



**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 ID: 1756A-TVG850EVDO**

**REPORT NUMBER: 10U13184-3**

**ISSUE DATE: JUNE 18, 2010**

*Prepared for*  
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888 TASMAN ROAD  
MILPITAS, CA 95035, U.S.A.**

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**NVLAP LAB CODE 200065-0**

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Revision History

Rev.	Issue Date	Revisions	Revised By
---	06/18/10	Initial Issue	T. Chan

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## 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

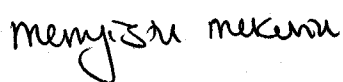
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 7 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 2	Pass

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 firmware installed in the EUT during testing was ITSE-0056-02, rev. 01

The EUT driver software installed during testing was Ver. 6.0.

The test utility software used during testing was CSR Blue Suite / Blue Test Tool, provided by Bluetooth Module supplier (CSR), Ver. 1.22.

## 5.4. 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

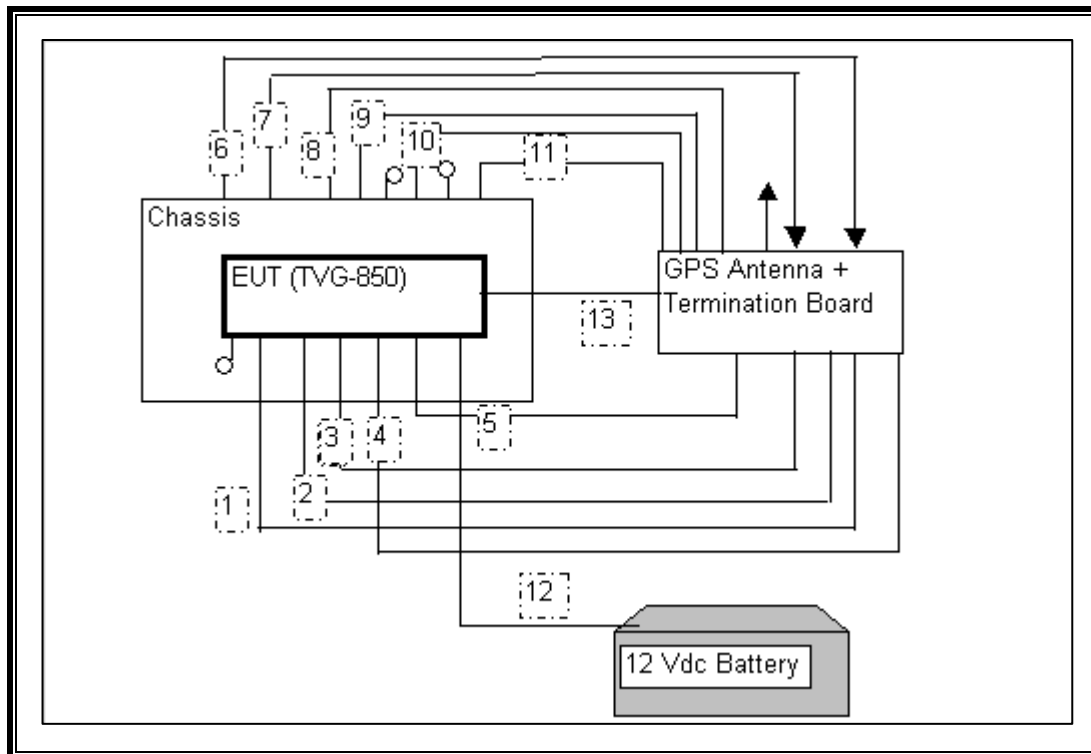
### I/O CABLES

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

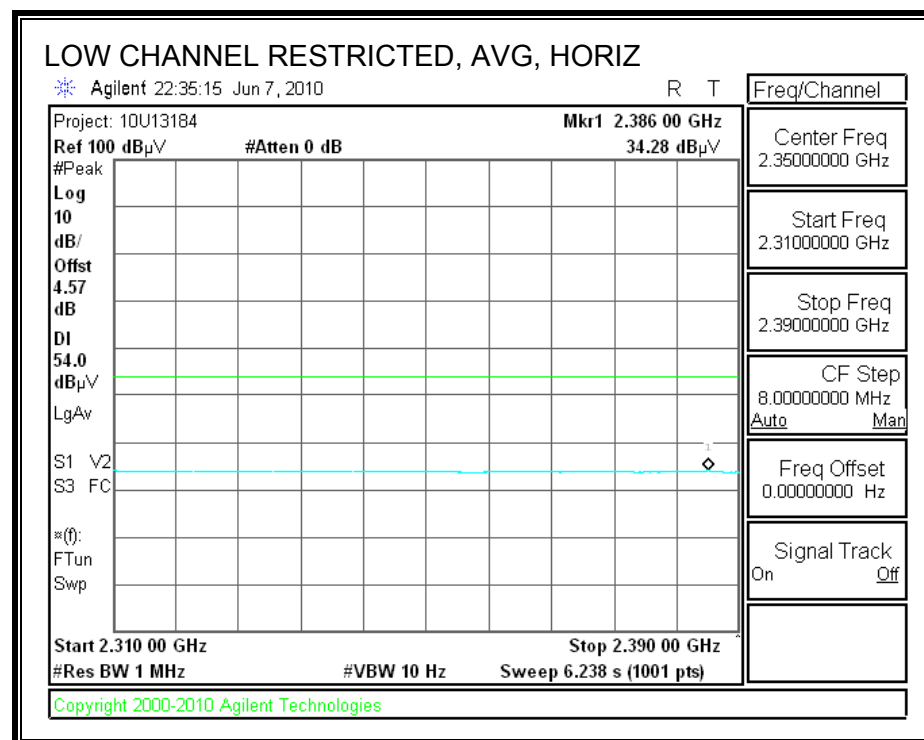
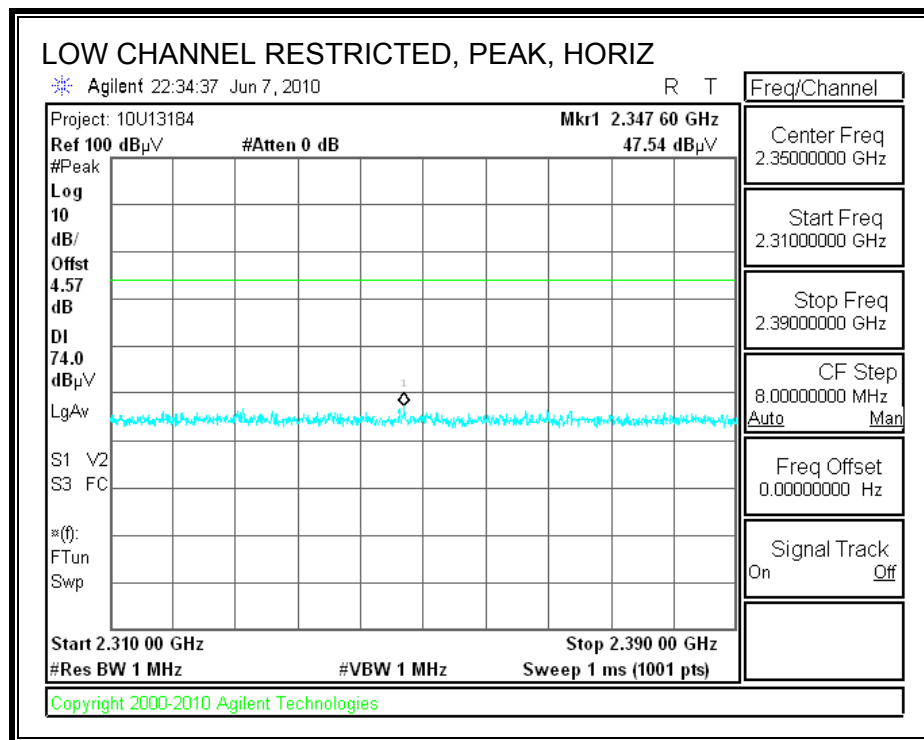
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

The 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.

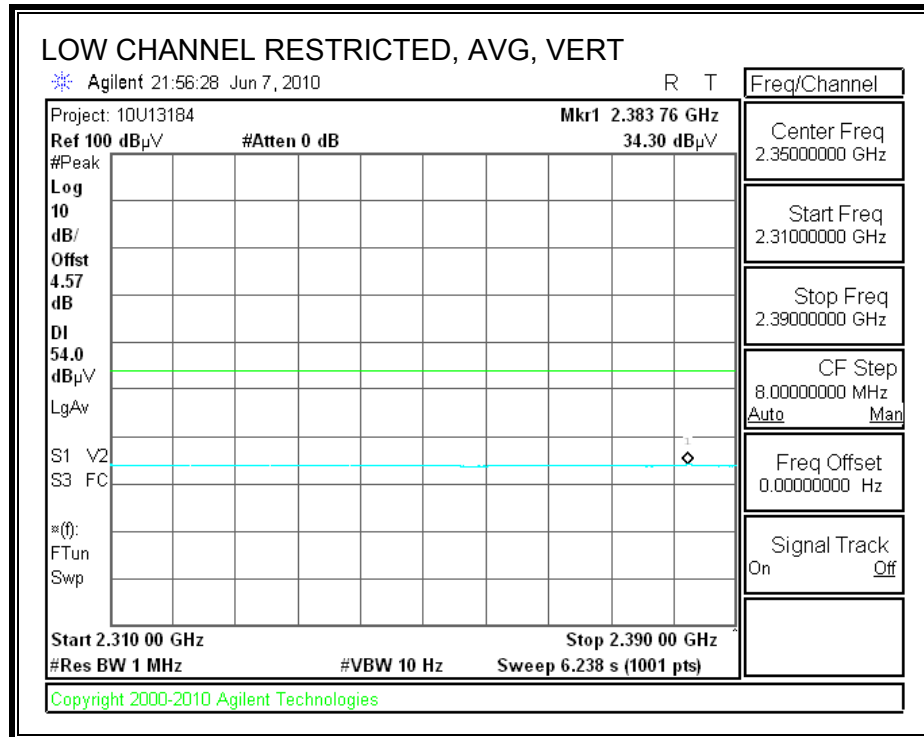
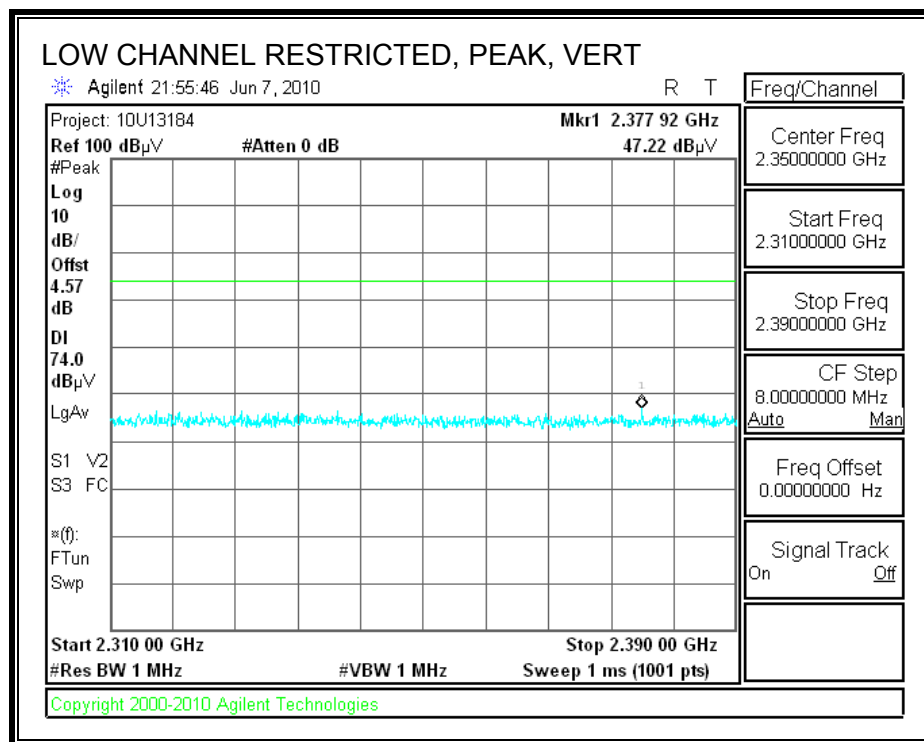
## 7.2. TRANSMITTER ABOVE 1 GHz

### 7.2.1. BASIC DATA RATE GFSK MODULATION

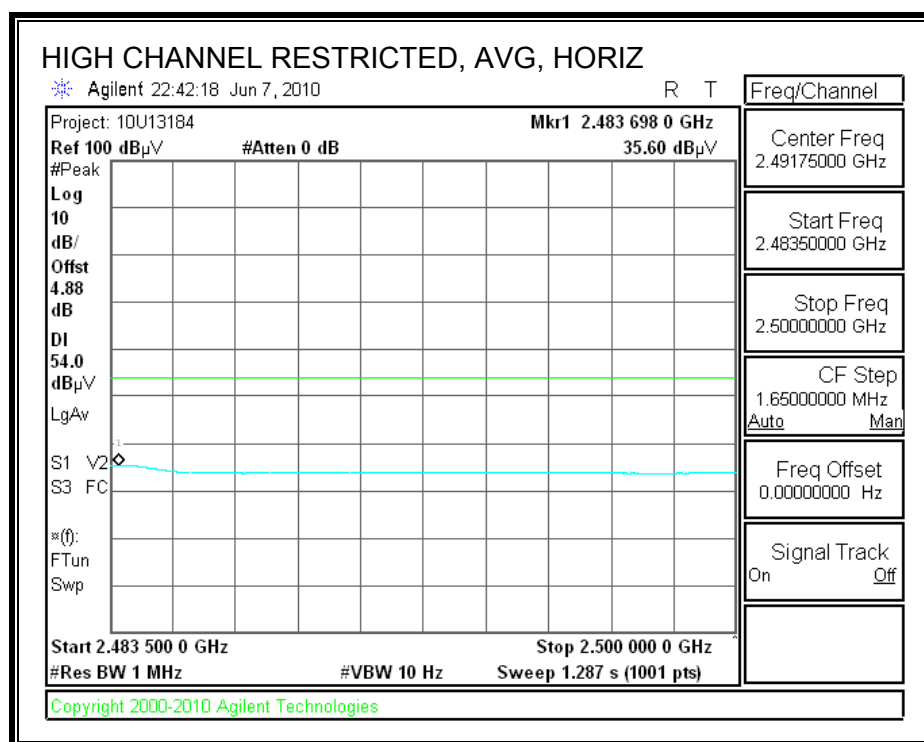
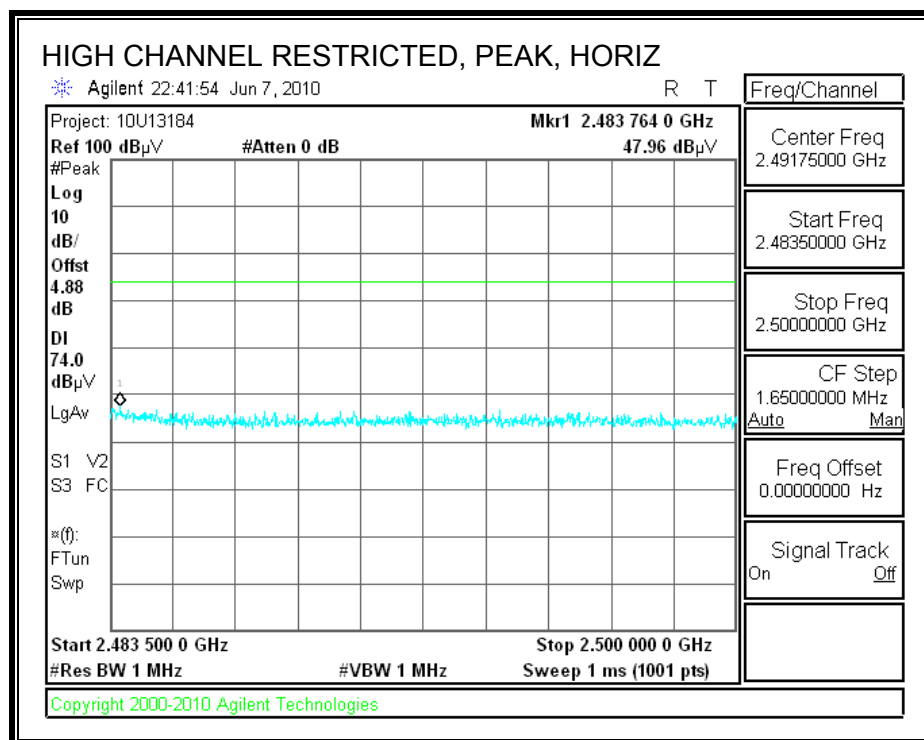
#### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



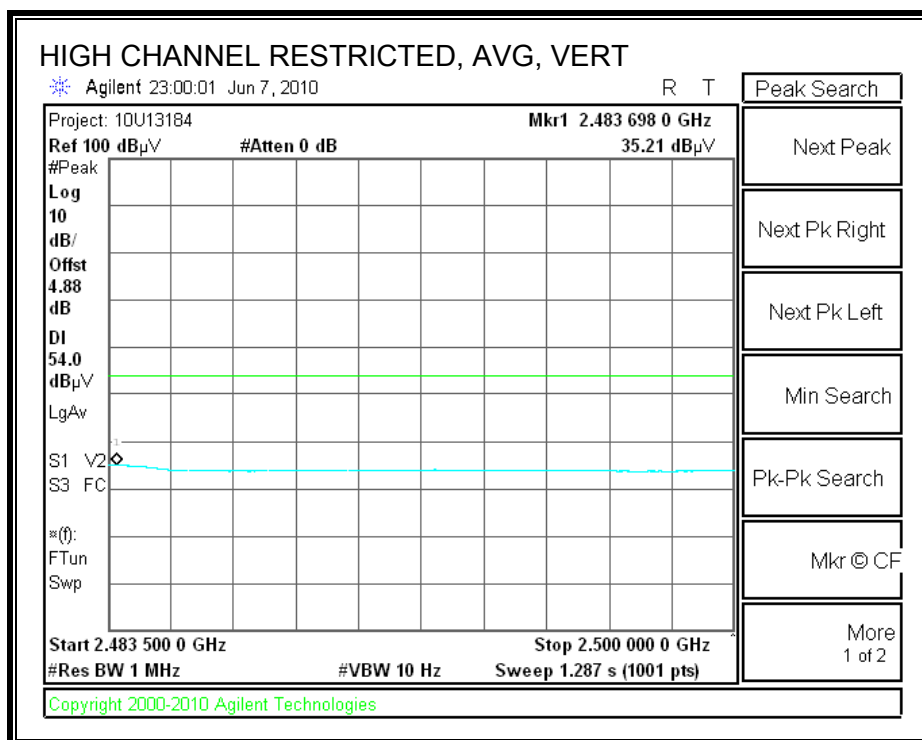
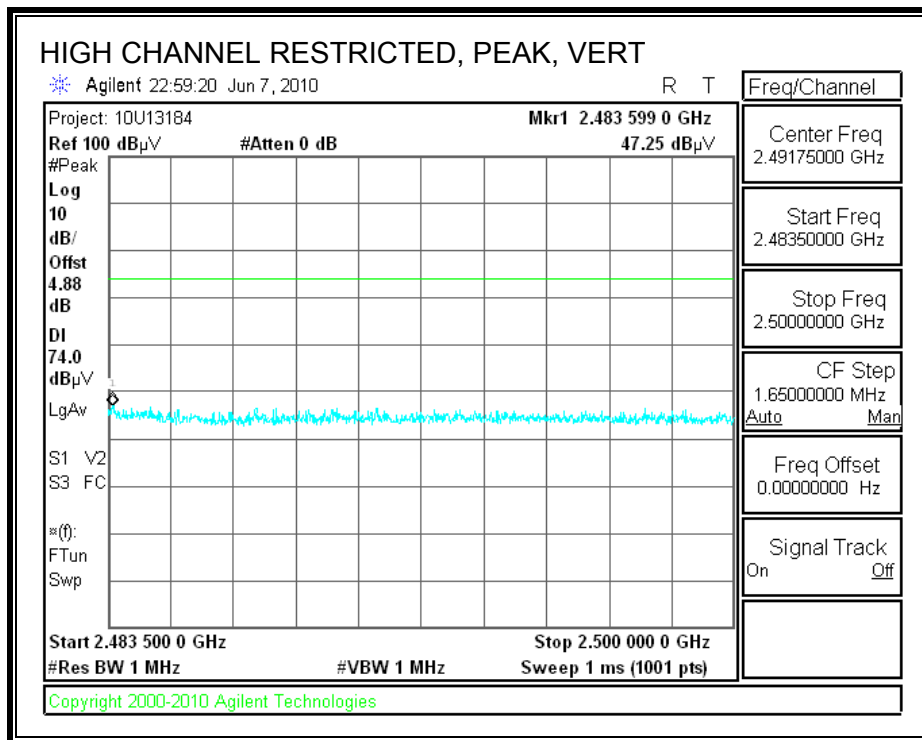
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



**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: 6/7/2010  
Test Engineer: MENGISTU MEKURIA  
Configuration: EUT and Support Equipments  
Mode: Tx, GFSK Mode

**Test Equipment:**

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

☐ Hi Frequency Cables

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

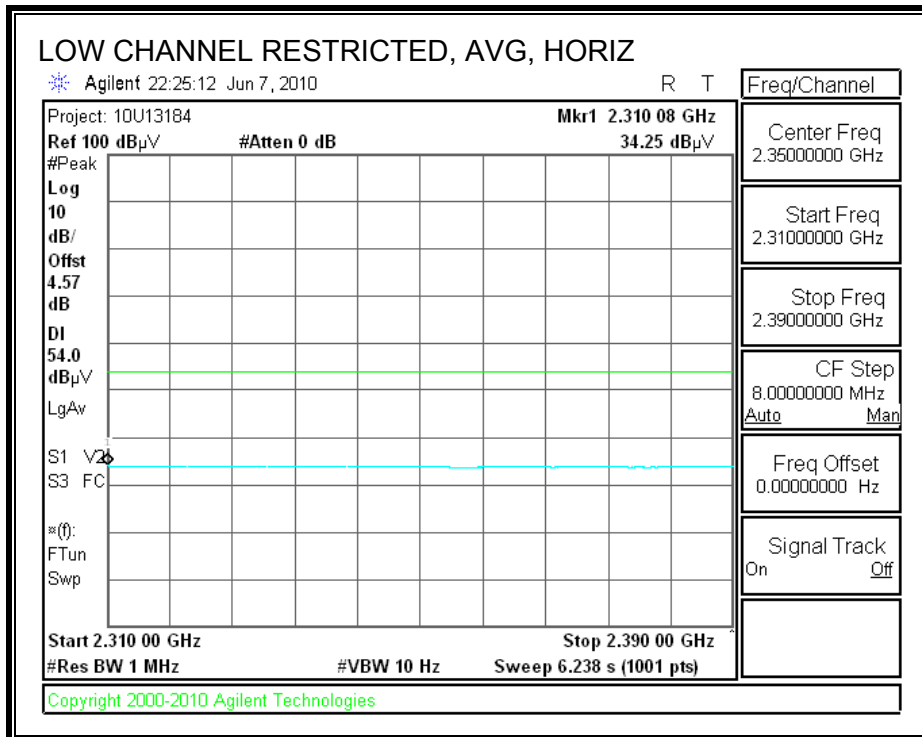
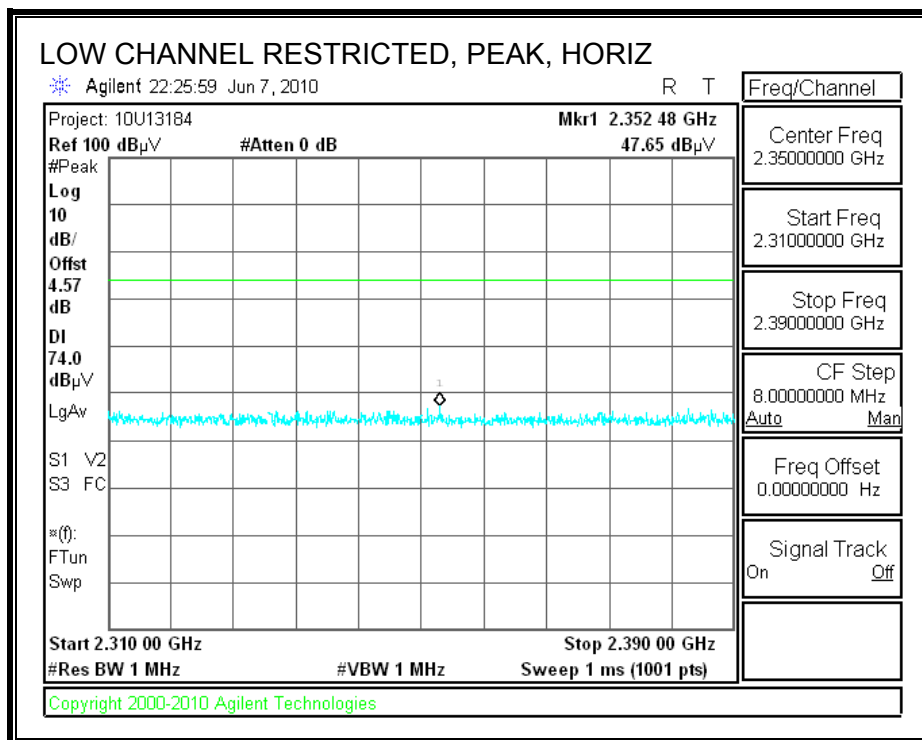
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filt dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
<b>Low Channel (2402 MHz)</b>															
4.804	3.0	41.8	30.0	33.0	5.8	-36.5	0.0	0.0	44.1	32.4	74	54	-29.9	-21.6	V
4.804	3.0	41.3	29.6	33.0	5.8	-36.5	0.0	0.0	43.6	31.9	74	54	-30.4	-22.1	H
<b>Mid Channel (2441 MHz)</b>															
4.882	3.0	43.4	33.8	33.1	5.8	-36.5	0.0	0.0	45.9	36.3	74	54	-28.1	-17.7	V
4.882	3.0	43.4	33.3	33.1	5.8	-36.5	0.0	0.0	45.8	35.7	74	54	-28.2	-18.3	H
<b>Hi Channel (2480 MHz)</b>															
4.960	3.0	45.4	37.1	33.2	5.9	-36.5	0.0	0.0	48.0	39.7	74	54	-26.0	-14.3	V
4.960	3.0	44.8	36.1	33.2	5.9	-36.5	0.0	0.0	47.5	38.7	74	54	-26.5	-15.3	H

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	

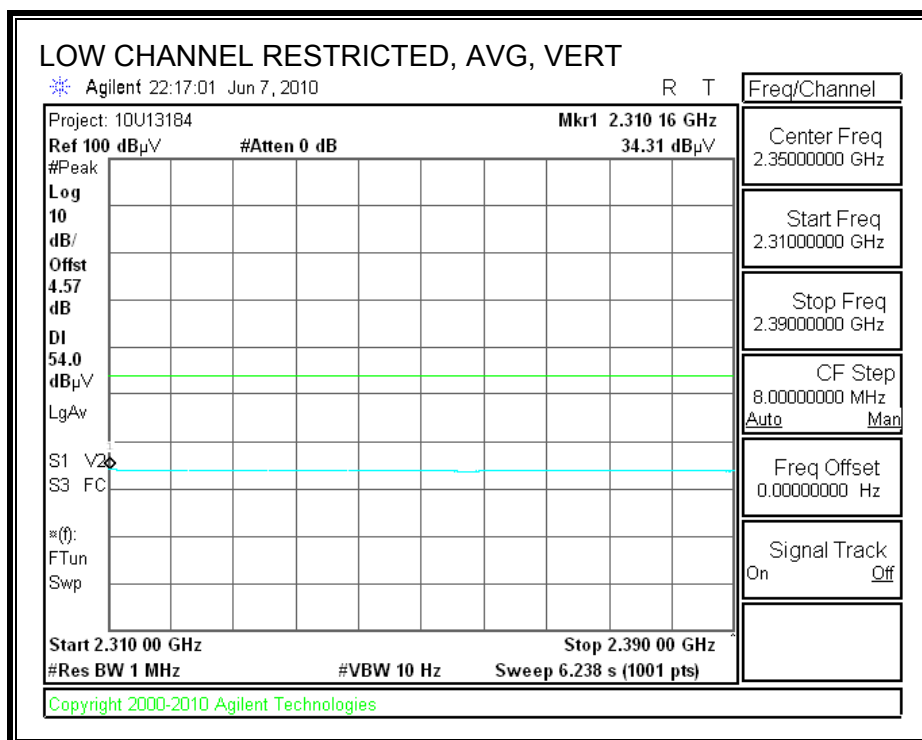
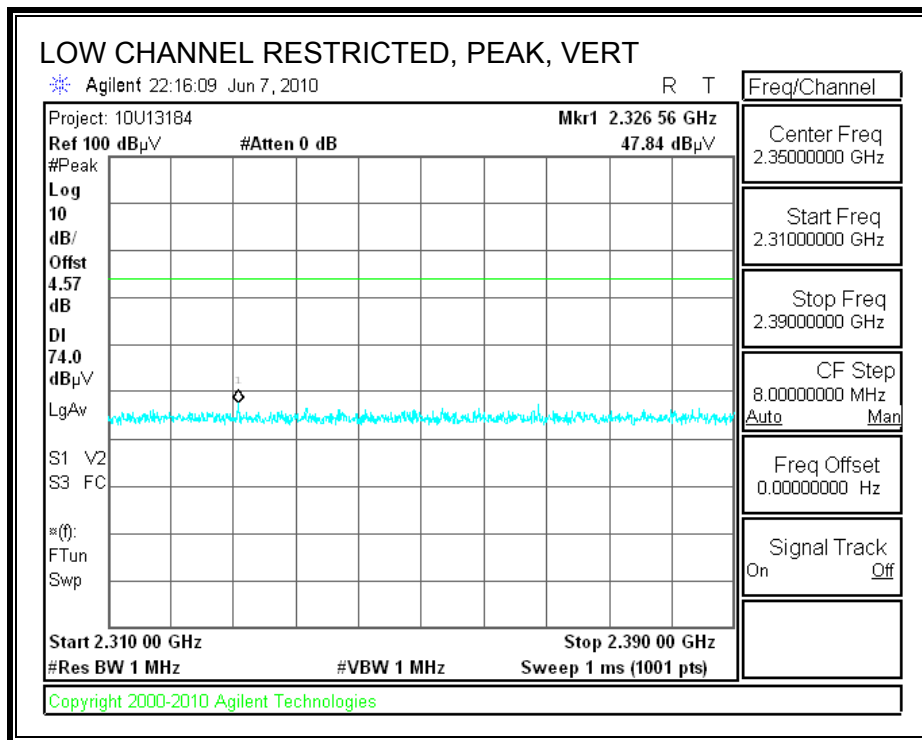
## 7.2.2. ENHANCED DATA RATE 8PSK MODULATION

### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

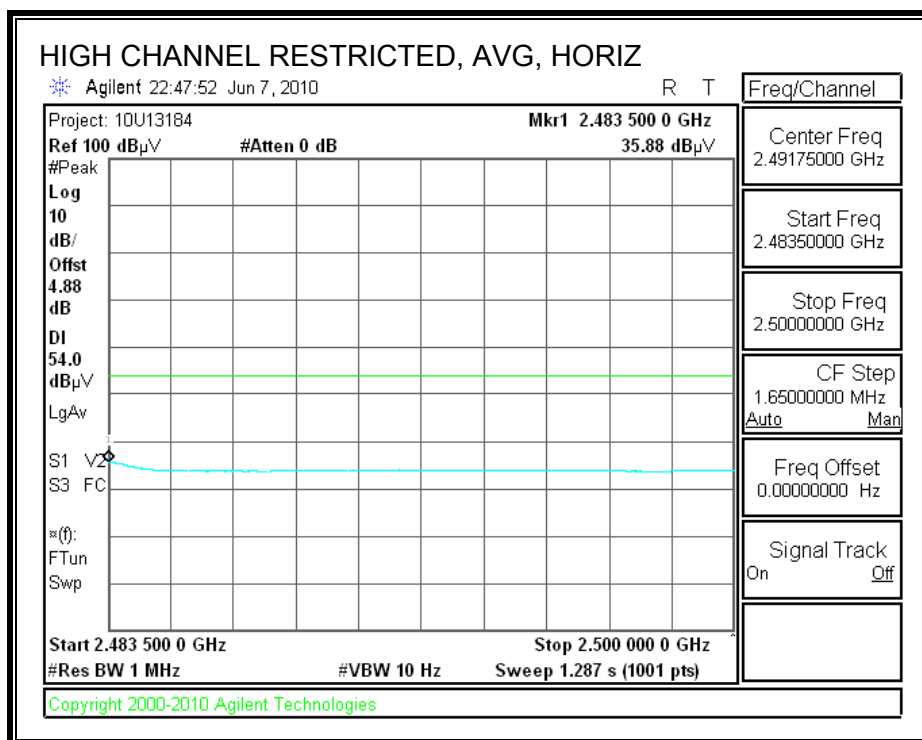
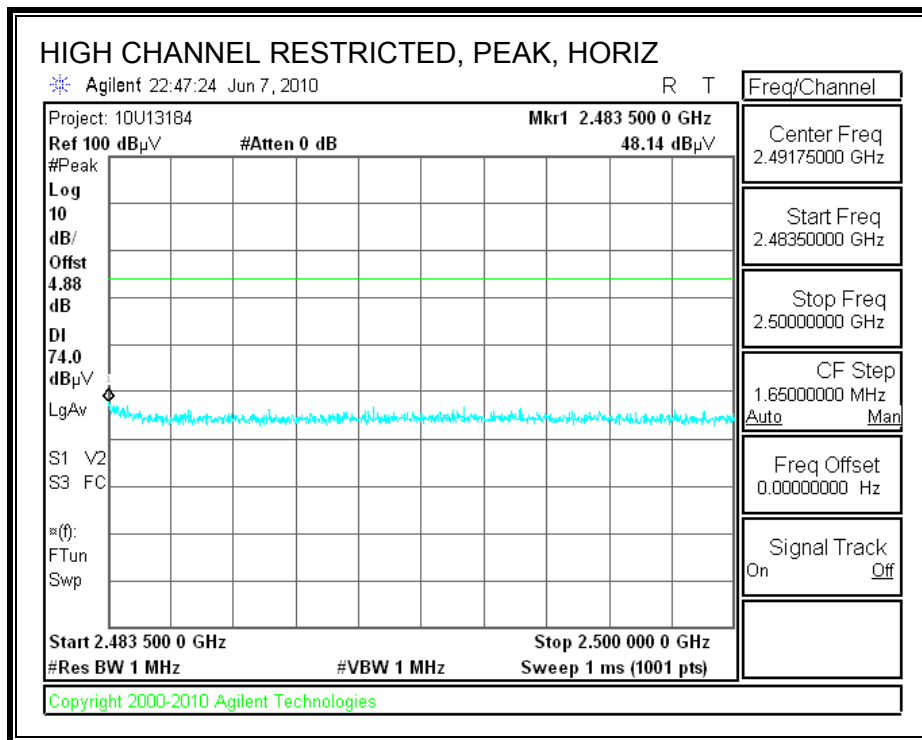




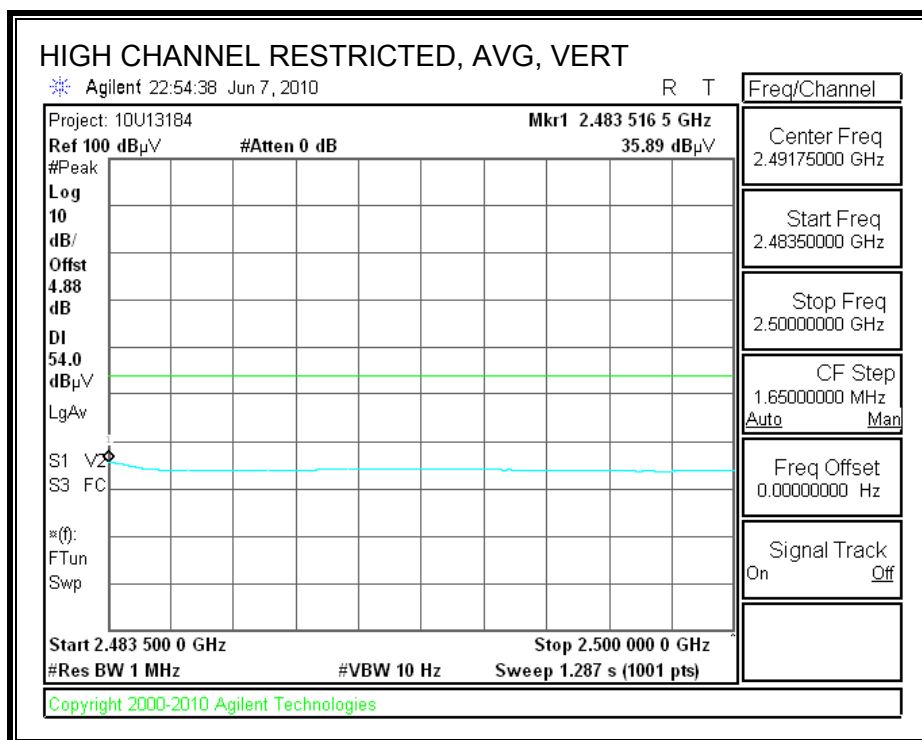
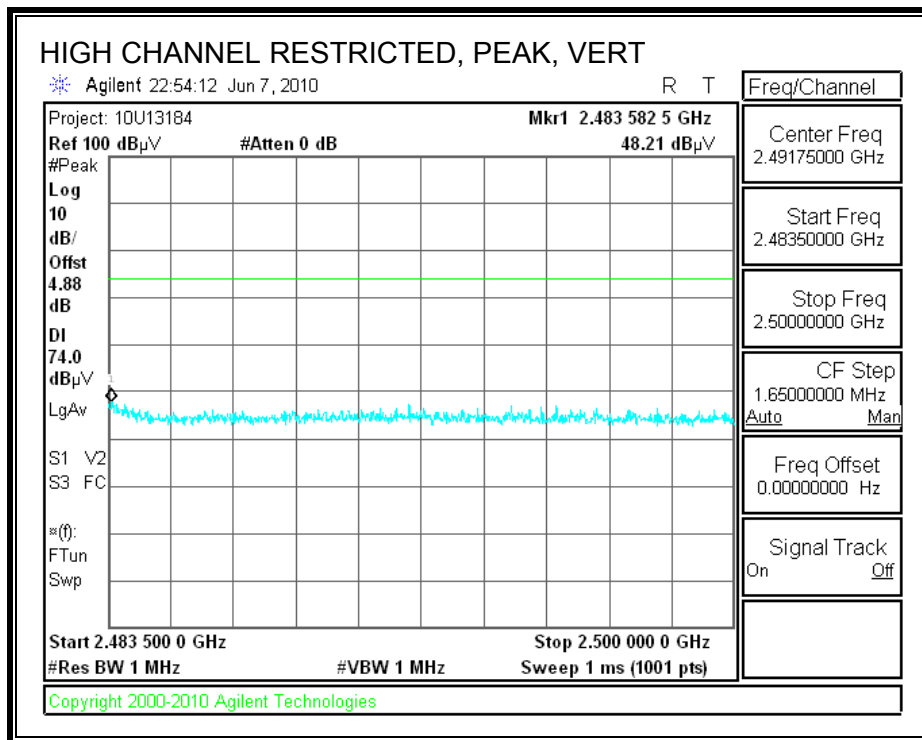
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



**RESTRICTED BANEDGE (HIGH CHANNEL, HORIZONTAL)**



**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**



## HARMONICS AND SPURIOUS EMISSIONS

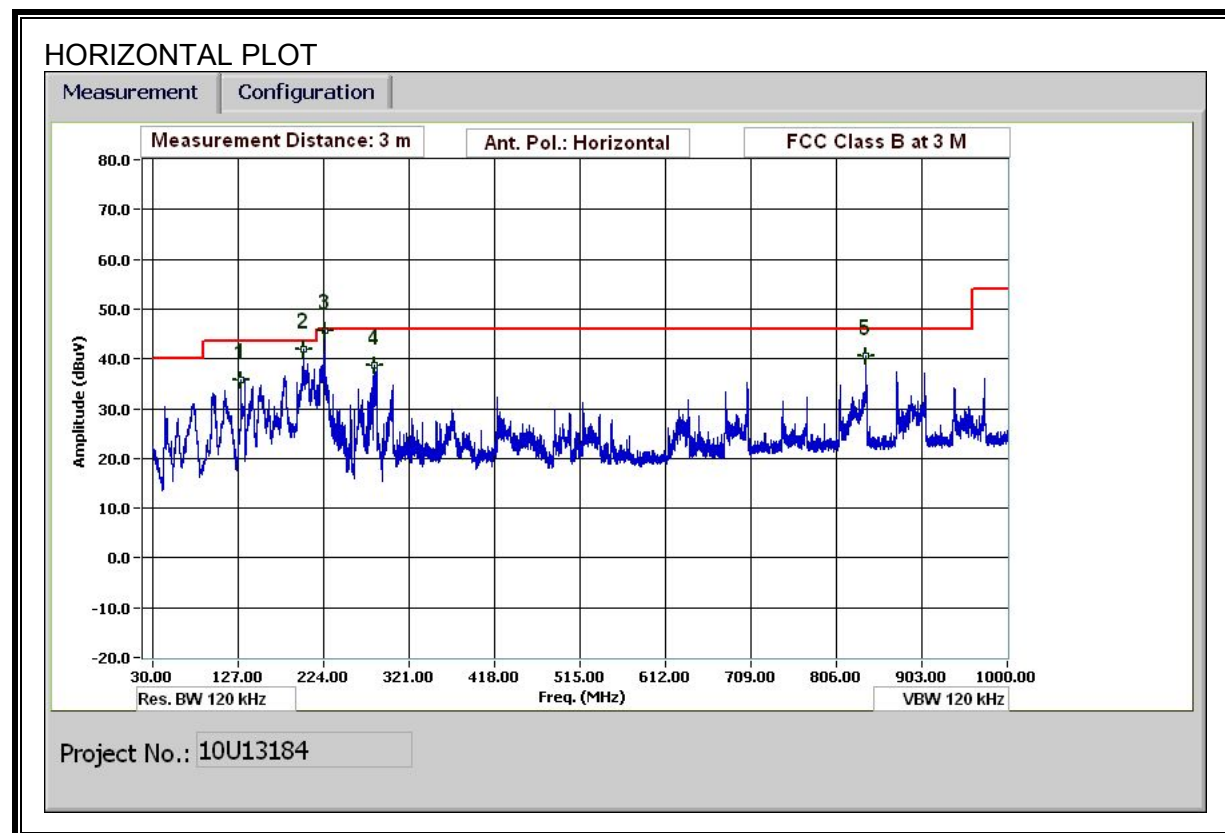
High Frequency Measurement																
Compliance Certification Services, Fremont 5m Chamber																
Company:		Trimble MRM														
Project #:		10U13184														
Date:		6/7/2010														
Test Engineer:		MENGISTU MEKURIA														
Configuration:		EUT and Support Equipments														
Mode:		Tx, 8PSK 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)	
<b>Low Channel (2402 MHz)</b>																
4.804	3.0	40.2	27.6	33.0	5.8	-36.5	0.0	0.0	42.5	30.0	74	54	-31.5	-24.0	V	
4.804	3.0	39.9	27.2	33.0	5.8	-36.5	0.0	0.0	42.2	29.5	74	54	-31.8	-24.5	H	
<b>Mid Channel (2441 MHz)</b>																
4.882	3.0	40.2	27.4	33.1	5.8	-36.5	0.0	0.0	42.7	29.8	74	54	-31.3	-24.2	V	
4.882	3.0	39.5	27.2	33.1	5.8	-36.5	0.0	0.0	42.0	29.7	74	54	-32.0	-24.3	H	
<b>Hi Channel (2480 MHz)</b>																
4.960	3.0	39.9	27.2	33.2	5.9	-36.5	0.0	0.0	42.5	29.8	74	54	-31.5	-24.2	V	
4.960	3.0	39.4	27.1	33.2	5.9	-36.5	0.0	0.0	42.0	29.8	74	54	-32.0	-24.2	H	
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												

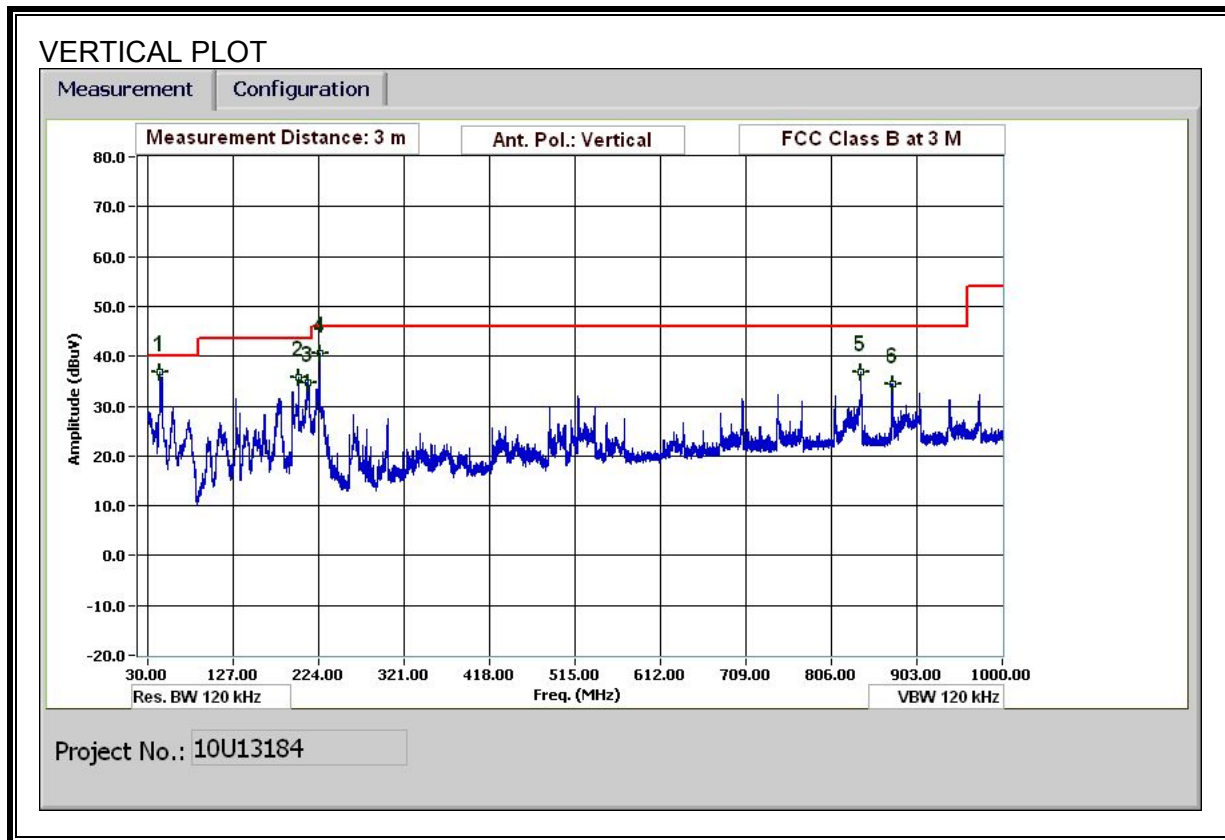
### 7.3. RECEIVER ABOVE 1 GHz

High Frequency Measurement																	
Compliance Certification Services, Fremont 5m Chamber																	
Company:		Trinble MRM															
Project #:		10U13184															
Date:		06/16/10															
Test Engineer:		Mengistu Mekuria															
Configuration:		EUT with 12VDC (Battery)															
Mode:		Normal															
Test Equipment:																	
Horn 1-18GHz				Pre-amplifier 1-26GHz				Pre-amplifier 26-40GHz				Horn > 18GHz				Limit	
T59; S/N: 3245 @3m				T145 Agilent 3008A0050												FCC Class B	
Hi Frequency Cables																	
3' cable 22807700				12' cable 22807600				20' cable 22807500				HPF				Reject Filter	
3' cable 22807700				12' cable 22807600				20' cable 22807500									
<div style="display: flex; justify-content: space-between;"> <div> <b>Peak Measurements</b>  RBW=VBW=1MHz  <b>Average Measurements</b>  RBW=1MHz ; VBW=10Hz </div> </div>																	
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)		
<b>Horizontal</b>																	
1.012	3.0	59.4	42.2	24.0	2.4	-36.1	0.0	0.0	49.6	32.4	74	54	-24.4	-21.6	H		
1.085	3.0	59.0	40.2	24.2	2.5	-36.1	0.0	0.0	49.6	30.9	74	54	-24.4	-23.1	H		
1.221	3.0	54.3	35.6	24.8	2.6	-36.0	0.0	0.0	45.7	27.0	74	54	-28.3	-27.0	H		
1.419	3.0	56.0	35.3	25.5	2.9	-35.8	0.0	0.0	48.5	27.8	74	54	-25.5	-26.2	H		
<b>Vertical</b>																	
1.012	3.0	55.4	36.3	24.0	2.4	-36.1	0.0	0.0	45.6	26.5	74	54	-28.4	-27.5	V		
1.085	3.0	54.7	33.5	24.2	2.5	-36.1	0.0	0.0	45.3	24.1	74	54	-28.7	-29.9	V		
1.221	3.0	53.6	33.7	24.8	2.6	-36.0	0.0	0.0	45.0	25.1	74	54	-29.0	-28.9	V		
1.419	3.0	54.6	32.8	25.5	2.9	-35.8	0.0	0.0	47.1	25.3	74	54	-26.9	-28.7	V		
<div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div> f      Measurement Frequency  Dist   Distance to Antenna  Read   Analyzer Reading  AF      Antenna Factor  CL      Cable Loss </div> <div> Amp    Preamp Gain  D Corr   Distance Correct to 3 meters  Avg     Average Field Strength @ 3 m  Peak    Calculated Peak Field Strength  HPF     High Pass Filter </div> <div> Avg Lim   Average Field Strength Limit  Pk Lim    Peak Field Strength Limit  Avg Mar   Margin vs. Average Limit  Pk Mar    Margin vs. Peak Limit </div> </div>																	

## 7.4. WORST-CASE BELOW 1 GHz

### SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)





## VERTICAL AND HORIZONTAL DATA

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

Test Engr: MENGISTU MEKURIA

Date: 06/08/10

Project #: 10U13184

Company: TRIMBLE MRM

EUT Description: TELEMATICS PLATFORM

EUT M/N: TVG-850

Test Target: FCC CLASS B

Mode Oper: TX MODE

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
43.855	3.0	53.2	11.5	0.6	28.4	0.0	0.0	36.9	40.0	-3.1	V	P	
43.855	3.0	52.3	11.5	0.6	28.4	0.0	0.0	36.1	40.0	-3.9	V	QP	
201.487	3.0	50.8	12.0	1.3	28.2	0.0	0.0	35.8	43.5	-7.7	V	P	
212.408	3.0	49.7	11.9	1.3	28.2	0.0	0.0	34.7	43.5	-8.8	V	P	
224.997	3.0	55.7	11.9	1.3	28.2	0.0	0.0	40.7	46.0	-5.3	V	P	
224.997	3.0	54.3	11.9	1.3	28.2	0.0	0.0	39.3	46.0	-6.7	V	QP	
839.553	3.0	40.4	21.3	2.7	27.6	0.0	0.0	36.8	46.0	-9.2	V	P	
875.075	3.0	37.7	21.6	2.8	27.7	0.0	0.0	34.4	46.0	-11.6	V	P	
129.604	3.0	49.4	13.5	1.1	28.3	0.0	0.0	35.7	43.5	-7.8	H	P	
201.487	3.0	57.0	12.0	1.3	28.2	0.0	0.0	42.0	43.5	-1.5	H	P	
201.496	3.0	52.4	12.0	1.3	28.2	0.0	0.0	37.4	43.5	-6.1	H	QP	
224.997	3.0	60.6	11.9	1.3	28.2	0.0	0.0	45.6	46.0	-0.4	H	P	
224.997	3.0	59.1	11.9	1.3	28.2	0.0	0.0	44.0	46.0	-2.0	H	QP	
281.650	3.0	52.7	12.8	1.5	28.1	0.0	0.0	38.8	46.0	-7.2	H	P	
839.433	3.0	44.2	21.3	2.7	27.6	0.0	0.0	40.7	46.0	-5.3	H	P	

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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 <sup>2</sup> )	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 <sup>2</sup> )	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> <sup>0.5</sup>	0.0042 <i>f</i> <sup>0.5</sup>	<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> <sup>1.2</sup>
150 000–300 000	0.158 <i>f</i> <sup>0.5</sup>	4.21 x 10 <sup>-4</sup> <i>f</i> <sup>0.5</sup>	6.67 x 10 <sup>-5</sup> <i>f</i>	616 000 / <i>f</i> <sup>1.2</sup>

\* 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/m<sup>2</sup> is equivalent to 1 mW/cm<sup>2</sup>.  
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/cm<sup>2</sup> (FCC) and 824 MHz / 150 = 5.5 W/m<sup>2</sup> (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/cm<sup>2</sup> and from IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m<sup>2</sup>.

## 8.2. EQUATIONS

Power density is given by:

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

where

S = Power density in W/m<sup>2</sup>

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.

$$\text{Total EIRP} = (P_1 * G_1) + (P_2 * G_2) + \dots + (P_n * G_n)$$

where

P<sub>x</sub> = Power of transmitter x

G<sub>x</sub> = 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 <sup>2</sup> )
850 MHz	Cell		29.82	-0.25	50	
2.4 GHz	BT		3.20	1.70	100	
Combined		0.20				0.91

The co-located Power Density is less than 5.5 W/m<sup>2</sup>, which is the most stringent of the limits for each separate transmitter (5.5 W/m<sup>2</sup> and 10 W/m<sup>2</sup> 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 <sup>2</sup> )
1900 MHz	PCS		29.10	1.70	100	
2.4 GHz	BT		3.20	1.70	100	
Combined		0.20				2.40

The co-located Power Density is less than 10 W/m<sup>2</sup>, which is the limit for each separate transmitter.