Ambient temperature 20 to 25 Deg C
Date of tests: 3rd to 13th October 2005

610, Unitechvill, 1141-2, BaeSuk-Dong, IlSan-Gu, GoYang City, GyeongGi-Do, SouthKorea
Tel : +82-31-813-1090 Fax :+82-31-813-1093
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Tests commissioned by Entel UK Limited for FCC approval.

Unit tested: HT840 Serial number 95E200046

Tests carried out according to 47CFR part 80
Stations in the Maritime Services

Test carried out at our purpose built test facility and where appropriate an outdoor test site in Seoul, South Korea.

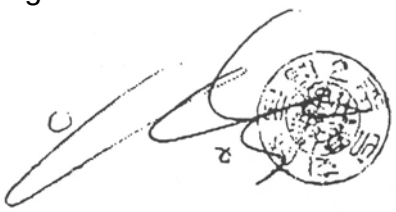
Tests completed 13th October 2005

Tester:-

KG Lee

KG Lee
Senior Engineer

Signed:-



SahngBok Yi
Quality Manager

Ambient temperature 20 to 25 Deg C
Date of tests: 3rd to 13th October 2005

TEST REPORT:

Ambient temperature 20 to 25 Deg C
Date of tests: 3rd to 13th October 2005

Application details

Testing Laboratory:	610, Unitechvill, 1141-2, BaeSuk-Dong, llSan-Gu, GoYang City, GyeongGi-Do, SouthKorea
Report Number:	FCCHT840/2
Applicant:	Entel UK Limited 4 Elstree Gate, Elstree Way, Borehamwood, Herts WD6 1JD United Kingdom
Manufacturer:	As above
Equipment:	HT840 Hand Held Marine Transceiver (NON GMDSS)
FCCID:	RV6HT840
FCC Rules:	80
Test carried out:	3rd to 13th October 2005

All tests carried out and performed at our purpose built facility and at an outdoor test site in Seoul, South Korea.

All tests carried out In accordance with the FCC rules and regulations volume ll, Part 2 and to part 80.

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The HT840 is a handheld, 5-watt, VHF, frequency modulated transceiver intended for applications in the 156-163MHz marine band.

General information. (Paragraph 2.1033 of the rules)

1. Applicant: Entel UK Limited
   4 Elstree Gate,
   Elstree Way,
   Borehamwood,
   Herts
   WD6 1JD
   United Kingdom

2. Identification of equipment: FCC ID: RV6HT840
   Model Number: HT840

   a. The equipment identification label is submitted separately.
   b. Photographs of the equipment are submitted separately.

3. Quantity production is being carried out for the European market.

4. Technical description:

   a. 16K0G3E emission
      Frequency range 156.000 – 163.275MHz.
   b. Operating power of the transmitter is fixed at the factory at 5 Watts with a 1 Watt low power setting.
   d. Maximum power permitted under part 80 of the FCC Rules is 25 Watts, with capability to reduce, readily, to one Watt maximum. The HT840 meets both of these requirements.
   e. The DC voltage and DC current at the final amplifier:
      Drain voltage: 7.4Vdc
      Drain current: 1.6A
   f. Function of each active semiconductor device:
      See Appendix 1.
   g. Complete circuit diagram:
      See service manual - separate exhibit.
   h. Instruction book is submitted separately.
   i. Transmitter set up procedure:
      See service manual separate exhibit.
   j. A description of circuits for stabilising the frequency is included in appendix 2.
   k. A description of circuits and devices employed for suppression of spurious radiation and for limiting modulation is included in appendix 3.

5. The equipment identification label is submitted separately.

6. Photographs of the equipment are submitted separately.

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Carrier output power (Conducted)
Specification: 47CFR 2.1046 (a)

Frequency used for testing: Channel 16 (156.800MHz)

A power output of 5.0 Watts (high power)
and
0.95 Watts (low power) was recorded

Note:-
The power is automatically reduced to the low setting on channels 15 and 17, channel 70 being receive only.

Test equipment used:
Agilent 8920A radio communications test set.

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2.1047(a) Modulation characteristics

A curve showing frequency response of the transmitter is shown in figure 1.

The reference was 1KHz audio generated by an Agilent 8929A radio communications test set.
Audio output was measured using the audio analyser of a second Agilent 8920A radio communications test set and the result plotted.

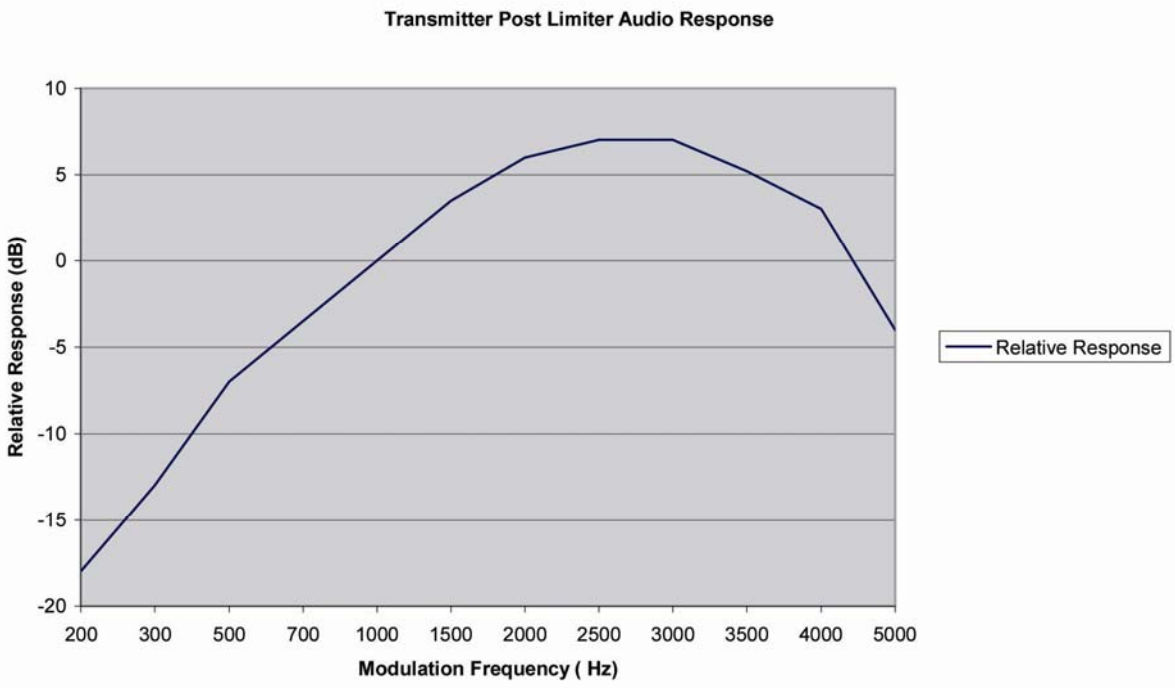

Figure 1

Ambient temperature 20 to 25 Deg C
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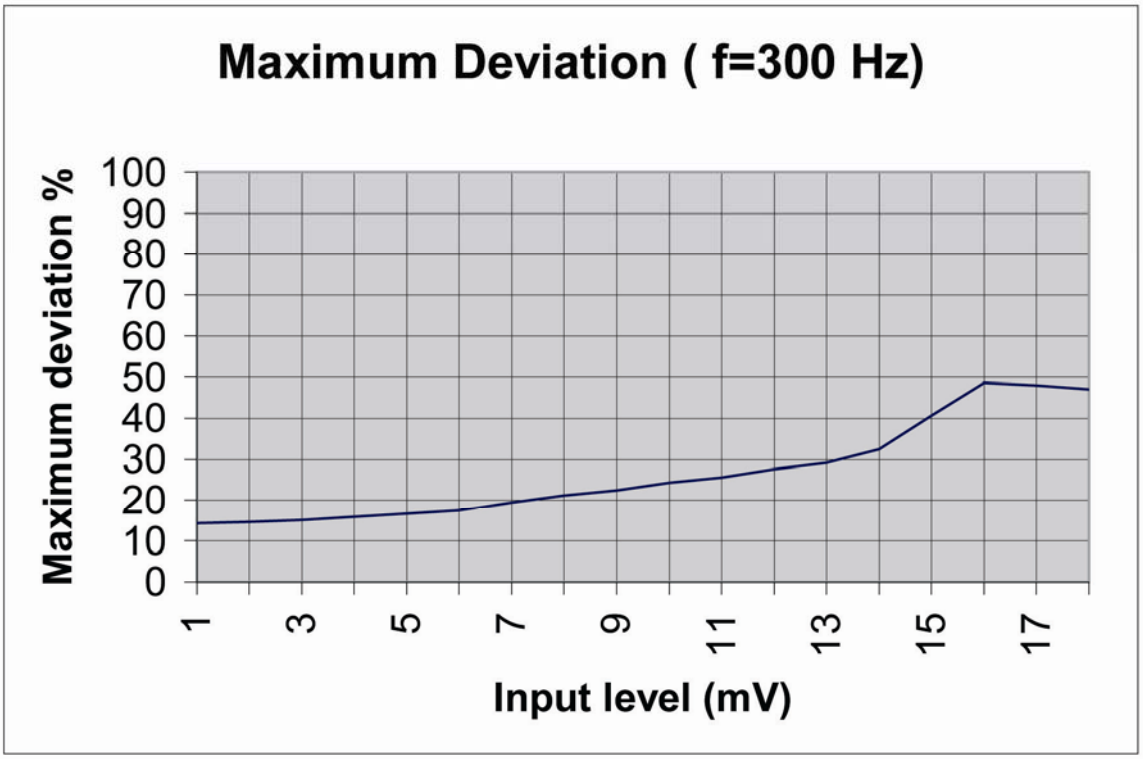
2.1047(b) and 80.213 (a) (2) Audio input versus modulation

Modulation limiting curves are shown in figure 2. These were plotted using results obtained from the modulation analyser in an Agilent 8920A radio communications test set. The curves show compliance with paragraphs 2.1047 (b)

Modulation Limiting 300Hz
Test carried out under normal conditions



Tests carried out in accordance with 47CFR part 80.213

Ambient temperature 20 to 25 Deg C
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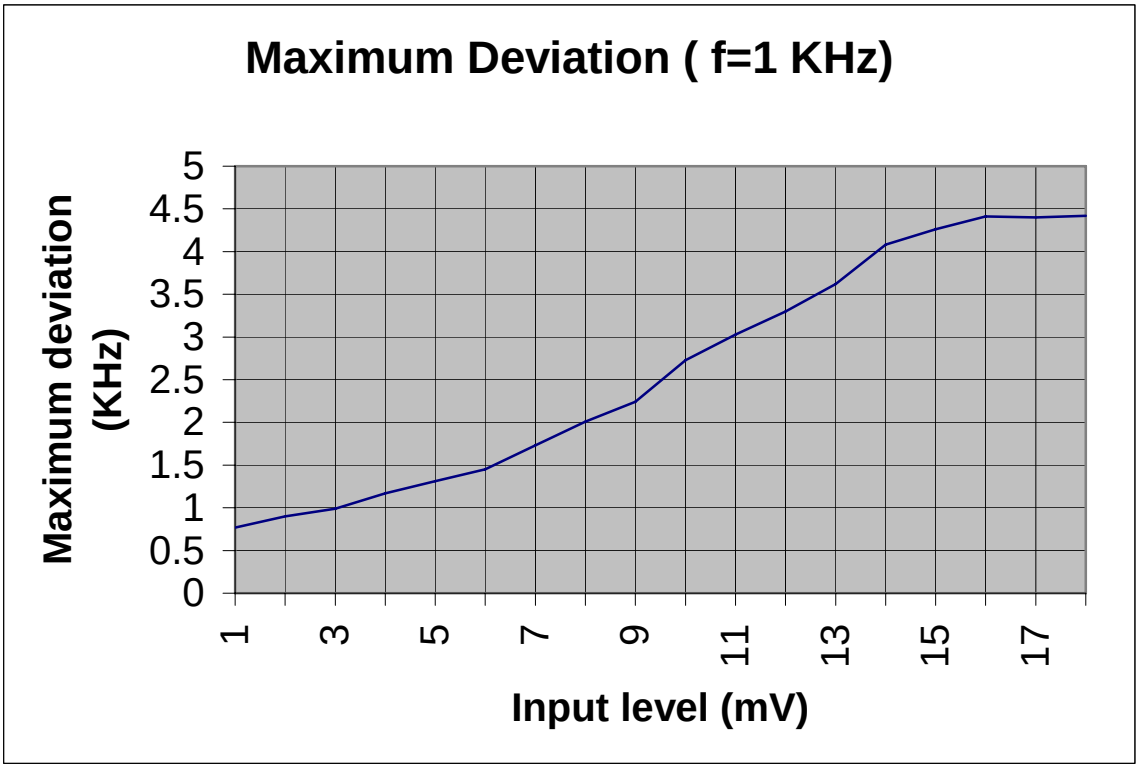
Modulation Limiting 1KHz
Test carried out under normal conditions



Tests carried out in accordance with 47CFR part 80.213

Ambient temperature 20 to 25 Deg C
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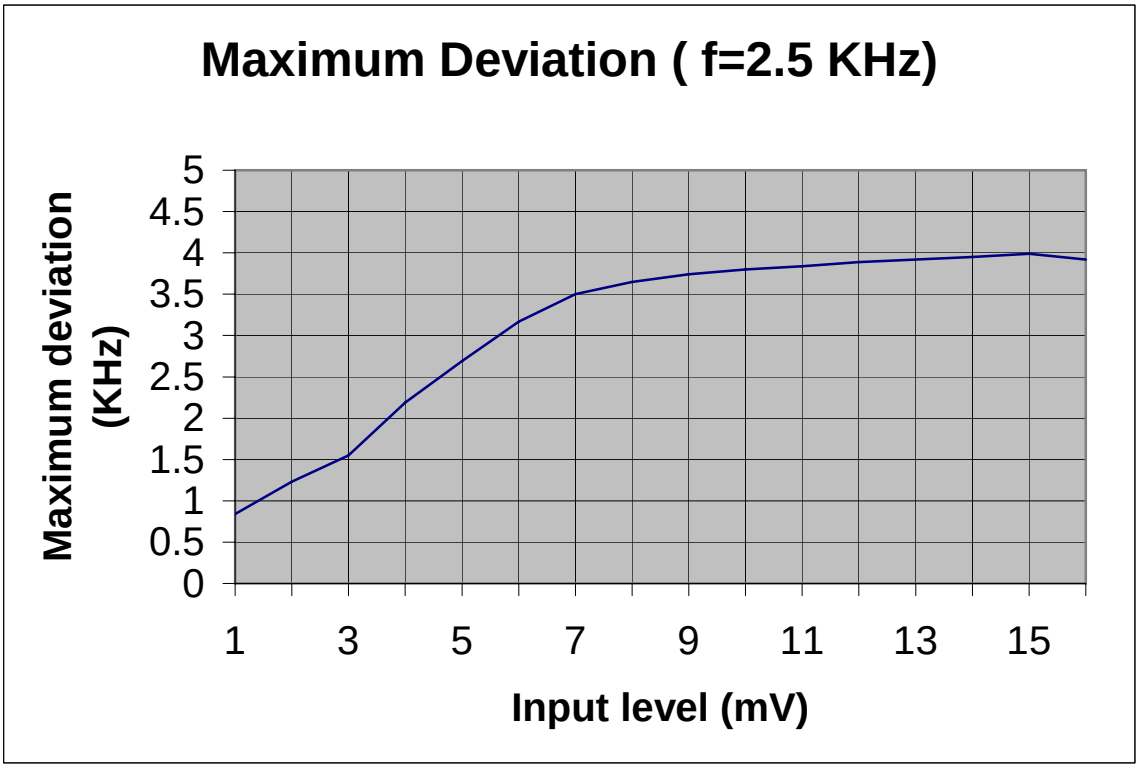
Modulation Limiting 2.5KHz
Test carried out under normal conditions



Tests carried out in accordance with 47CFR part 80.213

Ambient temperature 20 to 25 Deg C
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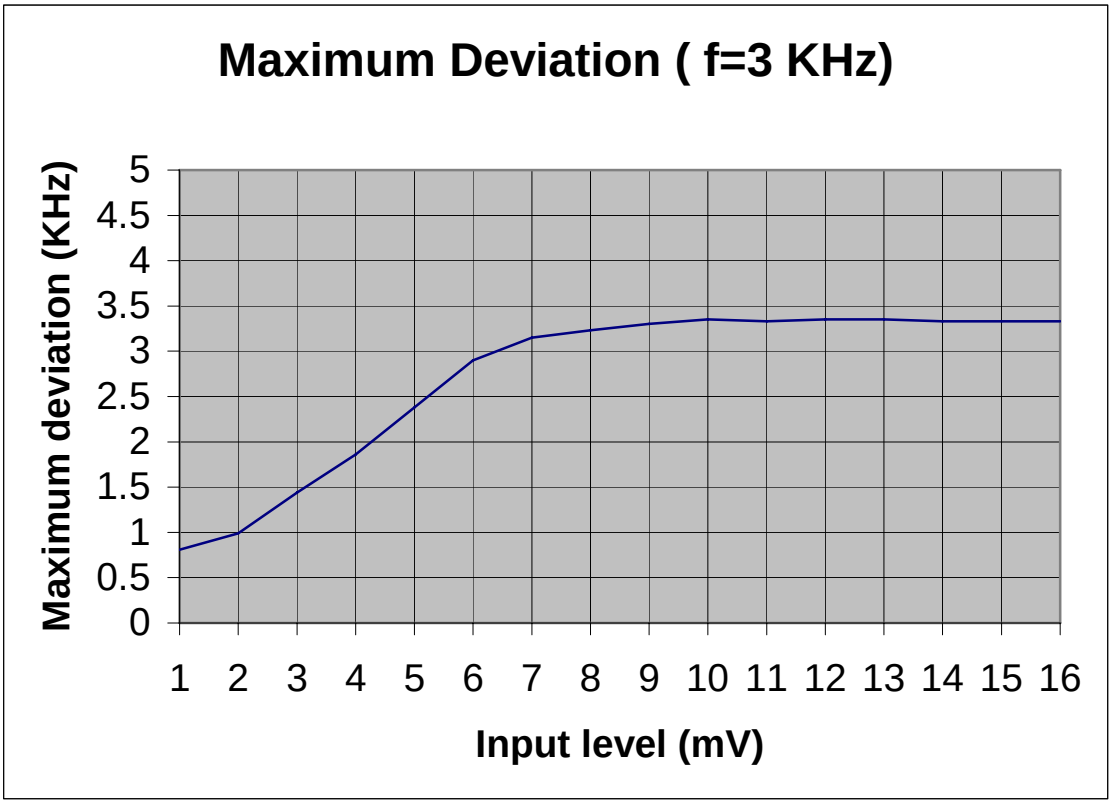
Modulation Limiting 3KHz
Test carried out under normal conditions



Tests carried out in accordance with 47CFR part 80.213

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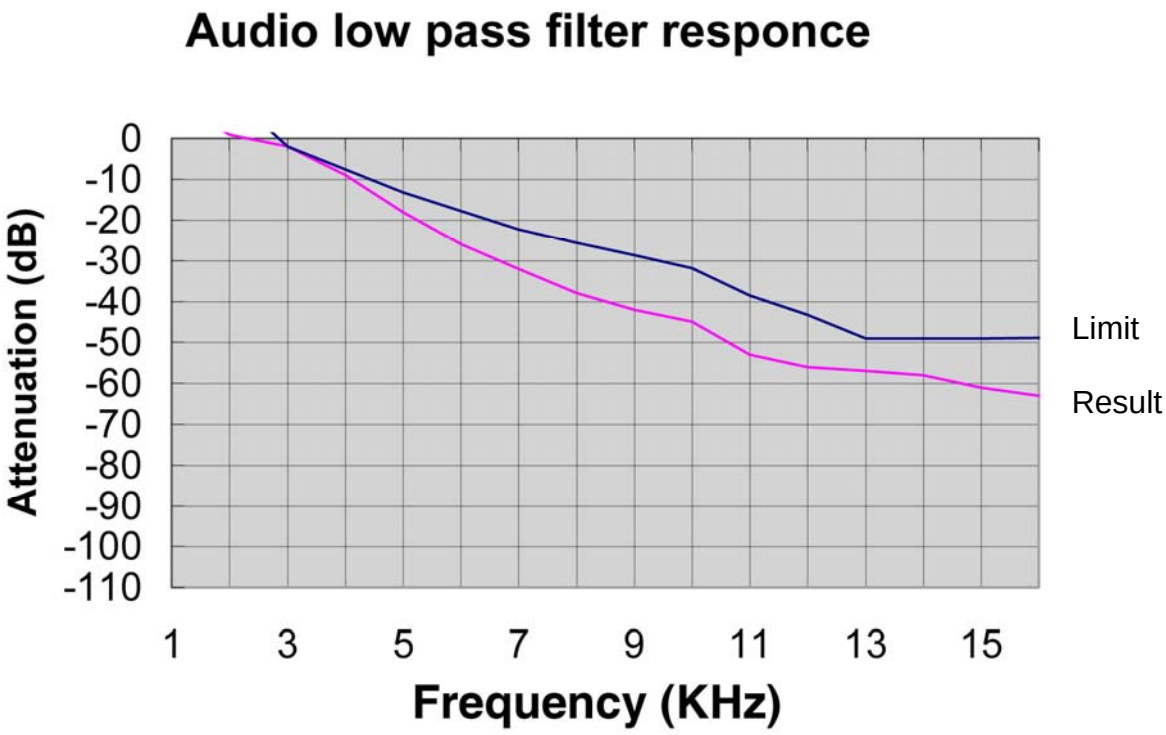
2.1047 (a) and 80.213 (e) Audio low pass filter.

The response of the audio low pass filter is shown below



Ambient temperature 20 to 25 Deg C
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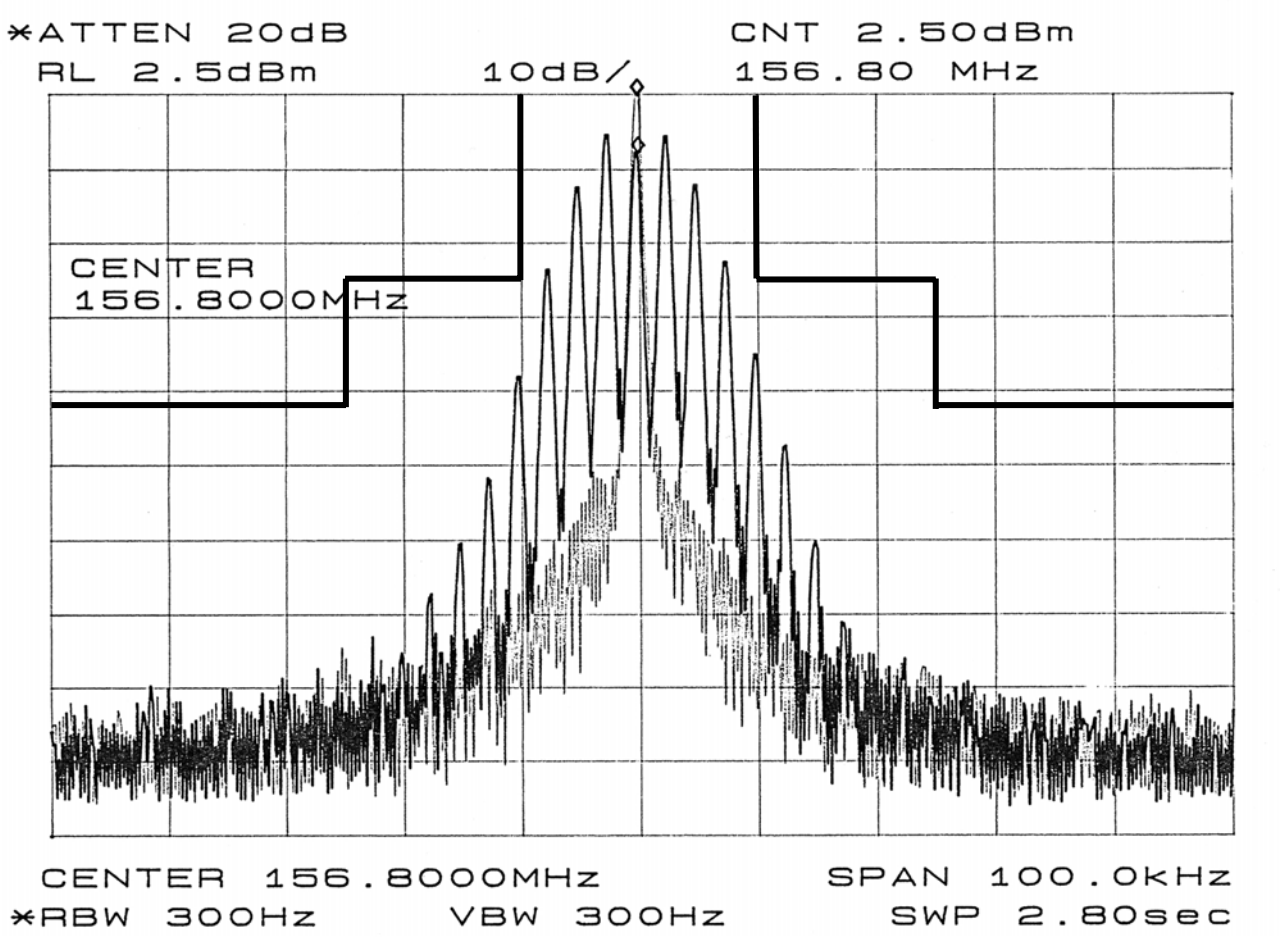
2.1049 (c) and 80.211 (f) Occupied bandwidth



Carrier with 2500Hz audio modulation only, 16K0G3E

The plots of the displayed sideband envelope of the transmitter taken from the display of an Agilent Spectrum analyser model 8594E.

Modulation corresponds to conditions of 2.1049 and consisted of 2500Hz to at an input level 16dB greater than that necessary to produce 50% modulation at 3KHz. The frequency of maximum response. Measured modulation under these conditions was 4.2KHz

Results obtained on high power (5Watt) setting

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2.1051 and 80.211 Spurious Emissions at the Antenna Terminals

The HT840 transmitter was tested for spurious emissions at the antenna terminals while the equipment was modulated with a 2500Hz signal, 16dB above minimum input signal for 50% (2.5KHz deviation) modulation at 3KHz.

Measurements were made with an Agilent spectrum analyser model 8594E through power attenuator. A notch filter was used to attenuate the carrier.

Throughout the tests the power was monitored and a DC power supply was used to maintain 7.4Volts.

Spurious emissions were measured between 3.5MHz (The lowest frequency generated inside the HT840 is 3.6864MHz) and 1600MHz

All emissions that were above the noise floor (88dB) were recorded

Conducted spurious emissions (1 Watt output)

Frequency MHz	Measured level (dB below carrier)	Limit (dB)
313.600	53	43
470.400	77	43
784.000	70	43
1097.600	80	43
Frequency	156.800MHz	
Measurement uncertainty (dB)	3	

Tests carried out in accordance with 47CFR part 80.211

Conducted spurious emissions (5 Watts output)

Frequency MHz	Measured level (dB below carrier)	Limit (dB)
313.600	62	50
470.400	69	50
784.000	77	50
1097.600	80	50
Frequency	156.800MHz	
Measurement uncertainty (dB)	3	

Tests carried out in accordance with 47CFR part 80.211

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2.1053(a) 80.211 Field Strength Measurements of Spurious Radiation.

Field strength measurements of radiated spurious emissions were made in an open air test site used for measurements to the ETSI standards.

Figures show the worst case in either the vertical or horizontal plane

Measurements were made from 3.5 to 1600MHz (The lowest frequency generated inside the HT840 is 3.6864MHz).

Frequency (MHz)	Measured level (dB below carrier)
21.250	100
270.200	110
675.500	102
945.700	104
Test frequency	156.800MHz
Measurement uncertainty (dB)	3

Limit 43+10log (5.1) = 50dBc

All other measurements better than 20dB outside limits

Results obtained on high power (5Watt) setting

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2.1055 and 80.209 Frequency Stability

Measurement of frequency stability versus temperature was made at temperatures from -20°C to +50°C at each temperature the unit under test was allowed to stabilize for 60 minutes.

The tests were carried out in a temperature chamber made by All Three Engineering Co Ltd (see separate submission)

The following Measurements were made at temperature and voltage extremes.

Temperature (°C)	Frequency (MHz)	Error (KHz)
-20	156.79994	-0.06
-10	156.79901	+0.01
0	156.79910	+0.10
10	156.79916	+0.16
20	156.79921	+0.21
30	156.80024	+0.24
40	156.80025	+0.25
50	156.80030	+0.30
Test voltage 7.4VDC	Temperature ±0.5°C	Limit ±1.568KHz

Supply Voltage	Frequency (MHz)	Error (KHz)
7.4	156.80023	+0.23
7.3	156.80023	+0.23
7.1	156.80020	+0.20
6.9	156.80010	+0.10
6.7	156.80003	+0.03
6.5	156.79995	-1.05
End Voltage 6.5V	Temperature 25°C	Limit ±1.568KHz

Results obtained on high power (5Watt) setting

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Description of Semiconductor Devices

Reference	Component	Part number	Description
D105	Diode	KDS122	Protection
D802,808	Diode	KDS226	Protection
D108,202	PIN Diode	KDS114	RF Switching
D402	Diode	KDS160	Isolation
D401	Vari-cap Diode	KDV154	Local Osc compensation
D500	Zener Diode	KDZ5.1V	Voltage reference APC
D303	Vari-cap Diode	1SV217	Frequency control
D304	Vari-cap Diode	1SV324	Modulation
D100, 101,201, D203	PIN Diode	HVC131	Antenna switching
D813-D820	LED Green	KP-2012SRC	Backlight
D901	Diode	DL4004	Reverse protection
D807	Bi-colour LED	YGUR302TM	TX/RX indicator
Q301,302	Transistor	2SC4901	VCO
Q101	Transistor	2SC4901	1st Amplifier
Q203	Transistor	2SC4226	Buffer
Q802	Transistor	KRA302	PTT control
Q106,305,500,801	Transistor	KRA305	Switching
Q502,803~806	Transistor	KRC404	Switching
Q602,	Transistor	KTC3875Y	VOX amplifier
Q105	Transistor	KTC3880Y	IF amplifier
Q103	FET	3SK240	Mixer
Q202	FET	2SK3475	RF driver
Q201,	FET	2SK3476	RF output
IC801	IC	Upd789418AGK	Microprocessor
IC101	IC	TA31136FN	IF and demodulator
IC401	IC	U2781B	PLL
IC901	IC	TDA7233D	Audio output
IC802	IC	TK71750SCL	5 Volt regulator
IC501	IC	TA75W01FU	Comparator APC
IC803	IC	AT24C08M SMD	EEPROM
IC601	IC	AK2342B	Audio processor

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Circuits and devices to determine and stabilise frequency.

The frequency is generated by a voltage controlled oscillator centred around Q301 and Q302 , The control being provided by PLL technology IC401 and referenced to a quartz crystal (X401 21.250MHz).

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Circuits to suppress spurious emissions, control modulation and power.

A. Circuits to suppress spurious emissions:
The spurious filter comprises L201, 202, 203, C201, 202, 203, 209, 215, and C220.

B. Modulation limiter:
The limiter and low pass filter circuit is part of IC601 (AK2342B)

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Test equipment used

Make	Model – serial number	Description	Calibration due date
Hewlett Packard	8920A - 3211A01798	RF Test set	17 November 2005
Hewlett Packard	8920A - 3612A07867	RF Test set	30 March 2006
Hewlett Packard	8594E – 8594A08678	Spectrum Analyzer	5 August 2006
Eaton	96005 - 2504	Log periodic	18 March 2007
Eaton	94455-1 – 1099	biconnical antenna	18 March 2007