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TEST REPORT

Report No.: 18020547HKG-001R1

CCL Electronics Ltd.

Application For Certification
(Original Grant)

FCC ID: 2ALZ7-3107B1709

Transmitter

This report supersedes previous report with report number 18020547HKG-001 dated March 23, 2018. Please refer ICT-S20-0011 Letter issued on July 10, 2020 for amendment/ supersede notification.

Prepared and Checked by:	**Approved by:**
Signed On File Wong Cheuk Ho, Herbert Lead Engineer	Digitally signed by Kenneth Wong Location: Intertek Testing Services Hong Kong Ltd. Wong Kwok Yeung, Kenneth Senior Lead Engineer Date: July 10, 2020

TEST REPORT

GENERAL INFORMATION

Grantee:	CCL Electronics Ltd.
Grantee Address:	Unit 1-3, 9/F., Wang Lung Industrial Building, 11 Lung Tak Street, Tsuen Wan, N.T., Hong Kong.
Contact Person:	Joey Yip
Tel:	2611 3000
Fax:	2611 3088
e-mail:	joey@cclel.com
Manufacturer:	CCL Electronics Ltd.
Manufacturer Address:	Unit 1-3, 9/F., Wang Lung Industrial Building, 11 Lung Tak Street, Tsuen Wan, N.T., Hong Kong.
Brand Name:	CCL
Model:	C3107B
Additional Model:	N/A
Type of EUT:	Transmitter
Description of EUT:	Transmitter
Serial Number:	N/A
FCC ID :	2ALZ7-3107B1709
Date of Sample Submitted:	February 13, 2018
Date of Test:	February 13, 2018 to March 02, 2018
Report No.:	18020547HKG-001R1
Report Date:	July 10, 2020
Environmental Conditions:	Temperature: +10 to 40°C Humidity: 10 to 90%
Conclusion:	Test was conducted by client submitted sample. The submitted sample as received complied with the 47 CFR Part 15 Certification.

TEST REPORT

SUMMARY OF TEST RESULT

Test Specification	Reference	Results
Radiated Emission Radiated Emission on the Bandedge	15.249, 15.209	Pass
Radiated Emission in Restricted Bands	15.205	Pass

The equipment under test is found to be complying with the following standards:
FCC Part 15, October 1, 2019 Edition

Note: 1. The EUT uses a permanently attached antenna which, in accordance to section 15.203, is considered sufficient to comply with the pervisions of this section.
2. Pursuant to FCC part 15 Section 15.215(c), the 20 dB bandwidth of the emission was contained within the frequency band designated (mentioned as above) which the EUT operated. The effects, if any, from frequency sweeping, frequency hopping, other modulation techniques and frequency stability over excepted variations in temperature and supply voltage were considered.

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1.0 GENERAL DESCRIPTION

1.1 Product Description

The equipment under test (EUT) is a 915MHz transmitter (i.e. Pool Sensor) system. The sensor is operating at 915MHz and it sends the data to the main console (corresponding receiver unit) for measurement. The EUT is powered by 2 x AA batteries (3.0VDC).

Antenna Type: Internal, Integral

For electronic filing, the brief circuit description is saved with filename: descri.pdf.

1.2 Related Submittal(s) Grants

This is a single application for certification of a transmitter.

1.3 Test Methodology

Radiated emission measurements were performed according to the procedures in ANSI C63.10 (2013). All radiated measurements were performed in an 3m Chamber. Preliminary scans were performed in the 3m Chamber only to determine worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the **"Justification Section"** of this Application.

1.4 Test Facility

The 3m Chamber used to collect the radiated data is located at Workshop No. 3, G/F., World-Wide Industrial Centre, 43-47 Shan Mei Street, Fo Tan, Sha Tin, N.T., Hong Kong SAR, China. This test facility and site measurement data have been placed on file with the FCC.

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2.0 SYSTEM TEST CONFIGURATION

2.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in ANSI C63.10 (2013).

The device was powered by 3VDC (2 x new 1.5V size “AA” batteries).

For maximizing emissions, the EUT was rotated through 360°, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the data reported in Exhibit 3.0.

The unit was operated standalone and placed in the centre of the turntable.

The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). The EUT was mounted to a plastic stand if necessary and placed on the wooden turntable, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

2.2 EUT Exercising Software

The EUT exercise program (if any) used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use.

2.3 Special Accessories

There are no special accessories necessary for compliance of this product.

2.4 Measurement Uncertainty

When determining of the test conclusion, the Measurement Uncertainty of test has been considered.

Uncertainty and Compliance - Unless the standard specifically states that measured values are to be extended by the measurement uncertainty in determining compliance, all compliance determinations are based on the actual measured value

2.5 Support Equipment List and Description

N/A

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3.0 EMISSION RESULTS

Data is included of the worst-case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

3.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any), Average Factor (optional) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG - AV

where FS = Field Strength in dBµV/m
RA = Receiver Amplitude (including preamplifier) in dBµV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB
AV = Average Factor in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows:

FS = RR + LF

where FS = Field Strength in dBµV/m
RR = RA - AG - AV in dBµV
LF = CF + AF in dB

Assume a receiver reading of 52.0 dBµV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB are added. The amplifier gain of 29 dB and average factor of 5 dB are subtracted, giving a field strength of 27 dBµV/m. This value in dBµV/m was converted to its corresponding level in µV/m.

RA = 52.0 dBµV/m
AF = 7.4 dB
CF = 1.6 dB
AG = 29.0 dB
AV = 5.0 dB
FS = RR + LF
FS = 18 + 9 = 27 dBµV/m

RR = 18.0 dBµV
LF = 9.0 dB

Level in µV/m = Common Antilogarithm [(27 dBµV/m)/20] = 22.4 µV/m

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3.2 Radiated Emission Configuration Photograph

The worst case in radiated emission was found at 11895 MHz

For electronic filing, the worst case radiated emission configuration photographs are saved with filename: radiated photos.pdf.

3.3 Radiated Emission Data

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Judgment: Passed by 4.7 dB

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RADIATED EMISSIONS

Model: C3107B
Date of Test: March 02, 2018
Worst-Case Operating Mode: Transmitting

Table 1
Pursuant to FCC Part 15 Section 15.249 Requirement

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Average (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
H	1830.000	46.9	33	27.2	41.1	54.0	-12.9
H	***2745.000***	***47.0***	***33***	***30.4***	***44.4***	***54.0***	***-9.6***
H	***3660.000***	***41.9***	***33***	***33.3***	***42.2***	***54.0***	***-11.8***
V	***4575.000***	***35.2***	***33***	***34.9***	***37.1***	***54.0***	***-16.9***
V	5490.000	34.8	33	35.7	37.5	54.0	-16.5
V	6405.000	35.9	33	36.9	39.8	54.0	-14.2
H	***7320.000***	***36.3***	***33***	***37.9***	***41.2***	***54.0***	***-12.8***
V	***8235.000***	***35.4***	***33***	***39.0***	***41.4***	***54.0***	***-12.6***
V	***9150.000***	***37.2***	***33***	***40.4***	***44.6***	***54.0***	***-9.4***
V	10065.000	34.5	33	40.5	42.0	54.0	-12.0
V	***10980.000***	***37.6***	***33***	***40.4***	***45.0***	***54.0***	***-9.0***
V	***11895.000***	***41.8***	***33***	***40.5***	***49.3***	***54.0***	***-4.7***
H	12810.000	37.1	33	41.7	45.8	54.0	-8.2

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
H	1830.000	51.4	33	27.2	45.6	74.0	-28.4
H	***2745.000***	***51.5***	***33***	***30.4***	***48.9***	***74.0***	***-25.1***
H	***3660.000***	***46.4***	***33***	***33.3***	***46.7***	***74.0***	***-27.3***
V	***4575.000***	***39.7***	***33***	***34.9***	***41.6***	***74.0***	***-32.4***
V	5490.000	39.3	33	35.7	42.0	74.0	-32.0
V	6405.000	40.4	33	36.9	44.3	74.0	-29.7
H	***7320.000***	***40.8***	***33***	***37.9***	***45.7***	***74.0***	***-28.3***
V	***8235.000***	***39.9***	***33***	***39.0***	***45.9***	***74.0***	***-28.1***
V	***9150.000***	***41.7***	***33***	***40.4***	***49.1***	***74.0***	***-24.9***
V	10065.000	39.0	33	40.5	46.5	74.0	-27.5
V	***10980.000***	***42.1***	***33***	***40.4***	***49.5***	***74.0***	***-24.5***
V	***11895.000***	***46.3***	***33***	***40.5***	***53.8***	***74.0***	***-20.2***
H	12810.000	41.6	33	41.7	50.3	74.0	-23.7

NOTES:
1. Peak Detector Data unless otherwise stated.
2. Average detector is applied according to ANSI C63.10.
3. All measurements were made at 3 meters.
4. Negative sign in the column shows value below limit.
5. Horn antenna is used for the emission over 1000MHz.
6. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205.
7. Measurement Uncertainty is ±5.3dB at a level of confidence of 95%.

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Model: C3107B
Date of Test: March 02, 2018
Worst-Case Operating Mode: Transmitting

Table 2
Pursuant to FCC Part 15 Section 15.209 Requirement

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-amp (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Limit at 3m (dBµV/m)	Margin (dB)
V	144.437	24.9	16	14.0	22.9	43.5	-20.6
H	211.433	18.0	16	17.0	19.0	43.5	-24.5
H	295.562	17.5	16	22.0	23.5	46.0	-22.5
H	428.858	18.8	16	25.0	27.8	46.0	-18.2
H	***612.507***	***19.6***	***16***	***29.0***	***32.6***	***46.0***	***-13.4***
V	797.200	19.3	16	31.0	34.3	46.0	-11.7
H	902.000	19.2	16	32.0	35.2	46.0	-10.8
H	915.000	71.9	16	33.0	88.9	94.0	-5.1
H	928.000	9.4	16	33.0	26.4	46.0	-19.6

NOTES:
1. Quasi-Peak Detector Data unless otherwise stated.
2. All measurements were made at 3 meters.
3. Negative sign in the column shows value below limit.
4. Horn antenna is used for the emission over 1000MHz.
5. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205.
6. Measurement Uncertainty is ±5.3dB at a level of confidence of 95%.

TEST REPORT

4.0 EQUIPMENT PHOTOGRAPHS

For electronic filing, the photographs are saved with filename: external photos.pdf and internal photos.pdf.

5.0 PRODUCT LABELLING

For electronics filing, the FCC ID label artwork and the label location are saved with filename: label.pdf.

6.0 TECHNICAL SPECIFICATIONS

For electronic filing, the block diagram and schematic of the tested EUT are saved with filename: block.pdf and circuit.pdf respectively.

7.0 INSTRUCTION MANUAL

For electronic filing, a preliminary copy of the Instruction Manual is saved with filename: manual.pdf.

This manual will be provided to the end-user with each unit sold/leased in the United States.

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8.0 MISCELLANEOUS INFORMATION

The miscellaneous information includes details of the test procedure and measured bandwidth / calculation of factor such as pulse desensitization and averaging factor (calculation and timing diagram).

8.1 Radiated Emission on the Bandedge

The bandedge data is shown in frequency table 2.

8.2 Discussion of Pulse Desensitization

Pulse desensitivity is not applicable for this device. Since the transmitter transmits the RF signal continuously.

8.3 Calculation of Average Factor

N/A.

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8.4 Emissions Test Procedures

The following is a description of the test procedure used by Intertek Testing Services Hong Kong Ltd. in the measurements of transmitter operating under the Part 15, Subpart C rules.

The transmitting equipment under test (EUT) is placed on a wooden turntable which is four feet in diameter and approximately 0.8m in height above the ground plane for emission measurement at or below 1GHz and 1.5m in height above the ground plane for emission measurement above 1GHz. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The EUT is adjusted through all three orthogonal axis to obtain maximum emission levels. The antenna height and polarization are also varied during the testing to search for maximum signal levels. The height of the antenna is varied from one to four meters.

Detector function for radiated emissions is in peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings. A detailed description for the calculation of the average factor can be found in Exhibit 8.3.

The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.

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8.4 Emissions Test Procedures (cont'd)

The EUT is warmed up for 15 minutes prior to the test.

AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

Conducted measurements were made as described in ANSI C63.10 (2013).

The IF bandwidth used for measurement of radiated signal strength was 100 kHz or greater when frequency is below 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. A discussion of whether pulse desensitivity is applicable to this unit is included in this report (See Exhibit 8.1). Above 1000 MHz, a resolution bandwidth of 3 MHz is used.

Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the forbidden bands and above 1 GHz, signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, unless otherwise reported. Measurements taken at a closer distance are so marked.

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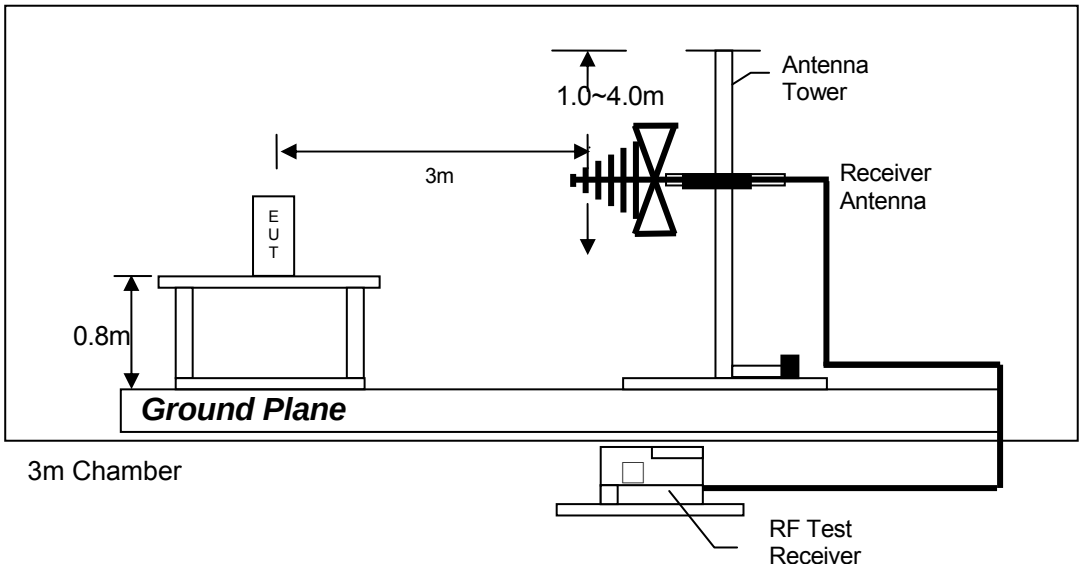
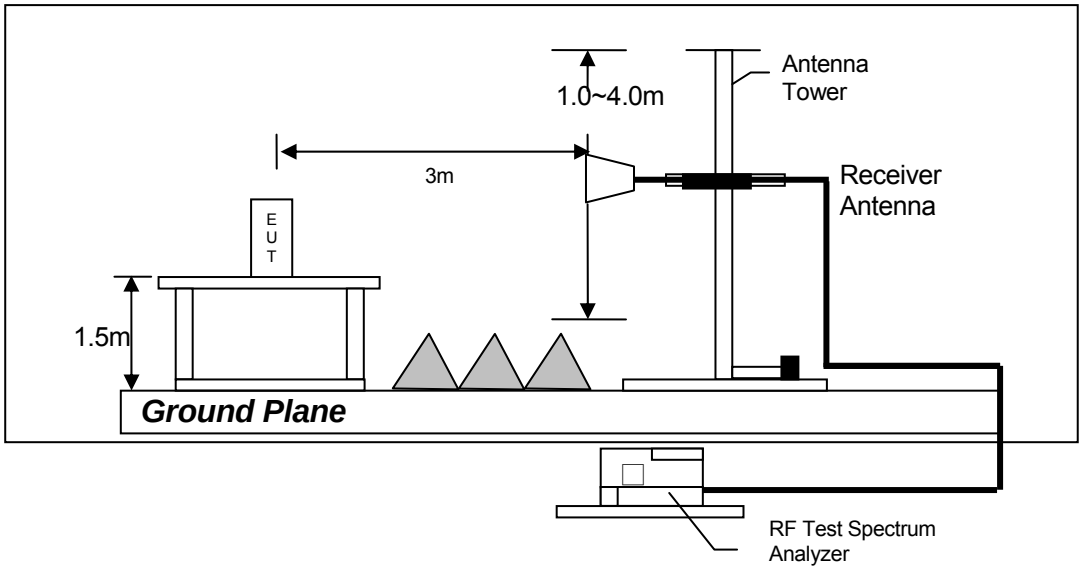
8.4.1 Radiated Emission Test Setup

The figure below shows the test setup, which is utilized to make these measurements.



Test setup of radiated emissions up to 1GHz



Test setup of radiated emissions above 1GHz

TEST REPORT

9.0 CONFIDENTIALITY REQUEST

For electronic filing, a preliminary copy of the confidentiality request is saved with filename: request.pdf.

10.0 EQUIPMENT LIST

Radiated Emissions Test

EQUIPMENT	EMI TEST RECEIVER	LOG PERIODIC ANTENNA	BICONICAL ANTENNA
Registration No.	EW-3156	EW-1042	EW-3241
Manufacturer	R&S	EMCO	EMCO
Model No.	ESCI	3146	3110C
Calibration Date	November 10, 2017	June 19, 2017	August 17, 2016
Calibration Due Date	November 10, 2018	December 19, 2019	February 17, 2018

EQUIPMENT	DOUBLE RIDGED GUIDE ANTENNA	14M DOUBLE SHIELD RF CABLE (20MHZ TO 6GHZ)	RF CABLE 14M (1GHZ TO 26.5GHZ)
Registration No.	EW-1133	EW-2505	EW-2781
Manufacturer	EMCO	RADIALL	GREATBILLION
Model No.	3115	nm / br5d / sma 14m	SMA m/SHF5MPU /SMA m ra14m,26G
Calibration Date	May 24, 2016	October 30, 2017	September 25, 2017
Calibration Due Date	November 24, 2018	October 30, 2018	September 25, 2018

EQUIPMENT	SOLID STATE LOW NOISE PREAMPLIFIER ASSEMBLY (1 - 18)GHZ	RF PRE-AMPLIFIER 3 PCS (9KHZ TO 40GHZ)
Registration No.	EW-3229	EW-3006
Manufacturer	SCHWARZBECK	SCHWARZBECK
Model No.	BBV 9718	BBV 9718
Calibration Date	January 30, 2018	March 23, 2017
Calibration Due Date	January 30, 2019	March 23, 2018

END OF TEST REPORT