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# Report On

FCC Testing of the  
The Boeing Company Black Smartphone  
In accordance with FCC CFR 47 Part 15C (Bluetooth)

COMMERCIAL-IN-CONFIDENCE

FCC ID: H8V-BLK1

Document 75923267 Report 02 Issue 2

December 2013



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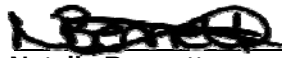
Document 75923267 Report 02 Issue 2

December 2013

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**Mark Jenkins**  
Authorised Signatory

**DATED**

19 December 2013

**This report has been up issued to Issue 2 to amend  
the Applicant Name and Address and Product Name.**

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**ENGINEERING STATEMENT**

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47 Part 15C. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);



G Lawler



A Galpin





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## **SECTION 1**

### **REPORT SUMMARY**

FCC Testing of the  
The Boeing Company Black Smartphone  
In accordance with FCC CFR 47 Part 15C (Bluetooth)



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## 1.1 INTRODUCTION

The information contained in this report is intended to show verification of the FCC Testing of the The Boeing Company Black Smartphone to the requirements of FCC CFR 47 Part 15C.

|                                      |                                                                                                                                                     |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Objective                            | To perform FCC Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out. |
| Manufacturer                         | The Boeing Company                                                                                                                                  |
| Model Number(s)                      | Black Smartphone                                                                                                                                    |
| Serial Number(s)                     | XCV23200791<br>XCV23200909                                                                                                                          |
| Number of Samples Tested             | 2                                                                                                                                                   |
| Test Specification/Issue/Date        | FCC CFR 47 Part 15C (2012)                                                                                                                          |
| Incoming Release<br>Date             | Application Form<br>13 December 2013                                                                                                                |
| Disposal<br>Reference Number<br>Date | Held Pending Disposal<br>Not Applicable<br>Not Applicable                                                                                           |
| Order Number<br>Date                 | 48774<br>01 July 2013                                                                                                                               |
| Start of Test                        | 11 August 2013                                                                                                                                      |
| Finish of Test                       | 16 August 2013                                                                                                                                      |
| Name of Engineer(s)                  | G Lawler<br>A Galpin                                                                                                                                |
| Related Document(s)                  | ANSI C63.10: 2009                                                                                                                                   |



## 1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC CFR 47 Part 15C is shown below.

| Section          | Spec Clause        | Test Description                                                              | Result | Comments/Base Standard |
|------------------|--------------------|-------------------------------------------------------------------------------|--------|------------------------|
| Bluetooth        |                    |                                                                               |        |                        |
| 2.1              | 15.207             | AC Line Conducted Emissions                                                   | Pass   |                        |
| 2.2              | 15.247 (a)(1)      | Frequency Hopping Systems - 20dB Bandwidth and Channel Separation             | Pass   |                        |
| 2.3              | 15.247 (a)(1)(iii) | Frequency Hopping Systems - Channel Dwell Time and Number of Hopping Channels | Pass   |                        |
| 2.4              | 15.247 (b)(3)      | Maximum Peak Conducted Output Power                                           | Pass   |                        |
| 2.5              | 15.247 (b)(4)      | EIRP Peak Power                                                               | Pass   |                        |
| 2.6              | 15.247 (d)         | Spurious and Band Edge Emissions                                              | Pass   |                        |
| Bluetooth - 2DHx |                    |                                                                               |        |                        |
| 2.2              | 15.247 (a)(1)      | Frequency Hopping Systems - 20dB Bandwidth and Channel Separation             | Pass   |                        |
| 2.4              | 15.247 (b)(3)      | Maximum Peak Conducted Output Power                                           | Pass   |                        |
| 2.6              | 15.247 (d)         | Spurious and Band Edge Emissions                                              | Pass   |                        |
| Bluetooth - 3DHx |                    |                                                                               |        |                        |
| 2.2              | 15.247 (a)(1)      | Frequency Hopping Systems - 20dB Bandwidth and Channel Separation             | Pass   |                        |
| 2.4              | 15.247 (b)(3)      | Maximum Peak Conducted Output Power                                           | Pass   |                        |
| 2.6              | 15.247 (d)         | Spurious and Band Edge Emissions                                              | Pass   |                        |



### 1.3 APPLICATION FORM

| EQUIPMENT DESCRIPTION                                                                           |                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Model Name/Number                                                                               | Model:Black                                                                                                                                                                                 |
| Part Number                                                                                     | BLK1                                                                                                                                                                                        |
| FCC ID (if applicable)                                                                          | H8V-BLK1                                                                                                                                                                                    |
| Industry Canada ID (if applicable)                                                              | Not yet available, but coming                                                                                                                                                               |
| Technical Description (Please provide a brief description of the intended use of the equipment) | Quad-Band GSM(GSM850/900MHz, DCS1800MHz, PCS1900MHz) and Dual-band UMTS (FDDI, FDDII, FDDV) and Tri-Band LTE(B1, B4, B17) Multi Mode Cellular Phone with Bluetooth, W-LAN, and GPS receiver |

| EXTREME TEMPERATURE RANGE over which the equipment is to be type tested           |              |
|-----------------------------------------------------------------------------------|--------------|
| <input type="checkbox"/> -20°C to +55°C                                           |              |
| <input checked="" type="checkbox"/> Other (2)                                     |              |
| <input type="checkbox"/> Not applicable (no extreme temperature testing required) |              |
| Extreme temperature range for the host(s):                                        | -10C to +55C |

(2) The equipment shall be tested over the following temperature ranges :

- a) 0°C to +35°C for equipment for indoor use only, or intended for used in areas where the temperature is controlled within this range.
- b) Over the extremes of the temperature range(s) of the declared host equipment(s) in case of plug-in radio devices.

| TYPE OF ANTENNA                                                               |                                                                     |
|-------------------------------------------------------------------------------|---------------------------------------------------------------------|
| <input checked="" type="checkbox"/> Integral                                  |                                                                     |
| Temporary RF connector provided:                                              | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| <input type="checkbox"/> Antenna connector                                    |                                                                     |
| <input checked="" type="checkbox"/> Number of antenna assembly(ies) submitted |                                                                     |
| Gain of the antenna intended for normal use:                                  |                                                                     |
| -3 dBi for assembly identified as                                             | Bluetooth/WLAN                                                      |
| x dBi for assembly identified as                                              |                                                                     |
| x dBi for assembly identified as                                              |                                                                     |
| x dBi for assembly identified as                                              |                                                                     |
| x dBi for assembly identified as                                              |                                                                     |

| TRANSMITTER TECHNICAL CHARACTERISTICS           |                            |                  |
|-------------------------------------------------|----------------------------|------------------|
| TRANSMITTER OPERATING FREQUENCY RANGE(S)        |                            |                  |
|                                                 | FCC and/or Industry Canada | EU               |
| Bluetooth                                       | 2402 to 2480 MHz           | 2402 to 2480 MHz |
| WLAN                                            | 2412 to 2462 MHz           | 2412 to 2472 MHz |
| FCC and/or Industry Canada (only)               |                            |                  |
| Highest Internally Generated Frequency 2480 MHz |                            |                  |



| SPREAD SPECTRUM PARAMETERS                                                                                                                           |                                                                                                                                                                                                                                    |                                                                         |  |         |      |                  |   |  |               |   |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|--|---------|------|------------------|---|--|---------------|---|--|
| <input checked="" type="checkbox"/> <b>Bluetooth</b>                                                                                                 |                                                                                                                                                                                                                                    | Version: 2.1                                                            |  |         |      |                  |   |  |               |   |  |
| FHSS:                                                                                                                                                | Channel <input checked="" type="checkbox"/> 79 Other                                                                                                                                                                               | EDR <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |  |         |      |                  |   |  |               |   |  |
| <b>Medium Access Protocol (Customer Declaration)</b>                                                                                                 |                                                                                                                                                                                                                                    |                                                                         |  |         |      |                  |   |  |               |   |  |
| "We have implemented Bluetooth protocol which satisfies the medium access protocol requirement of EN 300 328".                                       |                                                                                                                                                                                                                                    |                                                                         |  |         |      |                  |   |  |               |   |  |
| <input checked="" type="checkbox"/> <b>WLAN</b>                                                                                                      |                                                                                                                                                                                                                                    |                                                                         |  |         |      |                  |   |  |               |   |  |
| IEEE 802.11(b) – DSSS <input checked="" type="checkbox"/>                                                                                            |                                                                                                                                                                                                                                    |                                                                         |  |         |      |                  |   |  |               |   |  |
| IEEE 802.11(g) – OFDM <input checked="" type="checkbox"/>                                                                                            |                                                                                                                                                                                                                                    |                                                                         |  |         |      |                  |   |  |               |   |  |
| IEEE 802.11(n) – OFDM <input checked="" type="checkbox"/>                                                                                            |                                                                                                                                                                                                                                    |                                                                         |  |         |      |                  |   |  |               |   |  |
| Supported Spatial Streams                                                                                                                            | <table border="1"> <thead> <tr> <th></th> <th>2.4 GHz</th> <th>5GHz</th> </tr> </thead> <tbody> <tr> <td>Transmitter (Tx)</td> <td>1</td> <td></td> </tr> <tr> <td>Receiver (Rx)</td> <td>1</td> <td></td> </tr> </tbody> </table> |                                                                         |  | 2.4 GHz | 5GHz | Transmitter (Tx) | 1 |  | Receiver (Rx) | 1 |  |
|                                                                                                                                                      | 2.4 GHz                                                                                                                                                                                                                            | 5GHz                                                                    |  |         |      |                  |   |  |               |   |  |
| Transmitter (Tx)                                                                                                                                     | 1                                                                                                                                                                                                                                  |                                                                         |  |         |      |                  |   |  |               |   |  |
| Receiver (Rx)                                                                                                                                        | 1                                                                                                                                                                                                                                  |                                                                         |  |         |      |                  |   |  |               |   |  |
| GI (Guard Interval)                                                                                                                                  | <input checked="" type="checkbox"/> 800 ns <input type="checkbox"/> 400 ns                                                                                                                                                         |                                                                         |  |         |      |                  |   |  |               |   |  |
| Band Width                                                                                                                                           | <input checked="" type="checkbox"/> 20 MHz <input type="checkbox"/> 40 MHz                                                                                                                                                         |                                                                         |  |         |      |                  |   |  |               |   |  |
| <b>Medium Access Protocol (Customer Declaration)</b>                                                                                                 |                                                                                                                                                                                                                                    |                                                                         |  |         |      |                  |   |  |               |   |  |
| "We have implemented IEEE 802.11 (b/g/n) protocol which satisfies the medium access protocol requirement of EN 300 328".                             |                                                                                                                                                                                                                                    |                                                                         |  |         |      |                  |   |  |               |   |  |
| <input type="checkbox"/> <b>Other Technology</b>                                                                                                     |                                                                                                                                                                                                                                    |                                                                         |  |         |      |                  |   |  |               |   |  |
| <input type="checkbox"/> Direct Sequence <input type="checkbox"/> Frequency Hopping <input type="checkbox"/> Combined <input type="checkbox"/> Other |                                                                                                                                                                                                                                    |                                                                         |  |         |      |                  |   |  |               |   |  |
| DSSS                                                                                                                                                 | Chip Sequence Length                                                                                                                                                                                                               | bit                                                                     |  |         |      |                  |   |  |               |   |  |
|                                                                                                                                                      | Spectrum Width                                                                                                                                                                                                                     | MHz                                                                     |  |         |      |                  |   |  |               |   |  |
| FHSS                                                                                                                                                 | Total Number of Hops                                                                                                                                                                                                               |                                                                         |  |         |      |                  |   |  |               |   |  |
|                                                                                                                                                      | Dwell Time                                                                                                                                                                                                                         | ms                                                                      |  |         |      |                  |   |  |               |   |  |
|                                                                                                                                                      | Bandwidth Per Hop                                                                                                                                                                                                                  | MHz                                                                     |  |         |      |                  |   |  |               |   |  |
|                                                                                                                                                      | Maximum Separation of Hops                                                                                                                                                                                                         | MHz for ETSI EN 300 328                                                 |  |         |      |                  |   |  |               |   |  |
| Other                                                                                                                                                |                                                                                                                                                                                                                                    |                                                                         |  |         |      |                  |   |  |               |   |  |
| <b>Medium Access Protocol (Customer Declaration)</b>                                                                                                 |                                                                                                                                                                                                                                    |                                                                         |  |         |      |                  |   |  |               |   |  |
| "We have implemented a protocol which satisfies the medium access protocol requirement of EN 300 328".                                               |                                                                                                                                                                                                                                    |                                                                         |  |         |      |                  |   |  |               |   |  |



| TRANSMITTER POWER CHARACTERISTICS                               |         |                                     |                                  |                                     |    |
|-----------------------------------------------------------------|---------|-------------------------------------|----------------------------------|-------------------------------------|----|
| <b>Bluetooth</b>                                                |         |                                     |                                  |                                     |    |
| Maximum Rated Transmitter Output                                |         |                                     |                                  |                                     |    |
| Effective radiated power (for equipment with antenna connector) |         |                                     |                                  |                                     | W  |
| Effective radiated power (for equipment with integral antenna)  |         | 0,001                               |                                  |                                     | W  |
| Minimum Rated Transmitter Output                                |         |                                     |                                  |                                     |    |
| Effective radiated power (for equipment with antenna connector) |         |                                     |                                  |                                     | W  |
| Effective radiated power (for equipment with integral antenna)  |         | 0,001                               |                                  |                                     | W  |
| Is transmitter intended for :                                   |         |                                     |                                  |                                     |    |
| Continuous duty                                                 |         | <input checked="" type="checkbox"/> | Yes                              | <input type="checkbox"/>            | No |
| Intermittent duty                                               |         | <input type="checkbox"/>            | Yes                              | <input checked="" type="checkbox"/> | No |
| If intermittent state DUTY CYCLE                                |         |                                     |                                  |                                     |    |
| Transmitter ON                                                  | seconds |                                     | Transmitter OFF                  | minutes                             |    |
| Is continuous operation possible for testing purposes?          |         |                                     |                                  |                                     |    |
|                                                                 |         | <input checked="" type="checkbox"/> | Yes                              | <input type="checkbox"/>            | No |
| Is transmitter output power variable:                           |         |                                     |                                  |                                     |    |
|                                                                 |         | <input type="checkbox"/>            | Yes                              | <input checked="" type="checkbox"/> | No |
| State during the test:                                          |         |                                     |                                  |                                     |    |
| Transmitter duty cycle                                          | Tx on   | Seconds                             | Tx Off                           | Seconds                             |    |
| Duty cycle (Tx on / (Tx on + Tx off))                           |         |                                     |                                  |                                     |    |
|                                                                 |         | %                                   |                                  |                                     |    |
| <input type="checkbox"/> Continuously variable                  |         |                                     | <input type="checkbox"/> Stepped |                                     |    |
| dB per step                                                     |         |                                     |                                  |                                     |    |
| <b>WLAN</b>                                                     |         |                                     |                                  |                                     |    |
| Maximum Rated Transmitter Output                                |         |                                     |                                  |                                     |    |
| Effective radiated power (for equipment with antenna connector) |         |                                     |                                  |                                     | W  |
| Effective radiated power (for equipment with integral antenna)  |         | 0,01                                |                                  |                                     | W  |
| Minimum Rated Transmitter Output                                |         |                                     |                                  |                                     |    |
| Effective radiated power (for equipment with antenna connector) |         |                                     |                                  |                                     | W  |
| Effective radiated power (for equipment with integral antenna)  |         | 0,01                                |                                  |                                     | W  |
| Is transmitter intended for :                                   |         |                                     |                                  |                                     |    |
| Continuous duty                                                 |         | <input checked="" type="checkbox"/> | Yes                              | <input type="checkbox"/>            | No |
| Intermittent duty                                               |         | <input type="checkbox"/>            | Yes                              | <input checked="" type="checkbox"/> | No |
| If intermittent state DUTY CYCLE                                |         |                                     |                                  |                                     |    |
| Transmitter ON                                                  | seconds |                                     | Transmitter OFF                  | minutes                             |    |
| Is continuous operation possible for testing purposes?          |         |                                     |                                  |                                     |    |
|                                                                 |         | <input checked="" type="checkbox"/> | Yes                              | <input type="checkbox"/>            | No |
| Is transmitter output power variable:                           |         |                                     |                                  |                                     |    |
|                                                                 |         | <input type="checkbox"/>            | Yes                              | <input checked="" type="checkbox"/> | No |
| State during the test:                                          |         |                                     |                                  |                                     |    |
| Transmitter duty cycle                                          | Tx on   | Seconds                             | Tx Off                           | Seconds                             |    |
| Duty cycle (Tx on / (Tx on + Tx off))                           |         |                                     |                                  |                                     |    |
|                                                                 |         | %                                   |                                  |                                     |    |
| <input type="checkbox"/> Continuously variable                  |         |                                     | <input type="checkbox"/> Stepped |                                     |    |
| dB per step                                                     |         |                                     |                                  |                                     |    |



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| TRANSMITTER POWER SOURCE (3)                                                         |                                      |             |    |  |
|--------------------------------------------------------------------------------------|--------------------------------------|-------------|----|--|
| <input checked="" type="checkbox"/> Common power source for transmitter and receiver |                                      |             |    |  |
| <input type="checkbox"/> AC mains                                                    | State voltage                        |             |    |  |
| AC supply frequency (Hz)                                                             | VAC                                  | Max Current | Hz |  |
| <input type="checkbox"/> Single phase                                                | <input type="checkbox"/> Three phase |             |    |  |
| And / Or                                                                             |                                      |             |    |  |
| <input type="checkbox"/> External DC supply                                          |                                      |             |    |  |
| Nominal voltage                                                                      | Max Current                          | A           |    |  |
| Extreme upper voltage                                                                | Extreme lower voltage                |             |    |  |
| Battery                                                                              |                                      |             |    |  |
| <input type="checkbox"/> Nickel Cadmium                                              |                                      |             |    |  |
| <input type="checkbox"/> Lead acid (Vehicle regulated)                               |                                      |             |    |  |
| <input type="checkbox"/> Alkaline                                                    |                                      |             |    |  |
| <input checked="" type="checkbox"/> Lithium                                          |                                      |             |    |  |
| <input type="checkbox"/> Other Details :                                             |                                      |             |    |  |
| 3.8                                                                                  | Volts nominal.                       |             |    |  |
| End point voltage as quoted by equipment manufacturer                                | 3.8                                  | V           |    |  |

(3) If a transmitter and receiver use the same power source, this should be declared. In such cases only the box for the transmitter power source should be filled in.

| AUTOMATIC EQUIPMENT SWITCH OFF                                                                                                                                                                                   |      |                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------------------|
| If the equipment is designed to automatically switch off at a predetermined voltage level which is higher or lower in value than the battery minimum and minimum calculated values this shall be clearly stated. |      |                   |
| <input checked="" type="checkbox"/> Applies                                                                                                                                                                      | 3.3V | V cut-off voltage |
| <input type="checkbox"/> Does not apply                                                                                                                                                                          |      |                   |



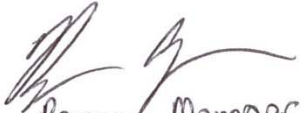
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| RECEIVER POWER SOURCE (4)                              |               |                                      |             |    |
|--------------------------------------------------------|---------------|--------------------------------------|-------------|----|
| <input type="checkbox"/> AC mains                      | State voltage |                                      |             |    |
| AC supply frequency                                    | (Hz)          | VAC                                  | Max Current | Hz |
| <input type="checkbox"/> Single phase                  |               | <input type="checkbox"/> Three phase |             |    |
| And / Or                                               |               |                                      |             |    |
| <input type="checkbox"/> External DC supply            |               |                                      |             |    |
| Nominal voltage                                        |               | Max Current                          | A           |    |
| Extreme upper voltage                                  |               | Extreme lower voltage                |             |    |
| Battery                                                |               |                                      |             |    |
| <input type="checkbox"/> Nickel Cadmium                |               |                                      |             |    |
| <input type="checkbox"/> Lead acid (Vehicle regulated) |               |                                      |             |    |
| <input type="checkbox"/> Alkaline                      |               |                                      |             |    |
| <input type="checkbox"/> Lithium                       |               |                                      |             |    |
| <input type="checkbox"/> Other Details :               |               |                                      |             |    |
| Volts nominal.                                         |               |                                      |             |    |
| End point voltage as quoted by equipment manufacturer  |               | V                                    |             |    |

(4) If a transmitter and receiver use the same power source, this should be declared. In such cases only the box for the transmitter power source should be filled in.

| AUTOMATIC EQUIPMENT SWITCH OFF                                                                                                                                                                                   |                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| If the equipment is designed to automatically switch off at a predetermined voltage level which is higher or lower in value than the battery minimum and minimum calculated values this shall be clearly stated. |                   |
| <input type="checkbox"/> Applies                                                                                                                                                                                 | V cut-off voltage |
| <input type="checkbox"/> Does not apply                                                                                                                                                                          |                   |

I hereby declare that I am entitled to sign on behalf of the applicant and that the information supplied is correct and complete.

Signature:  Name: Brian Chapman  
 Position held: Program Manager Date: 12/13/13



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## **1.4 PRODUCT INFORMATION**

### **1.4.1 Technical Description**

The Equipment Under Test (EUT) was a The Boeing Company Black Smartphone. A full technical description can be found in the manufacturer's documentation.

## **1.5 TEST CONDITIONS**

For all tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. Tests were applied with the EUT situated in a shielded enclosure.

The EUT was powered from a 3.8 V DC supply.

FCC Accreditation  
90987 Octagon House, Fareham Test Laboratory

## **1.6 DEVIATIONS FROM THE STANDARD**

No deviations from the applicable test standard were made during testing.

## **1.7 MODIFICATION RECORD**

Modification 0 - No modifications were made to the test sample during testing.



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## **SECTION 2**

### **TEST DETAILS**

FCC Testing of the  
The Boeing Company Black Smartphone  
In accordance with FCC CFR 47 Part 15C (Bluetooth)



## **2.1 AC LINE CONDUCTED EMISSIONS**

### **2.1.1 Specification Reference**

FCC CFR 47 Part 15C, Clause 15.207

### **2.1.2 Equipment Under Test and Modification State**

Black Smartphone S/N: XCV23200791 - Modification State 0

### **2.1.3 Date of Test**

11 August 2013

### **2.1.4 Test Equipment Used**

The major items of test equipment used for the above tests are identified in Section 3.1.

### **2.1.5 Test Procedure**

The EUT is set up on a test table 800mm above a horizontal ground plane. A vertical ground plane is also required and is placed 400mm from the EUT. Where a EUT is floor standing it will be stood on but insulated from the ground plane by up to 12mm.

The EUT is powered through a Line Impedance Stabilisation Network (LISN) which is bonded to the ground plane. The EUT is located so that the distance between the EUT and the LISN is no less than 800mm. Where possible the cable between the mains input of the EUT and the LISN is 1m. Where this is not possible the cable is non inductively bundled with the bundle not exceeding 400mm in length.

A preliminary profile of the Conducted Emissions is obtained over the frequency range 150kHz to 30MHz. Any points of interest are noted for formal measurements.

During formal measurements, the measuring receiver is tuned to the emission of interest where Quasi – Peak and Average measurements are performed in a 9kHz Video and Resolution Bandwidth.

### **2.1.6 Environmental Conditions**

|                     |        |
|---------------------|--------|
| Ambient Temperature | 23.0°C |
| Relative Humidity   | 47.0%  |

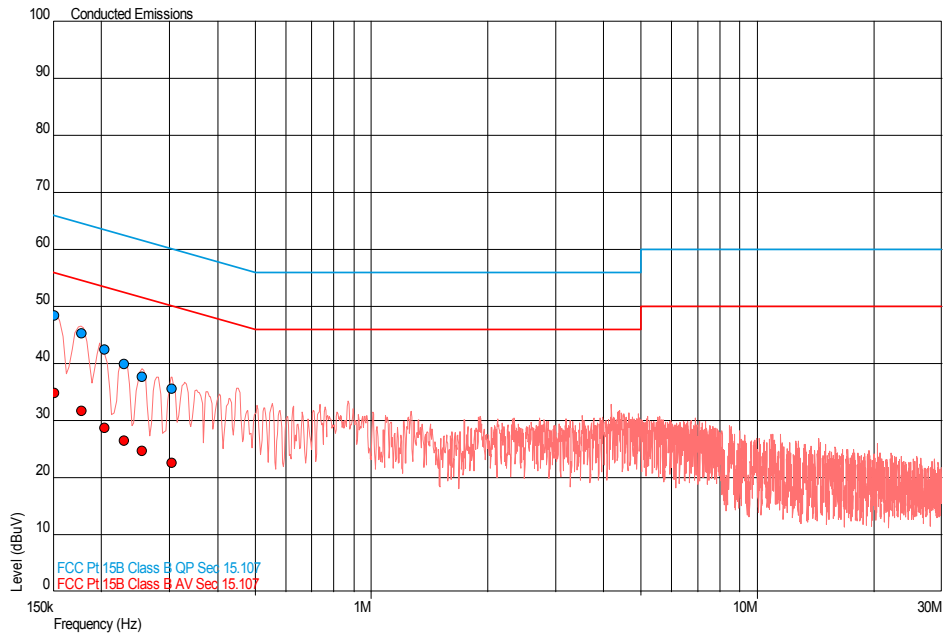


Product Service

2.1.7 Test Results

Bluetooth

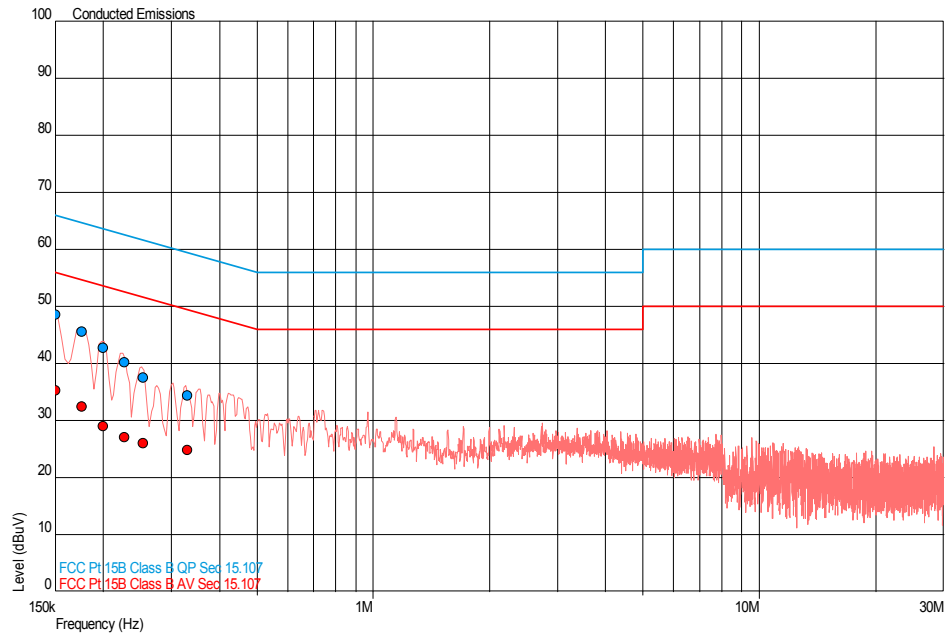
Live Line



| Frequency (MHz) | QP Level (dBμV) | QP Limit (dBμV) | QP Margin (dBμV) | AV Level (dBμV) | AV Limit (dBμV) | AV Margin (dBμV) |
|-----------------|-----------------|-----------------|------------------|-----------------|-----------------|------------------|
| 0.151           | 48.4            | 65.9            | -17.5            | 34.8            | 55.9            | -21.1            |
| 0.178           | 45.2            | 64.6            | -19.3            | 31.7            | 54.6            | -22.9            |
| 0.204           | 42.4            | 63.5            | -21.0            | 28.8            | 53.5            | -24.7            |
| 0.229           | 39.9            | 62.5            | -22.6            | 26.5            | 52.5            | -26.0            |
| 0.254           | 37.7            | 61.6            | -23.9            | 24.7            | 51.6            | -26.9            |
| 0.304           | 35.6            | 60.1            | -24.5            | 22.5            | 50.1            | -27.6            |



### Neutral Line



| Frequency (MHz) | QP Level (dBμV) | QP Limit (dBμV) | QP Margin (dBμV) | AV Level (dBμV) | AV Limit (dBμV) | AV Margin (dBμV) |
|-----------------|-----------------|-----------------|------------------|-----------------|-----------------|------------------|
| 0.150           | 48.5            | 66.0            | -17.5            | 35.3            | 56.0            | -20.7            |
| 0.176           | 45.5            | 64.7            | -19.1            | 32.4            | 54.7            | -22.2            |
| 0.200           | 42.7            | 63.6            | -20.9            | 29.0            | 53.6            | -24.6            |
| 0.227           | 40.2            | 62.5            | -22.4            | 27.1            | 52.5            | -25.4            |
| 0.253           | 37.5            | 61.6            | -24.1            | 26.0            | 51.6            | -25.6            |
| 0.329           | 34.4            | 59.5            | -25.1            | 24.8            | 49.5            | -24.7            |



## **2.2 FREQUENCY HOPPING SYSTEMS - 20DB BANDWIDTH AND CHANNEL SEPARATION**

### **2.2.1 Specification Reference**

FCC CFR 47 Part 15C, Clause 15.247 (a)(1)

### **2.2.2 Equipment Under Test and Modification State**

Black Smartphone S/N: XCV23200909 - Modification State 0

### **2.2.3 Date of Test**

12 August 2013 & 16 August 2013

### **2.2.4 Test Equipment Used**

The major items of test equipment used for the above tests are identified in Section 3.1.

### **2.2.5 Test Procedure**

The EUT was transmitted at maximum power via a cable to the Spectrum Analyser. The Analyser settings were adjusted to display the resultant trace on screen. The peak point of the trace was measured and the markers positioned to give the -20dBc points of the displayed spectrum.

The EUT was transmitted at maximum power into a Spectrum Analyser. The trace was set to Max Hold to store several adjacent channels on screen. Using the marker delta function, the markers were positioned to show the separation between adjacent channels.

### **2.2.6 Environmental Conditions**

|                     |               |
|---------------------|---------------|
| Ambient Temperature | 22.0 - 22.6°C |
| Relative Humidity   | 46.7 - 51.0%  |



Product Service

2.2.7 Test Results

Bluetooth

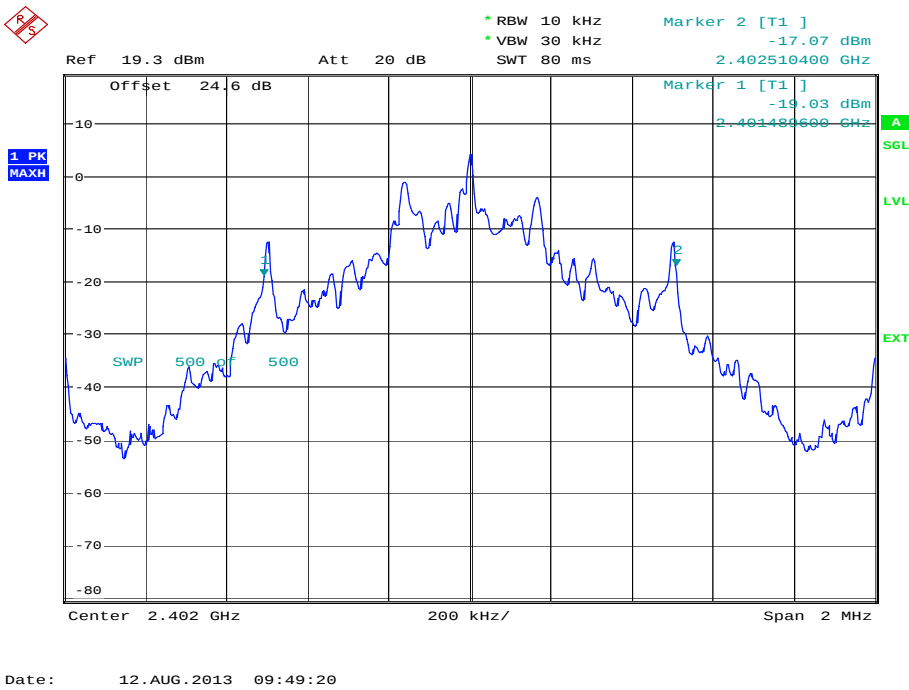
3.8 V DC Supply

20dB Bandwidth

2402 MHz

| Data Rate (Mbps) | 20dB Bandwidth (kHz) |
|------------------|----------------------|
| DH1              | 1020.8               |
| DH3              | 1020.8               |
| DH5              | 1020.8               |

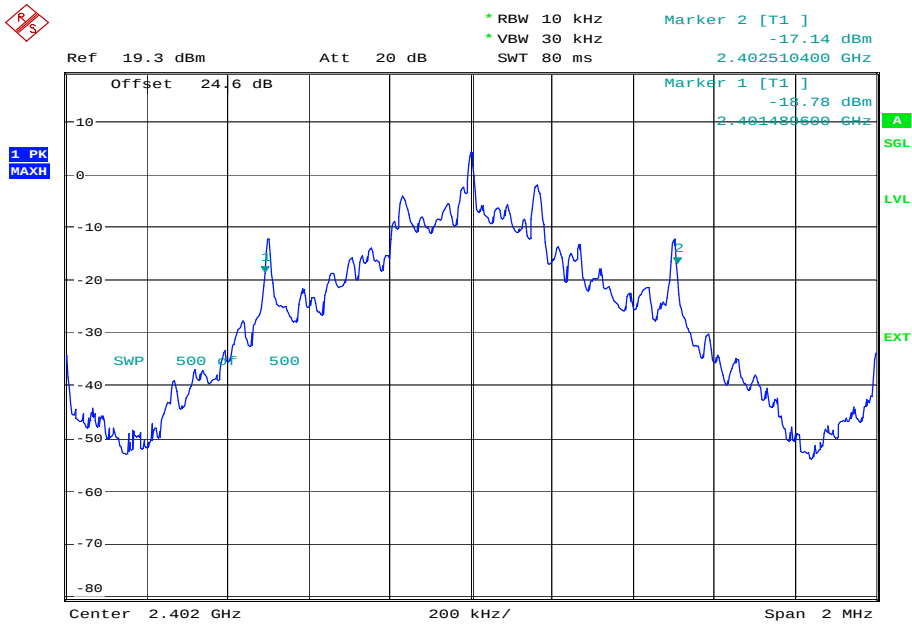
DH1





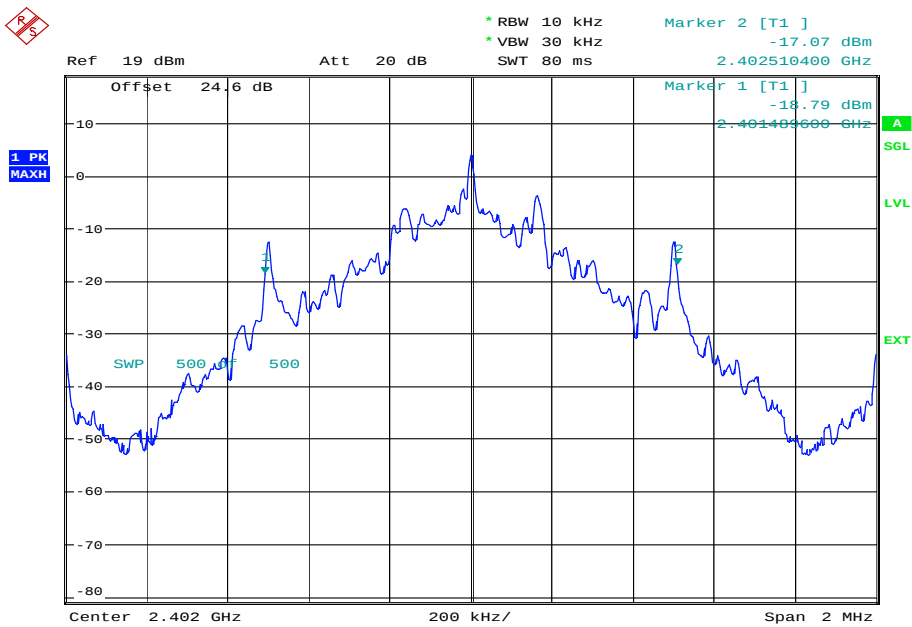
Product Service

DH3



Date: 12.AUG.2013 10:40:44

DH5



Date: 12.AUG.2013 15:53:30

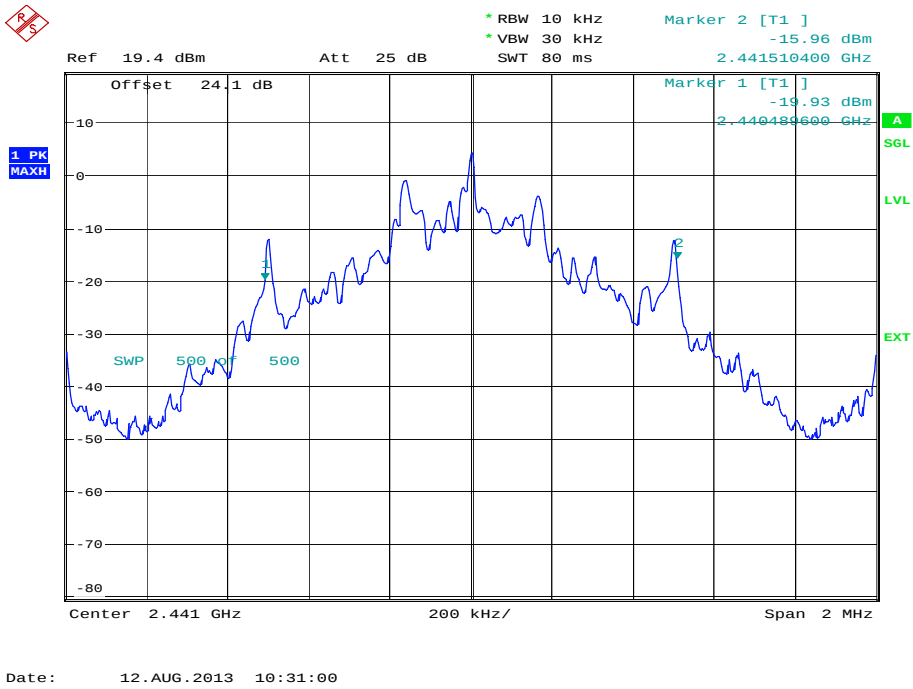


Product Service

2441 MHz

| Data Rate (Mbps) | 20dB Bandwidth (kHz) |
|------------------|----------------------|
| DH1              | 1020.8               |
| DH3              | 1020.8               |
| DH5              | 1024.0               |

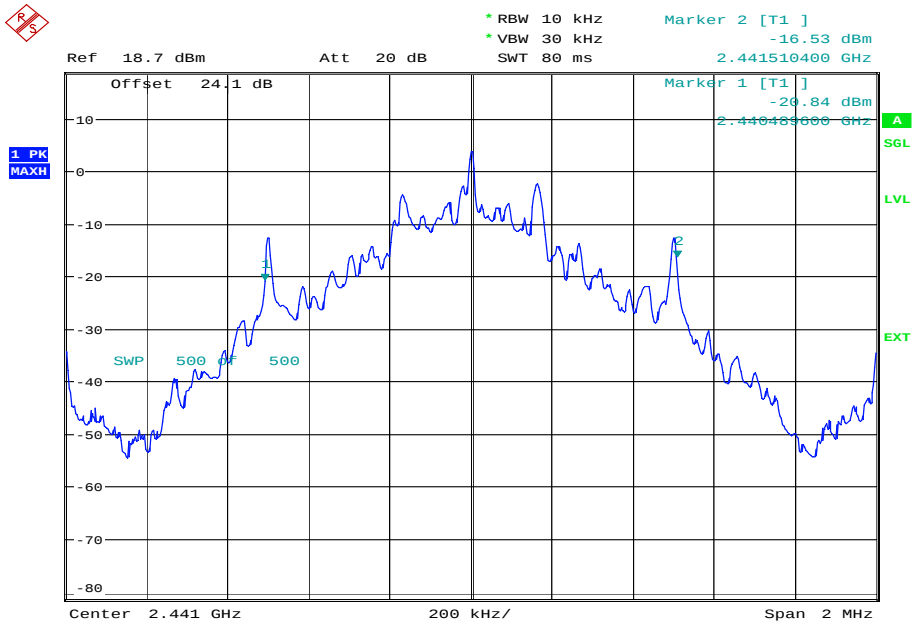
DH1





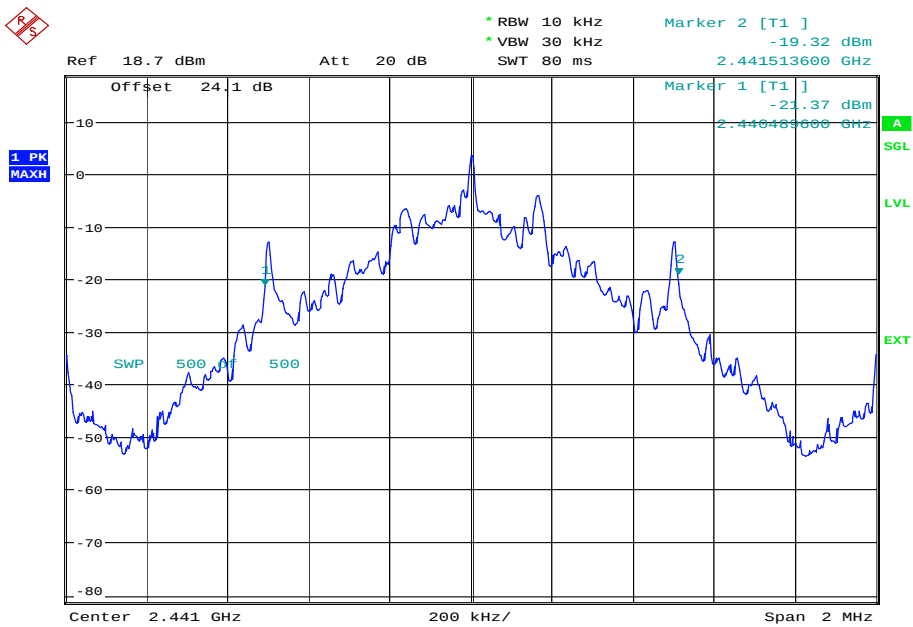
Product Service

DH3



Date: 12.AUG.2013 10:55:28

DH5



Date: 12.AUG.2013 16:07:58

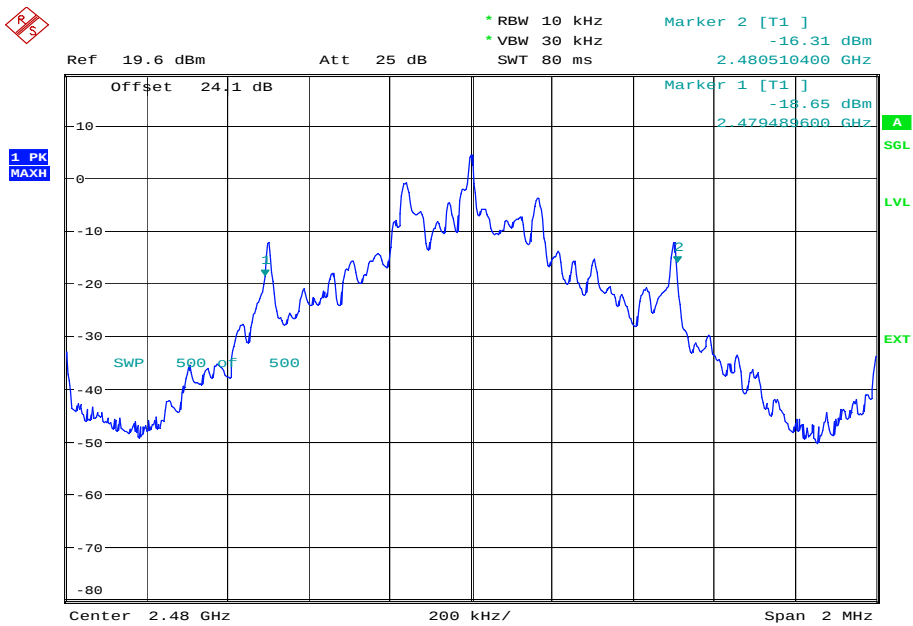


Product Service

2480 MHz

| Data Rate (Mbps) | 20dB Bandwidth (kHz) |
|------------------|----------------------|
| DH1              | 1020.8               |
| DH3              | 1020.8               |
| DH5              | 1024.0               |

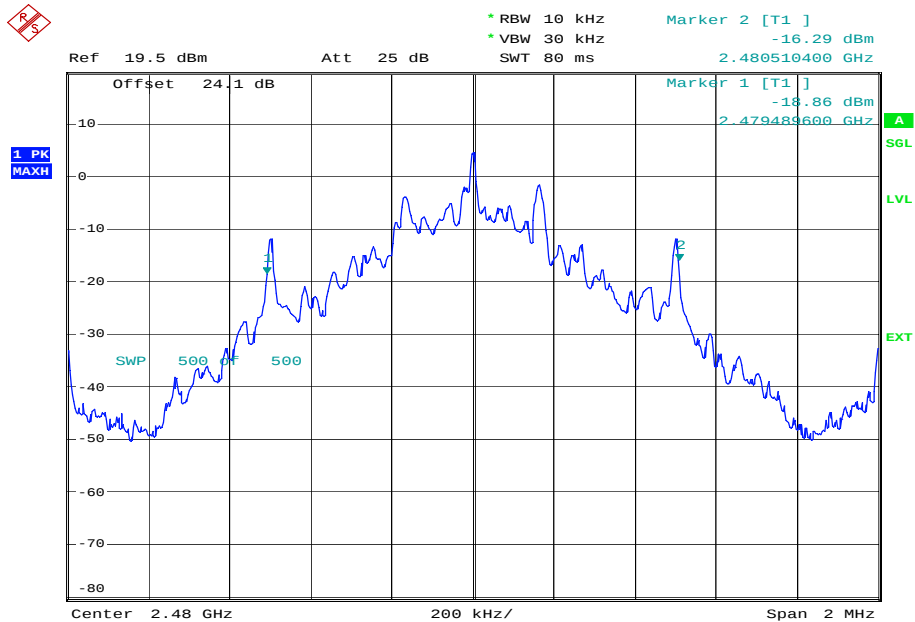
DH1



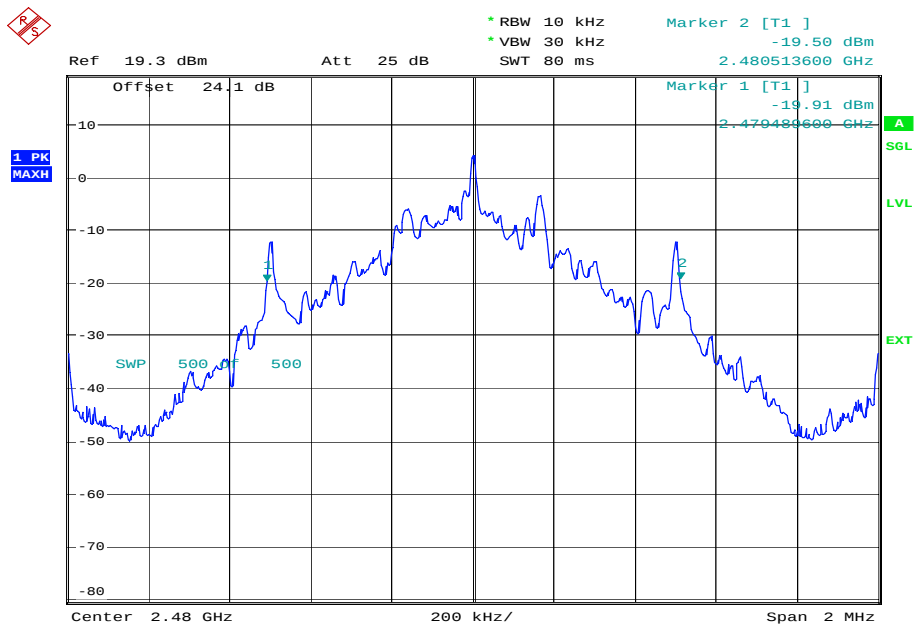
Date: 12.AUG.2013 11:01:28



Product Service

DH3

Date: 12.AUG.2013 11:02:56

DH5

Date: 12.AUG.2013 16:12:44

Limit Clause

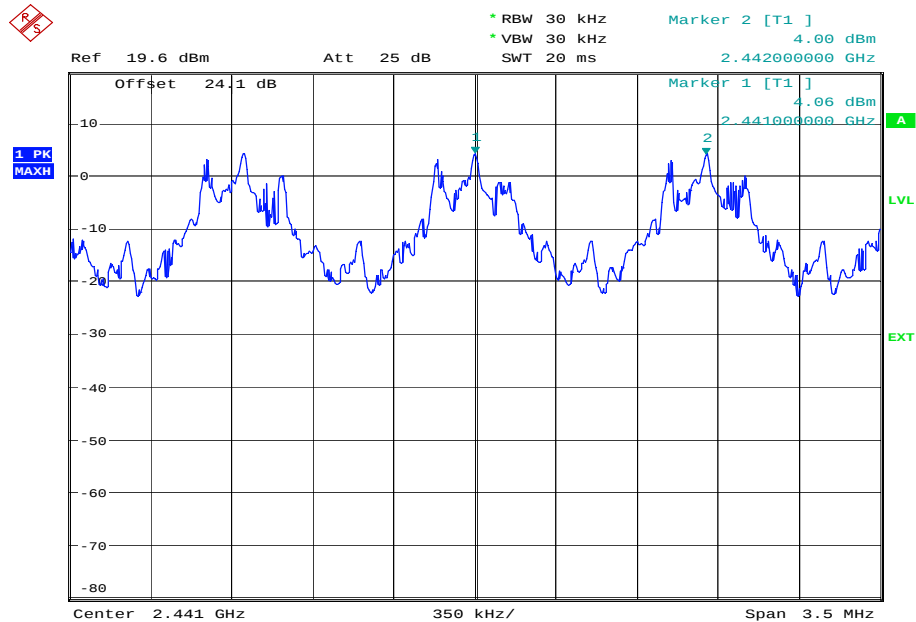
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater.



Product Service

### Channel Separation

Channel Separation: 1 MHz



Date: 12.AUG.2013 10:27:22

### Limit Clause

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 band 2400-2483.5 MHz 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 0.125 W.

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.



Product Service

Bluetooth - 2DHx

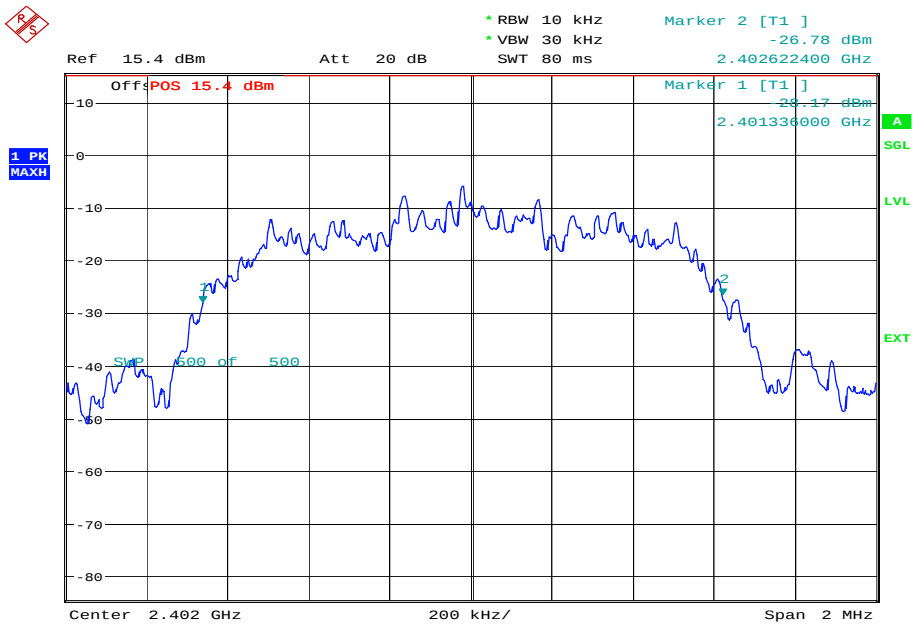
3.8 V DC Supply

20dB Bandwidth

2402 MHz

| Data Rate (Mbps) | 20dB Bandwidth (kHz) |
|------------------|----------------------|
| 2DH1             | 1286.4               |
| 2DH3             | 1324.8               |
| 2DH5             | 1324.8               |

2DH1

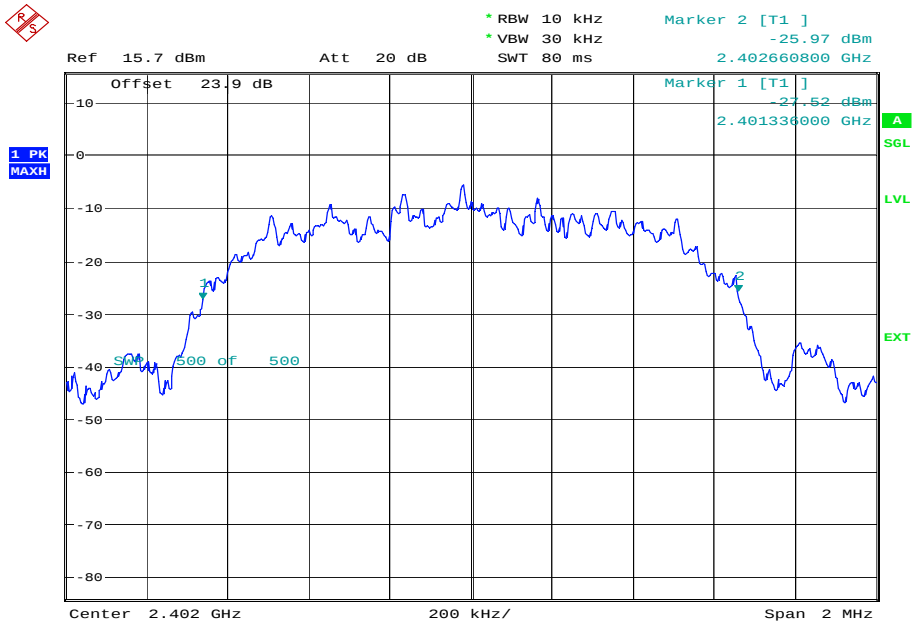


Date: 16.AUG.2013 12:48:23



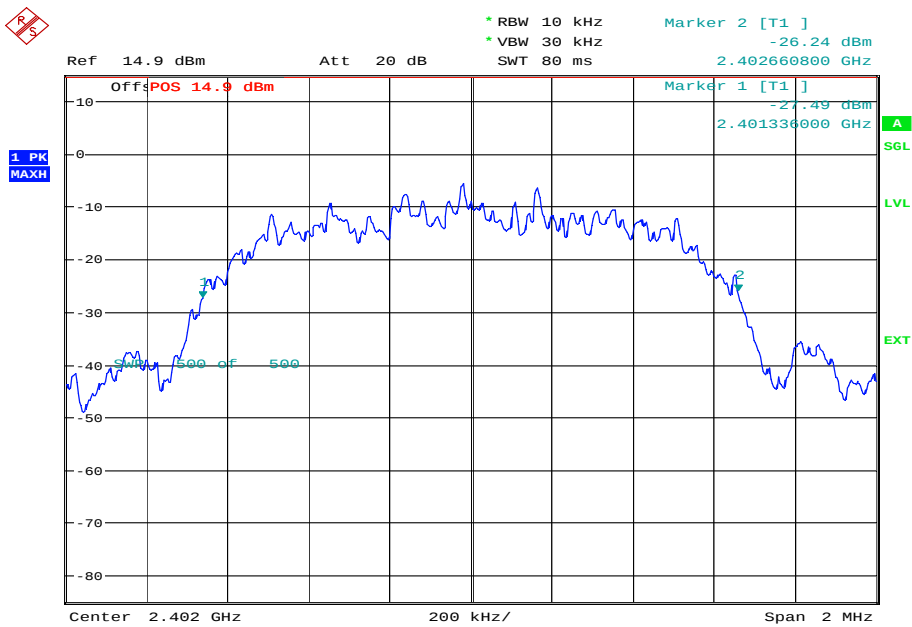
Product Service

2DH3



Date: 15.AUG.2013 10:23:40

2DH5



Date: 15.AUG.2013 10:56:20

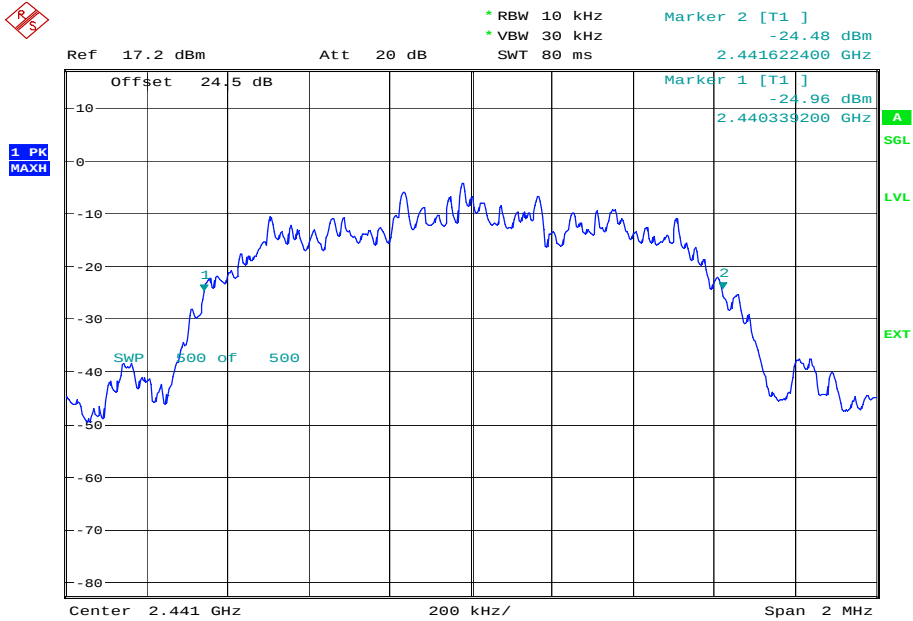


Product Service

2441 MHz

| Data Rate (Mbps) | 20dB Bandwidth (kHz) |
|------------------|----------------------|
| 2DH1             | 1283.2               |
| 2DH3             | 1324.8               |
| 2DH5             | 1324.8               |

2DH1

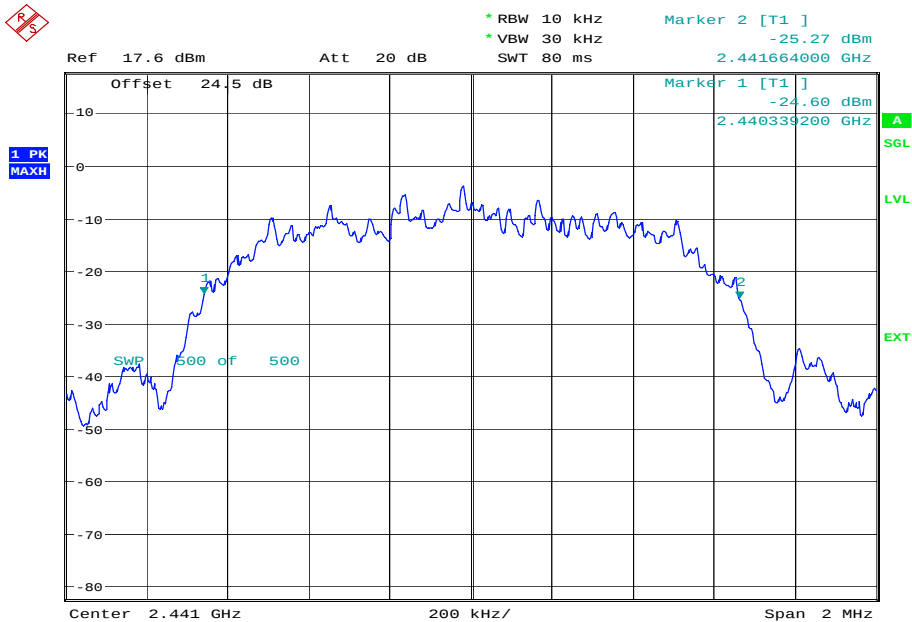


Date: 16.AUG.2013 12:50:26



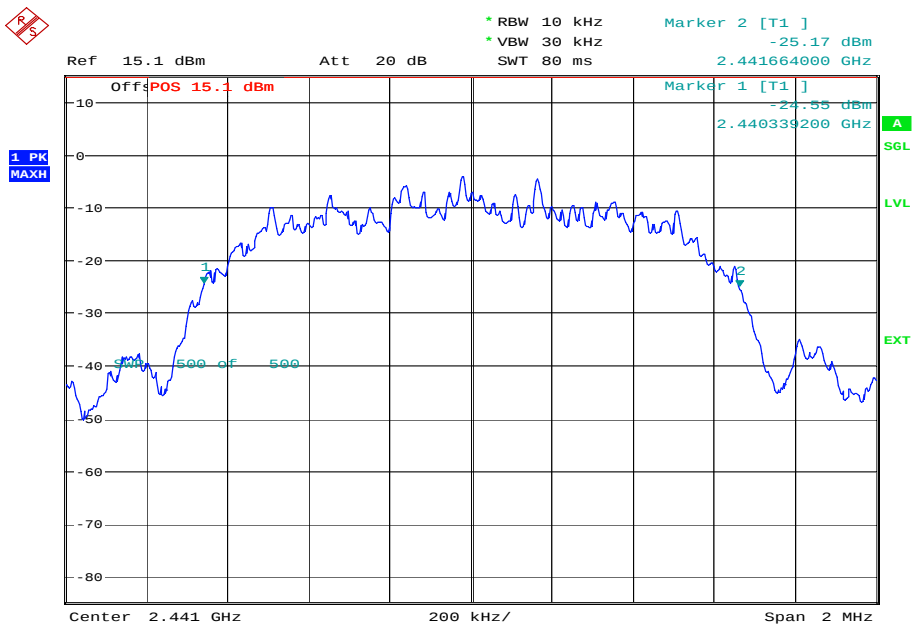
Product Service

2DH3



Date: 15.AUG.2013 10:49:53

2DH5



Date: 15.AUG.2013 10:58:23

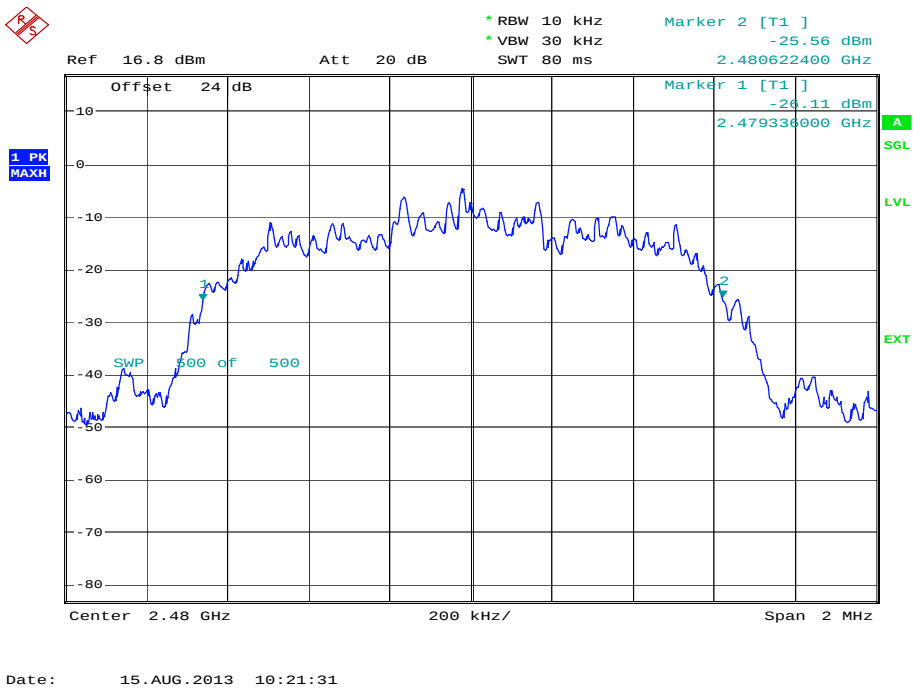


Product Service

2480 MHz

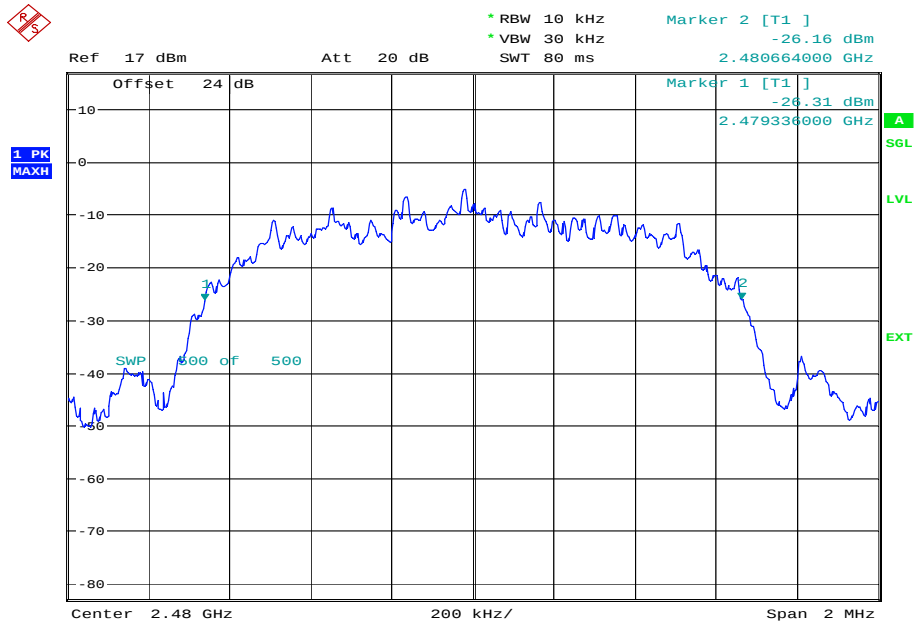
| Data Rate (Mbps) | 20dB Bandwidth (kHz) |
|------------------|----------------------|
| 2DH1             | 1286.4               |
| 2DH3             | 1328.0               |
| 2DH5             | 1328.0               |

2DH1

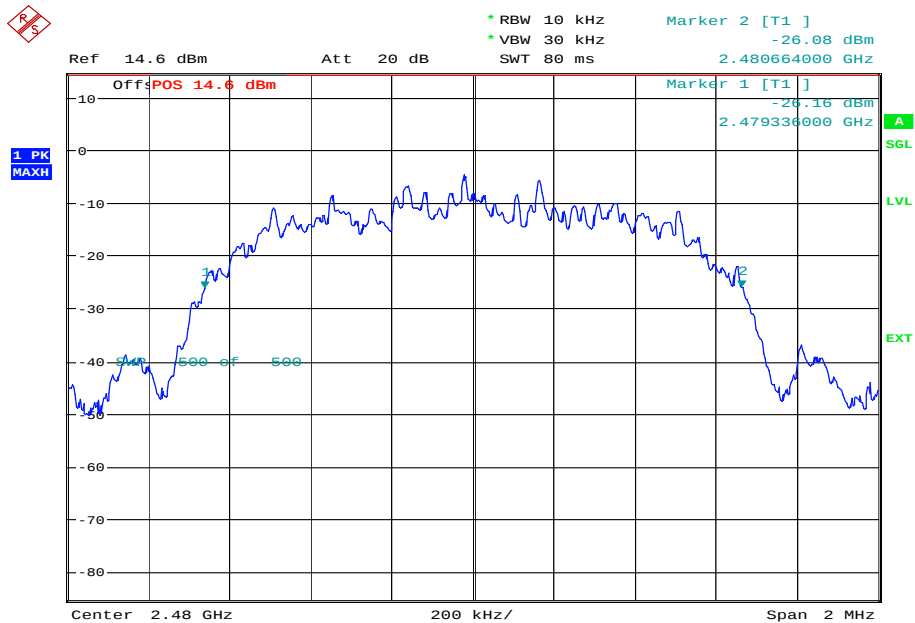




Product Service

2DH3

Date: 15.AUG.2013 10:51:29

2DH5

Date: 15.AUG.2013 11:00:37

Limit Clause

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater.



Product Service

Bluetooth - 3DHx

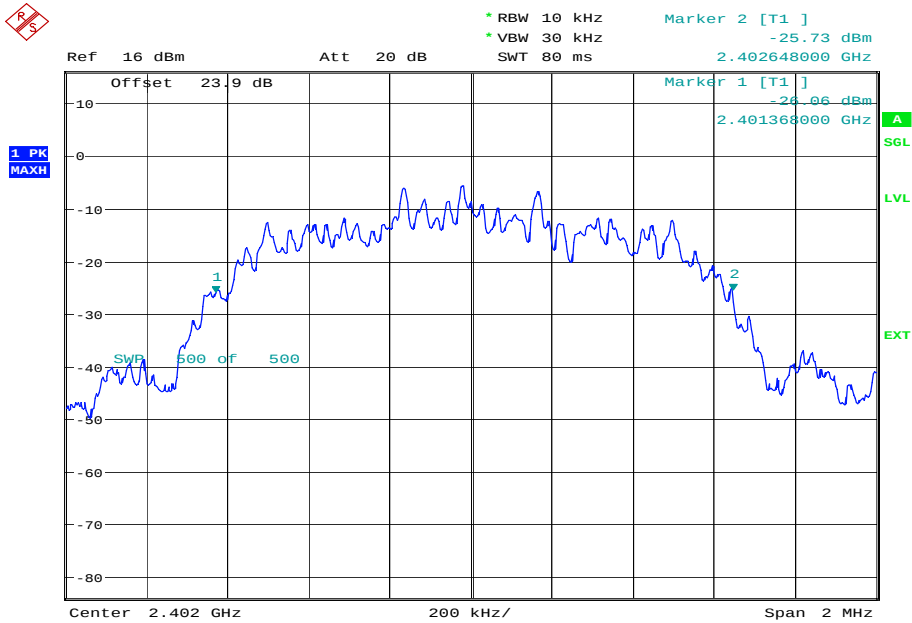
3.8 V DC Supply

20dB Bandwidth

2402 MHz

| Data Rate (Mbps) | 20dB Bandwidth (kHz) |
|------------------|----------------------|
| 3DH1             | 1280.0               |
| 3DH3             | 1296.0               |
| 3DH5             | 1296.0               |

3DH1

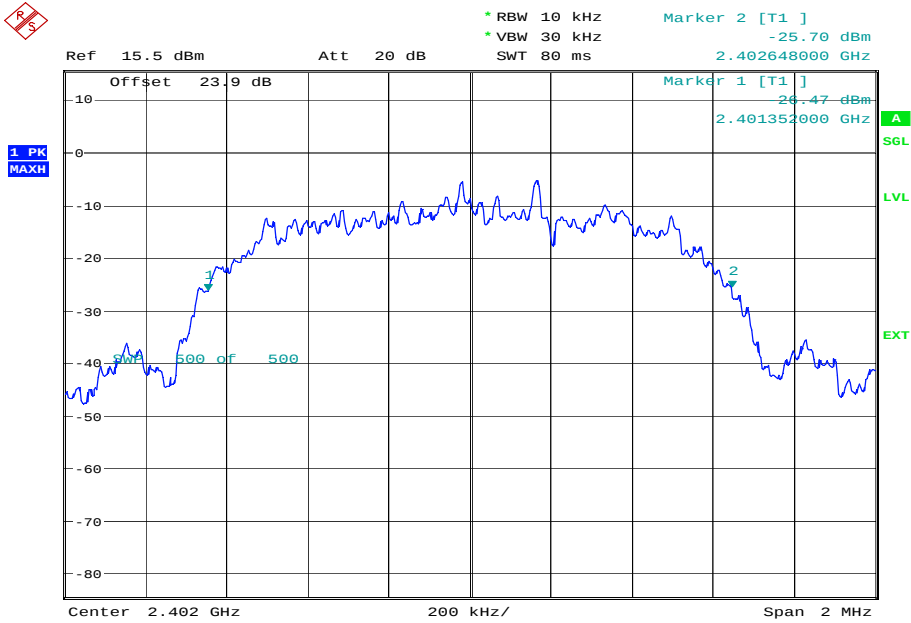


Date: 15.AUG.2013 11:03:05



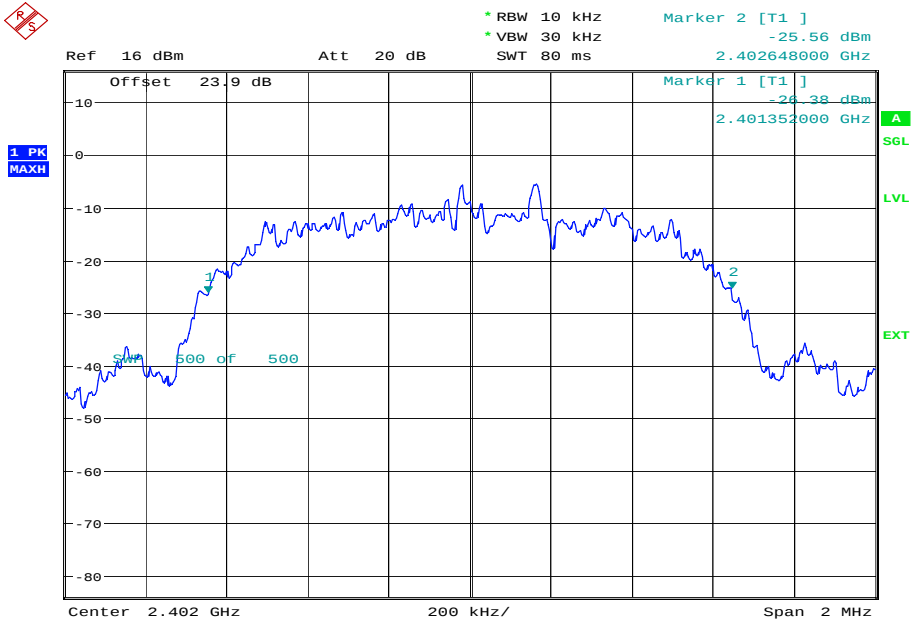
Product Service

3DH3



Date: 15.AUG.2013 11:09:10

3DH5



Date: 15.AUG.2013 11:14:58

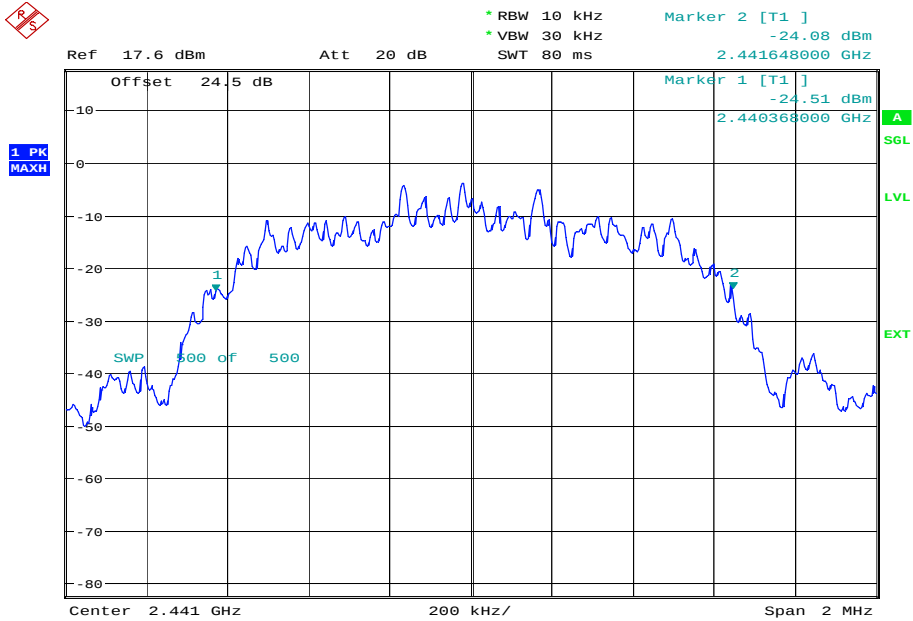


Product Service

2441 MHz

| Data Rate (Mbps) | 20dB Bandwidth (kHz) |
|------------------|----------------------|
| 3DH1             | 1280.0               |
| 3DH3             | 1296.0               |
| 3DH5             | 1318.4               |

3DH1

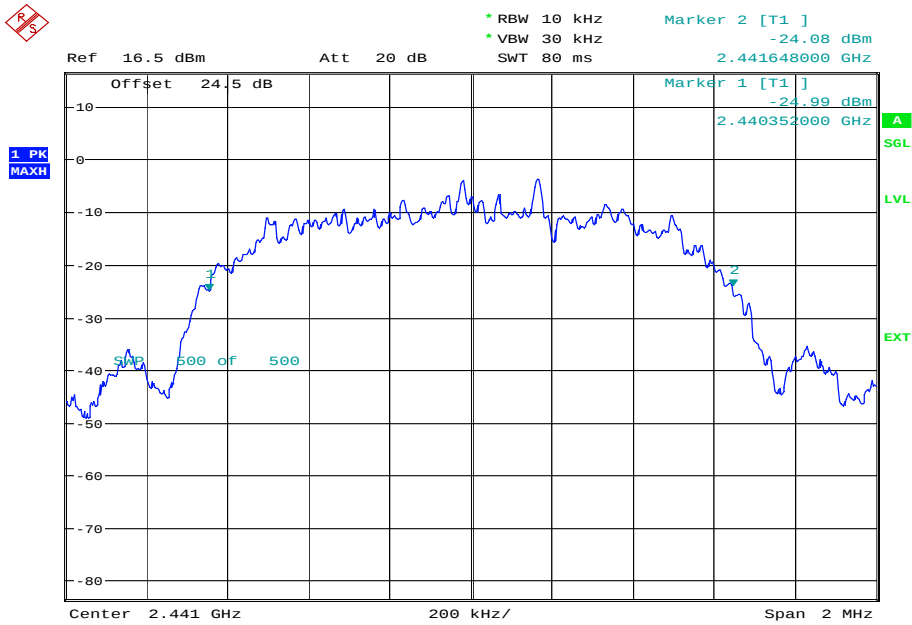


Date: 15.AUG.2013 11:05:35



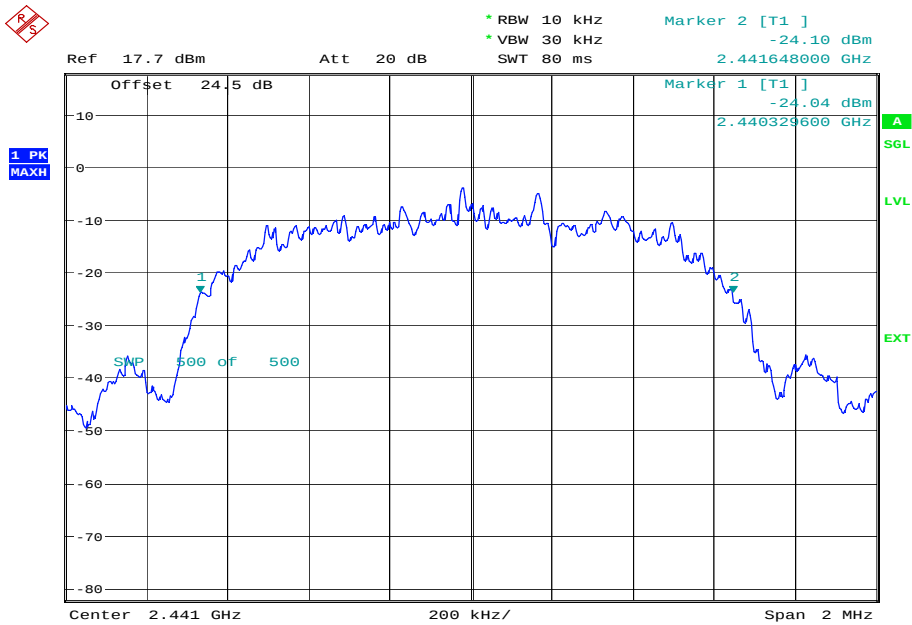
Product Service

3DH3



Date: 15.AUG.2013 11:11:25

3DH5



Date: 15.AUG.2013 11:17:07

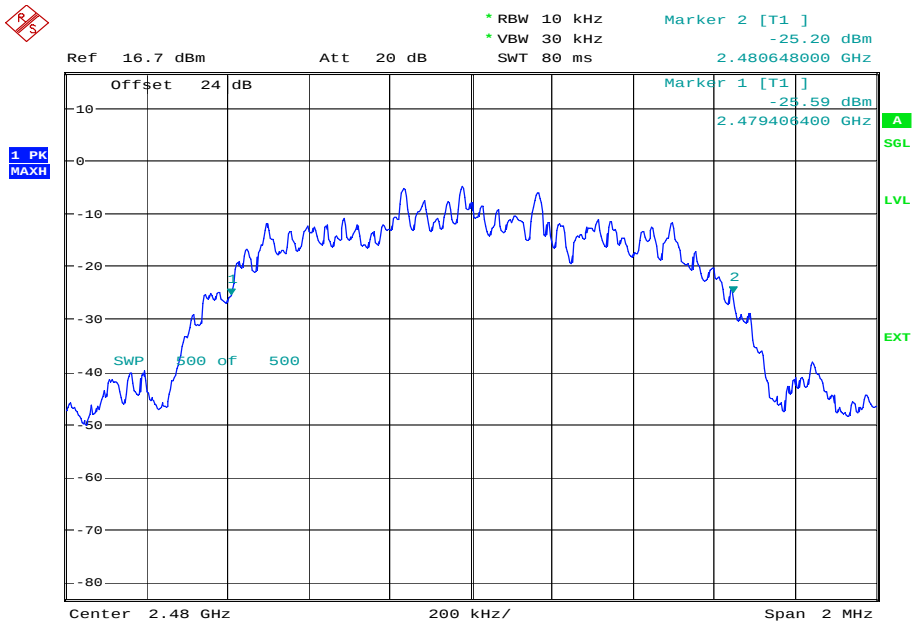


Product Service

2480 MHz

| Data Rate (Mbps) | 20dB Bandwidth (kHz) |
|------------------|----------------------|
| 3DH1             | 1241.6               |
| 3DH3             | 1315.2               |
| 3DH5             | 1324.8               |

3DH1

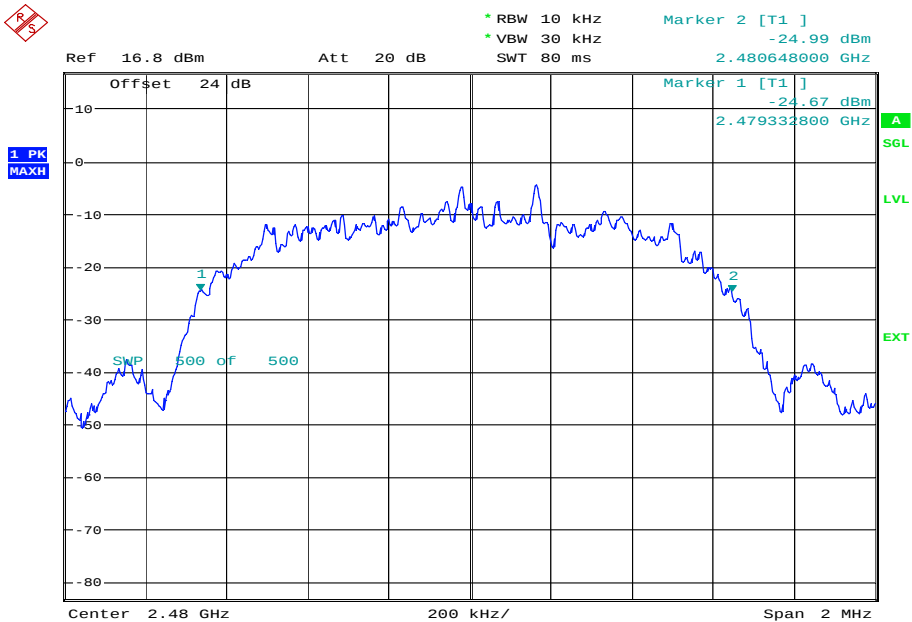


Date: 15.AUG.2013 11:07:09



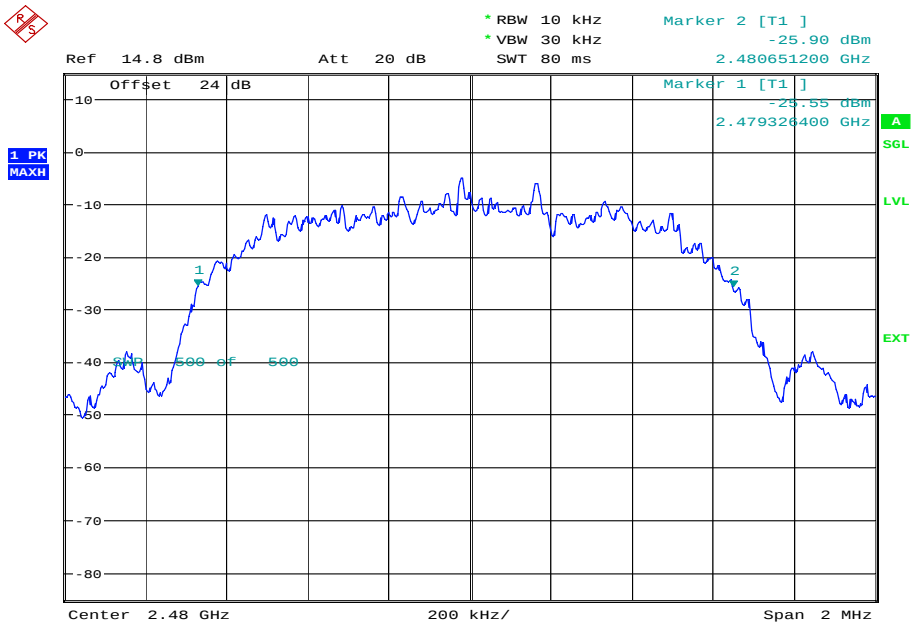
Product Service

3DH3



Date: 15.AUG.2013 11:12:54

3DH5



Date: 15.AUG.2013 11:18:40

Limit Clause

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater.



## 2.3 FREQUENCY HOPPING SYSTEMS - CHANNEL DWELL TIME AND NUMBER OF HOPPING CHANNELS

### 2.3.1 Specification Reference

FCC CFR 47 Part 15C, Clause 15.247 (a)(1)(iii)

### 2.3.2 Equipment Under Test and Modification State

Black Smartphone S/N: XCV23200909 - Modification State 0

### 2.3.3 Date of Test

12 August 2013 & 16 August 2013

### 2.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.3.5 Test Procedure

#### DH1

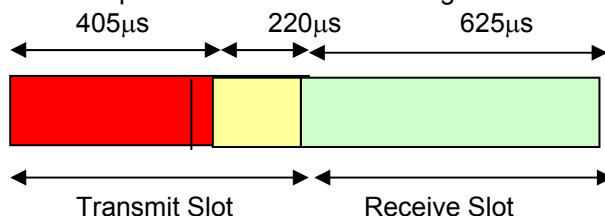
The Bluetooth system hops at a rate of 1600 times per second. Thus, this equates to 1600 timeslots in 1 second.

The DH1 data rate operates on a Transmit on 1 timeslot and Receive on 1 timeslot basis. Thus, in 1 second, there are 800 Transmit timeslots and 800 Receive timeslots.

Thus:

$$1 \text{ Timeslot} = \frac{1}{1600} = 625\mu\text{s}$$

In 1 transmit timeslot, the transmit on time is only 405 $\mu\text{s}$ . 220 $\mu\text{s}$  is reserved as off time for the synthesizer to re-tune ready for the next transmit frequency. The following timeslot is a receive slot. This process continues assuming the data rate remains the same.





### DH1 Timeslot Arrangement Showing One Complete Transmit and Receive Cycle

So, with 800 Tx and 800 Rx timeslots, the transmitter is on for  $800 \times 405\mu\text{s} = 0.324$  seconds.

$$\therefore \frac{\text{Total Tx Time On}}{\text{No of Channels}} = \frac{0.324}{80} = 4.05\text{ms}$$

So, in 32 seconds, the transmitter dwell time per channel is:

$$32 \times 4.05\text{ms} = 0.1296 \text{ seconds}$$

### DH3

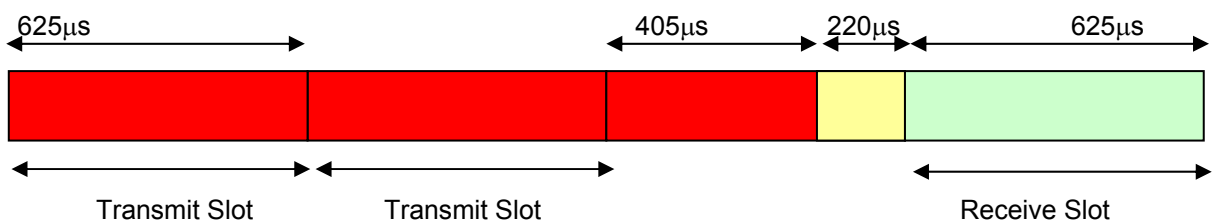
With data rate DH3, the data payload is higher and can use up to 3 timeslots. When more than one timeslot is used, the frequency does not hop and transmission is continuous on all 3 slots, (ie. no receive slot in-between the 3 transmit slots). The  $220\mu\text{s}$  off time for synthesizer re-tuning at the end of a slot is only used on the final slot. Thus, for one cycle, there are 3 transmit timeslots. 2 are  $625\mu\text{s}$  long and the final slot is transmitting for  $405\mu\text{s}$ .

The DH3 data rate operates on a Transmit on 3 timeslots and Receives on 1 timeslot basis, (assuming maximum data payload). The frequency-hopping rate is the same. Thus, in 1 second, there are 1200 Transmit timeslots and 400 Receive timeslots.

Thus:

$$1 \text{ Timeslot} = \frac{1}{1600} = 625\mu\text{s}$$

The first 2 Transmit timeslots are transmitting for the complete  $625\mu\text{s}$ . In the third transmit slot, the transmit on time is only  $405\mu\text{s}$ .  $220\mu\text{s}$  is reserved as off time for the synthesizer to re-tune ready for the next transmit frequency. The following timeslot is a receive slot. This process continues assuming the data rate remains the same.





### DH3 Timeslot Arrangement Showing One Complete Transmit and Receive Cycle, (Maximum Payload)

Thus, the transmitter for one complete transmit and receive cycle would be on for:

$$\text{Tx} \quad (2 \times 625\mu\text{s}) + (1 \times 405\mu\text{s}) = 1.655\text{ms}$$

So:

$$\begin{aligned} 800 \times 625\mu\text{s} &= 0.5 \text{ seconds} \\ 400 \times 405\mu\text{s} &= 0.162 \text{ seconds} \end{aligned}$$

Thus:  $0.5 + 0.162 = 0.662 \text{ seconds}$

$$\therefore \frac{\text{Total Tx Time On}}{\text{No Of Channels}} = \frac{0.662}{80} = 8.275\text{ms}$$

So, in 32 seconds, the transmitter dwell time per channel is:

$$32 \times 8.275\text{ms} = 0.2648 \text{ seconds}$$

### DH5

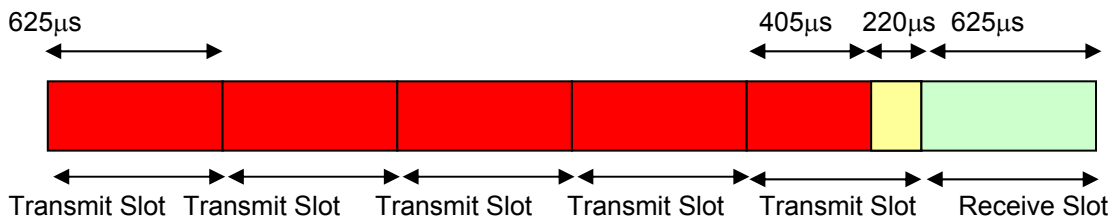
With data rate DH5, the data payload is higher and can use up to 5 timeslots. When more than one timeslot is used, the frequency does not hop and transmission is continuous on all 5 slots, (ie. no receive slot in-between the 5 transmit slots). The  $220\mu\text{s}$  off time for synthesizer re-tuning at the end of a slot is only used on the final slot. Thus, for one cycle, there are 5 transmit timeslots. 4 are  $625\mu\text{s}$  long and the final slot is transmitting for  $405\mu\text{s}$ .

The DH5 data rate operates on a Transmit on 5 timeslots and Receives on 1 timeslot basis, (assuming maximum data payload). The frequency-hopping rate is the same. Thus, in 1 second, there are 1333.3 Transmit timeslots and 266.7 Receive timeslots.

Thus:

$$1 \text{ Timeslot} = \frac{1}{1600} = 625\mu\text{s}$$

The first 4 Transmit timeslots are transmitting for the complete  $625\mu\text{s}$ . In the fifth transmit slot, the transmit on time is only  $405\mu\text{s}$ .  $220\mu\text{s}$  is reserved as off time for the synthesizer to re-tune ready for the next transmit frequency. The following timeslot is a receive slot. This process continues assuming the data rate remains the same.





DH5 Timeslot Arrangement Showing One Complete Transmit and Receive Cycle, (Maximum Payload)

Thus, the transmitter for one complete transmit and receive cycle would be on for:

$$\text{Tx} \quad (2 \times 625\mu\text{s}) + (1 \times 405\mu\text{s}) = 2.905\text{ms}$$

So:

$$1066.7 \times 625\mu\text{s} = 0.666 \text{ seconds}$$

$$266.7 \times 405\mu\text{s} = 0.108 \text{ seconds}$$

$$\text{Thus:} \quad 0.666 + 0.108 = 0.774 \text{ seconds}$$

$$\therefore \frac{\text{Total Tx Time On}}{\text{No Of Channels}} = \frac{0.774}{80} = 9.675\text{ms}$$

So, in 32 seconds, the transmitter dwell time per channel is:

$$32 \times 9.675\text{ms} = 0.31 \text{ seconds}$$

### 2.3.6 Environmental Conditions

Ambient Temperature 22.0 - 22.6°C

Relative Humidity 46.7 - 51.0%



Product Service

2.3.7 Test Results

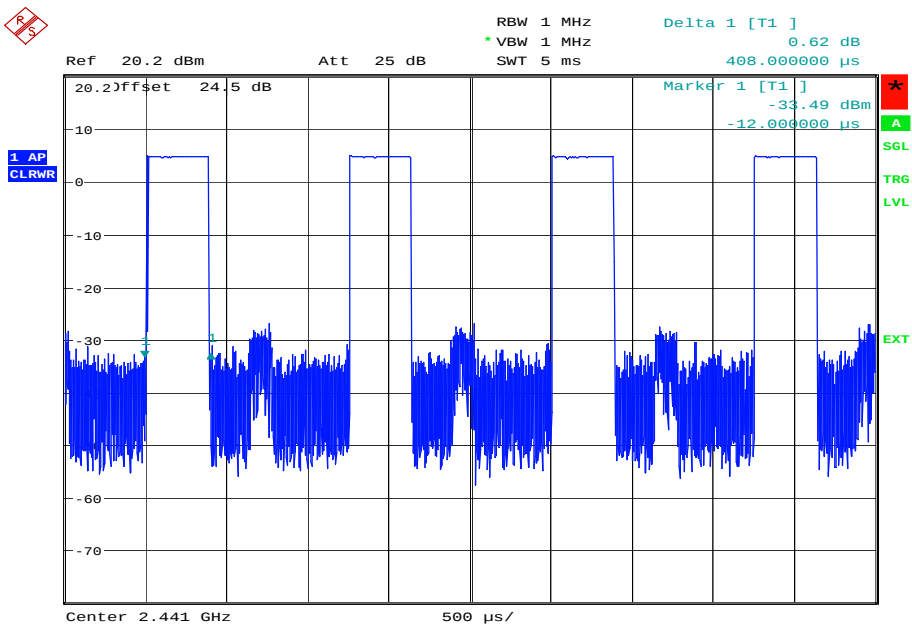
Bluetooth

3.8 V DC Supply

Channel Dwell Time

DH1

0.000408 ms



Date: 16.AUG.2013 10:33:38



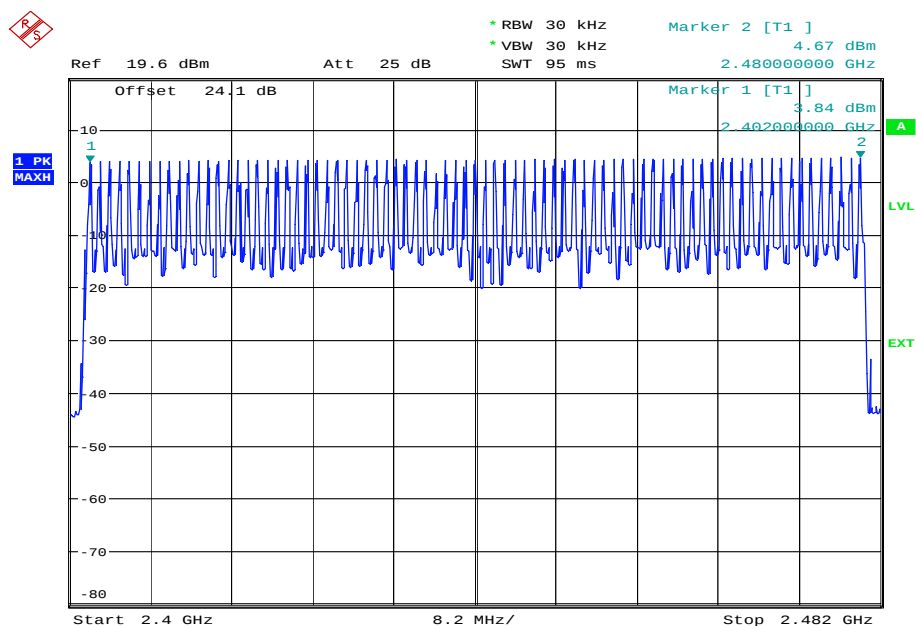


### Limit

Frequency hopping systems operating in the band 2400-2483.5 MHz shall use at least 15 hopping 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. Transmissions on particular hopping frequencies may be avoided or suppressed provided that a minimum of 15 hopping channels are used.

### Number of Hopping Channels

79



Date: 12.AUG.2013 10:19:44

### Limit

≥ 15 channels



Product Service

**2.4 MAXIMUM PEAK CONDUCTED OUTPUT POWER****2.4.1 Specification Reference**

FCC CFR 47 Part 15C, Clause 15.247 (b)(3)

**2.4.2 Equipment Under Test and Modification State**

Black Smartphone S/N: XCV23200909 - Modification State 0

**2.4.3 Date of Test**

12 August 2013 & 16 August 2013

**2.4.4 Test Equipment Used**

The major items of test equipment used for the above tests are identified in Section 3.1.

**2.4.5 Test Procedure**

The EUT was transmitted at maximum power via a cable to the Peak Power Meter. An offset was entered to account for the measurement path loss. The peak power was measured on bottom, middle and top channels and with the results recorded in the following tables.

**2.4.6 Environmental Conditions**

|                     |               |
|---------------------|---------------|
| Ambient Temperature | 22.0 - 22.3°C |
| Relative Humidity   | 46.7 - 51.0%  |



## 2.4.7 Test Results

### Bluetooth

3.8 V DC Supply

| Packet Type | Maximum Peak Conducted Output Power |          |          |             |             |             |
|-------------|-------------------------------------|----------|----------|-------------|-------------|-------------|
|             | dBm                                 |          |          | mW          |             |             |
|             | 2402 MHz                            | 2441 MHz | 2480 MHz | 2402 MHz    | 2441 MHz    | 2480 MHz    |
| DH1         | 9.22                                | 9.14     | 9.35     | 8.362143306 | 8.195700116 | 8.610553114 |
| DH3         | 8.93                                | 10.06    | 9.37     | 7.819875145 | 10.13805166 | 8.643674659 |
| DH5         | 8.94                                | 10.03    | 9.24     | 7.829334586 | 10.07517156 | 8.397636000 |

### Limit Clause

The maximum peak conducted output power of the intentional radiator shall not exceed the following:

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non overlapping hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

### Bluetooth - 2DHx

3.8 V DC Supply

| Packet Type | Maximum Peak Conducted Output Power |          |          |             |             |             |
|-------------|-------------------------------------|----------|----------|-------------|-------------|-------------|
|             | dBm                                 |          |          | mW          |             |             |
|             | 2402 MHz                            | 2441 MHz | 2480 MHz | 2402 MHz    | 2441 MHz    | 2480 MHz    |
| 2DH1        | 8.65                                | 9.80     | 9.06     | 7.332977374 | 9.556076483 | 8.050713691 |
| 2DH3        | 8.70                                | 9.81     | 9.05     | 7.416815967 | 9.565480044 | 8.029741235 |
| 2DH5        | 8.68                                | 9.89     | 9.00     | 7.383161222 | 9.754604665 | 7.951113391 |

### Limit Clause

The maximum peak conducted output power of the intentional radiator shall not exceed the following:

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non overlapping hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

Bluetooth - 3DHx

## 3.8 V DC Supply

| Packet Type | Maximum Peak Conducted Output Power |          |          |             |             |             |
|-------------|-------------------------------------|----------|----------|-------------|-------------|-------------|
|             | dBm                                 |          |          | mW          |             |             |
|             | 2402 MHz                            | 2441 MHz | 2480 MHz | 2402 MHz    | 2441 MHz    | 2480 MHz    |
| 3DH1        | 9.03                                | 10.11    | 9.34     | 7.991282266 | 10.24686820 | 8.594216778 |
| 3DH3        | 8.94                                | 10.22    | 9.28     | 7.834160702 | 10.53037676 | 8.478768175 |
| 3DH5        | 9.15                                | 10.22    | 9.24     | 8.221519174 | 10.50753608 | 8.393880905 |

Limit Clause

The maximum peak conducted output power of the intentional radiator shall not exceed the following:

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non overlapping hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.



Product Service

## **2.5 EIRP PEAK POWER**

### **2.5.1 Specification Reference**

FCC CFR 47 Part 15C, Clause 15.247 (b)(4)

### **2.5.2 Equipment Under Test and Modification State**

Black Smartphone S/N: XCV23200791 - Modification State 0

### **2.5.3 Date of Test**

11 August 2013

### **2.5.4 Test Equipment Used**

The major items of test equipment used for the above tests are identified in Section 3.1.

### **2.5.5 Test Procedure**

The EUT was transmitted at maximum power via a cable to the Spectrum Analyser. The Analyser settings were adjusted to display the resultant trace on screen and a resolution bandwidth and video bandwidth of 1 MHz were used to perform the measurement. The level on the spectrum analyser was maximised by rotating the EUT 360° and a height search of the measuring antenna. A substitution was then performed using a substitution antenna and signal generator.

This level was maximised by adjusting the height of the measuring antenna once more. The level from the signal generator was then adjusted to achieve the same raw result as with the EUT. This level was then corrected to account for cable loss and antenna factor. If applicable, a peak power analyser was also used to obtain a correction factor for wideband signals such as WLAN.

A calculation was then performed to obtain the final figure.

### **2.5.6 Environmental Conditions**

|                     |        |
|---------------------|--------|
| Ambient Temperature | 23.0°C |
| Relative Humidity   | 47.0%  |



Product Service

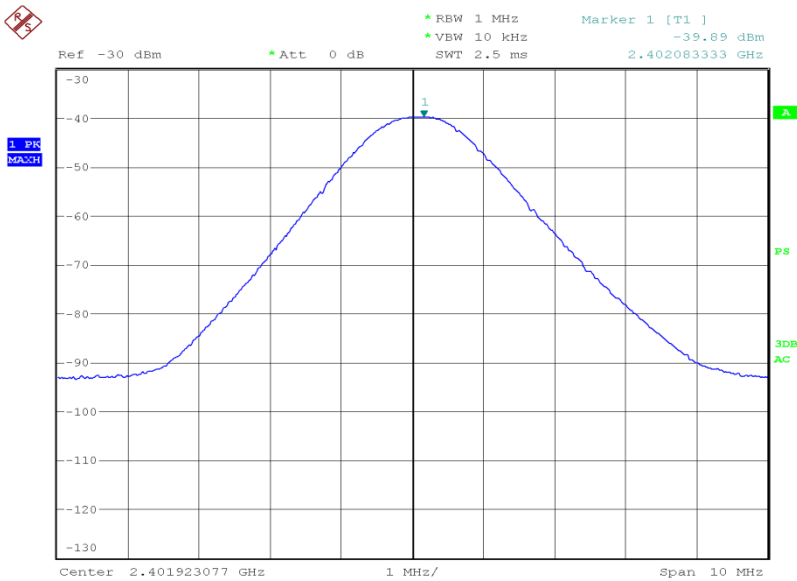
2.5.7 Test Results

Bluetooth

3.8 V DC Supply

2402 MHz

| EIRP (dBm) | EIRP (mW) |
|------------|-----------|
| 2.24       | 1.675     |



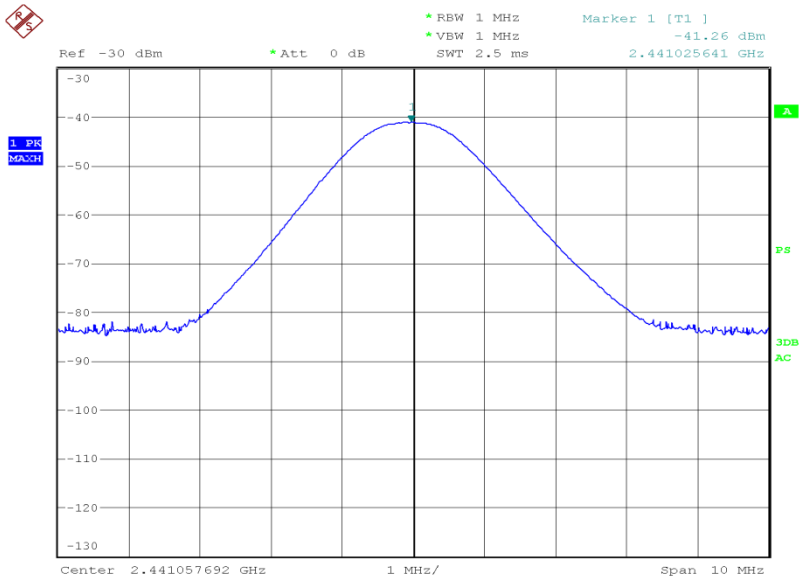
Date: 11.AUG.2013 07:40:32



Product Service

2441 MHz

| EIRP (dBm) | EIRP (mW) |
|------------|-----------|
| 1.61       | 1.445     |



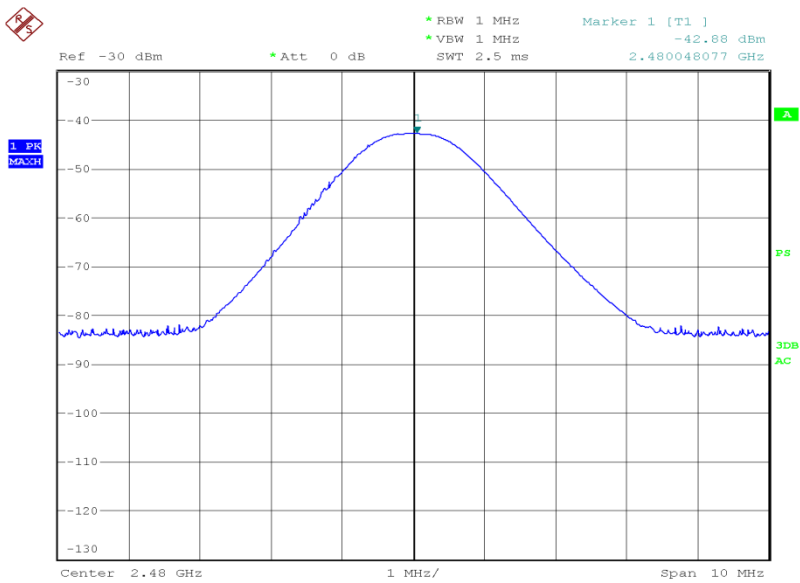
Date: 11.AUG.2013 08:10:07



Product Service

2480 MHz

| EIRP (dBm) | EIRP (mW) |
|------------|-----------|
| 0.34       | 1.08      |



Date: 11.AUG.2013 08:17:34

Limit

| EIRP (dBm) | EIRP (mW) |
|------------|-----------|
| 20.97      | 125       |



Product Service

## **2.6 SPURIOUS AND BAND EDGE EMISSIONS**

### **2.6.1 Specification Reference**

FCC CFR 47 Part 15C, Clause 15.247 (d)

### **2.6.2 Equipment Under Test and Modification State**

Black Smartphone S/N: XCV23200909 - Modification State 0

### **2.6.3 Date of Test**

11 August 2013, 15 August 2013 & 16 August 2013

### **2.6.4 Test Equipment Used**

The major items of test equipment used for the above tests are identified in Section 3.1.

### **2.6.5 Test Procedure**

For conducted emissions, the EUT was set to operate at maximum power on the worst case data rate. The test was performed on the bottom, middle and top channels. The test was performed from 9 kHz to 25 GHz. Firstly, the power of each fundamental frequency was measured in 100 kHz bandwidth and this was used to show a -20 dBc limit line on the trace. The measurement path loss in each relevant frequency band was measured and entered as a reference level offset.

For radiated emissions, the test method described above was also used. However, the measurement was performed from 30 MHz to 25 GHz and the path loss is incorporated as a transducer factor and entered into the spectrum analyser.

The band edge measurements were performed in accordance with ANSI C63.10, Clause 6.9.3. The results were analysed to ensure compliance with restricted bands. The EUT was set to the lowest and highest operating frequencies.

### **2.6.6 Environmental Conditions**

|                     |               |
|---------------------|---------------|
| Ambient Temperature | 22.0 - 23.0°C |
| Relative Humidity   | 46.7 - 51.0%  |



Product Service

## 2.6.7 Test Results

### Bluetooth

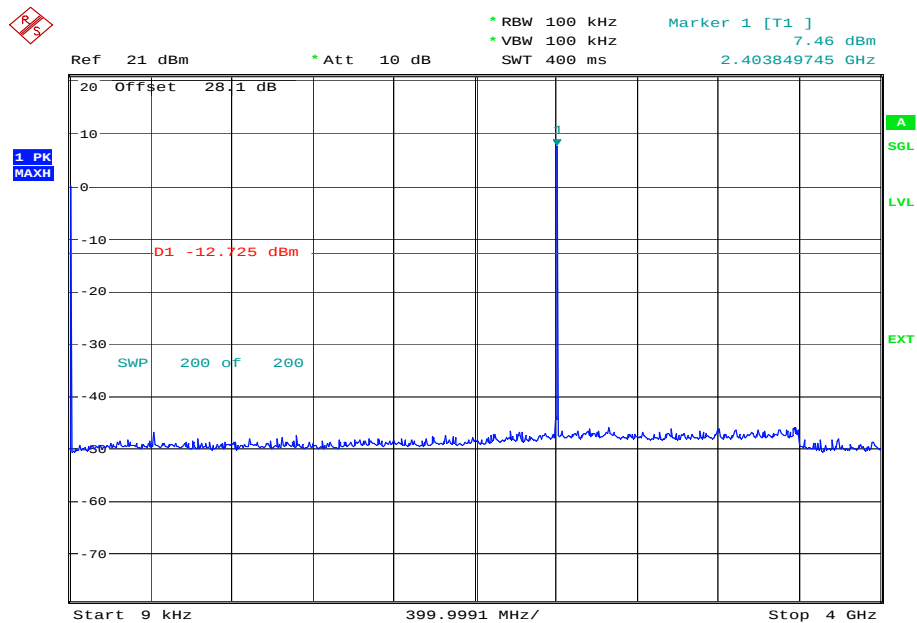
3.8 V DC Supply

### Spurious Conducted Emissions

### DH3

### 2402 MHz

### 9 kHz to 4 GHz

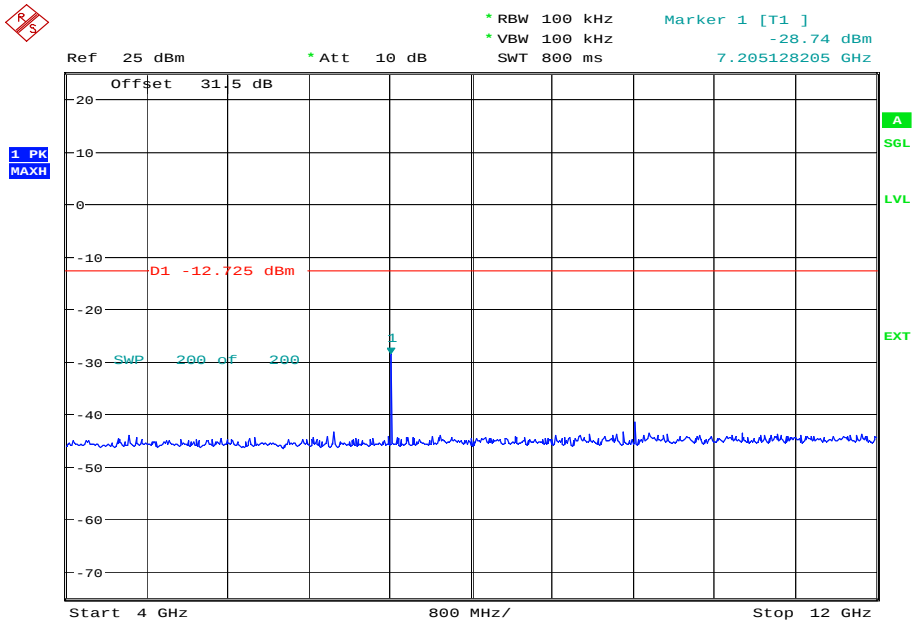


Date: 15.AUG.2013 15:37:02



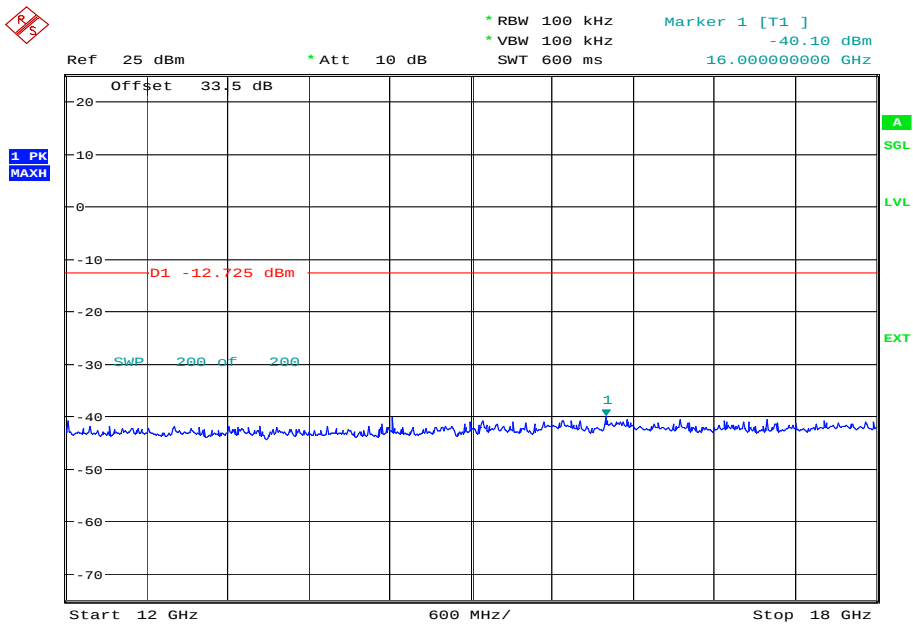
Product Service

4 GHz to 12 GHz



Date: 16.AUG.2013 08:03:21

12 GHz to 18 GHz

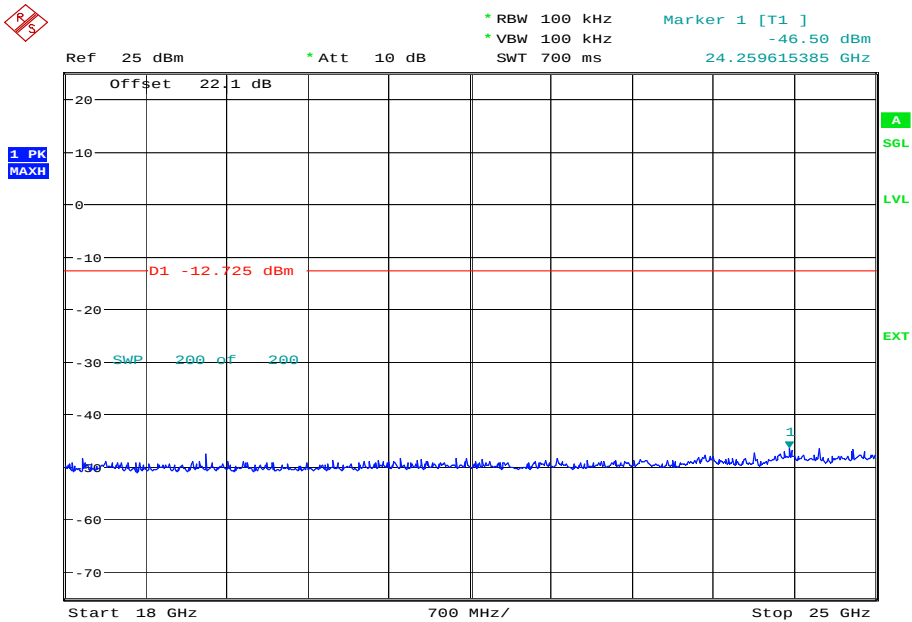


Date: 16.AUG.2013 08:49:44



Product Service

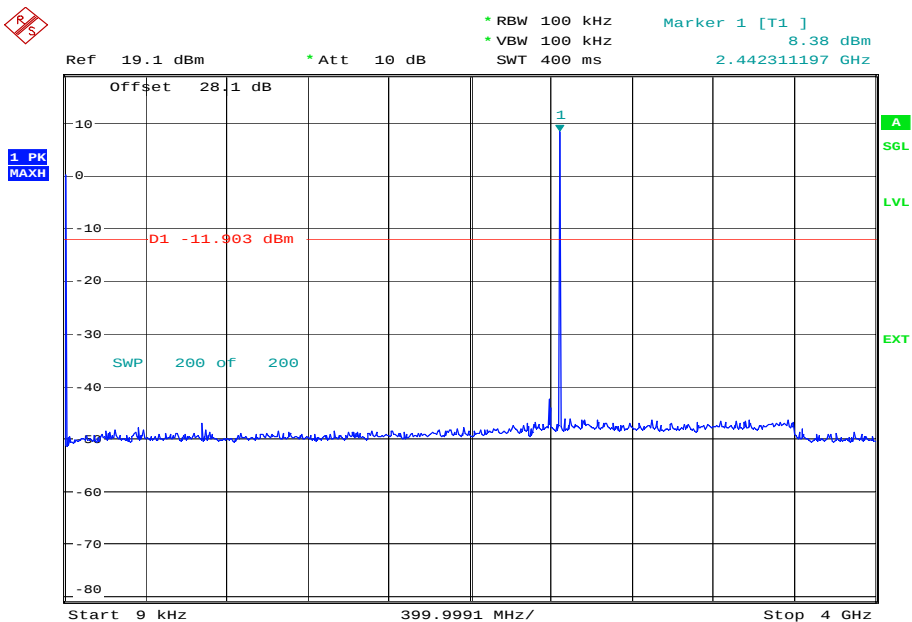
18 GHz to 25 GHz



Date: 16.AUG.2013 09:47:24

2441 MHz

9 kHz to 4 GHz

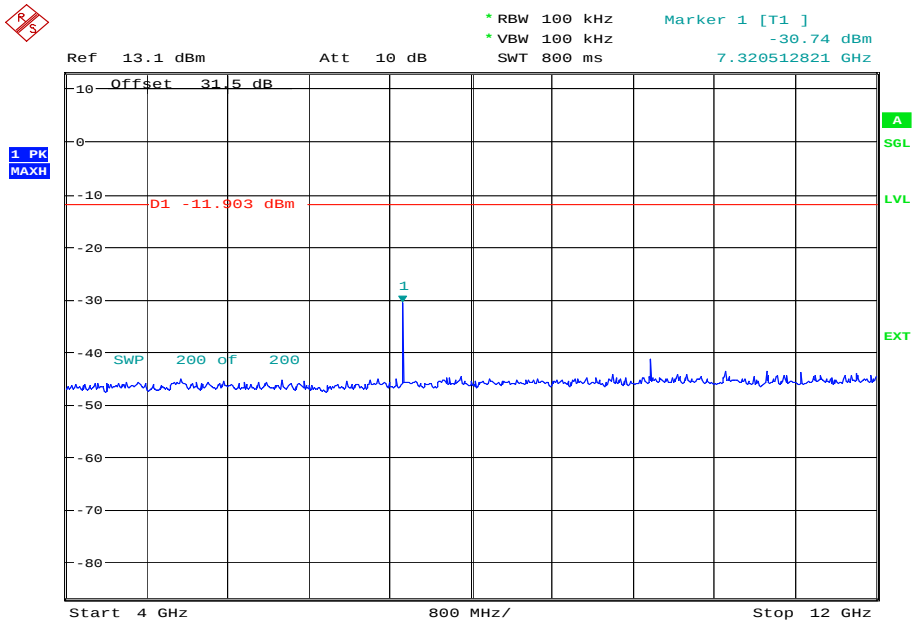


Date: 15.AUG.2013 15:41:35



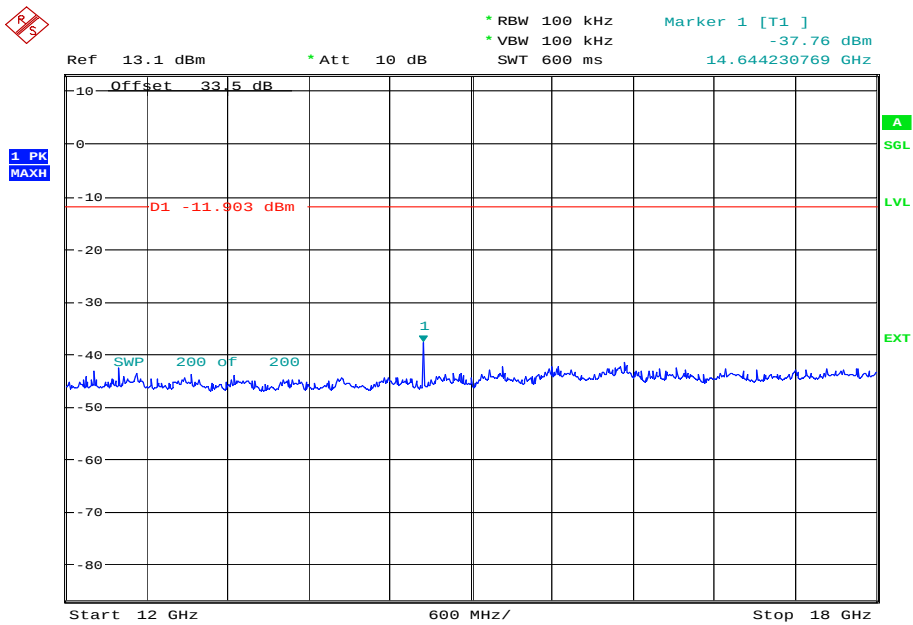
Product Service

4 GHz to 12 GHz



Date: 16.AUG.2013 08:07:21

12 GHz to 18 GHz

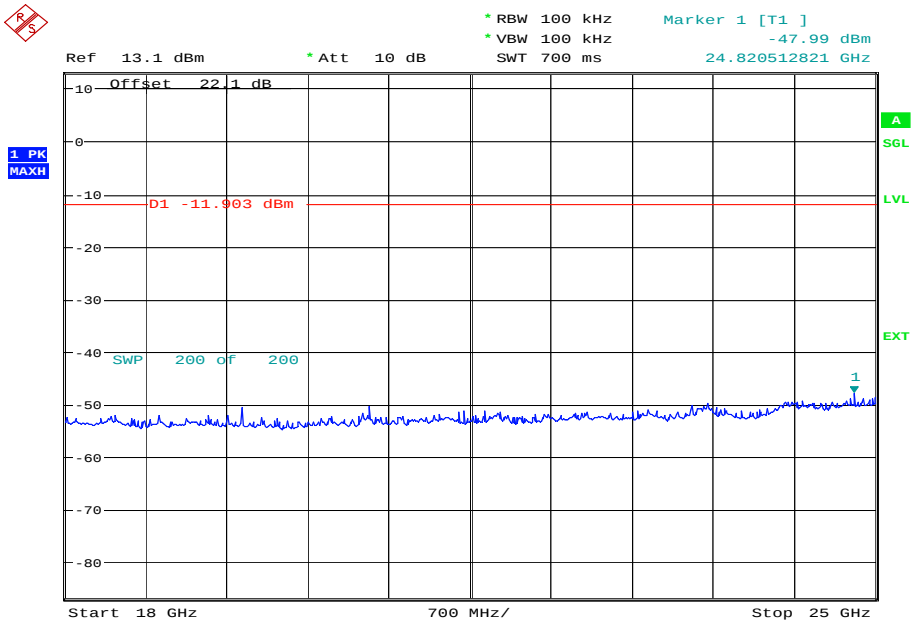


Date: 16.AUG.2013 08:54:53



Product Service

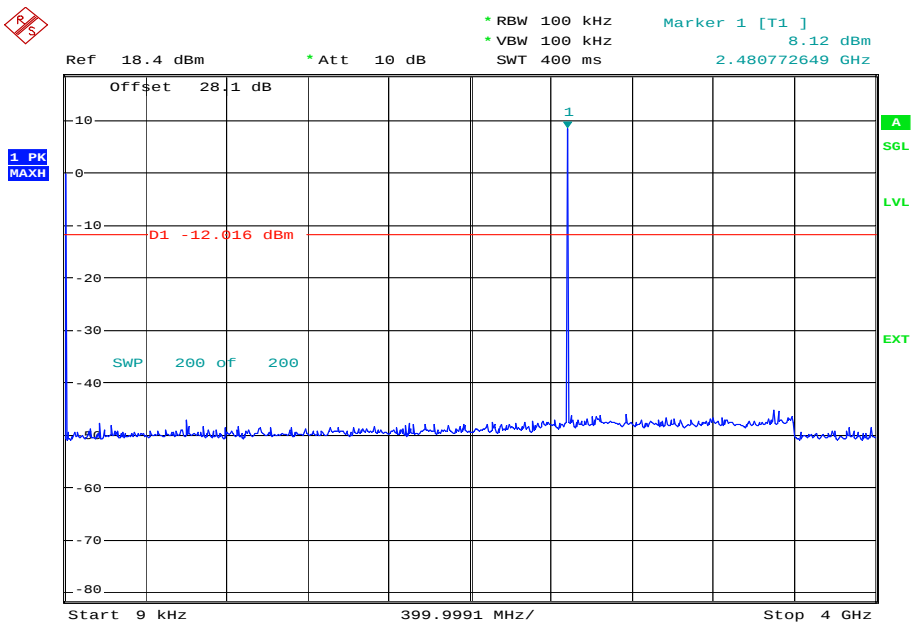
18 GHz to 25 GHz



Date: 16.AUG.2013 09:51:05

2480 MHz

9 kHz to 4 GHz

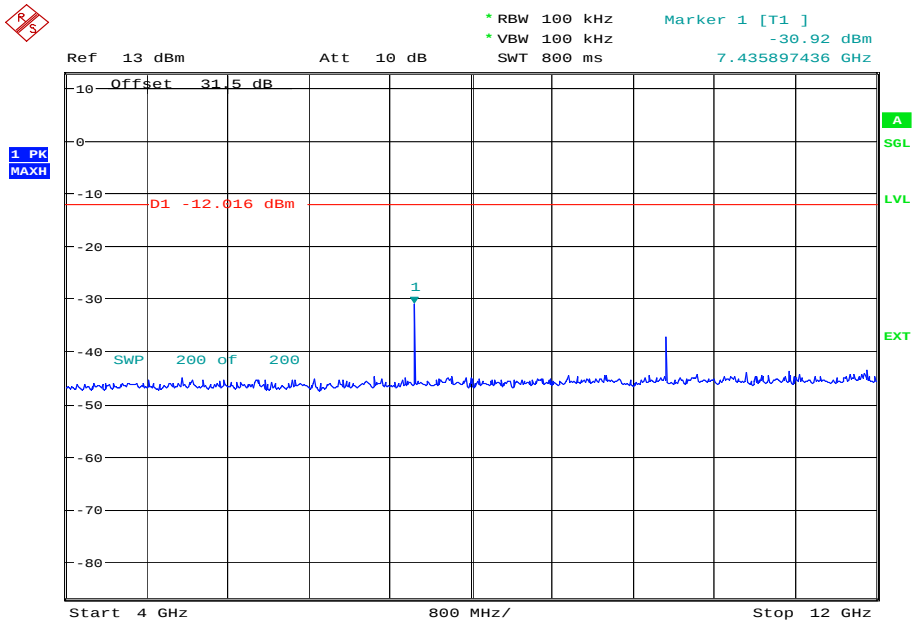


Date: 15.AUG.2013 15:44:22



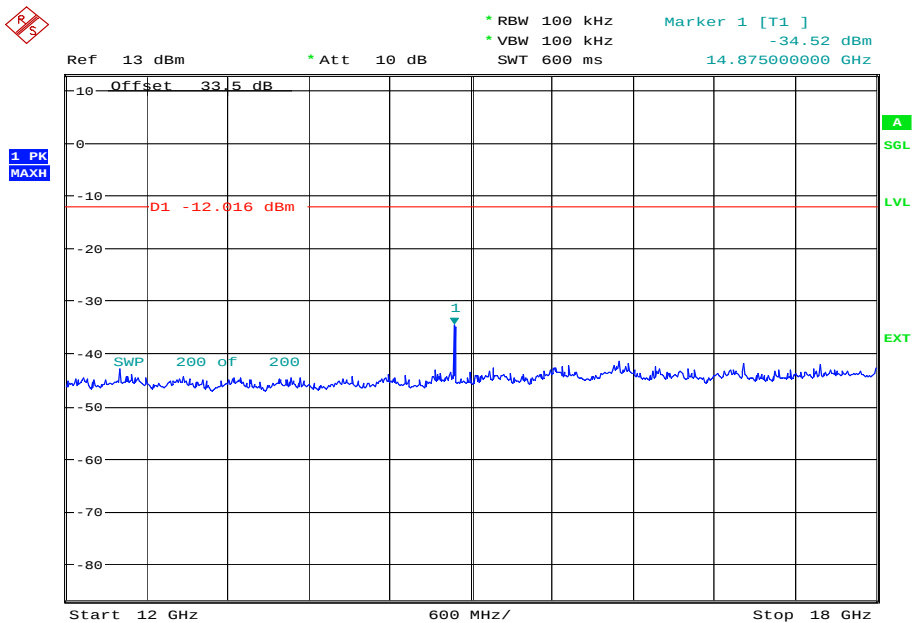
Product Service

4 GHz to 12 GHz



Date: 16.AUG.2013 08:10:54

12 GHz to 18 GHz

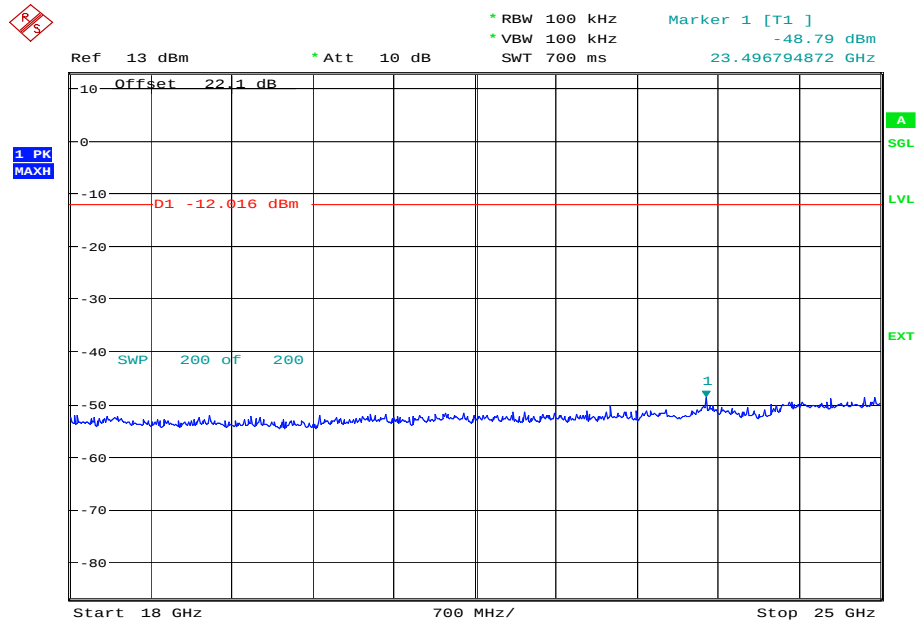


Date: 16.AUG.2013 08:58:56



Product Service

### 18 GHz to 25 GHz



Date: 16.AUG.2013 09:54:20

### Limit Clause

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.

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval the attenuation required shall be 30 dB instead of 20 dB.

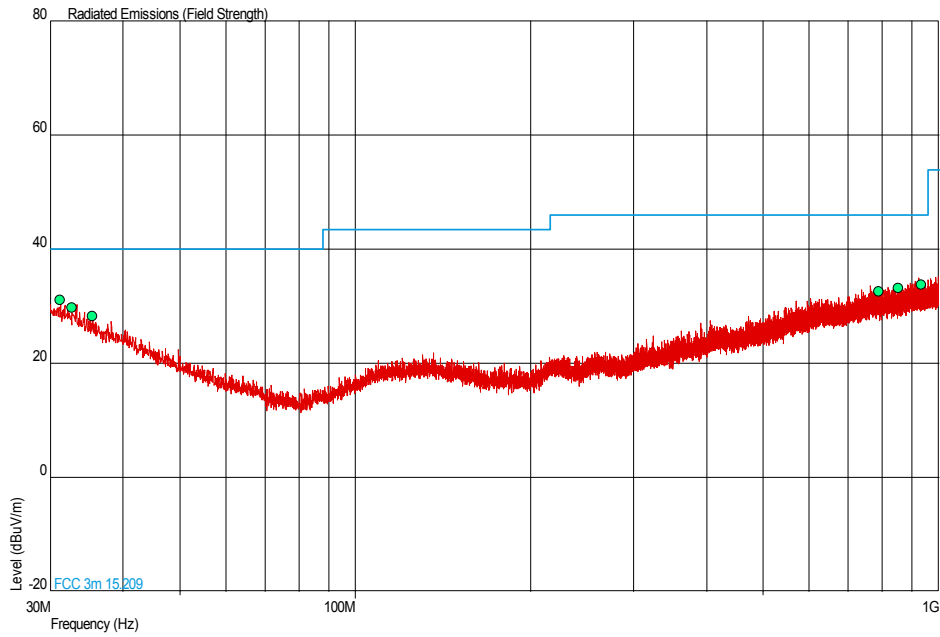


Product Service

Spurious Radiated Emissions

2402 MHz

30 MHz to 1 GHz

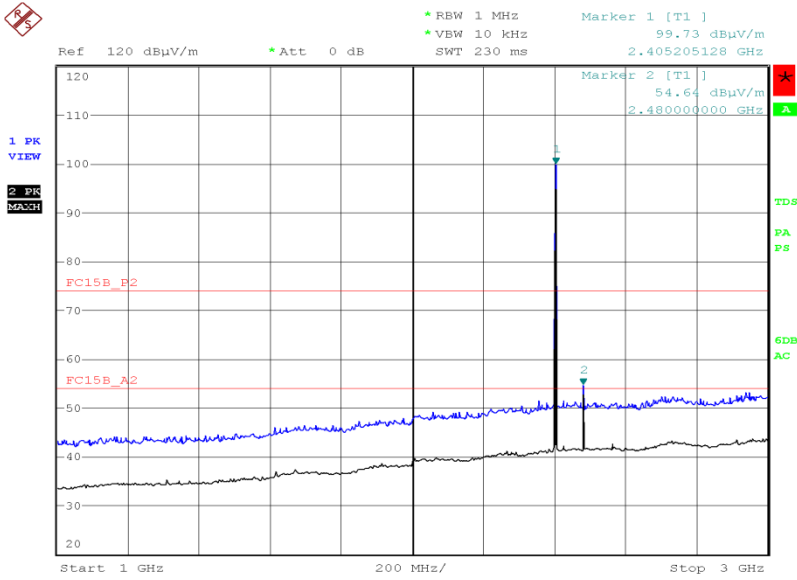


| Frequency (MHz) | QP Level (dBuV/m) | QP Level (uV/m) | QP Limit (dBuV/m) | QP Limit (uV/m) | QP Margin (dBuV/m) | QP Margin (uV/m) | Angle (Deg) | Height (m) | Polarity |
|-----------------|-------------------|-----------------|-------------------|-----------------|--------------------|------------------|-------------|------------|----------|
| 31.213          | 31.1              | 35.9            | 40.0              | 100             | -8.9               | 64.1             | 180         | 1.00       | Vertical |
| 32.668          | 29.7              | 30.5            | 40.0              | 100             | -10.3              | 69.5             | 180         | 1.00       | Vertical |
| 35.432          | 28.3              | 26.0            | 40.0              | 100             | -11.7              | 74.0             | 180         | 1.00       | Vertical |
| 789.898         | 32.6              | 42.7            | 46.0              | 200             | -13.4              | 157.3            | 180         | 1.00       | Vertical |
| 852.754         | 33.2              | 45.7            | 46.0              | 200             | -12.8              | 154.3            | 180         | 1.00       | Vertical |
| 934.574         | 33.9              | 49.5            | 46.0              | 200             | -12.1              | 150.5            | 180         | 1.00       | Vertical |



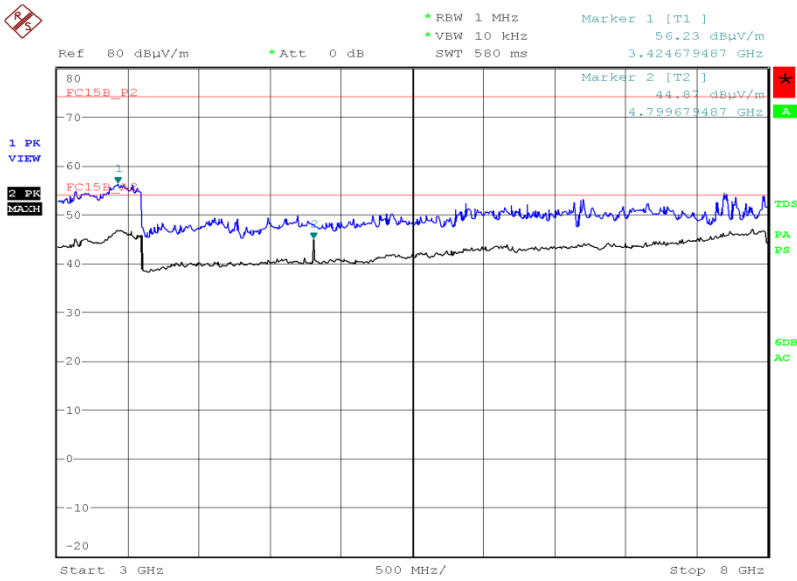
Product Service

1 GHz to 3 GHz



Date: 11.AUG.2013 08:00:23

3 GHz to 8 GHz

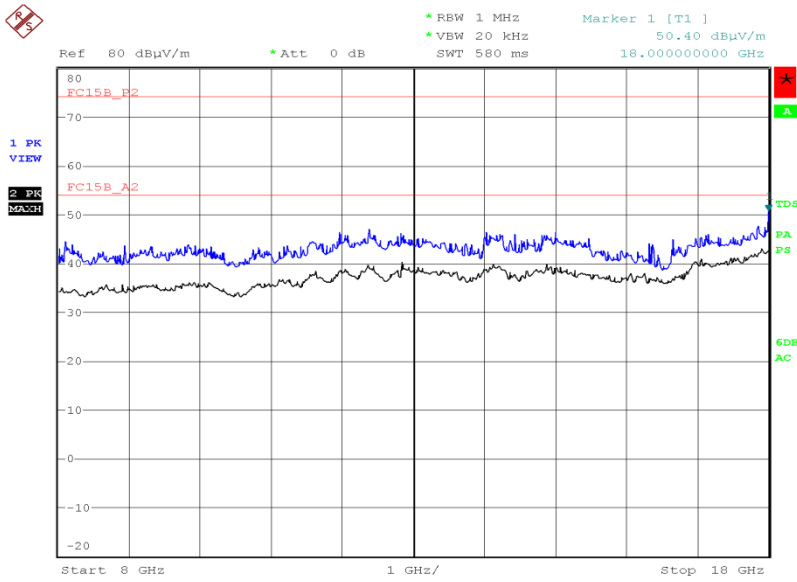


Date: 11.AUG.2013 10:16:35



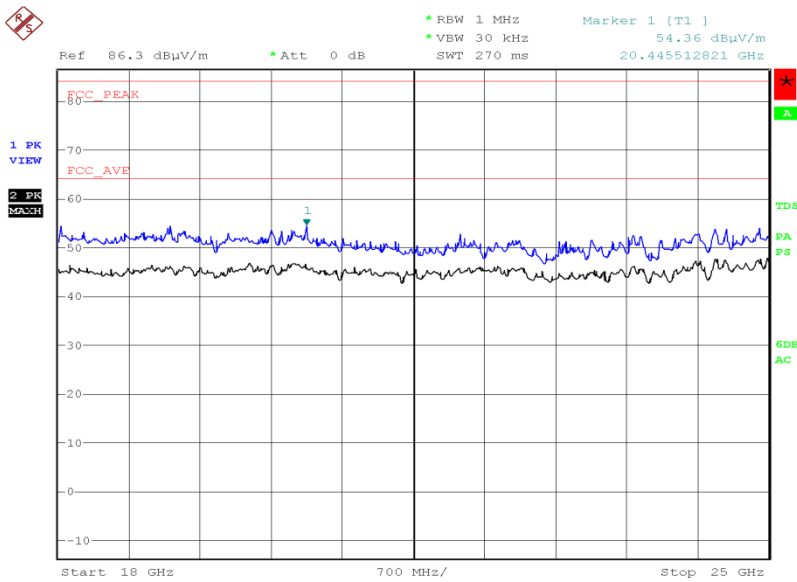
Product Service

8 GHz to 18 GHz



Date: 11.AUG.2013 10:43:58

18 GHz to 25 GHz



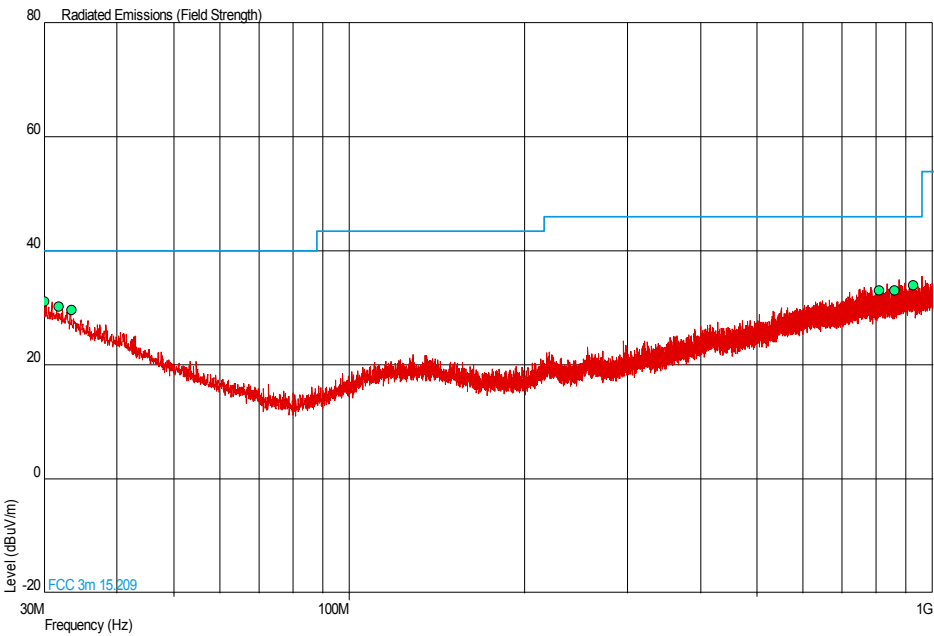
Date: 11.AUG.2013 11:41:46



Product Service

2441 MHz

30 MHz to 1 GHz

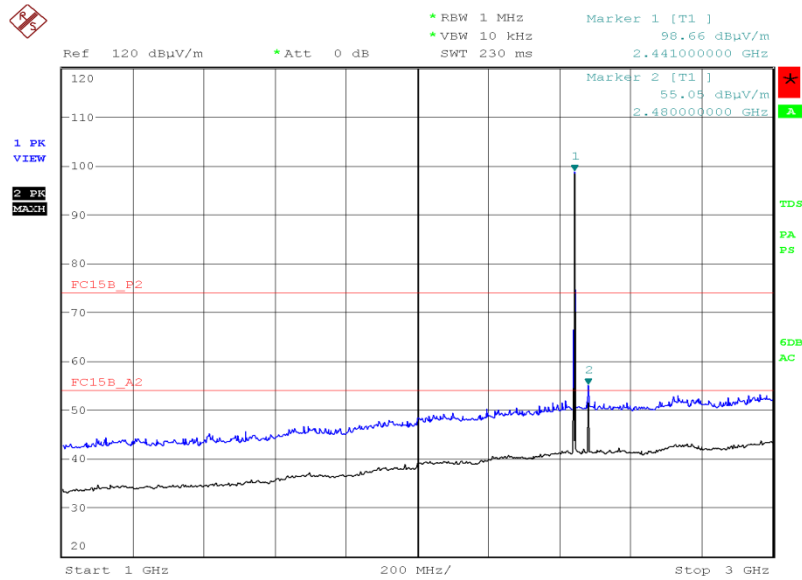


| Frequency (MHz) | QP Level (dBµV/m) | QP Level (µV/m) | QP Limit (dBµV/m) | QP Limit (µV/m) | QP Margin (dBµV/m) | QP Margin (µV/m) | Angle (Deg) | Height (m) | Polarity |
|-----------------|-------------------|-----------------|-------------------|-----------------|--------------------|------------------|-------------|------------|----------|
| 30.049          | 31.1              | 35.9            | 40.0              | 100             | -8.9               | 64.1             | 0           | 1.00       | Vertical |
| 31.795          | 30.3              | 32.7            | 40.0              | 100             | -9.7               | 67.3             | 0           | 1.00       | Vertical |
| 33.444          | 29.6              | 30.2            | 40.0              | 100             | -10.4              | 69.8             | 180         | 1.00       | Vertical |
| 810.899         | 33.1              | 45.2            | 46.0              | 200             | -12.9              | 154.8            | 0           | 1.00       | Vertical |
| 861.193         | 33.1              | 45.2            | 46.0              | 200             | -12.9              | 154.8            | 180         | 1.00       | Vertical |
| 926.668         | 34.0              | 50.1            | 46.0              | 200             | -12.0              | 149.9            | 0           | 1.00       | Vertical |



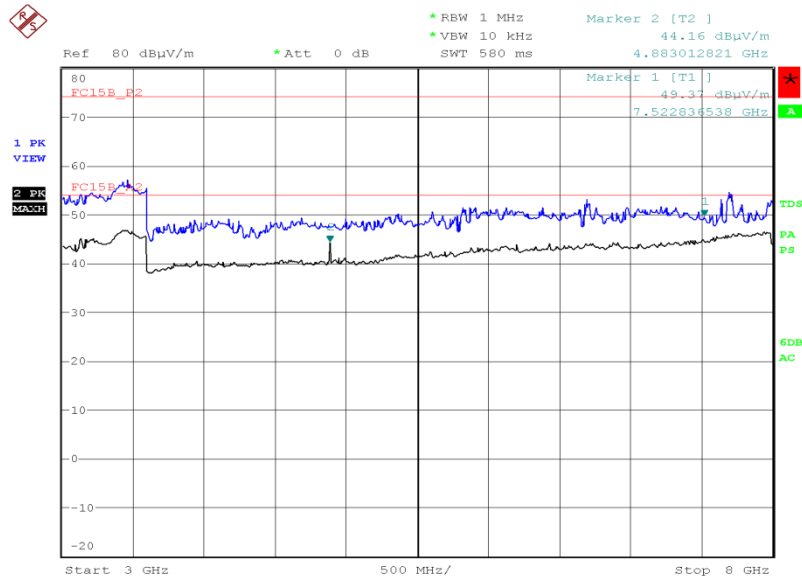
Product Service

### 1 GHz to 3 GHz



Date: 11.AUG.2013 08:04:14

### 3 GHz to 8 GHz

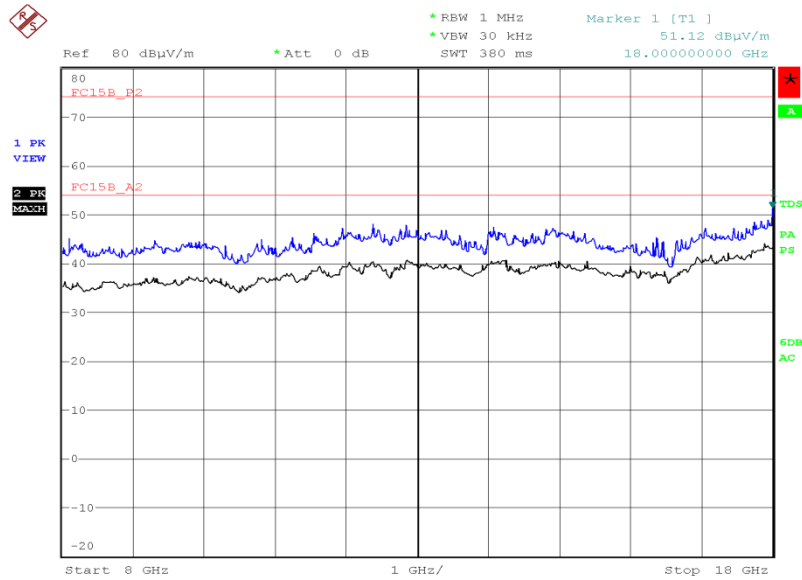


Date: 11.AUG.2013 10:01:42



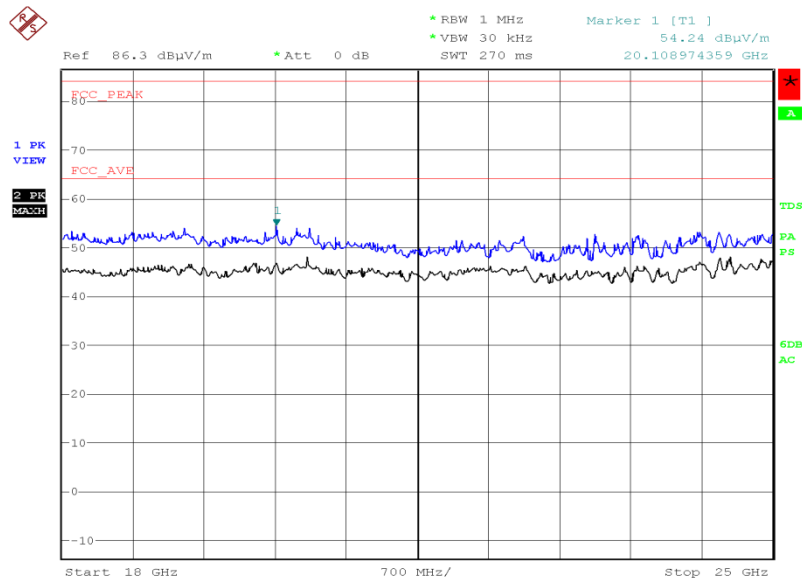
Product Service

### 8 GHz to 18 GHz



Date: 11.AUG.2013 10:48:04

### 18 GHz to 25 GHz



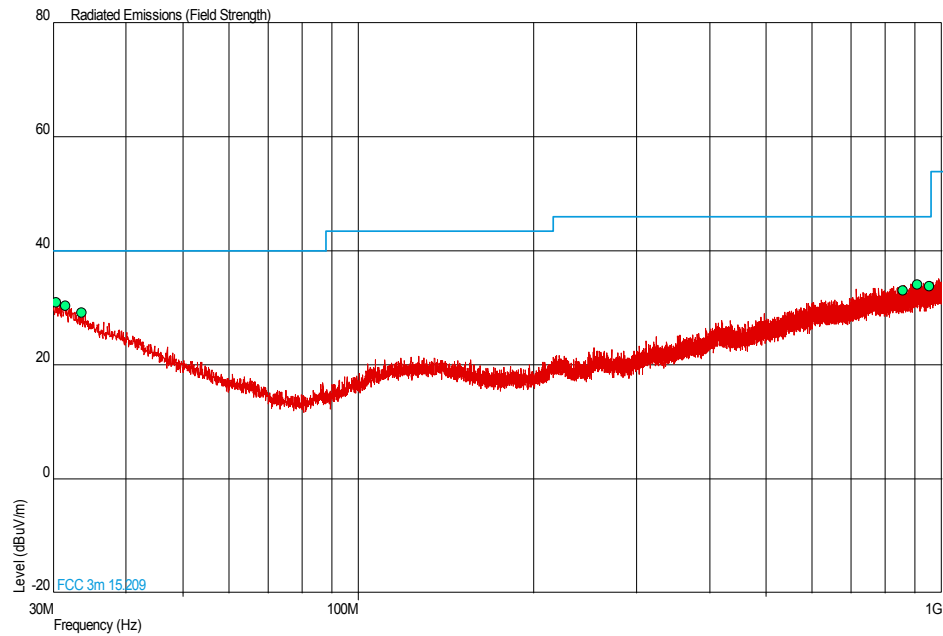
Date: 11.AUG.2013 11:39:48



Product Service

2480 MHz

30 MHz to 1 GHz

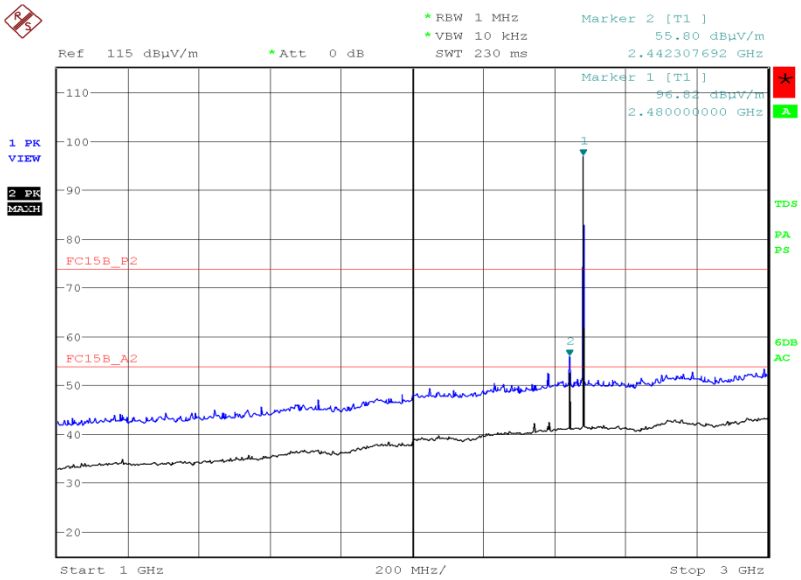


| Frequency (MHz) | QP Level (dBµV/m) | QP Level (µV/m) | QP Limit (dBµV/m) | QP Limit (µV/m) | QP Margin (dBµV/m) | QP Margin (µV/m) | Angle (Deg) | Height (m) | Polarity   |
|-----------------|-------------------|-----------------|-------------------|-----------------|--------------------|------------------|-------------|------------|------------|
| 30.388          | 31.0              | 35.5            | 40.0              | 100             | -9.0               | 64.5             | 180         | 1.00       | Horizontal |
| 31.504          | 30.4              | 33.1            | 40.0              | 100             | -9.6               | 66.9             | 180         | 1.00       | Horizontal |
| 33.589          | 29.1              | 28.5            | 40.0              | 100             | -10.9              | 71.5             | 180         | 1.00       | Vertical   |
| 858.526         | 33.0              | 44.7            | 46.0              | 200             | -13.0              | 155.3            | 0           | 1.00       | Horizontal |
| 908.820         | 34.2              | 51.3            | 46.0              | 200             | -11.8              | 148.7            | 180         | 1.00       | Horizontal |
| 953.343         | 33.8              | 49.0            | 46.0              | 200             | -12.2              | 151.0            | 0           | 1.00       | Vertical   |



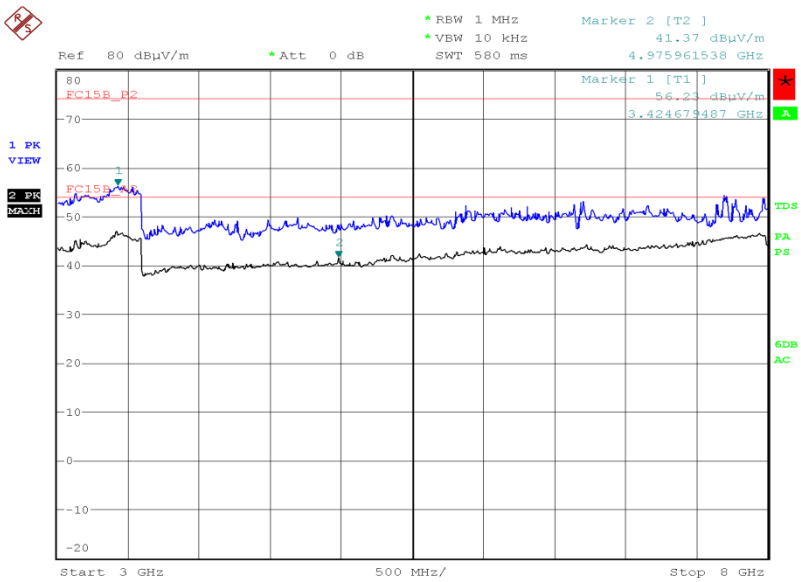
Product Service

1 GHz to 3 GHz



Date: 11.AUG.2013 08:34:00

3 GHz to 8 GHz

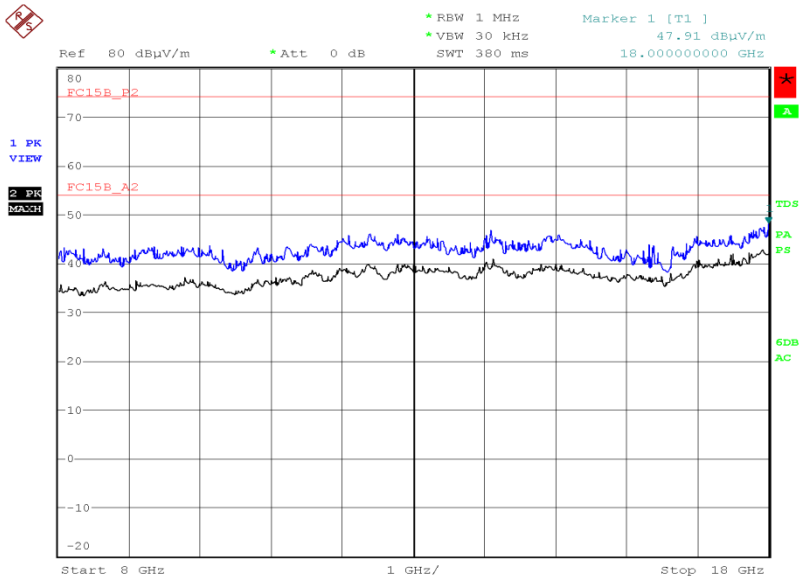


Date: 11.AUG.2013 10:17:54



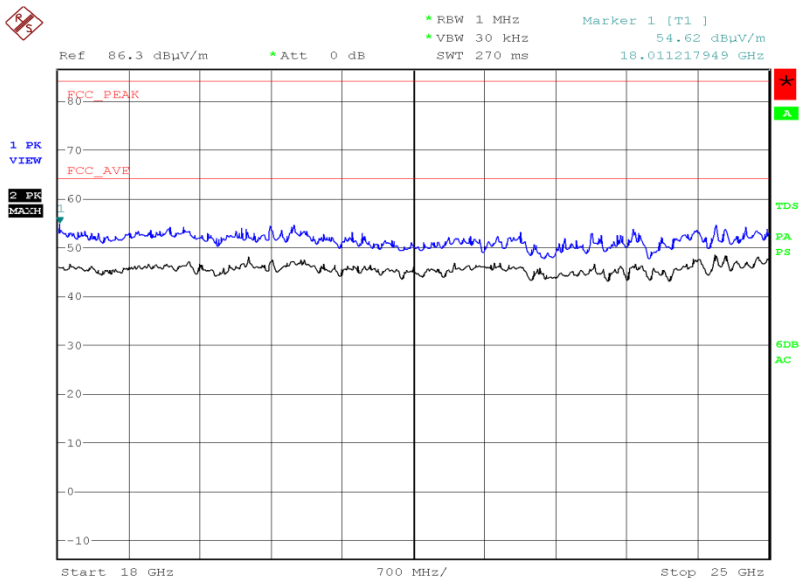
Product Service

8 GHz to 18 GHz



Date: 11.AUG.2013 11:06:40

18 GHz to 25 GHz



Date: 11.AUG.2013 11:37:48

Limit

| Peak (dBμV/m) | Average (dBμV/m) |
|---------------|------------------|
| 74.0          | 54.0             |

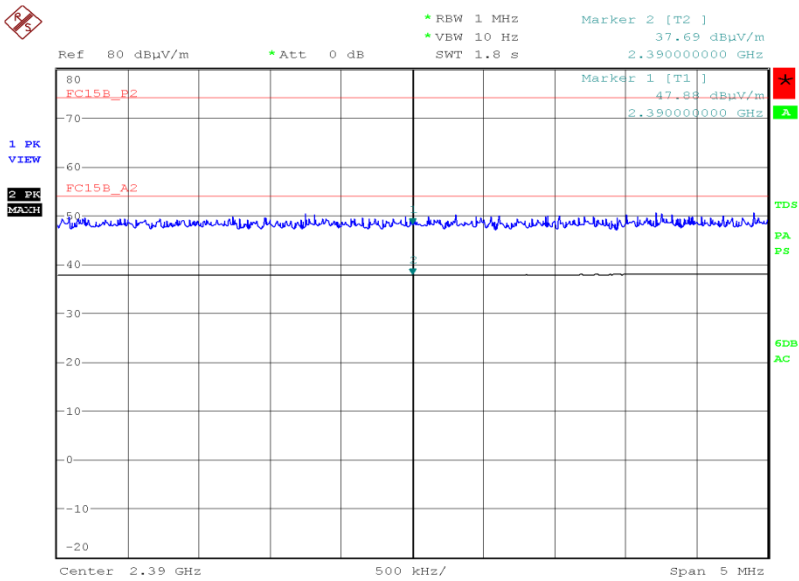


Product Service

Band Edge Emissions

2402 MHz

| Polarisation | Final Peak (dBμV/m) | Final Average (dBμV/m) |
|--------------|---------------------|------------------------|
| Horizontal   | 47.88               | 37.69                  |



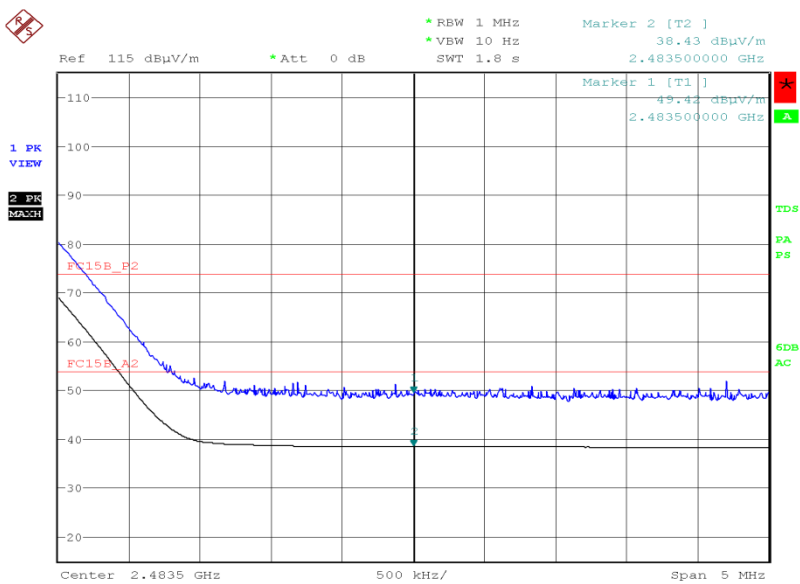
Date: 11.AUG.2013 07:51:44



Product Service

2480 MHz

| Polarisation | Final Peak (dBµV/m) | Final Average (dBµV/m) |
|--------------|---------------------|------------------------|
| Horizontal   | 49.42               | 38.43                  |



Date: 11.AUG.2013 08:25:35

Limit

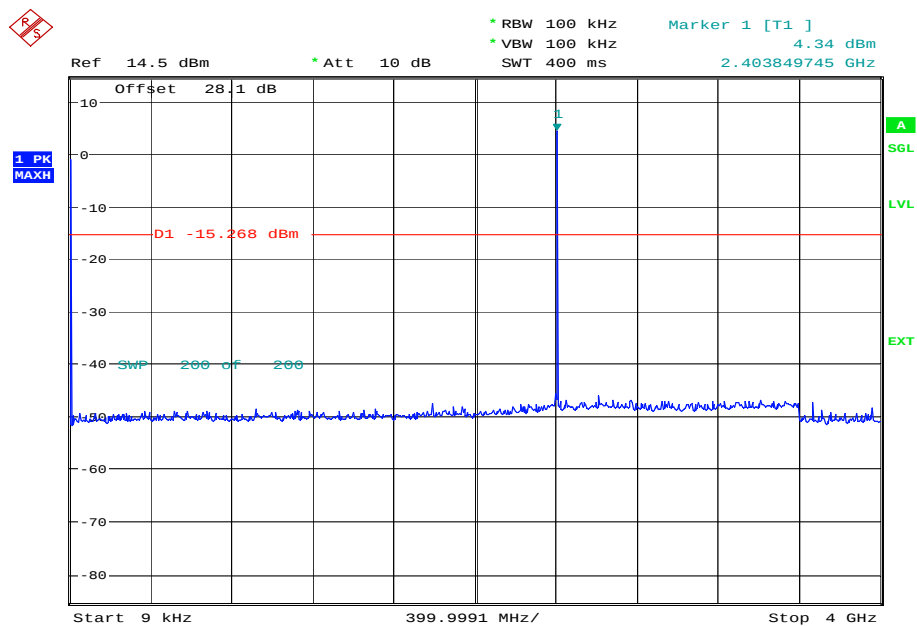
| Peak (dBµV/m) | Average (dBµV/m) |
|---------------|------------------|
| 74.0          | 54.0             |



Product Service

Bluetooth - 2DHx

3.8 V DC Supply

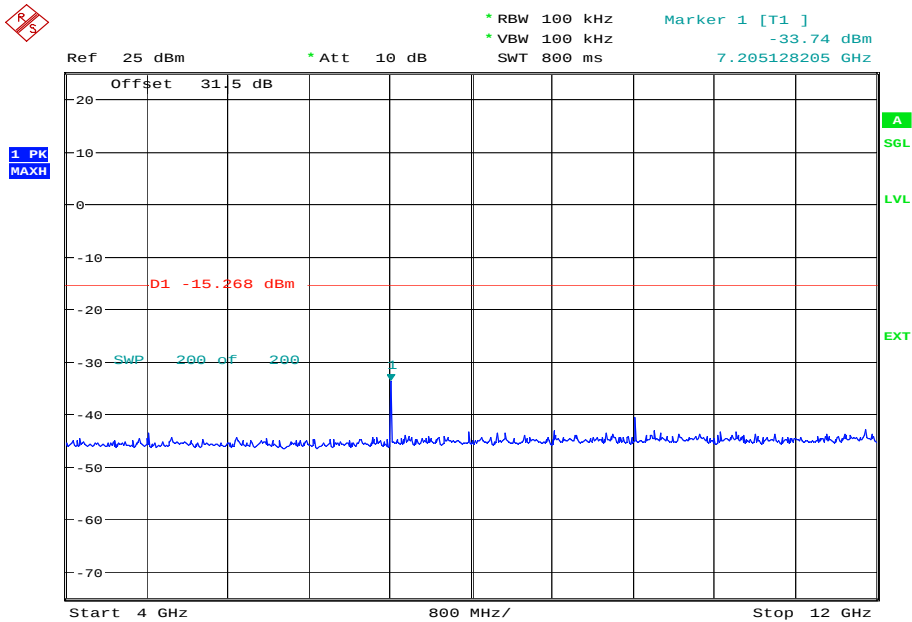
Spurious Conducted Emissions2DH52402 MHz9 kHz to 4 GHz

Date: 15.AUG.2013 15:47:56



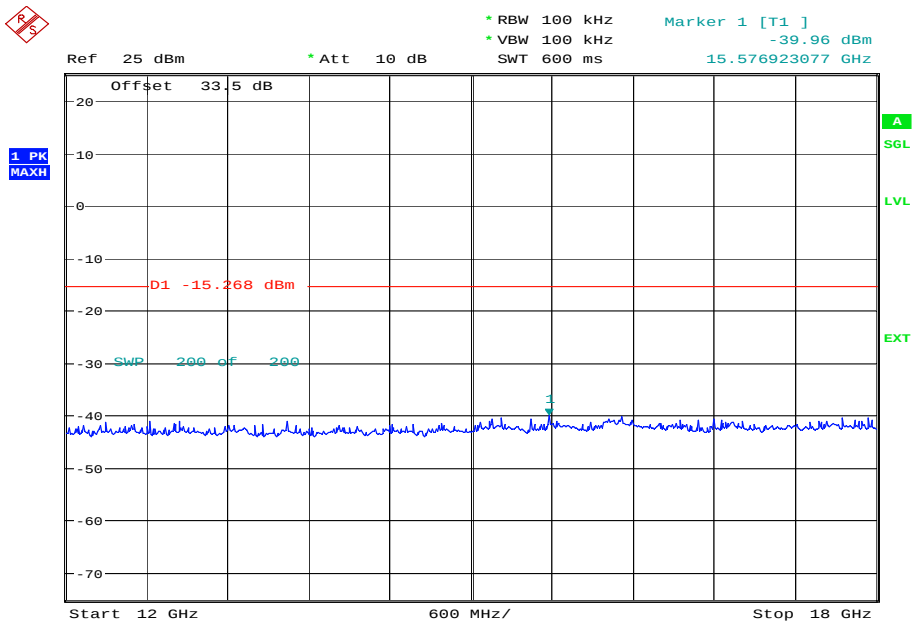
Product Service

4 GHz to 12 GHz



Date: 16.AUG.2013 08:16:41

12 GHz to 18 GHz

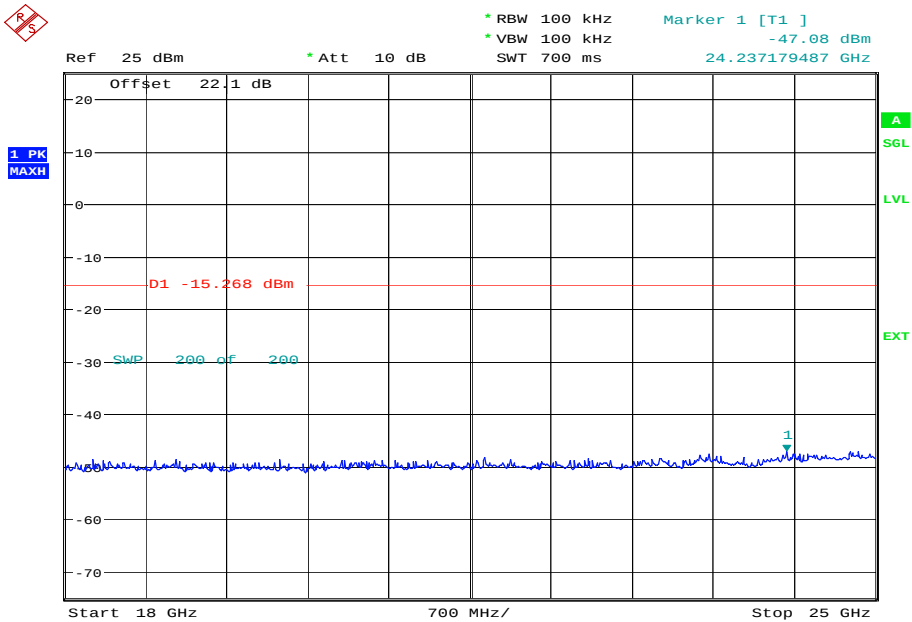


Date: 16.AUG.2013 09:02:56



Product Service

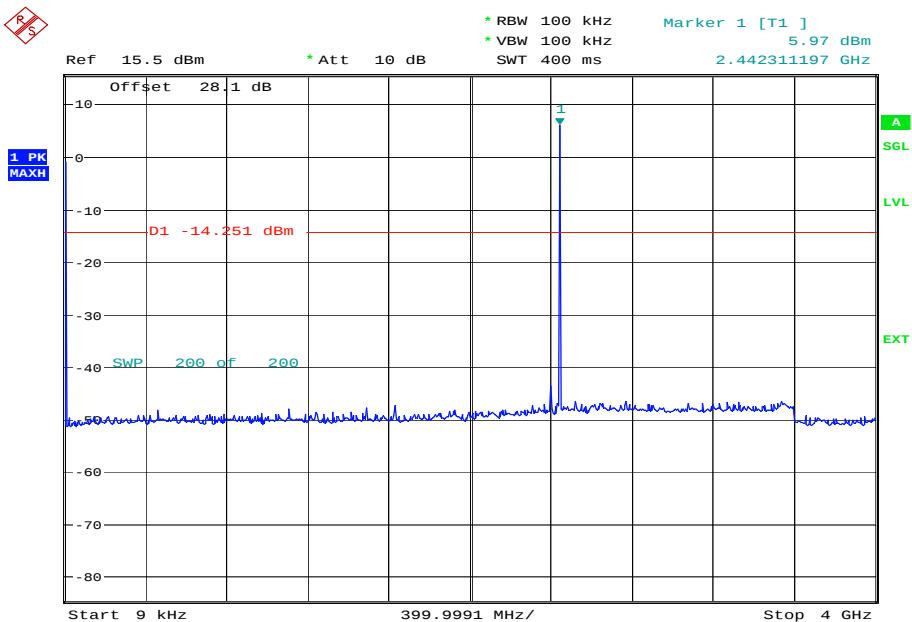
18 GHz to 25 GHz



Date: 16.AUG.2013 09:58:25

2441 MHz

9 kHz to 4 GHz

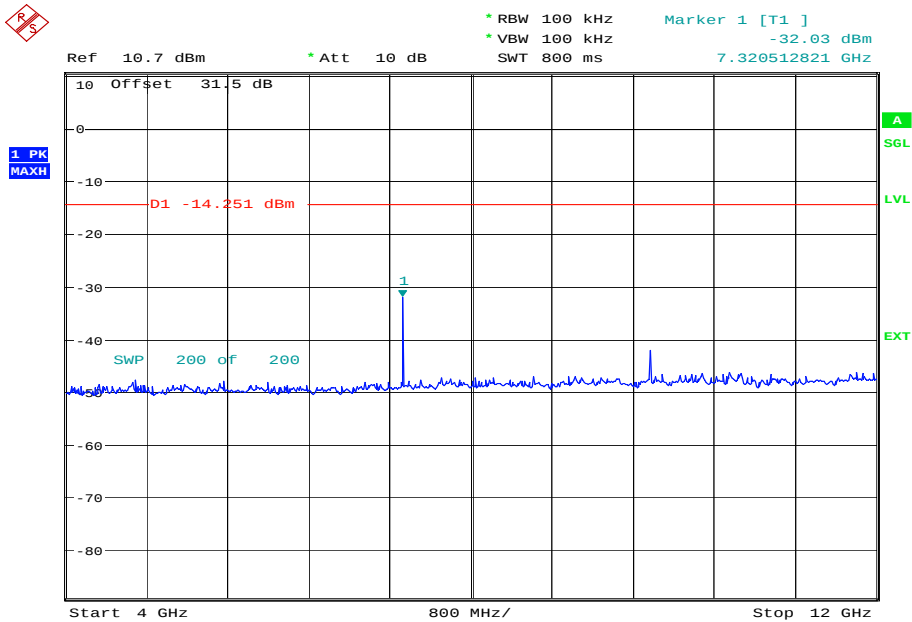


Date: 15.AUG.2013 15:51:16



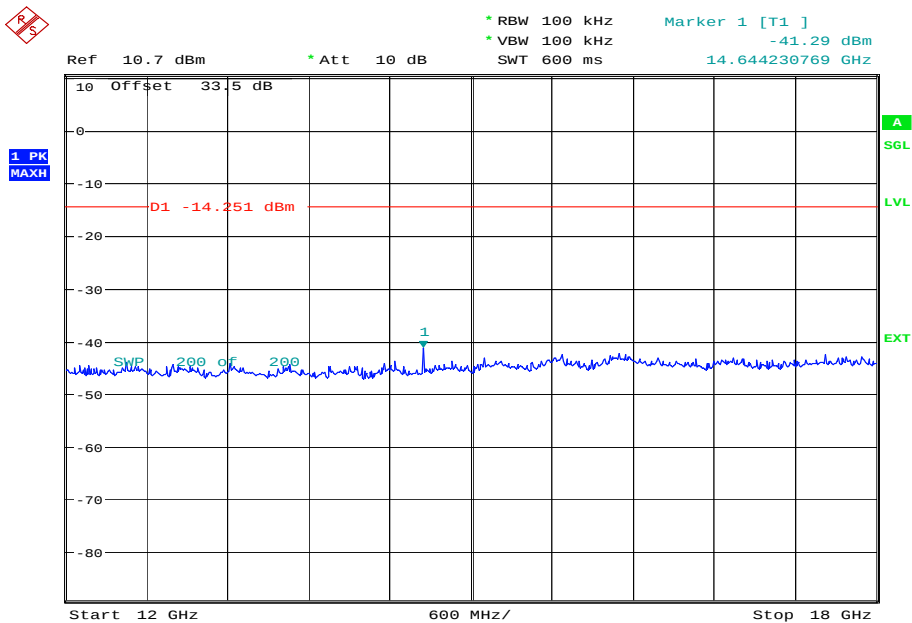
Product Service

4 GHz to 12 GHz



Date: 16.AUG.2013 08:20:38

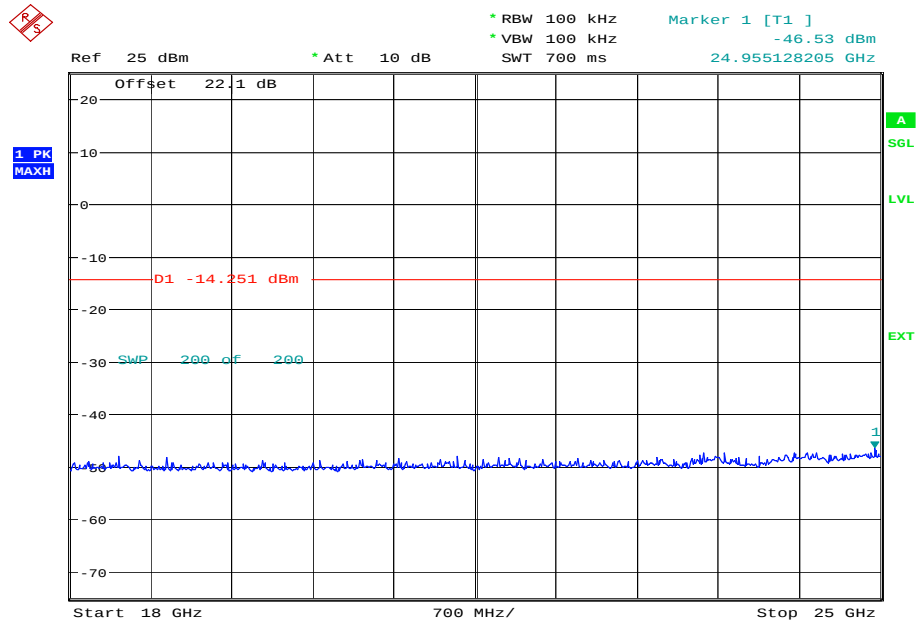
12 GHz to 18 GHz



Date: 16.AUG.2013 09:05:47



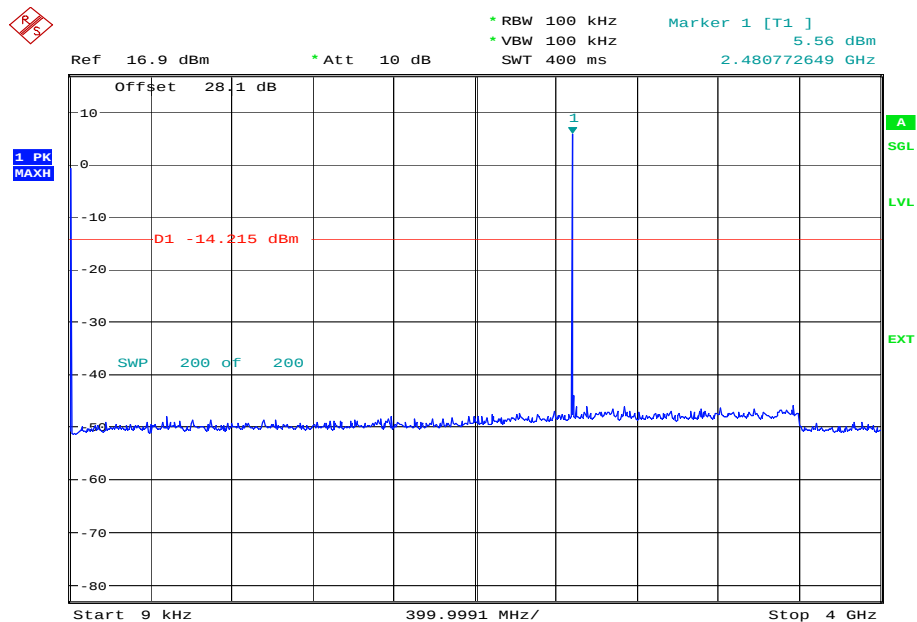
18 GHz to 25 GHz



Date: 16.AUG.2013 10:28:33

2480 MHz

9 kHz to 4 GHz

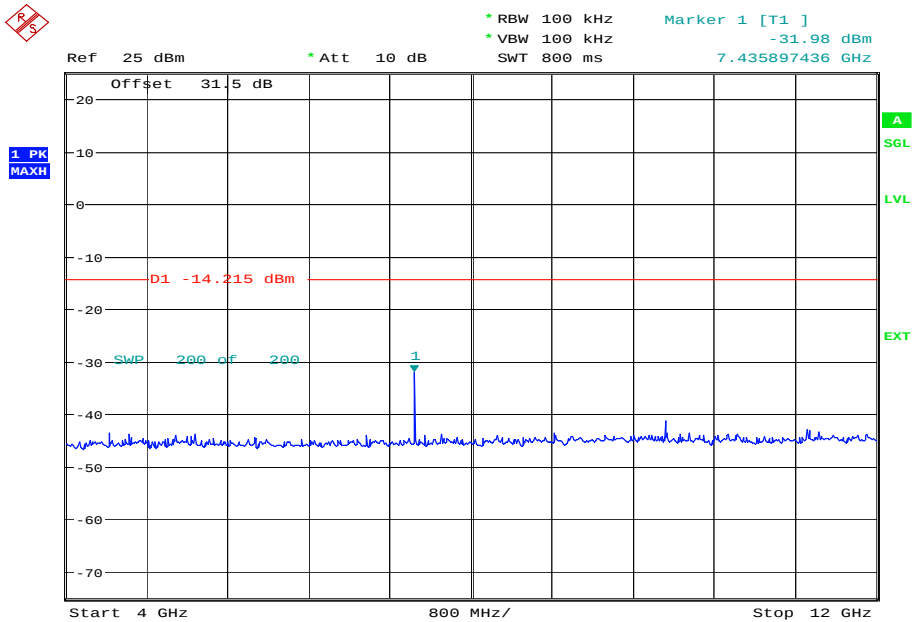


Date: 15.AUG.2013 15:55:37



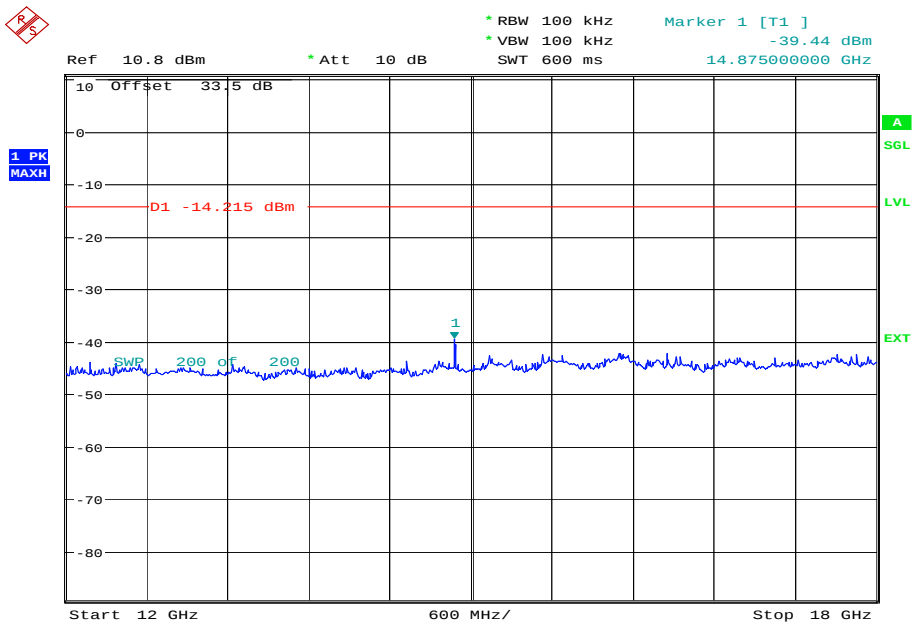
Product Service

4 GHz to 12 GHz



Date: 16.AUG.2013 08:30:29

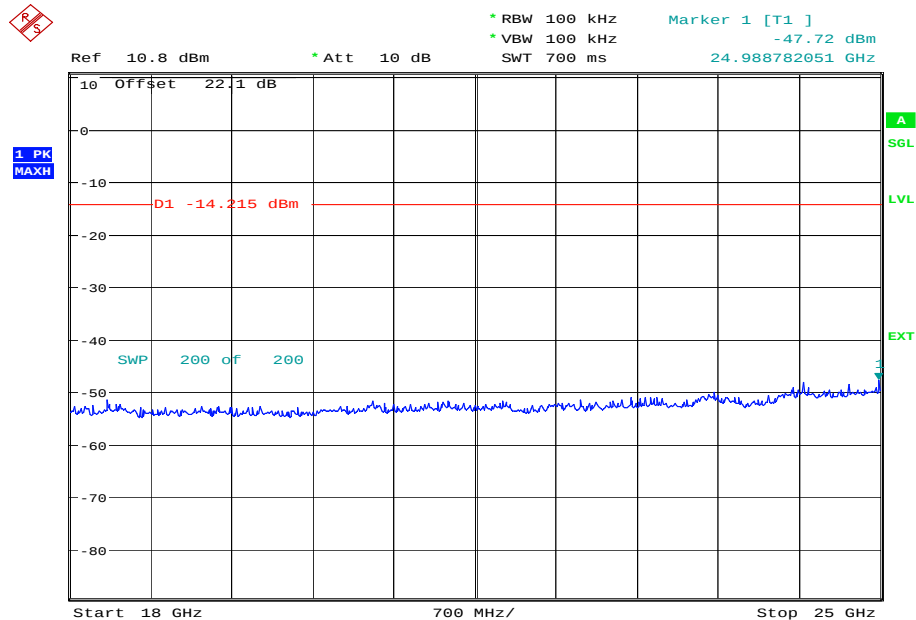
12 GHz to 18 GHz



Date: 16.AUG.2013 09:10:58



### 18 GHz to 25 GHz



Date: 16.AUG.2013 10:13:43

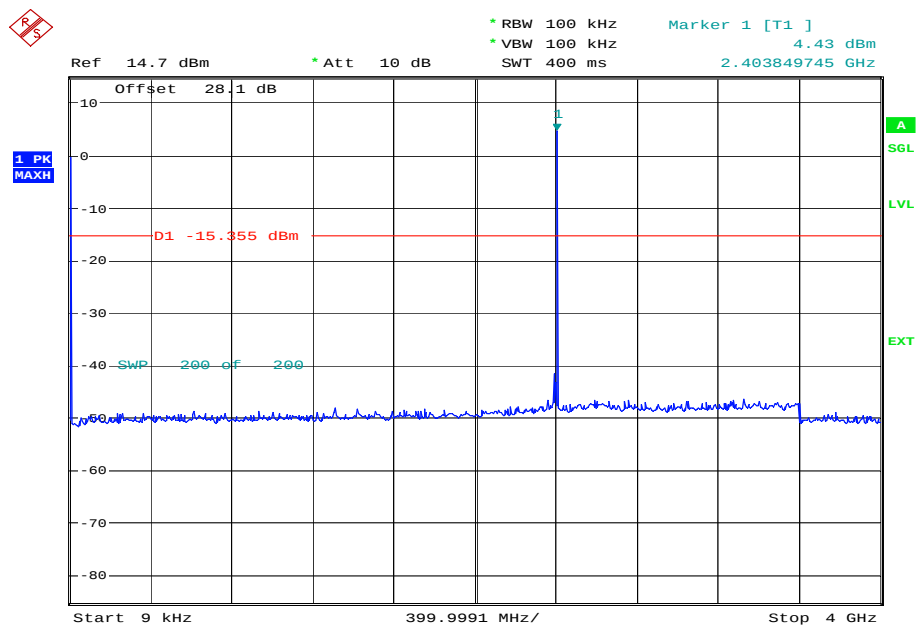
### Limit Clause

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.

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval the attenuation required shall be 30 dB instead of 20 dB.

Bluetooth - 3DHx

3.8 V DC Supply

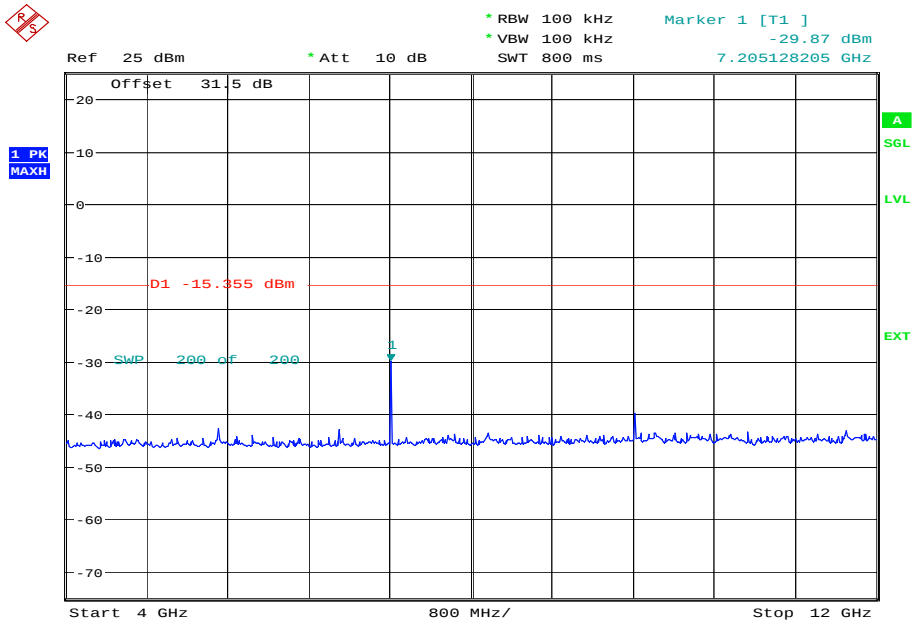
Spurious Conducted Emissions3DH52402 MHz9 kHz to 4 GHz

Date: 15.AUG.2013 15:58:57



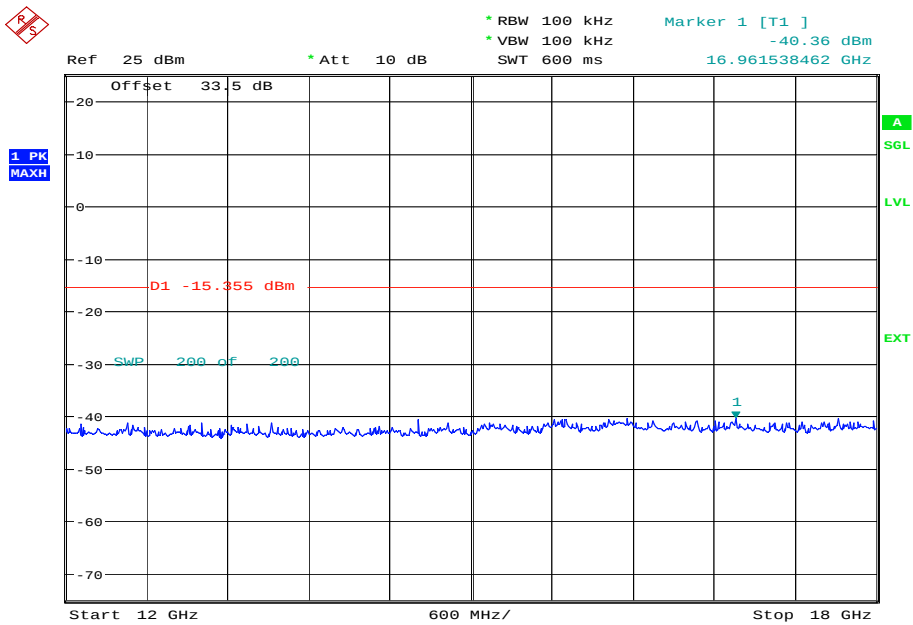
Product Service

4 GHz to 12 GHz



Date: 16.AUG.2013 08:36:22

12 GHz to 18 GHz

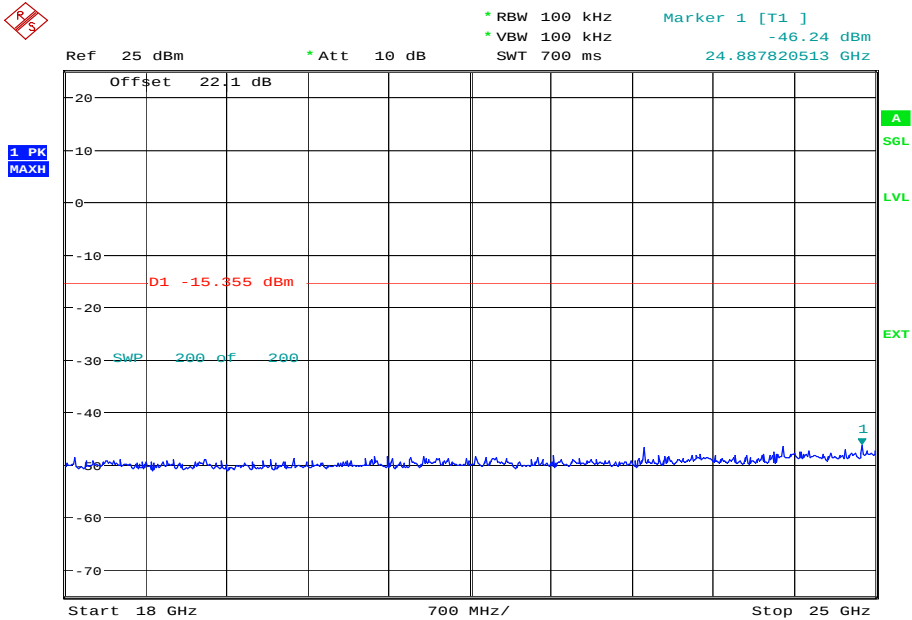


Date: 16.AUG.2013 09:14:07



Product Service

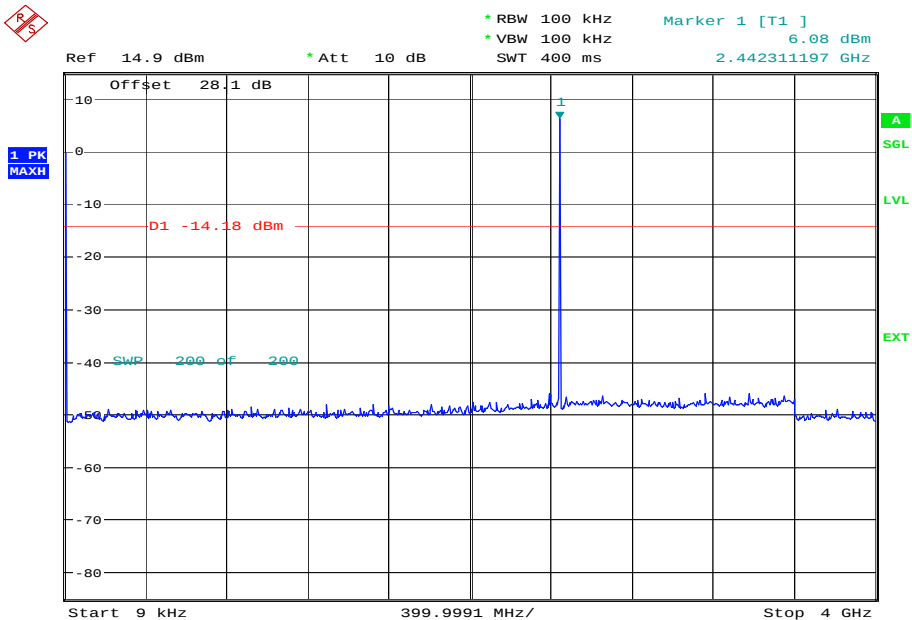
18 GHz to 25 GHz



Date: 16.AUG.2013 10:17:33

2441 MHz

9 kHz to 4 GHz

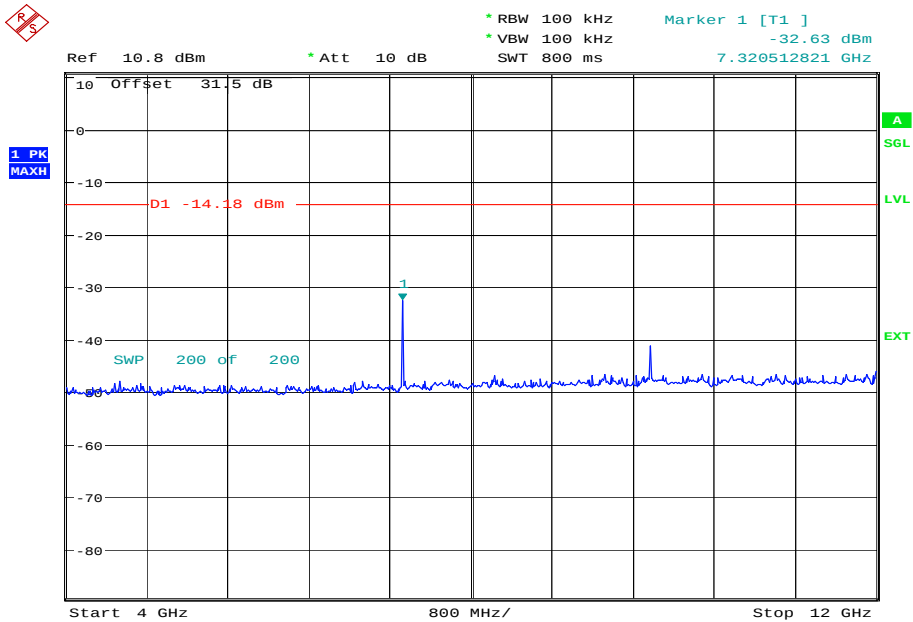


Date: 15.AUG.2013 16:03:21



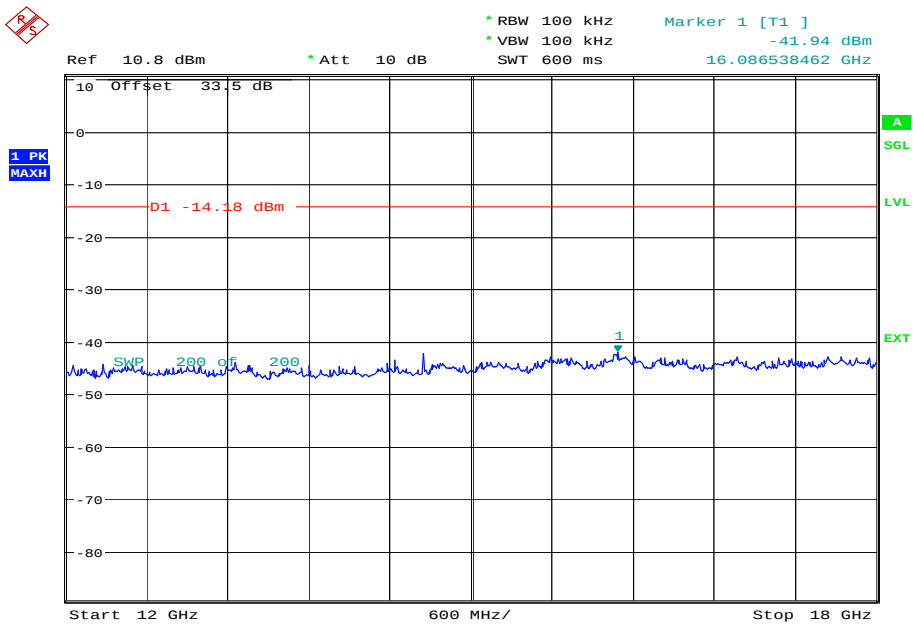
Product Service

4 GHz to 12 GHz



Date: 16.AUG.2013 08:41:47

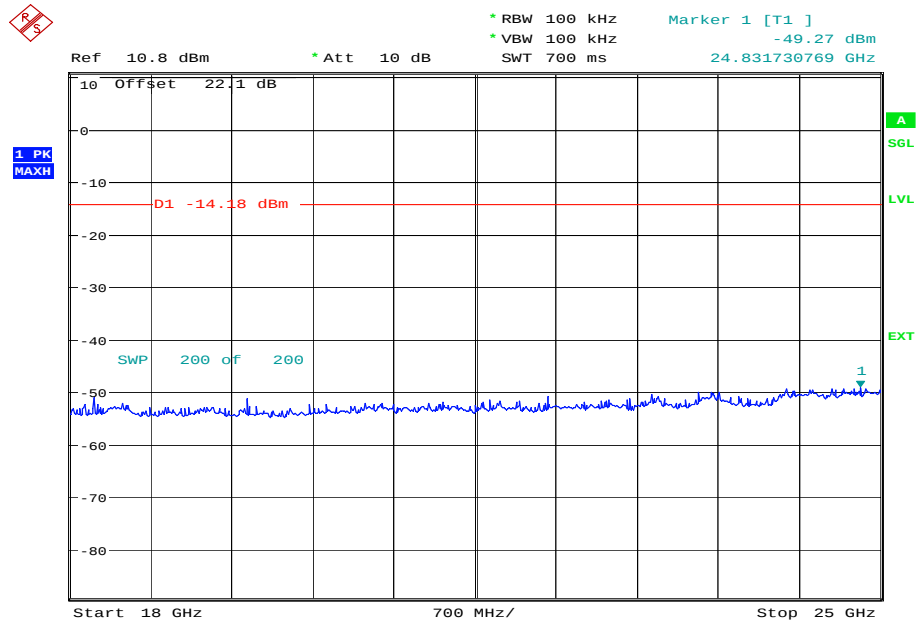
12 GHz to 18 GHz



Date: 16.AUG.2013 09:17:02



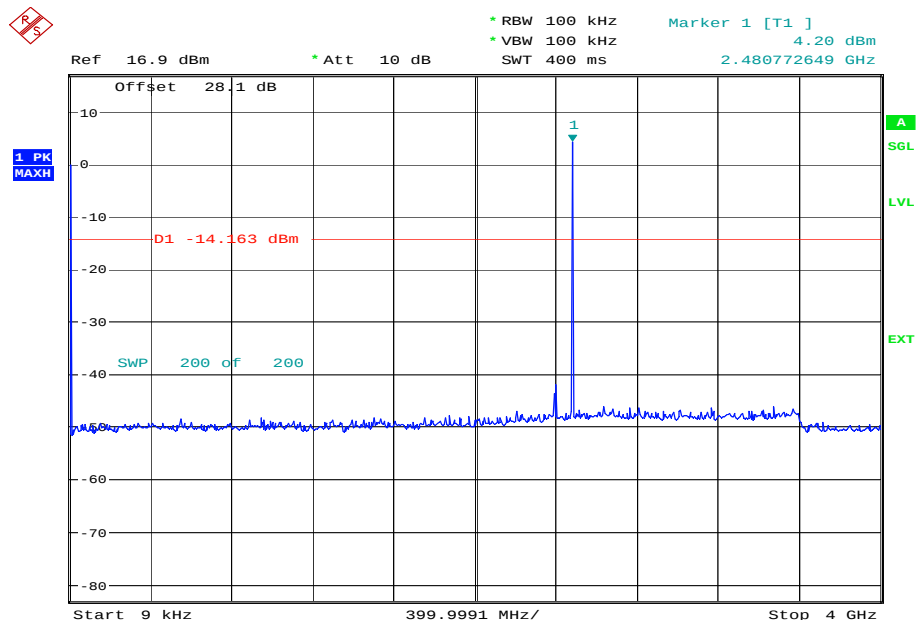
18 GHz to 25 GHz



Date: 16.AUG.2013 10:20:42

2480 MHz

9 kHz to 4 GHz

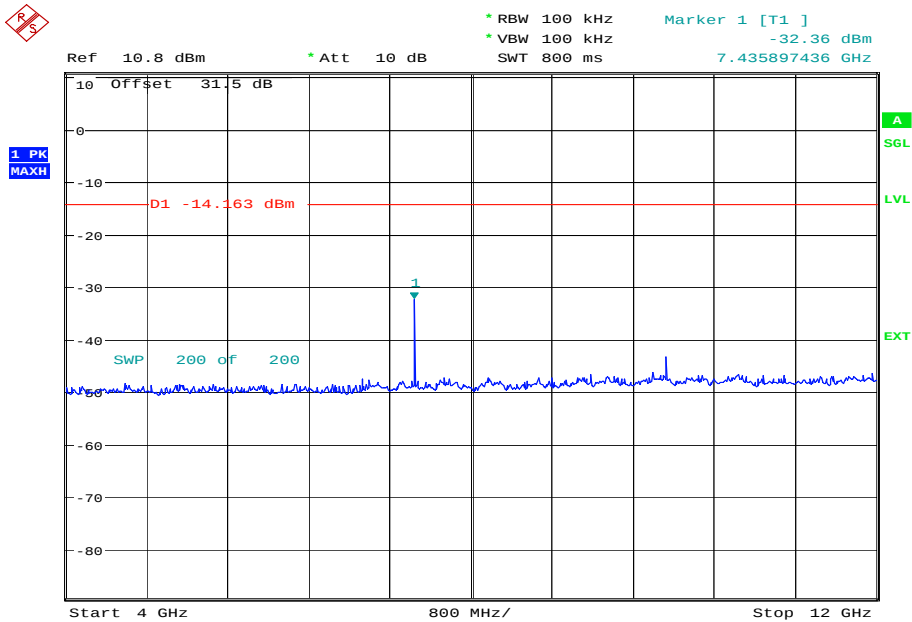


Date: 15.AUG.2013 16:06:05



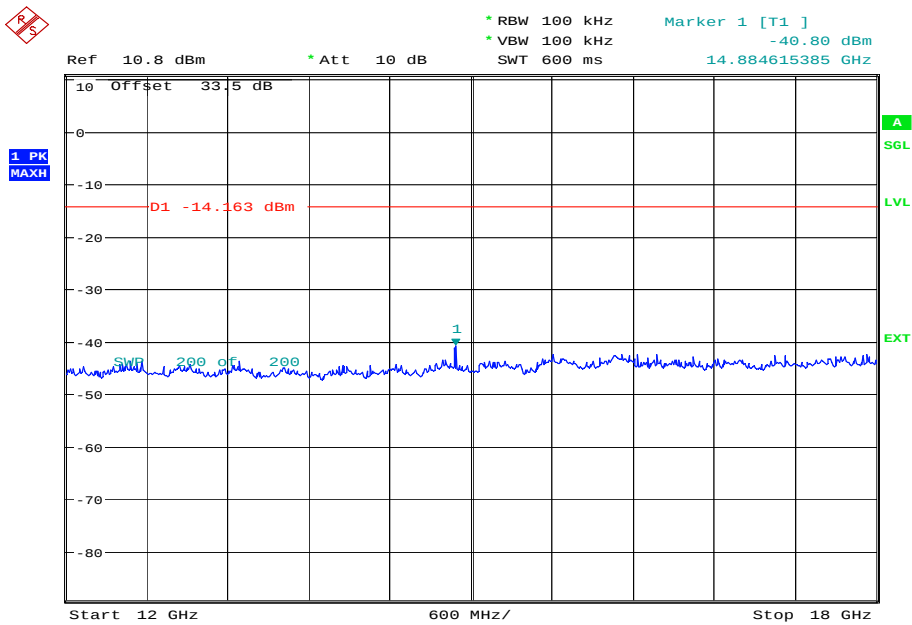
Product Service

4 GHz to 12 GHz



Date: 16.AUG.2013 08:45:32

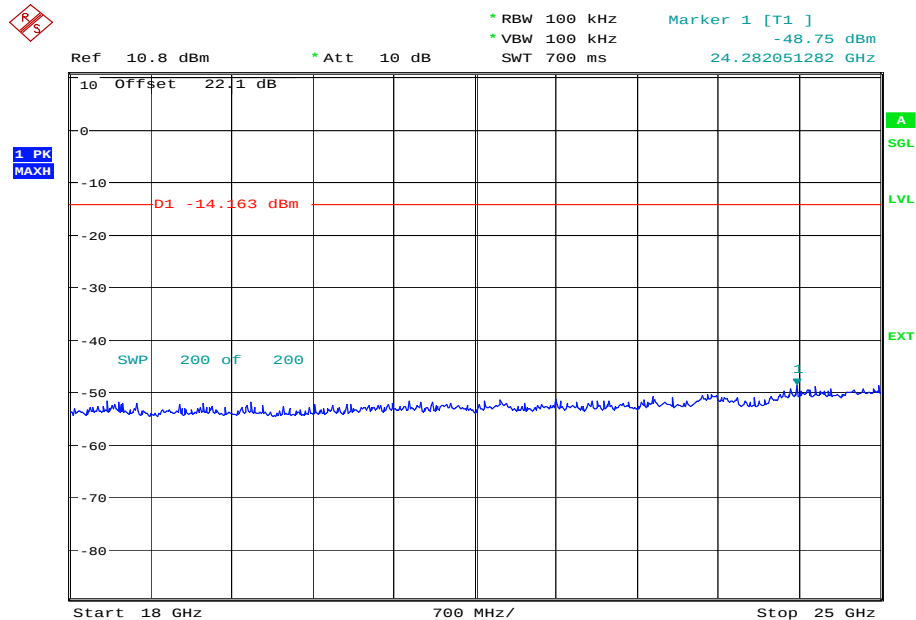
12 GHz to 18 GHz



Date: 16.AUG.2013 09:20:07



### 18 GHz to 25 GHz



Date: 16.AUG.2013 10:24:35

### Limit Clause

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.

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval the attenuation required shall be 30 dB instead of 20 dB.



Product Service

### **SECTION 3**

#### **TEST EQUIPMENT USED**



### 3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

| Instrument                                                                                        | Manufacturer         | Type No.            | TE No. | Calibration Period (months) | Calibration Due |
|---------------------------------------------------------------------------------------------------|----------------------|---------------------|--------|-----------------------------|-----------------|
| <b>Section 2.1 – AC Line Conducted Emissions</b>                                                  |                      |                     |        |                             |                 |
| LISN (1 Phase)                                                                                    | Chase                | MN 2050             | 336    | 12                          | 28-Mar-2014     |
| Screened Room (5)                                                                                 | Rainford             | Rainford            | 1545   | 36                          | 25-Dec-2013     |
| Transient Limiter                                                                                 | Hewlett Packard      | 11947A              | 2377   | 12                          | 13-Feb-2014     |
| EMI Test Receiver                                                                                 | Rohde & Schwarz      | ESU40               | 3506   | 12                          | 11-Oct-2013     |
| 7m Armoured RF Cable                                                                              | SSI Cable Corp.      | 1501-13-13-7m WA(-) | 3600   | -                           | TU              |
| <b>Section 2.2 - Frequency Hopping Systems - 20dB Bandwidth and Channel Separation</b>            |                      |                     |        |                             |                 |
| Attenuator (10dB, 10W)                                                                            | Texscan              | HFP-50N             | 468    | 12                          | 27-Jun-2014     |
| Attenuator (20dB/ 2W)                                                                             | Pasternack           | PE7004-20           | 489    | 12                          | 18-Oct-2013     |
| Spectrum Analyser                                                                                 | Rohde & Schwarz      | FSU26               | 2747   | 12                          | 30-Nov-2013     |
| Combiner/Splitter                                                                                 | Weinschel            | 1506A               | 3877   | 12                          | 19-Mar-2014     |
| P-Series Power Meter                                                                              | Agilent Technologies | N1911A              | 3980   | 12                          | 17-Sep-2013     |
| 1 Metre SMA Cable                                                                                 | Rhophase             | 3PS-1801A-1000-3PS  | 4099   | 12                          | 26-Oct-2013     |
| 1 Metre N Type Cable                                                                              | Rhophase             | NPS-1601A-1000-NPS  | 4103   | 12                          | 11-Jun-2014     |
| 1 Metre K Type Cable                                                                              | Rhophase             | KPS-1501A-1000-KPS  | 4106   | 12                          | 25-Oct-2013     |
| <b>Section 2.3- Frequency Hopping Systems - Channel Dwell Time and Number of Hopping Channels</b> |                      |                     |        |                             |                 |
| Attenuator (10dB, 10W)                                                                            | Texscan              | HFP-50N             | 468    | 12                          | 27-Jun-2014     |
| Attenuator (20dB/ 2W)                                                                             | Pasternack           | PE7004-20           | 489    | 12                          | 18-Oct-2013     |
| Spectrum Analyser                                                                                 | Rohde & Schwarz      | FSU26               | 2747   | 12                          | 30-Nov-2013     |
| Combiner/Splitter                                                                                 | Weinschel            | 1506A               | 3877   | 12                          | 19-Mar-2014     |
| P-Series Power Meter                                                                              | Agilent Technologies | N1911A              | 3980   | 12                          | 17-Sep-2013     |
| 1 Metre SMA Cable                                                                                 | Rhophase             | 3PS-1801A-1000-3PS  | 4099   | 12                          | 26-Oct-2013     |
| 1 Metre N Type Cable                                                                              | Rhophase             | NPS-1601A-1000-NPS  | 4103   | 12                          | 11-Jun-2014     |
| 1 Metre K Type Cable                                                                              | Rhophase             | KPS-1501A-1000-KPS  | 4106   | 12                          | 25-Oct-2013     |
| <b>Section 2.4 - Maximum Peak Conducted Output Power</b>                                          |                      |                     |        |                             |                 |
| Attenuator (20dB/ 2W)                                                                             | Pasternack           | PE7004-20           | 489    | 12                          | 18-Oct-2013     |
| GPS Frequency Standard                                                                            | Rapco                | GPS-804/3           | 1312   | 6                           | 24-Jan-2014     |
| Power Supply                                                                                      | Hewlett Packard      | 6104A               | 1948   | -                           | TU              |
| Spectrum Analyser                                                                                 | Rohde & Schwarz      | FSU26               | 2747   | 12                          | 30-Nov-2013     |
| Power Divider                                                                                     | Weinschel            | 1506A               | 3345   | 12                          | 23-May-2014     |
| P-Series Power Meter                                                                              | Agilent Technologies | N1911A              | 3980   | 12                          | 17-Sep-2013     |
| 50 MHz-18 GHz Wideband Power Sensor                                                               | Agilent Technologies | N1921A              | 3983   | 12                          | 17-Sep-2013     |
| 1 Metre SMA Cable                                                                                 | Rhophase             | 3PS-1801A-1000-3PS  | 4099   | 12                          | 26-Oct-2013     |
| 1 Metre N Type Cable                                                                              | Rhophase             | NPS-1601A-1000-NPS  | 4102   | 12                          | 11-Jun-2014     |



| Instrument                                           | Manufacturer      | Type No.               | TE No. | Calibration Period (months) | Calibration Due |
|------------------------------------------------------|-------------------|------------------------|--------|-----------------------------|-----------------|
| <b>Section 2.5 – EIRP Peak Power</b>                 |                   |                        |        |                             |                 |
| Antenna (Double Ridge Guide, 1GHz-18GHz)             | EMCO              | 3115                   | 234    | 12                          | 3-Apr-2014      |
| Antenna (Double Ridge Guide, 1GHz-18GHz)             | EMCO              | 3115                   | 235    | 12                          | 9-Nov-2013      |
| Signal Generator (10MHz to 40GHz)                    | Rohde & Schwarz   | SMR40                  | 1002   | 12                          | 6-Sep-2013      |
| Screened Room (5)                                    | Rainford          | Rainford               | 1545   | 36                          | 25-Dec-2013     |
| Turntable Controller                                 | Inn-Co GmbH       | CO 1000                | 1606   | -                           | TU              |
| EMI Test Receiver                                    | Rohde & Schwarz   | ESU40                  | 3506   | 12                          | 11-Oct-2013     |
| Tilt Antenna Mast                                    | mature GmbH       | TAM 4.0-P              | 3916   | -                           | TU              |
| Mast Controller                                      | mature GmbH       | NCD                    | 3917   | -                           | TU              |
| <b>Section 2.6- Spurious and Band Edge Emissions</b> |                   |                        |        |                             |                 |
| Antenna (Double Ridge Guide)                         | Link Microtek Ltd | AM180HA-K-TU2          | 230    | 24                          | 13-Sep-2013     |
| Antenna (Double Ridge Guide, 1GHz-18GHz)             | EMCO              | 3115                   | 234    | 12                          | 3-Apr-2014      |
| Antenna (Bilog)                                      | Schaffner         | CBL6143                | 287    | 24                          | 18-Jan-2014     |
| Communications Tester                                | Rohde & Schwarz   | CMU 200                | 442    | 12                          | 1-Nov-2013      |
| Filter (High Pass)                                   | Lorch             | SHP7-7000-SR           | 566    | 12                          | 20-Feb-2014     |
| Pre-Amplifier                                        | Phase One         | PS04-0086              | 1533   | 12                          | 27-Sep-2013     |
| Pre-Amplifier                                        | Phase One         | PS04-0087              | 1534   | 12                          | 28-Sep-2013     |
| Screened Room (5)                                    | Rainford          | Rainford               | 1545   | 36                          | 25-Dec-2013     |
| Turntable Controller                                 | Inn-Co GmbH       | CO 1000                | 1606   | -                           | TU              |
| Amplifier (1 - 8GHz)                                 | Phase One         | PS06-0060              | 3175   | 12                          | 9-Aug-2014      |
| Amplifier (8 - 18GHz)                                | Phase One         | PS06-0061              | 3176   | 12                          | 9-Aug-2014      |
| EMI Test Receiver                                    | Rohde & Schwarz   | ESU40                  | 3506   | 12                          | 11-Oct-2013     |
| 3 GHz High Pass Filter                               | K&L Microwave     | 11SH10-3000/X18000-O/O | 3552   | 12                          | 1-Feb-2014      |
| 10mohm Resistor                                      | Cropico           | RS3                    | 3616   | 48                          | 12-Mar-2017     |
| 9m RF Cable (N Type)                                 | Rhophase          | NPS-2303-9000-NPS      | 3791   | -                           | TU              |
| Tilt Antenna Mast                                    | mature GmbH       | TAM 4.0-P              | 3916   | -                           | TU              |
| Mast Controller                                      | mature GmbH       | NCD                    | 3917   | -                           | TU              |
| Wideband Radio Communication Tester                  | Rohde & Schwarz   | CMW 500                | 4144   | 12                          | 17-Jul-2014     |

TU – Traceability Unscheduled



### 3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:-

| Test Discipline                                                               | MU                                                         |
|-------------------------------------------------------------------------------|------------------------------------------------------------|
| Frequency Hopping Systems - 20dB Bandwidth and Channel Separation             | $\pm 16.74$ kHz                                            |
| Frequency Hopping Systems - Channel Dwell Time and Number of Hopping Channels | -                                                          |
| EIRP Peak Power                                                               | 30MHz to 1GHz: $\pm 5.1$ dB<br>1GHz to 40GHz: $\pm 6.3$ dB |
| Maximum Peak Conducted Output Power                                           | $\pm 0.70$ dB                                              |
| Spurious and Band Edge Emissions                                              | 30MHz to 1GHz: $\pm 5.1$ dB<br>1GHz to 40GHz: $\pm 6.3$ dB |
| AC Line Conducted Emissions                                                   | $\pm 3.2$ dB                                               |



Product Service

## **SECTION 4**

### **ACCREDITATION, DISCLAIMERS AND COPYRIGHT**



Product Service

#### 4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA  
(Not UKAS Accredited).

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