

RADIO PERFORMANCE TEST REPORT

Test Report No. : OT-218-RWD-063

Reception No. : 2104002111

Applicant : TIT ENG Co.,Ltd.

Address : 7 Floor Shin-do B/D, 10, Garak-dong, Songpa-Gu, Seoul, South Korea

Manufacturer : TIT ENG Co.,Ltd.

Address : 7 Floor Shin-do B/D, 10, Garak-dong, Songpa-Gu, Seoul, South Korea

Type of Equipment : ID CARD PRINTER

FCC ID : XTNNL300

Model Name : NR600 (Basic Model: NR300)

Multiple Model Name : Refer to the Clause 2.2

Serial number : N/A

Total page of Report : 36 pages (including this page)

Date of Incoming : August 09, 2021

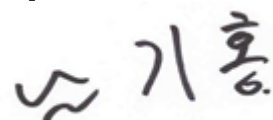
Date of Issuing : August 19, 2021

SUMMARY

The equipment complies with the requirements of **FCC CFR 47 PART 15 SUBPART C Section 15.225**

This test report contains only the result of a single test of the sample supplied for the examination.

It is not a general valid assessment of the features of the respective products of the mass-production.



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ONETECH Corp.

Reviewed by
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Approved by
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ONETECH Corp.

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OTC-TRF-RF-001(0)

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

CONTENTS

Page

1. VERIFICATION OF COMPLIANCE	5
2. GENERAL INFORMATION	6
2.1 PRODUCT DESCRIPTION.....	6
2.2 ALTERNATIVE TYPE(S)/MODEL(S); ALSO COVERED BY THIS TEST REPORT.....	6
2.3 RELATED SUBMITTAL(S) / GRANT(S)	7
2.4 PURPOSE OF THE TEST	7
2.5 TEST METHODOLOGY.....	7
2.6 TEST FACILITY	7
3. SYSTEM TEST CONFIGURATION	8
3.1 JUSTIFICATION.....	8
3.2 PERIPHERAL EQUIPMENT	8
3.3 MODE OF OPERATION DURING THE TEST	8
3.4 CONFIGURATION OF TEST SYSTEM.....	9
3.5 ANTENNA REQUIREMENT	9
4. PRELIMINARY TEST	9
4.1 AC POWER LINE CONDUCTED EMISSIONS TESTS.....	9
4.2 RADIATED EMISSIONS TESTS.....	9
5. FINAL RESULT OF MEASUREMENT.....	10
5.1 CONDUCTED EMISSION TEST.....	10
5.1.1 Test data for RF Tag Reader	10
5.1.2 Test data for RF Card Reader	12
5.1.3 Test data for Intermodulation	14
5.2 RADIATED EMISSION TEST.....	16
5.2.1 Test data for RF Tag Reader	16
5.2.2 Test data for RF Card Reader	18
5.3 SPURIOUS EMISSION TEST.....	20
5.3.1 Test data for RF Tag Reader.....	20
5.3.1.1 Spurious Radiated Emission Below 30 MHz	20
5.3.1.2 Spurious Radiated Emission below 1 GHz	22
5.3.2 Test data for RF Card Reader	23

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5.3.2.1 Spurious Radiated Emission Below 30 MHz	23
5.3.2.2 Spurious Radiated Emission below 1 GHz	25
5.3.3 Test data for Intermodulation	26
5.3.3.1 Spurious Radiated Emission Below 30 MHz	26
5.3.3.2 Spurious Radiated Emission below 1 GHz	28
5.4 20 dB BANDWIDTH	29
5.4.1 Operating environment	29
5.4.2 Test set-up	29
5.4.3 Test date	29
5.4.4 Test data	30
5.4.4.1 Test data for RF Tag Reader	30
5.4.4.2 Test data for RF Card Reader	31
5.5 FREQUENCY STABILITY WITH TEMPERATURE VARIATION	32
5.5.1 Operating environment	32
5.5.2 Test set-up	32
5.5.3 Test date	32
5.5.4 Test data	33
5.5.4.1 Test data for RF Tag Reader	33
5.5.4.2 Test data for RF Card Reader	33
5.6 FREQUENCY STABILITY WITH VOLTAGE VARIATION	34
5.6.1 Operating environment	34
5.6.2 Test set-up	34
5.6.3 Test date	34
5.6.4 Test data	34
5.6.4.1 Test data for RF Tag Reader	34
5.6.4.2 Test data for RF Card Reader	34
6. FIELD STRENGTH CALCULATION	35
7. LIST OF TEST EQUIPMENT	36

Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-218-RWD-063	August 19, 2021	Initial Release	All

1. VERIFICATION OF COMPLIANCE

-. APPLICANT : TIT ENG Co.,Ltd.
 -. ADDRESS : 7 Floor Shin-do B/D, 10, Garak-dong, Songpa-Gu, Seoul, South Korea
 -. CONTACT PERSON : Sang-Joong Lee / Chief Engineer
 -. TELEPHONE NO : +82-10-2391-1292
 -. FCC ID : XTNNL300
 -. MODEL NO. : NR600 (Basic Model: NR300)
 -. SERIAL NUMBER : N/A
 -. DATE : August 19, 2021

DEVICE TYPE	DXX – Low Power Communication Device Transmitter
E.U.T. DESCRIPTION	ID CARD PRINTER
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC CFR47 Part 15 Subpart C Section 15.225
MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE	None
FINAL TEST WAS CONDUCTED ON	10 m Semi Anechoic Chamber

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

2. GENERAL INFORMATION

2.1 Product Description

The TIT ENG Co.,Ltd., Model NR600 (Basic Model: NR300) (referred to as the EUT in this report) is an ID CARD PRINTER, Product specification information described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	ID CARD PRINTER	
TRANSMITTING FREQUENCY	RF Tag Reader	13.561 5 MHz
	Rf Card Reader	13.559 3 MHz
MODULATION	ASK	
ANTENNA TYPE	Loop Antenna	
LIST OF EACH OSC. or CRY. FREQ.(FREQ. >= 1 MHz)	4 MHz, 8 MHz, 12 MHz, 13.56 MHz, 18 MHz, 27.12 MHz	

2.2 Alternative type(s)/model(s); also covered by this test report.

-. The following lists consist of the added model and their differences.

Model Name	Differences	Tested
NR600 (Basic Model: NR300)	This model is identical to the basic model except for using a TPH with a resolution 600 DPI.	☒
NR300	Basic Model using TPH(Thermal Print Head) with a resolution 300 DPI.	☒
NR	This model is identical to the basic model. It is derived for Marketing purpose.	☐
JRT 300	This model is identical to the basic model. It is derived for Marketing purpose.	☐
JRT 600 PRO	This model is identical to the basic model except for using a TPH with a resolution 600 DPI.	☐

Note: 1. Applicant consigns only basic model to test. Therefore this test report just guarantees the units, which have been tested.

2. The Applicant/manufacture is responsible for the compliance of all variants.

2.3 Related Submittal(s) / Grant(s)

Original submittal only

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC PART 15 SUBPART C Section 15.225.

2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea.

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-20122/ C-14617/ G-10666/ T-11842

ISED (Innovation, Science and Economic Development Canada) – Registration No. Site# 3736A-3

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

3. SYSTEM TEST CONFIGURATION

3.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
TIT-RETRANSFER-MAIN	N/A	N/A	N/A
TIT-RETRANSFER-RF-TAG	N/A	N/A	N/A
TIT-NEW-MECH-PCB	N/A	N/A	N/A
TIT-NUVIA_CIS	N/A	N/A	N/A
TIT-NUVIA_MS	N/A	N/A	N/A

3.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

Model	Manufacturer	Description	Connected to
NR600 (Basic Model: NR300)	TIT ENG Co.,Ltd.	ID CARD PRINTER (EUT)	-
2ABU120M	Channel Well Technology	AC Adapter	EUT
E5500	DELL	Notebook	EUT
DA130PE1-00	DELL	AC Adapter	Notebook

3.3 Mode of operation during the test

-. The EUT has 13.56 MHz RF boards for reading Card and program was used for making continuous transmission mode during the test.

3.4 Configuration of Test System

Line Conducted Test : The EUT was connected to adaptor and the power of adaptor was connected to LISN. All supporting equipments were connected to another LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions.

Radiated Emission Test : Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. The radiated emissions measurements were performed on the 10 m Semi Anechoic Chamber.

For frequencies from 150 kHz to 30 MHz measurements were made of the magnetic H field. The measuring antenna is an electrically screened loop antenna.

The frequency spectrum from 30 MHz to 1 000 MHz was scanned and maximum emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

3.5 Antenna Requirement

For intentional device, according to 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.

Antenna Construction:

The transmitter antenna of the EUT is a PCB Antenna so there is no consideration of replacement by the user.

4. PRELIMINARY TEST

4.1 AC Power line Conducted Emissions Tests

During Preliminary Tests, the following operating mode was investigated

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	X

4.2 Radiated Emissions Tests

During Preliminary Tests, the following operating modes were investigated

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	X

5. FINAL RESULT OF MEASUREMENT

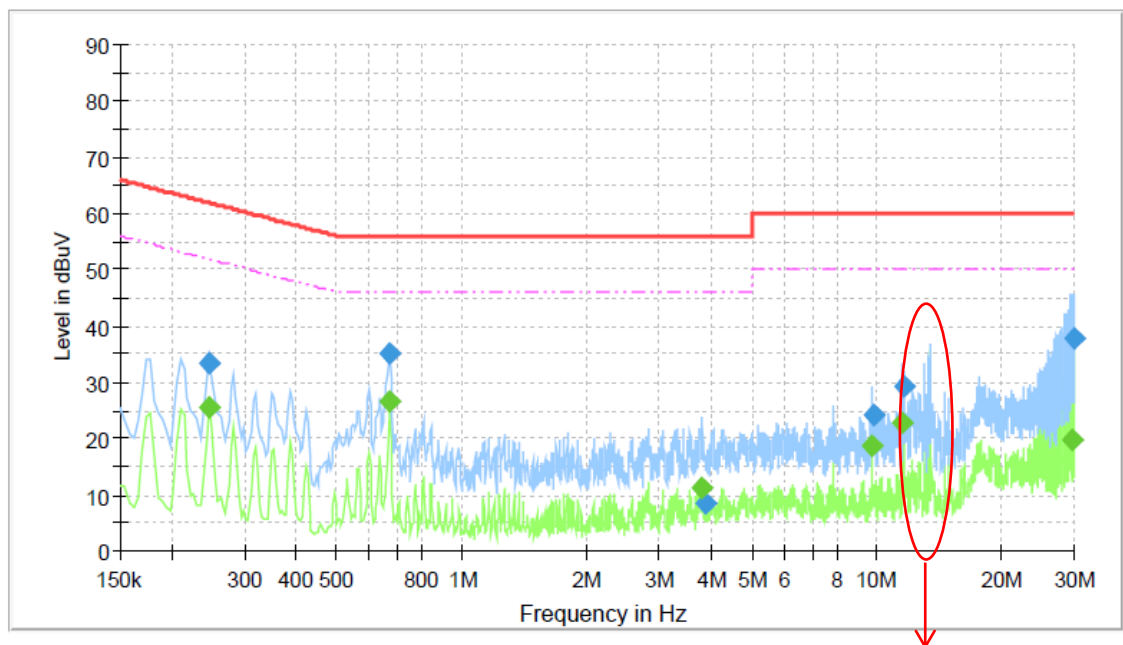
Preliminary test was done in normal operation mode. And the final measurement was selected for the maximized emission level.

5.1 Conducted Emission Test

5.1.1 Test data for RF Tag Reader

Humidity Level : 48 % R.H. Temperature: 24 °C
Limits apply to : FCC CFR 47, PART 15, SUBPART B, SECTION 15.207(a)
Result : PASSED

EUT : ID CARD PRINTER Date: August 09, 2021 ~ August 13, 2021
Detector : CISPR Quasi-Peak (6 dB Bandwidth: 9 kHz)
Tested Line : HOT LINE



13.56 MHz Carrier Frequency

Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.245	---	25.67	51.92	26.25	9.0	L1	9.93
0.245	33.38	---	61.92	28.55	9.0	L1	9.93
0.669	---	26.45	46.00	19.55	9.0	L1	9.95
0.669	35.18	---	56.00	20.82	9.0	L1	9.95
3.798	---	11.17	46.00	34.83	9.0	L1	10.04
3.858	8.61	---	56.00	47.39	9.0	L1	10.04
9.732	---	18.86	50.00	31.14	9.0	L1	10.32
9.840	24.33	---	60.00	35.67	9.0	L1	10.32
11.535	---	22.70	50.00	27.30	9.0	L1	10.39
11.683	29.42	---	60.00	30.58	9.0	L1	10.40
29.596	---	19.62	50.00	30.38	9.0	L1	10.76
29.960	37.90	---	60.00	22.10	9.0	L1	10.77

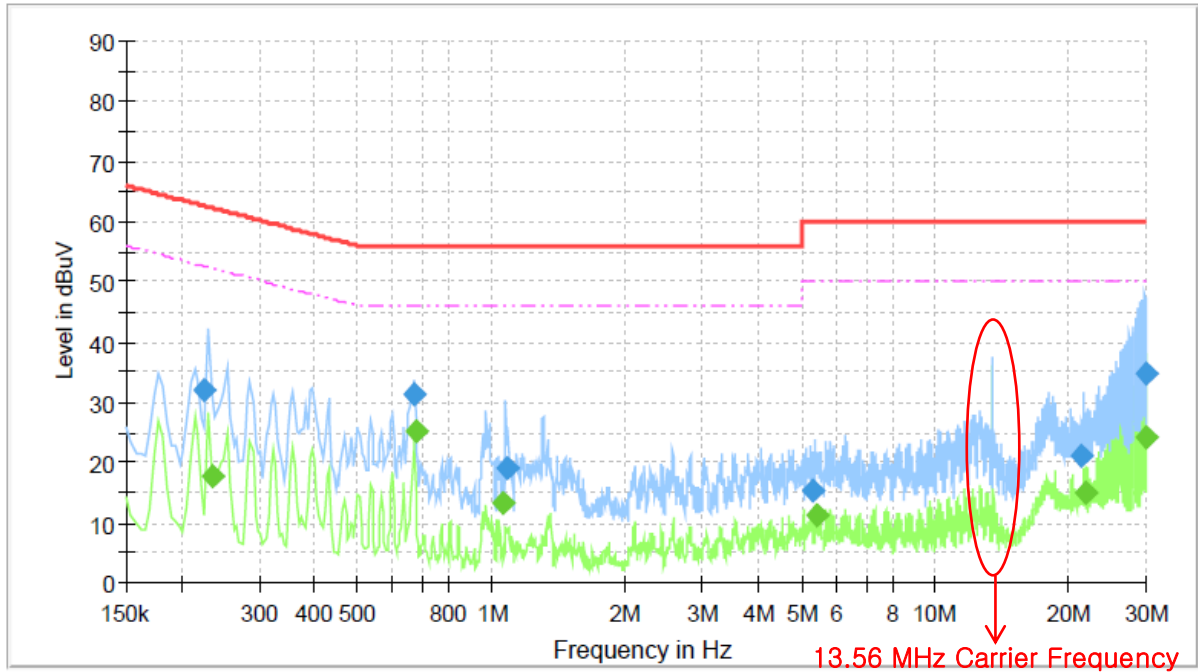
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Tested Line : NEUTRAL LINE



Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.225	32.08	---	62.62	30.54	9.0	N	9.94
0.235	---	17.72	52.29	34.57	9.0	N	9.94
0.669	31.27	---	56.00	24.73	9.0	N	9.96
0.681	---	25.16	46.00	20.84	9.0	N	9.96
1.060	---	13.37	46.00	32.63	9.0	N	9.99
1.088	19.19	---	56.00	36.81	9.0	N	9.99
5.303	15.46	---	60.00	44.54	9.0	N	10.11
5.407	---	11.15	50.00	38.85	9.0	N	10.12
21.491	21.04	---	60.00	38.96	9.0	N	10.79
21.864	---	15.09	50.00	34.91	9.0	N	10.79
29.856	---	24.08	50.00	25.92	9.0	N	10.84
29.858	34.64	---	60.00	25.36	9.0	N	10.84

Remark: Margin (dB) = Limit – Level (Result)

The emission level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

5.1.2 Test data for RF Card Reader

Humidity Level : 48 % R.H.

Temperature: 24 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART B, SECTION 15.207(a)

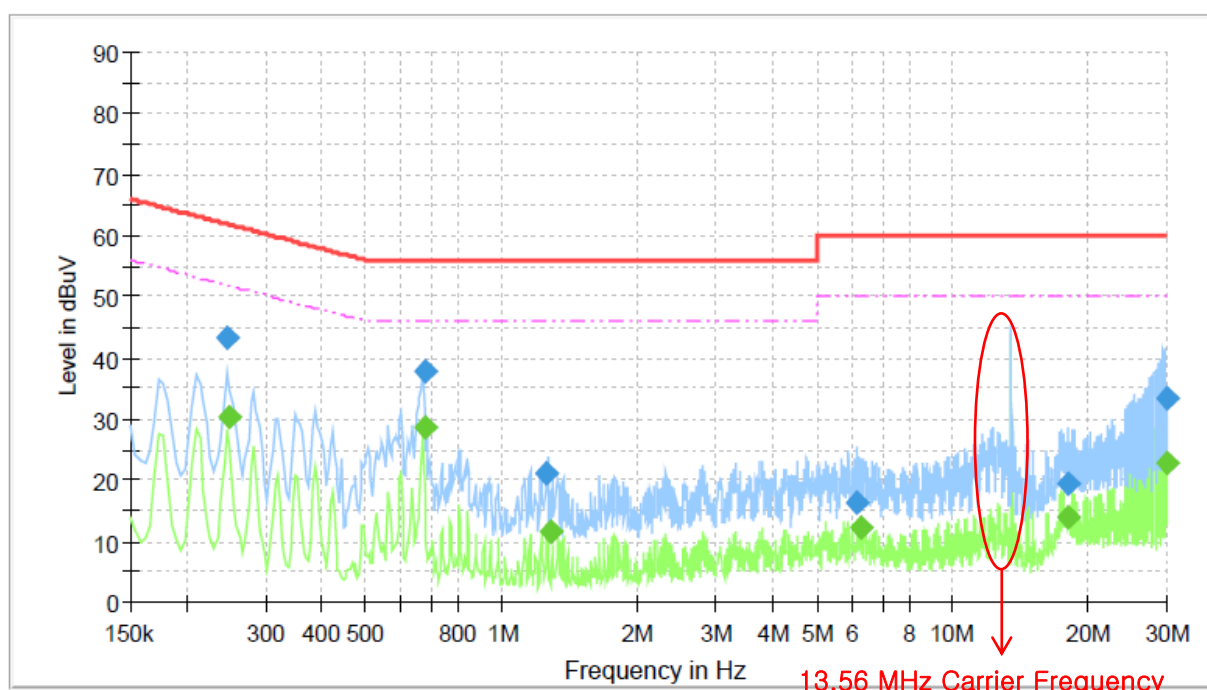
Result : PASSED

EUT : ID CARD PRINTER

Date: August 09, 2021 ~ August 13, 2021

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 9 kHz)

Tested Line : HOT LINE



Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.245	43.18	---	61.92	18.75	9.0	L1	9.93
0.249	---	30.18	51.79	21.60	9.0	L1	9.93
0.677	37.84	---	56.00	18.16	9.0	L1	9.95
0.679	---	28.67	46.00	17.33	9.0	L1	9.95
1.261	21.22	---	56.00	34.78	9.0	L1	9.98
1.285	---	11.66	46.00	34.34	9.0	L1	9.98
6.135	16.49	---	60.00	43.51	9.0	L1	10.12
6.251	---	12.40	50.00	37.60	9.0	L1	10.13
18.090	---	14.12	50.00	35.88	9.0	L1	10.59
18.126	19.56	---	60.00	40.44	9.0	L1	10.60
29.893	---	22.90	50.00	27.10	9.0	L1	10.77
29.901	33.46	---	60.00	26.54	9.0	L1	10.77

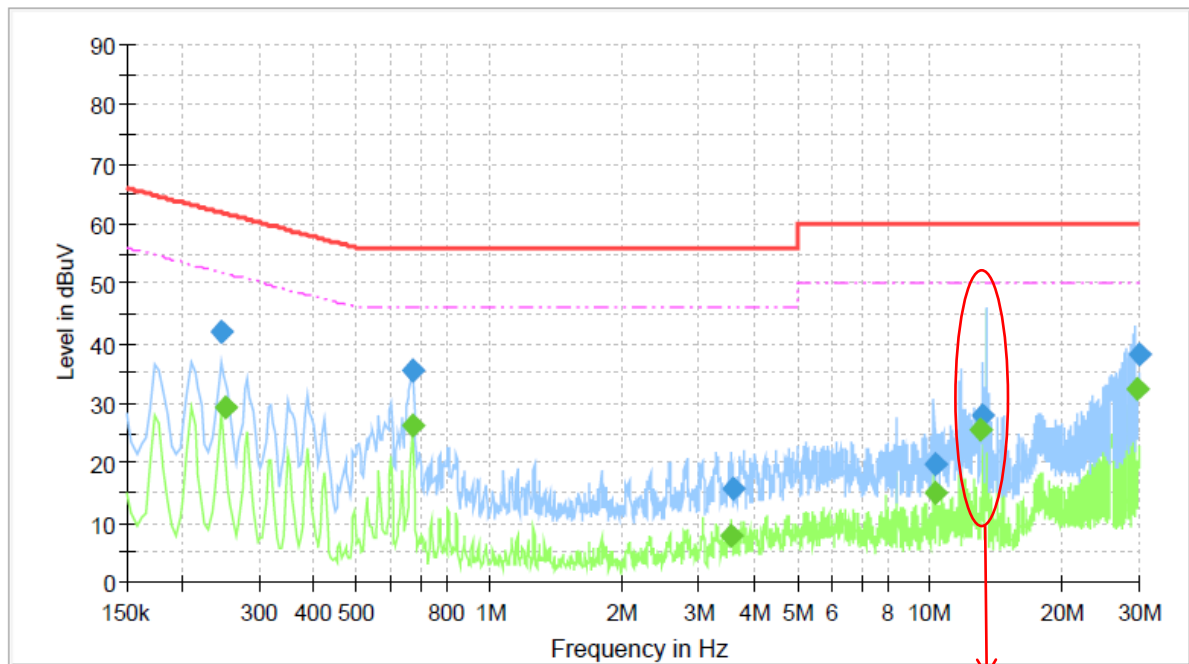
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Tested Line : NEUTRAL LINE



13.56 MHz Carrier Frequency

Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.245	41.88	---	61.92	20.05	9.0	N	9.94
0.251	---	29.30	51.73	22.43	9.0	N	9.94
0.669	---	26.15	46.00	19.85	9.0	N	9.96
0.669	35.49	---	56.00	20.51	9.0	N	9.96
3.539	---	7.87	46.00	38.13	9.0	N	10.06
3.563	15.80	---	56.00	40.20	9.0	N	10.06
10.261	---	14.92	50.00	35.08	9.0	N	10.42
10.333	19.85	---	60.00	40.15	9.0	N	10.43
13.058	---	25.69	50.00	24.31	9.0	N	10.55
13.134	28.00	---	60.00	32.00	9.0	N	10.55
29.629	---	32.22	50.00	17.78	9.0	N	10.84
29.833	38.16	---	60.00	21.84	9.0	N	10.84

Remark: Margin (dB) = Limit – Level (Result)

The emission level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

5.1.3 Test data for Intermodulation

Humidity Level : 48 % R.H.

Temperature: 24 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART B, SECTION 15.207(a)

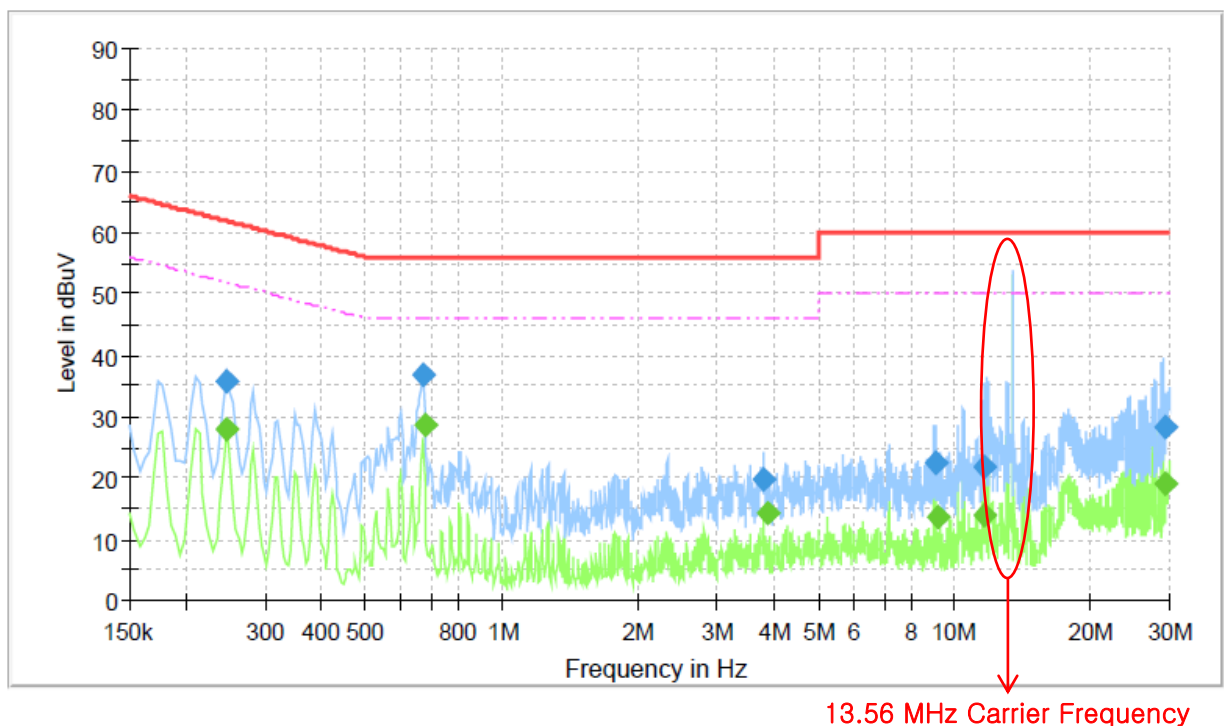
Result : PASSED

EUT : ID CARD PRINTER

Date: August 09, 2021 ~ August 13, 2021

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 9 kHz)

Tested Line : HOT LINE



Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.245	---	28.07	51.92	23.85	9.0	L1	9.93
0.245	35.82	---	61.92	26.11	9.0	L1	9.93
0.669	36.69	---	56.00	19.31	9.0	L1	9.95
0.679	---	28.67	46.00	17.33	9.0	L1	9.95
3.802	19.70	---	56.00	36.30	9.0	L1	10.04
3.854	---	14.41	46.00	31.59	9.0	L1	10.04
9.098	22.42	---	60.00	37.58	9.0	L1	10.28
9.202	---	13.58	50.00	36.42	9.0	L1	10.29
11.663	---	14.04	50.00	35.96	9.0	L1	10.40
11.687	21.88	---	60.00	38.12	9.0	L1	10.40
29.430	28.37	---	60.00	31.63	9.0	L1	10.76
29.478	---	19.13	50.00	30.87	9.0	L1	10.76

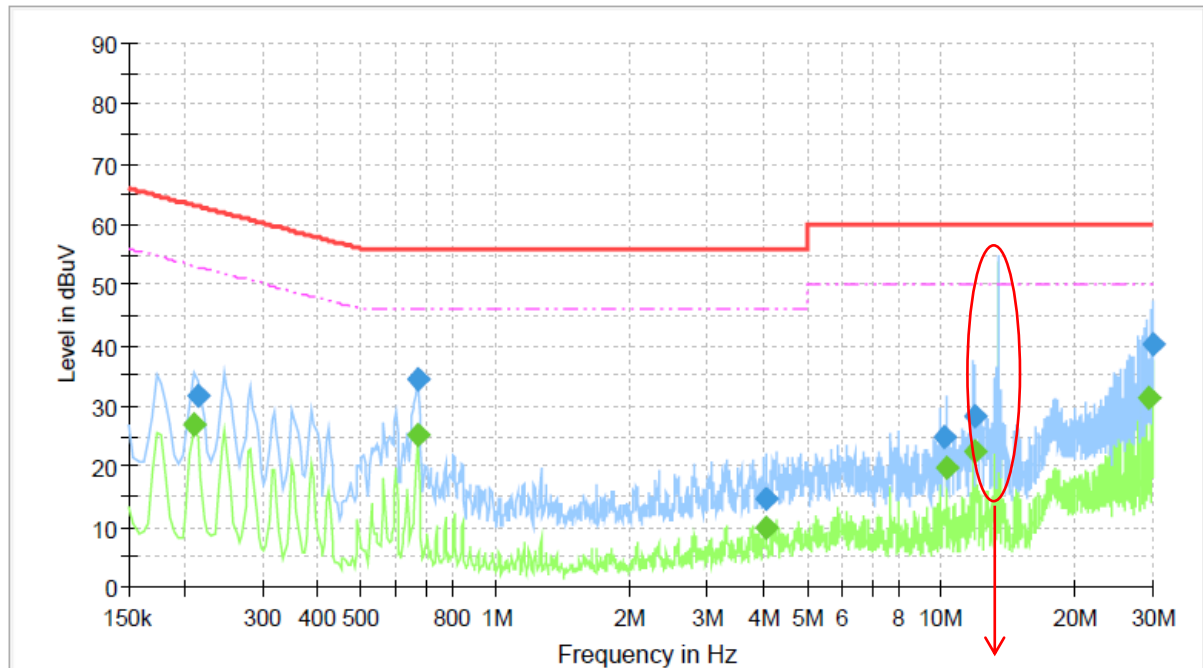
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Tested Line : NEUTRAL LINE



13.56 MHz Carrier Frequency

Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.209	---	26.91	53.23	26.32	9.0	N	9.94
0.215	31.61	---	63.03	31.42	9.0	N	9.94
0.669	---	25.30	46.00	20.70	9.0	N	9.96
0.669	34.44	---	56.00	21.56	9.0	N	9.96
4.049	---	9.80	46.00	36.20	9.0	N	10.07
4.053	14.59	---	56.00	41.41	9.0	N	10.07
10.224	25.06	---	60.00	34.94	9.0	N	10.42
10.292	---	19.92	50.00	30.08	9.0	N	10.42
11.946	28.43	---	60.00	31.57	9.0	N	10.50
11.946	---	22.64	50.00	27.36	9.0	N	10.50
29.391	---	31.52	50.00	18.48	9.0	N	10.84
29.979	40.22	---	60.00	19.78	9.0	N	10.84

Remark: Margin (dB) = Limit – Level (Result)

The emission level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

5.2 RADIATED EMISSION TEST

5.2.1 Test data for RF Tag Reader

5.2.1.1 Operation frequency band: (13.553 ~ 13.567) MHz

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Humidity Level : 48 % R.H. Temperature: 24 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.225
 Type of Test : Low Power Communication Device Transmitter
 Result : PASSED

EUT : ID CARD PRINTER Date: August 09, 2021 ~ August 13, 2021

Operating Condition : Transmitting Mode

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 9 kHz)

Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)
13.561 50	40.55	H	19.30	0.30	60.15	124.00	63.85
13.561 50	40.46	V	19.30	0.30	60.06	124.00	63.94

Remark. The EUT was tested at 3 m, so conversation factor was included at above limit.

5.2.1.2 Operation frequency band: Below 13.553 MHz and above 13.567 MHz

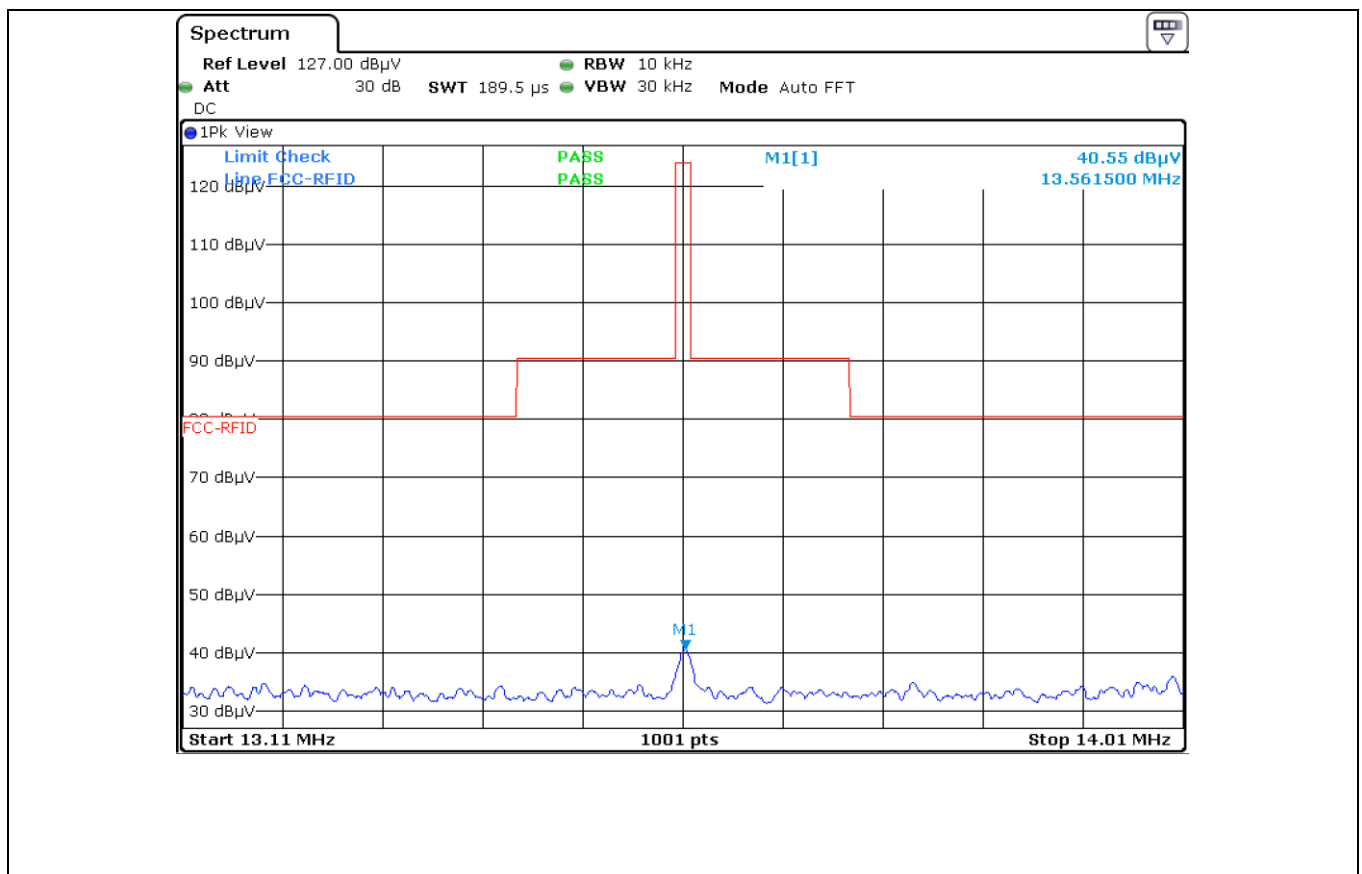
The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Humidity Level : 48 % R.H. Temperature: 24 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.225
 Type of Test : Low Power Communication Device Transmitter
 Result : PASSED

EUT : ID CARD PRINTER

Date: August 09, 2021 ~ August 13, 2021

Operating Condition : Transmitting Mode



cc. to above test data, the field strength level of 13.561 5 MHz is 40.55 dBuV/m and the worst limit subject to 15.225 (b) and (c) is 60.15 dBuV/m, so the EUT meets the requirement.

5.2.2 Test data for RF Card Reader

5.2.2.1 Operation frequency band: (13.553 ~ 13.567) MHz

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Humidity Level : 48 % R.H. Temperature: 24 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.225
 Type of Test : Low Power Communication Device Transmitter
 Result : PASSED

EUT : ID CARD PRINTER Date: August 09, 2021 ~ August 13, 2021

Operating Condition : Transmitting Mode

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 9 kHz)

Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)
13.559 30	47.30	H	19.30	0.30	66.90	124.00	57.10
13.559 30	47.11	V	19.30	0.30	66.71	124.00	57.29

Remark. The EUT was tested at 3 m, so conversation factor was included at above limit.

5.2.2.2 Operation frequency band: Below 13.553 MHz and above 13.567 MHz

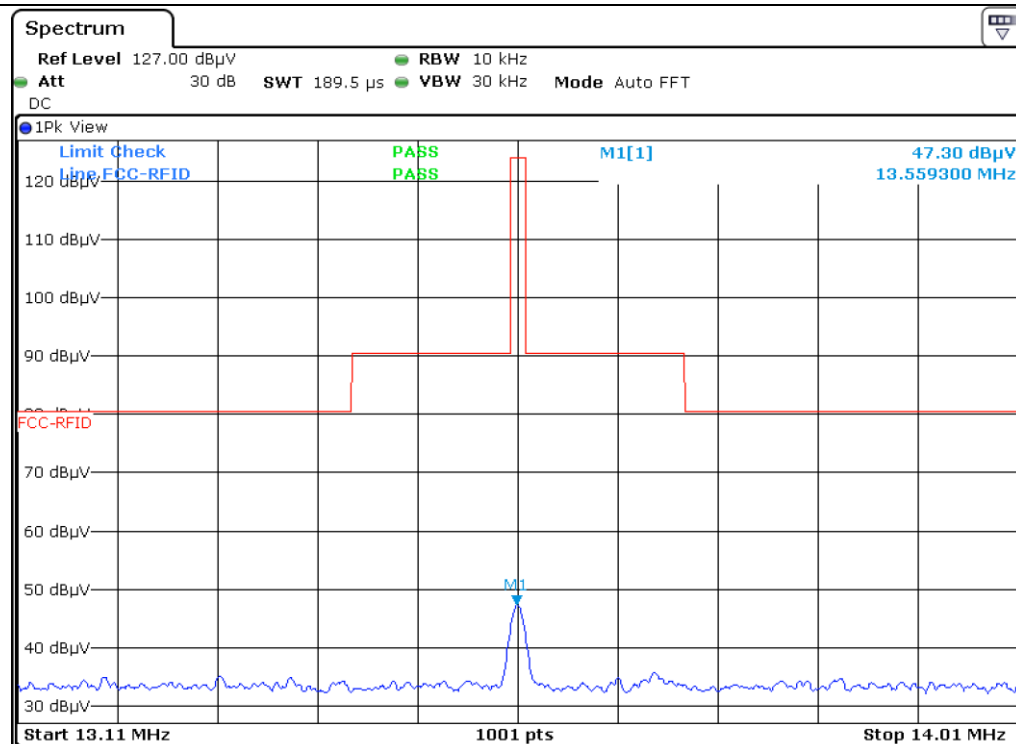
The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Humidity Level : 48 % R.H. Temperature: 24 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.225
 Type of Test : Low Power Communication Device Transmitter
 Result : PASSED

EUT : ID CARD PRINTER

Date: August 09, 2021 ~ August 13, 2021

Operating Condition : Transmitting Mode



cc. to above test data, the field strength level of 13.558 9 MHz is 47.30 dBuV/m and the worst limit subject to 15.225 (b) and (c) is 66.90 dBuV/m, so the EUT meets the requirement.

5.3 SPURIOUS EMISSION TEST

5.3.1 Test data for RF Tag Reader

5.3.1.1 Spurious Radiated Emission Below 30 MHz

Humidity Level : 48 % R.H. Temperature: 24 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.209

Type of Test : Low Power Communication Device Transmitter

Frequency Range : 9 kHz ~ 30 MHz

Result : PASSED

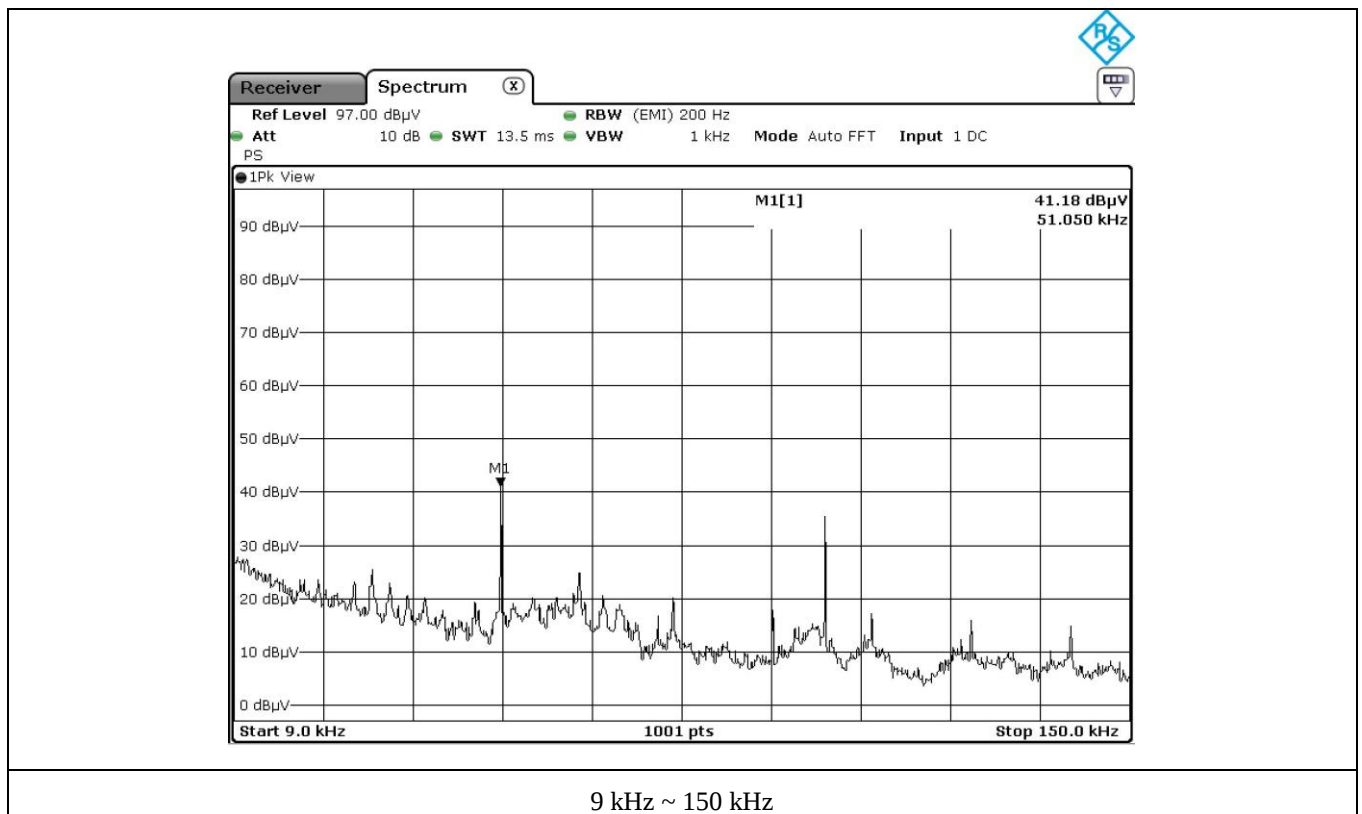
EUT : ID CARD PRINTER

Date: August 09, 2021 ~ August 13, 2021

Operating Condition : Transmitting Mode

Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0.051	41.18	H	18.9	0.10	60.18	113.45	53.27
0.156	31.19	H	18.9	0.10	50.19	103.74	53.55
29.46	10.55	H	20.4	0.50	31.45	69.54	38.09

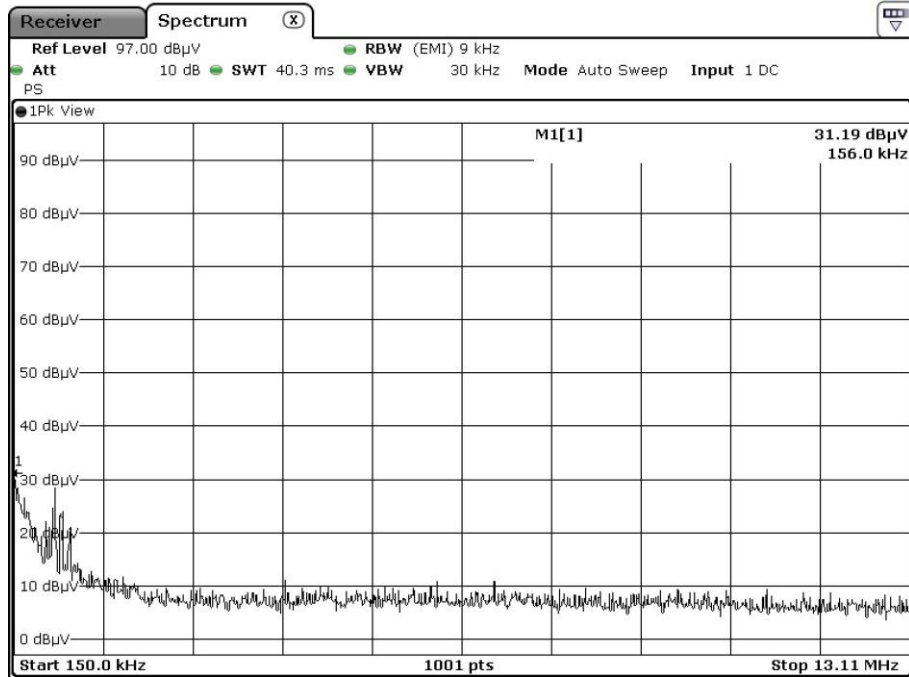


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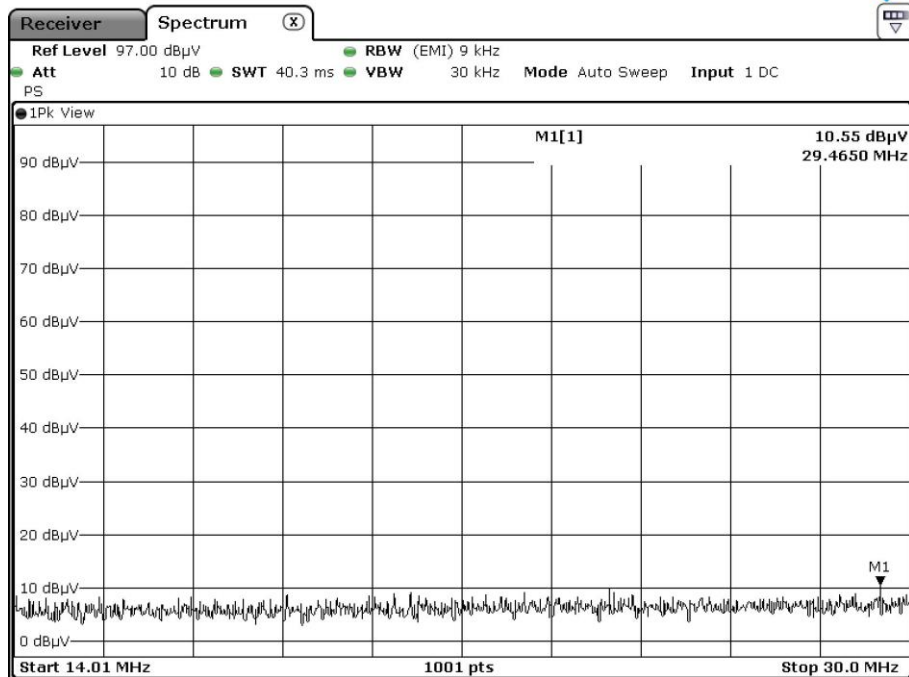
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150 kHz ~ 13.11 MHz



14.01 MHz ~ 30.00 MHz

5.3.1.2 Spurious Radiated Emission below 1 GHz

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

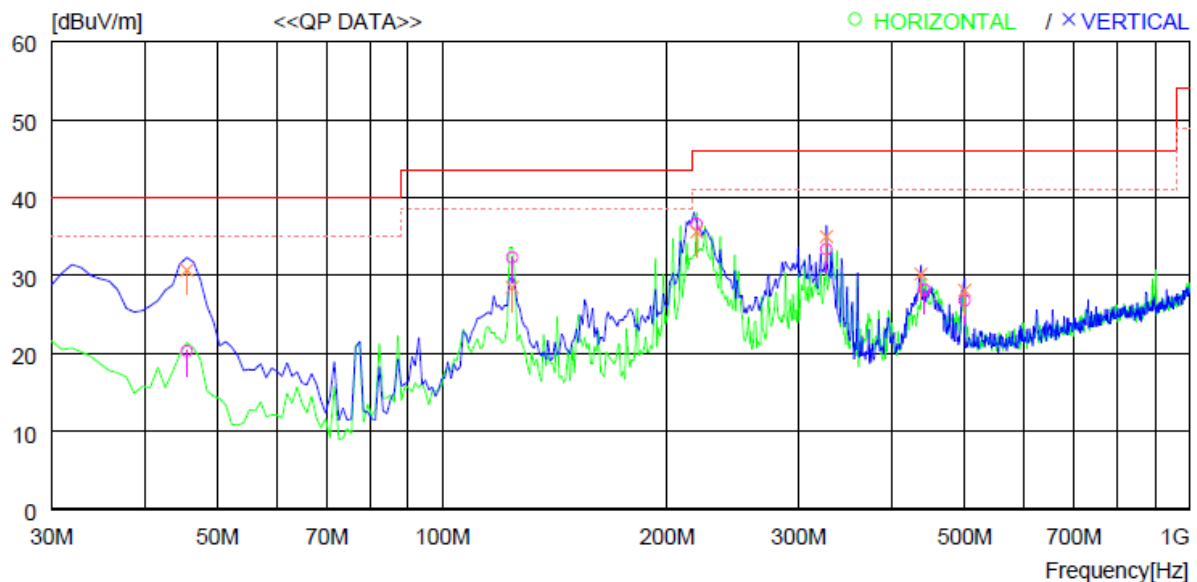
Humidity Level : 48 % R.H. Temperature: 24 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.209
 Type of Test : Low Power Communication Device Transmitter
 Frequency range : 30 MHz ~ 960 MHz
 Result : PASSED

EUT : ID CARD PRINTER

Date: August 09, 2021 ~ August 13, 2021

Operating Condition : Transmitting Mode

Distance : 3 m



No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	45.520	37.1	15.0	1.3	33.1	20.3	40.0	19.7	300	0
2	124.090	44.4	18.8	2.1	33.0	32.3	43.5	11.2	200	359
3	219.150	51.2	15.6	2.8	33.0	36.6	46.0	9.4	200	359
4	326.820	43.3	19.6	3.5	33.0	33.4	46.0	12.6	100	0
5	442.251	34.7	22.5	4.1	33.1	28.2	46.0	17.8	300	0
6	500.451	32.1	23.2	4.5	33.0	26.8	46.0	19.2	200	359
----- Vertical -----										
7	45.520	47.5	15.0	1.3	33.1	30.7	40.0	9.3	100	359
8	124.090	40.6	18.8	2.1	33.0	28.5	43.5	15.0	100	359
9	219.150	50.2	15.6	2.8	33.0	35.6	46.0	10.4	100	203
10	326.820	44.9	19.6	3.5	33.0	35.0	46.0	11.0	200	0
11	437.401	37.0	22.2	4.1	33.1	30.2	46.0	15.8	200	0
12	500.451	33.4	23.2	4.5	33.0	28.1	46.0	17.9	100	238

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5.3.2 Test data for RF Card Reader

5.3.2.1 Spurious Radiated Emission Below 30 MHz

Humidity Level : 48 % R.H. Temperature: 24 °C
Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.209
Type of Test : Low Power Communication Device Transmitter
Frequency Range : 9 kHz ~ 30 MHz
Result : PASSED

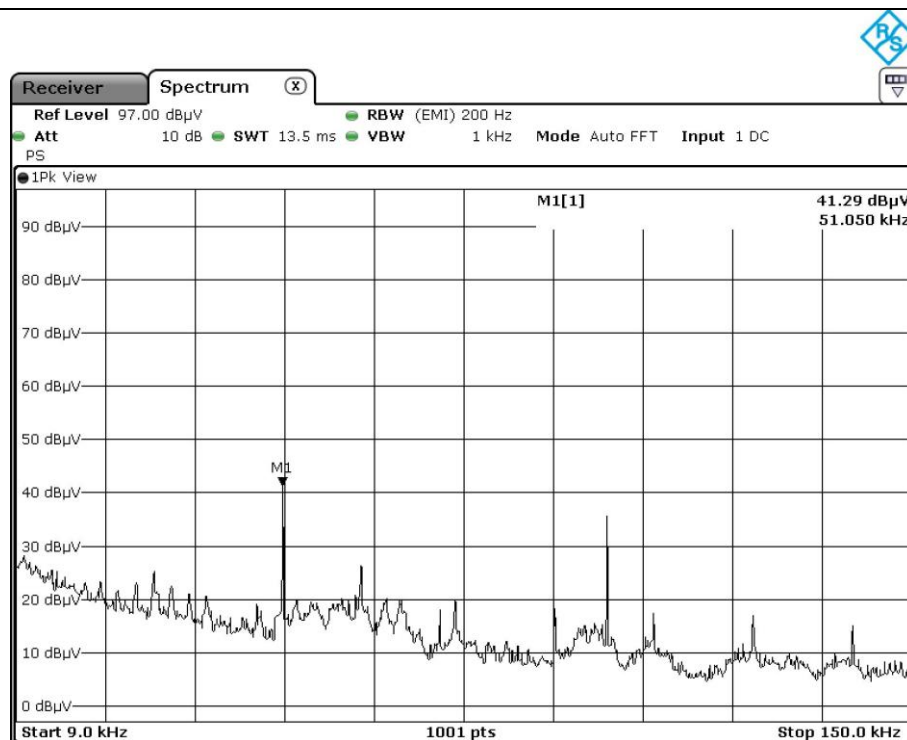
EUT : ID CARD PRINTER

Date: August 09, 2021 ~ August 13, 2021

Operating Condition : Transmitting Mode

Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0.051	41.29	H	18.9	0.10	60.29	113.45	53.16
0.156	31.77	H	18.9	0.10	50.77	103.74	52.97
22.85	9.72	H	20.1	0.50	30.32	69.54	39.22



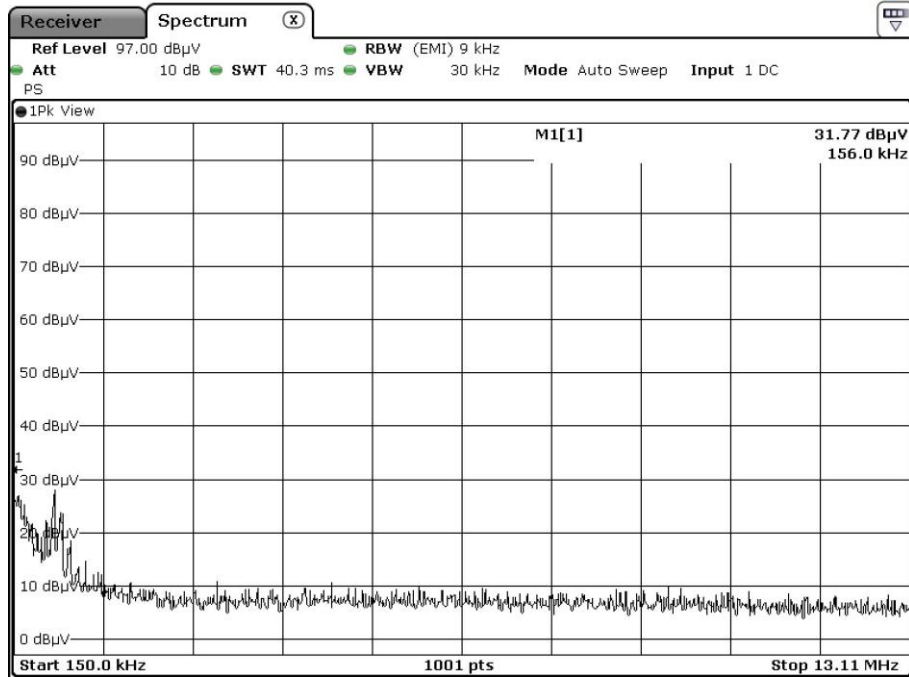
9 kHz ~ 150 kHz

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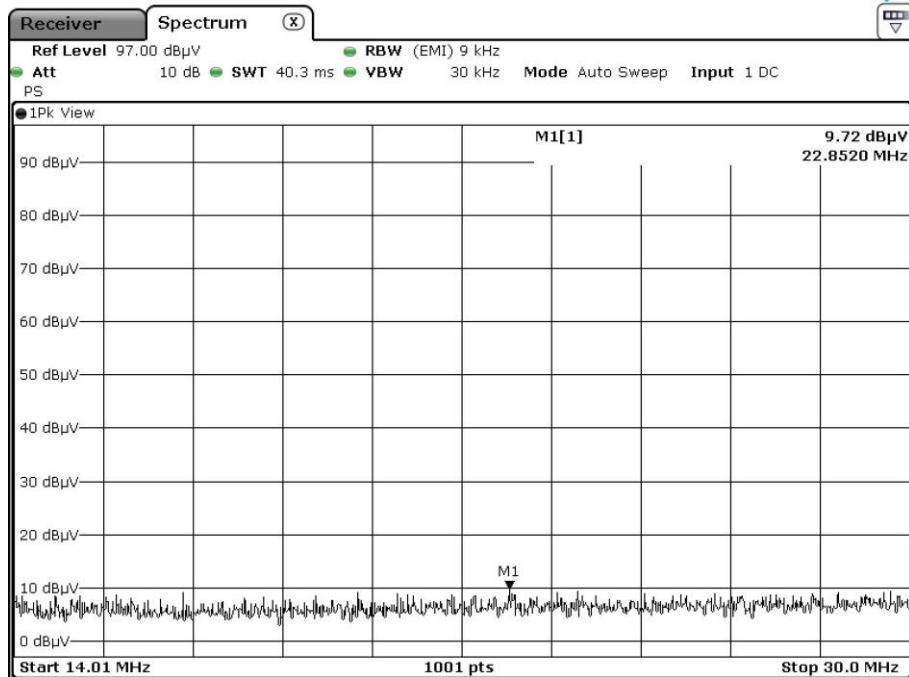
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150 kHz ~ 13.11 MHz



14.01 MHz ~ 30.00 MHz

5.3.2.2 Spurious Radiated Emission below 1 GHz

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

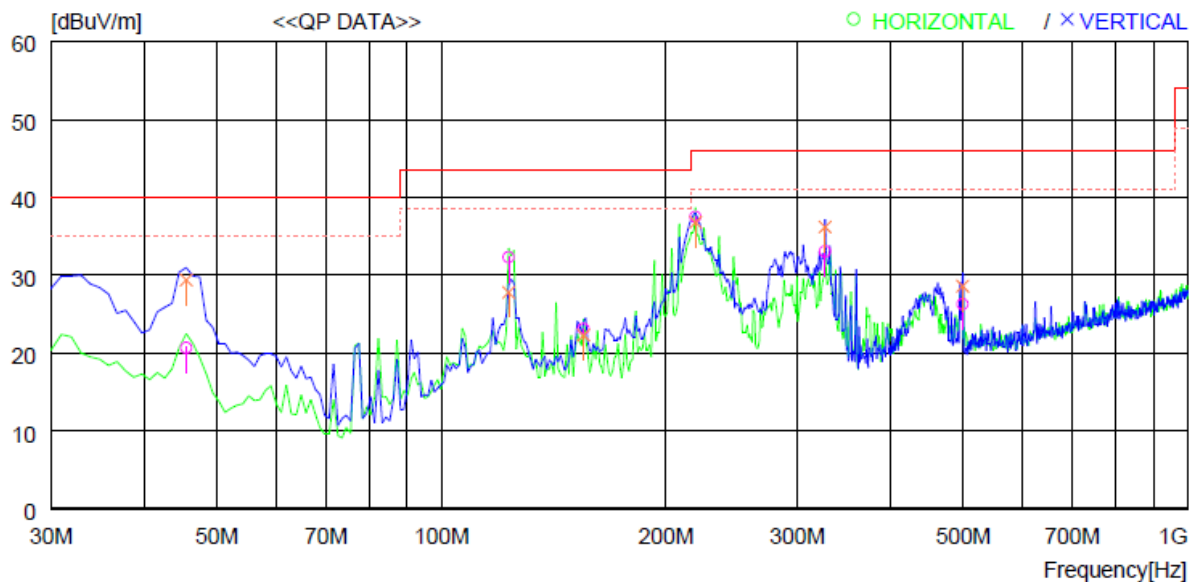
Humidity Level : 48 % R.H. Temperature: 24 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.209
 Type of Test : Low Power Communication Device Transmitter
 Frequency range : 30 MHz ~ 960 MHz
 Result : PASSED

EUT : ID CARD PRINTER

Date: August 09, 2021 ~ August 13, 2021

Operating Condition : Transmitting Mode

Distance : 3 m



No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	45.520	37.5	15.0	1.3	33.1	20.7	40.0	19.3	100	0
2	123.120	44.5	18.7	2.1	33.0	32.3	43.5	11.2	300	0
3	155.130	35.4	18.3	2.4	33.0	23.1	43.5	20.4	100	0
4	219.150	52.1	15.6	2.8	33.0	37.5	46.0	8.5	100	0
5	326.820	43.0	19.6	3.5	33.0	33.1	46.0	12.9	100	155
6	499.481	31.6	23.2	4.5	33.0	26.3	46.0	19.7	200	359
----- Vertical -----										
7	45.520	46.2	15.0	1.3	33.1	29.4	40.0	10.6	100	359
8	123.120	40.0	18.7	2.1	33.0	27.8	43.5	15.7	100	359
9	155.130	34.6	18.3	2.4	33.0	22.3	43.5	21.2	100	359
10	219.150	51.4	15.6	2.8	33.0	36.8	46.0	9.2	100	160
11	326.820	46.1	19.6	3.5	33.0	36.2	46.0	9.8	200	220
12	499.481	33.9	23.2	4.5	33.0	28.6	46.0	17.4	100	252

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5.3.3 Test data for Intermodulation

5.3.3.1 Spurious Radiated Emission Below 30 MHz

Humidity Level : 48 % R.H. Temperature: 24 °C
Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.209
Type of Test : Low Power Communication Device Transmitter
Frequency Range : 9 kHz ~ 30 MHz
Result : PASSED

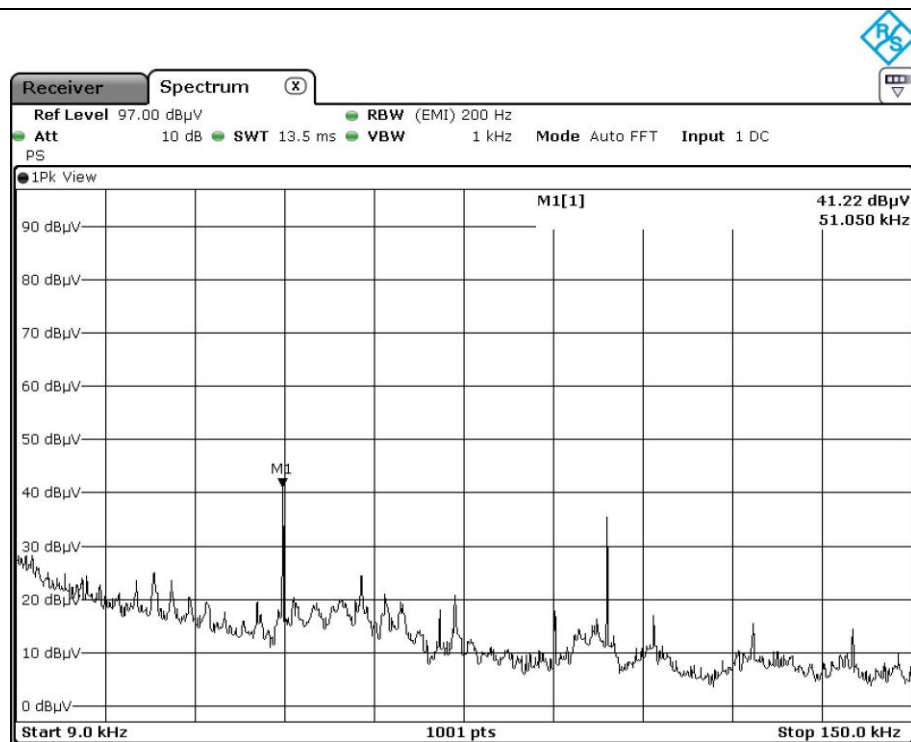
EUT : ID CARD PRINTER

Date: August 09, 2021 ~ August 13, 2021

Operating Condition : Transmitting Mode

Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0.051	41.22	H	18.9	0.10	60.22	113.45	53.23
0.156	31.43	H	18.9	0.10	50.43	103.74	53.31
25.91	9.91	H	20.1	0.50	30.51	69.54	39.03



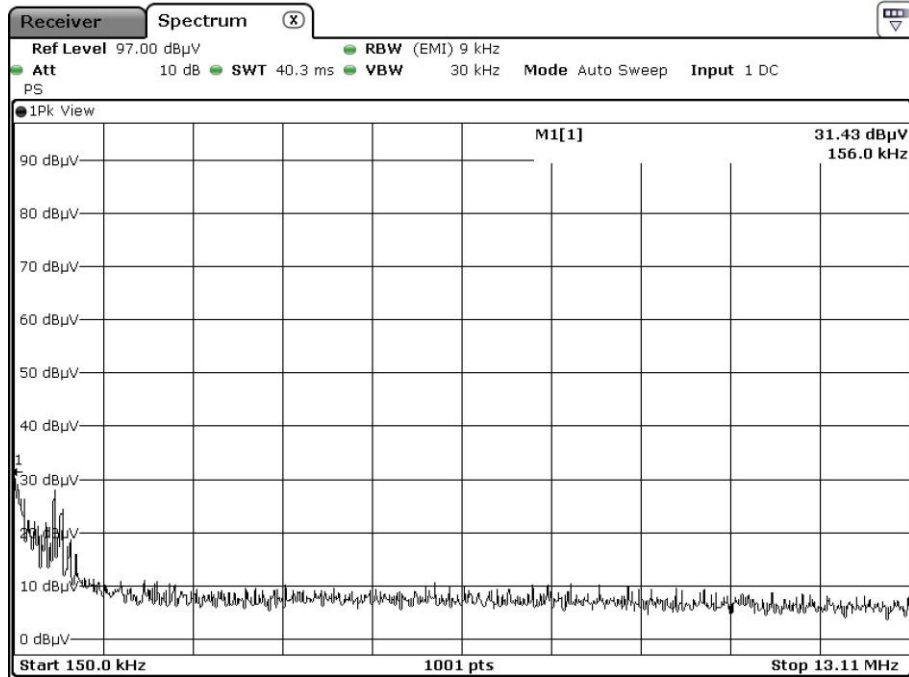
9 kHz ~ 150 kHz

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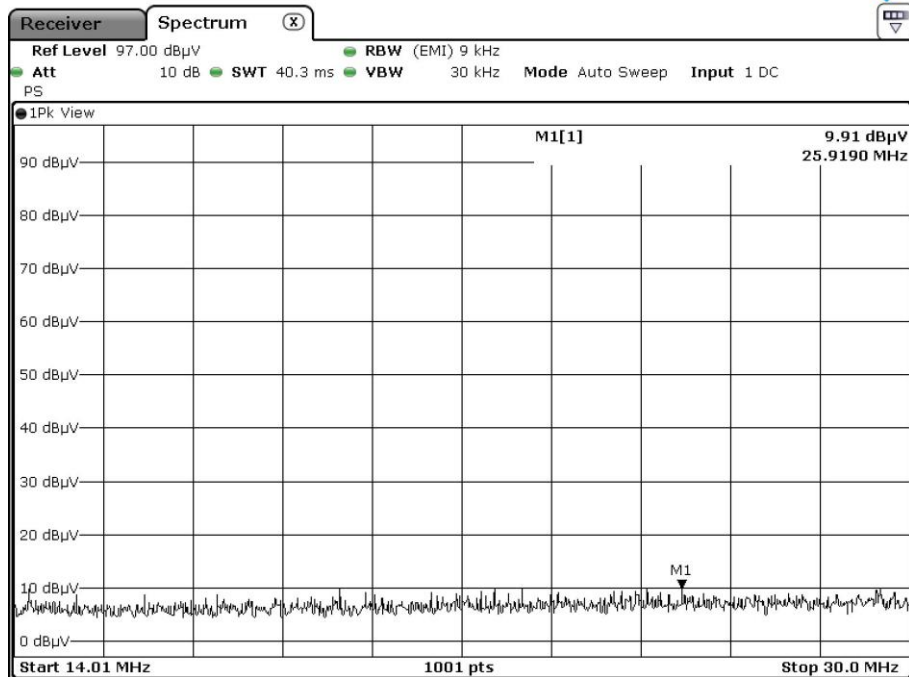
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150 kHz ~ 13.11 MHz



14.01 MHz ~ 30.00 MHz

5.3.3.2 Spurious Radiated Emission below 1 GHz

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

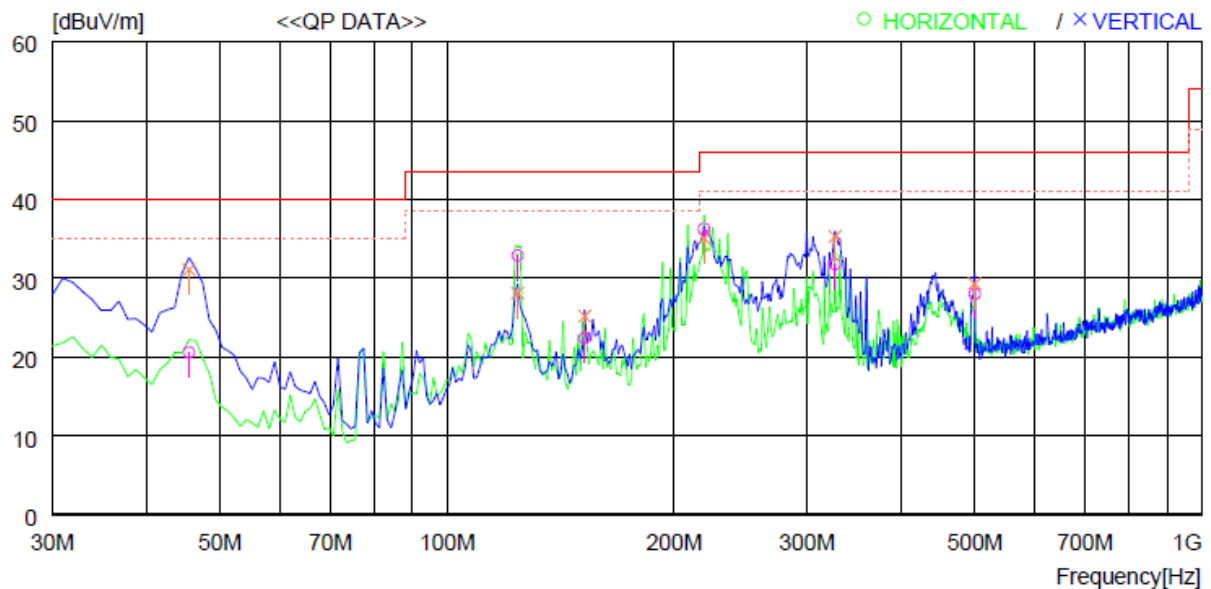
Humidity Level : 48 % R.H. Temperature: 24 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.209
 Type of Test : Low Power Communication Device Transmitter
 Frequency range : 30 MHz ~ 960 MHz
 Result : PASSED

EUT : ID CARD PRINTER

Date: August 09, 2021 ~ August 13, 2021

Operating Condition : Transmitting Mode

Distance : 3 m



No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
		QP	FACTOR							
	[MHz]	[dBuV]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	45.520	37.4	15.0	1.3	33.1	20.6	40.0	19.4	200	359
2	124.090	45.0	18.8	2.1	33.0	32.9	43.5	10.6	300	323
3	152.220	34.6	18.5	2.3	33.0	22.4	43.5	21.1	100	241
4	219.150	50.9	15.6	2.8	33.0	36.3	46.0	9.7	200	47
5	326.820	41.7	19.6	3.5	33.0	31.8	46.0	14.2	100	76
6	500.451	33.3	23.2	4.5	33.0	28.0	46.0	18.0	200	106
----- Vertical -----										
7	45.520	47.9	15.0	1.3	33.1	31.1	40.0	8.9	100	359
8	124.090	40.2	18.8	2.1	33.0	28.1	43.5	15.4	100	270
9	152.220	37.4	18.5	2.3	33.0	25.2	43.5	18.3	100	359
10	219.150	49.7	15.6	2.8	33.0	35.1	46.0	10.9	100	359
11	326.820	45.2	19.6	3.5	33.0	35.3	46.0	10.7	200	0
12	500.451	34.6	23.2	4.5	33.0	29.3	46.0	16.7	100	359

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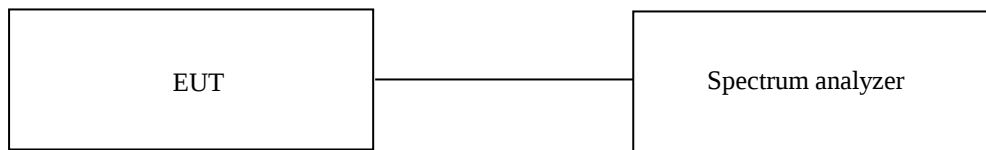
5.4 20 dB BANDWIDTH

5.4.1 Operating environment

Temperature : 24 °C
Relative humidity : 48 % R.H.

5.4.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1 % to 5 % of the OBW and video bandwidth (VBW) shall be approximately three times RBW. The 20 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 20 dB.



5.4.3 Test date

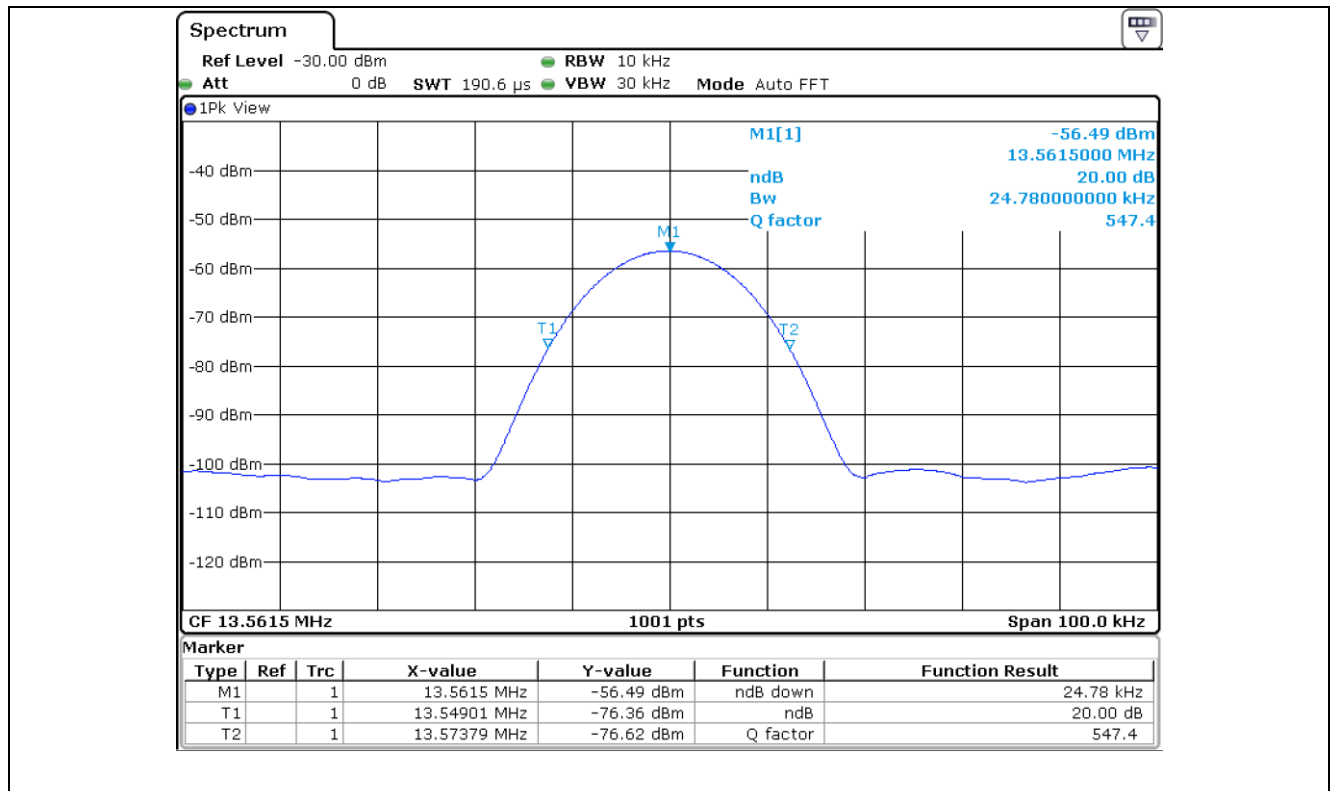
August 09, 2021 ~ August 13, 2021

5.4.4 Test data

5.4.4.1 Test data for RF Tag Reader

-. Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.215

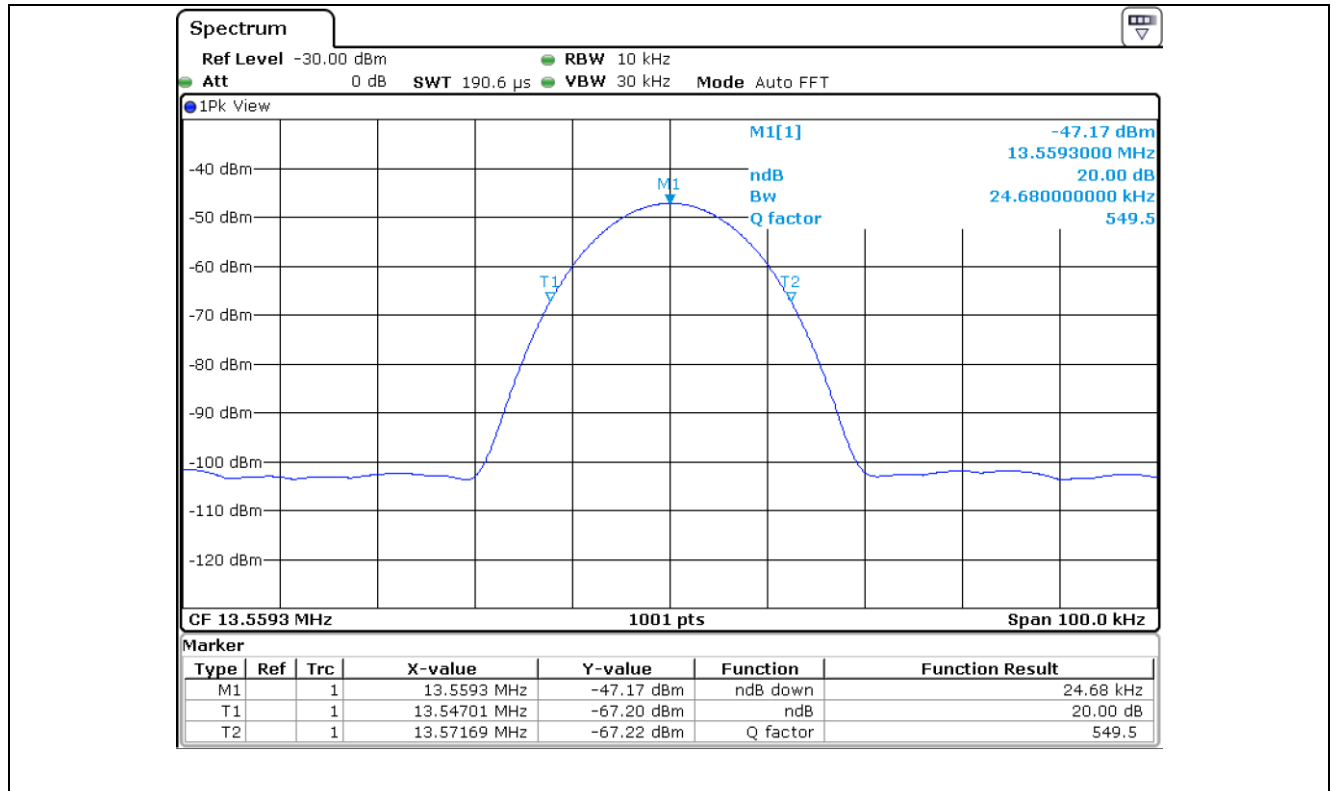
Operating Freq. (MHz)	Minimum Freq. (MHz)	Maximum Freq. (MHz)	20 dB Bandwidth (kHz)
13.561 500	13.549 010	13.573 790	24.68



5.4.4.2 Test data for RF Card Reader

-. Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.215

Operating Freq. (MHz)	Minimum Freq. (MHz)	Maximum Freq. (MHz)	20 dB Bandwidth (kHz)
13.559 300	13.547 010	13.571 690	24.68



5.5 FREQUENCY STABILITY WITH TEMPERATURE VARIATION

5.5.1 Operating environment

Temperature : 24 °C
Relative humidity : 48 % R.H.

5.5.2 Test set-up

Turn EUT off and set chamber temperature to -20 °C and then allow sufficient time (approximately 20 to 30 minutes after chamber reach the assigned temperature) for EUT to stabilize. Turn ON EUT and measure the EUT operating frequency and then turn off the EUT after the measurement. The temperature in the chamber was raised 10 °C step from -20 °C to +50°C. Repeat above method for frequency measurements every 10 °C step and then record all measured frequencies on each temperature step.

5.5.3 Test date

August 09, 2021 ~ August 13, 2021

5.5.4 Test data

5.5.4.1 Test data for RF Tag Reader

-. Result : PASSED

Temperature (°C)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Margin (Hz)	Limit (Hz)
-20	13 561 400	13 561 409	9	± 1 356.14
-10		13 561 412	12	
0		13 561 419	19	
10		13 561 410	10	
20		13 561 405	5	
30		13 561 395	-5	
40		13 561 392	-8	
50		13 561 384	-16	

5.5.4.2 Test data for RF Card Reader

-. Result : PASSED

Temperature (°C)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Margin (Hz)	Limit (Hz)
-20	13 559 300	13 559 356	56	± 1 355.93
-10		13 559 362	62	
0		13 559 370	70	
10		13 559 379	79	
20		13 559 348	48	
30		13 559 336	36	
40		13 559 340	40	
50		13 559 344	44	

5.6 FREQUENCY STABILITY WITH VOLTAGE VARIATION

5.6.1 Operating environment

Temperature : 24 °C
Relative humidity : 48 % R.H.

5.6.2 Test set-up

An external DC power supply was connected to the input of the EUT. The voltage of EUT set to 115 % of the nominal value and then was reduced to 85 % of nominal voltage. The output frequency was recorded at each step.

5.6.3 Test date

August 09, 2021 ~ August 13, 2021

5.6.4 Test data

5.6.4.1 Test data for RF Tag Reader

-. Result : PASSED

Voltage (Vdc)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Margin (Hz)	Limit (Hz)
27.6 (115 %)	13 561 400	13 561 384	-16	± 1 356.14
24.0 (100 %)		13 561 388	-12	
20.4 (85 %)		13 561 390	-10	

5.6.4.2 Test data for RF Card Reader

-. Result : PASSED

Voltage (Vdc)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Margin (Hz)	Limit (Hz)
27.6 (115 %)	13 559 300	13 559 347	47	± 1 355.93
24.0 (100 %)		13 559 336	36	
20.4 (85 %)		13 559 330	30	

6. FIELD STRENGTH CALCULATION

Meter readings are compared to the specification limit correcting for antenna and cable losses.

+	Meter reading	(dB μ V)
-	Amplifier Gain	(dB)
+	Cable Loss	(dB)
-	Antenna Factor	(dB/m)
=	Corrected Result	(dB μ V/m)
Margin (dB)		
	Specification Limit	(dB μ V/m)
-	Corrected Result	(dB μ V/m)
=	dB Relative to Spec	($\pm$ dB)

7. LIST OF TEST EQUIPMENT

Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
ESR	Rohde & Schwarz	EMI Test Receiver	101470	Oct. 20, 2020 (1Y)
ESR3	Rohde & Schwarz	EMI Test Receiver	102602	Mar. 15, 2021 (1Y)
FSV30	Rohde & Schwarz	SIGNAL ANALYZER	101372	Jul. 14, 2021 (1Y)
310N	Sonoma Instrument	AMPLIFIER	312544	Mar. 16, 2021 (1Y)
HLP-2008	TDK RF Solutions	Hybrid Antenna	131314	Feb. 27, 2020 (2Y)
NSLK8126	Schwarzbeck	LISN	8126479	Mar. 15, 2021 (1Y)
NSLK8126	Schwarzbeck	LISN	8126404	Mar. 15, 2021 (1Y)
ESH3Z2	Rohde & Schwarz	PULSE LIMITER	357.8810.52	Mar. 15, 2021 (1Y)
DT3000	Innco System	Turn Table	930611	N/A
MA-4000XPET	Innco Systems GmbH	Antenna Master	MA4640/592/ 40700517/-	N/A
FMZB 1513	Schwarzbeck	Loop Antenna	1513-235	Mar. 24, 2020 (2Y)
PSL-2KP	ESPEC	Environmental Test Chamber	14009407	Feb. 16, 2021 (1Y)
CO3000	Innco Systems GmbH	Controller	1026/40960617/P	N/A
DT2000-2t	Innco Systems GmbH	Turn Table	N/A	N/A
H-3005D	FinePower	DC Power Supply	FP09092008	Feb. 08, 2021 (1Y)

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