CLASS II PERMISSIVE CHANGE TEST REPORT

Report Number: 101844508MPK-001
Project Number: 101844508
December 28, 2014

Testing performed on the
DIG UHF-II Radio Module
Model: 05-100926-01LF
FCC ID: LCB-100926
IC: 6050B-100926

to

FCC Part 90
RSS-119 Issue 11
FCC Part 15, Subpart B
Industry Canada ICES-003

for

Topcon Positioning Systems, Inc.

Test Performed by:	**Test Authorized by:**
Intertek	Topcon Positioning Systems, Inc.
1365 Adams Court	7400 National Drive
Menlo Park, CA 94025	Livermore, CA 94551, USA

Prepared by: Ollie Moyrong **Date:** December 28, 2014

Reviewed by: Krishna K Vemuri **Date:** December 28, 2014

Report No. 101844508MPK-001

Equipment Under Test:	DIG UHF-II Radio Module
Trade Name:	Topcon Positioning Systems, Inc.
Part No.:	05-100926-01LF
Serial No.:	EMCProto1
FCC ID:	LCB-100926
IC:	6050B-100926
Applicant:	Topcon Positioning Systems, Inc.
Contact:	Ferdinand Riodique
Address:	7400 National Drive Livermore, CA 94551
Country	USA
Tel. number:	(925)-245-8516
Email:	friodique@topcon.com
Applicable Regulation:	FCC Part 90, RSS-119 Issue 11 FCC Part 15, Subpart B Industry Canada ICES-003
Test Site Location:	ITS - Site 1 1365 Adams Drive Menlo Park, CA 94025
Date of Test:	October 24, 2014

We attest to the accuracy of this report:

Edmund Cruz
Senior Project Engineer

Krishna K Vemuri
EMC Senior Staff Engineer

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1.0 Introduction

The Equipment Under Test (EUT) is the DIG UHF-II Radio Module, model number 05-100926-01LF. radio. As declared by the Applicant, the RF section is identical to the radio which was previously tested under Intertek report # 100387380MPK-003 (FCC ID: LCB-100926). The original certified unit was modified as described below:

Technical description of changes

DIG UHF-II Radio Module Rev6.12 includes a digital section (signal processing and interface functionality) and RF section (RF transceiver). Both sections are placed on a single PCB. RF section is covered by three sectioned metal shields.

RF section of DIG UHF-II radio Module Rev6.12 is exactly the same as RF section of DIG UHF-II radio Module Rev5.11. Changes are minor layout correction on track that supports new type of radio frequency switch integrated circuit. There are no changes made in the transmitter section of the module. Executed corrections do not create differences in electrical, functional and performance characteristics between DIG UHF-II Radio Module Rev6.12 and DIG UHF-II Radio Module Rev5.11.

Digital section of DIG UHF-II radio Module Rev6.12 is exactly the same as digital section of DIG UHF-II radio Module Rev5.11. Changes are minor layout correction on track that supports new type of clocking signal divider integrated circuit.
Executed corrections do not create differences in electrical, functional and performance characteristics between DIG UHF-II Radio Module Rev6.12 and DIG UHF-II Radio Module Rev5.11

Since there were no hardware changes to the RF section of the PCB, a Class II Permissive Change is being filed and limited tests were performed for spurious emissions to ensure continued compliance.

EUT receive date:	October 24, 2014
EUT receive condition:	A production version of the EUT was received in good condition with no apparent damage.
Test start date:	October 24, 2014
Test completion date:	October 24, 2014

1.2 Summary of Test Results

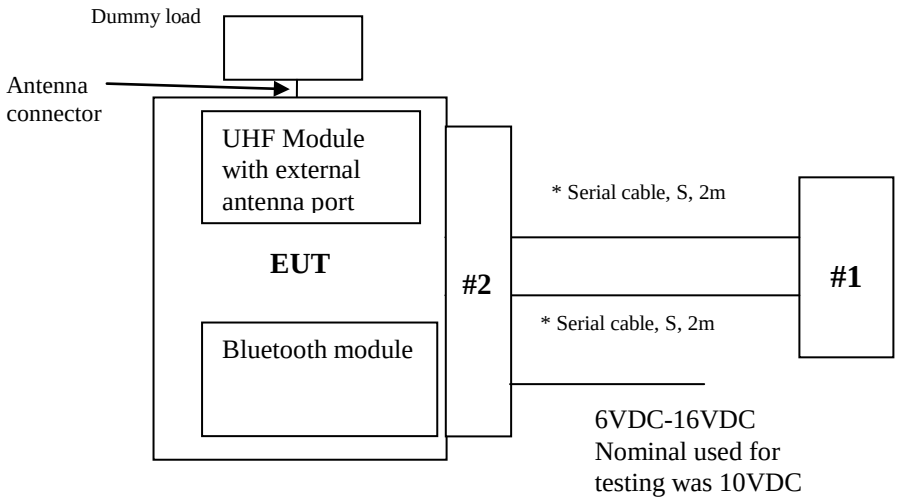
FCC Rule	RSS-119 Rule	Description of Test	Result
2.1053, 90.210	5.8	Spurious Radiation	Complies
15.109	ICES-003	Radiated Emission from Digital Parts and Receiver	Complies

1.3 Test Configuration

1.3.1 Support Equipment

Item #	Description	Model No.	S/N
1	Compaq Laptop	nc6400	CND7062PVK
2	Topcon Test Board	Not Labeled	Not Labeled

1.3.2 Block Diagram of Test Setup



* The DIG UHF-II Radio Module is a radio module intended to be installed in a host and does not contain any serial cables. The serial cables were used for setup purposes only which allowed control of the radio by test software. Radio tests were performed without these cables.

S = Shielded **U** = Unshielded	**F** = With Ferrite **m** = Length in Meters

2.0 Spurious Radiation

FCC 2.1053, 90.210

2.1 Requirement

The mean power of emissions must be attenuated below the mean power of the unmodulated carrier (P) on any frequency outside the frequency band by at least (50 + 10 log P) dB or 70 dB, whichever is lesser attenuation.

Note: Attenuation of (50 + 10 log P) dB corresponds to the level of -20 dBm for any out-of-band and spurious emissions.

2.2 Test Procedure

Radiated emissions are taken at 3 meters for frequencies above 1 GHz and at 10 meters for frequencies below 1 GHz. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.

The frequency range up to 10th harmonic was investigated. The worst case of emissions was reported.

For spurious emissions attenuation, the substitution method was used. The EUT was substituted by a reference antenna (half-wave dipole - below 1 GHz, or Horn antenna - above 1GHz), connected to a signal generator. The signal generator output level ($\mathbf{V_g}$ in dBm) was adjusted to obtain the same reading as from EUT. The ERP at the spurious emissions frequency was calculated as follows.

$$ERP_{(dBm)} = \mathbf{V_g} + \mathbf{G}_{(dBd)}$$

The spurious emissions attenuation is the difference between ERP at the fundamental frequency (see report section 3) and at the spurious emissions frequency.

2.3 Test Equipment

Roberts Antenna
EMCO 3115 Horn Antennas
Rohde & Schwarz FSU Spectrum Analyzer
Low Pass Filter
Preamplifiers

2.4 Test Results

Spurious Radiated Emissions (30 MHz - 1000 MHz – Horizontal)

Freq.	Raw Amplitude	Sig Gen	Cable Loss	Antenna Sub Gain	ERP	Limit	Margin
MHz	(dBuV/m)	dBm	dB	dBi	dBm	dBm	dB
196.6	49.2	-63.4	0.6	7.1	-58.95	-20	-38.95
206.4	50.4	-62.0	0.6	7.8	-56.95	-20	-36.95
226.1	47.2	-63.6	0.6	7.6	-58.75	-20	-38.75
265.4	45.8	-61.2	0.6	5.4	-58.55	-20	-38.55
363.7	43.9	-62.2	0.7	6.7	-58.35	-20	-38.35
422.7	41.7	-61.6	0.7	6.0	-58.45	-20	-38.45
783.6	45.1	-53.5	1.1	6.3	-50.45	-20	-30.45
783.8	48	-50.6	1.1	6.3	-47.55	-20	-27.55
784	42.5	-56.2	1.1	6.3	-53.15	-20	-33.15
836.1	36.2	-61.0	1.1	5.7	-58.65	-20	-38.65
860	42.9	-53.7	1.1	5.9	-51.05	-20	-31.05
Transmit Mode @ 430MHz							

Spurious Radiated Emissions (30 MHz - 1000 MHz – Vertical)

Freq.	Raw Amplitude	Sig Gen	Cable Loss	Antenna Sub Gain	ERP	Limit	Margin
MHz	(dBuV/m)	dBm	dB	dBi	dBm	dBm	dB
196.6	49.2	-60.5	0.6	7.1	-56.05	-20	-36.05
198.8	46.4	-63.5	0.6	7.3	-58.95	-20	-38.95
200.7	45.3	-64.5	0.6	7.4	-59.75	-20	-39.75
206.4	50.5	-59.0	0.6	7.8	-53.95	-20	-33.95
207.9	47	-62.4	0.6	7.8	-57.35	-20	-37.35
226.1	43.9	-64.0	0.6	7.6	-59.15	-20	-39.15
422.7	37.9	-62.5	0.7	6.0	-59.35	-20	-39.35
458.2	37.5	-63.4	0.8	6.4	-59.95	-20	-39.95
773.9	32	-62.7	1.1	6.1	-59.75	-20	-39.75
785.3	33.2	-62.8	1.1	6.3	-59.75	-20	-39.75
817.5	40.8	-54.8	1.1	6.3	-51.75	-20	-31.75
860	37	-56.7	1.1	5.9	-54.05	-20	-34.05
998.6	31.2	-59.3	1.2	5.8	-56.85	-20	-36.85
Transmit Mode @ 430MHz							

Spurious Radiated Emissions (1 GHz - 18 GHz) - Horizontal

Freq.	Raw Amplitude	Sig Gen	Cable Loss	Antenna Sub Gain	ERP	Limit	Margin
MHz	(dBuV/m)	dBm	dB	dBi	dBm	dBm	dB
1017.3	45.1	-60.2	1.2	6.6	-56.95	-20	-36.95
1290	47.9	-56.3	1.3	7.1	-52.65	-20	-32.65
1720	51.3	-53.2	1.5	8.4	-48.45	-20	-28.45
2150.3	47.3	-54.1	1.7	8.7	-49.35	-20	-29.35
2436.3	52.1	-50.5	1.9	9.3	-45.25	-20	-25.25
2580.3	50.1	-52.2	2.0	9.7	-46.55	-20	-26.55
3010.3	54.5	-46.2	2.2	9.5	-40.95	-20	-20.95
3440.3	48.1	-51.0	2.3	9.7	-45.75	-20	-25.75
4300	47.8	-49.7	2.6	10.6	-43.85	-20	-23.85
4730	43.7	-52.7	2.8	10.8	-46.75	-20	-26.75
5160.5	43.3	-51.5	2.9	10.5	-46.05	-20	-26.05
5929.8	41.4	-51.0	3.1	11.2	-45.05	-20	-25.05
Transmit Mode @ 430MHz							

Spurious Radiated Emissions (1 GHz - 18 GHz) - Vertical

Freq.	Raw Amplitude	Sig Gen	Cable Loss	Antenna Sub Gain	ERP	Limit	Margin
MHz	(dBuV/m)	dBm	dB	dBi	dBm	dBm	dB
1290	48.8	-55.6	1.3	7.1	-51.75	-20	-31.75
1720	46.2	-58.3	1.5	8.4	-53.55	-20	-33.55
1854.5	45.6	-56.3	1.6	6.5	-53.55	-20	-33.55
2150.3	44.8	-56.6	1.7	8.7	-51.85	-20	-31.85
2432	54.5	-48.1	1.9	9.3	-42.85	-20	-22.85
2436	54.5	-48.1	1.9	9.3	-42.85	-20	-22.85
2580	47.8	-54.5	2.0	9.7	-48.85	-20	-28.85
3010.3	57.2	-43.5	2.2	9.5	-38.25	-20	-18.25
3440	47.3	-51.8	2.3	9.7	-46.55	-20	-26.55
4300	51.2	-46.3	2.6	10.6	-40.45	-20	-20.45
4730.3	46	-50.4	2.8	10.8	-44.45	-20	-24.45
5160.3	47.4	-47.4	2.9	10.5	-41.95	-20	-21.95
5590.5	45.4	-47.7	3.0	11.0	-41.75	-20	-21.75
Transmit Mode @ 430MHz							

Result	Complies

3.0 Emission from Digital Parts and Receiver

3.1 Radiated Emission from Digital Parts and Receiver
FCC 15.109, FCC 15.111(a)

3.1.1 Test Limit

Radiated Emission Limit for FCC Part 15 Subpart B and ICES 003

Radiated Emission Limits for Class A at 10 meters	
Frequency (MHz)	**Quasi-Peak limits, dB (μV/m)**
30 to 88	39.1
88 to 216	43.5
216 to 960	46.4
960 and up	49.5
Radiated Emission Limits for Class B at 3 meters	
Frequency (MHz)	**Quasi-Peak limits, dB (μV/m)**
30 to 88	40.0
88 to 216	43.5
216 to 960	46.0
960 and up	54.0

3.1.2 Test Procedure

Measurements are conducted with a quasi-peak detector instrument in the frequency range of 30 MHz to 1000 MHz and with the average detector instrument in the frequency range above 1000 MHz. The measuring receiver meets the requirements of Section One of CISPR 16 and the measuring antenna correlates to a balanced dipole.

Measurements of the radiated field are made with the antenna located at a distance of 10 meters from the EUT. If the field-strength measurements at 10m cannot be made because of high ambient noise level or for other reasons, measurements of Class B equipment may be made at a closer distance, for example 3m. An inverse proportionality factor of 20 dB per decade should be used to normalize the measured data to the specified distance for determining compliance.

The antenna is adjusted between 1m and 4m in height above the ground plane for maximum meter reading at each test frequency.

The antenna-to-EUT azimuth is varied during the measurement to find the maximum field-strength readings.

The antenna-to-EUT polarization (horizontal and vertical) is varied during the measurements to find the maximum field-strength readings.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for a larger EUT.

Floor standing EUTs are placed on a horizontal metal ground plane and isolated from the ground plane by 3 to 12 mm of insulating material.

Equipment setup for radiated disturbance tests followed the guidelines of ANSI C63.4.

Example Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor. Then by subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

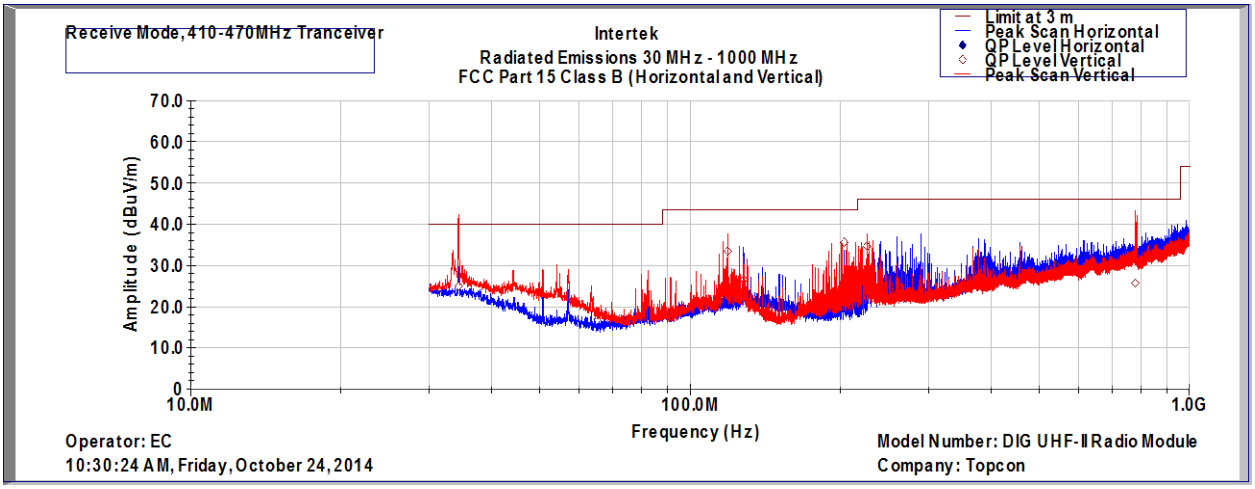
FS = RA + AF + CF – PA

Where FS = Field Strength in dB (μV/m)
RA = Receiver Amplitude (including preamplifier) in dB (μV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB (1/m)
PA= Preamplifier Factor in dB

Assume a receiver reading of 52.0 dB (μV) is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving field strength of 32 dB (μV/m).

RA = 52.0 dB (μV)
AF = 7.4 dB (1/m)
CF = 1.6 dB
PA = 29.0 dB
FS = RF + AF + CF – PA
FS = 52.0 + 7.4 + 1.6 – 29.0
FS = 32 dB (μV/m)

3.1.3 Test Results



Intertek Testing Services
Radiated Emissions 30 MHz - 1000 MHz
FCC Part 15 Class B (QP-Vertical)
Operator: EC Model Number: DUHF II

10:30:24 AM, Friday, October 24, 2014 Company: Topcon

Frequency	Quasi Pk FS	Limit@3m	Margin	RA	Cable	AG	DCF	AF	Azimuth	Height
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB	dB(1/m)	deg	cm
34.4	25.0	40.0	-15.0	28.6	0.7	32.1	10.5	17.3	0	100
118.9	33.5	43.5	-10.0	42.2	1.2	32.0	10.5	11.6	164	100
128.0	26.5	43.5	-17.0	35.2	1.2	32.0	10.5	11.6	228	100
203.5	35.6	43.5	-7.9	45.8	1.3	32.0	10.5	10.0	153	100
226.0	34.7	46.0	-11.3	43.1	1.4	32.0	10.5	11.6	287	100
779.0	25.7	46.0	-20.3	23.3	3.2	32.1	10.5	20.8	0	100

Receive Mode, 410-470MHz Tranceiver

Result	Complies by 7.9 dB

4.0 List of Test Equipment

Equipment	Manufacturer	Model/Type	Serial #	Cal Int	Cal Due
Spectrum Analyzer	Rohde & Schwarz	FSU	200482	12	12/11/14
Bi-Log Antenna	Teseq	CBL 6111D	31222	12	11/14/14
Horn Antenna	ETS-Lindgren	3115	00126795	12	11/14/14
Pre-Amplifier	Sonoma Instrument	310	185634	12	12/20/14
Pre-Amplifier	Miteq	AMF-4D-001180-24-10P	799159	12	10/01/15

5.0 Document History

Revision/ Job Number	Writer Initials	Date	Change
1.0 / 101844508	OM	December 28, 2014	Original document