



# FCC Test Report

## FCC Part 15.247 for FHSS systems/ CANADA RSS-210

FOR:

**Harman Becker Automotive Systems**  
39001 West 12 Mile Road  
Farmington Hills, MI 48375  
U.S.A

**MODEL #: NTG4 RER**

**FCC ID: QNG-BE2726**  
**IC ID: 6434A-BE2726**

**TEST REPORT #: EMC\_HARMA\_002\_07001\_15.247BT\_rev2**  
**DATE: 2007-11-5**



FCC listed:  
A2LA  
accredited

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](mailto: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



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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 and in compliance with the applicable criteria specified in Industry Canada rules RSS210.**

Company	Description	Model #
Harman Becker Automotive Systems	Automotive Infotainment Head Unit with Integrated BlueTooth for Hands Free Cell Phone	NTG4 RER

This report is reviewed by:

**Ivaylo Tankov**  
**(EMC Project Engineer)**

**2007-11-5 EMC & Radio**

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<b>Date</b>	<b>Section</b>	<b>Name</b>	<b>Signature</b>
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This report is prepared by:

**Peter Mu**  
**(EMC Project Engineer)**

**2007-11-5 EMC & Radio**

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<b>Date</b>	<b>Section</b>	<b>Name</b>	<b>Signature</b>
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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:	<b>CETECOM Inc.</b>
Department:	<b>EMC</b>
Address:	<b>411 Dixon Landing Road Milpitas, CA 95035 U.S.A.</b>
Telephone:	<b>+1 (408) 586 6200</b>
Fax:	<b>+1 (408) 586 6299</b>
Responsible Test Lab Manager:	<b>Lothar Schmidt</b>
Responsible Project Leader:	<b>Peter Mu</b>
Date of test:	<b>2007-6-28 to 2007-7-13</b>

**2.2 Identification of the Client**

<b>APPLICANT</b>	
<b>Applicant (Company Name)</b>	<b>Harman Becker Automotive System</b>
<b>Street Address</b>	<b>39001 West 12 Mile Road</b>
<b>City/Zip Code</b>	<b>Farmington Hills, MI 48331</b>
<b>Country</b>	<b>USA</b>
<b>Contact Person</b>	<b>Murugan Achanaicker</b>
<b>Telephone</b>	<b>248 994 2747</b>
<b>Fax</b>	<b>248 848 9463</b>
<b>e-mail</b>	<b>machanai@harmanbecker.com</b>

**2.3 Identification of the Manufacturer**

Same as above applicant.



### 3 Equipment Under Test (EUT)

#### 3.1 Specification of the Equipment under Test

EUT	
<b>Marketing Name of EUT (if not same as Model No.)</b>	NTG4 RER
<b>Description</b>	Automotive Infotainment Head Unit with integrated BlueTooth for Hands Free Cell Phone
<b>Model No.</b>	NTG4 RER
<b>Serial No.</b>	000e9f5009f5
<b>H/W &amp; S/W</b>	PV3/9.xxx
<b>FCC-ID</b>	QNG-BE2726
<b>IC-ID (Industry Canada)</b>	6434A-BE2726

<b>Frequency Range:</b>	2400MHz – 2483.5MHz
<b>Type(s) of Modulation:</b>	GFSK, DQPSK, 8PSK
<b>Number of Channels:</b>	79
<b>Antenna Type:</b>	Built in PCB Antenna
<b>Output Power:</b>	-1.47dBm (0.713mW) GFSK 2480MHz Radiated 5.0dBm (3.26mW) 8PSK 2402MHz Conducted.

#### 3.2 Identification of the Equipment under Test (EUT)

EUT #	TYPE	MANF.	MODEL	SERIAL #
1	EUT	Harman Becker	NTG4 RER	000e9f5009f5 (T00BE*10005)

#### 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. This test report contains full radiated testing as per FCC15.247 on the EUT with the Bluetooth module.

During the testing process the EUT was tested on low, mid, and high channels using PRBS9 payload using DH5, 2DH5, and 3DH5 packets, all data in this report shows the worst case between horizontal and vertical polarization for above 1GHz.

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 Industry Canada rules RSS210. The maximization of portable equipment is conducted in accordance with ANSI C63.4.



5 Measurements (RADIATED)

5.1 MAXIMUM PEAK OUTPUT POWER § 15.247 (RADIATED)

5.1.1 LIMIT SUB CLAUSE § 15.247 (b) (1) (2) (3) (4)

Frequency range	RF power output
2400-2483.5 MHz	36dBm EIRP

\*limit is based upon antenna gain of less than or equal to 6dBi.

5.1.2 Test Results

EIRP: GFSK

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)		2402	2441	2480
T <sub>nom</sub> (23)°C	V <sub>nom</sub> VDC	-1.83	-1.93	-1.47
Measurement uncertainty		±0.5dBm		

EIRP:  $\pi / 4$  DQPSK

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)		2402	2441	2480
T <sub>nom</sub> (23)°C	V <sub>nom</sub> VDC	-1.93	-2.35	-2.25
Measurement uncertainty		±0.5dBm		

EIRP: 8DPSK

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)		2402	2441	2480
T <sub>nom</sub> (23)°C	V <sub>nom</sub> VDC	-1.89	-2.24	-2.30
Measurement uncertainty		±0.5dBm		



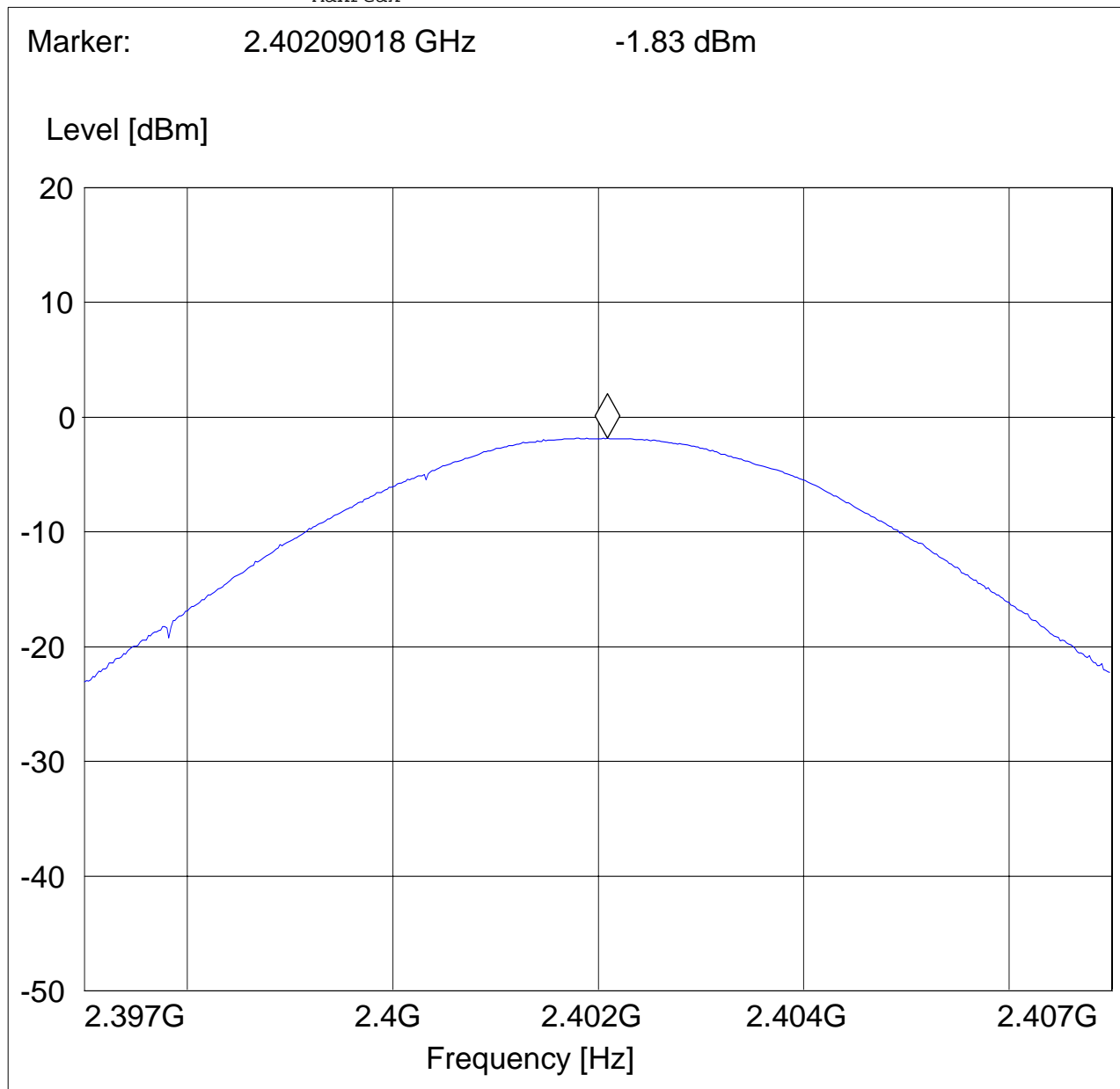


**EIRP 2402MHz GFSK**

EUT: NTG4 RER, T00BE\*10005  
 Customer: Harmen Becker  
 Test Mode: BT Test mode  
 ANT Orientation: H, TT37°  
 EUT Orientation: H  
 Test Engineer: Ed  
 Power Supply: 12v Battery  
 Comments:

**SWEEP TABLE: "EIRP BT low channel"**

Short Description:		EIRP Bluetooth channel-2402MHz			
Start	Stop	Detector	Meas. Time	IF Bandw.	Transducer
2.4 GHz	2.4 GHz	MaxPeak	Coupled	3 MHz	DUMMY-DBM
		MaxPeak			





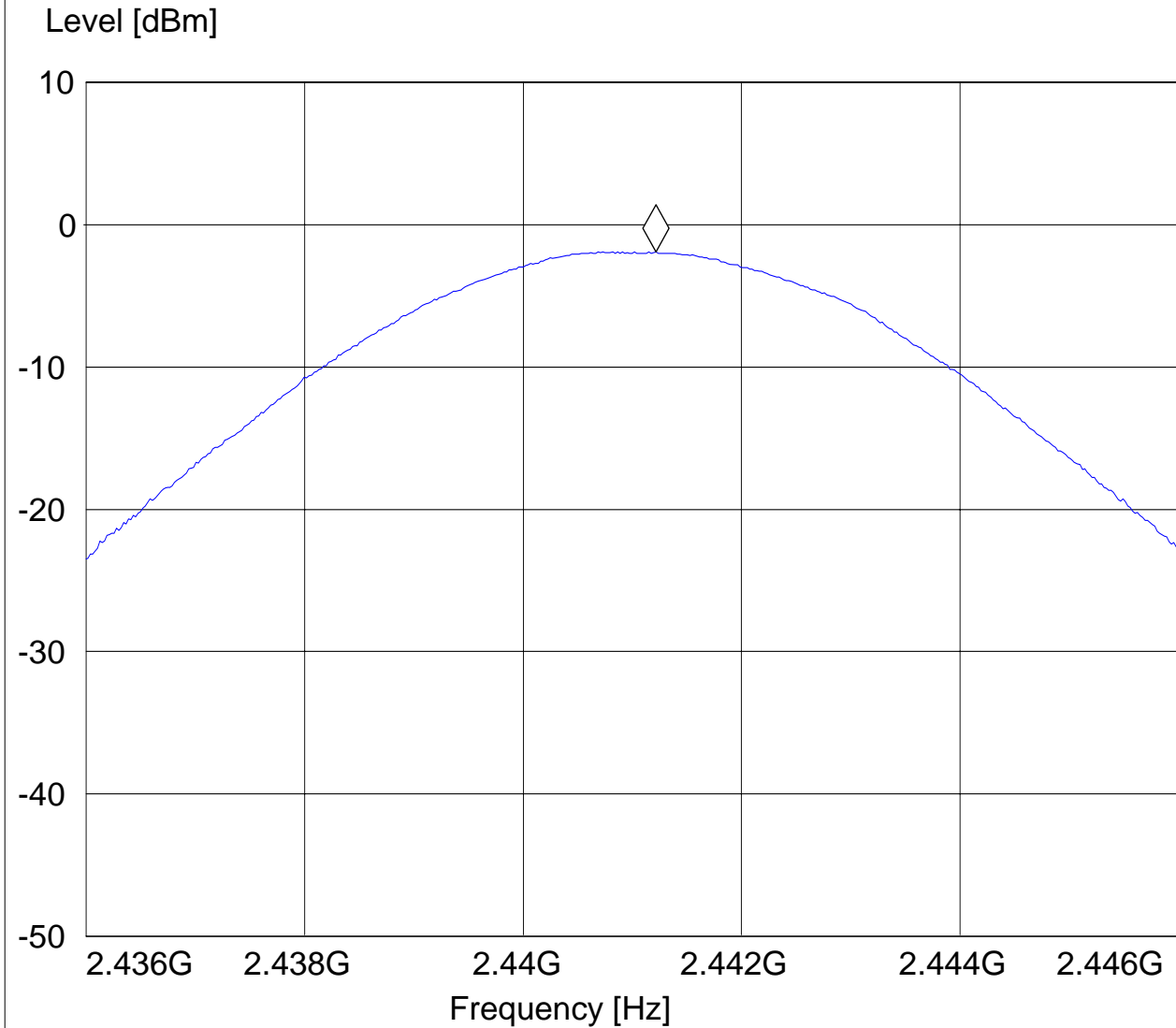
### EIRP 2441MHz GFSK

EUT: NTG4 RER, T00BE\*10005  
Customer: Harmen Becker  
Test Mode: BT Test mode  
ANT Orientation: H, TT37°  
EUT Orientation: H  
Test Engineer: Ed  
Power Supply: 12v Battery  
Comments:

**SWEEP TABLE: "EIRP BT mid channel"**

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
2.4 GHz	2.4 GHz	MaxPeak	Coupled	3 MHz	DUMMY-DBM

Marker: 2.441216433 GHz -1.93 dBm



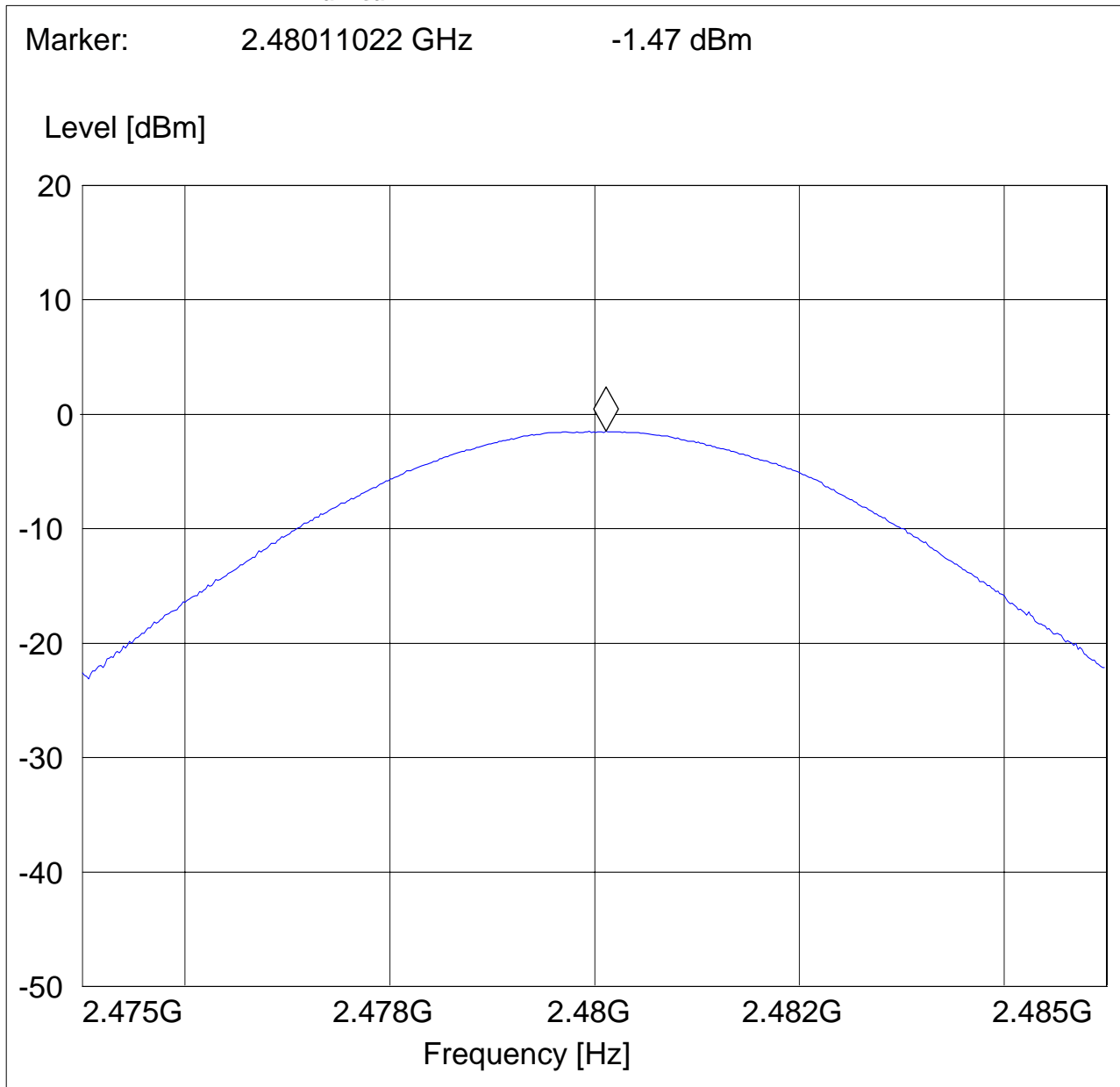


### EIRP 2480MHz GFSK

EUT: NTG4 RER, T00BE\*10005  
Customer: Harmen Becker  
Test Mode: BT Test mode  
ANT Orientation: H, TT37°  
EUT Orientation: H  
Test Engineer: Ed  
Power Supply: 12v Battery  
Comments:

**SWEEP TABLE: "EIRP BT high channel"**

Short Description:		EIRP Bluetooth channel-2480MHz			
Start	Stop	Detector	Meas. Time	IF Bandw.	Transducer
2.5 GHz	2.5 GHz	MaxPeak	Coupled	3 MHz	DUMMY-DBM
		MaxPeak			



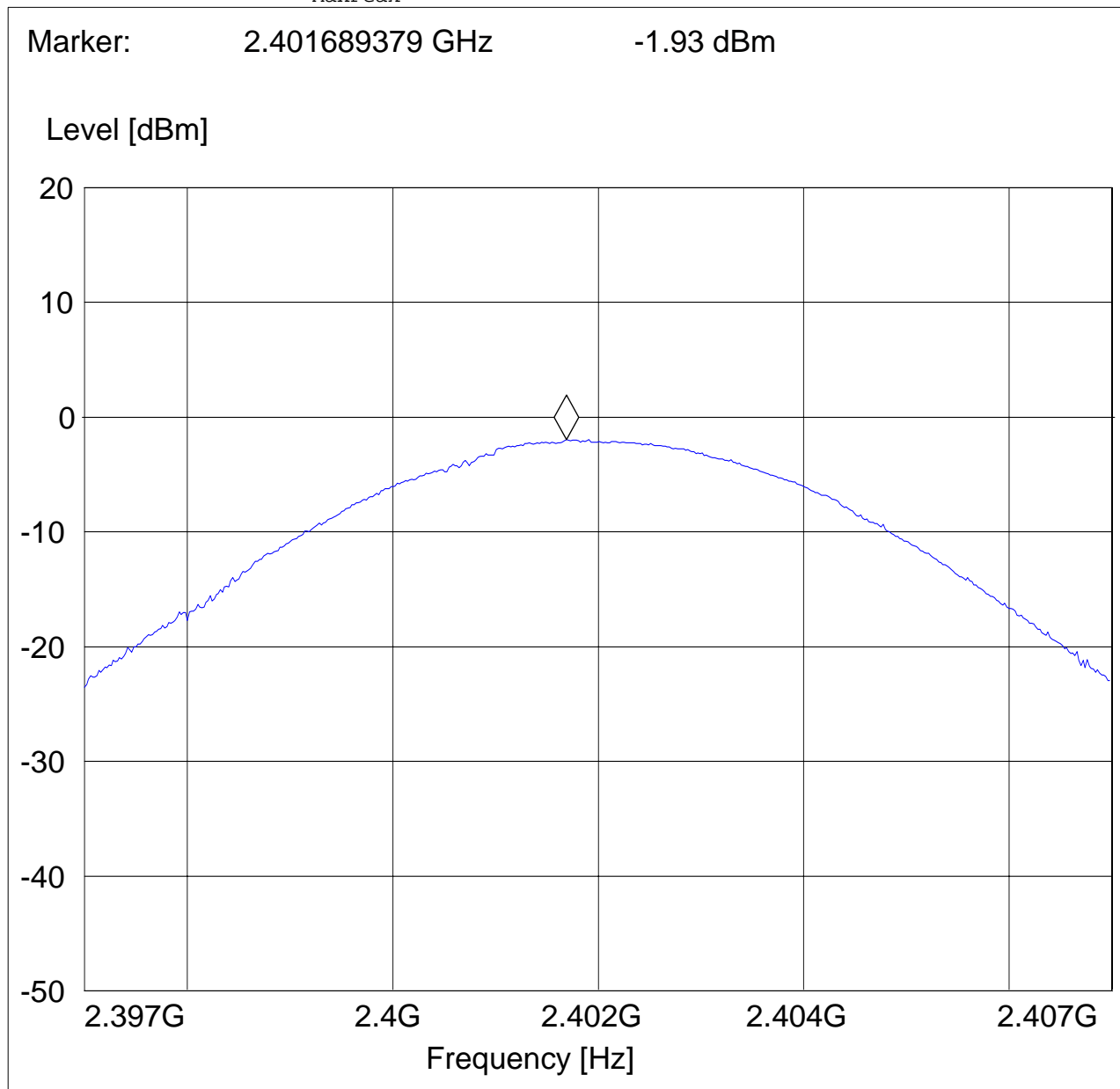


**EIRP 2402MHz II / 4 DQPSK**

EUT: NTG4 RER, T00BE\*10005  
 Customer: Harmen Becker  
 Test Mode: BT Test mode  
 ANT Orientation: H, TT37°  
 EUT Orientation: H  
 Test Engineer: Ed  
 Power Supply: 12v Battery  
 Comments:

**SWEEP TABLE: "EIRP BT low channel"**

Short Description:		EIRP Bluetooth channel-2402MHz			
Start	Stop	Detector	Meas.	IF	Transducer
Frequency	Frequency		Time	Bandw.	
2.4 GHz	2.4 GHz	MaxPeak	Coupled	3 MHz	DUMMY-DBM
		MaxPeak			





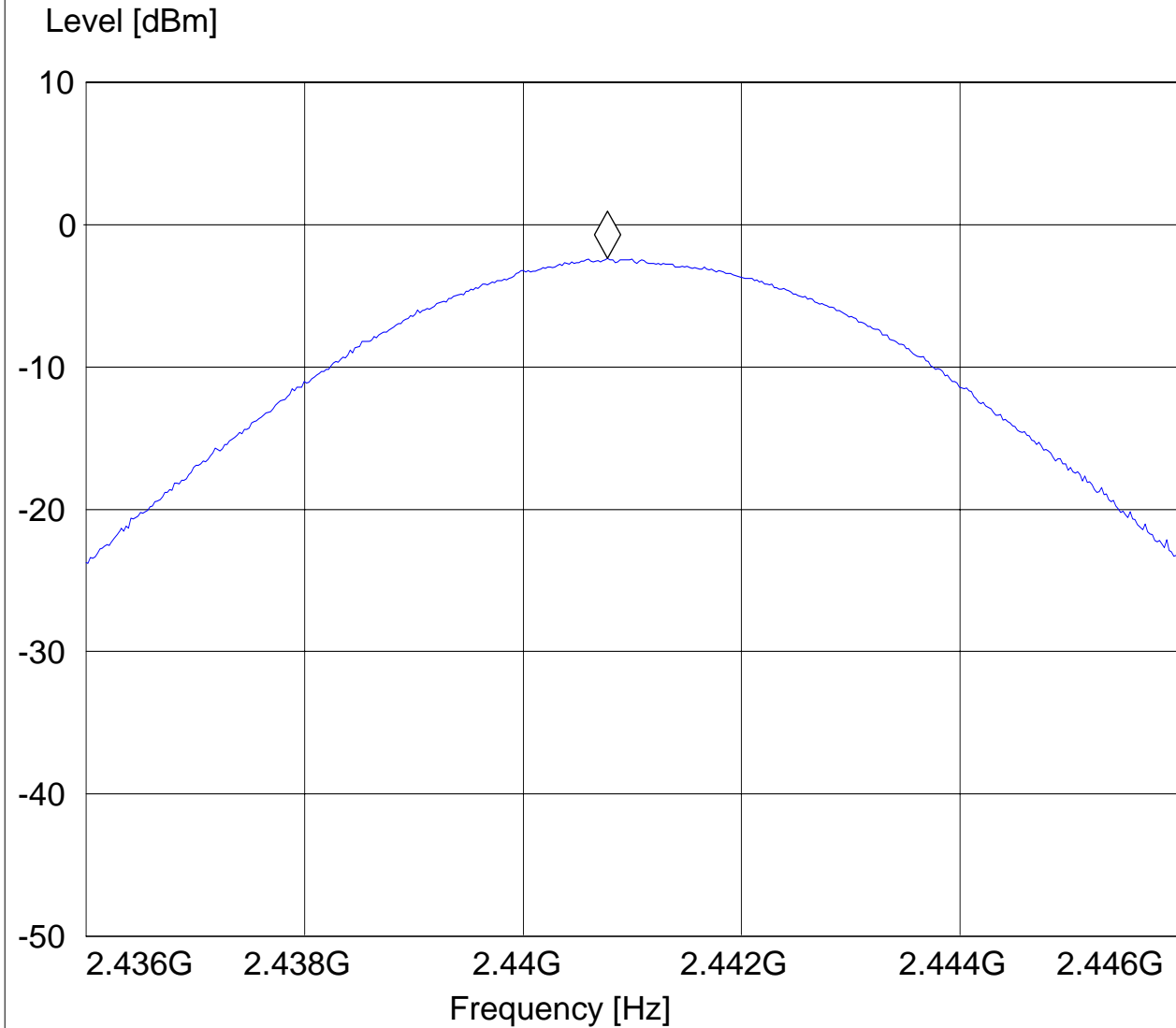
### EIRP 2441MHz II / 4 DQPSK

EUT: NTG4 RER, T00BE\*10005  
Customer: Harmen Becker  
Test Mode: BT Test mode  
ANT Orientation: H, TT37°  
EUT Orientation: H  
Test Engineer: Ed  
Power Supply: 12v Battery  
Comments:

**SWEEP TABLE: "EIRP BT mid channel"**

Short Description:	EIRP Bluetooth channel-2441MHz				
Start	Stop	Detector	Meas.	IF	Transducer
Frequency	Frequency		Time	Bandw.	
2.4 GHz	2.4 GHz	MaxPeak	Coupled	3 MHz	DUMMY-DBM

Marker: 2.440775551 GHz -2.35 dBm





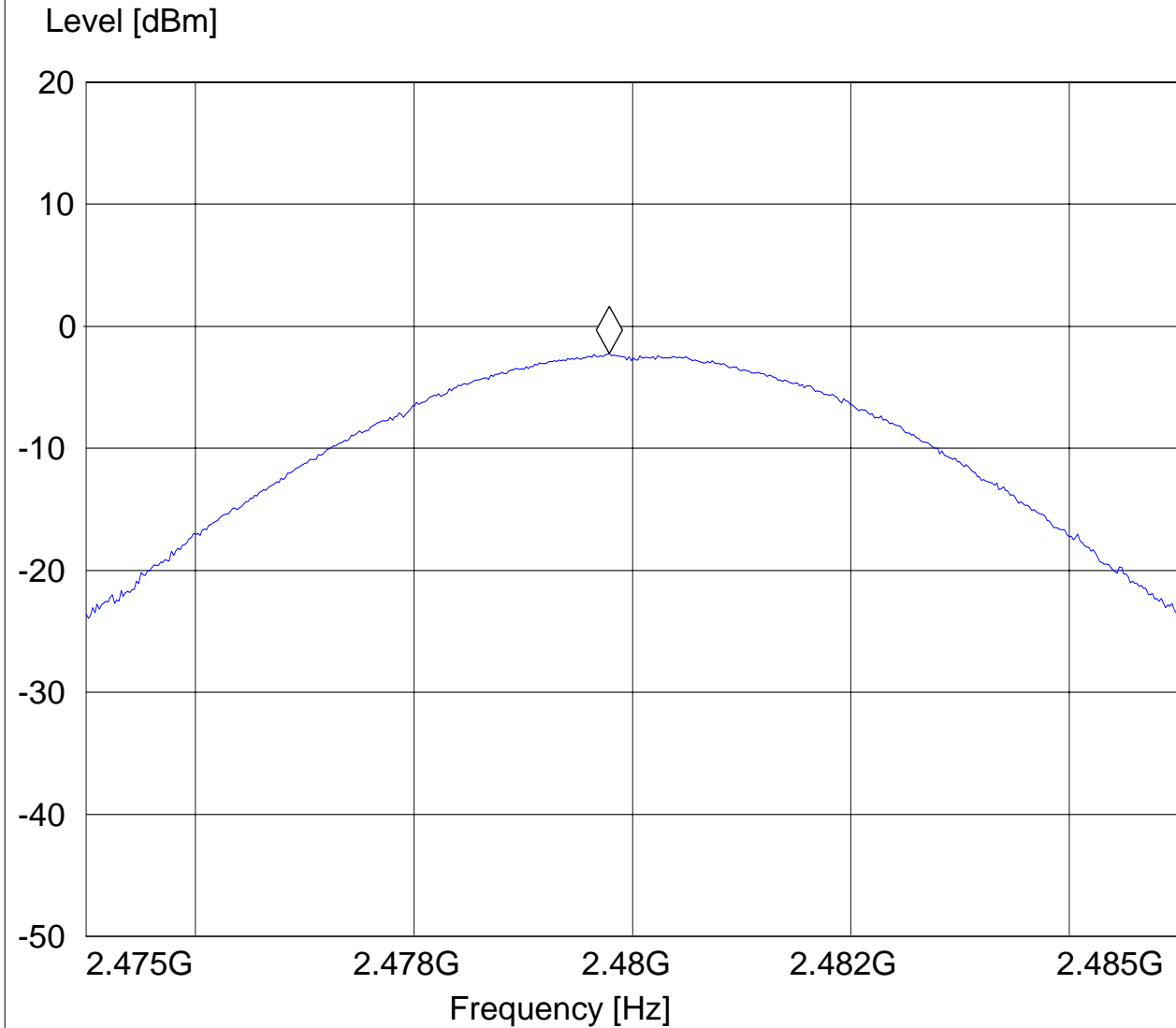
**EIRP 2480MHz II / 4 DQPSK**

EUT: NTG4 RER, T00BE\*10005  
 Customer: Harmen Becker  
 Test Mode: BT Test mode  
 ANT Orientation: H, TT37°  
 EUT Orientation: H  
 Test Engineer: Peter Mu  
 Power Supply: 12v Battery

**SWEEP TABLE: "EIRP BT high channel"**

Short Description:		EIRP Bluetooth channel-2480MHz			
Start	Stop	Detector	Meas. Time	IF Bandw.	Transducer
2.5 GHz	2.5 GHz	MaxPeak	Coupled	3 MHz	DUMMY-DBM
		MaxPeak			

Marker: 2.479789579 GHz -2.25 dBm





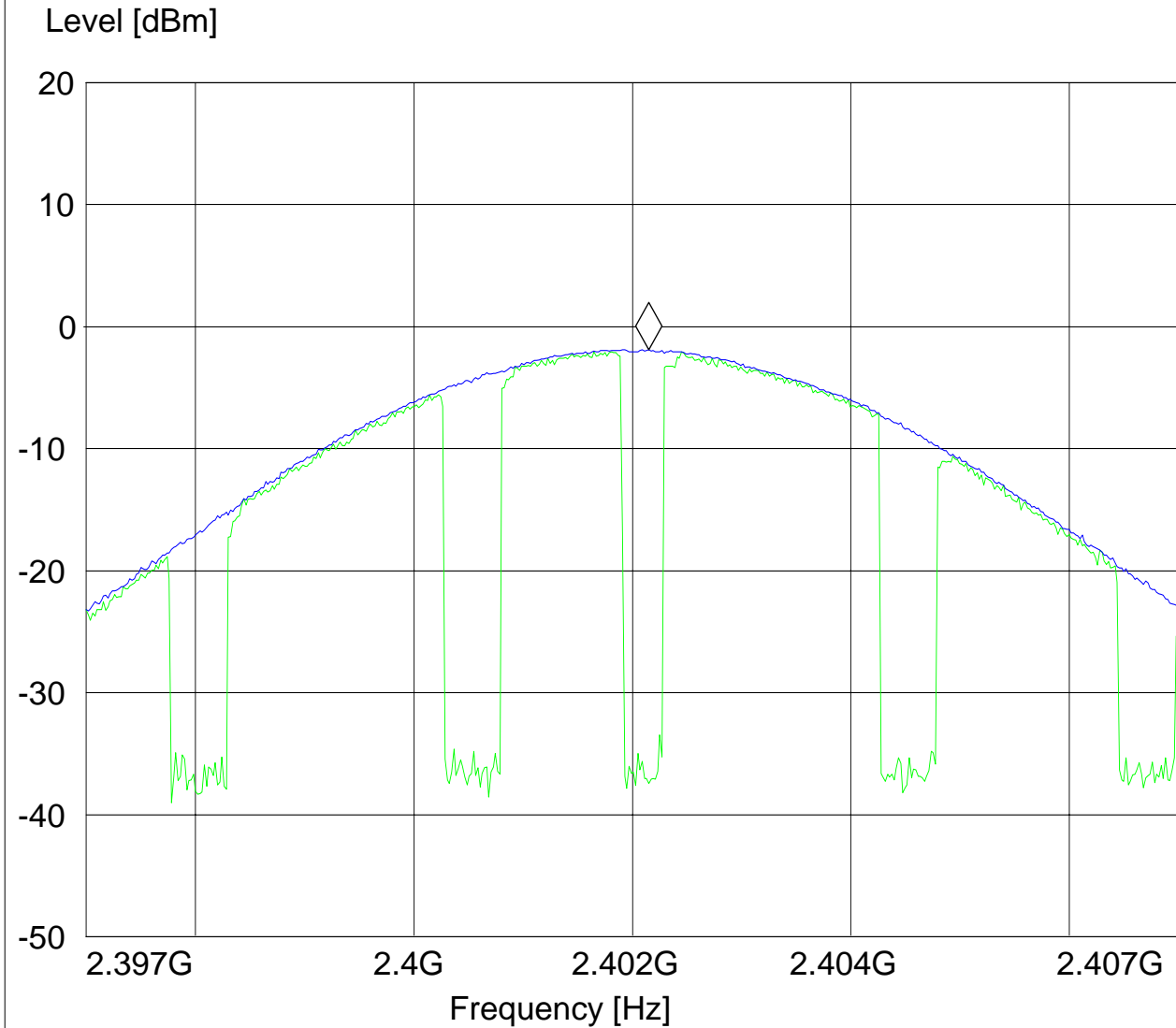
**EIRP 2402MHz 8DPSK**

EUT: NTG4 RER, T00BE\*10005  
 Customer: Harmen Becker  
 Test Mode: BT Test mode  
 ANT Orientation: H, TT37°  
 EUT Orientation: H  
 Test Engineer: Peter Mu  
 Power Supply: 12v Battery

**SWEEP TABLE: "EIRP BT low channel"**

Short Description:		EIRP Bluetooth channel-2402MHz			
Start	Stop	Detector	Meas.	IF	Transducer
Frequency	Frequency		Time	Bandw.	
2.4 GHz	2.4 GHz	MaxPeak	Coupled	3 MHz	DUMMY-DBM
		MaxPeak			

Marker: 2.402150301 GHz -1.89 dBm





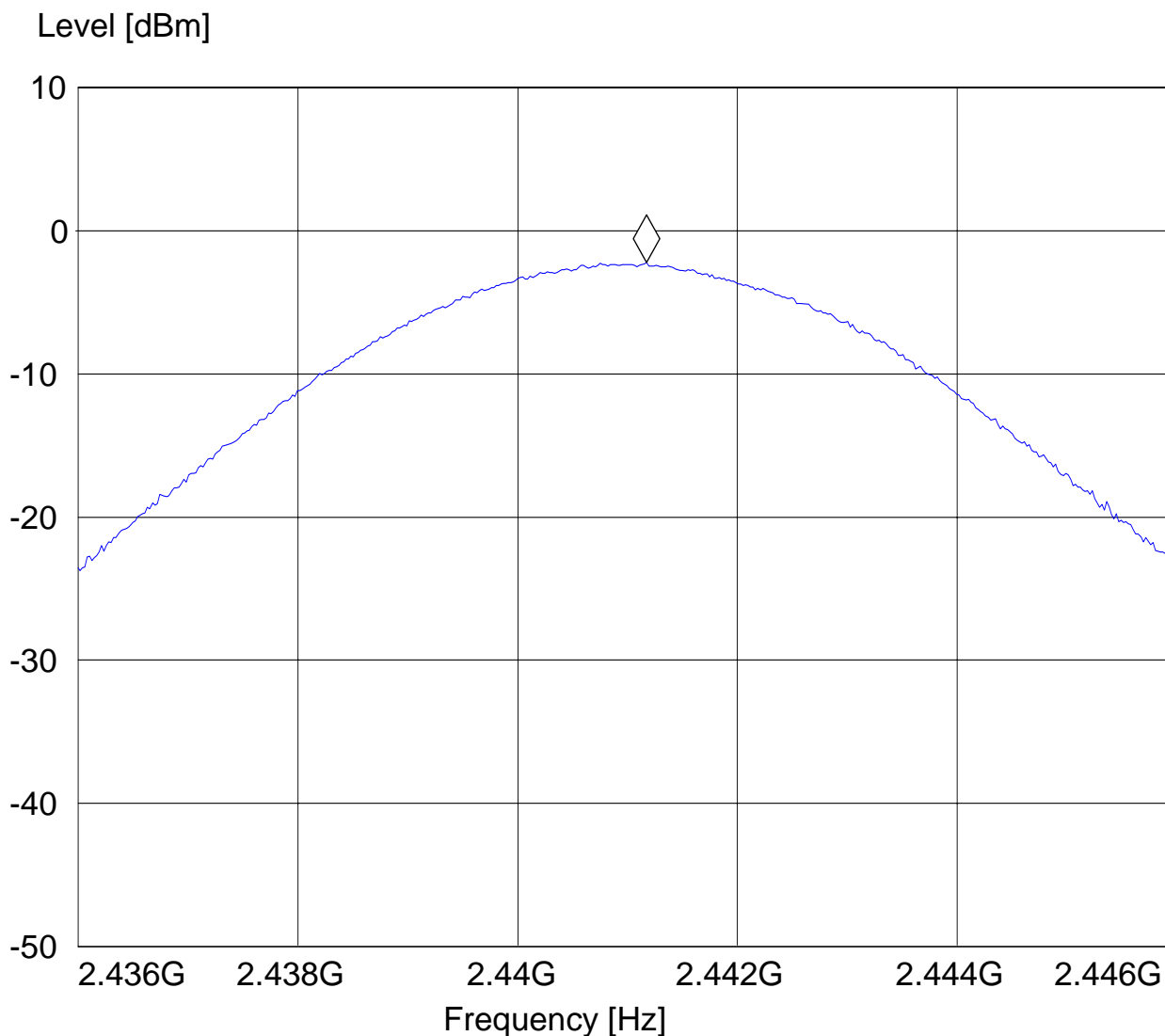
**EIRP 2441MHz 8DPSK**

EUT: NTG4 RER, T00BE\*10005  
 Customer: Harmen Becker  
 Test Mode: BT Test mode  
 ANT Orientation: H  
 EUT Orientation: H  
 Test Engineer: Peter Mu  
 Power Supply: 12v Battery  
 Comments:

**SWEEP TABLE: "EIRP BT mid channel"**

Short Description:		EIRP Bluetooth channel-2441MHz				
Start	Stop	Detector	Meas.	IF	Transducer	
Frequency	Frequency		Time	Bandw.		
2.4 GHz	2.4 GHz	MaxPeak	Coupled	3 MHz	DUMMY-DBM	

Marker: 2.44172345 GHz -2.24 dBm







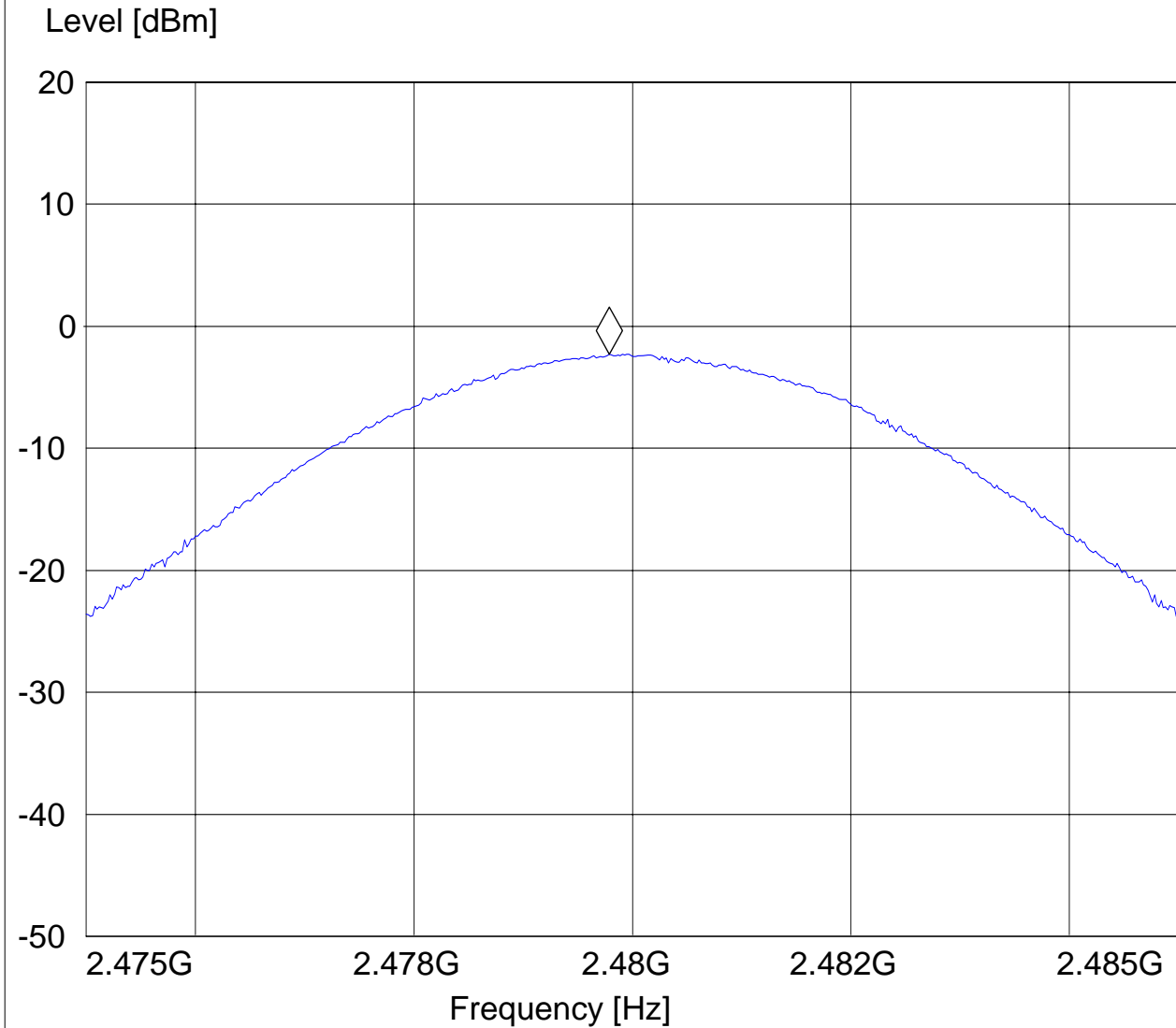
**EIRP 2480MHz 8DPSK**

EUT: NTG4 RER, T00BE\*10005  
 Customer: Harmen Becker  
 Test Mode: BT Test mode  
 ANT Orientation: H, TT37°  
 EUT Orientation: H  
 Test Engineer: Peter Mu  
 Power Supply: 12v Battery

**SWEEP TABLE: "EIRP BT high channel"**

Short Description:		EIRP Bluetooth channel-2480MHz			
Start	Stop	Detector	Meas. Time	IF Bandw.	Transducer
2.5 GHz	2.5 GHz	MaxPeak	Coupled	3 MHz	DUMMY-DBM
		MaxPeak			

Marker: 2.479789579 GHz -2.3 dBm





**5.2 RESTRICTED BAND EDGE COMPLIANCE RADIATED §15.247/15.205**

**5.2.1 LIMITS**

30.□ 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
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	( <sup>2</sup> )
13.36 - 13.41			

\*PEAK LIMIT= 74dBuV/m

\*AVG. LIMIT= 54dBuV/m



**5.2.2 RESULTS: GFSK  
(2402MHz) LOWER BAND EDGE PEAK –GFSK MODULATION**

EUT: NTG4 RER, T00BE\*10005

Customer: Harmen Becker

Test Mode: BT Test mode, ch 0

ANT Orientation: H

EUT Orientation: H

Test Engineer: Ed

Power Supply: 12v Battery

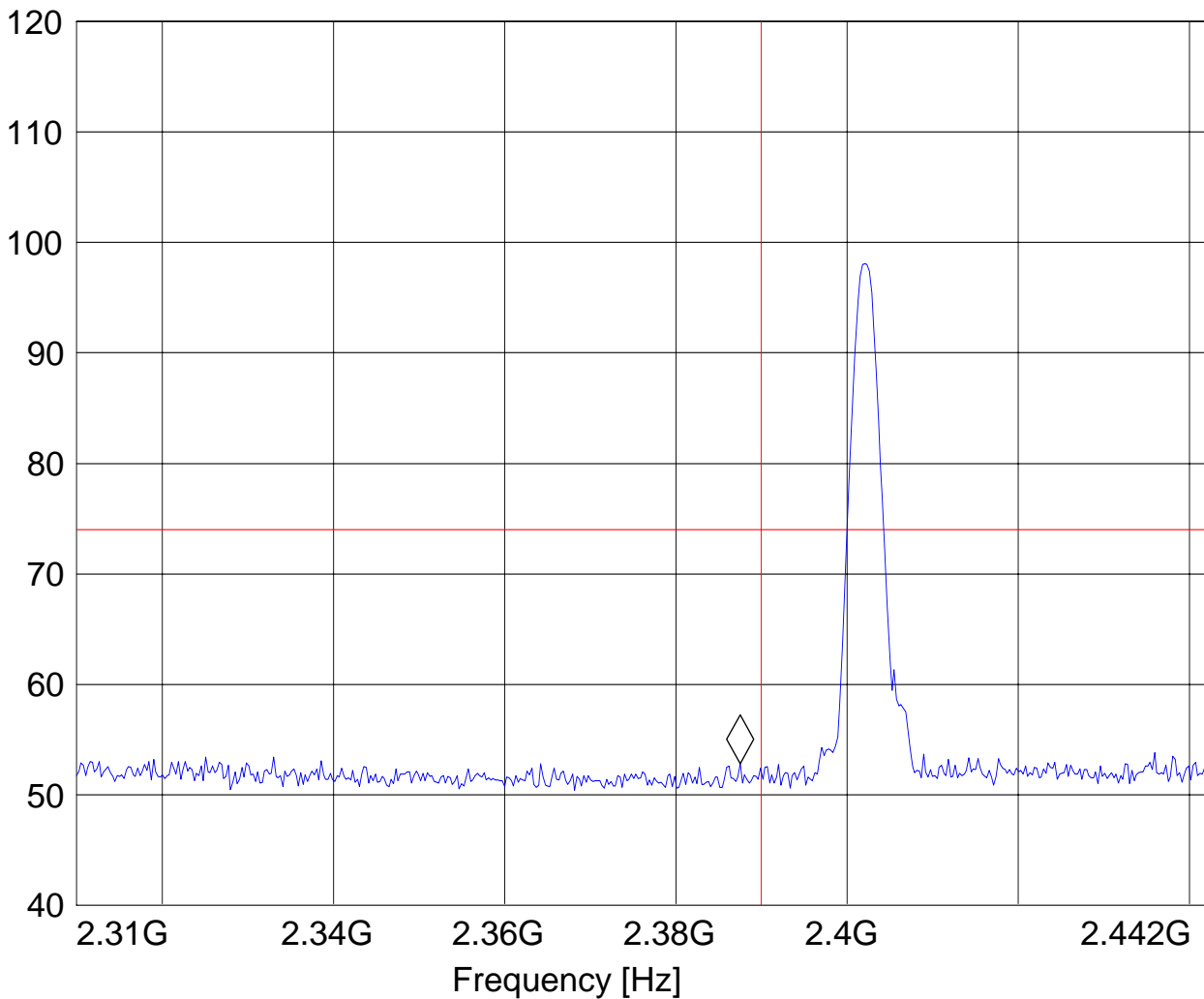
Comments:

**SWEEP TABLE: "FCC15.247 LBE\_PK"**

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

Marker: 2.387507014 GHz 52.78 dBμV/m

Level [dBμV/m]





**(2402MHz) LOWER BAND EDGE AVERAGE –GFSK MODULATION**

EUT: NTG4 RER, T00BE\*10005

Customer: Harmen Becker

Test Mode: BT Test mode, ch 0

ANT Orientation: H

EUT Orientation: H

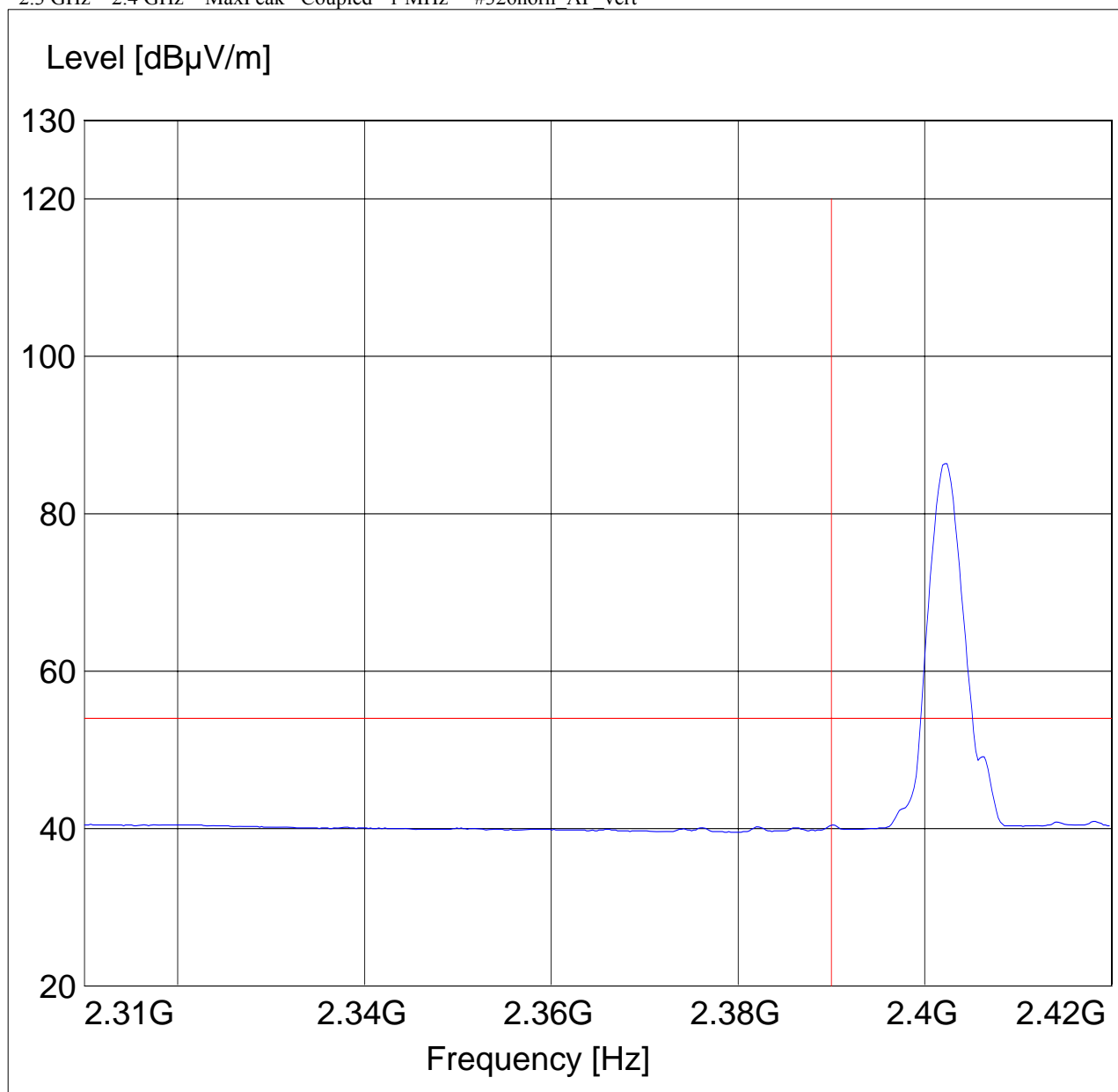
Test Engineer: Ed

Power Supply: 12v Battery

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





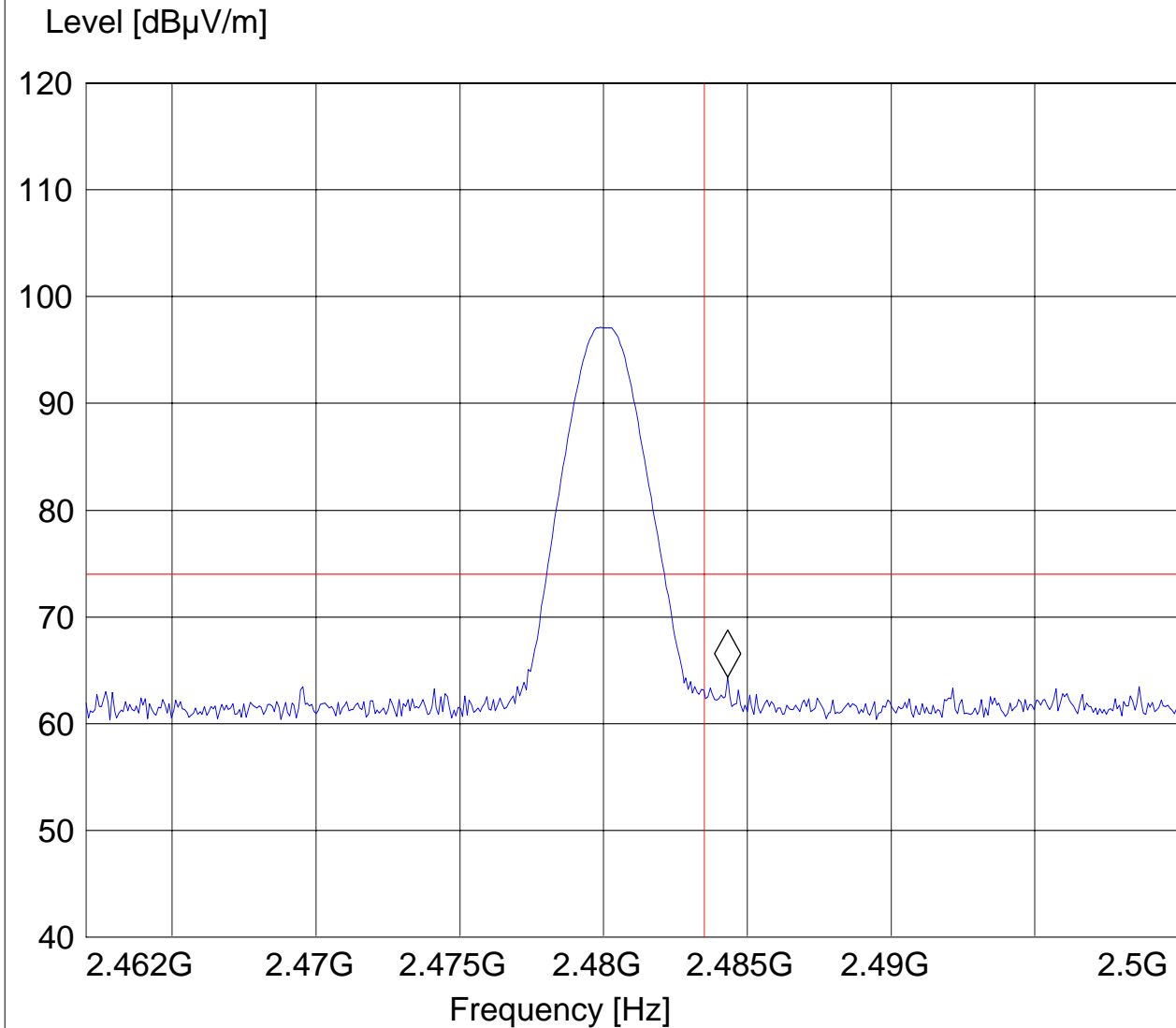
**(2480MHz) HIGHER BAND EDGE PEAK –GFSK MODULATION**

EUT: NTG4 RER, T00BE\*10005  
Customer: Harmen Becker  
Test Mode: BT Test mode, ch 78  
ANT Orientation: H  
EUT Orientation: H  
Test Engineer: Ed  
Power Supply: 12v Battery  
Comments:

**SWEEP TABLE: "FCC15.247 HBE\_PK"**

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

Marker: 2.484312625 GHz 64.37 dB $\mu$ V/m



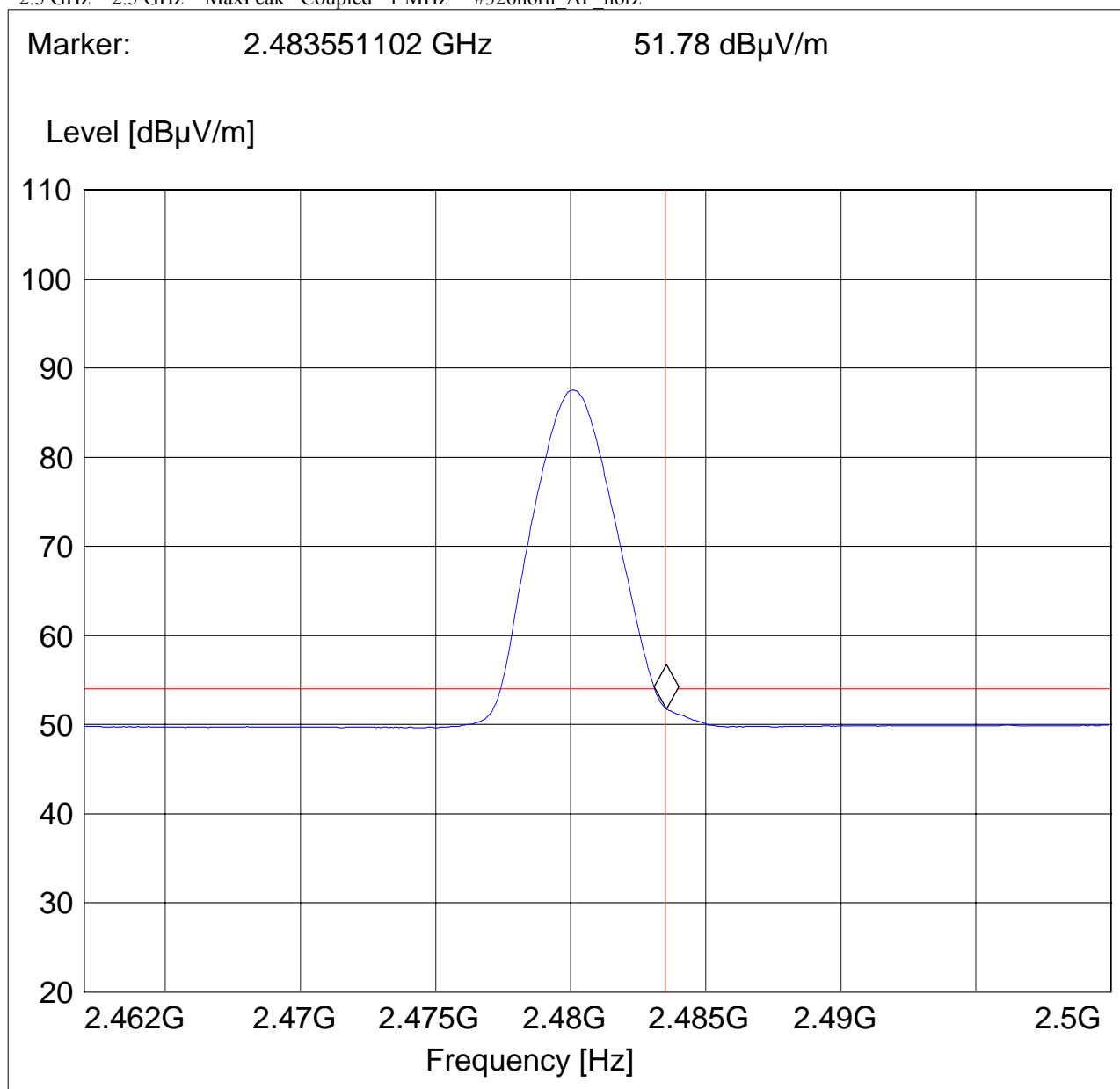


### HIGHER BAND EDGE AVERAGE-GFSK MODULATION

EUT: NTG4 RER, T00BE\*10005  
Customer: Harmen Becker  
Test Mode: BT Test mode, ch 78  
ANT Orientation: H  
EUT Orientation: H  
Test Engineer: Ed  
Power Supply: 12v Battery  
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 RESULTS: $\pi/4$ DQPSK



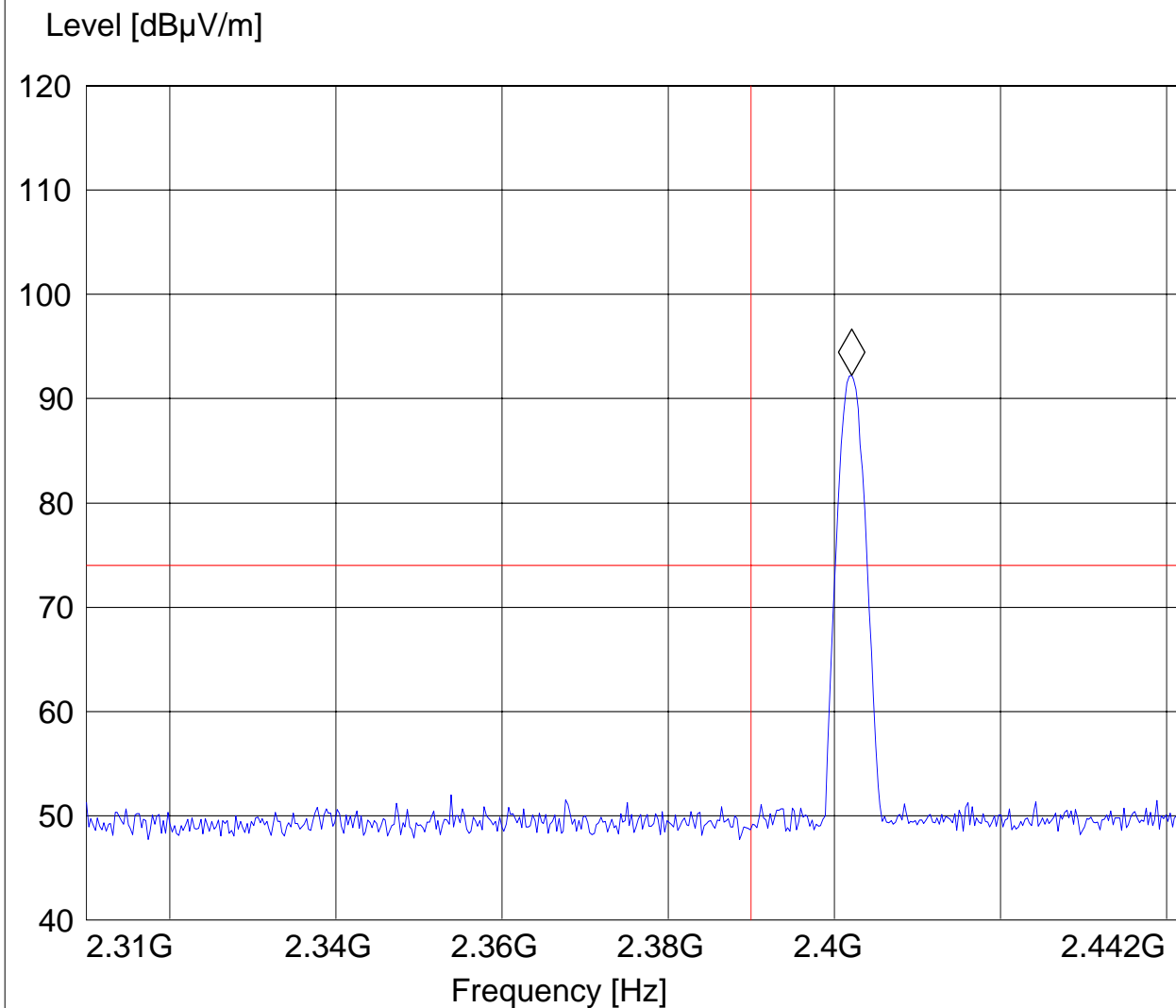
**(2402MHz) LOWER BAND EDGE PEAK –  $\pi/4$  DQPSK MODULATION**

EUT: NTG4 RER, T00BE\*10005  
Customer: Harmen Becker  
Test Mode: BT Test mode, ch 0  
ANT Orientation: H  
EUT Orientation: H  
Test Engineer: Ed  
Power Supply: 12v 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

Marker: 2.402056112 GHz 92.21 dB $\mu$ V/m



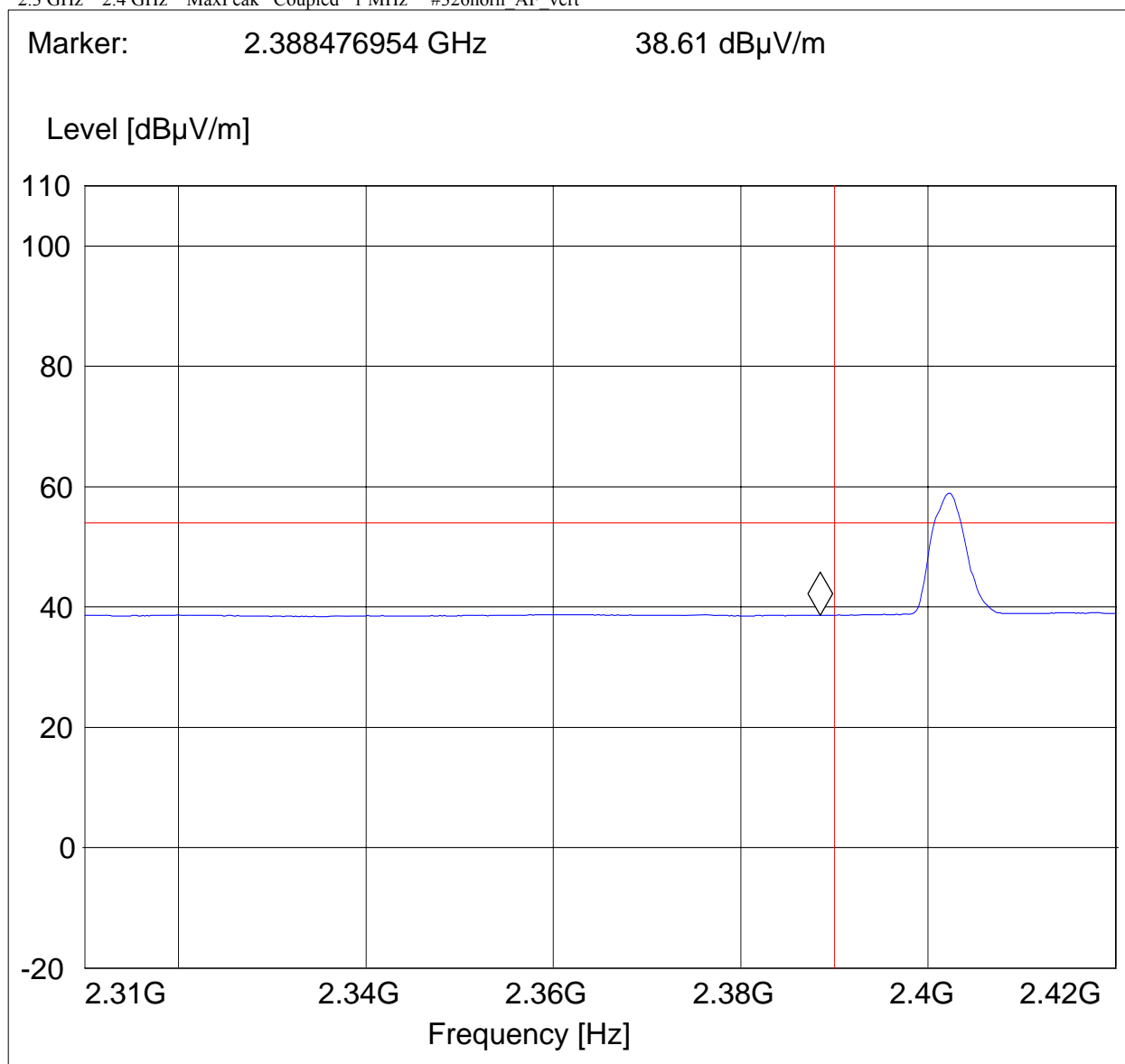


**(2402MHz) LOWER BAND EDGE AVERAGE  $-\pi/4$  DQPSK MODULATION**

EUT: NTG4 RER, T00BE\*10005  
Customer: Harmen Becker  
Test Mode: BT Test mode, ch 0  
ANT Orientation: H  
EUT Orientation: H  
Test Engineer: Ed  
Power Supply: 12v Battery  
Comments:

***SWEEP TABLE: "FCC15.247 LBE\_AVG"***

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





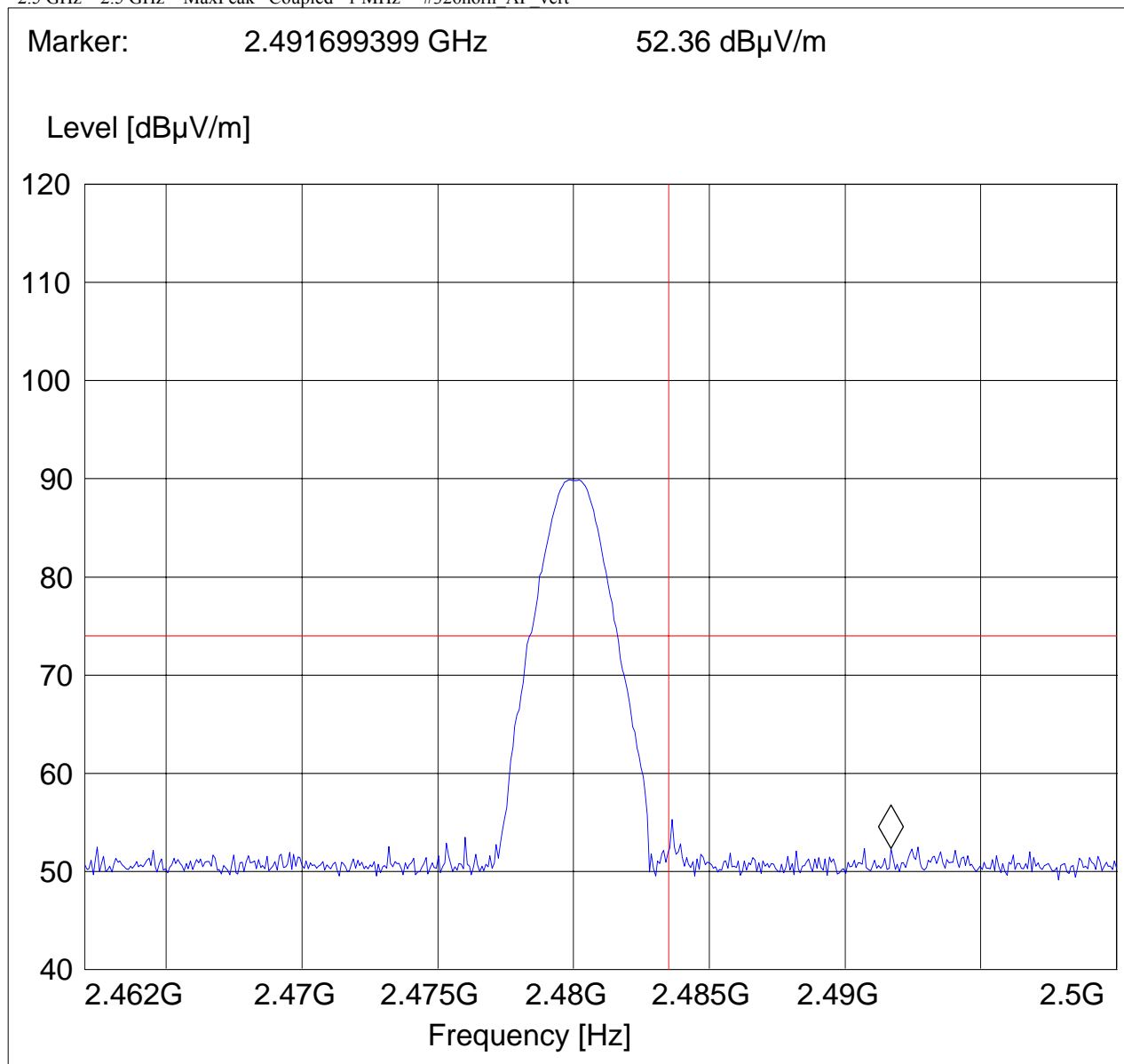


**(2480MHz) HIGHER BAND EDGE PEAK  $-\pi/4$  DQPSK MODULATION**

EUT: NTG4 RER, T00BE\*10005  
Customer: Harmen Becker  
Test Mode: BT Test mode, ch 78  
ANT Orientation: H  
EUT Orientation: H  
Test Engineer: Ed  
Power Supply: 12v Battery  
Comments:

***SWEEP TABLE: "FCC15.247 HBE\_PK"***

Start	Stop	Detector	Meas.	IF	Transducer
2.5 GHz	2.5 GHz	MaxPeak	Coupled	1 MHz	#326horn AF vert



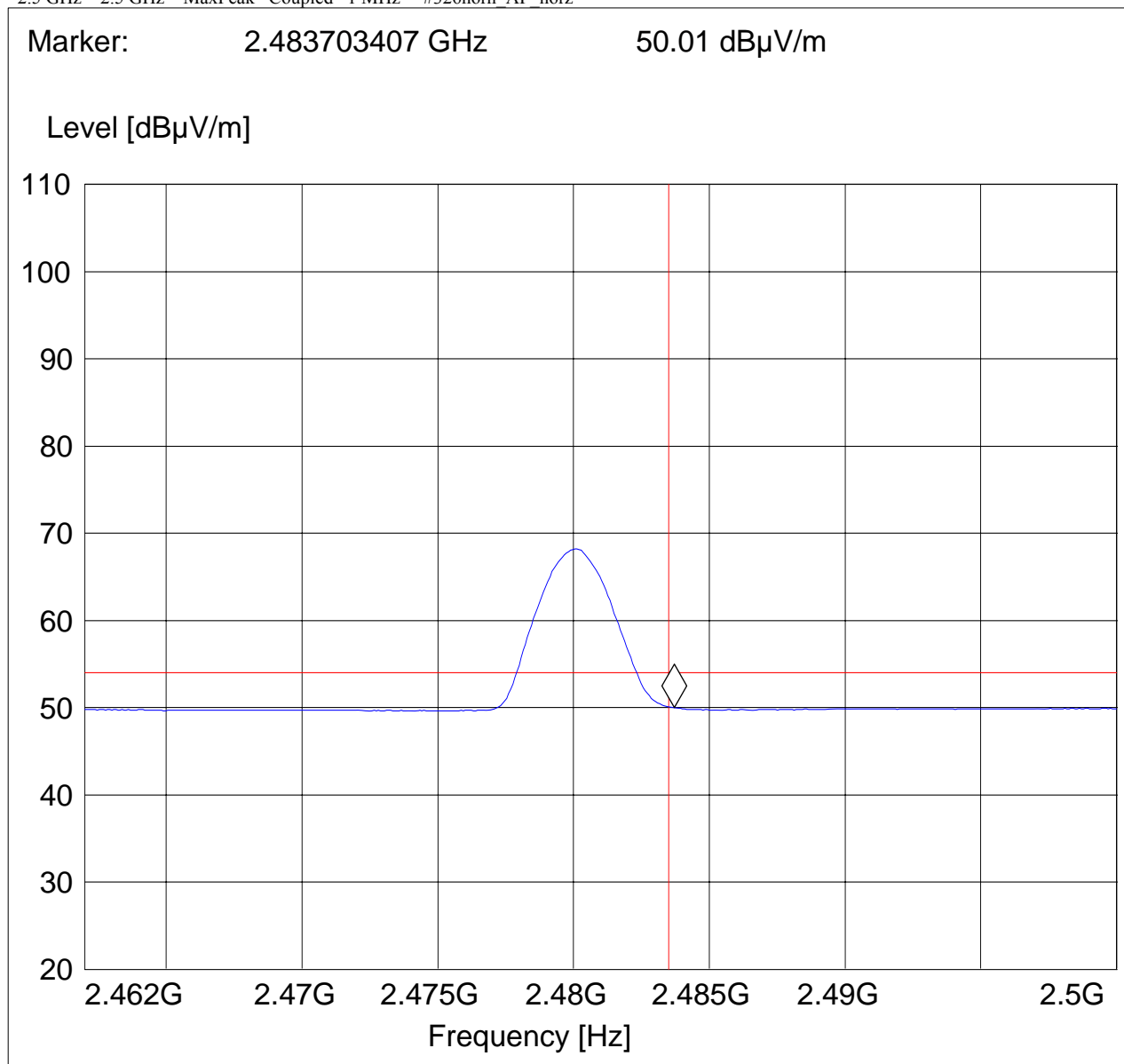


**HIGHER BAND EDGE AVERAGE-  $\pi/4$  DQPSK MODULATION**

EUT: NTG4 RER, T00BE\*10005  
Customer: Harmen Becker  
Test Mode: BT Test mode, ch 78  
ANT Orientation: H  
EUT Orientation: H  
Test Engineer: Ed  
Power Supply: 12v Battery  
Comments:

***SWEEP TABLE: "FCC15.247 HBE\_AVG"***

Start	Stop	Detector	Meas.	IF	Transducer
2.5 GHz	2.5 GHz	MaxPeak	Coupled	1 MHz	#326horn AF horz





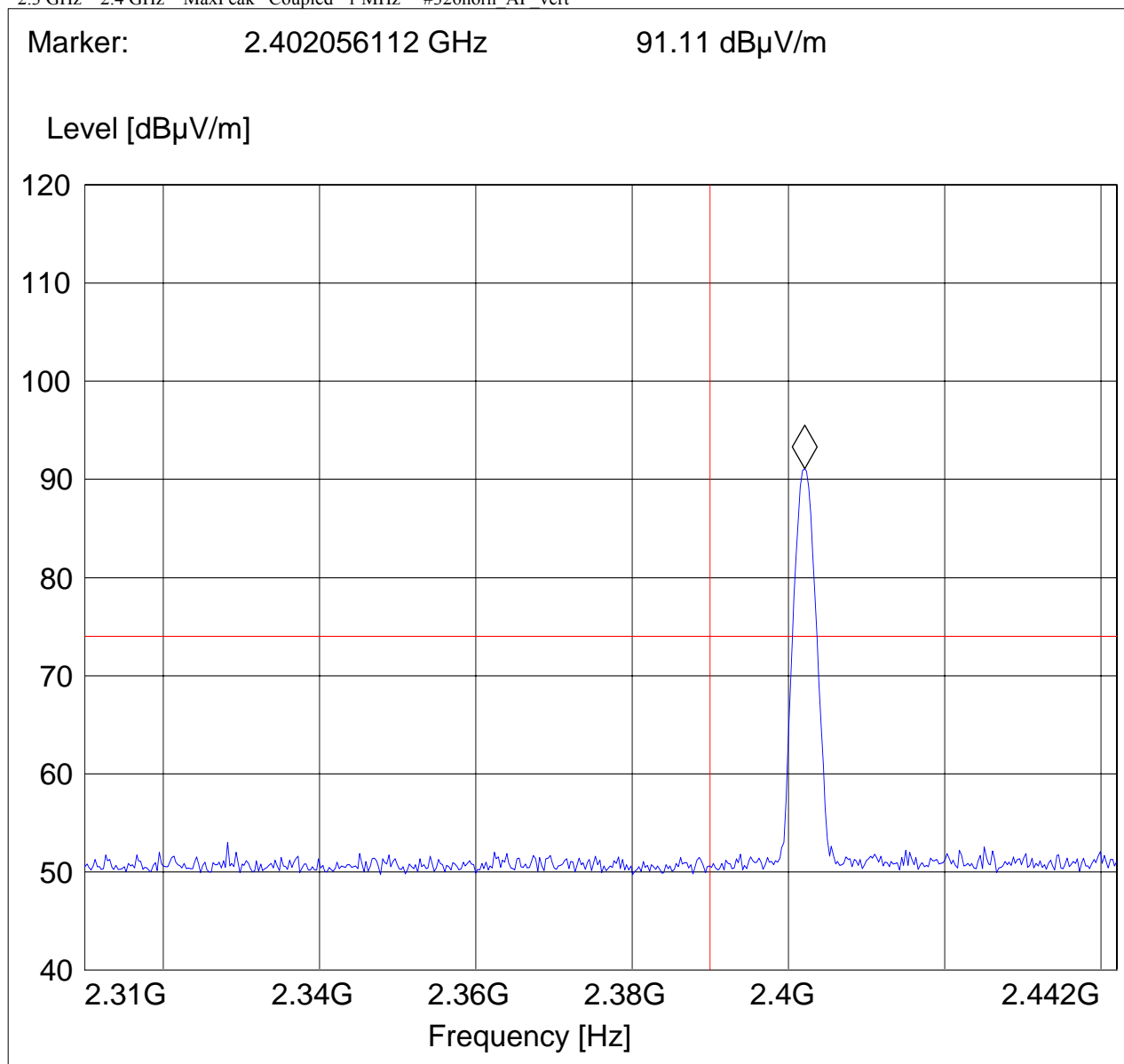
### 5.2.4 RESULTS: 8DPSK

#### (2402MHz) LOWER BAND EDGE PEAK – 8DPSK MODULATION

EUT: NTG4 RER, T00BE\*10005  
Customer: Harmen Becker  
Test Mode: BT Test mode, ch 0  
ANT Orientation: H  
EUT Orientation: H  
Test Engineer: Ed  
Power Supply: 12v Battery  
Comments:

#### ***SWEEP TABLE: "FCC15.247 LBE\_PK"***

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



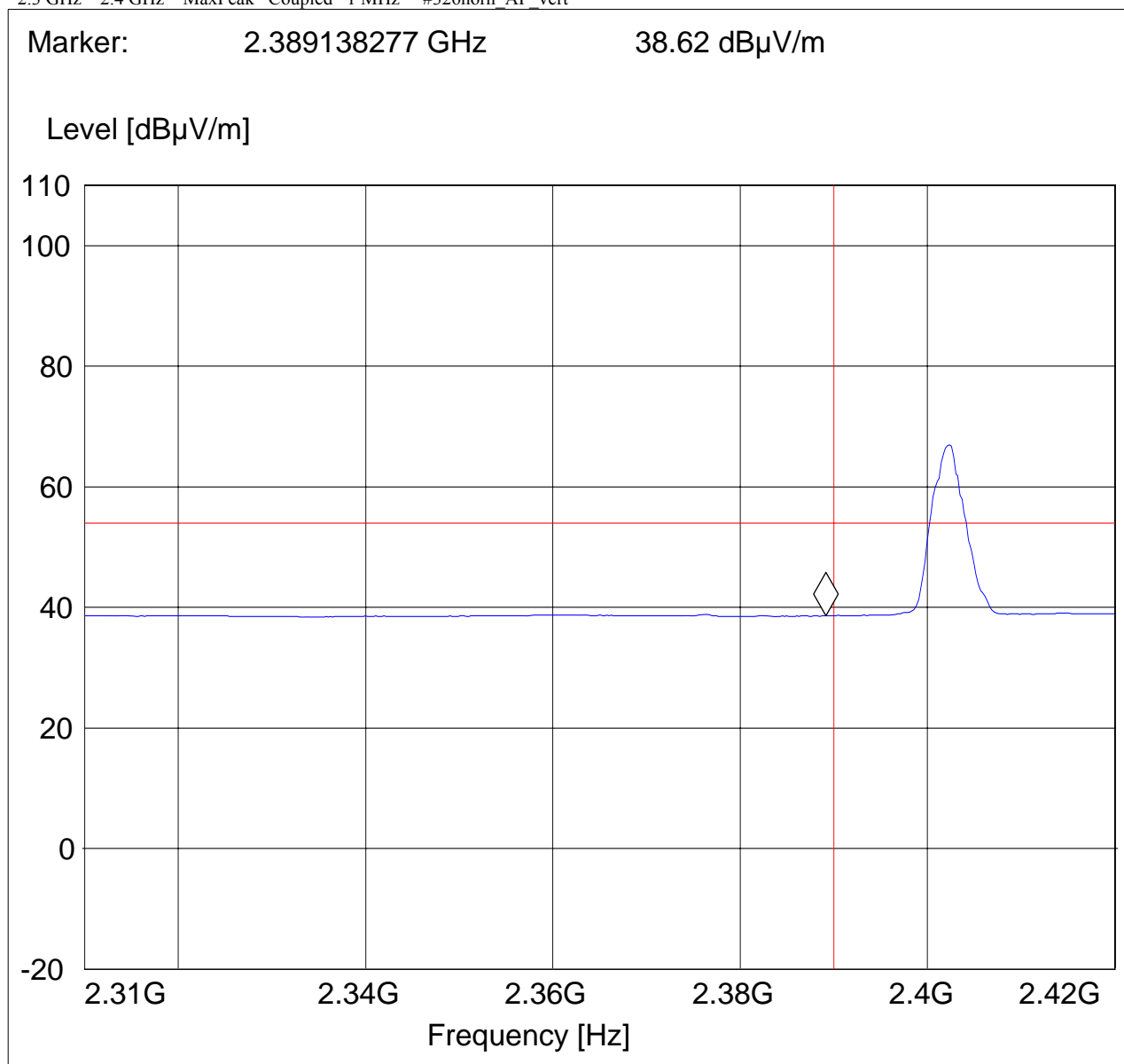


**(2402MHz) LOWER BAND EDGE AVERAGE -8DPSK MODULATION**

EUT: NTG4 RER, T00BE\*10005  
 Customer: Harmen Becker  
 Test Mode: BT Test mode, ch 0  
 ANT Orientation: H  
 EUT Orientation: H  
 Test Engineer: Ed  
 Power Supply: 12v Battery  
 Comments:

**SWEEP TABLE: "FCC15.247 LBE\_AVG"**

Start Stop Detector Meas. IF Transducer  
 Frequency Frequency Time Bandw.  
 2.3 GHz 2.4 GHz MaxPeak Coupled 1 MHz #326horn\_AF\_vert



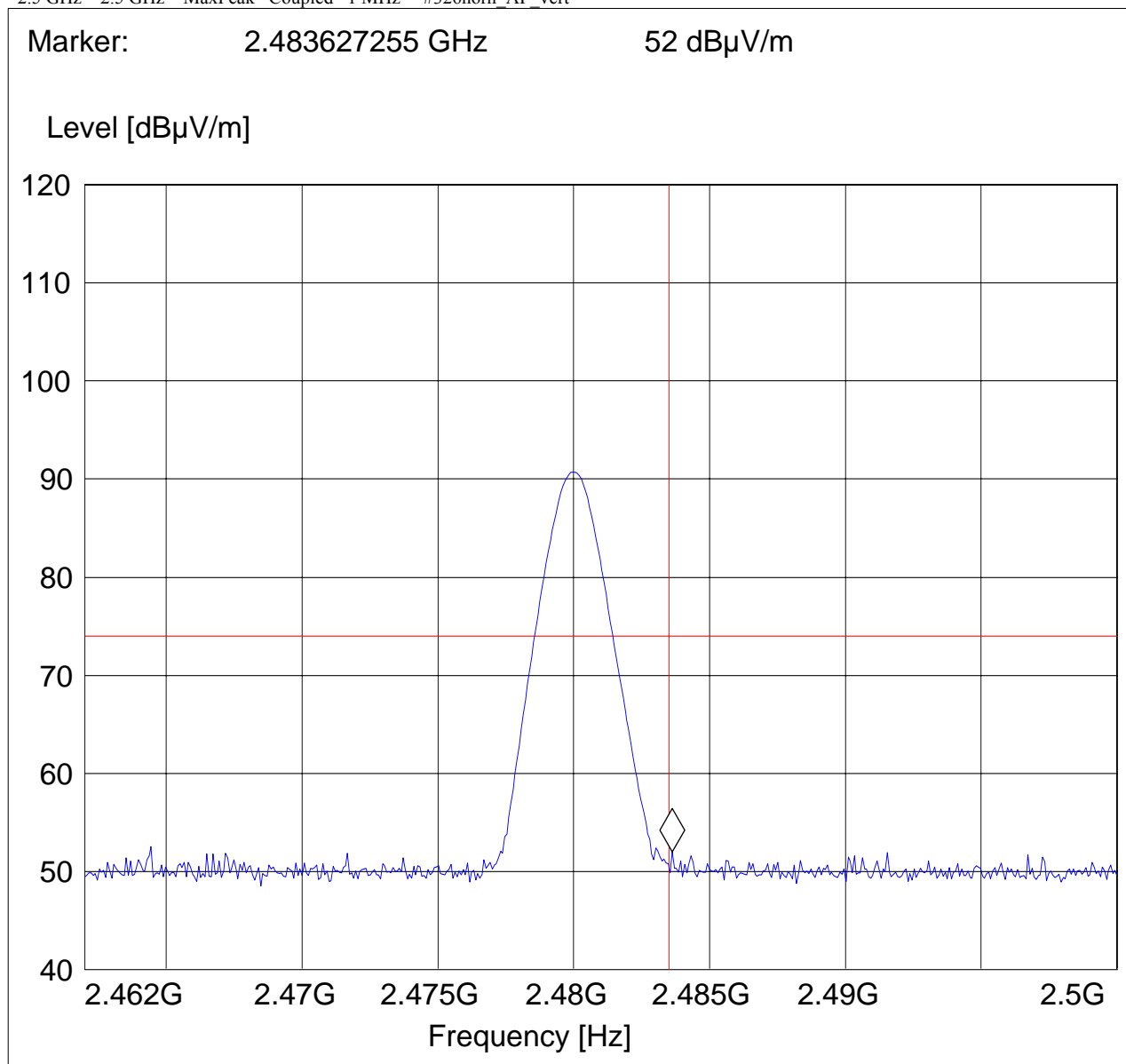


**RESULTS (2480MHz) HIGHER BAND EDGE PEAK – 8DPSK MODULATION**

EUT: NTG4 RER, T00BE\*10005  
 Customer: Harmen Becker  
 Test Mode: BT Test mode, ch 78  
 ANT Orientation: H  
 EUT Orientation: H  
 Test Engineer: Ed  
 Power Supply: 12v Battery  
 Comments:

***SWEEP TABLE: "FCC15.247 HBE\_PK"***

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



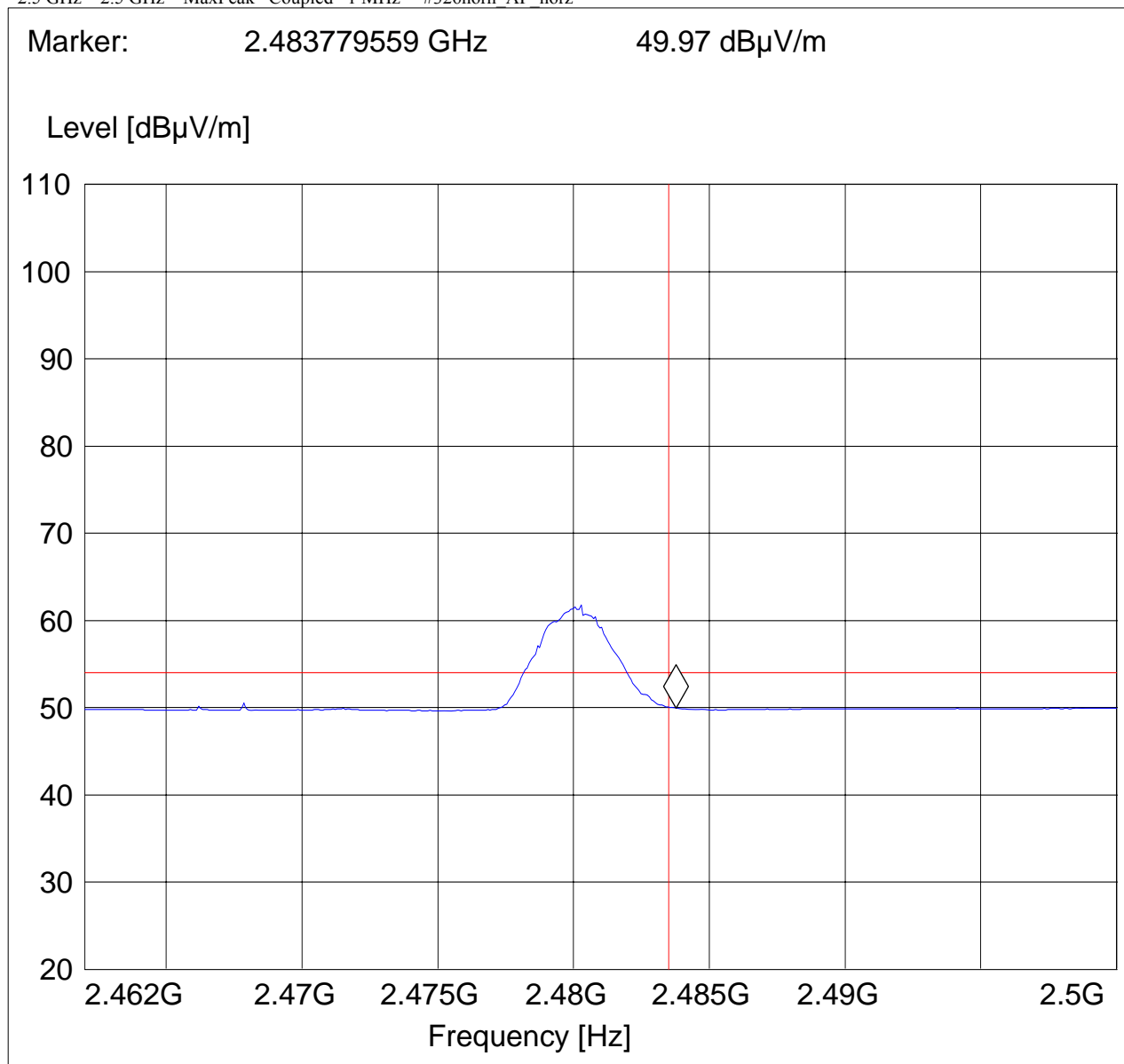


### HIGHER BAND EDGE AVERAGE-8DPSK MODULATION

EUT: NTG4 RER, T00BE\*10005  
Customer: Harmen Becker  
Test Mode: BT Test mode, ch 78  
ANT Orientation: H  
EUT Orientation: H  
Test Engineer: Ed  
Power Supply: 12v Battery  
Comments:

#### ***SWEEP TABLE: "FCC15.247 HBE\_AVG"***

Start	Stop	Detector	Meas.	IF	Transducer
2.5 GHz	2.5 GHz	MaxPeak	Coupled	1 MHz	#326horn AF horz





**5.3 TRANSMITTER SPURIOUS EMISSIONS RADIATED § 15.247/15.205/15.209**

**5.3.1 LIMITS**

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
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	( <sup>2</sup> )
13.36 - 13.41			

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

**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.

**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

All Spurious Emission measurements are done in GFSK mode and represents the worse case emission from the device.



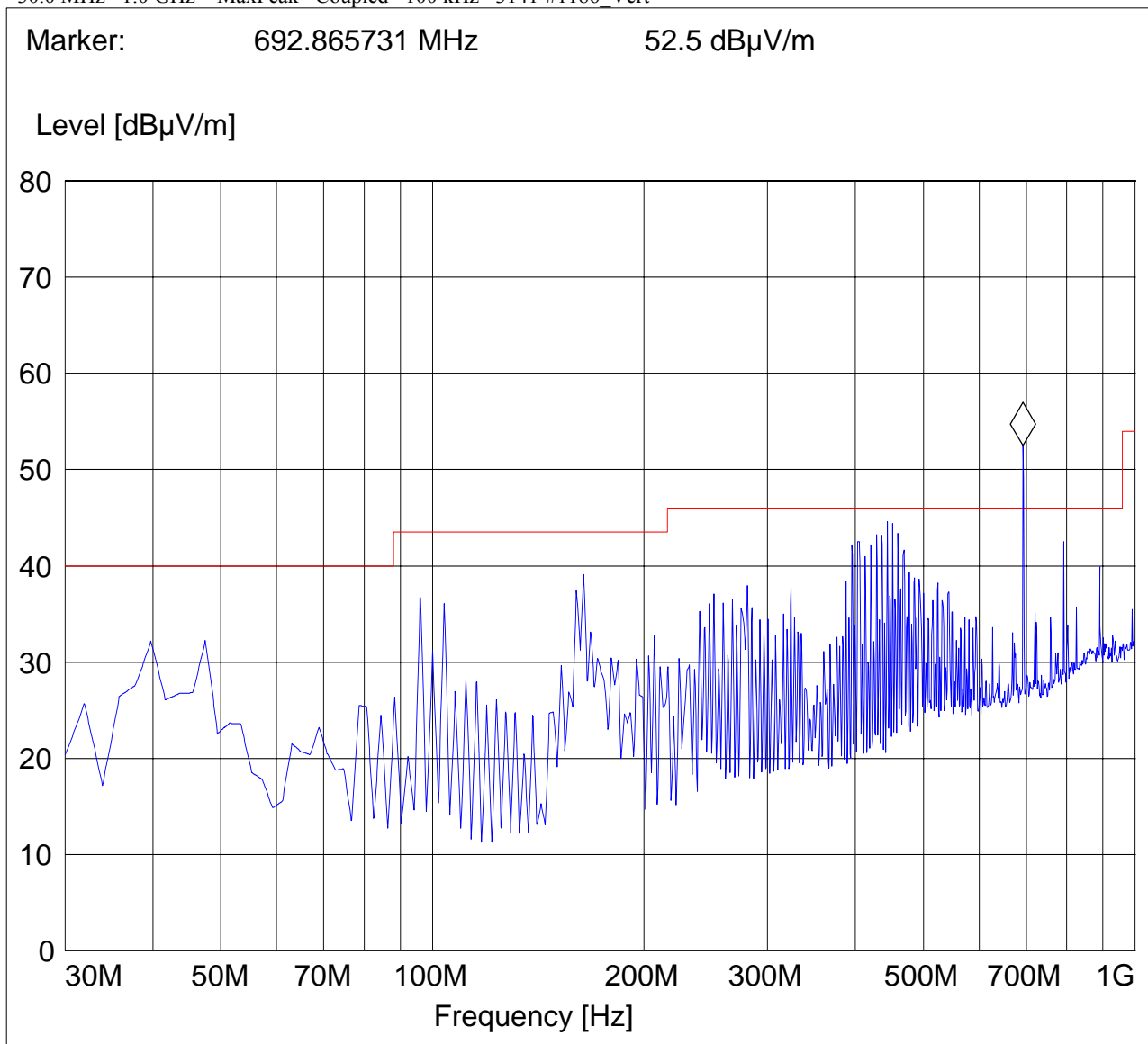
**5.3.2 RESULTS**

30MHz – 1GHz Antenna: vertical, **Quasi peak value passes.**

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

EUT: DCX NTG4 RER  
 Customer: HARMAN BECKER  
 Test Mode: BT  
 ANT Orientation: V  
 EUT Orientation: H  
 Test Engineer: Peter Mu  
 Power Supply: 12 V DC BATTERY  
 Comments: CHASSIS GROUNDED, ferrite on cable, normal mode setup  
**SWEEP TABLE: "FCC15.247\_30M-1G\_Ver"**

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



At 692MHz, peak 24.78dB, quasi peak 18.59dB, Diff = 6.18dB 52.5 – 6.18dB = 46.32dB (PASS)



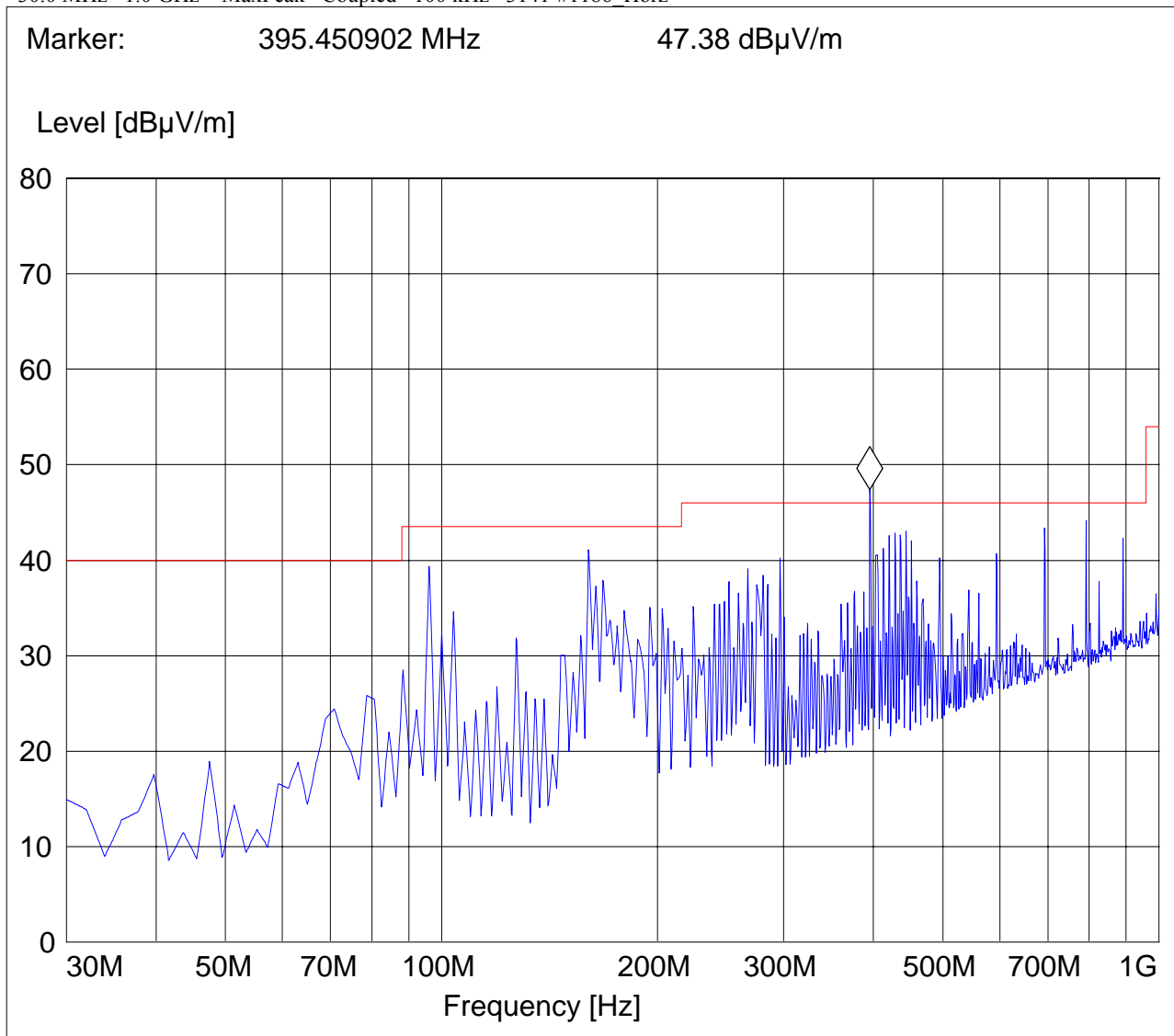


30MHz – 1GHz Antenna: horizontal, **Quasi peak value passes.**

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

EUT: DCX NTG4 RER  
Customer: HARMAN BECKER  
Test Mode: BT  
ANT Orientation: H  
EUT Orientation: H  
Test Engineer: Peter Mu  
Power Supply: 12 V DC BATTERY  
Comments: CHASSIS GROUNDED, ferrite on cable, normal mode setup  
**SWEEP TABLE: "FCC15.247\_30M-1G\_Hor"**

Start	Stop	Detector	Meas.	IF	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	3141-#1186 Horz



AT 395MHz, peak 21.78dB, quasi peak 16.48dB. Diff = -5.3dB. 47.38-5.3 = 42.08dB (PASS)



**1-18GHz (2402MHz)**

**Note: The peak above the limit line is the carrier freq.**

**Note: Peak Reading vs. Average limit**

EUT / Description: NTG4 RER, T00BE\*10005

Manufacturer: Harmen Becker

Test mode: BT Test mode, ch 0

ANT Orientation: : H

EUT Orientation: H

Test Engineer: Ed

Voltage: 12 Battery

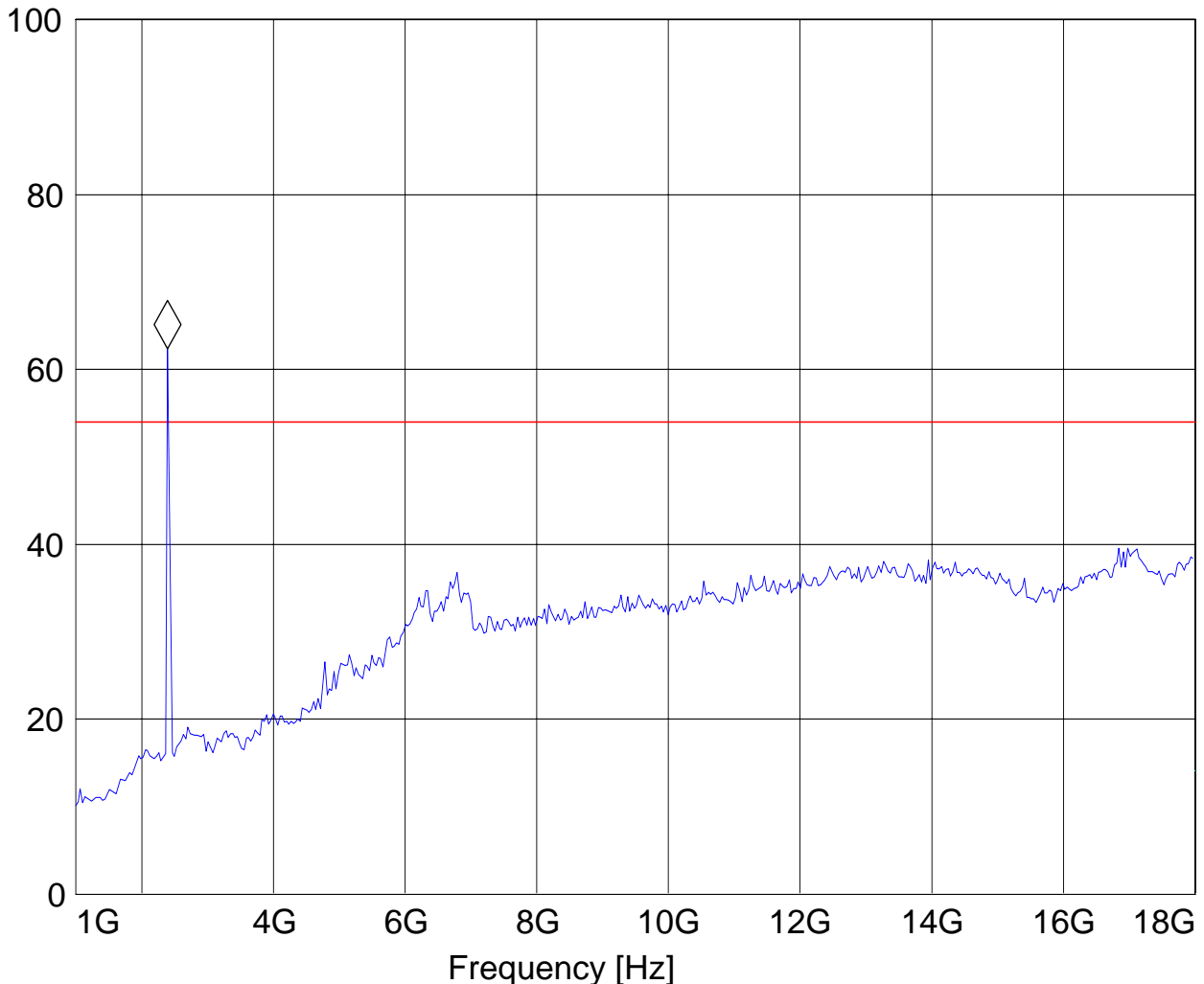
Comments: marker is on uplink sig.

**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

Marker: 2.396793587 GHz 62.38 dBµV/m

Level [dBµV/m]





**1-18GHz (2441MHz)**

**Note: The peaks above the limit line is the carrier freq.**

**Note: Peak Reading vs. Average limit**

EUT / Description: NTG4 RER, T00BE\*10005

Manufacturer: Harmen Becker

Test mode: BT Test mode, ch 39

ANT Orientation: : H

EUT Orientation: H

Test Engineer: Ed

Voltage: 12 Battery

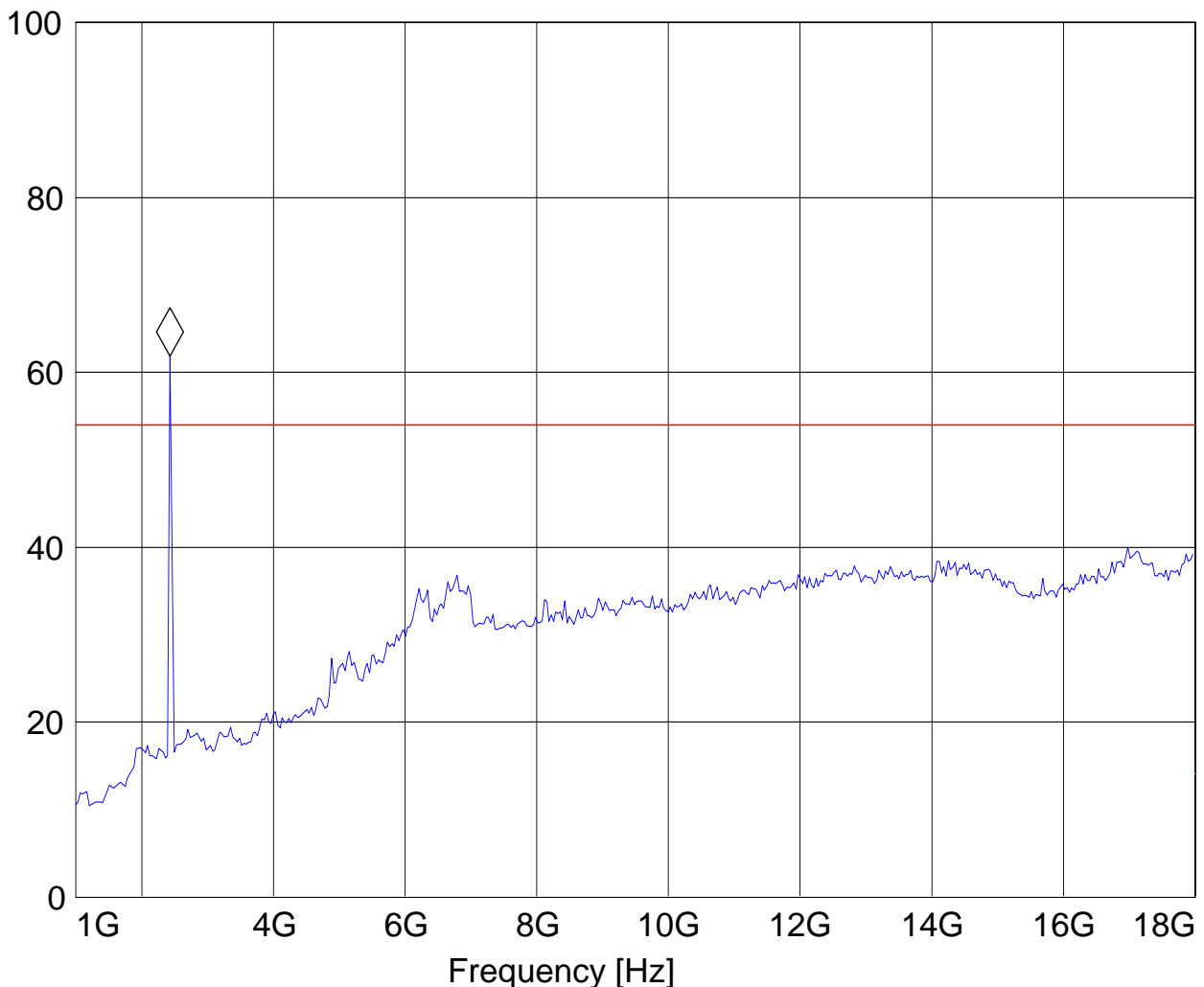
Comments: marker is on uplink sig.

**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

Marker: 2.430861723 GHz 61.85 dBµV/m

Level [dBµV/m]





**1-18GHz (2480MHz)**

**Note: The peaks above the limit line is the carrier freq.**

**Note: Peak Reading vs. Average limit**

EUT / Description: NTG4 RER, T00BE\*10005

Manufacturer: Harmen Becker

Test mode: BT Test mode, ch 78

ANT Orientation: : H

EUT Orientation: H

Test Engineer: Ed

Voltage: 12 Battery

Comments: marker is on uplink sig.

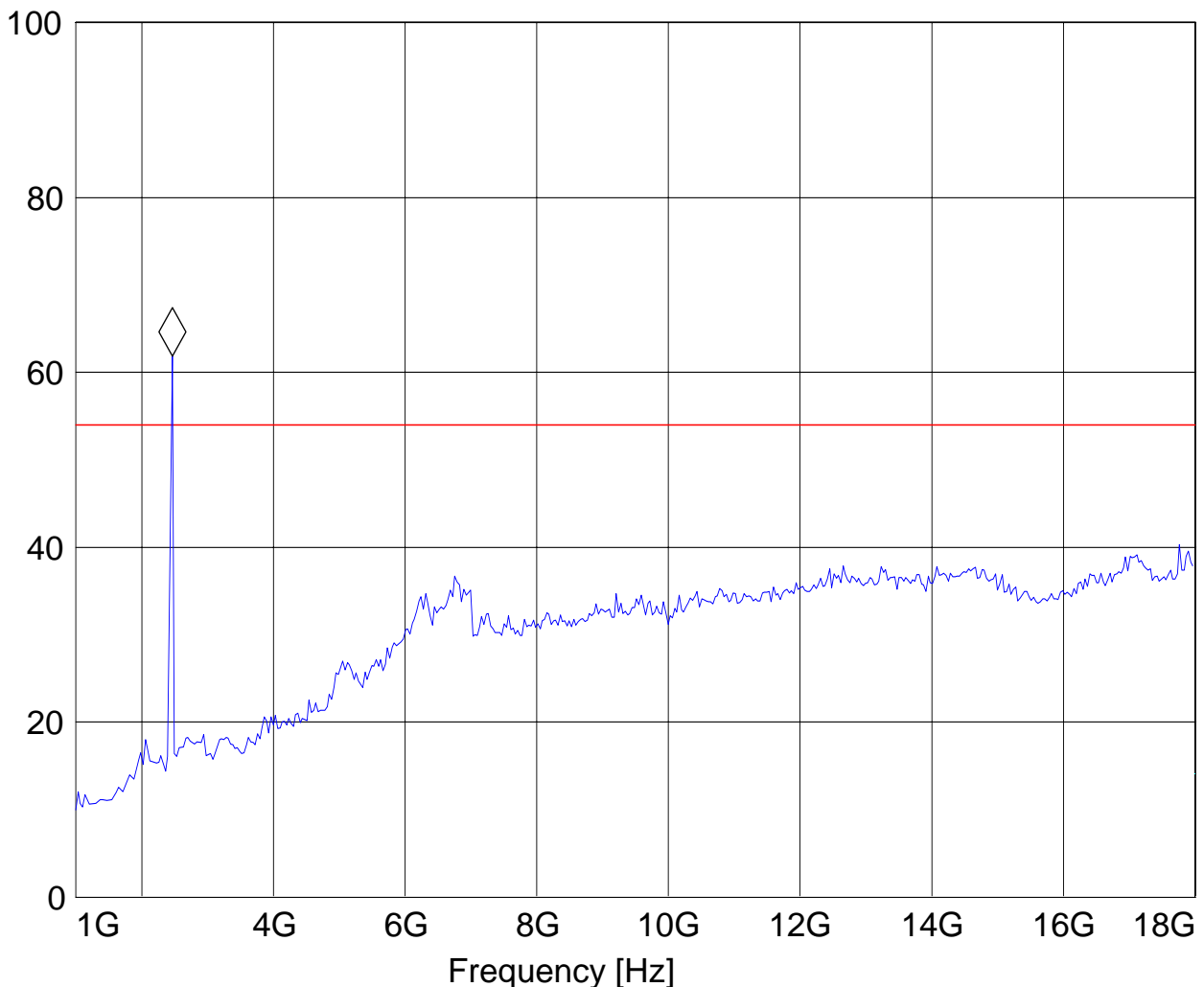
**SWEEP TABLE: "FCC 15.407 1-18G"**

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
-----------------	----------------	----------	------------	-----------	------------

1.0 GHz	18.0 GHz	MaxPeak	Coupled	1 MHz	#326horn_AF_horz
---------	----------	---------	---------	-------	------------------

Marker: 2.46492986 GHz 61.86 dBµV/m

Level [dBµV/m]





### 18-25GHz

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

#### Average limit

EUT: NTG4 RER, T00BE\*10005

Customer: Harmen Becker

Test Mode: BT Test mode, ch 78

ANT Orientation: H, TT37°

EUT Orientation: H

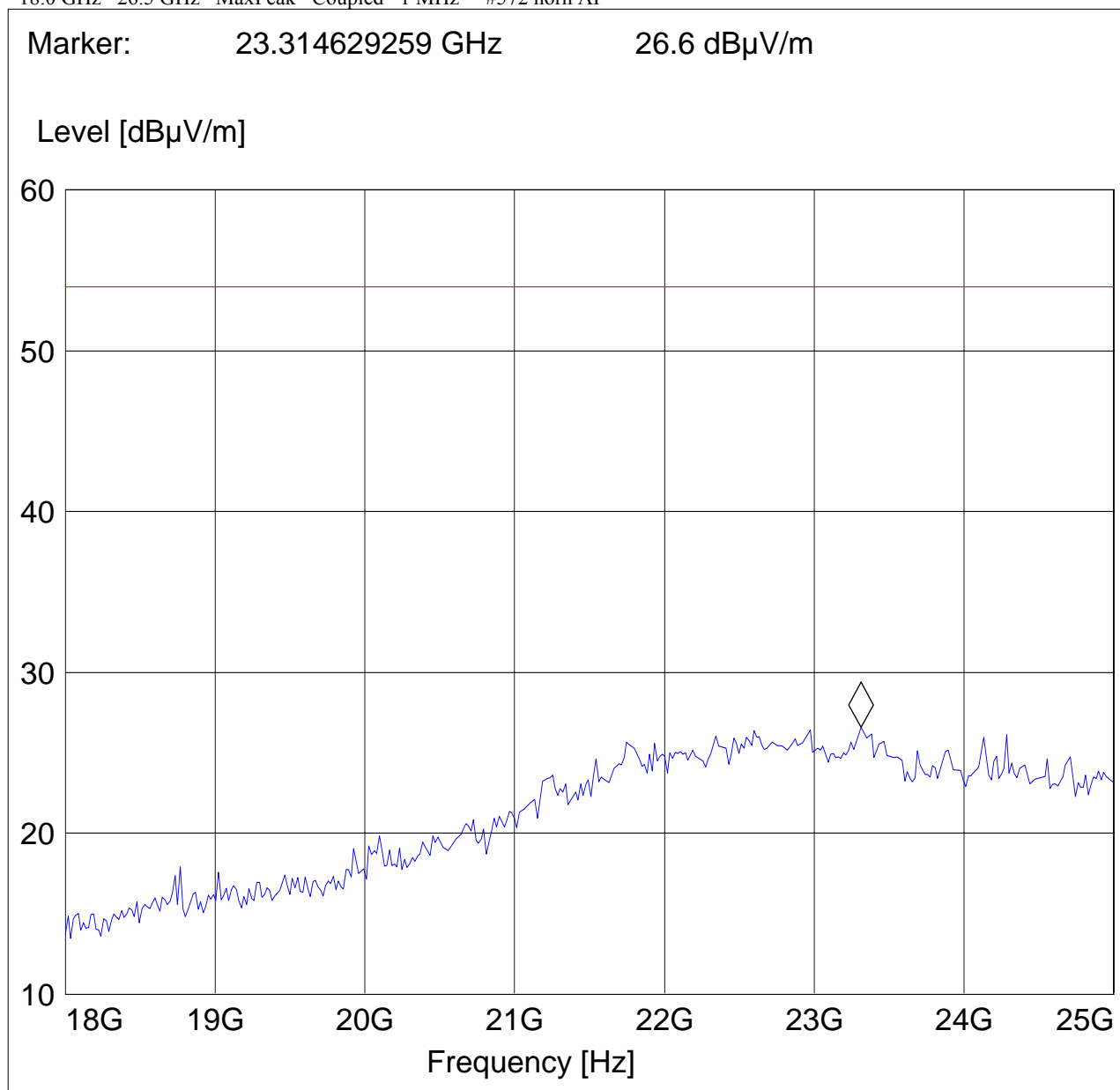
Test Engineer: Ed

Power Supply: 12v 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 Measurements (CONDUCTED)**

**6.1 MAXIMUM PEAK OUTPUT POWER § 15.247 (CONDUCTED)**

**6.1.1 LIMIT SUB CLAUSE § 15.247 (b) (1)**

Frequency range	RF power output
2400-2483.5 MHz	30dBm

\*limit is based upon antenna gain of less than or equal to 6dBi.

**6.1.2 RESULTS: GFSK**

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)		2402 MHz	2441 MHz	2480 MHz
T <sub>nom</sub> (23)°C	V <sub>nom</sub> VDC	4.9	4.8	4.4

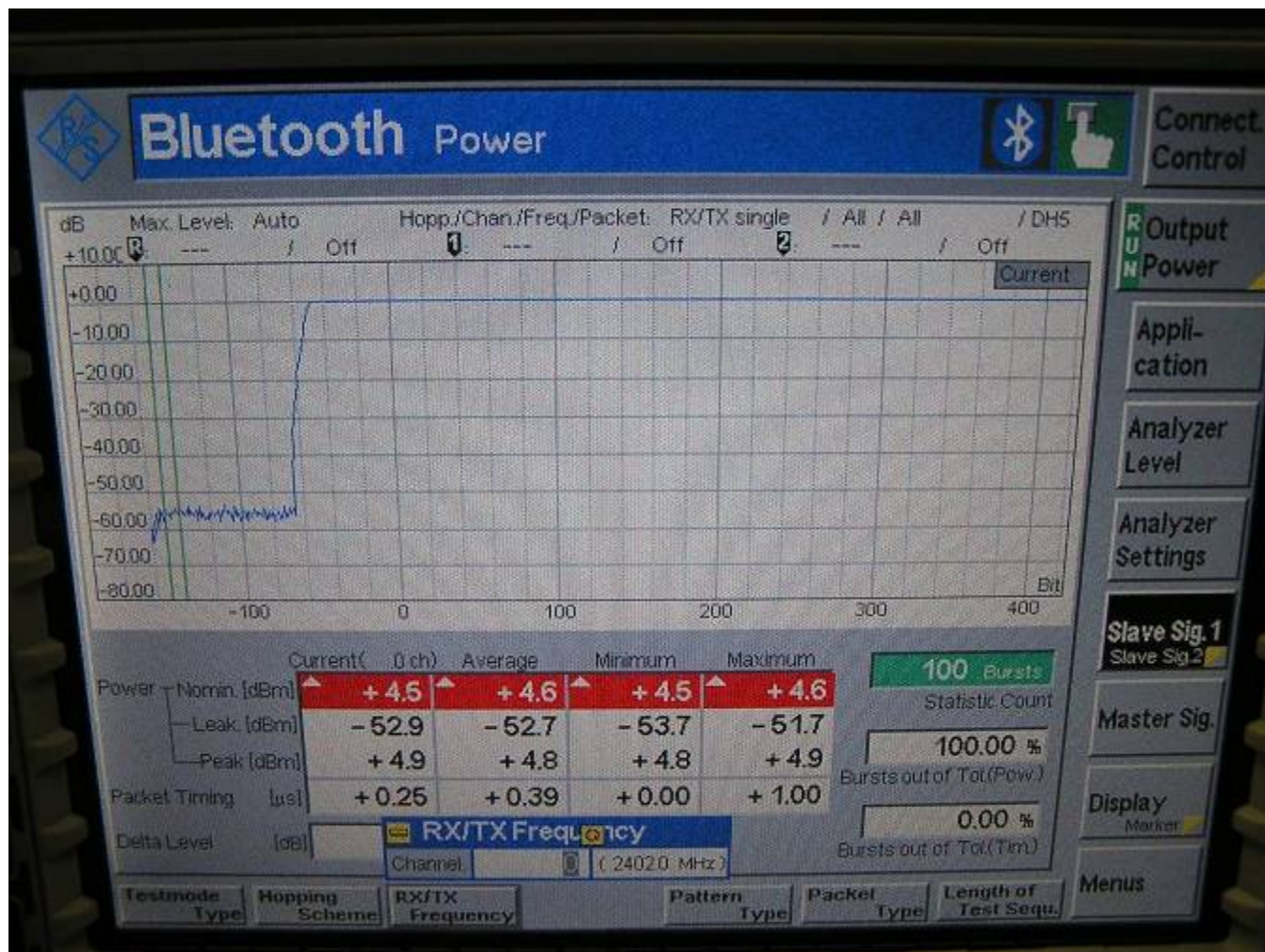
**6.1.3 RESULTS:  $\pi / 4$  DQPSK**

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)		2402 MHz	2441 MHz	2480 MHz
T <sub>nom</sub> (23)°C	V <sub>nom</sub> VDC	4.8	4.5	4.0

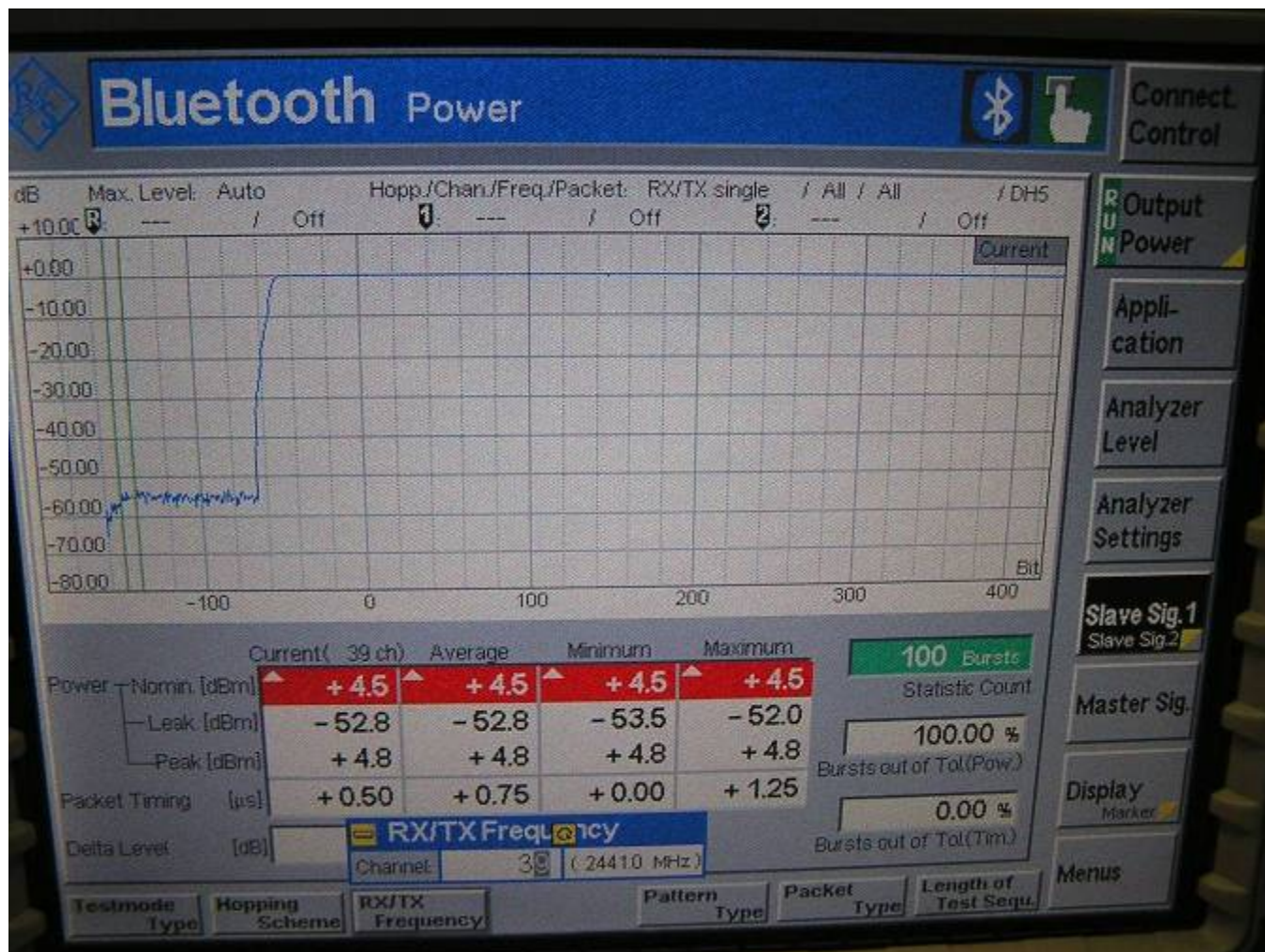
**6.1.4 RESULTS: 8DPSK**

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)		2402 MHz	2441 MHz	2480 MHz
T <sub>nom</sub> (23)°C	V <sub>nom</sub> VDC	5.0	4.7	4.1

(2402 MHz) GFSK



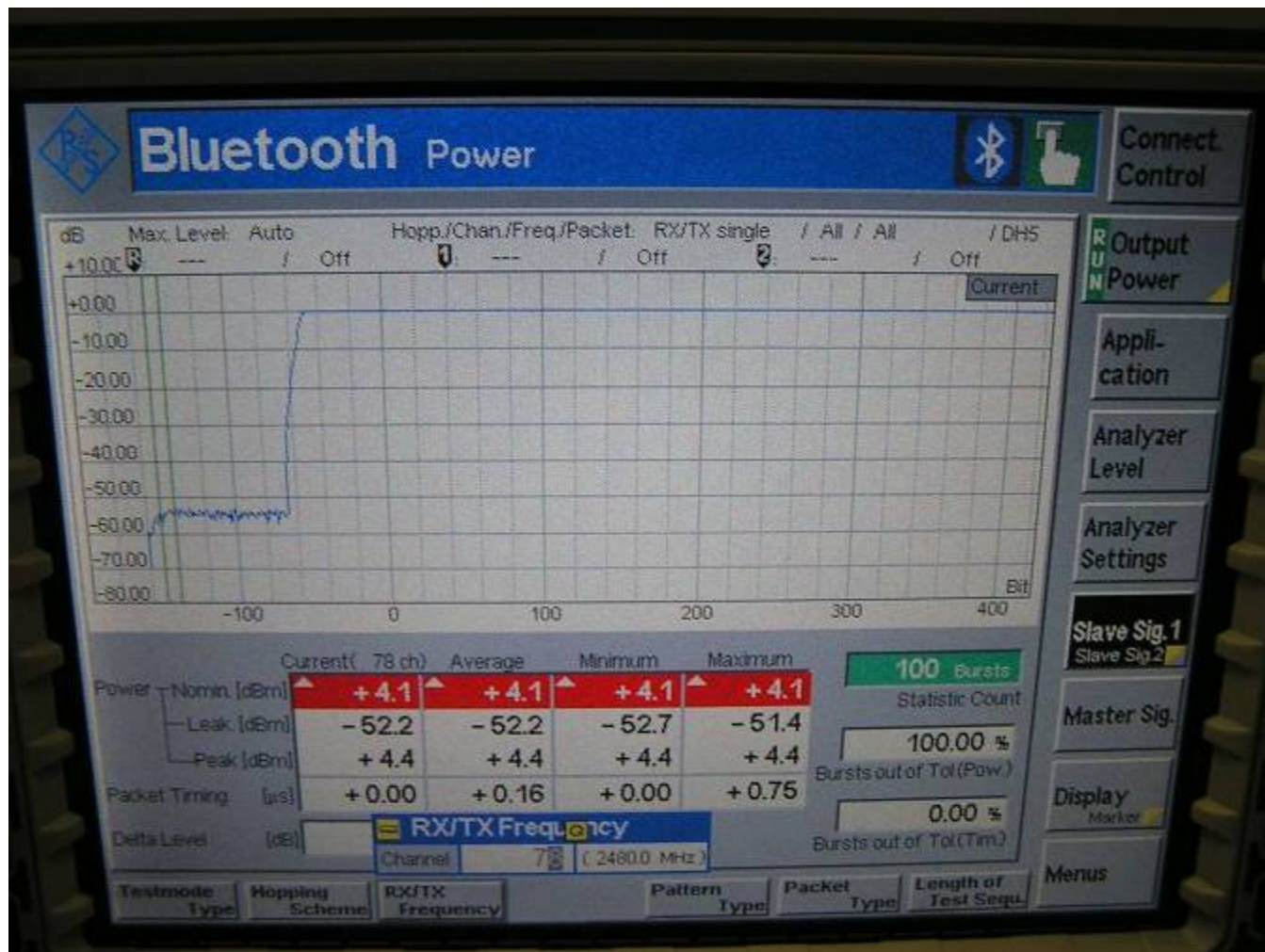
(2441 MHz) GFSK



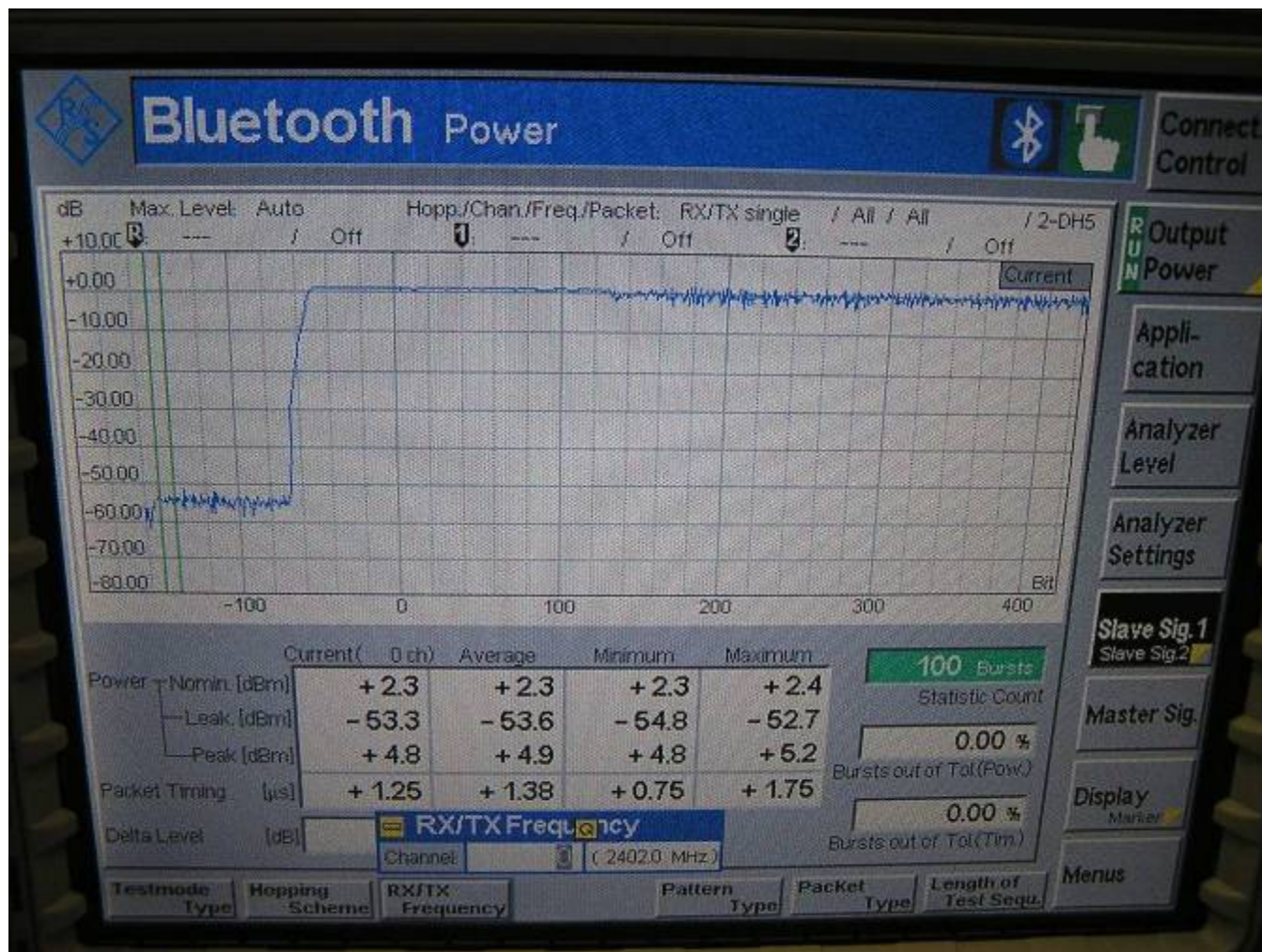




(2480 MHz) GFSK

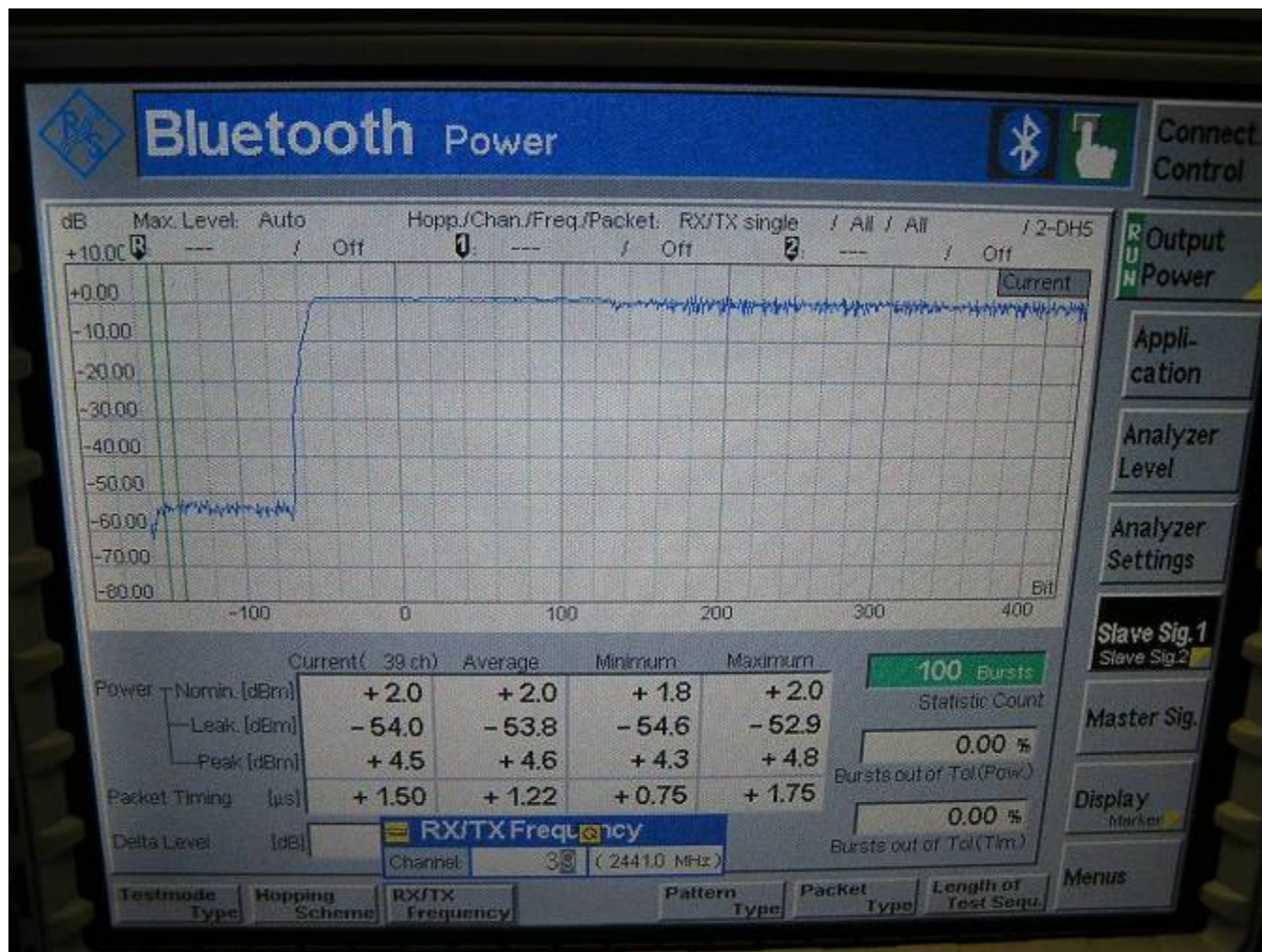


(2402 MHz)  $\pi / 4$  DQPSK



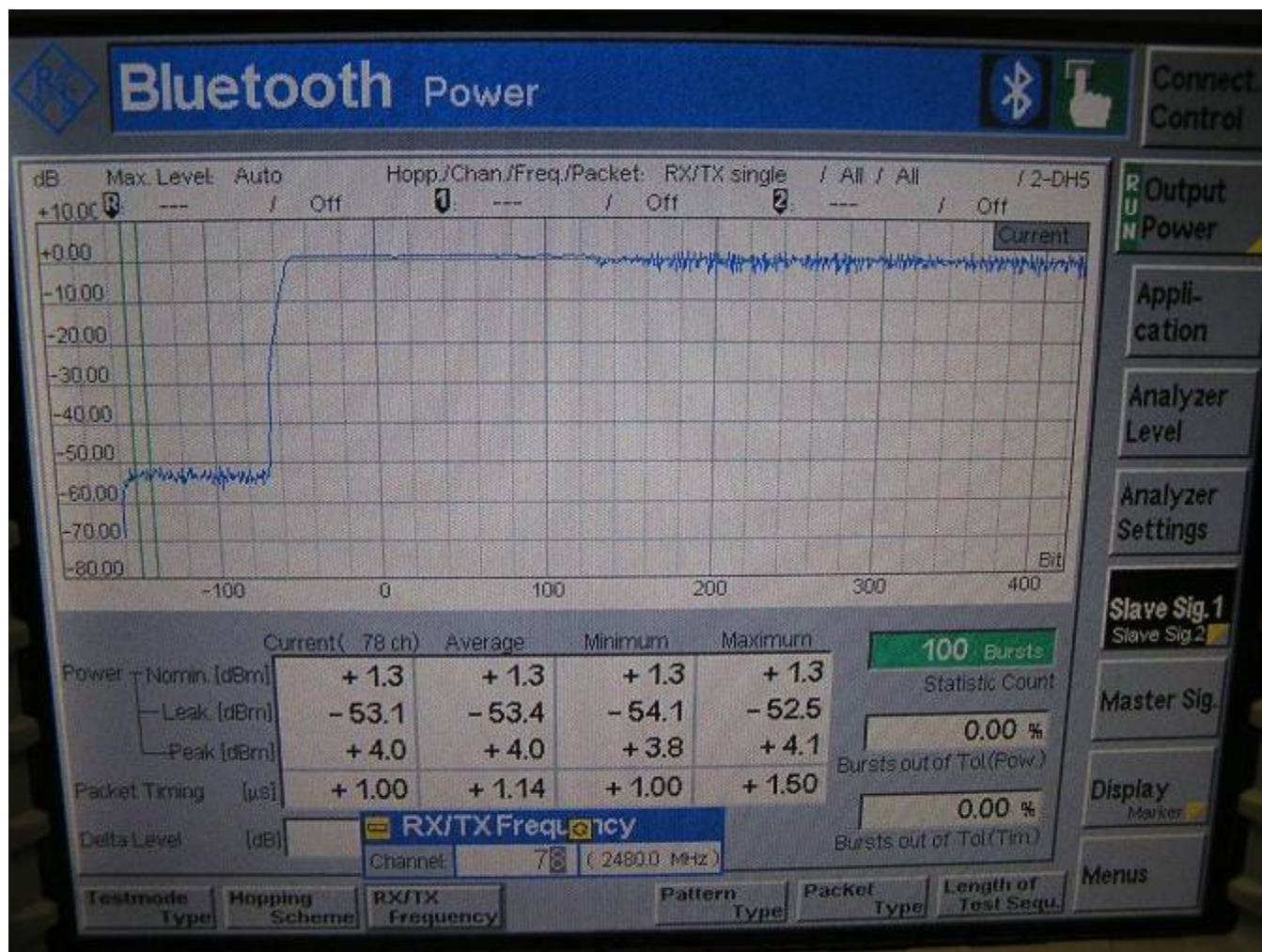


(2441 MHz)  $\pi / 4$  DQPSK

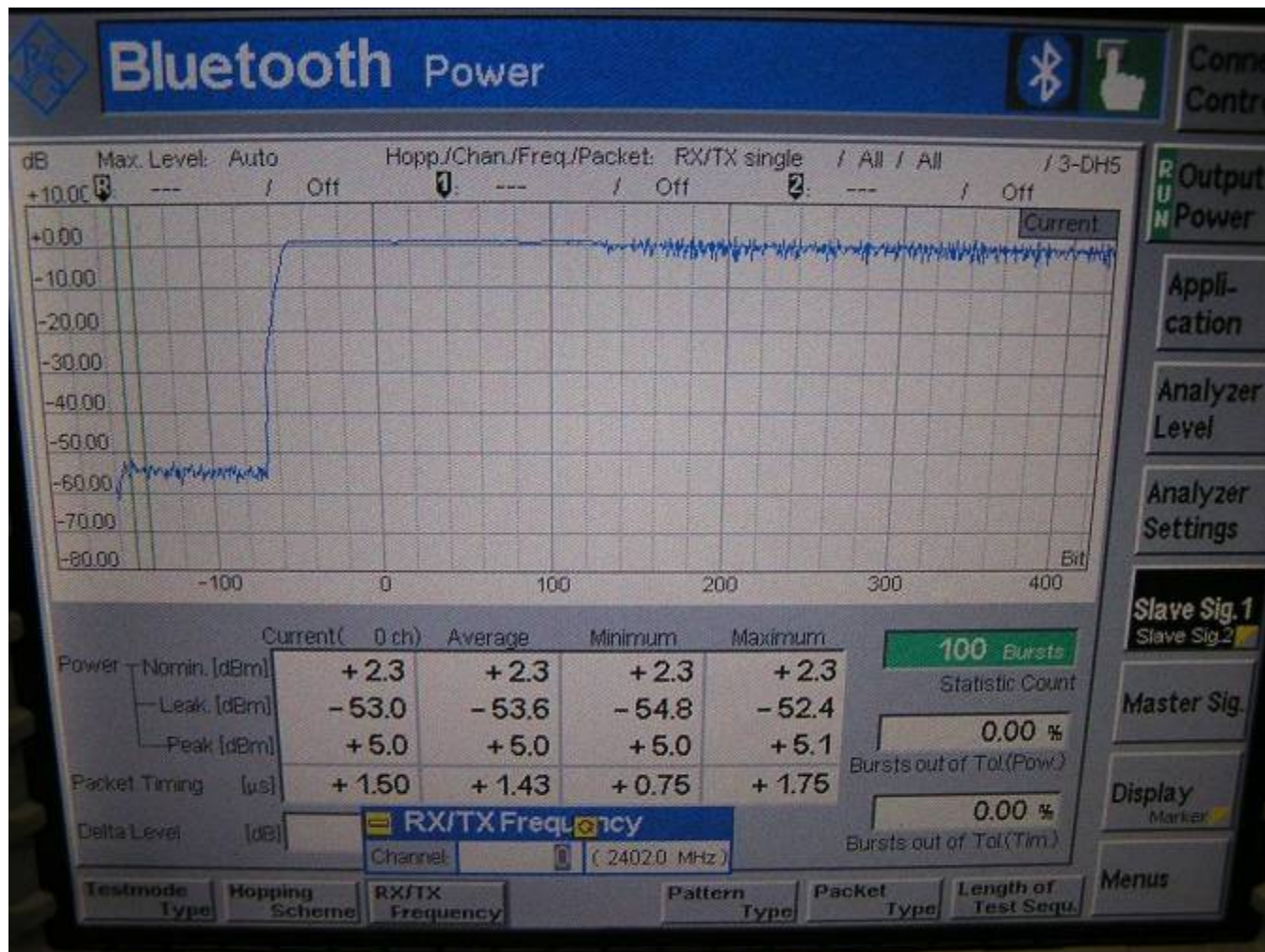




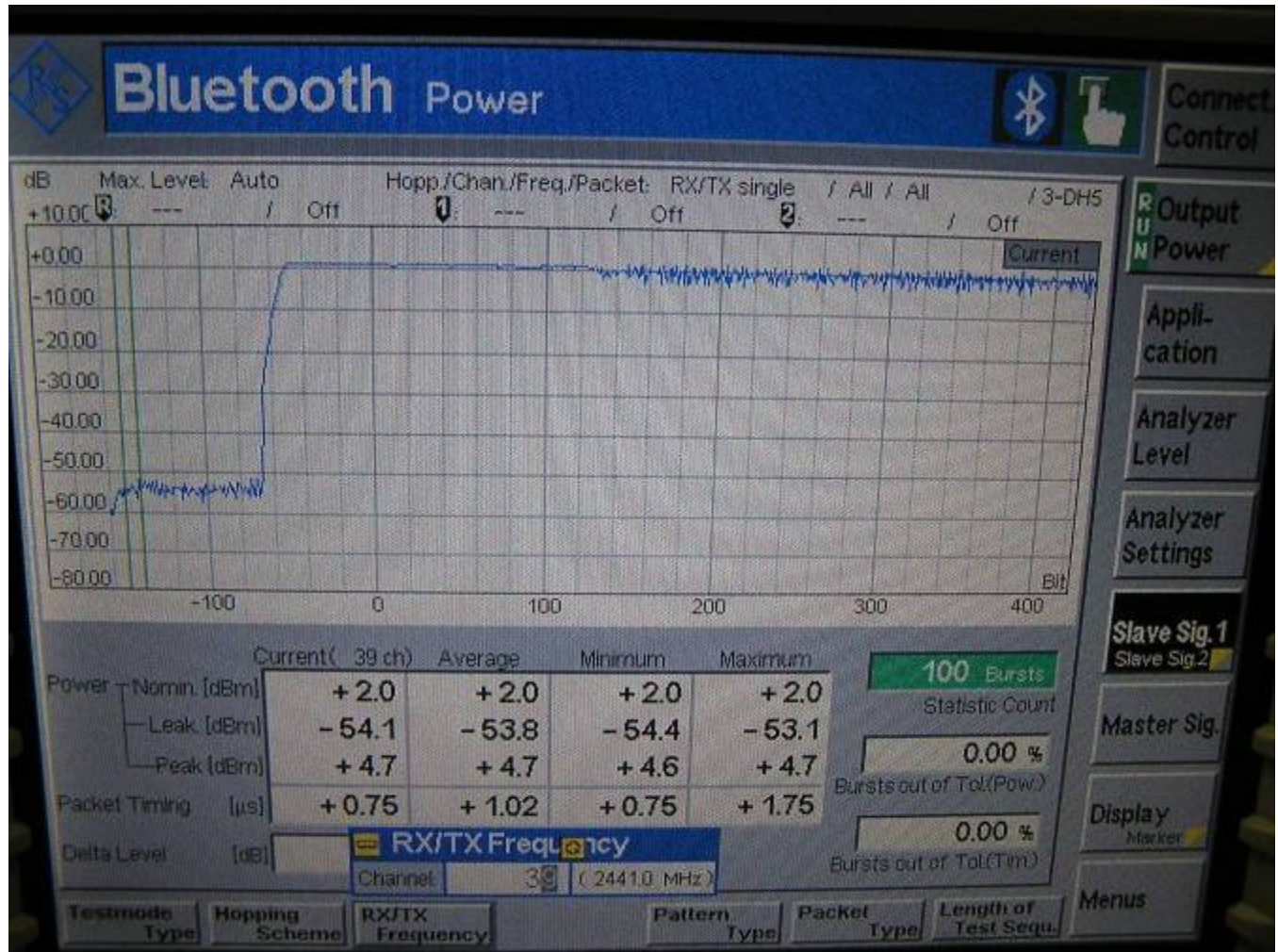
(2480 MHz)  $\pi / 4$  DQPSK



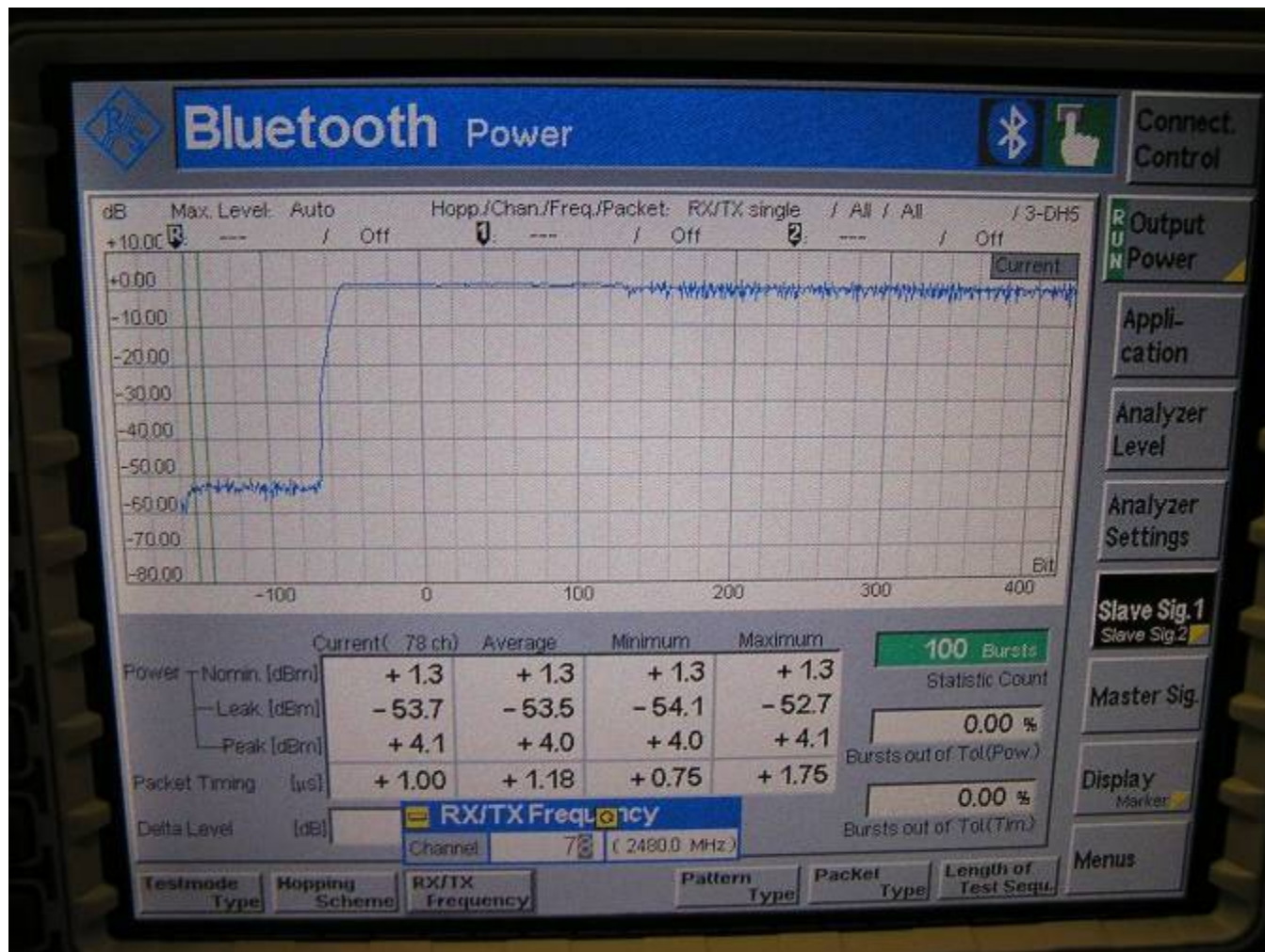
(2402 MHz) 8DPSK



(2441 MHz) 8DPSK



(2480 MHz) 8DPSK





**6.2 20dB BANDWIDTH**

**6.2.1 LIMIT SUB CLAUSE § 15.247 (a) (1) (i) (ii) (iii)**

Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

**6.2.2 RESULTS: GFSK**

TEST CONDITIONS		BANDWIDTH (KHz)		
		2402 MHz	2441 MHz	2480 MHz
Frequency (MHz)				
T <sub>nom</sub> (23)°C	V <sub>nom</sub> VDC	840	840	839

**6.2.3 RESULTS:  $\pi / 4$  DQPSK**

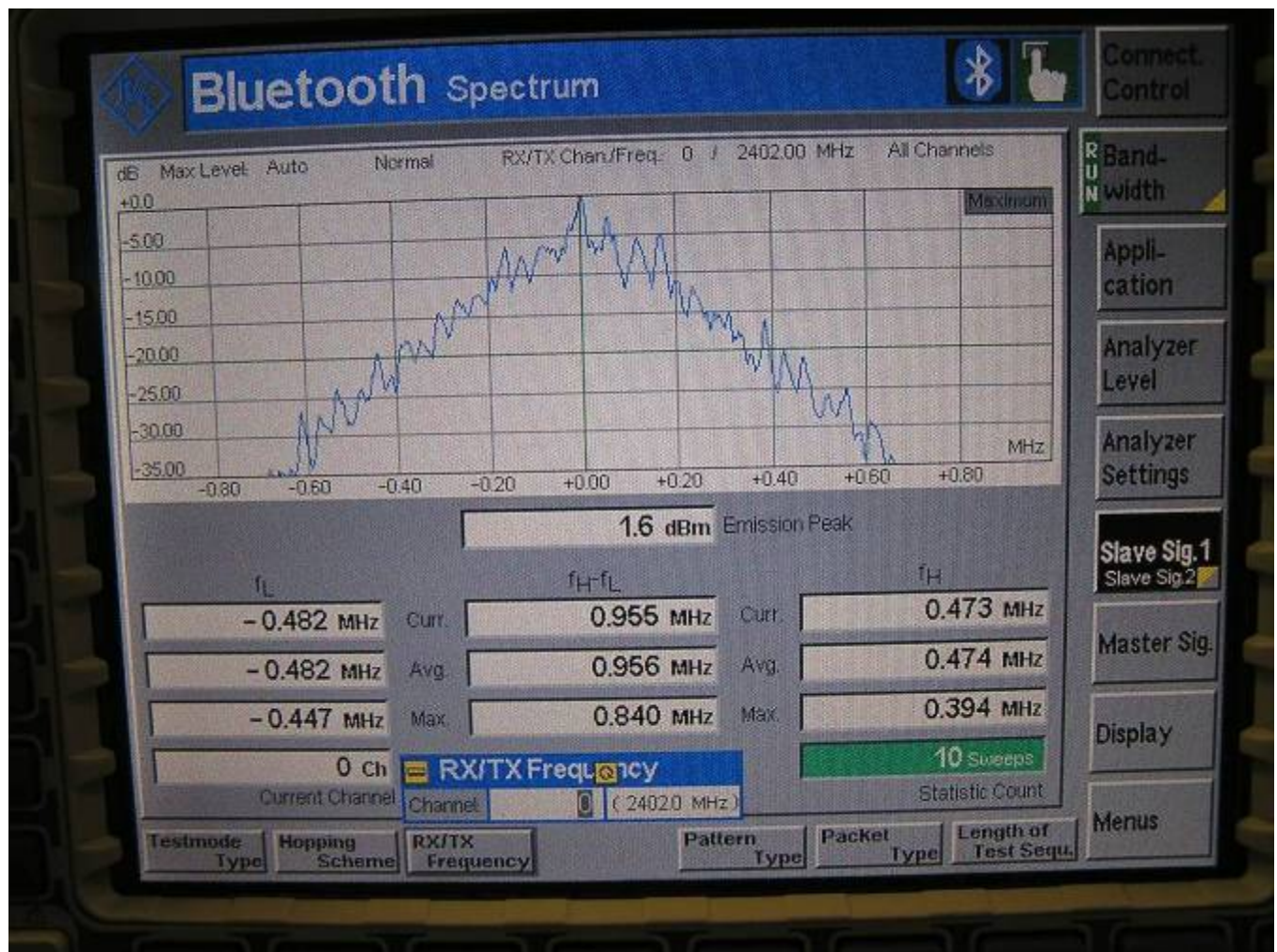
TEST CONDITIONS		BANDWIDTH (KHz)		
		2402 MHz	2441 MHz	2480 MHz
Frequency (MHz)				
T <sub>nom</sub> (23)°C	V <sub>nom</sub> VDC	1161	1161	1161

**6.2.4 RESULTS: 8DPSK**

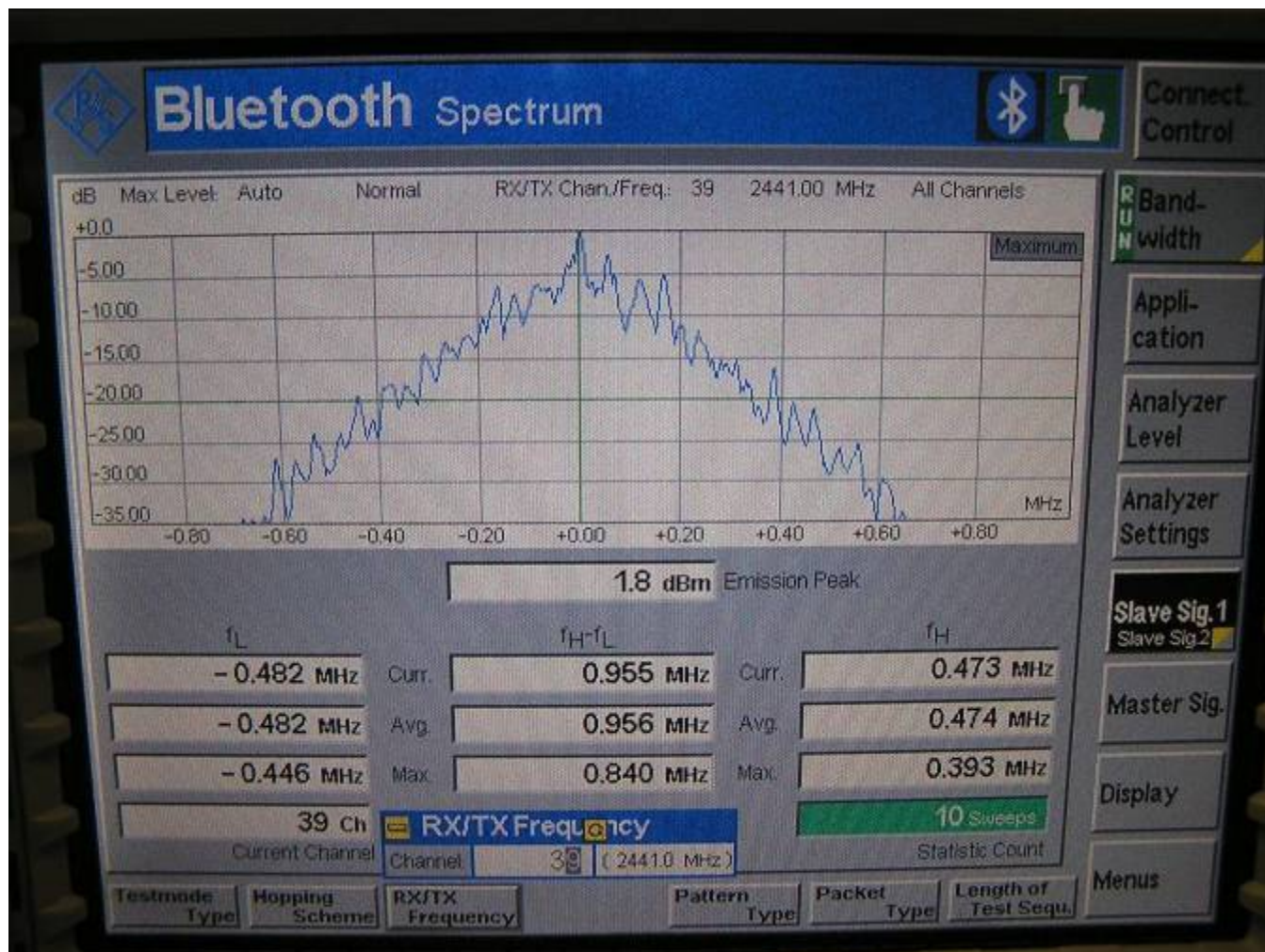
TEST CONDITIONS		BANDWIDTH (KHz)		
		2402 MHz	2441 MHz	2480 MHz
Frequency (MHz)				
T <sub>nom</sub> (23)°C	V <sub>nom</sub> VDC	1195	1194	1195



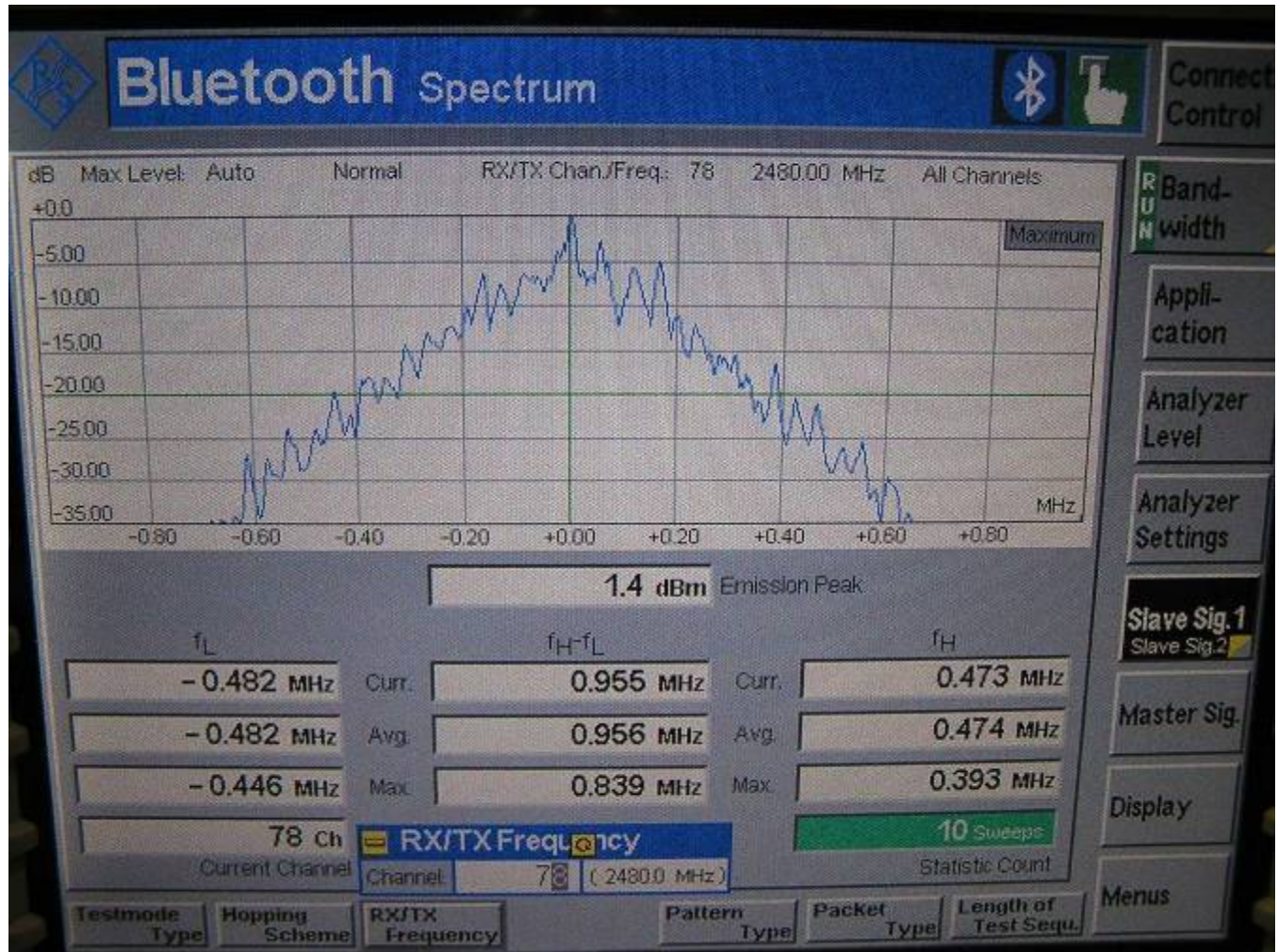
(2402 MHz) GFSK



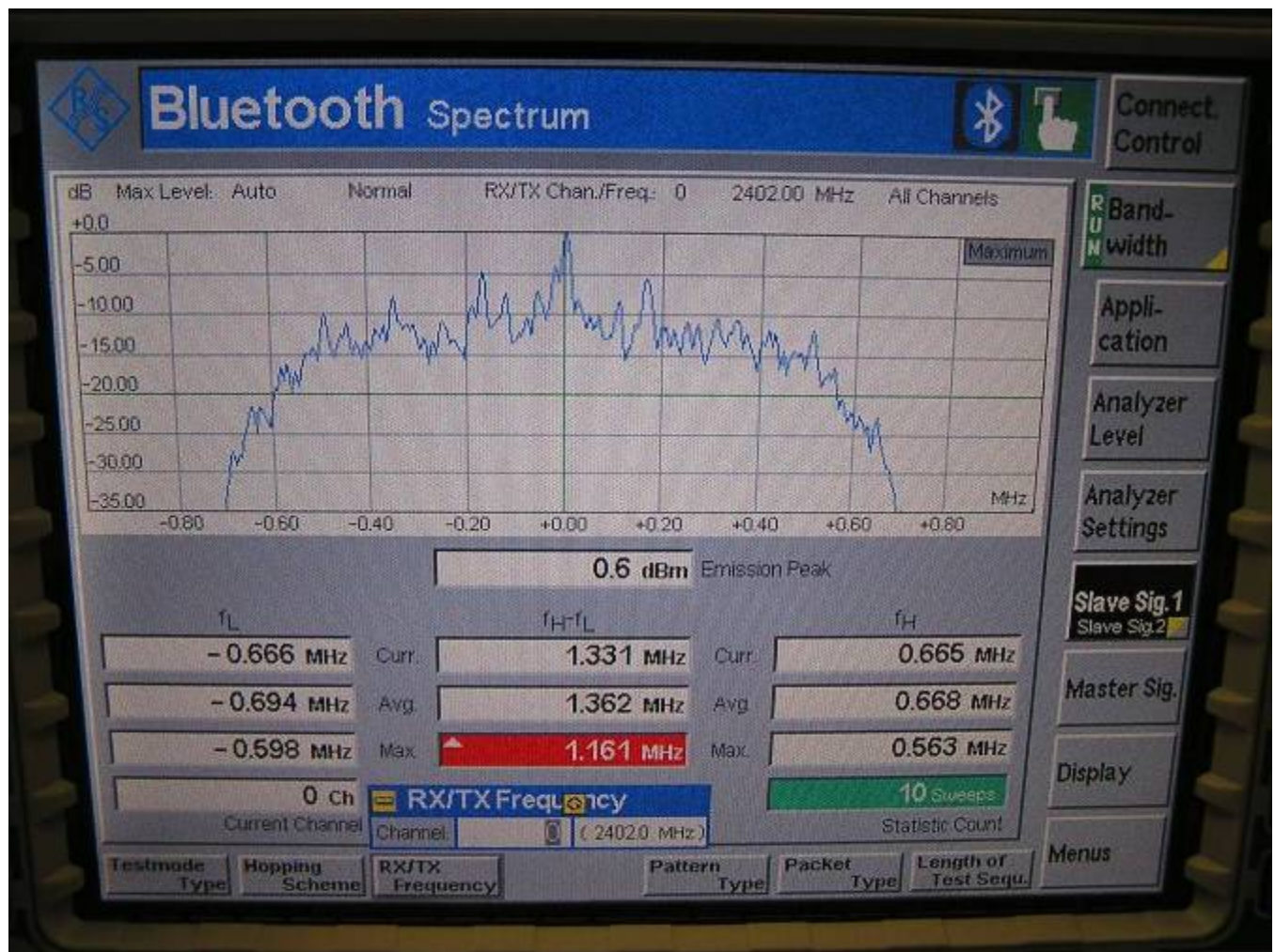
(2441 MHz) GFSK



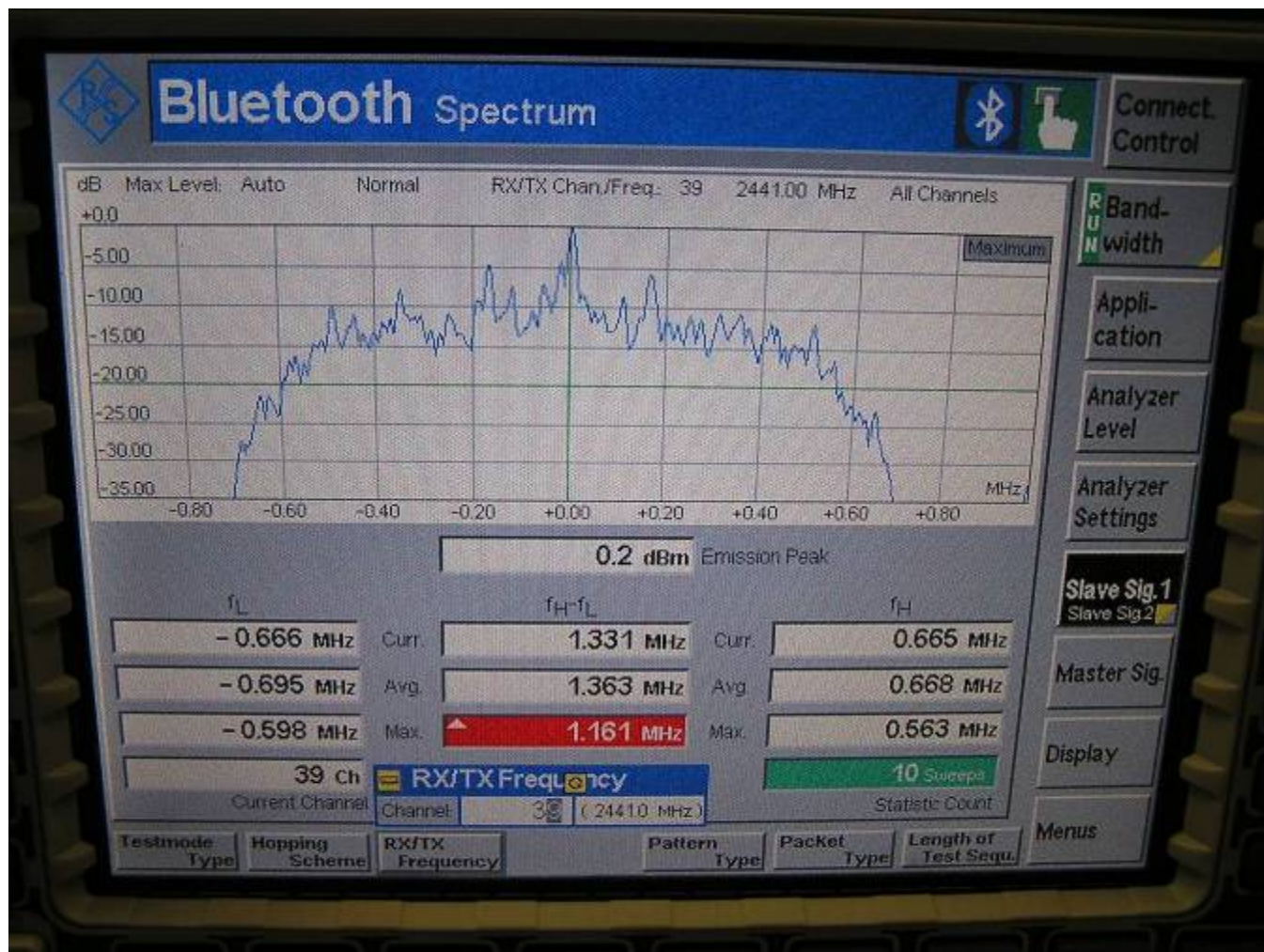
(2480 MHz) GFSK



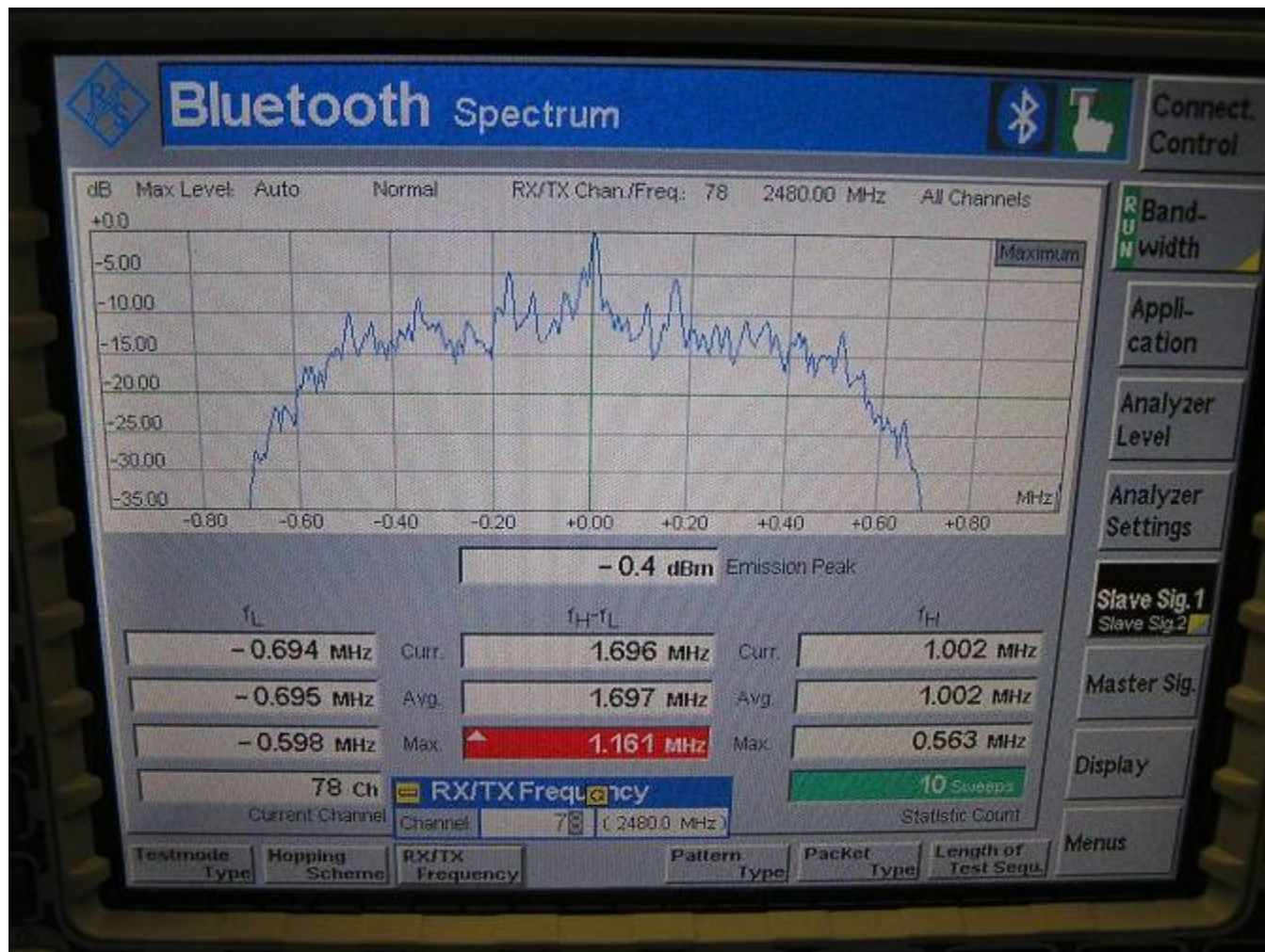
(2402 MHz)  $\pi / 4$  DQPSK



(2441 MHz)  $\pi / 4$  DQPSK



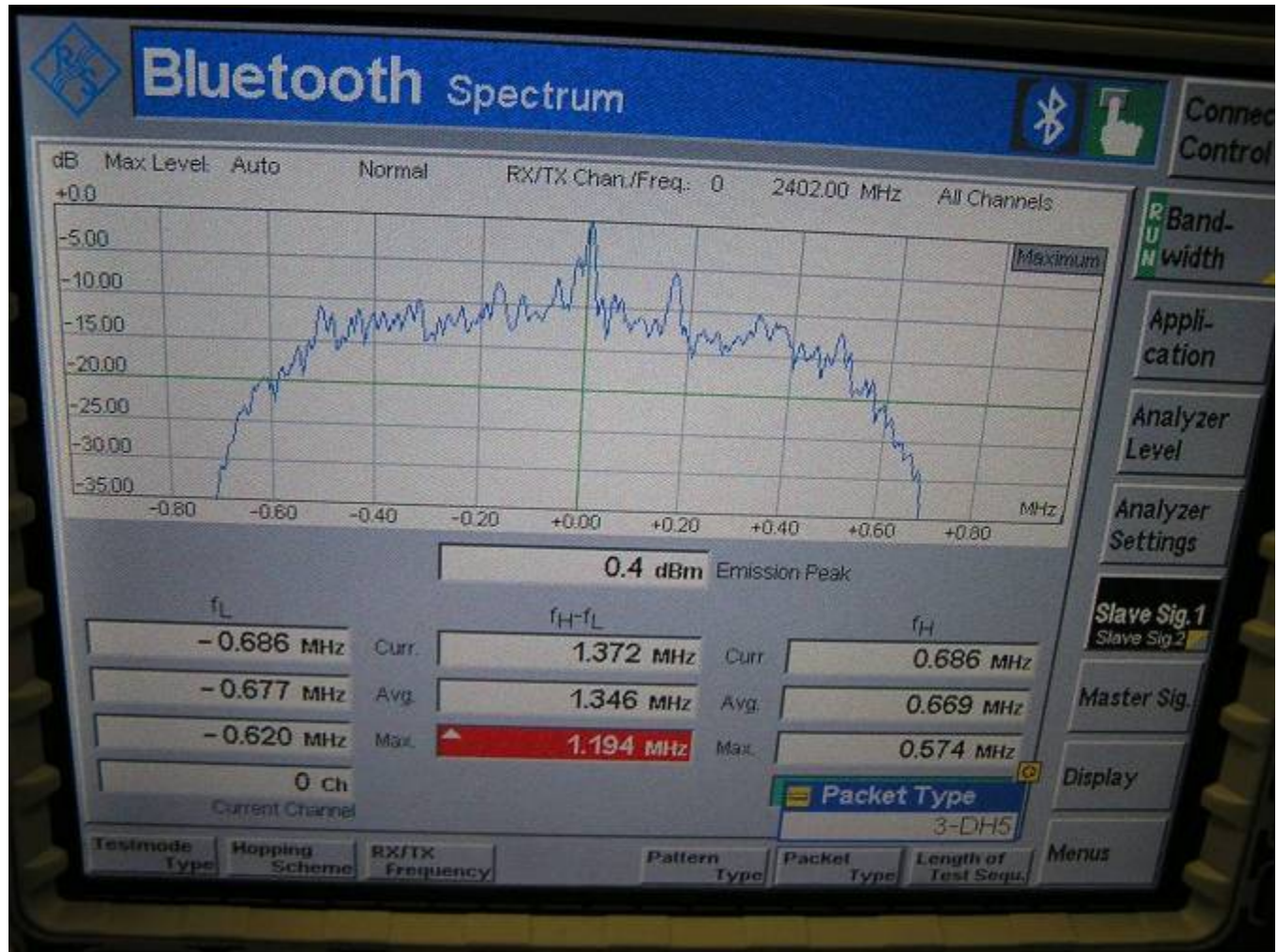
(2480 MHz)  $\pi / 4$  DQPSK



(2402 MHz) 8DPSK

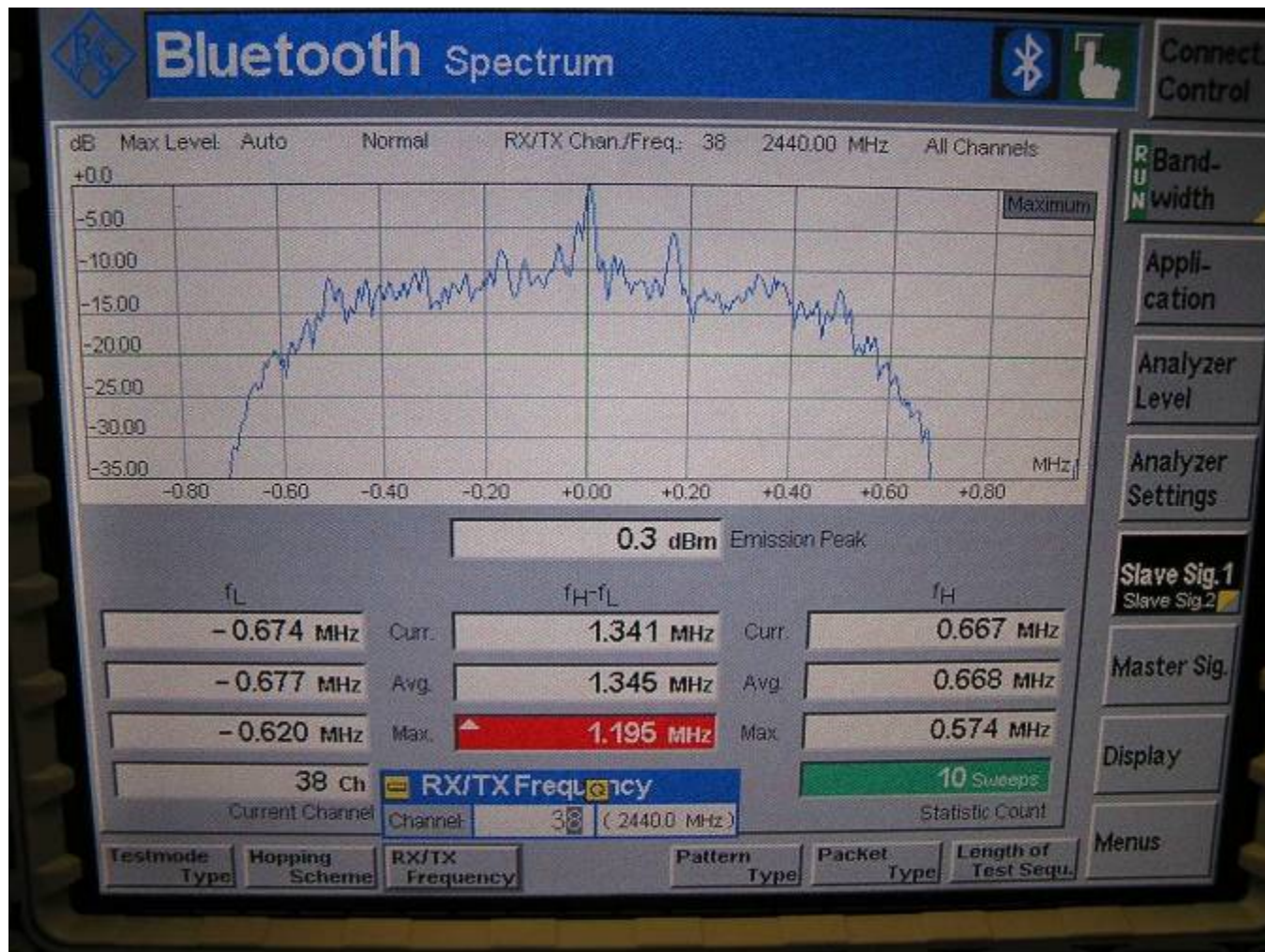


(2441 MHz) 8DPSK





(2480 MHz) 8DPSK





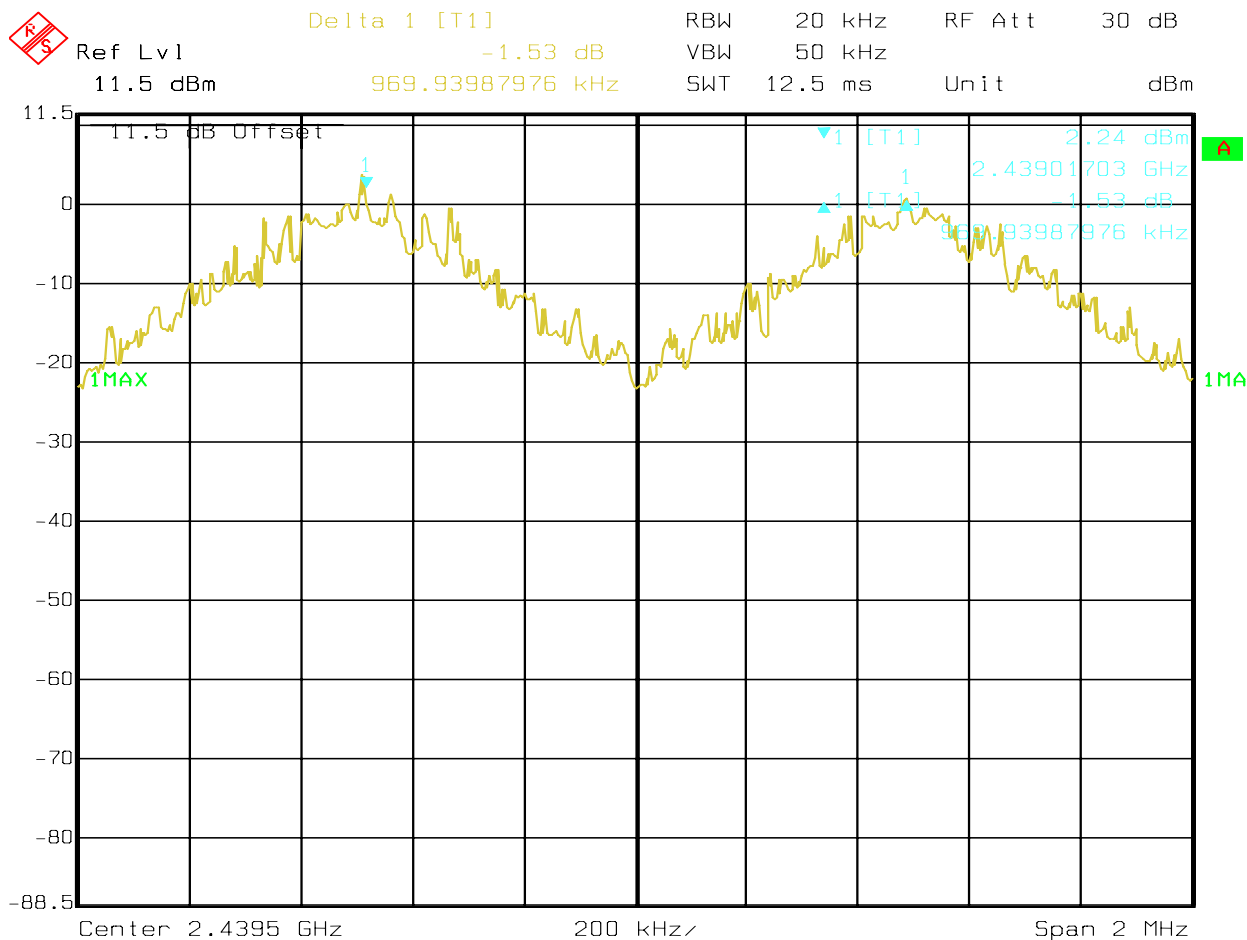
### 6.3 CARRIER FREQUENCY SEPARATION

#### 6.3.1 LIMIT SUB CLAUSE § 15.247 (a) (1) (i) (ii) (iii)

<b>SEPARATION</b>
<b>&gt; 25 KHz or &gt; 20 dB BANDWIDTH</b>

#### 6.3.2 RESULTS:

TEST CONDITIONS		SEPARATION (MHz)
<b>T<sub>nom</sub>(23)°C</b>	<b>V<sub>nom</sub>VDC</b>	<b>0.969</b>



Date: 28.JUN.2007 15:43:14



#### 6.4 NUMBER OF HOPPING CHANNELS

##### 6.4.1 LIMIT SUB CLAUSE § 15.247 (a) (1) (iii)

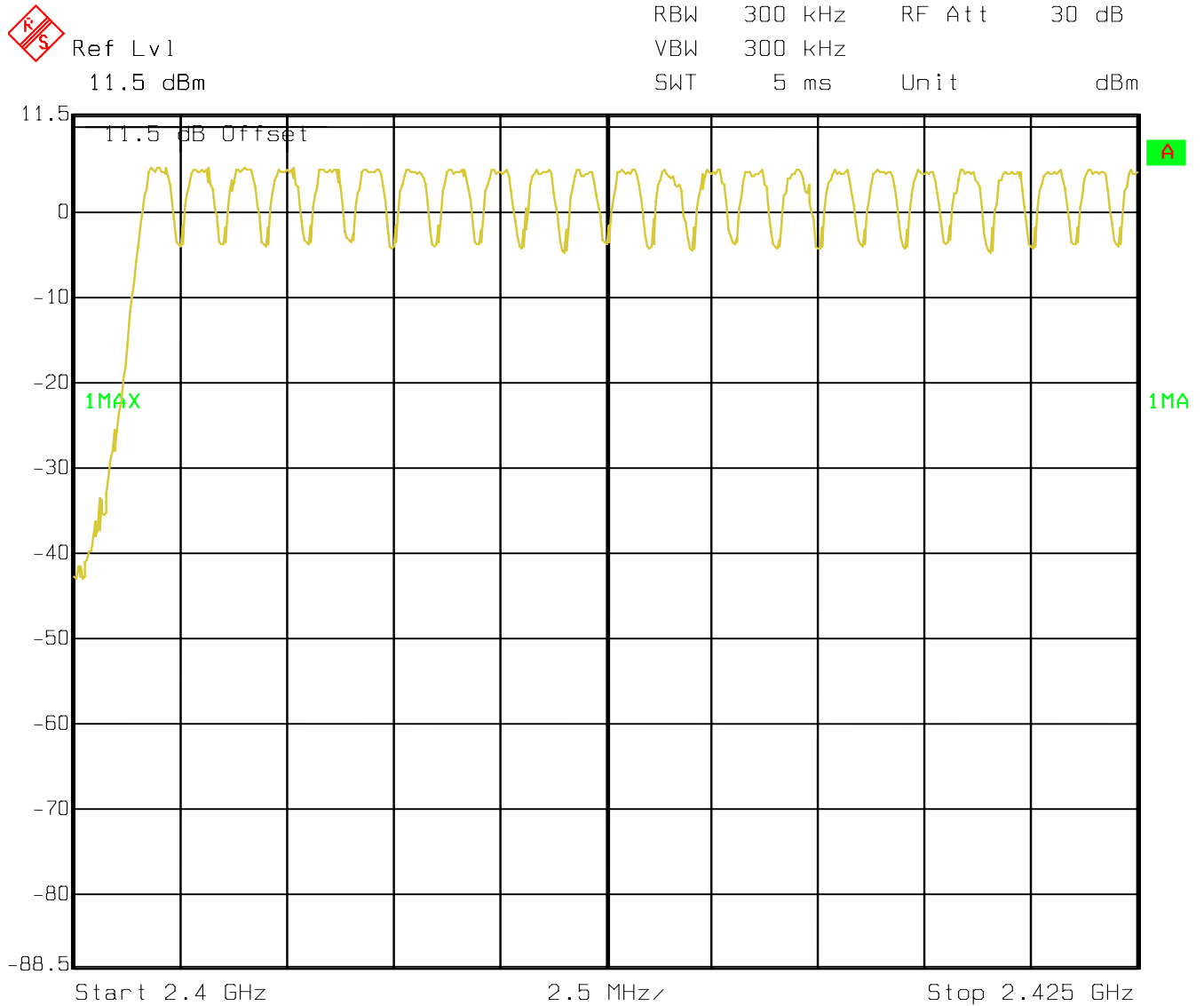
<b>NUMBER OF CHANNELS</b>
<b>&gt; 15</b>

##### 6.4.2 RESULTS:

<b>TEST CONDITIONS</b>		<b>NUMBER OF CHANNELS</b>
<b>T<sub>nom</sub>(23)°C</b>	<b>V<sub>nom</sub>VDC</b>	<b>79</b>



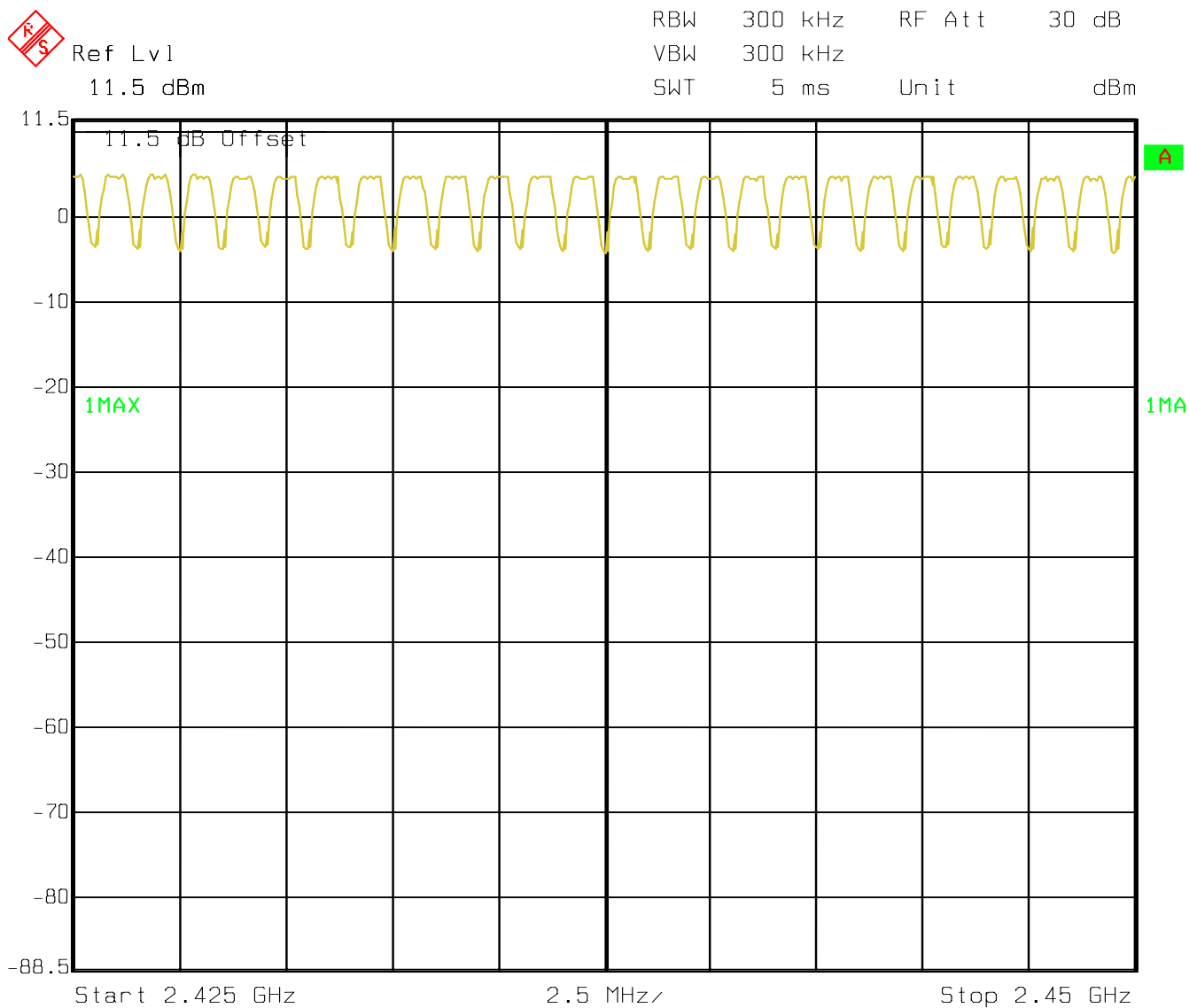
PLOT 1



Date: 28.JUN.2007 15:44:31



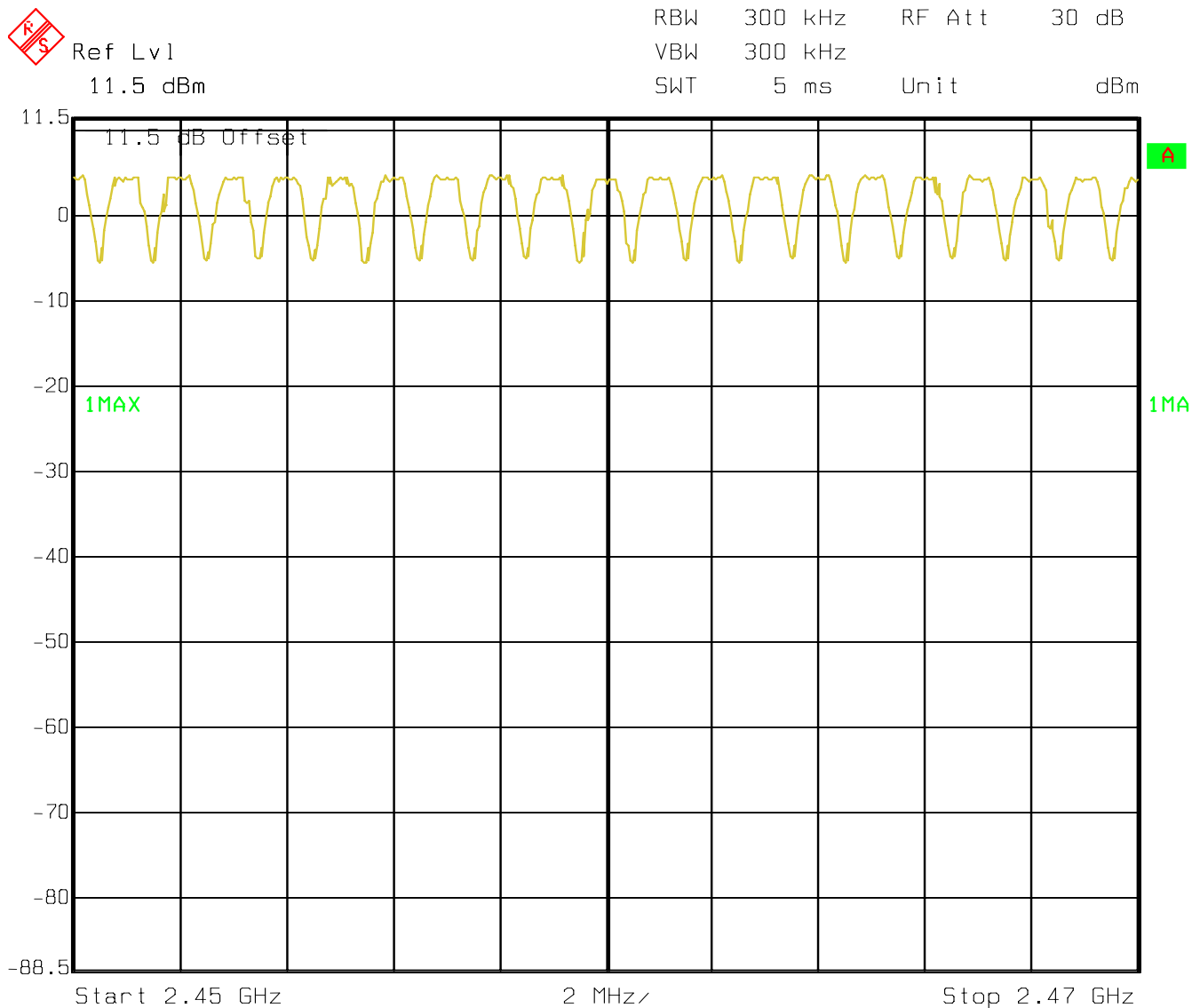
PLOT 2



Date: 28.JUN.2007 15:51:54



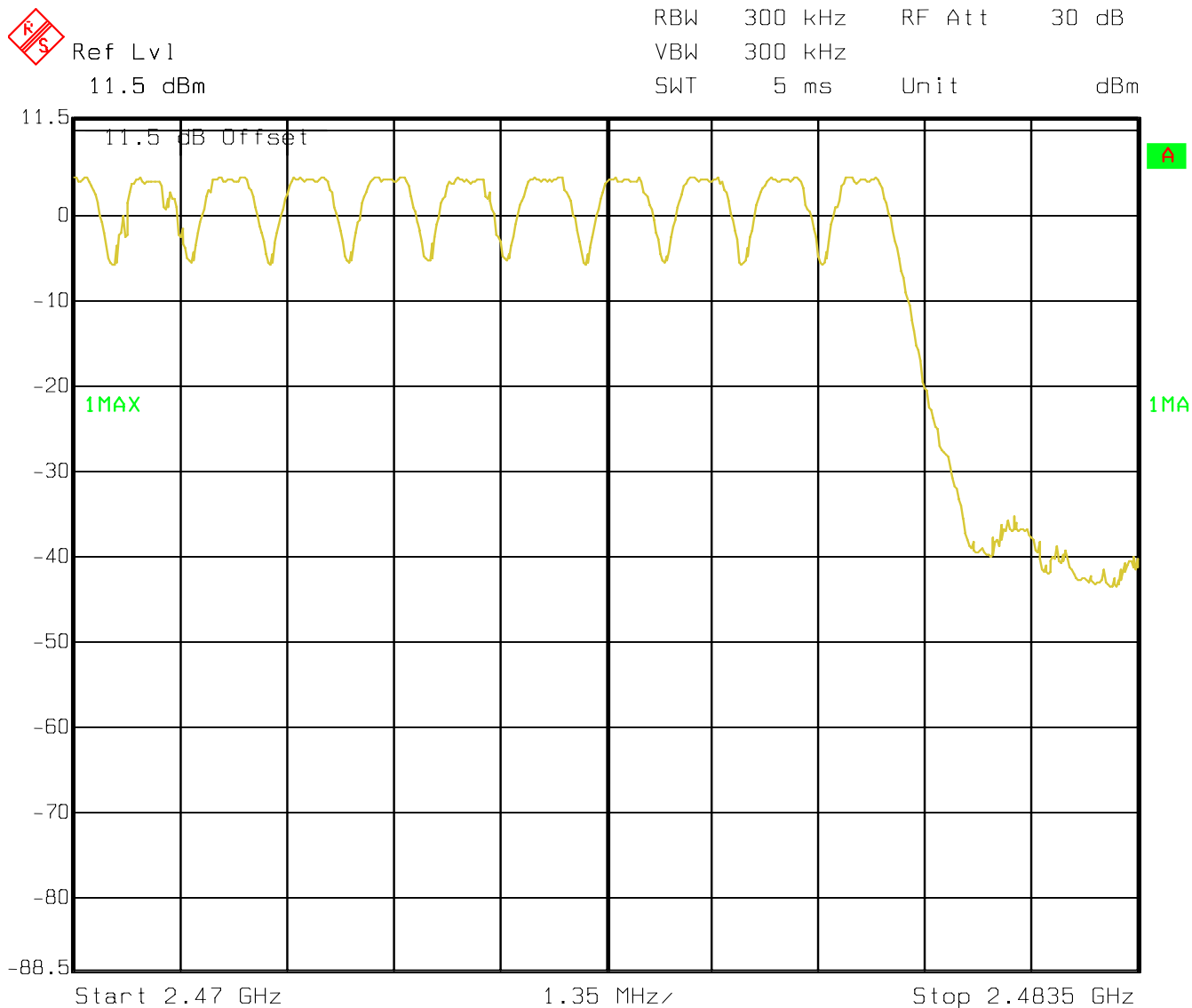
PLOT 3



Date: 28.JUN.2007 15:52:53



PLOT 4



Date: 28.JUN.2007 15:53:47



**6.5 TIME OF OCCUPANCY (DWELL TIME)**

**6.5.1 LIMIT SUB CLAUSE § 15.247 (a) (1) (i) (ii) (iii)**

FREQUENCY RANGE	AVERAGE TIME OF OCCUPANCY PER 31.6 SECONDS (LIMIT)
2400-2483.5	< 0.4 Seconds

**6.5.2 RESULTS:**

T <sub>nom</sub> (23)°C	V <sub>nom</sub> VDC
-------------------------	----------------------

**For Bluetooth devices:**

The dwell time of 0.4 s within a 31.6 second period in data mode is independent from the packet type (packet length). The calculation for a 31.6 second period is as follows:

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

**Example for a DH1 packet (with a maximum length of one time slot)**

**Dwell time = 625 μs \* 1600 1/s / 79 \* 31.6 s = 0.4 s (in a 31.6 s period)**

**For multi-slot packet the hopping is reduced according to the length of the packet.**

**Example for a DH5 packet (with a maximum length of five time slots)**

**Dwell time = 5 \* 625 μs \* 1600 \* 1/5 \* 1/s / 79 \* 31.6 s = 0.4 s (in a 31.6 s period)**

**This is the same for all BT devices and therefore all BT devices satisfy FCC requirement on time of occupancy (dwell time).**





6.6 CONDUCTED SPURIOUS EMISSION

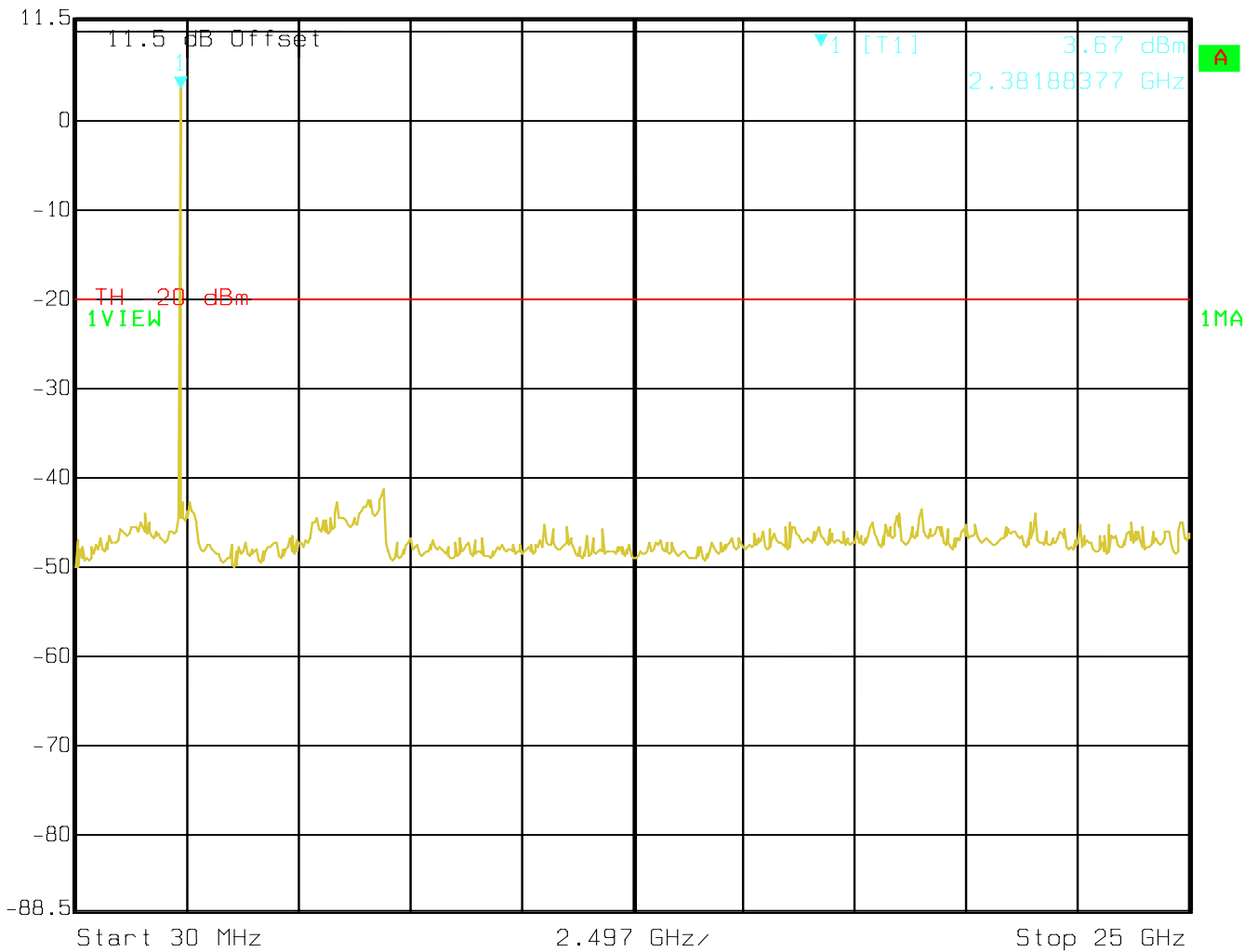
6.6.1 LIMIT SUB CLAUSE § 15.247 (d)

FREQUENCY RANGE	limit
30M-25GHz	-20dBc

6.6.2 RESULTS: Tnom(23)°C VnomVDC

(2402MHz)

⊠ Marker 1 [T1] RBW 100 kHz RF Att 30 dB  
 Ref Lvl 3.67 dBm VBW 300 kHz  
 11.5 dBm 2.38188377 GHz SWT 6.4 s Unit dBm

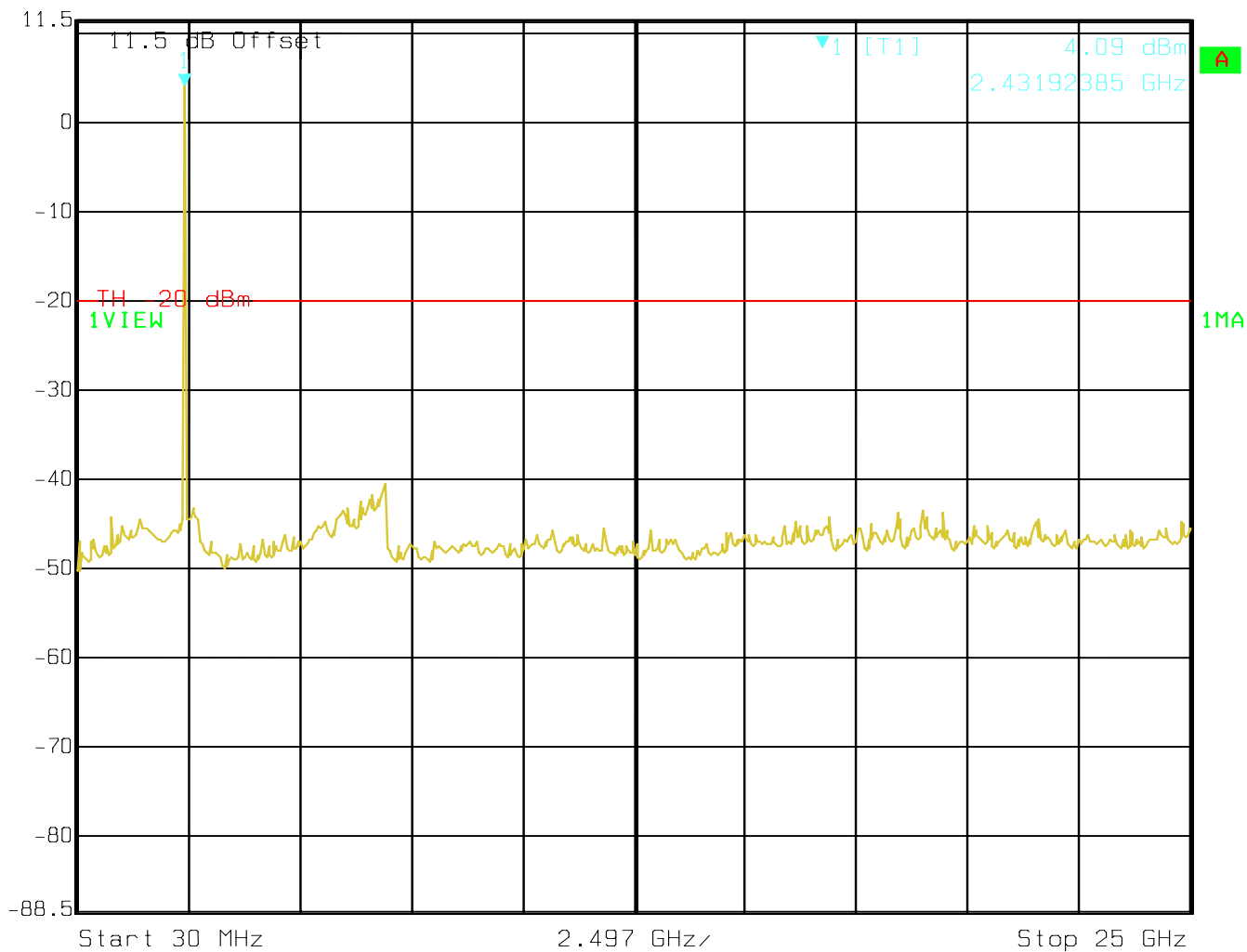


Date: 28.JUN.2007 15:55:29



(2441MHz)

⚠ Marker 1 [T1] RBW 100 kHz RF Att 30 dB  
 Ref Lvl 11.5 dBm 4.09 dBm VBW 300 kHz  
 11.5 dBm 2.43192385 GHz SWT 6.4 s Unit dBm

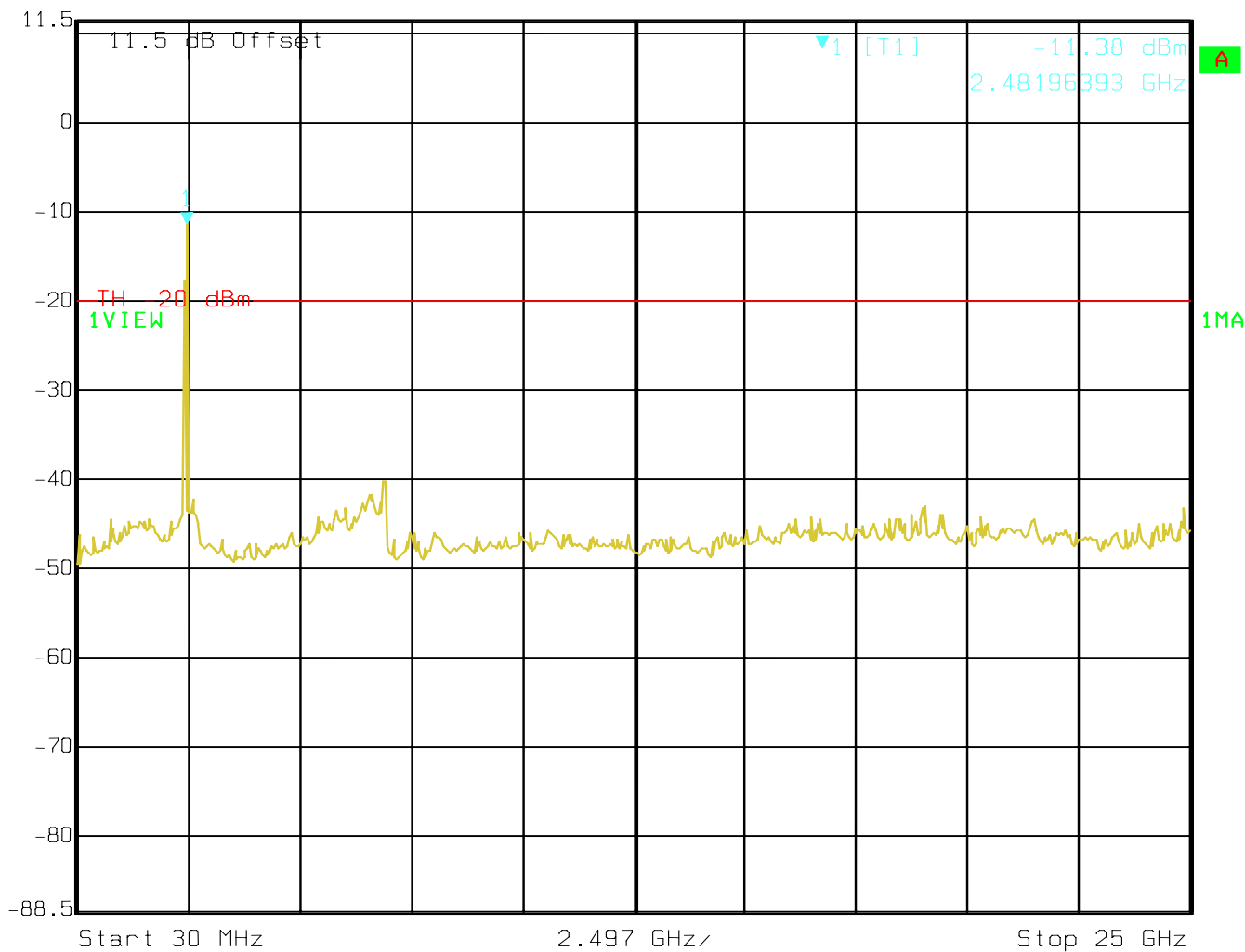


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(2480MHz)

 Ref Lvl 11.5 dBm  
Marker 1 [T1] -11.38 dBm  
2.48196393 GHz  
RBW 100 kHz RF Att 30 dB  
VBW 300 kHz  
SWT 6.4 s Unit dBm



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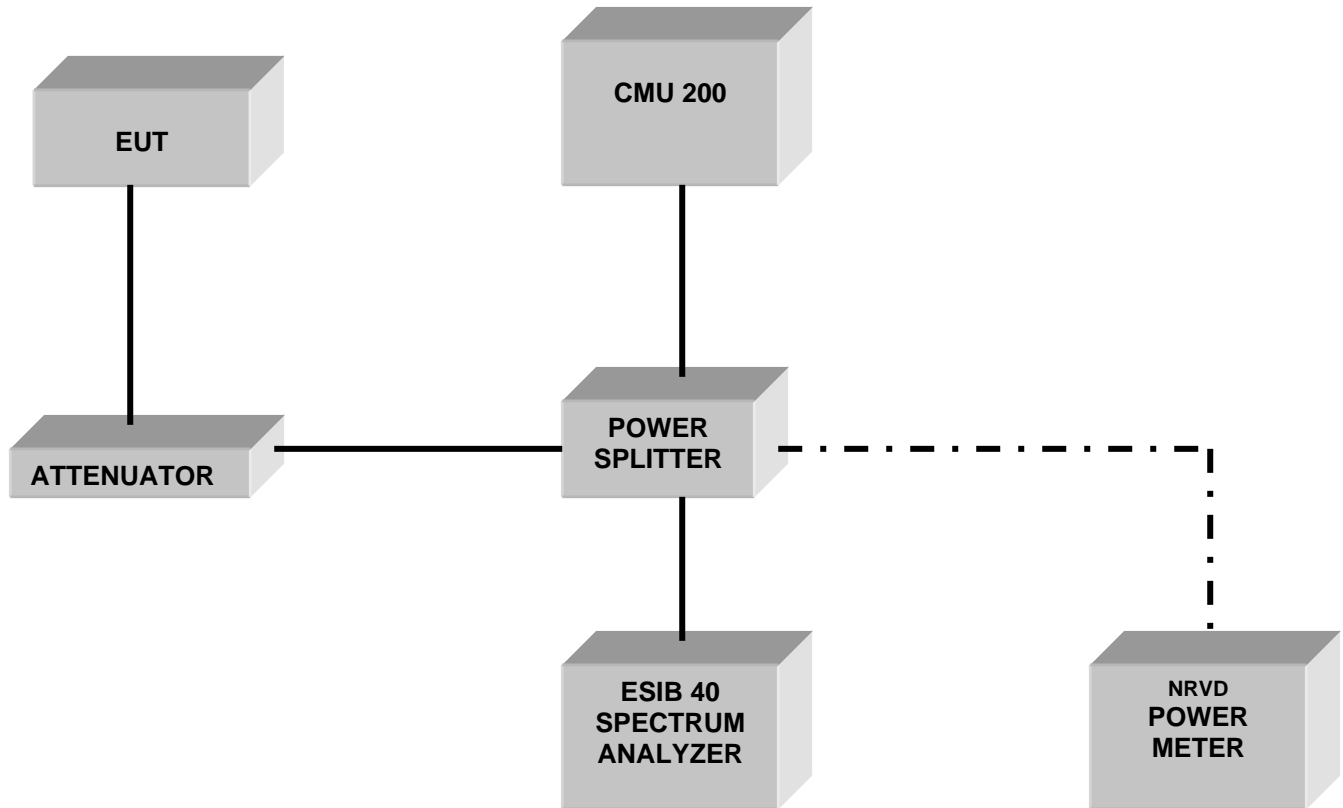


**7 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS**

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

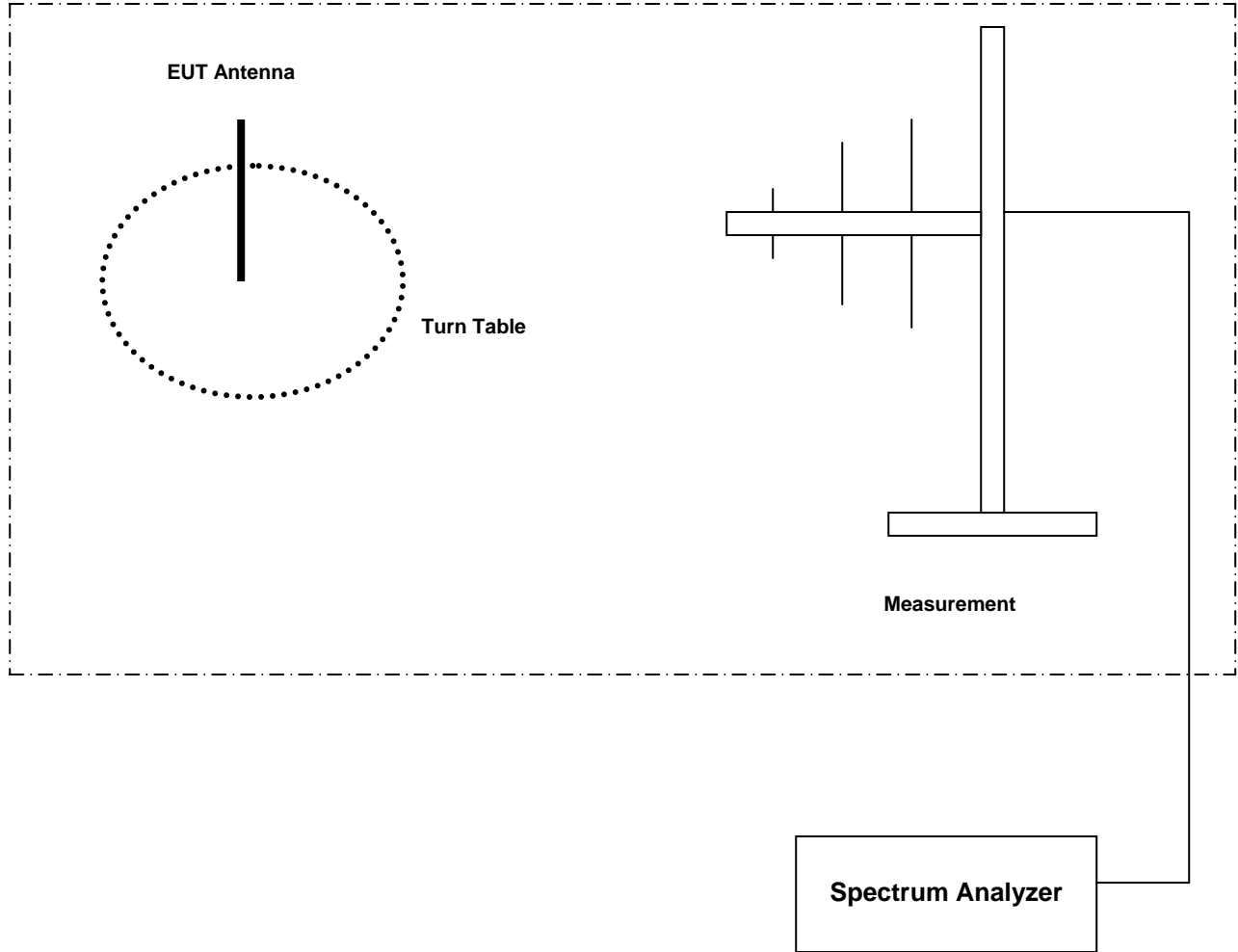
## 8 BLOCK DIAGRAMS

### Conducted Testing



**Radiated Testing**

**ANECHOIC CHAMBER**





## **9 Revision History.**

Rev1: Nov 1, 2007, Corrected model number from NTG4-RER to NTG4 RER. Added dwell time measurement plots on number of hops.

Rev2 Nov 5, 2007. Updated Dwell time statement.