



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

Matsushita Electric Industrial Co., Ltd.
1006 Oaza Kadoma
Kadoma, Osaka 571 Japan
Attention: Rich Mullen (PSCD, MECA)
K. Nawata (KMECL)

Dates of Tests: December 07-09, 1999
Test Report S/N: 15.991207656.ACJ
Test Site: PCTEST Lab, Columbia, MD

FCC ID

ACJ96NKX-TG2200

APPLICANT

Matsushita Electric Industrial Co., Ltd.

FCC Rule Part(s): 15.247 Subpart C; ANSI C-63.4 (1992)
Classification: Spread Spectrum Transceiver (DSS)
Method/System: Frequency Hopping Spread Spectrum System (FHSS)
Equipment Type: 2.4GHz Cordless Answering System (Base/Handset)
Tx/Rx Frequency Range: 2401.056 – 2479.680 MHz
Max. RF Output Power: Handset: 176 mW (22.47 dBm)
Base: 270 mW (24.32 dBm)
Trade Name/Model(s): *Panasonic KX-TG2200B-H (Base), KX-TG2200B-R (Handset)*

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 ANSI C-63-4-1992.

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



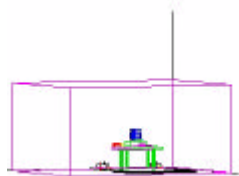
9 9 1 2 0 7 6 5 6 . A C J

NVLAP[®]
LAB CODE 100431-0

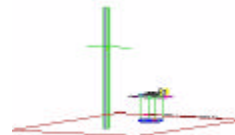
TABLE OF CONTENTS

SCOPE	1
INTRODUCTION (SITE DESCRIPTION)	2
PRODUCT INFORMATION	3
DESCRIPTION OF TESTS	
A. CONDUCTED EMISSIONS	4
B. RADIATED EMISSIONS	5
C. RESTRICTED BANDS	6
D. ANTENNA REQUIREMENT	7
E. 20dB BANDWIDTH	8
F. MAXIMUM PEAK POWER OUTPUT	9
G. CHANNEL SEPERATION/DWELL TIME	10-11
RADIATED MEASUREMENTS (FUNDAMENTAL & HARMONICS)	12-17
FREQUENCY MEASUREMENTS (SPURIOUS)	18
LIST OF TEST EQUIPMENT	19
RECOMMENDATION/CONCLUSION	20
ATTACHMENT A - PLOTS OF EMISSION	21
ATTACHMENT B - PHOTOGRAPHS OF TEST SET-UP	22
ATTACHMENT C - INTERNAL EUT PHOTOGRAPHS	23
ATTACHMENT D - EXTERNAL EUT PHOTOGRAPHS	24
ATTACHMENT E - OPERATIONAL DESCRIPTION	25
ATTACHMENT F - USERS MANUAL	26

MEASUREMENT REPORT



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.



§2983(a) General Information

Applicant Name:	Matsushita Electric Industrial Co., Ltd.
Address:	1006 Oaza Kadoma Kadoma, Osaka 571 JAPAN
Attention:	Rich Mullen (PSCD, MECA) K. Nawata (KMEC)

- FCC ID: **ACJ96NKX-TG2200**
- Equipment Class: Spread Spectrum Transceiver
- Equipment Type: 2.4GHz Cordless Answering System (Base/Handset)
- Tx/Rx Frequency Range: 2401.056 – 2479.680 MHz
- Method/System: Frequency Hopping Spread Spectrum (FHSS)
- Trade Name: **Panasonic**
- Model(s): **KX-TG2200B-H (Base), KX-TG2200B-R (Handset)**
- Max. RF Output Power: Handset: 176 mW (22.47 dBm)
Base: 270 mW (24.32 dBm)
- Power Supply: 12VDC 1.0A (AC Adapter Model: PQLV12ZA-SS)
- Cable(s): Telco
- USOC Jack: RJ-11C
- Rule Part(s): § 15.247 Subpart C
- Dates of Tests: December 07-09, 1999
- Place of Tests: PCTEST Lab, Columbia, MD U.S.A.
- Test Report S/N: 15.991207656.ACJ



INTRODUCTION

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C63.4-1992) were used in the measurement of **PANASONIC 2.4GHz Frequency Hopping Spread Spectrum Cordless Answering System FCC ID: ACJ96NKX-TG2200**.

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.

PCTEST Location

The map at right shows the location of the PCTEST Lab, its proximity to the FCC Lab, the Columbia vicinity area, the Baltimore-Washington International (BWI) airport, and the city of Baltimore, and the Washington, D.C. area. (see Figure1).

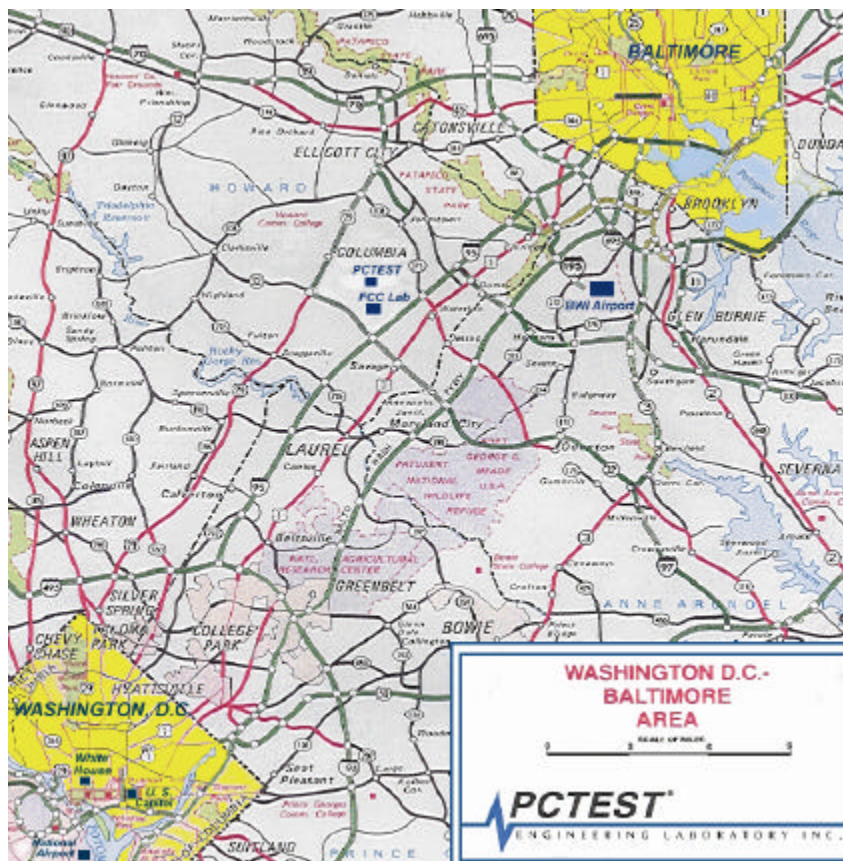


Figure 1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area.

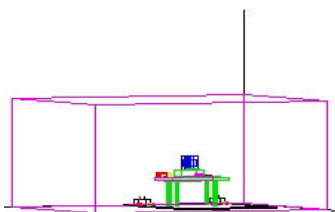
PRODUCT INFORMATION

Equipment Description:

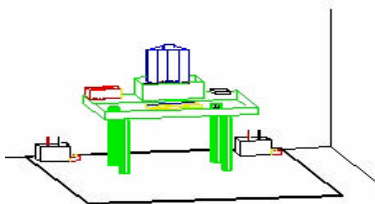
The Equipment under test (EUT) is the **PANASONIC 2.4GHz Frequency Hopping Spread Spectrum Cordless Answering System (Base/Handset) FCC ID: ACJ96NKX-TG2200.**

Tx/Rx Frequency Range: 2401.056 – 2479.680 MHz
Channels: 92
Channel Separation: 864 kHz
Spread Spectrum Method: Frequency Hopping
Modulation: GFSK (Gaussian-shaped Binary Frequency Shift Keying)
Gaussian Filter Bt = 0.5
Bit Rate = 576 kbps
Max. RF Output Power: 176 mW (22.47 dBm) Handset
270 mW (24.32 dBm) Base
Antenna: Omni-directional
Digital Security Codes: 429,467,296 (32 bit = 2^{32})
Port/Connector(s): RJ-11C
EMI suppression device(s) added and/or modified during testing: None

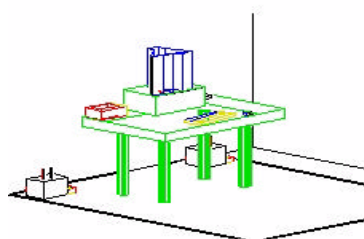
CH	0	1	2	3	4	5	6	7	8	9
0	2401.056	2401.920	2402.784	2403.648	2404.512	2405.376	2406.240	2407.104	2407.968	2408.832
10	2409.696	2410.560	2411.424	2412.288	2413.152	2414.016	2414.880	2415.744	2416.608	2417.472
20	2418.336	2419.200	2420.064	2420.928	2421.792	2422.656	2423.520	2424.384	2425.248	2426.112
30	2426.976	2427.840	2428.704	2429.568	2430.432	2431.296	2432.160	2433.024	2433.888	2434.752
40	2435.616	2436.480	2437.344	2438.208	2439.072	2439.936	2440.800	2441.664	2442.528	2443.392
50	2444.256	2445.120	2445.984	2446.848	2447.712	2448.576	2449.440	2450.304	2451.168	2452.032
60	2452.896	2453.760	2454.624	2455.488	2456.352	2457.216	2458.080	2458.944	2459.808	2460.672
70	2461.536	2462.400	2463.264	2464.128	2464.992	2465.856	2466.720	2467.584	2468.448	2469.312
80	2470.176	2471.040	2471.904	2472.768	2473.632	2474.496	2475.360	2476.224	2477.088	2477.952
90	2478.816	2479.680								



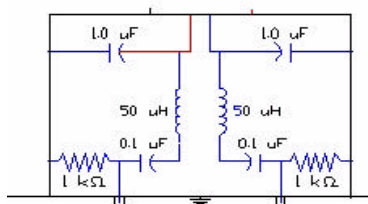
**Figure 2. Shielded Enclosure
 Line-Conducted Test Facility**



**Figure 3. Line Conducted
 Emission Test Set-Up**



**Figure 4. Wooden Table &
 Bonded LISNs**



**Figure 2. LISN Schematic
 Diagram**

DESCRIPTION OF TESTS

Conducted Emissions

The line-conducted facility is located inside a 16'x20'x10' shielded enclosure. It is manufactured by Ray Proof Series 81 (see Figure 2). The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 65-6. A 1m. x 1.5m. wooden table 80cm. high is placed 40cm. away from the vertical wall and 1.5m away from the side wall of the shielded room (see Figure 3). Solar Electronics and EMCO Model 3725/2 (10kHz-30MHz) 50Ω/50μH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room (see Figure 4). The EUT is powered from the Solar LISN and the support equipment is powered from the EMCO LISN. Power to the LISNs are filtered by a high-current high-insertion loss Ray Proof power line filters (100dB 14kHz-10GHz). The purpose of the filter is to attenuate ambient signal interference and this filter is also bonded to the shielded enclosure. All electrical cables are shielded by braided tinned copper zipper tubing with inner diameter of 1/2". If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the Solar LISN. LISN schematic diagram is shown in Figure 5. All interconnecting cables more than 1 meter were shortened by non-inductive bundling (serpentine fashion) to a 1-meter length. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer to determine the frequency producing the maximum EME from the EUT. The spectrum was scanned from 450kHz to 30MHz with 20 msec. sweep time. The frequency producing the maximum level was reexamined using EMI/ Field Intensity Meter and Quasi-Peak adapter. The detector function was set to CISPR quasi-peak mode. The bandwidth of the receiver was set to 10 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission. Each emission was maximized by: switching power lines; varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and/or support equipment, and powering the monitor from the floor mounted outlet box and the computer aux AC outlet, if applicable; whichever determined the worst-case emission. Photographs of the worst-case emission can be seen in the "Test Setup Photographs" attachment. Each EME reported was calibrated using the HP8640B signal generator.

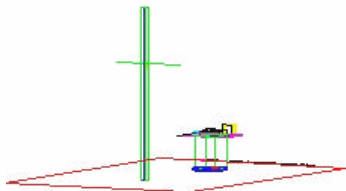


Figure 3. 3-Meter Test Site

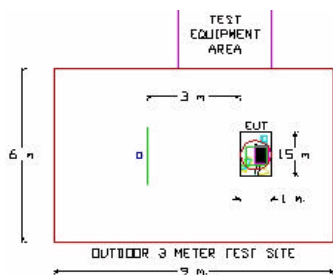


Figure 4. Dimensions of Outdoor Test Site

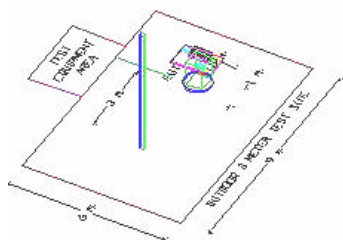


Figure 5. Turntable and System Setup

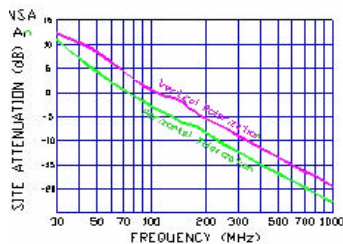


Figure 6. Normalized Site Attenuation Curves (H&V)

DESCRIPTION OF TESTS (CONTINUED)

Radiated Emissions

Preliminary measurements were made indoors at 1 meter using broadband antennas, broadband amplifier, and spectrum analyzer to determine the frequency producing the maximum EME. Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, turntable azimuth with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30 to 200 MHz using biconical antenna and from 200 to 1000 MHz using log-spiral antenna. Above 1 GHz, linearly polarized double ridge horn antennas were used.

Final measurements were made outdoors at 3-meter test range using Roberts™ Dipole antennas or horn antenna (see Figure 6). The test equipment was placed on a wooden and plastic bench situated on a 1.5 x 2 meter area adjacent to the measurement area (see Figure 7). Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. Each frequency found during pre-scan measurements was re-examined and investigated using EMI/Field Intensity Meter and Quasi-Peak Adapter. The detector function was set to CISPR quasi-peak mode and the bandwidth of the receiver was set to 100kHz or 1 MHz depending on the frequency or type of signal.

The half-wave dipole antenna was tuned to the frequency found during preliminary radiated measurements. The EUT, support equipment and interconnecting cables were re-configured to the set-up producing the maximum emission for the frequency and were placed on top of a 0.8-meter high non-metallic 1 x 1.5 meter table (see Figure 8). The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each EME emission. The turntable containing the system was rotated; the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission. Each emission was maximized by: varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and/or support equipment, and powering the monitor from the floor mounted outlet box and the computer aux AC outlet, if applicable; and changing the polarity of the antenna, whichever determined the worst-case emission. Photographs of the worst-case emission can be seen in "Test Setup Photographs" Attachment. Each EME reported was calibrated using the HP8640B signal generator. The Theoretical Normalized Site Attenuation Curves for both horizontal and vertical polarization are shown in Figure 9.

§ 15.205 RESTRICTED BANDS

Special attention is made for the EUT's harmonic and spurious radiated emission in the restricted bands of operation. The EUT was tested from 9kHz and up to the tenth harmonic of the fundamental frequency of the transmitter using CISPR quasi peak detector below 1GHz. Above 1 GHz, average measurements were used using RBW 1 MHz – VBW 10Hz and linearly polarized horn antennas. In addition, peak measurements were taken to ensure that the peak levels are not more than 20dB above the average limit. All out of band emissions, other than those created by the spreading sequence, data sequence, and the carrier modulation must not exceed the limits shown in Table 2 per §15.209.

Frequency (MHz)	F/S (μ V/m)	Meas. Dist. (Meters)
0.009-0.490	2400/F (kHz)	300
0.490-1.705	24000/F (kHz)	30
1.705-30.00	30	30
30.0-88.0	100	3
88.0-216.0	150	3
216.0-960.0	200	3
Above 960	500	3

Table. 2. Radiated Emission Limits Per §15.209

Test Equipment

HP 8566B	Spectrum Analyzer 100Hz-22GHz
HP83017A	Microwave Amplifier 40dB Gain (0.5 – 26.5 GHz)
HP 3784A	Digital Transmission Analyzer
EMCO 3115	Horn Antenna (1 – 18GHz)
HP 8495A	20dB Attenuator (DC-40GHz) 0-70dB
HP 8493B	10dB Attenuator
MicroCoax Cables	Low Loss Microwave Cables (1-26.5 GHz)
CDI Dipoles	Dipole Antennas (30 – 1000 MHz)

§ 15.203 ANTENNA REQUIREMENT

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the applicant can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with this requirement.

Base Unit

The **Panasonic KX-TG2200B-H** base unit complies with the requirement of §15.203. The antenna is a **permanently attached Omni-directional Antenna**.

Handset Unit

The **Panasonic KX-TG2200B-R** handset unit complies with the requirement of §15.203. The antenna is **permanently attached Omni-directional Antenna**.

CONCLUSION

There are no provisions for connection to an external antenna. The Base & Handset Units meet the antenna requirements of §15.203.

§15.247(a)(1)(ii) – 20dB BANDWIDTH

Minimum Standard – Frequency hopping systems shall use at least 75 hopping frequencies. The maximum 20dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 sec. within the 30 sec. period.

Res. Bandwidth = 30kHz (10db/div)
Video Bandwidth = 30kHz
Span 2MHz
Sweep 8s
Attenuator none
20dB Bandwidth-Mkr Delta (20dB down from peak)

(see attached spectrum plots)

Frequency (MHz)	Channel	20 dB Bandwidth (kHz)
2401.056	0	652
2440.800	46	612
2479.680	91	624

Table 3a. 20dB Bandwidth Measurements (**Handset**)

Frequency (MHz)	Channel	20 dB Bandwidth (kHz)
2401.056	0	580
2440.800	46	600
2479.680	91	620

Table 3b. 20dB Bandwidth measurements (**Base**)

Remarks:

PASS

§15.247(b) MAXIMUM PEAK POWER OUTPUT

Minimum Standard – The maximum peak power output of the transmitter will not exceed 1 watt.

Res. Bandwidth = 3 MHz (5dB/div)
 Vid. BW = 3 MHz
 Span = 20 MHz
 Ref. Level - 18 dBm
 Sweep 20ms
 Attenuator none

Freq (MHz)	Unit Base/Handset	Chan	Level (dBm)	AFCL (dB)	F/S (μV/m)	EIRP (W)
2401.056	Base	0	- 20.35	31.8	836565.6	0.210
2440.800	Base	46	- 19.45	32.0	949511.0	0.270
2479.680	Base	91	- 19.80	32.1	912011.0	0.267
2401.056	Handset	0	- 21.10	31.8	767361.5	0.176
2440.800	Handset	46	- 21.85	32.0	720277.8	0.156
2479.680	Handset	91	- 22.10	32.1	699842.0	0.157

Table 4. Radiated Output Power Measurements at 3m

The EUT is placed 3m. away from the receiving antenna and the EIRP is calculated using the formula:

$$\text{EIRP (dBm)} = 10 \log_{10} \left(\left(\frac{r(\text{mV/m})}{1 \times 10^6} \right)^2 / 30.0 / 1 \times 10^{-3} \right)$$

$$\text{EIRP (dBm)} = 10 \log_{10} \left[\left(\frac{3 \times \text{FS}}{1 \times 10^6} \right)^2 / (30.0) \times 1000 \right]$$

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

REMARKS:

PASS

§15.247(a)(1)(ii) CHANNEL SEPARATION /DWELL TIME

Minimum Standard – Frequency hopping systems shall use at least 75 hopping frequencies. The maximum 20dB bandwidth of the hopping channel is 1MHz. The average time of occupancy on any frequency shall not be greater than 0.4 sec. within the 30 sec. period.

Compliance with other provision of §15.247 is stated in project Gleneagles by Symbionics Ltd., as stated below:

Hopping channel carrier frequencies are separated by 864 kHz

Each bearer is independent and hops at a rate of 100 hops/sec.

The hopping sequence is either table-generated or RNG-generated:

1. A table-generated hop sequence is 75 hops long, each channel is used exactly once in the sequence. Therefore, in a 30 second period each frequency channel is used exactly 40 times in that sequence.
2. An RNG-generated hop sequence is 3000 hops long, each channel is used exactly 40 times in the entire sequence. Therefore, in a 30 second period each frequency channel is used exactly 40 times in that sequence.

The hopping sequence contains 50 logical channels these are mapped-onto 75 physical channels using a mapping table.

The highest channel occupancy, is when an FP has 4 traffic bearers (i.e. 8 slots utilized), each using the same hopping sequence. As shown previously, for a given sequence, in a 30 second period each frequency channel is used exactly 40 times. A slot is 750µs long, therefore the average time of occupancy on any frequency channel in a 30 second period is:

$$T = 750\mu\text{s} \times 40 \times 8 = 240$$

As a comparison, the lowest channel occupancy is when only a single dummy bearer is being transmitted. Because only the 'A-field' is used on a dummy bearer, the transmission is only 167µs long, therefore the average time of occupancy on any frequency channel in a 30 second period is:

$$T = 167\mu\text{s} \times 40 \times 1 = 6.68\text{ms}$$

The maximum 20dB bandwidth of the hopping channel is less than 850 kHz.

§15.247(g)

In the case of the dummy bearer (which the FP transmits all the time it is powered up and operating), the hopping sequence cycles through the 75 hops in the selected hopping pattern and the repeats.

In the case of a traffic bearer presented with continuous data (which is the normal case, as this is a voice system), the hopping sequence cycles through the 3000 hops in the sequence and then repeats. If this is a combined dummy/traffic bearer then the sequence cycles through the 75 hops in the selected pattern and then repeats.

In the case of a traffic bearer transmitting short bursts (for example, which may happen if a PP has several failed attempts² to establish a traffic bearer), then the successive traffic bearers will start on different patterns (because the PSPN is incremented each frame).

Note, that this system is a voice system and short burst transmissions are not typical.

§15.247(h)

There is no coordination between transmitters for the purpose of avoiding the simultaneous occupancy of hopping frequencies by multiple transmitters.

Communication only ever takes place between and FP and a PP, never between two FPs or two PPs. (It is actually impossible for a FP to receive an FP packet or a PP to receive a PP packet, because their respective 'sync-fields' are different).

An FP and a PP that have an active traffic bearer between them, will share a common hopping sequence and hop sequence adaption information (i.e. 'swapped channels'). However, neither the FP nor the PP transmits this information to a 3rd party, for any purpose whatsoever.

This is even true when in a state of bearer handOver, where the PP is simultaneously 'locked-onto' two FPs. The PP will know both FP's hopping sequences, but it does not share this information with either FP.

In actually fact, channel collisions between FPs and PPs can and will take place. These may result in reduced voice quality, but this had to be tolerated.

In the case of 'sequence collisions' (where two transmitters, with overlapping radio cells, are using the same slot, pattern and phase within the patter), this is detected by multiple consecutive corrupted packets. Each connection that is experiencing sequence collisions will independently attempt to remedy the situation (either by pattern changing or by bearer hand-over, as discussed previously).

2 The protocol actually limits the number of re-tries to 11 before giving up on the connection.

RADIATED MEASUREMENTS (FUNDAMENTAL & HARMONICS)

Unit tested: Handset
 Operating Frequency: 2401.056 MHz
 Distance of Measurements: 3 meters
 Channel: 0

FREQ. (MHz)	Level (dBm)	AFCL (dB)	POL (H/V)	Duty Cycle (dB)	F/S (μ V/m)	F/S (dB μ V/m)	Margin (dB)
2401.056	- 21.1	31.8	V	Peak	767361.5	117.7	- 7.5
4802.112*	- 78.0	39.8	V	- 18	347.1	50.8	- 3.2
7203.168	- 88.0	43.8	V	- 18	173.4	44.8	- 9.2
9604.224	- 99.0	46.5	V	- 18	66.8	36.5	- 17.5
12005.280*	< - 130						

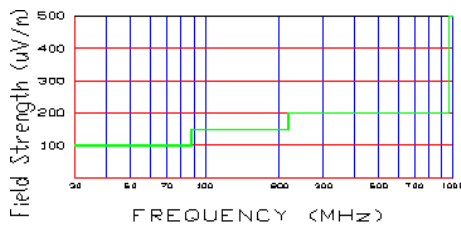


Figure 7. § 15.209 Restricted band harmonics and spurious limits.

NOTES:

1. All harmonics in the restricted bands specified in §15.205 are below the limit as shown in Fig. 7. (note: * Restricted Band)
2. All harmonics/spurs are at least 20 dB below the highest emission in the authorized band using RBW = 100kHz
3. Average Measurements > 1GHz using RBW = 1 MHz VBW = 10 Hz
4. The peak emissions above 1 GHz are not more than 20 dB above the average limit.
5. The antenna is manipulated through typical positions, polarity and length during the tests.
6. The EUT is supplied with nominal AC voltage or/and a new/fully recharged battery.
7. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported.
8. < - 130 are below the analyzer floor level.
9. Above 1 GHz, limit is 500 uV/m (54dBu/m)

RADIATED MEASUREMENTS (FUNDAMENTAL & HARMONICS)

Unit tested: Handset
 Operating Frequency: 2440.800 MHz
 Distance of Measurements: 3 meters
 Channel: 46

FREQ. (MHz)	Level (dBm)	AFCL (dB)	POL (H/V)	Duty Cycle (dB)	F/S (μ V/m)	F/S (dB μ V/m)	Margin (dB)
2440.800	- 21.9	32.0	V	Peak	720277.8	117.2	- 8.1
4881.600*	- 87.0	40.0	V	- 18	125.9	42.0	- 12.0
7322.400*	- 128.5	43.9	V	- 18	1.7	4.4	- 49.6
9763.200	< -130						
12204.000*	< - 130						

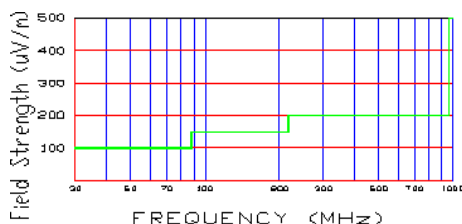


Figure 8. §15.209 Restricted band harmonics and spurious limits.

NOTES:

1. All harmonics in the restricted bands specified in §15.205 are below the limit as shown in Fig. 8. (note: * Restricted Band)
2. All harmonics/spurs are at least 20 dB below the highest emission in the authorized band using RBW = 100kHz
3. Average Measurements > 1GHz using RBW = 1 MHz VBW = 10 Hz
4. The peak emissions above 1 GHz are not more than 20 dB above the average limit.
5. The antenna is manipulated through typical positions, polarity and length during the tests.
6. The EUT is supplied with nominal AC voltage or/and a new/fully recharged battery.
7. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported.
8. < - 130 are below the analyzer floor level.
9. Above 1 GHz, limit is 500 uV/m (54dBu/m).

RADIATED MEASUREMENTS (FUNDAMENTAL & HARMONICS)

Unit tested: Handset
 Operating Frequency: 2479.680 MHz
 Distance of Measurements: 3 meters
 Channel: 91

FREQ. (MHz)	Level (dBm)	AFCL (dB)	POL (H/V)	Duty Cycle (dB)	F/S (μ V/m)	F/S (dB μ V/m)	Margin (dB)
2479.680	- 22.1	32.0	V	Peak	699842.0	116.9	- 8.3
4959.360*	- 93.1	40.3	V	- 18	64.6	36.2	- 25.4
7439.040*	- 104.5	44.1	V	- 18	27.0	28.6	- 52.8
9918.720	< -130						
12398.400*	< -130						

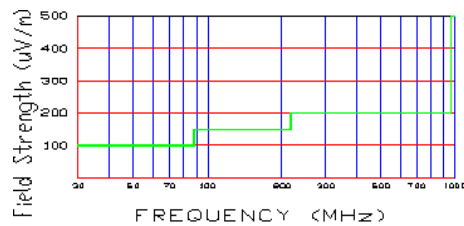


Figure 9. §15.209 Restricted band harmonics and spurious limits.

NOTES:

1. All harmonics in the restricted bands specified in §15.205 are below the limit as shown in Fig. 9. (note: * Restricted Band)
2. All harmonics/spurs are at least 20 dB below the highest emission in the authorized band using RBW = 100kHz
3. Average Measurements > 1GHz using RBW = 1 MHz VBW = 10 Hz
4. The peak emissions above 1 GHz are not more than 20 dB above the average limit.
5. The antenna is manipulated through typical positions, polarity and length during the tests.
6. The EUT is supplied with nominal AC voltage or/and a new/fully recharged battery.
7. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported.
8. < - 130 are below the analyzer floor level.
9. Above 1 GHz, limit is 500 uV/m (54dBu/m).

RADIATED MEASUREMENTS (FUNDAMENTAL & HARMONICS)

Unit tested: Base
 Operating Frequency: 2401.056 MHz
 Distance of Measurements: 3 meters
 Channel: 0

FREQ. (MHz)	Level (dBm)	AFCL (dB)	POL (H/V)	Duty Cycle (dB)	F/S (μ V/m)	F/S (dB μ V/m)	Margin (dB)
2401.056	- 20.4	31.8	V	Peak	836565.6	118.5	- 6.8
4802.112*	- 87.7	39.8	V	- 12	226.7	47.1	- 6.9
7203.168	- 101.0	43.8	V	- 12	77.5	37.8	- 16.2
9604.224	- 129.0	46.5	V	- 12	4.2	12.5	- 41.5
12005.28*	< - 130						

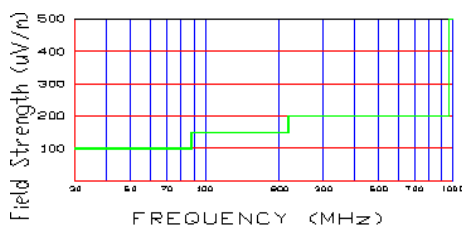


Figure 10. §15.209 Restricted band harmonics and spurious limits.

NOTES:

1. All harmonics in the restricted bands specified in §15.205 are below the limit as shown in Fig 10. (note: * Restricted Band)
2. All harmonics/spurs are at least 20 dB below the highest emission in the authorized band using RBW = 100kHz
3. Average Measurements > 1GHz using RBW = 1 MHz VBW = 10 Hz
4. The peak emissions above 1 GHz are not more than 20 dB above the average limit.
5. The antenna is manipulated through typical positions, polarity and length during the tests.
6. The EUT is supplied with nominal AC voltage or/and a new/fully recharged battery.
7. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported.
8. < - 130 are below the analyzer floor level.
9. Above 1 GHz, limit is 500 uV/m (54dBu/m).

RADIATED MEASUREMENTS (FUNDAMENTAL & HARMONICS)

Unit tested: Base
 Operating Frequency: 2440.800 MHz
 Distance of Measurements: 3 meters
 Channel: 46

FREQ. (MHz)	Level (dBm)	AFCL (dB)	POL (H/V)	Duty Cycle (dB)	F/S (μ V/m)	F/S (dB μ V/m)	Margin (dB)
2440.800	- 19.5	32.0	V	Peak	949511.0	119.6	- 5.7
4881.600*	- 91.5	40.0	V	- 12	149.6	43.5	- 10.5
7322.400*	- 90.6	43.9	V	- 12	260.0	48.3	- 5.7
9763.200	- 130.0	46.9	V	- 12	3.9	11.9	- 42.1
12204.000*	< - 130						

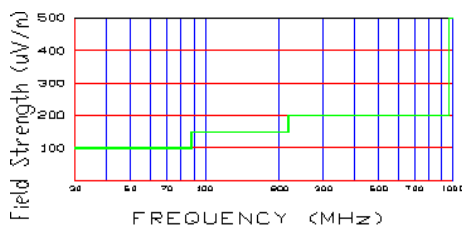


Figure 11. §15.209 Restricted band harmonics and spurious limits.

NOTES:

1. All harmonics in the restricted bands specified in §15.205 are below the limit as shown in Fig. 11. (note: * Restricted Band)
2. All harmonics/spurs are at least 20 dB below the highest emission in the authorized band using RBW = 100kHz
3. Average Measurements > 1GHz using RBW = 1 MHz VBW = 10 Hz
4. The peak emissions above 1 GHz are not more than 20 dB above the average limit.
5. The antenna is manipulated through typical positions, polarity and length during the tests.
6. The EUT is supplied with nominal AC voltage or/and a new/fully recharged battery.
7. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported.
8. < - 130 are below the analyzer floor level.
9. Above 1 GHz, limit is 500 uV/m (54dBu/m).

RADIATED MEASUREMENTS (FUNDAMENTAL & HARMONICS)

Unit tested: Base
 Operating Frequency: 2479.680 MHz
 Distance of Measurements: 3 meters
 Channel: 91

FREQ. (MHz)	Level (dBm)	AFCL (dB)	POL (H/V)	Duty Cycle (dB)	F/S (μ V/m)	F/S (dB μ V/m)	Margin (dB)
2479.680	- 19.8	32.0	V	Peak	912010.8	119.2	- 6.0
4959.360*	- 93.3	40.3	V	- 12	125.3	42.0	- 12.0
7439.040*	- 91.1	44.1	V	- 12	252.6	48.1	- 6.0
9918.720	- 129.8	47.2	V	- 12	4.2	12.4	- 41.6
12398.400*	< -130						

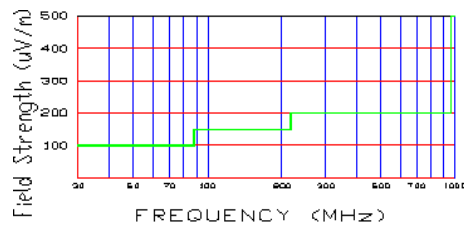


Figure 12. §15.209 Restricted band harmonics and spurious limits.

NOTES:

1. All harmonics in the restricted bands specified in §15.205 are below the limit shown in Fig. 12. (note: * Restricted Band)
2. All harmonics/spurs are at least 20 dB below the highest emission in the authorized band using RBW = 100kHz
3. Average Measurements > 1GHz using RBW = 1 MHz VBW = 10 Hz
4. The peak emissions above 1 GHz are not more than 20 dB above the average limit.
5. The antenna is manipulated through typical positions, polarity and length during the tests.
6. The EUT is supplied with nominal AC voltage or/and a new/fully recharged battery.
7. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported.
8. < - 130 are below the analyzer floor level.
9. Above 1 GHz, limit is 500 uV/m (54dBu/m).

RADIATED MEASUREMENTS (SPURIOUS)

Unit Tested: Base & Handset
 Operating Frequency: 2401.056 – 2479.680 MHz
 Distance of Measurements: 3 meters
 Channel: 0, 41, 91

FREQ. (MHz)	Level (dBm)	AFCL (dB)	POL (H/V)	Height (m)	Angle (°)	F/S (μ V/m)	DET QP/AVG	Margin (dB)
31.1	- 75.9	- 0.9	V	3.3	20	32.4	QP	- 9.8
40.0	- 75.2	1.2	V	3.2	10	44.7	QP	- 7.0
57.4	- 81.4	4.4	H	3.0	180	31.6	QP	- 10.0
66.0	- 82.2	5.7	H	2.8	10	33.5	QP	- 9.5
80.0	- 83.3	7.5	V	2.5	180	36.3	QP	- 8.8
120.0	- 87.0	11.5	V	2.2	10	37.6	QP	- 12.0

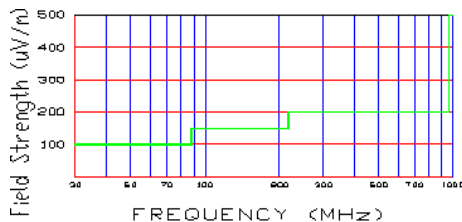


Figure 13. §15.209 Restricted band harmonics and spurious limits.

NOTES:

1. All emissions were investigated and the worst case emissions are reported.
2. For hand-held devices, the EUT is rotated through three orthogonal axis to determine which configuration produces the maximum emissions.
3. The EUT is supplied with the nominal AC voltage or/and a new/fully recharged battery.
4. The EUT was tested from 20MHz up to the 10th harmonic (24 GHz) and no significant emission was found.
5. Above 960MHz limit is 500 μ V/m (54dBu/m)

TEST EQUIPMENT

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)
Environmental Chamber	Associated Systems Model 1025 (Temperature/Humidity)		PCT285

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

RECOMMENDATION / CONCLUSION

The data collected shows that the **Panasonic 2.4GHz Frequency Hopping Spread Spectrum Cordless Answering System (Base/Headset) FCC ID: ACJ96NKX-TG2200** complies with Part 15C of the FCC Rules.

ATTACHMENT A – PLOTS OF EMISSION

ATTACHMENT B – TEST PHOTOGRAPHS

ATTACHMENT C – EXTERNAL EUT PHOTOGRAPHS

ATTACHMENT D – INTERNAL EUT PHOTOGRAPHS

ATTACHMENT E – OPERATIONAL DESCRIPTION

ATTACHMENT F – USERS MANUAL
