EMCC™ DR. RAŠEK

TEST REPORT # EMCC-140157ACAB, 2015-08-07

This report replaces Test Report # EMCC-140157ACA, 2015-07-14

EQUIPMENT UNDER TEST:

Trade Name:	RFID Module
Type Designation(s):	B40420
Serial Number:	Sample #1: 0086 14/26 Sample #3: 0095 14/26 Sample #7: 0023 14/26
Equipment Class:	Low Power Transceiver
Manufacturer:	Beckman Coulter Biomedical GmbH
Address:	Sauerbruchstraße 50 81377 München Germany
Phone:	+49 89 579589-3606
Fax:	+49 89 579589-3505

RELEVANT STANDARD(S): 47 CFR 15.225, RSS-210 Issue 8

MEASUREMENT PROCEDURE:

☒ RSS-Gen Issue 4 ☒ ANSI C63.10-2013 ☒ KDB 174176 D01

TEST REPORT PREPARED BY:

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HEAD OF COMMERCIAL EMC AND RADIO DEPT.:

Wolfgang Döring

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1 GENERAL INFORMATION

1.1 Purpose

The purpose of this report is to show compliance with the 47 CFR 15.225 and Industry Canada RSS-210 requirements for the certification of licence-exempt 15C Intentional Radiator.

1.2 Limits and Reservations

The test results in this report apply only to the particular equipment under test (EUT) as declared in this report. This test report shall not be reproduced except in full without the written permission of EMCCons DR. RAŠEK GmbH & Co. KG.

1.3 Test Location

Test Laboratory:	EMCCons DR. RAŠEK GmbH & Co. KG
Accreditation No.:	D-PL-12067-01-00
Address of Labs I, II, III and Head Office:	EMCCons DR. RAŠEK GmbH & Co. KG Moggast, Boelwiese 8 91320 Ebermannstadt GERMANY
Address of Labs IV and V:	EMCCons DR. RAŠEK GmbH & Co. KG Stoernhofer Berg 15 91364 Unterleinleiter GERMANY
Laboratory:	Test Laboratory IV The 3 m & 10 m semi-anechoic chamber site has been fully described in a report submitted to the FCC and accepted in the letter dated December 24, 2013, Registration Number 878769. This 3 m & 10 m alternative test site is approved by Industry Canada under file number 3464C-1.
Phone:	+49 9194 9016
Fax:	+49 9194 8125
E-Mail:	emc.cons@emcc.de
Web:	www.emcc.de

1.4 Manufacturer

Company Name:	Beckman Coulter Biomedical GmbH
Street:	Sauerbruchstraße 50
City:	81377 München
Country:	Germany
Name for contact purposes:	Mr Ciprian Coroina-Széllyes
Phone:	+49 89 579589-3606
Fax:	+49 89 579589-3505
E-Mail:	ccoroian@beckman.com

1.5 Dates and Test Location

Date of receipt of EUT: 2015-04-17
Test Date: CW 17, 20, 21 and 27/2015
Test Location: Lab IV

1.6 Ordering Information

Purchase Order and Date: 22402305, 2015-03-11
Vendor Number: 99832

1.7 Climatic Conditions

Date	Temperature [°C]	Relative Humidity [%]	Air Pressure [hPa]	Lab	Customer attended tests
2015-04-21	24	28	987	IV	no
2015-05-12	25	38	978	IV	no
2015-05-19	25	36	968	IV	no
2015-05-20	25	35	972	IV	no
2015-05-22	24	31	984	IV	no
2015-07-03	28	47	984	IV	no

2 PRODUCT DESCRIPTION

2.1 Equipment Under Test (EUT)

Trade Name:	RFID Module
Type Designation(s):	B40420
Serial Number(s):	Sample #1: 0086 14/26 Sample #3: 0095 14/26 Sample #7: 0023 14/26
FCC ID:	2AEGN-B40420
Industry Canada Certification Number:	IC: 20032-B40420
Application:	Low Power Transceiver
Transmit Frequency:	13.56 MHz
Modulation:	Load modulation
Emission Designator:	3K53A1D
Power Supply:	5 VDC
Ports:	Signal and supply - 8 pole connector
Antennas:	Integrated loop antenna
HVIN (Hardware Version Identification Number)	B40420 (as stated by customer)
FVIN (Firmware Version Identification Number)	0.7 (as stated by customer)
Variants:	None
Remarks:	None

Sample #1 was used for conducted emission test, spectrum mask occupied bandwidth and radiated emission test.

Sample #3 was used for frequency stability test.

Sample #7 was equipped with dummy load and was used for conducted emission test.

2.2 Intended Use

The EUT is RFID transceiver board for reading and writing up to 15 RFID tags.

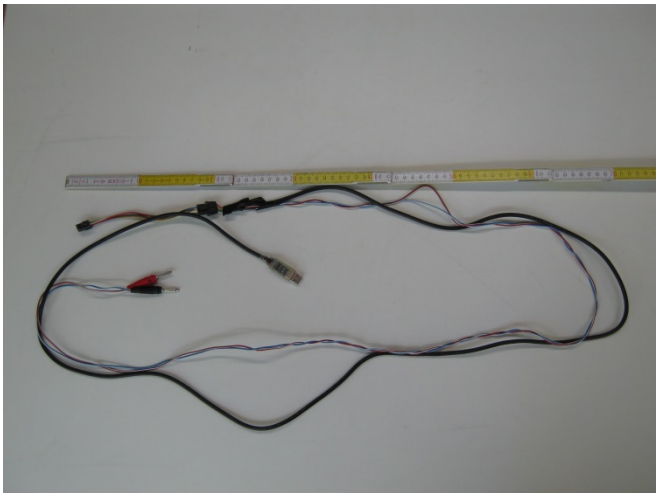
2.3 EUT Peripherals/Simulators

The EUT was tested connected with

- Power supply HAMEG 7042-3
- Extension cable with USB connector, and banana connectors for the power supply
- Laptop with testsoftware to execute commands on the EUT, e.g. to read RFID tags.
- RFID tags

The above listed equipment was provided by customer.

Photograph 2.3-1: Power supply HAMEG 7042-3



Photograph 2.3-2: Extension cable with USB and DC connectors

Photograph 2.3-3: Laptop with test software

Photograph 2.3-4: RFID tags used for testing

2.4 Mode of operation during testing and test set-up

The equipment under test (EUT) was operated during the tests under the following conditions:

Normal operation:
The EUT was connected to a Laptop with test software. The test software executed a script that did send a “get inventory” command to the EUT.

Under normal test conditions the EUT was connected with an extension cable. The extension cable was connected to the HAMEG 7042-3 power supply delivered by the customer. The USB connector of the extension cable was connected to the laptop provided by the customer. The test software on the laptop did execute a script that did send repetitively a “get_inventory” command to the EUT.

For the radiated emission test the laptop was operated on the groundplane, below the table.

Continuous TX:
The EUT Sample #3 had a test firmware that did transmit a continuous wave signal when powered on. Sample #3 was used for tests of frequency stability against variation of supply voltage and temperature.

2.5 Modifications required for compliance

None.

3 TEST RESULTS SUMMARY

Summary of test results for the following EUT:

Manufacturer: Beckman Coulter Biomedical GmbH
Device: RFID Module
Type(s): B40420
Serial No(s): Sample #1: 0086 14/26
Sample #3: 0095 14/26
Sample #7: 0023 14/26

Requirement	RSS, Section	47 CFR Section	Report Section	Result
Antenna Requirement	RSS-Gen, 8.3	15.203	4	Passed Sample #1
Occupied Bandwidth (99%)	RSS-Gen, 6.6		7	Passed Sample #1
Conducted AC Power Line Emissions 150 kHz – 30 MHz	RSS-Gen, 8.8	15.207	5	Passed Sample #7
Spectrum Mask	RSS-210, A2.6	15.225(a)-(d)	6	Passed Sample #1
Radiated Emissions 9 kHz – 30 MHz	RSS-210, A2.6 RSS-Gen, 8.9	15.205, 15.209, 15.225(d)	8	Passed Sample #1
Radiated Emissions 30 MHz – 1000 MHz	RSS-210, A2.6 RSS-Gen, 8.9	15.205, 15.209, 15.225(d)	9	Passed Sample #1
Carrier Frequency Stability	RSS-210, A2.6 RSS-Gen, 6.11, 8.11	15.225(e)	10	Passed Sample #3

N.A. – not applicable; N.T. – Not tested acc. to applicant's order.

The client has made the determination that EUT Condition, Characterization, and Mode of Operation are representative of production units and meet the requirements of the specifications referenced herein. Consistent with Industry practice, measurement and test equipment not directly involved in obtaining measurement results but having an impact on measurements (such as cable loss, antenna factors, etc.) are factored into the "Correction Factor" documented in certain test results. Instrumentation employed for testing meets tolerances consistent with known Industry Standards and Regulations.
The measurements contained in this report were made in accordance with the procedures described in ANSI C63.10-2013 and RSS-Gen Issue 4.
All requirements were found to be within the limits outlined in this report.
The test results in this report apply only to the particular equipment under test (EUT) as declared in this report.

Test Personnel: Ludwig Kraft
Issuance Date: 2015-08-07

4 ANTENNA REQUIREMENT

Test Requirement: 47 CFR 15.203, IC RSS-Gen

4.1 Regulation

FCC 15.203 An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of Part 15C. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221.
Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

IC RSS-Gen: 8.3 Transmitter Antenna for Licence-Exempt Radio Apparatus
The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the licence-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

Licence-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the licence-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level.9 When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

No applicable antenna requirement specified in **RSS-210**.

4.2 Result

EUT is equipped with a permanently attached antenna.

Manufacturer:	Beckman Coulter Biomedical GmbH
Device:	RFID Module
Type(s):	B40420
Serial No(s):	Sample #1 0086 14/26

The EUT meets the requirements of this section.

5 POWER LINE CONDUCTED EMISSIONS TEST

Test Requirement: FCC 47 CFR, §15.207, IC RSS-Gen, 8.8, KDB 174176 D01
Test Procedure: ANSI C63.10-2013, IC RSS-Gen

5.1 Regulation

FCC 15.207 (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

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

*Decreases with the logarithm of the frequency.

(b) The limit shown in paragraph (a) of this section shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz.

In lieu thereof, these carrier current systems shall be subject to the following standards:

(1) For carrier current system containing their fundamental emission within the frequency band 535–1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.

(2) For all other carrier current systems: 1000 μV within the frequency band 535–1705 kHz, as measured using a 50 μH/50 ohms LISN.

(3) Carrier current systems operating below 30 MHz are also subject to the radiated emission limits in § 15.205, § 15.209, § 15.221, § 15.223, or § 15.227, as appropriate.

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provisions for, the use of battery chargers which permit operating while charging, AC adapters or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

IC RSS-Gen: 8.8 AC Power Line Conducted Emissions Limits for Licence-Exempt Radio Apparatus
A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz-30 MHz, shall not exceed the limits in Table 3.
Unless the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply either directly or indirectly (such as with a battery charger), the radio frequency voltage of emissions conducted back onto the AC power lines in the

frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in Table 3 below. The more stringent limit applies at the frequency range boundaries.
The conducted emissions shall be measured in accordance with the reference publication mentioned in Section 3.
Table 3 – AC Power Line Conducted Emissions Limits

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

*Decreases with the logarithm of the frequency.
**A linear average detector is required.

→ The IC limits are equal to the FCC limits.

KDB 174176 D01 Line Conducted FAQ v01r01
Q5. How should the RF power output port of a Part 15 intentional radiator be configured when making AC power-line conducted emissions measurements?
The method used for AC power-line conducted measurements with suitable dummy loads will differ for detachable and non-detachable antennas, depending on whether the operating frequency is above or below 30 MHz.
A suitable dummy load is a radio frequency termination used in place of the antenna, which has the same electrical properties as the intended antenna without radiated emissions. A device with a suitable dummy load must supply identical signals to the dummy load, as it would if an antenna were connected. In the test report, results obtained using a suitable dummy antenna shall be so noted.
Devices Operating Above 30 MHz
For a device with a permanent or detachable antenna operating above 30 MHz, measurements must be performed with the antenna connected as specified in clause 6.2 of ANSI C63.10-2013.
Devices Operating Below 30 MHz
For a device with a permanent or detachable antenna operating at or below 30 MHz, the FCC will accept measurements performed with a suitable dummy load in lieu of the antenna under the following conditions: (1) perform the AC power-line conducted tests with the antenna connected to determine compliance with Section 15.207 limits outside the transmitter's fundamental emission band; (2) retest with a dummy load in lieu of the antenna to determine compliance with Section 15.207 limits within the transmitter's fundamental emission band. For a detachable antenna, remove the antenna and connect a suitable dummy load to the antenna connector. For a permanent antenna, remove the antenna and terminate the RF output with a dummy load or network which simulates the antenna in the fundamental frequency band.
All measurements must be performed as specified in clause 6.2 of ANSI C63.10-2013.

KDB 174176 D01 is accepted by Industry Canada according to the current list of ”List of Federal Communications Commission (FCC) KDB Procedures for RF Measurement accepted by Industry Canada”, (web page date modified 2015-05-29).

5.2 Test Equipment

Type	Manufacturer/ Model No.	EMCC Ident No.	Last Calibration	Next Calibration
EMI Test Receiver	Rohde & Schwarz / ESU8	3846	2014-07	2015-07
V-LISN 50 Ω//(50 uH + 5 Ω)	Rohde & Schwarz / ESH2-Z5	1901	2013-10	2015-10
V-LISN 50 Ω//(50 uH + 5 Ω)	Rohde & Schwarz / ESH-Z5	1470	2013-10	2015-10

Protector Limiter	Rohde & Schwarz / ESH3-Z2	1519	2014-09	2015-09
AC Power Source	AEG	0001	n.a	n.a
Multimeter	Agilent / U1241A	2720	2015-01	2017-01

5.3 Test Procedures

The EUT was placed on a wooden table of nominal size 1 m by 1.5 m, raised 80 cm above the reference groundplane. The vertical conducting wall of the screened room was located 40 cm to the rear of the EUT.
The excess length of the power cord of the ac adapter to the EUT was folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length. The laptop was placed on the wooden table in 10 cm distance and connected to the USB connector of the extension cable. The extension cable was folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length. The power supply of the laptop was connected to a second LISN.
LISN housing, measuring instrument case, reference ground plane and the vertical conducting wall of the screened room was bonded together.

The test was executed with an EUT (Sample #1) with the integrated antennas connected and with an EUT (Sample #7) with dummy loads connected instead of the integrated antennas.

5.4 Test Result

Sample #1 with integrated antennas:

Freq [MHz]	Line	Detector	Result [dBµV]	Limit [dBµV]	Margin
13.560	L	AV	69.5	no limit*	
13.560	L	QP	72.0	no limit*	
13.550	L	AV	42.7	50.0	7.3
13.515	L	QP	46.6	60.0	13.4
2.010	L	AV	26.2	46.0	19.8
1.435	L	AV	25.8	46.0	20.2
13.560	N	AV	69.5	no limit*	
13.560	N	QP	72.0	no limit*	
13.550	N	AV	42.6	50.0	7.4
13.550	N	QP	50.9	60.0	9.1
1.435	N	AV	26.2	46.0	19.8
1.720	N	AV	25.9	46.0	20.1

The table above contains worst-case emissions, only. For further details refer to the test plots.
** Acc. to KDB174176 D01 no limit for transmitters fundamental emission band.*

Sample #7 with dummy loads:

Freq [MHz]	Line	Detector	Result [dBµV]	Limit [dBµV]	Margin
13.560	L	AV	43.5	50.0	6.5
13.560	L	QP	47.5	60.0	12.5
1.430	L	AV	27.4	46.0	18.6
1.145	L	AV	27.3	46.0	18.7
1.715	L	AV	26.6	46.0	19.4
2.000	L	AV	26.0	46.0	20.0
13.560	N	QP	47.3	60.0	12.7
13.565	N	AV	35.7	50.0	14.3
1.140	N	AV	26.8	46.0	19.2
0.855	N	AV	26.7	46.0	19.3
1.425	N	AV	26.2	46.0	19.8
1.430	N	AV	26.0	46.0	20.0

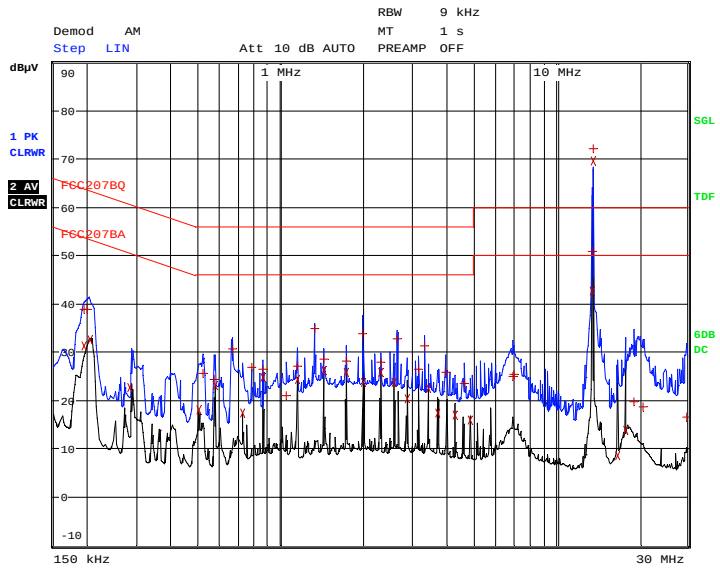
The table above contains worst-case emissions, only. For further details refer to the test plots.

Manufacturer:	Beckman Coulter Biomedical GmbH
Device:	RFID Module
Type(s):	B40420
Serial No(s):	Sample #1 0086 14/26, Sample #7 0023 14/26
Test date:	2015-05-12/22

The EUT meets the requirements of this section.

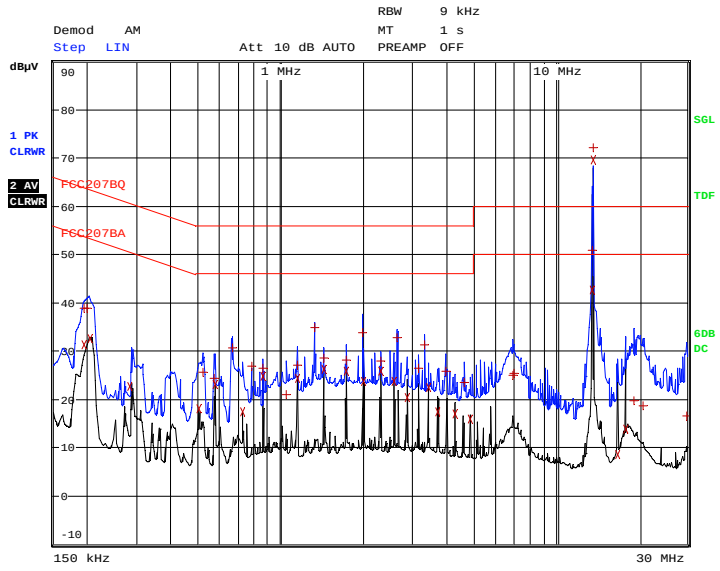
5.5 Measurement Plots

Test Sample #1 on line L:



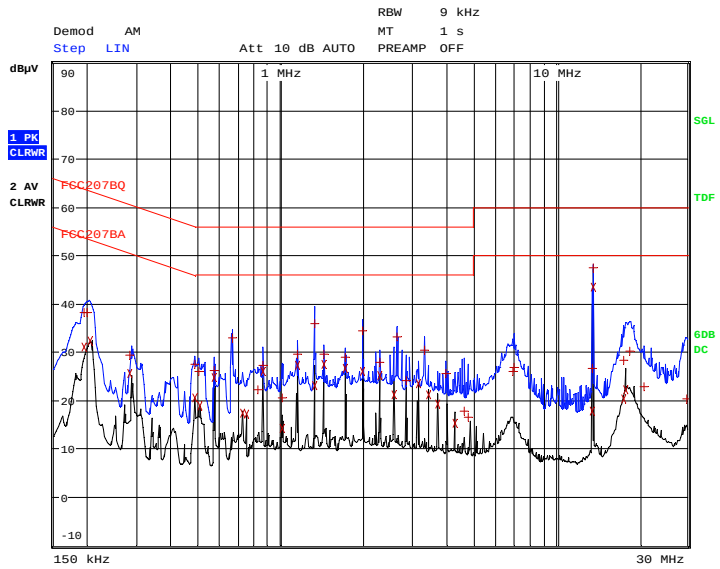
Manufacturer: Beckman Coulter, EUT: #1, Power: 115Vac / 60 H
z, Line: N
Date: 12.MAY.2015 15:58:53

Test Sample #1 on line N:



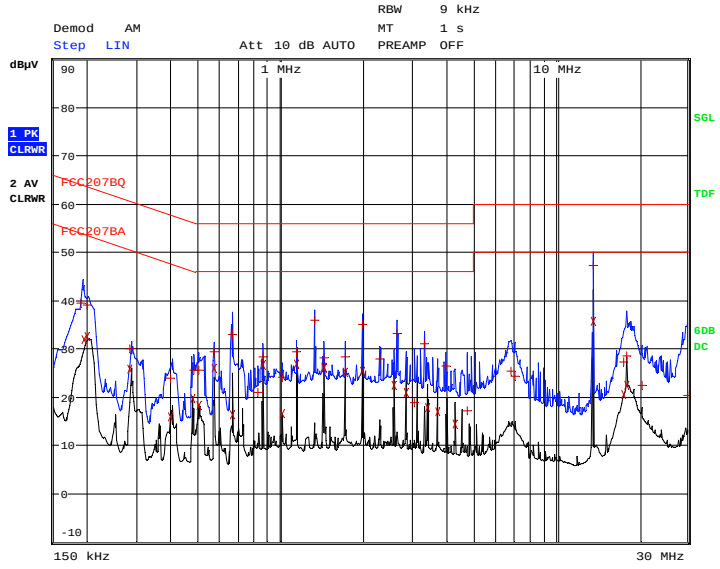
Manufacturer: Beckman Coulter, EUT: #1, Power: 115Vac / 60 H
z, Line: N
Date: 12.MAY.2015 15:58:53

Test Sample #7 on line L:



Manufacturer: Beckman Coulter, EUT: #7, Power: 115Vac / 60 H
z, Line: L
Date: 22.MAY.2015 14:35:51

Test Sample #7on line N:



Manufacturer: Beckman Coulter, EUT: #7, Power: 115Vac / 60 H
z, Line: N
Date: 22.MAY.2015 14:26:35

6 SPECTRUM MASK

Test Requirement: FCC 47 CFR, §15.225(a)-(d), IC RSS-210, A2.6

6.1 Regulation

FCC 15.225 (a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/ meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110– 14.010 MHz band shall not exceed the general radiated emission limits in§ 15.209.

IC RSS-210 A2.6 Band 13.110-14.010 MHz
The field strength of any emission shall not exceed the following limits:
(a) 15.848 millivolts/m (84 dBµV/m) at 30 m, within the band 13.553-13.567 MHz.
(b) 334 microvolts/m (50.5 dBµV/m) at 30 m, within the bands 13.410-13.553 MHz and 13.567-13.710 MHz.
(c) 106 microvolts/m (40.5 dBµV/m) at 30 m, within the bands 13.110-13.410 MHz and 13.710-14.010 MHz.
(d) 30 microvolts/m (29.5 dBµV/m) at 30 m, outside the band 13.110-14.010 MHz.
Carrier frequency stability shall be maintained to ±0.01% (±100 ppm).

→ The IC limits are equal to the FCC limits.

6.2 Test Equipment

Type	Manufacturer/ Model No.	EMCC Ident No.	Last Calibration	Next Calibration
Antenna (9 kHz – 30 MHz)	Rohde & Schwarz HFH-Z2	374	2014-06	2016-06
Receiver (20 Hz - 8 GHz)	Rohde & Schwarz ESU8	3846	2014-08	2015-08

6.3 Test Procedures

The measurement was performed in a semi-anechoic room at a test distance of 3 m. A calibrated loop antenna as specified in ANSI C63.4 clause 4.5 was positioned with its plane vertical at the test distance from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. For certain applications, the loop antenna may also need to be positioned horizontally at the specified distance from the EUT. Instead of changing the loop antenna polarization to horizontal the EUT antenna was rotated by 90 degrees. I.e. tests performed for 2 EUT antenna polarizations. The center of the loop antenna was 1 m above the ground.
The EUT was tested on a 0.8 meter high tabletop.
The EUT is connected to its associated peripherals, with any excess I/O cabling bundled to approximately 1 meter.

In certain applications, a remotely located device may be connected to the EUT. In these cases, it is permissible for cabling from the remotely located device to the EUT or accessories to be placed directly on the reference groundplane or, if normally installed beneath the reference groundplane, beneath it. The remotely located device shall be located at a distance sufficient to ensure that it does not contribute to the measured level. This procedure evaluates the interference potential of the EUT, its accessories, and interconnecting cables or wires standing apart from the remotely located device, which in turn shall be evaluated separately, if required.
Measurement initially performed as a pre-scan in the full frequency range in order to find worst case emissions. Final measurement performed at worst-case emission frequencies in a FCC and IC listed semi-anechoic room at the specified 3 m test distance. Pre-scan and final measurement performed in modulated mode with and without RFID tags.
Worst case emissions are listed under chapter: Final test results.

Radiated Emissions Test Characteristics	
Frequency range	13.11 MHz – 14.01 MHz
Test distance	3 m*
Test instrumentation resolution bandwidth	10 kHz (150 kHz - 30 MHz)
Receive antenna height	1 m
Receive antenna polarization	Vertical

* According to section 15.31 (f)(2): At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The 40 dB/decade factor was used.

6.4 Final Test Result

Frequency [MHz]	Detector	3m_Result [dB(µV/m)]	Distance Correction [dB]	30m_Result [dB(µV/m)]	30m_Limit [dB(µV/m)]	Margin [dB]
13.56	QP	69.4	40	29.4	50.5	21.1

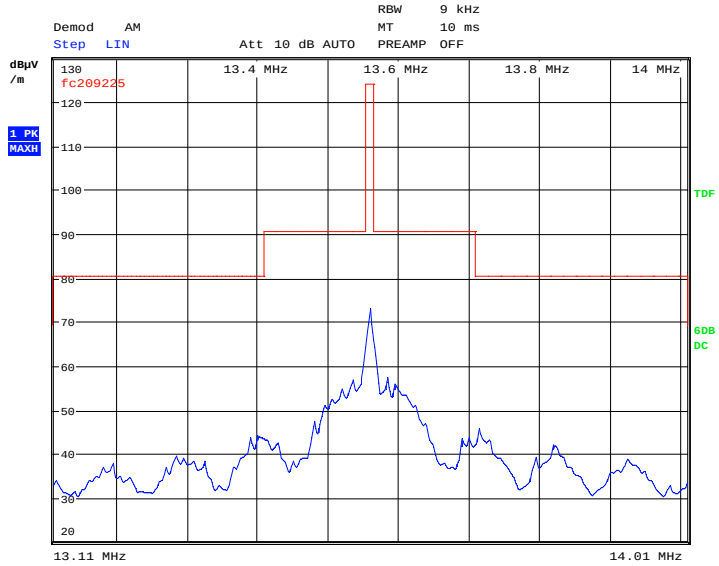
The table above contains worst-case emissions, only. For further details refer to the test plots.

Manufacturer: Beckman Coulter Biomedical GmbH
Device: RFID Module
Type(s): B40420
Serial No(s): Sample #1 0086 14/26
Test date: 2015-07-03

The EUT meets the requirements of this section.

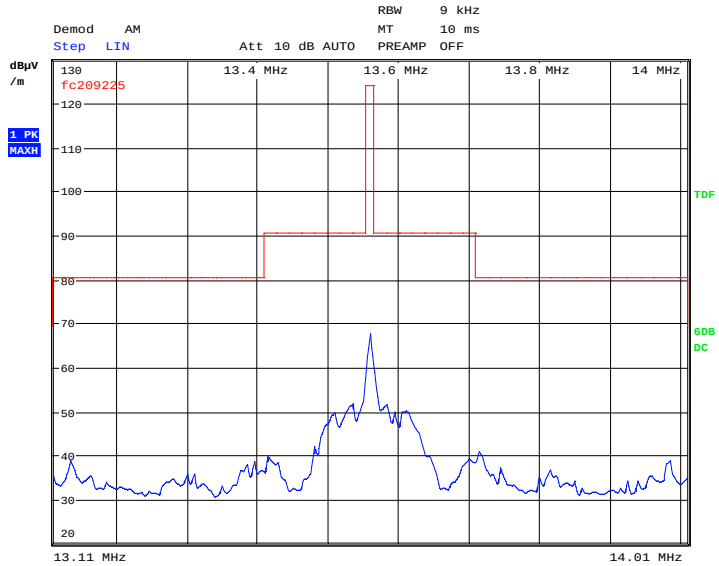
6.5 Pre-scan Plot(s)

Plot without RFID tags:



Manufacturer: Beckman Coulter, EUT: #1 without RFID tag, rep
etitive Get_Inventory, EUT in max H-Field position
Date: 3.JUL.2015 16:45:19

Plot with RFID tags:



Manufacturer: Beckman Coulter, EUT: #1 with 15 RFID tags, re
petitive Get_Inventory, EUT in max H-Field position
Date: 3.JUL.2015 17:25:28

7 OCCUPIED BANDWIDTH (99%)

Test Requirement: IC RSS-210. A6.2.3
Test Procedure: IC RSS-Gen, 6.6

7.1 Regulation

IC RSS-210: A6.2.3 Emission Bandwidth
The authorized bandwidth for emission types H1D, J1D, R1D, H3E, J3E and R3E is 4 kHz; for emission types A1D and A3E, it is 8 kHz; and for emission types F1D, G1D, F3E, G3E and F2D, it is 20 kHz.

IC RSS-Gen 6.6. Occupied Bandwidth
The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth.
When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.
• The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
• The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
• The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.
Note: Video averaging is not permitted.
A peak, or peak hold, may be used in place of the sampling detector as this may produce a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold may be necessary to determine the occupied bandwidth if the device is not transmitting continuously.
The trace data points are recovered and are directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded.

7.2 Test Equipment

Type	Manufacturer/ Model No.	EMCC Ident No.	Last Calibration	Next Calibration
EMI Test Receiver	Rohde & Schwarz / ESU8	3846	2014-07	2015-07
Antenna (9 kHz – 30 MHz)	Rohde & Schwarz HFH-Z2	374	2014-06	2016-06

7.3 Test Procedures

Measurement was performed in a semi-anechoic room. The EUT was tested on a 0.8 meter high tabletop and was connected to its associated peripherals. A calibrated loop antenna was positioned with its plane vertical at about 1.5m distance from the EUT. For certain applications, the loop antenna may also need to be positioned horizontally at the specified distance from the EUT. The analyzer was setup at the nominal centre frequency of the EUT. The span was 20 kHz, the resolution bandwidth 200 Hz and the video bandwidth 500 Hz. A max peak hold was used to measure the occupied bandwidth.
The measurement was performed with and without RFID tag.

7.4 Test Result

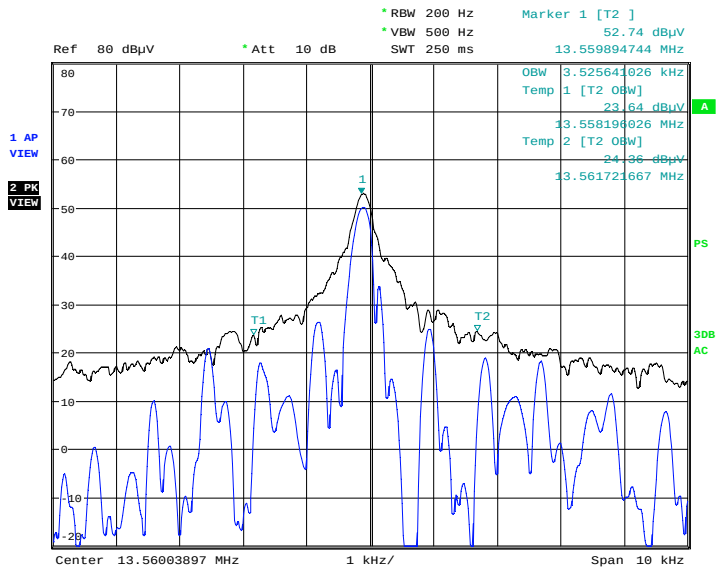
Occupied Bandwidth (99%)	[kHz]	3.53

Manufacturer: Beckman Coulter Biomedical GmbH
Device: RFID Module
Type(s): B40420
Serial No(s): Sample #1 0086 14/26
Test date: 2015-07-03

The EUT meets the requirements of this section.

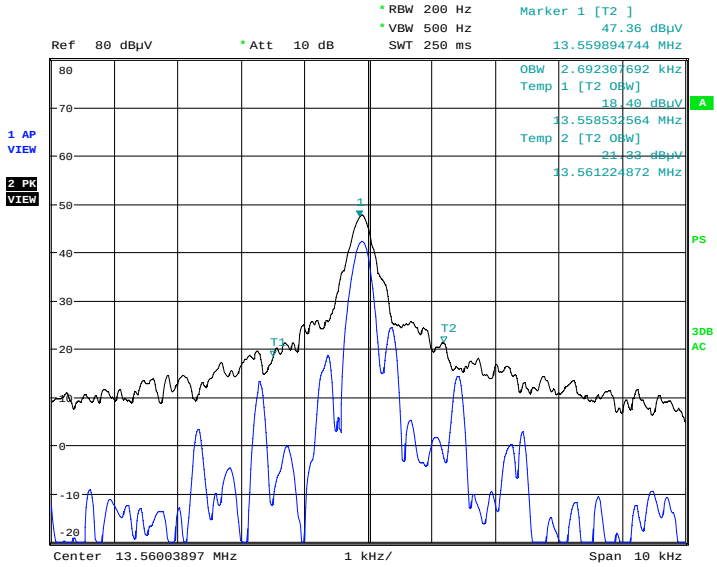
7.5 Measurement Plot

Plot without RFID tag:



EUT: #1 without RFID tag, Manufacturer: Beckman Coulter, MOD
E: repetitive Get_Inventory
Date: 3.JUL.2015 16:48:19

Plot with RFID tag:



EUT: #1 with 15 RFID tags, Manufacturer: Beckman Coulter, MO
DE: repetitive Get_Inventory
Date: 3.JUL.2015 17:29:16

8 RADIATED EMISSIONS 9 kHz – 30 MHz

Test requirement: FCC 47 CFR, §15.205, 15.209, 15.225(d)
IC RSS-Gen Issue 4, 8.9, RSS-210 A2.6
Test procedure: ANSI C63.10-2013, RSS-Gen

8.1 Regulation

FCC 15.33 Frequency range of radiated measurements:
(a) Unless otherwise noted in the specific rule section under which the equipment operates for an intentional radiator the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz […]

FCC 15.35 Measurement detector functions and bandwidths.
The conducted and radiated emission limits shown in this Part are based on the following, unless otherwise specified elsewhere in this Part:
(a) On any frequency or frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified.
(c) Unless otherwise specified, e.g. Section 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.

FCC 15.205(d)(7) Devices operated pursuant to § 15.225 are exempt from complying with this section for the 13.36–13.41 MHz band only.

FCC 15.225 Operation within the band 13.110–14.010 MHz.
(d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

FCC 15.209(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency	Field Strength		Measurement distance
[MHz]	[µV/m]	[dB(µV/m)]	[m]
0.009–0.490	2400/F[kHz]	67.6 – 20 logF[kHz]	300
0.490–1.705	24000/F[kHz]	87.6 – 20 logF[kHz]	30
1.705–30.0	30	29.5	30

(b) In the emission table above, the tighter limit applies at the band edges.
(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

(d) The emission limits shown in the above table are based on measurements employing a CISPR quasi peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.
(e) The provisions in §§ 15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

IC RSS-Gen 8.9 Transmitter Emission Limits for Licence-Exempt Radio Apparatus
Except when the requirements applicable to a given device state otherwise, emissions from licence-exempt transmitters shall comply with the field strength limits shown in Table 4 or Table 5 below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

Table 5 - General Field Strength Limits for Licence-Exempt Transmitters at Frequencies Below 30 MHz)

Frequency	Electric Field Strength (µV/m)	Magnetic Field Strength (H-Field) (µA/m)	Measurement Distance (metres)
9-490 kHz	2,400/F (F in kHz)	2,400/377F (F in kHz)	300
490-1,705 kHz	24,000/F (F in kHz)	24,000/377F (F in kHz)	30
1,705-30 MHz	30	N/A	30

Note: The emission limits for the bands 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector. Transmitting devices are not permitted in restricted frequency bands unless stated otherwise in the relevant RSS

IC RSS-210 A2.6 Band 13.110-14.010 MHz
The field strength of any emission shall not exceed the following limits:
(d) 30 microvolts/m (29.5 dBµV/m) at 30 m, outside the band 13.110-14.010 MHz.

8.2 Test Equipment

Type	Manufacturer/ Model No.	EMCC Ident No.	Last Calibration	Next Calibration
Antenna (9 kHz – 30 MHz)	Rohde & Schwarz HFH-Z2	374	2014-06	2016-06
Receiver (20 Hz - 8 GHz)	Rohde & Schwarz ESU8	3846	2014-08	2015-08

8.3 Test Procedures

Measurement was performed in a semi-anechoic room at a test distance of 3 m. A calibrated loop antenna as specified in ANSI C63.4 clause 4.5 was positioned with its plane vertical at the test distance from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. For certain applications, the loop antenna may also need to be positioned horizontally at the specified distance from the EUT. Instead of changing the loop antenna polarization to horizontal the EUT antenna was rotated by 90 degrees. I.e. tests performed for 2 EUT antenna polarizations. The center of the loop antenna was 1 m above the ground.
The EUT was tested on a 0.8 meter high tabletop.
The EUT is connected to its associated peripherals, with any excess I/O cabling bundled to approximately 1 meter.
In certain applications, a remotely located device may be connected to the EUT. In these cases, it is permissible for cabling from the remotely located device to the EUT or accessories to be placed directly on the reference groundplane or, if normally installed beneath the reference groundplane, beneath it.

The remotely located device shall be located at a distance sufficient to ensure that it does not contribute to the measured level. This procedure evaluates the interference potential of the EUT, its accessories, and interconnecting cables or wires standing apart from the remotely located device, which in turn shall be evaluated separately, if required.
Measurement initially performed as a pre-scan in the full frequency range in order to find worst case emissions. Final measurement performed at worst-case emission frequencies in a FCC and IC listed semi-anechoic room at the specified 3 m test distance. Pre-scan and final measurement performed in modulated mode with and without RFID tags.
Worst case emissions are listed under chapter: Final test results.

Radiated Emissions Test Characteristics	
Frequency range	9 kHz - 30 MHz
Test distance	3 m*
Test instrumentation resolution bandwidth	200 Hz (9 kHz - 150 kHz)
	10 kHz (150 kHz - 30 MHz)
Receive antenna height	1 m
Receive antenna polarization	Vertical

* According to Section 15.31 (f)(2): At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The 40 dB/decade factor was used.

8.4 Calculation of Field Strength Limits

E.g. radiated spurious emissions field strength limits for the band 1.705–30.0 MHz:

µV/m at 30 meters = 30

30 µV/m corresponds with 29.5 dBµV/m.

8.5 Field Strength Calculation

All emission measurements performed using the test receiver's transducer factor setting capability, i.e. the field strength value measured directly without the necessity of additional correction factors.
For test distance other than what is specified, but fulfilling the requirements of Section 15.31 (f)(2) the field strength is calculated by adding additionally an extrapolation factor of 40 dB/decade (inverse linear-distance for field strength measurements). The basic equation with a sample calculation is as follows:

FS = FST + DF

where

FS = Field Strength in dBµV/m

FST = Field Strength at test distance in dBµV/m

DF = Distance Extrapolation Factor in dB,

where DF = 40 log (Dtest/Dspec) where Dtest = Test Distance and Dspec = Specified Distance
Assume the tests performed at a reduced Test Distance of 3 m instead of the Specified Distance of 30 m giving a Distance Extrapolation Factor of DF = 40 log (3 m/30 m) = -40 dB.

Assuming a measured field strength level of 58.8 dBµV/m is obtained. The Distance Factor of -40 dB is added, giving a field strength of 18.8 dBµV/m. The 18.8 dBµV/m value can be mathematically converted to its corresponding level in µV/m.

FS = 58.8 - 40 = 18.8 [dBµV/m]
Level in µV/m = Common Antilogarithm (18.8/20) = 8.7

8.6 Final Test Results

Frequency [MHz]	Detector	3m_Result [dB(µV/m)]	Distance Correction [dB]	30m_Result [dB(µV/m)]	30m_Limit [dB(µV/m)]	Margin [dB]
13.56	QP	69.4	40	29.4	50.5	21.1

The table above contains worst-case emissions, only. For further details refer to the measurement plot.

Manufacturer:	Beckman Coulter Biomedical GmbH
Device:	RFID Module
Type(s):	B40420
Serial No(s):	Sample #1 0086 14/26
Test date:	2015-07-03

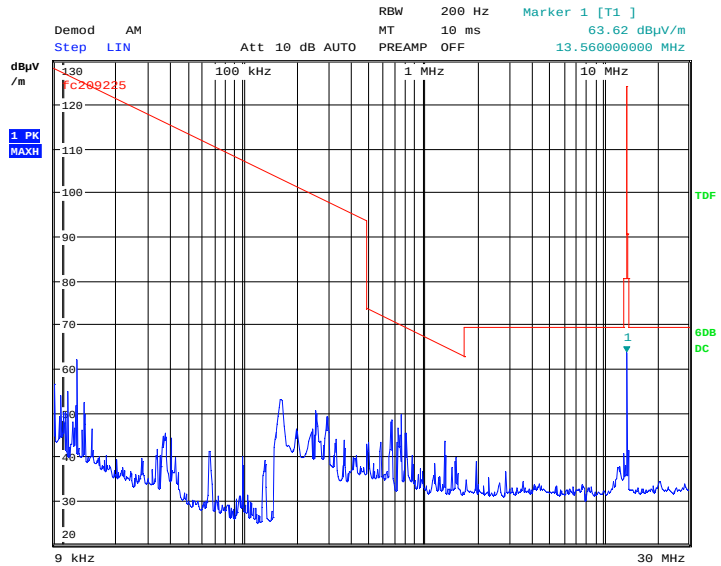
All emissions in the range 9 kHz to 30 MHz are below the specified limits.

The EUT meets the requirements of this section.

8.7 Measurement Plot

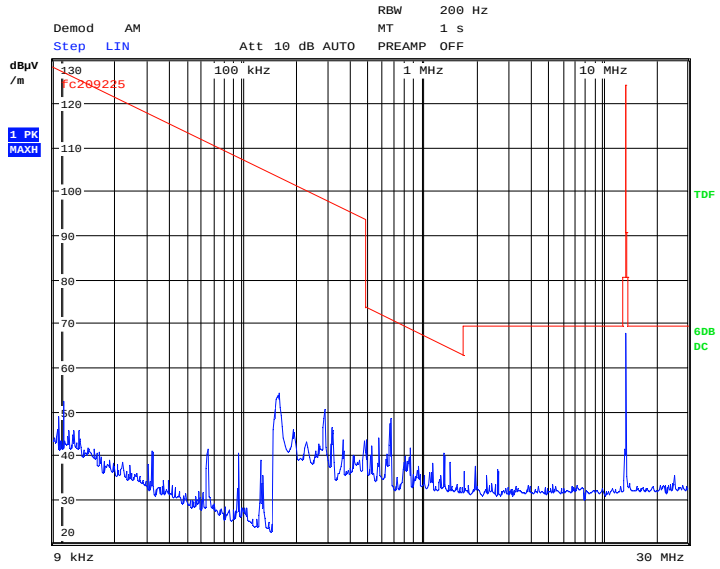
Test distance d = 3 m

Prescan with RFID tags:



Manufacturer: Beckman Coulter, EUT: #1 with 15 RFID tags, EU
T upright, H-antenna 2 directions, EUT 4 directions
Date: 3.JUL.2015 17:16:13

Prescan without RFID tags:



Manufacturer: Beckman Coulter, EUT: #1 without RFID, EUT axi
s horizontal, H-antenna 2 directions, EUT 4 directions
Date: 3.JUL.2015 15:54:55

9 RADIATED EMISSIONS 30 MHz – 1000 MHz

Test Requirement: FCC 47 CFR, §15.205, 15.209, 15.225(d)
IC RSS-Gen Issue 4, 8.9, RSS-210 A2.6
Test Procedure: ANSI C63.10-2013, IC RSS-Gen

9.1 Regulation

FCC 15.33 Frequency range of radiated measurements:
(a) Unless otherwise noted in the specific rule section under which the equipment operates for an intentional radiator the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in this paragraph:
(1) If the intentional radiator operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
(4) If the intentional radiator contains a digital device, regardless of whether this digital device controls the functions of the intentional radiator or the digital device is used for additional control or function purposes other than to enable the operation of the intentional radiator, the frequency range shall be investigated up to the range specified in paragraphs (a)(1)-(a)(3) of this section or the range applicable to the digital device, as shown in paragraph (b)(1) of this Section, whichever is the higher frequency range of investigation.

FCC 15.35 Measurement detector functions and bandwidths.
The conducted and radiated emission limits shown in this Part are based on the following, unless otherwise specified elsewhere in this Part:
(a) On any frequency or frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified. The specifications for the measuring instrument using the CISPR quasi-peak detector can be found in Publication 16 of the International Special Committee on Radio Interference (CISPR) of the International Electrotechnical Commission. As an alternative to CISPR quasi-peak measurements, the responsible party, at its option, may demonstrate compliance with the emission limits using measuring equipment employing a peak detector function, properly adjusted for such factors as pulse desensitization, as long as the same bandwidths as indicated for CISPR quasi-peak measurements are employed.
Note: For pulse modulated devices with a pulse-repetition frequency of 20 Hz or less and for which CISPR quasi-peak measurements are specified, compliance with the regulations shall be demonstrated using measuring equipment employing a peak detector function, properly adjusted for such factors as pulse desensitization, using the same measurement bandwidths that are indicated for CISPR quasi-peak measurements.

FCC 15.225 Operation within the band 13.110–14.010 MHz.
(d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

FCC 15.209(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency	Field Strength		Measurement Distance
[MHz]	[µV/m]	[dB(µV/m)]	[m]
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

(b) In the emission table above, the tighter limit applies at the band edges.
(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
(e) The provisions in §§ 15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

IC RSS-Gen 8.9
Except when the requirements applicable to a given device state otherwise, emissions from licence-exempt transmitters shall comply with the field strength limits shown in Table 4 or Table 5 below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission

Table 4 - General Field Strength Limits for Licence-Exempt Transmitters at Frequencies Above 30 MHz

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

Note: Transmitting devices are not permitted in restricted frequency bands unless stated otherwise in the specific RSS.

IC RSS-210 A2.6 Band 13.110-14.010 MHz
The field strength of any emission shall not exceed the following limits:
(d) 30 microvolts/m (29.5 dBµV/m) at 30 m, outside the band 13.110-14.010 MHz.

→ The IC limits for radiated spurious emissions within the range above 960 MHz are equal to the FCC limits. In the range 30 – 960 MHz less stringent limits apply.

9.2 Test Equipment

Type	Manufacturer/ Model No.	EMCC Ident No.	Last Calibration	Next Calibration
Antenna (30 MHz - 1 GHz)	EMCO Model 3143	898	2013-05	2015-05
Receiver (9 kHz - 1 GHz)	Rohde & Schwarz ESS	303	2015-03	2016-03

9.3 Test Procedures

The EUT was tested on a 0.8 meter high tabletop.
In certain applications, a remotely located device may be connected to the EUT. In these cases, it is permissible for cabling from the remotely located device to the EUT or accessories to be placed directly on the reference groundplane or, if normally installed beneath the reference groundplane, beneath it. The remotely located device shall be located at a distance sufficient to ensure that it does not contribute to the measured level. This procedure evaluates the interference potential of the EUT, its accessories, and interconnecting cables or wires standing apart from the remotely located device, which in turn shall be evaluated separately, if required.
With the EUT operating in "worst case" mode, emissions from the unit are maximized by adjusting the polarization and height of the receive antenna and rotating the EUT on the turntable. Manipulating the system cables also maximizes EUT emissions *[Remark: Not applicable]*. All tests performed with the EUT placed in both vertical and horizontal polarizations on the nonconductive table.

Measurement initially performed as a pre-scan in the full frequency range in order to find worst case emissions. Final measurement performed at worst-case emission frequencies in a FCC and IC listed semi-anechoic room at the specified 3 m test distance. Pre-scan and final measurement performed in modulated mode.
The pre-scan was done with and without RFID tags at the EUT. The Final measurement was done for the testsetup with RFID tags.

Worst case emissions are listed under chapter: test results.

Radiated Emissions Test Characteristics	
Frequency range	30 MHz - 1000 MHz
Test distance	3 m
Test instrumentation resolution bandwidth	120 kHz (30 MHz - 1,000 MHz)
Receive antenna scan height	1 m - 4 m
Receive antenna polarization	Vertical/Horizontal

* According to Section 15.31 (f)(1): At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. (...) When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

9.4 Calculation of Field Strength Limits

E.g. radiated spurious emissions field strength limits for the restricted band 108-121.94 MHz:

µV/m at 3 meters = 150

150 µV/m corresponds with 43.5 dBµV/m.

9.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF
where
FS = Field Strength in dBµV/m
RA = Receiver Amplitude in dBµV
AF = Antenna Factor in dB(1/m)
CF = Cable Attenuation Factor in dB
Assume a receiver reading of 23.5 dBµV is obtained. The Antenna Factor of 7.4 dB(1/m) and a Cable Factor of 1.1 dB are added, giving a field strength of 32 dBµV/m. The 32 dBµV/m value can be mathematically converted to its corresponding level in µV/m.

FS = 23.5 + 7.4 + 1.1 = 32 [dBµV/m]

Level in µV/m = Common Antilogarithm (32/20) = 39.8

9.6 Final Test Results

Frequency [MHz]	Reading [dB(µV)]	Antenna factor [dB(1/m)]	Result [dB(µV/m)]	Limit [dB(µV/m)]	Margin [dB]	Polarisation h / v	Remarks
366.12	22.9	18.6	41.5	46	4.5	v	
352.56	21.9	18.5	40.4	46	5.6	v	
30.00	17.9	14.5	32.4	40	7.6	v	
31.75	17.6	13.8	31.4	40	8.6	v	
41.60	19.8	10.4	30.1	40	9.9	v	
35.51	17.5	12.5	30.0	40	10.0	v	

All tests performed at 3 m distance. The table above contains worst-case emissions for the normal mode, only. For further details refer to the pre-scan test plots.

Manufacturer:	Beckman Coulter Biomedical GmbH
Device:	RFID Module
Type(s):	B40420
Serial No(s):	Sample #1 0086 14/26
Test date:	2015-04-21

The EUT meets the requirements of this section.

9.7 Pre-scan Plot(s)

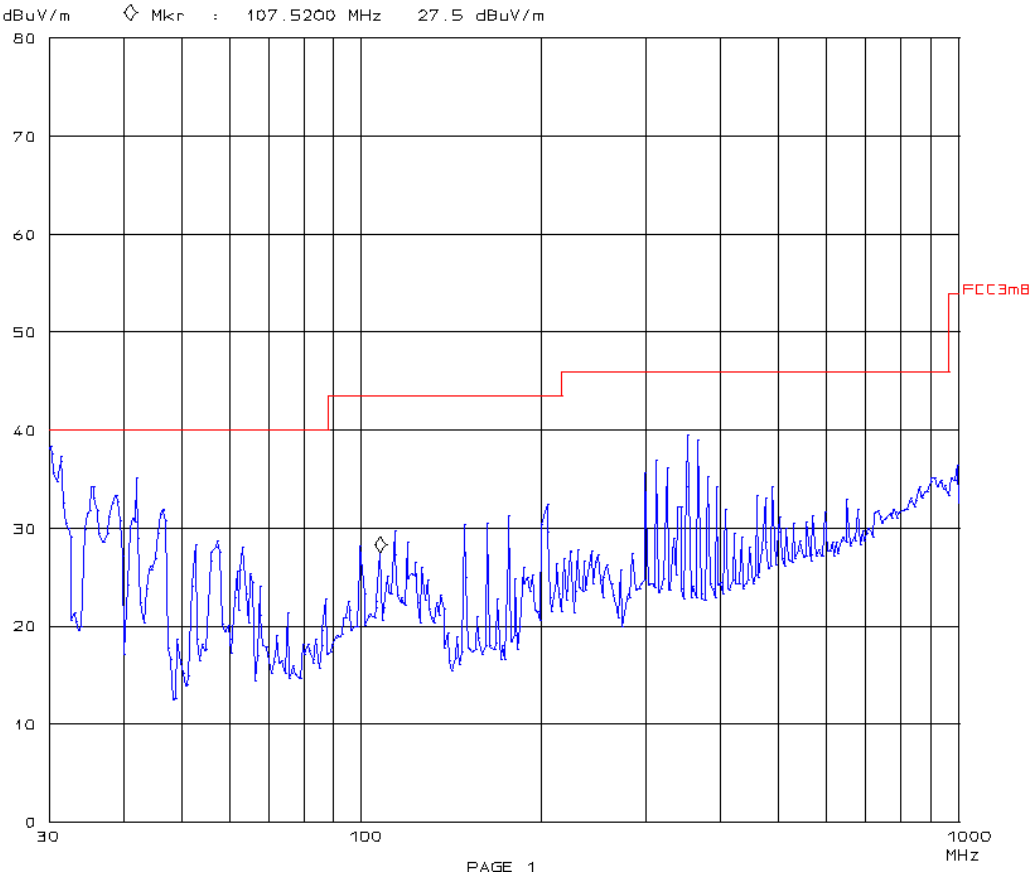
Prescan with RFID tags:

EMCC DR. RASEK 21. Apr 15 10:14
Radiated Emissions Prescan in SAR, d=3m

```
EUT:            #1 with 15 RFID tags
Manuf:          Beckman Coulter Biomedical GmbH
Op Cond:        normal, repetitiv Get_Inventory
Operator:       L.Kraft
Test Spec:      FCC 15.209
Comment:        4 sides, hor. and vert. pol. 4 heights
                Limit according to FCC

Fast Scan Settings (1 Range)
|--------- Frequencies -----------||----------- Receiver Settings ------------|
  Start       Stop          Step      IF BW  Detector  M-Time Atten Preamp OpRge
  30M       1000M           40k       120k      PK     0.10ms   0dBLN ON    60dB

                                    Transducer No. Start      Stop       Name
                                                21   30M      1000M      89826K33
```



Prescan without RFID tags:

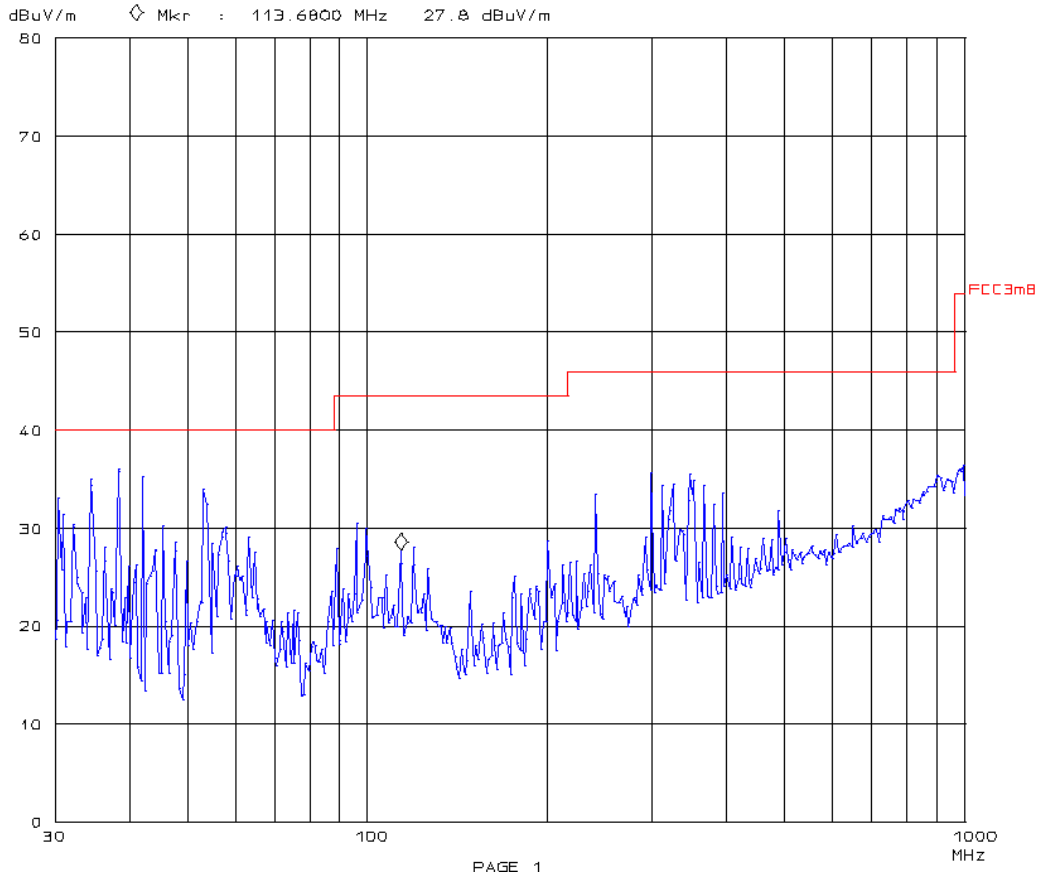
EMCC DR. RASEK 21. Apr 15 12:35
Radiated Emissions Prescan in SAR, d=3m

EUT: #1 without RFID tags
Manuf: Beckman Coulter Biomedical GmbH
Op Cond: normal, repetitiv Get_Inventory
Operator: L.Kraft
Test Spec: FCC 15.209
Comment: 4 sides, hor. and vert. pol. 4 heights
Limit according to FCC

Fast Scan Settings (1 Range)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
30M	1000M	40k	120k	PK	0.10ms	0dBLN	ON	60dB

Transducer	No.	Start	Stop	Name
	21	30M	1000M	89826K33



10 CARRIER FREQUENCY STABILITY

Test Requirement: FCC 47 CFR, §15.225(e)
IC RSS-210 A2.6
Test Procedure: ANSI C63.10-2013, RSS-Gen

10.1 Regulation

FCC 15.225 Operation within the band 13.110–14.010 MHz.
(e) The frequency tolerance of the carrier signal shall be maintained within +/- 0.01 % of the operating frequency over a temperature variation of –20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85 % to 115 % of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

IC RSS-210 A2.6 Band 13.110-14.010 MHz
Carrier frequency stability shall be maintained to ±0.01% (±100 ppm).

10.2 Test Procedures

Frequency stability with respect to ambient temperature:
The EUT was supplied with the nominal dc voltage (5 V). The EUT was placed in the centre of the environmental test chamber. The measurement antenna was placed in the environmental test chamber next to the EUT and connected to a receiver. It was verified that the receiver had an adequate signal level to allow the measurement.
The temperature control of the environmental test chamber was set to the highest temperature for sufficient time to allow the EUT to stabilize at the temperature.

a) While maintaining a constant temperature inside the environmental chamber, the EUT was turned on and the operating frequency was measured at startup, two, and ten minutes after the EUT was energized. Three measurements in total were made.
b) The EUT was switched off.
c) The chamber temperature was lowered by 10 °C and sufficient time was waited until the test chamber and the EUT did stabilize at the temperature.
d) The step a) through step c) were repeated down to the lowest specified temperature.
The highest deviation from the nominal carrier frequency was reported in the test result table.

Frequency stability when varying supply voltage:
The tests were made at ambient room temperature (+15 °C to +25 °C).The EUT was placed on a wooden table 0.8 meter high tabletop.
The EUT was connected to a dc power supply and dc supply voltage was measured with a multimeter. An antenna was above the EUT antenna and connected to receiver. It was verified that the receiver had an adequate signal level to allow the measurement.

The input voltage was set to 5 V, 4.25 V (U_{nom} - 15 %) and 5.75 V (U_{nom} - 15 %). The measurement of the centre frequency was measured at each voltage step.

10.3 Test Equipment

Type	Manufacturer/ Model No.	EMCC Ident No.	Last Calibration	Next Calibration
Receiver (20 Hz - 8 GHz)	Rohde & Schwarz ESU8	3846	2014-08	2015-08
Antenna	EMCC, MAG 1-01R	5369	not applicable	not applicable
Climatic Chamber	Binder/ MK 720	4463	2013-09	2015-09
Multimeter	Agilent/ 34401A	3070	2014-03	2016-03

10.4 Test Results

10.4.1 Carrier Frequency Stability vs Temperature

Test conditions: Supply voltage = 5 VDC
f_{nom} = 13.56 MHz

Temperatur	Frequency	Deviation from nominal		Limit	Lower limit	Upper Limit
[°C]	[MHz]	[kHz]	[%]	[%]	[MHz]	[MHz]
50	13.55990	-0.10	-0.001	+- 0.01	13.5586	13.5614
40	13.55990	-0.10	-0.001	+- 0.01	13.5586	13.5614
30	13.55998	-0.02	0.000	+- 0.01	13.5586	13.5614
20	13.55998	-0.02	0.000	+- 0.01	13.5586	13.5614
10	13.56003	0.03	0.000	+- 0.01	13.5586	13.5614
0	13.56000	0.00	0.000	+- 0.01	13.5586	13.5614
-10	13.56005	0.05	0.000	+- 0.01	13.5586	13.5614
-20	13.55999	-0.01	0.000	+- 0.01	13.5586	13.5614
-30	13.55999	-0.01	0.000	+- 0.01	13.5586	13.5614

Test performed at nominal supply voltage and within the temperature range of -30 °C up to +50 °C starting at nominal ambient temperature and continuing with the highest specified temperature and proceeding with temperature lowered in 10 degree steps down to the lowest specified

Manufacturer: Beckman Coulter Biomedical GmbH
Device: RFID Module
Type(s): B40420
Serial No(s): Sample #3 0095 14/26
Test date: 2015-05-19/20

Carrier frequency stability is within the specified limits.

The EUT meets the requirements of this section.

10.4.2 Carrier Frequency Stability vs Supply Voltage

Test conditions: Temperature = 23 °C
f_{nom} = 13.56 MHz

Supply voltage	Frequency	Deviation from nominal		Limit	Lower Limit	Upper Limit
[V]	[MHz]	[kHz]	[%]	[%]	[MHz]	[MHz]
4.25	13.55996	-0.04	-0.0003	+- 0.01	13.5586	13.5614
5	13.55995	-0.05	-0.0004	+- 0.01	13.5586	13.5614
5.75	13.55994	-0.06	-0.0004	+- 0.01	13.5586	13.5614

Test performed at normal ambient temperature and within the manufacture's specified supply voltage range.

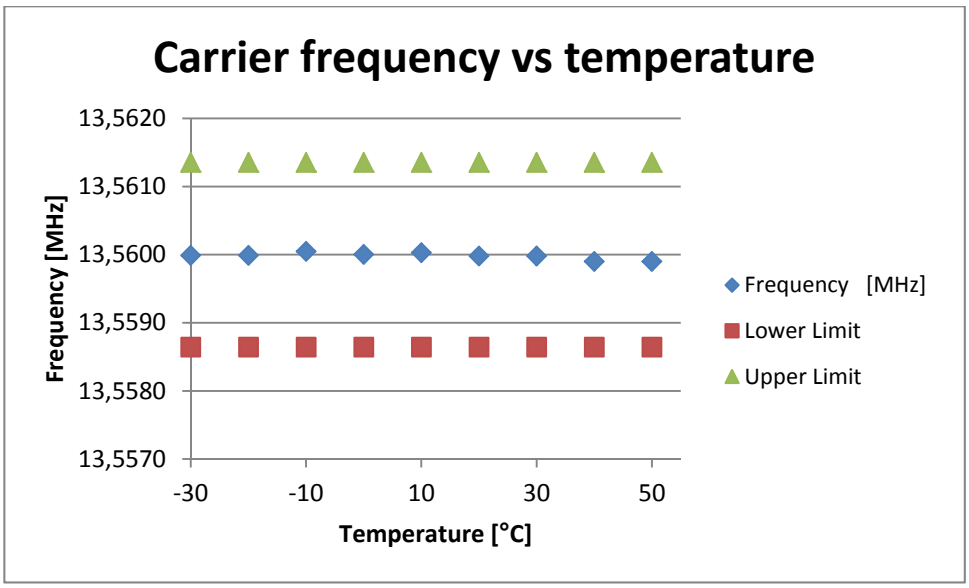
Manufacturer:	Beckman Coulter Biomedical GmbH
Device:	RFID Module
Type(s):	B40420
Serial No(s):	Sample #3 0095 14/26
Test date:	2015-05-22

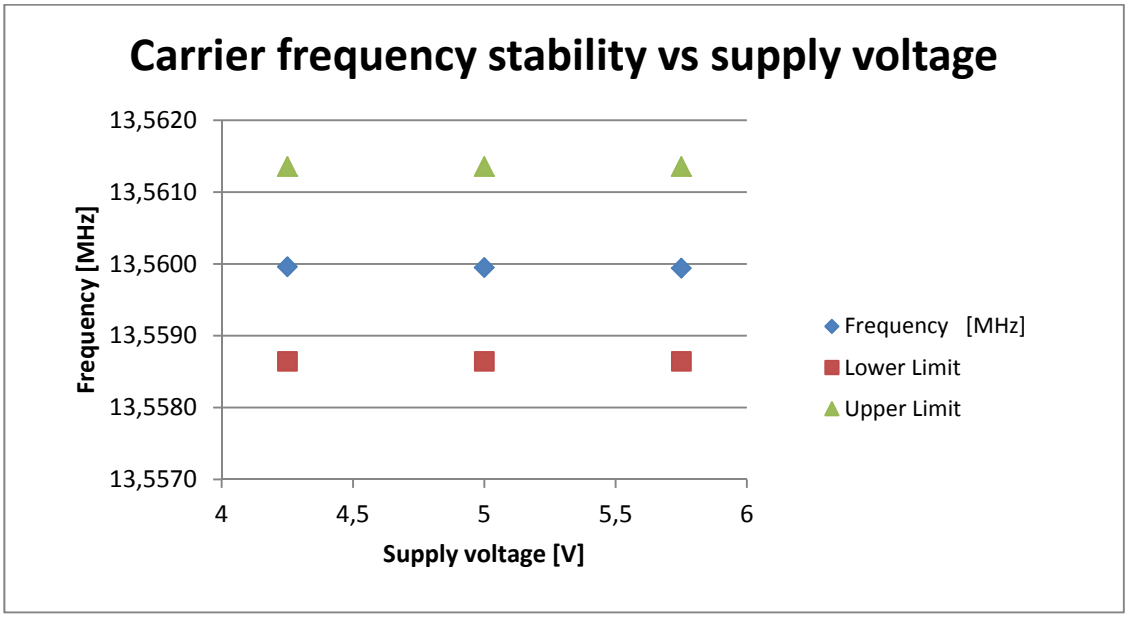
Carrier frequency stability is within the specified limits.

The EUT meets the requirements of this section.

10.5 Measurement Plots

Refer to the following page.





11 MEASUREMENT UNCERTAINTY

Measurement	Measurement Uncertainty
Conducted Emissions (150 kHz – 30 MHz)	± 3.5 dB
Radiated Emissions, H field (9 kHz – 30 MHz)	± 3.0 dB
Radiated Emissions (30 MHz – 1 GHz)	±5.2 dB

The reported uncertainty values are based on a standard uncertainty multiplied by a coverage factor of k=2.0, providing a level of confidence of 95 %.

The given values have been calculated on the basis of the following documents:
CISPR 16-4: 2002;
UKAS: LAB34, The Expression of Uncertainty in EMC Testing, August 2002;
ISO: Guide to the Expression of Uncertainty in Measurement, 1993.

12 LIST OF ANNEXES

Following annexes are separated parts from this test report.

Description	Pages
Annex 1: Photographs of test set-up	3
Annex 2: Photographs of equipment under test (EUT)	2