

TE Group

Application
For
Certification

Bluetooth Car Kit

(FCC ID: TQGBBLUEPERFECTION)

05275561
KL/ Ann Choy
September 22, 2006

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MEASUREMENT/TECHNICAL REPORT

TE Group - Model: HF4
Blue Perfection
FCC ID: TQGBLUEPERFECTION

This report concerns (check one:) Original Grant ☒ Class II Change ☐

Equipment Type : DXT - Part 15 Low Power Transceiver, RX Verified

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? Yes ☐ No ☒

If yes, defer until : _____
date

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 ☒

If no, assumed Part 15, Subpart C for intentional radiator - the new 47 CFR [04-05-05
Edition] Provision.

Report prepared by:

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List of attached file

Exhibit type	File Description	filename
Cover Page	Confidentiality Request	request.pdf
Test Report	Test Report	report.pdf
Operation Description	Technical Description	descri.pdf
Test Setup Photo	Radiated Emission for Handsfree	config photos.doc
Test Report	Emission Plot	emission.pdf
Test Report	Duty Cycle Calculation and Measurement	dcc.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

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EXHIBIT 1 GENERAL DESCRIPTION

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1.0 General Description

1.1 Product Description

The HF4 is a Bluetooth Car Kit. The Equipment Under Test (EUT) mainly consists of Handsfree Unit, Screen, Remote Control Microphone. It operates at frequency range of 2402.000MHz to 2480.000MHz with 79 hopping frequencies.

The Screen has two buttons, one for receiving a call, making connection with paired phone or switching on pairing mode. The other one is for ending a call, returning to previous level, deleting input data or returning to standby mode.

The IR Remote has two buttons, one for receiving a call. The other one is for ending a call, returning to previous level, deleting input data or returning to standby mode. There is a joystick on the Remote for the Options Selection on the Screen.

The antennas used in Handsfree Unit is integral, and the test sample is a prototype.

The Model: Blue Perfection is same as the Model: HF4 in hardware aspect. The difference in model number serves as marketing strategy and for cosmetic changes only.

The circuit description and frequency hopping algorithm is saved with filename: descri.pdf

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1.2 Related Submittal(s) Grants

This is an application for Certification of a DXT - Part 15 Low Power Transceiver, RX Verified. A Transmitter is included in this application.

1.3 Test Methodology

Radiated emission measurements was 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.

1.4 Test Facility

The open area test site 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.

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EXHIBIT 2 SYSTEM TEST CONFIGURATION

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2.0 System Test Configuration

2.1 Justification

For emission 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 Handsfree Unit was powered by a DC power supply.

For the measurements, the EUT is attached to a plastic stand if necessary and placed on the wooden turntable. 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 1000 MHz. The resolution is 1 MHz or greater for frequencies above 1000 MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed 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 to 40 GHz, whichever is lower.

2.2 EUT Exercising Software

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

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2.3 Support Equipment List and Description

The FCC ID's for all equipment, plus descriptions of all cables used in the tested system are:

HARDWARE:

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

CABLES:

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

OTHERS:

- (1) 1 x "2032" size 3.0V DC button cell (Supplied by Client)
- (2) Sony Ericsson Mobile Phone, Model: T630 (Supplied by Intertek)

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2.4 Measurement Uncertainty

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

2.5 Equipment Modification

Any modifications installed previous to testing by TE Group 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 2.0 of this report are confirmed by:

Confirmed by:

*Lam Chun Cheong, Kenneth
Senior Lead Engineer
Intertek Testing Services
Agent for TE Group*



Signature

September 22, 2006

Date

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EXHIBIT 3 EMISSION RESULTS

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.

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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) from the measured reading. The basic equation with a sample calculation is as follows:

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

where FS = Field Strength in $\text{dB}\mu\text{V/m}$
 RA = Receiver Amplitude (including preamplifier) in $\text{dB}\mu\text{V}$
 CF = Cable Attenuation Factor in dB
 AF = Antenna Factor in dB
 AG = Amplifier Gain 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 $\text{dB}\mu\text{V/m}$
 $RR = RA - AG$ in $\text{dB}\mu\text{V}$
 $LF = CF + AF$ in dB

Assume a receiver reading of $52.0 \text{ dB}\mu\text{V}$ 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, giving a field strength of $32 \text{ dB}\mu\text{V/m}$. This value in $\text{dB}\mu\text{V/m}$ was converted to its corresponding level in $\mu\text{V/m}$.

$RA = 52.0 \text{ dB}\mu\text{V}$	
$AF = 7.4 \text{ dB}$	$RR = 23.0 \text{ dB}\mu\text{V}$
$CF = 1.6 \text{ dB}$	$LF = 9.0 \text{ dB}$
$AG = 29.0 \text{ dB}$	
$FS = RR + LF$	
$FS = 23 + 9 = 32 \text{ dB}\mu\text{V/m}$	

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

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3.2 Radiated Emission Configuration Photograph - Handsfree

Worst Case Radiated Emission

at 19840.000 MHz

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

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3.3 Radiated Emission Data - Handsfree

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

Judgement : Passed by 20.1 dB margin compare with the peak limit

TEST PERSONNEL:



Tester Signature

Felix Ng, Lead Engineer
Typed/Printed Name

September 22, 2006
Date

INTERTEK TESTING SERVICES

Company: TE Group
Model: HF4
Mode : TX-Channel 1

Date of Test: July 11, 2005 to January 18, 2006

Table 1

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dB μ V/m)	Average Factor (-dB)	Calculated at 3m (dB μ V/m)	Limit at 3m (dB μ V/m)	Margin (dB)
H	2402.000	96.6	33	29.4	93.0	42.4	50.6	94	-43.4
V	*4804.000	46.5	33	34.9	48.4	42.4	6.0	54	-48.0
V	7206.000	45.8	33	37.9	50.7	42.4	8.3	54	-45.7
V	*12010.000	45.6	33	40.5	53.1	42.4	10.7	54	-43.3
V	*19216.000	48.3	33	37.7	53.0	42.4	10.6	54	-43.4

- NOTES: 1. Peak detector is used for the emission measurement.
2. All measurements were made at 3 meters. Radiated 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 radiated 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 is used for the emission over 1000MHz.
5. Emissions radiated outside of the specified frequency bands, except harmonics, are attenuated by 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation, which meet the requirement of part 15.249(d).
- * 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: Felix Ng

INTERTEK TESTING SERVICES

Company: TE Group
Model: HF4
Mode : TX-Channel 40

Date of Test: July 11, 2005 to January 18, 2006

Table 2

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dB μ V/m)	Average Factor (-dB)	Calculated at 3m (dB μ V/m)	Limit at 3m (dB μ V/m)	Margin (dB)
H	2441.000	95.5	33	29.4	91.9	42.4	49.5	94	-44.5
V	*4882.000	47.9	33	34.9	49.8	42.4	7.4	54	-46.6
V	*7323.000	47.9	33	37.9	52.8	42.4	10.4	54	-43.6
V	*12205.000	45.9	33	40.5	53.4	42.4	11.0	54	-43.0
V	*19528.000	48.5	33	37.8	53.3	42.4	10.9	54	-43.1
V	21969.000	48.1	33	38.2	53.3	42.4	10.9	54	-43.1

- NOTES: 1. Peak detector is used for the emission measurement.
2. All measurements were made at 3 meters. Radiated 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 radiated 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 is used for the emission over 1000MHz.
5. Emissions radiated outside of the specified frequency bands, except harmonics, are attenuated by 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation, which meet the requirement of part 15.249(d).
- * 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: Felix Ng

INTERTEK TESTING SERVICES

Company: TE Group
Model: HF4
Mode : TX-Channel 79

Date of Test: July 11, 2005 to January 18, 2006

Table 3

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dB μ V/m)	Average Factor (-dB)	Calculated at 3m (dB μ V/m)	Limit at 3m (dB μ V/m)	Margin (dB)
H	2480.000	95.6	33	29.4	92.0	42.4	49.6	94	-44.4
V	*4960.000	48.9	33	34.9	50.8	42.4	8.4	54	-45.6
V	*7440.000	48.0	33	37.9	52.9	42.4	10.5	54	-43.5
V	9920.000	48.3	33	38.3	53.6	42.4	11.2	54	-42.8
V	*12400.000	46.1	33	40.5	53.6	42.4	11.2	54	-42.8
V	*19840.000	49.1	33	37.8	53.9	42.4	11.5	54	-42.5
V	*22320.000	48.5	33	38.2	53.7	42.4	11.3	54	-42.7

- NOTES:
1. Peak detector is used for the emission measurement.
 2. All measurements were made at 3 meters. Radiated 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 radiated 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 is used for the emission over 1000MHz.
 5. Emissions radiated outside of the specified frequency bands, except harmonics, are attenuated by 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation, which meet the requirement of part 15.249(d).
- * 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 20.1dB margin at 19840.000MHz.

Test Engineer: Felix Ng

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3.4 Radiated Emission on the Bandedge

From the following plots, they show that the fundamental emissions are confined in the specified band (2400MHz and 2483.5MHz) . In case of the fundamental emissions are within two standard bandwidths from the bandedge, the delta measurement technique is used for determining bandedge compliance. Standard bandwidth is the bandwidth specified by ANSI C63.4 (2003) for frequency being measured.

Emissions radiated outside of the specified frequency bands, except harmonics, are attenuated by 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation, which meet the requirement of part 15.249(d).

Please refer to the following plots for radiated emission on the bandedge:

Plot B1A[#]: - Low Channel Emissions

Plot B1B*: - High Channel Emissions

The above plots are saved with filename: emission.pdf

Bandedge compliance is determined by applying marker-delta method, i.e.

Resultant field strength in peak value

$$\begin{aligned} &= \text{Fundamental emissions} - \text{delta from the plot} \\ &= 93.0\text{dB}\mu\text{V/m} - 47.53\text{dB} \\ &= 45.47\text{dB}\mu\text{V/m} \end{aligned}$$

Resultant field strength in average value

$$\begin{aligned} &= \text{Resultant field strength in peak value} - \text{average factor} \\ &= 45.47\text{dB}\mu\text{V/m} - 42.4\text{dB} \\ &= 3.07\text{dB}\mu\text{V/m} \end{aligned}$$

* Bandedge compliance is determined by applying marker-delta method, i.e.

Resultant field strength in peak value

$$\begin{aligned} &= \text{Fundamental emissions} - \text{delta from the plot} \\ &= 92.0\text{dB}\mu\text{V/m} - 49.52\text{dB} \\ &= 42.48\text{dB}\mu\text{V/m} \end{aligned}$$

Resultant field strength in average value

$$\begin{aligned} &= \text{Resultant field strength in peak value} - \text{average factor} \\ &= 42.48\text{dB}\mu\text{V/m} - 42.4\text{dB} \\ &= 0.08\text{dB}\mu\text{V/m} \end{aligned}$$

The resultant field strength meets the general radiated emission limit in section 15.209, which does not exceed 54dB μ V/m in average or 74dB μ V/m at in peak.

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Company: TE Group
Model: HF4

Date of Test: July 11, 2005 to January 18, 2006

3.5 Radiated Emissions from Digital Portion of EUT, FCC Ref: 15.109

☐ Not required - No digital part

☒ Test results are attached

☐ Included in the separated DOC report.

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Company: TE Group
Model: HF4
Mode : Talk

Date of Test: July 11, 2005 to January 18, 2006

Table 4

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	32.774	32.0	16	10.0	26.0	40	-14.0
V	36.871	32.0	16	10.0	26.0	40	-14.0
V	40.968	32.3	16	10.0	26.3	40	-13.7
V	45.065	32.7	16	10.0	26.7	40	-13.3
V	49.162	34.1	16	11.0	29.1	40	-10.9
V	53.259	33.0	16	11.0	28.0	40	-12.0

- NOTES:
1. Quasi-peak detector is used for the emission below or equal to 1000MHz.
 2. All measurements were made at 3 meters. Radiated 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 radiated 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: Felix Ng

INTERTEK TESTING SERVICES

Company: TE Group
Model: HF4

Date of Test: July 11, 2005 to January 18, 2006

3.6 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 SWEP function on the analyzer was set to ZERO SPAN. The transmitter ON time was determined from the resultant time-amplitude display:

Talk Operation:

Duty cycle (DC) = Maximum ON time in 98.75ms/98.75ms
= 0.44ms/98.75ms

Duty cycle correction, dB = $20 \cdot \log(\text{DC})$
= $20 \cdot \log(0.00446)$
= -47.0 dB

Paging Operation:

Duty cycle (DC) = Maximum ON time in 20ms/20ms
= 0.15ms/20ms

Duty cycle correction, dB = $20 \cdot \log(\text{DC})$
= $20 \cdot \log(0.0075)$
= -42.4 dB

X	See attached spectrum analyzer chart (s) for transmitter timing : Plot B7A-B
	See transmitter timing diagram provided by manufacturer
	Not applicable, duty cycle was not used.

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

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EXHIBIT 4 EQUIPMENT PHOTOGRAPHS

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4.0 Equipment Photographs

The photographs are saved with filename: external photos.doc & internal photos.doc

**EXHIBIT 5
PRODUCT LABELLING**

5.0 Product Labelling

The FCC ID label artwork and location is saved with filename: label.pdf

**EXHIBIT 6
TECHNICAL SPECIFICATIONS**

6.0 Technical Specifications

The block diagram and circuit diagram are saved with filename: block.pdf and circuit.pdf respectively.

**EXHIBIT 7
INSTRUCTION MANUAL**

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7.0 Instruction Manual

A preliminary copy of the Instruction Manual is saved with filename: manual.pdf

The required FCC Information to the User is stated on P.29 of the Instruction Manual.

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

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EXHIBIT 8 CONFIDENTIALITY REQUEST

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8.0 Confidentiality Request

A copy of the Confidentiality Request is saved with filename: request.pdf