

# Test report

**327248-1R2TRFWL**

Date of issue: August 3, 2017

Applicant:

**Eddy Home Inc.**

Product:

**Eddy Hub**

Model:

**HUBV1**

FCC ID:

**2AKHG-HUBV1**

IC Registration number:

**22180-HUBV1**

Specifications:

- ◆ FCC 47 CFR Part 15.247, Part 22 (h), and Part 24 (e)
- ◆ RSS-132, 133, and 247

#### Test location

|              |                                                      |
|--------------|------------------------------------------------------|
| Company name | Nemko Canada Inc.                                    |
| Address      | 303 River Road                                       |
| City         | Ottawa                                               |
| Province     | Ontario                                              |
| Postal code  | K1V 1H2                                              |
| Country      | Canada                                               |
| Telephone    | +1 613 737 9680                                      |
| Facsimile    | +1 613 737 9691                                      |
| Toll free    | +1 800 563 6336                                      |
| Website      | www.nemko.com                                        |
| Site number  | FCC: 176392; IC: 2040A-4 (3 m semi anechoic chamber) |

|                    |                                                                                     |
|--------------------|-------------------------------------------------------------------------------------|
| Tested by          | Kevin Rose, Wireless/EMC Specialist                                                 |
| Reviewed by        | David Duchesne, Senior EMC/Wireless Specialist                                      |
| Review date        | August 3, 2017                                                                      |
| Reviewer signature |  |

#### Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

#### Copyright notification

Nemko Canada Inc. authorizes the applicant to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

Nemko Canada Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

© Nemko Canada Inc.

## Table of contents

|                                                           |           |
|-----------------------------------------------------------|-----------|
| <b>Table of contents</b>                                  | <b>3</b>  |
| <b>Section 1. Report summary</b>                          | <b>4</b>  |
| 1.1 Applicant and manufacturer                            | 4         |
| 1.2 Test methods                                          | 4         |
| 1.3 Statement of compliance                               | 4         |
| 1.4 Exclusions                                            | 4         |
| 1.5 Test report revision history                          | 4         |
| <b>Section 2. Summary of test results</b>                 | <b>5</b>  |
| 2.1 Co location test results                              | 5         |
| <b>Section 3. Equipment under test (EUT) details</b>      | <b>6</b>  |
| 3.1 Sample information                                    | 6         |
| 3.2 EUT information                                       | 6         |
| 3.3 Technical information                                 | 6         |
| 3.4 Product description and theory of operation           | 7         |
| 3.5 EUT exercise details                                  | 7         |
| 3.6 EUT setup details                                     | 7         |
| 3.7 EUT setup diagram                                     | 8         |
| <b>Section 4. Engineering considerations</b>              | <b>9</b>  |
| 4.1 Modifications incorporated in the EUT                 | 9         |
| 4.2 Technical judgment                                    | 9         |
| 4.3 Deviations from laboratory tests procedures           | 9         |
| <b>Section 5. Test conditions</b>                         | <b>10</b> |
| 5.1 Atmospheric conditions                                | 10        |
| 5.2 Power supply range                                    | 10        |
| <b>Section 6. Measurement uncertainty</b>                 | <b>11</b> |
| 6.1 Uncertainty of measurement                            | 11        |
| <b>Section 7. Test equipment</b>                          | <b>12</b> |
| 7.1 Test equipment list                                   | 12        |
| <b>Section 8. Testing data</b>                            | <b>13</b> |
| 8.1 Co Location Per customer request                      | 13        |
| <b>Section 9. Block diagrams of test set-ups</b>          | <b>30</b> |
| 9.1 Radiated emissions set-up for frequencies below 1 GHz | 30        |
| 9.2 Radiated emissions set-up for frequencies above 1 GHz | 31        |



Section 1. Report summary

1.1 Applicant and manufacturer

|              |                                                        |
|--------------|--------------------------------------------------------|
| Company name | Eddy Home Inc.                                         |
| Address      | 1600-25 Sheppard Ave. W., Toronto, ON, Canada, M2N 6S6 |

1.2 Test methods

|                   |                                                                                                |
|-------------------|------------------------------------------------------------------------------------------------|
| ANSI C63.10 v2013 | American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices |
|-------------------|------------------------------------------------------------------------------------------------|

1.3 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See “Summary of test results” for full details.

1.4 Exclusions

None

1.5 Test report revision history

| Revision # | Details of changes made to test report |
|------------|----------------------------------------|
| TRF        | Original report issued                 |
| R1         | Clarification of voltage levels        |
| R2         | TCB comments                           |



**Section 2.** Summary of test results

---

2.1 Co location test results

---

| Test description | Verdict |
|------------------|---------|
| Co Location      | Pass    |



Section 3. Equipment under test (EUT) details

3.1 Sample information

|                        |                |
|------------------------|----------------|
| Receipt date           | March 23, 2017 |
| Nemko sample ID number | 1 and 2        |

3.2 EUT information

|                         |                                                                                        |
|-------------------------|----------------------------------------------------------------------------------------|
| Product name            | Eddy Hub                                                                               |
| Model                   | HUBV1                                                                                  |
| Serial number           | NA                                                                                     |
| Part number             | NA                                                                                     |
| Power requirements      | 120 Vac 60 Hz                                                                          |
| Operational frequencies | GSM 850 MHz, PCS 1900 MHz, Band V (850 MHz) Band II (1900 MHz), 2.4 GHz wi-fi, ISM 915 |
| Software details        | 1.1.3.1                                                                                |

3.3 Technical information

|                                      |         |
|--------------------------------------|---------|
| Applicant IC company number          | 22180   |
| IC UPN number                        | HUBV1   |
| All used IC test site(s) Reg. number | 2040A-4 |

### 3.4 Product description and theory of operation

---

The Eddy Hub is a LoRa gateway serving to provide connectivity from LoRa end node devices to the internet through cellular, WiFi, or Ethernet.

### 3.5 EUT exercise details

---

- The Transmitters were operational per the Customers test plan

### 3.6 EUT setup details

---

**Table 3.6-1: EUT sub assemblies**

| Description     | Brand name | Model/Part number | Serial number | Rev. |
|-----------------|------------|-------------------|---------------|------|
| Cellular module | Particle   | U260              |               |      |
| Wifi module     | Particle   | P1                |               |      |

**Table 3.6-2: EUT interface ports**

| Description     | Qty. |
|-----------------|------|
| DC power        | 1    |
| Ethernet        | 1    |
| uUSB (internal) | 2    |
| JTAG(internal)  | 1    |
| SWD(internal)   | 1    |

**Table 3.6-3: Support equipment**

| Description | Brand name | Model/Part number | Serial number | Rev. |
|-------------|------------|-------------------|---------------|------|
| AC adapter  |            |                   |               |      |

**Table 3.6-4: Inter-connection cables**

| Cable description | From | To                  | Length (m) |
|-------------------|------|---------------------|------------|
| μUSB              | EUT  | Diag. / flashing PC | 1          |

3.7 EUT setup diagram

---

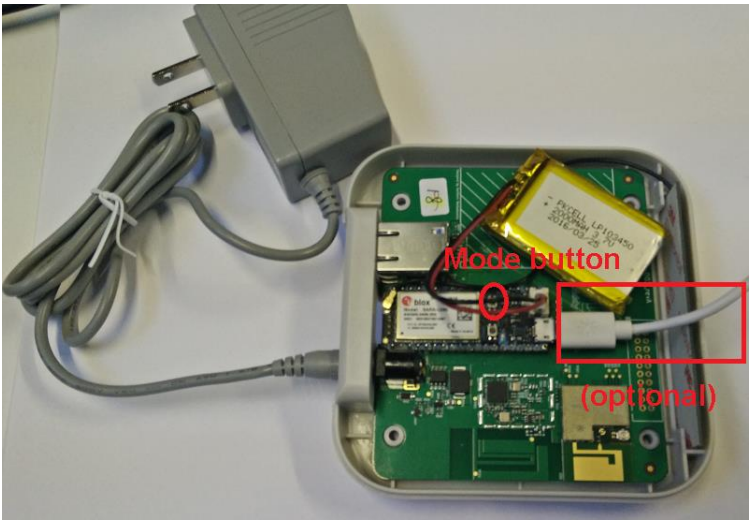


Figure 3.7-1: Setup diagram

## Section 4. Engineering considerations

---

### 4.1 Modifications incorporated in the EUT

---

There were no modifications performed to the EUT during this assessment.

### 4.2 Technical judgment

---

None

### 4.3 Deviations from laboratory tests procedures

---

No deviations were made from laboratory procedures.

# Section 5. Test conditions

---

## 5.1 Atmospheric conditions

---

|                   |               |
|-------------------|---------------|
| Temperature       | 15–30 °C      |
| Relative humidity | 20–75 %       |
| Air pressure      | 860–1060 mbar |

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

## 5.2 Power supply range

---

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages  $\pm 5\%$ , for which the equipment was designed.



**Section 6.**    Measurement uncertainty

---

**6.1**    Uncertainty of measurement

---

Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of  $K = 2$  with 95% certainty.

| Test name                         | Measurement uncertainty, dB |
|-----------------------------------|-----------------------------|
| All antenna port measurements     | 0.55                        |
| Conducted spurious emissions      | 1.13                        |
| Radiated spurious emissions       | 3.78                        |
| AC power line conducted emissions | 3.55                        |



Section 7. Test equipment

7.1 Test equipment list

Table 7.1-1: Equipment list

| Equipment                   | Manufacturer    | Model no.  | Asset no. | Cal cycle | Next cal.   |
|-----------------------------|-----------------|------------|-----------|-----------|-------------|
| 3 m EMI test chamber        | TDK             | SAC-3      | FA002047  | 1 year    | Dec. 01/17  |
| Horn antenna (1–18 GHz)     | EMCO            | 3115       | FA000825  | 1 year    | Apr. 26/17  |
| Bilog antenna (20–3000 MHz) | Sunol           | JB3        | FA002108  | 1 year    | Apr. 28/17  |
| Receiver/spectrum analyzer  | Rohde & Schwarz | ESU 26     | FA002043  | 1 year    | Jan. 31/18  |
| Pre-amplifier (1–18 GHz)    | JCA             | JCA118-503 | FA002091  | 1 year    | April 26/17 |

Note: None

## Section 8. Testing data

### 8.1 Co Location Per customer request.

#### 8.1.1 Definitions and limits

The Following test case senarios were evaluated.

*Table 8.1-1: Test case*

| Scenario | LoRa Frequency | Wi-Fi Frequency | Cellular Frequency |
|----------|----------------|-----------------|--------------------|
| #1       | 903            | 2412            | 848.8              |
| #2       | 915            | 2442            | 836.6              |
| #3       | 927.5          | 2462            | 824.2              |
| #4       | 927.5          | 2462            | 1850.2             |

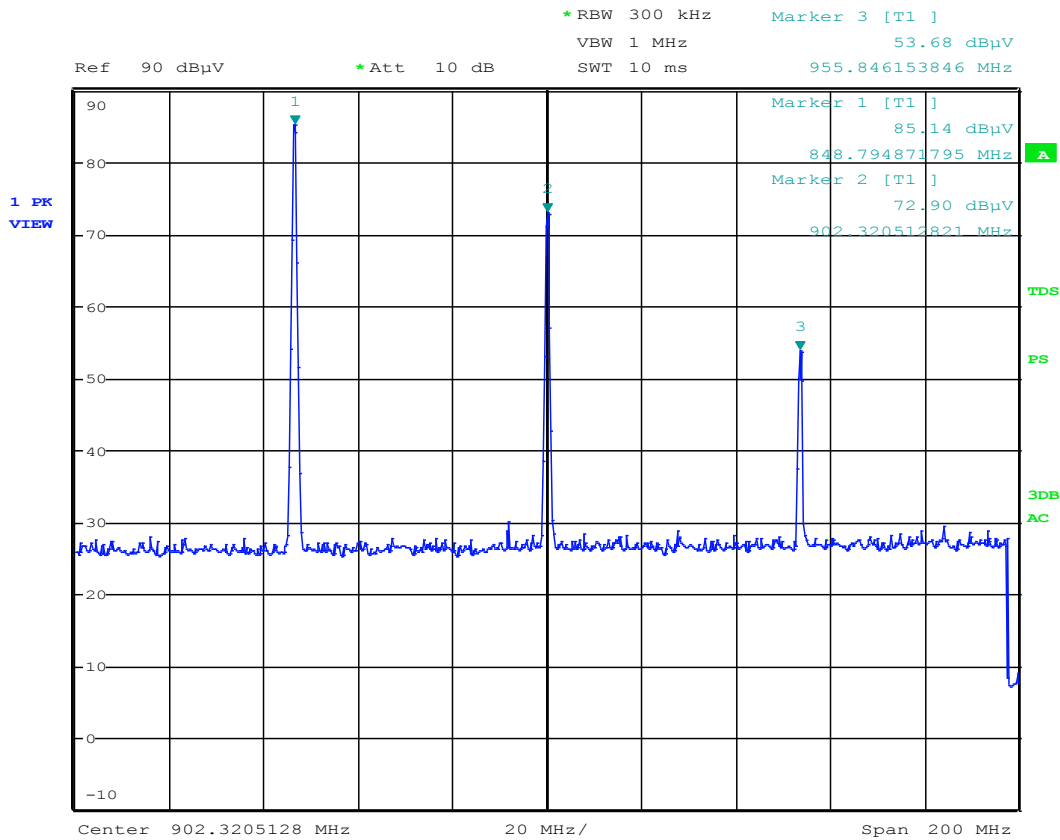
#### 8.1.2 Test summary

|               |               |                   |           |
|---------------|---------------|-------------------|-----------|
| Test date     | June 20, 2017 | Temperature       | 23 °C     |
| Test engineer | Kevin Rose    | Air pressure      | 1004 mbar |
| Verdict       | Pass          | Relative humidity | 39 %      |

#### 8.1.3 Observations, settings and special notes

None

8.1.4 Test data



Date: 20.JUN.2017 02:32:33

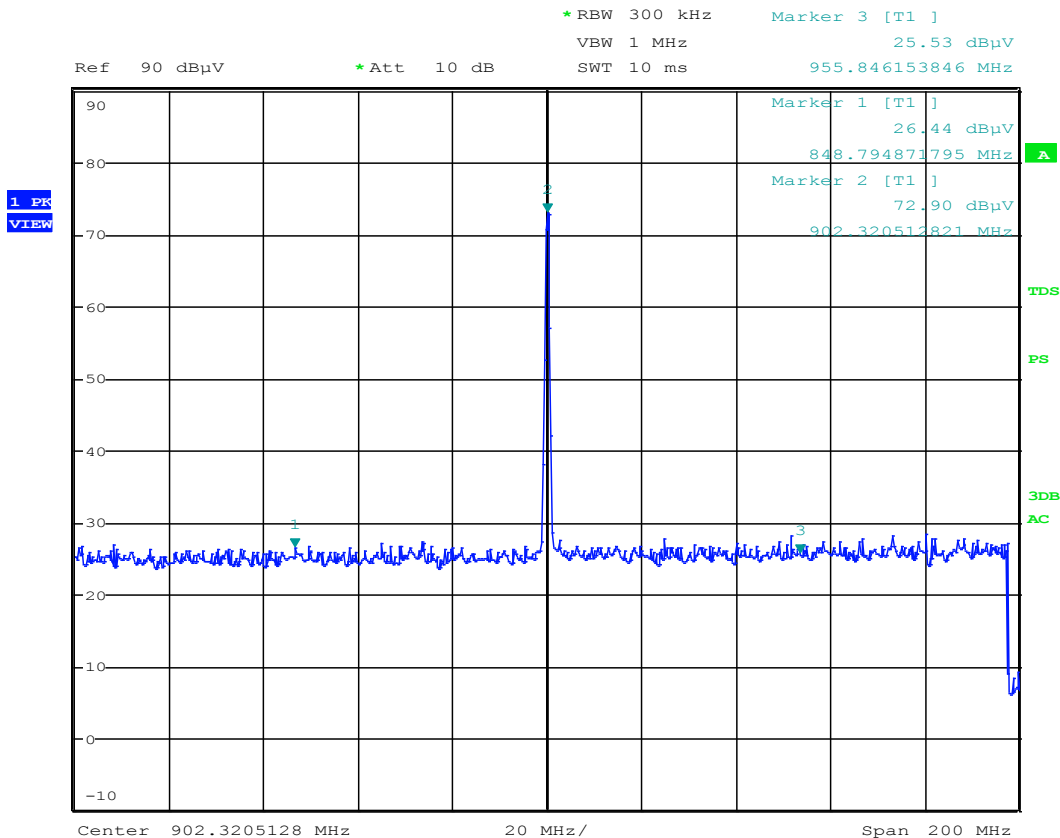
Plot 8.1-1: 955 MHz is caused when the cellular is operational No interaction with the 903 MHz

Table 8.1-2: Scenario 1

| Scenario | LoRa Frequency | Wi-Fi Frequency | Cellular Frequency |
|----------|----------------|-----------------|--------------------|
| #1       | 903            | 2412            | 848.8              |
| #2       | 915            | 2442            | 836.6              |
| #3       | 927.5          | 2462            | 824.2              |
| #4       | 927.5          | 2462            | 1850.2             |

**Section 8**  
**Test name**  
**Specification**

Testing data  
 Co Location Per customer request.  
 FCC Part 15 Subpart C

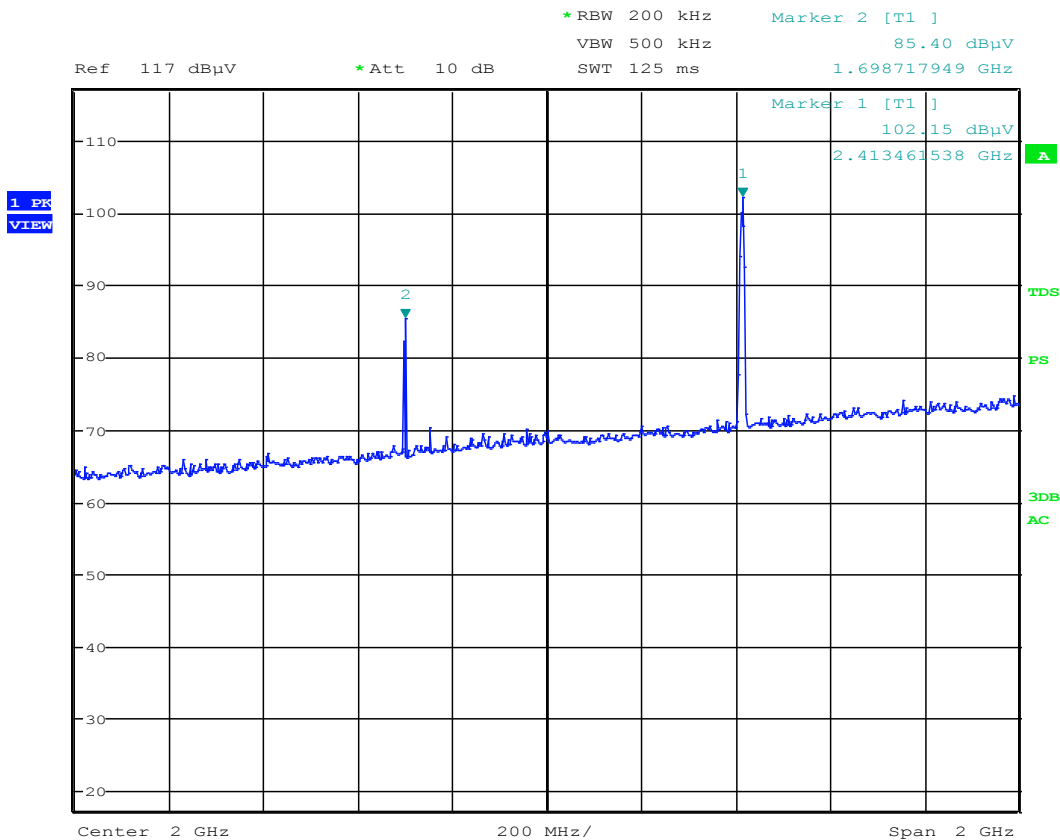


Date: 20.JUN.2017 02:35:13

**Plot 8.1-2: 903 MHz stand alone**

**Table 8.1-3: Test case Scenario 1**

| Scenario | LoRa Frequency | Wi-Fi Frequency | Cellular Frequency |
|----------|----------------|-----------------|--------------------|
| #1       | 903            | 2412            | 848.8              |
| #2       | 915            | 2442            | 836.6              |
| #3       | 927.5          | 2462            | 824.2              |
| #4       | 927.5          | 2462            | 1850.2             |

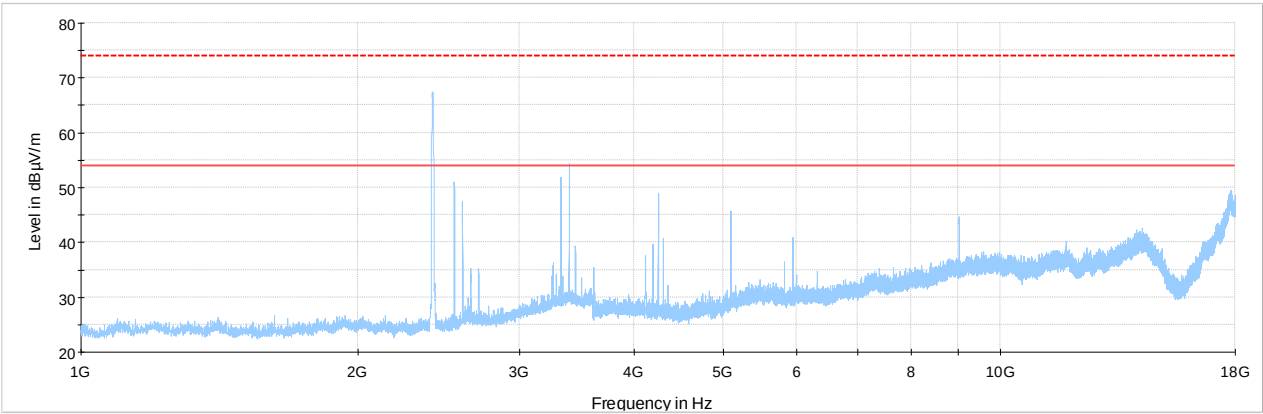


Date: 20.JUN.2017 02:39:42

Plot 8.1-3: 848.8 MHz 2nd Harmonic

Table 8.1-4: Test case Scenario 1

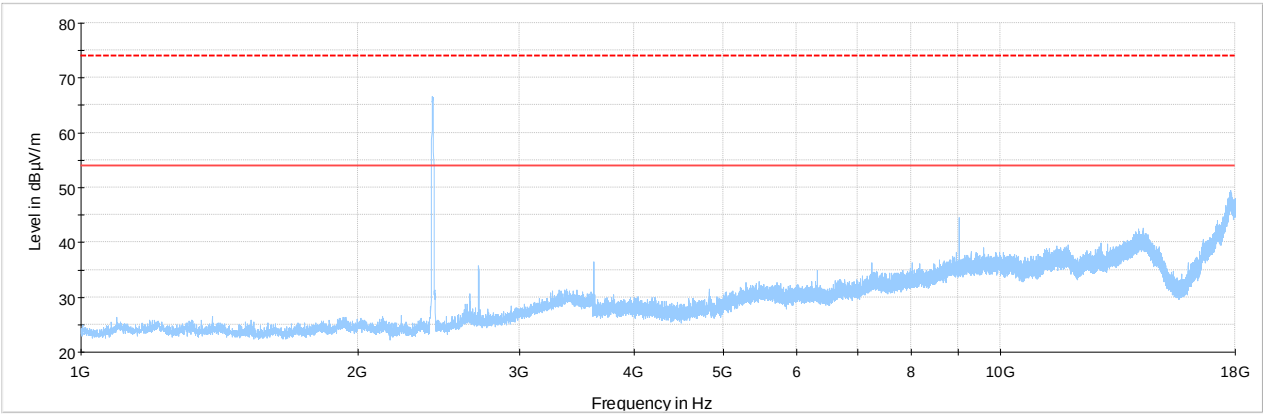
| Scenario | LoRa Frequency | Wi-Fi Frequency | Cellular Frequency |
|----------|----------------|-----------------|--------------------|
| #1       | 903            | 2412            | 848.8              |
| #2       | 915            | 2442            | 836.6              |
| #3       | 927.5          | 2462            | 824.2              |
| #4       | 927.5          | 2462            | 1850.2             |



Plot 8.1-4: Cell module creates the spikes. The limit for it is -13 dBm

Table 8.1-5: Test case Scenario 1

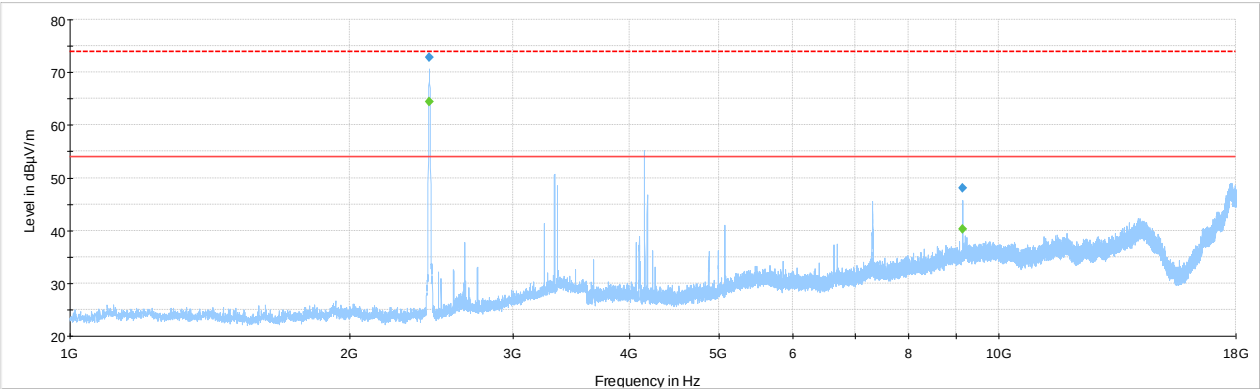
| Scenario | LoRa Frequency | Wi-Fi Frequency | Cellular Frequency |
|----------|----------------|-----------------|--------------------|
| #1       | 903            | 2412            | 848.8              |
| #2       | 915            | 2442            | 836.6              |
| #3       | 927.5          | 2462            | 824.2              |
| #4       | 927.5          | 2462            | 1850.2             |



Plot 8.1-5: No cell on to prove the signals

Table 8.1-6: Test case Scenario 1

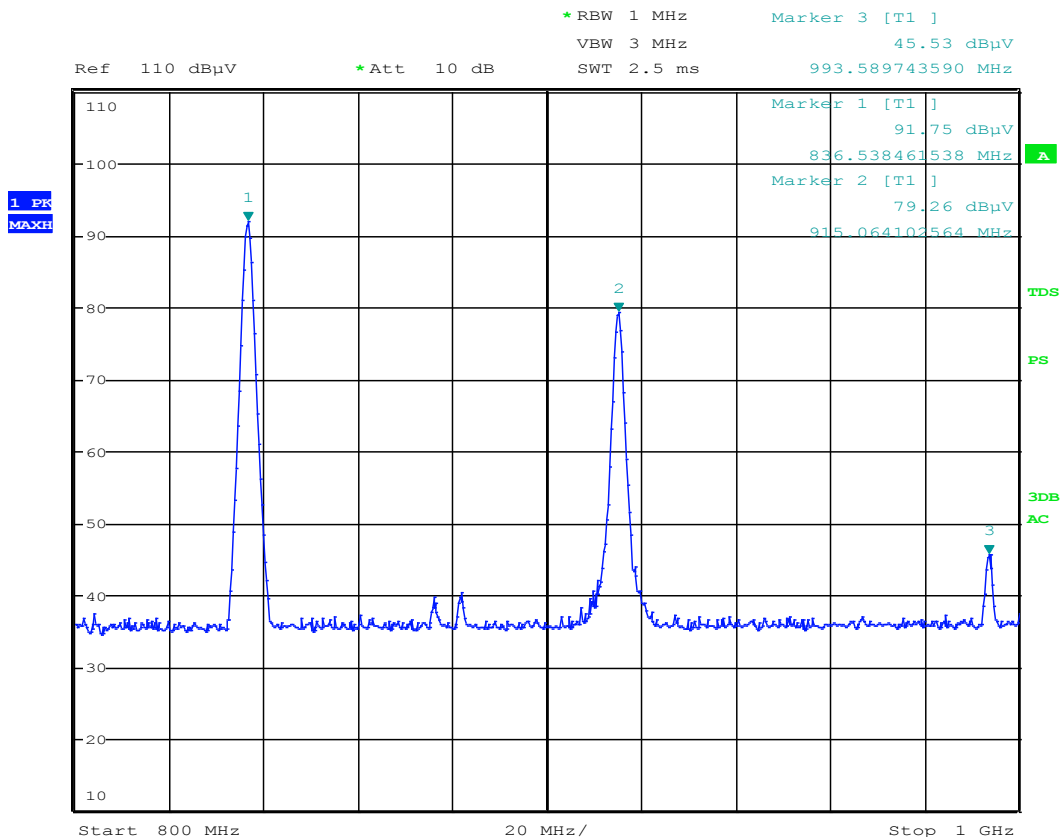
| Scenario | LoRa Frequency | Wi-Fi Frequency | Cellular Frequency |
|----------|----------------|-----------------|--------------------|
| #1       | 903            | 2412            | 848.8              |
| #2       | 915            | 2442            | 836.6              |
| #3       | 927.5          | 2462            | 824.2              |
| #4       | 927.5          | 2462            | 1850.2             |



Plot 8.1-6: 1–18 GHz using the 3000-12000 MHz filter

Table 8.1-7: Test case Scenario 2

| Scenario | LoRa Frequency | Wi-Fi Frequency | Cellular Frequency |
|----------|----------------|-----------------|--------------------|
| #1       | 903            | 2412            | 848.8              |
| #2       | 915            | 2442            | 836.6              |
| #3       | 927.5          | 2462            | 824.2              |
| #4       | 927.5          | 2462            | 1850.2             |

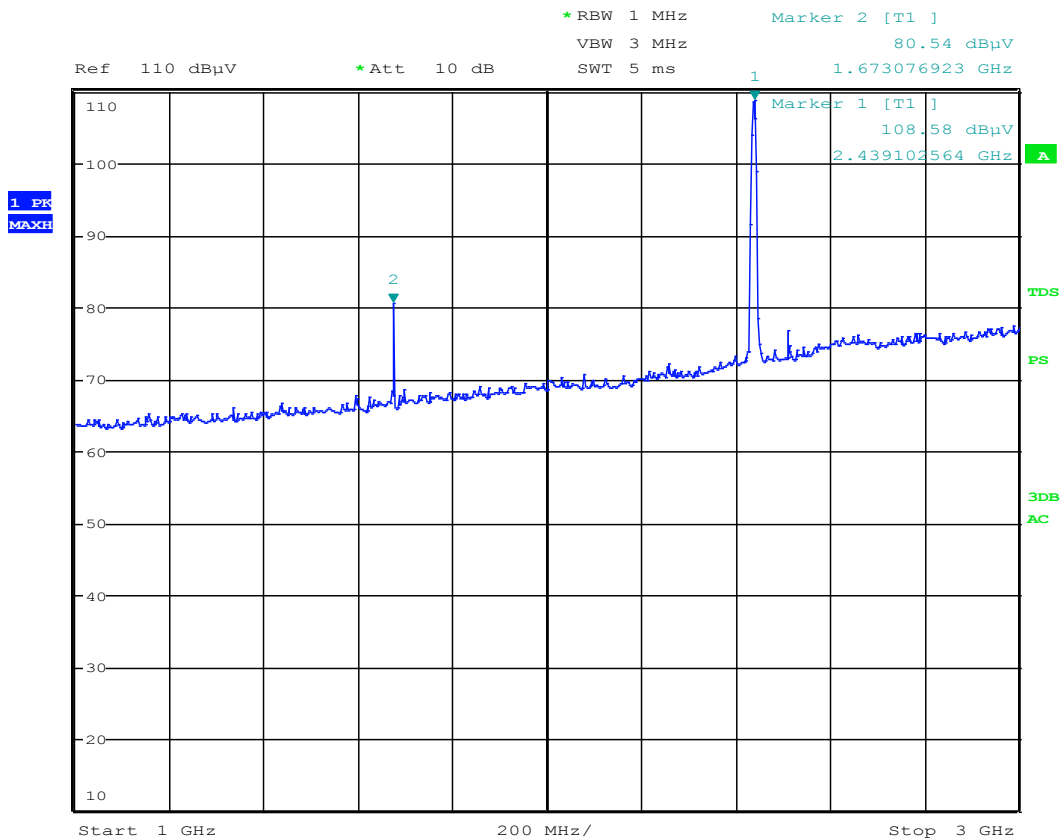


Date: 20.JUN.2017 03:51:47

Plot 8.1-7: Intermodulation Between 915 and 836.6 TX Below the limit. 54 dBµV/m

Table 8.1-8: Test case Scenario 2

| Scenario | LoRa Frequency | Wi-Fi Frequency | Cellular Frequency |
|----------|----------------|-----------------|--------------------|
| #1       | 903            | 2412            | 848.8              |
| #2       | 915            | 2442            | 836.6              |
| #3       | 927.5          | 2462            | 824.2              |
| #4       | 927.5          | 2462            | 1850.2             |

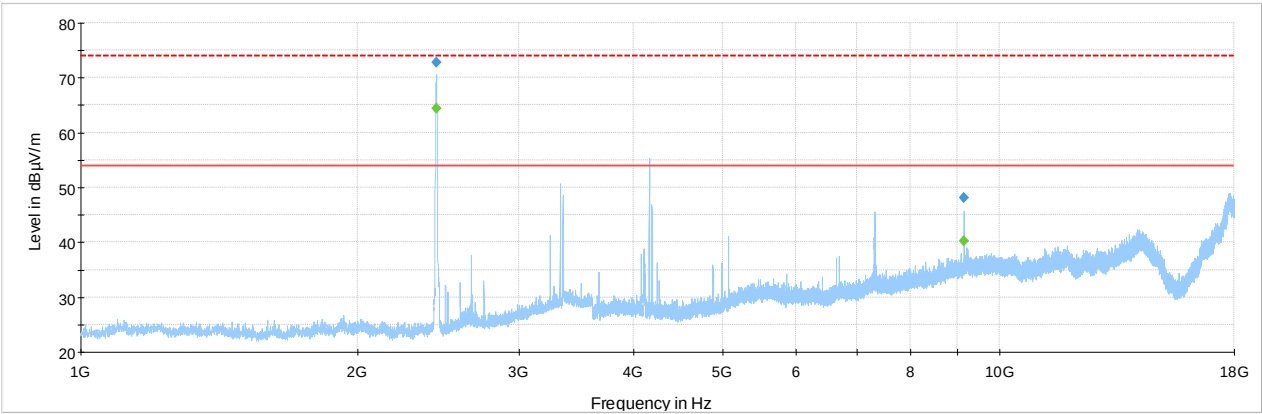


Date: 20.JUN.2017 03:53:43

Plot 8.1-8: 915, 2442 and 836.6 with no filter

Table 8.1-9: Test case Scenario 2

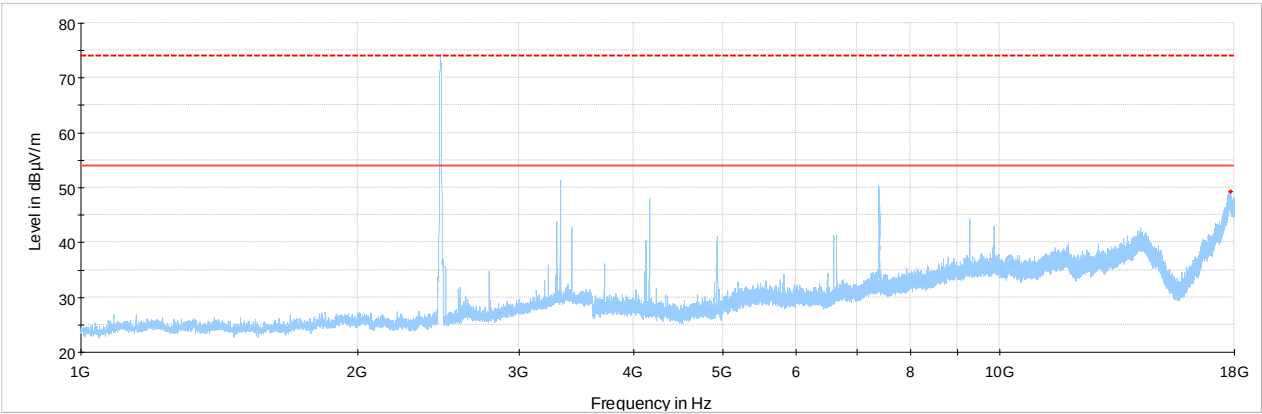
| Scenario | LoRa Frequency | Wi-Fi Frequency | Cellular Frequency |
|----------|----------------|-----------------|--------------------|
| #1       | 903            | 2412            | 848.8              |
| #2       | 915            | 2442            | 836.6              |
| #3       | 927.5          | 2462            | 824.2              |
| #4       | 927.5          | 2462            | 1850.2             |



Plot 8.1-9: 915, 2442 NO CELL 836.6 using the 3000-12000 MHz filter

Table 8.1-10: Test case Scenario 2

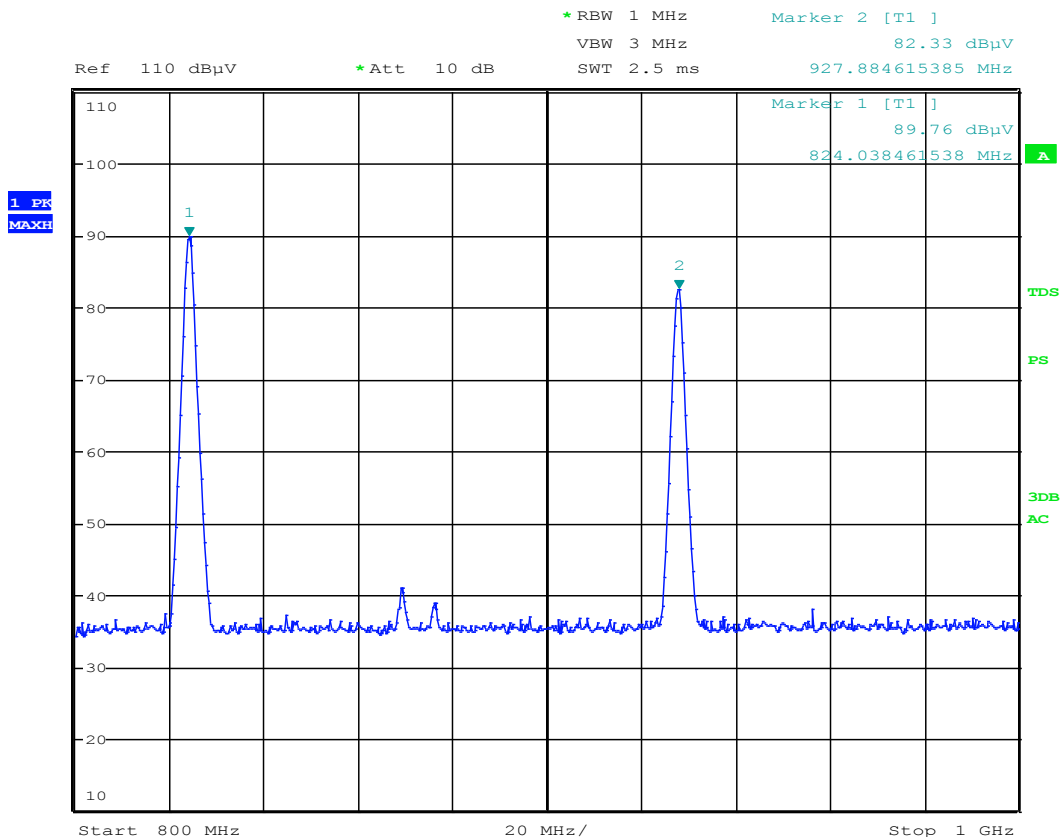
| Scenario | LoRa Frequency | Wi-Fi Frequency | Cellular Frequency |
|----------|----------------|-----------------|--------------------|
| #1       | 903            | 2412            | 848.8              |
| #2       | 915            | 2442            | 836.6              |
| #3       | 927.5          | 2462            | 824.2              |
| #4       | 927.5          | 2462            | 1850.2             |



Plot 8.1-10: 927.5, 2462, 824.2 with filter

Table 8.1-11: Test case Scenario 3

| Scenario | LoRa Frequency | Wi-Fi Frequency | Cellular Frequency |
|----------|----------------|-----------------|--------------------|
| #1       | 903            | 2412            | 848.8              |
| #2       | 915            | 2442            | 836.6              |
| #3       | 927.5          | 2462            | 824.2              |
| #4       | 927.5          | 2462            | 1850.2             |

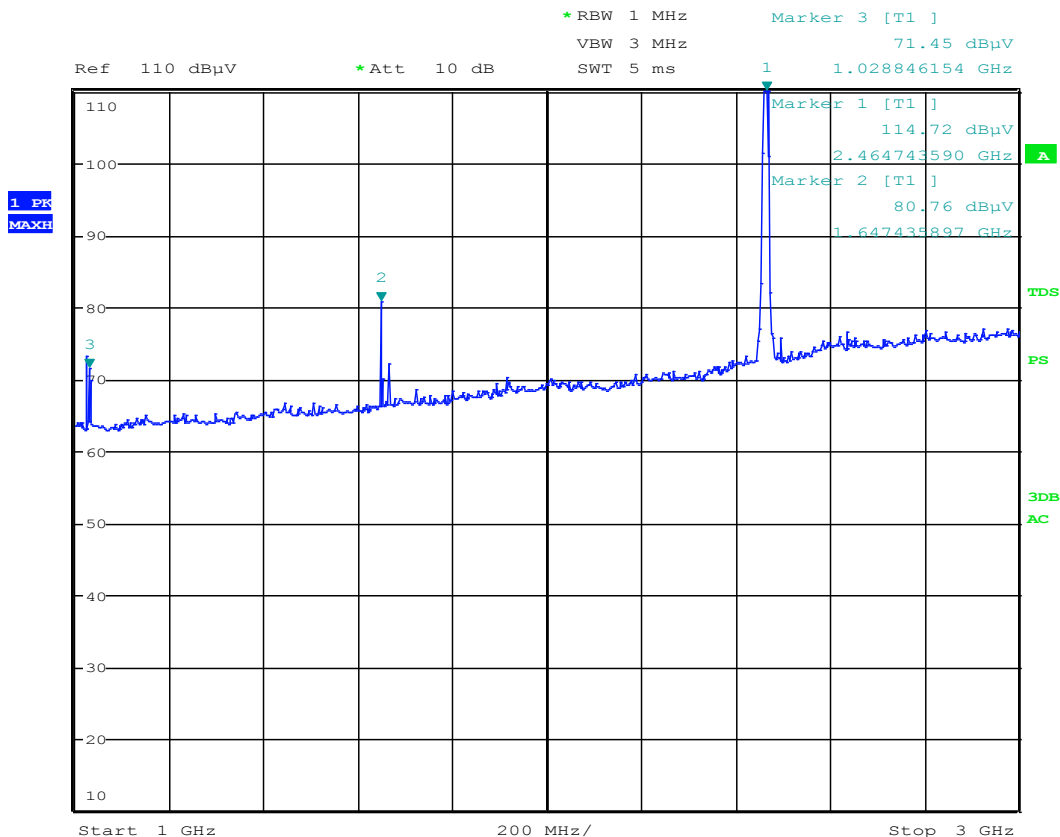


Date: 20.JUN.2017 03:59:45

Plot 8.1-11: 927.5, 2462, 824.2 no filter

Table 8.1-12: Test case Scenario 3

| Scenario | LoRa Frequency | Wi-Fi Frequency | Cellular Frequency |
|----------|----------------|-----------------|--------------------|
| #1       | 903            | 2412            | 848.8              |
| #2       | 915            | 2442            | 836.6              |
| #3       | 927.5          | 2462            | 824.2              |
| #4       | 927.5          | 2462            | 1850.2             |

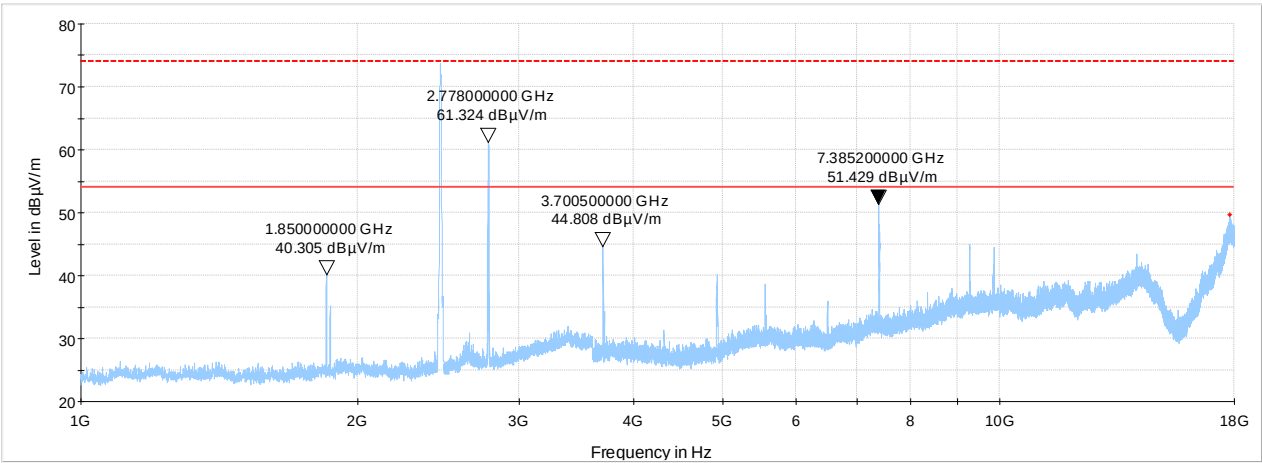


Date: 20.JUN.2017 04:00:54

Plot 8.1-12: 927.5, 2462, 824.2 no filter

Table 8.1-13: Test case Scenario 3

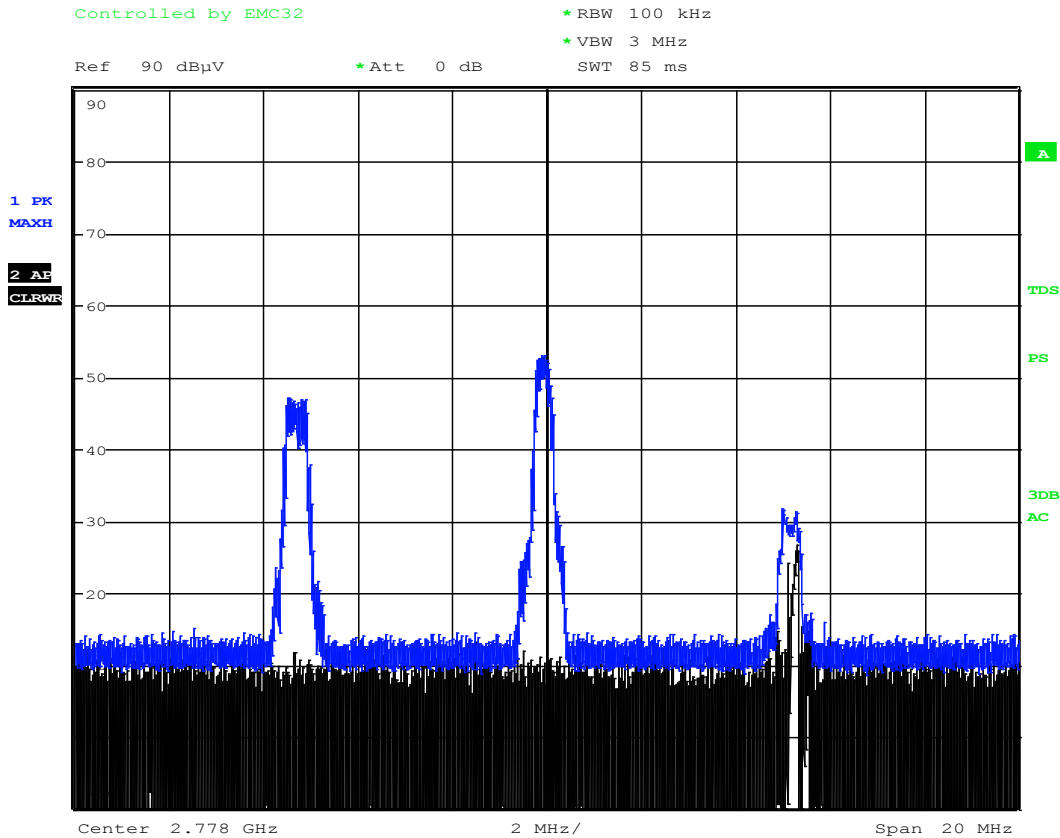
| Scenario | LoRa Frequency | Wi-Fi Frequency | Cellular Frequency |
|----------|----------------|-----------------|--------------------|
| #1       | 903            | 2412            | 848.8              |
| #2       | 915            | 2442            | 836.6              |
| #3       | 927.5          | 2462            | 824.2              |
| #4       | 927.5          | 2462            | 1850.2             |



Plot 8.1-13: 927.5, 2462, 1850 filter. 2.778 GHz is only present when the Cell is on

Table 8.1-14: Test case Scenario 4

| Scenario | LoRa Frequency | Wi-Fi Frequency | Cellular Frequency |
|----------|----------------|-----------------|--------------------|
| #1       | 903            | 2412            | 848.8              |
| #2       | 915            | 2442            | 836.6              |
| #3       | 927.5          | 2462            | 824.2              |
| #4       | 927.5          | 2462            | 1850.2             |

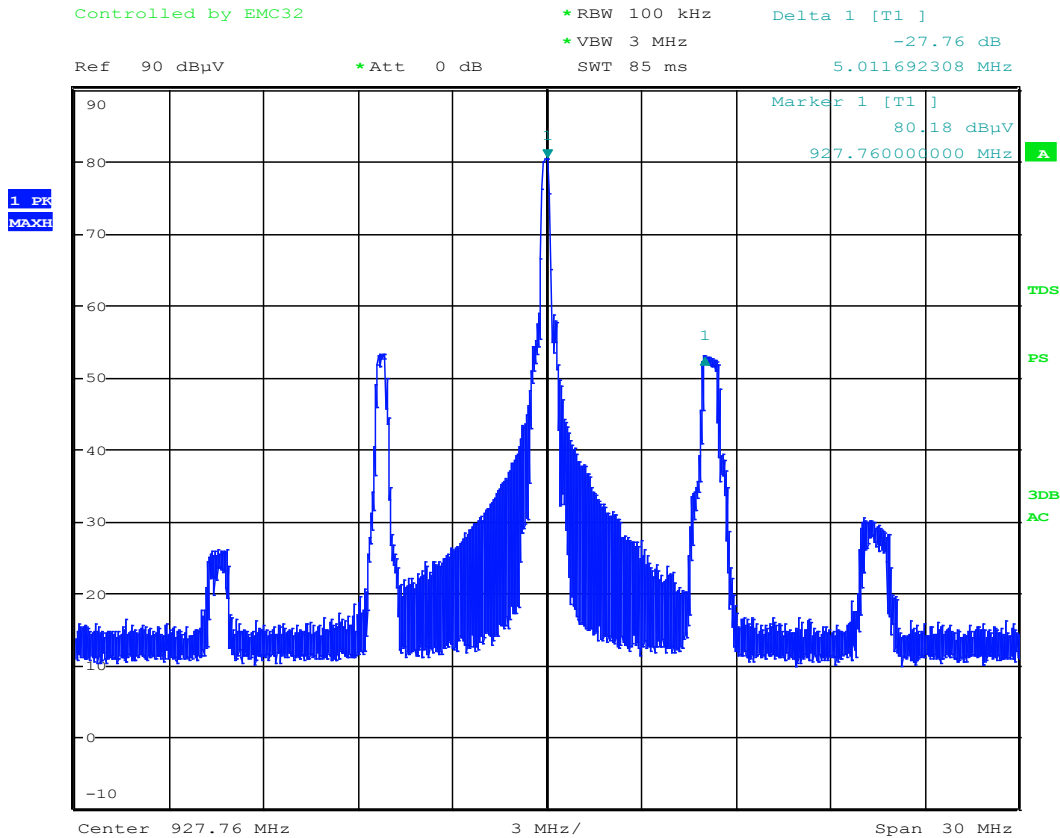


Date: 20.JUN.2017 04:34:41

Plot 8.1-14: With Cell and without Cell to show the signal

Table 8.1-15: Test case Scenario 4

| Scenario | LoRa Frequency | Wi-Fi Frequency | Cellular Frequency |
|----------|----------------|-----------------|--------------------|
| #1       | 903            | 2412            | 848.8              |
| #2       | 915            | 2442            | 836.6              |
| #3       | 927.5          | 2462            | 824.2              |
| #4       | 927.5          | 2462            | 1850.2             |



Date: 20.JUN.2017 04:42:24

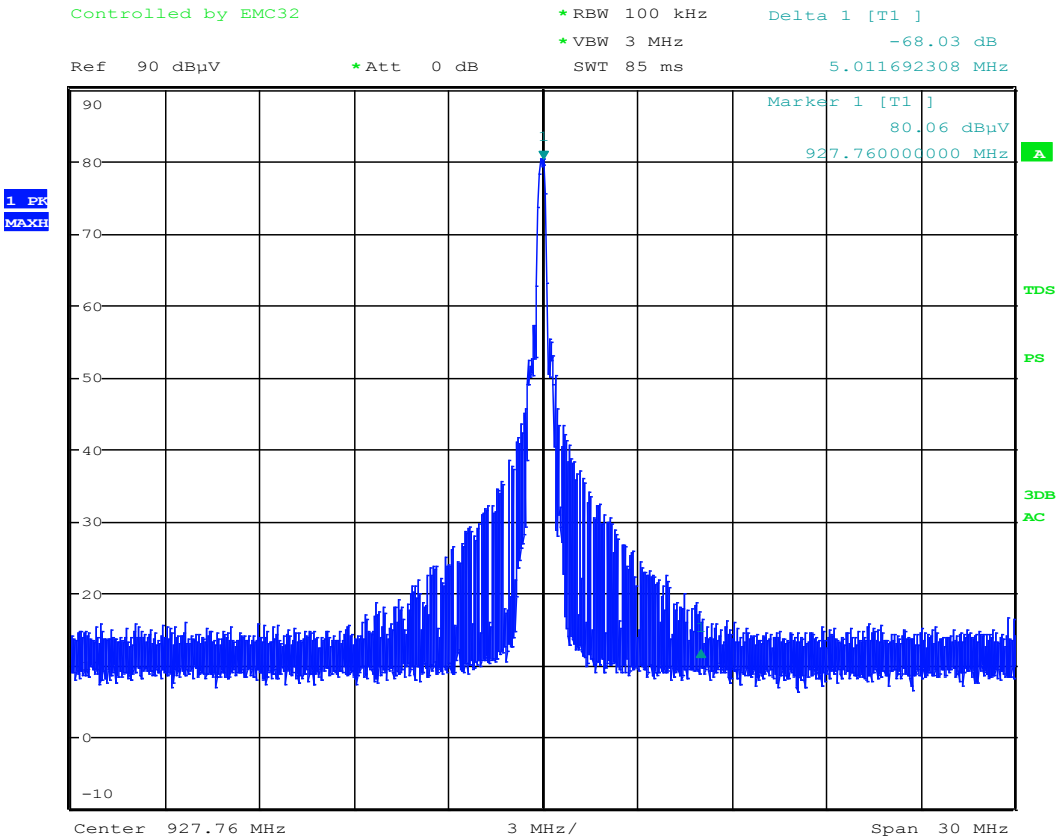
Plot 8.1-15: 927.5, 2462, 1850 no filter

Table 8.1-16: Test case Scenario 4

| Scenario | LoRa Frequency | Wi-Fi Frequency | Cellular Frequency |
|----------|----------------|-----------------|--------------------|
| #1       | 903            | 2412            | 848.8              |
| #2       | 915            | 2442            | 836.6              |
| #3       | 927.5          | 2462            | 824.2              |
| #4       | 927.5          | 2462            | 1850.2             |

Section 8  
Test name  
Specification

Testing data  
Co Location Per customer request.  
FCC Part 15 Subpart C



Date: 20.JUN.2017 04:43:28

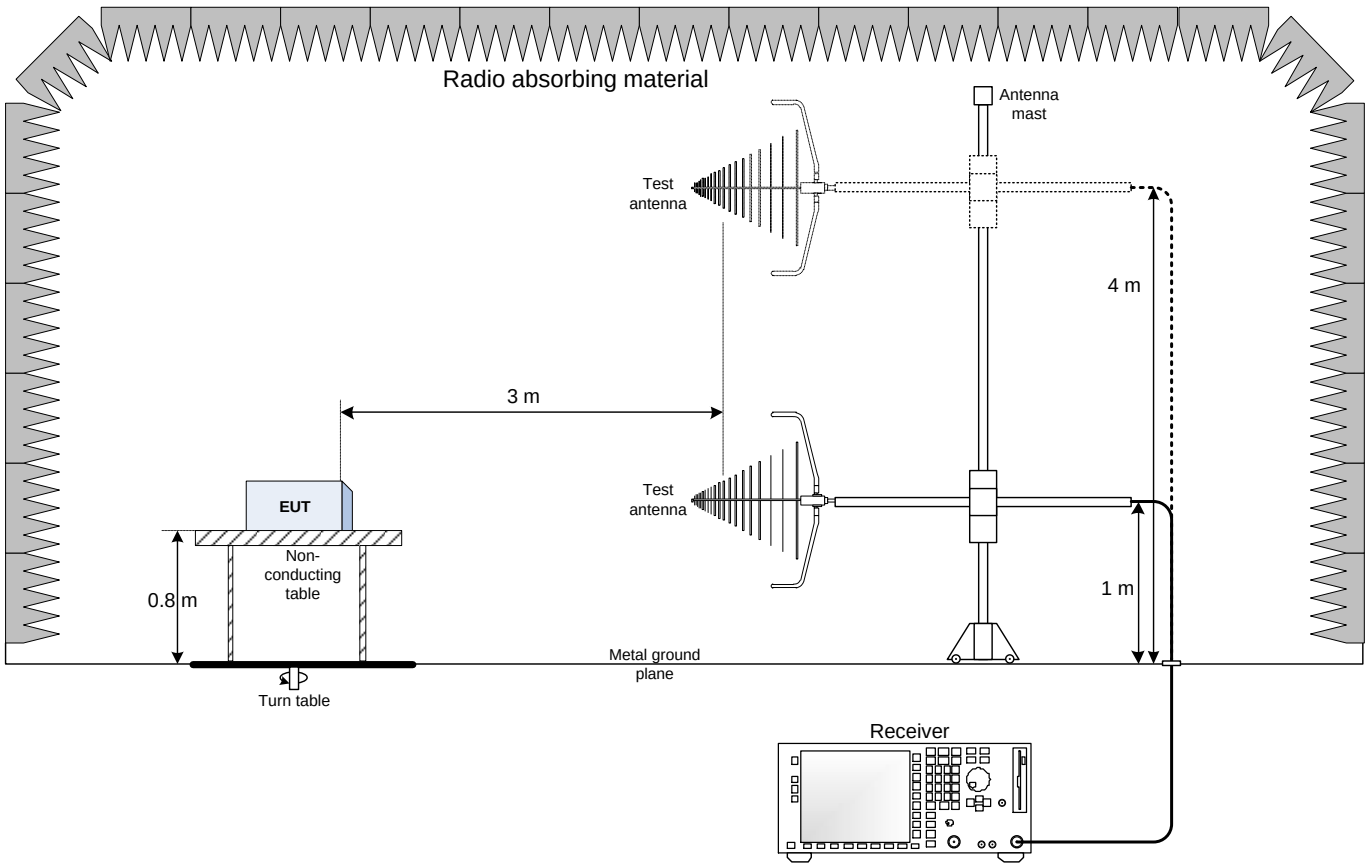
Plot 8.1-16: 927.5, 2462 No 1850

Table 8.1-17: Test case Scenario 4

| Scenario | LoRa Frequency | Wi-Fi Frequency | Cellular Frequency |
|----------|----------------|-----------------|--------------------|
| #1       | 903            | 2412            | 848.8              |
| #2       | 915            | 2442            | 836.6              |
| #3       | 927.5          | 2462            | 824.2              |
| #4       | 927.5          | 2462            | 1850.2             |

**Section 9.** Block diagrams of test set-ups

**9.1** Radiated emissions set-up for frequencies below 1 GHz



9.2 Radiated emissions set-up for frequencies above 1 GHz

