

TEST REPORT



Dt&C Co., Ltd.

42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea, 17042

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1. Report No : DRTFCC2506-0035(1)

2. Customer

- Name (FCC) : CanTops Co., Ltd.
- Address (FCC) : B-1202, Digital Empire BLDG, 16, Deogyeong-daero 1556beon-gil, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16690, Republic of Korea

3. Use of Report : FCC Original Certification

4. Product Name / Model Name : LF RFID Reader / CTS-RFID-LE21

FCC ID : RMN-CTS-RFID-LE21

5. FCC Regulation(s) : FCC Part 15 Subpart C

Test Method used : ANSI C63.10-2013

6. Date of Test : 2025.05.26 ~ 2025.06.12

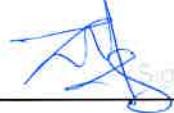
7. Location of Test : Permanent Testing Lab On Site Testing

8. Testing Environment: See appended test report.

9. Test Result: Refer to the attached test result.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

This test report is not related to KOLAS accreditation.

Affirmation	Tested by Name : JaeHun Yun 	Technical Manager Name : JaeJin Lee 
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2025 . 06 . 26.
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	Tested by	Reviewed by
DRTFCC2506-0035	Jun. 20. 2025	Initial issue	Yun JaeHun	JaeJin Lee
DRTFCC2506-0035(1)	Jun. 26. 2025	Correction of initial issue date and standard name typo.	Yun JaeHun	JaeJin Lee

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1. General Information

1.1. Description of EUT

Equipment Class	Part 15 Low Power Transmitter Below 1705 kHz (DCD)
Product Name	LF RFID Reader
Model Name	CTS-RFID-LE21
EUT Serial Number	No Specified
Power Supply	DC 24 V
Frequency Range	134.2 kHz
Antenna type	CTS-RFID: Stick Antenna CTS-STBA: STB Antenna

Antenna Information

Antenna Model Name	Cable length	Note
CTS-RFID-AB	2 m	Stick Antenna
CTS-RFID-AC	2 m	Stick Antenna
CTS-RFID-AO	2 m	Stick Antenna
CTS-STBA	2 m	Square Antenna

EUT was tested with antennas listed above.

1.2. Declaration by the applicant / manufacturer

N/A

1.3. Testing Laboratory

Dt&C Co., Ltd.

The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042.

The test site complies with the requirements of Part 2.948 according to ANSI C63.4-2014.

- FCC & ISED MRA Designation No. : KR0034

- ISED#: 5740A

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1.4. Testing Environment

Ambient Condition

▪ Temperature	21 °C ~ 23 °C
▪ Relative Humidity	41 % ~ 45 %

1.5. Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with requirements of ANSI C63.4-2014 and ANSI C63.10-2013. All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95 % level of confidence.

Parameter	Measurement uncertainty
AC power-line conducted emission	3.4 dB (The confidence level is about 95 %, $k = 2$)
Radiated emission (1 GHz Below)	5.0 dB (The confidence level is about 95 %, $k = 2$)

1.6. Test Equipment List

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent Technologies	N9020A	24/11/26	25/11/26	MY50410399
Receiver	Rohde Schwarz	ESCI3	25/05/27	26/05/27	100798
Multimeter	FLUKE	17B+	24/11/27	25/11/27	36390701WS
Signal Generator	Rohde Schwarz	SMBV100A	24/12/10	25/12/10	255571
Loop Antenna	ETS-Lindgren	6502	24/11/08	26/11/08	00060496
Hybrid Antenna	Schwarzbeck	VULB 9160	24/12/13	25/12/13	3362
PreAmplifier	H.P	8447D	24/12/11	25/12/11	2944A07774
Thermohygrometer	BODYCOM	BJ5478	24/12/05	25/12/05	120612-2
EMI Test Receiver	ROHDE&SCHWARZ	ESCI7	25/01/20	26/01/20	100910
PULSE LIMITER	Rohde Schwarz	ESH3-Z2	24/08/21	25/08/21	101333
LISN	SCHWARZBECK	NSLK 8128 RC	24/10/21	25/10/21	8128 RC-387
Digital Thermo Hygrometer	CAS	TE-303N	25/02/13	26/02/12	220502531
Cable	HUBER+SUHNER	SUCOFLEX100	25/01/02	26/01/02	M-01
Cable	HUBER+SUHNER	SUCOFLEX100	25/01/02	26/01/02	M-02
Cable	JUNKOSHA	MWX241/B	25/01/02	26/01/02	M-03
Cable	JUNKOSHA	J12J101757-00	25/01/02	26/01/02	M-07
Cable	HUBER+SUHNER	SUCOFLEX106	25/01/02	26/01/02	M-09
Cable	Dt&C	Cable	25/01/02	26/01/02	RFC-69
Test Software (AC Line Conducted)	tsj	EMI Measurement	NA	NA	Version 2.00.0190
Test Software (Radiated)	tsj	EMI Measurement	NA	NA	Version 2.00.0185
3m Semi Anechoic Chamber	SYC	3m-SAC	24/06/14(NSA) 24/06/19(VSWR)	25/06/14(NSA) 25/06/19(VSWR)	3m-SAC-1

Note1: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017

Note2: The cable is not a regular calibration item, so it has been calibrated by Dt&C itself.

2. Test Methodology

The measurement procedures provided in ANSI C63.10-2013 were used in measurement of the EUT.

2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2. EUT Exercise

The EUT was operated in the test mode to fix the TX frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the FCC Rules Part 15 Subpart C.

2.3. General Test Procedures

Conducted Emissions

The AC power line conducted emission tests were performed with ANSI C63.10-2013.

The EUT is placed on the wooden table, which is 0.8 m above ground plane and the conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-peak and Average detector.

Radiated Emissions

The radiated emission tests were performed with ANSI C63.10-2013.

EUT setup and maximizing procedure were fulfilled with the requirements in Section 5 and 6 of the ANSI C63.10-2013.

The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

2.4. Instrument Calibration

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

2.5. Description of Test Modes

The EUT has been tested with the operating condition for maximizing the emission characteristics. A test program is used to control the EUT for staying in continuous transmitting.

Test Mode	Antenna	Frequency(kHz)
TM 1	CTS-RFID-AB	134.2
TM 2	CTS-RFID-AC	134.2
TM 3	CTS-RFID-AO	134.2
TM 4	CTS-STBA	134.2

3. Antenna Requirements

According to Part 15.203

"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 uses a unique connector.

Therefore this E.U.T complies with the requirement of Part 15.203

4. Summary of Test Results

FCC Part Section(s)	Parameter	Limit	Test Condition	Status Note 1
15.215	20 dB Bandwidth	N/A	Radiated	C
15.209	Radiated Emission	Part 15.209 limits (Refer to section 5.2)		C Note 2
15.207	AC Conducted Emissions	Part 15.207 limits (Refer to section 5.3)	AC Line Conducted	C
15.203	Antenna Requirements	Part 15.203 (Refer to section 3)	-	C

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

Note 2: This test item was performed in three orthogonal EUT positions and the worst case data was reported.

5. Test Result

5.1. 20 dB Bandwidth

- Procedure:

The 20 dB Bandwidth is measured with a spectrum analyzer connected via a receive antenna placed near the EUT while the EUT is operating in transmission mode.

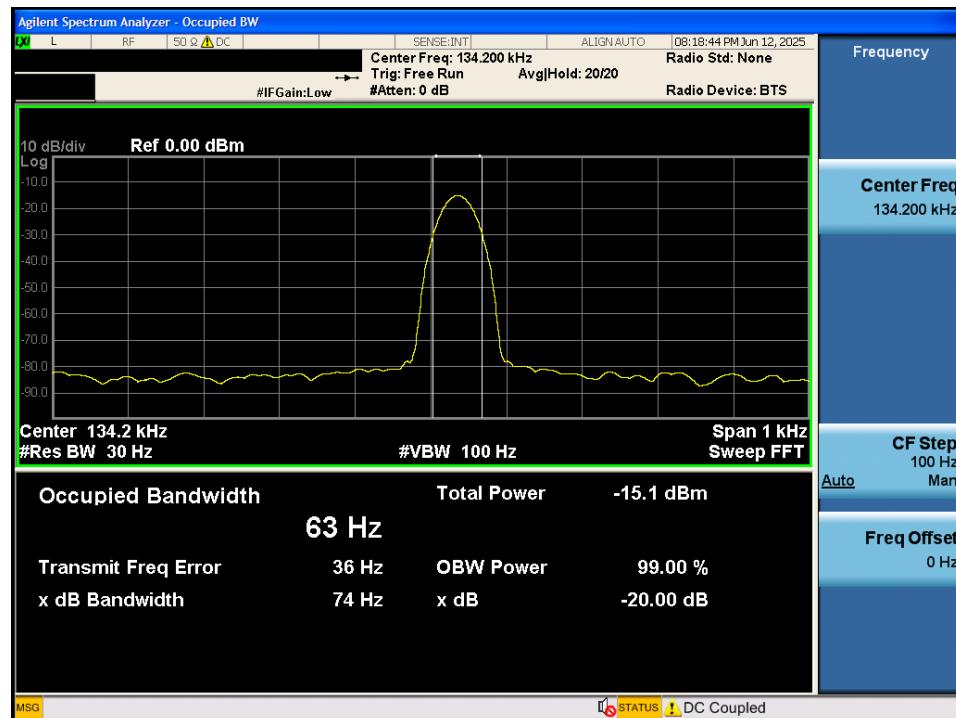
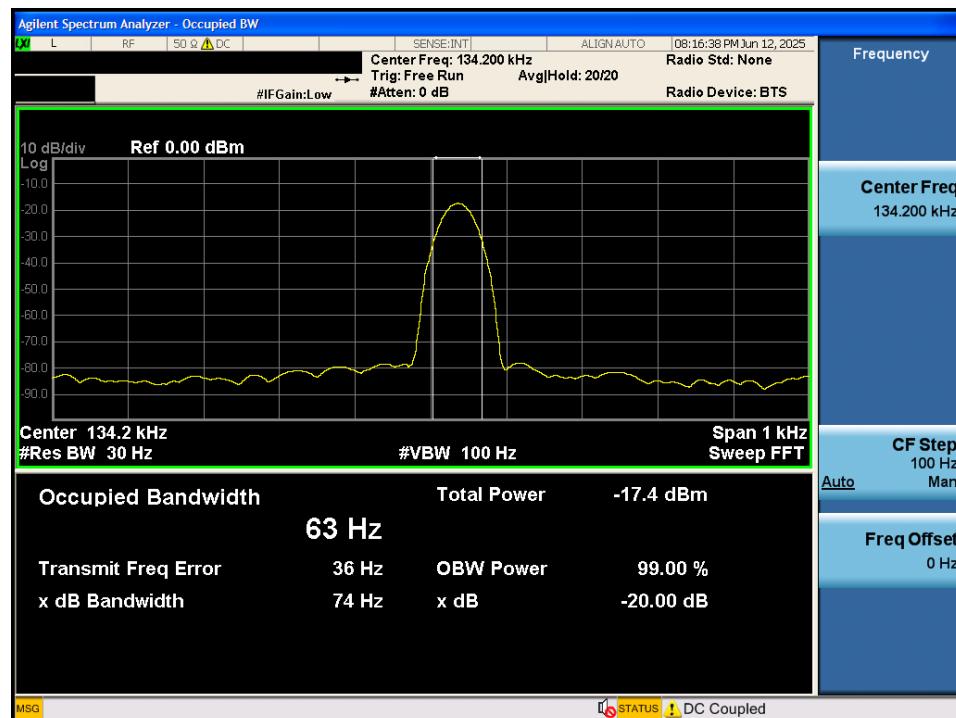
And spectrum analyzer setting use following test procedure of **ANSI C63.10-2013 – Section 6.9.2.**

1. Center frequency = EUT channel center frequency
2. Span = 2 ~ 5 times the OBW
3. RBW = 1 % ~ 5 % OBW
4. VBW \geq 3 x RBW
5. Detector = Peak
6. Trace = Max hold
7. The trace was allowed to stabilize
8. Determine the reference value = Set the spectrum analyzer marker to the highest level of the displayed trace
9. Using the marker-delta function of the instrument, determine the “-xx dB down amplitude” using [(reference value) – xx].
10. Reset the marker-delta function and move the marker to the other side of the emission until the delta marker amplitude is at the same level as the reference marker amplitude. The marker-delta frequency reading at this point is the specified emission bandwidth.

Note: Due to signal characteristics, the RBW setting cannot satisfy 1~5% of OBW.

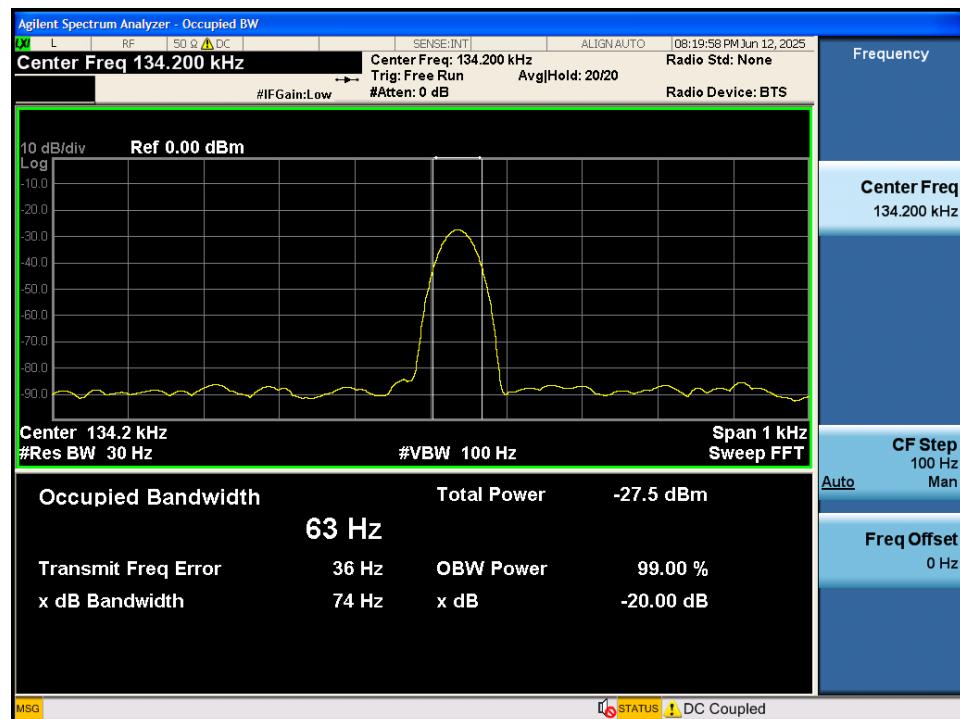
- Measurement Data: **Comply**

Test Mode	Tested Frequency(kHz)	20dB Bandwidth(Hz)
TM1	134.2	0.074
TM2	134.2	0.074
TM3	134.2	0.074
TM4	134.2	0.074

20dB Bandwidth
TM 1

20dB Bandwidth
TM 2


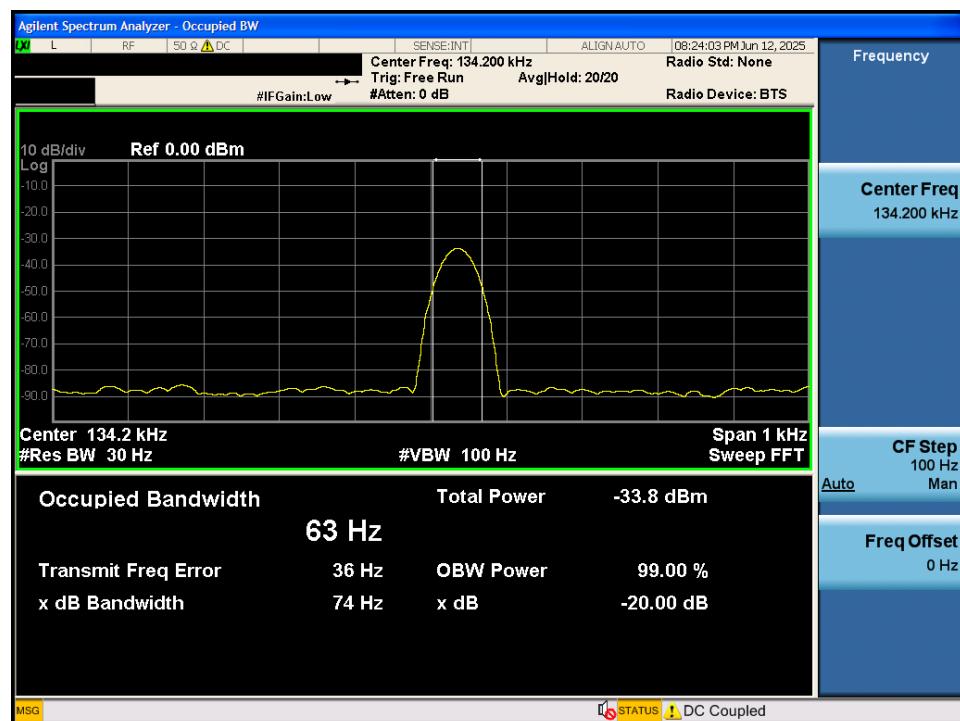
20dB Bandwidth

TM 3



20dB Bandwidth

TM 4



5.2. Radiated Emissions

- Limit: FCC Part 15.209(a): General requirement

Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (Meters)
0.009 ~ 0.490	2 400/F (kHz)	300
0.490 ~ 1.705	24 000/F (kHz)	30
1.705 ~ 30	30	30
30 ~ 88	100**	3
88 ~ 216	150**	3
216 ~ 960	200**	3
Above 960	500	3

** Except as provided in Part 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.

- Procedure:

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

- Measurement Data: **Comply** (refer to the next page)

- Test Notes

1. The radiated emissions were investigated 9 kHz to 25 GHz. And no other spurious and harmonic emissions were found below listed frequencies.

2. Information of Distance Correction Factor

For finding emissions, measurements may be performed at a distance closer than that specified in the regulations. In this case, the distance factor is applied to the result.

- Calculation of distance correction factor

At frequencies below 30 MHz = $40 \log(\text{tested distance} / \text{specified distance})$

At frequencies at or above 30 MHz = $20 \log(\text{tested distance} / \text{specified distance})$

When distance factor is "N/A", the measurements were performed at the specified distance and distance factor is not applied.

3. Loop antenna orientation (below 30 MHz)

"P"= Parallel, "V"= perpendicular, "G"= ground-parallel

Bilog antenna polarization (at or above 30 MHz)

"H"= Horizontal, "V"= Vertical

4. 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.

5. Sample calculation

Margin = Limit – Field Strength

Field Strength = Reading + TF – Distance factor

TF = 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

DCF= Distance Correction Factor

- Measurement Data: TM 1

Tested Frequency(kHz)	Freq. (MHz)	ANT pol (Note 3)	Reading (dBuV)	TF (dB/m)	DCF (dB)	Field Strength (dBuV/m)	Limit (dBuV/m)	Margin (dB)
134.2	0.134	P	91.90	12.66	80	24.56	25.06	0.50
	0.537	P	36.20	12.02	40	8.22	33.00	24.78
	0.940	P	33.20	12.05	N/A	5.25	28.14	22.89
	30.372	V	44.72	-9.56	N/A	35.16	40.00	4.84
	180.997	V	44.60	-7.76	N/A	36.84	43.50	6.66
	947.257	V	26.30	8.97	N/A	35.27	46.00	10.73
	982.497	V	24.90	9.29	N/A	34.19	54.00	19.81

- Measurement Data: TM 2

Tested Frequency(kHz)	Freq. (MHz)	ANT pol (Note 3)	Reading (dBuV)	TF (dB/m)	DCF (dB)	Field Strength (dBuV/m)	Limit (dBuV/m)	Margin (dB)
134.2	0.134	P	91.50	12.66	80	24.16	25.06	0.90
	0.537	P	38.20	12.02	40	10.22	33.00	22.78
	0.940	P	33.30	12.05	40	5.35	28.14	22.79
	35.497	V	37.70	-9.43	0	28.27	40.00	11.73
	165.359	V	44.96	-6.63	0	38.33	43.50	5.18
	926.889	V	26.50	8.63	0	35.13	46.00	10.87
	986.053	V	25.40	9.32	0	34.72	54.00	19.28

- Measurement Data: TM 3

Tested Frequency(kHz)	Freq. (MHz)	ANT pol (Note 3)	Reading (dBuV)	TF (dB/m)	DCF (dB)	Field Strength (dBuV/m)	Limit (dBuV/m)	Margin (dB)
134.2	0.134	P	79.70	12.66	80	12.36	25.06	12.70
	1.557	P	29.30	11.95	40	1.25	23.76	22.51
	3.293	P	28.00	11.62	40	-0.38	29.54	29.92
	40.347	V	38.00	-8.86	0	29.14	40.00	10.86
	169.166	V	44.61	-6.77	0	37.84	43.50	5.66
	770.087	V	29.80	5.49	0	35.29	46.00	10.71
	961.805	H	25.50	9.05	0	34.55	54.00	19.45

- Measurement Data: TM 4

Tested Frequency(kHz)	Freq. (MHz)	ANT pol (Note 3)	Reading (dBuV)	TF (dB/m)	DCF (dB)	Field Strength (dBuV/m)	Limit (dBuV/m)	Margin (dB)
134.2	0.134	P	74.00	12.66	80	6.66	25.06	18.40
	0.800	P	33.10	12.04	40	5.14	29.54	24.40
	10.740	P	27.20	10.63	40	-2.17	29.54	31.71
	38.083	V	38.50	-9.12	0	29.38	40.00	10.62
	177.107	V	45.70	-7.35	0	38.35	43.50	5.15
	923.979	V	26.20	8.63	0	34.83	46.00	11.17
	965.038	V	25.00	9.07	0	34.07	54.00	19.93

5.3. AC Power-Line Conducted Emissions

- Test Requirements and limit, Part 15.207

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 uH/50 ohm line impedance stabilization network (LISN).

Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5.0	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

- Test setup

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

- Procedure:

Conducted emissions from the EUT were measured according to the ANSI C63.10-2013.

1. The test procedure is performed in a 6.5 m × 3.5 m × 3.5 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) × 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

- Test Results

Refer to the next page. The worst case data (TM 2) was reported.

AC Power-Line Conducted Emissions (Graph)

TM 2

Results of Conducted Emission

Date 2025-05-30

Order No.		Reference No.	
Model No.	CTS-RFID-LE21	Power Supply	120 V, 60 Hz
Serial No.		Temp/Humi.	21 °C / 41 %
Test Condition	0.15-30MHz	Operator	J.H.Yun
Memo	RFID_134.2kHz_CTS-RFID-AC		

LIMIT : FCC P15.207 AV
FCC P15.207 QP

List Factor

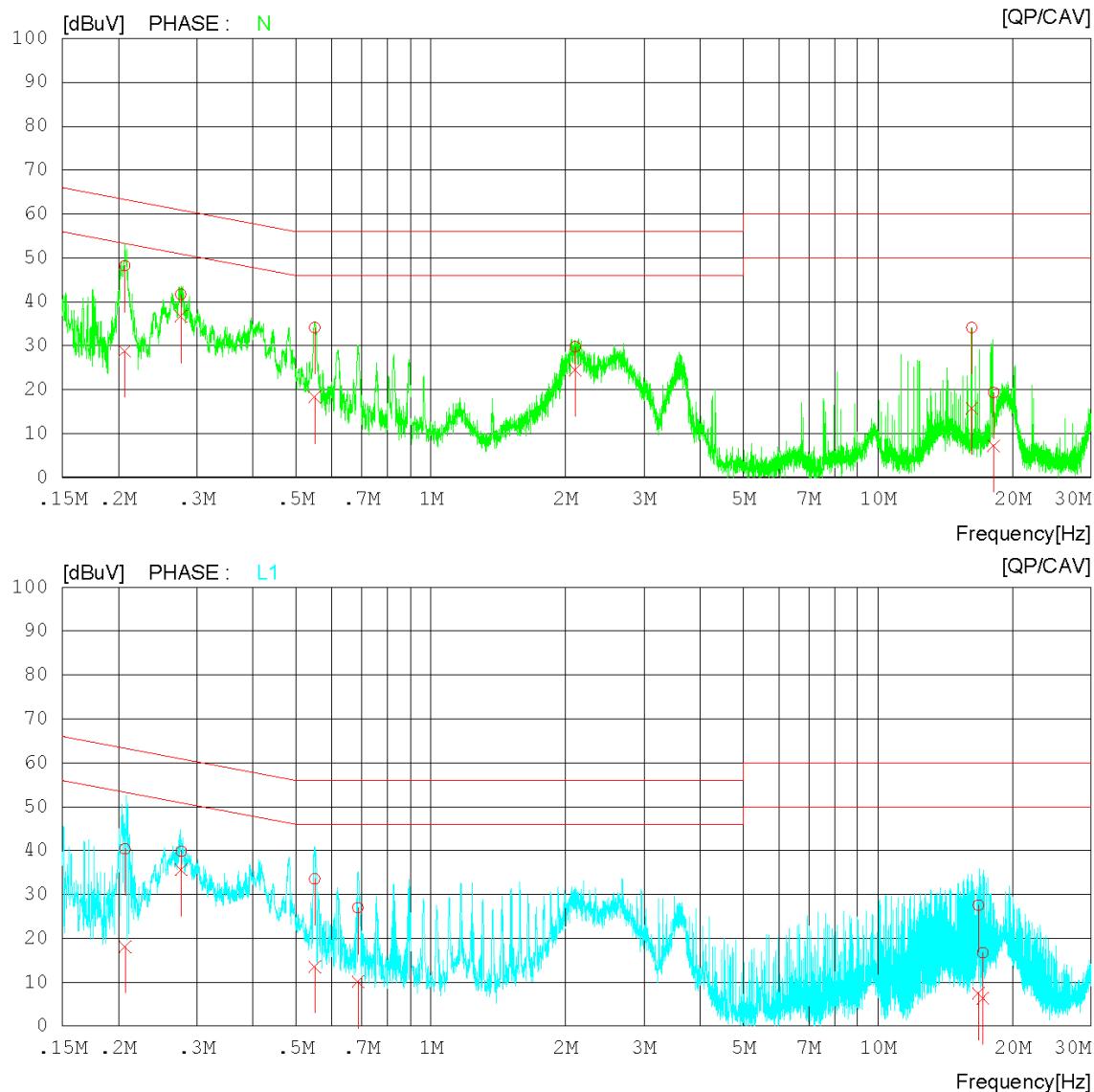
1. NSLK 8128 RC-387_N_24.10.21
2. NSLK 8128 RC-387_L1_24.10.21

Cable Loss

1. C1_LISN TO RECEIVER_2024-12-11

Pulse Limiter

1. PULSE LIMITER_ESH3-Z2_101333_2024.08.21



AC Power-Line Conducted Emissions (List)**Results of Conducted Emission**

Date 2025-05-30

Order No.		Referrence No.	
Model No.	CTS-RFID-LE21	Power Supply	120 V, 60 Hz
Serial No.		Temp/Humi.	21 °C / 41 %
Test Condition	0.15-30MHz	Operator	J.H.Yun
Memo	RFID_134.2kHz_CTS-RFID-AC		

LIMIT : FCC P15.207 AV
FCC P15.207 QP

Lisn Factor

1. NSLK 8128 RC-387_N_24.10.21
2. NSLK 8128 RC-387_L1_24.10.21

Cable Loss

1. C1_LISN TO RECEIVER_2024-12-11

Pulse Lmitter

1. PULSE LIMITER_ESH3-Z2_101333_2024.08.21

NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT [dBuV]		LIMIT [dBuV]		MARGIN [dBuV]	PHASE
		QP [dBuV]	CAV [dBuV]		QP [dBuV]	CAV [dBuV]	QP [dBuV]	CAV [dBuV]		
1	0.20677	38.22	18.78	10.00	48.22	28.78	63.33	53.33	15.11	24.55
2	0.27595	31.71	26.66	10.01	41.72	36.67	60.94	50.94	19.22	14.27
3	0.55000	24.07	8.28	10.04	34.11	18.32	56.00	46.00	21.89	27.68
4	2.10520	19.65	14.37	10.08	29.73	24.45	56.00	46.00	26.27	21.55
5	16.22780	23.49	5.13	10.62	34.11	15.75	60.00	50.00	25.89	34.25
6	18.15400	8.70	-3.43	10.61	19.31	7.18	60.00	50.00	40.69	42.82
7	0.20718	30.40	8.11	10.00	40.40	18.11	63.32	53.32	22.92	35.21
8	0.27675	29.81	25.64	10.01	39.82	35.65	60.91	50.91	21.09	15.26
9	0.54982	23.52	3.57	10.04	33.56	13.61	56.00	46.00	22.44	32.39
10	0.68741	16.91	0.08	10.05	26.96	10.13	56.00	46.00	29.04	35.87
11	16.77280	16.94	-3.15	10.62	27.56	7.47	60.00	50.00	32.44	42.53
12	17.17760	6.11	-4.21	10.62	16.73	6.41	60.00	50.00	43.27	43.59

- END -