

EMI - TEST REPORT

- EN 300 328 -

Type / Model Name : DS703 FC

Product Description : Diagnostic scope with WLAN 2.4 GHz

Applicant : Fluke Electronics Corporation

Address : 6920 Seaway Blvd.

EVERETT, WA 98203, USA

Manufacturer : Inspectron Inc.

Address : 39625 Lewis Drive, Suite 900

NOVI, MI 48377, USA

Test Result according to the standards listed in clause 1 test standards:	POSITIVE
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Test Report No. : T43838-00-01KS	23. April 2018 Date of issue
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Deutsche
Akkreditierungsstelle
D-PL-12030-01-01
D-PL-12030-01-02

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test results
without the written permission of the test laboratory.

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ATTACHMENT A as separate supplement

1 TEST STANDARDS

The tests were performed partly according to following standards:

ETSI EN 300 328 V2.1.1	: 2016-11	Wideband Transmission systems; Data transmission equipment operating in the 2.4 GHz ISM band and using wide band modulation techniques; Harmonized Standard covering essential requirements under article 3.2 of Directive 2014/53/EU.
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2 EQUIPMENT UNDER TEST

2.1 Photo documentation of the EUT – Detailed photos see ATTACHMENT A

The photo documentation can be viewed in the document T43838-00-xxKS. The pictures of the insides are provided by the manufacturer.

2.2 General remarks:

The WLAN-Module (CC3220MOD) is fully tested and approved according the EN 300 328 V2.1.1. This test report shows the further compliance to the EN 300 328 V2.1.1 after integration into the EUT. Therefore, the re-test is partly to the following requirements, only.

- RF output power (radiated) (EN 300 328 V2.1.1, clause 4.3.2.2.1)
- Transmitter unwanted emissions, radiated (EN 300 328 V2.1.1, clause 4.3.2.9.1)
- Receiver spurious emissions, radiated (EN 300 328 V2.1.1, clause 4.3.2.10.1)

2.3 Equipment type, category, receiver category

WLAN - AP, portable equipment., receiver category 1

2.4 Short description of the equipment under test (EUT)

The Fluke DS703 FC Diagnostic Scopes are handheld imaging cameras. The EUT is compatible with IEEE 802.11b/g/n Standard. It supports the 2.4 GHz frequency band and supports no beam forming.

- The equipment using other types of wide band modulation (e.g. DSSS, OFDM, etc.).
- The EUT is adaptive equipment.

Number of tested samples: 1
Serial number: ESL #5
Firmware version: v05.03.18

EUT configuration:

(The CDF filled by the applicant can be viewed at the test laboratory.)

2.5 Variants of the EUT

There are no variants.

2.6 Operation frequency and channel plan

The operating frequency is 2400 MHz to 2483.5 MHz.

Channel plan WLAN Standard 802.11b/g/n, HT20:

Channel	Frequency (MHz)
1	2412
2	2417
3	2422
4	2427
5	2432
6	2437
7	2442
8	2447
9	2452
10	2457
11	2462
12	2467
13	2472

Note: the marked frequencies are determined for final testing.

Channel plan WLAN Standard 802.11n, HT40:

Channel, HT40 up	Channel, HT40 down	Frequency
1 up	5 down	2422 MHz
2 up	6 down	2427 MHz
3 up	7 down	2432 MHz
4 up	8 down	2437 MHz
5 up	9 down	2442 MHz
6 up	10 down	2447 MHz
7 up	11 down	2452 MHz
8 up	12 down	2457 MHz
9 up	13 down	2462 MHz

2.7 Transmit operating modes

The EUT uses DSSS or OFDM modulation and provides following data rates:

- 802.11b 11, 5.5, 2, 1 Mbps (Mbps = *megabits per second*)
- 802.11g 54, 48, 36, 24, 18, 12, 9, 6 Mbps (Mbps = *megabits per second*)
- 802.11n HT20, MCS 0 - 7
- 802.11n HT40, MCS 0 - 7

2.8 Antenna

The following antennas shall be used with the EUT:

Number	Characteristic	Model number	Plug	Frequency range (GHz)	Gain (dBi)
1	Omni	MAF94045	MHF	2.4	2.0

2.9 Power supply system utilised

Power supply voltage, V_{nom} : 3.7 VDC (battery powered)

2.10 Peripheral devices and interface cables

The following peripheral devices and interface cables are connected during the measurements:

- _____ Model : _____
- _____ Model : _____
- _____ Model : _____

2.11 Determination of worst case conditions for final measurement

The test software for the EUT provides free power setting, the special test mode RX and the TX continuous mode, modulated. The maximum output power depends on used data rate.

According to the test reports of the radio module CC3220MOD 802.11g was chosen as worst case for testing.

For the final test the following channels and test modes are selected:

WLAN	Available channel	Tested channels	Power setting	Modulation	Modulation type	Data rate
802.11g	1 to 13	1, 7, 13	Pmax	OFDM	BPSK	6 Mbps

2.11.1 Test jig

No test jig was used.

2.11.2 Test software

The EUT has a special firmware that allows enabling TX continuous mode modulated and RX continuous mode.

3 TEST RESULT SUMMARY

Clause	Transmitter parameters	Test	Report page number
5.1	RF output power	P	10
-	Power spectral density	NT	-
-	Duty cycle	N/A	-
-	Medium utilisation factor	N/A	-
-	Adaptivity	NT	-
-	Occupied channel bandwidth	NT	--
-	Transmitter unwanted emissions in the out-of-band domain	NT	
5.2	Transmitter unwanted emissions, radiated	P	11
5.3	Receiver spurious emissions, radiated	P	14
-	Receiver blocking	NT	-
-	Geo-location capability	N/A	-

Note: P (Pass), F (Fail), NT (Not tested), N/A (Not applicable);

3.1 Final assessment

The equipment under test fulfills the EMI requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 06 March 2018

Testing concluded on : 08 March 2018

Checked by:

Tested by:

Klaus Gegenfurtner
Teamleader Radio

Kathrin Schiebl
Radio Team

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

**CSA Group Bayern GmbH
Ohmstrasse 1-4
94342 STRASSKIRCHEN
GERMANY**

4.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature: 15-35 °C

Humidity: 30-60 %

Atmospheric pressure: 86-106 kPa

4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. It is noted that the expanded measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor $k = 2$. The true value is located in the corresponding interval with a probability of 95 %. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4-2 / 11.2003 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements“ and is documented in the quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, CSA Group Bayern GmbH, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

5 TEST RESULTS

5.1 RF output power

For test instruments and accessories used see section 6 Part **CPR 3**.

5.1.1 Description of the test location

Test location: Anechoic chamber 2
Test distance: 3 m

5.1.2 Applicability

According to EN 300 328, clause 4.3.2.2.1:
This requirement applies to all types of equipment using wide band modulations other than FHSS.

5.1.3 Description of the measurement

The average output power of the transmitter is determined using a spectrum analyser in time domain power mode with trigger to the signal pulses. So, a maximum pulse power is measured as EIRP while the turn table turns the EUT 360°.

5.1.4 Test result

WLAN Standard 802.11g

Frequency (MHz)	P [EIRP] (dBm)	Limit (dBm)	Margin (dB)
2412	11.7	20	-8.3
2442	12.7	20	-7.3
2472	11.6	20	-8.4

Limit according to EN 300 328, clause 4.3.2.2.3:

Under all test conditions	20 dBm [EIRP]
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The requirements are **FULFILLED**.

Remarks:

5.2 Transmitter unwanted emissions, radiated

For test instruments and accessories used see section 6 Part **SER 2** and **SER 3**.

5.2.1 Description of the test location

Test location: OATS 1
Test distance: 10 m

Test location: Anechoic chamber 2
Test distance: 3 m

5.2.2 Applicability

According to EN 300 328, clause 4.3.2.9.1:

This requirement applies to all types of equipment using wide band modulations other than FHSS.

5.2.3 Description of measurement

The radiation is measured using a spectrum analyser. The EUT transmits at the lowest and the highest channel in the operating band while measuring. The frequency spectrum in the frequency range 30 MHz to 12.75 GHz is scanned for emissions that exceed the limit. Emissions that come to within 6 dB below the limit are measured again in RMS and compared with the limit. The measurement is performed at normal test conditions in TX mode.

Spectrum analysers setting for pre-scan:

$f < 1$ GHz: RBW: 120 kHz, Detector: QP

$f > 1$ GHz: RBW: 1 MHz, VBW: 3 MHz, Detector: Max peak, Trace mode: Max hold, Sweep points: 23500

Spectrum analysers setting for emission identified during pre-scan:

$f < 1$ GHz: RBW: 120 kHz, Detector: QP

$f > 1$ GHz: RBW: 1 MHz, VBW: 3 MHz, Detector: RMS, Span: zero span, Sweep time: 30 ms

5.2.4 Test result

Measurements 30 MHz to 1000 MHz

Note: No emissions belonging to the radio module could be detected. The determined emissions are values of the device and have to fulfil the requirements according to EN 55032. No difference could be detected between the operating frequencies 2412 MHz and 2472 MHz.

Measurements 1 GHz to 12.75 GHz

2412 MHz

802.11g			Frequency: 2412 MHz			
Test conditions: TX, Pmax					Radiated	
			Test results			
Start frequ.	Stop frequ.	RBW	Maximum emission observed		Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dBm)	(dBm)	(dB)
1000	4000	1000	2364.0	-36.1	-30.0	-6.1
4000	8000	1000	4825.2	-52.2	-30.0	-22.2
4000	8000	1000	7239.2	-49.6	-30.0	-19.6
8000	12750	1000	9647.9	-48.2	-30.0	-18.2
Measurement uncertainty				±6 dB		

2472 MHz

802.11g			Frequency: 2472 MHz			
Test conditions: TX, Pmax					Radiated	
			Test results			
Start frequ.	Stop frequ.	RBW	Maximum emission observed		Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dBm)	(dBm)	(dB)
1000	4000	1000	2519.5	-48.4	-30.0	-18.4
4000	8000	1000	4943.8	-52.0	-30.0	-22.0
4000	8000	1000	7414.7	-48.1	-30.0	-18.1
8000	12750	1000	9888.5	-46.6	-30.0	-16.6
Measurement uncertainty				±6 dB		

Limit according to EN 300 328, clause 4.3.2.9.3:

The transmitter unwanted emissions in the spurious domain shall not exceed the values given in table 12.

In case of equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted). For emissions radiated by the cabinet or emissions radiated by integral antenna equipment (without antenna connectors), these limits are e.r.p. for emissions up to 1 GHz and as e.i.r.p. for emissions above 1 GHz.

Table 12:

Frequency range	Maximum power	Measurement bandwidth
30 MHz to 47 MHz	-36 dBm	100 kHz
47 MHz to 74 MHz	-54 dBm	100 kHz
74 MHz to 87,5 MHz	-36 dBm	100 kHz
87,5 MHz to 118 MHz	-54 dBm	100 kHz
118 MHz to 174 MHz	-36 dBm	100 kHz
174 MHz to 230 MHz	-54 dBm	100 kHz
230 MHz to 470 MHz	-36 dBm	100 kHz
470 MHz to 862 MHz	-54 dBm	100 kHz
862 MHz to 1 GHz	-36 dBm	100 kHz
1 GHz to 12.75 GHz	-30 dBm	1 MHz

The requirements are **FULFILLED**.

Remarks:

5.3 Receiver spurious emissions, radiated

For test instruments and accessories used see section 6 Part **SER 2** and **SER 3**.

5.3.1 Description of the test location

Test location: OATS 1
Test distance: 10 m

Test location: Anechoic chamber 2
Test distance: 3 m

5.3.2 Applicability

According to EN 300 328, clause 4.3.2.10.1:

Receiver spurious emissions are emissions at any frequency when the equipment is in RX mode.

5.3.3 Description of measurement

The radiation is measured using a spectrum analyser. The EUT is set in RX mode while measured. Emissions that come to within 6 dB below the limit are measured in RMS and compared with the limit. In the frequency range below 1 GHz an OATS test site according EN 300 328, Annex B.2.1 is used. Up from 1 GHz an anechoic chamber according EN 300 328, Annex B.2.3 is used. The measurement is performed at normal test conditions.

Spectrum analysers setting for pre-scan:

$f < 1$ GHz: RBW: 120 kHz, Detector: QP

$f > 1$ GHz: RBW: 1 MHz, VBW: 3 MHz, Detector: Max peak, Trace mode: Max hold, Sweep time: auto

Spectrum analysers setting for emission identified during pre-scan:

$f < 1$ GHz: RBW: 120 kHz, Detector: QP

$f > 1$ GHz: RBW: 1 MHz, VBW: 3 MHz, Detector: RMS, Span: zero span, Sweep time: 30 ms

5.3.4 Test result

Measurements 30 MHz to 1000 MHz

Note: No emissions belonging to the radio module could be detected. The determined emissions are values of the device and have to fulfil the requirements according to EN 55032. No difference could be detected between the operating frequencies 2412 MHz and 2472 MHz.

Measurements 1 GHz to 12.75 GHz

2412 MHz

802.11g			Frequency: 2412 MHz			
Test conditions: RX, Pmax					Radiated	
			Test results			
Start frequ.	Stop frequ.	RBW	Maximum emission observed		Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dBm)	(dBm)	(dB)
1000	12750	1000	1024.9	-61.8	-47.0	-14.8
1000	12750	1000	2368.9	-61.5	-47.0	-14.5
Measurement uncertainty				±6 dB		

2472 MHz

802.11g			Frequency: 2472 MHz			
Test conditions: RX, Pmax					Radiated	
			Test results			
Start frequ.	Stop frequ.	RBW	Maximum emission observed		Limit	Margin
(MHz)	(MHz)	(kHz)	(MHz)	(dBm)	(dBm)	(dB)
1000	12750	1000	1024.6	-62.2	-47.0	-15.2
1000	12750	1000	2249.9	-60.9	-47.0	-13.9
Measurement uncertainty				±6 dB		

Limit according to EN 300 328, clause 4.3.2.10.3:

The spurious emissions of the receiver shall not exceed the values given in table 13:

In case of equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted). For emissions radiated by the cabinet or emissions radiated by integral antenna equipment (without antenna connectors), these limits are e.r.p. for emissions up to 1 GHz and as e.i.r.p. for emissions above 1 GHz.

Table 13:

Frequency range	Maximum power	Measurement bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 12.75 GHz	-47 dBm	1 MHz

The requirements are **FULFILLED**.

Remarks:

6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model / Type	Kind of Equipment	Manufacturer	Equipment No.
CPR 3	FSW43	Spectrum Analyser	Rohde & Schwarz München	02-02/11-15-001
	AFS4-01000400-10-10P-4	RF Amplifier 1 - 4 GHz	MITEQ, Inc.	02-02/17-13-002
	AMF-4F-04001200-15-10P	RF Amplifier 4 - 12 GHz	MITEQ, Inc.	02-02/17-13-003
	BBHA 9120 E 251	Broadband Horn Antenna	Schwarzbeck Mess-Elektronik	02-02/24-05-006
	WBH2-18NHG	Broadband Horn Antenna	Q-par Angus Ltd	02-02/24-08-002
	Sucoflex N-2000-SMA	RF Cable	novotronik Signalverarbeitung	02-02/50-05-075
	SF104/11N/11N/1500MM	RF Cable 1.5 m	Huber + Suhner	02-02/50-13-015
	SF104/11SMA/11N/1500MM	RF Cable 1.5 m	Huber + Suhner	02-02/50-13-016
SER 2	SF104/11SMA/11N/1500MM	RF Cable 1.5 m	Huber + Suhner	02-02/50-13-017
	ESVS 30	EMI Test Receiver	Rohde & Schwarz München	02-02/03-05-006
	VULB 9168	Trilog Broadband Antenna	Schwarzbeck Mess-Elektronik	02-02/24-05-005
	NW-2000-NB	RF Cable	Huber + Suhner	02-02/50-05-113
	KK-EF393/U-16N-21N20 m	RF Cable 20m	Huber + Suhner	02-02/50-12-018
SER 3	KK-SD_7/8-2X21N-33,0M	RF Cable 33 m	Huber + Suhner AG	02-02/50-15-028
	FSW43	Spectrum Analyser	Rohde & Schwarz München	02-02/11-15-001
	AFS4-01000400-10-10P-4	RF Amplifier 1 - 4 GHz	MITEQ, Inc.	02-02/17-13-002
	AMF-4F-04001200-15-10P	RF Amplifier 4 - 12 GHz	MITEQ, Inc.	02-02/17-13-003
	BBHA 9120 E 251	Broadband Horn Antenna	Schwarzbeck Mess-Elektronik	02-02/24-05-006
	WBH2-18NHG	Broadband Horn Antenna	Q-par Angus Ltd	02-02/24-08-002
	Sucoflex N-2000-SMA	RF Cable	novotronik Signalverarbeitung	02-02/50-05-075
	SF104/11N/11N/1500MM	RF Cable 1.5 m	Huber + Suhner	02-02/50-13-015
	SF104/11SMA/11N/1500MM	RF Cable 1.5 m	Huber + Suhner	02-02/50-13-016
	SF104/11SMA/11N/1500MM	RF Cable 1.5 m	Huber + Suhner	02-02/50-13-017