

FCC CFR47 PART 15 SUBPART C CERTIFICATION TEST REPORT

FOR

POCKET PC PHONE

MODEL NUMBER: HSTNH-H06C

FCC ID: NM8HHH06C

REPORT NUMBER: 04T3106-1

ISSUE DATE: JANUARY 19, 2005

Prepared for HIGH TECH COMPUTER CORP. 1F, 6-3, BAU-CHIAN RD., HSINTIEN TAIPEI, 231 TAIWAN

Prepared by

COMPLIANCE CERTIFICATION SERVICES 561F MONTEREY ROAD MORGAN HILL, CA 95037, USA TEL: (408) 463-0885 FAX: (408) 463-0888

LAB CODE:200065-0

Revision History

Rev. Revisions

Revised By

Page 2 of 103

TABLE OF CONTENTS

1.	ATTESTATION OF TEST RESULTS	4
2.	TEST METHODOLOGY	5
3.	FACILITIES AND ACCREDITATION	5
4.	CALIBRATION AND UNCERTAINTY	5
4.	1. MEASURING INSTRUMENT CALIBRATION	5
4.	2. MEASUREMENT UNCERTAINTY	5
5.	EQUIPMENT UNDER TEST Error! Bookmark not defin	ed.
5.	1. DESCRIPTION OF EUT	6
5.	2. MAXIMUM OUTPUT POWER	6
5.	3. DESCRIPTION OF AVAILABLE ANTENNAS	6
5.	4. SOFTWARE AND FIRMWARE	6
5.	5. WORST-CASE CONFIGURATION AND MODE	7
5.	6. DESCRIPTION OF TEST SETUP	7
6.	TEST AND MEASUREMENT EQUIPMENT	.11
7.	LIMITS AND RESULTS	.12
7.	1. ANTENNA PORT CHANNEL TESTS	. 12
	7.1.1. 20 dB BANDWIDTH	. 12
	7.1.2. HOPPING FREQUENCY SEPARATION	. 16
	7.1.5. NOMBER OF HOFFING CHANNELS	23
	7.1.5. PEAK OUTPUT POWER	.30
	7.1.6. MAXIMUM PERMISSIBLE EXPOSURE	. 31
	7.1.7. AVERAGE POWER	. 34
	7.1.8. PEAK POWER SPECTRAL DENSITY	.35
	7.1.9. CONDUCTED SPURIOUS EMISSIONS	. 39
7.	2. CO-LOCATED MAXIMUM PERMISSIBLE EXPOSURE	. 48
7.	3. RADIATED EMISSIONS	. 51
	7.3.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS	.51
	7.3.2. TRANSMITTER RADIATED EMISSIONS ABOVE 1 GHZ	. 54
	7.3.4 WORST_CASE RADIATED EMISSIONS RELOW 1 GH ₇	.03 72
7	4 POWERLINE CONDUCTED EMISSIONS	. 12
/.		
8.	SETUP PHOTOS	.91

Page 3 of 103

1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	HIGH TECH COMPUTE 1F, 6-3, BAU-CHIAN RI TAIPEI, 231 TAIWAN	ER, CORP. D., HSINTIEN		
EUT DESCRIPTION:	POCKET PC PHONE			
MODEL:	HSTNH-H06C			
SERIAL NUMBER:	71			
DATE TESTED: December 15 - 30, 2004				
APPLICABLE STANDARDS				
STANDARD		TEST RESULTS		
FCC PART 15 SUBP	ART C	NO NON-COMPLIANCE NOTED		

Compliance Certification Services, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

Approved & Released For CCS By:

THU CHAN EMC SUPERVISOR COMPLIANCE CERTIFICATION SERVICES

Tested By:

VIEN TRAN EMC TECHCIAN COMPLIANCE CERTIFICATION SERVICES

Page 4 of 103

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2 and FCC CFR 47 Part 15.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <u>http://www.ccsemc.com</u>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Radiated Emission, 30 to 200 MHz	+/- 3.3 dB
Radiated Emission, 200 to 1000 MHz	+4.5 / -2.9 dB
Radiated Emission, 1000 to 2000 MHz	+4.5 / -2.9 dB
Power Line Conducted Emission	+/- 2.9 dB

Uncertainty figures are valid to a confidence level of 95%.

Page 5 of 103

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a Bluetooth transceiver with all auxiliary equipment as described below.

Auxiliary Equipment	Brand	Model No.
Li-Ion Rechargeable Battery	HP	HSTNH-D06B
AC Adaptor	Hi Pro	HP-AC010L63
AC adaptor	Delta	EADP-10BB
USB Cradle	HP	HSTNH-F02X
Earphone	Merry	EMC147-008
Y cable	HP	N/A
DC Connector	HP	N/A

The model number was changed after testing commenced. All data in this report is applicable to the model number documented in Section 1 above.

5.2. MAXIMUM OUTPUT POWER

Frequency Range	Output Power	Output Power
(MHz)	(dBm)	(mW)
2402 - 2480	1.09	1.29

2400 to 2483.5 MHz Authorized Band

The transmitter has a maximum peak conducted output power as follows:

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a Chip Antenna, with a maximum gain of 0 dBi.

5.4. SOFTWARE AND FIRMWARE

The test software utility and SIM card installed in the EUT during testing.

Page 6 of 103

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power. The highest measured output power was at 2402 MHz.

5.6. DESCRIPTION OF TEST SETUP

SETUP FOR RF WIRELESS TESTS

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST						
Description Manufacturer Model Serial Number FCC ID						
N/A						

I/O CABLES

I/O CABLE LIST							
Cable	Port	# of	Connector	Cable	Cable	Remarks	
No.		Identical	Туре	Туре	Length		
		Ports					
1	AC	1	US 115V	Un-shielded	2m	No	
2	DC	1	DC	Un-shielded	2m	No	

TEST SETUP

The EUT is a PDA unit and operates either standalone or connected to a PC via a cradle to USB port or USB interface cable. Test software exercised the EUT.

Page 7 of 103

SETUP DIAGRAM FOR TESTS



Page 8 of 103

SETUP FOR DIGITAL DEVICE TESTS

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST							
Description	Manufacturer	Model	Serial Number	FCC ID			
Mouse	HP	M-S34	LZA81054997	DZL211029			
Keyboard	HP	SK-2502	HR805273662	GYUR41SK			
Modem	ACEEX	1414	9013540	IFAXDM1415			
Printer	HP	2225C	2930852614	DSI6XU2225			
PC	HP	Vectra VL400 MT	US03763261	DoC			
Cradle	HP	HSTNH-F02X	E89760AZDQV3VO	NA			
Monitor	LTX	1451C	Z80-54704540	DBC1451C			

I/O CABLES

I/O CABLE LIST							
Cable	Port	# of	Connector	Cable	Cable	Remarks	
No.		Identical	Туре	Туре	Length		
		Ports					
1	AC	4	US115V	Un-shielded	2m	N/A	
2	Mouse	1	PS/2	Un-shielded	2m	N/A	
3	KB	1	PS/2	Shielded	2m	N/A	
4	Paralled	1	DB25	Shielded	2m	N/A	
5	Serial	1	DB9	Shielded	1m	N/A	
6	Video	1	DB15	Shielded	2m	One Torroid on each end	
7	USB	1	USB	Un-shielded	2m	Connect EUT to PC	

TEST SETUP

The EUT is installed in the cradle. The cradle is connected to a laptop computer system with minimum configuration during the tests. Test software exercised and linked with the EUT.

Page 9 of 103

SETUP DIAGRAM FOR DIGITAL DEVICE TESTS (WORST CASE)



Page 10 of 103

6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST							
Description	Manufacturer	Model	Serial Number	Cal Due			
Power Meter	HP	436A	2709A29209	7/15/2005			
Oscilloscope, 100MHz 4Ch.	HP	54601A	3106A00123	11/6/05			
Signal Generator, 2 ~ 40 GHz	R & S	SMP04	DE 34210	5/25/05			
Temperature / Humidity Chamber	Thermotron	SE 600-10-10	29800	4/26/05			
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	6717	2/4/05			
LISN, 10 kHz ~ 30 MHz	FCC	50/250-25-2	114	10/13/05			
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	837990	10/13/05			
EMI Test Receiver	R & S	ESHS 20	827129/006	7/17/05			
Line Filter	Lindgren	LMF-3489	497	CNR			
Spectrum Analyzer	Agilent	E4446A	US42070220	1/13/05			
Preamplifier, 1 ~ 26 GHz	Miteq	NSP10023988	646456	4/25/05			
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	9001-3245	2/4/05			
30MHz 2Ghz	Sunol Sciences	JB1 Antenna	A121003	9/21/05			
EMI Receiver, 9 kHz ~ 2.9 GHz	HP	8542E	3942A00286	11/21/05			
Power Meter	HP	436A	2709A29209	7/15/2005			
Oscilloscope, 100MHz 4Ch.	HP	54601A	3106A00123	11/6/05			
Microwave Detector 0.01 ~ 50 GHz	Agilent	8474C	2905A04047	11/7/05			
RF Filter Section	HP	85420E	3705A00256	11/21/05			

Page 11 of 103

7. LIMITS AND RESULTS

7.1. ANTENNA PORT CHANNEL TESTS

7.1.1. 20 dB BANDWIDTH

<u>LIMIT</u>

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 1% to 3% of the 20 dB bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled.

RESULTS

No non-compliance noted:

Channel	Frequency	20 dB Bandwidth
	(MHz)	(kHz)
Low	2402	700
Middle	2441	700
High	2480	697

Page 12 of 103

20 dB BANDWIDTH



Page 13 of 103



Page 14 of 103



Page 15 of 103

7.1.2. HOPPING FREQUENCY SEPARATION

<u>LIMIT</u>

§15.247 (a) (1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping channel, whichever is greater.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

RESULTS

No non-compliance noted:

Page 16 of 103

HOPPING FREQUENCY SEPARATION



Page 17 of 103

7.1.3. NUMBER OF HOPPING CHANNELS

<u>LIMIT</u>

15.247 (a) (1) (iii) Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to 1 % of the span. The analyzer is set to Max Hold.

RESULTS

No non-compliance noted:

79 Channels observed.

Page 18 of 103

NUMBER OF HOPPING CHANNELS



Page 19 of 103



Page 20 of 103



Page 21 of 103



Page 22 of 103

7.1.4. AVERAGE TIME OF OCCUPANCY

<u>LIMIT</u>

15.247 (a) (1) (iii) Frequency hopping systems in the 2400 - 2483.5 MHz band shall use at least 15 nonoverlapping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

RESULTS

No non-compliance noted:

DH Packet	Pulse Width	Number of Pulses in	Average Time of	Limit	Margin
		3.16 seconds	Occupancy		
	(msec)		(sec)	(sec)	(sec)
1	0.4183	32	0.134	0.4	0.266
3	1.667	16	0.267	0.4	0.133
5	2.925	11	0.322	0.4	0.078

DH1 PACKET

PULSE WIDTH



Page 24 of 103

NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



Page 25 of 103

DH3 PACKET

PULSE WIDTH



Page 26 of 103

NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



Page 27 of 103

DH5 PACKET

PULSE WIDTH



Page 28 of 103

NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



Page 29 of 103

7.1.5. PEAK OUTPUT POWER

PEAK POWER LIMIT

§15.247 (b) The maximum peak output power of the intentional radiator shall not exceed the following:

§15.247 (b) (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels: 1 watt.

\$15.247 (b) (4) Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is 0 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

The transmitter output is connected to a Peak Power Meter.

RESULTS

No non-compliance noted:

Channel	Frequency	Peak Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	1.02	30	-28.98
Middle	2441	0.87	30	-29.13
High	2480	1.09	30	-28.91

Page 30 of 103

7.1.6. MAXIMUM PERMISSIBLE EXPOSURE

LIMITS

\$1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
(A) Lim	its for Occupational	I/Controlled Exposu	res	
0.3–3.0 3.0–30	614 1842/f	1.63 4.89/f	*(100) *(900/f²)	6
30–300 300–1500 1500–100 000	61.4	0.163	1.0 f/300 5	6 6 8
(B) Limits	for General Populati	ion/Uncontrolled Ex	posure	-
0.3–1.34	614 824 <i>/</i> f	1.63 2.19/f	*(100) *(180/f ²)	30 30

TABLE 1-LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

TABLE 1-LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)-Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
30–300 300–1500 1500–100,000	27.5	0.073	0.2 f/1500 1.0	30 30 30

f = frequency in MHz

* = Plane-wave equivalent power density NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occu-

pational/controlled limits apply provided he or she is made aware of the potential for exposure. NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be ex-posed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

Page 31 of 103

CALCULATIONS

Given

 $E = \sqrt{(30 * P * G)} / d$

where

and

E = Field Strength in Volts/meter

P = Power in Watts

 $S = E^{2}/3770$

G = Numeric antenna gain

d = Distance in meters

S = Power Density in milliwatts/square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

 $d = \sqrt{((30 * P * G) / (3770 * S))}$

Changing to units of Power to mW and Distance to cm, using:

P(mW) = P(W) / 1000 and d(cm) = 100 * d(m)

yields

 $d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$ $d = 0.282 * \sqrt{(P * G / S)}$

where

d = distance in cm P = Power in mW G = Numeric antenna gain S = Power Density in mW/cm^2

Substituting the logarithmic form of power and gain using:

P (mW) = 10 ^ (P (dBm) / 10) and G (numeric) = 10 ^ (G (dBi) / 10) yields $d = 0.282 * 10 ^ ((P + G) / 20) / \sqrt{S}$ Equation (1) where d = MPE distance in cm P = Power in dBm G = Antenna Gain in dBi $S = Power Density Limit in mW/cm^2$

Equation (1) and the measured peak power is used to calculate the MPE distance.

Page 32 of 103

LIMITS

From §1.1310 Table 1 (B), S = 1.0 mW/cm^2

RESULTS

No non-compliance noted:

Power Density	Output	Antenna	MPE	
Limit	Power	Gain	Distance	
(mW/cm^2)	(dBm)	(dBi)	(cm)	
1.0	1.23	0.00	0.32	

NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.

Page 33 of 103

7.1.7. AVERAGE POWER

AVERAGE POWER LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

No non-compliance noted:

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency	Average Power	
	(MHz)	(dBm)	
Low	2402	-3.93	
Middle	2441	-4.00	
High	2480	-3.75	

Page 34 of 103

7.1.8. PEAK POWER SPECTRAL DENSITY

<u>LIMIT</u>

§15.247 (d) For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

\$15.247 (f) The digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer, the maximum level in a 3 kHz bandwidth is measured with the spectrum analyzer using RBW = 3 kHz and VBW > 3 kHz, sweep time = span / 3 kHz, and video averaging is turned off. The PPSD is the highest level found across the emission in any 3 kHz band.

RESULTS

No non-compliance noted:

Channel	Frequency	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	-9.68	8	-17.68
Middle	2441	-9.73	8	-17.73
High	2480	-9.11	8	-17.11

Page 35 of 103

PEAK POWER SPECTRAL DENSITY



Page 36 of 103


Page 37 of 103



Page 38 of 103

7.1.9. CONDUCTED SPURIOUS EMISSIONS

LIMITS

§15.247 (c) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in§15.205(a), must also comply with the radiated emission limits specified in §15.205(a).

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

RESULTS

No non-compliance noted:

Page 39 of 103

SPURIOUS EMISSIONS, LOW CHANNEL



Page 40 of 103



Page 41 of 103

SPURIOUS EMISSIONS, MID CHANNEL



Page 42 of 103



Page 43 of 103

SPURIOUS EMISSIONS, HIGH CHANNEL



Page 44 of 103

HIGH (CHANNI	EL SPU	RIOUS						
🔆 Agiler	nt 15:28:55	Dec 10, 200)4					Т	Marker
Ret 10 dB #Peak	lm	Atten 10 d	B			Mk	ar3 4.9 -37.51	6 GHz dBm	Select Marker 1 2 <u>3 4</u>
Log 10									Marker Trace <u>Auto 1 2 3</u>
11 dB DI									Readout, Frequency
-19.7 dBm LgAv	and a start and a start and a start a s		Munanin Mur		no la proposición	9,4**********	Aldren parterned	r walker a	Marker Table <u>On O:f</u>
Start 30 N	/Hz			·		Sto	p 26.0	0 GHz	
#Res BW	100 kHz		#VBW 300	kHz	Sweep	2.482	s (601	pts)	Marker All Cif
Marker 1 2 3	Trace (1) (1) (1)	Type Fieq Fieq Fieq	X 2 3 4	Axis .50 GHz .32 GHz .96 GHz		-5- -3	Amplitud 0.41 dBr 4.38 dBr 7.51 dBr	de m n n	
									More 2 ct 2
Copyright	2000-2003 A	gilent Techn	ologies						

Page 45 of 103

SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



Page 46 of 103



Page 47 of 103

7.2. **CO-LOCATED MAXIMUM PERMISSIBLE EXPOSURE**

LIMITS

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
(A) Lim	its for Occupational	I/Controlled Exposu	res	
0.3–3.0 3.0–30 30–300 300–1500 1500–100,000	614 1842/f 61.4	1.63 4.89/f 0.163	*(100) *(900/f²) 1.0 f/300 5	6 6 6 6 8
(B) Limits	for General Populati	ion/Uncontrolled Exp	posure	
0.3–1.34	614 824 <i>f</i> f	1.63 2 19#	*(100) *(180/f ²)	30 30

TABLE 1-LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

TABLE 1-LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)-Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
30–300 300–1500 1500–100,000	27.5	0.073	0.2 f/1500 1.0	30 30 30

f = frequency in MHz
 * = Plane-wave equivalent power density NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occu-pational/controlled limits apply provided he or she is made aware of the potential for exposure. NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be ex-posed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

Page 48 of 103

CALCULATIONS

Given

 $E = \sqrt{(30 * P * G)} / d$

where

and

E = Field Strength in Volts/meter

P = Power in Watts

 $S = E^{2}/3770$

G = Numeric antenna gain

d = Distance in meters

S = Power Density in milliwatts/square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

 $d = \sqrt{((30 * P * G) / (3770 * S))}$

Changing to units of Power to mW and Distance to cm, using:

P (mW) = P (W) / 1000 andd (cm) =100 * d (m) $d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$ $d = 0.282 * \sqrt{(P * G / S)}$

where

vields

d = distance in cm P = Power in mW G = Numeric antenna gain S = Power Density in mW/cm^2

For multiple colocated transmitters operating simultaneously the total power density can be calculated by summing the Power * Gain product of each transmitter.

yields

 $d = 0.282 * \sqrt{((P1 * G1) + (P2 * G2) + ... + (Pn * Pn)) / S)}$ Equation (1) where d = distance in cmPx = Power of transmitter x in mWGx = Numeric gain of antenna x $S = \text{Power Density in mW/cm^{2}}$

Page 49 of 103

In the table below, Power and Gain are entered in units of dBm and dBi respectively, then these are converted to their linear forms prior to the summation function.

The conversions from the logarithmic form of power and gain are made using:

$P(mW) = 10 \wedge (P(dBm) / 10)$ and	Equation (2)
G (numeric) = $10 \land (G (dBi) / 10)$	Equation (3)

Equations (1), (2) and (3) and the measured peak powers are used to calculate the MPE distance.

<u>LIMITS</u>

From \$1.1310 Table 1 (B), S = 1.0 mW/cm²

RESULTS

No non-compliance noted:

Mode	Power Density	Output	Antenna	MPE
	Limit	Power	Gain	Distance
	(mW/cm^2)	(dBm)	(dBi)	(cm)
Bluetooth				
802.11g				
Combined	1.0			0.40

NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.

Page 50 of 103

7.3. RADIATED EMISSIONS

7.3.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS

LIMITS

§15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	$(^{2})$
13.36 - 13.41			

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² Above 38.6

§15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

Page 51 of 103

§15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

Page 52 of 103

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each 5 GHz band.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

SUPPLEMENTAL TEST PROCEDURE FOR CO-LOCATED TRANSMITTERS

The dominant transmitter is set to the worst case channel. The spurious emissions performance of the dominant transmitter is investigated as the settings of the non-dominant transmitter are varied. The spectrum is searched for intermodulation products. Worst-case results are reported.

Page 53 of 103

7.3.2. TRANSMITTER RADIATED EMISSIONS ABOVE 1 GHZ

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



Page 54 of 103

🔆 Agilent 10:00:	:12 Dec 15, 2004	Т	Trace
Ret 117 dBµV	#Atten 0 dB	Mkr1 2.365 47 GH: 43.74 dBµ∖	Trace
Log			
10 dB/			Clear Write
dB			Max Hold
54.0 dBμV LgAv			Min Hold
V1 S2 S3 FC		1 	View
¤it): FTun Swp			Blank
Start 2.310 00 GH	z #VBW 10 H;	Stop 2.390 00 GHz Sweep 6.238 s (601 pts)	z

Page 55 of 103

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



Page 56 of 103

🔆 Agilent 09:56:	:14 Dec 15, 2004			Т	Peak Search
Ref 117 dBµV	#Atten 0 dB	 	Akr1 2.360 40 43.66 d	GHz BµV	Next Peak
log					
10 1B/					Next Pk Right
Offst					
iB					Next Pk Lett
iΒµV					Min Search
.gAv					- Will Ocarci
/1 S2					DI: DI: O
\$3 FC		 1 ◊			PK-PK Search
41):					
Tun Swp					Mkr © C
Start 2.310 00 GH	Ζ		Stop 2.390 00	GHz	More 1 ct 2

Page 57 of 103

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



Page 58 of 103

🔆 Agilent 10:03:1	9 Dec 15, 2004		Т	Peak Search
Ref 117 dBµV	#Atten 0 dB	M	kr1 2.483 50 GHz 44.51 dBµ∨	Next Peak
l0 IB/				Next Pk Right
Dffst 60 IB				Next Pk Leit
)I i4.0 IBµV				Min Search
.gAv /1 S2				 Pk Pk Search
11):				
Swp				Mkr © C
Start 2.483 50 GHz Res BW 1 MHz	#VBW 10	Hz Sweep	itop 2.500 00 GHz 1.287 s (601 pts)	More 1 ct 2

Page 59 of 103

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



Page 60 of 103

🔆 Agilent 10:02:	43 Dec 15, 2004			Т	Peak Search
<mark>Ref 117 dB</mark> µV ∕Peak	#Atten 0 dB		Mkr1 2.483 44.5	50 GHz 51 dBμV	Next Peak
Log IO IB/					Next Pk Right
					Next Pk Lett
04.0 ΙΒμV .gAv					Min Search
/1 S2					Pk-Pk Search
(1): Tun Swp					Mkr © C
Start 2.483 50 GH; Res BW 1 MHz	z #VI	3W 10 Hz	Stop 2.500 Sweep 1.287 s (6)	00 GHz	More 1 ct 2

Page 61 of 103

HARMONICS AND SPURIOUS EMISSIONS

Company EUT Des EUT M/I	y: HIGH crip.: Pl N: HSTN	I TECH CO DA WITH H NH-H06C	MPUTER BLUETOOTI	ł											
l est Tar Mode Op	get: 15.2 oer: TX	4/													
FMCC	ipment:	18GHz	Pre-am	lifer 1-26	6GHz	Р	re-amplifer	26-400	GHz		Horn >1	8GHz			
T60; S/	N: 2238 (@3m 🗸	T63 Mit	eq 64645	6 -				Ŧ				-		
Hi Frequ 2 fo	uency Cable ot cable	es 3 foo	t cable	4 foot c	able	12	foot cable		1	IPF	Rejec	et Filter		<u>Peak Measu</u> RBW=VBW	irements /=1MHz
2_Vi	en	-	-		-	12_	Vien	•	HPF_4	I.0 GHz		Ŧ		<u>Average Me</u> RBW=1MH	z ; VBW=10Hz
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
JOW CH	2402MH	z 61.1	41.9	33.0	3.1	-35.5	0.0	0.6	62.2	43.0	74	54	-11.8	-11.0	v
.200	3.0	47.3	34.4	35.8	3.7	-34.9	0.0	0.6	52.5	39.6	74	54	-21.5	-14.4	v v
.804	3.0	55.4 37.3	40.6 33.8	33.0 35.8	3.1 3.7	-35.5 -34.9	0.0 0.0	0.6 0.6	56.5 42.5	41.7 39.0	74 74	54 54	-17.5 -31.5	-12.3 -15.0	<u>н</u> Н
AID CH 2	2442MH	z													
.882	3.0	63.0	43.0	33.0	3.1	-35.5	0.0	0.6	64.2	44.2	74	54	-9.8	-9.8	V
.323	3.0	46.9	33.5	35.9	3.7	-34.8	0.0	0.6	52.4 62.1	39.0 43.9	74	54 54	-21.6	-15.0	<u> </u>
.323	3.0	43.5	32.0	35.9	3.7	-34.8	0.0	0.6	49.0	37.5	74	54	-25.0	-16.5	н
II CH 24	80MHz														
1.960	3.0	60.0	42.6	33.0	3.1	-35.5	0.0	0.6	61.3	43.9	74	54	-12.7	-10.1	V
960	3.0	46.8	33.0	36.1	3.8	-34.7	0.0	0.6	52.6	38.8	74	54	-21.4	-15.2	<u> </u>
.440	3.0	48.0	32.6	36.1	3.8	-34.7	0.0	0.6	53.8	38.4	74	54	-20.2	-15.6	н
	f Dist Read AF CL	Measurem Distance to Analyzer R Antenna Fa Cable Loss	ent Frequenc Antenna Reading actor	у		Amp D Corr Avg Peak HPF	Preamp C Distance Average Calculate High Pas	Gain Correc Field S ed Peal s Filte	ct to 3 mete Strength @ k Field Stre r	ers 3 m ngth		Avg Lim Pk Lim Avg Mar Pk Mar	Average I Peak Fiel Margin v Margin v	Field Strengt d Strength L s. Average L s. Peak Limi	h Limit imit imit t

Page 62 of 103

7.3.3. CO-LOCATED TRANSMITTER RADIATED EMISSIONS

RESULTS

No non-compliance noted:

The dominant transmitter is the Bluetooth.

WORST-CASE RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



Page 63 of 103

*		L	Freq/Channel
Ref 117 dBµV #Peak	#Atten 0 dB	Mkr1 2.390 00 GHz 43.00 dBµ∨	Certer Freq 2.35000000 GHz
Log 10 dB/			Start Freq 2.31000000 GHz
			Stop Freq 2.39000000 GHz
54.0 1ΒμV			CF Step 8.0000000 MHz
/1 S2			Freq Clfset
(1): Tun Swp			Signal Track On <u>Q:f</u>
Start 2.310 00 GHz	2 #VBW 10 H	Stop 2.390 00 GHz	

Page 64 of 103

WORST-CASE RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



Page 65 of 103

*		L	Freq/Channel
Ref 117 dBµV ∕Peak	#Atten 0 dB	Mkr1 2.389 87 GHz 43.00 dBµ∨	Certer Freq 2.35000000 GHz
Log 10 1B/			Start Freq 2.31000000 GHz
19.9 IB			Stop Freq 2.39000000 GHz
i4.0 ΙΒμV _çAv			CF Step 8.0000000 MHz Auto Ma
/1 S2			Freq Clfset 0.00000000 Hz
(1): Tun			Signal Track On <u>Cif</u>
Start 2.310 00 GHz	#VBW 10 H	Stop 2.390 00 GHz	

Page 66 of 103

WORST-CASE RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



Page 67 of 103

* <u>.</u>	Lorrie ILD, Avo	(IIOIIZOIItal)	L Freq/Channel
Ref 117 dBµV #Peak	#Atten 0 dB	Mkr1 2.487 93 42.77 (GHz 1BµV 2.49175000 GHz
Log 10 dB/			Start Freq 2.48350000 GHz
30 dB DI			Stop Freq 2.5000000 GHz
54.0 dBμV LgAv			CF Step 1.6500000 MHz <u>Auto Man</u>
V1 S2 S3 FC			Freq Clfset 0.00000000 Hz
¤(I): FTun Swp			Signal Track ^{On <u>Q</u>!f}
Start 2.483 50 GH #Res BW 1 MHz	z #VBW 10	Stop 2.500 00 Iz Sweep 1.287 s (601	GHz [^] pts)

Page 68 of 103

WORST-CASE RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



Page 69 of 103

*		L	Freq/Channel
Ref 117 dBµV #Peak	#Atten 0 dB	Mkr1 2.483 94 GHz 42.86 dBμ∨	Certer Freq 2.49175000 GHz
_og 10 1B/			Start Freq 2.48350000 GHz
			Stop Freq 2.5000000 GHz
54.0 ΙΒμV _gAv			CF Step 1.6500000 MHz Auto Mar
/1 S2 53 FC 1			Freq Clifset 0.00000000 Hz
r(1): :Tun Swp			Signal Track ^{On <u>Q</u>:f}
Start 2.483 50 GHz Res BW 1 MHz	#VBW 10 H:	Stop 2.500 00 GHz z Sweep 1.287 s (601 pts)	

Page 70 of 103

WORST-CASE HARMONICS AND SPURIOUS EMISSIONS

Compliance Certification Services, Morgan Hill Open Field Site Test Eng: Vien Tran Project #: 04T3106-3 Company: HIGH TECH COMPUTER EUT Descrip: PDA WITH BLUETOOTH EUT MN: HSTNH-H0GC Test Target: FCC 15.247 Mode Oper: Dominant Bluetooth_ Tx at worst channel & GSM TX for Non-dominant channel Test Equipment: Ext Equipment: Pre-amplifer 1.26GHz Horn > 18GHz Pre-amplifer 1.26GHz 105 S/N: 2238 @3m 105 S/N: 2238 @3m Fre-amplifer 1.26GHz Pre-amplifer 26-40GHz Horn > 18GHz FCC 15 116 Frequency Cobies 3 footcable 4 footcable 12 footcable HPF Reject Filter REW=VEW=1 117 Frequency Cobies 3 footcable 4 footcable 12 footcable HPF Reject Filter REW=10H1z; 116 Frequency Cobies 3 footcable 4 footcable 12 footcable HPF Reject Filter REW=10H1z; 117 frequency Cobies 3 footcable 4 footcable 12 footcable HPF 4.0GHz Negative deale REW=10H1z; 118 frequency 3 footcable 4 footcable 12 footcable 12 footcable Negative deale Negative deale <td< th=""><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th>ent</th><th>Measurem</th><th>Frequency</th><th>High</th><th>12/21/04</th></td<>													ent	Measurem	Frequency	High	12/21/04	
The set Eng: Vien Trans Troject F: 04T3106-3 Sompany: HICH TECH COMPUTER SUT Descrip: PDA WITH BLUETOOTH SUT MN: HSTNH-HOGC Test Target: FCC 15.247 Mode Oper: Dominant Bluetooth_Tx at worst channel & GSM TX for Non-dominant channel Test Equipment: EMCO Horn 1-18GHz To3 Mileq 646456 To3 Mileq										l Site	en Field	fill Op	organ l	Services, M	tification \$	nce Ce	Complia	
by the set is 04T3106-3 : Company: HIGH TECH COMPUTER UUT MN: HSTNH-BOGC Test Target: FCC 15.247 Jode Oper: Dominant Bluetooth_Tx at worst channel & GSM TX for Non-dominant channel Test Equipment: Test Equipment: TG3 Mileq 646456 TG3 Mileq 74 TG3 Mileq MB															Tran	gr: Viei	est En	
$ \begin{array}{c} \mbox{Suppary: HIGH TECH COMPUTER} \\ \mbox{Suppary: Suppary: Suppary: Suppary: Suppary: Suppary: Suppary: HIGH TECH COMPUTER} \\ Suppary: S$.06-3	≠: 04T3	roject	
$ \begin{array}{c} Bit Descrip: PDA with BDD Floor In EUP Floor Floor In EUP Floor Floor In EUP Floor Floor$													ן דים	OMPUTER	I TECH C	y: HIG	lompan TUT Do	
Peet Target: FCC 15.247 Jode Oper: Dominant Eluetooth_ Tx at worst channel & GSM TX for Non-dominant channel Pre-amplifer 1-26GHz Horn > 18GHz Pre-amplifer 1-26GHz Horn > 18GHz Pre-amplifer 1-26GHz Pre-amplifer 26-40GHz Horn > 18GHz Pre-amplifer 1-26GHz Preak Measure <th co<="" td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>711</td><td>BLUEIOG</td><td>NH-HO6C</td><td>N: HST</td><td>EUT M</td></th>	<td></td> <td>711</td> <td>BLUEIOG</td> <td>NH-HO6C</td> <td>N: HST</td> <td>EUT M</td>													711	BLUEIOG	NH-HO6C	N: HST	EUT M
Jode Oper: Dominant Elheototh_ Tx at worst channel & GSM TX for Non-dominant channel Set Equipment: EMCO Horn 1.18GHz Pre-amplifer 1.26GHz Horn > 18GHz Pre-amplifer 26-40GHz Horn > 18GHz Toi; S/N: 2238 @3m Pre-amplifer 1.26GHz Pre-amplifer 26-40GHz Horn > 18GHz Peak Measur 2 foot cable 3 foot cable 12 foot cable HPF Reject Filter Peak Measur Colspan="2">Peak Measur Peak Measur 1 Jot cable 12 foot cable Peak Measur 2 foot cable 3 foot cable Peak Measur 2 foot cable Peak Measur 12 foot cable Peak Measur Quarter colspan="2">Peak Measur Measurement Frequency AF CL Peak Measur Adv Peak Measur Measurement Frequency Amp Pereamp Gain Arecard Main															C 15.247	get: F(est Ta	
Set Equipment: IMCO Horn 1.18 GHz Pre-amplifer 1.26 GHz Horn > 18 GHz FCC 16 To 3 Mizeq 646456 Pre-amplifer 26-40 GHz Horn > 18 GHz FCC 16 TH Frequency Cable 3 fixed cable 12 foot cable HPF Reject Filter Peak Measure RBW=10Hz; To transmitter to t							channel	dominant	or Non	SM TX fo	nel & G	t chan	at wors	uetooth_ Tx	minant Blu	per: De	/lode ()	
Test Equipment: Pre-amplifer 1-26GHz Pre-amplifer 26-40GHz Horn > 18GHz FCC 18 To 3 Mileq 646456 Pre-amplifer 26-40GHz Horn > 18GHz Pre-amplifer 26-40GHz FCC 18 To 3 Mileq 646456 Pre-amplifer 26-40GHz Horn > 18GHz Pre-amplifer 26-40GHz FCC 18 Pre-amplifer 26-40GHz HPF Reject Filter Peak Measur Point all foot cable 12 foot cable Peak Measur IPF 4 JGHz Peak Measur Measure Peak Measure GHz (m) dB v dB v Peak Measure Mead Prk Read Avg AF CL And Bb BB v Avg Pk Lim Avg Mar Avg Mar Mage Chaine D Corr Flat Peak Avg Pk Lim Avg Mar <th colspan="</td> <td></td>																		
EMCO Horn 1-18GHz Pre-amplifer 1-26GHz Pre-amplifer 26.40GHz Horn > 18GHz FCC 12 T60; S/N: 2238 @3m T63 Miteq 646456 T63 Miteq 646456 FCC 12 FCC 12 H Frequency Cables 3 footcable 4 footcable 12 footcable HPF Reject Filter Rewer Warm 1 S.Chin 4 footcable 12 footcable 12 footcable HPF Reject Filter Average Measure RBW=1MHz; f Dist Read Pk Read Avg AF CL Amp D Corr Flt Peak Avg Pk Lin Avg Lin Pk Mar Avg Mar GHz (n) dBuV dBuV dB dB dB dB dBuV/m dBuV/m dB dB dB g82 3.0 60.8 42.4 33.0 4.1 -35.5 0.0 0.6 63.1 44.7 74 54 -10.9 -9.3 323 3.0 45.7 32.7 35.9 5.9 -34.8 0.0 0.6 63.1 44.7 74 54 -13.2 -11.4 323 </td <td></td> <td><u>.</u></td> <td>tipmen</td> <td>est Eq</td>															<u>.</u>	tipmen	est Eq	
Fre-amputer 1-20 GHz T60; S/N: 2238 @3m T63 Miteq 646456 Fre-amputer 1-20 GHz Peak Measure RBW=10 Hz; 1	Limit	Li			18GHz	Horn >		9TT	- 26 40	overlife		COTL.	210 - 1 - 6	2				
T63 Miteq 646456 For the frequency Cables 2 foot cable 3 foot cable 4 foot cable 12 foot cable 12 foot cable HPF Reject Filter Peak Measure RBW=VBW=: f Dist Read Pk Read Avg AF CL Amp D Corr Fitr Peak Avg Pk Mar Avg Mar gHz (m) dBuV dBuV dBr/m dB	5 247	FCC 15 2/	_					H 2	r 20-40	те-атрине.		6 GHz	pliter 1-2	Pre-ang	18GHz) Horn	EMC	
Hi Frequency Cables 3 foot cable 4 foot cable 12 foot cable 13 foot ca	•	FUC 15 44	•					-			·	56	teq 6464:	T63 Mit	@3m 🚽	N: 2238	T60; S	
2 foot cable 3 foot cable 4 foot cable 12 foot cable 12 foot cable HPF Reject Filter Reject Filter RBW=VBW=: f Dist Read Pk Read Avg AF CL Amp D Corr Fltr Peak Avg Pk Lin Avg Mar Age Mar GHz (m) dBuV dBuV dB/m dB								_						1	es	Jency Cal	— Hi Freq	
2 mortcane 3 mortcane 4 mortcane 12 mortcane	iments MHz	<u>'eak Measuren</u> ?BW=VBW=1M	r F		-+ Filian	Paia	DE	1		2 .	10	11,	4 fact	st cable	3 foo	ot coble	2 6	
3_Chin Average Mea RBW=1MHz; f Dist Read Pk Read Avg dBuV AF CL Amp D Corr Fltr Peak Avg dBuV/m Pk Lin Avg Lim Pk Mar Avg Mar GHz (m) dBuV dBuV dB dB <td></td> <td></td> <td>-</td> <td></td> <td>serrmer</td> <td>neje</td> <td>FF</td> <td></td> <td></td> <td>foot cable</td> <td>12</td> <td>capite</td> <td>4 1001</td> <td>I Caste</td> <td></td> <td>oreance</td> <td></td>			-		serrmer	neje	FF			foot cable	12	capite	4 1001	I Caste		oreance		
f Dist Read Pk Read Avg. AF CL Amp D Corr Flt Peak Avg Pk Lin Avg Lim Pk Mar Avg Mar GHz (m) dBuV dBuV dB dB <td>isurements</td> <td>Average Measu</td> <td>A</td> <td></td> <td>-</td> <td></td> <td>0GHz 💂</td> <td>HPF_4</td> <td>-</td> <td>Hitesh</td> <td>12</td> <td>-</td> <td></td> <td>in 🗸</td> <td></td> <td></td> <td></td>	isurements	Average Measu	A		-		0GHz 💂	HPF_4	-	Hitesh	12	-		in 🗸				
fDistRead PkRead Avg.AFCLAmpD CorrFltrPeakAvgPk LinAvg LimPk MarAvg MarGHz(m)dBuVdBuVdBuVdBdBdBdBdBdBdBuV/m	, VBW=10Hz	⟨BW=1MHz; vı	F															
GHz (m) dBuV dB/m dB dB dB dB dB dBuV/m dBuV/m dBuV/m dBuV/m dB dB dB ID CH2442MHz Image: Character and the state an	Notes	Avg Mar	Pk Mar A	n I	Avg Lim	?k Lim	Avg	Peak	Fltr	D Corr	Amp	CL	AF	Read Avg.	Read Pk	Dist	f	
IDCH 2442MHz IDCH 2442MHz<	(V/H)	dB	dB	1 <u> </u>	dBuV/m	BuV/m	dBuV/m	dBuV/m	dB	dB	dB	dB	dB/m	dBuV	dBuV	(m)	GHz	
f Measurement Frequency Amp Preamp Gain Avg Lim Avg Lim Average Field Strength Limit f Measurement Frequency Amp Preamp Gain Avg Lim Avg Lim Average Field Strength Limit Read Analyzer Reading Avg Lim Average Field Strength Margin vs. Average Limit AF Anterna Factor Peak Calculated Peak Field Strength Pk Mar Margin vs. Peak Limit																44234014	m cu a	
1323 30 47.2 33.1 35.9 5.9 .34.8 0.0 0.6 54.9 40.8 74 54 .19.1 .13.2 1882 30 58.5 40.3 33.0 4.1 .35.5 0.0 0.6 60.8 42.6 74 54 .19.1 .13.2 .11.4 1323 3.0 45.7 32.7 35.9 5.9 .34.8 0.0 0.6 60.8 42.6 74 54 .13.2 .11.4 1323 3.0 45.7 35.9 5.9 .34.8 0.0 0.6 63.4 40.4 74 54 .13.2 .11.4 1323 3.0 45.7 35.9 5.9 .34.8 0.0 0.6 53.4 40.4 74 54 .20.6 .13.6 133 10 132 .14.8 0.0 0.6 53.4 40.4 74 54 .20.6 .13.6 10 10 10 10 10 10 10 10 10 10.6 11.4	v	-9.3	-10.9		54	74	44.7	63.1	6.0	۵0	-35.5	4.1	33.0	42.4	60.8	4421viria 3.0	лш сн 2 .882	
1.882 3.0 58.5 40.3 33.0 4.1 -35.5 0.0 0.6 60.8 42.6 74 54 -13.2 -11.4 '323 3.0 45.7 32.7 35.9 5.9 5.9 -34.8 0.0 0.6 63.4 40.4 74 54 -13.2 -11.4 '323 3.0 45.7 32.7 35.9 5.9 -34.8 0.0 0.6 53.4 40.4 74 54 -20.6 -13.6 f Measurement Frequency Amp Preamp Gain Avg Lim Avg Lim Average Field Strength L Pk Lim Peak Field Strength Limit Read Analyzer Reading Avg Average Field Strength @ 3 m Avg Mar Margin vs. Average Limit AF Antenna Factor Peak Calculated Peak Field Strength Pk Mar Margin vs. Peak Limit CL Cable Loss HPF High Pass Filter VMar Margin vs. Peak Limit	v	-13.2	-19.1		54	74	40.8	54.9	6.0	0.0	-34.8	59	35.9	33.1	47.2	3.0	323	
f Measurement Frequency Amp Preamp Gain Avg Lim Average Field Strength L Dist Distance to Antenna D Corr Distance Correct to 3 meters Pk Lim Peak Field Strength Limit Read Analyzer Reading Avg Average Field Strength @ 3 m Avg Mar Margin vs. Average Limit AF Antenna Factor Peak Calculated Peak Field Strength Pk Mar Margin vs. Peak Limit CL Cable Loss HPF High Pass Filter Pk Mar Margin vs. Peak Limit	H	-11.4	-13.2		54 54	74	42.6	60.8 53.4	0.0 0.0	0.0 0.0	-35.5 -34.8	4.1 5.9	33.0 35.9	40.3	58.5 45.7	3.0 3.0	.882 .323	
f Measurement Frequency Amp Preamp Gain Avg Lim Average Field Strength L Dist Distance to Antenna D Corr Distance Correct to 3 meters Pk Lim Peak Field Strength Limit Read Analyzer Reading Avg Average Field Strength @ 3 m Avg Mar Margin vs. Average Limit AF Antenna Factor Peak Calculated Peak Field Strength Pk Mar Margin vs. Peak Limit CL Cable Loss HPF High Pass Filter Pk Mar Margin vs. Peak Limit		-150	-200				40,4		0.0	0.0	-5420	55	555		40.0			
Image: The Automan and Stream and Stre	i	-1.1 Characteristic T (a)			ά				N	D	A				v	ç		
Read Analyzer Reading Avg Average Field Strength @ 3 m Avg Mar Margin vs. Average Limit AF Antenna Factor Peak Calculated Peak Field Strength Pk Mar Margin vs. Peak Limit CL Cable Loss HPF High Pass Filter Pk Mar Margin vs. Peak Limit	/imit +	sid Strength Limi Strength Limit	verage Field	P D	Avg Lim Dir Lim			to 3 mete	Jain Correc	Dictorce	Amp D.Corr		9	ent Frequency	Nieasureme Dictorce to	I Diet		
AF Antenna Factor Peak Calculated Peak Field Strength Pk Mar Margin vs. Peak Limit CL Cable Loss HPF High Pass Filter	t	Average Limit	fargin vs.	·N	Avg Mar		m	rength @	Field S	Average	Ava			eading	Analyzer Ri	Read		
CL Cable Loss HPF High Pass Filter		Peak Limit	Margin vs. 1	N	Pk Mar		gth	Field Stre	d Peak	Calculate	Peak			actor	Antenna Fa	AF		
			0				0		Filter	High Pass	HPF			3	Cable Loss	CL		

Page 71 of 103

7.3.4. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz

RF WIRELESS TEST AT TX MODE:

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)



Page 72 of 103
HORIZONTAL DATA										
	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark	Page: 1		
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB				
1 2 4 5	133.790 395.690 521.790 565.440 795.330	48.82 46.49 45.57 43.79 41.29	-11.27 -8.74 -6.71 -6.05 -2.48	37.55 37.75 38.86 37.74 38.81	43.50 46.00 46.00 46.00	-5.95 -8.25 -7.14 -8.26 -7.19	Peak Peak Peak Peak			

Page 73 of 103

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)



Page 74 of 103

VERTICA	L DATA						
	Freq MHz	Read Level Factor dBuv di	Level	Limit Line dBuV/m	Over Limit 	Remark	Page: 1
1 2 3 4 5	133.790 261.830 397.630 565.440 929.190	50.31 -11.2 54.53 -11.5 50.39 -8.7 48.59 -6.0 39.99 -0.2	7 39.04 7 42.96 2 41.67 5 42.54 3 39.76	43.50 46.00 46.00 46.00 46.00	-4.46 -3.04 -4.33 -3.46 -6.24	Peak Peak Peak Peak Peak	

Page 75 of 103

DIGITAL MODE WITH MINIMUM COFIGURATION:

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)



Page 76 of 103

HORIZ	ONTAL DATA						
	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	$\overline{\mathrm{dBuV}/\mathrm{m}}$	$\overline{\mathrm{dBuV}/\mathrm{m}}$	dB	
1 2 3 4 5	150.280 271.530 300.630 398.600 798.240	50.20 49.90 45.56 46.07 44.47	-12.45 -11.00 -10.30 -8.71 -2.38	37.75 38.90 35.26 37.36 42.09	43.50 46.00 46.00 46.00	-5.75 -7.10 -10.74 -8.64 -3.91	Peak Peak Peak Peak Peak

Page 77 of 103

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)



Page 78 of 103

VERTICAL DATA									
		Read			Limit	Over			
	Freq	Level	Factor	Level	Line	Limit	Remark		
-	MHz	dBuV	dB	$\overline{\mathrm{dBuV}/\mathrm{m}}$	$\overline{\mathrm{dBuV}/\mathrm{m}}$	dB			
1	46.490	51.37	-14.80	36.57	40.00	-3.43	Peak		
2	300.630	46.07	-10.30	35.77	46.00	-10.23	Peak		
3	400.540	41.39	-8.67	32.72	46.00	-13.28	Peak		
4	526.640	39.53	-6.57	32.96	46.00	-13.04	Peak		
5	798.240	46.70	-2.38	44.32	46.00	-1.68	Peak		
6	909.790	39.17	-0.60	38.57	46.00	-7.43	Peak		

Page 79 of 103

7.4. POWERLINE CONDUCTED EMISSIONS

LIMIT

\$15.207 (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted I	.imit (dBuV)
	Quasi-peak	Average
0.15-0.5	66 to 56 "	56 to 46 "
0.5-5	56	46
5-30	60	50

Decreases with the logarithm of the frequency.

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The resolution bandwidth is set to 9 kHz for both peak detection and quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

No non-compliance noted:

Page 80 of 103

TX MODE AT WORST CASE:

<u>6 WORST EMISSIONS:</u>

	CONDUCTED EMISSIONS DATA (115VAC 60Hz)											
Freq.	Reading			Closs	Limit	EN_B	Margin		Remark			
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2			
0.17	50.87			0.00	64.96	54.96	-14.09	-4.09	L1			
0.39	43.08			0.00	58.09	48.09	-15.01	-5.01	L1			
0.80	40.73			0.00	56.00	46.00	-15.27	-5.27	L1			
0.20	45.36			0.00	63.69	53.69	-18.33	-8.33	L2			
0.40	38.38			0.00	57.90	47.90	-19.52	-9.52	L2			
1.07	35.60			0.00	56.00	46.00	-20.40	-10.40	L2			
6 Worst I	Data											

Page 81 of 103

LINE 1 RESULT



Page 82 of 103

LINE 2 RESULT



Page 83 of 103

DIGITAL MODE:

Hi Pro Power Supply:

	CONDUCTED EMISSIONS DATA (115VAC 60Hz)											
Freq.	Reading			Closs	Limit	FCC_B	Margin		Remark			
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2			
0.16	50.32			0.00	65.62	55.62	-15.30	-5.30	L1			
0.80	38.10			0.00	56.00	46.00	-17.90	-7.90	L1			
1.43	39.26			0.00	56.00	46.00	-16.74	-6.74	L1			
0.17	47.20			0.00	65.21	55.21	-18.01	-8.01	L2			
0.34	43.48			0.00	59.28	49.28	-15.80	-5.80	L2			
1.03	41.30			0.00	56.00	46.00	-14.70	-4.70	L2			
6 Worst I	Data											

Delta Power Supply:

	CONDUCTED EMISSIONS DATA (115VAC 60Hz)											
Freq.		Reading		Closs	Limit	FCC_B	Margin		Remark			
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2			
0.44	41.90			0.00	57.06	47.06	-15.16	-5.16	L1			
0.19	42.90			0.00	63.91	53.91	-21.01	-11.01	L1			
1.56	39.64			0.00	56.00	46.00	-16.36	-6.36	L1			
0.47	44.88			0.00	56.44	46.44	-11.56	-1.56	L2			
1.56	42.16			0.00	56.00	46.00	-13.84	-3.84	L2			
0.23	41.78			0.00	62.31	52.31	-20.53	-10.53	L2			
6 Worst I	Data											

Page 84 of 103

LINE 1 RESULT



Page 85 of 103

LINE 2 RESULT



Page 86 of 103

Delta Power Supply:

LINE 1 RESULTS



Page 87 of 103

LINE 2 RESULTS



Page 88 of 103



Page 89 of 103

LINE 2 RESULTS



Page 90 of 103