# FCC and IC Test Report

## FCC Part 15.247 and RSS-210, Issue 7 for DTS systems

**for the**

## IRIS OEM Module 2.4GHz

**Model Number: M2110**

**FCC ID: SHUM2110**

**IC-ID: 6746A-M2110**

**TEST REPORT #:EMC_CROSS_005_07002_FCC_IC_Module**
**DATE: December 10, 2007**

Certificate # 2135.01

**Bluetooth Qualification Test Facility (BQTF)**

LAB CODE 20020328-00

**FCC listed# A2LA Certified**

**IC recognized # 3462B**


***CETECOM* Inc.**
411 Dixon Landing Road ◆ Milpitas, CA 95035 ◆ U.S.A.
Phone: + 1 (408) 586 6200 ◆ Fax: + 1 (408) 586 6299 ◆ E-mail: info@cetecomusa.com ◆ http://www.cetecom.com
*CETECOM* Inc. is a Delaware Corporation with Corporation number: 2113686
Board of Directors: Dr. Harald Ansorge, Dr. Klaus Matkey, Hans Peter May

## Test Report Cover Sheet/Performance Test Data

TEST REPORT NUMBER: EMC_CROSS_005_07002_FCC_IC_Module

EQUIPMENT MODEL NUMBER: M2110

CERTIFICATION NO: 6746A-M2110

MANUFACTURER: 6746A

RADIO STANDARD SPECIFICATION NO. : RSS 210, Issue 7

OPEN AREA TEST SITE INDUSTRY CANADA NUMBER: 3462B-1

FREQUENCY RANGE (or fixed frequency): 2405MHz to 2480MHz

R.F. POWER IN WATTS: 0.00164 conducted

OCCUPIED BANDWIDTH (99% BW): 2.43MHz

TYPE OF MODULATION: DSSS (QPSK)

EMISSION DESIGNATOR (TRC-43): **2M43G1D**

ANTENNA INFORMATION: External (0 & 2dBi)

TRANSMITTER SPURIOUS (worst case): 121.1993 uV/m @ 4.9519 GHz

RECEIVER SPURIOUS (worst case): 275.106 uV/m @ 2.89 GHz

**ATTESTATION:**
**DECLARATION OF COMPLIANCE:** I declare that the testing was performed or supervised by me; that the test measurements were made in accordance with the above-mentioned Industry Canada standard(s); and that the equipment identified in this application has been subjected to all the applicable test conditions specified in the Industry Canada standards and all of the requirements of the standard have been met.

**Signature:**
**Juan Martinez**
Project Engineer
CETECOM Inc.
411 Dixon Landing Road
Milpitas, CA 95035

**Date: 2007-12-10**

# TABLE OF CONTENTS

## 1 Assessment

**The following is in compliance with the applicable criteria specified in FCC rules Part 15.247 of the Code of Federal Regulations and IC RSS-210, Issue 7 Standards.**

| Company | Description | Model # |
|---|---|---|
| **Crossbow, Inc.** | **Module** | **M2110** |

**Technical responsibility for area of testing:**

| | | | |
|---|---|---|---|
| **December 10, 2007** | **EMC & Radio** | Ivaylo Tankov **(Project Engineer)** | Ivaylo Tankov I am approving this document |
| **Date** | **Section** | **Name** | **Signature** |

**Responsible for test report and project leader:**

| | | | |
|---|---|---|---|
| **December 10, 2007** | **EMC & Radio** | Juan Martinez **(Project Engineer)** | Reason: I am the author of this document Date: 2008.02.06 15:59:48 -08'00' |
| **Date** | **Section** | **Name** | **Signature** |

# 2 Administrative Data

## 2.1 Identification of the Testing Laboratory Issuing the Radio Assessment Report

| | |
|---|---|
| Company Name: | CETECOM, Inc. |
| Department: | EMC |
| Address: | 411 Dixon Landing Road<br>Milpitas, CA 95035<br>U.S.A. |
| Telephone: | +1 (408) 586 6200 |
| Fax: | +1 (408) 586 6299 |
| Project Leader: | Juan Martinez |
| Responsible Test Lab Manager: | Ivaylo |

## 2.2 Identification of the Client

| | |
|---|---|
| Applicant's Name: | Crossbow, Inc. |
| Address: | 4145 N. First Street<br>San Jose, CA 95134, USA |
| Contact Person: | Jaidev Prabhu |
| Phone No. | 408-250-2033 |
| Fax: | 408 324-4840 |
| e-mail: | jprabhu@xbow.com |

## 2.3 Identification of the Manufacturer

| | |
|---|---|
| Manufacturer's Name: | Crossbow, Inc. |
| Manufacturer's Address: | 4145 N. First Street, San USA |

# 3 Equipment under Test (EUT)

## 3.1 Specification of the Equipment under Test

| | |
|---|---|
| Product Type | Module |
| Marketing Name: | IRIS OEM Module 2.4GHz |
| Model No: | M2110 |
| FCC-ID: | SHUM2110 |
| IC-ID : | 6746A-M2110 |
| Frequency Range: | 2405MHz – 2480MHz |
| Number of Channels | 16 |
| Type(s) of Modulation: | DSSS (QPSK) |
| Antenna Type: | External (0 & 2dBi) |
| Output Power: | 2.14 dBm (0.00164W) Conducted |

## 3.2 Identification of Accessory and Remote (Host) equipment

| AE # | TYPE | MANF. | MODEL | SERIAL # |
|---|---|---|---|---|
| 1 | None | None | None | None |

## Subject Of Investigation

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

The objective of the measurements done by Cetecom Inc. was to measure the performance of the EUT as specified by requirements listed in FCC rules Part 15.247 of Title 47 of the Code of Federal Regulations and to Industry Canada RSS-210, Issue 7. The maximization of portable equipment is conducted in accordance with ANSI C63.4.

# 4 Measurements

## 5 ANTENNA PORT EMISSIONS

### 5.1 MAXIMUM PEAK OUTPUT POWER § 15.247 (b) (3) & RSS-210 (A8.4)(4) (CONDUCTED)

| TEST CONDITIONS | | MAXIMUM PEAK OUTPUT POWER (dBm) | | |
|---|---|---|---|---|
| Frequency (MHz) | | 2405 | 2445 | 2480 |
| $T_{nom}$(23)°C | $V_{nom}$ | 2.14 | 1.70 | 1.91 |
| Measurement uncertainty | | ±0.5dBm | | |

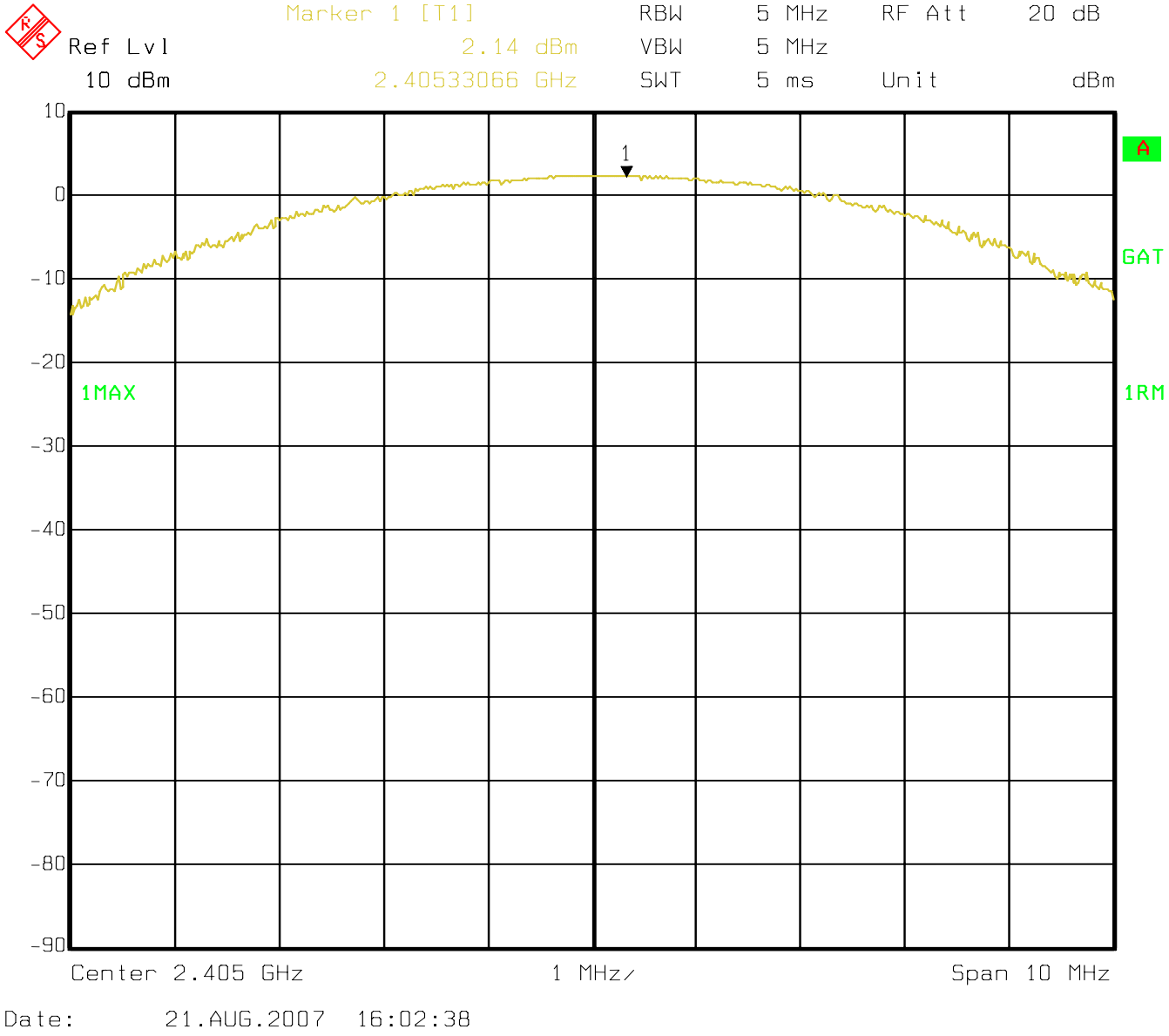
**LIMIT** **SUBCLAUSE § 15.247 (b) (3) & RSS-210 (A8.4)(4)**

| Frequency range | RF power output |
|---|---|
| 2400-2483.5 MHz | 30dBm on Conducted |

Notes:

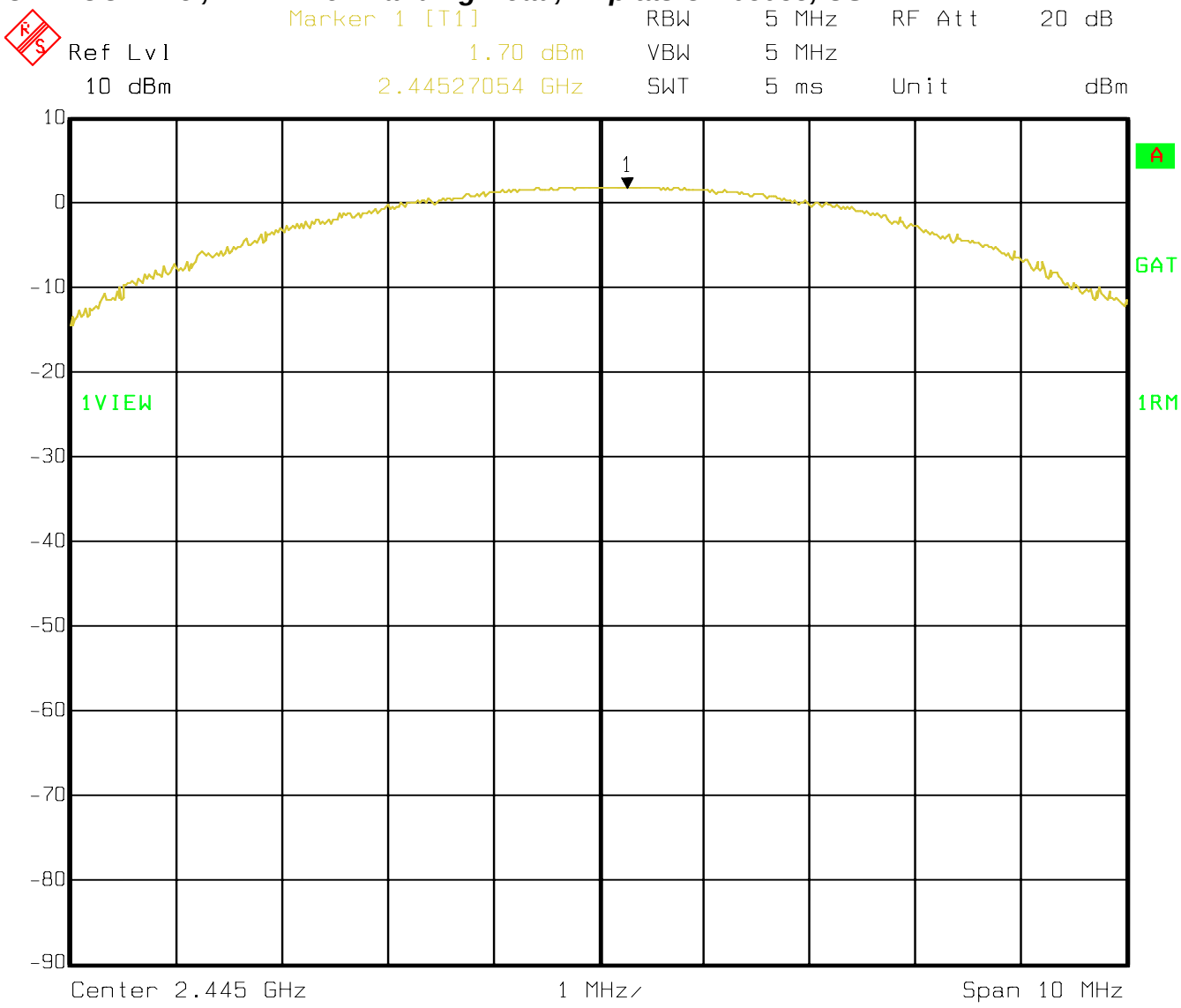
**2405 MHz**

***CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA***



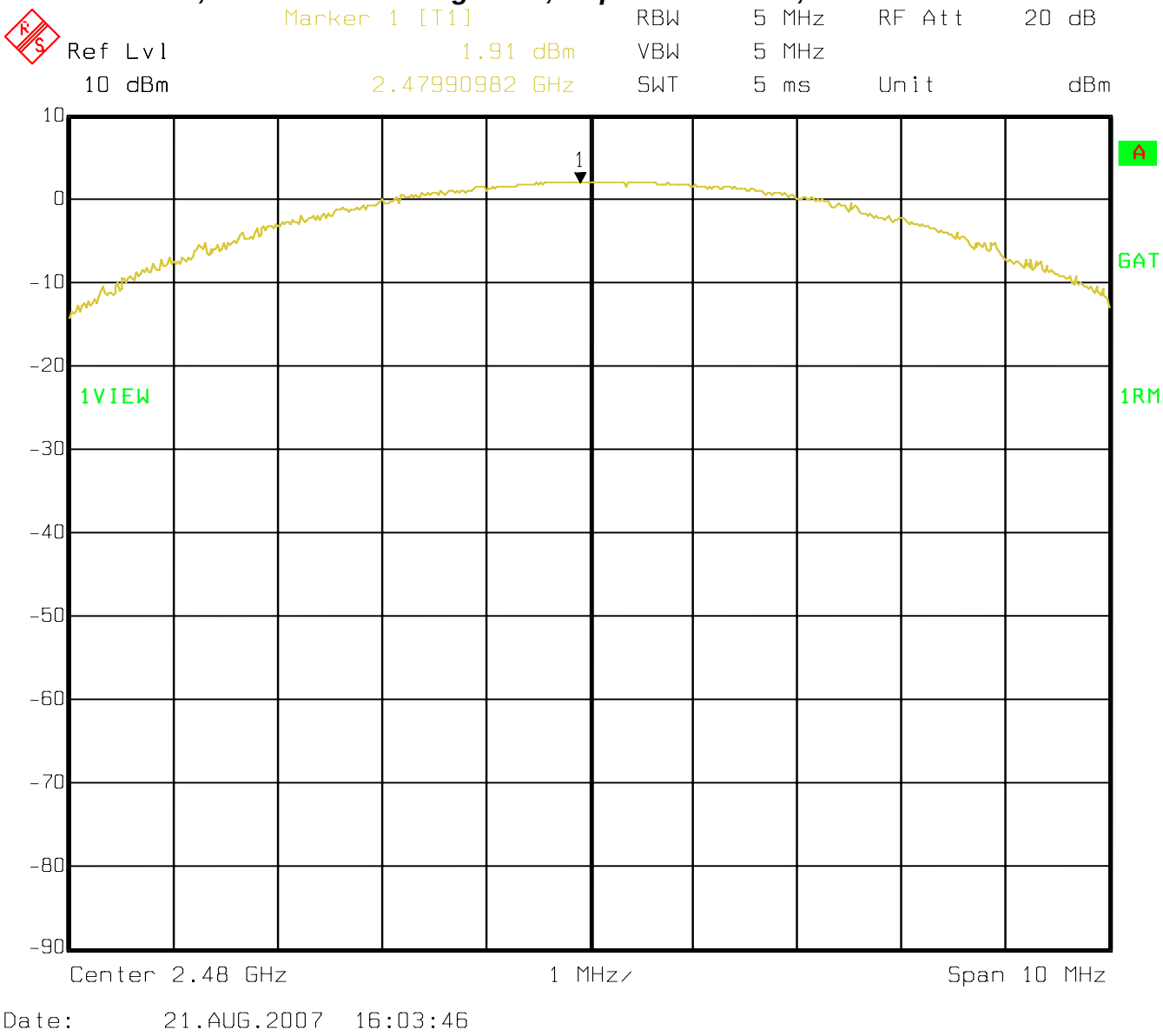
**2445 MHz**

***CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA***



2480 MHz

***CETECOM Inc., 411 Dixon Landing Road, Milpitas CA 95035, USA***



## 5.2 6-dB and 99% BANDWIDTH §15.247(a)(2) & § RSS-210 (A8.2)(a) (CONDUCTED)

**Limit: min. 6dB BW shall be at least 500kHz §15.247(a)(2)**

**ANALYZER SETTINGS: RBW: 100kHz, VBW: 100kHz SPAN: 5 MHz**

| Channel No. | Frequency (MHz) | 6dB BW (MHz) |
|---|---|---|
| 11 | 2405 | 1.57 |
| 19 | 2445 | 1.71 |
| 26 | 2480 | 1.50 |

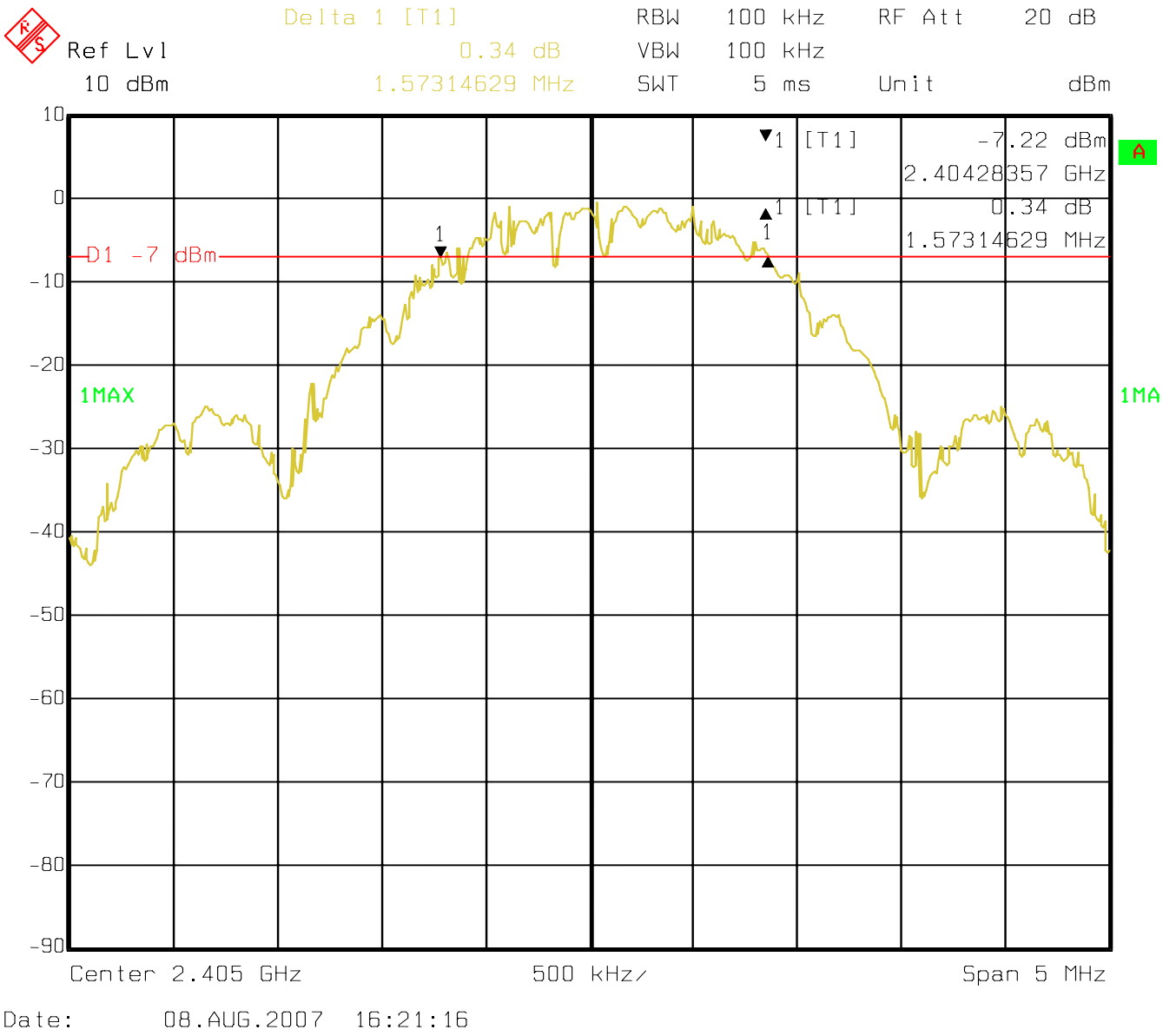
Conducted Measurement

**Limit: min. 99% BW shall be at least 500kHz § RSS-210 (A8.2)(a)**

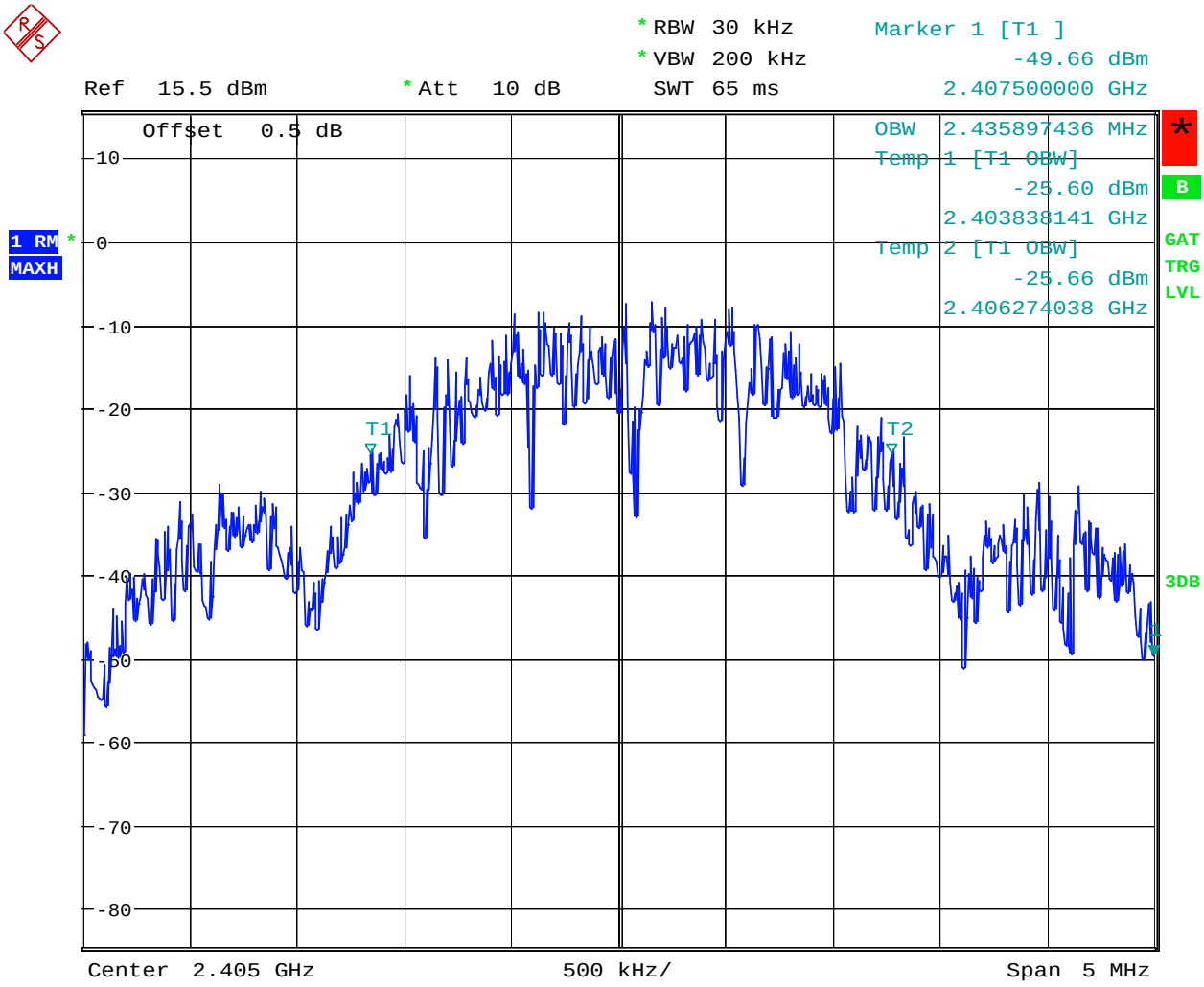
**RSS GEN (4.6) = 99% analyzer settings: Resolution Bandwidth: 1% of the emission bandwidth, Video Bandwidth: 3 times RBW. Trace set to max hold then view.**

| Channel No. | Frequency (MHz) | 99dB BW (MHz) |
|---|---|---|
| 11 | 2405 | 2.43 |
| 19 | 2445 | 2.44 |
| 26 | 2480 | 2.41 |

**2405 MHz – 6dB BW**

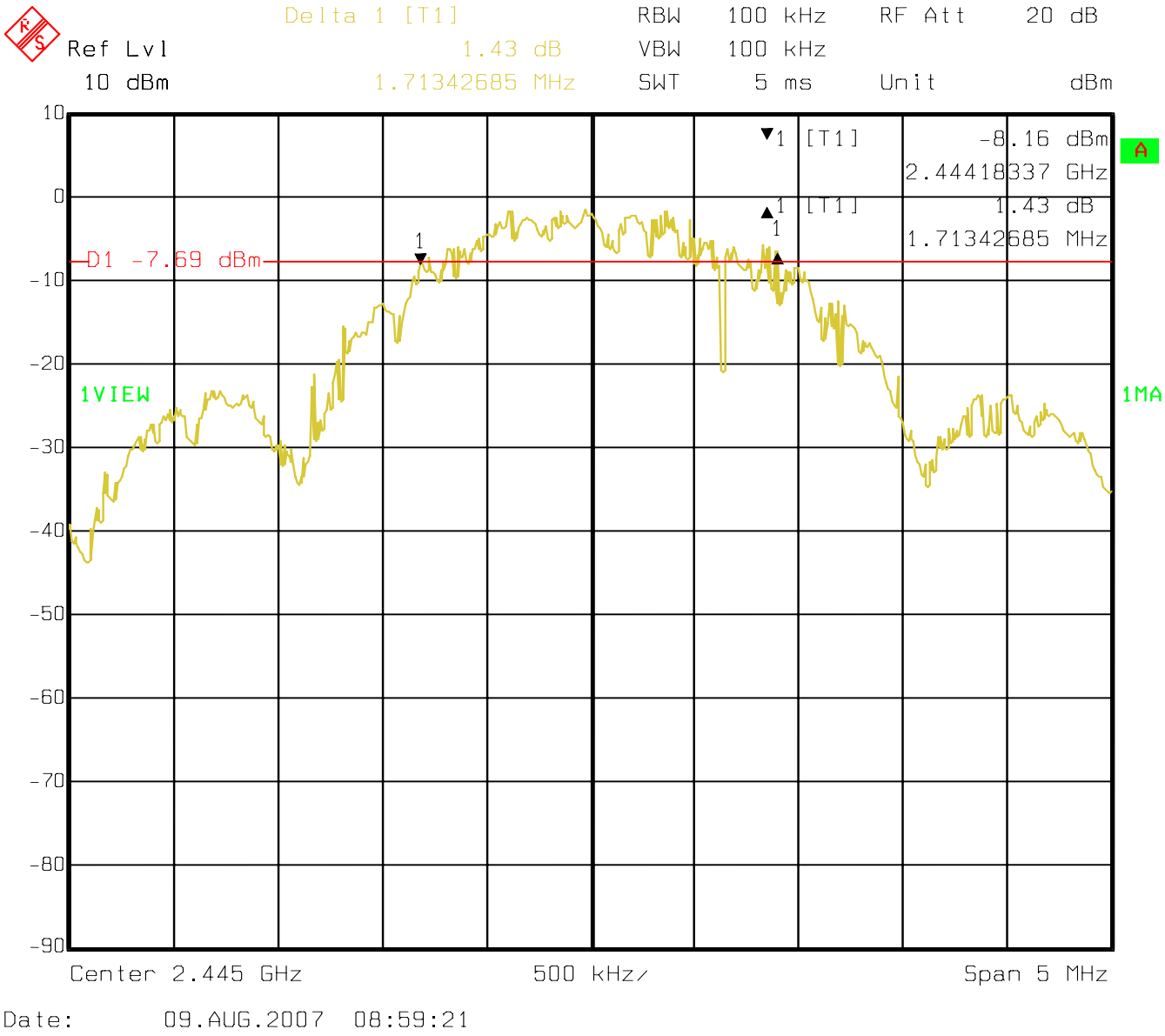


## 2405 MHz – 99% BW

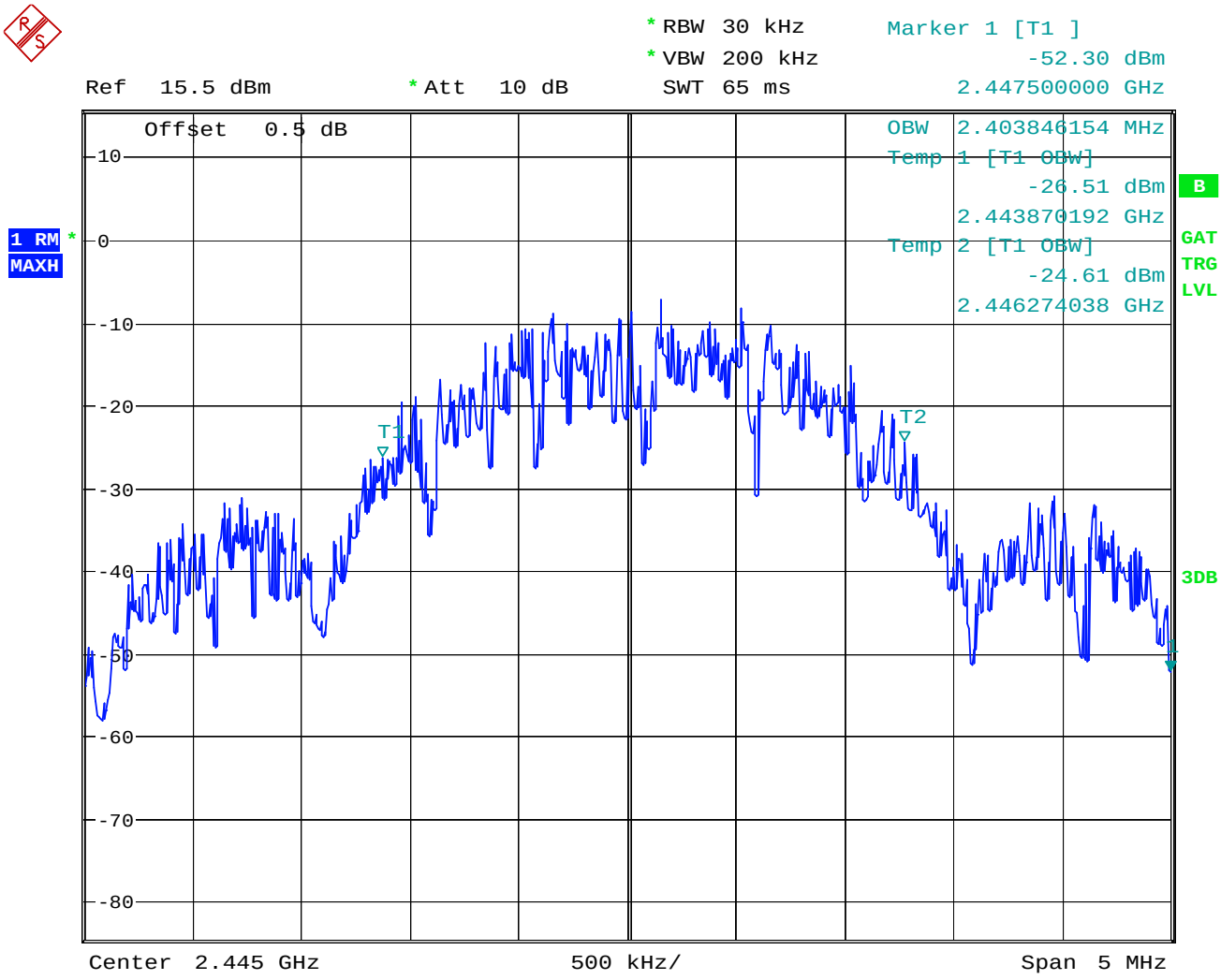



Date: 6.FEB.2008 18:45:42

**2445 MHz – 6dB BW**



## 2445 MHz – 99% BW

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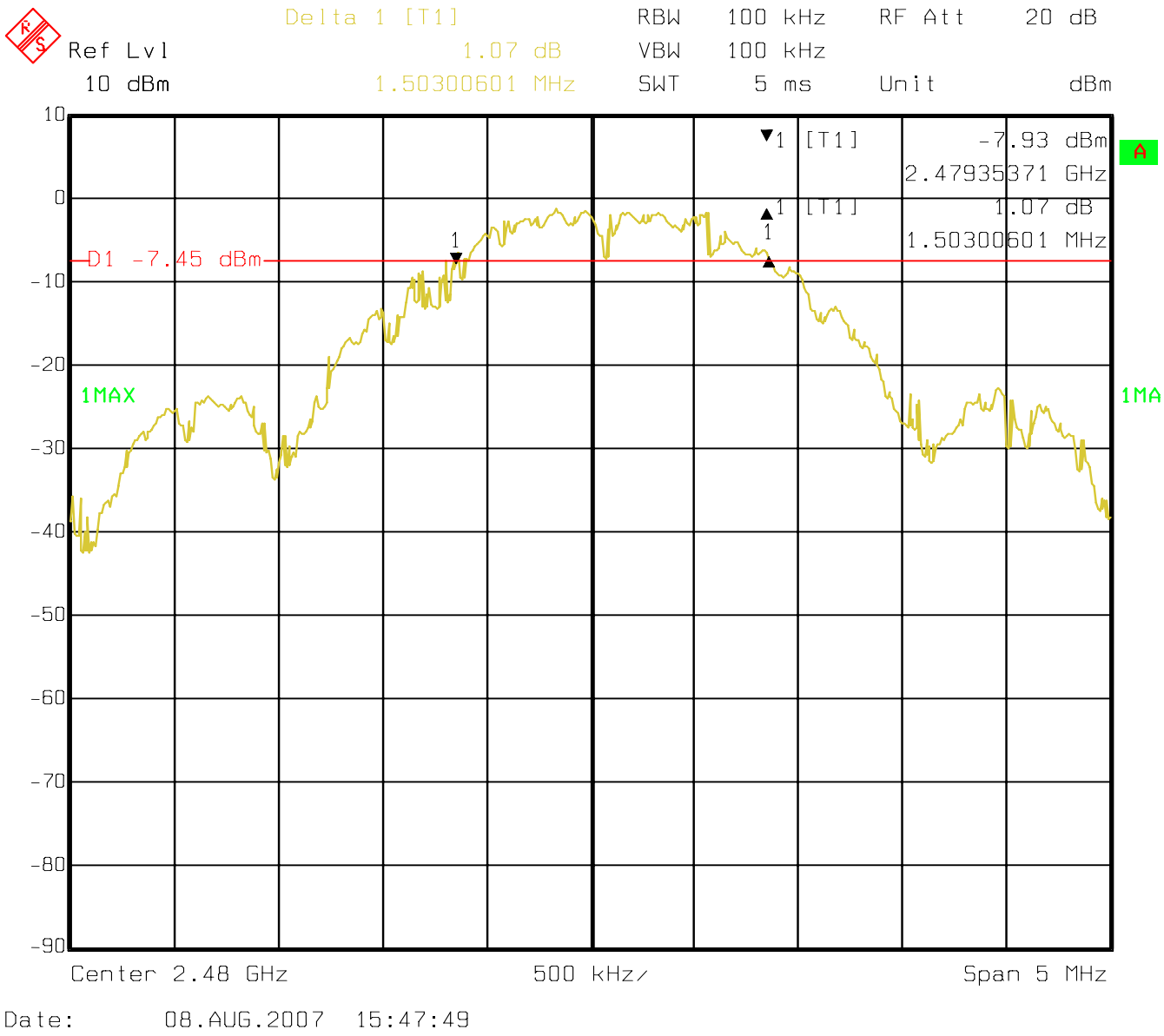
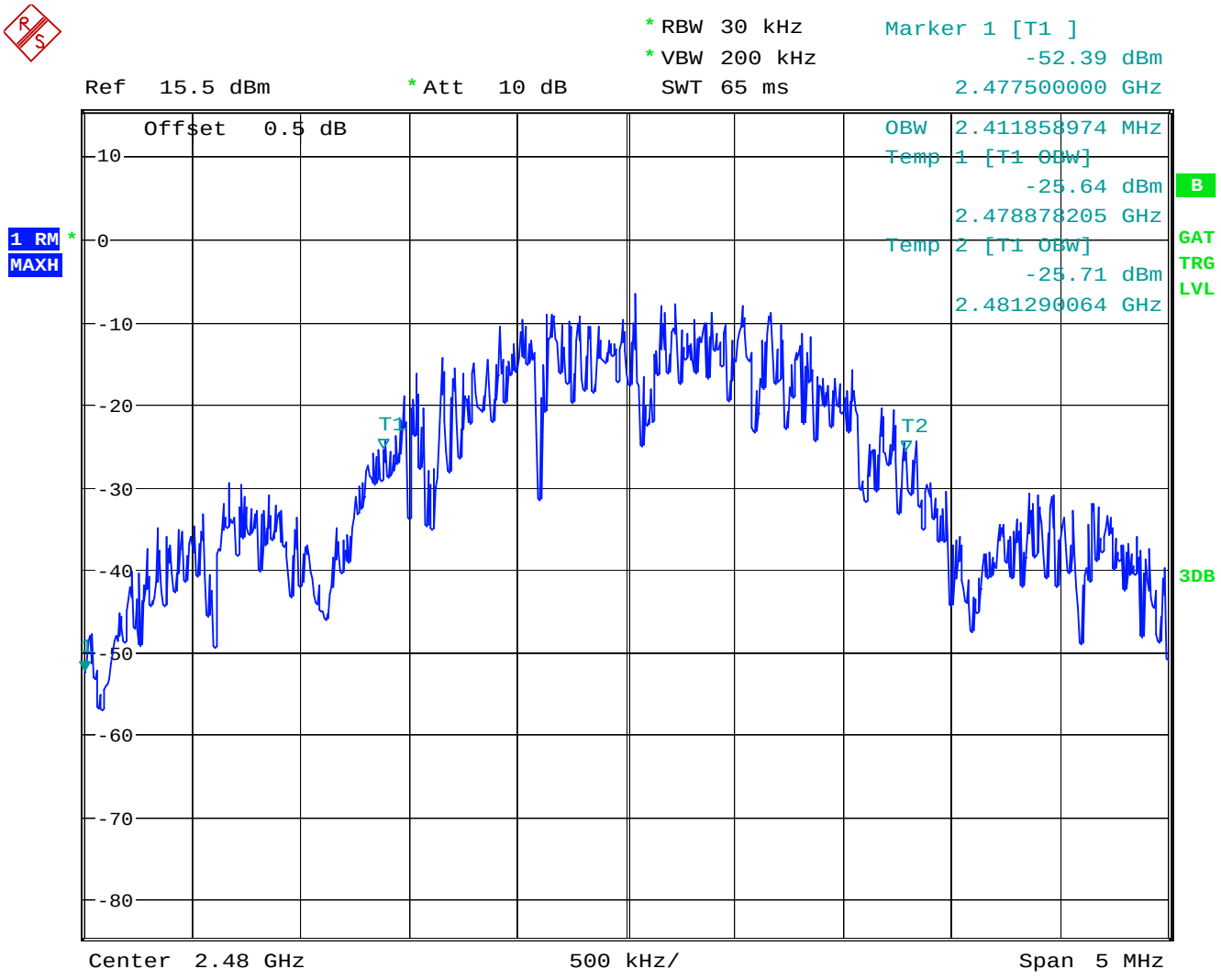
**2480 MHz – 6dB BW**



**2480 MHz – 99% BW**

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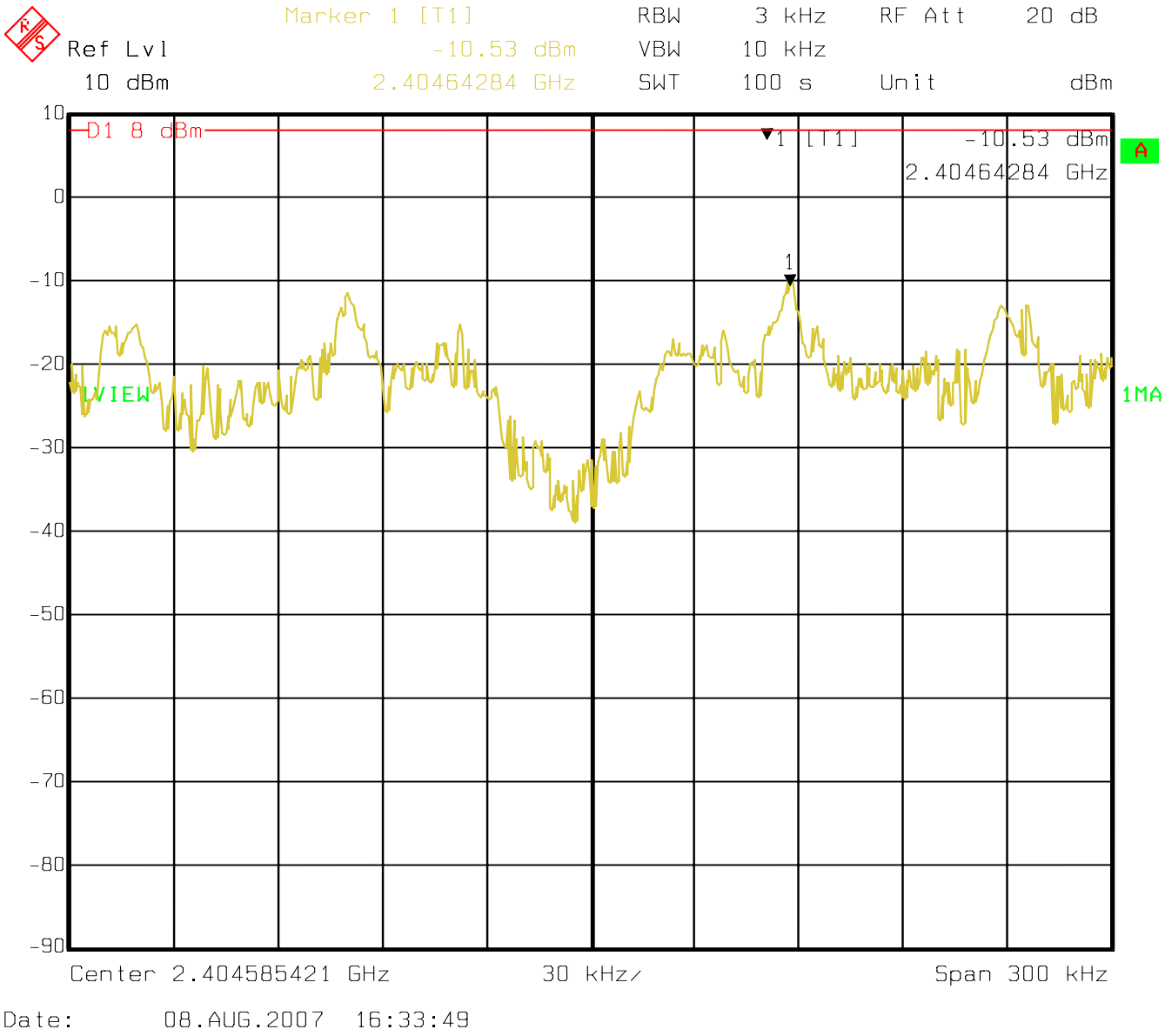
## 5.3 POWER SPECTRAL DENSITY §15.247(e) & RSS-210 (A8.2)(b) (CONDUCTED)

**Limit: ≤ 8dBm (in 3kHz BW)** **§15.247(e) & RSS-210 (A8.2)(b)**

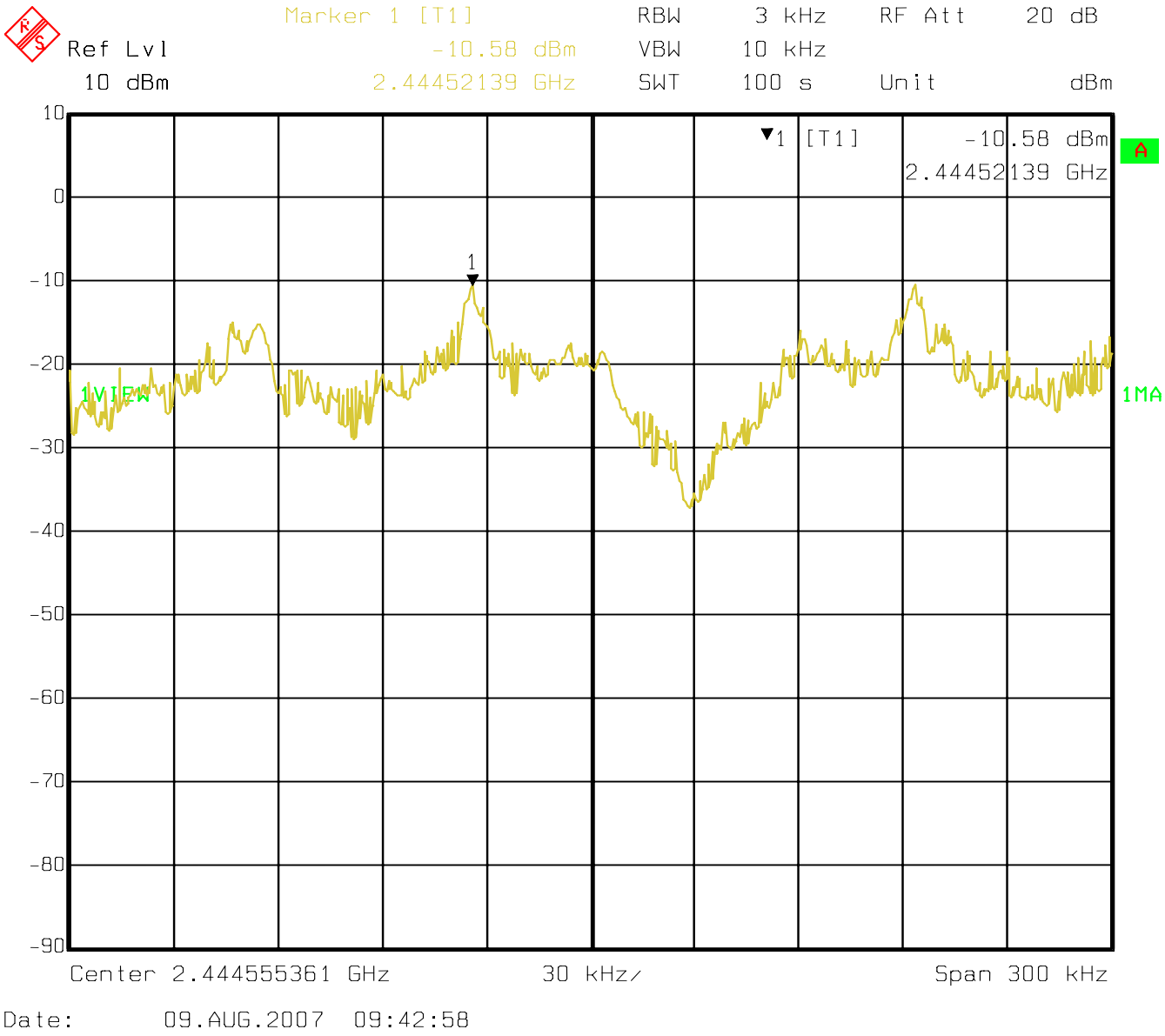
**ANALYZER SETTINGS:** **RBW= 3kHz, VBW: 10kHz** **SPAN: 300kHz**

| Channel No. | Frequency (MHz) | PSD (dBm) |
|---|---|---|
| 11 | 2405 | -10.53 |
| 19 | 2445 | -10.58 |
| 26 | 2480 | -10.25 |

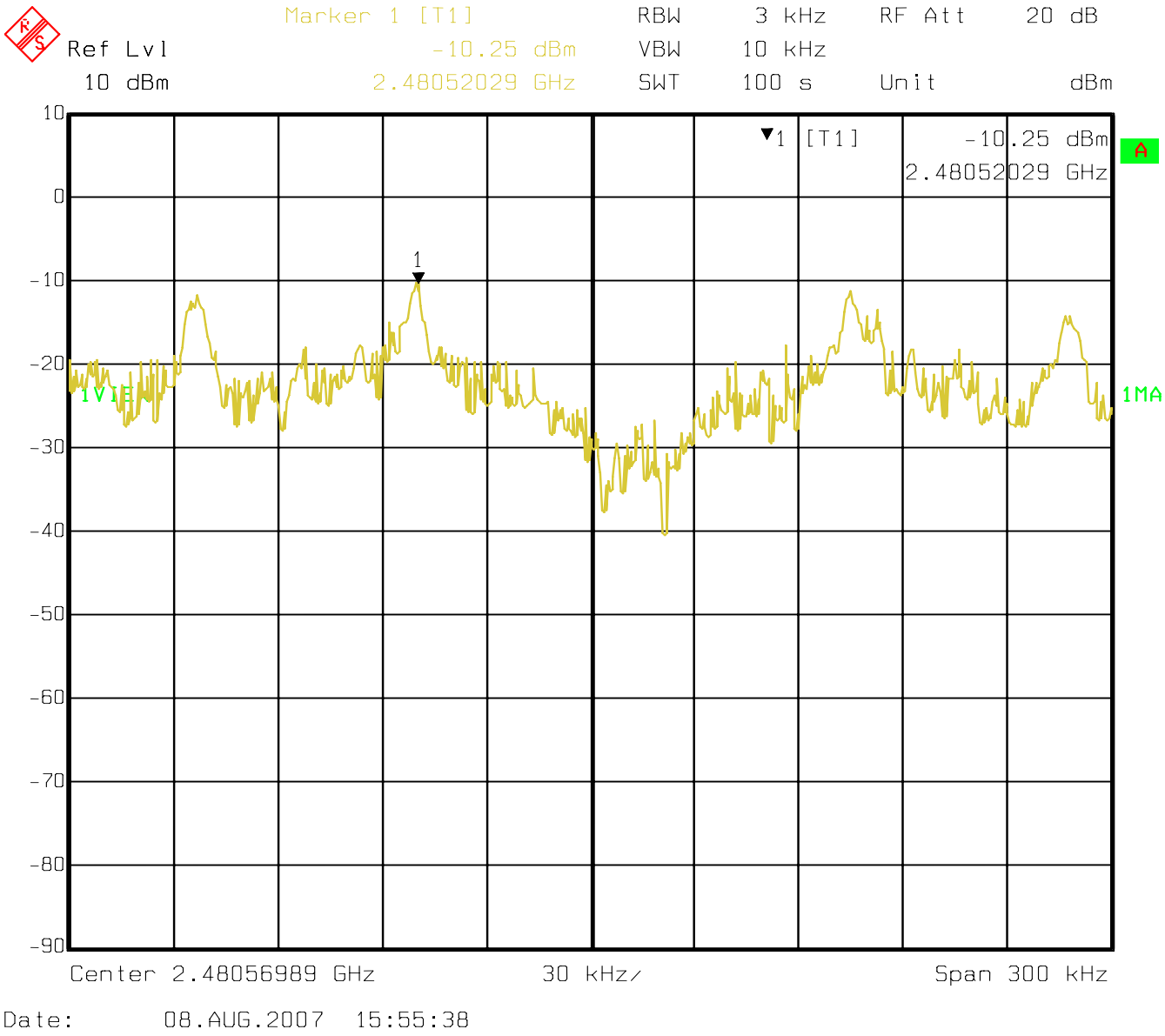
**2405 MHz**


Marker 1 [T1]
Ref Lvl
10 dBm
-10.53 dBm
2.40464284 GHz
RBW 3 kHz
VBW 10 kHz
SWT 100 s
RF Att 20 dB
Unit dBm
D1 8 dBm
1 [T1]
-10.53 dBm
2.40464284 GHz
A
1
1VIEW
1MA
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.404585421 GHz
30 kHz/
Span 300 kHz
Date: 08.AUG.2007 16:33:49

**2445 MHz**


Marker 1 [T1]
-10.58 dBm
2.44452139 GHz
RBW 3 kHz
VBW 10 kHz
SWT 100 s
RF Att 20 dB
Unit dBm
Ref Lvl
10 dBm
1 [T1]
-10.58 dBm
2.44452139 GHz
A
1VIEW
1MA
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.444555361 GHz
30 kHz/
Span 300 kHz
Date: 09.AUG.2007 09:42:58

**2480 MHz**


Marker 1 [T1]
-10.25 dBm
2.48052029 GHz
RBW 3 kHz
VBW 10 kHz
SWT 100 s
RF Att 20 dB
Unit dBm
Ref Lvl
10 dBm
1 [T1]
-10.25 dBm
2.48052029 GHz
A
1MA
1VIEW
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.48056989 GHz
30 kHz/
Span 300 kHz
Date: 08.AUG.2007 15:55:38

## 5.4 ANTENNA PORT EMISSIONS §15.247(d) & RSS-210 (A8.5) (CONDUCTED)

**Limit: -20dBc used, §15.247(d) & RSS-210 (A8.5):**

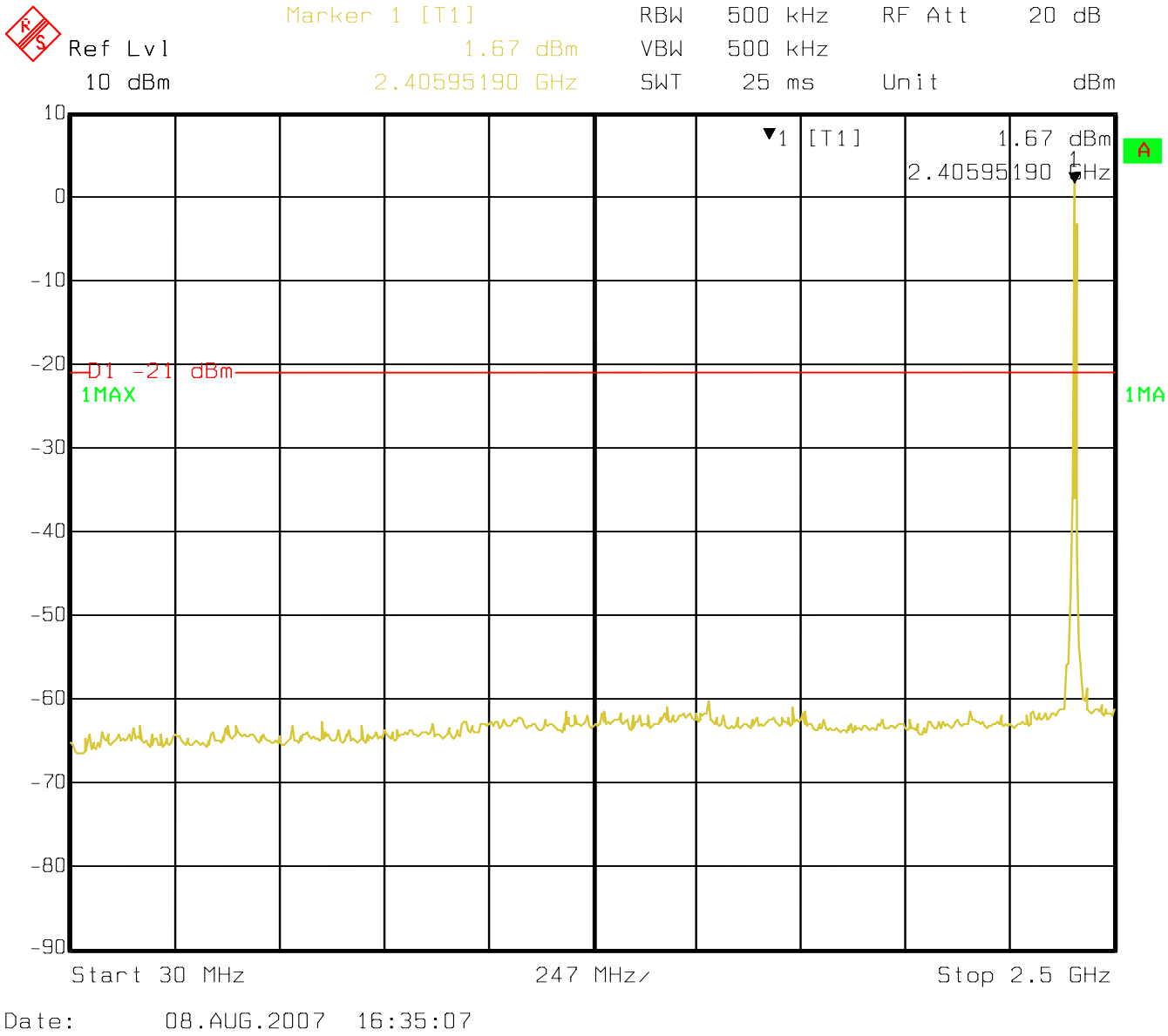
**NOTE: ANALYZER SETTINGS: RBW=VBW: 100 kHz (Note: Due to the fact that the radio was set to transmit every 1ms and off for 2ms, a RBW=VBW= 500 kHz was used to increase the sweep time and capture the emissions correctly.)**

**Measurements were performed on the low, middle, and high channel.**

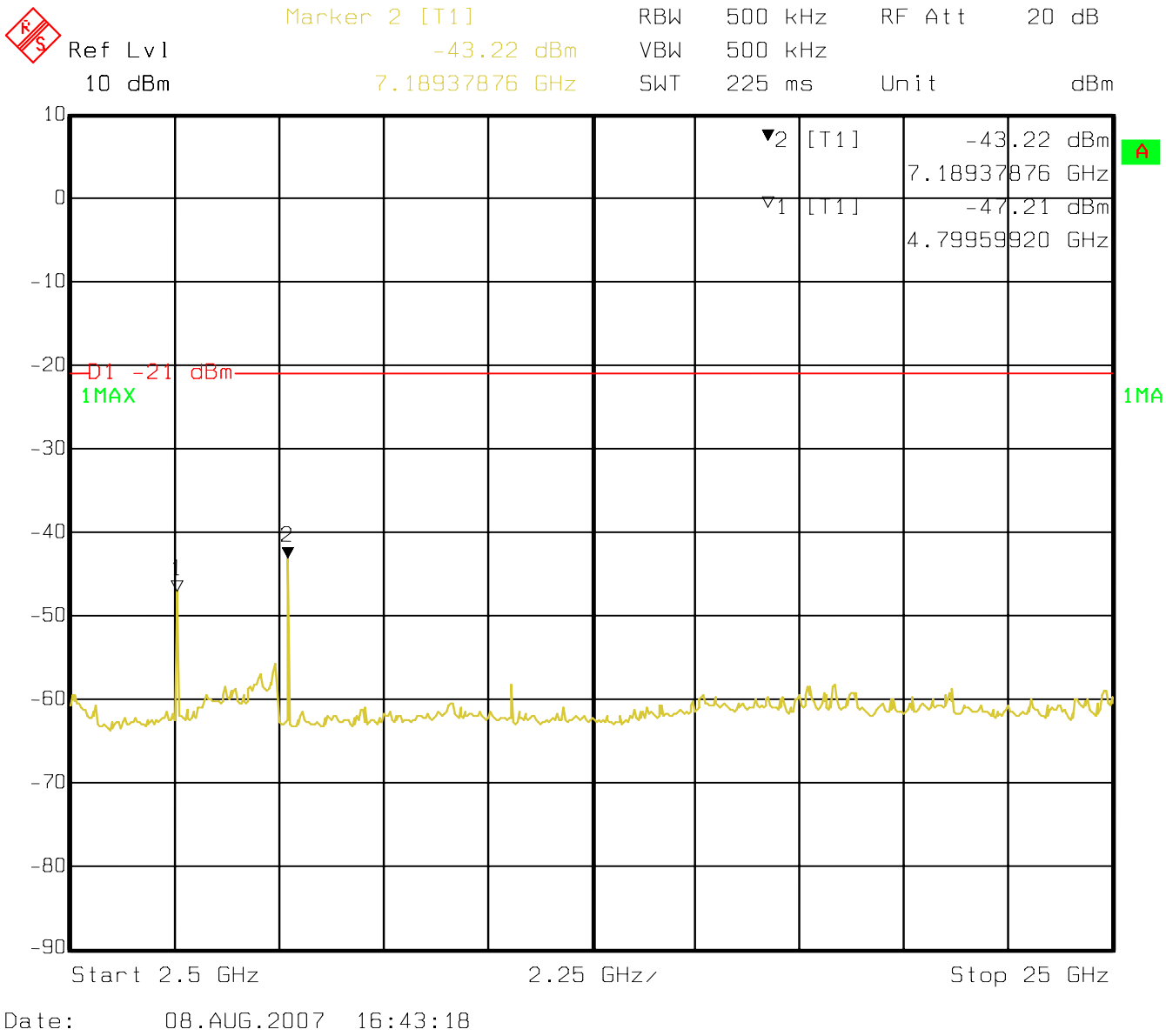
| **Transmit at Lowest channel Frequency 2405MHz** | |
|---|---|
| **Frequency (MHz)** | **Level (dBm)** |
| | **Peak** |
| 4799.59 | -43.22 |
| 7189.37 | -47.21 |
| **Transmit at Middle channel Frequency 2445MHz** | |
| **Frequency (MHz)** | **Level (dBm)** |
| | **Peak** |
| 836.83 | -56.96 |
| 7324.64 | -47.57 |
| **Transmit at Highest channel Frequency 2480MHz** | |
| **Frequency (MHz)** | **Level (dBm)** |
| | **Peak** |
| 4934.86 | -47.13 |

**2405 MHz**

**EMISSION SCAN FROM 30 – 2.5 GHz**

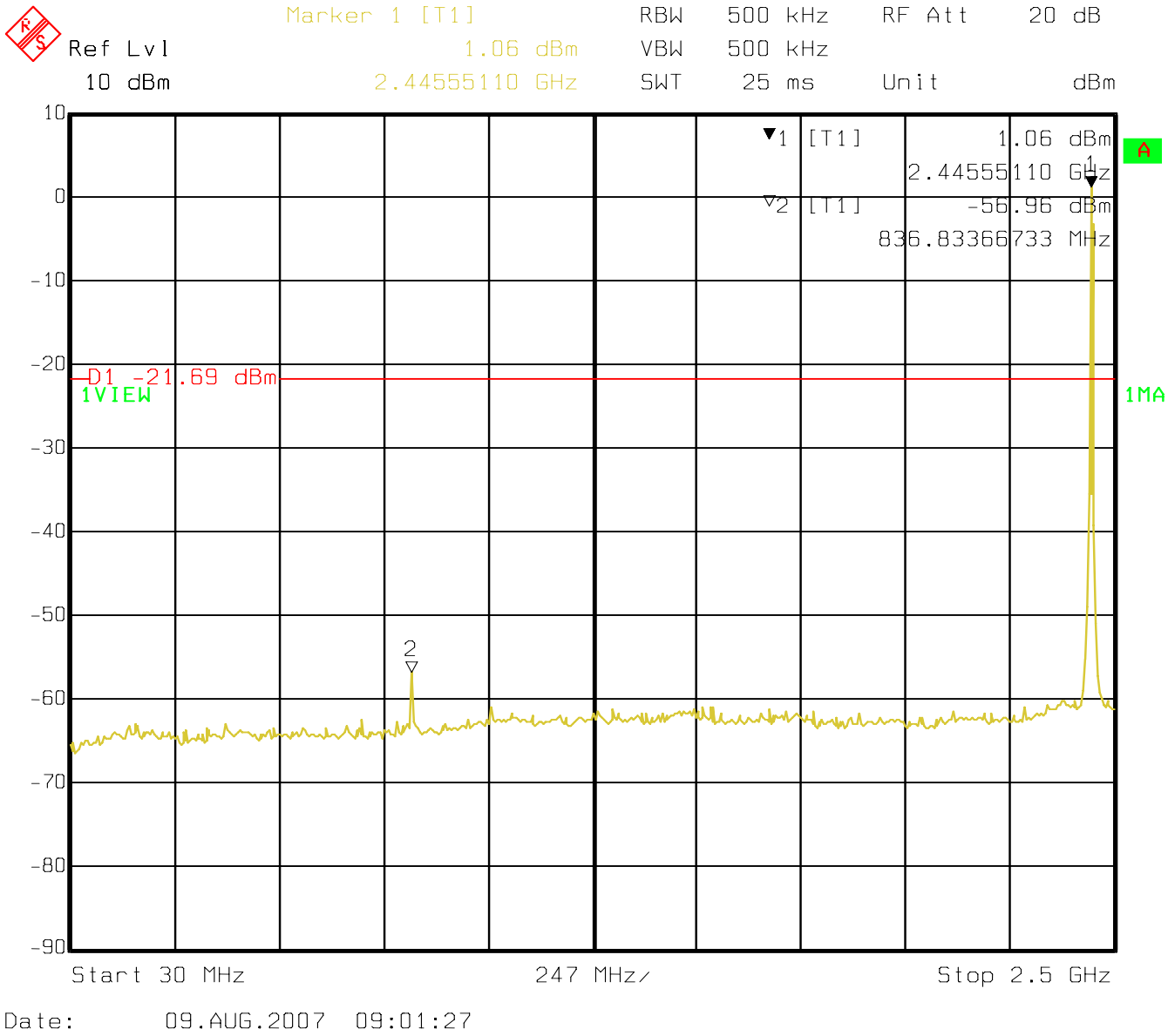


## EMISSION SCAN FROM 2.5 – 25 GHz

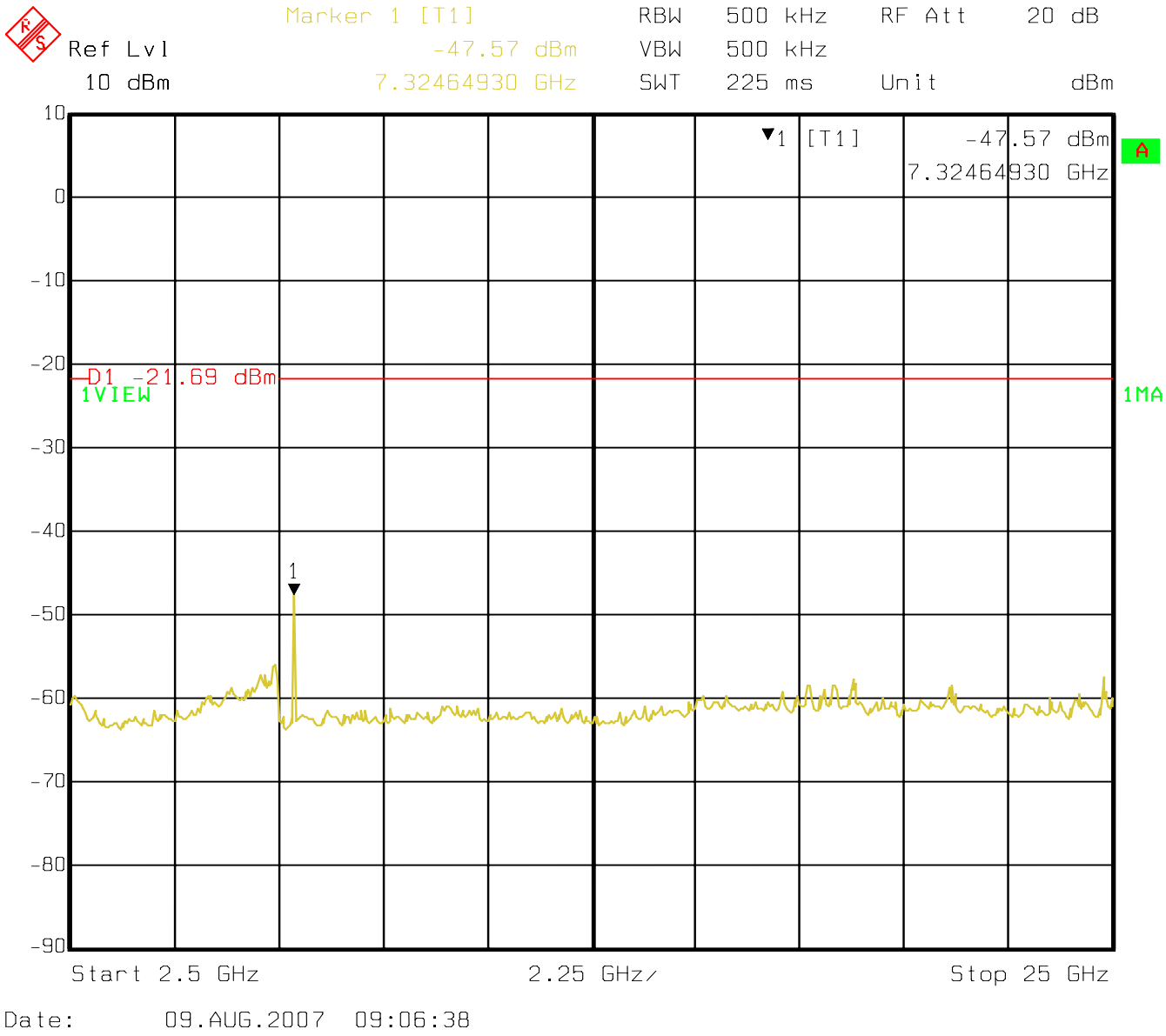


**2445 MHz**

**EMISSION SCAN FROM 30 – 2.5 GHz**



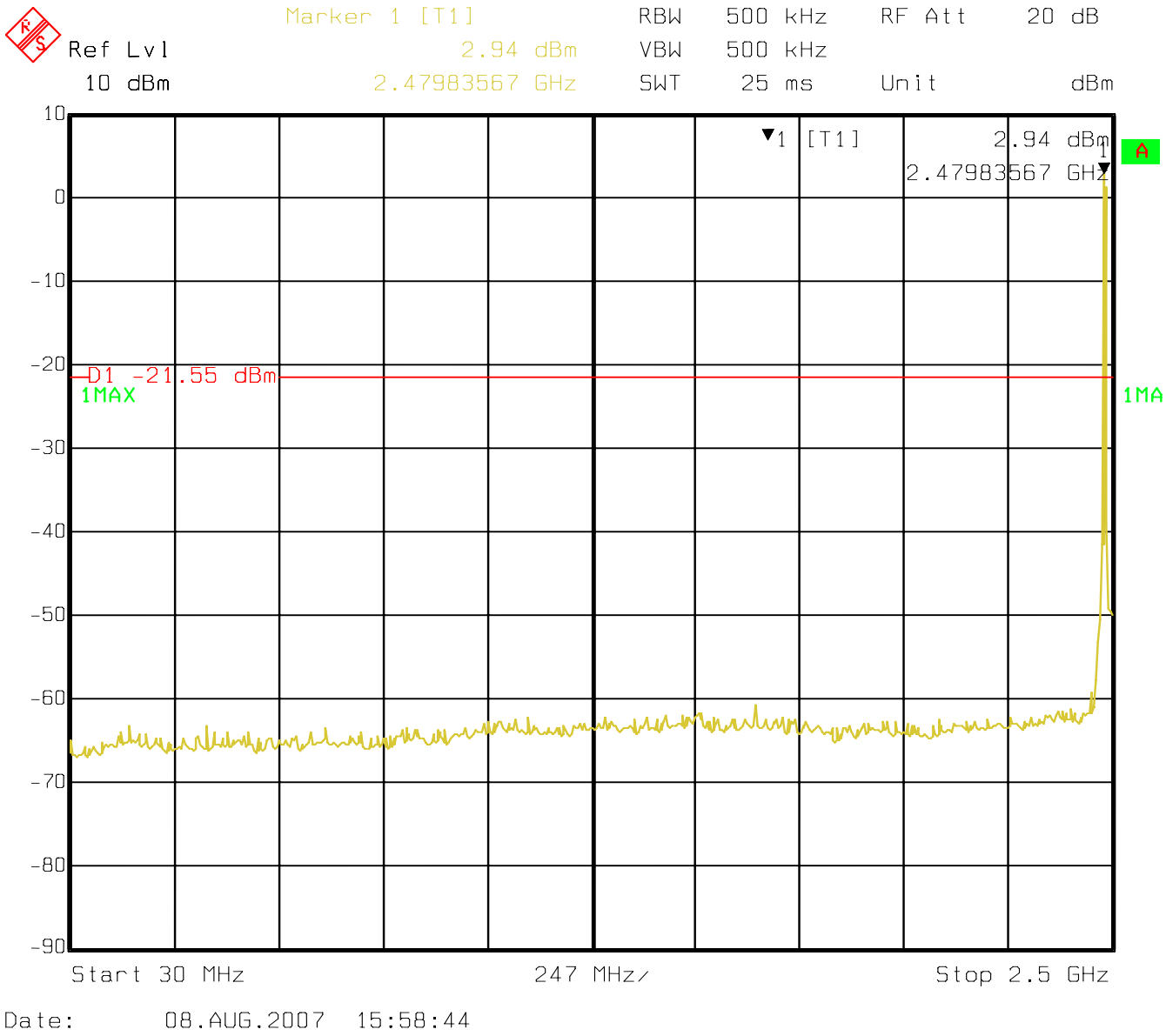
## EMISSION SCAN FROM 2.5 – 25 GHz



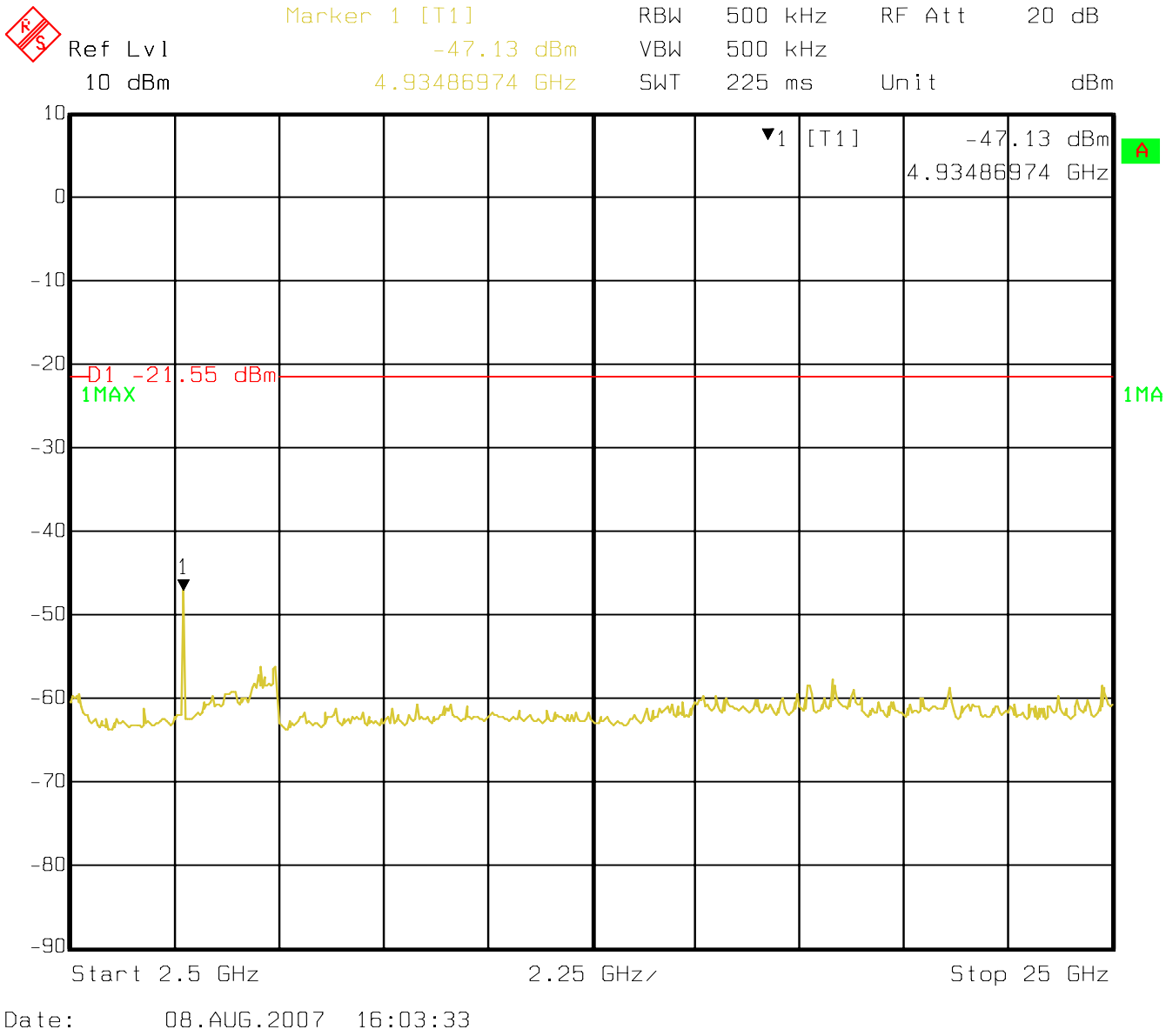

Date: 09.AUG.2007 09:06:38

**2480 MHz**

**EMISSION SCAN FROM 30 – 2.5 GHz**



## EMISSION SCAN FROM 2.5 – 25 GHz



# 6 RADIATED EMISSIONS MEASUREMENTS

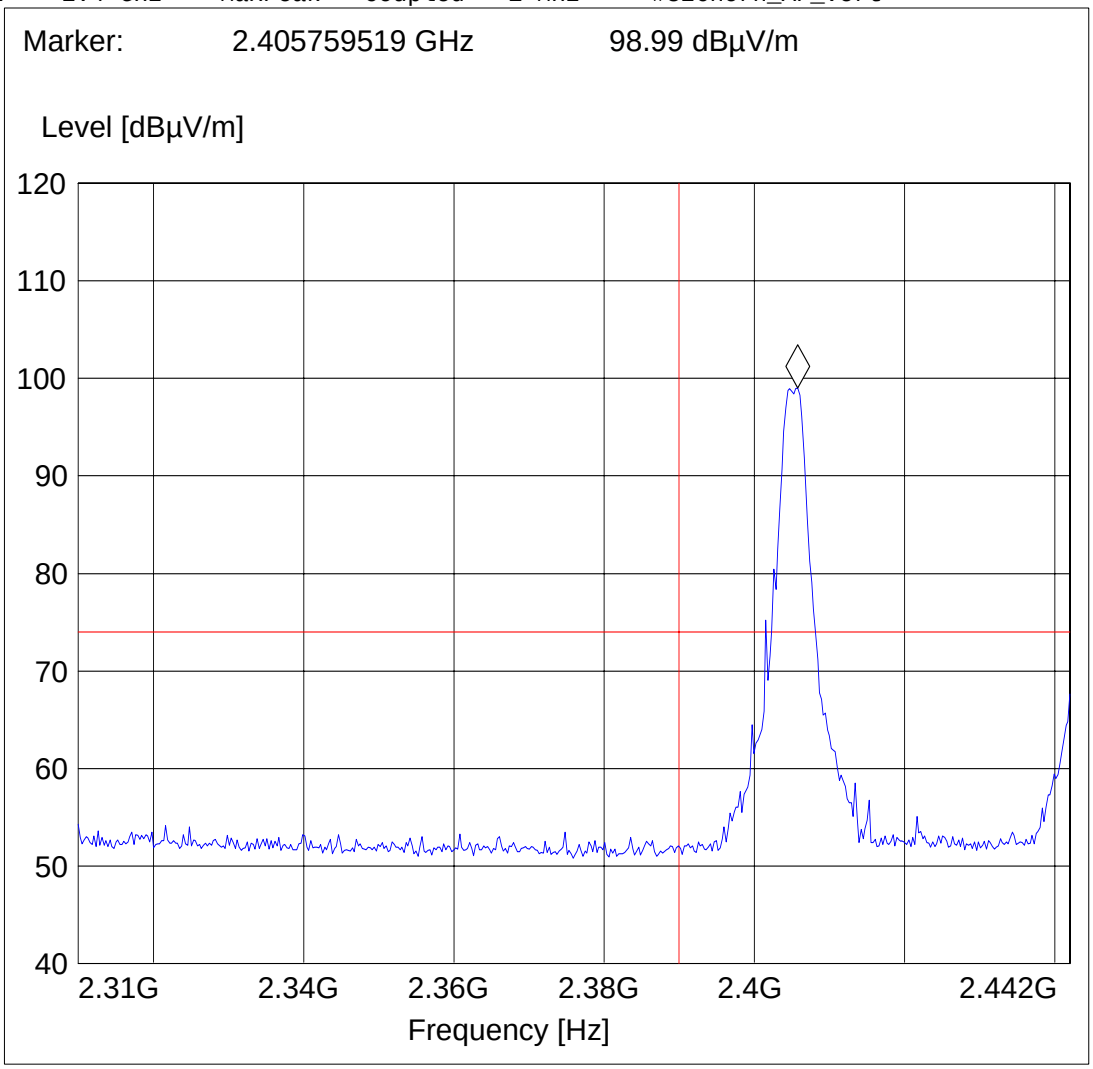
## 6.1 BAND EDGE COMPLIANCE §15.247 (d) & RSS-210(A8.5)

**Low frequency section (spurious in the restricted band 2310 – 2390 MHz)**

```
EUT:              M2110
Customer:         Crossbow
Test Mode:        Low channel (Tx mode
ANT Orientation:  V (Worst Case polarization)
EUT Orientation:  H (Antenna Vertical)with 0dBi antenna
Test Engineer:    Juan M.
Power Supply:     Battery
Comments:
```

***SWEEP TABLE: "FCC15.247 LBE_PK"***

| Start Frequency | Stop Frequency | Detector | Meas. Time | IF Bandw. | Transducer |
|---|---|---|---|---|---|
| 2.3 GHz | 2.4 GHz | MaxPeak | Coupled | 1 MHz | #326horn_AF_vert |



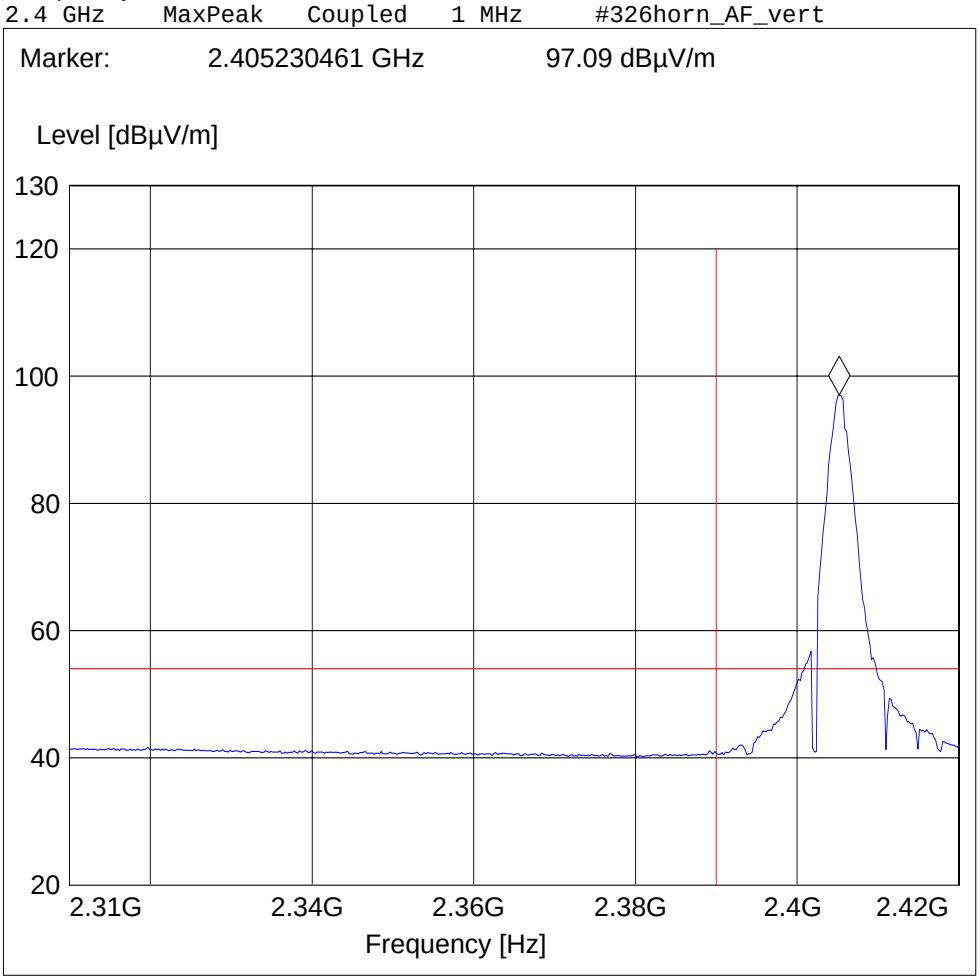
## BAND EDGE COMPLIANCE §15.247 (d) & RSS-210(A8.5)

### Low frequency section (spurious in the restricted band 2310 – 2390 MHz)

EUT: M2110
Customer: Crossbow
Test Mode: Low Channel (Tx mode)
ANT Orientation: V (Worst Case polarization)
EUT Orientation: H (Antenna Vertical)with 0dBi antenna
Test Engineer: Juan M.
Power Supply: Battery
Comments: **Average measurement was performed with RBW=1MHz, VBW=3kHz. A VBW=3kHz was used due to the fact that the emission is pulse and a VBW=10Hz will artificially drop the amplitude of the signal due to its low duty cycle. 3kHz was determine to be the appropriate setting so to prevent Desensitization on the signal.**

***SWEEP TABLE: "FCC15.247 LBE_AVG"***

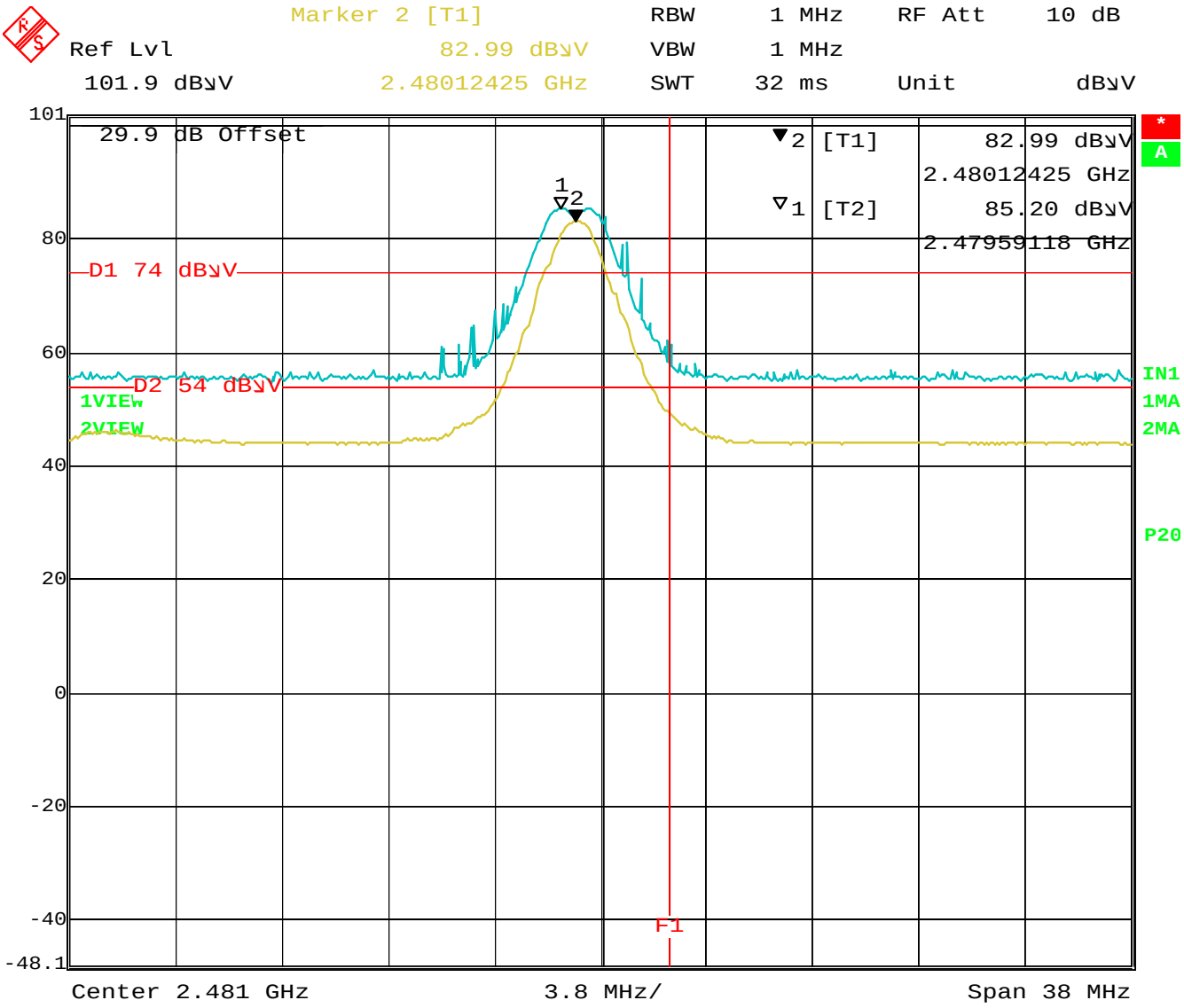
| Start Frequency | Stop Frequency | Detector | Meas. Time | IF Bandw. | Transducer |
|---|---|---|---|---|---|
| 2.3 GHz | 2.4 GHz | MaxPeak | Coupled | 1 MHz | #326horn_AF_vert |



## BAND EDGE COMPLIANCE §15.247 (d) & RSS-210(A8.5)

### High frequency section (spurious in the restricted band 2483.5 – 2500 MHz)

EUT: M2110
Customer: Crossbow
Test Mode: High Channel (Tx mode)
ANT Orientation: V (Worst Case polarization)
EUT Orientation: H (Antenna Vertical)with 0dBi antenna
Test Engineer: Juan M.
Power Supply: Battery
Comments: Plot below is with transducer factors included. Blue Trace is Peak RBW=VBW=1MHz and Yellow Trace is Average with RBW=1MHz, VBW=3kHz.

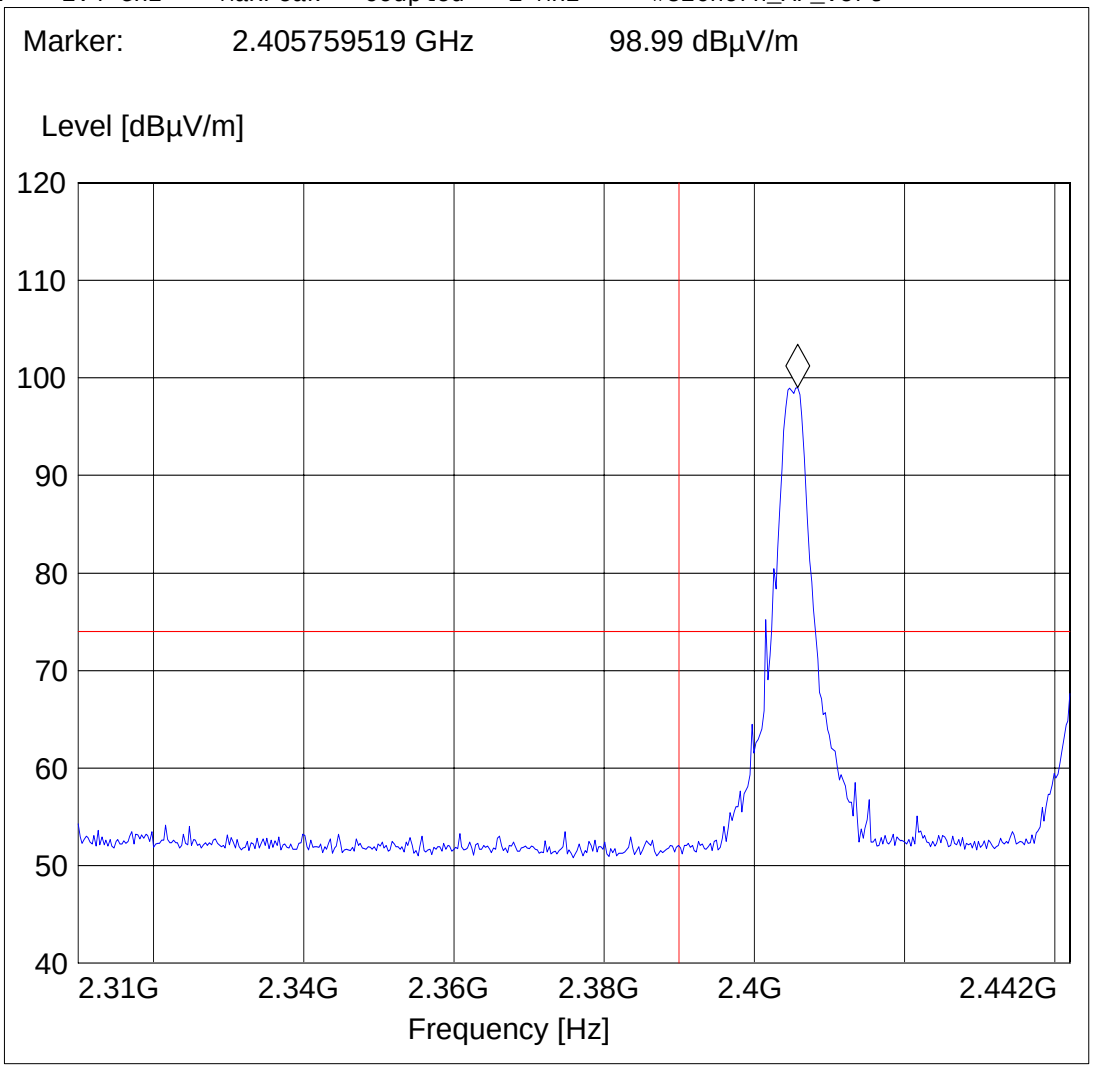


## Low frequency section (spurious in the restricted band 2310 – 2390 MHz)

```
EUT:              M2110
Customer:         Crossbow
Test Mode:        Low channel (Tx mode)
ANT Orientation:  V (Worst Case polarization)
EUT Orientation:  H (Antenna Vertical) w/ 2dBi antenna
Test Engineer:    Juan M.
Power Supply:     Battery
Comments:
```

***SWEEP TABLE: "FCC15.247 LBE_PK"***

| Start Frequency | Stop Frequency | Detector | Meas. Time | IF Bandw. | Transducer |
|---|---|---|---|---|---|
| 2.3 GHz | 2.4 GHz | MaxPeak | Coupled | 1 MHz | #326horn_AF_vert |



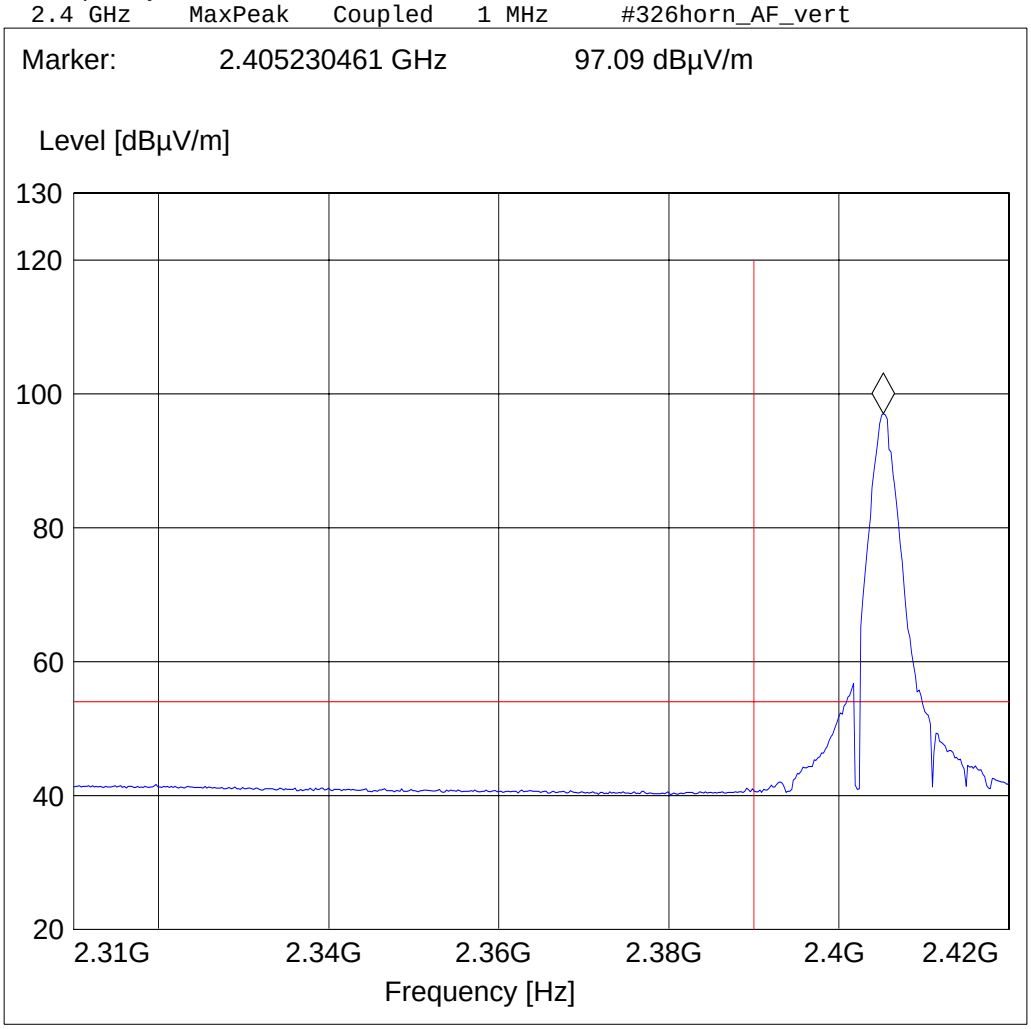
## BAND EDGE COMPLIANCE §15.247 (d) & RSS-210(A8.5)

### Low frequency section (spurious in the restricted band 2310 – 2390 MHz)

EUT: M2110
Customer: Crossbow
Test Mode: Low Channel (Tx mode)
ANT Orientation: V (Worst Case polarization)
EUT Orientation: H (Antenna Vertical) w/ 2dBi antenna
Test Engineer: Juan M.
Power Supply: Battery
Comments: **Average measurement was performed with RBW=1MHz, VBW=3 kHz. A VBW=3 kHz was used due to the fact that the emission is pulse and a VBW=10Hz will artificially drop the amplitude of the signal due to its low duty cycle. It was determine that the appropriate setting to prevent Desensitization on the signal is 3 kHz.**

***SWEEP TABLE: "FCC15.247 LBE_AVG"***

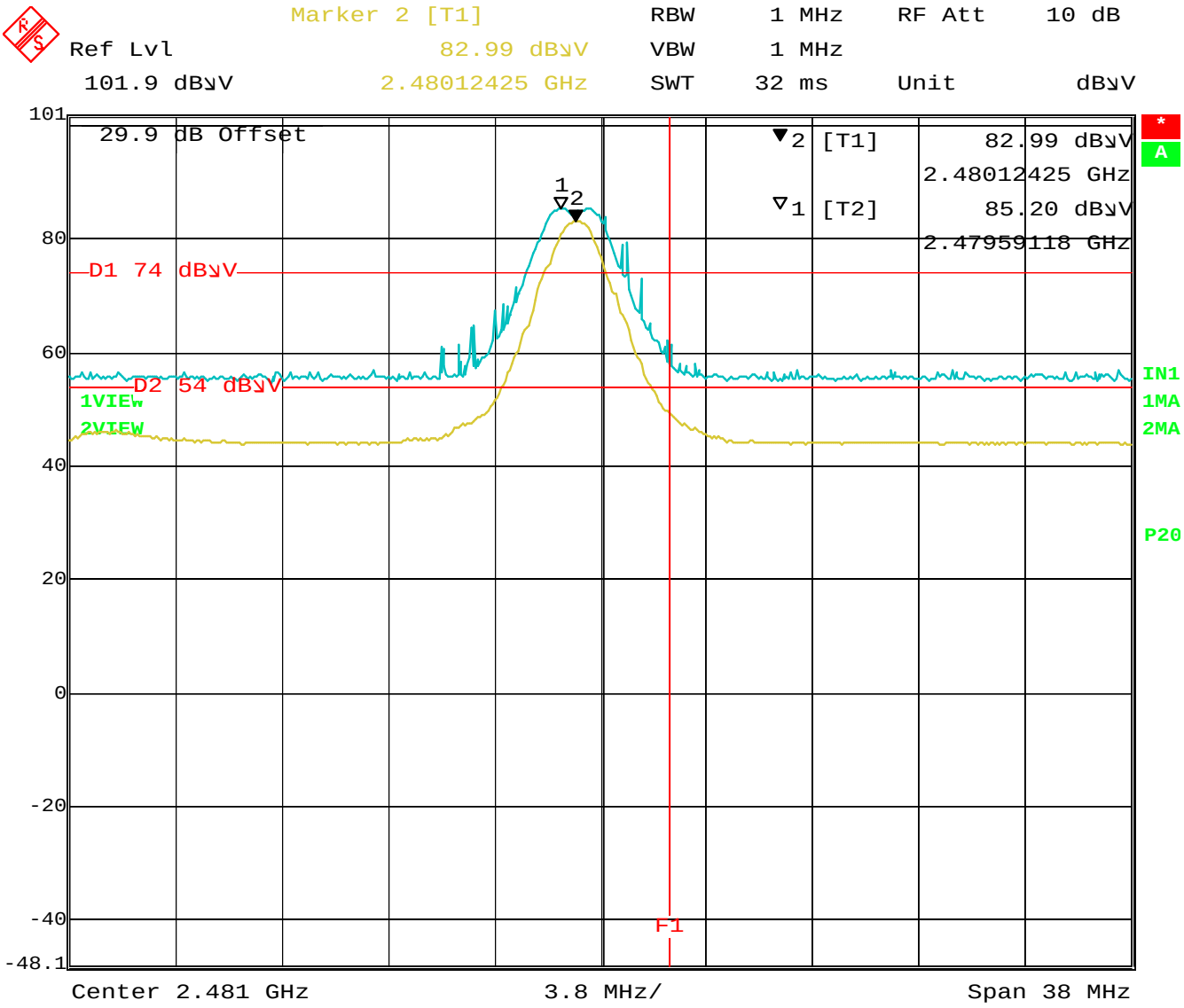
| Start Frequency | Stop Frequency | Detector | Meas. Time | IF Bandw. | Transducer |
|---|---|---|---|---|---|
| 2.3 GHz | 2.4 GHz | MaxPeak | Coupled | 1 MHz | #326horn_AF_vert |



## BAND EDGE COMPLIANCE §15.247 (d) & RSS-210(A8.5)

### High frequency section (spurious in the restricted band 2483.5 – 2500 MHz)

EUT: M2110
Customer: Crossbow
Test Mode: High Channel (Tx mode)
ANT Orientation: V (Worst Case polarization)
EUT Orientation: H (Antenna Vertical)w/ 2dBi antenna
Test Engineer: Juan M.
Power Supply: Battery
Comments: Plot below is with transducer factors included. Blue Trace is Peak RBW=VBW=1MHz and Yellow Trace is Average with RBW=1MHz, VBW=3kHz.



## 6.2 EMISSION LIMITATIONS – Radiated (Transmitter) §15.247 (d) & RSS-210(A8.5)

**LIMITS**

**In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions, which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).**

**NOTEs:**

1. The radiated emissions were done with different settings, using the relevant pre-amplifiers for the relevant frequency ranges. This is the reason that the graphs show different noise levels. In the range between 3 and 26.5 GHz very short cable connections to the antenna was used to minimize the noise level.

2. All measurements are done in peak mode unless specified with the plots.

3. Three devices were all place in the chamber. One device was transmitting on the low, the second on the middle, and the third on the high channel.

**Results for the radiated measurements below 30MHz according § 15.33**

| Frequency | Measured values | Remarks |
|---|---|---|
| 9KHz – 30MHz | No emissions found 20-dB of the FCC limit | This is valid for all the tested channels |

## EMISSION LIMITATIONS - Radiated (Transmitter)

§15.247 (d) & RSS-210(A8.5):

| **Transmit at Lowest channel Frequency 2405MHz** | | | |
|---|---|---|---|
| **Frequency (MHz)** | **Level (dBµV/m)** | | |
| | **Peak** | **Quasi-Peak** | **Average** |
| SEE PLOTS | | | |
| **Transmit at Middle channel Frequency 2441MHz** | | | |
| **Frequency (MHz)** | **Level (dBµV/m)** | | |
| | **Peak** | **Quasi-Peak** | **Average** |
| SEE PLOTS | | | |
| **Transmit at Highest channel Frequency 2480MHz** | | | |
| **Frequency (MHz)** | **Level (dBµV/m)** | | |
| | **Peak** | **Quasi-Peak** | **Average** |
| SEE PLOTS | | | |
| | | | |

## EMISSION LIMITATIONS - Radiated (Transmitter) §15.247 (d) & RSS-210(A8.5)

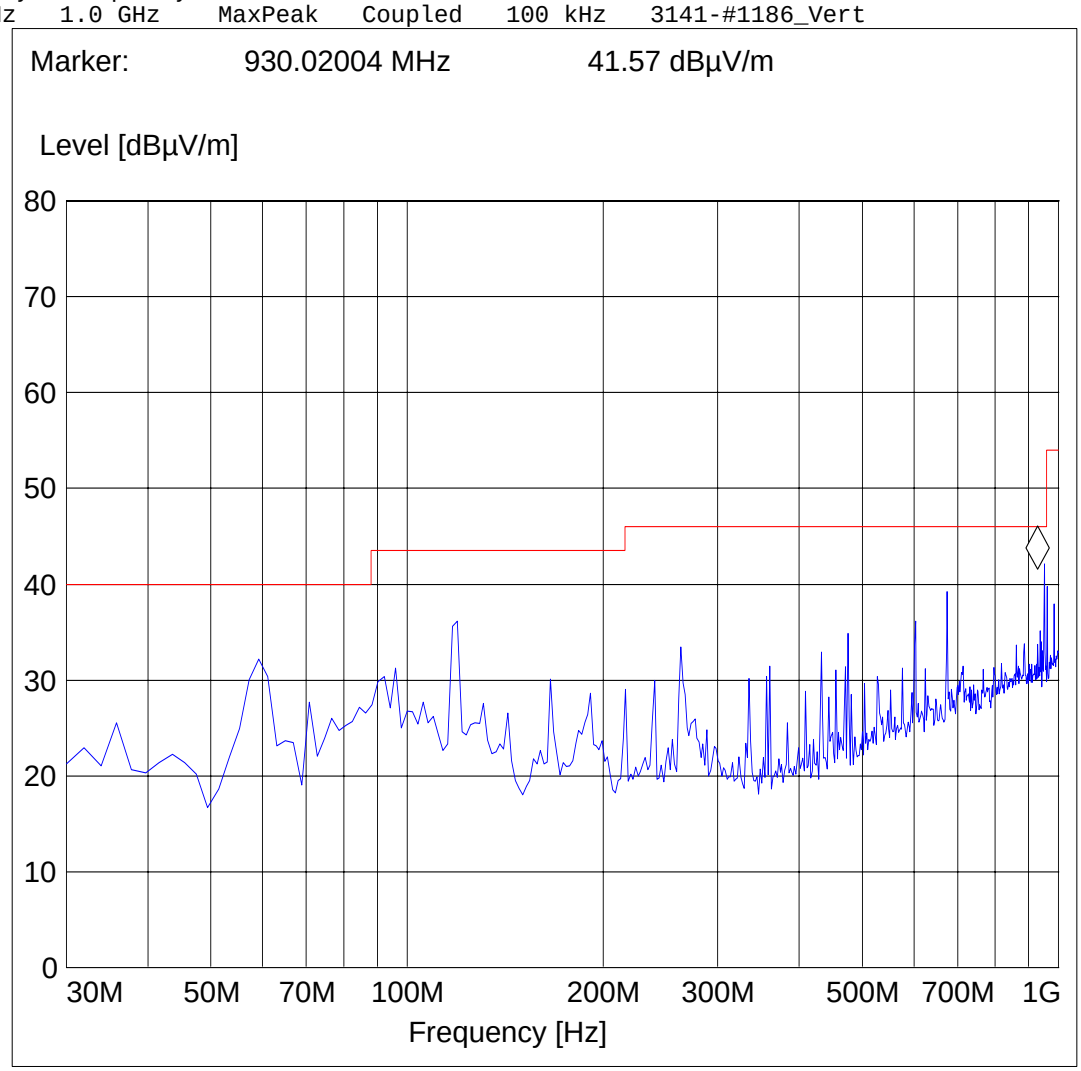
**Lowest Channel (2405MHz): 30MHz – 1GHz**

**Note: This plot is valid for low, mid, high channels**

```
EUT:              M2110
Customer:         Crossbow
Test Mode:        Low, Middle, and High channels (Tx mode)
ANT Orientation:  V
EUT Orientation:  H (Antenna Vertical)w/ 0dBi antenna
Test Engineer:    Juan M.
Power Supply:     Battery
Comments:
```

***SWEEP TABLE: "FCC15.247_30M-1G_Ver"***

| Start Frequency | Stop Frequency | Detector | Meas. Time | IF Bandw. | Transducer |
|---|---|---|---|---|---|
| 30.0 MHz | 1.0 GHz | MaxPeak | Coupled | 100 kHz | 3141-#1186_Vert |



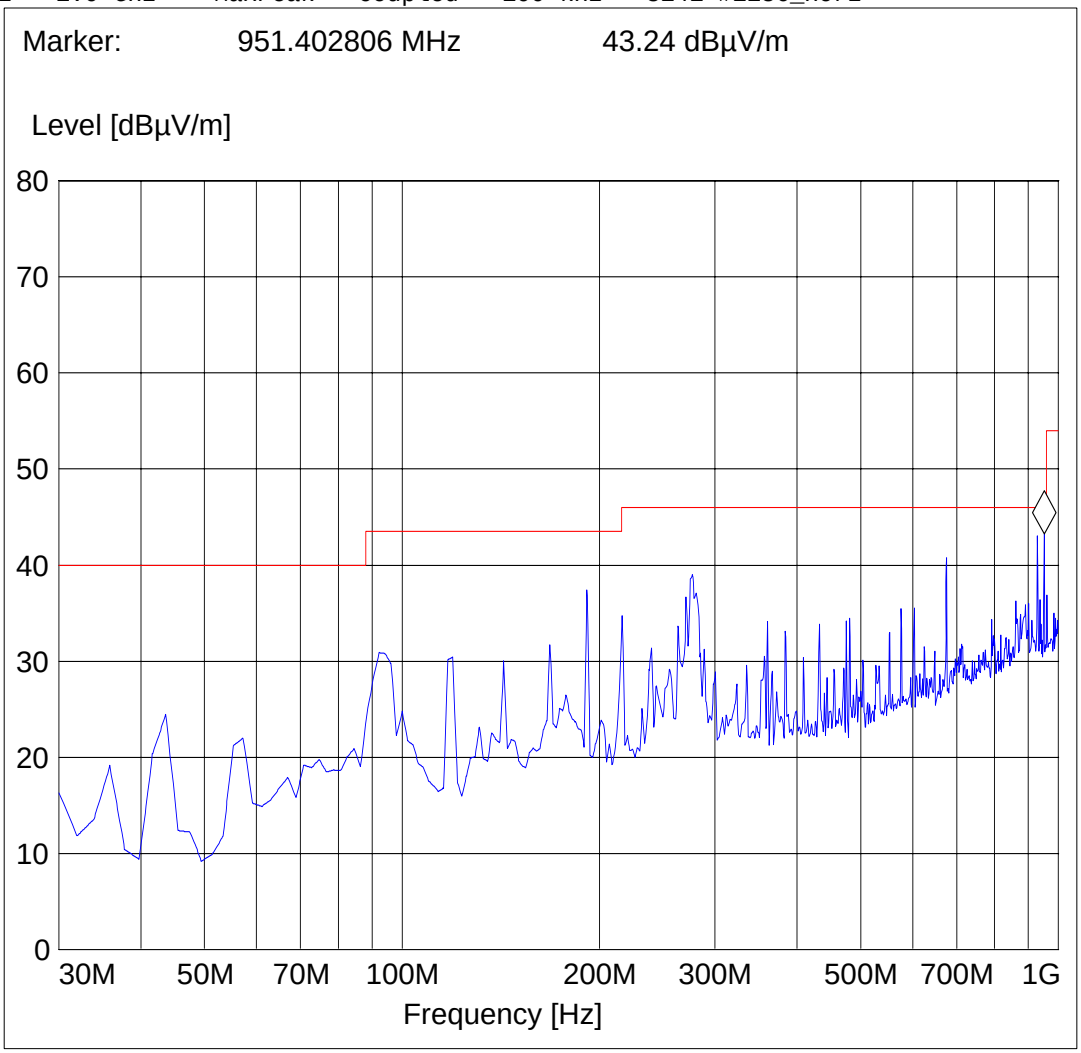
## EMISSION LIMITATIONS - Radiated (Transmitter) §15.247 (d) & RSS-210(A8.5)
## Lowest Channel (2405MHz): 30MHz – 1GHz
**Antenna: Horizontal**

### Note: This plot is valid for low, mid, high channels

```
EUT:              M2110
Customer:         Crossbow
Test Mode:        Low, Middle, and High channels (Tx mode)
ANT Orientation:  H
EUT Orientation:  H (Antenna Vertical)w/ 0dBi antenna
Test Engineer:    Juan M.
Power Supply:     Battery
Comments:
```

***SWEEP TABLE: "FCC15.247_30M-1G_Hor"***

| Start Frequency | Stop Frequency | Detector | Meas. Time | IF Bandw. | Transducer |
|---|---|---|---|---|---|
| 30.0 MHz | 1.0 GHz | MaxPeak | Coupled | 100 kHz | 3141-#1186_Horz |



## EMISSION LIMITATIONS - Radiated (Transmitter) §15.247 (d) & RSS-210(A8.5)

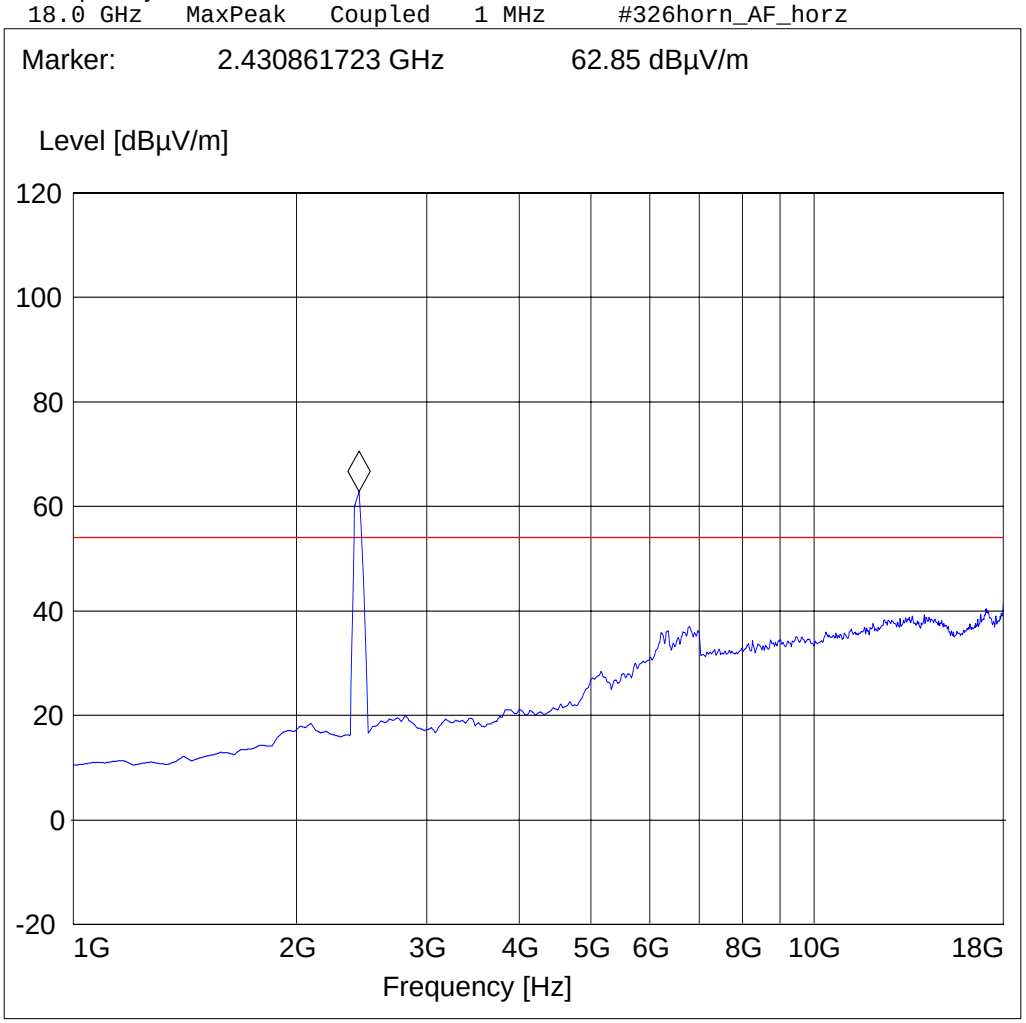
## Radios transmitting on 2405, 2445, and 2480 MHz at the same time: 1GHz – 18GHz

**Note: Peak above the limit line is the carrier freq.**

```
EUT / Description: M2110
Manufacturer:      Crossbow
Test mode:         Low, Middle, and High channels (Tx mode)
ANT Orientation: : V
EUT Orientation::  H w/ 0dBi antenna
Test Engineer:     Juan M.
Voltage:           Battery
Comments:
```

***SWEEP TABLE: "FCC15.247_1-18G"***

| Start Frequency | Stop Frequency | Detector | Meas. Time | IF Bandw. | Transducer |
|---|---|---|---|---|---|
| 1.0 GHz | 18.0 GHz | MaxPeak | Coupled | 1 MHz | #326horn_AF_horz |



## EMISSION LIMITATIONS - Radiated (Transmitter) §15.247 (d) & RSS-210(A8.5)

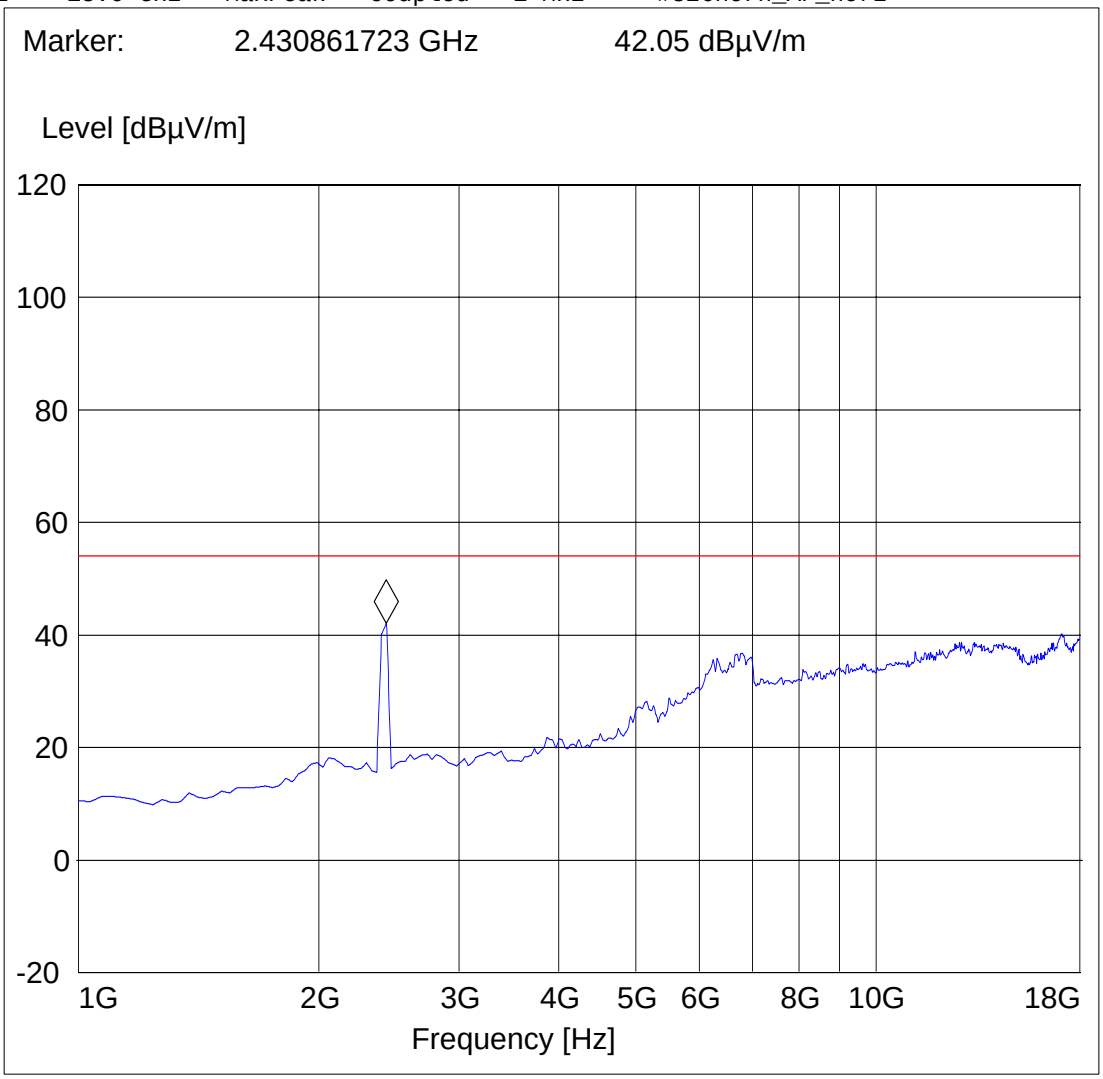
**Radios transmitting on 2405, 2445, and 2480 MHz at the same time: 1GHz – 18GHz**

**Note: Peak above the limit line is the carrier freq.**

```
EUT / Description: M2110
Manufacturer:      Crossbow
Test mode:         Low, Middle, and High channels (Tx mode)
ANT Orientation: : H
EUT Orientation::  H w/ 0dBi antenna
Test Engineer:     Juan M.
Voltage:           Battery
Comments:
```

***SWEEP TABLE: "FCC15.247_1-18G"***

| Start Frequency | Stop Frequency | Detector | Meas. Time | IF Bandw. | Transducer |
|---|---|---|---|---|---|
| 1.0 GHz | 18.0 GHz | MaxPeak | Coupled | 1 MHz | #326horn_AF_horz |



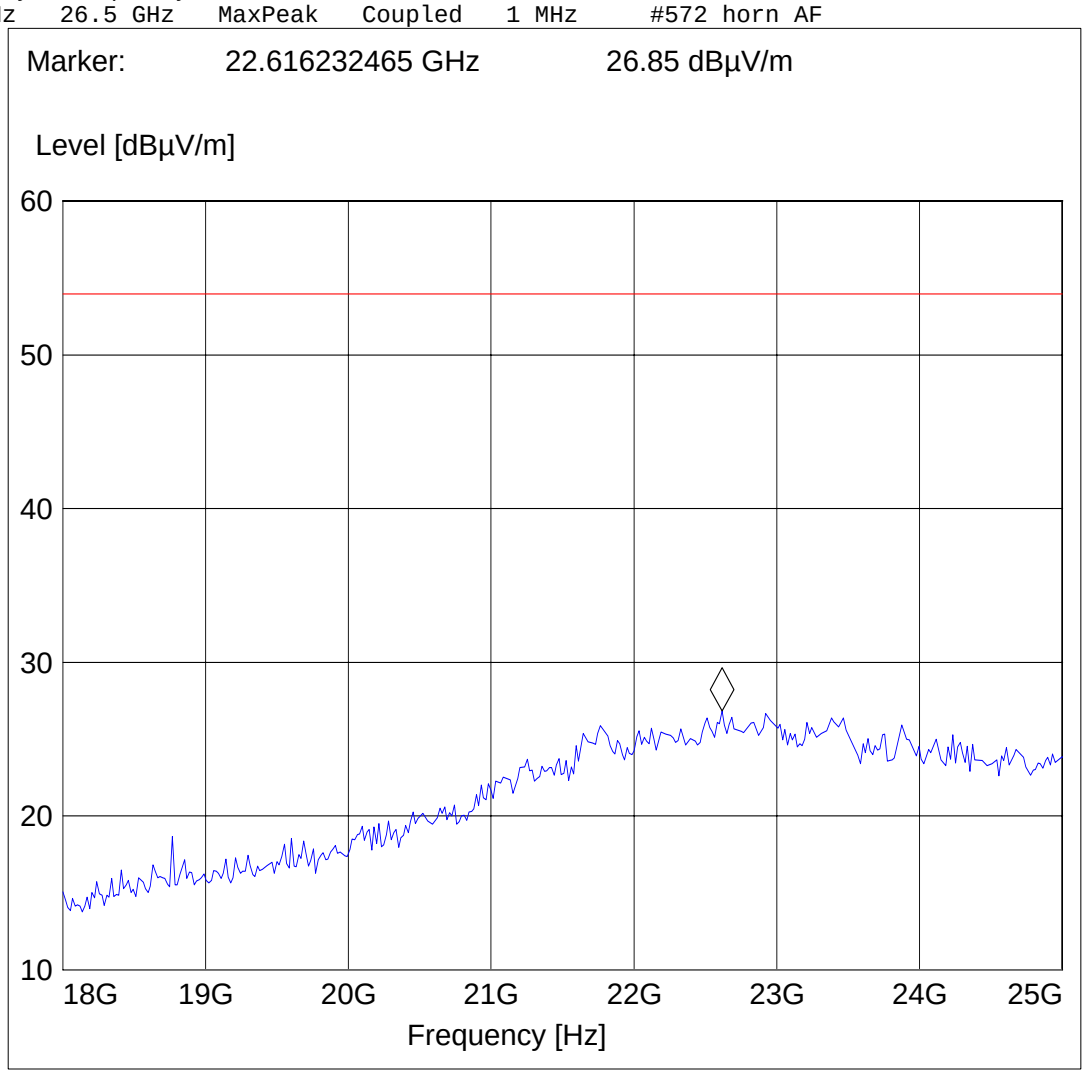
## EMISSION LIMITATIONS - Radiated (Transmitter) §15.247 (d) & RSS-210(A8.5) 18GHz – 26.5GHz for low, middle, and high channels

**Note: This plot is valid for low, mid, high channels (worst-case plot)**

```
EUT / Description: M2110
Manufacturer:      Crossbow
Test mode:         Low, Middle, and High channels (Tx mode)
ANT Orientation: : V
EUT Orientation::  H w/ 0dBi antenna
Test Engineer:     Juan M.
Voltage:           Battery
Comments:
```

***SWEEP TABLE: "FCC15.247_18-26.5G"***

| Start Frequency | Stop Frequency | Detector | Meas. Time | IF Bandw. | Transducer |
|---|---|---|---|---|---|
| 18.0 GHz | 26.5 GHz | MaxPeak | Coupled | 1 MHz | #572 horn AF |



## EMISSION LIMITATIONS - Radiated (Transmitter) §15.247 (d) & RSS-210(A8.5)

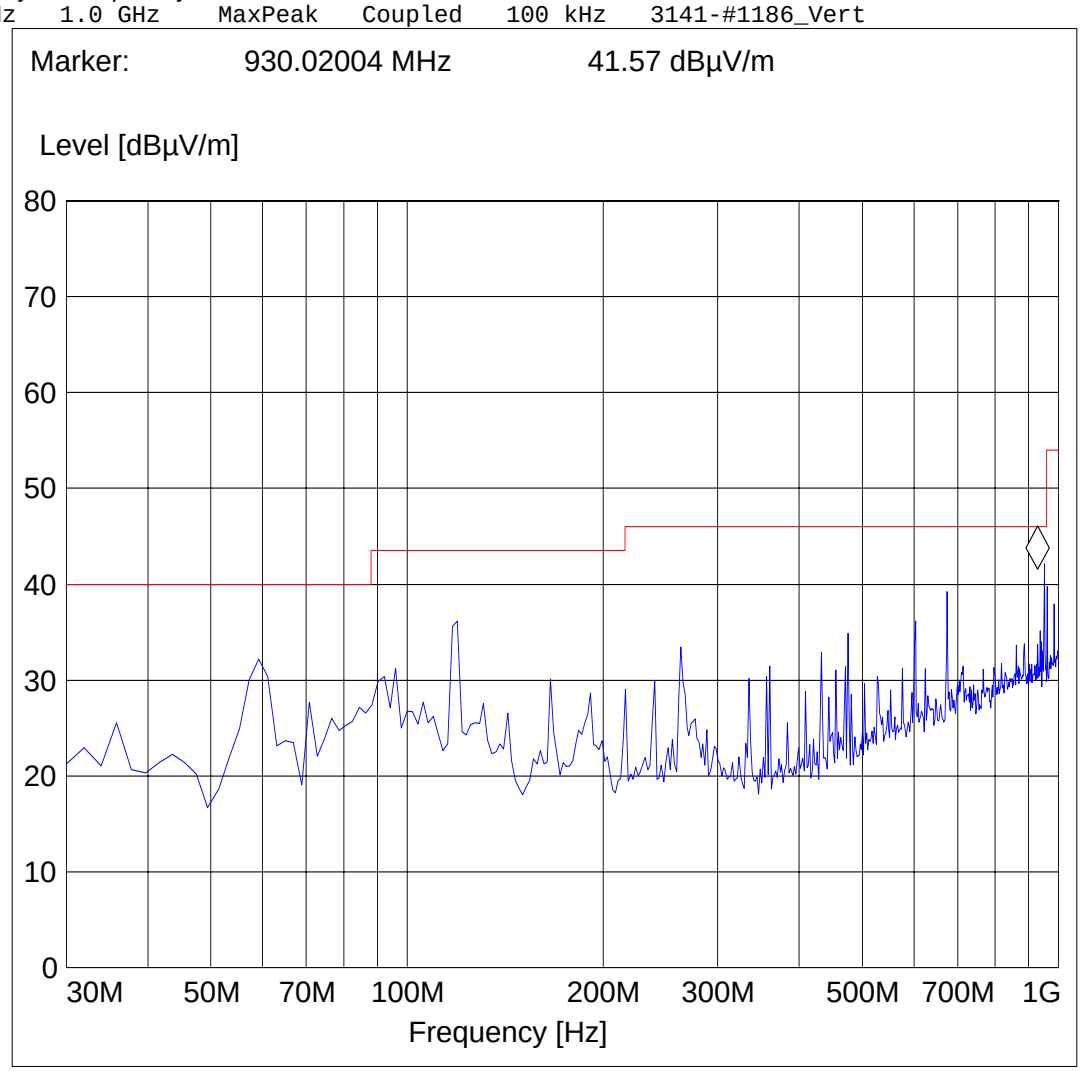
**Lowest Channel (2405MHz): 30MHz – 1GHz**

**Note: This plot is valid for low, mid, high channels**

```
EUT:              M2110
Customer:         Crossbow
Test Mode:        Low, Middle, and High channels (Tx mode)
ANT Orientation:  V
EUT Orientation:  H (Antenna Vertical) w/ 2dBi antenna
Test Engineer:    Juan M.
Power Supply:     Battery
Comments:
```

***SWEEP TABLE: "FCC15.247_30M-1G_Ver"***

| Start Frequency | Stop Frequency | Detector | Meas. Time | IF Bandw. | Transducer |
|---|---|---|---|---|---|
| 30.0 MHz | 1.0 GHz | MaxPeak | Coupled | 100 kHz | 3141-#1186_Vert |



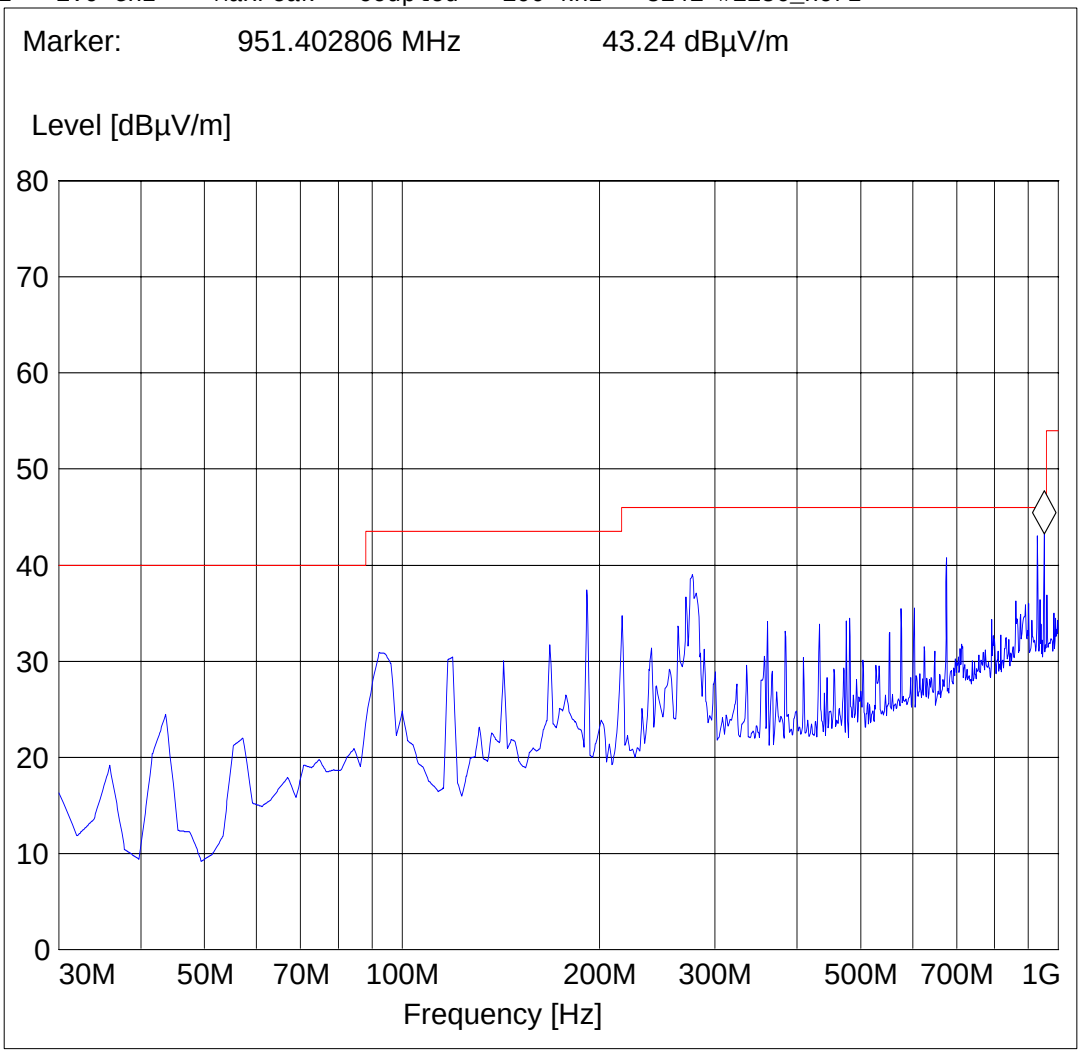
## EMISSION LIMITATIONS - Radiated (Transmitter) §15.247 (d) & RSS-210(A8.5)
## Lowest Channel (2405MHz): 30MHz – 1GHz
**Antenna: Horizontal**

### Note: This plot is valid for low, mid, high channels

```
EUT:              M2110
Customer:         Crossbow
Test Mode:        Low, Middle, and High channels (Tx mode)
ANT Orientation:  H
EUT Orientation:  H (Antenna Vertical) w/ 2dBi antenna
Test Engineer:    Juan M.
Power Supply:     Battery
Comments:
```

***SWEEP TABLE: "FCC15.247_30M-1G_Hor"***

| Start Frequency | Stop Frequency | Detector | Meas. Time | IF Bandw. | Transducer |
|---|---|---|---|---|---|
| 30.0 MHz | 1.0 GHz | MaxPeak | Coupled | 100 kHz | 3141-#1186_Horz |



## EMISSION LIMITATIONS - Radiated (Transmitter) §15.247 (d) & RSS-210(A8.5)

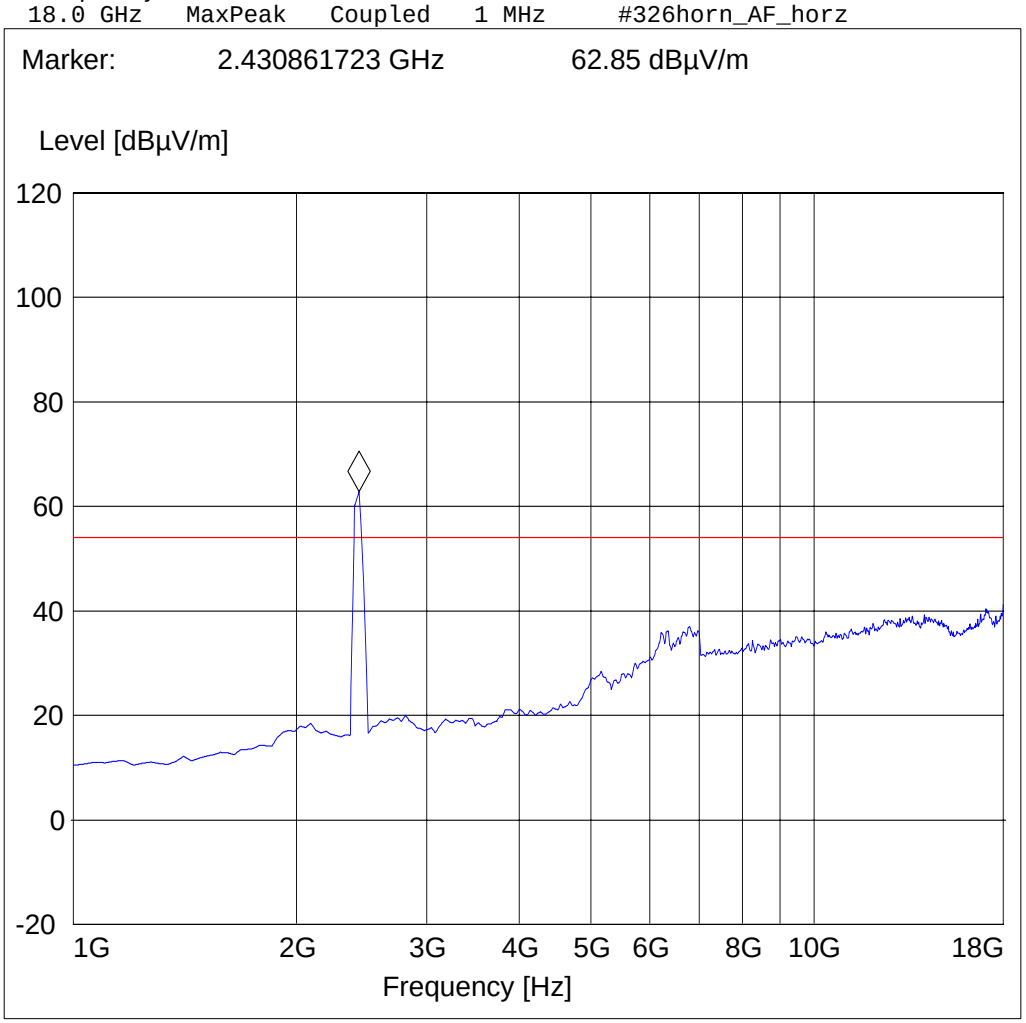
**Radios transmitting on 2405, 2445, and 2480 MHz at the same time: 1GHz – 18GHz**

**Note: Peak above the limit line is the carrier freq.**

```
EUT / Description: M2110
Manufacturer:      Crossbow
Test mode:         Low, Middle, and High channels (Tx mode)
ANT Orientation: : V
EUT Orientation::  H w/ 2dBi antenna
Test Engineer:     Juan M.
Voltage:           Battery
Comments:
```

***SWEEP TABLE: "FCC15.247_1-18G"***

| Start Frequency | Stop Frequency | Detector | Meas. Time | IF Bandw. | Transducer |
|---|---|---|---|---|---|
| 1.0 GHz | 18.0 GHz | MaxPeak | Coupled | 1 MHz | #326horn_AF_horz |



## EMISSION LIMITATIONS - Radiated (Transmitter) §15.247 (d) & RSS-210(A8.5)

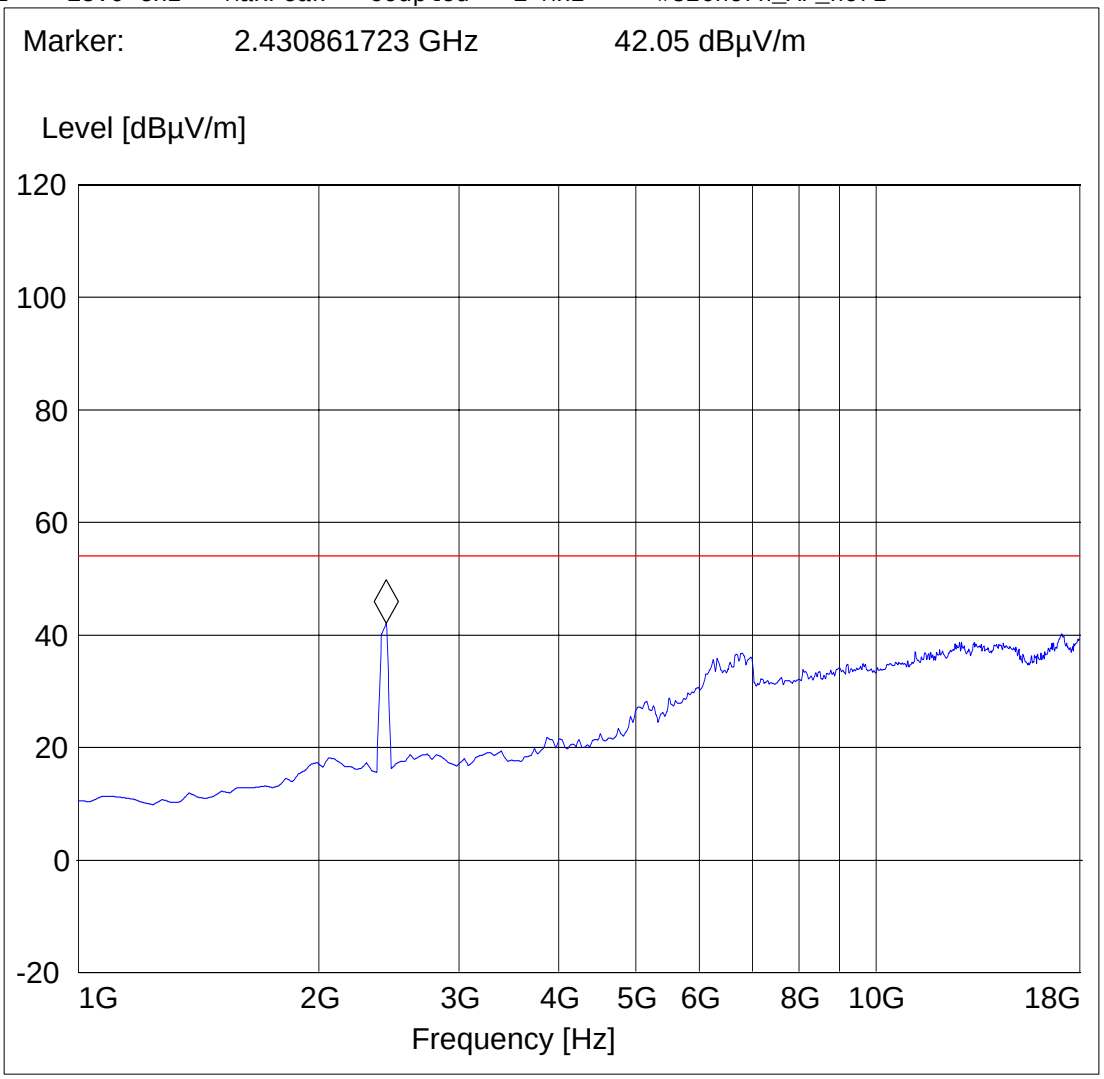
**Radios transmitting on 2405, 2445, and 2480 MHz at the same time: 1GHz – 18GHz**

**Note: Peak above the limit line is the carrier freq.**

```
EUT / Description: M2110
Manufacturer:      Crossbow
Test mode:         Low, Middle, and High channels (Tx mode)
ANT Orientation: : H
EUT Orientation::  H w/ 2dBi antenna
Test Engineer:     Juan M.
Voltage:           Battery
Comments:
```

***SWEEP TABLE: "FCC15.247_1-18G"***

| Start Frequency | Stop Frequency | Detector | Meas. Time | IF Bandw. | Transducer |
|---|---|---|---|---|---|
| 1.0 GHz | 18.0 GHz | MaxPeak | Coupled | 1 MHz | #326horn_AF_horz |



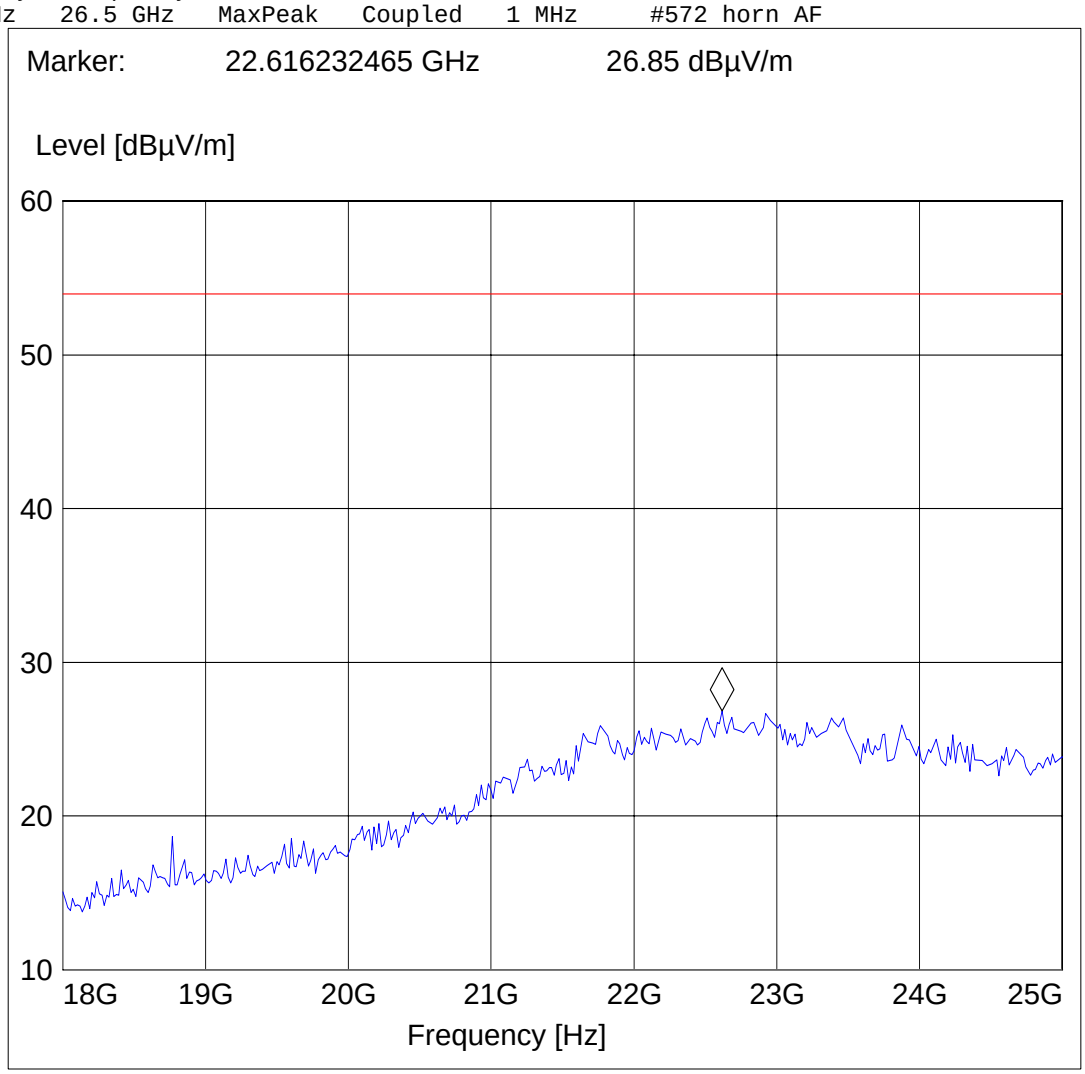
## EMISSION LIMITATIONS - Radiated (Transmitter) §15.247 (d) & RSS-210(A8.5) 18GHz – 26.5GHz for low, middle, and high channels

**Note: This plot is valid for low, mid, high channels (worst-case plot)**

```
EUT / Description: M2110
Manufacturer:      Crossbow
Test mode:         Low, Middle, and High channels (Tx mode)
ANT Orientation: : V
EUT Orientation::  H w/ 2dBi antenna
Test Engineer:     Juan M.
Voltage:           Battery
Comments:
```

***SWEEP TABLE: "FCC15.247_18-26.5G"***

| Start Frequency | Stop Frequency | Detector | Meas. Time | IF Bandw. | Transducer |
|---|---|---|---|---|---|
| 18.0 GHz | 26.5 GHz | MaxPeak | Coupled | 1 MHz | #572 horn AF |



## 6.3 EMISSION LIMITATIONS – Radiated (Receiver) RSS-GEN (4.10) & (6):

**Limits RSS-GEN (4.10) & (6):**

| Frequency (MHz) | Field strength (µV/m) | Field strength (dBµV/m) |
|---|---|---|
| 0.009 - 0.490 | 2400/F(kHz) | |
| 0.490 - 1.705 | 24000/F(kHz) | |
| **1.705 - 30.0** | **30** | **29.54** |
| **30 - 88** | **100** | **40.00** |
| **88 - 216** | **150** | **43.52** |
| **216 - 960** | **200** | **46.02** |
| **above 960** | **500** | **53.97** |

**Table 1. Limits are based on a 3 meter distance**

**RSS-GEN (4.10) peak measurements above 1GHz are taken with a RBW=VBW= 1MHz and average measurements above 1GHz with a RBW=1MHz, VBW=10Hz or an average detector. Set the radio to receive at the middle of the operating band.**

**EUT in Rx/Standby mode, test setup as per ANSI C63.4 (page 32)**

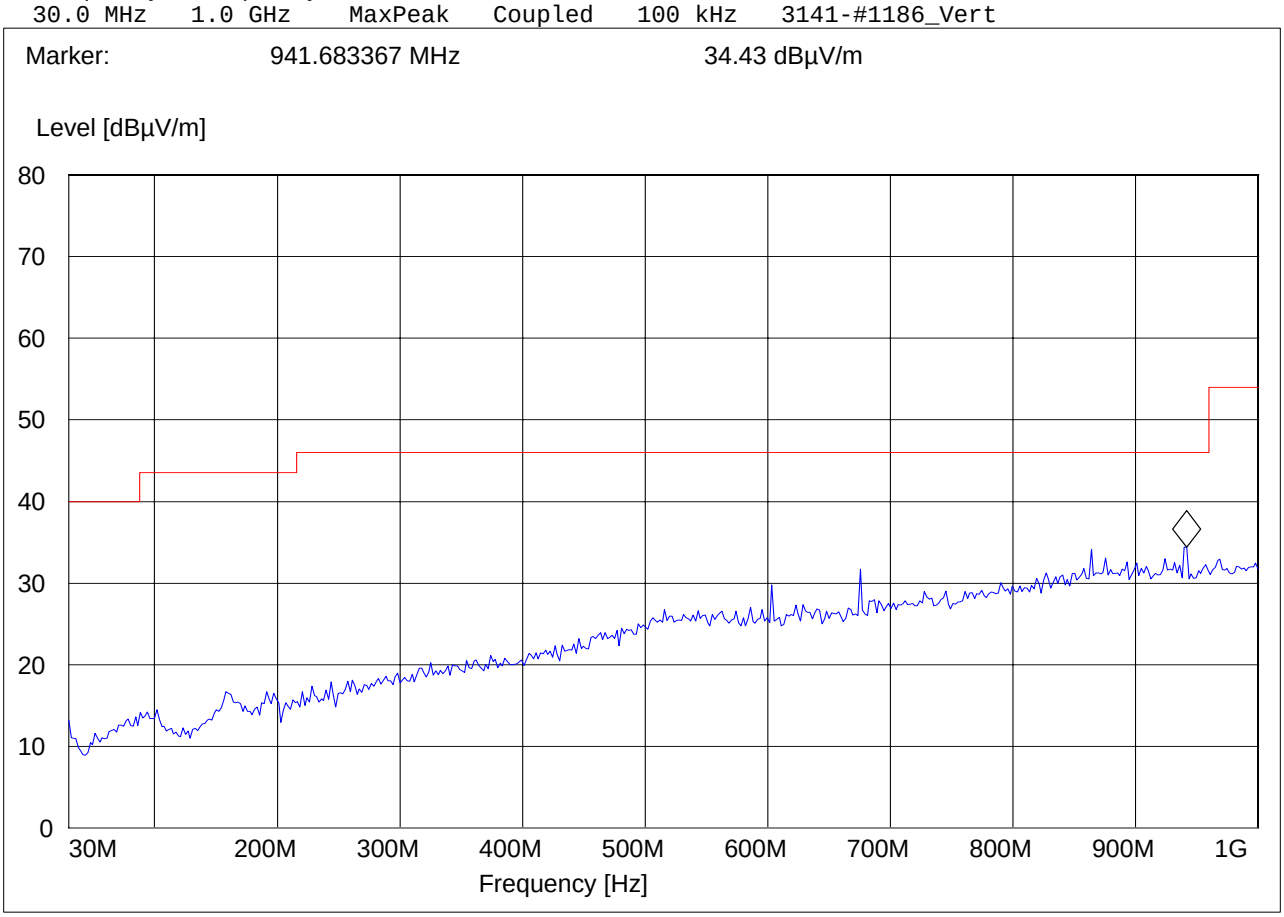
| Frequency Range | Sweep used | Filter / Amp used |
|---|---|---|
| **30MHz – 1GHz** | CANADA_30-1G | PASS |
| **1GHz – 18GHz** | CANADA_1-18G | PASS |

## 2445 MHz Receive

```
EUT:              M2110
Customer::        Crossbow
Test Mode:        Rx
ANT Orientation:  V
EUT Orientation:  H w/ 0dBi antenna
Test Engineer:    Chris
Voltage:          Battery
Start of Test:
```

***SWEEP TABLE: "FCC15.247_30M-1G_Ver"***

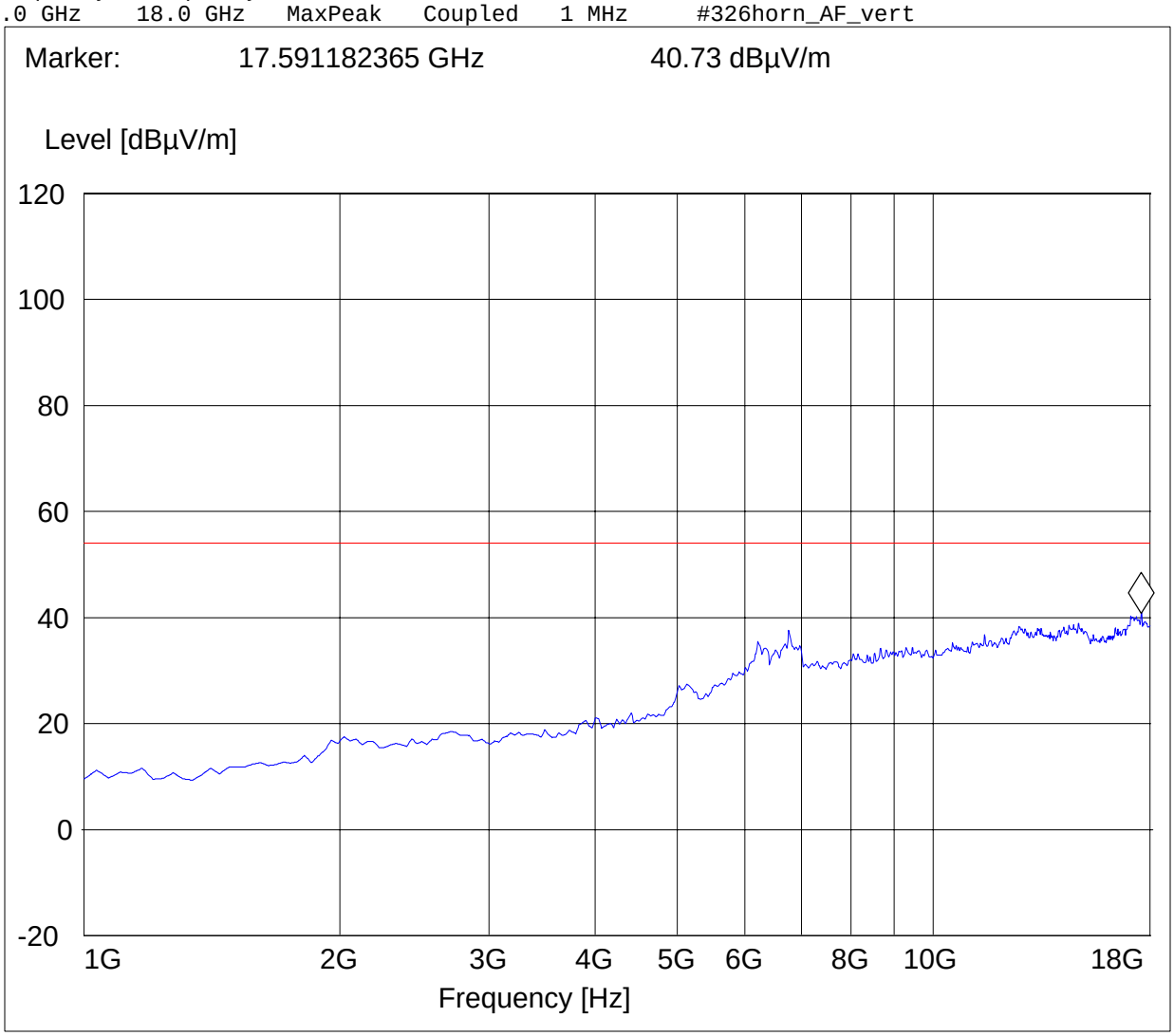
| Start Frequency | Stop Frequency | Detector | Meas. Time | IF Bandw. | Transducer |
|---|---|---|---|---|---|
| 30.0 MHz | 1.0 GHz | MaxPeak | Coupled | 100 kHz | 3141-#1186_Vert |



EUT / Description: M2110
Manufacturer: Crossbow
Test mode: Middle channel (Rx mode)
ANT Orientation: V
EUT Orientation: H w/ 0dBi antenna
Test Engineer: Juan M.
Voltage: Battery
Comments:

***SWEEP TABLE: "CANADA RE_1-18G"***

| Start Frequency | Stop Frequency | Detector | Meas. Time | IF Bandw. | Transducer |
|---|---|---|---|---|---|
| 1.0 GHz | 18.0 GHz | MaxPeak | Coupled | 1 MHz | #326horn_AF_vert |

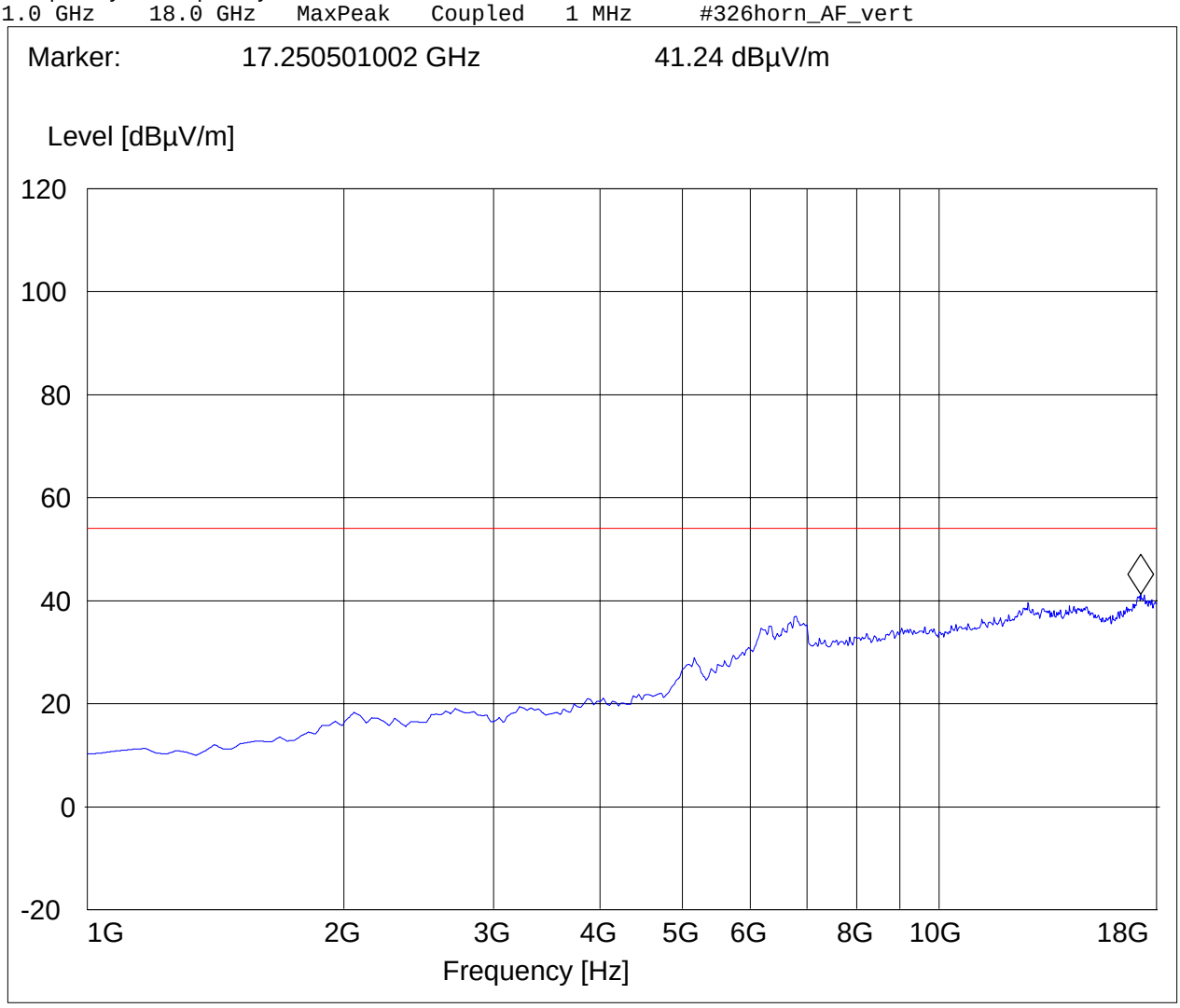


## 2445 MHz Receive

EUT / Description: M2110
Manufacturer: Crossbow
Test mode: Middle channel (Rx mode)
ANT Orientation: H
EUT Orientation: H w/ 0dBi antenna
Test Engineer: Juan M.
Voltage: Battery
Comments:

***SWEEP TABLE: "CANADA RE_1-18G"***

| Start Frequency | Stop Frequency | Detector | Meas. Time | IF Bandw. | Transducer |
|---|---|---|---|---|---|
| 1.0 GHz | 18.0 GHz | MaxPeak | Coupled | 1 MHz | #326horn_AF_vert |

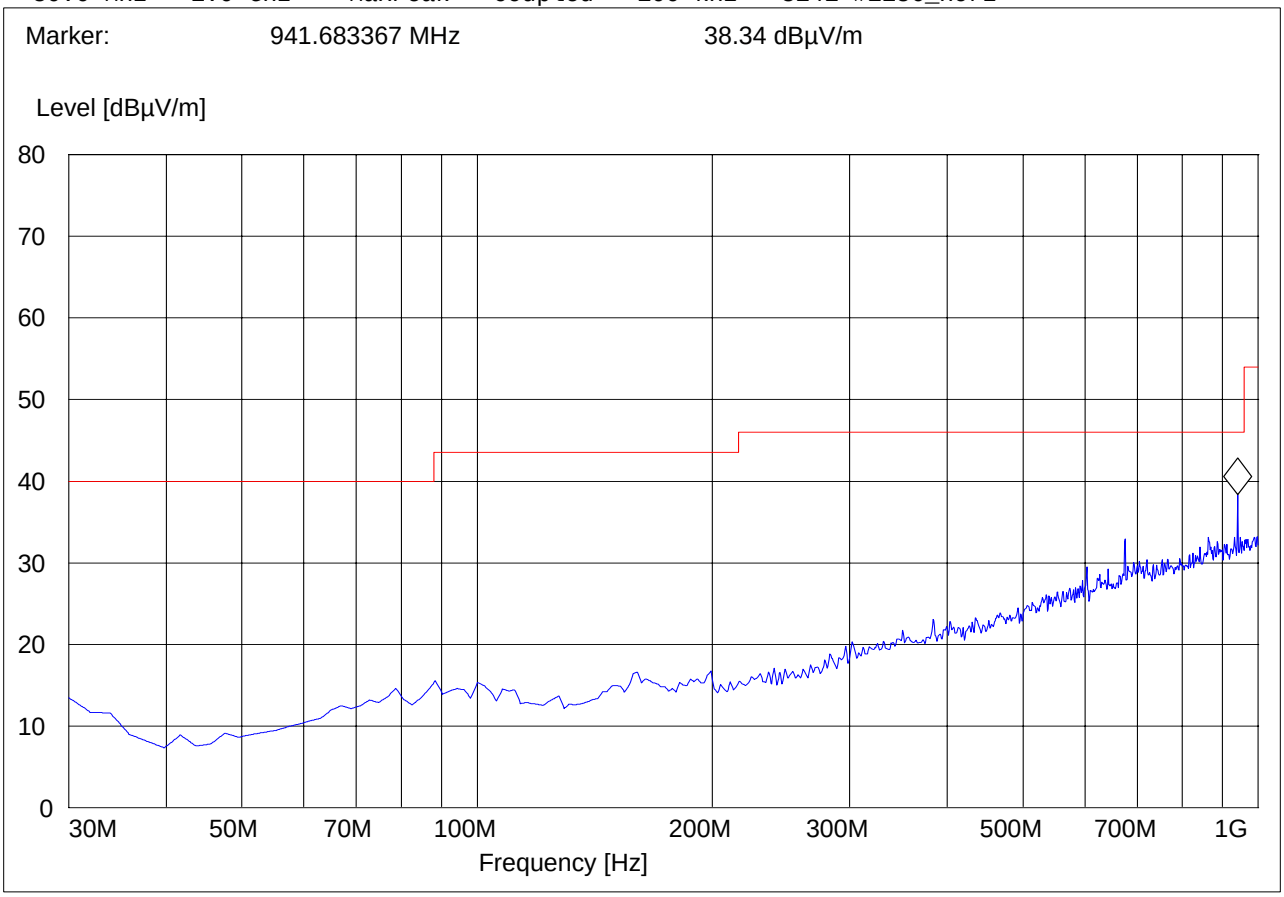


## 2445 MHz Receive

```
EUT:              M2110
Customer::        Crossbow
Test Mode:        Rx
ANT Orientation:  H
EUT Orientation:  H with 2dBi antenna
Test Engineer:    Chris
Voltage:          Battery
```

***SWEEP TABLE: "FCC15.247_30M-1G_Hor"***

| Start Frequency | Stop Frequency | Detector | Meas. Time | IF Bandw. | Transducer |
|---|---|---|---|---|---|
| 30.0 MHz | 1.0 GHz | MaxPeak | Coupled | 100 kHz | 3141-#1186_Horz |

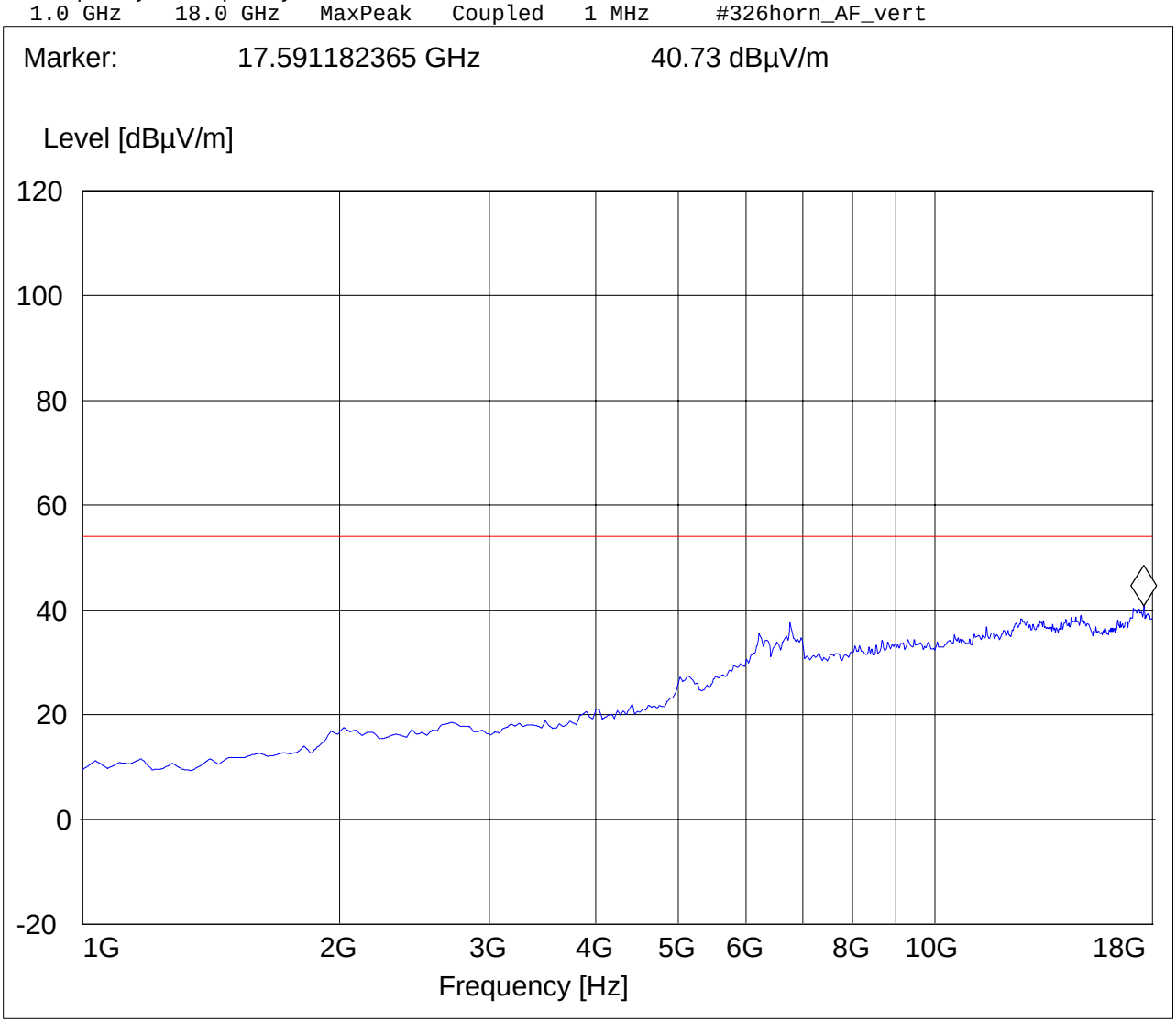


## 2445 MHz Receive

EUT / Description: M2110
Manufacturer: Crossbow
Test mode: Middle channel (Rx mode)
ANT Orientation: V
EUT Orientation: H with 2dBi antenna
Test Engineer: Juan M.
Voltage: Battery
Comments:

***SWEEP TABLE: "CANADA RE_1-18G"***

| Start Frequency | Stop Frequency | Detector | Meas. Time | IF Bandw. | Transducer |
|---|---|---|---|---|---|
| 1.0 GHz | 18.0 GHz | MaxPeak | Coupled | 1 MHz | #326horn_AF_vert |

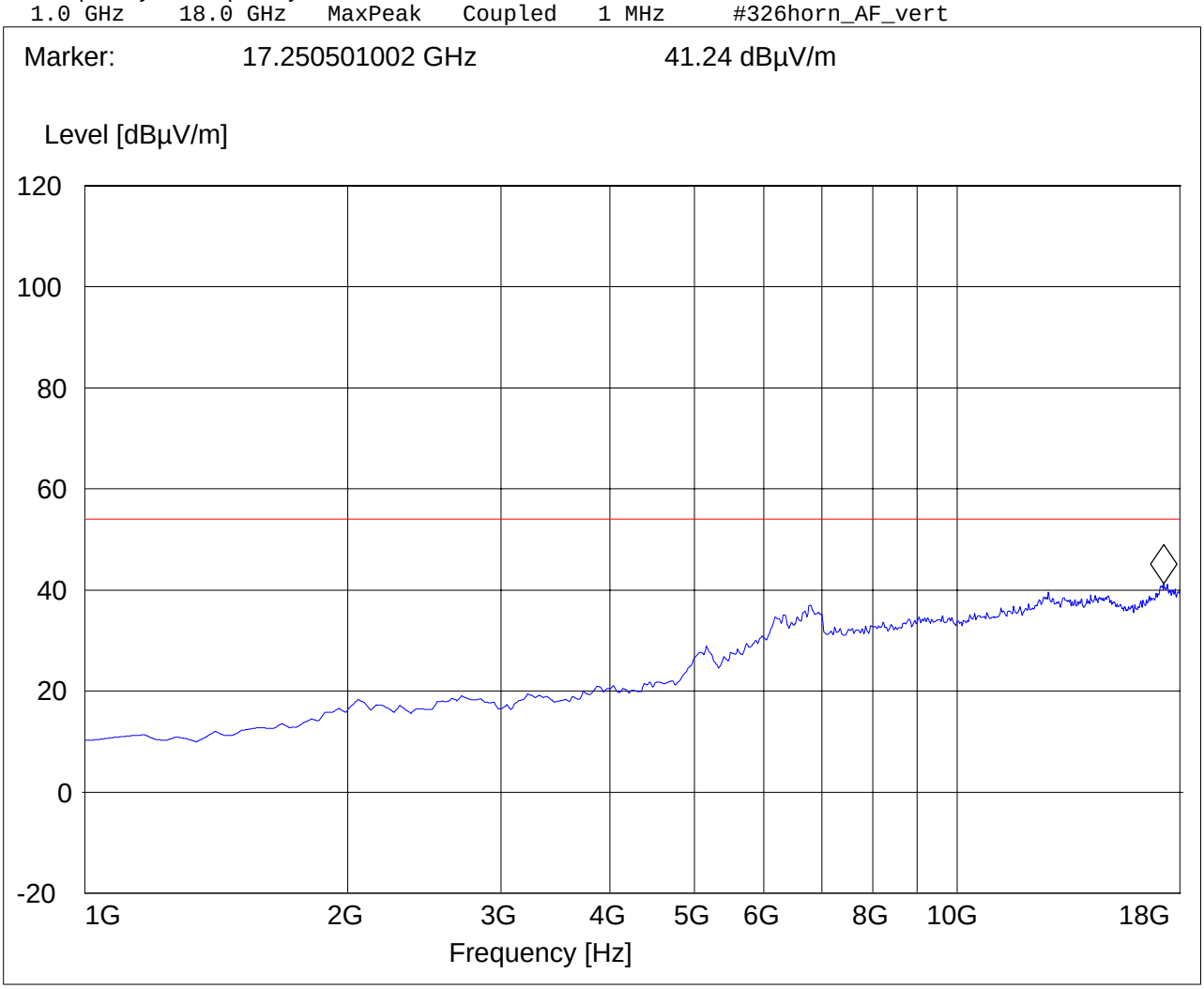


## 2445 MHz Receive

EUT / Description: M2110
Manufacturer: Crossbow
Test mode: Middle channel (Rx mode)
ANT Orientation: H
EUT Orientation: H with 2dBi antenna
Test Engineer: Juan M.
Voltage: Battery
Comments:

***SWEEP TABLE: "CANADA RE_1-18G"***

| Start Frequency | Stop Frequency | Detector | Meas. Time | IF Bandw. | Transducer |
|---|---|---|---|---|---|
| 1.0 GHz | 18.0 GHz | MaxPeak | Coupled | 1 MHz | #326horn_AF_vert |



## 7 AC POWER LINE CONDUCTED EMISSIONS § 15.207 & RSS-GEN (7.2.2)

**LIMITS**
**Technical specification: 15.207 (Revised as of August 20, 2002)**

§15.107 (a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

| Frequency of Emission (MHz) | Conducted Limit (dBµV) | |
|---|---|---|
| | Quasi-Peak | Average |
| 0.15 – 0.5 | 66 to 56* | 56 to 46* |
| 0.5 – 5 | 56 | 46 |
| 5 – 30 | 60 | 50 |
| * Decreases with logarithm of the frequency | | |

**ANALYZER SETTINGS: RBW = 10KHz VBW = 10KHz**

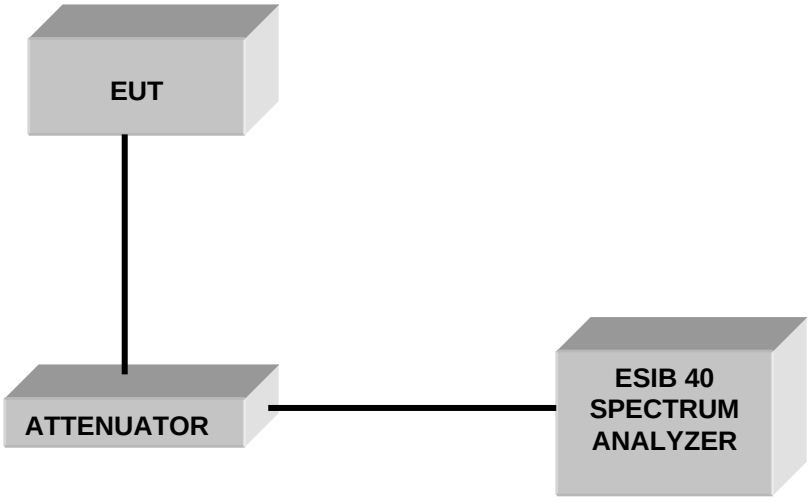
**OPERATING MODE**
AC conducted Emissions was not perform. The EUT is battery operated.

## 8 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

| No | Instrument/Ancillary | Type | Manufacturer | Serial No. | Cal Due | Interval |
|---|---|---|---|---|---|---|
| **01** | Spectrum Analyzer | ESIB 40 | Rohde & Schwarz | 100107 | May 2008 | 1 year |
| **05** | Biconilog Antenna | 3141 | EMCO | 0005-1186 | June 2008 | 1 year |
| **06** | Horn Antenna (1-18GHz) | SAS-200/571 | AH Systems | 325 | June 2008 | 1 year |
| **07** | Horn Antenna (18-26.5GHz) | 3160-09 | EMCO | 1240 | June 2008 | 1 year |
| **10** | High Pass Filter | 5HC2700 | Trilithic Inc. | 9926013 | n/a | n/a |
| **11** | High Pass Filter | 4HC1600 | Trilithic Inc. | 9922307 | n/a | n/a |
| **16** | LISN | ESH3-Z5 | Rohde & Schwarz | 836679/003 | May 2008 | 1 year |

# 9 BLOCK DIAGRAMS

## 9.1 Conducted Testing



# 10 BLOCK DIAGRAMS

## 10.1 Radiated Testing