



TEST REPORT FROM RFI GLOBAL SERVICES LTD

Test of: Torch DCM300G

FCC ID:JUP-WCDCM300G

To: FCC Parts 22.913 & 24.232

Test Report Serial No:
RFI-RPT-RP77996JD05B

This Test Report Is Issued Under The Authority
Of Chris Guy, Head of Global Approvals:

Checked By:

Ian Watch

Signature:

Date of Issue:

26 January 2011

This report is issued in Adobe Acrobat portable document format (PDF). It is only a valid copy of the report if it is being viewed in PDF format with the following security options not allowed: Changing the document, Selecting text and graphics, Adding or changing notes and form fields.

This report may not be reproduced other than in full, except with the prior written approval of RFI Global Services Ltd. The results in this report apply only to the sample(s) tested.

RFI Global Services Ltd

Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire RG23 8BG
Telephone: +44 (0)1256 312000 Facsimile: +44 (0)1256 312001
Email: info@rfi-global.com Website: www.rfi-global.com

Registered in England and Wales. Company number:2117901



This page has been left intentionally blank.

Table of Contents

1. Customer Information	4
2. Summary of Testing	5
2.1. General Information	5
2.2. Summary of Test Results	5
2.3. Methods and Procedures	5
2.4. Deviations from the Test Specification	5
3. Equipment Under Test (EUT)	6
3.1. Identification of Equipment Under Test (EUT)	6
3.2. Description of EUT	6
3.3. Modifications Incorporated in the EUT	6
3.4. Additional Information Related to Testing	7
3.5. Support Equipment	9
4. Operation and Monitoring of the EUT during Testing	10
4.1. Operating Modes	10
4.2. Configuration and Peripherals	10
5. Measurements, Examinations and Derived Results	11
5.1. General Comments	11
5.2. Test Results: Part 22 - GSM850	12
5.2.1. Transmitter Output Power (ERP)	12
5.3. Test Results: Part 22 – UMTS FDD V	14
5.3.1. Transmitter Output Power (ERP)	14
5.4. Test Results: Part 24 - PCS 1900	16
5.4.1. Transmitter Output Power (EIRP)	16
5.5. Test Results: Part 24 – UMTS FDD II	18
5.5.1. Transmitter Output Power (EIRP)	18
6. Measurement Uncertainty	20
Appendix 1. Test Equipment Used	21

1. Customer Information





Company Name:	Trimble Navigation Ltd
Address:	10355 Westmoor Dr Westminster Colo 80021 United States

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR22
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications) 2010: Part 22 Subpart H (Public Mobile Services) – Section 22.913
Specification Reference:	47CFR24
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications) 2010: Part 24 Subpart E (Personal Communication Services) – Section 24.232
Site Registration:	FCC: 209735
Location of Testing:	RFI Global Services Ltd, Wade Road, Basingstoke, Hampshire, RG24 8AH
Test Date:	11 January 2011

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 22		
Part 22.913(a)	Transmitter Output Power (ERP)	
Part 24		
Part 24.232	Transmitter Output Power (EIRP)	
Key to Results		
 = Complied  = Did not comply		

2.3. Methods and Procedures

Reference:	ANSI/TIA-603-D-2010
Title:	Land Mobile Communications Equipment, Measurements and Performance Standards

2.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	Trimble Navigation
Model Name or Number:	Torch DCM300G
IMEI:	354114012493061
Hardware Version Number:	A
Software Version Number:	0.1.5
FCC ID:	JUP-WCDCM300G

3.2. Description of EUT

The equipment under test was a data communications module (DCM) for use in construction vehicles. It contains a Cinterion HC25 module (FCC ID: QIPHC25) capable of GSM and UMTS and a Wi2Wi Wi-Fi module (FCC ID: U9R-W2CBW009DI) capable of 802.11b and 802.11g.

The following antennas have been specified for use with the EUT:

- Taoglas MA.104 "Hercules" Antenna, part number MA.104.C.A301111.B301311, declared antenna gain 0 dBi
- Pulse IP67 Active 6 bands GPS Antenna, part number W4120GW5000, declared antenna gain 0 dBi
- Wilson NMO Cellular Antenna /20 feet LMR-240 RF coaxial cable combination consisting of:
Wilson NMO Cellular Antenna, part number 301104, declared antenna gain 4.9 dBi in the 800 MHz band and 5.9 dBi in the 1900 MHz band and 20 feet of type LMR-240 cable, part number GBR-20-240-T1-A.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Technology Tested:	US Cellular (800 band)		
Mode:	GSM/GPRS		
Maximum Output Power (ERP):	GSM	33.05 dBm	
	GPRS	33.05 dBm	
Transmit Frequency Range:	824 to 849 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	128	824.2
	Middle	190	836.6
	Top	251	848.8
Technology Tested:	US PCS (1900 band)		
Maximum Output Power (EIRP):	GSM	32.3 dBm	
	GPRS	30.8 dBm	
Transmit Frequency Range:	1850 to 1910 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	512	1850.2
	Middle	660	1879.8
	Top	810	1909.8

Technology Tested:	US Cellular (800 band)		
Mode:	UMTS FDD V and UMTS Release 5 HSDPA		
Maximum Output Power (ERP):	Voice (12.2 kbps)	28.15 dBm	
	HSDPA Sub-Test 1	28.15 dBm	
Transmit Frequency Range:	824 to 849 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	4132	826.4
	Middle	4183	836.6
	Top	4233	846.6
Technology Tested:	US PCS (1900 band)		
Mode:	UMTS FDD II and UMTS Release 5 HSDPA		
Maximum Output Power (EIRP):	Voice (12.2 kbps)	30.2 dBm	
	HSDPA Sub-Test 1	30.2 dBm	
Transmit Frequency Range:	1850 to 1910 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	9262	1852.4
	Middle	9400	1880.0
	Top	9538	1907.6

3.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

Description:	Laptop
Brand Name:	Dell
Model Name or Number:	Latitude D610
Serial Number:	RFI Asset Number PC 344NT

Description:	Dual DC Power Supply
Brand Name:	TTi
Model Name or Number:	EL301D
Serial Number:	249944

Description:	Cable Harness with Ethernet and CAN loop back
Brand Name:	Trimble
Model Name or Number:	Not stated
Serial Number:	Not stated

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):

- Constantly transmitting at full power on bottom, middle and top channels as required.
- Transmitter Output Power tests in GSM mode were performed with the EUT in GSM single timeslot circuit switched and GPRS Multislot Class 10 with the unit transmitting on two timeslots in the uplink.
- Transmitter Output Power tests in UMTS mode were performed with the EUT in circuit switched speech and HSDPA Sub-test 1 modes.

4.2. Configuration and Peripherals

The EUT was tested in the following configuration(s):

- Connected to a calibrated Rohde & Schwarz CMU200 GSM/GPRS system simulator, operating in transceiver mode. The power meter on the CMU200 was used to perform conducted power measurements.
- Connected to a calibrated Rohde & Schwarz CMU200 UMTS system simulator, operating in transceiver mode. The power meter on the CMU200 was used to perform conducted power measurements.

5. Measurements, Examinations and Derived Results

5.1. General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to *Section 6 Measurement Uncertainty* for details.

5.2. Test Results: Part 22 - GSM850**5.2.1. Transmitter Output Power (ERP)****Test Summary:**

Test Engineer:	Andrew Edwards	Test Date:	11 January 2011
Test Sample IMEI:	354114012493061		

FCC Part:	22.913(a) & 2.1046(a)
Test Method Used:	As detailed in ANSI TIA-603-D-2010 Section 2.2.1 referencing FCC CFR Part 2.1046(a)

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	31

Results - GSM Circuit Switched: 0 dBi gain Antenna

Channel	Frequency (MHz)	Conducted Power (dBm)	Declared Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
Bottom	824.2	31.3	-2.15	29.15	38.45	9.3	Complied
Middle	836.6	31.6	-2.15	29.45	38.45	9.0	Complied
Top	848.8	31.7	-2.15	29.55	38.45	8.9	Complied

Results – GPRS: 0 dBi gain Antenna

Channel	Frequency (MHz)	Conducted Power (dBm)	Declared Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
Bottom	824.2	29.7	-2.15	27.55	38.45	10.9	Complied
Middle	836.6	30.0	-2.15	27.85	38.45	10.6	Complied
Top	848.8	31.7	-2.15	29.55	38.45	8.9	Complied

Note(s):

1. The declared antenna gain for the antennas specified for use with the EUT (i.e. Taoglas MA.104 Hercules Antenna, part number MA.104.C.A301111.B301311 and Pulse IP67 Active 6 bands GPS Antenna, part number W4120GW5000) are specified as having nominal gain of 0 dBi which equates to -2.15 dBd. This was calculated using the dBi to dBd conversion ($\text{dBd} = \text{dBi} - 2.15$) as the limit is stated as an ERP value.
2. The declared antenna gain in dBd was added to the conducted output power in order to calculate the final ERP figure.

Transmitter Output Power (ERP) (continued)**Results - GSM Circuit Switched: Wilson NMO Cellular Antenna:**

Channel	Frequency (MHz)	Conducted Power (dBm)	Declared Antenna Gain (dBd)	Cable Loss (dB)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
Bottom	824.2	31.3	2.75	1.4	32.65	38.45	5.8	Complied
Middle	836.6	31.6	2.75	1.4	32.95	38.45	5.5	Complied
Top	848.8	31.7	2.75	1.4	33.05	38.45	5.4	Complied

Results - GPRS: Wilson NMO Cellular Antenna

Channel	Frequency (MHz)	Conducted Power (dBm)	Declared Antenna Gain (dBd)	Cable Loss (dB)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
Bottom	824.2	29.7	2.75	1.4	31.05	38.45	7.4	Complied
Middle	836.6	30.0	2.75	1.4	31.35	38.45	7.1	Complied
Top	848.8	31.7	2.75	1.4	33.05	38.45	5.4	Complied

Note(s):

1. The declared antenna gain for the Wilson NMO Cellular Antenna, part number 301104, is stated as nominal 4.9 dBi which equates to 2.75 dBd. This was calculated using the specified dBi to dBd conversion ($\text{dBd} = \text{dBi} - 2.15$) as the limit is stated as an ERP value.
2. The combined declared antenna gain in dBd and cable loss in dB was added to the conducted output power in order to calculate the final ERP figure.
3. The RF coaxial cable (part number GBR-20-240-T1-A) specified for use with the Wilson NMO Cellular Antenna is a 20 feet length type LMR-240 cable which has a minimum loss of 1.4 dB in the 800 MHz cellular band.

5.3. Test Results: Part 22 – UMTS FDD V**5.3.1. Transmitter Output Power (ERP)****Test Summary:**

Test Engineer:	Andrew Edwards	Test Date:	11 January 2011
Test Sample IMEI:	354114012493061		

FCC Part:	22.913(a)
Test Method Used:	As detailed in 3GPP TS 34.121-1 V8.6.0 (2009-03) and ANSI TIA-603-D-2010 Section 2.2.1

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	30

Results: Peak conducted power

Modes		HSDPA				Voice			
Sub-test		1	2	3	4	12.2 kbps			
Band	Channel	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)	Limit (dBm)	Margin (dB)	Result
850	4132	26.8	26.2	26.4	25.5	26.8	38.45	11.65	Complied
	4183	26.4	25.7	26.0	24.8	26.4	38.45	12.05	Complied
	4233	26.4	25.7	25.8	25.2	26.4	38.5	12.05	Complied
β_c		2	12	15	15				
β_d		15	15	8	4				
$\Delta ACK, \Delta NACK, \Delta CQI$		8	8	8	8				

Results: Peak ERP - 0 dBi gain Antenna Types

Channel	Frequency (MHz)	Conducted Power (dBm)	Declared Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
Bottom	826.4	26.8	-2.15	24.65	38.45	13.8	Complied
Middle	836.6	26.4	-2.15	24.25	38.45	14.2	Complied
Top	846.6	26.4	-2.15	24.25	38.45	14.2	Complied

Transmitter Output Power (ERP) (continued)**Results: Peak ERP - Wilson NMO Cellular Antenna**

Channel	Frequency (MHz)	Conducted Power (dBm)	Declared Antenna Gain (dBd)	Cable Loss (dB)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
Bottom	826.4	26.8	2.75	1.4	28.15	38.45	10.3	Complied
Middle	836.6	26.4	2.75	1.4	27.75	38.45	10.7	Complied
Top	846.6	26.4	2.75	1.4	27.75	38.45	10.7	Complied

Note(s):

1. The ERP table has the antenna gain and cable loss added to the worst case (highest) conducted power.
2. All modes were compared on each channel and the highest power recorded was subtracted from the limit to show the margin.
3. The declared antenna gain for the Wilson NMO Cellular Antenna, part number 301104, is stated as nominal 4.9 dBi which equates to 2.75 dBd. This was calculated using the specified dBi to dBd conversion ($\text{dBd} = \text{dBi} - 2.15$) as the limit is stated as an ERP value.
4. The combined declared antenna gain in dBd and cable loss in dB was added to the conducted output power in order to calculate the final ERP figure.
5. The RF coaxial cable (part number GBR-20-240-T1-A) specified for use with the Wilson NMO Cellular Antenna is a 20 feet length type LMR-240 cable which has a minimum loss of 1.4 dB in the 800 MHz cellular band.

Results: RMS Conducted power

Modes		HSDPA				Voice			
Sub-test		1	2	3	4	12.2 kbps			
Band	Channel	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)	Limit (dBm)	Margin (dB)	Result
850	4132	23.3	22.0	21.9	20.8	23.3	38.45	15.15	Complied
	4183	23.0	21.4	21.4	20.3	23.0	38.45	15.45	Complied
	4233	23.0	21.3	21.2	20.5	23.0	38.5	15.45	Complied
βc		2	12	15	15				
βd		15	15	8	4				
ΔACK, ΔNACK, ΔCQI		8	8	8	8				

5.4. Test Results: Part 24 - PCS 1900**5.4.1. Transmitter Output Power (EIRP)****Test Summary:**

Test Engineer:	Andrew Edwards	Test Date:	11 January 2011
Test Sample IMEI:	354114012493061		

FCC Part:	2.1046(a) & 24.232
Test Method Used:	As detailed in ANSI TIA-603-D-2010 Section 2.2.1 referencing FCC CFR Part 2.1046(a)

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	31

Results - GSM Circuit Switched: 0 dBi gain Antenna

Channel	Frequency (MHz)	Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
Bottom	1850.2	28.6	0.0	28.6	33.0	4.4	Complied
Middle	1879.8	28.5	0.0	28.5	33.0	4.5	Complied
Top	1909.8	28.4	0.0	28.4	33.0	4.6	Complied

Results - GPRS: 0 dBi gain Antenna

Channel	Frequency (MHz)	Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
Bottom	1850.2	27.1	0.0	27.1	33.0	5.9	Complied
Middle	1879.8	27.0	0.0	27.0	33.0	6.0	Complied
Top	1909.8	26.9	0.0	26.9	33.0	6.1	Complied

Note(s):

- The declared antenna gain for the antennas specified for use with the EUT (i.e. Taoglas MA.104 Hercules Antenna, part number MA.104.C.A301111.B301311 and Pulse IP67 Active 6 bands GPS Antenna, part number W4120GW5000) is stated as nominal 0 dBi
- The declared antenna gain was added to the conducted output power in order to calculate the final EIRP figure.

Transmitter Output Power (EIRP) (continued)**Results- GSM Circuit Switched: NMO Cellular Antenna**

Channel	Frequency (MHz)	Conducted Power (dBm)	Declared Antenna Gain (dBi)	Cable Loss (dB)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
Bottom	1850.2	28.6	5.9	2.2	32.3	33.0	0.7	Complied
Middle	1879.8	28.5	5.9	2.2	32.2	33.0	0.8	Complied
Top	1909.8	28.4	5.9	2.2	32.1	33.0	0.9	Complied

Results – GPRS: Wilson NMO Cellular Antenna

Channel	Frequency (MHz)	Conducted Power (dBm)	Declared Antenna Gain (dBi)	Cable Loss (dB)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
Bottom	1850.2	27.1	5.9	2.2	30.8	33.0	2.2	Complied
Middle	1879.8	27.0	5.9	2.2	30.7	33.0	2.3	Complied
Top	1909.8	26.9	5.9	2.2	30.6	33.0	2.4	Complied

Note(s):

1. The declared antenna gain for the Wilson NMO Cellular Antenna, part number 301104, is stated as nominal 5.9 dBi.
2. The combined declared antenna gain in dBi and cable loss in dB was added to the conducted output power in order to calculate the final EIRP figure.
3. The RF coaxial cable (part number GBR-20-240-T1-A) specified for use with the Wilson NMO Cellular Antenna is a 20 feet length type LMR-240 cable which has a minimum loss of 2.2 dB in the 1900 MHz PCS band.

5.5. Test Results: Part 24 – UMTS FDD II**5.5.1. Transmitter Output Power (EIRP)****Test Summary:**

Test Engineer:	Andrew Edwards	Test Date:	11 January 2011
Test Sample IMEI:	354114012493061		

FCC Part:	2.1046(a) & 24.232
Test Method Used:	As detailed in 3GPP TS 34.121-1 V8.6.0 (2009-03) and ANSI TIA-603-D-2010 Section 2.2.1

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	30

Results - Peak Conducted power: 0 dBi gain Antenna

Mode		HSDPA				RMC 12.2kbps	Peak Limit (dBm)	Margin	Result
Sub-test		1	2	3	4				
Band	Channel	Power (dBm) Peak	Power (dBm) Peak	Power (dBm) Peak	Power (dBm) Peak	Power (dBm) Peak			
1900	9262	26.5	26.0	25.9	24.9	26.5	33.0	6.5	Complied
	9400	26.2	25.8	25.8	24.8	26.2	33.0	6.8	Complied
	9538	25.6	25.4	25.4	24.6	25.6	33.0	7.4	Complied
βc		2	12	15	15				
βd		15	15	8	4				
ΔACK, ΔNACK, ΔCQI		8	8	8	8				

Results - Peak EIRP: 0 dBi gain Antenna

Channel	Frequency (MHz)	Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
Bottom	1852.4	26.5	0.0	26.5	33.0	6.5	Complied
Middle	1880.0	26.2	0.0	26.2	33.0	6.8	Complied
Top	1907.6	25.6	0.0	25.6	33.0	7.4	Complied

Transmitter Output Power (EIRP) (continued)**Results - Peak EIRP - Wilson NMO Cellular Antenna**

Channel	Frequency (MHz)	Conducted Power (dBm)	Declared Antenna Gain (dBi)	Cable Loss (dB)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
Bottom	1852.4	26.5	5.9	2.2	30.2	33.0	3.8	Complied
Middle	1880.0	26.2	5.9	2.2	29.9	33.0	3.1	Complied
Top	1907.6	25.6	5.9	2.2	29.3	33.0	3.7	Complied

Note(s):

1. The Peak EIRP NMO Cellular Antenna table has the antenna gain and cable loss added to the worst case (highest) conducted power.
2. The declared antenna gain for the Wilson NMO Cellular Antenna, part number 301104, is stated as nominal 5.9 dBi.
3. The combined declared antenna gain in dBi and cable loss in dB was added to the conducted output power in order to calculate the final EIRP figure.
4. The RF coaxial cable (part number GBR-20-240-T1-A) specified for use with the Wilson NMO Cellular Antenna is a 20 feet length type LMR-240 cable which has a minimum loss of 2.2 dB in the 1900 MHz PCS band.

Results - RMS Conducted Output Power

Mode		HSDPA							
Sub-test		1	2	3	4	RMC 12.2kbps			
Band	Channel	Power (dBm) Avg.	Power (dBm) Avg.	Power (dBm) Avg.	Power (dBm) Avg.	Power (dBm) Avg.	Peak Limit (dBm)	Margin	Result
1900	9262	22.9	21.6	21.3	20.1	22.9	33.0	10.1	Complied
	9400	22.5	21.2	21.1	19.9	22.5	33.0	19.5	Complied
	9538	22.1	20.7	20.5	19.6	22.1	33.0	10.9	Complied
βc		2	12	15	15				
βd		15	15	8	4				
ΔACK, ΔNACK, ΔCQI		8	8	8	8				

6. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document "approximately" is interpreted as meaning "effectively" or "for most practical purposes".

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
Conducted Output Power	824 to 849 MHz / 1850 to 1910 MHz	95%	±0.27 dB

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval
L1005	CMU200	Rohde & Schwarz	CMU200	116284	29 Jan 2011	12

NB In accordance with UKAS requirements all the measurement equipment is on a calibration schedule.