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TEST REPORT
AND
ANALYSIS/EVALUATION

REGULATION : FCC 15.247(E)
PRODUCT : Direct Sequence Spread Spectrum Cordless Telephone
MODEL NO. : KX-TG2584
FCC ID : ACJ96NKX-TG2584
SERIAL NO. : Prototype
TEST DATE : March 25, 2002
JUDGEMENT: Passed FCC 15.247(e) Processing Gain Requirement

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Requirements

According to the FCC requirement 15.247(e) for direct sequence spread spectrum systems, the minimum processing gain is 10 dB. The CW jamming margin method was used to determine the KX-TG2584 processing gain. The processing gain was calculated using the following equation:

$G_p = (S/N)o + Mj + L_{sys}$ where:

G_p = Processing Gain
(S/N)o = Signal to noise required for a given error probability. In this case **1×10^{-4}** was used.
Mj = J/S Jammer to signal ratio required to produce given error probability.
L_{sys} = System losses to due non-ideal performance. Maximum allowed by the FCC is **2.0 dB.**

The (S/N)o ratio was determined to be **11.0 dB** according to Jakes "Microwave Mobile Communications". Page 229 indicates the relevant curve showing error probability Vs (S/N)o for a non-coherent FM system with a peak deviation equal to .35 of the modulation frequency: $F_d = .35\ F_s$.

Given a minimum processing gain of 10 dB, the minimum allowable J/S ratio is -3.0 dB.

I. Test Setup

The processing gain was measured using the test setup shown in Figure 1:

The following test equipment was used for this setup:

- KX-TG2584 (Equipment under test) .
- Dummy Set: Used KX-TG2584 evaluation set.
- IFR 2051 Signal Generator (for desire signal)
- Hewlett Packard ESG D3000A Signal Generator (for jamming signal)
- Taisei SPL1141 Coupler
- Japan Radio Co Ltd.(JRC) NJZ-940 TDMA Error Ratio Measuring Equipment (BER tester)
- Semiflex SMA cables

The Dummy Set was set up at the middle channel 2.4345 GHz. The KX-TG2584 base band 3dB bandwidth is less than 1.0 MHz; therefore, the signal generator was used to inject a CW jammer from 2.4335 GHz to 2.4355 GHz in 50 kHz increments. The DUT received input power was set at -70 dBm. The jammer power was adjusted to achieve a bit error rate of 1x10-4 at each jammer frequency. The jammer power was recorded and the processing gain calculated for each jammer frequency from 2.4335 GHz to 2.4355 GHz.

II. Test Results

The processing gain Vs jammer frequency is shown in Figure 2 and Figure 3 :

$Gp = (C/N)0+Mj+Lsys$

Gp = KX-TG2584 Process Gain
(S/N)0 = S/N ratio for keeping BER=1x10-4
(S/N)0 is 11dB on this system.
Mj = J/S ratio (CW Jamming margin method)
Lsys = system loss (<=2.0dB)

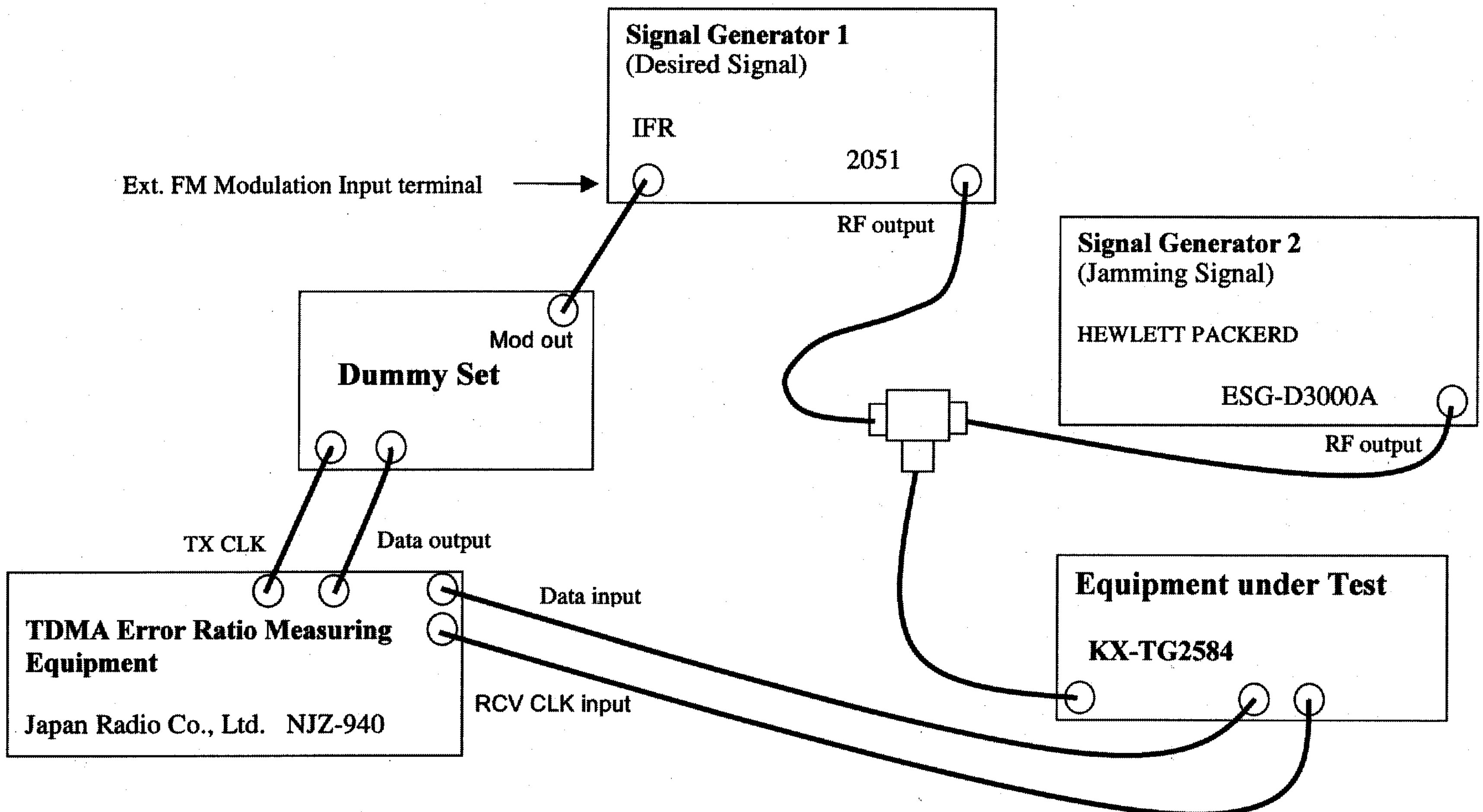

Figure 1: Processing Gain Test Setup

KX-TG2584 Processing Gain Test Results

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	KX-TG2584 -H
Δf(kHz)	J/S Ratio (dB)
1000	8.6
950	6.4
900	4.4
850	2.8
800	2.0
750	-0.3
700	-1.2
650	-1.6
600	-1.6
550	-1.5
500	-1.3
450	-1.4
400	-1.0
350	-1.2
300	-1.0
250	-0.9
200	-0.8
150	-0.6
100	-1.1
50	-0.5
0	0.1
-50	0.2
-100	-0.9
-150	-0.8
-200	-1.0
-250	-0.8
-300	-0.9
-350	-1.3
-400	-1.3
-450	-1.4
-500	-1.6
-550	-1.5
-600	-1.7
-650	-1.8
-700	-1.6
-750	-1.2
-800	-0.2
-850	1.0
-900	4.0
-950	5.3
-1000	8.3

Figure 2: Test Results of Process Gain

J/S Ratio = (Jammer Signal) /(Desired Signal) Ratio

[shaded] = worst 20% points

These points are excluded.

Mj Jamming Margin

Mj(J/S ratio)	
Base	-1.4dB

Note: Mj level is worst value after exclude worst 20% points.

Process Gain

Gp = (S/N)o + Mj + Lsys

(S/N)o = 11dB
Lsys = 2.0dB
Mj: compare above table.

Gp (Process Gain)	
Base	11.6dB

(=-1.4+11+2)

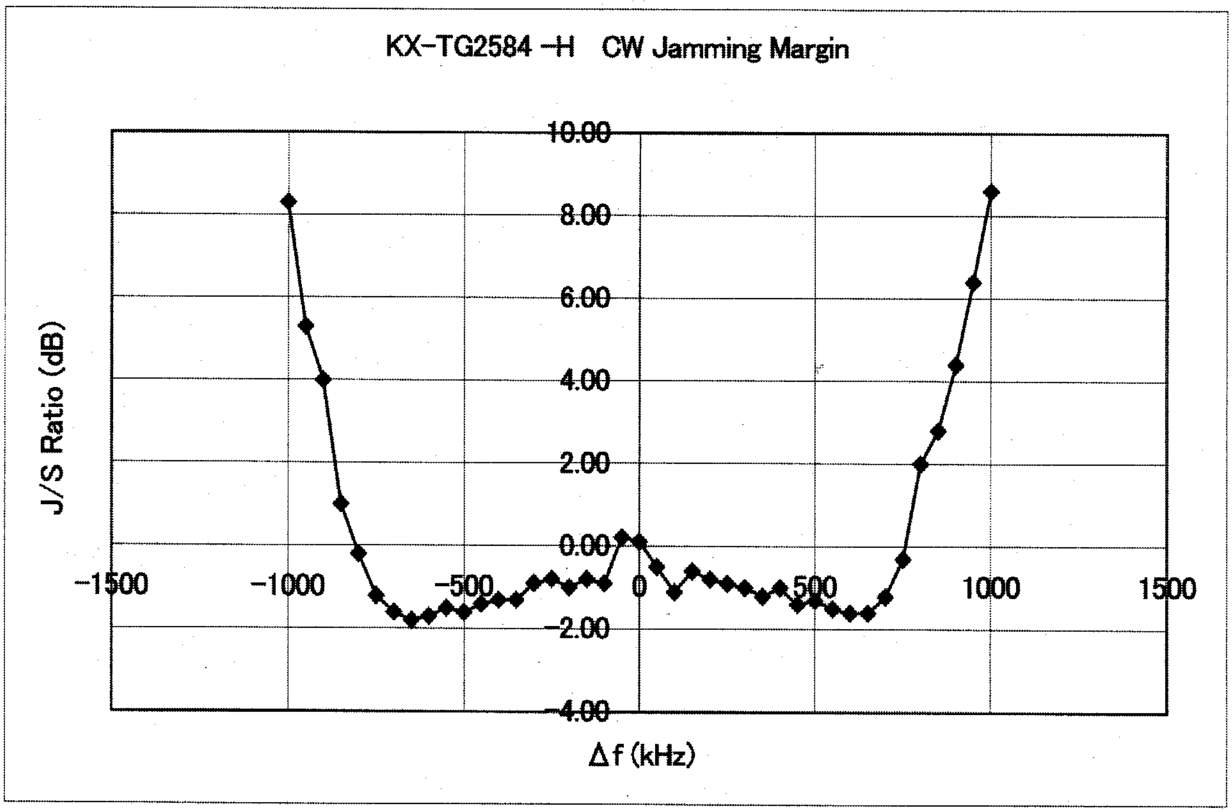

Figure 3: Test Results of Jamming Margin

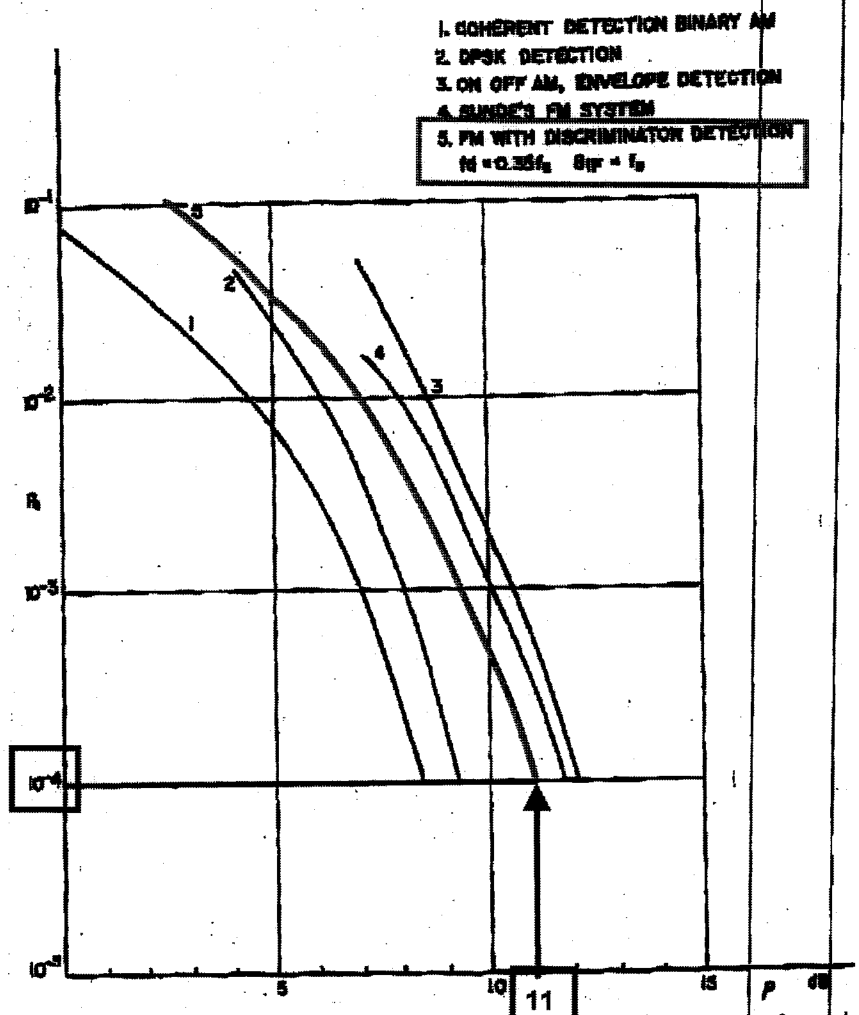

Figure 4.2-6 Error rate as a function of average transmitter power to noise ratio, $\rho = P_T/N_{0f_r}$.

The peak frequency deviation is f_d. It is clear that $x(t)$ is no longer band limited. Calculations show[31, 32] that for small deviations, that is, $f_d < f_r/4$, the spectrum of $x(t)$ is essentially contained in a narrow RF bandwidth of $1.5 f_r$. A narrow-band system has been described by Salz[32, 33] with $f_d = f_r/4$ and a bandwidth of $1.5 f_r$. The transmitted wave was no longer strictly FM but had small amplitude fluctuations. With conventional limiter discrim-