



FCC CFR47 PART 90 CERTIFICATION

TEST REPORT

FOR

450 – 470MHZ HALF DUPLEX

UHF RADIO (DATA ONLY) MODEM TRANSCEIVER

MODEL: LPB452P512, LPB452P525, LPB4520212, LPB4520225

FCC ID: KEALPB4520225

REPORT NUMBER: 01U0788-1

ISSUE DATE: MAY 28, 2001

Prepared for
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1. TEST RESULT CERTIFICATION

COMPANY NAME: PACIFIC CREST CORPORATION
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TELEPHONE NO: (408) 782-9370

EUT DESCRIPTION: 450-470MHZ HALF DUPLEX, UHF RADIO (DATA ONLY)
MODEM TRANSCEIVER

MODEM NAME: LPB452P512, LPB452P525, LPB4520212, LPB4520225
DATE TESTED: AUGUST 01 - 29 , 2001

TYPE OF EQUIPMENT	INTENTIONAL RADIATOR
EQUIPMENT TYPE	450-470MHz TRANSCEIVER
MEASUREMENT PROCEDURE	ANSI 63.4 / 1992, TIA/EIA 603
PROCEDURE	CIRTIIFICATION
FCC RULE	CFR 47 PART 90

Compliance Certification Services, Inc. tested the above equipment for compliance with the requirement set forth in CFR 47, PART 90-Private Land Mobile Radio Service. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

Warning : This document reports conditions under which testing was conducted and results of tests performed. 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.

Tested By:

Released For CCS By:




THU CHAN
SENIOR EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

TOM COKENIAS
DIRECTOR OF ENGINEERING
COMPLIANCE CERTIFICATION SERVICES

2. EUT DESCRIPTION

The Pacific Crest LPB family of products are all half duplex, UHF Radio Modem Transceivers. They are capable of taking incoming serial data from a data terminal, modulating it in GMSK or Four Level FSK (user selectable dependant upon the country of use), and transmitting the data at an RF power output level of 500mW or 2W. The RF output level is programmed at the factory and is not user selectable. The frequency of the RF signal is specified to be in the UHF band of 450 – 470 MHz, in 20 MHz bands. A channel spacing of either 12.5 KHz or 25 KHz is available.

3. TEST METHODOLOGY

Both conducted and radiated testing were performed according to the procedures documented on chapter 13 of ANSI C63.4 and FCC CFR 47 2.1046, 2.1051, 2.1053, 2.1055 and 2.1057.

4. TEST FACILITY

The open area test sites and conducted measurement facilities used to collect the radiated data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

5. ACCREDITATION AND LISTING

The test facilities used to perform radiated and conducted emissions tests are accredited by National Voluntary Laboratory Accreditation Program for the specific scope of accreditation under Lab Code: 200065-0 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government. In addition, the test facilities are listed with Federal Communications Commission (reference no: 31040/SIT (1300B3) and 31040/SIT (1300F2))

6. MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

7. APPLICABLE RULES AND BRIEF TEST RESULT

§90.205- POWER LIMIT

According to 90.205(g) 450–470 MHz. The maximum allowable station effective radiated power (ERP) is dependent upon the station’s antenna HAAT and required service area and will be authorized in accordance with table 2. (I.e. 2W for service area less than 3 km.)

Table 2-450-470 MHz-Maximum ERP/Reference HAAT for a Specific Service Area Radius

	Service area radius (km)									
	3	8	13	16	24	32	40	48	64	80
Maximum ERP (w) ¹	2	100	500	500	500	500	500	500	500	500
Up to reference HAAT (m) ³	15	15	15	27	63	125	250	410	950	2700

¹ Maximum ERP indicated provides for a 39 dBu signal strength at the edge of the service area per FCC Report R-6602, Fig. 29 (See Sec. 73.699, Fig. 10 b).

³ When the actual antenna HAAT is greater than the reference HAAT, the allowable ERP will be reduced in accordance with the following equation:

$$ERP_{allow} = ERP_{max} \times (HAAT_{ref} / HAAT_{actual})^2.$$

Spec limit: As specified above, 2W maximum.

Test result: Complies, The measured ERP power as described below:

LPB452P512 & LPB452P525 are 0.17Watt; LPB4520212 & LPB4520225 are 0.78 Watts.

§90.207- TYPE OF EMISSION

According to 90.207(e) for non-voice paging operations, only A1A, A1D, A2B, A2D, F1B, F1D, F2B, F2D, G1B, G1D, G2B, or G2D emissions will be authorized.

Spec limit: As stated above.

Test result: Complies, these EUTs use F1D emission to communicate each other.

§90.209- BANDWIDTH LIMITATION

According to 90.200(3) For all other types of emissions, the maximum authorized bandwidth shall not be more than that normally authorized for voice operations.

According to 90.200(5), unless specified elsewhere, channel spacing and bandwidths that will be authorized in the following frequency bands are given in the following “STANDARD CHANNEL SPACING/BANDWIDTH” table.

Standard Channel Spacing/Bandwidth

Frequency band (MHz)	Channel spacing (kHz)	Authorized bandwidth (kHz)
Below 25		
25-50.....	20	20
72-76.....	20	20
150-174.....	¹ 7.5	^{1,3} 20/11.25/6
220-222.....	5	4
421-512	¹ 6.25	^{1,3} 20/11.25/6
806-821/851-866.....	25	20
821-824/866-869.....	12.5	20
896-901/935-940.....	12.5	13.6
902-928		
929-930.....	25	20
1427-1435		
2450-2483.52.....		
Above 2500.....		

1) For stations authorized on or after August 18, 1995.

3) Operations using equipment designed to operate with a 25 kHz channel bandwidth will be authorized a 20 kHz bandwidth. Operations using equipment designed to operate with a 12.5 kHz channel bandwidth will be authorized an 11.25 kHz bandwidth. Operations using equipment designed to operate with a 6.25 kHz channel bandwidth will be authorized a 6 kHz bandwidth.

Spec limit: Not applicable.

Test result: The measurement results shown that the EUT complies with the rule. The frequency bandwidth which contains 99.5% of the power is between frequencies ranges:

- _ For 12.5KHz Unit: Bandwidth equals 8KHz < 11.25KHz
- _ For 25.0KHz Unit: Bandwidth equals 15KHz < 20KHz

§90.210- EMISSIONS MASKS

According to 90.210(c), Emission Mask C _ 25 KHZ channel bandwidth equipment. For transmitters that are not equipment with a audio low-pass filter pursuant to 90.211(b), the power of any emission must be attenuated below the unmodulated carrier output power (P) as follows:

- (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5 kHz, but not more than 10 kHz: At least $83 \log (f_d/5)$ dB;
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 10 kHz; but not more than 250 percent of the authorized bandwidth: At least $29 \log (f_d^2/11)$ dB or 50 dB, whichever is the lesser attenuation;
- (3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log (P)$ Commission approval is obtained.

And 90.210(d), Emission Mask D _ 12.5 KHZ channel bandwidth equipment. For transmitters designed to operate with 12.5 KHZ channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- (1) On any frequency from the center of the authorized bandwidth f_i to 5.625 KHz removed from f_i : Zero dB.
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in KHz) of more than 5.625 KHz but no more than 12.5 KHz: At least $7.27 (f_d - 2.88 \text{ KHz})$ dB.
- (3) On any frequency removed from the center of the authorized bandwidth by displacement frequency (f_d in KHz) of more than 12.5 KHz: At least $50 + 10 \log (P)$ dB or 70 dB, whichever is the lesser attenuation.
- (4) The reference level for showing shall be established using a resolution bandwidth sufficiently wide (usually two to three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emissions mask up to and including 50 KHz removed from the edge of the authorized bandwidth, adjust the resolution the bandwidth 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 KHz from the edge of the authorized bandwidth, see paragraph (m) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, the an alternate procedure may be used provided prior Commission approval is obtained.

Spec limit: Specified as above.

Test result: The measurement results shown that the EUT complies with the rule.

§90.211- MODULATION REQUIREMENTS

The requirements of this paragraph do not apply to mobile stations that are authorized to operate with a maximum power output of 2 watts or less.

Spec limit: Not applicable, EUT maximum output powers are 0.5 Watt and 2.0 Watts.

Test result: Not applicable.

§90.212- SCRAMBLING DEVICES AND DIGITAL VOICE MODULATION

Spec limit: Not applicable.

Test result: Not applicable. This EUT use FID emission for data transmission only.

§90.213- FREQUENCY STABILITY

(a) Unless noted elsewhere, transmitters used in the services governed by this part must have minimum frequency stability as specified in the following table.

Minimum Frequency Stability
[Parts per million (ppm)]

	Fixed and base stations	Mobile Stations	
		Over 2W output power	2 watts or less output power
Below 25	100	100	200
25-50	20	20	50
72-76	5	-----	50
150-174	5	5	50
220-222	0.1	1.5	1.5
421-512	1.5	5	⁸ 5
806-821	1.0	2.5	2.5
821-824	1.5	1.5	1.5
851-866	2.5	2.5	2.5
866-869	1.0	1.5	1.5
896-901	0.1	1.5	1.5
902-928	2.5	2.5	2.5
902-928	2.5	2.5	2.5
929-930	1.5	-----	-----
935-940	0.1	1.5	1.5
1427-1435	300	300	300
Above 2450	-----	-----	-----

⁸In the 421-512 MHz band, mobile stations designed to operate with a 12.5 kHz channel bandwidth must have a frequency stability of 2.5 ppm. Mobile stations designed to operate with a 6.25 kHz channel bandwidth must have a frequency stability of 1.0 ppm.

(b) For the purpose of determining the frequency stability limits, the power of a transmitter is considered to be the maximum rated output power as specified by the manufacturer.

Spec limit: 25Khz bandwidth is 5 ppm (2.30KHz), and 12.5Khz bandwidth is 2.5 ppm (1.15Khz)

Test result: Complies, measured EUT maximum frequency drift was 0.815 ppm (375Hz).

§90.214- TRANSIENT FREQUENCY BEHAVIOR

Transmitters designed to operate in the 150-174 MHz and 421-512 MHz frequency bands must maintain transient frequencies within the maximum frequency difference limits during the time intervals indicated:

Time Intervals	Maximum Frequency Difference	All Equipment	
		150 to 174MHz	421 to 512MHz
Transient frequency Behavior for Equipment Designed to Operate on 25kHz Channels			
t_1^4	$\pm 25.0\text{kHz}$	5.0ms	10.0ms
t_2	$\pm 12.5\text{kHz}$	20.0ms	25.0ms
t_3^4	$\pm 25.0\text{kHz}$	5.0ms	10.0ms
Transient frequency Behavior for Equipment Designed to Operate on 12.5kHz Channels			
t_1^4	$\pm 12.5\text{Hz}$	5.0ms	10.0ms
t_2	$\pm 6.25\text{kHz}$	20.0ms	25.0ms
t_3^4	$\pm 12.5\text{kHz}$	5.0ms	10.0ms
Transient frequency Behavior for Equipment Designed to Operate on 6.25kHz Channels			
t_1^4	$\pm 6.25\text{Hz}$	5.0ms	10.0ms
t_2	$\pm 3.125\text{kHz}$	20.0ms	25.0ms
t_3^4	$\pm 6.25\text{kHz}$	5.0ms	10.0ms

¹ t_{on} is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.

⁴If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

t_1 is the time period immediately following t_{on}

t_2 is the time period immediately following t_1

Spec limit: Transient frequency less than 12.5KHz in t_2 for 25Khz channel device, and less than 6.25KHz in t_2 for 12.5Khz channel device.

Test result: EUT compliance with the limits.

§90.217- EXEMPTION FROM TECHNICAL STANDARDS

Spec limit: Not applicable.

Test result: Not applicable.

§2.1057- SPECTRUM RANGE TO BE INVESTIGATED

Lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:

(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

(2) If the equipment operates at or above 10 GHz and below 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

(3) If the equipment operates at or above 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower.

(b) Particular attention should be paid to harmonics and sub-harmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency.

Radiation at the frequencies of multiplier stages should also be checked.

(c) The amplitude of spurious emissions, which are attenuated more than 20 dB below the permissible value, need not be reported.

(d) Unless otherwise specified, measurements above 40 GHz shall be performed using a minimum resolution bandwidth of 1 MHz.

Spec limit: Frequency investigation range from 9K to tenth harmonic (i.e. 4.65 GHz.).

§PART 15 RADIATED AND CONDUCTED EMISSION

Since digital control device is also used in the EUT to control the Tx and Rx, The part 15 compliance test was also performed to evaluate the compliance with the applicable rule 15.207 and 15.209

FCC PART 15 CLASS A

MEASURING DISTANCE OF 10 METER		
FREQUENCY RANGE (MHz)	FIELD STRENGTH (Microvolts/m)	FIELD STRENGTH (dBuV/m)
30-88	90	39.1
88-216	150	43.5
216-960	210	46.4
Above 960	300	49.5

FCC PART 15 CLASS B

MEASURING DISTANCE OF 3 METER		
FREQUENCY RANGE (MHz)	FIELD STRENGTH (Microvolts/m)	FIELD STRENGTH (dBuV/m)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

FCC CLASS A

FREQUENCY RANGE	FIELD STRENGTH (Microvolts)	FIELD STRENGTH (dBuV)/QP
450kHz-1.705MHz	1000	60
1.705MHz - 30MHz	3000	69.54

FCC CLASS B

FREQUENCY RANGE	FIELD STRENGTH (Microvolts)	FIELD STRENGTH (dBuV)/QP
450kHz-30MHz	250	48

Spec limit: As specified above.

Test result: Radiated emissions is complied.

Line conducted emissions is not applicable due to DC battery operating.

§SUBPART J- NON-VOICE AND OTHER SPECIALIZED OPERATION

Spec limit: Not applicable.

Test result: Not applicable.

8. TEST SETUP, PROCEDURE AND RESULT

8.1. CONDUCTED POWER

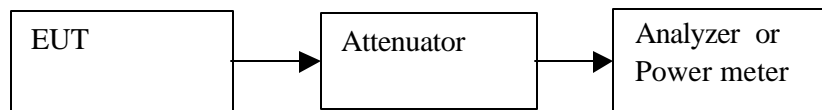
INSTRUMENTS LIST

EQUIPMENT	MANUFACTURE	MODEL NO.	CAL. DUE DATE
Spectrum Analyzer	HP	8593EM	06/20/02
Attenuator	HP	8496A	N/A
Attenuator	HP	8494A	N/A
Power Meter	HP	HP436A	4/02/2002
Power Sensor	HP	HP8482	4/02/2002
20 dB Fixed Attenuator	Bird	5A-MFB-20	N/A

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
30 to 1000	<input checked="" type="checkbox"/> Peak	<input checked="" type="checkbox"/> 100 KHz	<input checked="" type="checkbox"/> 100 KHz
	<input type="checkbox"/> Quasi Peak	<input type="checkbox"/> 120 KHz	<input type="checkbox"/> 120 KHz
Above 1000	<input checked="" type="checkbox"/> Peak	<input checked="" type="checkbox"/> 1 MHz	<input checked="" type="checkbox"/> 1 MHz
	<input type="checkbox"/> Average	<input type="checkbox"/> 1 MHz	<input type="checkbox"/> 10 Hz

TEST SETUP



TEST PROCEDURE

The EUT is configured on a test bench as shown above in a continuously transmitting / receiving mode. While the transceiver started, the analyzer MAX HOLD function is used to capture the emissions.

RESULT

Complies, output powers were measured to be 33.3 dBm = 2.14 Watts and 26.72dBm = 0.47Watt. See tabular data for 2 Watt data and plot *OutputPower*.for 0.5 watt data.



Measurement date: 29 August 2001

Serial number: LBP4520225

HP 436A reading: 13.3 dBm

Attenuator: 20 dB

P out, dBm: 33.3 dBm = 2.14 Watts

2 Watts Output Power

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FCC Rules concerning routine environmental evaluation requirement for mobile transmitters:

2.1091 (c) Mobile devices that operate in...Part 90 of this chapter are subject to routine environmental evaluation for RF exposure prior to equipment authorization if they operate at frequencies of 1.5 GHz or below and their effective radiated power (ERP) is 1.5 watts or more.

ERP, watts • Antenna power, watts x transmitter antenna gain referenced to dipole x source based time averaging (i.e., modulation duty cycle)

dBm: $10 \log (P, \text{watts} \times 1000)$

G dBi: $10 \log (\text{antenna gain above isotropic})$

G dBd: $10 \log (\text{antenna gain above a dipole})$

(1) ERP, dBm = P dBm + G dBd + 10log (modulation duty cycle)

(2) G dBd = G dBi - 2.15 dB

(3) $10 \log (1.5 \text{ watts} \times 1000 \text{ mW/watt}) = 31.8 \text{ dBm}$

Measured output power serial no. LPB4520225: 33.3 dBm

Duty cycle (radio is TDD TDMA): 0.6 = -2.2 dB

Measured output power serial no. LPB461P523 : 26.72 dBm

Duty cycle (radio is TDD TDMA): 0.6 = -2,2 dB

$$\begin{aligned} \text{ERP} &= P \text{ dBm} + G \text{ dBi} - 2.15 \text{ dB} + 10 \log (0.6) \\ &= P \text{ dBm} + G \text{ dBi} - 2.15 \text{ dB} - 2.2 \text{ dB} \end{aligned}$$

For 0 dBi gain antenna

2 watt radio: $\text{ERP} = 33.3 - 0 - 2.15 - 2.2 = 28.95 \text{ dBm} = 0.78 \text{ watt EIRP}$

0.5 watt radio: $\text{ERP} = 26.72 - 0 - 2.15 - 2.2 = 22.37 \text{ dBm} = 0.17 \text{ watt EIRP}$

To meet exclusion requirements of 2.1091, ERP must be less than 31.8 dBm, so maximum antenna gain that can be used with this product is

$$\mathbf{G, dBi} < (-33.3 + 2.15 + 31.8 + 2.2) \text{ dBi} = \mathbf{2.9 dBi}$$

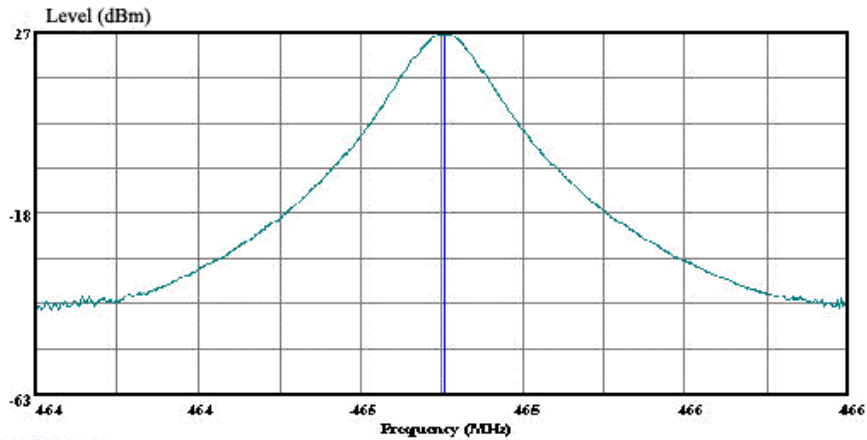
The instruction manual for this product will include the following wording:

"NOTE: In accordance with the United States FCC requirements, for the 2 watt version of the radio, the antenna gain must be less than or equal to 2.8 dBi."



561F Monterey Road
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 Tel: (408) 463-0885
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Data#: 20 File#: Pacific.emi Date: 08-13-2001 Time: 22:21:48



(Compliance)

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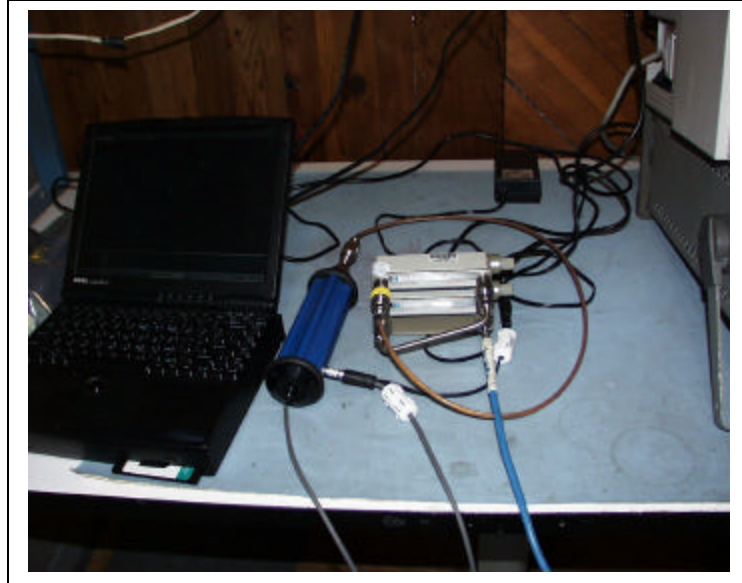
Ref Trace:

Project NO. : 01U0788-1
 Test Engr : Pete & Thu
 Company : Pacific Crest Corporation
 EUT : 450-470Mhz Half Duplex, UHF Radio
 : (data only) Modem Transceiver
 Test Config.: EUT only
 Test Target : FCC 90.210(c)
 Test Mode : 25KHz 0.5Watt Un-modulated
 : M/N: LPB461P525
 : S/N: 18
 : REW=VBW=100KHz

Page: 1

Freq	Level
MHz	dBm
1 465.008	26.72

0.5 Watt Output Power



Conducted Output Power Setup Photo (spectrum analyzer)

8.2. RADIATED OUTPUT POWER (ERP), HARMONIC, & SPURIOUS EMISSIONS

INSTRUMENTS LIST

EQUIPMENT	MANUFACTURE	MODEL NO.	CAL. DUE DATE
Spectrum Analyzer	HP	8593EM	06/20/02
Bilog Antenna	CHASE EMC LTD	CBL6112	11/21/01
Dipole Antenna	COMPLIANCE DESIGN	ROBERTS	05/05/02
Horn Antenna	EMCO	3115	06/20/02
Horn Antenna	EMCO	3115	06/20/02
Amplifier	HP	8447D	11/21/01
Amplifier	Miteq	NSP2600-44	04/12/02
RF Synthesizer	HP	83732B	02/11/02

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
30 to 1000	<input checked="" type="checkbox"/> Peak	<input checked="" type="checkbox"/> 100 KHz	<input checked="" type="checkbox"/> 100 KHz
	<input type="checkbox"/> Quasi Peak	<input type="checkbox"/> 120 KHz	<input type="checkbox"/> 120 KHz
Above 1000	<input checked="" type="checkbox"/> Peak	<input checked="" type="checkbox"/> 1 MHz	<input checked="" type="checkbox"/> 1 MHz
	<input type="checkbox"/> Average	<input type="checkbox"/> 1 MHz	<input type="checkbox"/> 10 Hz

TEST SETUP

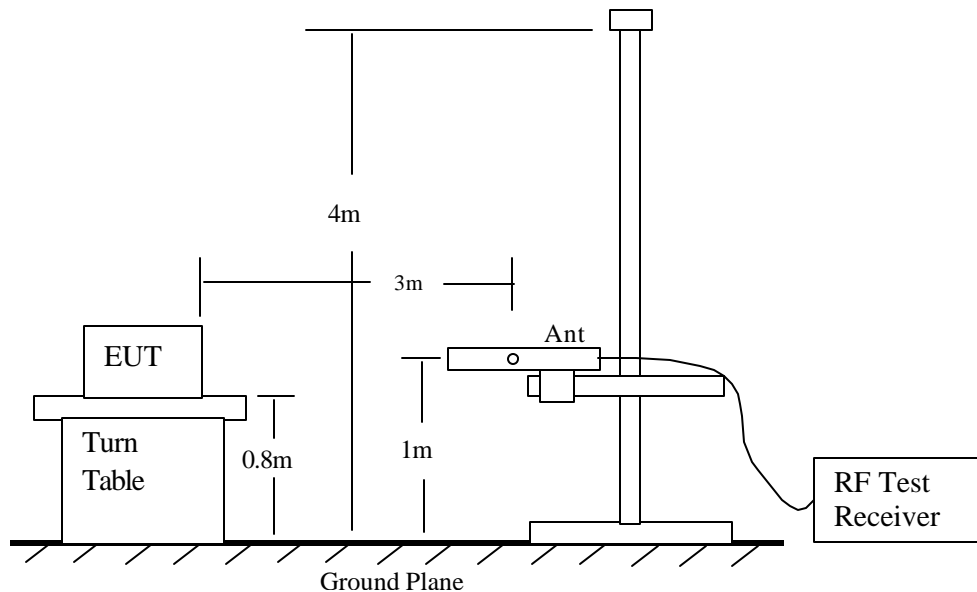


Fig 1: Radiated Emission Measurement Below 1GHz

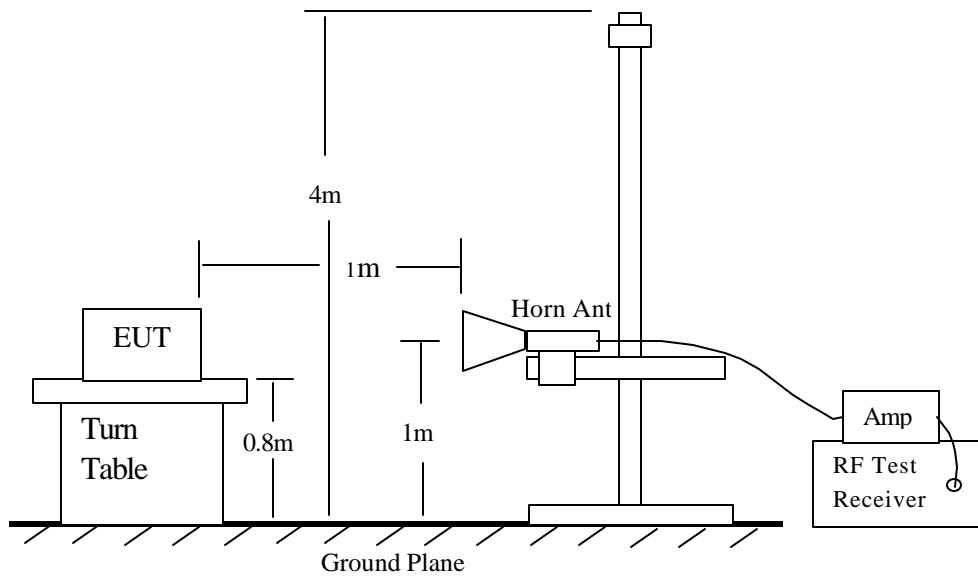


Fig 2: Radiated Emission Measurement Above 1GHz

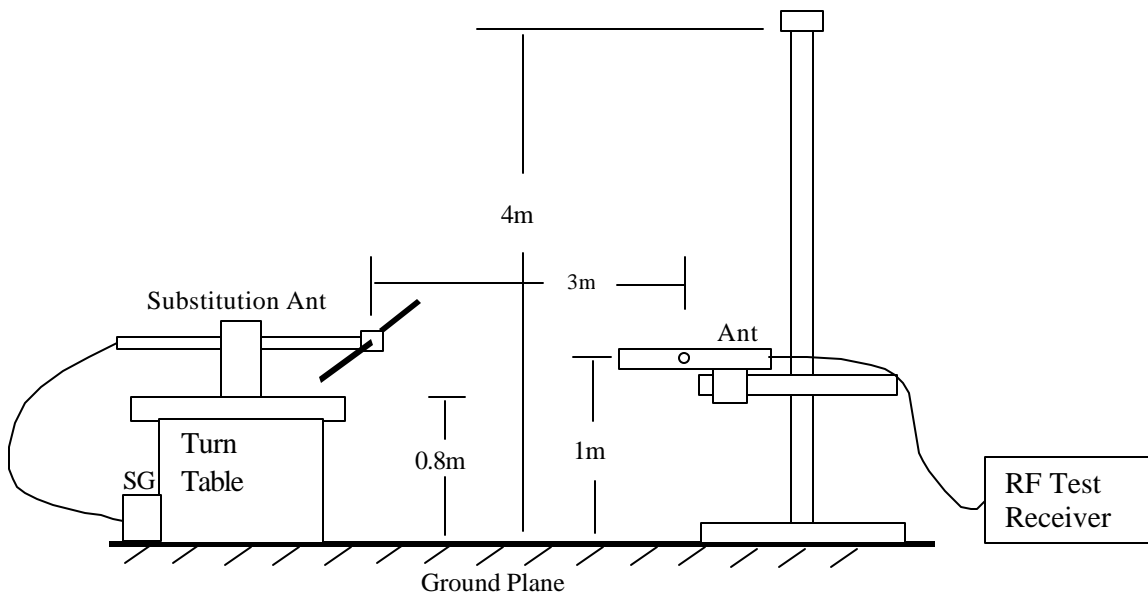


Fig 3: Radiated Emission – Substitution Method Below 1Ghz

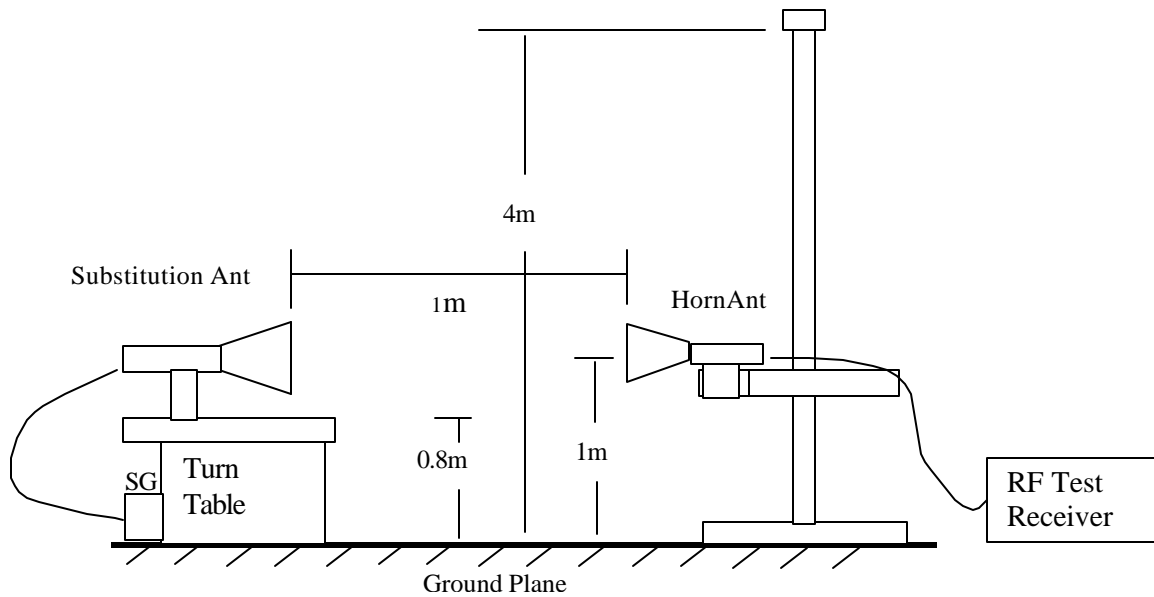
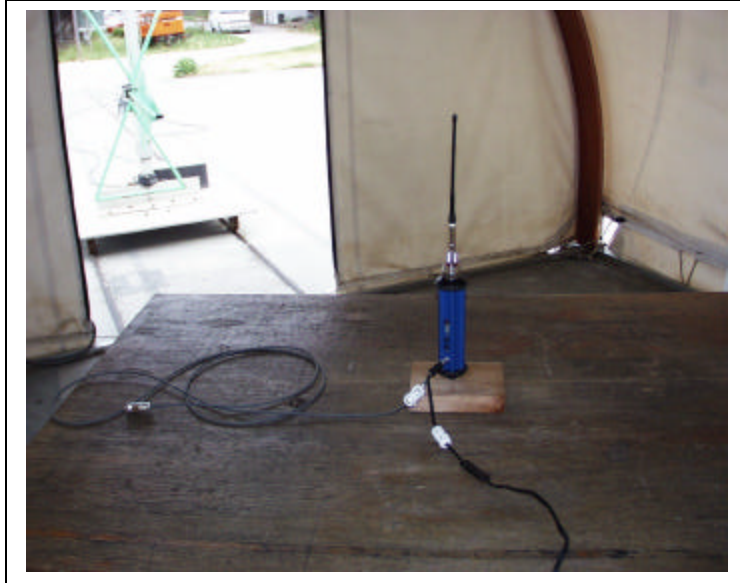
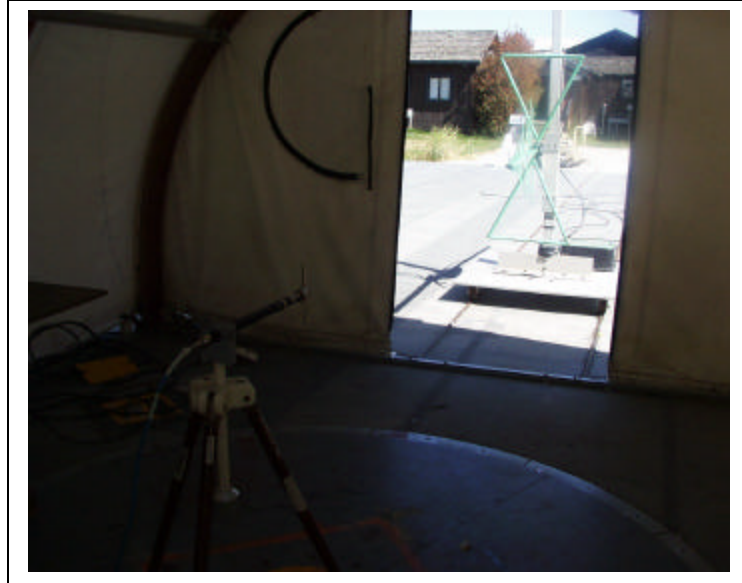


Fig 4: Radiated Emission – Substitution Method Above 1GHz



Radiated Emissions Setup Photos



Substitution Method Below 1GHz Setup Photo




Substitution Method Above 1GHz Setup Photo

TEST PROCEDURE (SPURIOUS AND HARMONICS)

- 1). On a test site, the EUT shall be placed on a turntable, and in the position closest to the normal use as declared by the user.
- 2). The test antenna shall be oriented initially for vertical polarization located 3m from the EUT to correspond to the frequency of the transmitter.
- 3). The output of the test antenna shall be connected to the measuring receiver and either a peak or quasi-peak detector was used for the measurement as indicated on the report. The detector selection is based on how close the emission level was approaching the limit.
- 4). The transmitter shall be switched on, if possible, without the modulation and the measurement receiver shall be tuned to the frequency of the transmitter under test.
- 5). The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
- 6). The transmitter shall than be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
- 7). The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
- 8). The maximum signal level detected by the measuring receiver shall be noted.
- 9). The transmitter shall be replaced by a substitution antenna.
- 10). The substitution antenna shall be oriented for vertical polarization and the length (if a dipole antenna is used) of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
- 11). The substitution antenna shall be connected to a calibrated signal generator.
- 12). If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
- 13). The test antenna shall be raised and lowered through the specified range of the height to ensure that the maximum signal is received.
- 14). The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuation setting of the measuring receiver.
- 15). The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
- 16). The measurement shall be repeated with the test antenna and the substitution antenna oriented for horizontal polarization.
- 17). The measure of the effective radiated power is the larger of the two levels recorded, at the input to the substitution antenna, corrected for the gain of the substitution antenna if necessary.

RESULT

Complies, as shown below.



FCC, VCCI, CISPR, CE, AUSTEL,
UL, CSA, TUV, BSMI, DHHS, NVLAP

561F MONTEREY ROAD, SAN JOSE, CA 95037-90
PHONE: (408) 463-0888 FAX: (408) 463-0888

Project #: 01U0788-1

Report #: 010517A1

Date & Time: 05/17/01 2:30 PM

Test Engr: Thu Chan

Company: Pacific Crest Corporation

EUT Description: 450-470MHz Half Duplex, UHF Radio (Data only) Modem Transceiver

Test Configuration: EUT/Notebook/Car Battery

Type of Test: FCC 90.210(c3)

Mode of Operation: Transmitting (M/N: LPB4520225, S/N: 11)

A-Site

B-Site

C-Site

F-Site

6 Worst Data

Descending

Freq.	SA Reading	SG Setting	Ant Gain	Dipole Gain	Cable Loss	Other	Result	Limit	Margin	Pol
(MHz)	(dBuV)	(dBm)	(dBi)	(dBd)	(dB)	(dB)	(dBm)	(dBm)	(dBm)	(H/V)
Spurious Emissions Measurement:										
930.00	49.13	-23.50	0.00	0.00	1.00	0.00	-24.50	-13.00	-11.50	V
930.00	46.20	-26.30	0.00	0.00	1.00	0.00	-27.30	-13.00	-14.30	H
1395.00	20.51	-59.00	9.20	2.15	1.20	0.00	-53.15	-13.00	-40.15	V
1860.00	10.94	-66.00	9.20	2.15	1.40	0.00	-60.35	-13.00	-47.35	V
2325.00	11.36	-64.00	9.50	2.15	1.60	0.00	-58.25	-13.00	-45.25	V
2790.00	11.56	-63.50	9.90	2.15	1.80	0.00	-57.55	-13.00	-44.55	V
3255.00	15.50	-57.50	9.60	2.15	2.00	0.00	-52.05	-13.00	-39.05	V
3720.00	15.16	-55.00	9.60	2.15	2.20	0.00	-49.75	-13.00	-36.75	V
4185.00	12.74	-59.80	10.10	2.15	2.40	0.00	-54.25	-13.00	-41.25	V
4650.00	11.70	-57.00	11.20	2.15	2.60	0.00	-50.55	-13.00	-37.55	V
Total data #: 10										
V.2c										

NOTE: Spurious emissions measurement performed 29 August 2001 after 2 watt power measurement test, as spot check for repeatability and accuracy. At 930 MHz readings were within 0.5 dB of measurements taken 05/17/01.

8.3 TYPE OF EMISSION

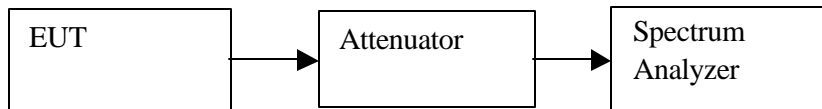
INSTRUMENTS LIST

EQUIPMENT	MANUFACTURE	MODEL NO.	CAL. DUE DATE
Spectrum Analyzer	HP	8593EM	6/20/02
Attenuator	HP	8496A	N/A
Attenuator	HP	8494A	N/A

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
30 to 1000	<input checked="" type="checkbox"/> Peak	<input checked="" type="checkbox"/> 100 Hz	<input checked="" type="checkbox"/> 100 Hz
	<input type="checkbox"/> Quasi Peak	<input type="checkbox"/> 120 KHz	<input type="checkbox"/> 120 KHz
Above 1000	<input checked="" type="checkbox"/> Peak	<input checked="" type="checkbox"/> 1 MHz	<input checked="" type="checkbox"/> 1 MHz
	<input type="checkbox"/> Average	<input type="checkbox"/> 1 MHz	<input type="checkbox"/> 10 Hz

TEST SETUP



TEST PROCEDURE

The EUT is configured on a test bench as shown above in a continuously transmitting mode. While the transceiver started, the analyzer MAX HOLD function was enabled and the frequency SPAN was adjusted to capture the whole emission.

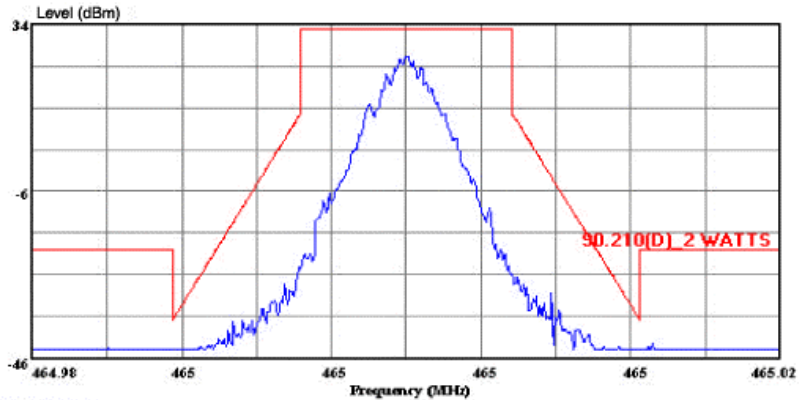
RESULT

Complies, see plot *ModulationType* below and also please refer to EUT Technical Description.



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(Compliance)

Trace:

Ref Trace:

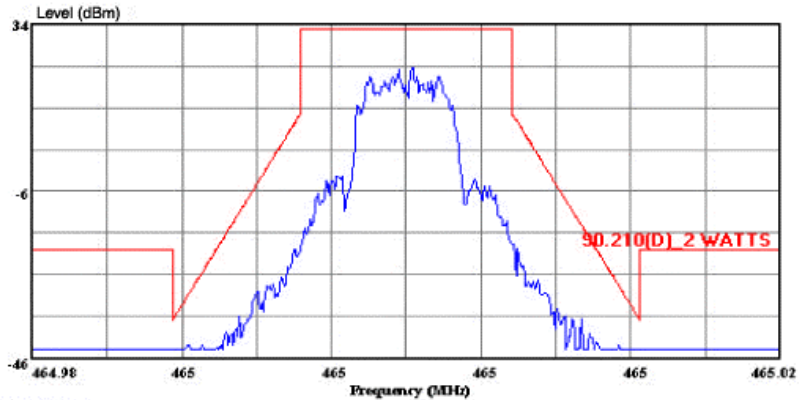
Project NO. : 01U0788-1
 Test Engr : Thu Chan
 Company : Pacific Crest Corporation
 EUT : 450-470Mhz Half Duplex, UHF Radio
 : (data only) Modem Transceiver
 Test Config.: EUT only
 Test Target : FCC 90.210(D)
 Test Mode : 12.5KHz 2Watt 4-Level-FSK Modulated
 : M/N: LPB4520212
 : S/N: 11
 : RBW=VBW=100Hz

4-Level FSK Modulation Type



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Data#: 2 File#: Pac_0523.emi Date: 05-23-2001 Time: 15:52:48



(Compliance)

Trace:

Ref Trace:

Project NO. : 01U0788-1
 Test Engr : Thu Chan
 Company : Pacific Crest Corporation
 EUT : 450-470Mhz Half Duplex, UHF Radio
 : (data only) Modem Transceiver
 Test Config.: EUT only
 Test Target : FCC 90.210(D)
 Test Mode : 12.5KHz 2 Watt GMSK
 : M/N: LPB4520212
 : S/N: 11
 : RBW=VBW=100Hz

GMSK Modulation Type

8.4 BANDWIDTH LIMITATION

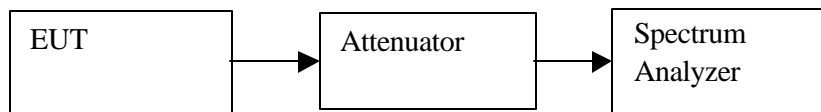
INSTRUMENTS LIST

EQUIPMENT	MANUFACTURE	MODEL NO.	CAL. DUE DATE
Spectrum Analyzer	HP	8593EM	06/20/02
Attenuator	HP	8496A	N/A
Attenuator	HP	8494A	N/A

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
30 to 1000	<input checked="" type="checkbox"/> Peak	<input checked="" type="checkbox"/> 100 Hz	<input checked="" type="checkbox"/> 100 Hz
	<input type="checkbox"/> Quasi Peak	<input type="checkbox"/> 120 KHz	<input type="checkbox"/> 120 KHz
Above 1000	<input checked="" type="checkbox"/> Peak	<input checked="" type="checkbox"/> 1 MHz	<input checked="" type="checkbox"/> 1 MHz
	<input type="checkbox"/> Average	<input type="checkbox"/> 1 MHz	<input type="checkbox"/> 10 Hz

TEST SETUP



TEST PROCEDURE

The EUT is configured on a test bench as shown above in a continuously transmitting mode. While the transceiver started, the analyzer MAX HOLD function was enabled and the frequency SPAN was adjusted to capture the whole emission.

RESULT

Complies. The frequency bandwidth which contains 99.5% of the power is between frequencies ranges:

12.5KHz Unit: 464.996MHz and 465.004MHz. Bandwidth equals 8KHz < 11.25KHz

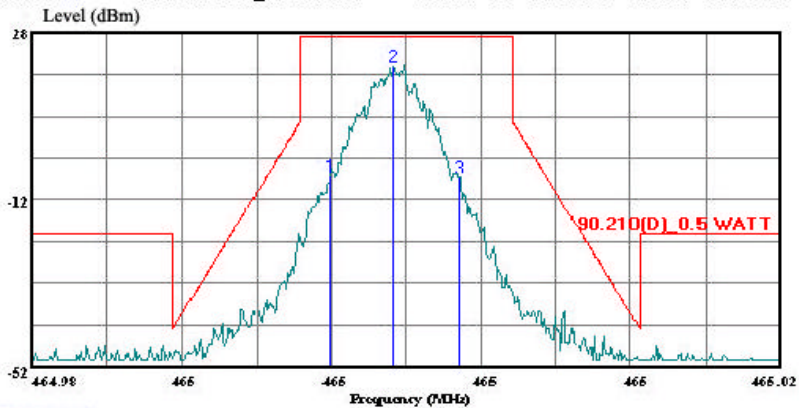
25KHz Unit: 464.992MHz and 465.007MHz. Bandwidth equals 15KHz < 20KHz

Please see plot *Bandwidth*.



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(Compliance)

Trace: 17

Ref Trace:

Project NO.: 01U0788-1
 Test Engr: Thu Chan
 Company: Pacific Crest Corporation
 EUT: 450-470Mhz Half Duplex, UHF Radio
 : (data only) Modem Transceiver
 Test Config.: EUT only
 Test Target: FCC 90.210(D)
 Test Mode: 12.5KHz 0.5Watt 4-Level-FSK
 : M/N: LPB452P512
 : S/N: 10
 : REW=VBW=100Hz

Page: 1

	Freq	Level
	MHz	dBm
1	464.996	-6.30
2	464.999	19.90
3	465.003	-6.52

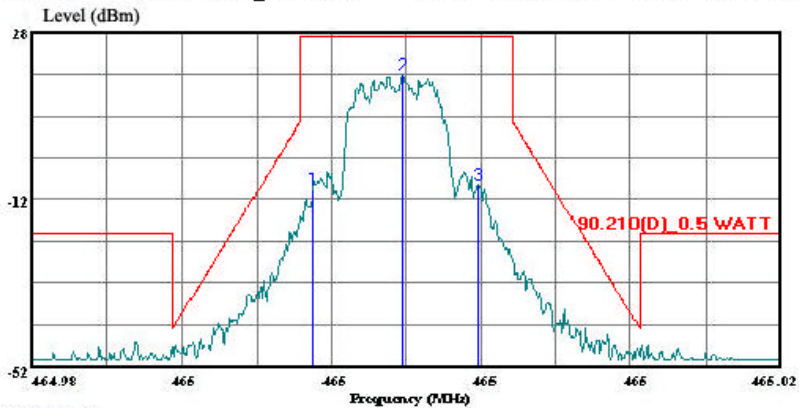
12.5KHz 0.5W 4-Level FSK Modulation Bandwidth

Bandwidth: 465.003 – 464.996 = 7KHz



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Data#: 23 File#: Pac_0523.emi Date: 08-08-2001 Time: 10:36:09



(Compliance)

Trace: 12

Ref Trace:

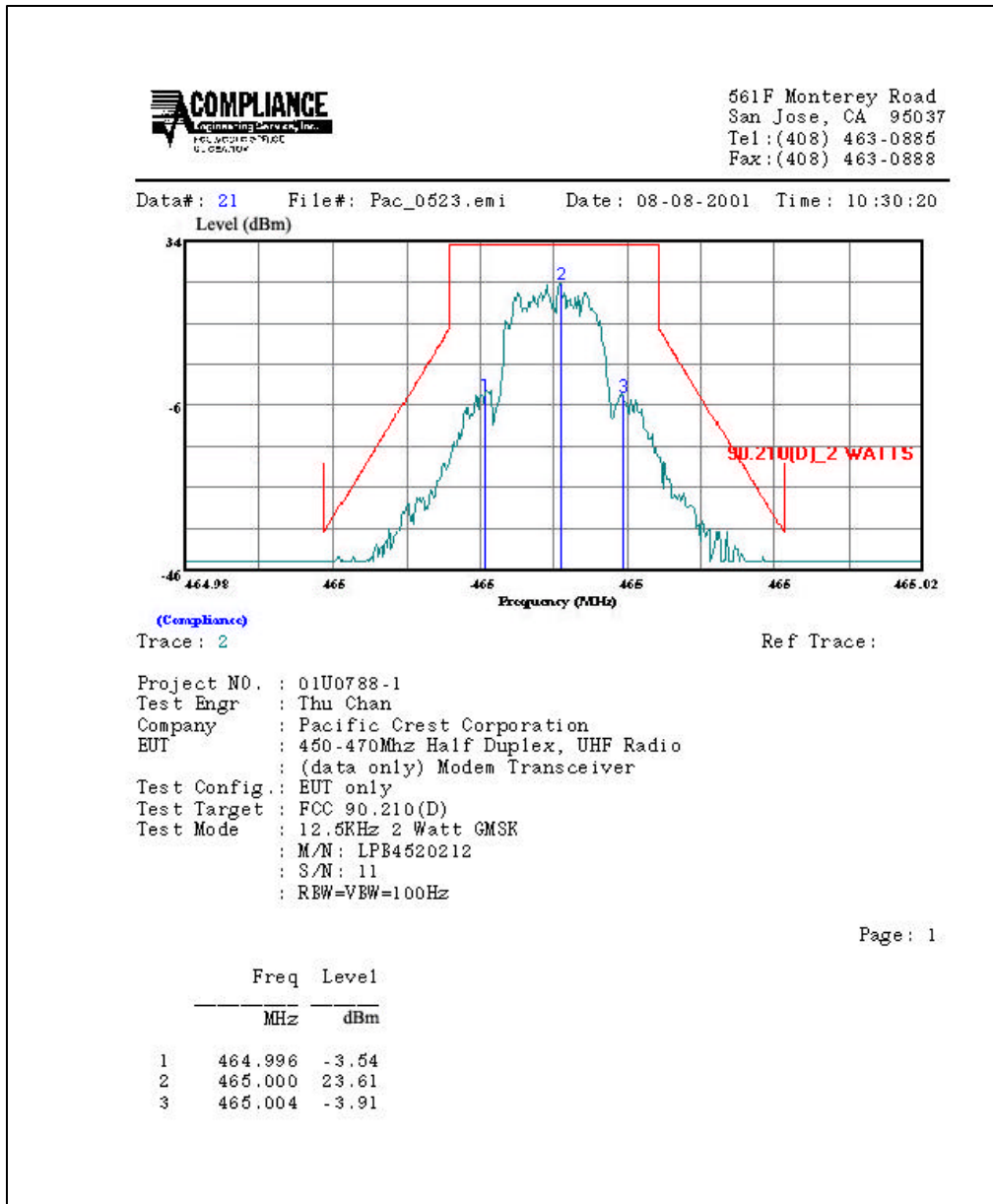
Project NO. : 01U0788-1
 Test Engr : Thu Chan
 Company : Pacific Crest Corporation
 EUT : 450-470Mhz Half Duplex, UHF Radio
 : (data only) Modem Transceiver
 Test Config.: EUT only
 Test Target : FCC 90.210(D)
 Test Mode : 12.5KHz 0.5Watt GMSK
 : M/N: LPB452P512
 : S/N: 10
 : REW=VBW=100Hz

Page: 1

	Freq	Level
	MHz	dBm
1	464.995	-9.46
2	465.000	18.09
3	465.004	-8.48

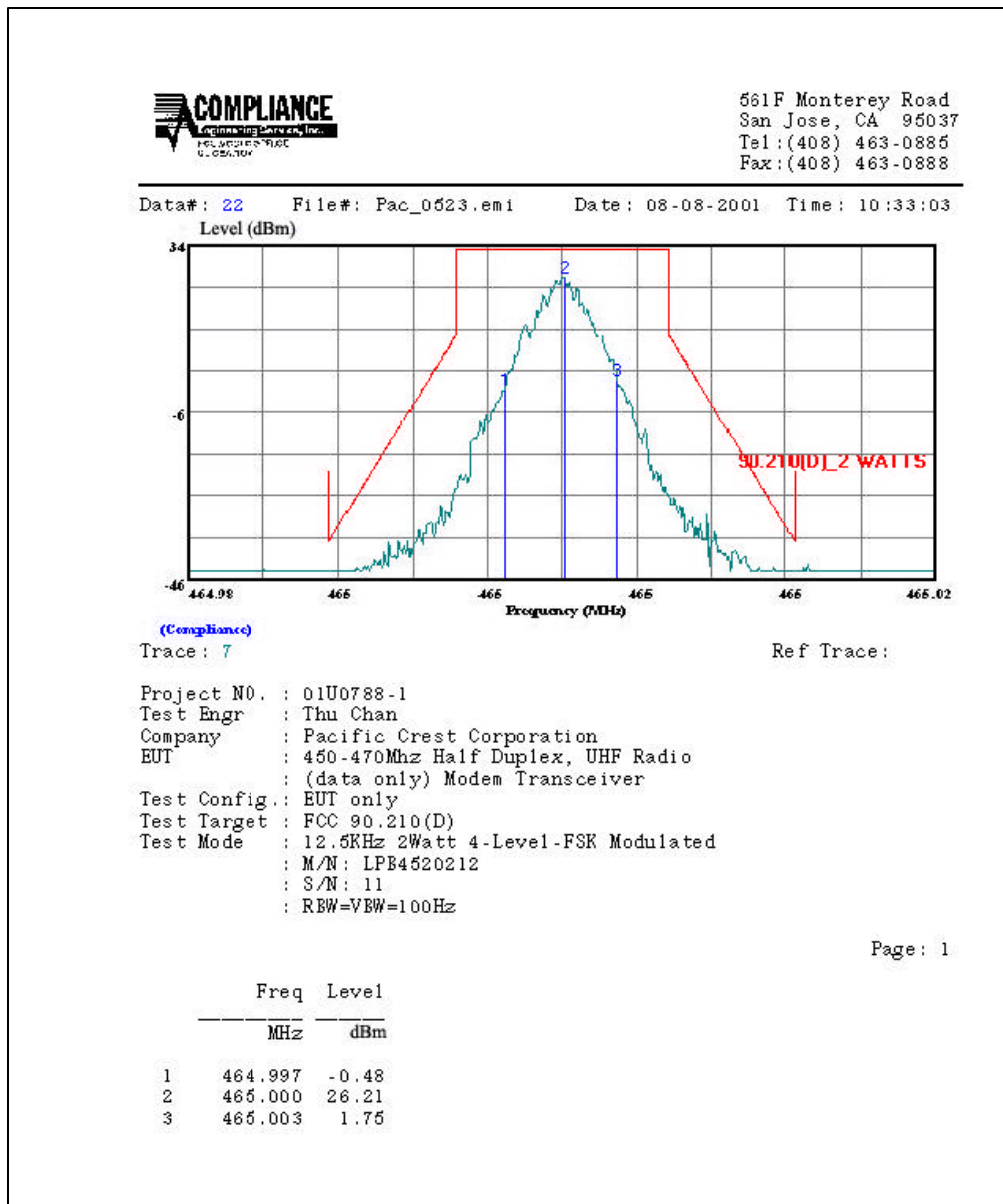
12.5KHz 0.5W GMSK Modulation Bandwidth

Bandwidth: 465.004 – 464.996 = 8KHz



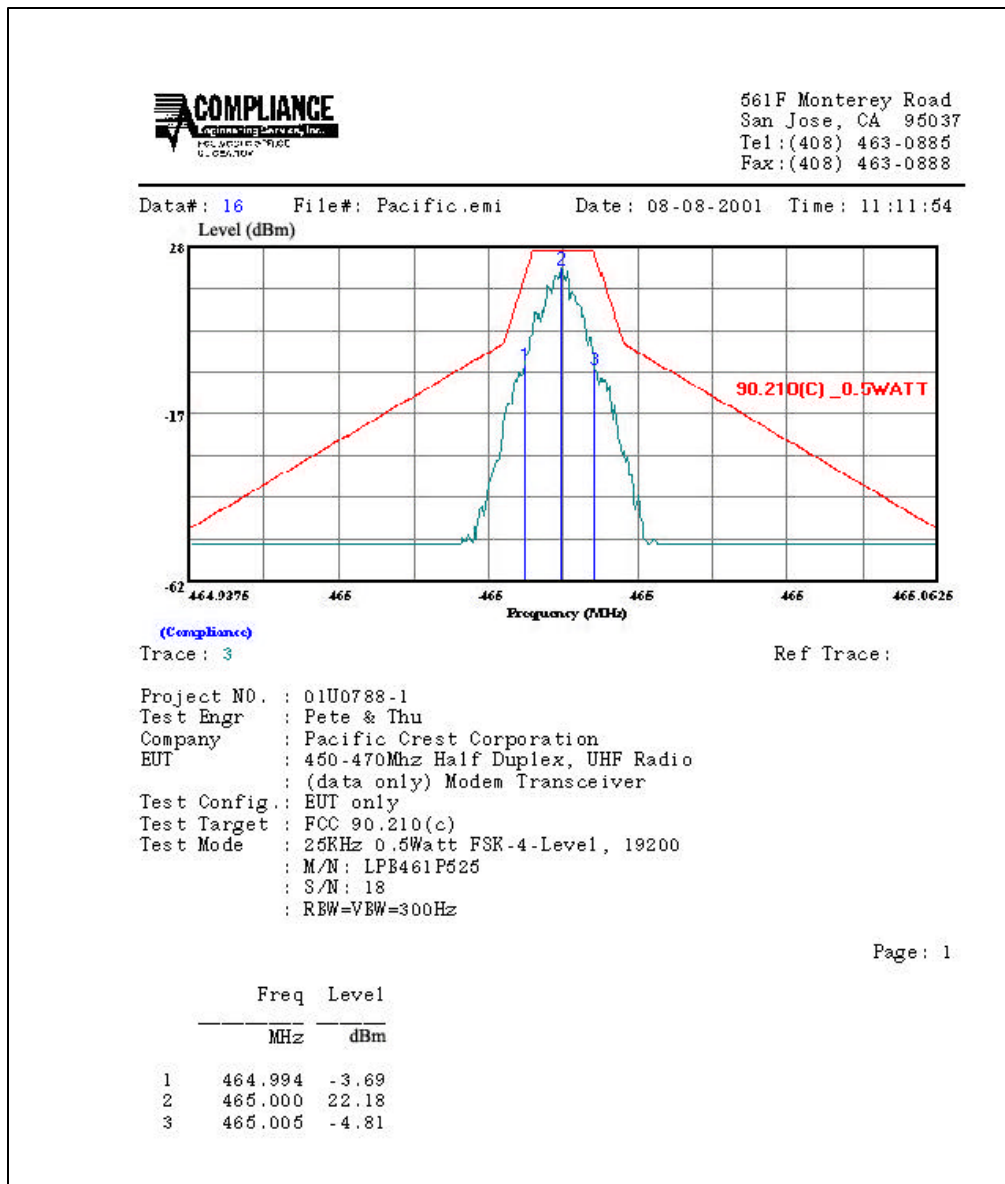
12.5KHz 2W GMSK Modulation Bandwidth

Bandwidth: 465.004 – 464.996 = 8KHz



12.5KHz 2W 4-Level-FSK Modulation Bandwidth

Bandwidth: 465.003 – 464.997 = 6KHz



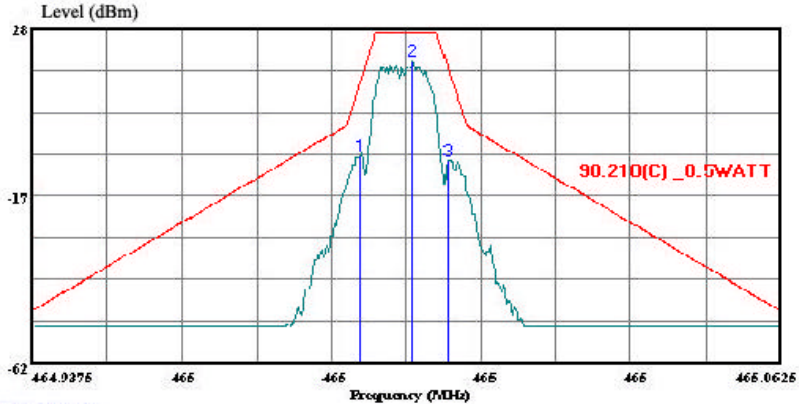
25KHz_0.5W_4-Level FSK Modulation Bandwidth

Bandwidth: 465.005 – 464.994 = 11KHz



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(Compliance)

Trace: 2

Ref Trace:

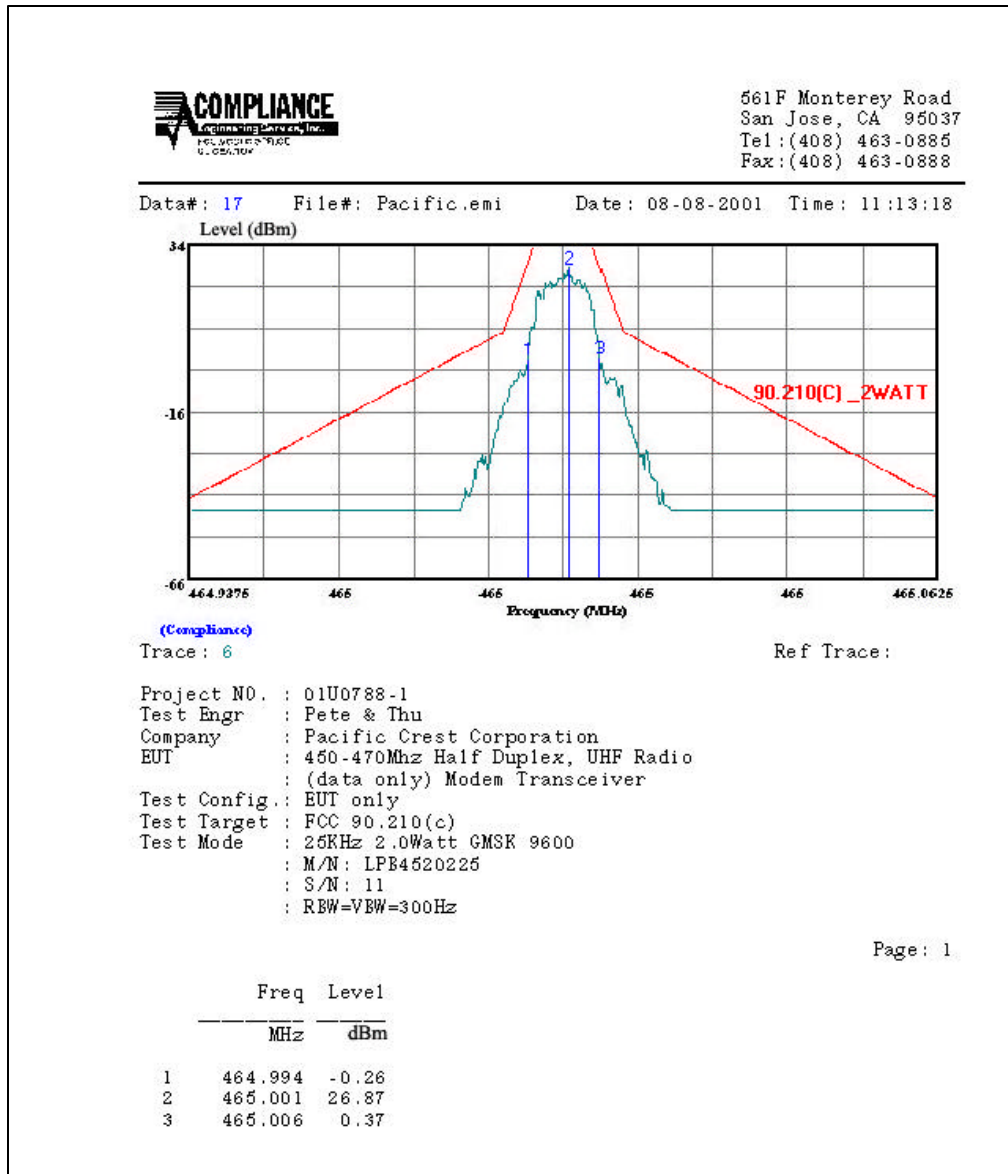
Project NO. : 01U0788-1
 Test Engr : Pete & Thu
 Company : Pacific Crest Corporation
 EUT : 450-470Mhz Half Duplex, UHF Radio
 : (data only) Modem Transceiver
 Test Config.: EUT only
 Test Target : FCC 90.210(c)
 Test Mode : 25KHz 0.5Watt GMSK 9600
 : M/N: LPB461P525
 : S/N: 18
 : REWA=VBW=300Hz

Page: 1

	Freq	Level
	MHz	dBm
1	464.992	-6.42
2	465.001	19.60
3	465.007	-7.45

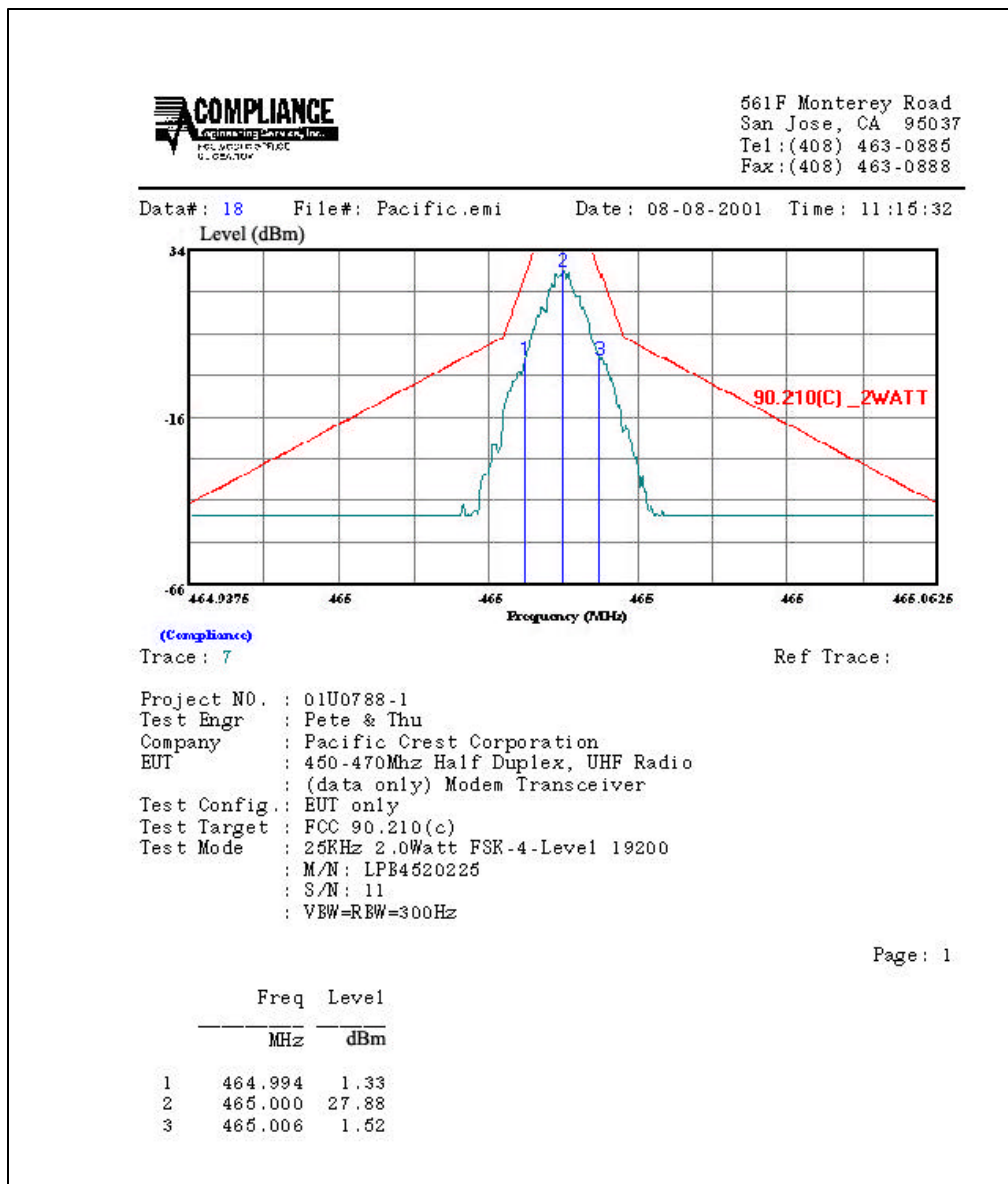
25KHz_0.5W_GMSK Modulation Bandwidth

Bandwidth: 465.007 – 464.992 = 15KHz



25KHz 2W_GMSK Modulation Bandwidth

Bandwidth: 465.006 – 464.994 = 12KHz



25KHz_2W_4-Level-FSK Modulation Bandwidth

Bandwidth: 465.006– 464.994 = 12KHz

8.5 EMISSIONS MASKS

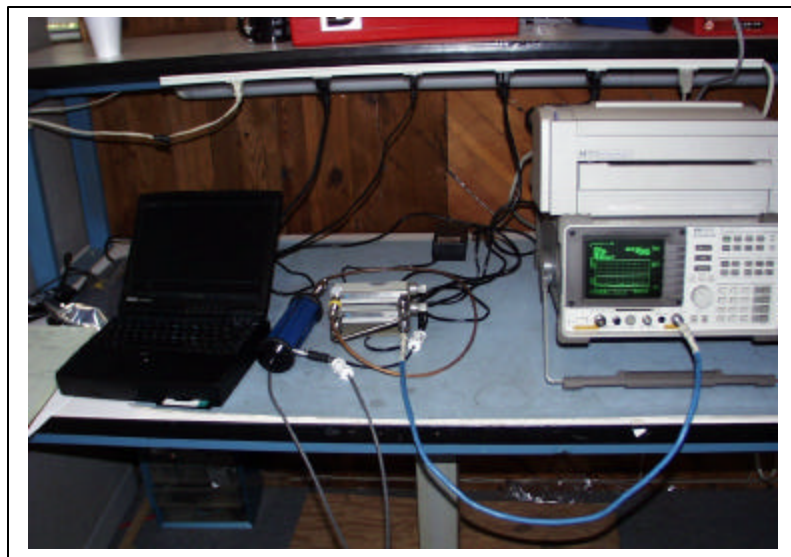
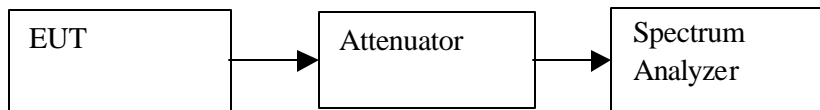
INSTRUMENTS LIST

EQUIPMENT	MANUFACTURE	MODEL NO.	CAL. DUE DATE
Spectrum Analyzer	HP	8593EM	06/20/02
Attenuator	HP	8496A	N/A
Attenuator	HP	8494A	N/A

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
Within 50KHz of authorized bandwidth	<input checked="" type="checkbox"/> Peak <input type="checkbox"/> Quasi Peak	<input checked="" type="checkbox"/> 100 Hz <input type="checkbox"/> 120 KHz	<input checked="" type="checkbox"/> 100 Hz <input type="checkbox"/> 120 KHz
30 to 1000	<input checked="" type="checkbox"/> Peak <input type="checkbox"/> Quasi Peak	<input checked="" type="checkbox"/> 30 KHz <input type="checkbox"/> 120 KHz	<input checked="" type="checkbox"/> 30 KHz <input type="checkbox"/> 120 KHz
Above 1000	<input checked="" type="checkbox"/> Peak <input type="checkbox"/> Average	<input checked="" type="checkbox"/> 1 MHz <input type="checkbox"/> 1 MHz	<input checked="" type="checkbox"/> 1 MHz <input type="checkbox"/> 10 Hz

TEST SETUP



TEST PROCEDURE

The EUT is configured on a test bench as shown above in a continuously transmitting / receiving mode. While the transceiver started, the analyzer MAX HOLD function was enabled and the frequency SPAN was adjusted to capture the whole emission.

RESULT

Complies. See plots:

Mask_12.5KHz_P5W (4-Level FSK &GMSK): Mask, Out of Band1, Out of Band2, Out of Band3.

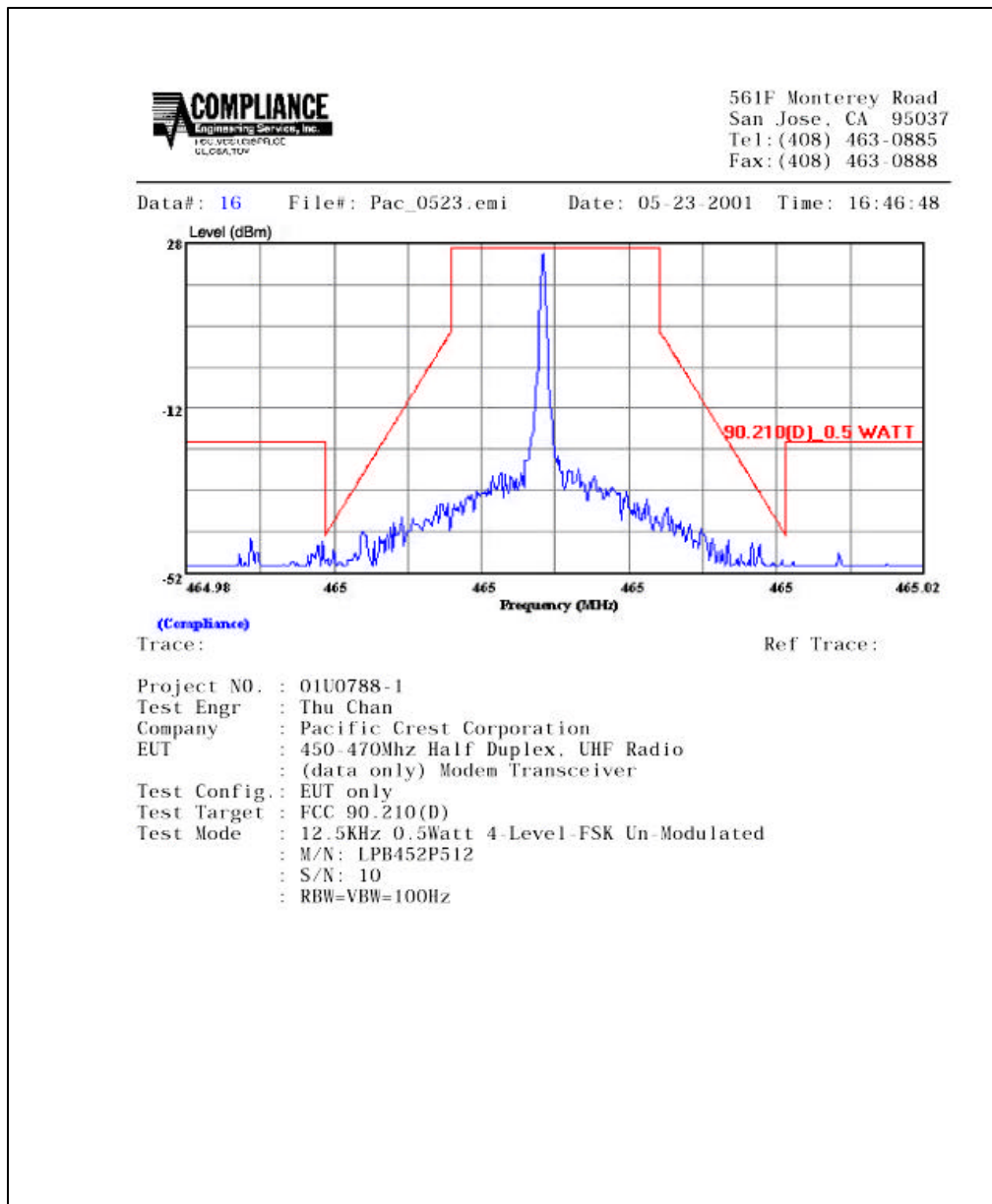
Mask_12.5KHz_2W (4-Level FSK &GMSK): Mask, Out of Band1, Out of Band2, Out of Band3.

Mask_25KHz_P5W (4-Level FSK &GMSK): Mask, Out of Band1, Out of Band2, Out of Band3.

Mask_25KHz_2W (4-Level FSK &GMSK): Mask, Out of Band1, Out of Band2, Out of Band3.

Mask 12.5KHz 4-Level FSK P5W:
Out of Band2, Out of Band 3.

Mask Unmodulated, Mask Modulation, Out of Band1,



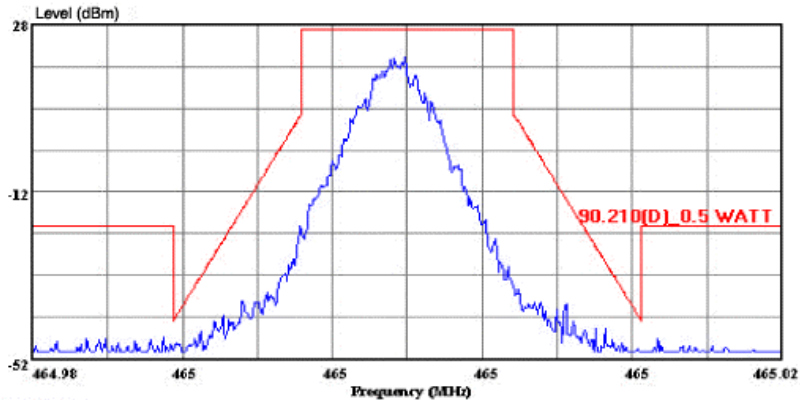
Mask: 4-Level FSK Unmodulated

_ 4KHz / Division



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(Compliance)

Trace:

Ref Trace:

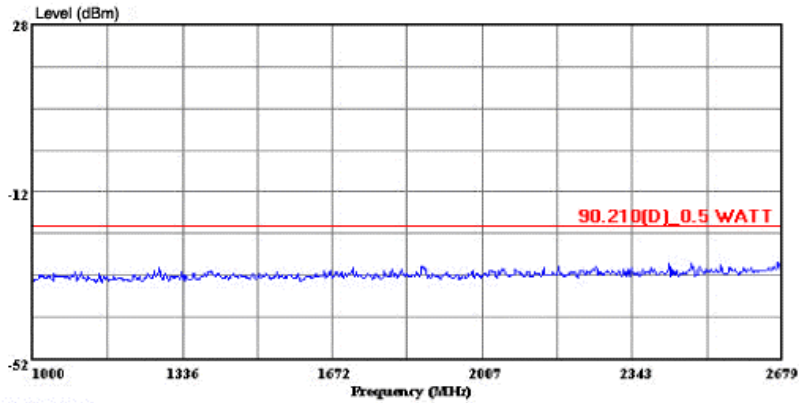
Project NO. : 01U0788-1
 Test Engr : Thu Chan
 Company : Pacific Crest Corporation
 EUT : 450-470Mhz Half Duplex, UHF Radio
 : (data only) Modem Transceiver
 Test Config.: EUT only
 Test Target : FCC 90.210(D)
 Test Mode : 12.5KHz 0.5Watt 4-Level-FSK
 : M/N: LPB452P512
 : S/N: 10
 : RBW=VBW=100Hz

Mask: 4-Level FSK Modulation



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(Compliance)

Trace:

Ref Trace:

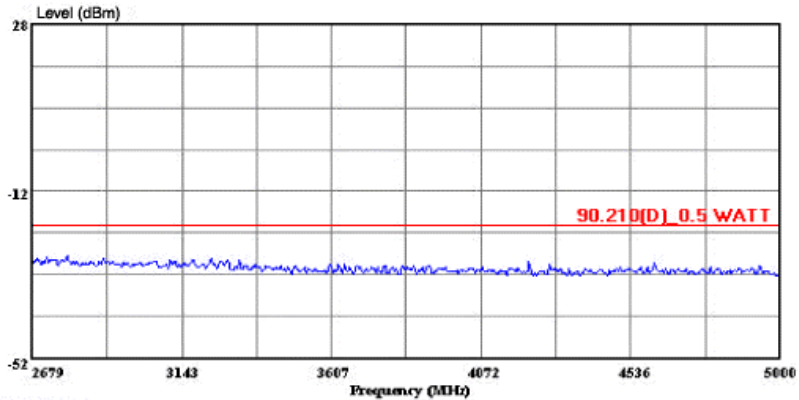
Project NO. : 01U0788-1
 Test Engr : Thu Chan
 Company : Pacific Crest Corporation
 EUT : 450-470Mhz Half Duplex, UHF Radio
 : (data only) Modem Transceiver
 Test Config.: EUT only
 Test Target : FCC 90.210(D)
 Test Mode : 12.5KHz 0.5Watt 4-Level-FSK
 : M/N: LPB452P512
 : S/N: 10
 : RBW=VBW=1MHz

Out-Of-Band2: 4-Level FSK Modulation



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(Compliance)

Trace:

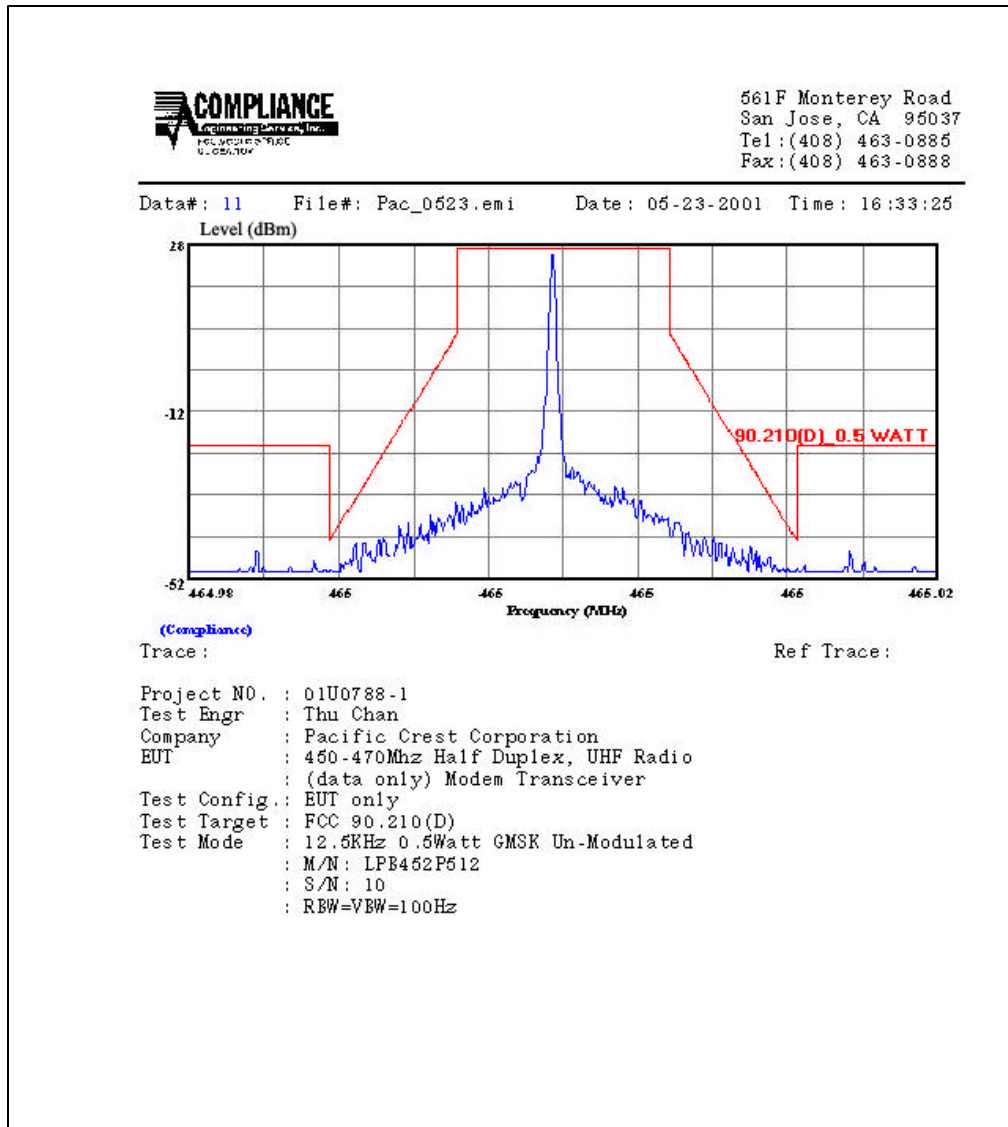
Ref Trace:

Project NO. : 01U0788-1
 Test Engr : Thu Chan
 Company : Pacific Crest Corporation
 EUT : 450-470Mhz Half Duplex, UHF Radio
 : (data only) Modem Transceiver
 Test Config.: EUT only
 Test Target : FCC 90.210(D)
 Test Mode : 12.5KHz 0.5Watt 4-Level-FSK
 : M/N: LPB452P512
 : S/N: 10
 : RBW=VBW=1MHz

Out-Of-Band3: 4-Level FSK Modulation

Mask 12.5KHz, GMSK P5W:
Band2, Out of Band3.

Mask Unmodulated, Mask Modulation, Out of Band1, Out of



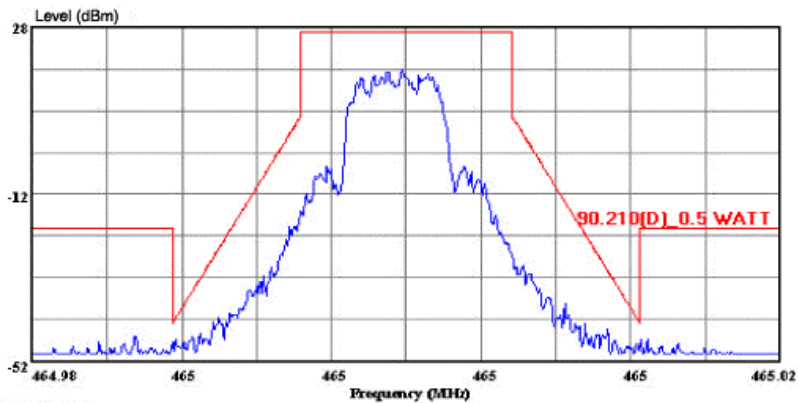
Mask: GMSK Unmodulated

_ 4KHz / Division



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Data#: 12 File#: Pac_0523.emi Date: 05-23-2001 Time: 16:34:51



(Compliance)

Trace:

Ref Trace:

Project NO. : 01U0788-1
 Test Engr : Thu Chan
 Company : Pacific Crest Corporation
 EUT : 450-470Mhz Half Duplex, UHF Radio
 : (data only) Modem Transceiver
 Test Config.: EUT only
 Test Target : FCC 90.210(D)
 Test Mode : 12.5KHz 0.5Watt GMSK
 : M/N: LPB452P512
 : S/N: 10
 : RBW=VBW=100Hz

Mask: GMSK Modulation

_ 4KHz / Division