

Intertek Testing Services

Glenayre Western Multiplex, Spread Spectrum Radio

Date of Test: June 11-12, 1998

1.0 Summary of Tests

Glenayre Western Multiplex - Model: 32000

TEST	REFERENCE	RESULTS
Max. Output power	15.247(b)	Pass
6 dB Bandwidth	Not 15.247(a)(2)	Pass
Max. Power Density	15.247(d)	Pass
RF Antenna Conducted Emission	15.247(c)	Pass
Radiated Emission in Restricted Bands	15.247(c), 15.209(a)	Pass
AC Conducted Emission	15.207	Pass
Radiated Emission from Digital Part	15.109	Pass
Radiated Emission from Receiver L.O.	15.109	Not Applicable
Processing Gain Measurements	15.247(e)	Provided by applicant
Antenna Requirement	15.203	Pass

EMC Site Mgr.:

David Chernomordik
David Chernomordik

Date: 7/28/98

Engineering Manager:

C.K. Li
C.K. Li

Date: 7/28/98

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2.0 General Description

2.1 Product Description

The Glenayre Western Multiplex LYNX.mini2 Model 32000 is a 2.4 GHz Fractional Spread Spectrum Digital Microwave Radio.

Overview of Glenayre Western Multiplex LYNX.sc2 (2T)Model 31650

Applicant	Glenayre Western Multiplex
Trade Name & Model No.	Glenayre Western Multiplex, Mode 32000
FCC Identifier	HZB-LYNX72
Use of Product	Point-to-Point Wireless Interconnect
Manufacturer & Model of Spread Spectrum Module	Glenayre Western Multiplex LYNX.mini2
Type of Transmission	Direct Sequence
Rated RF Output (mW)	190
Frequency Range (MHz)	2412 -2470
Number of Channel(s)	From 4 to 12
Antenna(s) & Gain, dBi	Comsat RSI, 27.5 dBi
Processing Gain Measurements	☒ Will be provided to ITS for submission with the application ☐ Will be provided directly to the FCC reviewing engineer by the client or manufacturer of the spread spectrum module
Antenna Requirement	☐ The EUT uses a permanently connected antenna. ☐ The antenna is affixed to the EUT using a unique connector which allows for replacement of a broken antenna, but DOES NOT use a standard antenna jack or electrical connector. ☒ The EUT requires professional installation (attach supporting documentation if using this option).
Manufacturer name & address	Glenayre Western Multiplex 1196 Borregas Ave. Sunnyvale, California 94089

2.2 Related Submittal(s) Grants

None.

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2.3 Test Methodology

AC mains line-conducted, antenna terminal conducted, and radiated emissions measurements were performed according to the procedures in ANSI C63.4 (1992). Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Data Sheet**" of this Application. All other measurements were made in accordance with the procedures in part 2 of CFR 47.

2.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at Menlo Park. This test facility and site measurement data have been fully placed on file with the FCC.

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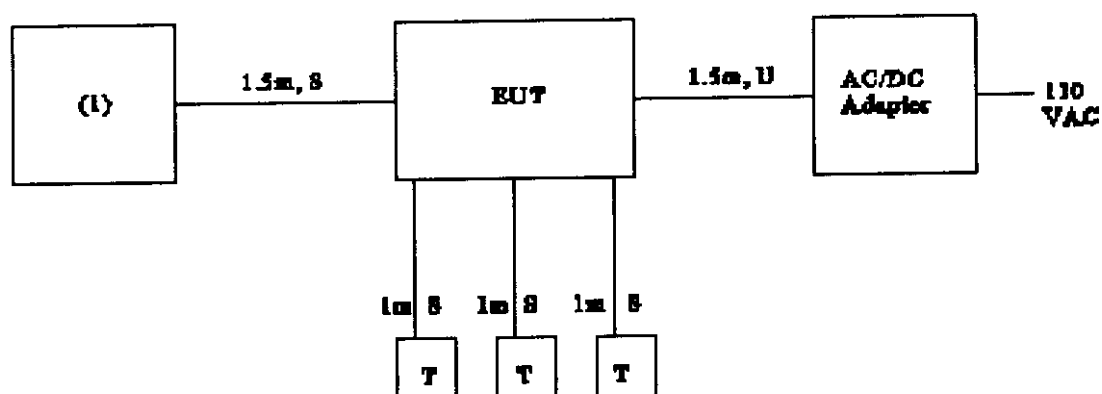
Date of Test: June 11-12, 1998

3.0 System Test Configuration

3.1 Support Equipment

Item #	Description	Model No.	Serial No.	FCC ID
1	Comsat Antenna	P-24A48G	Not Labeled	N/A

3.2 Block Diagram of Test Setup



* = EUT

** = No ferrites on video cable

S = Shielded;

U = Unshielded

F = With Ferrite

T - Termination

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3.3 Justification

For emission testing, the equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). During testing, all cables were manipulated to produce worst case emissions.

For radiated emission measurements, the EUT is attached to a cardboard box (if necessary) and placed on the wooden turntable. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). The EUT is wired to transmit full power.

The signal is maximized through rotation on the turntable. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use.

For emissions testing, the units were setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing.

3.5 Mode of Operation During Test

Transmitting and Receiving modes

3.6 Modifications Required for Compliance

The following modifications were installed during compliance testing in order to bring the product into compliance (Please note that this list does not include changes made specifically by Glenayre Western Multiplex prior to compliance testing):

No modifications were made to the EUT by Intertek Testing Services.

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Glenayre Western Multiplex, Spread Spectrum Radio

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4.0 Measurement Results

4.1 Maximum Conducted Output Power at Antenna Terminals:

Requirement:

Maximum allowed transmitter peak output power is $30 \text{ dBm} - (G - 6)/3$, where G - is an antenna gain.

Procedure:

- [] The antenna port of the EUT was connected to the input of a power meter. Power was read directly and cable loss correction was added to the reading to obtain power at the EUT antenna terminals.
- [X] The antenna port of the EUT was connected to the input of a spectrum analyzer. The analyzer was set for maximum RES BW and power was read directly in dBm. External attenuation and cable loss were compensated for using the OFFSET function of the analyzer.

Result:

Refer to the attached plots and data table below.

Max. antenna gain = 27.5 dBi		
Frequency (MHz)	Output in dBm	Output in mWatt
2412	22.6	182
2452	23.0	200
2470	22.6	182

Cable loss: 0 dB External Attenuation: 0 dB

Cable loss, external attenuation: [X] included in OFFSET function

EUT maximum allowed peak output power = $30 - (27.5 - 6) / 3 = 22.8 \text{ dBm}$

Mkr 2.412 9GHz

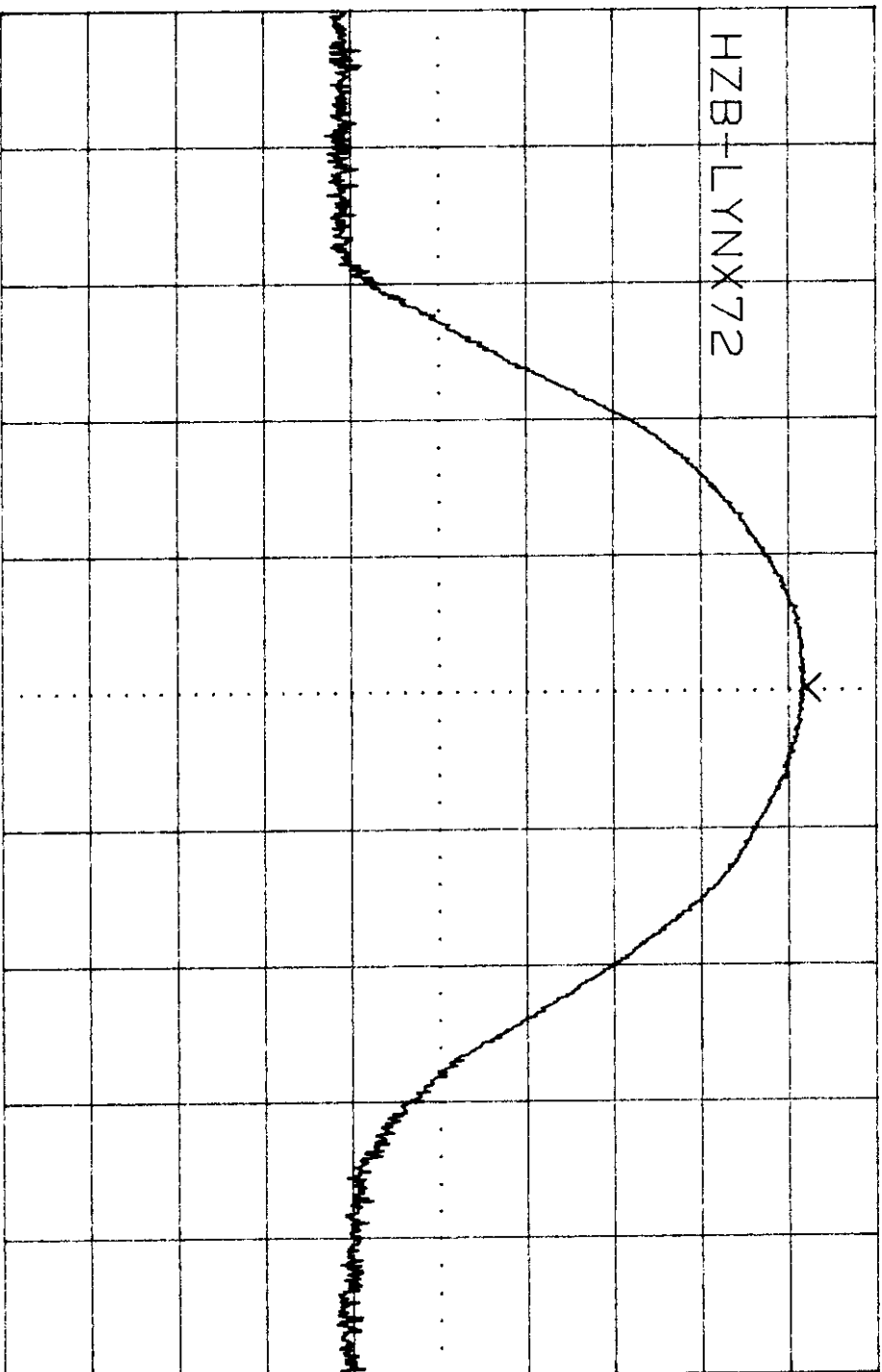
*22.60dBm

Ref Lvl *30.4dBm

10dB/

Atten 40dB

HZB-LYNX72



Freq 2.412 0GHz

Span 50MHz

ResBW 10MHz

VIDBW 7MHz

SWP 50ms

LEVEL

SPAN

Span 50MHz

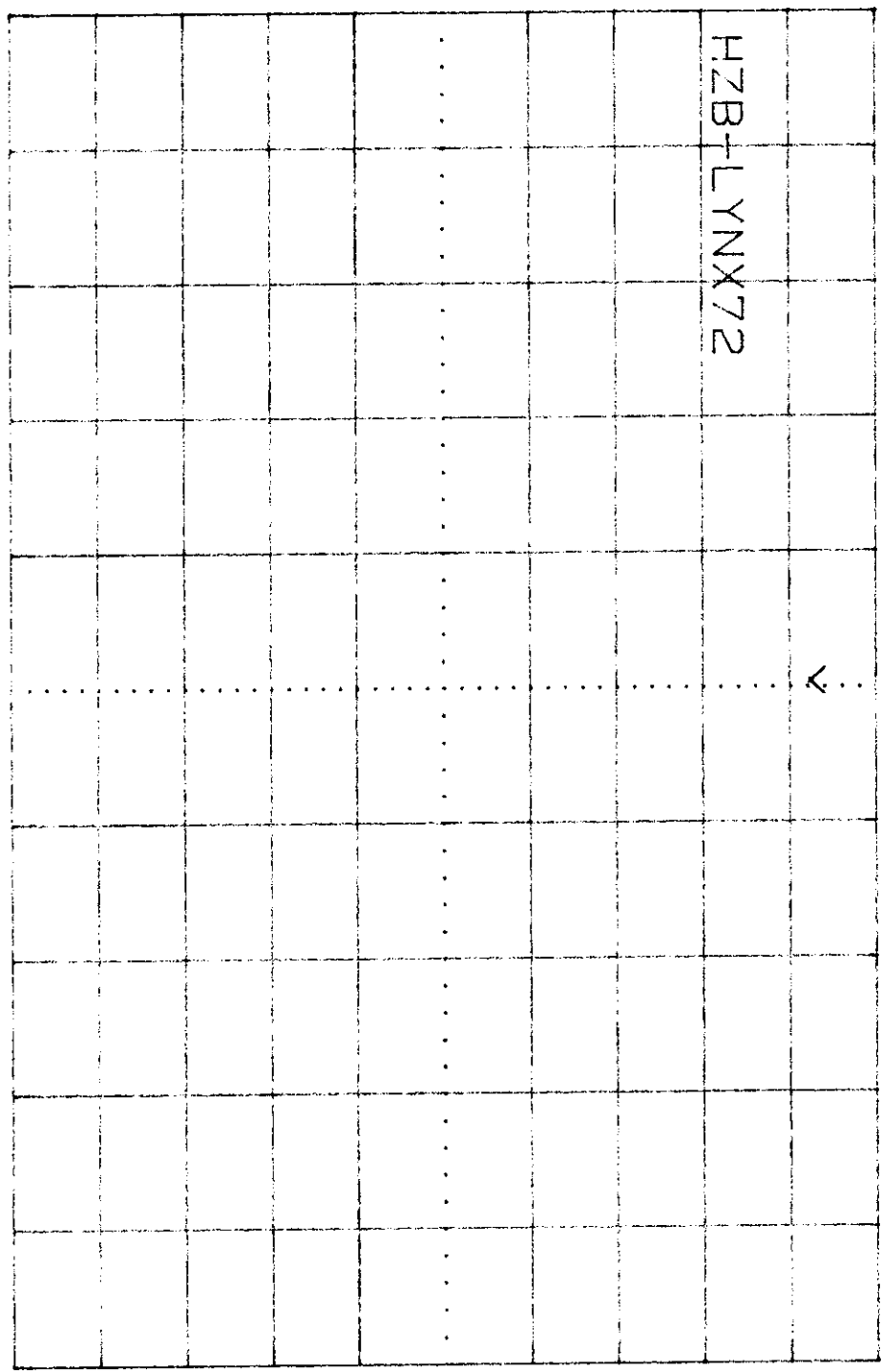
Mkr 2.451 8GHz

*23.00dBm

Ref Lvl*30.4dBm

10dB/

Atten 40dB



Freq 2.452 0GHz

Span 50MHz

ResBW 10MHz

VIDBW 7MHz

SWP 50ms

LEVEL

SPAN

Freq 2.452 0GHz

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4.2 Minimum 6 dB RF Bandwidth:

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RES BW was set to 100 kHz. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 6 dB lower than PEAK level. The 6 dB bandwidth was determined from where the channel output spectrum intersected the display line.

Frequency (MHz)	Min. 6 dB Bandwidth (kHz)
2470	3400

Plots attached:

Plot 2a: Low Channel 6 dB RF Bandwidth

Plot 2b: Middle Channel 6 dB RF Bandwidth

Plot 2c: High Channel 6 dB RF Bandwidth

PLOT # 2a

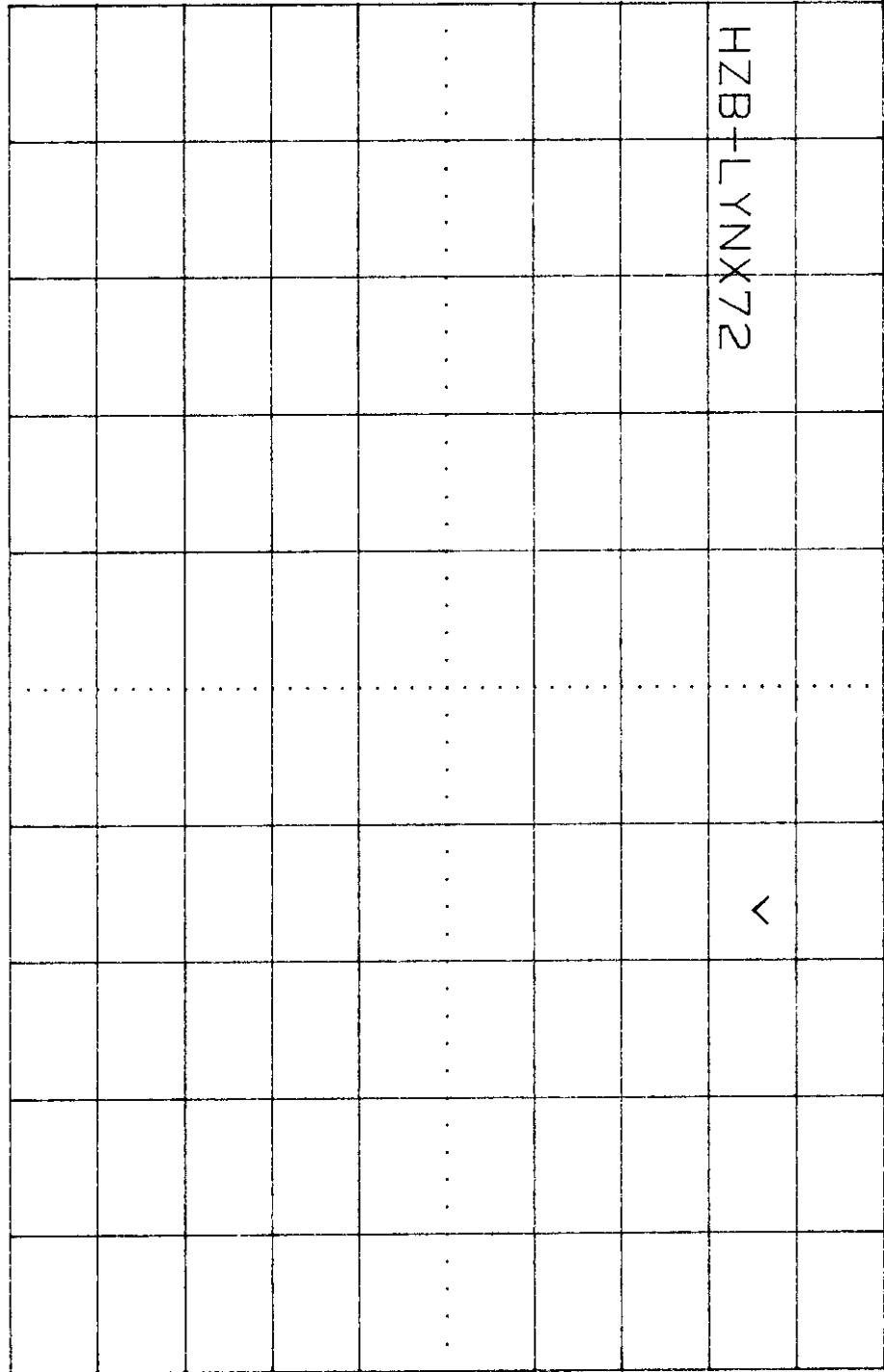
Mkr Δ 3.40MHz

Δ -0.10dB

Ref Lvl*20.4dBm

10dB/

Atten 40dB



Freq 2.470 00GHz

Span 10MHz

ResBW 100kHz

Vi dBW 100kHz

SWP 50ms

LEVEL

SPAN

Freq

2.470 00GHz

PLOT# 2b

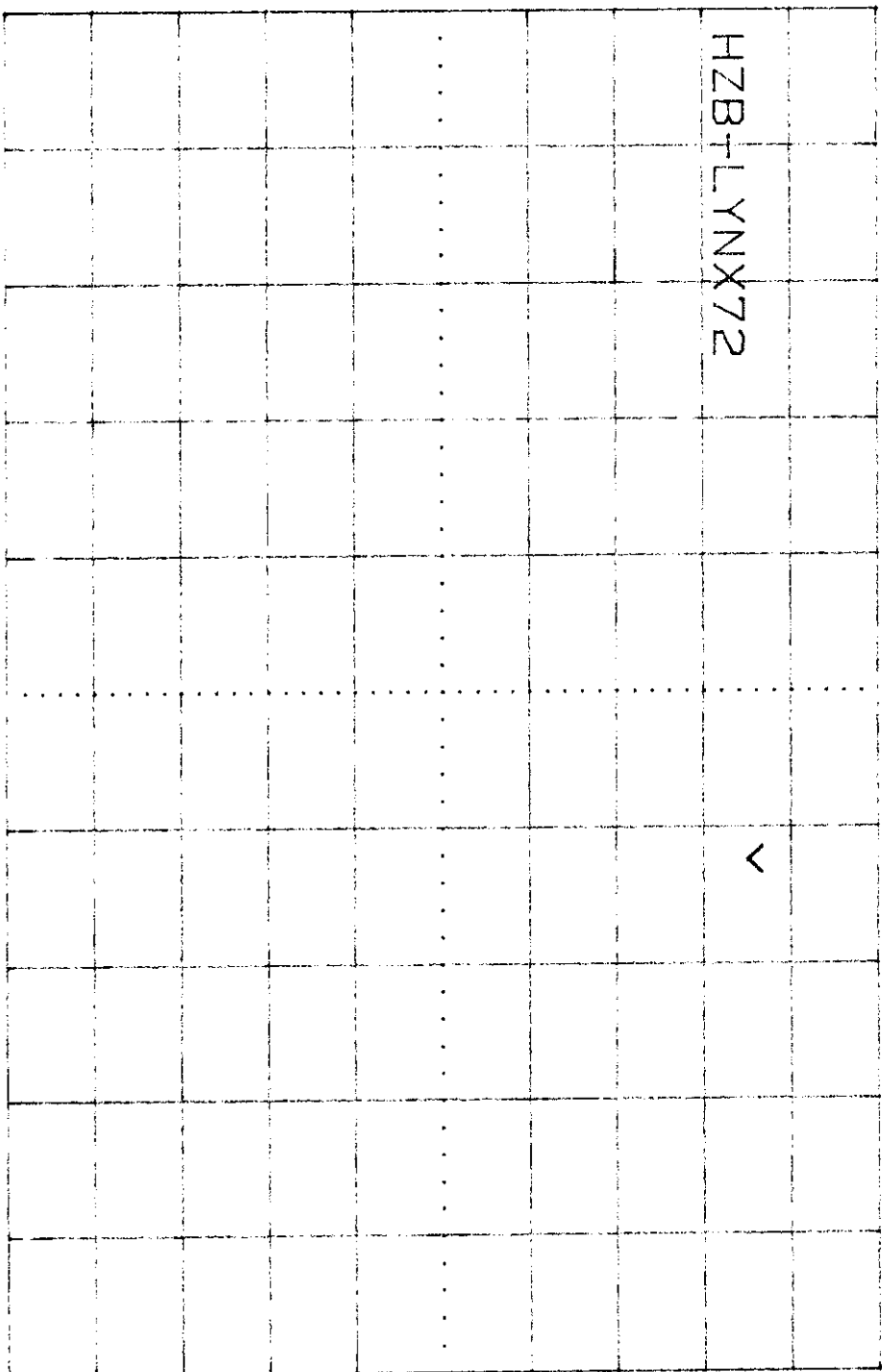
Mkr Δ 3.43MHz

Δ 0.00dB

Ref Lvl*20.4dBm

10dB/

Atten 40dB



Freq 2.452 00GHz

Span 10MHz

ResBW 100kHz

ViDBW 100kHz

SWP 50ms

LEVEL

SPAN

Ref Lvl*20.4dBm

PLOT# 2c

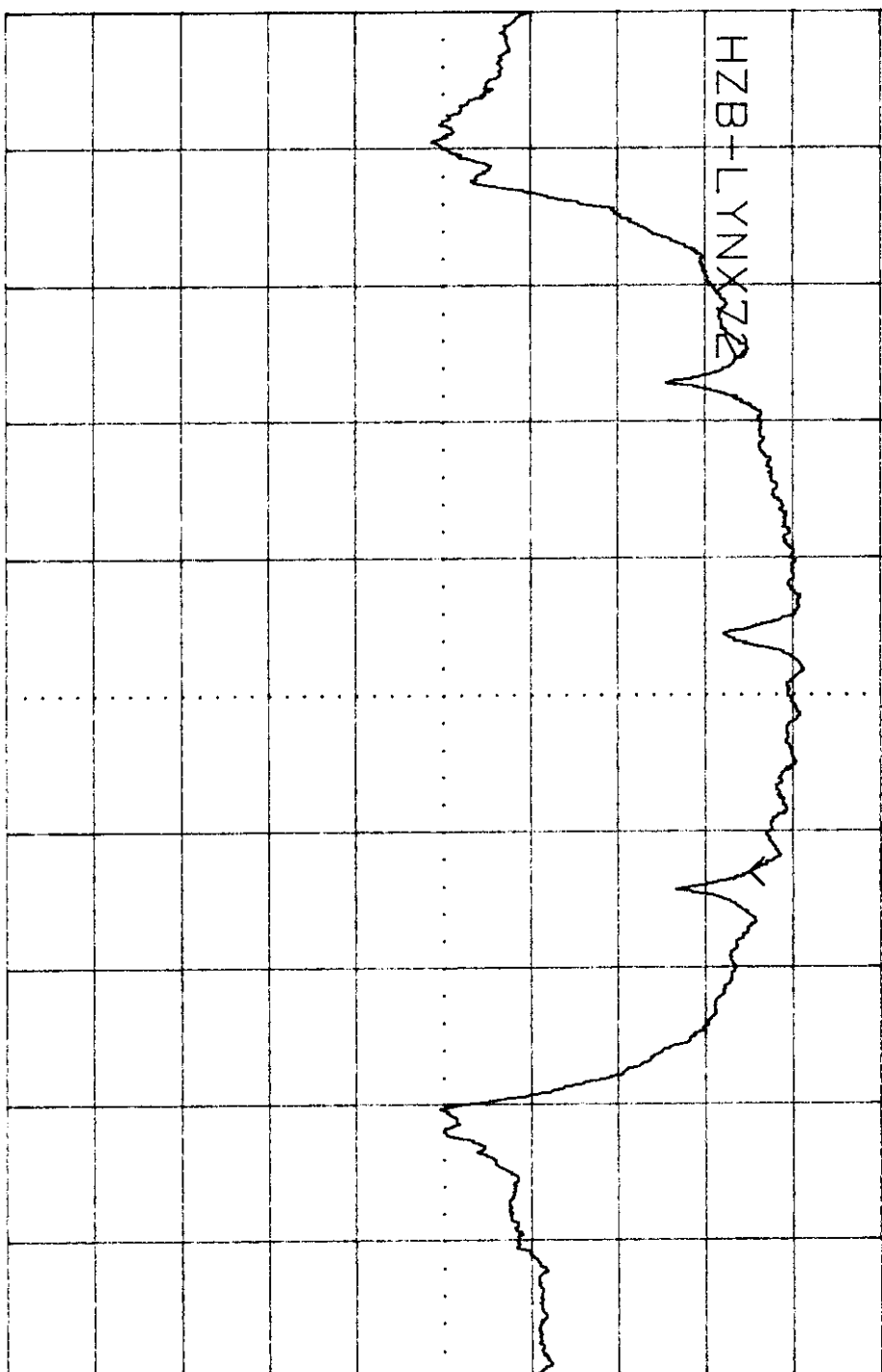
Mkr Δ 3.42MHz

Δ 0.10dB

Ref Lvl*20.4dBm

10dB/

Atten 40dB



Freq 2.412 00GHz

Span 10MHz

ResBW 100kHz

Vi dBW 100kHz

SWP 50ms

LEVEL

SPAN

Ref Lvl*20.4dBm

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4.3 Maximum Power Density Reading:

The spectrum analyzer RES BW was set to 3 kHz. The START and STOP frequencies were set to the band edges of the maximum output passband. If there is no clear maximum amplitude in any given portion of the band, it may be necessary to make measurements at a number of bands defined by several START and STOP frequency pairs. The specification calls for a 1 second interval at each 3 kHz bandwidth; total SWEEP TIME is calculated as follows:

$$\text{SWEEP TIME (SEC)} = (\text{Fstop, kHz} - \text{Fstart, kHz}) / 3 \text{ kHz}$$

Antenna output of the EUT was coupled directly to spectrum analyzer; if an external attenuator and/or cable was used, these losses are compensated for with the analyzer OFFSET function.

Frequency (MHz)	Power Density (dBm) Limit 8 dBm
2412	-1.5

Frequency Span = 600 KHz

Sweep Time = Frequency Span / 3 kHz = 200 seconds

Plots attached:

Plot 3a1-3a2: Low Channel Power Density

Plot 3b1-3b2: Middle Channel Power Density

Plot 3c1-3c2: High Channel Power Density

PLOT# 3a1

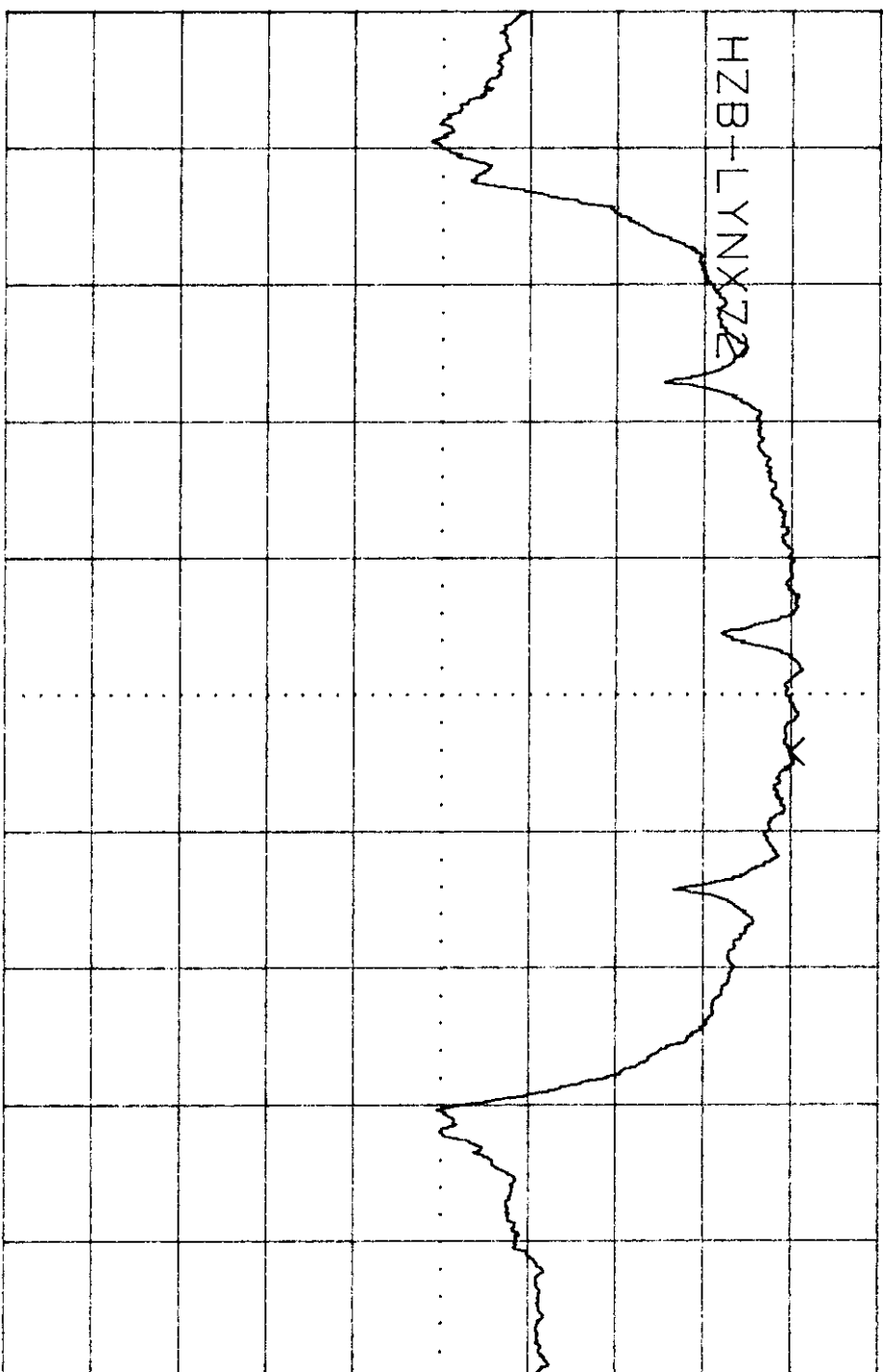
Mkr Δ 0.60MHz

Δ -1.30dB

Ref Lvl*20.4dBm

10dB/

Atten 40dB



Freq 2.412 00GHz

Span 10MHz

ResBW 100kHz

Vi dBW 100kHz

SWP 50ms

LEVEL

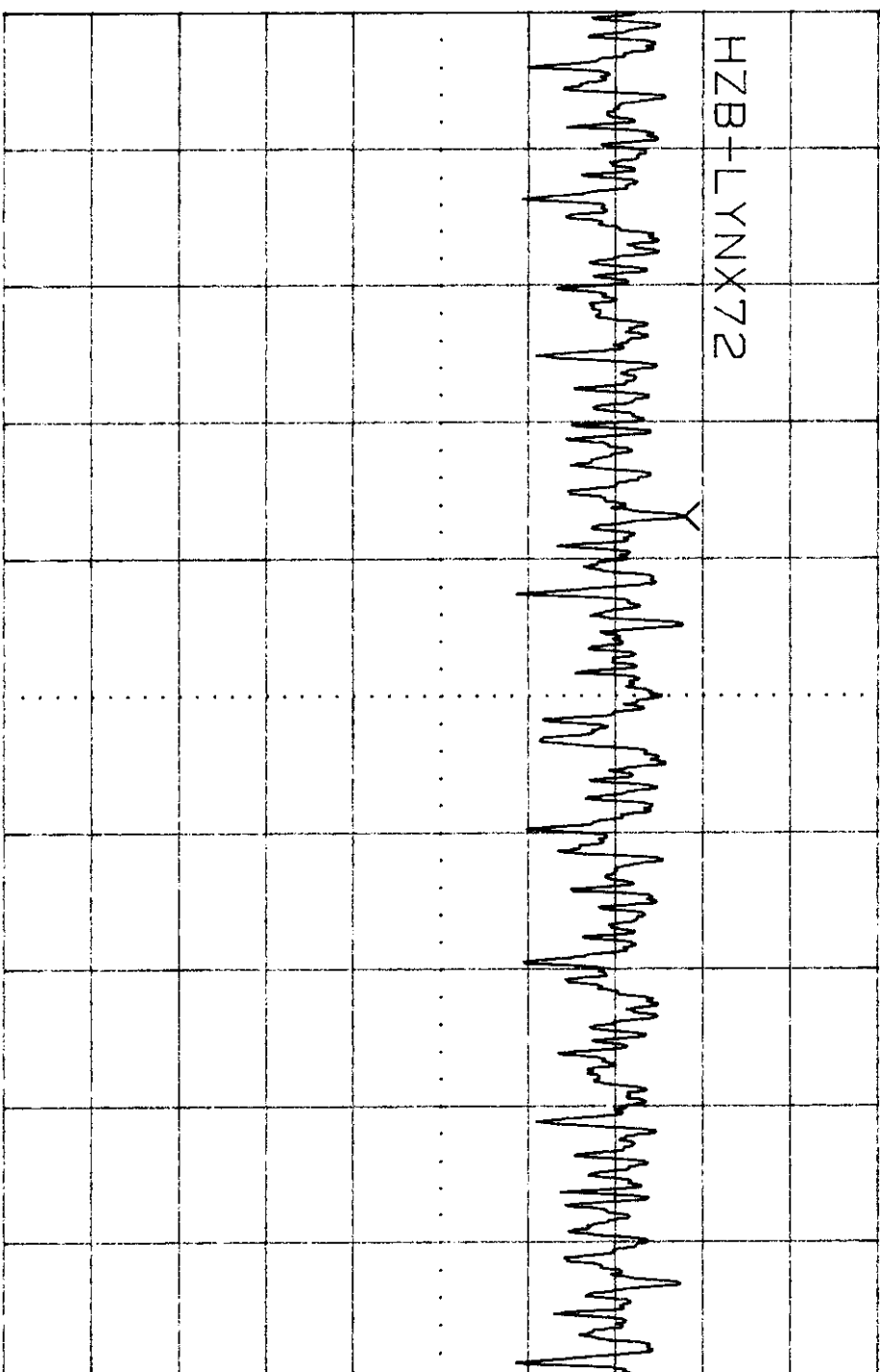
SPAN

Ref Lvl*20.4dBm

PLOT# 3a2

Mkr 2.412 041 4GHz *-1.80dBm

Ref Lvl*20.4dBm 10dB/ Atten 40dB



2.411 820 0GHz to 2.412 420 0GHz

ResBW 3kHz VidBW 3kHz SWP 200S

LEVEL

SPAN

SWP 200S

PLOT# 3b1

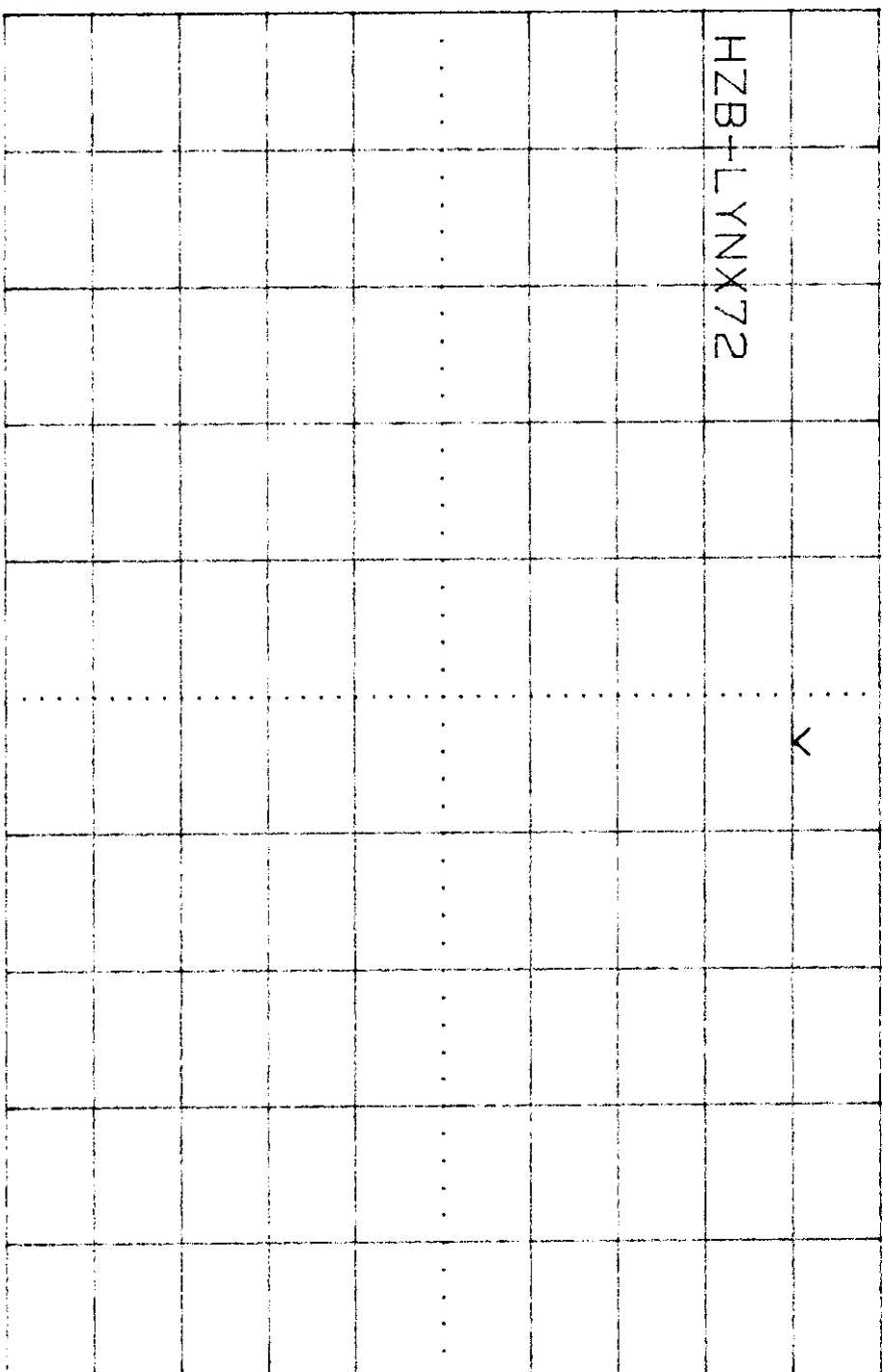
Mkr Δ 0.60MHz

Δ -1.50dB

Ref Lvl*20.4dBm

10dB/

Atten 40dB



Freq 2.452 00GHz

Span 10MHz

ResBW 100kHz

ViDBW 100kHz

SWP 50ms

LEVEL

SPAN

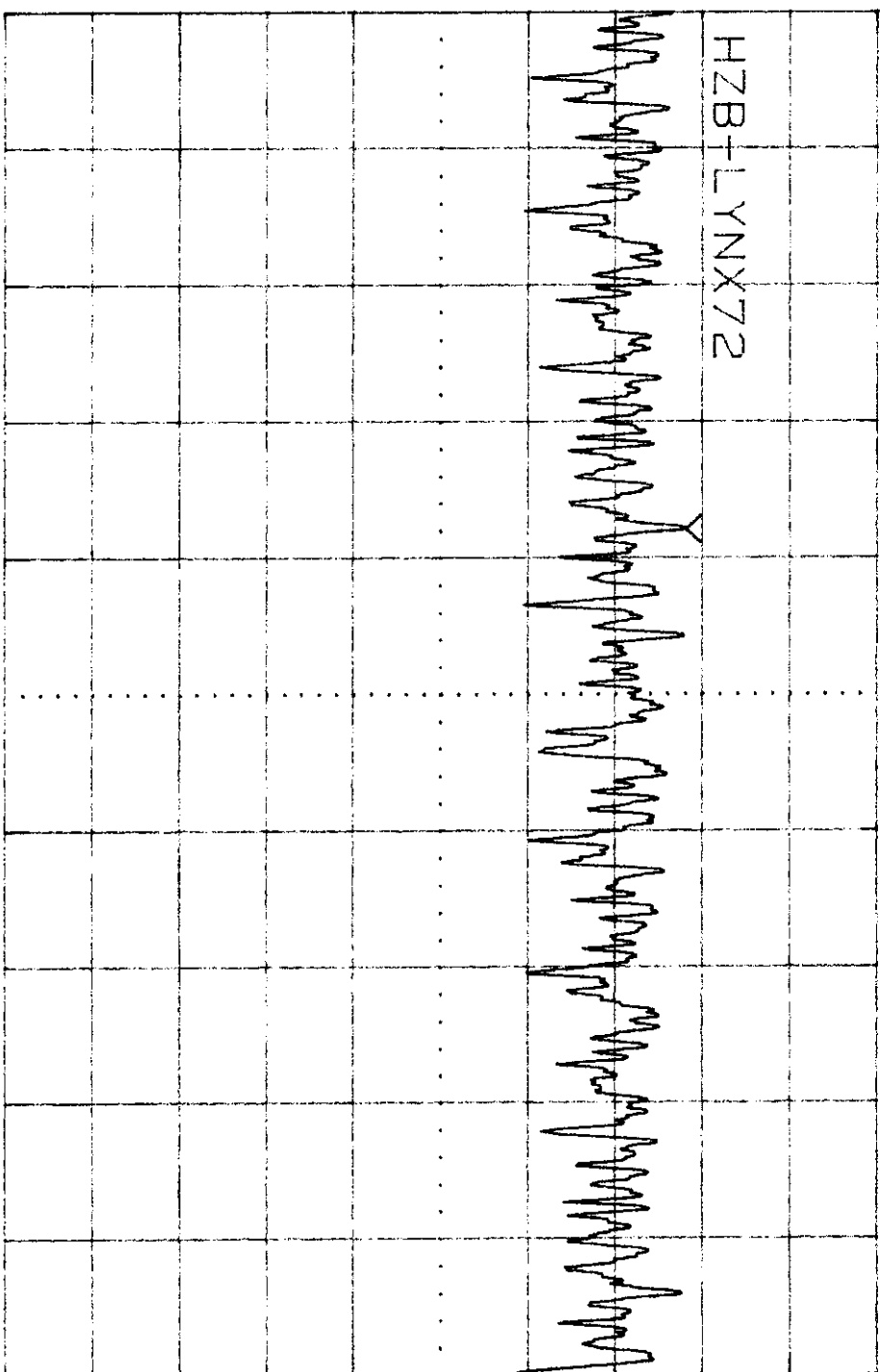
Ref Lvl*20.4dBm

PLOT# 3b2

Mkr 2.451 977 4GHz *-1.50dBm

Ref Lvl*20.4dBm 10dB/ Atten 40dB

HZB-LYNX72



2.451 750 0GHz to 2.452 350 0GHz

ResBW 3kHz VidBW 3kHz SWP 200S

LEVEL

SPAN

SWP 200S

PLOT# 3c1

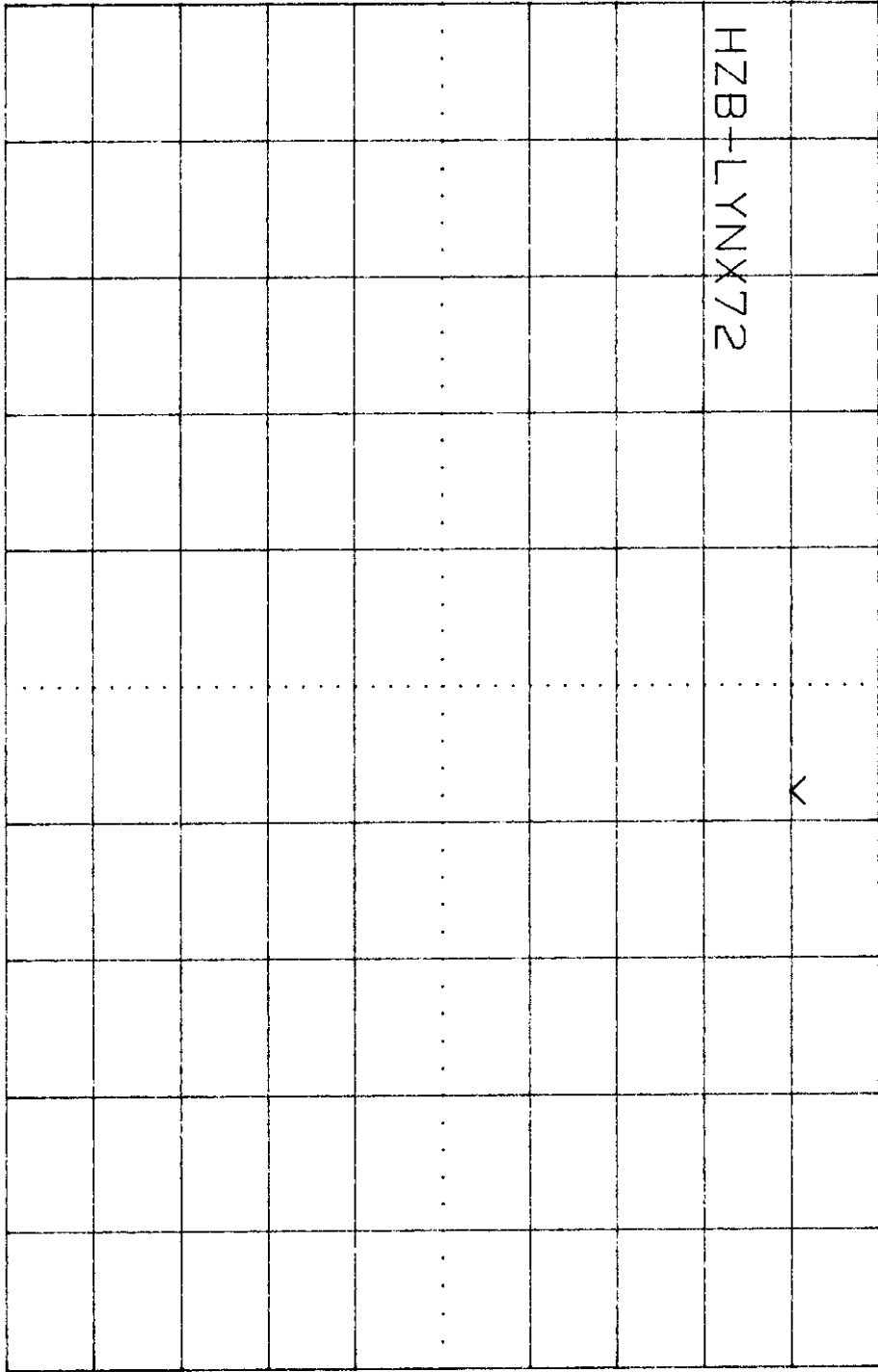
Mkr Δ 0.60MHz

Δ -1.80dB

Ref Lvl *20.4dBm

10dB/

Atten 40dB



Freq 2.470 00GHz

Span 10MHz

ResBW 100kHz

Vi dBW 100kHz

SWP 50ms

LEVEL

SPAN

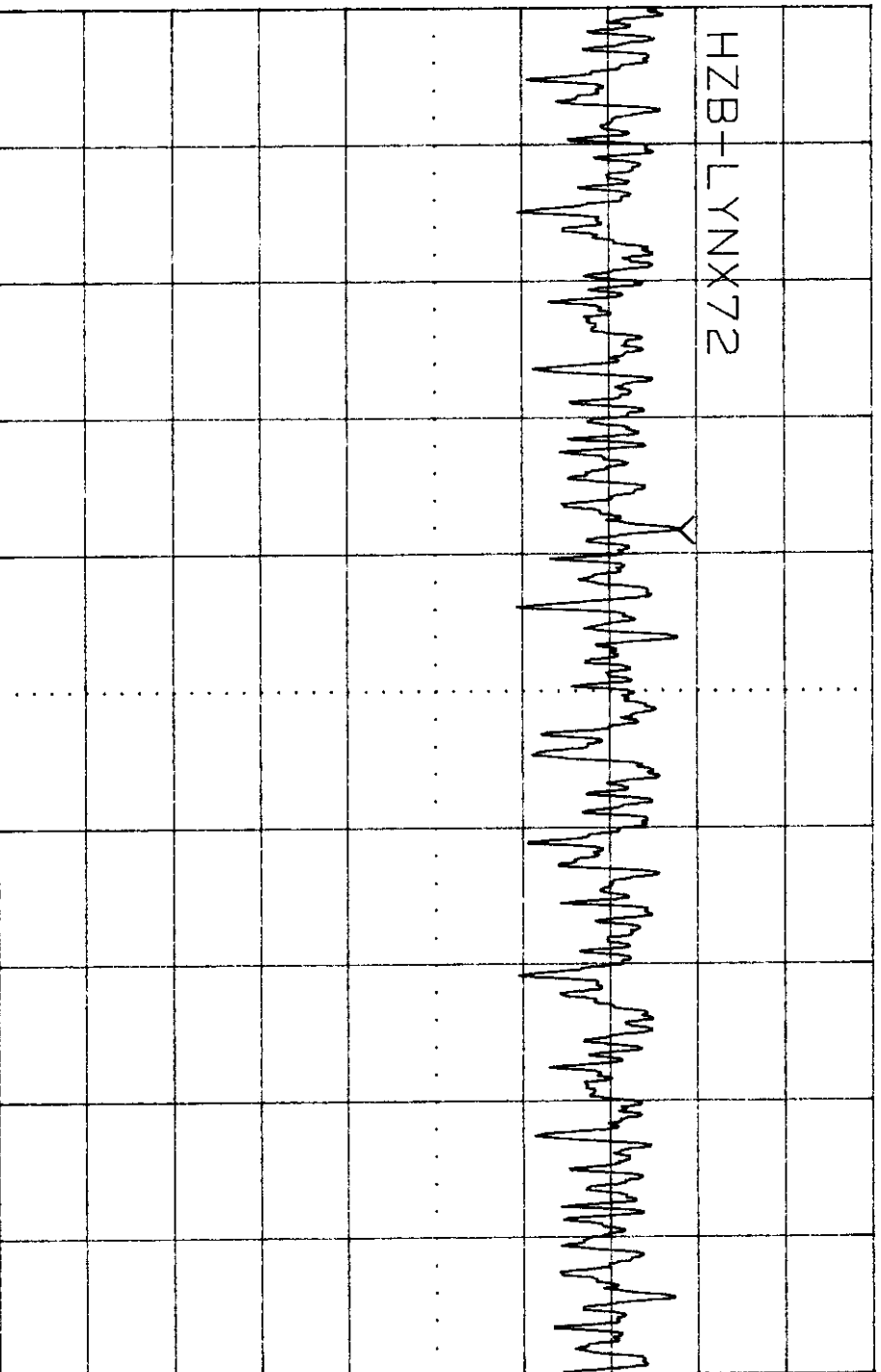
Freq

2.470 00GHz

PLOT# 3c2

Mkr 2.470 409 8GHz *-1.60dBm

Ref Lvl*20.4dBm 10dB/ Atten 40dB



2.470 180 0GHz to 2.470 780 0GHz

ResBW 3kHz VidBW 3kHz SWP 200S

LEVEL

SPAN

SWP 200S

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4.4 Out of Band Conducted Emissions:

In any 100 kHz bandwidth outside the EUT passband, the RF power shall be at least 20 dB below that of the maximum in-band 100 kHz emission.

Test Results:

Refer to the following plots for out of band conducted emissions data:

Plot 4a1 - 4a4: Low Channel Emissions

Plot 4b1 - 4b5: Middle Channel Emissions

Plot 4c1 - 4c4: High Channel Emissions

PLOT# 4a1

LOW CHANNEL 2412 MHz

Mkr 1.00MHz

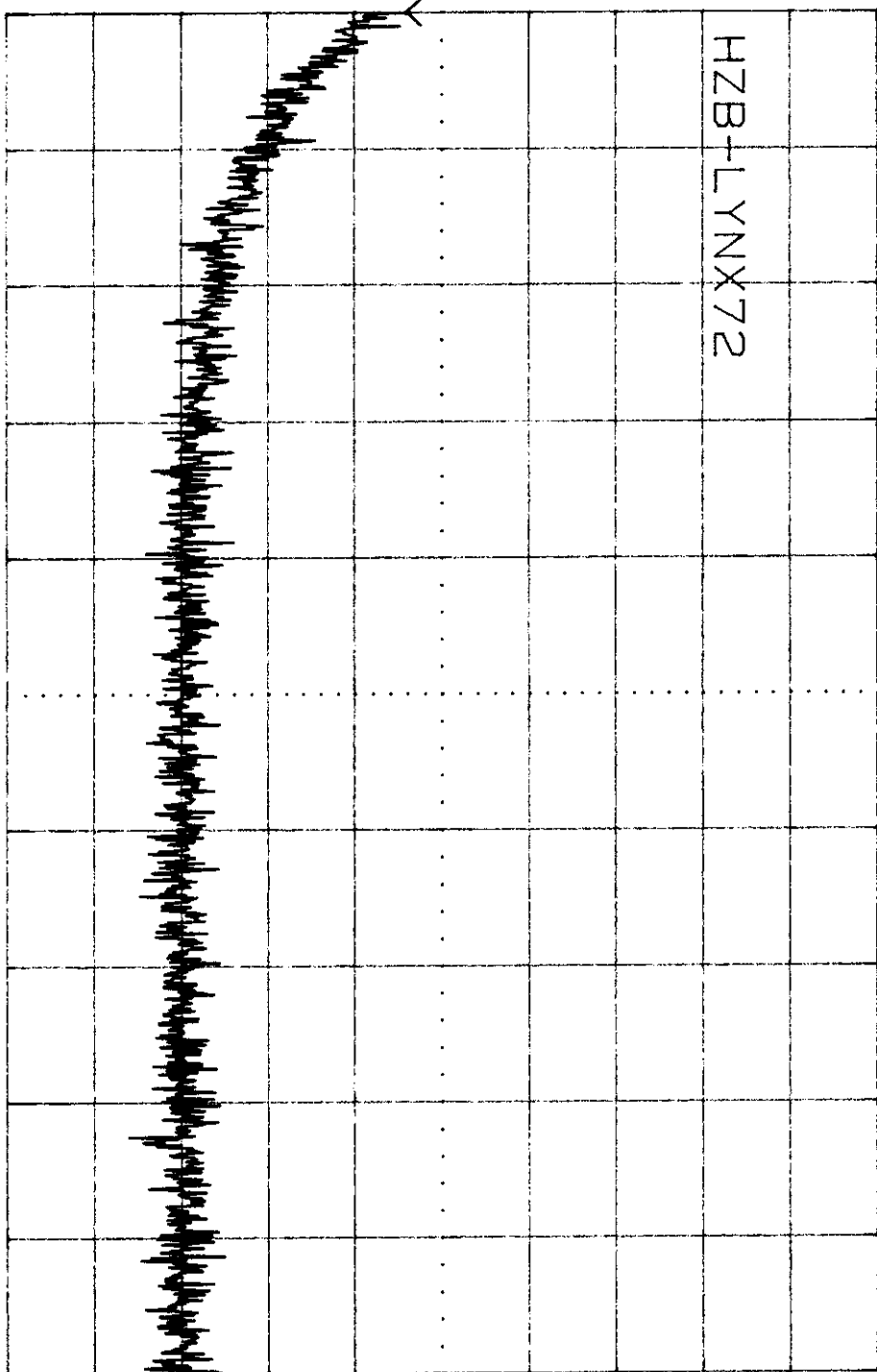
*-33.90dBm

Ref Lvl*20.4dBm

10dB/

Atten 40dB

HZB-LYNX72



1.00MHz

to

30.00MHz

ResBW 30kHz

VideoBW 30kHz

SWP 180ms

LEVEL

SPAN

Stop 30.00MHz

PLOT# 4a2
LOW CHANNEL 2412 MHz

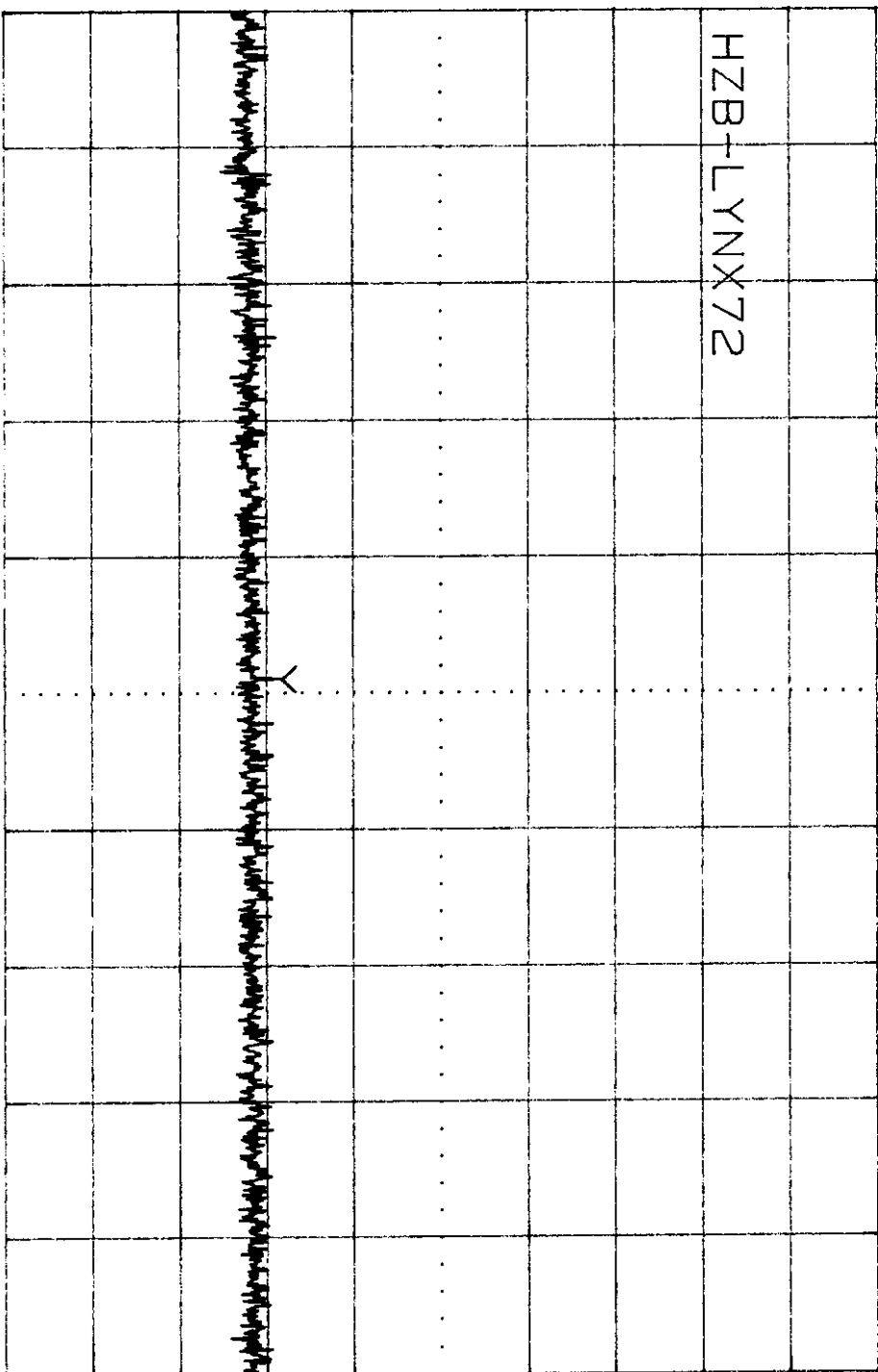
Mkr 505.3MHz

*-47.80dBm

Ref Lvl*20.4dBm

10dB/

Atten 40dB



30.0MHz

to

1.000 0GHz

ResBW 100kHz

ViDBW 100kHz

SWP 550ms

LEVEL

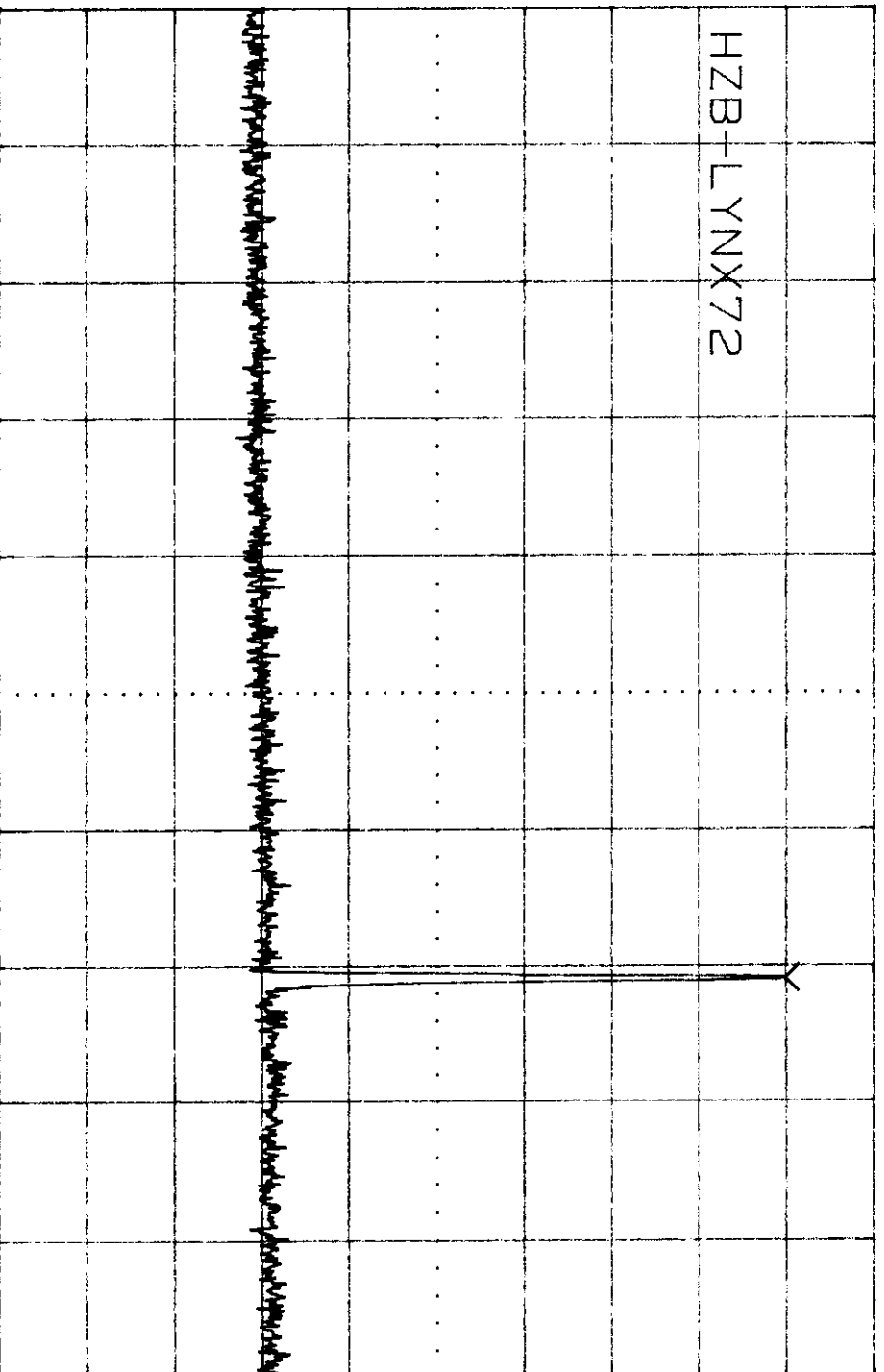
SPAN

ViDBW 100kHz

PLOT# 4a3
LOW CHANNEL 2412 MHz

Mkr 2.418GHz *9.90dBm

Ref Lvl*20.4dBm 10dB/ Atten 40dB



1.000GHz to 3.000GHz

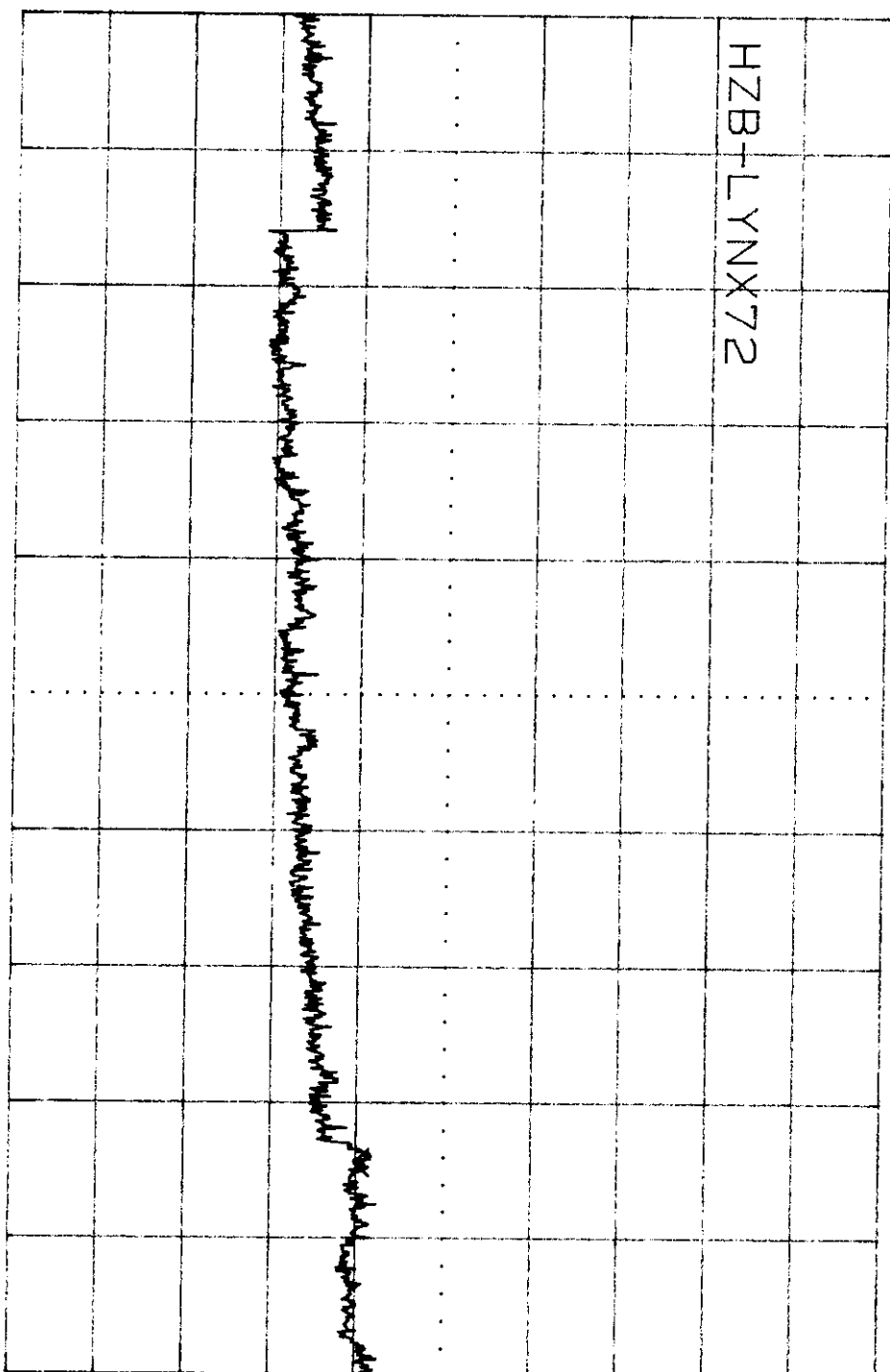
ResBW 100kHz VidBW 100kHz SWP 1.15

LEVEL SPAN Stop 3.000GHz

PLOT# 4a4
LOW CHANNEL 2412 MHz

Mkr 21.57GHz *-39.80dBm

Ref Lvl*20.4dBm 10dB/ Atten 40dB

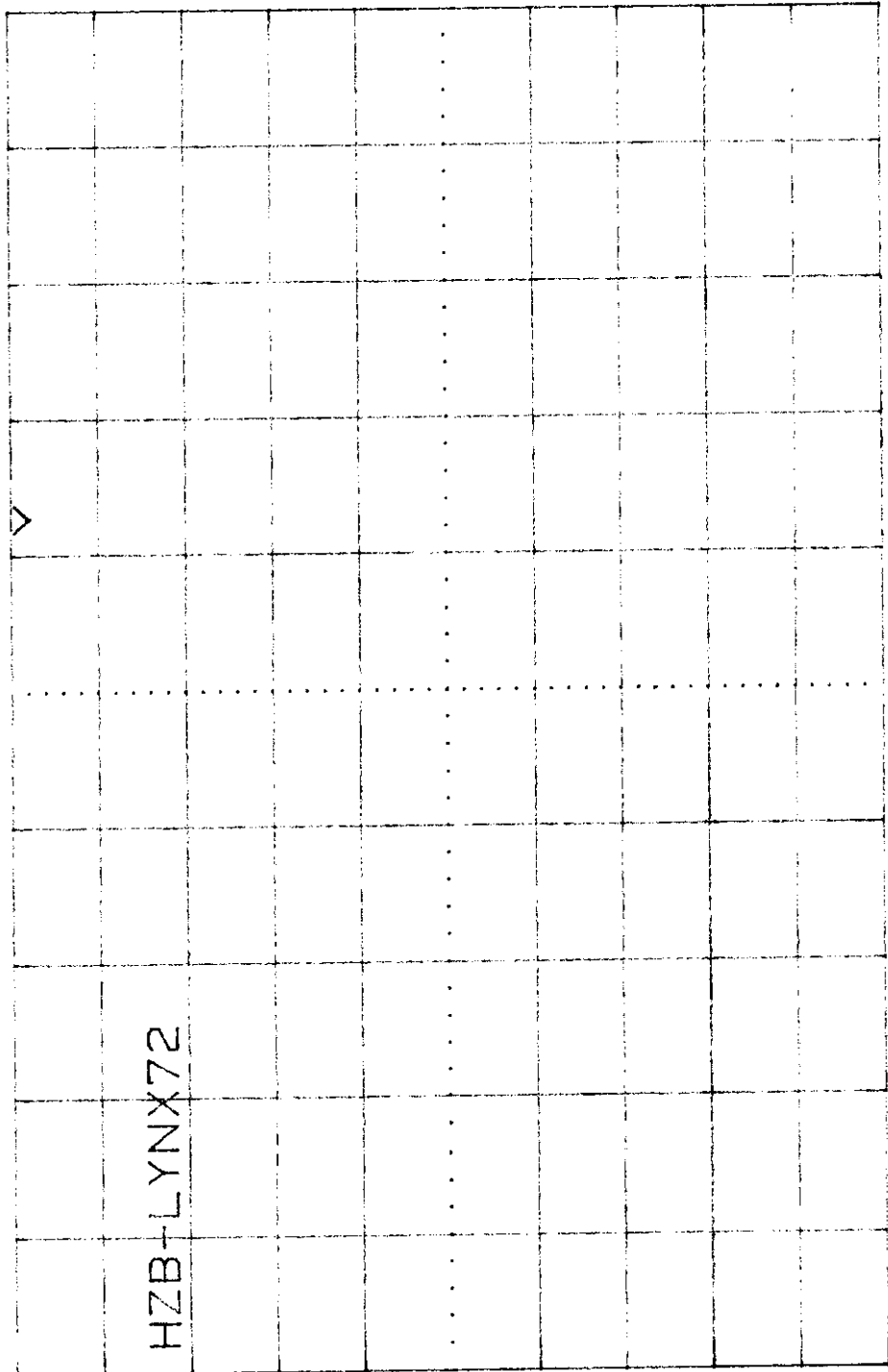


3.00GHz to 25.00GHz

ResBW 100kHz VidBW 100kHz SWP 135

LEVEL SPAN Stop 25.00GHz

Mkr 2.452 35GHz *14.30dBm
Ref Lvl*16.4dBm 10dB/ Atten 10dB



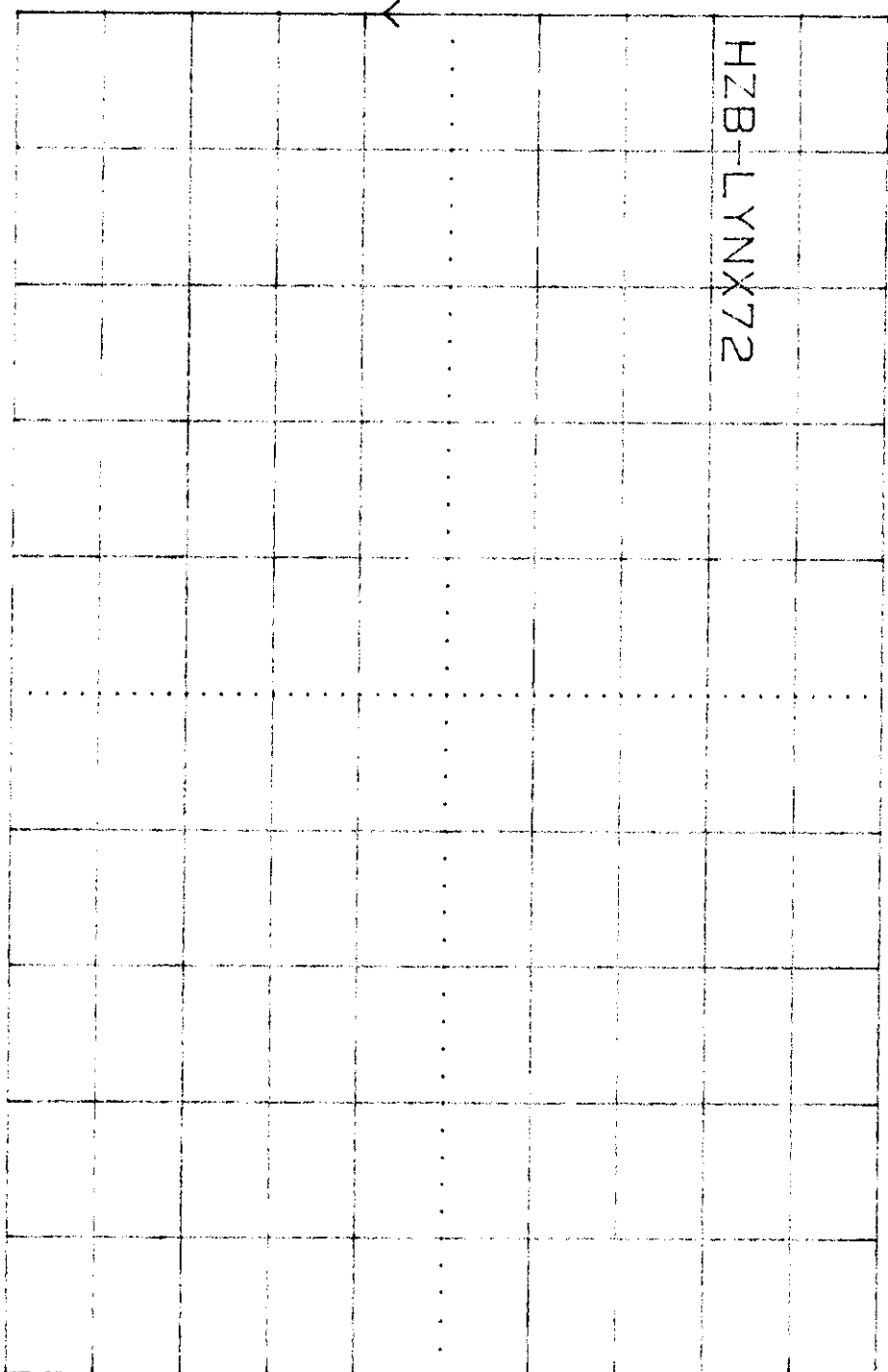
2.400 00GHz to 2.483 50GHz
ResBW 1MHz VidBW 100kHz SWP 20mS

LEVEL SPAN Ref Lvl*16.4dBm

PLOT# 4b1
MIDDLE CHANNEL 2452 MHz

Mkr 1.00MHz *-37.50dBm

Ref Lvl*20.4dBm 10dB/ Atten 40dB



1.00MHz to 30.00MHz

ResBW 30kHz VidBW 3kHz SWP 640ms

LEVEL SPAN Stop 30.00MHz

PLOT# 4b2
MIDDLE CHANNEL 2452 MHz

Mkr 448.1MHz

*-48.30dBm

Ref Lvl*20.4dBm

10dB/

Atten 40dB

HZB-LYNX72

>

30.0MHz

to

1.000 0GHz

ResBW 100kHz

ViDBW 100kHz

SWP 550ms

LEVEL

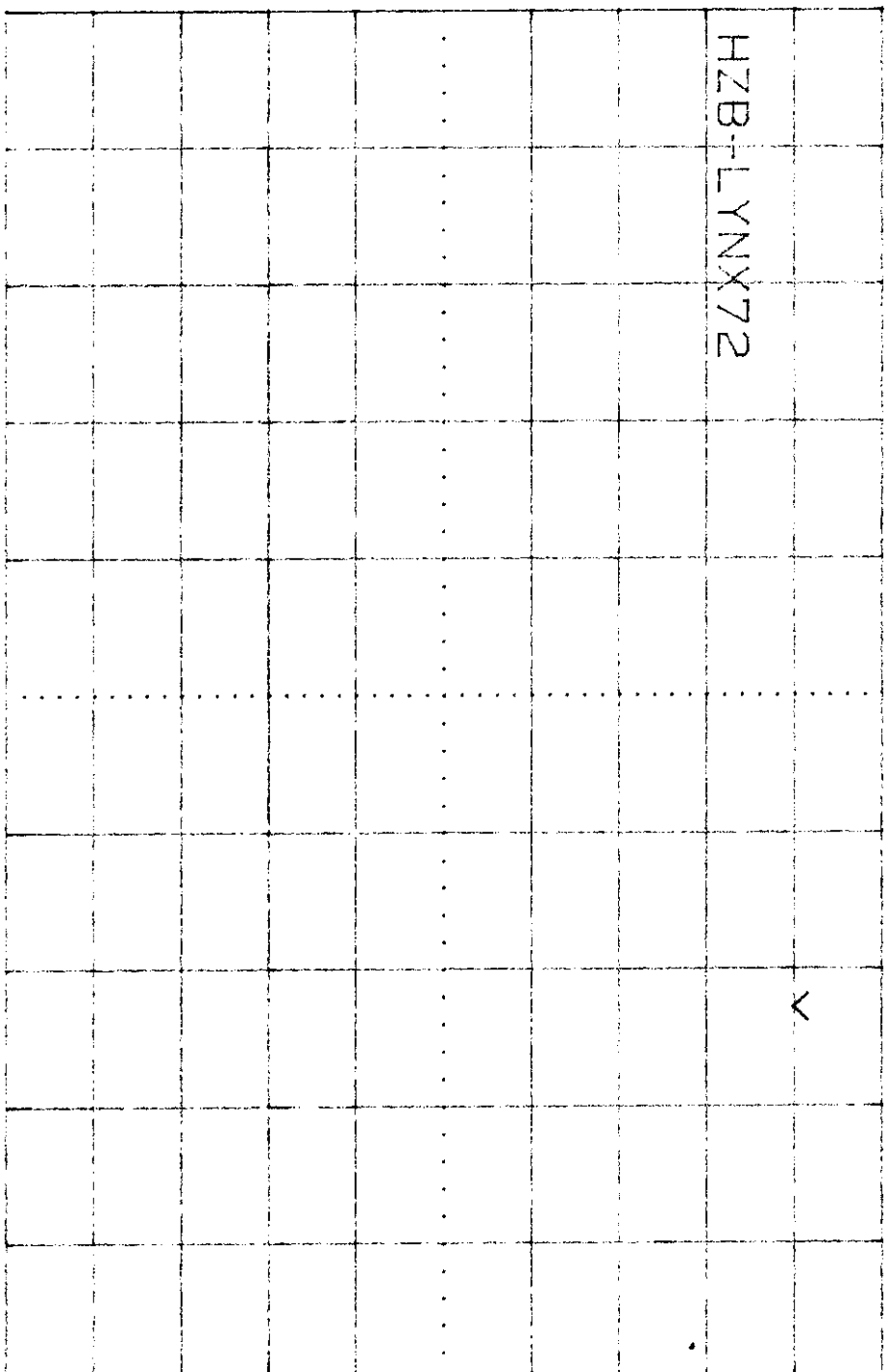
SPAN

ViDBW 100kHz

PLOT# 4b3
MIDDLE CHANNEL 2452 MHz

Mkr 2.456GHz *10.00dBm

Ref Lvl*20.4dBm 10dB/ Atten 40dB



1.000GHz to 3.000GHz

ResBW 100kHz VidBW 100kHz SWP 1.15

LEVEL

SPAN

Stop 3.000GHz

PLOT# 4b5
MIDDLE CHANNEL 2452 MHz

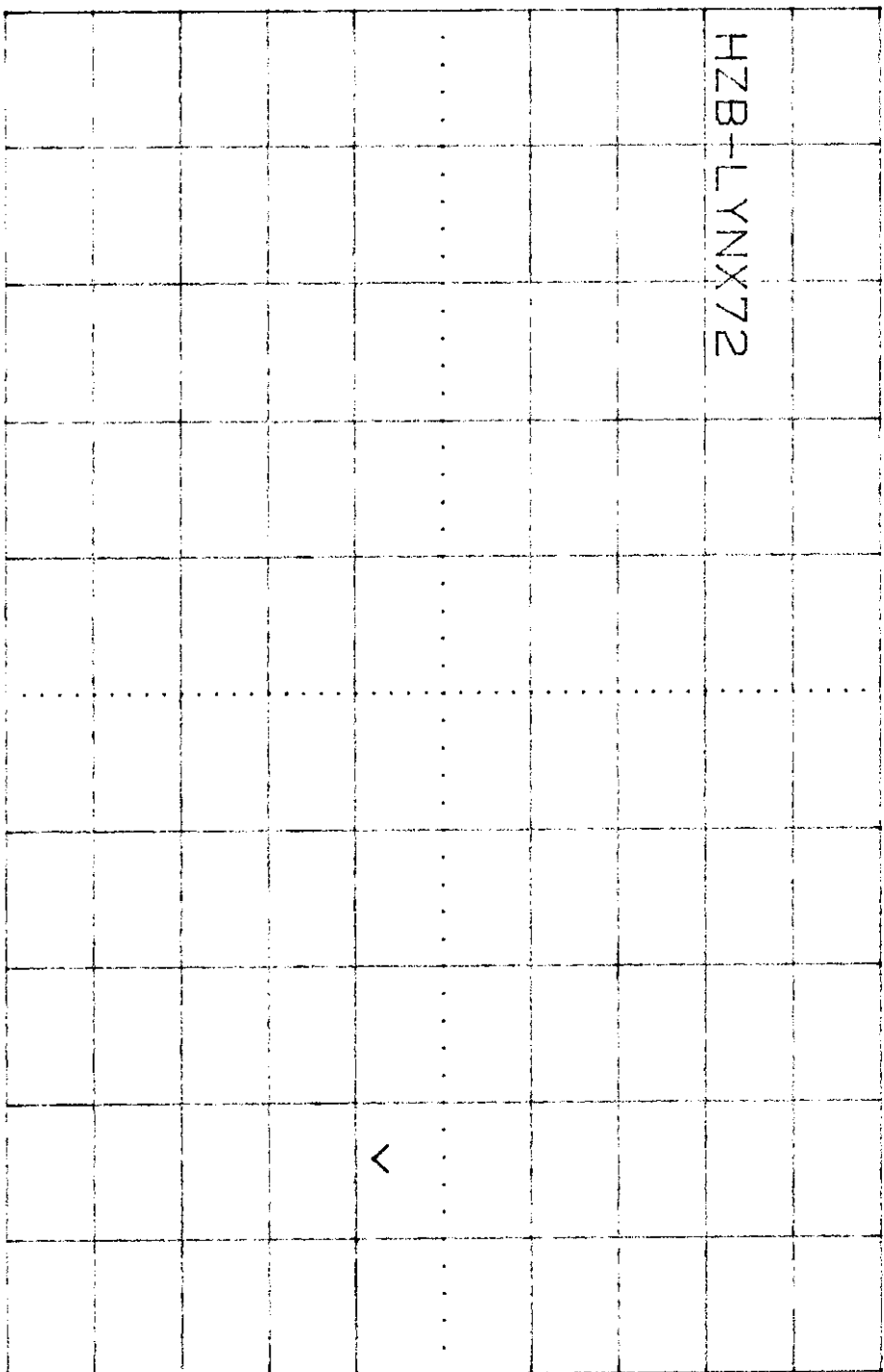
Mkr 21.50GHz

*-37.60dBm

Ref Lvl*20.4dBm

10dB/

Atten 40dB



3.00GHz

to

25.00GHz

ResBW 100kHz

ViDBW 100kHz

SWP 135

LEVEL

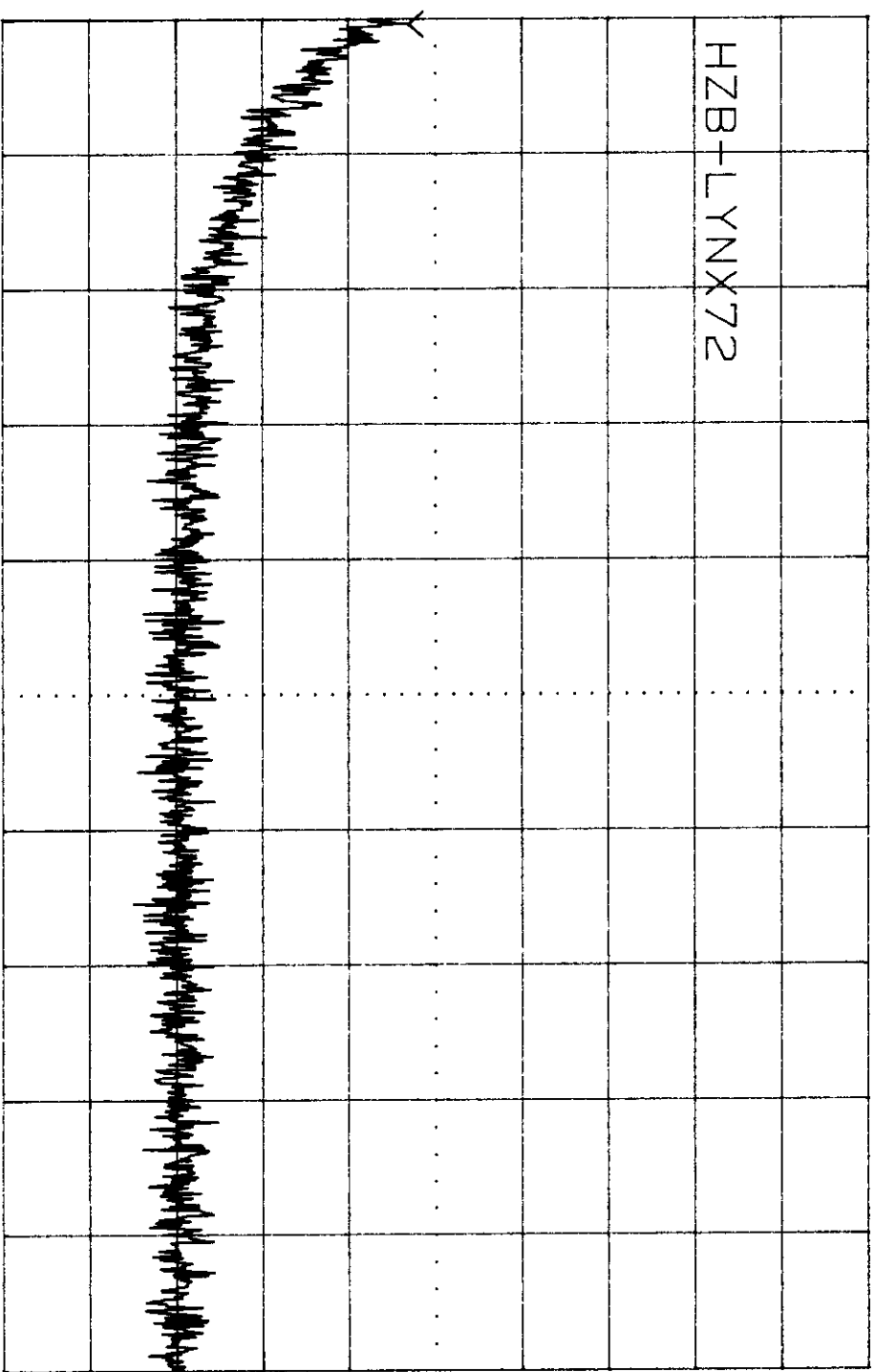
SPAN

Ref Lvl*20.4dBm

PLOT# 4c1
HIGH CHANNEL 2470 MHz

Mkr 1.12MHz *-32.80dBm

Ref Lvl*20.4dBm 10dB/ Atten 40dB



1.00MHz to 30.00MHz

ResBW 30kHz VidBW 30kHz SWP 180ms

LEVEL SPAN VidBW 30kHz

PLOT# 4c2
HIGH CHANNEL 2470 MHZ

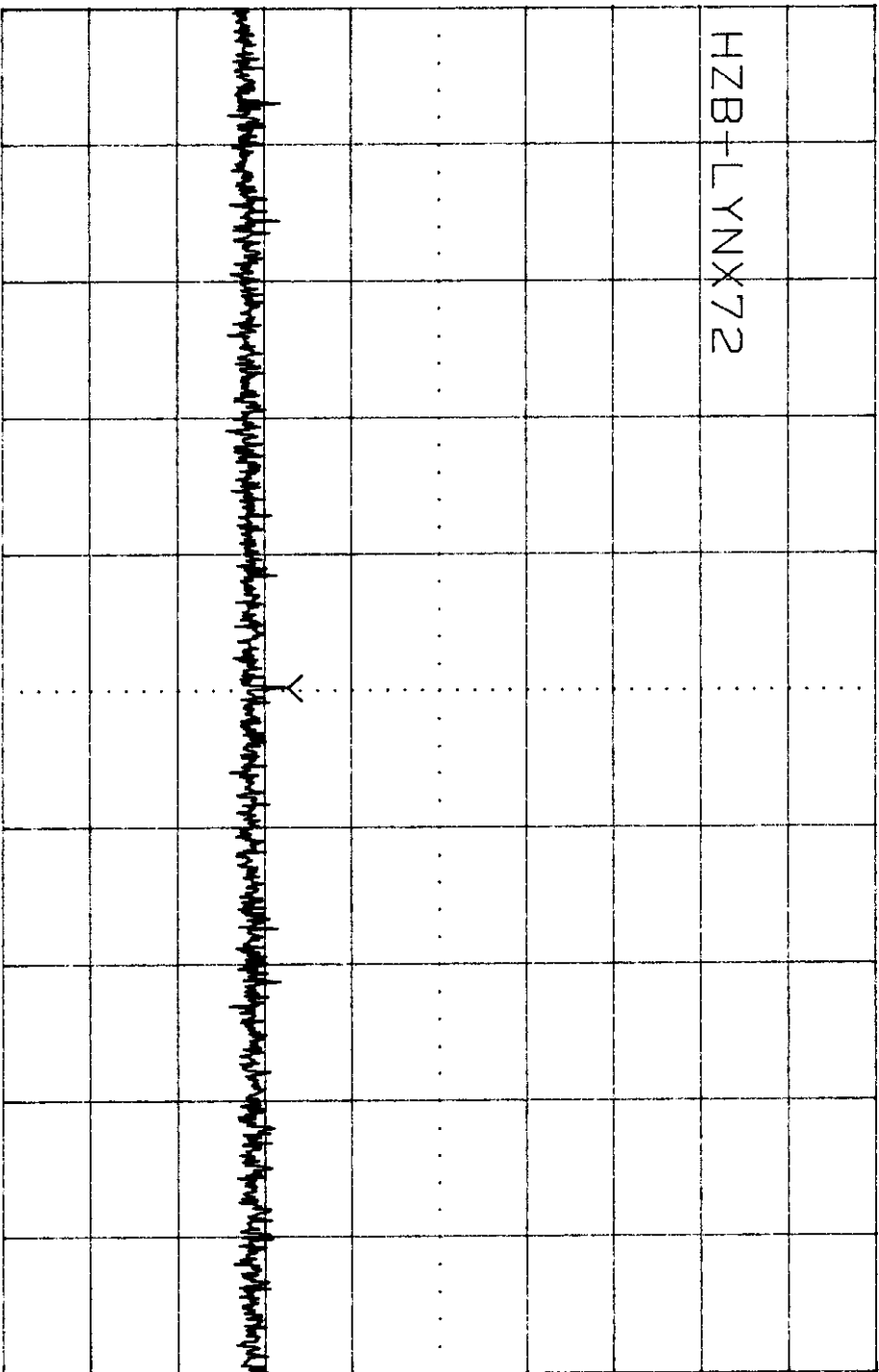
MKR 513. 1MHZ

*-46. 30dBm

Ref Lvl*20.4dBm

107B/

Atten 40dB



30. OMHN

十
〇

1.000 0GHz

ResBW 100kHz

VidBW 100kHz

SWP 550mS

LEVEL

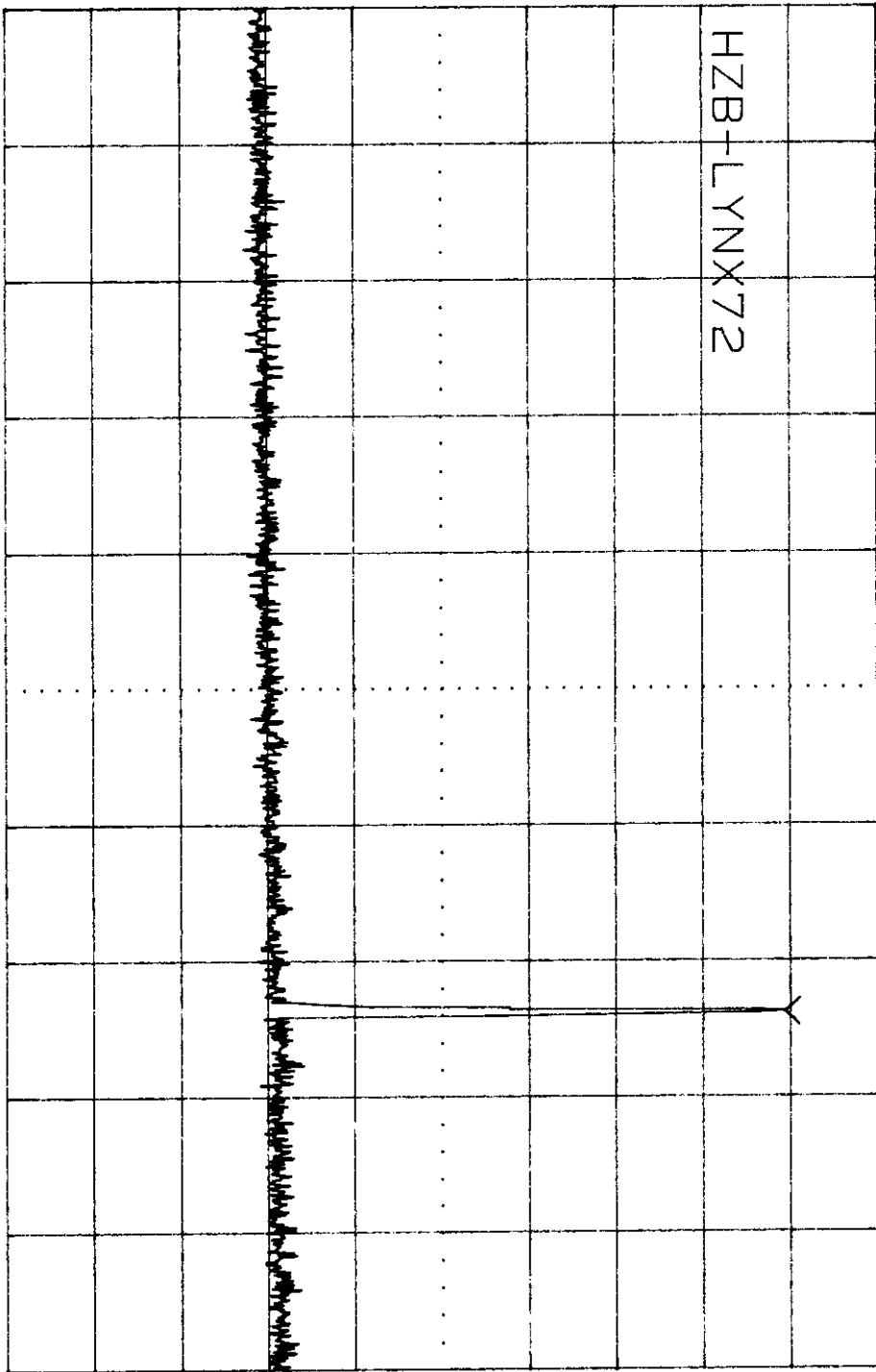
SPAN

VidBW 100kHz

PLOT# 4c3
HIGH CHANNEL 2470 MHz

Mkr 2.476GHz *9.50dBm

Ref Lvl*20.4dBm 10dB/ Atten 40dB



1.000GHz to 3.000GHz

ResBW 100kHz VidBW 100kHz SWP 1.1S

LEVEL SPAN Stop 3.000GHz

PIOT# 4c4
HIGH CHANNEL 2470 MHz

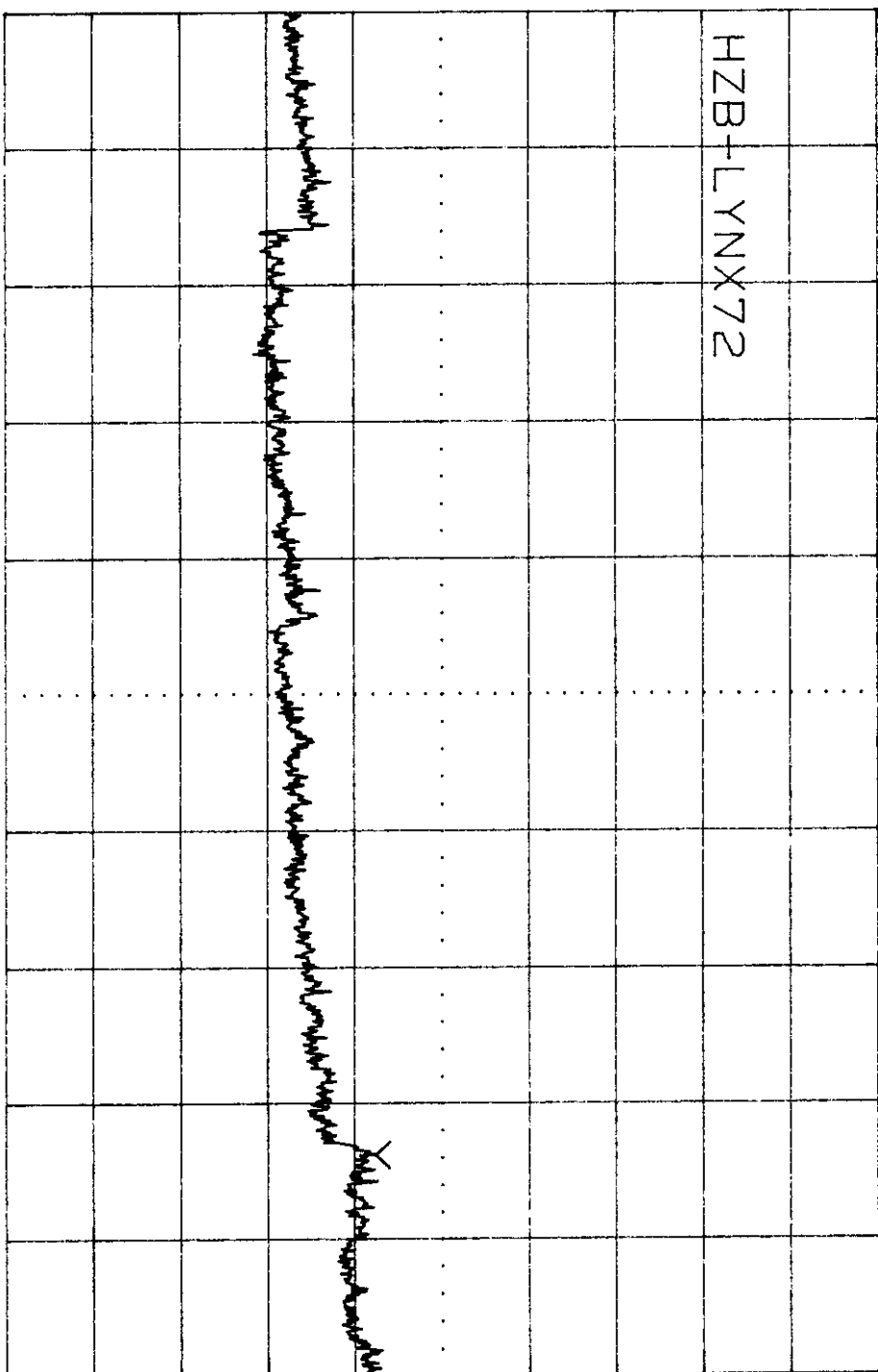
Mkr 21.44GHz

*-37.20dBm

Ref Lvl *20.4dBm

10dB/

Atten 40dB



3.00GHz

to

25.00GHz

ResBW 100kHz

ViDBW 100kHz

SWP 135

LEVEL

SPAN

Atten 40dB

Intertek Testing Services

Glenayre Western Multiplex, Spread Spectrum Radio

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4.5 Transmitter Radiated Emissions in Restricted Bands:

Radiated emission measurements were performed from 30 MHz to 24000 GHz. Analyzer resolution is 100 kHz or greater for frequencies from 30 MHz to 1000 MHz, 1 MHz for frequencies above 1000 MHz.

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included. All measurements were performed with peak detection and average detection (above 1 Ghz) unless otherwise specified.

On the following pages, the emissions on the harmonics frequencies, the limits, and the margin of compliance are presented. These tests were made when the transmitter is in full radiated power.

The additional test was performed to show compliance with the requirement at the band-edge frequency 2483.5 MHz and up to 2500 MHz.

The transmitter was setup to transmit at the highest channel. The spectrum analyzer with resolution bandwidth 1 MHz was connected to the antenna terminal of the transmitter. The antenna conducted emissions in the band 2400 - 2483.5 MHz were measured and plotted. The difference (delta) between the levels on fundamental frequency and on the frequency 2483.5 MHz was determined. Then the field strength E_0 in dBuV/m of radiated emission at the fundamental frequency at 3m was measured.

The radiated emission (E_1 in dBuV/m) at 2483.5 MHz was calculated as follows:

$$E_1 = E_0 - \text{delta}$$

The same procedure was used to measure the radiated emissions at the frequency 2390 MHz and down to 2310 MHz.

For the test results, refer to the attached data sheets and plots.

ITS Intertek Testing Services

Company: GLENAYER WESTERN MULTIPLEX
Project #: J98016754
Model: LYNX 2.4 GHz (High ch 2470 MHz)
Engineer: Xi-Ming Yang

FCC 15.247 Radiated Emissions

Frequency	Antenna	Reading	Antenna	Cable	Pre-amp	Distance	Corrected	Limit	Margin
MHz	Polarity	dB(uV)	Factor	Loss	dB	Factor	Reading	dB(uV/m)	dB
2471.0	V	104.4*	27.8	2.3	0.0	0.0	134.5		
2471.0	V	99.5	27.8	2.3	0.0	0.0	129.6		
2483.5							*56.1!	74.0	-17.9
2483.5							51.2!	54.0	-2.8
4942.0	V	50.5*	34.6	3.0	-38.0	0.0	50.1	74.0	-23.9
4942.0	V	47.2	34.6	3.0	-38.0	0.0	46.8	54.0	-7.2
7413.0	V	43.7*	37.5	4.2	-38.7	0.0	46.7	74.0	-27.3
7413.0	V	35.4	37.5	4.2	-38.7	0.0	38.4	54.0	-15.6
12355.0	V	39.0*	40.7	5.8	-39.0	0.0	46.5	74.0	-27.5
12355.0	V	29.0	40.7	5.8	-39.0	0.0	36.5	54.0	-17.5
17297.0	V	37.0*	43.2	7.2	-38.0	0.0	49.4	74.0	-24.6
17297.0	V	28.0	43.2	7.2	-38.0	-9.5	30.9	54.0	-23.1
19768.0	V	37.0*	40.2	8.4	-23.5	-9.5	52.6	74.0	-21.4
19768.0	V	28.0	40.2	8.4	-23.5	-9.5	43.6	54.0	-10.4
22239.0	V	37.0*	40.3	9.2	-24.2	-9.5	52.8	74.0	-21.2
22239.0	V	28.0	40.3	9.2	-24.2	-9.5	43.8	54.0	-10.2

- Note:**
1. All measurement were made at 3 meters
 2. Negative signs (-) in the margin column signify levels below the limit.
 3. Reading with * were peak-reading.
 4. Number with ! was made by subtract 78.4 dB (see attached plots) from fundamental

Company: GLENAYER WESTERN MULTIPLEX
Project #: J98016754
Model: LYNX 2.4 GHz (Mid ch 2452 MHz)
Engineer: Xi-Ming Yang

FCC 15.247 Radiated Emissions

Frequency	Antenna	Reading	Antenna	Cable	Pre-amp	Distance	Corrected	Limit	Margin
MHz	Polarity	dB(uV)	Factor	Loss	dB	Factor	Reading	dB(uV/m)	dB
4900.0	V	40.0*	34.6	3.0	-38.0	-9.5	30.1	74.0	-43.9
4900.0	V	37.0	34.6	3.0	-38.0	-9.5	27.1	54.0	-26.9
7350.0	V	42.5*	40.7	5.8	-39.0	-9.5	40.5	74.0	-33.5
7350.0	V	35.3	40.7	5.8	-39.0	-9.5	33.3	54.0	-20.7
1225.0	V	37.0*	40.2	8.4	-23.5	-9.5	52.6	74.0	-21.4
1225.0	V	26.0	40.2	8.4	-23.5	-9.5	41.6	54.0	-12.4
19600.0	H	39.0*	40.2	8.4	-23.5	-9.5	54.6	74.0	-19.4
19600.0	H	28.0	40.2	8.4	-23.5	-9.5	43.6	54.0	-10.4
22050.0	H	38.0*	40.3	9.2	-24.2	-9.5	53.8	74.0	-20.2
22050.0	H	29.0	40.3	9.2	-24.2	-9.5	44.8	54.0	-9.2

- Note:**
1. All measurement were made at 3 meters
 2. Negative signs (-) in the margin column signify levels below the limit.
 3. Reading with * were peak-reading.

Company: GLENAYER WESTERN MULTIPLEX
Project #: J98016754
Model: LYNX 2.4 GHz (Low ch 2412 MHz)
Engineer: Xi-Ming Yang

FCC 15.247 Radiated Emissions

Frequency	Antenna	Reading	Antenna	Cable	Pre-amp	Distance	Corrected	Limit	Margin
MHz	Polarity	dB(uV)	Factor	Loss	dB	Factor	Reading	dB(uV/m)	dB
2412.0	V	105.2*	27.8	2.3	0.0	0.0	135.3		
2412.0	V	100.3	27.8	2.3	0.0	0.0	130.4		
2390.0	V						*56.6!	74.0	-17.4
2390.0	V						51.7!	54.0	-2.3
4824.0	V	53.2*	34.6	3.0	-38.0	-9.5	43.3	74.0	-30.7
4824.0	V	49.2	34.6	3.0	-38.0	-9.5	39.3	54.0	-14.7
12035.0	V	42.0*	40.7	5.8	-39.0	-9.5	40.0	74.0	-34.0
12035.0	V	31.0	40.7	5.8	-39.0	-9.5	29.0	54.0	-25.0
19256.0	V	38.0*	40.2	8.4	-23.5	-9.5	53.6	74.0	-20.4
19256.0	V	27.0	40.2	8.4	-23.5	-9.5	42.6	54.0	-11.4

Note: 1. All measurement were made at 3 meters
 2. Negative signs (-) in the margin column signify levels below the limit.
 3. Reading with * were peak-reading.
 4. Number with ! was made by subtract 78.7 dB (see attached plots) from fundamental

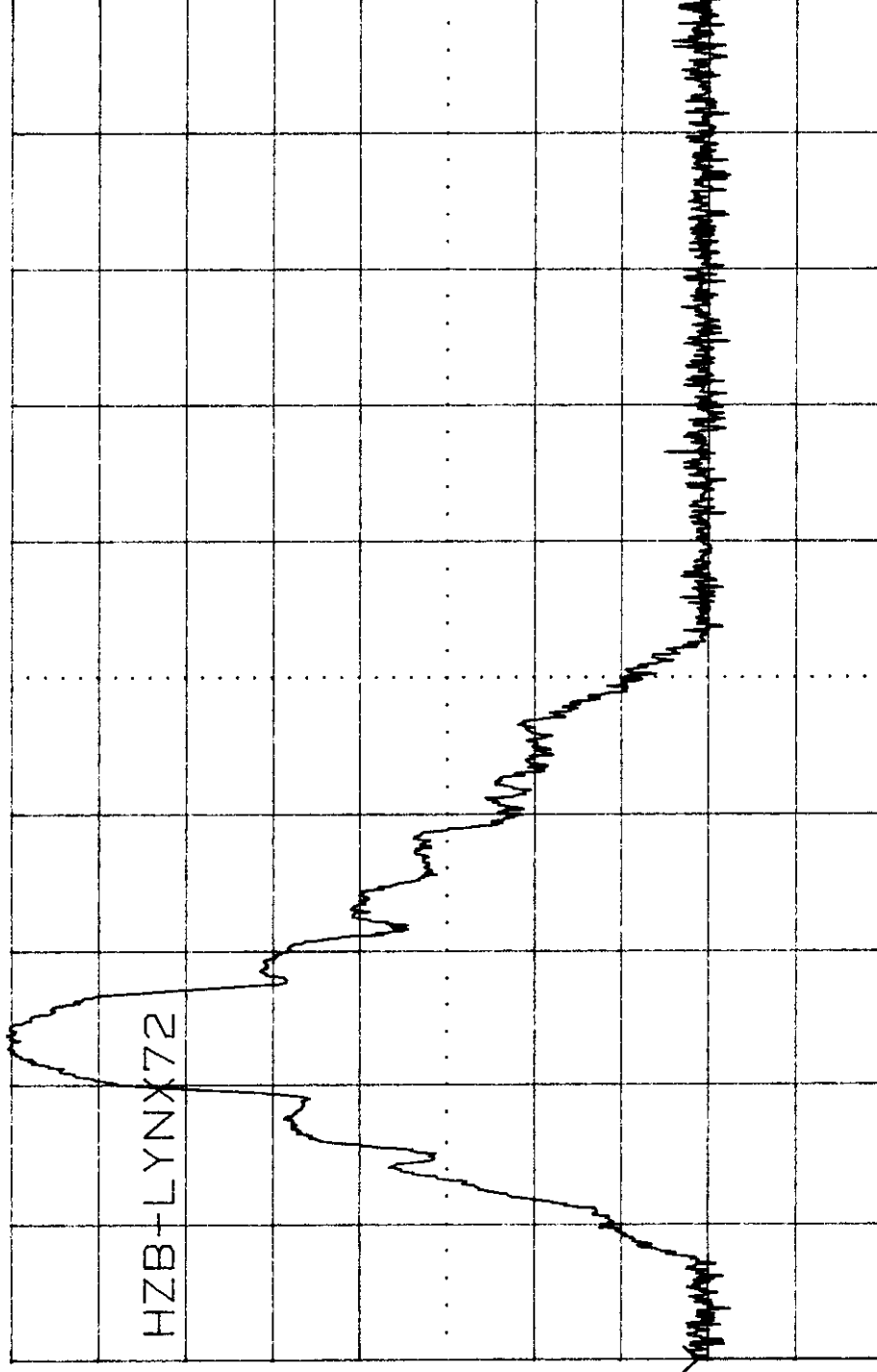
Mkr Δ -22.25MHz

Δ -78.70dB

Ref Lvl*16.4dBm

10dB/

Atten 10dB



2.390 00GHz

to

2.483 50GHz

ResBW 1MHz

Vi dBW 100kHz

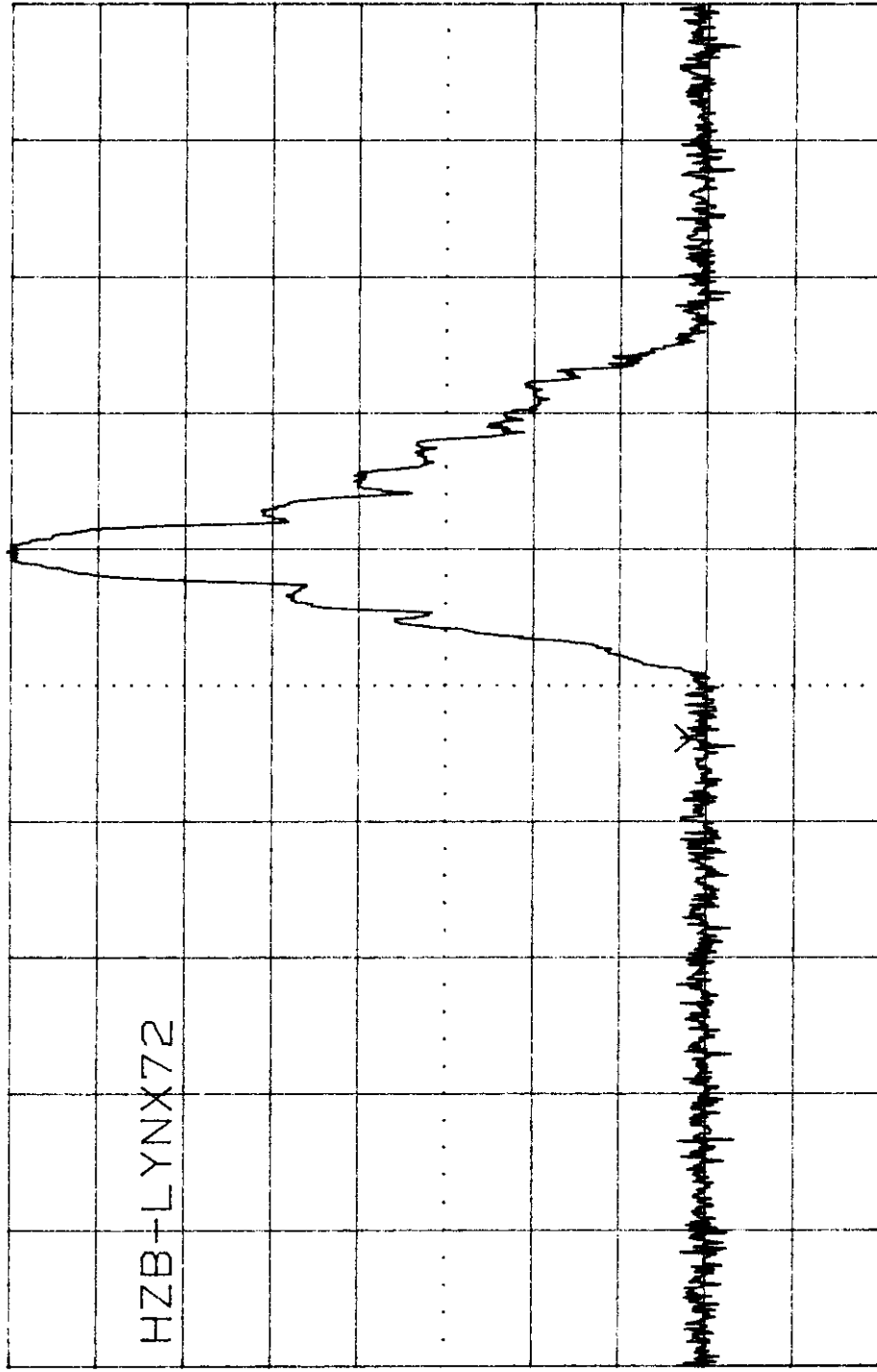
SWP 20mS

LEVEL

SPAN

Ref Lvl*16.4dBm

Mkr 2.390 0GHz *-61.60dBm
Ref Lvl*16.4dBm 10dB/ Atten 10dB

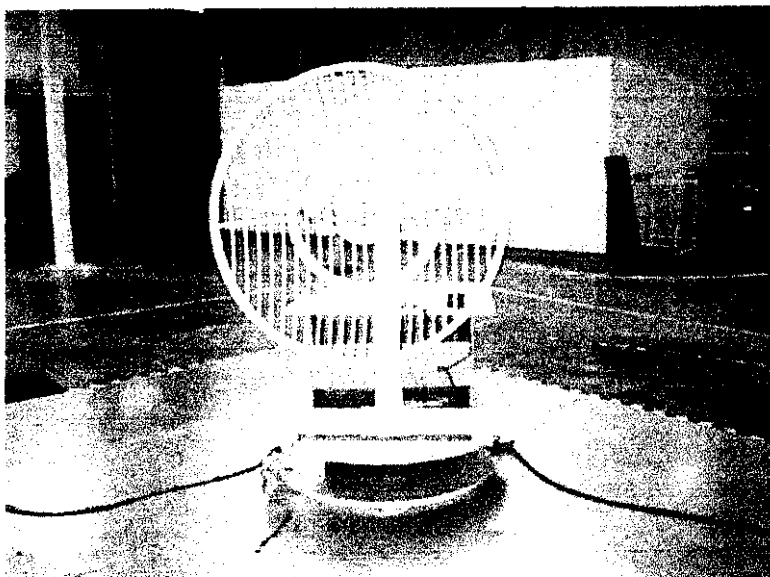
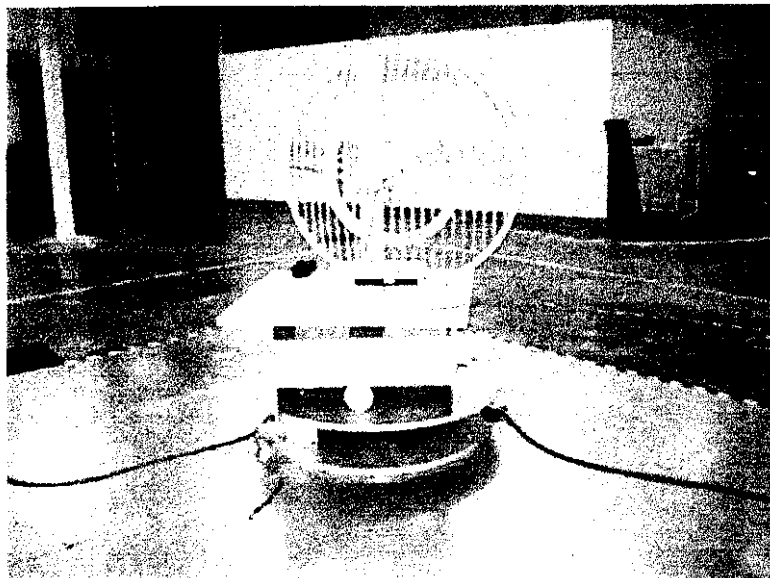


2.310 0GHz to 2.483 5GHz
ResBW 1MHz VidBW 100kHz SWP 20mS

LEVEL SPAN

Strt 2.310 0GHz

4.6 Radiated Emission Configuration Photograph



Intertek Testing Services

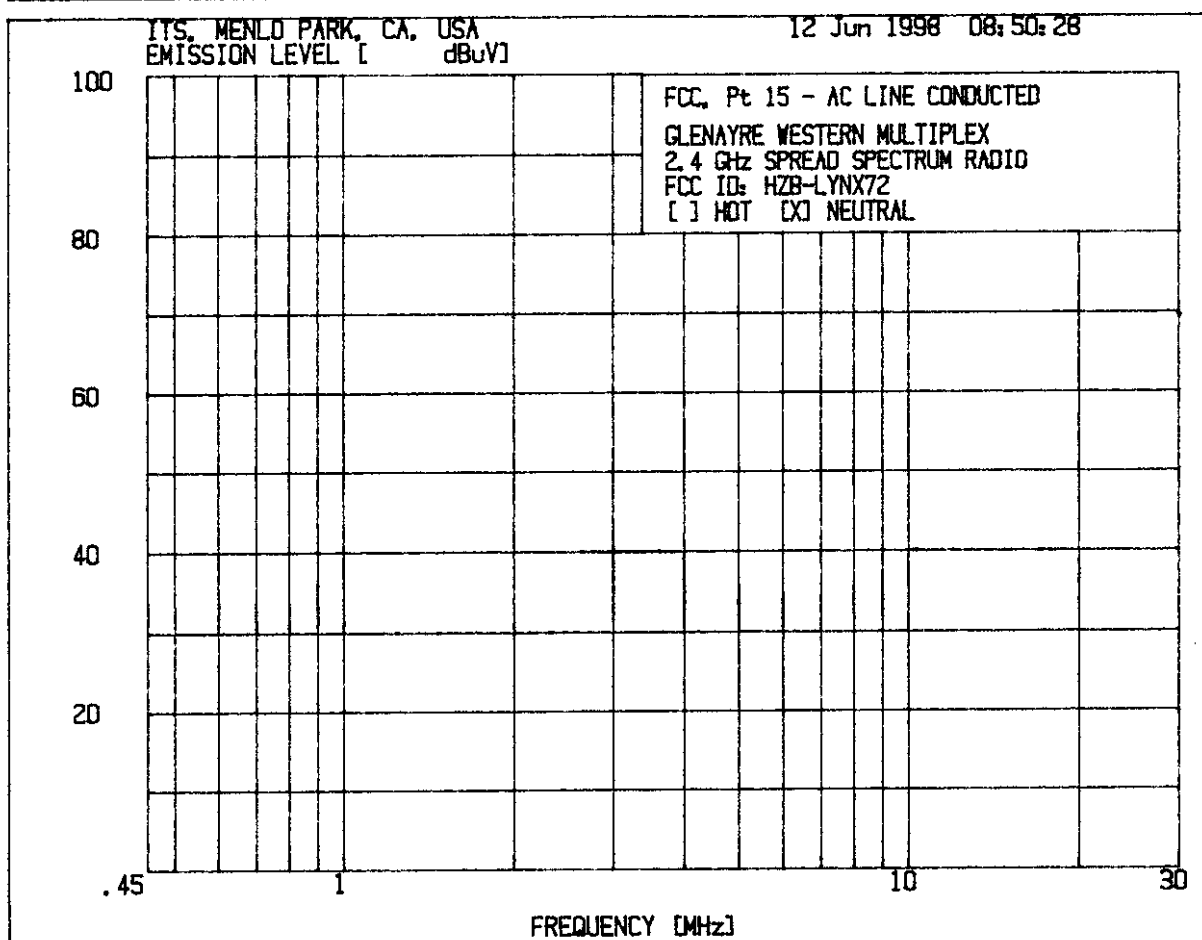
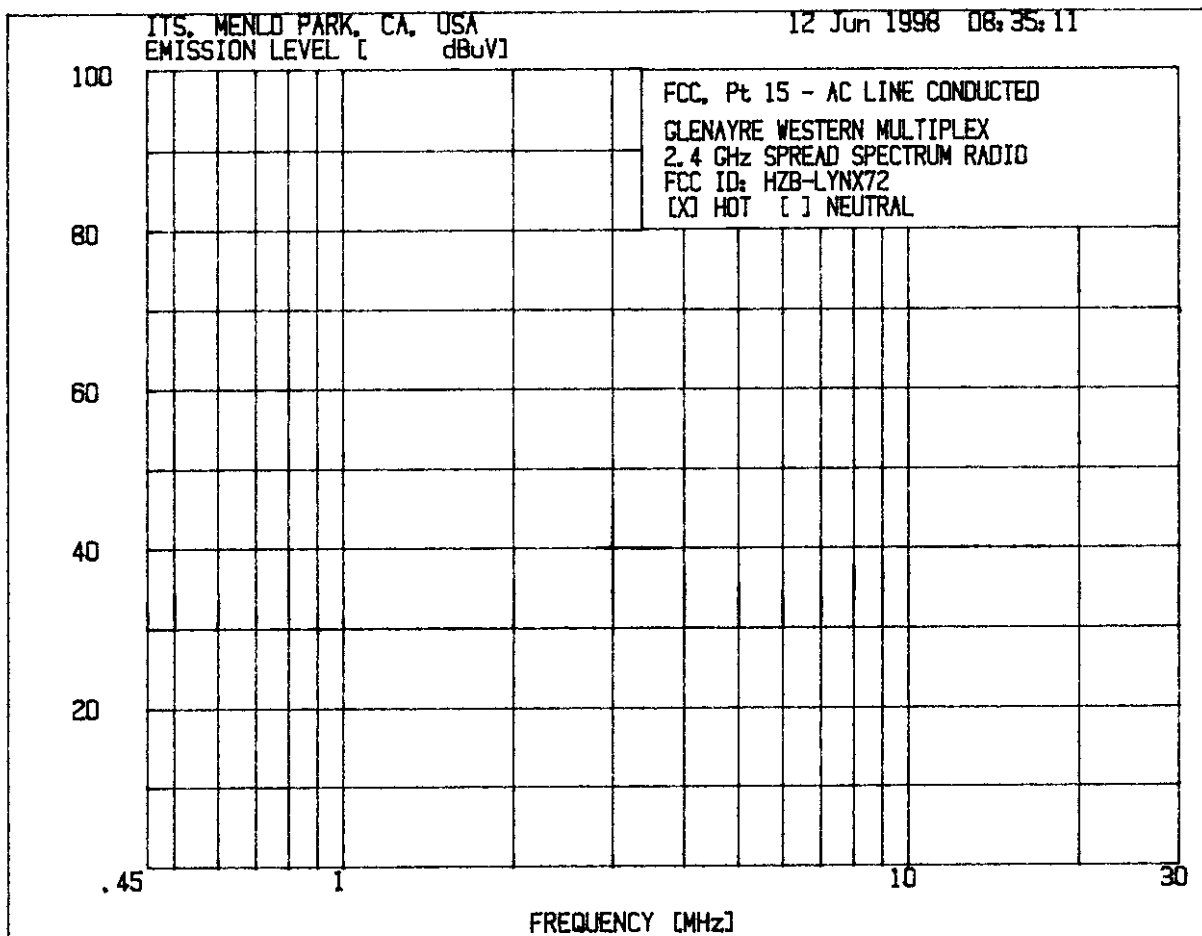
Glenayre Western Multiplex, Spread Spectrum Radio

Date of Test: June 11-12, 1998

4.7 AC Line Conducted Emission:

☐ Not required; battery operation only

☒ Test data attached



ITS, MENLO PARK, CA, USA 12 Jun 1988 08:28:11

3. FCC OFR 47, PL 15
3.1 FCC, PL 15 - AC LINE CONDUCTED

GLENNARE WESTERN MULTIFLEX
2.4 GHz SPREAD SPECTRUM RADIO
FCC ID: H3B-LYN472
(X) HOT () NEUTRAL

PEAKS FOUND ABOVE 44 dBW

PEAK#	FREQ (MHz)	AMPL (dBW)
1	2.848	44.2
2	3.010	45.1
3	3.061	45.5
4	3.135	44.7
5	3.182	45.0
6	3.315	44.7
7	3.501	44.6
8	10.07	44.0

ITS, MENLO PARK, CA, USA 12 Jun 1988 08:54:23

3. FCC OFR 47, PL 15
3.1 FCC, PL 15 - AC LINE CONDUCTED

GLENNARE WESTERN MULTIFLEX
2.4 GHz SPREAD SPECTRUM RADIO
FCC ID: H3B-LYN472
() HOT (X) NEUTRAL

PEAKS FOUND ABOVE 44 dBW

PEAK#	FREQ (MHz)	AMPL (dBW)
1	2.850	44.2
2	3.138	44.4
3	10.99	44.0
4	15.47	45.1

Intertek Testing Services

Glenayre Western Multiplex, Spread Spectrum Radio

Date of Test: June 11-12, 1998

4.9 Radiated Emissions from Digital Section of Transceiver (Transmitter)

☐ Not required - No digital part

☒ Test results are attached

Radiated Emissions Test Data

Company: Glenayre Western Multiplex

EUT:

Project #: J798016754

Test Mode:

Model #: LYNEX 2.4 GHz

S/N or FCC# Not labelled

Engineer: Ahmad

Date of Test: Initial:

	Antenna	Pre-Amp	Cable A	Cable B	OCF	Standard_	FCC Part 15B
Number:	2	5	12	0	0	Limits_	2
Model:	EMCO 3143	CDI P950	Green M+L	None	None	Test Distance_	3 meters

Frequency MHz	Reading dB(uV)	Det. P/A/Q	Ant. Pol. H/V	Ant. Factor dB(1/m)	Pre-Amp dB	Insert. Loss dB	D. F. dB	Net dB(uV/m)	Limit @3m dB(uV/m)	Margin dB
215.0	40.0	P	H	11.3	18.5	0.0	0.0	32.8	43.5	-10.7
291.8	42.8	P	H	13.8	17.8	0.0	0.0	38.8	46.0	-7.2
307.1	41.6	P	H	13.9	17.9	0.0	0.0	37.6	46.0	-8.4
353.2	37.9	P	H	15.3	17.4	0.0	0.0	35.8	46.0	-10.2
368.6	41.9	P	H	16.1	17.4	0.0	0.0	40.6	46.0	-5.4
522.2	38.8	P	H	18.4	16.6	0.0	0.0	40.6	46.0	-5.4
552.9	35.0	P	H	19.6	15.8	0.0	0.0	38.8	46.0	-7.2
583.6	37.8	P	H	19.5	15.8	0.0	0.0	41.5	46.0	-4.5
645.2	34.1	P	H	20.5	15.7	0.0	0.0	38.9	46.0	-7.1
706.0	35.7	P	H	20.9	14.7	0.0	0.0	41.9	46.0	-4.1

- Notes:**
- a) P: Peak; A: Average; Q: Quasi Peak; H: Horizontal; V: Vertical; OCF: Other Correction Factor; DF: Distance Factor
 - b) Insert. Loss = Cable A + Cable B + OCF.
 - c) Negative signs (-) in Margin column signify levels below the limits.
 - d) All other emissions not reported are below the equipment noise floor which is at least 20 dB below the limits.

Intertek Testing Services

Glenayre Western Multiplex, Spread Spectrum Radio

Date of Test: June 11-12, 1998

4.10 Radiated Emissions from Receiver Section of Transceiver (L.O. Radiation)

☒ **[X] Not required - EUT operation above 960 MHz only**

☐ **[] Not required - EUT is transmitter only**

☐ **[] Not performed; exempt until June 1999**

☐ **[] Test results are attached**

Intertek Testing Services

Glenayre Western Multiplex, Spread Spectrum Radio

Date of Test: June 11-12, 1998

4.11 Processing Gain Measurements

The processing gain shall be determined from the ratio in dB of the signal to noise ratio with the system spreading code turned OFF, to the signal to noise ratio with the system spreading code turned ON, as measured at the demodulated output of the receiver. The processing gain shall be at least 10 dB for a direct sequence spread spectrum system.

☒ [X] Refer to attached test procedure and data sheets.

☐ [] Refer to circuit analysis and processing gain calculations provided by manufacturer.

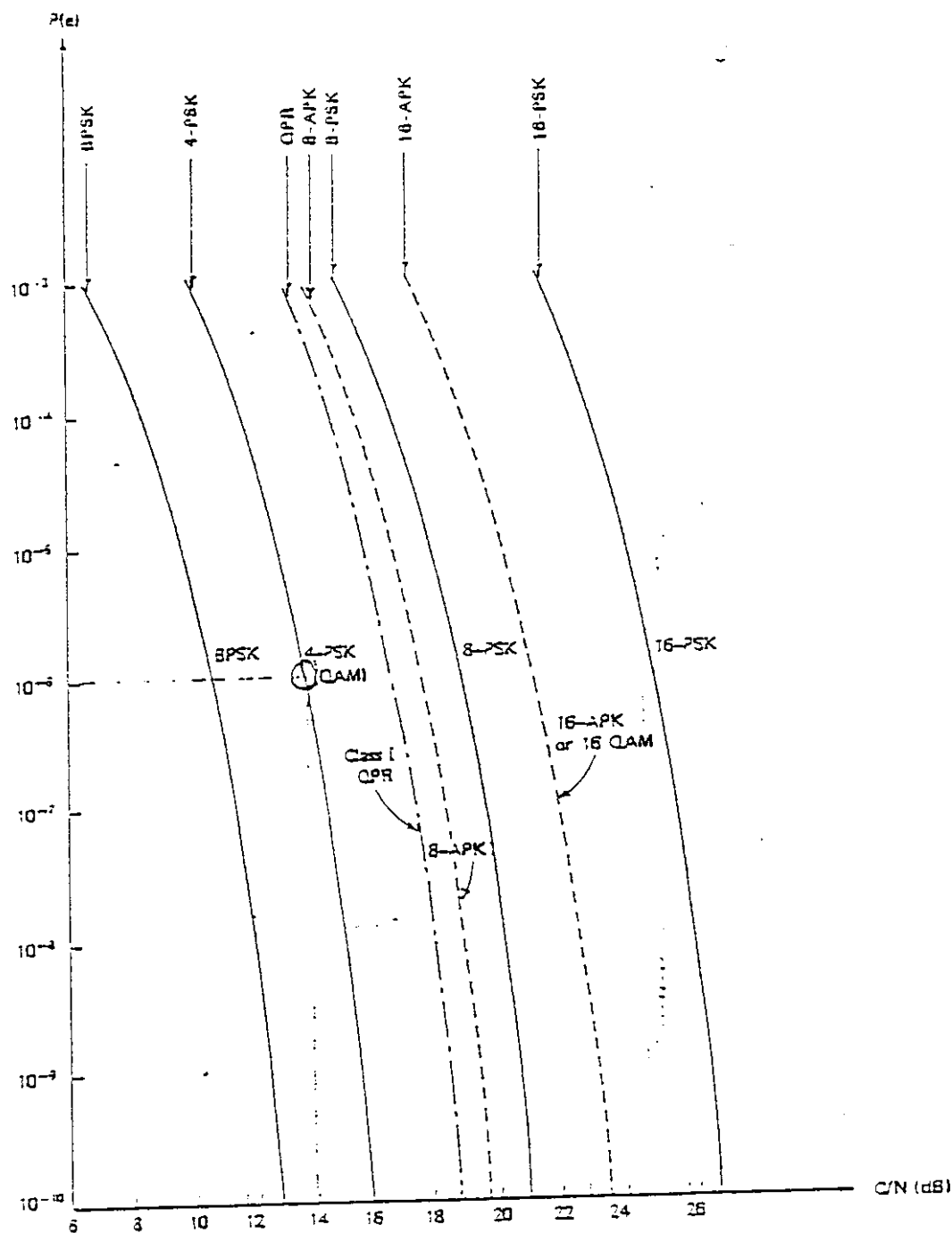


Fig. 3.1.1. $P(e)$ performance of M -ary PSK, QAM, QPSK, and M -ary APK coherent systems. The C/N is specified in the double-sided Nyquist bandwidth.

Figure showing offset for QPSK (4-PSK) modulation C/N offset (14 dB).
 (Obtained from DIGITAL COMMUNICATIONS: Microwave Applications, by
 Kamilo Feher, Prentice-Hall Inc., 1981)

June 16, 1998

Processing Gain Test for LYNX.mini2 (Model 32000, 2.4GHz Fractional)

Test Setup:

The processing gain was measured using the CW jamming margin method described by the FCC recommended test procedure, as described FCC-97-114. The specific test diagram is illustrated below.

All test equipment and the EUT were allowed to warm up for four hours prior to start of test to minimize drift over time. All test equipment had valid calibration. Calibration of carrier and interferer levels was performed several times during testing with no observed changes.

The measurements were performed at the upper center channel at 2460.672 MHz, over a range of 2457 - 2464.5 MHz. The measurements made across the center ± 3.5 MHz should be used for calculation of Gp since that bandwidth represents the receiver passband.

A signal level 30 dB above threshold was chosen so that thermal noise would not effect the processing gain measurements. The measured threshold of the radio was -90dBm $\text{BER} = 1 \times 10^{-6}$, therefore the signal level was -60dBm . The measured signal level at the output of the 6 dB splitter was -29.7dBm (Ps), used for calculating C/I and Gp.

For the jammer signal, 0 dBm at the generator corresponds to -10.7dBm (Pj) at the 6 dB splitter output. This figure is also used for calculating C/I and Gp.

Test Equipment:

Signal Generator	HP 8648C
Power Meter	HP437B/8484A
BER Test Set	Fireberd 6000

Explanation of Results:

The following notations are used on the spreadsheet data:

Pg: Power at Generator in dBm (as indicated by generator display).

Pj: Power of interferer:

Ps: Power of carrier at power meter test port. (initial calibration)

J/S: Jammer to Signal ratio, Pj-Ps (dB) (calculated in spreadsheet)

Gp: Processing Gain: $(S/N)_o + J/S + L_{sys}$ where:

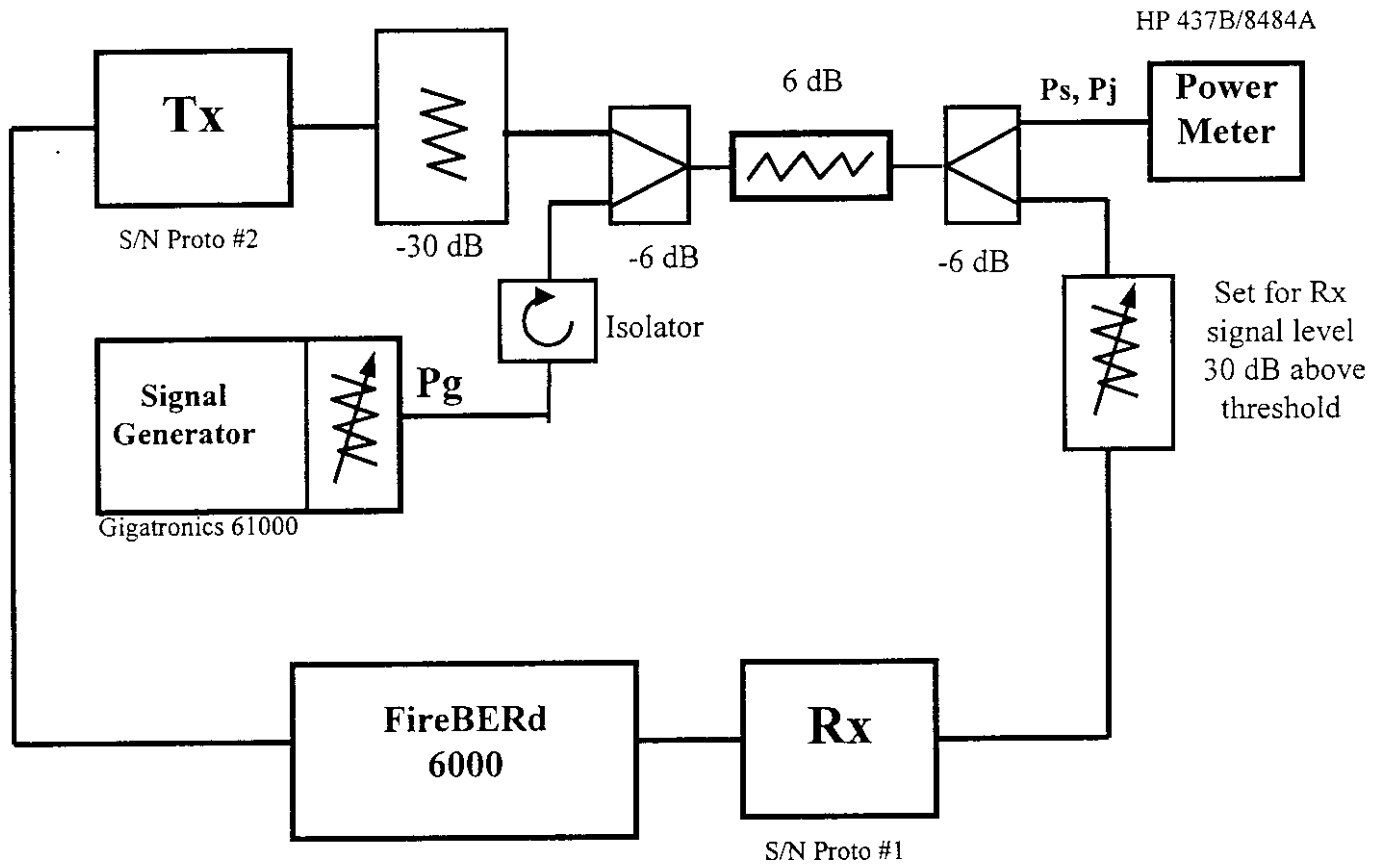
$$L_{sys} = 2 \text{ dB}$$

$$(S/N)_o = 14.0 \text{ dB for QPSK and BER} = 10^{-6} \text{ (see curve provided)}$$

therefore: $G_p = 14 + 2 + J/S = 16.0 + J/S$ (calculated in spreadsheet)

All measurements inside the ± 3.5 MHz passband of the receiver give Gp results that exceed the minimum required value of 10 dB. Elimination of the worst 20% measurements was therefore not needed in order to meet the requirements. (see spreadsheet and plotted results).

Processing Gain Test Equipment Setup



Processing Gain
LYNX.mini2 (Model 32000)

7/22/98

meas #	f MHz	Gp dBm	Pg dBm	Pj dBm	Ps dBm	J/S dB
1	2457	36.5	1.5	-9.2	-29.7	20.5
2	2457.05	36.6	1.6	-9.1	-29.7	20.6
3	2457.1	36.1	1.1	-9.6	-29.7	20.1
4	2457.15	35.3	0.3	-10.4	-29.7	19.3
5	2457.2	34.1	-0.9	-11.6	-29.7	18.1
6	2457.25	32.5	-2.5	-13.2	-29.7	16.5
7	2457.3	31.1	-3.9	-14.6	-29.7	15.1
8	2457.35	29.6	-5.4	-16.1	-29.7	13.6
9	2457.4	28.6	-6.4	-17.1	-29.7	12.6
10	2457.45	28	-7	-17.7	-29.7	12
11	2457.5	27.7	-7.3	-18	-29.7	11.7
12	2457.55	27.9	-7.1	-17.8	-29.7	11.9
13	2457.6	27.7	-7.3	-18	-29.7	11.7
14	2457.65	27.3	-7.7	-18.4	-29.7	11.3
15	2457.7	26.5	-8.5	-19.2	-29.7	10.5
16	2457.75	25.4	-9.6	-20.3	-29.7	9.4
17	2457.8	24.3	-10.7	-21.4	-29.7	8.3
18	2457.85	23.2	-11.8	-22.5	-29.7	7.2
19	2457.9	22.3	-12.7	-23.4	-29.7	6.3
20	2457.95	21.8	-13.2	-23.9	-29.7	5.8
21	2458	21.6	-13.4	-24.1	-29.7	5.6
22	2458.05	21.7	-13.3	-24	-29.7	5.7
23	2458.1	21.7	-13.3	-24	-29.7	5.7
24	2458.15	21.7	-13.3	-24	-29.7	5.7
25	2458.2	21.4	-13.6	-24.3	-29.7	5.4
26	2458.25	21.1	-13.9	-24.6	-29.7	5.1
27	2458.3	20.7	-14.3	-25	-29.7	4.7
28	2458.35	20.2	-14.8	-25.5	-29.7	4.2
29	2458.4	19.8	-15.2	-25.9	-29.7	3.8
30	2458.45	19.4	-15.6	-26.3	-29.7	3.4
31	2458.5	19.2	-15.8	-26.5	-29.7	3.2
32	2458.55	19.1	-15.9	-26.6	-29.7	3.1
33	2458.6	19	-16	-26.7	-29.7	3
34	2458.65	18.8	-16.2	-26.9	-29.7	2.8
35	2458.7	18.6	-16.4	-27.1	-29.7	2.6
36	2458.75	18.2	-16.8	-27.5	-29.7	2.2
37	2458.8	17.9	-17.1	-27.8	-29.7	1.9
38	2458.85	17.5	-17.5	-28.2	-29.7	1.5
39	2458.9	17.2	-17.8	-28.5	-29.7	1.2
40	2458.95	16.9	-18.1	-28.8	-29.7	0.9
41	2459	16.7	-18.3	-29	-29.7	0.7
42	2459.05	16.6	-18.4	-29.1	-29.7	0.6
43	2459.1	16.4	-18.6	-29.3	-29.7	0.4
44	2459.15	16.2	-18.8	-29.5	-29.7	0.2
45	2459.2	15.9	-19.1	-29.8	-29.7	-0.1
46	2459.25	15.6	-19.4	-30.1	-29.7	-0.4
47	2459.3	15.4	-19.6	-30.3	-29.7	-0.6

Processing Gain
LYNX.mini2 (Model 32000)

7/22/98

48	2459.35	15.3	-19.7	-30.4	-29.7	-0.7
49	2459.4	15.2	-19.8	-30.5	-29.7	-0.8
50	2459.45	15.2	-19.8	-30.5	-29.7	-0.8
51	2459.5	15.1	-19.9	-30.6	-29.7	-0.9
52	2459.55	15.1	-19.9	-30.6	-29.7	-0.9
53	2459.6	15	-20	-30.7	-29.7	-1
54	2459.65	14.8	-20.2	-30.9	-29.7	-1.2
55	2459.7	14.6	-20.4	-31.1	-29.7	-1.4
56	2459.75	14.2	-20.8	-31.5	-29.7	-1.8
57	2459.8	14	-21	-31.7	-29.7	-2
58	2459.85	13.8	-21.2	-31.9	-29.7	-2.2
59	2459.9	13.6	-21.4	-32.1	-29.7	-2.4
60	2459.95	13.6	-21.4	-32.1	-29.7	-2.4
61	2460	13.7	-21.3	-32	-29.7	-2.3
62	2460.05	13.8	-21.2	-31.9	-29.7	-2.2
63	2460.1	13.8	-21.2	-31.9	-29.7	-2.2
64	2460.15	13.8	-21.2	-31.9	-29.7	-2.2
65	2460.2	13.7	-21.3	-32	-29.7	-2.3
66	2460.25	13.6	-21.4	-32.1	-29.7	-2.4
67	2460.3	13.3	-21.7	-32.4	-29.7	-2.7
68	2460.35	13.1	-21.9	-32.6	-29.7	-2.9
69	2460.4	12.9	-22.1	-32.8	-29.7	-3.1
70	2460.45	12.8	-22.2	-32.9	-29.7	-3.2
71	2460.5	12.7	-22.3	-33	-29.7	-3.3
72	2460.55	12.7	-22.3	-33	-29.7	-3.3
73	2460.6	12.8	-22.2	-32.9	-29.7	-3.2
74	2460.65	13	-22	-32.7	-29.7	-3
75	2460.7	13.2	-21.8	-32.5	-29.7	-2.8
76	2460.75	13.3	-21.7	-32.4	-29.7	-2.7
77	2460.8	13.4	-21.6	-32.3	-29.7	-2.6
78	2460.85	13.5	-21.5	-32.2	-29.7	-2.5
79	2460.9	13.4	-21.6	-32.3	-29.7	-2.6
80	2460.95	13.3	-21.7	-32.4	-29.7	-2.7
81	2461	13.2	-21.8	-32.5	-29.7	-2.8
82	2461.05	13	-22	-32.7	-29.7	-3
83	2461.1	13	-22	-32.7	-29.7	-3
84	2461.15	13	-22	-32.7	-29.7	-3
85	2461.2	13.2	-21.8	-32.5	-29.7	-2.8
86	2461.25	13.4	-21.6	-32.3	-29.7	-2.6
87	2461.3	13.6	-21.4	-32.1	-29.7	-2.4
88	2461.35	13.7	-21.3	-32	-29.7	-2.3
89	2461.4	13.9	-21.1	-31.8	-29.7	-2.1
90	2461.45	13.9	-21.1	-31.8	-29.7	-2.1
91	2461.5	13.8	-21.2	-31.9	-29.7	-2.2
92	2461.55	13.7	-21.3	-32	-29.7	-2.3
93	2461.6	13.6	-21.4	-32.1	-29.7	-2.4
94	2461.65	13.5	-21.5	-32.2	-29.7	-2.5
95	2461.7	13.6	-21.4	-32.1	-29.7	-2.4
96	2461.75	13.8	-21.2	-31.9	-29.7	-2.2
97	2461.8	14	-21	-31.7	-29.7	-2

Processing Gain
LYNX.mini2 (Model 32000)

7/22/98

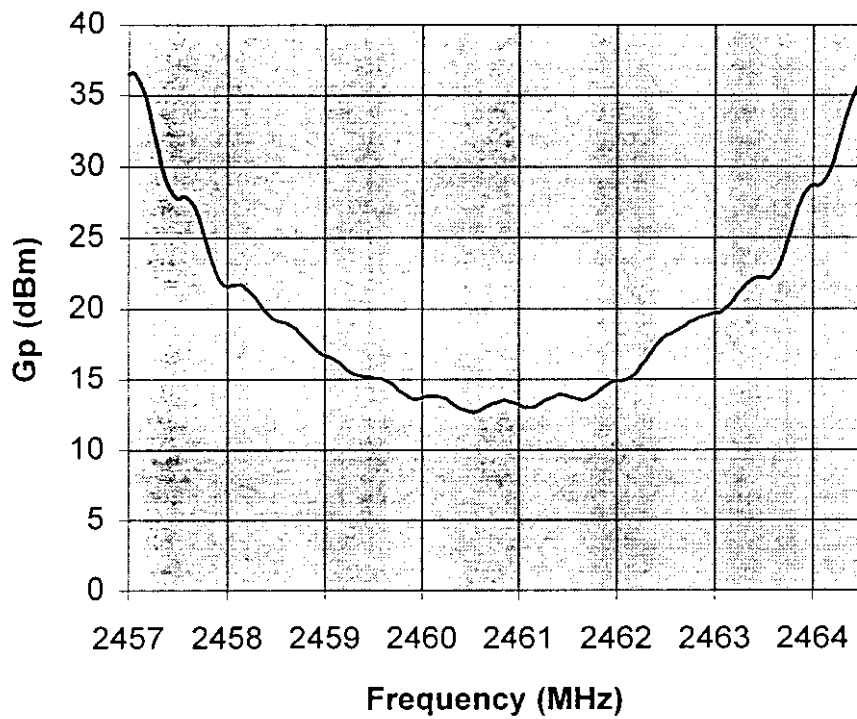
98	2461.85	14.3	-20.7	-31.4	-29.7	-1.7
99	2461.9	14.6	-20.4	-31.1	-29.7	-1.4
100	2461.95	14.8	-20.2	-30.9	-29.7	-1.2
101	2462	14.9	-20.1	-30.8	-29.7	-1.1
102	2462.05	14.9	-20.1	-30.8	-29.7	-1.1
103	2462.1	15	-20	-30.7	-29.7	-1
104	2462.15	15.2	-19.8	-30.5	-29.7	-0.8
105	2462.2	15.5	-19.5	-30.2	-29.7	-0.5
106	2462.25	16	-19	-29.7	-29.7	0
107	2462.3	16.4	-18.6	-29.3	-29.7	0.4
108	2462.35	16.9	-18.1	-28.8	-29.7	0.9
109	2462.4	17.4	-17.6	-28.3	-29.7	1.4
110	2462.45	17.8	-17.2	-27.9	-29.7	1.8
111	2462.5	18.1	-16.9	-27.6	-29.7	2.1
112	2462.55	18.2	-16.8	-27.5	-29.7	2.2
113	2462.6	18.4	-16.6	-27.3	-29.7	2.4
114	2462.65	18.6	-16.4	-27.1	-29.7	2.6
115	2462.7	18.8	-16.2	-26.9	-29.7	2.8
116	2462.75	19.1	-15.9	-26.6	-29.7	3.1
117	2462.8	19.2	-15.8	-26.5	-29.7	3.2
118	2462.85	19.4	-15.6	-26.3	-29.7	3.4
119	2462.9	19.5	-15.5	-26.2	-29.7	3.5
120	2462.95	19.6	-15.4	-26.1	-29.7	3.6
121	2463	19.7	-15.3	-26	-29.7	3.7
122	2463.05	19.7	-15.3	-26	-29.7	3.7
123	2463.1	20	-15	-25.7	-29.7	4
124	2463.15	20.3	-14.7	-25.4	-29.7	4.3
125	2463.2	20.7	-14.3	-25	-29.7	4.7
126	2463.25	21.2	-13.8	-24.5	-29.7	5.2
127	2463.3	21.6	-13.4	-24.1	-29.7	5.6
128	2463.35	21.9	-13.1	-23.8	-29.7	5.9
129	2463.4	22.1	-12.9	-23.6	-29.7	6.1
130	2463.45	22.2	-12.8	-23.5	-29.7	6.2
131	2463.5	22.2	-12.8	-23.5	-29.7	6.2
132	2463.55	22.1	-12.9	-23.6	-29.7	6.1
133	2463.6	22.4	-12.6	-23.3	-29.7	6.4
134	2463.65	22.9	-12.1	-22.8	-29.7	6.9
135	2463.7	23.8	-11.2	-21.9	-29.7	7.8
136	2463.75	24.9	-10.1	-20.8	-29.7	8.9
137	2463.8	26	-9	-19.7	-29.7	10
138	2463.85	27.1	-7.9	-18.6	-29.7	11.1
139	2463.9	27.9	-7.1	-17.8	-29.7	11.9
140	2463.95	28.4	-6.6	-17.3	-29.7	12.4
141	2464	28.7	-6.3	-17	-29.7	12.7
142	2464.05	28.6	-6.4	-17.1	-29.7	12.6
143	2464.1	28.9	-6.1	-16.8	-29.7	12.9
144	2464.15	29.4	-5.6	-16.3	-29.7	13.4
145	2464.2	30.2	-4.8	-15.5	-29.7	14.2
146	2464.25	31.4	-3.6	-14.3	-29.7	15.4
147	2464.3	32.6	-2.4	-13.1	-29.7	16.6

Processing Gain
LYNX.mini2 (Model 32000)

7/22/98

148	2464.35	33.8	-1.2	-11.9	-29.7	17.8
149	2464.4	34.9	-0.1	-10.8	-29.7	18.9
150	2464.45	35.6	0.6	-10.1	-29.7	19.6
151	2464.5	36.1	1.1	-9.6	-29.7	20.1

LYNX.mini2 Processing Gain



Intertek Testing Services

Glenayre Western Multiplex, Spread Spectrum Radio

Date of Test: June 11-12, 1998

4.12 Transmitter Duty Cycle Calculation and Measurements

The EUT antenna output port was connected to the input of the spectrum analyzer. The analyzer center frequency was set to EUT RF channel carrier. The SWEEP function on the analyzer was set to ZERO SPAN. The transmitter ON time was determined from the resultant time-amplitude display:

Duty cycle = Maximum ON time in 100 msec/100

Duty cycle correction, dB = $20 * \log(\text{DC})$

☐ See attached spectrum analyzer chart(s) for transmitter timing

☐ See transmitter timing diagram provided by manufacturer

☒ No duty cycle correction was used

Intertek Testing Services

Glenayre Western Multiplex, Spread Spectrum Radio

Date of Test: June 11-12, 1998

5.0 Equipment Photographs

Photographs of the EUT are attached.

Intertek Testing Services

Glenayre Western Multiplex, Spread Spectrum Radio

Date of Test: June 11-12, 1998

7.0 Technical Specifications

7.1 Circuit Diagram

See the enclosed confidentiality package.

Intertek Testing Services

Glenayre Western Multiplex, Spread Spectrum Radio

Date of Test: June 11-12, 1998

7.2 Block Diagram

See the enclosed confidentiality package.

Intertek Testing Services

Glenayre Western Multiplex, Spread Spectrum Radio

Date of Test: June 11-12, 1998

7.3 Antenna gain and Mounting Information

See the attached pages.

(Comsat RSI Mark)

GRID ANTENNAS

1990-2700 MHz

SPECIFICATIONS

Wind loading characteristics to 45% of comparable size solid
parabolas.
Cross polarization discrimination response better than solids.
Survival: 125 MPH with 1/2 inch radial ice.

Dual Band Antennas 1990-2110 & 2450-2500 MHz										
Diameter	Model Number	U.S. FCC Category	Gain - dBi			Half Power B/W	F/B Ratio	Max VSWR		Windthrust 100 MPH
			Low	Mid	High			Std.	Low	
			@2050	@2475	@2050					
4'	P-22WA48G		26.0	27.6	8.0		34	1.3	-	250
6'	P-22WA72G		29.5	31.0	5.4		38	1.3	-	500
8'	P-22WA96G		31.9	33.6	4.1		40	1.25	-	800
10'	P-22WA120G		33.8	35.5	3.3		44	1.25	-	1300
12'	P-22WA144G		35.5	37.0	2.7		46	1.25	-	1500
15'	P-22WA180G		37.2	38.9	2.2		46	1.25	-	2700
2200-2300 MHz										
4'	P-23A48G		26.4	26.6	26.8	7.6	36	1.3	1.15	250
6'	P-23A72G		29.9	30.1	30.3	5.1	38	1.3	1.10	500
8'	P-23A96G		32.2	32.4	32.6	3.8	40	1.1	1.06	800
10'	P-23A120G		34.4	34.6	34.8	2.8	42	1.1	1.06	1300
12'	P-23A144G		35.9	36.1	36.3	2.5	44	1.1	1.06	1500
15'	P-23A180G		37.9	38.1	38.2	2.0	46	1.1	1.06	2700
2290-2450 MHz										
4'	P-24LA48G		26.7	27.0	27.3	7.0	34	1.3	1.15	250
6'	P-24LA72G		30.2	30.5	30.8	4.7	37	1.3	1.10	500
8'	P-24LA96G		32.7	33.0	33.3	3.5	38	1.1	1.08	800
10'	P-24LA120G		34.7	35.0	35.3	2.8	42	1.1	1.08	1300
12'	P-24LA144G		36.3	36.6	36.9	2.4	40	1.1	1.08	1500
15'	P-24LA180G		38.2	38.5	38.8	1.9	48	1.1	1.08	2700
2300-2500 MHz										
3'	P-24A36G		25.3	25.7	26.0	8.4	28	1.5	-	97
4'	P-24A48G		26.8	27.5	27.7	6.7	34	1.3	1.15	250
6'	P-24A72G		30.1	30.8	31.1	4.4	37	1.3	1.10	500
8'	P-24A96G		32.6	33.5	33.6	3.5	38	1.1	1.08	800
10'	P-24A120G		34.7	35.1	35.6	2.8	42	1.1	1.08	1300
12'	P-24A144G		36.1	36.8	37.3	2.4	40	1.1	1.08	1500
15'	P-24A180G		38.1	38.6	39.1	1.9	48	1.1	1.08	2700
2480-2700 MHz										
4'	P-25A48G		27.6	28.0	28.3	6.0	27	1.3	1.15	250
6'	P-25A72G		31.0	31.4	31.8	4.2	38	1.3	1.10	500
8'	P-25A96G		33.5	33.9	34.3	3.3	36	1.1	1.06	800
10'	P-25A120G		35.5	35.8	36.2	2.7	42	1.1	1.06	1300
12'	P-25A144G		37.0	37.4	37.8	2.7	42	1.1	1.06	1500
15'	P-25A180G		38.9	39.3	39.6	1.8	47	1.1	1.06	2700

2300-2700 MHz On Application

Model used for testing



2300-2700 MHz On Application

PLEASE USE PROPER SUFFIX WHEN ORDERING.

G = Pressurized, 7/8" EIA Termination
GL = Pressurized, 7/8" EIA Termination, Low VSWR
GF = Non Pressurized, 7/8" EIA Termination
GN = Non Pressurized, N Female Termination