



# FCC/IC Test Report

**FOR:**

**Model Name: Fusion**  
**Ambulatory Arrhythmia Monitoring System**  
**FCC ID: HHMFUSIONMCT**  
**IC ID: 9158A FUSION**

**47 CFR Part 2, 22, 24**

**RSS-132 Issue 2**

**RSS-133 Issue 5**

**TEST REPORT #: EMC\_BRAEM\_008\_10001\_FCC\_22\_24\_Rev8**  
**DATE: 2010-12-10**



FCC listed:  
A2LA Accredited

IC recognized #  
3462B-1

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## 1 Assessment

The following device was tested against the applicable criteria specified in FCC rules Parts 2, 22 and 24 of Title 47 of the Code of Federal Regulations and Industry Canada Standards RSS 132 and RSS 133 and no deviations were ascertained during the course of the tests performed.

| Company      | Description                             | Model # |
|--------------|-----------------------------------------|---------|
| Braemar Inc. | Ambulatory Arrhythmia Monitoring System | Fusion  |

### Responsible for Testing Laboratory:

| 2010-12-10 | Compliance | Marc Douat<br>(Test Lab Manager) |           |
|------------|------------|----------------------------------|-----------|
| Date       | Section    | Name                             | Signature |

### Responsible for the Report:

| 2010-12-10 | Compliance | Christopher Torio<br>(EMC Engineer) |           |
|------------|------------|-------------------------------------|-----------|
| Date       | Section    | Name                                | Signature |

The test results of this test report relate exclusively to the test item specified in Section 3. CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

## **2 Administrative Data**

### **2.1 Identification of the Testing Laboratory Issuing the EMC Test Report**

|                                    |                                                        |
|------------------------------------|--------------------------------------------------------|
| <b>Company Name:</b>               | CETECOM Inc.                                           |
| <b>Department:</b>                 | Compliance                                             |
| <b>Address:</b>                    | 411 Dixon Landing Road<br>Milpitas, CA 95035<br>U.S.A. |
| <b>Telephone:</b>                  | +1 (408) 586 6200                                      |
| <b>Fax:</b>                        | +1 (408) 586 6299                                      |
| <b>Test Lab Director:</b>          | Heiko Strehlow                                         |
| <b>Responsible Project Leader:</b> | Clarence Ip                                            |

### **2.2 Identification of the Client**

|                          |                             |
|--------------------------|-----------------------------|
| <b>Applicant's Name:</b> | Braemar Inc.                |
| <b>Street Address:</b>   | 1285 Corporate Center Drive |
| <b>City/Zip Code</b>     | Eagan, MN 55121             |
| <b>Country</b>           | USA                         |
| <b>Contact Person:</b>   | Paul Brinda                 |
| <b>Phone No.</b>         | 651-286-8620                |
| <b>Fax:</b>              | 651-286-8630                |
| <b>e-mail:</b>           | Paul.Brinda@braemarinc.com  |

### **2.3 Identification of the Manufacturer**

Same as above applicant

### 3 Equipment under Test (EUT)

#### 3.1 Specification of the Equipment under Test

|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Marketing Name / Model No:</b>                                                 | Fusion / Fusion                                                                                                                                                                                                                                                                                                                                                                      |
| <b>HW / SW Revision :</b>                                                         | 520 / 7.43                                                                                                                                                                                                                                                                                                                                                                           |
| <b>FCC-ID / IC-ID:</b>                                                            | HHMFUSIONMCT / 9158A FUSION                                                                                                                                                                                                                                                                                                                                                          |
| <b>Product Description:</b>                                                       | <b>Fusion Wireless Recorder</b> - a battery operated, solid state recorder designed to record symptomatic heart arrhythmias. Incorporates pre-certified Quad Band GSM/GPRS/EGPRS module with FCC-ID: N7NQ2687 PP, pre-certified Bluetooth v2.1+EDR module with FCC ID: T9JRN41-1                                                                                                     |
| <b>Frequency Range / number of channels:</b>                                      | GSM 850: 824.2-848.8MHz / 125;<br>PCS 1900: 1850.2-1909.8MHz / 300;<br>Bluetooth: 2400-2483.5MHz / 79;                                                                                                                                                                                                                                                                               |
| <b>Type(s) of Modulation:</b>                                                     | 2G: GMSK, 8PSK;<br>Bluetooth: GFSK, DQPSK, 8DPSK;                                                                                                                                                                                                                                                                                                                                    |
| <b>Modes of Operation:</b>                                                        | GPRS/EGPRS MS Class 10, GPRS Capability Class B, Data only                                                                                                                                                                                                                                                                                                                           |
| <b>Antenna Type / gain / position / min. distance to other antenna (if appl):</b> | GSM: Wire ¼ Wave Antenna / 850band 1dBi, 1900 band 1.5 dBi;<br>Bluetooth: Integral Chip antenna / -2.83dBi;<br>distance GSM-BT antennas: 4mm (measured, see appendix C);                                                                                                                                                                                                             |
| <b>Output Powers:</b>                                                             | GSM850 GMSK Conducted: 32.0 dBm,<br>GSM850 8PSK Conducted: 29.4dBm,<br>GSM850 GMSK Radiated: 31.0dBm,<br>GSM850 8PSK Radiated: 28.9dBm,<br>GSM1900 GMSK Conducted: 29.5dBm,<br>GSM1900 8PSK Conducted: 28.6dBm,<br>GSM1900 GMSK Radiated: 31.0dBm,<br>GSM1900 8PSK Radiated: 29.9dBm,<br>Bluetooth EDR conducted: 10.14 dBm;<br><i>conducted values are from module test reports</i> |
| <b>power supply</b>                                                               | AA lithium battery pack (dedicated), 3.6V DC;                                                                                                                                                                                                                                                                                                                                        |
| <b>operating temperature range</b>                                                | 0°C to 45°C                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Prototype / Production unit</b>                                                | Production                                                                                                                                                                                                                                                                                                                                                                           |

**3.2 Identification of the Equipment Under Test (EUT)**

| EUT # | Serial Number | HW Version | SW Version | Notes | Cetecom ID |
|-------|---------------|------------|------------|-------|------------|
| 1     | 01000129      | C007401    | 520        | 7.43  | None       |

**3.3 Identification of Accessory equipment**

| AE # | Type    | Manufacturer | Model    | Cetecom ID |
|------|---------|--------------|----------|------------|
| 1    | Battery | Braemar Inc. | ER14505M | C007402    |

#### **4 Subject of Investigation**

The objective of the measurements done by Cetecom Inc. was to measure the performance of the EUT as specified by requirements listed in the following test standards:

- 47 CFR Part 2: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communications Commission Frequency allocations and radio treaty matters; general rules and regulations.
- 47 CFR Part 22: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communications Commission subchapter B- common carrier services; Part 22- Public mobile services
- 47 CFR Part 24: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communications Commission subchapter B- common carrier services; Part 24- Personal communication services
- RSS 132- Issue 2: Spectrum management and telecommunication policy- Radio Standards Specifications Cellular telephones employing new technologies operating in the bands 824-849MHz and 869-894MHz
- RSS 133- Issue 5: Spectrum management and telecommunication policy- Radio Standards Specifications- 2GHz personal communication services

This test report is to support a request for new equipment authorization under the FCC ID **HHMFUSIONMCT** and IC ID **9158A FUSION**.

All testing was performed on the product referred to in Section 3 as EUT.

The EUT carries a pre-certified GSM/GPRS module with FCC ID# **N7NQ2687**. Since the module design is not modified and the module is integrated in device under test, only radiated measurements were performed at Cetecom Inc. This test report contains full radiated testing as per FCC 22H/24E on the EUT with the pre-certified GSM/GPRS module.

All FCC 22H/24E conducted measurements are covered under test report# **SHEMO10030019402** which can be found on <http://www.fcc.gov/oet/ea/fccid/> and entering the GSM/GPRS module's FCC ID.

## 5 Summary of Measurement Results

### 850 Band:

| Test Specification                   | Test Case                    | Temperature and Voltage Conditions | Mode    | Pass | Fail | NA | NP | Result   |
|--------------------------------------|------------------------------|------------------------------------|---------|------|------|----|----|----------|
| §2.1046<br>§22.913 (a)<br>RSS132 4.4 | RF Output Power              | Nominal                            | GSM 850 | ■    | □    | □  | □  | Complies |
| §2.1055<br>§22.355<br>RSS132 4.3     | Frequency Stability          | Nominal                            | GSM 850 | □    | □    | □  | ■  | NP       |
| §2.1049<br>§22.917(b)<br>RSS132 4.2  | Occupied Bandwidth           | Nominal                            | GSM 850 | □    | □    | □  | ■  | NP       |
| §2.1051<br>§22.917<br>RSS132 4.5     | Band Edge Compliance         | Nominal                            | GSM 850 | □    | □    | □  | ■  | NP       |
| §2.1051<br>§22.917<br>RSS132 4.5     | Conducted Spurious Emissions | Nominal                            | GSM 850 | □    | □    | □  | ■  | NP       |
| §2.1053<br>§22.917<br>RSS132 4.5     | Radiated Spurious Emissions  | Nominal                            | GSM 850 | ■    | □    | □  | □  | Complies |
| §15.107<br>§15.207<br>RSS Gen        | Line Conducted Emissions     | Nominal                            | GSM 850 | □    | □    | ■  | □  | N/A      |
| §2.1053<br>§15.109<br>RSS Gen        | Receiver Emissions-Radiated  | Nominal                            | RX Mode | ■    | □    | □  | □  | Complies |

**Note:** NA= Not Applicable; NP= Not Performed.

- All FCC 22H/24E conducted measurements are covered under test report# **SHEMO10030019402**
- Line/Conducted Emissions not applicable since device is powered through a DC supply.

**1900 Band:**

| Test Specification                   | Test Case                    | Temperature and Voltage Conditions | Mode     | Pass | Fail | NA | NP | Result   |
|--------------------------------------|------------------------------|------------------------------------|----------|------|------|----|----|----------|
| §2.1046<br>§24.232 (a)<br>RSS133 6.4 | RF Output Power              | Nominal                            | GSM 1900 | ■    | □    | □  | □  | Complies |
| §2.1055<br>§24.235<br>RSS133 6.3     | Frequency Stability          | Nominal                            | GSM 1900 | □    | □    | □  | ■  | NP       |
| §2.1049<br>§24.238(b)<br>RSS133 6.2  | Occupied Bandwidth           | Nominal                            | GSM 1900 | □    | □    | □  | ■  | NP       |
| §2.1051<br>§24.238<br>RSS133 6.5     | Band Edge Compliance         | Nominal                            | GSM 1900 | □    | □    | □  | ■  | NP       |
| §2.1051<br>§24.238<br>RSS133 6.5     | Conducted Spurious Emissions | Nominal                            | GSM 1900 | □    | □    | □  | ■  | NP       |
| §2.1053<br>§24.238<br>RSS133 6.5     | Radiated Spurious Emissions  | Nominal                            | GSM 1900 | ■    | □    | □  | □  | Complies |
| §15.107<br>§15.207<br>RSS Gen        | Line conducted Emissions     | Nominal                            | GSM 1900 | □    | □    | ■  | □  | N/A      |
| §2.1053<br>§15.109<br>RSS Gen        | Receiver Emissions-Radiated  | Nominal                            | RX Mode  | ■    | □    | □  | □  | Complies |

**Note:** NA= Not Applicable; NP= Not Performed.

- All FCC 22H/24E conducted measurements are covered under test report# **SHEMO10030019402**
- Line/Conducted Emissions not applicable since device is powered through a DC supply.

## **6 Measurements**

### **6.1 RF Power Output**

#### **6.1.1 References**

FCC: CFR Part 2.1046, CFR Part 22.913, CFR Part 24.232

IC: RSS-Gen Section 4.8; RSS 132 Section 4.4; RSS 133 Section 6.4

#### **6.1.2 Measurement requirements:**

##### **6.1.2.1 FCC 2.1046: RF power output.**

Power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on circuit elements as specified. The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

##### **6.1.2.2 RSS-Gen 4.8: RF power output.**

Transmitter output power measurements shall be carried out before the unwanted emissions test. The transmitter output power value, obtained from this test, serves as the reference level used to determine the unwanted emissions.

#### **6.1.3 Limits:**

##### **6.1.3.1 FCC 22.913 (a) Effective radiated power limits.**

The effective radiated power (ERP) of mobile transmitters must not exceed 7 Watts.

##### **6.1.3.2 FCC 24.232 (b)(c) Power limits.**

(b) Mobile/portable stations are limited to 2 Watts effective isotropic radiated power (EIRP).

(c) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms equivalent voltage. The measurement results shall be properly adjusted for any limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement over the full bandwidth of the channel.

##### **6.1.3.3 RSS-132 Section 4.4**

The transmitter output power shall not exceed the limits given in SRSP-503.

SRSP-503: The maximum EIRP shall be 11.5W for mobile stations.

##### **6.1.3.4 RSS-133 Section 6.4**

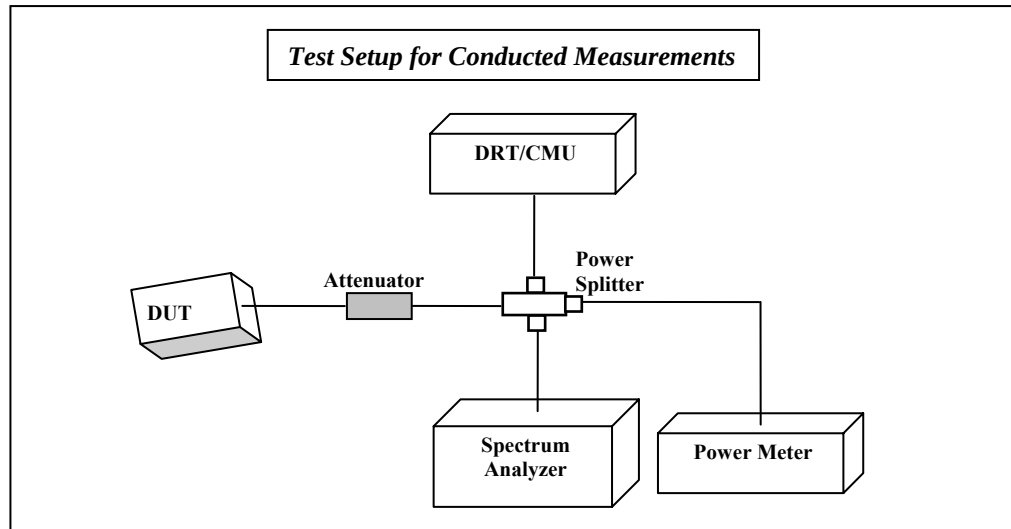
The average equivalent isotropically radiated power (e.i.r.p.) for transmitters shall not exceed the limits given in SRSP-510.

SRSP-510: Mobile stations and hand-held portables are limited to 2 watts maximum e.i.r.p.

In addition, when the transmitter power is measured in terms of average value, the peak-to-average ratio of the power shall not exceed 13 dB.

#### 6.1.4 Conducted Output Power Measurement procedure

Ref: TIA-603C 2004 2.2.1 Conducted Carrier Output Power Rating



1. Connect the equipment as shown in the above diagram. A Digital Radio Communication Tester (DRT- CMU200 here) is used to enable the EUT to transmit and to measure the output power.
2. Adjust the settings of the DRT to set the EUT to its maximum power at the required channel.
3. Record the output power level measured by the DRT.
4. Correct the measured level for all losses in the RF path.
5. Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band.

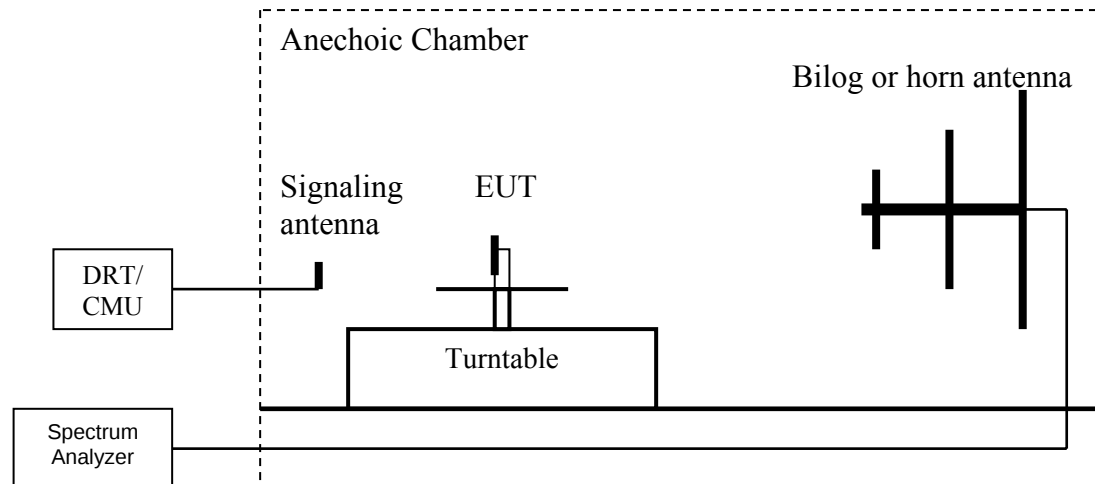
**Spectrum Analyzer Settings:**

GSM: RBW=3MHz; VBW=10MHz; Span=10MHz; Detector: Peak- Max Hold;  
Sweep time: Auto.

Average measurements performed using RMS detector functionality of the Spectrum Analyzer.

### 6.1.5 Radiated Output Power Measurement procedure

**Ref: TIA-603C 2004 -2.2.17.2 Effective Radiated Power (ERP) or Effective Isotropic Radiated Power (EIRP)**



1. Connect the equipment as shown in the above diagram with the EUT's antenna in center of the turn table.
2. Adjust the settings of the Digital Radio Communication Tester (DRT) to set the EUT to its maximum power at the required channel.
3. Set the spectrum analyzer to the channel frequency. Set the analyzer to measure peak hold with the required settings.
4. Rotate the EUT 360°. Record the peak level in dBm (**LVL**).
5. Replace the EUT with a vertically polarized half wave dipole or known gain antenna. The center of the antenna should be at the same location as the center of the EUT's antenna.
6. Connect the antenna to a signal generator with known output power and record the path loss in dB (**LOSS**). **LOSS** = Generator Output Power (dBm) – Analyzer reading (dBm).
7. Determine the ERP using the following equation:  
**ERP (dBm) = LVL (dBm) + LOSS (dB)**
8. Determine the EIRP using the following equation:  
**EIRP (dBm) = ERP (dBm) + 2.14 (dB)**
9. Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band.

**Spectrum analyzer settings: RBW=VBW=5MHz**

(**Note:** Steps 5 and 6 above are performed prior to testing and **LOSS** is recorded by test software. Steps 3, 4, 7 and 8 above are performed with test software.)

### 6.1.6 RF Power Output 850MHz band

**Limit: FCC: Nominal Peak Output Power < 38.45 dBm (7W)**

**IC: Nominal Peak Output Power < 40.60 dBm (11.5W)**

**Measurement Uncertainty (Conducted):  $\pm 0.5$  dB**

**Measurement Uncertainty (Radiated):  $\pm 3.0$  dB**

**Calculated antenna gain= Radiated peak power- Conducted peak power**

|                          |                   |
|--------------------------|-------------------|
| <b>Power Class Level</b> | <b>4 (33 dBm)</b> |
|--------------------------|-------------------|

| <b>GSM 850: GMSK Mode</b> |                       |
|---------------------------|-----------------------|
| <b>Frequency (MHz)</b>    | <b>Radiated Power</b> |
|                           | <b>ERP (dBm)</b>      |
| <b>824.2</b>              | 31.0                  |
| <b>836.6</b>              | 30.4                  |
| <b>848.8</b>              | 30.1                  |

|                          |                    |
|--------------------------|--------------------|
| <b>Power Class Level</b> | <b>E2 (27 dBm)</b> |
|--------------------------|--------------------|

| <b>GSM 850: 8PSK Mode</b> |                       |
|---------------------------|-----------------------|
| <b>Frequency (MHz)</b>    | <b>Radiated Power</b> |
|                           | <b>ERP (dBm)</b>      |
| <b>824.2</b>              | 28.9                  |
| <b>836.6</b>              | 28.3                  |
| <b>848.8</b>              | 27.8                  |

#### 6.1.6.1 Measurement Result

Pass.

### 6.1.7 RF Power Output 1900MHz band

**Limit: Nominal Peak Output Power < 33 dBm (2W)**

**PAR may not exceed 13dB**

**Measurement Uncertainty (Conducted):  $\pm 0.5$  dB**

**Measurement Uncertainty (Radiated):  $\pm 3.0$  dB**

**Calculated antenna gain= Radiated peak power- Conducted peak power**

|                          |                   |
|--------------------------|-------------------|
| <b>Power Class Level</b> | <b>1 (30 dBm)</b> |
|--------------------------|-------------------|

| <b>GSM 1900: GMSK Mode</b> |                       |
|----------------------------|-----------------------|
| <b>Frequency (MHz)</b>     | <b>Radiated Power</b> |
|                            | <b>EIRP (dBm)</b>     |
| <b>1850.2</b>              | 31.0                  |
| <b>1880</b>                | 30.1                  |
| <b>1909.8</b>              | 30.9                  |

|                          |                    |
|--------------------------|--------------------|
| <b>Power Class Level</b> | <b>E2 (26 dBm)</b> |
|--------------------------|--------------------|

| <b>EGPRS 1900: 8PSK Mode</b> |                       |
|------------------------------|-----------------------|
| <b>Frequency (MHz)</b>       | <b>Radiated Power</b> |
|                              | <b>EIRP (dBm)</b>     |
| <b>1850.2</b>                | 29.9                  |
| <b>1880</b>                  | 29.6                  |
| <b>1909.8</b>                | 29.9                  |

#### 6.1.7.1 Measurement Result

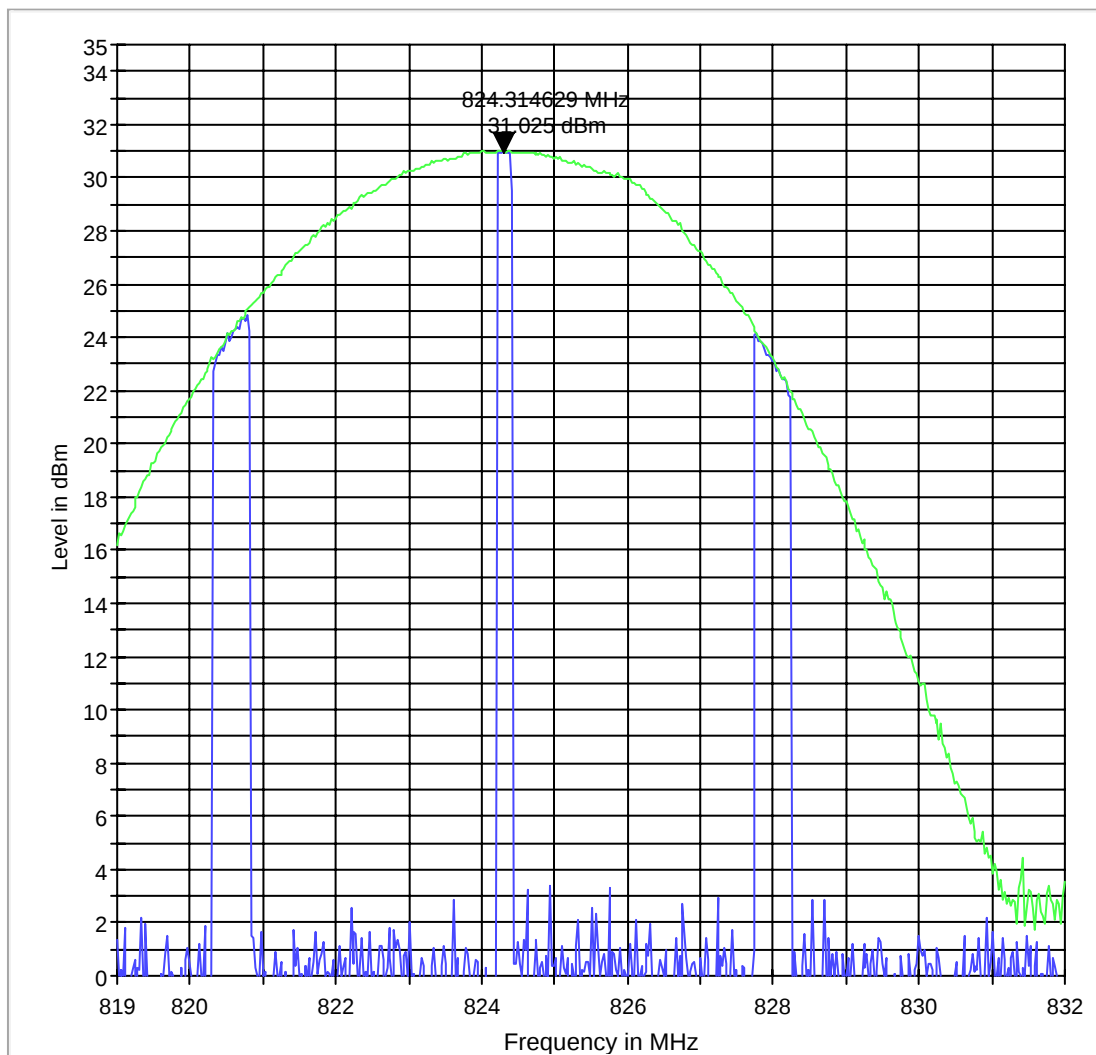
Pass.

### 6.1.8 Results

#### ERP (GSM 850) CHANNEL 128

|                  |                    |
|------------------|--------------------|
| EUT Name:        | Fusion             |
| Manufacturer:    | Braemar            |
| Serial Number:   | 01000129           |
| Test Mode:       | GSM                |
| EUT/ANT Position | V/V                |
| Comment:         | ANT-134cm; TT@230° |

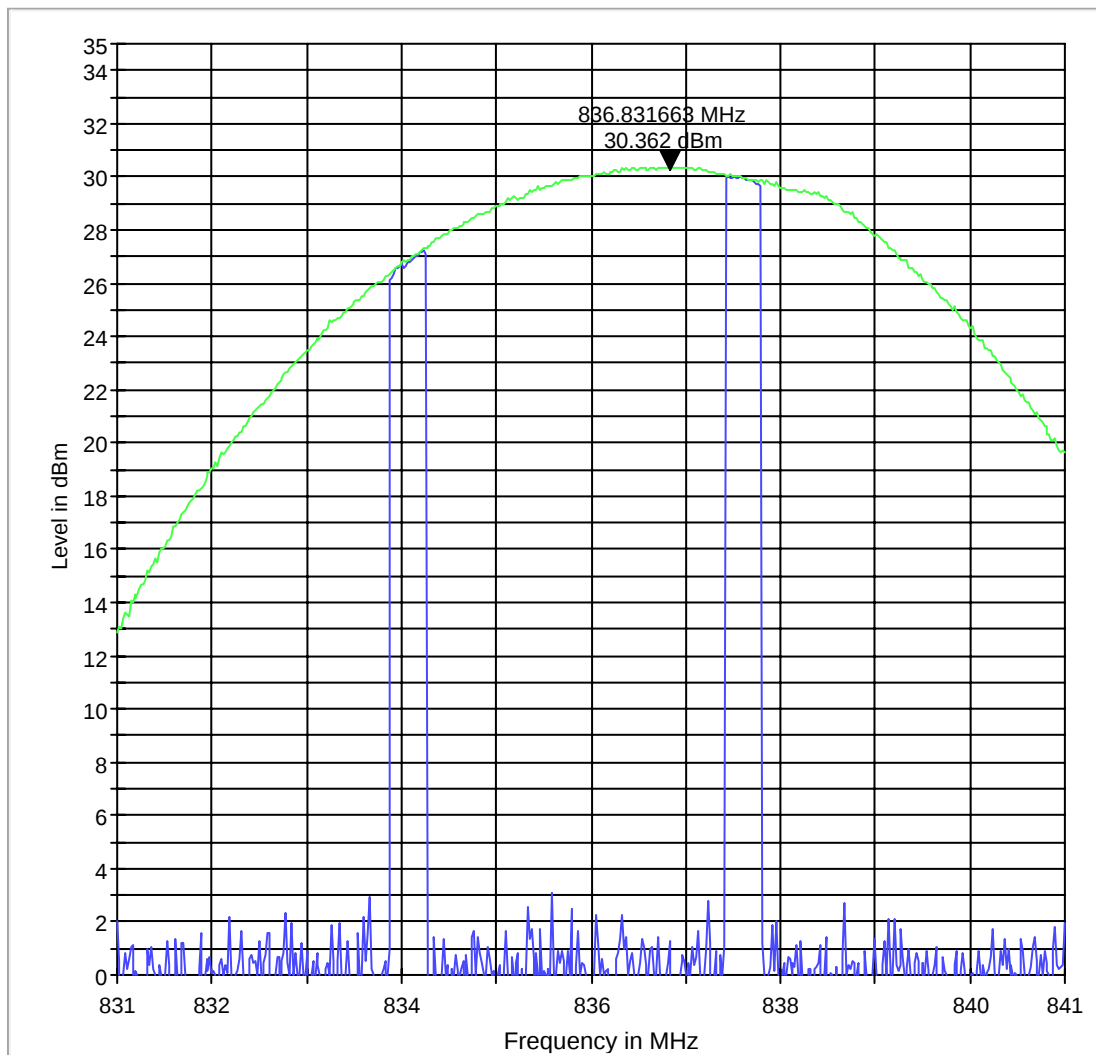
ERP 850 L



**ERP (GSM 850) CHANNEL 190**

|                  |                    |
|------------------|--------------------|
| EUT Name:        | Fusion             |
| Manufacturer:    | Braemar            |
| Serial Number:   | 01000129           |
| Test Mode:       | GSM                |
| EUT/ANT Position | V/V                |
| Comment:         | ANT-134cm; TT@230° |

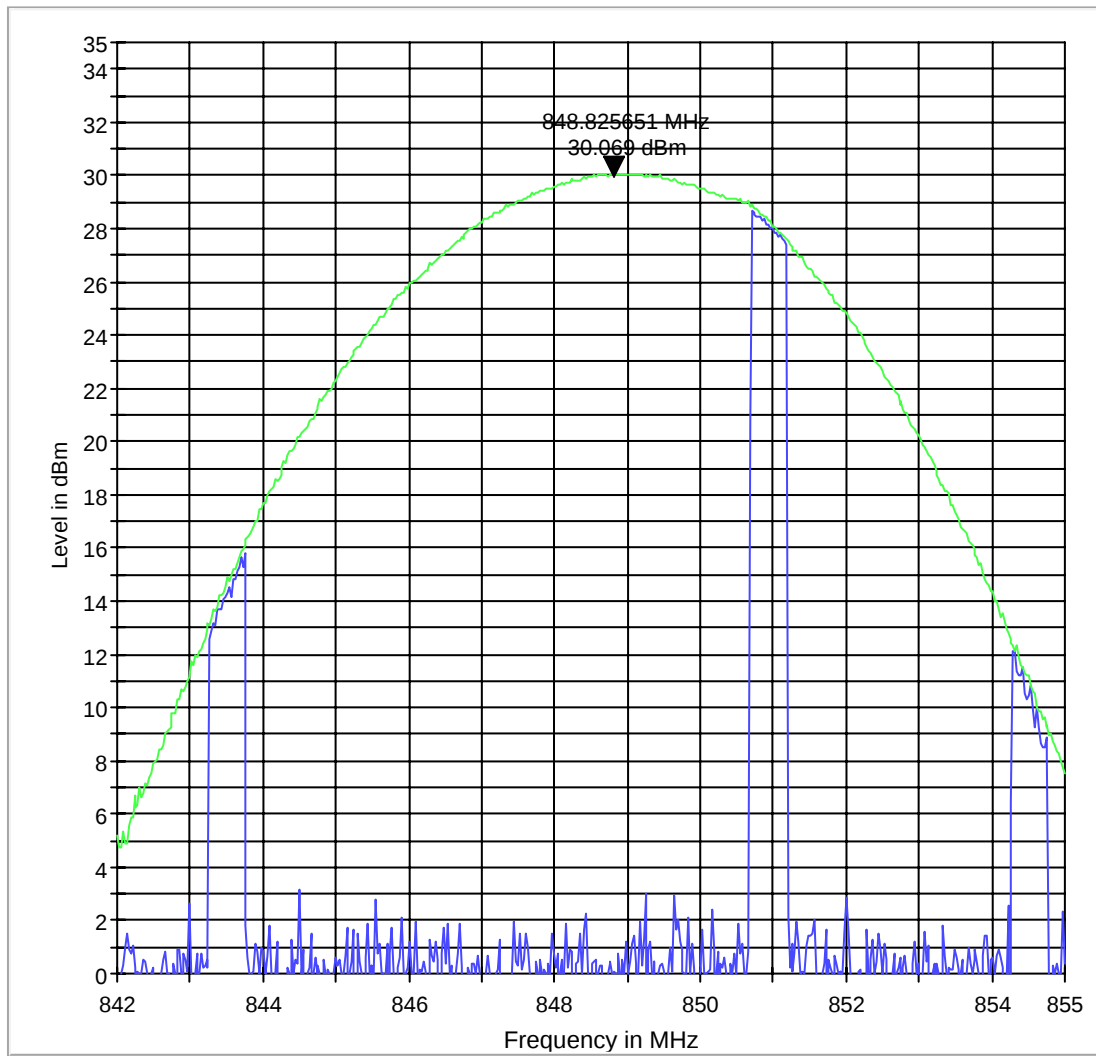
ERP 850 M



**ERP (GSM 850) CHANNEL 251**

|                  |                    |
|------------------|--------------------|
| EUT Name:        | Fusion             |
| Manufacturer:    | Braemar            |
| Serial Number:   | 01000129           |
| Test Mode:       | GSM                |
| EUT/ANT Position | V/V                |
| Comment:         | ANT-134cm; TT@230° |

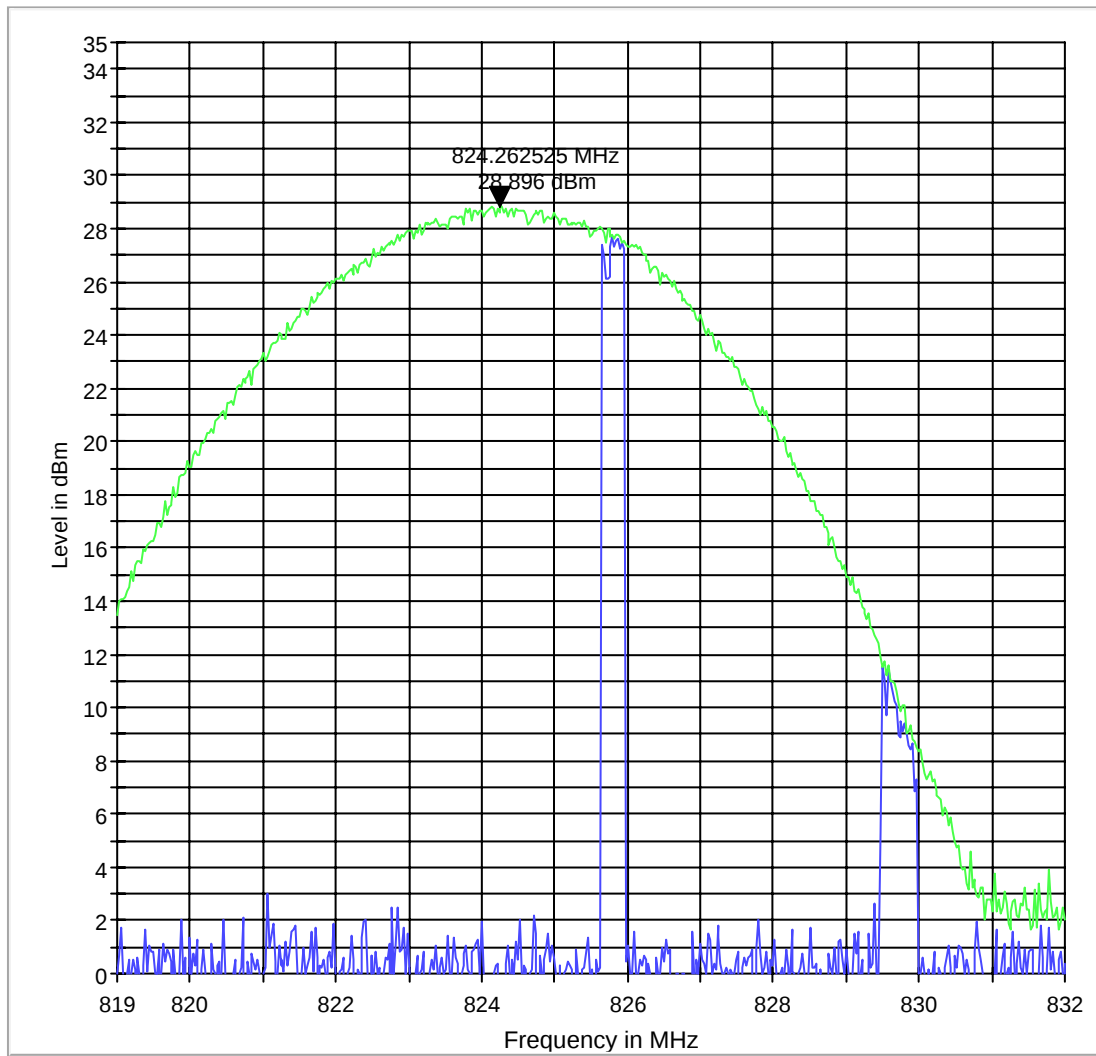
ERP 850 H



**ERP (EGPRS 850) CHANNEL 128**

|                  |                    |
|------------------|--------------------|
| EUT Name:        | Fusion             |
| Manufacturer:    | Braemar            |
| Serial Number:   | 01000129           |
| Test Mode:       | EGPRS              |
| EUT/ANT Position | V/V                |
| Comment:         | ANT-134cm; TT@230° |

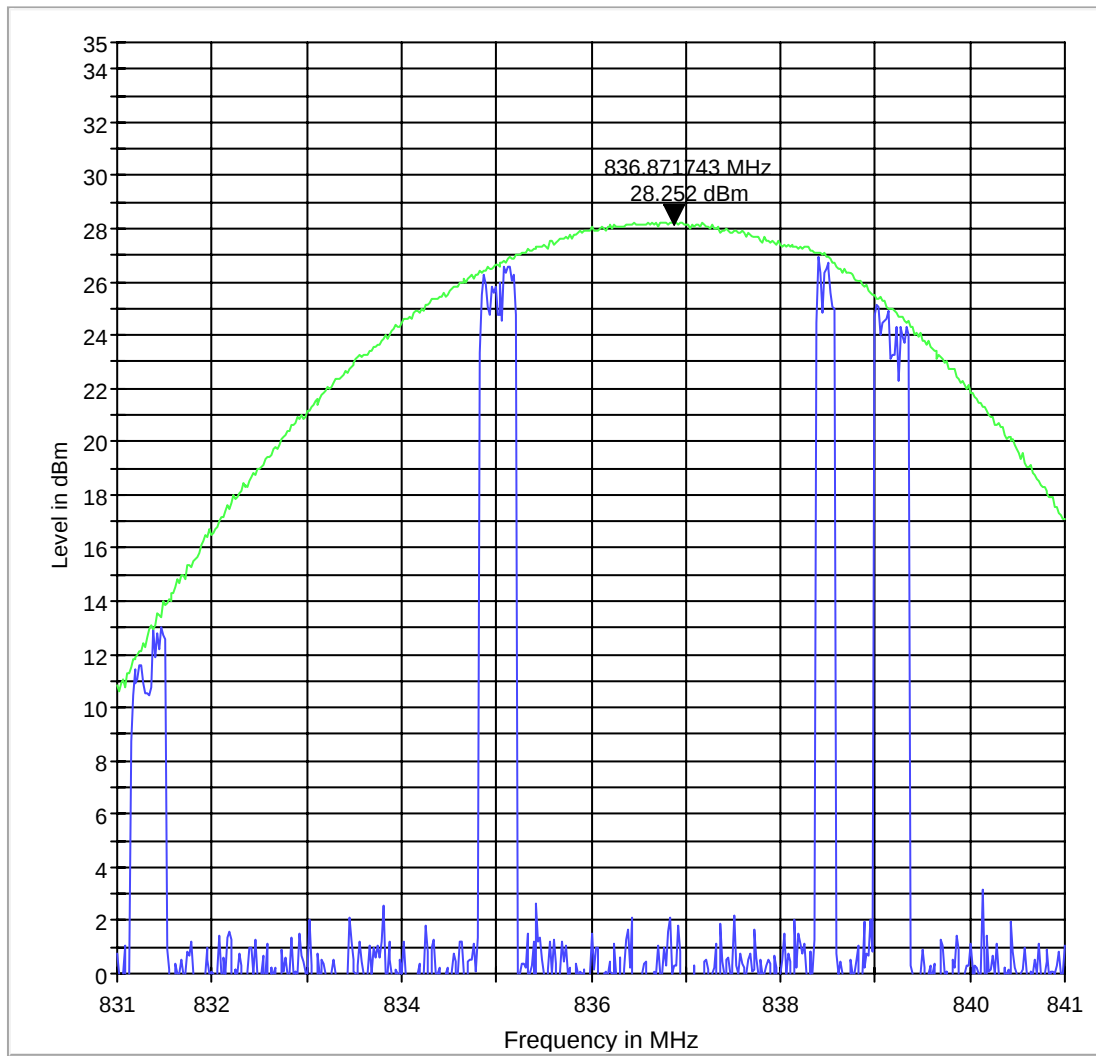
ERP 850 L



**ERP (EGPRS 850) CHANNEL 190**

|                  |                    |
|------------------|--------------------|
| EUT Name:        | Fusion             |
| Manufacturer:    | Braemar            |
| Serial Number:   | 01000129           |
| Test Mode:       | EGPRS              |
| EUT/ANT Position | V/V                |
| Comment:         | ANT-134cm; TT@230° |

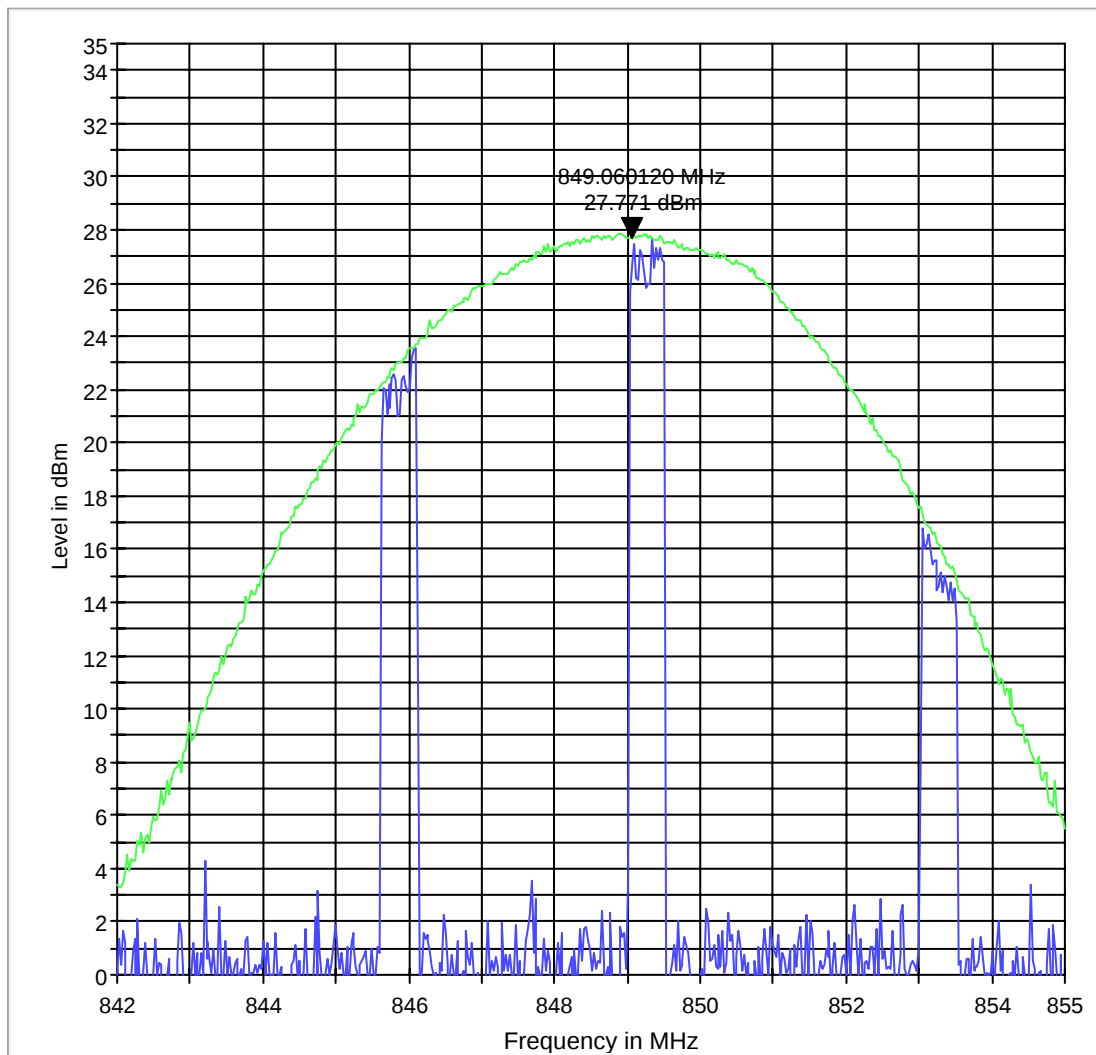
ERP 850 M



**ERP (EGPRS 850) CHANNEL 251**

EUT Name: Fusion  
Manufacturer: Braemar  
Serial Number: 01000129  
Test Mode: EGPRS  
EUT/ANT Position: V/V  
Comment: ANT-134cm; TT@230°

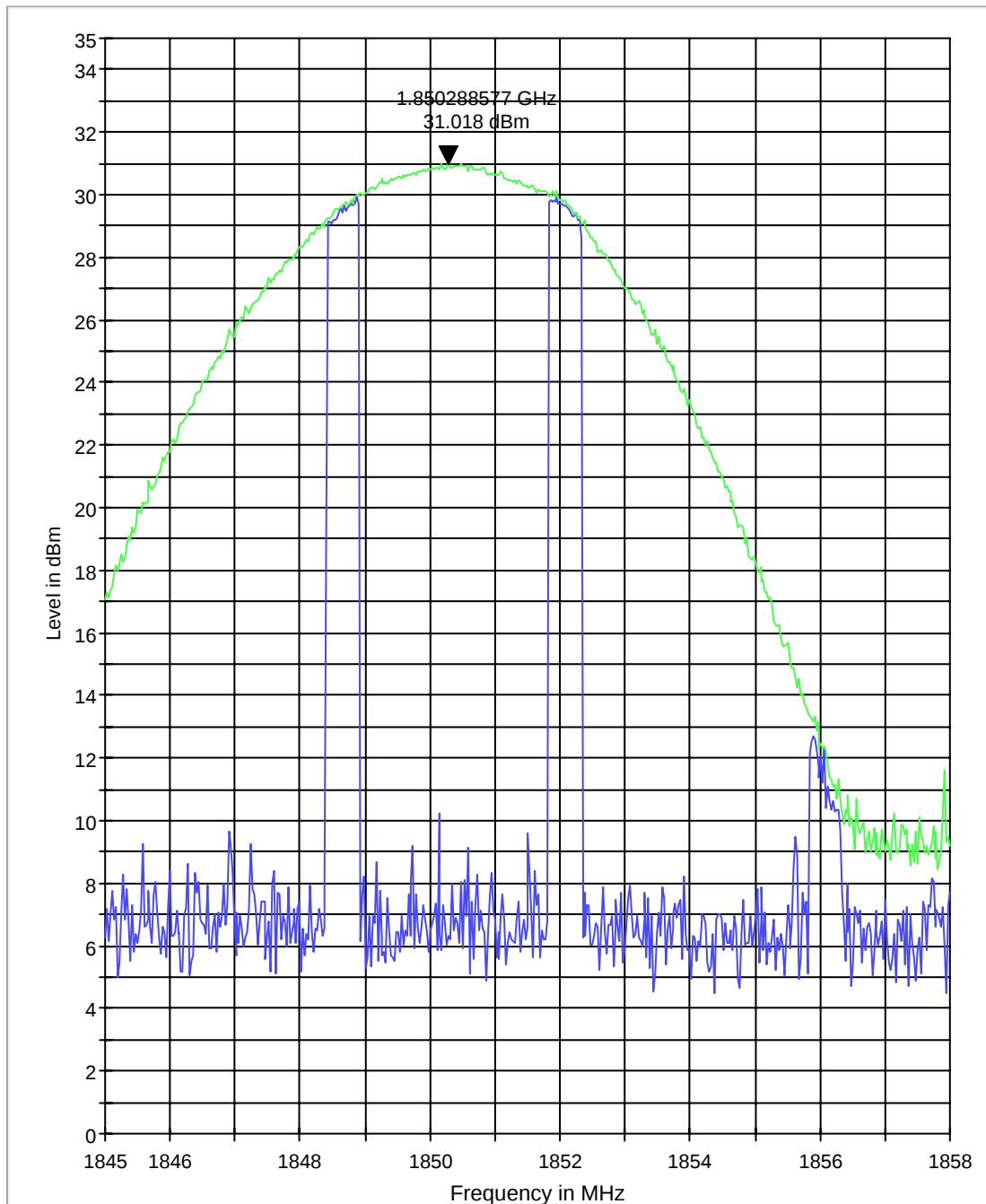
ERP 850 H



**EIRP (PCS-1900) CHANNEL 512**

EUT Name: Fusion  
Manufacturer: Braemar  
Serial Number: 01000129  
Test Mode: GSM  
EUT/ANT: H/H  
Comment: ANT-101cm; TT@ 232°

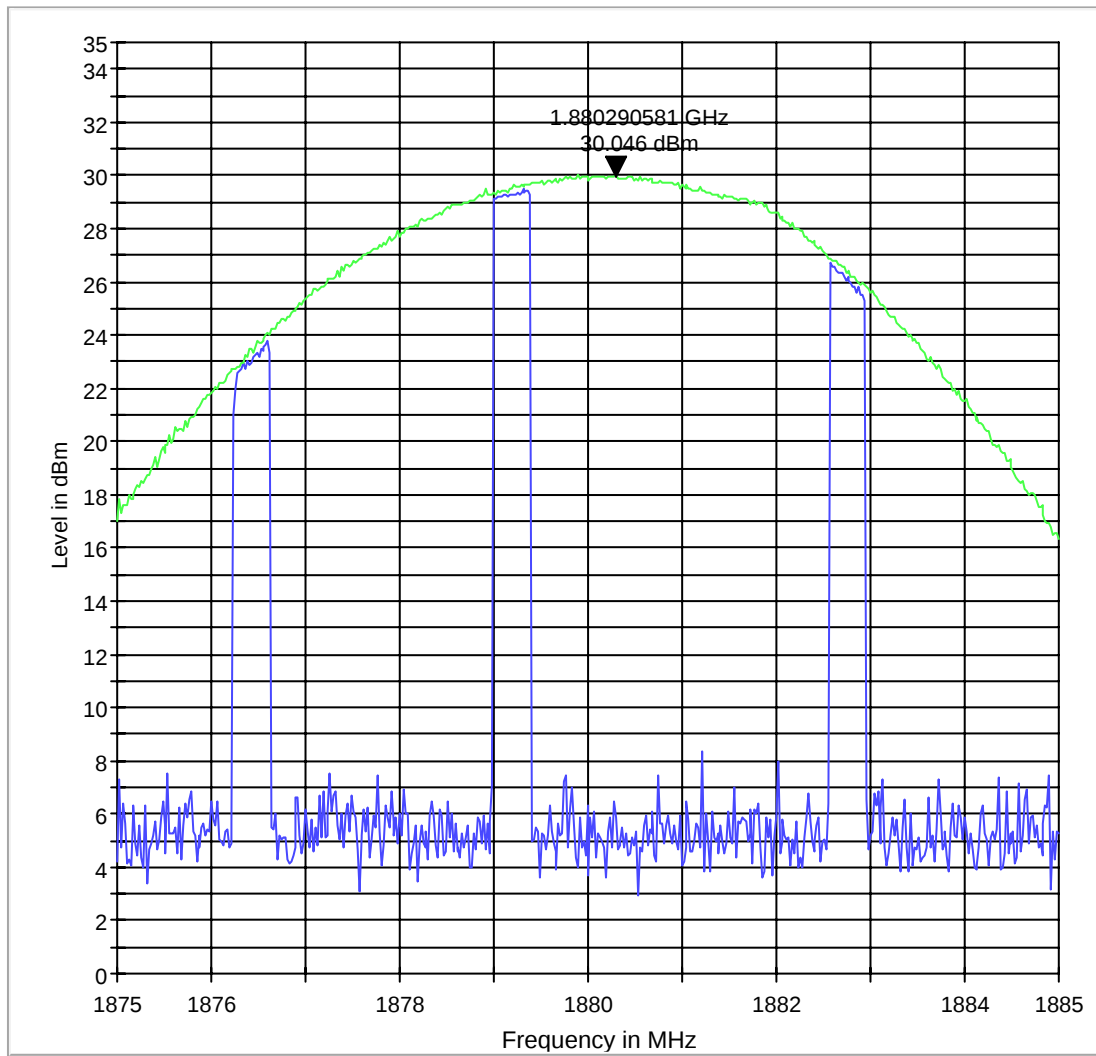
EIRP 1900 L



**EIRP (PCS-1900) CHANNEL 661**

EUT Name: Fusion  
Manufacturer: Braemar  
Serial Number: 01000129  
Test Mode: GSM  
EUT/ANT: H/H  
Comment: ANT-101cm; TT@ 232°

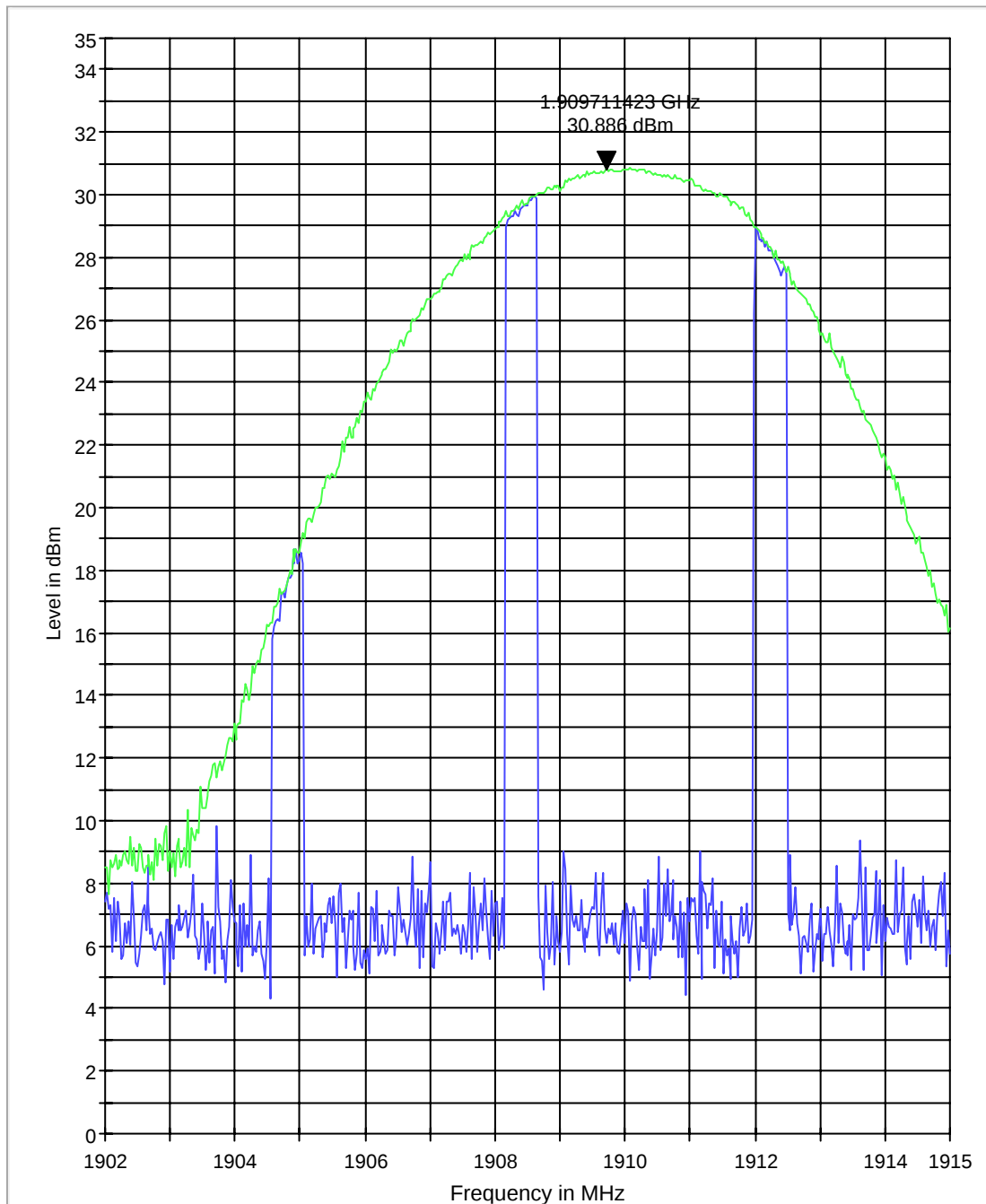
EIRP 1900 M



**EIRP (PCS-1900) CHANNEL 810**

EUT Name: Fusion  
Manufacturer: Braemar  
Serial Number: 01000129  
Test Mode: GSM  
EUT/ANT: H/H  
Comment: ANT-101cm; TT@ 232°

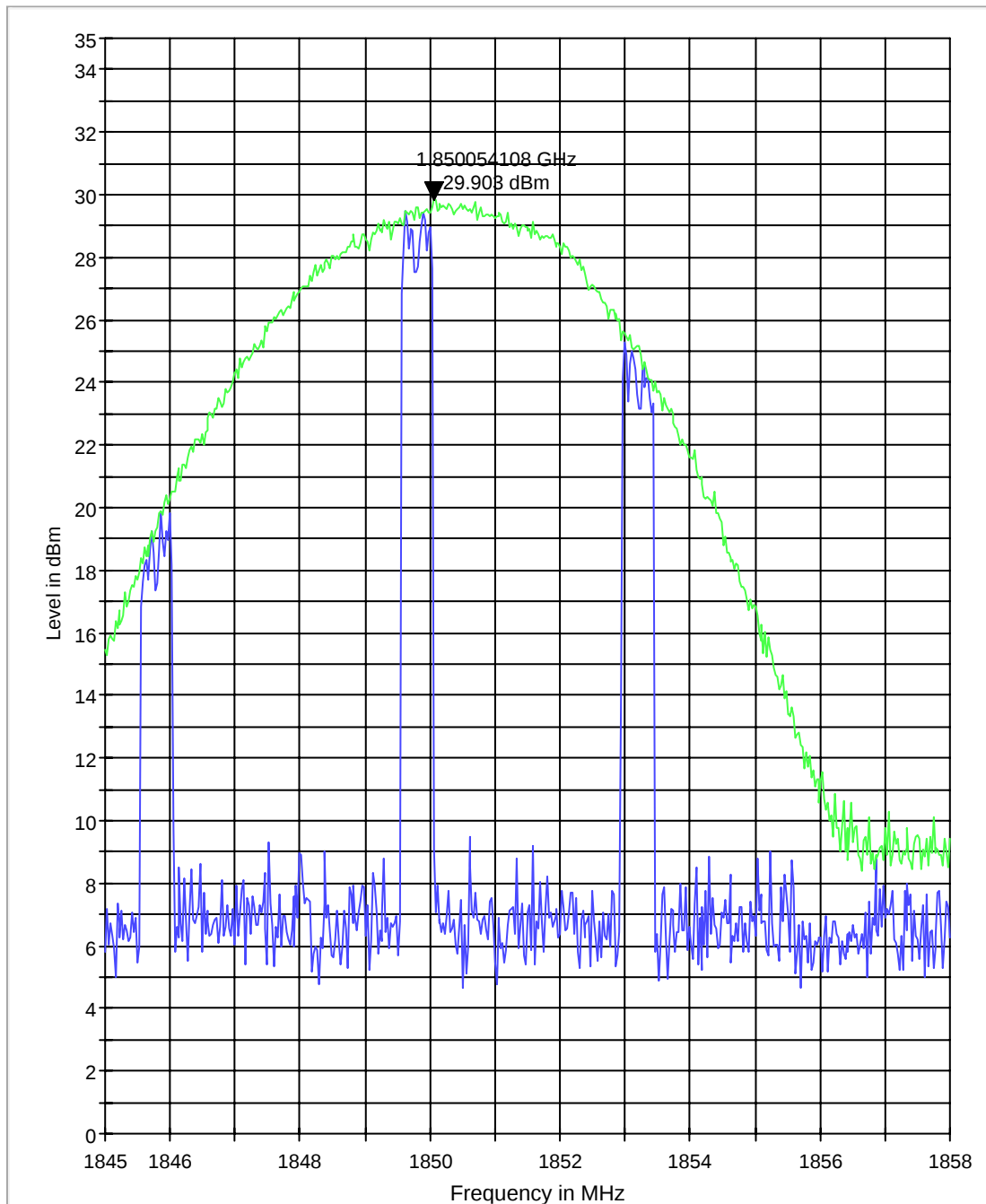
EIRP 1900 H



**EIRP (EGPRS 1900) CHANNEL 512**

EUT Name: Fusion  
Manufacturer: Braemar  
Serial Number: 01000129  
Test Mode: EGPRS  
EUT/ANT: H/H  
Comment: ANT-101cm; TT@ 232°

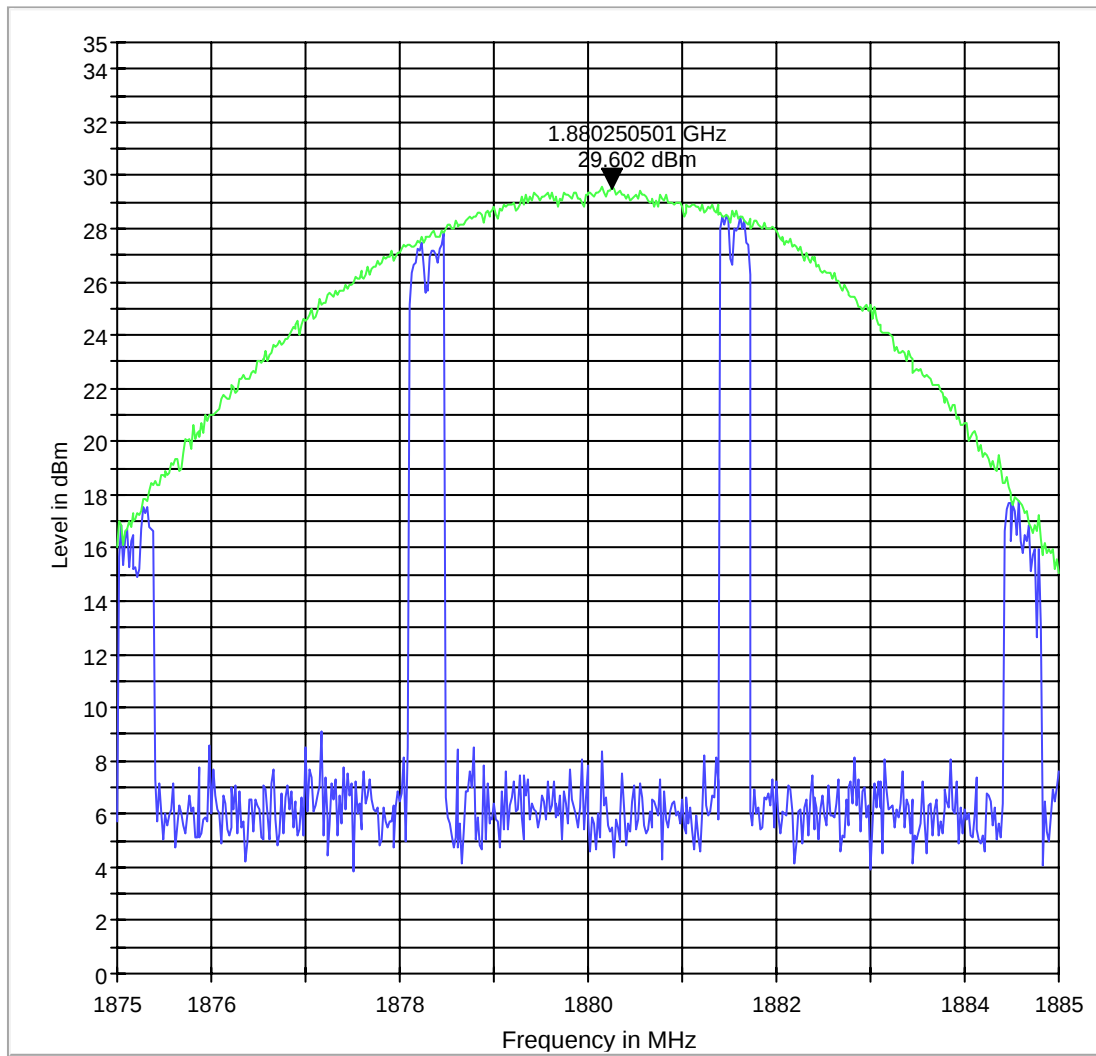
EIRP 1900 L



**EIRP (EGPRS 1900) CHANNEL 661**

EUT Name: Fusion  
Manufacturer: Braemar  
Serial Number: 01000129  
Test Mode: EGPRS  
EUT/ANT: H/H  
Comment: ANT-101cm; TT@ 232°

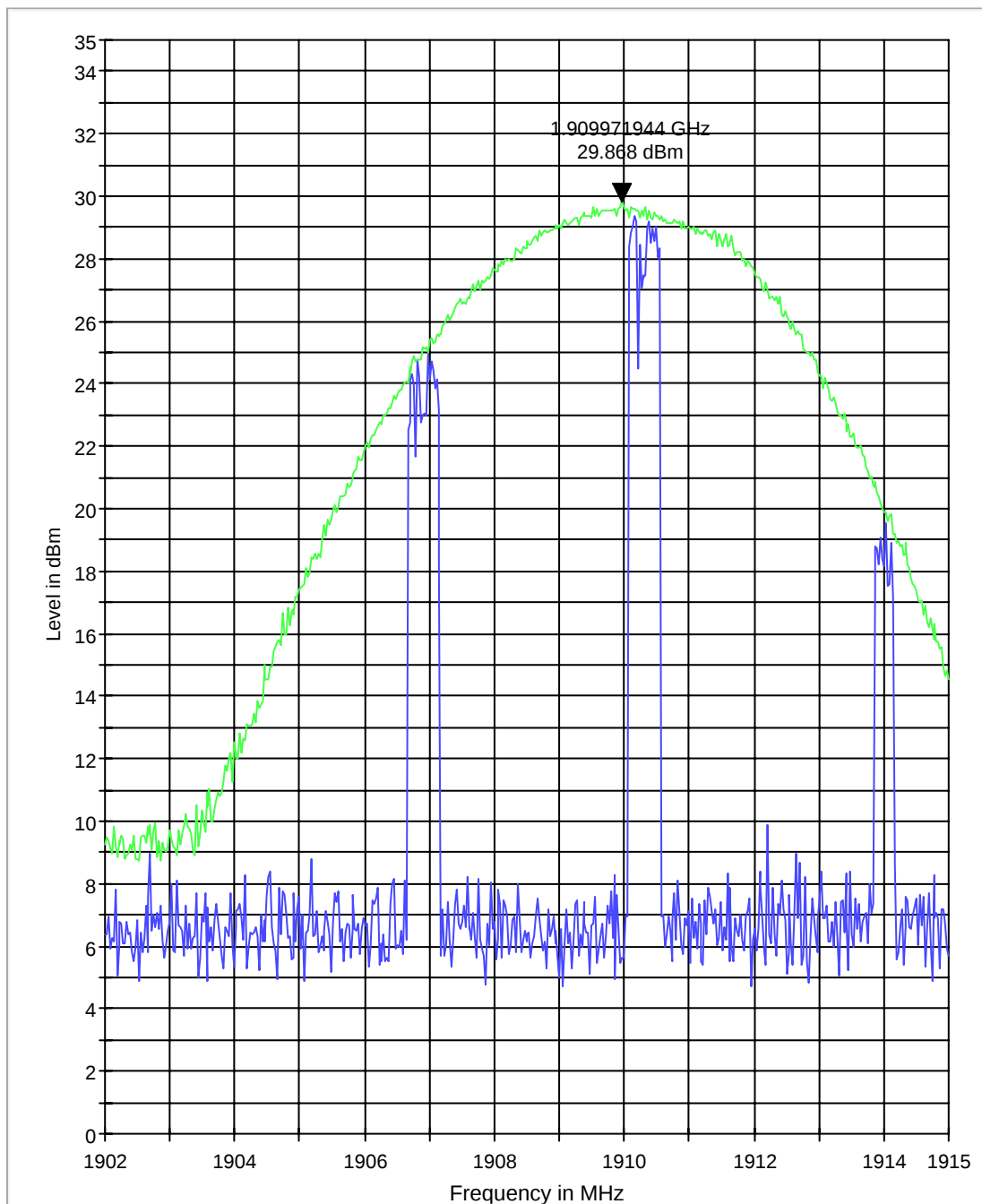
EIRP 1900 M



**EIRP (EGPRS 1900) CHANNEL 810**

EUT Name: Fusion  
Manufacturer: Braemar  
Serial Number: 01000129  
Test Mode: EGPRS  
EUT/ANT: H/H  
Comment: ANT-101cm; TT@ 232°

EIRP 1900 H



## **6.2 Occupied/Emission Bandwidth- 850/1900 MHz band**

Refer to test report [SHEMO10030019402](#)

## **6.3 Frequency Stability**

Refer to test report [SHEMO10030019402](#)

## **6.4 Conducted Spurious Emissions**

Refer to test report [SHEMO10030019402](#)

## **6.5 Spurious Emissions Radiated**

### **6.5.1 References**

FCC: CFR Part 2.1053, CFR Part 22.917, CFR Part 24.238

IC: RSS-Gen Section 4.9; RSS 132 Section 4.5; RSS 133 Section 6.5

### **6.5.2 Measurement requirements:**

#### **6.5.2.1 FCC 2.1053: Field strength of spurious radiation.**

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission.

#### **6.5.2.2 RSS-Gen 4.9: Transmitter unwanted spurious emissions**

The same parameter, peak power or average power, used for the transmitter output power measurement shall be used for unwanted emission measurements.

The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate or carrier frequency), or from 30 MHz, whichever is the lower, to the 5th harmonic of the highest frequency generated without exceeding 40 GHz.

### **6.5.3 Limits:**

(a) *Out of band emissions.* The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

For all power levels +30dBm to 0dBm, this becomes a constant specification of -13dBm.

#### **6.5.3.1 FCC 22.917 Emission limitations for cellular equipment.**

The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.

(b) *Measurement procedure.* Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

#### **6.5.3.2 FCC 24.238 Emission limitations for Broadband PCS equipment.**

The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.

(b) *Measurement procedure.* Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (*i.e.* 100 kHz of 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

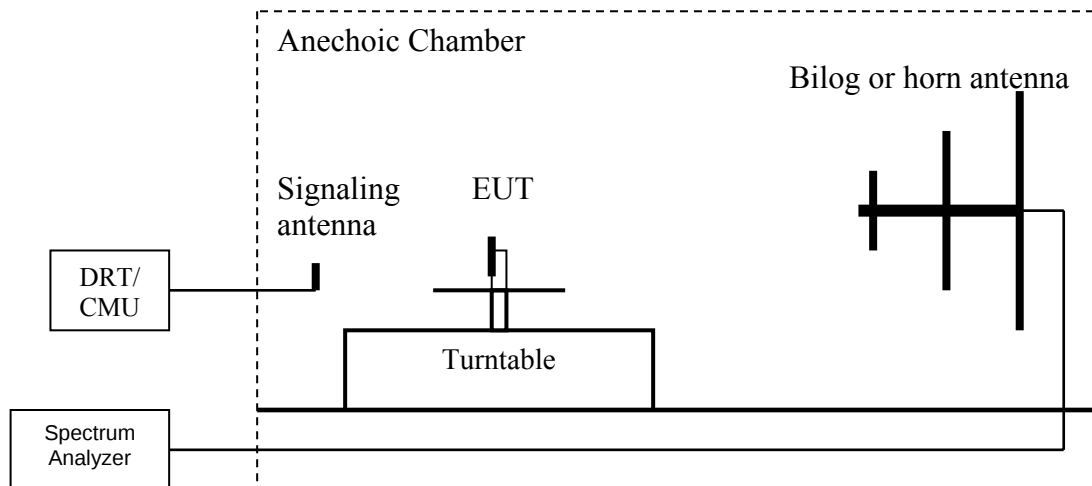
#### **6.5.3.3 RSS-132 Section 4.5.1.1 and RSS-133 Section 6.5.1**

In the first 1.0 MHz band immediately outside and adjacent to the licensee's frequency block, the power of emissions per any 1% of the emission bandwidth shall be attenuated below the transmitter output power  $P$  (in watts) by at least  $43 + 10 \log_{10}(P)$ , dB. After the first 1.0 MHz, the power of emissions shall be attenuated below the transmitter output power by at least  $43 + 10 \log_{10}(P)$ , dB, in any 100 kHz bandwidth.

After the first 1.5 MHz, the power of emissions shall be attenuated below the transmitter output power by at least  $43 + 10 \log_{10}(P)$ , dB, in any MHz of bandwidth.

#### 6.5.4 Radiated out of band measurement procedure:

Ref: TIA-603C 2004- 2.2.12 Unwanted emissions: Radiated Spurious



1. Connect the equipment as shown in the above diagram with the EUT's antenna in a horizontal orientation.
2. Adjust the settings of the Digital RadioCommunication Tester (DRT) to set the EUT to its maximum power at the required channel.
3. Set the spectrum analyzer to measure peak hold with the required settings.
4. Place the measurement antenna in a horizontal orientation. Rotate the EUT 360°. Raise the measurement antenna up to 4 meters in 0.5 meters increments and rotate the EUT 360° at each height to maximize all emissions. Measure and record all spurious emissions (**LVL**) up to the tenth harmonic of the carrier frequency.
5. Replace the EUT with a horizontally polarized half wave dipole or known gain antenna. The center of the antenna should be at the same location as the center of the EUT's antenna.
6. Connect the antenna to a signal generator with known output power and record the path loss in dB (**LOSS**). **LOSS** = Generator Output Power (dBm) – Analyzer reading (dBm).
7. Determine the level of spurious emissions using the following equation:  
**Spurious** (dBm) = **LVL** (dBm) + **LOSS** (dB):
8. Repeat steps 4, 5 and 6 with all antennas vertically polarized.
9. Determine the level of spurious emissions using the following equation:  
**Spurious** (dBm) = **LVL** (dBm) + **LOSS** (dB):
10. Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band.  
 (Note: Steps 5 and 6 above are performed prior to testing and **LOSS** is recorded by test software. Steps 3, 4 and 7 above are performed with test software.)

**Spectrum analyzer settings: RBW=VBW=1MHz**

**Measurement Survey:**

The site is constructed in accordance with ANSI C63.4 requirements and is recognized by the FCC to be in compliance for a 3m site. The spectrum is scanned from 30MHz to the 10<sup>th</sup> harmonic of the highest frequency generated by the EUT.

Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of the GSM-850 & PCS-1900 bands. It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the GSM-850 & PCS-1900 band into any of the other blocks respectively. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

Radiated emission measurements were made only with Circuit Switched mode GMSK modulation because this mode represents the worse case emission for all the modulations for GSM. All measurements are done in horizontal and vertical antenna polarization; and on three orientations of the EUT. The plots show the worst case where it is not indicated otherwise. Unless mentioned otherwise, the peaks in the plots are from the carrier frequency.

### 6.5.5 Radiated out of band emissions results on EUT- Transmit Mode:

#### 6.5.5.1 Test Results Transmitter Spurious Emission GSM850:

| Harmonic                                                | Tx ch-128<br>Freq.<br>(MHz) | Level<br>(dBm) | Tx ch-190<br>Freq.<br>(MHz) | Level<br>(dBm) | Tx ch-251<br>Freq.<br>(MHz) | Level<br>(dBm) |
|---------------------------------------------------------|-----------------------------|----------------|-----------------------------|----------------|-----------------------------|----------------|
| 1                                                       | 824.2                       | -              | 836.6                       | -              | 848.8                       | -              |
| 2                                                       | 1648.4                      | -35.2          | 1673.2                      | -38.1          | 1697.6                      | -34.7          |
| 3                                                       | 2472.6                      | -38.4          | 2509.8                      | -36.2          | 2546.4                      | -38.1          |
| 4                                                       | 3296.8                      | NF             | 3346.4                      | NF             | 3395.2                      | NF             |
| 5                                                       | 4121                        | NF             | 4183                        | NF             | 4244                        | NF             |
| 6                                                       | 4945.2                      | NF             | 5019.6                      | NF             | 5092.8                      | NF             |
| 7                                                       | 5769.4                      | NF             | 5856.2                      | NF             | 5941.6                      | NF             |
| 8                                                       | 6593.6                      | NF             | 6692.8                      | NF             | 6790.4                      | NF             |
| 9                                                       | 7417.8                      | NF             | 7529.4                      | NF             | 7639.2                      | NF             |
| 10                                                      | 8242                        | NF             | 8366                        | NF             | 8488                        | NF             |
| NF = Noise Floor<br>Measurement Uncertainty: $\pm 3$ dB |                             |                |                             |                |                             |                |

#### 6.5.5.2 Measurement Result

Pass.

#### Legend for the plots:

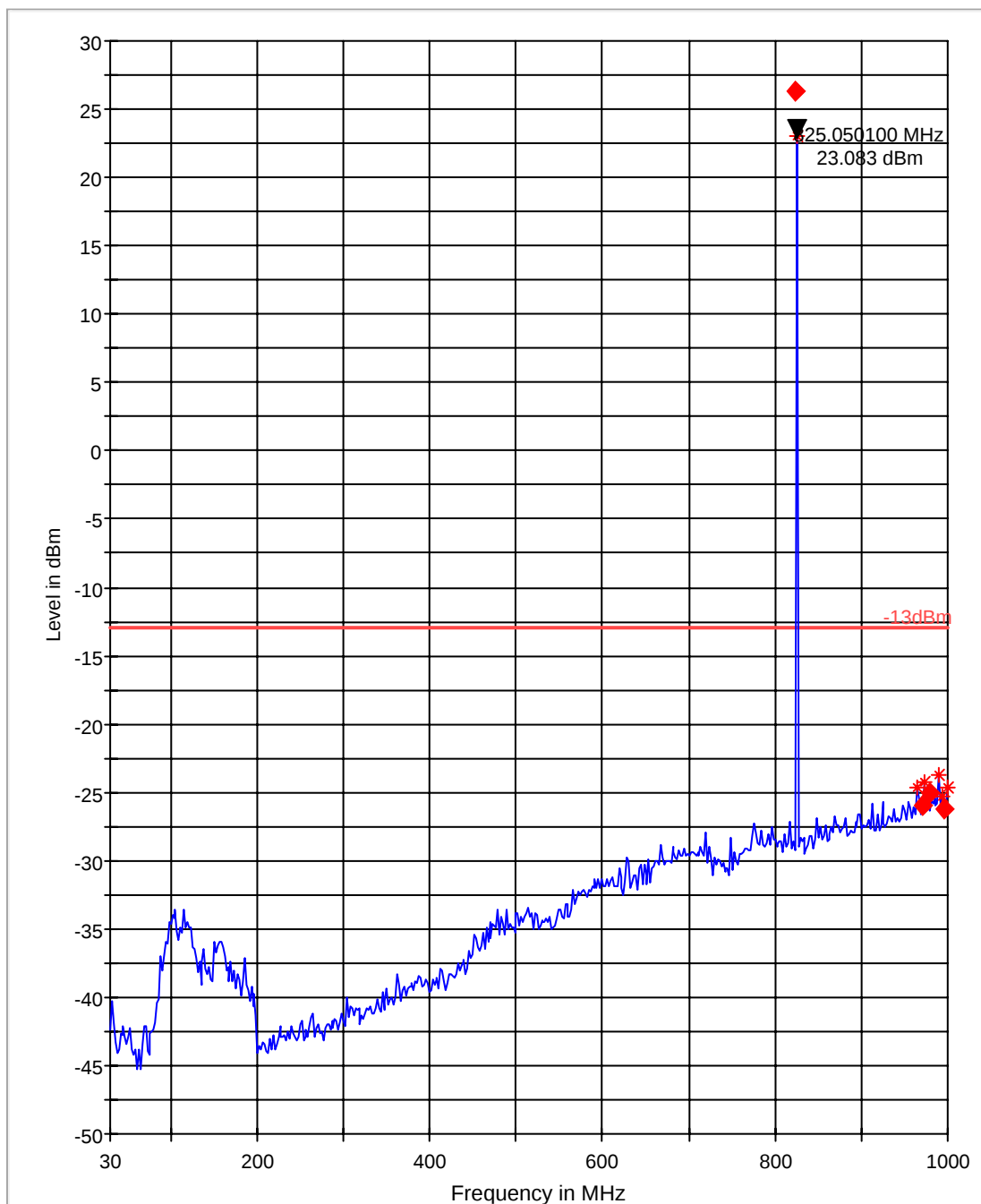
-  -13dBm.LimitLine
-  Preview Result
-  Data Reduction Result
-  Final Measurement Result

**Note: Worst case representation of all channels**

**Radiated Spurious Emissions (GSM-850) Tx: Low Channel**  
**Test results 30M-1GHz**

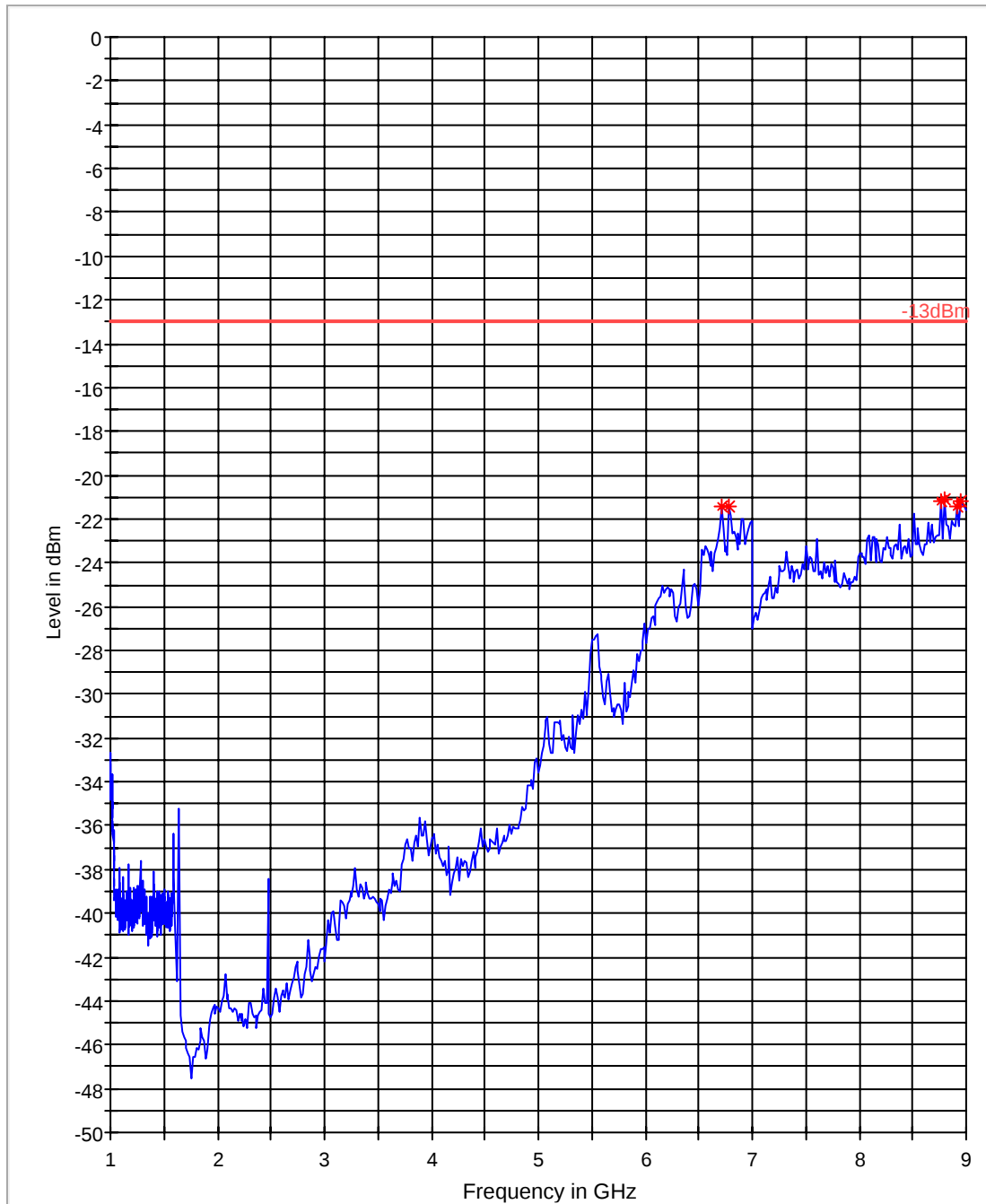
**\*\*Marker placed on Transmit signal**

FCC 22 30-1000MHz



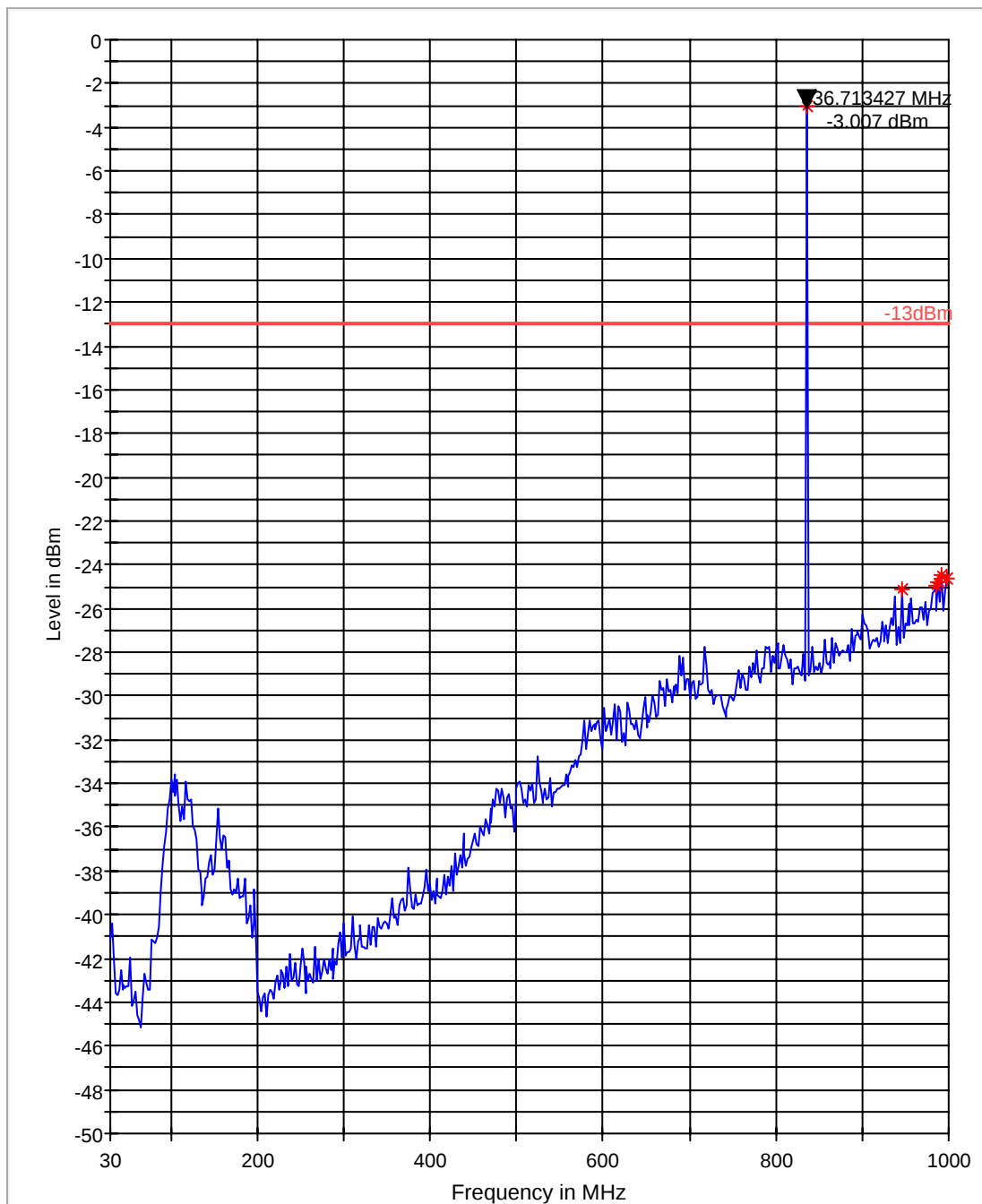
**Test results 1GHz-9GHz**

FCC 22 1-9GHz



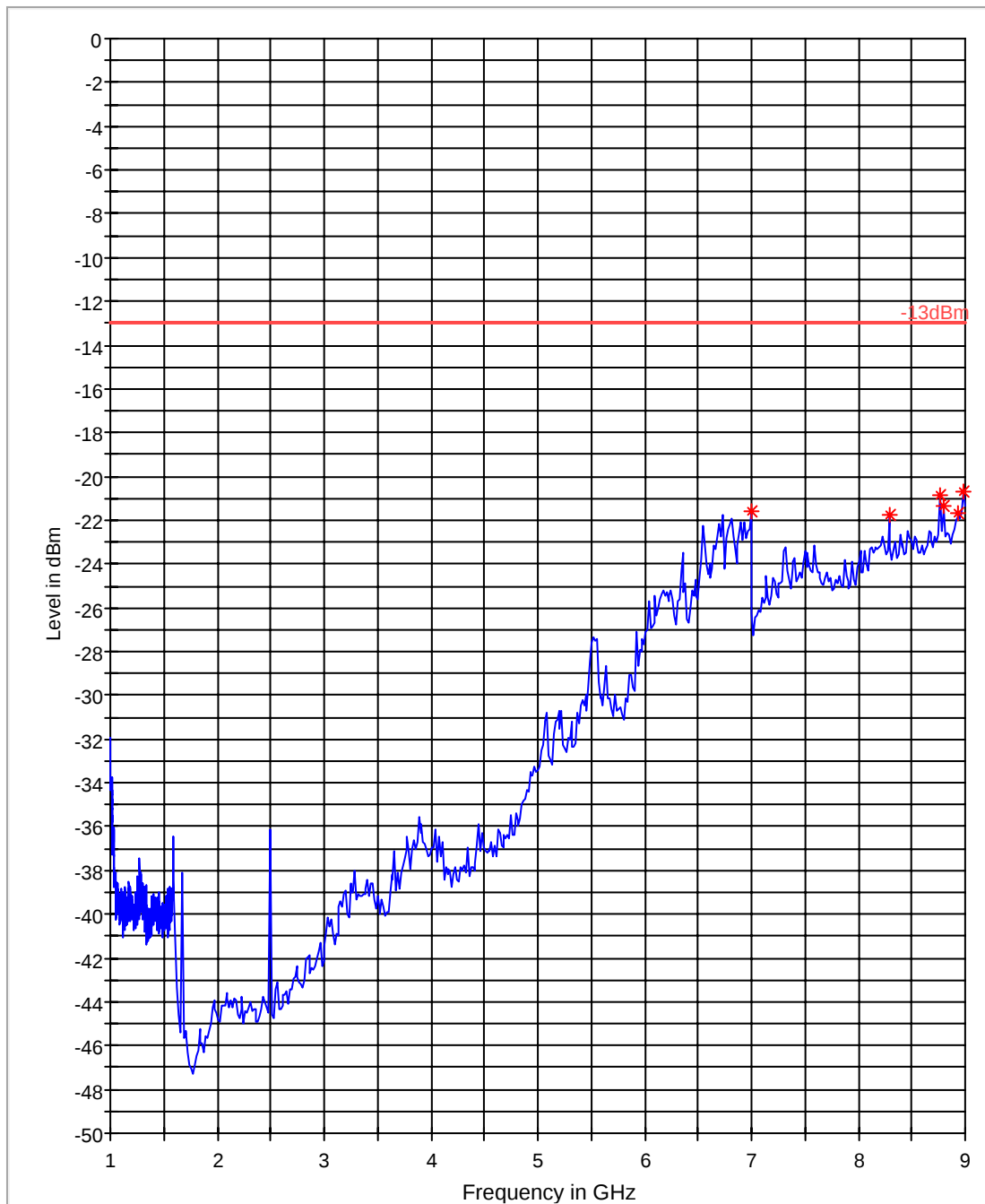
**Radiated Spurious Emissions (GSM-850) Tx: Mid Channel**  
**Test results 30M-1GHz****\*\*Marker placed on Transmit signal**

FCC 22 30-1000MHz



## Test results 1GHz-9GHz

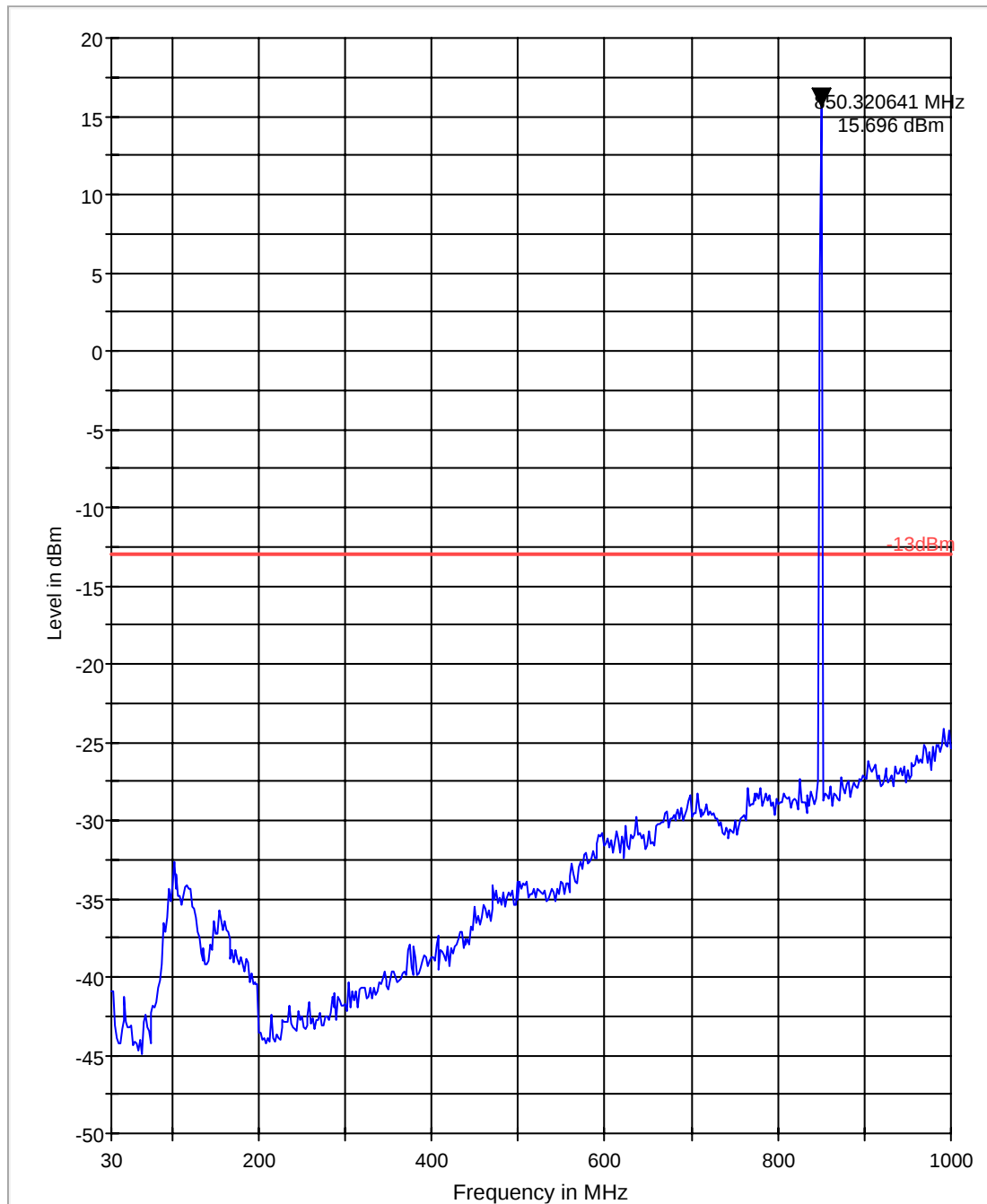
FCC 22 1-9GHz



**Radiated Spurious Emissions (GSM-850) Tx: High Channel**  
**Test results 30M-1GHz**

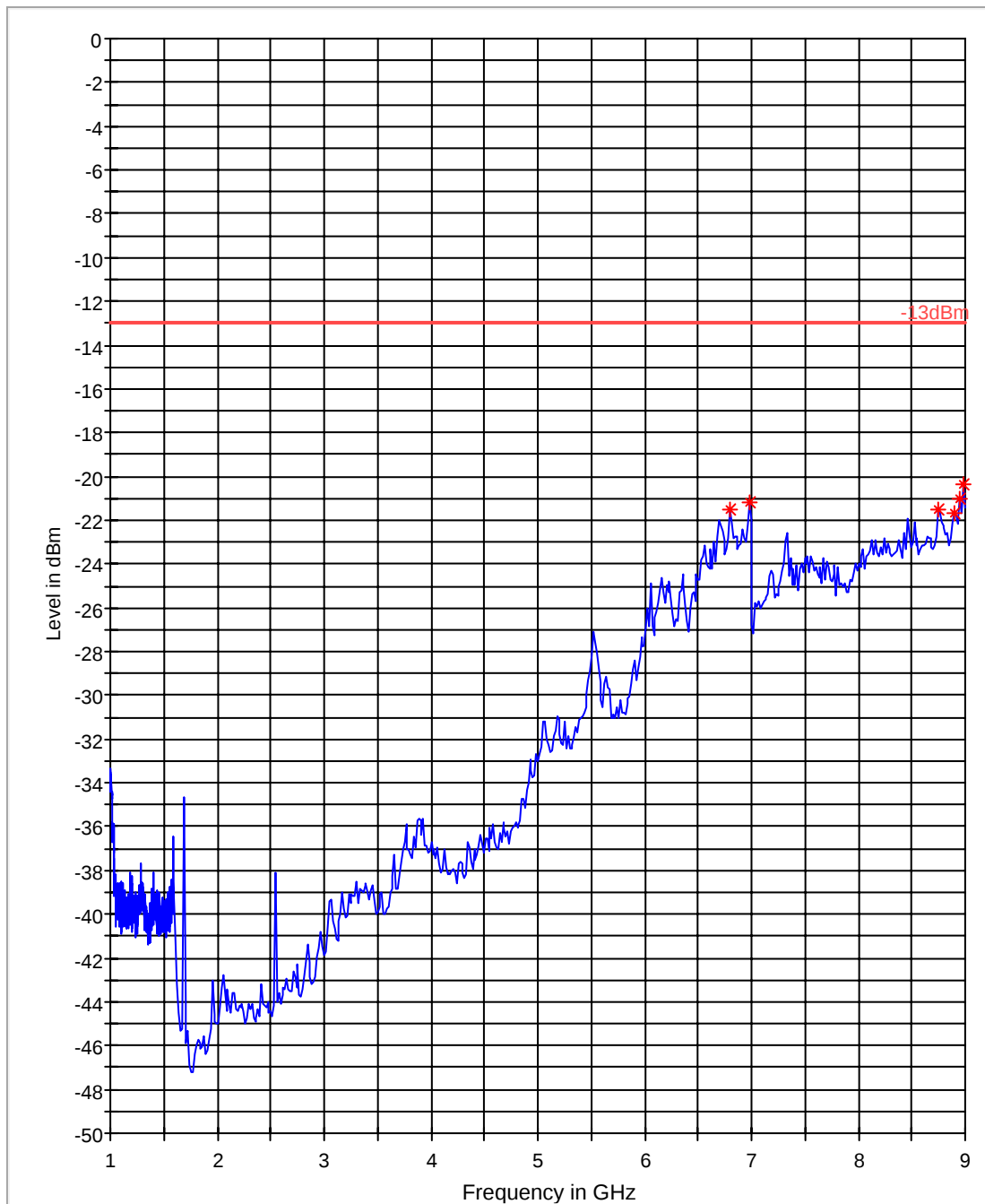
**\*\*Marker placed on Transmit signal**

FCC 22 30-1000MHz



## Test results 1GHz-9GHz

FCC 22 1-9GHz



### 6.5.6 Radiated out of band emissions results on EUT- Transmit Mode:

#### Test Results Transmitter Spurious Emission PCS-1900:

| Harmonic                                                | Tx ch-512<br>Freq.(MHz) | Level<br>(dBm) | Tx ch-661<br>Freq. (MHz) | Level<br>(dBm) | Tx ch-810<br>Freq. (MHz) | Level<br>(dBm) |
|---------------------------------------------------------|-------------------------|----------------|--------------------------|----------------|--------------------------|----------------|
| 1                                                       | 1850.2                  | -              | 1880.0                   | -              | 1909.8                   | -              |
| 2                                                       | 3700.4                  | -36.8          | 3760                     | -30.5          | 3819.6                   | -28.6          |
| 3                                                       | 5550.6                  | -37            | 5640                     | -37.2          | 5729.4                   | -37            |
| 4                                                       | 7400.8                  | NF             | 7520                     | NF             | 7639.2                   | NF             |
| 5                                                       | 9251                    | NF             | 9400                     | NF             | 9549                     | NF             |
| 6                                                       | 11101.2                 | NF             | 11280                    | NF             | 11458.8                  | NF             |
| 7                                                       | 12951.4                 | NF             | 13160                    | NF             | 13368.6                  | NF             |
| 8                                                       | 14801.6                 | NF             | 15040                    | NF             | 15278.4                  | NF             |
| 9                                                       | 16651.8                 | NF             | 16920                    | NF             | 17188.2                  | NF             |
| 10                                                      | 18502                   | NF             | 18800                    | NF             | 19098                    | NF             |
| NF = Noise Floor<br>Measurement Uncertainty: $\pm 3$ dB |                         |                |                          |                |                          |                |

#### 6.5.6.1 Measurement Result

Pass.

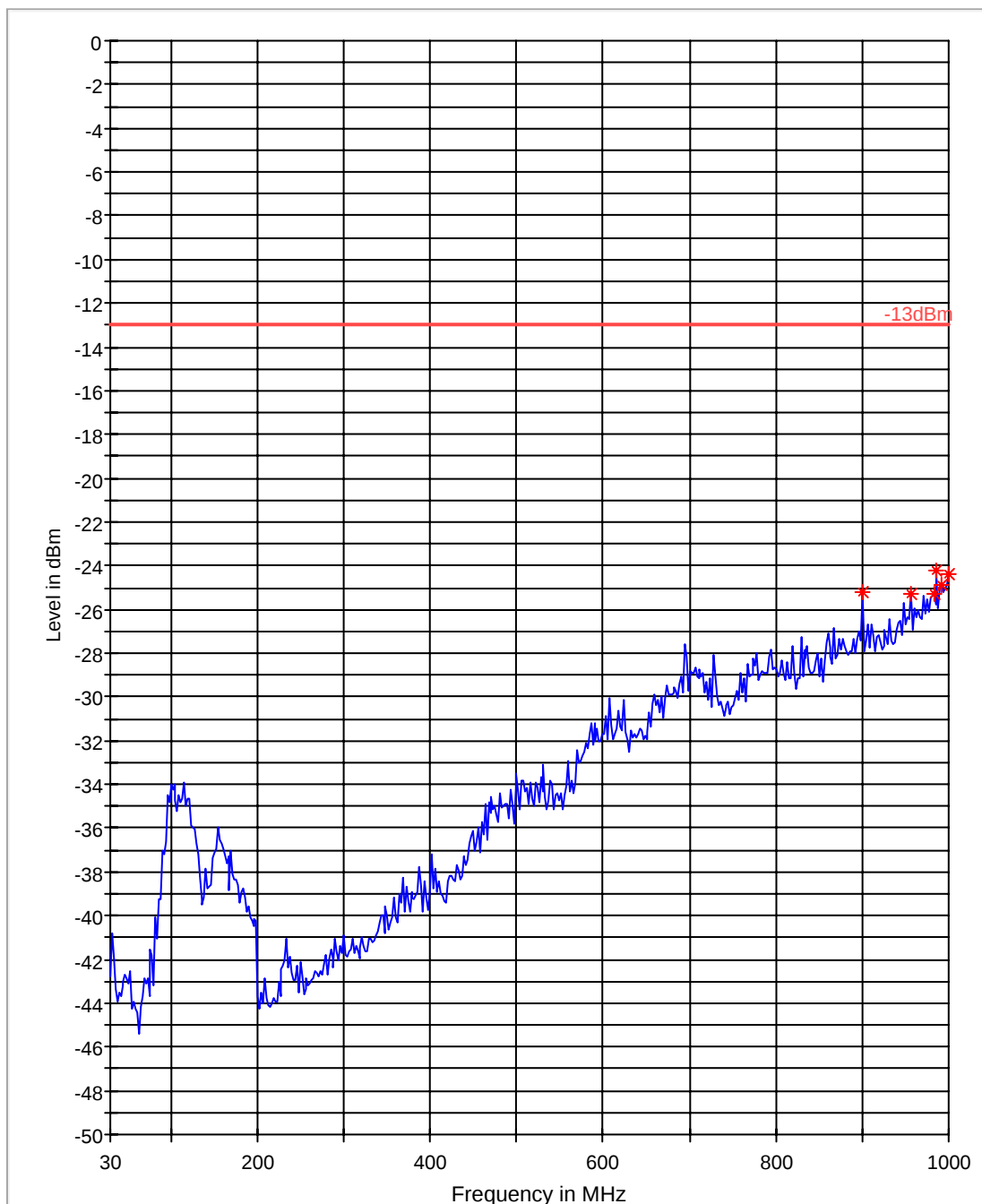
#### Legend for the plots:

- -13dBm.LimitLine
- Preview Result
- \* Data Reduction Result
- ◆ Final Measurement Result

## Radiated Spurious Emissions (GSM-1900) Tx: Low Channel

### Test results 30M-1GHz

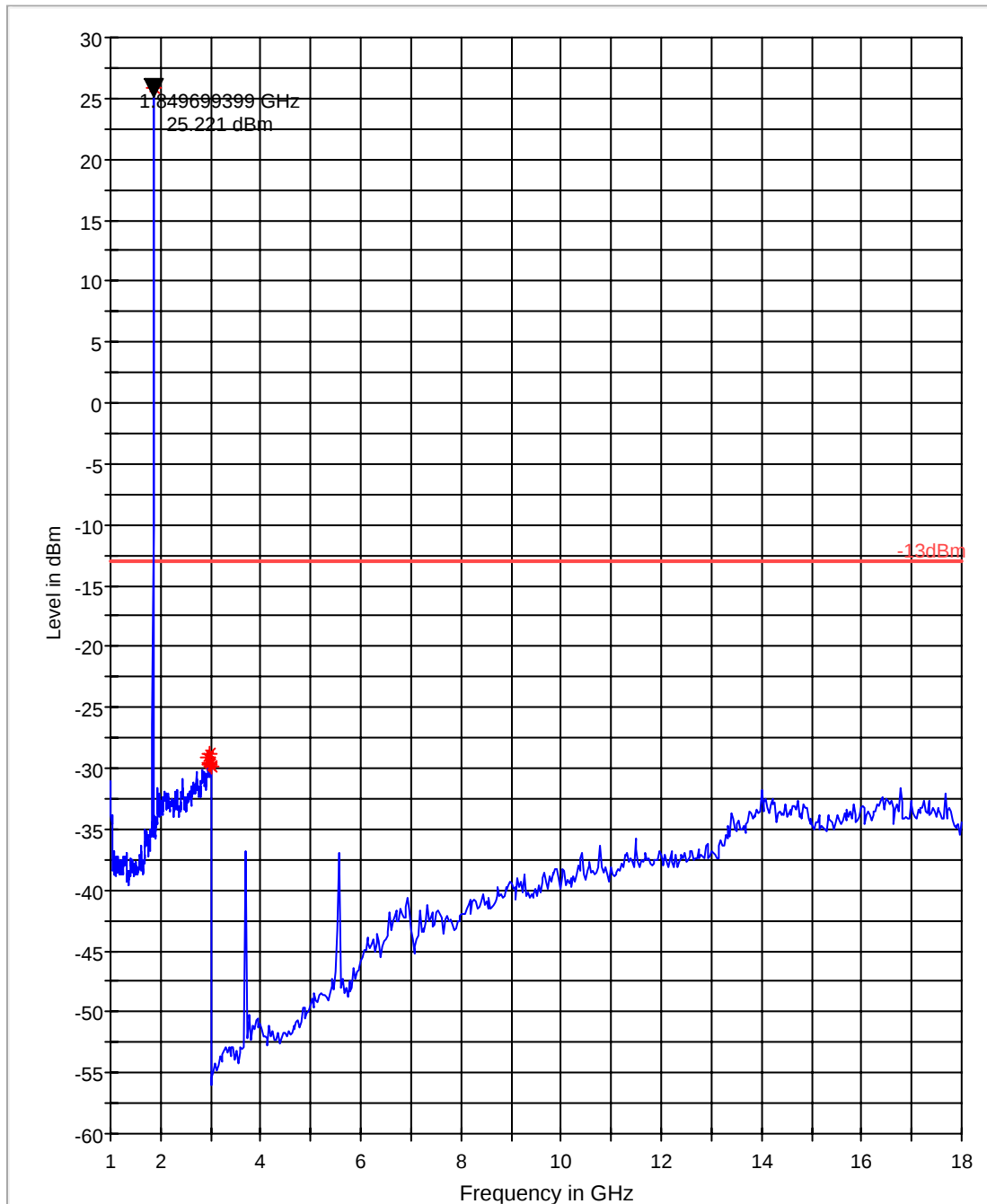
FCC 22 30-1000MHz



## Test results 1GHz-18GHz

**\*\*Marker placed on Transmit signal**

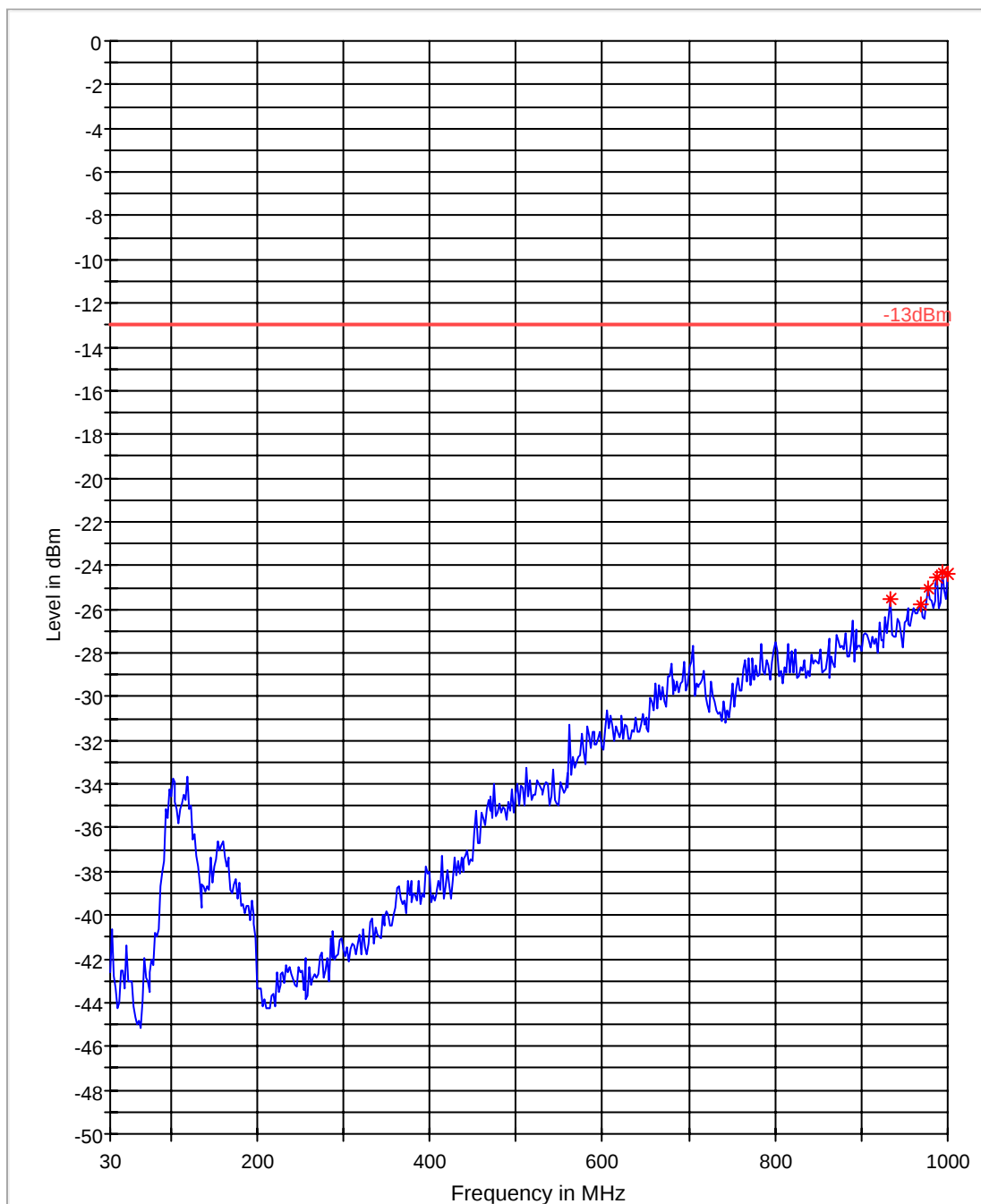
FCC 24 1-18GHz



**Radiated Spurious Emissions (GSM-1900) Tx: Mid Channel**

**Test results 30M-1GHz**

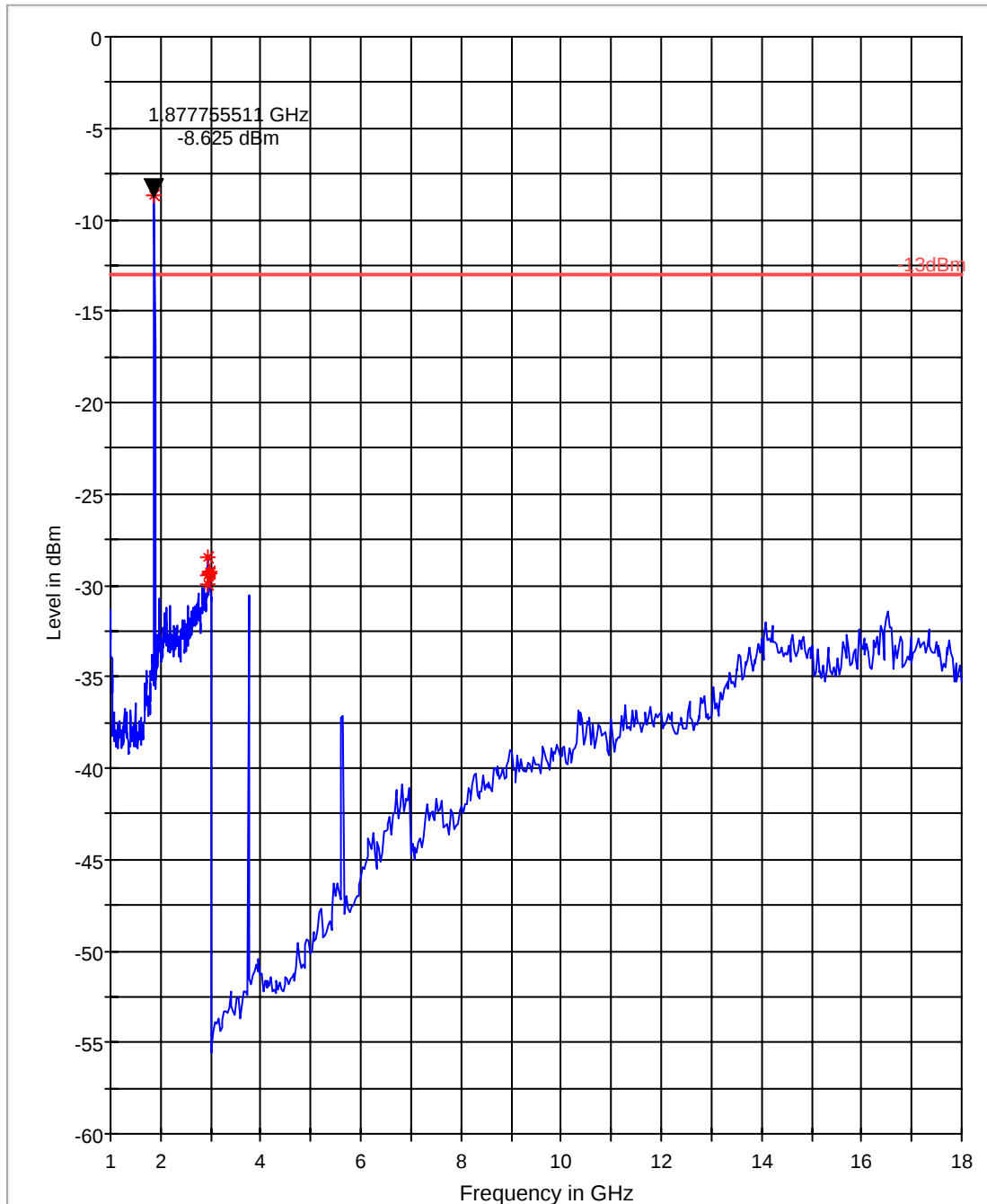
FCC 22 30-1000MHz



## Test results 1GHz-18GHz

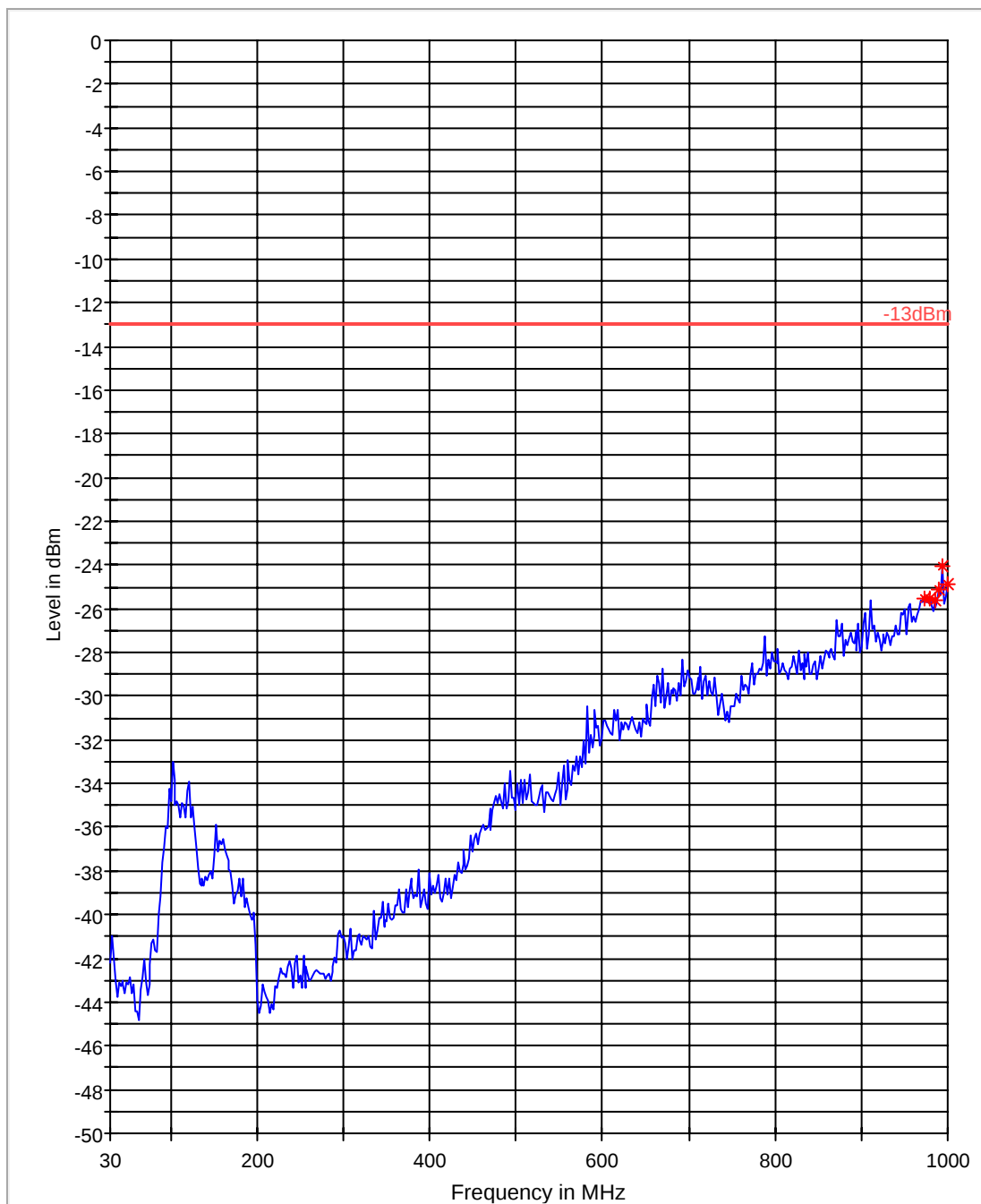
**\*\*Marker placed on Transmit signal**

FCC 24 1-18GHz



**Radiated Spurious Emissions (GSM-1900) Tx: High Channel**  
**Test results 30M-1GHz**

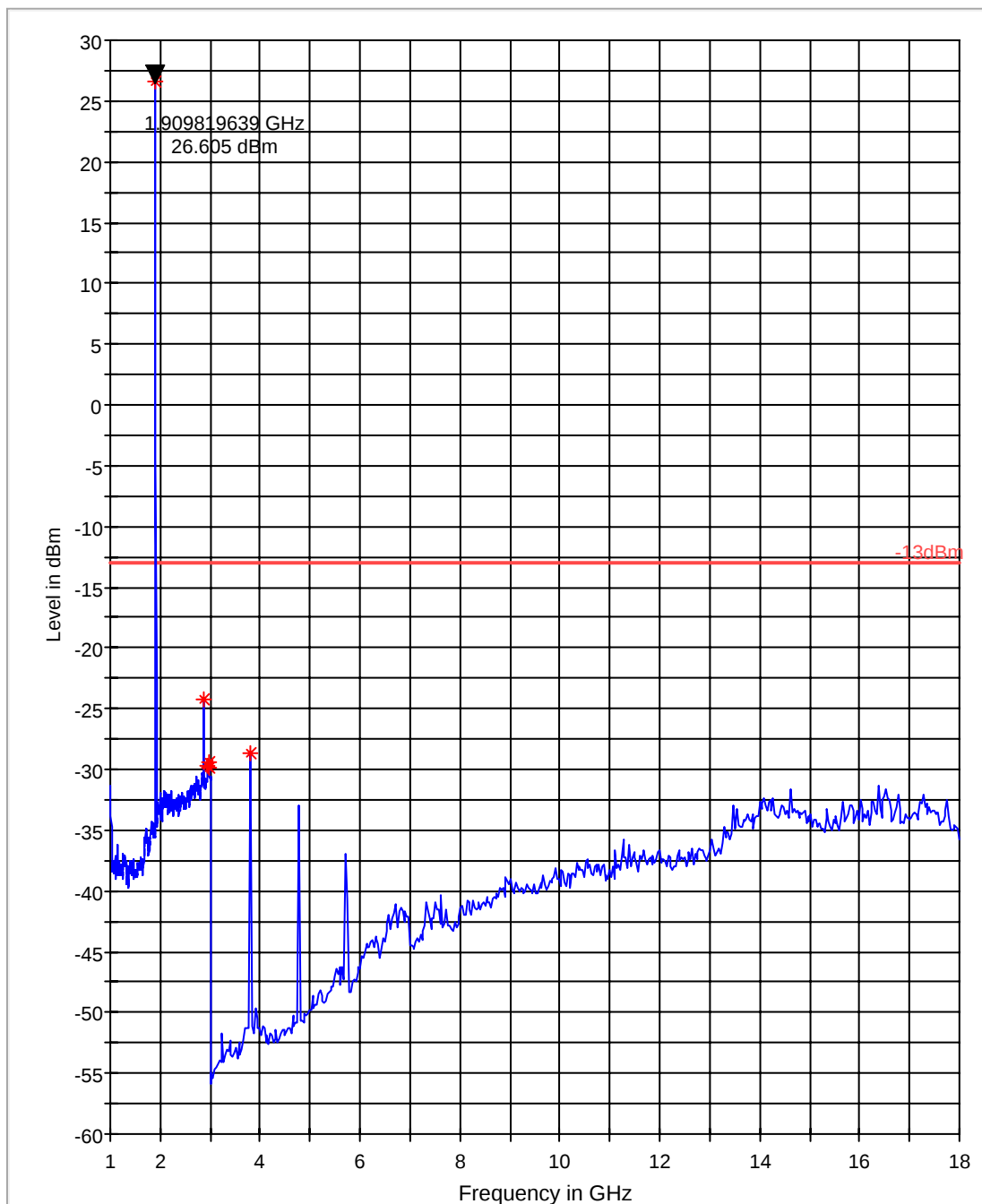
FCC 22 30-1000MHz



## Test results 1GHz-18GHz

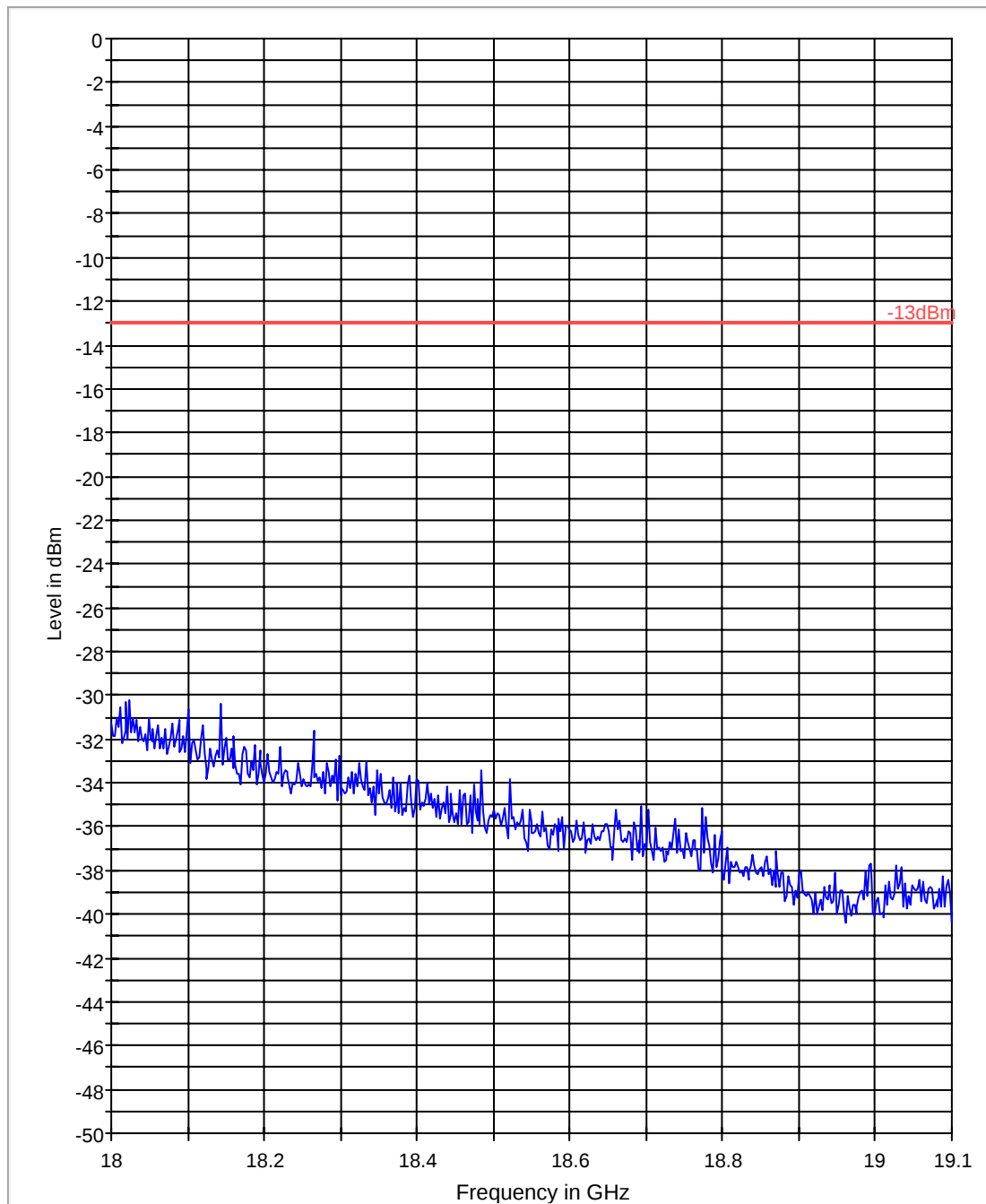
**\*\*Marker placed on Transmit signal**

FCC 24 1-18GHz



**Test results 18GHz-19.1GHz**

FCC 24 18-19.1GHz



Note: Worst case representation of all channels

**6.6 Radiated out of band emissions results on EUT- Receive Mode:****6.6.1 References**

FCC: CFR Part 15.109, 2.1053

IC: RSS-Gen Section 4.10; RSS 132 Section 4.6; RSS-133 Section 6.6

**6.6.2 Limits****6.6.2.1 §15.109 Radiated emission limits- Unintentional Radiators:****6.6.2.2 RSS-Gen Section 6**

If a radiated measurement is made, all spurious emissions shall comply with the limits of table (1) as shown.

(a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

| Frequency of emission (MHz) | Field strength (μV/m) |
|-----------------------------|-----------------------|
| 30–88                       | 100 (40dBμV/m)        |
| 88–216                      | 150 (43.5 dBμV/m)     |
| 216–960                     | 200 (46 dBμV/m)       |
| Above 960                   | 500 (54 dBμV/m)       |

(b) The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the following:

| Frequency of emission (MHz) | Field strength (μV/m) |
|-----------------------------|-----------------------|
| 30–88                       | 90                    |
| 88–216                      | 150                   |
| 216–960                     | 210                   |
| Above 960                   | 300                   |

**6.6.3 Measurement settings:**

RBW= 120kHz below 1GHz and 1MHz above 1GHz.

#### **6.6.4 Results**

Plots reported here represent the worse case emissions for all EUT orientations and horizontal/vertical polarizations of the measurement antenna.

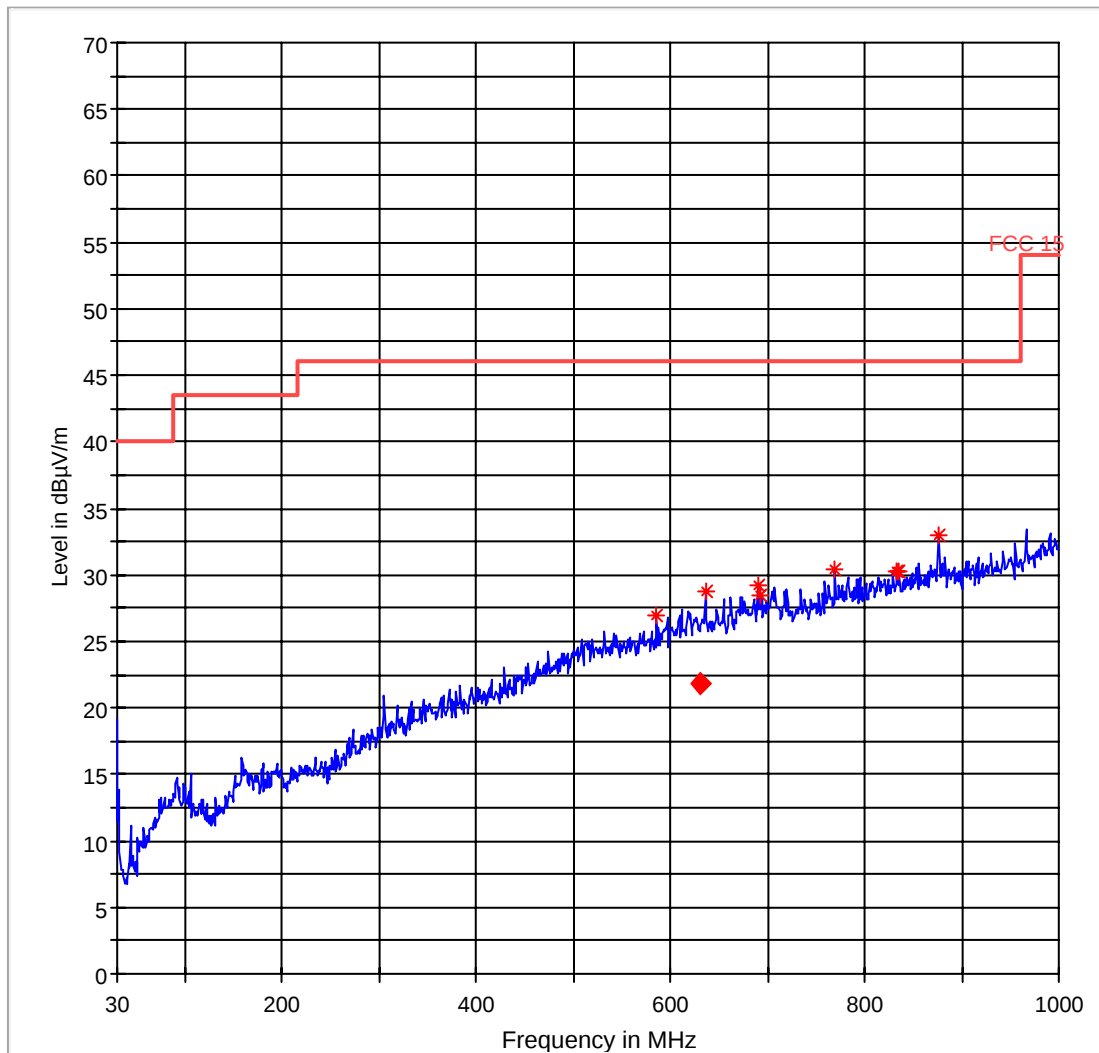
##### **6.6.4.1 Measurement Result**

Pass.

## 6.6.4.2 Test Results Receiver Spurious Emission

Receive Mode: 30MHz-1GHz

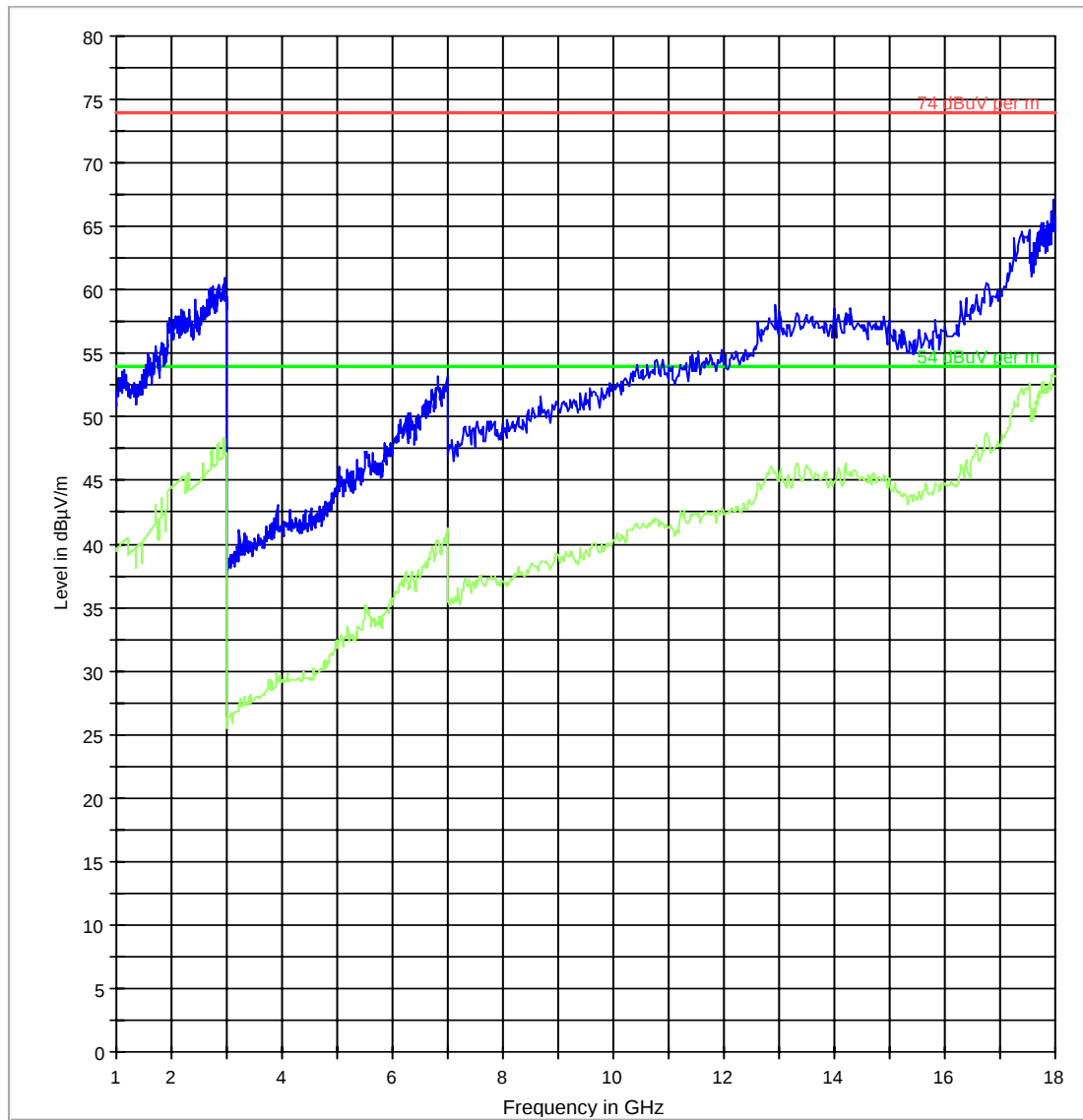
FCC 15 30-1000MHz



— FCC 15.LimitLine — MaxPeak-ClearWrite  
 \* Data Reduction Result ◆ Final Measurement Result

**Receive Mode: 1GHz-18GHz**

FCC 15 1-18GHz



— 74 dBuV per m      — 54 dBuV per m  
— MaxPeak-ClearWrite      — Average-ClearWrite

## **AC Power Line Conducted Emissions**

### **6.6.5 References:**

FCC: CFR Part 15.207

IC: RSS-Gen Section 7.2.2

The purpose of this test is to measure unwanted radio frequency currents induced in any AC conductor external to the equipment which could conduct interference to other equipment via the AC electrical network.

### **6.6.6 Limits:**

#### **6.6.6.1 §15.207 Conducted limits- Intentional Radiators:**

(a) Except as shown in paragraphs (b) and (c) of this section of the CFR, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table (1), as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

#### **6.6.6.2 RSS-Gen 7.2.2**

Except when the requirements applicable to a given device state otherwise, for any licence-exempt radiocommunication device equipped to operate from the public utility AC power supply, either directly or indirectly, the radio frequency voltage that is conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown below. The tighter limit applies at the frequency range boundaries.

**Table 1:**

| Frequency of emission (MHz) | Conducted limit (dB $\mu$ V) |           |
|-----------------------------|------------------------------|-----------|
|                             | Quasi-peak                   | Average   |
| 0.15–0.5                    | 66 to 56*                    | 56 to 46* |
| 0.5–5                       | 56                           | 46        |
| 5–30                        | 60                           | 50        |

\*Decreases with the logarithm of the frequency.

### **6.6.7 Measurement settings:**

RBW= 9kHz

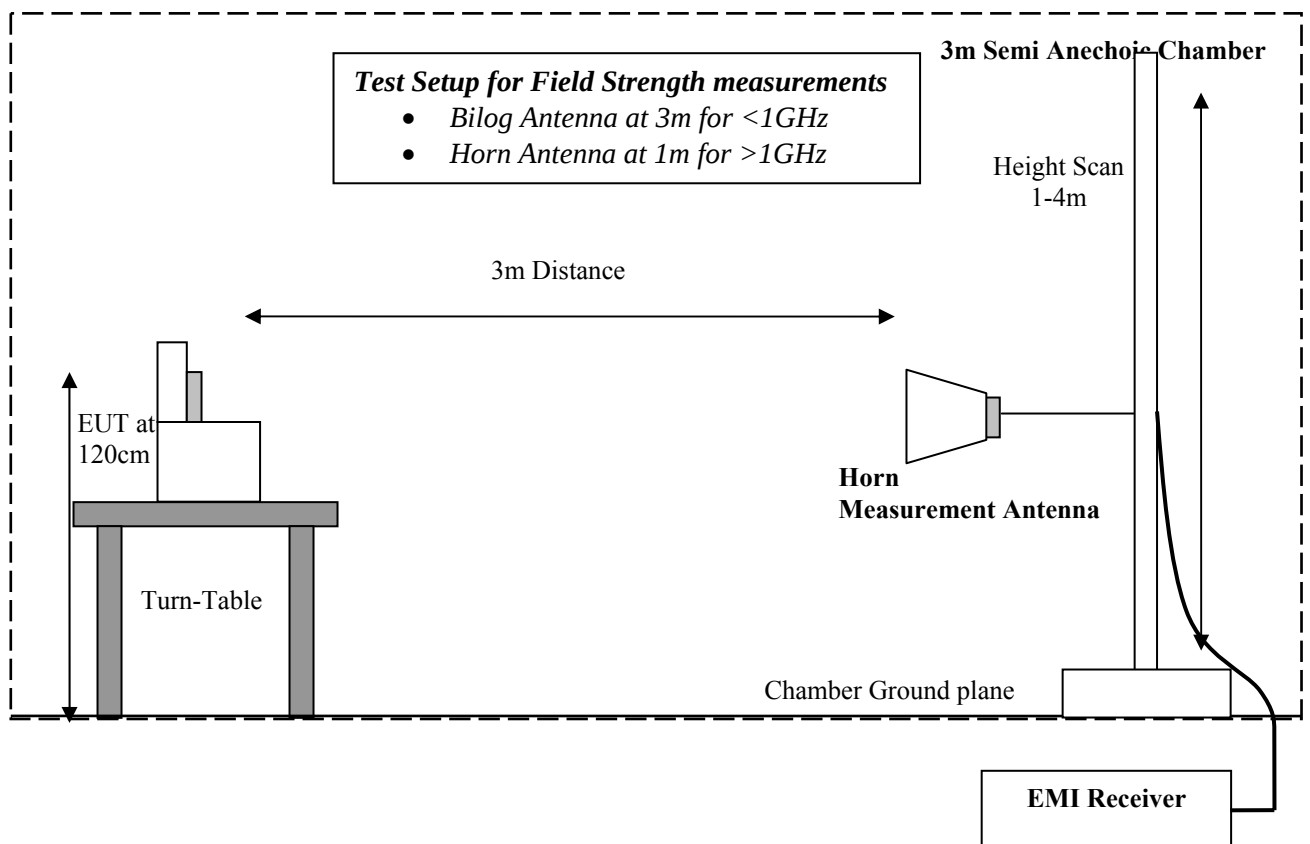
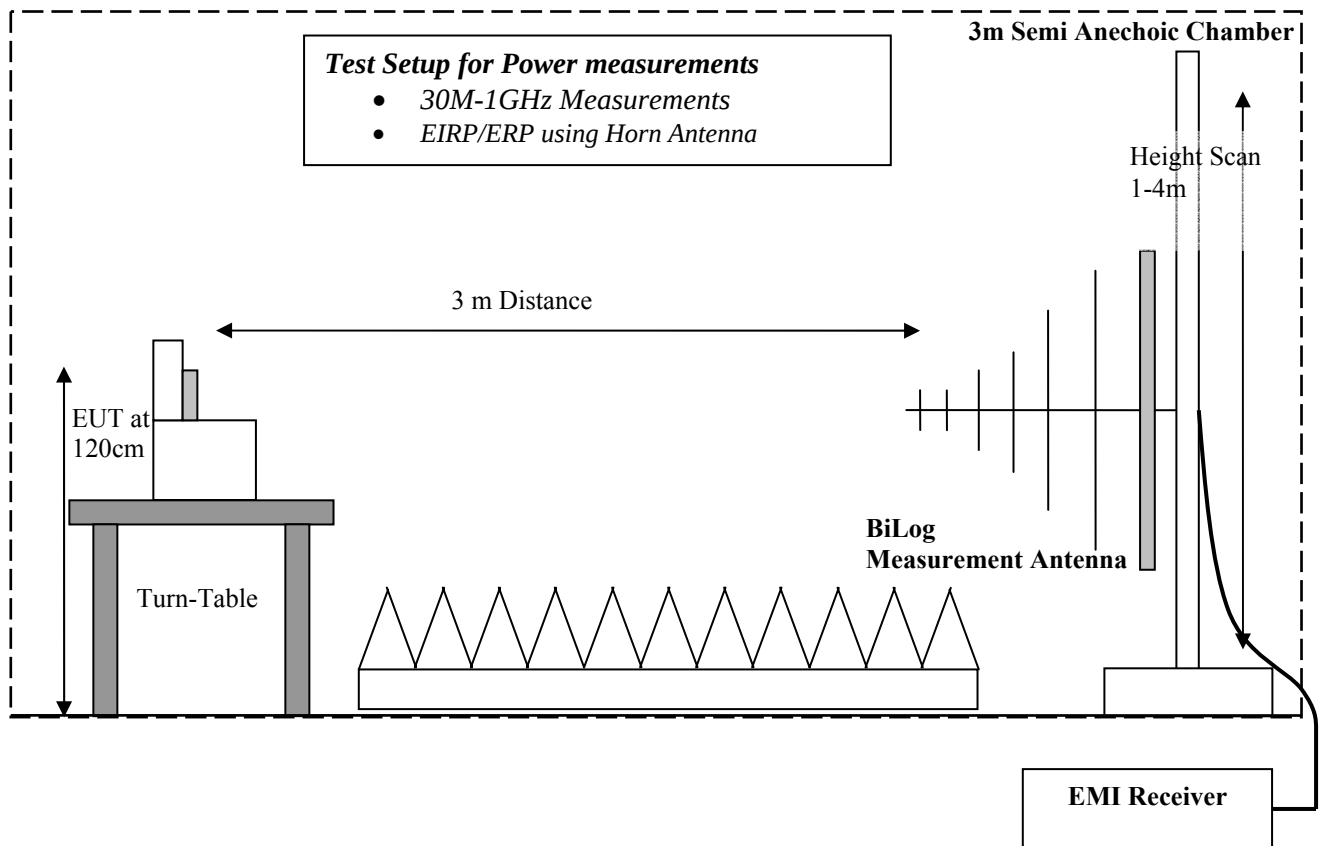
#### **6.6.8 Results**

**Measurements were not taken. The EUT is powered through an internal battery and is not designed to be connected to the public utility (AC) power line.**

## 7 Test Equipment and Ancillaries used for tests

| Instrument/Ancillary       | Model         | Manufacturer    | Serial No. | Cal Date                   | Cal Interval |
|----------------------------|---------------|-----------------|------------|----------------------------|--------------|
| Radio Communication Tester | CMU 200       | Rohde & Schwarz | 101821     | June 2010                  | 1 year       |
| EMI Receiver/Analyzer      | ESIB 40       | Rohde & Schwarz | 100107     | May 2010                   | 1 year       |
| Spectrum Analyzer          | FSU           | Rohde & Schwarz | 200302     | Jul 2010                   | 1 year       |
| Loop Antenna               | 6512          | EMCO            | 00049838   | April 2009                 | 2 years      |
| Biconilog Antenna          | 3141          | EMCO            | 0005-1186  | June 2009                  | 2 years      |
| Horn Antenna (1-18GHz)     | 3115          | ETS             | 00035111   | Jan 2009                   | 3 years      |
| Horn Antenna (18-40GHz)    | 3116          | ETS             | 00070497   | Jan 2009                   | 3 years      |
| Communication Antenna      | IBP5-900/1940 | Kathrein        | n/a        | n/a                        | n/a          |
| High Pass Filter           | 5HC2700       | Trilithic Inc.  | 9926013    | Part of system calibration |              |
| High Pass Filter           | 4HC1600       | Trilithic Inc.  | 9922307    | Part of system calibration |              |
| 6GHz High Pass Filter      | HPM50106      | Microtronics    | 001        | Part of system calibration |              |
| Pre-Amplifier              | JS4-00102600  | Miteq           | 00616      | Part of system calibration |              |
| Power Smart Sensor         | R&S           | NRP-Z81         | 100161     | June 2010                  | 1 Year       |
| Multimeter                 | 179           | Fluke           | N/A        | Feb 2010                   | 1 Year       |
| Temp Hum Logger            | TM320         | Dickson         | 03280063   | Feb 2010                   | 1 Year       |
| Temp Hum Logger            | TM325         | Dickson         | 5285354    | Feb 2010                   | 1 Year       |

## 8 Block Diagrams



## 9 Revision History

| Date       | Report Name                        | Changes to report                                                               | Report prepared by |
|------------|------------------------------------|---------------------------------------------------------------------------------|--------------------|
| 2010-08-09 | EMC_BRAEM_008_10001_FCC22_24       | First Version                                                                   | Christopher Torio  |
| 2010-10-22 | EMC_BRAEM_008_10001_FCC22_24_Rev1  | Updated ERP results                                                             | Christopher Torio  |
| 2010-10-27 | EMC_BRAEM_008_10001_FCC_22_24_Rev2 | Added Summary<br>Changed lead contact<br>Added module test report for reference | Christopher Torio  |
| 2010-11-11 | EMC_BRAEM_008_10001_FCC_22_24_Rev3 | Updated Section 3 (EUT Information)                                             | Christopher Torio  |
| 2010-11-15 | EMC_BRAEM_008_10001_FCC_22_24_Rev4 | Updated report to reflect PCL during test                                       | Christopher Torio  |
| 2010-11-16 | EMC_BRAEM_008_10001_FCC_22_24_Rev5 | Changed Section 3 (EUT information)                                             | Christopher Torio  |
| 2010-11-17 | EMC_BRAEM_008_10001_FCC22_24_Rev6  | Updated Section 6.5.6 & 6.5.5 to reflect harmonics                              | Christopher Torio  |
| 2010-12-10 | EMC_BRAEM_008_10001_FCC22_24_Rev7  | Updated ERP results                                                             | Christopher Torio  |
| 2012-12-14 | EMC_BRAEM_008_10001_FCC22_24_Rev8  | Updated tables                                                                  | Christopher Torio  |