PCTEST Engineering Laboratory, Inc.
6660-B Dobbin Road • Columbia, MD 21045 • U.S.A.
TEL (410) 290-6652 • FAX (410) 290-6654
http://www.pctestlab.com

CERTIFICATE OF COMPLIANCE
FCC Part 95 Certification

DSI (HK) LTD.
Rm 803-6 World Finance Centre
South Tower, Harbour City
Tsimshatsui, Kowloon, Hong Kong
Attention: Mr. Tommy Yau, Managing Director

Dates of Tests: February 16-18, 2000
Test Report S/N: 95.200207075.KNZ
Test Site: PCTEST Lab, MD U.S.A.

FCC ID	**KNZ48413**
APPLICANT	**DSI (HK) LTD.**

Classification:	**Family Radio Body-worn Transmitter (FRT)**
FCC Rule Part(s):	**§§§ 95(B), 2(J)**
EUT Type:	**2-Way Portable Wrist-worn Radio Transceiver (FRS)**
Trade Name(s):	***DSI (HK) LTD.***
Model(s):	***48413***
Tx/Rx Frequency Range:	**462.6375 MHz**
Max. RF Output Power:	**0.1 W**
Frequency Tolerance:	**0.0025% (2.5 ppm)**
Emission Designator:	**8K0F3E**
Channel Capacity:	**1**

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947 with the following remarks (Note Codes):

- *(BC) The output power is continuously variable from the value listed in this entry to 5%-10% of the value listed.*

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

PCTEST certifies that no party to this application has been denied the FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 853(a).

Randy Ortanez
President & Chief Engineer

2 0 0 2 0 7 0 7 5 . K N Z

© 2000 PCTEST Engineering Lab., Inc.

NVLAP LAB CODE 100431-0

TABLE OF CONTENTS

ATTACHMENT A: COVER LETTER(S)

ATTACHMENT B: ATTESTATION STATEMENT(S)

ATTACHMENT C: TEST REPORT

SCOPE	**1**
INTRODUCTION	**2**
2.1033 INSERTS	**3**
DESCRIPTION OF TESTS	**4-6**
RADIATED MEASUREMENTS	**7**
FREQUENCY STABILITY	**8-9**
PLOTS OF EMISSIONS	**10**
LIST OF TEST EQUIPMENT	**11**
SAMPLE CALCULATIONS	**12**
CONCLUSION	**13**

ATTACHMENT D: TEST PLOTS

ATTACHMENT E: FCC ID LABEL & LOCATION

ATTACHMENT F: TEST SETUP PHOTOGRAPHS

ATTACHMENT G: EXTERNAL PHOTOGRAPHS

ATTACHMENT H: INTERNAL PHOTOGRAPHS

ATTACHMENT I: BLOCK DIAGRAM(S)

ATTACHMENT J: SCHEMATIC DIAGRAM(S)

ATTACHMENT K: OPERATIONAL DESCRIPTION

ATTACHMENT L: USER'S MANUAL

MEASUREMENT REPORT

1.1 Scope

Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission.

§2.1033 General Information

Applicant Name:	**DSI (HK) LTD.**
Address:	**Rm 803-6 World Finance Centre**
	South Tower, Harbour City
	Tsimshatsui, Kowloon, Hong Kong
Attention:	**Mr. Tommy Yau, Managing Director**

- **FCC ID:** **KNZ48413**
- **Model(s):** **48413**
- Quantity: Quantity production is planned
- Emission Designator: 8K0F3E
- Tx/Rx Freq. Range: 462.6375 MHz
- Equipment Class: Family Radio Body-Worn Transmitter (FRT)
- Equipment Type: 2-Way Portable FM Wrist-worn Radio Transceiver (FRS)
- Modulation: FM
- Frequency Tolerance: ± 0.0025% (2.5 ppm)
- Max. Power: 0.1W
- FCC Rule Part(s): §§§§ 95(B), 2(J)
- Power Supply: (4) 1.5 VDC LR44 Alkaline batteries
- Dates of Tests: February 16-18, 2000
- Place of Tests: PCTEST Lab, Columbia, MD U.S.A.
- Test Report S/N: 95.200207075.KNZ

NVLAP LAB CODE 100431-0

2.1 INTRODUCTION

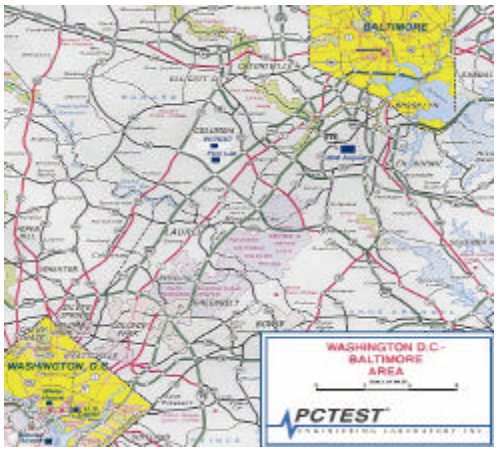


Figure 1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area.

These measurement tests were conducted at ***PCTEST Engineering Laboratory, Inc.*** facility in New Concept Business Park, Guilford Industrial Park, Columbia, Maryland. The site address is 6660-B Dobbin Road, Columbia, MD 21045. The test site is one of the highest points in the Columbia area with an elevation of 390 feet above mean sea level. The site coordinates are 39° 11'15" N latitude and 76° 49'38" W longitude. The facility is 1.5 miles North of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. There are no FM or TV transmitters within 15 miles of the site. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4 on October 19, 1992.

Measurement Procedure

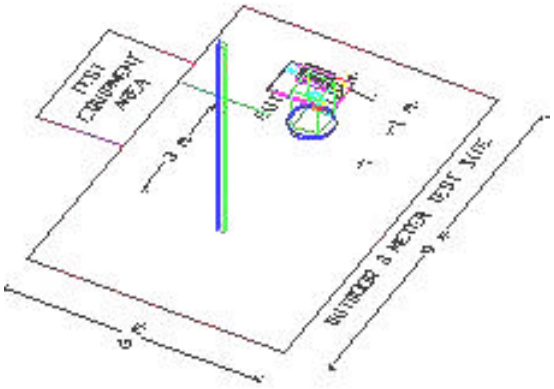


Figure 2. 3-meter outdoor test site

The radiated and spurious measurements were made outdoors at 3-meter test range (see Figure2). The equipment under test is placed on the turntable connected to a RF wattmeter and a dummy RF load, and then its power is adjusted to its rated output. A receiving antenna located 2 meters from the turntable picks up any signal radiated from the transmitter. The turntable containing the system was rotated; the receiving antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission. The testing procedure is repeated for both horizontal and vertical polarization of the receiving antenna. The actual radiated signal strength is obtained by substitution method with a signal generator with a calibrated output. The signal generator is adjusted in output until its reading is identical to that obtained when the receiving antenna is connected to the receiver. Signal strength is then read directly from the signal generator.

3.1 INSERTS PER §2.1033(d)

§2.1033(d) Block Diagram(s) & Circuit Diagram(s)

The block diagram is shown in Attachment I, and the circuit diagram is shown in Attachment J.

§2.1033(d) Operating Instructions

The instruction manual is shown in Attachment M.

§2.1033(d) Operational Description

The operational description is shown in Attachment K.

4.1 DESCRIPTION OF TESTS

4.2 §2.1047(a) Transmitter Audio Frequency Response

The frequency response of the audio modulating circuit over the frequency range 100 – 5000 Hz is measured. The audio signal generator is connected to the audio input circuit/microphone of the EUT. The audio signal input is adjusted to obtain 50% modulation at 1kHz and this point is taken as the 0dB reference. With the input held constant and below the limit at all frequencies, the audio signal generator is varied from 100 to 50 kHz. The response in dB relative to 1kHz is measured using the HP8901 a Modulation Analyzer. For the frequency response of the audio low-pass filter, the audio input is connected at the input to the modulation limiter and the modulated stage. The audio output is connected at the output of the modulated stage. The corresponding plots are shown herein.

4.3 §2.1047(b) Modulation Limiting

The audio signal generator is connected to the audio input circuit/microphone of the EUT. The modulation response is measured for each of the three modulating frequencies (300Hz, 1000 Hz, and 2990Hz), and the input voltage is varied from 30% modulation (±3.6kHz deviation) to at least 20dB higher than the saturation point. Measurements of modulation and the plots are attached herein.

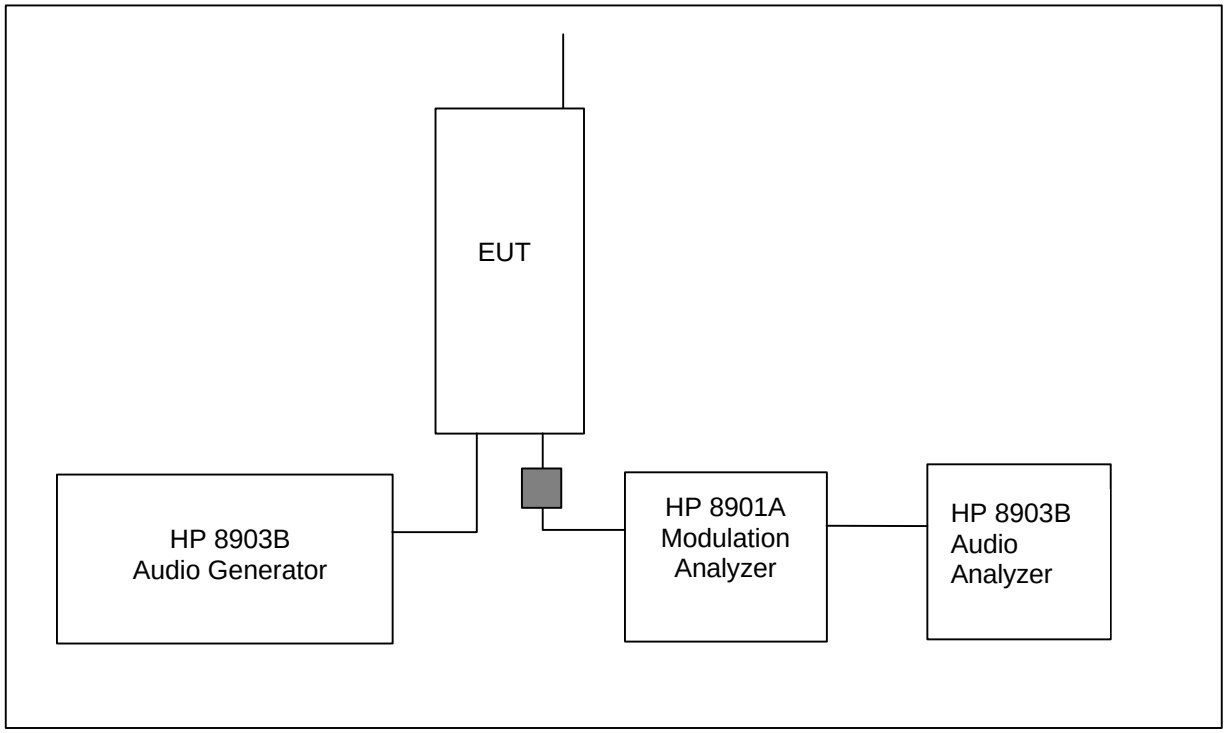


Fig. 3. Transmitter Audio Freq. Test Setup

4.1 DESCRIPTION OF TESTS (CONTINUED)

4.4 §2.1049 Occupied Bandwidth

The audio signal generator is adjusted to 1kHz. The output level is set to +/- 6kHz deviation. With the level constant, the freq. Is set to 2,500Hz. Then the audio signal level is increased by 16dB.

The limits are specified in Section 2.1049.

Bandwidth Calculations (2M + 2D):

2(3) + 2 (2.20)
6 + 4.4 = 10.4 kHz

Emission Designator = 10K4F3E

M = maximum modulation frequency
D = maximum deviation from modulating limiting plot

4.5 §2.1051 Spurious and Harmonic Emissions at Antenna Terminal

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to the tenth harmonic.

4.6 §2.1053 Radiation Spurious and Harmonic Emissions

Radiation and harmonic emissions above 1 GHz is measured at out 3-meter indoor site. The EUT is placed on the turntable connected to a dummy load in normal operation using the intended power source. A receiving antenna located 3 meters from the turntable receives any signal radiated from the transmitter and its operating accessories. The antenna is varied from 1 to 4 meters and the polarization is varied (horizontal and vertical) to determine the worst-case emission level. To obtain actual radiated signal strength, a signal generator is adjusted in output until a reading identical to that obtained with the actual transmitter is obtained at the receiver. Signal strength is read directly from the generator and recorded on the attached table.

4.1 DESCRIPTION OF TESTS (CONTINUED)

4.7 §2.995 Frequency Stability/Temperature Variation

The frequency stability of the transmitter is measured by:

a.) **Temperature:** The temperature is varied from -30°C to +60°C using an environmental chamber.

b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

Specification – The minimum frequency stability shall be +/- 0.0010% at any time during normal operation.

Time Period and Procedure:

1. The carrier frequency of the transmitter and the individual oscillators is measured at room temperature (25°C to 27°C to provide a reference).
2. The equipment is subjected to an overnight "soak" at -30°C without any power applied.
3. After the overnight "soak" at 30°C (usually 14-16 hours), the equipment is turned on in a "standby" condition for one minute before applying power to the transmitter. Measurement of the carrier frequency of the transmitter and the individual oscillators is made within a three minute interval after applying power to the transmitter.
4. Frequency measurements are made at 10°C interval up to room temperature. At least a period of one and one half-hour is provided to allow stabilization of the equipment at each temperature level.
5. Again the transmitter carrier frequency and the individual oscillators is measured at room temperature to begin measurement of the upper temperature levels.
6. Frequency were made at 10 intervals starting at 30°C up to +50°C allowing at least two hours at each temperature for stabilization. In all measurements the frequency is measured within three minutes after applying power to the transmitter.
7. The artificial load is mounted external to the temperature chamber.

NOTE: The EUT is tested down to the battery endpoint.

5.1 Test Data

5.2 Radiated Measurements

§ 2.1053 Field Strength of SPURIOUS Radiation

OPERATING FREQUENCY: 462.6375 MHz
CHANNEL: 4
MEASURED OUTPUT POWER: 19.97 dBm = 0.1 W
MODULATION SIGNAL: FM
DISTANCE: 3 meters
LIMIT: 43 + 10 $\log_{10}$ (W) = 32.98 dBc

FREQ. (MHz)	LEVEL (dBm)	AFCL (dB)	POL (H/V)	F/S (μV/m)	EIRP (dBm)	(dBc)
462.6375	-17.0	25.2	H	575439.9	19.97	0.0
925.2750	-68.0	33.0	V	3981.1	-23.23	43.2
1387.9125	-75.0	32.6	V	1698.2	-30.63	50.6
1850.5500	-80.0	35.3	V	1303.2	-32.93	52.9
2313.1875	-89.5	37.9	V	588.8	-39.83	59.8
2775.8250	-95.0	39.0	V	354.8	-44.23	64.2
3238.4625	< -130					

NOTES:

1. The spectrum was checked from 25 MHz up to the 10th harmonic.
2. All emissions not listed were found to be more than 20dB below the limit.
3. < -130dBm is below the floor of the spectrum analyzer.
4. The EUT is manipulated through 3 orthogonal axis and the worst-case are reported.
5. The EUT is placed 3m. away from the receiving antenna and the ERP is calculated using the formula:

   EIRP (dBm) $= 10 \text{ Log}_{10} (((r(\text{mV/m})/1 \times 10^6)^2 / 30.0/1 \times 10^{-3})$

   EIRP (dBm) $= 10 \text{ Log}_{10} [(3 \times \text{FS}/1 \times 10^6)^2 / (30.0) \times 1000]$

   EIRP (Watts) $= \{(3 \times \text{FS})/1 \times 10^6\}^2 / 30.0$

6.1 Test Data

6.2 § 2.995 FREQUENCY STABILITY

OPERATING FREQUENCY: 462,637,503 Hz

CHANNEL: 4

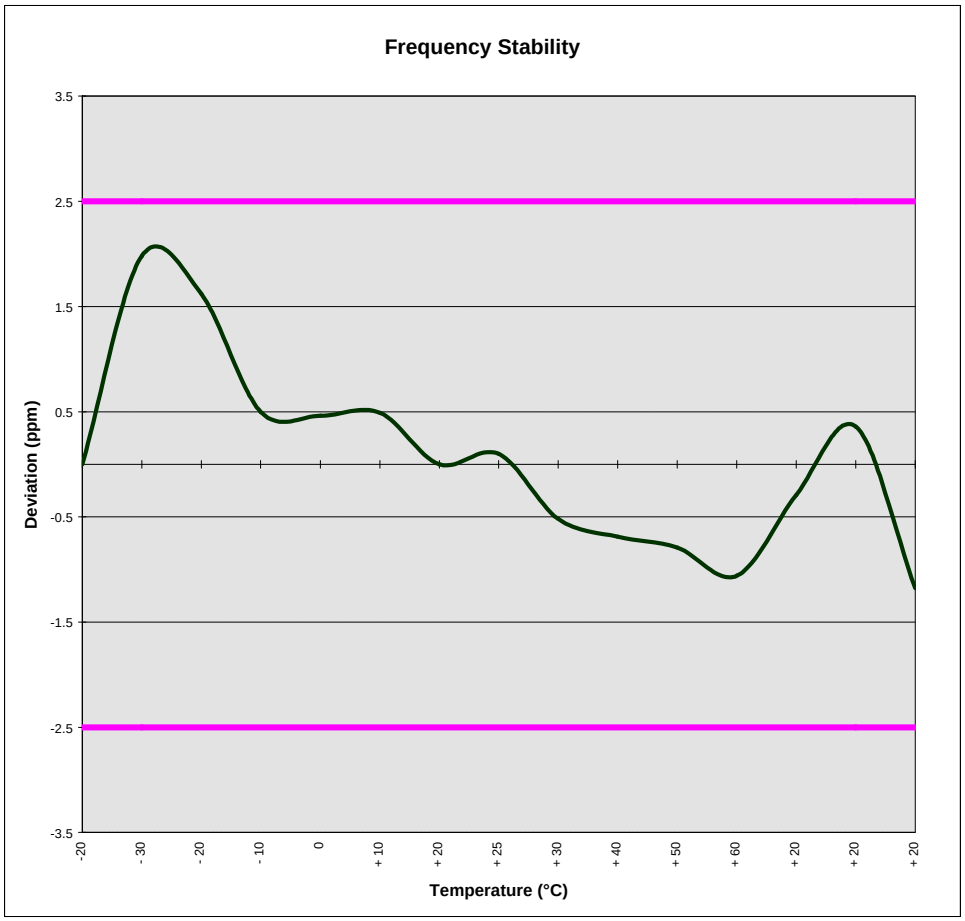
REFERENCE VOLTAGE: 6.0 VDC

DEVIATION LIMIT: ± 0.0025 % or 2.5 ppm

VOLTAGE (%)	POWER (VDC)	TEMP (ºC)	FREQ. (Hz)	Deviation (%)
100 %	6.00	+ 20 (Ref)	462,637,503	0.000000
100 %		- 30	462,636,587	0.000198
100 %		- 20	462,636,754	0.000162
100 %		- 10	462,637,272	0.000050
100 %		0	462,637,290	0.000046
100 %		+ 10	462,637,276	0.000049
100 %		+ 20	462,637,503	0.000000
100 %		+ 25	462,637,457	0.000010
100 %		+ 30	462,637,744	-0.000052
100 %		+ 40	462,637,822	-0.000069
100 %		+ 50	462,637,868	-0.000079
100 %		+ 60	462,637,993	-0.000106
85 %	5.10	+ 20	462,562,389	-0.000029
115 %	6.90	+ 20	462,562,370	0.000036
BATT. ENDPOINT	2.80	+ 20	462,562,218	-0.000118

6.1 Test Data (Continued)

6.3 § 2.995 FREQUENCY STABILITY



7.1 PLOT(S) OF EMISSIONS

SEE ATTACHMENT D

8.1 TEST EQUIPMENT

8.2 Type	Model	Cal. Due Date	S/N
Microwave Spectrum Analyzer	HP 8566B (100Hz-22GHz)	08/15/00	3638A08713
Microwave Spectrum Analyzer	HP 8566B (100Hz-22GHz)	04/17/00	2542A11898
Spectrum Analyzer/Tracking Gen.	HP 8591A (100Hz-1.8GHz)	08/10/00	3144A02458
Signal Generator*	HP 8640B (500Hz-1GHz)	06/03/00	2232A19558
Signal Generator*	HP 8640B (500Hz-1GHz)	06/03/00	1851A09816
Signal Generator*	Rohde & Schwarz (0.1-1000MHz)	09/11/00	894215/012
Ailtech/Eaton Receiver	NM 37/57A-SL (30-1000MHz)	04/12/00	0792-03271
Ailtech/Eaton Receiver	NM 37/57A (30-1000MHz)	03/11/00	0805-03334
Ailtech/Eaton Receiver	NM 17/27A (0.1-32MHz)	09/17/00	0608-03241
Quasi-Peak Adapter	HP 85650A	08/15/00	2043A00301
Ailtech/Eaton Adapter	CCA-7 CISPR/ANSI QP Adapter	03/11/00	0194-04082
RG58 Coax Test Cable	No. 167		n/a
Harmonic/Flicker Test System	HP 6841A (IEC 555-2/3)		3531A00115
Broadband Amplifier (2)	HP 8447D		1145A00470, 1937A03348
Broadband Amplifier	HP 8447F		2443A03784
Transient Limiter	HP 11947A (9kHz-200MHz)		2820A00300
Horn Antenna	EMCO Model 3115 (1-18GHz)		9704-5182
Horn Antenna	EMCO Model 3115 (1-18GHz)		9205-3874
Horn Antenna	EMCO Model 3116 (18-40GHz)		9203-2178
Biconical Antenna (4)	Eaton 94455/Eaton 94455-1/Singer 94455-1/Compliance Design 1295, 1332, 0355		
Log-Spiral Antenna (3)	Ailtech/Eaton 93490-1		0608, 1103, 1104
Roberts Dipoles	Compliance Design (1 set)		
Ailtech Dipoles	DM-105A (1 set)		33448-111
EMCO LISN	3816/2		1079
EMCO LISN	3816/2		1077
EMCO LISN	3725/2		2009
Microwave Preamplifier 40dB Gain	HP 83017A (0.5-26.5GHz)		3123A00181
Microwave Cables	MicroCoax (1.0-26.5GHz)		
Ailtech/Eaton Receiver	NM37/57A-SL		0792-03271
Spectrum Analyzer	HP 8594A		3051A00187
Spectrum Analyzer (2)	HP 8591A		3034A01395, 3108A02053
Modulation Analyzer	HP 8901A		2432A03467
NTSC Pattern Generator	Leader 408		0377433
Noise Figure Meter	HP 8970B		3106A02189
Noise Figure Meter	Ailtech 7510		TE31700
Noise Generator	Ailtech 7010		1473
Microwave Survey Meter	Holaday Model 1501 (2.450GHz)		80931
Digital Thermometer	Extech Instruments 421305		426966
Attenuator	HP 8495A (0-70dB) DC-4GHz		
Bi-Directional Coax Coupler	Narda 3020A (50-1000MHz)		
Shielded Screen Room	RF Lindgren Model 26-2/2-0		6710 (PCT270)
Shielded Semi-Anechoic Chamber	Ray Proof Model S81		R2437 (PCT278)
Enviromental Chamber	Associated Systems Model 1025 (Temperature/Humidity)		PCT285

* Calibration traceable to the National Institute of Standards and Technology (NIST).

9.1 SAMPLE CALCULATIONS

Level μ/Vm @ 3 meters = $\frac{\text{Log } 10^{-1} \text{ (dBm + 107 + AFCL)}}{20}$

$\frac{\text{Log } 10^{-1} \text{ (-14 + 107 + 31.7)}}{20}$

1717908.4 μ/Vm @ 3 meters

Sample Calculation (relative to a dipole)

EIRP (dBm) = $10 \text{ Log}_{10} (((r(\mu V/m)1x10^{6})^{2}/30.0/1x10^{-3})$

EIRP (dBm) = $10 \text{ Log}_{10}(((3(1717908.4)1x10^{6})^{2}/30.0/1x10^{-3})$

EIRP (dBm) = 27.32

10.1 CONCLUSION

The data collected shows that the **DSI (HK) LTD. 2-Way Portable FM Wrist-worn Radio Transceiver (FRS) FCC ID: KNZ48413** complies with all the requirements of Parts 2 and 95 of the FCC rules.