

VTech Electronics Limited

Application
For
Certification

Two Way Radio with FRS

(FCC ID: G2R-115300)

HK10050660-1
KS/ cl
June 22, 2010

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INTERTEK TESTING SERVICES

MEASUREMENT/TECHNICAL REPORT

Applicant : VTech Electronics Limited
Trade Name/Model No : 1153
Date : June 22, 2010

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

Equipment Type: FRF – Part 95 Family Radio Face Held Transmitter

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.

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EXHIBIT 1

GENERAL DESCRIPTION

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1.0 General Description

1.1 Product Description

The Equipment Under Test (EUT) is a Two Way Radio with FRS operating between 462.5875MHz – 467.5625MHz. The EUT is powered by 4.5V (3 x “AA” size 1.5V alkaline batteries).

Transmitter Portion

- (i) Type of Emission : FRS (Channel 1-4): 5K68F3E,
FRS (Channel 1-4): 7K40F2D
- (ii) Frequency Range : FRS 1-3 Channels from 462.5875MHz to 462.6875MHz
FRS 4 Channel 467.5625MHz
- (iii) Maximum Power Rating : FRS: 0.12W ERP
- (iv) Antenna Type : Integral, vertically polarized
- (v) Antenna Gain : 0dBi
- (vi) DC Voltage and DC Current of final RF amplifying device (refer to technical specification) : 2.5VDC and 280mA respectively.

The Model: 80-115300 and 80-115350 are the same as the Model: 1153 in electrical designs, including software & firmware, PCB layout and construction design/Physical design/Enclosure. The only differences between these model are color and model number.

The brief circuit description is saved with filename: descri.pdf

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1.2 Test Methodology

Radiated emission measurements were performed according to the procedures in ANSI C63.4 (2003) and ANSI/TIA-603-C-2004. All radiated measurement 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 the EUT distance of 3 meters, unless stated otherwise in the “**Justification Section**” of this Application.

1.3 Test Facility

The open area test site used to collect the emission data is located at Garment Centre, 576 Castle Peak Road, Kowloon, Hong Kong. The 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

The device was configured for testing in a typical fashion (as a customer would normally use it). The device was placed on a turntable, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

The device was powered by 3 x new "AA" size 1.5V alkaline batteries.

The frequency range of transmitter from 30MHz to 10th harmonics was searched for spurious emissions from the device. Only those emissions reported were detected. All other emissions were at least 20 dB below the applicable limits.

For transmitter radiated spurious measurement, the spectrum analyzer resolution bandwidth was 10kHz for emissions below 1GHz, and 1MHz for emissions above 1GHz. Video bandwidth was 300kHz for emissions below 1GHz, and 3MHz for emissions above 1GHz.

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2.2 EUT Exercising Software

There was no special software to exercise the device. Once the PTT button was pushed, a signal was transmitted.

2.3 Special Accessories

No special accessory is needed for compliance of this device.

2.4 Measurement Uncertainty

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

2.5 Equipment Modification

Any modification installed previous to testing by VTech Electronics Limited will be incorporated in each production model sold/leased in the United States.

No modification were installed by Intertek Testing Services Hong Kong Ltd.

2.6 Support Equipment

N/A

Confirmed by:

*Sit Kim Wai, Ken
Manager
Intertek Testing Services Hong Kong Ltd.
Agent for VTech Electronics Limited*



_____ Signature

_____ Date
June 22, 2010

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EXHIBIT 3

RF POWER OUTPUT

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3.0 **RF Power Output (Section 2.1046(a), 95.639(d))**

A. Equipment Used

Equipment	Brand Name	Model No.
Log Periodic Antenna	EMCO	3148
Biconical Antenna	EMCO	3104C
Test receiver	Rohde & Schwarz	ESVS30
Tuned Dipole Antenna	CDI	A100
Signal Generator	IFR	2023B

B. Testing Procedure

1. On a test site, the EUT shall be placed at 0.8m height on a wooden turntable, and in the position 2closest to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarisation located 3m from EUT to correspond to the frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the peak detector is used for the measurement.
4. The transmitter shall be switched on, if possible, without modulation and the measuring receiver shall be tuned to the frequency of the transmitter under test.
5. The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.

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6. The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
7. The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
8. The maximum signal level detected by the measuring receiver shall be noted.
9. The transmitter shall be replaced by a tuned dipole (substitution antenna).
10. The substitution antenna shall be orientated for vertical polarisation and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
11. The substitution antenna shall be connected to a calibrated signal generator.
12. If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
13. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
14. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
15. The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
16. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarisation.
17. The measure of the effective radiated power is the larger of the two levels recorded, at the input to the substitution antenna, corrected for gain of the substitution antenna if necessary.

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Table 1

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Transmission Power

Channel	Frequency (MHz)	Effective Radiated Power		FCC 95.639 Limit (W)	Margin (W)
		(dBm)	(W)		
1	462.5875	20.8	0.12	0.50	-0.38
2	462.6375	20.8	0.12	0.50	-0.38
3	462.6875	20.8	0.12	0.50	-0.38
4	467.5625	20.4	0.11	0.50	-0.39

Notes: Negative sign in the margin column shows the value below limits.

Verdict: Passed

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

Test Engineer: Koo Wai Ip

Date of Test: May 18-20, 2010

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EXHIBIT 4

MODULATION CHARACTERISTICS

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4.0 Modulation Characteristics (Section 2.1047(a)(b), 95.637(a), 95.637(b))

In order to satisfy the 95.637(a) and 2.1047(b) requirements, Modulation Frequency Response and Modulation Limiting Characteristics are attached in Exhibit 4.1 & 4.2.

In order to satisfy the 2.1047(a) requirement, Audio Low Pass Filter Response is attached in Exhibit 4.3.

For electronic filing, the modulation frequency response curve and modulation limiting characteristic curve are saved with filename: mfr.pdf and mlc.pdf respectively.

For electronic filing, the audio low pass frequency response curve is saved with filename: lpf.pdf.

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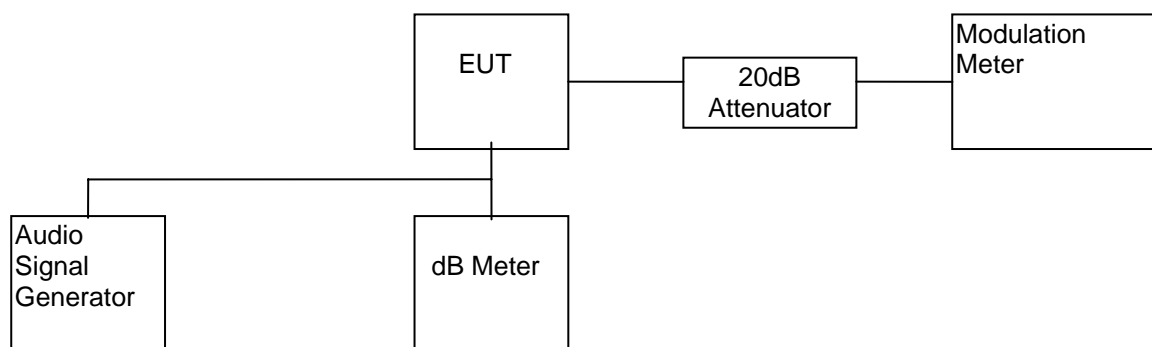
4.1 Modulation Frequency Response (Section 2.1047(a), 95.637(a), 95.637(b))

A. Test Equipment

Equipment	Brand Name	Model No.
Audio Signal Generator	HP	HP8904A
AC Millivoltmeter	Leader	LMV-182A
20 dB RF Attenuator	Bird	8304-200-N
Radiocommunication Service Monitor	R&S	CMS54

B. Testing Procedure

- 1) Set-up the test equipment in the following configuration:



- 2) Set the audio signal generator frequency to the sound pressure level 127dB SPL at the microphone of the EUT.
- 3) The frequency of the audio signal generator is changed from 100Hz to 5kHz.
- 4) Record the frequency deviation.
- 5) The peak frequency deviation must not exceed:

FRS : $\pm 2.5\text{kHz}$

- 6) Calculate the audio frequency response at each frequency as:

$$\text{response} = 20 \log_{10}(\text{DEV}_{\text{FREQ}} / \text{DEV}_{\text{REF}});$$

DEV_{REF} = Frequency deviation at 1000Hz ;

DEV_{FREQ} = Frequency deviation at 100 - 5000Hz ;

- 7) From the plot, audio frequency response rolls off before 3.125kHz.

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C. Test Result

Table 2

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Modulation Frequency Response

Test Channel : 2
Input level = 127dBSPL

Modulation Frequency(Hz)	Frequency Deviation(kHz)	Audio Frequency Response
100	0.980	-5.94
200	2.044	0.45
300	2.014	0.32
400	1.716	-1.07
500	2.143	0.86
600	2.067	0.55
700	2.036	0.42
800	2.013	0.32
900	1.557	-1.91
1000	1.941	0.00
1250	2.051	0.48
1500	2.106	0.71
1750	2.040	0.43
2000	2.146	0.87
2250	2.014	0.32
2500	2.071	0.56
2750	1.199	-4.18
3000	0.065	-29.50
3125	0.064	-29.64
3250	0.064	-29.64
3500	0.064	-29.64
4000	0.064	-29.64
5000	0.064	-29.64

Verdict: Passed

Test Engineer: Koo Wai Ip

Date of Test: May 18-20, 2010

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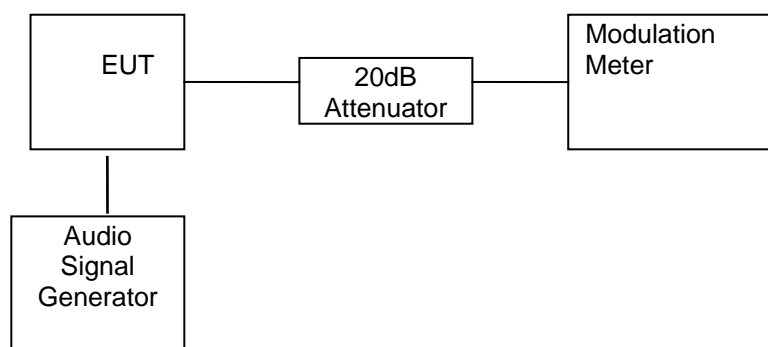
4.2 Modulation Limiting Characteristics (Section 2.1047(b), 95.637(a))

A. Test Equipment

Equipment	Brand Name	Model No.
Audio Signal Generator	HP	HP8904A
20 dB RF Attenuator	Bird	8304-200-N
Radiocommunication Service Monitor	R&S	CMS54

B. Testing Procedure

- 1) Set-up the test equipment in the following configuration:



- 2) Set the frequency of the audio signal generator to 500Hz and adjust the level from 47dBSPL to 137dBSPL.
- 3) Record the maximum value of plus or minus peak frequency deviation.
- 4) Repeat the above procedure with frequency 1000Hz, 2500Hz & 3125Hz.
- 5) The peak frequency deviation must not exceed:

FRS : $\pm 2.5\text{kHz}$

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C. Test Result

Table 3

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Modulation Limiting Characteristics

Test Channel : 2

Modulation Input (dB SPL)	Peak Frequency Deviation (kHz) at 500Hz	Peak Frequency Deviation (kHz) at 1000Hz	Peak Frequency Deviation (kHz) at 2500Hz	Peak Frequency Deviation (kHz) at 3125Hz
47	0.060	0.060	0.060	0.060
57	0.064	0.063	0.065	0.064
67	0.065	0.069	0.070	0.065
77	0.069	0.069	0.108	0.065
87	0.105	0.489	0.590	0.064
97	0.574	1.103	1.430	0.065
107	1.552	1.903	2.063	0.065
117	2.067	1.911	2.081	0.065
127	2.143	1.941	2.075	0.065
137	2.173	1.924	2.070	0.065

Verdict: Passed

Test Engineer: Koo Wai Ip

Date of Test: May 18-20, 2010

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4.3 Audio Low Pass Filter Response (Section 95.637(b), 2.1047(a))

A. Test Equipment

Equipment	Brand Name	Model No.
Audio Signal Generator	HP	HP8904A
AC Millivoltmeter	Leader	LMV-182A

B. Testing Procedure

- 1) Connect the audio signal generator to the input of the post limiter low pass filter and the dB meter to the output of the post limiter low pass filter.
- 2) Apply a 1000 Hz tone from the audio signal generator and adjust the level per manufacturer's specifications. Record the dB level of the 1000 Hz tone as LEV_{REF} .
- 3) Set the audio signal generator to the desired test frequency between 3000 Hz and the upper low pass filter limit. Record the dB level at the test frequency as LEV_{FREQ} .
- 4) Calculate the audio frequency response at the test frequency as:

$$\text{low pass filter response} = LEV_{FREQ} - LEV_{REF}$$

- 5) Repeat the above procedure for all the desired test frequencies.

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C. Test Result

Table 4

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Low-Pass Filter Response

Test Channel : 2

Audio Input Strength = 50mVrms

Frequency (kHz)	dB relative to 1 kHz	TIA/EIA-603C
1	0.0	0.0
3	-52.0	0.0
4	-56.0	-7.5
5	-56.0	-13.3
6	-56.0	-18.1
8	-56.0	-25.6
10	-56.0	-31.4
15	-56.0	-41.9
20	-56.0	-50.0
30	-56.0	-50.0
40	-56.0	-50.0
50	-56.0	-50.0
60	-56.0	-50.0
70	-56.0	-50.0
80	-56.0	-50.0
90	-56.0	-50.0
100	-56.0	-50.0

Audio Output at 1kHz: 50dBV

Verdict: Passed

Test Engineer: Koo Wai Ip

Date of Test: May 18-20, 2010

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EXHIBIT 5

OCCUPIED BANDWIDTH

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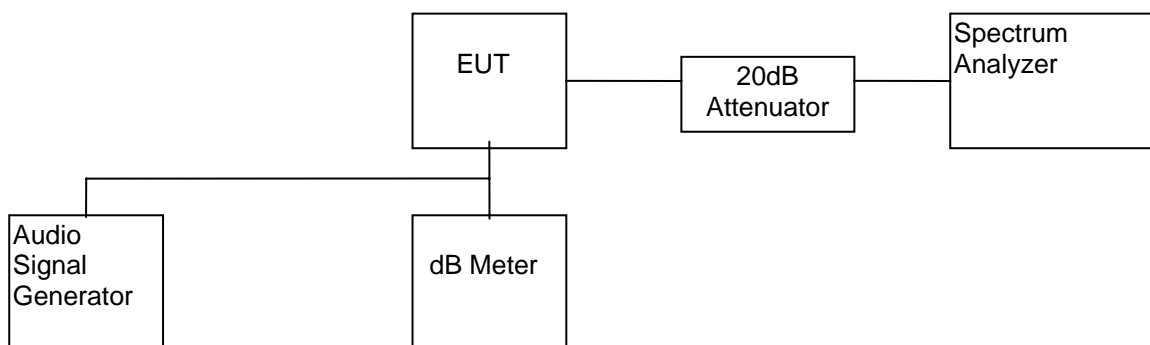
5.0 Occupied Bandwidth (Section 2.1049, 95.633(c))

A. Test Equipment

Equipment	Brand Name	Model No.
Audio Signal Generator	HP	HP8904A
AC Millivoltmeter	Leader	LMV-182A
20 dB RF Attenuator	Bird	8304-200-N
Spectrum Analyzer	HP	8951EM

B. Testing Procedure

- 1) Set-up the test equipment in the following configuration:



- 2) Set the level of audio signal generator to obtain 16 dB greater than required for 50% modulation.
- 3) The occupied bandwidth is measured with the spectrum analyzer set at 2kHz/div scan and 10dB/div.

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C. Test Result

Table 5

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System	Channel	Measured Bandwidth (kHz)	Limit (kHz)
FRS	2	5.68	≤12.5
FRS (Data)	4	7.40	≤12.5

Verdict: Passed

For the electronic filing, the bandwidth plot is saved with filename: bw.pdf

Test Engineer: Koo Wai Ip

Date of Test: May 18-20, 2010

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EXHIBIT 6

SPURIOUS EMISSION

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6.0 Spurious Emission

In order to satisfy the 95.635(b) requirement, the spurious emission from the EUT are measured and shown in the Exhibit 6.1.

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6.1 Power of Spurious Radiation (Section 2.1053, 95.635(b))

A. Test Equipment

Equipment	Brand Name	Model No.
Antenna	EMCO	A100, 3148, 3104C, 3115
Spectrum Analyzer	ADVANTEST	U3661
Test receiver	Rohde & Schwarz	ESVS30
RF Filter	Trilithic	3VF500/1000-5-50-CC
Signal Generator	IFR	2023B

B. Testing Procedure

Radiated emission measurements were performed according to the procedures in ANSI/TIA-603-C-2004. All measurements were performed in Open Area Test Sites located at Roof Top of Garment Centre, 576 Castle Peak Road, Kowloon, Hong Kong.

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C. Radiated Emission Configuration Photograph

Worst Case Radiated Emission

For electronic filing, the radiated emission configurations photograph is saved with filename: config photos.pdf

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C. Test Result

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Table 6(a)

1) Unwanted emission from CARRIER $\pm 6.25\text{kHz}$ to CARRIER $\pm 31.25\text{kHz}$

(Refer to the plots which is saved with filename: spurious.pdf)

Region	Unwanted emission	
	Channel 2	Channel 4
CARRIER $\pm 6.25\text{kHz}$ to $\pm 12.5\text{kHz}$	<25dB	<25dB
CARRIER $\pm 12.5\text{kHz}$ to $\pm 31.25\text{kHz}$	<35dB	<35dB

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Table 6(b): Channel 2

Frequency (MHz)	Effective Radiated Power (dBm)	Transmission Power (dBm)	Attenuation (dBc)	Limit (dBc)	Margin (dB)
925.274	-38.4	20.8	59.2	33.8	-25.4
1387.911	-42.0	20.8	62.8	33.8	-29.0
1850.548	-40.8	20.8	61.6	33.8	-27.8
2313.185	-37.0	20.8	57.8	33.8	-24.0
2775.822	-43.5	20.8	64.3	33.8	-30.5
3238.459	-44.2	20.8	65.0	33.8	-31.2
3701.096	-44.3	20.8	65.1	33.8	-31.3
4163.733	-45.0	20.8	65.8	33.8	-32.0
4626.370	-44.9	20.8	65.7	33.8	-31.9

- Remark: 1. Transmission power is 20.8 dBm or -9.2 dB(W).
2. According to Section 95.635(b7), the unwanted emission should be attenuated below TP by at least $43 + 10 \log_{10} (TP)$ dB or 33.8 dB.
3. The test is performed according to ANSI/TIA-603-C-2004.

Verdict: Passed

Test Engineer: Koo Wai Ip

Date of Test: May 18-20, 2010

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Table 6(b): Channel 4 (Data)

Frequency (MHz)	Effective Radiated Power (dBm)	Transmission Power (dBm)	Attenuation (dBc)	Limit (dBc)	Margin (dB)
935.124	-39.2	20.4	59.6	33.4	-26.2
1402.686	-41.4	20.4	61.8	33.4	-28.4
1870.248	-41.2	20.4	61.6	33.4	-28.2
2337.810	-37.4	20.4	57.8	33.4	-24.4
2805.372	-44.4	20.4	64.8	33.4	-31.4
3272.934	-44.2	20.4	64.6	33.4	-31.2
3740.496	-44.4	20.4	64.8	33.4	-31.4
4208.058	-45.0	20.4	65.4	33.4	-32.0
4675.620	-44.9	20.4	65.3	33.4	-31.9

- Remark: 1. Transmission power is 20.4 dBm or -9.6 dB(W).
2. According to Section 95.635(b7), the unwanted emission should be attenuated below TP by at least $43 + 10 \log_{10} (TP)$ dB or 33.4 dB.
3. The test is performed according to ANSI/TIA-603-C-2004.

Verdict: Passed

Test Engineer: Koo Wai Ip

Date of Test: May 18-20, 2010

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EXHIBIT 7

FREQUENCY STABILITY

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7.0 Frequency Stability (Section 2.1055(a)(b)(d), 95.627(b) for FRS, 95.621(b) for GMRS)

The frequency tolerance was tested in normal condition & over extreme ambient conditions with respect to voltage and temperature variation.

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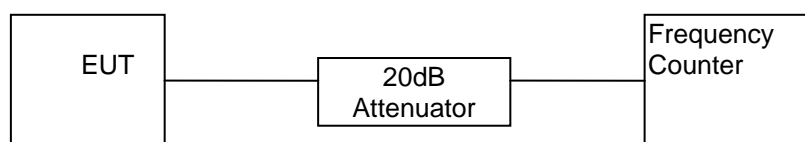
7.1 Frequency Tolerance (Section 95.627(b) for FRS, 95.621(b) for GMRS)

A. Test Equipment

Equipment	Brand Name	Model No.
20 dB RF Attenuator	Bird	8304-200-N
Frequency Counter	OPTOELECTRONICS	3000A

B. Testing Procedure

- 1) Set-up the test equipment in the following configuration:



- 2) Measure all transmit channel frequencies in MHz.

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C. Test Result

Table 7

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Frequency Tolerance

Channel	Frequency (MHz)	Measured Frequency (MHz)	Tolerance (%)
1	462.5875	462.58725	-0.000054
2	462.6375	462.63725	-0.000054
3	462.6875	462.68725	-0.000054
4	467.5625	467.56225	-0.000053

FCC Limit for FRS (95.627(b)): $\leq \pm 0.00025\%$

Verdict: Passed

Test Engineer: Koo Wai Ip

Date of Test: May 18-20, 2010

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7.2 Frequency Stability - Temperature (Section 2.1055(a)(b), 95.627(b) for FRS, 95.621(b) for GMRS)

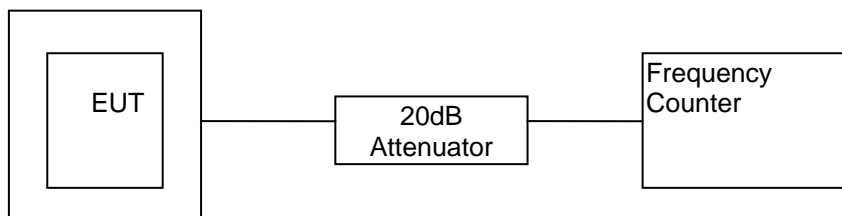
A. Test Equipment

Equipment	Brand Name	Model No.
20 dB RF Attenuator	Bird	8304-200-N
Frequency Counter	OPTOELECTRONICS	3000A

B. Testing Procedure

- 1) Set-up the test equipment in the following configuration:

Temperature Chamber



- 2) Set the Temperature Chamber to 20°C and stabilize the EUT temperature for one hour. Set transmitter ON for two minutes.
- 3) Measure the channel frequency of channel 2 in MHz.
- 4) Turn the EUT OFF.
- 5) Repeat the above procedure from -20°C to 50°C with 10°C increment for FRS.

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C. Test Result

Table 8(a)

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Frequency Tolerance with Temperature Variation

Channel : 2

Temperature (°C)	Assigned Frequency (MHz)	Measured Frequency (MHz)	Tolerance (%)	*Frequency Tolerance with reference to its value at +20°C (ppm)
#-20	462.63750	N/A	N/A	N/A
#-10	462.63750	N/A	N/A	N/A
0	462.63750	462.63725	-0.000054	0.0
10	462.63750	462.63705	-0.000097	-0.4
20	462.63750	462.63725	-0.000054	0.0
30	462.63750	462.63735	-0.000032	0.2
40	462.63750	462.63665	-0.000184	-1.3
50	462.63750	462.63695	-0.000119	-0.6

Remark: 1) For FRS, frequency tolerance must be maintained within a frequency tolerance of 0.00025%.

2) # This device can not operate at this temperature.

3) Data transmission has been considered, worst case is reported only.

Verdict: Passed

Test Engineer: Koo Wai Ip

Date of Test: May 18-20, 2010

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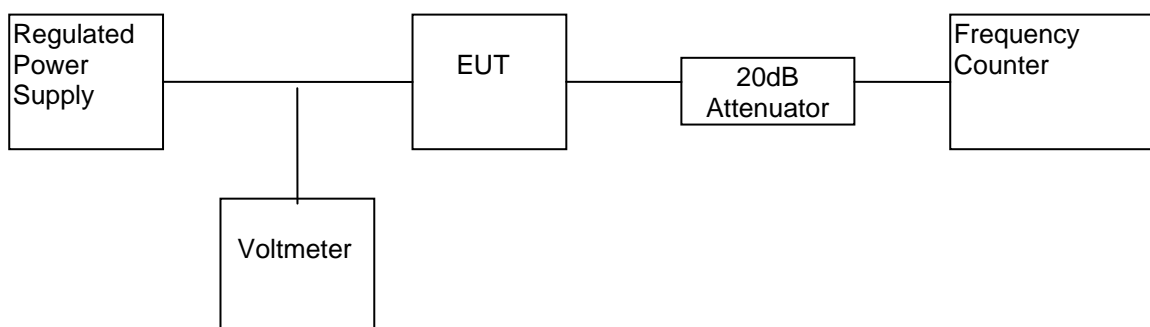
7.3 Frequency Stability - Voltage (Section 2.1055(d), 95.627(b) for FRS, 95.621(b) for GMRS)

A. Test Equipment

Equipment	Brand Name	Model No.
Regulated Power Supply	PAD	30-35L
20 dB RF Attenuator	Bird	8304-200-N
Voltage meter	Fluke	87
Frequency Counter	OPTOELECTRONICS	3000A

B. Testing Procedure

- 1) Set-up the test equipment in the following configuration:



- 2) Vary the level of regulated power supply to the manufacturer specified battery end point of the EUT.
- 3) Measure the channel frequency of channel 2 in MHz.

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C. Test Result

Table 9

**VTech Electronics Limited
1153**

Frequency Deviation with Voltage Variation

The manufacturer specified battery end point 4.1V

Channel	Frequency (MHz)	Measured Frequency (MHz)	Tolerance (%)
2	462.63750	462.63740	-0.000022

Remark: 1) For FRS, frequency tolerance must be maintained within a frequency tolerance of 0.00025%.
2) The test voltage is from primary supply voltage to 4.1V

Test Engineer: Koo Wai Ip

Date of Test: May 18-20, 2010

INTERTEK TESTING SERVICES

EXHIBIT 8

DIGITAL TRANSMISSION

INTERTEK TESTING SERVICES

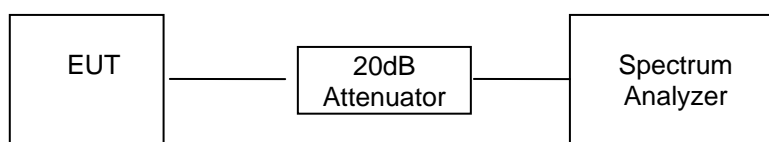
8.0 Digital Transmission (Section 95.193(b))

A. Test Equipment

Equipment	Brand Name	Model No.
Spectrum Analyzer	HP	8951EM
20 dB RF Attenuator	Bird	8304-200-N

B. Testing Procedure

- 1) Set-up the test equipment in the following configuration:



- 2) Trigger the EUT "ON".
- 3) Capture data on the display of spectrum Analyzer.

For the electronic filing, the digital transmission plot is saved with filename: timing.pdf.