

TEST REPORT



DT&C Co., Ltd.

42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea,17042
Tel : 031-321-2664, Fax : 031-321-1664

1. Report No : DRTFCC1611-0152
2. Customer
 - Name : Asterisk Inc.
 - Address : 5-6-16 Nishinakajima, Yodogawa-ku, Shin-Osaka Dainichi Bldg 201, Osaka, Japan
3. Use of Report : FCC Original Grant
4. Product Name / Model Name : COMBO RFID Reader / ASR-0240D
FCC ID : 2AJXE-ASR-0240D
6. Test Method Used : FCC Part 15.225
7. Date of Test : 2016-09-06 ~ 2016-09-27
8. Testing Environment : See appended test report.
9. Test Result : Refer to the attached Test Result.

Affirmation	Tested by	Technical Manager
	Name : JungWoo Kim (Signature)	Name : GeunKi Son (Signature)

The test results presented in this test report are limited only to the sample supplied by applicant and the use of this test report is inhibited other than its purpose. This test report shall not be reproduced except in full, without the written approval of DT&C Co., Ltd.

2016 . 11 . 23 .

DT&C Co., Ltd.

If this report is required to confirmation of authenticity, please contact to report@dtnc.net

Test Report Version

Test Report No.	Date	Description
DRTFCC1611-0152	Nov, 23. 2016	Initial issue

CONTENTS

1. General Information	4
1.1. Testing Laboratory.....	4
1.2. Details of Applicant.....	4
1.3. Description of EUT	4
2. Information about test items.....	5
2.1 Test mode.....	5
2.2 Support equipments	5
2.3 Tested frequency	5
2.4 Tested environment	5
2.5 EMI Suppression Device(s)/Modifications	5
3. Antenna requirements.....	5
4. Test report	6
4.1 Summary of tests	6
4.2 Transmitter requirements.....	7
4.2.1 20dB bandwidth	7
4.2.2 Occupied bandwidth.....	8
4.2.3 In-band emissions	9
4.2.4 Out-of-band emissions	10
4.2.5 Frequency Stability.....	11
4.2.6 AC Line Conducted Emissions	12
APPENDIX	15

1. General Information

1.1. Testing Laboratory

DT&C Co., Ltd.			
Standard		Site number	Address
FCC	<input checked="" type="checkbox"/>	165783	42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935
	<input type="checkbox"/>	804488	42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935
	<input type="checkbox"/>	596748	42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935
	<input type="checkbox"/>	678747	683-3, Yubang-dong, Cheoin-gu, Yongin-si, Kyeonggi-do, Korea, 449-080
IC	<input type="checkbox"/>	5740A-3	42, Yurim-ro 154 beon-gil, Cheoin -gu, Yongin-si, Gyeonggi -do, South Korea 449-935
	<input type="checkbox"/>	5740A-2	683-3, Yubang-dong, Cheoin-gu, Yongin-si, Kyeonggi-do, Korea, 449-080
www.dtnc.net			
Telephone	:	+ 82-31-321-2664	
FAX	:	+ 82-31-321-1664	

1.2. Details of Applicant

Applicant : Asterisk Inc.
 Address : 5-6-16 Nishinakajima, Yodogawa-ku, Shin-Osaka Dainichi Bldg 201,
 Osaka, Japan
 Contact person : Naoki Kumamoto

1.3. Description of EUT

FCC Equipment Class	Low Power Communications Device Transmitter(DXX)
EUT	COMBO RFID Reader
Model Name	ASR-0240D
Serial Number	Identical prototype
Power Supply	DC 3.7 V
Frequency Band	13.56 MHz
Modulation Type	ASK
Channel(s)	1
Antenna type	Loop Antenna

2. Information about test items

2.1 Test mode

Test mode1	Continuous transmitting mode
Test mode2	-

Note: For this test mode, a test program was supported by manufacturer.

2.2 Support equipments

Equipment	Model No.	Serial No.	Manufacturer	Note
-	-	-	-	-

2.3 Tested frequency

Channel	TX Frequency(MHz)	RX Frequency(MHz)
Lowest	13.56	13.56
Middle	-	-
Highest	-	-

2.4 Tested environment

Temperature	: 23 ~ 24 °C
Relative humidity content	: 42 ~ 46 % R.H.
Details of power supply	: DC 3.7 V

2.5 EMI Suppression Device(s)/Modifications

EMI suppression device(s) added and/or modifications made during testing
→ None

3. Antenna requirements

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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 this section.”

**The antenna is attached to the internal PCB.
Therefore this E.U.T Complies with the requirement of §15.203**

4. Test report

4.1 Summary of tests

FCC part section(s)	RSS section(s)	Parameter	Limit	Test condition	Status Note 1
2.1049	-	20 dB Bandwidth	-	Radiated	C
-	RSS-Gen [6.6]	Occupied Bandwidth	-		NA
15.225 (a)	RSS-210 [A2.6 (a)]	In-Band Emissions	15,848 $\mu\text{V/m}$ @ 30 m 13.553 – 13.567 MHz		C
15.225 (b)	RSS-210 [A2.6 (b)]	In-Band Emissions	334 $\mu\text{V/m}$ @ 30 m 13.410 – 13.553 MHz 13.567 – 13.710 MHz		C
15.225 (c)	RSS-210 [A2.6 (c)]	In-Band Emissions	106 $\mu\text{V/m}$ @ 30 m 13.110 – 13.410 MHz 13.710 – 14.010 MHz		C
15.225 (d) 15.209	RSS-210 [A2.6 (d)]	Out-of Band Emissions	Emissions outside of the specified band (13.110-14.010 MHz) must meet the radiated limits detailed in 15.209		C
15.225 (e)	RSS-210 [A2.6]	Frequency Stability	± 0.01 % of operating frequency	Temp & Humid Test Chamber	C
15.207	RSS-Gen [8.8]	AC Conducted Emissions	FCC Part 15.207	AC Line Conducted	C
15.203	RSS-Gen [6.7]	Antenna Requirements	FCC Part 15.203	-	C

Note 1: C=Comply NC=Not Comply NT=Not Tested NA=Not Applicable

Note 2: Semi anechoic chamber registration number is 165783

The sample was tested according to the following specification:
ANSI C-63.10-2013

4.2.2 Occupied bandwidth

- Procedure:

The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

The resolution bandwidth (RBW) shall be in the range of 1 % to 5 % of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3 x RBW.

- Measurement Data: NA

- Minimum Standard: NA

4.2.3 In-band emissions

- Procedure:

The EUT was placed on a 0.8 m high non-conductive table inside a 10 m semi anechoic chamber. An antenna was placed at 3 m distance from the EUT. Measurements were performed with the EUT oriented in 3 orthogonal axis and rotated 360 degrees to determine worst-case orientation for maximum emissions. A loop antenna was used for this test item. And the loop antenna was rotated about vertical axis.

- Measurement Data: **Comply**

Tested Frequency : 13.56 MHz
Measurement Distance : 3 Meters

Test Frequency Band [MHz]	Freq. [MHz]	EUT Posi.	Reading Level [dBuV]	T.F	Field Strength @3 m [dBuV/m]	Field Strength @30 m [dBuV/m]	Limit [dBuV/m]	Margin [dB]
13.110 ~ 13.410	13.216	Z	8.10	20.20	28.30	-11.70	40.51	52.21
13.410 ~ 13.553	13.539	Y	12.40	20.20	32.60	-7.40	50.47	57.87
13.553 ~ 13.567	13.553	Z	23.30	20.20	43.50	3.50	84.00	80.50
13.567 ~ 13.710	13.568	Z	22.00	20.20	42.20	2.20	50.47	48.27
13.710 ~ 14.010	13.880	Z	8.10	20.30	28.40	-11.60	40.51	52.11

Note 1. This test item was performed using a loop antenna.

Note 2. This test item was performed at 3 m and the data were extrapolated to the specified measurement distance of 30 m using the square of an inverse linear distance extrapolation factor (40 dB/decade) as specified in §15.31(f)2.

▪ Extrapolation Factor = $20 \log_{10}(30/3)^2 = 40 \text{ dB}$

Note 3. All data were recorded using a spectrum analyzer employing a peak detector.

If PK results were meet Quasi-peak limit, Quasi-peak measurements were omitted.

Note 4. Sample Calculation.

Margin = Limit – Field Strength @ 30 m / Field Strength @ 30 m = Field Strength @ 3 m – 40 dB

Field Strength @ 3 m = Reading + T.F / T.F = AF + CL – AG

Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain

- Minimum Standard: Part 15.225(a), (b), (c)& RSS-210 [A2.6(a), (b), (c)]

Frequency Band [MHz]	Limit	
	[uV/m]	[dBuV/m]
13.553-13.567	15,848	84.00
13.410-13.553 13.567-13.710	334	50.47
13.110-13.410 13.710-14.010	106	40.51

4.2.4 Out-of-band emissions

- Procedure:

The EUT was tested from 9 kHz up to the 1 GHz excluding the band 13.110-14.010 MHz. All measurements were recorded with spectrum analyzer employing a peak detector for emissions below 30 MHz. Above 30 MHz a Quasi-peak detector was used. All out-of-band emissions must not exceed the limits §15.209. A loop antenna was used for searching for emissions below 30 MHz.

- Measurement Data: **Comply**

Tested Frequency : 13.56 MHz
Measurement Distance : 3 Meters

Frequency [MHz]	EUT Posi.	ANT Pol	Reading [dBuV]	T.F [dB/m]	Distance factor	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
0.044	Z	N/A	44.2	19.6	80	-16.2	34.7	50.9
0.533	Z	N/A	19.8	18.7	40	-1.5	33.1	34.6
1.033	Z	N/A	16	19.8	40	-4.2	27.3	31.5
40.670	Z	V	40.8	-16.2	0	24.6	40	15.4
54.129	Z	V	32.3	-22	0	10.3	40	29.7
67.709	Z	V	41.7	-23.9	0	17.8	40	22.2
230.664	Z	V	42.9	-16.9	0	26	46	20
338.937	Z	H	35	-12.7	0	22.3	46	23.7
793.924	Z	H	39.9	-4.9	0	35	46	11
869.358	Z	V	28.3	-3.5	0	24.8	46	21.2

Note 1. All measurements were recorded using a spectrum analyzer employing a peak detector for below 30 MHz and a Quasi-peak detector for above 30 MHz.

Note 2. Both Vertical and Horizontal polarities of the receiver antenna were evaluated with the worst case emissions being reported. For 30 MHz below the loop antenna was rotated about vertical axis.

Note 3. No other spurious and harmonic emissions were reported greater than listed emissions above table.

Note 4. Sample calculation

Margin = Limit – Field Strength

Field Strength = Reading + T.F – Distance factor

T.F = AF + CL – AG

Distance factor = $20\log(\text{Measurement distance} / \text{The measured distance})^2$

Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain

- Minimum Standard: Part 15.209, 225(d) & RSS-210[A2.6 (d)]

• FCC Part 15.209(a):

Frequency [MHz]	Field Strength [uV/m]	Measurement Distance [Meters]
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30	30	30
30 ~ 88	100 **	3
88 ~ 216	150 **	3
216 ~ 960	200 **	3
Above 960	200	3

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

• FCC Part 15.209(b):

In the emission table above, the tighter limit applies at the band edges.

4.2.5 Frequency Stability

- Procedure:

Part 15.225 requires that devices operating in the 13.553 – 13.567 MHz shall maintain the carrier frequency within 0.01 % of the operating frequency over the temperature variation of -20 degrees to + 50 degrees C at normal supply voltage.

- Measurement Data: **Comply**

Operating Frequency : 13,560,000 Hz

VOLTAGE (%)	POWER (V _{DC})	TEMP (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100%	3.70	+20(ref)	13,559,454	-546	0.004027
100%		-10	13,559,721	-279	0.002058
100%		0	13,559,643	-357	0.002633
100%		0	13,559,571	-429	0.003164
100%		20	13,559,649	-351	0.002589
100%		30	13,559,637	-363	0.002677
100%		40	13,559,623	-377	0.002780
100%		50	13,559,553	-447	0.003297
115%	4.255	20	13,559,647	-353	0.002603
BATT.ENDPINIT	2.800	20	13,559,819	-181	0.001335

Note : Tested by customers as a declare temperature is -10°C ~ + 50°C.

- Minimum Standard: Part 15. 225(e) & RSS-210 [A2.6]

The frequency tolerance of the carrier signal shall be maintained within ± 0.01 % of the operating frequency.

4.2.6 AC Line Conducted Emissions

- Test Requirements and limit

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 ohms line impedance stabilization network (LISN).

Frequency Range (MHz)	Conducted Limit (dBuV)	
	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

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

Test Configuration

See test photographs for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors – Quasi Peak and Average Detector.

- **Measurement Data: Comply**(Refer to next page.)

RESULT PLOTS

AC Line Conducted Emissions (Graph)

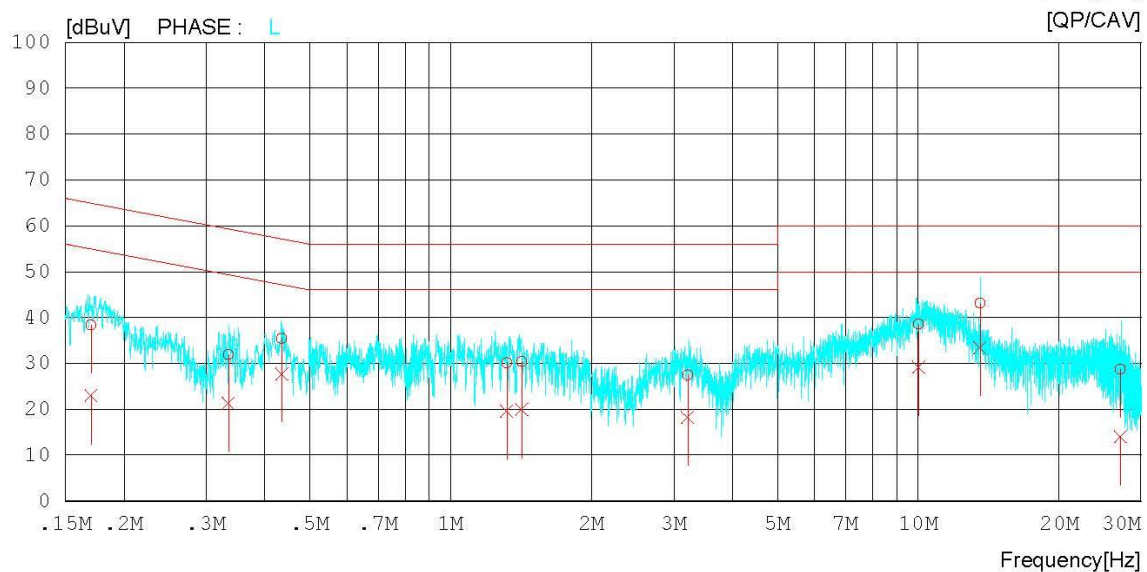
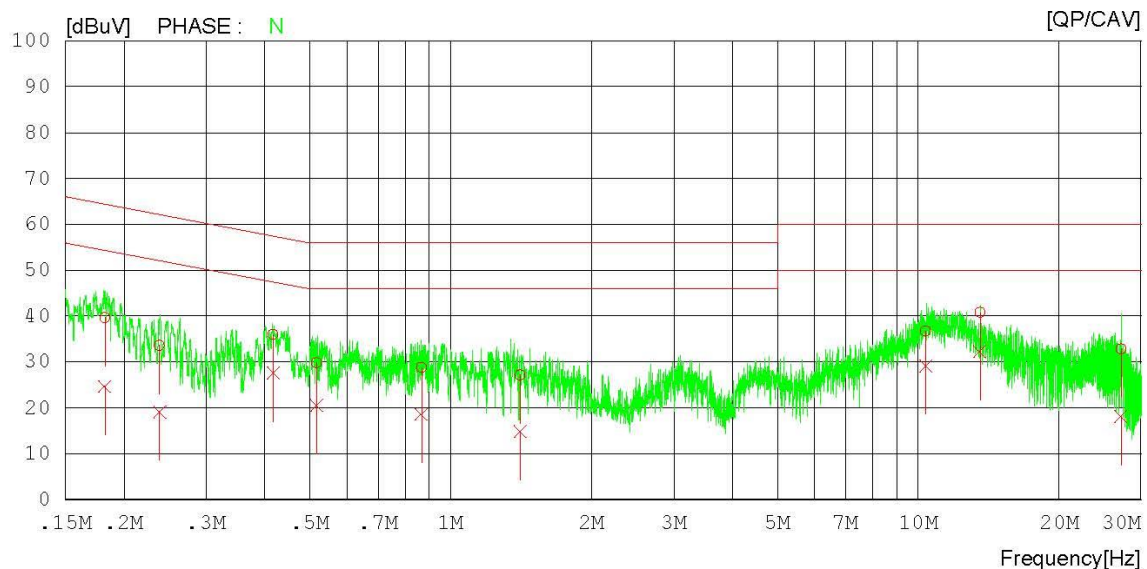
Test Mode: 13.56 MHz

Results of Conducted Emission

DT&C
Date : 2016-09-27

Order No. : DTNC1607-04513
Serial No. : Identical prototype
Model No. : ASR-0240D
Test Condition : 13.56MHz RFID

Power Supply : 120V 60Hz
Temp/Humi/Atm : 23 'C 44 % R.H.
Operator : J.W.Kim

LIMIT : CISPR32_B QP
CISPR32_B AV


AC Line Conducted Emissions (List)

Test Mode: 13.56 MHz

Results of Conducted Emission

DT&C
Date : 2016-09-27

Order No. : DTNC1607-04513
Serial No. : Identical prototype
Model No. : ASR-0240D
Test Condition : 13.56MHz RFID

Power Supply : 120V 60Hz
Temp/Humi/Atm : 23 'C 44 % R.H.
Operator : J.W.Kim

LIMIT : CISPR32_B QP
CISPR32_B AV

NO	FREQ [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	CAV [dBuV]		QP [dBuV]	CAV [dBuV]	QP [dBuV]	CAV [dBuV]	QP [dBuV]	CAV [dBuV]	
1	0.18193	37.18	22.21	2.42	39.60	24.63	64.40	54.40	24.80	29.77	N
2	0.23830	31.94	17.52	1.64	33.58	19.16	62.16	52.16	28.58	33.00	N
3	0.41750	35.16	26.75	0.84	36.00	27.59	57.50	47.50	21.50	19.91	N
4	0.51579	29.18	19.88	0.67	29.85	20.55	56.00	46.00	26.15	25.45	N
5	0.86522	28.29	18.10	0.44	28.73	18.54	56.00	46.00	27.27	27.46	N
6	1.40780	26.76	14.44	0.35	27.11	14.79	56.00	46.00	28.89	31.21	N
7	10.37680	36.34	28.78	0.39	36.73	29.17	60.00	50.00	23.27	20.83	N
8	13.55680	40.30	31.77	0.46	40.76	32.23	60.00	50.00	19.24	17.77	N
9	27.11800	32.25	17.51	0.57	32.82	18.08	60.00	50.00	27.18	31.92	N
10	0.17004	35.68	20.26	2.70	38.38	22.96	64.96	54.96	26.58	32.00	L
11	0.33460	30.79	20.22	1.10	31.89	21.32	59.34	49.34	27.45	28.02	L
12	0.43487	34.59	26.87	0.83	35.42	27.70	57.16	47.16	21.74	19.46	L
13	1.31680	29.71	19.24	0.39	30.10	19.63	56.00	46.00	25.90	26.37	L
14	1.41880	30.04	19.57	0.38	30.42	19.95	56.00	46.00	25.58	26.05	L
15	3.20960	27.15	17.90	0.36	27.51	18.26	56.00	46.00	28.49	27.74	L
16	10.01060	38.15	28.71	0.43	38.58	29.14	60.00	50.00	21.42	20.86	L
17	13.55960	42.61	33.03	0.46	43.07	33.49	60.00	50.00	16.93	16.51	L
18	27.02780	28.01	13.34	0.72	28.73	14.06	60.00	50.00	31.27	35.94	L

APPENDIX

TEST EQUIPMENT FOR TESTS

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
MXA Signal Analyzer	Agilent	N9020A	15/09/09	16/09/09	MY50200834
			16/09/09	17/09/09	
DIGITAL MULTIMETER	Agilent	34401A	16/01/05	17/01/05	US36099541
DC Power Supply	SM techno	SDP30-5D	16/01/05	17/01/05	305DLJ204
Vector Signal Generator	Rohde Schwarz	SMBV100A	16/01/05	17/01/05	255571
Low Noise Pre Amplifier(10kHz-1GHz)	tsj	MLA-010K01-B01-27	16/03/10	17/03/10	1844539
Thermohygrometer	BODYCOM	BJ5478	16/04/22	17/04/22	120612-2
Loop Antenna	Schwarzbeck	FMZB1513	16/04/22	18/04/22	1513-128
BILOG ANTENNA(30MHz~2GHz)	SCHAFFNER	CBL6112B	16/05/23	18/05/23	2737
EMI TEST RECEIVER(20Hz~40GHz)	ROHDE&SCHWARZ	ESU	16/07/18	17/07/18	100469
EMI TEST RECEIVER	R&S	ESCI	16/02/25	17/02/25	100364
ARTIFICIAL MAINS NETWORK	Narda S.T.S. / PMM	PMM L2-16B	16/06/22	17/06/22	000WX20305
SINGLE-PHASE MASTER	NF	4420	15/09/09	16/09/09	3049354420023
			16/09/08	17/09/08	
Temp & Humi Test Chamber	SJ Science	SJ-TH-S50	16/02/24	17/02/24	SJ-TH-S50-140205