

Test Report

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

Equipment Under Test: 2.4 GHz Transceiver

Type/ Model: DRC-DR D3

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

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

FCC Rule Part: 15.247: 2012
IC Rule Part: RSS-210, Issue 8, 2010
RSS-GEN Issue 4, 2014

KDB: Filing and Measurement Guidelines for
Frequency Hopping Spread Spectrum Systems
DA 00-705 (March 30, 2000)

Date: February 6, 2015

Issued by:



Timo Hietala
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Date: February 6, 2015

Checked by:



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Equipment Under Test (EUT)

Wireless System-on-Module
 Type/ Model: DRC-DR D3
 Serial Number: -

DRC-DR D3 is a 2.4 GHz radio module that supports frequency hopping.

The sample had an antenna connector and an external antenna.

Conducted measurements were made with the sample having an external antenna. Measurements were made from the antenna connector (SMA).

Classification of the device

Fixed device	<input type="checkbox"/>
Mobile Device (Human body distance > 20cm)	<input checked="" type="checkbox"/>
Portable Device (Human body distance < 20cm)	<input type="checkbox"/>

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: 19.84 dBm
 Transmission technique: FHSS
 Modulation: GFSK
 Integrated antenna gain: -
 External antenna gain: 4.0 dBi

Power Supply

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

Charger:

Manufacturer: Friwo Mobile Power GmbH
 Model: FW7600/05
 Serial number: -
 Input voltage: 100-240 VAC
 Rated current: 0.09A max
 Rated frequency: 50-60 Hz
 Output voltage: 5 V DC
 Output current: 0.65A max

Disclaimer

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SUMMARY OF TESTING

Test Specification	Description of Test	Result
15.247(a)(1) / RSS-210 A8.1	Hopping Channel Carrier Frequency Separation	PASS
§15.247(a)(1)(iii) / RSS-210 A8.1	Number of Hopping Frequencies	PASS
§15.247(a)(1)(iii) / RSS-210 A8.1	Average Time of Occupancy of Hopping Frequency	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

<input type="checkbox"/> Testing Location / address: FCC registration number: 90598	SGS Fimko Ltd Särkiniementie 3 FI-00210, HELSINKI FINLAND
<input checked="" type="checkbox"/> Testing Location / address: FCC registration number: 178986 Industry Canada registration number: 8708A-2	SGS Fimko Ltd Karakaarenkuja 4 FI-02610, ESPOO FINLAND

Hopping Channel Carrier Frequencies Separation

Standard: ANSI C63.10 (2013)
Tested by: PKA
Date: 31.10.2014
Temperature: 22.7 °C
Humidity: 37 % RH

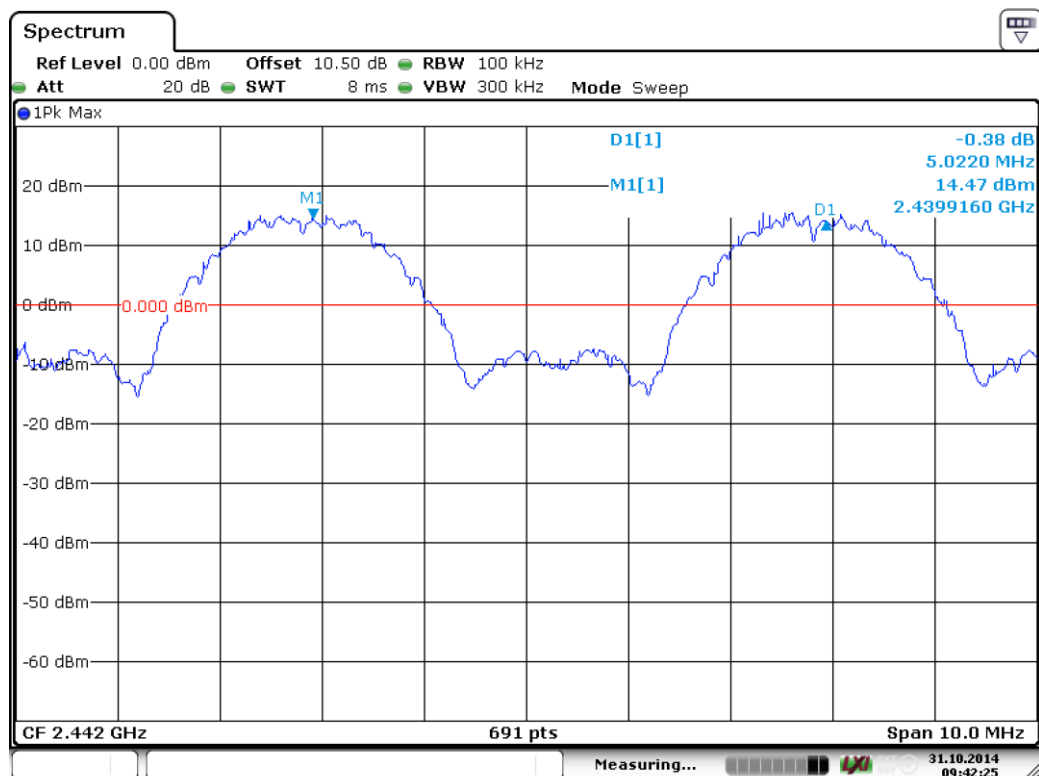
FCC Rule: 15.247(a)(1)

Frequency hopping systems with an output power less than 125mW shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or 2/3 of the 20 dB bandwidth of the hopping channel, whichever is greater.

Test result

Table 1. Hopping channel carrier frequencies separation test result.

Data rate	Measured separation	Measured 20 dB BW	Limit	Result
1 Mbps	5.022 MHz	2.822 MHz	1.881 MHz	PASS
Limit:	25 kHz or 2/3 of the 20 dB bandwidth of the hopping channel whichever is greater			



Date: 31.OCT.2014 09:42:25

Figure 1. Measured hopping channels carrier frequency separation.

Number of Hopping Channels

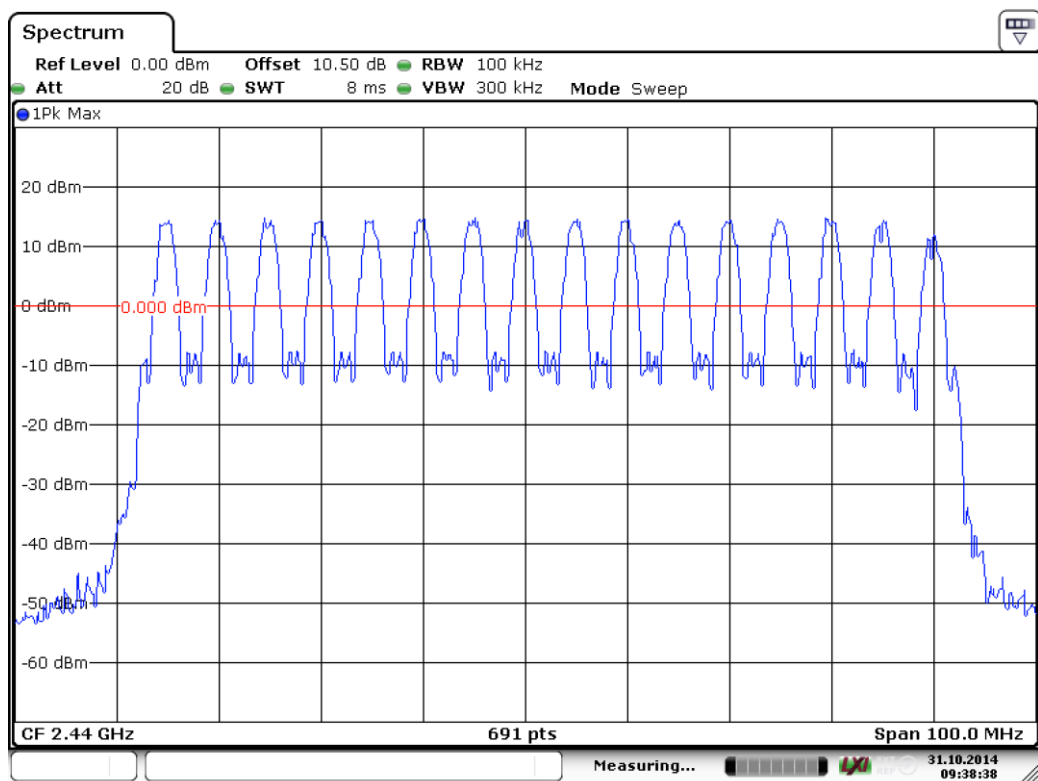
Standard: ANSI C63.10 (2013)
Tested by: PKA
Date: 31.10.2014
Temperature: 22.7 °C / 23.1 °C
Humidity: 37 % / 38 % RH

FCC Rule: 15.247(a)(1)(iii)

For frequency hopping systems operating in the 2400 – 2483.5 MHz band shall use at least 15 channels.

Channels measured: 16

Result: PASS



Date: 31.OCT.2014 09:38:37

Figure 2. 16 channels.

Average Time of Occupancy of Hopping Frequency

Standard: ANSI C63.10 (2013)
Tested by: PKA
Date: 31.10.2014
Temperature: 22.7 °C
Humidity: 37 % RH

FCC Rule: 15.247(a)(1)(iii)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Time of occupancy calculation:

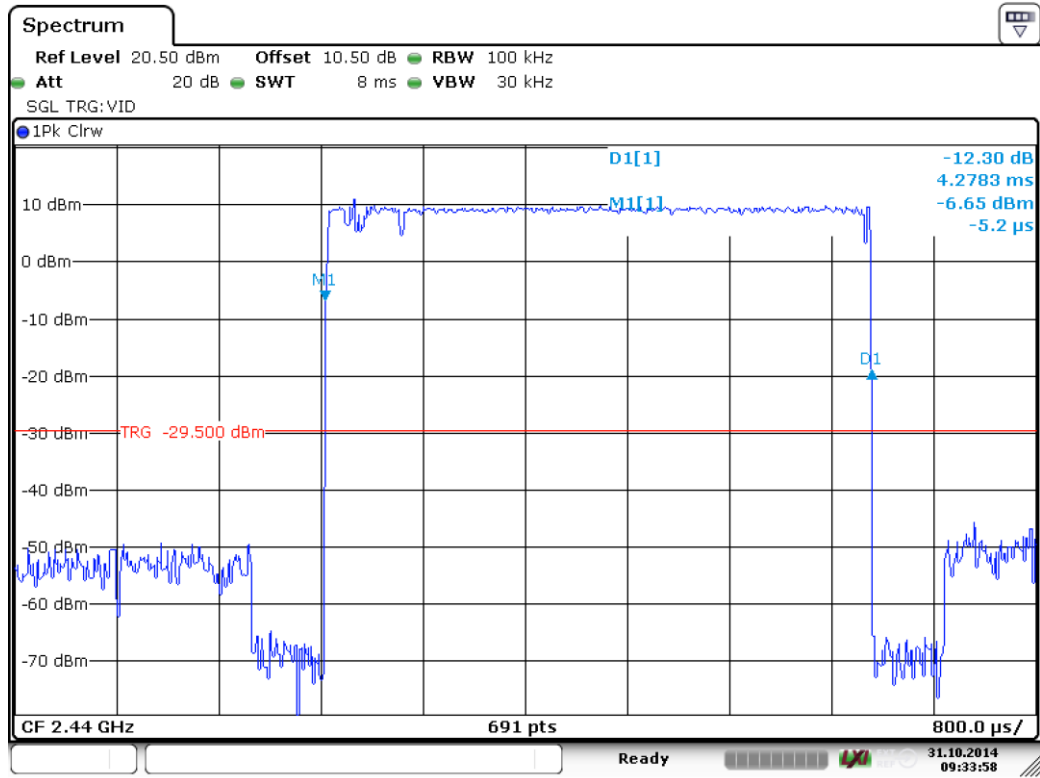
Number of channels = 16

Measurement period = 0.4 s x 16 = 6.4 s

Number of transmission cycles in measurement period = 83

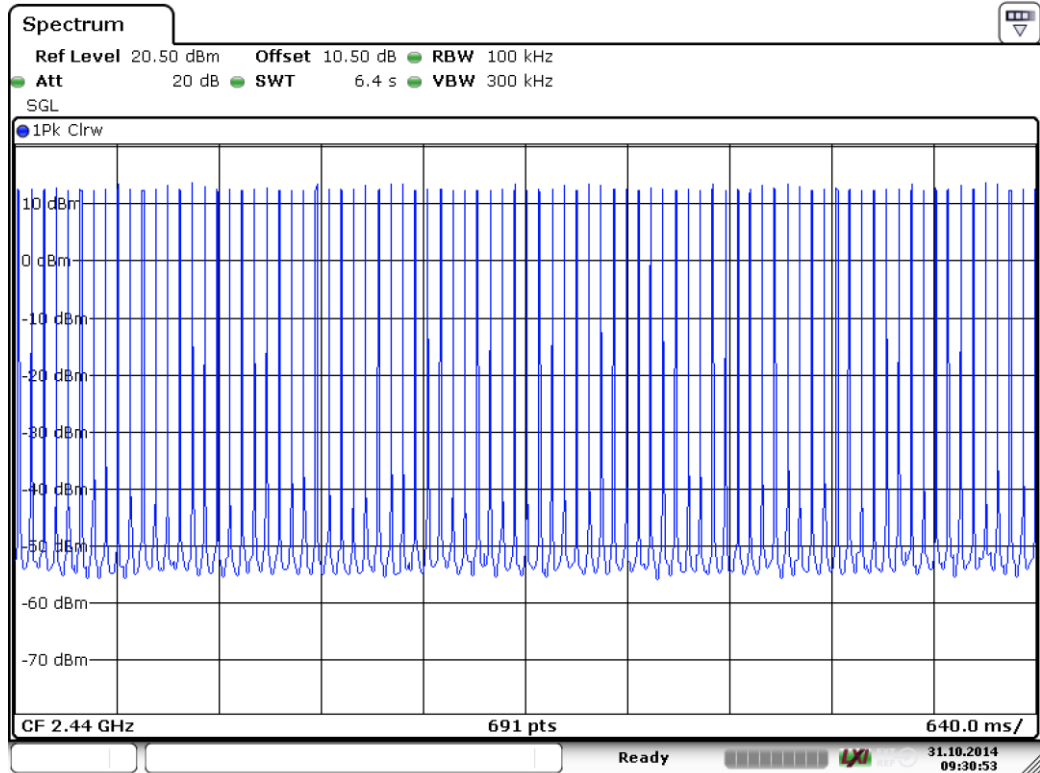
Time of occupancy = (single duration) x (repetition) = 4.2783 ms x 83 times = 355.1 ms

Average Time of Occupancy of Hopping Frequency



Date: 31.OCT.2014 09:33:58

Figure 3. One channel dwell time.



Date: 31.OCT.2014 09:30:53

Figure 4. Hopping on, number of transmissions, channel 2440MHz, 83 transmissions

Duty cycle correction factor, Transmit time in 100 ms

Standard: ANSI C63.10 (2013)
Tested by: PKA
Date: 31.10.2014
Temperature: 22.7 °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) = $6.4\text{s}/83=77.1\text{ms}$

Pulses/100ms=2

Length of one pulse = 4.278ms

DutyCycleCorrectionFactor = $20 \cdot \log(T_{\text{occ}}/100) = 20 \cdot \log(2 \cdot 4.278/100) = -21.35\text{dB}$

LIST OF TEST EQUIPMENT
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
AC Power Source	CALIFORNIA INSTRUMENTS	5001 iX Series II	58209	7826

All used measurement equipment was calibrated (if required).