

**InterLab<sup>®</sup>**  
**Final Report on**  
**Jabra SPEAK 810**  
**PHS004W**  
**FCC ID BCE-PHS004W**  
**IC: 2386C-PHS004W**

**Report Reference:** MDE\_GNNET\_1509\_FCCb\_rev1  
acc. Title 47 CFR chapter I part 15 subpart C

**Date:** September 16, 2015

**Test Laboratory:**

7layers GmbH  
Borsigstraße 11  
40880 Ratingen  
Germany



**Note:**

The following test results relate only to the devices specified in this document. This report shall not be reproduced in parts without the written approval of the test laboratory.

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Geschäftsführer /  
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Dr. Harald Ansorge

Registergericht registered in:  
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USt-IdNr VAT No.:  
DE203159652  
TAX No. 147/5869/0385  
A Bureau Veritas Group Company

## 1 Administrative Data

### 1.1 Project Data

*Project Responsible:* Patrick Menge  
*Date Of Test Report:* 2015/09/16  
*Date of first test:* 2015/06/02  
*Date of last test:* 2015/09/16

### 1.2 Applicant Data

*Company Name:* GN Netcom A/S  
*Street:* Lautrupbjerg 7  
*City:* DK-2750 Ballerup  
*Country:* Denmark  
*Contact Person:* Mr. Tom Ringtved  
*Phone:* +45 45 75 91 86  
*E-Mail:* tringtved@jabra.com

### 1.3 Test Laboratory Data

The following list shows all places and laboratories involved for test result generation:

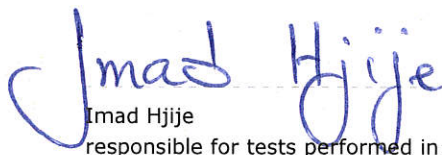
#### 7 layers DE

|                         |                            |
|-------------------------|----------------------------|
| <i>Company Name :</i>   | 7 layers GmbH              |
| <i>Street :</i>         | Borsigstrasse 11           |
| <i>City :</i>           | 40880 Ratingen             |
| <i>Country :</i>        | Germany                    |
| <i>Contact Person :</i> | Mr. Michael Albert         |
| <i>Phone :</i>          | +49 2102 749 201           |
| <i>Fax :</i>            | +49 2102 749 444           |
| <i>E Mail :</i>         | Michael.Albert@7Layers.com |

#### Laboratory Details

| Lab ID | Identification                           | Responsible                                | Accreditation Info                      |
|--------|------------------------------------------|--------------------------------------------|-----------------------------------------|
| Lab 1  | Conducted Emissions                      | Mr. Andreas Petz<br>Mr. Wolfgang Richter   | DAkKS-Registration no. D-PL-12140-01-01 |
| Lab 2  | Radiated Emissions                       | Mr. Marco Kullik<br>Mr. Robert Machulec    | DAkKS-Registration no. D-PL-12140-01-01 |
| Lab 3  | Regulatory Bluetooth<br>RF Test Solution | Mr. Jimmy Chatheril<br>Mr. Sören Berentzen | DAkKS-Registration no. D-PL-12140-01-01 |

### 1.4 Signature of the Testing Responsible



Imad Hjije  
responsible for tests performed in: Lab 1, Lab 2, Lab 3

## 1.5 Signature of the Accreditation Responsible

 [B. RETKA]

Accreditation scope responsible person  
responsible for Lab 1, Lab 2, Lab 3

## 2 Test Object Data

### 2.1 General OUT Description

The following section lists all OUTs (Object's Under Test) involved during testing.

#### OUT: Jabra SPEAK 810

Type / Model / Family: Jabra SPEAK 810  
PHS004W  
FCC ID BCE-PHS004W  
IC: 2386C-PHS004W

Product Category: Office Equipment

**Manufacturer:**  
Company Name: See applicant data:

Contact Person: -

#### Parameter List:

| Parameter name                               | Value      |
|----------------------------------------------|------------|
| AC Power Supply                              | 120 (V)    |
| Antenna Gain                                 | 2,06 (dBi) |
| DC Power Supply                              | 12 (V)     |
| highest channel (BT)                         | 2480 (MHz) |
| highest internal frequency of host equipment | 26 MHz     |
| lowest channel (BT)                          | 2402 (MHz) |
| mid channel (BT)                             | 2441 (MHz) |

## 2.2 Detailed Description of OUT Samples

### **Sample : ab01**

|                           |                 |                     |        |
|---------------------------|-----------------|---------------------|--------|
| <i>OUT Identifier</i>     | Jabra SPEAK 810 |                     |        |
| <i>Sample Description</i> | radiated sample |                     |        |
| <i>Serial No.</i>         | Alpha 1 219     |                     |        |
| <i>HW Status</i>          | 28-04370        |                     |        |
| <i>SW Status</i>          | 0-0-26          |                     |        |
| <i>Date of Receipt</i>    | 2015/06/01      |                     |        |
| <i>Low Voltage</i>        | 11.4 V          | <i>Low Temp.</i>    | -10 °C |
| <i>High Voltage</i>       | 12.6 V          | <i>High Temp.</i>   | 55 °C  |
| <i>Nominal Voltage</i>    | 12 V            | <i>Normal Temp.</i> | 25 °C  |

#### ***Parameter List:***

| <i>Parameter Description</i> | <i>Value</i> |
|------------------------------|--------------|
|------------------------------|--------------|

#### **Parameter for Scope FCC\_v2**

|                |      |       |
|----------------|------|-------|
| Antenna Gain   | 2,06 | (dBi) |
| Frequency_high | 2480 | (MHz) |
| Frequency_low  | 2402 | (MHz) |
| Frequency_mid  | 2441 | (MHz) |

### **Sample : ac01**

|                           |                  |                     |        |
|---------------------------|------------------|---------------------|--------|
| <i>OUT Identifier</i>     | Jabra SPEAK 810  |                     |        |
| <i>Sample Description</i> | conducted sample |                     |        |
| <i>Serial No.</i>         | Alpha 1 314      |                     |        |
| <i>HW Status</i>          | 28-04370         |                     |        |
| <i>SW Status</i>          | 0-0-26           |                     |        |
| <i>Date of Receipt</i>    | 2015/06/01       |                     |        |
| <i>Low Voltage</i>        | 11.4 V           | <i>Low Temp.</i>    | -10 °C |
| <i>High Voltage</i>       | 12.6 V           | <i>High Temp.</i>   | 55 °C  |
| <i>Nominal Voltage</i>    | 12 V             | <i>Normal Temp.</i> | 25 °C  |

#### ***Parameter List:***

| <i>Parameter Description</i> | <i>Value</i> |
|------------------------------|--------------|
|------------------------------|--------------|

#### **Parameter for Scope FCC\_v2**

|                |      |       |
|----------------|------|-------|
| Antenna Gain   | 2.06 | (dBi) |
| Frequency_high | 2480 | (MHz) |
| Frequency_low  | 2402 | (MHz) |
| Frequency_mid  | 2441 | (MHz) |

## 2.3 OUT Features

### Features for OUT: Jabra SPEAK 810

| <i>Designation</i>                | <i>Description</i>                                                                                                   | <i>Allowed Values</i> | <i>Supported Value(s)</i> |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------|-----------------------|---------------------------|
| <b>Features for scope: FCC_v2</b> |                                                                                                                      |                       |                           |
| AC                                | The OUT is powered by or connected to AC Mains                                                                       |                       |                           |
| BT                                | EUT supports Bluetooth data rate of 1 Mbps with GFSK modulation in the band 2400 MHz - 2483.5 MHz                    |                       |                           |
| BTLE                              | Support of Bluetooth Low Energy                                                                                      |                       |                           |
| EDR2                              | EUT supports Bluetooth using data rate of 2 Mbps with PI/4 DQPSK modulation in the band 2400 MHz - 2483.5 MHz        |                       |                           |
| EDR3                              | EUT supports Bluetooth using data rate of 3 Mbps with 8DPSK modulation in the band 2400 MHz - 2483.5 MHz             |                       |                           |
| Iant                              | Integral Antenna: permanent fixed antenna, which may be built-in, designed as an indispensable part of the equipment |                       |                           |
| TantC                             | temporary antenna connector, which may be only built-in for testing, designed as an example part of the equipment    |                       |                           |

## 2.4 Auxiliary Equipment

| <i>AE No.</i> | <i>Type Designation</i>        | <i>Serial No.</i> | <i>HW Status</i> | <i>SW Status</i> | <i>Description</i>     |
|---------------|--------------------------------|-------------------|------------------|------------------|------------------------|
| AE AE06       | CHERRY RS 6000 USB ON          | G 0000273 2P28    |                  |                  | Keyboard               |
| AE AE04       | FUJITSU                        | 13300281B         | Model: PJW1942NA |                  | AC Adapter             |
| AE AE03       | FUJITSU LIFEBOOK E Series E781 | DSCK013817        |                  |                  | Laptop                 |
| AE AE05       | Logitech M-BT58                | HC60915A2XC       |                  |                  | PC Mouse               |
| AE AE01       | Phihong PSAA30R-120            | P151301251A1      |                  |                  | Switching Power Supply |
| AE AE02       | SAMSUNG S22B350H               | 0166H4MC40232 8Y  |                  |                  | Monitor                |

## 2.5 Setups used for Testing

For each setup a relation is given to determine if and which samples and auxiliary equipment is used. The left side list all OUT samples and the right side lists all auxiliary equipment for the given setup.

| Setup No. List of OUT samples     |                    | List of auxiliary equipment |                        |
|-----------------------------------|--------------------|-----------------------------|------------------------|
| Sample No.                        | Sample Description | AE No.                      | AE Description         |
| <b>S01_AC01 (conducted setup)</b> |                    |                             |                        |
| Sample: ac01                      | conducted sample   | AE AE06                     | Keyboard               |
|                                   |                    | AE AE04                     | AC Adapter             |
|                                   |                    | AE AE03                     | Laptop                 |
|                                   |                    | AE AE05                     | PC Mouse               |
|                                   |                    | AE AE01                     | Switching Power Supply |
|                                   |                    | AE AE02                     | Monitor                |
| <b>S02_AB01 (radiated setup)</b>  |                    |                             |                        |
| Sample: ab01                      | radiated sample    | AE AE01                     | Switching Power Supply |

## 3 Results

### 3.1 General

**Documentation of tested devices:**

Available at the test laboratory.

**Interpretation of the test results:**

The results of the inspection are described on the following pages, where 'Conformity' or 'Passed' means that the certification criteria were verified and that the tested device is conform to the applied standard.

In cases where 'Declaration' is printed, the required documents are available in the manufacturers product documentation.

In cases where 'not applicable' is printed, the test case requirements are not relevant to the specific equipment implementation.

**Note:**

1. This report contains the abbreviated information content pertaining to services rendered. Supporting documentation not included herein is maintained and available at the laboratory.
2. All tests are performed under environmental conditions within the requirements of the specifications. Environmental conditions are available at the laboratory.
3. This test report covers only the normal Bluetooth functionality of this device. Bluetooth low energy is reported separately.
3. This report is revision of MDE\_GNNET\_1509\_FCCb. Corresponding revision table can be found in the Annex.

### 3.2 List of the Applicable Body

(Body for Scope: FCC\_v2)

| <i>Designation</i>                              | <i>Description</i>                                                                                                       |
|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| FCC47CFRChIPART15c247RADIO<br>FREQUENCY DEVICES | Subpart C - Intentional Radiators; 15.247 Operation within the<br>bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz. |

### 3.3 List of Test Specification

|                            |                                                                             |
|----------------------------|-----------------------------------------------------------------------------|
| <i>Test Specification:</i> | <b>FCC part 2 and 15</b>                                                    |
| <i>Version</i>             | 10-1-13 Edition                                                             |
| <i>Title:</i>              | PART 2 - GENERAL RULES AND REGULATIONS<br>PART 15 - RADIO FREQUENCY DEVICES |

### 3.4 Summary

| Test Case Identifier / Name<br>Test (condition)                                                          | Result | Date of Test | Lab<br>Ref. | Setup    |
|----------------------------------------------------------------------------------------------------------|--------|--------------|-------------|----------|
| <b>15c.1 Conducted emissions (AC power line) §15.207</b>                                                 |        |              |             |          |
| 15c.1; Mode = transmit                                                                                   | Passed | 2015/06/24   | Lab 1       | S02_AB01 |
| <b>15c.2 Spurious radiated emissions §15.247 (d), §15.35 (b), §15.209</b>                                |        |              |             |          |
| 15c.2; Frequency = 2402 - 2480, Mode = BT<br>transmit using GFSK/PSK Modulation,<br>Maximum Output Power | Passed | 2015/06/06   | Lab 2       | S02_AB01 |
| <b>15c.3 Occupied bandwidth §15.247 (a) (1)</b>                                                          |        |              |             |          |
| 15c.3; Frequency = 2402, Mode = BT<br>transmit using 1 Mbps with GFSK modulation                         | Passed | 2015/09/16   | Lab 3       | S01_AC01 |
| 15c.3; Frequency = 2402, Mode = BT<br>transmit using 2 Mbps with PI/4 DQPSK<br>modulation                | Passed | 2015/09/16   | Lab 3       | S01_AC01 |
| 15c.3; Frequency = 2402, Mode = BT<br>transmit using 3 Mbps with 8DPSK modulation                        | Passed | 2015/09/16   | Lab 3       | S01_AC01 |
| 15c.3; Frequency = 2441, Mode = BT<br>transmit using 1 Mbps with GFSK modulation                         | Passed | 2015/09/16   | Lab 3       | S01_AC01 |
| 15c.3; Frequency = 2441, Mode = BT<br>transmit using 2 Mbps with PI/4 DQPSK<br>modulation                | Passed | 2015/09/16   | Lab 3       | S01_AC01 |
| 15c.3; Frequency = 2441, Mode = BT<br>transmit using 3 Mbps with 8DPSK modulation                        | Passed | 2015/09/16   | Lab 3       | S01_AC01 |
| 15c.3; Frequency = 2480, Mode = BT<br>transmit using 1 Mbps with GFSK modulation                         | Passed | 2015/09/16   | Lab 3       | S01_AC01 |
| 15c.3; Frequency = 2480, Mode = BT<br>transmit using 2 Mbps with PI/4 DQPSK<br>modulation                | Passed | 2015/09/16   | Lab 3       | S01_AC01 |
| 15c.3; Frequency = 2480, Mode = BT<br>transmit using 3 Mbps with 8DPSK modulation                        | Passed | 2015/09/16   | Lab 3       | S01_AC01 |
| <b>15c.4 Peak power output §15.247 (b) (1)</b>                                                           |        |              |             |          |
| 15c.4; Peak power output Summary                                                                         | Passed | 2015/08/25   | Lab 3       | S01_AC01 |
| <b>15c.5 Spurious RF conducted emissions §15.247 (d)</b>                                                 |        |              |             |          |
| 15c.5; Frequency = 2402, Mode = BT<br>transmit using 1 Mbps with GFSK modulation                         | Passed | 2015/08/26   | Lab 3       | S01_AC01 |
| 15c.5; Frequency = 2402, Mode = BT<br>transmit using 2 Mbps with PI/4 DQPSK<br>modulation                | Passed | 2015/08/26   | Lab 3       | S01_AC01 |
| 15c.5; Frequency = 2402, Mode = BT<br>transmit using 3 Mbps with 8DPSK modulation                        | Passed | 2015/08/26   | Lab 3       | S01_AC01 |
| 15c.5; Frequency = 2441, Mode = BT<br>transmit using 1 Mbps with GFSK modulation                         | Passed | 2015/08/26   | Lab 3       | S01_AC01 |
| 15c.5; Frequency = 2441, Mode = BT<br>transmit using 2 Mbps with PI/4 DQPSK<br>modulation                | Passed | 2015/08/26   | Lab 3       | S01_AC01 |
| 15c.5; Frequency = 2441, Mode = BT<br>transmit using 3 Mbps with 8DPSK modulation                        | Passed | 2015/08/26   | Lab 3       | S01_AC01 |
| 15c.5; Frequency = 2480, Mode = BT<br>transmit using 1 Mbps with GFSK modulation                         | Passed | 2015/08/26   | Lab 3       | S01_AC01 |
| 15c.5; Frequency = 2480, Mode = BT<br>transmit using 2 Mbps with PI/4 DQPSK<br>modulation                | Passed | 2015/08/26   | Lab 3       | S01_AC01 |
| 15c.5; Frequency = 2480, Mode = BT<br>transmit using 3 Mbps with 8DPSK modulation                        | Passed | 2015/08/26   | Lab 3       | S01_AC01 |



| Test Case Identifier / Name<br>Test (condition)                                                                                          | Result | Date of Test | Lab<br>Ref. | Setup    |
|------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------|-------------|----------|
| <b>15c.6 Band edge compliance §15.247 (d)</b>                                                                                            |        |              |             |          |
| 15c.6; Frequency = 2402, Mode = BT<br>transmit using 1 Mbps with GFSK modulation,<br>Method = conducted, band edge = 2400 MHz            | Passed | 2015/08/26   | Lab 3       | S01_AC01 |
| 15c.6; Frequency = 2402, Mode = BT<br>transmit using 2 Mbps with PI/4 DQPSK<br>modulation, Method = conducted, band edge<br>= 2400 MHz   | Passed | 2015/08/26   | Lab 3       | S01_AC01 |
| 15c.6; Frequency = 2402, Mode = BT<br>transmit using 3 Mbps with 8DPSK<br>modulation, Method = conducted, band edge<br>= 2400 MHz        | Passed | 2015/08/26   | Lab 3       | S01_AC01 |
| 15c.6; Frequency = 2480, Mode = BT<br>transmit using 1 Mbps with GFSK modulation,<br>Method = conducted, band edge = 2483.5<br>MHz       | Passed | 2015/08/26   | Lab 3       | S01_AC01 |
| 15c.6; Frequency = 2480, Mode = BT<br>transmit using 1 Mbps with GFSK modulation,<br>Method = radiated                                   | Passed | 2015/06/06   | Lab 2       | S02_AB01 |
| 15c.6; Frequency = 2480, Mode = BT<br>transmit using 2 Mbps with PI/4 DQPSK<br>modulation, Method = conducted, band edge<br>= 2483.5 MHz | Passed | 2015/08/26   | Lab 3       | S01_AC01 |
| 15c.6; Frequency = 2480, Mode = BT<br>transmit using 2 Mbps with PI/4 DQPSK<br>modulation, Method = radiated                             | Passed | 2015/06/06   | Lab 2       | S02_AB01 |
| 15c.6; Frequency = 2480, Mode = BT<br>transmit using 3 Mbps with 8DPSK<br>modulation, Method = conducted, band edge<br>= 2483.5 MHz      | Passed | 2015/08/26   | Lab 3       | S01_AC01 |
| 15c.6; Frequency = 2480, Mode = BT<br>transmit using 3 Mbps with 8DPSK<br>modulation, Method = radiated                                  | Passed | 2015/06/06   | Lab 2       | S02_AB01 |
| 15c.6; Frequency = hopping, Mode = BT<br>transmit using 1 Mbps with GFSK modulation,<br>Method = conducted, band edge = 2400 MHz         | Passed | 2015/06/02   | Lab 3       | S01_AC01 |
| 15c.6; Frequency = hopping, Mode = BT<br>transmit using 1 Mbps with GFSK modulation,<br>Method = conducted, band edge = 2483.5<br>MHz    | Passed | 2015/06/02   | Lab 3       | S01_AC01 |
| 15c.6; Frequency = hopping, Mode = BT<br>transmit using 2 Mbps with PI/4 DQPSK<br>modulation, Method = conducted, band<br>edge=2400 MHz  | Passed | 2015/06/02   | Lab 3       | S01_AC01 |
| 15c.6; Frequency = hopping, Mode = BT<br>transmit using 2 Mbps with PI/4 DQPSK<br>modulation, Method=conducted, band<br>edge=2483.5 MHz  | Passed | 2015/06/02   | Lab 3       | S01_AC01 |
| 15c.6; Frequency = hopping, Mode = BT<br>transmit using 3 Mbps with 8DPSK<br>modulation, Method = conducted, band edge<br>= 2400 MHz     | Passed | 2015/06/02   | Lab 3       | S01_AC01 |
| 15c.6; Frequency = hopping, Mode = BT<br>transmit using 3 Mbps with 8DPSK<br>modulation, Method = conducted, band edge<br>= 2483.5 MHz   | Passed | 2015/06/02   | Lab 3       | S01_AC01 |
| <b>15c.7 Dwell time §15.247 (a) (1) (iii)</b>                                                                                            |        |              |             |          |
| 15c.7; Frequency = 2441, Mode = BT<br>transmit using 1 Mbps with GFSK modulation                                                         | Passed | 2015/06/02   | Lab 3       | S01_AC01 |
| <b>15c.8 Channel separation §15.247 (a) (1)</b>                                                                                          |        |              |             |          |
| 15c.8; Frequency = 2441, Mode = BT<br>transmit using 1 Mbps with GFSK modulation                                                         | Passed | 2015/06/02   | Lab 3       | S01_AC01 |
| <b>15c.9 Number of hopping frequencies §15.247 (a) (1) (iii)</b>                                                                         |        |              |             |          |
| 15c.9; Frequency = 2441, Mode = BT<br>transmit using 1 Mbps with GFSK modulation                                                         | Passed | 2015/06/02   | Lab 3       | S01_AC01 |

### **3.5 Detailed Results**

#### **3.5.1 15c.1 Conducted emissions (AC power line) §15.207**

**Test: 15c.1; Mode = transmit**

|                            |                                              |
|----------------------------|----------------------------------------------|
| <i>Result:</i>             | Passed                                       |
| <i>Setup No.:</i>          | S02_AB01                                     |
| <i>Date of Test:</i>       | 2015/06/24 17:41                             |
| <i>Body:</i>               | FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES |
| <i>Test Specification:</i> | FCC part 2 and 15                            |

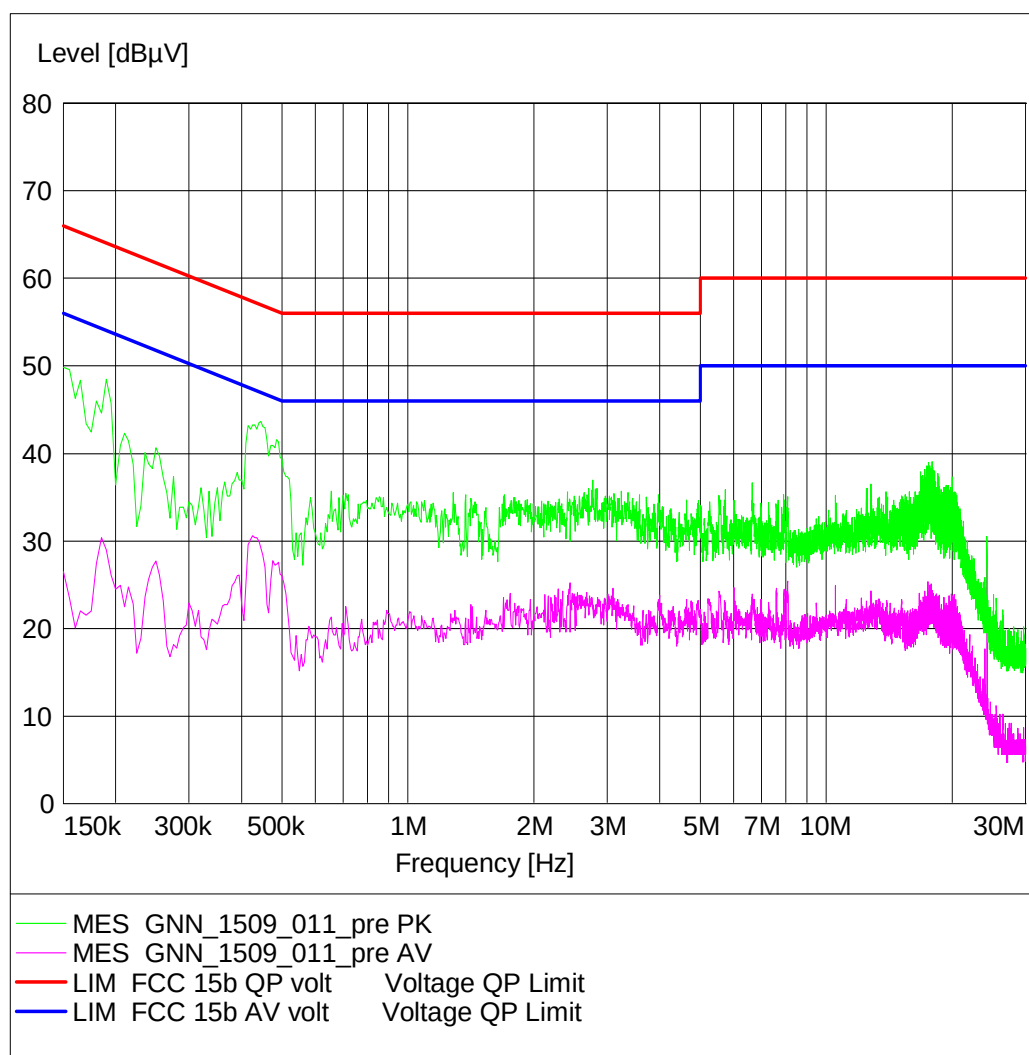
## Detailed Results:

### AC MAINS CONDUCTED

EUT: (DE1021008ab01)  
 Manufacturer: GNNET  
 Operating Condition: music playback via USB cable from laptop  
 Test Site: 7 layers Ratingen  
 Operator: URO  
 Test Specification: ANSI C63.4; FCC 15.107 / 15.207  
 Comment: computer peripheral setup, 120 V / 60 Hz  
 Start of Test: 24.06.2015 / 12:37:05

### SCAN TABLE: "FCC Voltage"

| Short Description:         | FCC Voltage     | Meas.   | IF     | Transducer |
|----------------------------|-----------------|---------|--------|------------|
| Start Stop Step            | Detector        | Time    | Bandw. |            |
| Frequency Frequency Width  |                 |         |        |            |
| 150.0 kHz 30.0 MHz 5.0 kHz | MaxPeak Average | 20.0 ms | 9 kHz  | ESH3-Z5    |



### 3.5.2 15c.2 Spurious radiated emissions §15.247 (d), §15.35 (b), §15.209

**Test: 15c.2; Frequency = 2402 - 2480, Mode = BT transmit using GFSK/PSK Modulation, Maximum Output Power**

Result: Passed  
Setup No.: S02\_AB01  
Date of Test: 2015/06/06 17:49  
Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES  
Test Specification: FCC part 2 and 15

#### Detailed Results:

| Test                                                                                                                                                             | TX freq.    | EUT              | Diagram no.     | Result                     | Measure-ment Range        | EUT                       | Diagram no.    | Result         | Measure-ment Range |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------------|-----------------|----------------------------|---------------------------|---------------------------|----------------|----------------|--------------------|
| FCC 15c247                                                                                                                                                       | Ch./MHz     | GFSK Modulation  |                 |                            |                           | PSK Modulation            |                |                |                    |
| H-Field                                                                                                                                                          | 39 / 2441   | ab01             | 020-023         | Passed                     | 9k-30M                    | -                         | -              | -              | -                  |
| 30M-1G                                                                                                                                                           | 0 / 2402    | ab01             | 018             | Passed                     | 30M-1G                    | -                         | -              | -              | -                  |
|                                                                                                                                                                  | 39 / 2441   | ab01             | FCC15B          | Passed                     | 30M-1G                    | -                         | -              | -              | -                  |
|                                                                                                                                                                  | 78 / 2480   | ab01             | 019             | Passed                     | 30M-1G                    | -                         | -              | -              | -                  |
| 1G-18G                                                                                                                                                           | 0 / 2402    | ab01             | 001             | Passed                     | 1G-3G                     | ab01                      | 004            | Passed         | 1G-3G              |
|                                                                                                                                                                  | 39 / 2441   | ab01             | 002             | Passed                     | 1G-3G                     | ab01                      | 005            | Passed         | 1G-3G              |
|                                                                                                                                                                  | 78 / 2480   | ab01             | 003             | Passed                     | 1G-3G                     | ab01                      | 006            | Passed         | 1G-3G              |
|                                                                                                                                                                  | 2480 BE     | ab01             | 003 BE          | Passed                     | 78/2.48G-2.5G             | ab01                      | 006 BE         | Passed         | 78/2.48G-2.5G      |
|                                                                                                                                                                  | 0 / 2402    | ab01             | 001             | Passed                     | 3G-18G                    | ab01                      | 004            | Passed         | 3G-8G              |
|                                                                                                                                                                  | 39 / 2441   | ab01             | 002             | Passed                     | 3G-18G                    | ab01                      | 005            | Passed         | 3G-8G              |
|                                                                                                                                                                  | 78 / 2480   | ab01             | 003             | Passed                     | 3G-18G                    | ab01                      | 006            | Passed         | 3G-8G              |
| 18G-25G                                                                                                                                                          | 0 / 2402    | ab01             | 008             | Passed                     | 18G-25G                   | -                         | -              | -              | -                  |
|                                                                                                                                                                  | 39 / 2441   | ab01             | 009             | Passed                     | 18G-25G                   | -                         | -              | -              | -                  |
|                                                                                                                                                                  | 78 / 2480   | ab01             | 010             | Passed                     | 18G-25G                   | -                         | -              | -              | -                  |
| ** REMARK: Emissions which are within 20 dB of the limit are listed in the tables below.                                                                         |             |                  |                 |                            |                           |                           |                |                |                    |
| ** Remark: Because no emission where found within 20 dB of the limit under GFSK modulation, PSK modulation was tested using a reduced frequency range of 1-18GHz |             |                  |                 |                            |                           |                           |                |                |                    |
| Diagram No.                                                                                                                                                      | Ant. Polar. | Limit QPK [dBµV] | Frequency [MHz] | Corrected value QPK [dBµV] | Margin QPK [dB]           | Result                    |                |                |                    |
|                                                                                                                                                                  | Ver + Hor   |                  |                 |                            |                           | Passed                    |                |                |                    |
| Frequency range 1 GHz - 25 GHz                                                                                                                                   |             |                  |                 |                            |                           |                           |                |                |                    |
| Diagram No.                                                                                                                                                      | Ant. Polar. | Limit PK [dBµV]  | Limit AV [dBµV] | Frequency [MHz]            | Corrected value PK [dBµV] | Corrected value AV [dBµV] | Margin PK [dB] | Margin AV [dB] | Result             |
|                                                                                                                                                                  | Ver + Hor   |                  |                 |                            |                           |                           |                |                | Passed             |
| Remark: The device is powered via AC/DC adapter, as it is the worst case                                                                                         |             |                  |                 |                            |                           |                           |                |                |                    |

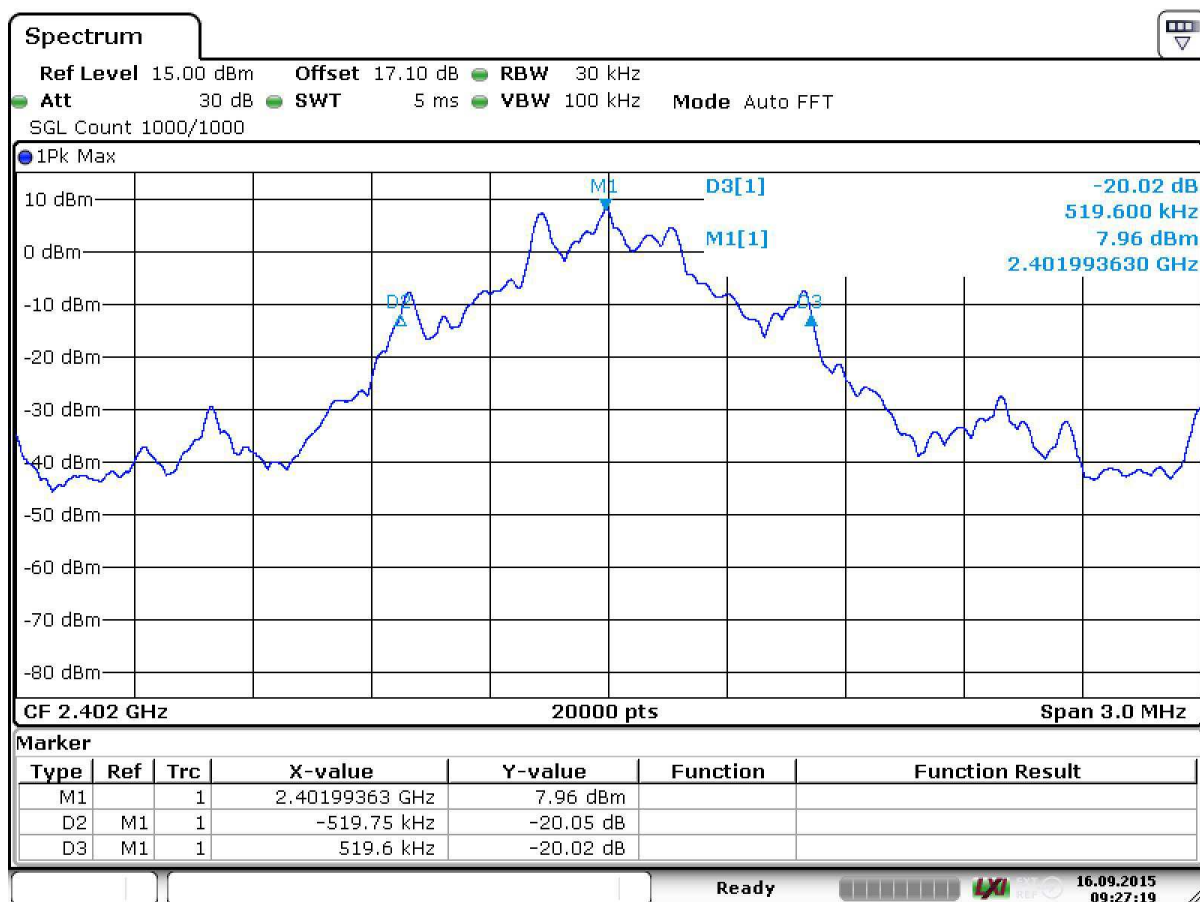
### 3.5.3 15c.3 Occupied bandwidth §15.247 (a) (1)

**Test: 15c.3; Frequency = 2402, Mode = BT transmit using 1 Mbps with GFSK modulation**

Result: Passed  
Setup No.: S01\_AC01  
Date of Test: 2015/09/16 10:41  
Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES  
Test Specification: FCC part 2 and 15

#### Detailed Results:

| 20 dB bandwidth MHz |
|---------------------|
| 1.039               |



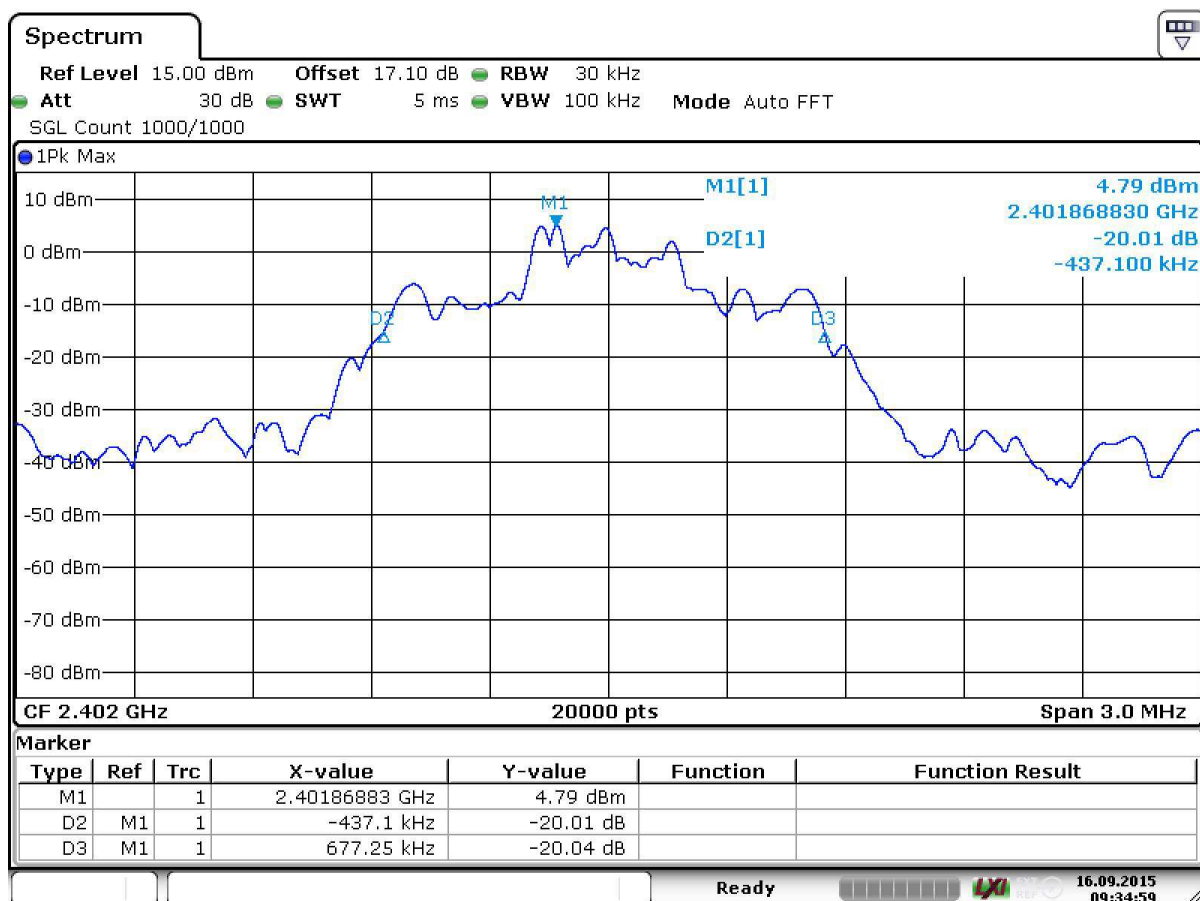
Date: 16.SEP.2015 09:27:19

**Test: 15c.3; Frequency = 2402, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation**

Result: Passed  
Setup No.: S01\_AC01  
Date of Test: 2015/09/16 10:45  
Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES  
Test Specification: FCC part 2 and 15

**Detailed Results:**

| 20 dB bandwidth MHz |
|---------------------|
| 1.114               |



Date: 16.SEP.2015 09:34:59

**Test: 15c.3; Frequency = 2402, Mode = BT transmit using 3 Mbps with 8DPSK modulation**

Result: Passed

Setup No.: S01\_AC01

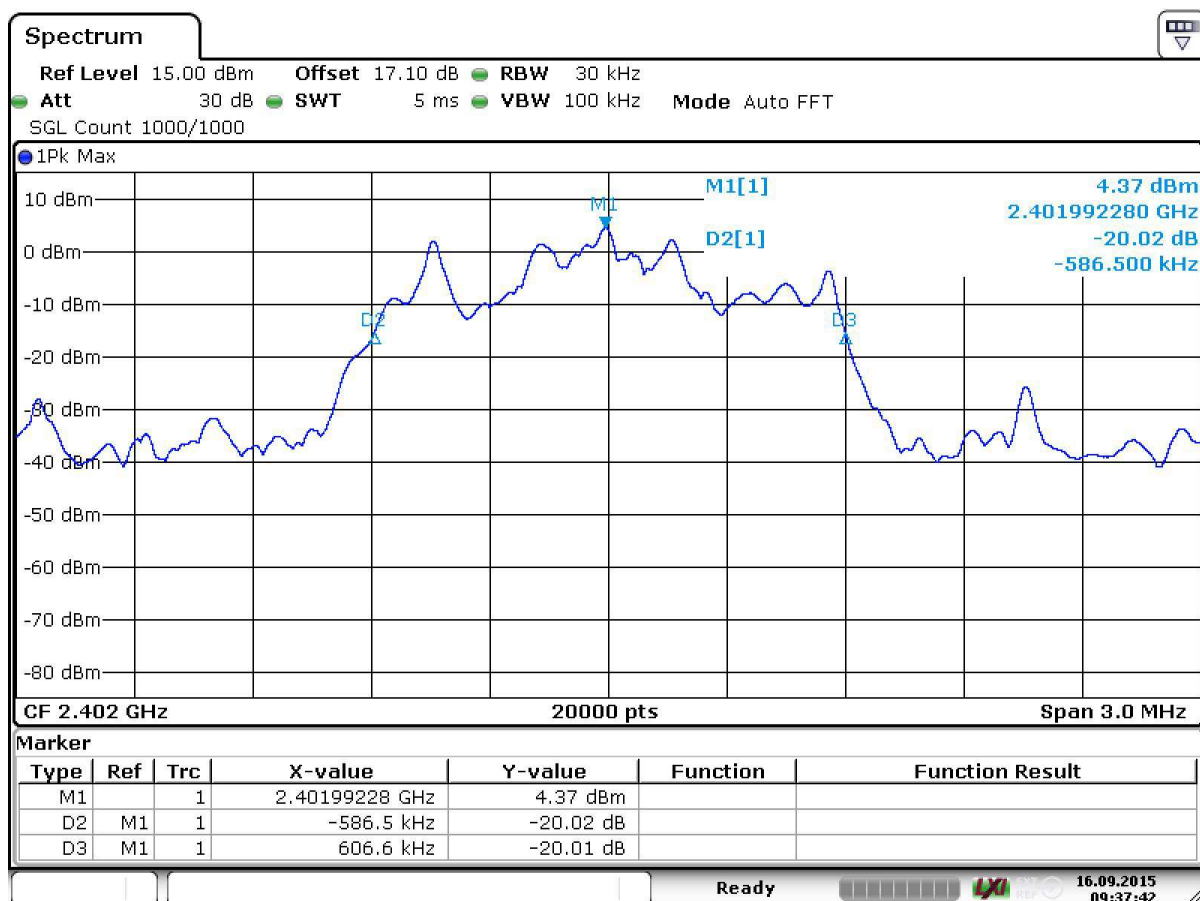
Date of Test: 2015/09/16 11:01

Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES

Test Specification: FCC part 2 and 15

**Detailed Results:**

| 20 dB bandwidth MHz |
|---------------------|
| 1.193               |



Date: 16.SEP.2015 09:37:42

**Test: 15c.3; Frequency = 2441, Mode = BT transmit using 1 Mbps with GFSK modulation**

Result: Passed

Setup No.: S01\_AC01

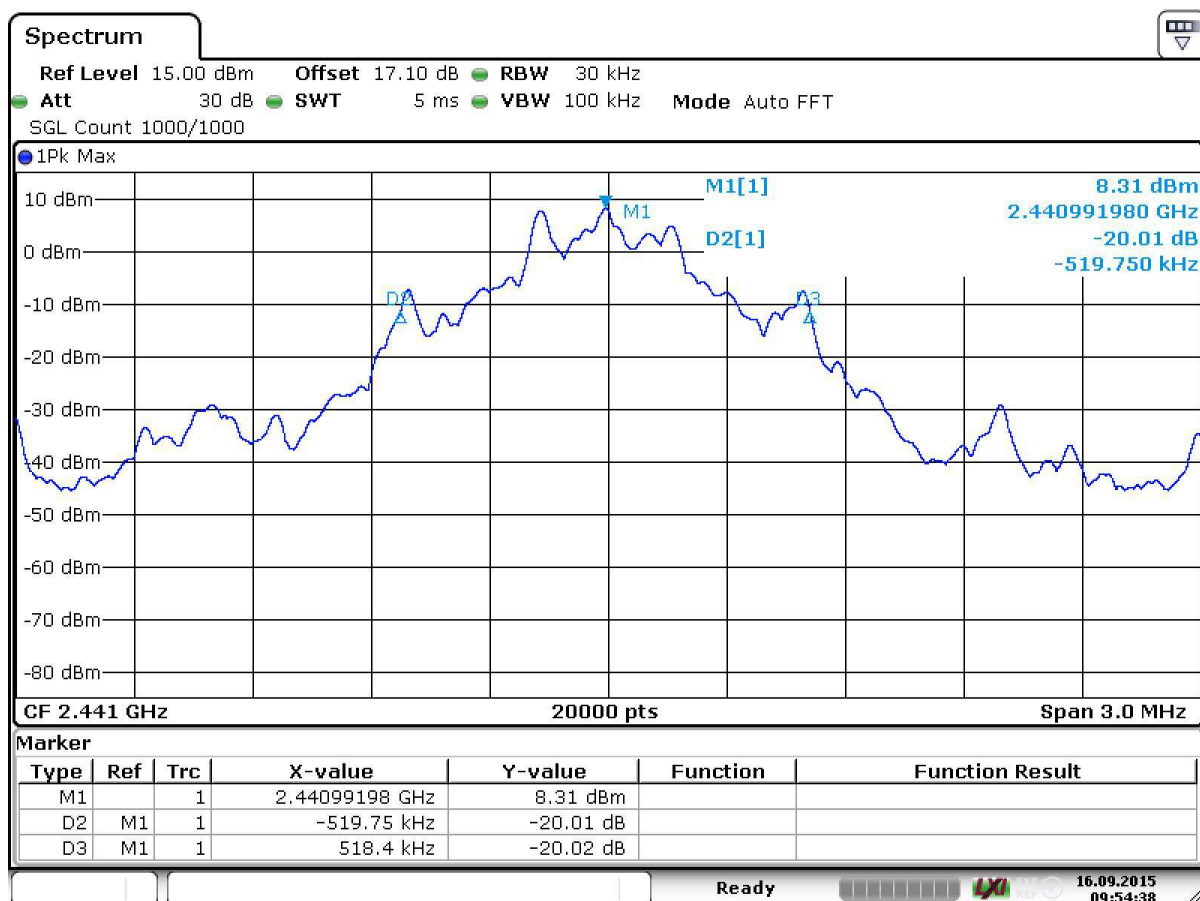
Date of Test: 2015/09/16 10:41

Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES

Test Specification: FCC part 2 and 15

**Detailed Results:**

| 20 dB bandwidth MHz |
|---------------------|
| 1.038               |



Date: 16.SEP.2015 09:54:37

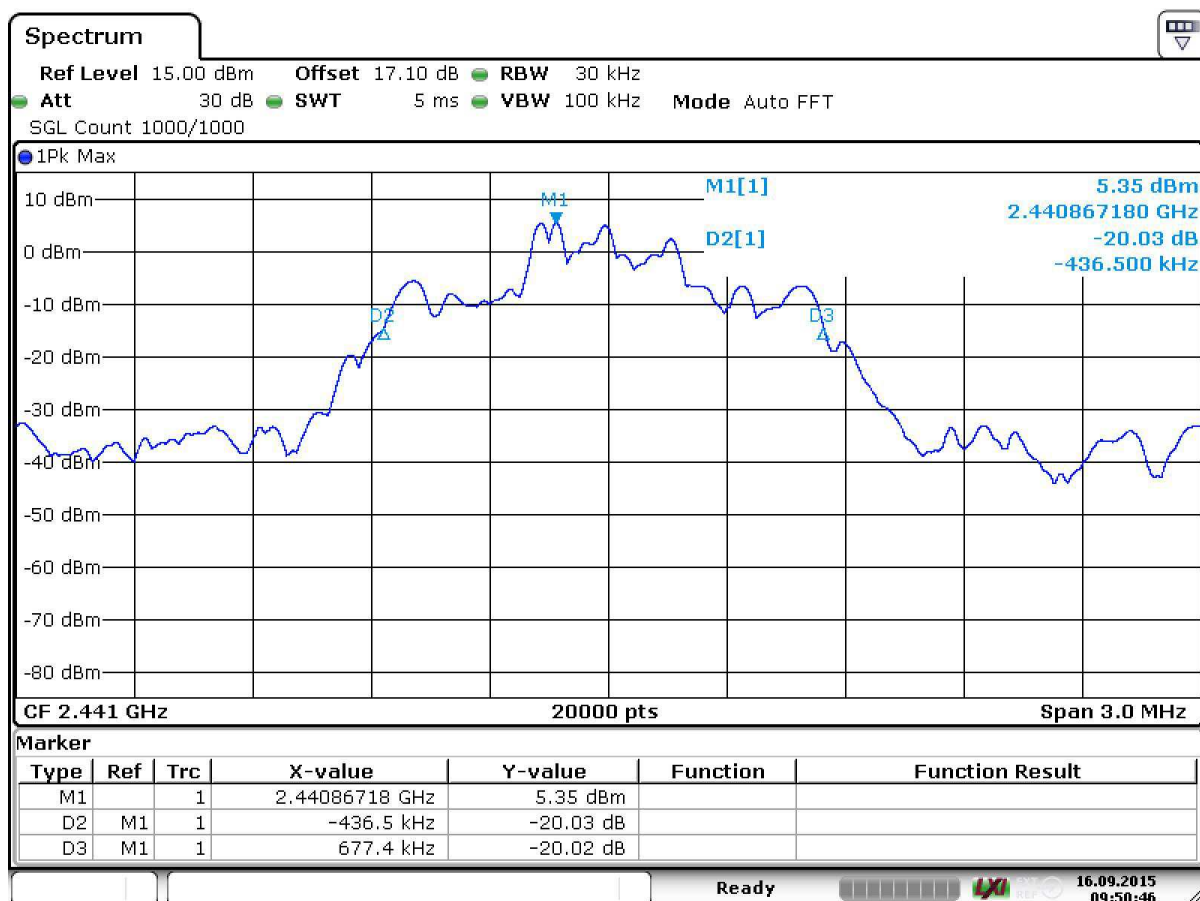


**Test: 15c.3; Frequency = 2441, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation**

Result: Passed  
Setup No.: S01\_AC01  
Date of Test: 2015/09/16 10:45  
Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES  
Test Specification: FCC part 2 and 15

**Detailed Results:**

| 20 dB bandwidth MHz |
|---------------------|
| 1.114               |



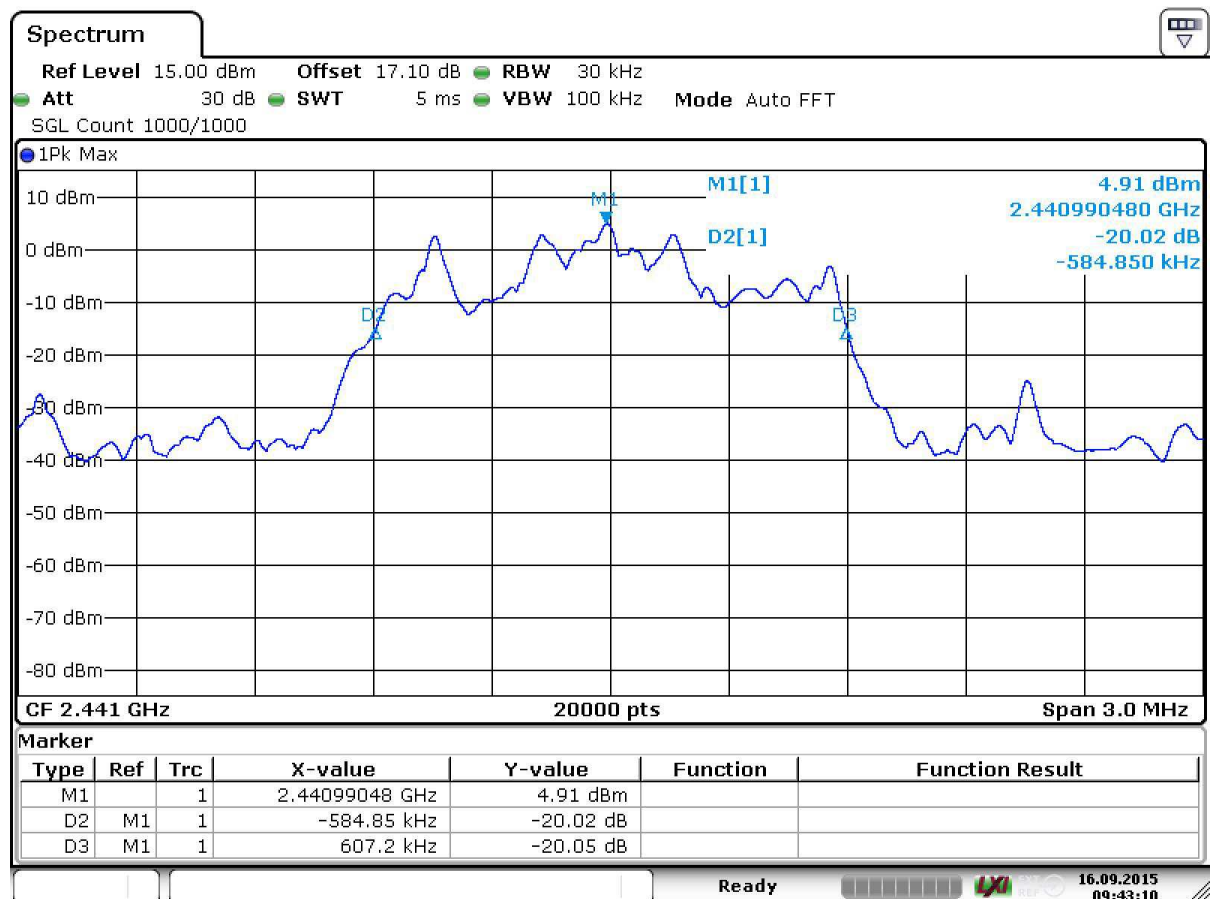
Date: 16.SEP.2015 09:50:46

**Test: 15c.3; Frequency = 2441, Mode = BT transmit using 3 Mbps with 8DPSK modulation**

Result: Passed  
Setup No.: S01\_AC01  
Date of Test: 2015/09/16 11:01  
Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES  
Test Specification: FCC part 2 and 15

**Detailed Results:**

| 20 dB bandwidth MHz |
|---------------------|
| 1.192               |



Date: 16.SEP.2015 09:43:10

**Test: 15c.3; Frequency = 2480, Mode = BT transmit using 1 Mbps with GFSK modulation**

Result: Passed

Setup No.: S01\_AC01

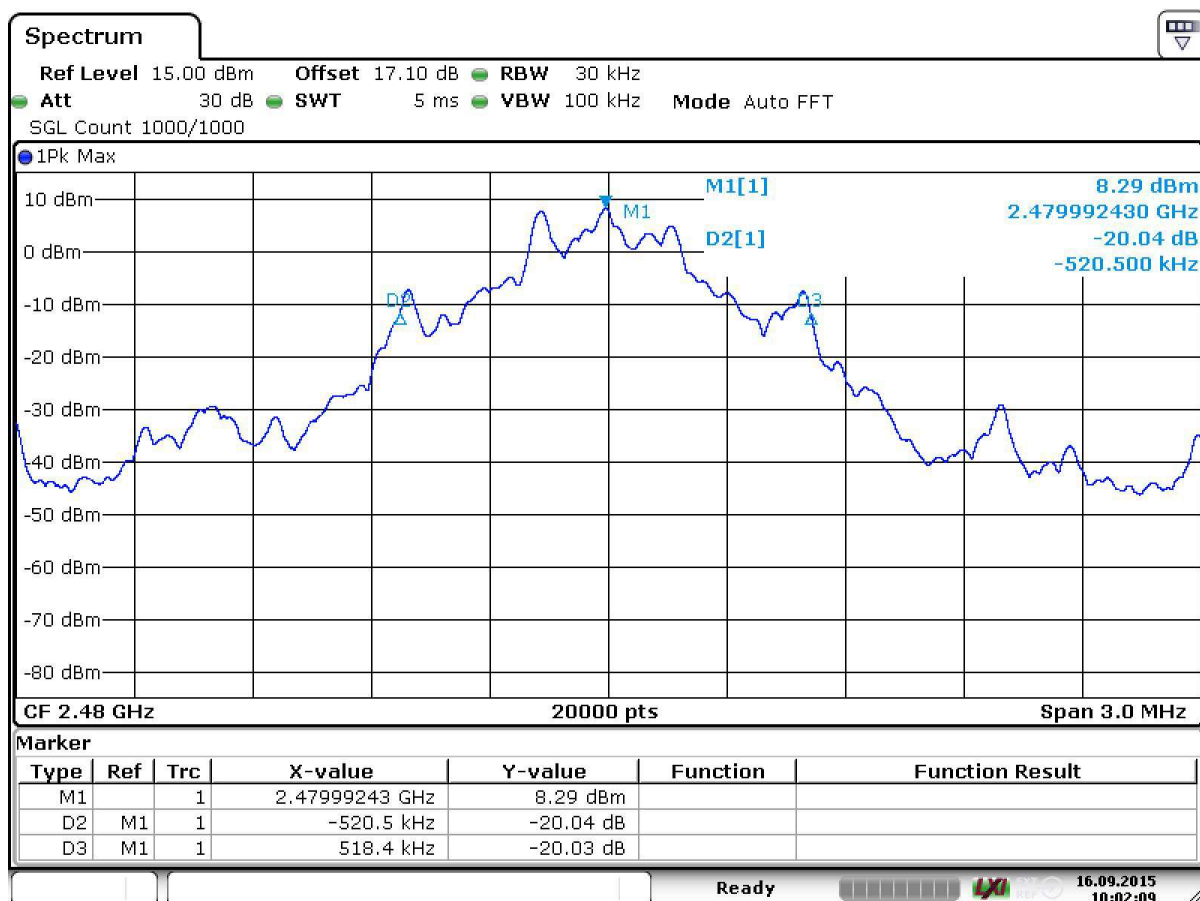
Date of Test: 2015/09/16 10:41

Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES

Test Specification: FCC part 2 and 15

**Detailed Results:**

| 20 dB bandwidth MHz |
|---------------------|
| 1.039               |



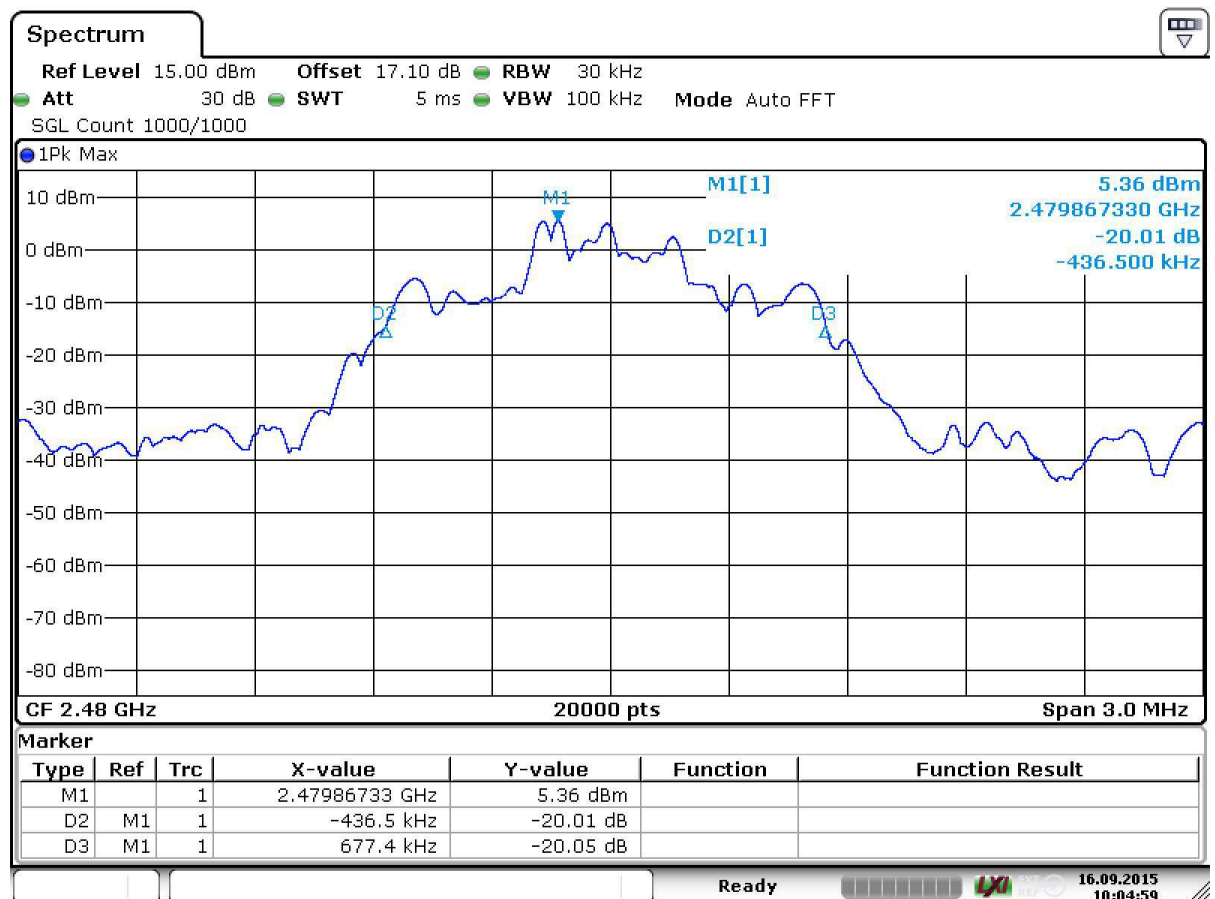
Date: 16.SEP.2015 10:02:09

**Test: 15c.3; Frequency = 2480, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation**

Result: Passed  
Setup No.: S01\_AC01  
Date of Test: 2015/09/16 10:45  
Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES  
Test Specification: FCC part 2 and 15

**Detailed Results:**

| 20 dB bandwidth MHz |
|---------------------|
| 1.114               |



Date: 16.SEP.2015 10:04:59

**Test: 15c.3; Frequency = 2480, Mode = BT transmit using 3 Mbps with 8DPSK modulation**

Result: Passed

Setup No.: S01\_AC01

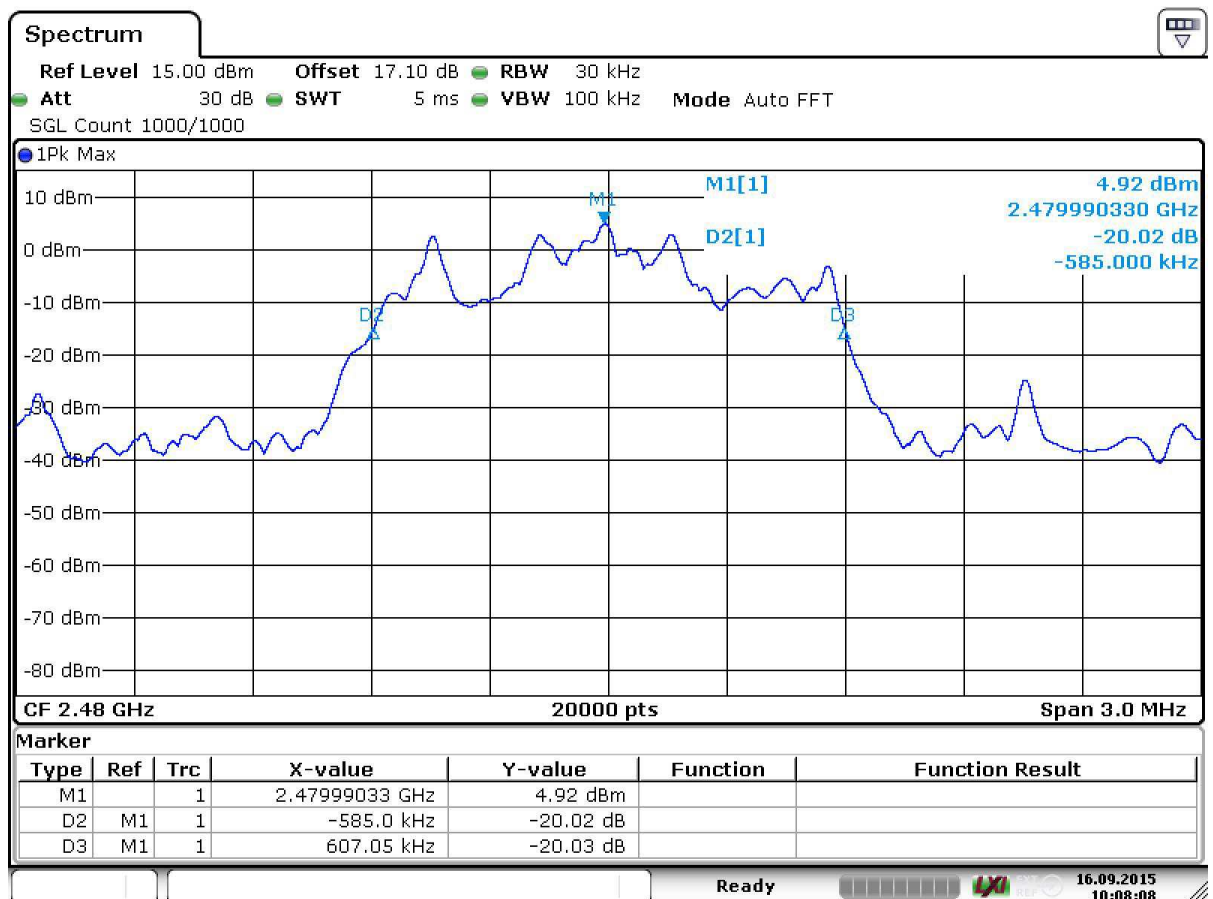
Date of Test: 2015/09/16 11:01

Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES

Test Specification: FCC part 2 and 15

**Detailed Results:**

| 20 dB bandwidth MHz |
|---------------------|
| 1.192               |



Date: 16.SEP.2015 10:08:08

### **3.5.4 15c.4 Peak power output §15.247 (b) (1)**

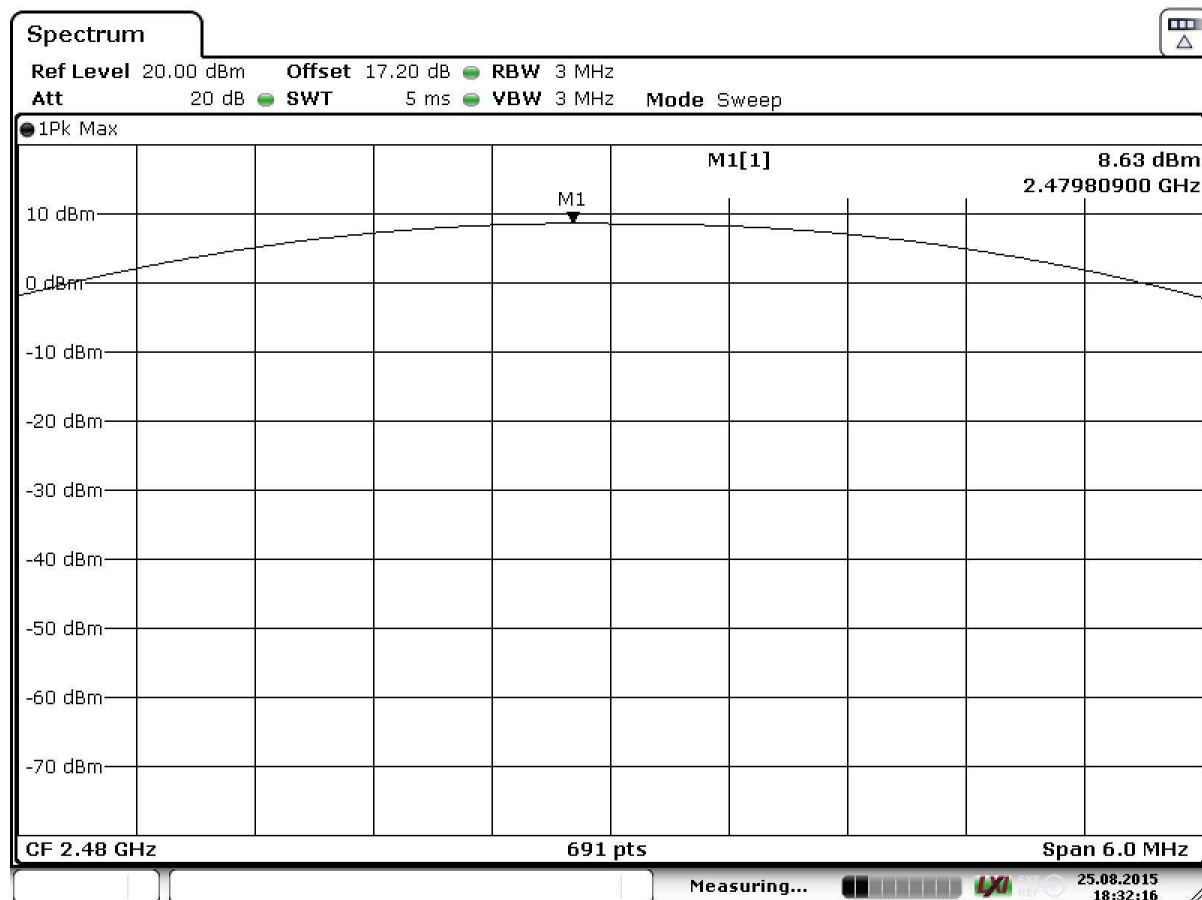
#### **Test: 15c.4; Peak power output Summary**

|                            |                                              |
|----------------------------|----------------------------------------------|
| <i>Result:</i>             | Passed                                       |
| <i>Setup No.:</i>          | S01_AC01                                     |
| <i>Date of Test:</i>       | 2015/08/25 12:47                             |
| <i>Body:</i>               | FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES |
| <i>Test Specification:</i> | FCC part 2 and 15                            |

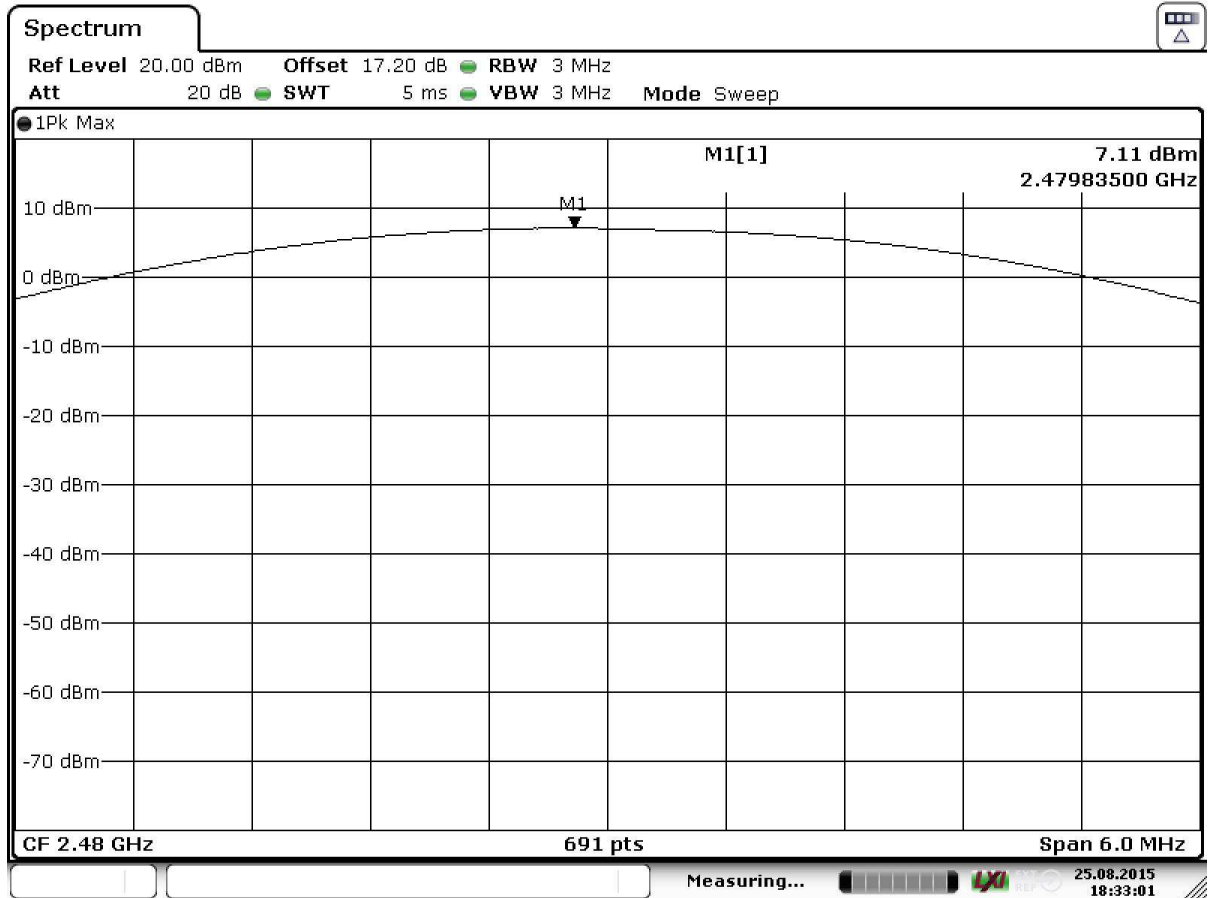
### Detailed Results:

|            |            | Conducted Transmitter Power |                   |                    |                   |                    |                   |
|------------|------------|-----------------------------|-------------------|--------------------|-------------------|--------------------|-------------------|
|            |            | 2402 MHz                    |                   | 2441 MHz           |                   | 2480 MHz           |                   |
| Modulation | Conditions | Output Power (dBm)          | Output Power (mW) | Output Power (dBm) | Output Power (mW) | Output Power (dBm) | Output Power (mW) |
| GFSK       | TN, VN     | 8.18                        | 6.58              | 8.59               | 7.23              | 8.63               | 7.29              |
| n/4 DQPSK  | TN, VN     | 6.47                        | 4.44              | 7.06               | 5.08              | 7.11               | 5.14              |
| 8-DPSK     | TN, VN     | 6.38                        | 4.35              | 6.95               | 4.95              | 7.03               | 5.05              |

|                                             |      |     |      |    |
|---------------------------------------------|------|-----|------|----|
| Max Conducted Output Power (FSK Modulation) | 8.63 | dBm | 7.29 | mW |
| Max Conducted Output Power (PSK Modulation) | 7.11 | dBm | 5.14 | mW |



Date: 25.AUG.2015 18:32:16



Date: 25.AUG.2015 18:33:00

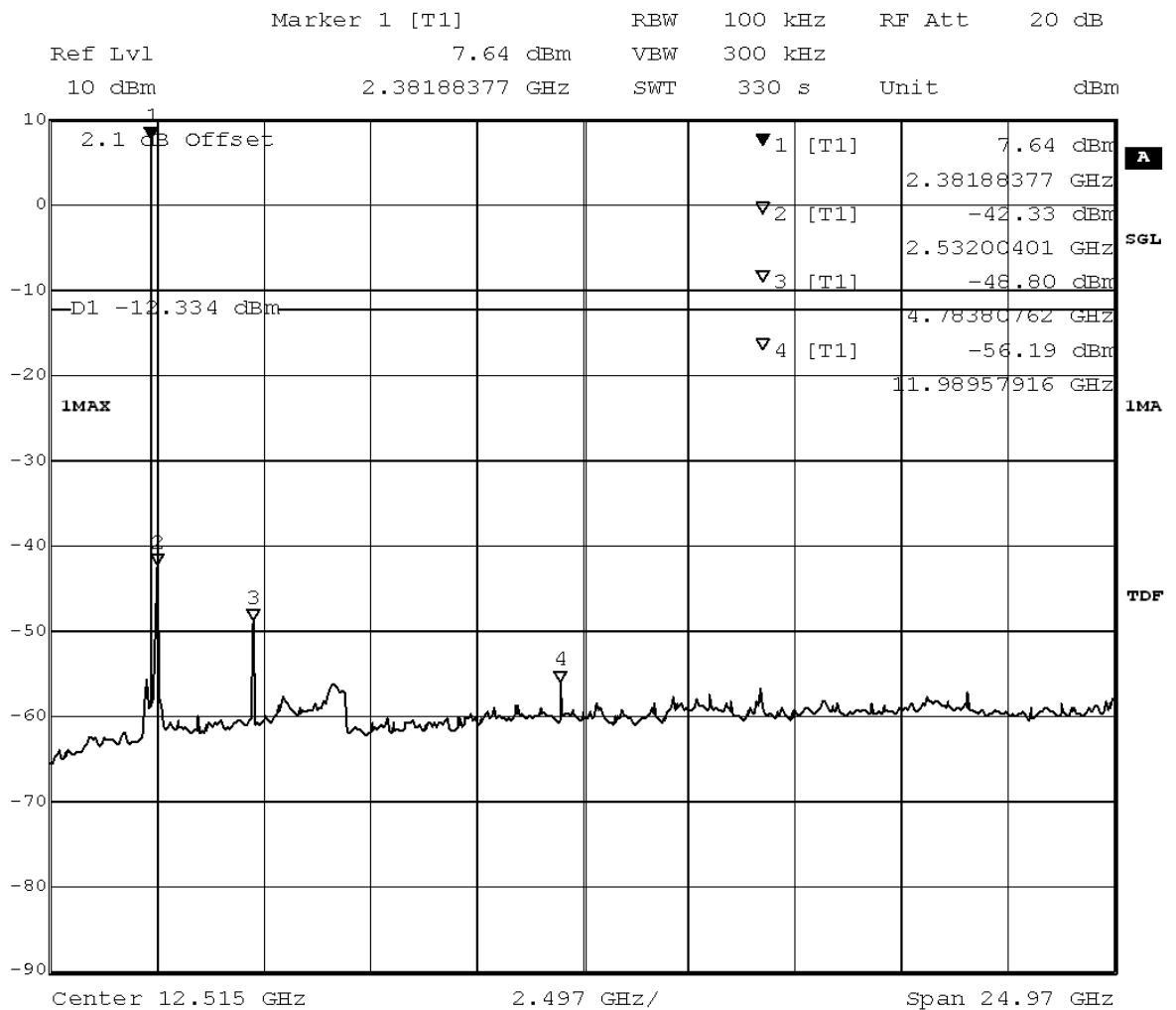


### 3.5.5 15c.5 Spurious RF conducted emissions §15.247 (d)

**Test: 15c.5; Frequency = 2402, Mode = BT transmit using 1 Mbps with GFSK modulation**

**Result:** Passed  
**Setup No.:** S01\_AC01  
**Date of Test:** 2015/08/26 10:43  
**Body:** FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES  
**Test Specification:** FCC part 2 and 15

#### Detailed Results:



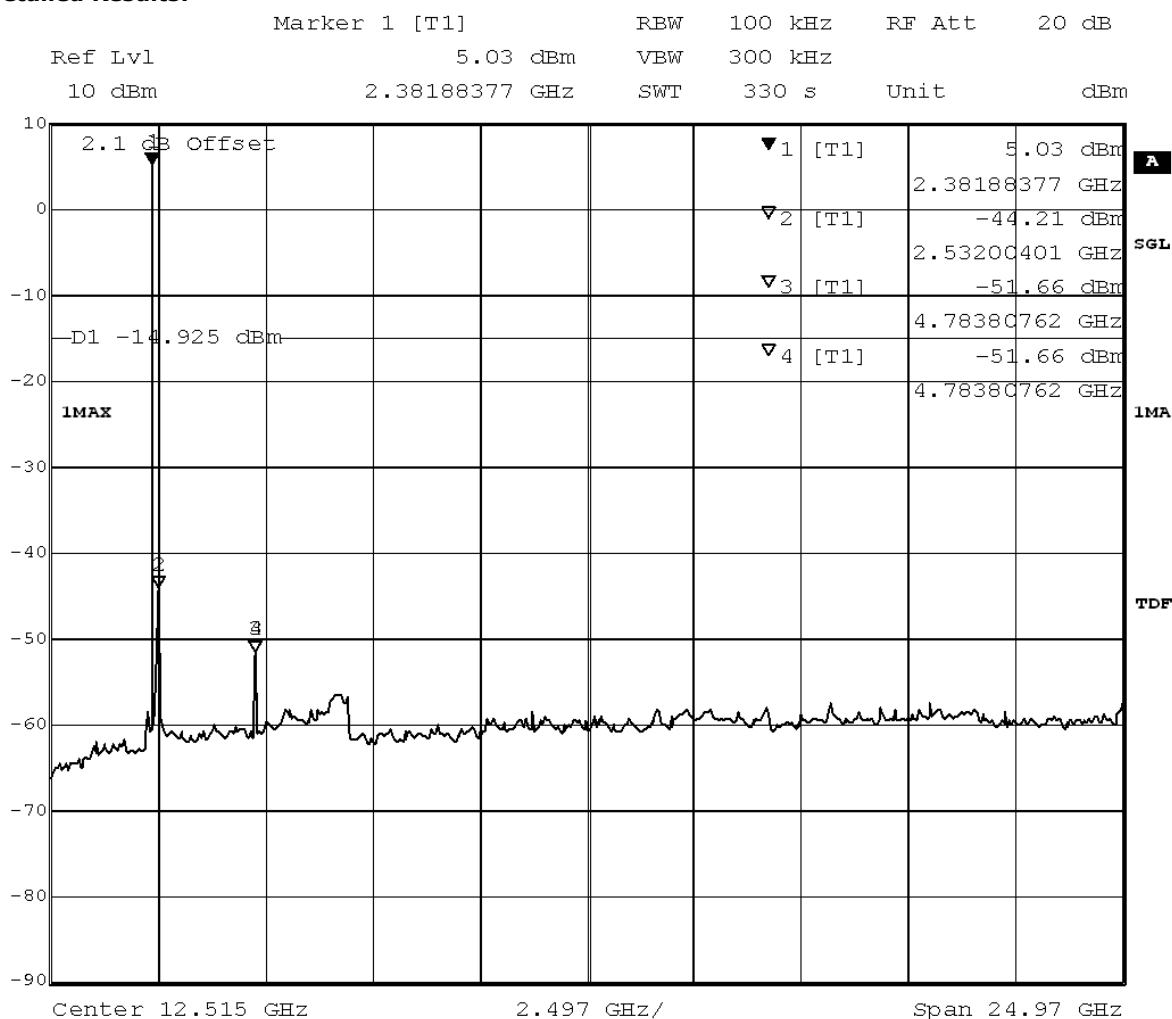
**Title:** spurious emissions  
**Comment A:** CH B: 2402 MHz  
**Date:** 26.AUG.2015 10:52:10

No further spurious emissions found within 20 dB to the limit

**Test: 15c.5; Frequency = 2402, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation**

Result: Passed  
Setup No.: S01\_AC01  
Date of Test: 2015/08/26 10:50  
Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES  
Test Specification: FCC part 2 and 15

**Detailed Results:**



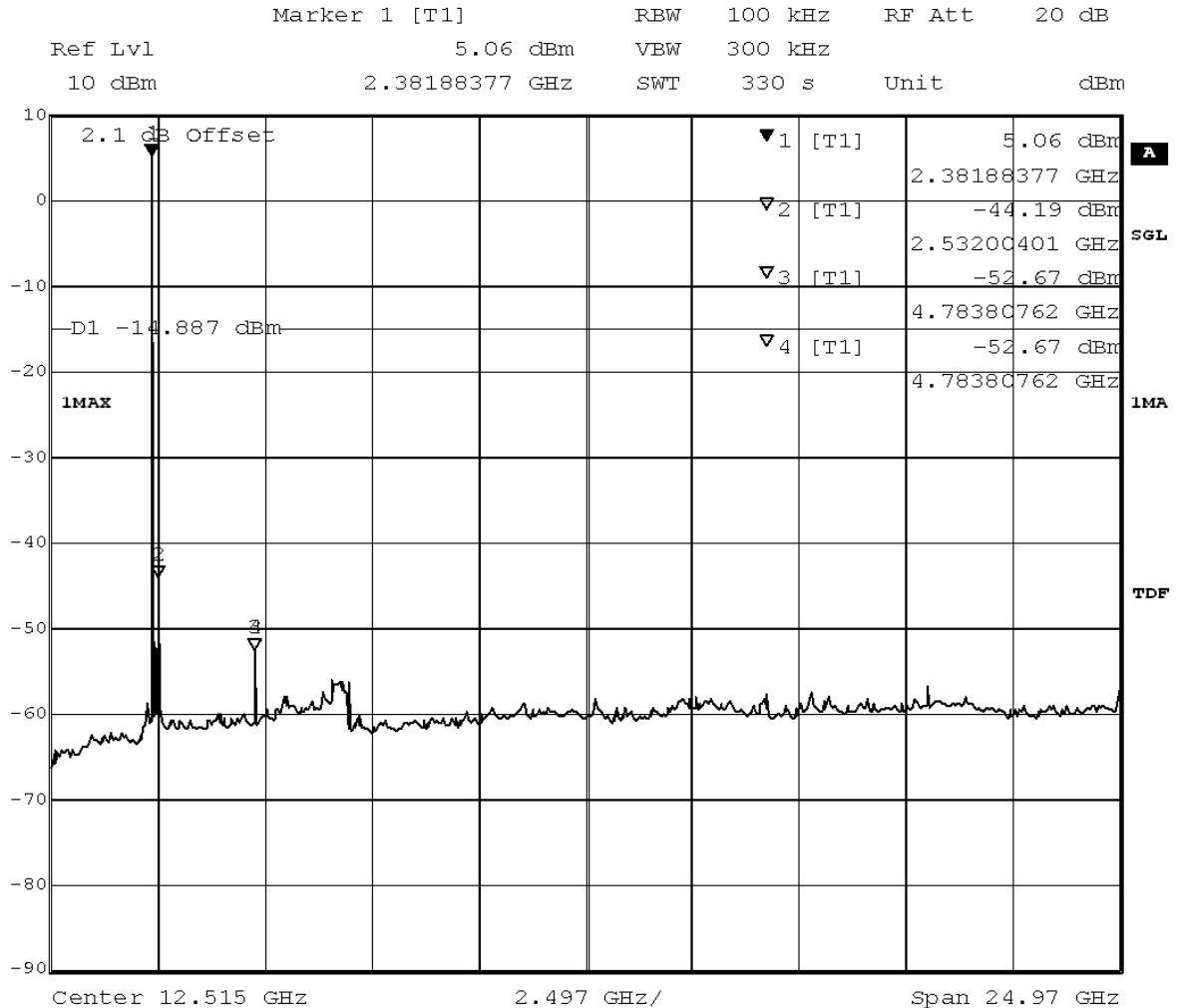
Title: spurious emissions  
Comment A: CH B: 2402 MHz  
Date: 26.AUG.2015 12:11:59

No further spurious emissions found within 20 dB to the limit

**Test: 15c.5; Frequency = 2402, Mode = BT transmit using 3 Mbps with 8DPSK modulation**

Result: Passed  
Setup No.: S01\_AC01  
Date of Test: 2015/08/26 11:02  
Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES  
Test Specification: FCC part 2 and 15

### Detailed Results:



Title: spurious emissions  
Comment A: CH B: 2402 MHz  
Date: 26.AUG.2015 13:10:39

No further spurious emissions found within 20 dB to the limit

**Test: 15c.5; Frequency = 2441, Mode = BT transmit using 1 Mbps with GFSK modulation**

Result: Passed

Setup No.: S01\_AC01

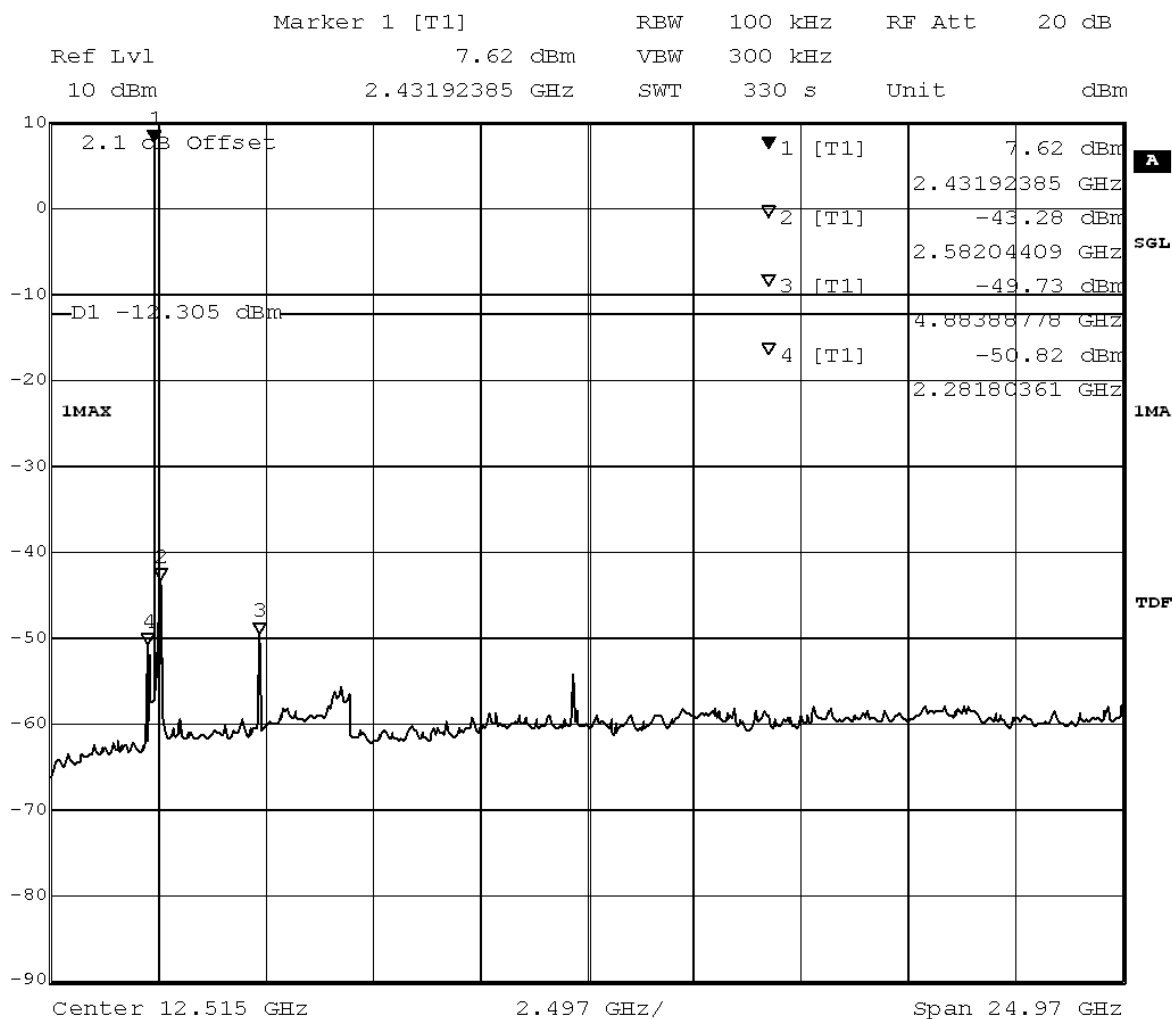
Date of Test: 2015/08/26 10:43

Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES

Test Specification: FCC part 2 and 15

#### Detailed Results:

| Frequency<br>MHz | Measured value<br>dBm | Reference value<br>dBm | Limit<br>dBm | Margin to limit<br>dB |
|------------------|-----------------------|------------------------|--------------|-----------------------|
| 2441             |                       | 7.69                   |              |                       |



Title: spurious emissions  
Comment A: CH M: 2441 MHz  
Date: 26.AUG.2015 11:10:47

No further spurious emissions found within 20 dB to the limit

**Test: 15c.5; Frequency = 2441, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation**

Result: Passed

Setup No.: S01\_AC01

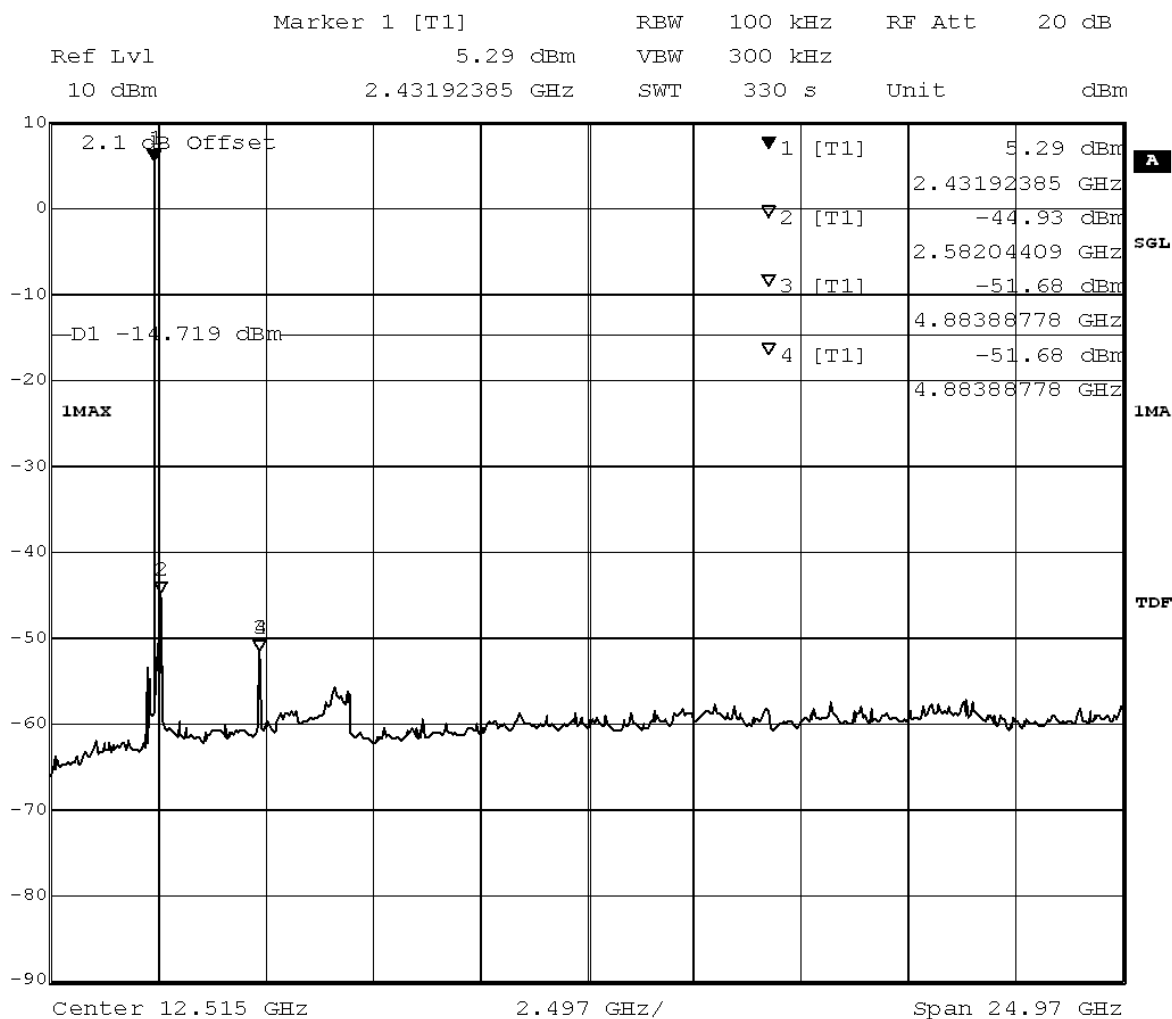
Date of Test: 2015/08/26 10:50

Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES

Test Specification: FCC part 2 and 15

#### Detailed Results:

| Frequency<br>MHz | Measured value<br>dBm | Reference value<br>dBm | Limit<br>dBm | Margin to limit<br>dB |
|------------------|-----------------------|------------------------|--------------|-----------------------|
| 2441             |                       | 5.28                   |              |                       |



Title: spurious emissions  
Comment A: CH M: 2441 MHz  
Date: 26.AUG.2015 11:56:49

No further spurious emissions found within 20 dB to the limit

**Test: 15c.5; Frequency = 2441, Mode = BT transmit using 3 Mbps with 8DPSK modulation**

Result: Passed

Setup No.: S01\_AC01

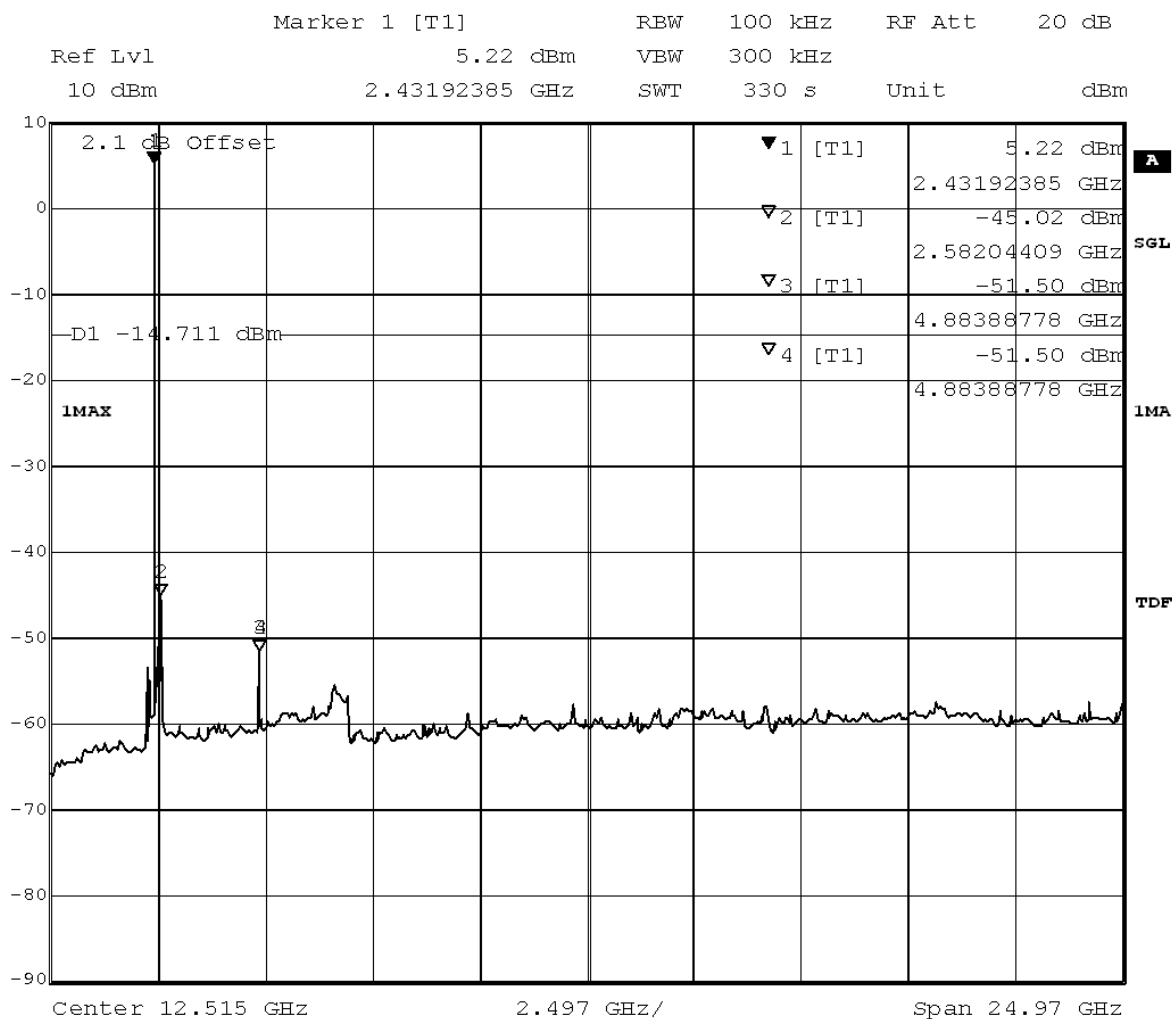
Date of Test: 2015/08/26 11:02

Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES

Test Specification: FCC part 2 and 15

#### Detailed Results:

| Frequency<br>MHz | Measured value<br>dBm | Reference value<br>dBm | Limit<br>dBm | Margin to limit<br>dB |
|------------------|-----------------------|------------------------|--------------|-----------------------|
| 2441             |                       | 5.29                   |              |                       |



Title: spurious emissions  
Comment A: CH M: 2441 MHz  
Date: 26.AUG.2015 13:27:32

No further spurious emissions found within 20 dB to the limit

**Test: 15c.5; Frequency = 2480, Mode = BT transmit using 1 Mbps with GFSK modulation**

Result: Passed

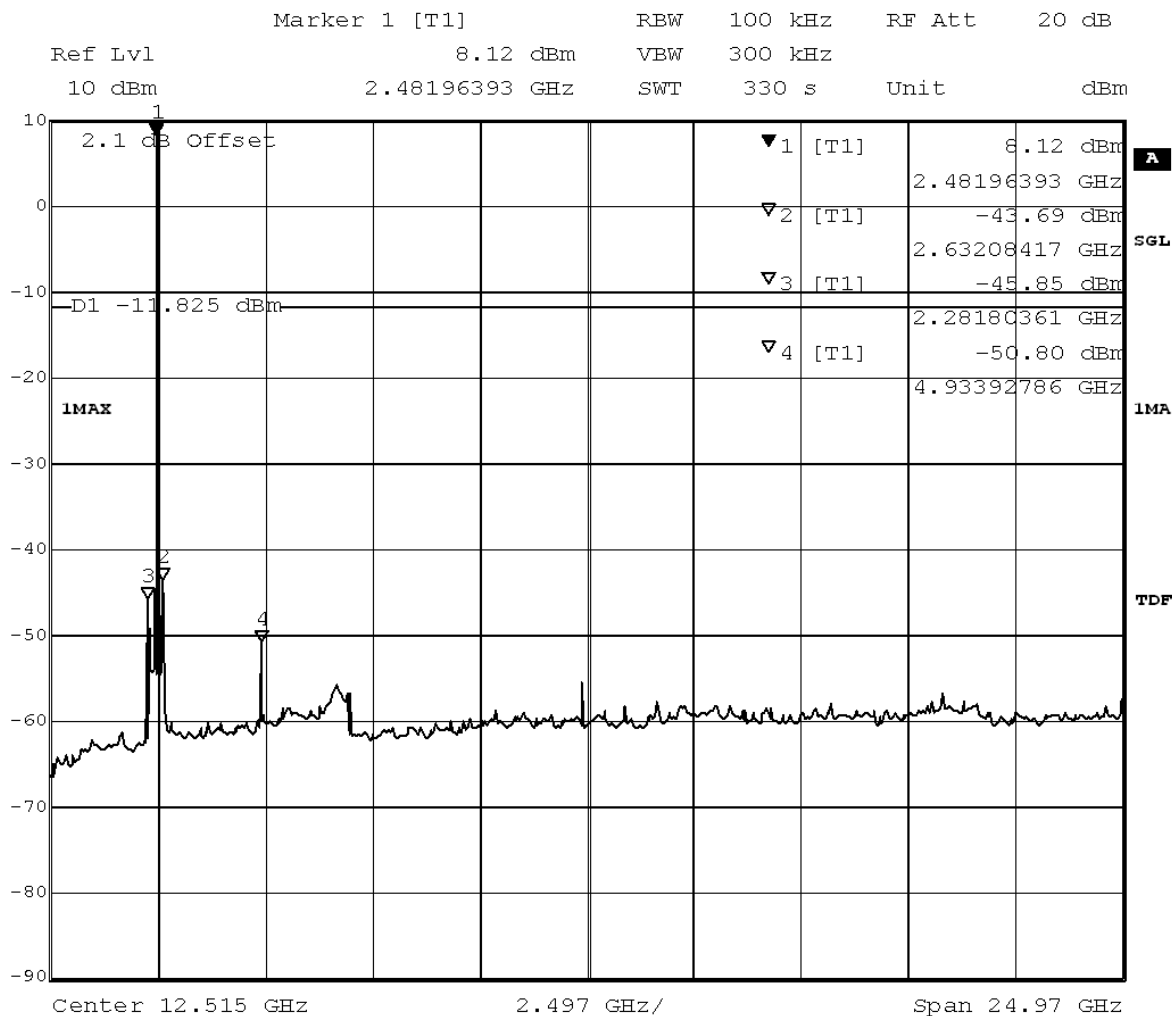
Setup No.: S01\_AC01

Date of Test: 2015/08/26 10:43

Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES

Test Specification: FCC part 2 and 15

### Detailed Results:



Title: spurious emissions  
Comment A: CH T: 2480 MHz  
Date: 26.AUG.2015 11:26:04

No further spurious emissions found within 20 dB to the limit

**Test: 15c.5; Frequency = 2480, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation**

Result: Passed

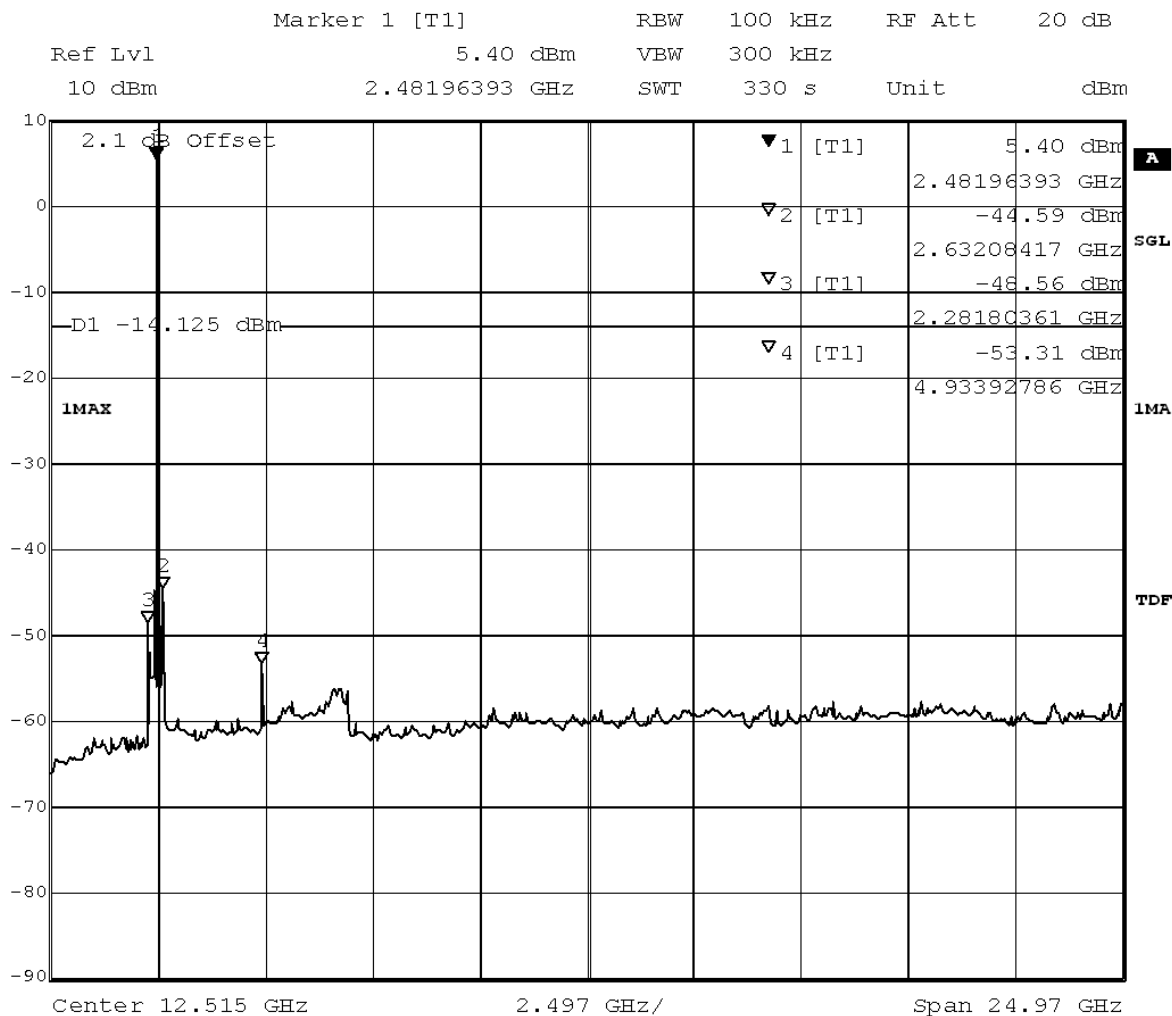
Setup No.: S01\_AC01

Date of Test: 2015/08/26 10:50

Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES

Test Specification: FCC part 2 and 15

### Detailed Results:



Title: spurious emissions  
Comment A: CH T: 2480 MHz  
Date: 26.AUG.2015 11:41:22

No further spurious emissions found within 20 dB to the limit

**Test: 15c.5; Frequency = 2480, Mode = BT transmit using 3 Mbps with 8DPSK modulation**

Result: Passed

Setup No.: S01\_AC01

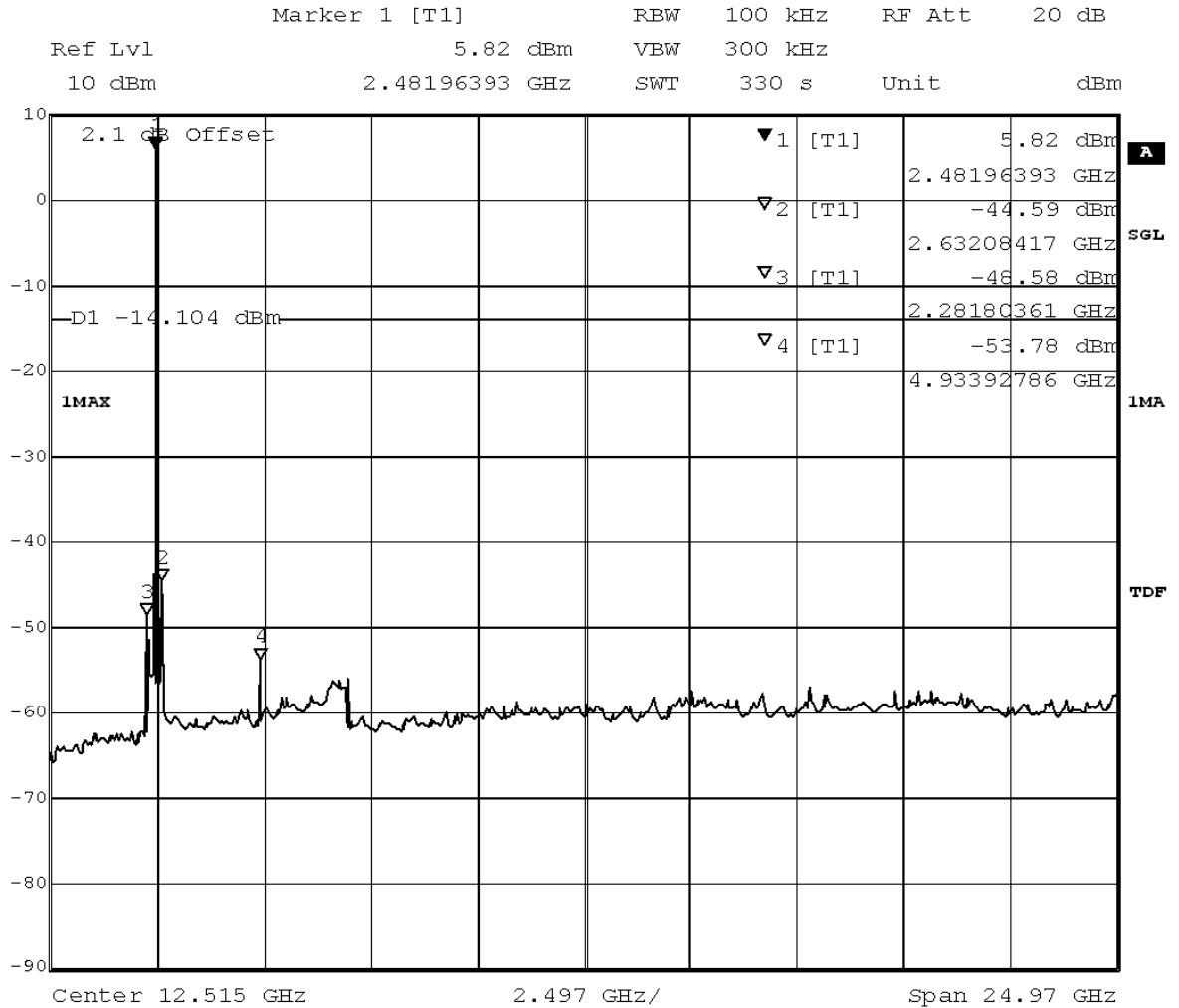
Date of Test: 2015/08/26 11:02

Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES

Test Specification: FCC part 2 and 15



### Detailed Results:



Title: spurious emissions  
Comment A: CH T: 2480 MHz  
Date: 26.AUG.2015 13:43:04

No further spurious emissions found within 20 dB to the limit

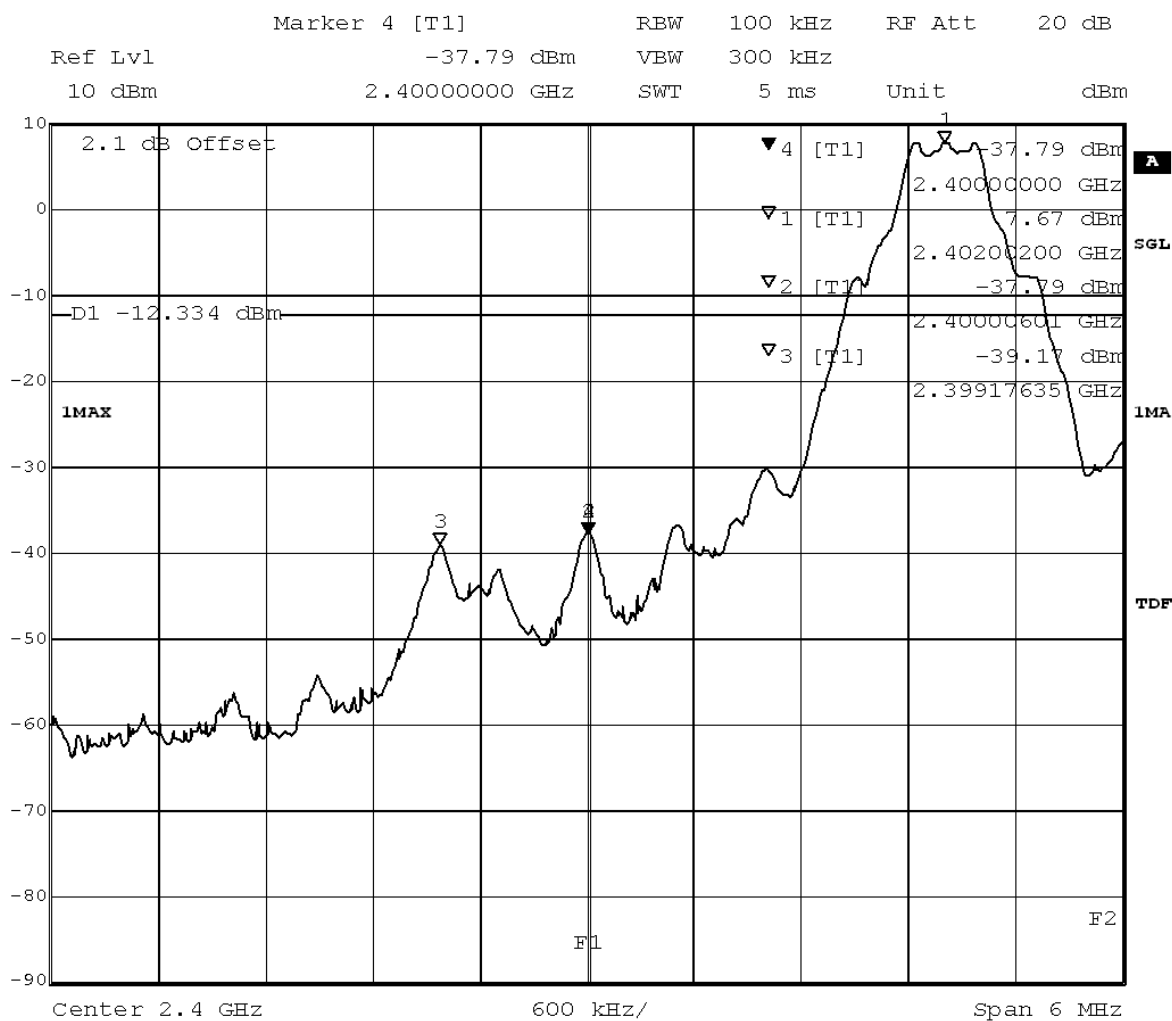
### 3.5.6 15c.6 Band edge compliance §15.247 (d)

**Test: 15c.6; Frequency = 2402, Mode = BT transmit using 1 Mbps with GFSK modulation, Method = conducted, band edge = 2400 MHz**

Result: Passed  
Setup No.: S01\_AC01  
Date of Test: 2015/08/26 10:52  
Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES  
Test Specification: FCC part 2 and 15

#### Detailed Results:

| Frequency MHz | Measured value dBm | Reference value dBm | Limit dBm | Margin to limit dB |
|---------------|--------------------|---------------------|-----------|--------------------|
| 2400          | -37.79             | 7.67                | -12.33    | 25.46              |



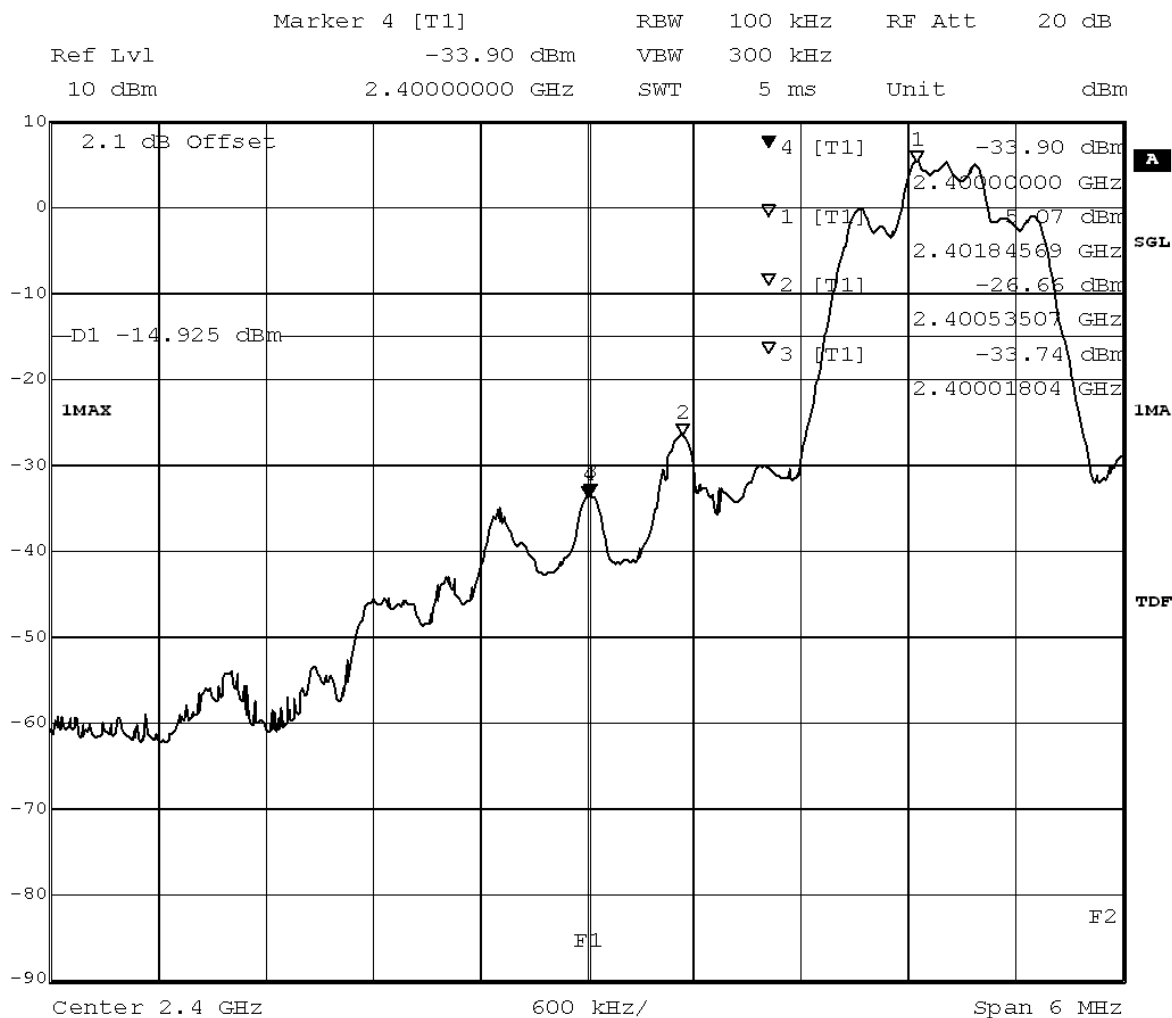
Title: Band Edge Compliance  
Comment A: CH B: 2402 MHz  
Date: 26.AUG.2015 10:39:30

**Test: 15c.6; Frequency = 2402, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation, Method = conducted, band edge = 2400 MHz**

Result: Passed  
Setup No.: S01\_AC01  
Date of Test: 2015/08/26 10:54  
Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES  
Test Specification: FCC part 2 and 15

**Detailed Results:**

| Frequency MHz | Measured value dBm | Reference value dBm | Limit dBm | Margin to limit dB |
|---------------|--------------------|---------------------|-----------|--------------------|
| 2400          | -33.90             | 5.07                | -14.93    | 18.98              |



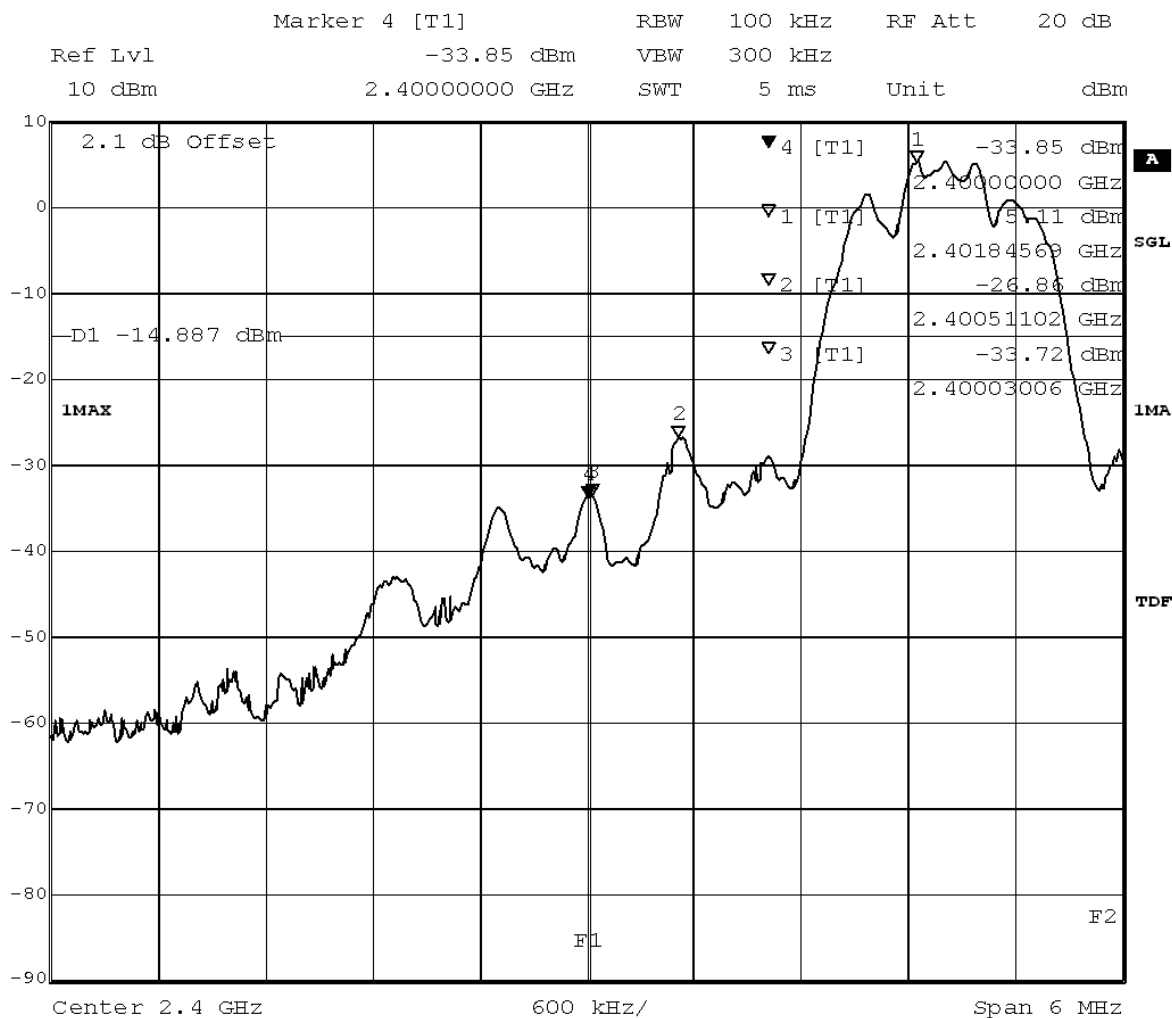
Title: Band Edge Compliance  
Comment A: CH B: 2402 MHz  
Date: 26.AUG.2015 11:59:21

**Test: 15c.6; Frequency = 2402, Mode = BT transmit using 3 Mbps with 8DPSK modulation, Method = conducted, band edge = 2400 MHz**

Result: Passed  
Setup No.: S01\_AC01  
Date of Test: 2015/08/26 10:59  
Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES  
Test Specification: FCC part 2 and 15

**Detailed Results:**

| Frequency MHz | Measured value dBm | Reference value dBm | Limit dBm | Margin to limit dB |
|---------------|--------------------|---------------------|-----------|--------------------|
| 2400          | -33.85             | 5.11                | -14.89    | 18.96              |



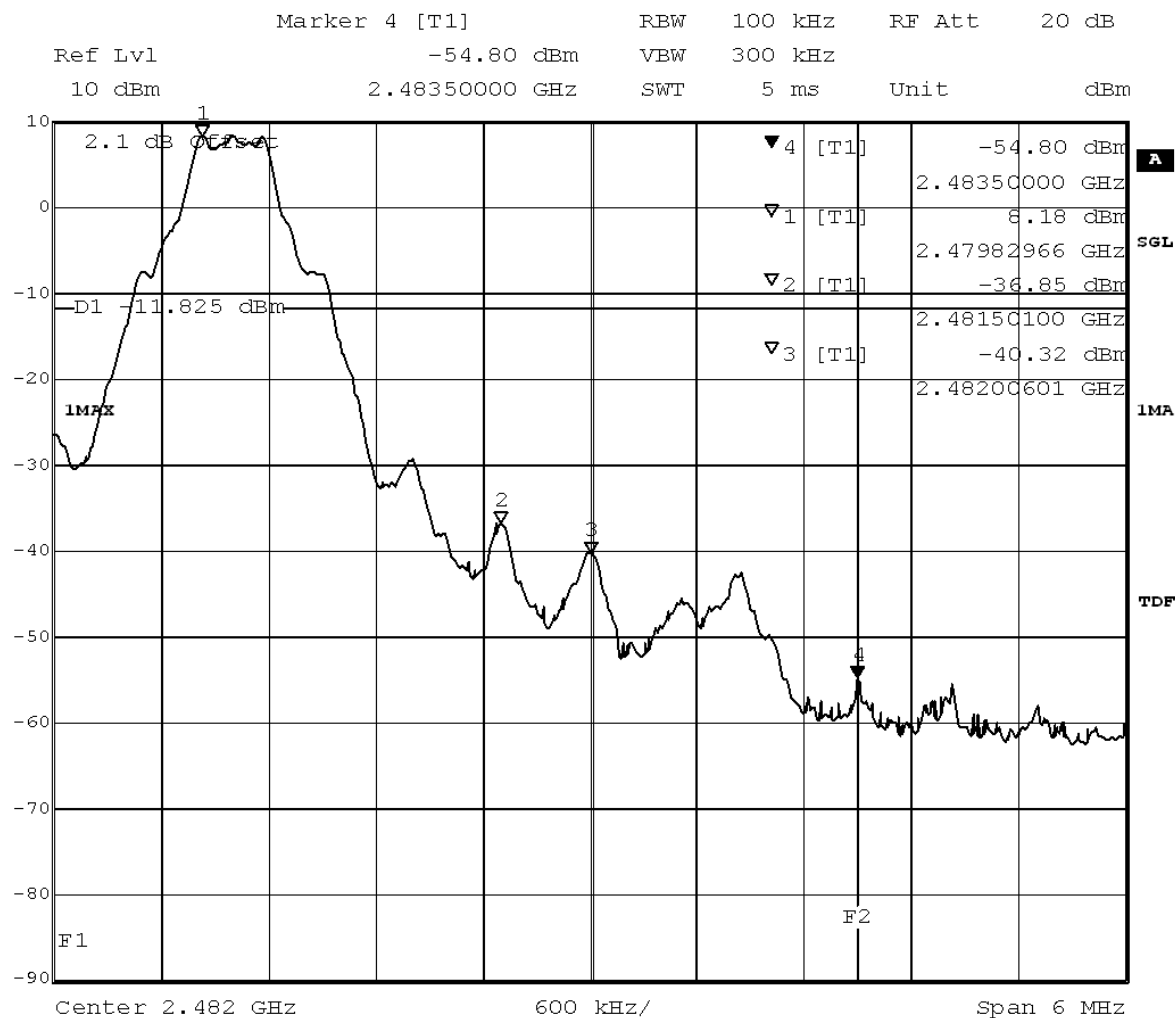
Title: Band Edge Compliance  
Comment A: CH B: 2402 MHz  
Date: 26.AUG.2015 12:58:02

**Test: 15c.6; Frequency = 2480, Mode = BT transmit using 1 Mbps with GFSK modulation, Method = conducted, band edge = 2483.5 MHz**

Result: Passed  
Setup No.: S01\_AC01  
Date of Test: 2015/08/26 10:52  
Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES  
Test Specification: FCC part 2 and 15

**Detailed Results:**

| Frequency MHz | Measured value dBm | Reference value dBm | Limit dBm | Margin to limit dB |
|---------------|--------------------|---------------------|-----------|--------------------|
| 2484          | -54.80             | 8.18                | -11.82    | 42.97              |



Title: Band Edge Compliance  
Comment A: CH T: 2480 MHz  
Date: 26.AUG.2015 11:13:27

**Test: 15c.6; Frequency = 2480, Mode = BT transmit using 1 Mbps with GFSK modulation, Method = radiated**

*Result:* Passed

*Setup No.:* S02\_AB01

*Date of Test:* 2015/06/06 17:32

*Body:* FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES

*Test Specification:* FCC part 2 and 15

**Detailed Results:**

| TX on    | Ant. Polar. | Limit PK [dBμV] | Limit AV [dBμV] | Frequency [MHz] | Corrected value PK [dBμV] | Corrected value AV [dBμV] | Margin PK [dB] | Margin AV [dB] | Result |
|----------|-------------|-----------------|-----------------|-----------------|---------------------------|---------------------------|----------------|----------------|--------|
| 2480 MHz | Ver + Hor   | 74              | 54              | 2483.5          | 47.10                     | 35.10                     | 26.90          | 18.90          | Passed |

**Test: 15c.6; Frequency = 2480, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation, Method = conducted, band edge = 2483.5 MHz**

*Result:* Passed

*Setup No.:* S01\_AC01

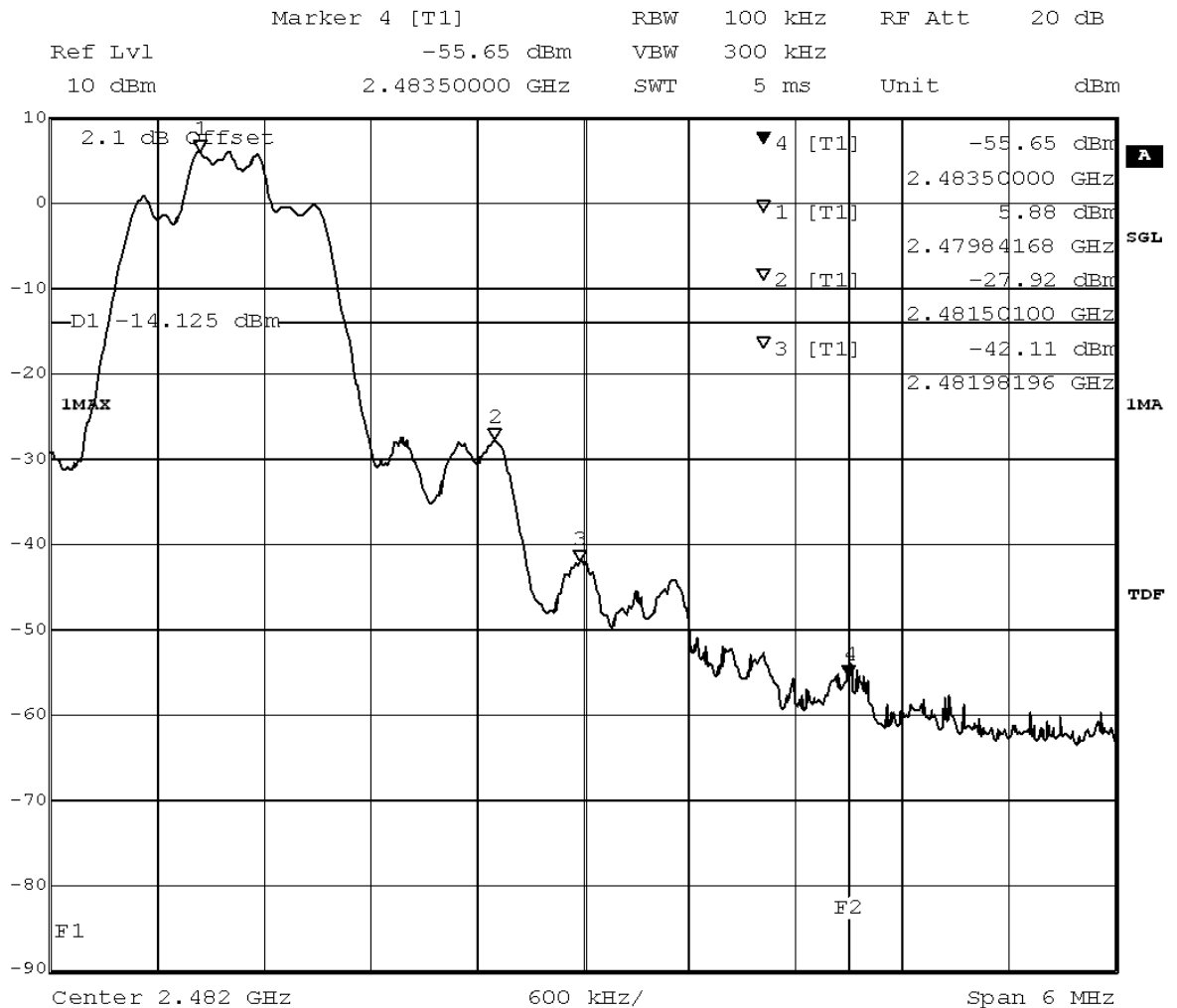
*Date of Test:* 2015/08/26 10:54

*Body:* FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES

*Test Specification:* FCC part 2 and 15

**Detailed Results:**

| Frequency<br>MHz | Measured value<br>dBm | Reference value<br>dBm | Limit<br>dBm | Margin to limit<br>dB |
|------------------|-----------------------|------------------------|--------------|-----------------------|
| 2484             | -55.65                | 5.88                   | -14.12       | 41.52                 |



Title: Band Edge Compliance  
Comment A: CH T: 2480 MHz  
Date: 26.AUG.2015 11:28:43

**Test: 15c.6; Frequency = 2480, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation, Method = radiated**

Result: Passed

Setup No.: S02\_AB01

Date of Test: 2015/06/06 17:30

Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES

Test Specification: FCC part 2 and 15

**Detailed Results:**

| TX on    | Ant.<br>Polar. | Limit PK<br>[dBμV] | Limit AV<br>[dBμV] | Frequency<br>[MHz] | Corrected<br>value PK<br>[dBμV] | Corrected<br>value AV<br>[dBμV] | Margin<br>PK [dB] | Margin<br>AV [dB] | Result |
|----------|----------------|--------------------|--------------------|--------------------|---------------------------------|---------------------------------|-------------------|-------------------|--------|
| 2480 MHz | Ver + Hor      | 74                 | 54                 | 2483.5             | 48.40                           | 35.00                           | 25.60             | 19.00             | Passed |

**Test: 15c.6; Frequency = 2480, Mode = BT transmit using 3 Mbps with 8DPSK modulation, Method = conducted, band edge = 2483.5 MHz**

*Result:* Passed

*Setup No.:* S01\_AC01

*Date of Test:* 2015/08/26 10:59

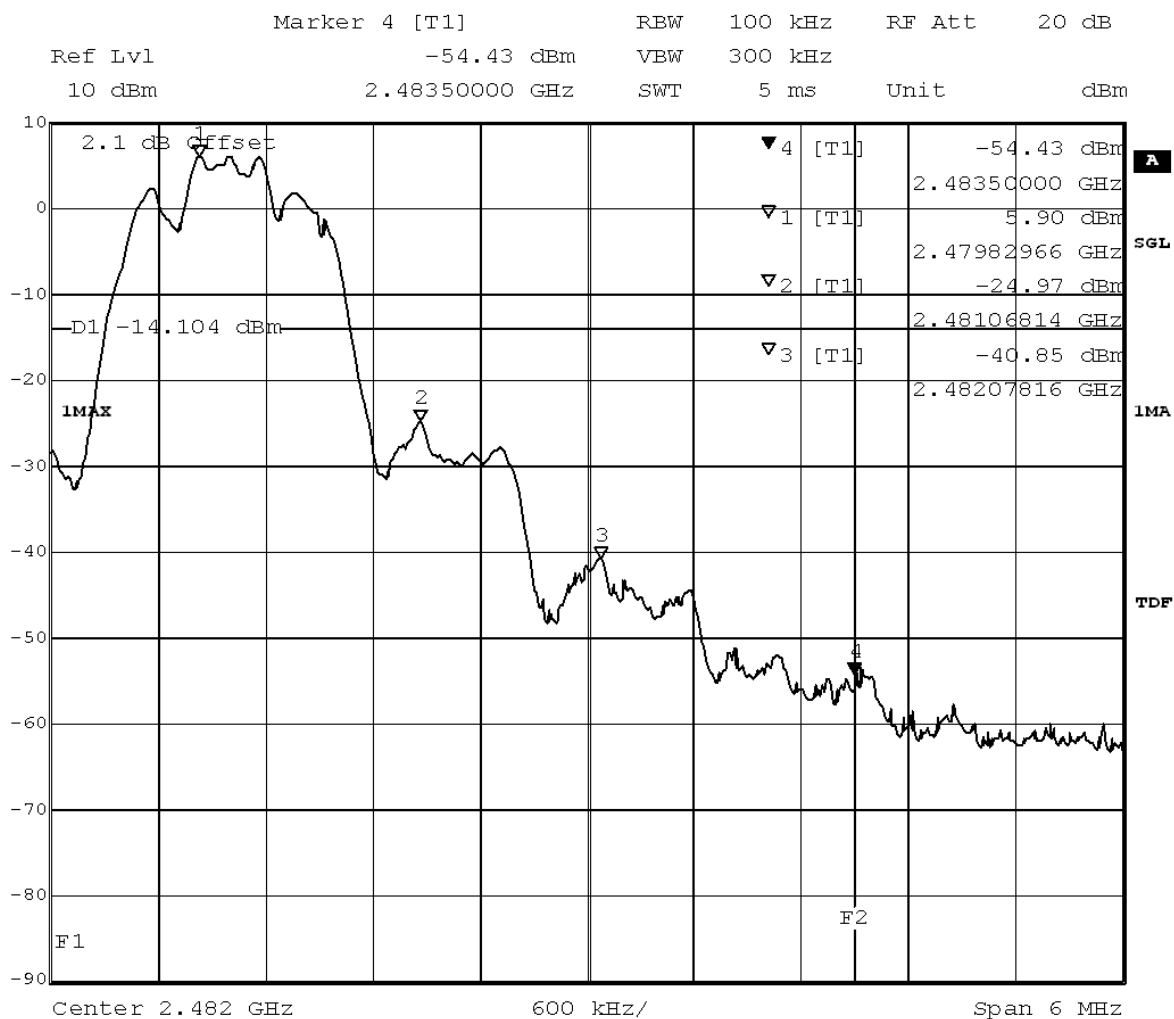
*Body:* FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES

*Test Specification:* FCC part 2 and 15



#### Detailed Results:

| Frequency<br>MHz | Measured value<br>dBm | Reference value<br>dBm | Limit<br>dBm | Margin to limit<br>dB |
|------------------|-----------------------|------------------------|--------------|-----------------------|
| 2484             | -54.43                | 5.90                   | -14.10       | 40.32                 |



Title: Band Edge Compliance  
Comment A: CH T: 2480 MHz  
Date: 26.AUG.2015 13:30:24

**Test: 15c.6; Frequency = 2480, Mode = BT transmit using 3 Mbps with 8DPSK modulation, Method = radiated**

Result: Passed

Setup No.: S02\_AB01

Date of Test: 2015/06/06 17:31

Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES

Test Specification: FCC part 2 and 15

### Detailed Results:

| TX on    | Ant. Polar. | Limit PK [dBμV] | Limit AV [dBμV] | Frequency [MHz] | Corrected value PK [dBμV] | Corrected value AV [dBμV] | Margin PK [dB] | Margin AV [dB] | Result |
|----------|-------------|-----------------|-----------------|-----------------|---------------------------|---------------------------|----------------|----------------|--------|
| 2480 MHz | Ver + Hor   | 74              | 54              | 2483.5          | 48.10                     | 35.40                     | 25.90          | 18.60          | Passed |

**Test: 15c.6; Frequency = hopping, Mode = BT transmit using 1 Mbps with GFSK modulation, Method = conducted, band edge = 2400 MHz**

**Result:** Passed

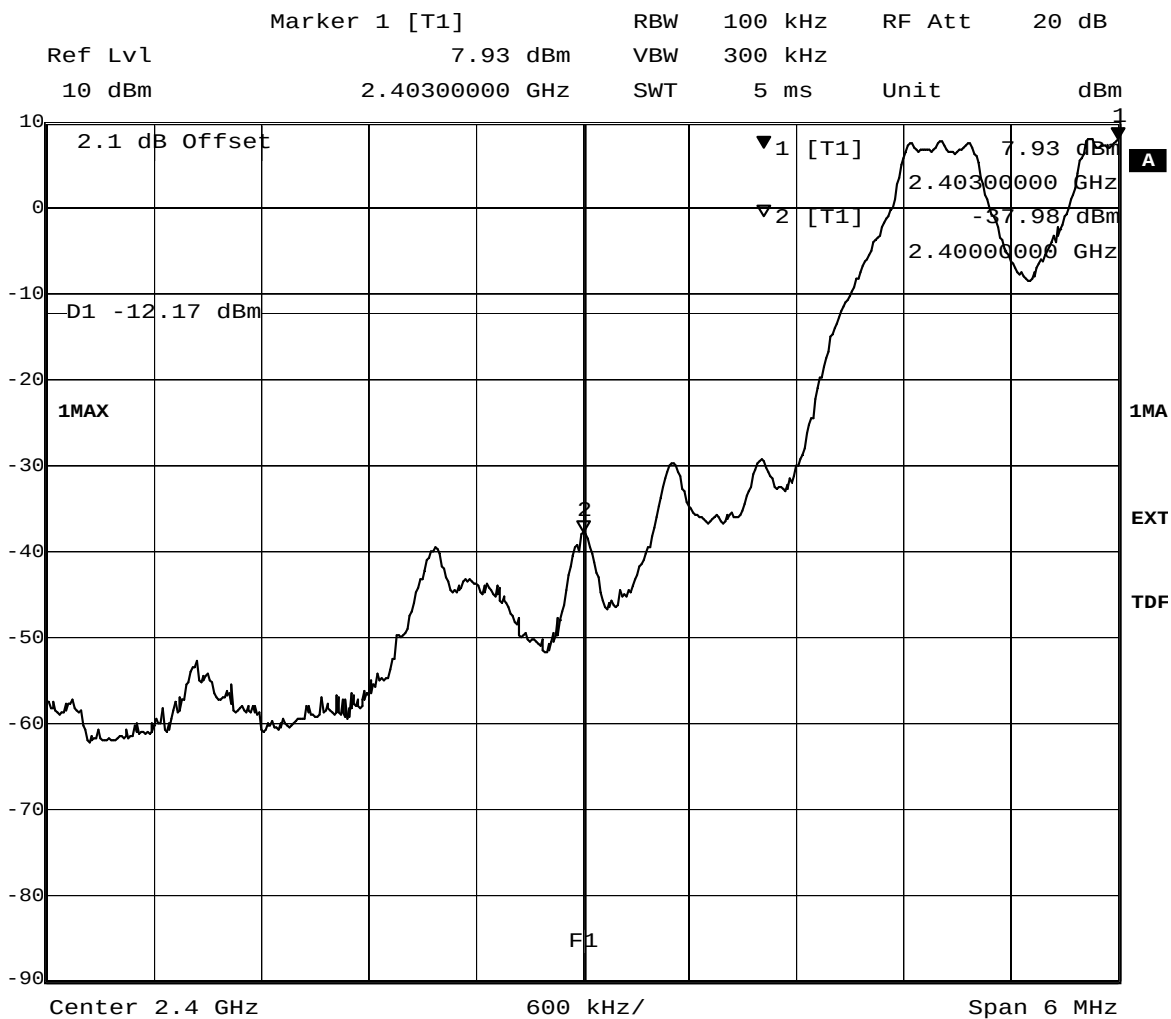
Setup No.: S01\_AC01

Date of Test: 2015/06/02 11:28

*Body:* FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES

*Test Specification:* FCC part 2 and 15

### Detailed Results:

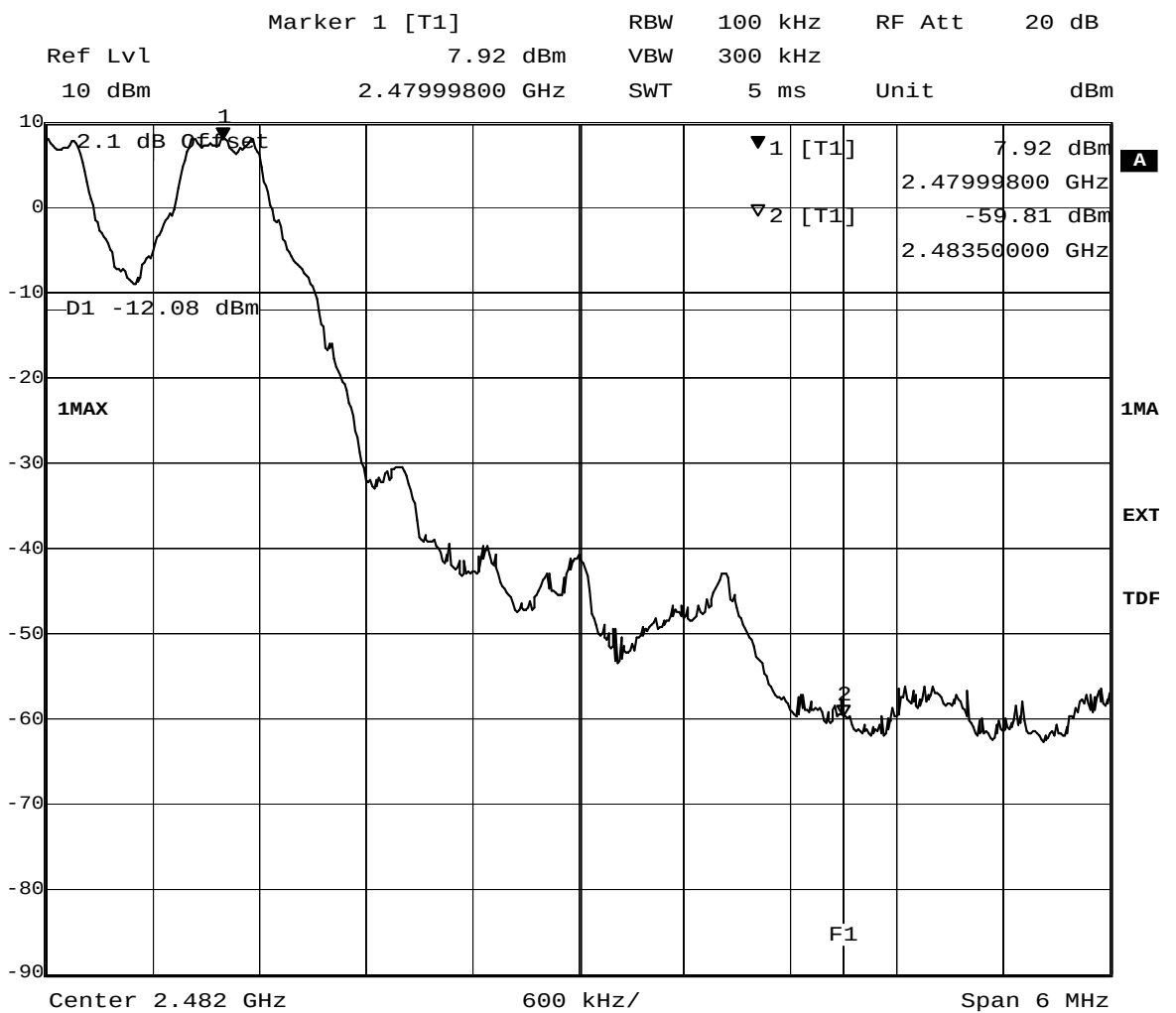


Title: Number of hopping frequencies  
Comment A: CH H: Hopping  
Date: 2.JUN.2015 11:14:13

**Test: 15c.6; Frequency = hopping, Mode = BT transmit using 1 Mbps with GFSK modulation, Method = conducted, band edge = 2483.5 MHz**

Result: Passed  
Setup No.: S01\_AC01  
Date of Test: 2015/06/02 11:34  
Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES  
Test Specification: FCC part 2 and 15

**Detailed Results:**

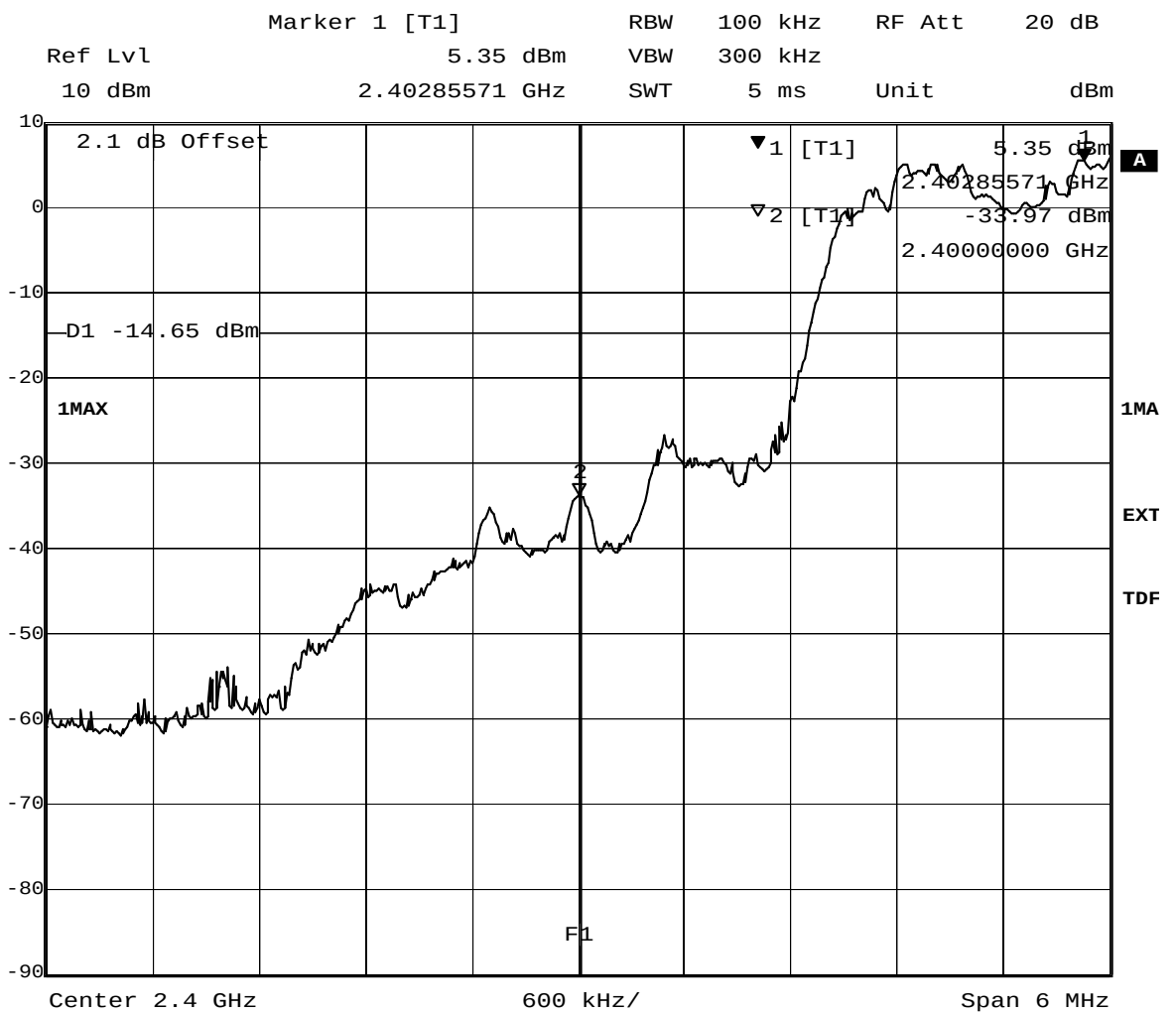


Title: Number of hopping frequencies  
Comment A: CH H: Hopping  
Date: 2.JUN.2015 11:20:50

**Test: 15c.6; Frequency = hopping, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation, Method = conducted, band edge=2400 MHz**

Result: Passed  
Setup No.: S01\_AC01  
Date of Test: 2015/06/02 11:16  
Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES  
Test Specification: FCC part 2 and 15

#### Detailed Results:

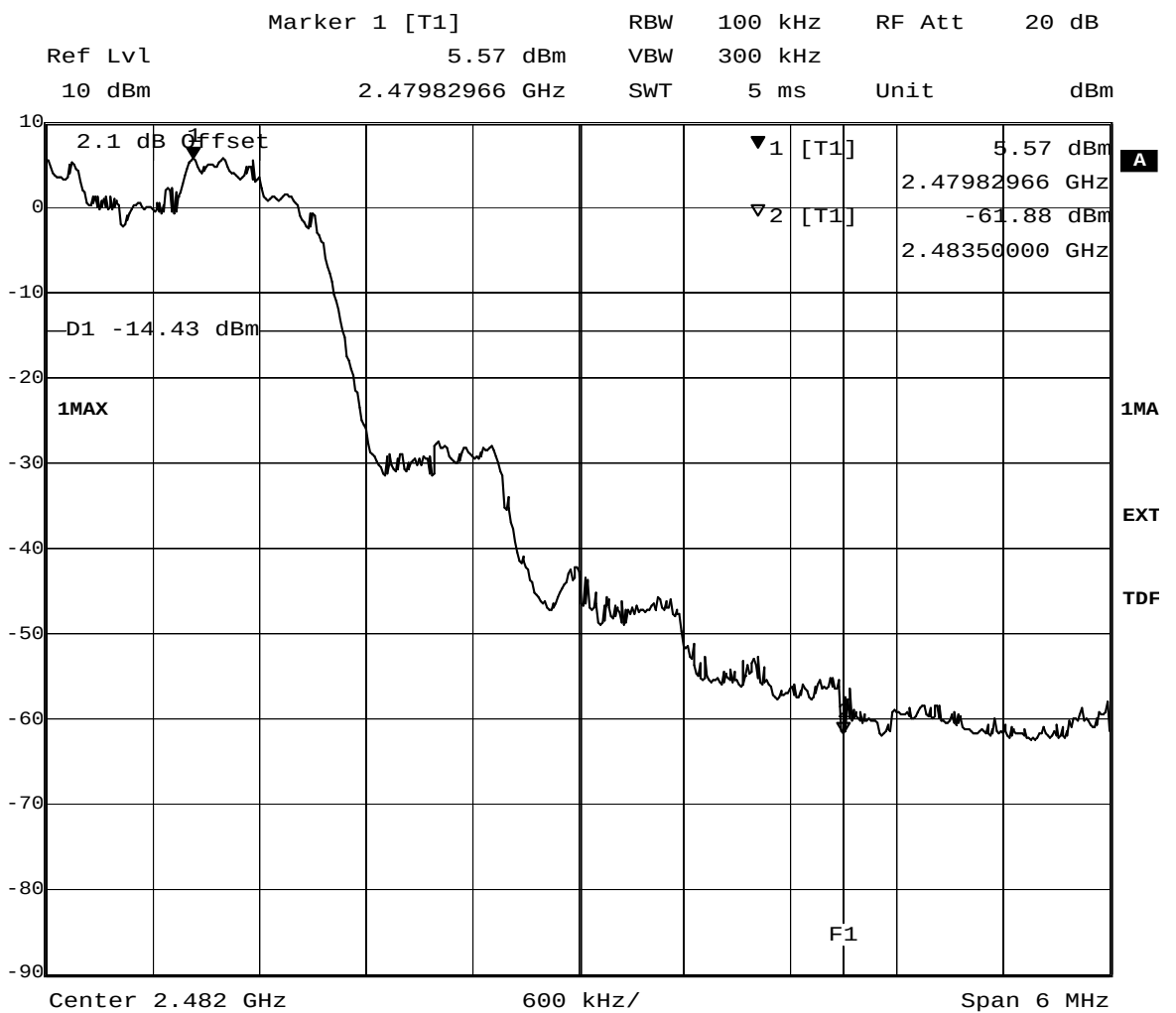


Title: Number of hopping frequencies  
Comment A: CH H: Hopping  
Date: 2.JUN.2015 11:02:15

**Test: 15c.6; Frequency = hopping, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation, Method=conducted, band edge=2483.5 MHz**

Result: Passed  
Setup No.: S01\_AC01  
Date of Test: 2015/06/02 12:46  
Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES  
Test Specification: FCC part 2 and 15

**Detailed Results:**

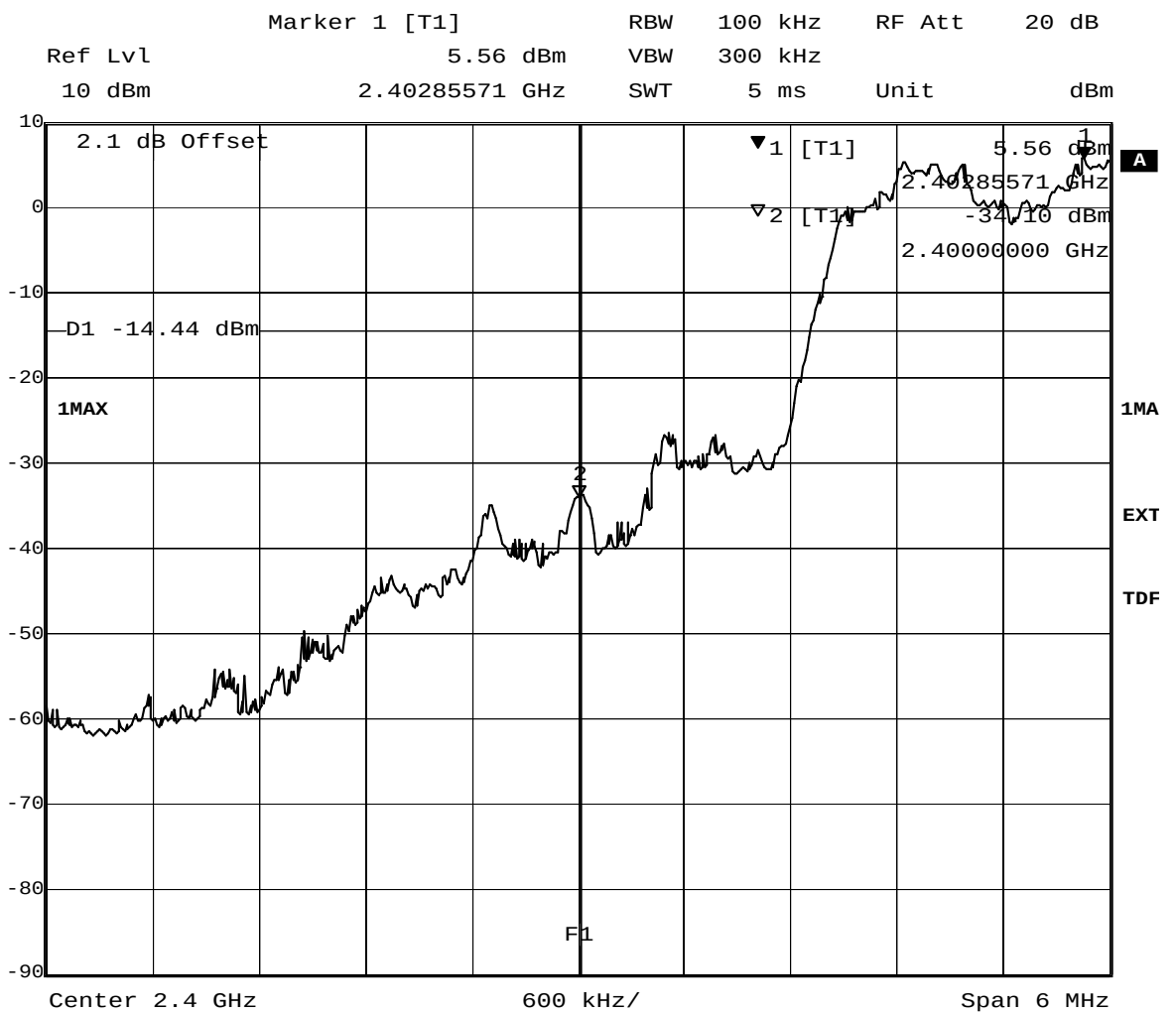


Title: Number of hopping frequencies  
Comment A: CH H: Hopping  
Date: 2.JUN.2015 11:32:30

**Test: 15c.6; Frequency = hopping, Mode = BT transmit using 3 Mbps with 8DPSK modulation,  
Method = conducted, band edge = 2400 MHz**

*Result:* Passed  
*Setup No.:* S01\_AC01  
*Date of Test:* 2015/06/02 11:00  
*Body:* FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES  
*Test Specification:* FCC part 2 and 15

**Detailed Results:**

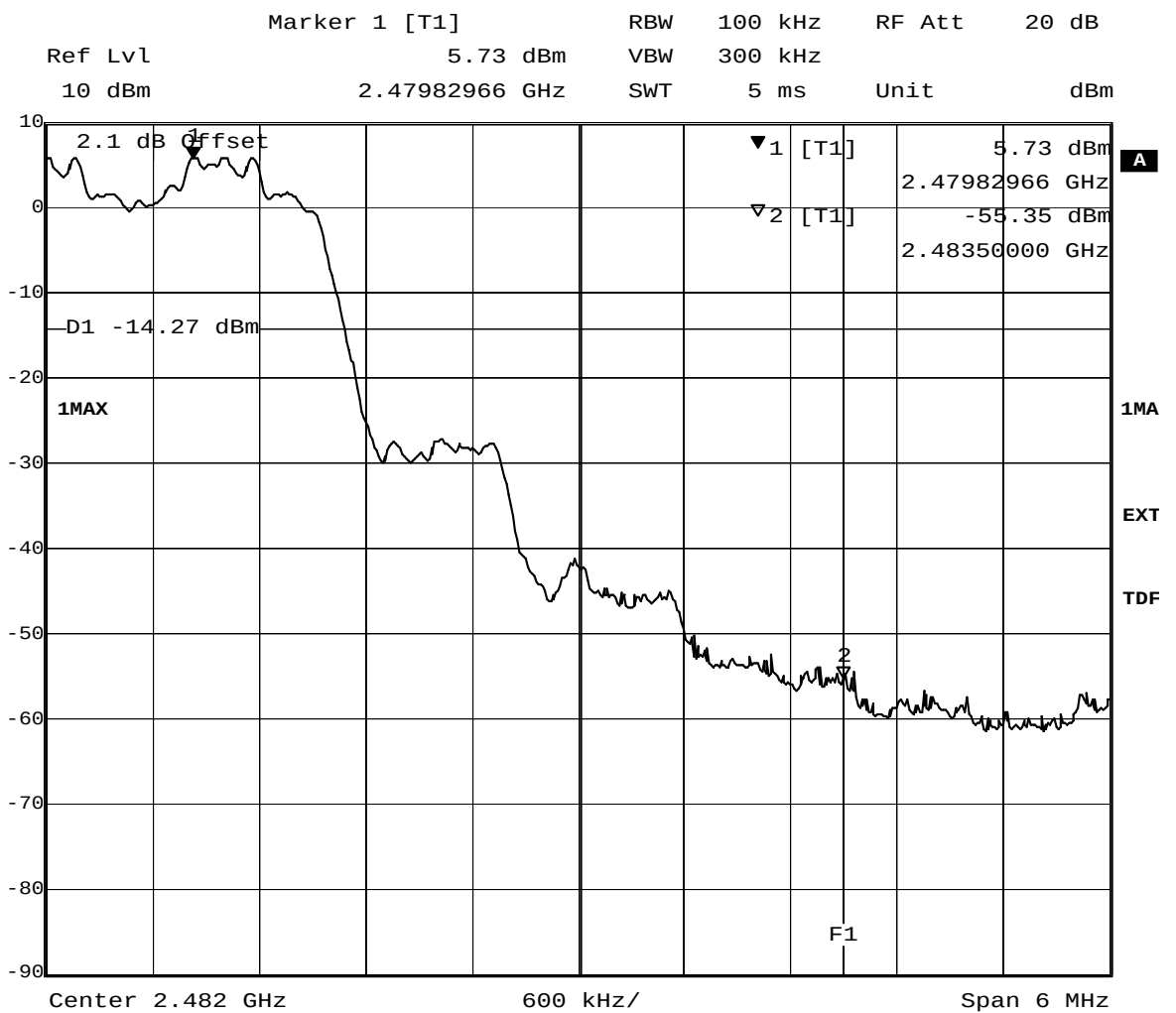


Title: Number of hopping frequencies  
Comment A: CH H: Hopping  
Date: 2.JUN.2015 10:44:40

**Test: 15c.6; Frequency = hopping, Mode = BT transmit using 3 Mbps with 8DPSK modulation, Method = conducted, band edge = 2483.5 MHz**

Result: Passed  
Setup No.: S01\_AC01  
Date of Test: 2015/06/02 12:46  
Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES  
Test Specification: FCC part 2 and 15

**Detailed Results:**



Title: Number of hopping frequencies  
Comment A: CH H: Hopping  
Date: 2.JUN.2015 12:31:19

### **3.5.7 15c.7 Dwell time §15.247 (a) (1) (iii)**

**Test: 15c.7; Frequency = 2441, Mode = BT transmit using 1 Mbps with GFSK modulation**

|                            |                                              |
|----------------------------|----------------------------------------------|
| <i>Result:</i>             | Passed                                       |
| <i>Setup No.:</i>          | S01_AC01                                     |
| <i>Date of Test:</i>       | 2015/06/02 10:44                             |
| <i>Body:</i>               | FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES |
| <i>Test Specification:</i> | FCC part 2 and 15                            |

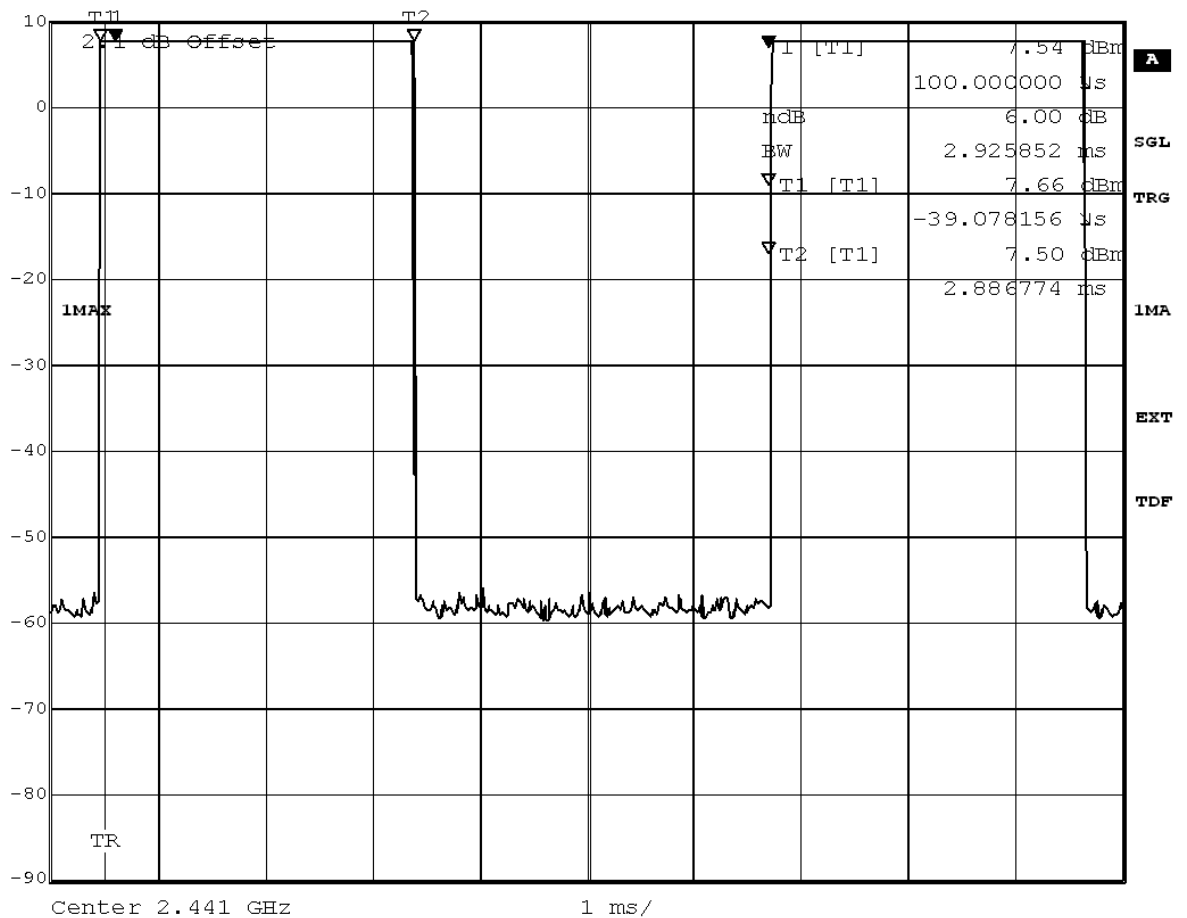


**Detailed Results:**

| Packet type | Time slot length | Dwell time                              | Dwell time ms |
|-------------|------------------|-----------------------------------------|---------------|
| DH5         | 2.93             | time slot length *<br>1600/5 /79 * 31.6 | 374.51        |

added by operator

Marker 1 [T1 ndB] RBW 1 MHz RF Att 20 dB  
Ref Lvl ndB 6.00 dB VBW 1 MHz  
10 dBm BW 2.925852 ms SWT 10 ms Unit dBm



Title: Dwell time  
Comment A: CH M: 2441 MHz  
Date: 2.JUN.2015 09:20:37

added by operator

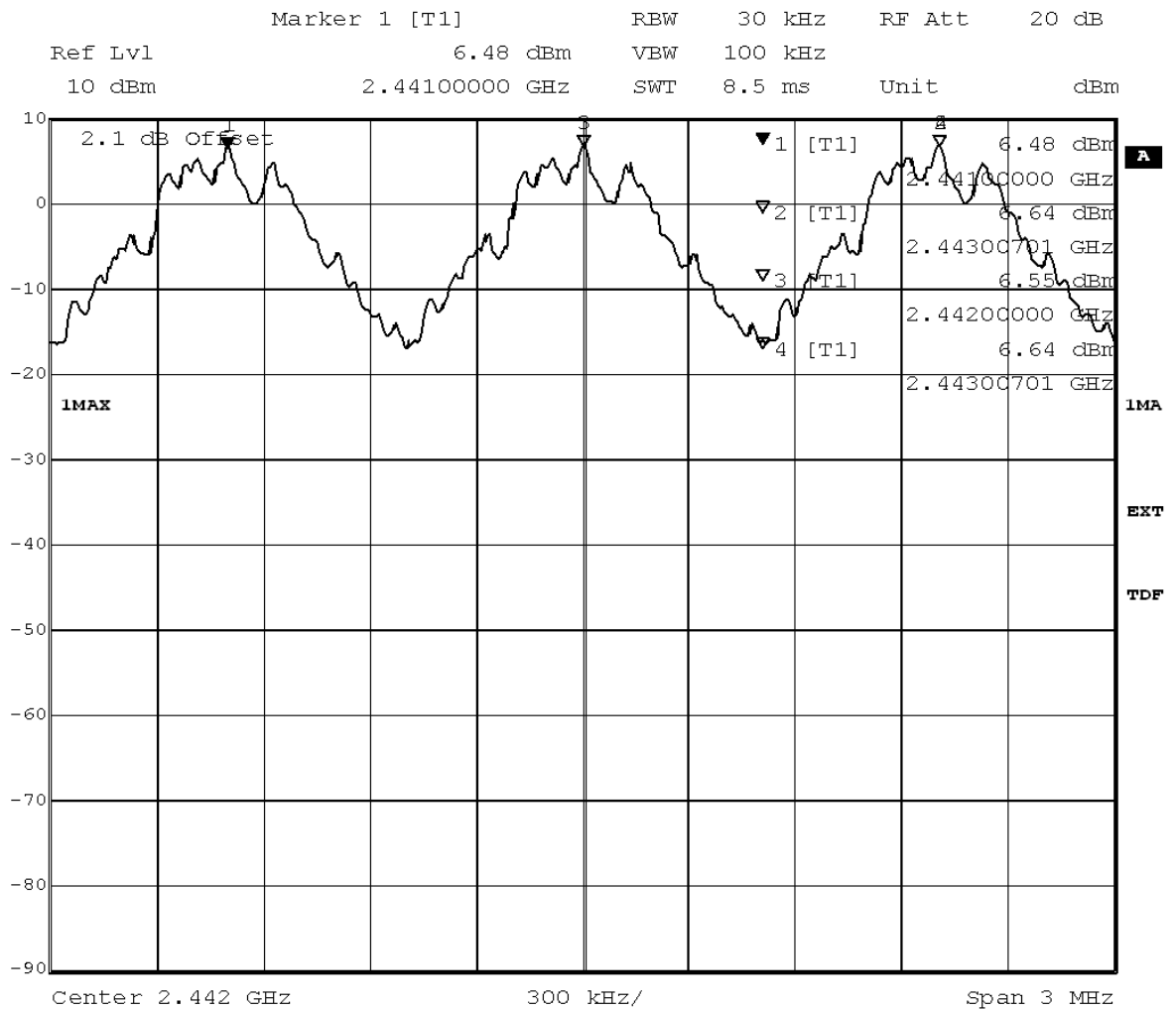
### **3.5.8 15c.8 Channel separation §15.247 (a) (1)**

**Test: 15c.8; Frequency = 2441, Mode = BT transmit using 1 Mbps with GFSK modulation**

|                            |                                              |
|----------------------------|----------------------------------------------|
| <i>Result:</i>             | Passed                                       |
| <i>Setup No.:</i>          | S01_AC01                                     |
| <i>Date of Test:</i>       | 2015/06/02 10:44                             |
| <i>Body:</i>               | FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES |
| <i>Test Specification:</i> | FCC part 2 and 15                            |

### Detailed Results:

| Channel separation / MHz |
|--------------------------|
| 1.000                    |



Title: Channel separation  
Comment A: CH H: Hopping  
Date: 2.JUN.2015 09:42:26  
added by operator

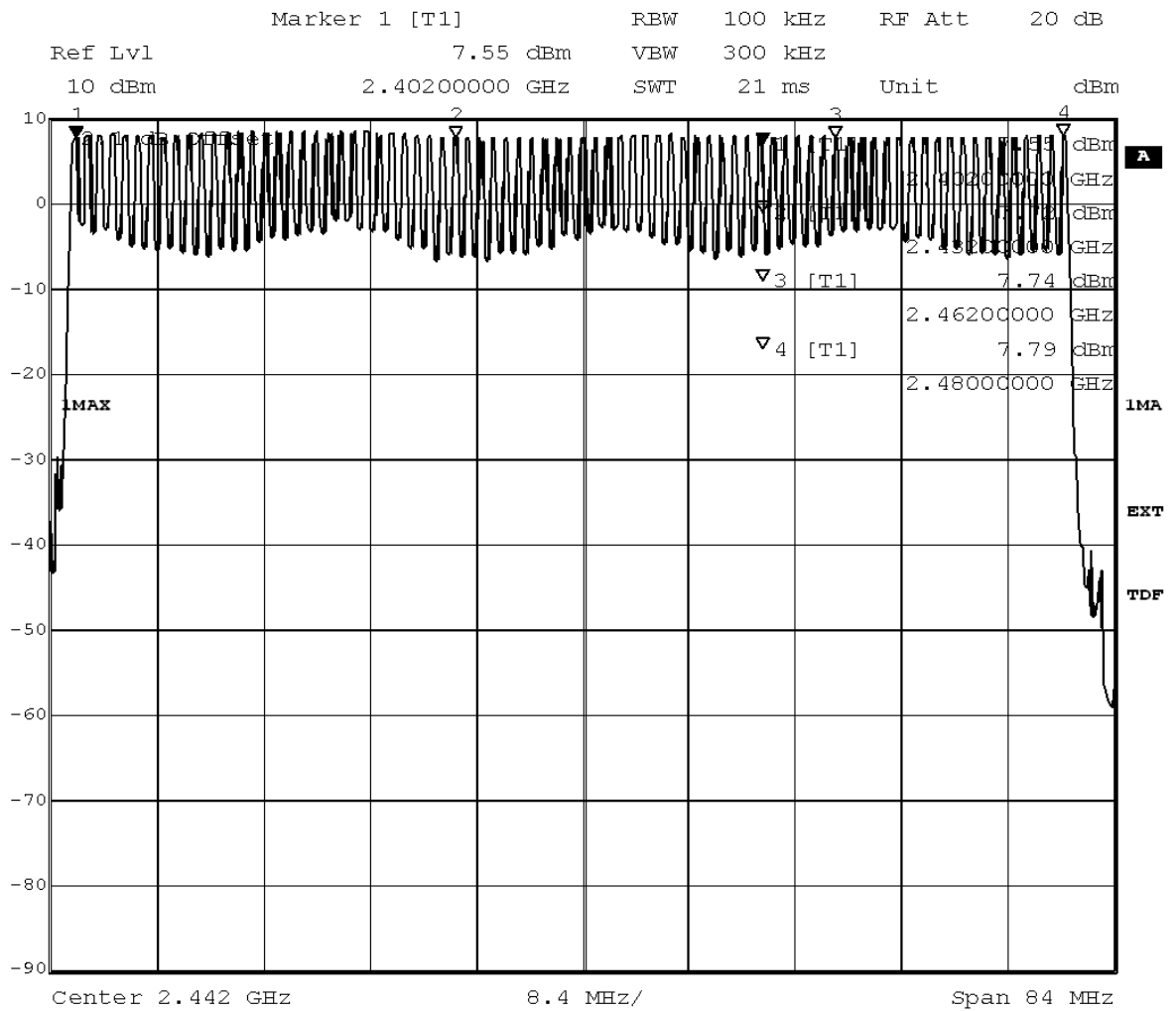
### **3.5.9 15c.9 Number of hopping frequencies §15.247 (a) (1) (iii)**

**Test: 15c.9; Frequency = 2441, Mode = BT transmit using 1 Mbps with GFSK modulation**

|                            |                                              |
|----------------------------|----------------------------------------------|
| <i>Result:</i>             | Passed                                       |
| <i>Setup No.:</i>          | S01_AC01                                     |
| <i>Date of Test:</i>       | 2015/06/02 10:44                             |
| <i>Body:</i>               | FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES |
| <i>Test Specification:</i> | FCC part 2 and 15                            |

### Detailed Results:

| Number of Hopping Frequencies |
|-------------------------------|
| 79                            |



Title: Number of hopping frequencies

Comment A: CH H: Hopping

Date: 2.JUN.2015 09:54:29

added by operator

## 4 Test Equipment Details

### 4.1 List of Used Test Equipment

The calibration, hardware and software states are shown for the testing period.

#### Test Equipment Anechoic Chamber

|                      |                                       |                       |                   |
|----------------------|---------------------------------------|-----------------------|-------------------|
| <b>Lab ID:</b>       | <b>Lab 2</b>                          |                       |                   |
| <b>Manufacturer:</b> | Frankonia                             |                       |                   |
| <b>Description:</b>  | Anechoic Chamber for radiated testing |                       |                   |
| <b>Type:</b>         | 10.58x6.38x6.00 m <sup>3</sup>        |                       |                   |
|                      | <i>Calibration Details</i>            | <i>Last Execution</i> | <i>Next Exec.</i> |
|                      | NSA (FCC)                             | 2014/01/09            | 2017/01/09        |

#### Single Devices for Anechoic Chamber

| <i>Single Device Name</i> | <i>Type</i>                        | <i>Serial Number</i> | <i>Manufacturer</i>                     |
|---------------------------|------------------------------------|----------------------|-----------------------------------------|
| Air compressor            | none                               | -                    | Atlas Copco                             |
| Anechoic Chamber          | 10.58 x 6.38 x 6.00 m <sup>3</sup> | none                 | Frankonia                               |
|                           | <i>Calibration Details</i>         |                      | <i>Last Execution</i> <i>Next Exec.</i> |
|                           | FCC listing 96716 3m Part15/18     |                      | 2014/01/09 2017/01/08                   |
| Controller Maturo         | MCU                                | 961208               | Maturo GmbH                             |
| EMC camera                | CE-CAM/1                           | -                    | CE-SYS                                  |
| EMC camera Nr.2           | CCD-400E                           | 0005033              | Mitsubishi                              |
| Filter ISDN               | B84312-C110-E1                     |                      | Siemens&Matsushita                      |
| Filter Universal 1A       | BB4312-C30-H3                      | -                    | Siemens&Matsushita                      |

## Test Equipment Auxiliary Equipment for Conducted emissions

**Lab ID:** Lab 1  
**Manufacturer:** Rohde & Schwarz GmbH & Co.KG  
**Description:** EMI Conducted Auxiliary Equipment

### Single Devices for Auxiliary Equipment for Conducted emissions

| Single Device Name                                           | Type            | Serial Number | Manufacturer                     |
|--------------------------------------------------------------|-----------------|---------------|----------------------------------|
| Cable "LISN to ESI"                                          | RG214           | W18.03+W48.03 | Huber&Suhner                     |
| Impedance Stabilization Network                              | ISN T800        | 36159         | Teseq GmbH                       |
| <i>Calibration Details</i>                                   |                 |               | <i>Last Execution Next Exec.</i> |
| Standard Calibration                                         |                 |               | 2014/02/06 2016/02/28            |
| Impedance Stabilization Network, Coupling Decoupling Network | ISN/CDN ENY41   | 100002        | Rohde & Schwarz GmbH & Co. KG    |
| Impedance Stabilization Network, Coupling Decoupling Network | ISN/CDN ST08    | 36292         | Teseq GmbH                       |
| <i>Calibration Details</i>                                   |                 |               | <i>Last Execution Next Exec.</i> |
| Standard calibration                                         |                 |               | 2014/01/10 2016/01/31            |
| Impedance Stabilization Network, Coupling Decoupling Network | ISN/CDN T8-Cat6 | 32187         | Teseq GmbH                       |
| <i>Calibration Details</i>                                   |                 |               | <i>Last Execution Next Exec.</i> |
| Standard Calibration                                         |                 |               | 2014/01/08 2016/01/31            |
| One-Line V-Network                                           | ESH 3-Z6        | 100489        | Rohde & Schwarz GmbH & Co. KG    |
| <i>Calibration Details</i>                                   |                 |               | <i>Last Execution Next Exec.</i> |
| standard calibration                                         |                 |               | 2014/06/18 2017/11/30            |
| One-Line V-Network                                           | ESH 3-Z6        | 100570        | Rohde & Schwarz GmbH & Co. KG    |
| <i>Calibration Details</i>                                   |                 |               | <i>Last Execution Next Exec.</i> |
| Standard Calibration                                         |                 |               | 2013/11/25 2016/11/24            |
| Two-Line V-Network                                           | ESH 3-Z5        | 828304/029    | Rohde & Schwarz GmbH & Co. KG    |
| <i>Calibration Details</i>                                   |                 |               | <i>Last Execution Next Exec.</i> |
| DAkKS Calibration                                            |                 |               | 2015/03/30 2017/03/31            |
| Two-Line V-Network                                           | ESH 3-Z5        | 829996/002    | Rohde & Schwarz GmbH & Co. KG    |
| <i>Calibration Details</i>                                   |                 |               | <i>Last Execution Next Exec.</i> |
| DAkKS Calibration                                            |                 |               | 2015/03/30 2017/03/31            |

## Test Equipment Auxiliary Equipment for Radiated emissions

**Lab ID:** Lab 2  
**Description:** Equipment for emission measurements  
**Serial Number:** see single devices

### Single Devices for Auxiliary Equipment for Radiated emissions

| Single Device Name                                | Type                           | Serial Number       | Manufacturer                        |
|---------------------------------------------------|--------------------------------|---------------------|-------------------------------------|
| Antenna mast                                      | AM 4.0                         | AM4.0/180/11920 513 | Maturo GmbH                         |
| Biconical Broadband Antenna                       | SBA 9119                       | 9119-005            | Schwarzbeck Mess-Elektronik OHG     |
| Biconical dipole                                  | VUBA 9117                      | 9117-108            | Schwarzbeck Mess-Elektronik OHG     |
| Broadband Amplifier 1 GHz - 4 GHz                 | AFS4-01000400-1Q-10P-4         | -                   | Miteq                               |
| Broadband Amplifier 18 GHz - 26 GHz               | JS4-18002600-32-5P             | 849785              | Miteq                               |
| Broadband Amplifier 30 MHz - 18 GHz               | JS4-00101800-35-5P             | 896037              | Miteq                               |
| Cable "ESI to EMI Antenna"                        | EcoFlex10                      | W18.01-2+W38.01-2   | Kabel Kusch                         |
| Cable "ESI to Horn Antenna"                       | SucoFlex                       | W18.02-2+W38.02-2   | HUBER+SUHNER                        |
| Cable "ESI to Horn Antenna"                       | UFB311A+UFB293C                | W18.02-2+W38.02-2   | Rosenberger Micro-Coax              |
| Double-ridged horn                                | HF 906                         | 357357/002          | Rohde & Schwarz GmbH & Co. KG       |
| <i>Calibration Details</i>                        |                                |                     | <i>Last Execution    Next Exec.</i> |
| Standard Calibration                              |                                |                     | 2012/06/26    2015/06/25            |
| Standard Calibration                              |                                |                     | 2015/06/23    2018/06/22            |
| Double-ridged horn                                | HF 907                         | 102444              | Rohde & Schwarz GmbH & Co. KG       |
| <i>Calibration Details</i>                        |                                |                     | <i>Last Execution    Next Exec.</i> |
| Standard Calibration                              |                                |                     | 2015/05/11    2018/05/10            |
| Double-ridged horn-duplicated 2015-07-15 10:47:55 | HF 906                         | 357357/001          | Rohde & Schwarz GmbH & Co. KG       |
| High Pass Filter                                  | 4HC1600/12750-1.5-KK           | 9942011             | Trilithic                           |
| High Pass Filter                                  | 5HC2700/12750-1.5-KK           | 9942012             | Trilithic                           |
| High Pass Filter                                  | 5HC3500/18000-1.2-KK           | 200035008           | Trilithic                           |
| High Pass Filter                                  | WHKX 7.0/18G-8SS               | 09                  | Wainwright                          |
| Horn Antenna Schwarzbeck 15-26.5 GHz BBHA 9170    | BBHA 9170                      | BBHA9170262         | Schwarzbeck Mess-Elektronik OHG     |
| Log.-per. Antenna                                 | HL 562 Ultralog                | 100609              | Rohde & Schwarz GmbH & Co. KG       |
| <i>Calibration Details</i>                        |                                |                     | <i>Last Execution    Next Exec.</i> |
| Standard Calibration                              |                                |                     | 2012/12/18    2015/12/17            |
| Log.-per. Antenna (upgraded)                      | HL 562 Ultralog new biconicals | 830547/003          | Rohde & Schwarz GmbH & Co. KG       |
| <i>Calibration Details</i>                        |                                |                     | <i>Last Execution    Next Exec.</i> |
| Standard Calibration                              |                                |                     | 2015/06/30    2018/06/29            |



**Single Devices for Auxiliary Equipment for Radiated emissions (continued)**

| <i>Single Device Name</i>                             | <i>Type</i>                | <i>Serial Number</i>           | <i>Manufacturer</i>                     |
|-------------------------------------------------------|----------------------------|--------------------------------|-----------------------------------------|
| Loop Antenna                                          | HFH2-Z2                    | 829324/006                     | Rohde & Schwarz GmbH & Co. KG           |
|                                                       | <i>Calibration Details</i> |                                | <i>Last Execution</i> <i>Next Exec.</i> |
|                                                       | DKD Calibration            |                                | 2014/11/27 2017/11/27                   |
| Standard Gain /<br>Pyramidal Horn<br>Antenna 26.5 GHz | 3160-09                    | 00083069                       | EMCO Elektronik GmbH                    |
| Standard Gain /<br>Pyramidal Horn<br>Antenna 40 GHz   | 3160-10                    | 00086675                       | EMCO Elektronik GmbH                    |
| Tilt device Maturo<br>(Rohacell)                      | Antrieb TD1.5-10kg         | TD1.5-<br>10kg/024/379070<br>9 | Maturo GmbH                             |

## Test Equipment Auxiliary Test Equipment

|                       |                                           |
|-----------------------|-------------------------------------------|
| <b>Lab ID:</b>        | <b>Lab 2</b>                              |
| <b>Manufacturer:</b>  | see single devices                        |
| <b>Description:</b>   | Single Devices for various Test Equipment |
| <b>Type:</b>          | various                                   |
| <b>Serial Number:</b> | none                                      |

## Single Devices for Auxiliary Test Equipment

| Single Device Name                 | Type             | Serial Number              | Manufacturer                         |
|------------------------------------|------------------|----------------------------|--------------------------------------|
| Broadband Power Divider N (Aux)    | 1506A / 93459    | LM390                      | Weinschel Associates                 |
| Broadband Power Divider SMA        | WA1515           | A855                       | Weinschel Associates                 |
| Digital Multimeter 03 (Multimeter) | Fluke 177        | 86670383                   | Fluke Europe B.V.                    |
|                                    |                  | <i>Calibration Details</i> | <i>Last Execution Next Exec.</i>     |
|                                    |                  | Customized calibration     | 2013/12/04 2015/12/03                |
| Fibre optic link Satellite (Aux)   | FO RS232 Link    | 181-018                    | Pontis                               |
| Fibre optic link Transceiver (Aux) | FO RS232 Link    | 182-018                    | Pontis                               |
| Isolating Transformer              | LTS 604          | 1888                       | Thalheimer Transformatorenwerke GmbH |
| Notch Filter Ultra Stable (Aux)    | WRCA800/960-6EEK | 24                         | Wainwright                           |
| Signal Analyzer                    | FSV30            | 103005                     | Rohde & Schwarz GmbH & Co. KG        |
|                                    |                  | <i>Calibration Details</i> | <i>Last Execution Next Exec.</i>     |
|                                    |                  | Standard                   | 2014/02/10 2016/02/09                |
| Spectrum Analyser                  | FSP3             | 836722/011                 | Rohde & Schwarz GmbH & Co. KG        |
|                                    |                  | <i>Calibration Details</i> | <i>Last Execution Next Exec.</i>     |
|                                    |                  | Standard                   | 2012/06/13 2015/06/12                |
|                                    |                  | DKD calibration            | 2015/06/23 2018/06/22                |
| Spectrum Analyser                  | FSU26            | 200418                     | Rohde & Schwarz GmbH & Co.KG         |
|                                    |                  | <i>Calibration Details</i> | <i>Last Execution Next Exec.</i>     |
|                                    |                  | Standard calibration       | 2014/07/29 2015/07/28                |
| Vector Signal Generator            | SMIQ 03B         | 832492/061                 | Rohde & Schwarz GmbH & Co.KG         |

## Test Equipment Digital Signalling Devices

**Lab ID:** Lab 1, Lab 2  
**Description:** Signalling equipment for various wireless technologies.

### Single Devices for Digital Signalling Devices

| Single Device Name                   | Type                                                                                                                                                                                                                                                                                                                                                         | Serial Number | Manufacturer                     |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------------------------|
| CMW500                               | CMW500                                                                                                                                                                                                                                                                                                                                                       | 107500        | Rohde & Schwarz GmbH & Co.KG     |
|                                      | <i>Calibration Details</i>                                                                                                                                                                                                                                                                                                                                   |               | <i>Last Execution Next Exec.</i> |
|                                      | Standard calibration                                                                                                                                                                                                                                                                                                                                         |               | 2014/01/27 2016/01/26            |
| Digital Radio Communication Tester   | CMD 55                                                                                                                                                                                                                                                                                                                                                       | 831050/020    | Rohde & Schwarz GmbH & Co. KG    |
|                                      | <i>Calibration Details</i>                                                                                                                                                                                                                                                                                                                                   |               | <i>Last Execution Next Exec.</i> |
|                                      | DKD calibration                                                                                                                                                                                                                                                                                                                                              |               | 2014/12/02 2017/12/01            |
| Universal Radio Communication Tester | CMU 200                                                                                                                                                                                                                                                                                                                                                      | 102366        | Rohde & Schwarz GmbH & Co. KG    |
|                                      | <i>HW/SW Status</i>                                                                                                                                                                                                                                                                                                                                          |               | <i>Date of Start Date of End</i> |
|                                      | Hardware:<br>B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2, B56V14, B68 3v04, PCMCIA, U65V04<br>Software:<br>K21 4v21, K22 4v21, K23 4v21, K24 4v21, K42 4v21, K43 4v21, K53 4v21, K56 4v22, K57 4v22, K58 4v22, K59 4v22, K61 4v22, K62 4v22, K63 4v22, K64 4v22, K65 4v22, K66 4v22, K67 4v22, K68 4v22, K69 4v22<br>Firmware:<br>µP1 8v50 02.05.06<br>--- |               | 2007/07/16                       |
| Universal Radio Communication Tester | CMU 200                                                                                                                                                                                                                                                                                                                                                      | 837983/052    | Rohde & Schwarz GmbH & Co. KG    |
|                                      | <i>Calibration Details</i>                                                                                                                                                                                                                                                                                                                                   |               | <i>Last Execution Next Exec.</i> |
|                                      | DKD calibration                                                                                                                                                                                                                                                                                                                                              |               | 2014/12/03 2017/12/02            |
|                                      | <i>HW/SW Status</i>                                                                                                                                                                                                                                                                                                                                          |               | <i>Date of Start Date of End</i> |
|                                      | HW options:<br>B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2, B54V14, B56V14, B68 3v04, B95, PCMCIA, U65V02<br>SW options:<br>K21 4v11, K22 4v11, K23 4v11, K24 4v11, K27 4v10, K28 4v10, K42 4v11, K43 4v11, K53 4v10, K65 4v10, K66 4v10, K68 4v10,<br>Firmware:<br>µP1 8v40 01.12.05<br>---                                                               |               | 2007/01/02                       |
|                                      | SW:<br>K62, K69                                                                                                                                                                                                                                                                                                                                              |               | 2008/11/03                       |
| Vector Signal Generator              | SMU200A                                                                                                                                                                                                                                                                                                                                                      | 100912        | Rohde & Schwarz GmbH & Co. KG    |

### Test Equipment Emission measurement devices

**Lab ID:** Lab 1, Lab 2  
**Description:** Equipment for emission measurements  
**Serial Number:** see single devices

#### Single Devices for Emission measurement devices

| Single Device Name                  | Type                                                | Serial Number | Manufacturer                     |
|-------------------------------------|-----------------------------------------------------|---------------|----------------------------------|
| EMI Receiver /<br>Spectrum Analyser | ESR 7                                               | 101424        | Rohde & Schwarz                  |
|                                     | Calibration Details                                 |               | Last Execution Next Exec.        |
|                                     | Initial Factory Calibration                         |               | 2014/11/13 2016/11/12            |
| Personal Computer                   | Dell                                                | 30304832059   | Dell                             |
| Power Meter                         | NRVD                                                | 828110/016    | Rohde & Schwarz GmbH &<br>Co.KG  |
|                                     | Calibration Details                                 |               | Last Execution Next Exec.        |
|                                     | Standard calibration                                |               | 2015/05/11 2016/05/10            |
| Sensor Head A                       | NRV-Z1                                              | 827753/005    | Rohde & Schwarz GmbH &<br>Co.KG  |
|                                     | Calibration Details                                 |               | Last Execution Next Exec.        |
|                                     | Standard calibration                                |               | 2015/05/11 2016/05/10            |
| Signal Generator                    | SMR 20                                              | 846834/008    | Rohde & Schwarz GmbH &<br>Co. KG |
|                                     | Calibration Details                                 |               | Last Execution Next Exec.        |
|                                     | Standard Calibration                                |               | 2014/06/24 2017/06/23            |
| Spectrum Analyser                   | FSW 43                                              | 103779        | Rohde & Schwarz                  |
|                                     | Calibration Details                                 |               | Last Execution Next Exec.        |
|                                     | Initial Factory Calibration                         |               | 2014/11/17 2016/11/16            |
| Spectrum Analyzer                   | ESIB 26                                             | 830482/004    | Rohde & Schwarz GmbH &<br>Co. KG |
|                                     | Calibration Details                                 |               | Last Execution Next Exec.        |
|                                     | Standard Calibration                                |               | 2014/01/07 2016/01/31            |
|                                     | HW/SW Status                                        |               | Date of Start Date of End        |
|                                     | Firmware-Update 4.34.4 from 3.45 during calibration |               | 2009/12/03                       |

### Test Equipment Multimeter 03

**Lab ID:** Lab 2  
**Description:** Fluke 177  
**Serial Number:** 86670383

#### Single Devices for Multimeter 03

| Single Device Name                    | Type                   | Serial Number | Manufacturer              |
|---------------------------------------|------------------------|---------------|---------------------------|
| Digital Multimeter 03<br>(Multimeter) | Fluke 177              | 86670383      | Fluke Europe B.V.         |
|                                       | Calibration Details    |               | Last Execution Next Exec. |
|                                       | Customized calibration |               | 2013/12/04 2015/12/03     |

## Test Equipment Multimeter 12

**Lab ID:** Lab 3  
**Description:** Ex-Tech 520  
**Serial Number:** 05157876

### Single Devices for Multimeter 12

| Single Device Name                 | Type  | Serial Number | Manufacturer                            |
|------------------------------------|-------|---------------|-----------------------------------------|
| Digital Multimeter 12 (Multimeter) | EX520 | 05157876      | Extech Instruments Corp.                |
| <i>Calibration Details</i>         |       |               | <i>Last Execution</i> <i>Next Exec.</i> |
| Customized calibration             |       |               | 2013/12/04 2015/12/03                   |

## Test Equipment Regulatory Bluetooth RF Test Solution

**Lab ID:** Lab 3  
**Description:** Regulatory Bluetooth RF Tests  
**Type:** Bluetooth RF  
**Serial Number:** 001

### Single Devices for Regulatory Bluetooth RF Test Solution

| Single Device Name              | Type         | Serial Number | Manufacturer                            |
|---------------------------------|--------------|---------------|-----------------------------------------|
| ADU 200 Relay Box 7             | Relay Box    | A04380        | Ontrak Control Systems Inc.             |
| Bluetooth Signalling Unit CBT   | CBT          | 100302        | Rohde & Schwarz GmbH & Co.KG            |
| <i>Calibration Details</i>      |              |               | <i>Last Execution</i> <i>Next Exec.</i> |
| Standard calibration            |              |               | 2014/08/29 2015/08/28                   |
| Standard Calibration            |              |               | 2015/08/20 2016/08/19                   |
| Power Meter NRVD                | NRVD         | 832025/059    |                                         |
| <i>Calibration Details</i>      |              |               | <i>Last Execution</i> <i>Next Exec.</i> |
| Standard calibration            |              |               | 2014/08/29 2015/08/28                   |
| Standard Calibration            |              |               | 2015/08/19 2016/08/18                   |
| Power Sensor NRV Z1 A           | PROBE        | 832279/013    |                                         |
| <i>Calibration Details</i>      |              |               | <i>Last Execution</i> <i>Next Exec.</i> |
| Standard calibration            |              |               | 2014/08/28 2015/08/27                   |
| Standard Calibration            |              |               | 2015/08/18 2016/08/17                   |
| Power Supply                    | NGSM 32/10   | 2725          |                                         |
| <i>Calibration Details</i>      |              |               | <i>Last Execution</i> <i>Next Exec.</i> |
| Standard calibration            |              |               | 2013/06/20 2015/06/19                   |
| Standard calibration            |              |               | 2015/06/22 2016/06/21                   |
| Rubidium Frequency Normal MFS   | Datum MFS    | 002           | Datum GmbH                              |
| <i>Calibration Details</i>      |              |               | <i>Last Execution</i> <i>Next Exec.</i> |
| Standard calibration            |              |               | 2014/08/29 2015/08/28                   |
| Standard Calibration            |              |               | 2015/08/25 2016/08/24                   |
| Signal Analyser FSIQ26          | 1119.6001.26 | 832695/007    | Rohde & Schwarz GmbH & Co.KG            |
| Vector Signal Generator SMIQ03B | SMIQ03B      | 832870/017    |                                         |
| <i>Calibration Details</i>      |              |               | <i>Last Execution</i> <i>Next Exec.</i> |
| Standard calibration            |              |               | 2013/06/21 2016/06/20                   |

### Test Equipment Shielded Room 02

**Lab ID:** Lab 1  
**Manufacturer:** Frankonia  
**Description:** Shielded Room for conducted testing  
**Type:** 12 qm  
**Serial Number:** none

### Test Equipment Shielded Room 07

**Lab ID:** Lab 3  
**Description:** Shielded Room 4m x 6m

### Test Equipment T/A Logger 13

**Lab ID:** Lab 1, Lab 2  
**Description:** Lufft Opus10 TPR  
**Type:** Opus10 TPR  
**Serial Number:** 13936

#### Single Devices for T/A Logger 13

| Single Device Name                        | Type                 | Serial Number | Manufacturer                      |
|-------------------------------------------|----------------------|---------------|-----------------------------------|
| ThermoAirpressure Datalogger 13 (Environ) | Opus10 TPR (8253.00) | 13936         | Lufft Mess- und Regeltechnik GmbH |
| Calibration Details                       |                      |               | Last Execution Next Exec.         |
| Customized calibration                    |                      |               | 2015/02/27 2017/02/26             |

### Test Equipment T/H Logger 02

**Lab ID:** Lab 1  
**Description:** Lufft Opus10  
**Serial Number:** 7489

#### Single Devices for T/H Logger 02

| Single Device Name                  | Type                 | Serial Number | Manufacturer                      |
|-------------------------------------|----------------------|---------------|-----------------------------------|
| ThermoHygro Datalogger 02 (Environ) | Opus10 THI (8152.00) | 7489          | Lufft Mess- und Regeltechnik GmbH |
| Calibration Details                 |                      |               | Last Execution Next Exec.         |
| Customized calibration              |                      |               | 2015/02/27 2017/02/26             |

### Test Equipment T/H Logger 12

**Lab ID:** Lab 2  
**Description:** Lufft Opus10  
**Serial Number:** 12482

#### Single Devices for T/H Logger 12

| Single Device Name                  | Type                 | Serial Number | Manufacturer                      |
|-------------------------------------|----------------------|---------------|-----------------------------------|
| ThermoHygro Datalogger 12 (Environ) | Opus10 THI (8152.00) | 12482         | Lufft Mess- und Regeltechnik GmbH |
| Calibration Details                 |                      |               | Last Execution Next Exec.         |
| Customized calibration              |                      |               | 2015/03/10 2017/03/09             |

### Test Equipment T/H Logger 15

**Lab ID:** Lab 3  
**Description:** Lufft Opus10  
**Serial Number:** 13985

#### Single Devices for T/H Logger 15

| Single Device Name                        | Type                 | Serial Number | Manufacturer                            |
|-------------------------------------------|----------------------|---------------|-----------------------------------------|
| ThermoHygro<br>Datalogger 15<br>(Environ) | Opus10 THI (8152.00) | 13985         | Lufft Mess- und<br>Regeltechnik GmbH    |
| <i>Calibration Details</i>                |                      |               | <i>Last Execution</i> <i>Next Exec.</i> |
| Customized calibration                    |                      |               | 2015/03/10 2017/03/09                   |

### Test Equipment Temperature Chamber 01

**Lab ID:** Lab 3  
**Manufacturer:** see single devices  
**Description:** Temperature Chamber KWP 120/70  
**Type:** Weiss  
**Serial Number:** see single devices

#### Single Devices for Temperature Chamber 01

| Single Device Name              | Type       | Serial Number  | Manufacturer                            |
|---------------------------------|------------|----------------|-----------------------------------------|
| Temperature<br>Chamber Weiss 01 | KWP 120/70 | 59226012190010 | Weiss Umwelttechnik GmbH                |
| <i>Calibration Details</i>      |            |                | <i>Last Execution</i> <i>Next Exec.</i> |
| Customized calibration          |            |                | 2014/03/12 2016/03/11                   |

## **5 Annex**

### **5.1 Additional Information for Report**



## Summary of Test Results

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The EUT complied with all performed tests as listed in the summary section of this report.

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## Technical Report Summary

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### Type of Authorization :

Certification for an Intentional Radiator (Frequency Hopping Spread Spectrum).

### Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 2 and 15. The following subparts are applicable to the results in this test report:

Part 2, Subpart J - Equipment Authorization Procedures, Certification

Part 15, Subpart C – Intentional Radiators

§ 15.201 Equipment authorization requirement

§ 15.207 Conducted limits

§ 15.209 Radiated emission limits; general requirements

§ 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz

### Additional documents

The tests were selected and performed with reference to the FCC Public Notice DA 00-705, released March 30, 2000. Instead of applying ANSI C63.4-1992 which is referenced in the FCC Public Note, the newer ANSI C63.4-2014 is applied.

## Description of Methods of Measurements

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### Conducted emissions (AC power line)

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Standard FCC Part 15, Subpart C

The test was performed according to: ANSI C 63.4,

### Test Description

The test set-up was made in accordance to the general provisions of ANSI C 63.4.

The Equipment Under Test (EUT) was setup in a shielded room to perform the conducted emissions measurements in a typical installation configuration. The EUT was powered from 50µH || 50 Ohm Line Impedance Stabilization Network (LISN). The LISN's unused connections were terminated with 50 Ohm loads. The measurement procedure consists of two steps. It is implemented into the EMI test software ES-K1 from R&S.

#### Step 1: Preliminary scan

Intention of this step is, to determine the conducted EMI-profile of the EUT.

EMI receiver settings:

- Detector: Peak - Maxhold
- Frequency range: 150 kHz – 30 MHz
- Frequency steps: 5 kHz
- IF-Bandwidth: 9 kHz
- Measuring time / Frequency step: 20 ms

- Measurement on phase + neutral lines of the power cords.

On basis of this preliminary scan the highest amplitudes and the corresponding frequencies relative to the limit are identified. Emissions above the limit and emissions which are in the 10 dB range below the limit are considered.

#### Step 2: Final measurement

Intention of this step is, to determine the highest emissions with the settings defined in the test specification for the frequencies identified in step 1.

EMI receiver settings:

- Detector: Quasi-Peak
- IF - Bandwidth: 9 kHz
- Measuring time: 1 s / frequency

At each frequency determined in step 1, four measurements are performed in the following combinations:

- 1) Neutral lead - reference ground (PE grounded)
- 2) Phase lead - reference ground (PE grounded)
- 3) Neutral lead - reference ground (PE floating)
- 4) Phase lead - reference ground (PE floating)

The highest value is reported.

#### Test Requirements / Limits

FCC Part 15, Subpart C, §15.207

| Frequency Range<br>(MHz) | QP Limit<br>(dBµV) | AV Limit<br>(dBµV) |
|--------------------------|--------------------|--------------------|
| 0.15 – 0.5               | 66 to 56           | 56 to 46           |
| 0.5 – 5                  | 56                 | 46                 |
| 5 – 30                   | 60                 | 50                 |

Used conversion factor: Limit (dBµV) = 20 log (Limit (µV)/1µV).

#### Occupied bandwidth

Standard FCC Part 15, Subpart C

The test was performed according to: FCC §15.31

#### Test Description

The Equipment Under Test (EUT) was setup to perform the occupied bandwidth measurements.

The reference level is the level of the highest amplitude signal observed from the transmitter at either the fundamental frequency or first-order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical.

The results recorded were measured with the modulation which produces the worst-case (widest) occupied bandwidth. The resolution bandwidth for measuring the reference level and the occupied bandwidth was 30 kHz.

The EUT was connected to the spectrum analyzer via a short coax cable.

#### Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (a) (1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Implication by the test laboratory:

Since the Bluetooth technology defines a fixed channel separation of 1 MHz this design parameter defines the maximum allowed occupied bandwidth depending on the EUT's output power:

1. Under the provision that the system operates with an output power not greater than 125 mW (21.0 dBm):

Implicit Limit: Max. 20 dB BW =  $1.0 \text{ MHz} / 2/3 = 1.5 \text{ MHz}$

2. If the system output power exceeds 125 mW (21.0 dBm):

Implicit Limit: Max. 20 dB BW = 1.0 MHz

Used conversion factor: Output power (dBm) =  $10 \log (\text{Output power (W)} / 1\text{mW})$

The measured output power of the system is below 125 mW (21.0 dBm). For the results, please refer to the related chapter of this report. Therefore the limit is determined as 1.5 MHz.

---

#### Peak power output

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Standard FCC Part 15, Subpart C

The test was performed according to: FCC §15.31

#### Test Description

The Equipment Under Test (EUT) was set up to perform the output power measurements. The resolution bandwidth for measuring the output power was set to 3 MHz. The reference level of the spectrum analyzer was set higher than the output power of the EUT. The EUT was connected to the spectrum analyzer via a short coax cable with a known loss.

#### Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (b) (1)

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:  
(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt.

Used conversion factor: Limit (dBm) =  $10 \log (\text{Limit (W)}/1\text{mW})$

==> Maximum Output Power: 30 dBm

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#### Spurious RF conducted emissions

---

Standard FCC Part 15, Subpart C

The test was performed according to: FCC §15.31

#### Test Description

The Equipment Under Test (EUT) was set up to perform the spurious emissions measurements.

The EUT was connected to spectrum analyzer via a short coax cable with a known loss.

Analyzer settings:

- Detector: Peak-Maxhold
- Frequency range: 30 – 25000 MHz
- Resolution Bandwidth (RBW): 100 kHz
- Video Bandwidth (VBW): 300 kHz
- Sweep Time: 330 s

The reference value for the measurement of the spurious RF conducted emissions is determined during the test "band edge compliance" (cf. chapter 3.6). This value is used to calculate the 20 dBc limit.

## Test Requirements / Limits

### FCC Part 15, Subpart C, §15.247 (c)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power

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## Spurious radiated emissions

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### Standard FCC Part 15, Subpart C

The test was performed according to: ANSI C 63.4,

## Test Description

The test set-up was made in accordance to the general provisions of ANSI C63.4 in a typical installation configuration.

The Equipment Under Test (EUT) was set up on a non-conductive table 1.0 x 2.0 m<sup>2</sup> in the semi-anechoic chamber. The influence of the EUT support table that is used between 30–1000 MHz was evaluated.

The measurement procedure is implemented into the EMI test software ES-K1 from R&S. Exploratory tests are performed at 3 orthogonal axes to determine the worst-case orientation of a body-worn or handheld EUT. The final test on all kind of EUTs is performed at 2 axes. A pre-check is also performed while the EUT is powered from both AC and DC (battery) power in order to find the worst-case operating condition.

### 1. Measurement up to 30 MHz

The Loop antenna HFH2-Z2 is used.

#### Step 1: pre-measurement

- Anechoic chamber
- Antenna distance: 10 m
- Detector: Peak-Maxhold
- Frequency range: 0.009 – 0.15 and 0.15 – 30 MHz
- Frequency steps: 0.1 kHz and 5 kHz
- IF-Bandwidth: 0.2 kHz and 10 kHz
- Measuring time / Frequency step: 100 ms

Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

#### Step 2: final measurement

For the relevant emissions determined in step 1, an additional measurement with the following settings will be performed. Intention of this step is to find the maximum emission level.

- Open area test side
- Antenna distance: according to the Standard
- Detector: Quasi-Peak
- Frequency range: 0.009 – 30 MHz
- Frequency steps: measurement at frequencies detected in step 1
- IF-Bandwidth: 200 Hz – 10 kHz
- Measuring time / Frequency step: 100 ms

### 2. Measurement above 30 MHz and up to 1 GHz

#### Step 1: Preliminary scan

Preliminary test to identify the highest amplitudes relative to the limit.

#### Settings for step 1:

- Detector: Peak-Maxhold
- Frequency range: 30 – 1000 MHz
- Frequency steps: 60 kHz
- IF-Bandwidth: 120 kHz
- Measuring time / Frequency step: 100 µs (BT Timing 1.25 ms)
- Turntable angle range: –180 to +180°
- Turntable step size: 90°
- Height variation range: 1 – 3 m
- Height variation step size: 2 m
- Polarisation: Horizontal + Vertical

Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

#### Step 2: second measurement

For the relevant emissions determined in step 1, an additional measurement with the following settings will

be performed. Intention of this step is, to find out the approximate turntable angle and antenna height for each frequency.

- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100 ms
- Turntable angle range:  $-180$  to  $+180^\circ$
- Turntable step size:  $45^\circ$
- Height variation range: 1 – 4 m
- Height variation step size: 0.5 m
- Polarisation: horizontal + vertical

After this step the EMI test system has determined the following values for each frequency (of step 1):

- Frequency
- Azimuth value (of turntable)
- Antenna height

The last two values have now the following accuracy:

- Azimuth value (of turntable):  $45^\circ$
- Antenna height: 0.5 m

Step 3: final measurement

In this step the accuracy of the turntable azimuth and antenna height will be improved. This is necessary to find out the maximum value of every frequency.

For each frequency, which was determined the turntable azimuth and antenna height will be adjusted. The turntable azimuth will be slowly varied by  $\pm 22.5^\circ$  around this value. During this action the value of emission is continuously measured. The turntable azimuth at the highest emission will be recorded and adjusted. In this position the antenna height is also slowly varied by  $\pm 25$  cm around the antenna height determined. During this action the value of emission is also continuously measured. The antenna height of the highest emission will also be recorded and adjusted.

- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100 ms
- Turntable angle range:  $-22.5^\circ$  to  $+22.5^\circ$  around the determined value
- Height variation range:  $-0.25$  m to  $+0.25$  m around the determined value

Step 4: final measurement with QP detector

With the settings determined in step 3, the final measurement will be performed:

EMI receiver settings for step 4:

- Detector: Quasi-Peak ( $< 1$  GHz)
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 1 s

### 3. Measurement above 1 GHz

The following modifications apply to the measurement procedure for the frequency range above 1 GHz:

The measurement distance was reduced to 1.4 m. The results were extrapolated by the extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements, inverse linear-distance squared for the power reference level measurements). Due to the fact that in this frequency range a double ridged wave guided horn antenna (up to 18 GHz) and a standard gain horn antenna (18–25 GHz) are used, the steps 2–4 are omitted. Step 1 was performed with one height of the receiving antenna only.

EMI receiver settings:

- Detector: Peak, Average
- IF Bandwidth = 1 MHz

After the measurement a plot will be generated which contains a diagram with the results of the preliminary scan and a chart with the frequencies and values of the results of the final measurement.

For the enhanced data rate packets the test is performed as worst-case-check in order to verify that emissions have a comparable level as found at basic data rate. Typically, the measurement for these packets is performed in the frequency range 1 to 8 GHz but it depends on the emissions found during the test for the basic data rate. Please refer to the results for the used frequency range.

### Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (d)

... In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

FCC Part 15, Subpart C, §15.209, Radiated Emission Limits

| Frequency<br>(MHz) | Limit<br>( $\mu$ V/m) | Measurement<br>distance (m) | Limit @ 10 m distance<br>(dB $\mu$ V/m) |
|--------------------|-----------------------|-----------------------------|-----------------------------------------|
|--------------------|-----------------------|-----------------------------|-----------------------------------------|

|              |              |     |                                              |
|--------------|--------------|-----|----------------------------------------------|
| 0.009 – 0.49 | 2400/F(kHz)  | 300 | $48.5..13.8 + 59.1 \text{ dB} = 107.6..72.9$ |
| 0.49 – 1.705 | 24000/F(kHz) | 30  | $33.8..23.0 + 19.1 \text{ dB} = 52.9..42.1$  |
| 1.705 - 30   | 30           | 30  | $29.5 + 19.1 = 48.6$                         |

| Frequency (MHz) | Limit (µV/m) | Measurement distance (m) | Limit (dBµV/m) |
|-----------------|--------------|--------------------------|----------------|
| 30 - 88         | 100          | 3                        | 40.0           |
| 88 - 216        | 150          | 3                        | 43.5           |
| 216 - 960       | 200          | 3                        | 46.0           |
| above 960       | 500          | 3                        | 54.0           |

#### §15.35(b)

..., there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit....

Used conversion factor:  $\text{Limit (dBµV/m)} = 20 \log (\text{Limit (µV/m)}/1\mu\text{V/m})$

#### Band edge compliance

Standard FCC Part 15, Subpart C

The test was performed according to: ANSI C 63.4, FCC §15.31

#### Test Description

The procedure to show compliance with the band edge requirement is divided into two measurements:

1. Show compliance of the lower band edge by a conducted measurement and
2. show compliance of the higher band edge by a radiated and conducted measurement.

For the first measurement the EUT is set to transmit on the lowest channel (2402 MHz). The lower band edge is 2400 MHz.

Analyzer settings:

- Detector: Peak
- RBW= 100 kHz
- VBW= 300 kHz

For the second measurement the EUT is set to transmit on the highest channel (2480 MHz). The higher band edge is 2483.5 MHz.

Analyzer settings for conducted measurement:

- Detector: Peak
- RBW= 100 kHz
- VBW= 300 kHz

EMI receiver settings for radiated measurement:

- Detector: Peak, Average
- IF Bandwidth = 1 MHz

#### Test Requirements / Limits

##### FCC Part 15.247 (d)

"In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

...

Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c))."

For the measurement of the lower band edge the RF power at the band edge shall be "at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power..."

For the measurement of the higher band edge the limit is "specified in Section 15.209(a)".

---

## Dwell time

---

Standard FCC Part 15, Subpart C

The test was performed according to: FCC §15.31

### Test Description

The Equipment Under Test (EUT) was set up to perform the dwell time measurements. The EUT was connected to the spectrum analyzer via a short coax cable. The dwell time is independent from the modulation pattern. The dwell time is calculated by:

Dwell time = time slot length \* hop rate / number of hopping channels \* 31.6 s

with:

- hop rate =  $1600 * 1/s$  for DH1 packets = 1600 s<sup>-1</sup>
- hop rate =  $1600/3 * 1/s$  for DH3 packets = 533.33 s<sup>-1</sup>
- hop rate =  $1600/5 * 1/s$  for DH5 packets = 320 s<sup>-1</sup>
- number of hopping channels = 79
- 31.6 s = 0.4 seconds multiplied by the number of hopping channels = 0.4 s \* 79

The highest value of the dwell time is reported.

### Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (a) (1) (iii)

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Since the Bluetooth technology uses 79 channels this period is calculated to be 31.6 seconds.

---

## Channel separation

---

Standard FCC Part 15, Subpart C

The test was performed according to: FCC §15.31

### Test Description

The Equipment Under Test (EUT) was set up to perform the channel separation measurements. The channel separation is independent from the modulation pattern.

The EUT was connected to spectrum analyzer via a short coax cable.

Analyzer settings:

- Detector: Peak-Maxhold
- Span: 3 MHz
- Centre Frequency: a mid frequency of the 2.4 GHz ISM band
- Resolution Bandwidth (RBW): 30 kHz
- Video Bandwidth (VBW): 100 kHz
- Sweep Time: Coupled

### Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (a) (1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are

separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

---

#### Number of hopping frequencies

---

Standard     FCC Part 15, Subpart C

The test was performed according to: FCC §15.31

#### Test Description

The Equipment Under Test (EUT) was set up to perform the number of hopping frequencies measurement. The number of hopping frequencies is independent from the modulation pattern. The EUT was connected to spectrum analyzer via a short coax cable.

Analyzer settings:

- Detector: Peak-Maxhold
- Centre frequency: 2442 MHz
- Frequency span: 84 MHz
- Resolution Bandwidth (RBW): 100 kHz
- Video Bandwidth (VBW): 300 kHz
- Sweep Time: Coupled

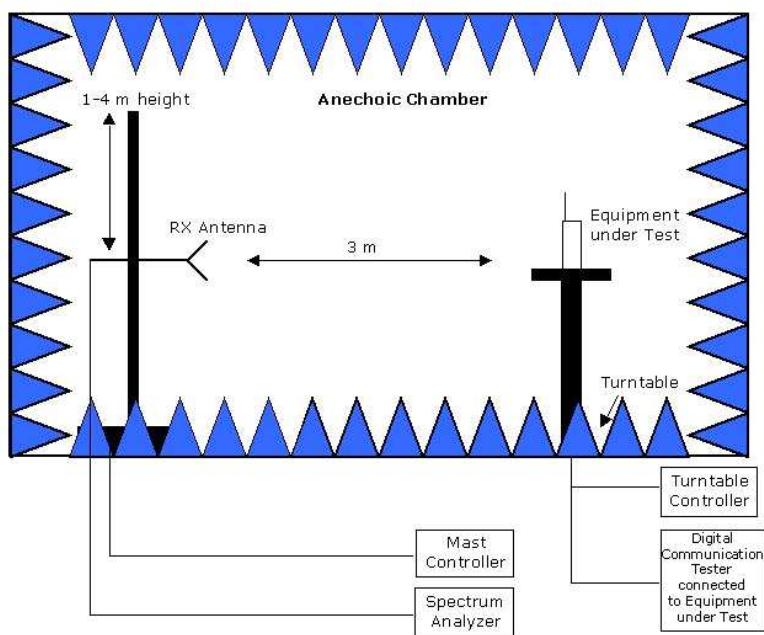
#### Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (a) (iii)

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

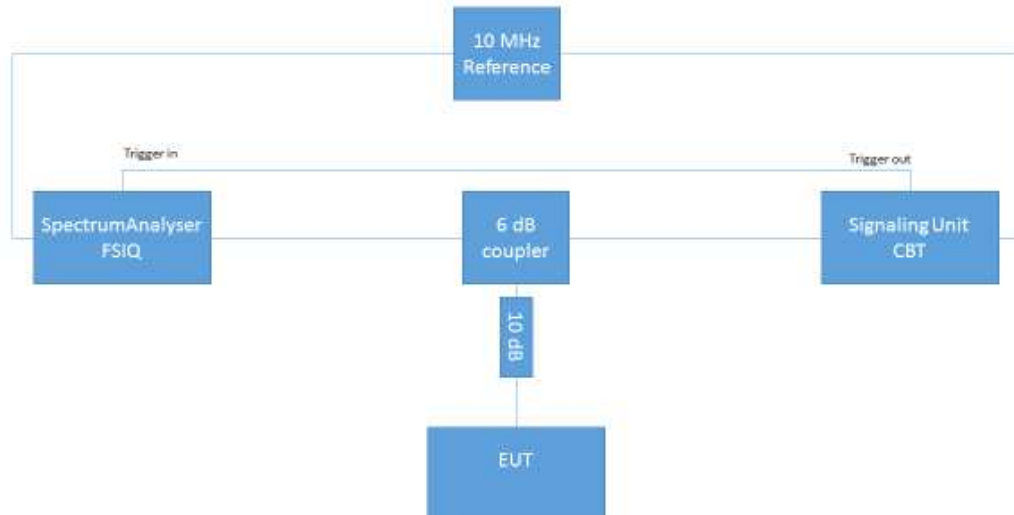


## Setup Drawings

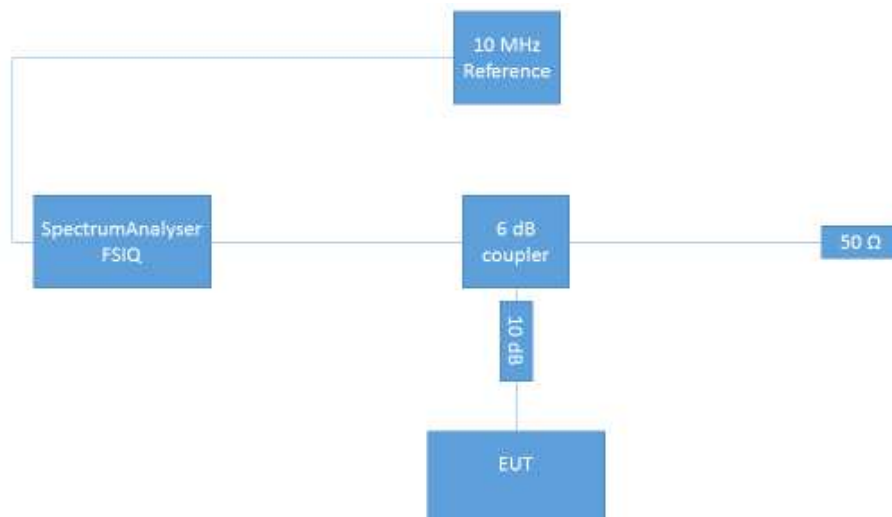


Remark: Depending on the frequency range suitable antenna types, attenuators or preamplifiers are used.

Setup in the Anechoic chamber:  
Measurements below 1 GHz: Semi-anechoic, conducting ground plane.  
Measurements above 1 GHz: Fully-anechoic, absorbers on all surfaces



Test Setup; Conducted Tests; Bluetooth normal mode (BDR/EDR)



Test Setup; Conducted Tests; Bluetooth Low Energy Mode

September, 2015

**To Whom This May Concern**

**Correlation of measurement requirements for  
FHSS (e.g. Bluetooth®) equipment  
from  
FCC and IC**

**FHSS equipment**

| Measurement                                 | FCC reference                 | IC reference                                              |
|---------------------------------------------|-------------------------------|-----------------------------------------------------------|
| Conducted emissions on AC Mains             | § 15.207                      | RSS-Gen Issue 4: 8.8                                      |
| Occupied bandwidth                          | § 15.247 (a) (1)              | RSS-247 Issue 1: 5.1 (2)                                  |
| Peak conducted output power                 | § 15.247 (b) (1), (4)         | RSS-247 Issue 1: 5.4 (2)                                  |
| Transmitter spurious RF conducted emissions | § 15.247 (d)                  | RSS-Gen Issue 4: 6.13/8.9/8.10;<br>RSS-247 Issue 1: 5.5   |
| Transmitter spurious radiated emissions     | § 15.247 (d);<br>§ 15.209 (a) | RSS-Gen Issue 4: 6.13 / 8.9/8.10;<br>RSS-247 Issue 1: 5.5 |
| Band edge compliance                        | § 15.247 (d)                  | RSS-210 Issue 8: A8.5                                     |
| Dwell time                                  | § 15.247 (a) (1) (iii)        | RSS-247 Issue 1: 5.1 (4)                                  |
| Channel separation                          | § 15.247 (a) (1)              | RSS-247 Issue 1: 5.1 (2)                                  |
| No. of hopping frequencies                  | § 15.247 (a) (1) (iii)        | RSS-247 Issue 1: 5.1 (4)                                  |
| Hybrid systems (only)                       | § 15.247 (f);<br>§ 15.247 (e) | RSS-247 Issue 1: 5.3                                      |
| Antenna requirement                         | § 15.203 / 15.204             | RSS-Gen Issue 4: 8.3                                      |
| Receiver spurious emissions                 | -                             | -                                                         |

## Measurement Uncertainties

FCC Part 22, 24, 27, 90

IC RSS-132, RSS-133, RSS-139

| Test Case                              | Parameter          | Uncertainty                                                       |
|----------------------------------------|--------------------|-------------------------------------------------------------------|
| RF Power Output                        | Power              | $\pm 2.2$ dB                                                      |
| Frequency Stability                    | Frequency          | $\pm 25$ Hz                                                       |
| Spurious Emissions at antenna terminal | Power              | $\pm 2.2$ dB                                                      |
| Field strength of spurious radiation   | Power              | $\pm 4.5$ dB                                                      |
| Emission and Occupied Bandwidth        | Power<br>Frequency | $\pm 2.9$ dB<br>GSM: $\pm 10.6$ kHz<br>UMTS, LTE: $\pm 120.0$ kHz |
| Band Edge Compliance                   | Power<br>Frequency | $\pm 2.9$ dB<br>GSM: $\pm 14.6$ kHz<br>UMTS, LTE: $\pm 68.0$ kHz  |

FCC Part 15b

IC ICES-003

| Test Case                            | Parameter | Uncertainty  |
|--------------------------------------|-----------|--------------|
| AC Power Line                        | Power     | $\pm 3.4$ dB |
| Field Strength of spurious radiation | Power+    | $\pm 5.5$ dB |

FCC Part 15c, 15e

IC RSS-210, IC RSS-247

| Test Case                              | Parameter          | Uncertainty                    |
|----------------------------------------|--------------------|--------------------------------|
| AC Power Line                          | Power              | $\pm 3.4$ dB                   |
| Field Strength of spurious radiation   | Power              | $\pm 5.5$ dB                   |
| 6 dB / 26 dB / 99% Bandwidth           | Power<br>Frequency | $\pm 2.9$ dB<br>$\pm 11.2$ kHz |
| Conducted Output Power                 |                    | $\pm 2.2$ dB                   |
| Spurious Emissions at antenna terminal | Power              | $\pm 2.2$ dB                   |
| Band Edge Compliance                   | Power<br>Frequency | $\pm 2.2$ dB<br>$\pm 11.2$ kHz |
| Frequency Stability                    | Frequency          | $\pm 25$ Hz                    |
| Power Spectral Density                 | Power              | $\pm 2.2$ dB                   |

## Revision History

| Report version control |              |                                                                                                                                                                                                                                                                      |                  |
|------------------------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Version                | Release date | Change Description                                                                                                                                                                                                                                                   | Version validity |
| initial                | 2015-08-26   | --                                                                                                                                                                                                                                                                   | invalid          |
| rev1                   | 2015-09-16   | <ul style="list-style-type: none"> <li>Added the measurement uncertainty Annex</li> <li>Added New measurement results of the occupied bandwidth</li> <li>Added test setups document as appendix3</li> <li>Added new correlation table referencing RSS-247</li> </ul> | valid            |

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