SK TECH CO., LTD.

TEST REPORT

Test Report No.:	SKTRFC-130326-003		
Applicant:	TIT ENG Co.,Ltd.		
Applicant Address:	7 Floor, Shin-do B/D. 10, Garak-dong, Songpa-Gu, Seoul, 138-160 South Korea		
Manufacturer:	TIT ENG Co.,Ltd.		
Manufacturer Address:	7 Floor, Shin-do B/D. 10, Garak-dong, Songpa-Gu, Seoul, 138-160 South Korea		
Equipment Under Test:	ID CARD PRINTER		
FCC ID:	XTNTP9200	**Model No.:**	TP-9200
Variant Model name	J230i, J200i, C-1		
Brand/Trade Name:	POINTMAN, Javelin, Metapace		
Receipt No.:	SKTEU13-0233	**Date of receipt:**	February 21, 2013
Date of Issue:	March 26, 2013		
Location of Testing:	**SK TECH CO., LTD.** #820-2, Wolmoon-ri, Wabu-up, Namyangju-si, Kyunggi-do, 472-905 South Korea		
Test Procedure:	ANSI C63.10-2009 and ANSI C63.4-2009		
Test Specification:	47CFR, Part 15 Rules		
Equipment Class:	DXT - Part 15 Low Power Transceiver, Rx Verified		
Test Result:	The above-mentioned device has been tested and passed.		

Tested & Reported by: *Jungtae Kim*

Signature *March 26, 2013* *Date*

Approved by: *Jongsoo Yoon*

Signature *March 26, 2013* *Date*

Other Aspects:	-
Abbreviations:	· OK, Pass = passed · Fail = failed · N/A = not applicable

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1. GENERAL

These tests were performed using the test procedure outlined in ANSI C63.10-2009 and ANSI C63.4-2009 for intentional radiators, and in accordance with the limits set forth in FCC Part 15, Subpart C, section 15.225. The EUT (Equipment Under Test) has been shown to be capable of compliance with the applicable technical standards.

We attest to the accuracy of data. All measurements reported herein were performed by SK TECH CO., LTD. and were made under Chief Engineer's supervision.
We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

2. TEST SITE

SK TECH Co., Ltd.

2.1 Location

#820-2, Wolmoon-ri, Wabu-up, Namyangju-si, Kyunggi-do, 472-905 South Korea
(FCC Registered Test Site Number: 938639)
(OPEN AREA TEST SITE INDUSTRY CANADA NUMBER: IC 5429A-1)

This test site is in compliance with ISO/IEC 17025 for general requirements for the competence of testing and calibration laboratories.
This laboratory is recognized as a Conformity Assessment Body (CAB) for CAB's Designation Number: KR0007 by FCC.

2.2 List of Test and Measurement Instruments

No.	Description	Manufacturer	Model No.	Serial No.	Calibrated until	Used
1	Spectrum Analyzer	Agilent	E4405B	US40520856	2014.03.07	☒
2	Spectrum Analyzer	Agilent	E4440A	MY46186322	2014.03.18	☒
3	EMC Spectrum Analyzer	Agilent	E7405A	US40240203	2013.07.09	☒
4	EMI Test Receiver	Rohde&Schwarz	ESPI7	101206	2014.07.10	☒
5	EMI Test Receiver	Rohde&Schwarz	ESIB40	100277	2014.03.07	
6	EMI Test Receiver	Rohde&Schwarz	ESHS10	835871/002	2013.09.18	☒
7	Artificial Mains Network	Rohde&Schwarz	ESH3-Z5	834549/011	2013.07.09	☒
8	Pre-amplifier	HP	8447F	3113A05153	2013.07.10	☒
9	Pre-amplifier	MITEQ	AFS44	1116321	2013.12.15	
10	Pre-amplifier	MITEQ	AFS44	1116322	2014.03.08	
11	Power Meter	Agilent	E4417A	MY45100426	2013.07.10	
12	Power Meter	Agilent	E4418B	US39402176	2013.07.10	
13	Power Sensor	Agilent	E9327A	MY44420696	2013.07.10	
14	Power Sensor	Agilent	8482A	MY41094094	2013.07.10	
15	Power Sensor	Agilent	8485A	3318A13916	2013.07.10	
16	Attenuator (10dB)	HP	8491B	38067	2013.07.09	
17	Attenuator (20dB)	Weinschel	44	AH6967	2013.07.09	
18	High Pass Filter	Wainwright	WHKX3.0/18G	8	2013.07.09	
19	VHF Precision Dipole Antenna (TX/RX)	Schwarzbeck	VHAP	1014 / 1015	2013.10.04	
20	UHF Precision Dipole Antenna (TX/RX)	Schwarzbeck	UHAP	989 / 990	2013.10.04	
21	Loop Antenna	Schwarzbeck	HFH2-Z2	863048/019	2013.12.22	☒
22	TRILOG Broadband Antenna	Schwarzbeck	VULB9168	189	2013.05.31	☒
23	Horn Antenna	AH Systems	SAS-200/571	304	N/A	
24	Horn Antenna	EMCO	3115	00040723	2013.05.31	
25	Horn Antenna	EMCO	3115	00056768	2013.09.06	
26	Horn Antenna	Schwarzbeck	BBHA9170	BBHA9170318	2013.09.28	
27	Vector Signal Generator	Agilent	E4438C	MY42080359	2013.07.09	
28	PSG analog signal generator	Agilent	E8257D-520	MY45141255	2013.07.10	
29	DC Power Supply	HP	6633A	3325A04972	2013.07.10	
30	DC Power Supply	HP	6622A	3348A03223	2013.07.10	
31	Temperature/Humidity Chamber	All Three	ATM-50M	20030425	2014.03.08	
32	Hygro/Thermo Graph	SATO	PC-5000TRH-II	-	2013.07.18	☒

2.3 Test Date

Date of Test: March 13, 2013 ~ March 21, 2013

2.4 Test Environment

See each test item's description.

3. DESCRIPTION OF THE EQUIPMENT UNDER TEST

Description of the buyer and multiple model

Variant model name	Difference
J230i, J200i, C-1	The applicant declared that the variant models are electrically identical to the basic model TP-9200, and added for the marketing purpose

3.1 Rating and Physical Characteristics

The product specification described herein was obtained from the product data sheet or user's manual.

Power source		External AC/DC Adapter	
Local Oscillator or X-Tal		X-Tal: (Main board) 24 MHz, 16 MHz, 12 MHz, 32.768 kHz (Card RFID board) 13.56 MHz (Ribbon tag RFID board) 13.56 MHz, 8 MHz (SAM board) 22.1184 MHz, 4 MHz, (Ethernet board) 25 MHz (Side change board) 14.7456 MHz	
Tx Frequency		13.56 MHz (two RFID boards)	
Antenna Type		Card RFID board - External PCB antenna (66 × 35 mm, 3-turns) - Internal PCB antenna (66 × 35 mm, 3-turns)	Ribbon tag RFID board -Internal PCB antenna (51 × 25 mm, 10-turns)
Type of Modulation		ASK	
External Ports *	RJ-45	- Ethernet interface	
	RS-232C	- Serial port	
	USB	- USB interface	
	DC IN	- from the AC/DC Adapter Manufacturer: Dong Guan Sea Sonic Electronics Co., Ltd. Model Name: SSA-0901-24 Input: AC 100 – 240 V, 50/60 Hz, 2 A Output: DC 24 V, 3.75 A	

* The test report for compliance with FCC Part 15B as a digital device was made under DoC process with a separate report.

3.2 Equipment Modifications

None

3.3 Submitted Documents

Block diagram

Schematic diagram

Part List

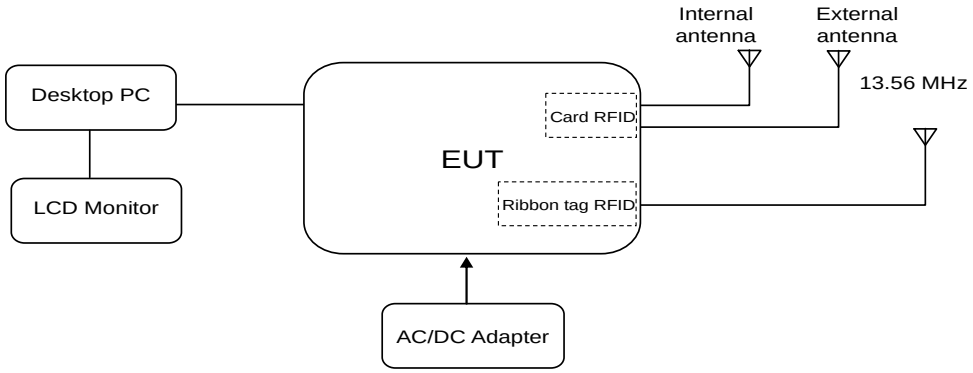
User manual

4. MEASUREMENT CONDITIONS

4.1 Description of test configuration

The measurements were taken in transmitting RF signals continuously.

Test software used: TP9000_TP.exe, Ver2.1.5.0 (Card Printer Test Program)



[System Block Diagram of Test Configuration]

4.2 List of Peripherals

Equipment Type	Manufacturer	Model	S/N
Desktop PC	Samsung Electronics Co., Ltd.	DM-V75	BY6497EQ500013J
LCD Monitor	Qisda(Suzhou) Co., Ltd.	ST2220Lb	CN-0WD4D2-74261-253-1HNM
Keyboard (USB)	HEWLETT-PACKARD COMPANY	ST-2210b	CN-0T503R-74261-04T-OUJM
Mouse (USB)	Logitech Inc	M-UAE96	537749-001
AC/DC Adapter	Dong Guan Sea Sonic Electronics Co., Ltd.	KPA-060M	1001324
USB Flash Memory	N/A	N/A	N/A
RFID cards	N/A	N/A	N/A

4.3 Type of Used Cables

#	START		END		CABLE	
	NAME	I/O PORT	NAME	I/O PORT	LENGTH(m)	SHIELDED
1	EUT	USB	Desktop PC	USB	1.9	NO
2	EUT	Serial	Desktop PC	Serial	1.7	NO
3	EUT	Ethernet	Desktop PC	Ethernet	1.0	NO
4	EUT	DC IN	AC/DC Adapter	DC OUT	0.5	NO (core)
5	AC/DC Adapter	AC IN	AC mains	AC mains	1.8	NO
6	Desktop PC	AC IN	AC mains	AC mains	1.8	NO
7	LCD Monitor	AC IN	AC mains	AC mains	1.8	NO
8	LCD Monitor	RGB	Desktop PC	RGB	1.8	NO

4.4 Uncertainty

Measurement Item	Combined Standard Uncertainty Uc	Expanded Uncertainty $U = k \times Uc$ ($k = 2$)
Radiated disturbance	± 2.30 dB	± 4.60 dB
Conducted disturbance	± 1.96 dB	± 3.92 dB

5. TEST AND MEASUREMENTS

Summary of Test Results

Requirement	FCC, 47CFR15	Report Section	Test Result
Antenna Requirement	15.203	5.1	PASS
Radiated Emissions Field Strength within the band 13.553-13.567 MHz	15.225(a)	5.2	PASS
Field Strength within the bands 13.410-13.553 MHz and 13.567-13.710 MHz 13.110-13.410 MHz and 13.710-14.010 MHz	15.225(b) & (c)	5.2	PASS
Radiated Harmonics and Spurious Emissions Outside of the 13.110 – 14.010 MHz	15.225(d) 15.209(a)	5.2	PASS
Frequency Tolerance of Carrier Signal	15.225(e)	5.3	PASS
AC Power Line Conducted Emissions	15.207(a)	5.4	PASS

5.1 ANTENNA REQUIREMENT

5.1.1 Regulation

FCC section 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.

5.1.2 Result: PASS

The EUT has three integral PCB loop antennas, and meets the requirements of this section.

5.2 RADIATED EMISSIONS

5.2.1 Regulation

FCC 47CFR15 – 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.

Frequency (MHz)	Field strength limit (μV/m) @ 30 m	Field strength limit (dBμV/m) @ 30 m	Field strength limit (dBμV/m) @ 3 m
13.110 – 13.410	106	40.5	80.5
13.410 – 13.553	334	50.5	90.5
13.553 – 13.567	15,848	84.0	124.0
13.567 – 13.710	334	50.5	90.5
13.710 – 14.010	106	40.5	80.5

FCC 47CFR15 – 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 (MHz)	Field strength limit (μV/m)	Field strength limit (dBμV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F (kHz) = 266.7 – 4.9	48.5 – 13.8	300
0.490 – 1.705	24000/F (kHz) = 49.0 – 14.1	33.8 – 23.0	30
1.705 – 30.0	30	29.5	30
30 – 88	100	40.0	3
88 – 216	150	43.5	3
216 – 960	200	46.0	3
Above 960	500	54.0	3

* The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector. For the frequency bands 9 – 90 kHz, 110 – 490 kHz and above 1000 MHz, the radiated emission limits are based on measurements employing an average detector.

* The lower limit shall apply at the transition frequencies.

5.2.2 Measurement Procedure

Radiated Emissions Test, 9 kHz to 30 MHz (Magnetic Field Test)

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions at a distance of 1 meter or 3 meters according to Section 15.31(f)(2).
2. The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table.
3. Emissions from the EUT are maximized by adjusting the orientation of the Loop antenna and rotating the EUT on the turntable. Manipulating the system cables also maximizes EUT emissions if applicable.
4. To obtain the final measurement data, each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.

Radiated Emissions Test, above 30 MHz

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber at a distance of 3 meters.
2. The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360˚.
3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 30 to 1000 MHz using the TRILOG broadband antenna.
4. To obtain the final measurement data, the EUT was arranged on a turntable situated on a 4 × 4 meter at the Open Area Test Site. The EUT was tested at a distance 3 meters.
5. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.
6. The EUT is situated in three orthogonal planes (if appropriate)
7. The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT.

5.2.3 Calculation of the field strength limits below 30 MHz

1. No special calculation for obtaining the field strength in dBμV/m is necessary, because the EMI receiver and the active loop antenna operate as a system, where the reading gives directly the field strength result (dBμV/m). The antenna factors and cable losses are already taken into consideration.
2. 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 40dB/decade (inverse linear distance for field strength measurements).
3. All following emission measurements were performed using the test receiver's average, peak, and quasi-peak detector function with specified bandwidth.
4. The basic equation is as follows;

FS= RA + DF

Where

FS = Field strength in dBμV/m

RA = Receiver Amplitude in dBμV/m

DF = Distance Extrapolation Factor in dB

Where DF = $40\log(D_{TEST} / D_{SPEC})$ where D_{TEST} = Test Distance and D_{SPEC} = Specified Distance

DF = 40log(3m/300m) = -80 dB, for frequency band: 0.009 to 0.490 MHz

DF = 40log(3m/30m) = -40 dB, for frequency band: 0.490 to 30 MHz

5.2.4 Test Results: PASS

Table 1: Field strength below 30 MHz

Frequency [MHz]	RBW [kHz]	Reading [dB(μV/m)]	Cable Loss [dB]	Actual [dB(μV/m)]	Limit (at 3m) [dB(μV/m)]	Margin [dB]
Emissions Quasi-peak DATA under 15.225(a), (b)&(c) (Card RFID - External antenna)						
13.490	9	---	0.3	---	90.5	---
13.556	9	60.61	0.3	60.91	124.0	63.09
13.627	9	---	0.3	---	90.5	---
Emissions Quasi-peak DATA under 15.225(a), (b)&(c) (Card RFID - Internal antenna)						
13.565	9	56.04	0.3	56.34	124.0	67.66
Emissions Quasi-peak DATA under 15.225(a), (b)&(c) (Ribbon tag RFID)						
13.565	9	50.56	0.3	50.86	124.0	73.14
Emissions Quasi-peak DATA under 15.225(d), 15.209 (Card RFID - External antenna, Card RFID - Internal antenna, Ribbon tag RFID)						
27.12	9	---	0.3	---	69.5	---

Actual (dBμV/m) = Reading + Cable Loss

Margin (dB) = Limit – Actual

NOTE: These test results were measured at the 3 m distance.

Remark:"---" means the emission level was too low to be measured or in the noise floor.

Table 2: Measured values of the Field strength (above 30 MHz)
(Card RFID-External antenna, Card RFID-Internal antenna, Ribbon tag RFID)

Frequency [MHz]	RBW [kHz]	POL [V/H]	ANT [m]	Reading [dBμV]	AMP [dB]	AF [dB/m]	CL [dB]	Actual [dBμV/m]	Limit [dBμV/m]	Margin [dB]
243.31	120	H	2.77	54.77	26.85	12.04	1.92	41.88	46.00	4.12
243.31	120	V	1.93	56.70	26.85	12.04	1.92	43.81	46.00	2.19**
298.61	120	H	2.17	46.31	26.79	13.79	2.13	35.44	46.00	10.56
298.61	120	V	2.05	49.87	26.79	13.79	2.13	39.00	46.00	7.00
602.31	120	H	1.00	45.11	28.26	19.75	3.09	39.69	46.00	6.31
602.31	120	V	2.77	40.76	28.26	19.75	3.09	35.34	46.00	10.66
749.98	120	H	1.00	41.52	27.91	21.35	3.46	38.42	46.00	7.58
749.98	120	V	2.07	37.72	27.91	21.35	3.46	34.62	46.00	11.38
800.31	120	H	1.02	39.66	27.75	22.22	3.57	37.70	46.00	8.30
800.31	120	V	2.59	36.24	27.75	22.22	3.57	34.28	46.00	11.72

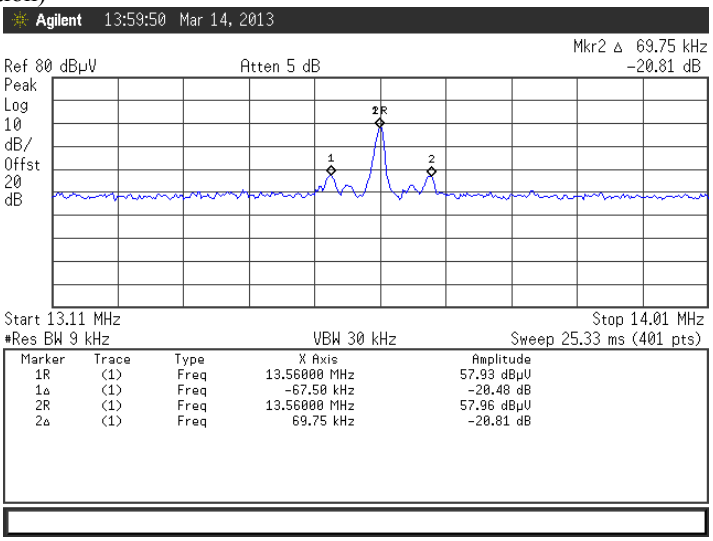
Margin (dB) = Limit – Actual
[Actual = Reading + AF + CL]
1. H = Horizontal, V = Vertical Polarization
2. AF/CL = Antenna Factor and Cable Loss

NOTE: 1. All emissions not reported were more than 20 dB below the specified limit or in the noise floor.
2. These test results measured at the 3 m distance.

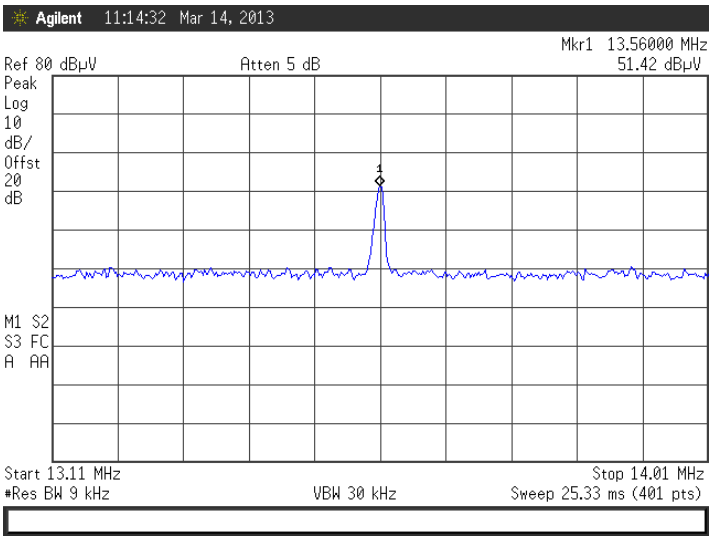
*** The measured result is within the test standard limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliance based on the 95 % level of confidence. However, the result indicates that compliance is more probable than non-compliance.*

Figure 1. Plot of the Band edge (Preliminary measurement in the anechoic chamber at 3 m distance to find out the frequencies, at which the spurious emissions occur, with the peak detector function)

Card RFID
External antenna



Card RFID
Internal antenna



Ribbon tag RFID

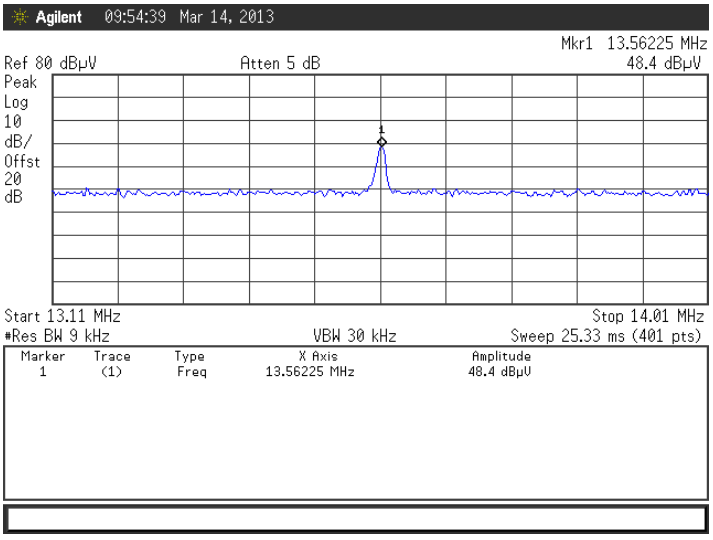
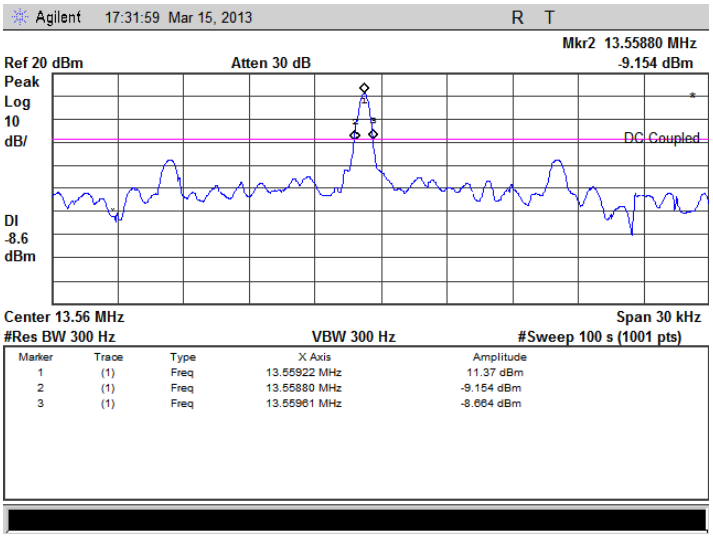
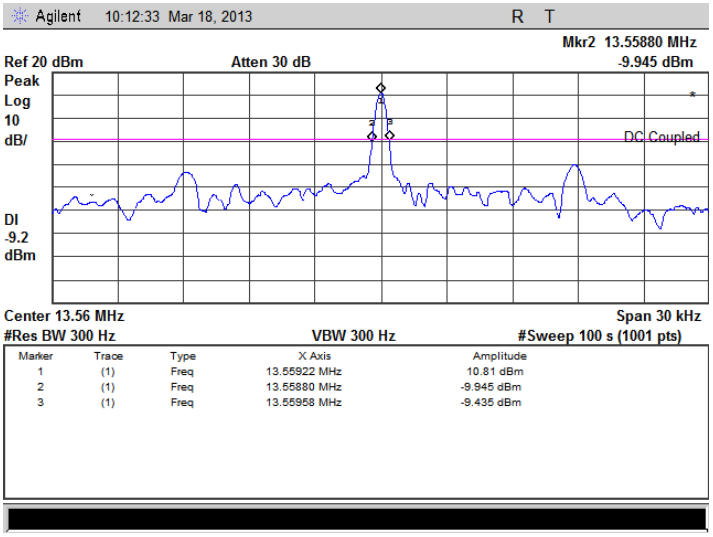


Figure 2. Plot of the 20 dB bandwidth

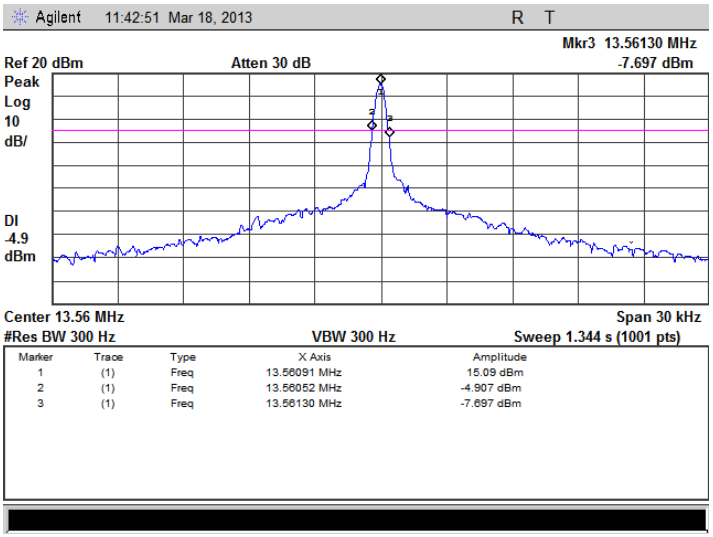
Card RFID
External antenna



Card RFID
Internal antenna



Ribbon tag RFID



5.3 FREQUENCY TOLERANCE OF CARRIER SIGNAL

5.3.1 Regulation

FCC 47CFR15 – 15.225(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.

5.3.2 Measurement Procedure

Frequency stability versus environmental temperature

1. Supply the EUT with nominal AC voltage.
2. Turn the EUT off, and place it inside an environmental temperature chamber. For devices that are normally operated continuously, the EUT may be energized while inside the test chamber. For devices that have oscillator heaters, energize only the heater circuit while the EUT is inside the chamber.
3. RF output was connected to a frequency counter or other frequency-measuring instrument via feed through attenuators.
4. Set the temperature control on the chamber to the highest specified EUT operating temperature, and allow the temperature inside the chamber to stabilize at the set temperature before starting frequency measurements.
5. While maintaining a constant temperature inside the environmental chamber, turn the EUT on and record the operating frequency at startup and two, five, and ten minutes after the EUT is energized.
6. After all measurements have been made at the highest specified temperature turn the EUT off.
7. Repeat the above measurement process for the EUT with the test chamber set at the appropriate temperature.

Frequency Stability versus Input Voltage

1. At room temperature (20 ± 5) °C supply the EUT with nominal AC voltage.
2. Couple RF output to a frequency counter or other frequency-measuring instrument.
3. Turn the EUT on, and measure the EUT operating frequency at startup and two, five, and ten minutes after startup.
4. Supply it with 85 % of the nominal AC voltage and repeat the above procedure.
5. Supply it with 115 % of the nominal AC voltage and repeat the above procedure.

5.3.3 Test Results: **PASS**

Table 3: Frequency Tolerance

Environment Temperature	Power Supplied	Carrier Frequency Measured with Time Elapsed							
		STARUP		2 minutes		5 minutes		10 minutes	
[°C]	[V_{AC}]	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]
Reference Frequency: 13.56 MHz, LIMIT: within ± 1 356 Hz (Card RFID - External antenna)									
+50	120	13.559190	810	13.559189	811	13.559188	812	13.559187	813
+40	120	13.559197	803	13.559196	804	13.559195	805	13.559193	807
+30	120	13.559255	745	13.559254	746	13.559251	749	13.559250	750
+20	120	13.559267	733	13.559266	734	13.559266	734	13.559267	733
+10	120	13.559287	713	13.559287	713	13.559288	712	13.559288	712
0	120	13.559296	704	13.559291	709	13.559290	710	13.559295	705
-10	120	13.559319	681	13.559318	682	13.559317	683	13.559318	682
-20	120	13.559317	683	13.559316	684	13.559315	685	13.559318	682
Reference Frequency: 13.56 MHz, LIMIT: within ± 1 356 Hz (Card RFID - Internal antenna)									
+50	120	13.559184	816	13.559183	817	13.559181	819	13.559180	820
+40	120	13.559198	802	13.559198	802	13.559197	803	13.559196	804
+30	120	13.559236	764	13.559235	765	13.559234	766	13.559232	768
+20	120	13.559272	728	13.559272	728	13.559271	729	13.559270	730
+10	120	13.559297	703	13.559293	707	13.559291	709	13.559290	710
0	120	13.559303	697	13.559302	698	13.559300	700	13.559298	702
-10	120	13.559315	685	13.559315	685	13.559314	686	13.559313	687
-20	120	13.559300	700	13.559302	698	13.559305	695	13.559303	697
Reference Frequency: 13.56 MHz, LIMIT: within ± 1 356 Hz (Ribbon tag RFID)									
+50	120	13.560847	-847	13.560845	-845	13.560840	-840	13.560838	-838
+40	120	13.560907	-907	13.560905	-905	13.560901	-901	13.560899	-899
+30	120	13.560935	-935	13.560933	-933	13.560931	-931	13.560924	-924
+20	120	13.561005	-1005	13.561006	-1006	13.561007	-1007	13.561006	-1006
+10	120	13.561072	-1072	13.561073	-1073	13.561073	-1073	13.561075	-1075
0	120	13.561130	-1130	13.561132	-1132	13.561134	-1134	13.561135	-1135
-10	120	13.561138	-1138	13.561136	-1136	13.561130	-1130	13.561132	-1132
-20	120	13.561095	-1095	13.561096	-1096	13.561097	-1097	13.561094	-1094

Err [Hz] = Measured carrier frequency (MHz) - Reference Frequency (13.56 MHz)

Table 3: Frequency Tolerance (continued)

Power Supplied	Carrier Frequency Measured with Time Elapsed							
	STARUP		2 minutes		5 minutes		10 minutes	
[V_{AC}]	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]
Reference Frequency: 13.56 MHz, LIMIT: within ± 1 356 Hz (Card RFID - External antenna)								
85 %	13.559255	745	13.559254	746	13.559250	750	13.559249	751
100 %	13.559267	733	13.559266	734	13.559266	734	13.559267	733
115 %	13.559254	746	13.559253	747	13.559250	750	13.559249	751
Reference Frequency: 13.56 MHz, LIMIT: within ± 1 356 Hz (Card RFID - Internal antenna)								
85 %	13.559272	728	13.559272	728	13.559271	729	13.559270	730
100 %	13.559272	728	13.559272	728	13.559271	729	13.559270	730
115 %	13.559272	728	13.559271	729	13.559270	730	13.559269	731
Reference Frequency: 13.56 MHz, LIMIT: within ± 1 356 Hz (Ribbon tag RFID)								
85 %	13.561005	-1005	13.561006	-1006	13.561007	-1007	13.561007	-1007
100 %	13.561005	-1005	13.561006	-1006	13.561007	-1007	13.561006	-1006
115 %	13.561004	-1004	13.561005	-1005	13.561008	-1008	13.561008	-1008

Err [Hz] = Measured carrier frequency (MHz) - Reference Frequency (13.56 MHz)

5.4 AC POWER LINE CONDUCTED EMISSIONS

5.4.1 Regulation

According to §15.207(a), 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 50μH/50Ω 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)	
	Qausi-peak	Average
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5	56	46
5 – 30	60	50

* Decreases with the logarithm of the frequency.

5.4.2 Test Procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50Ω/50μH LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source.
3. Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
5. The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 kHz or to QUASI-PEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

5.4.3 Test Results: **PASS**

Table 4: Measured values of the Conducted Emissions

Frequency [MHz]	Reading [dBµV]	L / N	CF [dB]	CL [dB]	Actual [dBµV]	Limit [dBµV]	Margin [dB]
QUASI-PEAK DATA (Card RFID - External antenna & Ribbon tag RFID)							
0.1500	42.21	N	0.10	0.03	42.34	66.00	23.66
0.2600	42.51	N	0.11	0.04	42.66	61.43	18.77
0.2800	40.24	N	0.12	0.04	40.40	60.82	20.42
0.3450	50.47	N	0.12	0.04	50.63	59.08	8.45
0.3650	50.31	N	0.12	0.04	50.47	58.61	8.14
1.4550	38.30	N	0.16	0.07	38.53	56.00	17.47
1.5700	40.78	N	0.16	0.07	41.01	56.00	14.99
1.5850	38.97	L	0.16	0.07	39.20	56.00	16.80
4.0600	32.33	L	0.20	0.11	32.64	56.00	23.36
4.1550	31.27	N	0.20	0.11	31.58	56.00	24.42
13.5600	46.41	N	0.35	0.18	46.94	60.00	13.06
AVERAGE DATA (Card RFID - External antenna & Ribbon tag RFID)							
0.1500	28.64	N	0.10	0.03	28.77	56.00	27.23
0.2600	33.08	N	0.11	0.04	33.23	51.43	18.20
0.2800	31.33	N	0.12	0.04	31.49	50.82	19.33
0.3450	41.56	N	0.12	0.04	41.72	49.08	7.36
0.3650	40.98	N	0.12	0.04	41.14	48.61	7.47
1.4550	25.05	N	0.16	0.07	25.28	46.00	20.72
1.5700	27.26	N	0.16	0.07	27.49	46.00	18.51
1.5850	24.22	L	0.16	0.07	24.45	46.00	21.55
4.0600	26.85	L	0.20	0.11	27.16	46.00	18.84
4.1550	25.17	N	0.20	0.11	25.48	46.00	20.52
13.5600	44.99	N	0.35	0.18	45.52	50.00	4.48

Margin (dB) = Limit – Actual
[Actual = Reading + CF + CL]
L/N = LINE / NEUTRAL
CF/CL = Correction Factor and Cable Loss

NOTE: All emissions not reported were more than 20 dB below the specified limit.

Table 4: Measured values of the Conducted Emissions (continued)							
Frequency [MHz]	Reading [dBµV]	L / N	CF [dB]	CL [dB]	Actual [dBµV]	Limit [dBµV]	Margin [dB]
QUASI-PEAK DATA (Card RFID - Internal antenna & Ribbon tag RFID)							
0.1550	50.88	L	0.10	0.03	51.01	65.73	14.72
0.2600	47.92	L	0.11	0.04	48.07	61.43	13.36
0.2800	41.49	N	0.12	0.04	41.65	60.82	19.17
0.3450	50.49	N	0.12	0.04	50.65	59.08	8.43
0.3650	49.94	L	0.12	0.04	50.10	58.61	8.51
0.3650	50.53	N	0.12	0.04	50.69	58.61	7.92
1.5650	42.92	L	0.16	0.07	43.15	56.00	12.85
1.5750	39.03	N	0.16	0.07	39.26	56.00	16.74
4.0900	32.01	N	0.20	0.11	32.32	56.00	23.68
4.1300	36.72	L	0.20	0.11	37.03	56.00	18.97
13.5600	40.41	L	0.39	0.18	40.98	60.00	19.02
AVERAGE DATA (Card RFID - Internal antenna & Ribbon tag RFID)							
0.1550	24.92	N	0.10	0.03	25.05	55.73	30.68
0.2600	34.41	N	0.11	0.04	34.56	51.43	16.87
0.2800	33.35	N	0.12	0.04	33.51	50.82	17.31
0.3450	41.23	N	0.12	0.04	41.39	49.08	7.69
0.3650	39.22	L	0.12	0.04	39.38	48.61	9.23
0.3650	41.23	N	0.12	0.04	41.39	48.61	7.22
1.5650	27.06	L	0.16	0.07	27.29	46.00	18.71
1.5750	25.91	N	0.16	0.07	26.14	46.00	19.86
4.0900	26.17	N	0.20	0.11	26.48	46.00	19.52
4.1300	26.22	L	0.20	0.11	26.53	46.00	19.47
13.5600	36.50	L	0.39	0.18	37.07	50.00	12.93

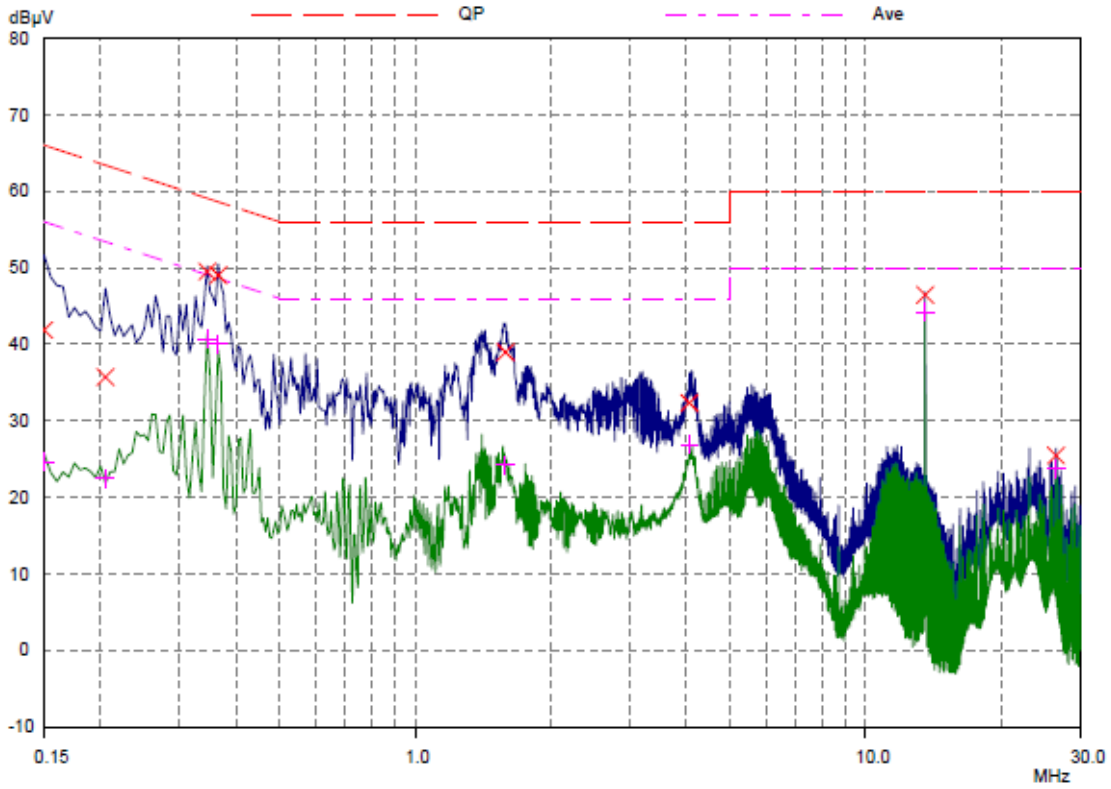
Margin (dB) = Limit – Actual
[Actual = Reading + CF + CL]
L/N = LINE / NEUTRAL
CF/CL = Correction Factor and Cable Loss

NOTE: All emissions not reported were more than 20 dB below the specified limit.

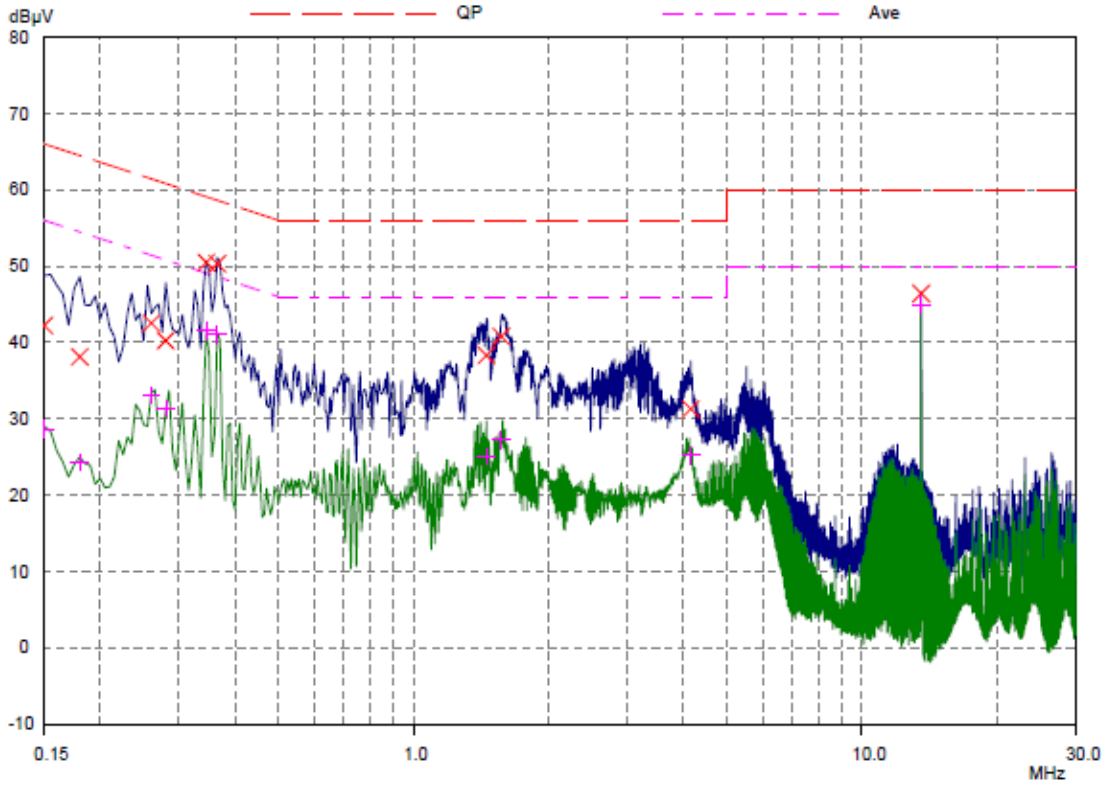
Figure 3. Plot of the Conducted Emissions

Card RFID - External antenna & Ribbon tag RFID

Line – PE (Peak and Average detector used)

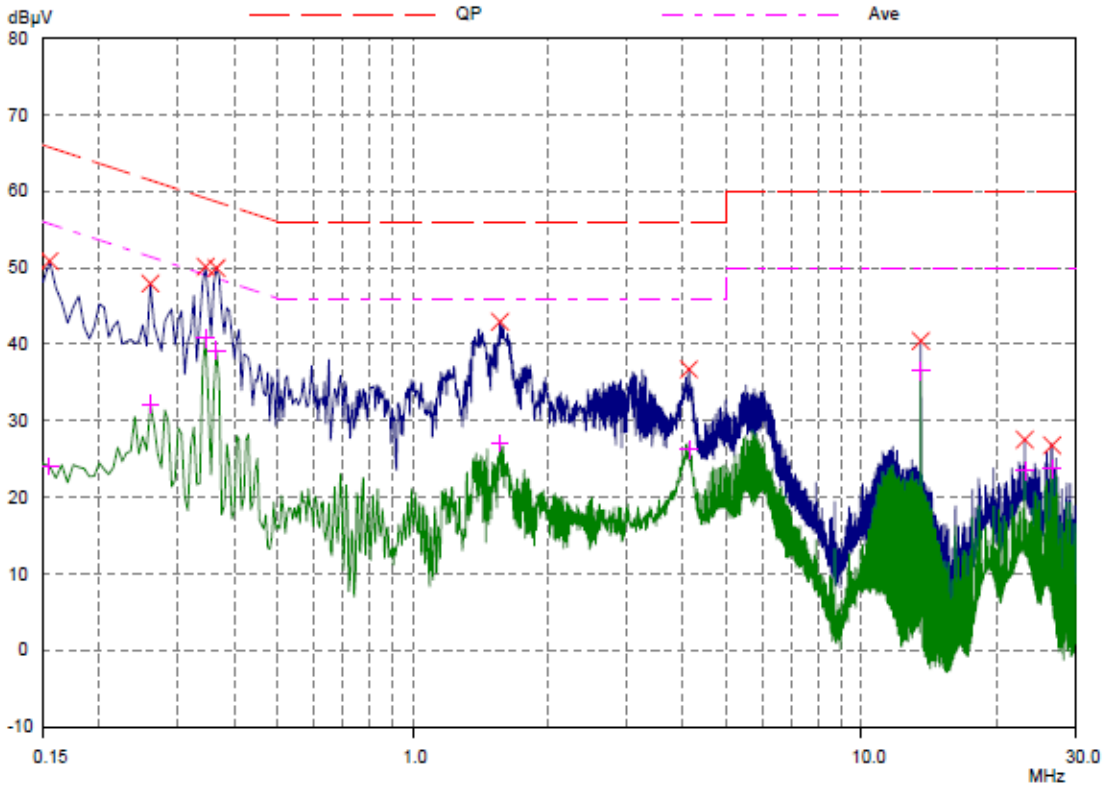


Neutral – PE (Peak and Average detector used)



Card RFID - Internal antenna & Ribbon tag RFID

Line – PE (Peak and Average detector used)



Neutral – PE (Peak and Average detector used)