Test Report

FCC Part 15.247
Industry Canada RSS210

DTS Devices Operating in range 2400-2483.5MHz

Elektrobit Wireless Communications, Ltd.
Automaatiotie 1
FI-90460 OULUNSALO
FINLAND
Product Name: Integrated Service Access Point

FCC ID: V27-DT40ISAP
IC ID: 3282B-DT40ISAP

TEST REPORT #:EMC_CETEC_029_15_247n_2.4G_rev3
DATE: 2008-04-22

Certificate # 2135.01

Bluetooth Qualification Test Facility (BQTF)

CTIA Authorized Test Lab
LAB CODE 20020328-00

FCC listed: A2LA accredited

IC recognized # 3462B

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1 Assessment

The following is in compliance with the applicable criteria specified in FCC rules Part 15.247 of the Code of Federal Regulations.

Company	Product Name
Elektrobit Wireless Communications, Ltd.	**Integrated Service Access Point**

This report is reviewed by:

Date	Section	Name	Signature
2008-04-22	**EMC & Radio**	**Lothar Schmidt (Director Regulatory and Antenna Services)**	Lothar Schmidt I am approving this document

This report is prepared by:

Date	Section	Name	Signature
2008-04-22	**EMC & Radio**	**Peter Mu (EMC Project Engineer)**	Peter Mu I am the author of this document

The test results of this test report relate exclusively to the test item specified in Identification of the Equipment under Test. The CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM Inc USA.

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

Company Name:	**CETECOM Inc.**
Department:	**EMC**
Address:	**411 Dixon Landing Road** **Milpitas, CA 95035** **U.S.A.**
Telephone:	**+1 (408) 586 6200**
Fax:	**+1 (408) 586 6299**
Responsible Test Lab Manager:	**Lothar Schmidt**
Responsible Project Leader:	**Peter Mu**
Date of test:	**2008-3-4 to 2008-3-25**

2.2 Identification of the Client

APPLICANT	
Applicant (Company Name)	Elektrobit Wireless Communications, Ltd.
Street Address	Automaatiotie 1
City/Zip Code	FI-90460 OULUNSALO
Country	FINLAND
Contact Person	Jussi Harju
Telephone	+41 55 253 2055
Fax	+41 55 253 2070
e-mail	jussi.harju@elektrobit.com

2.3 Identification of the Manufacturer

Same as above applicant.

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

EUT	
Marketing Name of EUT (if not same as Model No.):	**Integrated Service Access Point**
Description:	Wireless LAN Access Point
Model No:	ISAP
FCC ID:	V27-DT40ISAP
IC ID:	3282B-DT40ISAP

Frequency Range:	2400-2483.5MHz Channel 1, 6, 11 for HT20 mode Channel 2, 6, 10 for HT40 mode
Type(s) of Modulation:	OFDM
Antenna Type:	Whip 2.6dBi
Max Output Power:	EIRP: 19.2dBm (0.0832W) HT20 mode. 19.1dBm (0.0813W) HT40 mode. Conducted Output power: 13.6dBm (0.0229W) HT20 mode, 13.5dBm (0.0224W) HT40 mode.
Specified Operating Temperature Range:	-10C to +50C

3.2 Identification of the Equipment under Test (EUT)

EUT #	TYPE	MANF.	MODEL	SERIAL #
1	EUT	Elektrobit	ISAP	026
2	EUT	Elektrobit	ISAP	027

3.3 Identification of Accessory equipment

None

4 Subject Of Investigation

All testing was performed on the product referred to in Section 3 as EUT. EUT operates in the band 2400-2483.5MHz in 802.11ng 20MHz mode (HT20) and 802.11ng 40MHz mode (HT40). The EUT does not support 802.11b/g legacy mode of operation.

Although the EUT has three antenna ports only two will be used in actual operation. All three ports are measured during testing and ports with worse case performance are reported here to show compliance to applicable standards.

The objective of the measurements done by Cetecom Inc. was to measure the performance of the EUT operating under 802.11ng 20MHz mode (HT20) and 802.11ng 40MHz mode (HT40) in the 2400-2483.4MHz range as specified by requirements listed in FCC rules Part 15.247 of Title 47 of the Code of Federal Regulations. The maximization of portable equipment is conducted in accordance with ANSI C63.4

5 Radiated Measurements

5.1 Maximum Peak Output Power § 15.247 (b)(1) (Radiated)

EIRP is calculated from conducted peak power with the following formula:

EIRP = Conducted Peak Power + Directional Antenna Gain (G)

Directional Antenna Gain = Max Stated Antenna Gain + 10*log(N)

N is the number of active transmitting ports. For this EUT N=2 under normal operation mode and all antennae have stated gain of 2.6dBi. G = 2.6dBi + 10*log(2) = 5.6dBi.

5.1.1 EIRP 802.11ng HT20 MODE:

TEST CONDITIONS			MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)			2412	2437	2462
Chain AB	T_{nom}(23)°C	V_{nom}VDC	19.1	19.2	19.2
Measurement uncertainty			±0.5dBm		

5.1.2 EIRP 802.11ng HT40 MODE:

TEST CONDITIONS			MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)			2422	2447	2452
Chain AB	T_{nom}(23)°C	V_{nom}VDC	19.1	19.0	19.1
Measurement uncertainty			±0.5dBm		

5.2 Restricted Band Edge Compliance §15.247/15.205

5.2.1 Limits

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

***PEAK LIMIT= 74dBuV/m**
***AVG. LIMIT= 54dBuV/m**

<u>Notes:</u>

1. Radiated emissions are maximized by rotating the EUT 360° at 0.5 meter height increments between 1 and 4 meters.
2. Measurements were performed with the EUT in X, Y and Z orientations with the measurement antenna in both horizontal and vertical polarity. The plots below show the results of the worst case orientation and polarity.

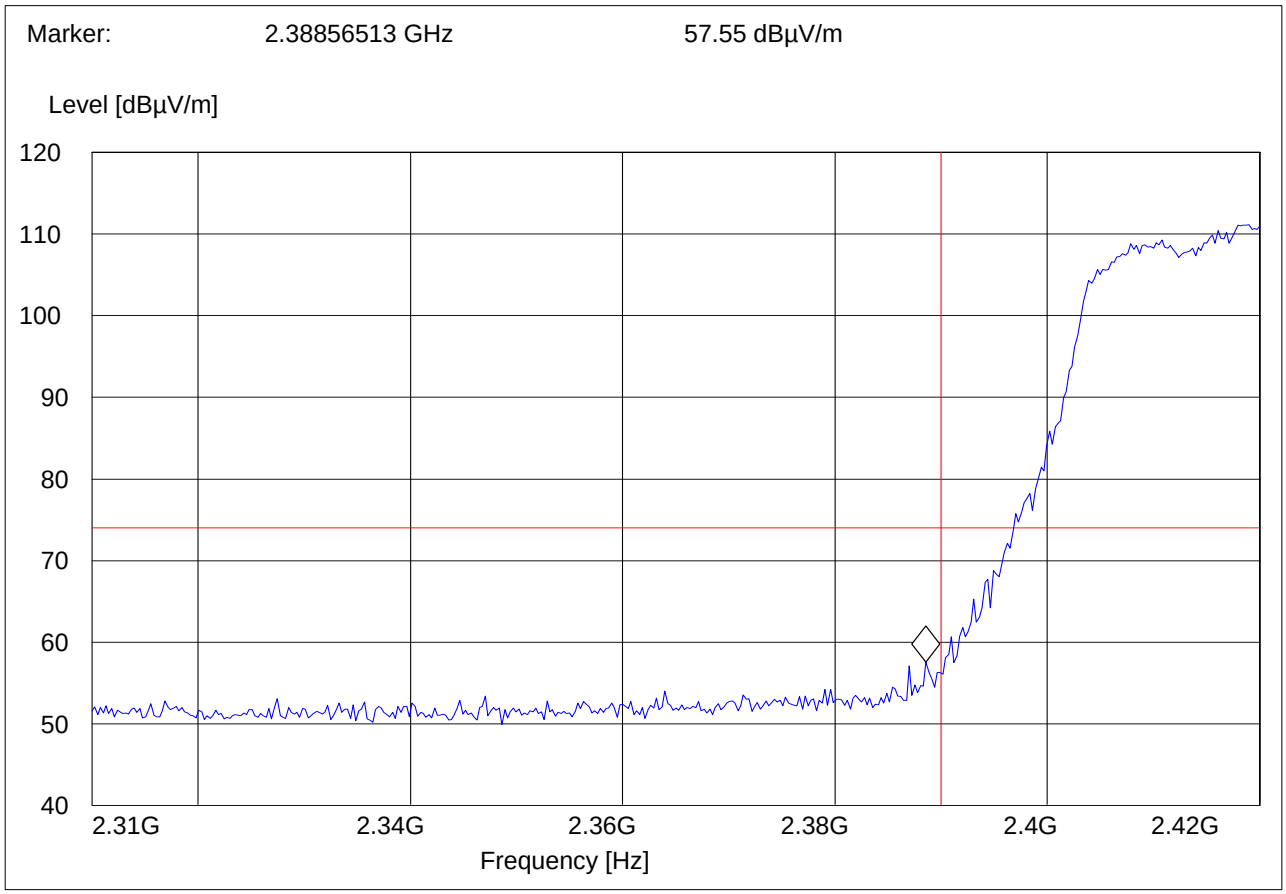
5.2.2 802.11 (ng) HT20 MODE

2412MHz Chain AB, Lower band edge PEAK

```
EUT:              026
Customer::        Elektrobit
Test Mode:        802.11ng CH.1
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Chris
Voltage:          Power Cable
Comments:
```

SWEEP TABLE: "FCC15.247 LBE_PK"

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

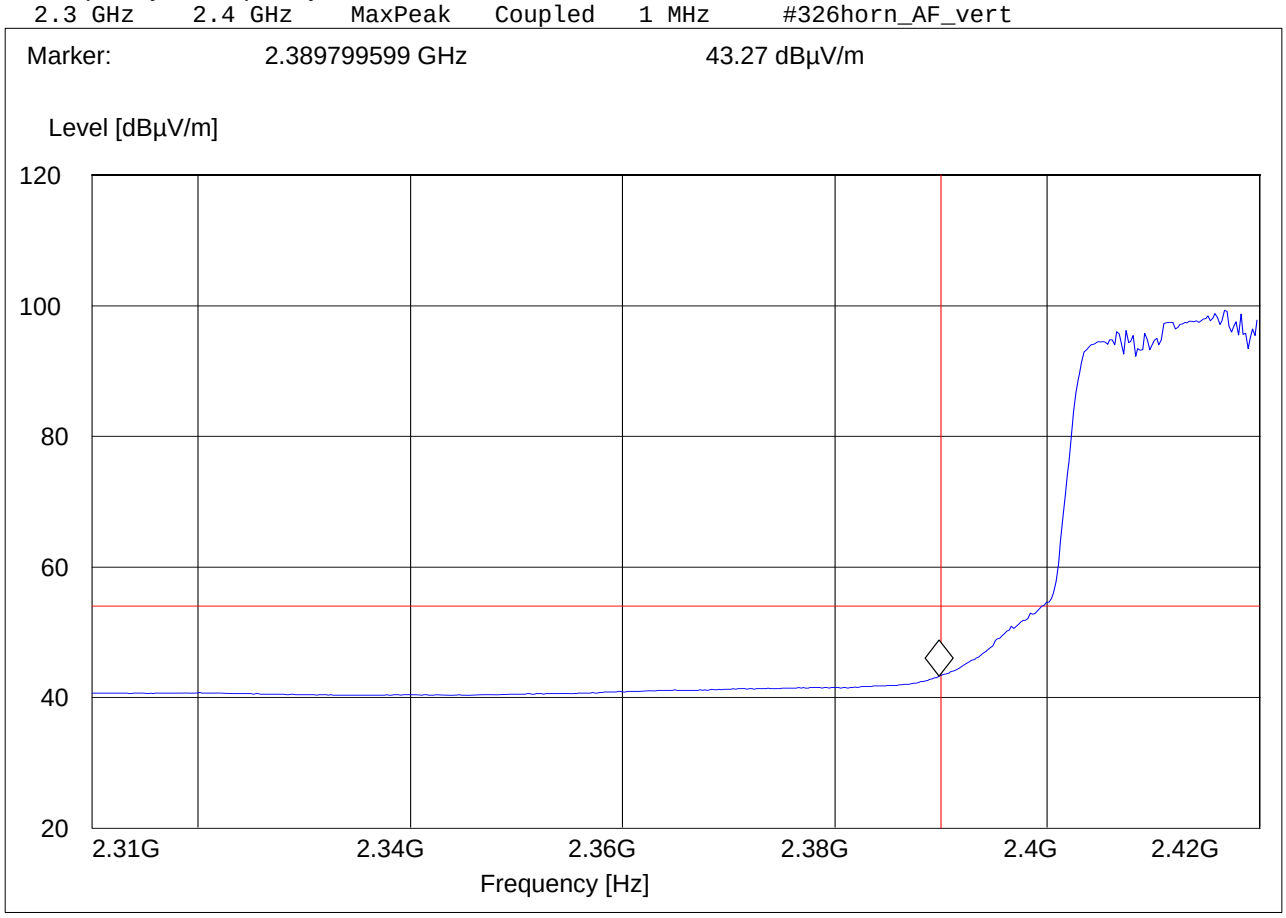


2412MHz Chain AB, Lower band edge AVERAGE

```
EUT:              026
Customer::        Elektrobit
Test Mode:        802.11ng CH.1
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Chris
Voltage:          Power Cable
Comments:
```

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

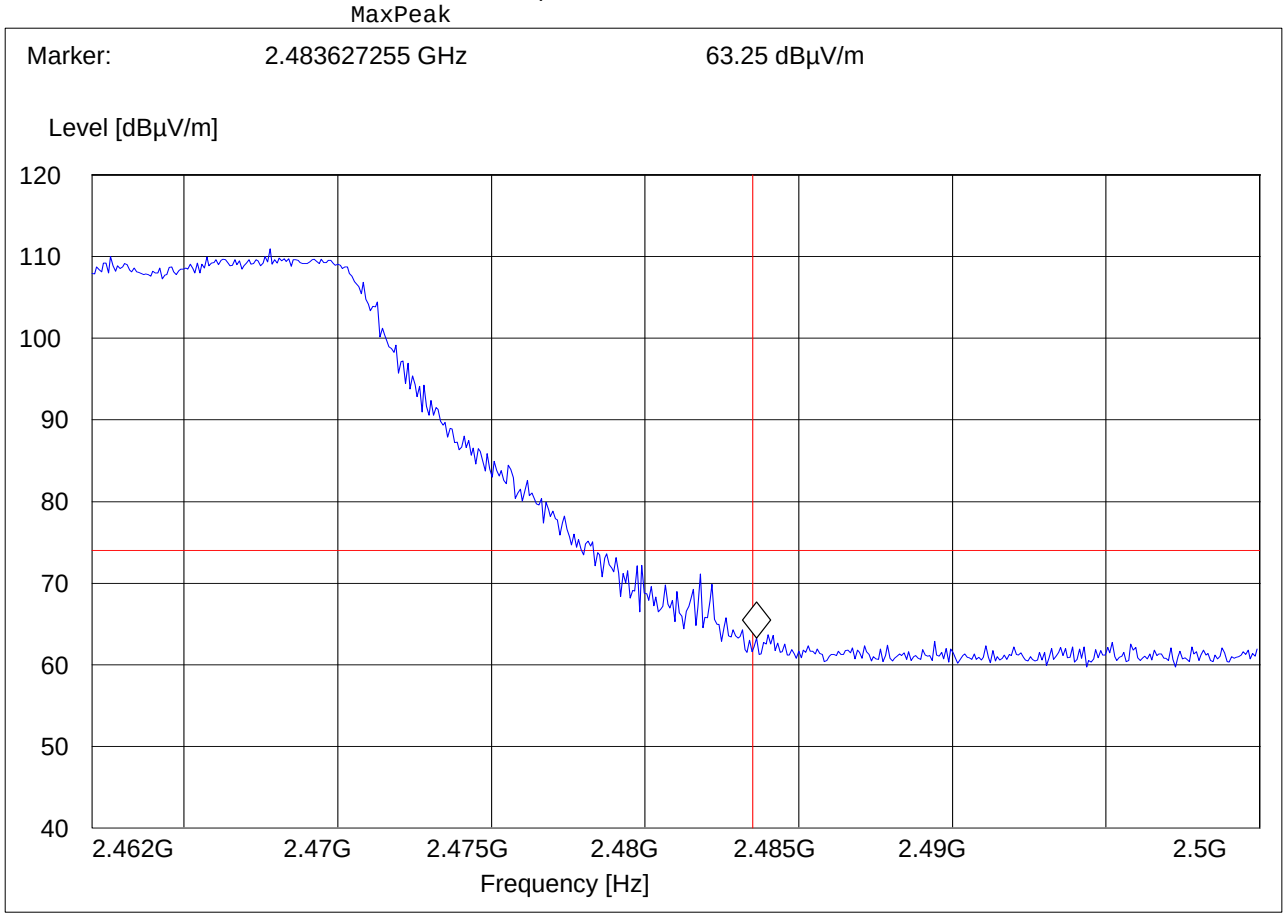


2462MHz Chain AB, Upper band edge PEAK

```
EUT:              026
Customer::        Elektrobit
Test Mode:        802.11ng CH.11
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Chris
Voltage:          Power Cable
Comments:
```

SWEEP TABLE: "FCC15.247 HBE_PK"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
2.5 GHz	2.5 GHz	MaxPeak MaxPeak	Coupled	1 MHz	#326horn_AF_vert

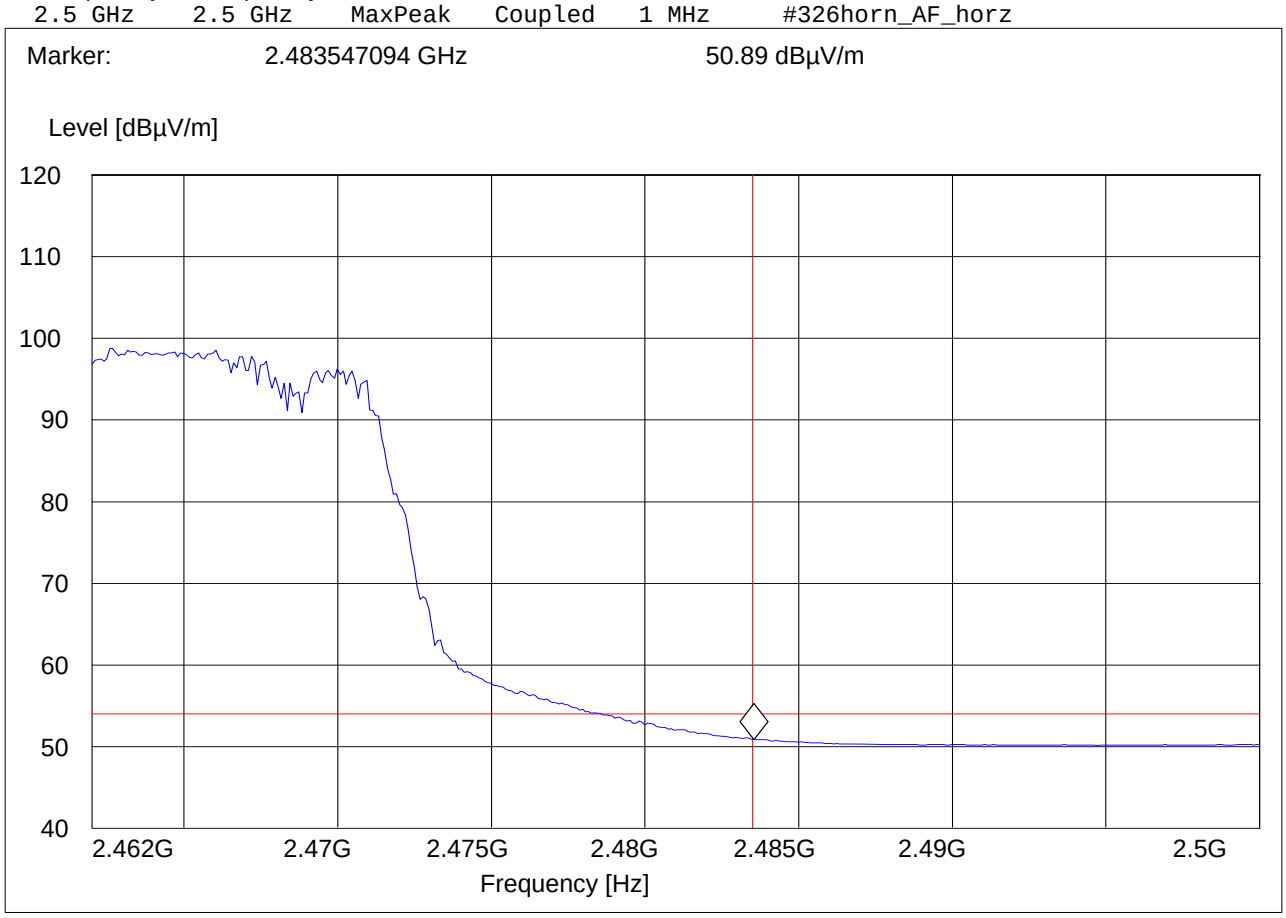


2462MHz Chain AB, Upper band edge AVERAGE

```
EUT:              026
Customer::        Elektrobit
Test Mode:        802.11ng CH.11
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Chris
Voltage:          Power Cable
Comments:
```

SWEEP TABLE: "FCC15.247 HBE_AVG"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
2.5 GHz	2.5 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_horz



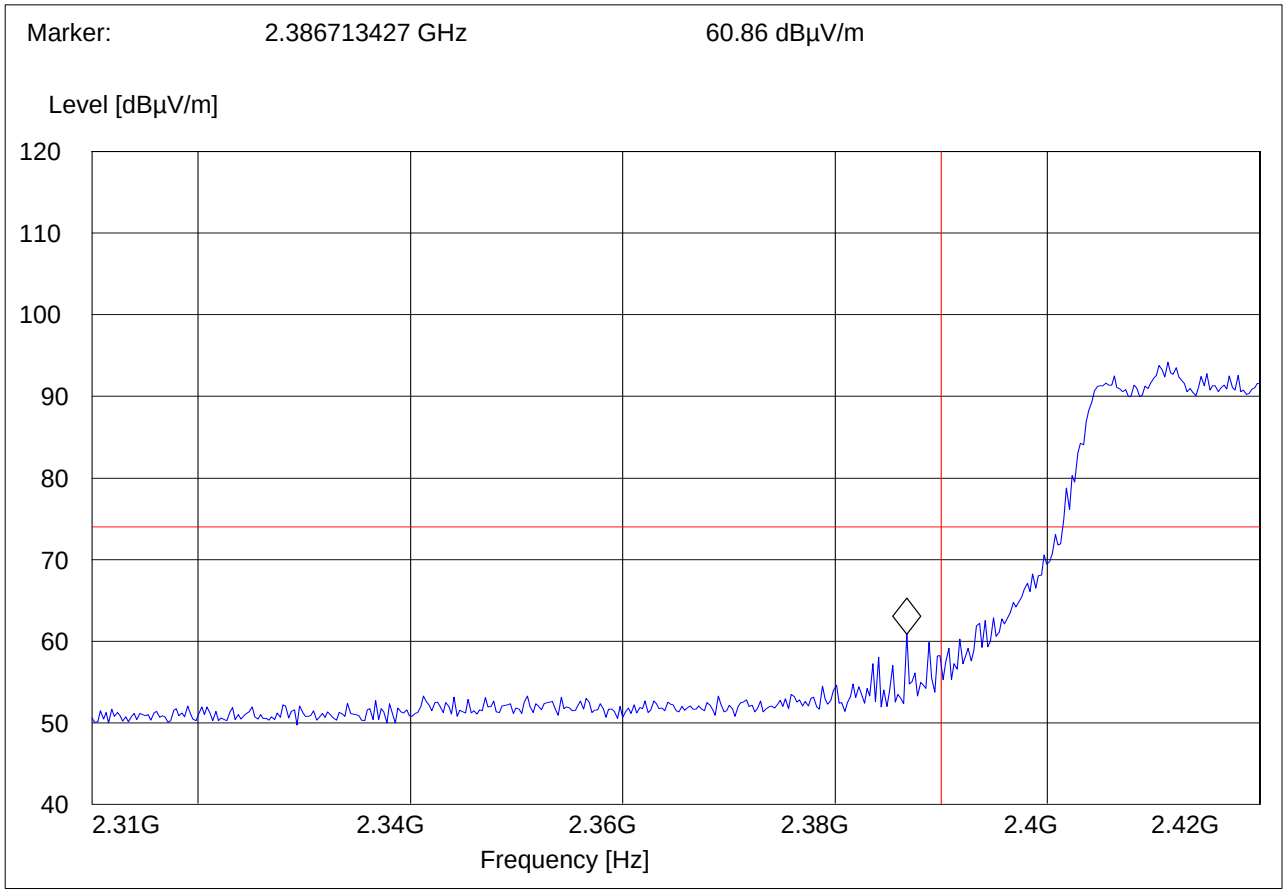
5.2.3 802.11 (ng) HT40 MODE

2422MHz Chain AB, Lower band edge PEAK

```
EUT:              026
Customer::        Elektrobit
Test Mode:        802.11ng, 40
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Satya
Voltage:          AC
Comments:
```

SWEEP TABLE: "FCC15.247 LBE_PK"

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

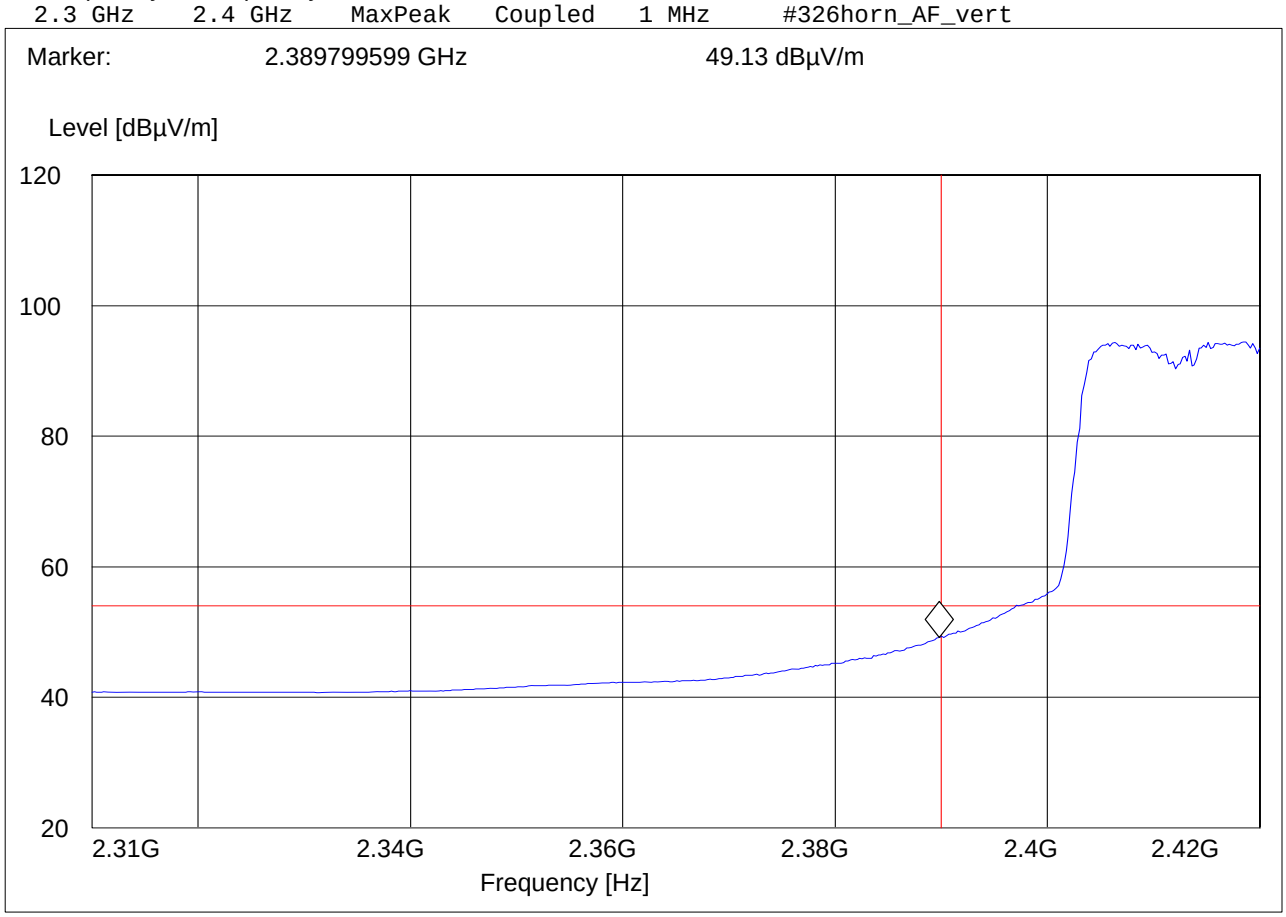


2422MHz Chain AB, Lower band edge AVERAGE

```
EUT:              026
Customer::        Elektrobit
Test Mode:        802.11ng CH.1; 40MHz
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Chris
Voltage:          Power Cable
Comments:
```

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

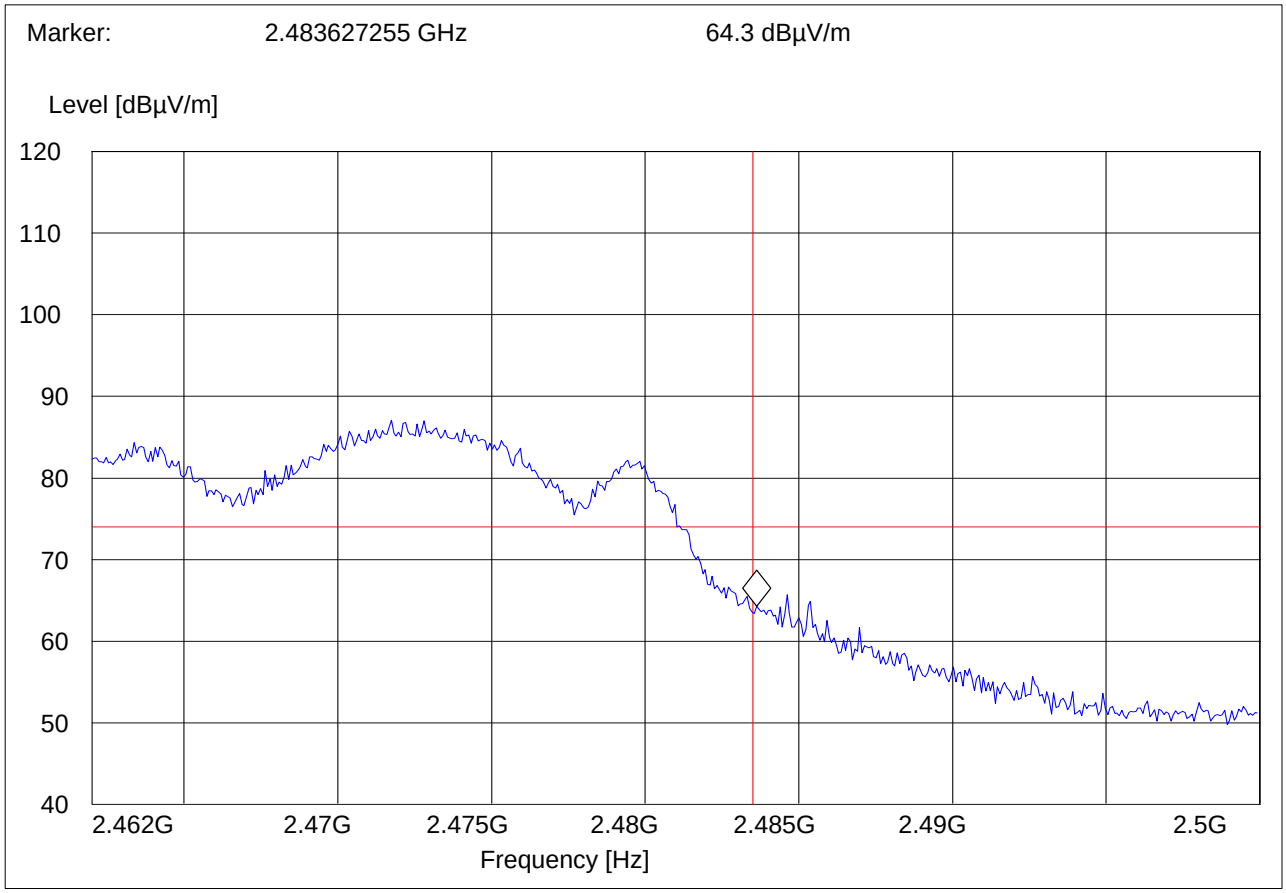


2452MHz Chain AB, Upper band edge PEAK

```
EUT:              026
Customer::        Elektrobit
Test Mode:        802.11ng, 40
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Satya
Voltage:          AC
Comments:
```

SWEEP TABLE: "FCC15.247 HBE_PK"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
2.5 GHz	2.5 GHz	MaxPeak MaxPeak	Coupled	1 MHz	#326horn_AF_vert

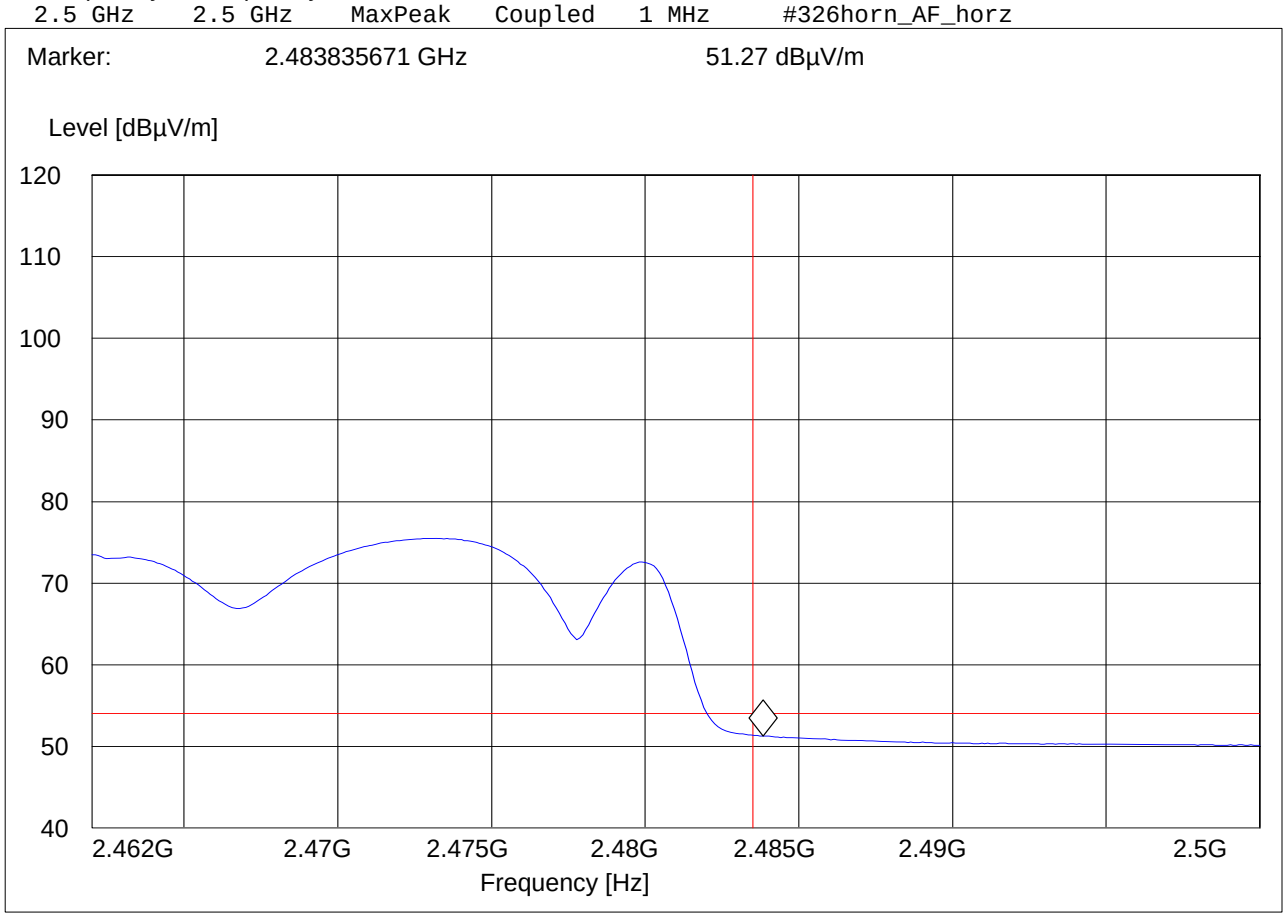


2452MHz Chain AB, Upper band edge AVERAGE

```
EUT:              026
Customer::        Elektrobit
Test Mode:        802.11ng, 40
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Satya
Voltage:          AC
Comments:
```

SWEEP TABLE: "FCC15.247 HBE_AVG"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
2.5 GHz	2.5 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_horz



5.3 Transmitter Spurious Emission § 15.247/15.205/15.209

5.3.1 Limits

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

***PEAK LIMIT= 74dBuV/m**
***AVG. LIMIT= 54dBuV/m**

<u>Notes</u>:

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 25 GHz very short cable connections to the antenna was used to minimize the noise level.
2. All measurements are done in peak mode using an average limit , unless specified with the plots.
3. Radiated emissions are maximized by rotating the EUT 360° at 0.5 meter height increments between 1 and 4 meters.
4. Measurements were performed with the EUT in X, Y and Z orientations with the measurement antenna in both horizontal and vertical polarity. The plots below show the results of the worst case orientation and polarity

Results for the radiated measurements below 30MHz according § 15.33

Frequency	Measured values	Remarks
9KHz – 30MHz	No emissions found, caused by the EUT	This is valid for all the tested channels

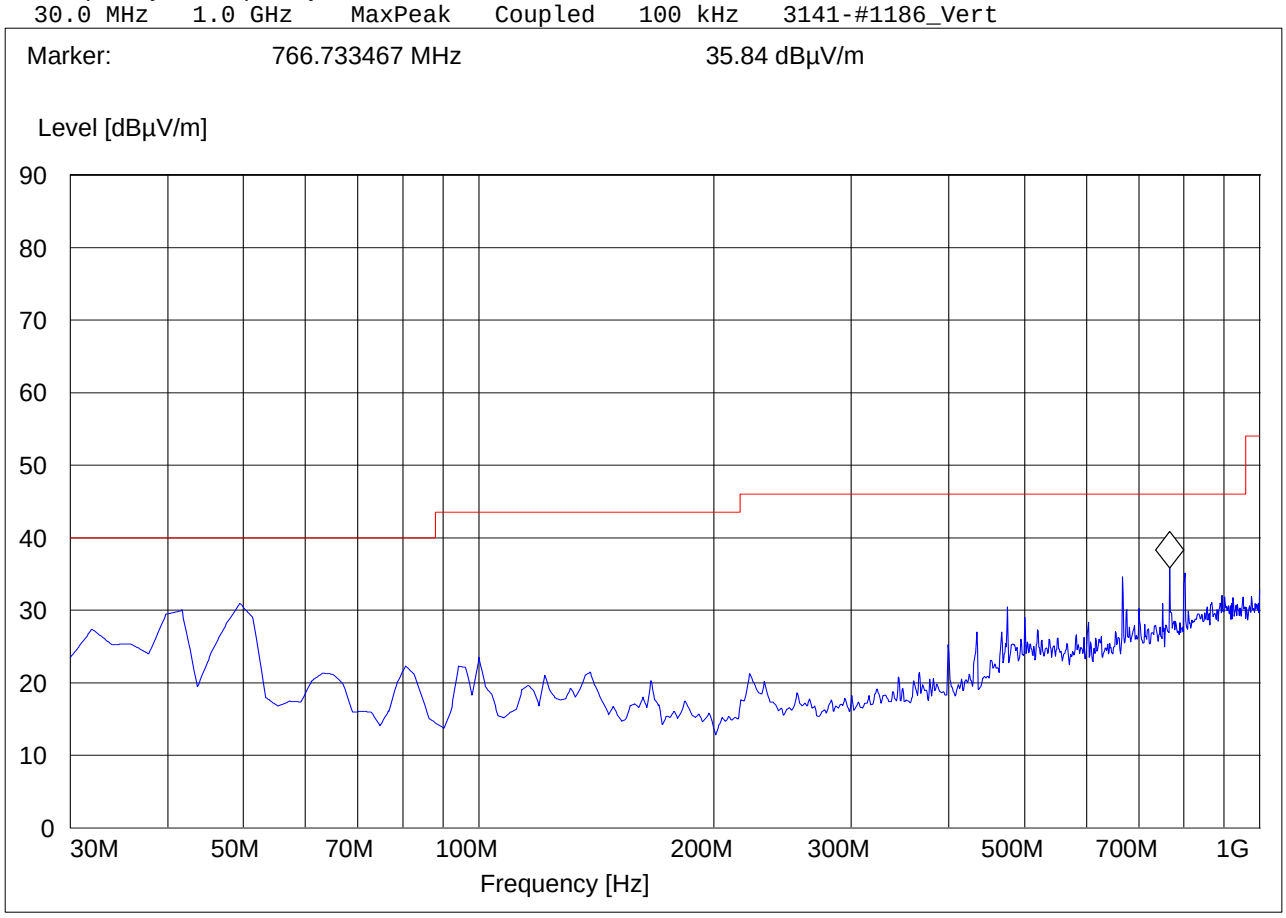
5.3.2 RESULTS 802.11 (ng) HT20 MODE Chain AB
30MHz – 1GHz, Antenna: Vertical

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

```
EUT:              026
Customer::        Elektrobit
Test Mode:        802.11ng ch 11
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Sam
Voltage:          Power Cable
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



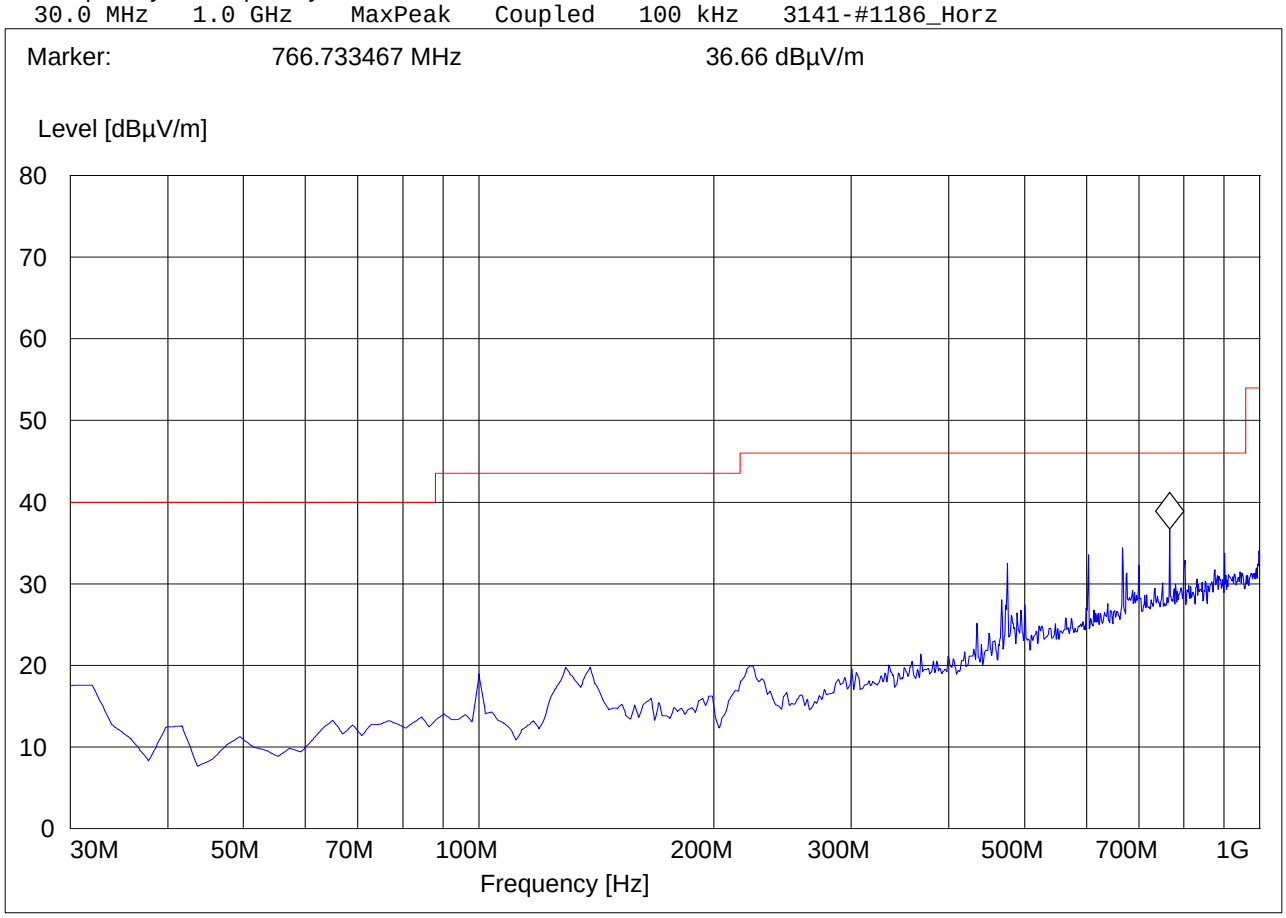
30MHz – 1GHz, Antenna: Horizontal

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

EUT: 026
Customer:: Elektrobit
Test Mode: 802.11ng ch 11
ANT Orientation: H
EUT Orientation: H
Test Engineer: Sam
Voltage: Power Cable
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



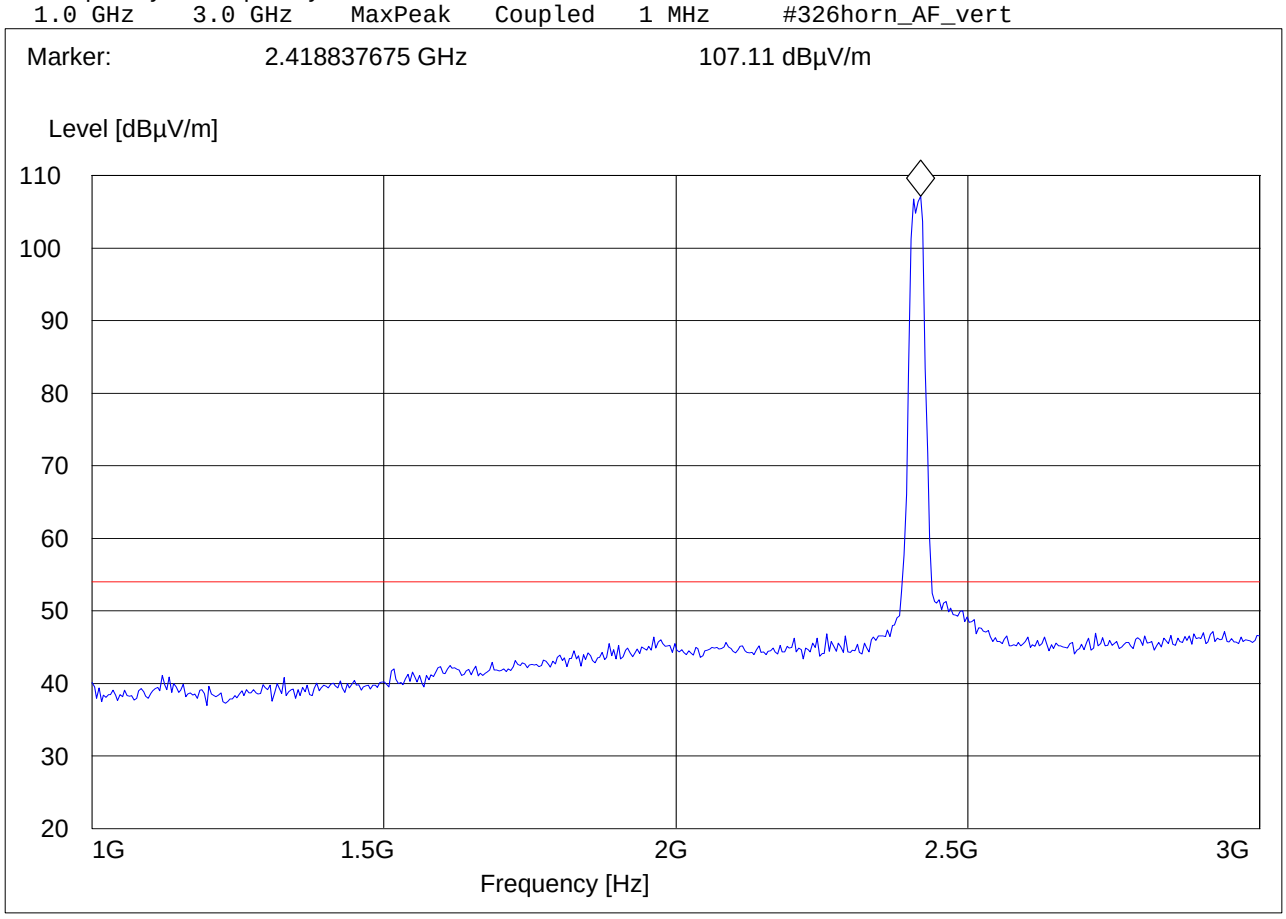
1-3GHz (2412MHz) Chain AB

Note: The peak above the limit line is the carrier freq.
Note: Peak Reading vs. Average limit

```
EUT:              026
Customer::        Elektrobit
Test Mode:        802.11g,ch 1
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Sam
Voltage:          Power Cable
Comments:
```

SWEEP TABLE: "FCC15.247_1-3G"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	3.0 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_vert



1-3GHz (2437MHz) Chain AB

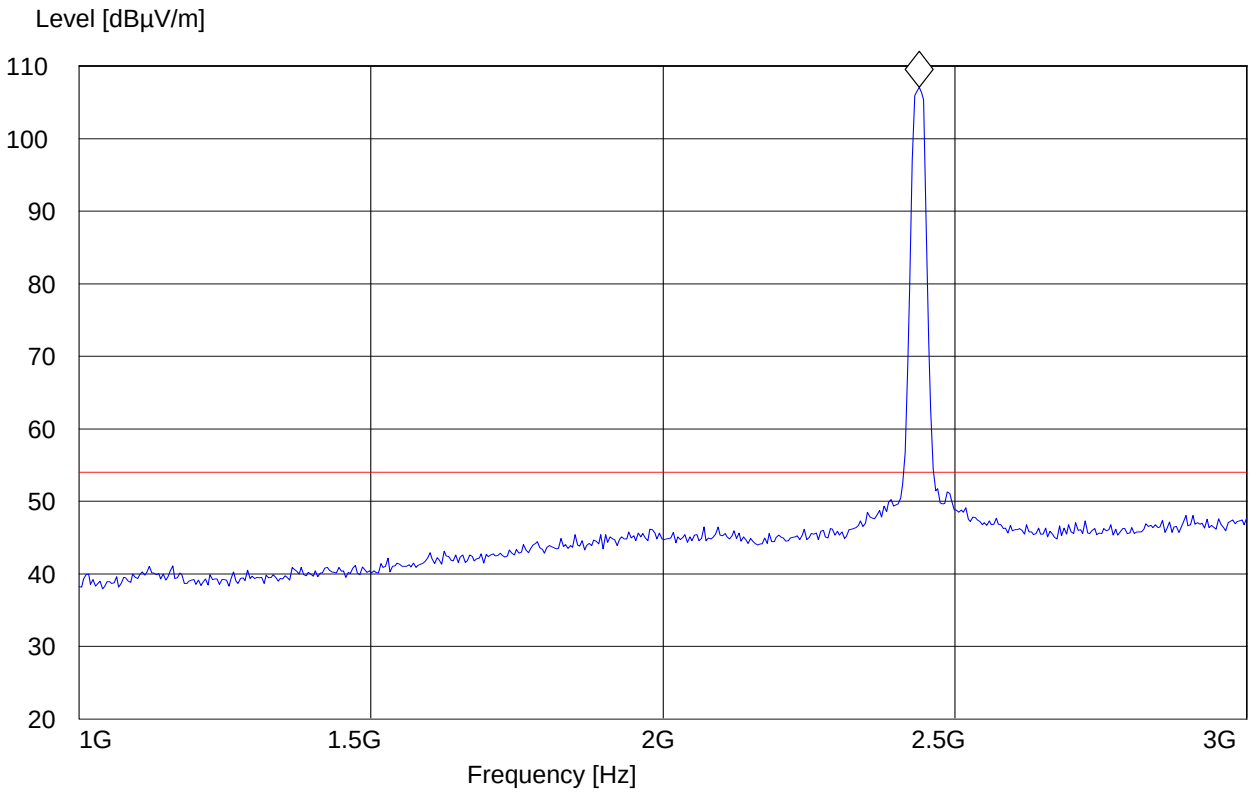
Note: The peak above the limit line is the carrier freq.
Note: Peak Reading vs. Average limit

```
EUT:              026
Customer::        Elektrobit
Test Mode:        802.11g
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Sam
Voltage:          Power Cable
Comments:
```

SWEEP TABLE: "FCC15.247_1-3G"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	3.0 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_vert

Marker: 2.438877756 GHz 107.02 dBµV/m



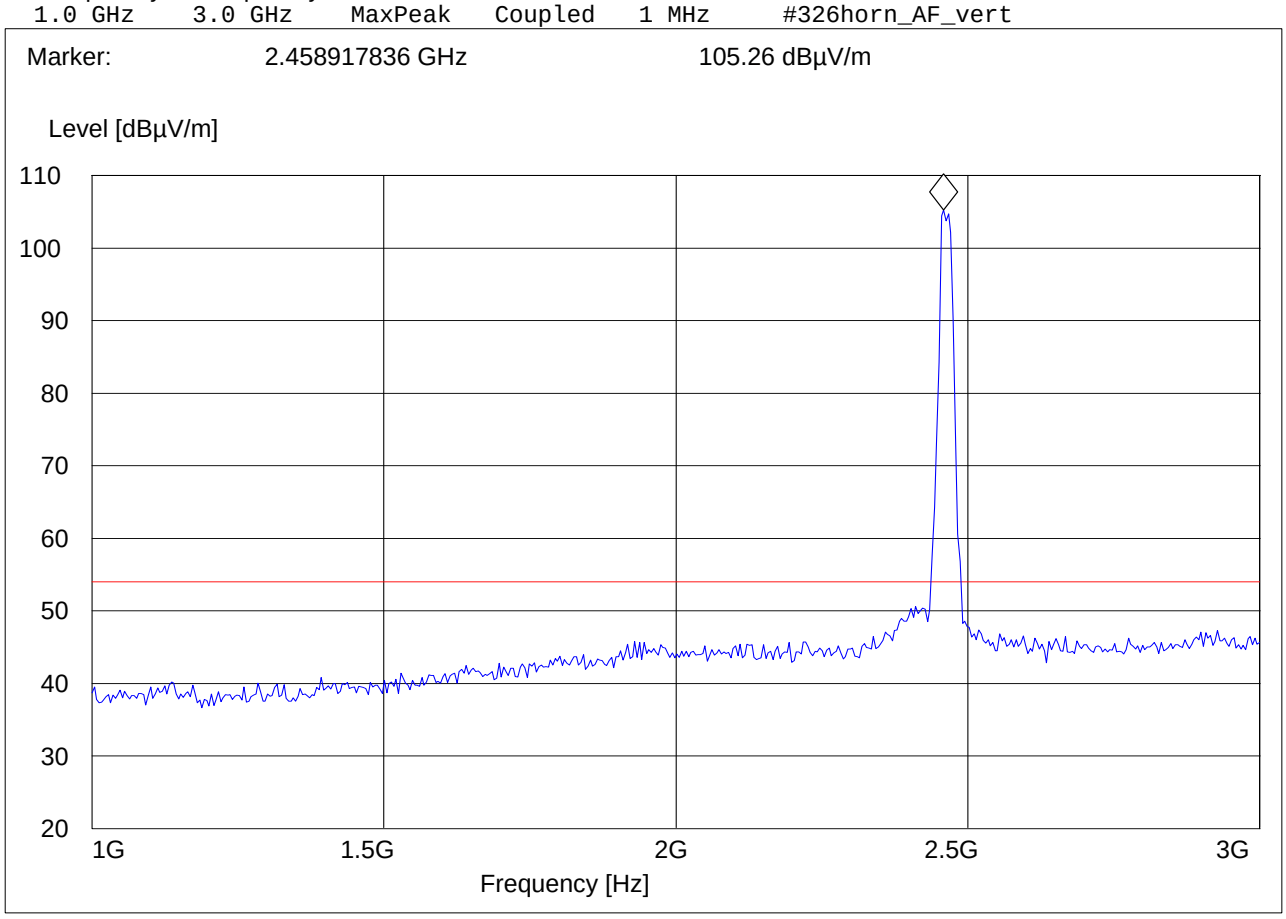
1-3GHz (2462MHz) Chain AB

Note: The peak above the limit line is the carrier freq.
Note: Peak Reading vs. Average limit

```
EUT:              026
Customer::        Elektrobit
Test Mode:        802.11g
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Sam
Voltage:          Power Cable
Comments:
```

SWEEP TABLE: "FCC15.247_1-3G"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	3.0 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_vert



3-18GHz (2412MHz) Chain AB

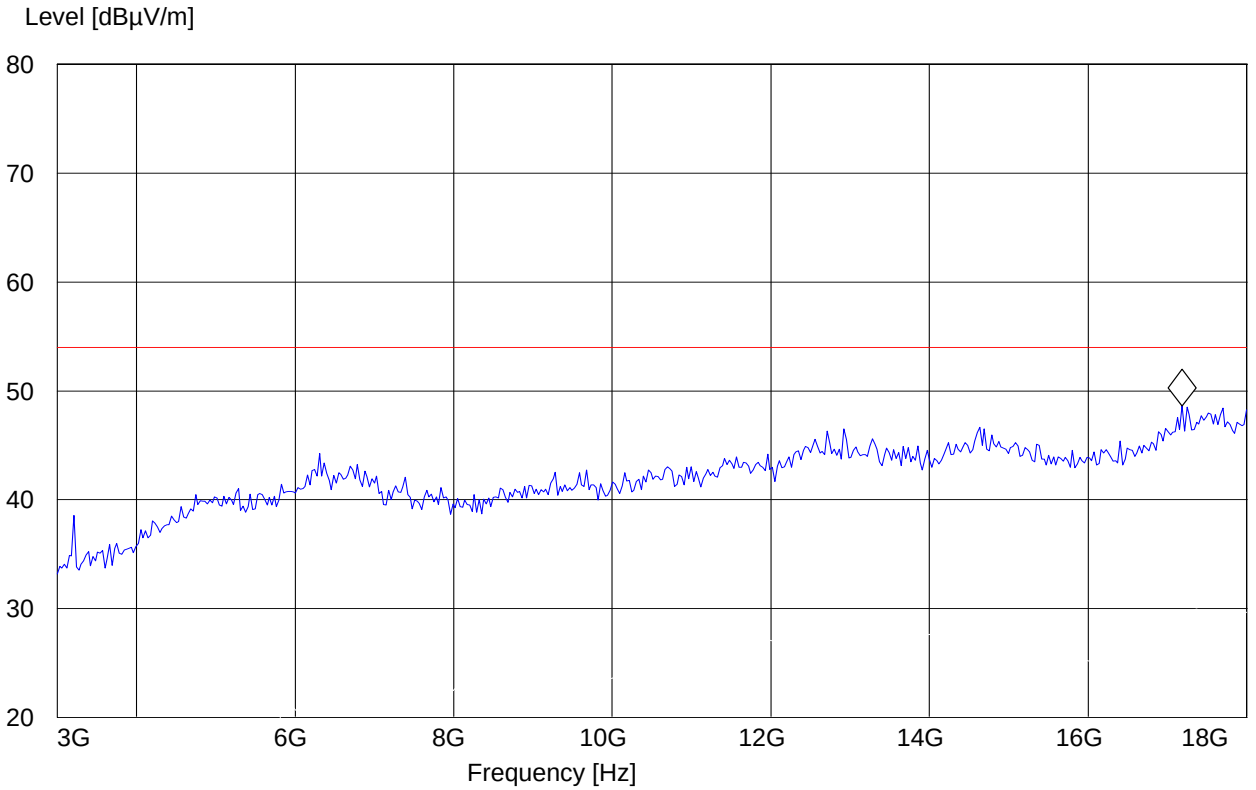
Note: Peak Reading vs. Average limit

EUT: 026
Customer:: Elektrobit
Test Mode: 802.11g
ANT Orientation: V
EUT Orientation: H
Test Engineer: Sam
Voltage: Power Cable
Comments:

SWEEP TABLE: "FCC15.247_3-18G"

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

Marker: 17.188376754 GHz 48.61 dBµV/m



1-18GHz (2437MHz) Chain AB

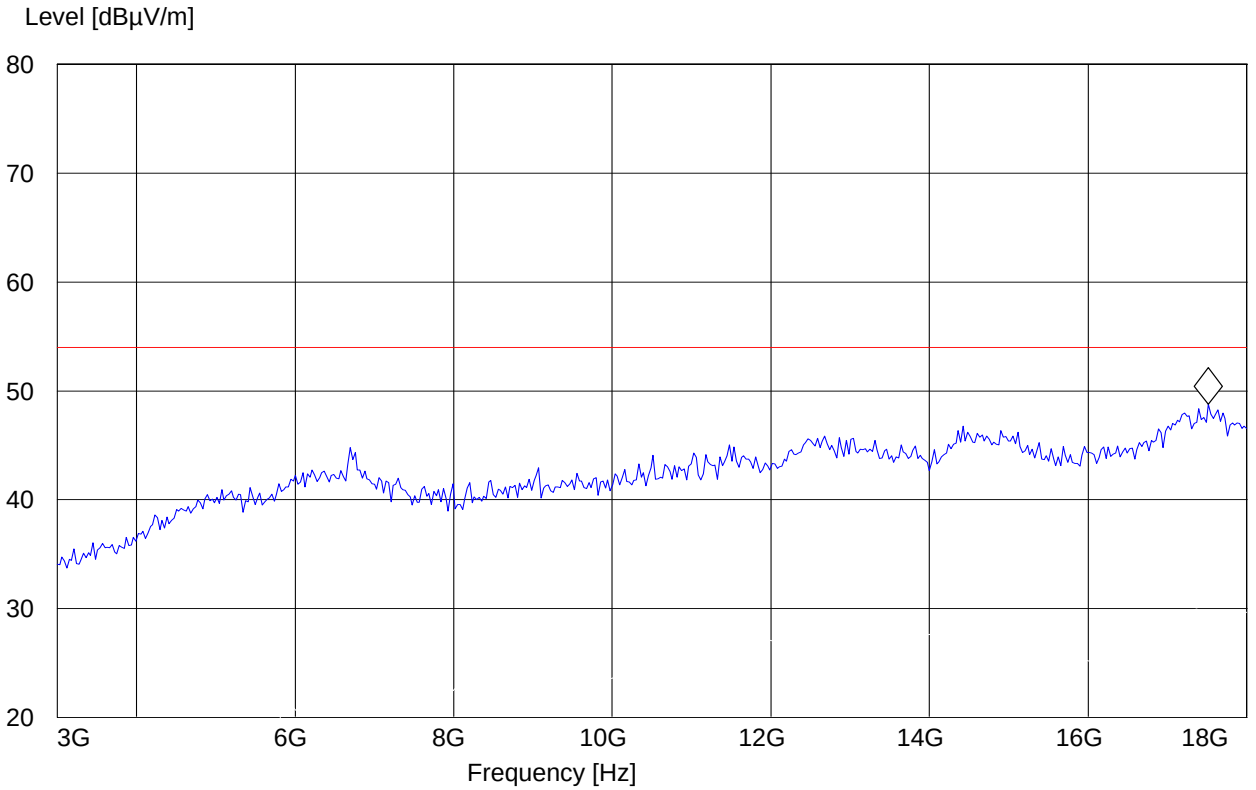
Note: Peak Reading vs. Average limit

EUT: 026
Customer:: Elektrobit
Test Mode: 802.11g
ANT Orientation: V
EUT Orientation: H
Test Engineer: Sam
Voltage: Power Cable
Comments:

SWEEP TABLE: "FCC15.247_3-18G"

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

Marker: 17.519038076 GHz 48.78 dBµV/m



3-18GHz (2462MHz) Chain AB

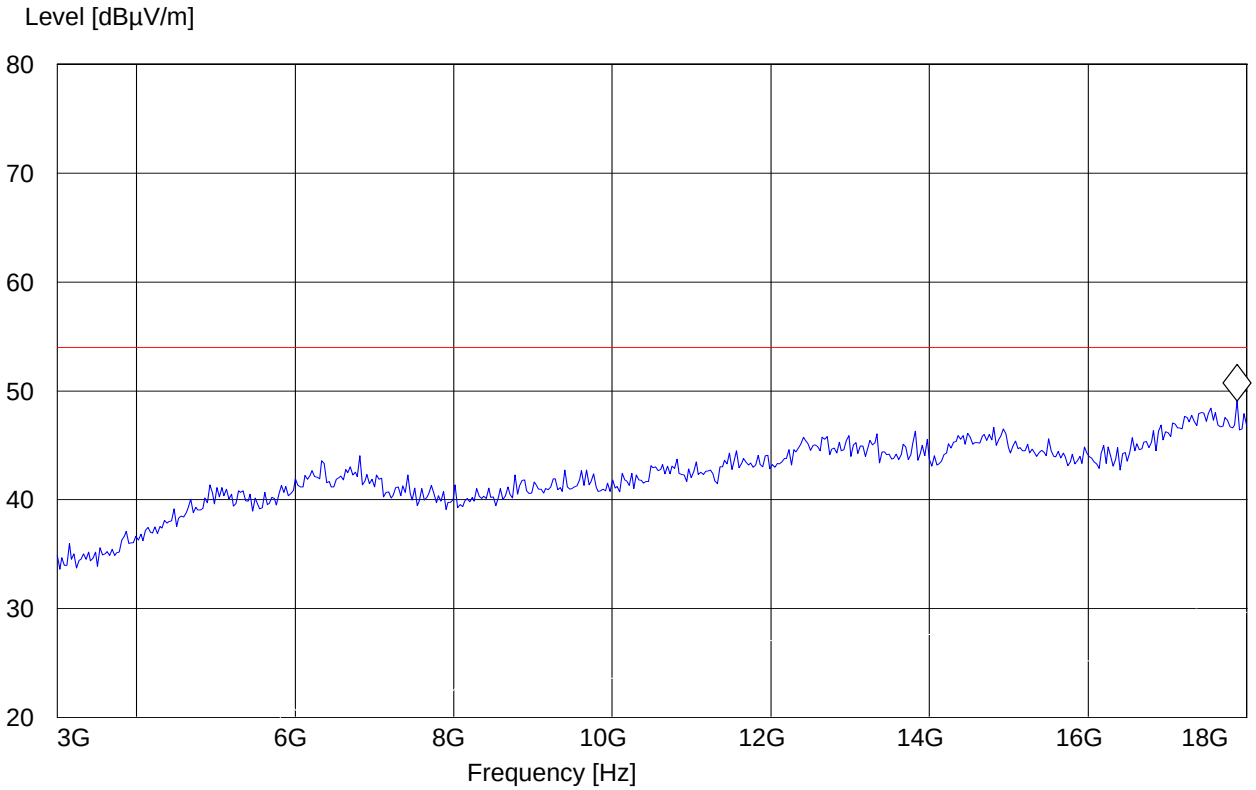
Note: Peak Reading vs. Average limit

EUT: 026
Customer:: Elektrobit
Test Mode: 802.11g
ANT Orientation: V
EUT Orientation: H
Test Engineer: Sam
Voltage: Power Cable
Comments:

SWEEP TABLE: "FCC15.247_3-18G"

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

Marker: 17.879759519 GHz 49.08 dBµV/m



18-25GHz Chain AB

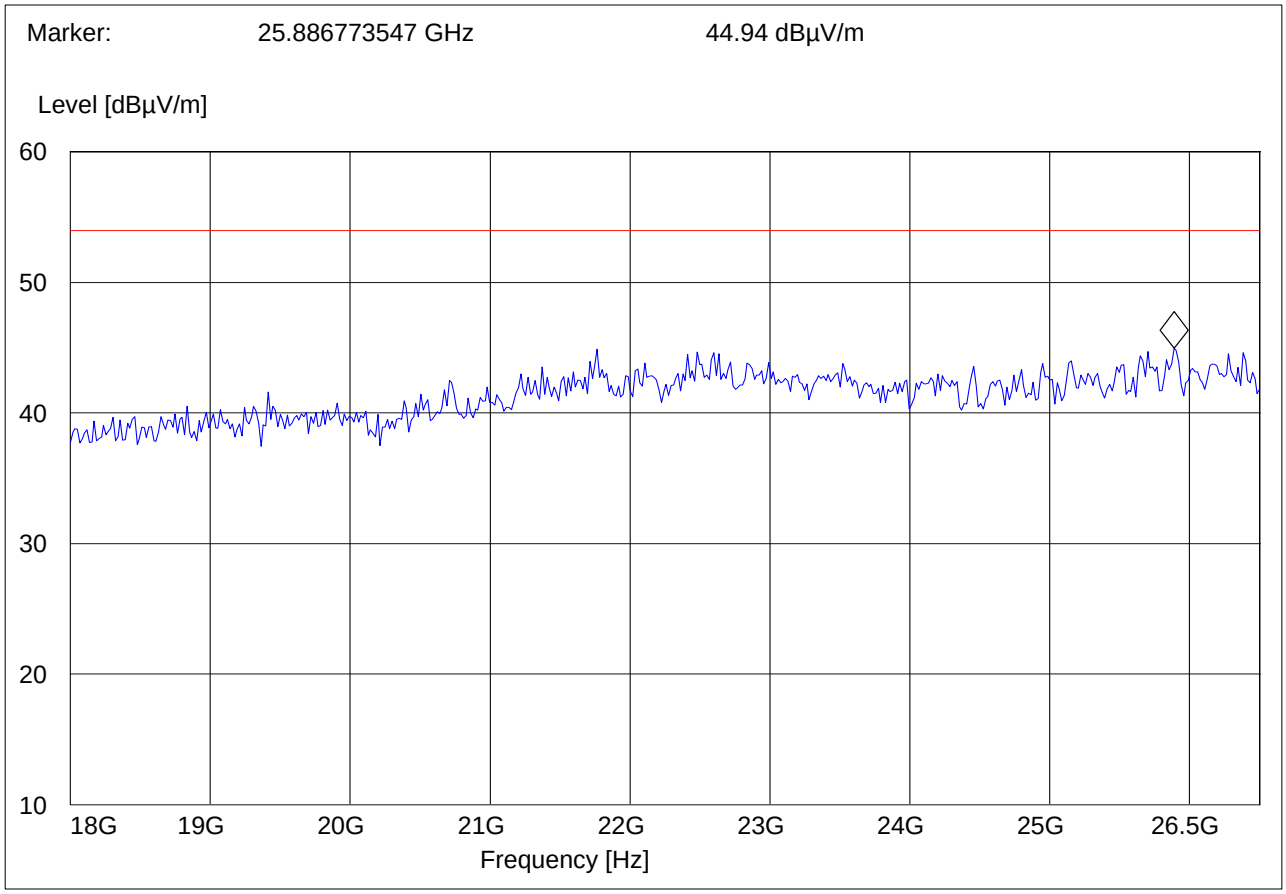
Note: This plot is valid for low, mid, high channels (worst-case plot).
Note: Peak Reading vs. Average limit

```
EUT:              026
Customer::        Elektrobit
Test Mode:        802.11g
ANT Orientation:  H
EUT Orientation:  H
Test Engineer:    Sam
Voltage:          Power Cable
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	100 kHz	Horn # 3116_18-40G

MaxPeak



5.3.3 RESULTS 802.11 (ng) HT40 MODE Chain AB

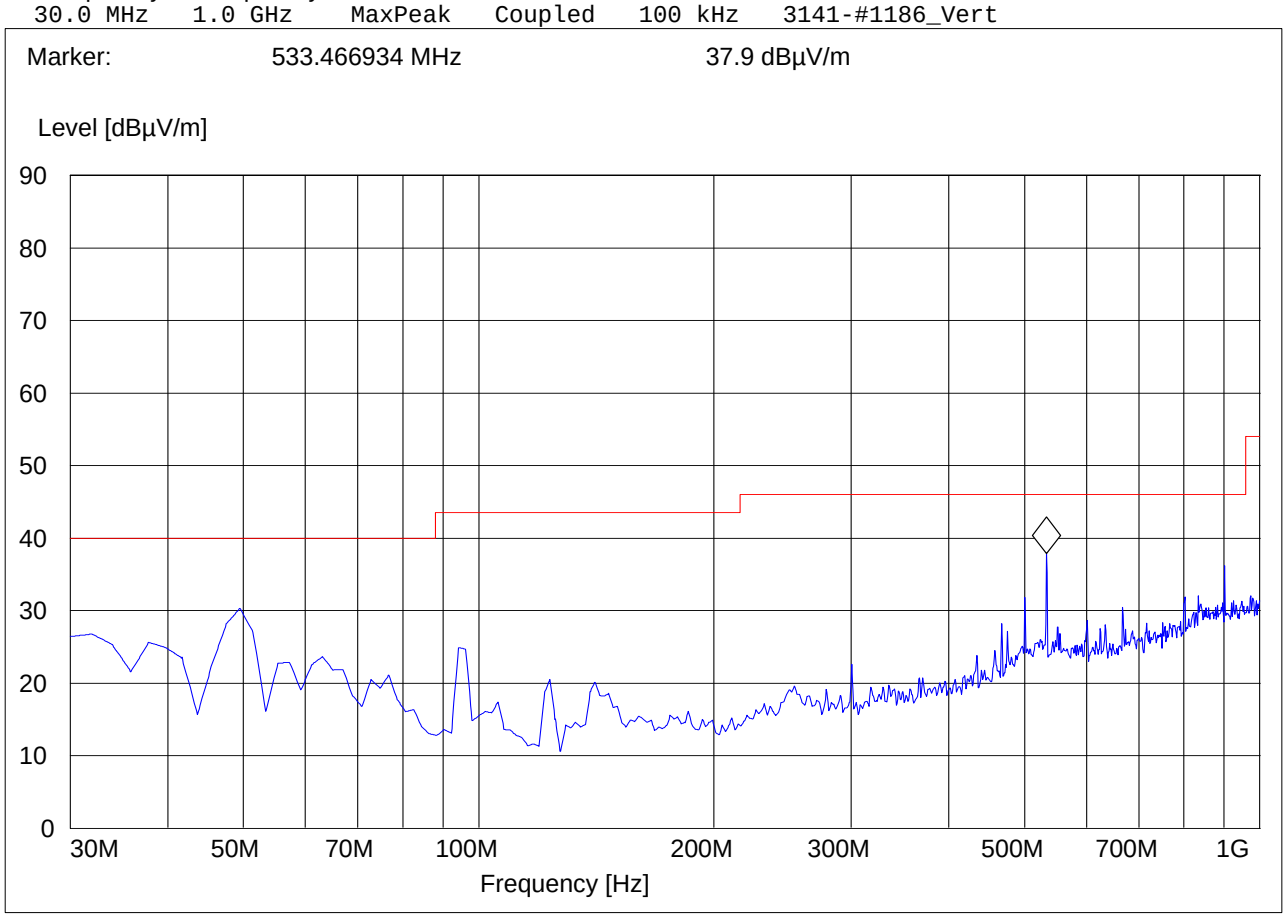
30MHz – 1GHz, Antenna: Vertical

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

```
EUT:              026
Customer::        Elektrobit
Test Mode:        802.11n, 40MHz
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Chris
Voltage:          AC
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



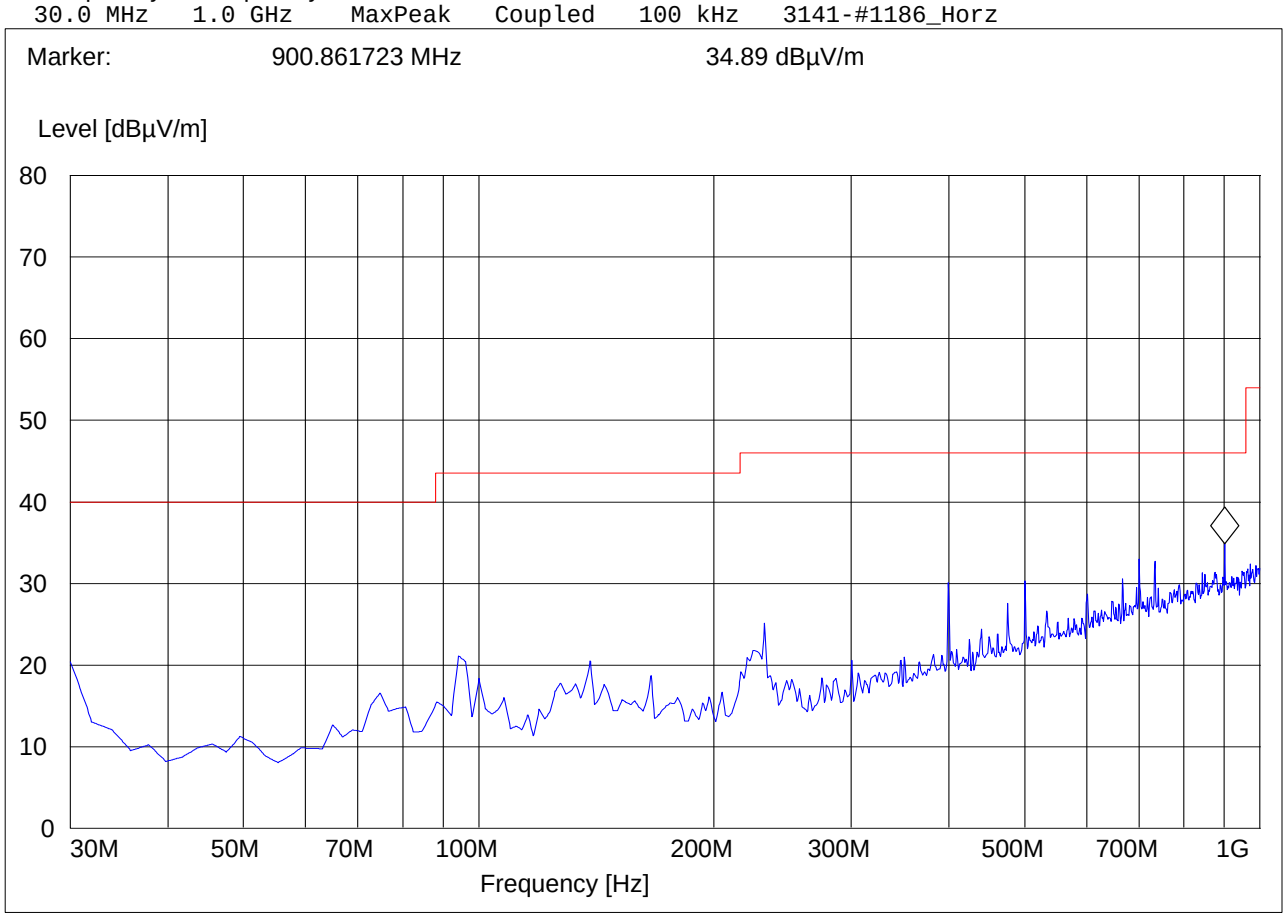
30MHz – 1GHz, Antenna: Horizontal

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

EUT: 026
Customer:: Elektrobit
Test Mode: 802.11n, 40MHz
ANT Orientation: H
EUT Orientation: H
Test Engineer: Chris
Voltage: AC
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



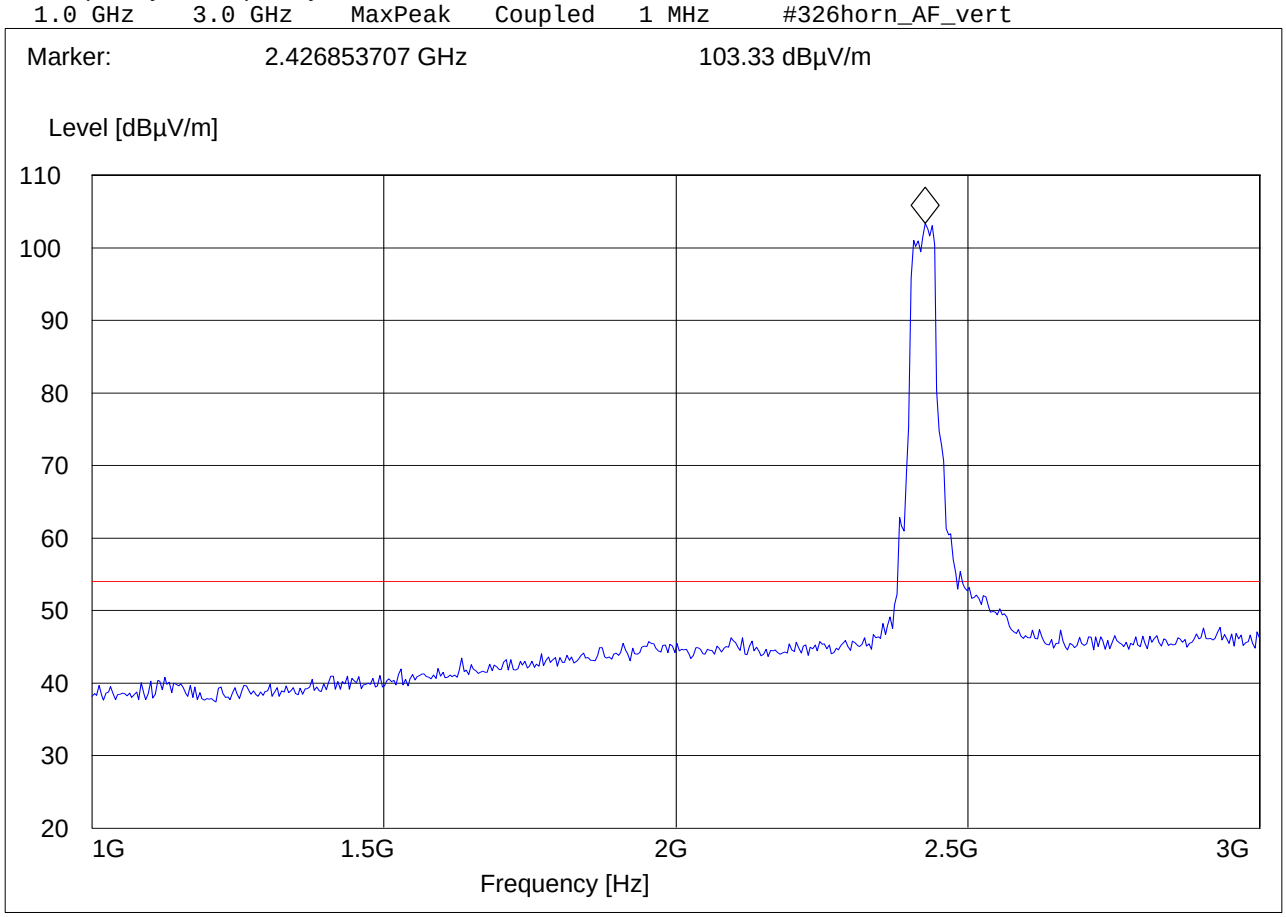
1-3GHz (2422MHz) Chain AB

Note: The peak above the limit line is the carrier freq.
Note: Peak Reading vs. Average limit

```
EUT:              026
Customer::        Elektrobit
Test Mode:        802.11n, 40MHz
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Chris
Voltage:          AC
Comments:
```

SWEEP TABLE: "FCC15.247_1-3G"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	3.0 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_vert



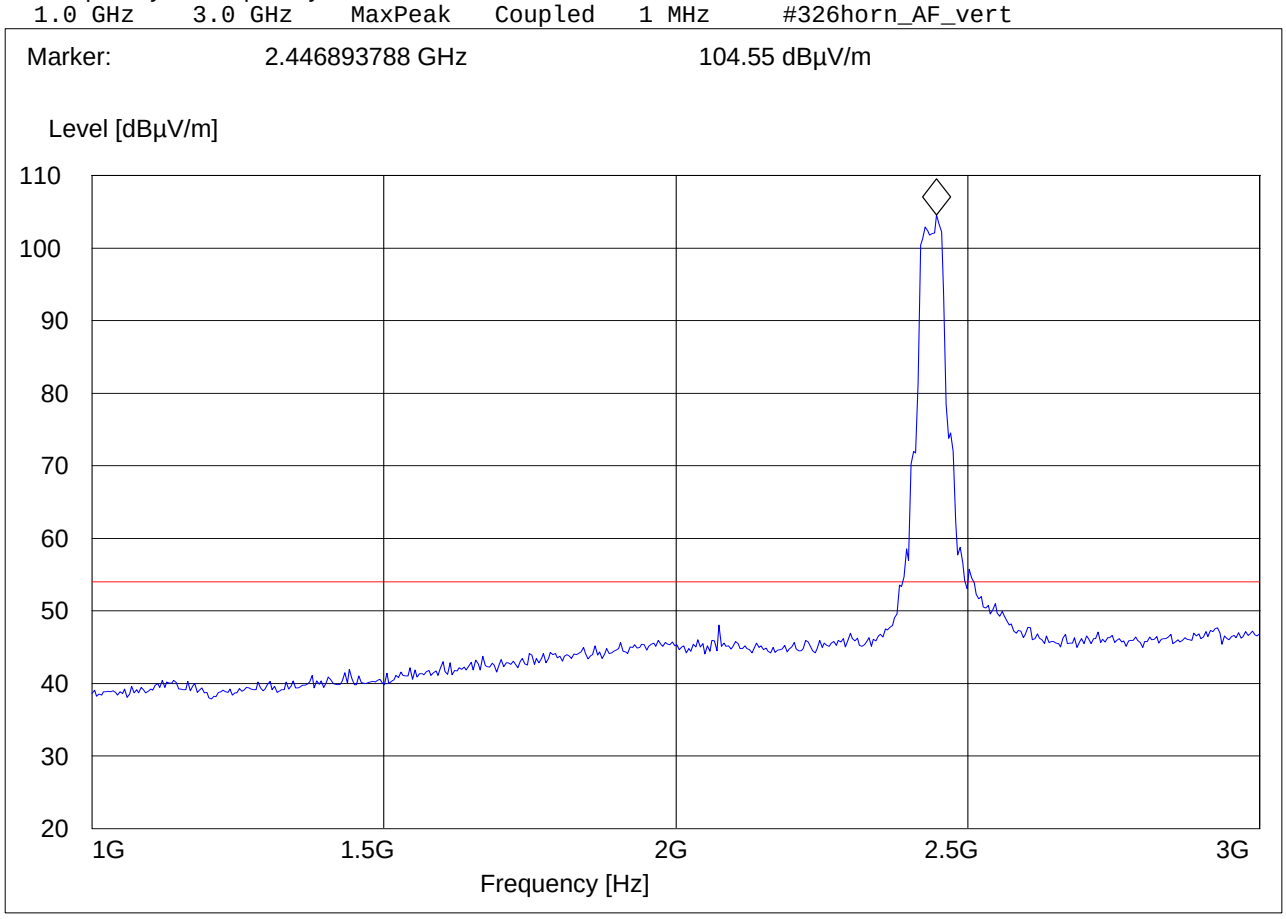
1-3GHz (2447MHz) Chain AB

Note: The peak above the limit line is the carrier freq.
Note: Peak Reading vs. Average limit

```
EUT:              026
Customer::        Elektrobit
Test Mode:        802.11n, 40MHz
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Chris
Voltage:          AC
Comments:
```

SWEEP TABLE: "FCC15.247_1-3G"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	3.0 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_vert



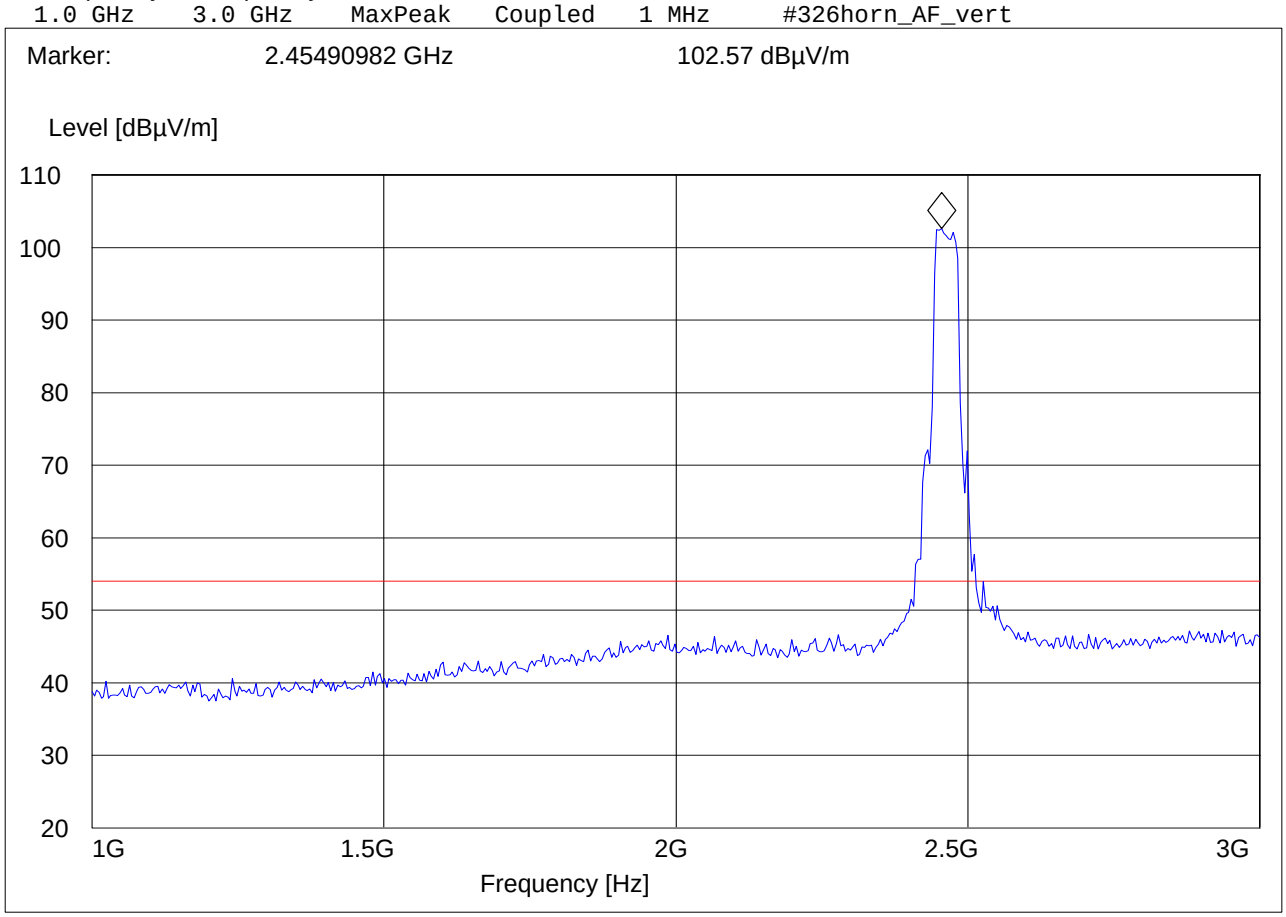
1-3GHz (2452MHz) Chain AB

Note: The peak above the limit line is the carrier freq.
Note: Peak Reading vs. Average limit

```
EUT:              026
Customer::        Elektrobit
Test Mode:        802.11n, 40MHz
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Chris
Voltage:          AC
Comments:
```

SWEEP TABLE: "FCC15.247_1-3G"

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	3.0 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_vert



3-18GHz (2422MHz) Chain AB

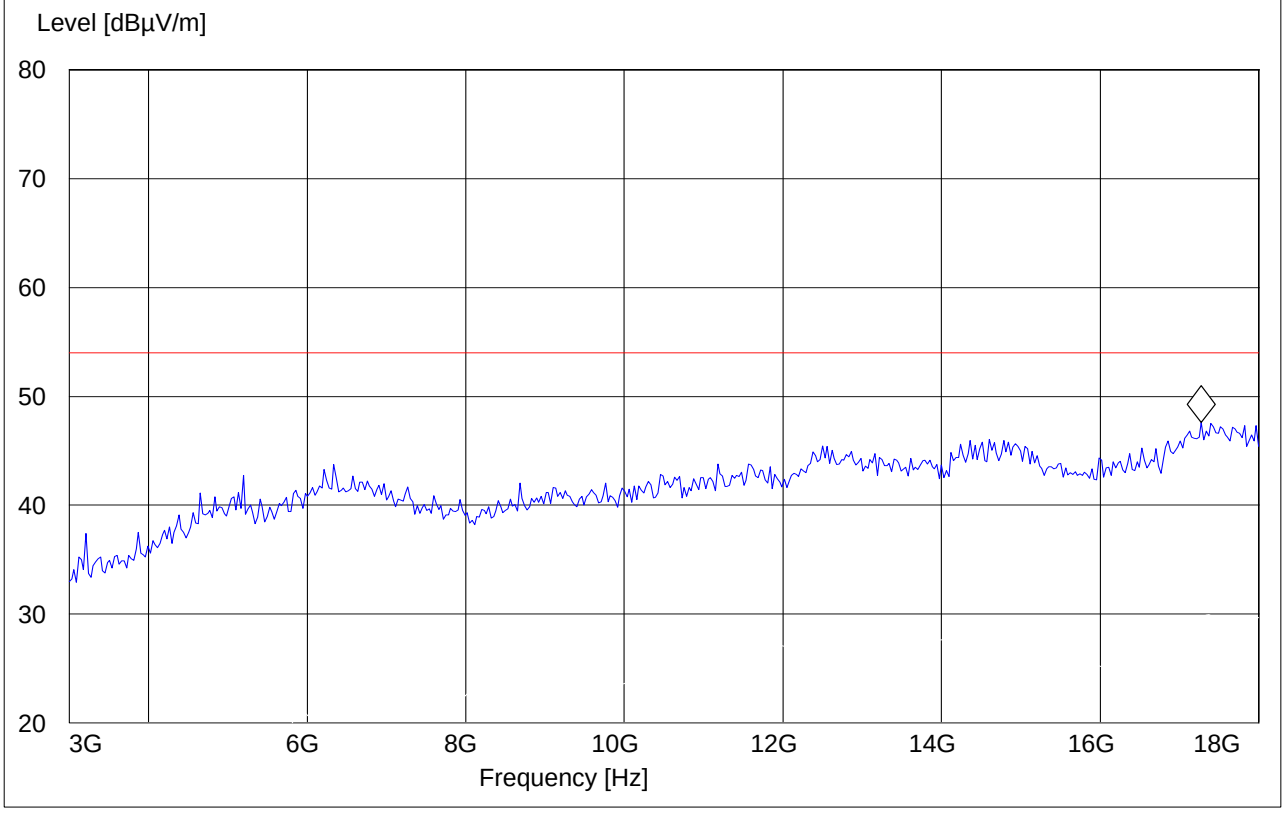
Note: Peak Reading vs. Average limit

EUT: 026
Customer:: Elektrobit
Test Mode: 802.11n, 40MHz
ANT Orientation: V
EUT Orientation: H
Test Engineer: Chris
Voltage: AC
Comments:

SWEEP TABLE: "FCC15.247_3-18G"

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

Marker: 17.278557114 GHz 47.6 dBµV/m



3-18GHz (2447MHz) Chain AB

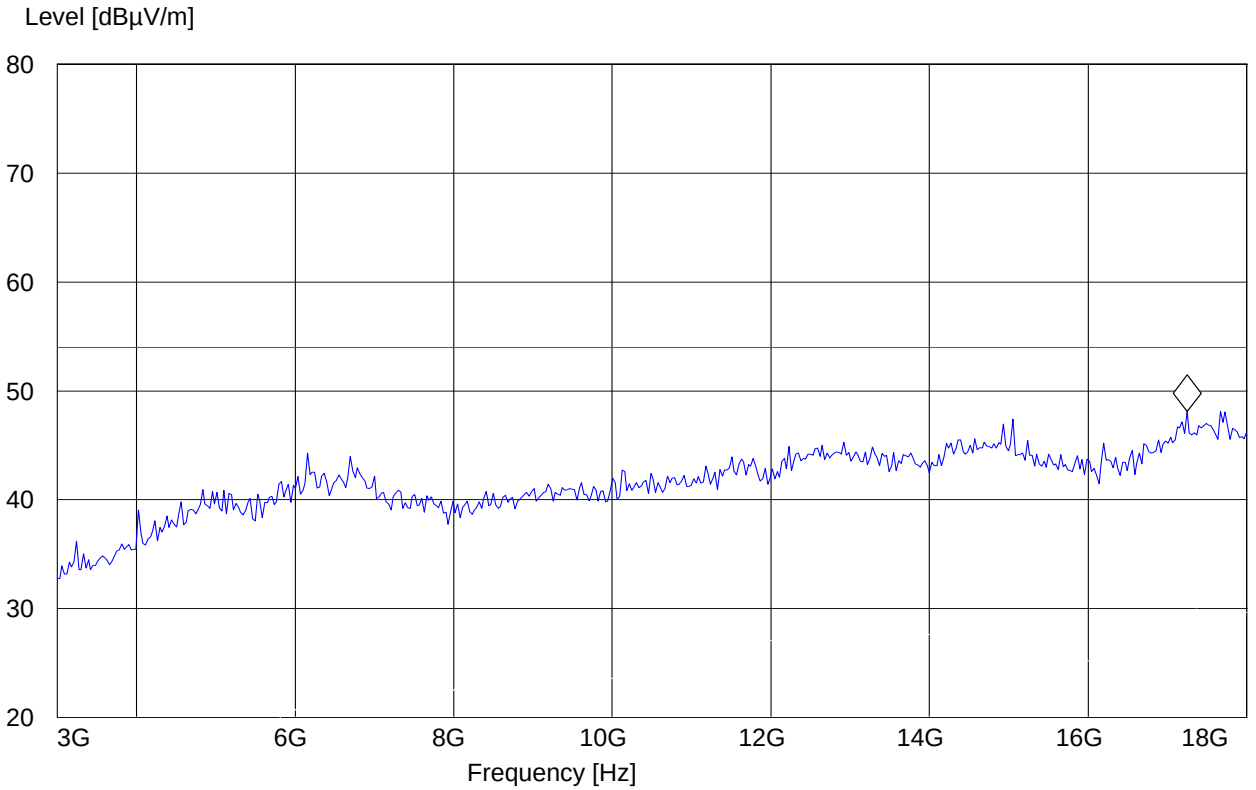
Note: Peak Reading vs. Average limit

EUT: 026
Customer:: Elektrobit
Test Mode: 802.11n, 40MHz
ANT Orientation: V
EUT Orientation: H
Test Engineer: Chris
Voltage: AC
Comments:

SWEEP TABLE: "FCC15.247_3-18G"

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

Marker: 17.248496994 GHz 48.13 dBµV/m



3-18GHz (2452MHz) Chain AB

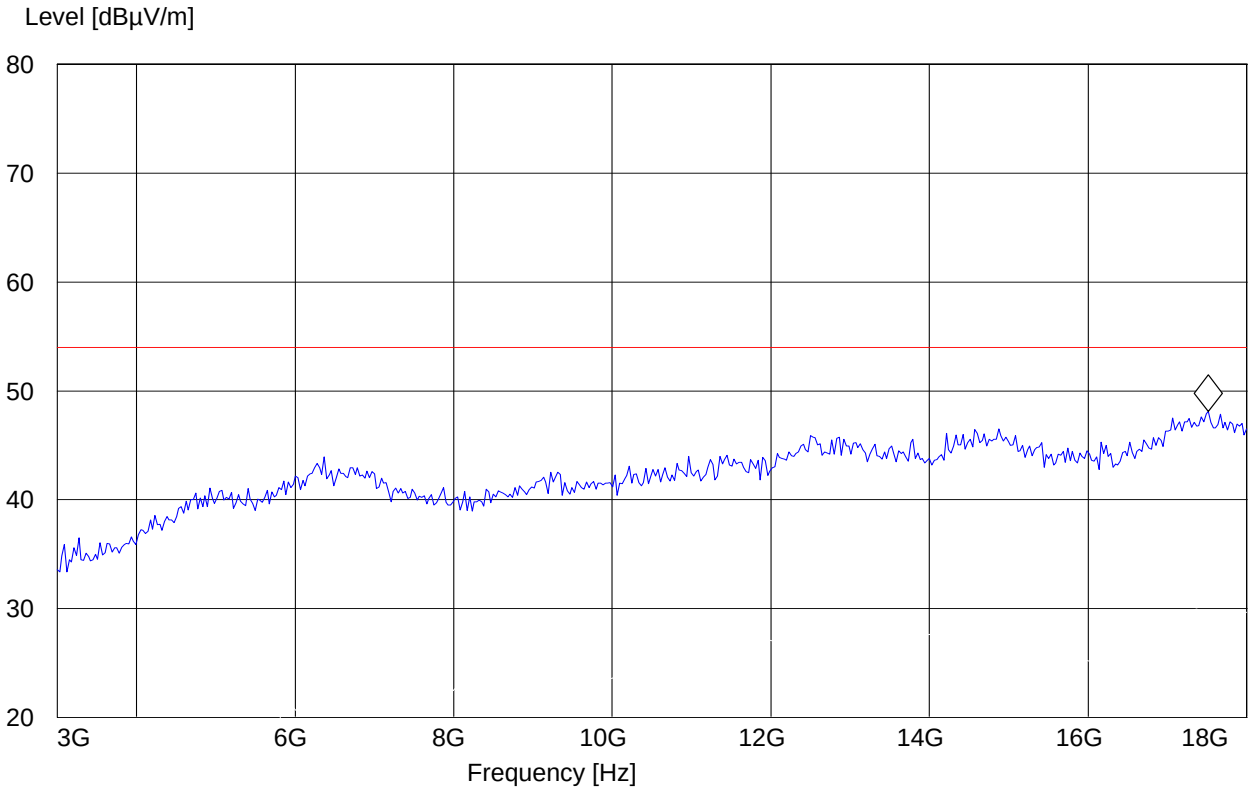
Note: Peak Reading vs. Average limit

EUT: 026
Customer:: Elektrobit
Test Mode: 802.11n, 40MHz
ANT Orientation: V
EUT Orientation: H
Test Engineer: Chris
Voltage: AC
Comments:

SWEEP TABLE: "FCC15.247_3-18G"

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

Marker: 17.519038076 GHz 48.1 dBµV/m



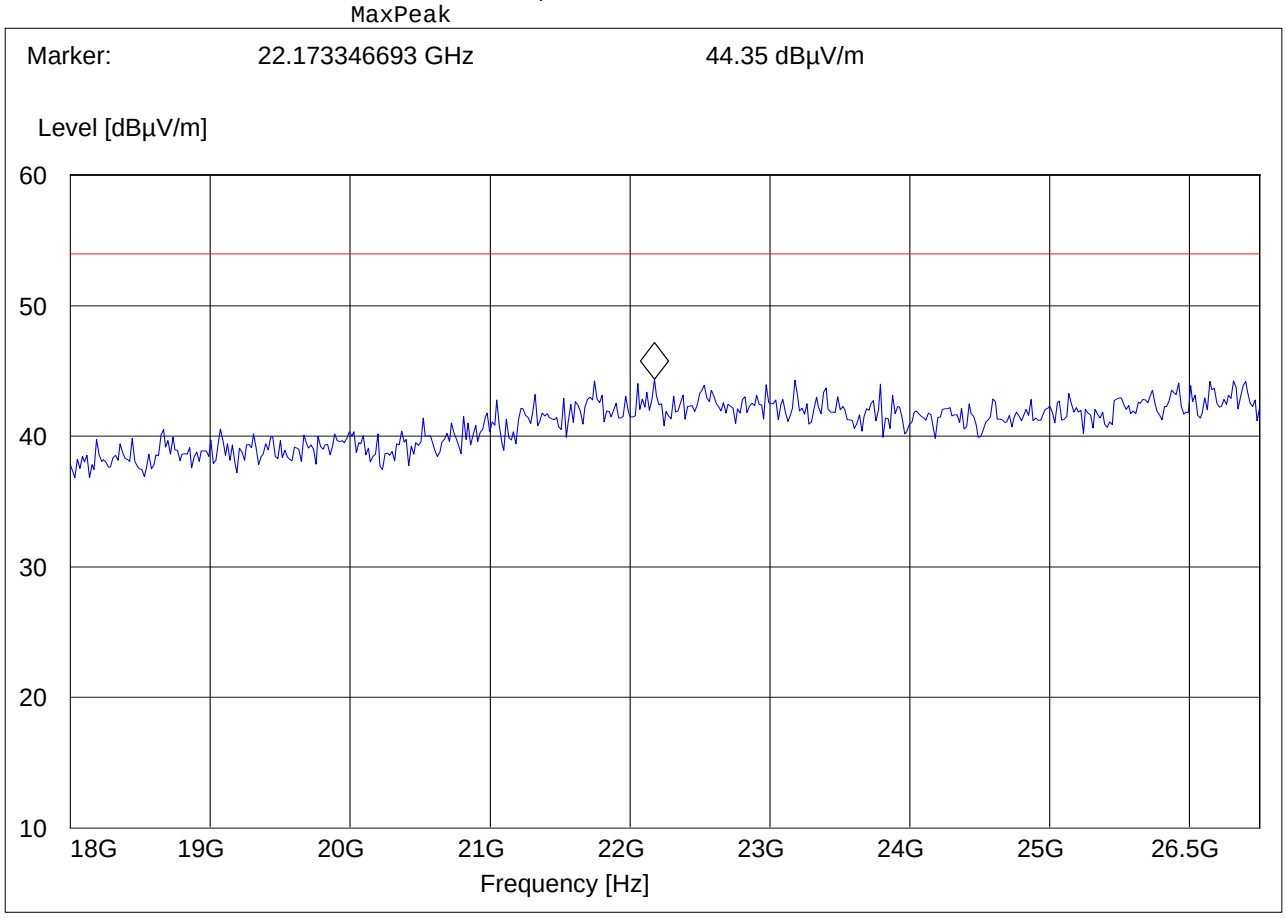
18-26.5GHz Chain AB

Note: This plot is valid for low, mid, high channels (worst-case plot)
Note: Peak Reading vs. Average limit

```
EUT:              026
Customer::        Elektrobit
Test Mode:        802.11n, 40MHz
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Chris
Voltage:          AC
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 MaxPeak	Coupled	100 kHz	Horn # 3116_18-40G



5.4 Receiver Spurious Emission § 15.209/RSS210

5.4.1 Limits

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

NOTE:

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 25 GHz very short cable connections to the antenna was used to minimize the noise level.

2. All measurements are done in peak mode using an average limit unless specified with the plots.

3. There are no measurable emissions up to 18GHz in Rx mode.

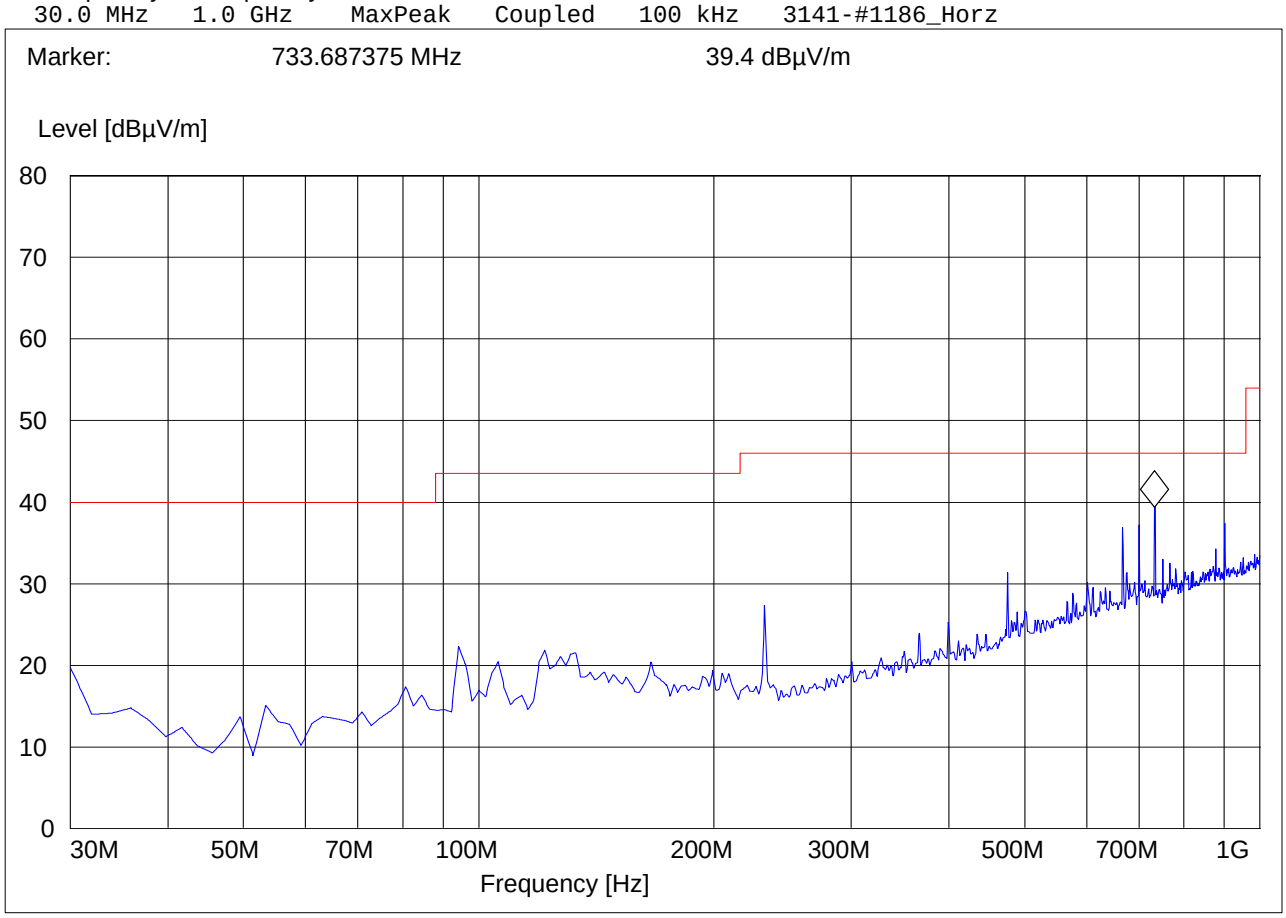
5.4.2 RESULTS 802.11 (ng) HT20 MODE Chain AB
30MHz – 1GHz, Antenna: Horizontal

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

```
EUT:              026
Customer::        Elektrobit
Test Mode:        RX mode; 20 MHz BW
ANT Orientation:  H
EUT Orientation:  H
Test Engineer:    Satya
Voltage:          Power Cable
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



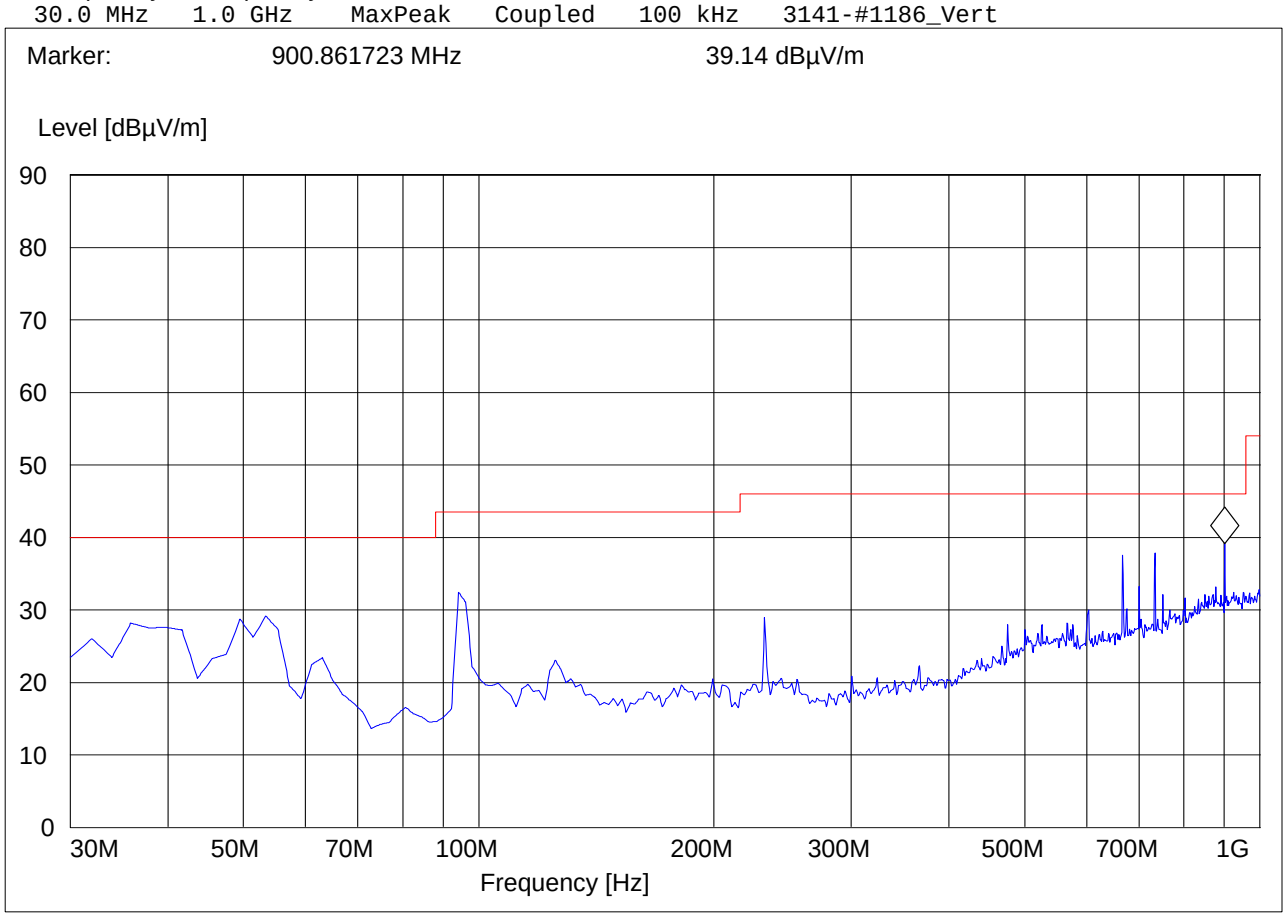
30MHz – 1GHz, Antenna: Vertical

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

EUT: 026
Customer:: Elektrobit
Test Mode: RX mode; 20 MHz BW
ANT Orientation: V
EUT Orientation: H
Test Engineer: Satya
Voltage: Power Cable
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



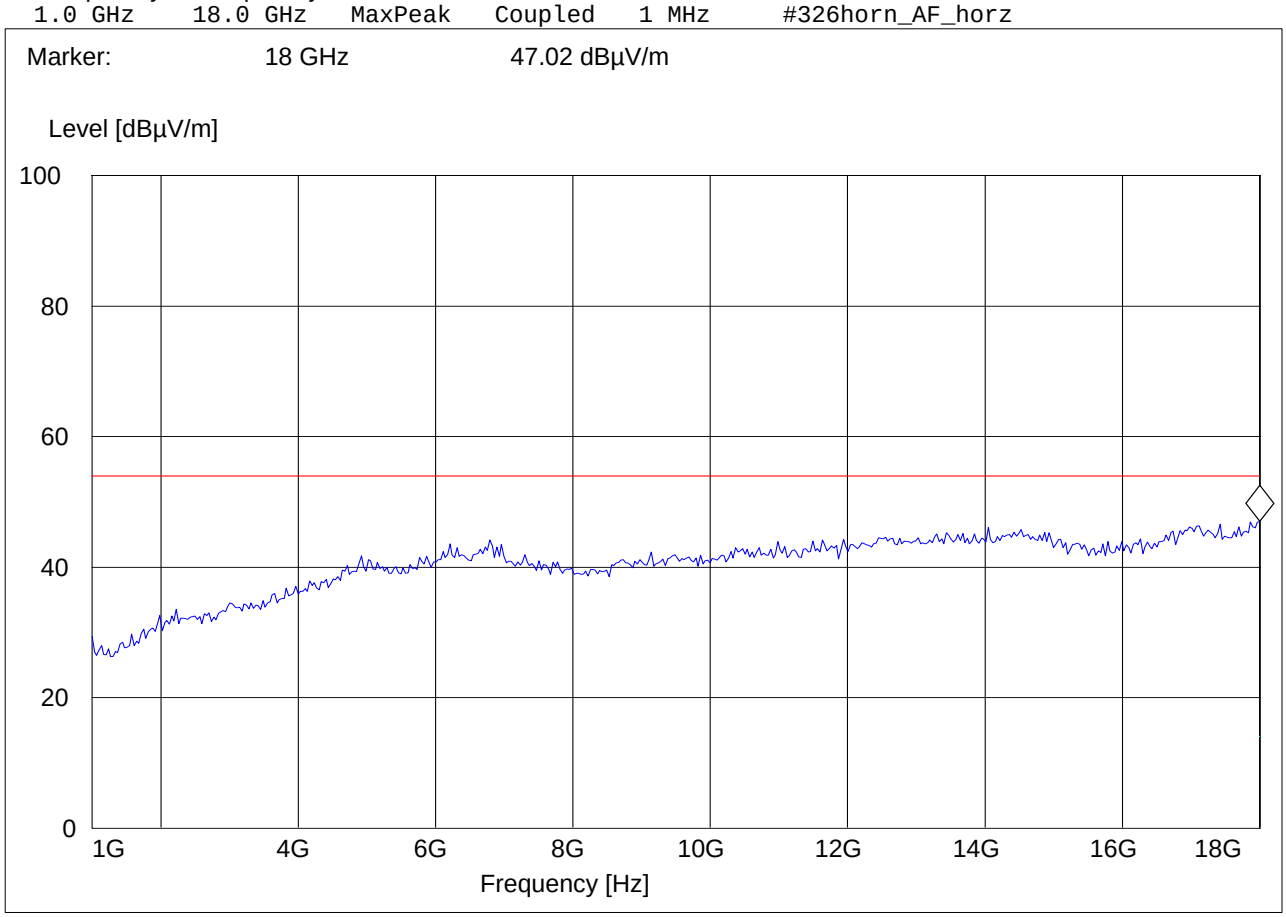
1-18GHz Chain AB

Note: The peak above the limit line is the carrier freq.
Note: Peak Reading vs. Average limit

```
EUT / Description: 026
Manufacturer:      Elektrobit
Operation Mode:    RX mode; 20 MHz BW
ANT Orientation: : H
EUT Orientation::  H
Test Engineer:     Chris
Voltage:           Power cable
Comments::
```

SWEEP TABLE: "FCC 15.407 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



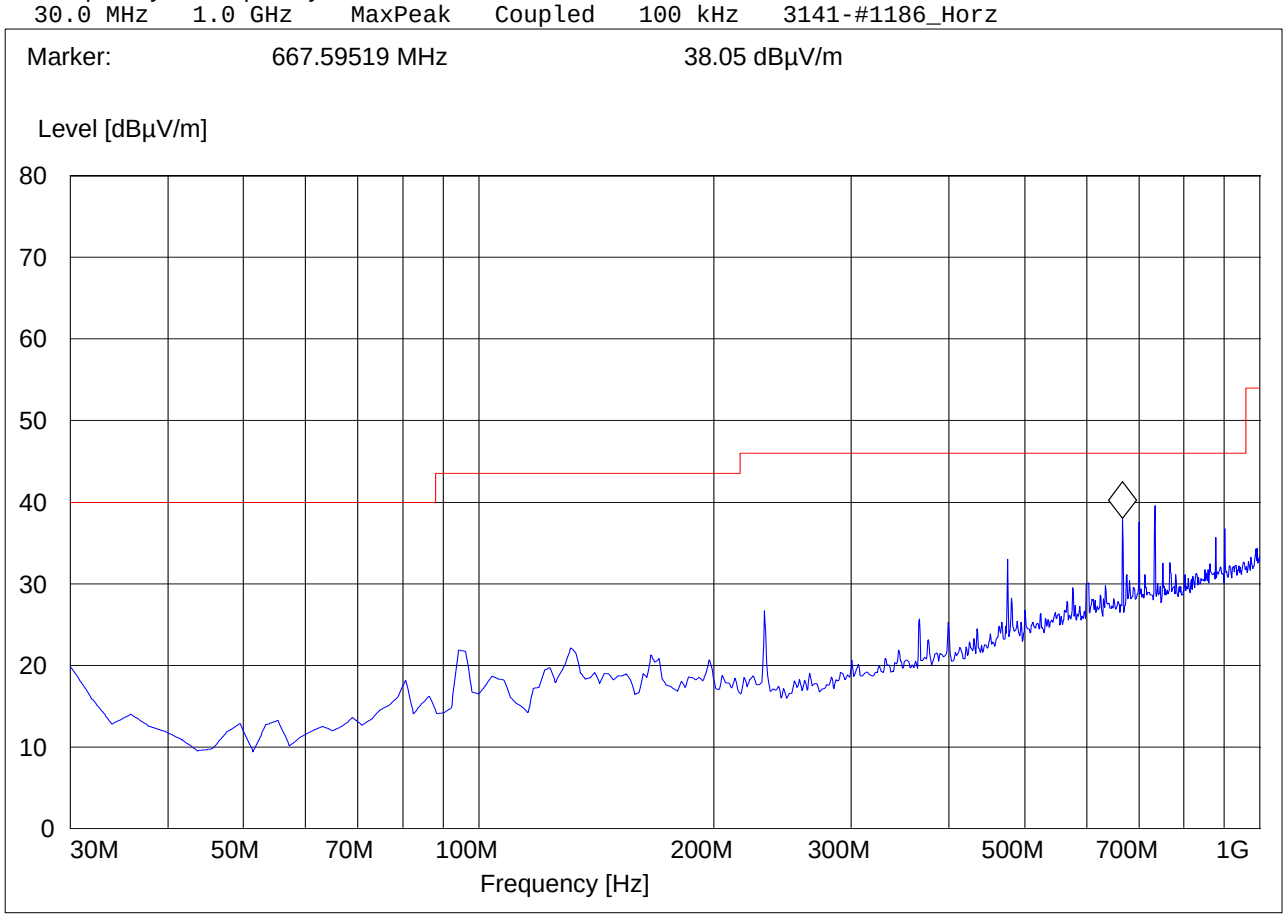
5.4.3 RESULTS 802.11 (ng) HT40 MODE Chain AB
30MHz – 1GHz, Antenna: Horizontal

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

```
EUT:              026
Customer::        Elektrobit
Test Mode:        RX mode
ANT Orientation:  H
EUT Orientation:  H
Test Engineer:    Satya
Voltage:          Power Cable
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



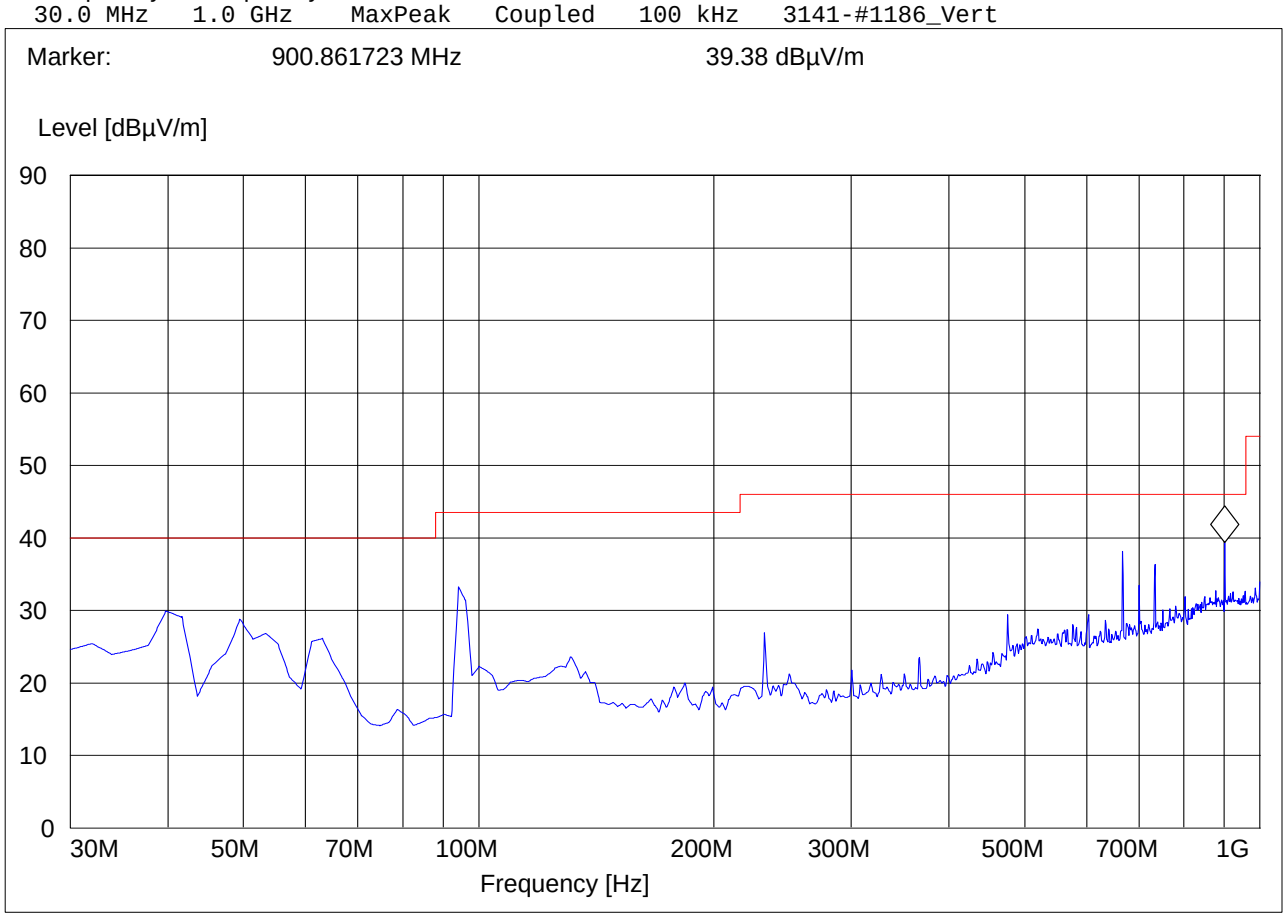
30MHz – 1GHz, Antenna: Vertical

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

```
EUT:              026
Customer::        Elektrobit
Test Mode:        RX mode
ANT Orientation:  V
EUT Orientation:  H
Test Engineer:    Satya
Voltage:          Power Cable
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



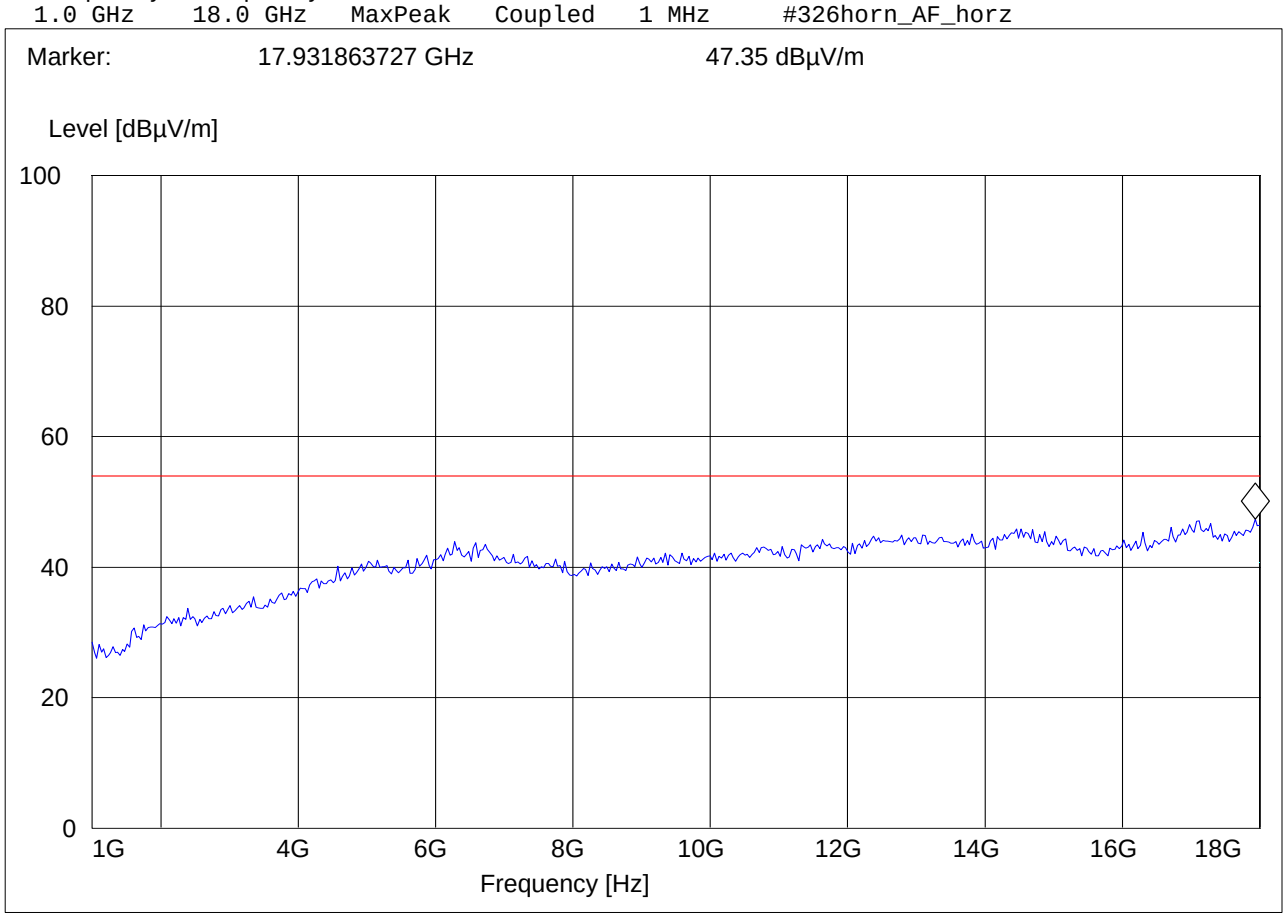
1-18GHz Chain AB

Note: The peak above the limit line is the carrier freq.
Note: Peak Reading vs. Average limit

```
EUT / Description: 026
Manufacturer:      Elektrobit
Operation Mode:    Rx Mode
ANT Orientation: : H
EUT Orientation::  H
Test Engineer:     Satya
Voltage:           Power cable
Comments::
```

SWEEP TABLE: "FCC 15.407 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



6 Conducted Measurements

6.1 6dB bandwidth and 99% bandwidth.

6.1.1 Limit

FCC15.247(a)(2) Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

RSS210 A8.2 (a): The minimum 6 dB bandwidth shall be at least 500 kHz.

6.1.2 Measurement Result:

HT20 Mode:

Channel Frequency (MHz)		6dB Bandwidth (MHz)	99% Bandwidth (MHz)
2412	Chain A	17.56	17.88
	Chain B	17.56	17.76
2437	Chain A	17.63	17.82
	Chain B	17.56	17.82
2462	Chain A	17.63	17.88
	Chain B	17.56	17.82
Min:		**17.56**	**17.76**

HT40 Mode:

Channel Frequency (MHz)		6dB Bandwidth (MHz)	99% Bandwidth (MHz)
2422	Chain A	36.54	36.92
	Chain B	36.41	36.92
2447	Chain A	36.41	36.92
	Chain B	36.54	36.92
2452	Chain A	36.56	38.64
	Chain B	36.71	38.00
Min:		**36.71**	**38.64**

6.2 Conducted Power Measurement

6.2.1 Limit

FCC15.247 (b)(3): For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt

RSS210 A8.4(4): For systems employing digital modulation techniques operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz, the maximum peak conducted output power shall not exceed 1 W. Except as provided in Section A8.4(5), the e.i.r.p. shall not exceed 4 W.

6.2.2 Results

The peak conducted power is measured with a power sensor with thermal detector. The EUT is set to transmit at 100% duty cycle and powers from all three transmit ports are measured. The two highest powers measured are reported here. Calculated directional gain of the two transmit port is 5.6dBi and the EUT does not support TPC.

HT20 Mode

Frequency (MHz)	Chain A (dBm)	Chain B (dBm)	Total (dBm)	Margin (dBm)
2412	10.6	10.4	13.5	16.5
2437	10.6	10.6	13.6	16.4
2462	10.3	10.8	13.6	16.4

HT40 Mode

Frequency (MHz)	Chain A (dBm)	Chain B (dBm)	Total (dBm)	Margin (dBm)
2422	10.2	10.5	13.4	16.6
2447	10.2	10.6	13.4	16.6
2452	10.0	11.0	13.5	16.5

6.3 Power Spectral Density

6.3.1 Limit

FCC 15.247 (e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

6.3.2 Results

The peak conducted power is measured with a combiner, spectrum analyzer and method 1 specified in FCC public knowledge DA-02-2138A1. The EUT is set to transmit at 100% duty cycle and powers from the two ports with highest transmit power are measured and reported here. The EUT does not support TPC.

HT20 Mode

Frequency (MHz)	Power Spectral Density (dBm)	Margin (dBm)
2412	-7.88	15.88
2437	-7.82	15.82
2462	-6.68	14.68

HT40 Mode

Frequency (MHz)	Power Spectral Density (dBm)	Margin (dBm)
2422	-7.93	15.93
2447	-8.20	16.20
2452	-6.40	14.40

6.4 Conducted Spurious Emission

6.4.1 Limit

§15.247(d) & RSS-210 (A8.5): -30dBc

6.4.2 Results:

Measurement conducted on Chain A with worse case power output. 30M-1GHz emissions are measured in HT20 mode which has worse case power output comparing with HT40 mode.

No measurable emission over the limit. See plots for details.

6.5 AC Power Line Conducted Emissions § 15.107/207

6.5.1 Limits

Technical specification: 15.107 / 15.207 (Revised as of August 20, 2002)

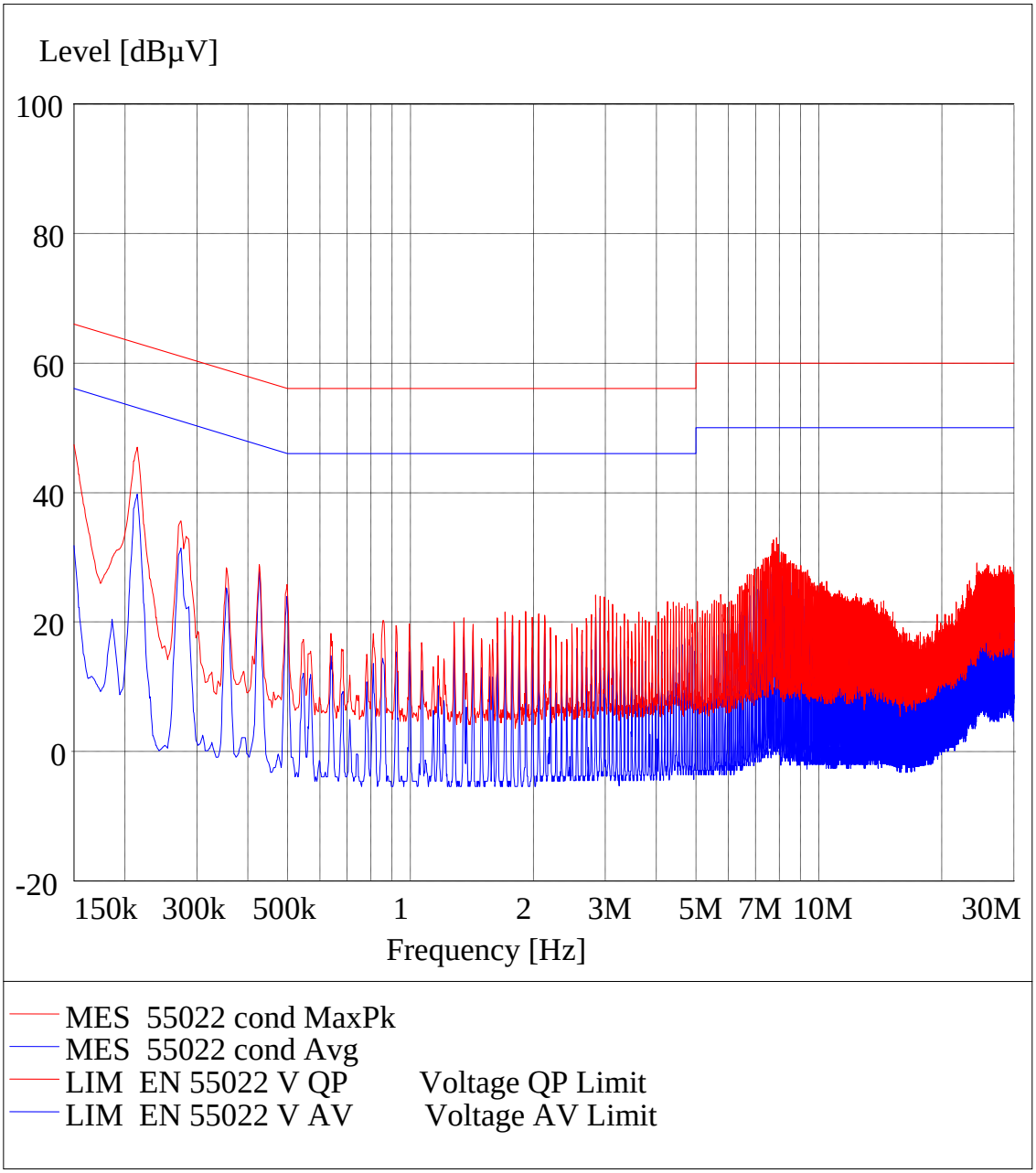
Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-Peak	Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30	60	50
* Decreases with logarithm of the frequency		

ANALYZER SETTINGS: RBW = 10KHz VBW = 10KHz

6.5.2 RESULTS 802.11ng HT20 Mode

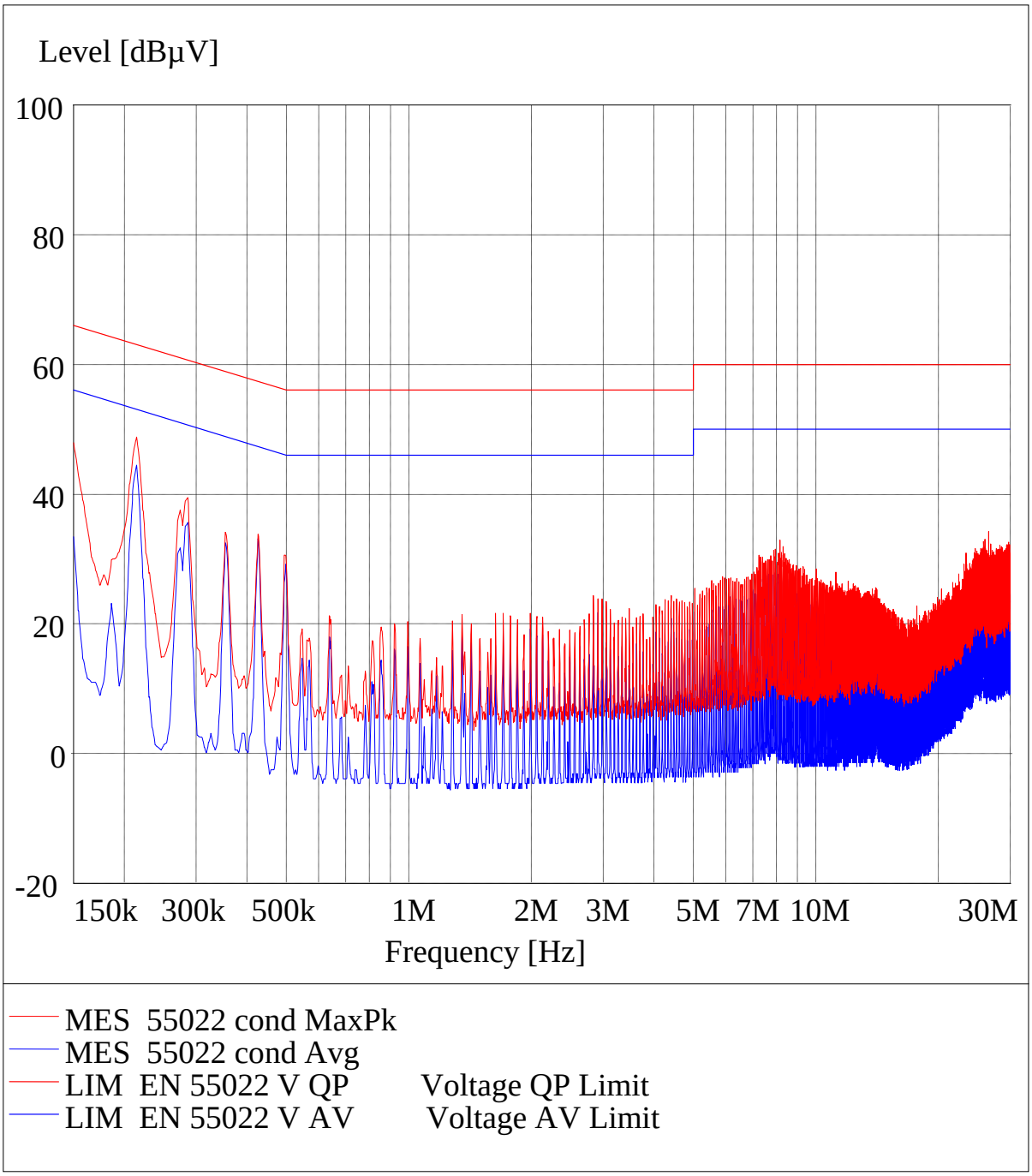
Line:

```
EUT:                026
Manufacturer:       Elektrobit
Test Mode:          802.11g CH.6
ANT Orientation:: Conducted
EUT Orientation:: H
Test Engineer::     Chris
Power Supply: :     Power Cable
Comments:  :        120V Line
```



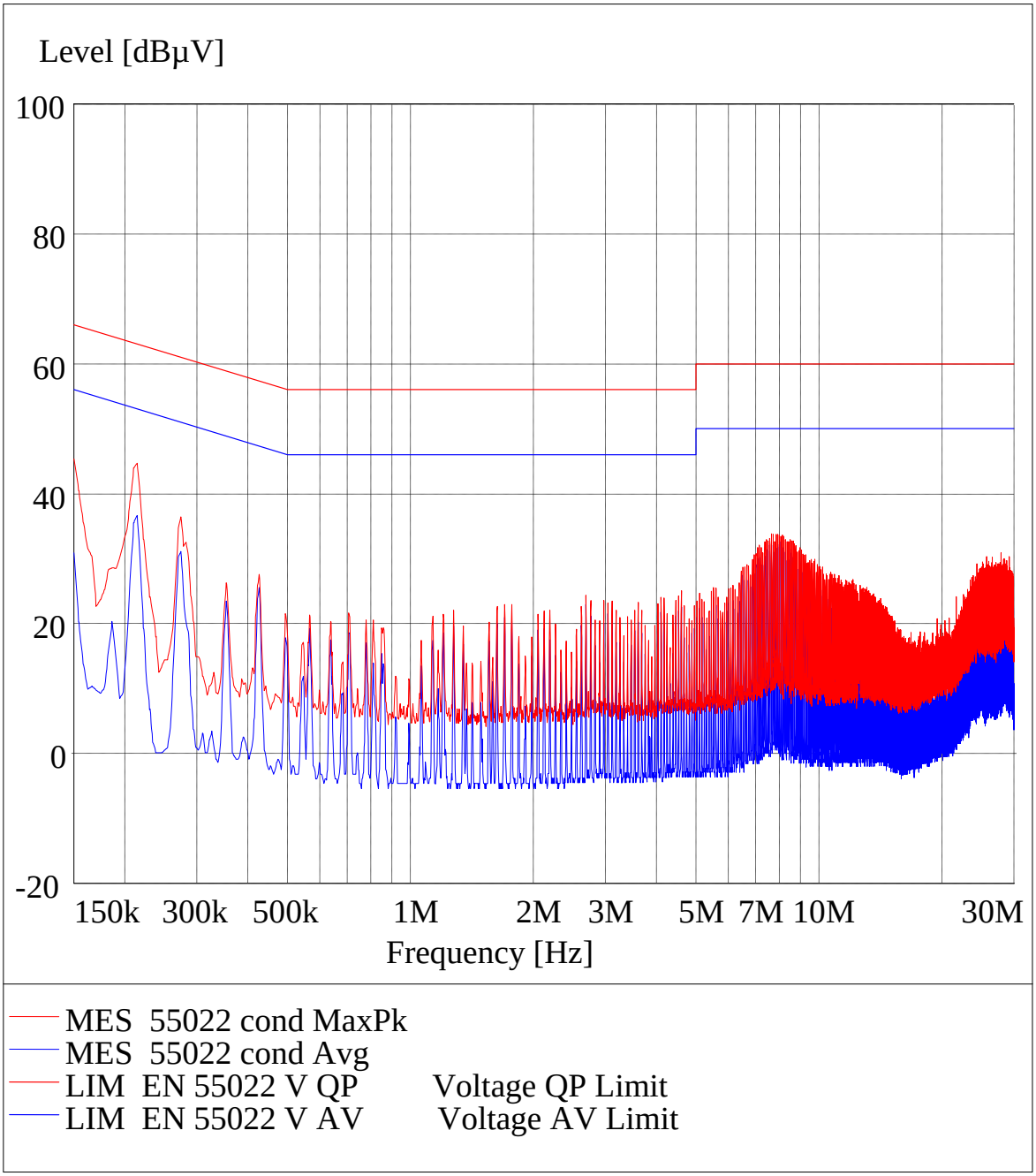
Neutral:

```
EUT:                026
Manufacturer:       Elektrobit
Test Mode:          802.11g CH.6
ANT Orientation:: Conducted
EUT Orientation:: H
Test Engineer::     Chris
Power Supply: :     Power Cable
Comments:  :        120V Neutral
```



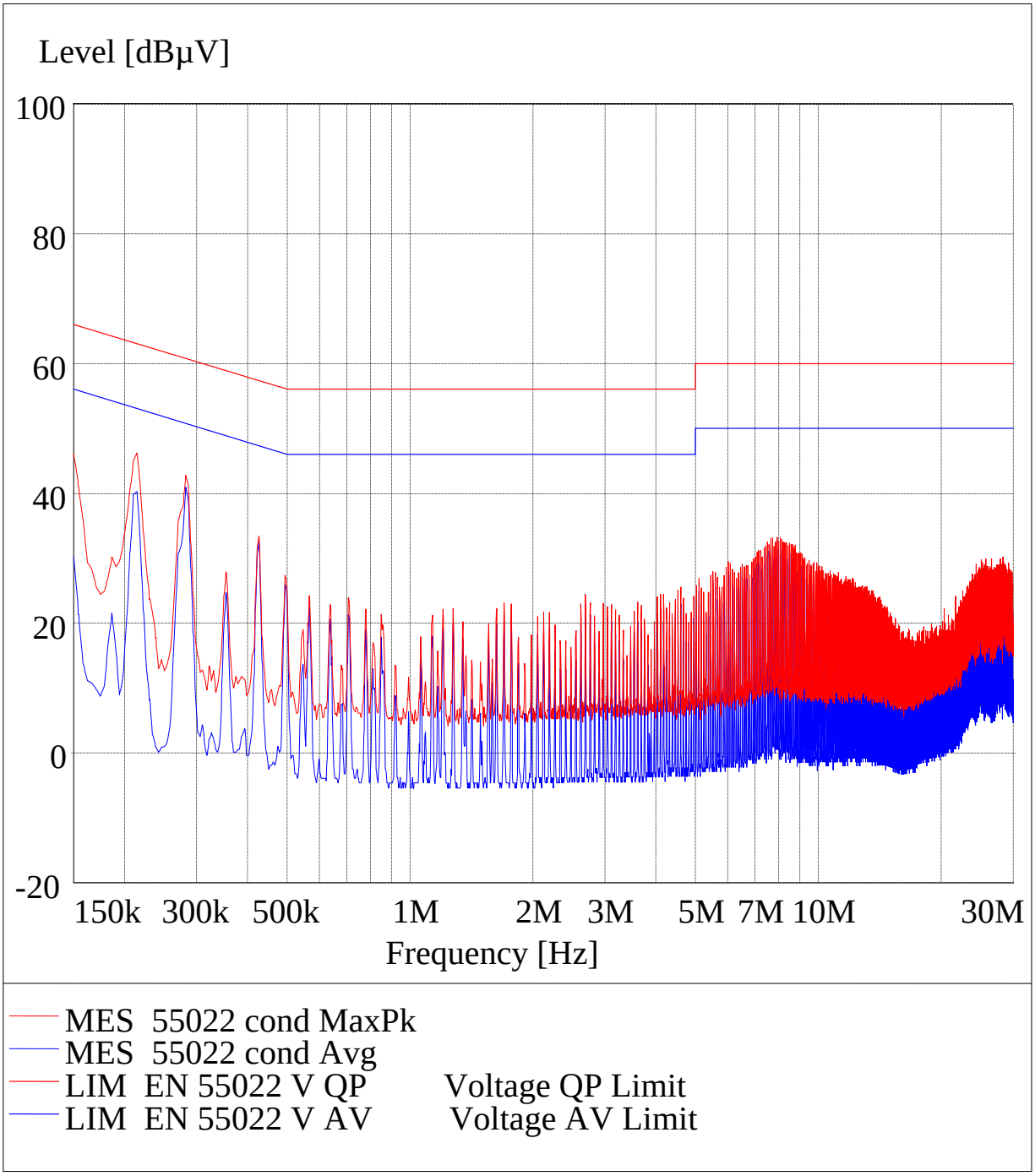
Line, Receiver mode.

```
EUT:                026
Manufacturer:       Elektrobit
Test Mode:          802.11g CH.6; Rx
ANT Orientation:: Conducted
EUT Orientation:: H
Test Engineer::     Chris
Power Supply: :     Power Cable
Comments:  :        120V
```



Neutral, Receiver Mode

```
EUT:                026
Manufacturer:       Elektrobit
Test Mode:          802.11g CH.6; Rx
ANT Orientation:: Conducted
EUT Orientation:: H
Test Engineer::     Chris
Power Supply: :     Power Cable
Comments:  :        120V Neutral
```

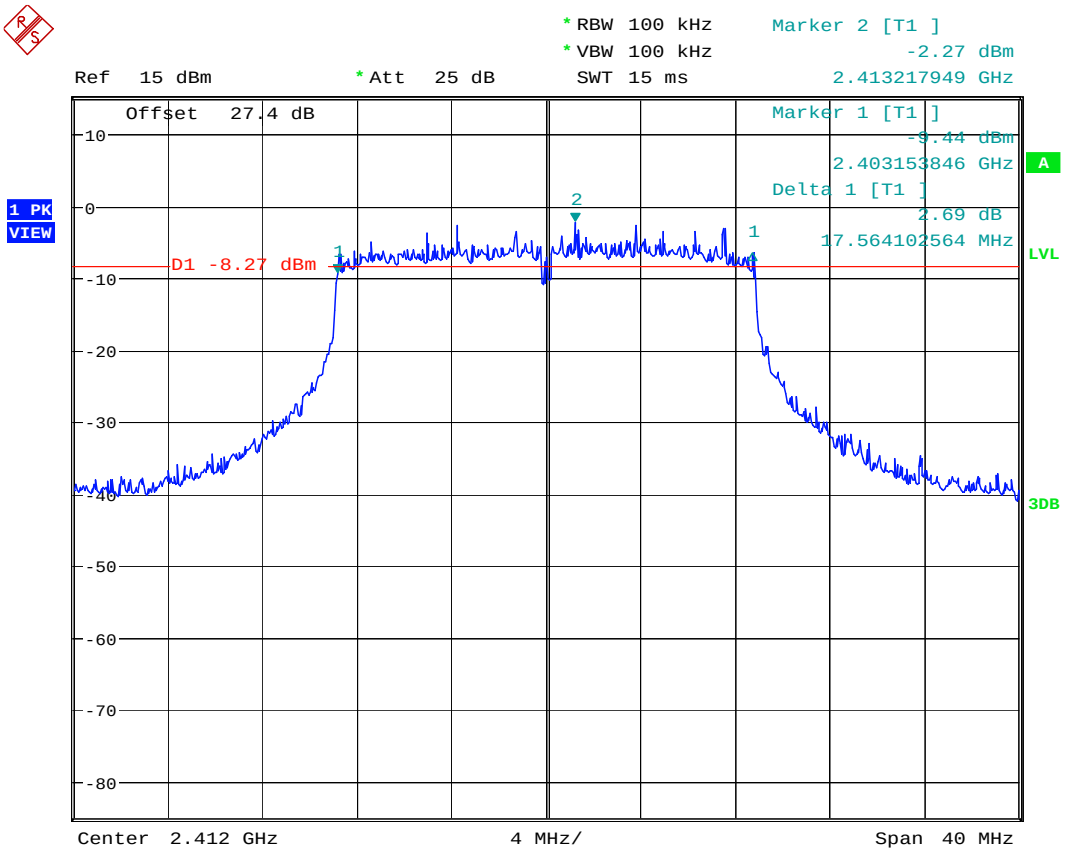


6.6 Conducted Measurement Plots

6.6.1 6dB Bandwidth

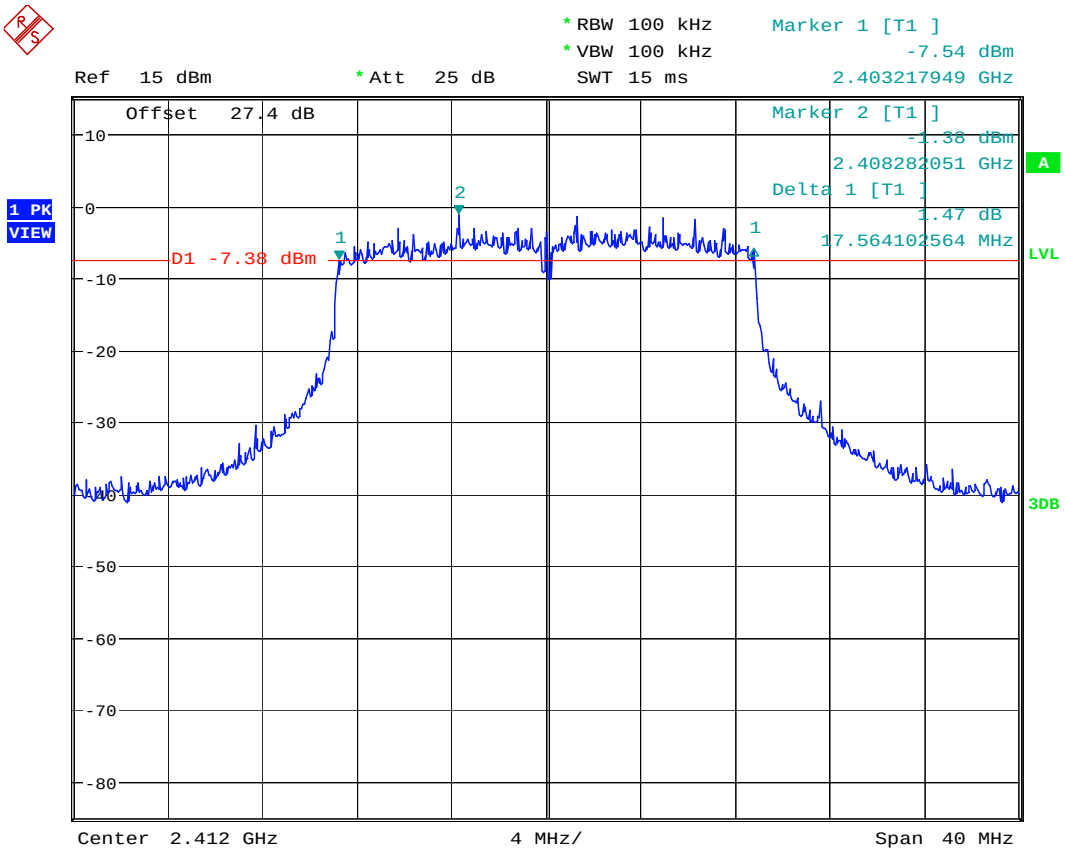
6.6.1.1 802.11ng HT20 Mode

2412MHz Chain A



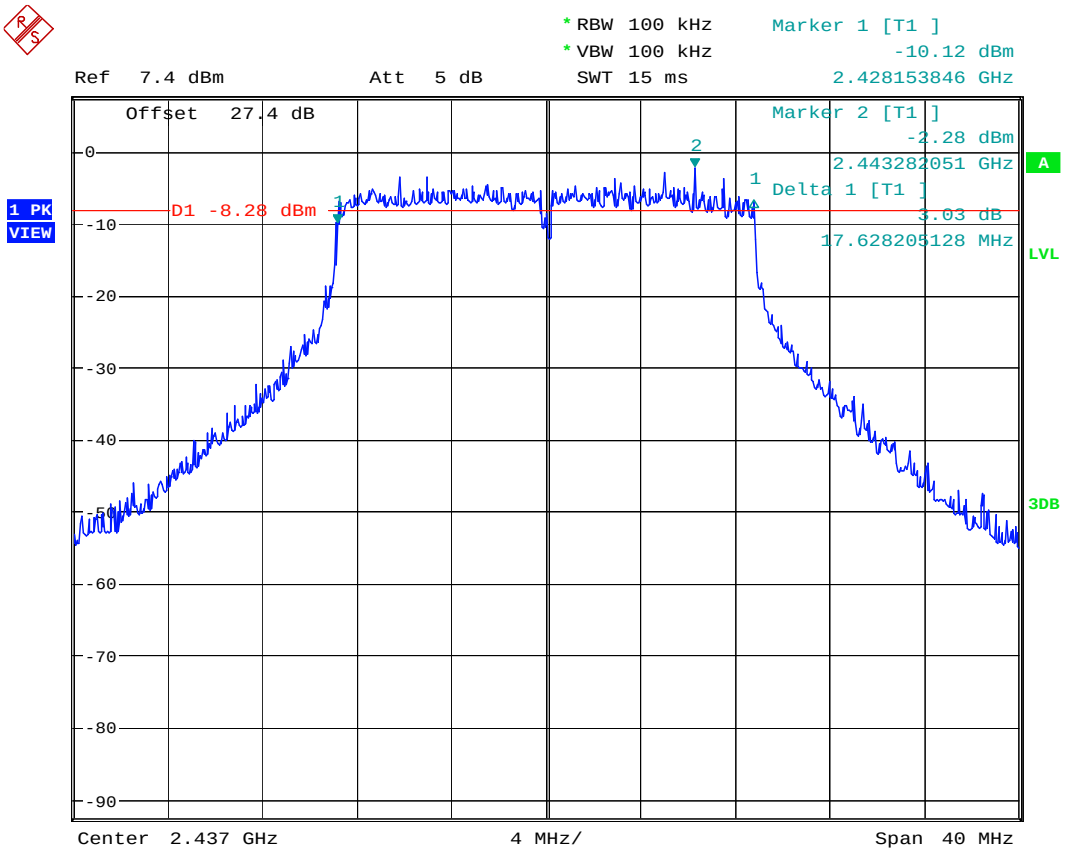
Date: 28.MAR.2008 11:01:18

2412MHz Chain B



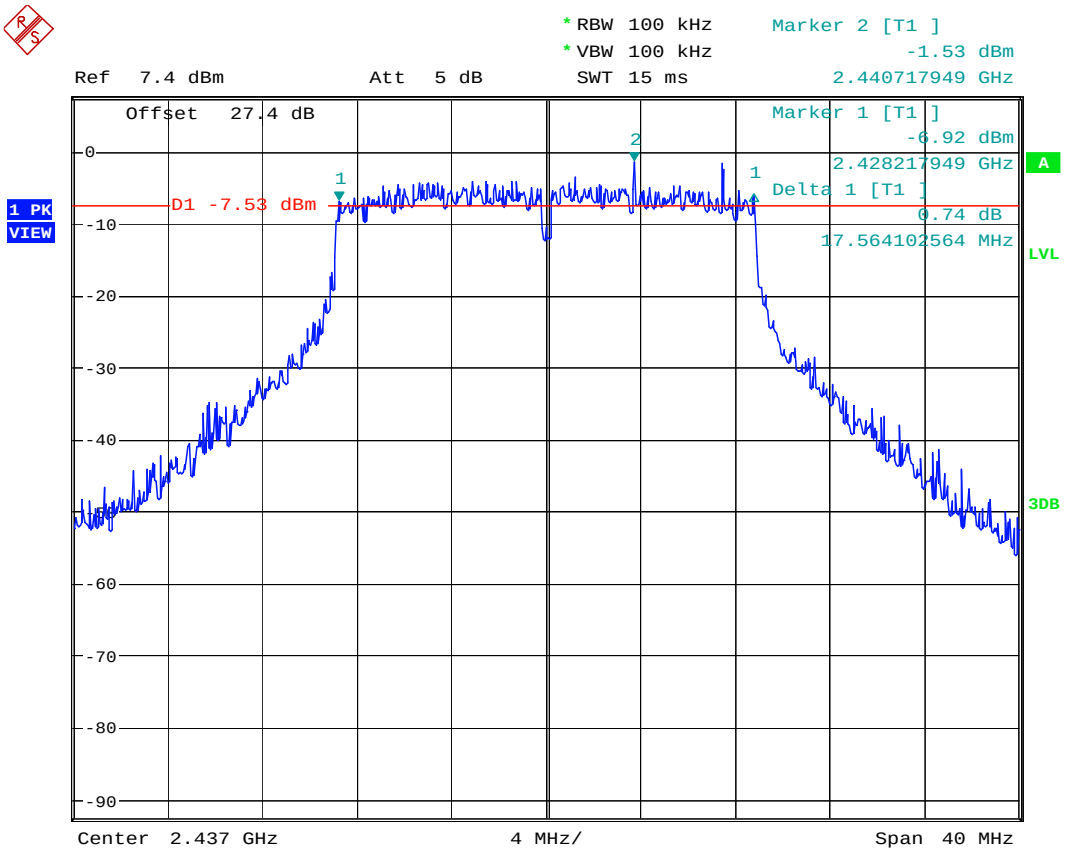
Date: 28.MAR.2008 10:51:27

2437MHz Chain A



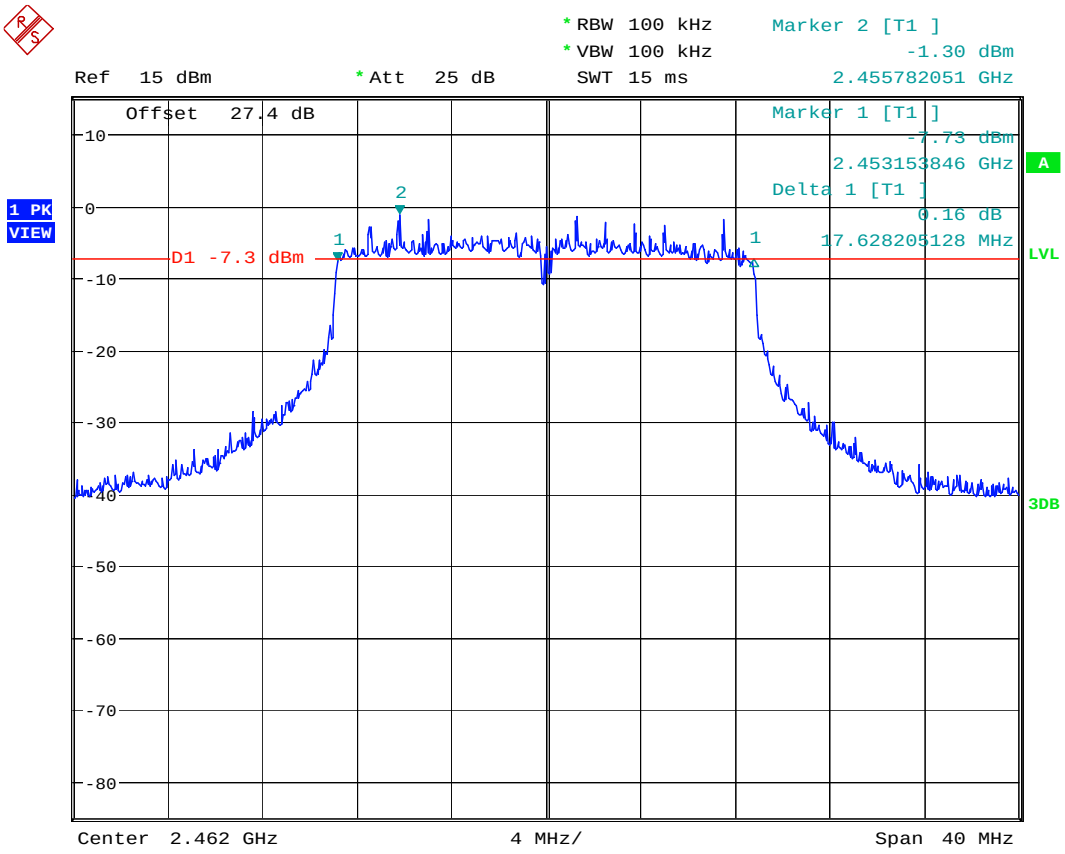
Date: 27.MAR.2008 15:21:59

2437MHz Chain B



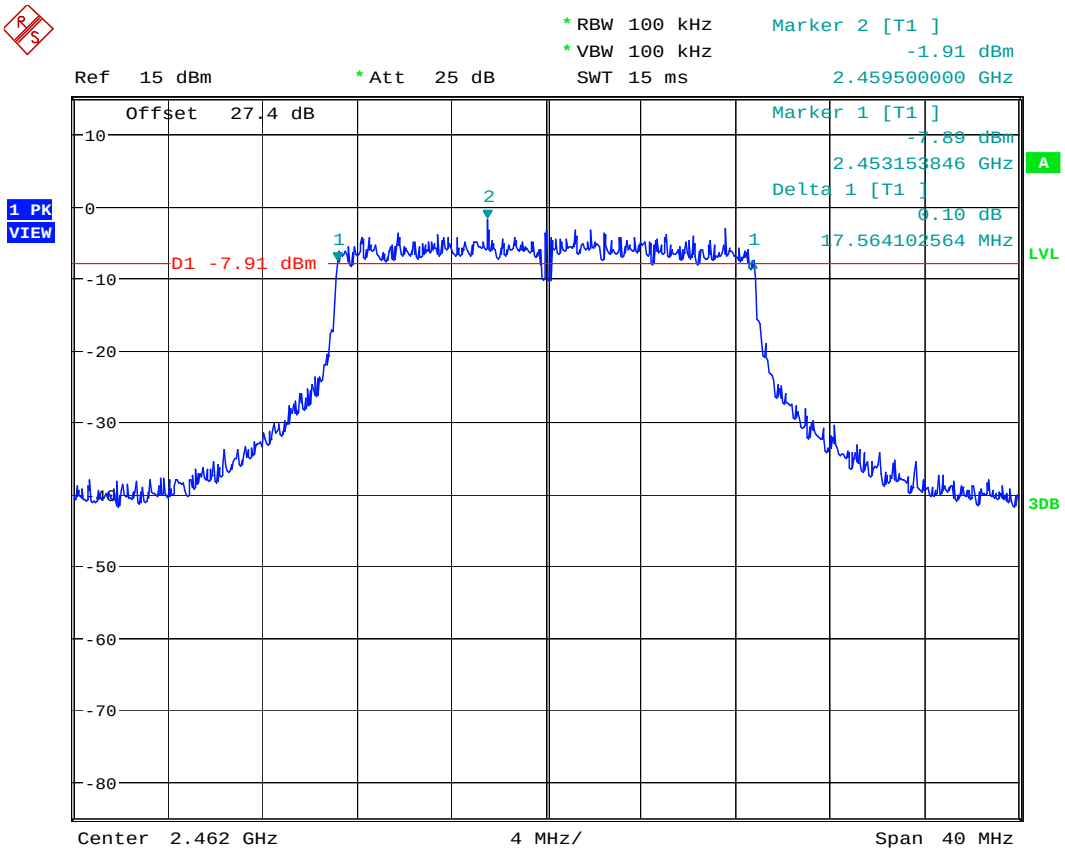
Date: 27.MAR.2008 15:46:33

2462MHz Chain A



Date: 28.MAR.2008 10:58:48

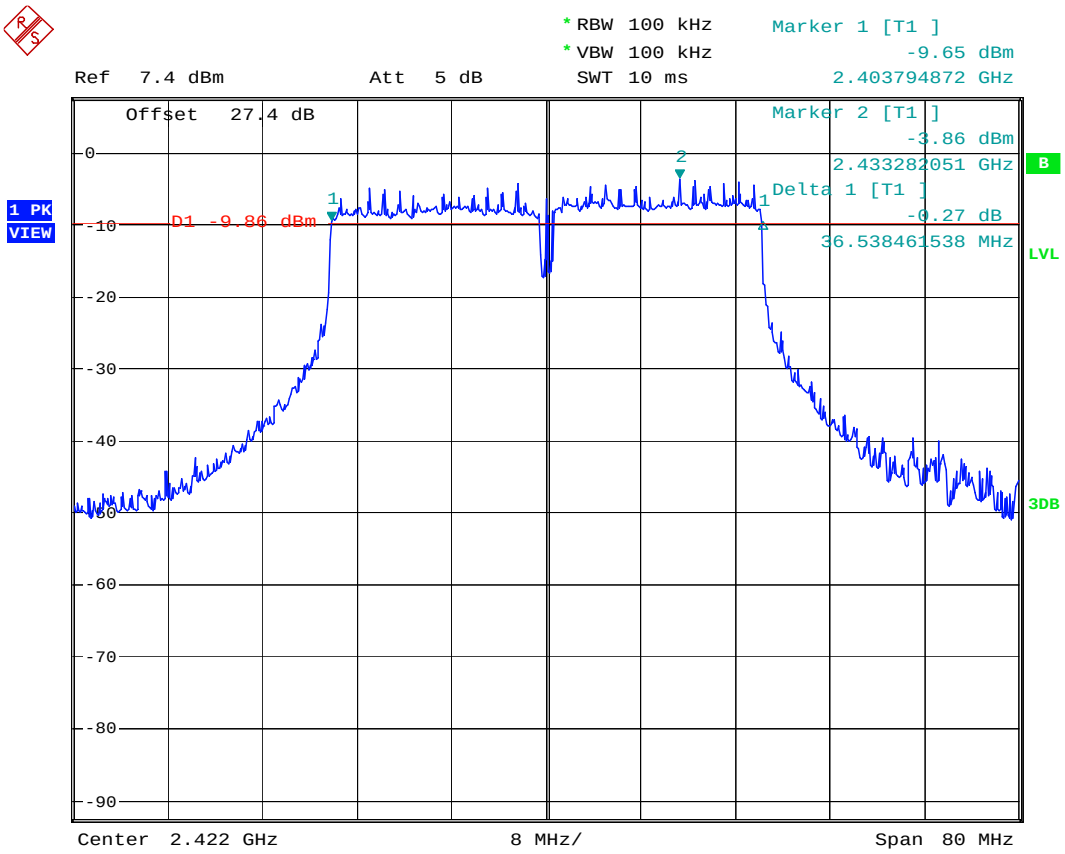
2462MHz Chain B



Date: 28.MAR.2008 10:54:34

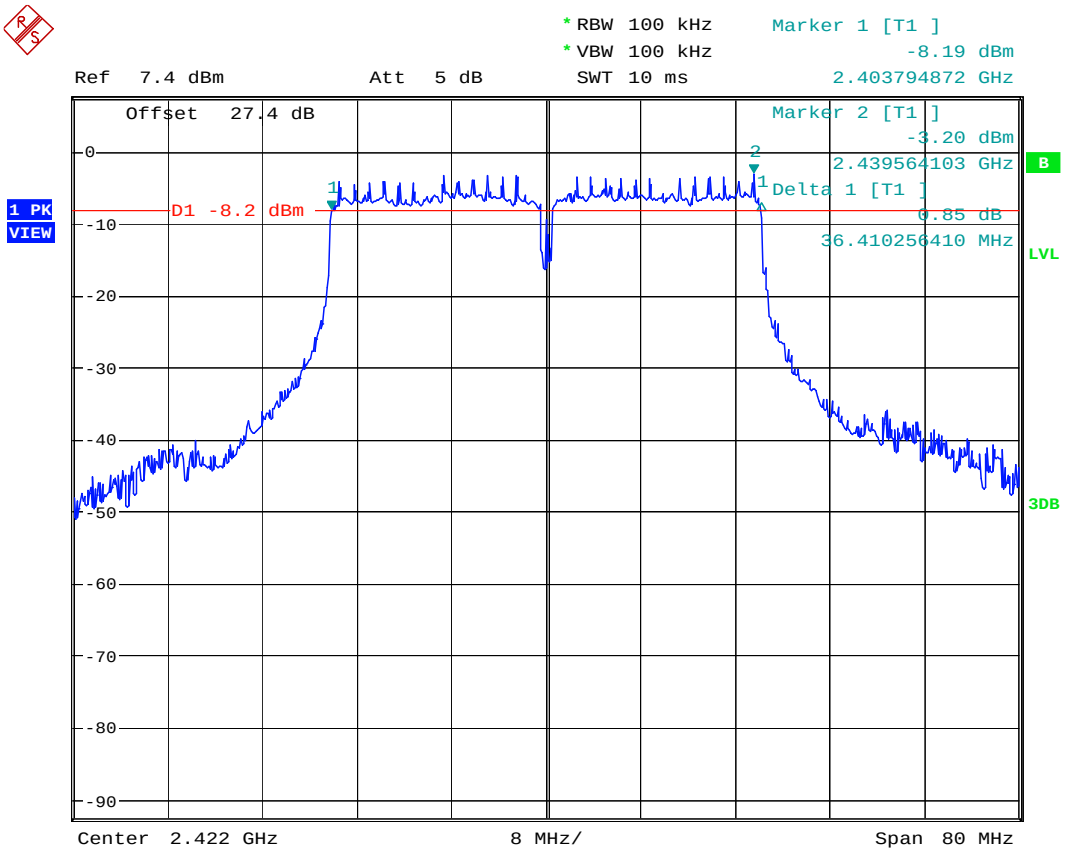
6.6.1.2 802.11ng HT40 Mode

2422MHz Chain A



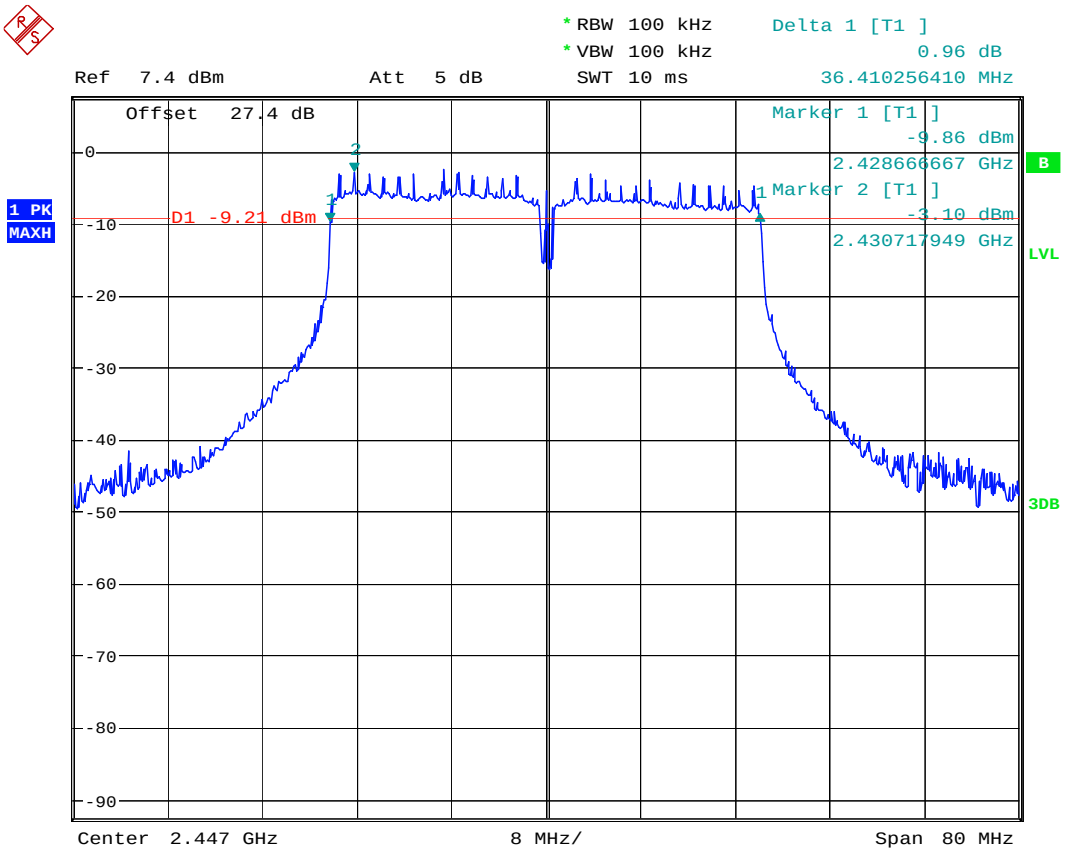
Date: 27.MAR.2008 10:05:14

2422MHz Chain B



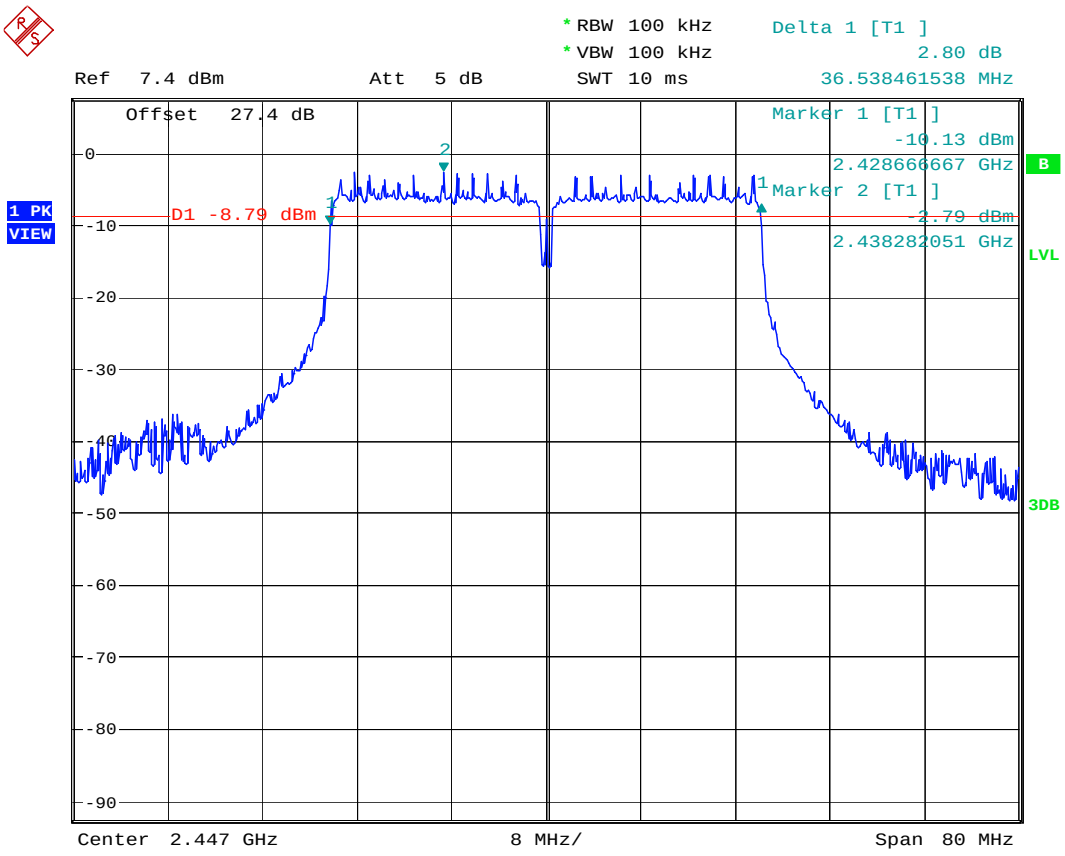
Date: 27.MAR.2008 10:28:53

2447MHz Chain A



Date: 27.MAR.2008 09:47:47

2447MHz Chain B



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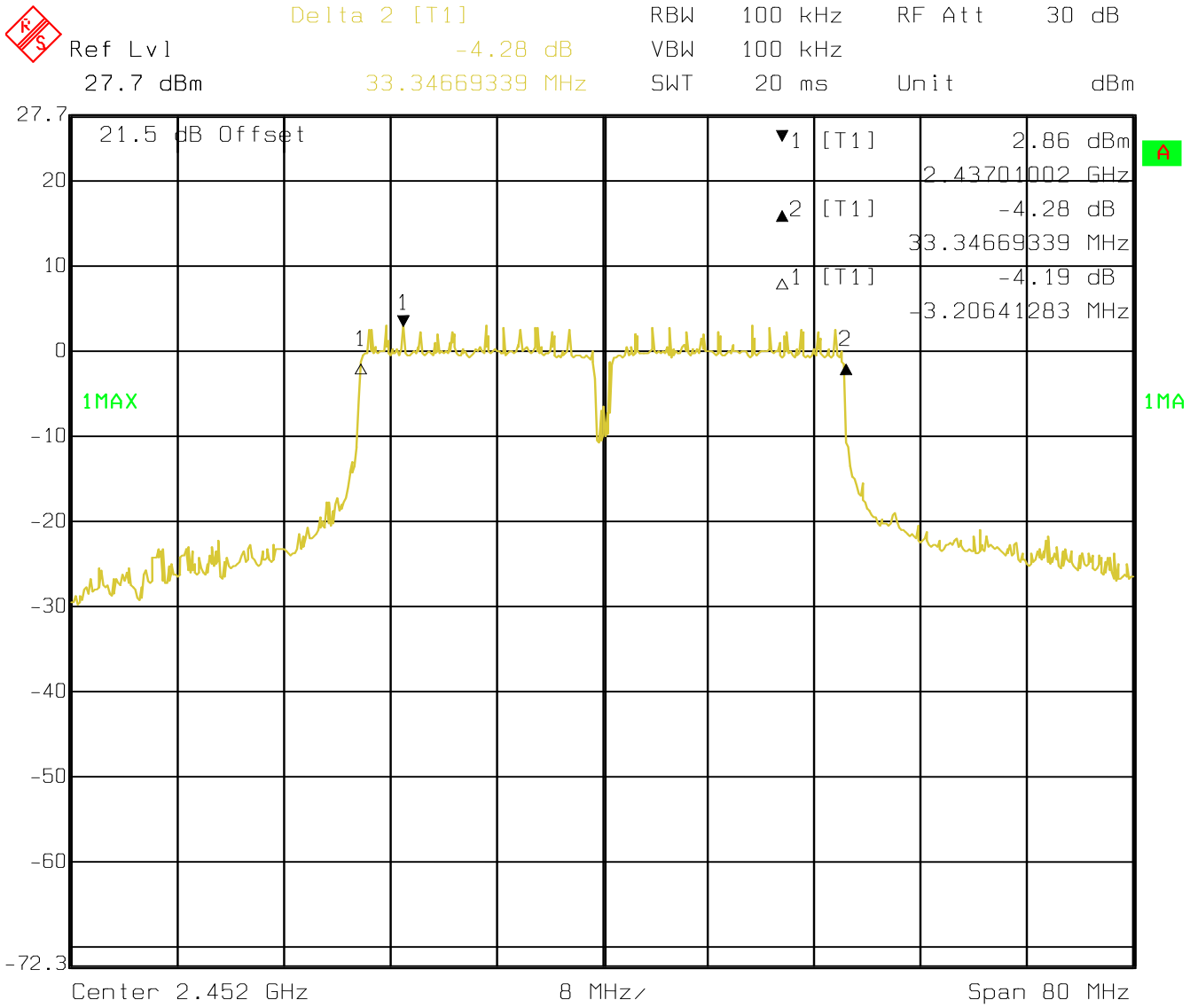
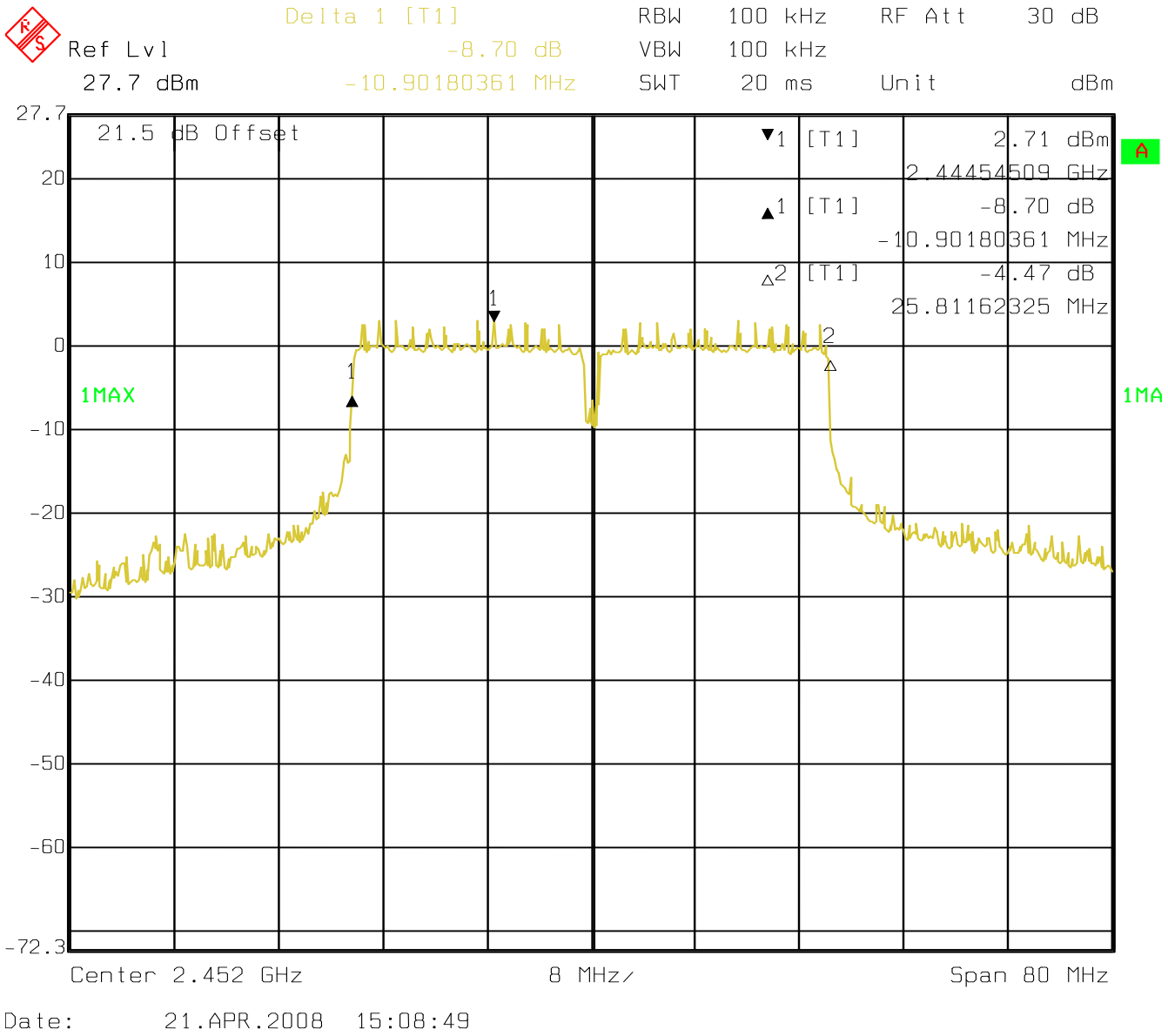
2452MHz Chain A



Date: 21.APR.2008 15:07:46

2452MHz Chain B

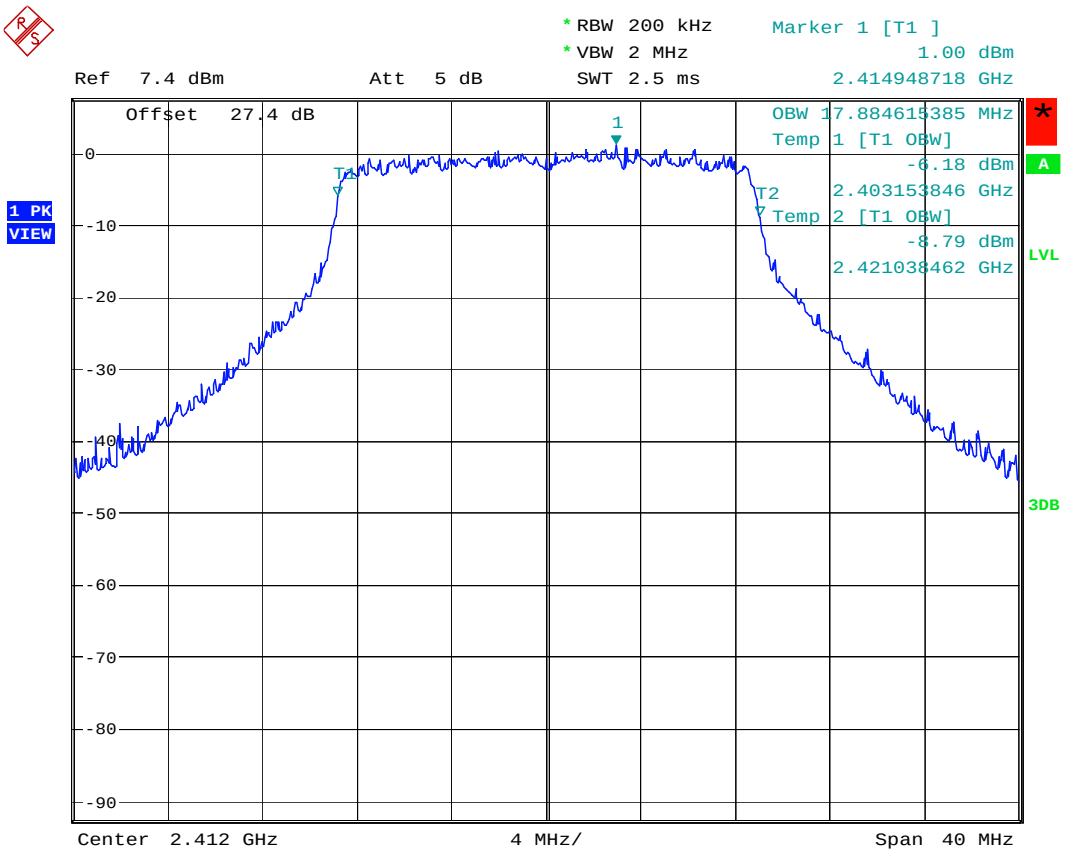


Date: 21.APR.2008 15:08:49

6.6.2 99% Bandwidth

6.6.2.1 802.11 ng HT20 mode

2412MHz Chain A



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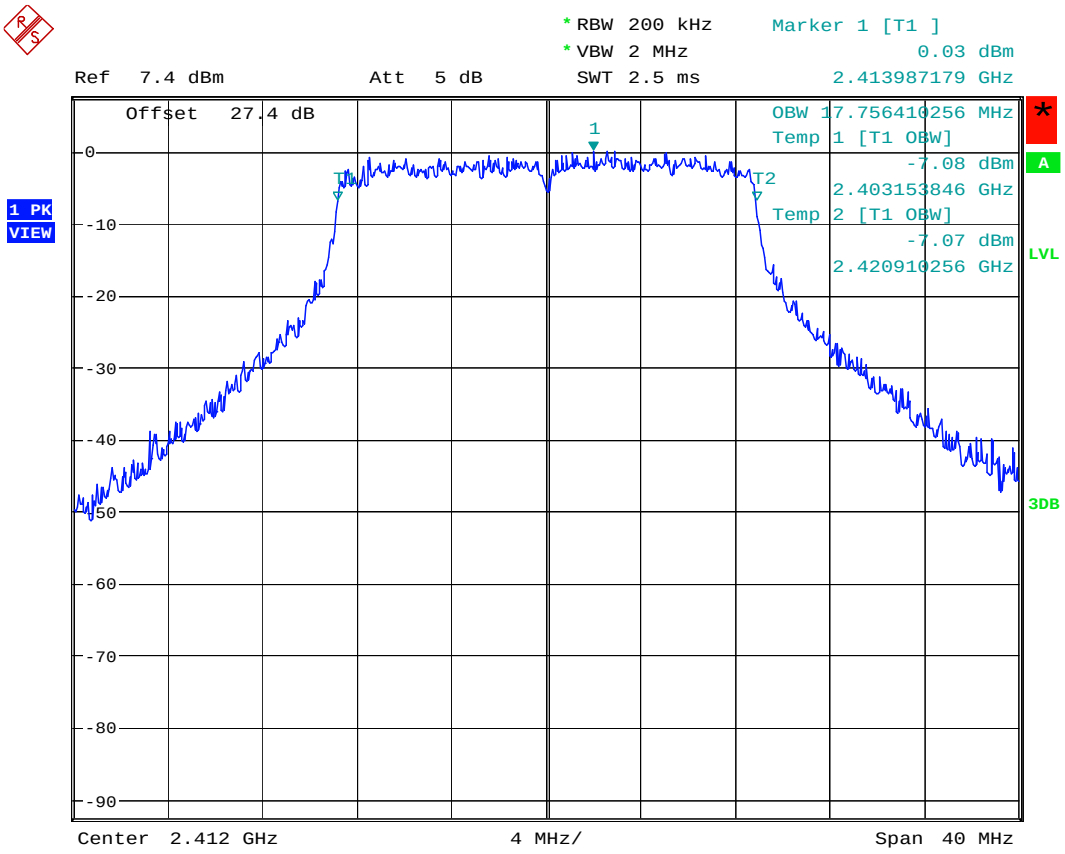
2412MHz Chain B



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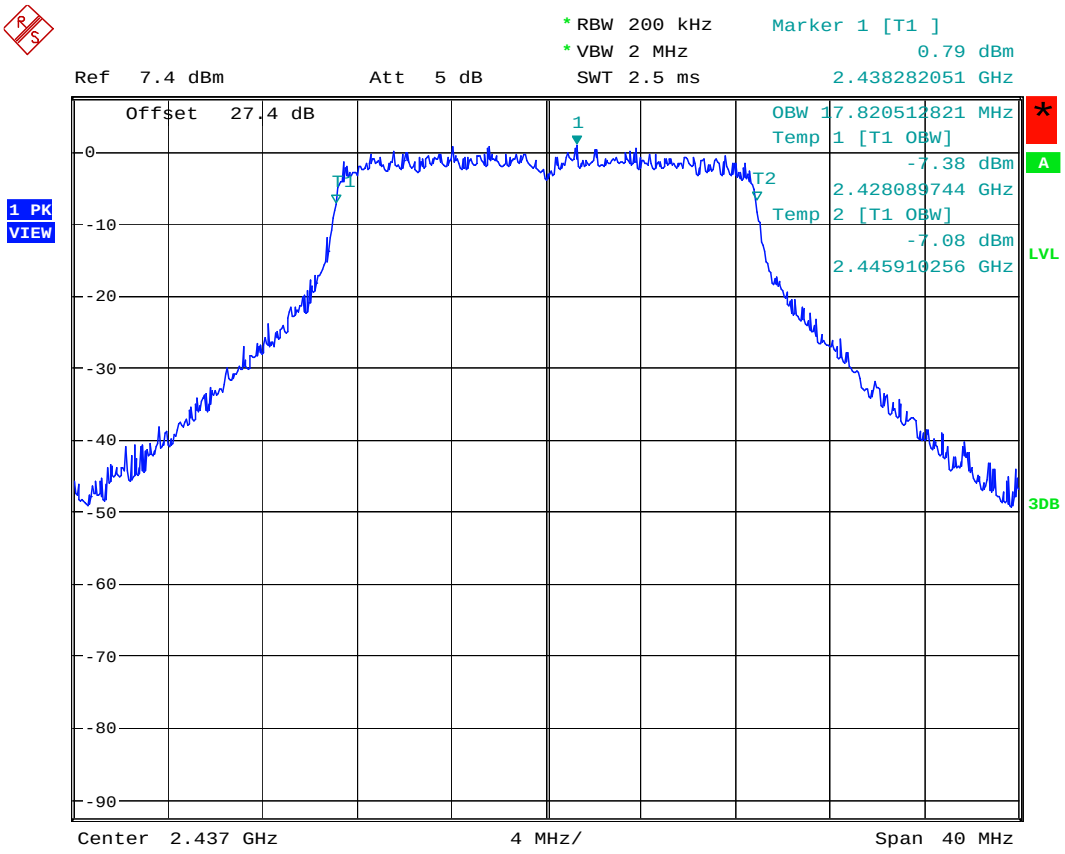
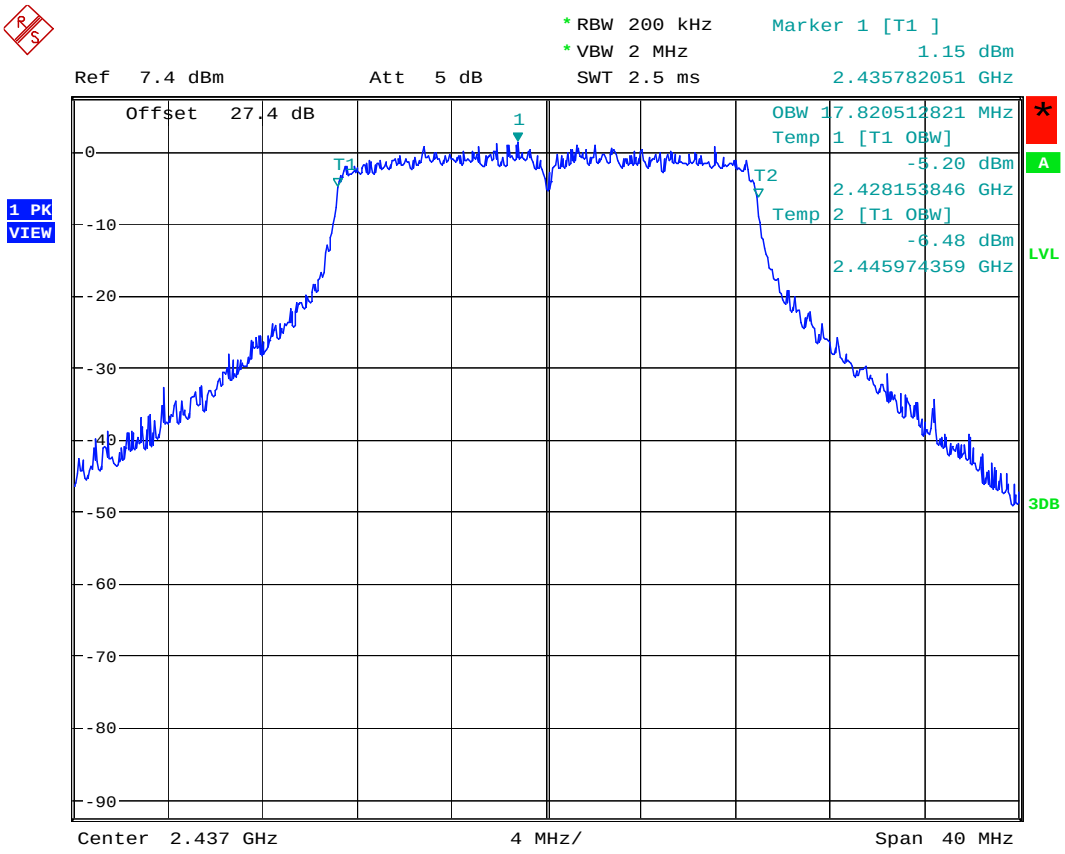
2437MHz Chain A



Date: 27.MAR.2008 15:27:14

2437MHz Chain B



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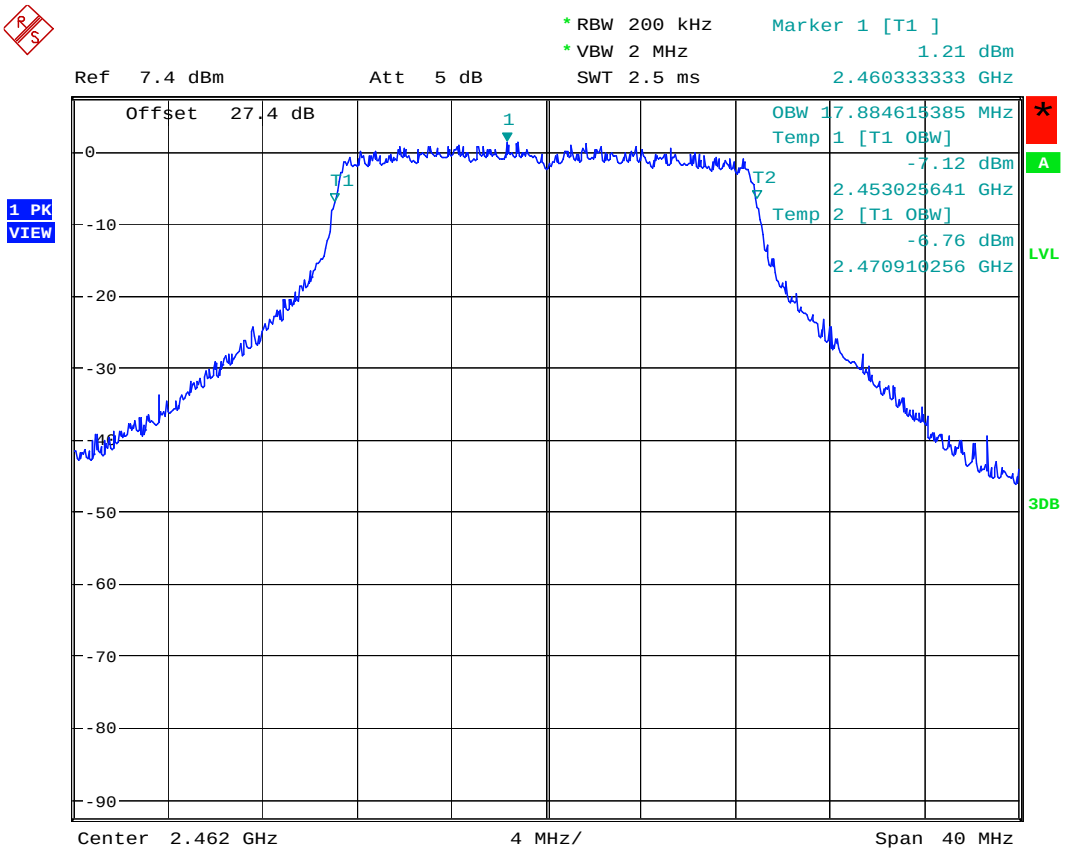
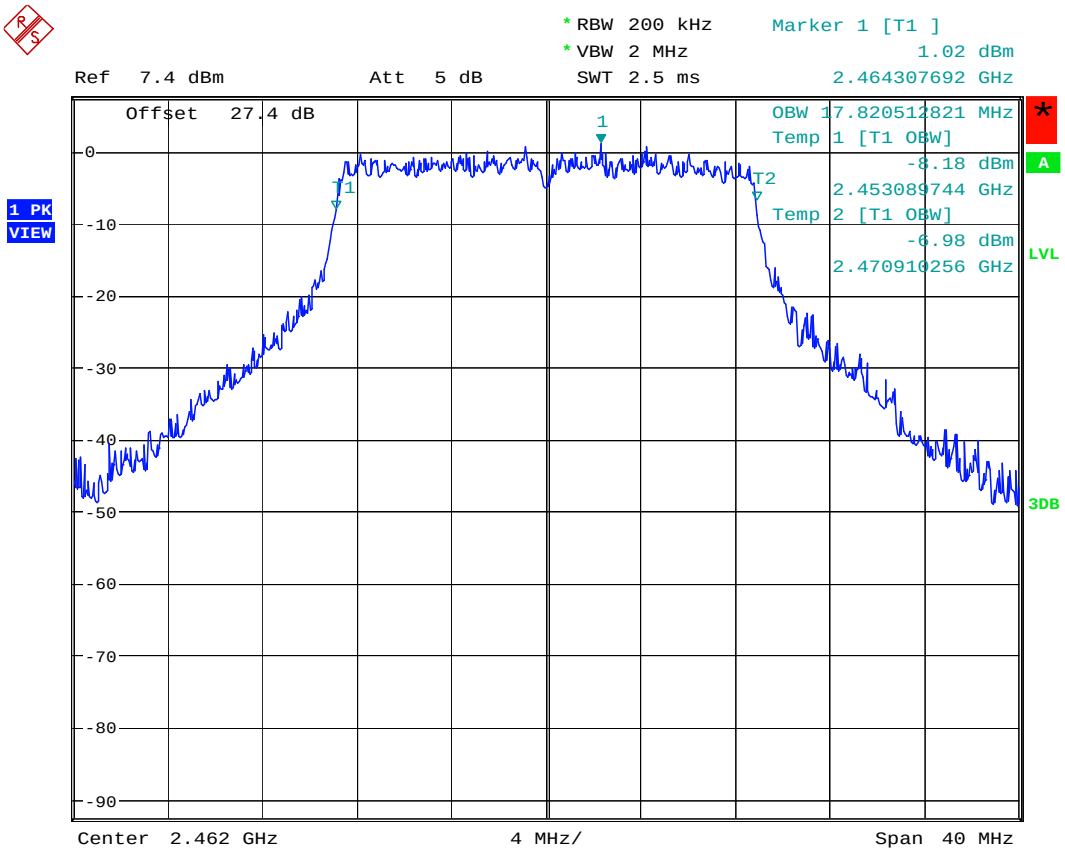
2462MHz Chain A



Date: 27.MAR.2008 15:26:13

2462MHz Chain B



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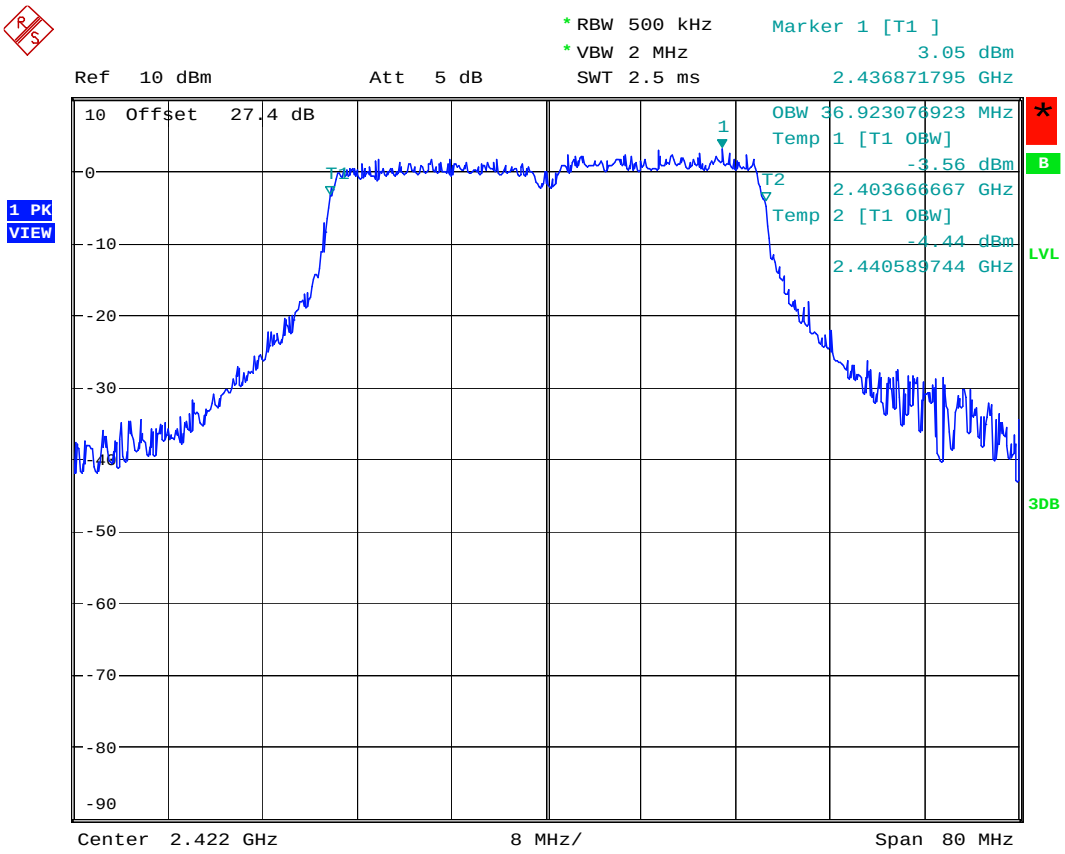
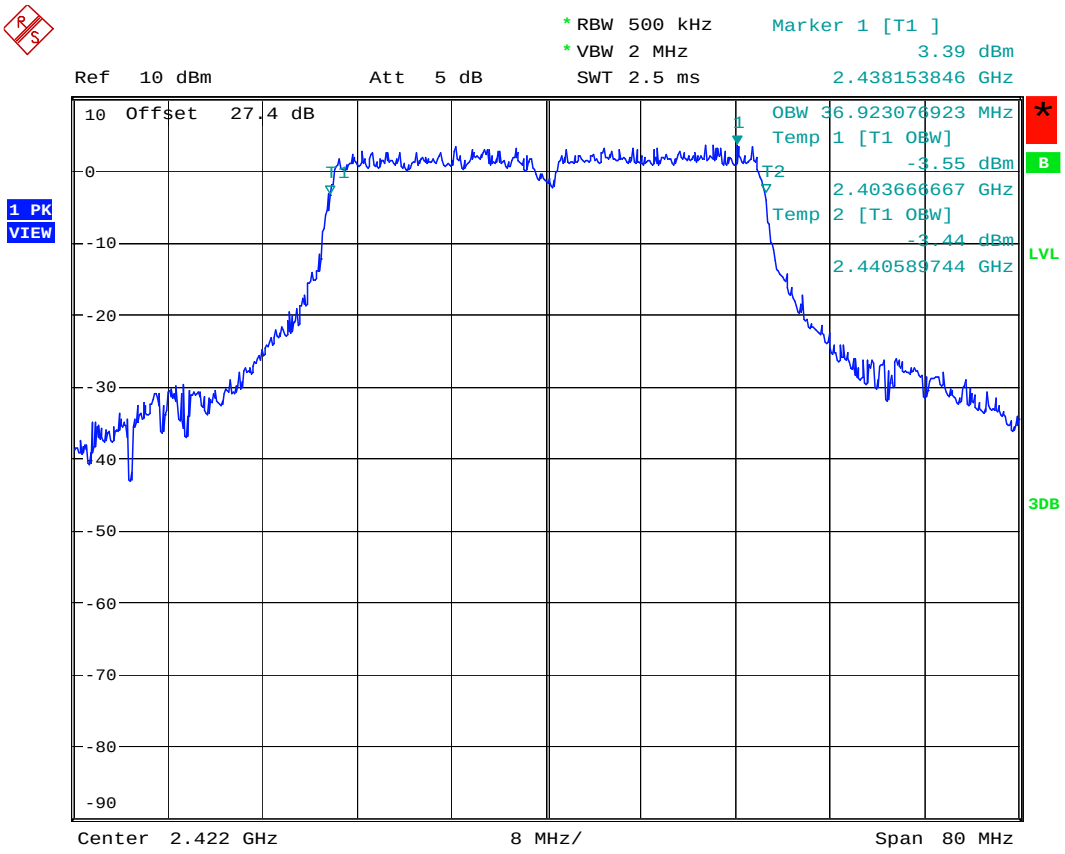
6.6.2.2 802.11ng HT40 Mode

2412MHz Chain A



Date: 27.MAR.2008 11:06:45

2412MHz Chain B



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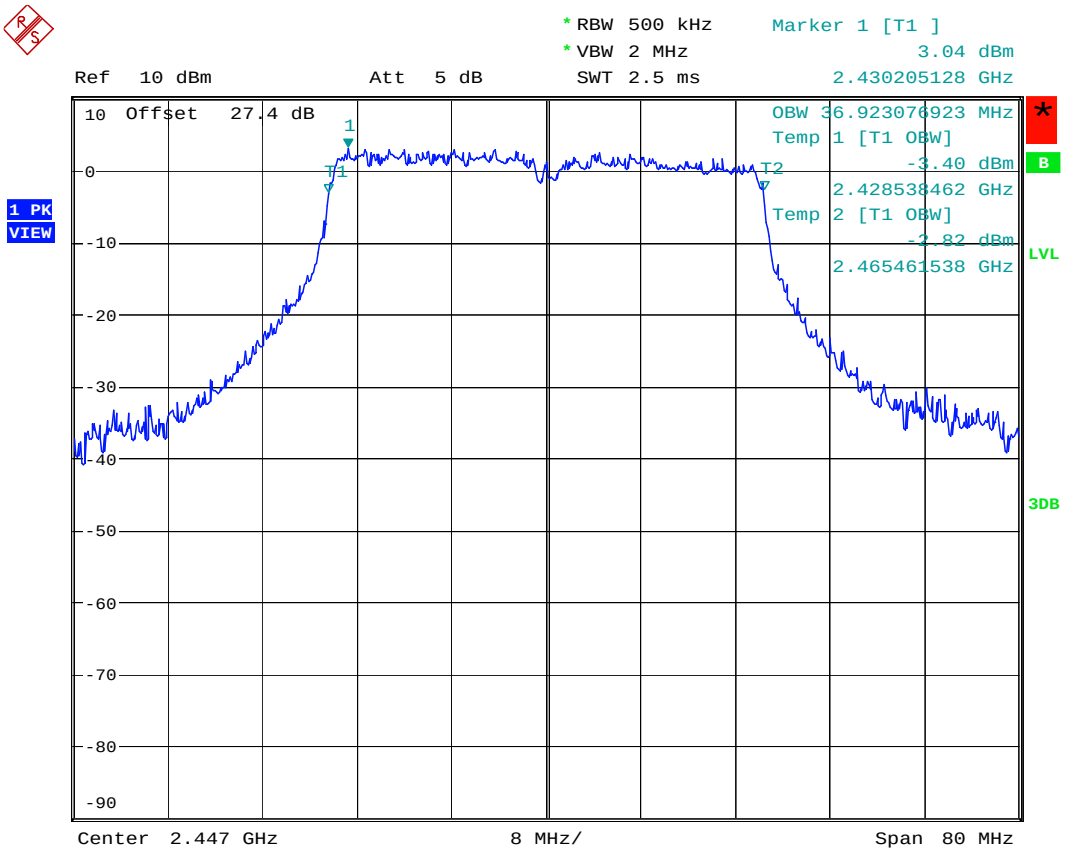
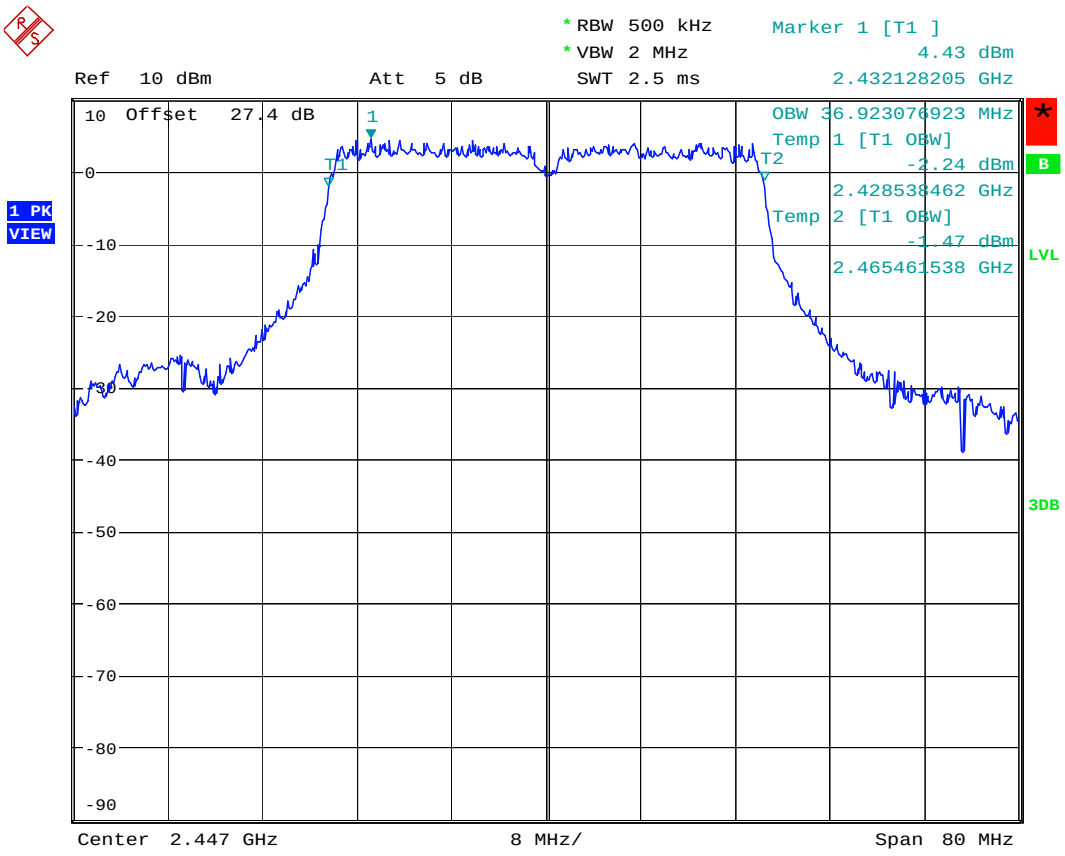
2447MHz Chain A



Date: 27.MAR.2008 11:05:50

2447MHz Chain B



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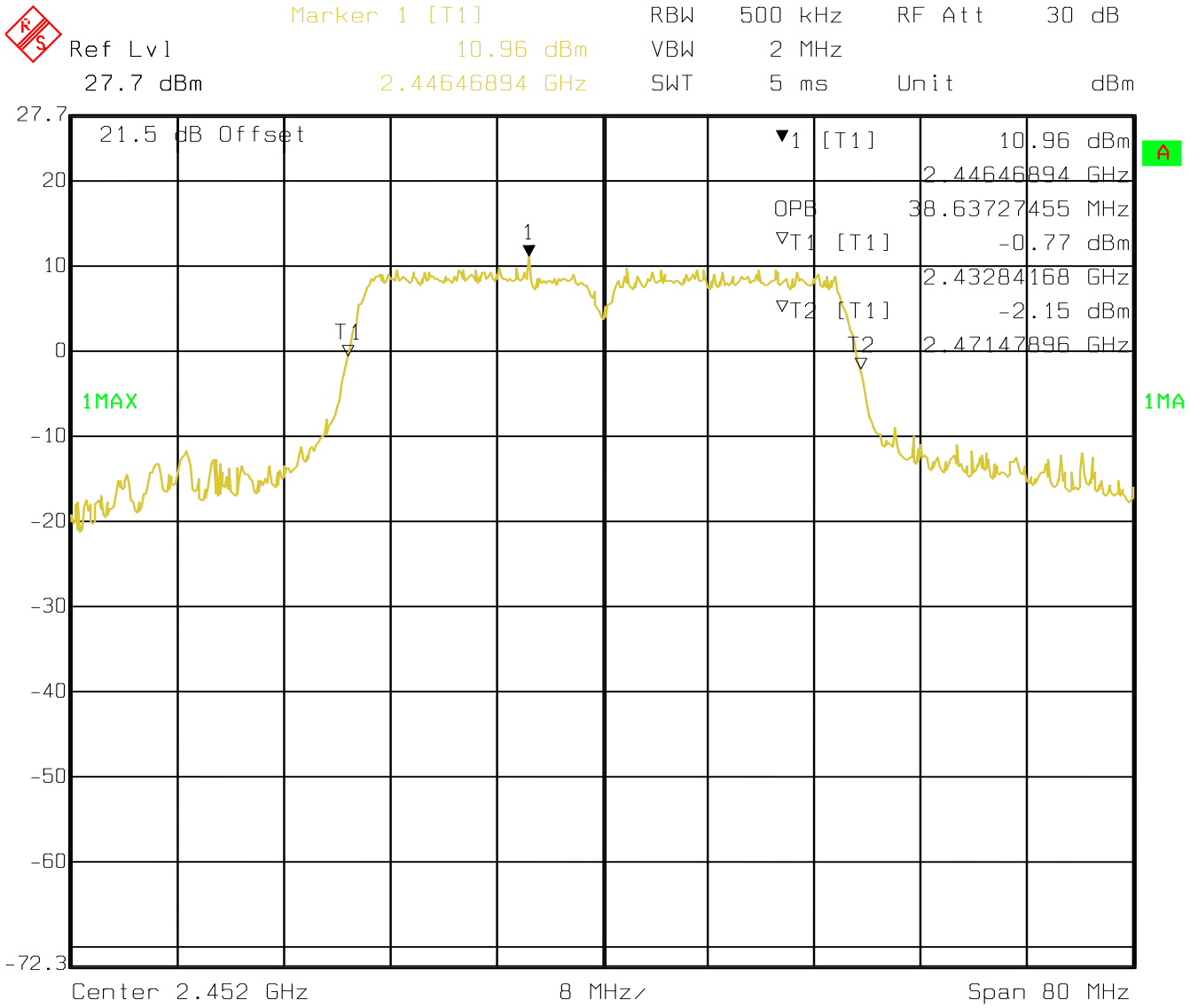
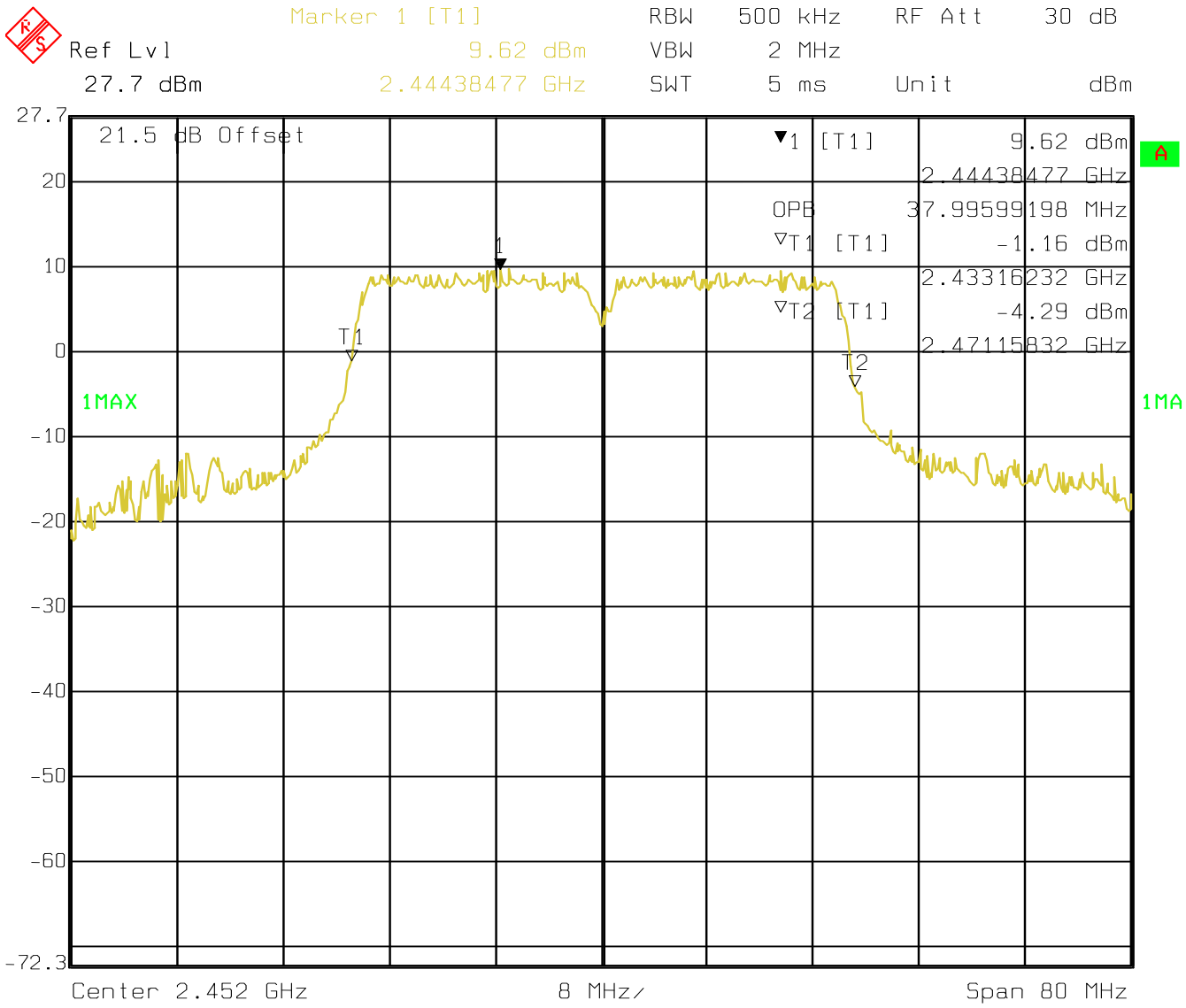
2452MHz Chain A



Date: 21.APR.2008 15:06:30

2452MHz Chain B

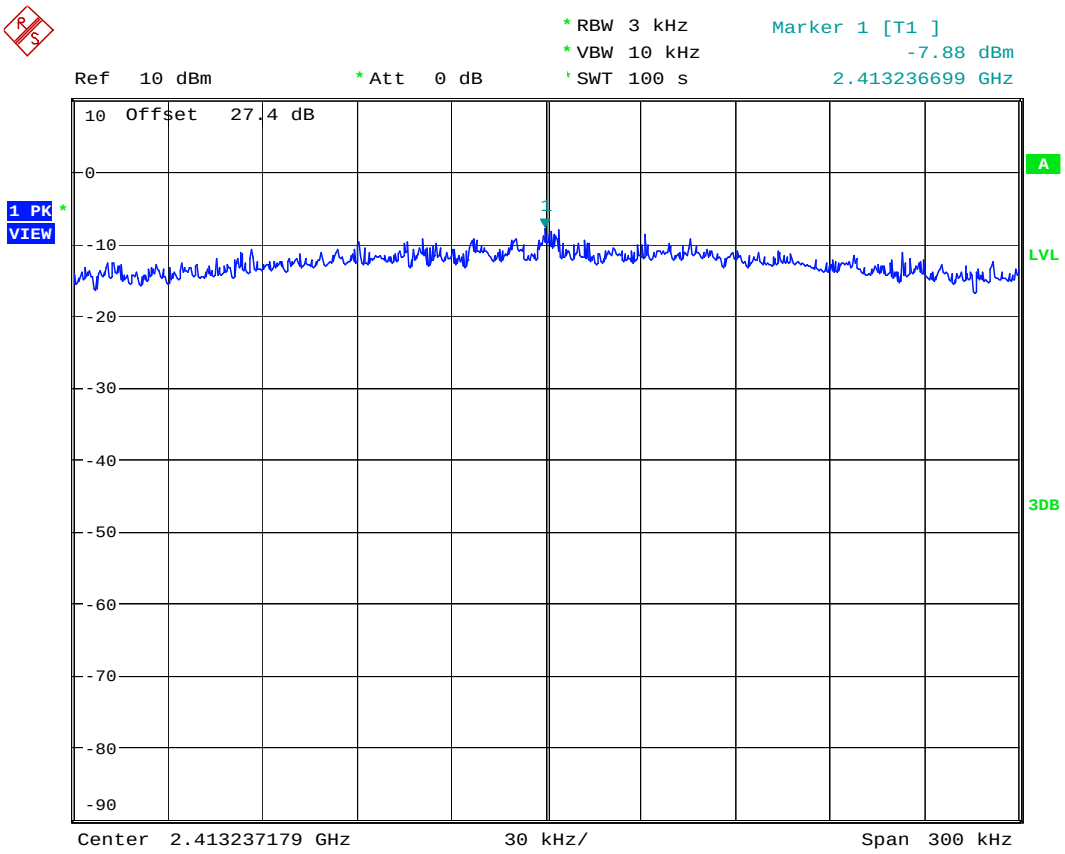


Date: 21.APR.2008 15:09:43

6.6.3 Power Spectral Density

6.6.3.1 802.11ng HT20 mode

2412MHz



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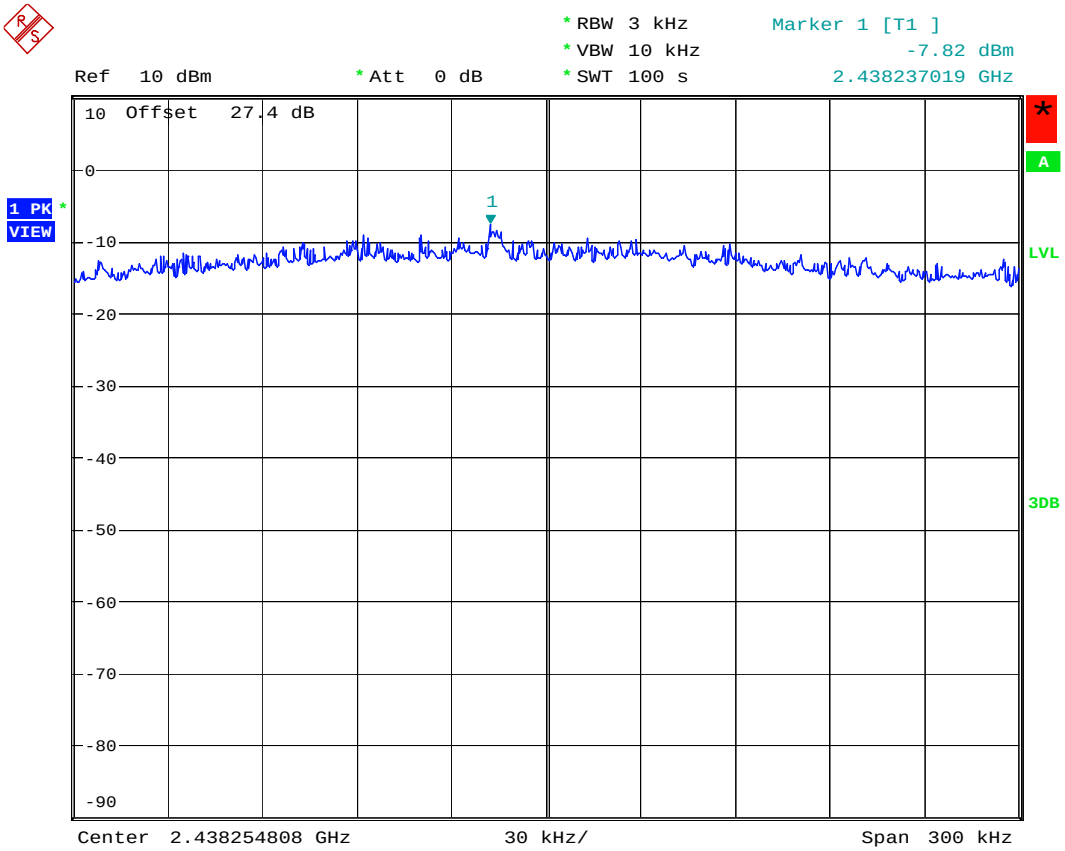
2437 MHz



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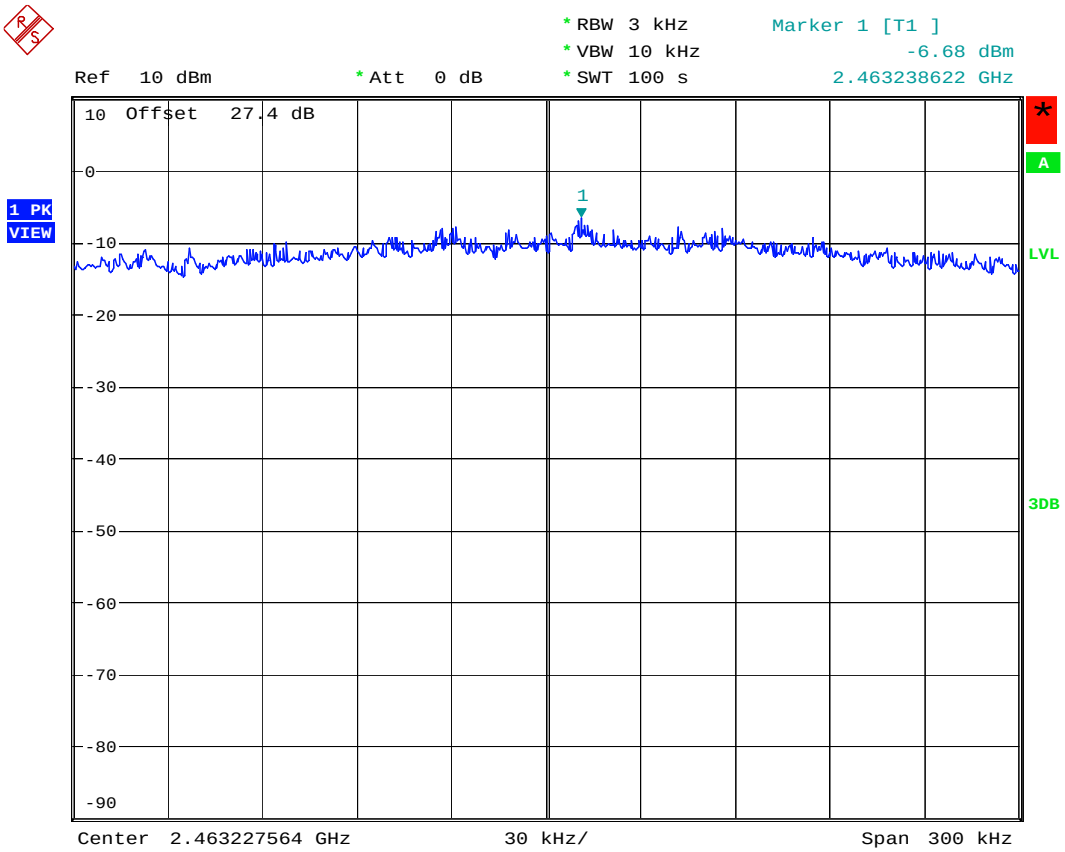
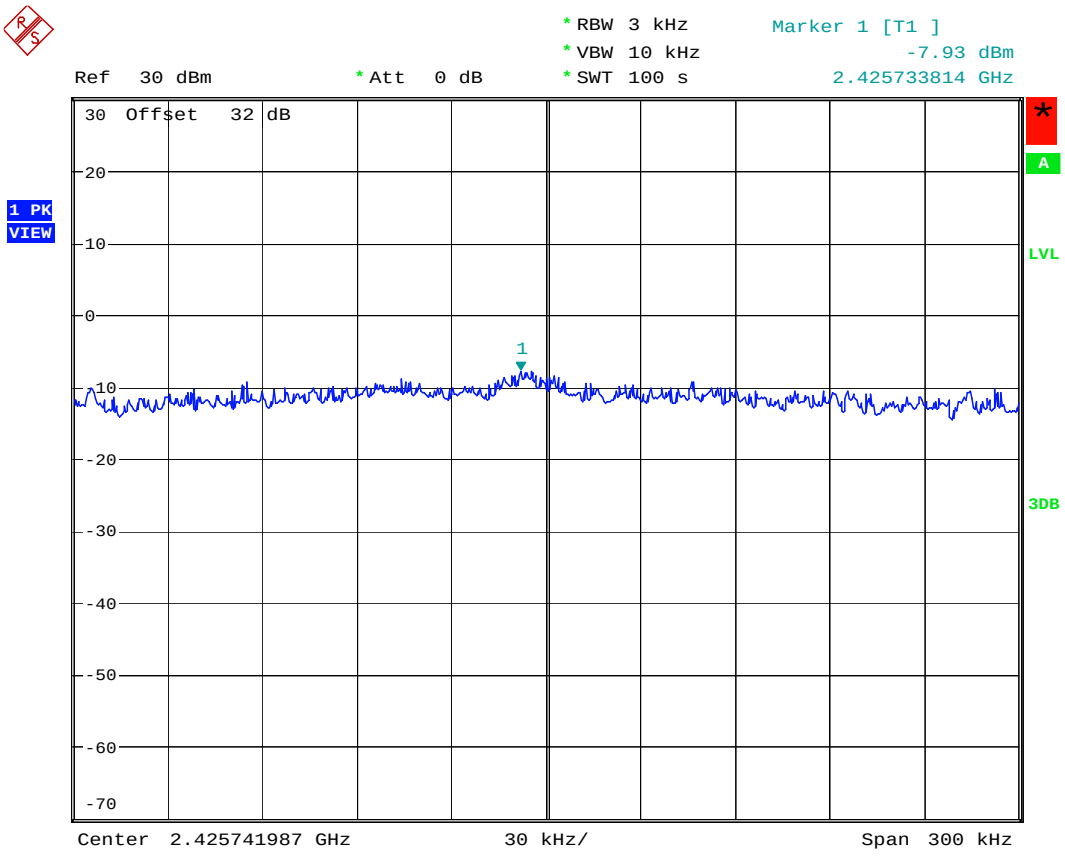
2462 MHz



Date: 27.MAR.2008 14:48:23

6.6.3.2 802.11ng HT40 mode

2422 MHz



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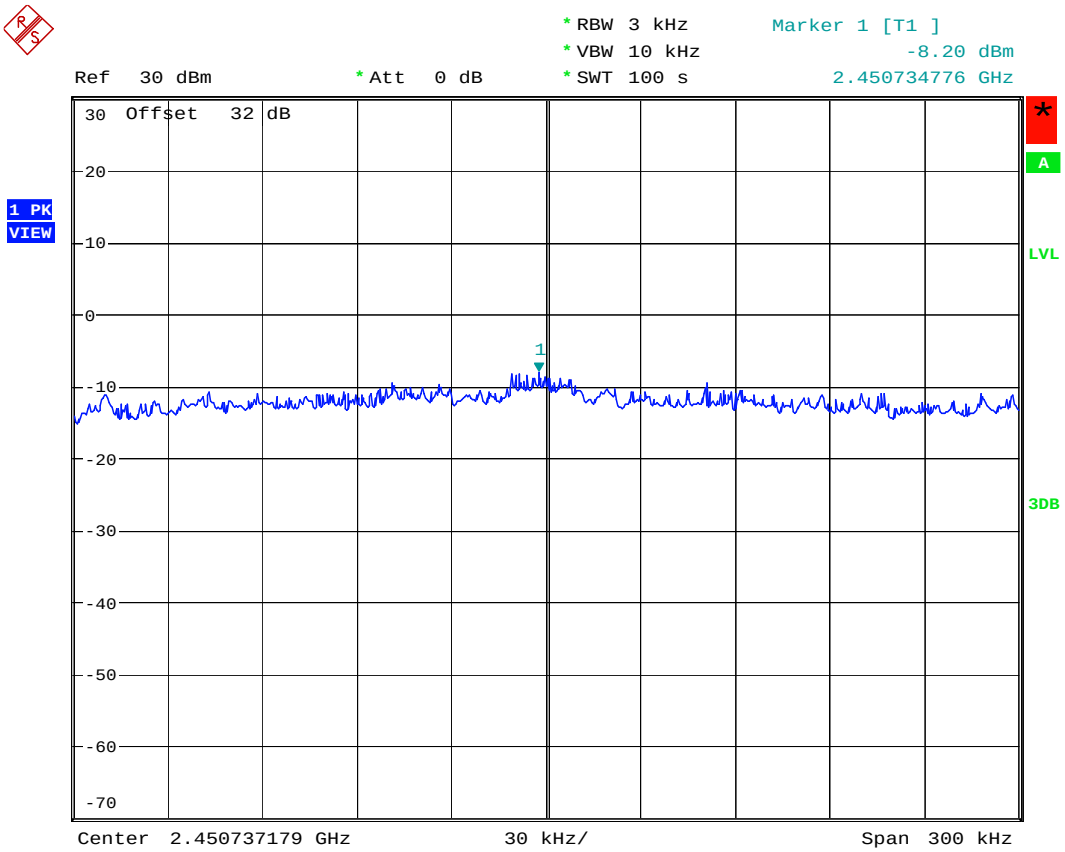
2447MHz



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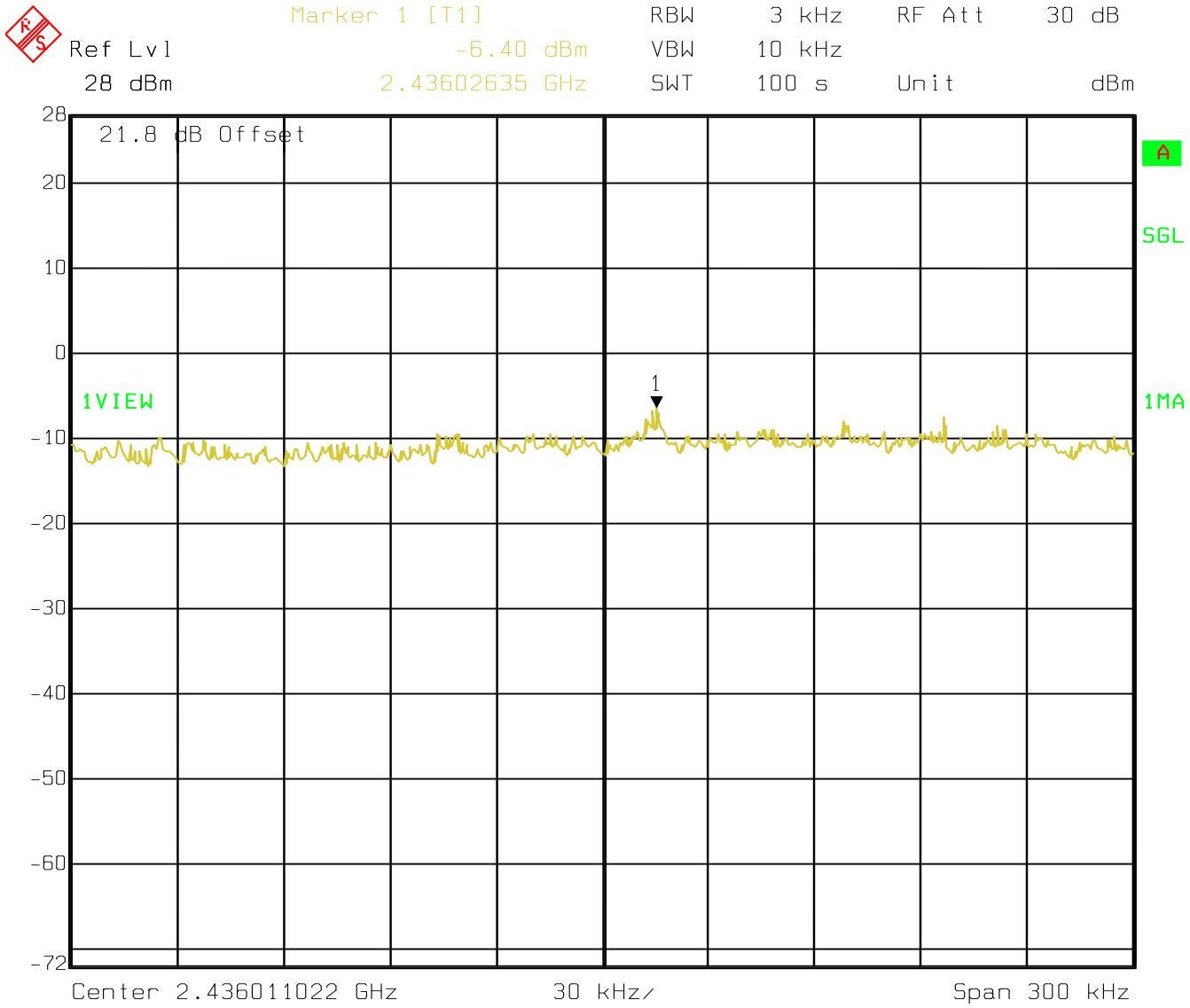
2452MHz



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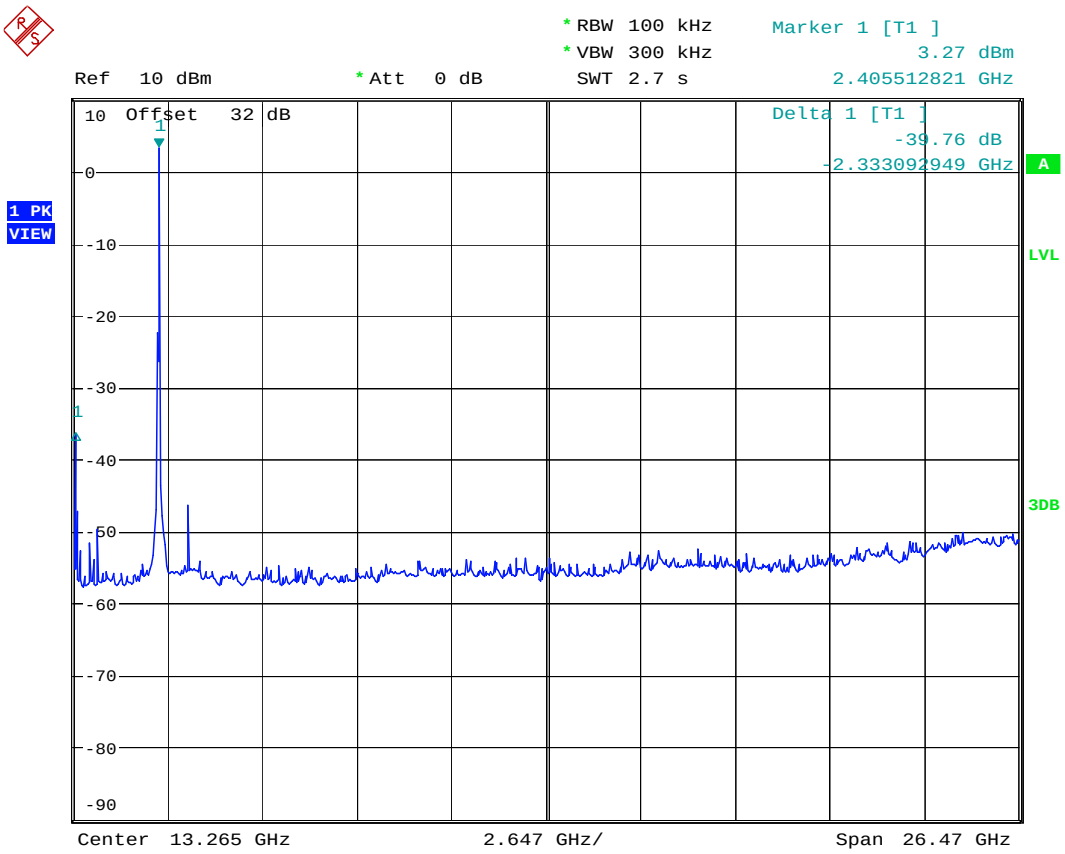
6.6.4 Conducted Spurious Emissions

6.6.4.1 802.11ng HT20 Mode

2412MHz



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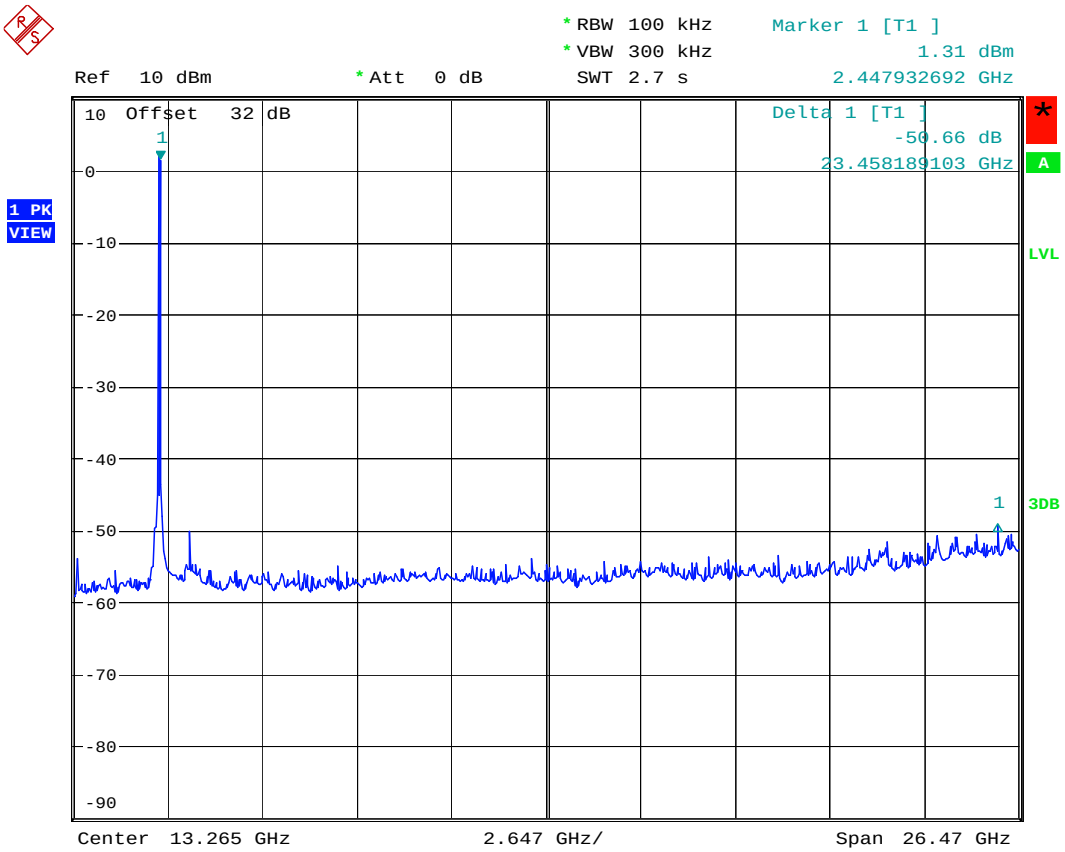
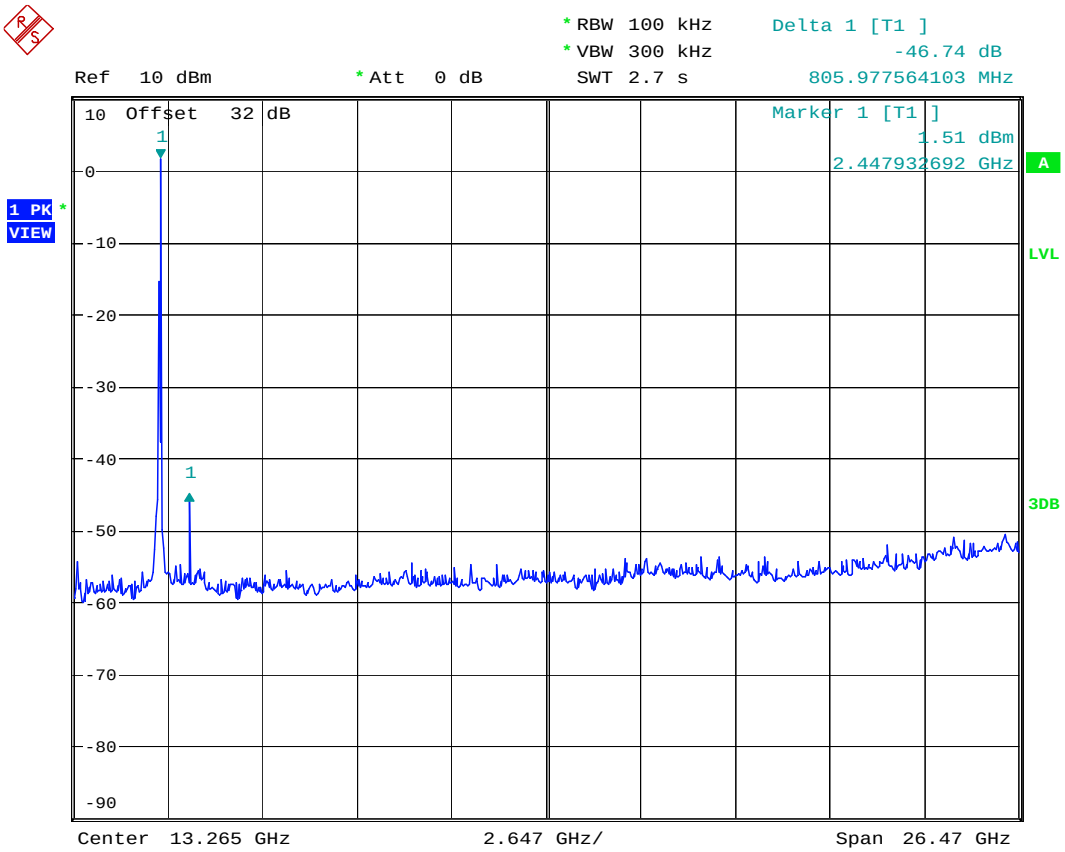
2437MHz



Date: 26.MAR.2008 16:47:49

2462MHz



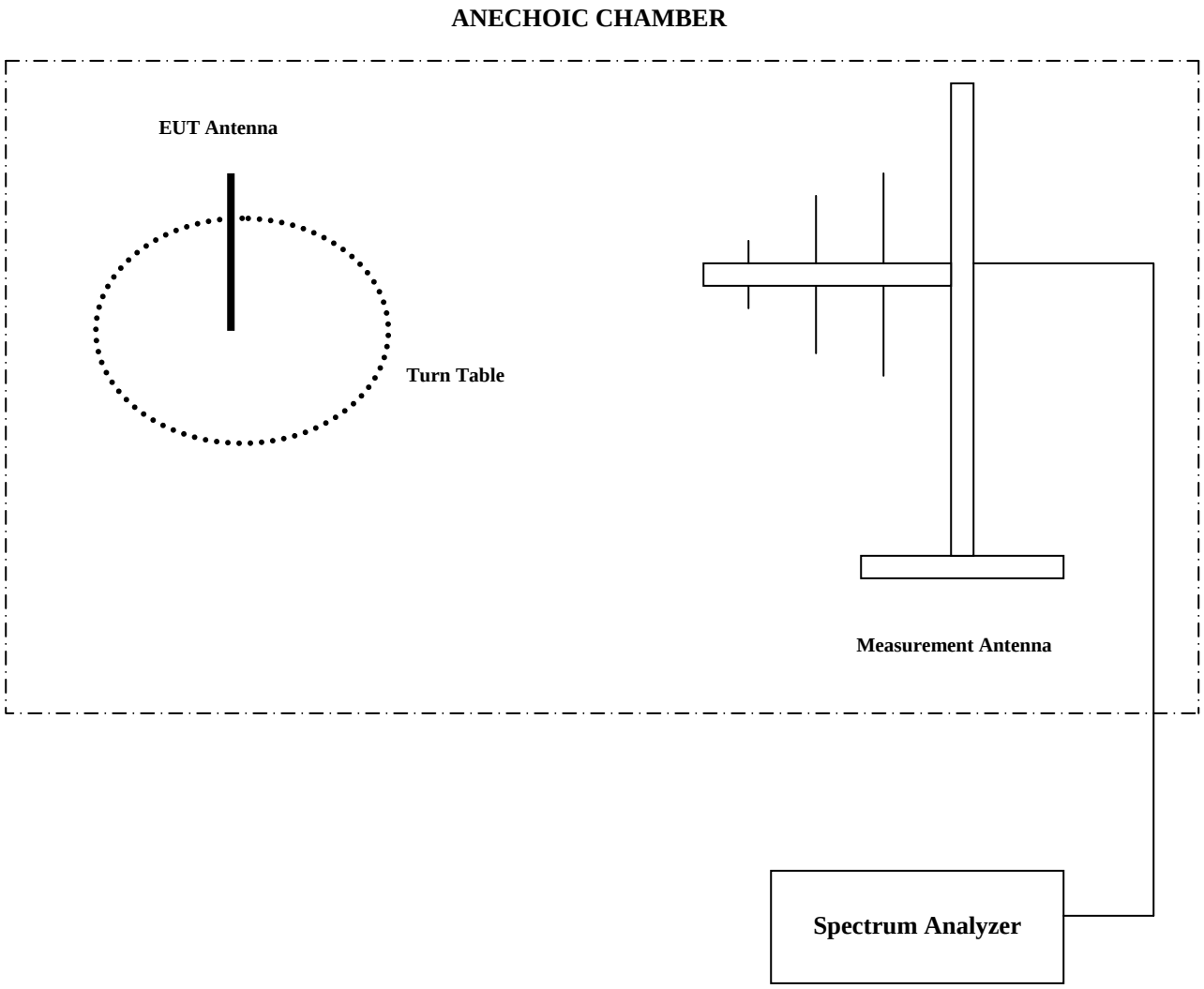
Date: 26.MAR.2008 16:44:43

7 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
02	Spectrum Analyzer	FSEM 30	Rohde & Schwarz	100017	August 2008	1 year
03	Signal Generator	SMY02	Rohde & Schwarz	836878/011	May 2008	1 year
04	Power-Meter	NRVD	Rohde & Schwarz	0857.8008.02	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
08	Power Splitter	11667B	Hewlett Packard	645348	n/a	n/a
09	Climatic Chamber	VT4004	Voltsch	G1115	May 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
12	Pre-Amplifier	JS4-00102600	Miteq	00616	May 2008	1 year
13	Power Sensor	URV5-Z2	Rohde & Schwarz	DE30807	May 2008	1 year
14	Digital Radio Comm. Tester	CMD-55	Rohde & Schwarz	847958/008	May 2008	1 year
15	Universal Radio Comm. Tester	CMU 200	Rohde & Schwarz	832221/06	May 2008	1 year
16	LISN	ESH3-Z5	Rohde & Schwarz	836679/003	May 2008	1 year
17	Loop Antenna	6512	EMCO	00049838	July 2008	2 years

8 BLOCK DIAGRAMS

Radiated Testing



9 Revision History

2008-3-26: First Issue.

2008-3-31: Rev1, adding FCC ID, IC ID on the cover page; adding channel numbers and output power in EUT section; adding EUT number on each measurement plot; deletion of empty quasi-peak frequency list in conducted emissions measurements. Replaces original titled *EMC_CETEC_029_15_247n_2.4GHz* and dated 2008-3-26.

2008-04-03: Rev2, corrected typo on output power in section 3.1. Replaces original titled *EMC_CETEC_029_15_247n_2.4GHz_rev1* and dated 2008-3-31.

2008-04-22: Rev3, updated 2452MHz channel measurements. Replaces original titled *EMC_CETEC_029_15_247n_2.4GHz_rev2* and dated 2008-04-03.