

CCT R&D Ltd.

Application
For
Permissive Change

2.4GHz Frequency Hopping Spread Spectrum Cordless Phone with Caller ID,
Speakerphone and Digital Answering Machine

(FCC ID: NC8SD4581)

05147031
TL/Ann Choy
August 5, 2005

- The test results reported in this test report shall refer only to the sample actually tested and shall not refer or be deemed to refer to bulk from which such a sample may be said to have been obtained.
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Intertek Testing Services Hong Kong Ltd.

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MEASUREMENT/TECHNICAL REPORT

CCT R&D Ltd.- MODEL: SD459X series
FCC ID: NC8SD4581

This report concerns (check one) Original Grant _____ Class II Change X _____

Equipment Type: DSS-Part 15 Spread Spectrum Transmitter

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? Yes _____ No X _____

If yes, defer until : _____
dae

Company Name agrees to notify the Commission by: _____
date

of the intended date of announcement of the product so that the grant can be issued on that date.

Transition Rules Request per 15.37? Yes _____ No X _____

If no, assumed Part 15, Subpart C for intentional radiator - the new 47 CFR [10-01-04 Edition] provision.

Report prepared by:

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List of attached file

Exhibit type	File Description	filename
Test Report	Confidentiality Request	request.pdf
Test Report	Test Report	report.pdf
Operation Description	Technical Description	descri.pdf
Cover Page	Purpose of Application	product change.pdf
Test Setup Photo	Radiated Emission for Base	config photos.doc
Test Report	Out Band Antenna Conducted Emission Plot	obantcon.pdf
Test Report	Duty Cycle Calculation and Measurement	dcc.pdf
Test Setup Photo	Conducted Emission	config photos.doc
Test Report	Conducted Emission Test Result	conduct.pdf
External Photo	External Photo	external photos.doc
Internal Photo	Internal Photo	internal photos.doc
Block Diagram	Block Diagram	block.pdf
Schematics	Circuit Diagram	circuit.pdf
ID Label/Location	Label Artwork and Location	label.pdf
User Manual	User Manual	manual.pdf
User Manual	FCC Information	FCC information.pdf
RF Exposure Info	RF Safety	RF exposure info.pdf
Operation Description	Security Code Information	security code information.pdf

EXHIBIT 1
SUMMARY OF TEST RESULTS

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1.0 Summary of Test

CCT R&D Ltd.- MODEL: SD459X series
FCC ID: NC8SD4581

TEST	REFERENCE	RESULTS
Out of Band Antenna Conducted Emission	15.247(d)	Pass
Radiated Emission in Restricted Bands	15.247(d)	Pass
AC Conducted Emission	15.207	Pass
Radiated Emission from Digital Part	15.109	Pass
Antenna Requirement	15.203	Pass (See Notes)

Notes: The EUT uses a permanently attached antenna which, in accordance to Section 15.203, is considered sufficient to comply with the provisions of this section.

EXHIBIT 2
GENERAL DESCRIPTION

2.0 **General Description**

2.1 Product Description

The SD4591 is a 2.4GHz Frequency Hopping Spread Spectrum Cordless Phone with Caller ID, Speakerphone and Digital Answering Machine. It operates at frequency range of 2401.808MHz to 2478.509MHz with 87 physical hopping frequencies and 45 logical hopping frequencies. The unit is capable of either tone or pulse dialing. The internal power supply's isolation is accomplished through a power transformer having an adequate dielectric rating. The circuit wiring is consistent under the requirement of part 68.

The handset unit consists of a keypad with twelve standard keys (0,...9,*,#), eight function keys (Left soft key, Right soft key, redial, delete, up, down, connect to, handsfree). A Phone On key and a End Call key are provided to control pick and release telephone line in a toggle base.

The base unit has a page key, which is used to communicate with handset unit. In addition, the unit also has another feature, Corded Handset.

The antennas used in base unit and handset are integral, and the test sample is a prototype.

The model: SD4591 is one of the model: SD459X series, and the letter "X" at the end of the model numbers is in term of number from "0" to "9" with different color. The difference in model number serves as marketing strategy.

The circuit description, frequency hopping algorithm, and RF IC specification are saved with filename: descri.pdf

Connection between the device and the telephone network is accomplished through the use of USOC RJ11C in the 2-wire loop calling central office line.

2.2 Purpose of Application

The purpose of application is saved with filename: product change.pdf.

As the RF module and the FHSS mechanism of the base unit remained unchanged and they have the same handset, only the out of band conducted emissions result, radiated emission result, and AC line conducted emission result of the base unit were included in this report.

2.3 Test Methodology

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.4 (2003). All measurements were performed in Open Area Test Sites. Preliminary scans were performed in the Open Area Test Sites 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. All other measurements were made in accordance with the procedures in part 2 of CFR 47.

2.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at Garment Centre, 576 Castle Peak Road, Kowloon, Hong Kong. This test facility and site measurement data have been fully placed on file with the FCC.

EXHIBIT 3
SYSTEM TEST CONFIGURATION

3.0 **System Test Configuration**

3.1 Justification

For emissions testing, the equipment under test (EUT) was setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, all cables were manipulated to produce worst case emissions. The handset was powered by a fully charged battery.

For the measurements, the EUT is attached to a plastic stand if necessary and placed on the wooden turntable. If the base unit attaches to peripherals, they are connected and operational (as typical as possible). The handset is remotely located as far from the antenna and the base as possible to ensure full power transmission from the base. Else, the base is wired to transmit full power without modulation, and two antennas are tested separately.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Detector function is in peak mode. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance.

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000MHz. The resolution is 1MHz or greater for frequencies above 1000MHz.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9kHz to 25GHz.

3.2 EUT Exercising Software

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

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3.3 Support Equipment List and Description

The FCC ID's for all equipment, plus descriptions of all cables used in the tested system (included inserted cards, which have grants) are:

HARDWARE:

The unit was operated standalone. An AC adapter and a battery (provided with the unit) were used to power the device. Their description are listed below.

- (1) Base Unit: An AC adaptor (120VAC to 9VDC 500mA, Model: DU41090050C)
- (2) Handset: A "Ni-MH" type rechargeable battery (3.6V 600mAh)

CABLES:

- (1) Telecommunication cable with RJ11C connectors (1m, unshielded), terminated

OTHERS:

- (1) A headset for telephone use with 1.2m unshielded cable permanently affixed. (Supplied by Intertek)
- (2) 4 x "AA" size 1.5VDC backup battery.

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3.4 Measurement Uncertainty

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

3.5 Equipment Modification

Any modifications installed previous to testing by CCT R&D Ltd. will be incorporated in each production model sold/leased in the United States.

No modifications were installed by ETL Division, Intertek Testing Services Hong Kong Ltd.

All the items listed under section 3.0 of this report are confirmed by:

Confirmed by:

*Tommy Leung
Assistant Manager
Intertek Testing Services Hong Kong Ltd.
Agent for CCT R&D Ltd.*



Signature

August 25, 2005 Date

EXHIBIT 4
MEASUREMENT RESULTS

INTERTEK TESTING SERVICES

Company: CCT R&D Ltd.
Model: SD4591

Date of Test: July 13-28, 2005

4.0 Measurement Results

4.1 Out of Band Conducted Emissions, FCC Rule 15.247(c):

In any 100 kHz bandwidth outside the EUT passband, the RF power produced by the modulation products of the spreading sequence, the information sequence, and the carrier frequency shall be at least 20 dB below that of the maximum in-band 100 kHz emission, or else shall meet the general limits for radiated emissions at frequencies outside the passband, whichever results in lower attenuation.

All other types of emissions from the EUT shall meet the general limits for radiated frequencies outside the passband.

Refer to the following plots for out of band conducted emissions data:

Plot B6A1 - B6A2: Low Channel Emissions
Plot B6B1 - B6B2: Middle Channel Emissions
Plot B6C1- B6C2: High Channel Emissions
Plot B6D1- B6D2: Modulation Products Emissions*

The plots showed the 2nd harmonic and modulation products at the band edges of 2400 MHz and 2483.5 MHz. In addition, all spurious emission and up to the tenth harmonic was measured and they were found to be at least 20 dB below the highest level of the desired power in the passband.

Furthermore, delta measurement technique for measuring bandedge emissions was incorporated in the test of the edge at 2483.5MHz.

*These 2 plots are shown the worst-case which has been already considered between enable and disable the hopping function of the EUT.

For electronic filing, the above plots are saved with filenames: obantcon.pdf.

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Company: CCT R&D Ltd.
Model: SD4591

Date of Test: July 13-28, 2005

4.2 Out of Band Radiated Emissions (for emissions in 4.1 above that are less than 20 dB below carrier), FCC Rule 15.247(c):

For out of band emissions that are close to or that exceed the 20dB attenuation requirement described in the specification, radiated measurements were performed at a 3m separation distance to determine whether these emissions complied with the general radiated emission requirement.

- ☒ Not required, all emissions more than 20dB below fundamental
- ☐ See attached data sheet

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Company: CCT R&D Ltd.
Model: SD4591

Date of Test: July 13-28, 2005

4.3 Transmitter Radiated Emissions in Restricted Bands, FCC Rule 15.35(b), (c):

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. All measurements were performed with peak detection unless otherwise specified.

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

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Company: CCT R&D Ltd.
Model: SD4591

Date of Test: July 13-28, 2005

4.4 Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below.

$$FS = RA + AF + CF - AG + PD + AV$$

where FS = Field Strength in dB μ V/m

RA = Receiver Amplitude (including preamplifier) in dB μ V

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB

AG = Amplifier Gain in dB

PD = Pulse Desensitization in dB

AV = Average Factor in -dB

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

$$FS = RA + AF + CF - AG + PD + AV$$

Example

Assume a receiver reading of 62.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted. The pulse desensitization factor of the spectrum analyzer was 0 dB, and the resultant average factor was -10 dB. The net field strength for comparison to the appropriate emission limit is 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

$$RA = 62.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$PD = 0 \text{ dB}$$

$$AV = -10 \text{ dB}$$

$$FS = 62 + 7.4 + 1.6 - 29 + 0 + (-10) = 32 \text{ dB}\mu\text{V/m}$$

$$\text{Level in mV/m} = \text{Common Antilogarithm} [(32 \text{ dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}$$

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Company: CCT R&D Ltd.
Model: SD4591

Date of Test: July 13-28, 2005

4.5 Radiated Emission Configuration Photograph - Base Unit

Worst Case Radiated Emission
at
7320.477 MHz

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

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Company: CCT R&D Ltd.
Model: SD4591

Date of Test: July 13-28, 2005

4.6 Radiated Emission Data - Base Unit

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

Judgement : Passed by 8.0 dB compare with the peak limit

TEST PERSONNEL:



Tester Signature

Jess Tang, Engineer
Typed/Printed Name

August 5, 2005
Date

INTERTEK TESTING SERVICES

Company: CCT R&D Ltd.
Model: SD4591
Mode : TX-Channel 1

Date of Test: July 13-28, 2005

Table 1, Base Unit

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBμV/m)	Average Factor (-dB)	Calculated at 3m (dBμV/m)	Limit at 3m (dBμV/m)	Margin (dB)
H	*4803.617	53.6	34	34.0	53.6	28.3	25.3	54	-28.7
V	*12009.042	47.9	34	40.2	54.1	28.3	25.8	54	-28.2
V	*19214.468	45.7	34	45.3	57.0	28.3	28.7	54	-25.3

- NOTES: 1. Peak detector is used for the emission measurement.
2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna used for the emission over 1000MHz.
- * Emission within the restricted band meets the requirement of part 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

Test Engineer: Jess Tang

INTERTEK TESTING SERVICES

Company: CCT R&D Ltd.
Model: SD4591
Mode : TX-Channel 44

Date of Test: July 13-28, 2005

Table 2, Base unit

Radiated Emissions

Polari- zation	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBμV/m)	Average Factor (-dB)	Calculated at 3m (dBμV/m)	Limit at 3m (dBμV/m)	Margin (dB)
H	*4880.318	53.1	34	34.0	53.1	28.3	24.8	54	-29.2
V	*7320.477	63.0	34	37.0	66.0	28.3	37.7	54	-16.3
V	*12200.795	48.1	34	40.2	54.3	28.3	26.0	54	-28.0
V	*19521.271	45.8	34	45.3	57.1	28.3	28.8	54	-25.2

- NOTES: 1. Peak detector is used for the emission measurement.
2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna used for the emission over 1000MHz.
- * Emission within the restricted band meets the requirement of part 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function, and this is the worst-case of 8.0dB margin at 7320.477MHz.

Test Engineer: Jess Tang

INTERTEK TESTING SERVICES

Company: CCT R&D Ltd.
Model: SD4591
Mode : TX-Channel 87

Date of Test: July 13-28, 2005

Table 3, Base unit

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBμV/m)	Average Factor (-dB)	Calculated at 3m (dBμV/m)	Limit at 3m (dBμV/m)	Margin (dB)
H	**2478.509	121.2	34	29.1	116.3	28.3	88.0	---	---
H	*4957.019	53.5	34	34.0	53.5	28.3	25.2	54	-28.8
V	*7435.528	62.3	34	37.0	65.3	28.3	37.0	54	-17.0
V	*12392.547	47.9	34	40.2	54.1	28.3	25.8	54	-28.2
V	*19828.075	45.9	34	45.3	57.2	28.3	28.9	54	-25.1
V	*22306.584	46.8	34	45.3	58.1	28.3	29.8	54	-24.2

- NOTES: 1. Peak detector is used for the emission measurement.
2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna used for the emission over 1000MHz.
- * Emission within the restricted band meets the requirement of part 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.
- ** Fundamental emission was measured for determining band-edge compliance of using delta measurement technique.

Test Engineer: Jess Tang

INTERTEK TESTING SERVICES

Company: CCT R&D Ltd.
Model: SD4591

Date of Test: July 13-28, 2005

4.7 AC Line Conducted Emission, FCC Rule 15.207:

☐ Not required; battery operation only

☒ Test data attached

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Company: CCT R&D Ltd.
Model: SD4591

Date of Test: July 13-28, 2005

4.8 Line Conducted Configuration Photograph - Base

Worst Case Line-Conducted Configuration
at
13.825 MHz

For electronic filing, the worst case line conducted configuration photographs are saved with filename: config photos.doc

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Company: CCT R&D Ltd.
Model: SD4591

Date of Test: July 13-28, 2005

4.9 Line Conducted Emission Data

The data on the following pages list the significant emission frequencies, the limit, and the margin of compliance.

Judgement : Passed 15.5 dB margin compare with the average limit

For electronic filing, the worst case line conducted emission data are saved with filename: conduct.pdf

TEST PERSONNEL:



Tester Signature

Jess Tang, Engineer
Typed/Printed Name

August 5, 2005
Date

INTERTEK TESTING SERVICES

Company: CCT R&D Ltd.
Model: SD4591

Date of Test: July 13-28, 2005

4.10 Radiated Emissions from Digital Section of Transceiver (Transmitter), FCC Ref: 15.109

- ☐ Not required - No digital part
- ☒ Test results are attached
- ☐ Included in the separated DOC report.

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Company: CCT R&D Ltd.
Model: SD4591

Date of Test: July 13-28, 2005

Table 4, Base Unit

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Limit at 3m (dBμV/m)	Margin (dB)
V	41.491	30.1	16	11.7	25.8	40.0	-14.2
V	49.231	30.5	16	11.9	26.4	40.0	-13.6
V	55.436	32.8	16	11.0	27.8	40.0	-12.2
V	147.639	33.2	16	11.6	28.8	43.5	-14.7
V	196.717	28.4	16	17.3	29.7	43.5	-13.8
V	207.409	33.2	16	11.8	29.0	43.5	-14.5

- NOTES: 1. Quasi-peak detector is used for the emission below or equal to 1000 MHz.
2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.

Test Engineer: Jess Tang

INTERTEK TESTING SERVICES

Company: CCT R&D Ltd.
Model: SD4591

Date of Test: July 13-28, 2005

4.11 Transmitter Duty Cycle Calculation and Measurements, FCC Rule 15.35(b), (c)

The EUT antenna output port was connected to the input of the spectrum analyzer. The analyzer center frequency was set to EUT RF channel carrier. The SWEF function on the analyzer was set to ZERO SPAN. The transmitter ON time was determined from the resultant time-amplitude display:

Base Unit:

Duty cycle (DC) = Maximum ON time in 100ms/100ms
= (0.960ms x 4)/100ms for 4 handsets operation

Duty cycle correction, dB = $20 \times \log(\text{DC})$
= $20 \times \log(0.0384)$
= -28.3 dB

X	See attached spectrum analyzer chart (s) for transmitter timing Base Unit: Plot B7
	See transmitter timing diagram provided by manufacturer
	Not applicable, duty cycle was not used.

For electronic filing, the above plot is saved with filenames: dcc.pdf.

EXHIBIT 5
EQUIPMENT PHOTOGRAPHS

5.0 **Equipment Photographs**

For electronic filing, the photographs are saved with filename: external photos.doc & internal photos.doc

EXHIBIT 6
PRODUCT LABELLING

6.0 **Product Labelling**

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

EXHIBIT 7
TECHNICAL SPECIFICATIONS

7.0 **Technical Specifications**

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

EXHIBIT 8
INSTRUCTION MANUAL

8.0 **Instruction Manual**

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

Please note that the required FCC Information to the User is saved with filename: FCC information.pdf.

For RF Safety, the information is saved with filename: RF exposure info.pdf.

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

EXHIBIT 9
SECURITY CODE INFORMATION

9.0 **Security Code Information**

For electronic filing, security code information is saved with filename: security code information.pdf.

EXHIBIT 10
CONFIDENTIALITY REQUEST

10.0 **Confidentiality Request**

For electronic filing, confidentiality request is saved with filename: request.pdf.