



FCC Test Report

FCC Part 15.247 and RSS 210 for FHSS systems

FOR:
Garmin International

MODEL #: 01102291

FCC ID: IPH-01102291

TEST REPORT #: EMC_GARMI_009_09001_15.247_rev1

DATE: 2009-07-29



FCC listed
A2LA Accredited

IC recognized #
3462B

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Board of Directors: Dr. Harald Ansorge, Dr. Klaus Matkey, Hans Peter May



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This report is reviewed by: _____ **4**
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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 Industry Canada rules RSS210.

Company	Description	Model #
Garmin International	Connected Personal Navigation Device	01102291

This report is reviewed by:

**Heiko Strehlow
 (Director Regulatory and
 Antenna Services)**

2009-07-29 EMC & Radio

Date	Section	Name	Signature
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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.

This report is prepared by:

**Josie Sabado
 (Project Engineer)**

2009-07-29 EMC & Radio

Date	Section	Name	Signature
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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:	Marc Douat
Responsible Project Leader:	Josie Sabado
Date of test:	2009-06-23 to 2008-06-25

2.2 Identification of the Client

APPLICANT	
Applicant (Company Name)	Garmin International
Street Address	1200 E 151st Street
City/Zip Code	Olathe, KS 66062
Country	USA
Contact Person	Van Ruggles
Telephone	913.440.1321
Fax	913.397.8282
e-mail	Van.ruggles@garmin.com



3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Marketing Name:	Nuvi 1690
Description:	Connected Personal Navigation Device
Model No:	01102291
Antenna Type:	Integral
Type(s) of Modulation:	GFSK, DQPSK, 8DPSK
Frequency Band(s) of Operation:	2400~2483.5MHz
Numbers of Channels:	79
Equipment Classification: (CLASS)	<input type="checkbox"/> FIXED <input type="checkbox"/> VEHICULAR <input checked="" type="checkbox"/> MOBILE <input type="checkbox"/> MODULE
Equipment Classification: (POWER(AC MAINS))	<input type="checkbox"/> 110VAC (<i>GROUND</i>) <input checked="" type="checkbox"/> 110/230 VAC (<i>NO GROUND</i>) <input type="checkbox"/> 12VDC

3.2 Identification of the Equipment Under Test (EUT)

EUT #	TYPE	MODEL
1	EUT	Nuvi 1690

3.3 Identification of Accessory equipment

AE #	TYPE	MODEL
1	AC Adapter	PSAA05A-050
2	Cradle	NA



4 Subject of Investigation

All testing was performed on the EUT listed in Section 3. The EUT was maximized in the X,Y, Z positions , all data in this report shows the worst case between horizontal and vertical polarization.

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 Parts 2, 22 and 24 of Title 47 of the Code of Federal Regulations and Industry Canada rules RSS132 and RSS133.

All measurements were made with the unit in a cradle, plugged into a 110VAC power outlet.



5 Measurements (Radiated)

5.1 MAXIMUM PEAK OUTPUT POWER

5.1.1 Test Result:

EIRP: GFSK

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)		2402	2441	2480
T _{nom} (23)°C	V _{nom}	3.885	6.009	6.412
Measurement uncertainty		±0.5dBm		

EIRP: $\pi / 4$ DQPSK

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)		2402	2441	2480
T _{nom} (23)°C	V _{nom}	2.085	3.568	4.505
Measurement uncertainty		±0.5dBm		

EIRP: 8DPSK

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)		2402	2441	2480
T _{nom} (23)°C	V _{nom}	2.077	3.568	4.505
Measurement uncertainty		±0.5dBm		



5.2 RESTRICTED BAND EDGE COMPLIANCE RADIATED §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
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

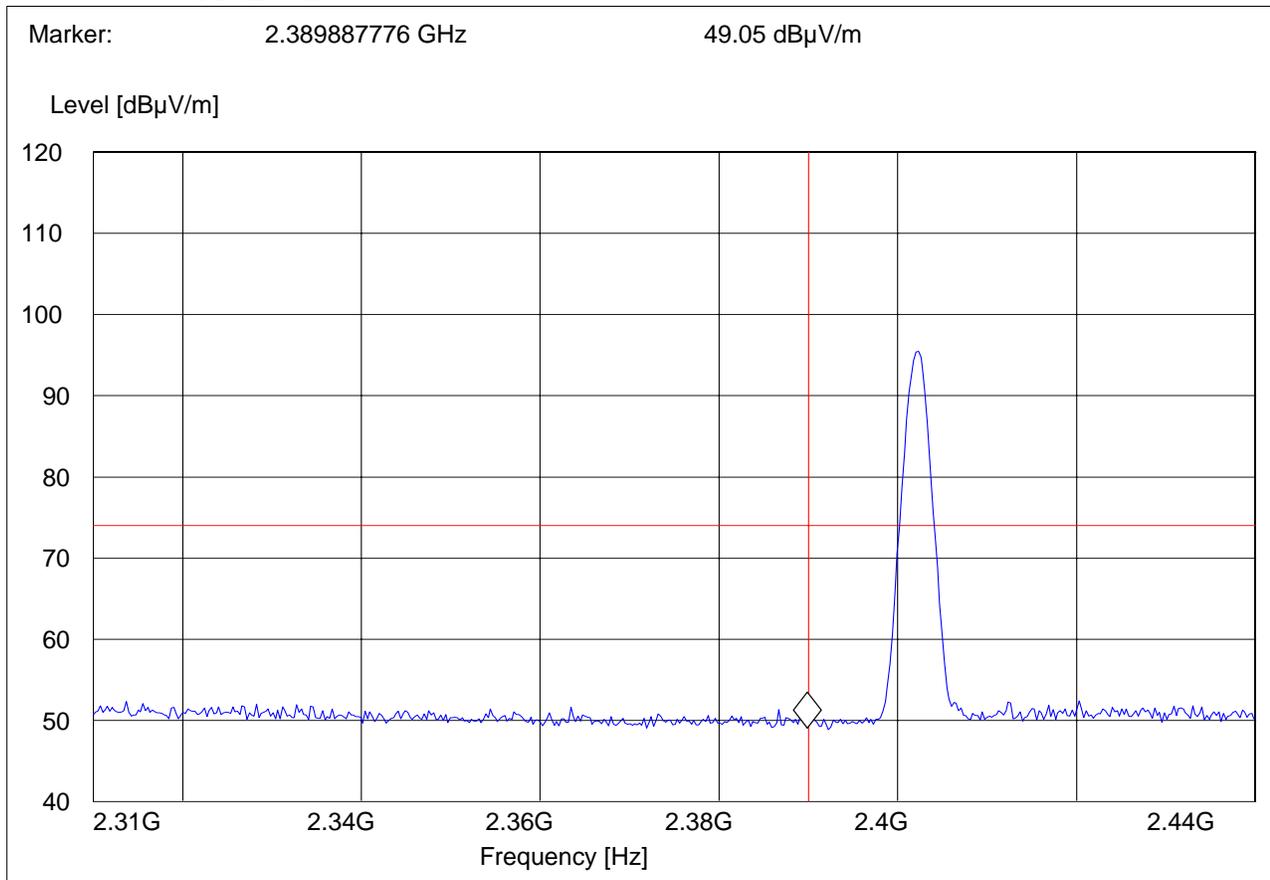


**5.2.2 RESULTS: GFSK
(2402MHz) LOWER BAND EDGE PEAK -GFSK MODULATION**

EUT: Nuvi 1690
Customer:: Garmin
Test Mode: BT DH5
ANT Orientation: H
EUT Orientation: V
Test Engineer: Josie
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	Coupled	1 MHz	#326horn_AF_vert
MaxPeak					



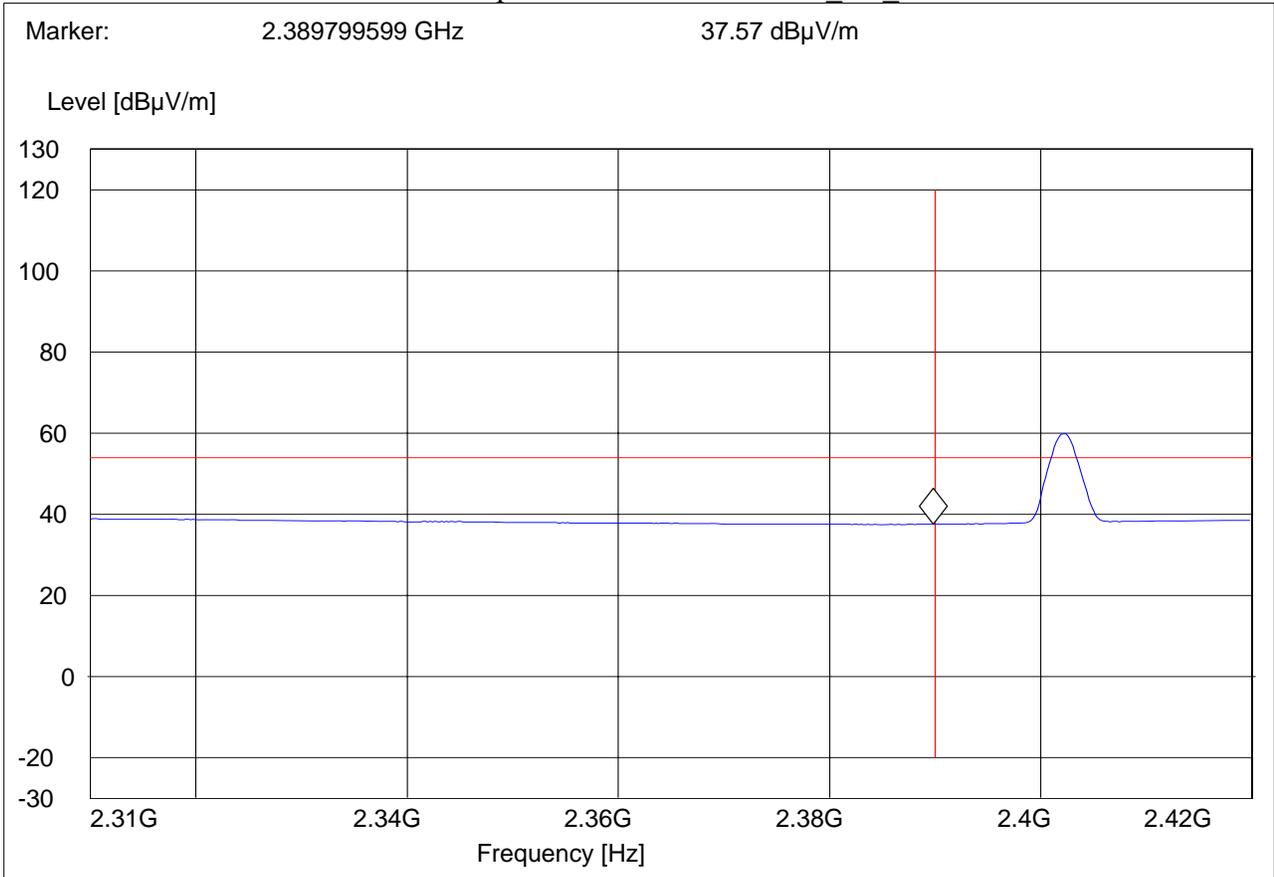


(2402MHz) LOWER BAND EDGE AVERAGE -GFSK MODULATION

EUT: Nuvi 1690
 Customer:: Garmin
 Test Mode: BT DH5
 ANT Orientation: H
 EUT Orientation: V
 Test Engineer: Josie
 Voltage: AC
 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





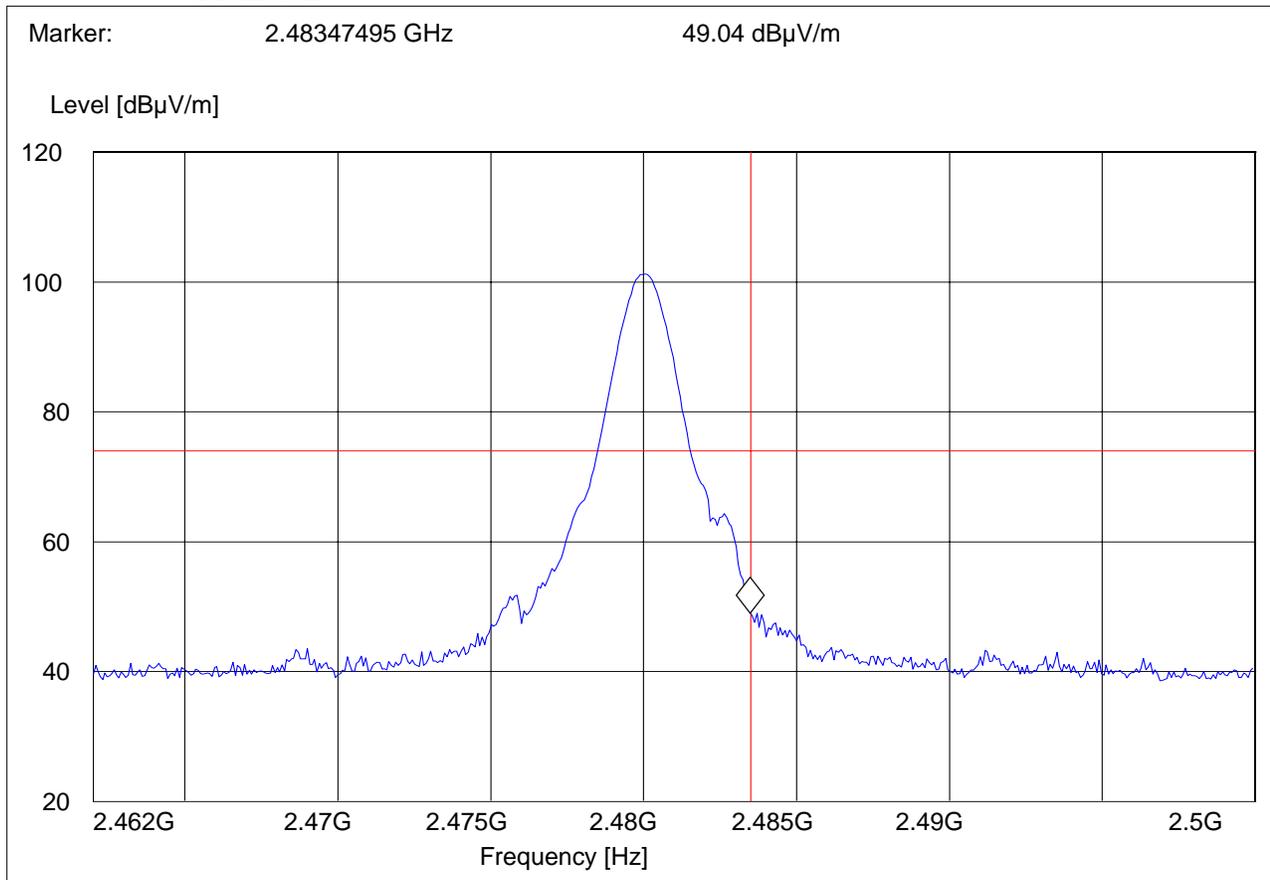
(2480MHz) HIGHER BAND EDGE PEAK -GFSK MODULATION

EUT: Nuvi 1690
 Customer:: Garmin
 Test Mode: BT DH5
 ANT Orientation: H
 EUT Orientation: V
 Test Engineer: Josie
 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	Coupled	1 MHz	#326horn_AF_vert

MaxPeak



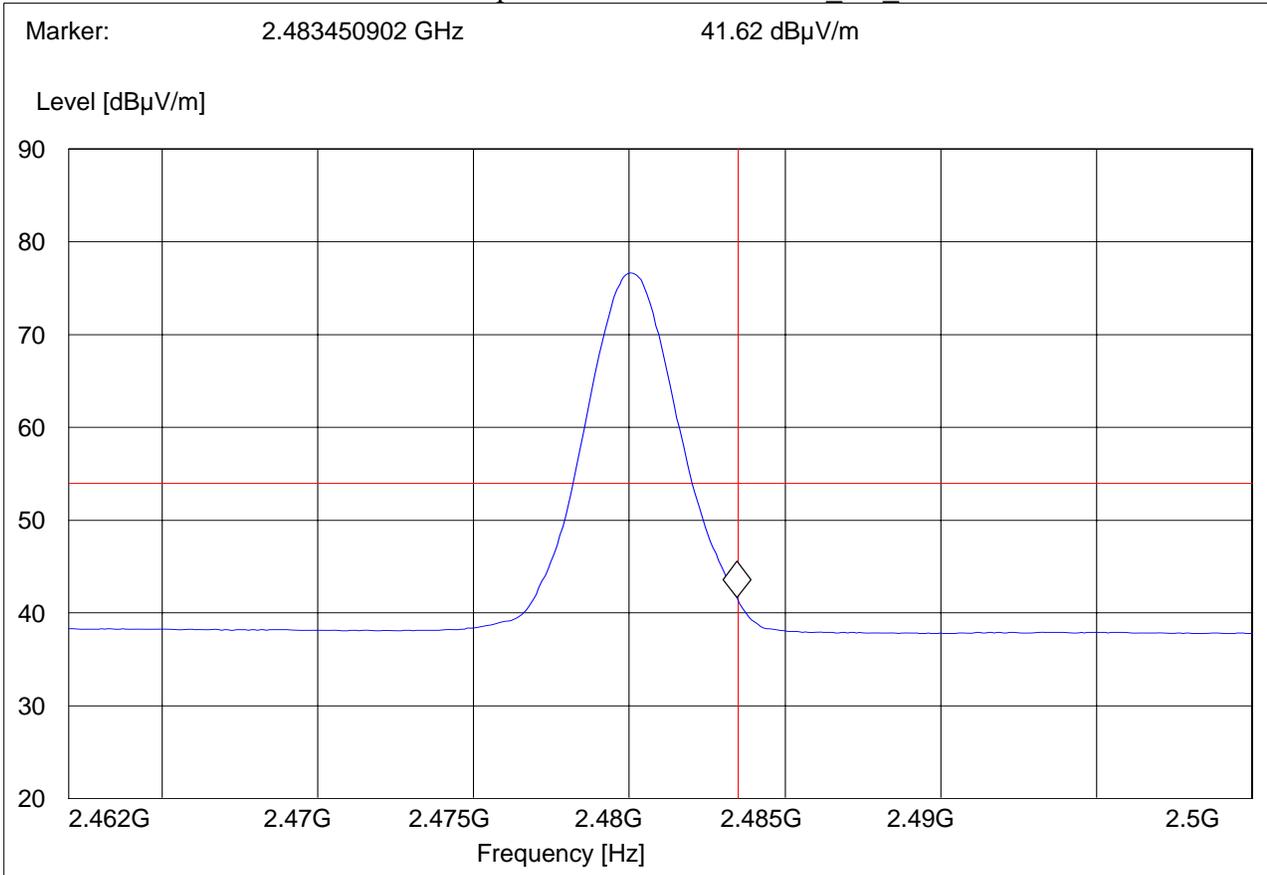


HIGHER BAND EDGE AVERAGE-GFSK MODULATION

EUT: Nuvi 1690
 Customer:: Garmin
 Test Mode: BT DH5
 ANT Orientation: H
 EUT Orientation: V
 Test Engineer: Josie
 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



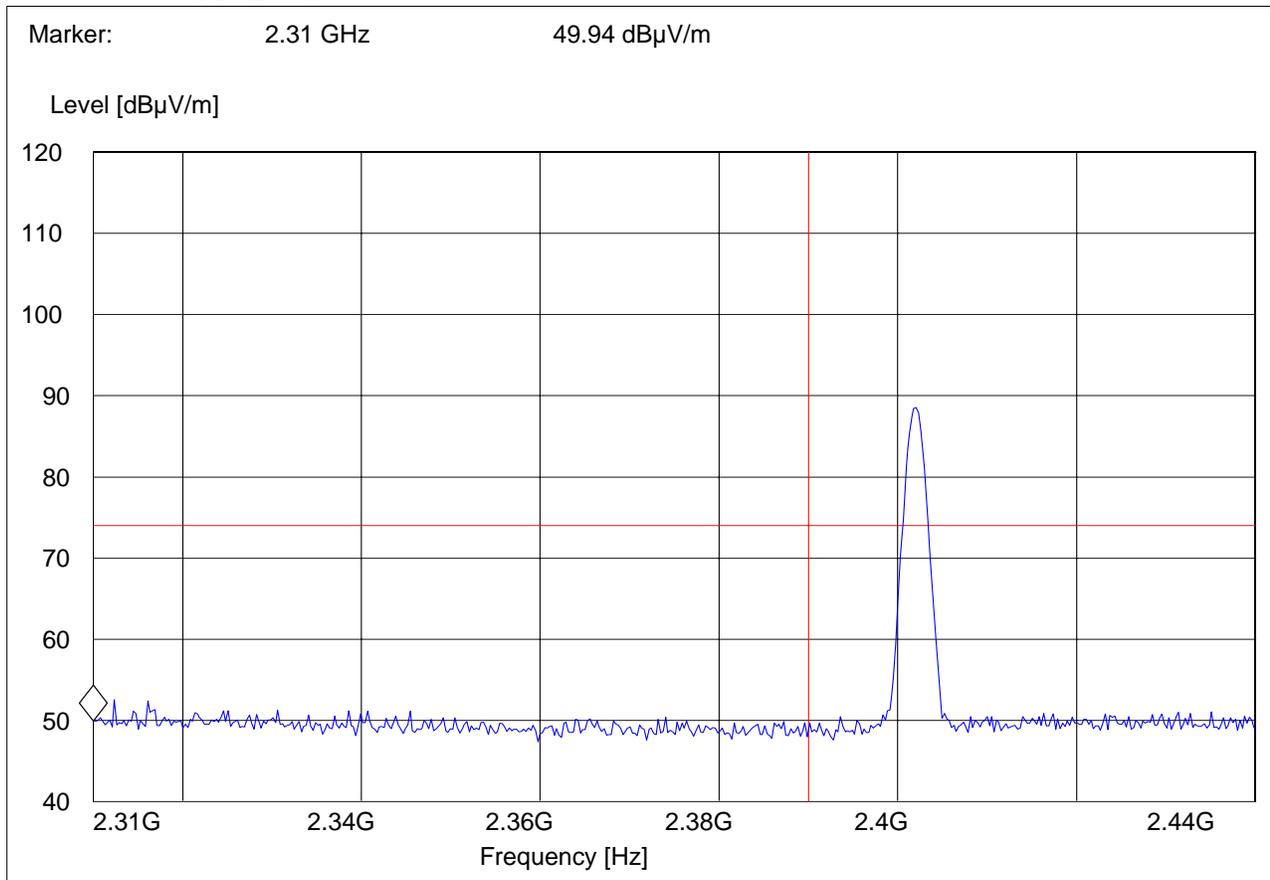


**5.2.3 RESULTS: $\pi/4$ DQPSK
(2402MHz) LOWER BAND EDGE PEAK - $\pi/4$ DQPSK MODULATION**

EUT: Nuvi 1690
Customer:: Garmin
Test Mode: BT 2-DH5
ANT Orientation: H
EUT Orientation: V
Test Engineer: Josie
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	Coupled	1 MHz	#326horn_AF_vert



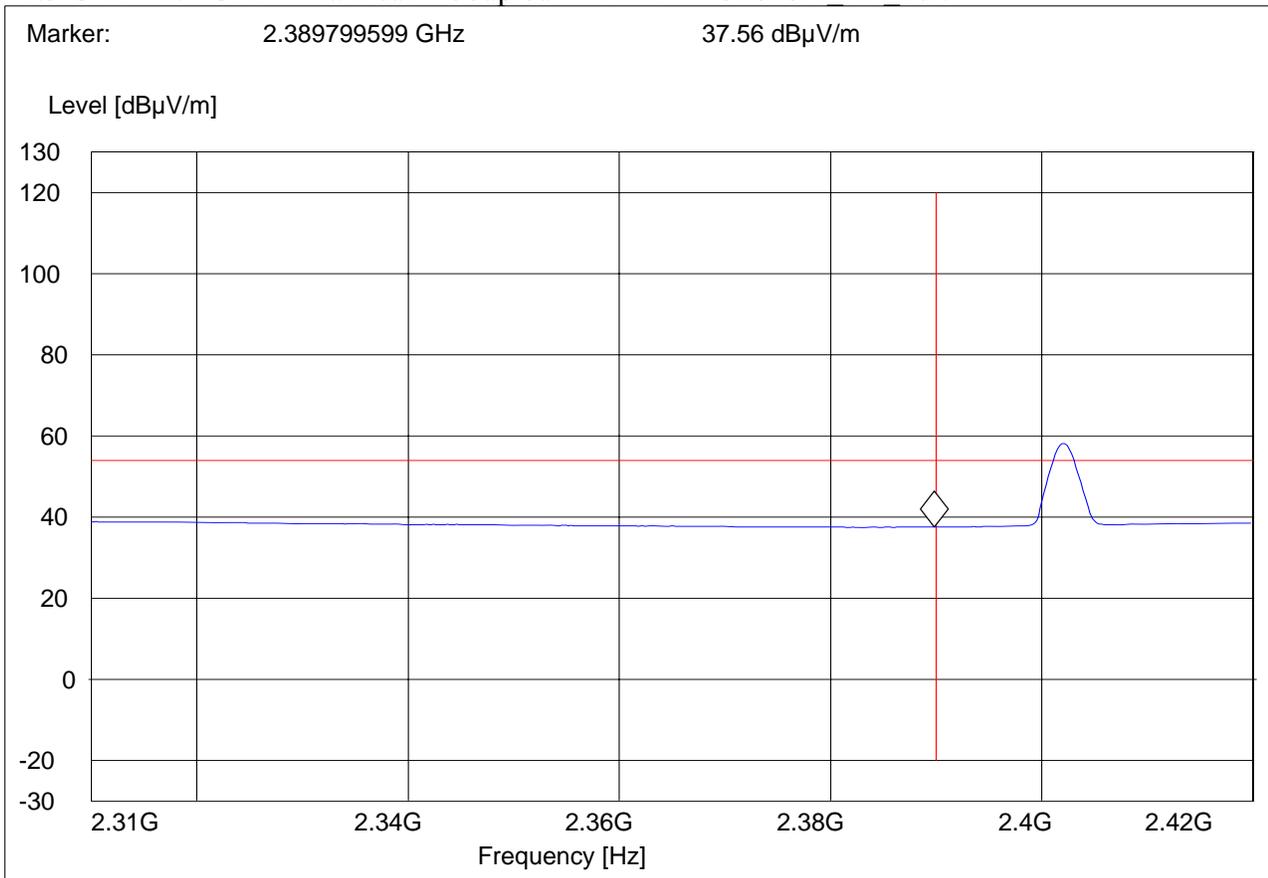


(2402MHz) LOWER BAND EDGE AVERAGE $-\pi/4$ DQPSK MODULATION

EUT: Nuvi 1690
Customer:: Garmin
Test Mode: BT 2-DH5
ANT Orientation: H
EUT Orientation: V
Test Engineer: Josie
Voltage: AC
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



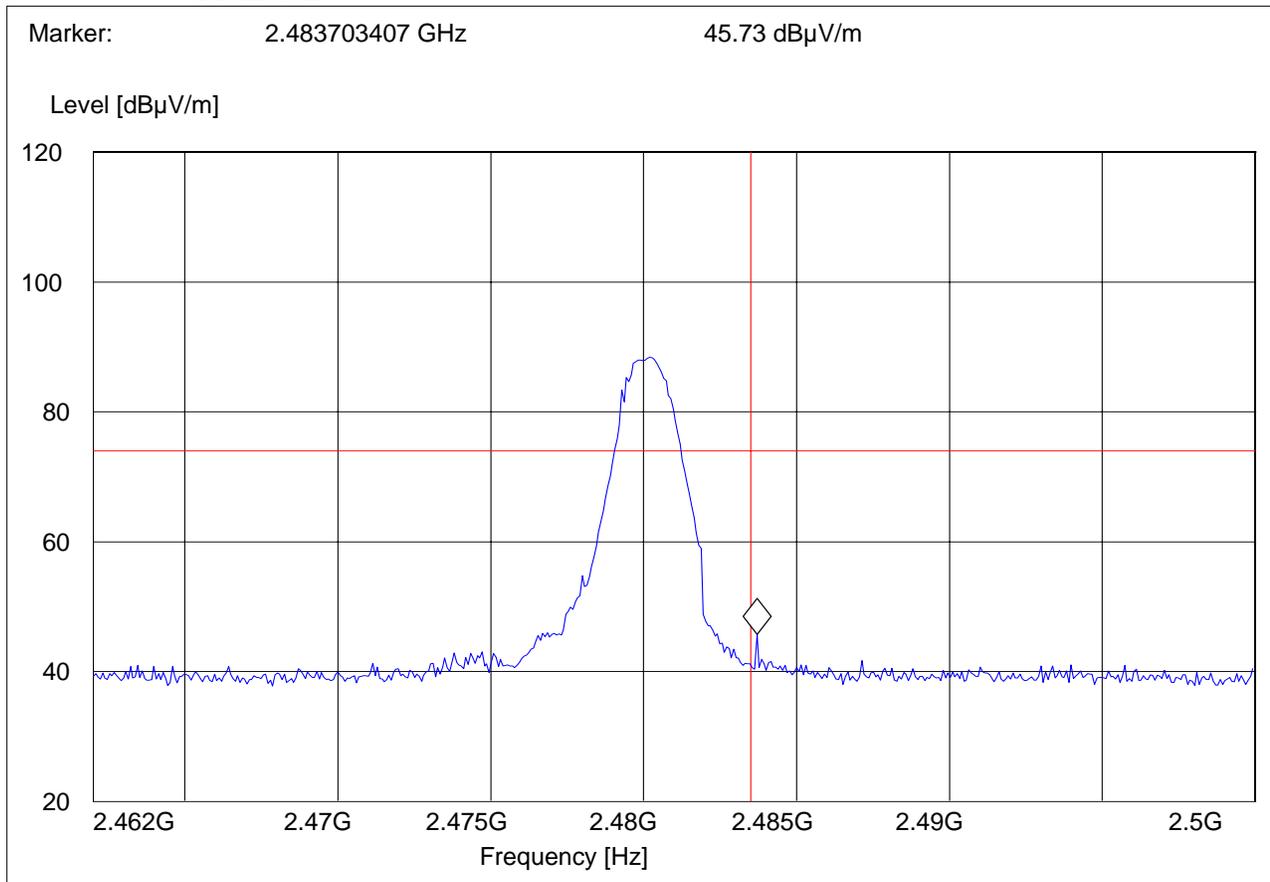


(2480MHz) HIGHER BAND EDGE PEAK - $\pi/4$ DQPSK MODULATION

EUT: Nuvi 1690
Customer:: Garmin
Test Mode: BT 2-DH5
ANT Orientation: H
EUT Orientation: V
Test Engineer: Josie
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	Coupled	1 MHz	#326horn_AF_vert
MaxPeak					



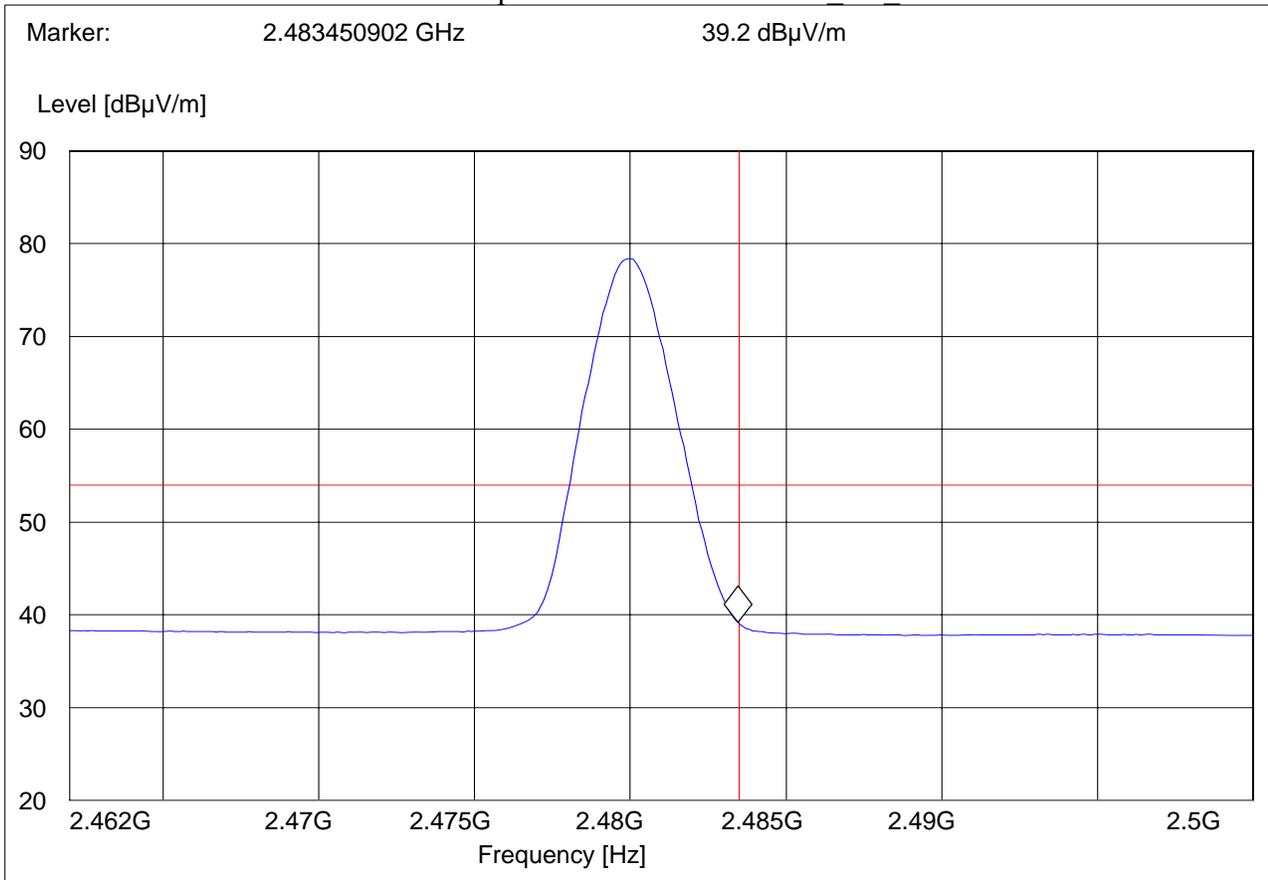


HIGHER BAND EDGE AVERAGE- $\pi/4$ DQPSK MODULATION

EUT: Nuvi 1690
 Customer:: Garmin
 Test Mode: BT 2-DH5
 ANT Orientation: H
 EUT Orientation: V
 Test Engineer: Josie
 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



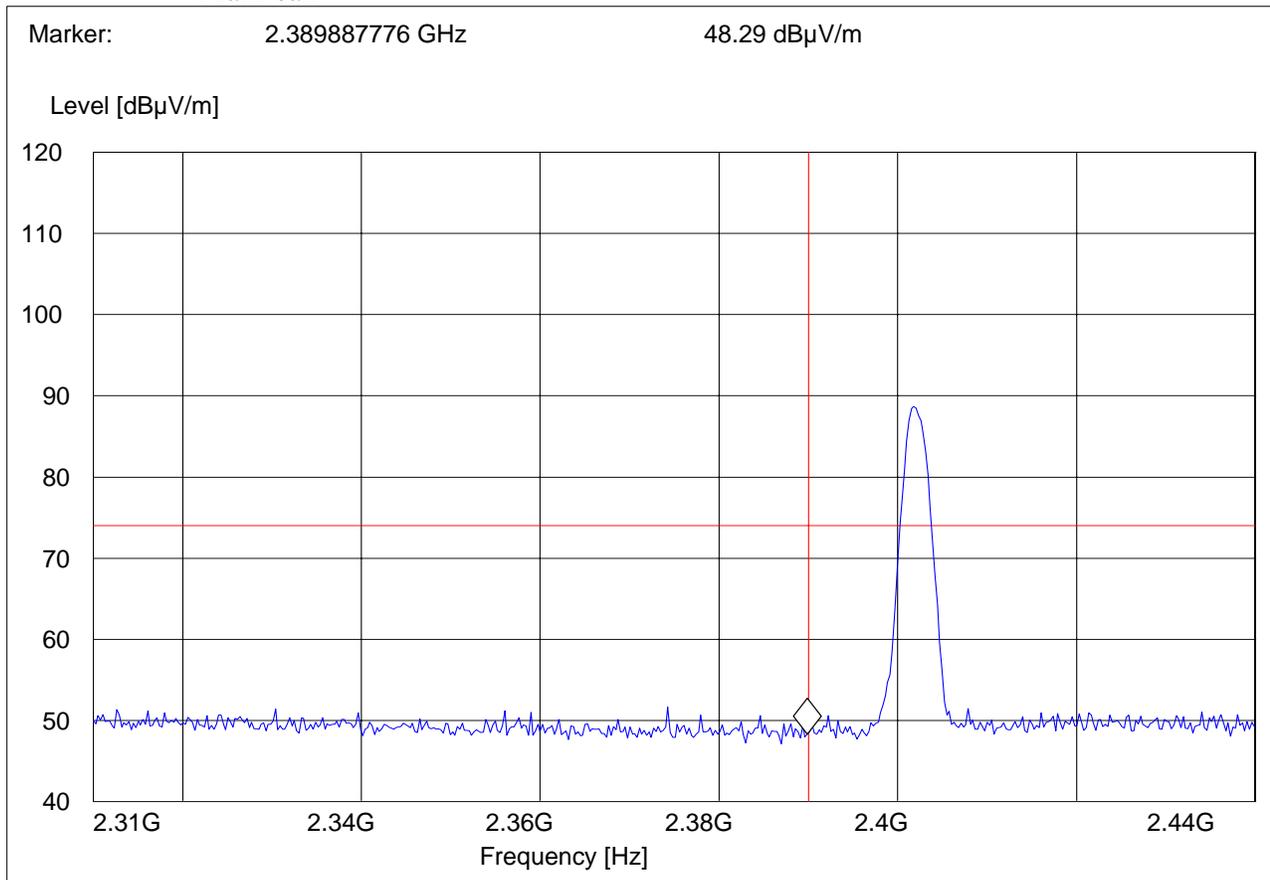


**5.2.4 RESULTS: 8DPSK
(2402MHz) LOWER BAND EDGE PEAK - 8DPSK MODULATION**

EUT: Nuvi 1690
Customer:: Garmin
Test Mode: BT 3-DH5
ANT Orientation: H
EUT Orientation: V
Test Engineer: Josie
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	Coupled	1 MHz	#326horn_AF_vert
MaxPeak					



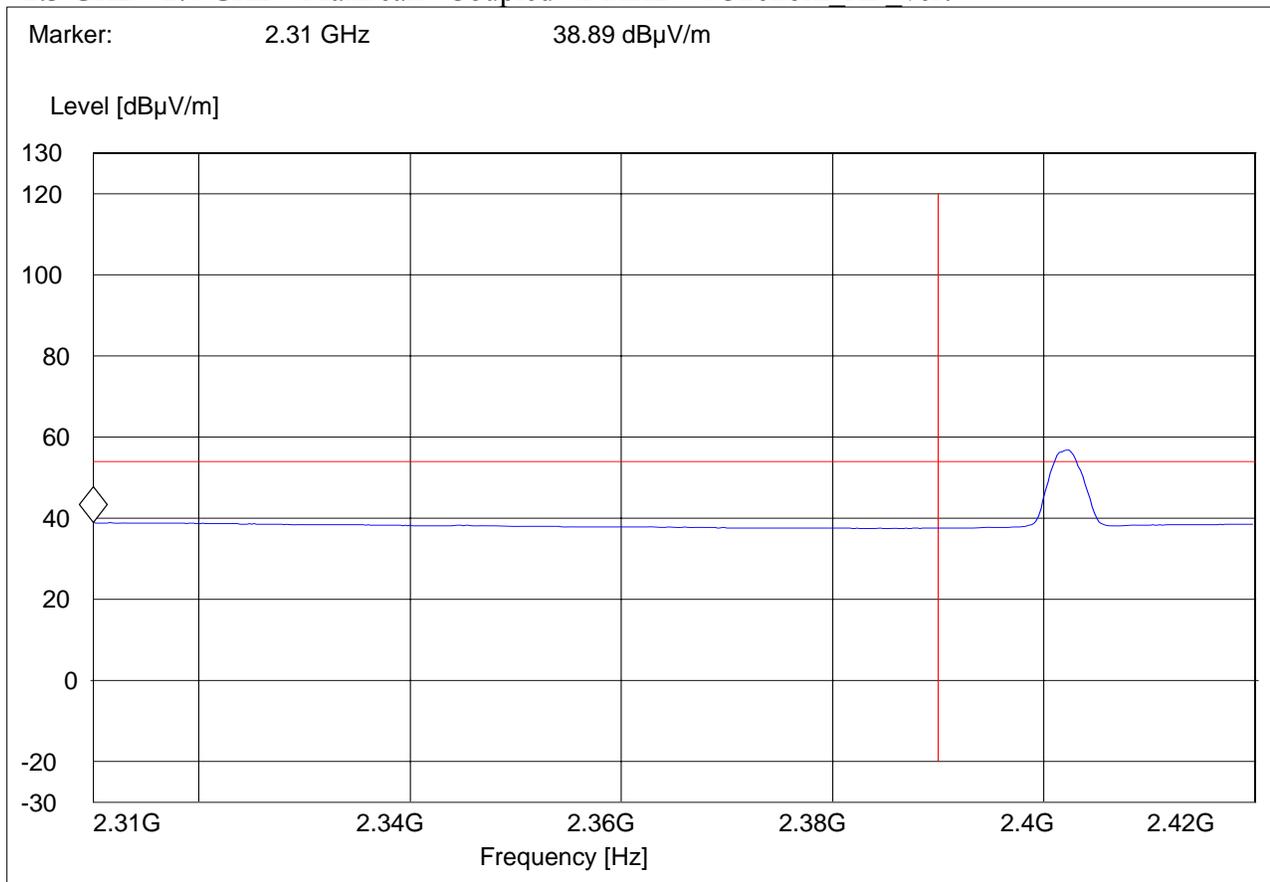


(2402MHz) LOWER BAND EDGE AVERAGE -8DPSK MODULATION

EUT: Nuvi 1690
Customer:: Garmin
Test Mode: BT 3-DH5
ANT Orientation: H
EUT Orientation: V
Test Engineer: Josie
Voltage: AC
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



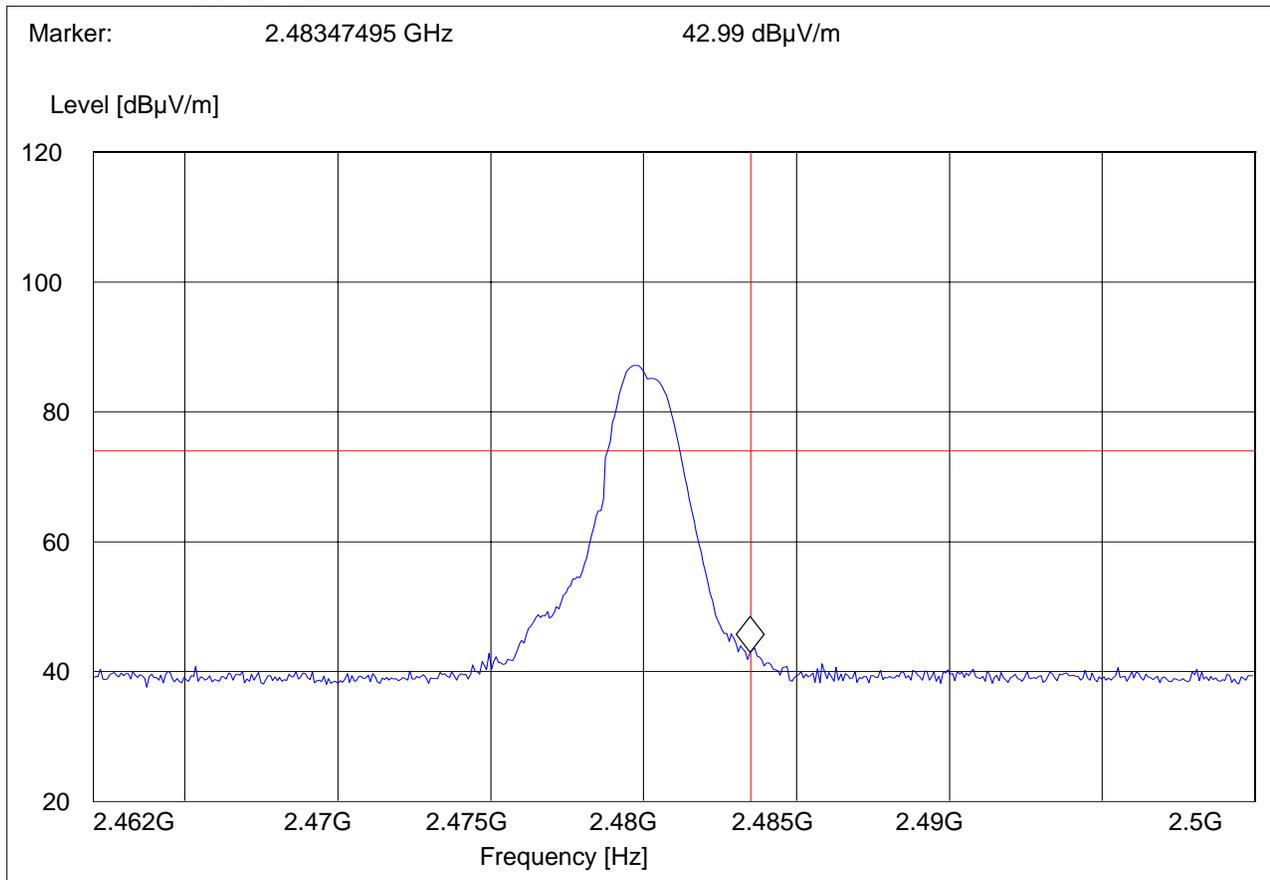


RESULTS (2480MHz) HIGHER BAND EDGE PEAK - 8DPSK MODULATION

EUT: Nuvi 1690
Customer:: Garmin
Test Mode: BT 3-DH5
ANT Orientation: H
EUT Orientation: V
Test Engineer: Josie
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	Coupled	1 MHz	#326horn_AF_vert
MaxPeak					



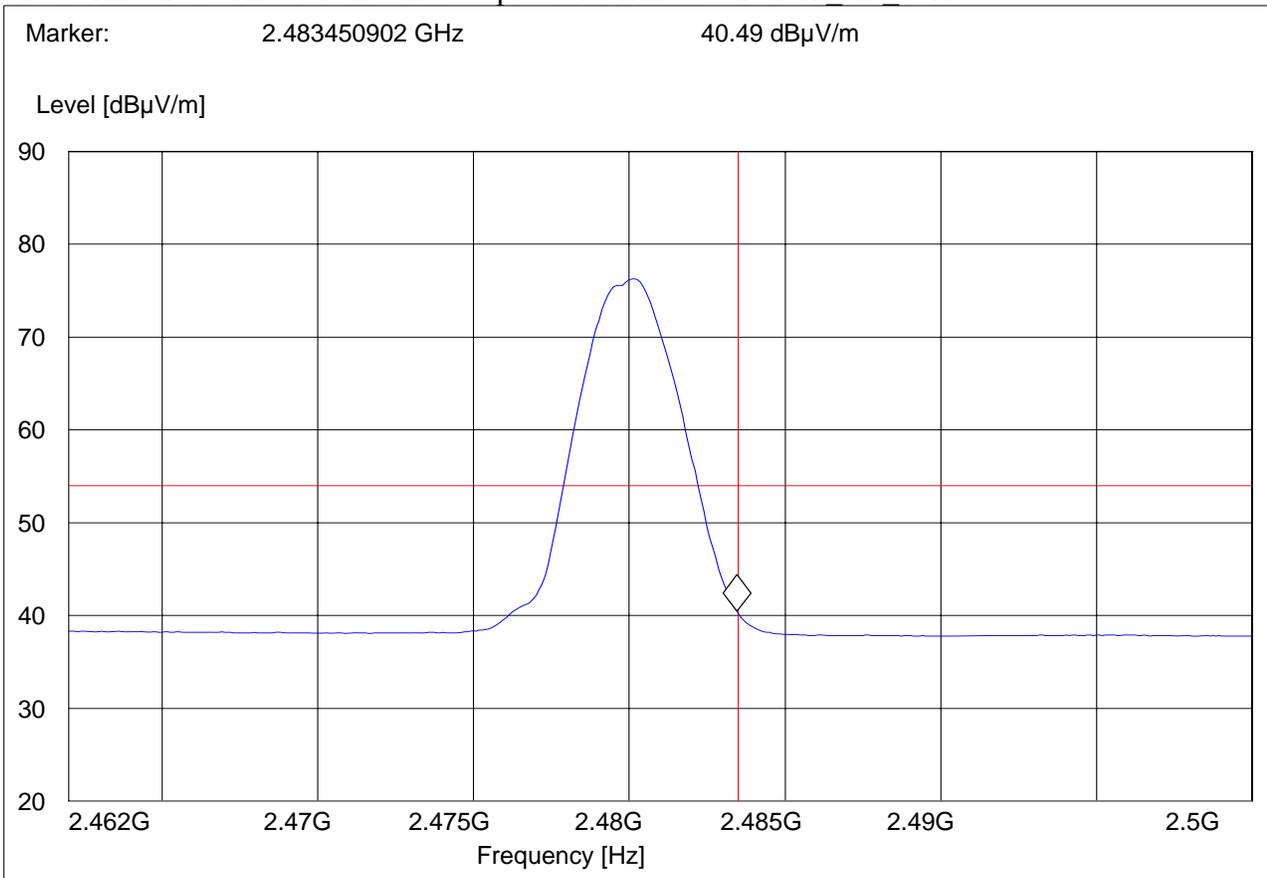


HIGHER BAND EDGE AVERAGE-8DPSK MODULATION

EUT: Nuvi 1690
 Customer:: Garmin
 Test Mode: BT 3-DH5
 ANT Orientation: H
 EUT Orientation: V
 Test Engineer: Josie
 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 EMISSIONS RADIATED § 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
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

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. All measurements done in GFSK mode and represents the worst case emission.

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
30MHz – 1GHz
Channel 0, 2402MHz

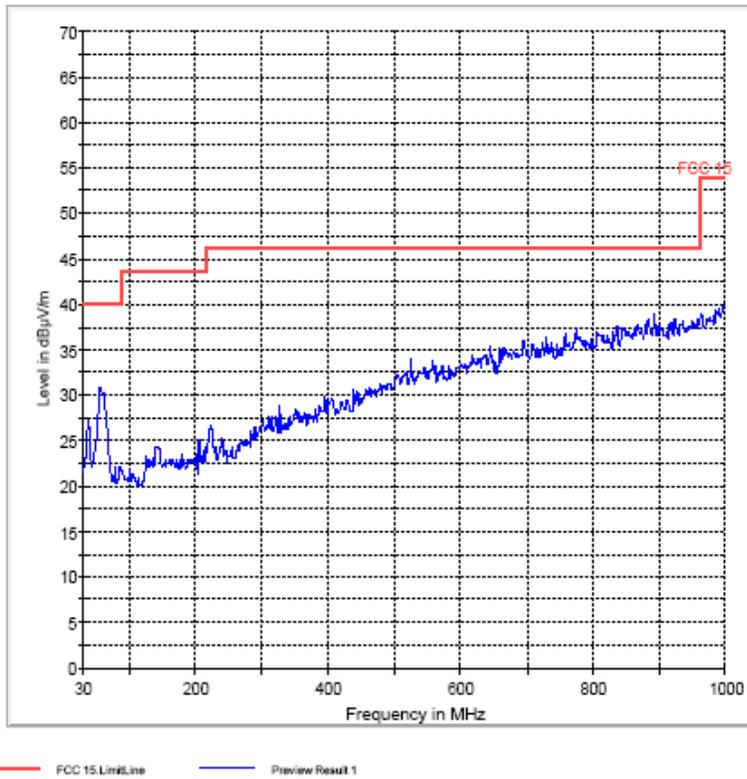
Test 1 / 1

EUT Information

Description:
EUT Name: Nuvi 1890
Manufacturer: Garmin
Serial Number:
Hardware Rev:
Software Rev:
Comment: AC; new unit

Test

FCC 15 30-1000MHz



6/24/2009 mdouat

EMC32 V8.10.10

4:46:03



30MHz – 1GHz
Channel 39, 2441MHz

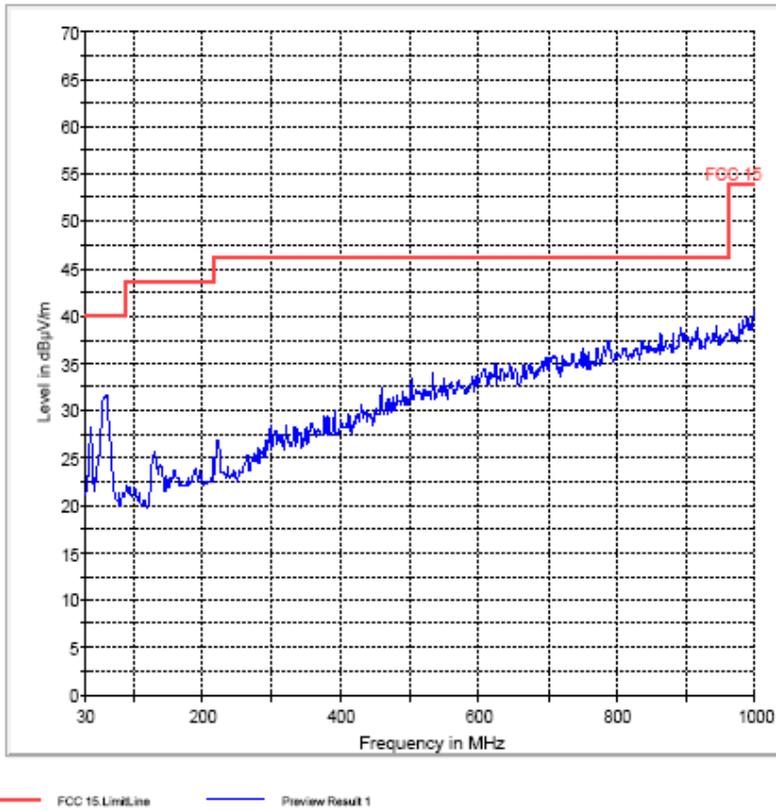
Test 1 / 1

EUT Information

Description:
EUT Name: Nuvi 1690
Manufacturer: Garmin
Serial Number:
Hardware Rev:
Software Rev:
Comment: AC; new unit

Test

FCC 15 30-1000MHz





30MHz – 1GHz
Channel 78, 2480MHz

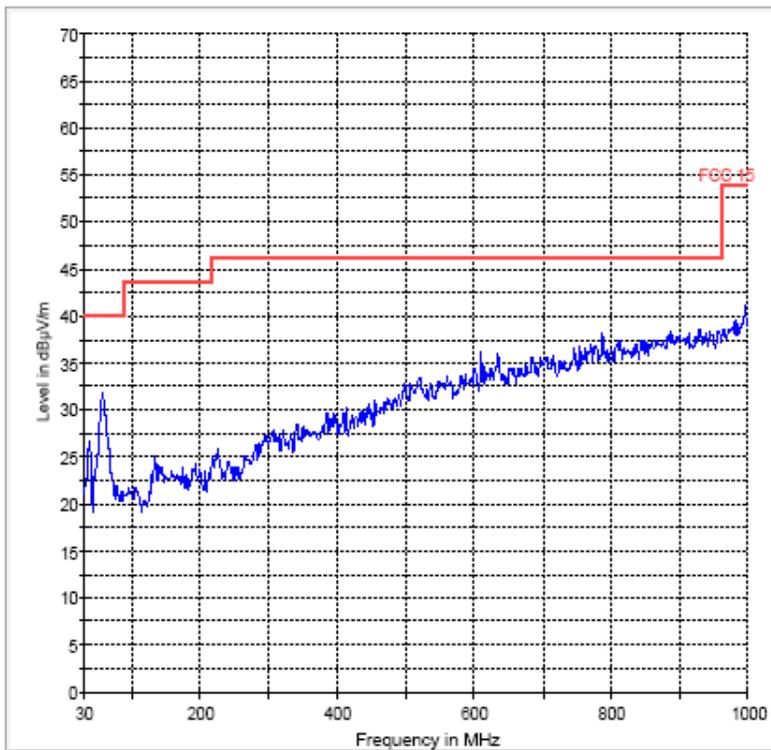
Test 1 / 1

EUT Information

Description:
EUT Name: Nuvi 1090
Manufacturer: Garmin
Serial Number:
Hardware Rev:
Software Rev:
Comment: AC; new unit

Test

FCC 15 30-1000MHz



— FCC 15 Limit Line — Preview Result 1



1-18GHz
Channel 0, 2402MHz

Test 1 / 1

EUT Information

Description:
 EUT Name: Nuvi 1690
 Manufacturer: Garmin
 Serial Number:
 Hardware Rev:
 Software Rev:
 Comment: AC; new unit

Test

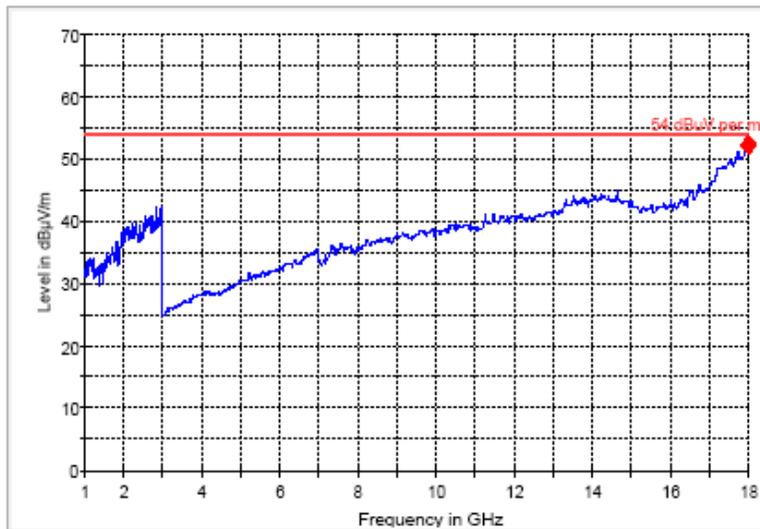
Final Result 1

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
17395.521042	52.2	20.000	1000.000	154.0	H	22.0	29.3	1.8	54.0

(continuation of the "Final Result 1" table from column 10 ...)

Frequency (MHz)	Comment
17395.521042	

FCC 15 1-18GHz



— 54 dBµV perm. Limit Line — Preview Result 1 ◆ Final Result 1



1-18GHz
Channel 39, 2441MHz

Test 1 / 1

EUT Information

Description:
 EUT Name: Nuvi 1890
 Manufacturer: Garmin
 Serial Number:
 Hardware Rev:
 Software Rev:
 Comment: AC; new unit

Test

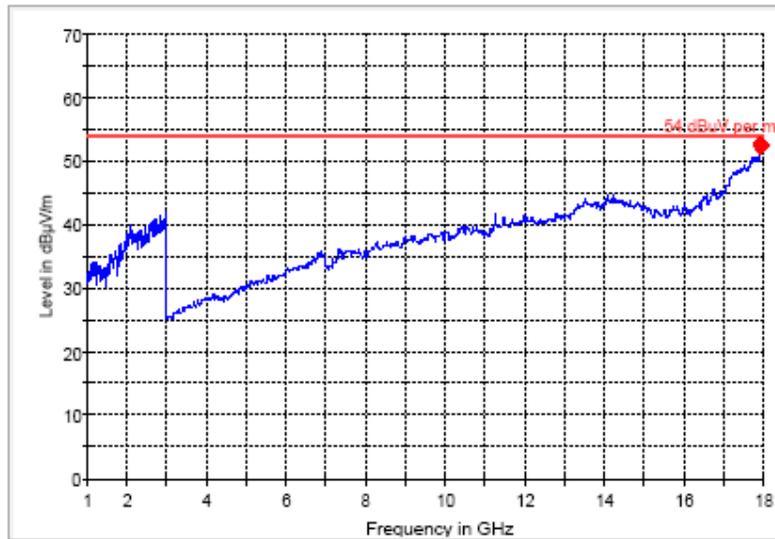
Final Result 1

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
17344.218437	52.5	20.000	1000.000	154.0	V	267.0	29.5	1.5	54.0

(continuation of the "Final Result 1" table from column 10 ...)

Frequency (MHz)	Comment
17344.218437	

FCC 15 1-18GHz



— 54 dBµV per m.LimitLine — Preview Result 1 ◆ Final Result 1



1-18GHz
Channel 78, 2480MHz

Test 1 / 1

EUT Information

Description:
 EUT Name: Nuvi 1890
 Manufacturer: Garmin
 Serial Number:
 Hardware Rev:
 Software Rev:
 Comment: AC; new unit

Test

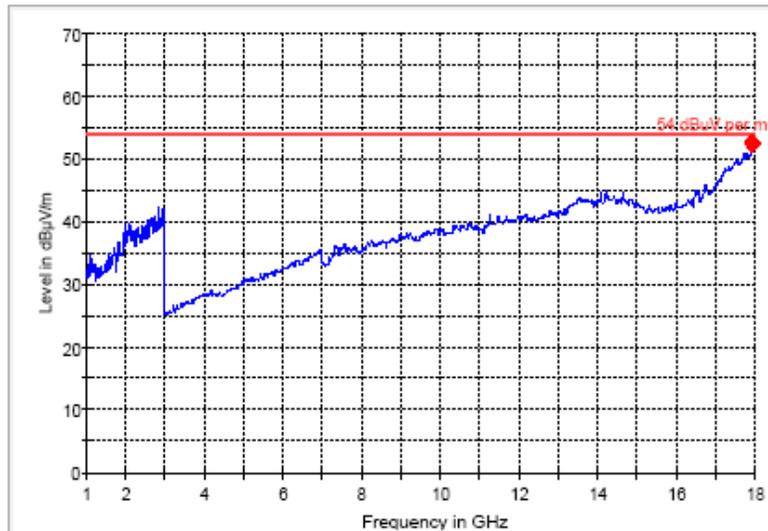
Final Result 1

Frequency (MHz)	Average (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBuV/m)
17944.519039	52.4	20.000	1000.000	139.0	V	292.0	29.5	1.6	54.0

(continuation of the "Final Result 1" table from column 10 ...)

Frequency (MHz)	Comment
17944.519039	

FCC 15 1-18GHz



— 54 dBuV per m Limit Line — Preview Result 1 ◆ Final Result 1



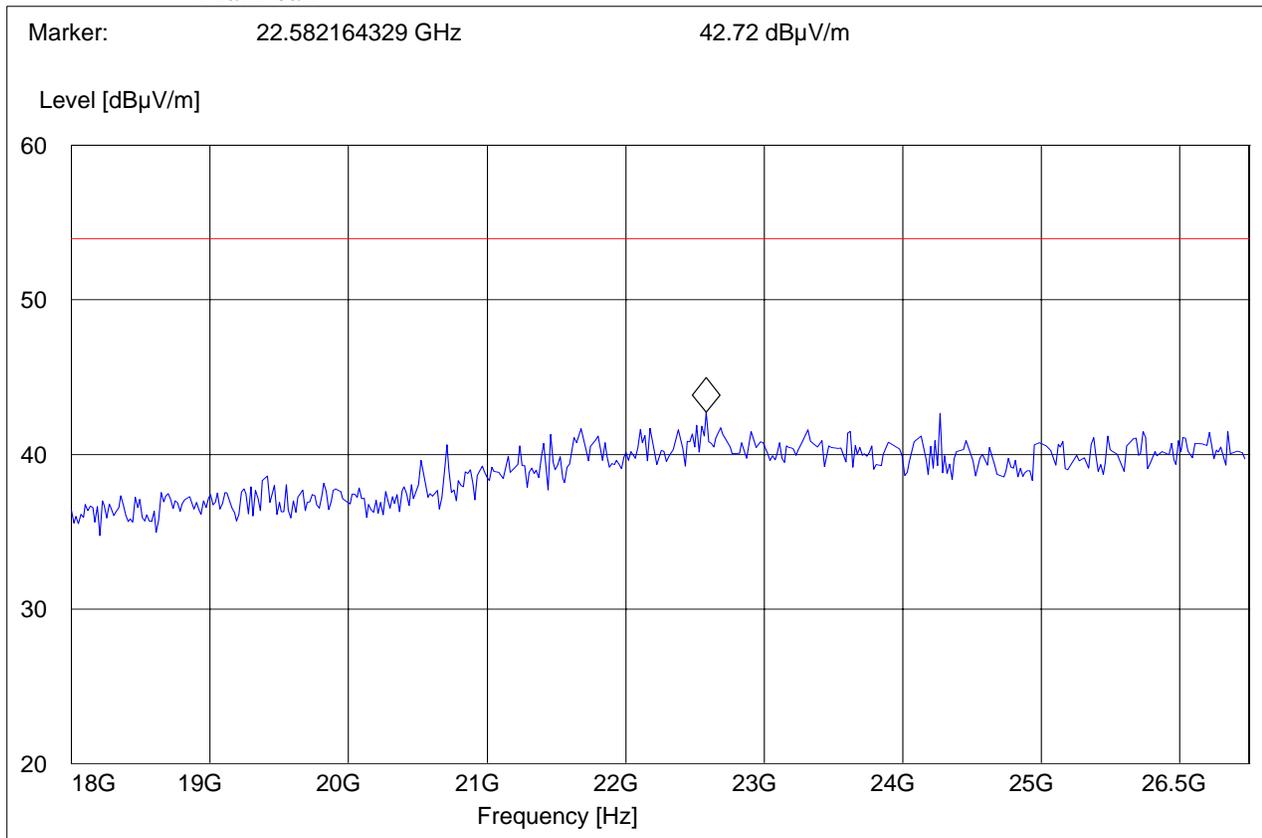
18GHz – 25GHz
Channel 0, 2402 MHz

EUT: NUVI 1690
Customer:: GARMIN
Test Mode: BT CH 0
ANT Orientation: H
EUT Orientation: V
Test Engineer: SAM
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	Coupled	100 kHz	Horn # 3116_18-40G

MaxPeak



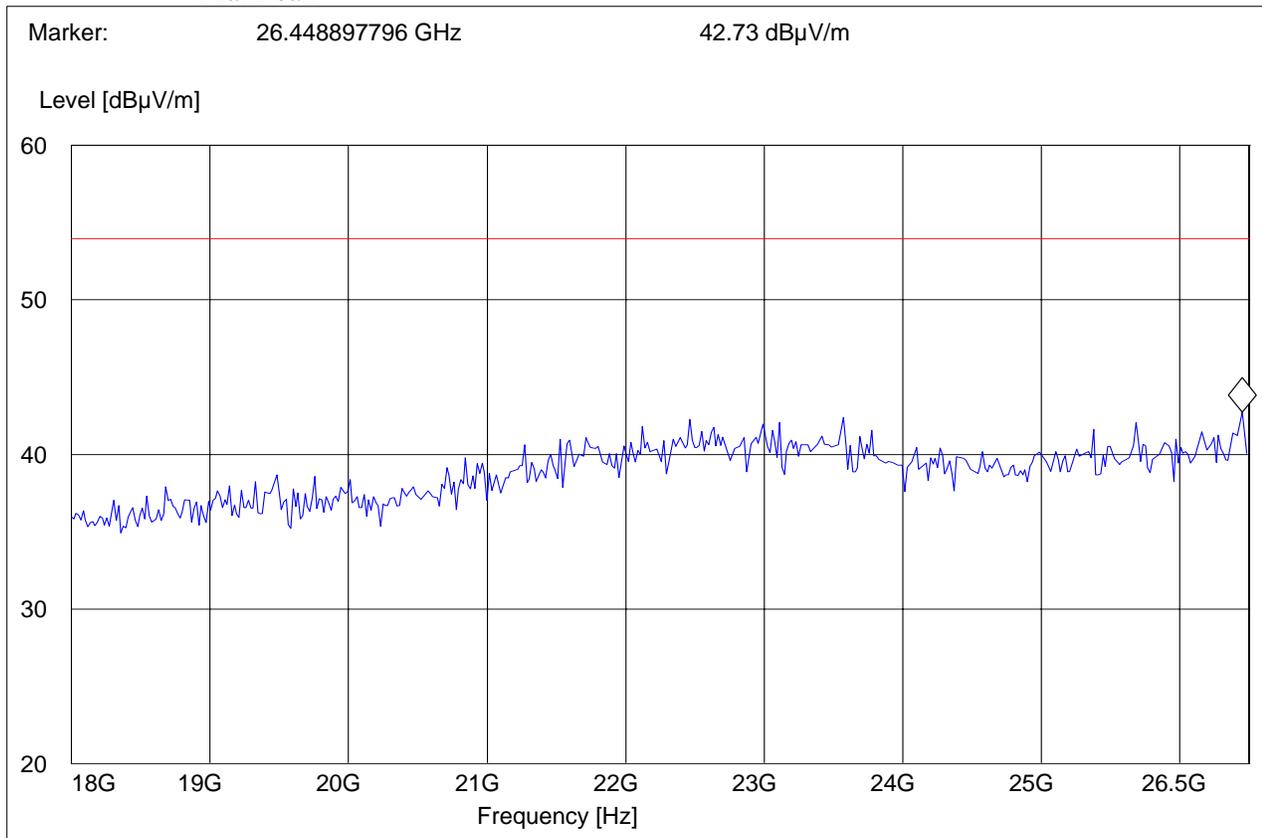


18GHz – 25GHz
Channel 39, 2441MHz

EUT: NUVI 1690
Customer:: GARMIN
Test Mode: BT CH 39
ANT Orientation: H
EUT Orientation: V
Test Engineer: SAM
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	Coupled	100 kHz	Horn # 3116_18-40G
MaxPeak					





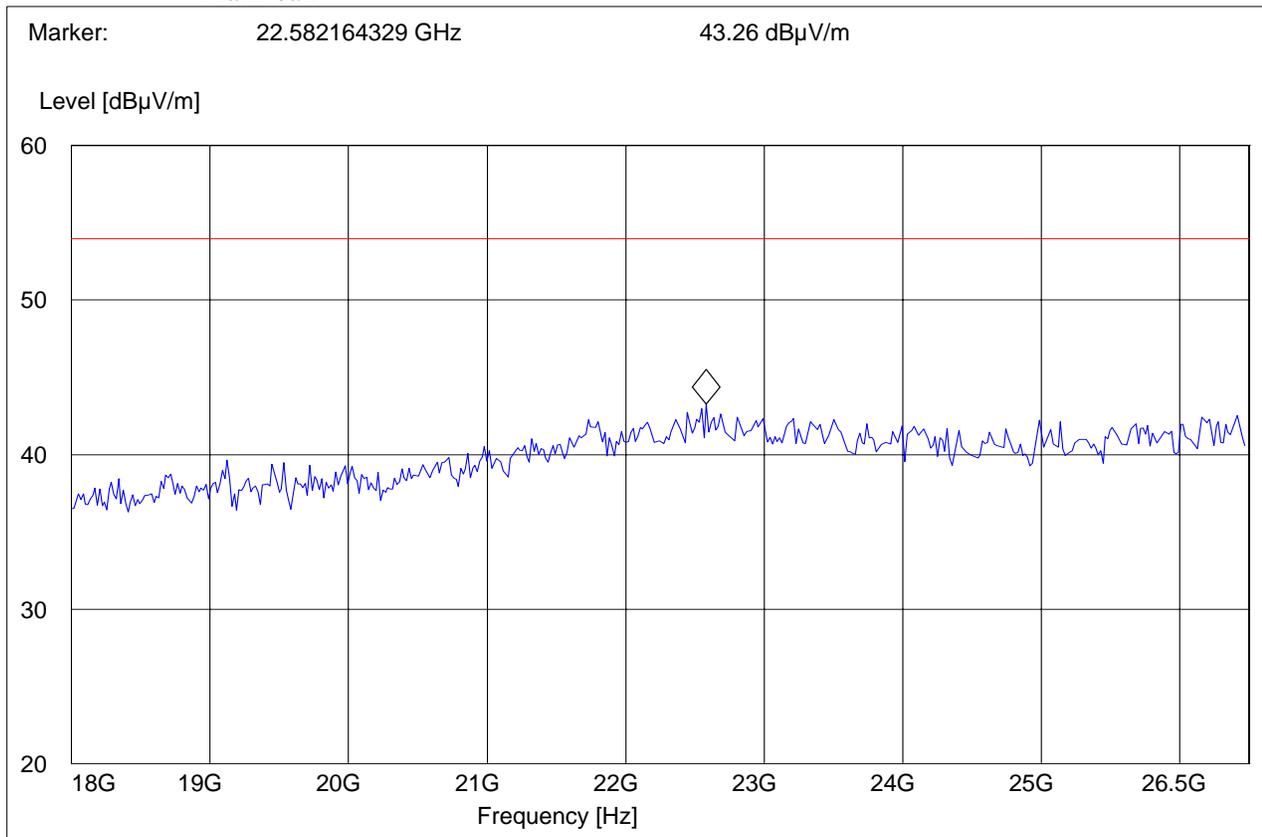
18GHz – 25GHz
Channel 78, 2480MHz

EUT: NUVI 1690
Customer:: GARMIN
Test Mode: BT CH 78
ANT Orientation: H
EUT Orientation: V
Test Engineer: SAM
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	Coupled	100 kHz	Horn # 3116_18-40G

MaxPeak





5.4 RECEIVER SPURIOUS RADIATION RSS-Gen(4.10)

5.4.1 LIMITS

Frequency (MHz)	Field strength ($\mu\text{V/m}$)	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.

5.4.2 Results 30MHz - 1GHz

Test

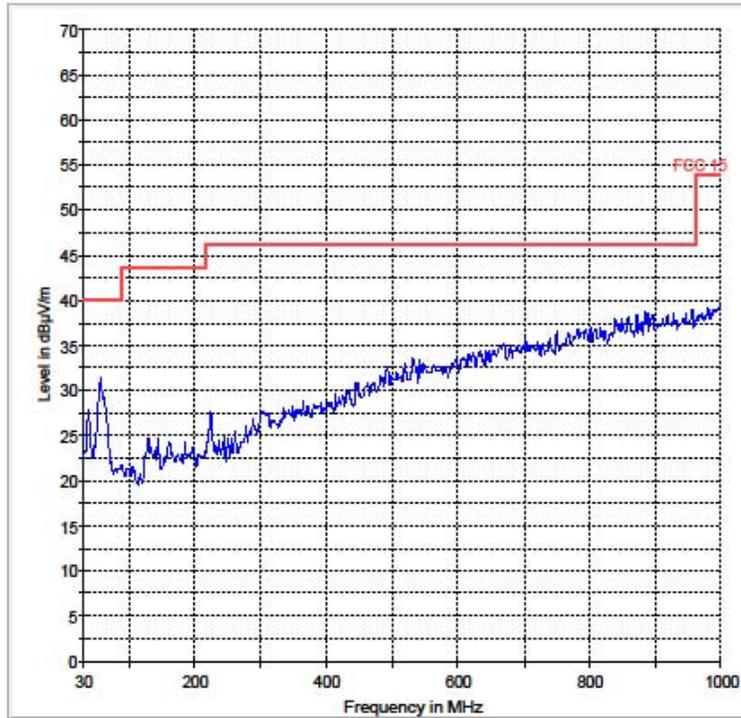
1/1

EUT Information

Description:
EUT Name: Nuvi 1690
Manufacturer: Garmin
Serial Number:
Hardware Rev:
Software Rev:
Comment: AC; new unit

Test

FCC 15 30-1000MHz



— FCC 15 Limit Line — Preview Result 1



1GHz - 18GHz

Test 1 / 1

EUT Information

Description:
 EUT Name: Nuvi 1890
 Manufacturer: Garmin
 Serial Number:
 Hardware Rev:
 Software Rev:
 Comment: AC; new unit

Test

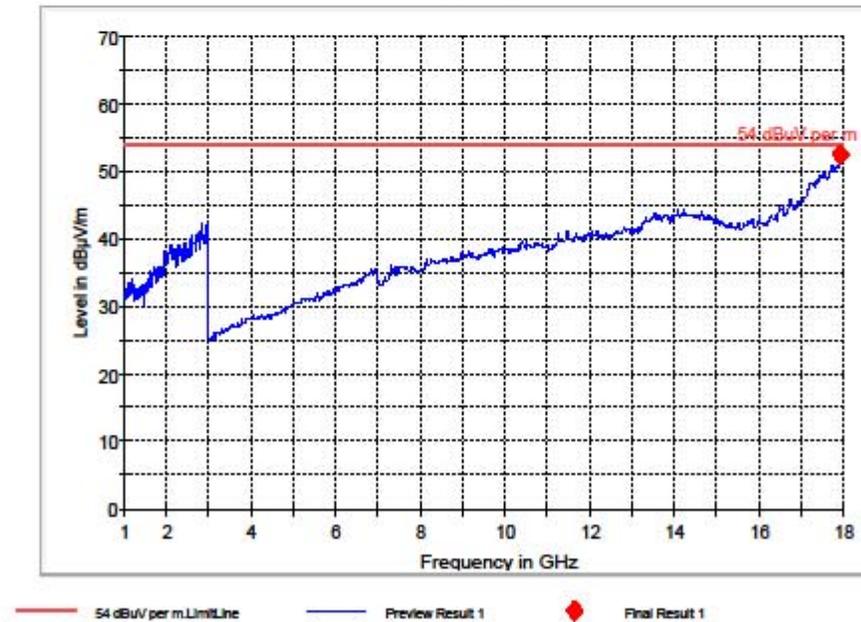
Final Result 1

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
17943.476954	52.5	20.000	1000.000	154.0	V	112.0	29.5	1.5	54.0

(continuation of the "Final Result 1" table from column 10 ...)

Frequency (MHz)	Comment
17943.476954	

FCC 15 1-18GHz





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:

Conducted Peak Power: GFSK

TEST CONDITIONS		Conducted Peak Power (dBm)		
Frequency (MHz)		2402	2441	2480
T _{nom} (23)°C	V _{nom}	2.7	3.2	3.6
Measurement uncertainty		±0.5dBm		

Conducted Peak Power: $\pi / 4$ DQPSK

TEST CONDITIONS		Conducted Peak Power (dBm)		
Frequency (MHz)		2402	2441	2480
T _{nom} (23)°C	V _{nom}	-1.9	-1.1	-0.3
Measurement uncertainty		±0.5dBm		

Conducted Peak Power: 8DPSK

TEST CONDITIONS		Conducted Peak Power (dBm)		
Frequency (MHz)		2402	2441	2480
T _{nom} (23)°C	V _{nom}	-1.7	-0.9	-0.4
Measurement uncertainty		±0.5dBm		

NOTE: all conducted power measurements were done with 3MHz RBW/VBW



Conducted Peak Power GFSK 2402 MHz

Bluetooth Power

dB Max. Level: Auto Hopp./Chan./Freq./Packet: RX/TX single / All / All / DHS
 +10.0c --- / Off 0: --- / Off 2: --- / Off

Current

	Current(0 ch)	Average	Minimum	Maximum
Power Nomin. [dBm]	+2.5	+2.5	+2.5	+2.7
Leak. [dBm]	-61.6	-61.1	-63.4	-59.4
Peak [dBm]	+2.8	+2.8	+2.7	+2.9
Packet Timing [µs]	+1.00	+1.17	+0.75	+1.75
Delta Level [dB]	---			

100 Bursts
 Statistic Count

0.00 %
 Bursts out of Tol.(Pow.)

0.00 %
 Bursts out of Tol.(Tim.)

TX Frequency

Channel: (2402.0 MHz)

Testmode Type

Hopping Scheme

RX Frequency

TX Frequency

Pattern Type

Packet Type

Length of Test Sequ.

Connect. Control

Output Power

Application

Analyzer Level

Analyzer Settings

Slave Sig. 1
Slave Sig. 2

Master Sig.

Display Marker

Menus

Conducted Peak Power GFSK 2441 MHz

Bluetooth Power

dB Max. Level: Auto Hopp./Chan./Freq./Packet: RX/TX single / All / All / DH5
 +10.00 --- / Off 0: --- / Off 2: --- / Off

Current

	Current (39 ch)	Average	Minimum	Maximum	
Power Nomin. [dBm]	+3.0	+3.0	+3.0	+3.2	<div style="background-color: #008000; color: white; padding: 2px; display: inline-block; font-weight: bold;">100</div> Bursts Statistic Count
Leak. [dBm]	-61.9	-61.4	-63.9	-59.3	
Peak [dBm]	+3.2	+3.2	+3.2	+3.4	
Packet Timing [µs]	+1.00	+1.06	+0.50	+1.75	0.00 % Bursts out of Tol.(Pow.)
Delta Level [dB]	---				0.00 % Bursts out of Tol.(Tim.)

TX Frequency

Channel: 39 (2441.0 MHz)

Testmode Type

Hopping Scheme

RX Frequency

TX Frequency

Pattern Type

Packet Type

Length of Test Sequ.

Connect. Control

Output Power

Application

Analyzer Level

Analyzer Settings

Slave Sig. 1
Slave Sig.2

Master Sig.

Display Marker

Menus

Conducted Peak Power GFSK 2480 MHz

Bluetooth Power

dB Max. Level: Auto Hopp./Chan./Freq./Packet: RX/TX single / All / All / DHS
 +10.0c --- / Off 0: --- / Off 2: --- / Off

Current

	Current(78 ch)	Average	Minimum	Maximum	
Power Nomin. [dBm]	+3.4	+3.4	+3.4	+3.6	<div style="background-color: #008000; color: white; padding: 2px; display: inline-block; font-weight: bold;">100</div> Bursts Statistic Count
Leak. [dBm]	-61.3	-61.8	-63.7	-59.5	
Peak [dBm]	+3.7	+3.7	+3.6	+3.8	
Packet Timing [µs]	+1.25	+1.33	+0.75	+1.75	0.00 % Bursts out of Tol.(Pow.)
Delta Level [dB]	---				0.00 % Bursts out of Tol.(Tim.)

TX Frequency

Channel: 78 (2480.0 MHz)

Testmode Type

Hopping Scheme

RX Frequency

TX Frequency

Pattern Type

Packet Type

Length of Test Sequ.

Connect. Control

Output Power

Application

Analyzer Level

Analyzer Settings

Slave Sig. 1
Slave Sig. 2

Master Sig.

Display Marker

Menus



Conducted Peak Power $\pi / 4$ DQPSK 2402 MHz

Bluetooth Power

dB Max. Level: Auto Hopp./Chan./Freq./Packet: RX/TX single / All / All / 2-DH5
 +10.00 --- / Off 0: --- / Off 2: --- / Off

Current

	Current(0 ch)	Average	Minimum	Maximum
Power Nomin. [dBm]	-1.9	-1.9	-1.9	-1.9
Leak. [dBm]	-58.8	-59.1	-61.3	-57.1
Peak [dBm]	+0.7	+0.6	+0.3	+0.7
Packet Timing [μs]	+0.75	+0.38	-0.25	+1.00
Delta Level [dB]	---			

Statistic Count
100 Bursts
0.00 %
Bursts out of Tol.(Pow.)
0.00 %
Bursts out of Tol.(Tim.)

TX Frequency

 Channel: (2402.0 MHz)

Testmode Type

Hopping Scheme

RX Frequency

TX Frequency

Pattern Type

Packet Type

Length of Test Sequ.

Connect. Control

Output Power

Application

Analyzer Level

Analyzer Settings

Slave Sig. 1
Slave Sig. 2

Master Sig.

Display Marker

Menus

Conducted Peak Power $\pi / 4$ DQPSK 2441 MHz

Bluetooth Power

dB Max. Level: Auto Hopp./Chan./Freq./Packet: RX/TX single / All / All / 2-DH5
 +10.00 --- / Off 0: --- / Off 2: --- / Off

Current

	Current (39 ch)	Average	Minimum	Maximum
Power Nomin. [dBm]	-1.1	-1.1	-1.1	-1.1
Leak. [dBm]	-58.7	-59.0	-60.7	-57.7
Peak [dBm]	+1.2	+1.3	+1.0	+1.5
Packet Timing [μs]	+0.25	+0.45	+0.25	+0.50
Delta Level [dB]	---			

100 Bursts
Statistic Count
0.00 %
Bursts out of Tol.(Pow.)
0.00 %
Bursts out of Tol.(Tim.)

TX Frequency

 Channel: 39 (2441.0 MHz)

Testmode Type

Hopping Scheme

RX Frequency

TX Frequency

Pattern Type

Packet Type

Length of Test Sequ.

Connect. Control

Output Power

Application

Analyzer Level

Analyzer Settings

Slave Sig. 1

Slave Sig. 2

Master Sig.

Display Marker

Menus



Conducted Peak Power $\pi / 4$ DQPSK 2480 MHz

Bluetooth Power

dB Max. Level: Auto Hopp./Chan./Freq./Packet: RX/TX single / All / All / 2-DH5
 +10.00 --- / Off 0: --- / Off 2: --- / Off

Current

	Current(78 ch)	Average	Minimum	Maximum	
Power Nomin. [dBm]	-0.3	-0.3	-0.3	-0.3	<div style="background-color: #008000; color: white; padding: 2px; display: inline-block; font-weight: bold;">100</div> Bursts Statistic Count
Leak. [dBm]	-57.7	-58.6	-61.3	-56.8	
Peak [dBm]	+2.2	+2.0	+1.7	+2.2	
Packet Timing [μs]	+0.50	+0.49	-0.25	+0.75	Bursts out of Tol.(Pow.)
Delta Level [dB]	---				0.00 %
					Bursts out of Tol.(Tim.)
					0.00 %

TX Frequency

Channel: 78 (2480.0 MHz)

Testmode Type

Hopping Scheme

RX Frequency

TX Frequency

Pattern Type

Packet Type

Length of Test Sequ.

Connect. Control

Output Power

Application

Analyzer Level

Analyzer Settings

Slave Sig. 1
Slave Sig. 2

Master Sig.

Display Marker

Menus



Conducted Peak Power 8DPSK 2402 MHz

Bluetooth Power

dB Max. Level: Auto Hopp./Chan./Freq./Packet: RX/TX single / All / All / 3-DH5
 +10.00 --- / Off 0: --- / Off 2: --- / Off

Current

	Current(0 ch)	Average	Minimum	Maximum
Power Nomin. [dBm]	-1.7	-1.7	-1.7	-1.7
Leak. [dBm]	-57.9	-58.7	-61.2	-56.7
Peak [dBm]	+0.4	+0.6	+0.3	+0.7
Packet Timing [µs]	+0.50	+0.61	+0.00	+1.00
Delta Level [dB]	---			

TX Frequency

Channel: (2402.0 MHz)

100 Bursts
Statistic Count

0.00 %
Bursts out of Tol.(Pow.)

0.00 %
Bursts out of Tol.(Tim.)

Testmode Type

Hopping Scheme

RX Frequency

TX Frequency

Pattern Type

Packet Type

Length of Test Sequ.

Connect. Control

Output Power

Application

Analyzer Level

Analyzer Settings

Slave Sig. 1
Slave Sig. 2

Master Sig.

Display Marker

Menus

Conducted Peak Power 8DPSK 2441 MHz

Bluetooth Power

dB Max. Level: Auto Hopp./Chan./Freq./Packet: RX/TX single / All / All / 3-DH5
 +10.00 --- / Off 0: --- / Off 2: --- / Off

Current

	Current (39 ch)	Average	Minimum	Maximum
Power Nomin. [dBm]	-0.9	-0.9	-0.9	-0.9
Leak. [dBm]	-59.2	-58.5	-60.4	-57.3
Peak [dBm]	+1.6	+1.4	+1.1	+1.6
Packet Timing [µs]	+0.75	-0.07	-0.25	+0.75
Delta Level [dB]	---			

100 Bursts
Statistic Count

0.00 %
Bursts out of Tol.(Pow.)

TX Frequency
Channel: 39 (2441.0 MHz)

0.00 %
Bursts out of Tol.(Tim.)

Testmode Type

Hopping Scheme

RX Frequency

TX Frequency

Pattern Type

Packet Type

Length of Test Sequ.

Connect. Control

Output Power

Application

Analyzer Level

Analyzer Settings

Slave Sig. 1
Slave Sig. 2

Master Sig.

Display Marker

Menus



Conducted Peak Power 8DPSK 2480 MHz

Bluetooth Power

dB Max. Level: Auto Hopp./Chan./Freq./Packet: RX/TX single / All / All / 3-DH5
 +10.0c --- / Off 0: --- / Off 2: --- / Off

RUN Output Power

	Current(78 ch)	Average	Minimum	Maximum
Power Nomin. [dBm]	+0.4	+0.4	+0.4	+0.4
Leak. [dBm]	-58.1	-58.0	-60.2	-56.5
Peak [dBm]	+2.8	+2.6	+2.4	+2.9
Packet Timing [µs]	+0.25	+0.44	+0.25	+0.75
Delta Level [dB]	---			

100 Bursts
 Statistic Count

0.00 %
 Bursts out of Tol.(Pow.)

0.00 %
 Bursts out of Tol.(Tim.)

TX Frequency
 Channel: 78 (2480.0 MHz)

Slave Sig. 1
 Slave Sig. 2

Master Sig.

Display Marker

Testmode Type

Hopping Scheme

RX Frequency

TX Frequency

Pattern Type

Packet Type

Length of Test Sequ.

Menus



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:

20dB Bandwidth: GFSK

TEST CONDITIONS		20dB Bandwidth (MHz)		
Frequency (MHz)		2402	2441	2480
T_{nom}(23)°C	V_{nom}	0.951	0.951	0.921

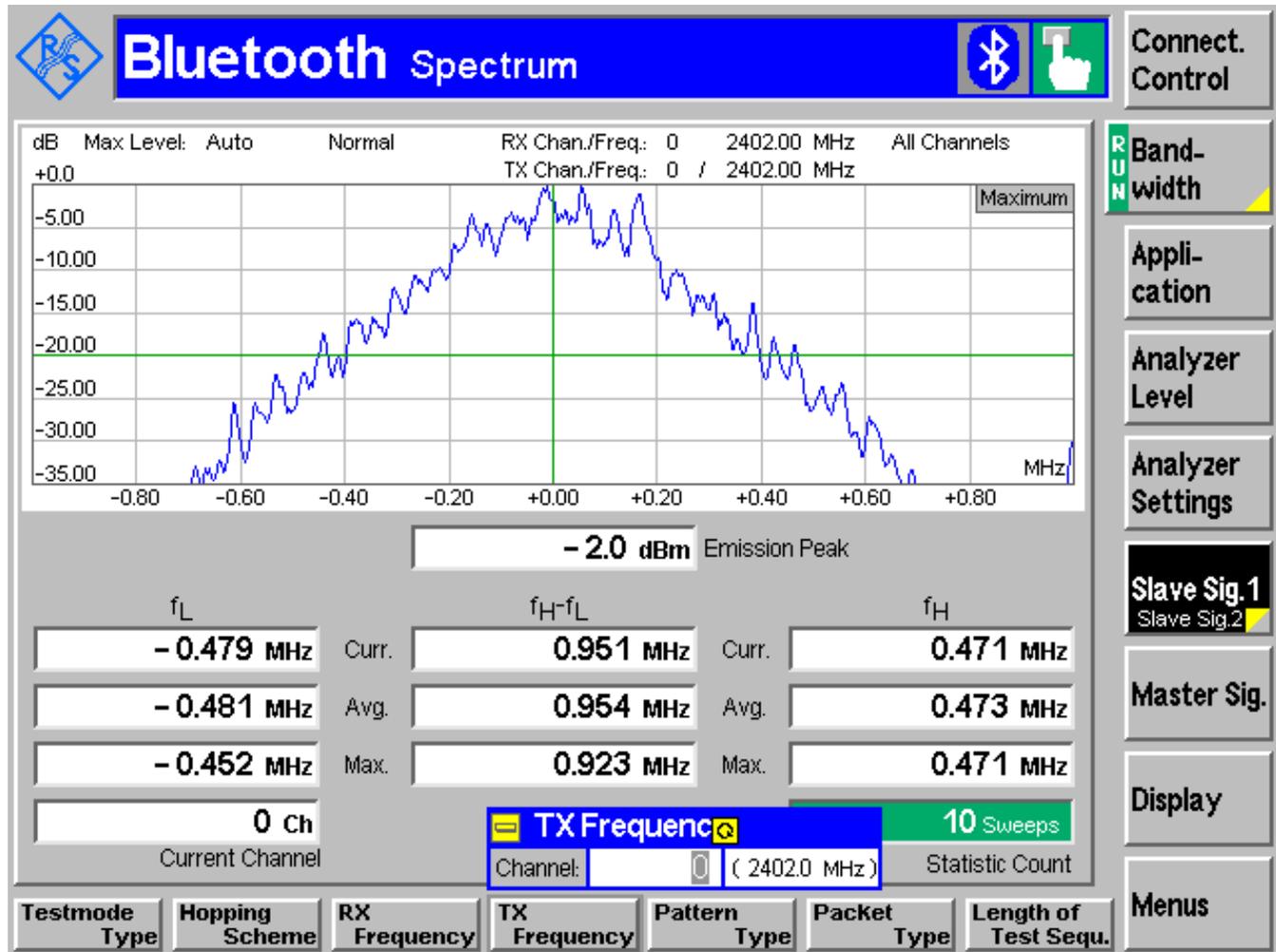
20dB Bandwidth: $\pi / 4$ DQPSK

TEST CONDITIONS		20dB Bandwidth (MHz)		
Frequency (MHz)		2402	2441	2480
T_{nom}(23)°C	V_{nom}	1.336	1.352	1.351

20dB Bandwidth: 8DPSK

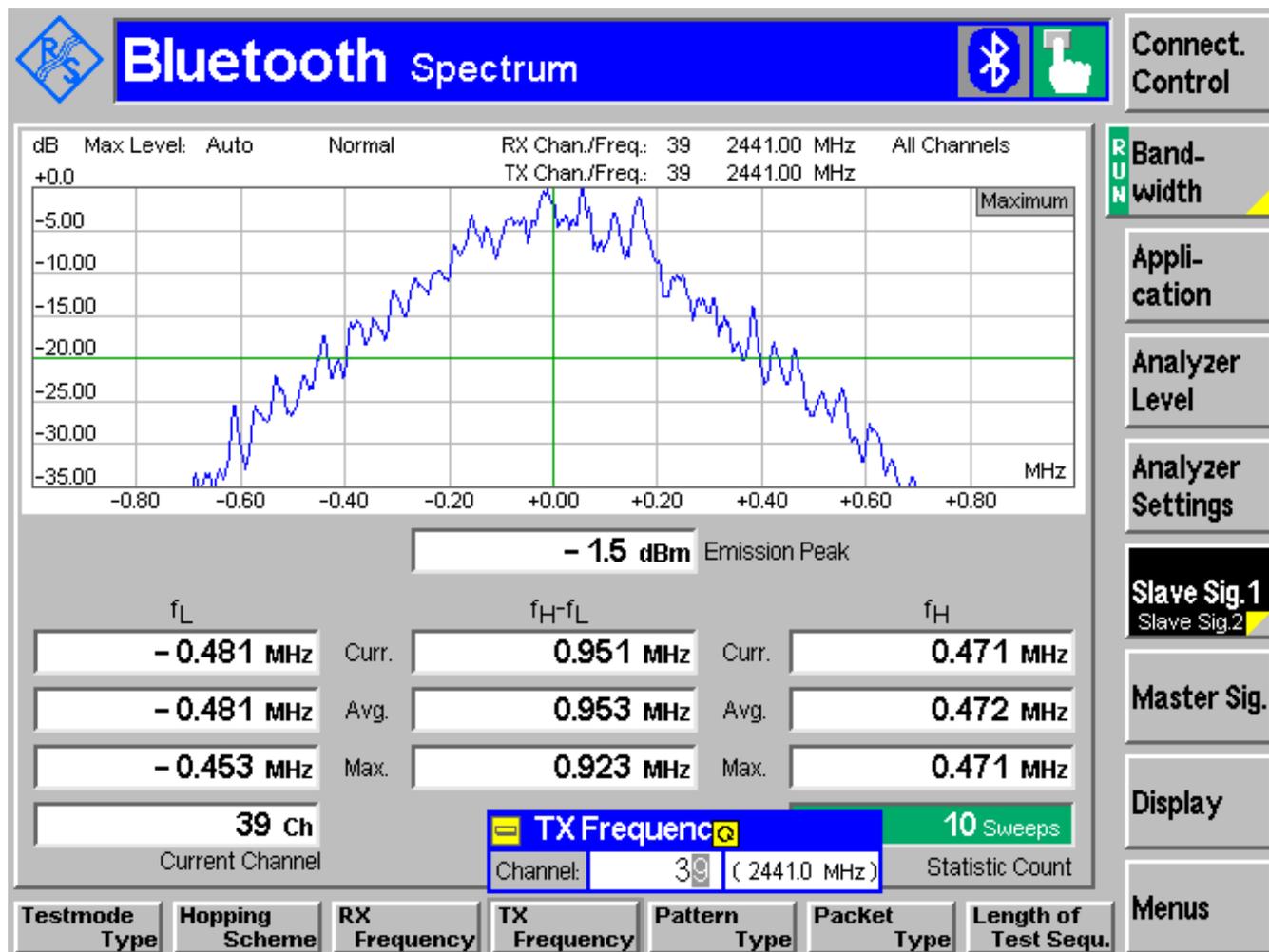
TEST CONDITIONS		20dB Bandwidth (MHz)		
Frequency (MHz)		2402	2441	2480
T_{nom}(23)°C	V_{nom}	1.361	1.366	1.367

20dB Bandwidth GFSK 2402MHz



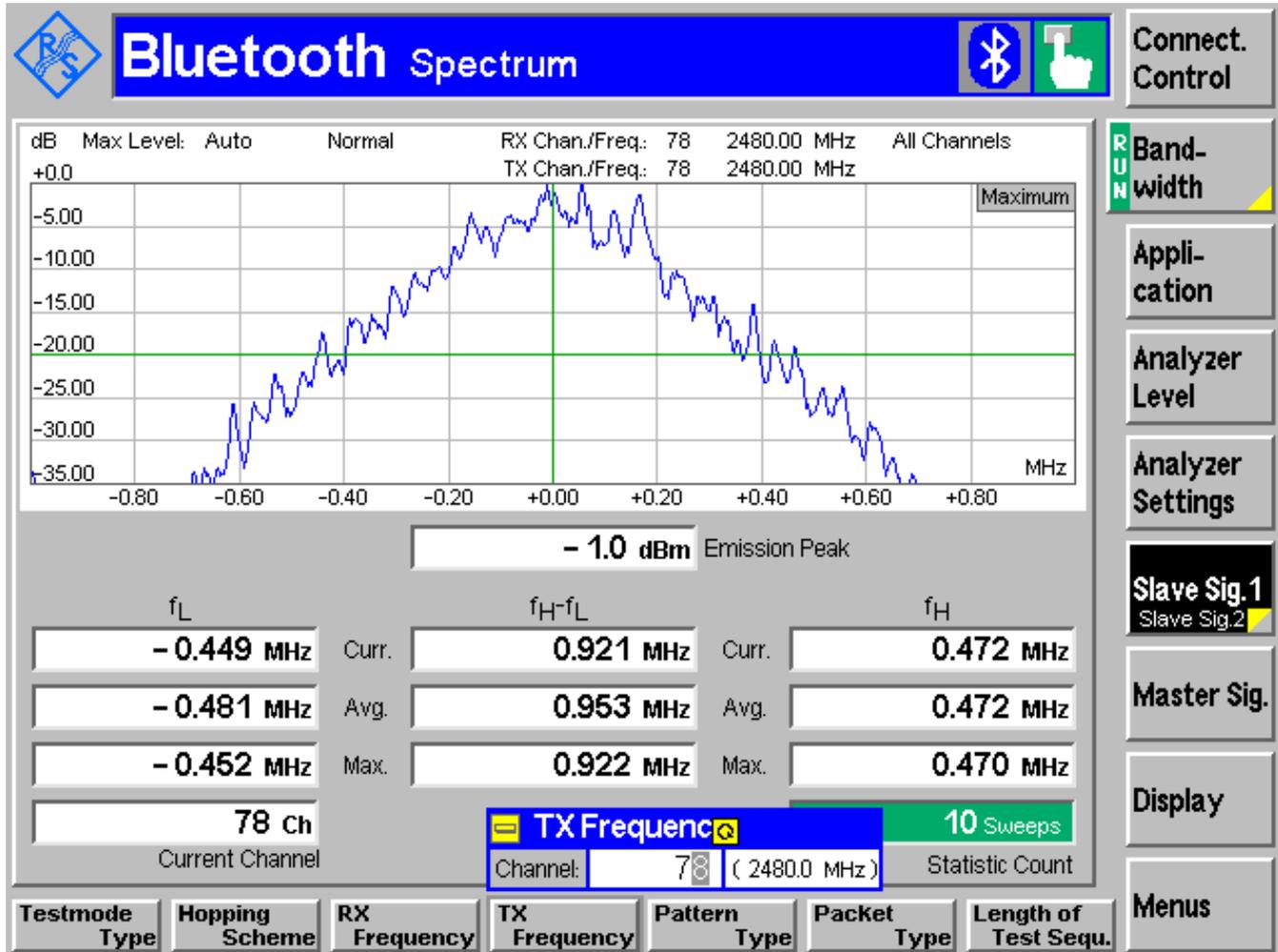


20dB Bandwidth GFSK 2441MHz



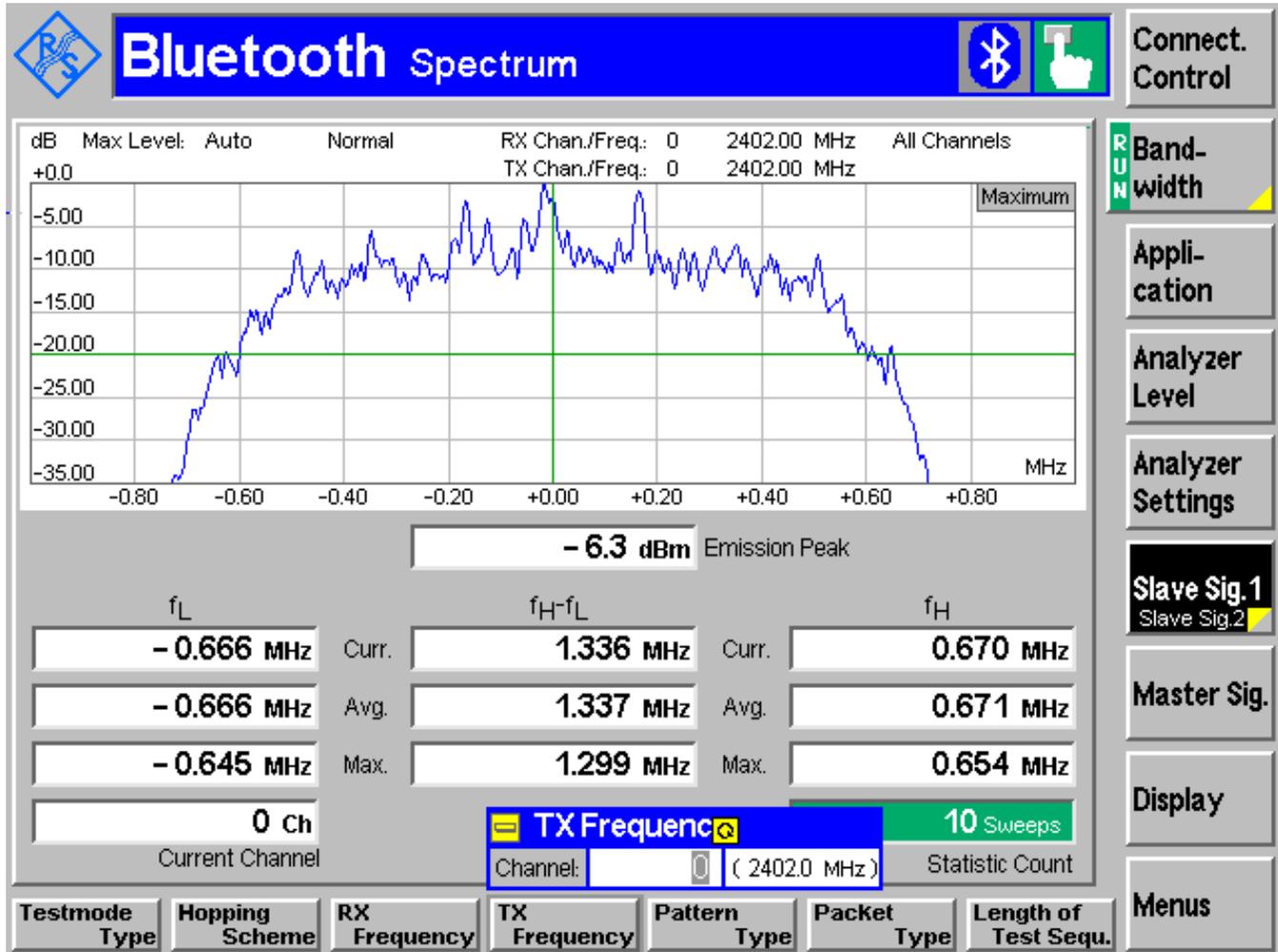


20dB Bandwidth GFSK 2480MHz

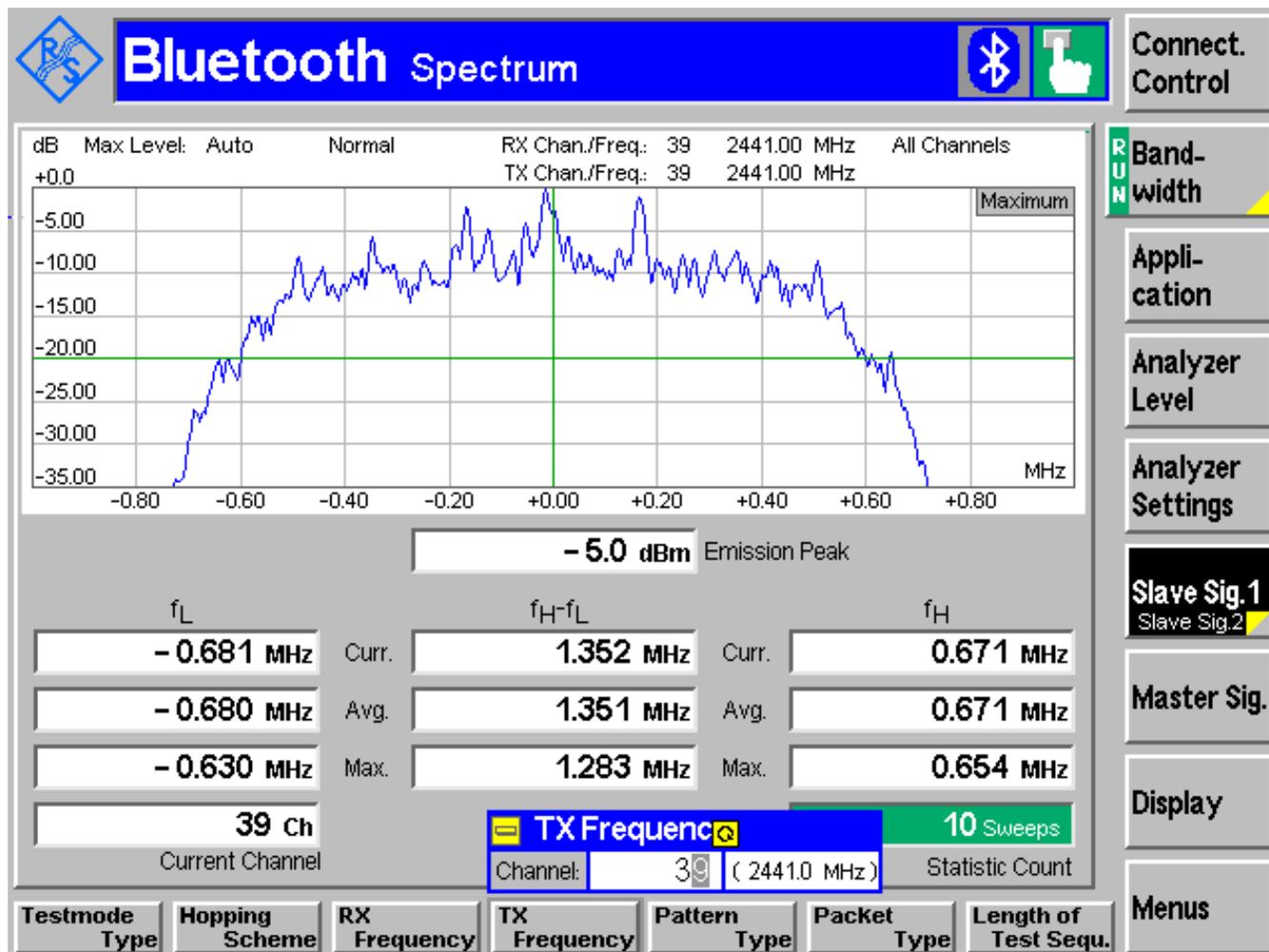




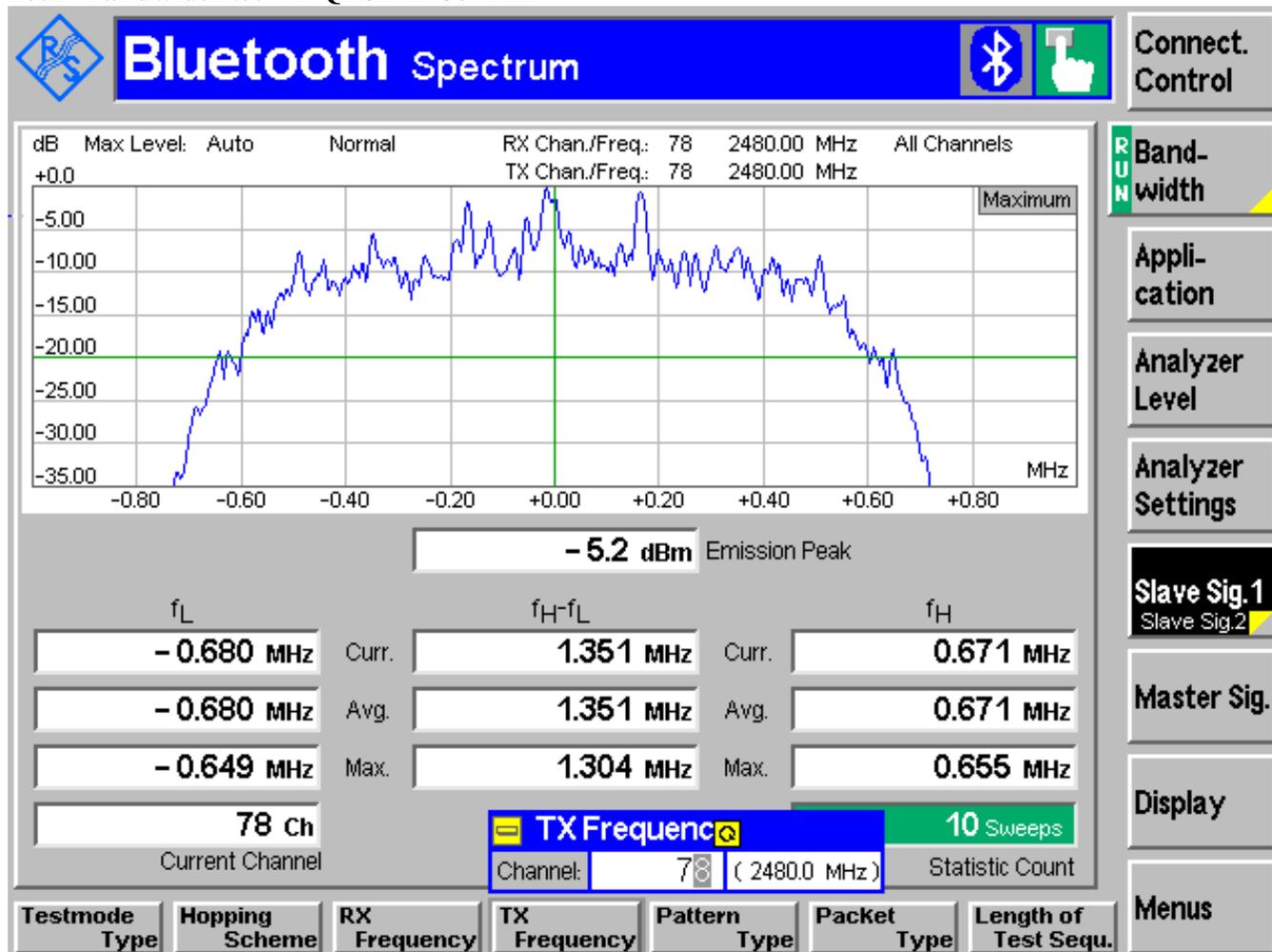
20dB Bandwidth $\pi / 4$ DQPSK 2402MHz



20dB Bandwidth $\pi / 4$ DQPSK 2441MHz

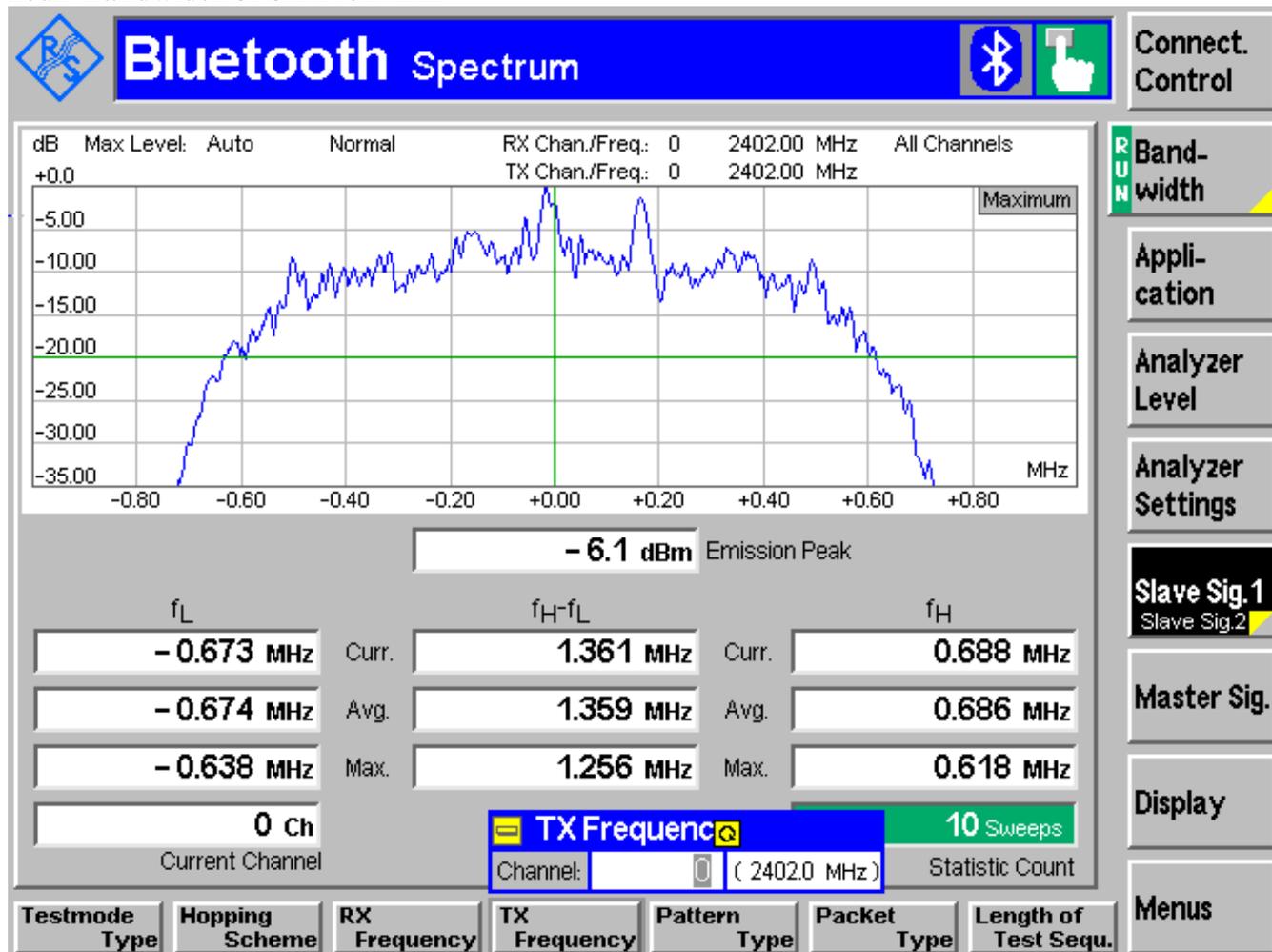


20dB Bandwidth $\pi / 4$ DQPSK 2480MHz

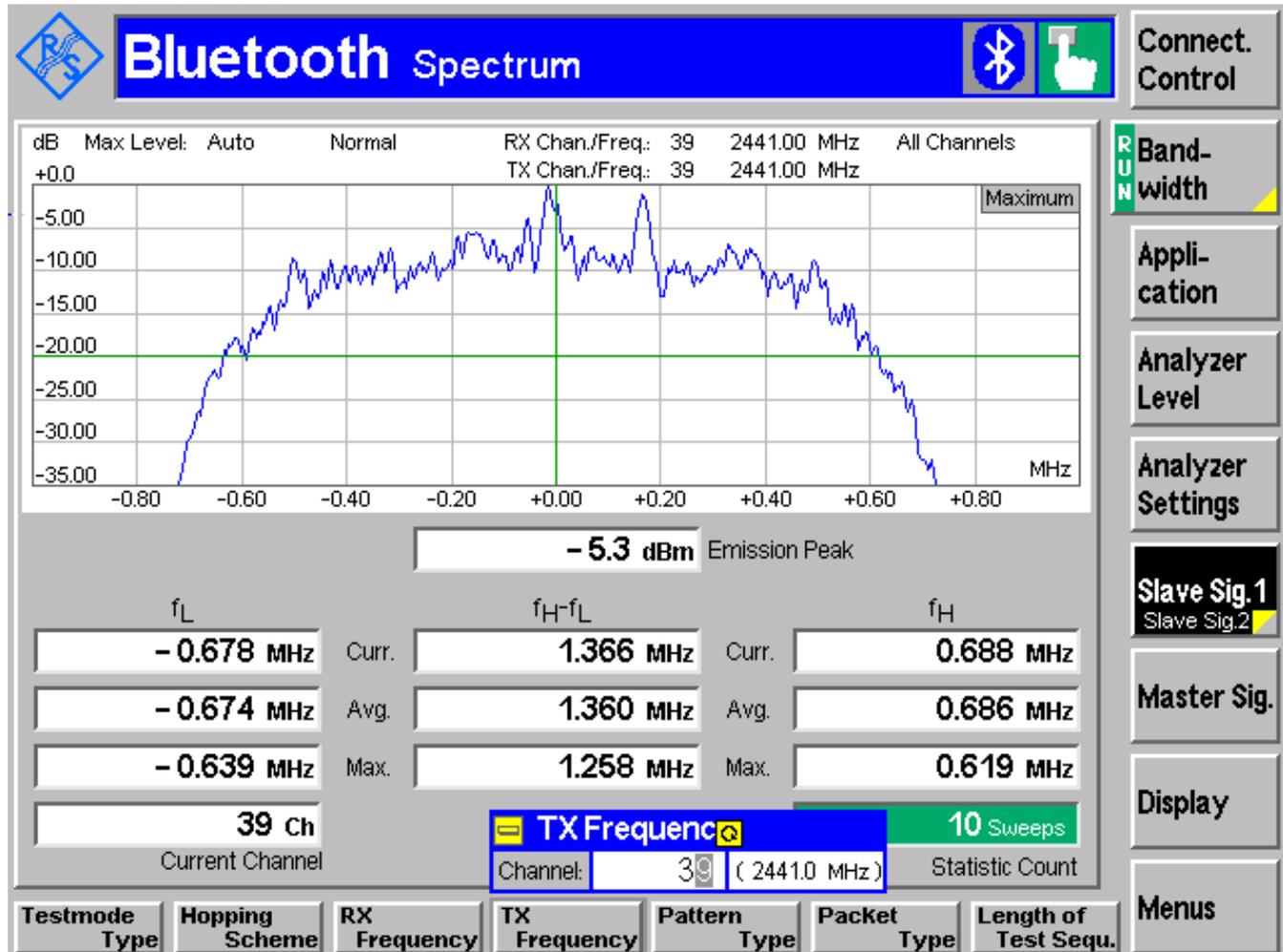




20dB Bandwidth 8PSK 2402MHz



20dB Bandwidth 8PSK 2441MHz



20dB Bandwidth 8PSK 2480MHz

Bluetooth Spectrum

dB Max Level: Auto Normal
RX Chan./Freq.: 78 2480.00 MHz All Channels

+0.0
TX Chan./Freq.: 78 2480.00 MHz

Maximum

- 5.1 dBm Emission Peak

f_L		$f_H - f_L$		f_H
-0.678 MHz	Curr.	1.367 MHz	Curr.	0.689 MHz
-0.674 MHz	Avg.	1.360 MHz	Avg.	0.685 MHz
-0.641 MHz	Max.	1.261 MHz	Max.	0.619 MHz

78 ch
Current Channel
TX Frequency
10 Sweeps

Channel: 78 (2480.0 MHz)
Statistic Count

Testmode Type
Hopping Scheme
RX Frequency
TX Frequency
Pattern Type
Packet Type
Length of Test Sequ.

Connect. Control
Bandwidth
Application
Analyzer Level
Analyzer Settings
Slave Sig. 1
Slave Sig. 2
Master Sig.
Display
Menus

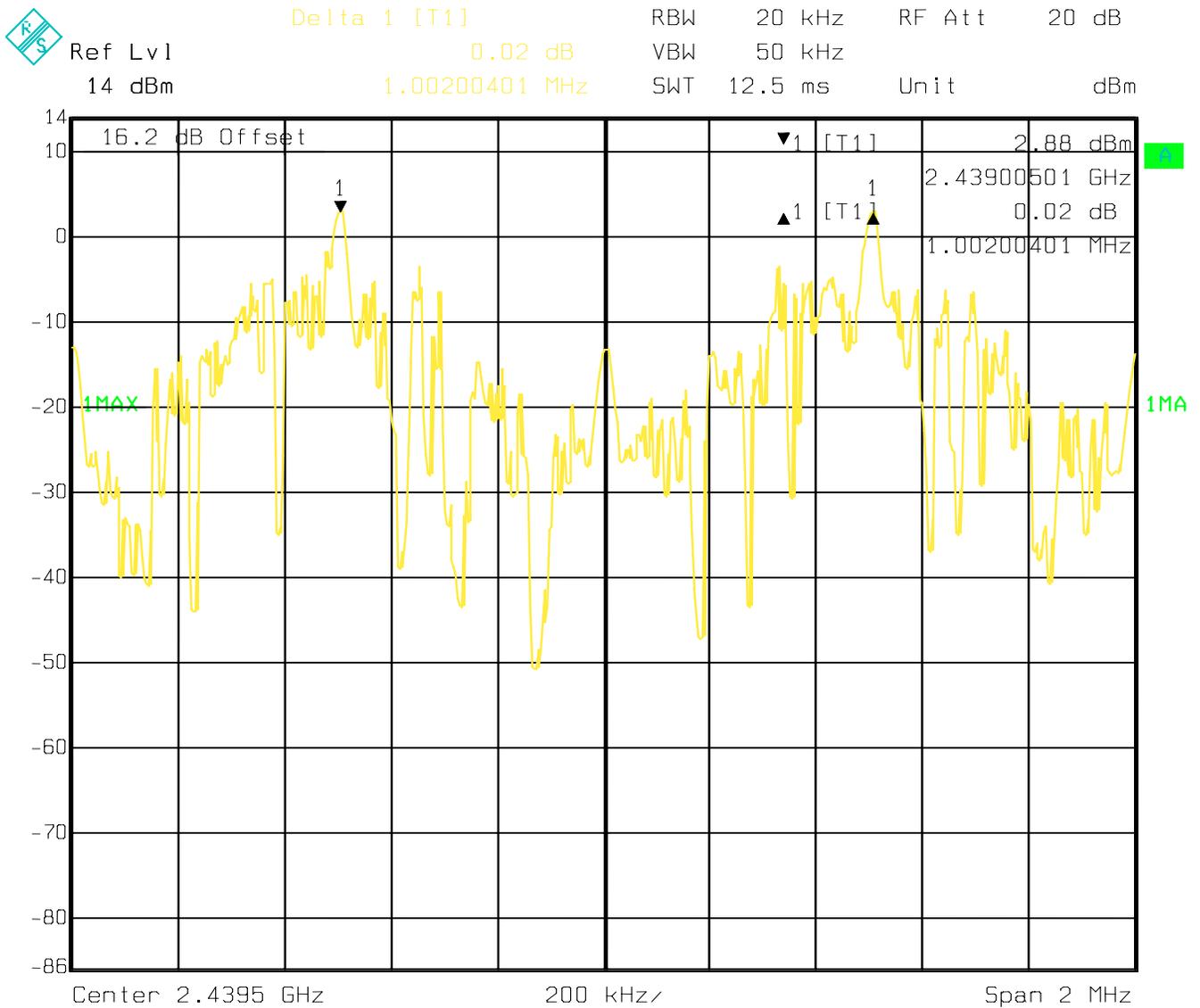


6.3 CARRIER FREQUENCY SEPARATION

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

SEPARATION
> 25 KHz or > 2/3 * 20 dB BANDWIDTH

6.3.2 RESULTS: 1.002 MHz



Date: 02.JUL.2009 11:55:32

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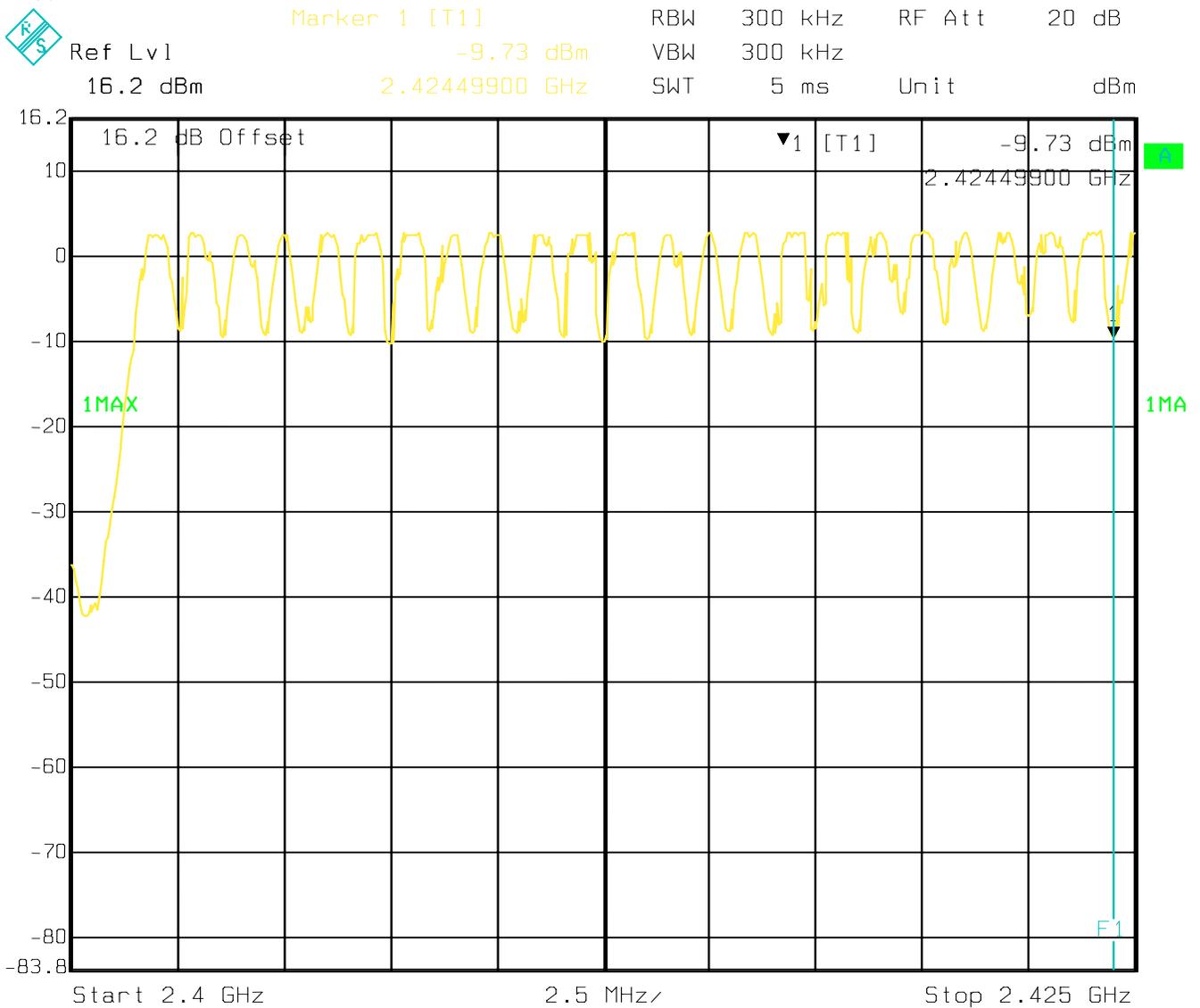
6.4 NUMBER OF HOPPING CHANNELS

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

NUMBER OF CHANNELS
> 15

6.4.2 RESULTS: 79

Plot 1

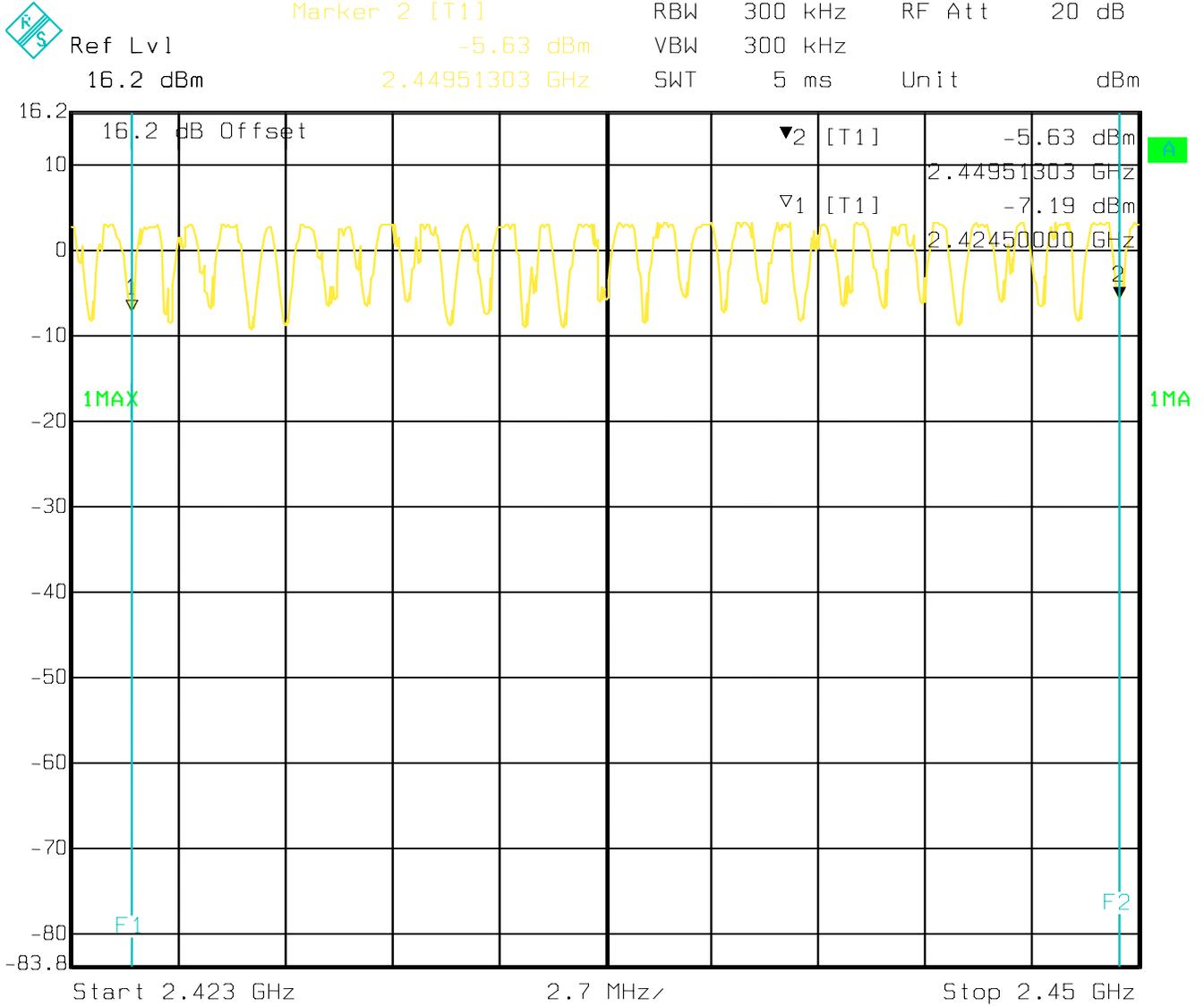


Date: 01.JUL.2009 16:29:24

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Plot 2

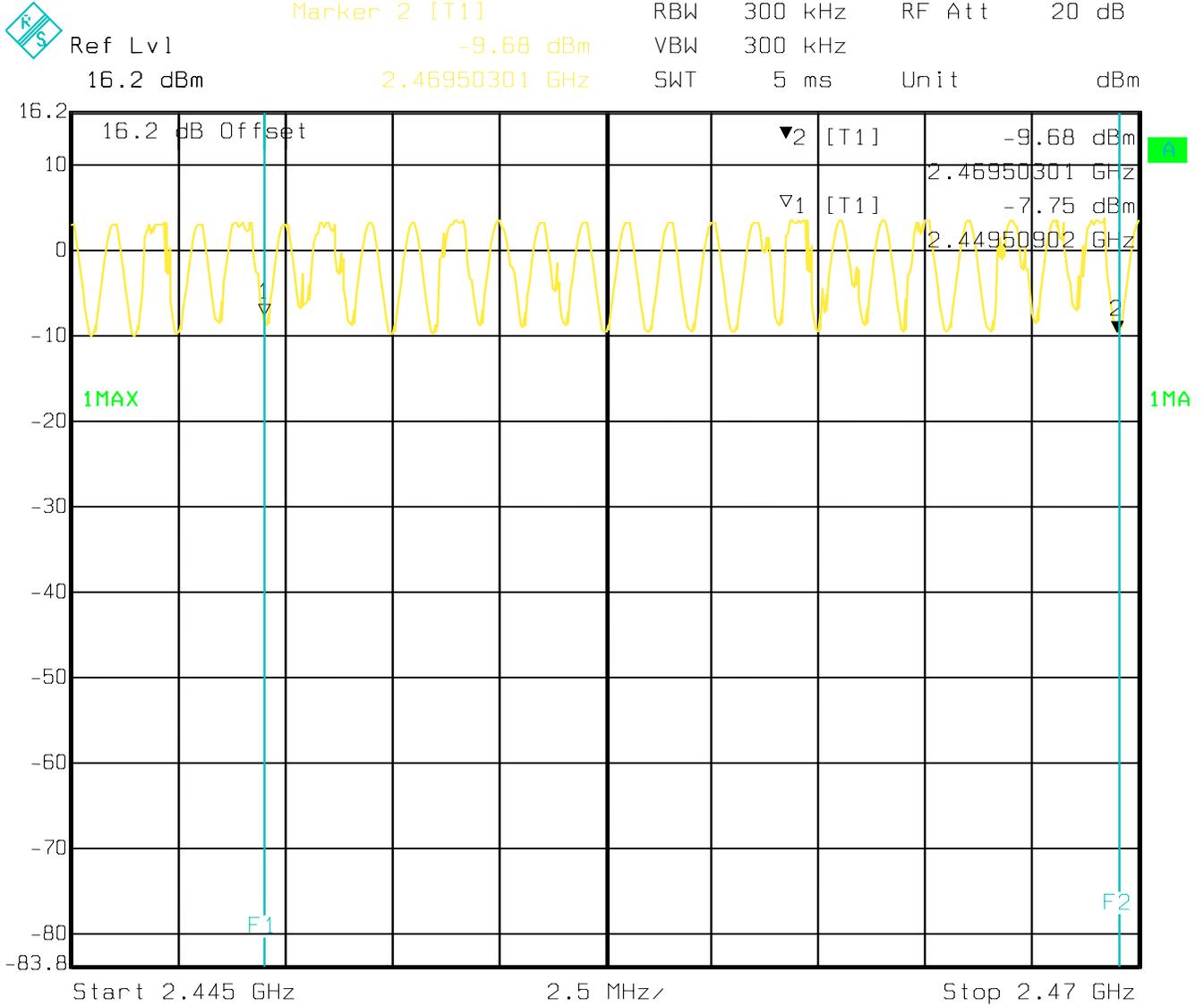


Date: 01.JUL.2009 16:39:13

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Plot 3

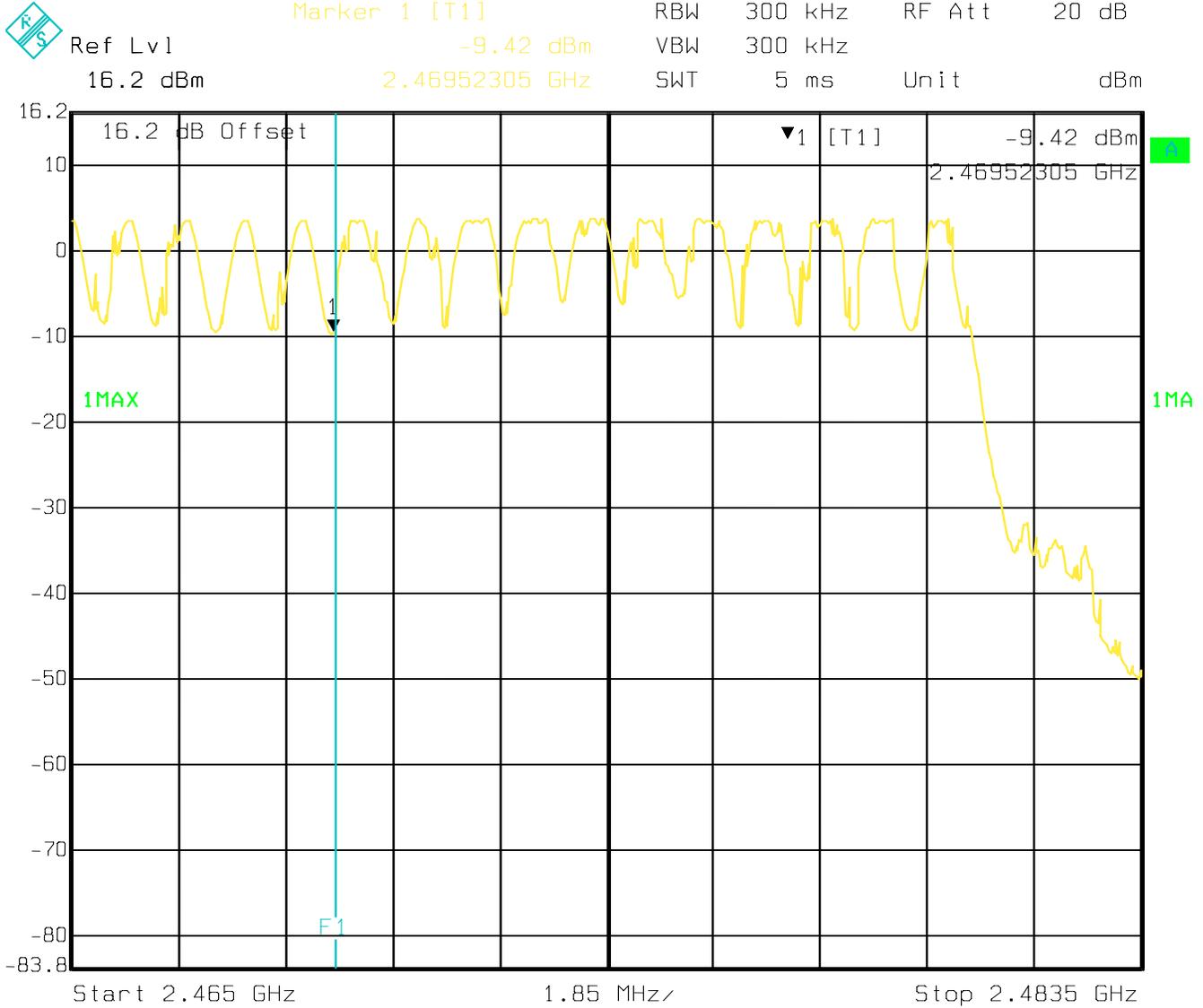


Date: 01.JUL.2009 16:44:23

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Plot 4



Date: 01.JUL.2009 17:06:12



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: .309 seconds

T _{nom} (23)°C	V _{nom}
-------------------------	------------------

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 a 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 Vnom

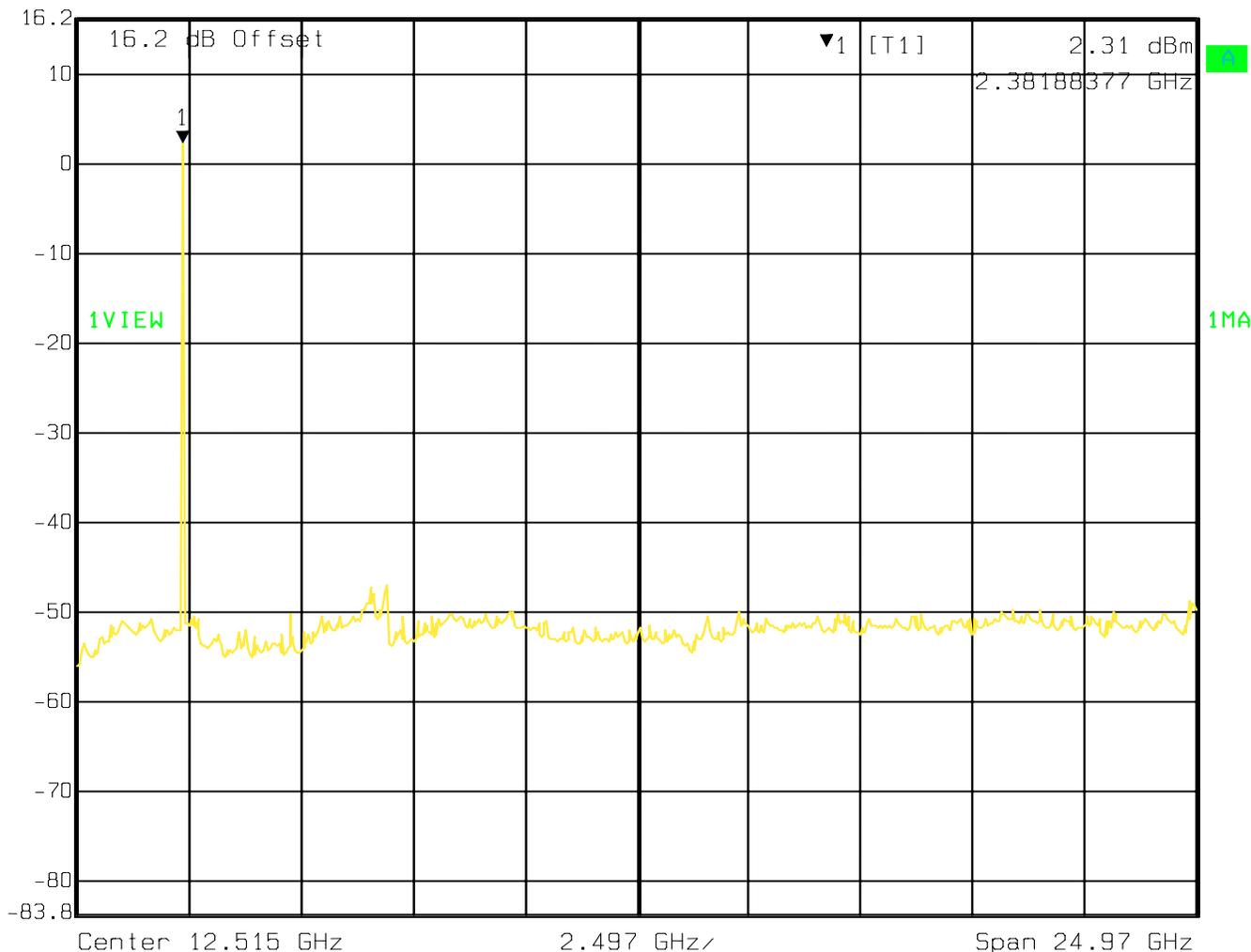
All tests conducted in GFSK mode and represents worst case emission.

Verdict: PASS



Conducted Spurious Emission 2402MHz


 Marker 1 [T1] RBW 100 kHz RF Att 20 dB
 Ref Lvl 16.2 dBm 2.31 dBm VBW 300 kHz
 2.38188377 GHz SWT 6.4 s Unit dBm

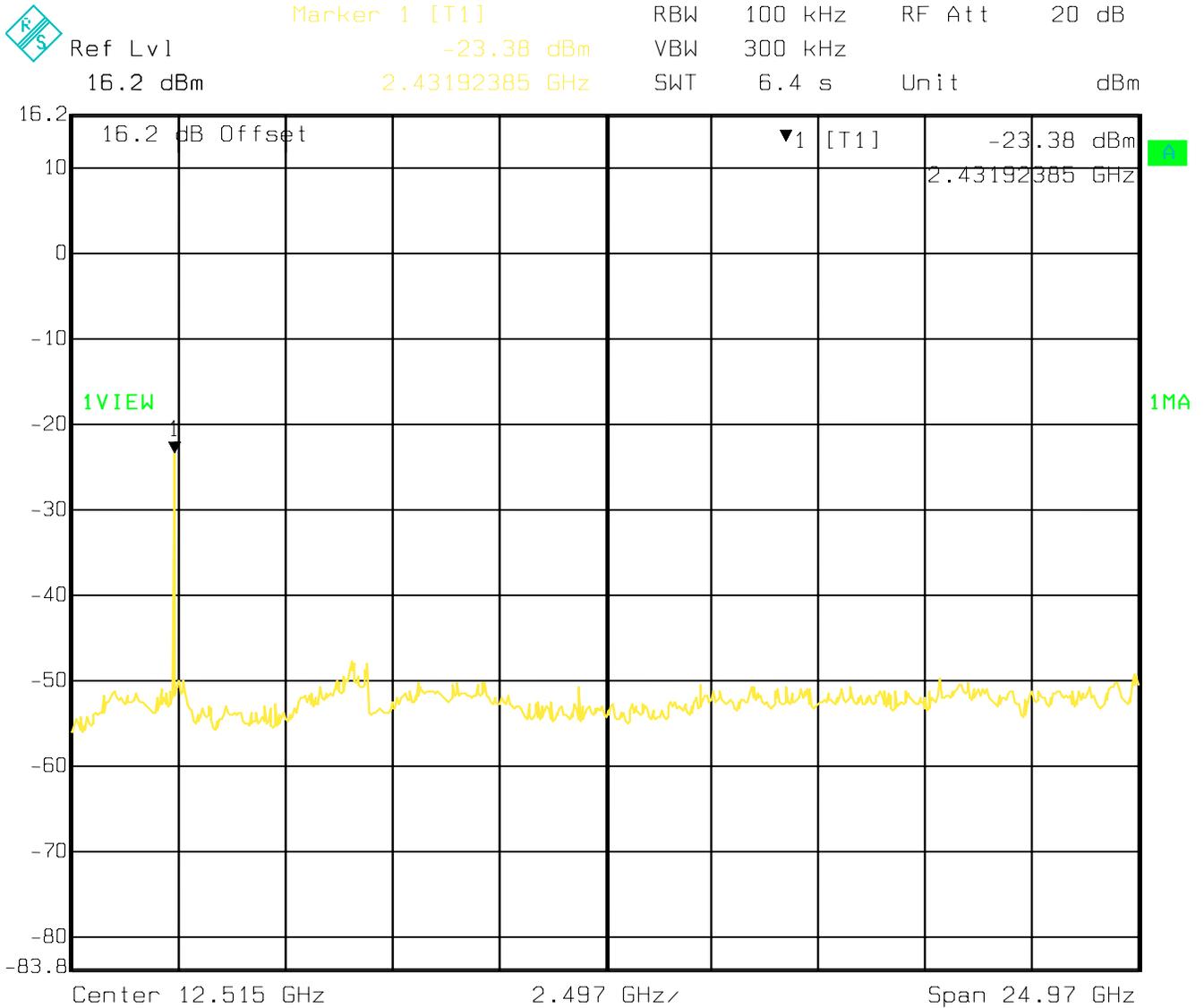


Date: 02.JUL.2009 11:11:27

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Conducted Spurious Emission 2441 MHz

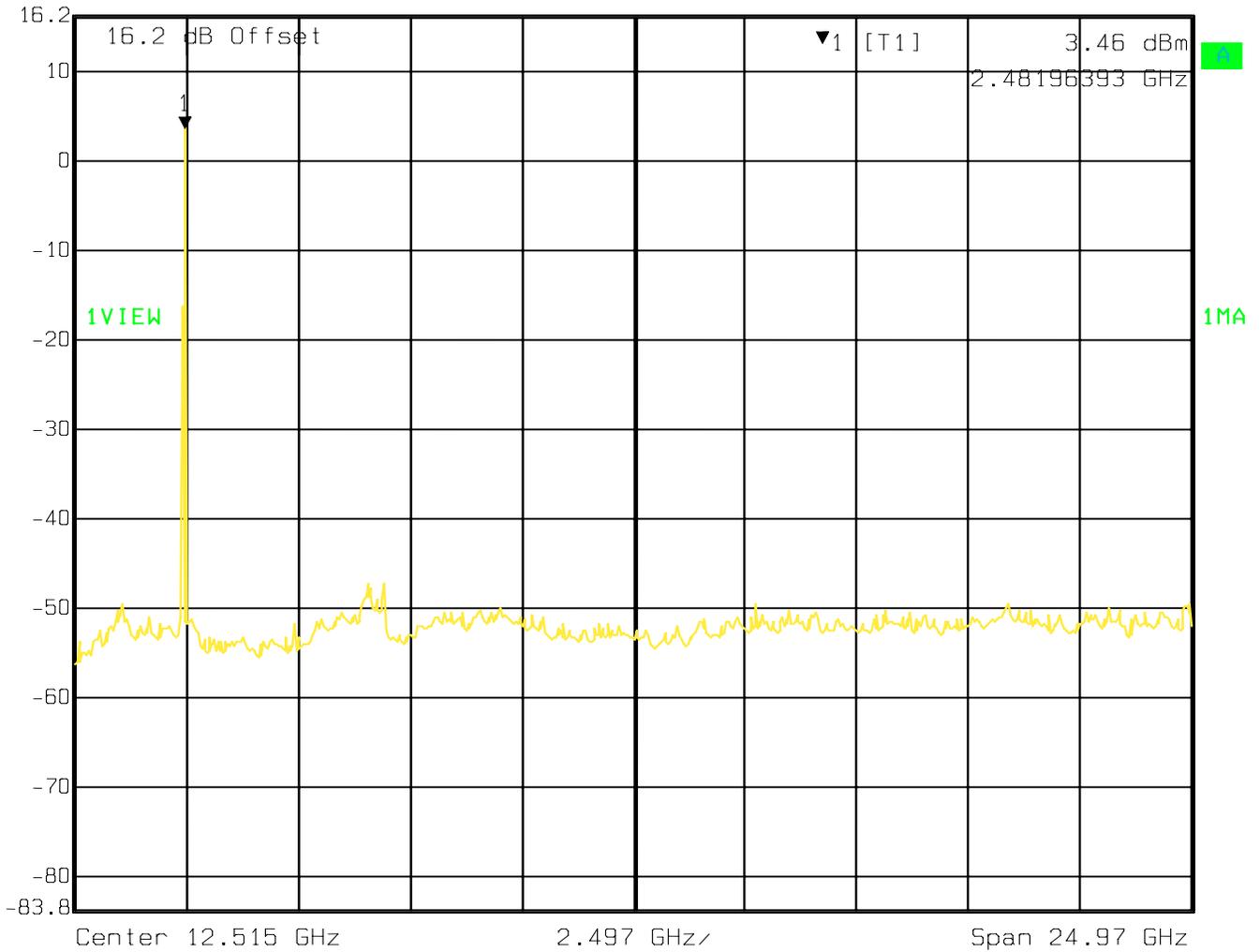


Date: 02.JUL.2009 11:43:05



Conducted Spurious Emission 2480MHz

Ref Lvl 16.2 dBm
Marker 1 [T1] 3.46 dBm
2.48196393 GHz
RBW 100 kHz RF Att 20 dB
VBW 300 kHz
SWT 6.4 s Unit dBm



Date: 02.JUL.2009 11:44:09



6.7 AC POWER LINE CONDUCTED EMISSIONS § 15.107/207

6.7.1 LIMITS

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

Limit

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

6.7.2 Test Results:

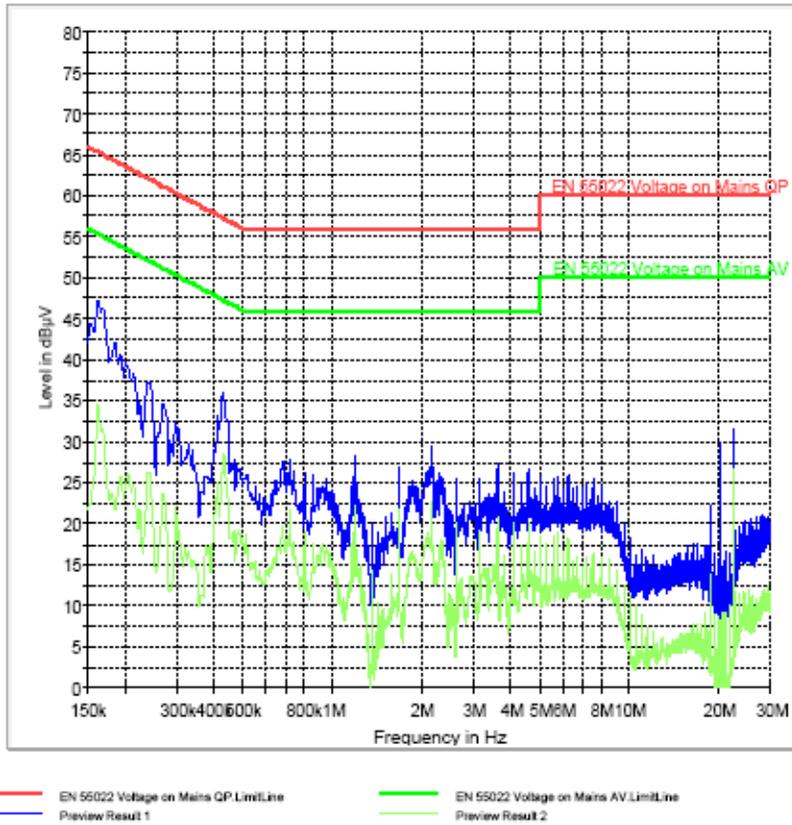
Line 1 / 1

EUT Information

Description:
EUT Name: Nuvi 1690
Manufacturer: Garmin
Serial Number:
Hardware Rev:
Software Rev:
Comment: AC; new unit

Line

CISPR 22 Mains Conducted - L



Neutral

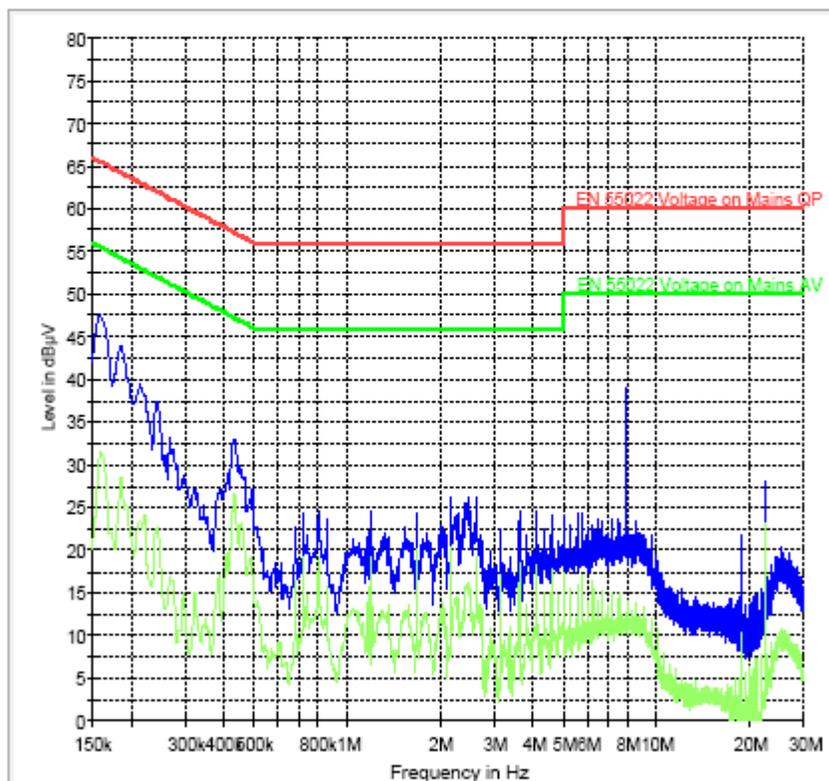
1 / 1

EUT Information

Description:
EUT Name: Nuvi 1800
Manufacturer: Garmin
Serial Number:
Hardware Rev:
Software Rev:
Comment: AC; new unit

Neutral

CISPR 22 Mains Conducted - N



EN 55022 Voltage on Mains GP Limit Line
EN 55022 Voltage on Mains AV Limit Line
Preview Result 1
Preview Result 2

6/24/2009 smoon

EMC32 V8.10.10

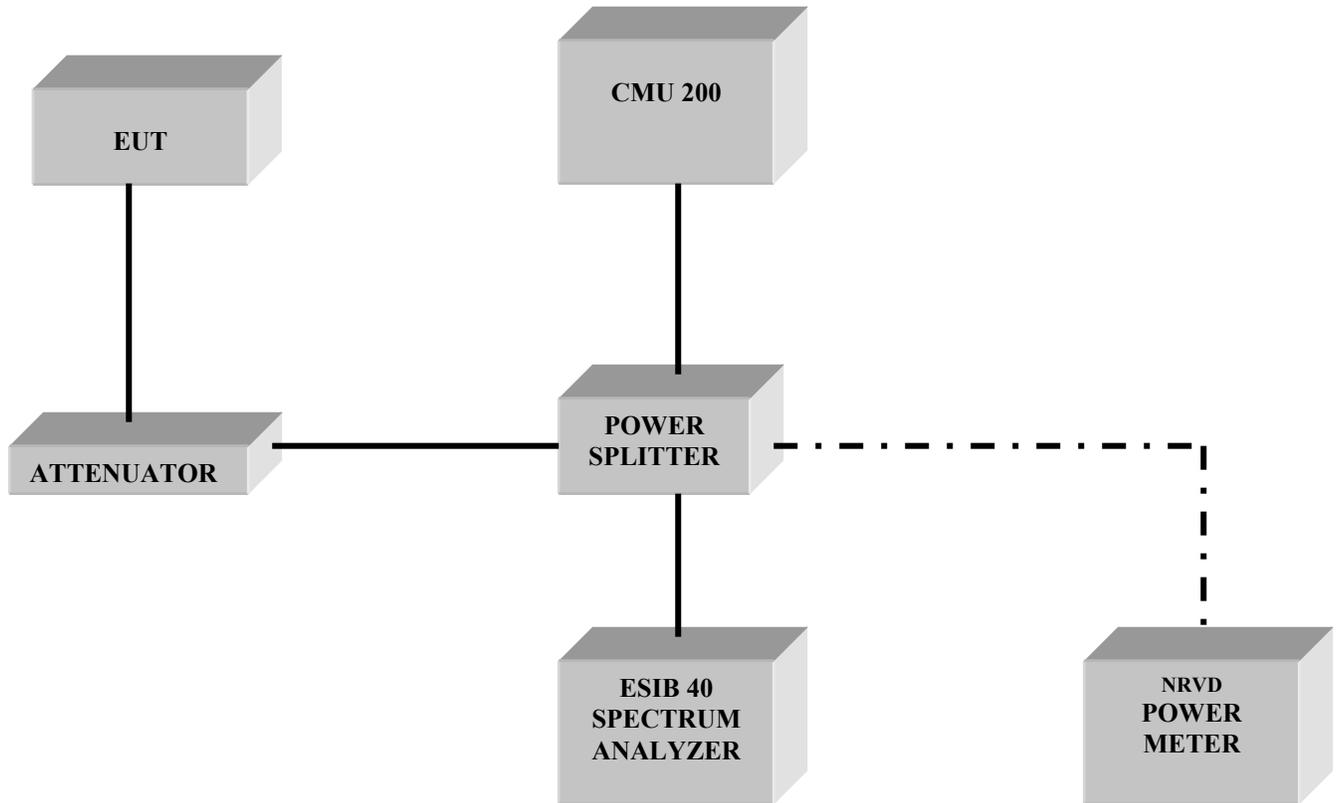
3:34:07

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 2010	1 year
02	Spectrum Analyzer	FSEM 30	Rohde & Schwarz	100017	May 2010	1 year
03	Signal Generator	SMY02	Rohde & Schwarz	836878/011	May 2010	1 year
04	Power-Meter	NRVD	Rohde & Schwarz	0857.8008.02	May 2010	1 year
05	Biconilog Antenna	3141	EMCO	0005-1186	June 2010	1 year
06	Horn Antenna (1-18GHz)	SAS-200/571	AH Systems	325	June 2010	1 year
07	Horn Antenna (18-26.5GHz)	3160-09	EMCO	1240	June 2010	1 year
08	Power Splitter	11667B	Hewlett Packard	645348	n/a	n/a
09	Climatic Chamber	VT4004	Voltsch	G1115	May 2010	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 2010	1 year
13	Power Sensor	URV5-Z2	Rohde & Schwarz	DE30807	May 2010	1 year
14	Digital Radio Comm. Tester	CMD-55	Rohde & Schwarz	847958/008	May 2010	1 year
15	Universal Radio Comm. Tester	CMU 200	Rohde & Schwarz	832221/06	May 2010	1 year
16	LISN	ESH3-Z5	Rohde & Schwarz	836679/003	May 2010	1 year
17	Loop Antenna	6512	EMCO	00049838	July 2010	2 years

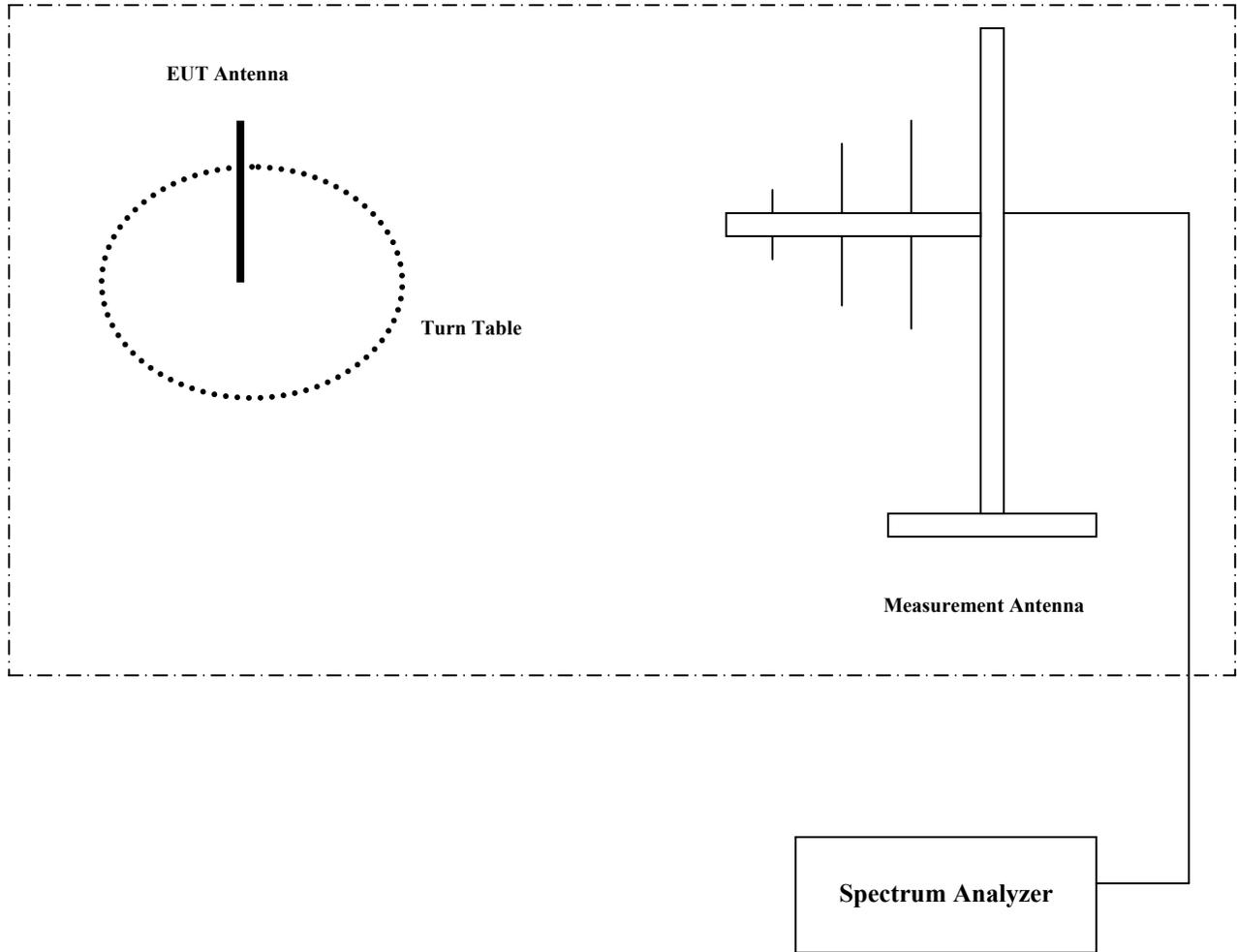
8 **BLOCK DIAGRAMS**

Conducted Testing



Radiated Testing

ANECHOIC CHAMBER





9 REPORT HISTORY

2009-07-03 Original Report

2009-07-29 Occupied Bandwidth updated. Added receiver radiated spurious, transmitter radiated spurious 18-25GHz.