FCC/IC Test Report

FOR:

Model Name: Ranger 4 HSPA, Ranger 4 EVDO, Ranger 4
Rugged and compact vehicular computer connecting the fleet and the office, supports voice and data, automatic vehicle location, e-work orders and vehicle telemetry

FCC ID: RZ3RAN48790, RZ3RAN45728, RZ3RAN49110
IC ID: 2234A-RAN48790, 2234A-RAN45728, 2234A-RAN49110

47 CFR Part 15.247 for FHSS Systems

IC RSS-210 Issue 8

TEST REPORT #: EMC_MENTO_003_10002_FHSS_BT
DATE: 2012-02-17

ilac-MRA A2LA ACCREDITED TESTING LABORATORY Certificate #2135.01

Bluetooth

Bluetooth Qualification Test Facility (BQTF)

CTIA Authorized Test Lab
LAB CODE 20020328-00

FCC listed
A2LA Accredited

IC recognized # 3462B

***CETECOM* Inc.**
411 Dixon Landing Road ◆ Milpitas, CA 95035 ◆ U.S.A.
Phone: + 1 (408) 586 6200 ◆ Fax: + 1 (408) 586 6299 ◆ E-mail: info@cetecomusa.com ◆ http://www.cetecom.com
CETECOM Inc. is a Delaware Corporation with Corporation number: 2113686

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1 Assessment

The following device was tested against the applicable criteria specified in FCC rules Parts 15.247 of Title 47 of the Code of Federal Regulations and Industry Canada Standards RSS 210 Issue 8 and no deviations were ascertained during the course of the tests performed.

Company	Description	Model #
Mentor Engineering Inc.	**Rugged and compact vehicular computer, connecting the fleet and the office, supports voice and data, automatic vehicle location, e-work orders and vehicle telemetry**	**Ranger 4 HSPA, Ranger 4 EVDO, Ranger 4**

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2012-02-17	Compliance	Sajay Jose (EMC Lab Manager)	

Responsible for the Report:

Date	Section	Name	Signature
2012-02-17	Compliance	Calvin Lee (EMC Project Engineer)	Calvin Lee Digitally signed by Calvin Lee DN: cn=Calvin Lee, c=US, o=CETECOM Inc, ou=Compliance, email=calvin.lee@cetecomusa.com Date: 2012.02.17 13:53:12 -08'00'

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Address:	411 Dixon Landing Road Milpitas, CA 95035 U.S.A.
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Test Lab Director:	Heiko Strehlow
Responsible Project Leader:	Rami Saman

2.2 Identification of the Client

Applicant's Name:	Mentor Engineering Inc.
Street Address:	10, 2175 - 29th St NE
City/Zip Code	Calgary, Alberta /T1Y 7H8
Country	Canada
Contact Person:	Dominic Pituch
Phone No.	403-777-3760 x289
Fax:	403-777-3769
e-mail:	dpituch@mentoreng.com

2.3 Identification of the Manufacturer

Same as above.

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Marketing Name / Model No:	Ranger 4.0/ Ranger 4 HSPA, Ranger 4 EVDO, Ranger 4
HW / SW Revision :	4 1.02
FCC-ID / IC-ID:	RZ3RAN48790/2234A-RAN48790 RZ3RAN45728/2234A-RAN45728 RZ3RAN49110/ 2234A-RAN49110
Product Description:	Rugged and compact vehicular computer, connecting the fleet and the office, supports voice and data, automatic vehicle location, e-work orders and vehicle telemetry
Frequency Band of operation:	ISM: 2400 – 2483.5 MHz
Supported Frequency range:	2402 MHz- 2480 MHz
No. of Channels:	79
Type(s) of Modulation:	Bluetooth: GFSK, π/4 DQPSK, 8DPSK;
Antenna Type / gain:	Bluetooth: Chip antenna / 1 dBi
Output Powers:	Bluetooth conducted power: 7.36 dBm(5.45 mW) Bluetooth EIRP: 8.36 dBm(6.85 mW);
Power supply	12 VDC ; Car battery
Operating temperature range	-40ºC to 85ºC
Prototype / Production unit	Production

3.2 Identification of the Equipment Under Test (EUT)

EUT #	Model No.	HW Version	SW Version	Serial Number	Comments
1	Ranger 4 HSPA	4	1.02	31-11100019	Radiated measurements
2	Ranger 4 EVDO	4	1.02	31-11100024	Radiated measurements
3	Ranger 4 HSPA	4	1.02	31-11100025	Conducted measurements

3.3 Identification of Accessory equipment

AE #	Type	Manufacturer	Model	Serial Number
1	DC power cable	Mentor Engineering Inc.	4-CAS-CGRDMMLX18-31	PO.00009069-2

4 Subject of Investigation

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 RSS-210 Issue 8.

This test report contains full radiated testing results as per

- 47 CFR Part 15: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communications Commission subchapter A- General, Part 15- Radio Frequency Devices.
- RSS-210 Issue 8: Spectrum Management and Telecommunications- Radio Standards Specification. Low-power Licence-exempt radio communication devices (All frequency bands): Category 1 equipment.

During the testing process the EUT was tested on a single channel using PRBS payload using DH5, 2DH5 or 3DH5 packets, all data in this report shows the worst case between horizontal and vertical antenna polarizations and for all orientations of the EUT.

The Ranger 4 is available in three different configurations/models

1. BT, WiFi and HSPA radios (Ranger 4 HSPA)
2. BT, WiFi and EVDO radios (Ranger 4 HSPA)
3. Only BT and WiFi radios (Ranger 4)

This test report is to support a request for new equipment authorization under the FCC/IC IDs:

1. RZ3RAN48790 and IC ID 2234A-RAN48790 for the Ranger 4 HSPA.
2. RZ3RAN45728 and IC ID 2234A-RAN45728 for the Ranger 4 EVDO.
3. RZ3RAN49110 and IC ID 2234A-RAN49110 for the Ranger 4.

These three configurations are identical except for the WWAN Radios that are integrated into respective models. Hence this test report covering the BT radio can be shared for all three models. All testing was performed on the products referred to in Section 3 as EUT.

The EUT uses Bluegiga Technologies OY's, FCC certified WT21-N module (FCC ID: QOQWT21N). All conducted test data other than output power for this module is obtained from the test report number RFI/RPT1/RP74713JD08B. Output power was measured at Cetecom Inc. for verification purposes.

5 Summary of Measurement Results

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§15.247(b)(4) RSS210 A8.4(2)	Antenna Gain	Nominal	GFSK π/4DQPSK 8DPSK	■	☐	☐	☐	Complies
§15.247(e) RSS210 A8.2(b)	Power Spectral Density	Nominal	GFSK π/4DQPSK 8DPSK	☐	☐	■	☐	-
§15.247(a)(1) RSS210 A8.1(b)	Carrier Frequency Separation	Nominal	GFSK π/4DQPSK 8DPSK	☐	☐	☐	■	Complies*
§15.247(a)(1) RSS210 A8.1(d)	Number of Hopping Channels	Nominal	GFSK π/4DQPSK 8DPSK	☐	☐	☐	■	Complies*
§15.247(a)(1)(iii) RSS210 A8.3(1)	Time of occupancy	Nominal	GFSK π/4DQPSK 8DPSK	☐	☐	☐	■	Complies*
§15.247(a)(1) RSS210 A8.2(a)	Spectrum Bandwidth	Nominal	GFSK π/4DQPSK 8DPSK	☐	☐	☐	■	Complies*
§15.247(b)(1) RSS210 A8.4(2)	Maximum Output Power	Nominal	GFSK π/4DQPSK 8DPSK	■	☐	☐	☐	Complies
§15.247(d) RSS210 A8.5	Band edge compliance-Conducted	Nominal	GFSK π/4DQPSK 8DPSK	☐	☐	☐	■	-
§15.247(d) RSS210 A8.5	Band edge compliance-Radiated	Nominal	GFSK π/4DQPSK 8DPSK	■	☐	☐	☐	Complies
§15.247(d) RSS210 A8.5	TX Spurious emissions-Conducted	Nominal	GFSK π/4DQPSK 8DPSK	☐	☐	☐	■	Complies*
§15.247(d) RSS210 A8.5	TX Spurious emissions-Radiated	Nominal	GFSK π/4DQPSK 8DPSK	■	☐	☐	☐	Complies
§15.209(a) RSS Gen	TX Spurious Emissions Radiated<30MHz	Nominal	GFSK π/4DQPSK 8DPSK	■	☐	☐	☐	Complies

Note: NA= Not Applicable; NP= Not Performed.

1. Band Edge compliance-conducted is NOT PERFORMED as the device passes radiated measurement.
2. Power Spectral Density is NOT APPLICABLE for devices with hopping functionality.
3. * Please refer module test report number RFI/RPT1/RP74713JD08B
4. Conducted Emissions not performed since device is Vehicular DC powered.

6 Measurements

6.1 Radiated Measurement Procedure

ANSI C63.4:2003 Section 8.3.1.1: Exploratory radiated emission measurements

Exploratory radiated measurements shall be performed at the measurement distance or at a closer distance than that specified for compliance to determine the emission characteristics of the EUT. At near distances, for EUTs of comparably small size, it is relatively easy to determine the spectrum signature of the EUT and, if applicable, the EUT configuration that produces the maximum level of emissions. A shielded room may be used for exploratory testing, but may have anomalies that can lead to significant errors in amplitude measurements.

Broadband antennas and a spectrum analyzer or a radio-noise meter with a panoramic display are often useful in this type of testing. It is recommended that either a headset or loudspeaker be connected as an aid in detecting ambient signals and finding frequencies of significant emission from the EUT when the exploratory and final testing is performed in an OATS with strong ambient signals. Caution should be taken if either antenna height between 1 and 4 meters or EUT azimuth is not fully explored. Not fully exploring these parameters during exploratory testing may require complete testing at the OATS or semi-anechoic chamber when the final full spectrum testing is conducted.

The EUT should be set up in its typical configuration and arrangement, and operated in its various modes. For tabletop systems, cables or wires should be manipulated within the range of likely arrangements. For floor-standing equipment, the cables or wires should be located in the same manner as the user would install them and no further manipulation is made. For combination EUTs, the tabletop and floor-standing portions of the EUT shall follow the procedures for their respective setups and cable manipulation. If the manner of cable installation is not known, or if it changes with each installation, cables or wires for floor-standing equipment shall be manipulated to the extent possible to produce the maximum level of emissions.

For each mode of operation required to be tested, the frequency spectrum shall be monitored. Variations in antenna height between 1 and 4 m, antenna polarization, EUT azimuth, and cable or wire placement (each variable within bounds specified elsewhere) shall be explored to produce the emission that has the highest amplitude relative to the limit. A step-by-step technique for determining this emission can be found in Annex C.

When measuring emissions above 1 GHz, the frequencies of maximum emission shall be determined by manually positioning the antenna close to the EUT and by moving the antenna over all sides of the EUT while observing a spectral display. It will be advantageous to have prior knowledge of the frequencies of emissions above 1 GHz. If the EUT is a device with dimensions approximately equal to that of the measurement antenna beamwidth, the measurement antenna shall be aligned with the EUT.

ANSI C63.4:2003 Section 8.3.1.2: Final radiated emission measurements

Based on the measurement results in 8.3.1.1, the one EUT, cable and wire arrangement, and mode of operation that produces the emission that has the highest amplitude relative to the limit is selected for the final measurement. The final measurement is then performed on a site meeting the requirements of 5.3, 5.4, or 5.5 as appropriate without variation of the EUT arrangement or EUT mode of operation. If the EUT is relocated from an exploratory test site to a final test site, the highest emission shall be remaximized at the final test location before final radiated emissions measurements are performed. However, antenna height and polarity and EUT azimuth are to be varied. In addition, the full frequency spectrum (for the range to be checked for meeting compliance) shall be investigated.

This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. During the full frequency spectrum investigation, particular focus should be made on those frequencies found in exploratory testing that were used to find the final test configuration, mode of operation, and arrangement (associated with achieving the least margin with respect to the limit). This full spectrum test constitutes the compliance measurement.

For measurements above 1 GHz, use the cable, EUT arrangement, and mode of operation determined in the exploratory testing to produce the emission that has the highest amplitude relative to the limit. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the antenna in the “cone of radiation” from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response. The antenna may have to be higher or lower than the EUT, depending on the EUT’s size and mounting height, but the antenna should be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. If the transmission line for the measurement antenna restricts its range of height and polarization, the steps needed to ensure the correct measurement of the maximum emissions, shall be described in detail in the report of measurements. Data collected shall satisfy the report requirements of Clause 10.

NOTES

1— Where limits are specified by agencies for both average and peak (or quasi-peak) detection, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.
2—Use of waveguide and flexible waveguide may be necessary at frequencies above 10 GHz to achieve usable signal-to noise ratios at required measurement distances. If so, it may be necessary to restrict the height search of the antenna, and special care should be taken to ensure that maximum emissions are correctly measured.
3—All presently known devices causing emissions above 10 GHz are physically small compared with the beam-widths of typical horn antennas used for EMC measurements. For such EUTs and frequencies, it may be preferable to vary the height and polarization of the EUT instead of the receiving antenna to maximize the measured emissions.

6.2 Sample Calculations for Radiated Measurements

6.2.1 Field Strength Measurements:

Field Strength measurements are directly taken from the Spectrum Analyzer/ Receiver, taking into account the cable loss between the Receiving Antenna and the Spectrum Analyzer/ Receiver. Antenna Factor is accounted for by the test SW.

FS (dBµV/m)= Measured Value on SA (dBµV)+ Cable Loss (dB)
Eg:

Frequency (MHz)	Measured SA (dBµV)	Cable Loss (dB)	Field Strength Result (dBµV/m)
1000	95.5	3.5	99.0

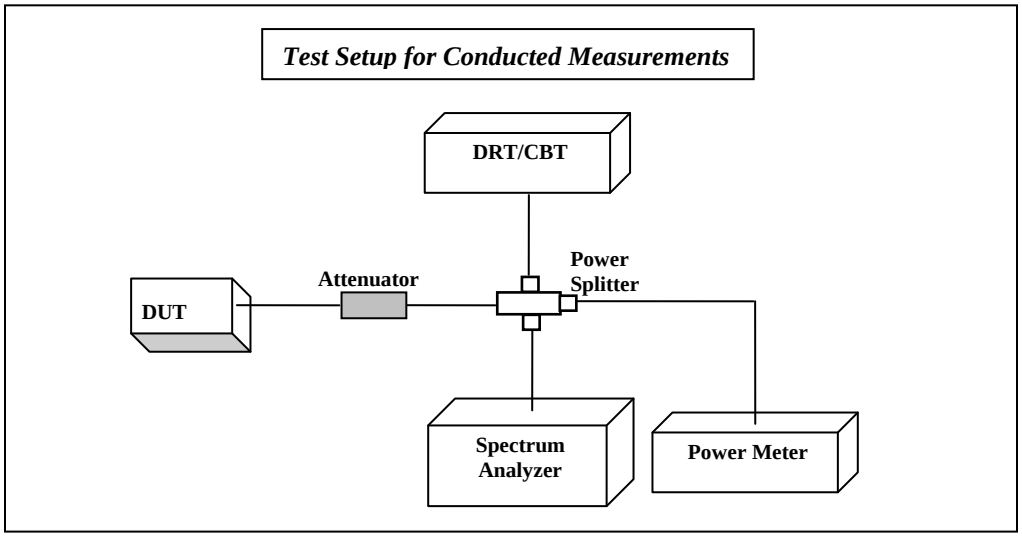
6.2.2 Power Measurements using Substitution Procedure:

The measurement on the Spectrum Analyzer is used as a basis for the Substitution procedure.
The EUT is replaced with a Signal Generator and an antenna. The setting on the Signal Generator is varied until the Spectrum Analyzer displays the original reading. EIRP is calculated as-

EIRP (dBm)= Signal Generator setting (dBm)- Cable Loss (dB)+ Antenna Gain (dBi)
Eg:

Frequency (MHz)	Measured SA (dBµV)	Signal Generator setting (dBm)	Antenna Gain (dBi)	Dipole Gain (dBd)	Cable Loss (dB)	EIRP (dBm)
1000	95.5	24.5	6.5	0	3.5	27.5

6.3 Conducted Measurement Procedure



1. Connect the equipment as shown in the above diagram.
2. Adjust the settings of the Digital Radio Communication Tester (DRT) to connect the EUT at the required channel.
3. Measurements are to be performed with the EUT set to the low, middle and high channels.

6.4 Maximum Peak Output Power

6.4.1 Limits:

6.4.1.1 §15.247 (b)(1)

The maximum peak conducted output power of the intentional radiator shall not exceed the following: For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

6.4.1.2 RSS 210- A8.4(2)

Nominal Peak Output Power < 30 dBm (1W)

6.4.2 Test Conditions:

Tnom: 25°C; Vnom: 12 V
Hopping OFF
Spectrum Analyzer settings:
RBW=VBW=3MHz, Detector: Peak- Max Hold.
Sweep Time: Auto
Span=3MHz
Antenna Gain (dBi):
Low Channel: 1
Mid Channel: 1
High Channel: 1

6.4.3 Test Result:

Measured Max Peak Output Power- Conducted (dBm)			
Modulation	**Frequency (MHz)**		
	2402	**2441**	**2480**
GFSK	7.36	5.88	6.27
π/4 DQPSK	7.22	5.64	5.97
8-DPSK	7.08	5.54	5.82
Measurement Uncertainty: ±0.5dB			

Calculated Max Peak Output Power- Radiated (dBm)			
Modulation	**Frequency (MHz)**		
	2402	**2441**	**2480**
GFSK	8.36	6.88	7.27
π/4 DQPSK	8.22	6.64	6.97
8-DPSK	8.08	6.54	6.82
Measurement Uncertainty: ±3.0dB			

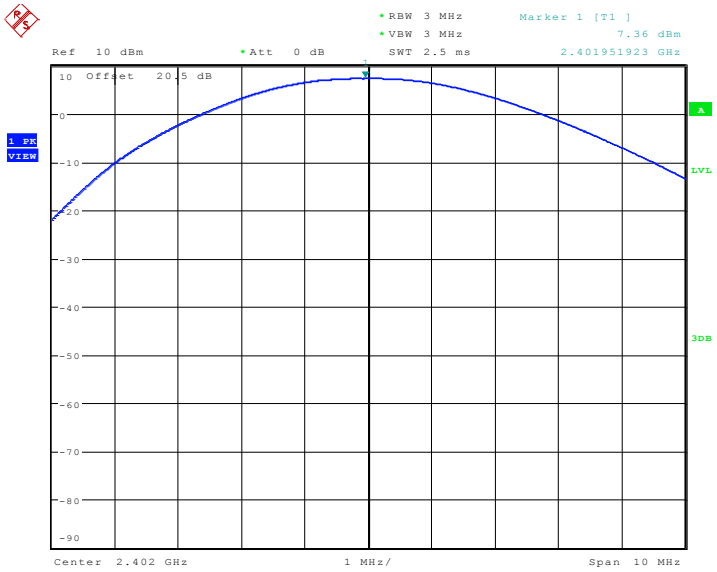
Radiated EIRP is calculated as Conducted Peak power +Gain. Gain =1dBi

6.4.3.1 Measurement Result

Pass.

6.4.4 Test Data/plots:

Conducted Peak Power GFSK 2402 MHz



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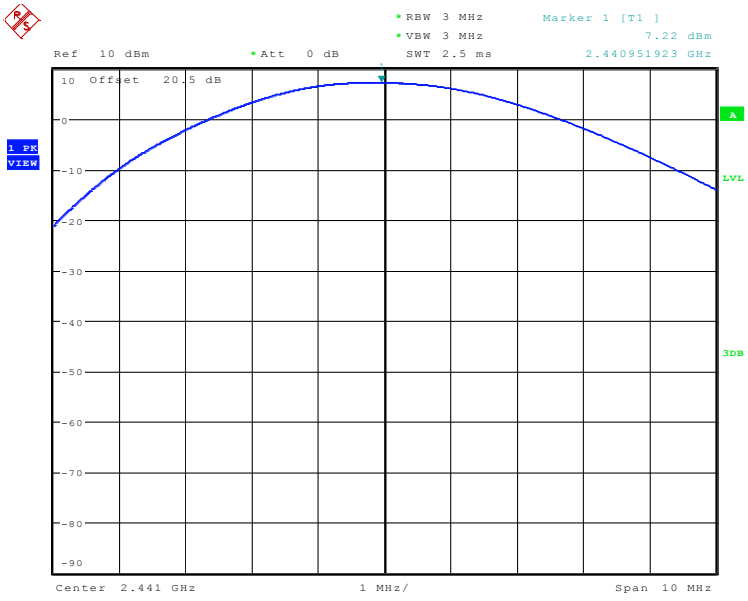
Conducted Peak Power GFSK 2441 MHz



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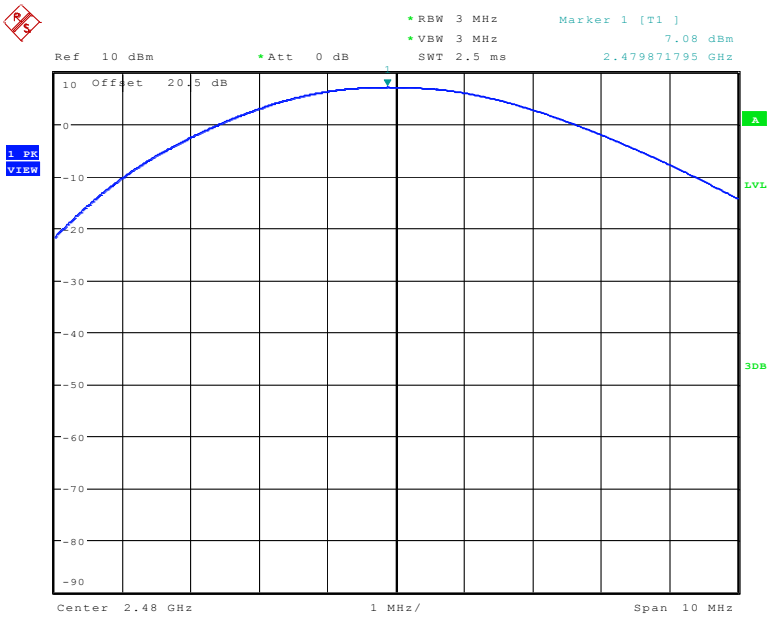
Conducted Peak Power GFSK 2480 MHz



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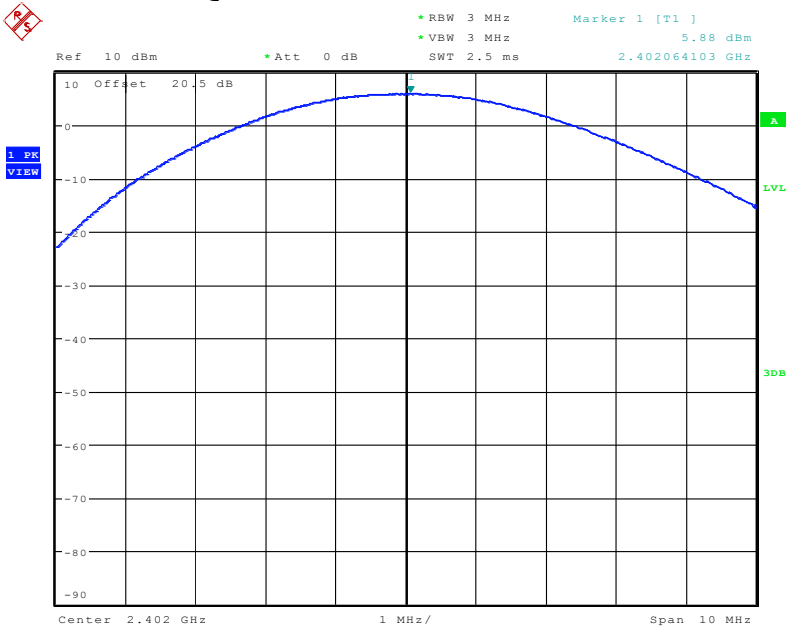
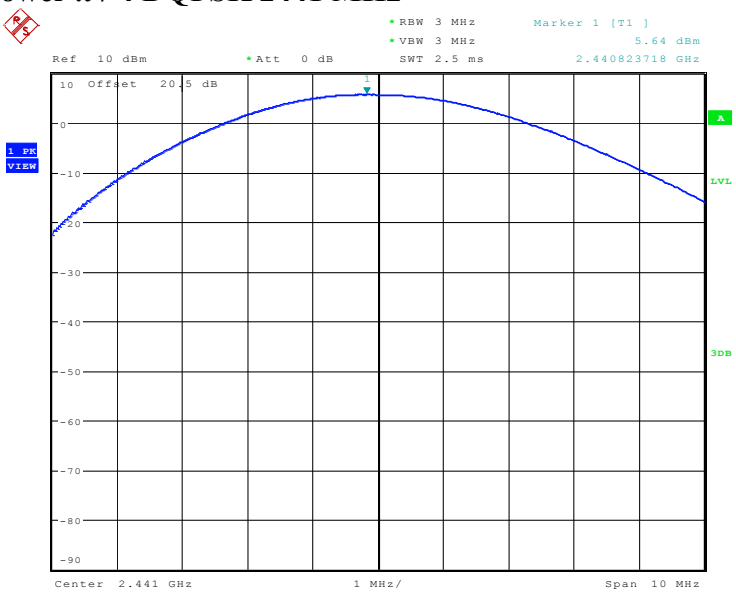
Conducted Peak Power π / 4 DQPSK 2402 MHz



Date: 20.JAN.2012 20:17:28

Conducted Peak Power π / 4 DQPSK 2441 MHz



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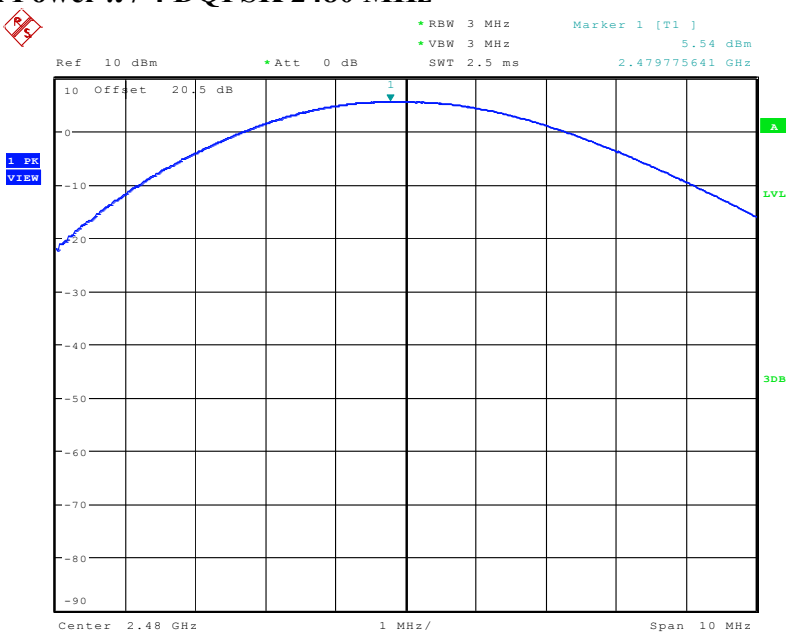
Conducted Peak Power π / 4 DQPSK 2480 MHz



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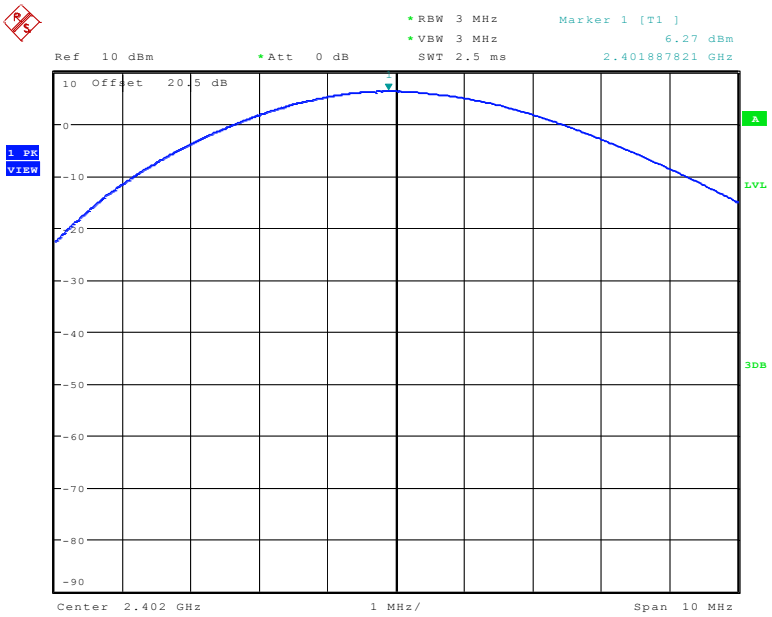
Conducted Peak Power 8DPSK 2402 MHz



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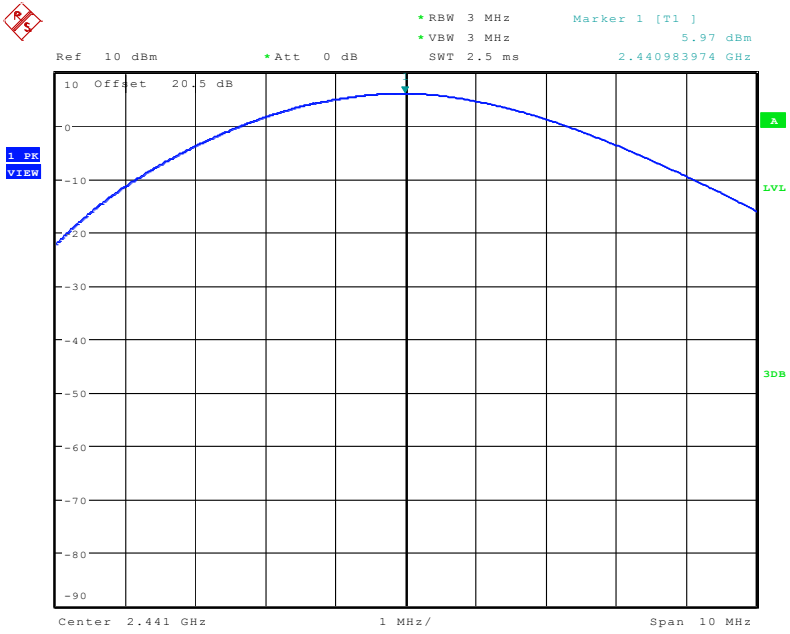
Conducted Peak Power 8DPSK 2441 MHz



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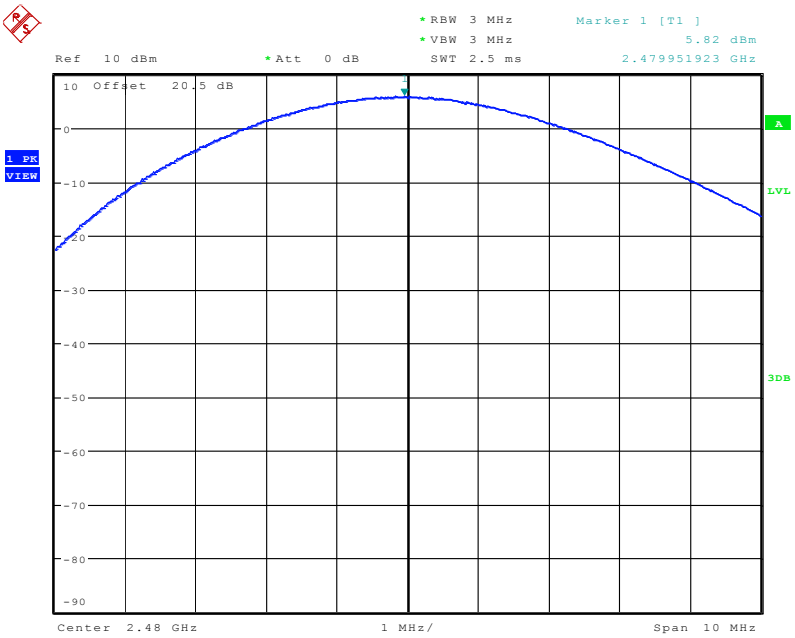
Conducted Peak Power 8DPSK 2480 MHz



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6.5 Restricted Band Edge Compliance

6.5.1 Limits: §15.247/15.205
RSS-210 A8.5

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

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

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

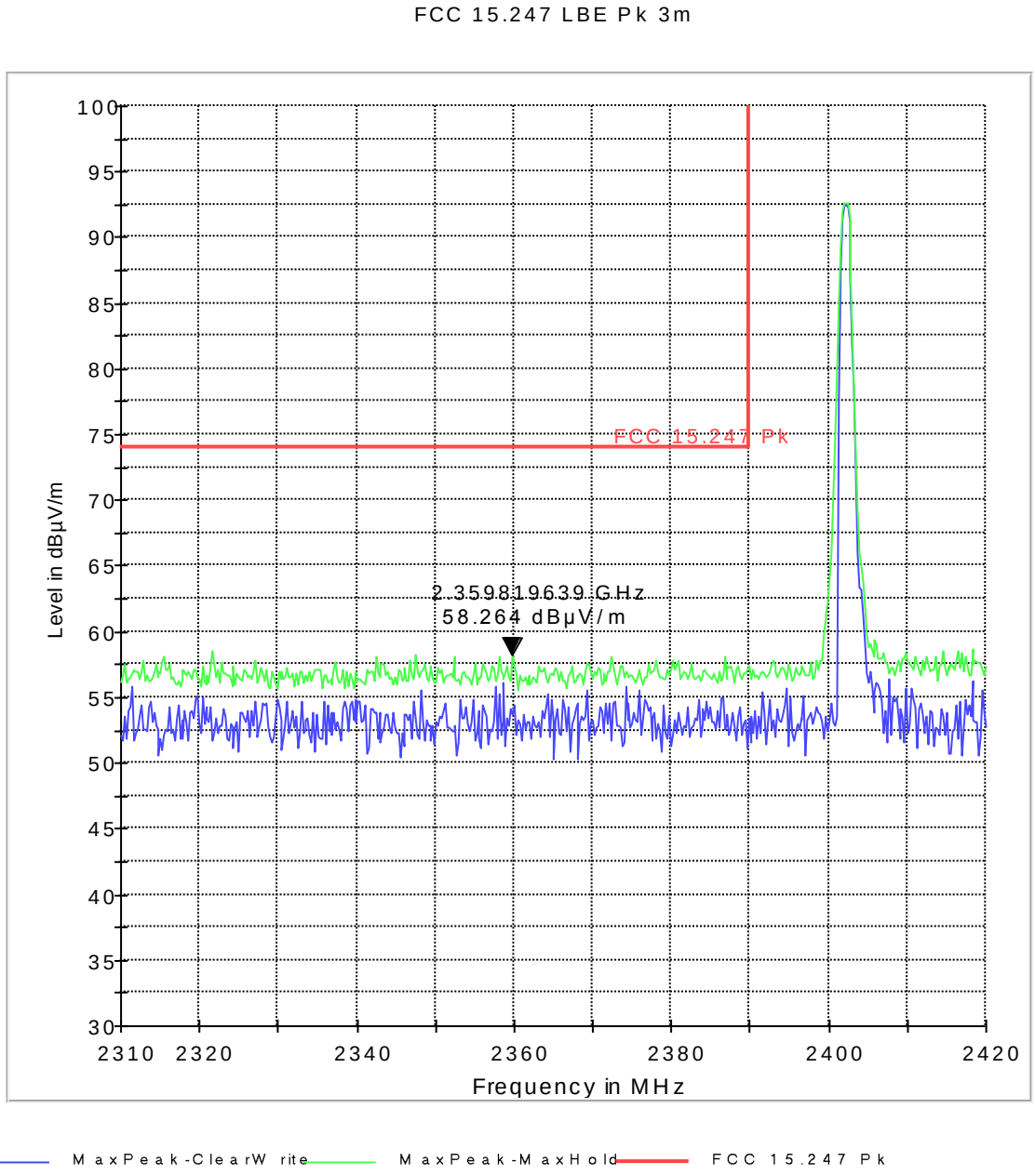
6.5.2 Measurement Procedure:
Peak measurements are made using a peak detector and RBW=1MHz.
Average measurements performed using a peak detector and according to video averaging procedure with RBW=1MHz and VBW=10Hz.
*PEAK LIMIT= 74dBµV/m
*AVG. LIMIT= 54dBµV/m
Measurement Uncertainty: ±3.0dB

6.5.2.1 Measurement Result
Pass.

6.5.3 Test Data/plots:

Lower band edge peak -GFSK modulation

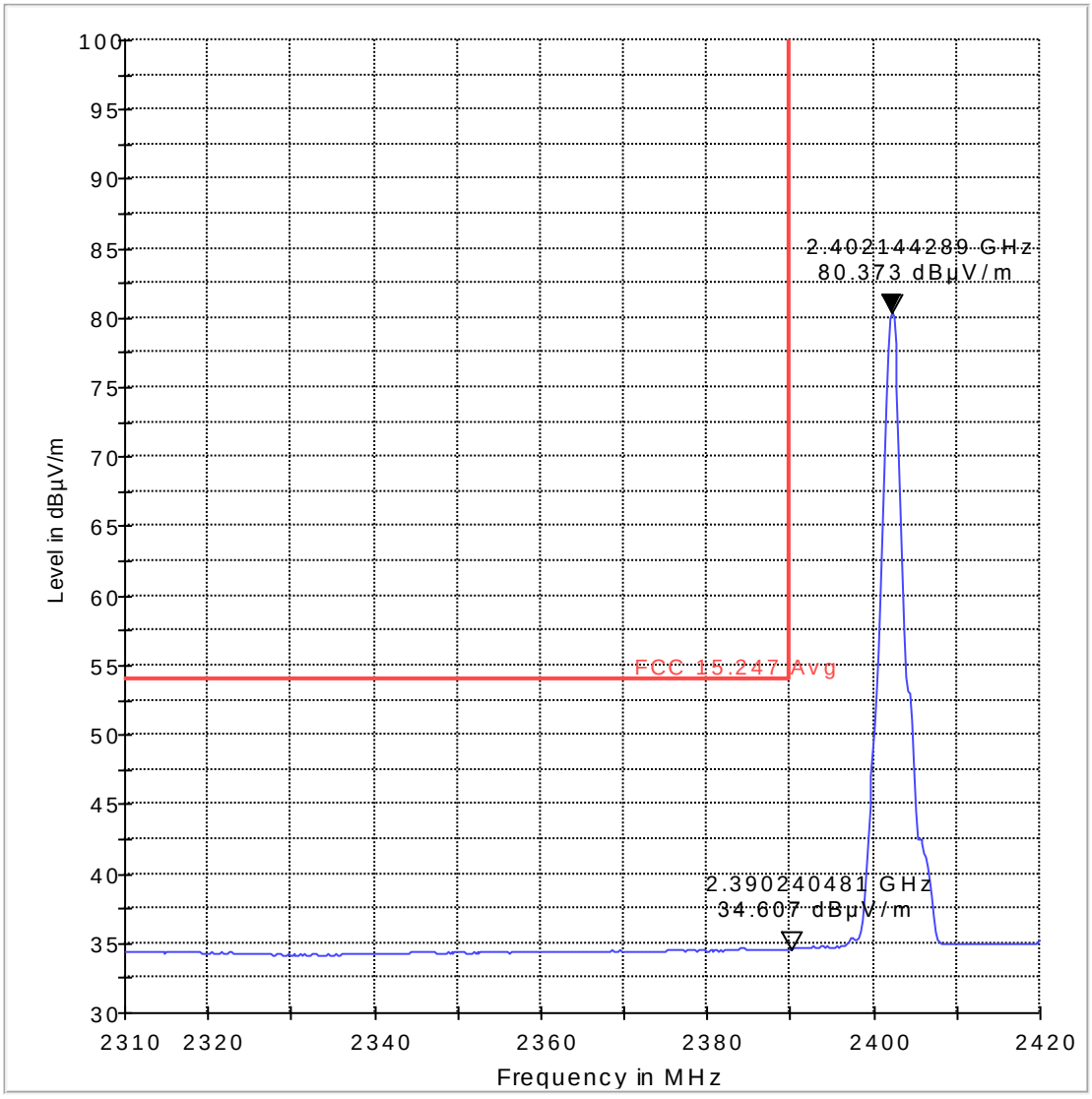
EUT Name:	Ranger 4 HSPA
Manufacturer:	Mentor Engineering Inc.
S/N:	31-11100019
Comment:	12V; GFSK mode(DH5) channel 0



Lower band edge average -GFSK modulation

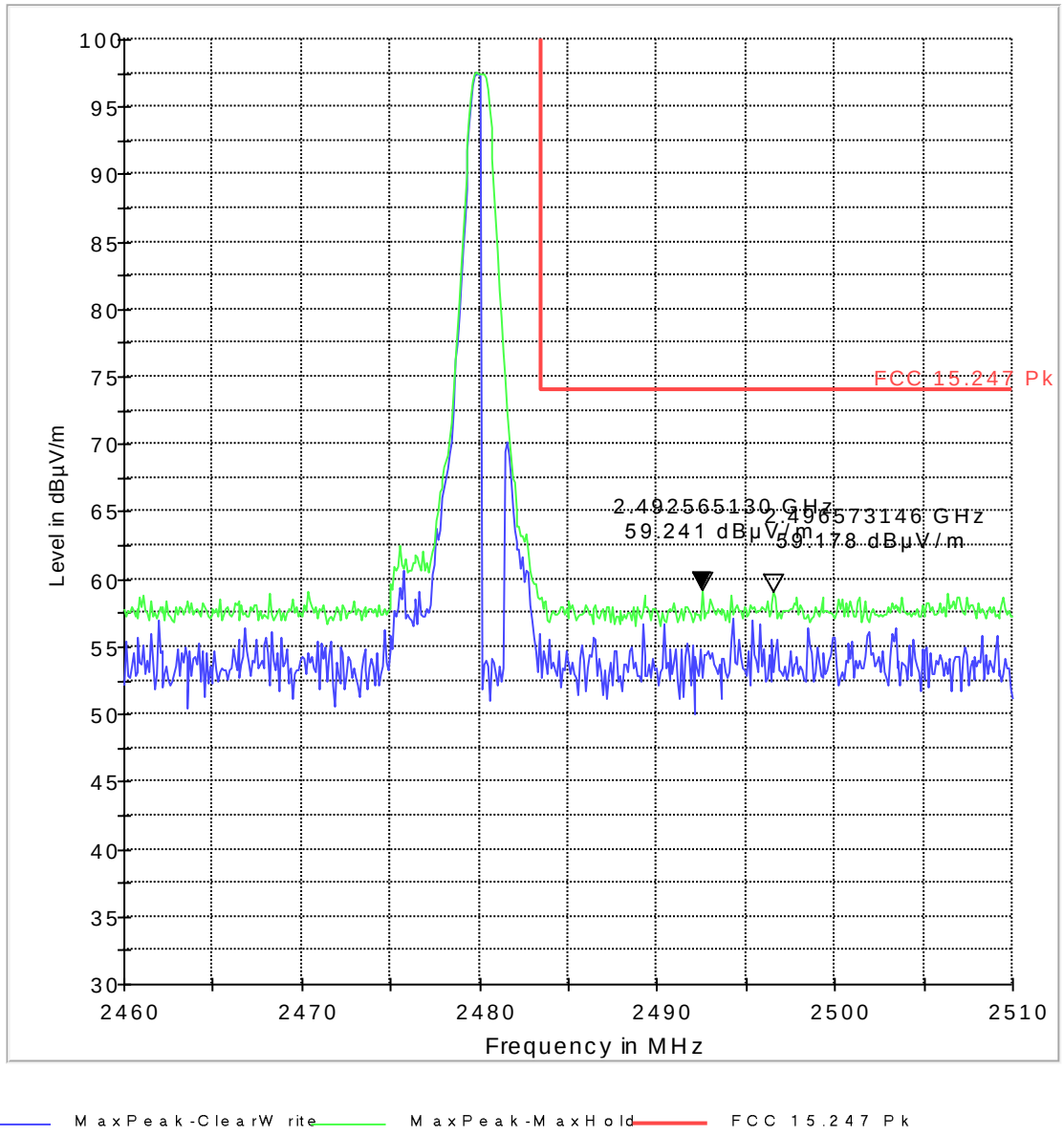
EUT Name: Ranger 4 HSPA
Manufacturer: Mentor Engineering Inc.
S/N: 31-11100019
Comment: 12V; GFSK mode(DH5) channel 0

FCC 15.247 LBE Avg 3m



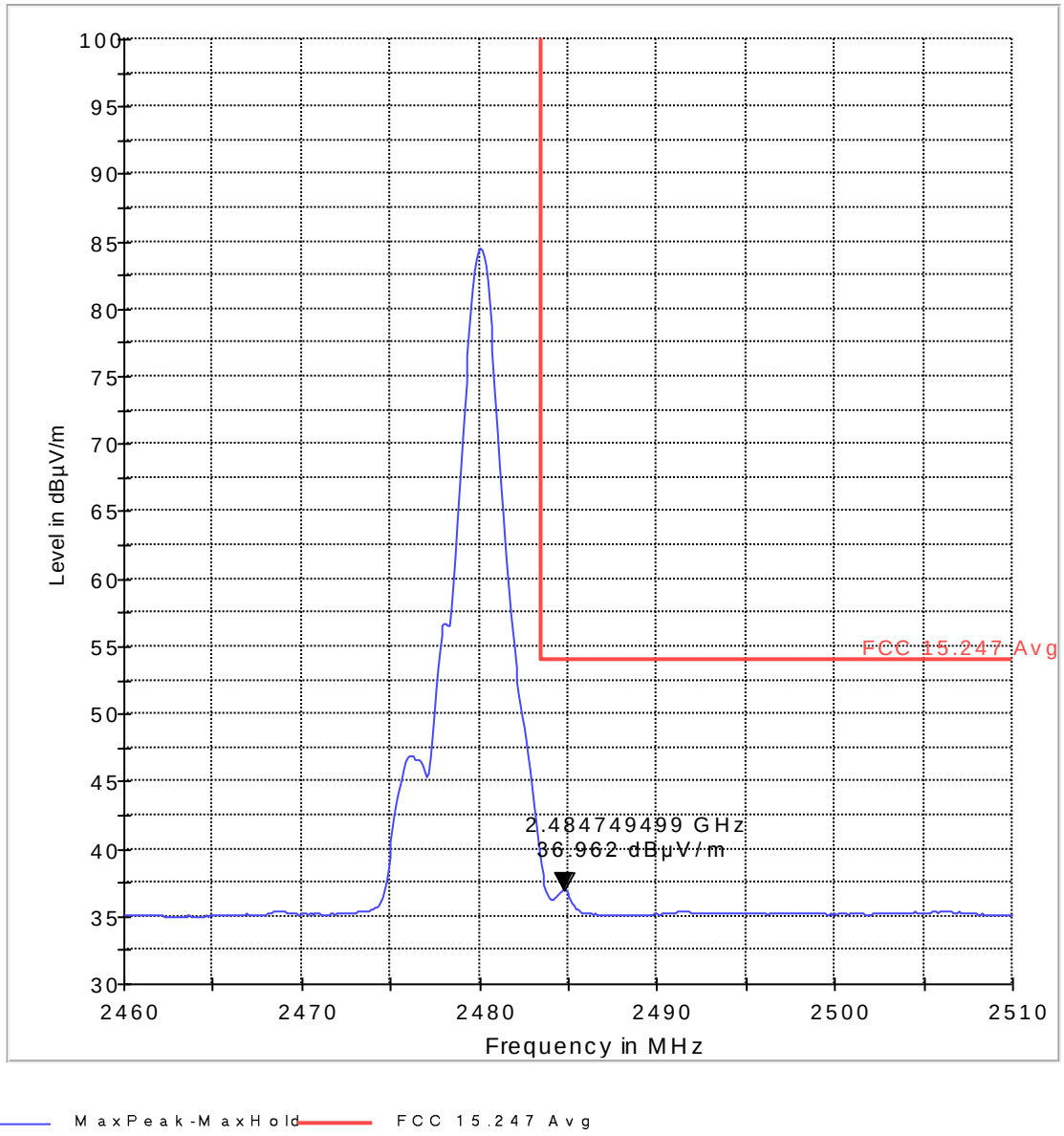
Higher band edge peak -GFSK modulation

EUT Name: Ranger 4 HSPA
Manufacturer: Mentor Engineering Inc.
S/N: 31-11100019
Comment: 12V; GFSK mode(DH5) channel 78



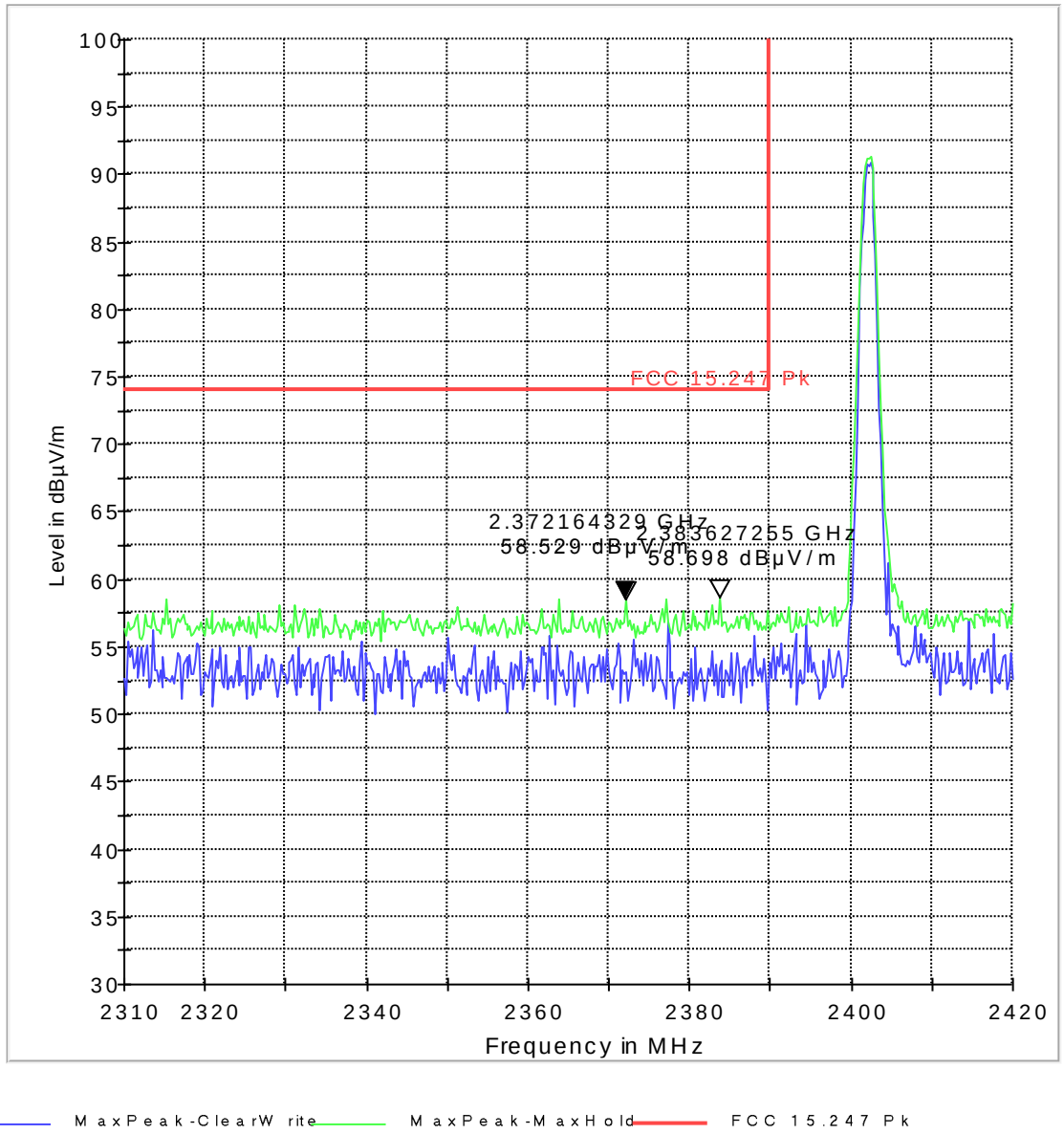
Higher band edge average-GFSK modulation

EUT Name: Ranger 4 HSPA
Manufacturer: Mentor Engineering Inc.
S/N: 31-11100019
Comment: 12V; GFSK mode(DH5) channel 78



Lower band edge peak - π/4 DQPSK modulation

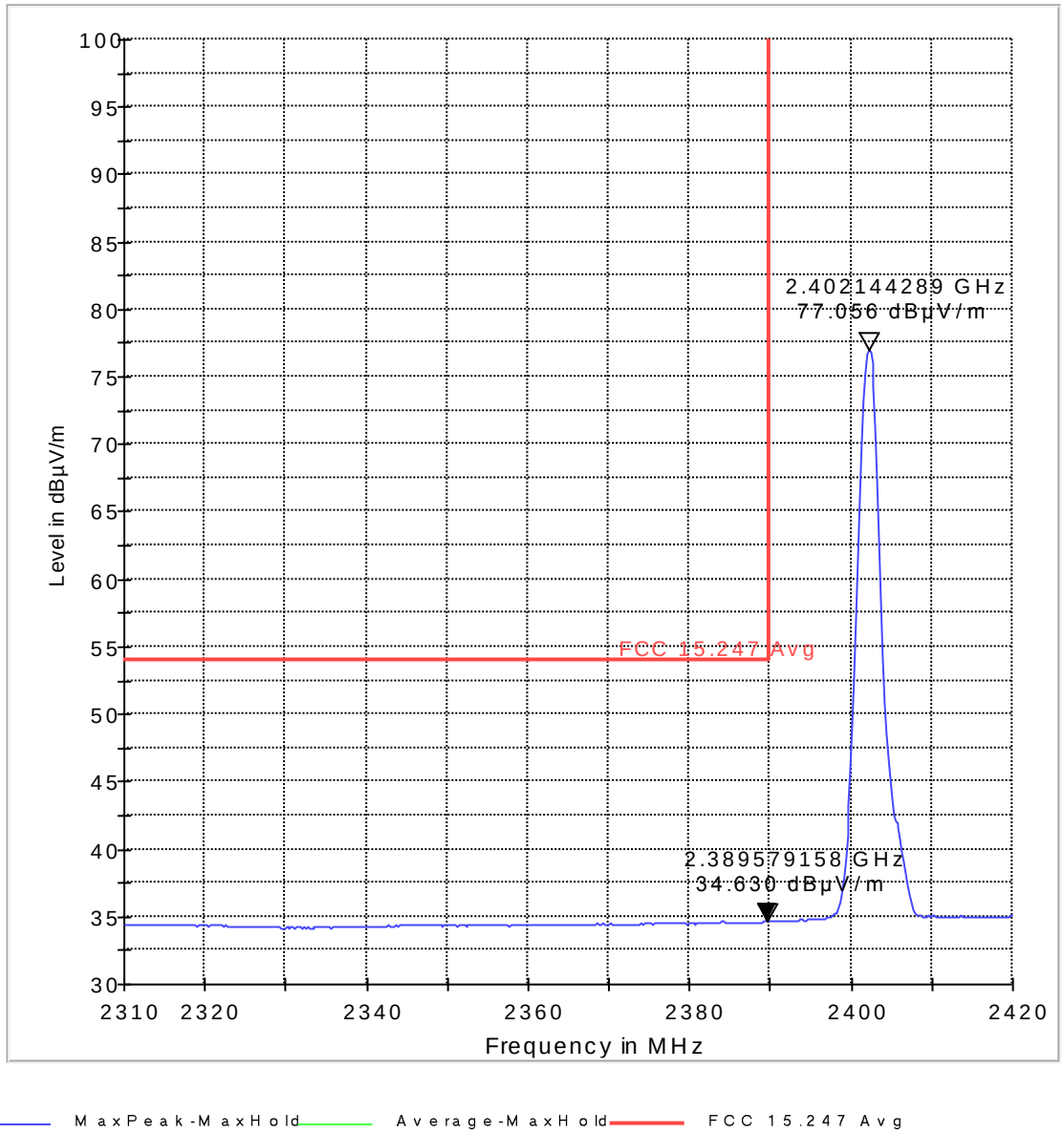
EUT Name: Ranger 4 HSPA
Manufacturer: Mentor Engineering Inc.
S/N: 31-11100019
Comment: 12V; π/4 DQPSK mode(2-DH5) channel 0



Lower band edge average -π/4 DQPSK modulation

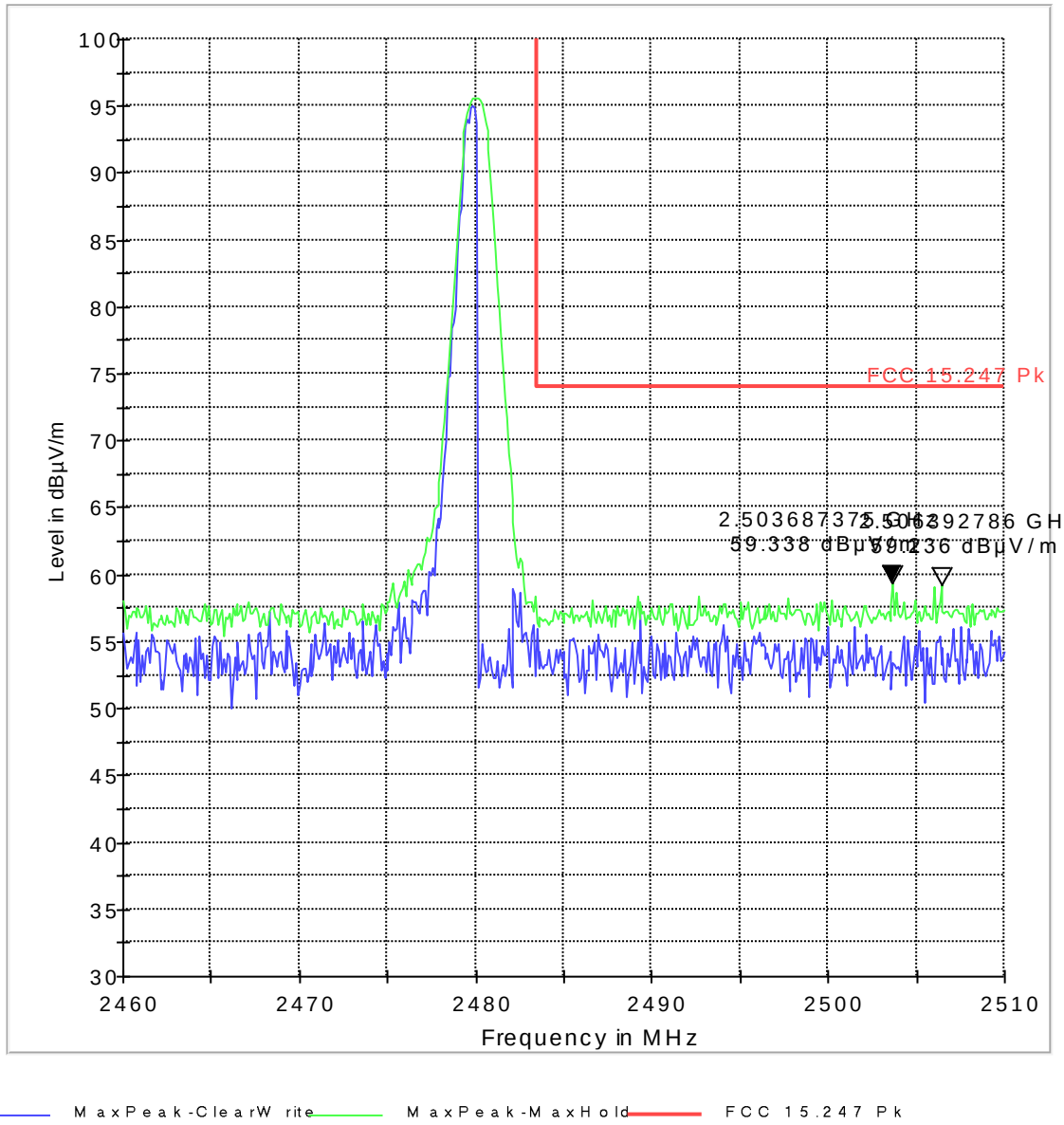
EUT Name: Ranger 4 HSPA
Manufacturer: Mentor Engineering Inc.
S/N: 31-11100019
Comment: 12V; π/4 DQPSK mode(2-DH5) channel 0

FCC 15.247 LBE Avg 3m



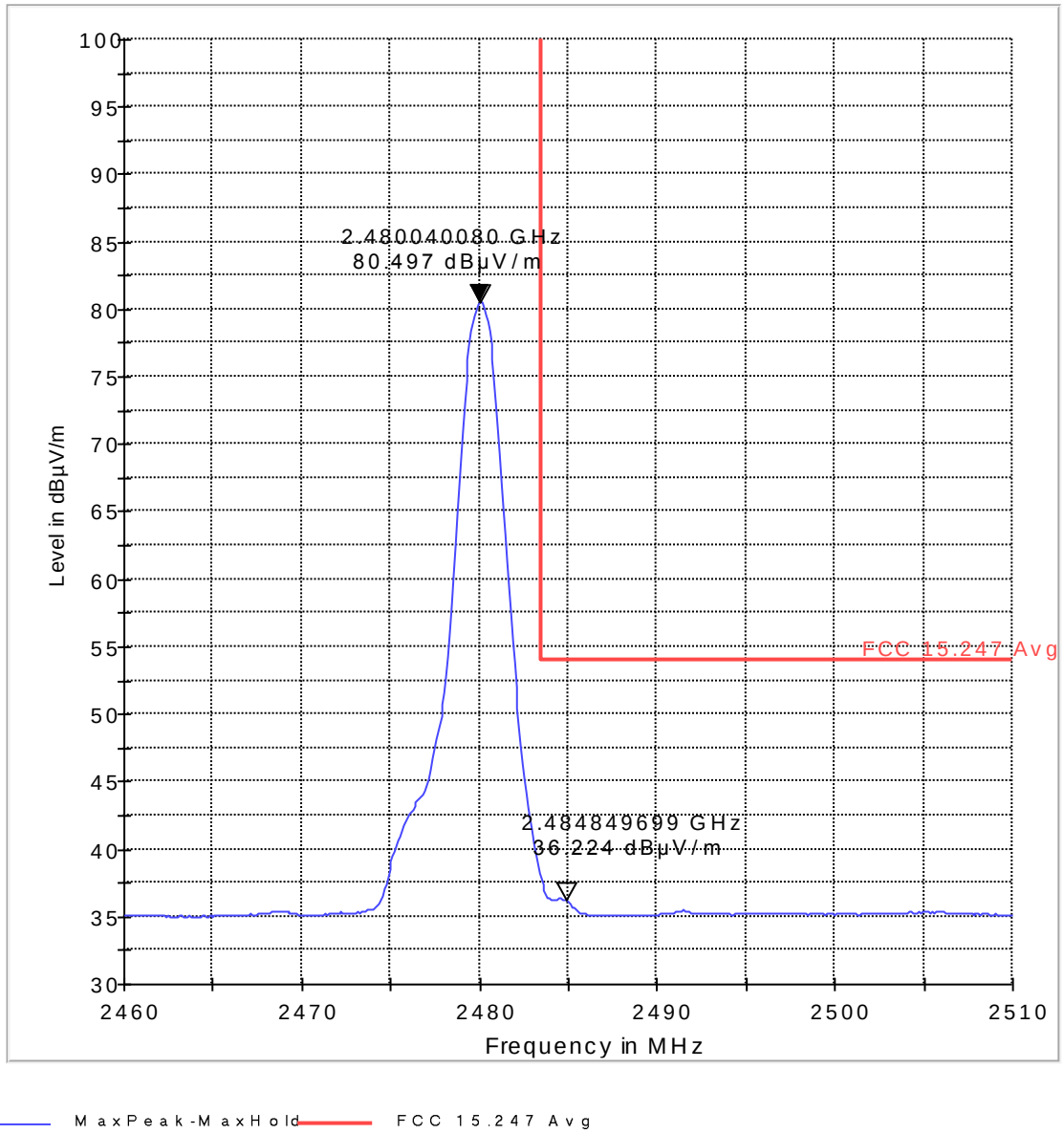
Higher band edge peak -π/4 DQPSK modulation

EUT Name: Ranger 4 HSPA
Manufacturer: Mentor Engineering Inc.
S/N: 31-11100019
Comment: 12V; π/4 DQPSK mode(2-DH5) channel 78



Higher band edge average- π/4 DQPSK modulation

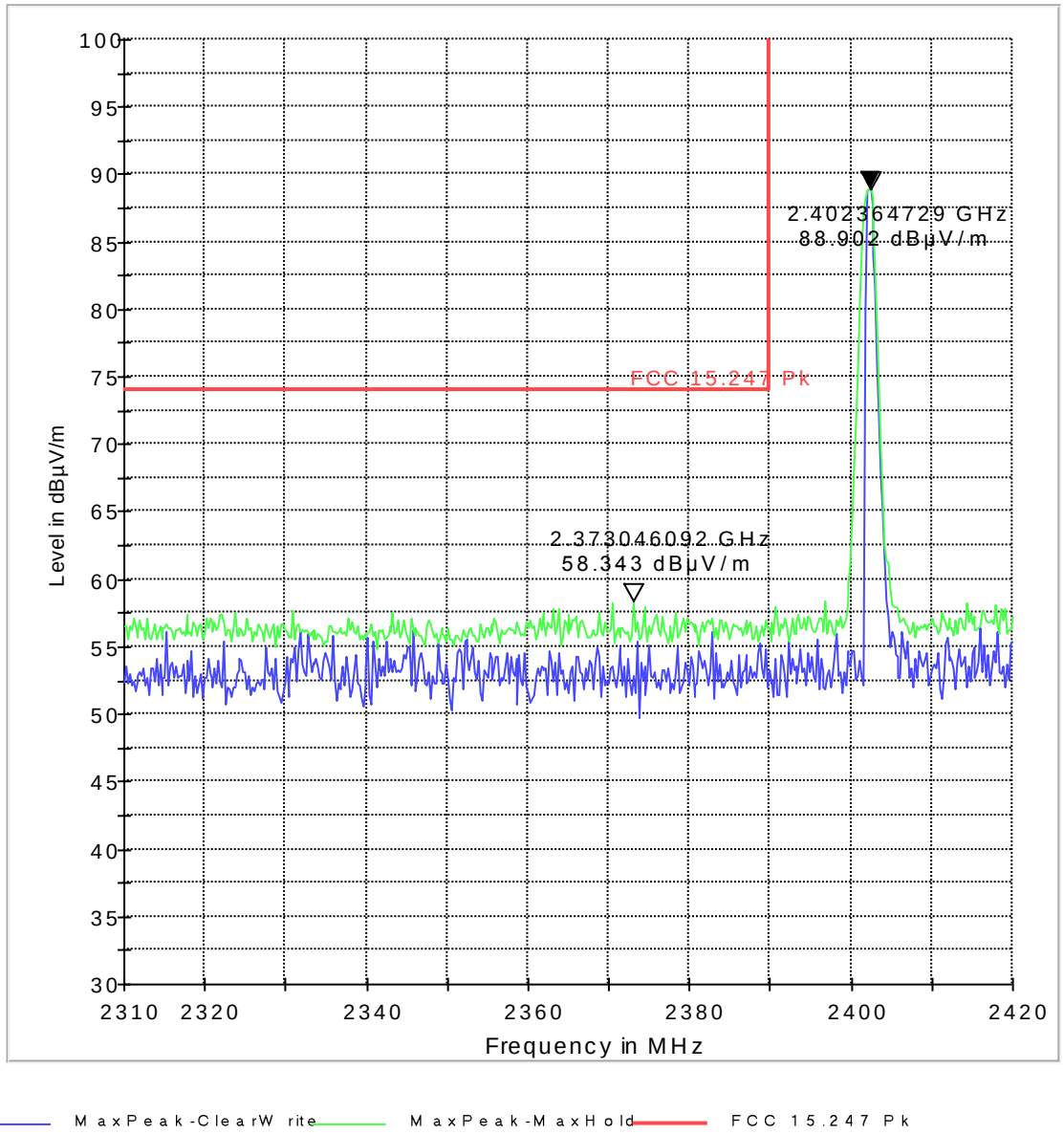
EUT Name: Ranger 4 HSPA
Manufacturer: Mentor Engineering Inc.
S/N: 31-11100019
Comment: 12V; π/4 DQPSK mode(2-DH5) channel 78



Lower band edge peak - 8DPSK modulation

EUT Name:	Ranger 4 HSPA
Manufacturer:	Mentor Engineering Inc.
S/N:	31-11100019
Comment:	12V; 8DPSK mode(3-DH5) channel 0

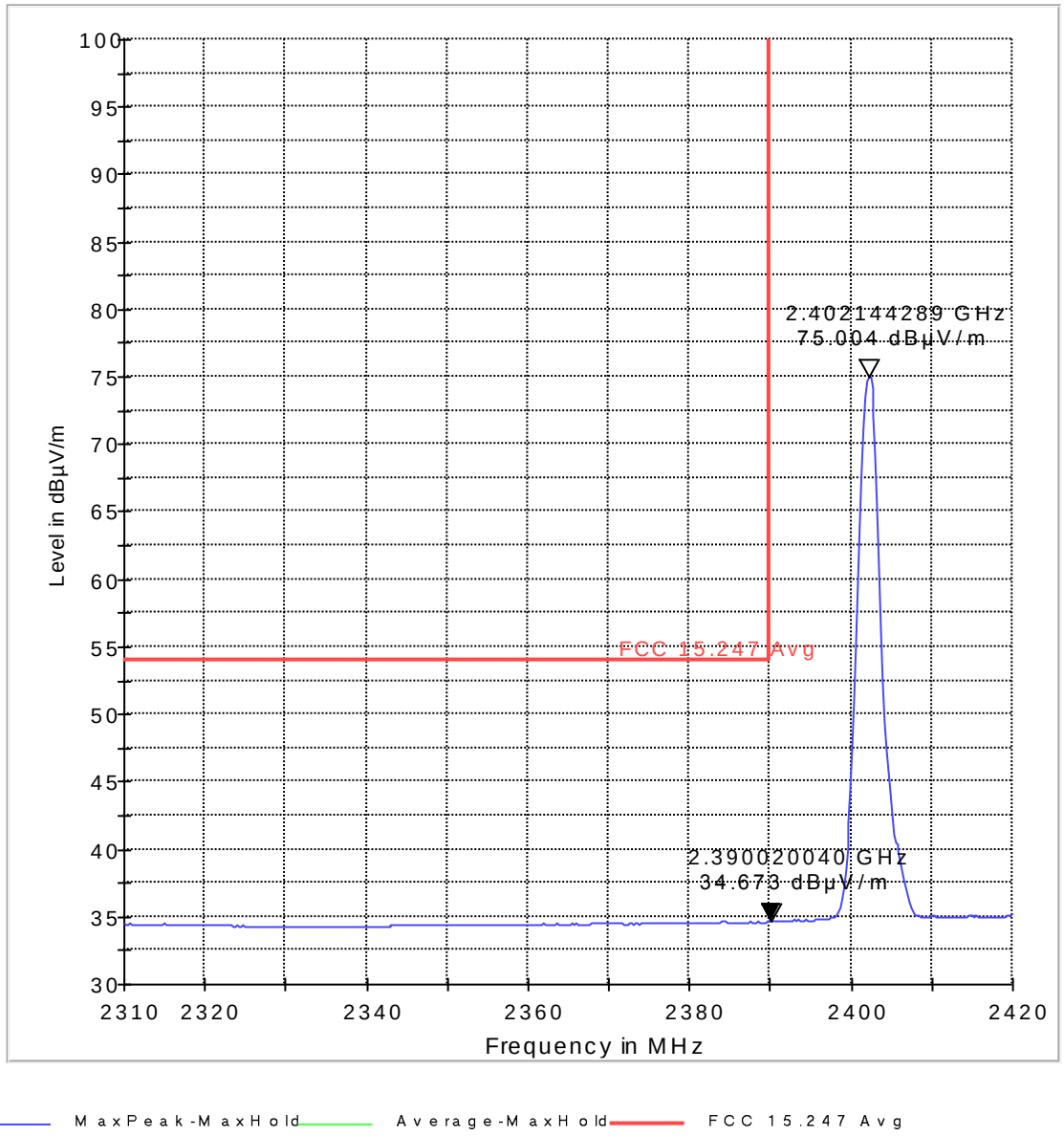
FCC 15.247 LBE Pk 3m



Lower band edge average -8DPSK modulation

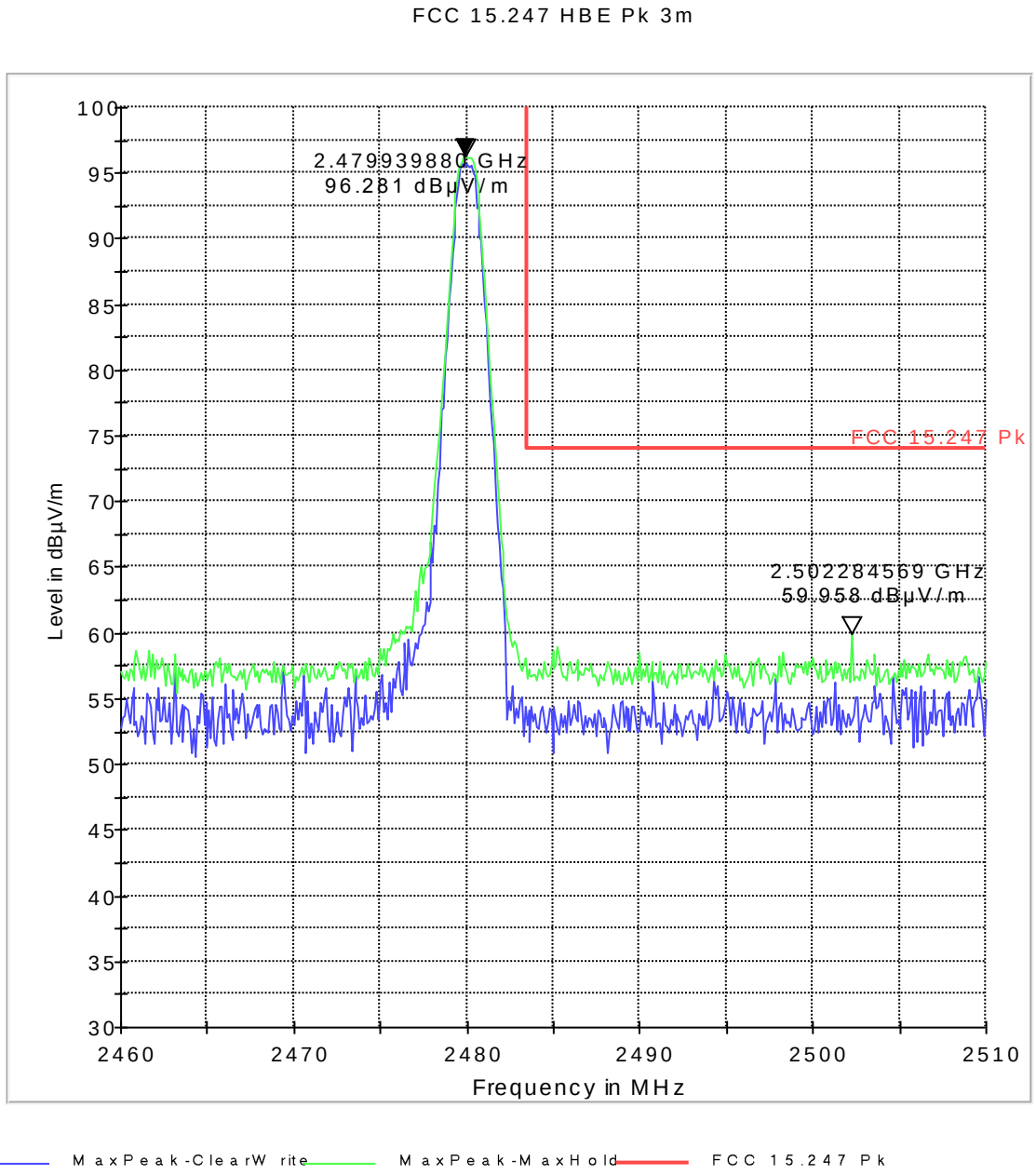
EUT Name:	Ranger 4 HSPA
Manufacturer:	Mentor Engineering Inc.
S/N:	31-11100019
Comment:	12V; 8DPSK mode(3-DH5) channel 0

FCC 15.247 LBE Avg 3m



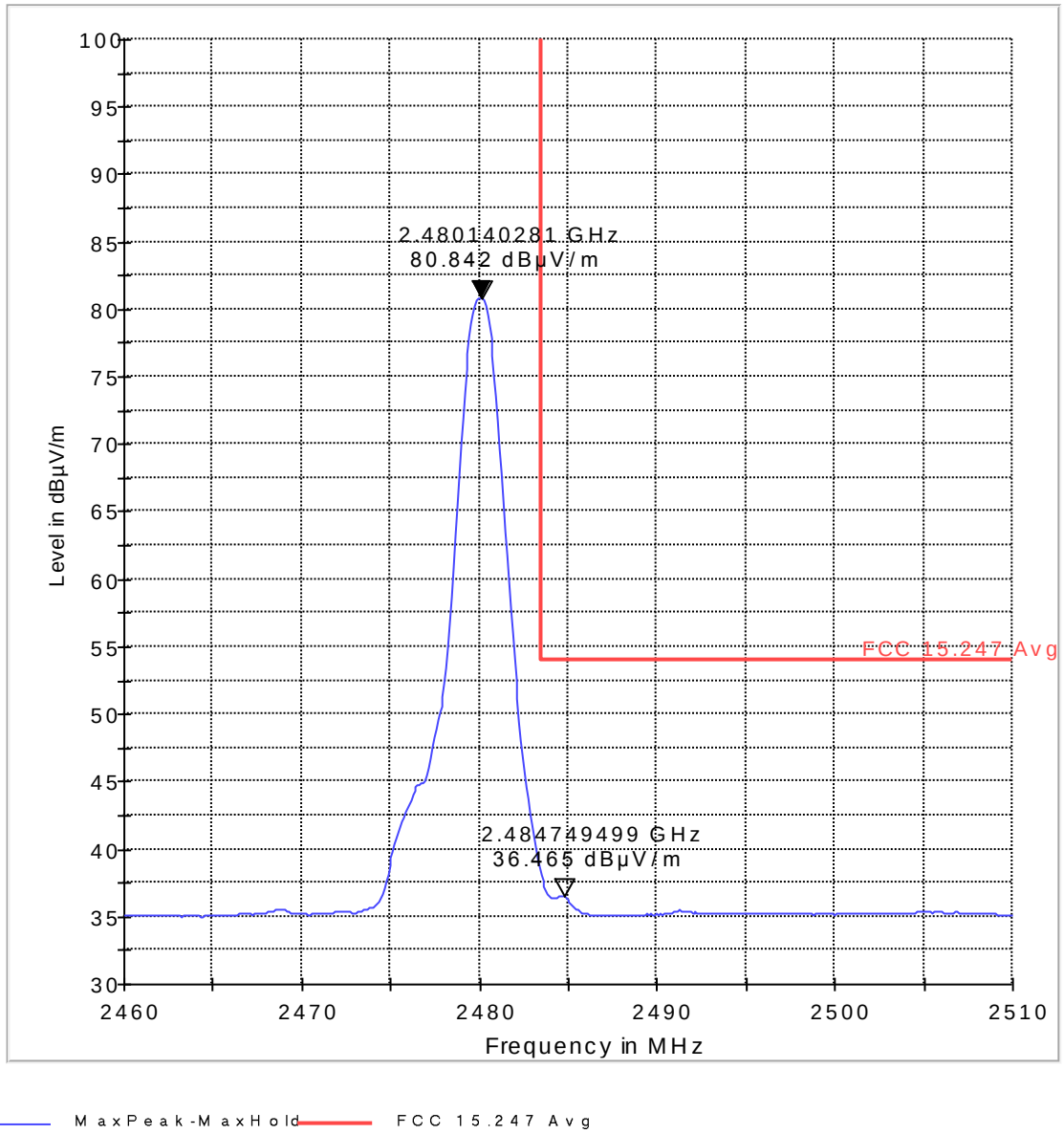
Higher band edge peak - 8DPSK modulation

EUT Name:	Ranger 4 HSPA
Manufacturer:	Mentor Engineering Inc.
S/N:	31-11100019
Comment:	12V



Higher band edge average-8DPSK modulation

EUT Name: Ranger 4 HSPA
Manufacturer: Mentor Engineering Inc.
S/N: 31-11100019
Comment: 12V



6.6 Transmitter Spurious Emissions- Radiated

6.6.1 Limits:

§15.247/15.205
RSS 210-A8.5

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

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

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under Section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB.

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

Table 1:

Frequency of emission (MHz)	Field strength (µV/m)
30–88	100 (40dBµV/m)
88–216	150 (43.5 dBµV/m)
216–960	200 (46 dBµV/m)
Above 960	500 (54 dBµV/m)

Table 2:

Frequency of emission (MHz)	Field strength (µV/m)	Measurement Distance (m)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30

6.6.2 Test Result:

Test mode: Modulation: GFSK- since highest output power.
Unless mentioned otherwise, the emissions outside the limit lines in the plots are from the transmit signal.
Plots reported here represent the worse case emissions for horizontal and vertical antenna polarizations and for three orientations of the EUT.
Measurement Uncertainty: ±3.0dB

6.6.2.1 Measurement Result

Pass.

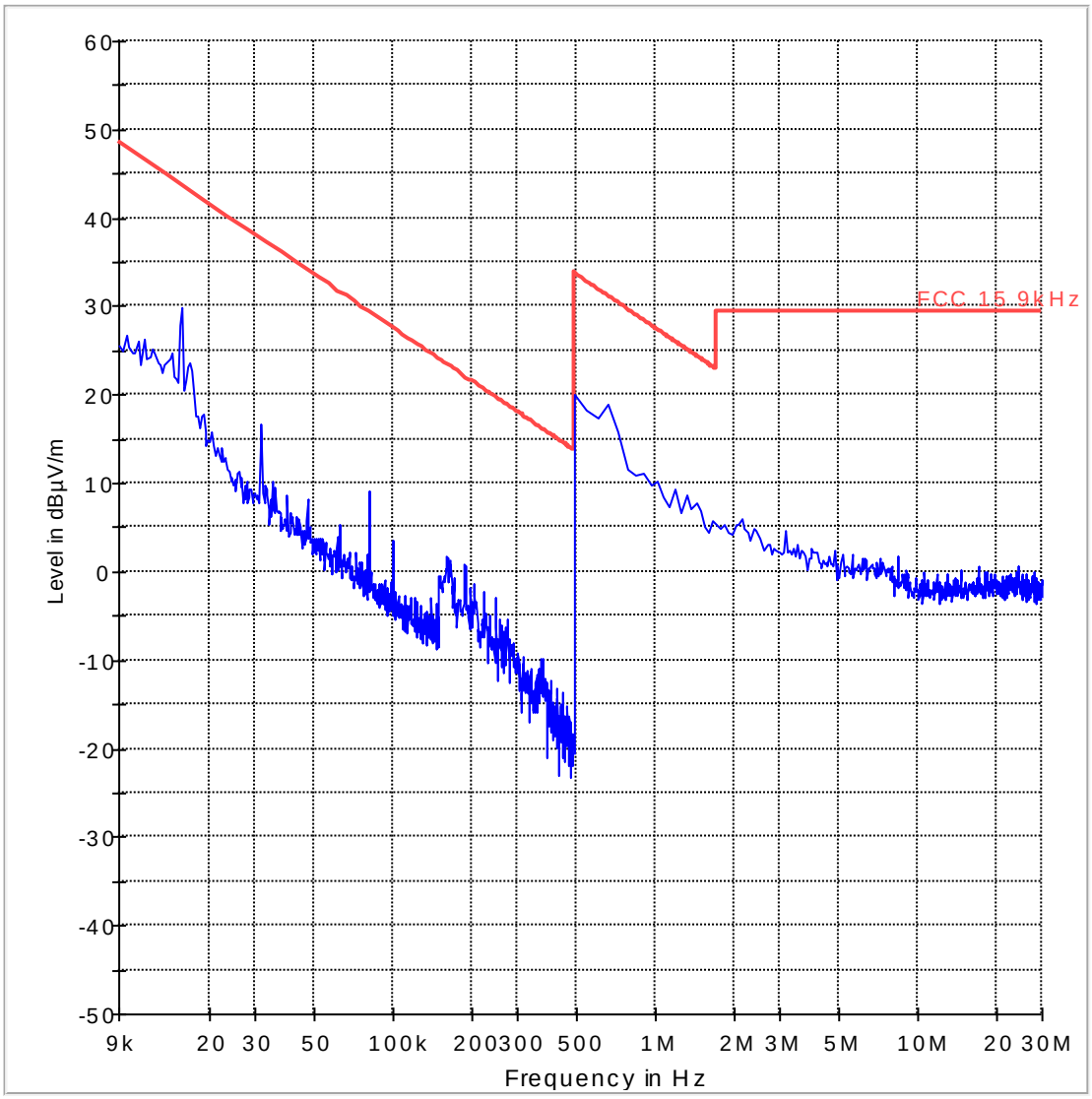
No spurious emissions reported below 30MHz.

6.6.3 Test data/ plots:

Transmitter Radiated Spurious Emission:<30MHz
Note: Worst case representation for all modes of operation in this frequency range-
Limits adjusted for 3m measurement.

EUT Name:	Ranger 4 HSPA
Manufacturer:	Mentor Engineering Inc.
S/N:	31-11100019
Comment:	12V

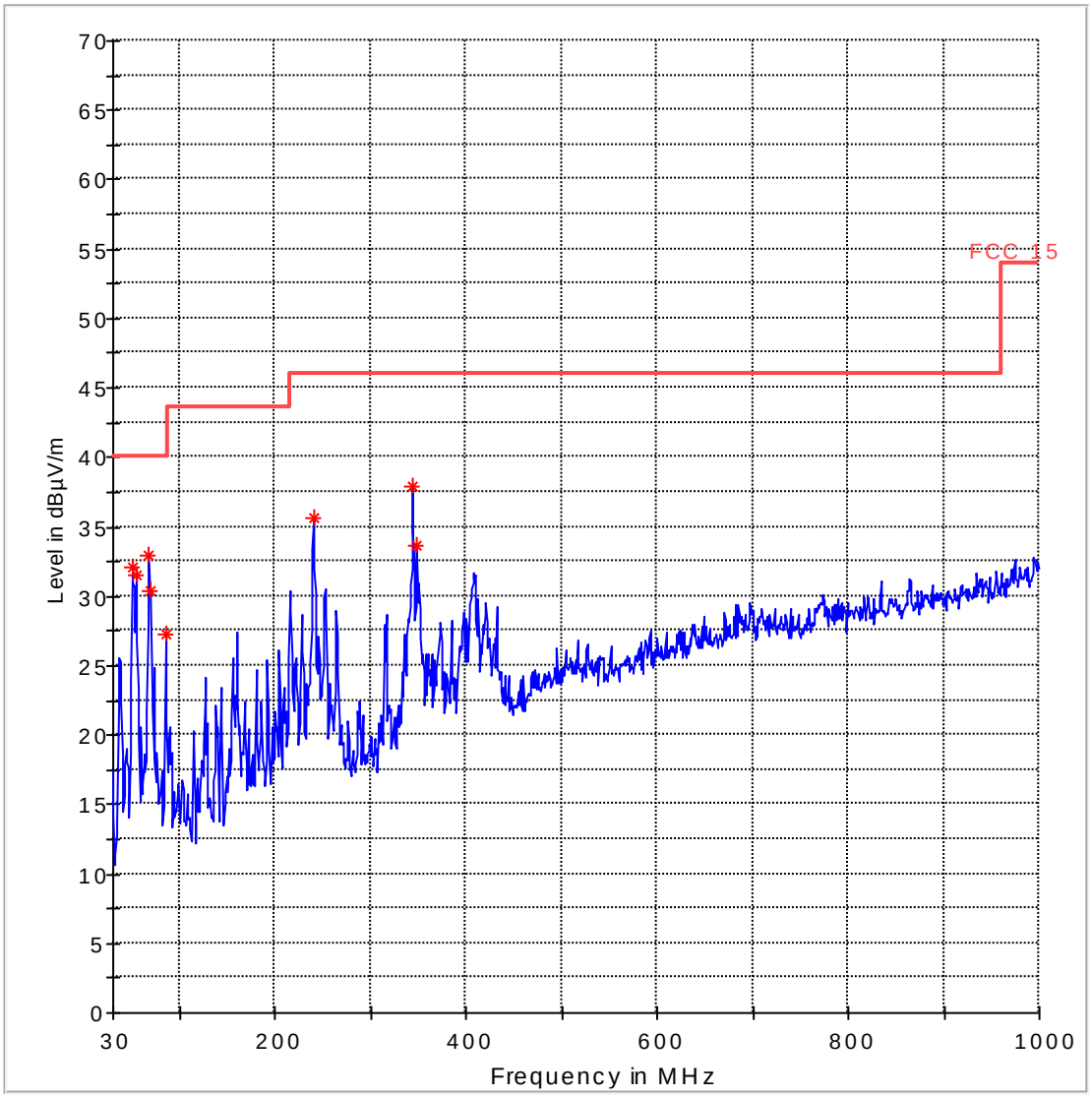
FCC 15 9kHz - 30 MHz



Transmitter Radiated Spurious Emission- Ch0- 30M-1GHz

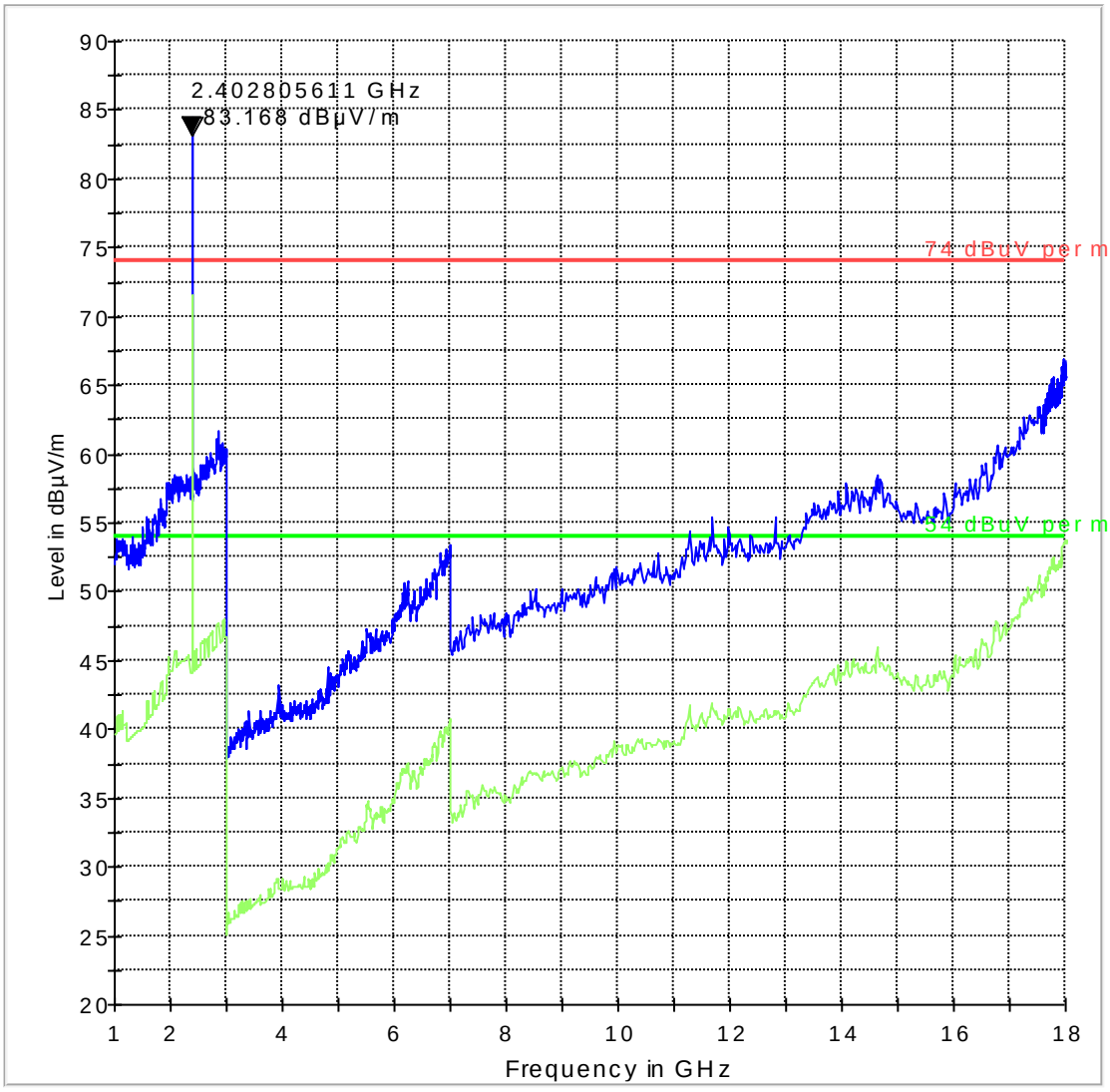
EUT Name:	Ranger 4 HSPA
Manufacturer:	Mentor Engineering Inc.
S/N:	31-11100019
Comment:	12V

FCC 15 30-1000MHz



Transmitter Radiated Spurious Emission- Ch0- 1G-18GHz

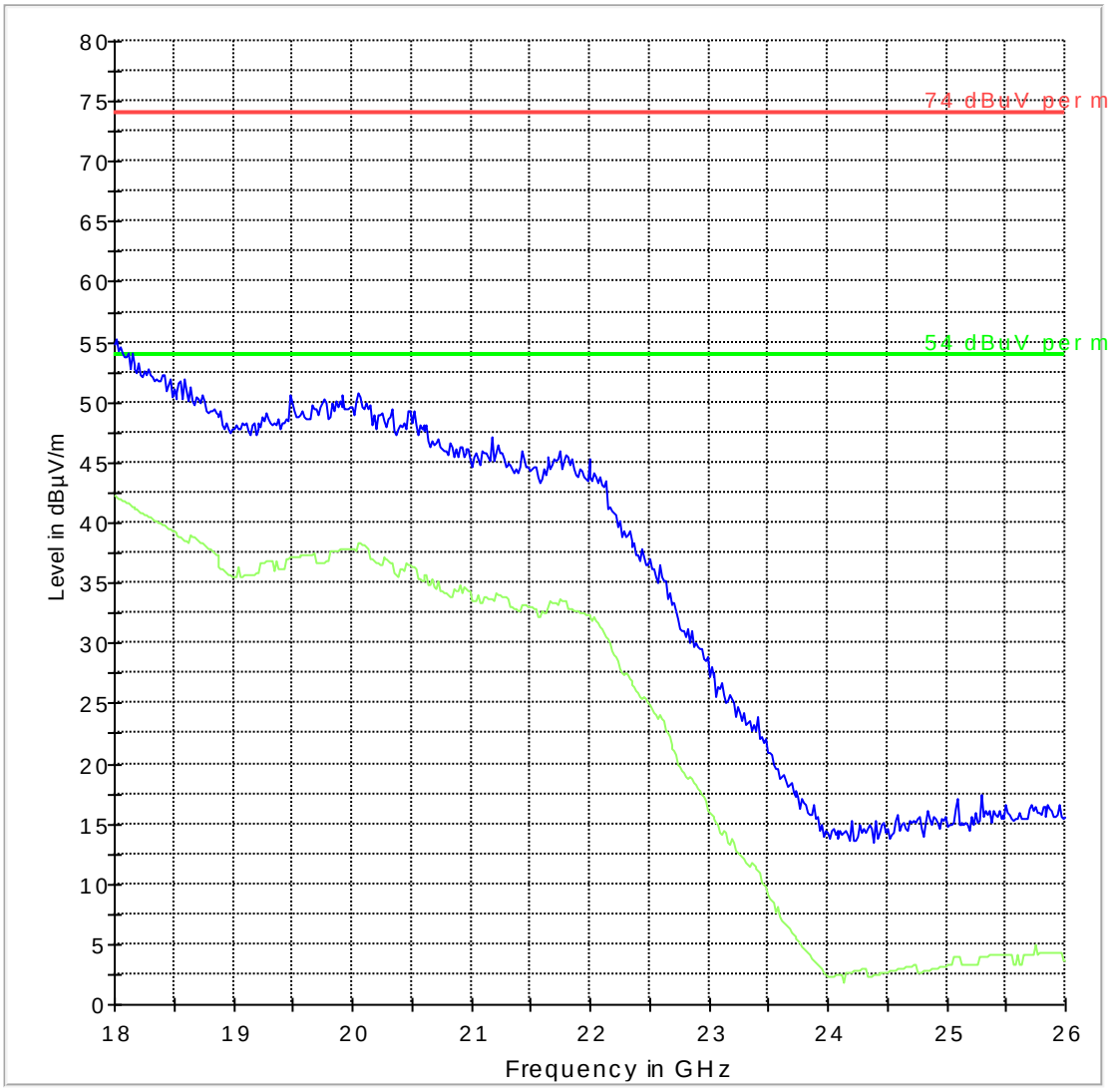
EUT Name:	Ranger 4 HSPA
Manufacturer:	Mentor Engineering Inc.
S/N:	31-11100019
Comment:	12V; Marker placed on transmit signal



Transmitter Radiated Spurious Emission- Ch0- 18G-26GHz

EUT Name:	Ranger 4 EVDO
Manufacturer:	Mentor Engineering Inc.
S/N:	31-11100024
Comment:	12v

FCC 15 18-26GHz

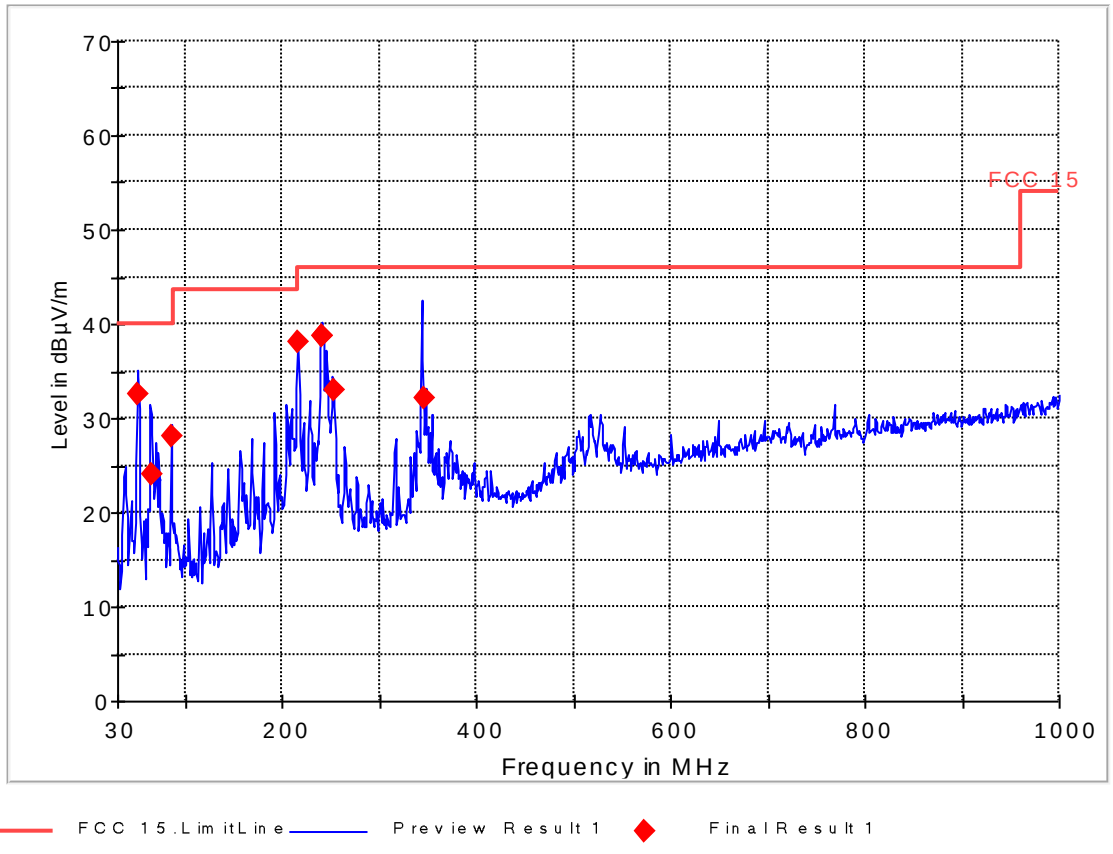


Transmitter Radiated Spurious Emission- Ch39- 30M-1GHz

EUT Name:	Ranger 4 HSPA
Manufacturer:	Mentor Engineering Inc.
S/N:	31-11100019
Comment:	12V

Final Result 1

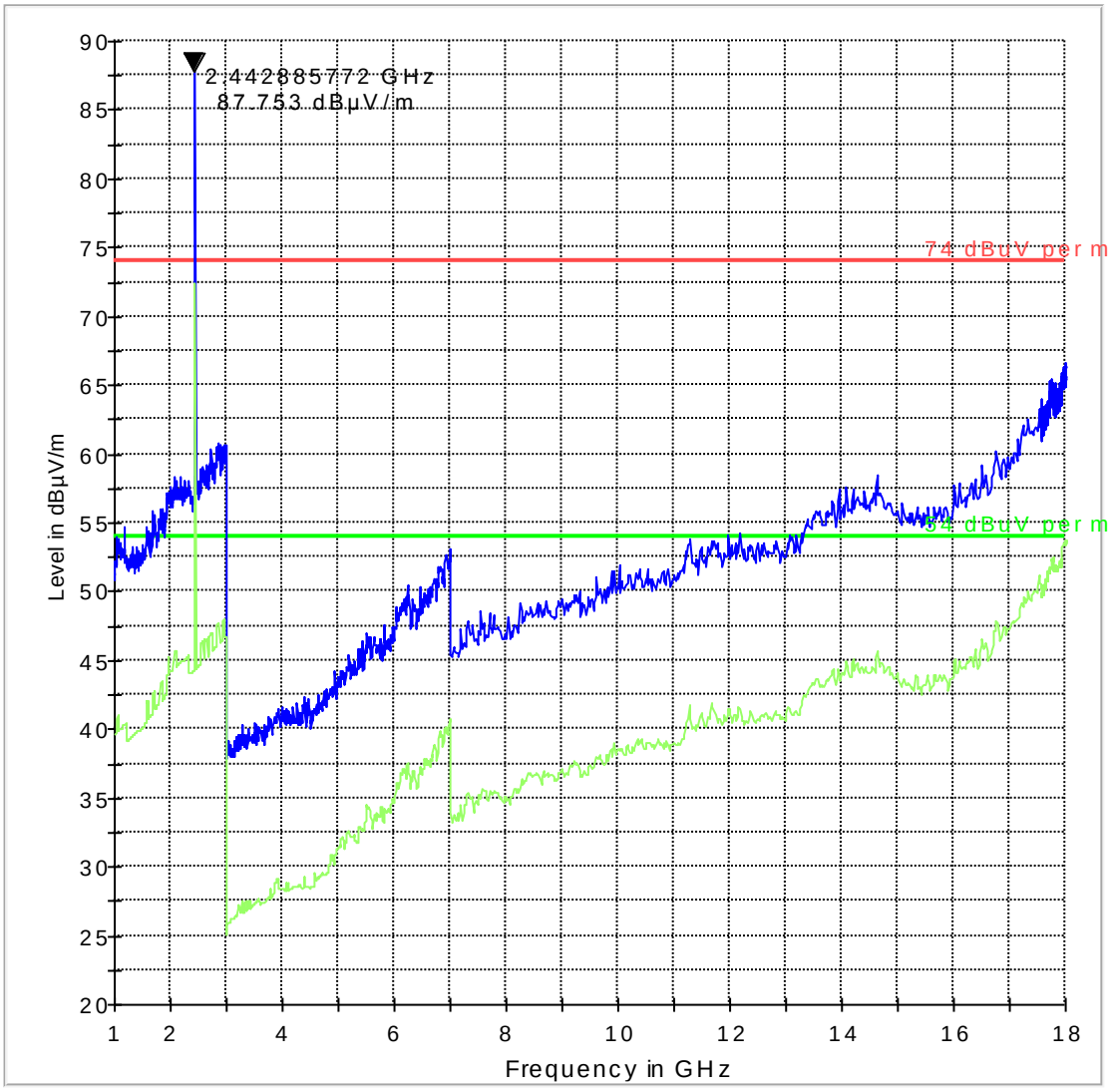
Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
51.389748	32.6	20.0	120.000	120.0	V	248.0	7.1	7.4	40.0
65.185176	24.0	20.0	120.000	120.0	V	0.0	8.7	16.0	40.0
86.227141	28.1	20.0	120.000	120.0	V	225.0	10.1	11.9	40.0
215.950687	38.0	20.0	120.000	138.0	H	68.0	12.7	5.5	43.5
240.052106	38.8	20.0	120.000	120.0	H	81.0	13.5	7.2	46.0
240.053336	38.8	20.0	120.000	120.0	H	81.0	13.5	7.2	46.0
251.884149	33.0	20.0	120.000	120.0	H	81.0	13.6	13.0	46.0
344.920256	32.0	20.0	120.000	120.0	H	182.0	17.4	14.0	46.0



Transmitter Radiated Spurious Emission- Ch39- 1G-18GHz

EUT Name:	Ranger 4 HSPA
Manufacturer:	Mentor Engineering Inc.
S/N:	31-11100019
Comment:	12V; Marker placed on transmit signal

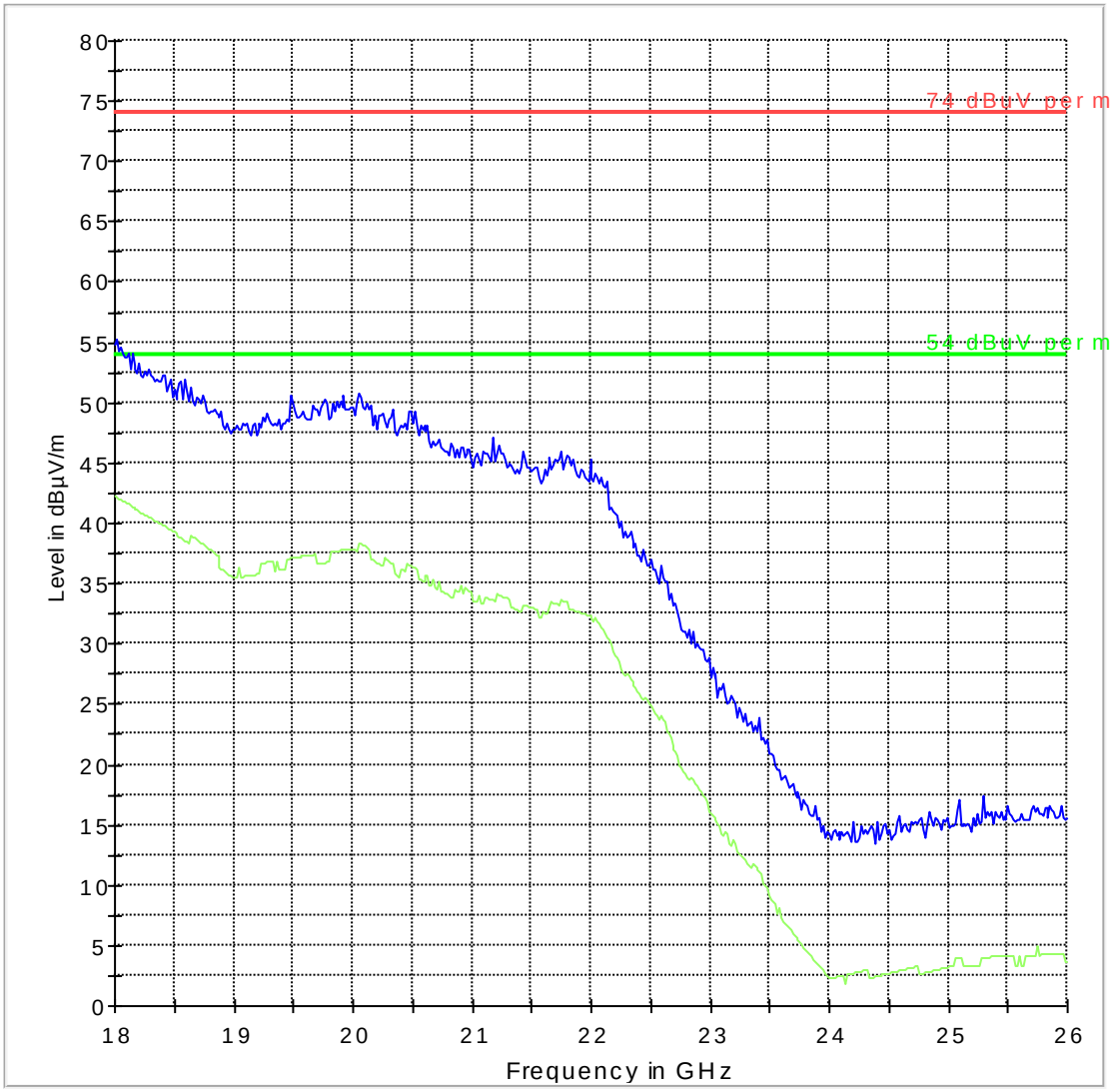
FCC 15 1-18GHz



Transmitter Radiated Spurious Emission- Ch39- 18G-26GHz

EUT Name:	Ranger 4 EVDO
Manufacturer:	Mentor Engineering Inc.
S/N:	31-11100024
Comment:	12v

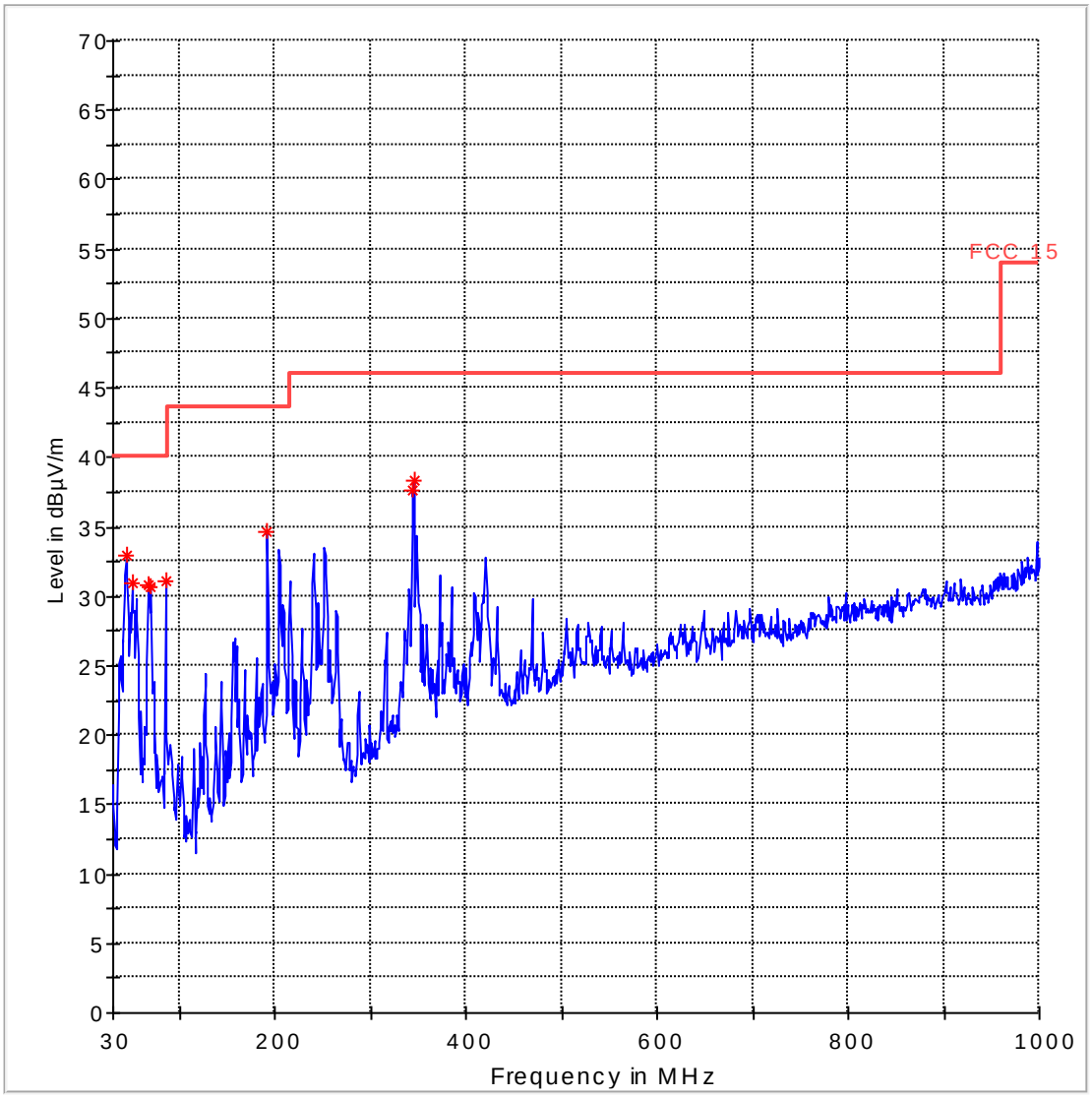
FCC 15 18-26GHz



Transmitter Radiated Spurious Emission- Ch78- 30M-1GHz

EUT Name:	Ranger 4 HSPA
Manufacturer:	Mentor Engineering Inc.
S/N:	31-11100019
Comment:	12V

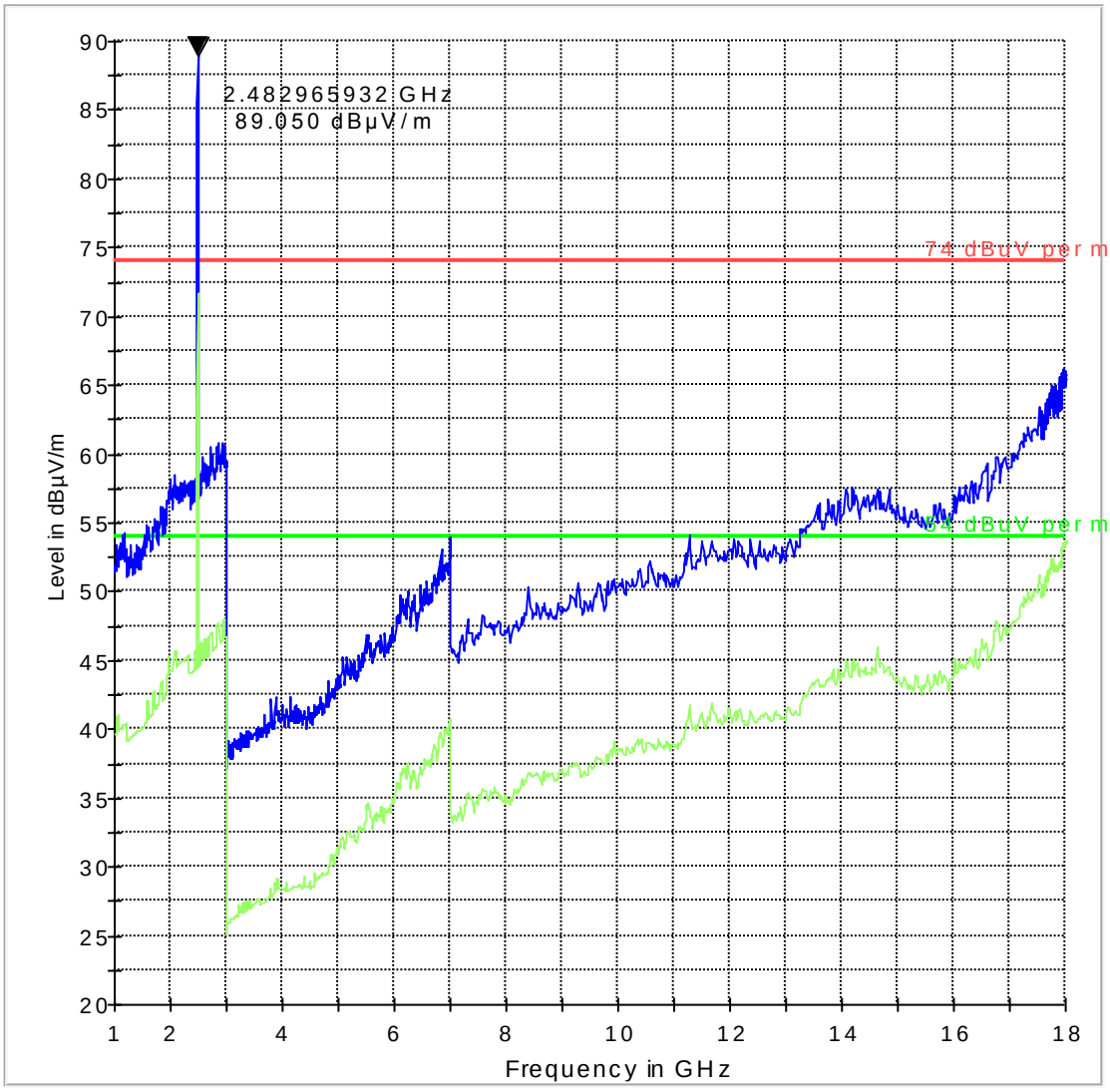
FCC 15 30-1000MHz



Transmitter Radiated Spurious Emission- Ch78- 1G-18GHz

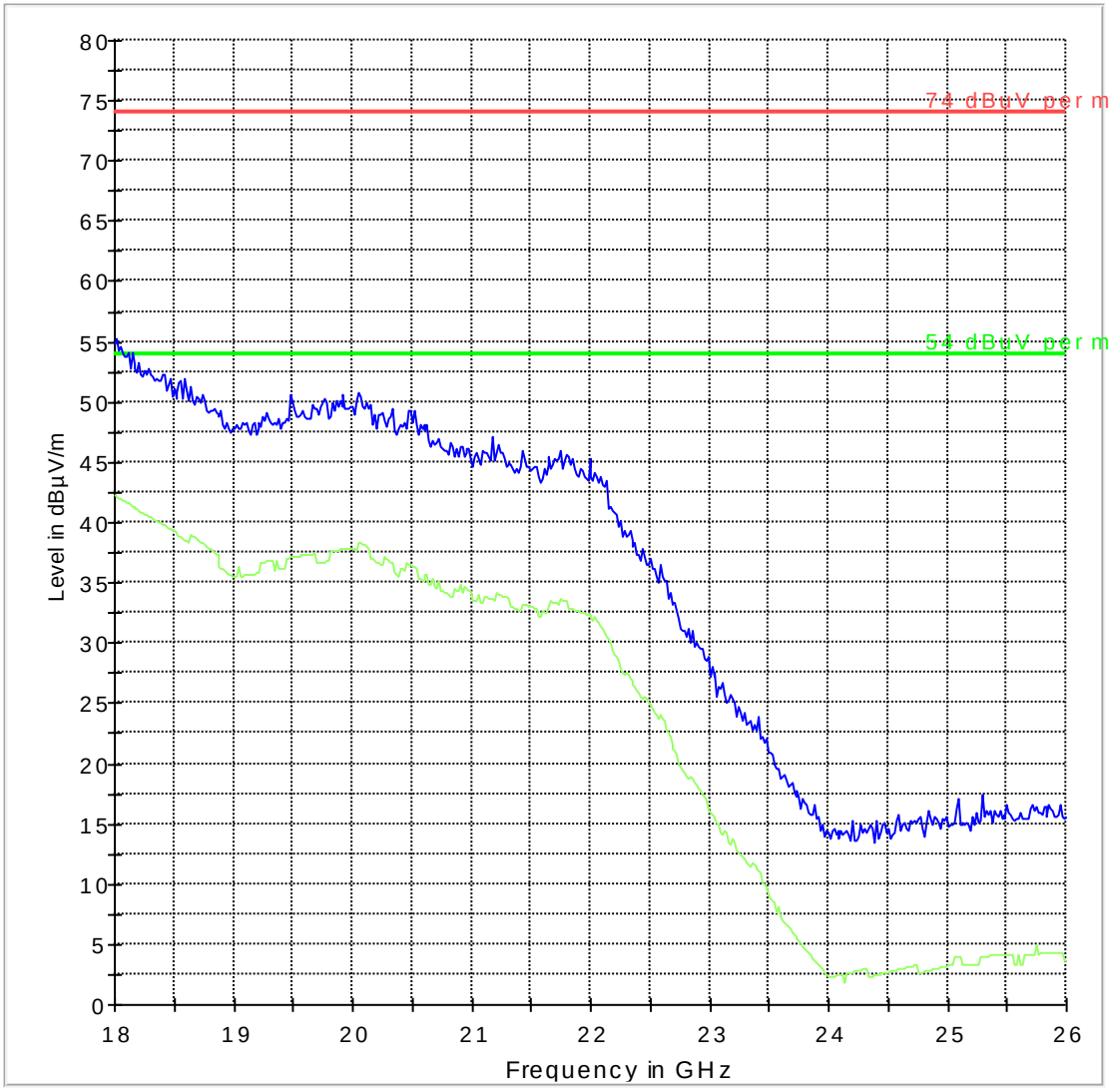
EUT Name:	Ranger 4 HSPA
Manufacturer:	Mentor Engineering Inc.
S/N:	31-11100019
Comment:	12V; Marker placed on transmit signal

FCC 15 1-18GHz



Transmitter Radiated Spurious Emission- Ch78- 18G-26GHz

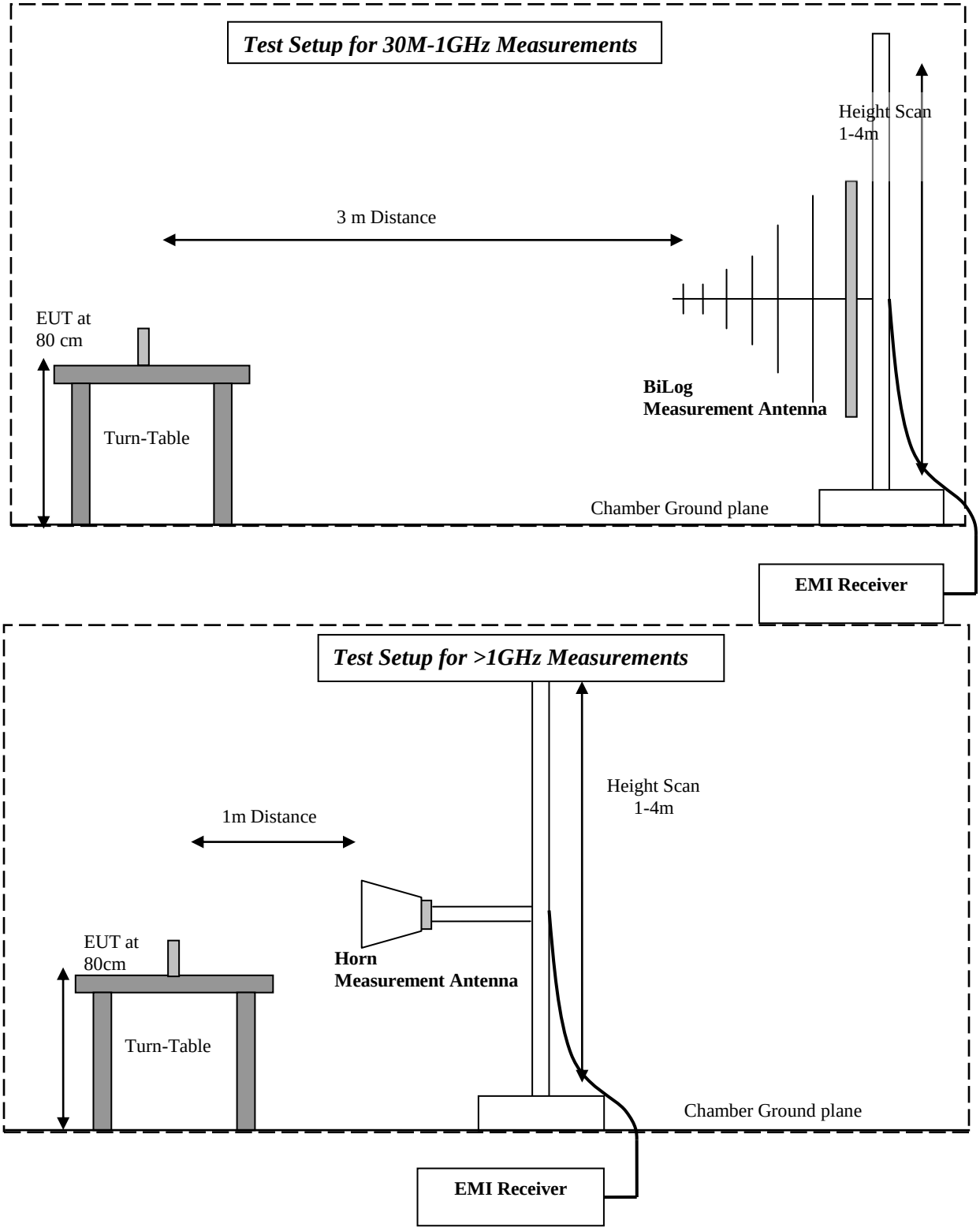
EUT Name:	Ranger 4 EVDO
Manufacturer:	Mentor Engineering Inc.
S/N:	31-11100024
Comment:	12v



7 Test Equipment and Ancillaries used for tests

Instrument/Ancillary	Model	Manufacturer	Serial No.	Cal Date	Cal Interval
EMI Receiver/Analyzer	ESIB 40	Rohde & Schwarz	100107	May 2011	2 Years
Spectrum Analyzer	FSU	Rohde & Schwarz	200302	May 2011	2 Years
Loop Antenna	6512	EMCO	00049838	Aug 2011	3 years
Biconilog Antenna	3141	EMCO	0005-1186	June 2009	3 years
Horn Antenna (1-18GHz)	3115	ETS	00035111	Jan 2009	3.5 years
Horn Antenna (1-18GHz)	3115	ETS	00035114	Mar 2009	3 years
Horn Antenna (18-40GHz)	3116	ETS	00070497	Aug 2011	3 years
Communication Antenna	IBP5-900/1940	Kathrein	n/a	n/a	n/a
High Pass Filter	5HC2700	Trilithic Inc.	9926013	Part of system calibration	
High Pass Filter	4HC1600	Trilithic Inc.	9922307	Part of system calibration	
6GHz High Pass Filter	HPM50106	Microtronics	001	Part of system calibration	
Pre-Amplifier	JS4-00102600	Miteq	00616	Part of system calibration	
Power Smart Sensor	R&S	NRP-Z81	100161	May 2011	2 Years
DC Power Supply	E3610A	Hewlett Packard	KR83021224	n/a	n/a
Multimeter	MM200	Klein	N/A	Apr 2011	2 Years
Temp Hum Logger	TM320	Dickson	03280063	Feb 2011	1 Year
Temp Hum Logger	TM325	Dickson	5285354	Feb 2011	1 Year

8 Test Setup Info:



9 Revision History

Date	Report Name	Changes to report	Report prepared by
2012-02-17	EMC_MENTO_003_10002_FHSS_BT	First Version	C Lee