑ Yes (Load Based) | ☐ Off mode | ☑ No | | |
| | Clear Channel Assessment Time | | µs | | |
| | q value for Load Based Equipment | | | | |
| Duty cycle: | ☑ Continuous duty | ☐ Intermittent duty | ☐ 100% duty | | |
| Equipment type: | ☐ Production model | | ☑ Pre-production model | | |
| Type of power source: | ☐ AC power supply | ☑ DC power supply | ☐ Battery (Select Type) | | |

| CHANNEL PLAN | |
|---|---|
| **802.11b / 802.11g / 802.11n HT20** | |
| Channel | Frequency (MHz) |
| **Cmin: 1** | **2412** |
| 2 | 2417 |
| 3 | 2422 |
| 4 | 2427 |
| 5 | 2432 |
| 6 | 2437 |
| **Cmid: 7** | **2442** |
| 8 | 2447 |
| 9 | 2452 |
| 10 | 2457 |
| 11 | 2462 |
| 12 | 2467 |
| **Cmax: 13** | **2472** |

| CHANNEL PLAN | |
|---|---|
| **802.11n HT40** | |
| Channel | Frequency (MHz) |
| **Cmin: 3** | **2422** |
| 4 | 2427 |
| 5 | 2432 |
| 6 | 2437 |
| **Cmid: 7** | **2442** |
| 8 | 2447 |
| 9 | 2452 |
| 10 | 2457 |
| **Cmax: 11** | **2462** |

| DATA RATE | | |
|---|---|---|
| 802.11b | | |
| **Data Rate (Mbps)** | **Modulation Type** | **Modulation Worst Case** |
| 1 | DBPSK | ☑ |
| 2 | DQPSK | ☐ |
| 5.5 | DQPSK | ☐ |
| 11 | CCK | ☐ |

| DATA RATE | | |
|---|---|---|
| 802.11g | | |
| **Data Rate (Mbps)** | **Modulation Type** | **Modulation Worst Case** |
| 6 | BPSK | ☑ |
| 9 | BPSK | ☐ |
| 12 | QPSK | ☐ |
| 18 | QPSK | ☐ |
| 24 | 16-QAM | ☐ |
| 36 | 16-QAM | ☐ |
| 48 | 64-QAM | ☐ |
| 54 | 64-QAM | ☐ |

| DATA RATE | | | | | | |
|---|---|---|---|---|---|---|
| 802.11n HT20 | | | | | | |
| Available for EUT | MCS Index | Spatial streams | Modulation | Data Rate (Mbps) | | Worst Case Modulation |
| | | | | (GI = 800ns) | (GI = 400ns) | |
| ☑ | 0 | 1 | BPSK | 6.5 | 7.2 | ☑ |
| ☑ | 1 | 1 | QPSK | 13 | 14.4 | ☐ |
| ☑ | 2 | 1 | QPSK | 19.5 | 21.7 | ☐ |
| ☑ | 3 | 1 | 16-QAM | 26 | 28.9 | ☐ |
| ☑ | 4 | 1 | 16-QAM | 39 | 43.3 | ☐ |
| ☑ | 5 | 1 | 64-QAM | 52 | 57.8 | ☐ |
| ☑ | 6 | 1 | 64-QAM | 58.5 | 65 | ☐ |
| ☑ | 7 | 1 | 64-QAM | 65 | 72.2 | ☐ |
| ☐ | 8 | 2 | BPSK | 13 | 14.4 | ☐ |
| ☐ | 9 | 2 | QPSK | 26 | 28.9 | ☐ |
| ☐ | 10 | 2 | QPSK | 39 | 43.3 | ☐ |
| ☐ | 11 | 2 | 16-QAM | 52 | 57.8 | ☐ |
| ☐ | 12 | 2 | 16-QAM | 78 | 86.7 | ☐ |
| ☐ | 13 | 2 | 64-QAM | 104 | 115.6 | ☐ |
| ☐ | 14 | 2 | 64-QAM | 117 | 130.3 | ☐ |
| ☐ | 15 | 2 | 64-QAM | 130 | 144.4 | ☐ |
| ☐ | 16 | 3 | BPSK | 19.5 | 21.7 | ☐ |
| ☐ | 17 | 3 | QPSK | 39 | 43.3 | ☐ |
| ☐ | 18 | 3 | QPSK | 58.5 | 65 | ☐ |
| ☐ | 19 | 3 | 16-QAM | 78 | 86.7 | ☐ |
| ☐ | 20 | 3 | 16-QAM | 117 | 130 | ☐ |
| ☐ | 21 | 3 | 64-QAM | 156 | 173.3 | ☐ |
| ☐ | 22 | 3 | 64-QAM | 175.5 | 195 | ☐ |
| ☐ | 23 | 3 | 64-QAM | 195 | 216.7 | ☐ |
| ☐ | 24 | 4 | BPSK | 26 | 28.9 | ☐ |
| ☐ | 25 | 4 | QPSK | 52 | 57.8 | ☐ |
| ☐ | 26 | 4 | QPSK | 78 | 86.7 | ☐ |
| ☐ | 27 | 4 | 16-QAM | 104 | 115.6 | ☐ |
| ☐ | 28 | 4 | 16-QAM | 156 | 173.3 | ☐ |
| ☐ | 29 | 4 | 64-QAM | 208 | 231.1 | ☐ |
| ☐ | 30 | 4 | 64-QAM | 234 | 260 | ☐ |
| ☐ | 31 | 4 | 64-QAM | 260 | 288.9 | ☐ |

| DATA RATE | | | | | | |
|---|---|---|---|---|---|---|
| 802.11n HT40 | | | | | | |
| Available for EUT | MCS Index | Spatial streams | Modulation | Data Rate (Mbps) | | Worst Case Modulation |
| | | | | (GI = 800ns) | (GI = 400ns) | |
| ☑ | 0 | 1 | BPSK | 13 | 15 | ☑ |
| ☑ | 1 | 1 | QPSK | 27 | 30 | ☐ |
| ☑ | 2 | 1 | QPSK | 40.5 | 45 | ☐ |
| ☑ | 3 | 1 | 16-QAM | 54 | 60 | ☐ |
| ☑ | 4 | 1 | 16-QAM | 81 | 90 | ☐ |
| ☑ | 5 | 1 | 64-QAM | 108 | 120 | ☐ |
| ☑ | 6 | 1 | 64-QAM | 121.5 | 135 | ☐ |
| ☑ | 7 | 1 | 64-QAM | 135 | 150 | ☐ |
| ☐ | 8 | 2 | BPSK | 27 | 30 | ☐ |
| ☐ | 9 | 2 | QPSK | 54 | 60 | ☐ |
| ☐ | 10 | 2 | QPSK | 81 | 90 | ☐ |
| ☐ | 11 | 2 | 16-QAM | 108 | 120 | ☐ |
| ☐ | 12 | 2 | 16-QAM | 162 | 180 | ☐ |
| ☐ | 13 | 2 | 64-QAM | 216 | 240 | ☐ |
| ☐ | 14 | 2 | 64-QAM | 243 | 270 | ☐ |
| ☐ | 15 | 2 | 64-QAM | 270 | 300 | ☐ |
| ☐ | 16 | 3 | BPSK | 40.5 | 45 | ☐ |
| ☐ | 17 | 3 | QPSK | 81 | 90 | ☐ |
| ☐ | 18 | 3 | QPSK | 121.5 | 135 | ☐ |
| ☐ | 19 | 3 | 16-QAM | 162 | 180 | ☐ |
| ☐ | 20 | 3 | 16-QAM | 243 | 270 | ☐ |
| ☐ | 21 | 3 | 64-QAM | 324 | 360 | ☐ |
| ☐ | 22 | 3 | 64-QAM | 364.5 | 405 | ☐ |
| ☐ | 23 | 3 | 64-QAM | 405 | 450 | ☐ |
| ☐ | 24 | 4 | BPSK | 54 | 60 | ☐ |
| ☐ | 25 | 4 | QPSK | 108 | 120 | ☐ |
| ☐ | 26 | 4 | QPSK | 162 | 180 | ☐ |
| ☐ | 27 | 4 | 16-QAM | 216 | 240 | ☐ |
| ☐ | 28 | 4 | 16-QAM | 324 | 360 | ☐ |
| ☐ | 29 | 4 | 64-QAM | 432 | 480 | ☐ |
| ☐ | 30 | 4 | 64-QAM | 486 | 540 | ☐ |
| ☐ | 31 | 4 | 64-QAM | 540 | 600 | ☐ |

## 2.1. RUNNING MODE

The EUT is set in the following modes during tests with simulator / software (PuTTY v0.62):
- Permanent emission with modulation on a fixed channel in the data rate that produced the highest power
- Permanent reception
- Emission-reception with a duty cycle above 30% in the data rate that produced the highest output power

## 2.2. EQUIPMENT MODIFICATIONS

☑ None ☐ Modification:

## 2.3. 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 dBµV/m
The 32 dBµV/m value can be mathematically converted to its corresponding level in µV/m.
Level in µV/m = Common Antilogarithm [(32dBµV/m)/20] = 39.8 µV/m.

## 2.4. CALIBRATION DATE

The calibration intervals are extended at 12+2 months. This extended interval is based on the fact that there is sufficient calibration data to statistically establish a trend or based on experience of use of the test equipment to assure good measurement results for a longer period

## 3. CONDUCTED EMISSION DATA

### 3.1. ENVIRONMENTAL CONDITIONS

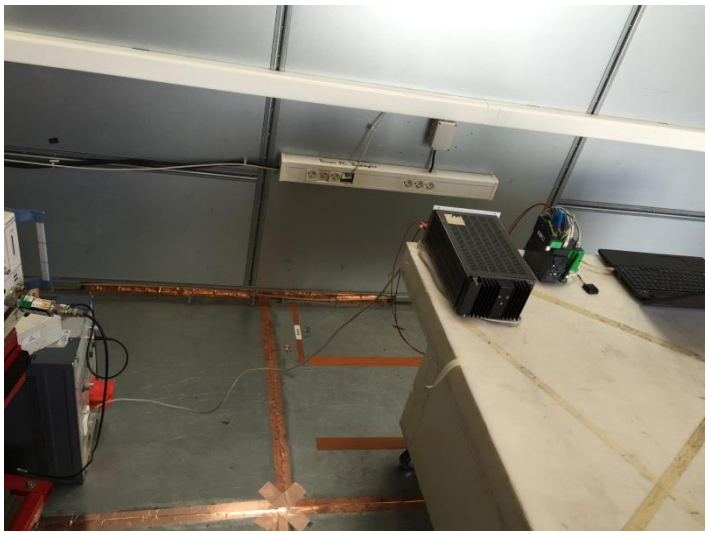
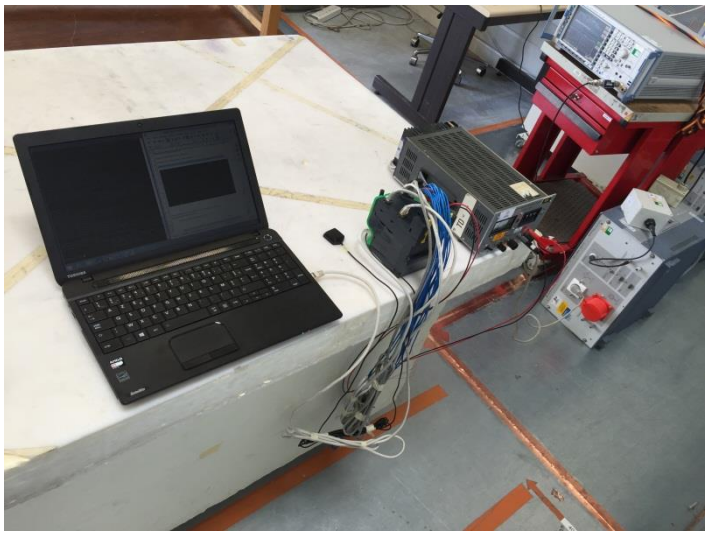
| | |
|---|---|
| Date of test | :August 13th, 2015 |
| Test performed by | :G.Deschamps |
| Atmospheric pressure (hPa) | :993 |
| Relative humidity (%) | :33 |
| Ambient temperature (°C) | :22 |

### 3.2. TEST SETUP

***Mains terminals***

The EUT and auxiliaries are set:
☑ 80cm above the ground on the non-conducting table (Table-top equipment)
☐ 10cm above the ground on isolating support (Floor standing equipment)
The distance between the EUT and the LISN is 80cm. The EUT is 40cm away for the vertical ground plane.

The EUT is powered by $V_{nom}$.
The EUT is powered through a LISN (measure). Auxiliaries are powered by another LISN.

*Test setup*

### 3.3. TEST METHOD

The product has been tested according to ANSI C63.10 and FCC Part 15 subpart C. The product has been tested with 120V/60Hz power line voltage and compared to the FCC Part 15 limits. Measurement bandwidth was 9kHz from 150kHz to 30MHz. 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.
Measurements are performed on the phase (L1) and neutral (N) of power line voltage. Graphs are obtained in PEAK detection. Measures are also performed in Quasi-Peak and Average for any strong signal.

### *3.4. TEST EQUIPMENT LIST*

| DESCRIPTION | MANUFACTURER | MODEL | N° LCIE | Cal_Date | Cal_Due |
|---|---|---|---|---|---|
| Cable + self | - | - | A5329585 | 06/15 | 06/16 |
| Conducted emission comb generator | BARDET | - | A3169049 | - | - |
| Power supply DC | TDK | - | A7044055 | - | - |
| LISN tri-phase ESH2-Z5 | RHODE & SCHWARZ | 33852.19.53 | C2320063 | 11/14 | 11/15 |
| Receiver 20Hz – 8GHz | ROHDE & SCHWARZ | ESU8 | A2642019 | 04/15 | 04/16 |
| Thermo-hygrometer (PM2) | OREGON | BAR916HG-G | B4206011 | 04/15 | 04/16 |
| Transient limiter | RHODE & SCHWARZ | ESH3-Z2 | A7122204 | 11/14 | 11/15 |

### *3.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION*

☑ None ☐ Divergence:

### *3.6. TEST RESULTS*

Measurements are performed on the phase (L1) and neutral (N) of the power line.
**Results: (PEAK detection)**

| | | |
|---|---|---|
| Measure on L1: | graph **Emc#1** | (see annex 1) |
| Measure on N: | graph **Emc#2** | (see annex 1) |

### *3.7. CONCLUSION*

Conducted emission data measurement performed on the sample of the product **EMS59000**, SN: **MP1-5**, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 and RSS-247 Issue 1.0 limits.

## 4. RADIATED EMISSION DATA

### *4.1. ENVIRONMENTAL CONDITIONS*

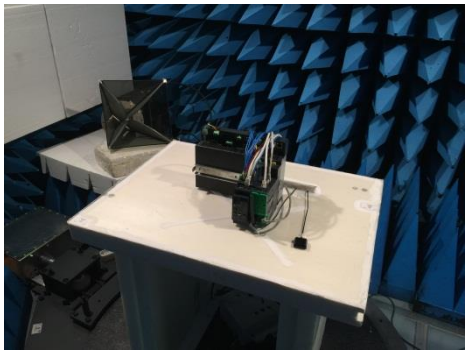
| | | |
|---|---|---|
| Date of test | :August 13th, 2015 | :August 14th, 2015 |
| Test performed by | :G.Deschamps | :G.Deschamps |
| Atmospheric pressure (hPa) | :993 | :992 |
| Relative humidity (%) | :33 | :39 |
| Ambient temperature (°C) | :22 | :20 |

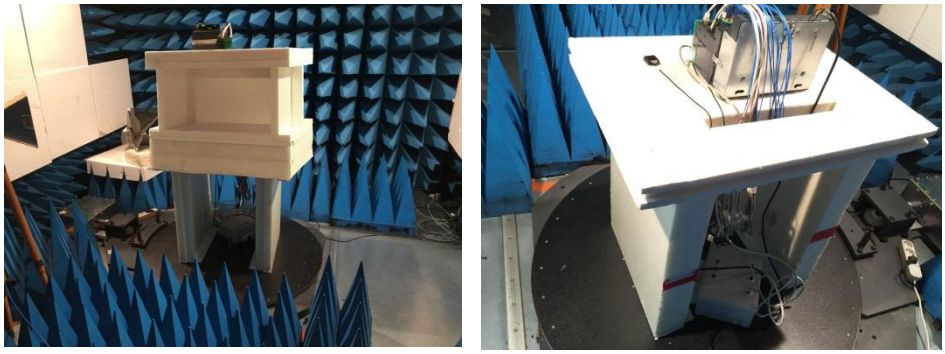
### *4.2. TEST SETUP*

The installation of EUT is identical for pre-characterization measures in a 3 meters semi- anechoic chamber and for measures on the 10 meters Open site.
The EUT and auxiliaries are set:
☑ 80cm above the ground on the non-conducting table (Table-top equipment) - Below 1GHz
☑ 150cm above the ground on the non-conducting table (Table-top equipment) - Above 1GHz
☐ 10cm above the ground on isolating support (Floor standing equipment)
The EUT is powered by $V_{nom}$.



*Test setup on OATS*



*Test setup in anechoic chamber*

### *4.3. TEST METHOD*

The product has been tested according to ANSI C63.10, FCC part 15 subpart C.

Pre-characterisation measurement: (9kHz – 25GHz)
A pre-scan of all the setup has been performed in a 3 meters semi-anechoic chamber for frequency from 30MHz to 25GHz. Test is performed in horizontal (H) and vertical (V) polarization, the loop antenna was rotated during the test to maximize the emission measurement. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on all axis of EUT used in normal configuration.
The pre-characterization graphs are obtained in PEAK detection and PEAK/AVERAGE from 1GHz to 25GHz.

Characterization on 10 meters open site from 9kHz to 1GHz:
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 limits. Measurement bandwidth was 9kHz below 30MHz and 120kHz from 30 MHz to 1GHz. Test is performed in horizontal (H) and vertical (V) polarization, the loop antenna was rotated during the test to maximize the emission measurement. The height antenna is varied from 1m to 4m. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on all axis of EUT used in normal configuration. A summary of the worst case emissions found in all test configurations and modes is shown.
Frequency list has been created with anechoic chamber pre-scan results.

Characterization on 3 meters full anechoic chamber from 1GHz to 25GHz:
The product has been tested at a distance of **3 meters** from the antenna and compared to the FCC part 15 subpart C limits. Measurement bandwidth was 1MHz from 1GHz to 25GHz.
Test is performed in horizontal (H) and vertical (V) polarization. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on all axis of EUT used in normal configuration. A summary of the worst case emissions found in all test configurations and modes is shown.The height antenna is
☐ On mast, varied from 1m to 4m
☑ Fixed and centered on the EUT (EUT smaller than the beamwidth of the measurement antenna, ANSI C63.10 §6.6.5)
Frequency list has been created with anechoic chamber pre-scan results.

## 4.4. TEST EQUIPMENT LIST

| DESCRIPTION | MANUFACTURER | MODEL | N° LCIE | Cal_Date | Cal_Due |
|---|---|---|---|---|---|
| Antenna Bi-log | CHASE | CBL6111A | C2040051 | 04/14 | 04/16 |
| Antenna Bi-log | CHASE | CBL6111A | C2040172 | 06/15 | 06/17 |
| Cable Measure @3m | - | - | A5329038 | 08/14 | 08/15 |
| Cable | SUCOFLEX | 106G | A5329061 | 03/15 | 03/16 |
| Cable Measure @3m | - | - | A5329206 | 04/15 | 04/16 |
| Cable (OATS) | - | - | A5329623 | 10/14 | 10/15 |
| Semi-Anechoic chamber #3 | SIEPEL | - | D3044017 | - | - |
| Radiated emission comb generator | BARDET | - | A3169050 | - | - |
| OATS | - | - | F2000409 | 09/14 | 09/15 |
| Power supply DC | TDK | - | A7044055 | - | - |
| Receiver 20Hz – 8GHz | ROHDE & SCHWARZ | ESU8 | A2642019 | 04/15 | 04/16 |
| Spectrum analyzer | ROHDE & SCHWARZ | FSV 30 | A4060050 | 01/15 | 01/16 |
| Thermo-hygrometer (PM2) | OREGON | BAR916HG-G | B4206011 | 04/15 | 04/16 |
| Turntable chamber (Cage#3) | ETS Lingren | Model 2165 | F2000371 | - | - |
| Turntable / Mast controller (OATS) | ETS Lindgren | Model 2066 | F2000372 | - | - |
| Antenna mast (OATS) | ETS Lindgren | 2071-2 | F2000392 | - | - |
| Turntable (OATS) | ETS Lindgren | Model 2187 | F2000403 | - | - |
| Table | MATURO Gmbh | - | F2000437 | - | - |
| Table | LCIE | - | F2000461 | - | - |
| Turntable controller (Cage#3) | ETS Lingren | Model 2090 | F2000444 | - | - |

## 4.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

## *4.6. TEST RESULTS*

### 4.6.1. Pre-characterization at 3 meters [30MHz-1GHz]

**See graphs for 30MHz-1GHz:**

| Graph identifier | Polarization | Mode | EUT position | Comments |
|---|---|---|---|---|
| Emr# 1 | H/V | TX | Axis XY | See annex 1 |

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

**Worst case final data result:**

Frequency list has been created with semi-anechoic chamber pre-scan results.
Measurements are performed using a QUASI-PEAK detection.

| No | Frequency (MHz) | Limit QPeak (dBµV/m) | Measure QPeak (dBµV/m) | Margin QPeak (dB) | Angle Table (°) | Pol. Ant. | Ht. Ant. (cm) | FC (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 38.186 | 40.0 | 35.6 | **-4.4** | 320 | V | 100 | 15.3 | |
| 2 | 49.298 | 40.0 | 37.6 | **-2.4** | 290 | V | 100 | 9.7 | |
| 3 | 60.209 | 40.0 | 34.6 | **-5.4** | 240 | V | 100 | 7.6 | |
| 4 | 67.196 | 40.0 | 30.7 | **-9.3** | 175 | V | 100 | 7.8 | |
| 5 | 127.274 | 43.5 | 42.3 | **-1.2** | 215 | V | 100 | 13.8 | |
| 6 | 138.834 | 43.5 | 41.3 | **-2.2** | 15 | H | 400 | 13.7 | |
| 7 | 157.520 | 43.5 | 41.8 | **-1.7** | 120 | V | 100 | 12.7 | |
| 8 | 198.878 | 43.5 | 41.9 | **-1.6** | 109 | V | 100 | 11.0 | |
| 9 | 325.000 | 46.0 | 38.1 | **-7.9** | 122 | H | 250 | 16.9 | |
| 10 | 394.200 | 46.0 | 37.0 | **-9.0** | 85 | H | 250 | 19.4 | |
| 11 | 425.016 | 46.0 | 43.1 | **-2.9** | 280 | H | 215 | 19.8 | |
| 12 | 531.052 | 46.0 | 39.6 | **-6.4** | 315 | V | 95 | 22.8 | |
| 13 | 714.720 | 46.0 | 42.0 | **-4.0** | 0 | H | 200 | 25.2 | |
| 14 | 875.028 | 46.0 | 44.2 | **-1.8** | 145 | H | 100 | 28.4 | |
| 15 | 925.029 | 46.0 | 44.2 | **-1.8** | 90 | H | 250 | 28.3 | |

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

### 4.6.3. Characterization on 3meters anechoic chamber from 1GHz to 25GHz

**Worst case final data result:**

The frequency list is created from the results obtained during the pre-characterization in anechoic chamber.
Measurements are performed using a PEAK and AVERAGE detection.

| No | Frequency (MHz) | Limit Peak (dBµV/m) | Measure Peak (dBµV/m) | Margin Peak (dB) | Limit Average (dBµV/m) | Measure Average (dBµV/m) | Margin Average (dB) | Angle Table (°) | Pol. Ant. | Ht. Ant. (cm) | FC (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2310.120 | 74.0 | 58.1 | **-15.9** | 54.0 | 42.9 | **-11.1** | 0 | H | 80 | 30.1 | |
| 2 | 2365.120 | 74.0 | 57.7 | **-16.3** | 54.0 | 43.1 | **-10.9** | 0 | H | 80 | 30.2 | |
| 3 | 2375.550 | 74.0 | 58.2 | **-15.8** | 54.0 | 42.7 | **-11.3** | 0 | H | 80 | 30.2 | |
| 4 | 2381.880 | 74.0 | 58.7 | **-15.3** | 54.0 | 44.2 | **-9.8** | 0 | H | 80 | 30.2 | |
| 5 | 2386.560 | 74.0 | 58.4 | **-15.6** | 54.0 | 44.2 | **-9.8** | 0 | H | 80 | 30.2 | |
| 6 | 2484.020 | 74.0 | 58.4 | **-15.6** | 54.0 | 47.7 | **-6.3** | 120 | H | 80 | 30.4 | |
| 7 | 2487.460 | 74.0 | 58.4 | **-15.6** | 54.0 | 47.7 | **-6.3** | 120 | H | 80 | 30.4 | |
| 8 | 2488.470 | 74.0 | 58.4 | **-15.6** | 54.0 | 47.7 | **-6.3** | 120 | H | 80 | 30.4 | |
| 9 | 2490.450 | 74.0 | 51.4 | **-22.6** | 54.0 | 40.4 | **-13.6** | 140 | H | 80 | 30.4 | |
| 10 | 2491.970 | 74.0 | 51.4 | **-22.6** | 54.0 | 40.4 | **-13.6** | 140 | H | 80 | 30.4 | |
| 11 | 4824.000 | 74.0 | 59.5 | **-14.5** | 54.0 | 52.6 | **-1.4** | 30 | H | 100 | 36.3 | |
| 12 | 4874.000 | 74.0 | 60.2 | **-13.8** | 54.0 | 53.6 | **-0.4** | 30 | H | 100 | 36.5 | |
| 13 | 4924.000 | 74.0 | 60.2 | **-13.8** | 54.0 | 52.2 | **-1.8** | 30 | H | 100 | 36.6 | |

*Note: Measures have been done at 3m distance.*

## *4.7. CONCLUSION*

Radiated emission data measurement performed on the sample of the product **EMS59000**, SN: **MP1-5**, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 and RSS-247 Issue 1.0 limits.

# 5. BANDWIDTH (15.247)

## 5.1. TEST CONDITIONS

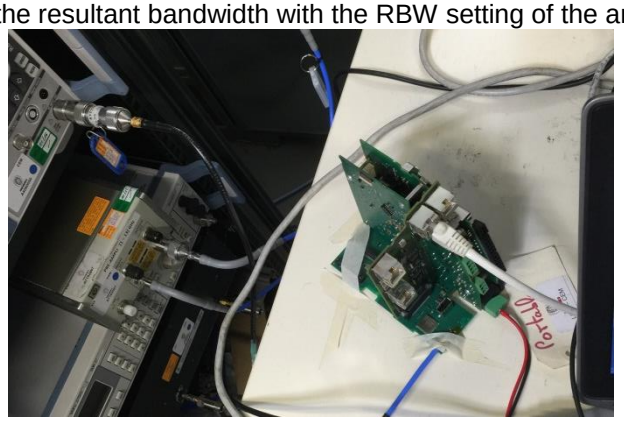
| | |
|---|---|
| Date of test | :August 13th, 2015 |
| Test performed by | :G.Deschamps |
| Atmospheric pressure (hPa) | :990 |
| Relative humidity (%) | :33 |
| Ambient temperature (°C) | :22 |

## 5.2. SETUP

☑ ***Conducted measurement:***
The EUT is turned ON and connected to measurement instrument; the center frequency of the spectrum analyzer is set to the fundamental frequency. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.
Offset: Attenuator+cable 12.7dB

☐ ***Radiated measurement:***
The EUT is placed in an anechoic chamber; the center frequency of the spectrum analyzer is set to the fundamental frequency. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete, a delta marker is used to measure the frequency difference as the emission bandwidth.

***Measurement Procedure: §8.1 Option 1 (DTS Measurement Guidance)***
1. Set resolution bandwidth (RBW) = 100kHz.
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. Compare the resultant bandwidth with the RBW setting of the analyzer.



## 5.3. TEST EQUIPMENT LIST

| DESCRIPTION | MANUFACTURER | MODEL | N° LCIE | Cal_Date | Cal_Due |
|---|---|---|---|---|---|
| Attenuator 10dB | JFW | - | A7122166 | 10/14 | 10/15 |
| Cable SMA | - | - | A5329636 | 11/14 | 11/15 |
| Spectrum analyzer | ROHDE & SCHWARZ | FSV 30 | A4060050 | 01/15 | 01/16 |
| Power supply DC | TDK | - | A7044055 | - | - |
| Thermo-hygrometer (C3) | OREGON | BAR206 | B4204078 | 04/15 | 04/16 |
| Thermo-hygrometer (PM2) | OREGON | BAR916HG-G | B4206011 | 04/15 | 04/16 |

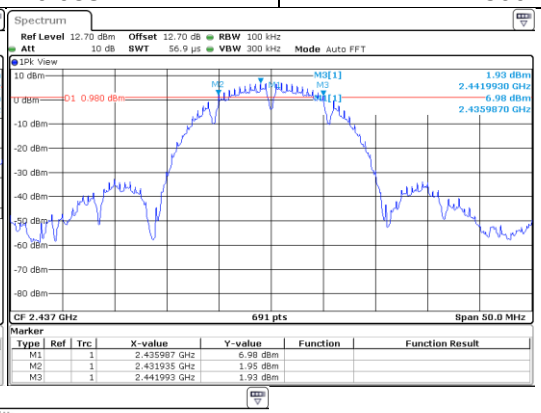
## 5.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

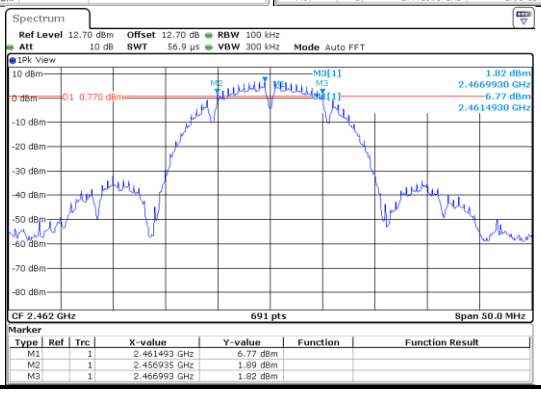
☑ None ☐ Divergence:

## 5.5. TEST SEQUENCE AND RESULTS

***802.11b***

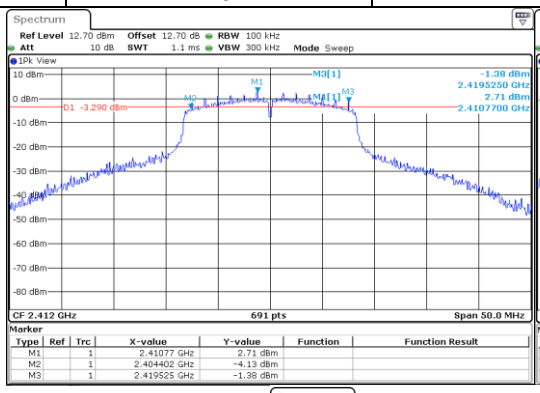
| Channel | Channel Frequency (MHz) | 6dB Bandwidth (kHz) | Bandwidth Limit (kHz) |
|---|---|---|---|
| 1 | 2412 | **10 057** | **>500** |
| 6 | 2437 | **10 043** | **>500** |
| 11 | 2462 | **10 058** | **>500** |

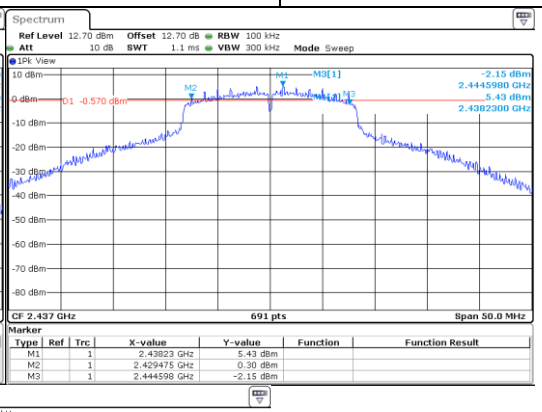



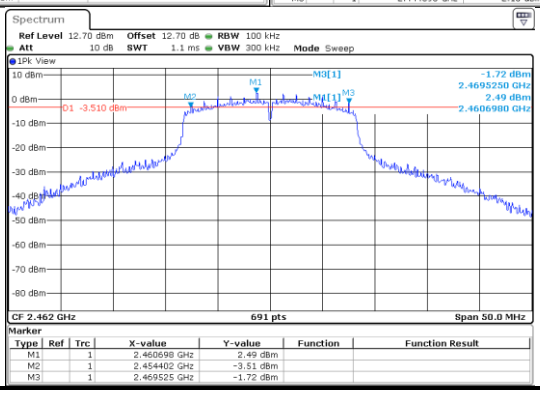



***802.11g***

| Channel | Channel Frequency (MHz) | 6dB Bandwidth (kHz) | Bandwidth Limit (kHz) |
|---|---|---|---|
| 1 | 2412 | **15 123** | **>500** |
| 6 | 2437 | **15 123** | **>500** |
| 11 | 2462 | **15 123** | **>500** |

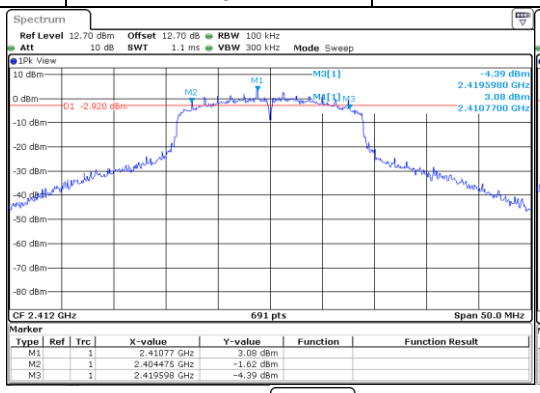


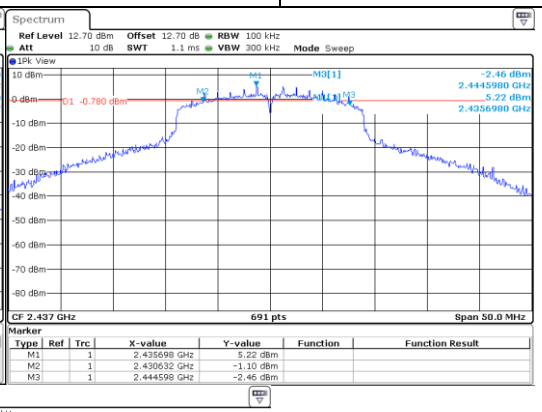



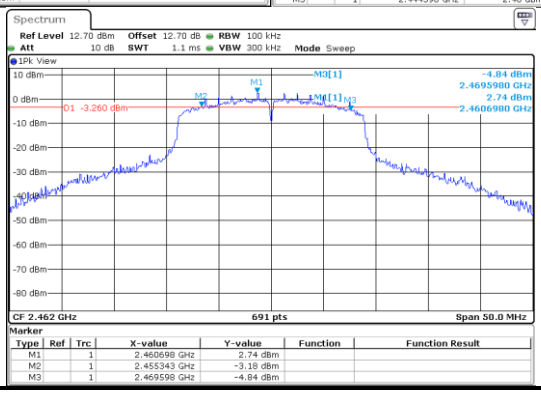



***802.11n HT20***

| Channel | Channel Frequency (MHz) | 6dB Bandwidth (kHz) | Bandwidth Limit (kHz) |
|---|---|---|---|
| 1 | 2412 | **15 123** | **>500** |
| 6 | 2437 | **13 966** | **>500** |
| 11 | 2462 | **14 255** | **>500** |

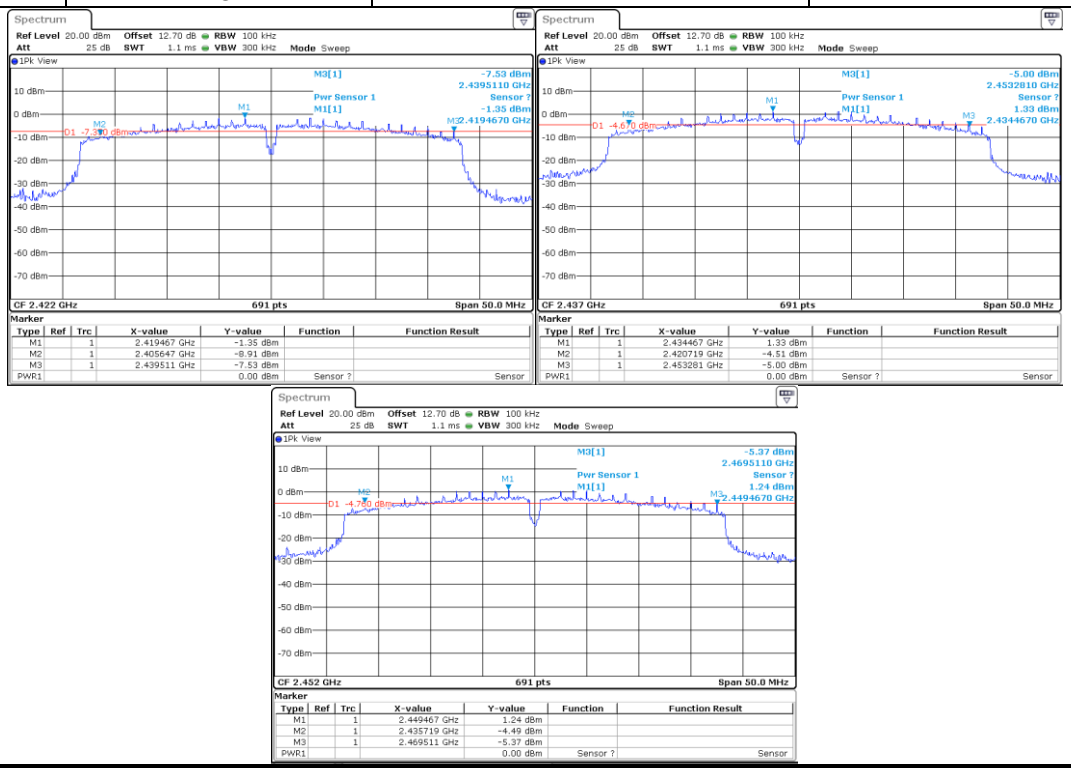


***802.11n HT40***

| Channel | Channel Frequency (MHz) | 6dB Bandwidth (kHz) | Bandwidth Limit (kHz) |
|---|---|---|---|
| 3 | 2422 | **33 864** | **>500** |
| 6 | 2437 | **32 562** | **>500** |
| 9 | 2452 | **33 792** | **>500** |




## *5.6. CONCLUSION*

Bandwidth measurement performed on the sample of the product **EMS59000**, SN: **MP1-7**, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 and RSS-247 Issue 1.0 limits.

# 6. MAXIMUM PEAK OUTPUT POWER (15.247)

## 6.1. TEST CONDITIONS

Date of test :August 13th, 2015
Test performed by :G.Deschamps
Atmospheric pressure (hPa) :990
Relative humidity (%) :33
Ambient temperature (°C) :22

## 6.2. SETUP

☑ ***Conducted measurement:***
The EUT is turned ON and connected to measurement instrument; the center frequency of the spectrum analyzer is set to the fundamental frequency.
Offset: Attenuator+cable 12.7dB

☐ ***Radiated measurement:***
The EUT is placed in an anechoic chamber; the center frequency of the spectrum analyzer is set to the fundamental frequency.
The product has been tested at a distance of 3 meters from the antenna. 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 following table. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.
To demonstrate compliance with peak output power requirement of section 15.247 (b), the transmitter's peak output power is calculated using the following equation:

$$E = \frac{\sqrt{30PG}}{d}$$

Where:
- E is the measured maximum fundamental field strength in V/m.
- G is the numeric gain of the transmitting antenna with reference to an isotropic radiator.
- d is the distance in meters from which the field strength was measured.
- P is the power in watts for which you are solving:

$$P = \frac{(Ed)^2}{30G}$$

***Maximum peak conducted output power***

One of the following procedures may be used to determine the maximum peak conducted output power of a DTS EUT.

- ☐ ***RBW ≥ DTS bandwidth***

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.

a) Set the RBW ≥ DTS bandwidth.
b) Set VBW ≥ 3 x RBW.
c) Set span ≥ 3 x RBW
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

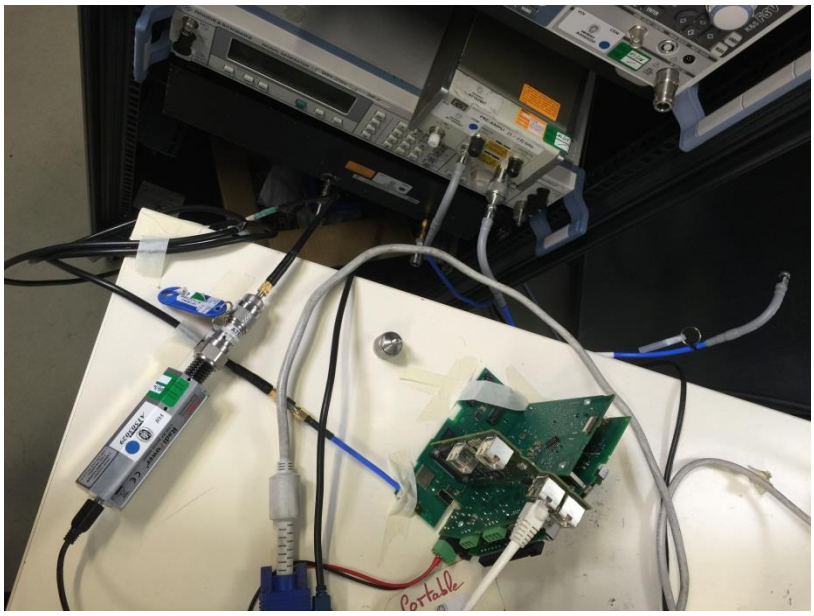
- ☐ ***Integrated band power method***

This procedure may be used when the maximum available RBW of the measurement instrument is less than the DTS bandwidth.

a) Set the RBW = 1 MHz.
b) Set the VBW ≥ 3 x RBW
c) Set the span ≥ 1.5 x DTS bandwidth.
d) Detector = peak.
e) Sweep time = auto couple.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges

- ☑ ***Power meter***

Mean power at the output of the transmitter (A) is deduced after correction due to RF cables loss between the EUT and the fast power sensor.



## *6.3. TEST EQUIPMENT LIST*

| DESCRIPTION | MANUFACTURER | MODEL | N° LCIE | Cal_Date | Cal_Due |
|---|---|---|---|---|---|
| Attenuator 10dB | JFW | - | A7122166 | 10/14 | 10/15 |
| Cable SMA | - | - | A5329636 | 11/14 | 11/15 |
| RF Power sensor | DARE | RPR3006W | A1503029 | 07/14 | 07/15 |
| Power supply DC | TDK | - | A7044055 | - | - |
| Spectrum analyzer | ROHDE & SCHWARZ | FSV 30 | A4060050 | 01/15 | 01/16 |

## *6.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION*

☑ None ☐ Divergence:

## 6.5. TEST SEQUENCE AND RESULTS

***Modulation:***

**802.11b:**

| **Temperature** | **Tnom** | | |
|---|---|---|---|
| **Voltage** | **Vnom** | | |
| Channel | 1 | 6 | 11 |
| **Peak Output (dBm)** | **14.8** | **15.5** | **15.2** |

**802.11g:**

| **Temperature** | **Tnom** | | |
|---|---|---|---|
| **Voltage** | **Vnom** | | |
| Channel | 1 | 6 | 11 |
| **Peak Output (dBm)** | **12.0** | **14.8** | **12.1** |

**802.11n HT20:**

| **Temperature** | **Tnom** | | |
|---|---|---|---|
| **Voltage** | **Vnom** | | |
| Channel | 1 | 6 | 11 |
| **Peak Output (dBm)** | **12.1** | **14.2** | **12.0** |

**802.11n HT40:**

| **Temperature** | **Tnom** | | |
|---|---|---|---|
| **Voltage** | **Vnom** | | |
| Channel | 3 | 6 | 9 |
| **Peak Output (dBm)** | **12.6** | **10.8** | **10.1** |

## 6.6. CONCLUSION

Maximum Peak Output Power measurement performed on the sample of the product **EMS59000**, SN: **MP1-7**, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 and RSS-247 Issue 1.0 limits.

# 7. POWER SPECTRAL DENSITY (15.247)

## 7.1. TEST CONDITIONS

Date of test :August 13th, 2015
Test performed by :G.Deschamps
Atmospheric pressure (hPa) :990
Relative humidity (%) :33
Ambient temperature (°C) :22

## 7.2. SETUP

☑ ***Conducted measurement:***
The EUT is turned ON and connected to measurement instrument; the center frequency of the spectrum analyzer is set to the fundamental frequency.
Offset: Attenuator+cable 12.7dB

☐ ***Radiated measurement:***
The EUT is placed in an anechoic chamber; the center frequency of the spectrum analyzer is set to the fundamental frequency.
The product has been tested at a distance of 3 meters from the antenna. 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 following table. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.
To demonstrate compliance with peak output power requirement of section 15.247 (b), the transmitter's peak output power is calculated using the following equation:

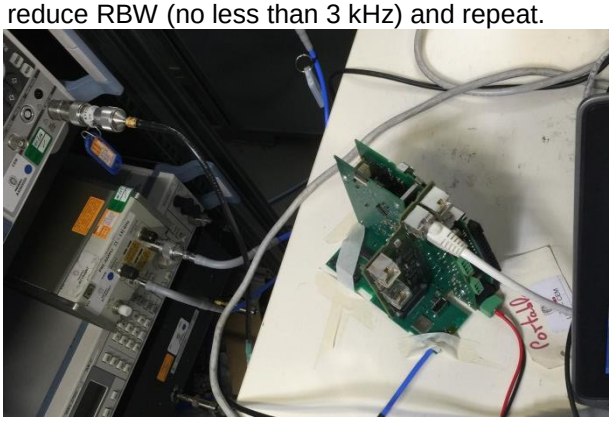
$$E = \frac{\sqrt{30PG}}{d}$$

Where:
- E is the measured maximum fundamental field strength in V/m.
- G is the numeric gain of the transmitting antenna with reference to an isotropic radiator.
- d is the distance in meters from which the field strength was measured.
- P is the power in watts for which you are solving:

$$P = \frac{(Ed)^2}{30G}$$

***Measurement Procedure PKPSD:  §10.2 (DTS Measurement Guidance)***

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to: 3 kHz.
d) Set the VBW ≥ 3 x RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.



## *7.3. TEST EQUIPMENT LIST*

| DESCRIPTION | MANUFACTURER | MODEL | N° LCIE | Cal_Date | Cal_Due |
|---|---|---|---|---|---|
| Attenuator 10dB | JFW | - | A7122166 | 10/14 | 10/15 |
| Cable SMA | - | - | A5329636 | 11/14 | 11/15 |
| Spectrum analyzer | ROHDE & SCHWARZ | FSV 30 | A4060050 | 01/15 | 01/16 |
| Power supply DC | TDK | - | A7044055 | - | - |
| Thermo-hygrometer (C3) | OREGON | BAR206 | B4204078 | 04/15 | 04/16 |
| Thermo-hygrometer (PM2) | OREGON | BAR916HG-G | B4206011 | 04/15 | 04/16 |

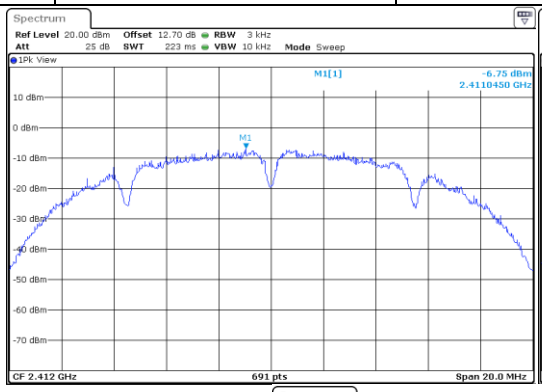
## *7.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION*

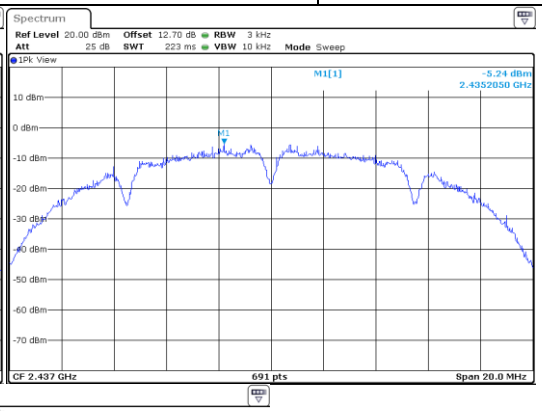
☑ None  ☐ Divergence:

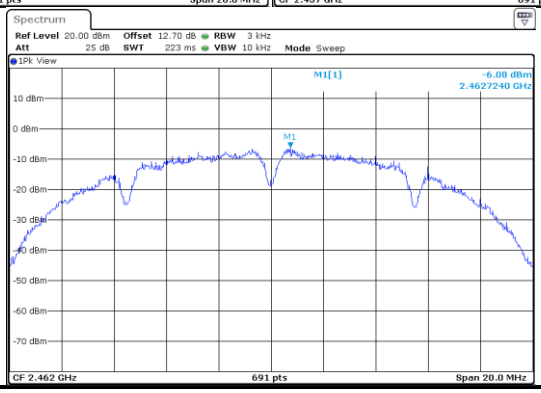
## 7.5. TEST SEQUENCE AND RESULTS

***Modulation:***
***802.11b***

| Channel | Channel Frequency (MHz) | Power Spectral Density (dBm) | PSD Limit (dBm) |
|---|---|---|---|
| 1 | 2412 | **-6.75** | 8.0 |
| 6 | 2437 | **-5.24** | 8.0 |
| 11 | 2462 | **-6.08** | 8.0 |

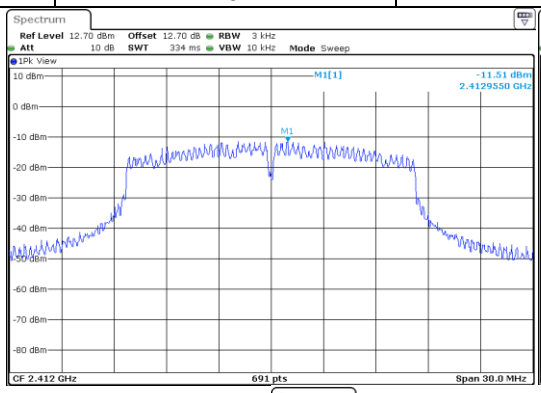


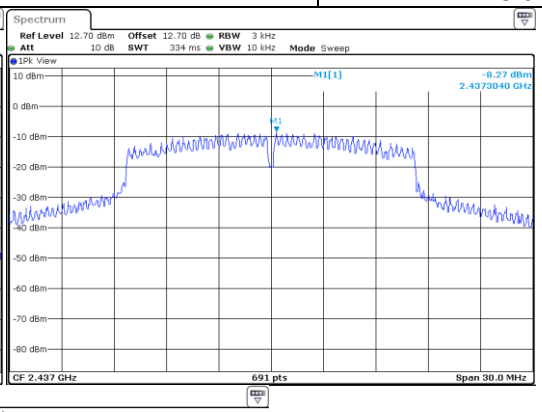



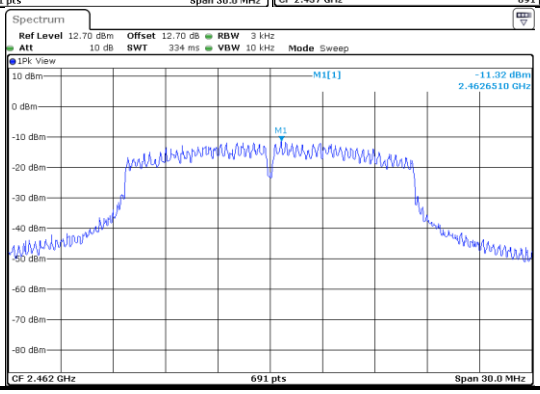



***802.11g***

| Channel | Channel Frequency (MHz) | Power Spectral Density (dBm) | PSD Limit (dBm) |
|---|---|---|---|
| 1 | 2412 | **-11.51** | 8.0 |
| 6 | 2437 | **-8.27** | 8.0 |
| 11 | 2462 | **-11.32** | 8.0 |

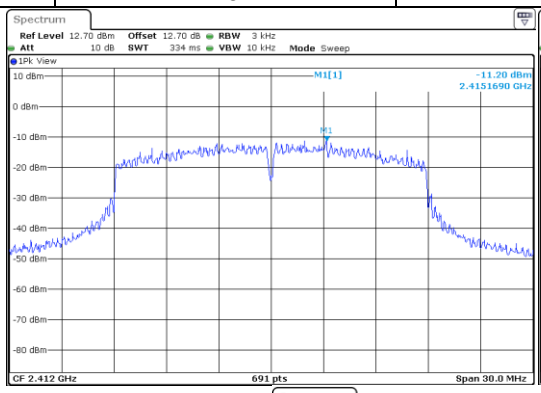


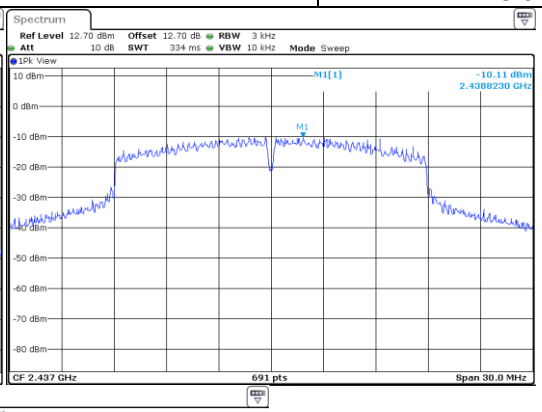



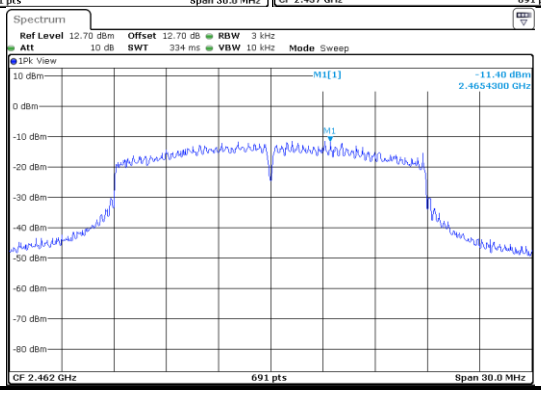



***802.11n HT20***

| Channel | Channel Frequency (MHz) | Power Spectral Density (dBm) | PSD Limit (dBm) |
|---|---|---|---|
| 1 | 2412 | **-11.20** | 8.0 |
| 6 | 2437 | **-10.11** | 8.0 |
| 11 | 2462 | **-11.40** | 8.0 |

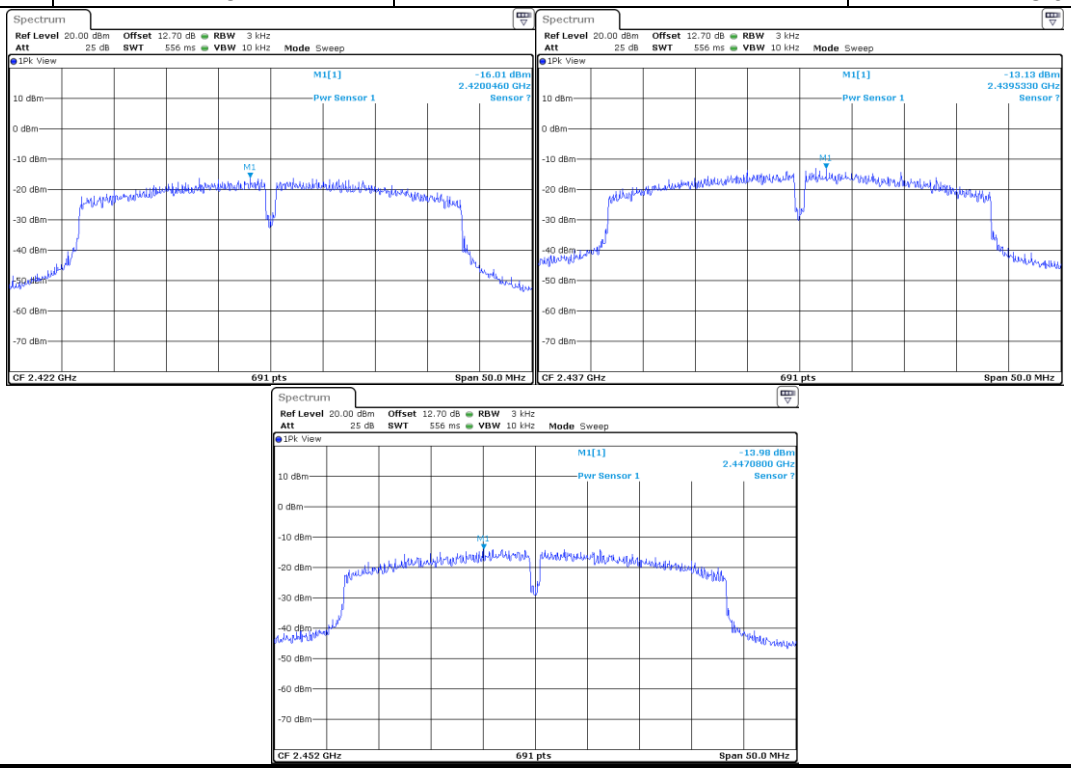


***802.11n HT40***

| Channel | Channel Frequency (MHz) | Power Spectral Density (dBm) | PSD Limit (dBm) |
|---|---|---|---|
| 3 | 2422 | **-16.01** | 8.0 |
| 6 | 2437 | **-13.13** | 8.0 |
| 9 | 2452 | **-13.98** | 8.0 |




## *7.6. CONCLUSION*

Power Spectral Density measurement performed on the sample of the product **EMS59000**, SN: **MP1-7**, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 and RSS-247 Issue 1.0 limits.

# 8. BAND EDGE MEASUREMENT (15.247)

## 8.1. TEST CONDITIONS

| | |
|---|---|
| Date of test | :August 14th, 2015 |
| Test performed by | :G.Deschamps |
| Atmospheric pressure (hPa) | :992 |
| Relative humidity (%) | :39 |
| Ambient temperature (°C) | :20 |

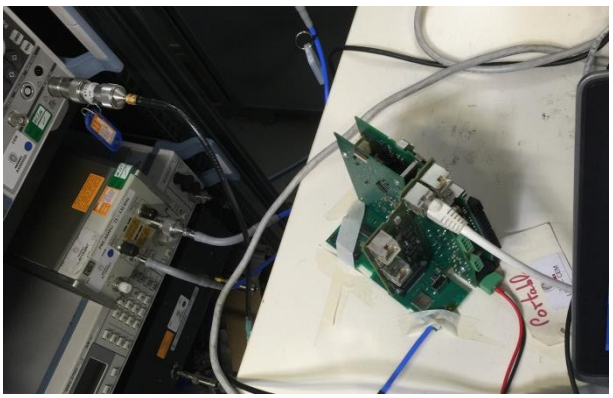
## 8.2. LIMIT

***RF antenna conducted test: § 11 (DTS Measurement Guidance)***
Set RBW = 100 kHz, Video bandwidth (VBW) > RBW, scan up through 10th harmonic. All harmonics/spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW. Note: If the device complies with the use of power option 2 the attenuation under this paragraph shall be 30 dB instead of 20 dB. *For -20dBc limit, lowest power output level is considered, worst case.*

***Radiated emission test: § 12 (DTS Measurement Guidance)***
Applies to harmonics/spurs that fall in the restricted bands listed in Section 15.205. The maximum permitted average field strength is listed in Section 15.209. For measurements above 1 GHz, set RBW = 1MHz, VBW = 10 Hz, Sweep: Auto. If the emission is pulsed, modify the unit for continuous operation; use the settings shown above, then correct the reading by subtracting the peak-average correction factor, derived from the appropriate duty cycle calculation. See results in Radiated emissions section before.

## 8.3. SETUP

The EUT is placed in an anechoic chamber; levels have been corrected to be in compliant with Peak Output Power measurement. The EUT is turn ON; the graphs of the restrict frequency band are recorded with a display line indicating the highest level and other the 20dB offset below to show compliance with 15.247 (d) and 15.205. The emissions in restricted bands are compared to 15.209 limits.
RBW: 100kHz
VBW: 300kHz



## 8.4. TEST EQUIPMENT LIST

| DESCRIPTION | MANUFACTURER | MODEL | N° LCIE | Cal_Date | Cal_Due |
|---|---|---|---|---|---|
| Attenuator 10dB | JFW | - | A7122166 | 10/14 | 10/15 |
| Cable SMA | - | - | A5329636 | 11/14 | 11/15 |
| Spectrum analyzer | ROHDE & SCHWARZ | FSV 30 | A4060050 | 01/15 | 01/16 |
| Power supply DC | TDK | - | A7044055 | - | - |
| Thermo-hygrometer (C3) | OREGON | BAR206 | B4204078 | 04/15 | 04/16 |
| Thermo-hygrometer (PM2) | OREGON | BAR916HG-G | B4206011 | 04/15 | 04/16 |

## 8.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

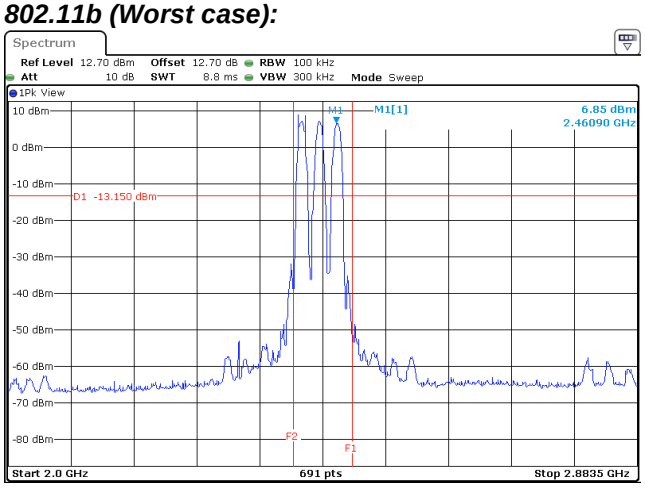
☑ None ☐ Divergence:

## 8.6. TEST SEQUENCE AND RESULTS

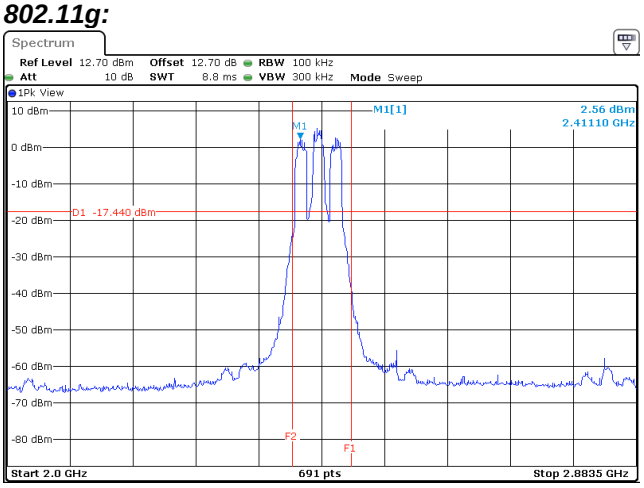
Offset: Attenuator+cable 12.7dB

**GRAPH / MODULATION.**

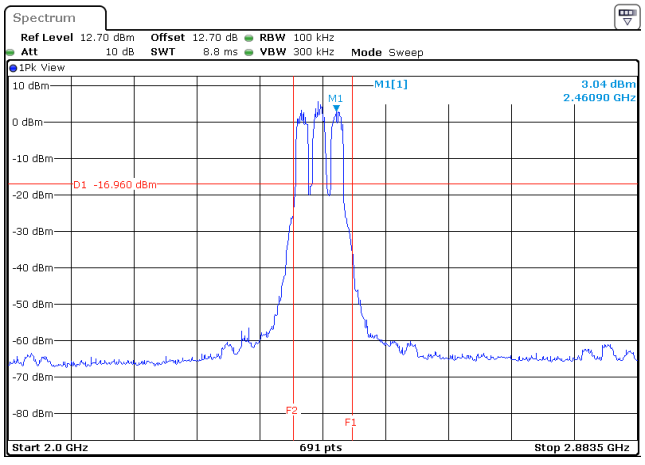
***802.11b (Worst case):***



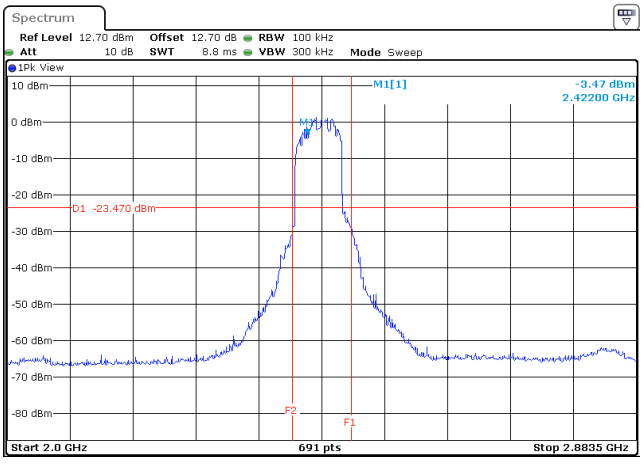

***802.11g:***



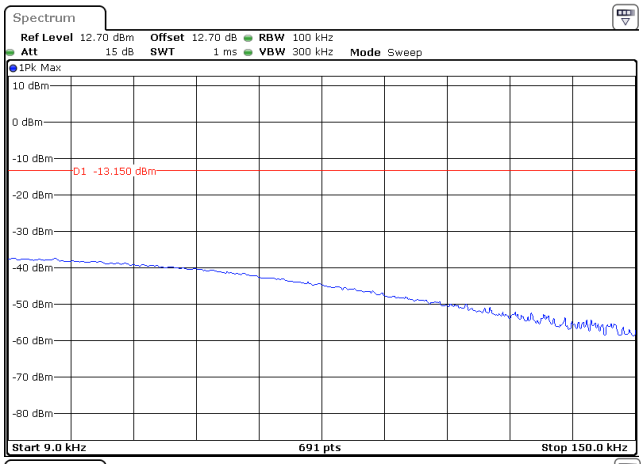

***802.11n HT20:***

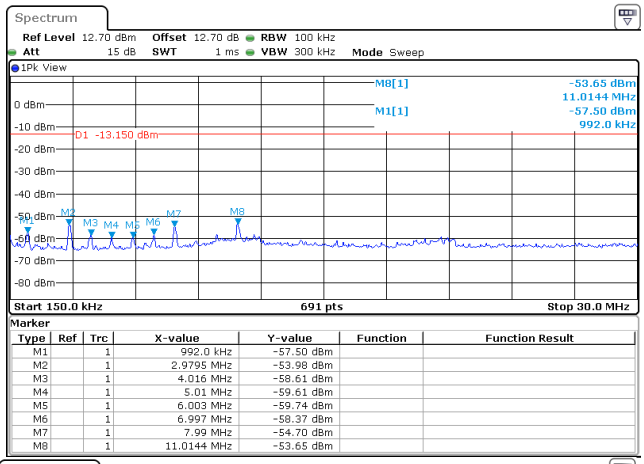


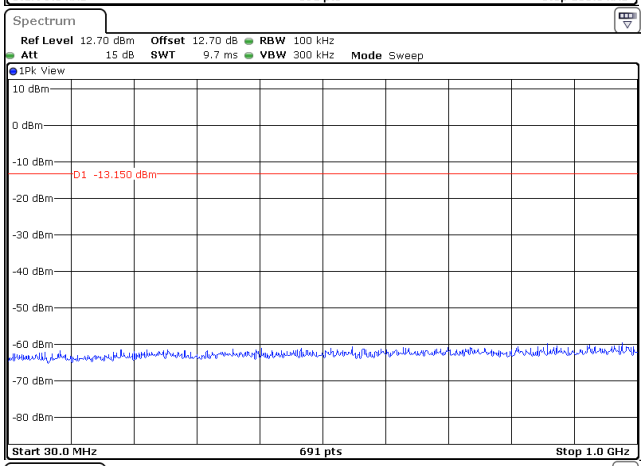

***802.11n HT40:***

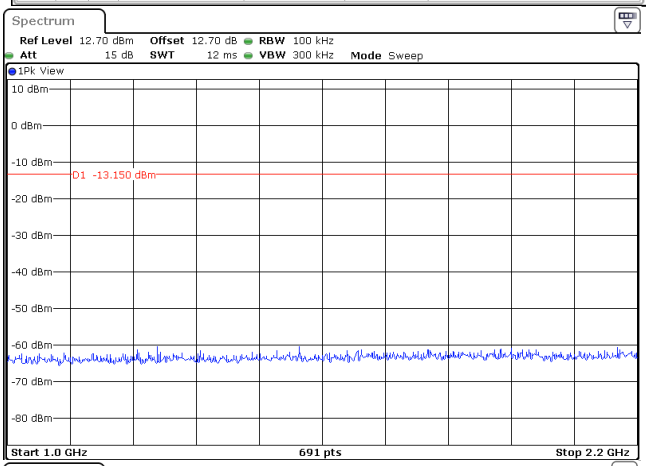


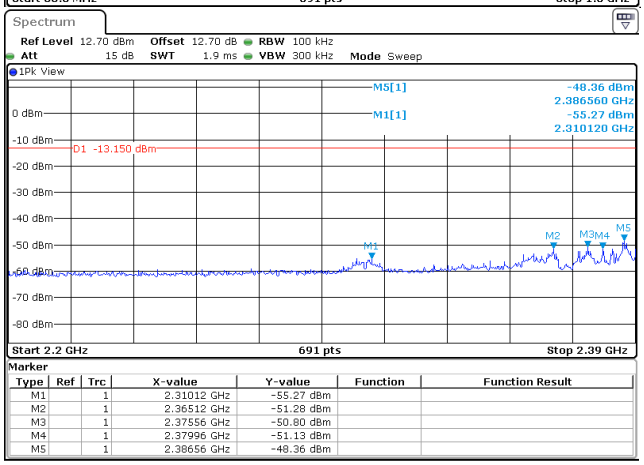
*Worst case in modulation 802.11b for channel Cmax and display line at -13.15dBm*

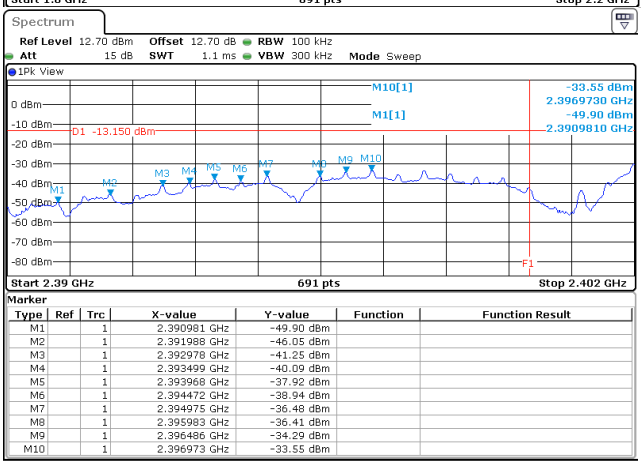


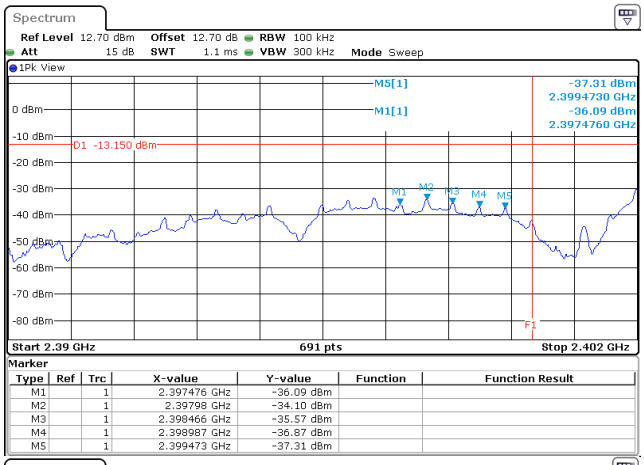



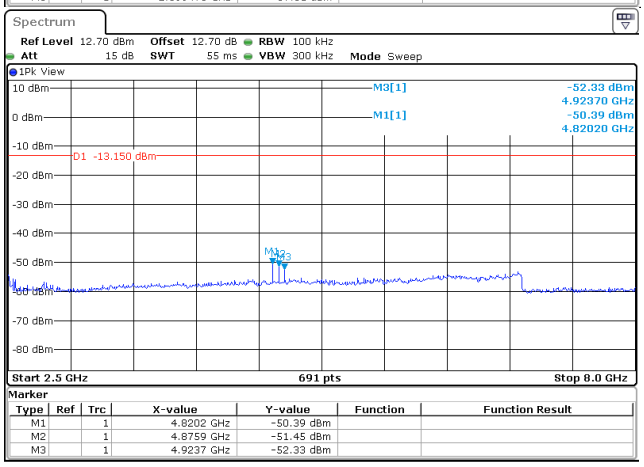



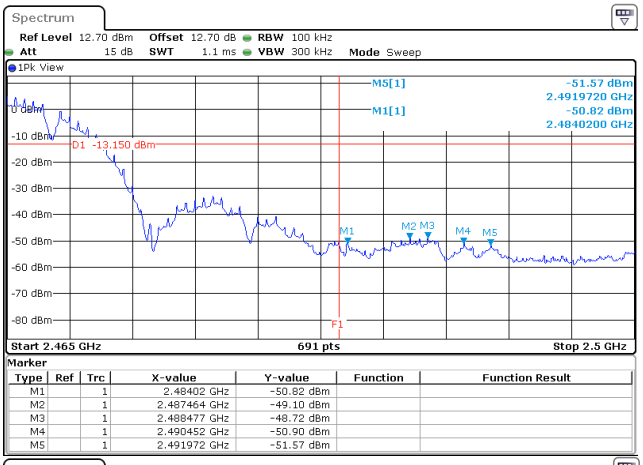



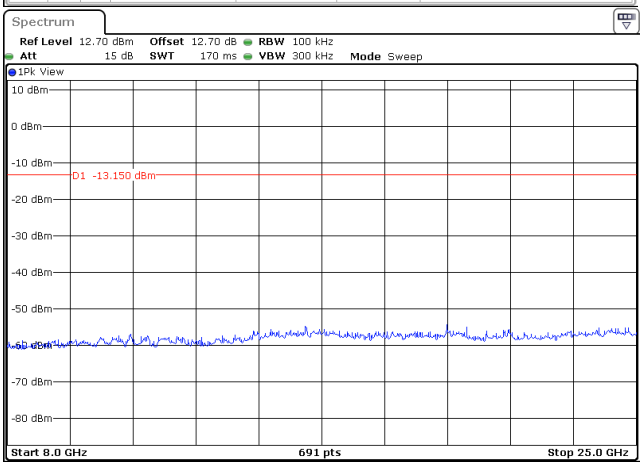






## *8.7. CONCLUSION*

Band Edge Measurement performed on the sample of the product **EMS59000**, SN: **MP1-7**, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 and RSS-247 Issue 1.0 limits.

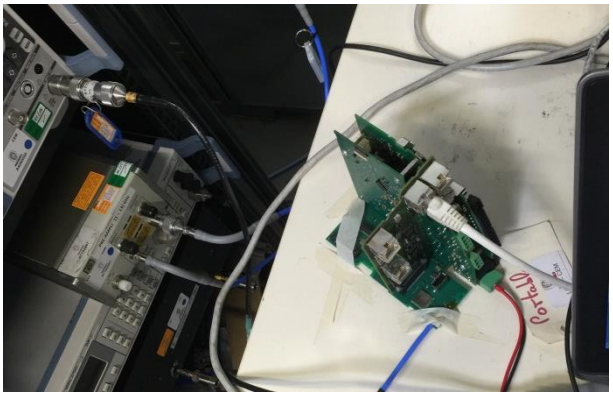
# 9. OCCUPIED BANDWIDTH

## 9.1. TEST CONDITIONS

Date of test :August 13th, 2015
Test performed by :G.Deschamps
Atmospheric pressure (hPa) :990
Relative humidity (%) :33
Ambient temperature (°C) :22

## 9.2. SETUP

☑ ***Conducted measurement:***
The EUT is turned ON and connected to measurement instrument; the center frequency of the spectrum analyzer is set to the fundamental frequency. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.
Offset: Attenuator+cable 12.7dB



☐ ***Radiated measurement:***
The EUT is turned ON and connected to measurement instrument; the center frequency of the spectrum analyzer is set to the fundamental frequency. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.

***Measurement Procedure:***
1. RBW used should not be lower than 1% of the selected span
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. OBW 99% function of spectrum analyzer used

## 9.3. TEST EQUIPMENT LIST

| DESCRIPTION | MANUFACTURER | MODEL | N° LCIE | Cal_Date | Cal_Due |
|---|---|---|---|---|---|
| Attenuator 10dB | JFW | - | A7122166 | 10/14 | 10/15 |
| Cable SMA | - | - | A5329636 | 11/14 | 11/15 |
| Spectrum analyzer | ROHDE & SCHWARZ | FSV 30 | A4060050 | 01/15 | 01/16 |
| Power supply DC | TDK | - | A7044055 | - | - |

| | | | | | |
|---|---|---|---|---|---|
| Thermo-hygrometer (C3) | OREGON | BAR206 | B4204078 | 04/15 | 04/16 |
| Thermo-hygrometer (PM2) | OREGON | BAR916HG-G | B4206011 | 04/15 | 04/16 |

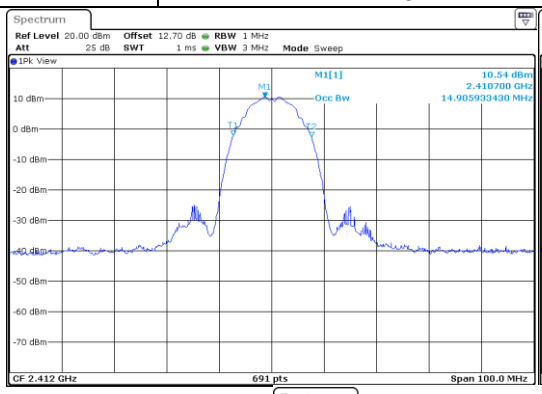
## *9.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION*

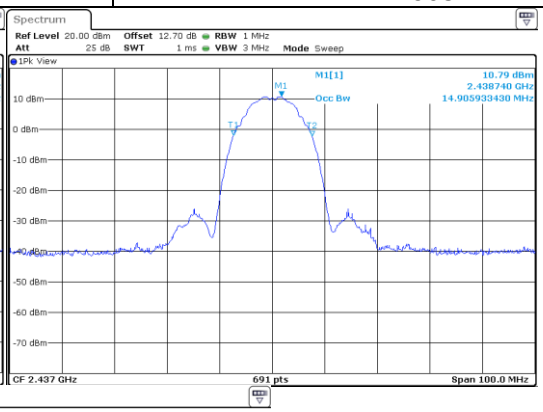
☑ None ☐ Divergence:

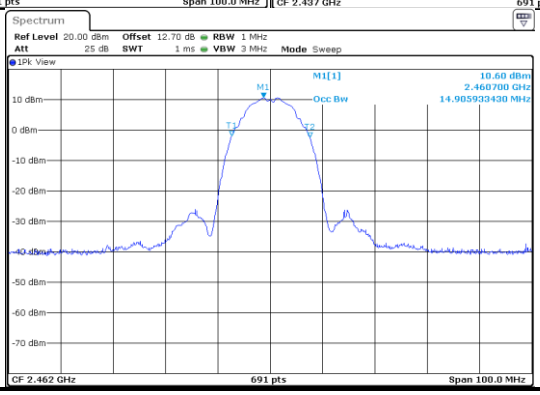
## *9.5. TEST SEQUENCE AND RESULTS*

***802.11b***

| Channel | Channel Frequency (MHz) | 99% Occupied Bandwidth (MHz) |
|---|---|---|
| 1 | 2412 | **14.905** |
| 6 | 2437 | **14.905** |
| 11 | 2462 | **14.905** |

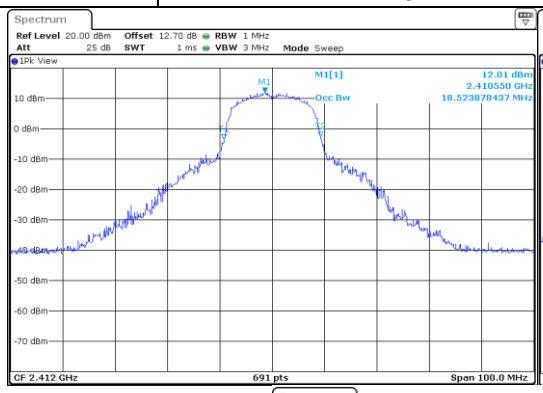


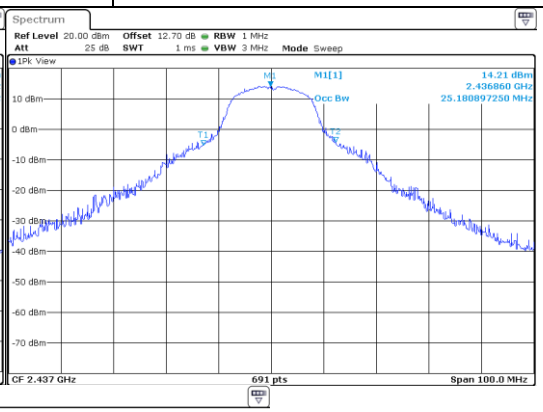



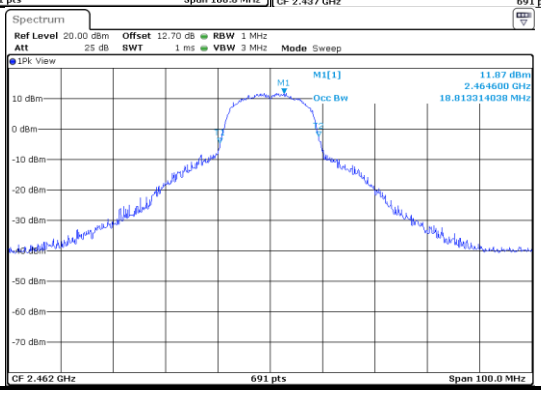



***802.11g***

| Channel | Channel Frequency (MHz) | 99% Occupied Bandwidth (MHz) |
|---|---|---|
| 1 | 2412 | **18.523** |
| 6 | 2437 | **25.180** |
| 11 | 2462 | **18.813** |

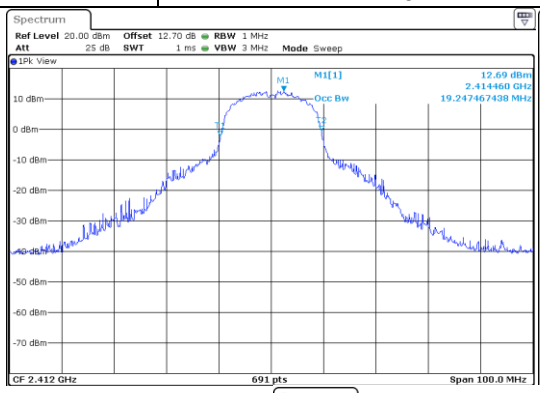


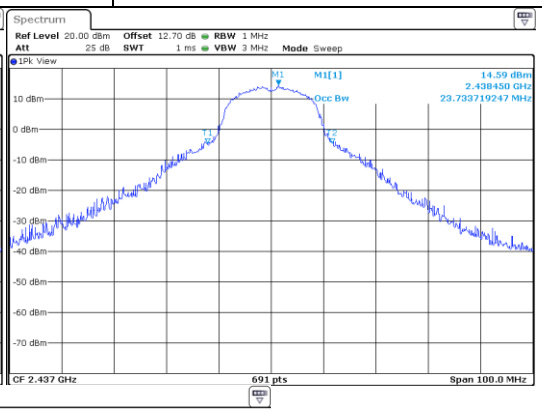



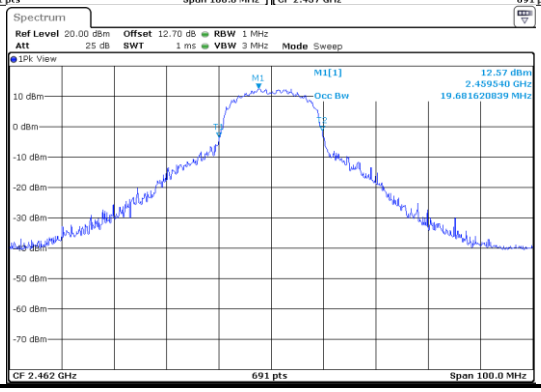



***802.11n HT20***

| Channel | Channel Frequency (MHz) | 99% Occupied Bandwidth (MHz) |
|---|---|---|
| 1 | 2412 | **19.247** |
| 6 | 2437 | **23.733** |
| 11 | 2462 | **19.681** |

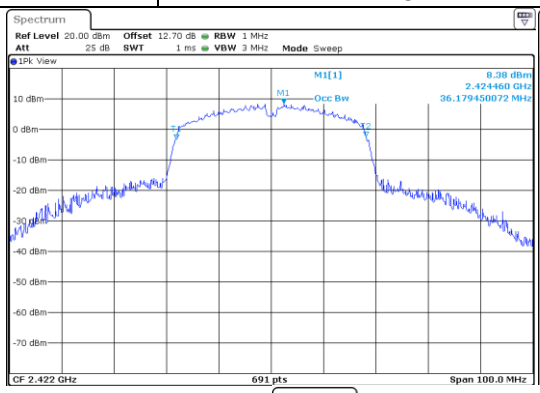


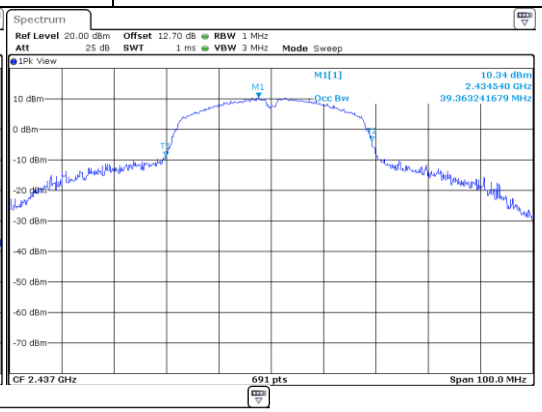



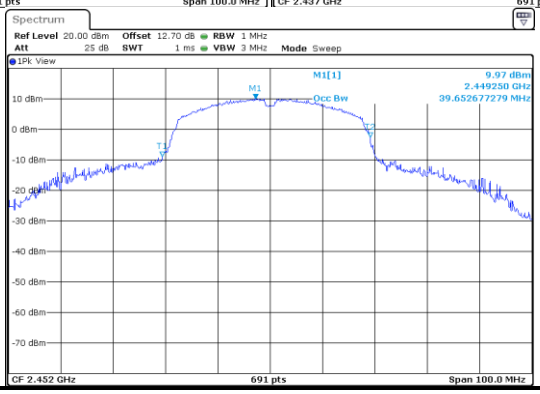



***802.11n HT40***

| Channel | Channel Frequency (MHz) | 99% Occupied Bandwidth (MHz) |
|---|---|---|
| 3 | 2422 | **36.179** |
| 6 | 2437 | **39.363** |
| 9 | 2452 | **39.652** |

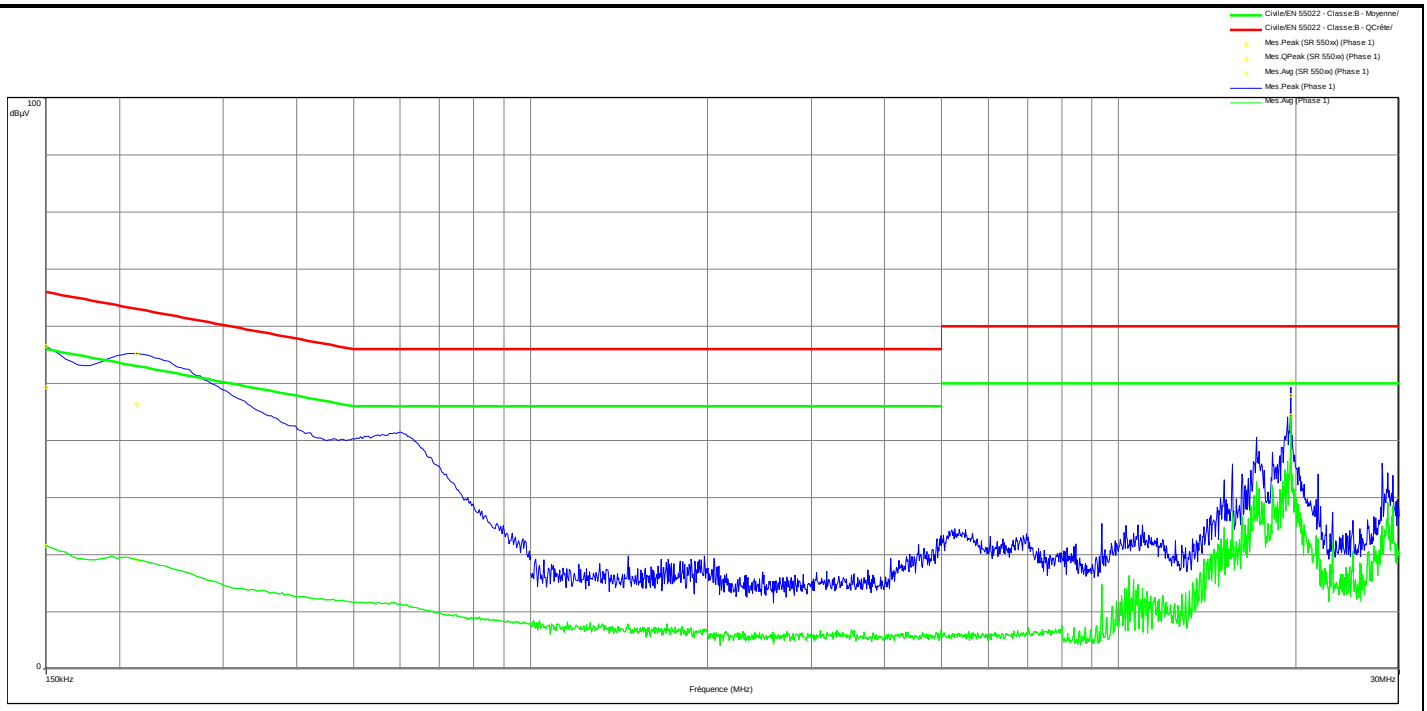


## 10. ANNEX 1 (GRAPHS)

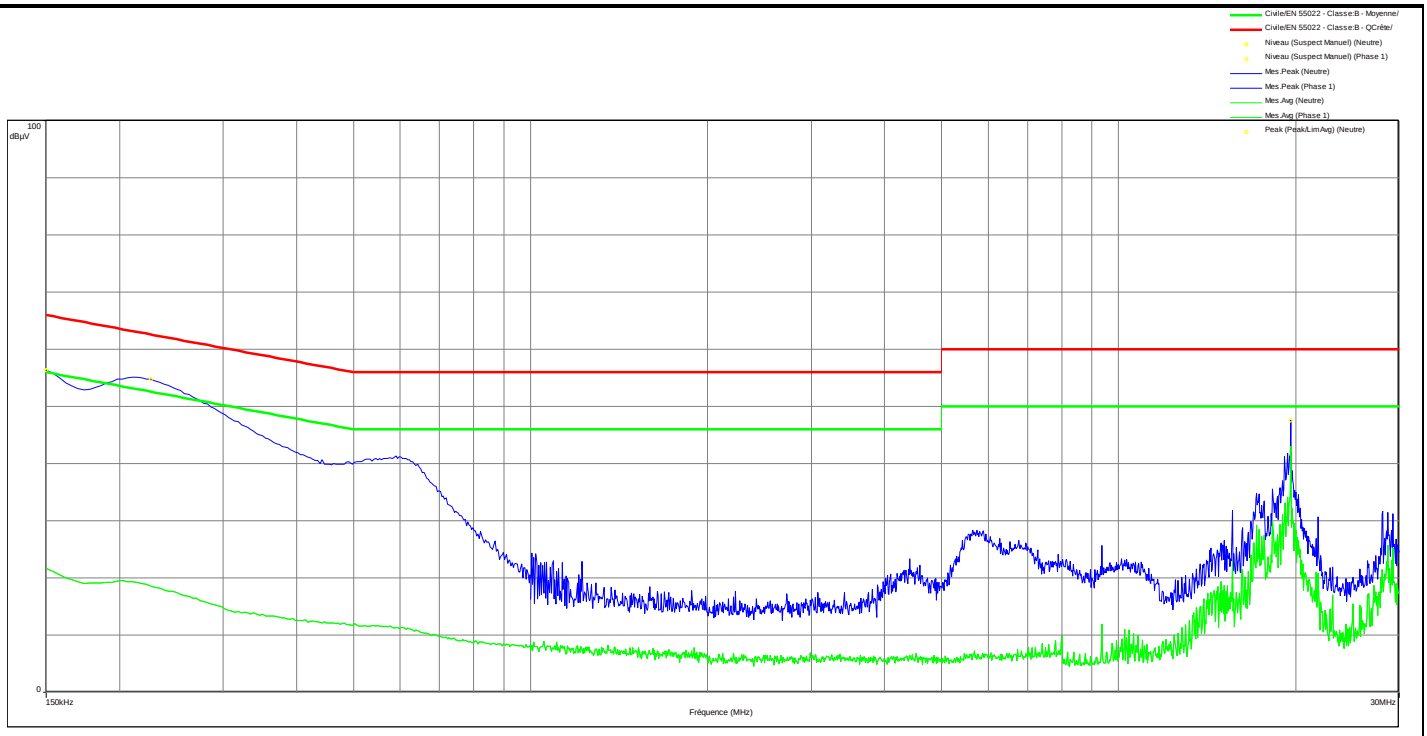
| CONDUCTED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emc#1 | **Test configuration:** | |
| **Limit:** | EN 55022 | Phase | |
| **Class:** | B | | |
| **Frequency range: [150kHz - 30MHz]** | | | |
| **Voltage / Frequency:** | 230VAC / 50Hz | **RBW :** | 10kHz |
| **Line:** | Phase | **VBW :** | 30kHz |




***Spurious emissions***

| Frequency (MHz) | Mes.Peak (dBµV) | Mes.QPeak (dBµV) | LimQP (dBµV) | Mes.QPeak-LimQP (dB) | Mes.Avg (dBµV) | LimAvg (dBµV) | Mes.Avg-LimAvg (dB) |
|---|---|---|---|---|---|---|---|
| 0.15 | 56.6 | 49.38 | 66 | -16.62 | 21.54 | 56 | -34.46 |
| 0.215 | 55.22 | 46.33 | 63.21 | -16.88 | 19.03 | 53.21 | -34.17 |
| 19.603 | 50.43 | 47.92 | 60 | -12.08 | 44.38 | 50 | -5.62 |

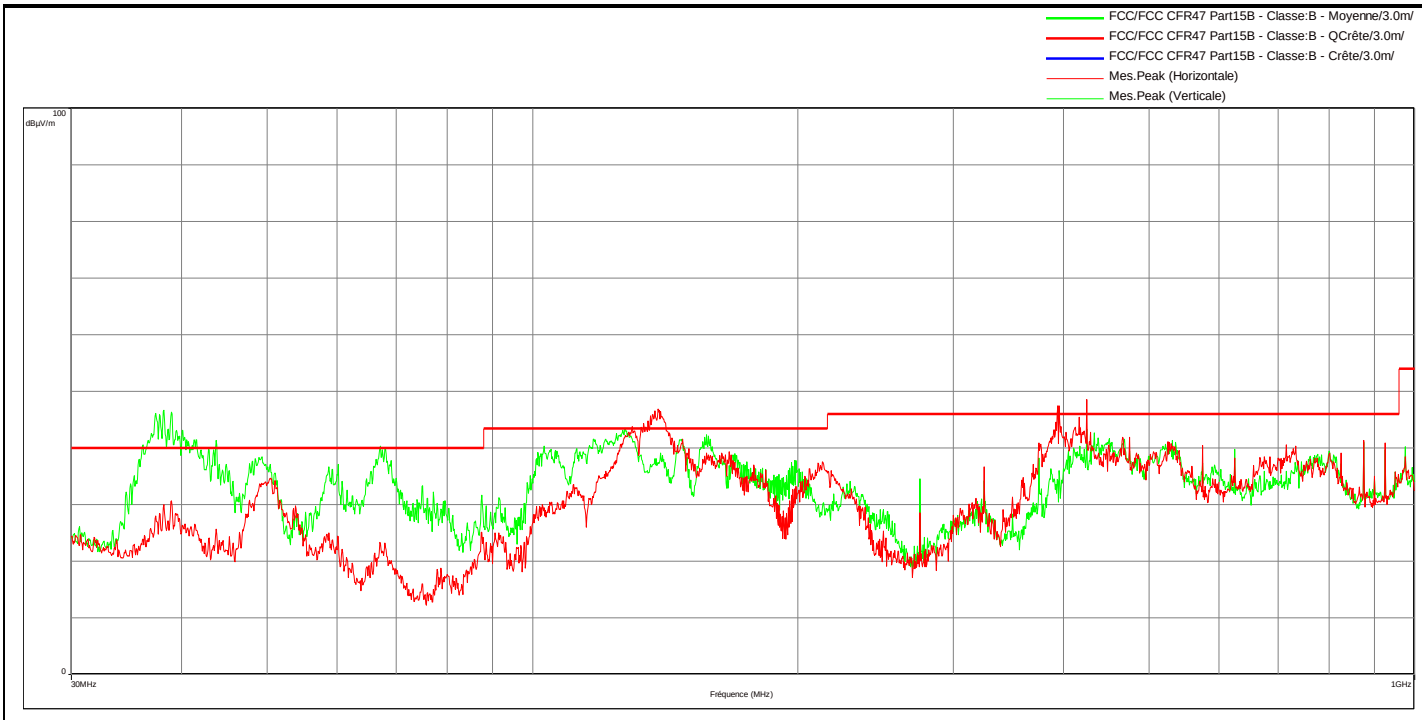
| CONDUCTED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emc#2 | **Test configuration:** | |
| **Limit:** | EN 55022 | Neutral | |
| **Class:** | B | | |
| **Frequency range: [150kHz - 30MHz]** | | | |
| **Voltage / Frequency:** | 230VAC / 50Hz | **RBW :** | 10kHz |
| **Line:** | Neutral | **VBW :** | 30kHz |




***Spurious emissions***

| Frequency (MHz) | Peak (dBµV) |
|---|---|
| 0.15 | 56.29 |
| 0.226 | 54.79 |
| 18.244 | 35.52 |
| 19.624 | 47.61 |

| RADIATED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emr#1 | **Test configuration:** | |
| **Limit:** | FCC CFR47 Part15B | (H+V) TX mode - Axis XY | |
| **Class:** | B | | |
| **Frequency range: [30MHz - 1GHz]** | | | |
| **Antenna polarization:** | Horizontal & Vertical | **RBW :** | 100kHz |
| **Azimuth:** | 0° - 360° | **VBW :** | 300kHz |




***Spurious emissions***

## 11. 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<br>*Measurement of conducted disturbances in voltage on the power port* | 3.57 dB | 3.6 dB |
| Mesure des perturbations conduites en tension sur le réseau de télécommunication<br>*Measurement of conducted disturbances in voltage on the telecommunication port.* | 3.28 dB | A l'étude /<br>Under consid. |
| Mesure des perturbations discontinues conduites en tension<br>*Measurement of discontinuous conducted disturbances in voltage* | 3.47 dB | 3.6 dB |
| Mesure des perturbations conduites en courant<br>*Measurement of conducted disturbances in current* | 2.90 dB | A l'étude /<br>Under consid. |
| Mesure du champ électrique rayonné sur le site en espace libre de Moirans<br>*Measurement of radiated electric field on the Moirans open area test site* | 5.07 dB | 5.2 dB |

Les valeurs d'incertitudes calculées du laboratoire étant inférieures aux valeurs d'incertitudes limites établies par la norme, la conformité de l'échantillon est établie directement par les niveaux limites applicables. / *The uncertainty values calculated by the laboratory are lower than limit uncertainty values defined by the standard. The conformity of the sample is directly established by the applicable limits values.*