



# Wireless Transceiver Test Report

FCC ID: A94415859 IC: 3232A 415859



Certificate # 1514.1

Report number: EMC.415859.14.79.1

Prepared for: Bose Corporation  
DCE - EMC  
1 New York Ave, Framingham MA 01701

Product Tested: Bose® Bluetooth® speaker

Standards: FCC part 15, RSS210, RSS-gen and ICES-003

Report prepared by: Bryan Cerqua

Signature: *Bryan H Cerqua*

March 20, 2014

Report reviewed by: Chad Bell

Signature: *Chad Bell*

March 20, 2014

Report issue date: March 20, 2014

Changes from  
previous revision: Original version

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## 1. Report Summary

### 1.1 Product

Bose® Bluetooth speaker

### 1.2 Client

Bose Corporation  
The Mountain, Framingham, MA 01701

### 1.3 Applicable Standards

FCC part 15 B and C  
RSS-210 issue 8  
RSS-Gen issue 3  
ICES-003 issue 5

Test Results: Pass ☒ Fail ☐

### 1.4 Test Laboratory

Bose DCE laboratories  
1 New York Ave  
Framingham, MA 01701  
IC registration : 3232A  
FCC site registration under A2LA cert. #1514

This report relates only to the items tested.

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## 2. Product description

Bluetooth wireless speaker.

A USB 5V power supply and USB charging cable are supplied with the EUT for charging the internal non user replaceable lithium ion battery. The EUT is allowed to operate while charging the battery. In addition to operating in Bluetooth mode, the EUT also has a 3.5 mm stereo auxiliary rear panel jack input to allow audio to be supplied using an external audio source such as an MP3 player. The 3.5 mm cable is not supplied with the EUT.

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## 3. Applicable standards, requirements and tests

| FCC part 15       | RSS210                          | RSS-Gen      | Test references.                                                                                                                                                                                    | Result / Data section    |
|-------------------|---------------------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| 15.15(b)          |                                 | 5.4          | There are no user-accessible controls for the adjustment of any transmitter parameters in the device under test.                                                                                    | Complies                 |
| 15.27             |                                 |              | There are no special devices such as shielded cables or special connectors required for compliance to the applicable standards.                                                                     | Complies                 |
| 15.203            |                                 |              | An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.<br>The antenna is not accessible by the user. | Complies                 |
| 15.205            | 2.2                             |              | The device does not operate in either the US or Canadian restricted bands.                                                                                                                          | Complies                 |
| 15.107<br>15.207  |                                 | 7.2.4        | Conducted emissions, 150kHz–30 MHz                                                                                                                                                                  | Complies<br>Section 6.1  |
| 15.109<br>15.209  |                                 |              | Radiated emissions, 30MHz–1GHz                                                                                                                                                                      | Complies<br>Section 6.2  |
| 15.247 (b)(1)     | A8.4 (2)                        |              | Output power:                                                                                                                                                                                       | Complies<br>Section 6.3  |
| 15.247 (a)(1)     | A8.1 (b)                        |              | Occupied Bandwidth / Channel Spacing                                                                                                                                                                | Complies<br>Section 6.4  |
| 15.247(a) (1) iii | A8.1 (d)                        |              | Time of Occupancy                                                                                                                                                                                   | Complies<br>Section 6.5  |
| 15.247(d)         | A8.5                            | 4.9          | Spurious emissions - Conducted                                                                                                                                                                      | Complies<br>Section 6.6  |
| 15.247(d)         |                                 | 4.9          | Harmonics - Radiated.                                                                                                                                                                               | Complies<br>Section 6.7  |
| 15.247(d)         |                                 | 7.2.5        | Spurious radiated emissions 1 – 25 GHz                                                                                                                                                              | Complies<br>Section 6.8  |
|                   |                                 | 4.10,<br>6.2 | Receiver mode radiated spurious emissions                                                                                                                                                           | Complies<br>Section 6.9  |
| OET65             | Canada Health and Safety code 6 |              | SAR exemption calculation                                                                                                                                                                           | Complies<br>Section 6.10 |

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## 4. Environmental Conditions

All testing is performed under the following conditions, unless otherwise defined in the detail test report section.

Temperature:  $22 \pm 4$  °C

Humidity: 30 – 60 % RH

## 5. EUT configuration

The Bose® Bluetooth® speaker is powered by an internal rechargeable, non-user replaceable lithium-ion polymer battery. The battery is charged using the supplied USB power supply and USB cable. Optionally a personal computer, laptop or other USB type charger can be used.

For all conducted RF measurements an 8 inch u.FL to SMA adapter cable with 0.7 dB loss was used to connect the EUT RF output port to the test equipment. The 0.7 dB loss is accounted for using the reference level offset feature on the spectrum analyzer.

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## 6. Detailed Test Results

### 6.1. Conducted Emissions

#### 6.1.1. Requirements

47CFR15.207, RSS 210 section 7.2.4

| Frequency | Limits dB(μV) |         |
|-----------|---------------|---------|
| MHz       | Quasi-peak    | Average |
| 0.15 -0.5 | 66-56         | 56-46   |
| 0.5 – 1.6 | 56            | 46      |
| 1.6 – 30  | 60            | 50      |

#### 6.1.2. Test setup details

The EUT was tested in accordance with ANSI C63.4 test setup conditions in both AUX input and Bluetooth modes. For each mode the EUT is operating at the worst case maximum volume pink noise. The battery was discharged prior to testing to allow maximum load on the power supply.

The R&S ESR receiver has a feature that performs FFT based quasi-peak and average measurements over the entire 150 kHz to 30 MHz range.

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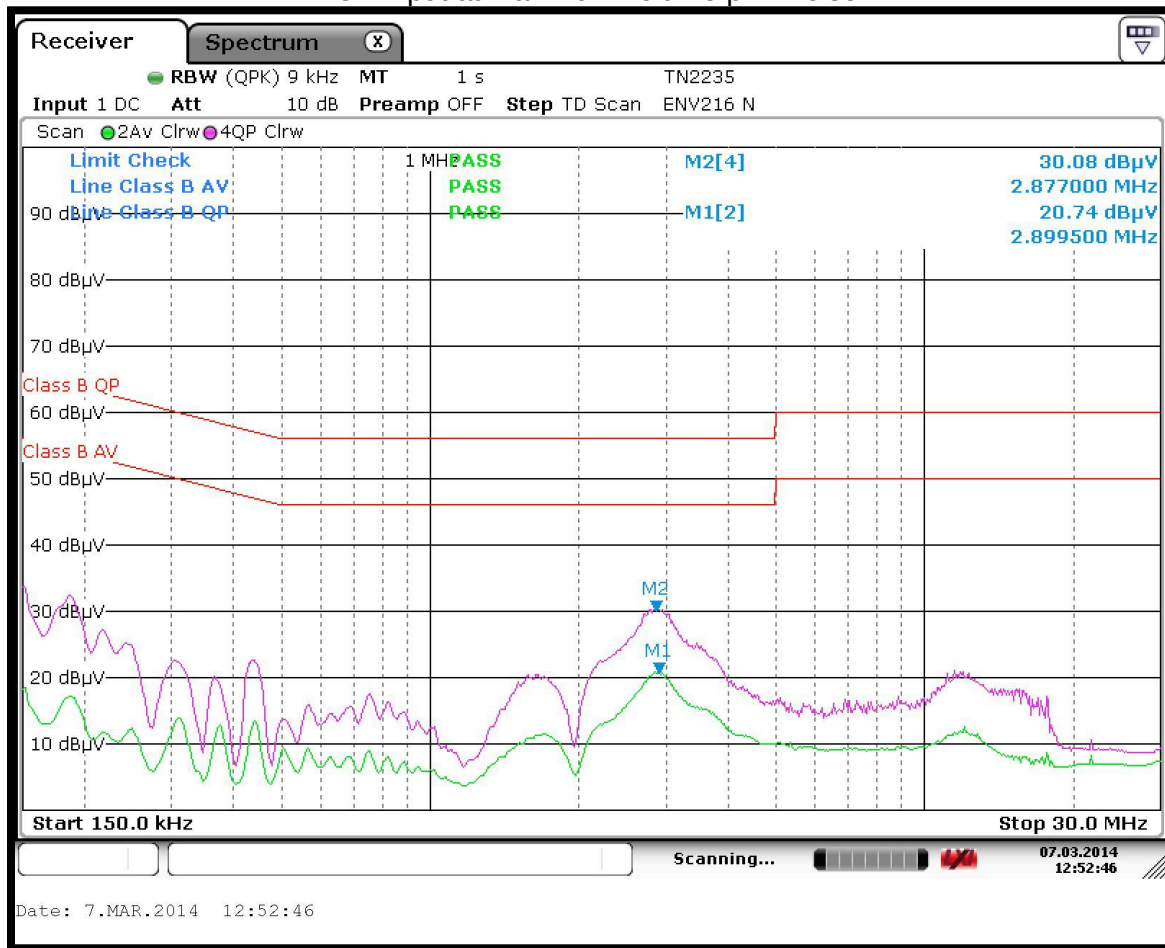
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## 6.1.3. Test data

120 VAC 60 Hz

LISN Neutral (Worst case)

AUX input at maximum volume pink noise.



Maximum QP emission of 30.0 dBuV at 2.87 MHz, 26 dB margin.

Maximum AV emission of 20.7 dBuV at 2.9 MHz, 25.2 dB margin.

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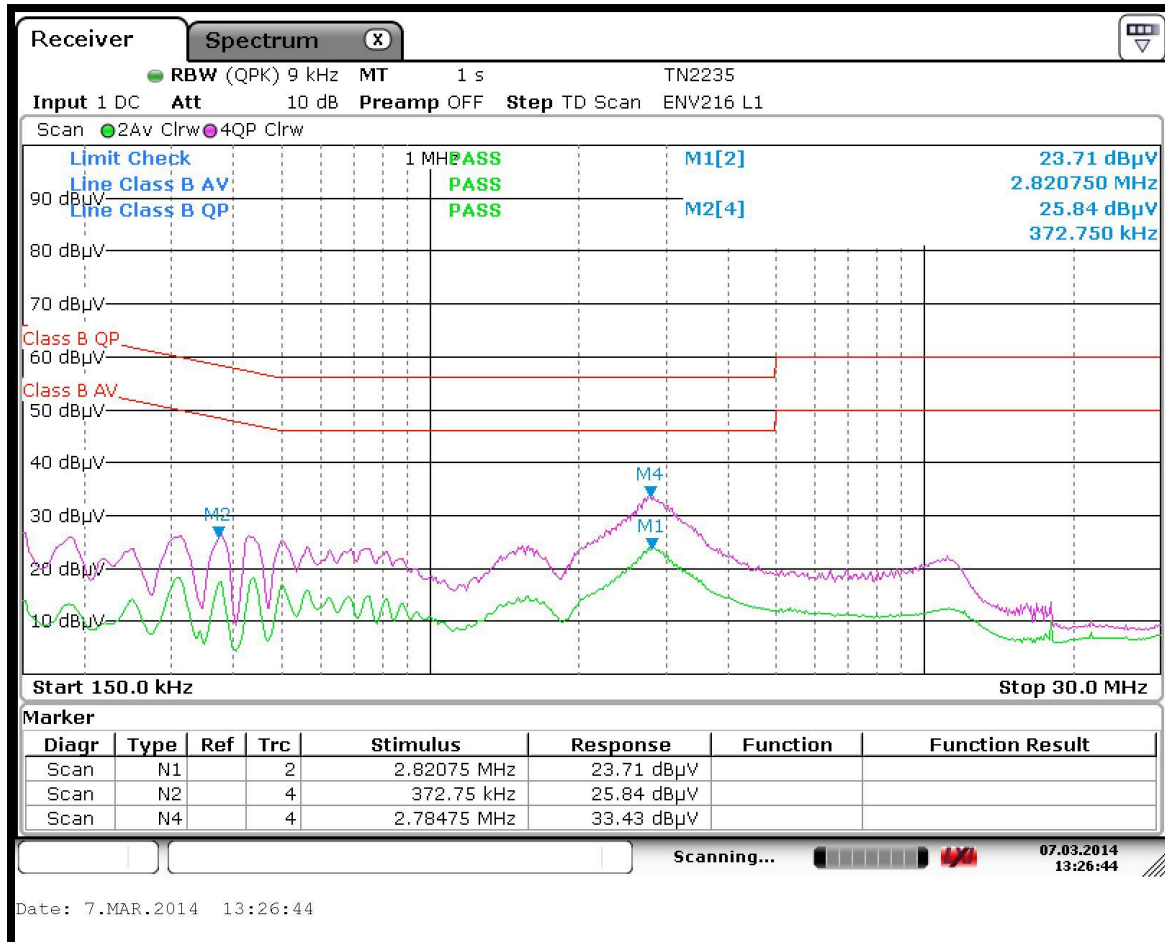


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120 VAC 60 Hz

LISN Line (Worst case)

Bluetooth mode: iPod paired playing maximum volume pink noise.



Maximum QP emission of 33.4 dBuV at 2.78 MHz, 22.6 dB margin.

Maximum AV emission of 23.7 dBuV at 2.82 MHz, 22.3 dB margin.

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## 6.1.4. Test Equipment

| Equipment Type    | Manufacturer    | Model                | Serial or other ID | Service           |          |
|-------------------|-----------------|----------------------|--------------------|-------------------|----------|
|                   |                 |                      |                    | Last              | Due      |
| LISN              | Rohde & Schwarz | ENV216               | TN2235             | 4/3/2013          | 4/3/2014 |
| EMI Test Receiver | Rohde & Schwarz | ESR                  | TN2247             | 4/3/2013          | 4/3/2014 |
| iPod              | Apple           | 4 <sup>th</sup> gen. | TN2005             | Verify before use |          |

## 6.1.5. Test information

|                         |          |                        |                      |
|-------------------------|----------|------------------------|----------------------|
| <b>Date of test:</b>    | 3/7/2014 | <b>Test location :</b> | DCE lab – Henry room |
| <b>EUT serial:</b>      | 149      | <b>Tested by:</b>      | B. Cerqua            |
| <b>Test Conclusion:</b> | Pass     |                        |                      |

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## 6.2. Radiated emissions 30 MHz – 1 GHz

### 6.2.1. Requirements

FCC rules part 15.109 (g), 15.209,

ICES-003 issue 5 and CAN/CSA-CEI/IEC CISPR 22:02

| Frequency  | Limit in dB $\mu$ V/m @3m |
|------------|---------------------------|
| MHz        | Quasi-peak                |
| 30 – 230   | 40                        |
| 230 - 1000 | 47                        |
| Above 1000 | 54                        |

### 6.2.2. Test setup details

The EUT was placed on an 80 cm high table and configured for worst case emissions based on previous testing. Worst case was using the supplied power supply charging internal EUT battery while operating at maximum volume into the AUX input.

### 6.2.3. Test data

#### Summary:

AUX mode is worst case, maximum volume pink noise.

| Emission Frequency (MHz) | Measured Amplitude (dB $\mu$ V/m) QP/AVG* | Measured Amplitude (dB $\mu$ V/m) Peak | FCC 15B                      |                           |                     |                  |
|--------------------------|-------------------------------------------|----------------------------------------|------------------------------|---------------------------|---------------------|------------------|
|                          |                                           |                                        | Limit (dB $\mu$ V/m) QP/AVG* | Limit (dB $\mu$ V/m) Peak | Margin (dB) QP/AVG* | Margin (dB) Peak |
| 38.910                   | 27.50                                     | 36.40                                  | 40.0                         | N/A                       | 12.5                | N/A              |
| 146.500                  | 32.30                                     | 35.20                                  | 43.5                         | N/A                       | 11.2                | N/A              |
| 167.700                  | 29.30                                     | 35.50                                  | 43.5                         | N/A                       | 14.2                | N/A              |
| 245.600                  | 32.50                                     | 36.20                                  | 46.0                         | N/A                       | 13.5                | N/A              |

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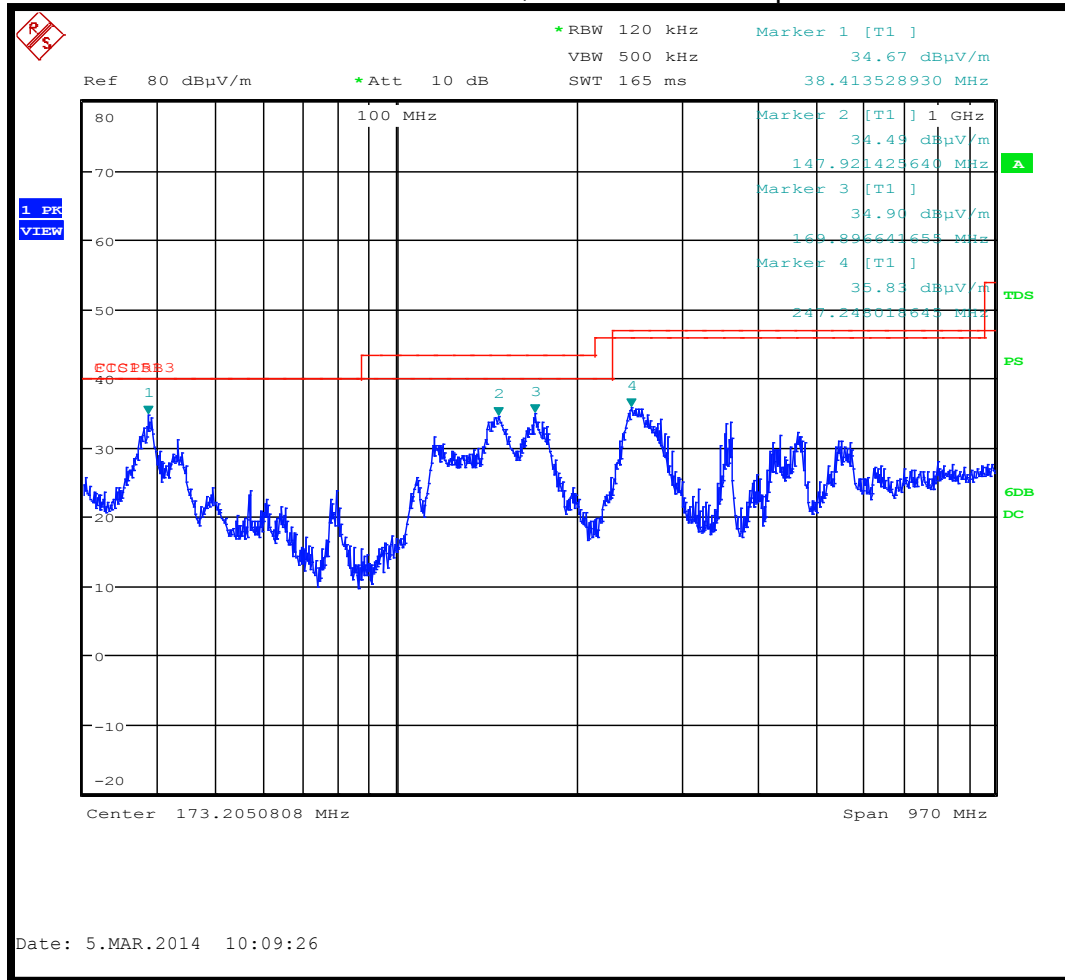
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Max-Hold Peak Pre-scan, 30MHz – 1GHz

AUX mode was worst case, maximum volume pink noise.



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## 6.2.4. Test Equipment

| Equipment Type                             | Manufacturer     | Model       | Serial or other ID | Service  |          |
|--------------------------------------------|------------------|-------------|--------------------|----------|----------|
|                                            |                  |             |                    | Last     | Due      |
| Antenna                                    | Sunol Sciences   | JB6         | TN1397             | 9/4/2013 | 9/4/2014 |
| EMI Test Receiver                          | Rohde & Schwarz  | ESU40       | TN1663             | 4/5/2013 | 4/5/2014 |
| Maxwell House Radiated Emissions Cable Set | Bose Corporation | N/A         | TN1445             | 3/5/2013 | 3/5/2014 |
| Pre-amp                                    | Mini-Circuits    | ZX60-3018G+ | TN2077             | 4/8/2013 | 4/8/2014 |
| Reference source                           | Com-Power        | CG 520      | TN1569             | 9/9/2013 | 9/9/2014 |

## 6.2.5. Test information

|                         |          |                        |                     |
|-------------------------|----------|------------------------|---------------------|
| <b>Date of test:</b>    | 3/5/2014 | <b>Test location :</b> | DCE - Maxwell House |
| <b>EUT serial:</b>      | 152      | <b>Tested by:</b>      | Kevin Strong        |
| <b>Test Conclusion:</b> | Pass     |                        |                     |

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## 6.3. Output power

### 6.3.1. Requirements:

FCC 15.247(a)(1) , RSS 210 A8.4 (2)

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.

### 6.3.2. Test setup details:

The EUT is controlled via the USB port with CSR's Blue Suite software which is used to set the test modes of the Bluetooth device. The EUT antenna is disconnected. A temporary test connector is mounted to the PCB. An 8 inch u.FL to SMA adapter cable with 0.7 dB loss was used for all conducted measurements. To compensate for the cable loss the reference level offset feature of the spectrum analyzer was used. The EUT is programmed to operate on fixed frequencies at the low, middle, and high end of the authorized frequency band.

The spectrum analyzer resolution bandwidth is set to 3 MHz (higher than the occupied bandwidth), peak detector and max hold. The maximum output power is recorded for each of the three frequencies in both basic and enhanced data rates.

### 6.3.3. Test data.

#### Summary:

RBW = 3 MHz, detector = peak, max power = 9.54 dBm (9 mW) (Basic Rate)

| Channel | Center Frequency (MHz) | Basic Rate: DH5 (dBm) | EDR: 3-DH5 (dBm) |
|---------|------------------------|-----------------------|------------------|
| 0       | 2402                   | 7.28                  | 5.77             |
| 39      | 2441                   | 6.25                  | 4.36             |
| 78      | 2480                   | 9.54                  | 8.68             |

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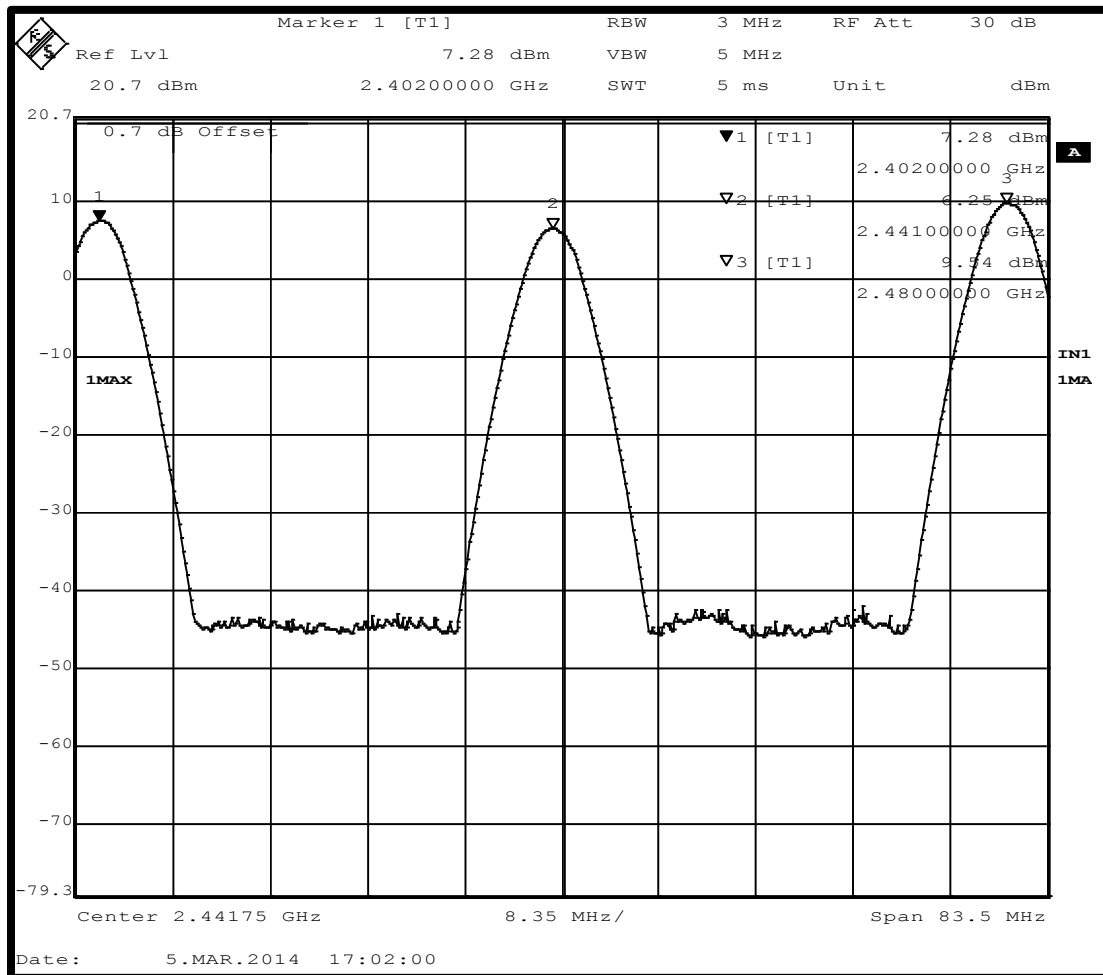
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Output power for basic rate: (DH5)



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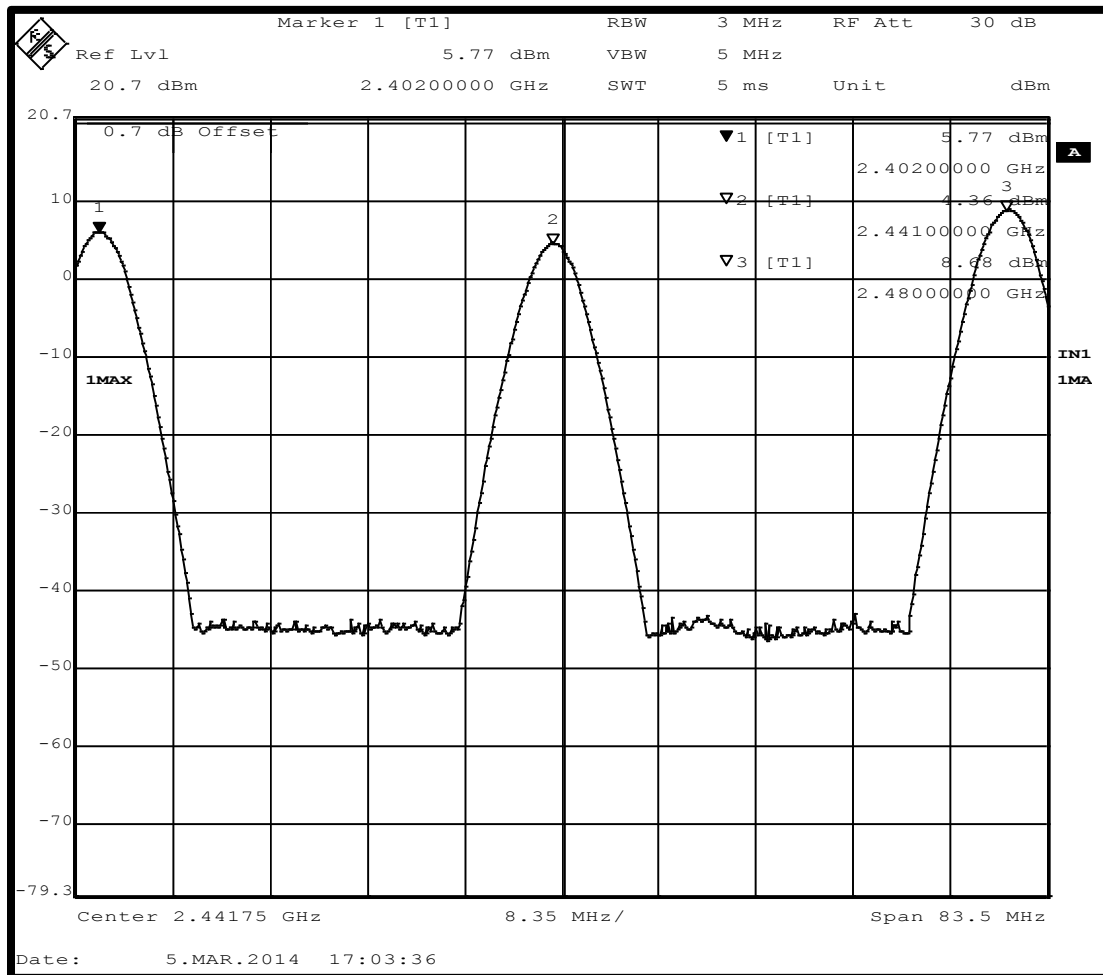
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Output power for enhanced rate: (3-DH5)



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## 6.3.4. Test Equipment

| Equipment Type    | Manufacturer    | Model  | Serial or other ID | Service date |          |
|-------------------|-----------------|--------|--------------------|--------------|----------|
|                   |                 |        |                    | Last         | Due      |
| EMI Test Receiver | Rohde & Schwarz | ESIB40 | TN1560             | 4/4/2013     | 4/4/2014 |

## 6.3.5. Test information

|                         |          |                       |                        |
|-------------------------|----------|-----------------------|------------------------|
| <b>Date of test:</b>    | 3/5/2014 | <b>Test location:</b> | Transmitter Test Bench |
| <b>EUT serial:</b>      | 1 (PCB)  | <b>Tested by:</b>     | B. Cerqua              |
| <b>Test Conclusion:</b> | Pass     |                       |                        |

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## 6.4. Occupied Bandwidth/Channel Spacing

### 6.4.1. Requirements

RSS210 section A8.1 (b)

The bandwidth of a frequency hopping channel is the 20 dB emission bandwidth, measured with the hopping stopped. The system RF bandwidth is equal to the channel bandwidth multiplied by the number of channels in the hopping frequency set.

FCC part 15.247(a)(1)

The hopping channel carrier frequencies are separated by at least  $2/3^{\text{rd}}$  of the 20dB bandwidth provided the output power is less than 125 mW (20.96 dBm)

### 6.4.2. Test setup details

The test setup is described in section 6.3.2 except that the RBW is set to 100 kHz

#### Bandwidth summary table:

EDR mode packet 3-DH5 (showed widest bandwidth)

| BT Channel | Center Frequency (MHz) | -20dB OBW (MHz) | 99% OBW (MHz) |
|------------|------------------------|-----------------|---------------|
| 0          | 2402                   | 1.412           | 1.232         |
| 39         | 2441                   | 1.412           | 1.232         |
| 78         | 2480                   | 1.422           | 1.252         |

Conclusion:  $2/3^{\text{rd}}$  of the highest 20 dB bandwidth =  $2/3 \times (1.422 \text{ MHz}) = 946 \text{ kHz}$ , which is less than the carrier channel separation of 1 MHz. In addition, the output power is less than 125 mW. See section 6.3 for the measurement of output power.

The system RF bandwidth as defined in RSS 210 A8.1 (a) is:

Channel bandwidth multiplied by the number of channels in the hop set.

(79 channels)  $\times$  (1.422 MHz) = 112 MHz.

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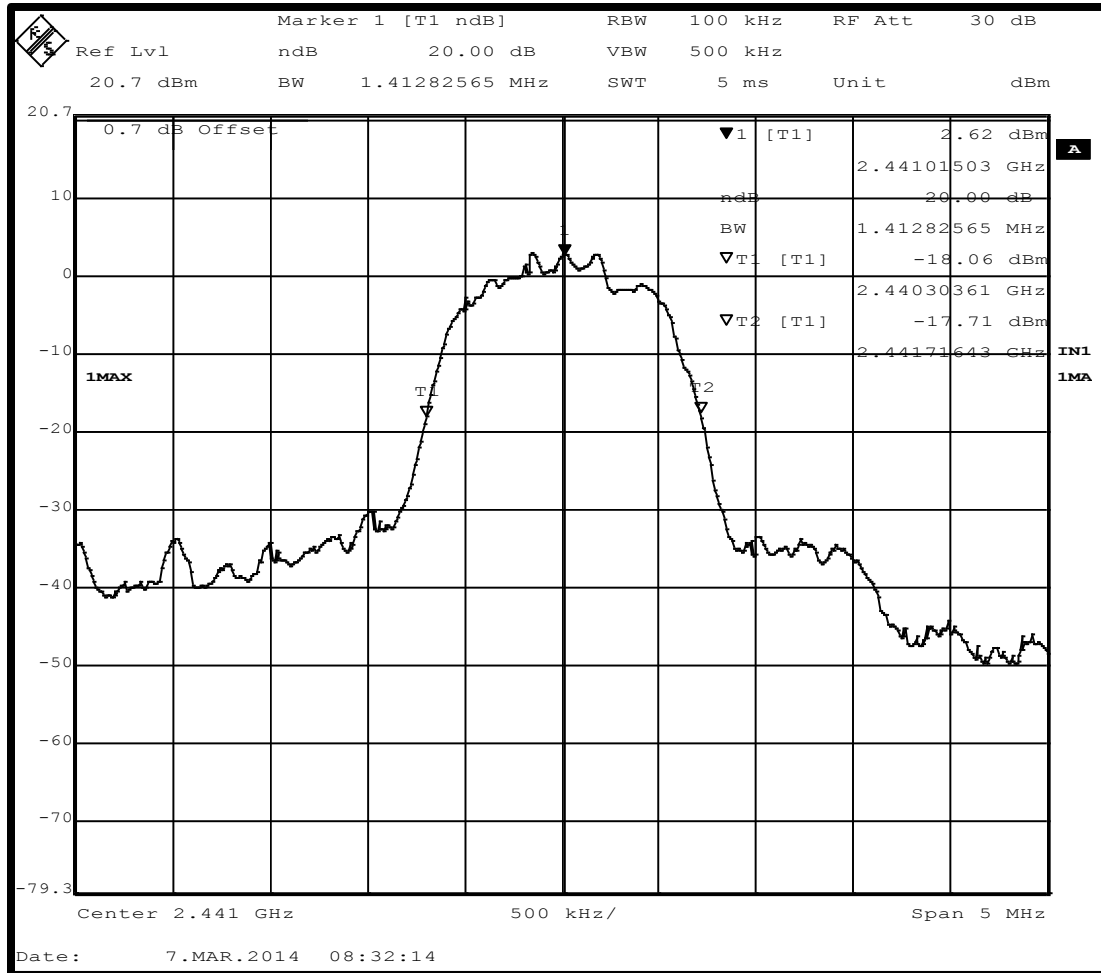
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Example spectrum analyzer plot showing how the 20 dB bandwidth was measured.  
Used the R&S ESIB40's built in n dB down measurement.

20 dB OBW = 1.41 MHz. (EDR 3-DH5)



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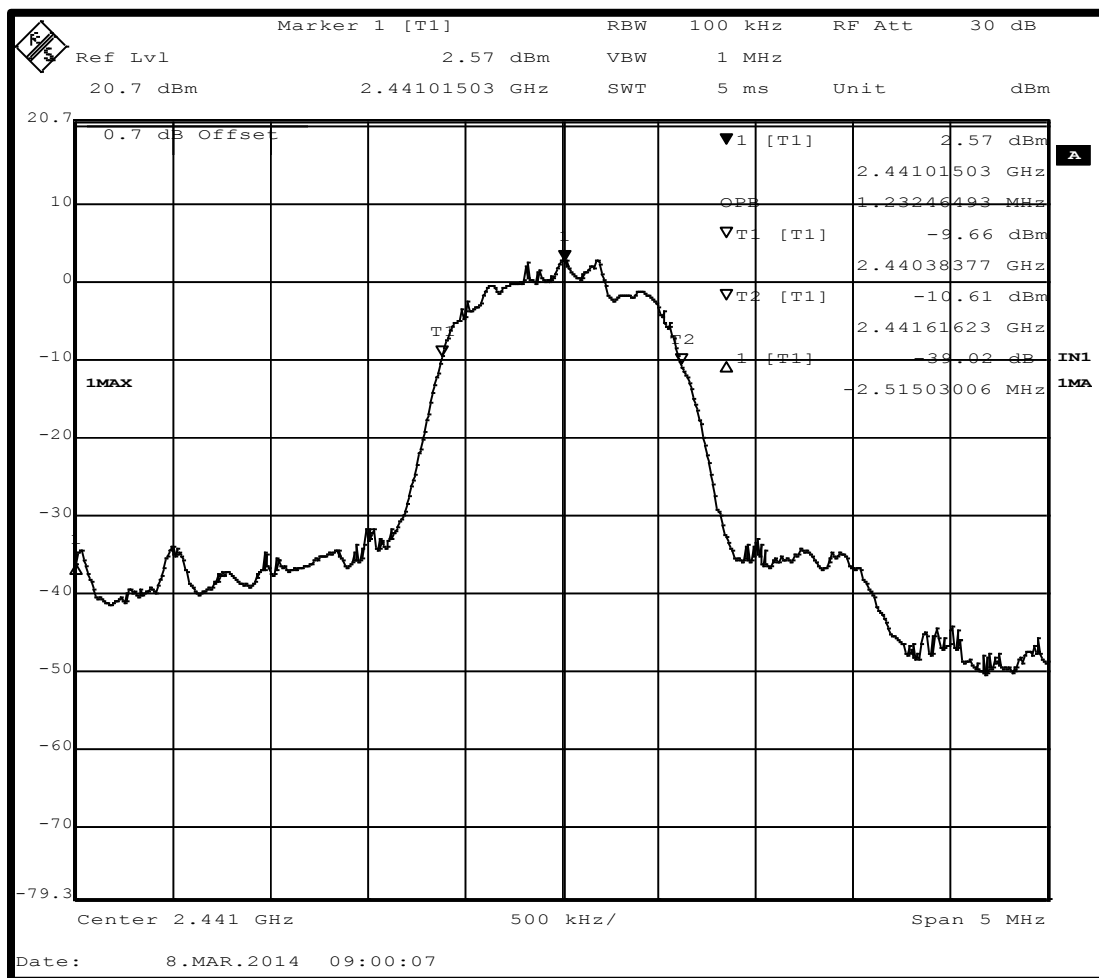
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Example spectrum analyzer plot showing how the 99% bandwidth was measured.  
Used the R&S ESIB40's built in 99% OBW measurement.

99% OBW = 1.23 MHz. (EDR 3-DH5)



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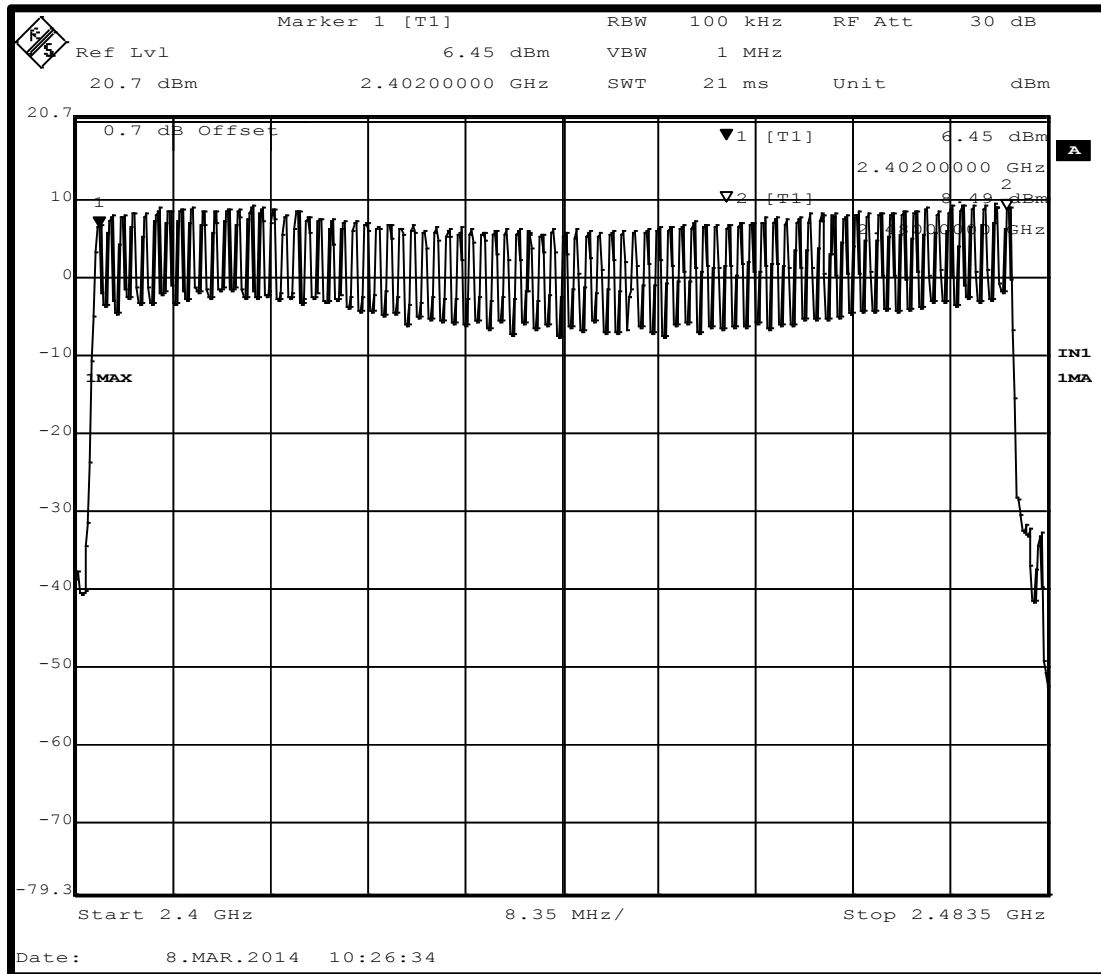
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## Channel Spacing

79 channels between 2402 MHz and 2480 MHz = 1 MHz channel spacing



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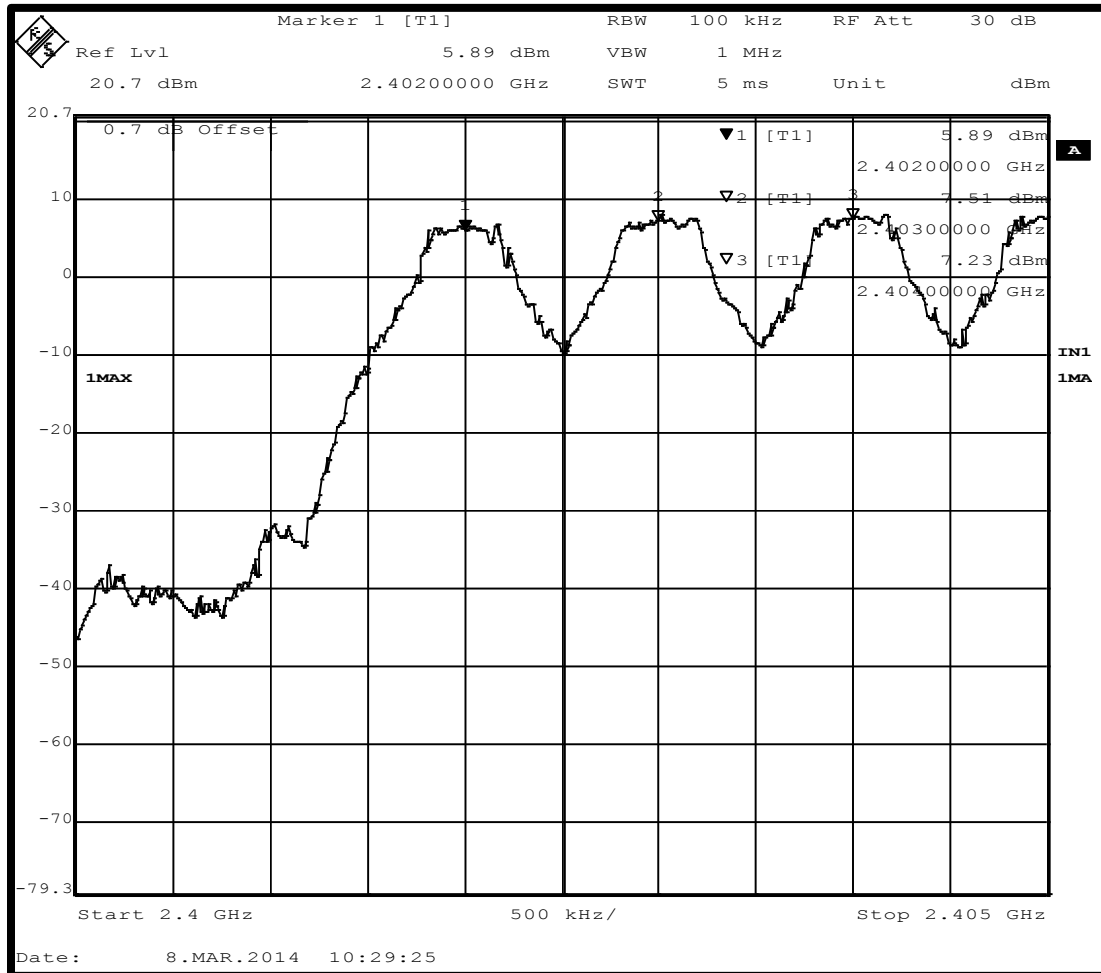
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Low band end channel spacing detail.



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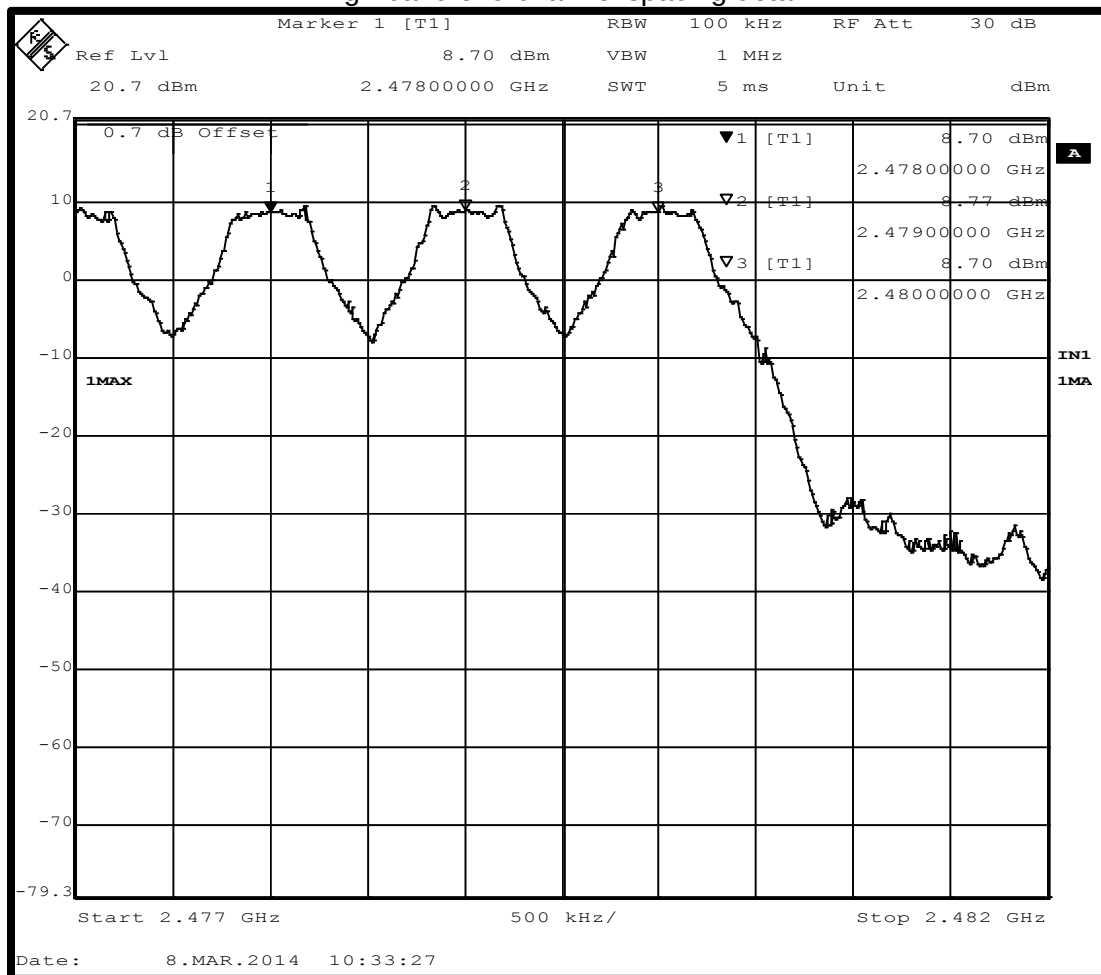
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## High band end channel spacing detail



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## 6.4.3. Test Equipment

| Equipment Type    | Manufacturer    | Model   | Serial or other ID | Service date |          |
|-------------------|-----------------|---------|--------------------|--------------|----------|
|                   |                 |         |                    | Last         | Due      |
| EMI Test Receiver | Rohde & Schwarz | ESIB 40 | TN1560             | 4/4/2013     | 4/4/2014 |

## 6.4.4. Test information

|                         |                     |                       |                        |
|-------------------------|---------------------|-----------------------|------------------------|
| <b>Date of test:</b>    | 3/7/2014 - 3/8/2014 | <b>Test location:</b> | Transmitter Test Bench |
| <b>EUT serial:</b>      | 1 (PCB)             | <b>Test by:</b>       | B. Cerqua              |
| <b>Test Conclusion:</b> | Pass                |                       |                        |

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## 6.5. Time of occupancy

### 6.5.1. Requirements

FCC 15.247 (a) (1) iii, RSS210 A8.1 (d)

The frequency hopping operation shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within the duration in seconds equal to the number of hopping frequencies employed multiplied by 0.4

### 6.5.2. Test setup details

The EUT is controlled via the USB cable with CSR's Blue Suite software which is used to set the test modes of EUT. The EUT is programmed to operate at fixed frequencies at the low, middle, and high end of the authorized frequency band.

Using zero span mode on the channel center frequency the transmit pulse width was measured for each of the following modes, DH1, DH3 & DH5 with the maximum payload size for basic and enhanced data rates.

### 6.5.3. Test data

$$\begin{aligned}\text{Dwell Time} &= (\text{TX Pulse Width}) * (\text{Hop Rate}) / (\# \text{ of Channels}) / (\# \text{ of slots}) * 31.6 \\ &= (\text{TX Pulse Width}) * 1600 / 79 / (\# \text{ of Slots}) * 31.6 \\ &= (\text{TX Pulse Width}) * 640 / (\# \text{ Slots})\end{aligned}$$

$$\text{Hop Rate} = 1600 \text{ hops} / S$$

$$\# \text{ of channels} = 79$$

$$\# \text{ of slots} = \text{number of slots used per packet in a given mode: DH1} = 2, \text{DH3} = 4, \text{DH5} = 6$$

$$31.6 \text{ Seconds} = (79 \text{ channels}) * 0.4 \text{ Seconds}$$

#### Dwell time summary table.

(Measured at 2480 MHz)

| Mode | # of Slots | Pulse Width (uS) | Dwell Time (S) | Limit (S) | Result |
|------|------------|------------------|----------------|-----------|--------|
| DH1  | 2          | 416              | 0.133          | 0.400     | Pass   |
| DH3  | 4          | 1685             | 0.270          | 0.400     | Pass   |
| DH5  | 6          | 2927             | 0.312          | 0.400     | Pass   |
| 2DH1 | 2          | 423              | 0.135          | 0.400     | Pass   |
| 2DH3 | 4          | 1683             | 0.269          | 0.400     | Pass   |
| 2DH5 | 6          | 2936             | 0.313          | 0.400     | Pass   |
| 3DH1 | 2          | 434              | 0.139          | 0.400     | Pass   |
| 3DH3 | 4          | 1686             | 0.270          | 0.400     | Pass   |
| 3DH5 | 6          | 2929             | 0.312          | 0.400     | Pass   |

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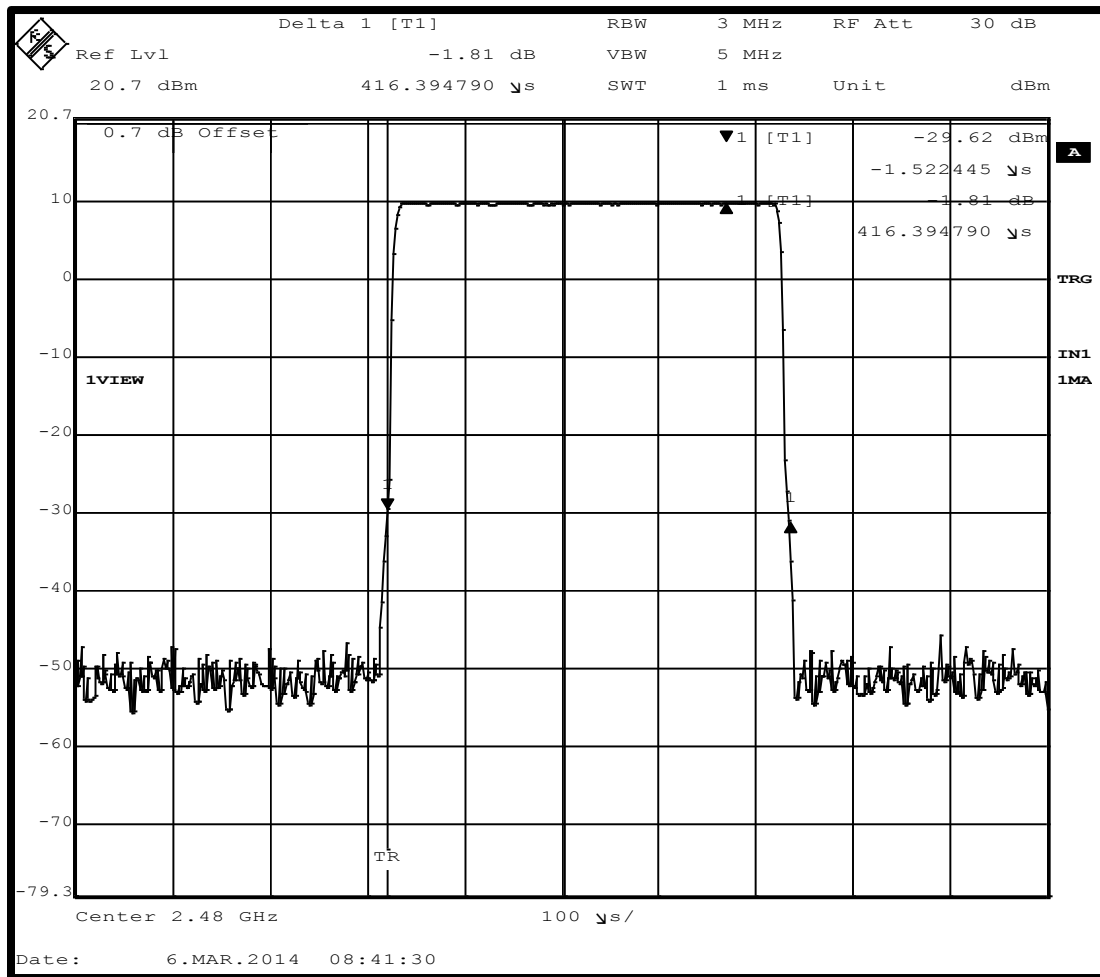
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Representative plot for **DH1** with maximum payload size  
Channel frequency 2480 MHz

Measured TX pulse width is 416 uS



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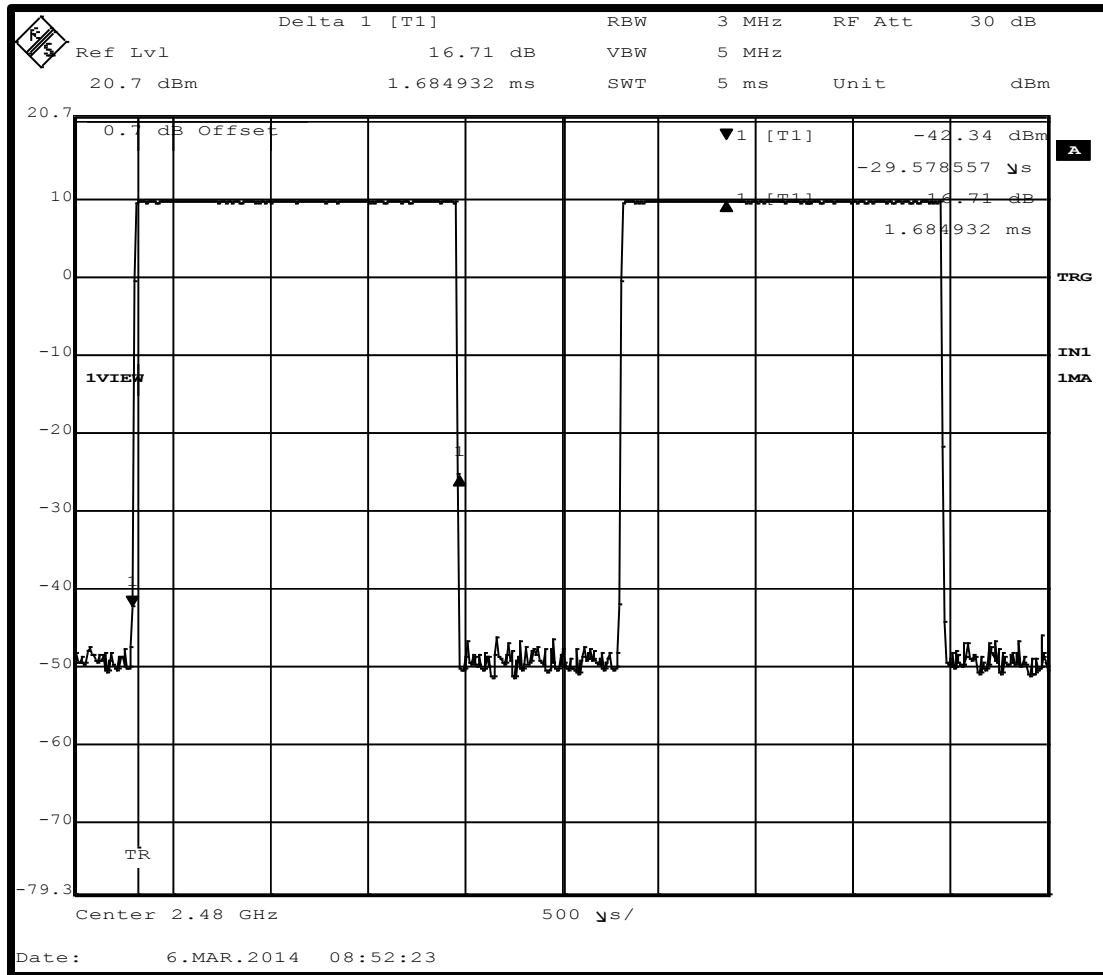
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Representative plot for **DH3** with maximum payload size  
Channel frequency 2480 MHz

Measured TX pulse width is 1.68 mS



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# Wireless Transceiver Test Report

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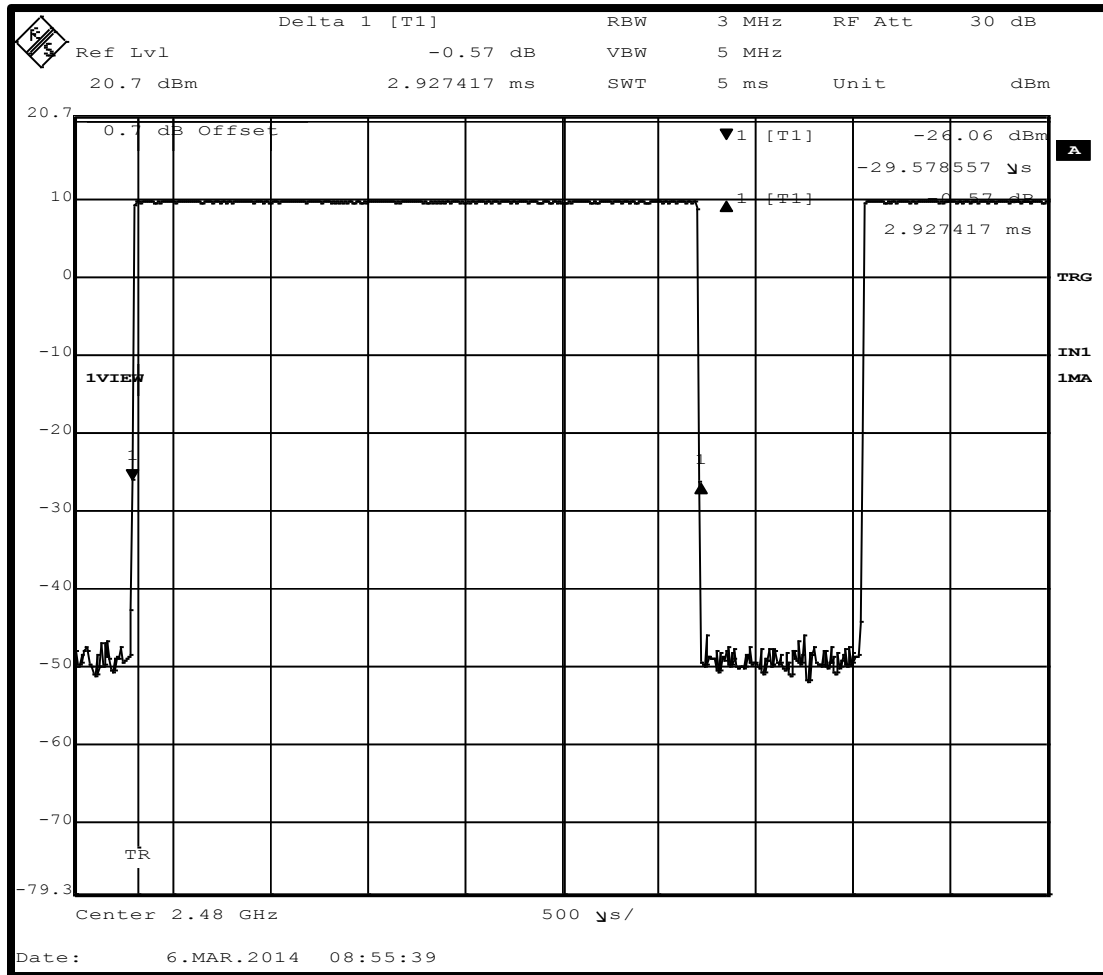
IC: 3232A 415859



Certificate # 1514.1

Representative plot for **DH5** with maximum payload size  
Channel frequency 2441 MHz

Measured TX pulse width is 2.92 mS



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# Wireless Transceiver Test Report

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IC: 3232A 415859



Certificate # 1514.1

## 6.5.4. Test Equipment

| Equipment Type    | Manufacturer    | Model  | Serial or other ID | Service date |          |
|-------------------|-----------------|--------|--------------------|--------------|----------|
|                   |                 |        |                    | Last         | Due      |
| EMI Test Receiver | Rohde & Schwarz | ESIB40 | TN1560             | 4/4/2013     | 4/4/2014 |

## 6.5.5. Test information

|                         |          |                       |                        |
|-------------------------|----------|-----------------------|------------------------|
| <b>Date of test:</b>    | 3/6/2014 | <b>Test location:</b> | Transmitter Test Bench |
| <b>Serial number:</b>   | 1 (PCB)  | <b>Tested by:</b>     | B. Cerqua              |
| <b>Test Conclusion:</b> | Pass     |                       |                        |

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# Wireless Transceiver Test Report

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## 6.6. Spurious emissions- Conducted

### 6.6.1. Requirements

FCC part 15.247(d), RSS210 A8.5

In any 100 kHz bandwidth, the conducted spurious emissions shall be attenuated at least 20dB below the level of the wanted signal.

### 6.6.2. Test Setup

The test setup is described section 6.3.2

EUT is controlled by CSR's Blue Suite software to enable testing of the spurious output in specific operational modes.

Measurements are made with the EUT in normal operation (hopping through all available channels) in basic and enhanced data rate modes.

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# Wireless Transceiver Test Report

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## 6.6.3. Test data

### Conducted spurious for transmit mode:

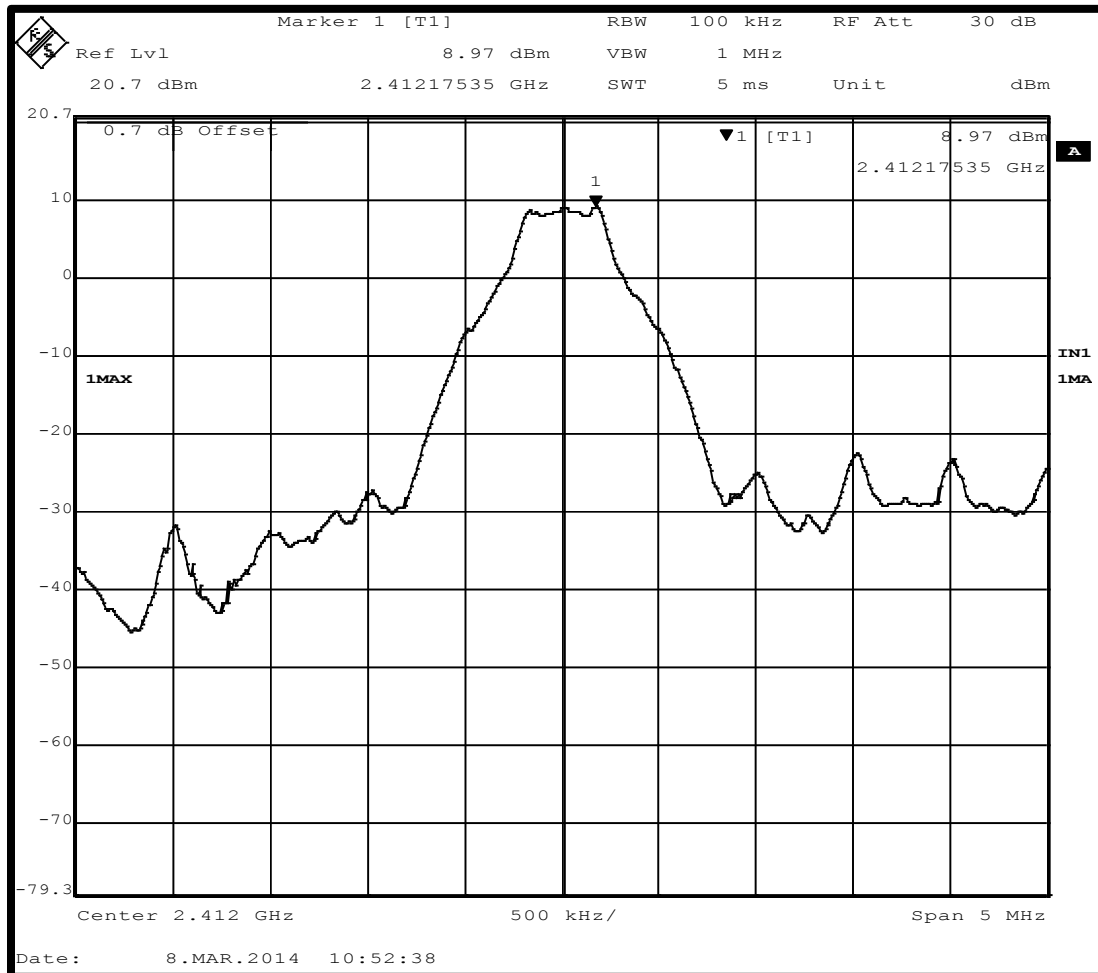
30 MHz – 25 GHz conducted spurious scan, 100 kHz RBW, peak detector.

### Basic data rate, DH5, hopping stopped.

Highest power frequency found at 2412 MHz.

Maximum in band peak measured 8.96 dBm ~ 9 dBm.

(Used to determine the display line values on the following plots.)



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# Wireless Transceiver Test Report

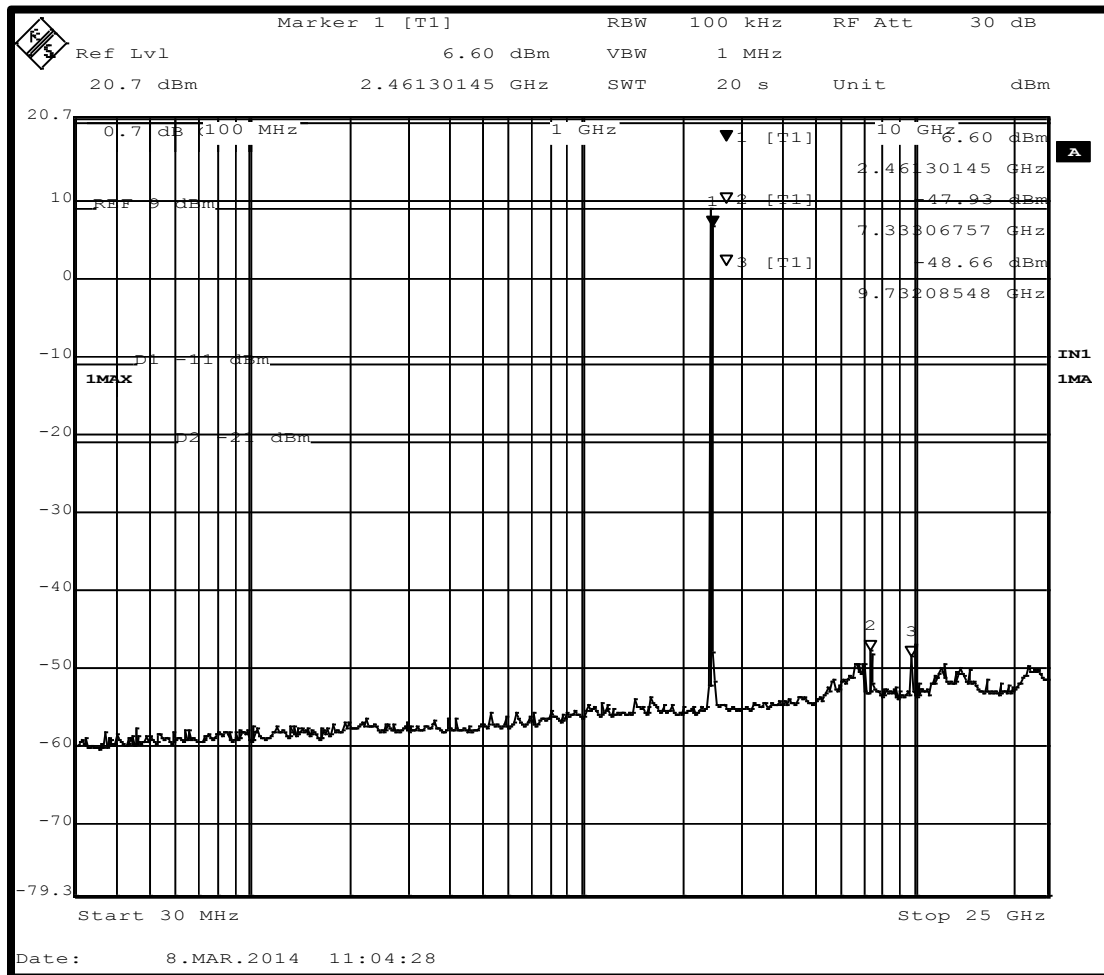
FCC ID: A94415859

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Basic data rate hopping on all channels



Spurious peak emissions are more than 20 dB below maximum in band peak.

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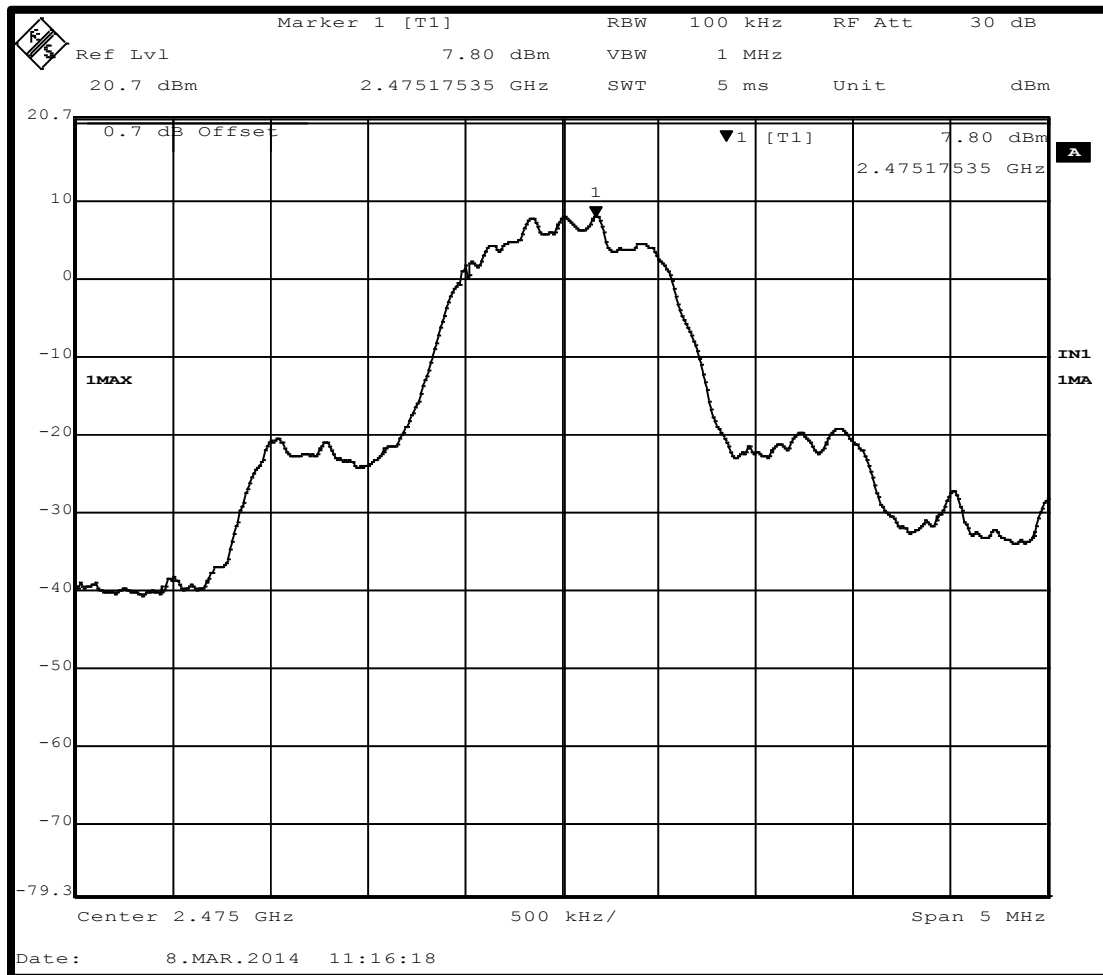


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Enhanced data rate, 3-DH5, hopping stopped.

Maximum in band peak measured 7.8 dBm ~ 8 dBm

(Used to determine the display line values on the following plots.)



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# Wireless Transceiver Test Report

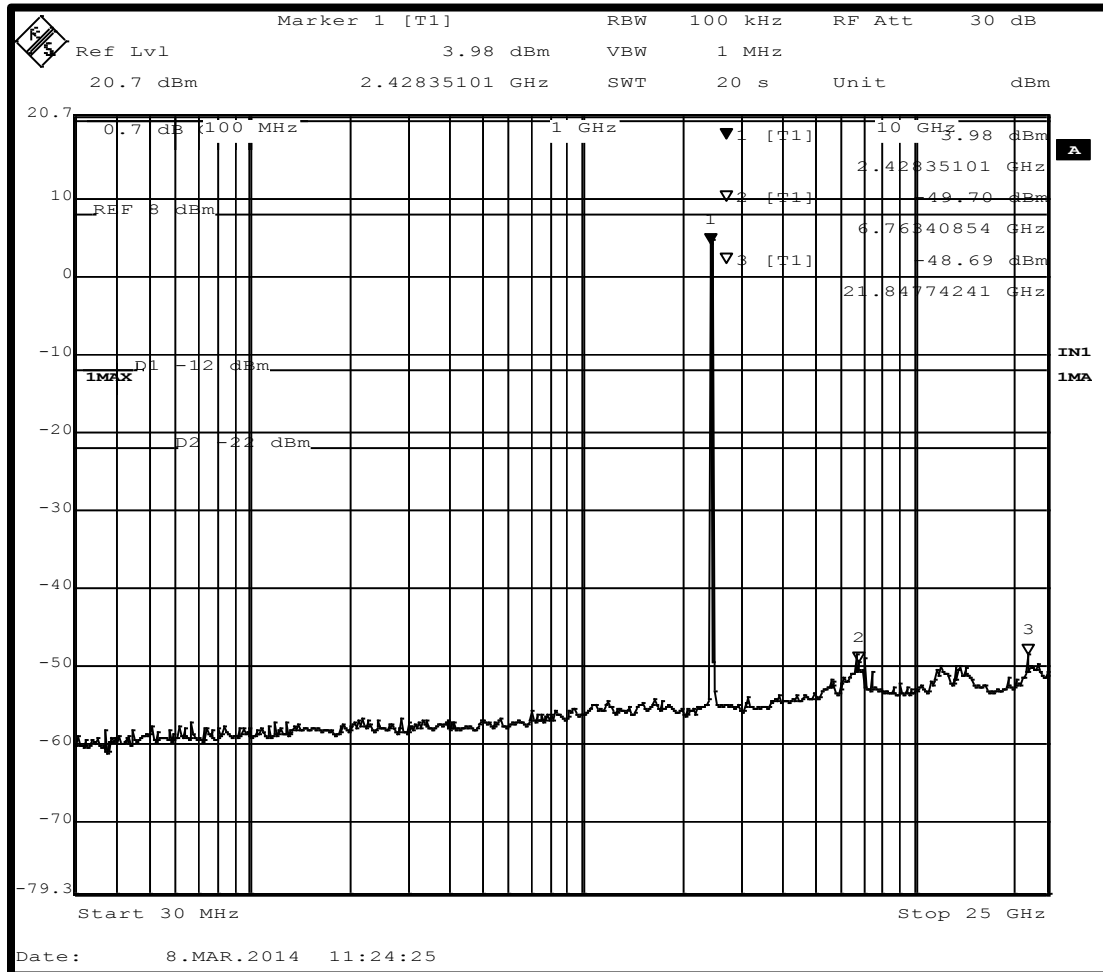
FCC ID: A94415859

IC: 3232A 415859



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## Enhanced data rate hopping on all channels



Spurious peak emissions are more than 20 dB below maximum in band peak.

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# Wireless Transceiver Test Report

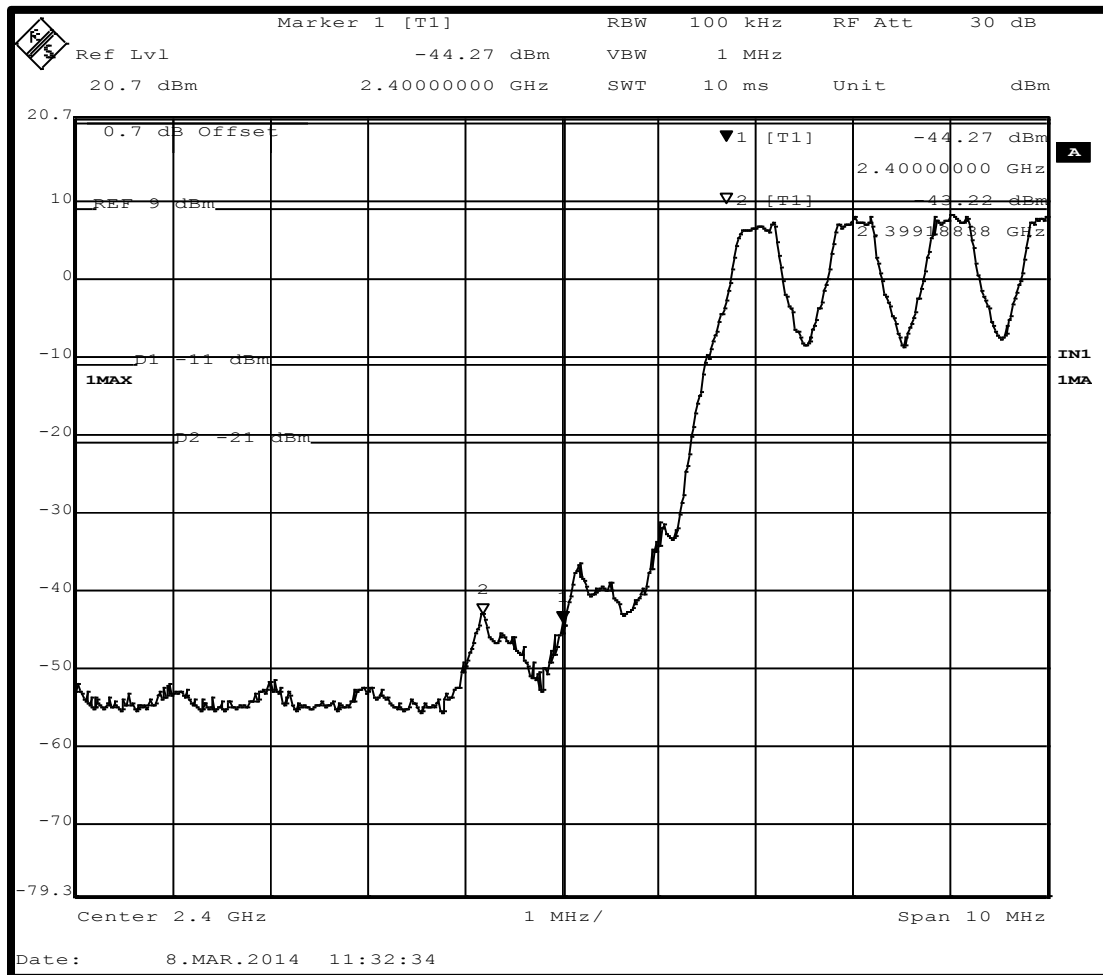
FCC ID: A94415859

IC: 3232A 415859



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Lower band edge (Basic data rate, hopping on all channels)



Out of band peak emissions are more than 20 dB below in band peak.

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# Wireless Transceiver Test Report

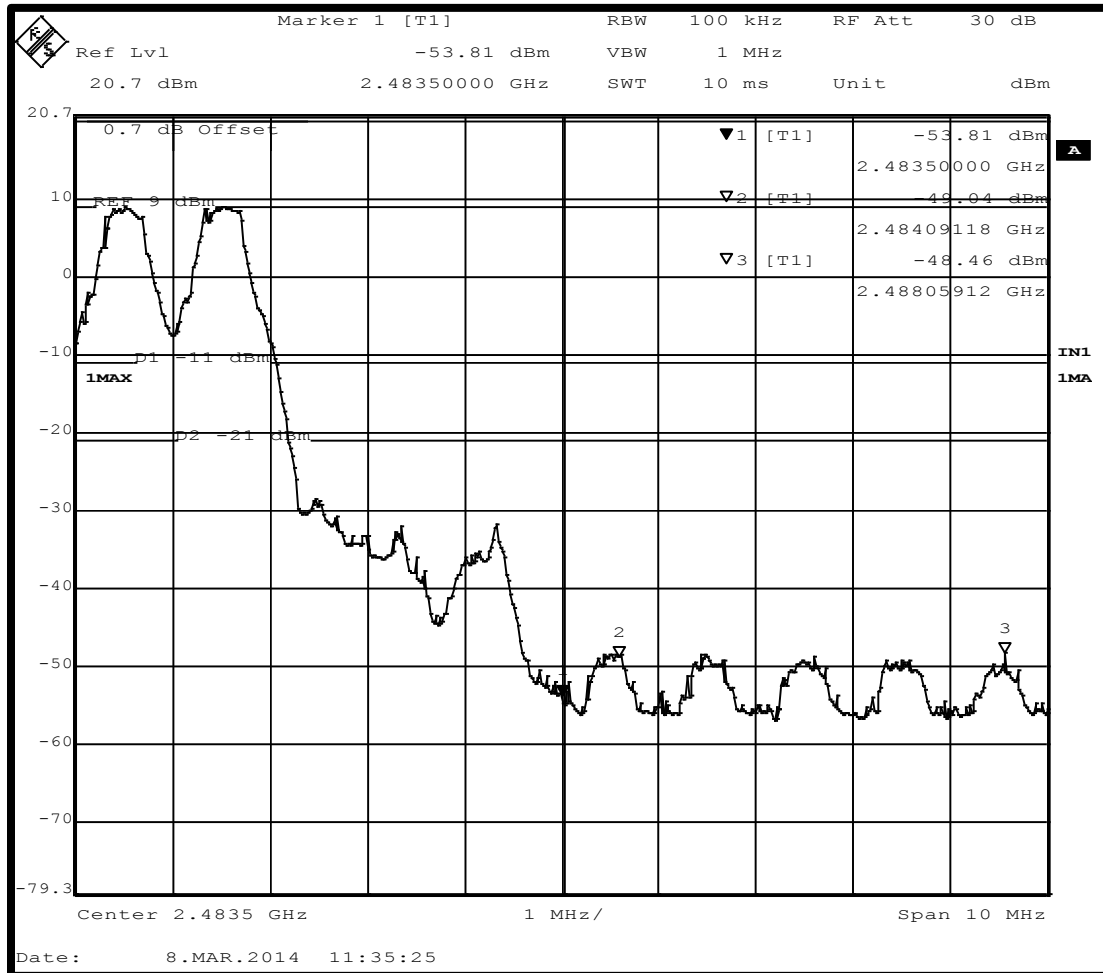
FCC ID: A94415859

IC: 3232A 415859



Certificate # 1514.1

Upper band edge (Basic data rate, hopping on all channels)



Out of band peak emissions are more than 20 dB below in band peak.

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# Wireless Transceiver Test Report

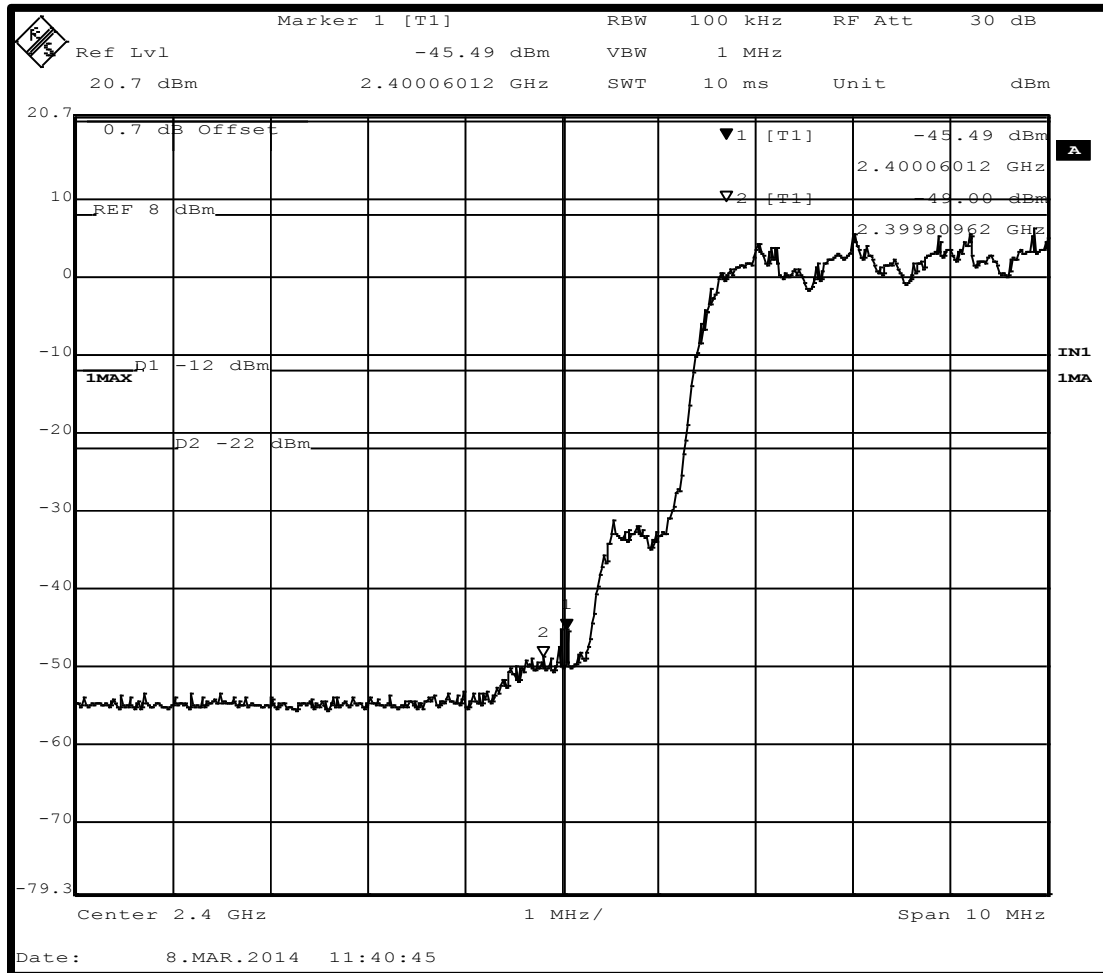
FCC ID: A94415859

IC: 3232A 415859



Certificate # 1514.1

Lower band edge (Enhanced data rate), hopping on all channels



Out of band peak emissions are more than 20 dB below in band peak.

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# Wireless Transceiver Test Report

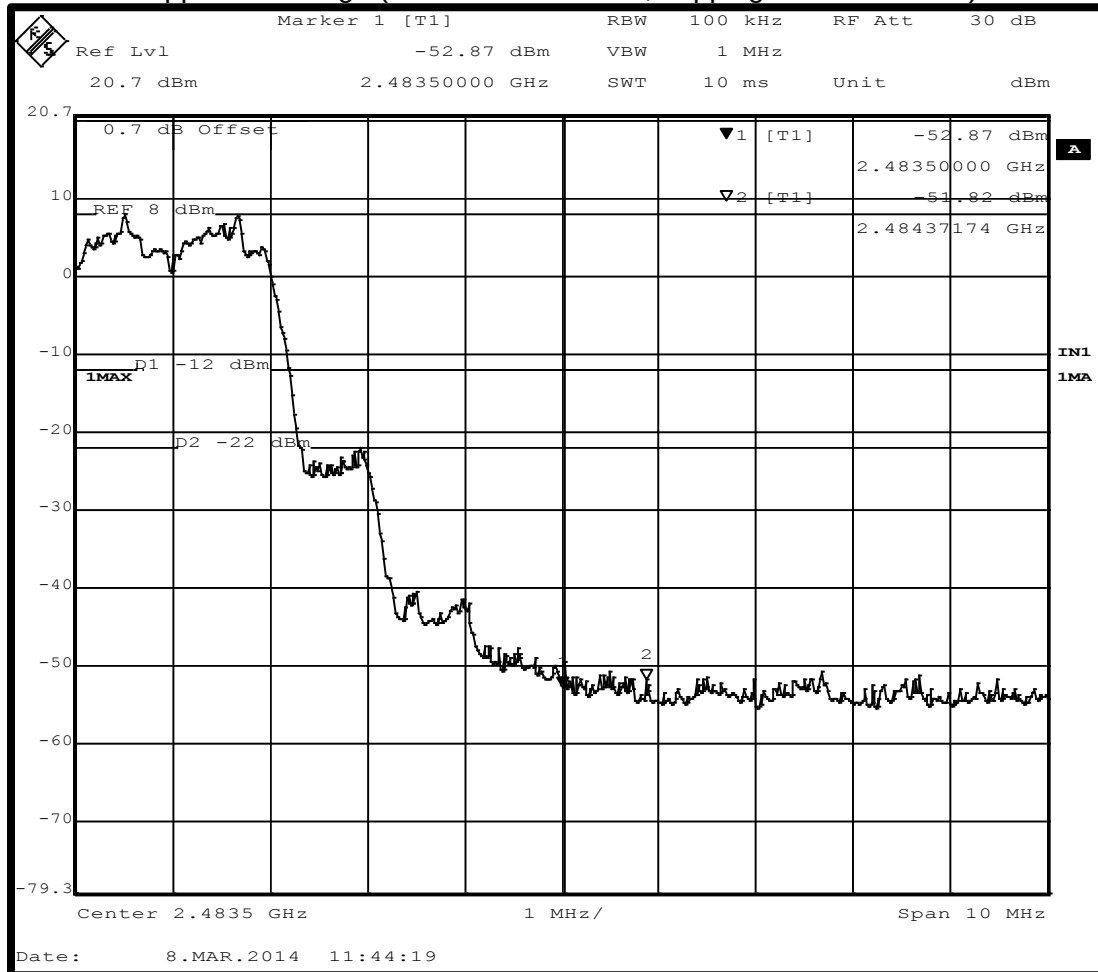
FCC ID: A94415859

IC: 3232A 415859



Certificate # 1514.1

## Upper band edge (Enhanced data rate, hopping on all channels)



Out of band peak emissions are more than 20 dB below in band peak.

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# Wireless Transceiver Test Report

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## 6.6.4. Test Equipment

| Equipment Type    | Manufacturer    | Model  | Serial or other ID | Service date |          |
|-------------------|-----------------|--------|--------------------|--------------|----------|
|                   |                 |        |                    | Last         | Due      |
| EMI Test Receiver | Rohde & Schwarz | ESIB40 | TN1560             | 4/4/2013     | 4/4/2014 |

## 6.6.5. Test information

|                         |          |                       |                        |
|-------------------------|----------|-----------------------|------------------------|
| <b>Date of test:</b>    | 3/8/2014 | <b>Test Location:</b> | Transmitter Test Bench |
| <b>EUT serial:</b>      | 1 (PCB)  | <b>Tested by:</b>     | B. Cerqua              |
| <b>Test Conclusion:</b> | Pass     |                       |                        |

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# Wireless Transceiver Test Report

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Certificate # 1514.1

## 6.7. Harmonics - Radiated

### 6.7.1. Requirements

FCC part 15.247(d) RSS-Gen 4.9, 4.10

In any of the restricted bands defined in FCC part 15.209(a), the field strength at a distance of 3 meters shall not exceed 54dBμV/m (average) or 74dBμV/m (peak)

### 6.7.2. Test Setup

The EUT is placed in a standard ANSI C63.10 test setup. Standard antennas and gain horns with suitable pre-amps mounted directly on the horn antennas are used for the measurement of the harmonics. The EUT hopping is stopped and measurements are made in the low, mid and high end of the frequency range at the defined limit distance of 3 meters. The EUT is rotated around the vertical axis, the antenna polarization changed from H to V and the antenna height is varied from 1 to 4 meters in order to find the maximum value of the harmonic emission. Account is taken of the beam width of the horn antennas to make sure the EUT remains in the main lobe of the antenna.

### 6.7.3. Test data

2<sup>nd</sup> & 3<sup>rd</sup> Harmonics of transmitter at (2402, 2441, 2480) MHz

| Emission Frequency (MHz) | Measured Amplitude (dBμV/m) QP/AVG* | Measured Amplitude (dBμV/m) Peak | FCC 15B                |                     |                     |                  | Data Rate |
|--------------------------|-------------------------------------|----------------------------------|------------------------|---------------------|---------------------|------------------|-----------|
|                          |                                     |                                  | Limit (dBμV/m) QP/AVG* | Limit (dBμV/m) Peak | Margin (dB) QP/AVG* | Margin (dB) Peak |           |
| 4804.000                 | 44.50                               | 53.90                            | 54.0                   | 74.0                | 9.5                 | 20.1             | EDR       |
| 4804.000                 | 46.50                               | 58.40                            | 54.0                   | 74.0                | 7.5                 | 15.6             | BR        |
|                          |                                     |                                  |                        |                     |                     |                  |           |
| 4882.000                 | 46.60                               | 55.20                            | 54.0                   | 74.0                | 7.4                 | 18.8             | EDR       |
| 4882.000                 | 46.80                               | 58.60                            | 54.0                   | 74.0                | 7.2                 | 15.4             | BR        |
|                          |                                     |                                  |                        |                     |                     |                  |           |
| 4960.000                 | 46.90                               | 55.10                            | 54.0                   | 74.0                | 7.1                 | 18.9             | EDR       |
| 4960.000                 | 44.60                               | 56.50                            | 54.0                   | 74.0                | 9.4                 | 17.5             | BR        |
|                          |                                     |                                  |                        |                     |                     |                  |           |
| 7206.000                 | 30.50                               | 43.00                            | 54.0                   | 74.0                | 23.5                | 31.0             | EDR       |
| 7206.000                 | 37.50                               | 45.10                            | 54.0                   | 74.0                | 16.5                | 28.9             | BR        |
|                          |                                     |                                  |                        |                     |                     |                  |           |
| 7323.000                 | 37.50                               | 45.10                            | 54.0                   | 74.0                | 16.5                | 28.9             | EDR       |
| 7323.000                 | 38.10                               | 45.60                            | 54.0                   | 74.0                | 15.9                | 28.4             | BR        |
|                          |                                     |                                  |                        |                     |                     |                  |           |
| 7440.000                 | 34.50                               | 45.70                            | 54.0                   | 74.0                | 19.5                | 28.3             | EDR       |
| 7440.000                 | 42.60                               | 49.50                            | 54.0                   | 74.0                | 11.4                | 24.5             | BR        |

\* Higher order harmonics are in the measurement noise floor.

In all cases the noise floor was in excess of 10dB below the limit value.

Payload size was adjusted to 33% duty cycle; device is a Bluetooth sink only device with actual duty cycle of less than 10%.

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# Wireless Transceiver Test Report

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## RSS Gen 4.10 Receiver mode spurious emissions

The EUT is programmed to receive on 2441 MHz.

The receive mode local oscillator is offset 1.5 MHz above the receive frequency.

For a receive frequency of 2441 MHz the local oscillator is at **2442.5 MHz**.

2<sup>nd</sup> harmonic = 4885 MHz

3<sup>rd</sup> harmonic = 7326 MHz

4<sup>th</sup> harmonic = 9770 MHz

| Emission<br>Frequency<br>(MHz) | Measured<br>Amplitude<br>(dBμV/m)<br>QP/AVG* | Measured<br>Amplitude<br>(dBμV/m)<br>Peak | FCC 15B                      |                           |                           |                        |
|--------------------------------|----------------------------------------------|-------------------------------------------|------------------------------|---------------------------|---------------------------|------------------------|
|                                |                                              |                                           | Limit<br>(dBμV/m)<br>QP/AVG* | Limit<br>(dBμV/m)<br>Peak | Margin<br>(dB)<br>QP/AVG* | Margin<br>(dB)<br>Peak |
| 4885.000                       | 24.60                                        | 46.50                                     | 54.0                         | 74.0                      | 29.4                      | 27.5                   |
| 7327.000                       | 24.20                                        | 51.00                                     | 54.0                         | 74.0                      | 29.8                      | 23.0                   |
| 9770.000                       | 32.10                                        | 44.00                                     | 54.0                         | 74.0                      | 21.9                      | 30.0                   |

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# Wireless Transceiver Test Report

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## 6.7.4. Test Equipment

| Equipment Type     | Manufacturer    | Model                  | Tracking Number | Service date      |            |
|--------------------|-----------------|------------------------|-----------------|-------------------|------------|
|                    |                 |                        |                 | Last              | Due        |
| EMI Test Receiver  | Rohde & Schwarz | ESU40                  | TN1663          | 4/5/2013          | 4/5/2014   |
| Antenna 4 – 8G     | AR              | AT4003                 | TN727           | 12/5/2011         | 12/5/2014  |
| Antenna 0.8 - 18 G | EMCO            | 3115                   | TN478           | 7/12/2012         | 7/12/2015  |
| Antenna 8 – 18G    | AR              | AT4004                 | TN728           | 12/1/2011         | 11/30/2014 |
| Antenna 18 – 26.5G | AR              | AT4640                 | TN1596          | Verify before use |            |
| 20 GHz Pre-amp     | MITEQ           | AFS4-00102000-30-10P-4 | TN1672          | 10/8/2013         | 10/8/2014  |
| 40 GHz pre-amp     | MITEQ           | JS4018004000-30-8P-A1  | TN1757          | 9/18/2013         | 9/18/2014  |
| Cable              | Florida Labs    | NMS-290-360            | TN2165          | 3/15/2013         | 3/15/2014  |

## 6.7.5. Test information

|                         |          |                       |                       |
|-------------------------|----------|-----------------------|-----------------------|
| <b>Date of test:</b>    | 3/5/2014 | <b>Test Location:</b> | Maxwell House         |
| <b>EUT serial:</b>      | 149      | <b>Tested by:</b>     | B. Cerqua / K. Strong |
| <b>Test Conclusion:</b> | Pass     |                       |                       |

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# Wireless Transceiver Test Report

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IC: 3232A 415859



Certificate # 1514.1

## 6.8. Spurious radiated emissions 1-25 GHz

### 6.8.1. Requirements

FCC part 15.247(d), RSS-Gen7.2.5

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

In any of the restricted bands defined in FCC part 15.205(a), the field strength at a distance of 3 meters shall not exceed limits shown in 15.209, 54dB $\mu$ V/m (average) or 74dB $\mu$ V/m (peak).

### 6.8.2. Test Setup

The EUT is placed in a standard ANSI C63.10 test setup. From 1 to 4 GHz a Double-Ridged Guide Horn Antenna is used. Above 4 GHz, standard gain horns with suitable pre-amps mounted directly on the horn antennas are used for the measurement of the emissions.

The EUT is operating normally (hopping), and measurements are made at the defined limit distance of 3 meters. Above 18GHz the measurement distance may be reduced to make sure the emissions are well below the limit. Measurements are made with a 1 MHz resolution bandwidth and an average detector. There is an implied peak limit 20dB above the average limit.

The EUT is rotated around the vertical axis, the antenna polarization changed from H to V and the antenna height is varied from 1 to 4 meters in order to find the maximum value of the emissions. EUT was positioned in the worst case upright orientation. Account is taken of the beam width of the horn antennas to make sure the EUT remains in the main lobe of the antenna.

### 6.8.3. Test Setup

Frequency range 30MHz – 1 GHz. Passes, see section 6.2 of this report

Note upper and lower band edge measurements are covered in section 6.8.4

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# Wireless Transceiver Test Report

FCC ID: A94415859

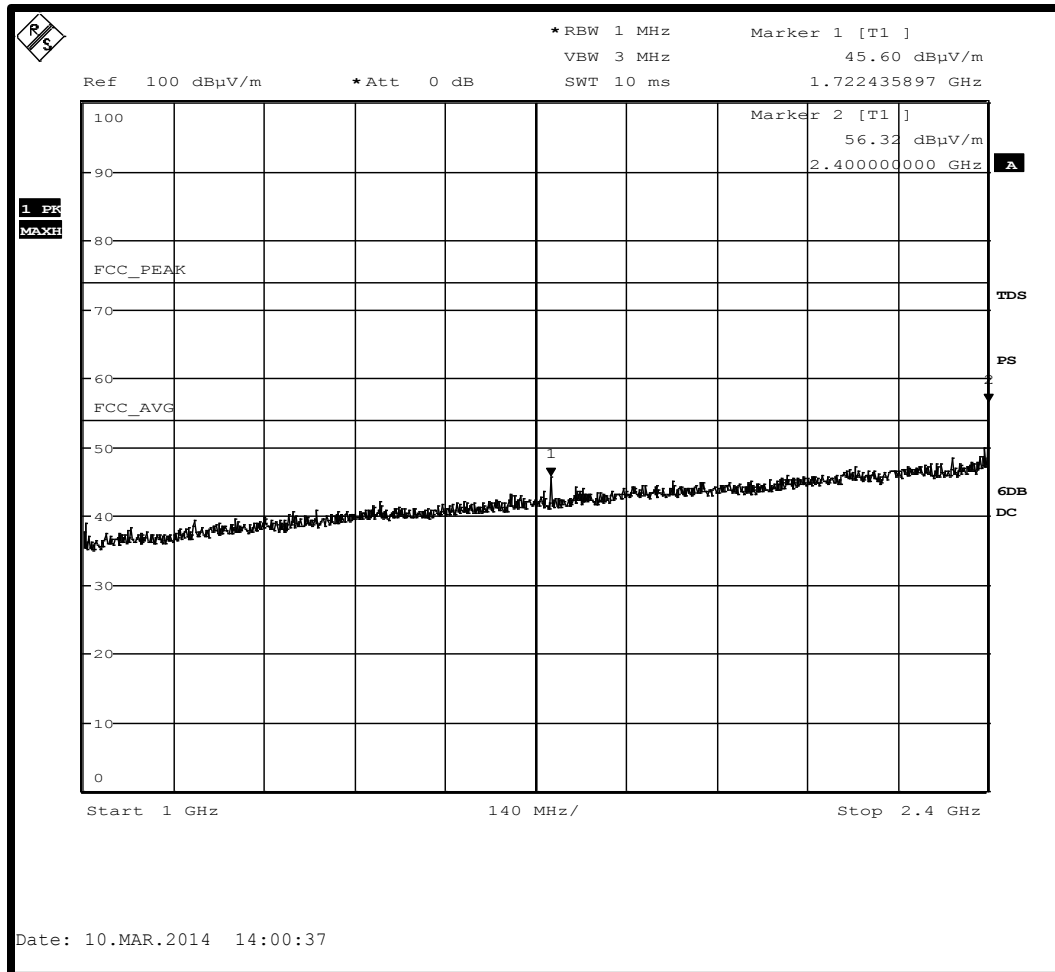
IC: 3232A 415859



Certificate # 1514.1

Radiated Emissions 1 GHz to 2.4 GHz

Max-Hold Peak Pre-scan, Basic data rate hopping on all channels.



Max peak hold emissions are more than 10 dB below the peak limit.

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# Wireless Transceiver Test Report

FCC ID: A94415859

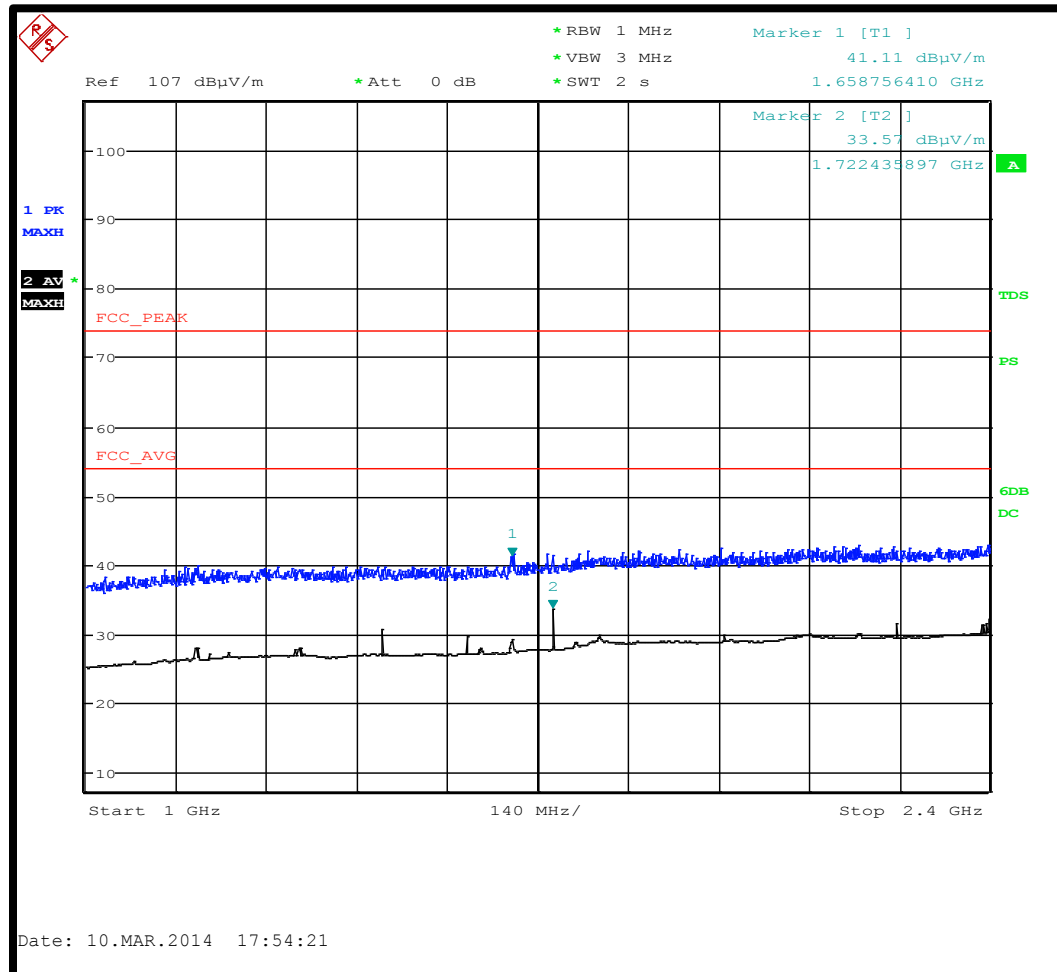
IC: 3232A 415859



Certificate # 1514.1

Radiated Emissions 1 GHz to 2.4 GHz

Max-Hold Peak Pre-scan, Enhanced data rate hopping on all channels.



Max peak hold emissions are more than 10 dB below the peak limit.

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# Wireless Transceiver Test Report

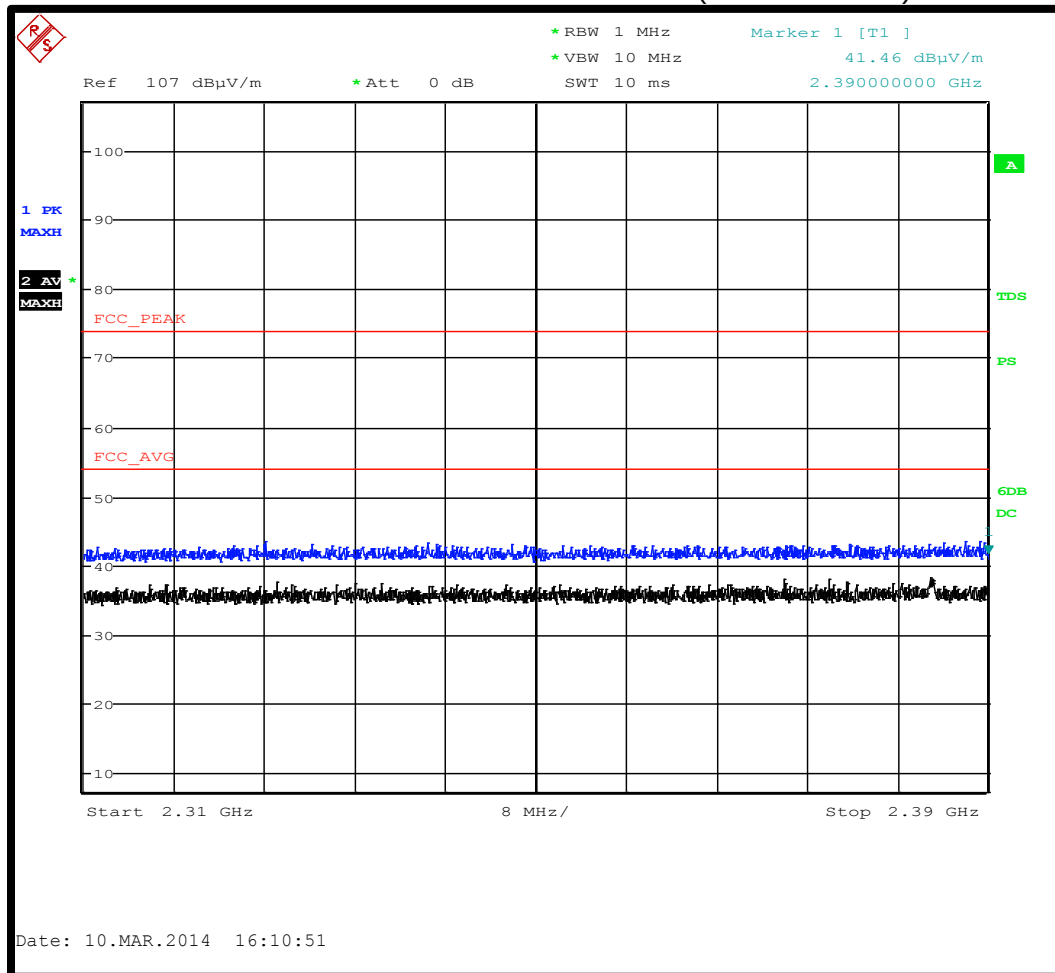
FCC ID: A94415859

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Lower restricted band 2310 – 2390 MHz: (Basic data rate)



Max peak hold emissions are more than 10 dB below the peak limit.

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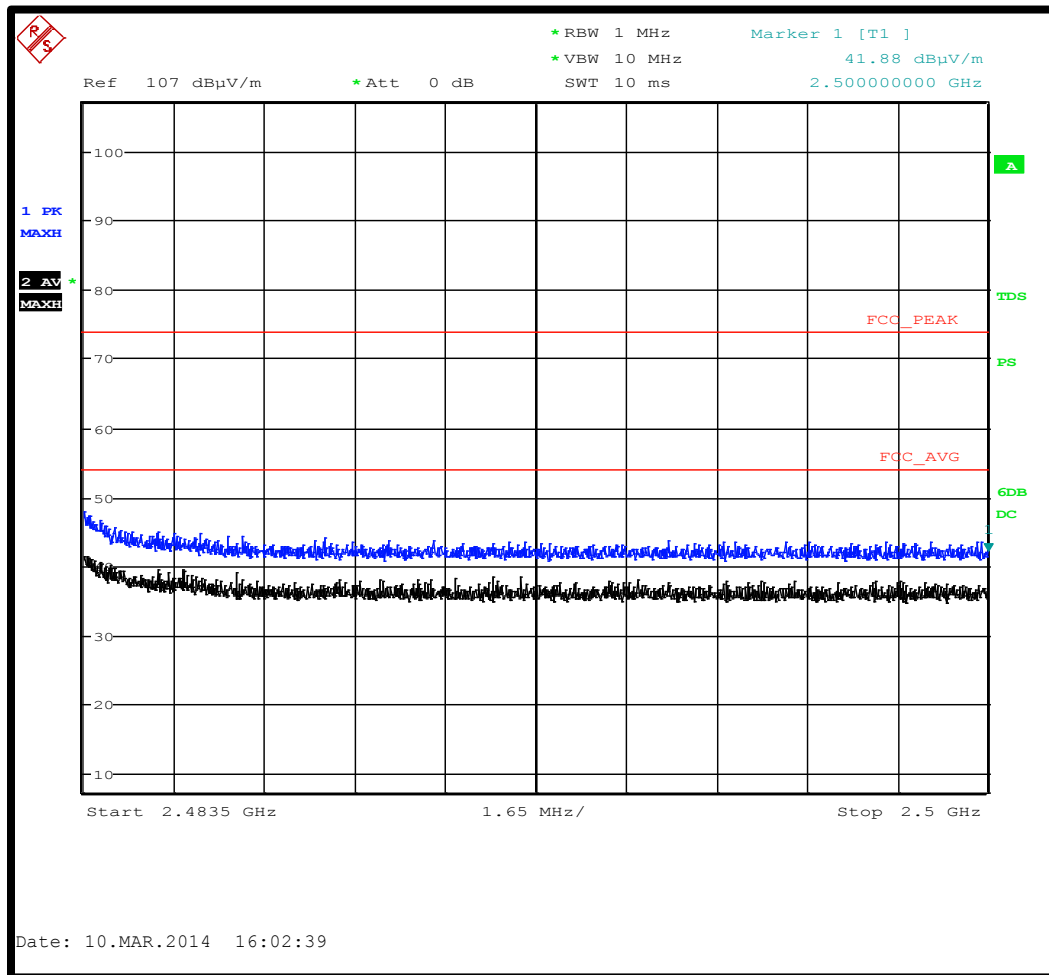
FCC ID: A94415859

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Upper restricted band 2483.5 – 2500 MHz: (Basic data rate)



Max peak hold emissions are more than 10 dB below the peak limit.

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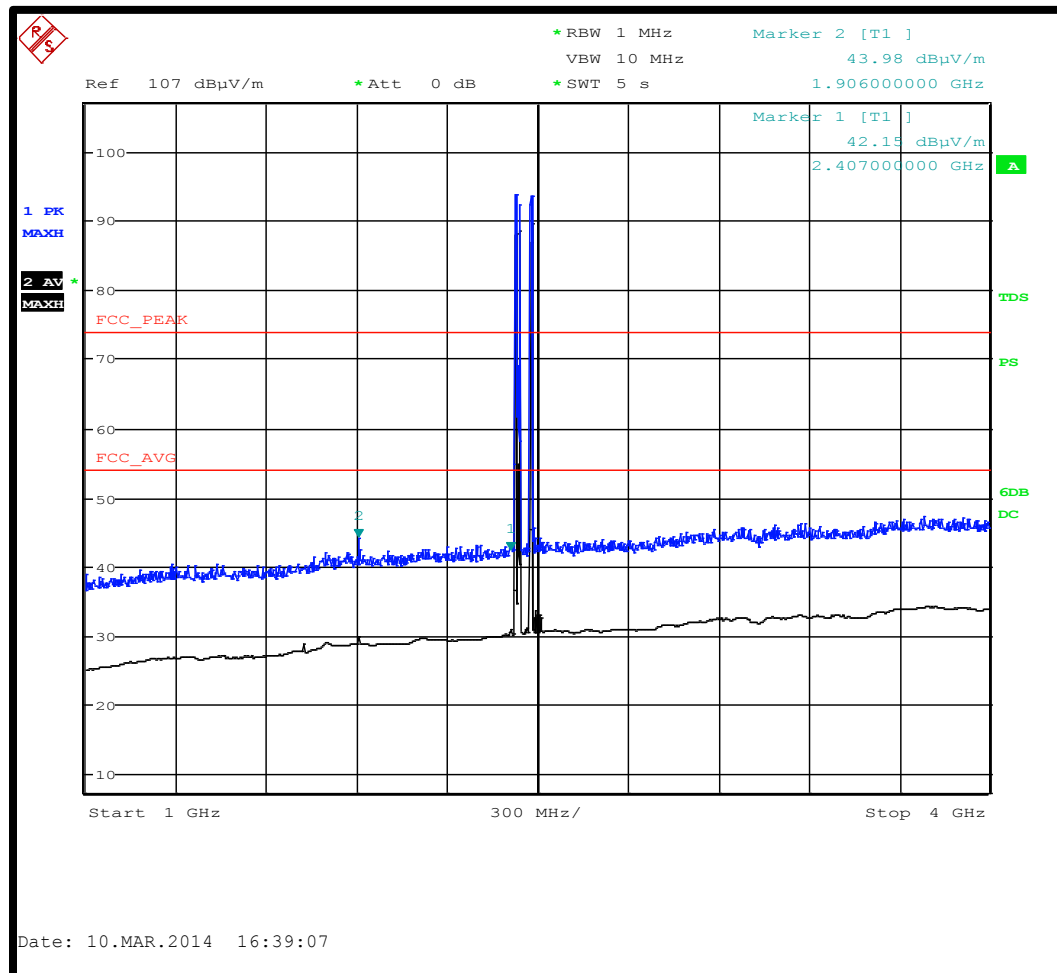
FCC ID: A94415859

IC: 3232A 415859



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1 to 4 GHz (Basic data rate)



Max peak hold emissions are more than 10 dB below the peak limit, excluding the fundamental.

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# Wireless Transceiver Test Report

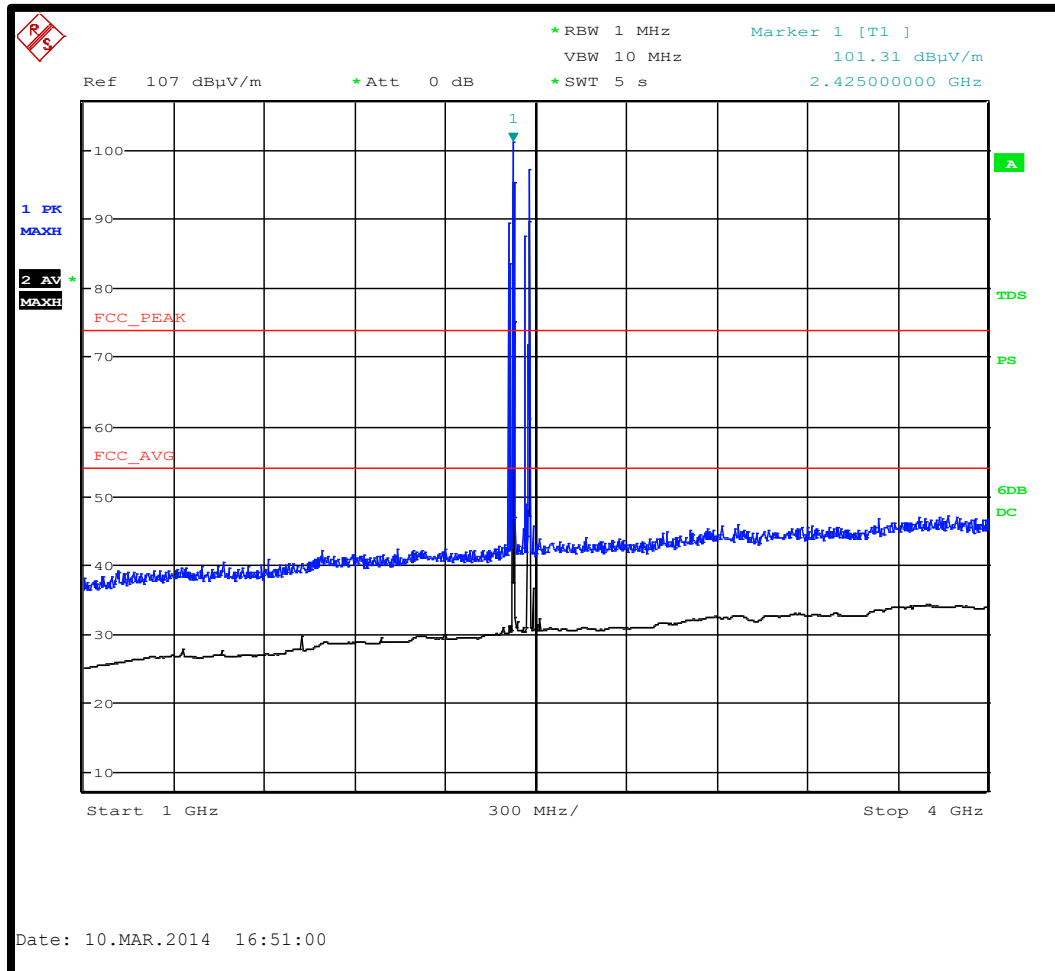
FCC ID: A94415859

IC: 3232A 415859



Certificate # 1514.1

1 to 4 GHz (Enhanced data rate)



Max peak hold emissions are more than 10 dB below the peak limit, excluding the fundamental.

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# Wireless Transceiver Test Report

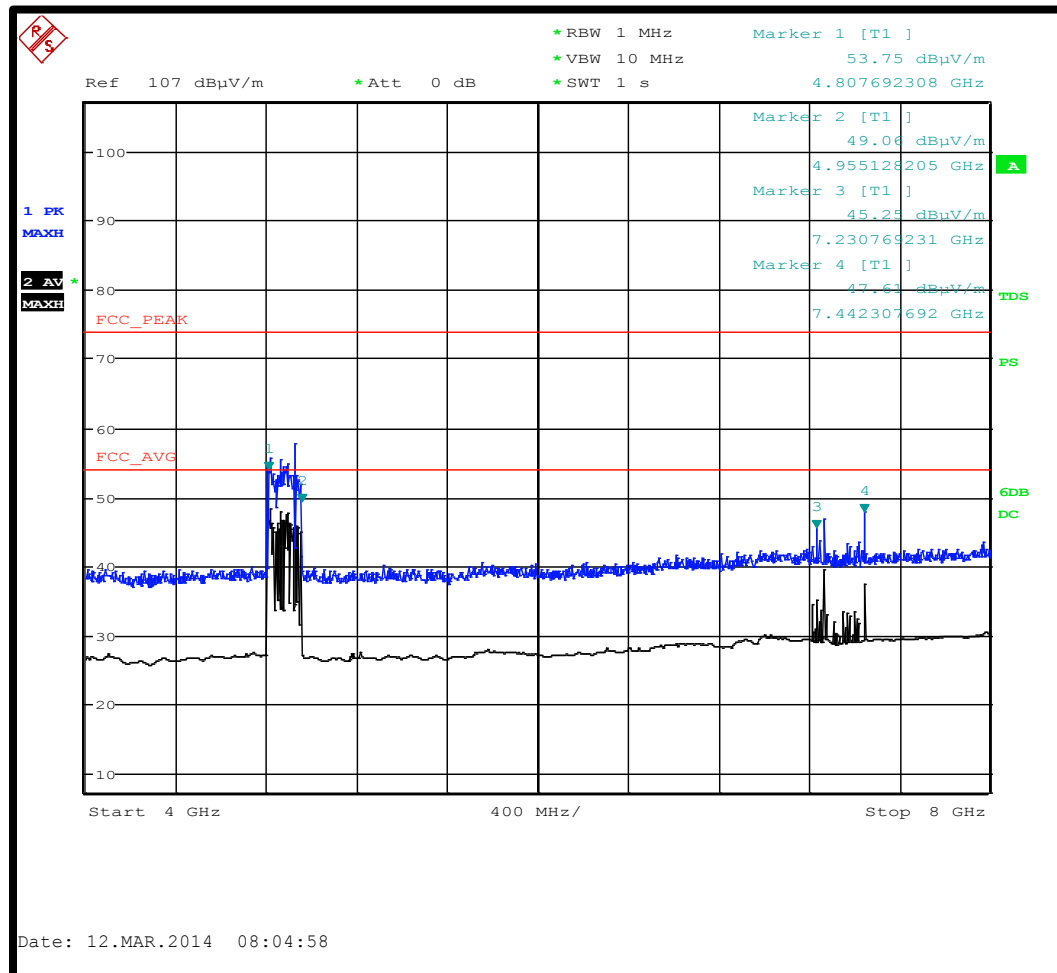
FCC ID: A94415859

IC: 3232A 415859



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## Radiated Emissions 4 – 8 GHz (Basic data rate)



Emissions at the marker frequencies are covered in section 6.7, harmonics.

Other than the harmonics the maximum peak hold emissions are more than 10 dB below the peak limit.

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# Wireless Transceiver Test Report

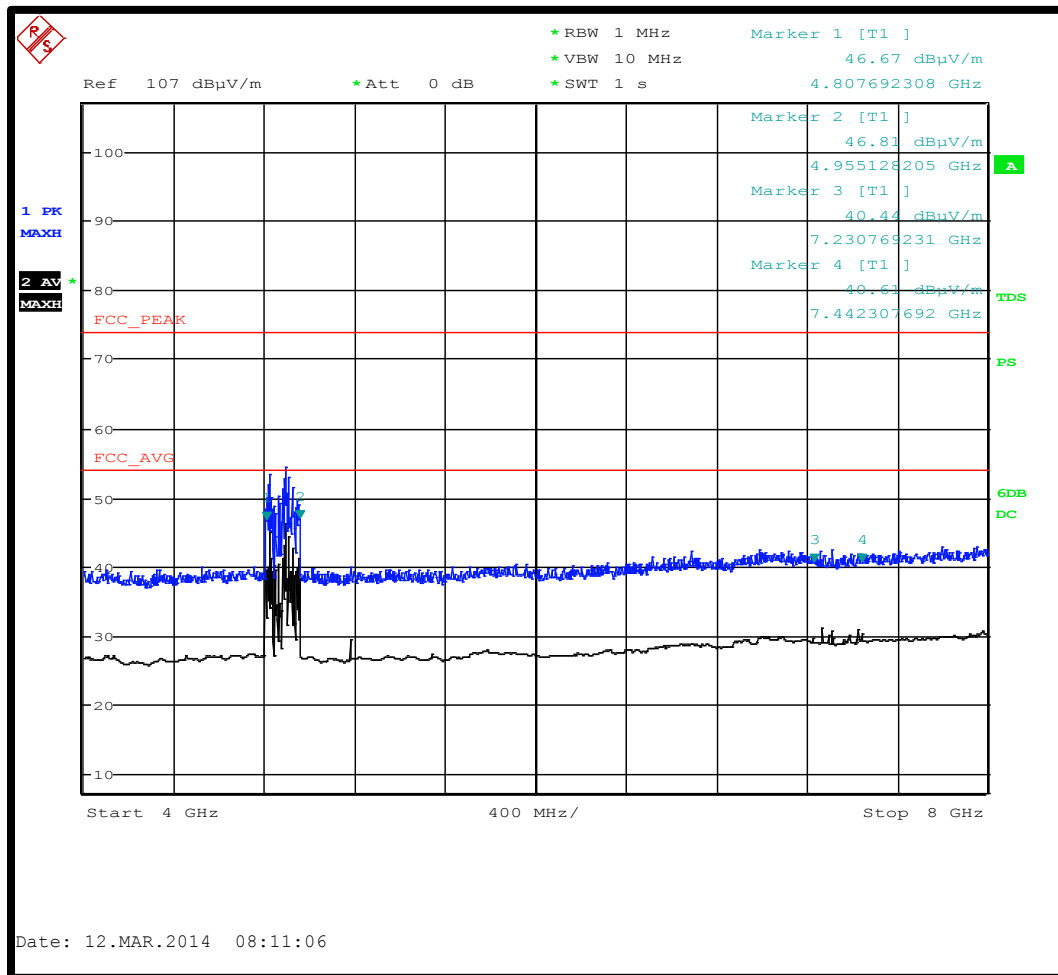
FCC ID: A94415859

IC: 3232A 415859



Certificate # 1514.1

## Radiated Emissions 4 – 8 GHz (Enhanced data rate)



Emissions at the marker frequencies are covered in section 6.7, harmonics.

Other than the harmonics the maximum peak hold emissions are more than 10 dB below the peak limit.

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# Wireless Transceiver Test Report

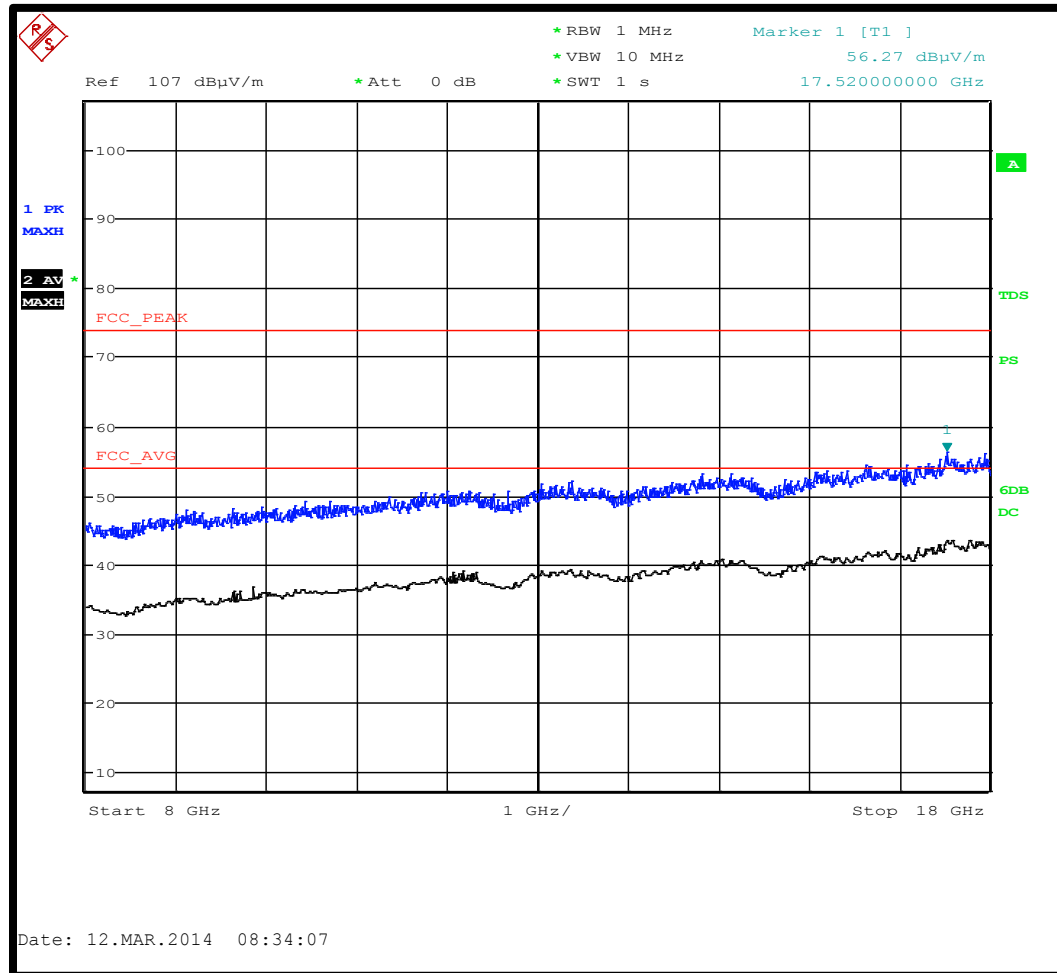
FCC ID: A94415859

IC: 3232A 415859



Certificate # 1514.1

## Radiated emissions 8 GHz to 18 GHz (Basic data rate)



Max peak hold emissions are more than 10 dB below the peak limit.

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# Wireless Transceiver Test Report

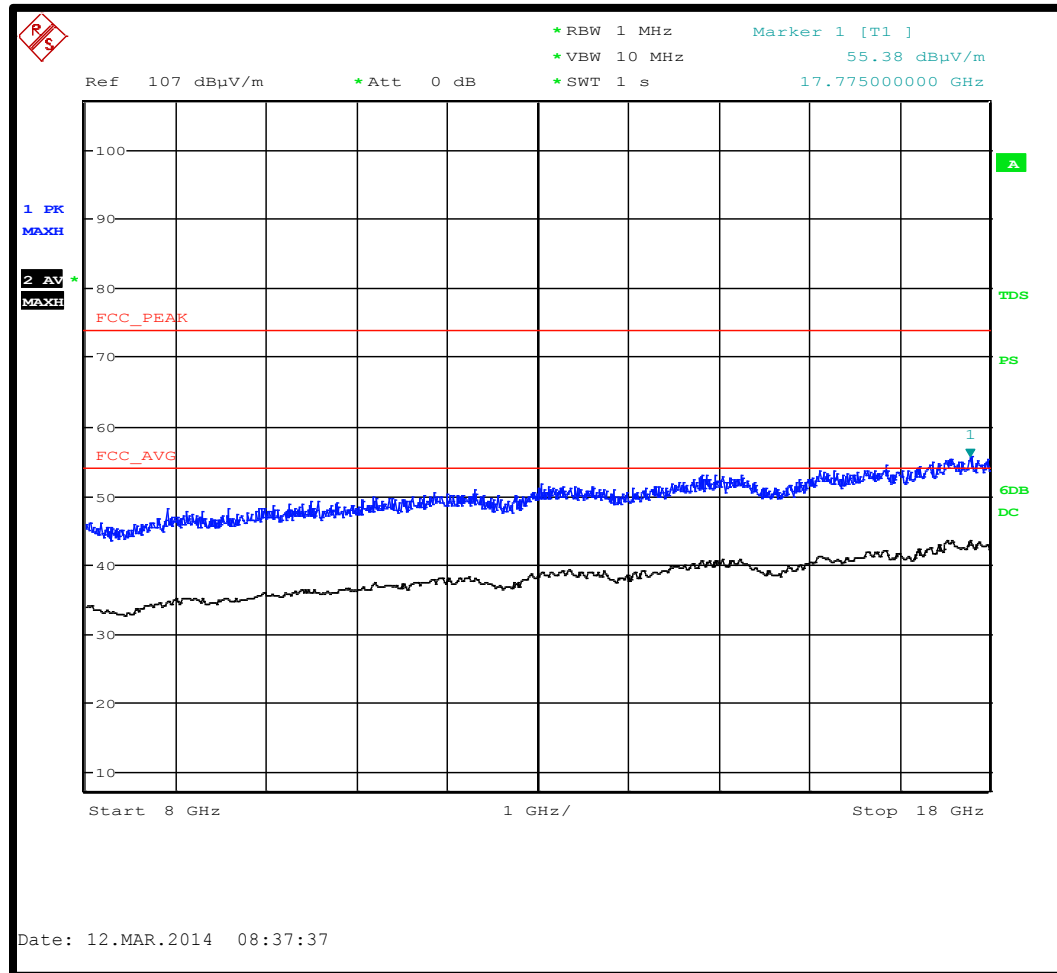
FCC ID: A94415859

IC: 3232A 415859



Certificate # 1514.1

## Radiated emissions 8 GHz to 18 GHz (Enhanced data rate)



Max peak hold emissions are more than 10 dB below the peak limit.

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# Wireless Transceiver Test Report

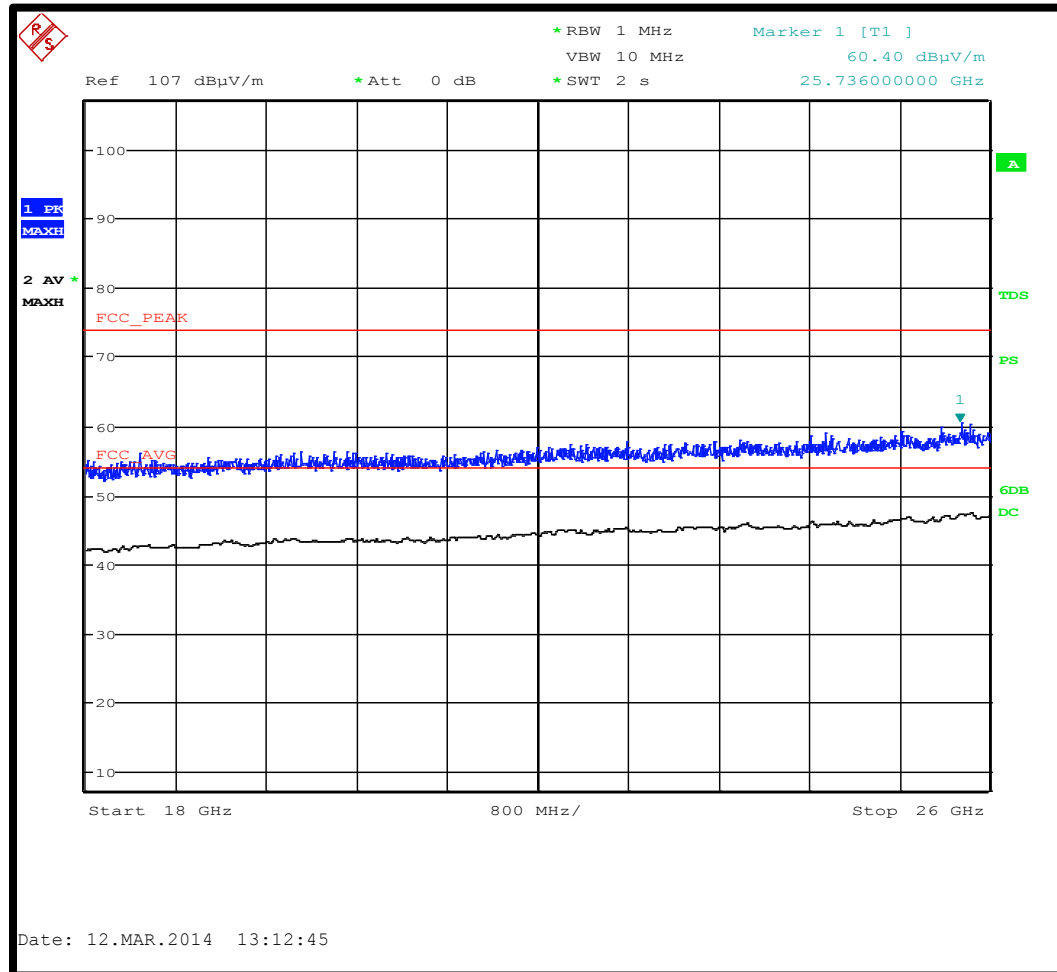
FCC ID: A94415859

IC: 3232A 415859



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Radiated Emission, 18 to 26 GHz (Basic data rate)  
3 meter distance



Max peak hold emissions are more than 10 dB below the peak limit.

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# Wireless Transceiver Test Report

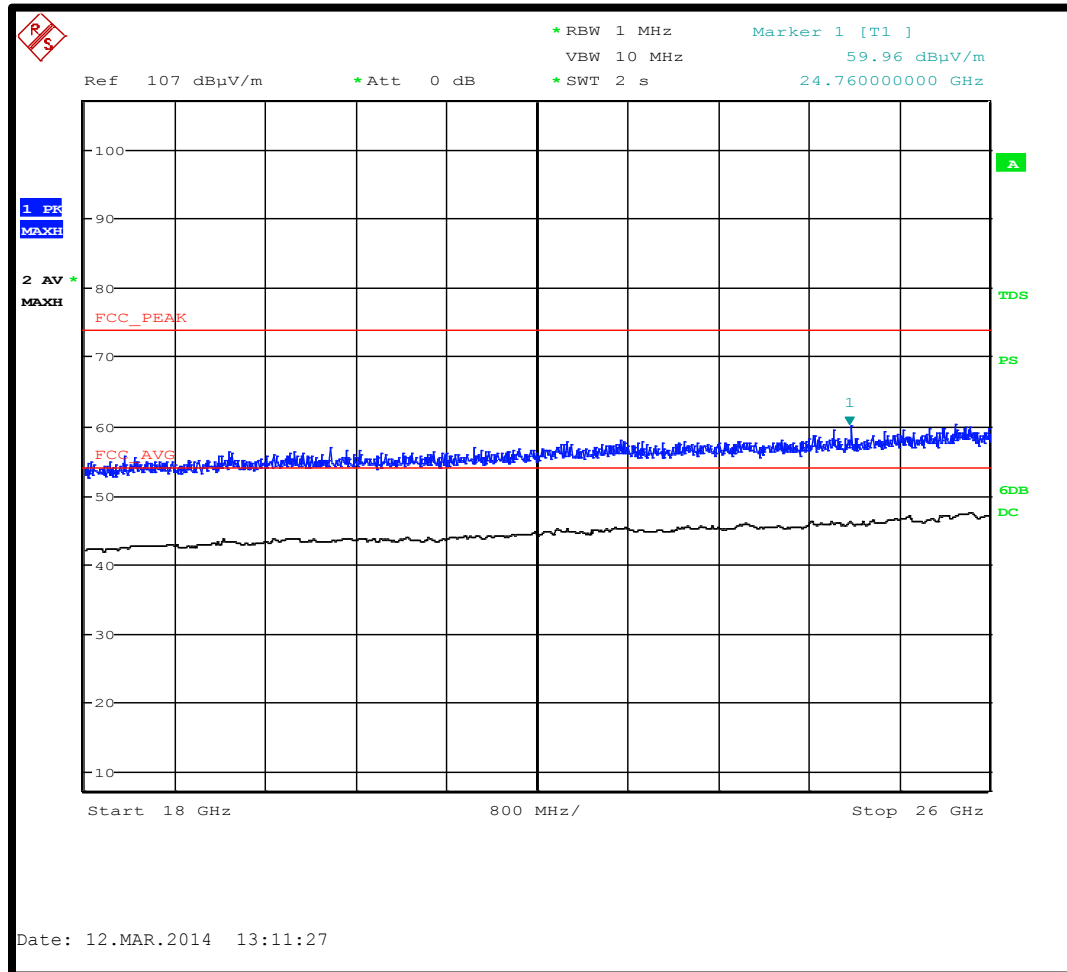
FCC ID: A94415859

IC: 3232A 415859



Certificate # 1514.1

Radiated Emission, 18 to 26 GHz (Enhanced data rate)  
3 meter distance



Max peak hold emissions are more than 10 dB below the peak limit.

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# Wireless Transceiver Test Report

FCC ID: A94415859

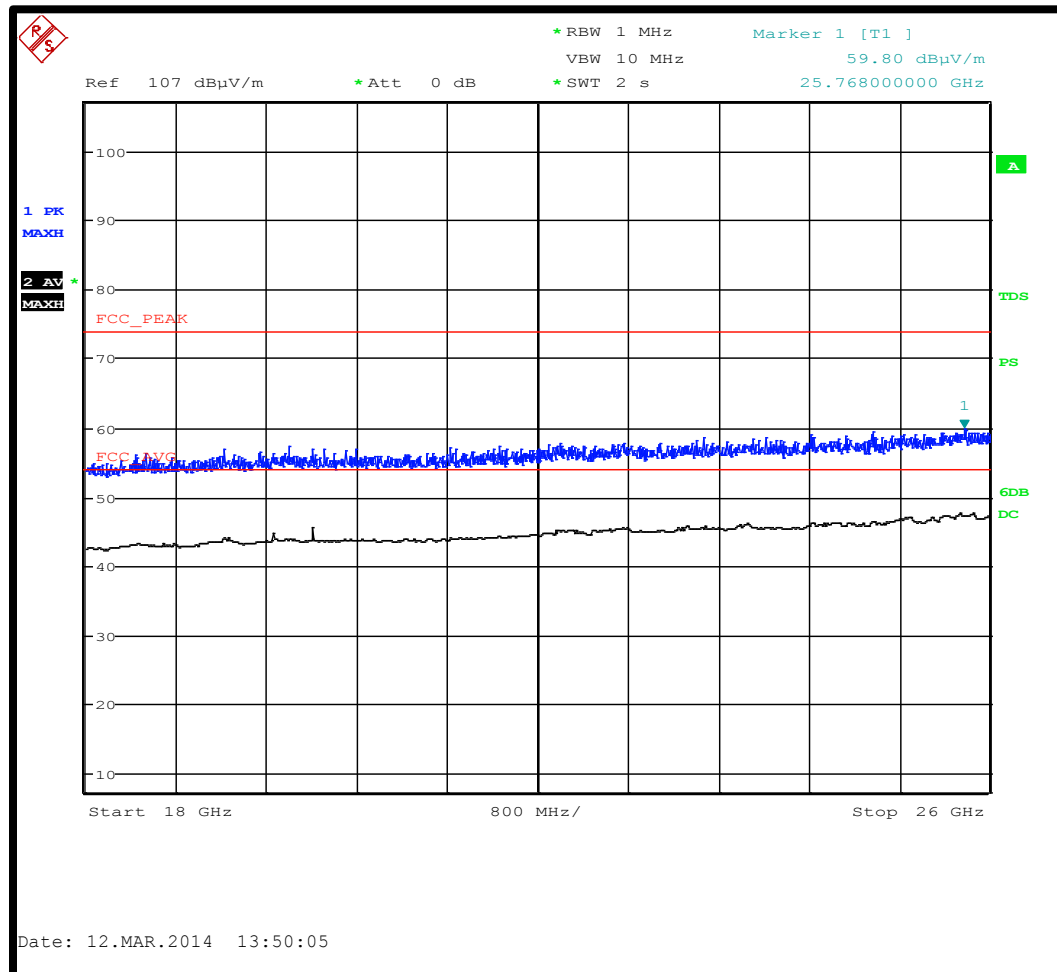
IC: 3232A 415859



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18 to 26 GHz, Measurement distance reduced to 25cm.

## Basic data rate



Max peak hold emissions are more than 10 dB below the peak limit.

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# Wireless Transceiver Test Report

FCC ID: A94415859

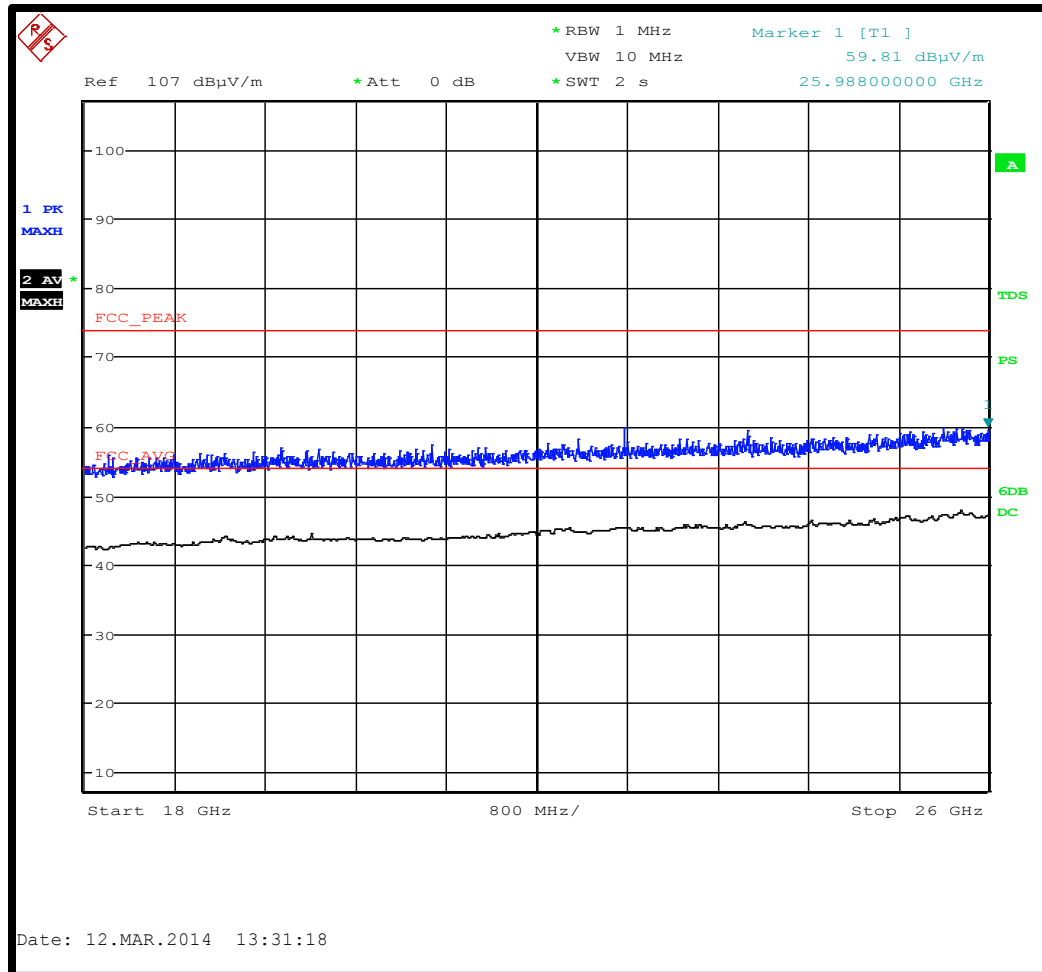
IC: 3232A 415859



Certificate # 1514.1

18 to 26 GHz, Measurement distance reduced to 25cm.

## Enhanced data rate



Max peak hold emissions are more than 10 dB below the peak limit.

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# Wireless Transceiver Test Report

FCC ID: A94415859

IC: 3232A 415859



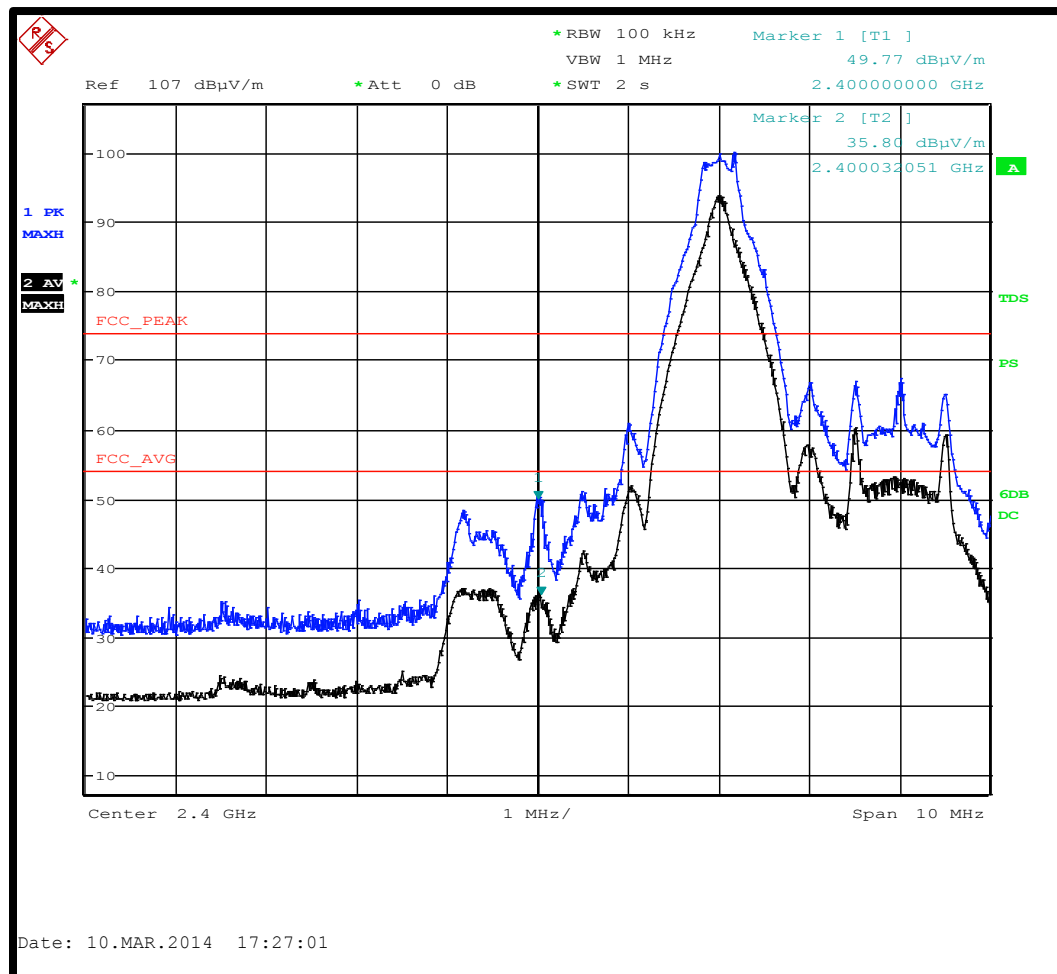
Certificate # 1514.1

## 6.8.4. Band edge radiated emission measurements, 15.247 (d)

Measured radiated at 3 meters, EUT is 80 cm off ground plane.

- (a) More than 20 dB down from in band peak, RBW = 100 kHz
- (b) Radiated emissions which fall in the restricted bands, as defined in 15.205(a), must also comply with the radiated emissions limits specified in 15.205(a).

Basic data rate transmitting on 2402 MHz



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# Wireless Transceiver Test Report

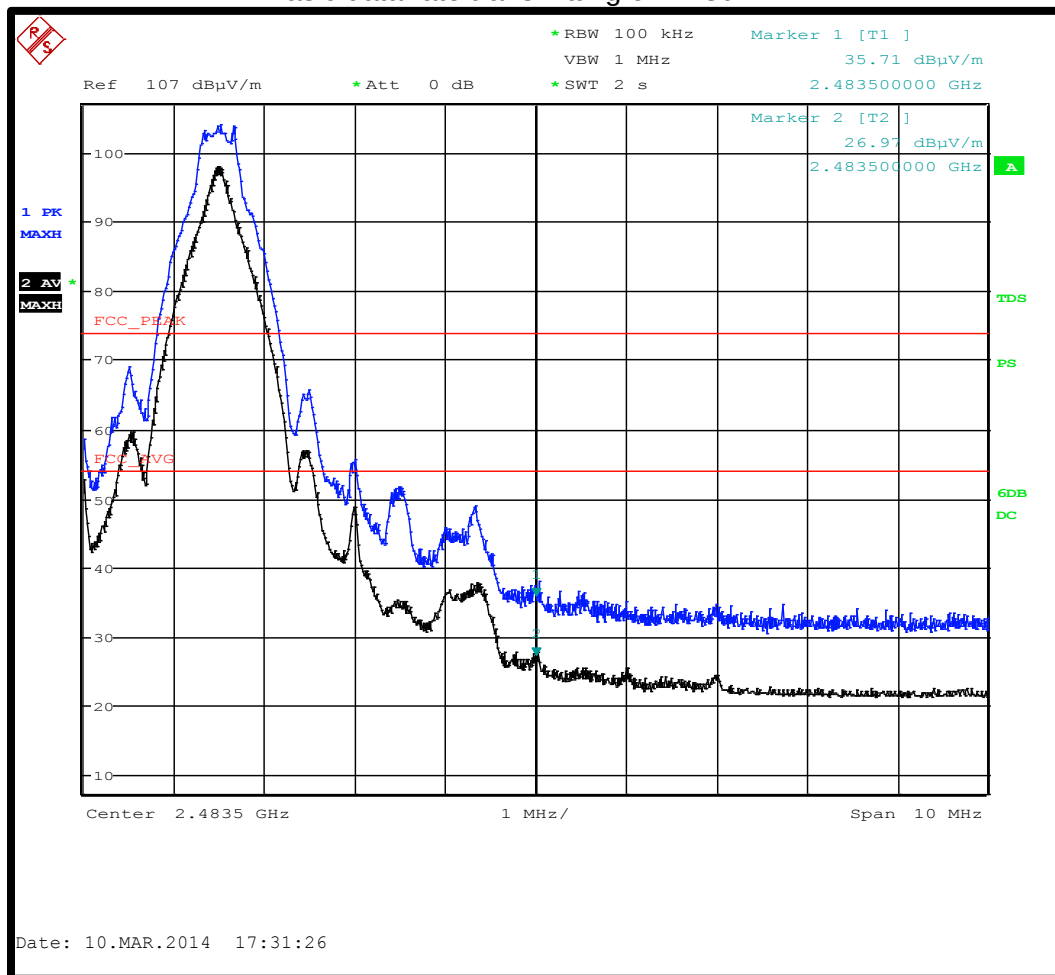
FCC ID: A94415859

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Certificate # 1514.1

Basic data rate transmitting on 2480 MHz



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# Wireless Transceiver Test Report

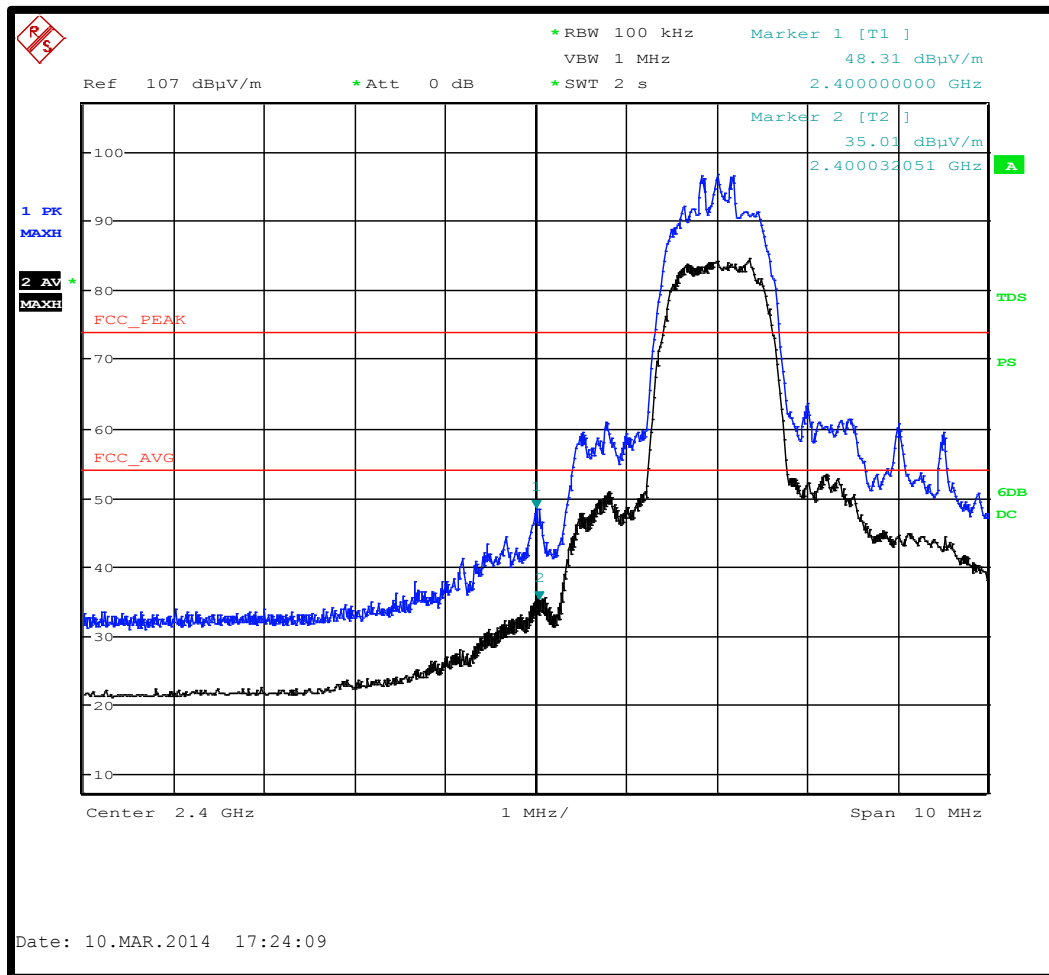
FCC ID: A94415859

IC: 3232A 415859



Certificate # 1514.1

Enhanced data rate transmitting on 2402 MHz



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# Wireless Transceiver Test Report

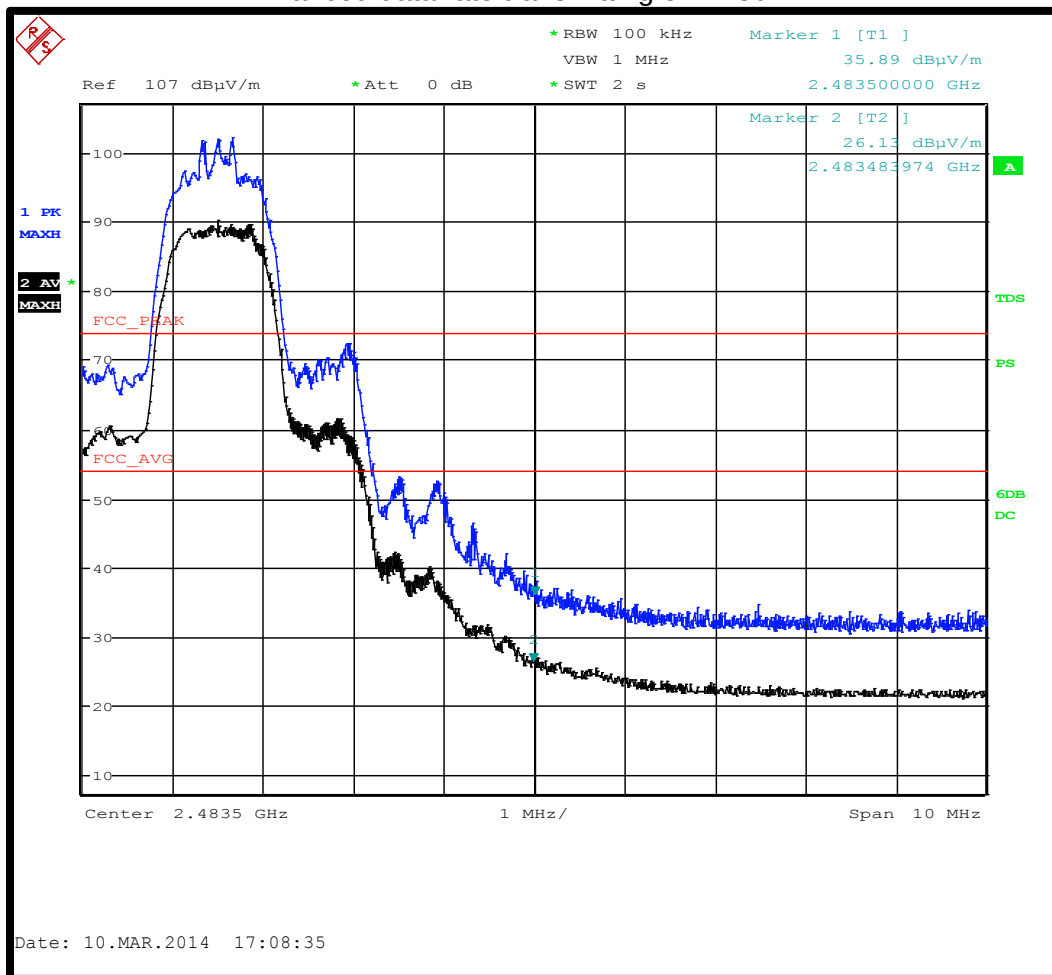
FCC ID: A94415859

IC: 3232A 415859



Certificate # 1514.1

Enhanced data rate transmitting on 2480 MHz



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# Wireless Transceiver Test Report

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IC: 3232A 415859



Certificate # 1514.1

## 6.8.5. Test Equipment

| Equipment Type     | Manufacturer    | Model                  | Tracking Number | Service date      |            |
|--------------------|-----------------|------------------------|-----------------|-------------------|------------|
|                    |                 |                        |                 | Last              | Due        |
| EMI Test Receiver  | Rohde & Schwarz | ESU40                  | TN1663          | 4/5/2013          | 4/5/2014   |
| Antenna 4 – 8G     | AR              | AT4003                 | TN727           | 12/5/2011         | 12/5/2014  |
| Antenna 0.8 - 18 G | EMCO            | 3115                   | TN478           | 7/12/2012         | 7/12/2015  |
| Antenna 8 – 18G    | AR              | AT4004                 | TN728           | 12/1/2011         | 11/30/2014 |
| Antenna 18 – 26.5G | AR              | AT4640                 | TN1596          | Verify before use |            |
| 20 GHz Pre-amp     | MITEQ           | AFS4-00102000-30-10P-4 | TN1672          | 10/8/2013         | 10/8/2014  |
| 40 GHz pre-amp     | MITEQ           | JS4018004000-30-8P-A1  | TN1757          | 9/18/2013         | 9/18/2014  |
| Cable              | Florida Labs    | NMS-290-360            | TN2165          | 3/15/2013         | 3/15/2014  |

## 6.8.6. Test information

|                         |                        |                       |                       |
|-------------------------|------------------------|-----------------------|-----------------------|
| <b>Date of test:</b>    | 3/10/2014<br>3/12/2014 | <b>Test Location:</b> | Maxwell House         |
| <b>EUT serial:</b>      | 149                    | <b>Tested by:</b>     | B. Cerqua / K. Strong |
| <b>Test Conclusion:</b> | Pass                   |                       |                       |

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# Wireless Transceiver Test Report

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Certificate # 1514.1

## 6.9. Receiver mode spurious emissions

### 6.9.1. Requirements

RSS-Gen section 4.10

If the antenna is detachable, a conducted measurement may be performed.

RSS-Gen section 6.2

No spurious output signals appearing at the antenna terminals shall exceed 2 nW (-57dBm) in the band 30-1000 MHz, or 5 nW (-53dBm) above 1 GHz.

### 6.9.2. Test Setup

The EUT is controlled via the USB cable with CSR's Blue Suite software which is used to set the test modes of the EUT. The EUT's RF test connector is fed to the spectrum analyzer using an 8 inch u.FL to SMA-Female adapter cable; the loss of this adapter cable is 0.7 dB and is accounted for using the reference level offset feature of the R&S ESIB40 spectrum analyzer. The EUT is programmed to receive on the target frequency. To help attenuate the ambient 2.4 & 5 GHz WiFi that are being picked up, the EUT was placed inside a shielded box with the USB cable and RF output cable passed through the box to the PC and spectrum analyzer. The ambient WiFi signals while attenuated greatly by the shielded box are still being picked up on the measurement.

The local oscillator for the radio IC is 1.5 MHz above the programmed receive frequency.

A spectrum scan is made from 30 MHz to 3 times the highest tunable or local oscillator frequency.  $2.4815 \text{ GHz} * 3 = 7.44 \text{ GHz} \sim 7.5 \text{ GHz}$ .

### 6.9.3. Test data

| RX Frequency (MHz) | Receive local oscillator frequency (MHz) | Emission amplitude (dBm ) | Margin (dB) |
|--------------------|------------------------------------------|---------------------------|-------------|
| 2402               | 2403.5                                   | -77.0                     | 24.0        |
| 2441               | 2442.5                                   | -76.0                     | 23.0        |
| 2480               | 2481.5                                   | -76.5                     | 23.5        |

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# Wireless Transceiver Test Report

FCC ID: A94415859

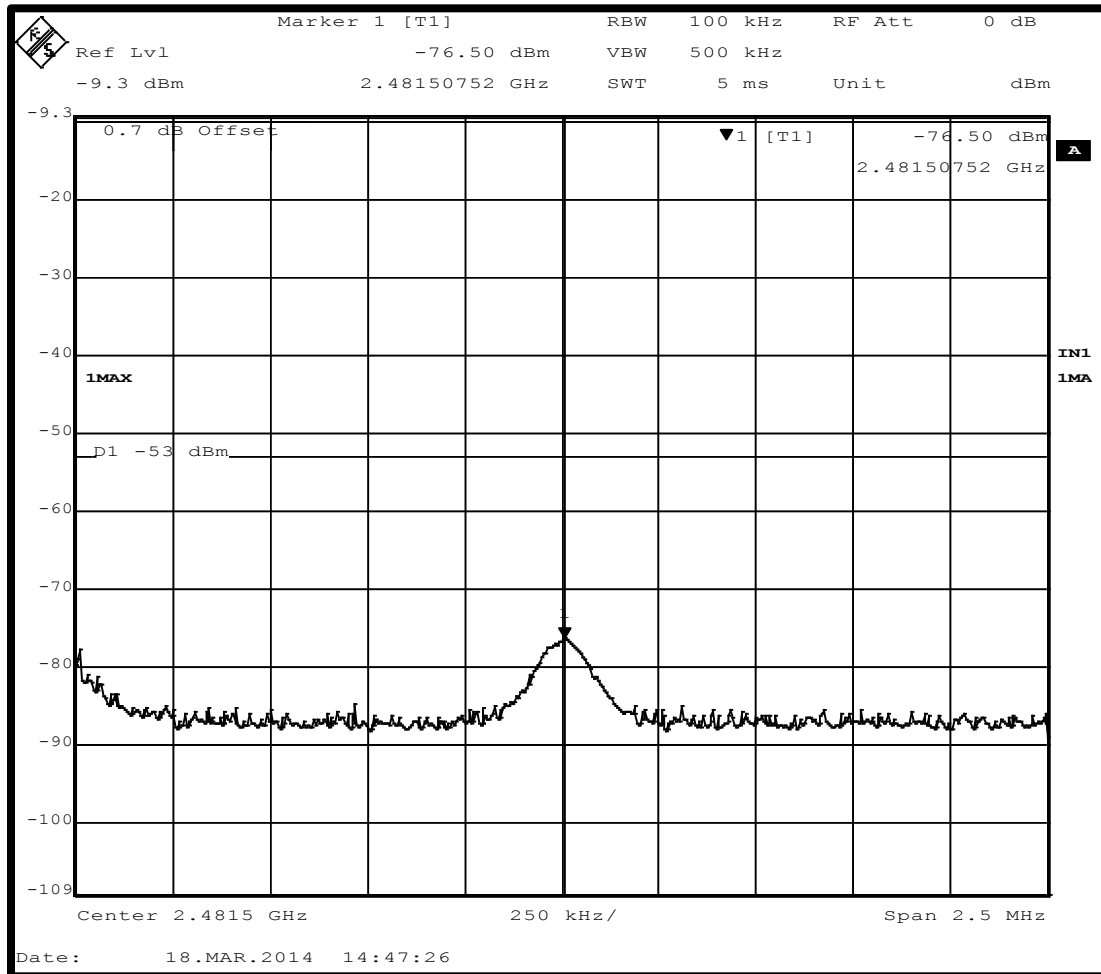
IC: 3232A 415859



Certificate # 1514.1

Emissions due to local oscillator (2481.5 MHz)

Example measurement for EUT receiving on 2480 MHz.



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# Wireless Transceiver Test Report

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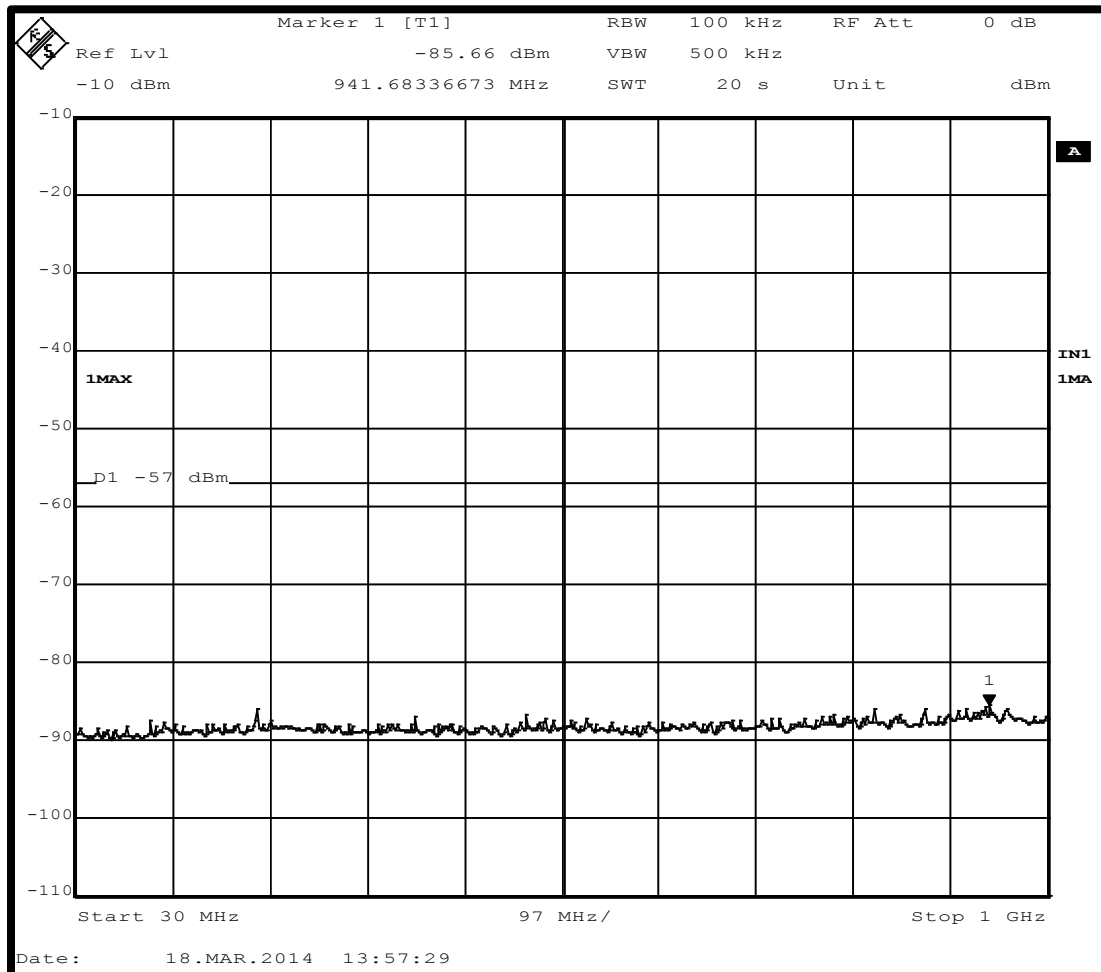
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Certificate # 1514.1

Receiver mode on 2441 GHz

30 MHz to 1 GHz



Emissions are more than 10 dB below the limit.

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# Wireless Transceiver Test Report

FCC ID: A94415859

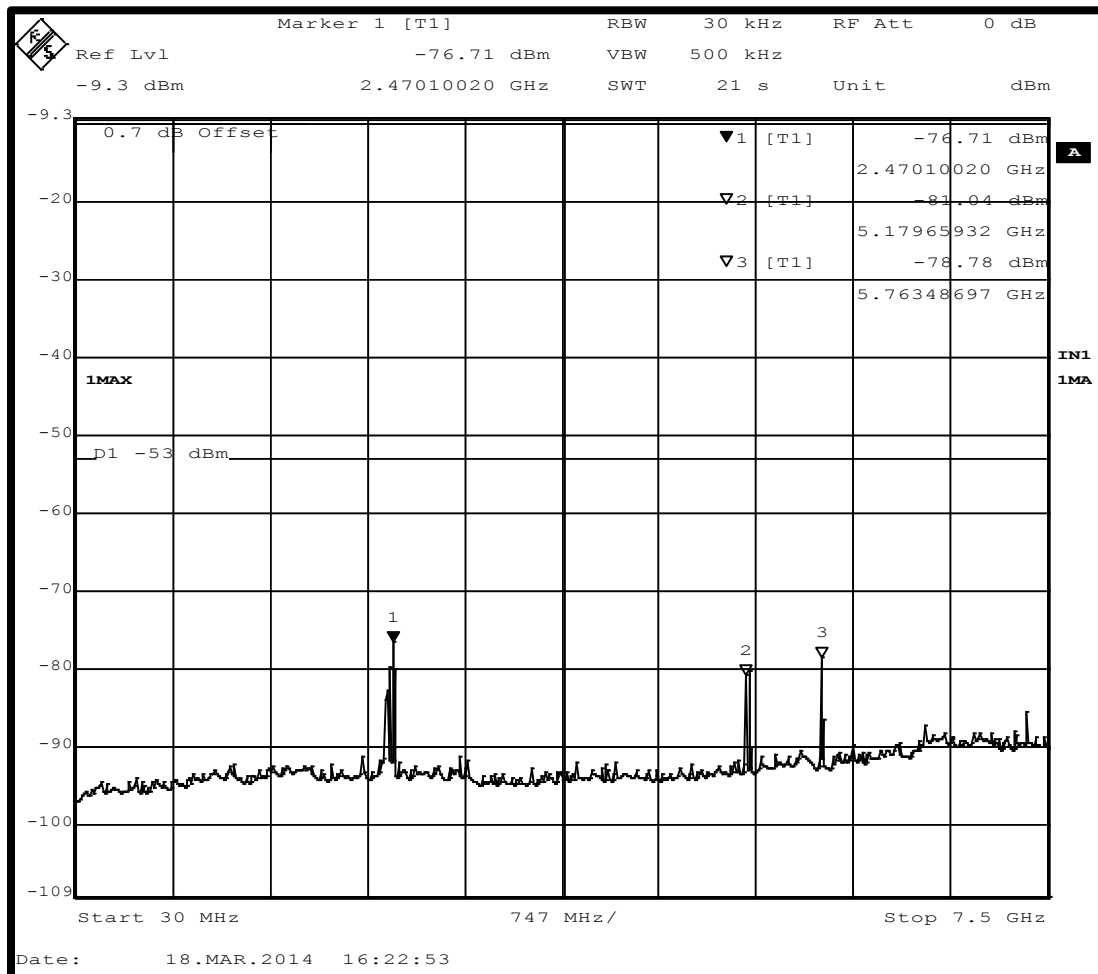
IC: 3232A 415859



Certificate # 1514.1

Receiver mode on 2441 GHz

30 MHz to 7.5 GHz



Emissions at the marker frequencies are ambient WiFi pickup and not EUT related, see plot on next page. Emissions are more than 10 dB below the limit.

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# Wireless Transceiver Test Report

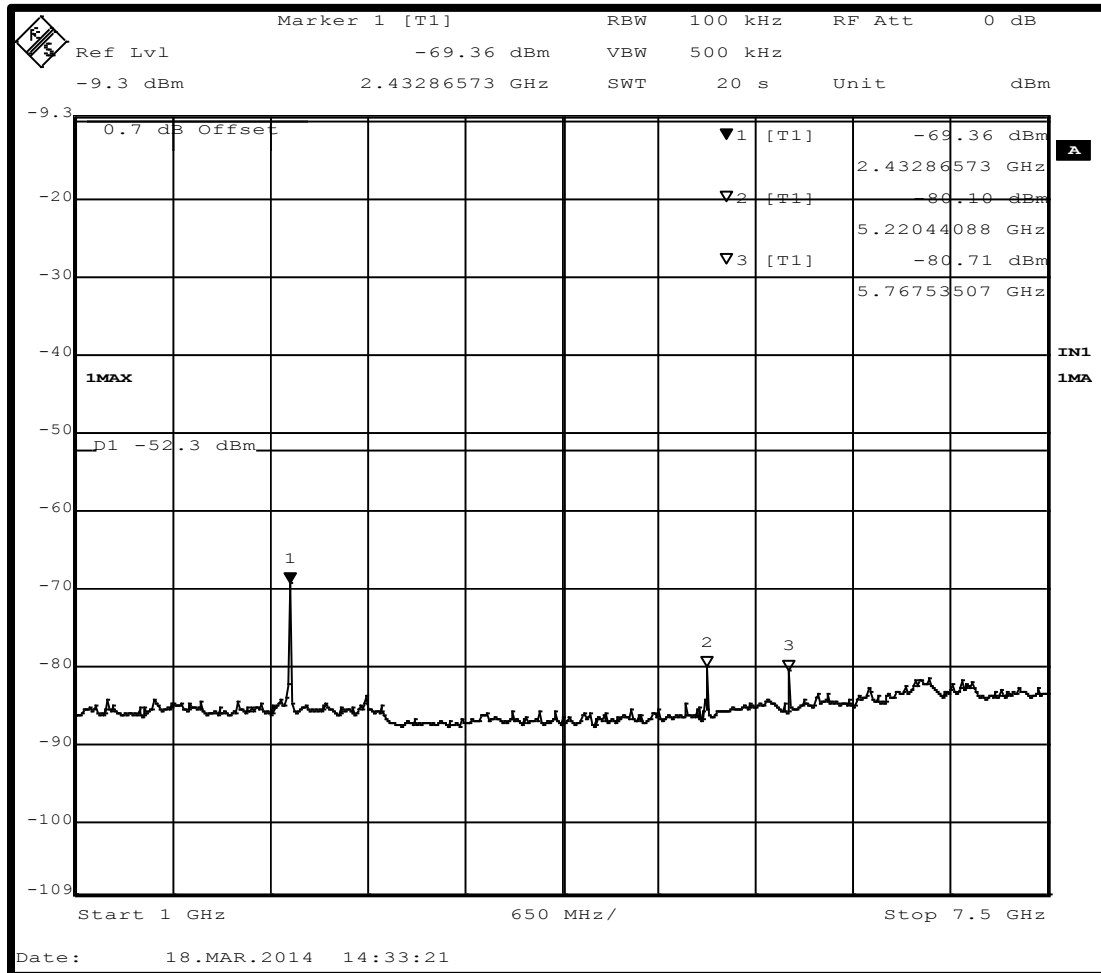
FCC ID: A94415859

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EUT is power off, plot shows ambient pickup



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# Wireless Transceiver Test Report

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Certificate # 1514.1

## 6.9.4. Test Equipment

| Equipment Type    | Manufacturer    | Model  | Serial or other ID | Service date |          |
|-------------------|-----------------|--------|--------------------|--------------|----------|
|                   |                 |        |                    | Last         | Due      |
| EMI Test Receiver | Rohde & Schwarz | ESIB40 | TN1560             | 4/4/2013     | 4/4/2014 |

## 6.9.5. Test information

|                  |           |                |                        |
|------------------|-----------|----------------|------------------------|
| Date of test:    | 3/18/2014 | Test location: | Transmitter Test Bench |
| EUT serial:      | 1 (PCB)   | Tested by:     | B. Cerqua              |
| Test Conclusion: | Pass      |                |                        |

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# Wireless Transceiver Test Report

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Certificate # 1514.1

## 6.10. SAR exemption calculation

Frequency Range: 2402-2480MHz

Based on FCC KDB 4447498 D01 General RF Exposure Guidance v05

### Equation 1:

$$\frac{[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})]}{[\sqrt{f(\text{GHz})}]}$$

Distance between EUT and body is 10 mm

Maximum conducted output power measured (dBm) = 9.54 dBm (8.99 mW) (see section 6.3 of this report)

Applying equation 1:

$$(8.99/10) * [\sqrt{f(2.480)}] = 1.41 \leq 3.0$$

Equation one is below the 3.0 1-g SAR exemption limit, device complies with FCC exposure limits for general population/uncontrolled exposure as a portable device without SAR evaluation.

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