



DATE: 24 August 2016

I.T.L. (PRODUCT TESTING) LTD.

FCC/IC Radio Test Report

for

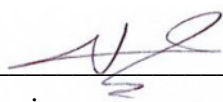
Kornit Digital Technologies Ltd.

Equipment under test:

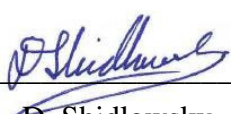
RFID Bulk System for Kornit Printers

RFID Bulk System

Tested by:


N. Levi

Approved by:


D. Shidlow

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This report relates only to items tested.



Measurement/Technical Report for
Kornit Digital Technologies Ltd.
RFID Bulk System for Kornit Printers

RFID Bulk System
FCC ID: 2AGY2RFIDBULKSYS
IC: 21026-RFIDBULKSYS

This report concerns: Original Grant: X
Class I change:
Class II change:

Equipment type: FCC: Part 15 Low Power Communication Device Transmitter-DXX
IC: Low Power Transmitter General Field Limits
(9 kHz-30 MHz)

Limits used: FCC: 47CFR15 Section 15.225
IC: RSS 210, Issue 8: 2010

Measurement procedure used is ANSI C63.10: 2013.

Application for Certification
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1. General Information

1.1 Administrative Information

Manufacturer:	Kornit Digital Technologies Ltd.
Manufacturer's Address:	12 Ha'amal, Rosh-Ha'Ayin 4809246, Israel Tel: +972-3-908-5800 Fax: +972-3-908-0280
Manufacturer's Representative:	Dori Brudner
Equipment Under Test (E.U.T):	RFID Bulk System for Kornit Printers
Equipment Name:	RFID Bulk System
Equipment Serial No.:	Not Designated
HVIN:	1.0
Date of Receipt of E.U.T:	December 24, 2015
Start of Test:	1. December 24, 2015 2. August 24, 2016 (See Note below)
End of Test:	1. January 12, 2016 2. August 24, 2016 (See Note below)
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod ISRAEL 7120101
Test Specifications:	FCC Part 15, Subpart C IC: RSS -210 Issue 8, RSS Gen- issue 4

Note: Occupied Bandwidth and Frequency Tolerance testing were performed on August 24, 2016.

2. List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), FCC Designation No. IL1005
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-3006, R-2729, T-1877, G-245.
5. Industry Canada (Canada), IC File No.: 46405-4025; Sites No. IC 4025A-1, 4025A-2.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

2.1 Product Description

E.U.T. is a 13.56MHz RFID module intended to be used in several Kornit Printing Machine models.

2.2 Test Methodology

Radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at an antenna to EUT distance of 3 meters.

2.3 Test Facility

Emissions tests were performed at I.T.L.'s testing facility in Lod, Israel. I.T.L.'s EMC Laboratory is accredited by A2LA, certificate No. 1152.01 and its FCC Designation Number is IL1005.

2.4 Measurement Uncertainty

Radiated Emission

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) for open site 30-1000MHz:

Expanded Uncertainty (95% Confidence, K=2):

± 4.98 dB

3. System Test Configuration

3.1 *Justification*

Kornit Digital is applying for limited modular approval for its 13.56 MHz module.

Per FCC response on 04/07/2014 (Tracking Number 219279), the E.U.T. was tested as “stand alone” as would be the installation position in the following host printers: Paradigm, Avalanche, Avalanche 1000, Avalanche Hexa, Allegro, Vulcan, Storm and Breeze.

The EUT was connected to an AC/DC adapter to simulate the power it would receive from the actual printer the E.U.T. would be installed in.

3.2 *EUT Exercise Software*

No special exercise software was used.

3.3 *Special Accessories*

No special accessories were needed in order to achieve compliance.

3.4 *Equipment Modifications*

No modifications were needed in order to achieve compliance

3.5 Configuration of Tested System

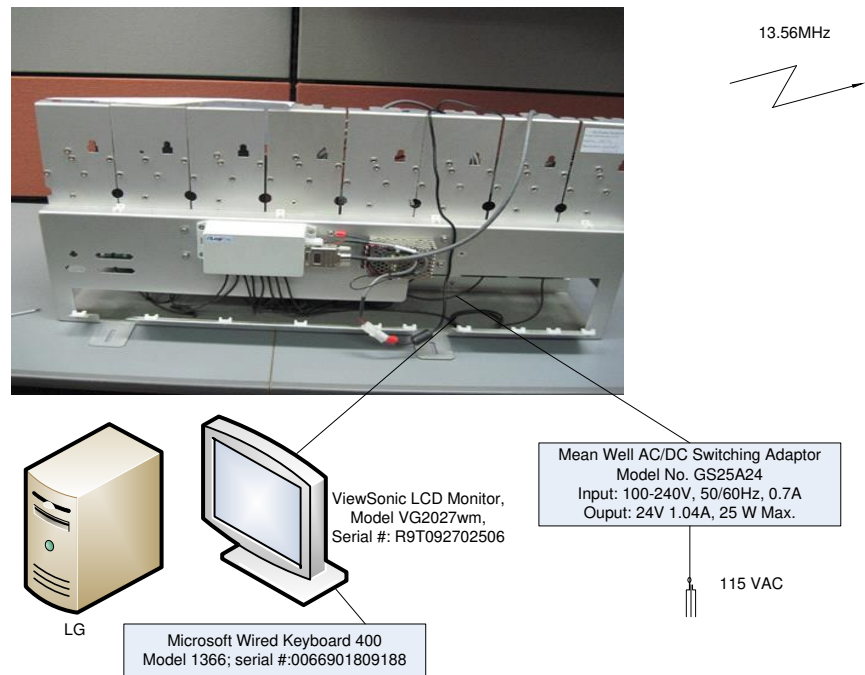


Figure 1. Configuration of Tested System

4. Test Set-up Photos



Figure 2. Radiated Emission Test



Figure 3. Radiated Emission Test



Figure 4. Radiated Emissions Test



Figure 5. Frequency Tolerance Test



Figure 6. Field Strength of Fundamental Test

5. Field Strength of Fundamental

5.1 Test Specification

F.C.C., Part 15, Subpart C, Section 15.225(a) (b) (c)
RSS-210 section 2.5, Annex 2 A2.6(a) (b) (c)

5.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3 of this report.

The E.U.T. was placed on a non-conductive table, 0.8 meters above in the chamber.

The EMI receiver was set to the E.U.T. Fundamental Frequency (13.56 MHz) and Peak Detection.

The distance between the E.U.T. and test antenna was 1 meter.

The turntable and antenna were adjusted for maximum level reading on the EMI receiver. The loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1 meter.

The average result is:

Peak Level(dB μ V/m) + E.U.T. Duty Cycle Factor, in 100msec time window (dB)

5.3 Test Results

Field Strength Reading	Limit Section 15.225(a) @1m	Margin A	Limit Section 15.225(b) @1m	Margin B	Limit Section 15.225(c) @1m	Margin C
dB μ V/m	dB μ V/m	dB	dB μ V/m	dB	dB μ V/m	dB
84.08			110.50	-26.42	100.50	-16.42
87.83	144.0	-56.17				

Figure 7. Field Strength of Fundamental Test Results

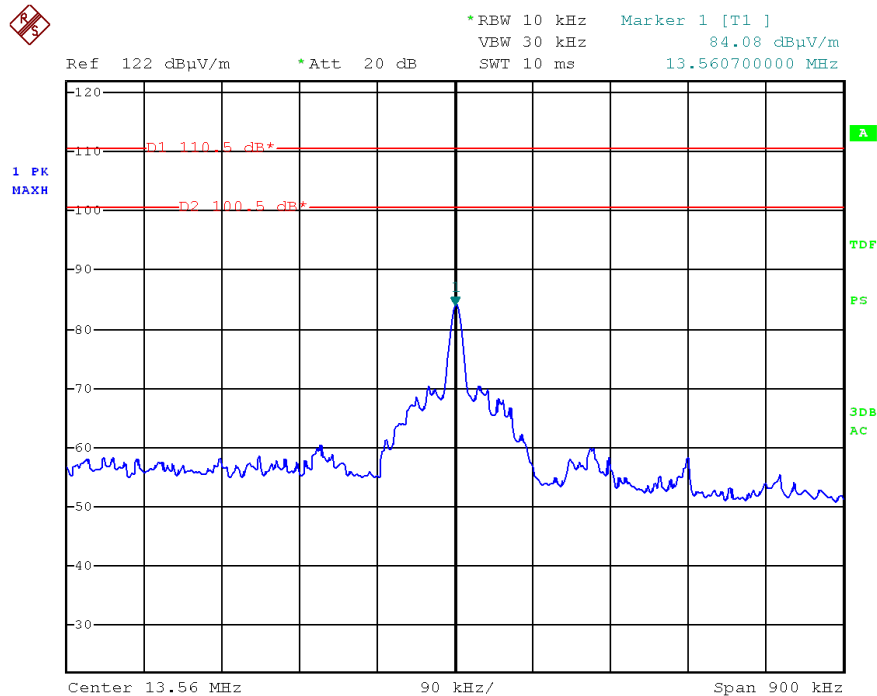
JUDGEMENT: Passed by 56.17 dB (Section 15.225(a))
Passed by 26.42 dB (Section 15.225(b))
Passed by 16.42 dB (Section 15.225(c))

The EUT met the FCC Part 15, Subpart C, Sections 15.225(a); (b); (c) and RSS-210 section 2.5, Annex 2 A2. 6(a) (b) (c) specification requirements.

The details of the highest emissions are given in *Figure 8* to *Figure 9*.

Field Strength of Fundamental

E.U.T Description RFID Bulk System for Kornit Printers
Model/Part Number RFID Bulk System
Serial Number: Not Designated



Date: 27.DEC.2015 16:05:28

**Figure 8. Field Strength of Fundamental Mask
Detector: Peak**

Section 15.225 (b): $L_{im30m} = 334.00 \mu V/m = 50.50 \text{ dB}\mu V/m$

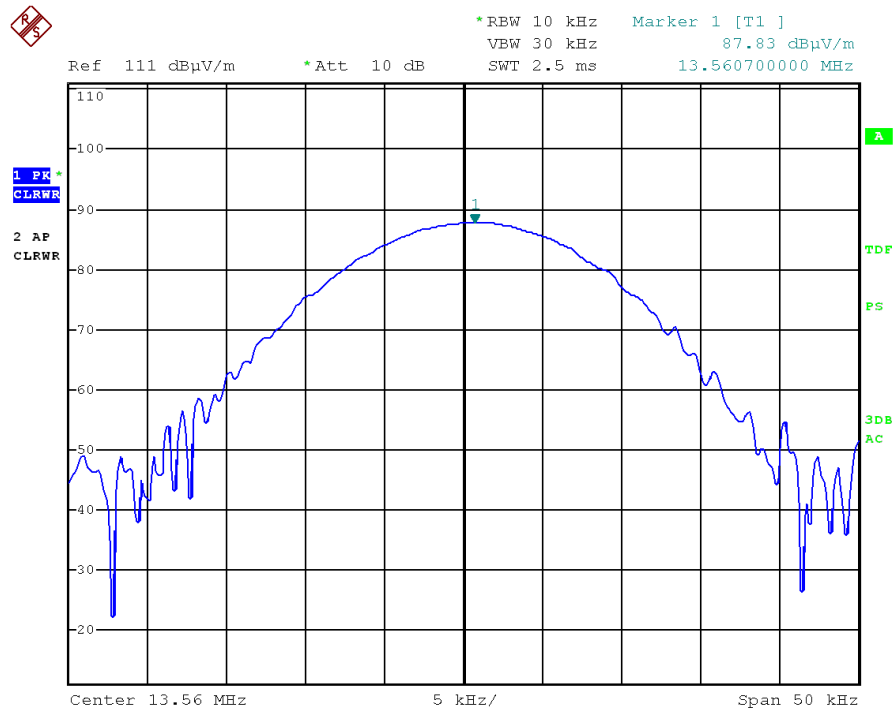
Section 15.225 (b): $L_{im1m} = 60 + 50.50 \text{ dB}\mu V/m = 110.50 \text{ dB}\mu V/m$

Section 15.225 (c): $L_{im30m} = 106.00 \mu V/m = 40.50 \text{ dB}\mu V/m$

Section 15.225 (c) $L_{im1m} = 60 + 40.50 \text{ dB}\mu V/m = 100.50 \text{ dB}\mu V/m$

Field Strength of Fundamental

E.U.T Description	RFID Bulk System for Kornit Printers
Model/Part Number	RFID Bulk System
Serial Number:	Not Designated



Date: 27.DEC.2015 15:44:48

**Figure 9. Field Strength of Fundamental
Detector: Peak**

Section 15.225 (a): $L_{im30m} = 15848.00 \mu V/m = 84.0 \text{ dB}\mu V/m$

Section 15.225(a): $L_{im1m} = 60 + 84.0 \text{ dB}\mu V/m = 144.0 \text{ dB}\mu V/m$

5.4 Test Equipment Used, Field Strength of Fundamental

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Test Receiver	Rohde & Schwarz	ESCI7	100724	January 4, 2015	January 4, 2016
Loop Antenna	EMCO	6502	2950	November 5, 2015	November 30, 2016
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 10 Test Equipment Used

6. Spurious Radiated Emission, 9 kHz – 30 MHz

6.1 Test Specification

FCC, Part 15, Subpart C, Section 209
RSS-210 issue 8, section A2.6 (d)

6.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3 of this report.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters for the frequency range 30MHz and above, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the chamber, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in *Figure 1*.

The frequency range 9 kHz-30 MHz was scanned.

The emissions were measured using a computerized EMI receiver complying with CISPR 16 requirements. The specification limits and applicable correction factors are pre-loaded to the receiver.

In the frequency range 9 kHz-30MHz, the loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1 meter at a distance of 1 meters.

The E.U.T. was operated at the frequency of 13.56 MHz. This frequency was measured using a peak detector.

6.3 Test Results

JUDGEMENT: Passed by 29.2 dB

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 209 and RSS-210 issue 8, section A2.6 (d) specification.

Radiated Emission 9 kHz – 30 MHz

E.U.T Description	RFID Bulk System for Kornit Printers
Model/Part Number	RFID Bulk System
Serial Number:	Not Designated

Specification: FCC, Part 15, Subpart C;
RSS-210 issue 8, Section A2.6 (d)

Antenna Polarization: Vertical
Test Distance: 3 meters
Operation Frequency: 13.56 MHz

Frequency range: 9 kHz - 30 MHz
Detector: Peak

Frequency (MHz)	Peak Reading (dBμV/m)	Specification (dBμV/m)	Margin (dB)
26.20	40.3	69.5	-29.2

Figure 11. Radiated Emission

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Reading” includes correction factor.

“Correction Factor” = Antenna Factor + Cable Loss

6.4 Test Equipment Used, Radiated Measurements 9kHz-30MHz

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Test Receiver	Rohde & Schwarz	ESCI7	100724	January 4, 2015	January 4, 2016
Loop Antenna	EMCO	6502	9506-2950	November 5, 2015	November 30, 2016
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 12 Test Equipment Used

6.5 Field Strength Calculation

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$FS = RA + AF + CF$$

FS: Field Strength [dB μ V/m]
 RA: Receiver Amplitude [dB μ V]
 AF: Receiving Antenna Correction Factor [dB/m]
 CF: Cable Attenuation Factor [dB]

Example: FS = 30.7 dB μ V (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dB μ V

No external pre-amplifiers are used.

7. Spurious Radiated Emission 30 MHz – 1000 MHz

7.1 Test Specification

F.C.C., Part 15, Subpart C
RSS-210 issue 8, Section A2.6 (d)

7.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site for measurements below 1GHz, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The frequency range 30 MHz-1000 MHz was scanned, and the list of the highest emissions was verified and updated accordingly.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

The emissions were measured using a computerized EMI receiver complying with CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 30-1000 MHz, the readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

Verification of the E.U.T emissions was based on the following methods:

- Turning the E.U.T on and off.

- Using a frequency span less than 10 MHz.

- Observation of the signal level during turntable rotation. Background noise is not affected by the rotation of the E.U.T.

7.3 Test Results

JUDGEMENT: Passed by 4.4 dB

The EUT met the requirements of the F.C.C. Part 15, Subpart C and RSS-210 issue 8, section A2.6 (d) specification.

Radiated Emission 30 MHz– 1000 MHz

E.U.T Description RFID Bulk System for
Kornit Printers
Model/Part Number RFID Bulk System
Serial Number: Not Designated

Specification: FCC, Part 15, Subpart C;
RSS-210 issue 8, section A2.6 (d)

Antenna Polarization: Vertical/Horizontal Frequency range: 30 MHz - 1000 MHz
Test Distance: 3 meters Detector: Quasi Peak
Operation Frequency: 13.56 MHz

Frequency (MHz)	Antenna Polarization	Q.Peak Reading (dBμV/m)	Specification (dBμV/m)	Margin (dB)
298.2	H	41.0	46.0	-5.0
298.2	V	40.5	46.0	-5.5
325.0	H	38.1	46.0	-7.9
325.0	V	41.1	46.0	-4.9
455.3	H	39.3	46.0	-6.7
455.3	V	41.6	46.0	-4.4

Figure 13. Radiated Emission

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Reading” includes correction factor.

“Correction Factor” = Antenna Factor + Cable Loss

7.4 Test Equipment Used, Radiated Measurements 30MHz-1000MHz

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	HP	8542E	3906A00276	March 11, 2015	March 31, 2016
RF Filter Section	HP	85420E	3705A00248	March 19, 2015	March 31, 2016
Biconical Antenna	EMCO	3104	2606	December 31, 2015	March 31, 2016
Log Periodic Antenna	EMCO	3146	9505-4081	December 31, 2015	March 31, 2016
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 14 Test Equipment Used

7.5 Field Strength Calculation

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$[\text{dB}\mu\text{V/m}] \text{ FS} = \text{RA} + \text{AF} + \text{CF}$$

FS: Field Strength [dB μ V/m]

RA: Receiver Amplitude [dB μ V]

AF: Receiving Antenna Correction Factor [dB/m]

CF: Cable Attenuation Factor [dB]

Example: FS = 30.7 dB μ V (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dB μ V

No external pre-amplifiers are used.

8. Occupied Bandwidth

8.1 Test Specification

FCC, Part 2, Section 2.1049
RSS-GEN issue 4 11 2014, Section 6.6

8.2 Test Procedure

The transmitter unit was operated with normal modulation. The spectrum analyzer was set to 10 kHz resolution BW and center frequency of the transmitter fundamental. The spectrum bandwidth of the transmitter unit was measured and recorded. The BW was measured at 26dBc points.

The EUT was set up as shown in *Figure 1*, and its proper operation was checked. The transmitter occupied bandwidth was measured with the EMI receiver as frequency delta between reference points on the modulation envelope.

8.3 Test Limit

N/A

8.4 Test Results

FREQUENCY	READING
(MHz)	(kHz)
13.56	167.7

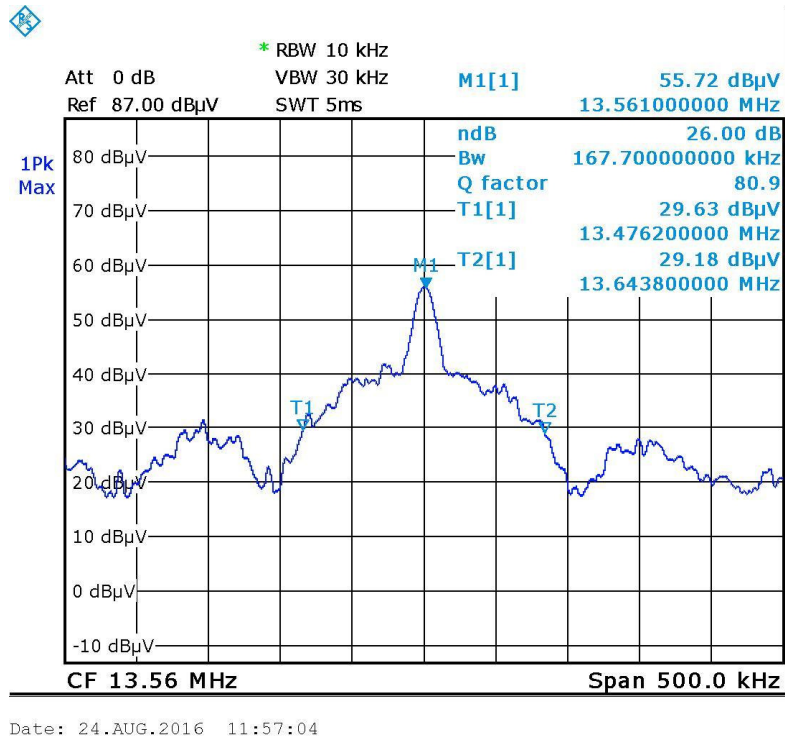
Figure 15. Bandwidth Test Results

JUDGEMENT: Passed

See additional information in *Figure 16*.

Occupied Bandwidth

E.U.T Description RFID Bulk System for Kornit
Printers
Model Number RFID Bulk System
Part Number: Not Designated



Date: 24.AUG.2016 11:57:04

Figure 16 26dB Bandwidth



8.5 Test Equipment Used; Occupied Bandwidth

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Test Receiver	Rohde & Schwarz	FSL6	100194	February 29, 2016	March 1, 2017
Loop Antenna	EMCO	6502	2950	November 5, 2015	November 30, 2016
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 17 Test Equipment Used

9. Frequency Tolerance

9.1 Test Specification

Part 15 Subpart C Section 15.225(e)
RSS-210 issue 8, section A2.6 (d)

9.2 Test Procedure

The E.U.T operation mode and test setup are as described in Section 3.

The E.U.T. was placed in a test fixture enabling coupling from the E.U.T. to the spectrum analyzer.

The E.U.T. and test fixture were placed inside a temperature chamber. The E.U.T. was operated from 115 VAC at normal temperature (20°C).

The chamber temperature was set to +20°C and tested at 115VAC, 97.75VAC and 133.25VAC.

The spectrum analyzer was set to 1.0 kHz span and 3.0 kHz resolution B.W.

“Frequency Counter” was used for these measurements.

The carrier frequency measurement was repeated for:

115 VAC @ +50°C

115 VAC @ +40°C

115 VAC @ +30°C

115 VAC @ +20°C

115 VAC @ +10°C

115 VAC @ 0°C

115 VAC @ -10°C

115 VAC @ -20°C

The carrier frequency was measured and recorded after at least 10 minutes of exposing the E.U.T. to the temperature.

The configuration tested is shown in photograph, *Figure 5. Frequency Tolerance Test.*

9.3 Test Results

The E.U.T met the requirements of Part 15 Subpart C, Section 225(e) specification.

The frequency offset between the frequency measured under extreme conditions and the nominal carrier frequency measured under normal test conditions, is in the worst case, +0.67 kHz at -20 °C (spec: +/-1.356 kHz).

The details of the highest emissions are given in *Figure 18.*



Frequency Tolerance

E.U.T Description RFID Bulk System for Kornit Printers
Model/Part Number RFID Bulk System
Serial Number: Not Designated

Specification: FCC Part 15 Subpart C Section 15.225(e);
RSS-210 Issue 8, Section A2.6 (d)

Temperature	Voltage	Measured Carrier Frequency	Nominal Carrier Frequency	Δ	Limit	Verdict
(°C)	(VAC)	(MHz)	(MHz)	(kHz)	(kHz)	(Pass/Fail)
+20.0	115.0	13.560601	13.560000	+0.601	+/-1.356	Pass
	97.75	13.560602	13.560000	+0.602	+/-1.356	Pass
	132.25	13.560602	13.560000	+0.602	+/-1.356	Pass
-20.0	115.0	13.560670	13.560000	+0.670	+/-1.356	Pass
-10.0	115.0	13.560632	13.560000	+0.632	+/-1.356	Pass
0.0	115.0	13.560615	13.560000	+0.615	+/-1.356	Pass
+10.0	115.0	13.560601	13.560000	+0.601	+/-1.356	Pass
+20.0	115.0	13.560610	13.560000	+0.610	+/-1.356	Pass
+30.0	115.0	13.560613	13.560000	+0.613	+/-1.356	Pass
+40.0	115.0	13.560620	13.560000	+0.620	+/-1.356	Pass
+50.0	115.0	13.560635	13.560000	+0.635	+/-1.356	Pass

Figure 18. Frequency Tolerance

9.4 Test Equipment Used, Frequency Tolerance

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSL6	100194	February 29, 2016	March 1, 2017
DMM	UNI-T	UT50B	1080731928	March 3, 2016	March 3, 2017
Thermal Chamber	Thermotron	SM-4S-SLE	23028	March 23, 2016	March 23, 2017
Variable Transformer	VOLTAC	SB-5	-	N/A	N/A

Figure 19 Test Equipment Used

10. APPENDIX A - CORRECTION FACTORS

10.1 Correction factors for CABLE RF

from EMI receiver
to test antenna
at 3 meter length

Frequency (MHz)	Cable Loss (dB)	Frequency (MHz)	Cable Loss (dB)
0.010	0.4	50.00	1.2
0.015	0.2	100.00	0.7
0.020	0.2	150.00	2.1
0.030	0.3	200.00	2.3
0.050	0.3	300.00	2.9
0.075	0.3	500.00	3.8
0.100	0.2	750.00	4.8
0.150	0.2	1000.00	5.4
0.200	0.3	1500.00	6.7
0.500	0.4	2000.00	9.0
1.00	0.4	2500.00	9.4
1.50	0.5	3000.00	9.9
2.00	0.5	3500.00	10.2
5.00	0.6	4000.00	11.2
10.00	0.8	4500.00	12.1
15.00	0.9	5000.00	13.1
20.00	0.8	5500.00	13.5
		6000.00	14.5

NOTES:

1. The cable type is SPUMA400 RF-11N(X2) and 39m long
2. The cable is manufactured by Huber + Suhner



10.2 Correction factors for Log Periodic Antenna

Model: 3146

Antenna serial number: 9505-4081

3 meter range

CALIBRATION DATA

Frequency, MHz	Antenna factor, dB/m ¹⁾
200	11.55
250	11.60
300	14.43
400	15.38
500	17.98
600	18.78
700	21.17
800	21.16
900	22.67
1000	24.09

¹⁾ The antenna factor shall be added to receiver reading in dB μ V to obtain field strength in dB μ V/m.

10.3 Correction factors for Biconical ANTENNA

Model: 3104

Antenna serial number: 2606

3 meter range

CALIBRATION DATA

Frequency, MHz	Near free space antenna factor, dB/m	Geometry specific correction factor, dB	Free space antenna factor, dB/m ¹⁾
30	12.97	0.13	12.84
35	12.34	0.09	12.25
40	12.03	0.06	11.97
45	11.42	0.02	11.40
50	11.91	0.03	11.88
60	11.92	0.37	11.55
70	9.60	0.25	9.35
80	6.99	-0.45	7.44
90	10.87	-0.34	11.21
100	11.51	-0.06	11.57
120	13.30	0.20	13.10
140	12.56	-0.01	12.57
160	14.49	-0.12	14.61
180	16.53	0.05	16.48
200	15.30	0.15	15.15

¹⁾ The antenna factor shall be added to receiver reading in dBμV to obtain field strength in dBμV/m.

10.4 Correction Factors for Active Loop Antenna

Model 6502

S/N 9506-2950

FREQUENCY	Magnetic Antenna Factor	Electric Antenna Factor
(MHz)	(dB)	(dB)
.009	-35.1	16.4
.010	-35.7	15.8
.020	-38.5	13.0
.050	-39.6	11.9
.075	-39.8	11.8
.100	-40.0	11.6
.150	-40.0	11.5
.250	-40.0	11.6
.500	-40.0	11.5
.750	-40.1	11.5
1.000	-39.9	11.7
2.000	-39.5	12.0
3.000	-39.4	12.1
4.000	-39.7	11.9
5.000	-39.7	11.8
10.000	40.2	11.3
15.000	-40.7	10.8
20.000	-40.5	11.0
25.000	-41.3	10.2
30.000	42.3	9.2