



FCC/IC Test Report

Model #: ILN7100 series, ILN7100ABE
FCC ID: V57-IL04
IC ID: 7120A-IL04

47 CFR Part 15.247 for FHSS systems
IC RSS-210 Issue 7

TEST REPORT #: EMC_INTE1_003_09002_15.247FHSS_rev2
DATE: 2010-03-01



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 and Industry Canada Standards RSS 210 Issue 7.

Company	Description	Model #
Intelligent Mechatronic Systems Inc.	Electronic device to support hands-free wireless communication including emails in 2.4 GHz ISM band using voice recognition technology	ILN7100 series, ILN7100ABE

Technical responsibility for area of testing:

Marc Douat
(Test Lab Manager)

2010-03-01	EMC & Radio	Marc Douat	(Test Lab Manager)
Date	Section	Name	Signature

This report is prepared by:

Satya Radhakrishna
(EMC Project Engineer)

2010-03-01	EMC & Radio	Satya Radhakrishna	(EMC Project Engineer)
Date	Section	Name	Signature

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 Director:	Heiko Strehlow
Responsible Project Leader:	Satya Radhakrishna

2.2 Identification of the Client

APPLICANT	
Applicant (Company Name)	Intelligent Mechatronic Systems Inc
Street Address	435 King St. N.
City/Zip Code	Waterloo, Ontario N2J 2Z5
Country	Canada
Contact Person	Inam Rahim
Telephone	(519) 745 8887 x245
e-mail	(519) 745 9774

2.3 Identification of the Manufacturer

Same as above client.



3 Equipment Under Test (EUT)

3.1 Specification of the Equipment under Test

EUT	
Marketing Name of EUT (if not same as Model No.)	iLane
Description	Electronic device to support hands-free wireless communication including emails in 2.4 GHz ISM band using voice recognition technology
Model No.	ILN7100 series, ILN7100ABE
HW Version:	Alpha-2
SW Version:	-
FCC-ID:	V57-IL04
IC-ID:	7120A-IL04

Frequency Range:	2400MHz – 2483.5MHz
Type(s) of Modulation:	GFSK, DQPSK, 8PSK
Number of Channels:	79
Antenna Type/gain:	Monopole, surface mount / gain: 2 dBi
Output Power:	Peak Measured value GFSK: Conducted 2.0dBm @2402 MHz/Radiated 4.5dBm@2402 MHz DQPSK: Conducted 3.3dBm @2402MHz/Radiated 4.6dBm@2402 MHz 8DPSK:Conducted dBm @2402 MHz /Radiated 4.7dBm@2402 MHz



3.2 Identification of the Equipment under Test (EUT)

EUT #	TYPE	MANUFACTURER	MODEL	SERIAL#
1	Electronic device to support hands-free wireless communication including emails in 2.4 GHz ISM band using voice recognition technology	Intelligent Mechatronic Systems Inc.	ILN7100 series, ILN7100ABE	0404010943000078
2	Electronic device to support hands-free wireless communication including emails in 2.4 GHz ISM band using voice recognition technology	Intelligent Mechatronic Systems Inc	ILN7100 series, ILN7100ABE	0404010943000090

4 Subject Of Investigation

All testing was performed on the product referred to in Section 3 as EUT. Radiated tests were performed on EUT#1 only and all conducted tests were performed on EUT#2 only. This test report contains full radiated and contacted testing as per FCC rules Part 15.247 of Title 47 of the Code of Federal Regulations and Industry Canada rules RSS-210 Issue 7 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 RESTRICTED BAND EDGE COMPLIANCE RADIATED §15.247/15.205 and RSS-210. sec2.1 and sec.2.2

5.1.1 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
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= 74dB μ V/m**

***AVG. LIMIT= 54dB μ V/m**

Note: Radiated tests contain results with measurement maximized according to the procedure defined in ANSI C63.4.

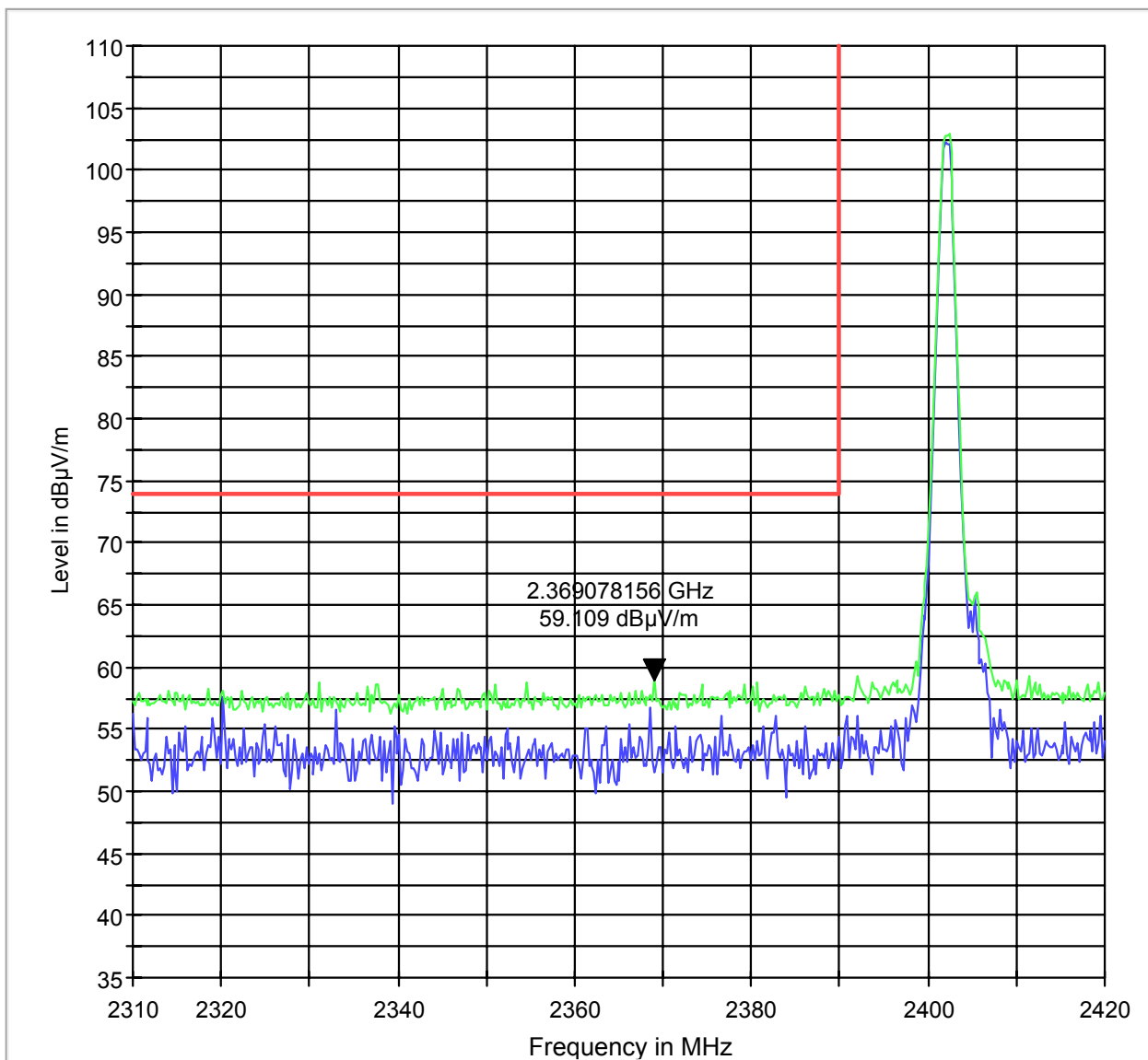


5.1.2 RESULTS: GFSK

PLOT 5.1.2 A

(2402MHz) LOWER BAND EDGE PEAK –GFSK MODULATION

FCC 15.247 LBE Pk 3m

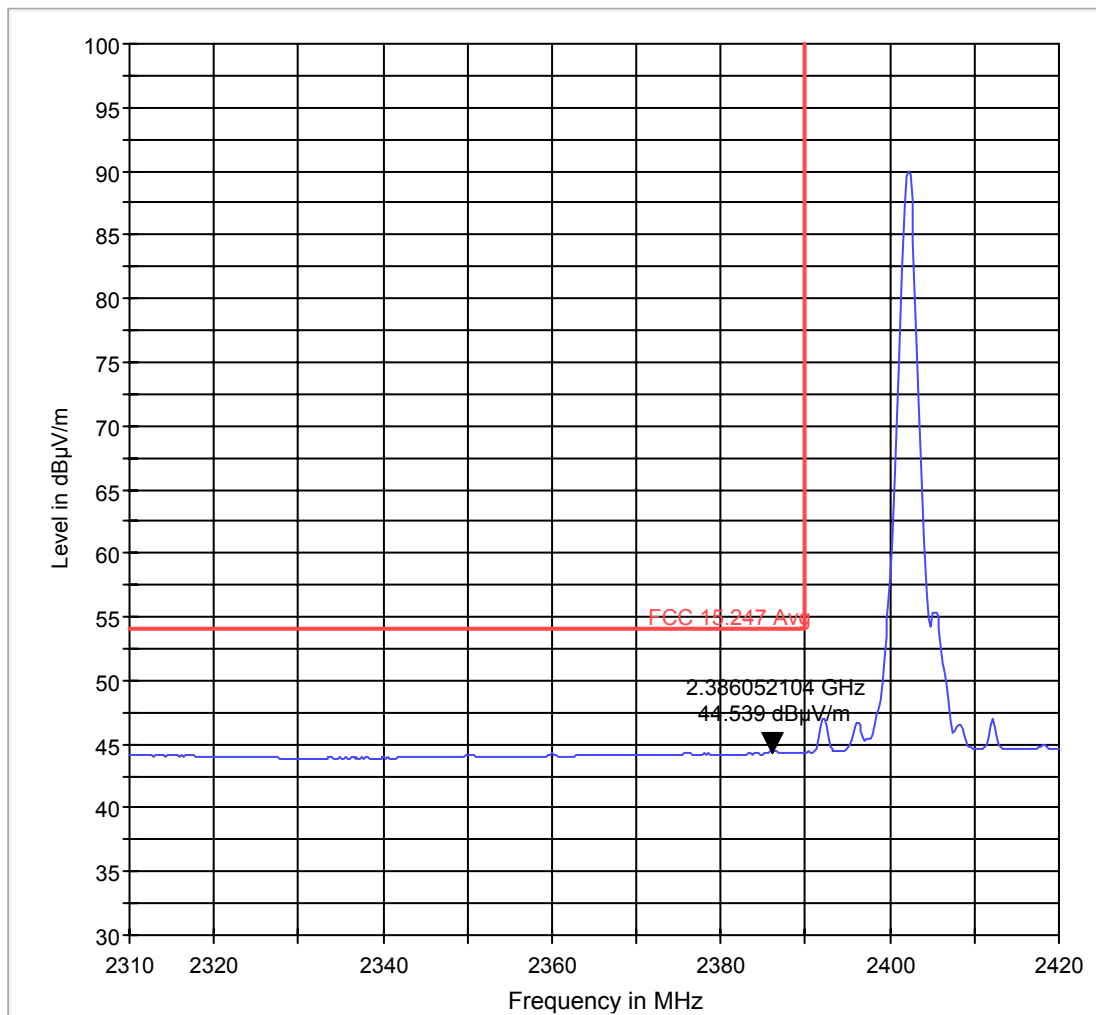


MaxPeak-ClearWrite MaxPeak-MaxHold FCC 15.247 Pk



PLOT 5.1.2 B
(2402MHz) LOWER BAND EDGE AVERAGE -GFSK MODULATION

FCC 15.247 LBE Avg 3m

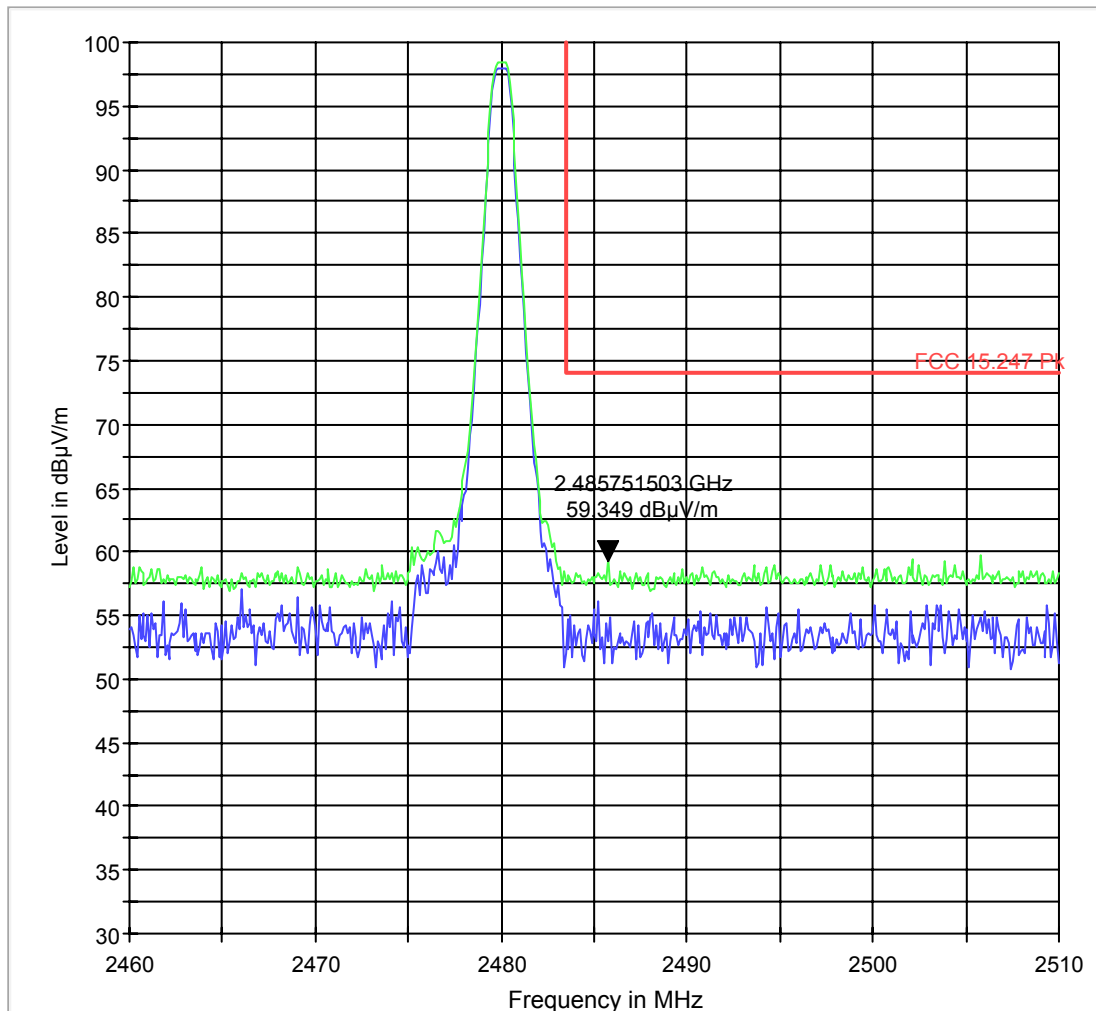


— MaxPeak-MaxHold — Average-MaxHold — FCC 15.247 Avg



PLOT 5.1.2 C
(2480MHz) HIGHER BAND EDGE PEAK –GFSK MODULATION

FCC 15.247 HBE Pk 3m

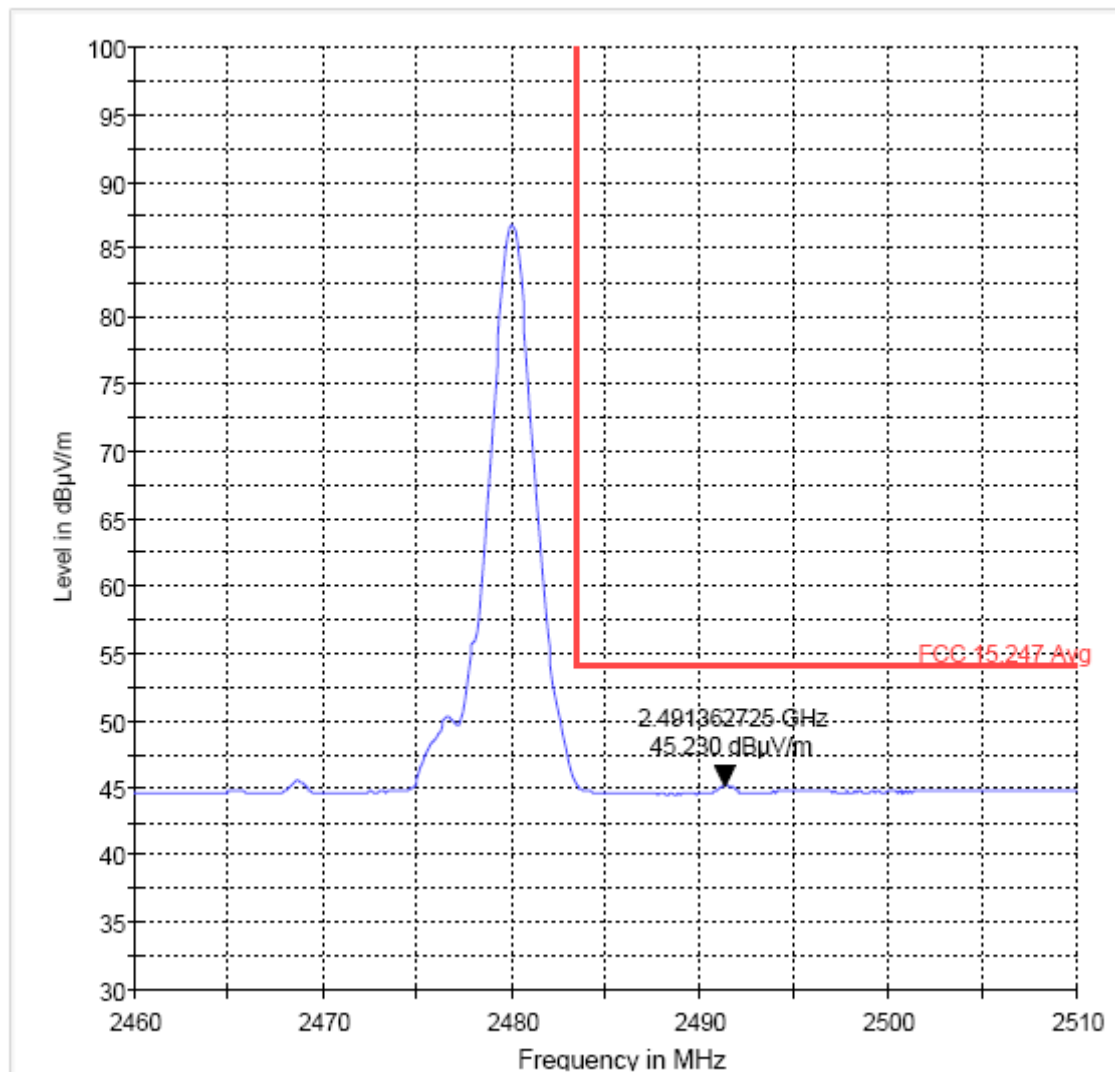


MaxPeak-ClearWrite MaxPeak-MaxHold FCC 15.247 Pk



PLOT 5.1.2 D
HIGHER BAND EDGE AVERAGE-GFSK MODULATION

FCC 15.247 HBE Avg 3m



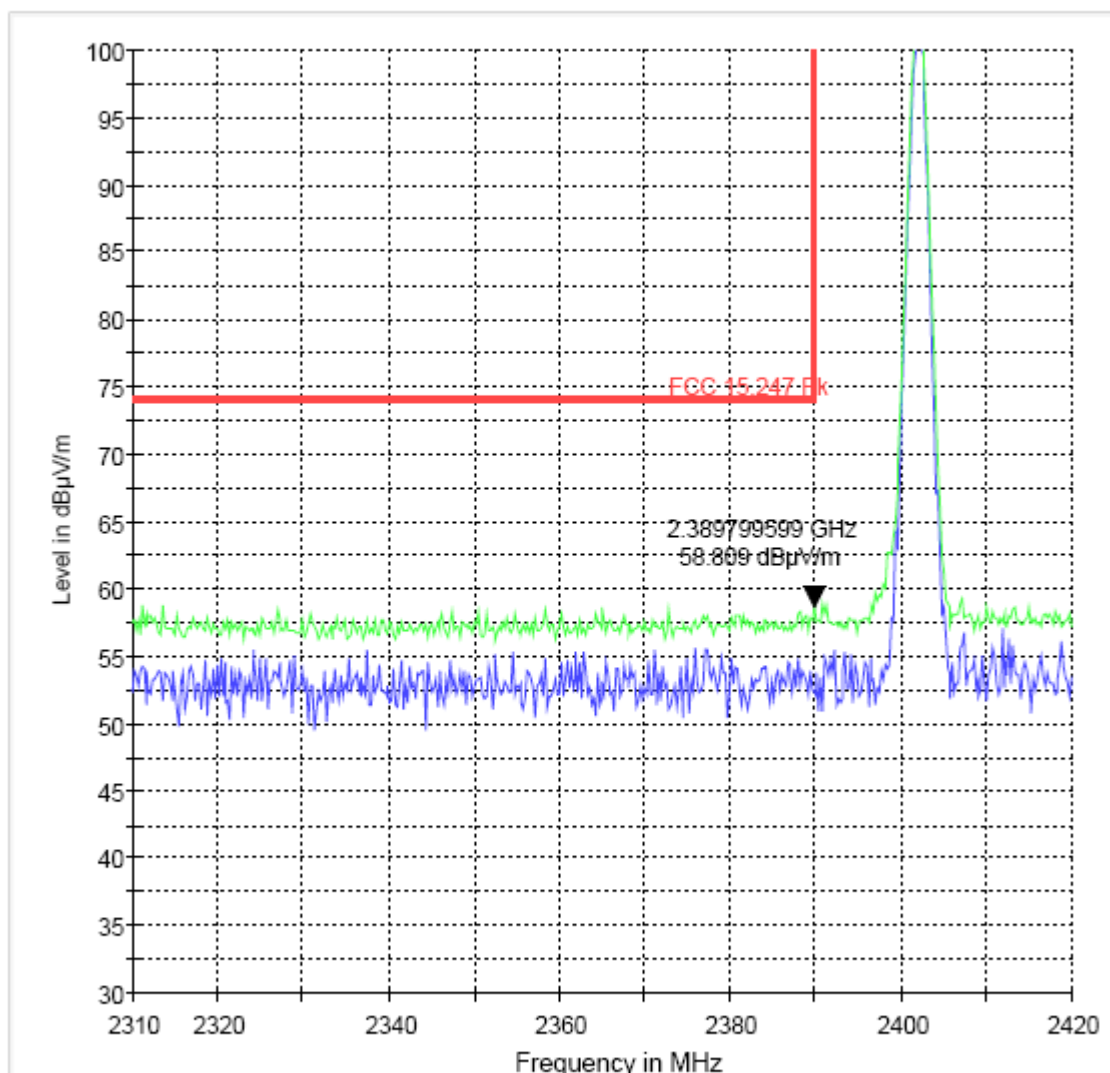
MaxPeak-MaxHold FCC 15.247 Avg



5.1.3 RESULTS: $\pi/4$ DQPSK
PLOT 5.1.3 A

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

FCC 15.247 LBE Pk 3m

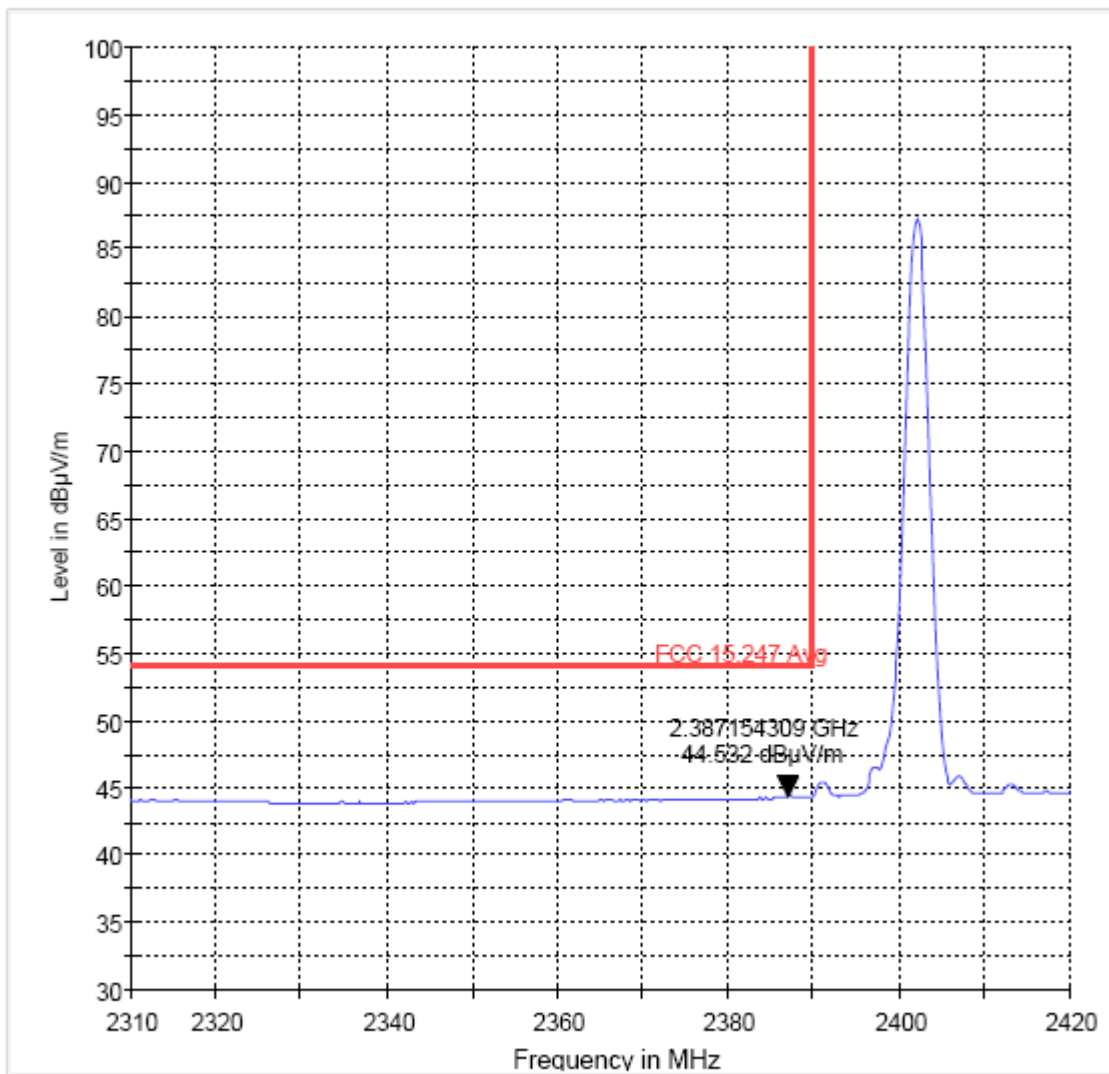


— MaxPeak-ClearWrite — MaxPeak-MaxHold — FCC 15.247 Pk



PLOT 5.1.3 B
(2402MHz) LOWER BAND EDGE AVERAGE $-\pi/4$ DQPSK MODULATION

FCC 15.247 LBE Avg 3m

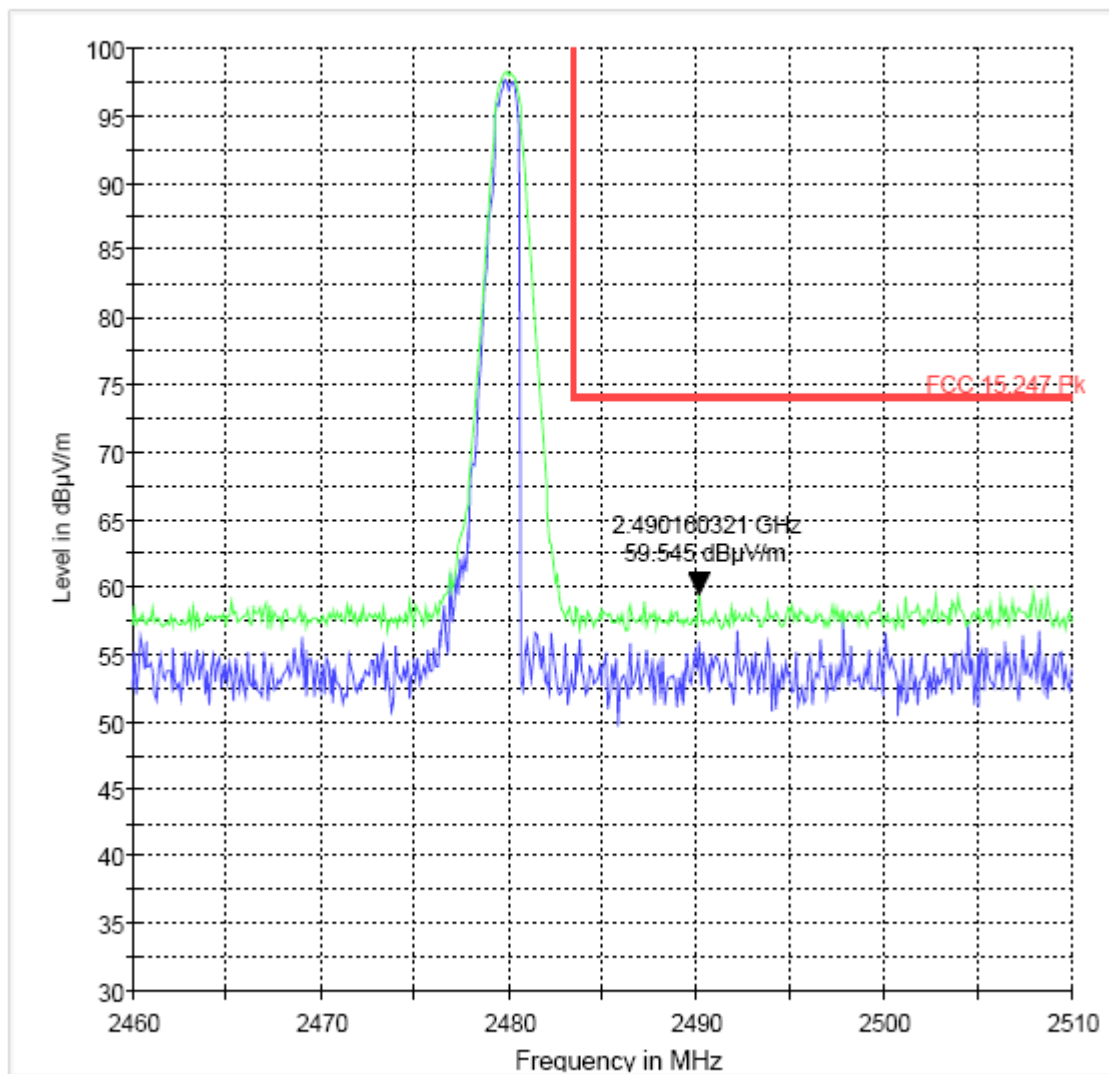


— MaxPeak-MaxHold — Average-MaxHold — FCC 15.247 Avg



PLOT 5.1.3 C
(2480MHz) HIGHER BAND EDGE PEAK $-\pi/4$ DQPSK MODULATION

FCC 15.247 HBE Pk 3m

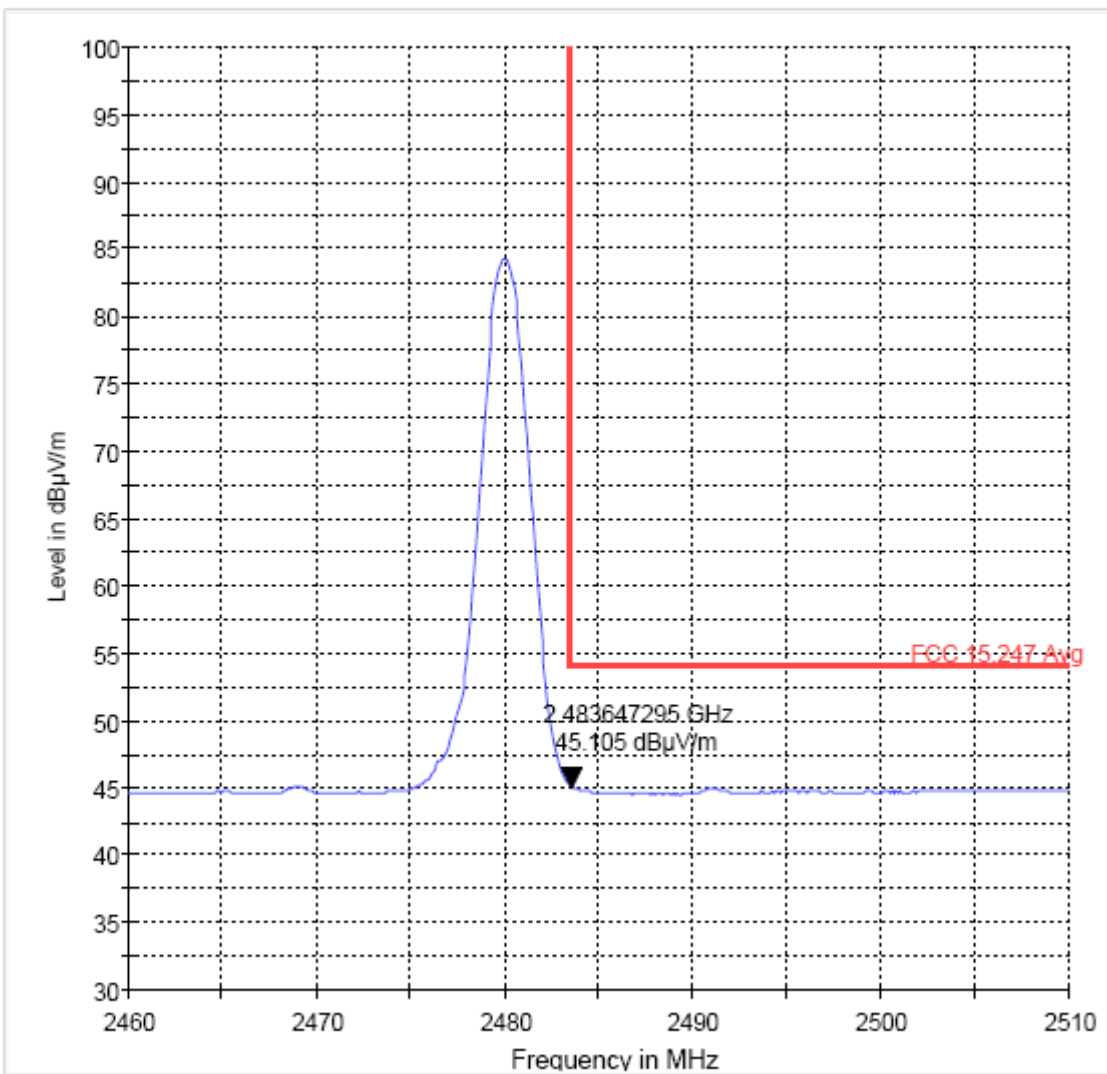


— MaxPeak-ClearWrite — MaxPeak-MaxHold — FCC 15.247 Pk



PLOT 5.1.3 D
HIGHER BAND EDGE AVERAGE- $\pi/4$ DQPSK MODULATION

FCC 15.247 HBE Avg 3m



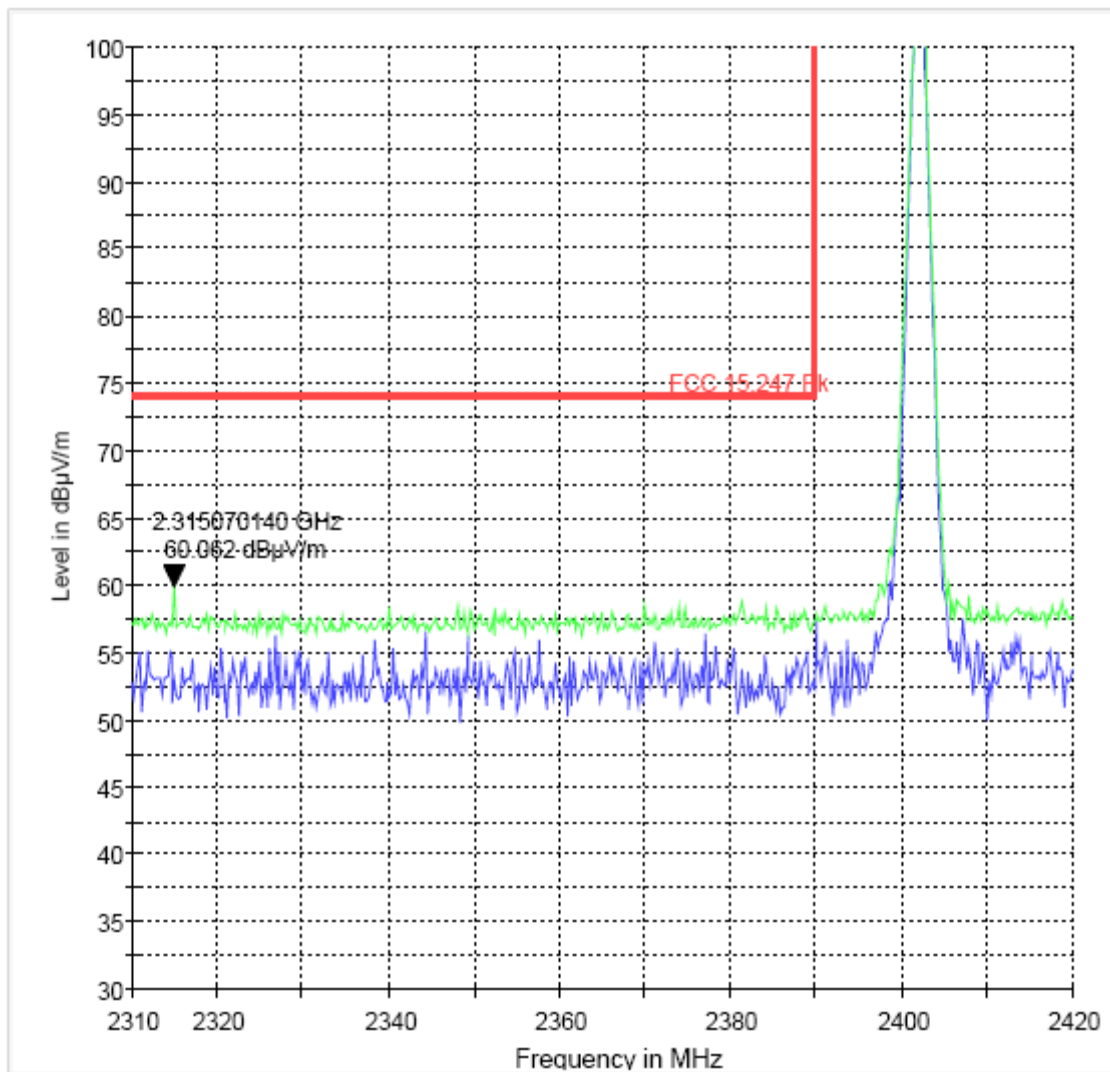
— MaxPeak-MaxHold — FCC 15.247 Avg



5.1.4 RESULTS: 8DPSK
PLOT 5.1.4 A

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

FCC 15.247 LBE Pk 3m

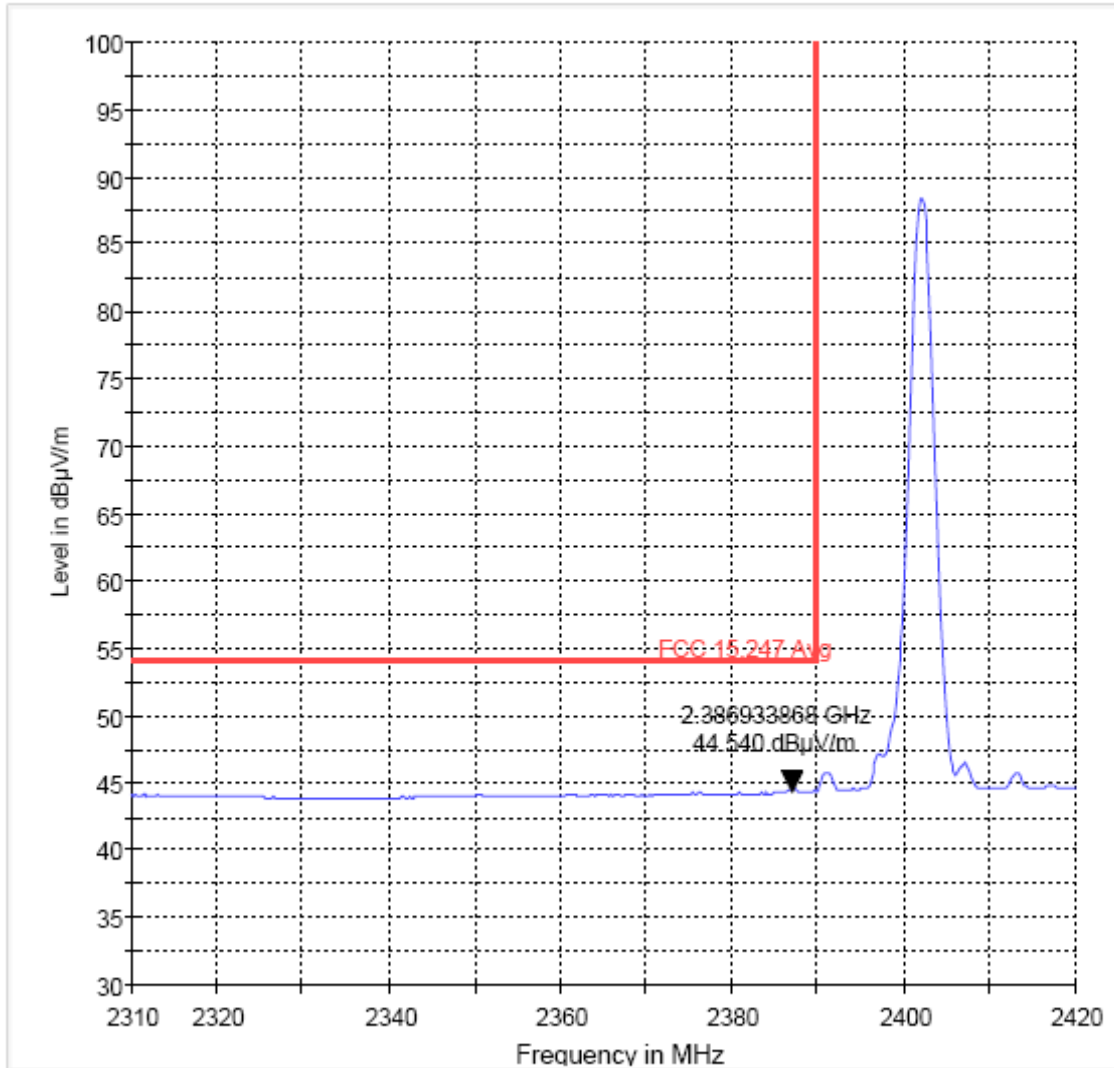


MaxPeak-ClearWrite MaxPeak-MaxHold FCC 15.247 Pk



PLOT 5.1.4 B
(2402MHz) LOWER BAND EDGE AVERAGE -8DPSK MODULATION

FCC 15.247 LBE Avg 3m

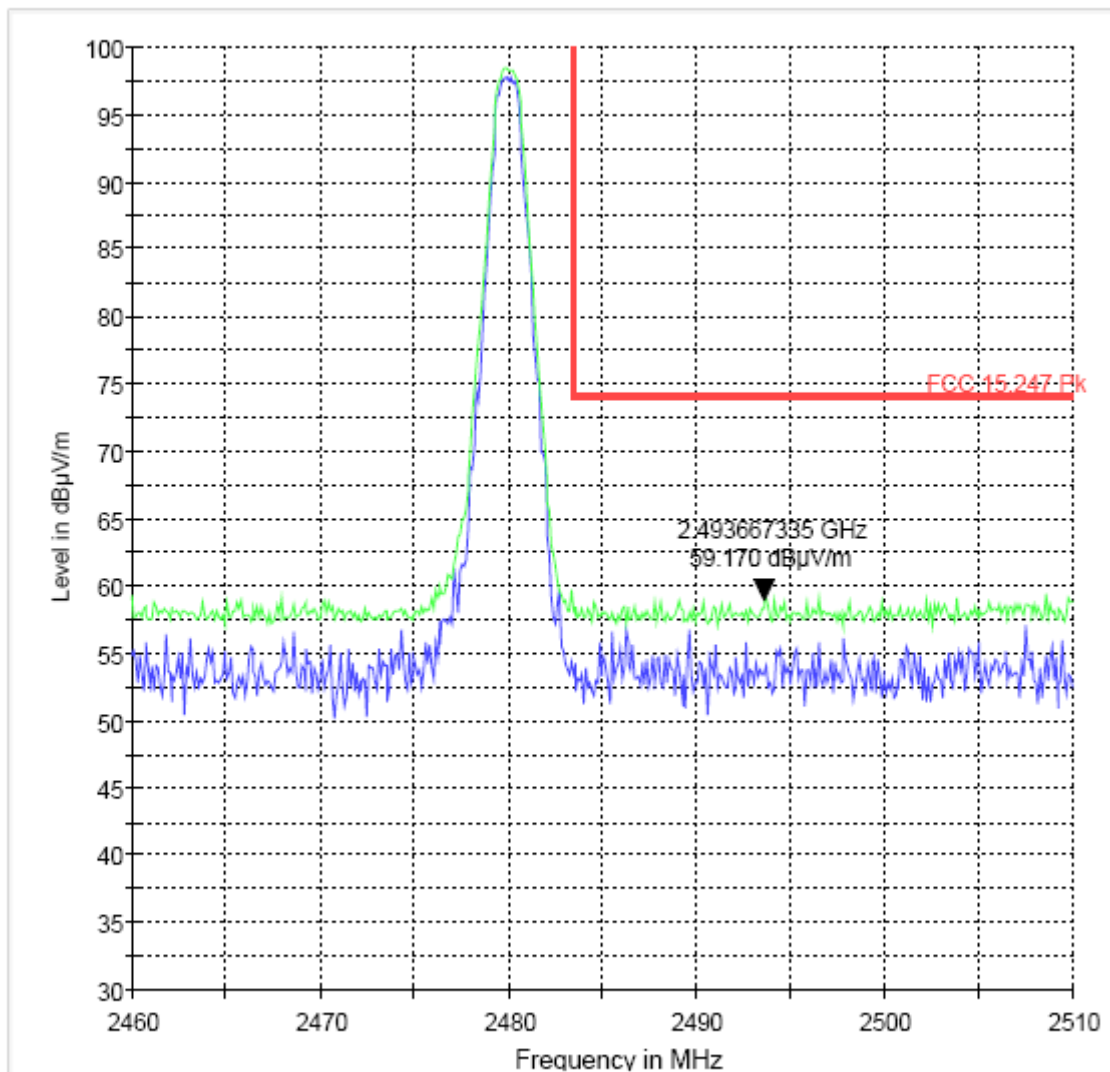


MaxPeak-MaxHold Average-MaxHold FCC 15.247 Avg



PLOT 5.1.4 C
(2480MHz) HIGHER BAND EDGE PEAK – 8DPSK MODULATION

FCC 15.247 HBE Pk 3m

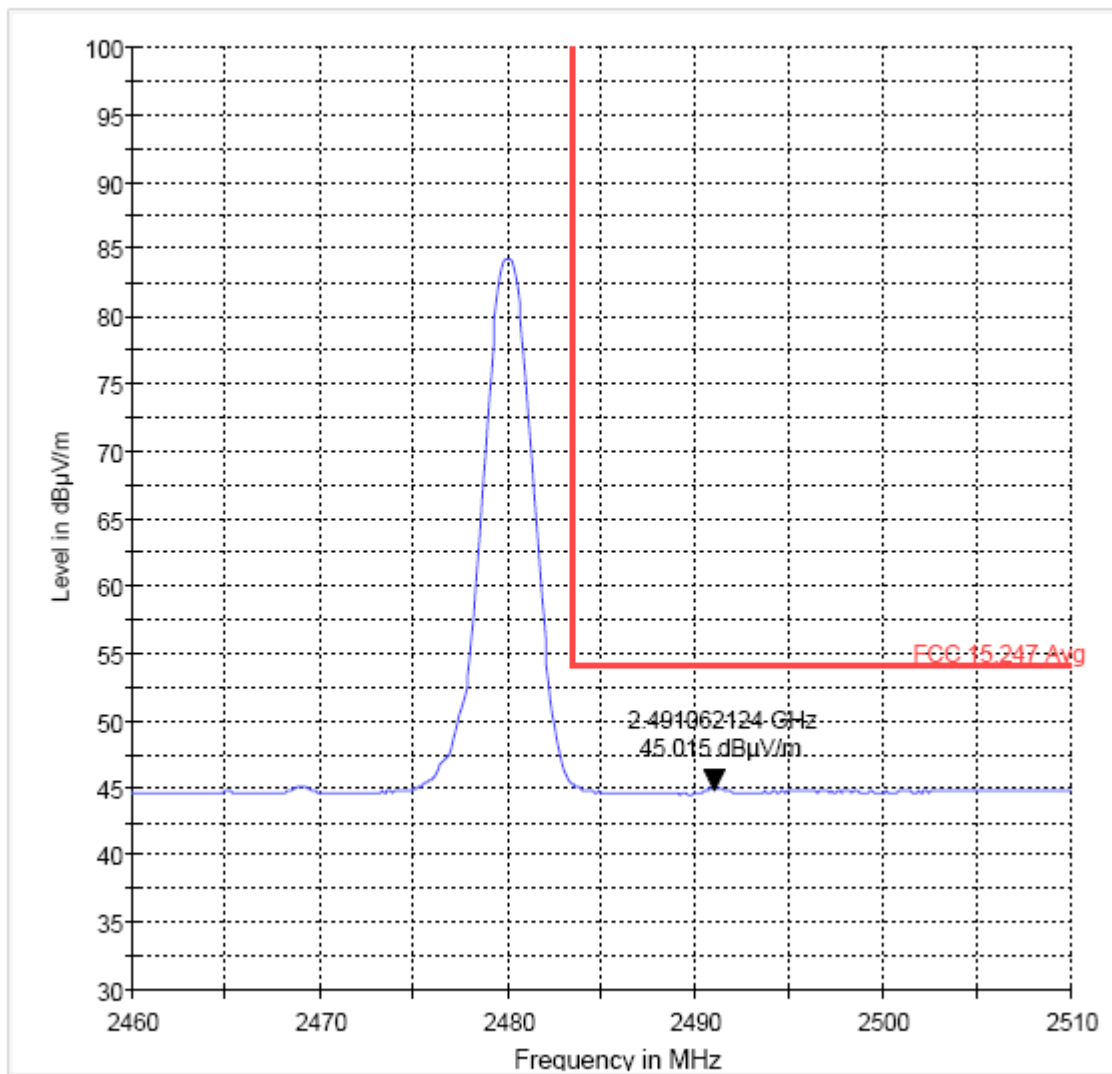


MaxPeak-ClearWrite MaxPeak-MaxHold FCC 15.247 Pk



PLOT 5.1.4 D
HIGHER BAND EDGE AVERAGE-8DPSK MODULATION

FCC 15.247 HBE Avg 3m



— MaxPeak-MaxHold — FCC 15.247 Avg



5.2 TRANSMITTER SPURIOUS EMISSIONS RADIATED § 15.247/15.205/15.209 and ICES-003 sec.5.5

5.2.1 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	(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. Radiated tests contain results with measurement maximized according to the procedure defined in ANSI C63.4.

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 represent the worse case emission from the device.



5.2.2 RESULTS

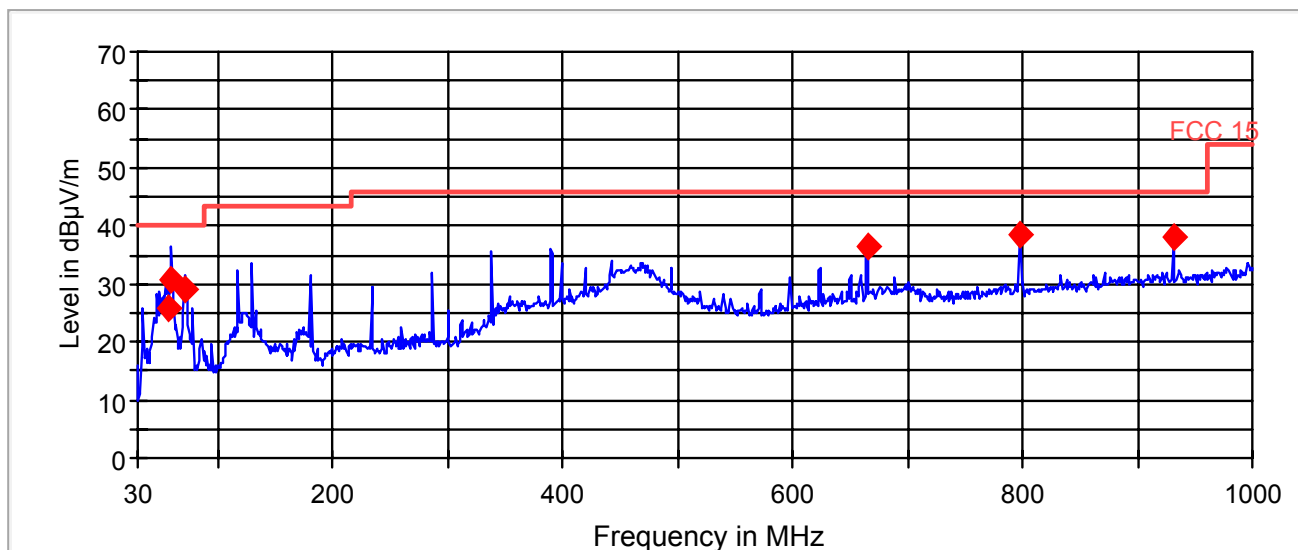
PLOT 5.2.2 A

30MHz – 1GHz Antenna

Channel 0: GFSK: Plot contains results of both horizontal and vertical polarizations

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
56.068974	25.8	20.000	120.000	180.0	V	315.0	7.4	14.2	40.0
59.178229	30.5	20.000	120.000	151.0	V	278.0	7.8	9.5	40.0
70.900832	29.1	20.000	120.000	120.0	V	45.0	9.1	10.9	40.0
665.007652	36.3	20.000	120.000	120.0	H	256.0	23.9	9.7	46.0
798.005046	38.6	20.000	120.000	120.0	V	11.0	24.7	7.4	46.0
930.992303	37.9	20.000	120.000	120.0	V	10.0	26.3	8.1	46.0

FCC 15 30-1000MHz



— FCC 15.LimitLine — Preview Result 1 ◆ Final Result 1



PLOT 5.2.2 B

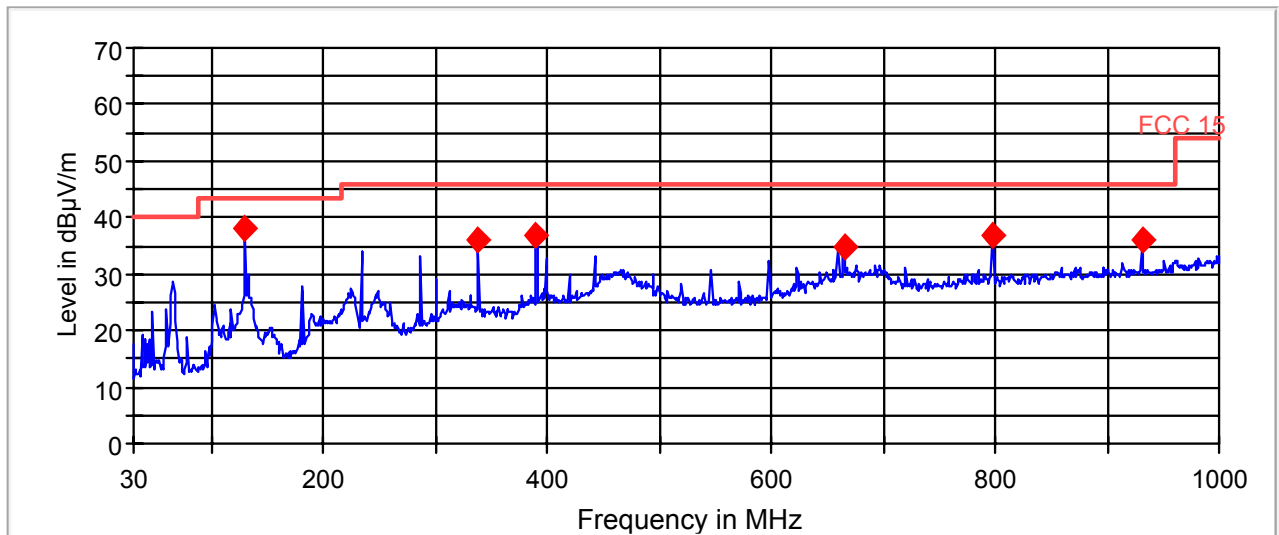
30MHz – 1GHz

Channel 39: GFSK: Plot contains results of both horizontal and vertical polarizations

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
129.993209	38.2	20.000	120.000	120.0	V	218.0	8.3	5.3	43.5
338.002766	35.9	20.000	120.000	120.0	H	32.0	17.2	10.1	46.0
390.010513	37.0	20.000	120.000	120.0	H	256.0	18.2	9.0	46.0
664.997319	34.7	20.000	120.000	120.0	H	0.0	23.9	11.3	46.0
797.994789	36.9	20.000	120.000	120.0	V	29.0	24.7	9.1	46.0
930.986033	36.1	20.000	120.000	120.0	V	0.0	26.3	9.9	46.0

FCC 15 30-1000MHz



— FCC 15.LimitLine — Preview Result 1 ◆ Final Result 1



PLOT 5.2.2 C

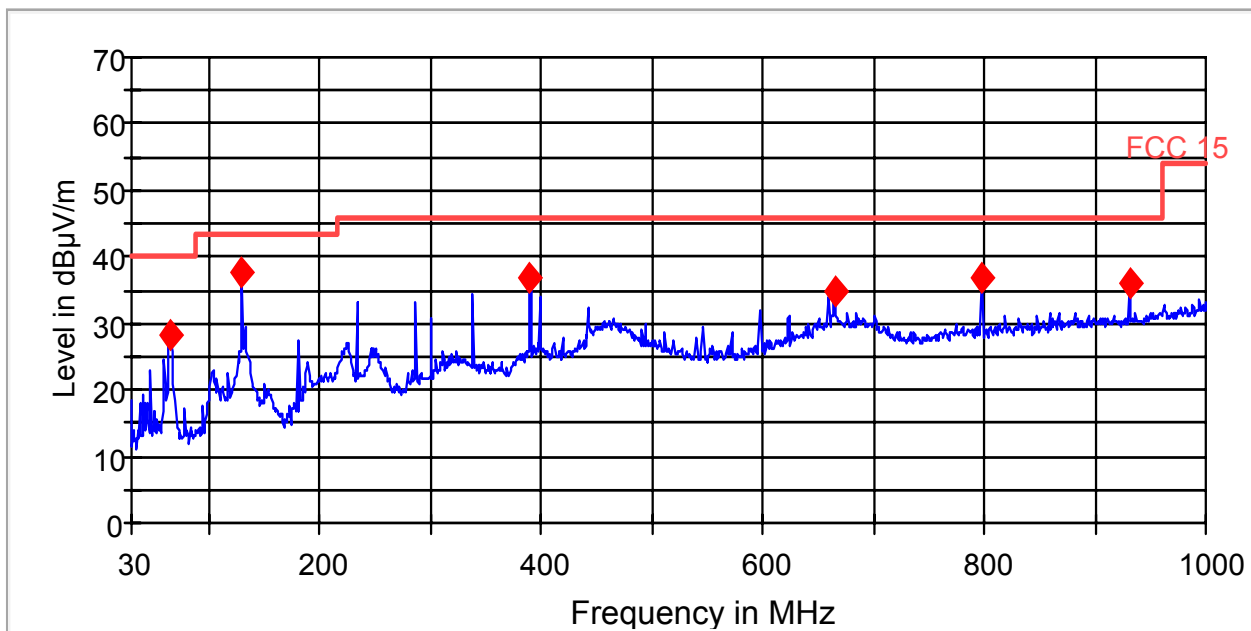
30MHz – 1GHz

Channel 78: GFSK: Plot contains results of both horizontal and vertical polarizations

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
65.485203	28.3	20.000	120.000	120.0	V	46.0	8.6	11.7	40.0
129.998413	37.7	20.000	120.000	120.0	V	196.0	8.3	5.8	43.5
389.994890	37.0	20.000	120.000	120.0	H	252.0	18.2	9.0	46.0
665.007652	34.8	20.000	120.000	120.0	H	0.0	23.9	11.2	46.0
798.005046	36.9	20.000	120.000	120.0	V	30.0	24.7	9.1	46.0
930.986033	36.2	20.000	120.000	120.0	V	0.0	26.3	9.8	46.0

FCC 15 30-1000MHz



— FCC 15.LimitLine — Preview Result 1 ◆ Final Result 1



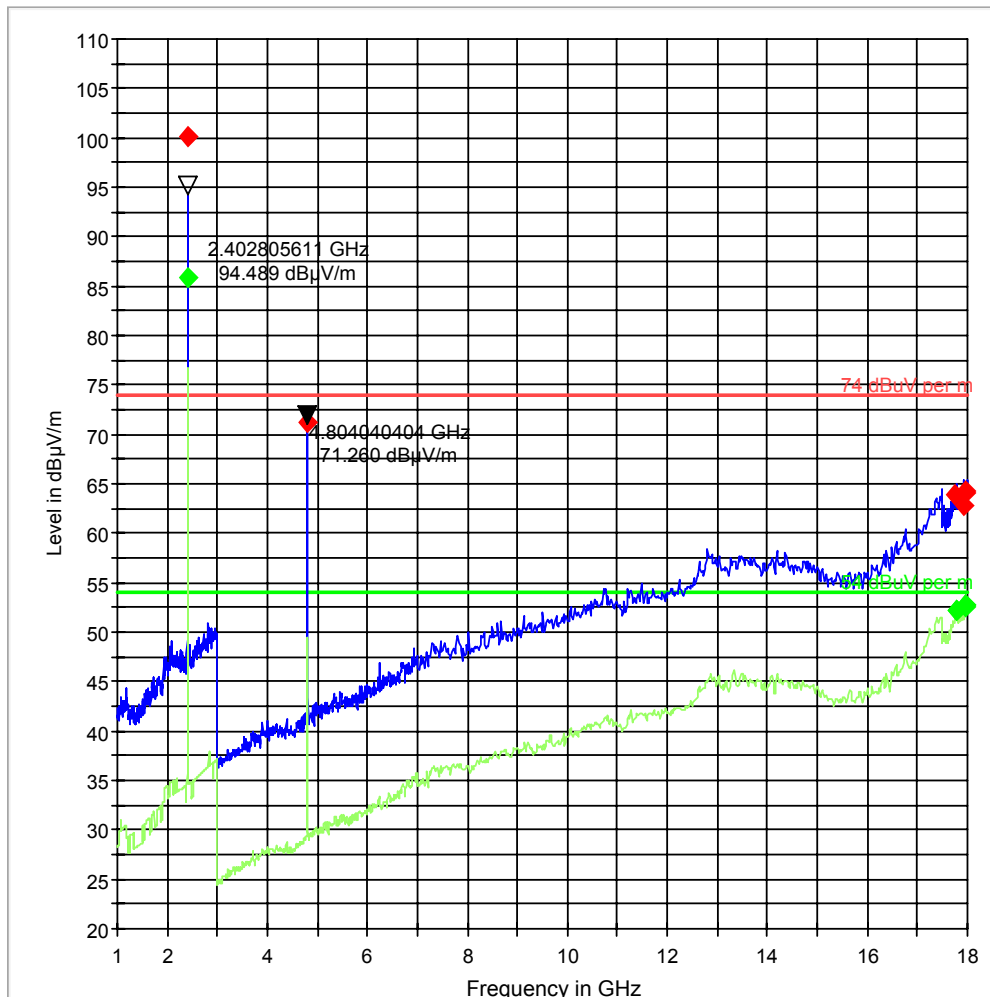
PLOT 5.2.2 D
1-18GHz (2402MHz)

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

Plot contains results of both horizontal and vertical polarizations

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2402.155555	100.1	20.000	1000.000	120.0	H	159.0	24.4	-26.1	74.0
4804.040404	71.3	20.000	1000.000	120.0	H	97.0	3.6	2.7	74.0
17760.155409	63.8	20.000	1000.000	120.0	H	1.0	29.1	10.2	74.0
17913.958563	62.8	20.000	1000.000	145.0	V	292.0	28.7	11.2	74.0
17951.624727	64.1	20.000	1000.000	120.0	V	112.0	30.1	9.9	74.0
17972.449312	64.2	20.000	1000.000	120.0	H	249.0	29.8	9.8	74.0

FCC 15 1-18GHz



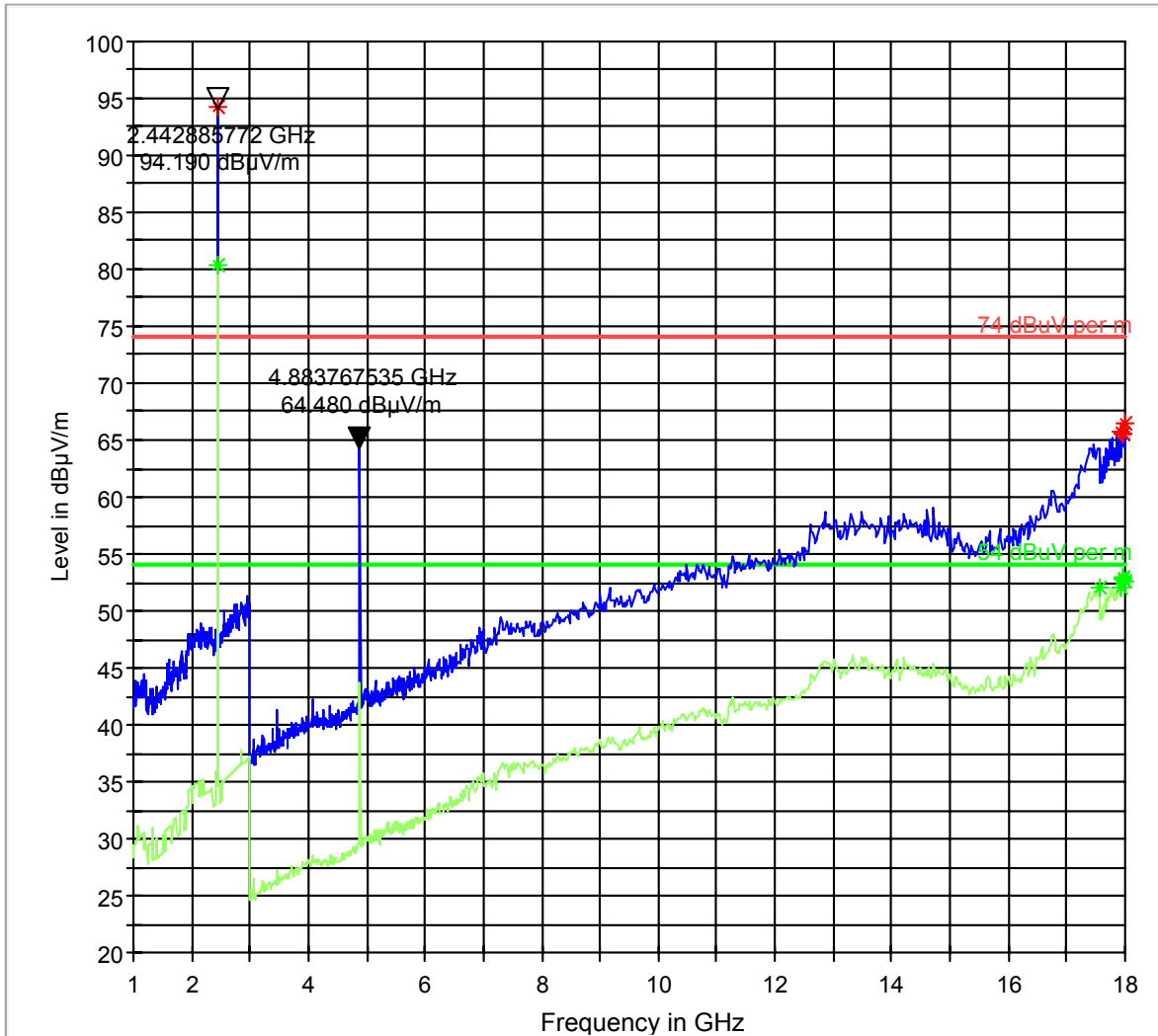
— 74 dBuV per m.LimitLine
— 54 dBuV per m.LimitLine
— Preview Result 1
◆ Final Result 1
◆ Final Result 2



PLOT 5.2.2 E
1-18GHz (2441MHz)

Note: The peak above the limit line is the carrier freq.
 Plot contains results of both horizontal and vertical polarizations

FCC 15 1-18GHz



- 74 dBuV per m.LimitLine
- 54 dBuV per m.LimitLine
- Preview Result 1
- * Data Reduction 1 [2]
- * Data Reduction 2 [2]
- Preview Result 2



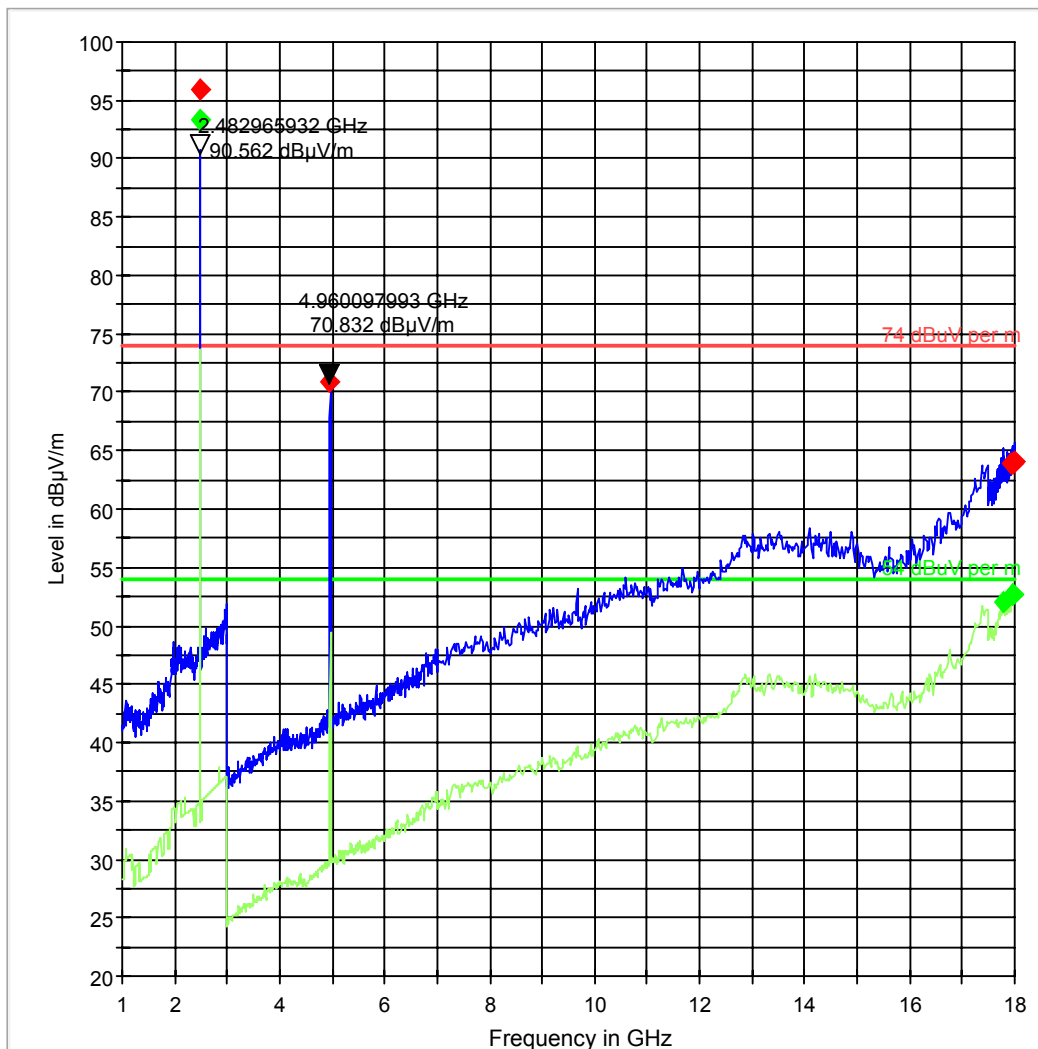
PLOT 5.2.2 F
1-18GHz (2480MHz)

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

Plot contains results of both horizontal and vertical polarizations

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2479.827305	96.0	20.000	1000.000	120.0	H	159.0	24.7	-22.0	74.0
4960.097993	70.8	20.000	1000.000	120.0	H	69.0	4.1	3.2	74.0
17943.607975	63.9	20.000	1000.000	120.0	V	188.0	29.9	10.1	74.0
17954.467165	63.8	20.000	1000.000	120.0	H	159.0	30.0	10.2	74.0
17971.922700	63.9	20.000	1000.000	145.0	V	292.0	29.9	10.1	74.0
17983.911298	64.0	20.000	1000.000	120.0	H	188.0	29.7	10.0	74.0

FCC 15 1-18GHz

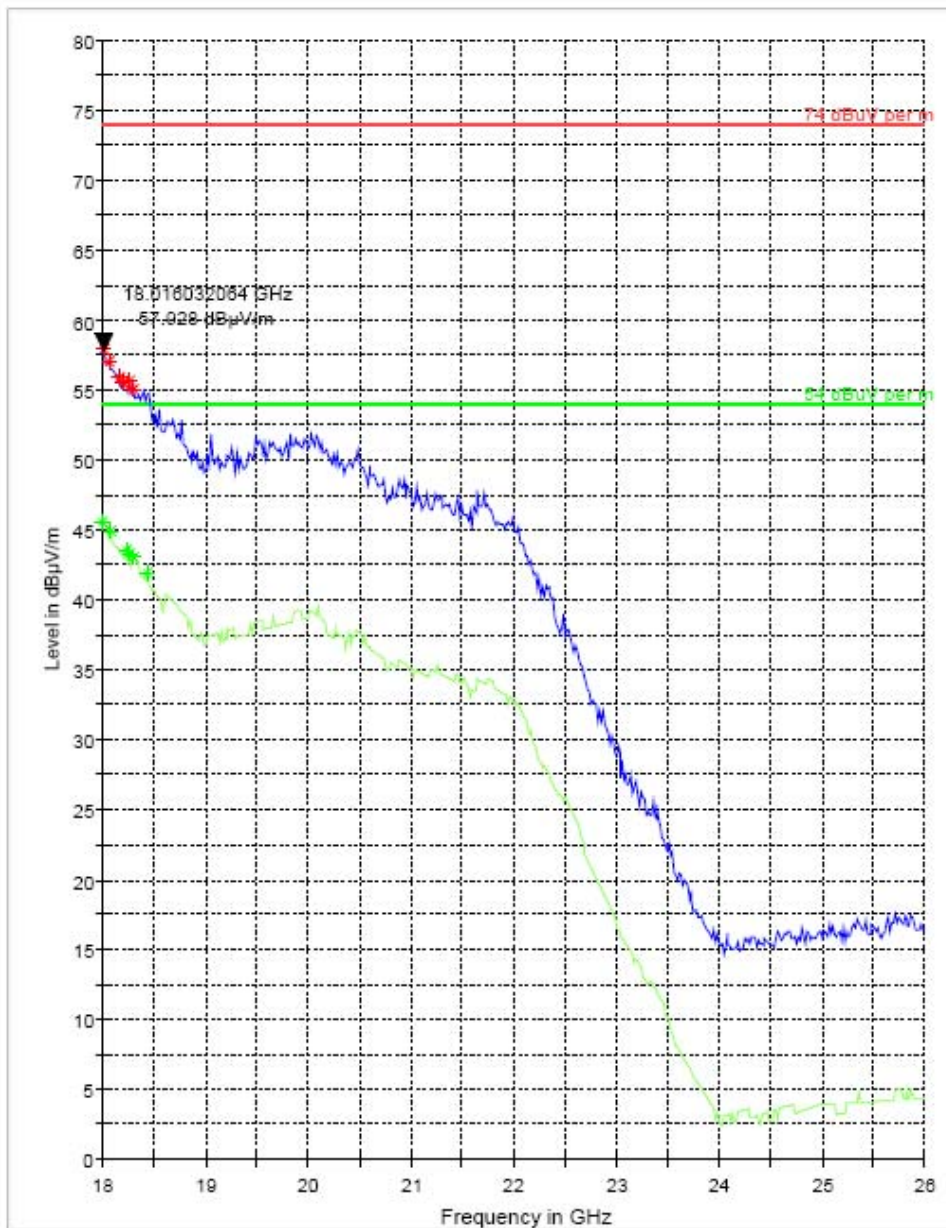


- 74 dBµV per m.LimitLine
- 54 dBµV per m.LimitLine
- Preview Result 1
- Preview Result 2
- ◆ Final Result 1
- ◆ Final Result 2



PLOT 5.2.2 G
18-25GHz

Note: This plot is valid for low, mid, high channels (worst-case plot)
 Plot contains results of both horizontal and vertical polarizations



- 74 dBµV per m.LimitLine
- 54 dBµV per m.LimitLine
- Preview Result 1
- Preview Result 2
- + Data Reduction 1 [6]
- + Data Reduction 2 [6]



5.3 RECEIVER SPURIOUS RADIATION RSS-Gen(4.10)

5.3.1 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.
3. Radiated tests contain results with measurement maximized according to the procedure defined in ANSI C63.4.



5.3.2 Results

PLOT 5.3.2 A

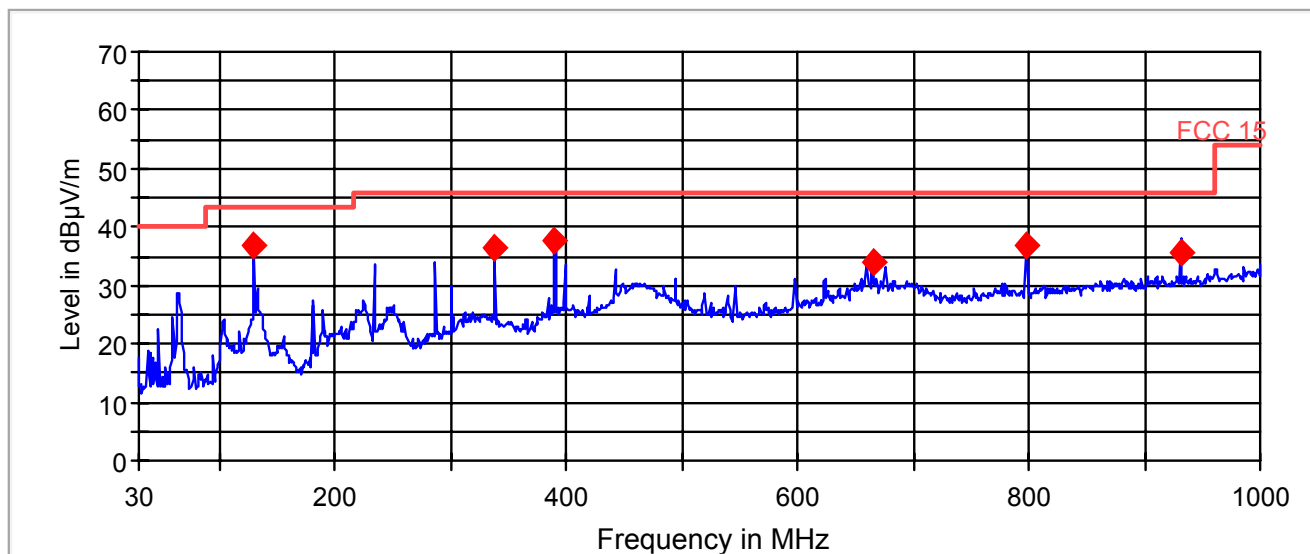
30MHz – 1GHz Antenna: Vertical.

Note: This plot is valid for low, mid, high channels (worst-case plot)
 Plot contains results of both horizontal and vertical polarizations

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
130.003618	36.8	20.000	120.000	120.0	V	188.0	8.3	6.7	43.5
338.002766	36.2	20.000	120.000	120.0	H	30.0	17.2	9.8	46.0
389.994890	37.5	20.000	120.000	120.0	H	255.0	18.2	8.5	46.0
665.023987	34.1	20.000	120.000	120.0	H	1.0	23.9	11.9	46.0
798.005046	36.8	20.000	120.000	120.0	V	19.0	24.7	9.2	46.0
931.029612	35.6	20.000	120.000	120.0	V	1.0	26.3	10.4	46.0

FCC 15 30-1000MHz



— FCC 15.LimitLine — Preview Result 1 ◆ Final Result 1



PLOT 5.3.2 B

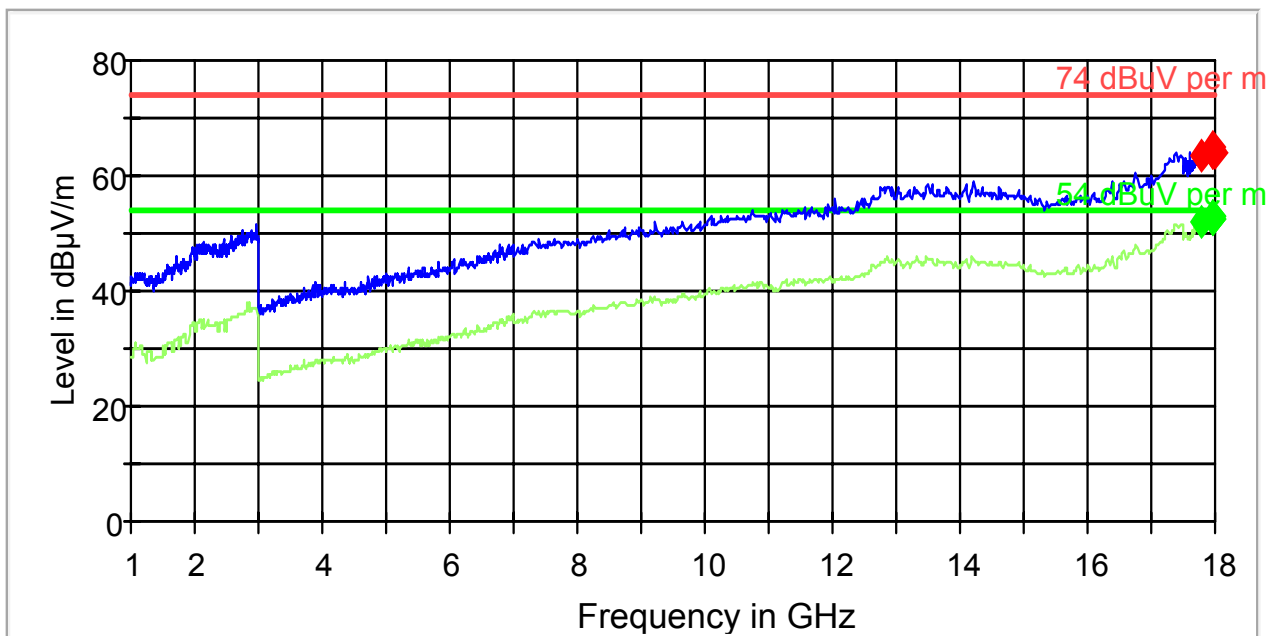
1-18GHz

Plot contains results of both horizontal and vertical polarizations

Final Result 1

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
17780.645205	63.5	20.000	1000.000	120.0	V	112.0	28.9	10.5	74.0
17948.939557	64.9	20.000	1000.000	120.0	H	292.0	30.0	9.1	74.0
17950.550502	64.1	20.000	1000.000	120.0	V	202.0	30.1	9.9	74.0
17954.790990	64.7	20.000	1000.000	145.0	V	89.0	30.1	9.3	74.0
17969.608898	64.0	20.000	1000.000	120.0	V	180.0	29.9	10.0	74.0
17999.249130	63.8	20.000	1000.000	120.0	H	2.0	29.7	10.2	74.0

FCC 15 1-18GHz



- 74 dBuV per m.LimitLine
- 54 dBuV per m.LimitLine
- Preview Result 1
- Preview Result 2
- ◆ Final Result 1
- ◆ Final Result 2



6 Measurements (CONDUCTED)

6.1 MAXIMUM PEAK OUTPUT POWER § 15.247 (CONDUCTED)

6.1.1 LIMIT SUB CLAUSE § 15.247 (b) (1) and RSS 210 A8.4(2)

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 _{nom} (23)°C	V _{nom} VDC	2.0	1.7	0.8

6.1.3 RESULTS: $\pi / 4$ DQPSK

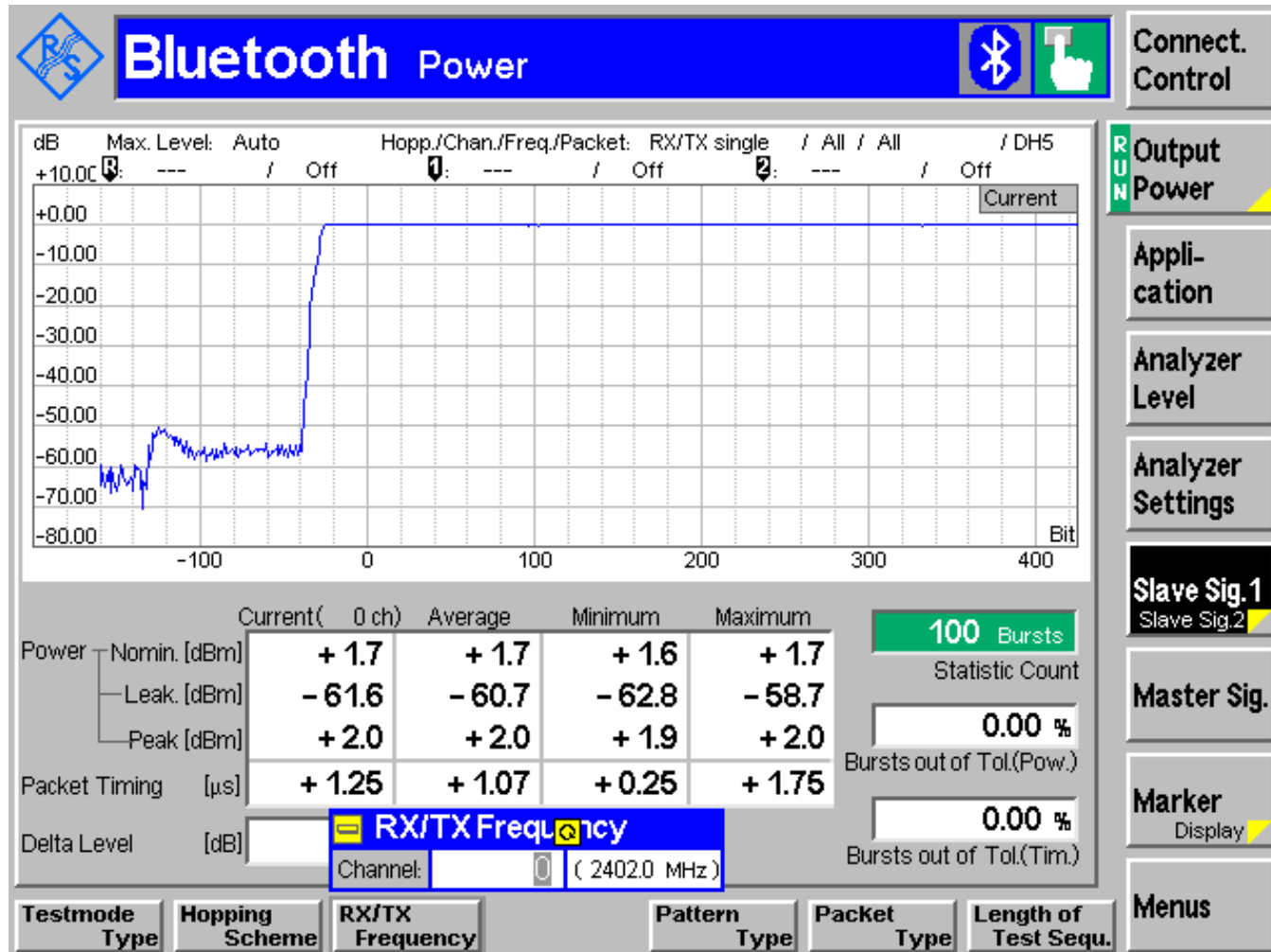
TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)		2402 MHz	2441 MHz	2480 MHz
T _{nom} (23)°C	V _{nom} VDC	3.3	3.0	1.9

6.1.4 RESULTS: 8DPSK

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)		2402 MHz	2441 MHz	2480 MHz
T _{nom} (23)°C	V _{nom} VDC	3.4	3.0	1.9

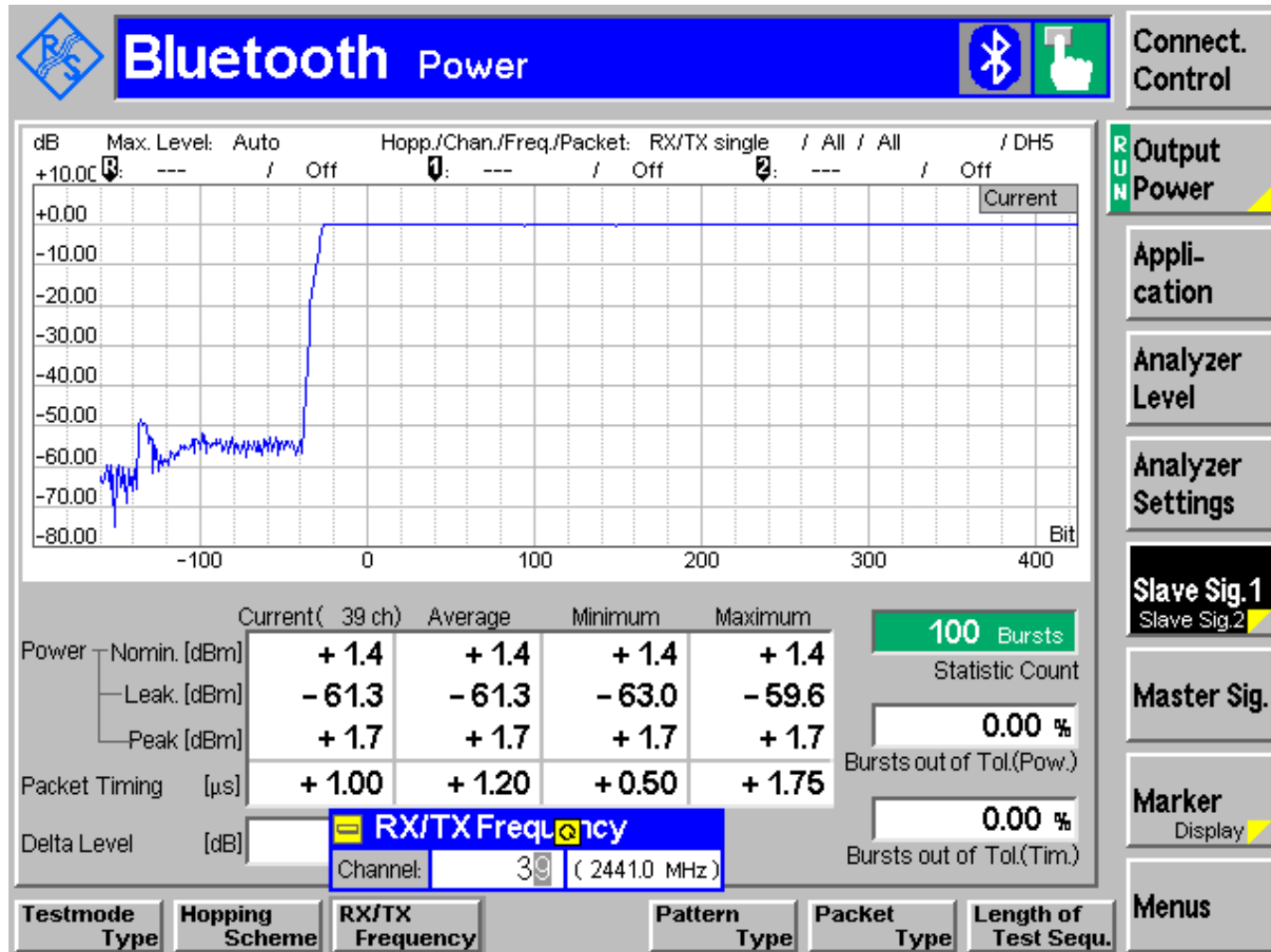


PLOT 6.1A



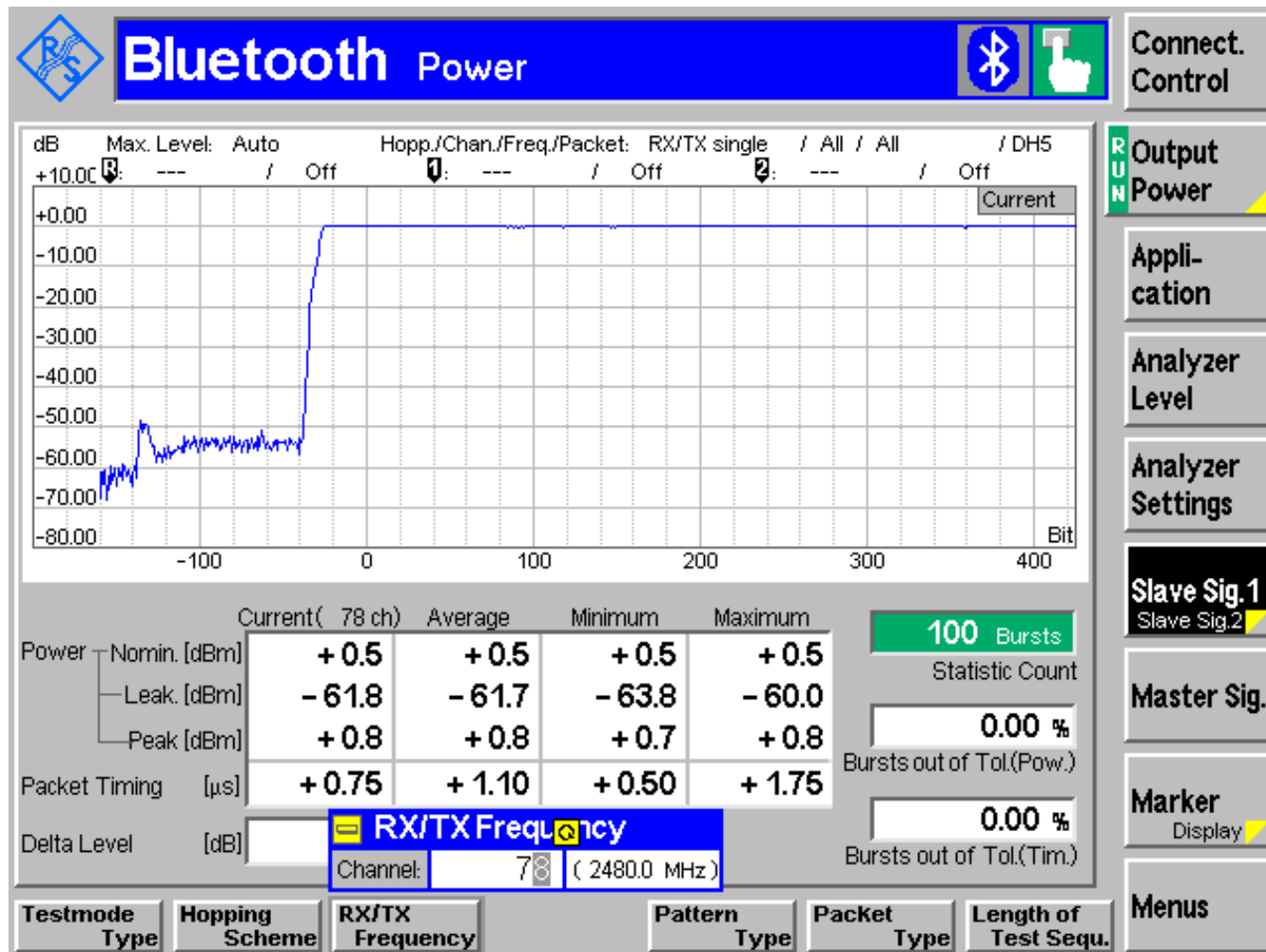


PLOT 6.1B



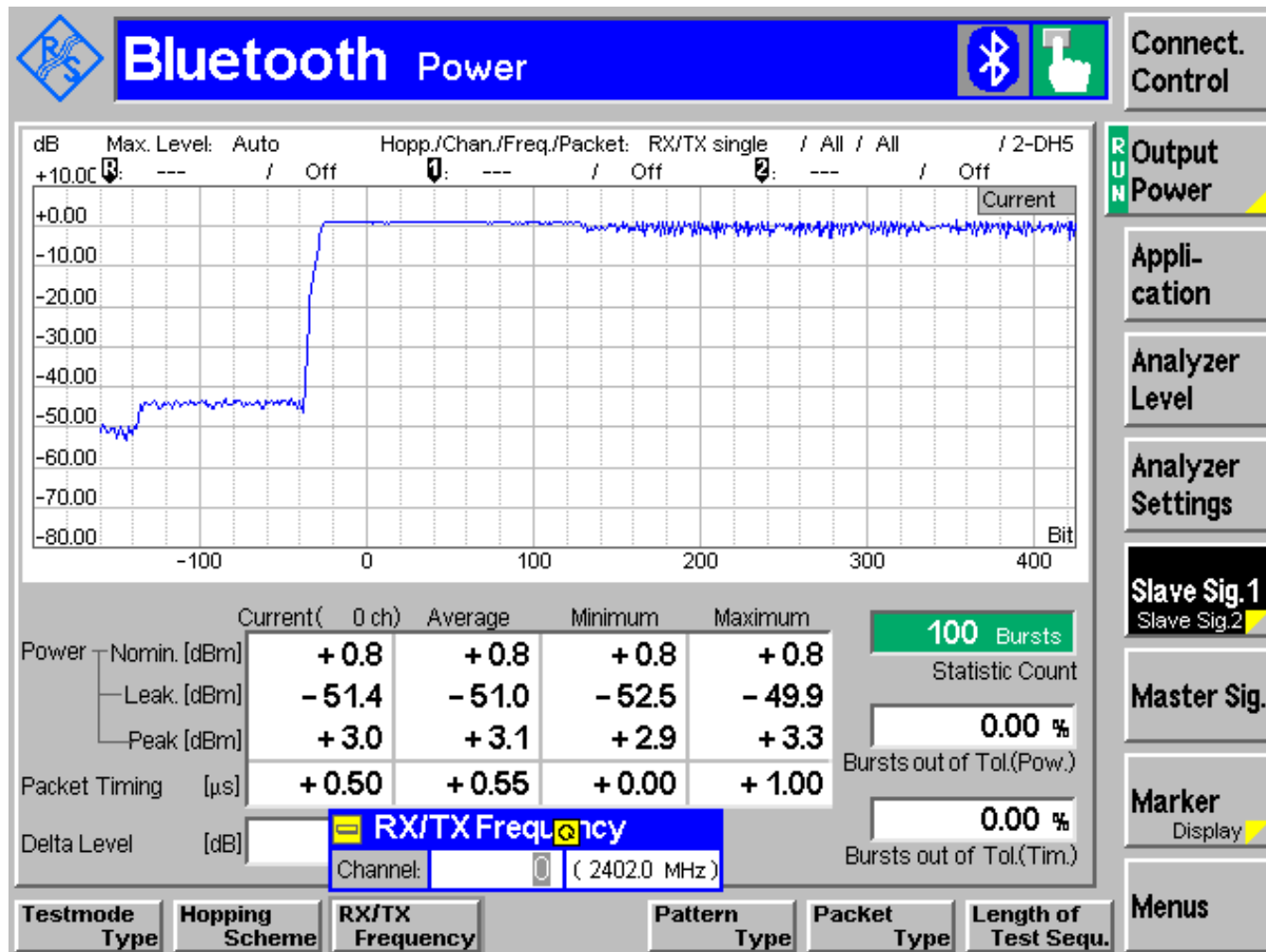


PLOT 6.1C



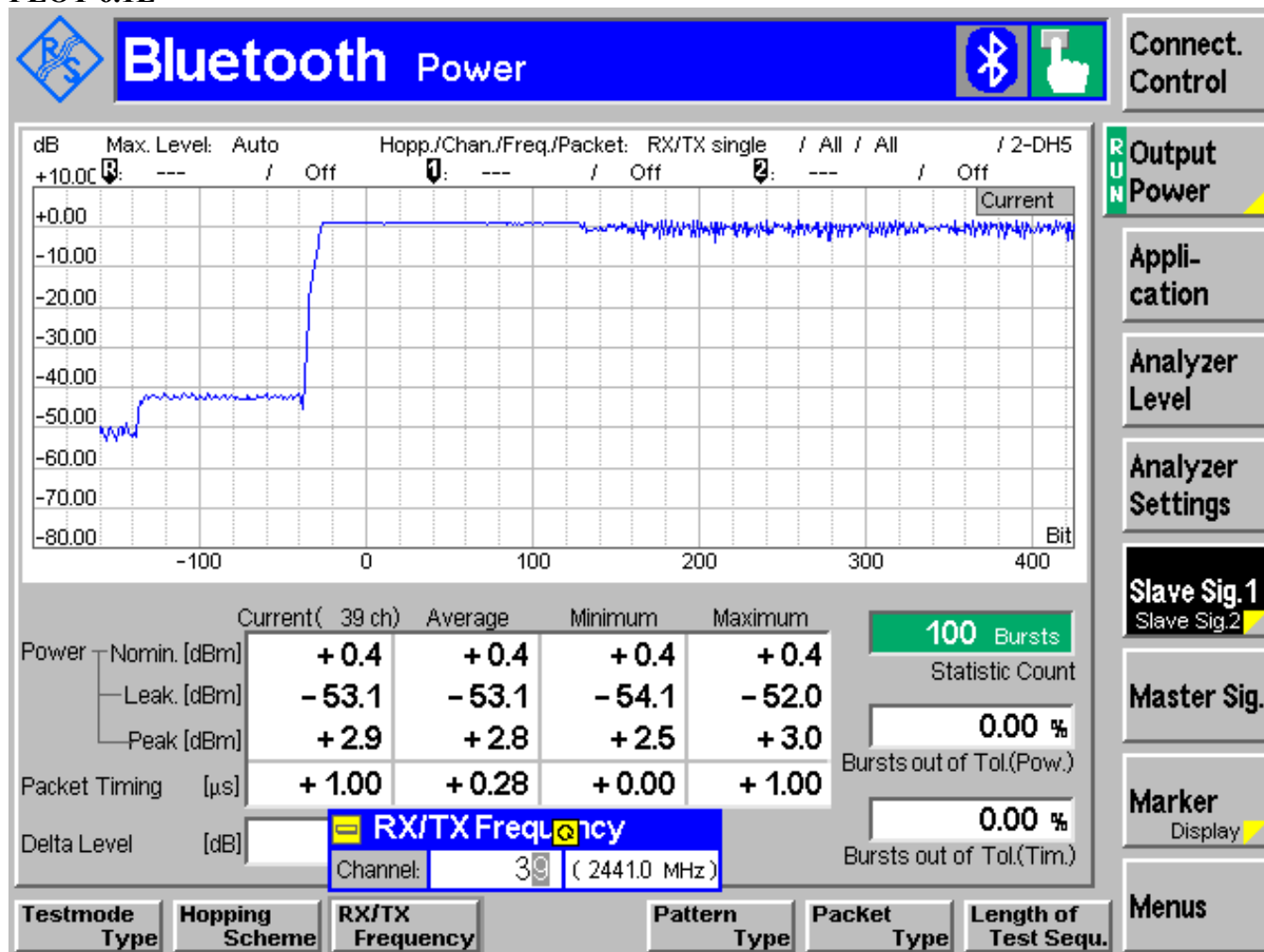


PLOT 6.1D



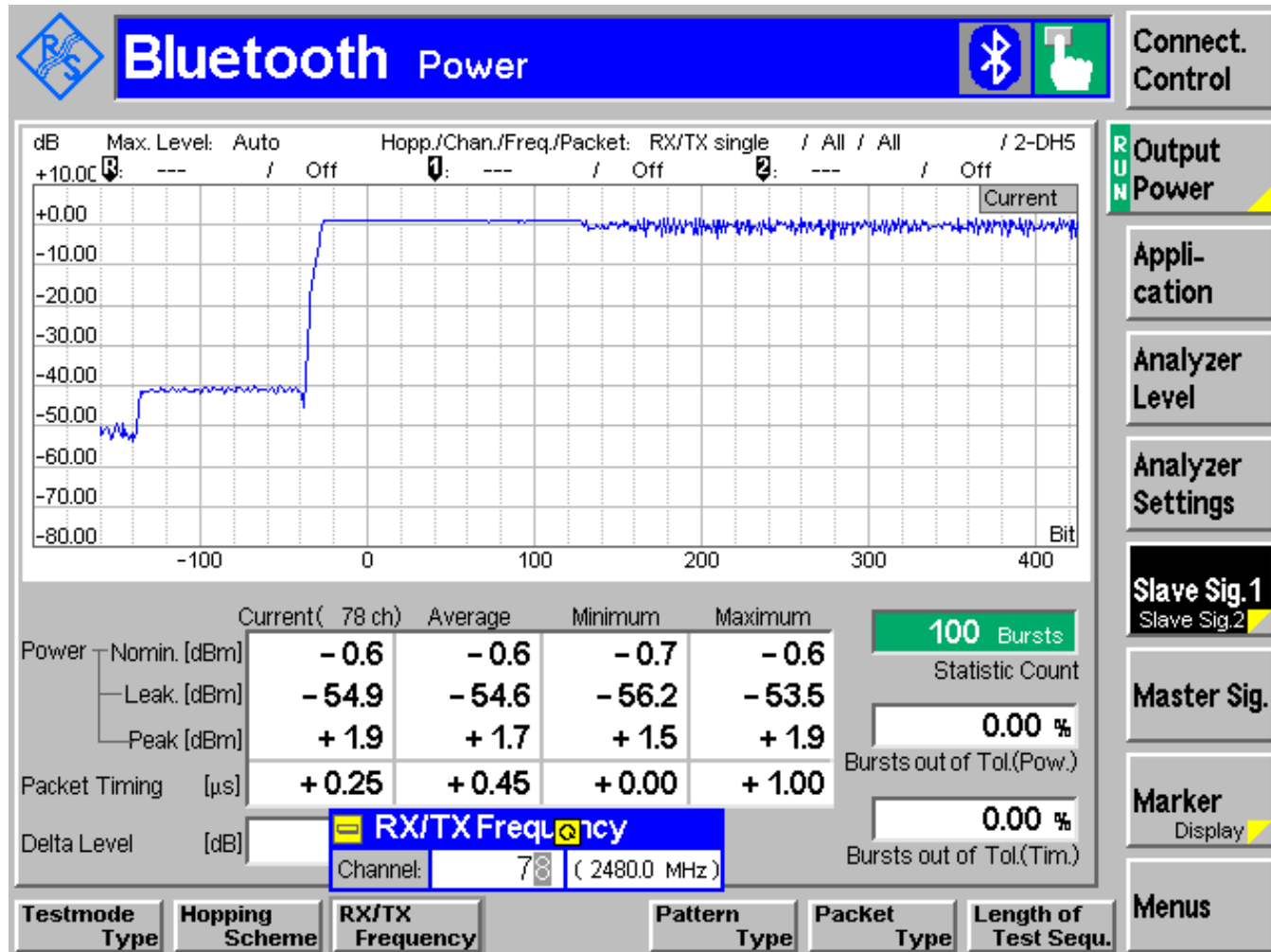


PLOT 6.1E



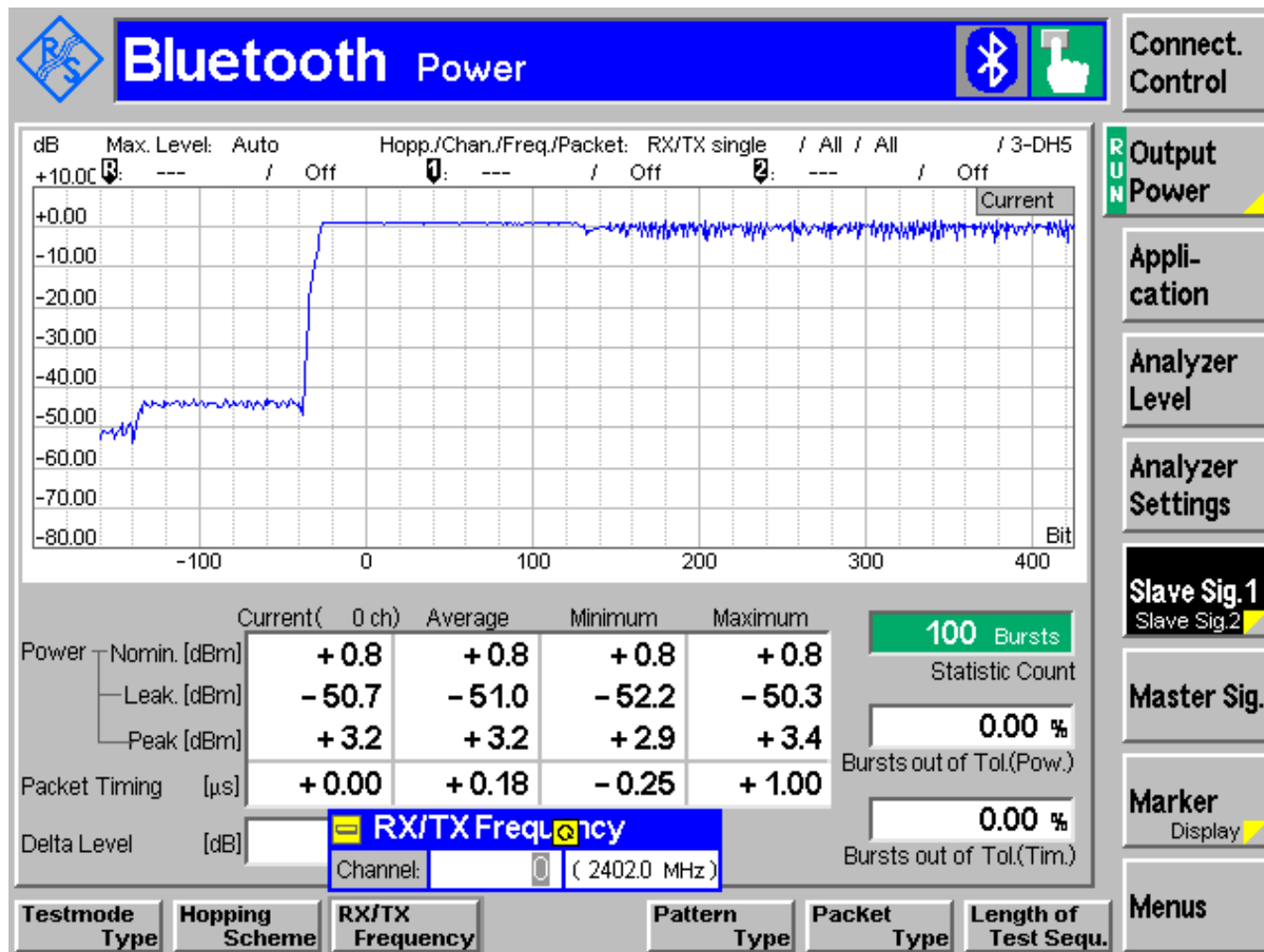


PLOT 6.1F

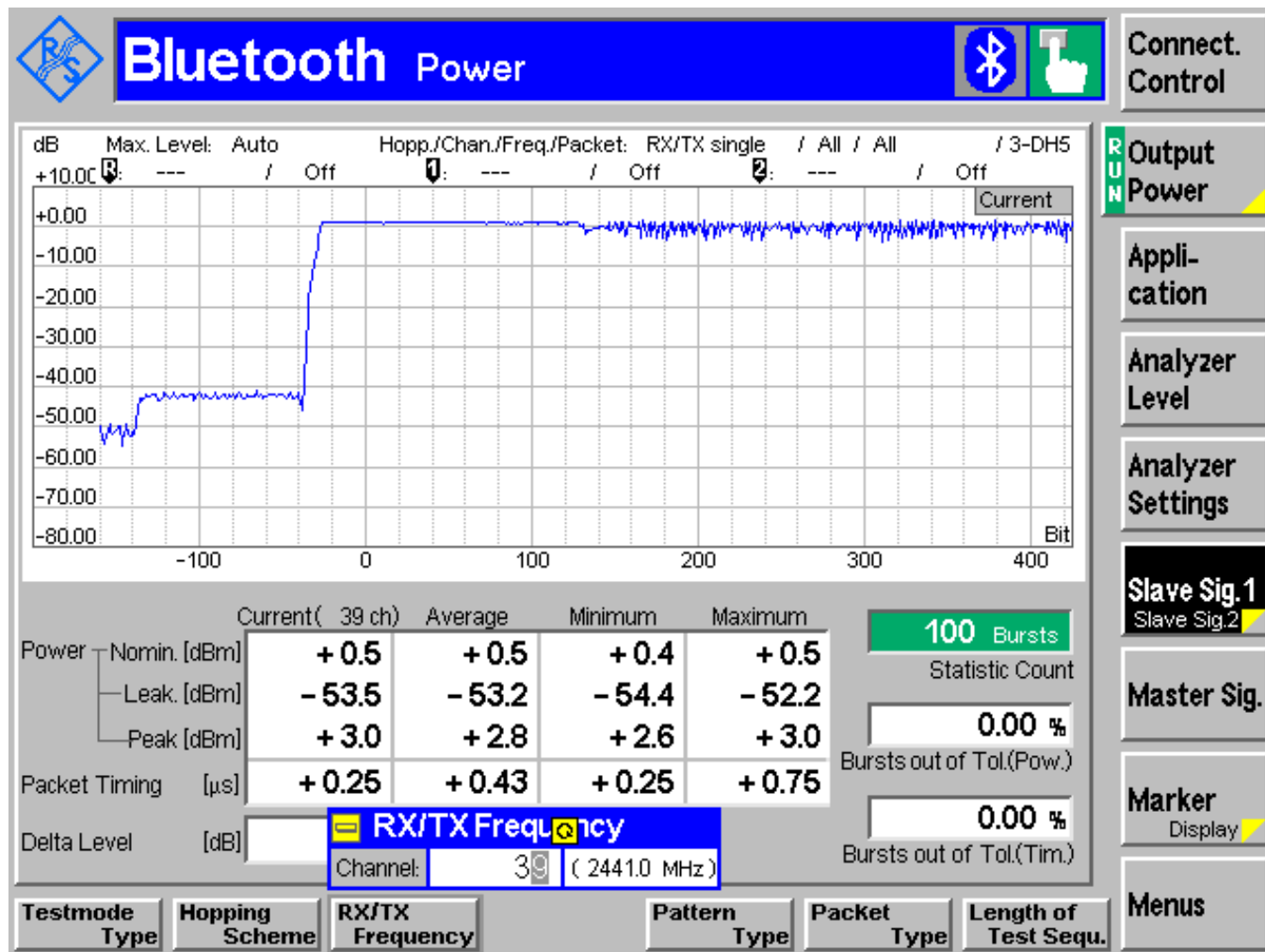




PLOT 6.1G

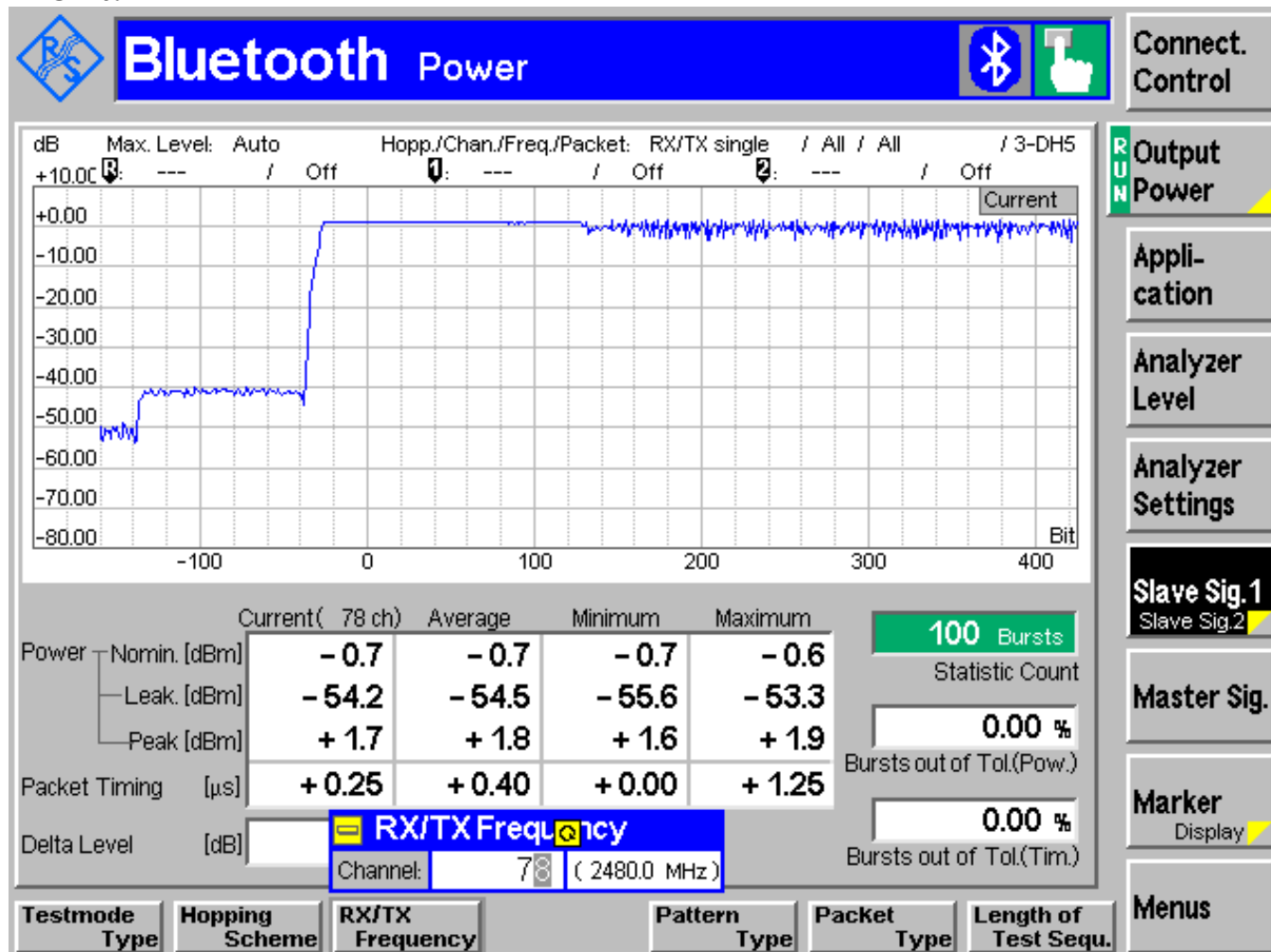


PLOT 6.1H





PLOT 6.11





6.2 EIRP

6.2.1 LIMIT SUB CLAUSE § 15.247 (b) (1) (2) (3) (4) and RSS-210 Annex 8.4(2) & A8.4(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.

6.2.2 Test Results

Note: Radiated tests contain results with measurement maximized according to the procedure defined in ANSI C63.4.

EIRP: GFSK

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)		2402	2441	2480
T_{nom}(23)°C	V_{nom}VDC	4.501	3.616	1.772
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}VDC	4.646	3.491	1.292
Measurement uncertainty		±0.5dBm		

EIRP: 8DPSK

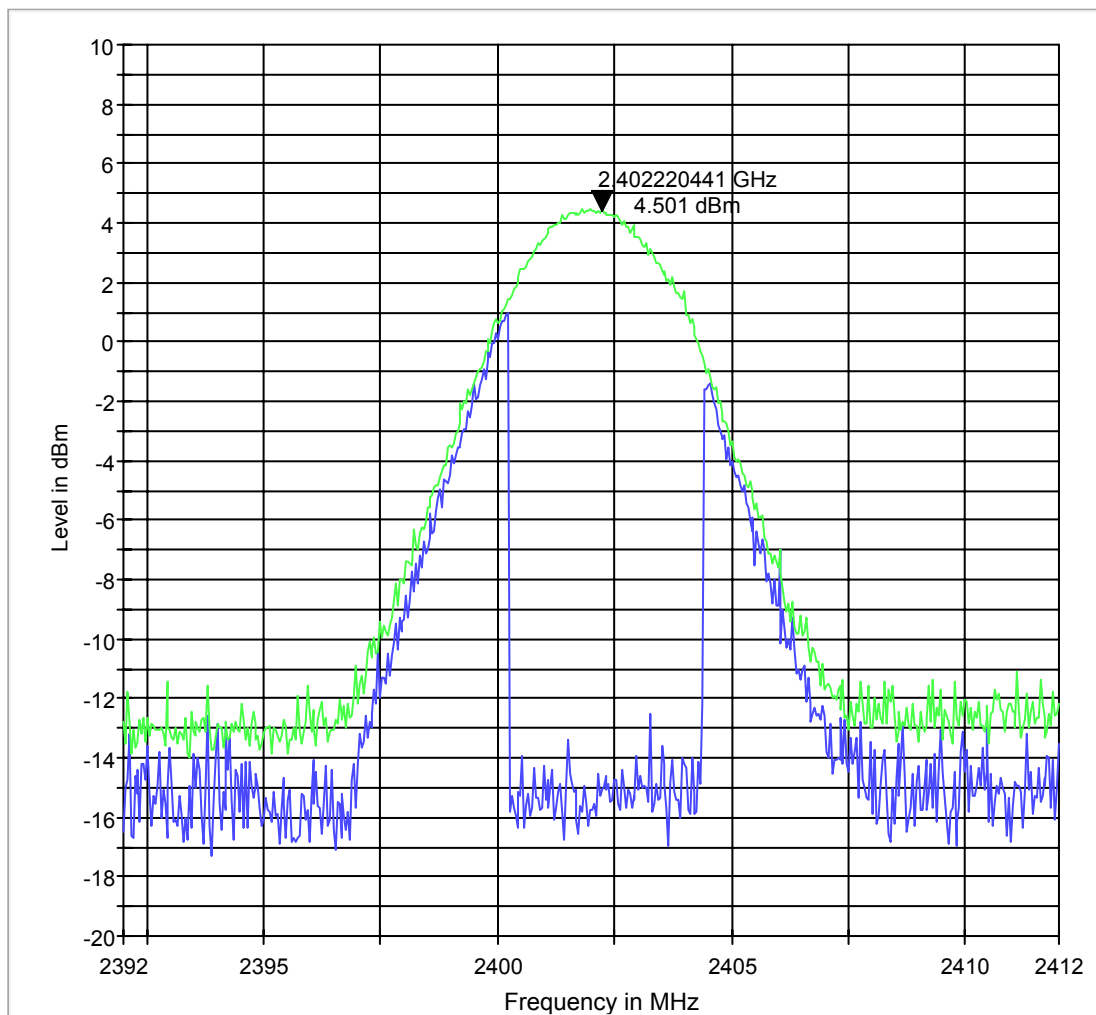
TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)		2402	2441	2480
T_{nom}(23)°C	V_{nom}VDC	4.689	3.344	1.390
Measurement uncertainty		±0.5dBm		



PLOT 6.2.2A

GFSK CH0

EIRP BT L

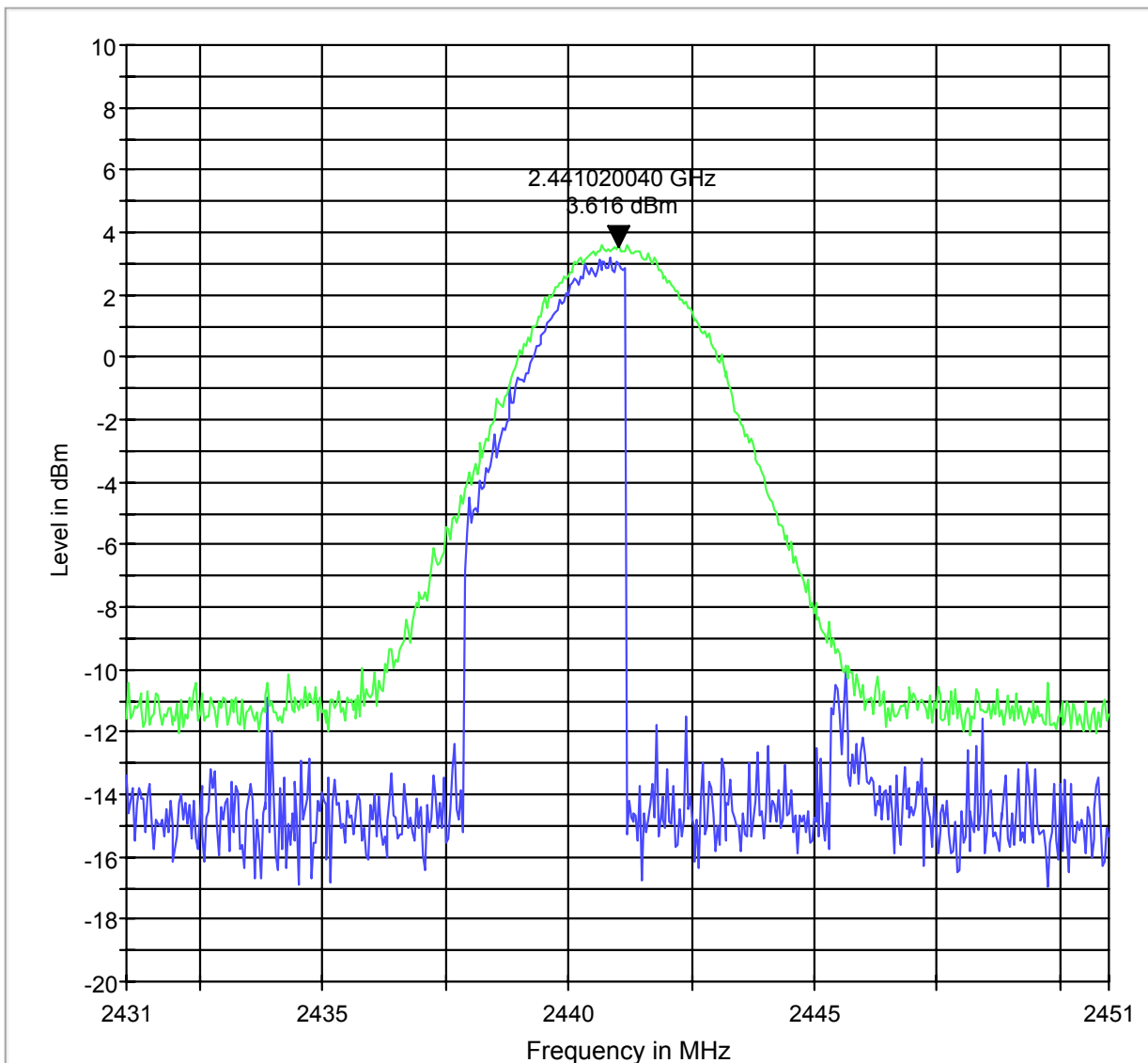


— MaxPeak-ClearWrite — MaxPeak-MaxHold



PLOT 6.2.2B
GFSK CH39

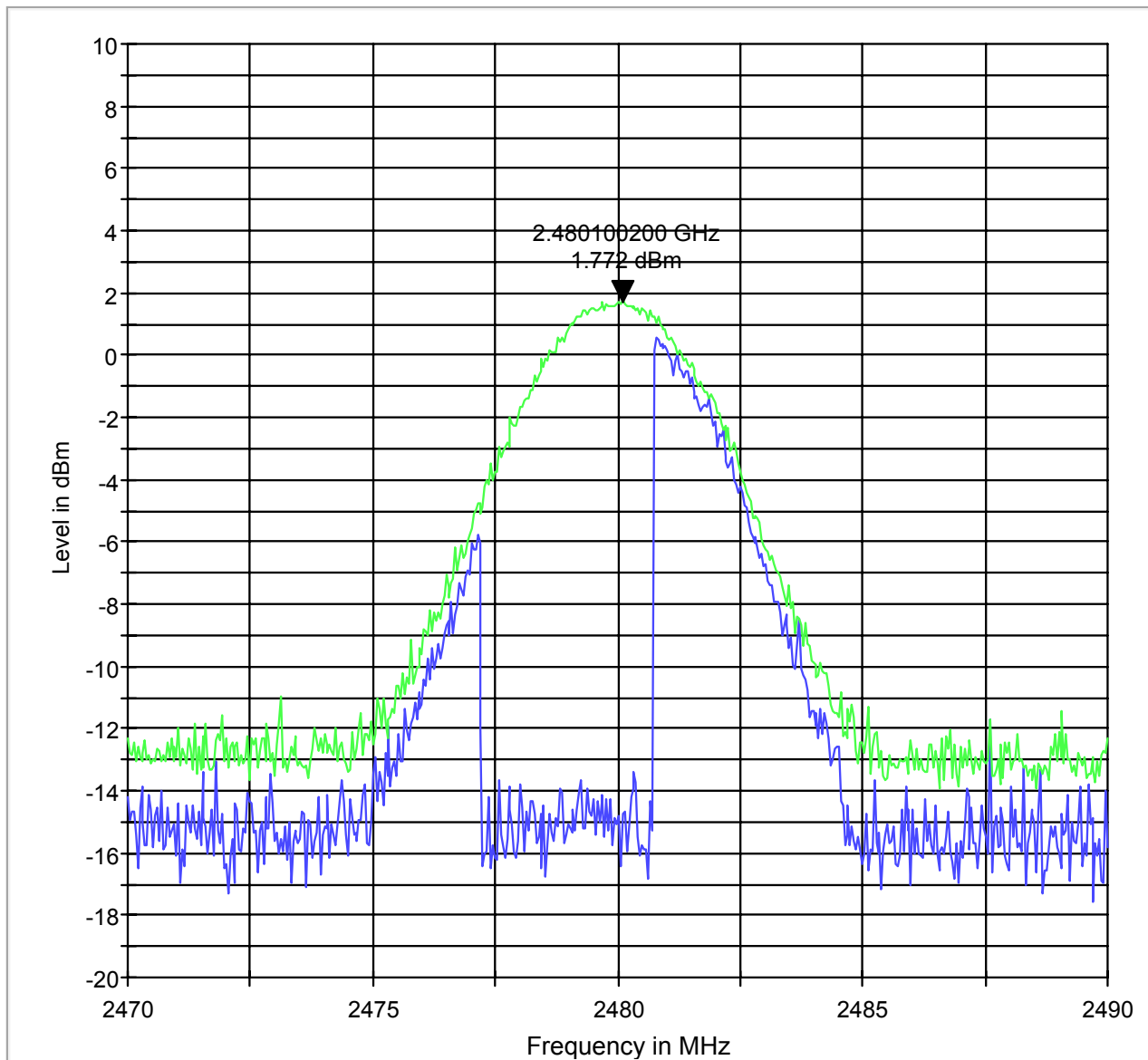
EIRP BT M



— MaxPeak-ClearWrite — MaxPeak-MaxHold

PLOT 6.2.2C
GFSK CH78

EIRP BT H

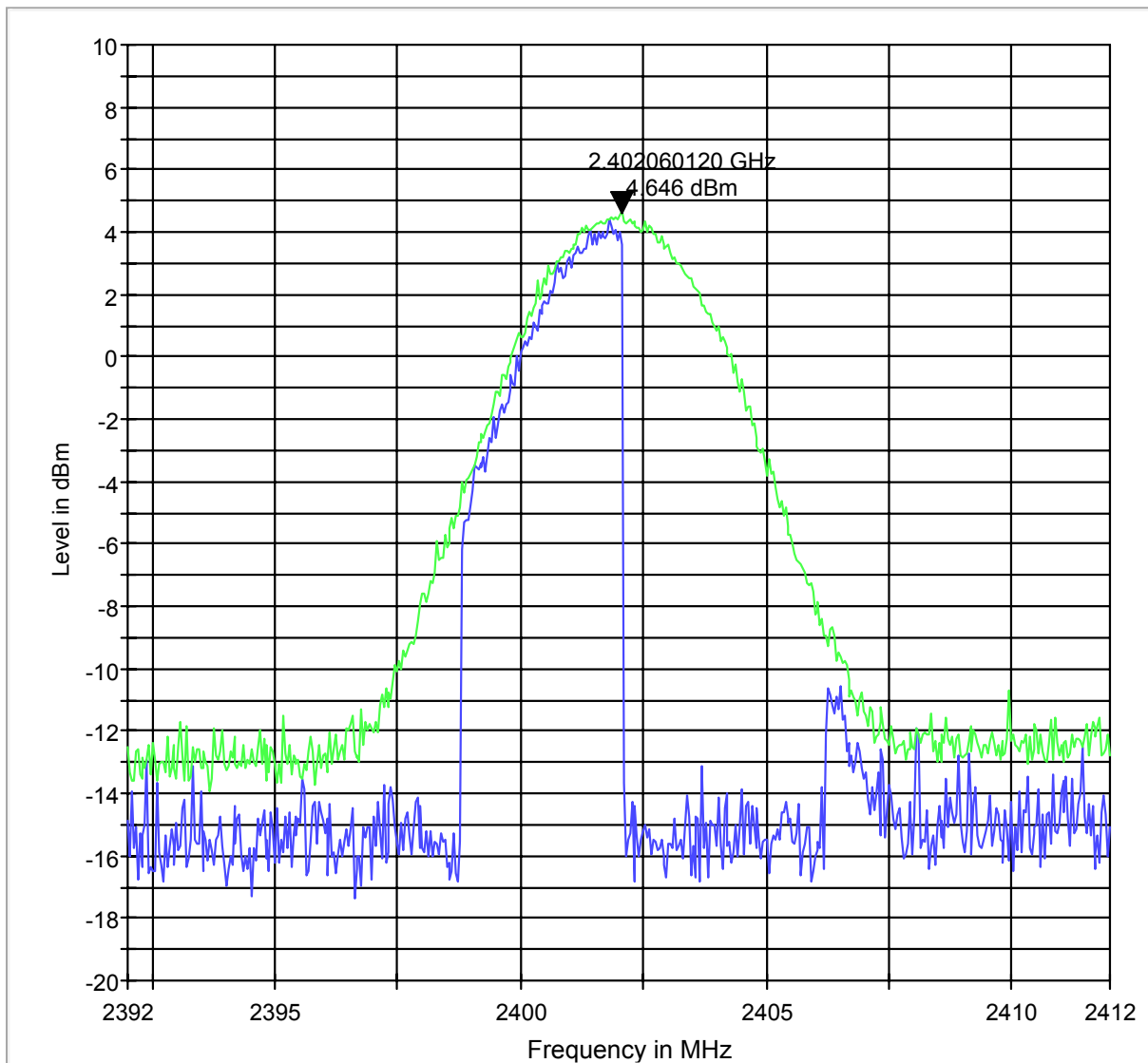


— MaxPeak-ClearWrite — MaxPeak-MaxHold



PLOT 6.2.2D
 $\pi / 4$ DQPSK CH0

EIRP BT L

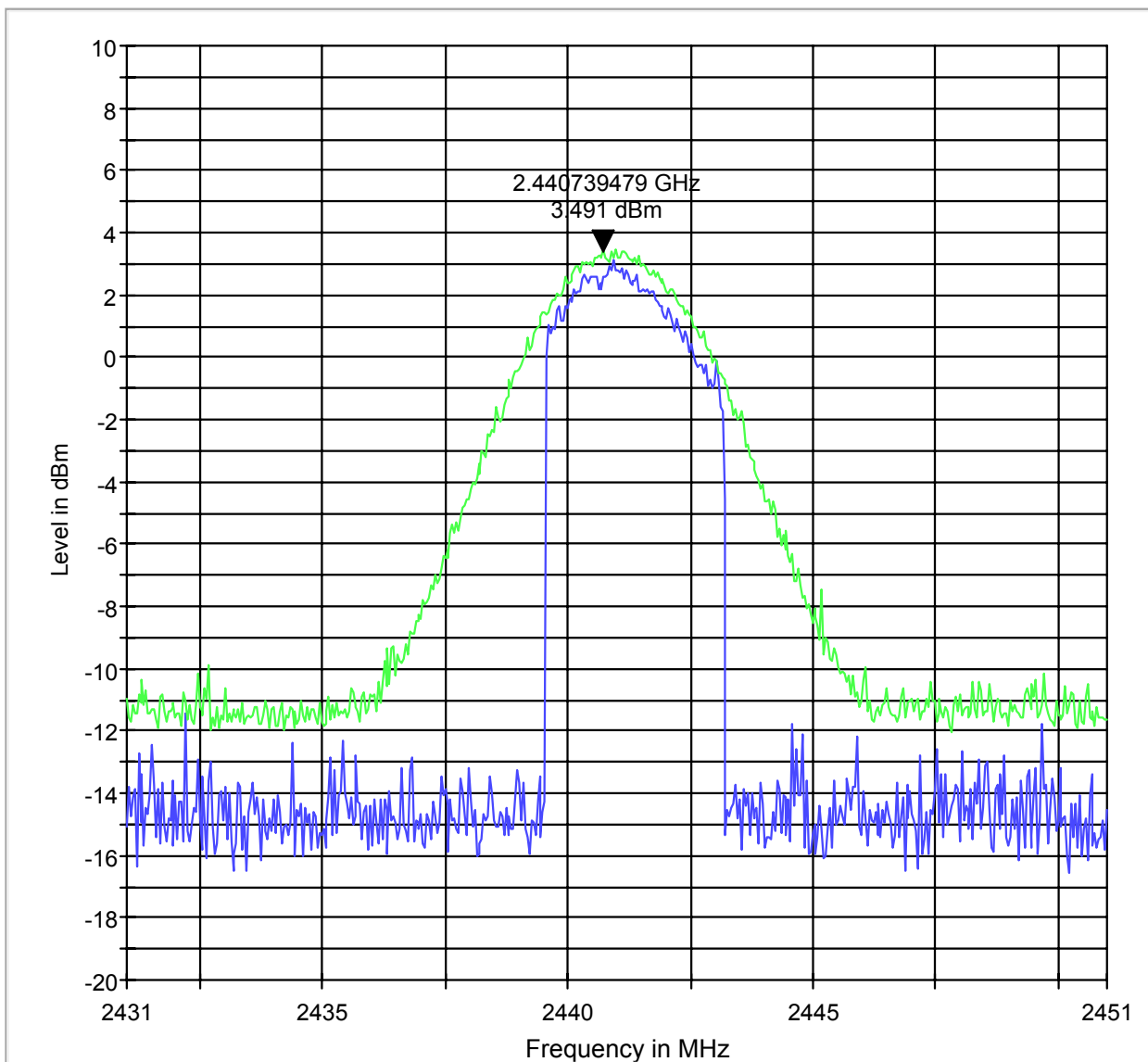


— MaxPeak-ClearWrite — MaxPeak-MaxHold



PLOT 6.2.2E
 $\pi / 4$ DQPSK CH39

EIRP BT M

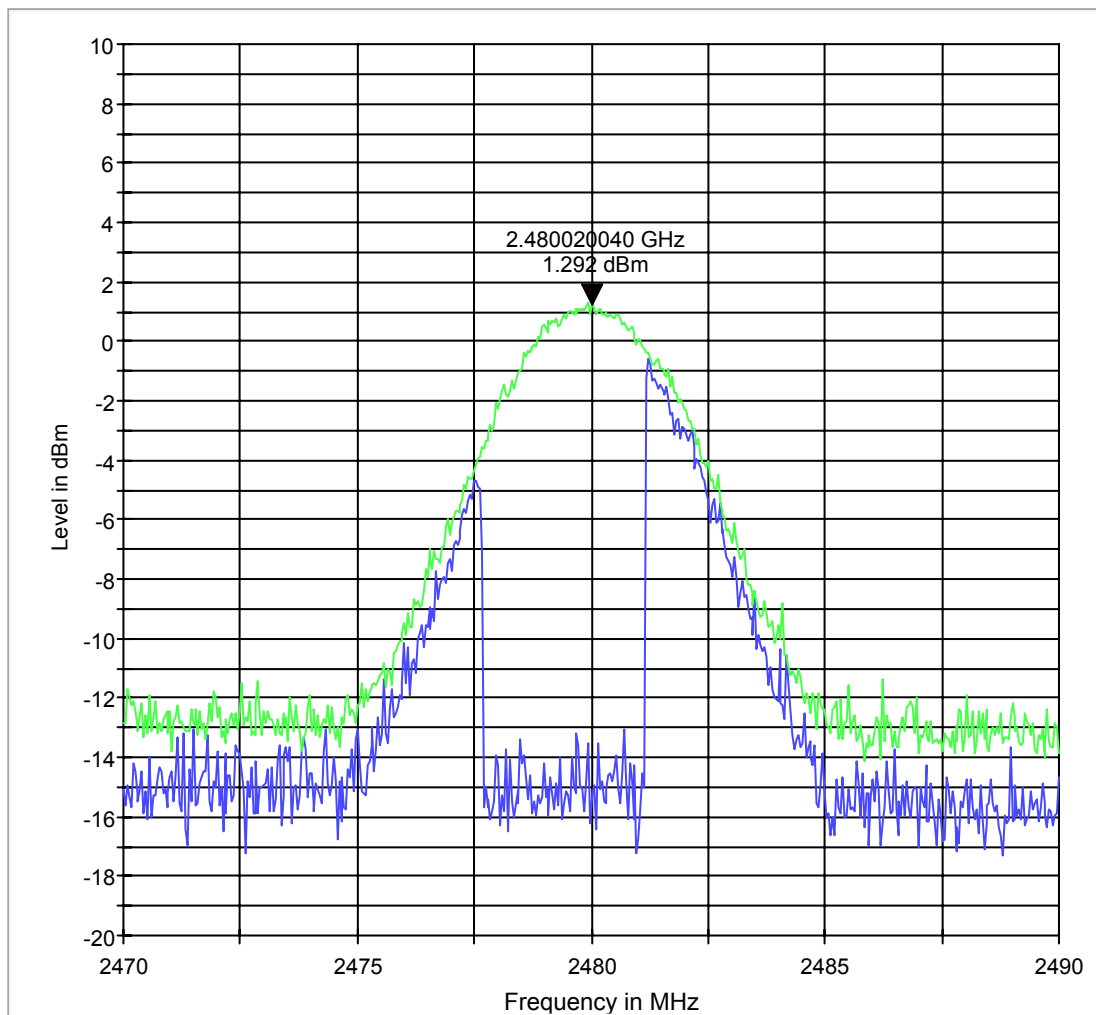


— MaxPeak-ClearWrite — MaxPeak-MaxHold



PLOT 6.2.2F
 $\pi / 4$ DQPSK CH78

EIRP BT H

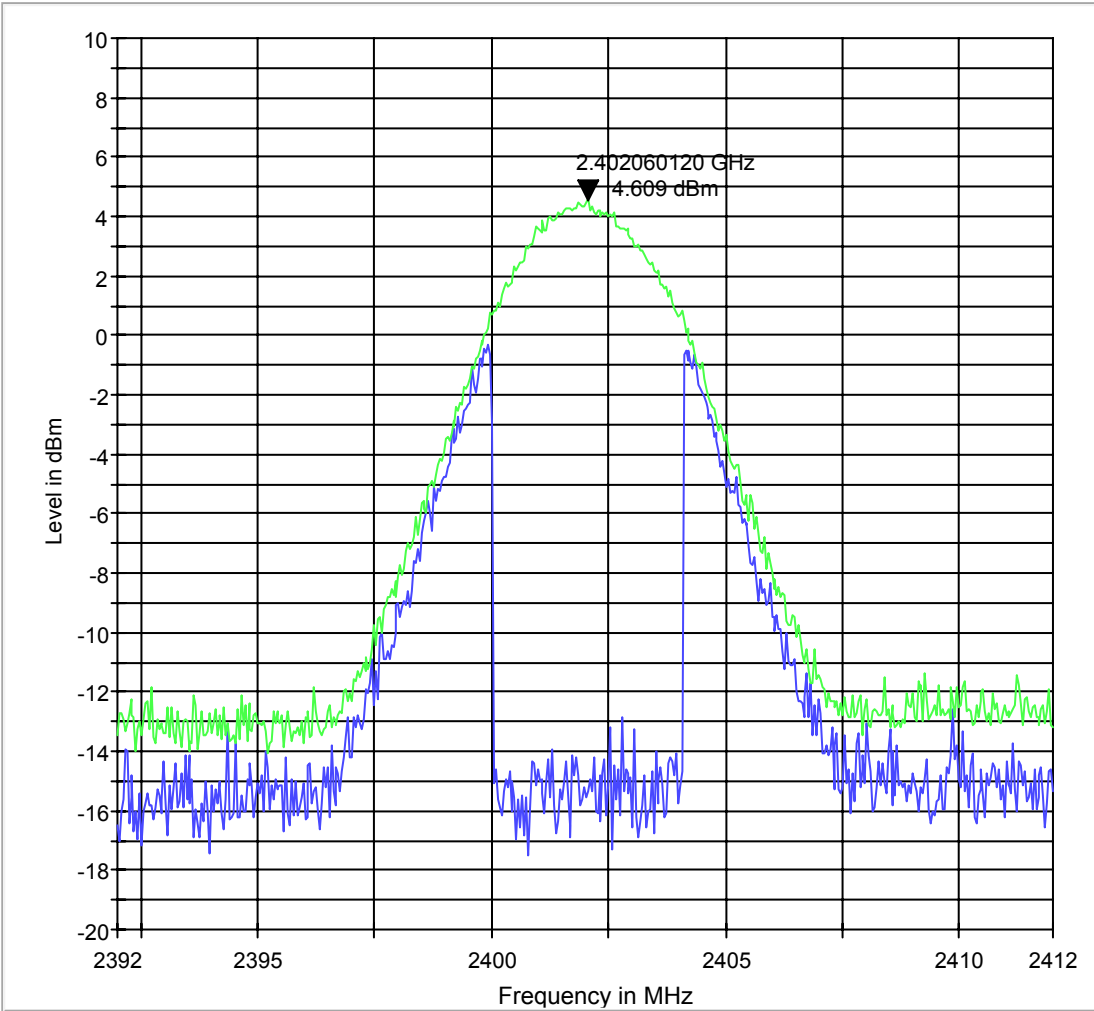


MaxPeak-ClearWrite MaxPeak-MaxHold



PLOT 6.2.2G
8 DPSK CH0

EIRP BT L

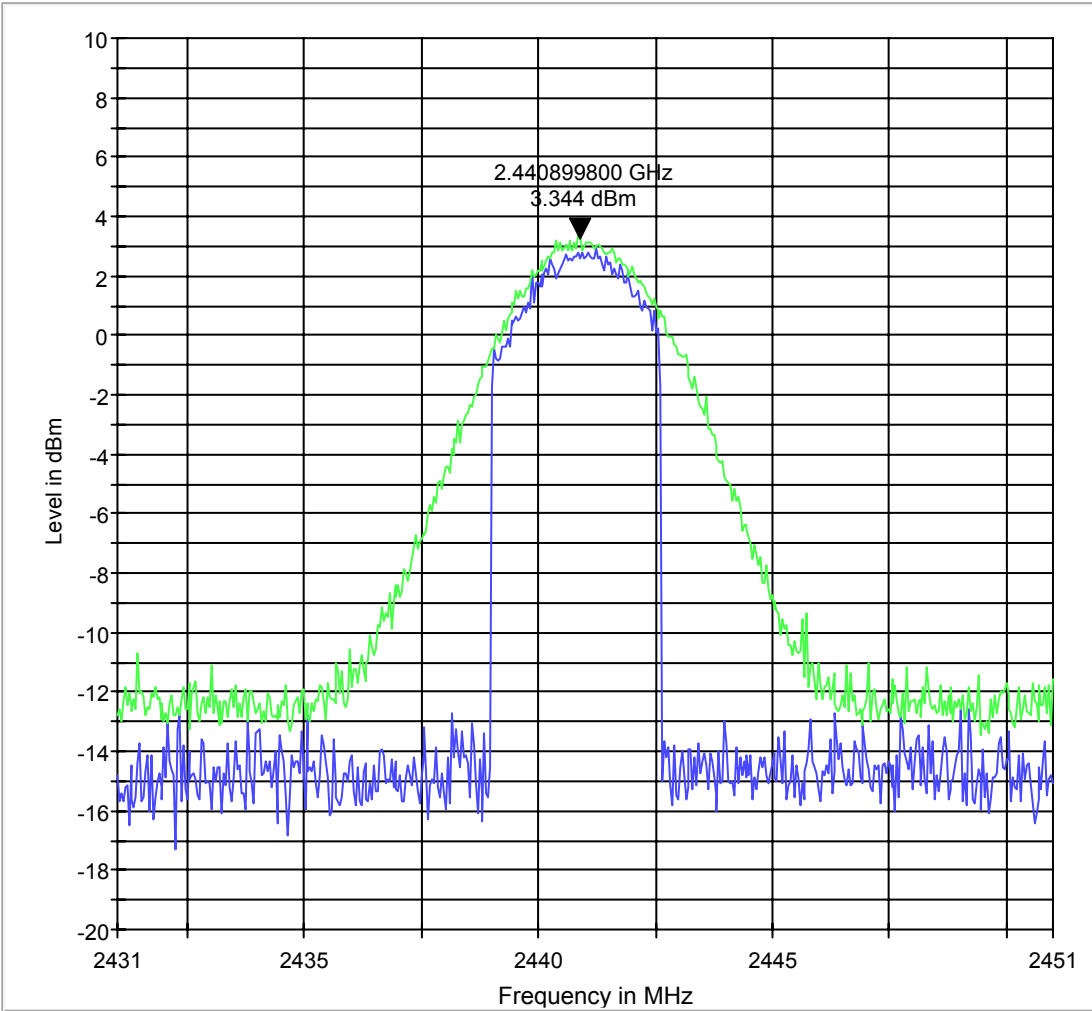


MaxPeak-ClearWrite MaxPeak-MaxHold



PLOT 6.2.2H
8 DPSK CH39

EIRP BT M

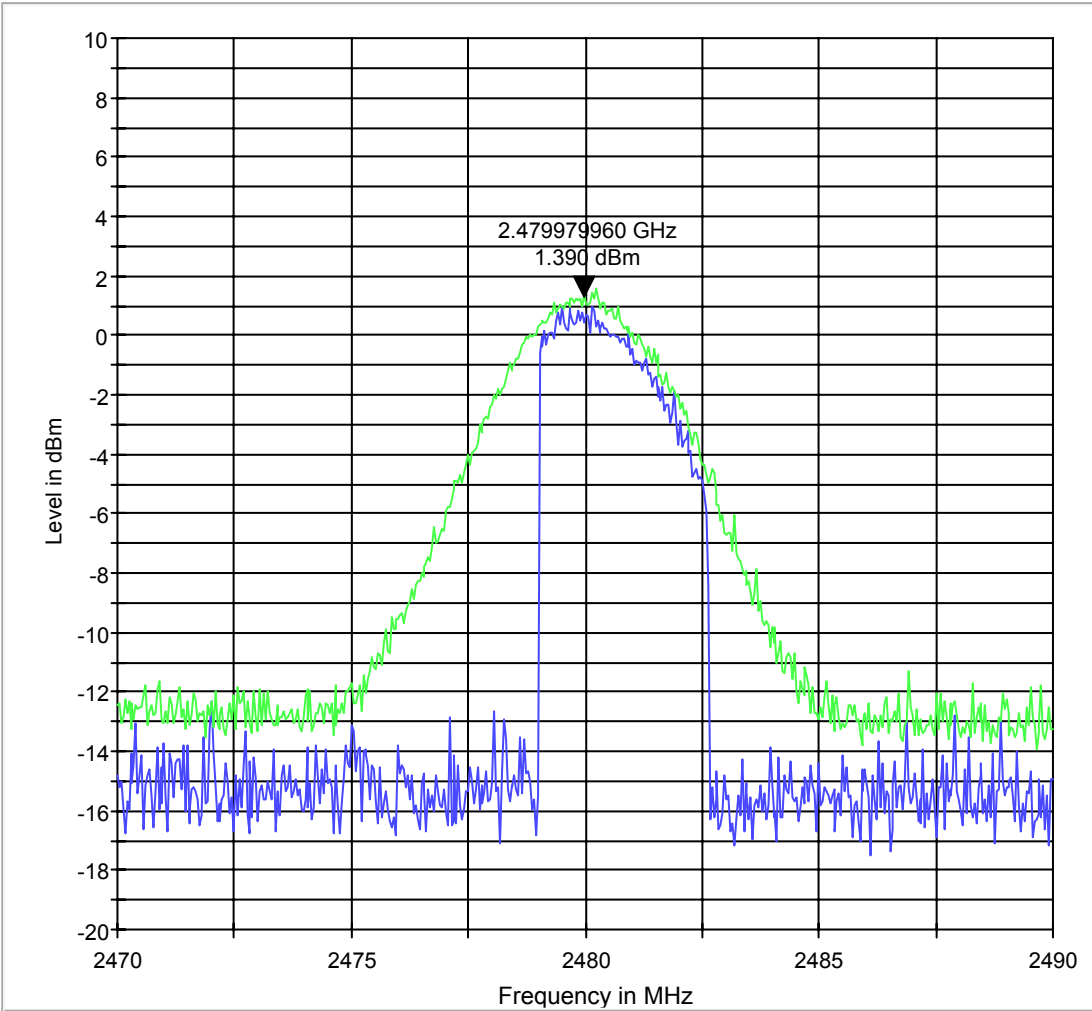


MaxPeak-ClearWrite MaxPeak-MaxHold



PLOT 6.2.21
8 DPSK CH78

EIRP BT H



MaxPeak-ClearWrite MaxPeak-MaxHold



6.3 20dB BANDWIDTH

6.3.1 LIMIT SUB CLAUSE § 15.247 (a) (1) (i) (ii) (iii) and RSS-210 Annex 8.4.1.a

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.

6.3.2 RESULTS:

GFSK

Channel No.	Frequency (MHz)	20dB BW (MHz)	Result (Fail/Pass)
0	2402	0.922	PASS
39	2441	0.923	PASS
78	2480	0.924	PASS

Pi/4 DQPSK

Channel No.	Frequency (MHz)	20dB BW (MHz)	Result (Fail/Pass)
0	2402	1.317	PASS
39	2441	1.315	PASS
78	2480	1.313	PASS

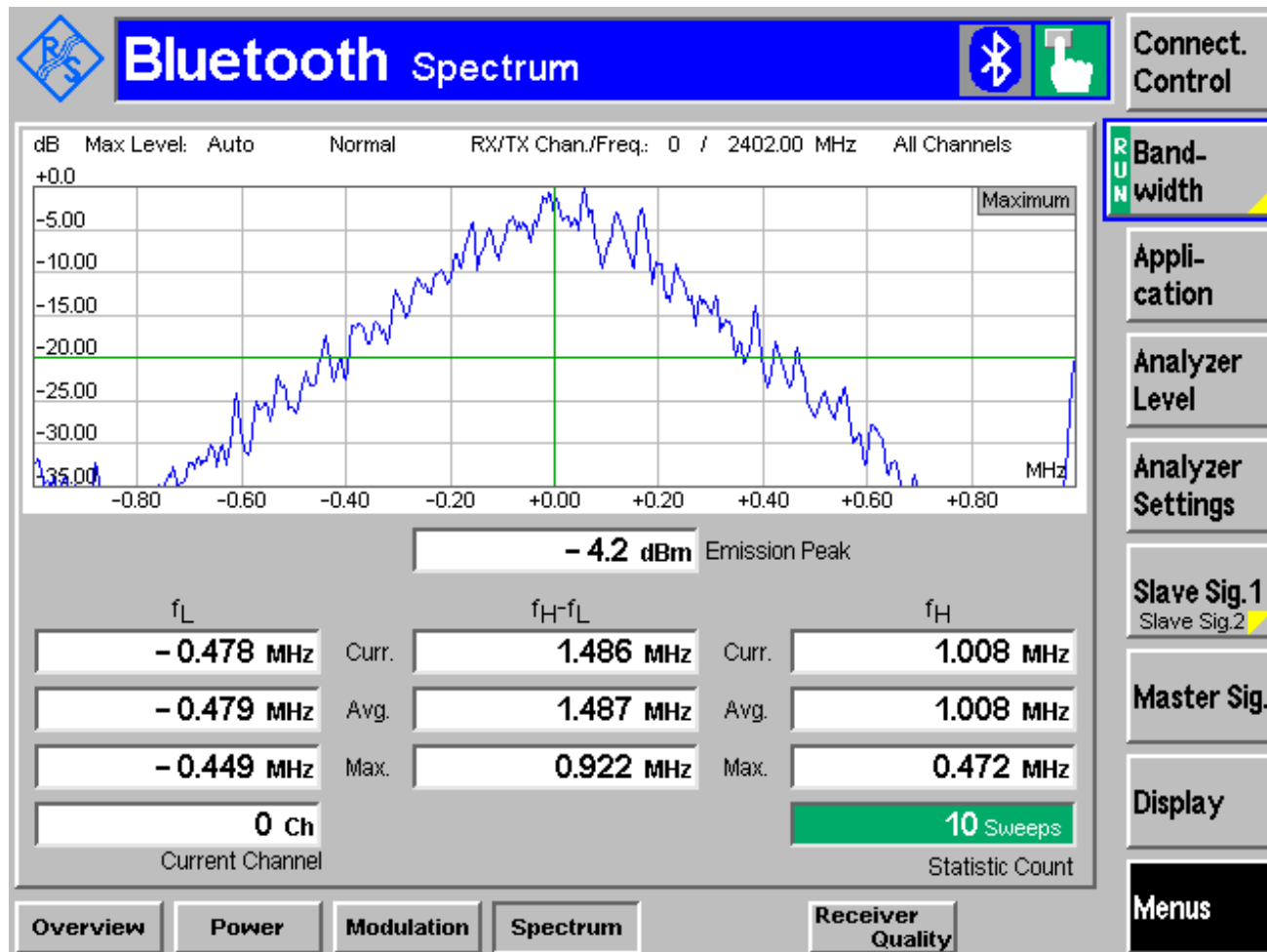
8DPSK

Channel No.	Frequency (MHz)	20dB BW (kHz)	Result (Fail/Pass)
0	2402	1.284	PASS
39	2441	1.283	PASS
78	2480	1.263	PASS



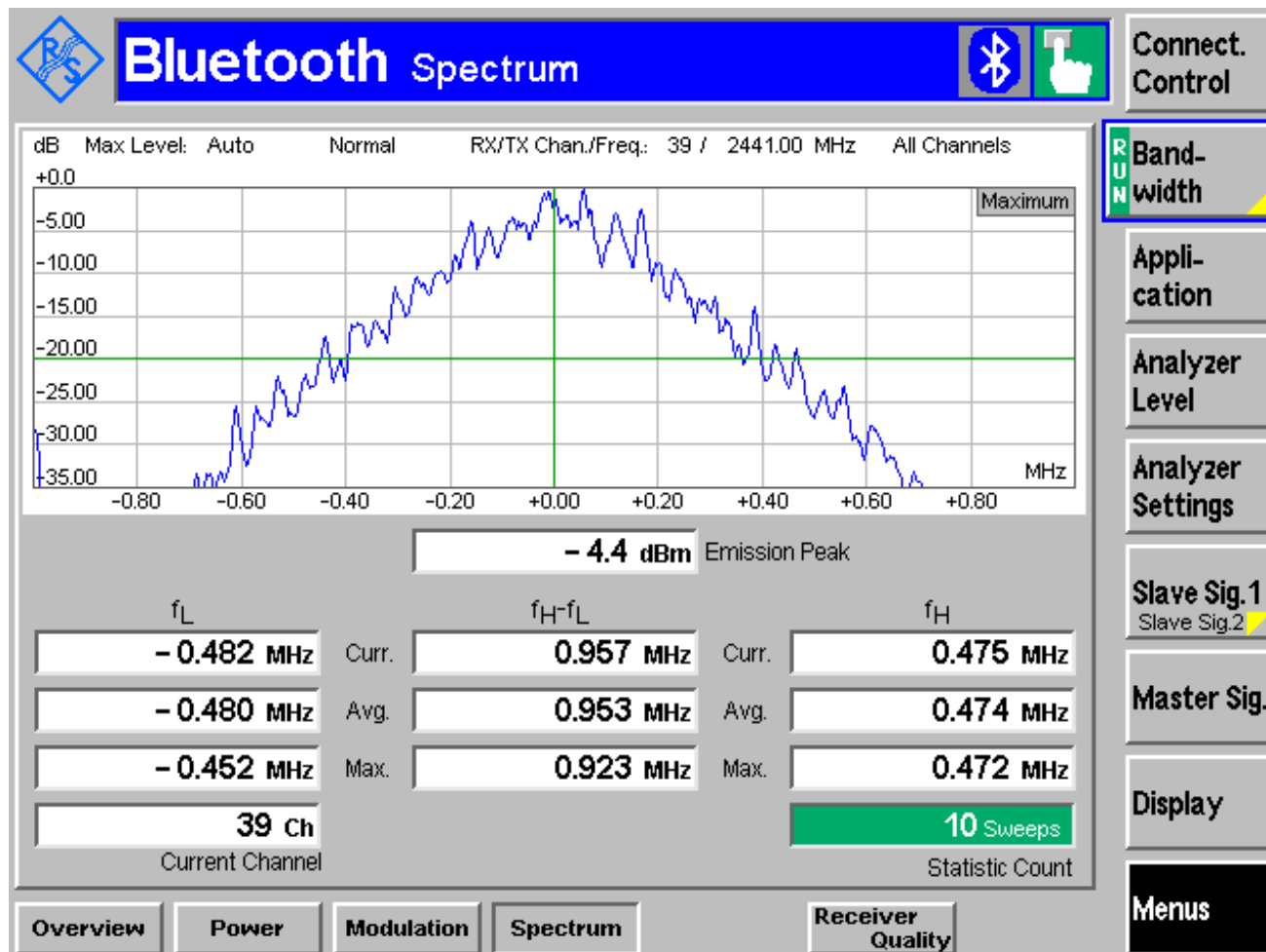
PLOT 6.3.2 A

(2402 MHz) GFSK





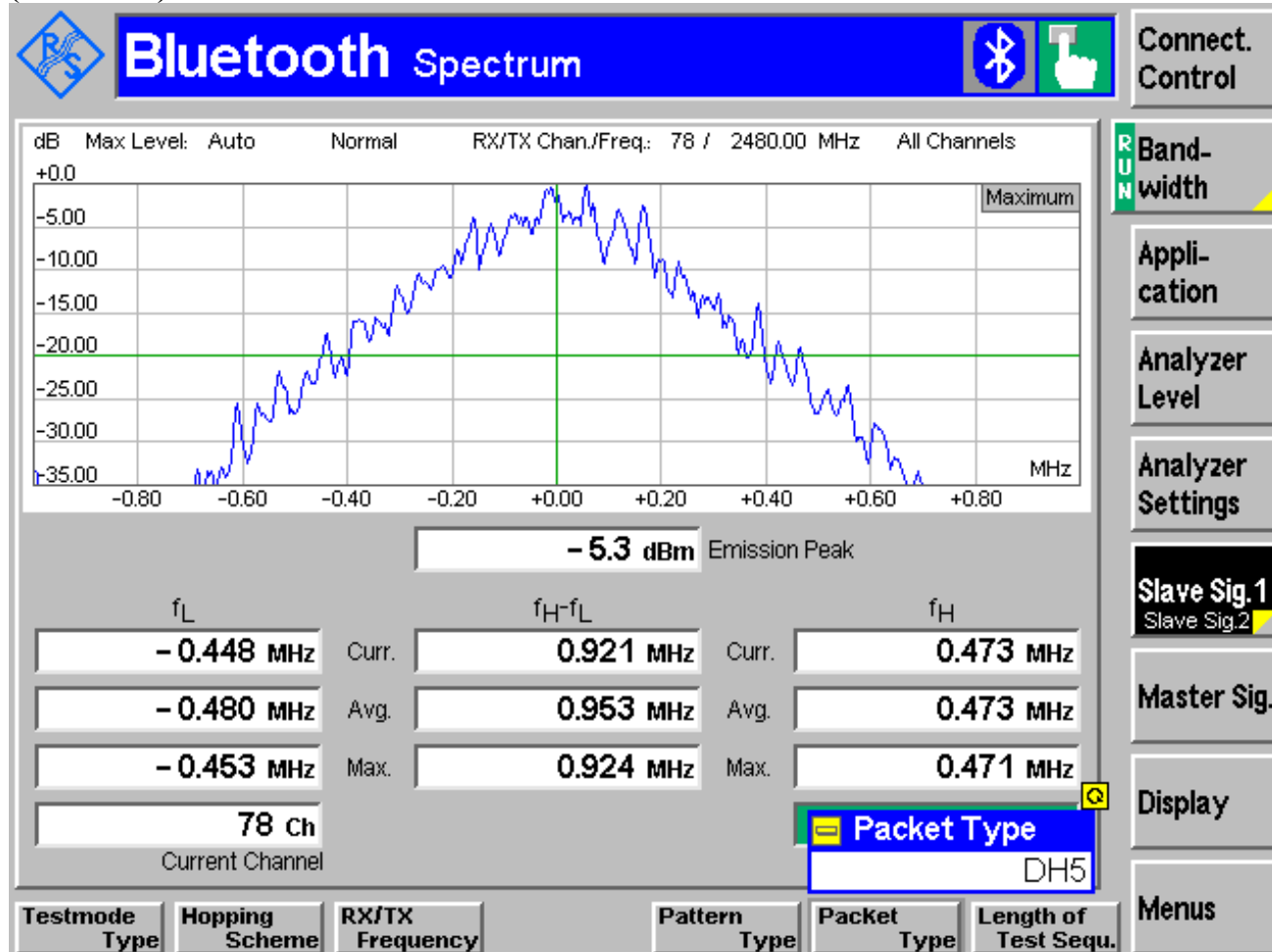
PLOT 6.3.2 B
(2441 MHz) GFSK





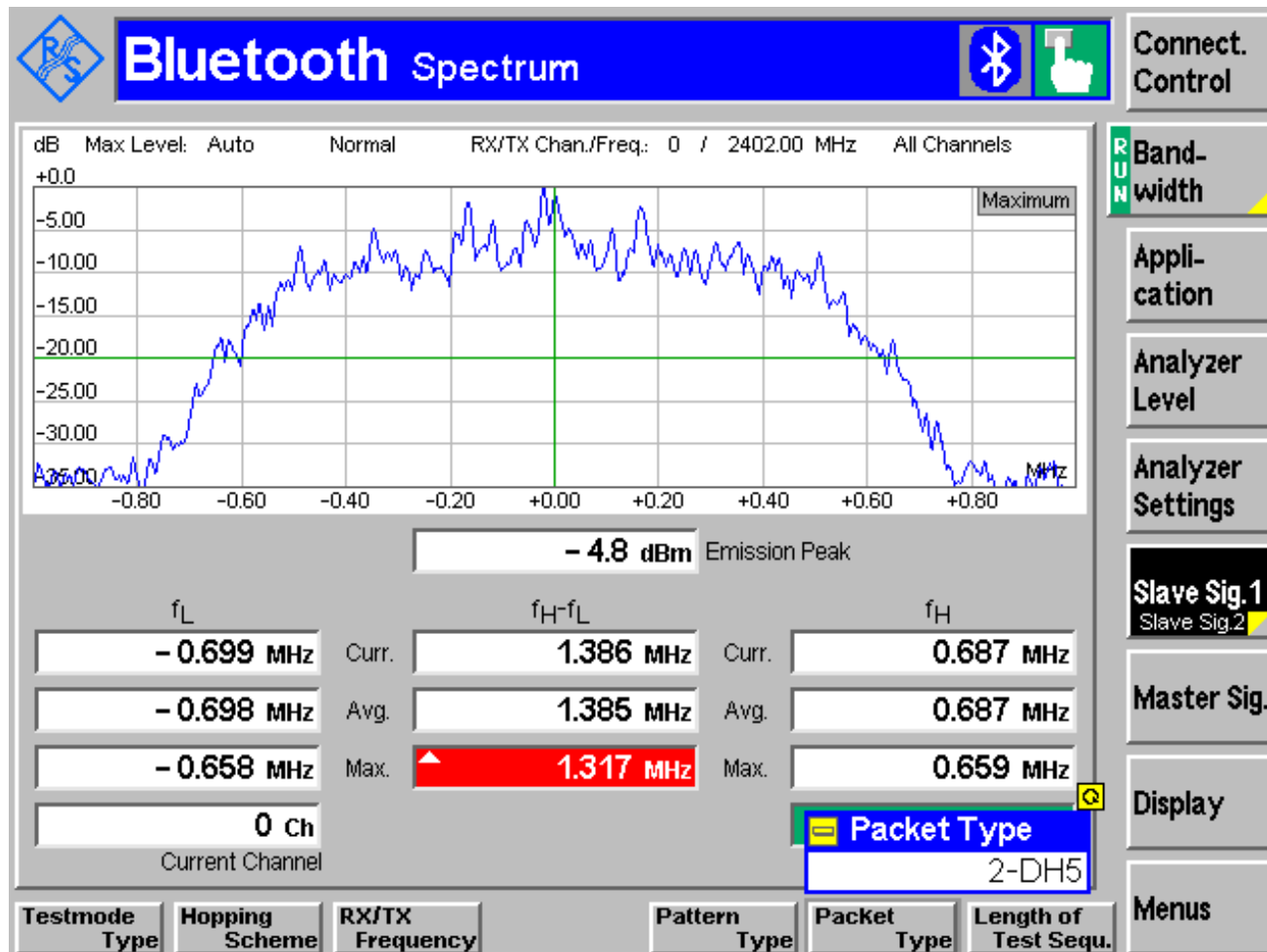
PLOT 6.3.2 C

(2480 MHz) GFSK

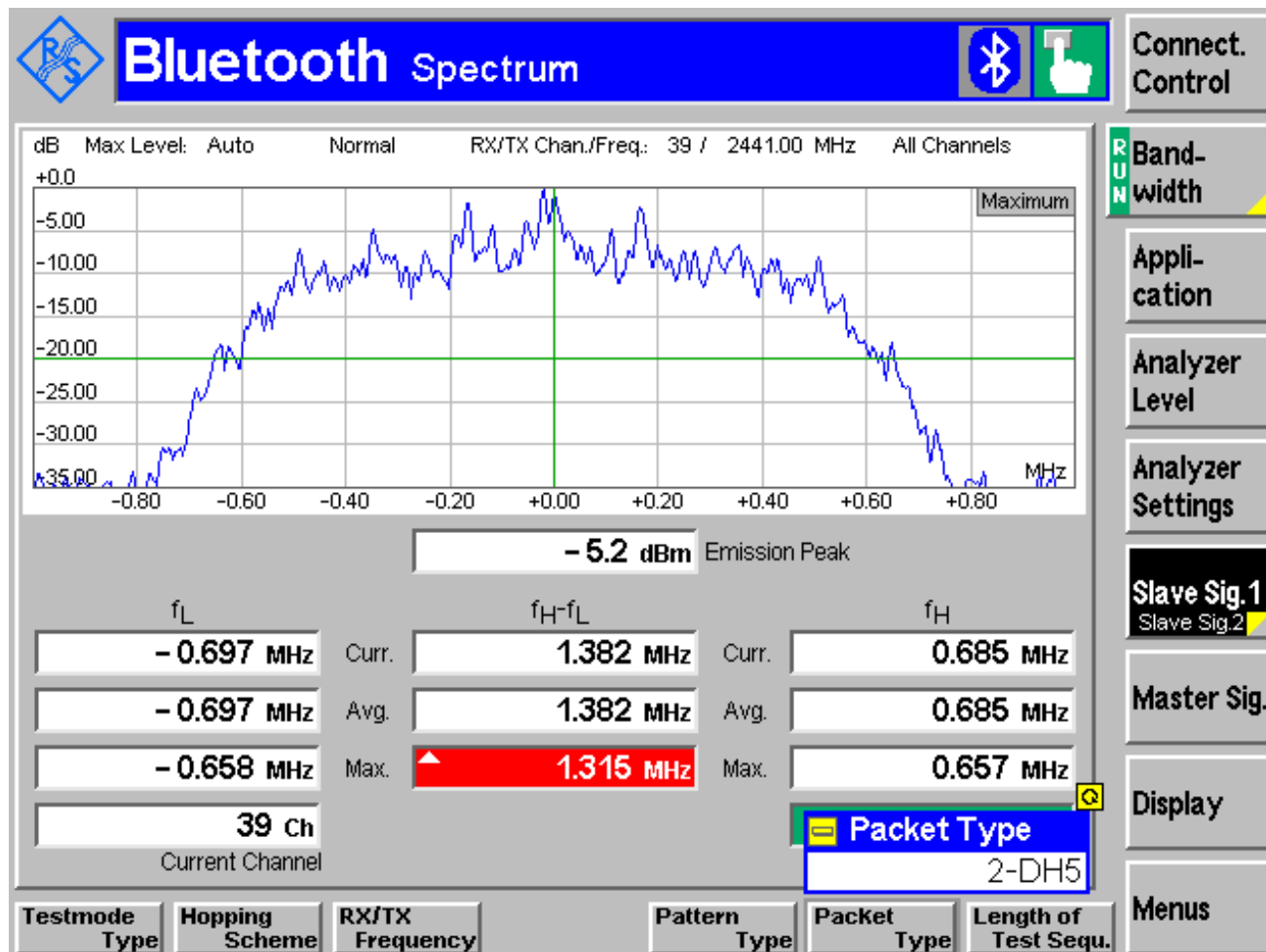




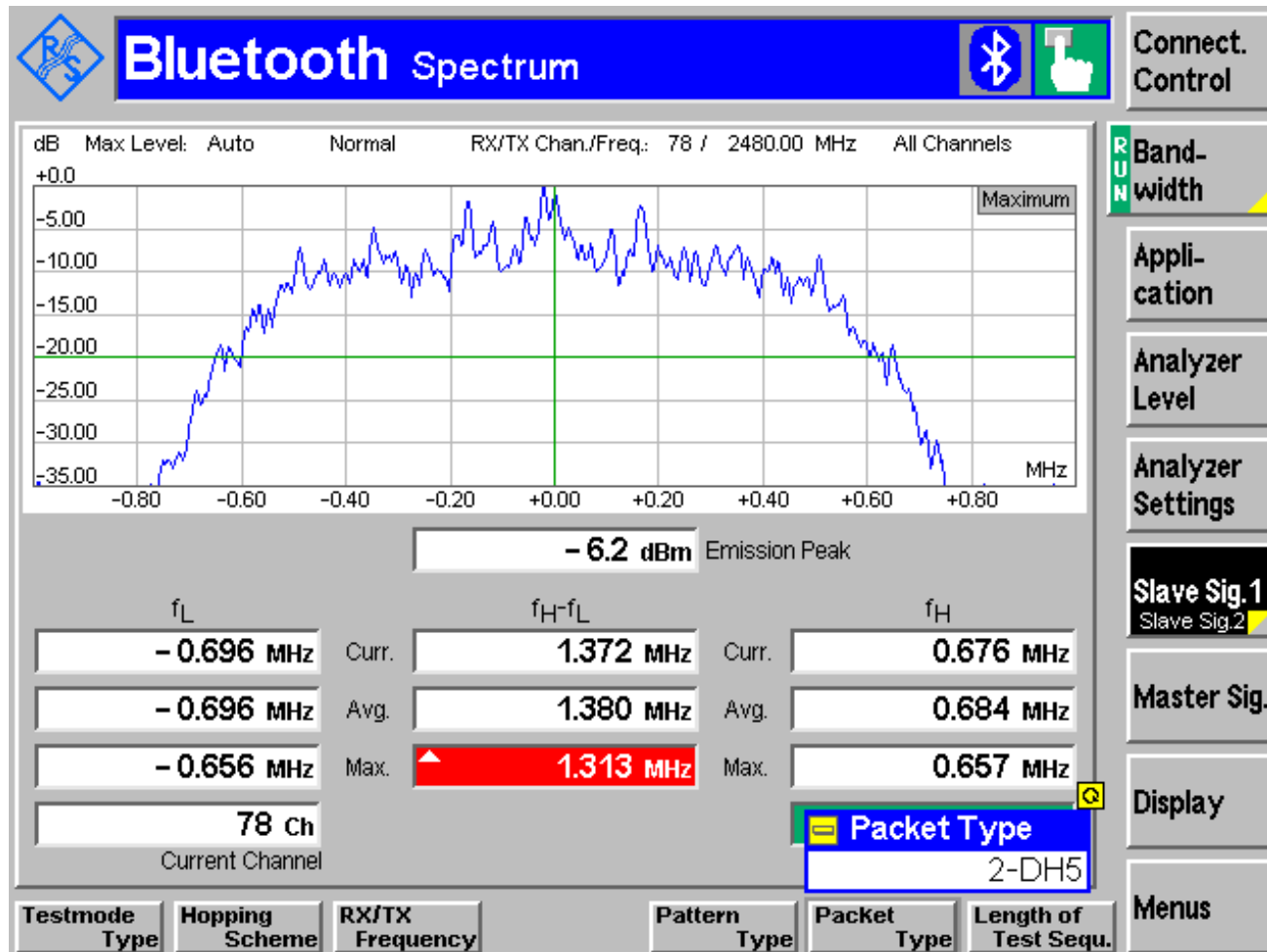
PLOT 6.3.2 D
 (2402 MHz) $\pi / 4$ DQPSK



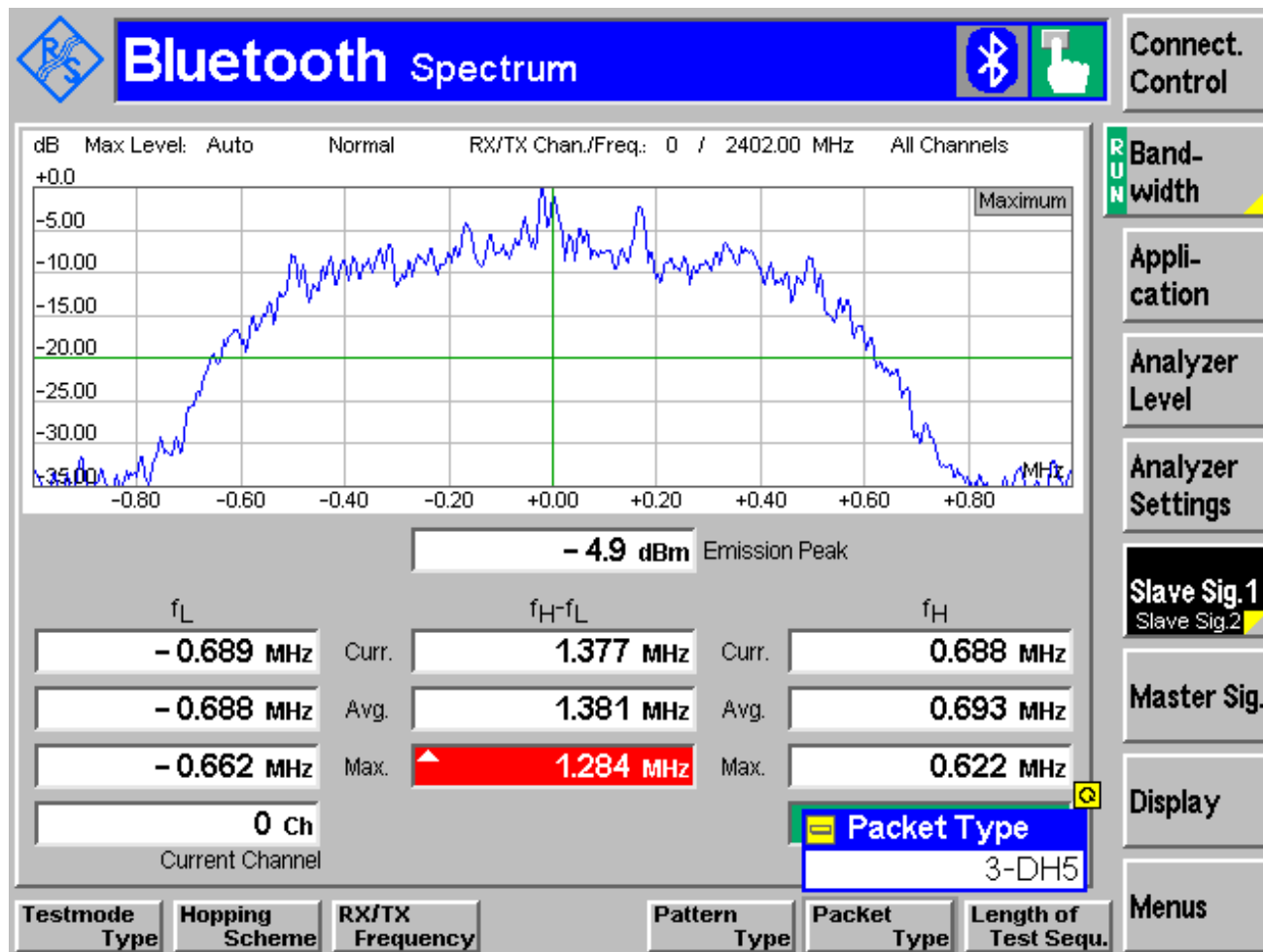
PLOT 6.3.2 E
 (2441 MHz) $\pi / 4$ DQPSK



PLOT 6.3.2 F
 (2480 MHz) $\pi / 4$ DQPSK

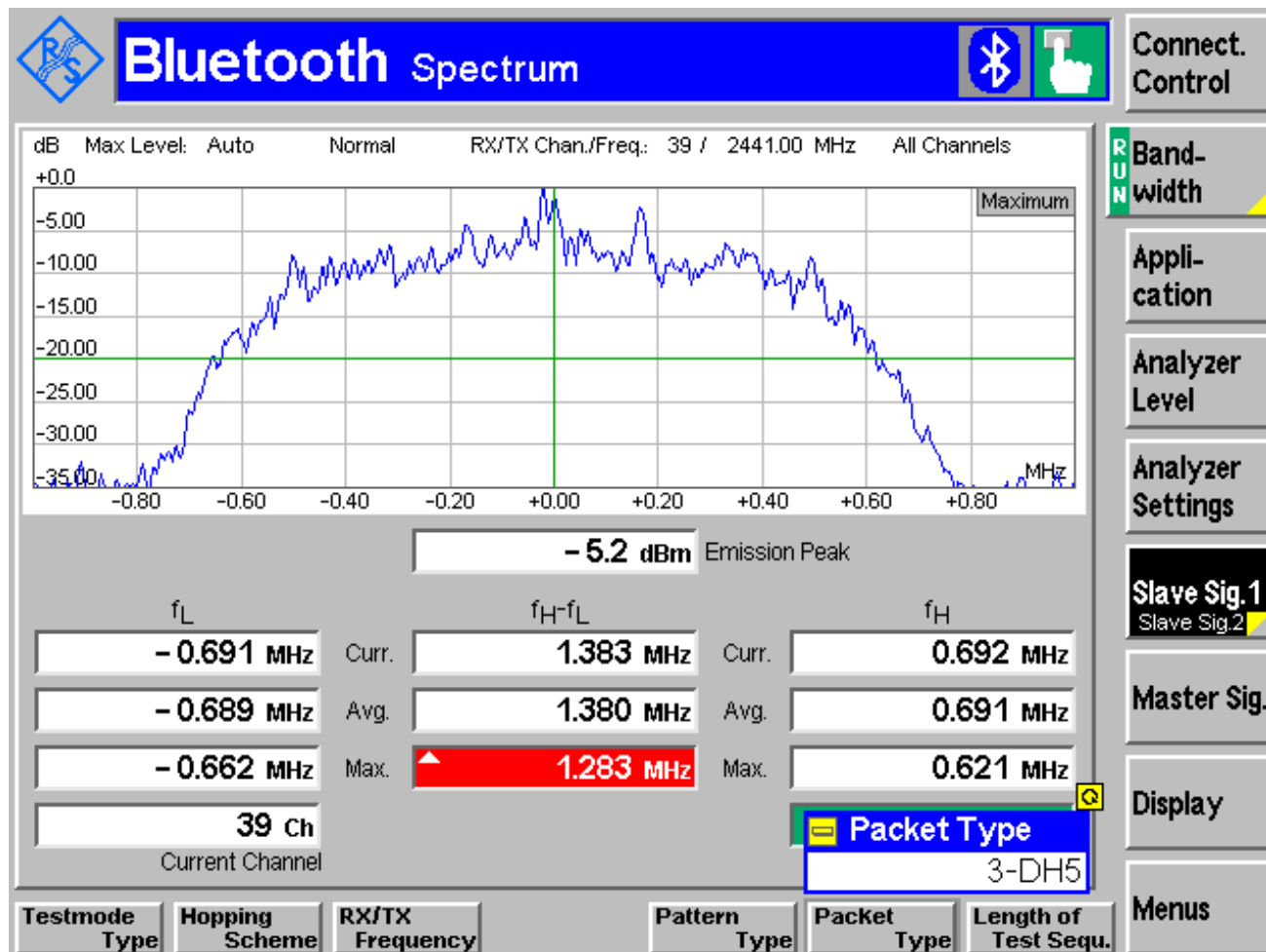


PLOT 6.3.2 G
(2402 MHz) 8DPSK

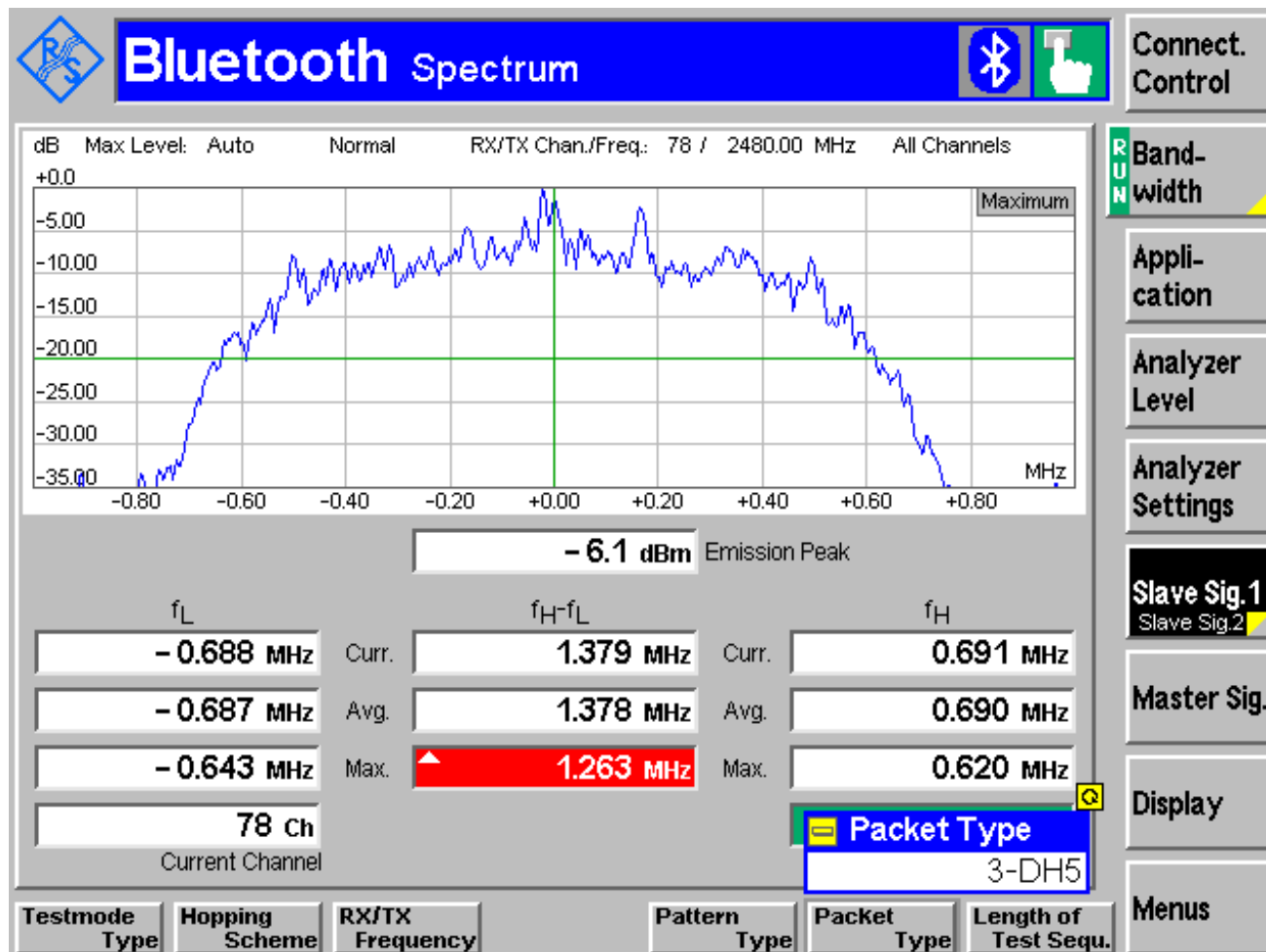




PLOT 6.3.2 H
(2441 MHz) 8DPSK



PLOT 6.3.2 I
(2480 MHz) 8DPSK



6.4 CARRIER FREQUENCY SEPARATION

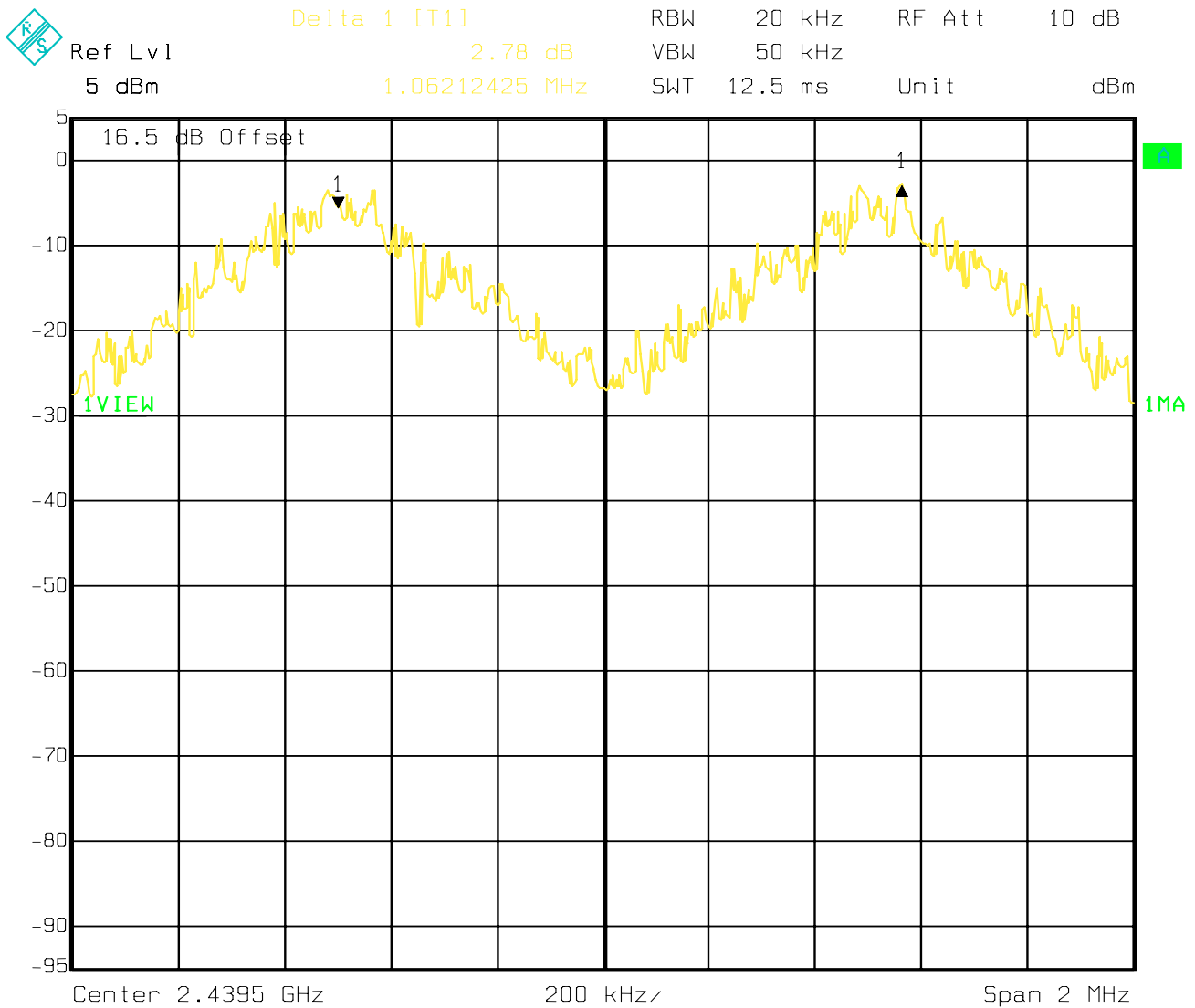
6.4.1 LIMIT SUB CLAUSE § 15.247 (a) (1) (i) (ii) (iii) and RSS-210 Annex 8.4.1.b

SEPARATION
> 25 KHz or > 20 dB BANDWIDTH

6.4.2 RESULTS:

TEST CONDITIONS		SEPARATION(MHz)
T_{nom}(23)°C	V_{nom}VDC	1.062

PLOT 6.4.2





6.5 NUMBER OF HOPPING CHANNELS

6.5.1 LIMIT SUB CLAUSE § 15.247 (a) (1) (iii) and RSS-210 Annex 8.4 (2)

NUMBER OF CHANNELS
> 15

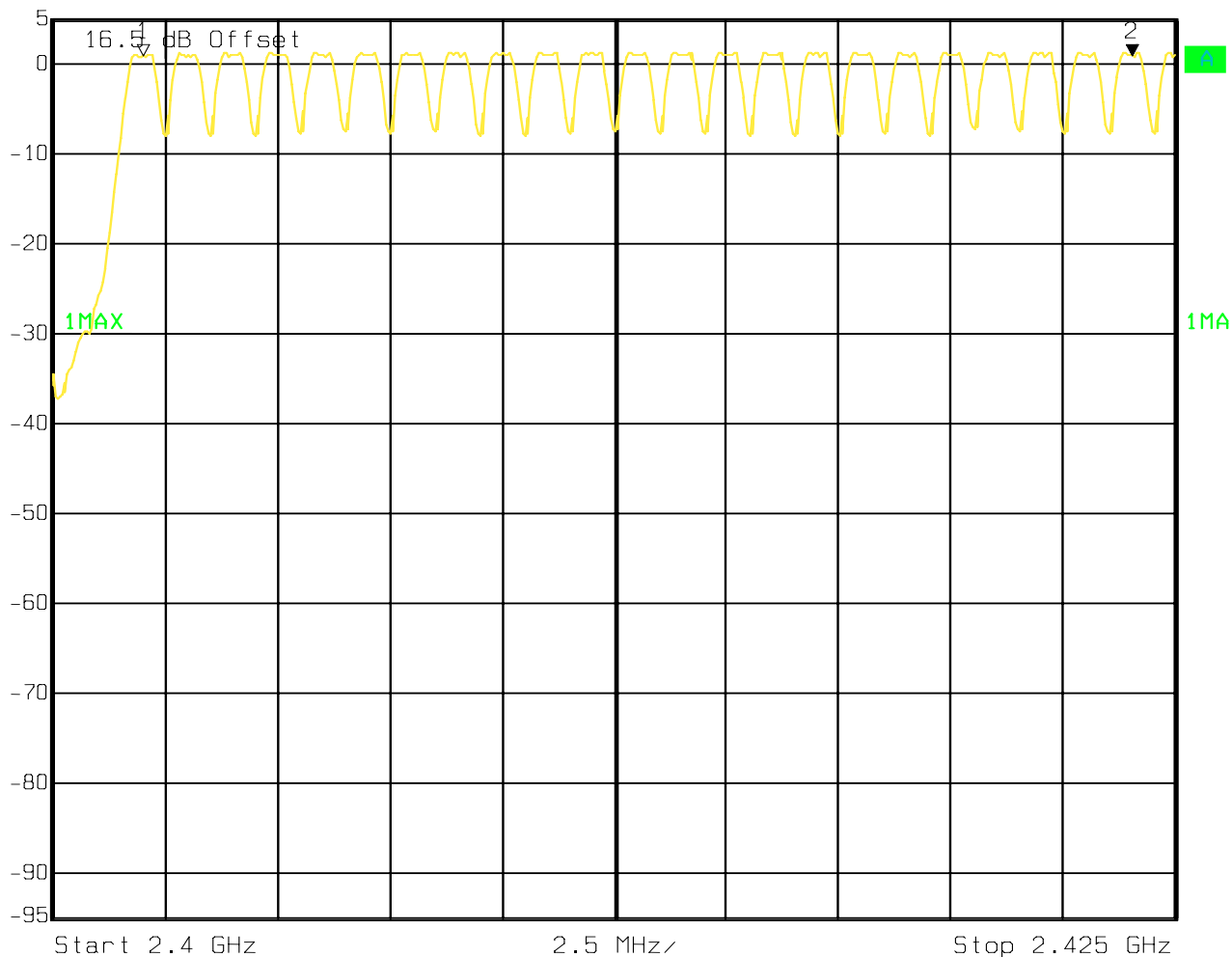
6.5.2 RESULTS:

TEST CONDITIONS		NUMBER OF CHANNELS
T_{nom}(23)°C	V_{nom}VDC	79



PLOT 6.5.2A

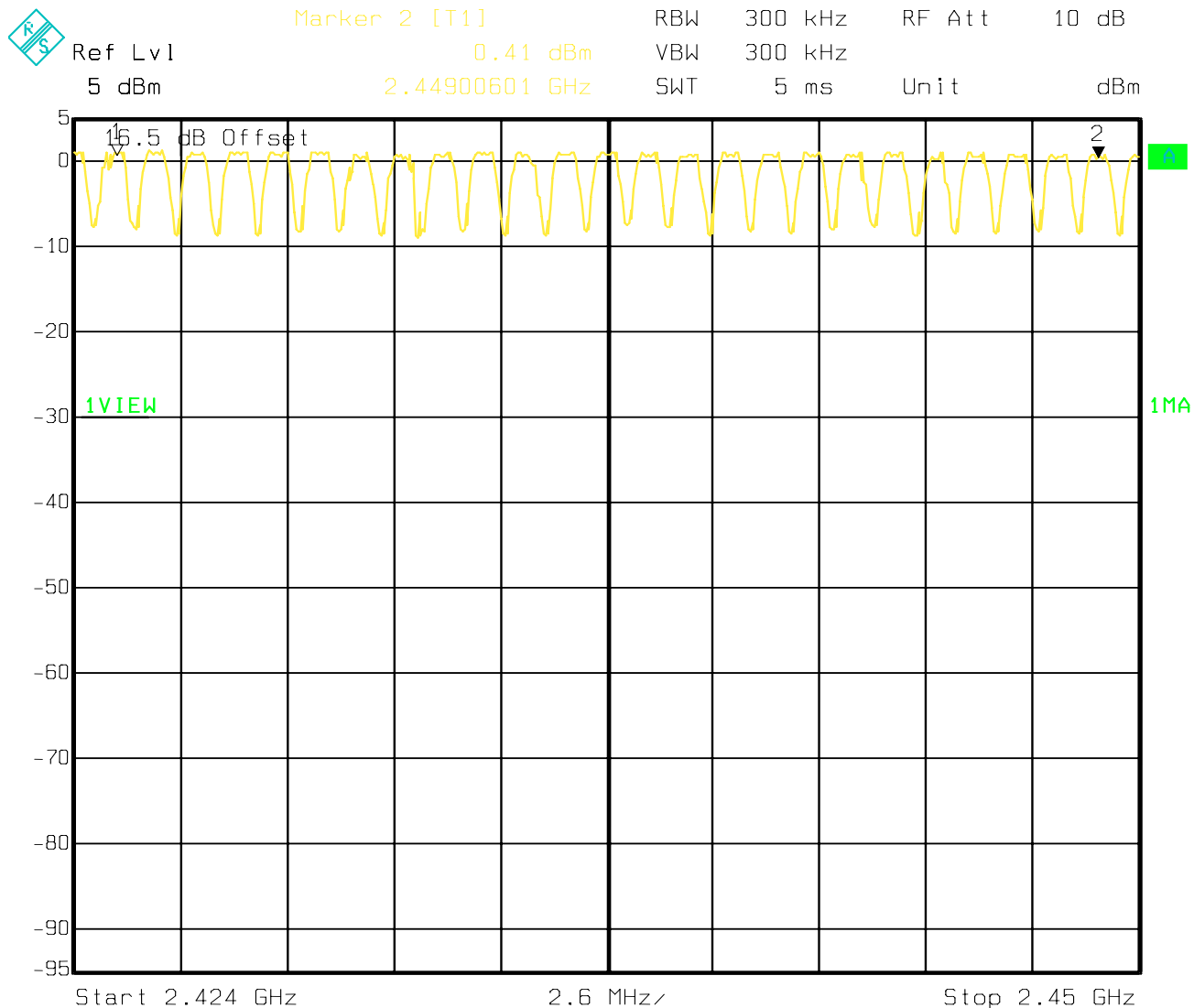
RS Marker 2 [T1] RBW 300 kHz RF Att 10 dB
 Ref Lvl 0.79 dBm VBW 300 kHz
 5 dBm 2.42404810 GHz SWT 5 ms Unit dBm



Date: 10.DEC.2009 14:22:41



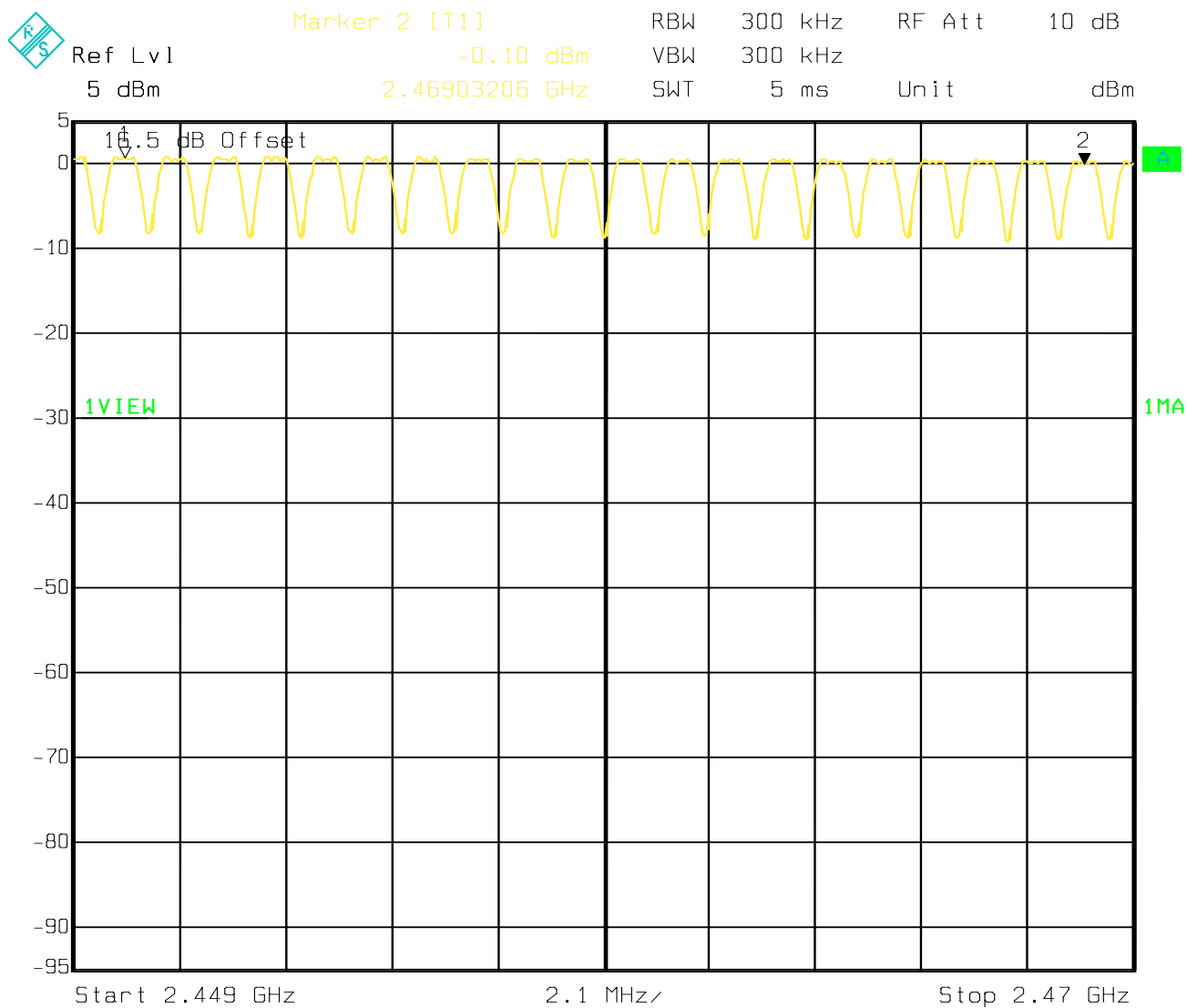
PLOT 6.5.2B



Date: 10.DEC.2009 14:25:30



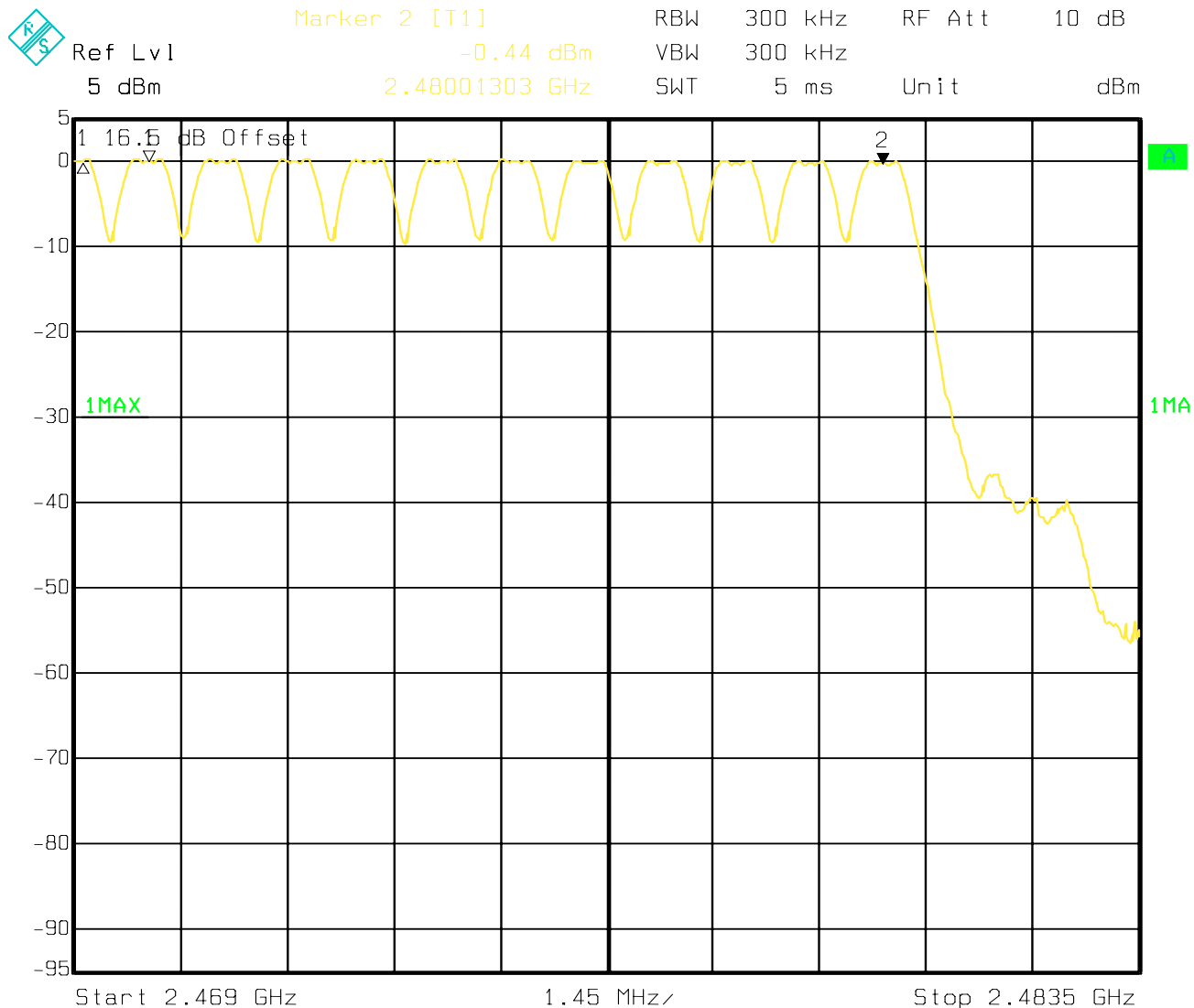
PLOT 6.5.2C



Date: 10.DEC.2009 14:35:54



PLOT 6.5.2D



Date: 10.DEC.2009 14:32:11



6.6 TIME OF OCCUPANCY (DWELL TIME)

6.6.1 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

6.6.2 RESULTS:

$T_{nom}(23)^{\circ}C$	$V_{nom}VDC$
------------------------	--------------

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 = $625 \mu s * 1600 \text{ 1/s} / 79 * 31.6 \text{ s} = 0.4 \text{ s}$ (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 = $5 * 625 \mu s * 1600 * 1/5 * 1/s / 79 * 31.6 \text{ s} = 0.4 \text{ s}$ (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).



6.7 CONDUCTED SPURIOUS EMISSION

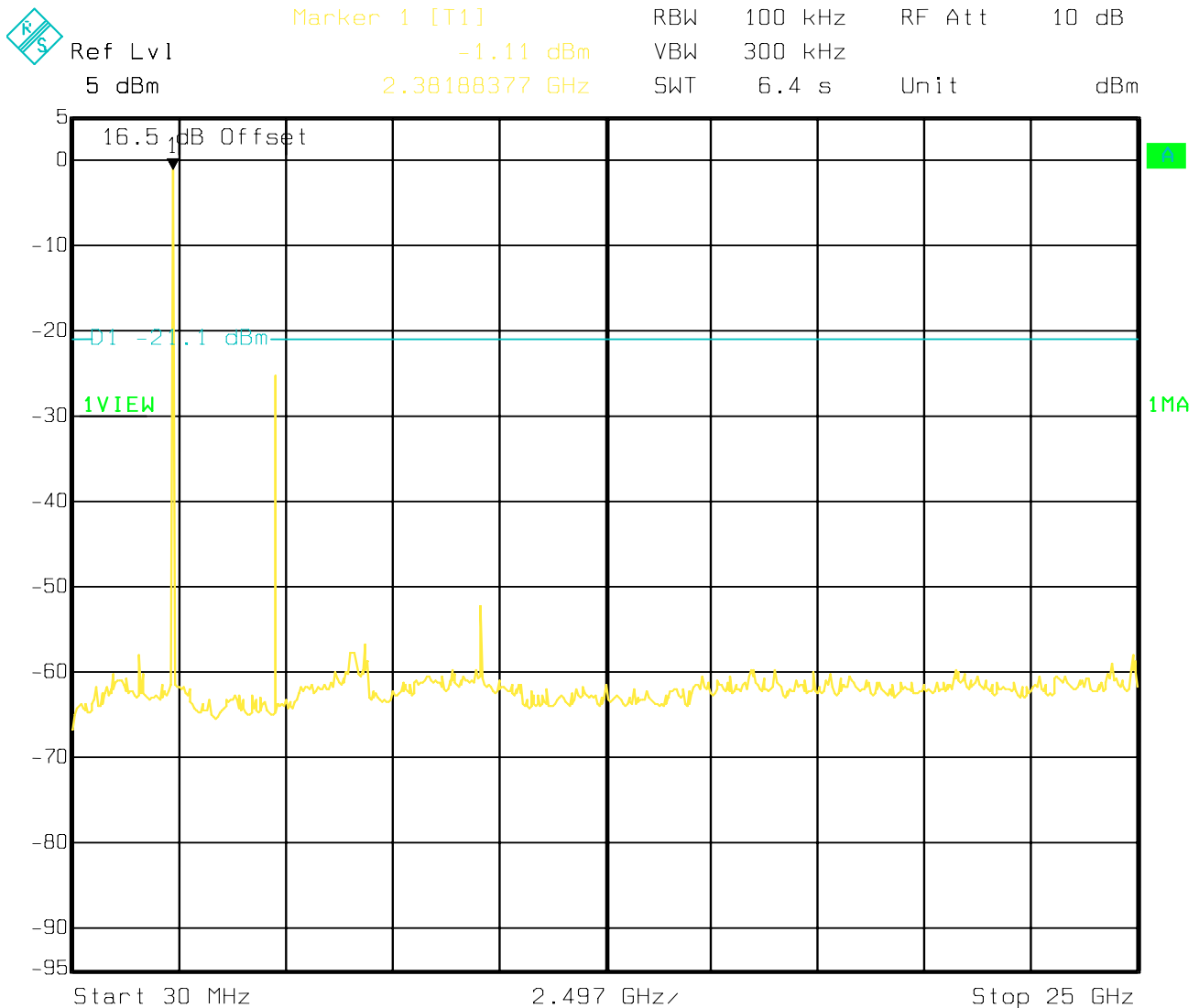
6.7.1 LIMIT SUB CLAUSE § 15.247 (d) and RSS-210 Annex 8.5

FREQUENCY RANGE	limit
30MHz-25GHz	-20dBc

6.7.2 RESULTS: Tnom(23)°C VnomVDC

Plot shows worse case emission for all modulations on each channel.

PLOT 6.7.1A (2402MHz)

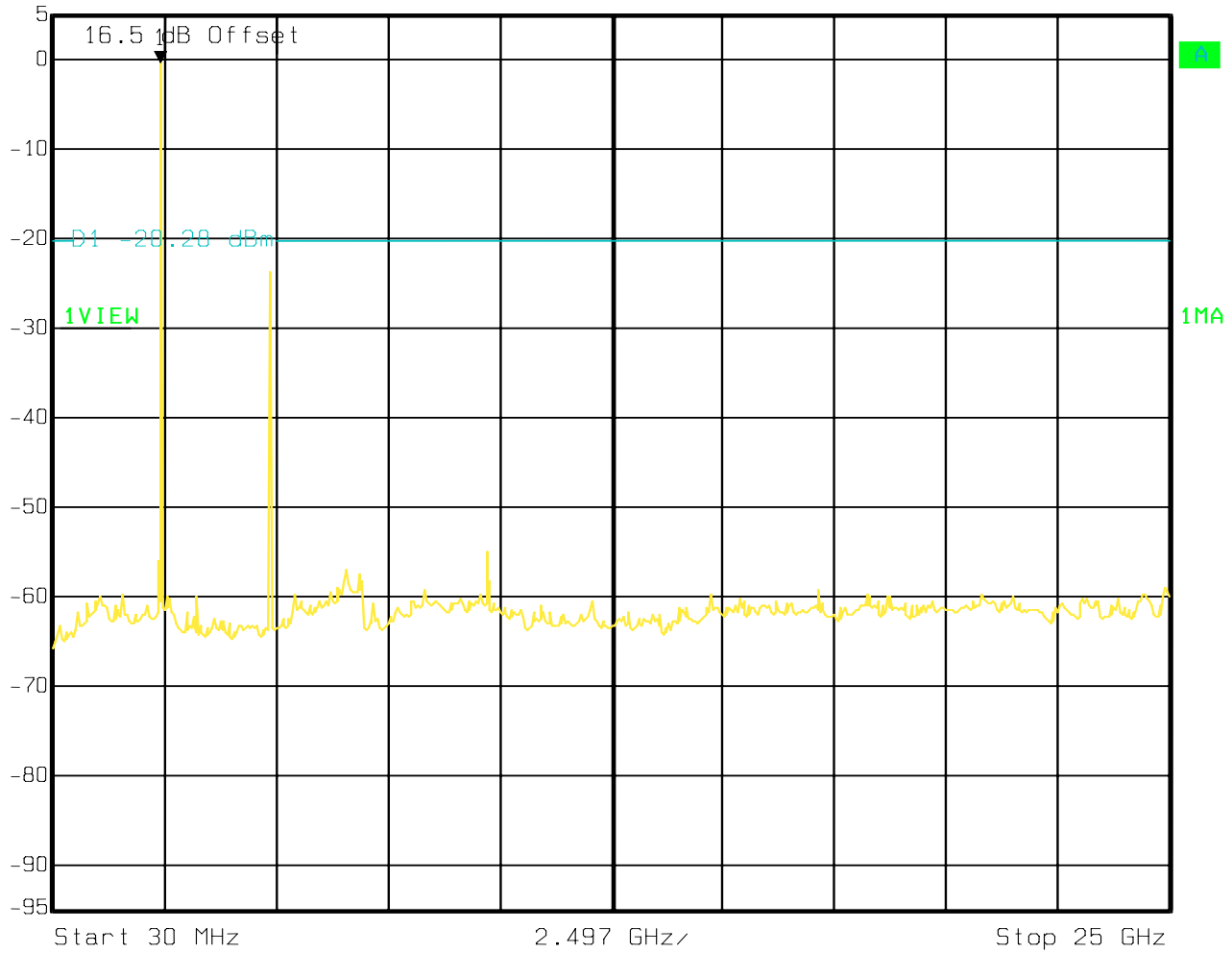


Date: 10.DEC.2009 14:47:43



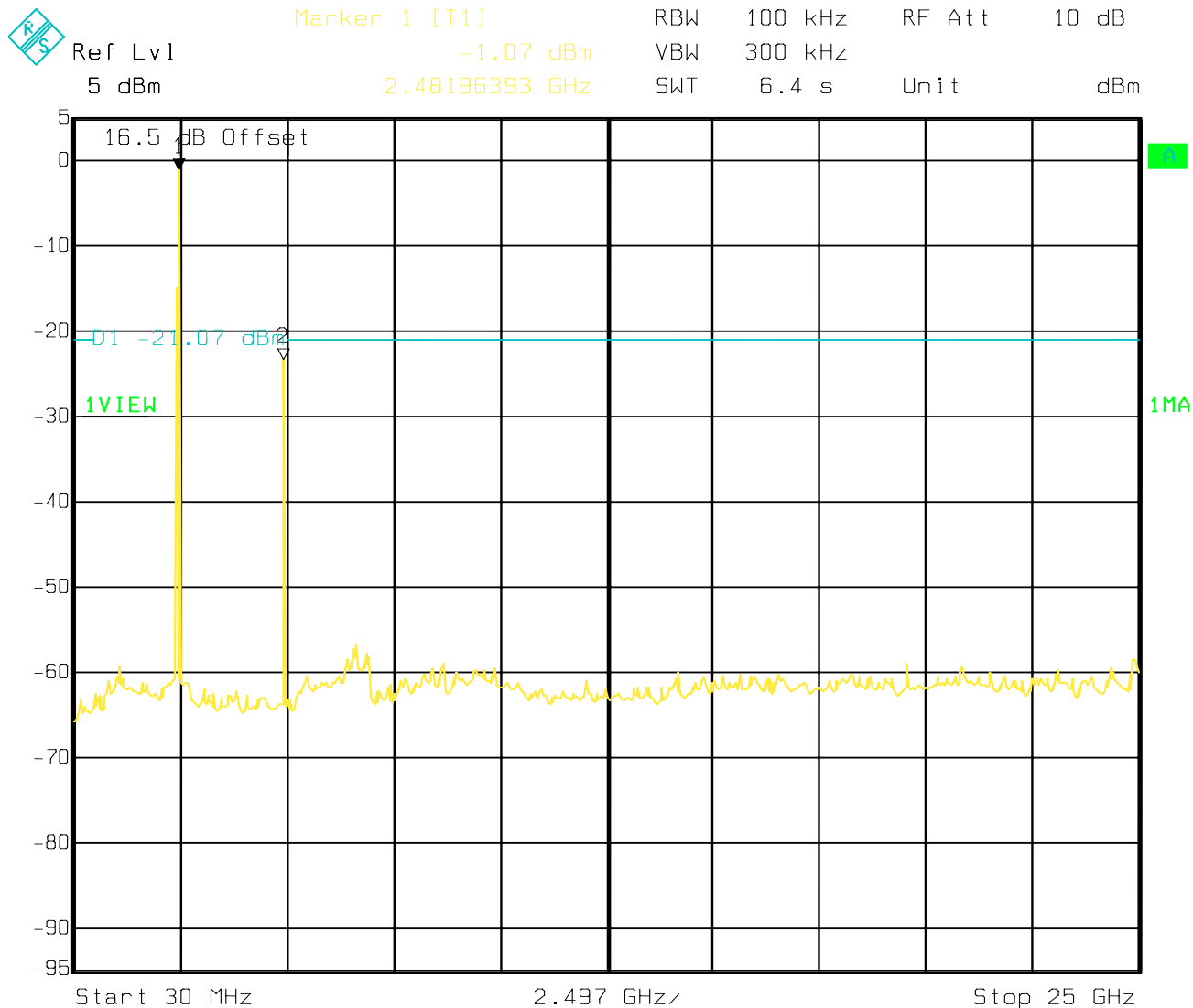
PLOT 6.7.1B
(2441MHz)

 Marker 1 [T1] RBW 100 kHz RF Att 10 dB
Ref Lvl -0.28 dBm VBW 300 kHz
5 dBm 2.43192385 GHz SWT 6.4 s Unit dBm



Date: 10.DEC.2009 14:49:57

PLOT 6.7.1C
(2480MHz)



Date: 10.DEC.2009 14:52:19

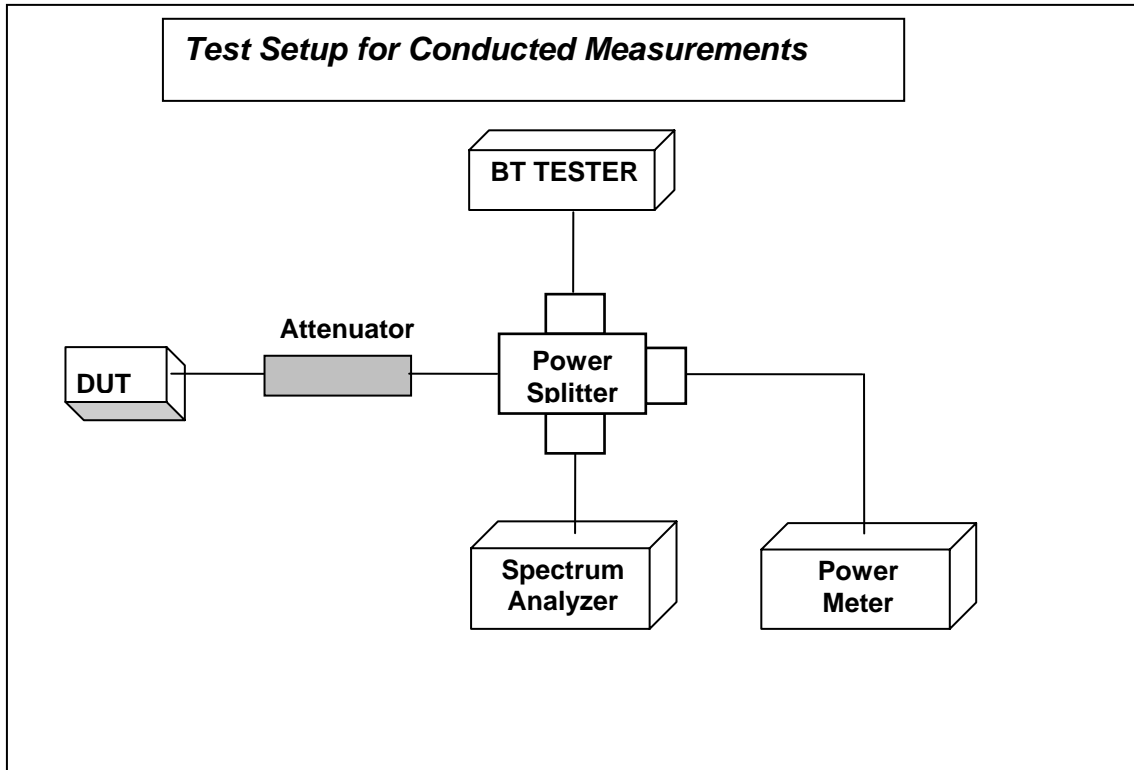


7 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

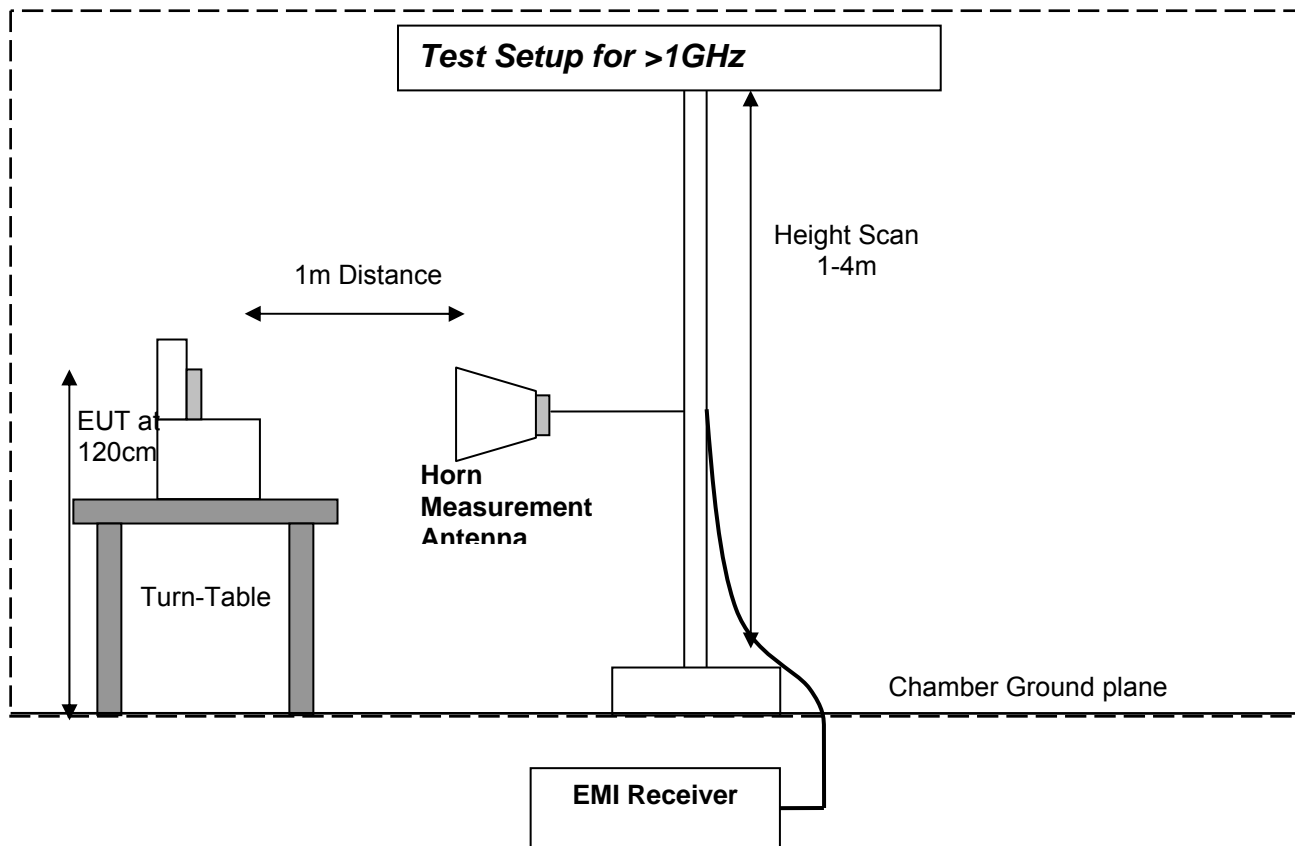
No	Instrument/Ancillary	Type	Manufacturer	Serial No.	Cal Due	Interval
01	Spectrum Analyzer	ESIB 40	Rohde & Schwarz	100107	May 2010	1 year
02	Spectrum Analyzer	FSEM 30	Rohde & Schwarz	100017	August 2010	1 year
03	Signal Generator	SMY02	Rohde & Schwarz	836878/011	May 2010	1 year
04	Power-Meter	NRVD	Rohde & 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

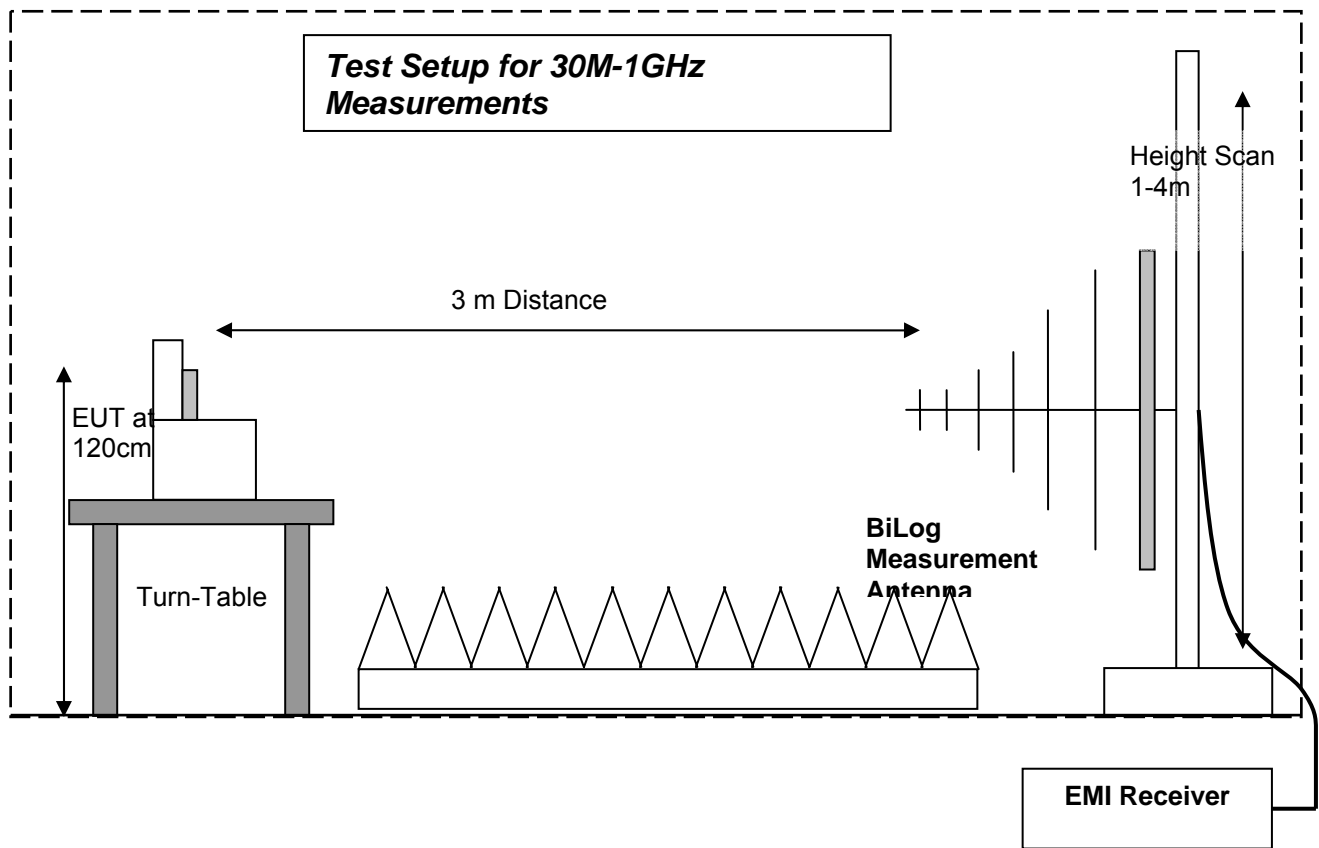
8 BLOCK DIAGRAMS

Conducted Testing



Radiated Testing







9 Revision History

2010-01-12:

EMC_INTE1_003_09002_15.247FHSS: Original report

2010-02-02:

EMC_INTE1_003_09002_15.247FHSS_rev1: (replaces report# EMC_INTE1_003_09002_15.247FHSS)

1. Industry Canada information added
2. EUT#2 Information added in section 3.2

2010-03-01:

EMC_INTE1_003_09002_15.247FHSS_rev2: (replaces report# EMC_INTE1_003_09002_15.247FHSS_rev1)

1. Note stating radiated measurements maximized according to ANSI C63.4 added on
 - a. Page 8 section 5.1.1
 - b. Page 21 section 5.2.1
 - c. Page 29 section 5.3.1
 - d. Page 42 section 6.2.2