



**RADIATED SPURIOUS EMISSIONS PORTIONS OF
FCC CFR47 PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 7**

CERTIFICATION TEST REPORT

FOR

TELEMATICS PLATFORMS

(GPS+WWAN (CDMA2000 EV-DO/1xRTT) +WLAN (802.11a/b/g) + BLUETOOTH (Ver.2.0))

MODEL NUMBER: TVG-850 EVDO

FCC ID: JUP-TVG850EVDO

IC: 1756A-TVG850EVDO

REPORT NUMBER: 10U13184-4, Revision A

ISSUE DATE: JULY 15, 2010

Prepared for

TRIMBLE MRM

888 TASMAN ROAD

MILPITAS, CA 95035, U.S.A.

Prepared by

COMPLIANCE CERTIFICATION SERVICES

47173 BENICIA STREET

FREMONT, CA 94538, U.S.A.

TEL: (510) 771-1000

FAX: (510) 661-0888



NVLAP LAB CODE 200065-0

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	06/18/10	Initial Issue	T. Chan
A	07/15/10	Revised Cell Band Duty Cycle to 100% & Added Radiated Emissions Portion Report on Cover Page	T. Chan

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	4
2. TEST METHODOLOGY	5
3. FACILITIES AND ACCREDITATION	5
4. CALIBRATION AND UNCERTAINTY	5
4.1. MEASURING INSTRUMENT CALIBRATION	5
4.2. SAMPLE CALCULATION	5
4.3. MEASUREMENT UNCERTAINTY	5
5. EQUIPMENT UNDER TEST	6
5.1. DESCRIPTION OF EUT	6
5.2. DESCRIPTION OF AVAILABLE ANTENNAS	6
5.3. SOFTWARE AND FIRMWARE	6
5.4. WORST-CASE CONFIGURATION AND MODE	6
5.5. DESCRIPTION OF TEST SETUP	7
6. TEST AND MEASUREMENT EQUIPMENT	9
7. RADIATED TEST RESULTS	10
7.1. LIMITS AND PROCEDURE	10
7.2. TRANSMITTER ABOVE 1 GHz	11
7.2.1. TRANSMITTER ABOVE 1 GHz FOR 802.11b MODE IN THE 2.4 GHz BAND	11
7.2.2. TRANSMITTER ABOVE 1 GHz FOR 802.11g MODE IN THE 2.4 GHz BAND	20
7.3. RECEIVER ABOVE 1 GHz	29
7.4. WORST-CASE BELOW 1 GHz	30
7.5. DIGITAL DEVICE BELOW 1 GHz	33
8. REQUIREMENTS - LIMITATION OF EXPOSURE	36
8.1. LIMITS	36
8.2. EQUATIONS	38
8.3. RESULTS	39
8.3.1. CO-LOCATED RESULTS FOR SIMULTANEOUS OPERATION IN THE CELLULAR BAND AND 2.4 GHz BAND	39
8.3.2. CO-LOCATED RESULTS FOR SIMULTANEOUS OPERATION IN THE PCS BAND AND 2.4 GHz BAND	39
9. SETUP PHOTOS	40

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: TRIMBLE MRM
888 TASMAN ROAD,
MILPITAS, CA 95035, U.S.A.

EUT DESCRIPTION: TELEMATICS PLATFORM
Contains: GPS+WWAN (CDMA2000 EV-DO/1xRTT) +WLAN
(802.11a/b/g) + BLUETOOTH (Ver.2.0)

MODEL: TVG-850 EVDO

SERIAL NUMBER: 38

DATE TESTED: APRIL 27 – JUNE 16, 2010

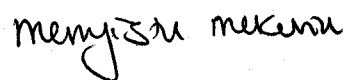
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 7 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 2	Pass

Compliance Certification Services, Inc. (CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For CCS By:

Tested By:



THU CHAN
EMC MANAGER
COMPLIANCE CERTIFICATION SERVICES

MENGISTU MEKURIA
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 2, and RSS-210 Issue 7.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

TVG-850 EVDO is a telematics platform primarily intended for use in: transportation and distribution vehicles, telecommunications, and other vertical markets that may require high data rates, WiFi access point connections, and permit the use of an environmentally unsealed enclosure. TVG-850 performs data collection from the vehicle and other sensors, processes the data, and then sends the data wirelessly to a central data server using various wireless technologies. It also acts as a WiFi hotspot when in cellular coverage.

5.2. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA antenna, with a maximum gain of 1.7 dBi.

5.3. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was ATHEROS_ART, rev. 5.3.

The test utility software used during testing was iperf program Ver. 1.7.0.

5.4. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Dell	PP18L	N/A	DoC
AC/DC Adapter	Dell	LA65NS0-00	CN-0DF263-71615-72M-2925	DoC
12V DC Battery	N/A	N/A	N/A	N/A

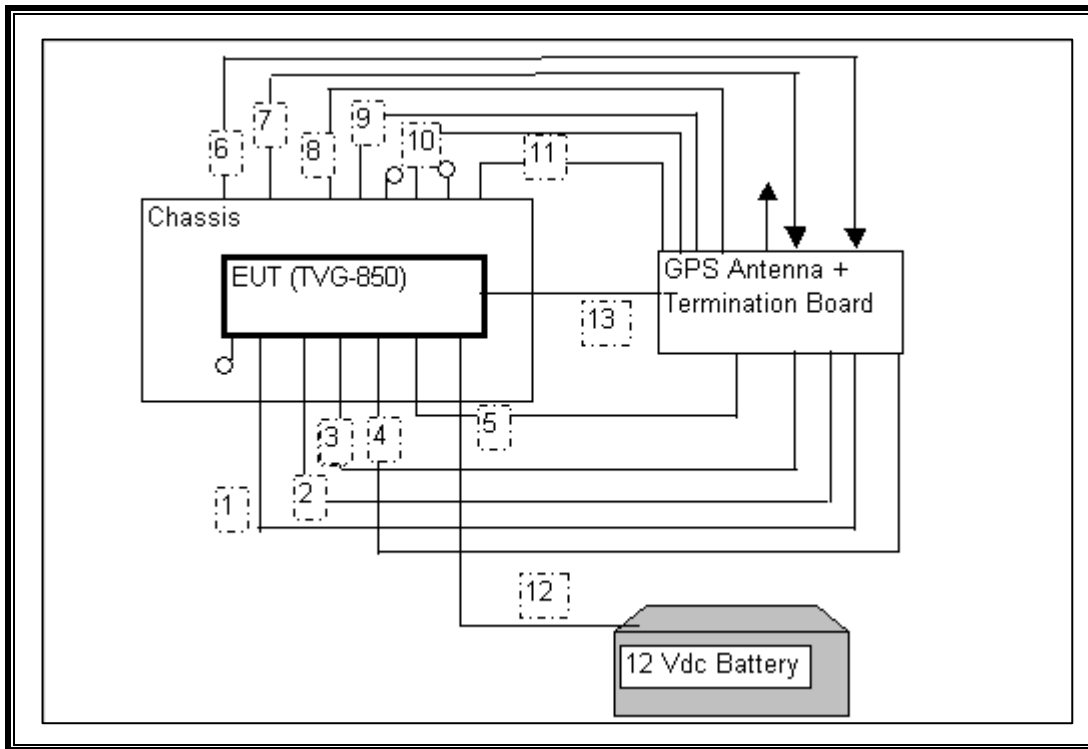
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	Ethernet	1	RJ45	Un-Shielded	0.5m	
2	Serial	1		Un-Shielded	0.4m	
3	Serial	1	RS232	Un-Shielded	0.4m	
4	Serial	1		Un-Shielded	0.4m	
5	Digital I/O	1		Un-Shielded	0.4m	
6	WLAN_Main	1	Fakra Black	RG-58	4.5m	Bundled Together
7	WLAN_Diversity	1	Fakra Black	RG-58	3.0m	
8	WWAN_Main	1	Fakra Purple	RG-58	4.5m	Bundled Together
9	WWAN_Diversit	1	Fakra Purple	RG-174	3.0m	
10	GPS	1	Fakra Blue	RG-174	4.5m	Bundled Together
11	Bluetooth	1	Fakra White	RG-174	3.0m	
12	Battery	1	Wires	Un-Shielded	0.4m	
13	Ground	1	Wire	Un-Shielded	0.4m	

TEST SETUP

The EUT is stand-alone unit with all ports are terminated by termination board during the tests. The support laptop was used only to program the EUT for the appropriate channel and modulation changes.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Asset	Cal Due
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01178	08/31/10
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	07/06/10
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	08/04/10
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01016	07/14/10
Antenna, Horn, 18 GHz	EMCO	3115	C00945	07/29/10
Reject Filter, 2.4-2.5 GHz	Micro-Tronics	BRM50702	N02685	CNR

7. RADIATED TEST RESULTS

7.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

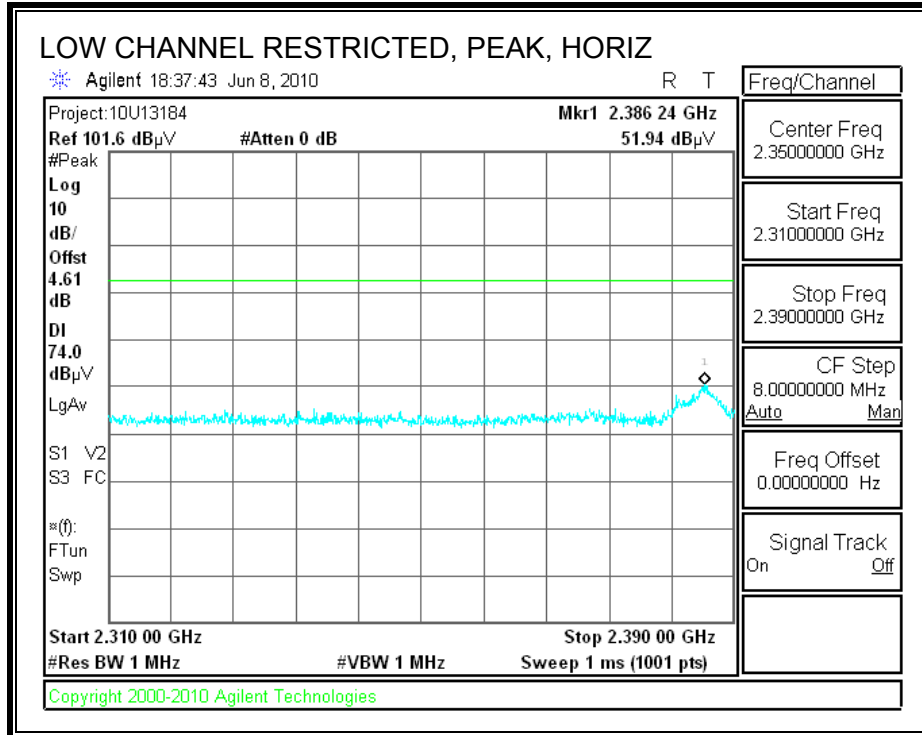
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

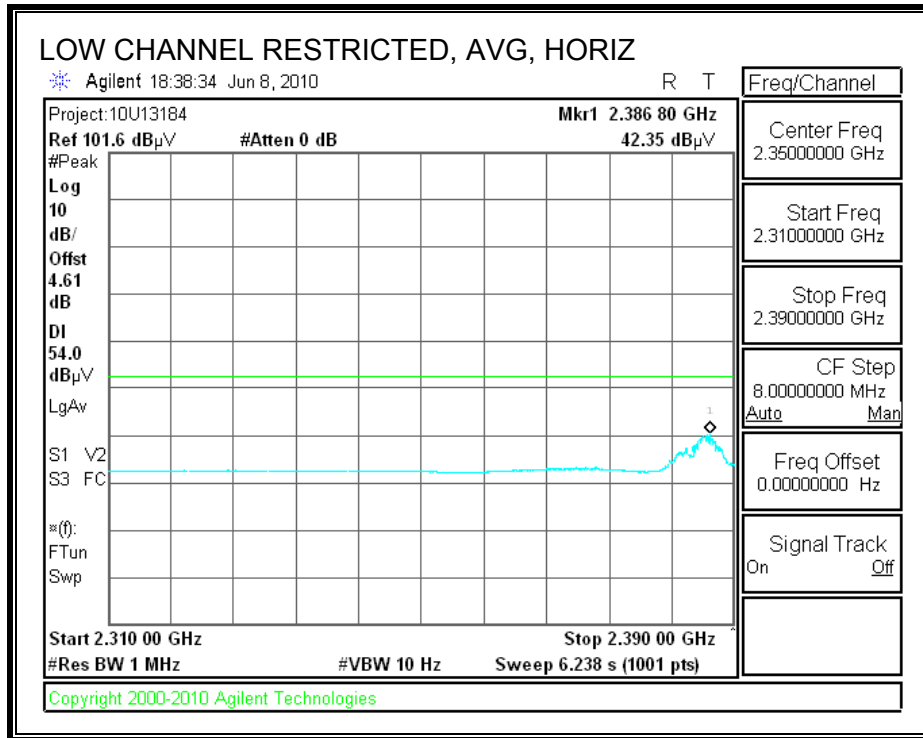
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

7.2. TRANSMITTER ABOVE 1 GHz

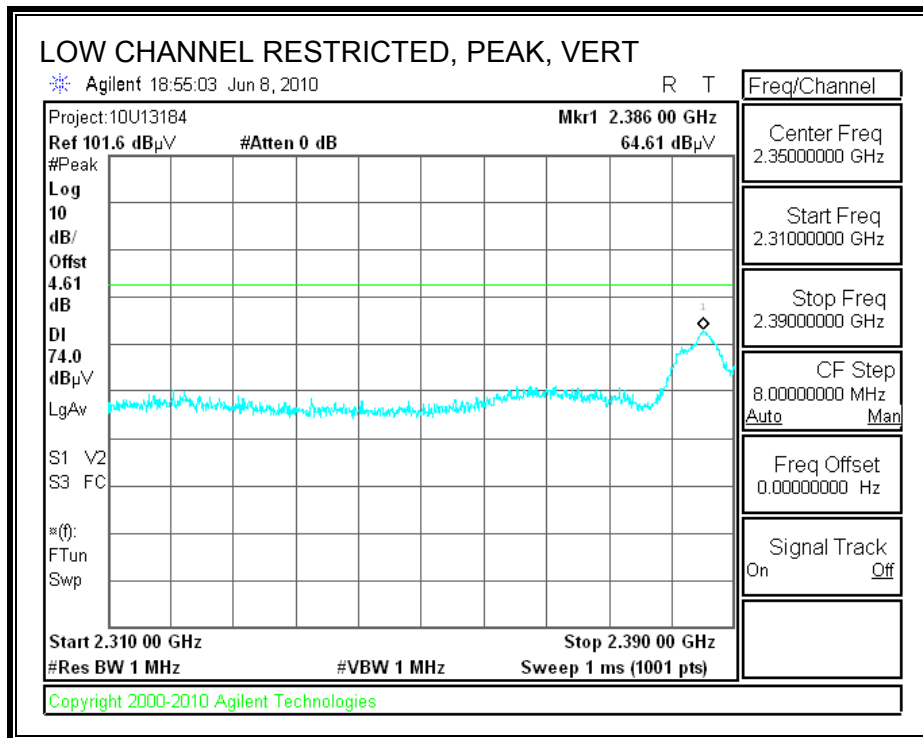
7.2.1. TRANSMITTER ABOVE 1 GHz FOR 802.11b MODE IN THE 2.4 GHz BAND

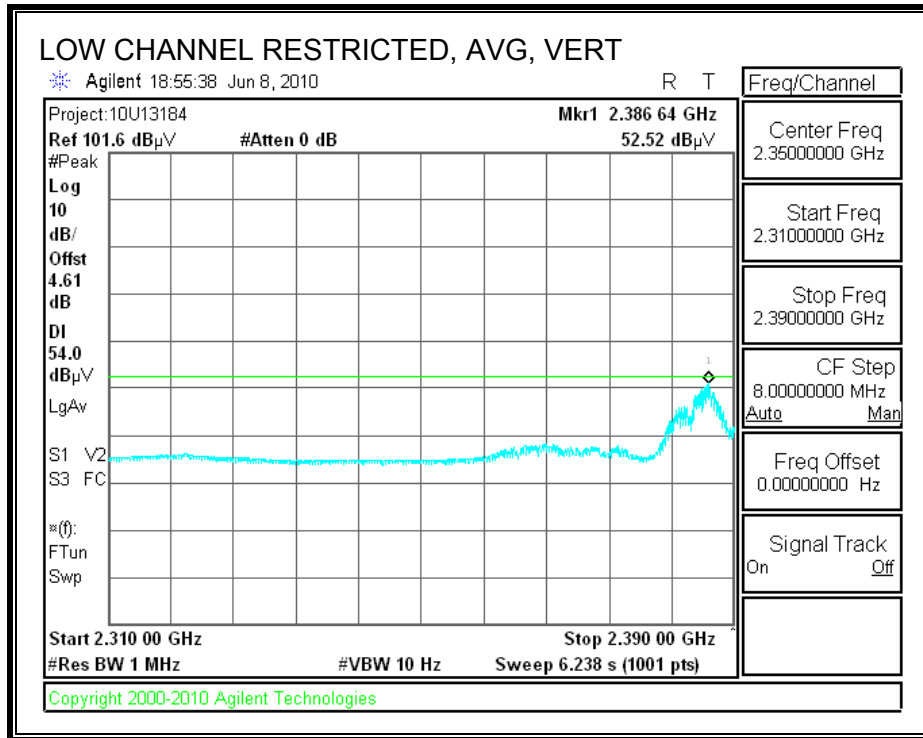
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



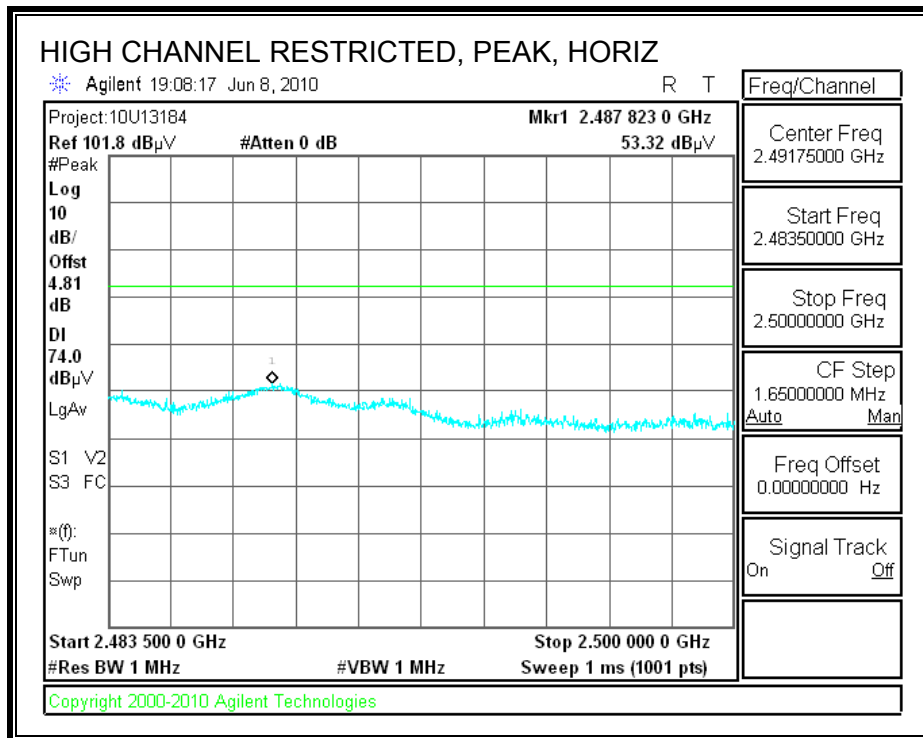


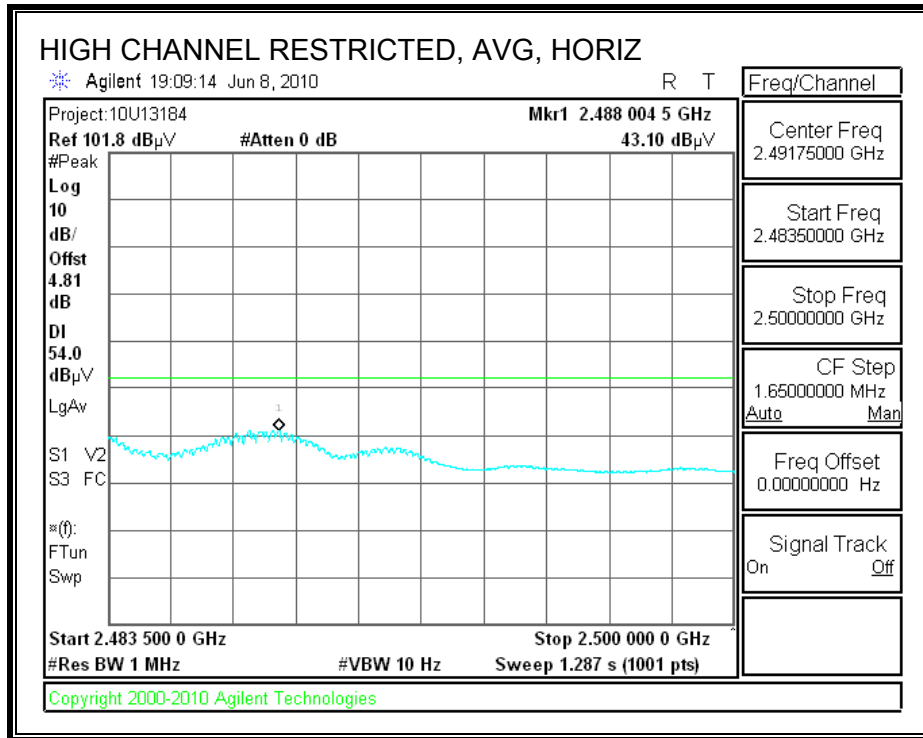
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



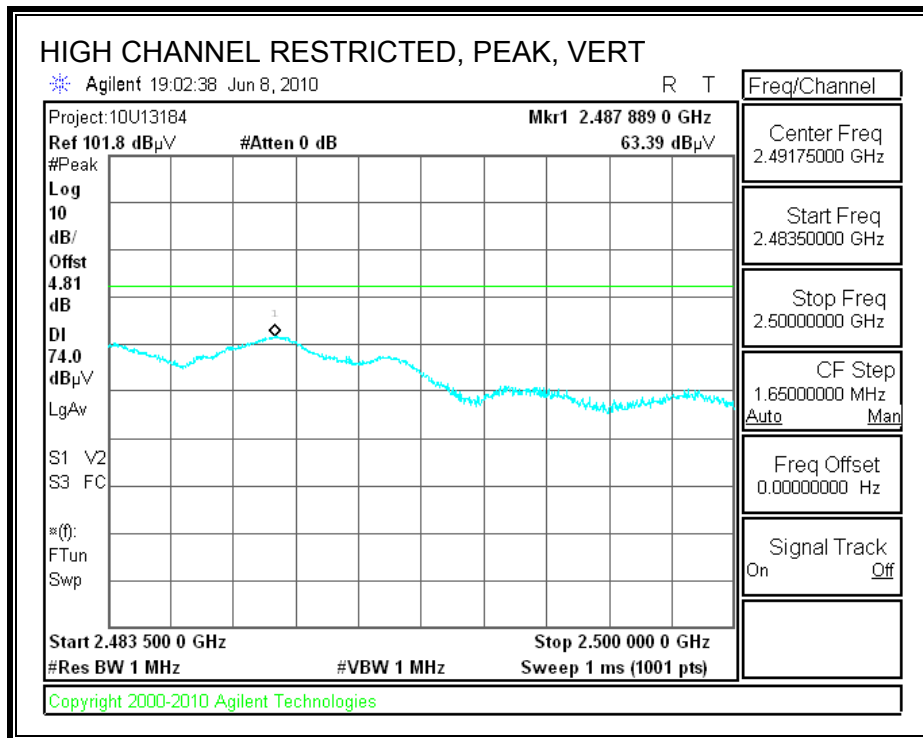


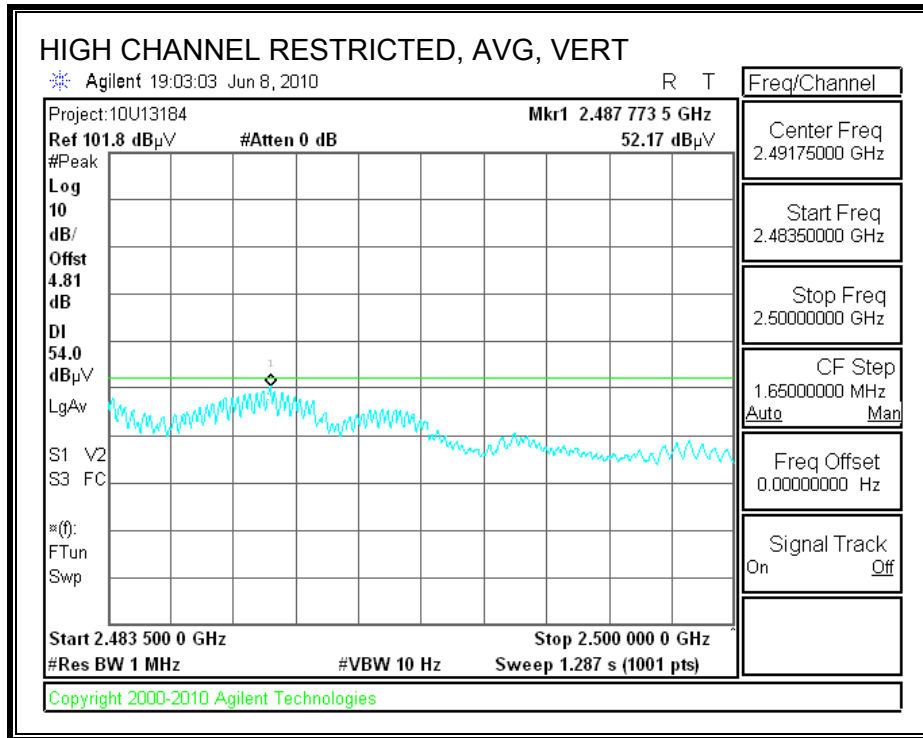
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
 Compliance Certification Services, Fremont 5m Chamber

Company: Trimble MRM
 Project #: 10U13184
 Date: 6/21/2010
 Test Engineer: Mengistu Mekuria
 Configuration: EUT Alone
 Mode: TX, b Mode

Test Equipment:

Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz	Limit
T73; S/N: 6717 @3m	T144 Miteq 3008A00931			FCC 15.205

Hi Frequency Cables

3' cable 22807700	12' cable 22807600	20' cable 22807500	HPF	Reject Filter	Peak Measurements RBW=VBW=1MHz
3' cable 22807700	12' cable 22807600	20' cable 22807500		R_001	Average Measurements RBW=1MHz, VBW=10Hz

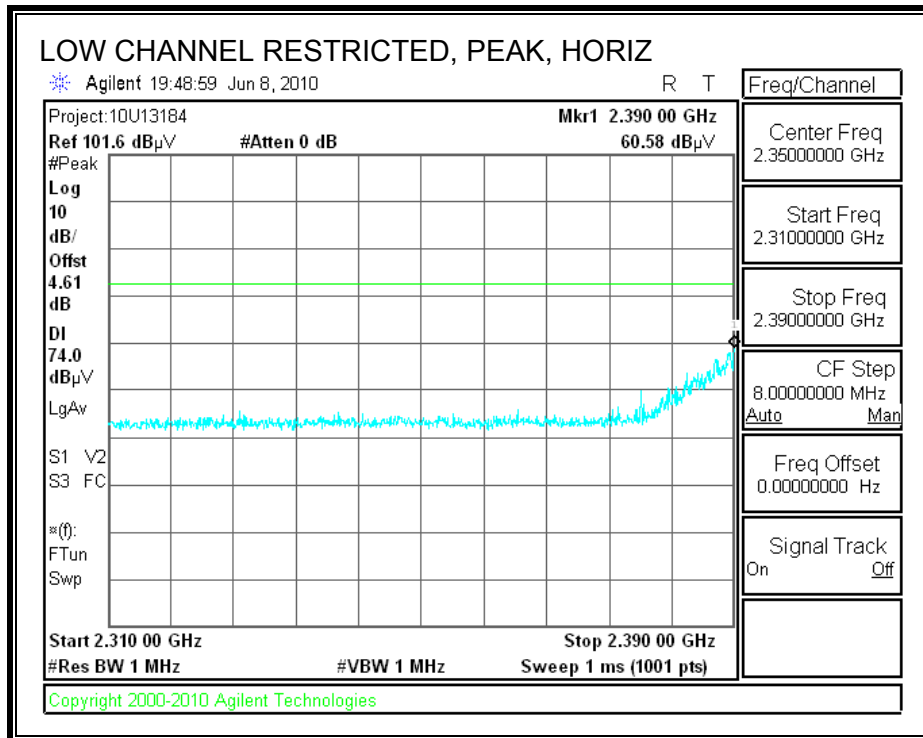
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filt dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Low Channel (2412 MHz)															
4.824	3.0	48.5	41.2	33.0	5.8	-36.5	0.0	0.0	50.9	43.6	74	54	-23.1	-10.4	H
4.824	3.0	52.6	46.8	33.0	5.8	-36.5	0.0	0.0	55.0	49.2	74	54	-19.0	-4.8	V
Mid Channel (2437 MHz)															
4.874	3.0	48.2	39.7	33.1	5.8	-36.5	0.0	0.0	50.6	42.2	74	54	-23.4	-11.8	H
7.311	3.0	43.2	37.3	35.3	7.3	-36.2	0.0	0.0	49.5	43.7	74	54	-24.5	-10.3	H
4.874	3.0	52.7	46.4	33.1	5.8	-36.5	0.0	0.0	55.1	48.9	74	54	-18.9	-5.1	V
7.311	3.0	47.5	42.7	35.3	7.3	-36.2	0.0	0.0	53.9	49.0	74	54	-20.1	-5.0	V
Hi Channel (2462 MHz)															
4.924	3.0	54.5	46.0	33.1	5.9	-36.5	0.0	0.0	57.0	48.6	74	54	-17.0	-5.4	H
7.310	3.0	42.8	36.4	35.3	7.3	-36.2	0.0	0.0	49.1	42.7	74	54	-24.9	-11.3	H
4.924	3.0	53.6	45.7	33.1	5.9	-36.5	0.0	0.0	56.2	48.3	74	54	-17.8	-5.7	V
7.310	3.0	48.3	43.9	35.3	7.3	-36.2	0.0	0.0	54.6	50.3	74	54	-19.4	-3.7	V

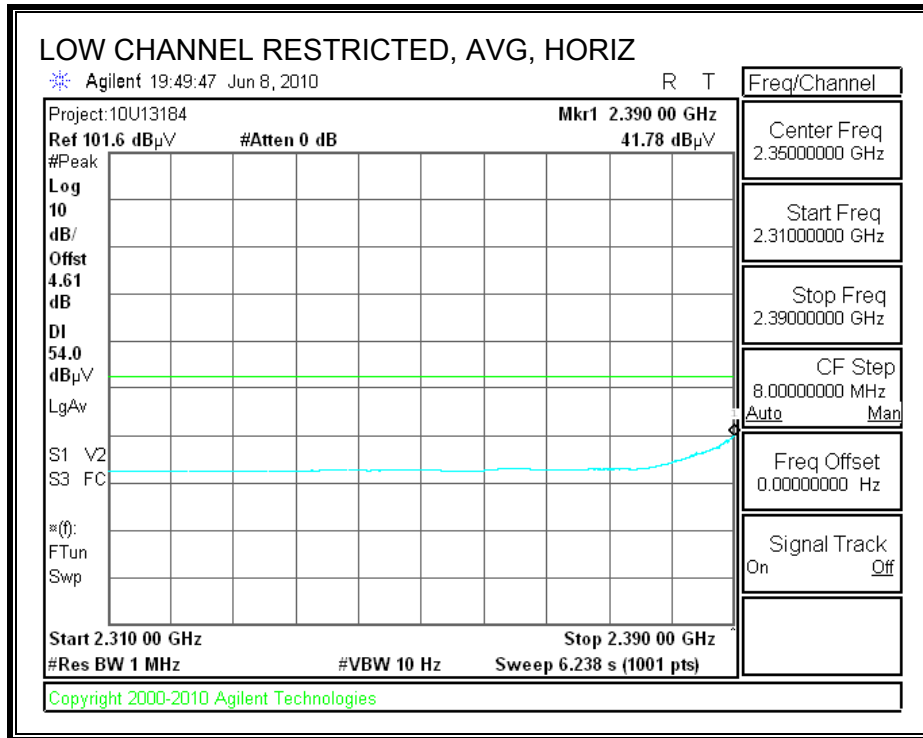
Note: No other emissions were detected above the noise floor.
 Rev. 07.22.09

f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

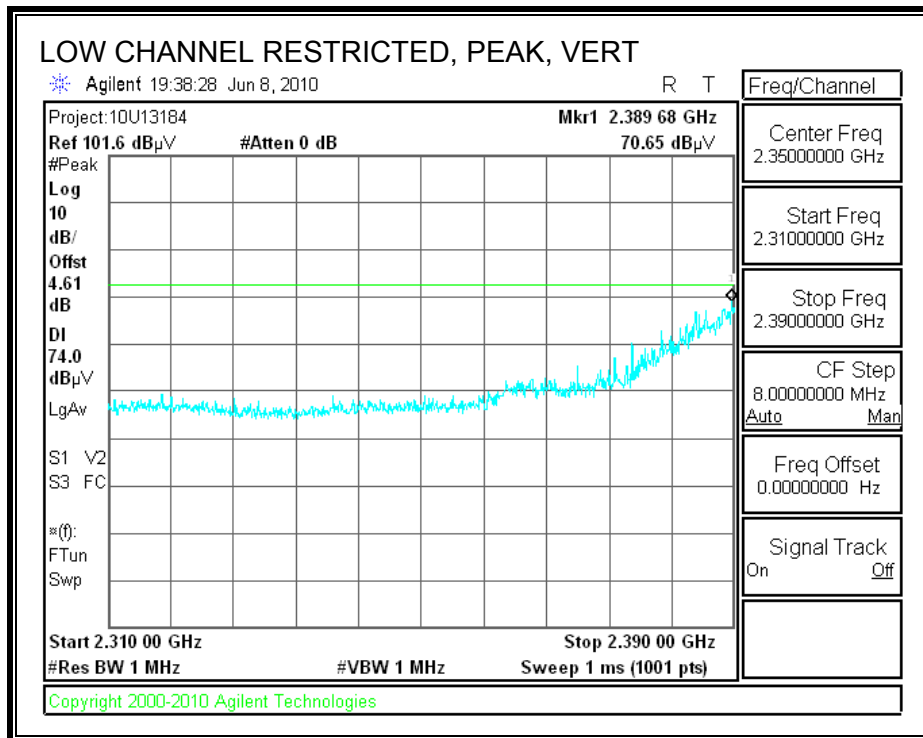
7.2.2. TRANSMITTER ABOVE 1 GHz FOR 802.11g MODE IN THE 2.4 GHz BAND

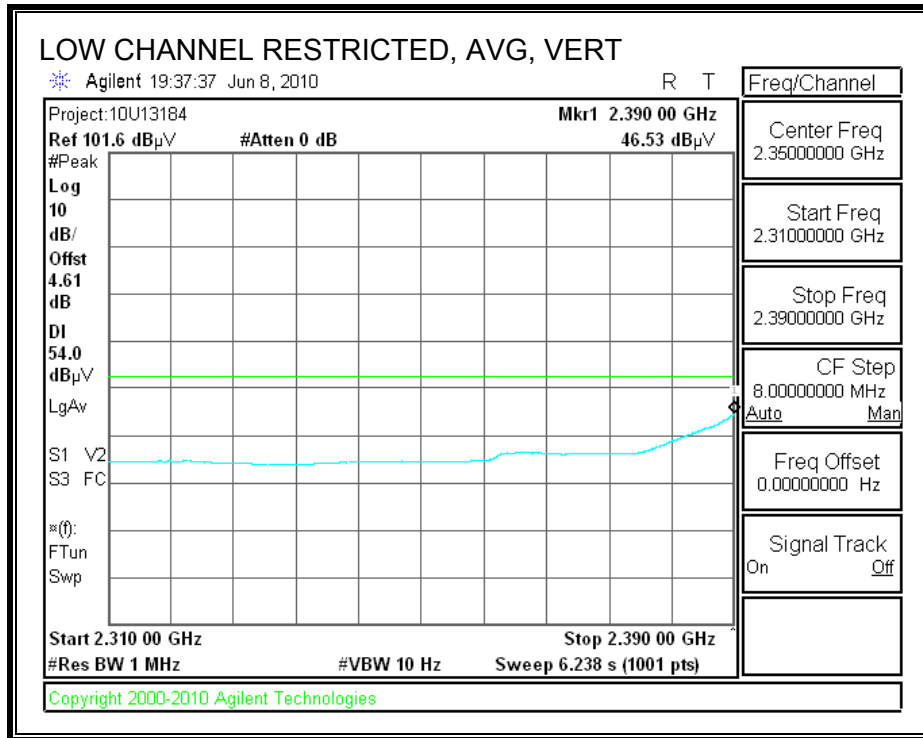
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



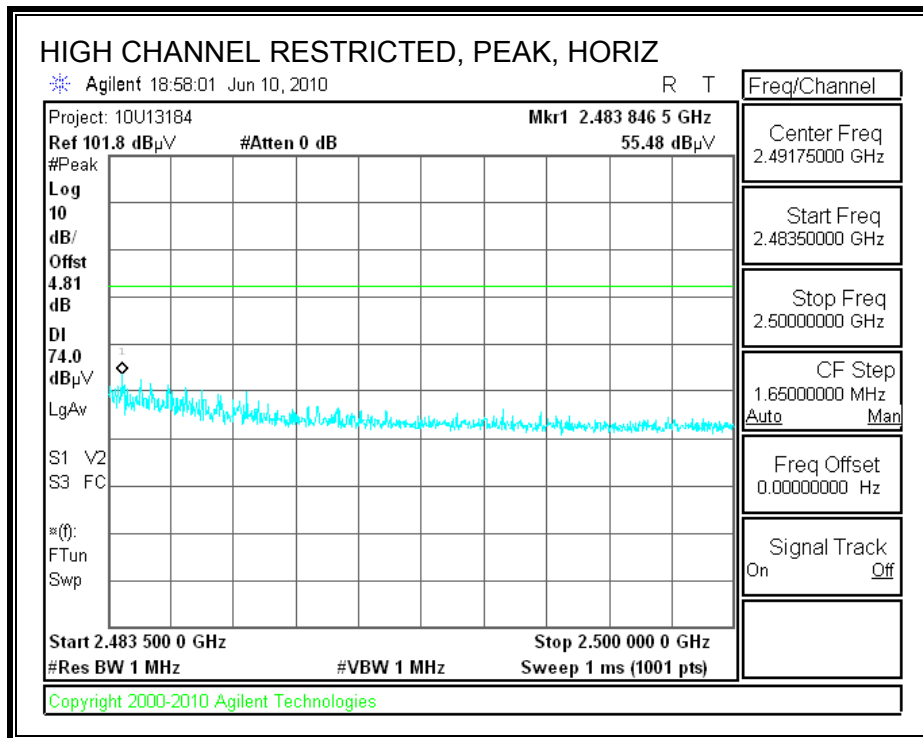


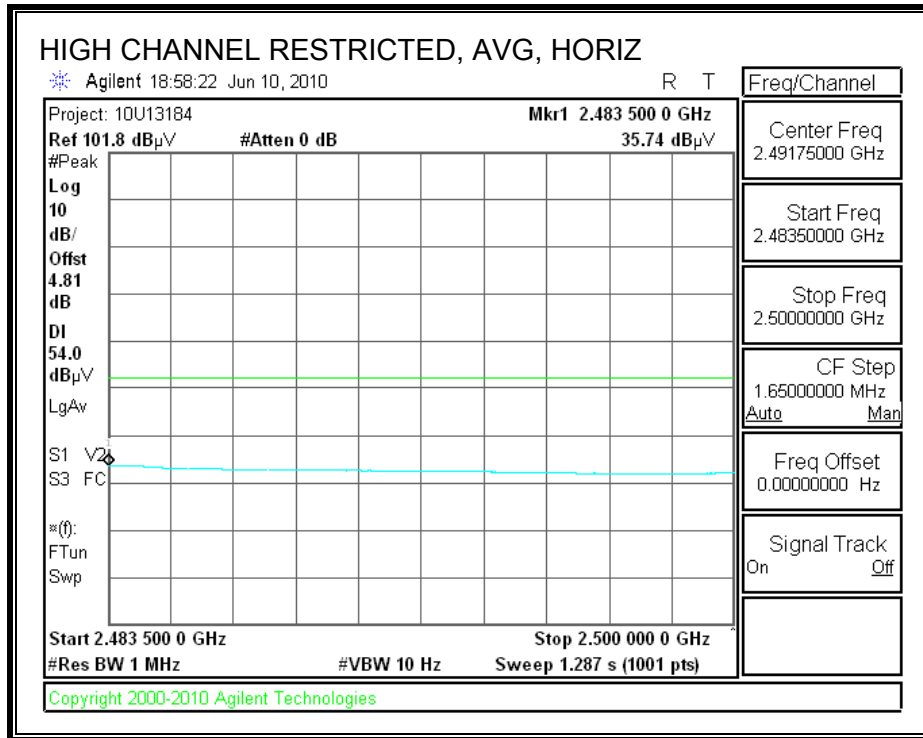
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



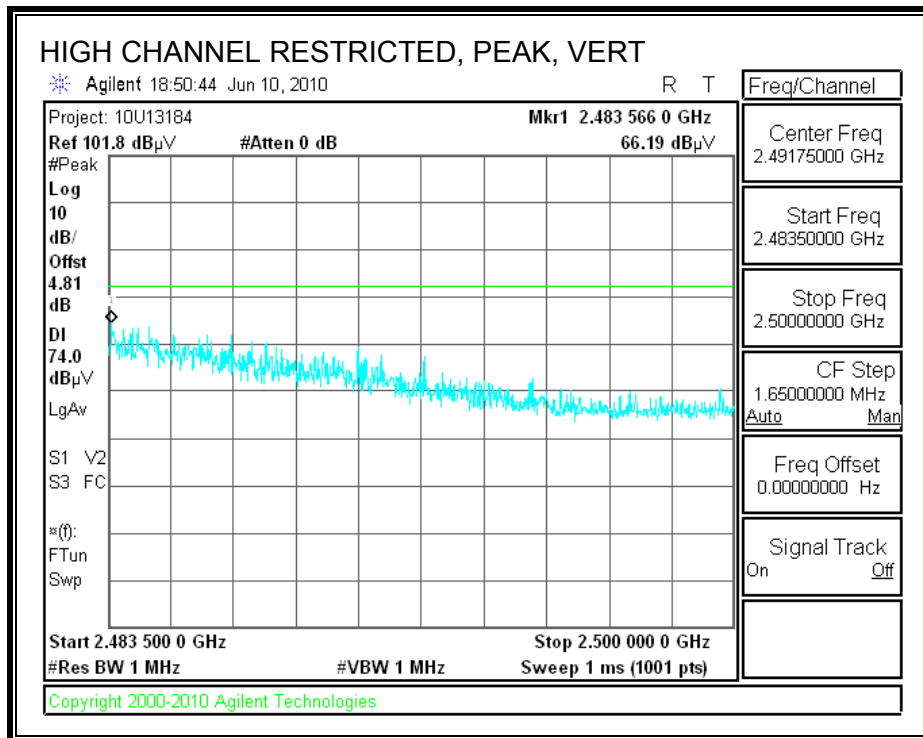


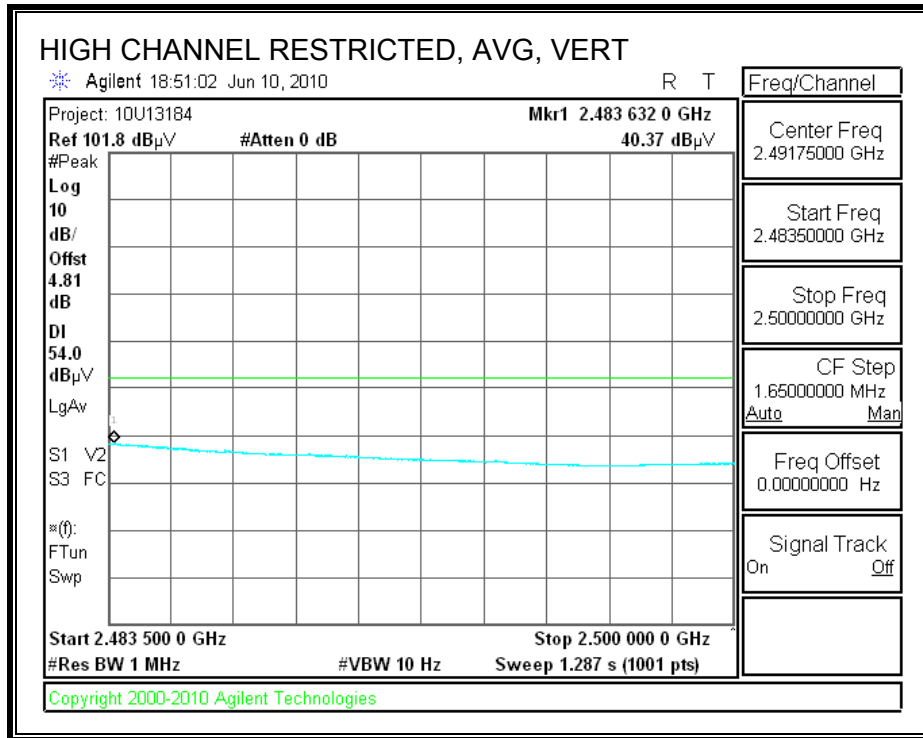
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
 Compliance Certification Services, Fremont 5m Chamber

Company: Trimble MRM
 Project #: 10U13184
 Date: 6/21/2010
 Test Engineer: Mengistu Mekuria
 Configuration: EUT Alone
 Mode: TX, g Mode

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T73; S/N: 6717 @3m	T144 Miteq 3008A00931			FCC 15.209

Hi Frequency Cables

3' cable 22807700	12' cable 22807600	20' cable 22807500	HPF	Reject Filter	Peak Measurements RBW=VBW=1MHz
3' cable 22807700	12' cable 22807600	20' cable 22807500		R_001	Average Measurements RBW=1MHz, VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Low Channel (2412 MHz)															
4.824	3.0	45.7	28.0	33.0	5.8	-36.5	0.0	0.0	48.1	30.3	74	54	-25.9	-23.7	H
4.824	3.0	48.6	30.6	33.0	5.8	-36.5	0.0	0.0	51.0	33.0	74	54	-23.0	-21.0	V
Mid Channel (2437 MHz)															
4.874	3.0	48.5	30.6	33.1	5.8	-36.5	0.0	0.0	51.0	33.1	74	54	-23.0	-20.9	H
7.311	3.0	49.6	35.0	35.3	7.3	-36.2	0.0	0.0	56.0	41.3	74	54	-18.0	-12.7	H
4.874	3.0	49.1	32.5	33.1	5.8	-36.5	0.0	0.0	51.5	35.0	74	54	-22.5	-19.0	V
7.311	3.0	57.5	43.8	35.3	7.3	-36.2	0.0	0.0	63.8	50.1	74	54	-10.2	-3.9	V
Hi Channel (2462 MHz)															
4.924	3.0	48.4	30.1	33.1	5.9	-36.5	0.0	0.0	50.9	32.7	74	54	-23.1	-21.3	H
7.310	3.0	46.9	32.4	35.3	7.3	-36.2	0.0	0.0	53.2	38.7	74	54	-20.8	-15.3	H
4.924	3.0	48.7	31.9	33.1	5.9	-36.5	0.0	0.0	51.3	34.4	74	54	-22.7	-19.6	V
7.310	3.0	56.3	41.1	35.3	7.3	-36.2	0.0	0.0	62.6	47.4	74	54	-11.4	-6.6	V

Note: No other emissions were detected above the noise floor.
 Rev. 07.22.09

f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

7.3. RECEIVER ABOVE 1 GHz

High Frequency Measurement
 Compliance Certification Services, Fremont 5m Chamber

Company: Trimble MRM
 Project #: 10U13184
 Date: 06/22/10
 Test Engineer: Mengistu Mekuria
 Configuration: EUT with 12VDC (Battery)
 Mode: Normal

Test Equipment:

Horn 1-18GHz T73; S/N: 6717 @3m	Pre-amplifer 1-26GHz T144 Miteq 3008A00931	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit FCC Class B
------------------------------------	---	-----------------------	--------------	----------------------

Hi Frequency Cables

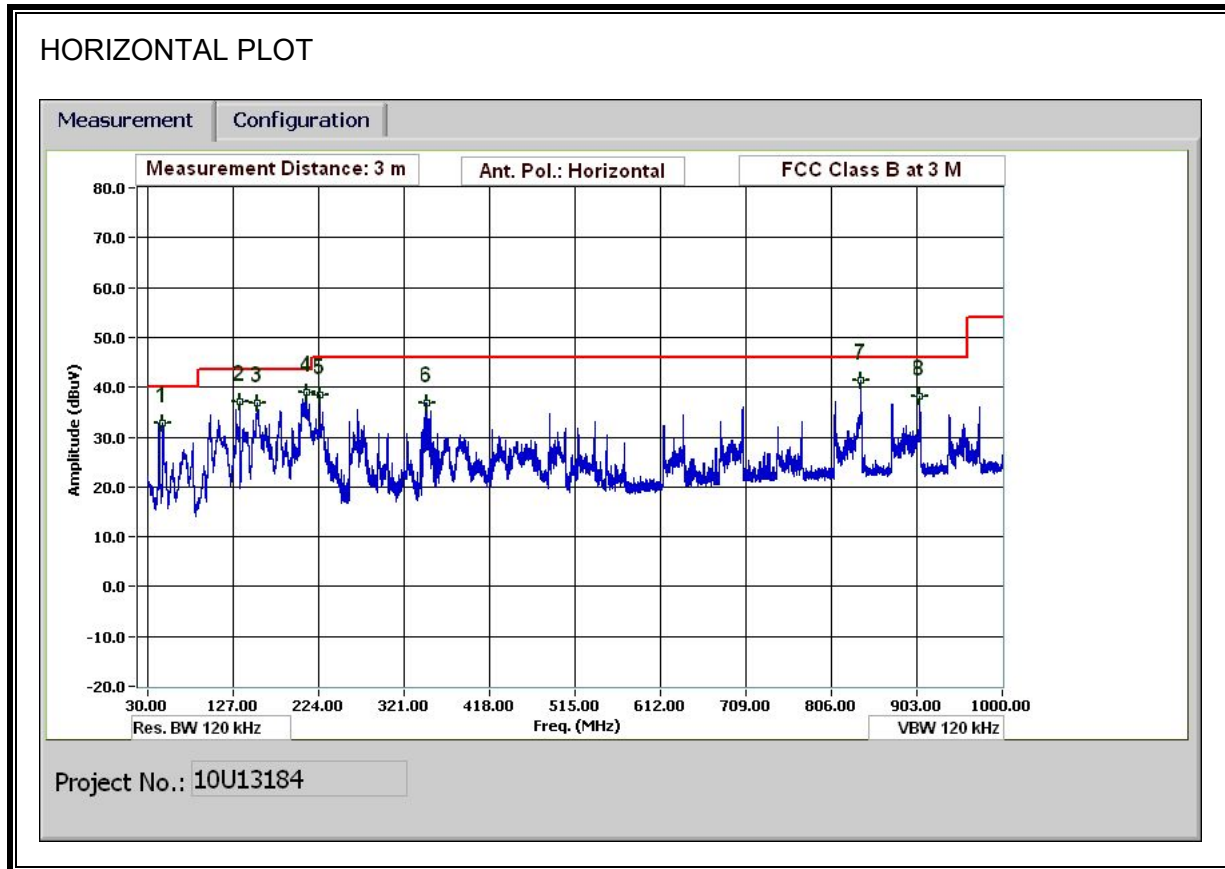
3' cable 22807700 3' cable 22807700	12' cable 22807600 12' cable 22807600	20' cable 22807500 20' cable 22807500	HPF	Reject Filter	Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz; VBW=10Hz
--	--	--	-----	---------------	---

f GHz	Dist (m)	Read Pk dBuV	Read Avg dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filt dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Horizontal															
1.041	3.0	60.7	38.4	24.0	2.4	-39.4	0.0	0.0	47.7	25.3	74	54	-26.3	-28.7	H
1.069	3.0	61.8	38.6	24.1	2.4	-39.4	0.0	0.0	49.0	25.8	74	54	-25.0	-28.2	H
1.529	3.0	55.4	40.2	25.6	3.0	-38.7	0.0	0.0	45.2	30.1	74	54	-28.8	-23.9	H
1.660	3.0	57.2	41.9	26.1	3.1	-38.5	0.0	0.0	47.9	32.5	74	54	-26.1	-21.5	H
1.791	3.0	56.3	40.4	26.5	3.2	-38.4	0.0	0.0	47.7	31.7	74	54	-26.3	-22.3	H
1.995	3.0	52.3	35.5	27.2	3.5	-38.1	0.0	0.0	44.9	28.1	74	54	-29.1	-25.9	H
3.215	3.0	48.3	42.7	30.5	4.5	-37.2	0.0	0.0	46.1	40.5	74	54	-27.9	-13.5	H
Vertical															
1.030	3.0	62.0	38.6	24.0	2.4	-39.4	0.0	0.0	48.9	25.5	74	54	-25.1	-28.5	V
1.263	3.0	60.0	45.1	24.7	2.7	-39.1	0.0	0.0	48.3	33.4	74	54	-25.7	-20.6	V
1.492	3.0	56.2	41.6	25.5	2.9	-38.8	0.0	0.0	45.8	31.3	74	54	-28.2	-22.7	V
1.591	3.0	55.4	39.3	25.8	3.0	-38.6	0.0	0.0	45.6	29.5	74	54	-28.4	-24.5	V
1.659	3.0	54.5	39.6	26.1	3.1	-38.5	0.0	0.0	45.1	30.2	74	54	-28.9	-23.8	V
1.794	3.0	55.2	38.3	26.5	3.2	-38.4	0.0	0.0	46.6	29.7	74	54	-27.4	-24.3	V
1.857	3.0	54.6	39.3	26.7	3.3	-38.3	0.0	0.0	46.4	31.1	74	54	-27.6	-22.9	V
1.992	3.0	52.8	36.2	27.2	3.5	-38.1	0.0	0.0	45.3	28.7	74	54	-28.7	-25.3	V

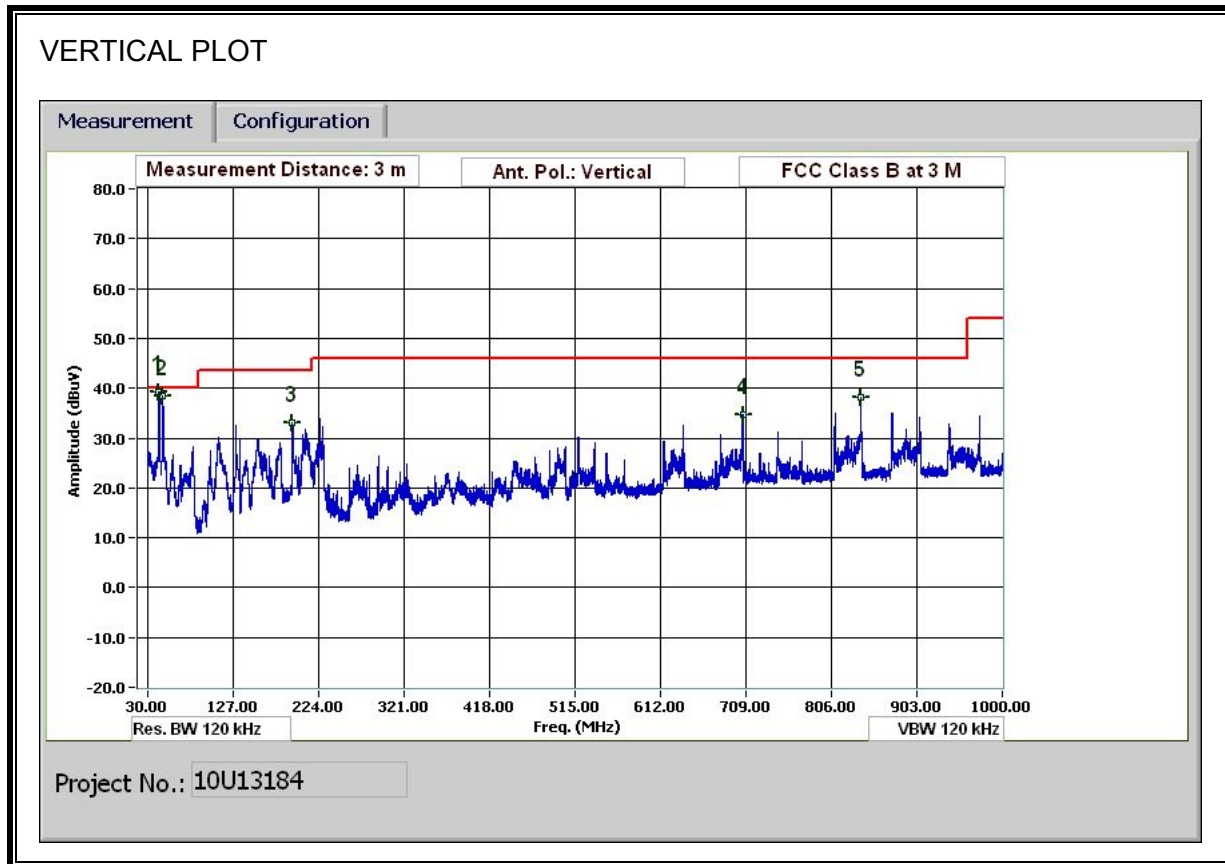
f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

7.4. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (DIGITAL DEVICE, HORIZONTAL)



SPURIOUS EMISSIONS 30 TO 1000 MHz (DIGITAL DEVICE, VERTICAL)



HORIZONTAL & VERTICAL DATA

30-1000MHz Frequency Measurement

Compliance Certification Services, Fremont 5m Chamber

Test Engr: Mengsitu Mekuria
 Date: 06/21/09
 Project #: 10U13184
 Company: Trimble MRM
 EUT Description: TELEMATICS PLATFORMS
 EUT M/N: TVG-850 EVDO
 Test Target: FCC Class B
 Mode Oper: Tx Worst-Case

f Measurement Frequency Amp Preamp Gain Margin Margin vs. Limit
 Dist Distance to Antenna D Corr Distance Correct to 3 meters
 Read Analyzer Reading Filter Filter Insert Loss
 AF Antenna Factor Corr. Calculated Field Strength
 CL Cable Loss Limit Field Strength Limit

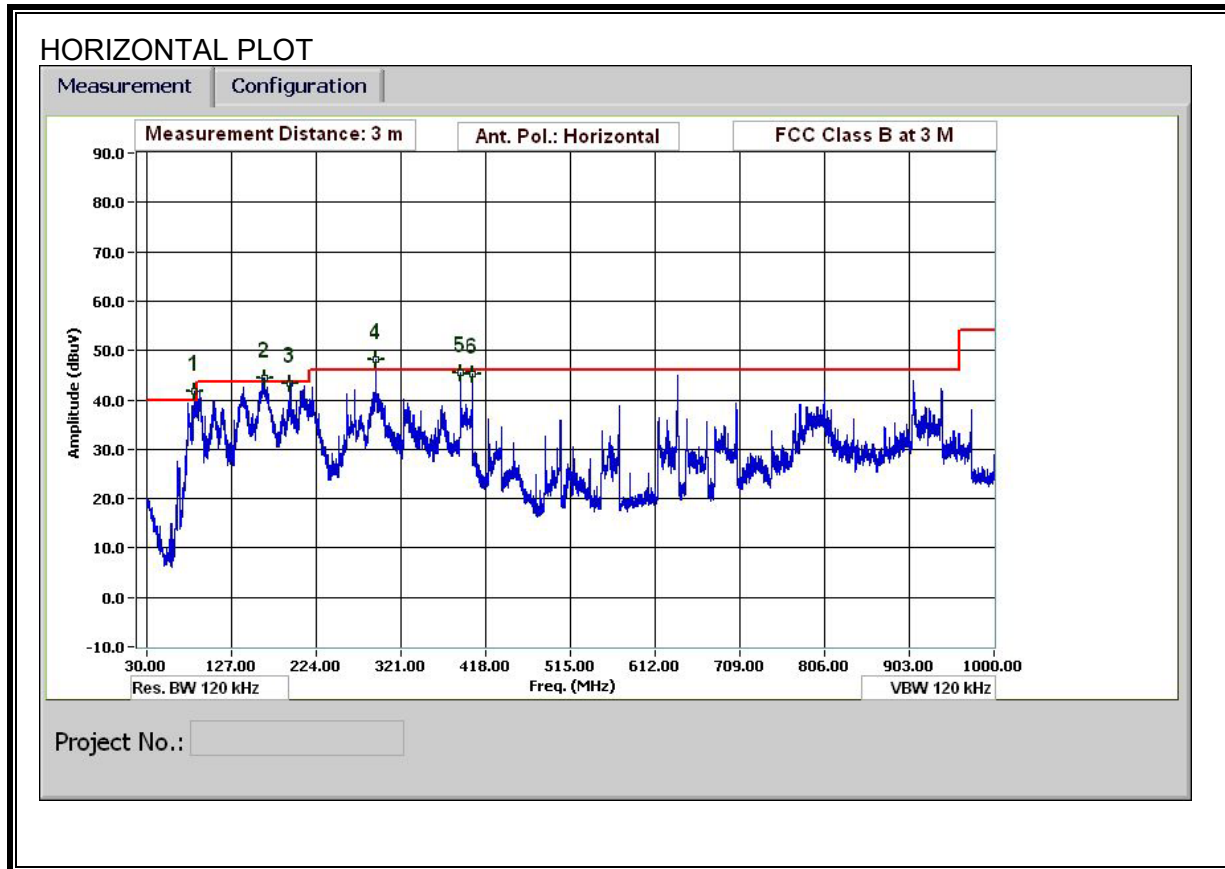
f MHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filter dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
47.401	3.0	50.9	9.6	0.6	28.4	0.0	0.0	32.8	40.0	-7.2	H	P	
134.284	3.0	51.0	13.4	1.1	28.3	0.0	0.0	37.2	43.5	-6.3	H	P	
154.085	3.0	51.6	12.2	1.1	28.3	0.0	0.0	36.7	43.5	-6.8	H	P	
206.698	3.0	54.1	12.0	1.3	28.2	0.0	0.0	39.1	43.5	-4.4	H	P	
206.698	3.0	49.5	12.0	1.3	28.2	0.0	0.0	34.6	43.5	-8.9	H	QP	
225.008	3.0	53.4	11.9	1.3	28.2	0.0	0.0	38.4	46.0	-7.6	H	P	
346.573	3.0	49.3	14.1	1.7	28.1	0.0	0.0	36.9	46.0	-9.1	H	P	
839.431	3.0	44.9	21.3	2.7	27.6	0.0	0.0	41.3	46.0	-4.7	H	P	
839.431	3.0	42.3	21.3	2.7	27.6	0.0	0.0	38.7	46.0	-7.3	H	QP	
906.636	3.0	41.3	21.9	2.8	27.8	0.0	0.0	38.2	46.0	-7.8	H	P	
43.086	3.0	55.0	12.1	0.6	28.4	0.0	0.0	39.3	40.0	-0.7	V	P	
43.086	3.0	52.9	12.0	0.6	28.4	0.0	0.0	37.1	40.0	-2.9	V	QP	
47.142	3.0	56.4	9.7	0.6	28.4	0.0	0.0	38.4	40.0	-1.6	V	P	
47.142	3.0	54.8	9.8	0.6	28.4	0.0	0.0	36.8	40.0	-3.2	V	QP	
194.407	3.0	48.4	11.6	1.2	28.2	0.0	0.0	33.0	43.5	-10.5	V	P	
705.268	3.0	39.7	19.7	2.5	27.2	0.0	0.0	34.6	46.0	-11.4	V	P	
839.433	3.0	41.6	21.3	2.7	27.6	0.0	0.0	38.1	46.0	-7.9	V	P	

Rev. 1.27.09

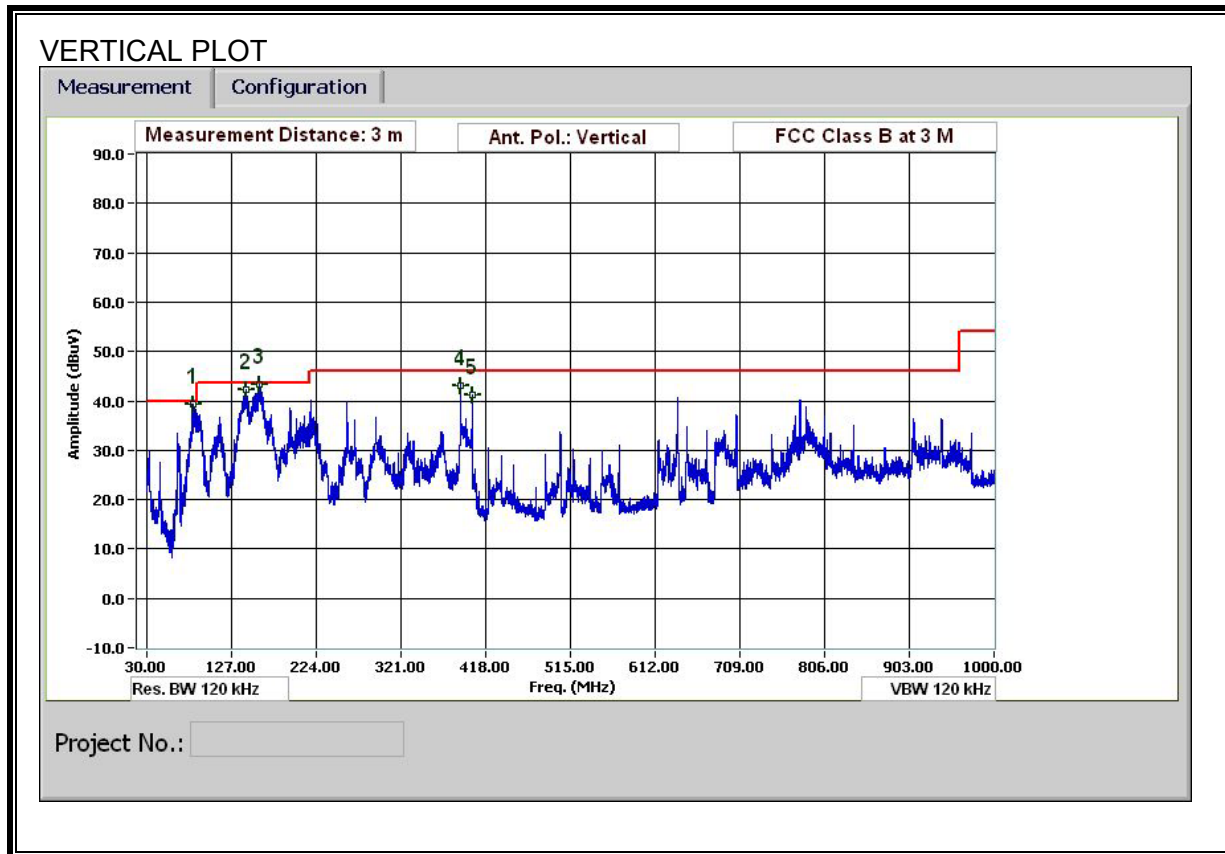
Note: No other emissions were detected above the system noise floor.

7.5. DIGITAL DEVICE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (DIGITAL DEVICE, HORIZONTAL)



SPURIOUS EMISSIONS 30 TO 1000 MHz (DIGITAL DEVICE, VERTICAL)



HORIZONTAL & VERTICAL DATA

30-1000MHz Frequency Measurement
 Compliance Certification Services, Fremont 5m Chamber

Test Engr: Vien Tran
 Date: 04/23/10
 Project #: 10U13184
 Company: Trible MRM
 EUT Description: Telematics Platform
 EUT M/N: TVG-850
 Test Target: Digital Part 15B
 Mode Oper: Normal

f Measurement Frequency Amp Preamp Gain Margin Margin vs. Limit
 Dist Distance to Antenna D Corr Distance Correct to 3 meters
 Read Analyzer Reading Filter Filter Insert Loss
 AF Antenna Factor Corr. Calculated Field Strength
 CL Cable Loss Limit Field Strength Limit

f MHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filter dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
WITH POWER CONNECTED DIRECT TO EUT, GROUND PLANE CONNECTED TO BATTERY GROUND, RE-ARRANGE CABLES													
Horizontal													
84.962	3.0	62.8	7.5	0.8	29.6	0.0	0.0	41.6	40.0	1.6	H	P	
84.962	3.0	58.5	7.5	0.8	29.6	0.0	0.0	38.3	40.0	-1.7	H	QP	
164.166	3.0	62.0	10.5	1.2	29.3	0.0	0.0	44.4	43.5	0.9	H	P	
164.166	3.0	59.6	10.5	1.2	29.3	0.0	0.0	42.0	43.5	-1.5	H	QP	
194.407	3.0	59.4	11.6	1.2	29.0	0.0	0.0	43.2	43.5	-0.3	H	P	
291.731	3.0	62.2	13.0	1.6	28.8	0.0	0.0	48.0	46.0	2.0	H	P	
291.731	3.0	59.6	13.0	1.6	28.8	0.0	0.0	45.4	46.0	-0.6	H	QP	
389.055	3.0	57.9	14.8	1.9	29.2	0.0	0.0	45.4	46.0	-0.6	H	P	
402.855	3.0	57.5	15.1	1.9	29.3	0.0	0.0	45.2	46.0	-0.8	H	P	
Vertical													
82.322	3.0	60.7	7.6	0.8	29.6	0.0	0.0	39.5	40.0	-0.5	V	P	
82.322	3.0	56.4	7.6	0.8	29.6	0.0	0.0	35.2	40.0	-4.8	V	QP	
144.125	3.0	57.6	13.0	1.1	29.3	0.0	0.0	42.3	43.5	-1.2	V	P	
159.005	3.0	60.4	11.0	1.1	29.3	0.0	0.0	43.2	43.5	-0.3	V	P	
159.005	3.0	58.5	11.0	1.1	29.3	0.0	0.0	41.3	43.5	-2.2	V	QP	
388.935	3.0	55.7	14.8	1.9	29.2	0.0	0.0	43.2	46.0	-2.8	V	P	
402.855	3.0	53.5	15.1	1.9	29.3	0.0	0.0	41.2	46.0	-4.8	V	P	

Rev. 1.27.09

Note: No other emissions were detected above the system noise floor.

8. REQUIREMENTS - LIMITATION OF EXPOSURE

8.1. LIMITS

FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500	f/1500	30
1500–100,000	1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

IC RULES

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

**Table 5
 Exposure Limits for Persons Not Classed As RF and Microwave Exposed Workers (Including the General Public)**

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m ²)	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	280/ <i>f</i>	2.19/ <i>f</i>		6
10–30	28	2.19/ <i>f</i>		6
30–300	28	0.073	2*	6
300–1 500	1.585 <i>f</i> ^{0.5}	0.0042 <i>f</i> ^{0.5}	<i>f</i> /150	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	616 000 / <i>f</i> ^{1.2}
150 000–300 000	0.158 <i>f</i> ^{0.5}	4.21 x 10 ⁻⁴ <i>f</i> ^{0.5}	6.67 x 10 ⁻⁵ <i>f</i>	616 000 / <i>f</i> ^{1.2}

* Power density limit is applicable at frequencies greater than 100 MHz.

- Notes:**
1. Frequency, *f*, is in MHz.
 2. A power density of 10 W/m² is equivalent to 1 mW/cm².
 3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

LIMITS APPLICABLE TO THE EUT

For mobile radio equipment operating in the cellular phone band, the lowest power density limit is calculated using the lowest frequency, as 824 MHz / 1500 = 0.55 mW/cm² (FCC) and 824 MHz / 150 = 5.5 W/m² (IC).

For operation in the PCS band and the 2.4 GHz band, from FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm² and from IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m².

8.2. EQUATIONS

Power density is given by:

$$S = \text{EIRP} / (4 * \text{Pi} * \text{D}^2)$$

where

S = Power density in W/m²

EIRP = Equivalent Isotropic Radiated Power in W

D = Separation distance in m

Where applicable (for example, multi-slot cell phone applications) a duty cycle factor may be applied.

$$\text{Source-based time-averaged EIRP} = (\text{DC} / 100) * \text{EIRP}$$

where

DC = Duty Cycle in %, as applicable

EIRP = Equivalent Isotropic Radiated Power in W

For multiple colocated transmitters operating simultaneously in frequency bands where the limit is identical, the total power density is calculated using the total EIRP obtained by summing the Power * Gain product (in linear units) of each transmitter.

$$\text{Total EIRP} = (\text{P1} * \text{G1}) + (\text{P2} * \text{G2}) + \dots + (\text{Pn} * \text{Gn})$$

where

Px = Power of transmitter x

Gx = Numeric gain of antenna x

For multiple colocated transmitters operating simultaneously in frequency bands where different limits apply, either the lowest limit applicable to the co-located transmitters can be applied or a fraction of the exposure limit is established for each band, such that the sum of the fractions is less than or equal to one.

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

8.3. RESULTS

8.3.1. CO-LOCATED RESULTS FOR SIMULTANEOUS OPERATION IN THE CELLULAR BAND AND 2.4 GHz BAND

Band	Mode	Separation Distance (m)	Output Power (dBm)	Antenna Gain With Cable Loss (dBi)	Duty Cycle (%)	IC Power Density (W/m ²)
850 MHz	Cell		29.82	-0.25	100	
2.4 GHz	WLAN		16.45	1.70	100	
Combined		0.20				1.93

The co-located Power Density is less than 5.5 W/m², which is the most stringent of the limits for each separate transmitter (5.5 W/m² and 10 W/m² for the WAN and WLAN respectively).

8.3.2. CO-LOCATED RESULTS FOR SIMULTANEOUS OPERATION IN THE PCS BAND AND 2.4 GHz BAND

Band	Mode	Separation Distance (m)	Output Power (dBm)	Antenna Gain With Cable Loss (dBi)	Duty Cycle (%)	IC Power Density (W/m ²)
1900 MHz	PCS		29.10	1.70	100	
2.4 GHz	WLAN		16.45	1.70	100	
Combined		0.20				2.52

The co-located Power Density is less than 10 W/m², which is the limit for each separate transmitter.