

KTL Test Report: 9L0023RUS


Applicant: Andrew Corporation
2601 Telecom Parkway
Richardson, Tx.

Equipment Under Test: 2400 Base Data Radio (P/N 38700-3000-001) and
4 Port Line Amplifier

FCC ID: KUWMDL2400BDR

In Accordance With: **FCC Part 15, Subpart C**
Direct Sequence Transmitters 2.4 – 2.4835 GHz

Tested By: KTL Dallas Inc.
802 N Kealy
Lewisville, Tx 75057-3136

Authorized By: 
Tom Tidwell, RF Group Manager

Date: January 4, 2000

Total Number of Pages: 50

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

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EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

Section 1. Summary Of Test Results

Manufacturer: Andrew Corporation

Model No.: 2400 Base Data Radio

Serial No.: BDR052

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 15, Subpart C, Paragraph 15.247 for Direct Sequence Spread Spectrum devices.



New Submission



Production Unit



Class II Permissive Change



Pre-Production Unit

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.

See " Summary of Test Data".



NVLAP LAB CODE: 100426-0

TESTED BY: Ron Gaytan

DATE: 8/10/99-8/17/99

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EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
*FCC ID: KUWMDL2400BDR***Summary Of Test Data**

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT
Powerline Conducted Emissions	15.207 (a)	48 dB μ V	42.8	Complies
Occupied Bandwidth	15.247 (a)(2)	\geq 500 kHz	13.6347 MHz	Complies
Peak Power Output	15.247 (b)	4 W E.I.R.P.	4 W E.I.R.P.	Complies
Spurious Emissions (Antenna Conducted)	15.247 (c)	-20 dBc	-18.46 dBm	Complies
Spurious Emissions (Radiated)	15.247 (c)	Table 15.209 (a)	61.3 dBuV/m	Complies
Transmitter Power Density	15.247 (d)	\leq +8 dBm	5 dBm	Complies
Processing Gain	15.247 (e)	\geq 10 dB	15.9 dB	Complies

Footnotes: None**Test Conditions:****Indoor** Temperature: 24°C
Humidity: 42%**Outdoor** Temperature: 28°C
Humidity: 48%

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

Section 2. General Equipment Specification

Transmitter

Power Input:	85-265 VAC	
Frequency Range:	2417 MHz (Fixed)	
Tunable Bands:	Not Applicable	
6 dB Bandwidth:	13.6347 MHz	
Type of Modulation	GPSK	
Chip Rate:	16.896 Mbps	
Data Rate:	128 Kbps	Radio to radio
	64 Kbps	User equipment to radio
Internal / External Data Source:	External	
Emissions Designator:	13M6F9W	
Output Impedance:	50 ohms	
RF Power Output (Rated):	4 Watts E.I.R.P. maximum (see note below)	
Duty Cycle:	Up to 100%	
Channel Spacing:	Not Applicable	
Operator Selection of Operating Frequency:	Not Applicable	
Power Output Adjustment Capability:	Computer controlled. Not adjustable above +30 dBm at the antenna port.	

Note: The power output is set by the installer upon installation of the unit. Power is adjusted through software and is not accessible to the user. Instructions are given to the installer to set the output power appropriately for the antenna used for a particular installation.

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

Receiver

Frequency Range:	2467 MHz(Fixed)
Tunable Bands:	Not Applicable
1st IF:	2327.552 MHz
2nd IF:	129.6 MHz
Bandwidth:	13.6347 MHz
Type of Modulation:	GPSK
Operator Selection of Operating Frequency	Not Applicable

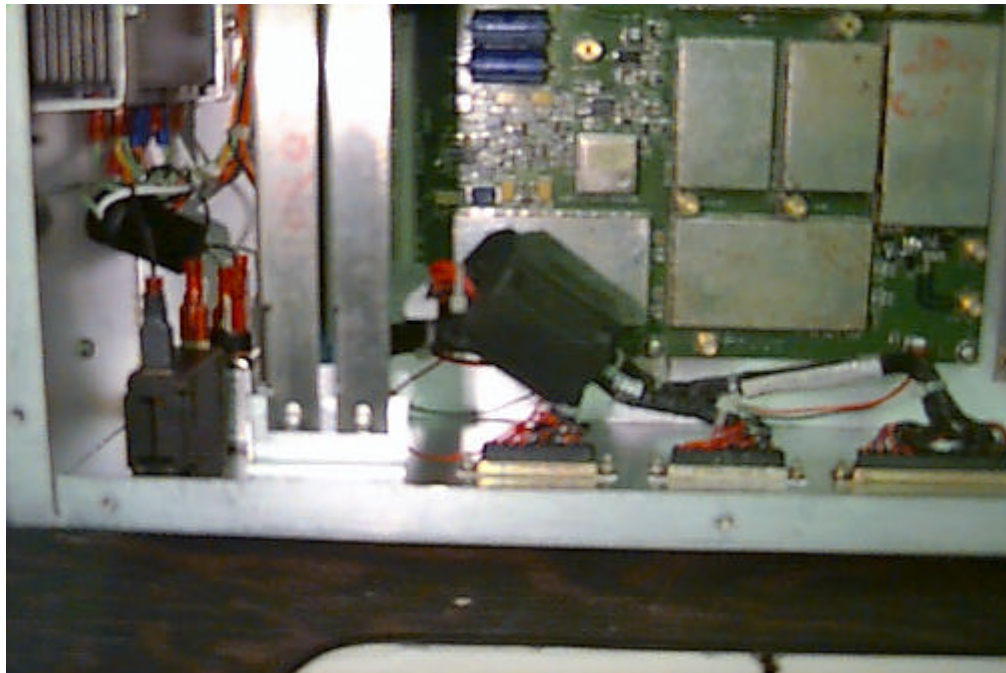
NOTE: other oscillators in receiver section are
42.752 MHz
16.896 MHz

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

Description of Modification

- 1.) Properly shielded Data 1 And Data 2 ports at both ends of the cables. (See Photograph)
- 2.) Added ferrite to AC input. The ferrite was locate inside the chassis as close to the line filter as possible P/N 0431164281 Fair-rite Products. (See Photograph)
- 3.) Added ferrite to Data1 and Data2 wire harness located inside the chassis. The ferrite is located as close to the ports as possible. P/N 0444176451 Fair-rite Products. (See Photograph)

Modification Photograph-



EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

Theory of Operation

The Base Data Radio is a full duplex transceiver. The main input power source is AC. The unit receives and transmits data to customer provided equipment through a synchronous interface EIA-530 interface.

This unit is intended to be used with either a leaky coax radiator or a high gain directional antenna. The output power is set by the installer upon installation and can not be accessed by the user. The installer is instructed to set the power output at the antenna port to an appropriate level for the antenna used in the installation. This guarantees that the maximum power level of 4 W E.I.R.P. is not exceeded.

The line amplifier is used only with this base transmitter and may be used when the leaky coaxial cable is used as the radiator. In this situation, the line amplifier may be installed at intervals along the cable to allow for better signal coverage.

This transmitter and its antenna are located in areas where access to within 20 cm of the radiator is restricted.

Test Setup Diagram

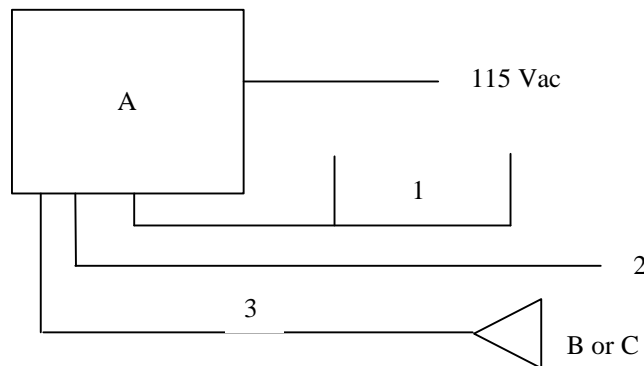


Figure 1 - Base Station Setup

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

Equipment Configuration List (Hardware/Peripherals):

Item	Generic Description	Manufacturer	Model No.	Serial No.	Rev. No.	FCC ID Status*
(A)	Base Data Radio	Andrew Corporation	2400 Base Data Radio P/N 385700-3000-001	DL	A	3
(B)	Transmit Antenna	Antenna Products	ISM PNL P/N 10009-0080-401	005	N/A	3
(C)	50 ohm Load	Sierra Electronic Operation	160B-300	557	N/A	3

* = EUT (Equipment-Under-Test) or part of EUT.

***FCC ID STATUS**

- | | |
|--|--|
| 1. FCC DOC | 2. FCC A/B Verification |
| 3. None – (If performing FCC testing, contact lab manager) | 4. Certification (include FCC ID in parenthesis) |

Inter-Connection Cables:

Item	Cable Type	Manufacturer	Length (m)	Termination**	Shield	Quantity
(1)	Data 1 Cable P/N 385700-1812-001	Andrew Corporation	3.0/3.0	1/6	Yes	1
(2)	Data 2 Cable P/N 385700-1813-001	Andrew Corporation	3.0/3.0	6/6	Yes	1
(3)	RF Output Coax KTL # C22	Unknown	2.5	4	Yes	1
(4)	Power Cord	Unknown	1.5	1	No	1

**** TERMINATION**

- | | |
|---------------------|---------------------|
| 1. Peripheral | 2. Loopback |
| 3. EUT | 4. Resistive |
| 5. Remote Equipment | 6. Other Cable Only |

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

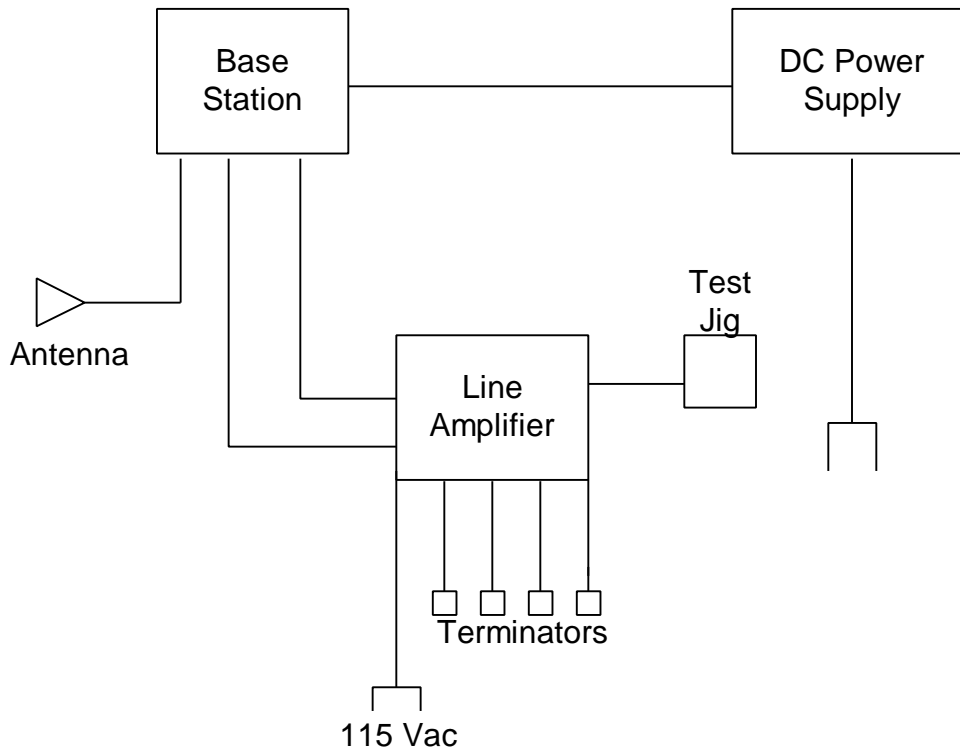


Figure 2 - Line Amplifier Setup

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

Section 3. Powerline Conducted Emissions

NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a)
TESTED BY: Ron Gaytan	DATE: 8/11/99

Test Results: Complies. See attached data.

Measurement Data: See attached data.

Test CE-1 – Base in RX mode.

Test CE-2 – Base and Line Amplifier in TX mode. Transmitting into 50 ohm load.

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
 FCC ID: KUWMDL2400BDR

Measurement Data:

Conducted Emissions Data (CISPR Quasi-Peak Detector) FCC (CFR 47)								
Complete	<u> X </u>				Page <u> 1 </u> of <u> 2 </u>			
Preliminary	<u> </u>							
Client:	<u>Andrew Coproration</u>		W.O.#:	<u>9L0023R</u>		Date:	<u>8/11/99</u>	
EUT:	<u>2400 Base Data Radio</u>		S/N:	<u>BDR052</u>		Specification:	<u>CFR 47 Part 15.107 (a)</u>	
Tech:	<u>Ron Gaytan</u>		Test #:	<u>CE-1</u>	Lab:	<u>1</u>	Photo ID: <u>9L0023 CE-1</u>	
Equipment Used:	<u>G2624-G2408-C24</u>							
Configuration:	<u>Rx Mode</u>							
IF Bandwidth:	<u>10kHz</u>	Video Bandwidth:	<u>10kHz</u>	Detector:	<u> </u> Peak <u> X </u> CISPR			
Ambient Temperature:	<u>24</u> C	EUT Power:	<u> X </u> 115 V.A.C.	<u> X </u> 60 Hz	<u> X </u> 1 Phase			
Relative Humidity:	<u>42</u> %		<u> </u> 230 V.A.C.	<u> </u> 50 Hz	<u> </u> 3 Phase			
Atmospheric Pressure:	<u>989</u> mbar		<u> </u> Other <u> </u>					
Freq. (MHz)	Meter Reading (dBuV)	Attn. (dB)	Cable Loss (dB)	Probe Factor (dB)	Corrected Reading (dBuV)	Spec.limit (dBuV)	Pol.	Comments:
0.45	24.3	0	0	0	24.3	48	Lo	L0= Nuetral Side of the Line
0.5071	28.6	0	0	0	28.6	48	L0	
0.5794	28.7	0	0	0	28.7	48	L0	
0.652	28	0	0	0	28	48	L0	
2.172	27.6	0	0	0	27.6	48	L0	
2.39	32.4	0	0	0	32.4	48	L0	
4.97	23.2	0	0	0	23.2	48	L0	
11.411	25.7	0	0	0	25.7	48	L0	
11.54	27.5	0	0	0	27.5	48	L0	
12.31	29.3	0	0	0	29.3	48	L0	
13.2	32.3	0	0	0	32.3	48	L0	
16.89	42.8	0	0	0	42.8	48	L0	
22.05	32.7	0	0	0	32.7	48	L0	
22.43	34.1	0	0	0	34.1	48	L0	
22.56	36.1	0	0	0	36.1	48	L0	
29.99	28.5	0	0	0	28.5	48	L0	
0.45	23.6	0	0	0	23.6	48	L1	L1= Hot Side of the Line
0.5069	27.5	0	0	0	27.5	48	L1	
0.6517	28.1	0	0	0	28.1	48	L1	
2.172	27.4	0	0	0	27.4	48	L1	

Note: Verify that the IF Bandwidth is in the proper setting.

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

Powerline Conducted Emissions Photographs

FRONT VIEW



SIDE VIEW



EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
 FCC ID: KUWMDL2400BDR

Powerline Conducted Emissions Test # CE-2:

Conducted Emissions Data (CISPR Quasi-Peak Detector) FCC (CFR 47)								
Complete	<u> X </u>							
Preliminary	<u> </u>		Page <u> 1 </u> of <u> 2 </u>					
Client:	<u> Andrew Coporation </u>			W.O.#:	<u> 9L0025R </u>		Date:	<u> 12/20/99 </u>
EUT:	<u> 385700-4000-001 </u>			S/N:	<u> None </u>		Specification:	<u> CFR47 part 15.207 </u>
Tech:	<u> Ron Gaytan </u>			Test #:	<u> CE-2 </u>		Lab:	<u> 3 </u>
				Photo ID:	<u> 9L0025 CE-2 </u>			
Equipment Used: <u> G2634-G2408-C21-G1605-G1705 </u>								
Configuration: <u> Tx into 50 ohms </u>								
IF Bandwidth: <u> 10 kHz </u>			Video Bandwidth: <u> 10 kHz </u>			Detector: <u> </u> Peak <u> X </u> CISPR		
Ambient Temperature: <u> 23 </u> C			EUT Power: <u> X </u> 115 V.A.C. <u> X </u> 60 Hz <u> X </u> 1 Phase					
Relative Humidity: <u> 40 </u> %			<u> </u> 230 V.A.C. <u> </u> 50 Hz <u> </u> 3 Phase					
Atmospheric Pressure: <u> 999 </u> mbar			<u> </u> Other <u> </u>					
Freq. (MHz)	Meter Reading (dBuV)	Attn. (dB)	Cable Loss (dB)	Probe Factor (dB)	Corrected Reading (dBuV)	Spec. limit (dBuV)	Pol.	Comments:
0.507	40.5	0	0	0	40.5	48	H	(H= Hot Side of Line)
0.608	42	0	0	0	42	48	H	
0.71	39.4	0	0	0	39.4	48	H	
1.014	43.7	0	0	0	43.7	48	H	
1.521	46	0	0	0	46	48	H	
2.737	43.3	0	0	0	43.3	48	H	
11.161	31.6	0	0	0	31.6	48	H	
18.368	26	0	0	0	26	48	H	
29.924	32.2	0	0	0	32.2	48	H	
0.507	52.6	0	0	0	52.6	48	N	
0.507	42	0	0	0	42	48	N	Average detector qualifies for
507	39.6	0	0	0	39.6	48	N	13 dB relaxation
0.608	51.1	0	0	0	51.1	48	N	Average detector qualifies for
0.608	41.8	0	0	0	41.8	48	N	13 dB relaxation
0.608	38.1	0	0	0	38.1	48	N	
0.709	44.6	0	0	0	44.6	48	N	
1.014	41.8	0	0	0	41.8	48	N	
1.519	43	0	0	0	43	48	N	
2.737	37.7	0	0	0	37.7	48	N	
11.156	31.6	0	0	0	31.6	48	N	
<i>Note: Verify that the IF Bandwidth is in the proper setting.</i>								

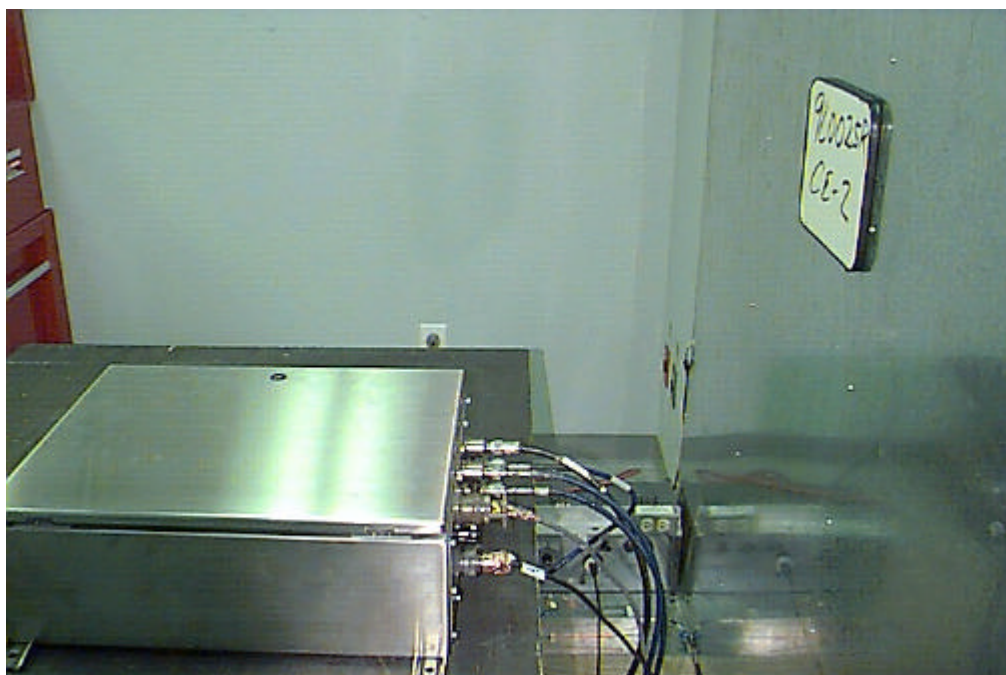
EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

Powerline Conducted Emissions Photographs

SIDE VIEW:



SIDE VIEW:



EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.247(a)(2)
TESTED BY: Ron Gaytan	DATE: 8/10/99

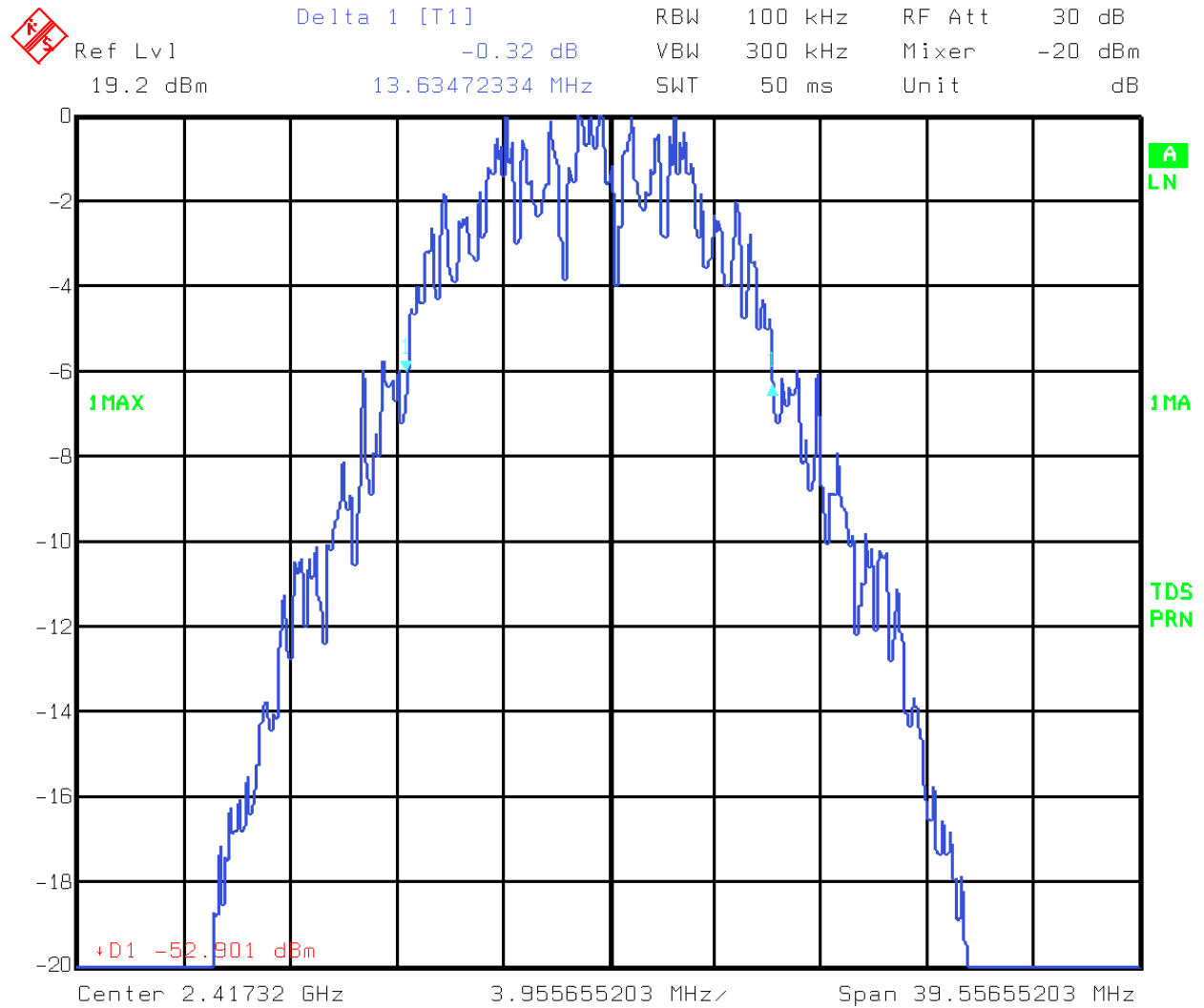
Test Results: Complies. The 6 dB bandwidth is 13.6347 MHz.

Measurement Data: See attached graph.

NOTE: The rf power output level was set to +30 dBm for this test. Measurement of rf power was made using a peak power meter.

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

Occupied Bandwidth



Title: Occupied Bandwidth
Date: 10.AUG.1999 9:45:48

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

Section 5. Peak Power Output

NAME OF TEST: Peak Power Output	PARA. NO.: 15.247 (b)
TESTED BY: Ron Gaytan	DATE: 8/17/99

Test Results:

Complies. The maximum available peak power output power at the antenna terminals is 1.0 watts. When using a gain antenna, the installer is instructed to set the power output at the antenna terminals appropriately. For this testing a 12 dBi gain antenna was used; thus the power output at the rf output port was set to +24 dBm. The resulting field strength was measured at a distance of 3m and the E.I.R.P. was calculated. The resulting E.I.R.P. was 2.276 W.

Measurement Data:

Detachable antenna? Yes No

If yes, state the type of non-standard connector used at the antenna port: Type N female connector. The equipment is professionally installed in a specific application. The equipment is marketed to select users only.

Directional Gain of Antenna: 12 dBi or 15.8 Numeric.

Measured Peak Power Output at input to antenna: +24 dBm.

Measured FS: 128.8 dBµV/m @ 3m or 2.75 V/m @ 3m.

E.I.R.P. calculated from measured field strength: 2.276 W

The power output was measured with a peak power meter. The output level was set via software to + 24 dBm. The field strength of the transmitted signal was measured with the rf power output set to + 24 dBm and the 12 dBi gain panel antenna attached. This is representative of the method used to set the power output during installation.

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

Section 6. Spurious Emissions (Antenna Conducted)

NAME OF TEST: Spurious Emissions (Antenna Conducted)	PARA. NO.: 15.247(c)
TESTED BY: Ron Gaytan	DATE:8/10/99

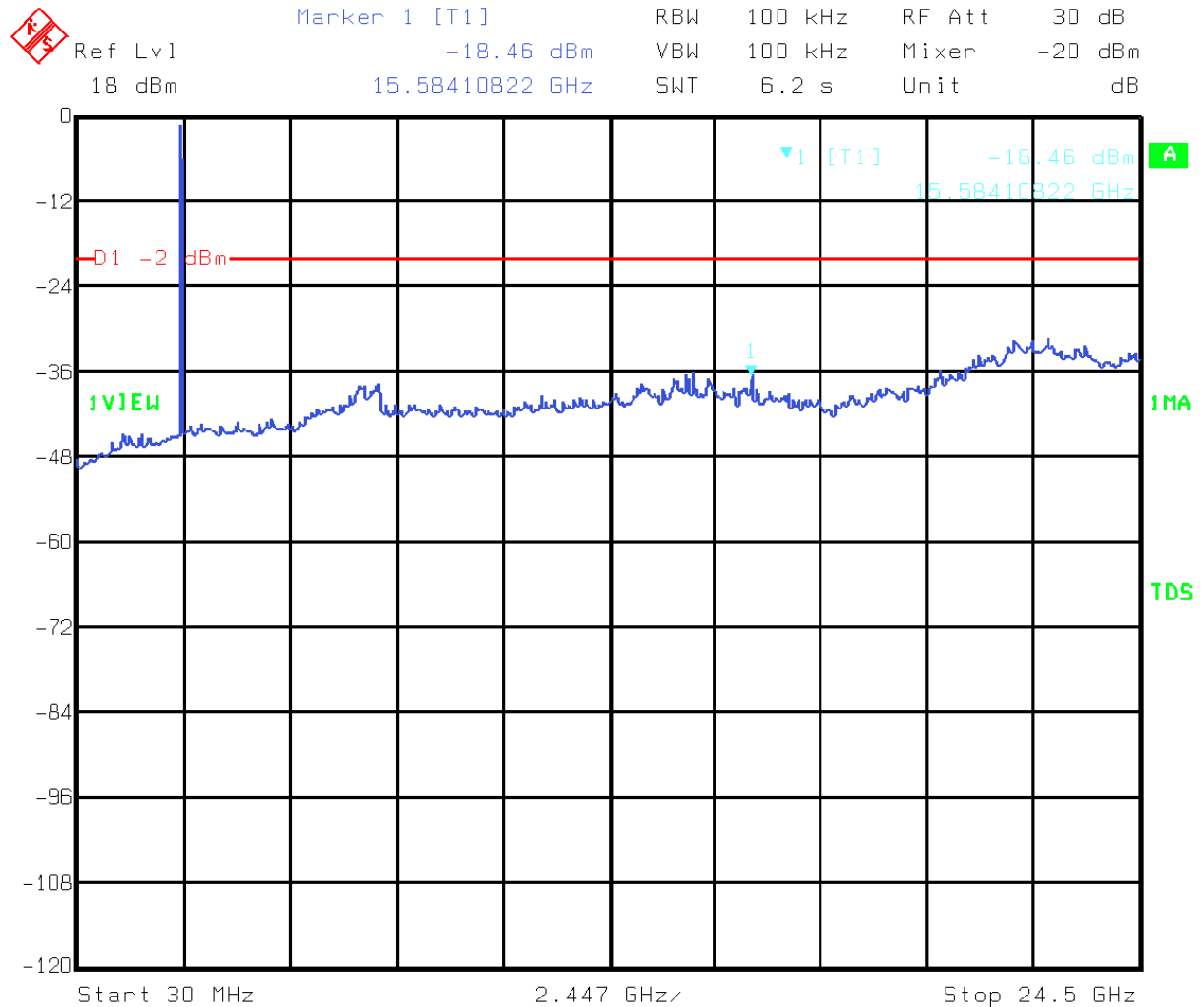
Test Results: Complies. The worst-case emission level is 3.35 dBm at 22.3815 GHz. This is 6.65 dB below the specification limit (+30 dBm – 20 dB = +10 dBm).

Measurement Data: See attached graphs.

NOTE: The rf power output level was set to +30 dBm for this test. Measurement of rf power was made using a peak power meter.

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

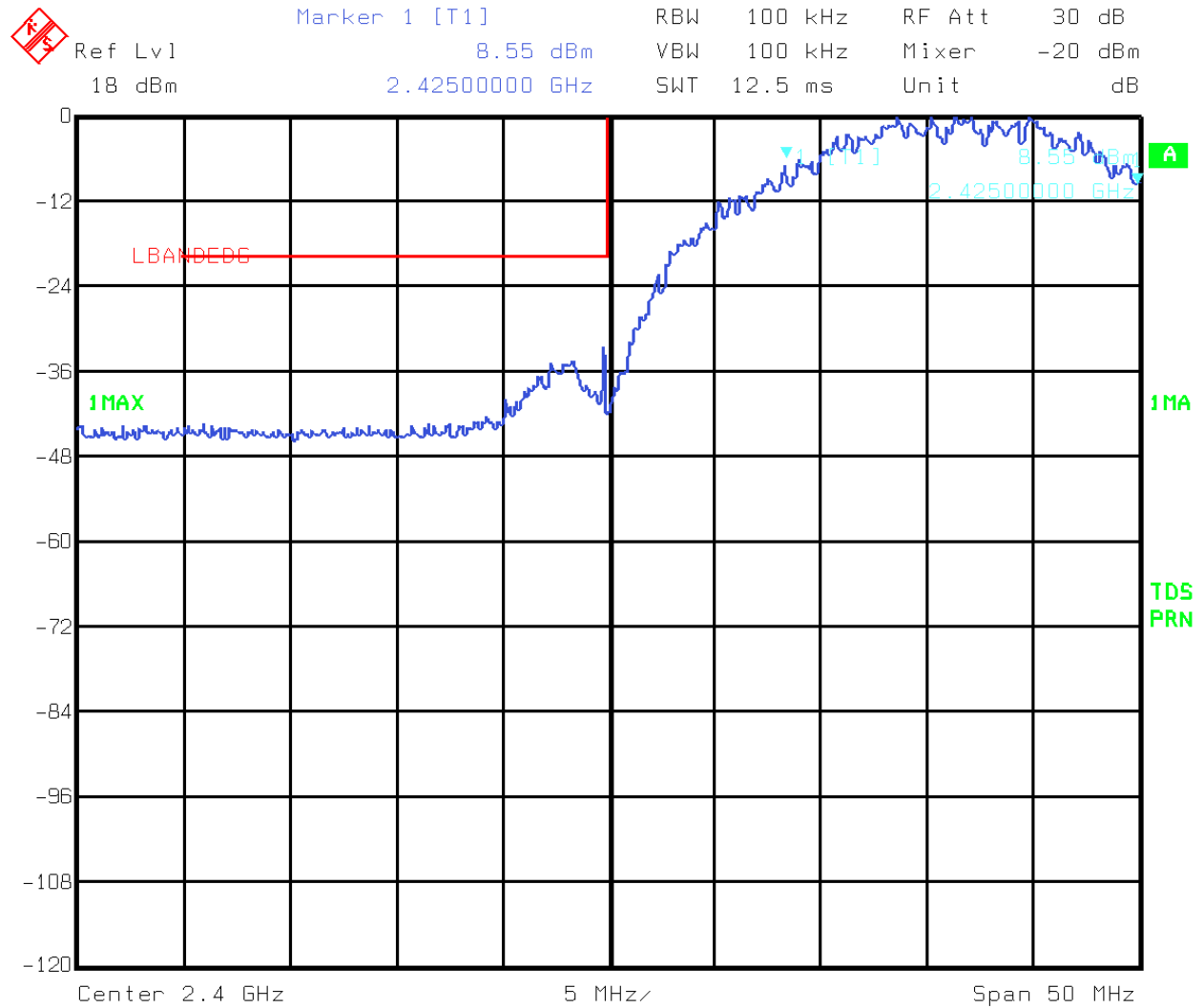
Antenna Port Spurious Emissions



Title: Antenna Port Spurious Emissions
Date: 10.AUG.1999 12:09:42

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

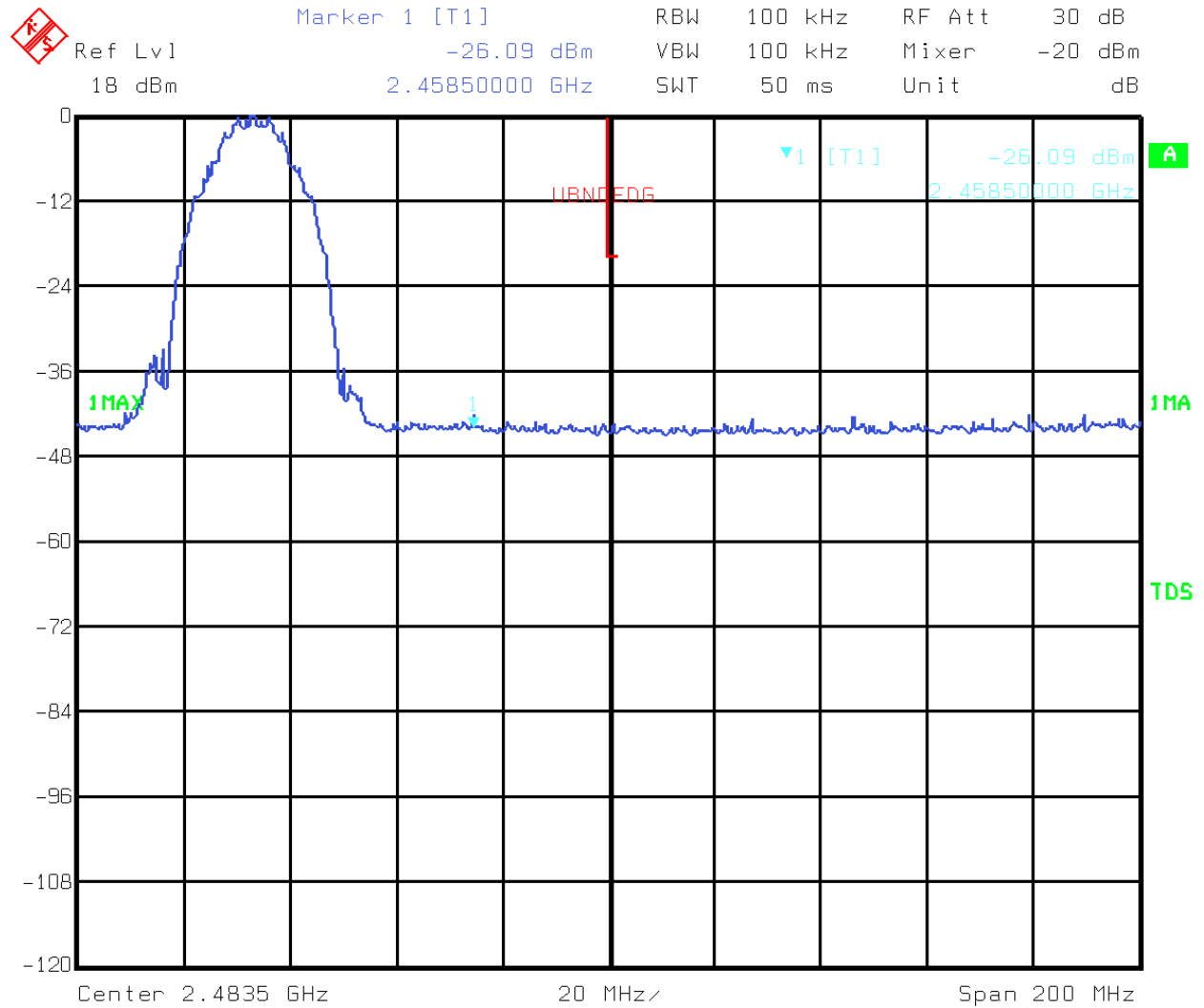
Lower Band Edge



Title: Lower Band Edge
Date: 10.AUG.1999 12:15:14

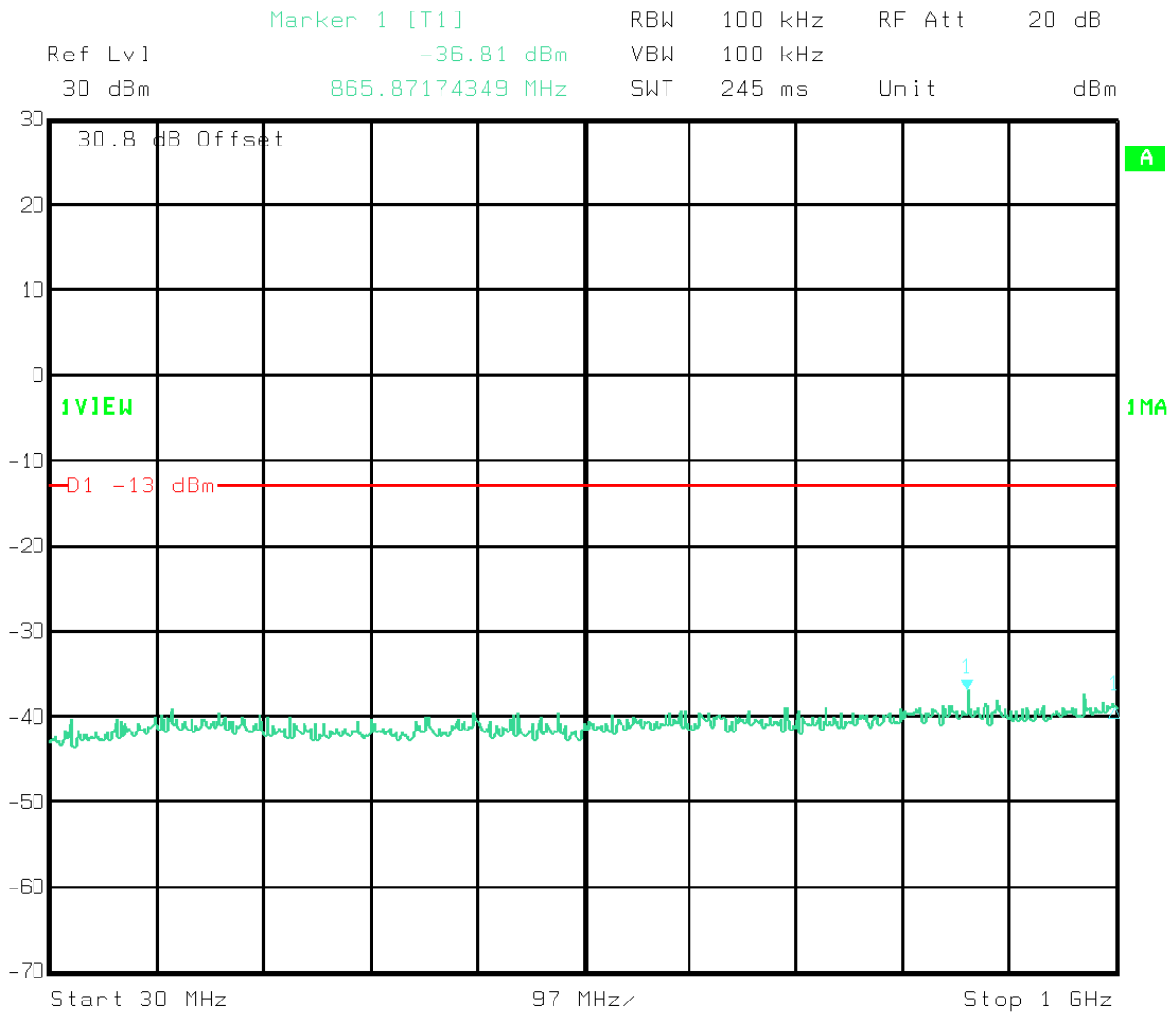
EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

Upper Band Edge



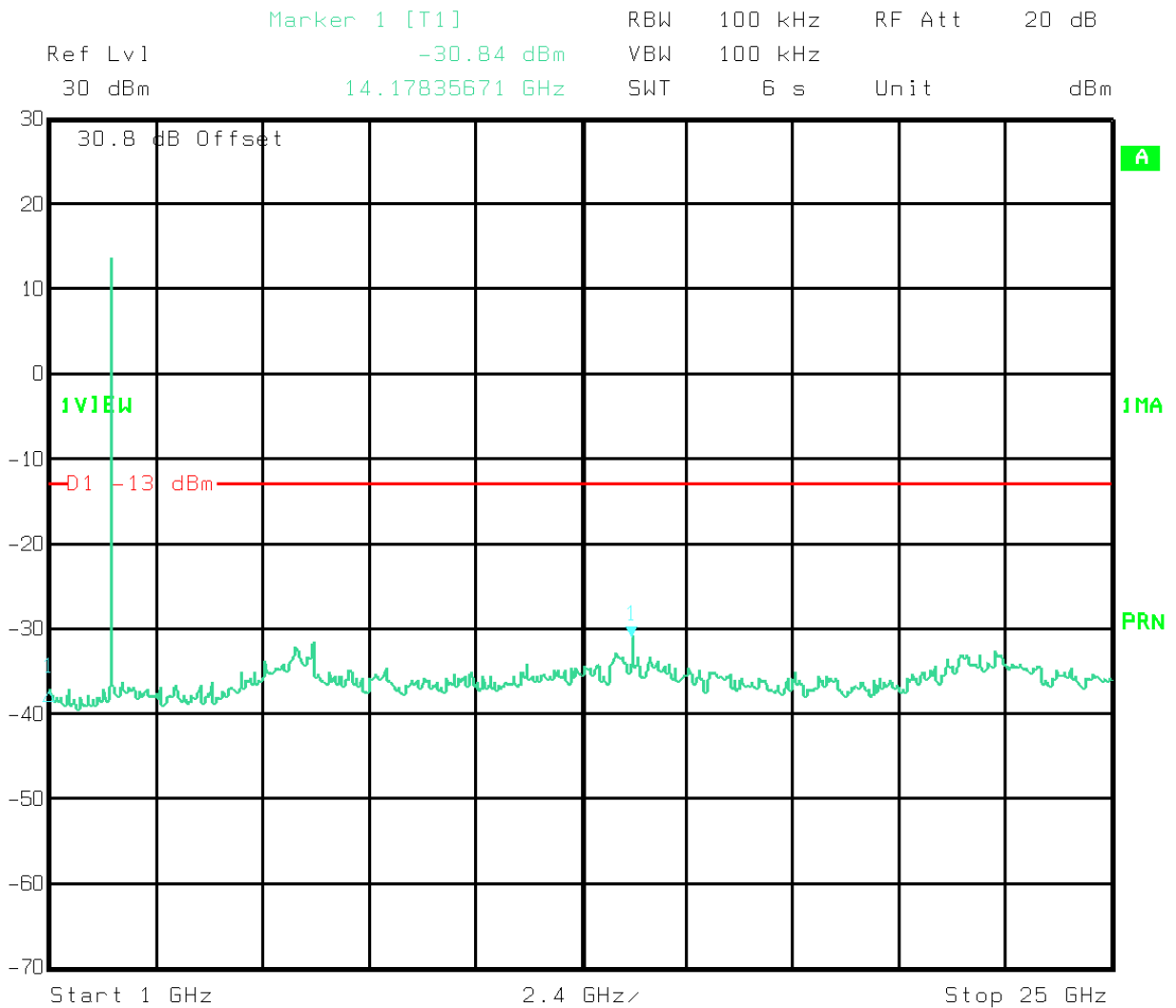
Title: Upper Band Edge
Date: 10.AUG.1999 12:23:50

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR



Title: Antenna Port Conducted (385700-4000-001)
Comment A: APSE1
Date: 26.OCT.1999 8:40:09

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR



Title: Antenna Port Conducted (385700-4000-001)
Comment A: APSE2
Date: 26.OCT.1999 8:44:13

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

Section 7. Spurious Emissions (Radiated)

NAME OF TEST: Spurious Emissions (Radiated)	PARA. NO.: 15.247(c)
TESTED BY: Ron Gaytan	DATE:8/17/99

Test Results Complies. The worst-case noise floor emission level is 61.3 dB μ V/m @ 3m at 4.833 GHz. This is 5.6 dB below the specification limit.

Measurement Data: See attached table.

NOTE: Spurious emissions were measured with the EUT in the following modes:

- 1. MW-2 Set for full transmit power(1 watt) operating into a leaky coaxial cable emitter.**
- 2. MW-3 Set to +24 dBm feeding a 12 dBi gain antenna.**

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
 FCC ID: KUWMDL2400BDR

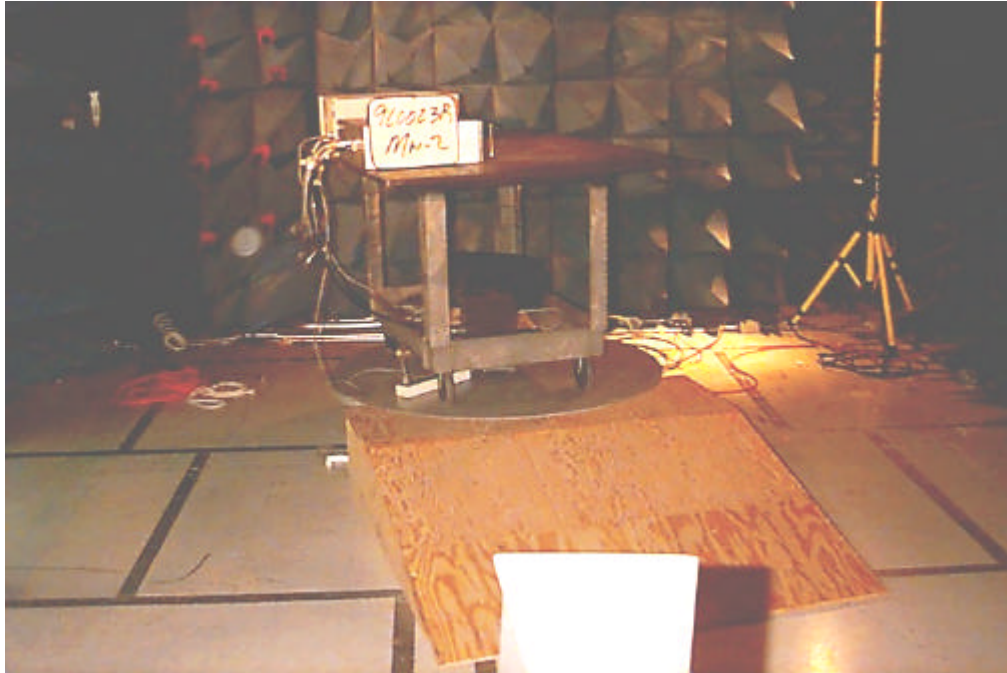
3. Test Data - Radiated Emissions (PEAK/AVERAGE)

Microwave Radiated Emissions Data								
Complete <input checked="" type="checkbox"/>		Preliminary <input type="checkbox"/>		Page <u>1</u> of <u>2</u>				
Client: <u>Andrew Corporation</u>			Test #: <u>MW-2</u>		W.O.#: <u>9L00023R</u>			
EUT: <u>2400 Base Data Radio</u>			S/N: <u>BDR052</u>		Photo ID: <u>9L0023R MW-2</u>			
Technician: <u>Ron Gaytan</u>		Specification: <u>CFR 47 Part 15.247</u>			Lab: <u>ANC1</u>		Date: <u>8/17/99</u>	
Equipment Used: <u>G2200-G2626-CF31-G2034-934-G2235-CF34-CF35</u>								
Configuration: <u>Tx mode, Full power output, Leaky coax radiator</u>								
Bandwidth: <u>1 MHz</u>		Video Bandwidth: <u>1 MHz</u>		Antenna Distance <u>3</u> m		Detector:		
Climatic Conditions:			EUT Power: <input checked="" type="checkbox"/> 115 V.A.C.		<input checked="" type="checkbox"/> 60 Hz		<input checked="" type="checkbox"/> Peak	
Temperature: <u>25</u> C			<input type="checkbox"/> 208 V.A.C.		<input type="checkbox"/> 50 Hz		<input type="checkbox"/> Average	
Relative Humidity: <u>38</u> %			<input type="checkbox"/> 230 V.A.C.		<input type="checkbox"/>		<input type="checkbox"/>	
Atmospheric Pressure: <u>1002</u> mbar			<input type="checkbox"/> Other		<input checked="" type="checkbox"/> 1 Phase		<input type="checkbox"/> 3 Phase	
Freq. (GHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	RF Gain (dB)	Corrected Reading (dBuV/m)	Spec. Limit (dBuV/m)	Pol.	Comments:
2.417	65.6	28.5	3.1	32	65.2	N/A	V	Fundamental Freq.
2.328	47.2	28.4	3.0	31.6	47	54	V	
4.833	45.9	33	4.6	30.3	53.2	54	V	Refer to Average Det.
4.833	41.1	33	4.6	30.3	48.4	54	V	Average Detector
7.250	48.0	36.2	5.8	33.8	56.2	108.8	V	Refer to Average Det.
7.250	40.9	36.2	5.8	33.8	49.1	108.8	V	Average Detector
9.667	40.1	37.6	6.8	33.9	50.6	108.8	V	Average Detector
12.084	37.6	39.3	8.0	33.5	51.4	54	V	Average Detector, N.F
14.502	39.6	43.4	8.7	30.7	61	108.8	v	Average Detector, N.F
16.919	39.8	43.0	9.8	31.3	61.3	108.8	V	Average Detector, N.F
19.336	44.6	40.3	9.4	43.1	51.2	108.8	V	Average Detector, N.F
2.417	61.0	28.5	3.1	32	60.6	N/A	H	Fundamental Freq.
2.328	45.5	28.4	3.0	31.6	45.3	54	H	
4.833	37.5	33	4.6	30.3	44.8	54	H	Average Detector
7.25	38.2	36.2	5.8	33.8	46.4	108.8	H	Average Detector, N.F
9.667	38.2	37.6	6.8	33.9	48.7	108.8	H	Average Detector, N.F
12.084	37.6	39.3	8.0	33.5	51.4	54	H	Average Detector, N.F
14.502	39.6	43.4	8.7	30.7	61	108.8	H	Average Detector, N.F

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

Radiated Photographs (Worst Case Configuration)

FRONT VIEW

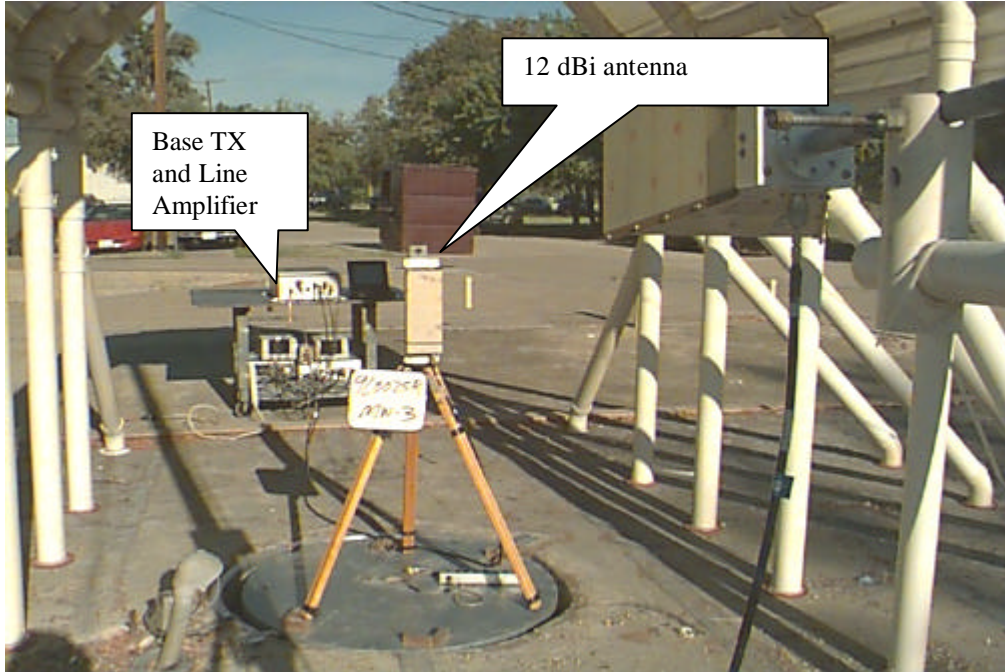


REAR VIEW



EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

FRONT VIEW OF ANTENNA



KTL Dallas, Inc.

FCC PART 15, SUBPART C
DIRECT SEQUENCE TRANSMITTERS
PROJECT NO.: 9L0023RUS

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

Section 8. Transmitter Power Density

NAME OF TEST: Transmitter Power Density	PARA. NO.: 15.247(d)
TESTED BY: Ron Gaytan	DATE: 8/13/99

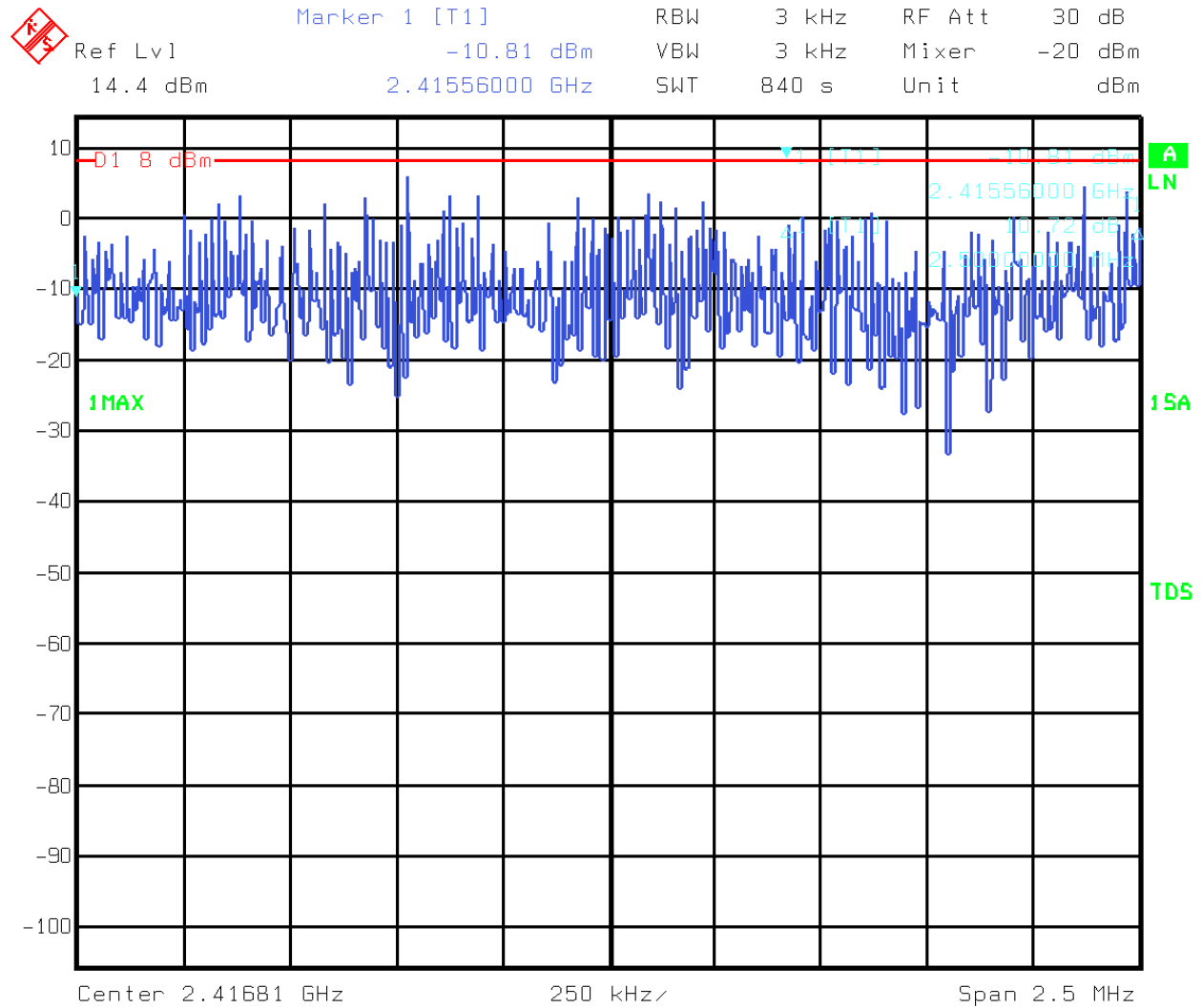
Test Results: Complies.

Measurement Data: See attached graphs.

NOTE: Power output was set to +30 dBm (1 watt) using a peak power meter.

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

Power Spectral Density Data-



Title: Power Spectral Density
Date: 10.AUG.1999 10:41:09

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

Section 9. Processing Gain

NAME OF TEST: Processing Gain	PARA. NO.: 15.247(e)
TESTED BY: Ron Gaytan	DATE: 8/13/99

Test Results: Complies. The processing gain of the system is 15.9 dB.

Measurement Data: See attached data.

The processing gain of the system was demonstrated by measuring the rf signal before de-correlation and after de-correlation and comparing the bandwidth of the two waveforms.

1st graph is the RF output from the base transmitter

2nd graph is plot of the IF spectrum measured at the output of the correlator.


$$G_p = 10 \text{ Log}(\text{BW before de-correlation} / \text{BW after de-correlation})$$

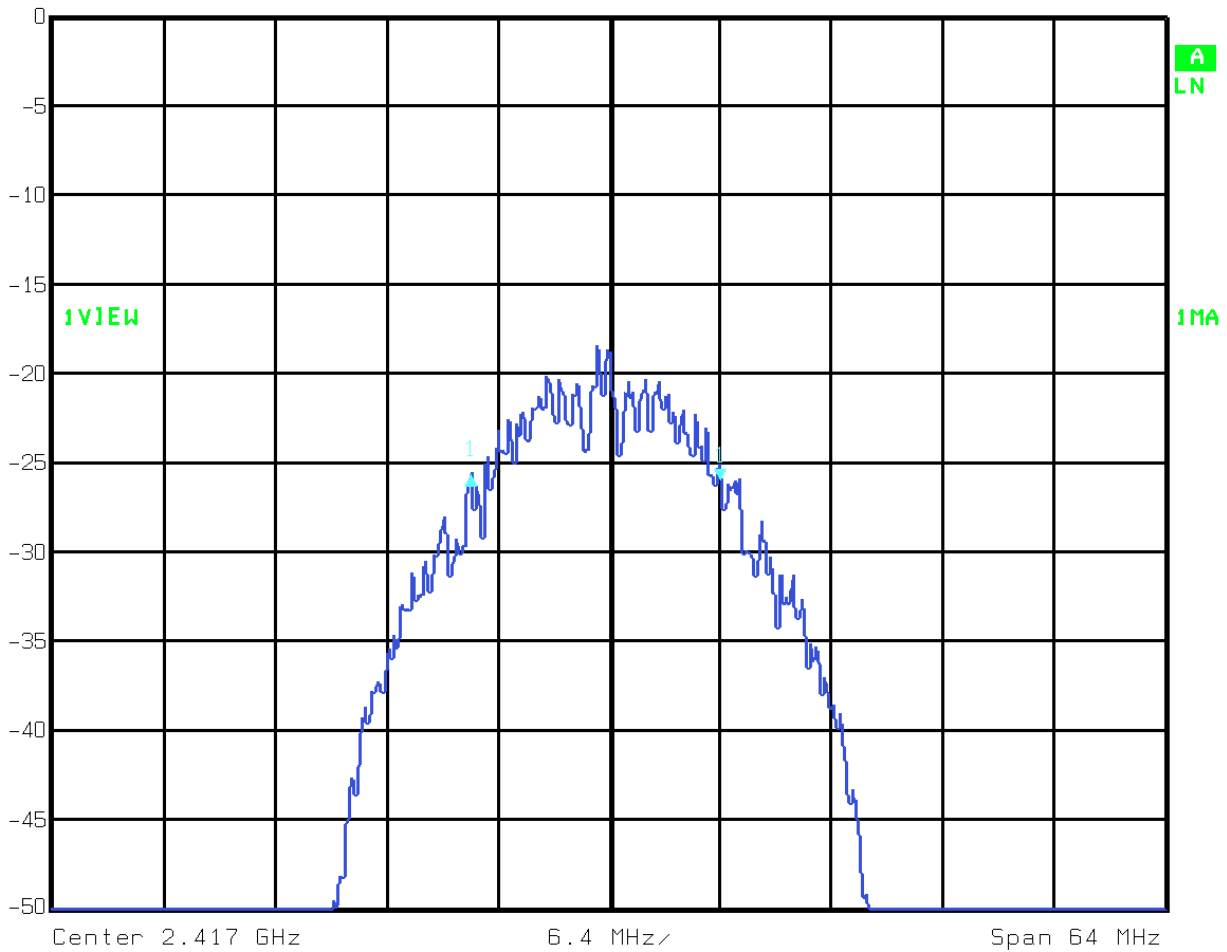
$$G_p = 10 \text{ Log}(14.36 / .373)$$

$$G_p = 15.85 \text{ dB}$$

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

Processing Gain Data (Base RF Out)

	Delta 1 [T1]	RBW	100 kHz	RF Att	10 dB
Ref Lvl	0.33 dB	VBW	10 kHz	Mixer	-20 dBm
-9.5 dBm	-14.36472946 MHz	SWT	160 ms	Unit	dB

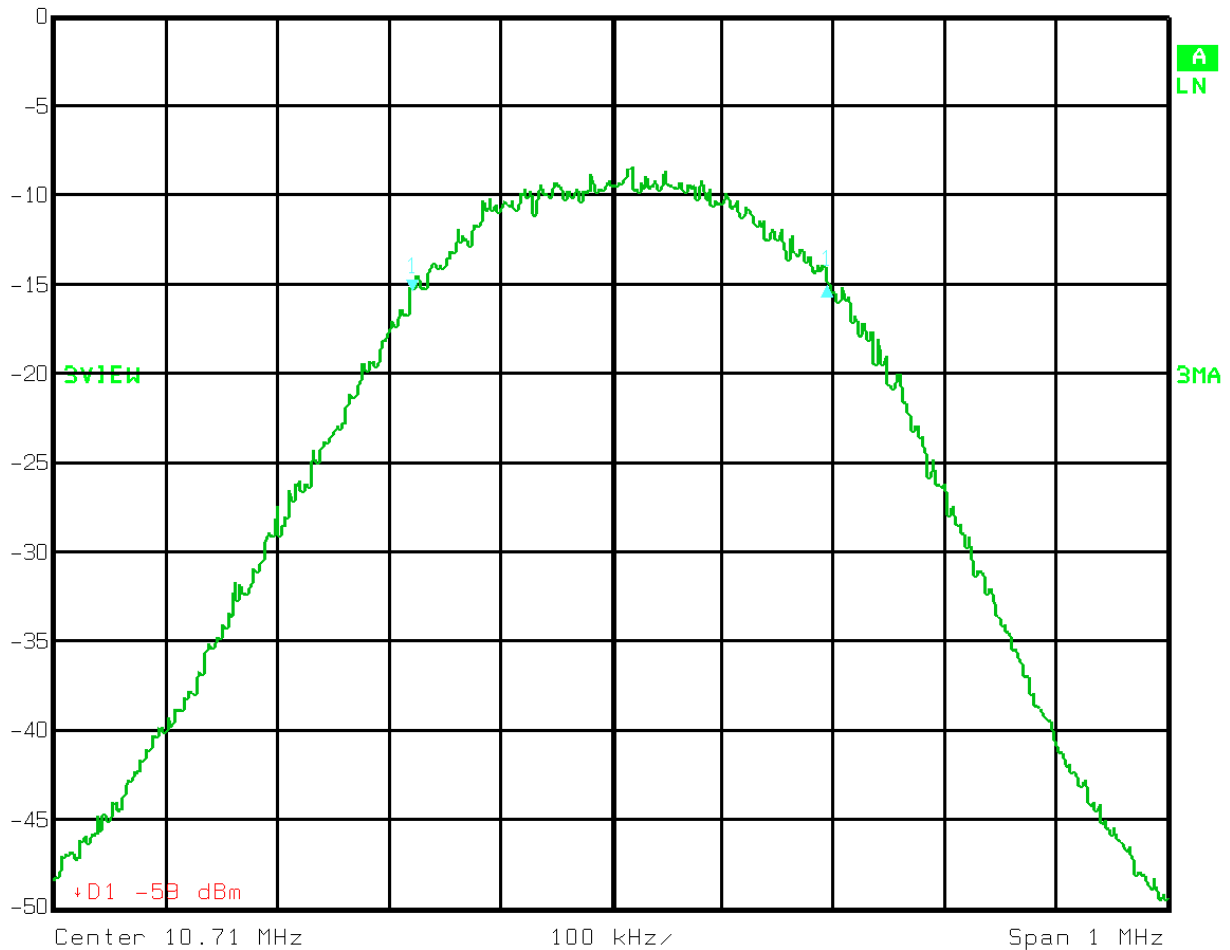


Title: 6 dB BW of Transmitted Signal (Base RF Out)
Date: 13.AUG.1999 11:13:30

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

Processing Gain Data (Mobile IF)

	Delta 1 [T3]	RBW	100 kHz	RF Att	10 dB
Ref Lvl	0.29 dB	VBW	10 kHz	Mixer	-20 dBm
-4.5 dBm	372.74549098 kHz	SWT	5 ms	Unit	dB



Title: 6 dB BW of De-Correlated Signal (Mobile IF)
Date: 13.AUG.1999 10:59:59

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

Section 10. Test Equipment List

<u>KTL ID</u>	<u>Description</u>	<u>Manufacturer Model Number</u>	<u>Serial Number</u>	<u>Calibration Date</u>
C24	CABLE, 14.8m	KTL RG223	N/A	08/10/99
CF31	CABLE, 7.6m	KTL Semi-Flex, Storm	N/A	01/29/99
CF34	CABLE, 12'	KTL Armored, Storm CABLE	N/A	04/01/99
CF35	CABLE, 12'	KTL Armored, Storm CABLE	N/A	04/01/99
934	HORN ANTENNA (18-26.5GHZ)	EMCO 3160-09	9705-1079	08/13/97
G2034	ANTENNA-HORN	ELECTRO METRICS RGA-60	6174	06/28/99
G2200	AMPLIFIER	HEWLETT PACKARD 8449A	2749A00159	06/11/99
G2235	PRE-AMP, 18-40 GHz	KTL BB1	1	11/23/99
G2408	RECEIVER (9 kHz-30 MHz)	ROHDE & SCHWARZ ESH 3	860318/012	04/03/99
G2624	SPECTRUM ANALYZER	HP 8563E	3551A04428	11/03/99
G2626	SPECTRUM ANALYZER	HEWLETT PACKARD 8566B	2618A02843	04/21/99
Lab 1	Lab #1 (Indoor)			CNR
ANC1	Anechoic Chamber #1			CNR

Calibration interball on all items is typically 12 months from the calibration date shown. Where relevant, measuring equipment is subjected to in-service checks between testing. Should any measurement equipment be utilized beyond its scheduled calibration date, the measuring equipment is subjected to in-service checks prior to use. KTL shall notify clients promptly, in writing, of identification of defective measuring equipment that casts doubt on the validity of results given in this report.

LEGEND:

- CNR Calibration not required
- N/A Not applicable
- CBU Calibrated before use

KTL Dallas, Inc.

FCC PART 15, SUBPART C
DIRECT SEQUENCE TRANSMITTERS
PROJECT NO.: 9L0023RUS

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier

FCC ID: KUWMDL2400BDR

ANNEX A - TEST METHODOLOGIES

KTL Dallas, Inc.

FCC PART 15, SUBPART C
DIRECT SEQUENCE TRANSMITTERS
PROJECT NO.: 9L0023RUS

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a)
---	----------------------

Minimum Standard:

The R.F. that is conducted back onto the AC power line on any frequency within the band 0.45 to 30 MHz shall not exceed 250 μ V (48 dB μ V) across 50 ohms.

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.247(a)(2)
----------------------------------	-------------------------

Minimum Standard: The minimum bandwidth shall be at least 500 kHz.

Method Of Measurement:

The spectrum analyzer is set as follows:

- RBW: 100 kHz
- VBW: 100 kHz
- Span: >RBW
- LOG dB/div.: 2 dB
- Sweep: Auto

Number of channels tested:

Tuning Range	Number Of Channels Tested	Channel Location In Band
1 MHz or Less	1	Middle
1 to 10 MHz	2	Top And Bottom
More Than 10 MHz	3	Top, Middle, Bottom

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

NAME OF TEST: Peak Power Output	PARA. NO.: 15.247(b)
---------------------------------	----------------------

Minimum Standard: The maximum peak power output shall not exceed 1 watt. If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400-2483.5 Mhz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

Direct Measurement Method For Detachable Antennas:

If the antenna is detachable, a peak power meter is used to measure the power output with the transmitter operating into a 50 ohm load.

Calculation Of EIRP For Integral Antenna:

If the antenna is not detachable from the circuit then the Peak Power Output is derived from the peak radiated field strength of the fundamental emission by using the plane wave relation $GP/4\pi R^2 = E^2/120\pi$ and proceeding as follows:

$$P = \frac{E^2 R^2}{30G} = \frac{E^2 3^2}{30G}$$

where,

P = the equivalent isotropic radiated power in watts

E = the maximum measured field strength in V/m

R = the measurement range (3 meters)

G = the numeric gain of the transmit antenna in relation to an isotropic radiator

The RBW of the spectrum analyzer shall be set to a value greater than the measured 6 dB occupied bandwidth of the E.U.T.

Number of channels tested:

Tuning Range	Number Of Channels Tested	Channel Location In Band
1 MHz or Less	1	Middle
1 to 10 MHz	2	Top And Bottom
More Than 10 MHz	3	Top, Middle, Bottom

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

NAME OF TEST: Spurious Emissions at Antenna Terminal	PARA. NO.: 15.247(c)
--	----------------------

Minimum Standard:

In any 100kHz bandwidth outside the 2400-2483.5 MHz bands emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits. Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:

Frequency (MHz)	Field Strength (mV/m @ 3m)	Field Strength (dB @ 3m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

The spectrum was searched to the 10th harmonic.

Method Of Measurement:

Upper Band Edge

RBW: At least 1% of span/div.
 VBW: >RBW
 Span: As necessary to display any spurious at band edge.
 Sweep: Auto
 Center Frequency: 2483.5 MHz
 Marker: Peak of fundamental emission
 Marker Δ: Peak of highest spurious level above 928 MHz

Lower Band Edge

RBW: At least 1% of span/div.
 VBW: >RBW
 Span: As necessary to display any spurious at band edge.
 Sweep: Auto
 Center Frequency: 2400 MHz
 Marker: Peak of fundamental emission
 Marker Δ: Peak of highest spurious level below 902 MHz

30 MHz - 10th Harmonic Plot

RBW: 100 kHz
 VBW: 300 kHz
 Sweep: Auto
 Display line: -20 dBc

Number of channels tested:

Tuning Range	Number Of Channels Tested	Channel Location In Band
1 MHz or Less	1	Middle
1 to 10 MHz	2	Top And Bottom
More Than 10 MHz	3	Top, Middle, Bottom

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

NAME OF TEST: Radiated Spurious Emissions	PARA. NO.: 15.247(c)
---	----------------------

Minimum Standard: In any 100kHz bandwidth outside the 2400-2483.5 MHz bands emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits. *Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:*

Frequency (MHz)	Field Strength (mV/m @ 3m)	Field Strength (dB @ 3m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

The spectrum was searched to the 10th harmonic.

15.205 Restricted Bands

MHz	MHz	MHz	GHz
0.09-0.11	16.42-16.423	399.9-410	4.5-5.25
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.125-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41	1718		

Number of channels tested:

Tuning Range	Number Of Channels Tested	Channel Location In Band
1 MHz or Less	1	Middle
1 to 10 MHz	2	Top And Bottom
More Than 10 MHz	3	Top, Middle, Bottom

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

NAME OF TEST: Transmitter Power Density	PARA. NO.: 15.247(d)
---	----------------------

Minimum Standard: The transmitted power density averaged over any 1 second interval shall not be greater than +8 dBm in any 3 kHz bandwidth.

Method Of Measurement: The spectrum analyzer is set as follows:

- RBW: 3 kHz
- VBW: >3 kHz
- Span: => measured 6 dB bandwidth
- Sweep: Span(kHz)/3 (i.e. for a span of 1.5 MHz the sweep rate is 1500/3 = 500 sec.
- LOG dB/div.: 2 dB

Note: For devices with spectrum line spacing =< 3 kHz, the RBW of the analyzer is reduced until the spectral lines are resolved. The measurement data is normalized to 3 kHz by summing the power of all the individual spectral lines within a 3 kHz band in linear power units.

For Devices With Integral Antenna:

For devices with non-detachable antennas, the received field strength is peaked and the spectrum analyzer is set as above. The peak emission level is then measured and converted to a field strength by adding the appropriate antenna factor and cable loss. This field strength is then converted to an equivalent isotropic radiated power using the same method as described for Peak Power output.

Number of channels tested:

Tuning Range	Number Of Channels Tested	Channel Location In Band
1 MHz or Less	1	Middle
1 to 10 MHz	2	Top And Bottom
More Than 10 MHz	3	Top, Middle, Bottom

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

NAME OF TEST: Processing Gain	PARA. NO.: 15.247(e)
-------------------------------	----------------------

Minimum Standard: The processing gain shall be at least 10 dB.

Method Of Measurement: A plot was taken of the spectrum of the transmitted rf signal and compared to a plot of the de-correlated IF waveform. The processing gain is equivalent to 10 Log (BW₁/BW₂).

Calculation Of Processing Gain:

The processing gain was determined by the ratio of the bandwidth correlated waveform to the bandwidth of the de-correlated waveform as follows:

$$G_p = 10 \text{ Log}(\text{BW before de-correlation} / \text{BW after de-correlation})$$

$$G_p = 10 \text{ Log}(14.36 / .373)$$

$$G_p = 15.85 \text{ dB}$$

KTL Dallas, Inc.

FCC PART 15, SUBPART C
DIRECT SEQUENCE TRANSMITTERS
PROJECT NO.: 9L0023RUS

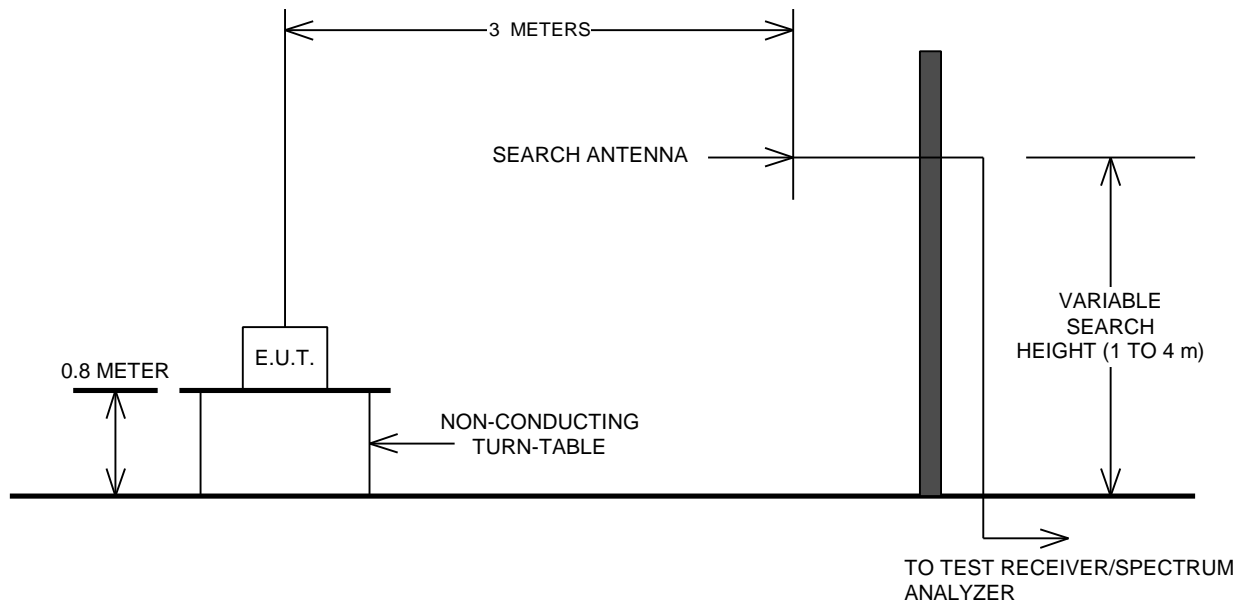
EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier

FCC ID: KUWMDL2400BDR

ANNEX B - BLOCK DIAGRAMS

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

Test Site For Radiated Emissions



Below 1 GHz

Peak detector.
RBW = 100 kHz

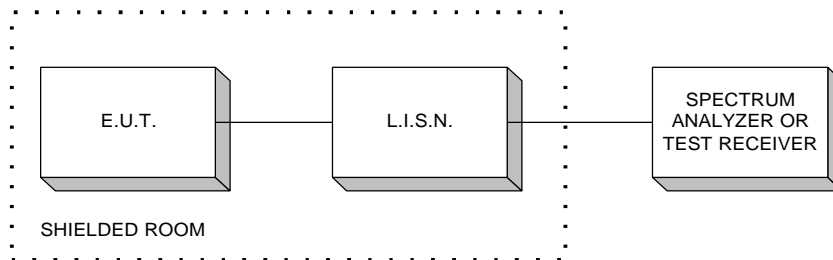
Above 1 GHz For Peak Emission Levels

Peak detector
RBW = 1 MHz
VBW = >RBW

Above 1 GHz For Average Emission Levels

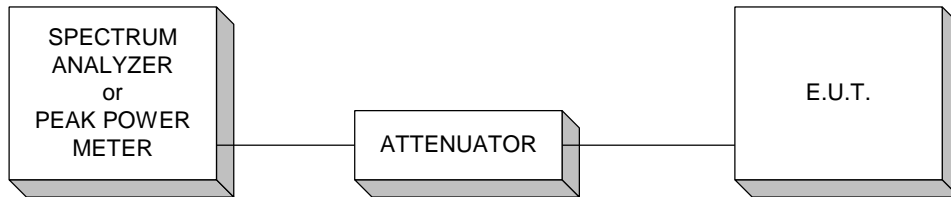
Peak detector
RBW = 1 MHz
VBW = 10 Hz

Conducted Emissions



EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001) and 4-Port Line Amplifier
FCC ID: KUWMDL2400BDR

Transmitter Power Density & Peak Power At Antenna Terminals



If the E.U.T. has an integral (non-detachable) antenna, the above test is performed as a radiated measurement and the result is reported as EIRP.

Processing Gain

