



RADIATED SPURIOUS EMISSIONS PORTIONS OF

**FCC CFR47 PART 22 SUBPART H
FCC CFR47 PART 24 SUBPART E
INDUSTRY CANADA RSS-132 ISSUE 2
INDUSTRY CANADA RSS-133 ISSUE 5**

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: 10U13184-2, Revision B
ISSUE DATE: JULY 06, 2010**

Prepared for

**TRIMBLE MRM
888 TASMAN ROAD,
MILPITAS, CA 95035, U.S.A.**

Prepared by

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Date	Revisions	Revised By
--	06/18/10	Initial Issue	T. Chan
A	07/01/10	Revised Software and Firmware Section	A. Zaffar
B	07/06/10	Revised MPE Co-located Section	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 - MAY 07, 2010

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 22 Subpart H	PASS (Radiated Portion)
CFR 47 Part 24 Subpart E	PASS (Radiated Portion)
INDUSTRY CANADA RSS-132 Issue 2	PASS (Radiated Portion)
INDUSTRY CANADA RSS-133 Issue 5	PASS (Radiated Portion)

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:



THU CHAN
EMC MANAGER
COMPLIANCE CERTIFICATION SERVICES

Tested By:



VIEN TRAN
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with TIA-603-C, FCC CFR 47 Part 2, FCC CFR 47 Part 22, FCC CFR Part 24, RSS-132 Issue 2, and RSS-133.

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:

$$\text{Field Strength (dBuV/m)} = \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} - \text{Preamp Gain (dB)}$$

$$36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$$

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. MAXIMUM RADIATED OUTPUT POWER

The transmitter has a maximum ERP & EIRP peak output powers as follows:

Part 22 Cellular Band

Frequency range (MHz)	Modulation	ERP	
		dBm	mW
824.7 – 848.31	1xRTT (RC3, +SCH)	25.30	338.8
824.7 – 848.31	EV-DO - REV A	25.50	354.8

Part 24 PCS Band

Frequency range (MHz)	Modulation	ERP	
		dBm	mW
1851.25 - 1908.8	1xRTT (RC3, +SCH)	25.20	331.1
1851.25 - 1908.9	EV-DO - REV A	25.40	346.7

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a multi-band PIFA antenna for the 900MHz and 1800MHz bands with a maximum peak gain of -0.25dBi for Cell band and 1.7dBi for PCS band.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the WWAN Module: 1.10.01

The Hardware Revision of WWAN Module : Rev. 2

5.5. WORST-CASE CONFIGURATION AND MODE

Based on the following investigation results, the highest peak power and enhanced data rate is the worst-case scenario for all measurements.

Worst case modes:

- For Cellular and PCS band: 1xRTT (RC3, +SCH)
- For Cellular and PCS band: EVDO-Rev A

In addition to the conducted power measurements, to determine the worst-position the EUT was investigated for horizontal and vertical positions. After the investigations, the worst-position was turned out to be a horizontal position for both Cell band and PCS bands.

5.6. DETAILS OF TESTED SYSTEM

SUPPORT EQUIPMENT

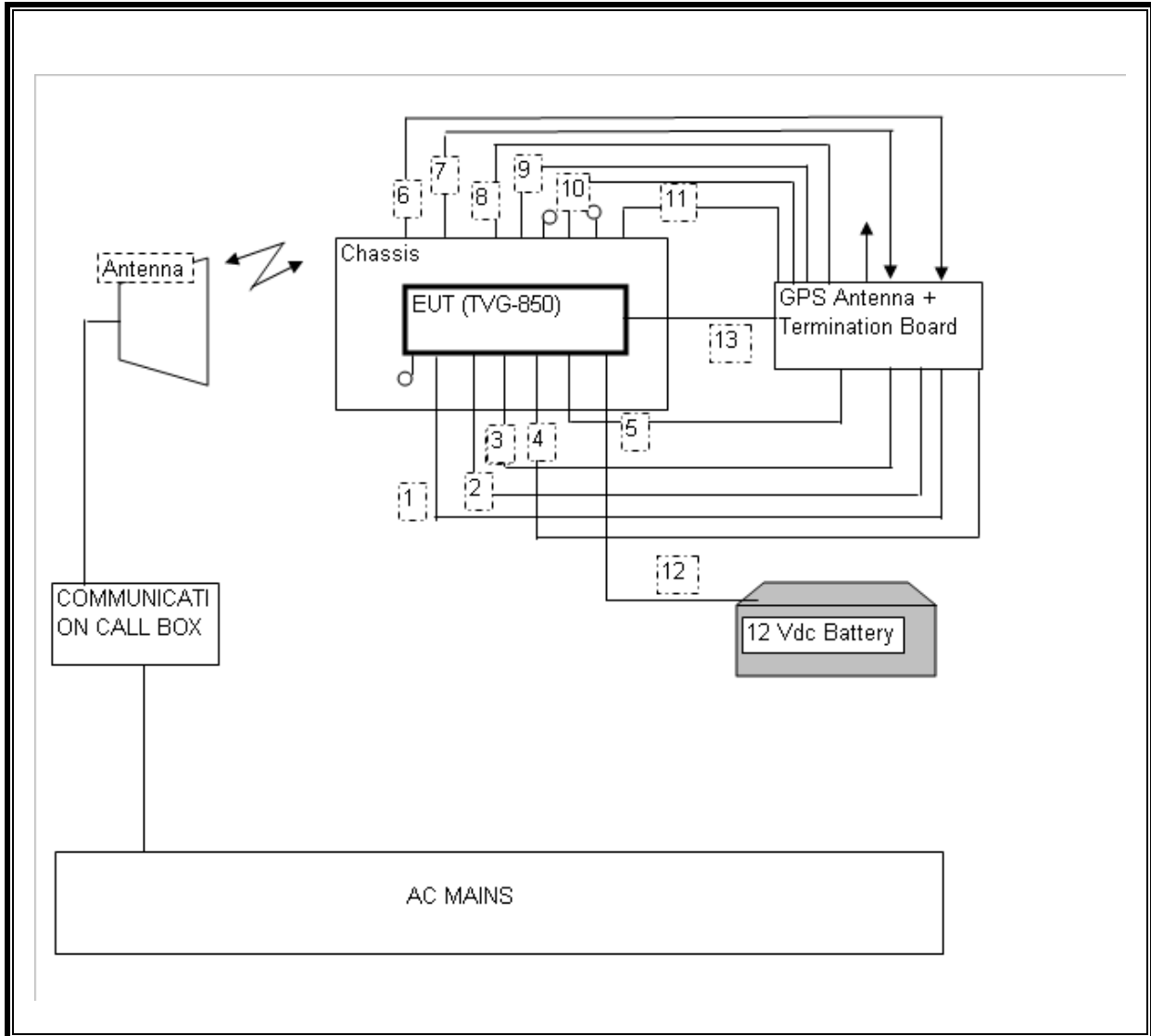
I/O CABLES

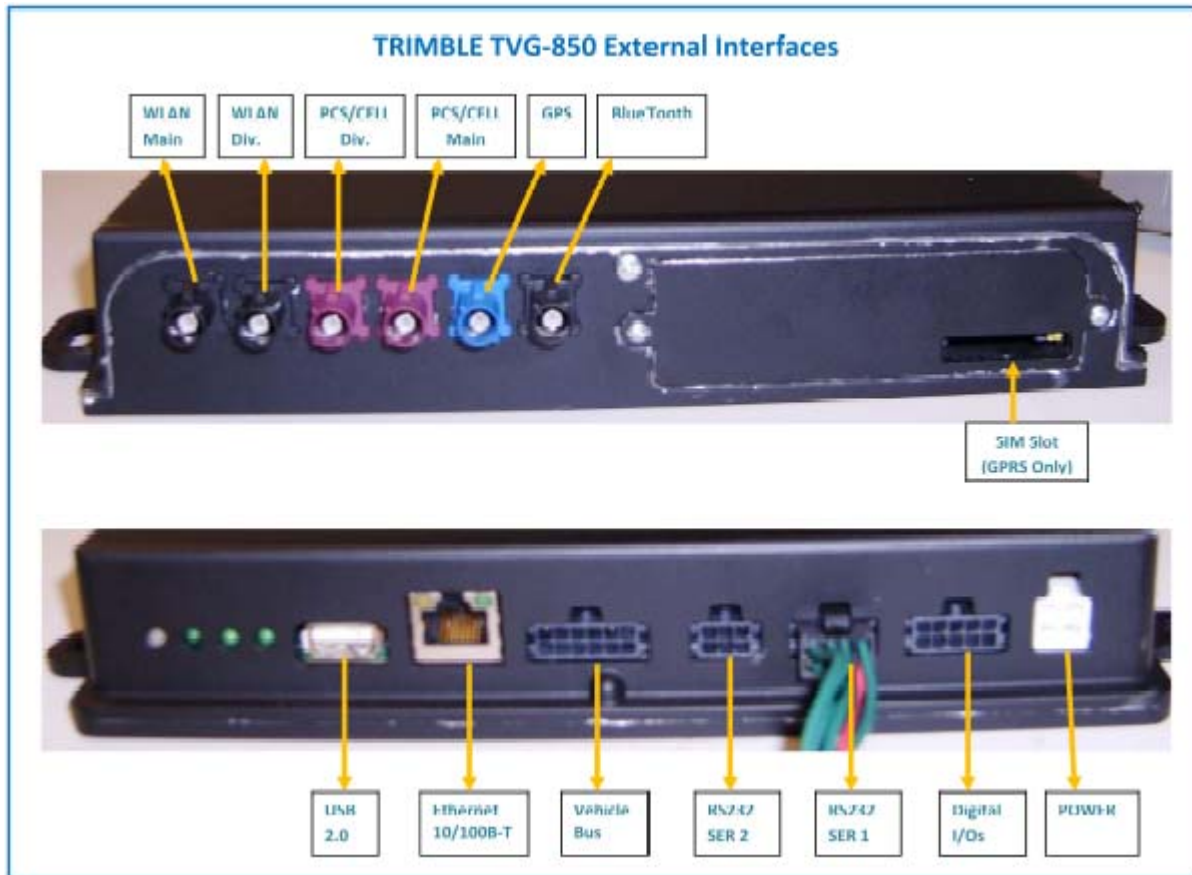
I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	Ethernet	1	RJ45	Un-Shielded	0.5m	
2	Serial	1		Un-Shielded	0.4m	
3	Serial	1	RS232	Un-Shielded	0.4m	
4	Serial	1		Un-Shielded	0.4m	
5	Digital I/O	1		Un-Shielded	0.4m	
6	WLAN_Main	1	Fakra Black	RG-58	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. A link is established between the EUT and the Agilent 8960 communications test set.

SETUP DIAGRAM





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	C01179	08/24/10
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01178	08/31/10
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00778	07/06/10
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	08/04/10
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	08/05/10
Antenna, Horn, 18 GHz	EMCO	3115	C00945	07/29/10
Antenna, Horn, 18 GHz	EMCO	3115	C00783	07/29/10
Antenna, Horn, 18 GHz	EMCO	3115	C00943	07/29/10
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01016	07/14/10
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	07/15/10
Highpass Filter, 1.5 GHz	Micro-Tronics	HPM13193	N02689	CNR
Highpass Filter, 2.7 GHz	Micro-Tronics	HPM13194	N02687	CNR

7. RADIATED TEST RESULTS

7.1. RADIATED POWER (ERP & EIRP)

RULE PART(S)

FCC: §2.1046, §22.913, §24.232

LIMITS

22.913(a) - The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

24.232(c) & RSS-133 § 6.4 - Mobile/portable stations are limited to 2 watts e.i.r.p. peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

RSS-132 4.4, SRSP503 5.1.3 - The maximum ERP shall be 11.5 Watts for mobile stations.

TEST PROCEDURE

ANSI / TIA / EIA 603C
 RSS-132; RSS-133

MODES TESTED

- 1xRTT – RC3, +SCH
- Ev-DO – Rev A

RESULTS for Cellular Band (ERP)

Mode	Channel	f (MHz)	ERP	
			dBm	mW
1xRTT (RC3, +SCH)	1013	824.70	25.30	338.84
	384	836.52	23.90	245.47
	777	848.75	22.50	177.83
EVDO-REV A	1013	824.70	25.50	354.81
	384	836.52	24.50	281.84
	777	848.75	24.90	309.03

RESULTS for PCS Band (EIRP)

Mode	Channel	f (MHz)	EIRP	
			dBm	mW
1xRTT (RC3, +SCH)	25	1851.25	25.20	331.13
	600	1880.00	25.00	316.23
	1175	1908.75	23.80	239.88
EVDO-REV A	25	1851.25	25.40	346.74
	600	1880.00	25.10	323.59
	1175	1908.75	24.50	281.84

ERP for 1xRTT Mode (Cellular Band)

High Frequency Substitution Measurement Compliance Certification Services Chamber A							
Company:		Trimble					
Project #:		10U13184					
Date:		6/7/2010					
Test Engineer:		MENGISTU MEKURIA					
Configuration:		EUT and Support Equipments					
Mode:		Tx, CDMA_1xRTT_Cell Band					
Test Equipment:							
Receiving: Sunol T122, and 3m Chamber N-type Cable (Setup this one for testing EUT)							
Substitution: Dipole S/N: 00022117, 6ft SMA Cable (SN # 208947003) Warehouse.							
f MHz	SA reading (dBm)	Ant. Pol. (H/V)	Path Loss (dBm)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Channel (1013)							
824.70	-9.5	V	34.8	25.3	38.5	-13.2	
824.70	-13.1	H	30.5	17.4	38.5	-21.0	
Mid Channel (384)							
836.52	-9.2	V	33.1	23.9	38.5	-14.6	
836.52	-12.5	H	31.2	18.7	38.5	-19.8	
Channel (777)							
848.31	-9.6	V	32.1	22.5	38.5	-16.0	
848.31	-14.0	H	31.2	17.2	38.5	-21.3	

ERP for EVDO-REV A Mode (Cellular Band)

High Frequency Substitution Measurement Compliance Certification Services 3m Chamber							
Company:		Trimble					
Project #:		10U13184					
Date:		4/30/2010					
Test Engineer:		Vien Tran					
Configuration:		EUT and Support Equipments					
Mode:		Tx, CDMA_1xEv-DO_Cell Band					
Test Equipment:							
Receiving: Sunol T185, and 3m Chamber N-type Cable (Setup this one for testing EUT)							
Substitution: Dipole S/N: 00022117, 6ft SMA Cable (SN # 208947003) Warehouse.							
f MHz	SA reading (dBm)	Ant. Pol. (H/V)	Path Loss (dBm)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes
824.70	-5.3	V	30.8	25.5	38.5	-12.9	
824.70	-10.2	H	28.9	18.7	38.5	-19.8	
836.52	-7.4	V	31.8	24.5	38.5	-14.0	
836.52	-8.7	H	28.8	20.1	38.5	-18.3	
848.31	-7.9	V	32.8	24.9	38.5	-13.5	
848.31	-9.1	H	29.6	20.5	38.5	-18.0	

EIRP for 1xRTT Mode (PCS Band)

High Frequency Fundamental Measurement Compliance Certification Services Chamber A							
Company:		Trimble					
Project #:		10U13184					
Date:		6/7/2010					
Test Engineer:		MENGISTU MEKURIA					
Configuration:		EUT and Support Equipments					
Mode:		Tx, CDMA_1xRTT_PCS Band					
Test Equipment:							
Receiving: Horn T73, and Chamber A SMA Cables							
Substitution: Horn T72 Substitution, 6ft SMA Cable (208947003) Warehouse							
f GHz	SA reading (dBm)	Ant. Pol. (H/V)	Path Loss (dBm)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Channel (25)							
1.850	-15.2	V	40.4	25.2	33.0	-7.8	
1.850	-23.5	H	39.7	16.2	33.0	-16.8	
Mid Channel (600)							
1.880	-15.0	V	39.9	25.0	33.0	-8.0	
1.880	-23.4	H	40.1	16.7	33.0	-16.3	
Channel (1175)							
1.910	-16.0	V	39.8	23.8	33.0	-9.2	
1.910	-25.6	H	40.2	14.6	33.0	-18.4	

EIRP for EVDO-REV A Mode (PCS Band)

High Frequency Fundamental Measurement Compliance Certification Services 3m Chamber							
Company:		Trimble					
Project #:		10U13184					
Date:		4/30/2010					
Test Engineer:		Vien Tran					
Configuration:		EUT and Support Equipments					
Mode:		Tx, CDMA_1xEv-DO_PCS Band					
Test Equipment:							
Receiving: Horn T60, and 3m Camber SMA Cables							
Substitution: Horn T72 Substitution, 6ft SMA Cable (SN # 208947003) Warehouse							
f GHz	SA reading (dBm)	Ant. Pol. (H/V)	Path Loss (dBm)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
1.850	-13.4	V	38.7	25.4	33.0	-7.6	
1.850	-17.2	H	36.8	19.6	33.0	-13.4	
	0.0						
1.880	-14.8	V	39.9	25.1	33.0	-7.9	
1.880	-17.2	H	38.8	21.6	33.0	-11.4	
	0.0						
1.910	-16.4	V	40.9	24.5	33.0	-8.5	
1.910	-18.3	H	37.6	19.3	33.0	-13.7	

7.2. FIELD STRENGTH OF SPURIOUS RADIATION

RULE PART(S)

FCC: §2.1053, §22.917, §24.238
IC: RSS-132, 4.5; RSS-233, 6.5

LIMIT

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log (P)$ dB.

TEST PROCEDURE

For Cellular equipment - Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

For PCS equipment - Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

MODES TESTED

- 1xRTT – RC3, +SCH
- Ev-DO – Rev A

RESULTS

1xRTT Mode (Cellular Band)

Compliance Certification Services
 Above 1GHz High Frequency Substitution Measurement

Company: Trimble
 Project #: 10U13184
 Date: 5/6/2010
 Test Engineer: Vien Tran
 Configuration: EUT and Support Equipments
 Mode: Tx, CDMA_1xRTT_Cell Band

Chamber

Pre-amplifier

Filter

Limit

3m Chamber

T34 8449B

Filter 1

FCC PART 22

f GHz	SA reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Path Loss (dB)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch. (824.7 MHz)										
1.649	-48.5	H	3.0	36.6	37.4	1.0	-48.2	-13.0	-35.2	
1.649	-40.2	V	3.0	36.9	37.4	1.0	-39.7	-13.0	-26.7	
Mid Ch. (836.52 MHz)										
1.673	-50.6	H	3.0	36.9	37.3	1.0	-50.1	-13.0	-37.1	
1.673	-44.1	V	3.0	37.1	37.3	1.0	-43.3	-13.0	-30.3	
Hi Ch. (848.31 MHz)										
1.697	-49.5	H	3.0	37.1	37.3	1.0	-48.7	-13.0	-35.7	
1.697	-41.5	V	3.0	37.4	37.3	1.0	-40.4	-13.0	-27.4	
No other emissions were detected greater than -20dBm to the limit										

EVDO-REV A Mode (Cellular Band)

Compliance Certification Services										
Above 1GHz High Frequency Substitution Measurement										
Company:		Trimble								
Project #:		10U13184								
Date:		5/6/2010								
Test Engineer:		Vien Tran								
Configuration:		EUT and Support Equipments								
Mode:		Tx, CDMA_1xEv-DO_PCS Band								
Chamber		Pre-amplifier			Filter			Limit		
3m Chamber		T34 8449B			Filter 1			FCC PART 22		
f GHz	SA reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Path Loss (dB)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch. (824.7 MHz)										
1.649	-50.0	H	3.0	36.6	37.4	1.0	-49.7	-13.0	-36.7	
2.474	-62.2	H	3.0	40.0	36.4	1.0	-57.6	-13.0	-44.6	
1.649	-41.2	V	3.0	36.9	37.4	1.0	-40.7	-13.0	-27.7	
2.474	-58.9	V	3.0	41.6	36.4	1.0	-52.7	-13.0	-39.7	
Mid Ch. (836.52 MHz)										
1.673	-54.2	H	3.0	36.9	37.3	1.0	-53.7	-13.0	-40.7	
2.510	-65.1	H	3.0	40.2	36.4	1.0	-60.3	-13.0	-47.3	
1.673	-48.1	V	3.0	37.1	37.3	1.0	-47.3	-13.0	-34.3	
2.510	-60.2	V	3.0	41.8	36.4	1.0	-53.8	-13.0	-40.8	
Hi Ch. (848.31 MHz)										
1.697	-49.6	H	3.0	37.1	37.3	1.0	-48.7	-13.0	-35.7	
2.545	-62.2	H	3.0	40.4	36.3	1.0	-57.2	-13.0	-44.2	
1.697	-43.1	V	3.0	37.4	37.3	1.0	-42.0	-13.0	-29.0	
2.545	-58.2	V	3.0	41.9	36.3	1.0	-51.7	-13.0	-38.7	
No other emissions were detected greater than -20dBm to the limit										

1xRTT Mode (PCS Band)

Compliance Certification Services										
Above 1GHz High Frequency Substitution Measurement										
Company:		Trimble								
Project #:		10U13184								
Date:		5/6/2010								
Test Engineer:		Vien Tran								
Configuration:		EUT and Support Equipments								
Mode:		Tx, CDMA_1xRTT_PCS Band								
Chamber		Pre-amplifier			Filter			Limit		
3m Chamber		T34 8449B			Filter 1			FCC PART 24		
f GHz	SA reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Path Loss (dB)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch. (1851.25 MHz)										
3.703	-55.3	H	3.0	44.7	35.4	1.0	-45.0	-13.0	-32.0	
5.554	-56.2	H	3.0	49.7	34.7	1.0	-40.2	-13.0	-27.2	
7.405	-52.2	V	3.0	52.1	34.9	1.0	-34.0	-13.0	-21.0	
3.703	-49.3	V	3.0	44.9	35.4	1.0	-38.7	-13.0	-25.7	
5.554	-55.3	V	3.0	49.2	34.7	1.0	-39.9	-13.0	-26.9	
7.405	-51.8	V	3.0	52.1	34.9	1.0	-33.6	-13.0	-20.6	
Mid Ch. (1880.00 MHz)										
3.760	-55.8	H	3.0	44.8	35.3	1.0	-45.3	-13.0	-32.3	
5.640	-58.9	H	3.0	49.9	34.7	1.0	-42.7	-13.0	-29.7	
7.520	-53.9	H	3.0	53.3	34.9	1.0	-34.6	-13.0	-21.6	
3.760	-49.6	V	3.0	45.1	35.3	1.0	-38.8	-13.0	-25.8	
5.640	-56.2	V	3.0	49.3	34.7	1.0	-40.6	-13.0	-27.6	
7.520	-52.9	V	3.0	52.3	34.9	1.0	-34.5	-13.0	-21.5	
Hi Ch. (1908.75 MHz)										
3.818	-52.9	H	3.0	45.0	35.3	1.0	-42.2	-13.0	-29.2	
5.726	-53.6	H	3.0	50.1	34.7	1.0	-37.3	-13.0	-24.3	
7.635	-60.2	H	3.0	53.4	34.9	1.0	-40.8	-13.0	-27.8	
3.818	-44.5	V	3.0	45.3	35.3	1.0	-33.5	-13.0	-20.5	
5.726	-49.4	V	3.0	49.5	34.7	1.0	-33.7	-13.0	-20.7	
7.635	-59.1	V	3.0	52.4	34.9	1.0	-40.6	-13.0	-27.6	
No other emissions were detected greater than -20dBm to the limit										

EVDO-REV A Mode (PCS Band)

Compliance Certification Services
 Above 1GHz High Frequency Substitution Measurement

Company: Trimble
 Project #: 10U13184
 Date: 5/6/2010
 Test Engineer: Vien Tran
 Configuration: EUT and Support Equipments
 Mode: Tx, CDMA 1xEV-DO PCS Band

Chamber

Pre-amplifier

Filter

Limit

3m Chamber

T34 8449B

Filter 1

FCC PART 24

f GHz	SA reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Path Loss (dB)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch. (1851.25 MHz)										
3.703	-52.8	H	3.0	44.7	35.4	1.0	-42.5	-13.0	-29.5	
5.554	-51.2	H	3.0	49.7	34.7	1.0	-35.2	-13.0	-22.2	
3.703	-51.1	V	3.0	44.9	35.4	1.0	-40.6	-13.0	-27.6	
5.554	-53.9	V	3.0	49.2	34.7	1.0	-38.5	-13.0	-25.5	
Mid Ch. (1880.00 MHz)										
3.760	-52.2	H	3.0	44.8	35.3	1.0	-41.7	-13.0	-28.7	
5.640	-50.5	H	3.0	49.9	34.7	1.0	-34.3	-13.0	-21.3	
3.760	-50.1	V	3.0	45.1	35.3	1.0	-39.3	-13.0	-26.3	
5.640	-53.6	V	3.0	49.3	34.7	1.0	-38.0	-13.0	-25.0	
Hi Ch. (1908.75 MHz)										
3.818	-54.2	H	3.0	45.0	35.3	1.0	-43.5	-13.0	-30.5	
5.726	-52.2	H	3.0	50.1	34.7	1.0	-35.9	-13.0	-22.9	
3.818	-43.8	V	3.0	45.3	35.3	1.0	-32.8	-13.0	-19.8	
5.726	-48.9	V	3.0	49.5	34.7	1.0	-33.2	-13.0	-20.2	
No other emissions were detected greater than -20dBm to the limit										

Note: No other emissions were detected greater than -20dB to the limit.

7.3. RECEIVER SPURIOUS EMISSIONS

LIMIT

RSS-Gen 7.2.2

Spurious Emission Limits for Receivers:

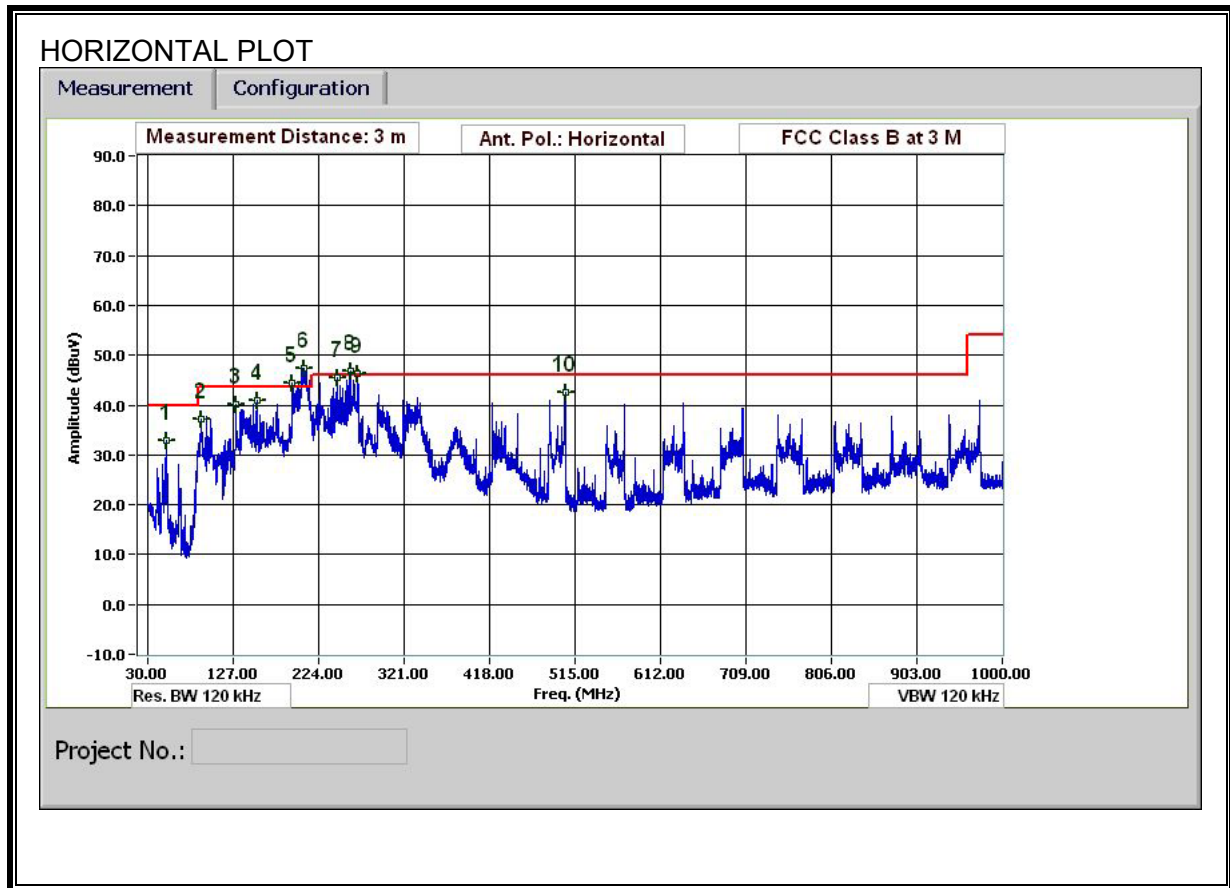
Spurious Frequency (MHz)	Field Strength (microvolts/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960	500

TEST PROCEDURE

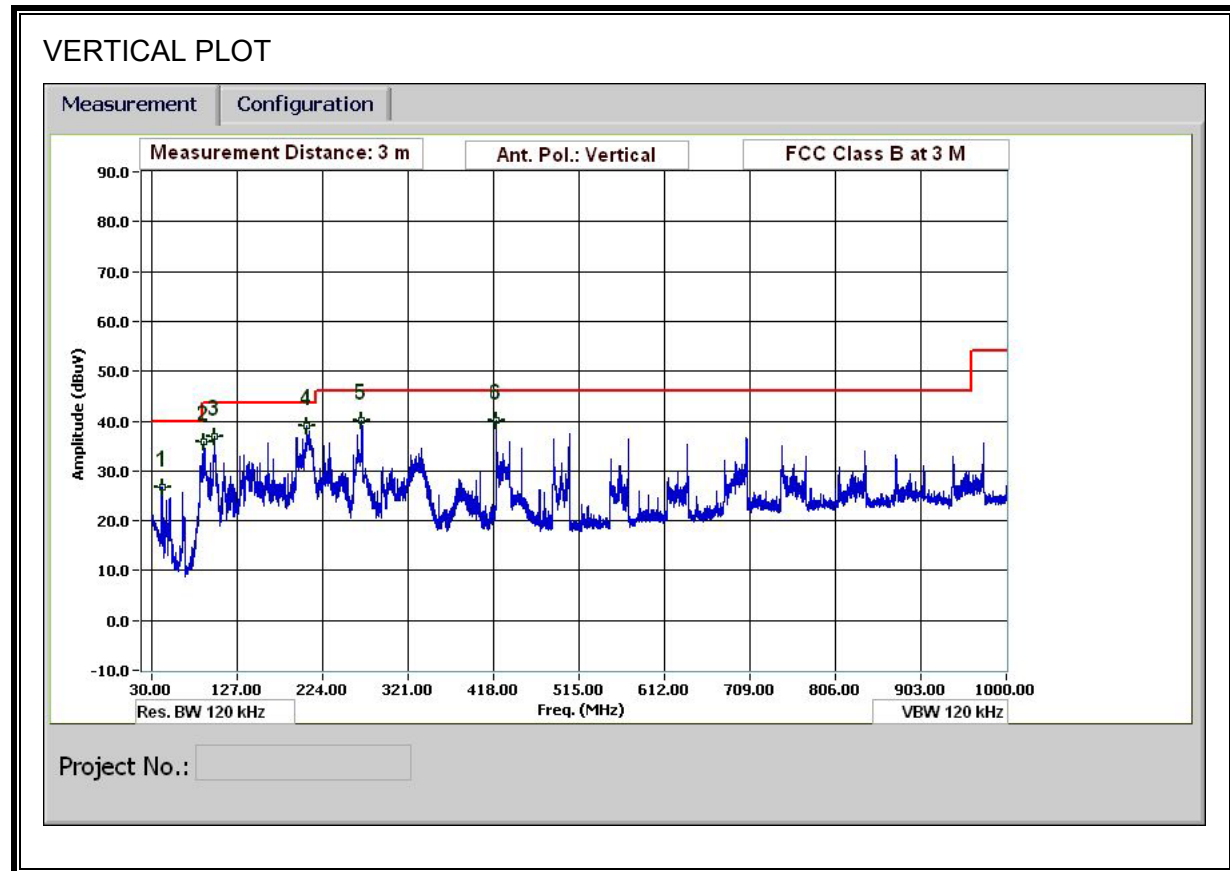
The search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (local oscillator frequency, intermediate frequency or carrier frequency), or 30 MHz, whichever is the higher, to at least 3 times the highest tunable and local oscillator frequencies.

RESULTS

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



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



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

HORIZONTAL AND VERTICAL DATA

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

Test Engr: Vien Tran
 Date: 04/28/10
 Project #: 10U13184
 Company: Trinble 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
Horizontal													
50.761	3.0	52.3	8.3	0.6	28.4	0.0	0.0	32.9	40.0	-7.1	H	P	
90.602	3.0	56.9	7.7	0.8	28.3	0.0	0.0	37.1	43.5	-6.4	H	P	
129.604	3.0	53.8	13.5	1.1	28.3	0.0	0.0	40.2	43.5	-3.3	H	P	
154.805	3.0	55.9	12.2	1.1	28.3	0.0	0.0	41.0	43.5	-2.5	H	P	
194.407	3.0	59.7	11.6	1.2	28.2	0.0	0.0	44.4	43.5	0.9	H	P	
194.407	3.0	56.2	11.6	1.2	28.2	0.0	0.0	42.2	43.5	-1.3	H	QP	
206.647	3.0	62.4	12.0	1.3	28.2	0.0	0.0	47.4	43.5	3.9	H	P	
206.647	3.0	58.2	12.0	1.3	28.2	0.0	0.0	43.2	43.5	-0.3	H	QP	
245.289	3.0	60.5	11.8	1.3	28.2	0.0	0.0	45.5	46.0	-0.5	H	P	
259.809	3.0	61.6	12.1	1.4	28.2	0.0	0.0	46.9	46.0	0.9	H	P	
259.809	3.0	59.1	12.1	1.4	28.2	0.0	0.0	44.4	46.0	-1.6	H	QP	
268.690	3.0	60.6	12.4	1.4	28.2	0.0	0.0	46.3	46.0	0.3	H	P	
268.690	3.0	57.7	12.4	1.4	28.2	0.0	0.0	43.4	46.0	-2.6	H	QP	
503.900	3.0	51.5	16.8	2.0	27.8	0.0	0.0	42.5	46.0	-3.5	H	P	
Vertical													
41.400	3.0	41.5	13.0	0.6	28.4	0.0	0.0	26.8	40.0	-13.2	V	P	
89.642	3.0	55.7	7.5	0.8	28.3	0.0	0.0	35.8	43.5	-7.7	V	P	
100.803	3.0	54.4	10.1	0.9	28.3	0.0	0.0	37.0	43.5	-6.5	V	P	
205.927	3.0	54.0	12.0	1.3	28.2	0.0	0.0	39.0	43.5	-4.5	V	P	
268.690	3.0	54.5	12.4	1.4	28.2	0.0	0.0	40.1	46.0	-5.9	V	P	
421.216	3.0	51.0	15.3	1.9	28.0	0.0	0.0	40.2	46.0	-5.8	V	P	

Rev. 1.27.09

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

SPURIOUS EMISSIONS ABOVE 1000 MHz

High Frequency Measurement
 Compliance Certification Services, Fremont 5m Chamber

Company: Trimble MRM
 Project #: 10U13184
 Date: 04/26/10
 Test Engineer: Vien Tran
 Configuration: EUT with 12VDC (Battery)
 Mode: Normal

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 15.209

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			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	Fltr 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															
1.037	3.0	70.6	44.6	24.0	2.4	-39.4	0.0	0.0	57.5	31.6	74	54	-16.5	-22.4	H
1.168	3.0	60.8	40.1	24.4	2.6	-39.3	0.0	0.0	48.5	27.8	74	54	-25.5	-26.2	H
1.611	3.0	57.3	38.6	25.9	3.1	-38.6	0.0	0.0	47.6	28.9	74	54	-26.4	-25.1	H
Vertical															
1.037	3.0	71.8	44.8	24.0	2.4	-39.4	0.0	0.0	58.8	31.8	74	54	-15.2	-22.2	V
1.168	3.0	58.2	38.5	24.4	2.6	-39.3	0.0	0.0	46.0	26.2	74	54	-28.0	-27.8	V
1.611	3.0	58.4	36.8	25.9	3.1	-38.6	0.0	0.0	48.7	27.2	74	54	-25.3	-26.8	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. POWER LINE CONDUCTED EMISSION

The EUT is operated by 12Vdc battery therefore no power line conducted emission test needed.

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)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f ²)	6
30–300	61.4	0.163	1.0	6
300–1500 .....	.....	.....	f/300	6
1500–100,000 .....	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f ²)	30

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.