

Test Report

INTENTIONAL RADIATOR TESTS ACCORDING TO FCC PART 15 C and INDUSTRY CANADA REQUIREMENTS

Equipment Under Test: 2.4 GHz Transceiver

Type/ Model: G5 RF10 Display, G5 RF12, G5 RF12 Display,
G5 RF14 and G5 RF14 Display

Manufacturer: Scanreco AB
Årsta Skolgränd 22
SE-47144 Stockholm
SWEDEN

Customer: Scanreco AB
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SE-47144 Stockholm
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FCC Rule Part: 15.247

Date: June 3, 2015

Issued by:


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Date: June 3, 2015

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Equipment Under Test (EUT)

Wireless Radio
Type/ Model: G5 RF14 Display
Serial Number: 1675

G5 RF14 Display, is a 2.4 GHz radio that supports frequency hopping.

This report covers models G5 RF10, G5 RF10 Display, G5 RF12, G5 RF12 Display, G5 RF14 and G5 RF14 Display. Electrical structure is similar in all models. Only model G5 RF14 Display was tested. The test results of G5 RF14 Display are sufficient also for models G5 RF10 Display, G5 RF12, G5 RF12 Display and G5 RF14, G5 RF14 Display.

Classification of the device

Fixed device	☐
Mobile Device (Human body distance > 20cm)	☒
Portable Device (Human body distance < 20cm)	☐

Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

Ratings and declarations

Operating Frequency Range (OFR): 2405 – 2480 MHz
Channels: 16
Channel separation: 5 MHz
Conducted power: 19.25 dBm
Transmission technique: FHSS
Modulation: GFSK
Integrated antenna gain: 0 dBi

Power Supply

The following wall charger was used during the tests (supplied with 115 V/ 60 Hz).

Charger:

Manufacturer: CMP
Model: S008CM0900090FW7600/05
Serial number: -
Input voltage: 100-240V AC
Rated current: 250mA
Rated frequency: 50/60Hz
Output current: 900mA

Adapter Scanreco Part Nr: 51070

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Disclaimer

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SUMMARY OF TESTING

Test Specification	Description of Test	Result
§15.207(a)	Conducted Emissions on Power Supply Lines	PASS
§15.209(a), §15.247(d)	Radiated Emissions Within The Restricted Bands	PASS
§15.209	Unintentional Radiated Emissions	PASS

EUT Test Conditions during Testing

The EUT was configured into the wanted channel and was in continuous transmit mode during all the tests.

Following channels were used during the tests:

Channel	Frequency/ MHz
LOW	2405
MID	2440
HIGH	2480

Test Facility

☐	Testing Location / address: FCC registration number: 90598	SGS Fimko Ltd Särkiniementie 3 FI-00210, HELSINKI FINLAND
☒	Testing Location / address: FCC registration number: 178986 Industry Canada registration number: 8708A-2	SGS Fimko Ltd Karakaarenkuja 4 FI-02610, ESPOO FINLAND

Conducted Emissions In The Frequency Range 150 kHz – 30 MHz

Conducted Emissions In The Frequency Range 150 kHz - 30 MHz.

Standard: ANSI C63.10 (2009)
Tested by: PKA
Date: 18.05.2015
Temperature: 20 °C
Humidity: 37 % RH
Barometric pressure: 1004 hPa
Measurement uncertainty: ± 2.9 dB

Level of confidence 95 % (k = 2)

FCC Rule: 15.207 (a)

Conducted disturbance voltage was measured with an artificial main network from 150 kHz to 30 MHz with 4.5 kHz steps and a resolution bandwidth of 9 kHz. Measurements were carried out with peak and average detectors.

During the test the EUT was powered from the separate power supply (115VAC / 60 Hz) through the LISN.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

Conducted Emissions In The Frequency Range 150 kHz – 30 MHz

Final results 0.15 – 30 MHz: MID channel

Conducted Emission Mains FCC Part 15 Class B with ESH3-Z5 8019

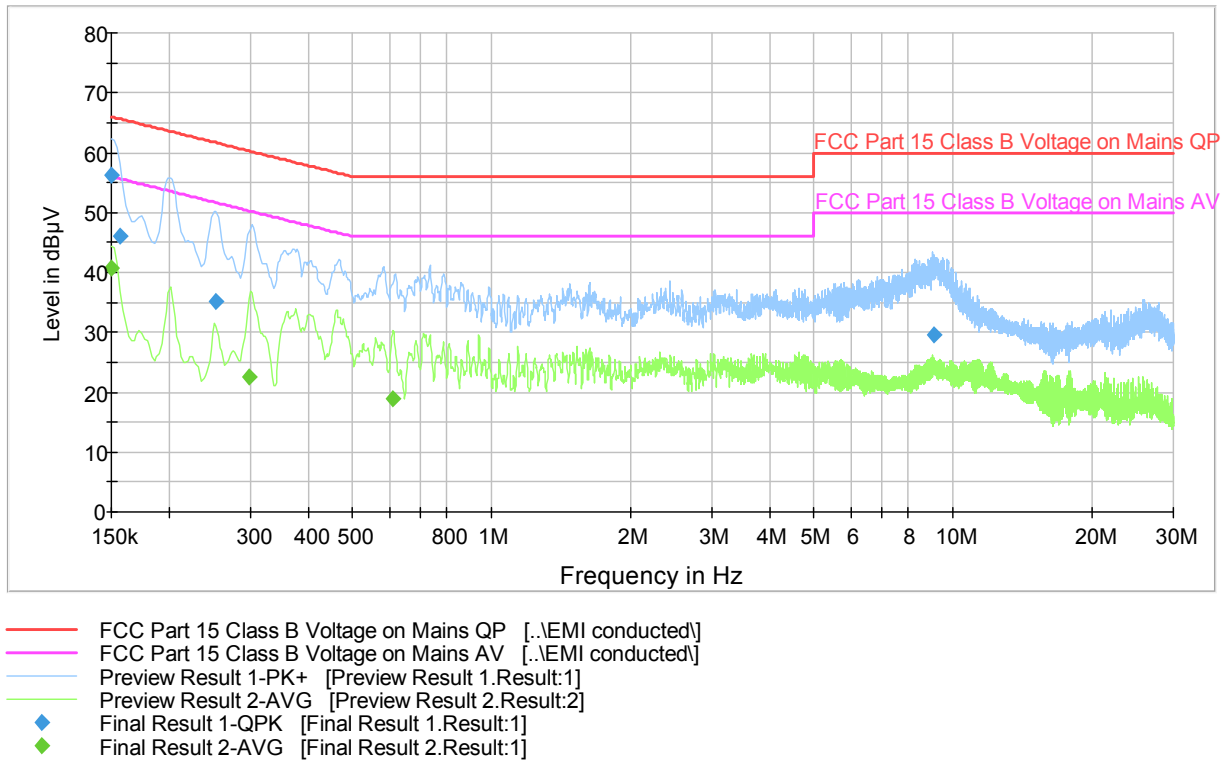


Figure 1. The measured curves with peak- and average detector

Final measurements from the worst frequencies

Table 1. Final results (QP).

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.150000	56.2	1000.0	9.000	GN	L1	10.7	9.8	66.0	PASS
0.156750	46.1	1000.0	9.000	GN	N	10.7	19.6	65.6	PASS
0.253500	35.3	1000.0	9.000	GN	N	10.8	26.4	61.6	PASS
9.055000	29.5	1000.0	9.000	GN	N	10.9	30.5	60.0	PASS

Table 2. Final results (AV).

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.150000	40.8	1000.0	9.000	GN	N	10.6	15.2	56.0	PASS
0.298500	22.6	1000.0	9.000	GN	N	10.5	27.7	50.3	PASS
0.609000	19.0	1000.0	9.000	GN	N	10.1	27.0	46.0	PASS

Transmitter Radiated Emissions 30 MHz to 26.5 GHz**Transmitter Radiated Emissions 30 MHz to 26.5 GHz**

Standard:	ANSI C63.10	(2009)
Tested by:	PKAE	
Date:	18.05.2015	
Temperature:	20 °C	
Humidity:	37 % RH	
Measurement uncertainty	± 4.51 dB	Level of confidence 95 % (k = 2)

FCC Rule: 15.247(d), 15.209(a)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

The correction factor in the final result table contains the sum of the transducers (antenna + amplifier + cables). The result value is the measured value corrected with the correction factor.

The measurements above 1 GHz were performed by using a peak detector and a Duty Cycle correction factor(dB) -25.19 dB, see chapter: Duty cycle correction factor, Transmit time in 100 ms.

The measurements were performed with the EUT being in three orthogonal positions (X, Y, Z). Below 1 GHz the measurements were performed at MID channel, above 1 GHz the measurements were performed at LOW, MID and HIGH channels..

Transmitter Radiated Emissions 30 MHz to 26.5 GHz

Final results 30 – 1000 MHz: MID channel

Radiated Emission FCC Part 15 Class B 30-1000MHz 3m

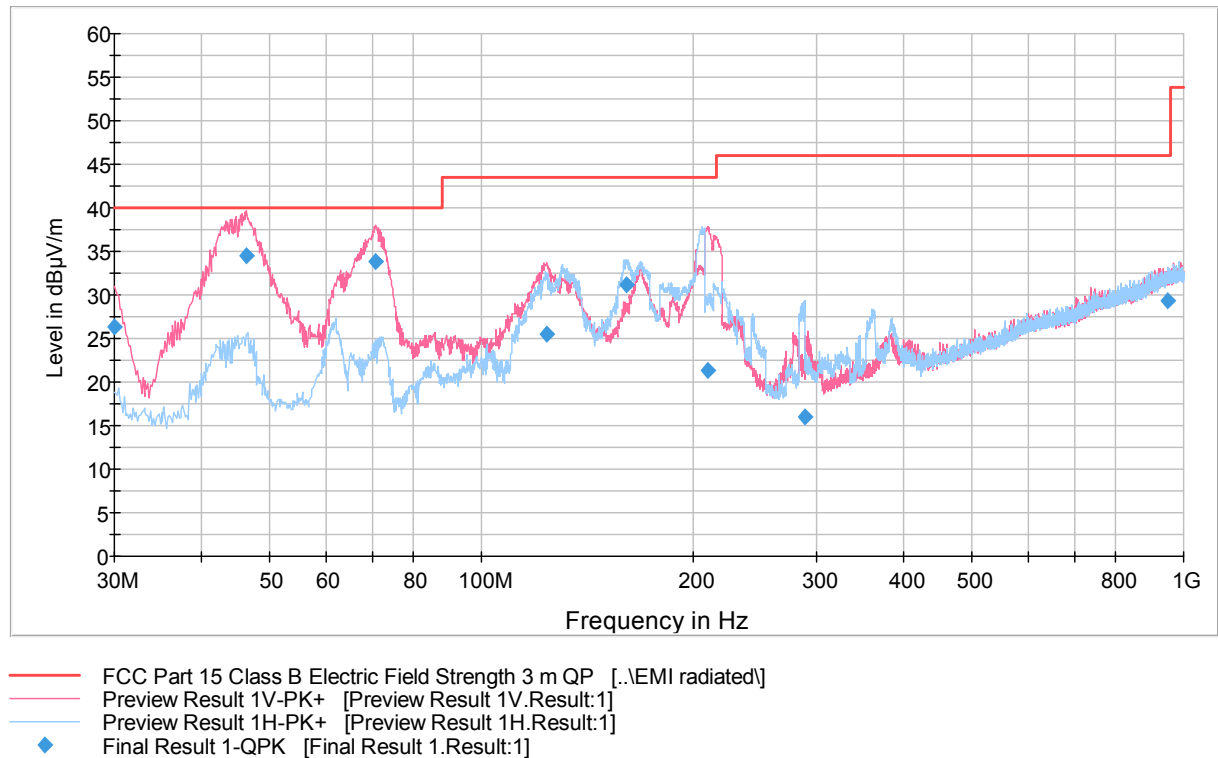


Figure 2. Measured curve with peak-detector. Channel MID.

Final measurements from the worst frequencies

Table 3. Final results 30 – 1000 MHz (QP).

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
30.020000	26.3	1000.0	120.000	100.0	V	122.0	12.9	13.7	40.0	PASS
46.295000	34.5	1000.0	120.000	100.0	V	47.0	14.5	5.5	40.0	PASS
70.645000	33.8	1000.0	120.000	100.0	V	222.0	12.3	6.2	40.0	PASS
123.925000	25.4	1000.0	120.000	100.0	V	55.0	12.7	18.1	43.5	PASS
161.245000	31.2	1000.0	120.000	175.0	H	279.0	14.4	12.3	43.5	PASS
210.305000	21.4	1000.0	120.000	193.0	V	50.0	11.4	22.1	43.5	PASS
288.805000	16.0	1000.0	120.000	100.0	H	323.0	14.9	30.0	46.0	PASS
948.135000	29.3	1000.0	120.000	304.0	H	251.0	27.5	16.7	46.0	PASS

Transmitter Radiated Emissions 30 MHz to 26.5 GHz

Final results 1.0 – 26.5 GHz:

Table 4. LOW channel (RBW 1000 kHz, VBW 3000 kHz)

Frequency (MHz)	Peak			Average		
	Result (dB μ V/m)	Limit (dB μ V/m)	Margin dB	Result (dB μ V/m)	Limit (dB μ V/m)	Margin dB
7214.1	65.2	74.0	8.8	40.0	54.0	14.0
9618.8	70.3	74.0	3.7	45.1	54.0	8.9

Table 5. MID channel (RBW 1000 kHz, VBW 3000 kHz)

Frequency (MHz)	Peak			Average		
	Result (dB μ V/m)	Limit (dB μ V/m)	Margin dB	Result (dB μ V/m)	Limit (dB μ V/m)	Margin dB
7319.1	65.9	74.0	8.1	40.7	54.0	13.3
9758.8	66.5	74.0	7.5	41.3	54.0	12.7

Table 6. HIGH channel (RBW 1000 kHz, VBW 3000 kHz)

Frequency (MHz)	Peak			Average		
	Result (dB μ V/m)	Limit (dB μ V/m)	Margin dB	Result (dB μ V/m)	Limit (dB μ V/m)	Margin dB
7439.1	66.1	74.0	7.9	40.9	54.0	13.9
9918.8	68.1	74.0	5.9	42.9	54.0	11.1

Duty cycle correction factor, Transmit time in 100 ms

Standard:	ANSI C63.10	(2009)
Tested by:	PKA	
Date:	18.05.2013	
Temperature:	20 °C	
Humidity:	37 % RH	

Spectrum analyzer with zero span was used to investigate spectrum.

15.35(c) Unless otherwise specified, e.g. § 15.255(b), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

Test data

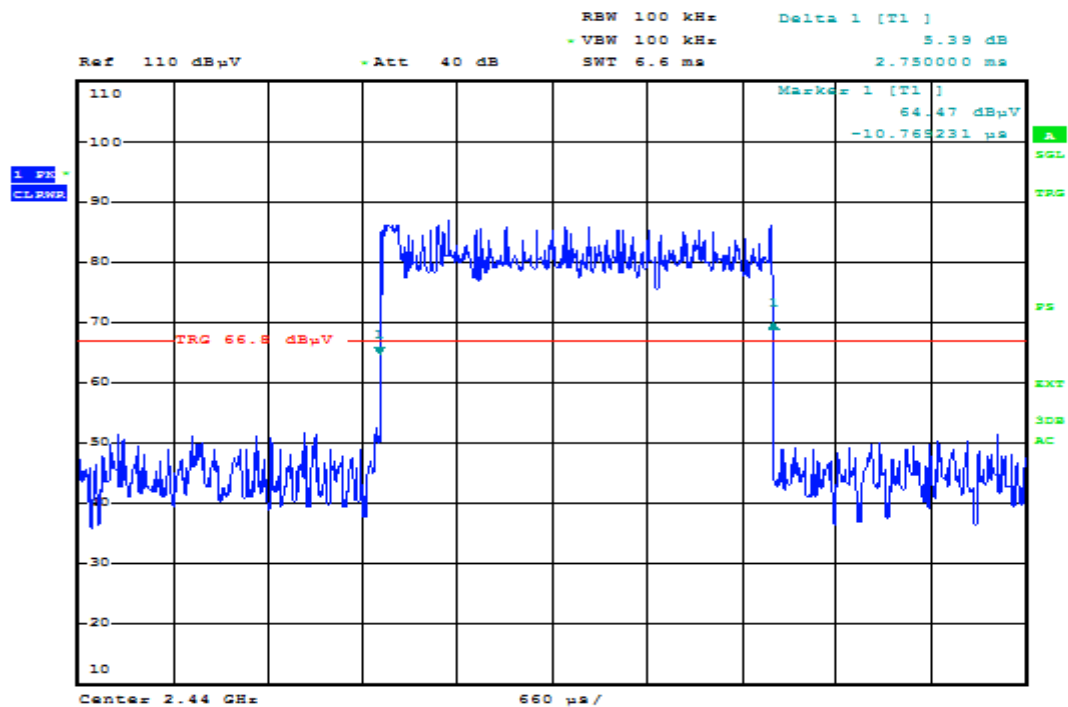
Pulse period (T) = 6.4s/89=71.9ms

Pulses/100ms=2

Length of one pulse = 2.750ms

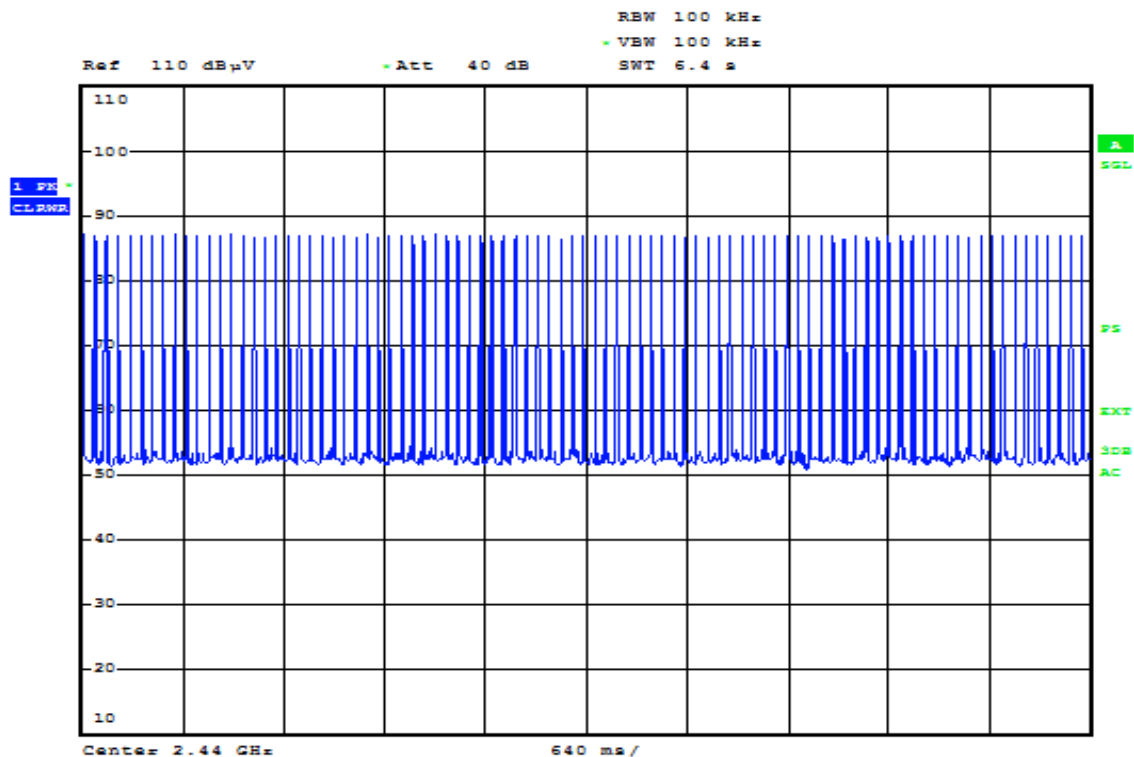
DutyCycleCorrectionFactor=20*log(Tocc/100)=20*log(2*2.750/100)=-25.19dB

Duty cycle correction factor, Transmit time in 100 ms



Date: 18.MAY.2015 15:15:28

Figure 3. One channel dwell time.



Date: 18.MAY.2015 15:10:46

Figure 4. Hopping on, number of transmissions, channel 2440MHz, 89 transmissions

LIST OF TEST EQUIPMENT
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Conducted Emissions

Equipment	Manufacturer	Type	Serial no	Inv.no
TEST RECEIVER	ROHDE & SCHWARZ	ESU 26	100185	8453
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	-
PULSE LIMITER	ROHDE & SCHWARZ	ESH3-Z2	#1	8359
LISN	ROHDE & SCHWARZ	ESH3-Z5	863794/014	8019
AC Power Source	CALIFORNIA INSTRUMENTS	5001 iX Series II	58209	7826

Radiated Emissions

Equipment	Manufacturer	Type	Serial no	Inv.no
TEST RECEIVER	ROHDE & SCHWARZ	ESU 26	100185	8453
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	-
ANTENNA (30-1000 MHz)	SCHWARZBECK	VULB 9168	8168-503	8911
ANTENNA MAST	DEISEL	MA240	240/455	5017
TURNTABLE	DEISEL	DS420	-	5015
CONTROLLER	COMTEST	HD100	100/457	5018
ANTENNA (1-18 GHz)	EMCO	3117	29617	7293
PREAMPLIFIER (0.5-26GHz)	HP	83017A	3950M00102	5226
ATTENUATOR 10 dB	HUBER & SUHNER	6810.17B	-	-
HIGH PASS FILTER	WAINWRIGHT	WHKX	10	8267
ANTENNA (18-26.5 GHz)	EMCO	3160- 09	030232-022	7294

All used measurement equipment was calibrated (if required).