

FCC RF TEST REPORT

Test Laboratory:**SK Tech Co., Ltd.**

820-2, Wolmoon-ri, Wabu-up,

Namyangju-si, Kyunggi-do

472-905 South Korea

TEL: +82-31-576-2204

FAX: +82-31-576-2205

Test Report Number: SKT-RFC-140007**Date of issue: August 21, 2014****Applicant:****DUALi Inc.**1-309 Innoplex, 552 Woncheon-dong, Youngtong-gu, Suwon, Gyeonggi-do
South Korea**Manufacturer:****DUALi Inc.**1-309 Innoplex, 552 Woncheon-dong, Youngtong-gu, Suwon, Gyeonggi-do
South Korea**Product:**

SMART CARD READER

Model:**DE-632**

(please see P5 for all the model numbers)

FCC ID:**SWUDE-632****File number:**

SKTEU14-0234

EUT received:

March 7, 2014

Applied standards:

ANSI C63.10-2009 and ANSI C63.4-2009

Rule parts:

FCC Part 15 Subpart C - Intentional radiators

Equipment Class:

DXT - Part 15 Low Power Transceiver, Rx Verified

Remarks to the standards: None

The above equipment has been tested by SK Tech Co., Ltd., and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product or system, which was tested.


Inyong Song / Testing Engineer
Jongsoo Yoon / Technical Manager

This report shall not be reproduced except in full, without the written approval of SK Tech Co., Ltd. The client should not use it to claim product endorsement by any government agencies.



Revision History of Report

Rev.	Revisions	Effect page	Reviewed by	Date
-	Initial issue	All	Jongsoo Yoon	August 21, 2014



TABLE OF CONTENTS

1	Summary of test results	4
2	Description of equipment under test (EUT)	5
3	Test and measurement conditions	6
	3.1. Test configuration (arrangement of EUT)	6
	3.2. Description of support units (accessory equipment).....	6
	3.3. Interconnection and I/O cables.....	6
	3.4. Measurement Uncertainty (<i>U</i>)	6
	3.5. Test date	6
4	Facilities and accreditations	7
	4.1. Facilities.....	7
	4.2. Accreditations	7
	4.3. List of test and measurement instruments.....	7
5	Test and measurements	8
	5.1. Antenna requirement	8
	5.2. Radiated emissions	9
	5.3. Frequency tolerance of carrier signal	16
	5.4. AC power line Conducted emissions	18



1 Summary of test results

Requirement	CFR 47 Section	Result
Antenna Requirement	15.203	Meets the requirements
Radiated Emissions Field Strength within the band 13.553-13.567 MHz	15.225(a)	Meets the requirements
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)	Meets the requirements
Radiated Harmonics and Spurious Emissions Outside of the 13.110 – 14.010 MHz	15.225(d) 15.209(a)	Meets the requirements
Frequency Tolerance of Carrier Signal	15.225(e)	Meets the requirements
AC power line Conducted emissions	15.207(a)	Meets the requirements

Note: -



2 Description of equipment under test (EUT)

Product: SMART CARD READER
Model: DE-632
Serial number: None (prototype)

Model differences:

Model name	Difference	Tested (checked)
DE-632	Fully tested model that was provided by the applicant	<input checked="" type="checkbox"/>

Technical data:

Power source	DC 5 V (powered from AC power adapter)
Local Oscillator or X-Tal	32.768 kHz, 12 MHz, 25 MHz, 27.12 MHz
Transmit Frequency	13.56 MHz
Antenna Type	Internal PCB antenna (88 x 70 mm, 4-turns)
Type of Modulation	ASK

I/O port	Type	Q'ty	Remark
DC input	Jack	1	
Ethernet (LAN)	RJ45 (LAN)	1	
USB	Mini USB 2.0	1	
RS-232	RJ-11	1	

Note: The equipment authorization for FCC Part 15B as a digital device was made under DoC process with a separate test report number.

Equipment Modifications

none

Submitted Documents

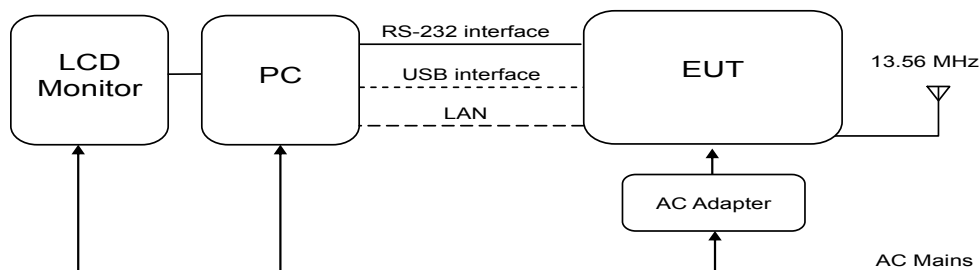
Block diagram
Schematic diagram
Parts List
User manual



3 Test and measurement conditions

3.1. Test configuration (arrangement of EUT)

The EUT was transmitting RF signals continuously while the RS-232 & USB cable was connected to PC.
Test software used: DualCard.exe, Ver2.2 (Card Reader Test Program)



3.2. Description of support units (accessory equipment)

#	Equipment	Manufacturer	Model No.	Serial No.
1	AC Adapter	Shenzhen Honor Electronic Co., Ltd.	ADS-12G-06 05010GPK	N/A
2	RFID card	N/A	N/A	N/A
3	Keyboard	CHICONY ELECTRONICS (MAINLAND CHINA II) CO LTD.	KB-0225	0008133
4	Mouse	CHIC TECHNOLOGY CORP.	SMOP5000WX	N/A
5	LCD Monitor	WISTRON CORPORATION	U2312HMT	CN-036N7K-74445-23T-706L
6	PC	DELL	D07M	F5NQVBX

3.3. Interconnection and I/O cables

The following support units or accessories were used to form a representative test configuration during the tests.

#	Start		End		Cable	
	Name	I/O port	Name	I/O port	length (m)	shielded (Y/N)
1	EUT	DC Input	AC Adapter	DC Output	1.5	N
2	EUT	LAN	PC	LAN	3.0	N
3	EUT	USB	PC	USB	1.5	Y
4	EUT	RS-232	PC	RS-232	1.1	N
5	PC	VGA	LCD Monitor	VGA	1.8	Y (core)
6	PC	AC Input	AC Mains	AC Mains	1.8	N
7	LCD Monitor	AC Input	AC Mains	AC Mains	1.8	N
8	AC Adapter	AC Input	AC Mains	AC Mains	1.2	N (core)
9	RFID card	-	-	-	-	-

Note: 1) All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2) Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

3.4. Measurement Uncertainty (U)

Measurement Item	Combined Standard Uncertainty U_c	Expanded Uncertainty $U = k \times U_c (k = 2)$
Conducted RF power	± 1.49 dB	± 2.98 dB
Radiated disturbance	± 2.30 dB	± 4.60 dB
Conducted disturbance	± 1.96 dB	± 3.92 dB

3.5. Test date

Date Tested	March 24, 2014 – April 2, 2014
-------------	--------------------------------

4 Facilities and accreditations

4.1. Facilities

All of the measurements described in this report were performed at SK Tech Co., Ltd

Site I: 820-2, Wolmoon-ri, Wabu-up, Namyangju-si, Kyunggi-do, Korea

Site II: 688-8, Wolmoon-ri, Wabu-up, Namyangju-si, Kyunggi-do, Korea

The sites are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-4. The sites comply with the Normalized Site Attenuation requirements given in ANSI C63.4, and site VSWR requirements specified in CISPR 16-1-4. The measuring apparatus and ancillary equipment conform to CISPR 16-1 series.

4.2. Accreditations

The laboratory has been also notified to FCC by RRA as a Conformity Assessment Body, and designated to perform compliance testing on equipment subject to Declaration of Conformity (DOC) and Certification under Parts 15 and 18 of the FCC Rules.

Designation No. KR0007

4.3. List of test and measurement instruments

No	Description	Model	Manufacturer	Serial No.	Cal. due	Use
1	Spectrum Analyzer	E4405B	Agilent	US40520856	2015.03.06	<input checked="" type="checkbox"/>
2	Spectrum Analyzer	E4440A	Agilent	MY46186322	2015.03.07	<input checked="" type="checkbox"/>
3	EMI Test Receiver	ESIB40	Rohde&Schwarz	100277	2015.03.06	<input checked="" type="checkbox"/>
4	EMI Test Receiver	ESPI7	Rohde&Schwarz	101206	2015.07.07	<input checked="" type="checkbox"/>
5	EMI Test Receiver	PMM9010F	Narda	020WW31008	2015.02.04	<input checked="" type="checkbox"/>
6	Artificial Mains Network	ESH3-Z5	Rohde&Schwarz	836679/018	2015.07.08	<input checked="" type="checkbox"/>
7	Artificial Mains Network	NNLK8129	Schwarzbeck	8129-215	2015.03.06	<input checked="" type="checkbox"/>
8	Pre-amplifier	8447D	HP	2944A07994	2015.07.08	<input checked="" type="checkbox"/>
9	Pre-amplifier	AFS44	MITEQ	1116321	2014.12.06	
10	Pre-amplifier	AFS44	MITEQ	1116322	2015.03.06	
11	Power Meter	E4417A	Agilent	MY45100426	2015.07.08	
12	Power Meter	E4418B	Agilent	US39402176	2015.07.08	
13	Power Sensor	E9327A	Agilent	MY44420696	2015.07.08	
14	Power Sensor	8485A	Agilent	3318A13916	2015.07.08	
15	Attenuator (10dB)	8491B	HP	38072	2015.07.08	
16	High Pass Filter	WHKX3.0/18G	Wainwright	8	2015.07.08	
17	VHF Precision Dipole Antenna (TX/RX)	VHAP	Schwarzbeck	1014 / 1015	2014.10.25	
18	UHF Precision Dipole Antenna (TX/RX)	UHAP	Schwarzbeck	989 / 990	2014.10.25	
19	Loop Antenna	HFH2-Z2	Schwarzbeck	863048/019	2015.12.04	<input checked="" type="checkbox"/>
20	Bilog Broadband Antenna	Sunol Science	JB1	A060910	2014.10.25	<input checked="" type="checkbox"/>
21	Horn Antenna	SAS-200/571	AH Systems	304	N/A	
22	Horn Antenna	3115	EMCO	00040723	2015.03.25	
23	Horn Antenna	3115	EMCO	00056768	2015.01.27	
24	Horn Antenna	BBHA9170	Schwarzbeck	BBHA9170318	2015.09.06	
25	Vector Signal Generator	E4438C	Agilent	MY42080359	2015.07.08	
26	PSG analog signal generator	E8257D-520	Agilent	MY45141255	2015.07.08	
27	DC Power Supply	6622A	HP	3348A03223	2015.07.07	
28	Digital Thermo-Hygrometer	608-H1	Testo	-	2015.07.25	<input checked="" type="checkbox"/>
29	Temperature/Humidity Chamber	DJ-THC02	DAE JIN ENG	06071	2015.03.06	<input checked="" type="checkbox"/>



5 Test and measurements

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 an integral PCB loop antenna, 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 broadband antenna.
4. 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)



5.2.3 Calculation of the field strength limits below 30 MHz

1. No special calculation for obtaining the field strength in dB μ V/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 (dB μ V/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 dB μ V/m

RA = Receiver Amplitude in dB μ V/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

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

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

**5.2.4 Test Results:****PASS****Table 1: Field strength below 30 MHz (RFID card type A)**

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)						
13.560 0	9	54.22	0.3	54.52	124.0	69.48
13.348 0	9	---	0.3	---	80.5	---
13.453 5	9	---	0.3	---	90.5	---
13.656 9	9	---	0.3	---	90.5	---
13.771 3	9	---	0.3	---	80.5	---
Emissions Quasi-peak DATA under 15.225(d), 15.209						
27.12	9	---	0.3	---	69.5	---

Table 2: Field strength below 30 MHz (RFID card type B)

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)						
13.560 0	9	57.82	0.3	58.12	124.0	65.88
13.392 4	9	---	0.3	---	80.5	---
13.459 6	9	---	0.3	---	90.5	---
13.662 9	9	---	0.3	---	90.5	---
13.723 2	9	---	0.3	---	80.5	---
Emissions Quasi-peak DATA under 15.225(d), 15.209						
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 3: Measured values of the Field strength (above 30 MHz) - (RFID card Type A)

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]
94.87	120	V	1.00	54.4	28.3	8.7	1.1	35.9	43.5	7.6
135.89	120	V	1.00	46.7	28.1	13.4	1.3	33.3	43.5	10.2
799.63	120	V	1.00	41.6	28.6	22.5	3.3	38.8	46.0	7.2
813.67	120	V	1.00	39.1	28.5	22.6	3.3	36.5	46.0	9.5
827.64	120	V	1.00	38.6	28.5	22.8	3.3	36.2	46.0	9.8
880.89	120	V	1.00	38.1	28.3	23.3	3.4	36.5	46.0	9.5

Table 4: Measured values of the Field strength (above 30 MHz) - (RFID card Type B)

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]
40.62	120	V	1.00	47.8	28.4	13.1	0.7	33.2	40.0	6.8
135.81	120	V	1.00	48.6	28.1	13.4	1.3	35.2	43.5	8.3
664.24	120	H	1.39	42.9	28.9	20.6	3.0	37.6	46.0	8.4
799.66	120	V	1.00	42.0	28.6	22.5	3.3	39.2	46.0	6.8
881.04	120	V	1.00	39.3	28.3	23.3	3.4	37.7	46.0	8.3
935.37	120	V	1.00	37.0	28.2	23.8	3.5	36.1	46.0	9.9

Margin (dB) = Limit – Actual

[Actual = Reading + AF + CL]

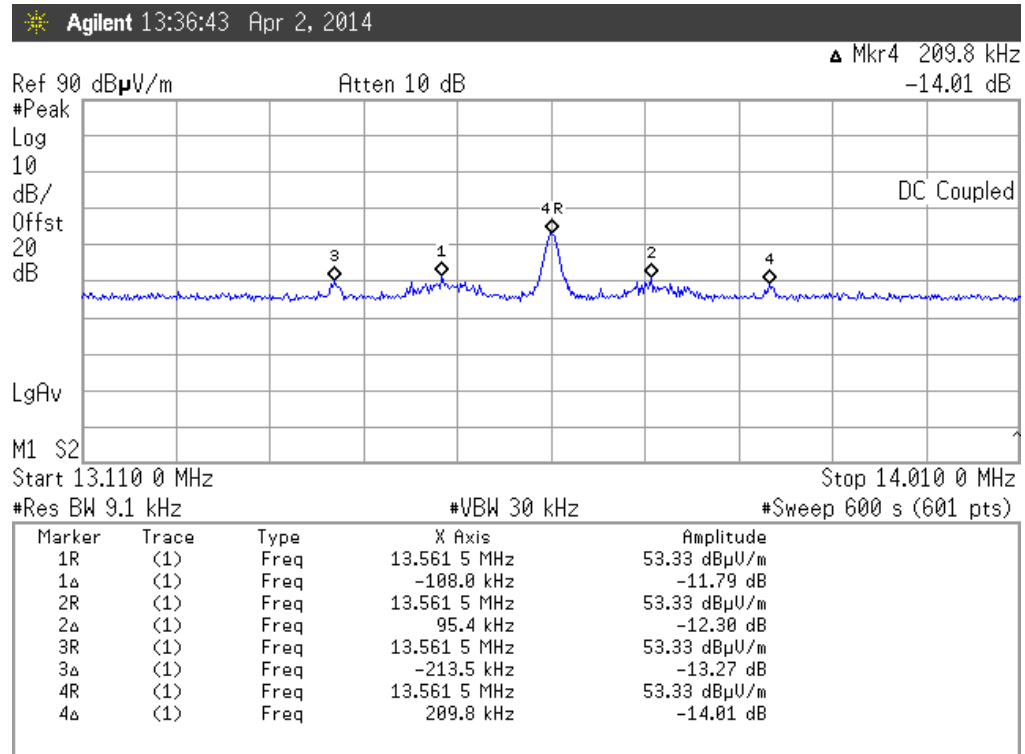
1. H = Horizontal, V = Vertical Polarization
2. AF/CL = Antenna Factor and Cable Loss

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.

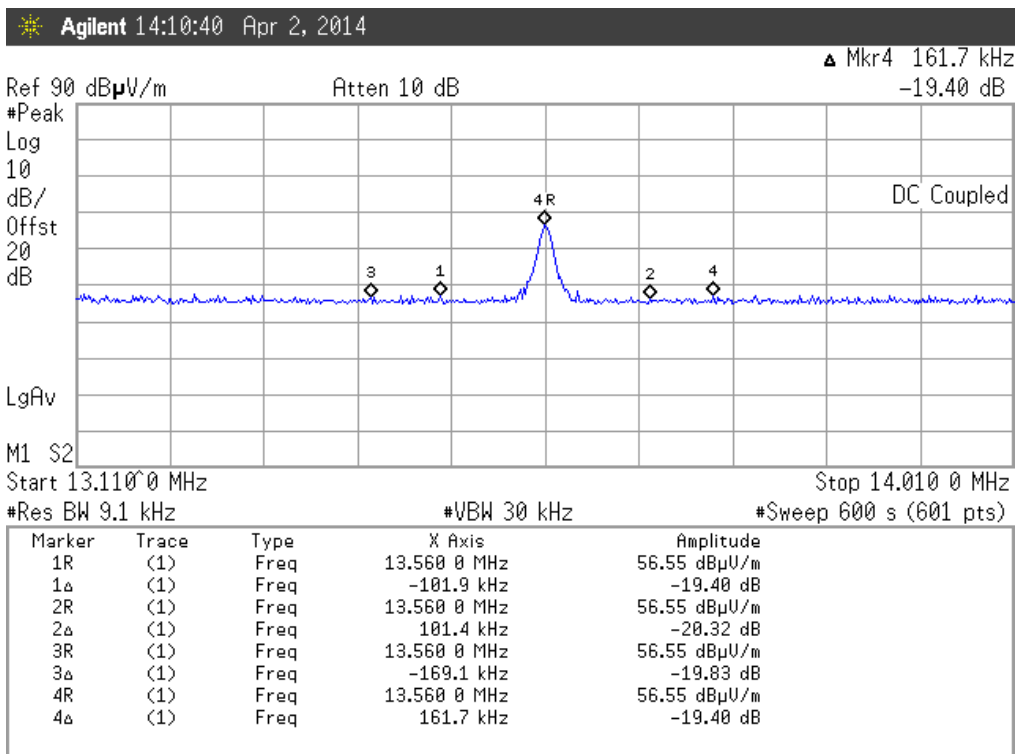


Plot of the Band edge (Preliminary measurement in the anechoic chamber at 3 m distance to find out the frequencies, at which the spurious emissions occur, with the peak detector function)

(RFID card type A)

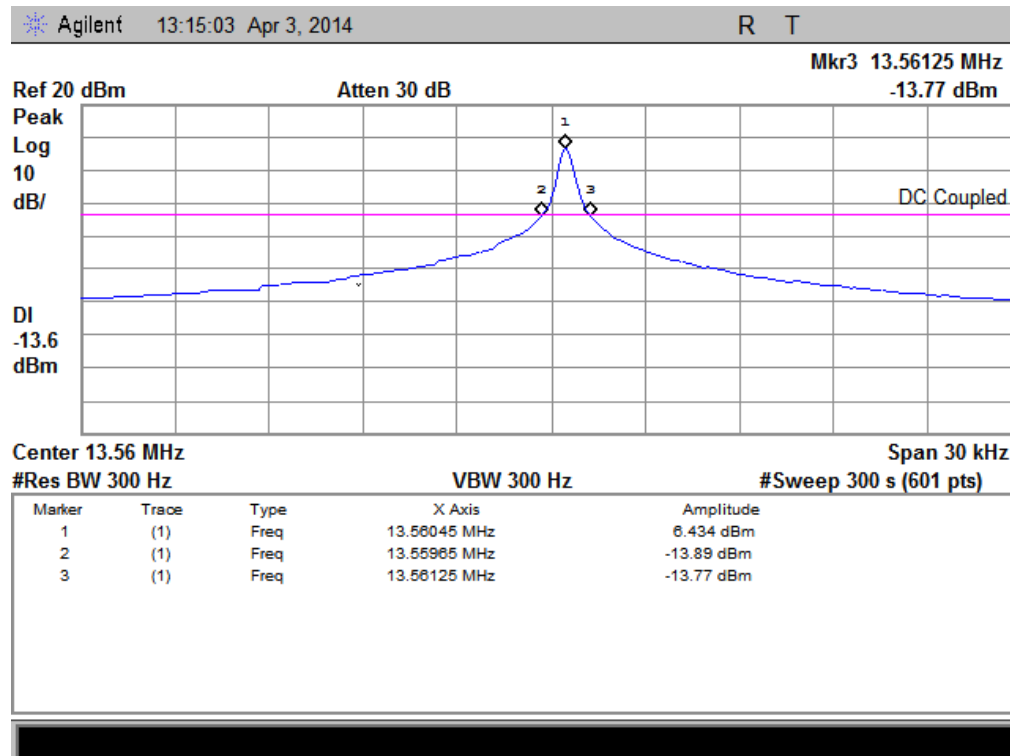


(RFID card type B)





Plot of the 20 dB Bandwidth





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 $\pm 0.01\%$ 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 Regulation

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 5: Frequency Tolerance

Reference Frequency: 13.5600MHz, LIMIT: within $\pm 1\ 356$ Hz									
Environment Temperature [°C]	Power Supplied [V _{AC}]	Carrier Frequency Measured with Time Elapsed							
		STARUP		2 minutes		5 minutes		10 minutes	
		[MHZ]	Err [Hz]	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]
+50	120	13.560495	-495	13.560491	-491	13.560491	-491	13.560494	-494
+40	120	13.560513	-513	13.560501	-501	13.560496	-496	13.560492	-492
+30	120	13.560534	-534	13.560519	-519	13.560510	-510	13.560502	-502
+20	120	13.560548	-548	13.560532	-532	13.560525	-525	13.560518	-518
+10	120	13.560575	-575	13.560564	-564	13.560559	-559	13.560550	-550
0	120	13.560577	-577	13.560576	-576	13.560572	-572	13.560567	-567
-10	120	13.560571	-571	13.560576	-576	13.560579	-579	13.560579	-579
-20	120	13.560573	-573	13.560577	-577	13.560579	-579	13.560579	-579

Reference Frequency: 13.5600MHz, LIMIT: within ± 1 356 Hz								
Power Supplied [V _{Ac}]	Carrier Frequency Measured with Time Elapsed							
	STARUP		2 minutes		5 minutes		10 minutes	
	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]
85 %	13.560547	-547	13.560531	-531	13.560525	-525	13.560517	-517
100 %	13.560548	-548	13.560532	-532	13.560525	-525	13.560518	-518
115 %	13.560545	-545	13.560528	-528	13.560523	-523	13.560516	-516

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



5.4. AC power line Conducted emissions

5.4.1 Regulation

FCC 47CFR15 – 15.207(a)

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 50 μ H/50 Ω 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 (dB μ V)	
	Quasi-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 50 Ω /50 μ H 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 6: Measured values of the Conducted Emissions – (RFID card type A)

Frequency (MHz)	Line (L/N)	CF (dB)	CL (dB)	Actual (dB μ V)		Limit (dB μ V)		Margin (dB)	
				QP	AV	QP	AV	QP	AV
0.1520	L	0.10	0.01	39.95	30.05	65.89	55.89	25.94	25.84
0.2114	L	0.13	0.02	41.23	28.91	63.15	53.15	21.92	24.24
0.3443	L	0.22	0.03	52.42	42.07	59.10	49.10	6.68	7.03
0.4895	L	0.24	0.04	44.32	32.35	56.18	46.18	11.86	13.83
0.4977	N	0.12	0.04	41.78	25.24	56.04	46.04	14.26	20.80
0.6756	L	0.26	0.04	45.72	30.98	56.00	46.00	10.28	15.02
0.7983	N	0.12	0.04	41.24	25.46	56.00	46.00	14.76	20.54
1.0314	L	0.28	0.04	43.46	31.30	56.00	46.00	12.54	14.70
1.0805	N	0.13	0.04	40.42	23.45	56.00	46.00	15.58	22.55
1.4199	N	0.15	0.05	40.25	23.22	56.00	46.00	15.75	22.78
3.8699	N	0.24	0.09	42.23	24.68	56.00	46.00	13.77	21.32
3.8985	L	0.39	0.09	43.72	31.15	56.00	46.00	12.28	14.85
13.5611	L	0.81	0.13	49.12	30.72	60.00	50.00	10.88	19.28

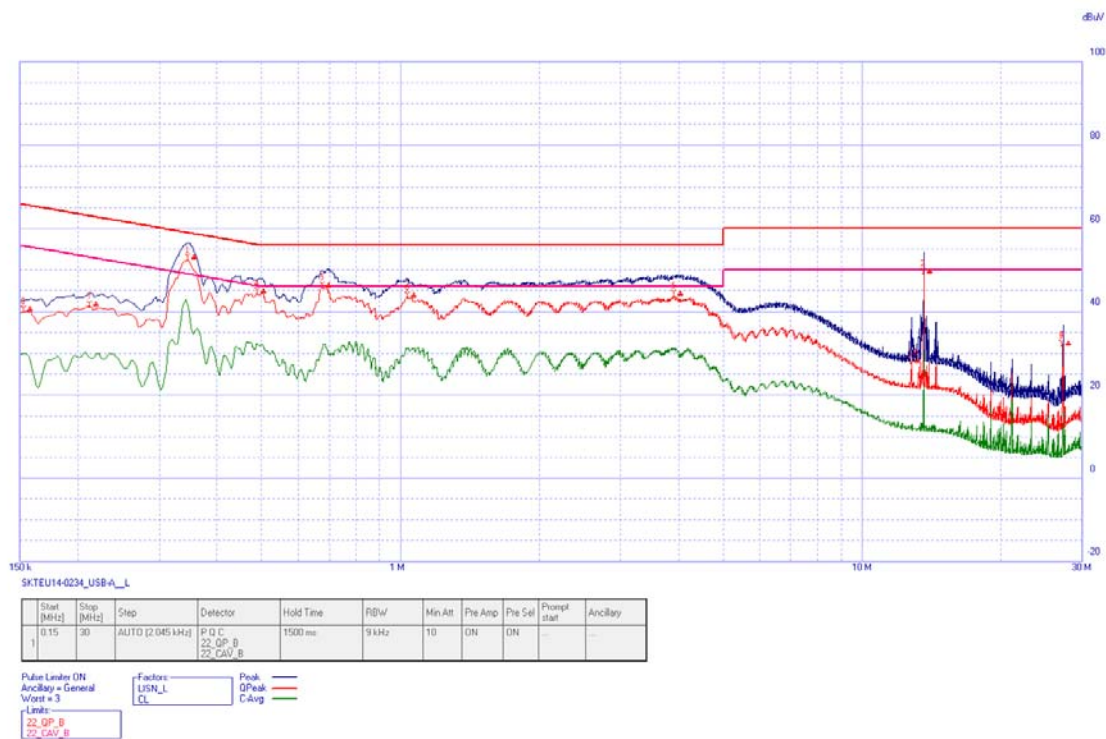
Table 7: Measured values of the Conducted Emissions – (RFID card type B)

Frequency (MHz)	Line (L/N)	CF (dB)	CL (dB)	Actual (dB μ V)		Limit (dB μ V)		Margin (dB)	
				QP	AV	QP	AV	QP	AV
0.1520	L	0.10	0.01	40.03	29.77	65.89	55.89	25.86	26.12
0.1561	N	0.06	0.01	39.64	22.08	65.67	55.67	26.03	33.59
0.2093	L	0.13	0.02	41.19	29.54	63.23	53.23	22.04	23.69
0.3443	L	0.22	0.03	52.43	42.02	59.10	49.10	6.67	7.08
0.6919	L	0.26	0.04	45.86	31.25	56.00	46.00	10.14	14.75
0.7962	N	0.12	0.04	41.29	24.99	56.00	46.00	14.71	21.01
3.8719	N	0.24	0.09	42.53	24.88	56.00	46.00	13.47	21.12
13.2196	L	0.79	0.13	32.53	15.41	60.00	50.00	27.47	34.59
13.5611	L	0.81	0.13	54.54	41.26	60.00	50.00	5.46	8.74
13.9006	L	0.83	0.14	33.25	15.56	60.00	50.00	26.75	34.44
14.4077	L	0.86	0.14	27.77	11.48	60.00	50.00	32.23	38.52
21.0438	L	1.02	0.17	25.01	21.91	60.00	50.00	34.99	28.09
27.1236	N	0.82	0.19	27.88	17.43	60.00	50.00	32.12	32.57

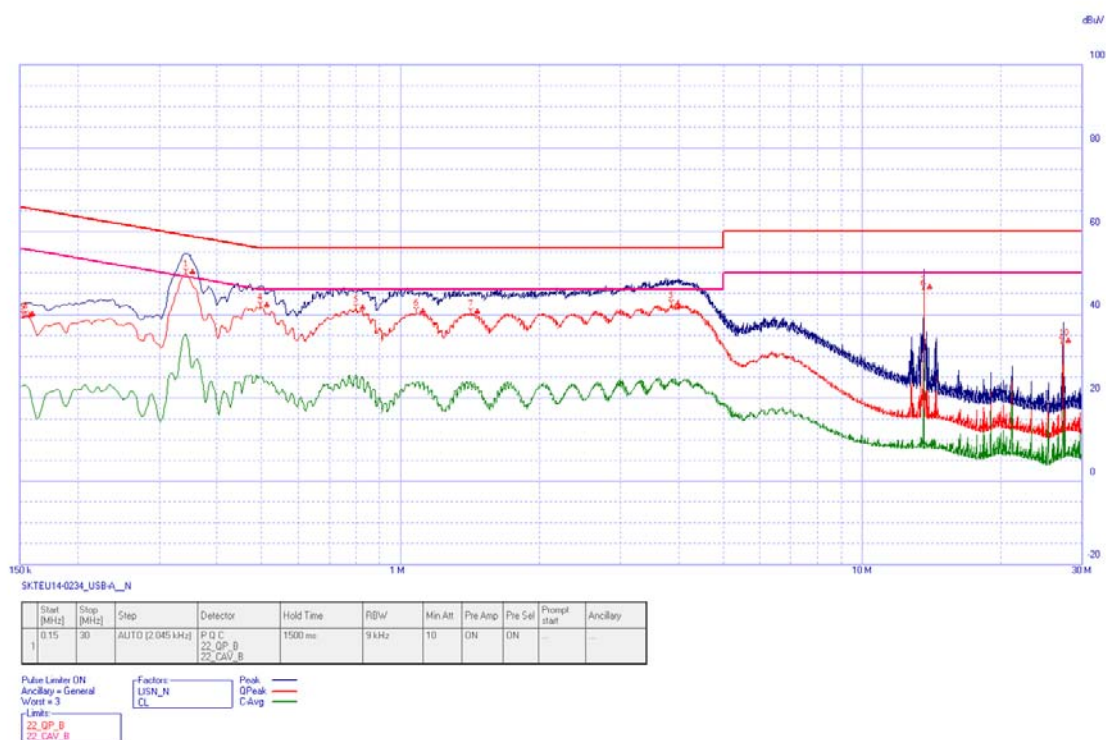
Note: 1) L/N: Line / Neutral
2) CF and CL: correction factor (LISN) and cable loss
3) Actual = Final measured values after containing CF and CL
4) Margin = Limit - Actual



Plot of the Conducted Emissions - RFID tag (A type)
Line – PE (Peak and Average detector used)

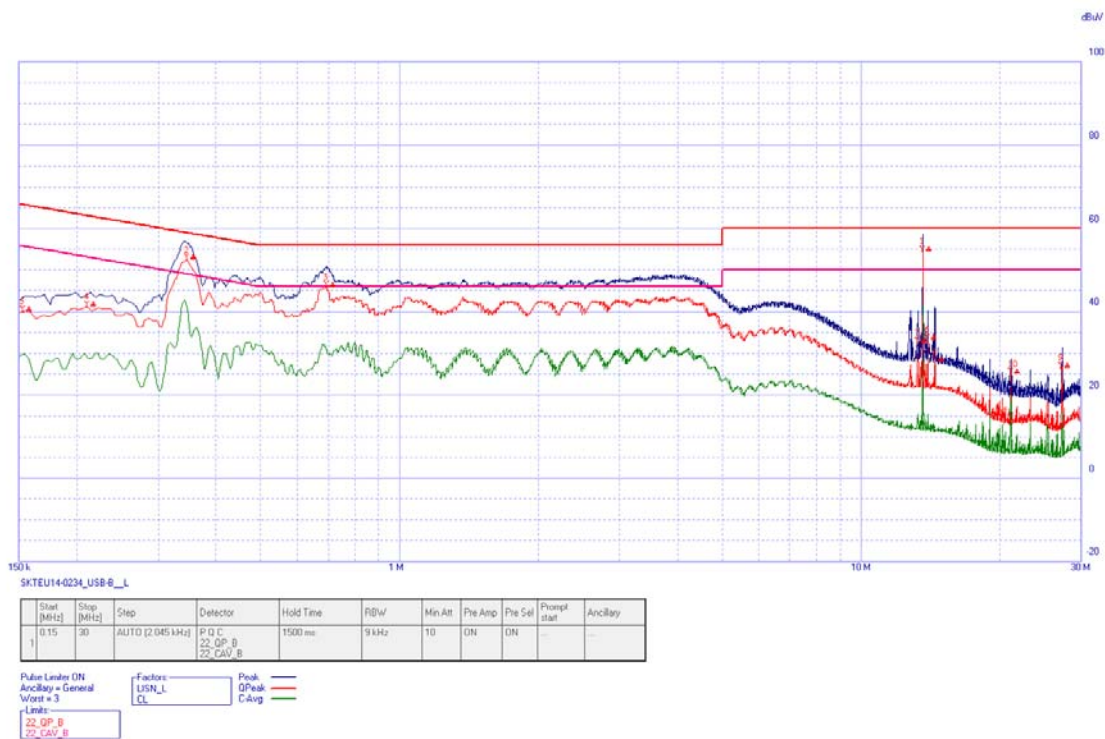


Neutral – PE (Peak and Average detector used)





Plot of the Conducted Emissions - RFID tag (B type)
Line – PE (Peak and Average detector used)



Neutral – PE (Peak and Average detector used)

