



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

2010-03-01 EMC & Radio (Test Lab Manager)

Date Section Name Signature

This report is prepared by:

Satya Radhakrishna

2010-03-01 EMC & Radio (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

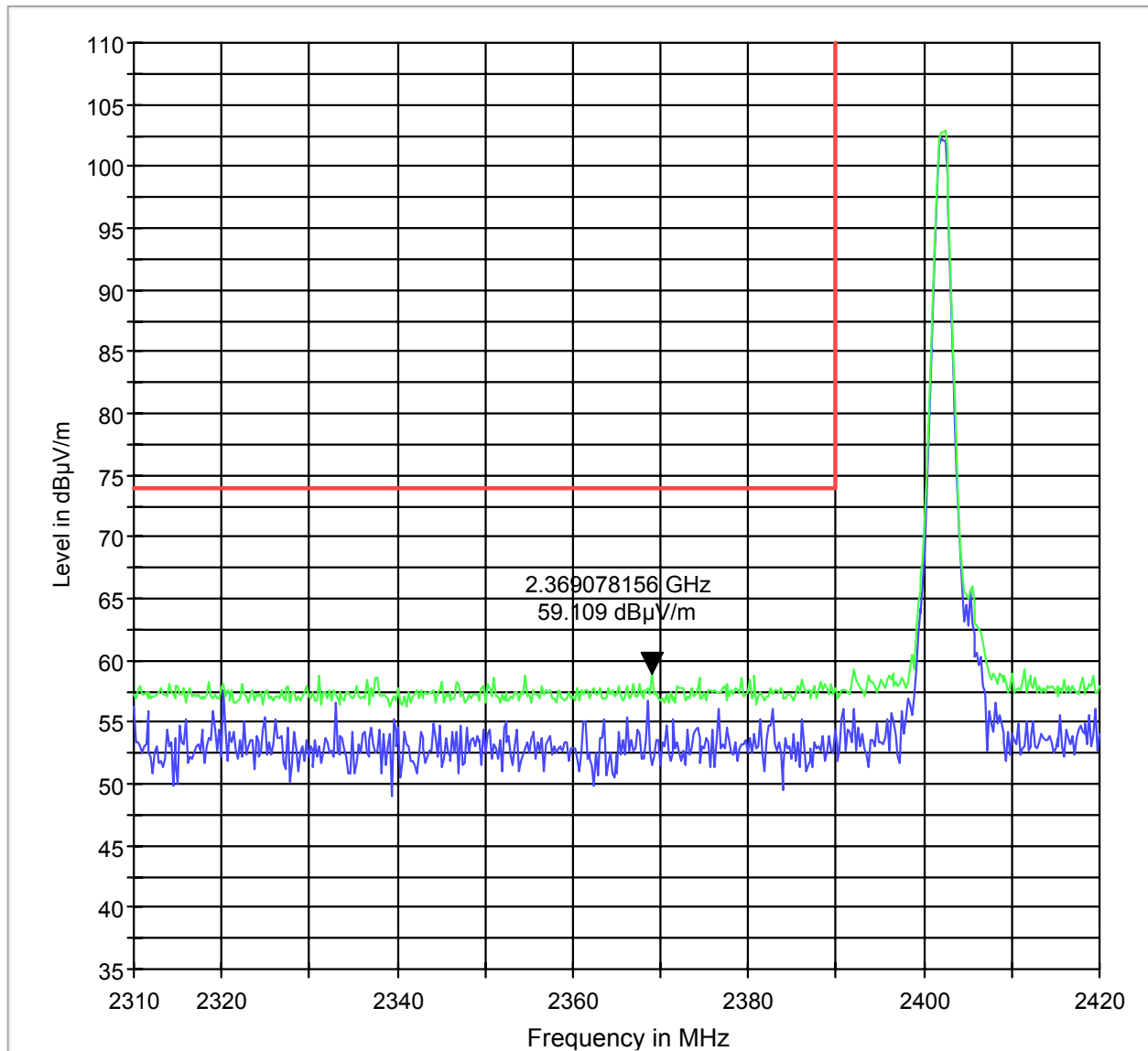
Note: Radiated tests contain results with measurement maximized according to the procedure defined in ANSI C63.4.

5.1.2 RESULTS: GFSK

PLOT 5.1.2 A

(2402MHz) LOWER BAND EDGE PEAK –GFSK MODULATION

FCC 15.247 LBE Pk 3m



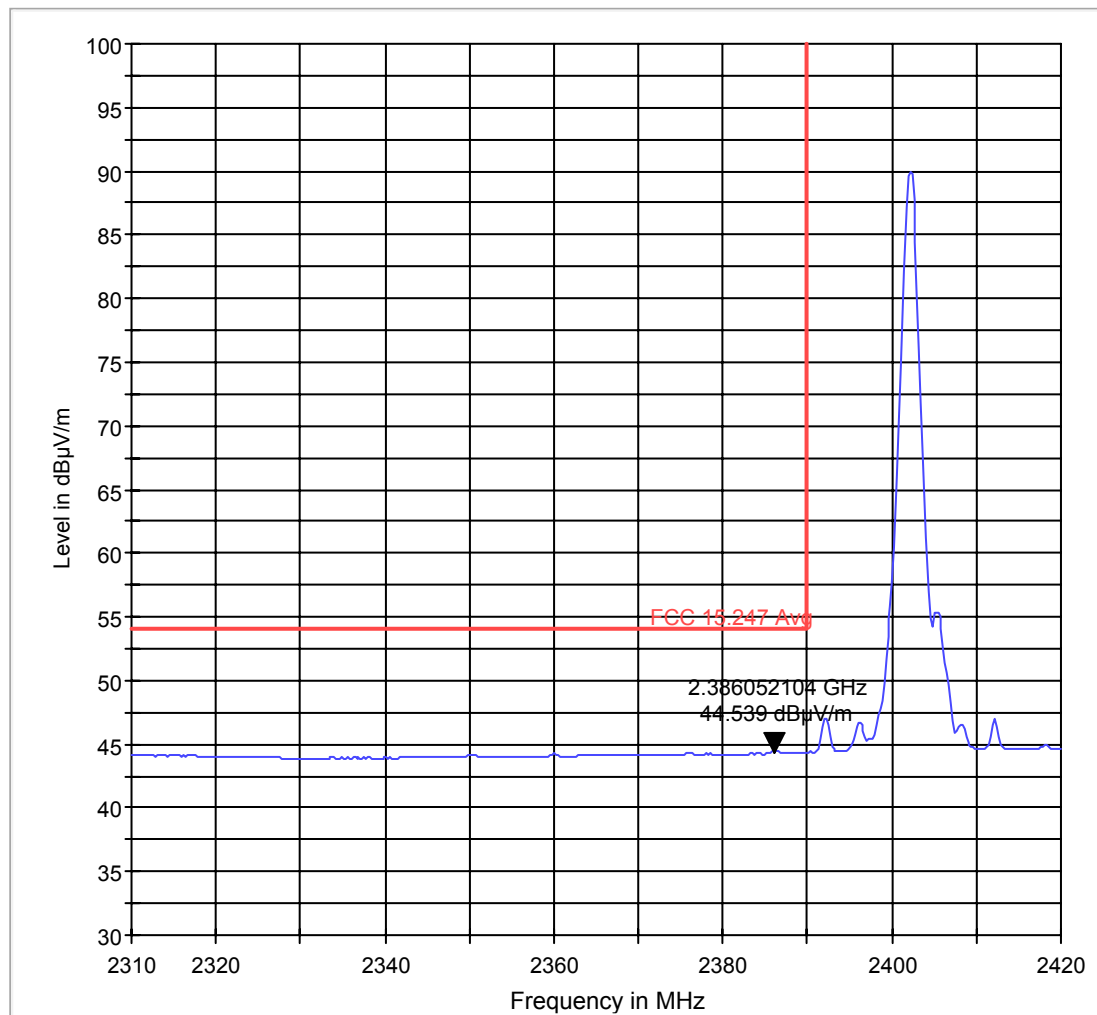
MaxPeak-ClearWrite

MaxPeak-MaxHold

FCC 15.247 Pk

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

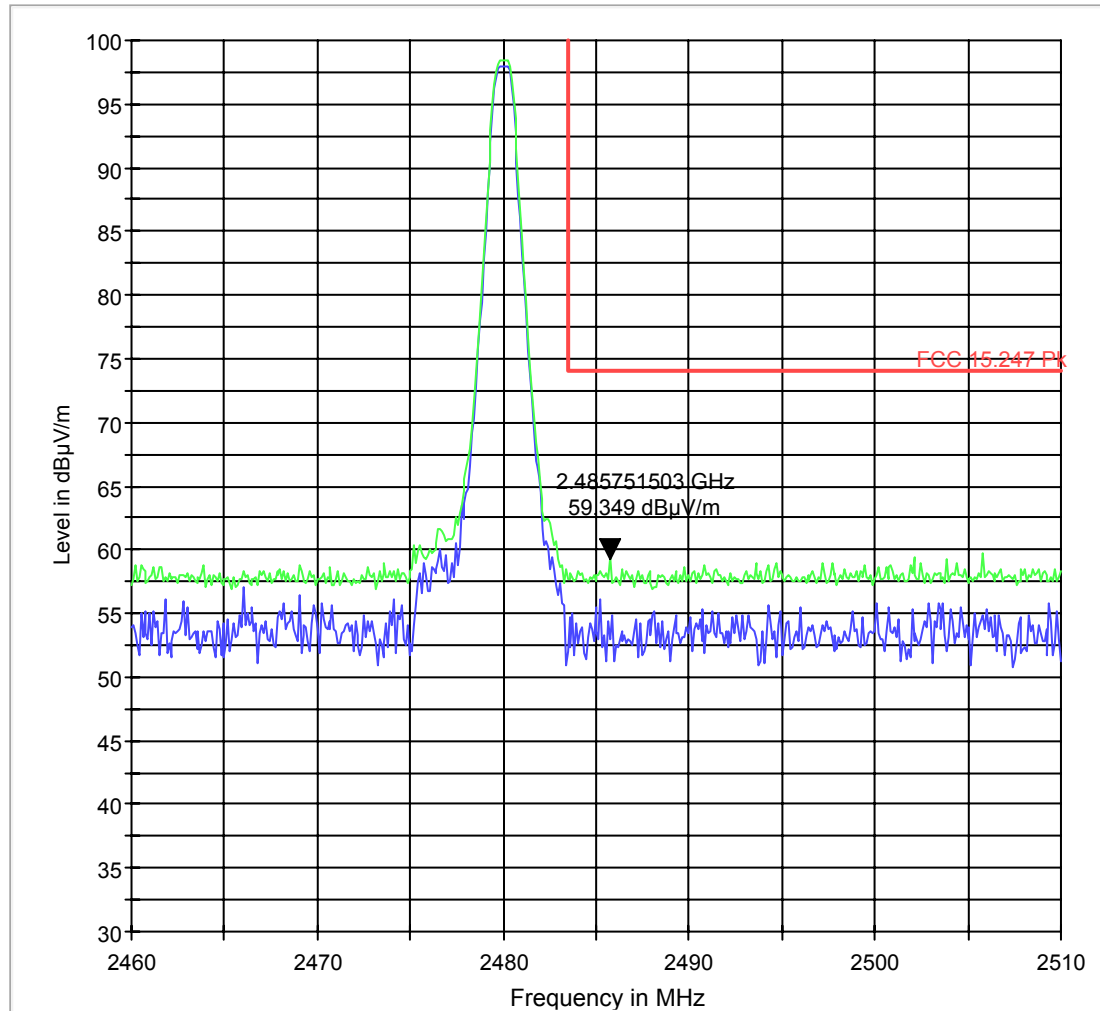
FCC 15.247 LBE Avg 3m



MaxPeak-MaxHold Average-MaxHold FCC 15.247 Avg

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

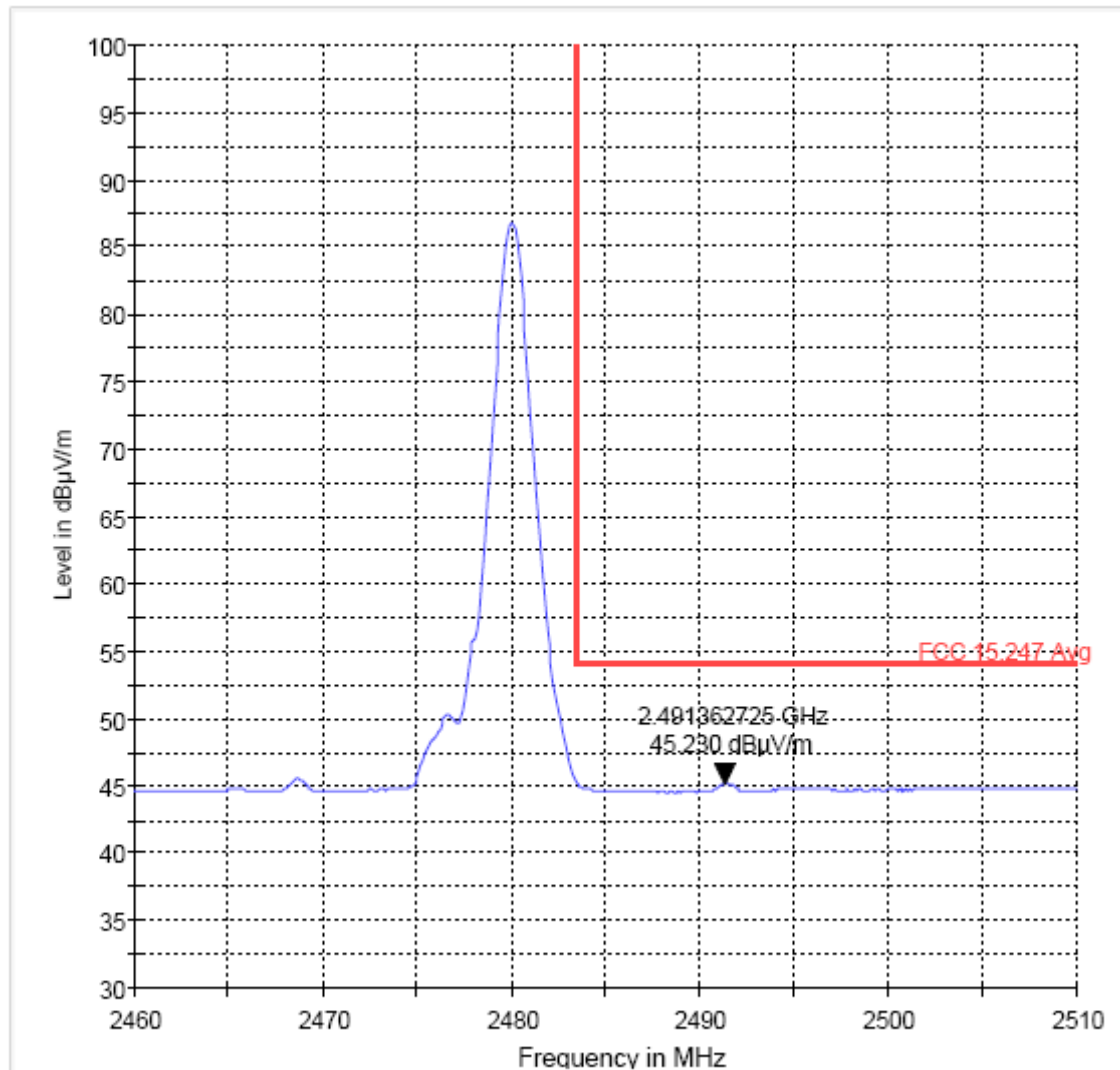
FCC 15.247 HBE Pk 3m



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

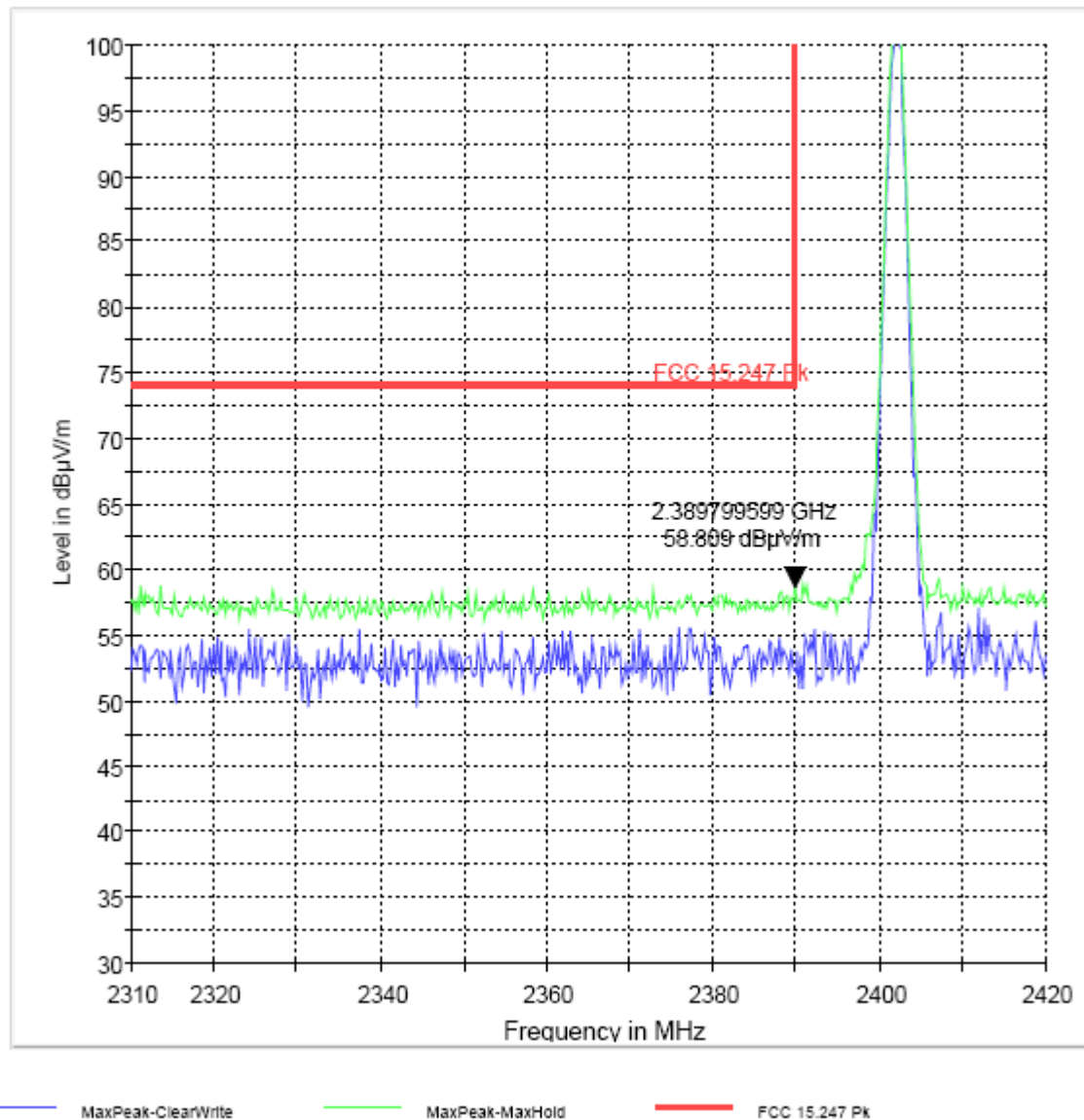


— MaxPeak-MaxHold — FCC 15.247 Avg

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

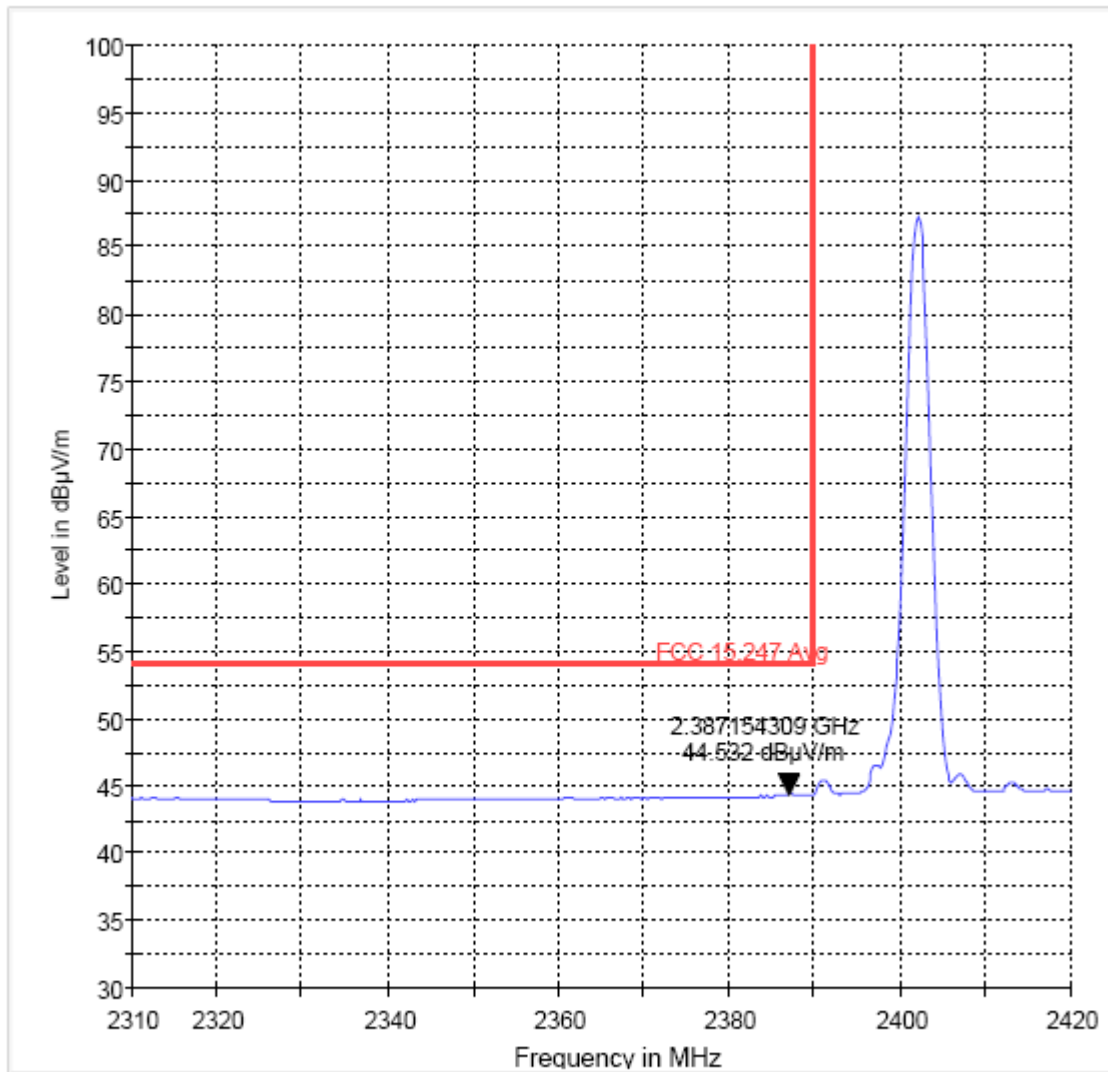
(2402MHz) LOWER BAND EDGE PEAK – $\pi/4$ DQPSK MODULATION

FCC 15.247 LBE Pk 3m



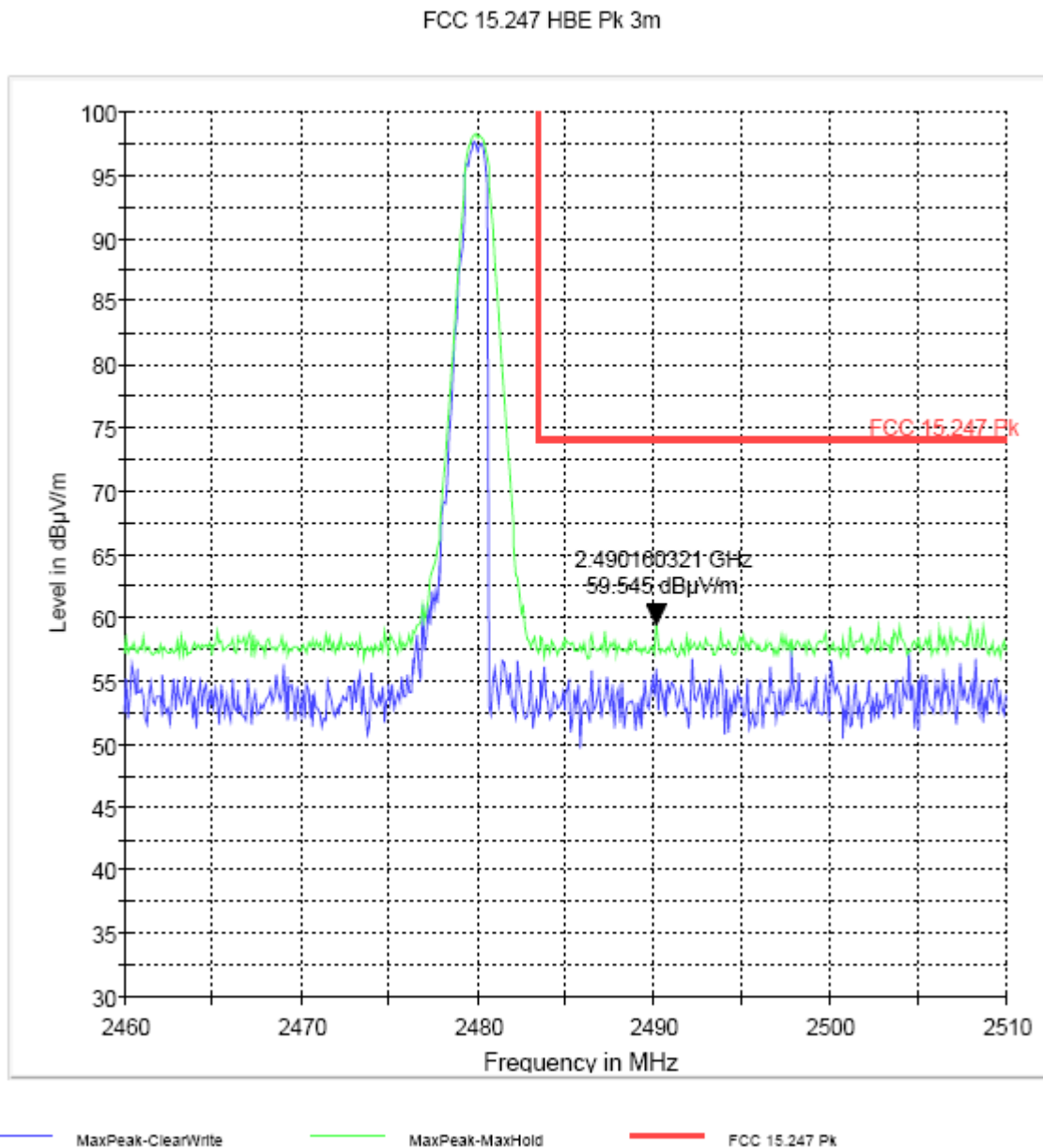
PLOT 5.1.3 B
(2402MHz) LOWER BAND EDGE AVERAGE $-\pi/4$ DQPSK MODULATION

FCC 15.247 LBE Avg 3m



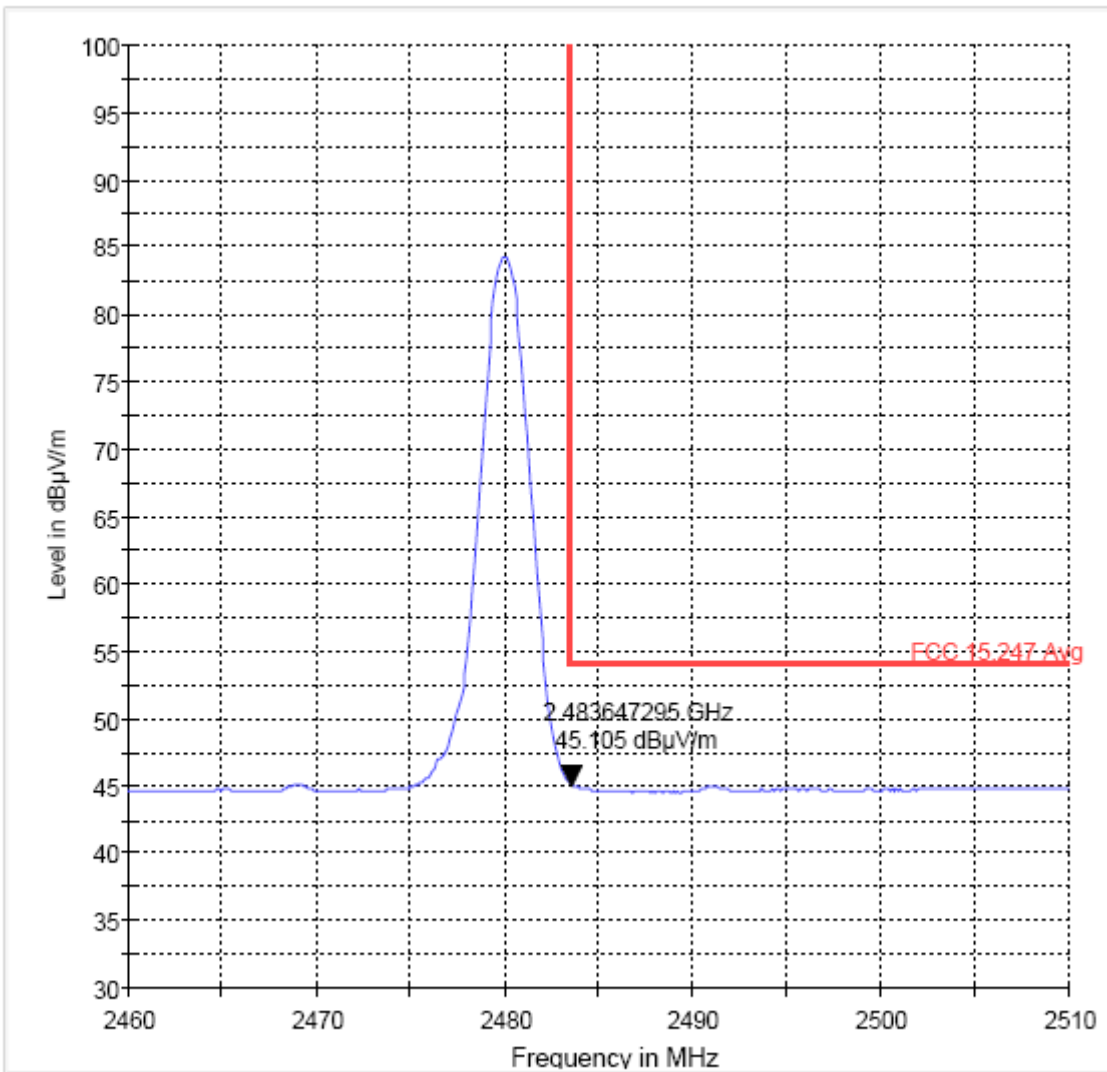
— MaxPeak-MaxHold — Average-MaxHold — FCC 15.247 Avg

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



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

FCC 15.247 HBE Avg 3m



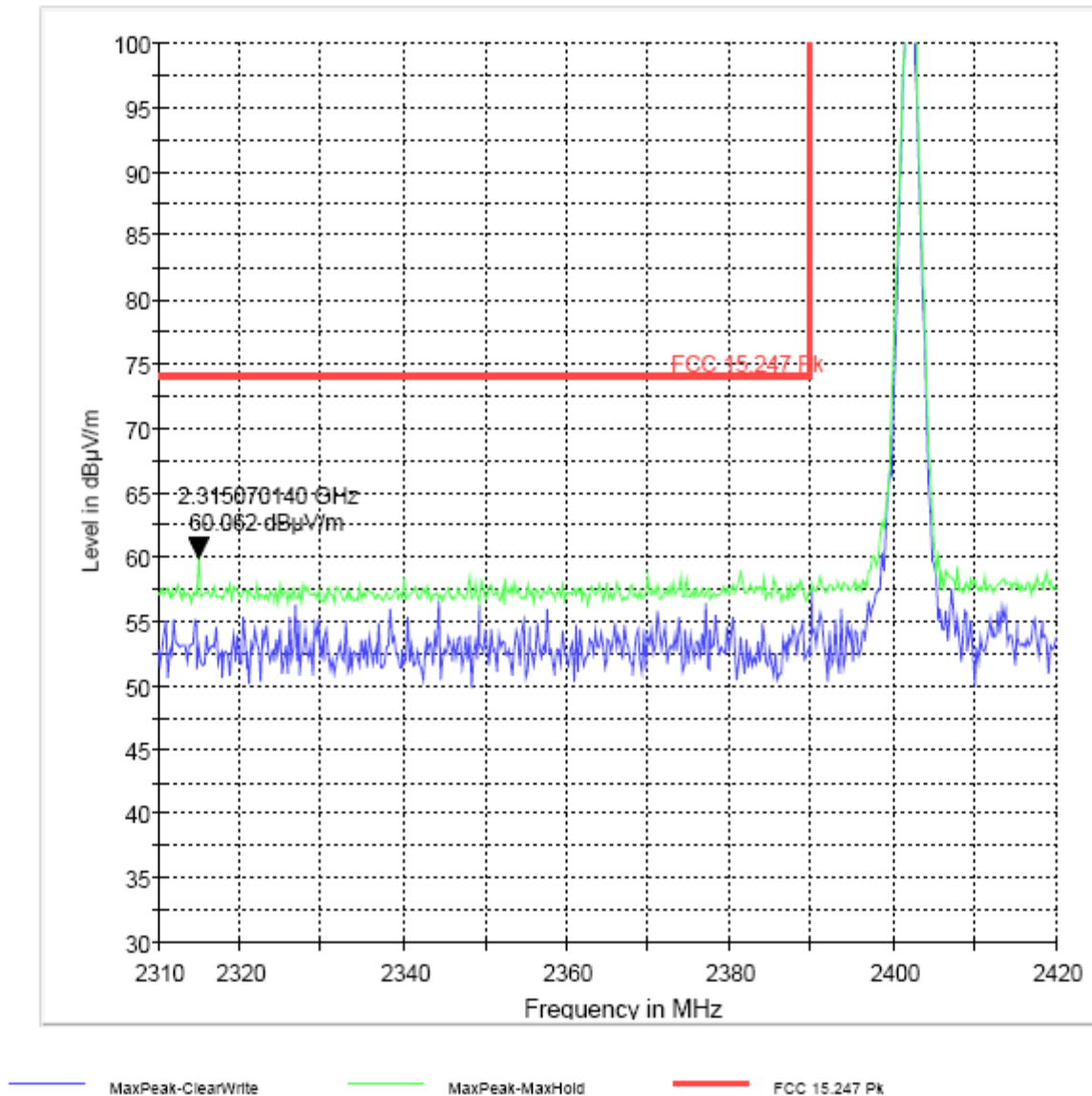
— MaxPeak-MaxHold — FCC 15.247 Avg

5.1.4 RESULTS: 8DPSK

PLOT 5.1.4 A

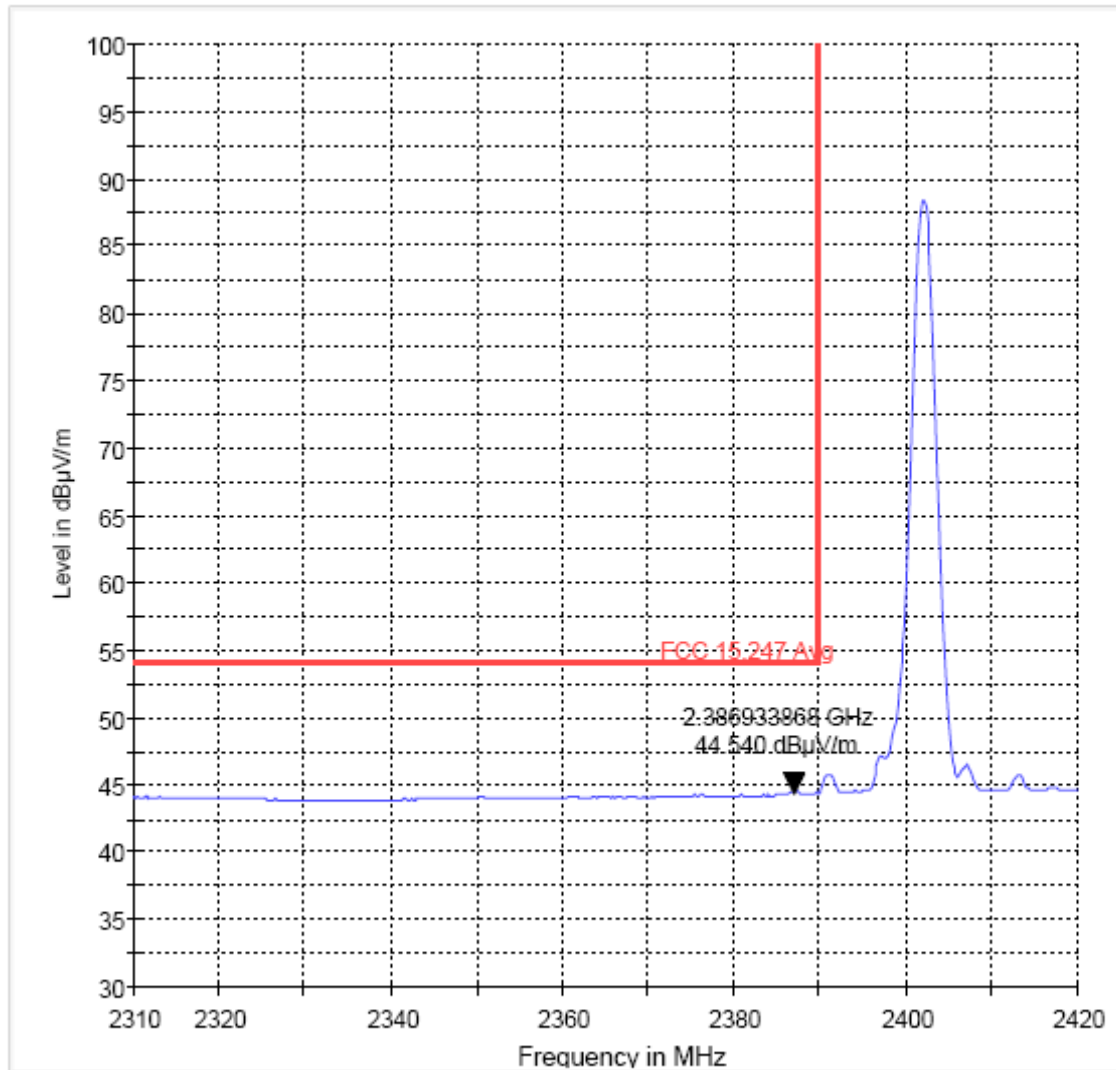
(2402MHz) LOWER BAND EDGE PEAK – 8DPSK MODULATION

FCC 15.247 LBE Pk 3m



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

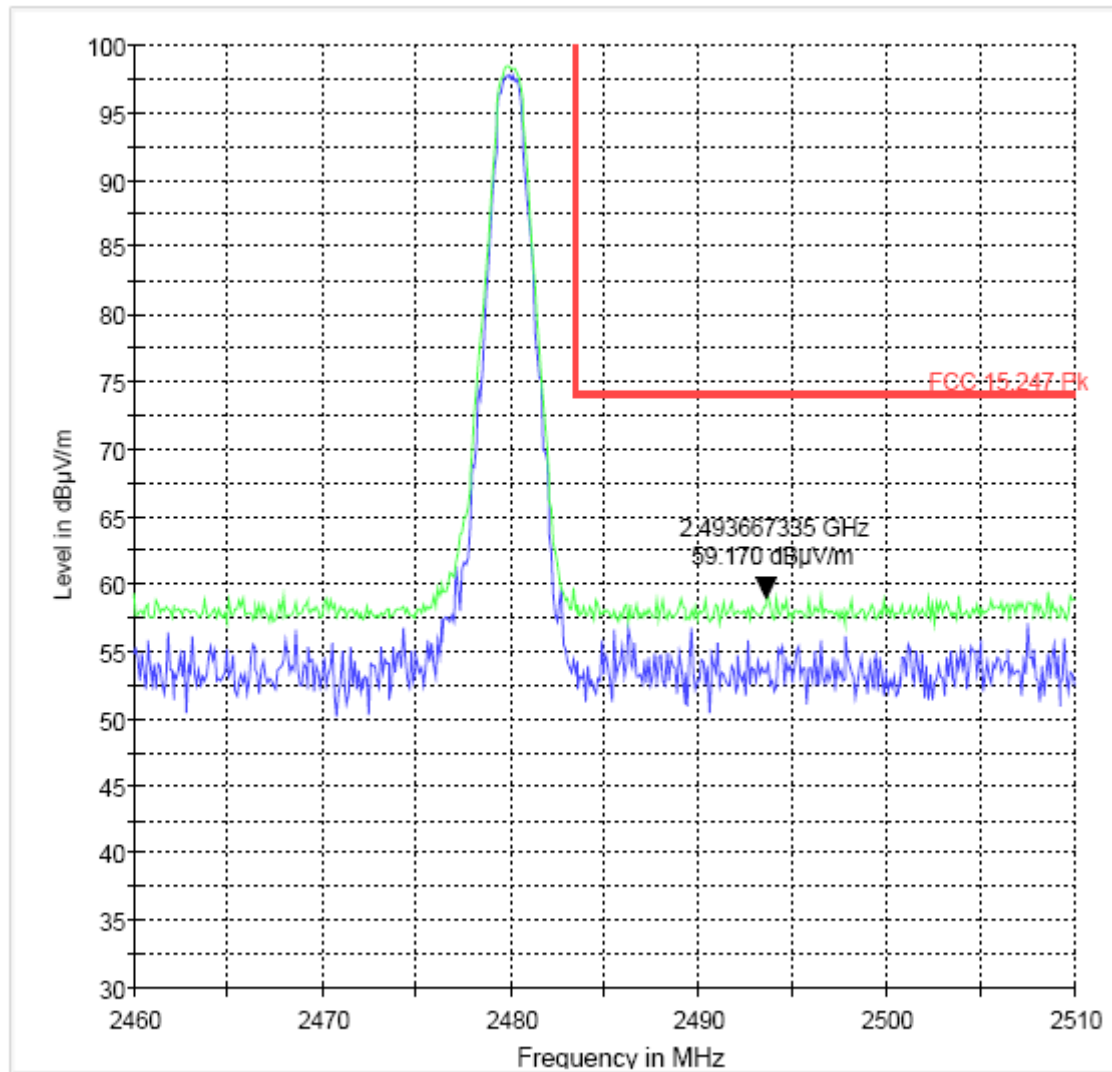
FCC 15.247 LBE Avg 3m



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

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

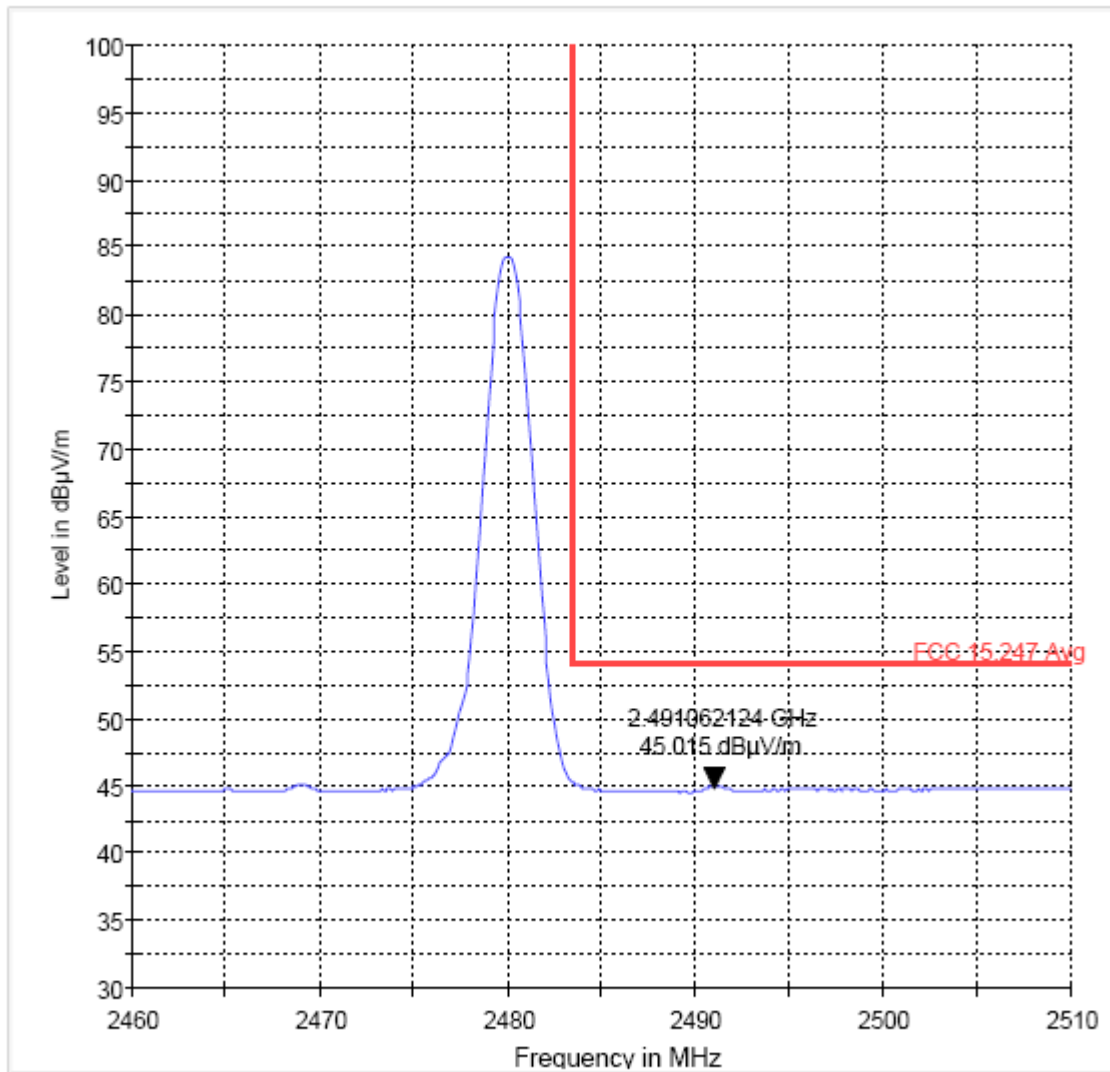
FCC 15.247 HBE Pk 3m



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

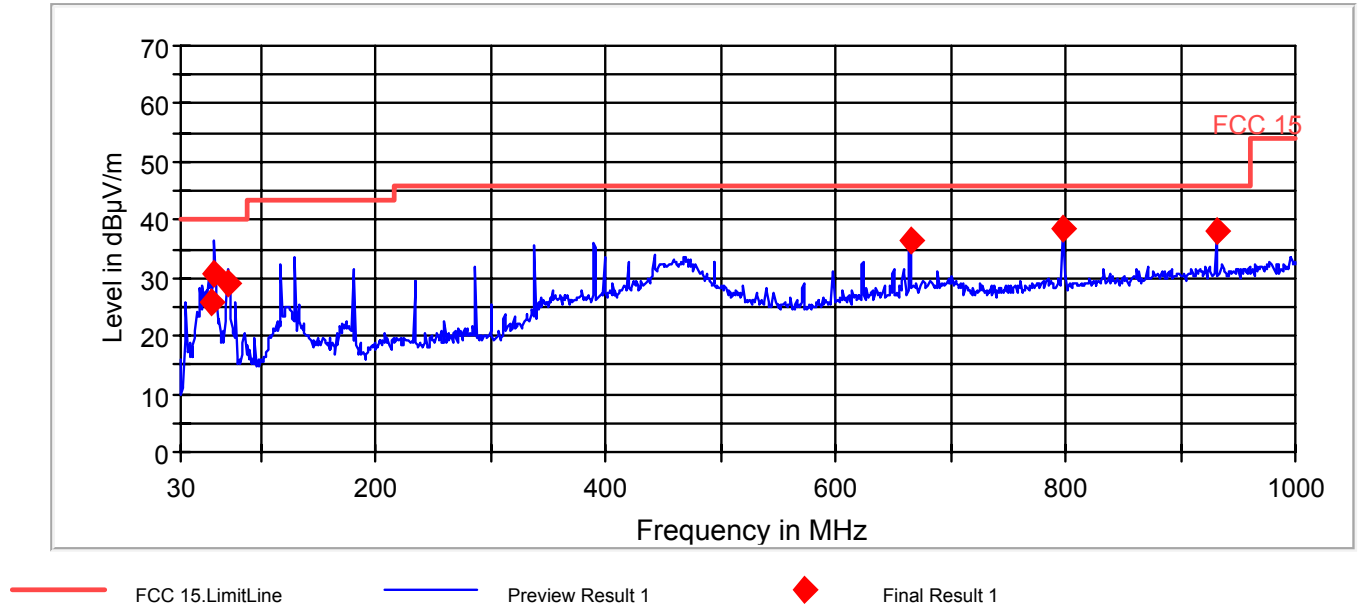
PLOT 5.2.2 A

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



PLOT 5.2.2 B

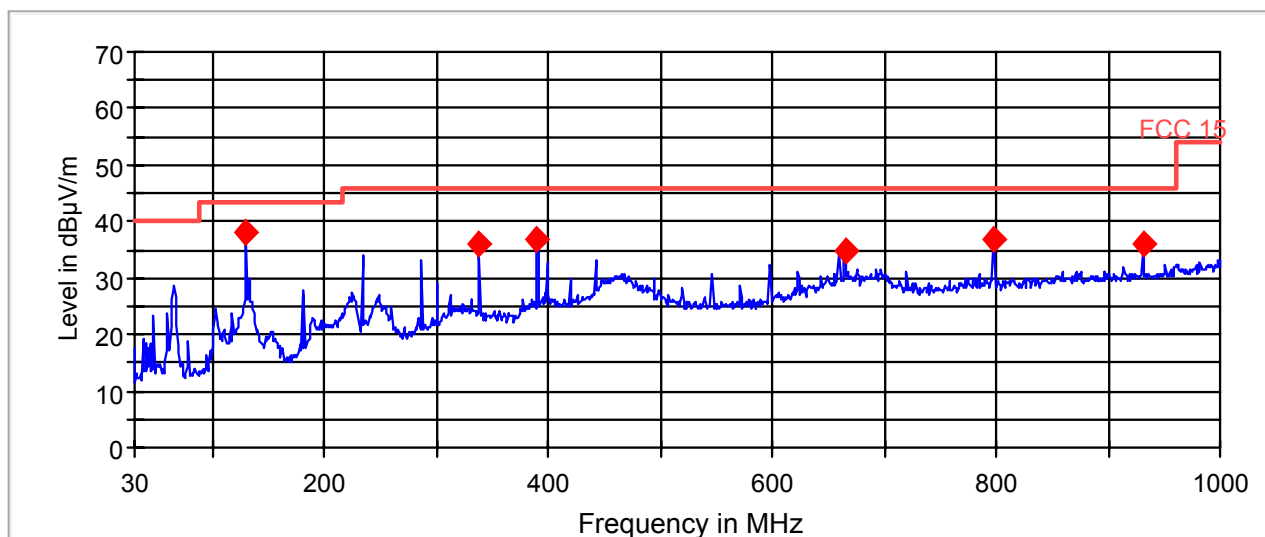
30MHz – 1GHz

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

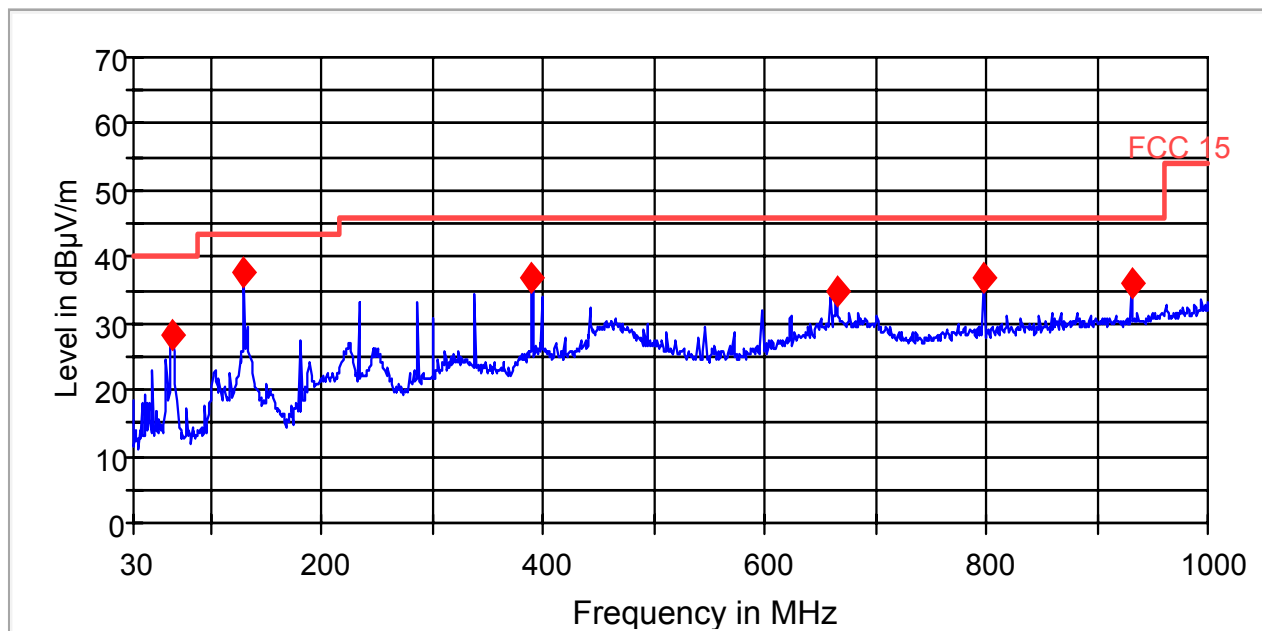
30MHz – 1GHz

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

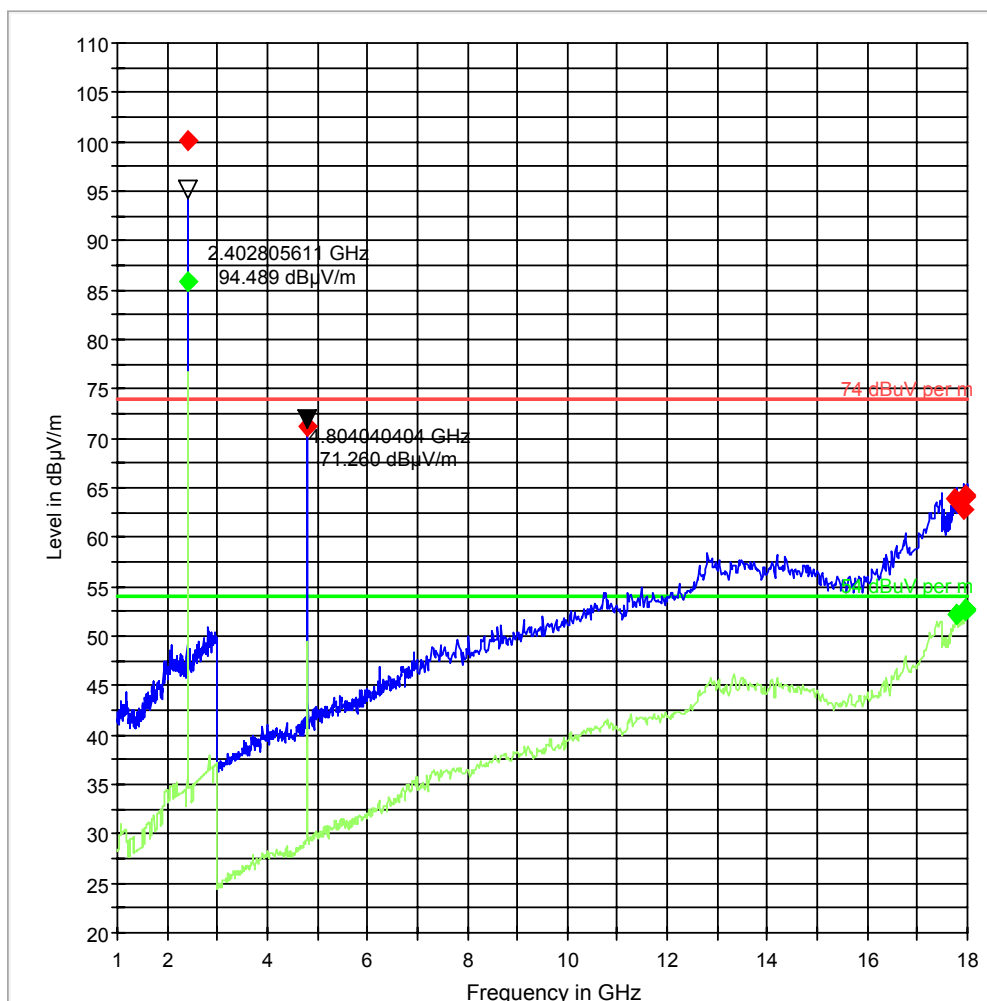
1-18GHz (2402MHz)

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

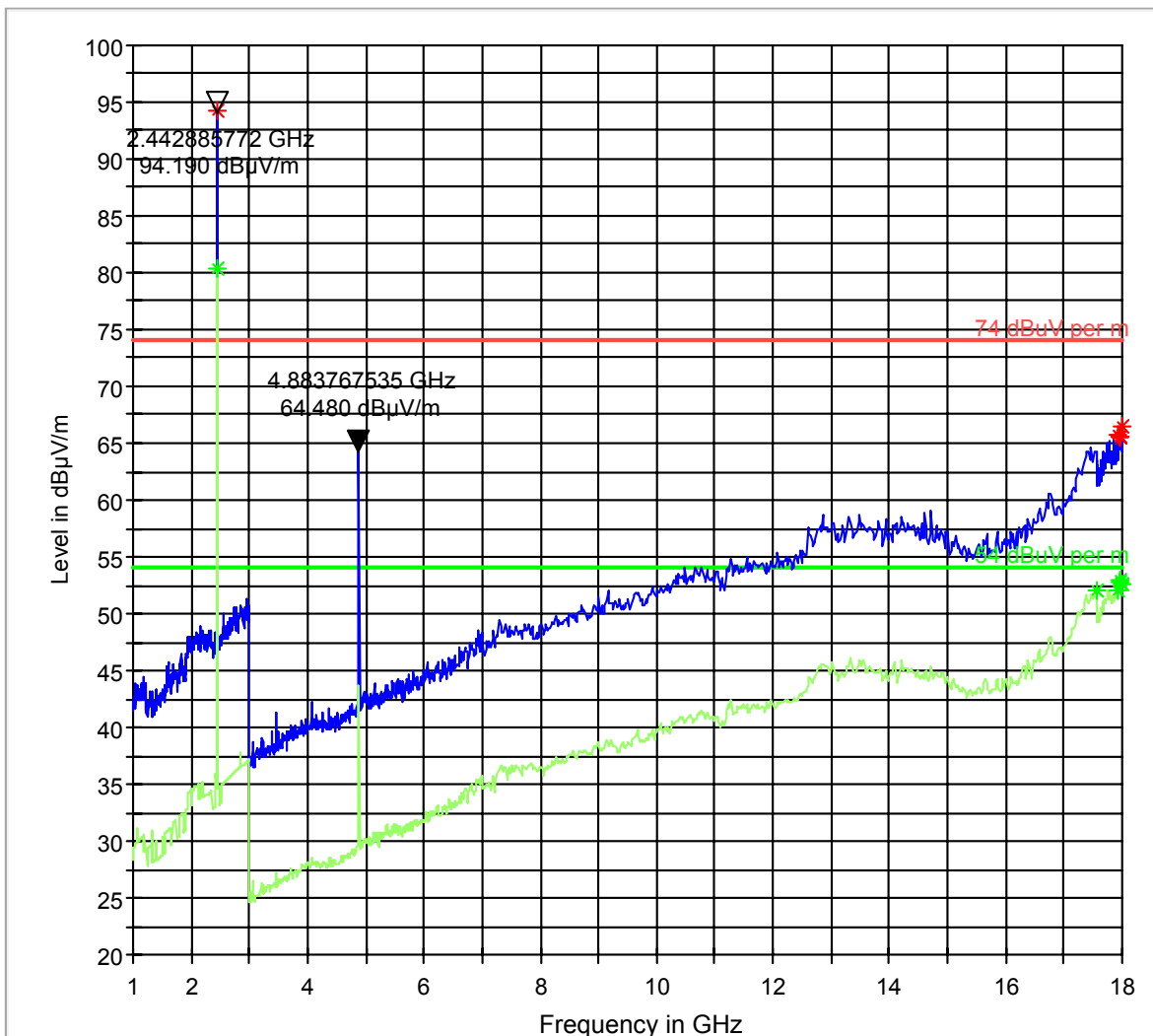
PLOT 5.2.2 E

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
Preview Result 2

54 dBuV per m.LimitLine
Data Reduction 1 [2]

Preview Result 1
Data Reduction 2 [2]

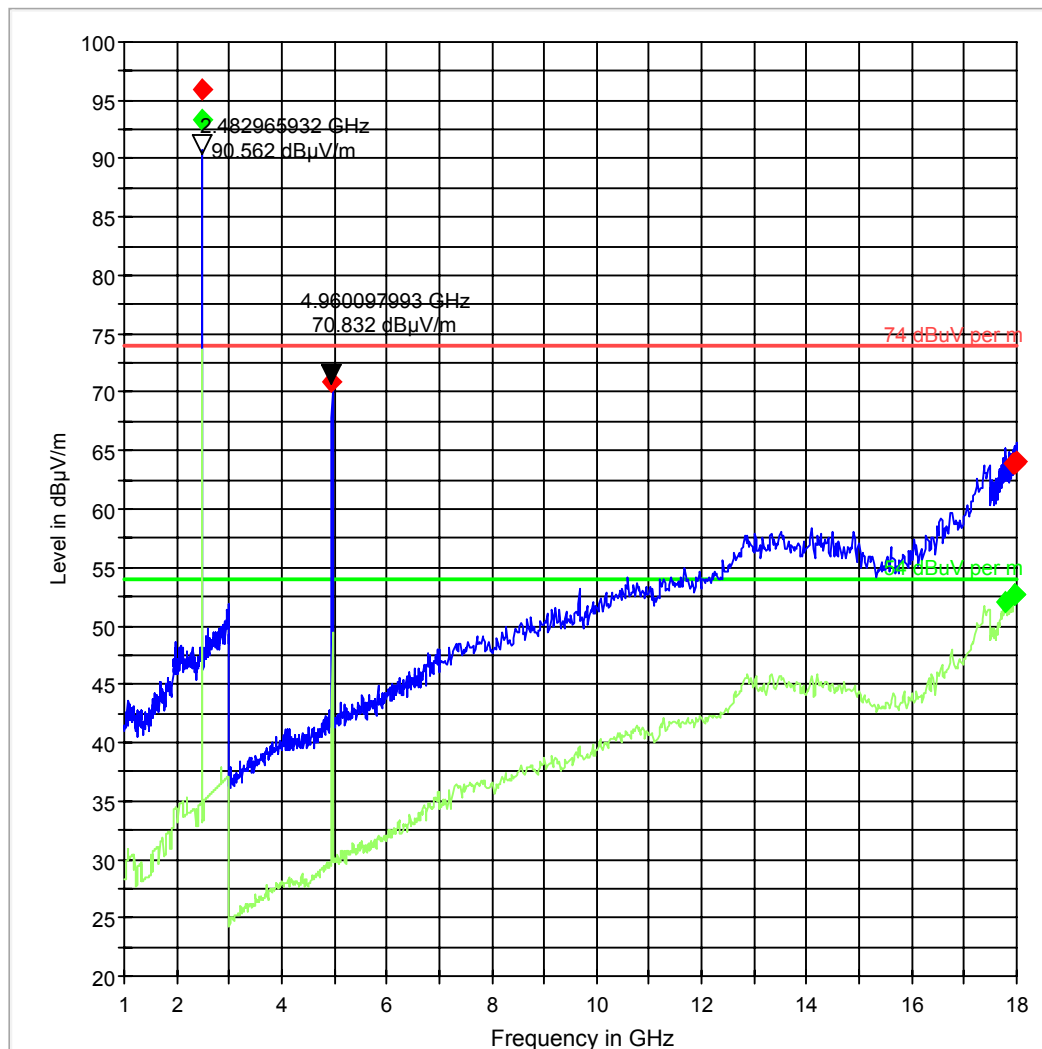
PLOT 5.2.2 F
1-18GHz (2480MHz)

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



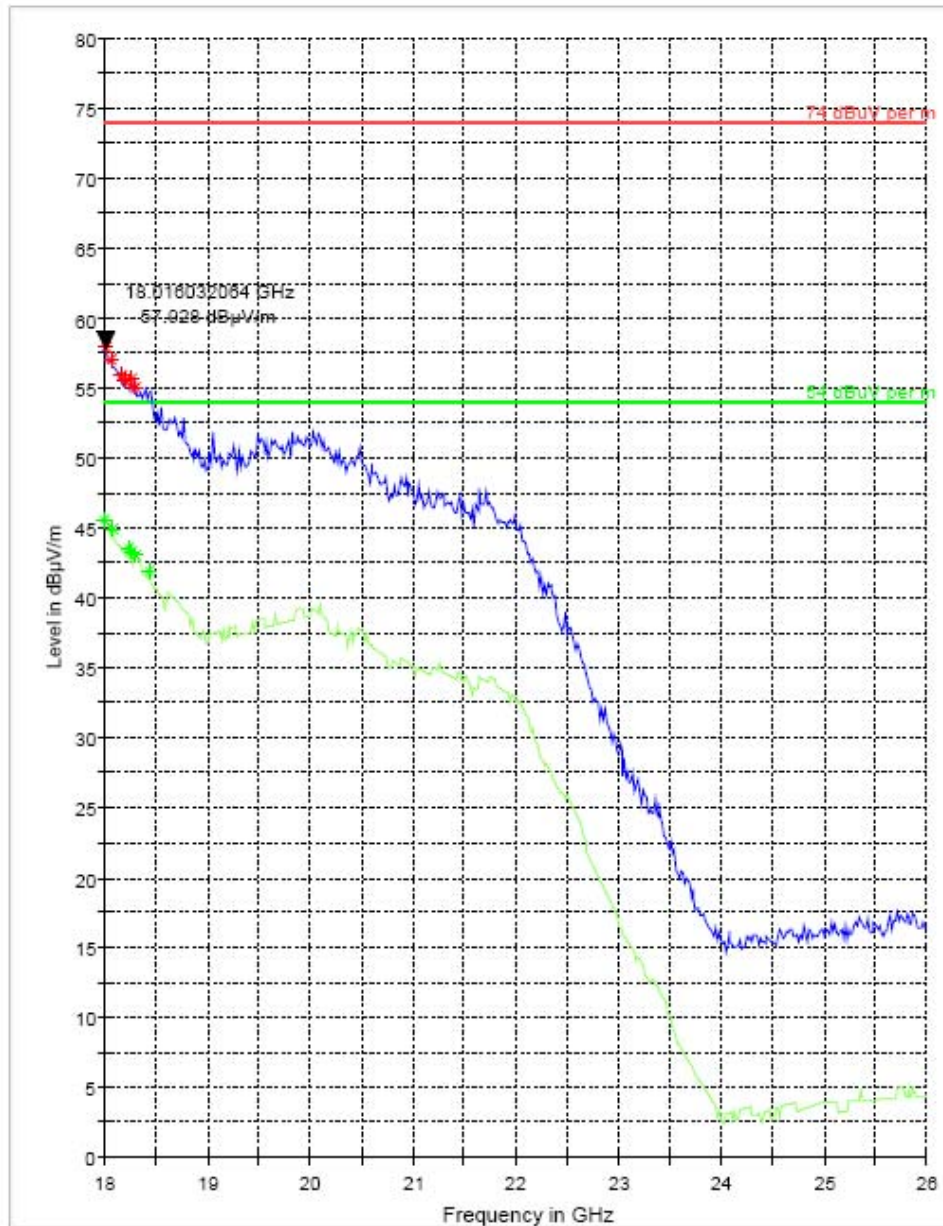
— 74 dBμV per m.LimitLine
— 54 dBμV per m.LimitLine
— Preview Result 1
— Preview Result 2
◆ Final Result 1
◆ Final Result 2

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 dBuV per m.LimitLine
54 dBuV 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.

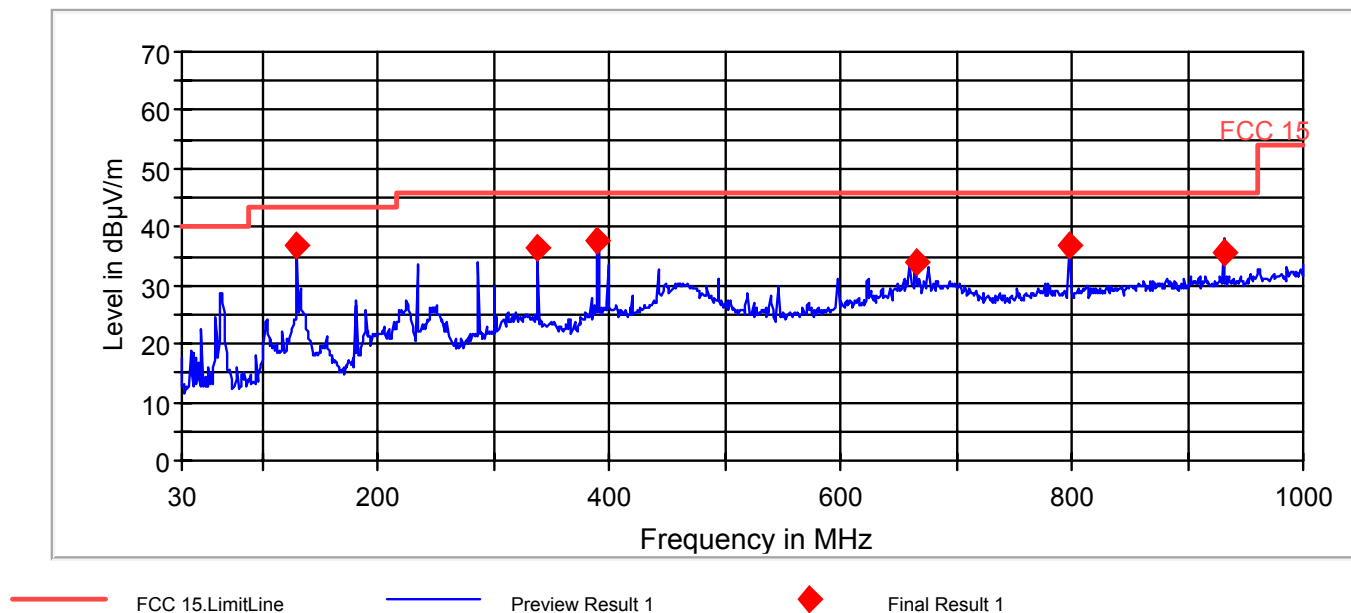
Note: This plot is valid for low, mid, high channels (worst-case plot)

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



PLOT 5.3.2 B

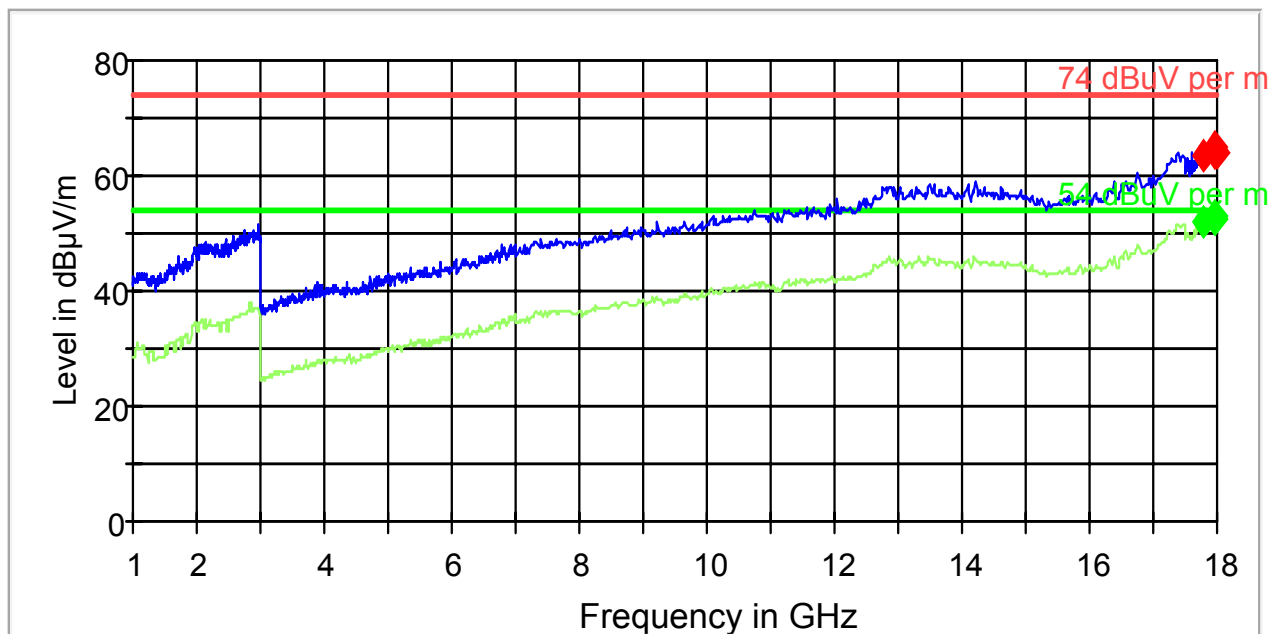
1-18GHz

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 |

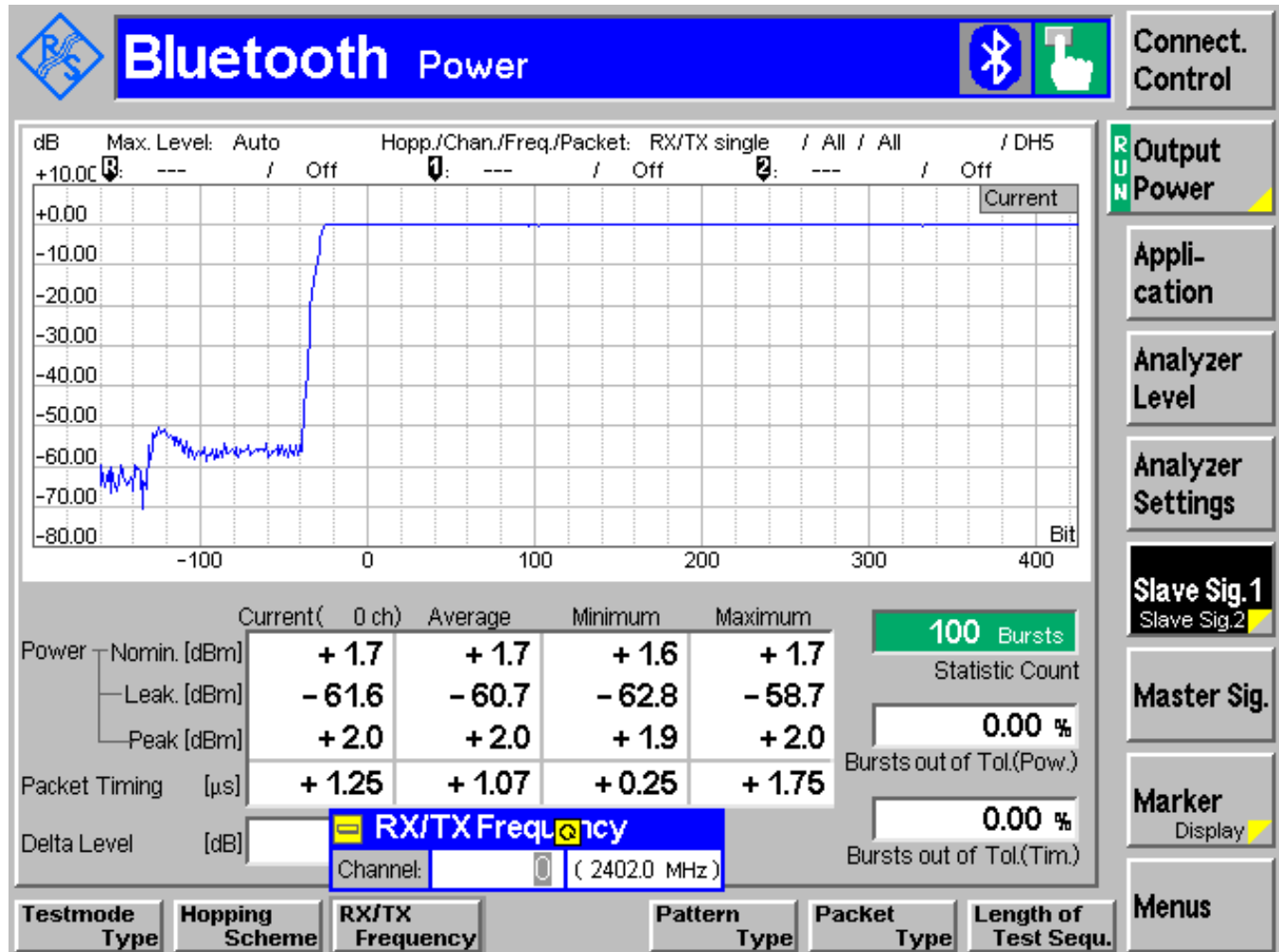
6.1.3 RESULTS: $\pi / 4$ DQPSK

| 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 |

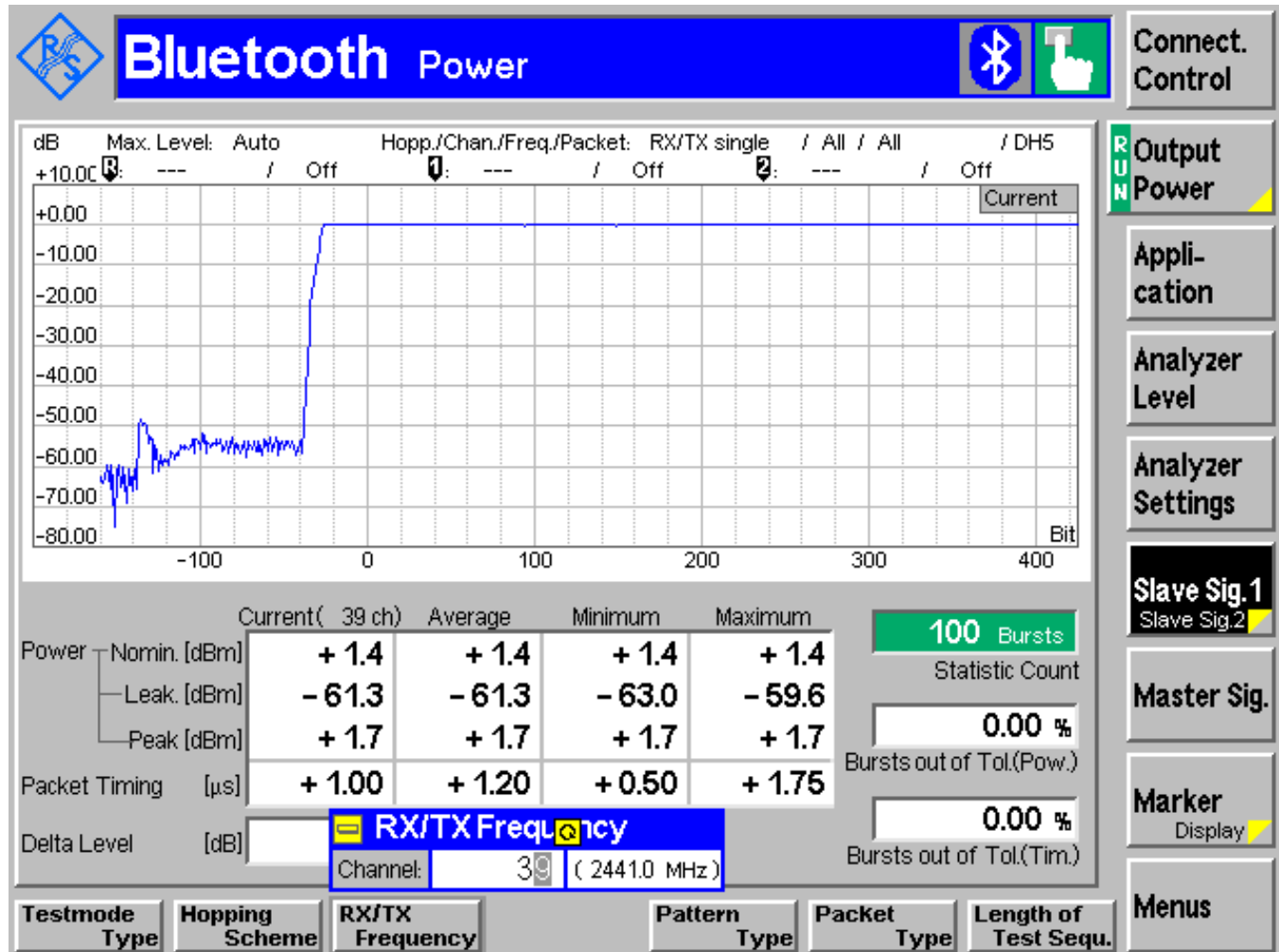
6.1.4 RESULTS: 8DPSK

| 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 |

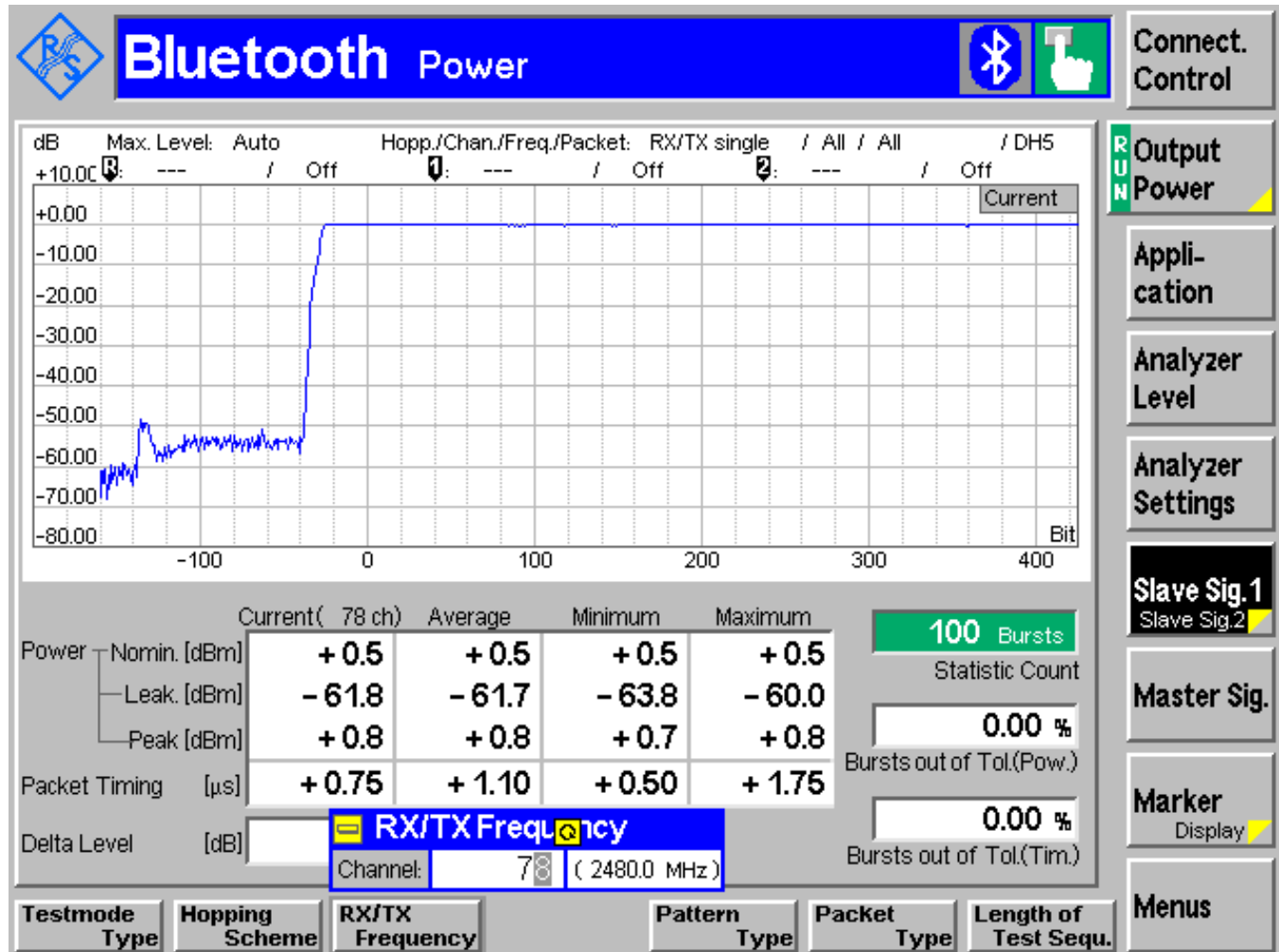
PLOT 6.1A



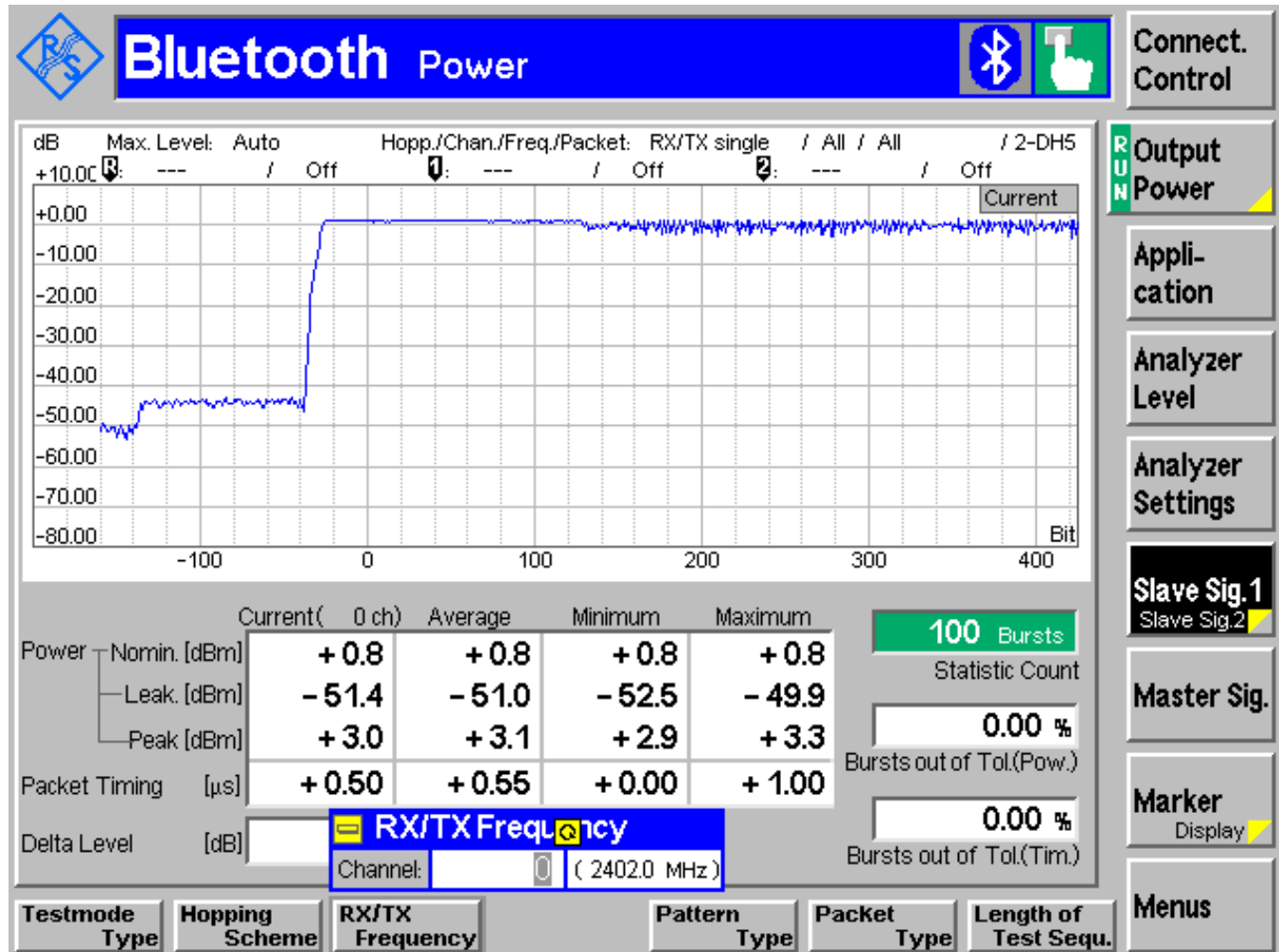
PLOT 6.1B



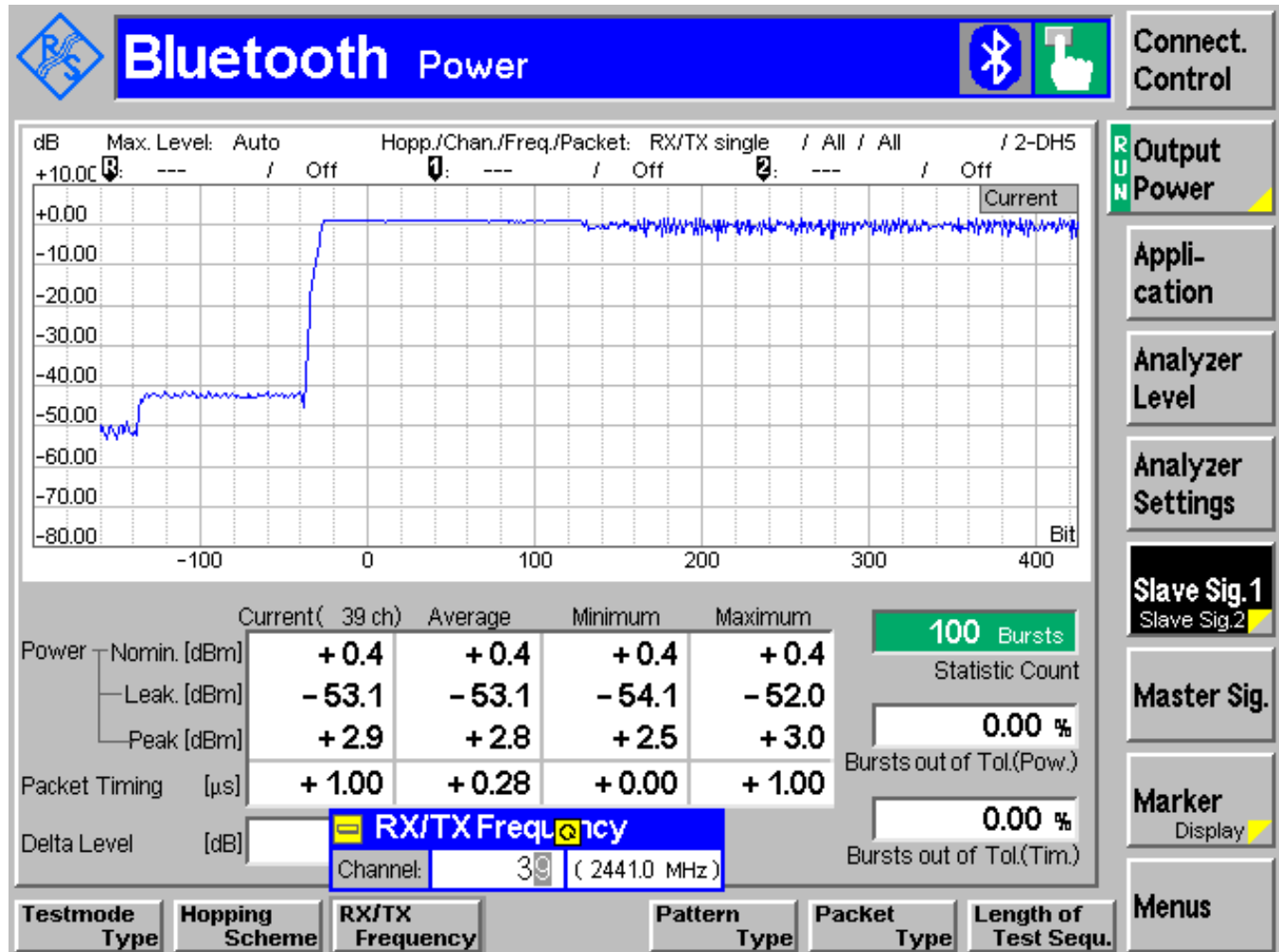
PLOT 6.1C



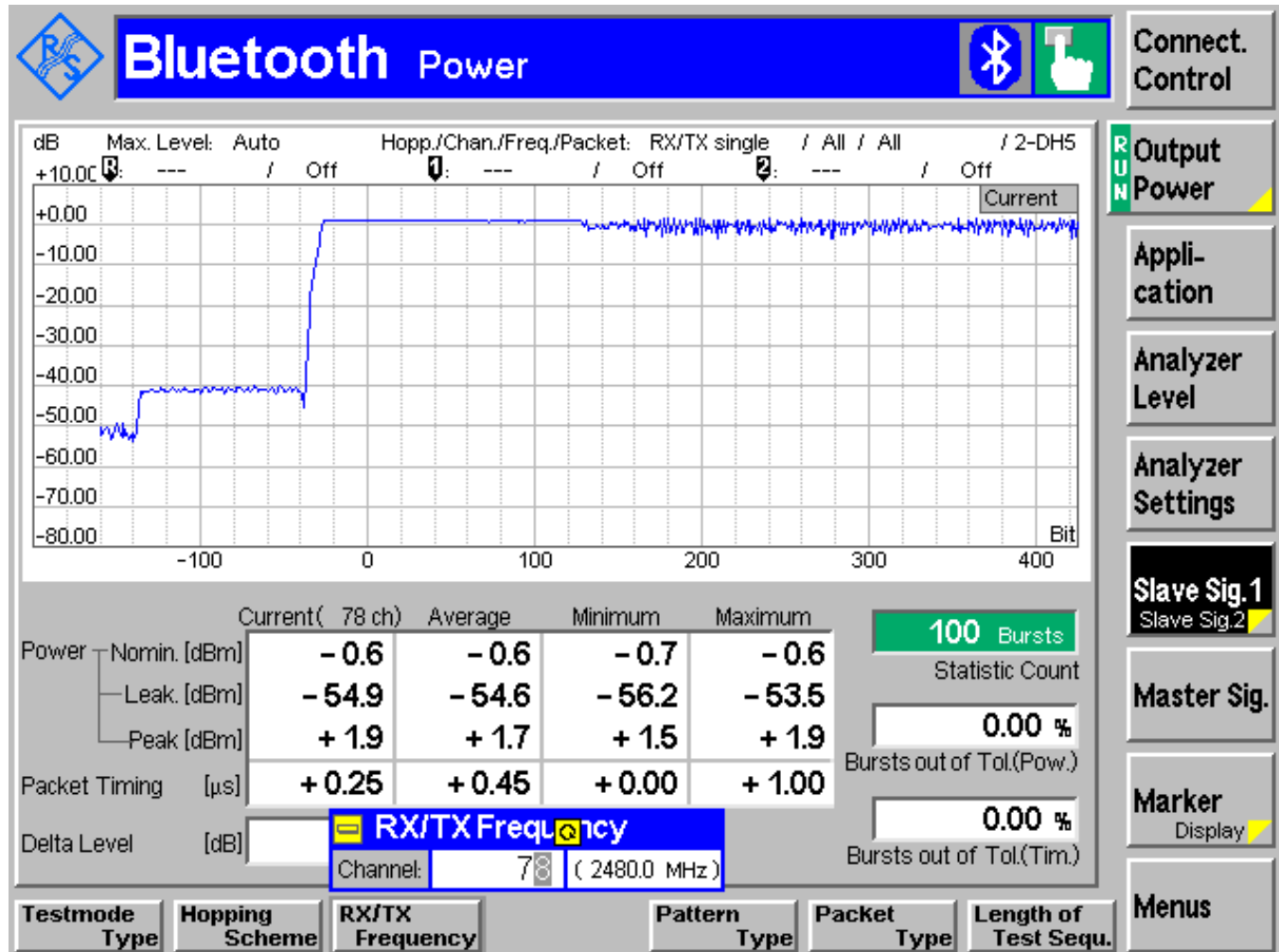
PLOT 6.1D



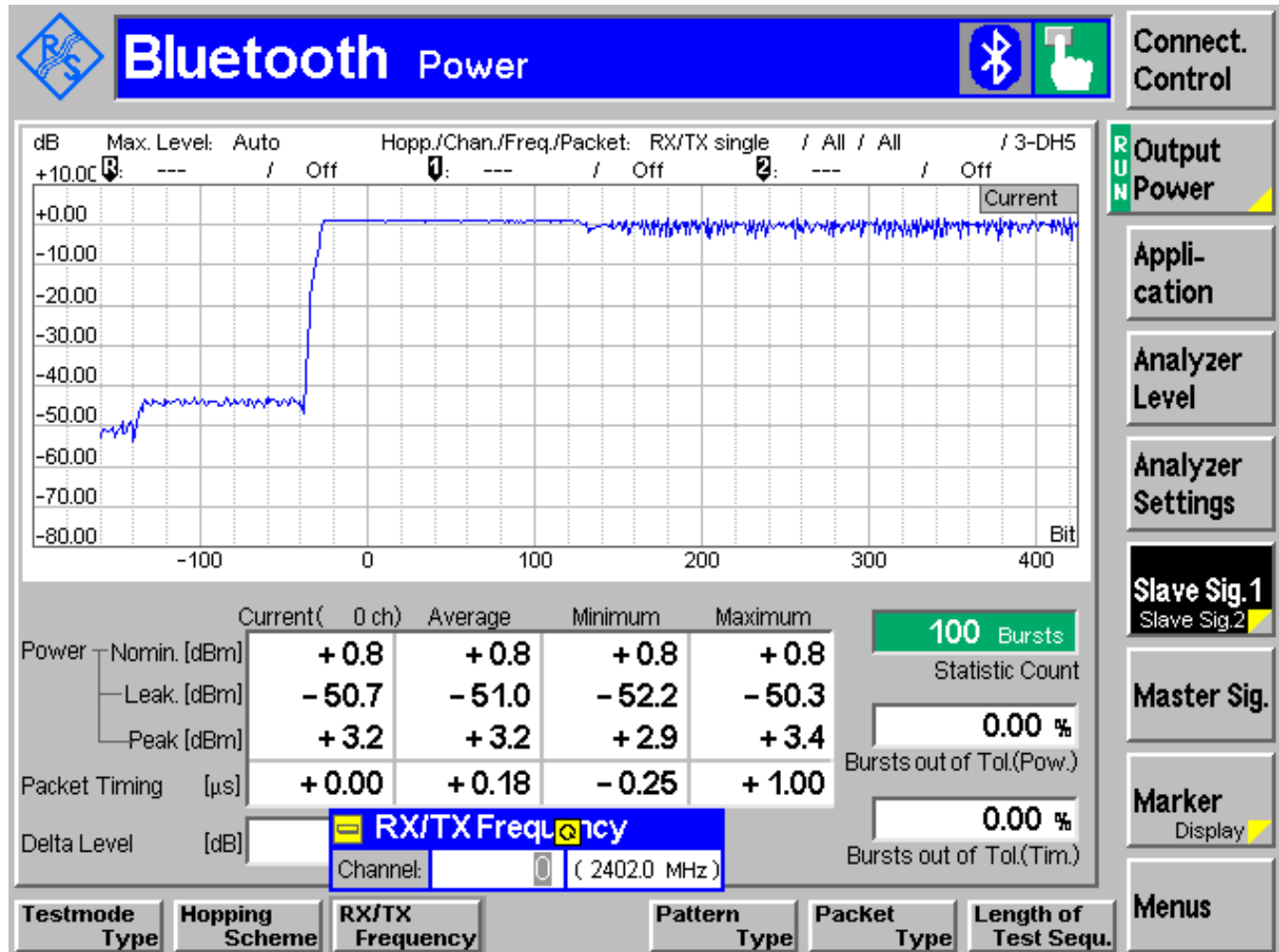
PLOT 6.1E



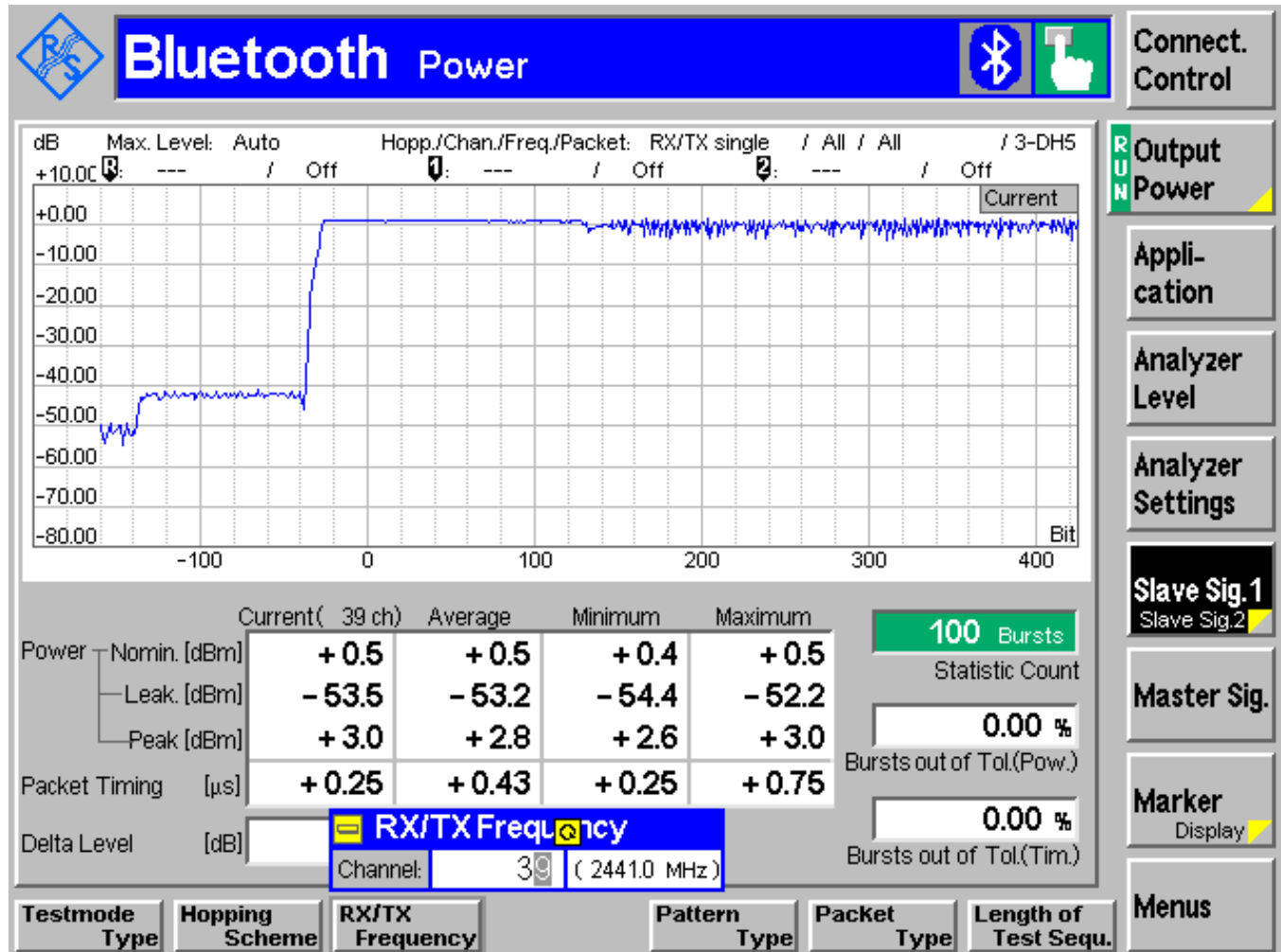
PLOT 6.1F



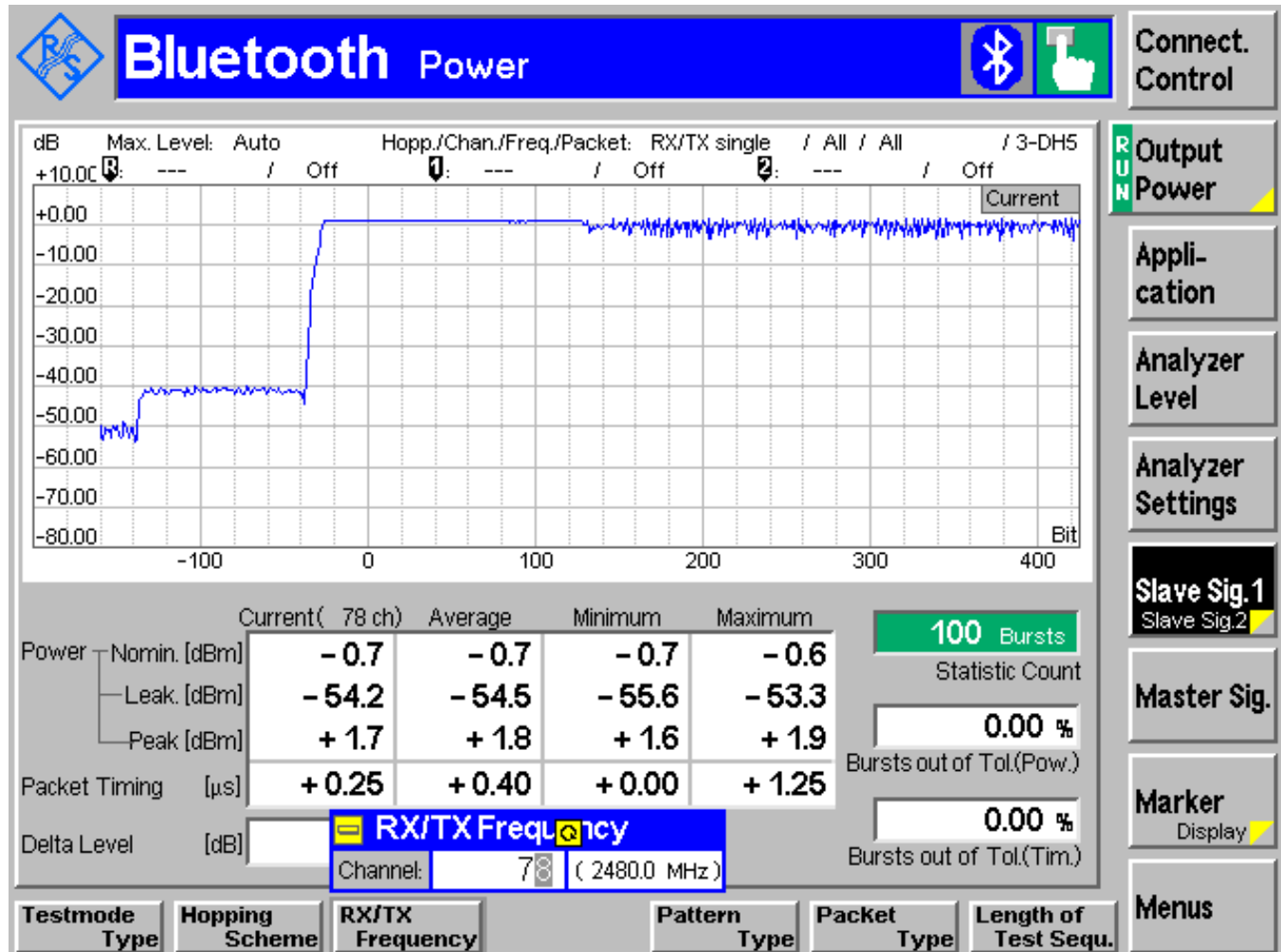
PLOT 6.1G



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 | | |

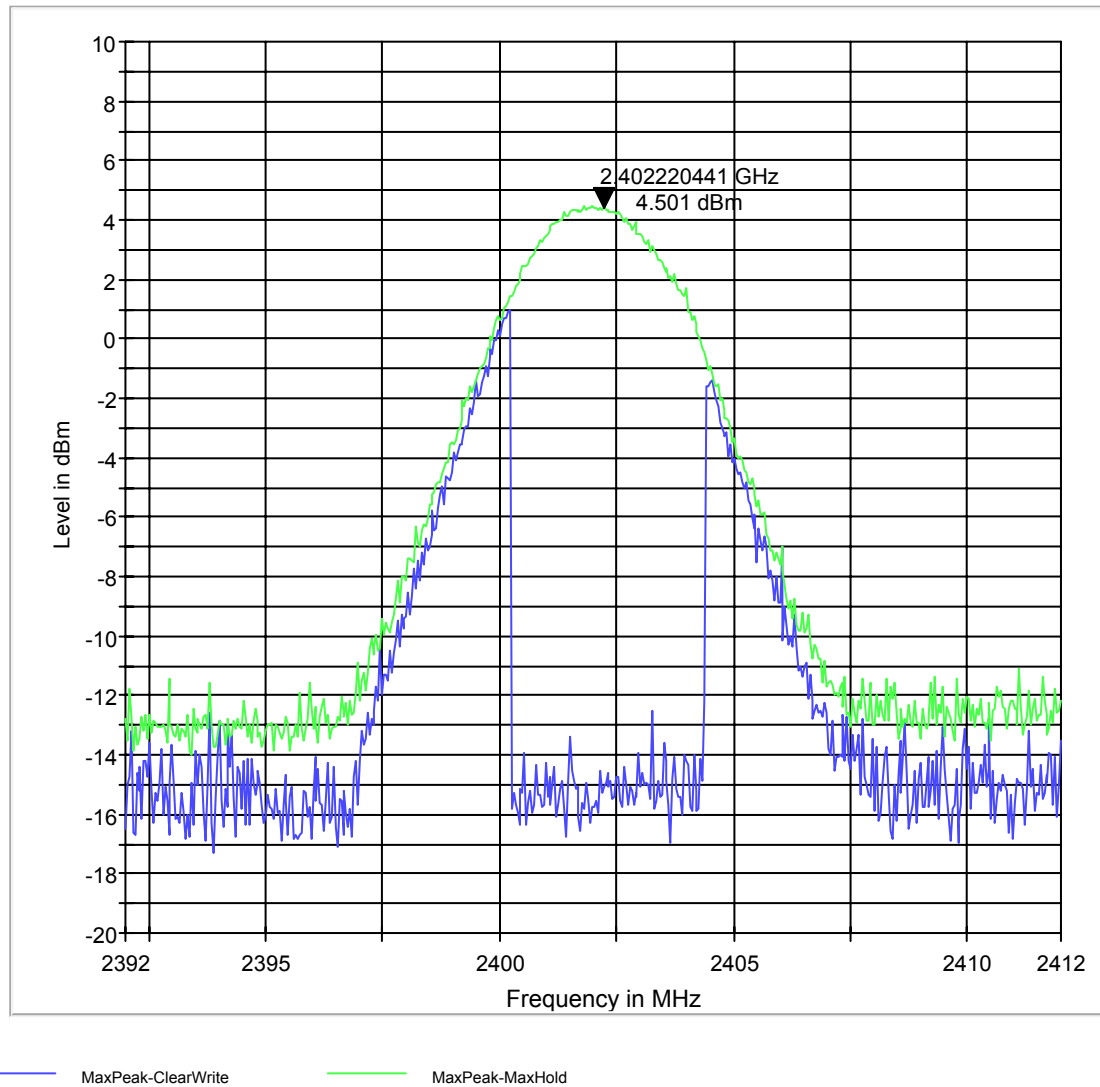
EIRP: 8DPSK

| 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

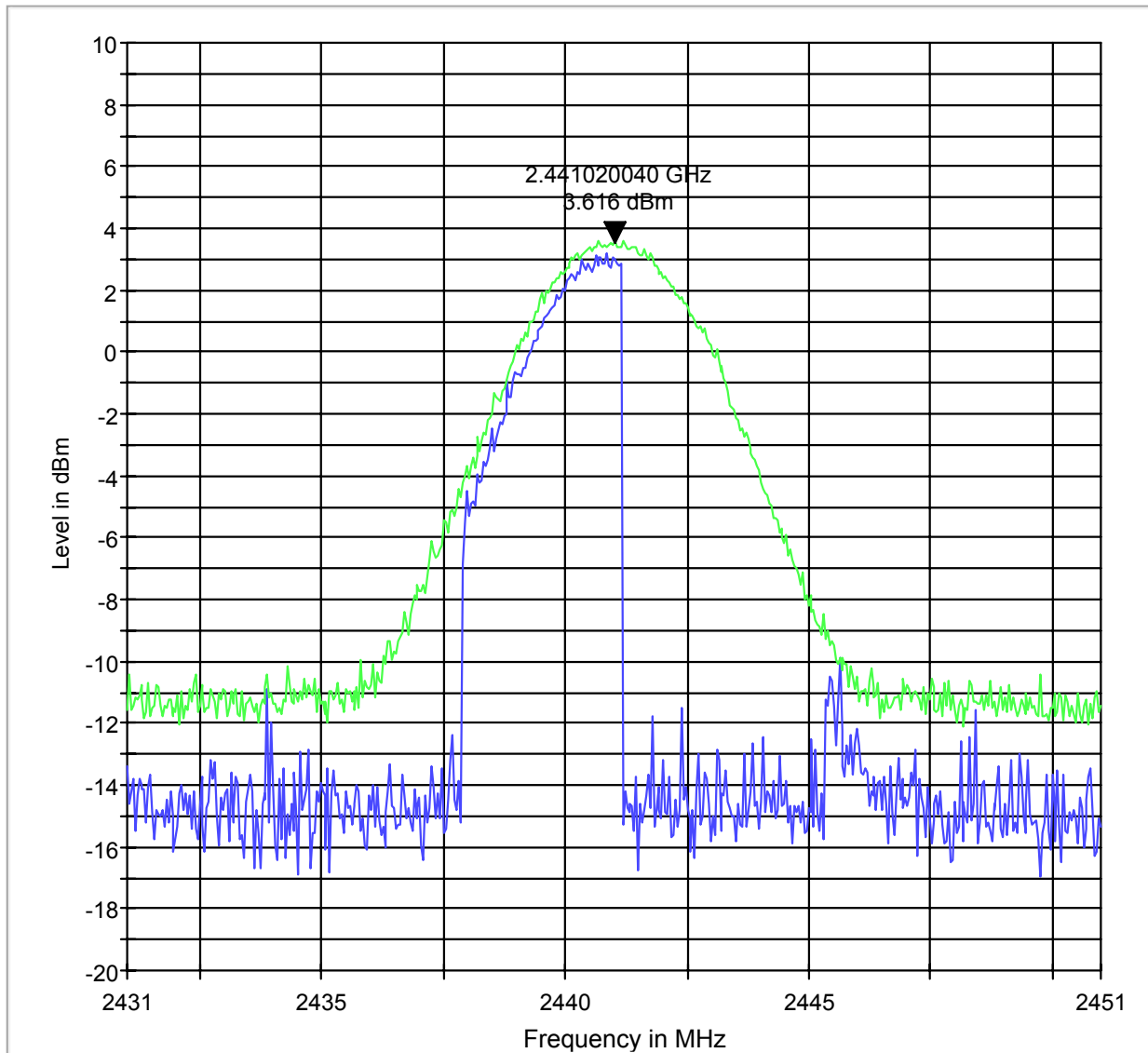
GFSK CH0

EIRP BT L



PLOT 6.2.2B
GFSK CH39

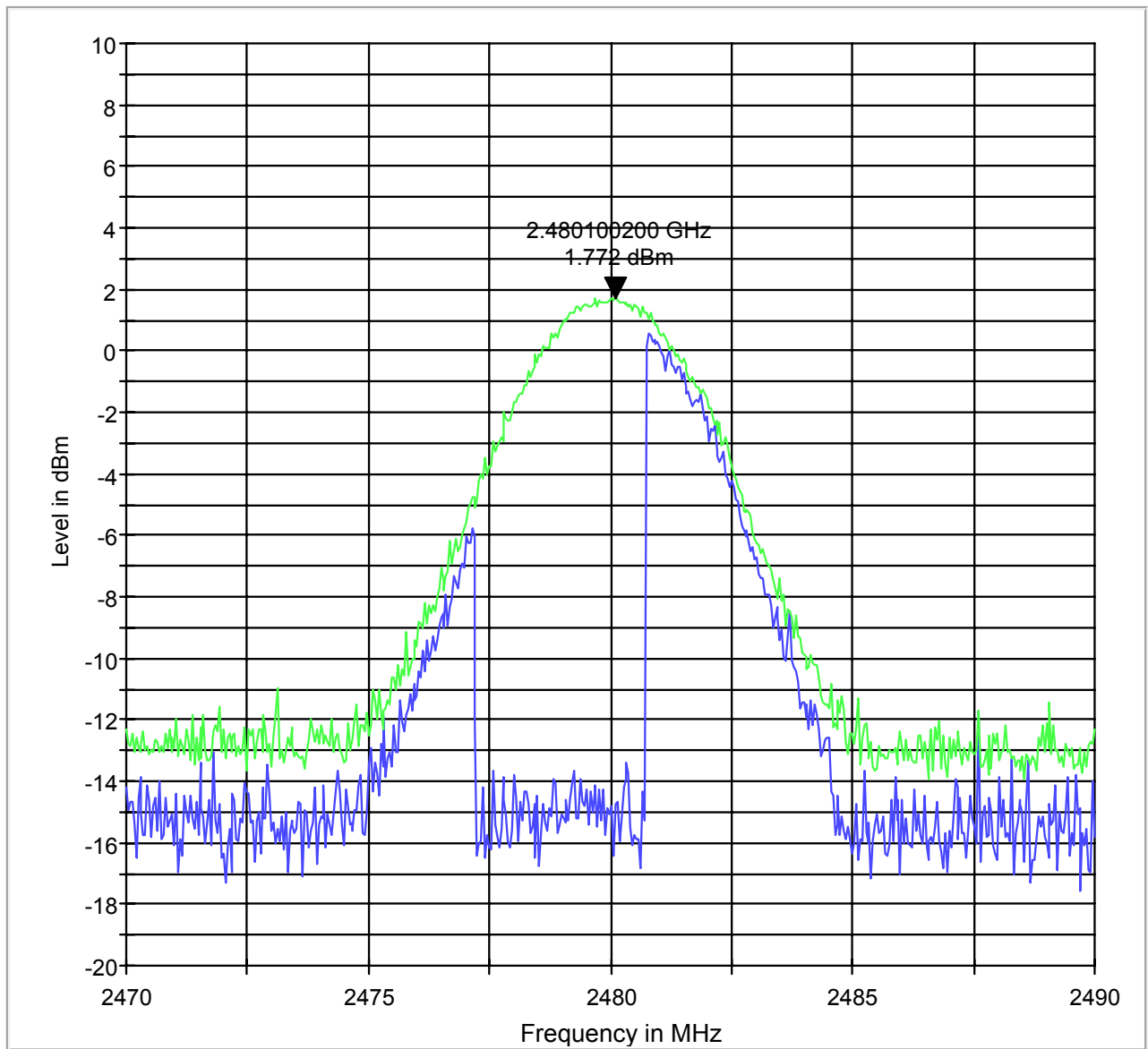
EIRP BT M



— MaxPeak-ClearWrite — MaxPeak-MaxHold

PLOT 6.2.2C
GFSK CH78

EIRP BT H

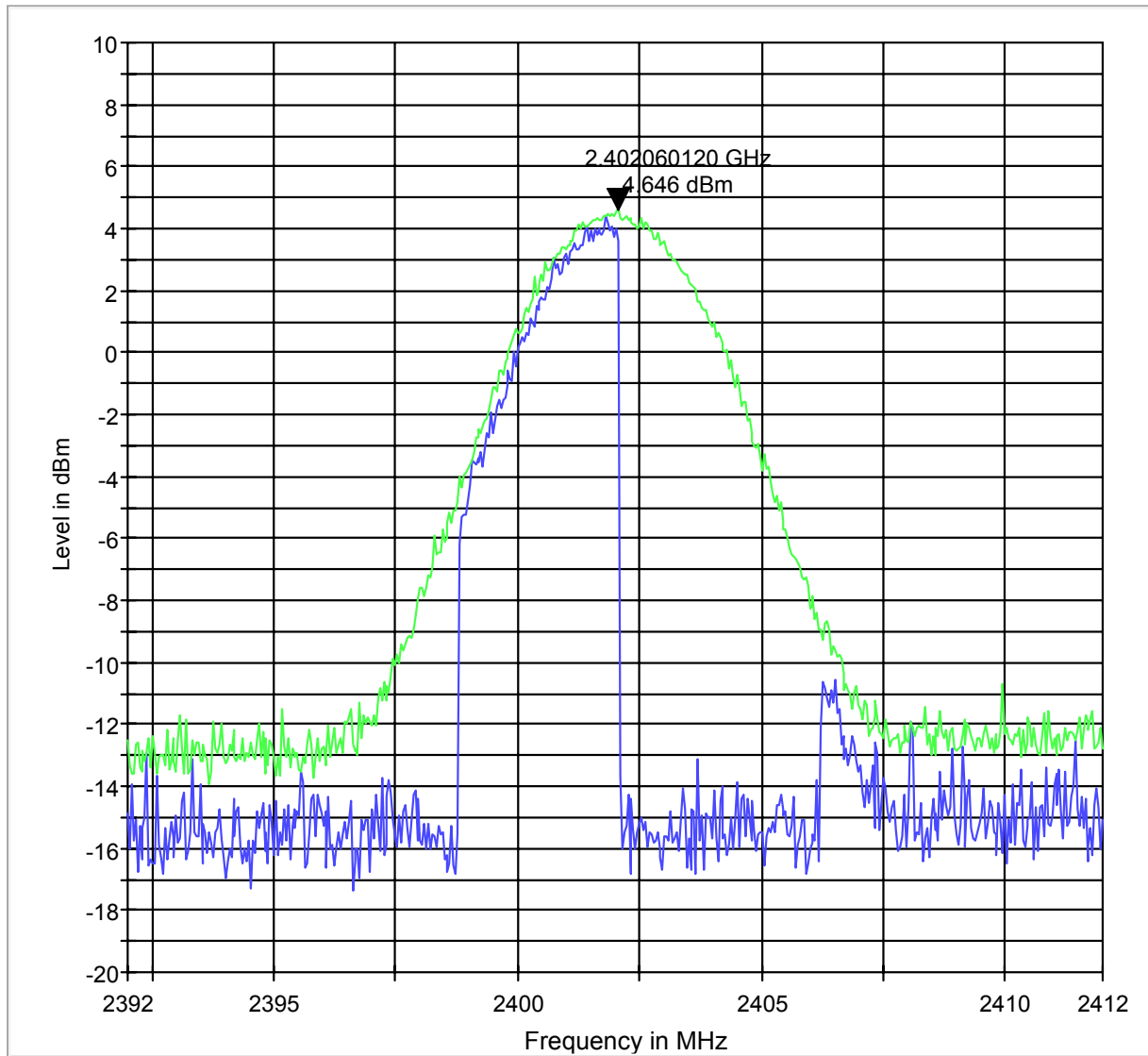


MaxPeak-ClearWrite

MaxPeak-MaxHold

PLOT 6.2.2D
 $\pi / 4$ DQPSK CH0

EIRP BT L

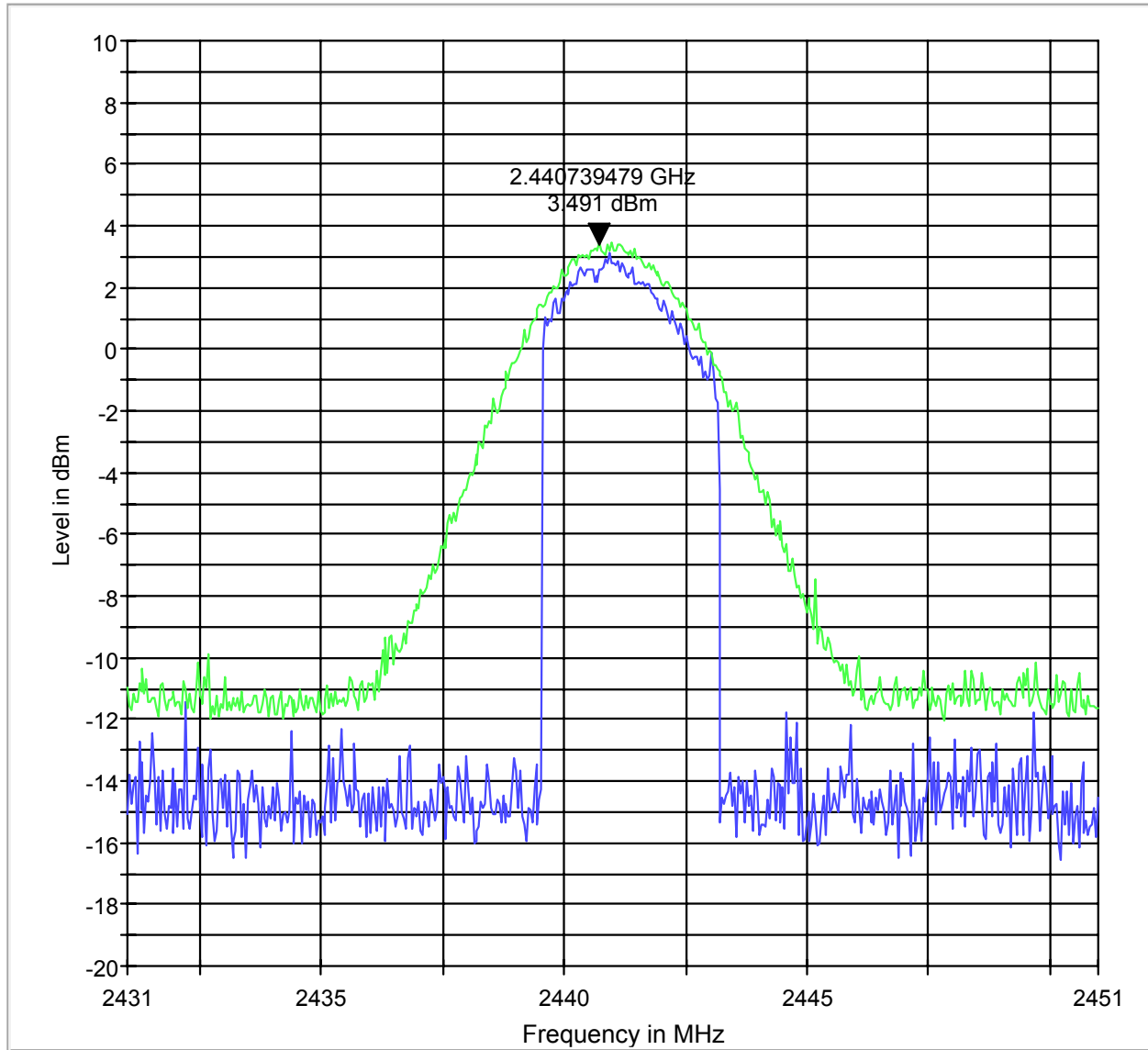


MaxPeak-ClearWrite

MaxPeak-MaxHold

PLOT 6.2.2E
 $\pi / 4$ DQPSK CH39

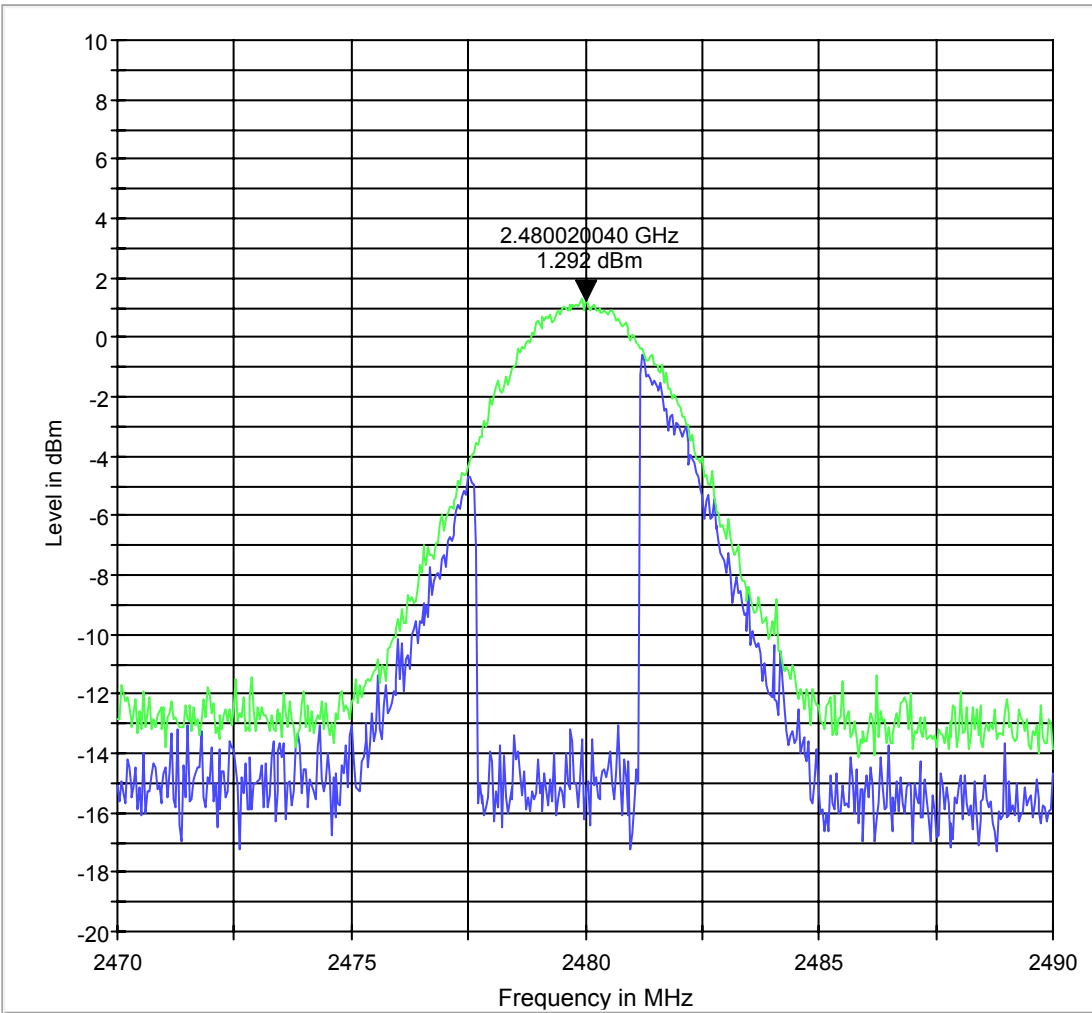
EIRP BT M



MaxPeak-ClearWrite MaxPeak-MaxHold

PLOT 6.2.2F
 $\pi / 4$ DQPSK CH78

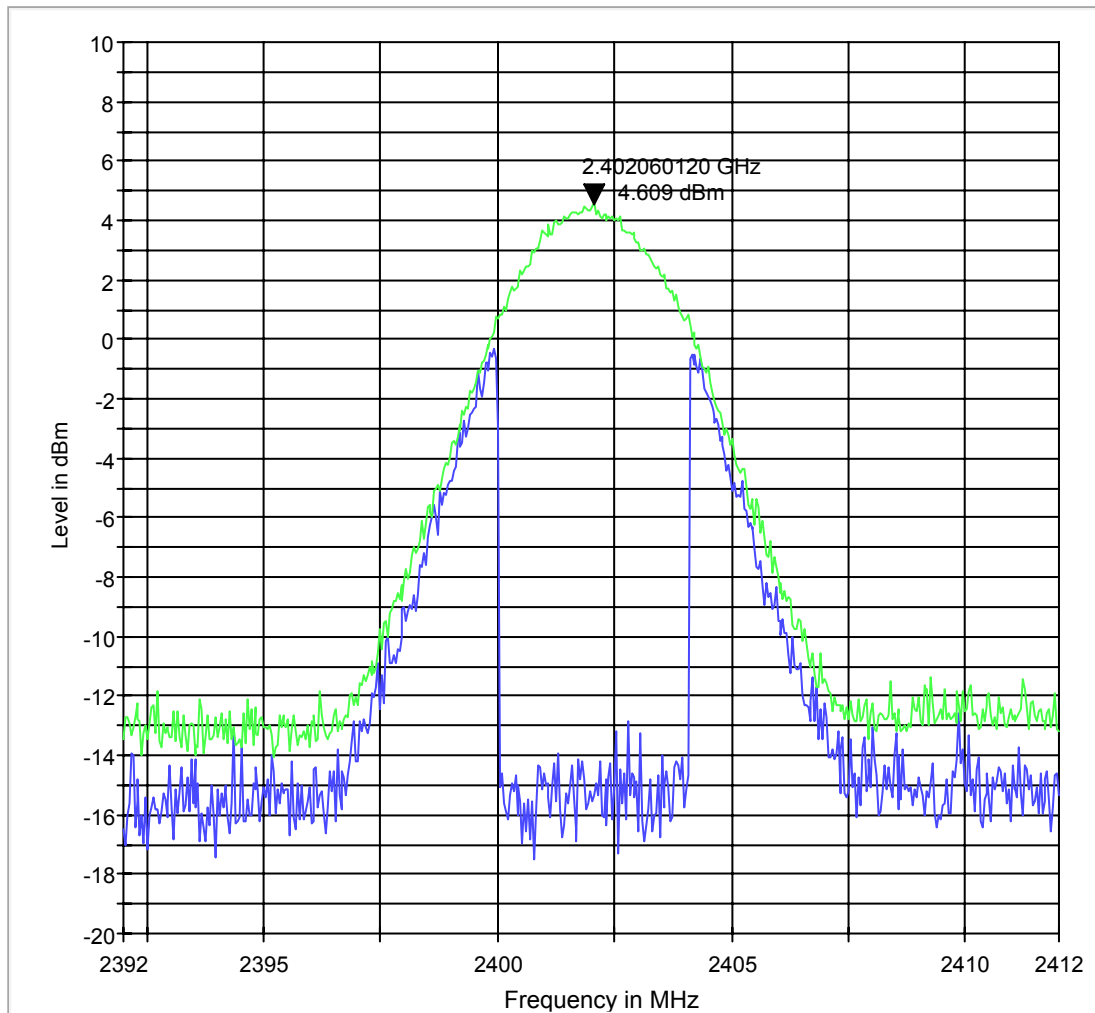
EIRP BT H



MaxPeak-ClearWrite MaxPeak-MaxHold

PLOT 6.2.2G
8 DPSK CH0

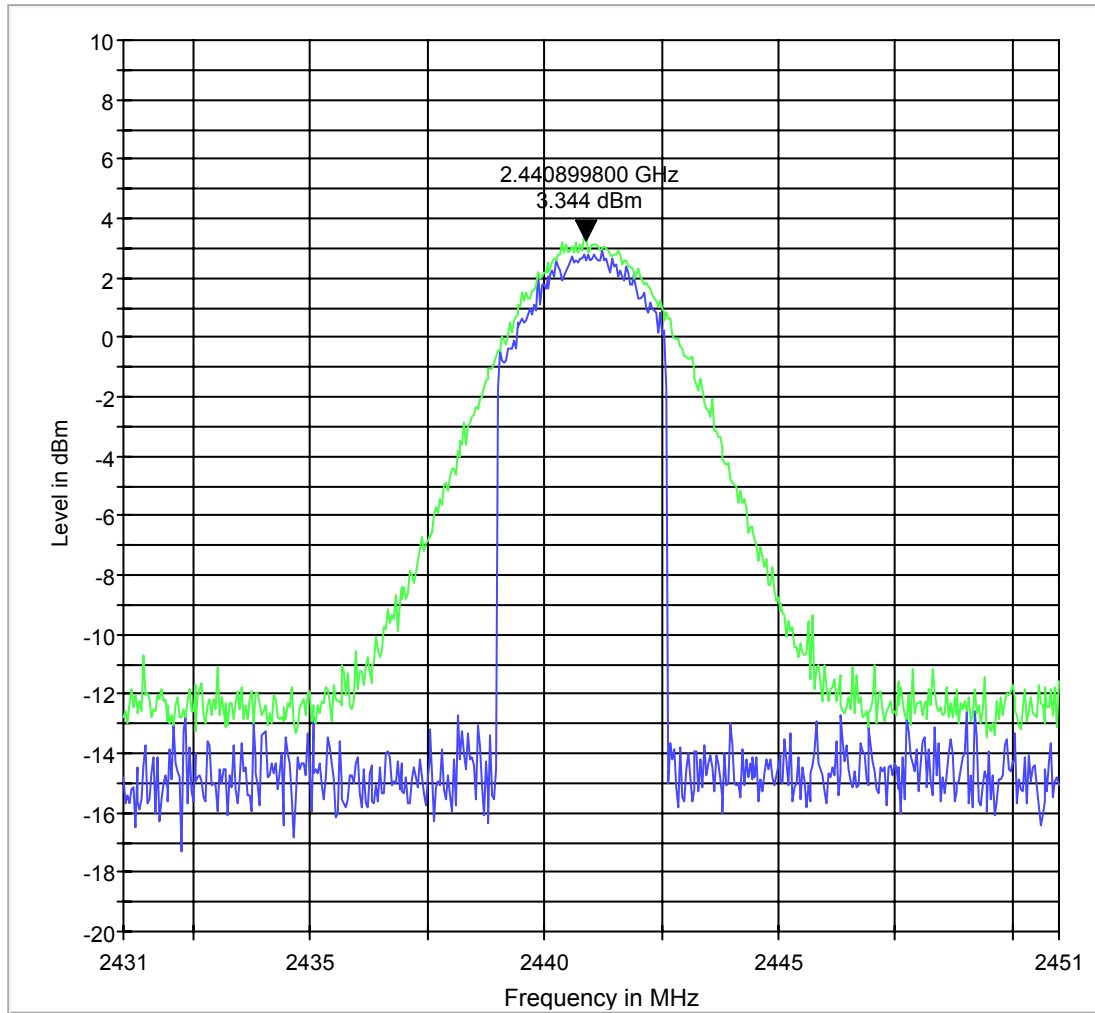
EIRP BT L



MaxPeak-ClearWrite MaxPeak-MaxHold

PLOT 6.2.2H
8 DPSK CH39

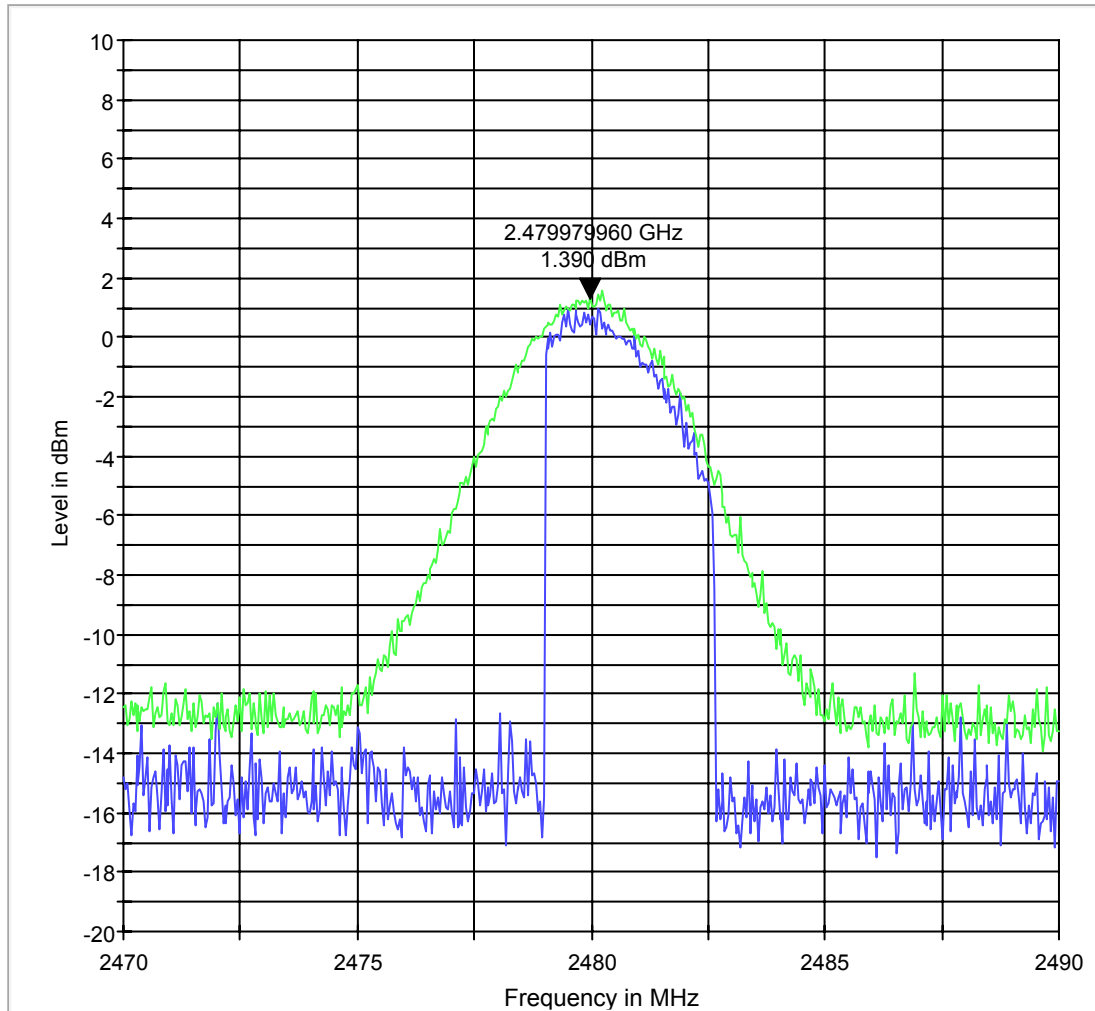
EIRP BT M



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

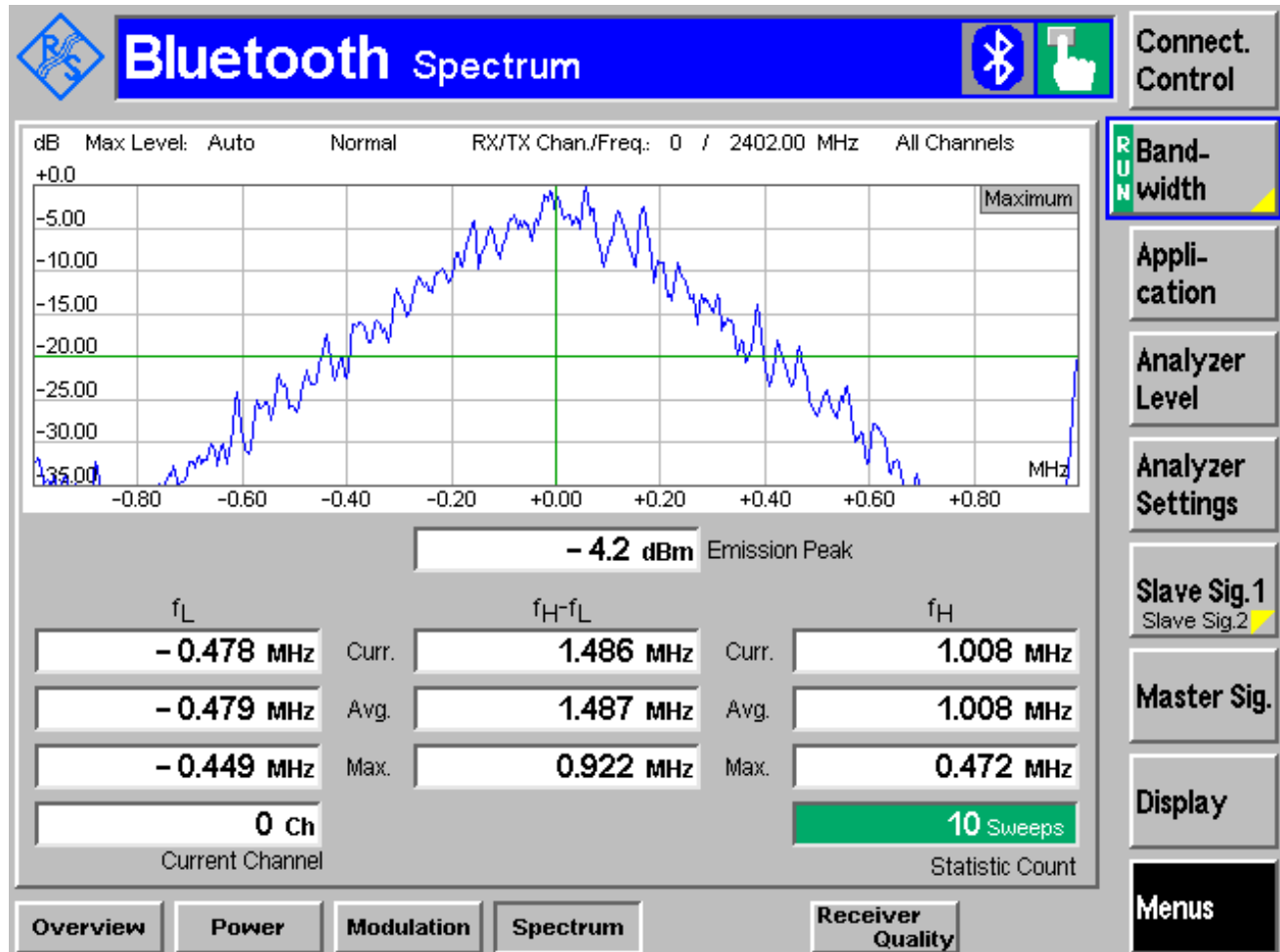
| Channel No. | Frequency (MHz) | 20dB BW (MHz) | Result (Fail/Pass) |
|-------------|-----------------|---------------|--------------------|
| 0 | 2402 | 1.317 | PASS |
| 39 | 2441 | 1.315 | PASS |
| 78 | 2480 | 1.313 | PASS |

8DPSK

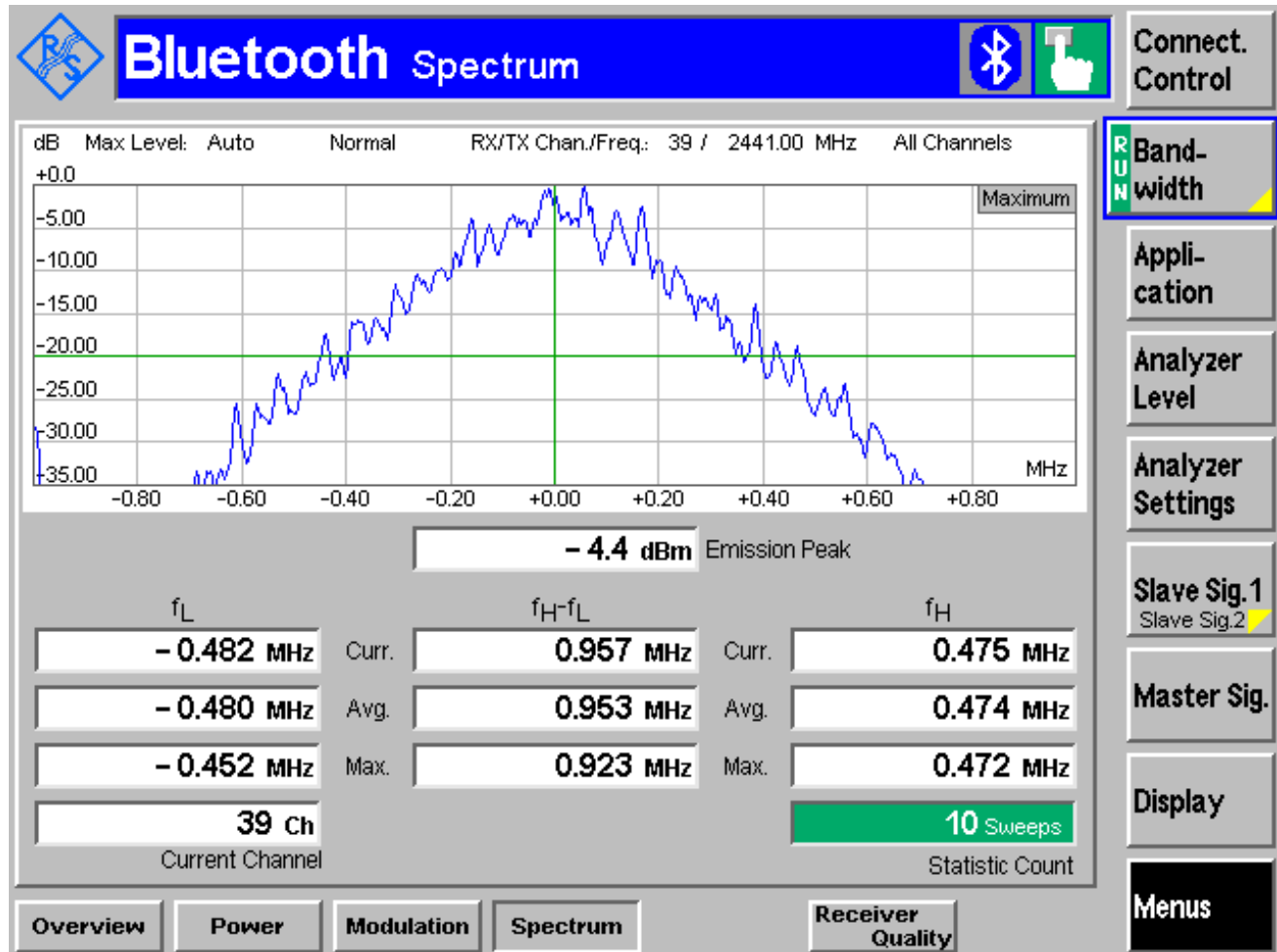
| Channel No. | Frequency (MHz) | 20dB BW (kHz) | Result (Fail/Pass) |
|-------------|-----------------|---------------|--------------------|
| 0 | 2402 | 1.284 | PASS |
| 39 | 2441 | 1.283 | PASS |
| 78 | 2480 | 1.263 | PASS |

PLOT 6.3.2 A

(2402 MHz) GFSK

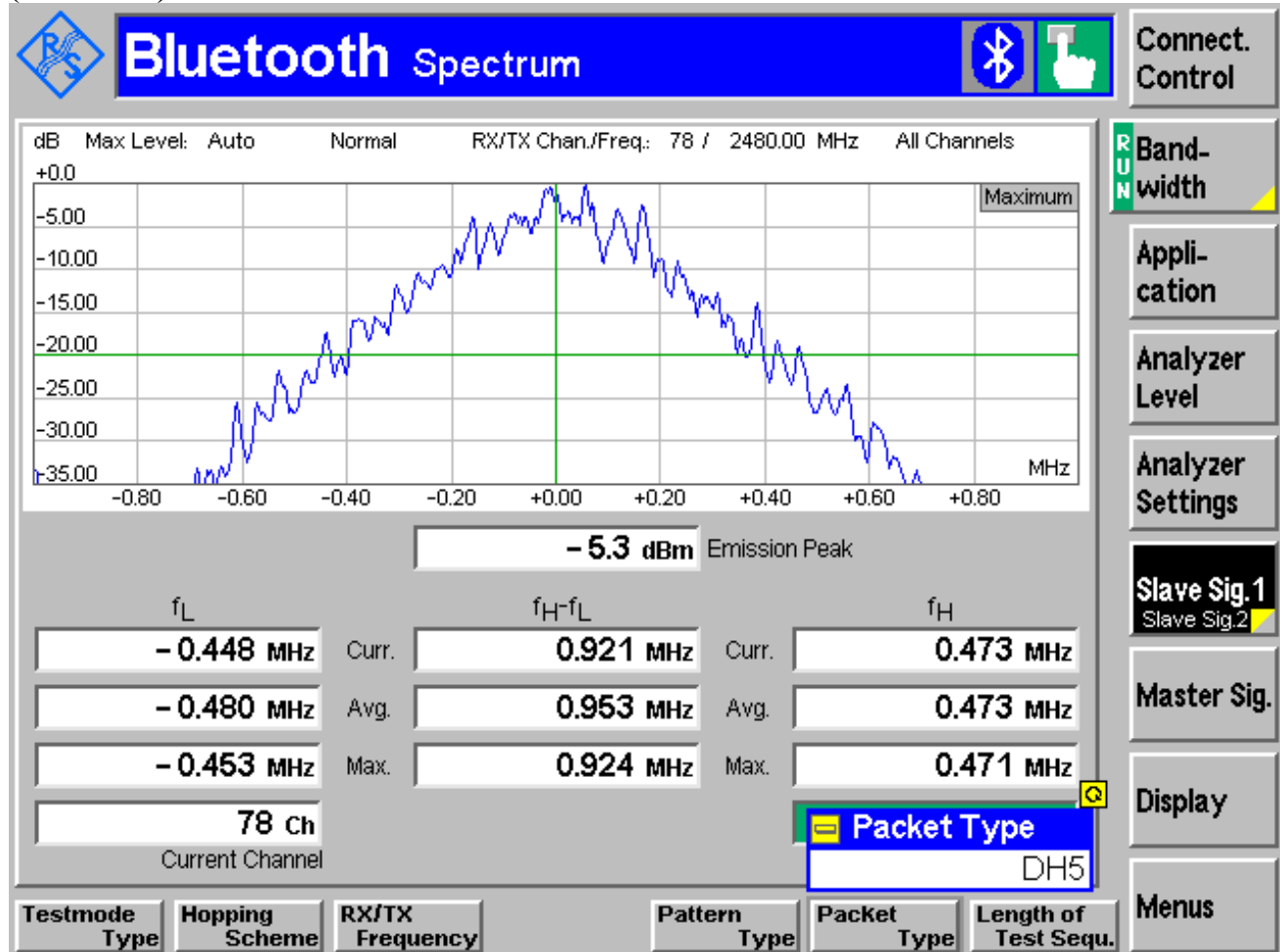


PLOT 6.3.2 B
(2441 MHz) GFSK

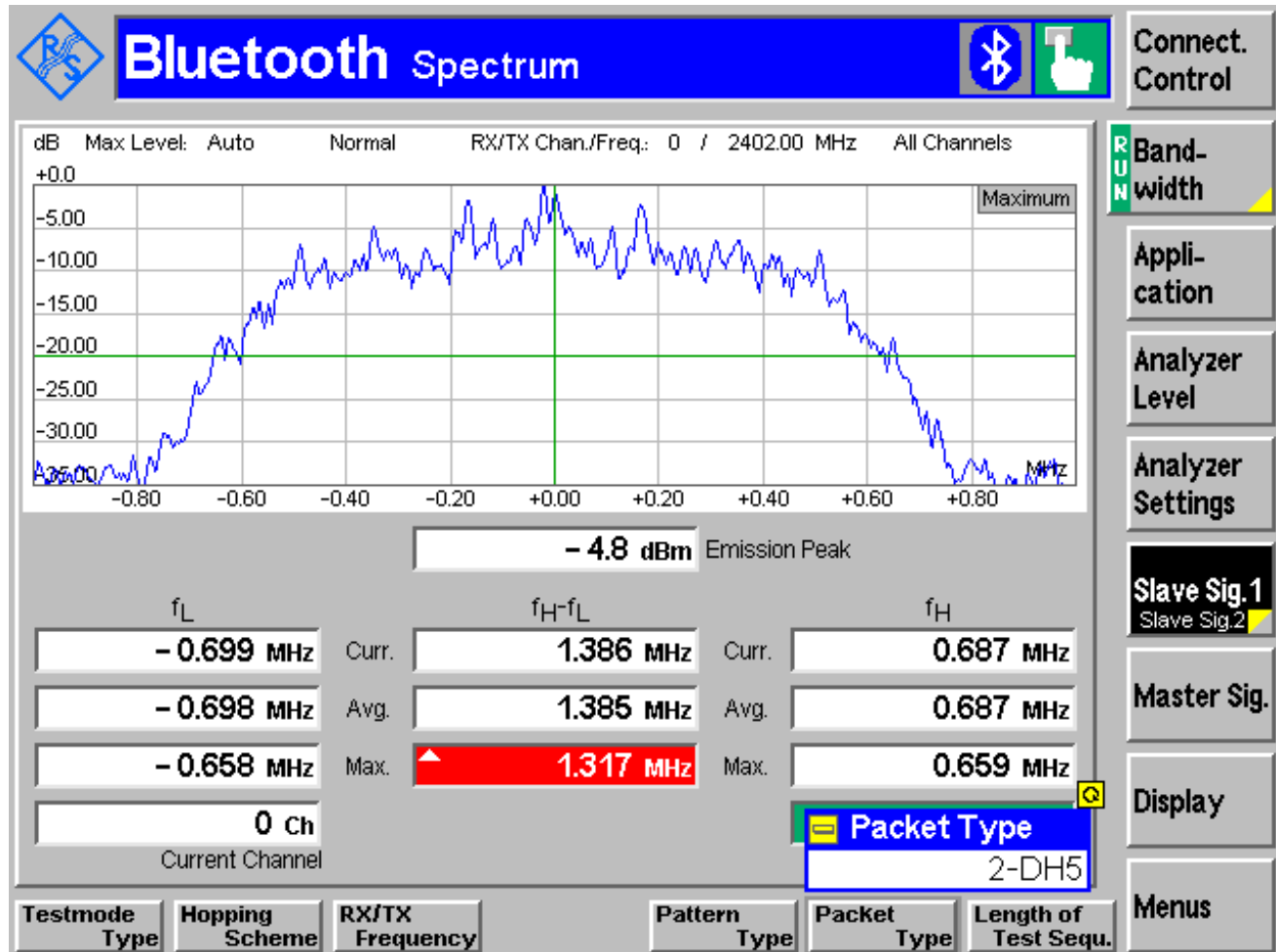


PLOT 6.3.2 C

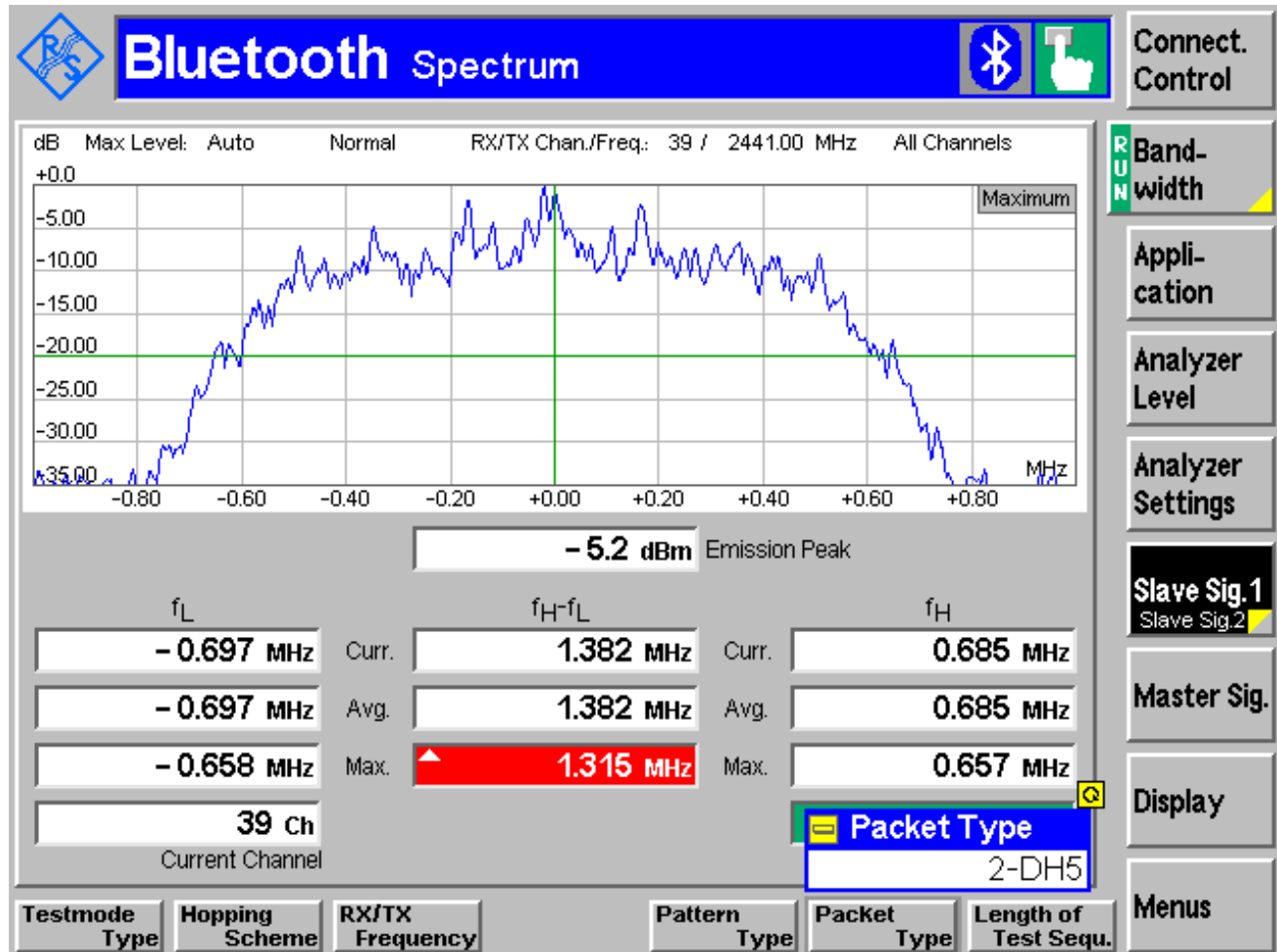
(2480 MHz) GFSK



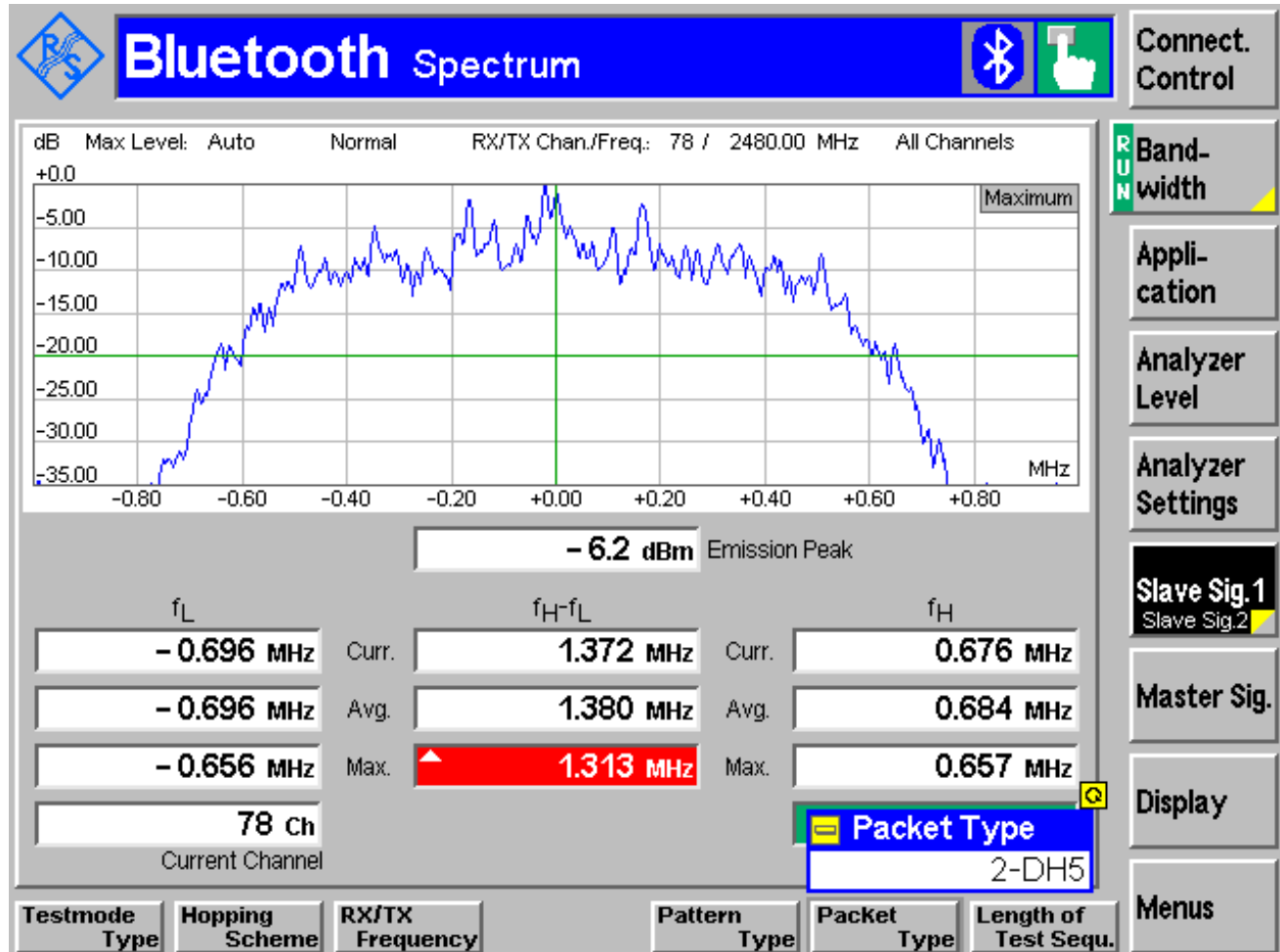
PLOT 6.3.2 D
(2402 MHz) $\pi / 4$ DQPSK



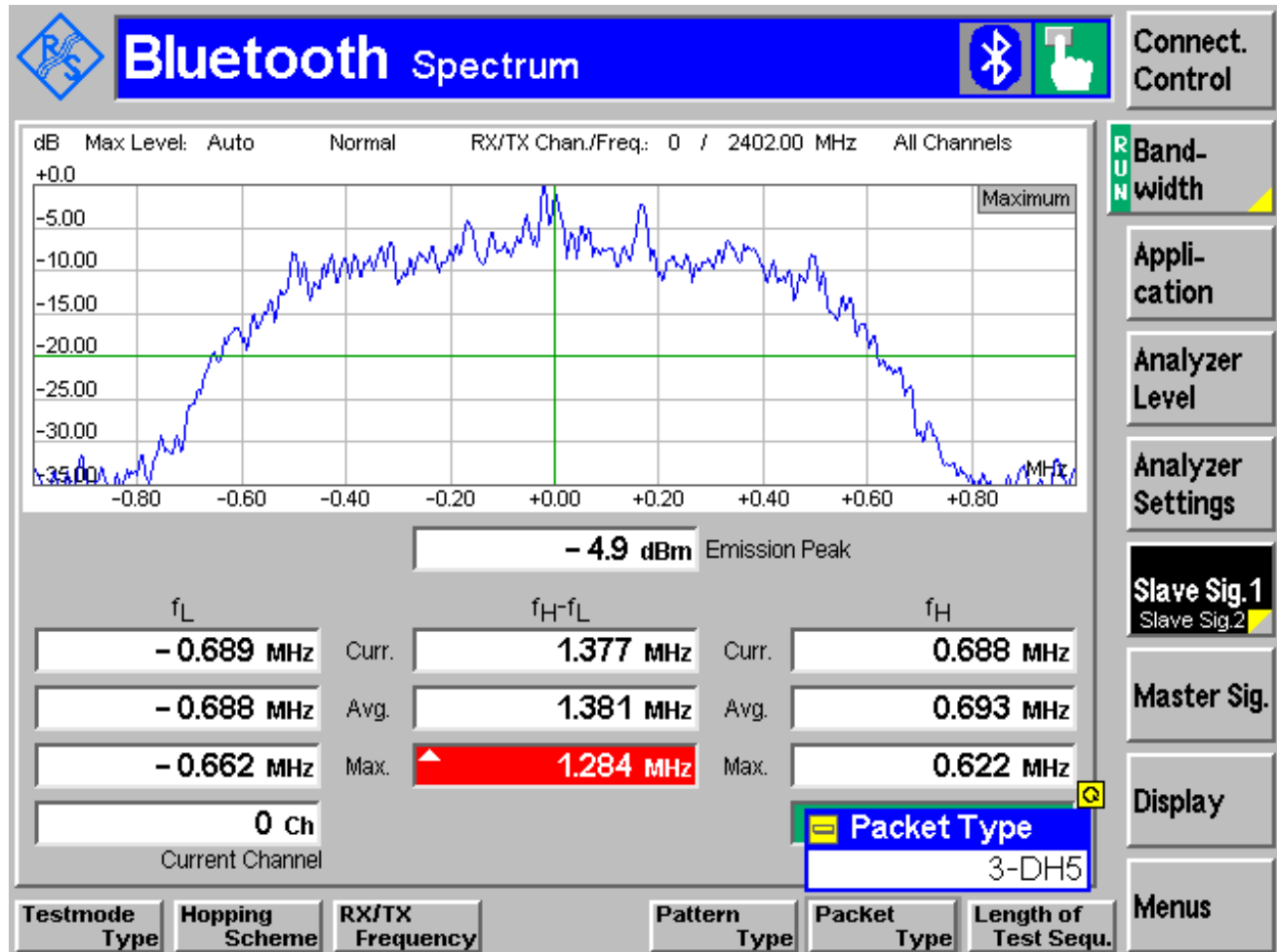
PLOT 6.3.2 E
(2441 MHz) $\pi / 4$ DQPSK



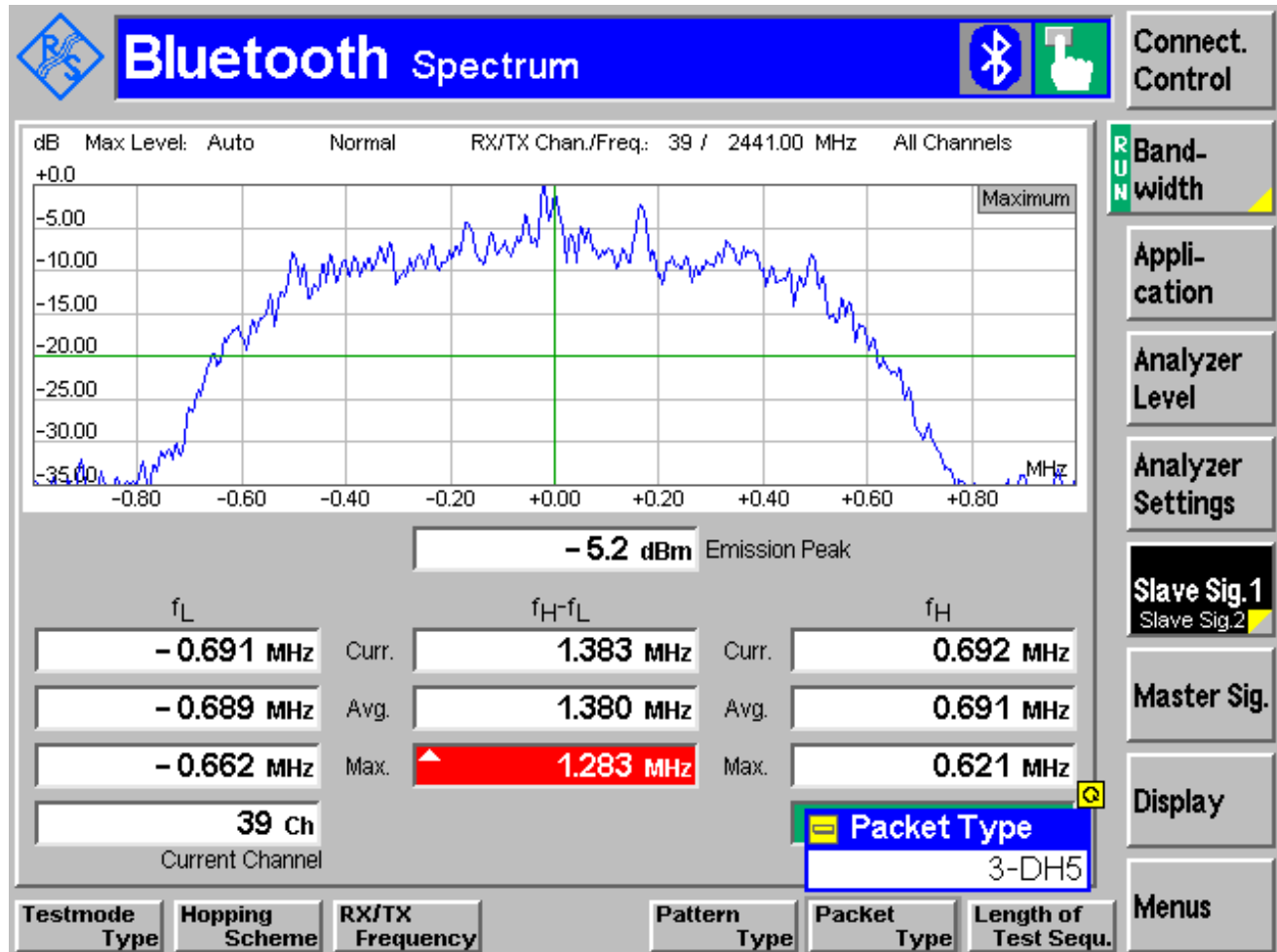
PLOT 6.3.2 F
(2480 MHz) $\pi / 4$ DQPSK



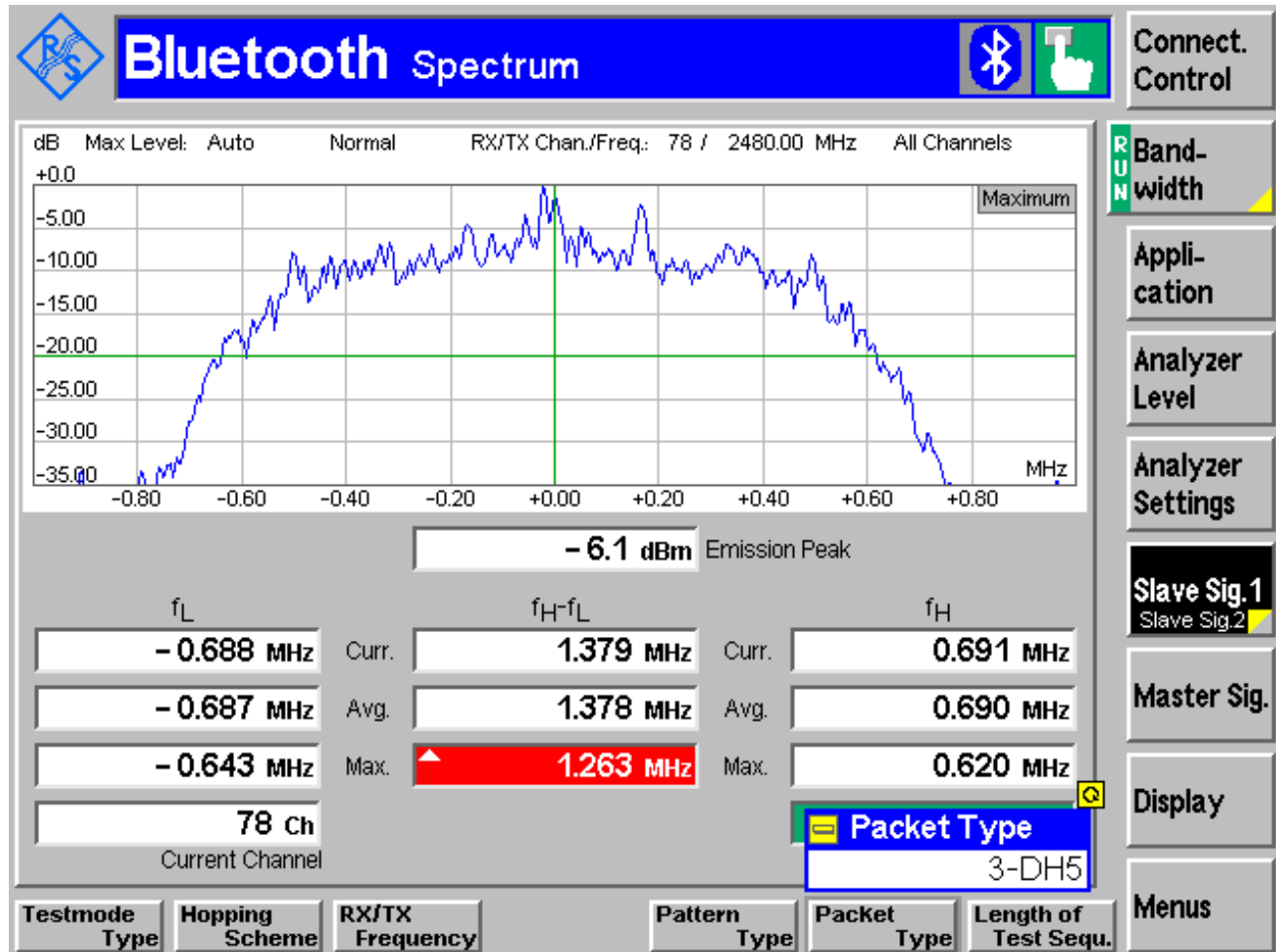
PLOT 6.3.2 G
(2402 MHz) 8DPSK



PLOT 6.3.2 H
(2441 MHz) 8DPSK



PLOT 6.3.2 I
(2480 MHz) 8DPSK



6.4 CARRIER FREQUENCY SEPARATION

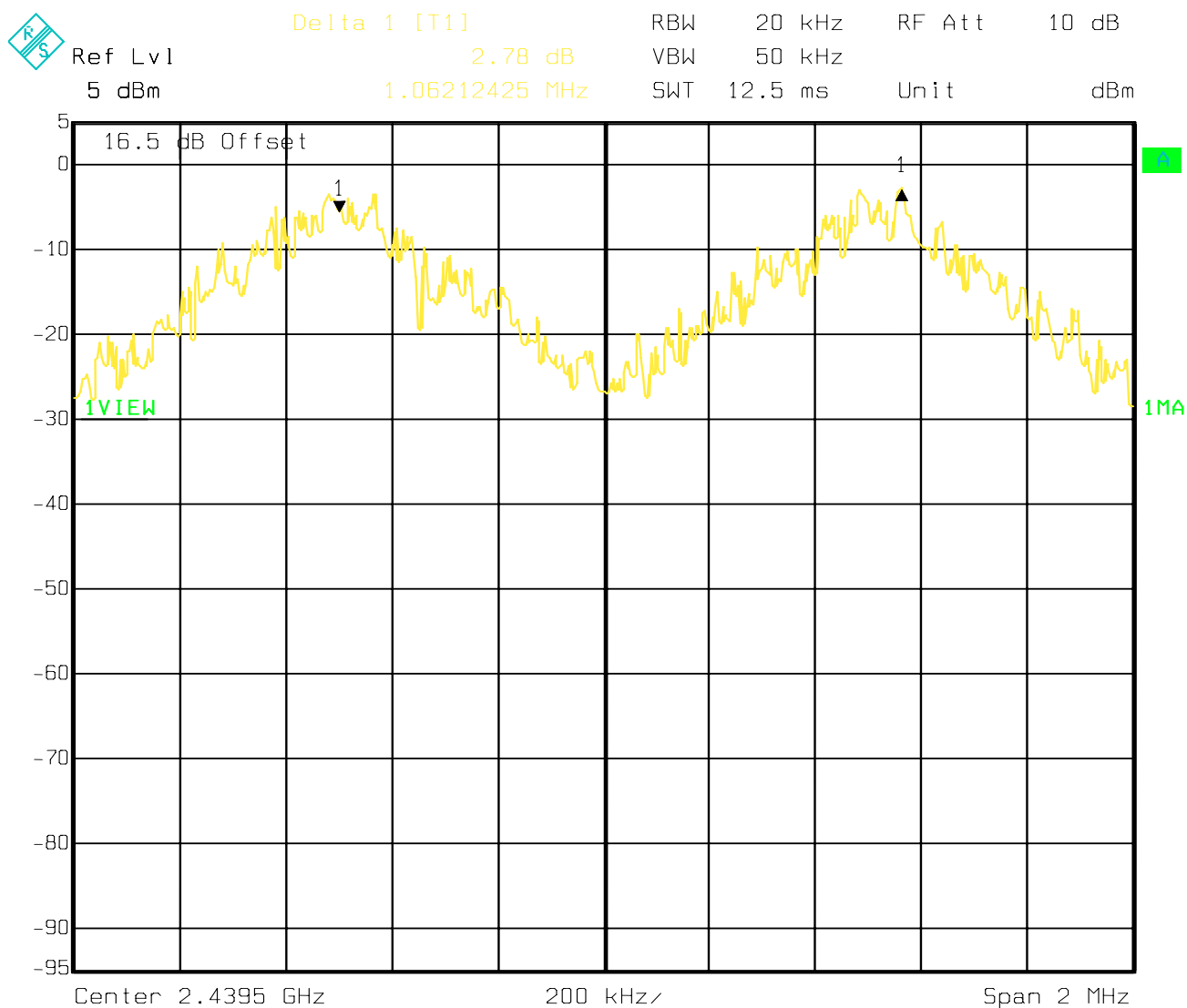
6.4.1 LIMIT SUB CLAUSE § 15.247 (a) (1) (i) (ii) (iii) and RSS-210 Annex 8.4.1.b

| 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



Date: 10.DEC.2009 14:41:06

6.5 NUMBER OF HOPPING CHANNELS

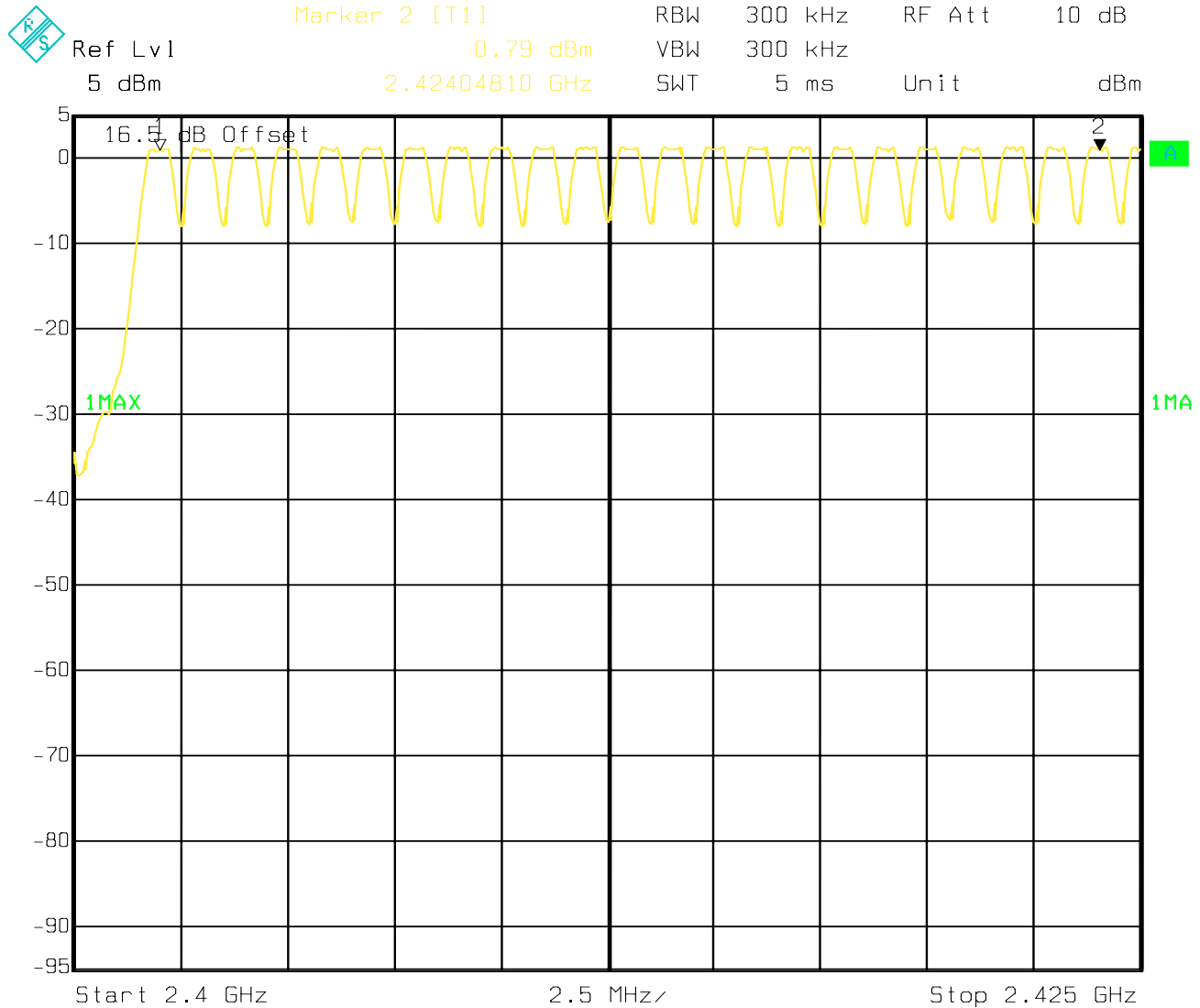
6.5.1 LIMIT SUB CLAUSE § 15.247 (a) (1) (iii) and RSS-210 Annex 8.4 (2)

| NUMBER OF CHANNELS |
|--------------------|
| > 15 |

6.5.2 RESULTS:

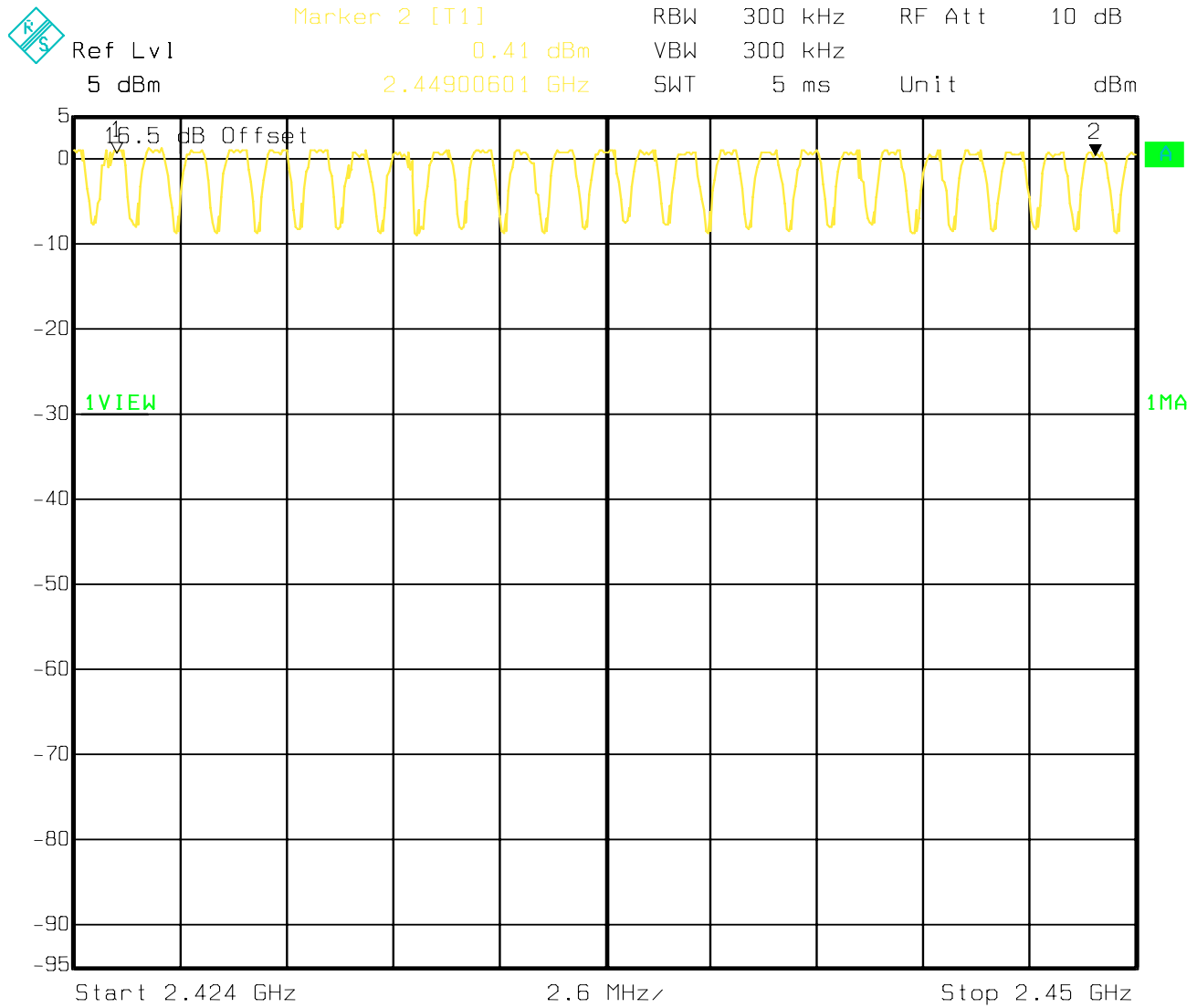
| TEST CONDITIONS | | NUMBER OF CHANNELS |
|-------------------------|----------------------|--------------------|
| T _{nom} (23)°C | V _{nom} VDC | 79 |

PLOT 6.5.2A



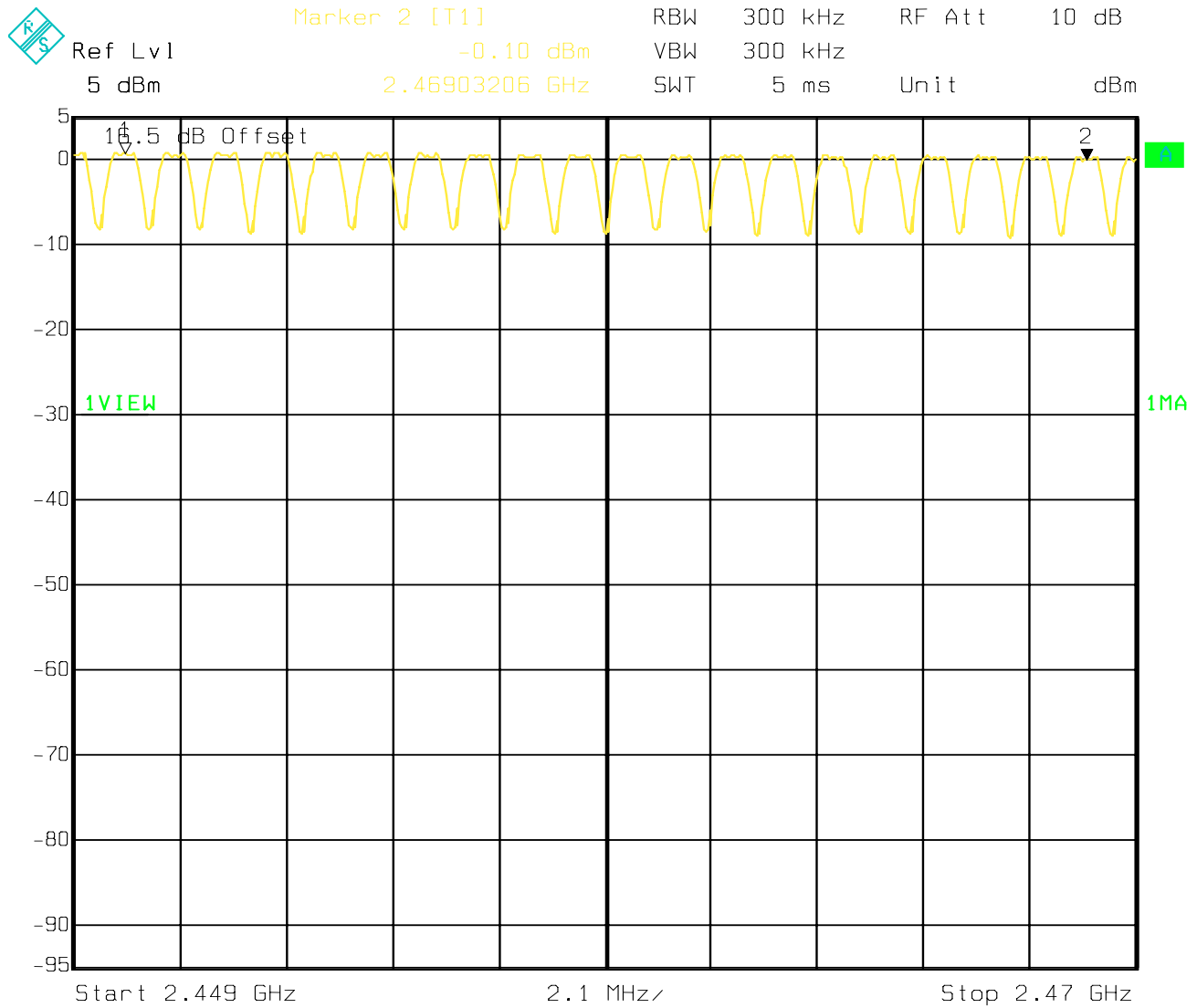
Date: 10.DEC.2009 14:22:41

PLOT 6.5.2B



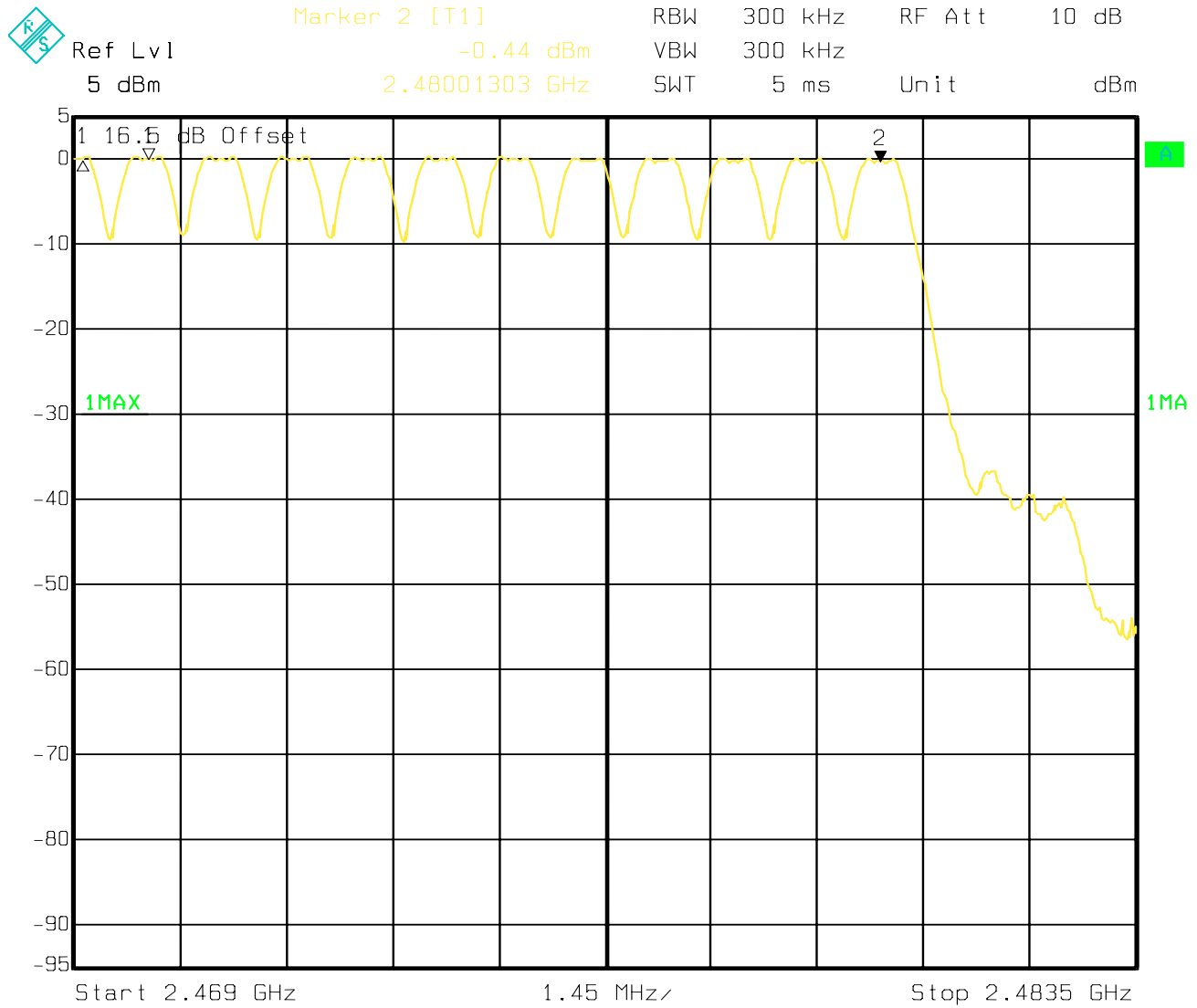
Date: 10.DEC.2009 14:25:30

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

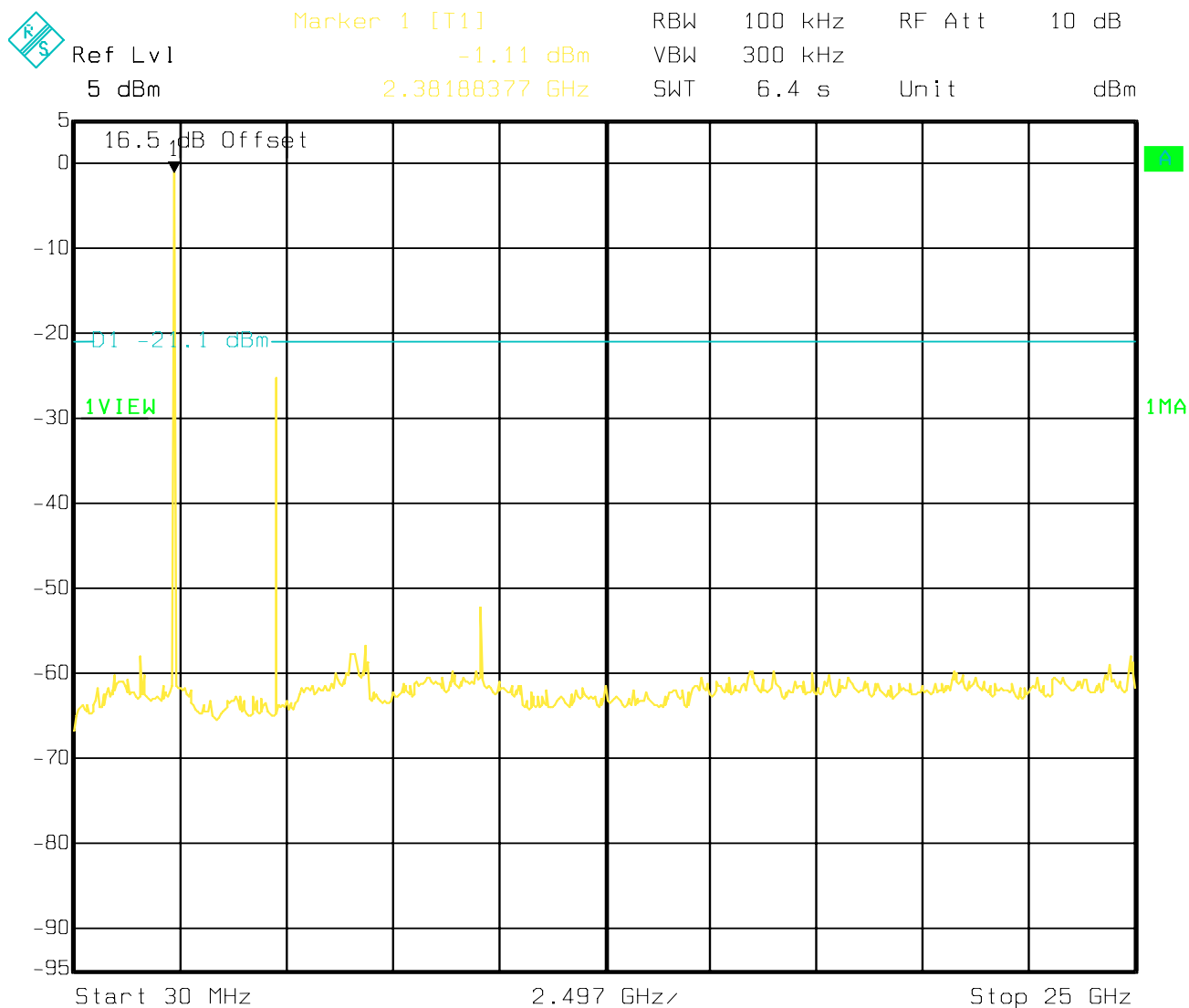
6.7.1 LIMIT SUB CLAUSE § 15.247 (d) and RSS-210 Annex 8.5

| FREQUENCY RANGE | limit |
|-----------------|--------|
| 30MHz-25GHz | -20dBc |

6.7.2 RESULTS: Tnom(23)°C VnomVDC

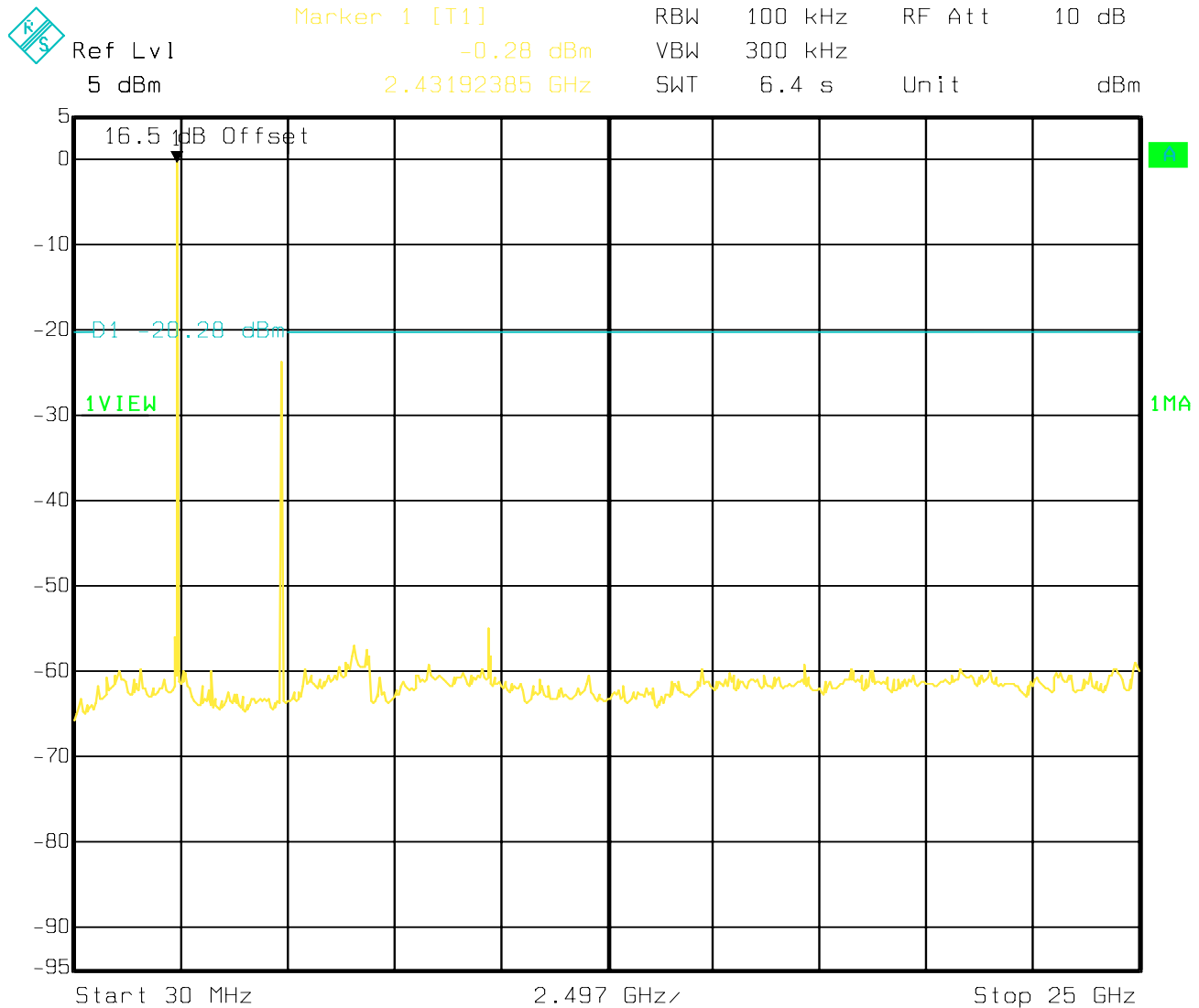
Plot shows worse case emission for all modulations on each channel.

PLOT 6.7.1A (2402MHz)



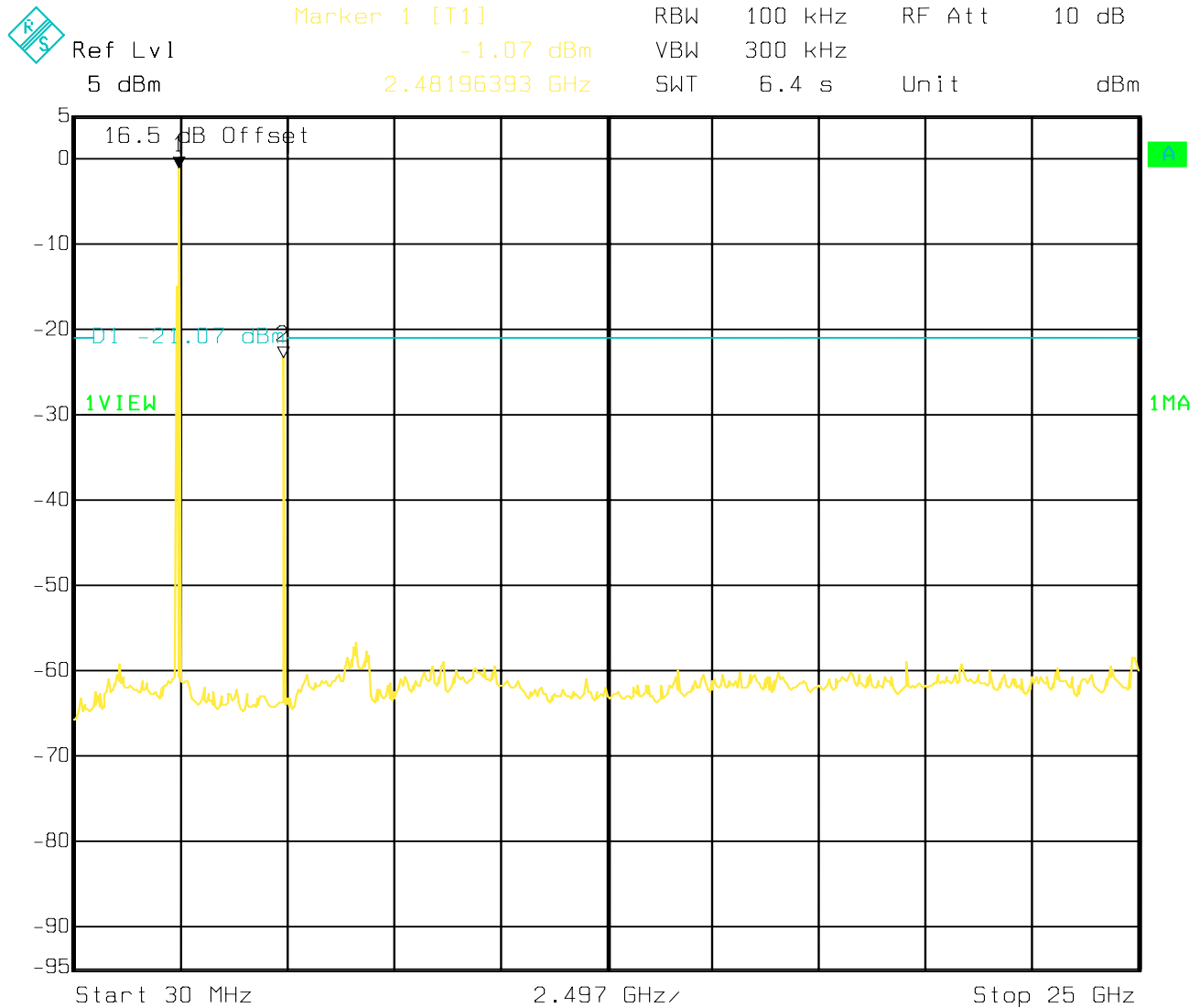
Date: 10.DEC.2009 14:47:43

PLOT 6.7.1B
(2441MHz)



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

PLOT 6.7.1C
(2480MHz)



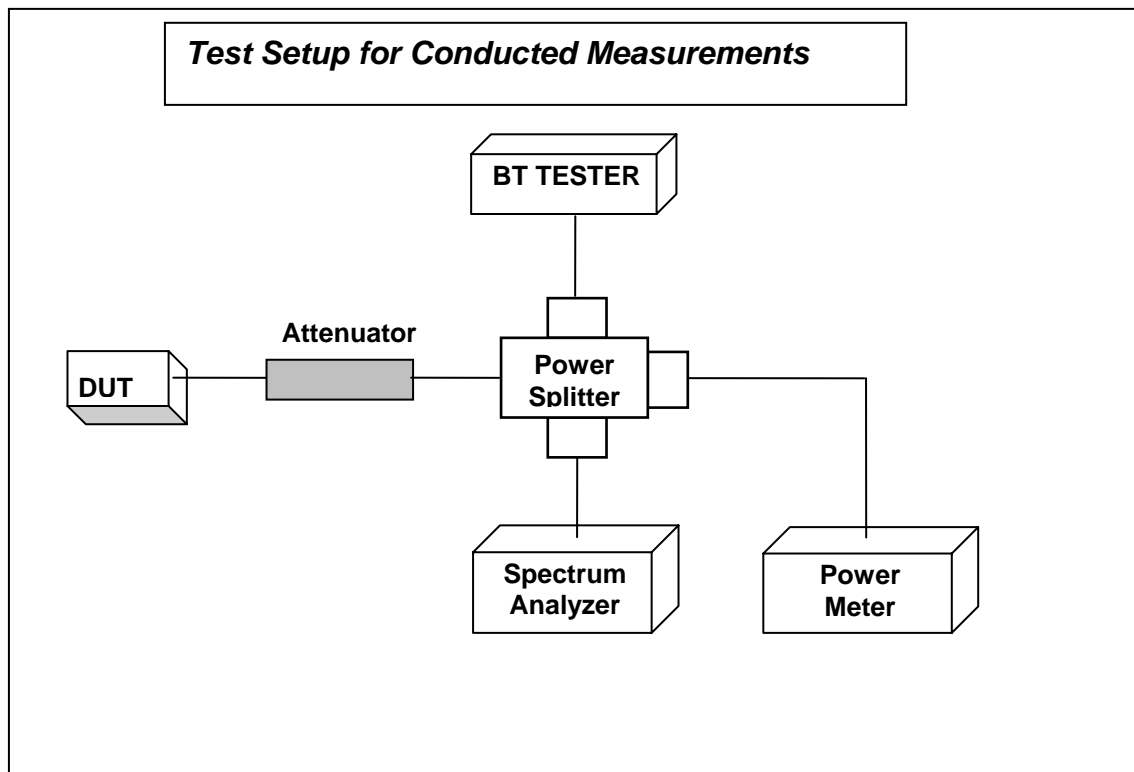
Date: 10.DEC.2009 14:52:19

7 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

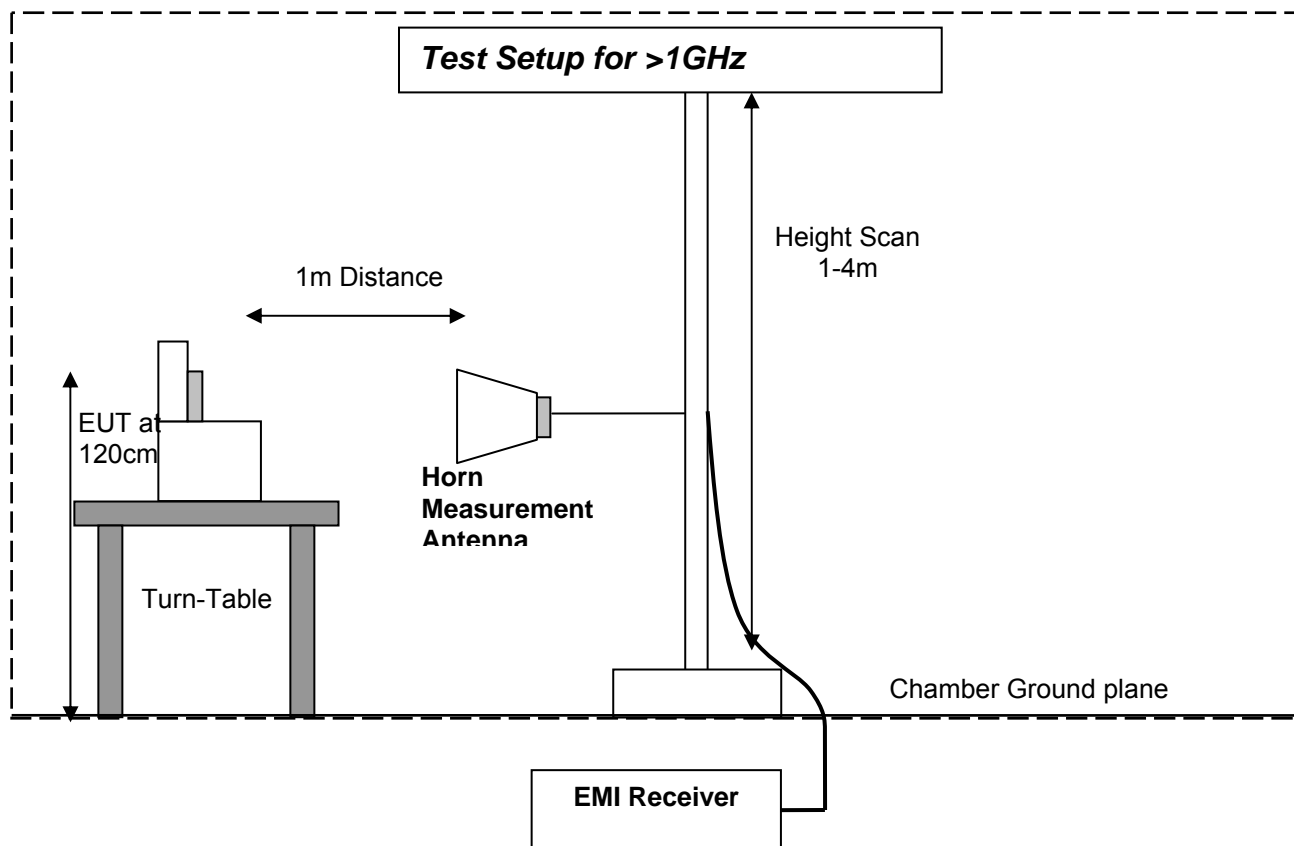
| No | Instrument/Ancillary | Type | Manufacturer | Serial No. | Cal Due | Interval |
|-----------|------------------------------|--------------|---------------------|-------------------|----------------|-----------------|
| 01 | Spectrum Analyzer | ESIB 40 | Rohde & Schwarz | 100107 | May 2010 | 1 year |
| 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 |

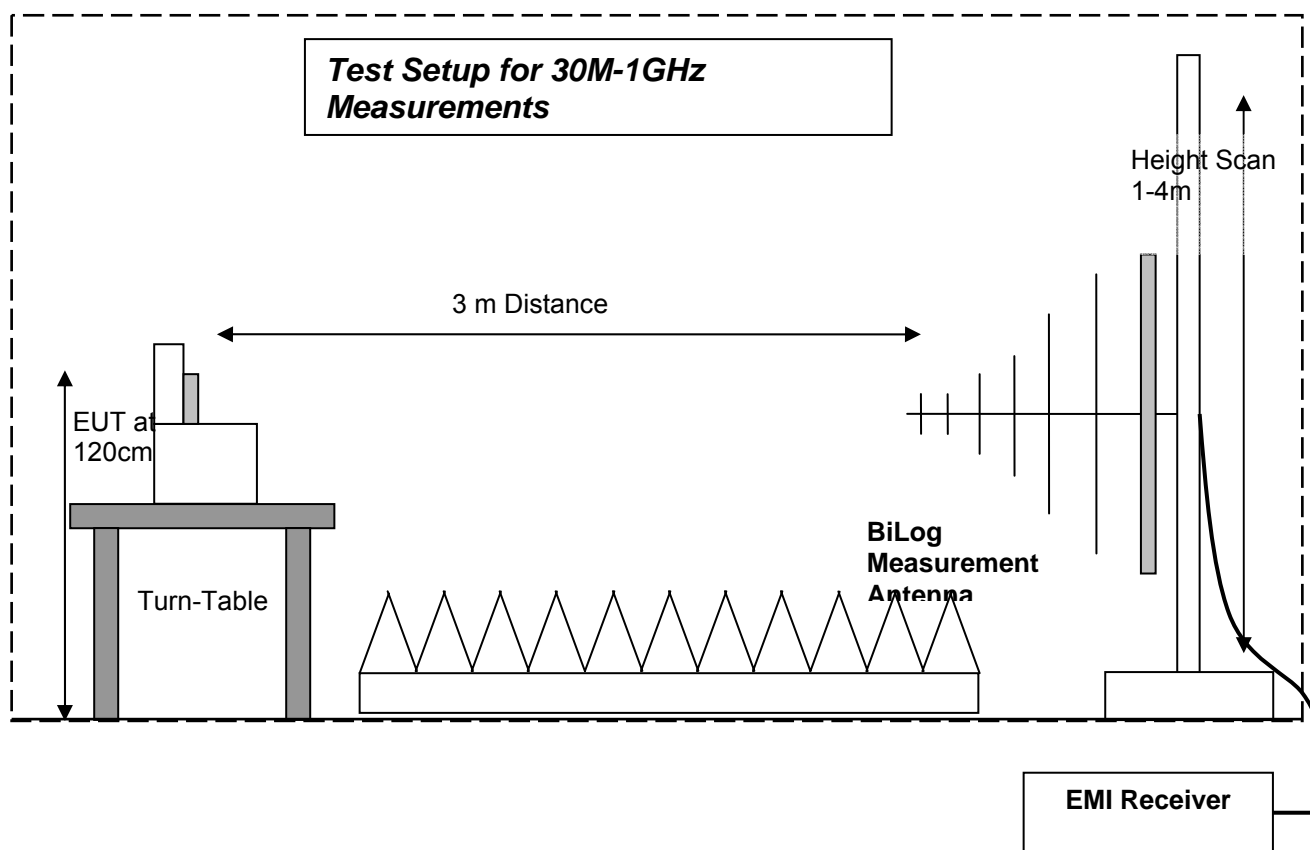
8 BLOCK DIAGRAMS

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