

**KTL Test Report:** 9L0023RUS


**Applicant:** Andrew Corporation  
2601 Telecom Parkway  
Richardson, Tx.

**Equipment Under Test:  
(E.U.T.)** 2400 Base Data Radio (P/N 38700-3000-001)

**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:** 42

*EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001)**FCC ID:*

## Table Of Contents

### Section 1. Summary of Test Results

General .....	04
Summary of Test Data .....	05

### Section 2. General Equipment Specification

Specifications - Transmitter .....	06
Specifications - Receiver .....	07
Modifications .....	08
Family List Rational .....	08
Theory of Operation .....	09
System Diagram .....	09

### Section 3. Powerline Conducted Emissions

Test Results .....	10
Graphs .....	11-13

### Section 4. Occupied Bandwidth

Test Results .....	14
Graphs .....	15

### Section 5. Peak Power Output

Test Results .....	16
Peak Power Output Table .....	18

### Section 6. Spurious Emissions (Antenna Conducted)

Test Results .....	19
Graphs .....	20-

22

### Section 7. Spurious Emissions (Radiated)

Test Results .....	23
Test Data - Radiated Emissions (PEAK) .....	24-25
Test Data - Radiated Emissions (AVERAGE) .....	25
Radiated Photographs .....	26

### Section 8. Transmitter Power Density

Test Results .....	27
Graphs .....	28

*EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001)*

*FCC ID:*

---

## **Table Of Contents, continued**

### **Section 9. Processing Gain**

Test Results .....	29
Processing Gain Data .....	30
Additional Data .....	31

### **Section 10. Test Equipment List**

Test Equipment List .....	32
---------------------------	----

### **Annex A. Test Methodologies**

Powerline Conducted Emissions .....	A2
Occupied Bandwidth .....	A3
Peak Power Output .....	A4
Spurious Emissions at Antenna Terminal .....	A6
Radiated Spurious Emissions .....	A7
Transmitter Power Density .....	A8
Processing Gain .....	A9

### **Annex B. Block Diagrams**

Test Site for Radiated Emissions .....	B2
Conducted Emissions .....	B2
Transmitter Power Density & Peak Power at Antenna Terminals .....	B3
Processing Gain .....	B3

*EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001)**FCC ID:*

---

**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 GaytanDATE: 8/10/99-8/17/99

KTL Dallas Inc. authorizes the above named company to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. KTL Dallas Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This report applies only to the items tested.

*EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001)**FCC ID:*

---

**Summary Of Test Data**

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT
Powerline Conducted Emissions	15.207 (a)	48 dB $\mu$ V	42.8	Complies
Occupied Bandwidth	15.247 (a)(2)	$\geq$ 500 kHz	13.6347 MHz	Complies
Peak Power Output	15.247 (b)	1 watt	1.06 watts	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 For N/A's:****Test Conditions:**

**Indoor**                      Temperature: 24°C  
                                    Humidity:     42%

**Outdoor**                    Temperature: 28°C  
                                    Humidity:     48%

*EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001)**FCC ID:*

---

**Section 2. General Equipment Specification****Transmitter**

<b>Power Input:</b>	<b>85-265 VAC</b>	
<b>Frequency Range:</b>	<b>2400-2483.5 GHz</b>	
<b>Tunable Bands:</b>	<b>Not Applicable</b>	
<b>6 dB Bandwidth:</b>	<b>13.6347 MHz</b>	
<b>Type of Modulation</b>	<b>GPSK</b>	
<b>Data Rate:</b>	<b>128 Kbps</b>	Radio to radio
	<b>64 Kbps</b>	User equipment to radio
<b>Internal / External Data Source:</b>	<b>External</b>	
<b>Emissions Designator:</b>	<b>13M6F9W</b>	
<b>Output Impedance:</b>	<b>50 ohms</b>	
<b>RF Power Output (Rated):</b>	<b>1Watt</b>	
<b>Duty Cycle:</b>	<b>Up to 100%</b>	
<b>Channel Spacing:</b>	<b>Not Applicable</b>	
<b>Operator Selection of Operating Frequency:</b>	<b>Not Applicable</b>	
<b>Power Output Adjustment Capability:</b>	<b>Computer controlled &lt;32 dBm</b>	

*EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001)*

FCC ID:

---

**Receiver**

**Frequency Range:** 2400-2483.5 GHz

**Tunable Bands:** Not Applicable

**1<sup>st</sup> IF:** 2327.552 MHz

**2<sup>nd</sup> 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)*

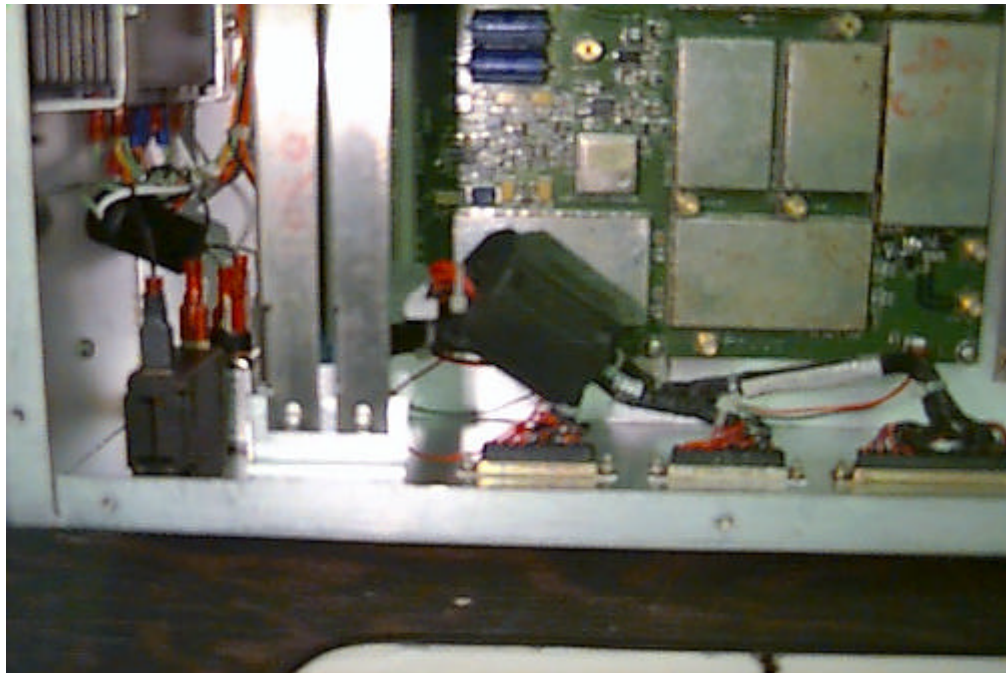
FCC ID:

---

### **Description of Modification for Modification Filing**

- 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 iside 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-**



### **Family List Rational**

**Not Applicable**

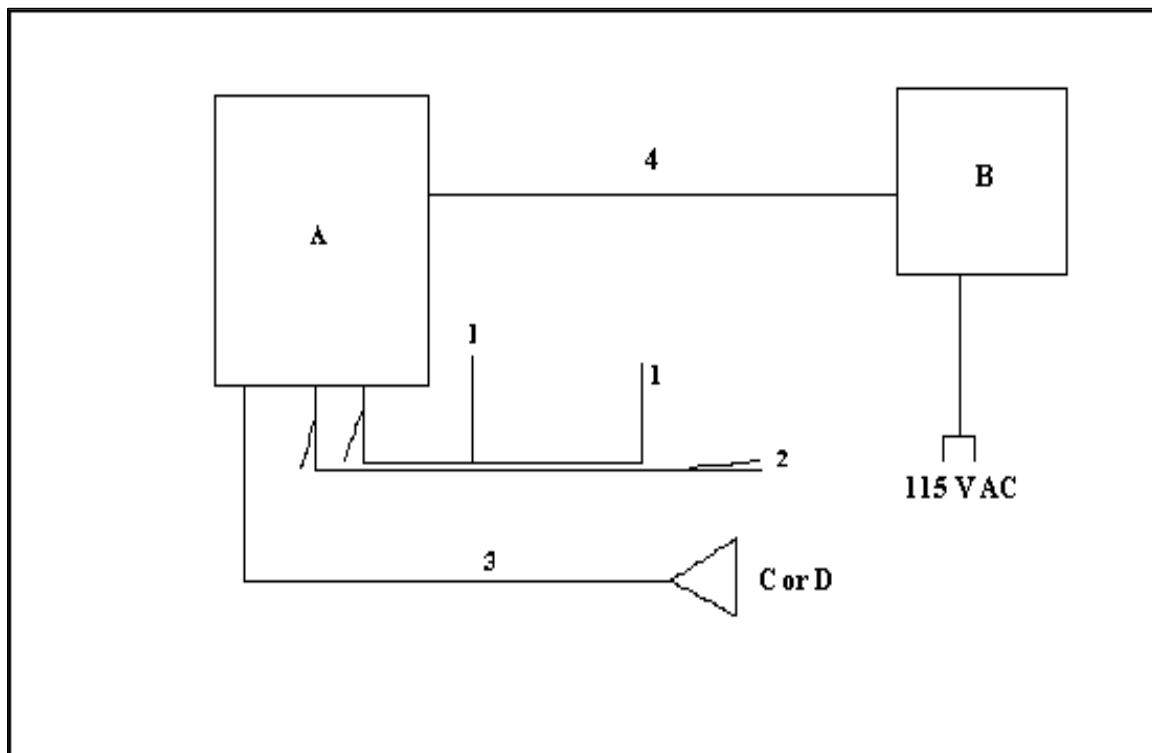


*EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001)**FCC ID:*

---

**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. The radio is used in a subway train system.

**System Diagram**

**KTL Dallas, Inc.**

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

*EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001)*

FCC ID:

---

### **Section 3. Powerline Conducted Emissions**

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

**Test Results:** Complies. See attached data.

**Measurement Data:** See attached data.

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001)

FCC ID: \_\_\_\_\_

**Measurement Data:**

Conducted Emissions Data (CISPR Quasi-Peak Detector) FCC (CFR 47)								
Complete	<u>  X  </u>							
Preliminary		Page <u>  1  </u> of <u>  2  </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.

*FCC ID:*

**Conducted Emissions Data**  
(CISPR Quasi-Peak Detector)  
FCC (CFR 47)

Page 2 of 2

Tech: Ron Gaytan                      Test #: CE-1    Lab: 1           Photo ID: 9L0023 CE-1

[illegible]

*EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001)*

FCC ID:

---

**Powerline Conducted Emissions Photographs**

FRONT VIEW



SIDE VIEW



**KTL Dallas, Inc.**

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

*EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001)*

FCC ID:

---

## **Section 4.          Occupied Bandwidth**

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

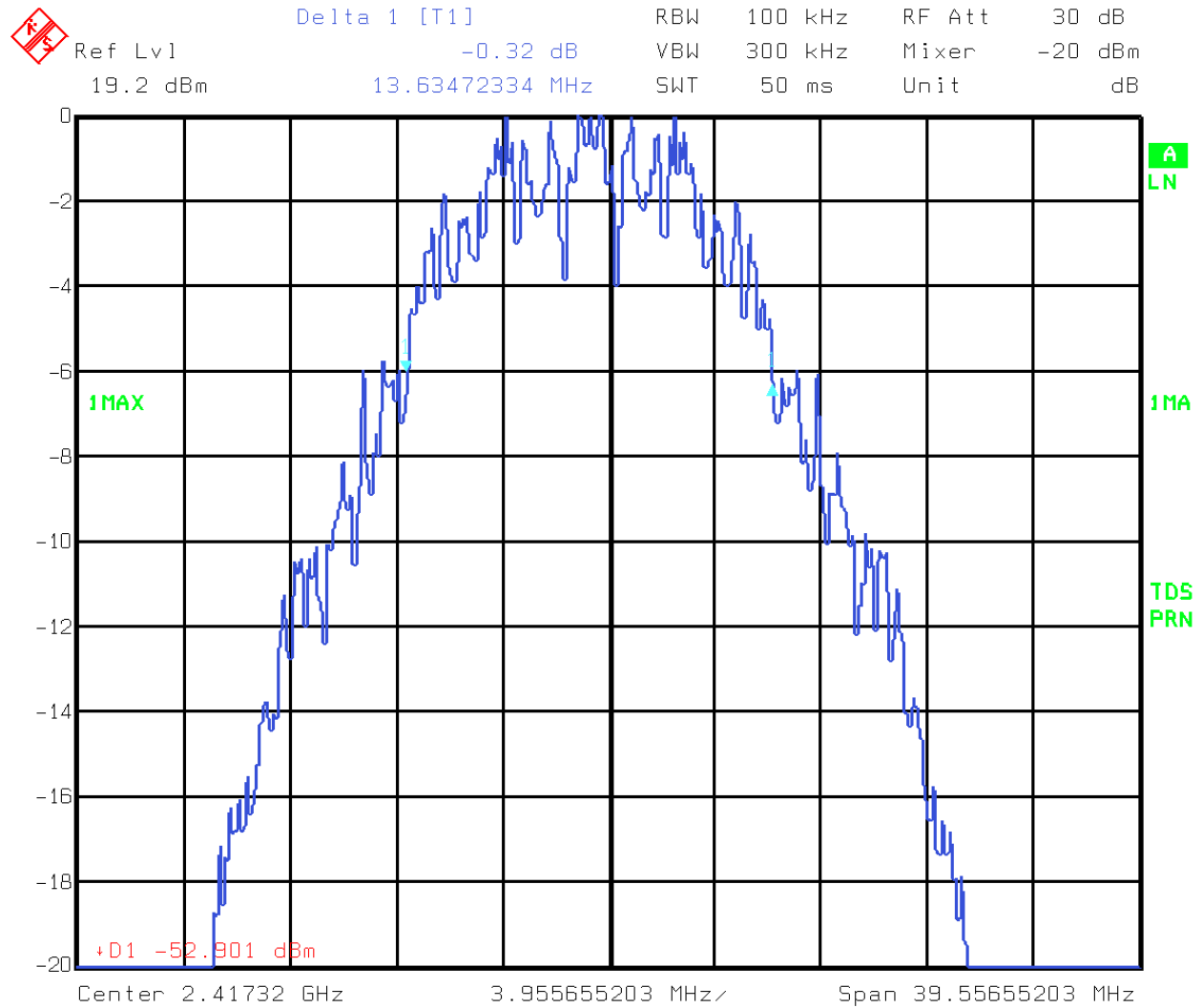
**Test Results:**                      Complies. The 6 dB bandwidth is 13.6347 MHz.

**Measurement Data:**              See attached graph.

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001)

FCC ID:

## Occupied Bandwidth



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

*EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001)**FCC ID:*

---

**Section 5. Peak Power Output**

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

**Test Results:** Complies. The maximum peak power output of the transmitter is 1.06 watts

**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.

Peak Power Output: 0.251 watts.

Field Strength: 128.8 dB $\mu$ V/m @ 3m or 2.75 V/m @ 3m.



FCC ID:

*EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001)*

*FCC ID:*

---

**Section 6. Spurious Emissions (Antenna Conducted)**

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

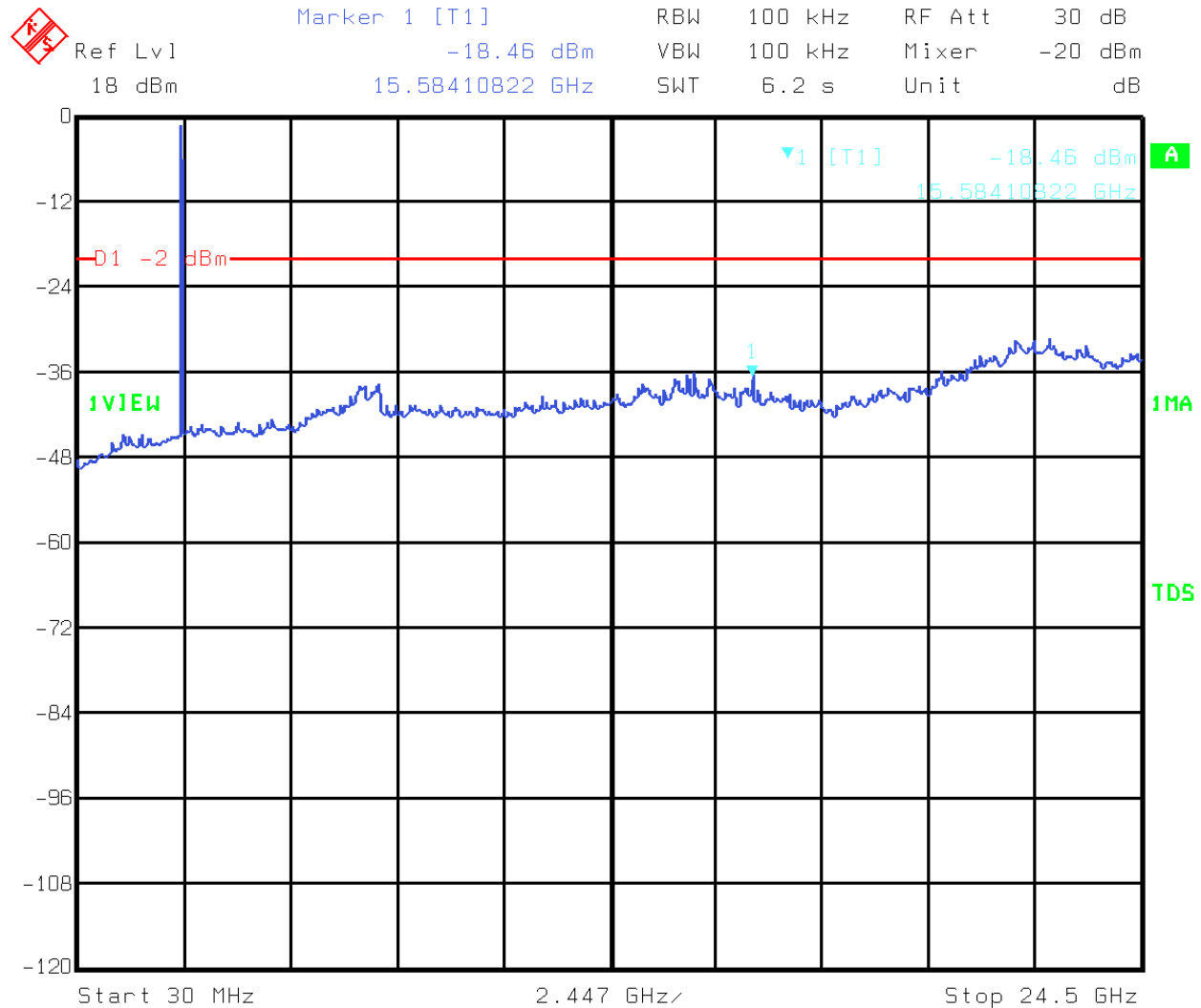
**Test Results:** Complies. The worst-case emission level is 3.35 dBm at 22.3815 GHz. This is 6.65 dB below the specification limit.

**Measurement Data:** See attached graphs.

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001)

FCC ID:

## Antenna Port Spurious Emissions

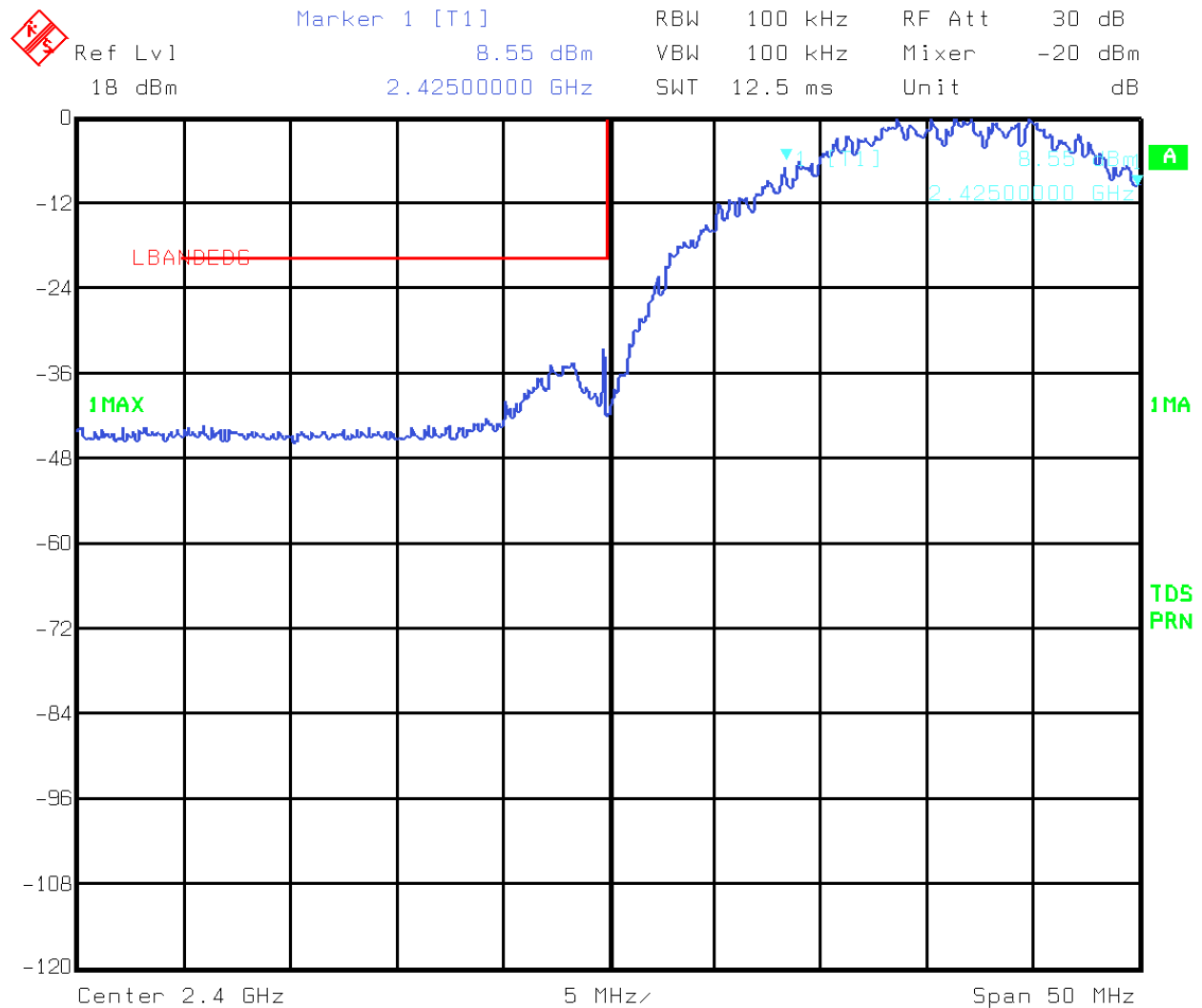


Title: Antenna Port Spurious Emissions  
Date: 10.AUG.1999 12:09:42

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001)

FCC ID:

## Lower Band Edge

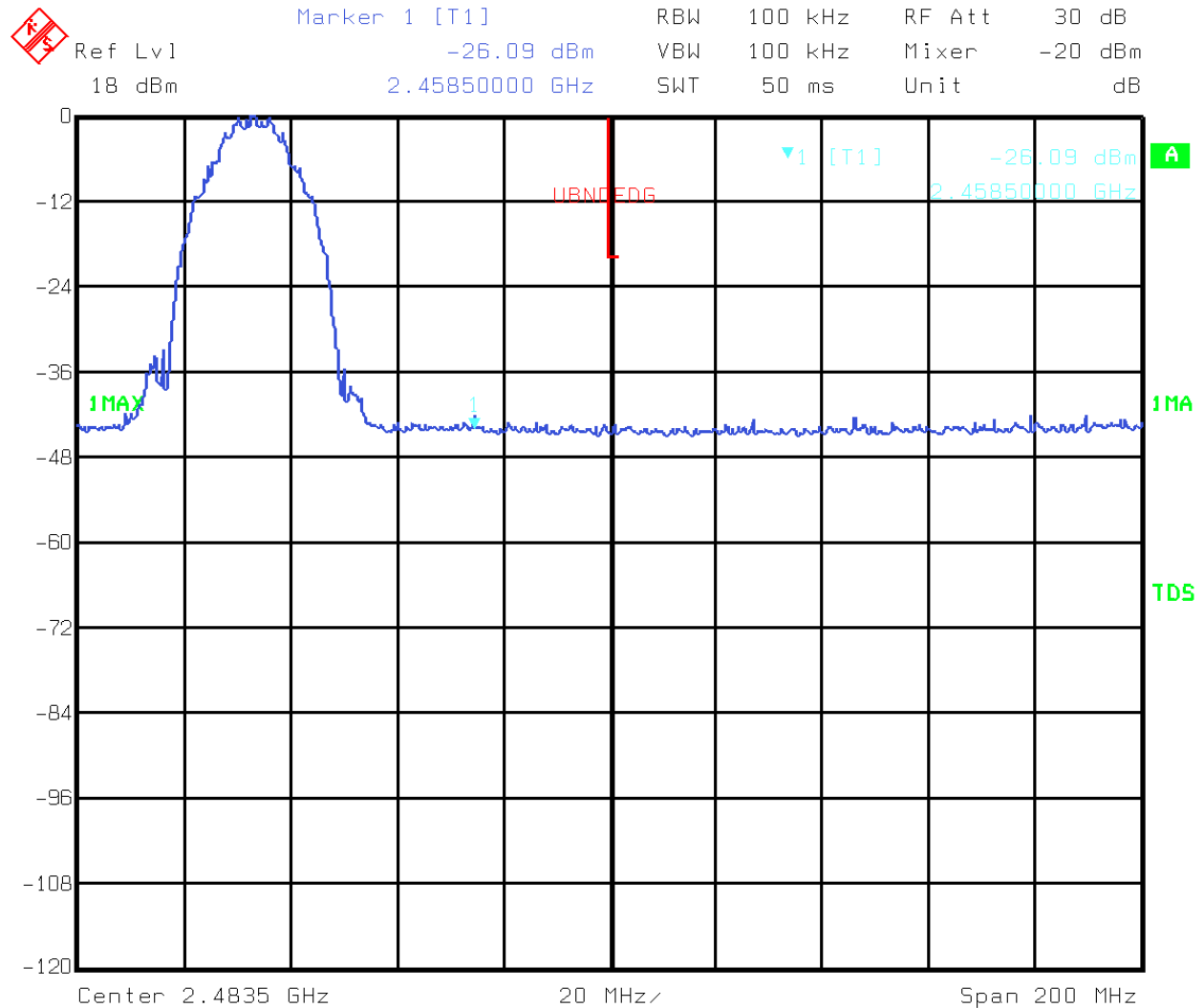


Title: Lower Band Edge  
Date: 10.AUG.1999 12:15:14

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001)

FCC ID:

## Upper Band Edge



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

*EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001)*

*FCC ID:*

---

**Section 7.            Spurious Emissions (Radiated)**

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

**Test Results**

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

**Measurement Data:**

See attached graphs.

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001)

FCC ID:

## 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</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.						
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		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
							V	
							V	
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

DATACOMMON\FORMS\TESTDATASHEETS\MICRORE REV 030597

FCC ID:

[illegible]



*EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001)*

FCC ID:

---

**Radiated Photographs (Worst Case Configuration)**

FRONT VIEW



REAR VIEW



**KTL Dallas, Inc.**

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

*EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001)*

FCC ID:

---

## **Section 8. Transmitter Power Density**

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

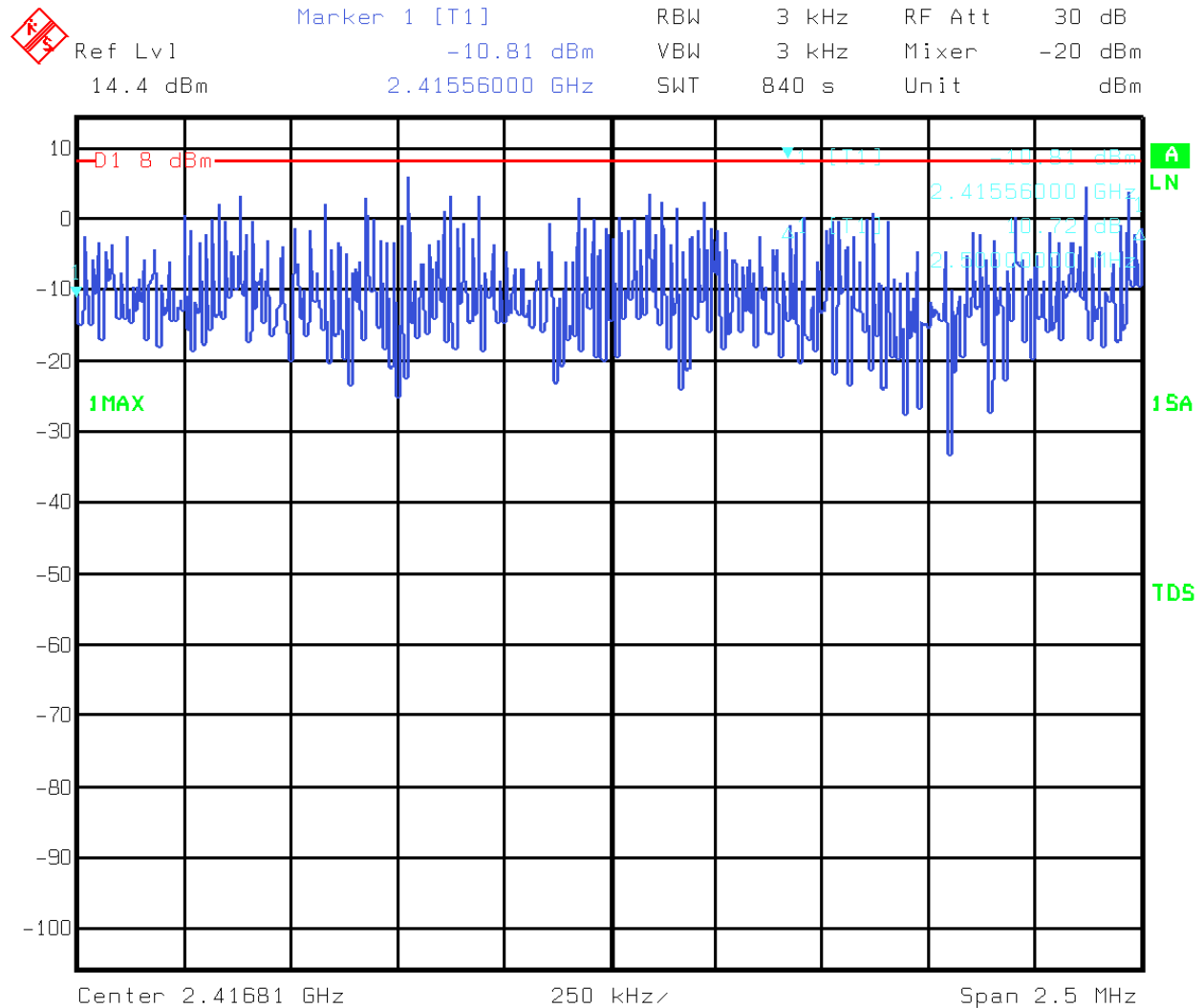
**Test Results:** Complies.

**Measurement Data:** See attached graphs.

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001)

FCC ID:

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)**FCC ID:*

---

**Section 9. Processing Gain**

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

**Test Results:** Complies. The processing gain of the system is 15.9 dB.**Measurement Data:** See attached data.

1<sup>st</sup> graph is the RF output from the base transmitter

2<sup>nd</sup> graph is plot of the IF spectrum measured at the output of the correlator.

$G_p = 10 \log(\text{RF bandwidth} / \text{De-correlated BW})$

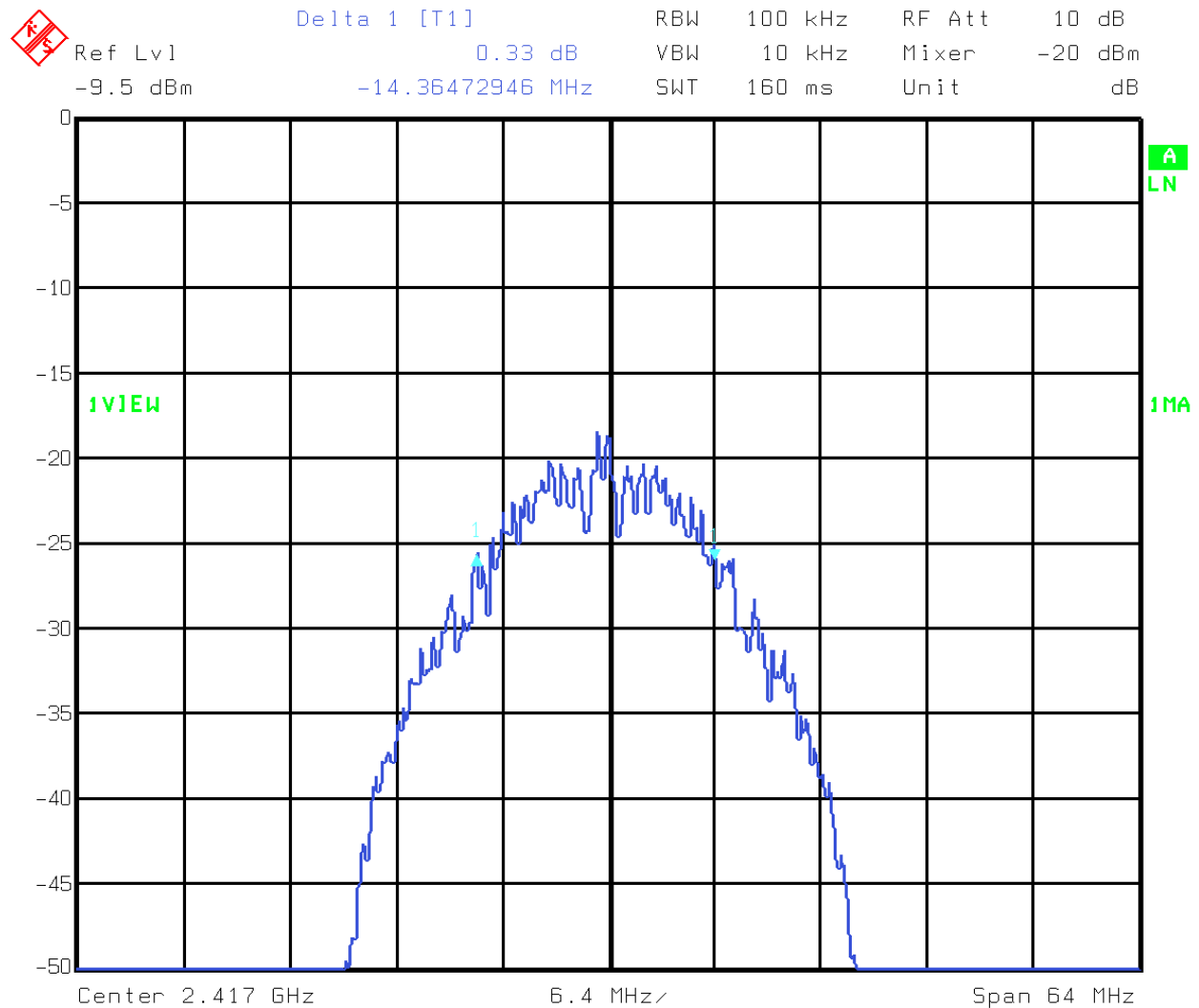
$G_p = 10 \log(14.36 / .373)$

$G_p = 15.85 \text{ dB}$

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001)

FCC ID:

## Processing Gain Data ( Base RF Out)



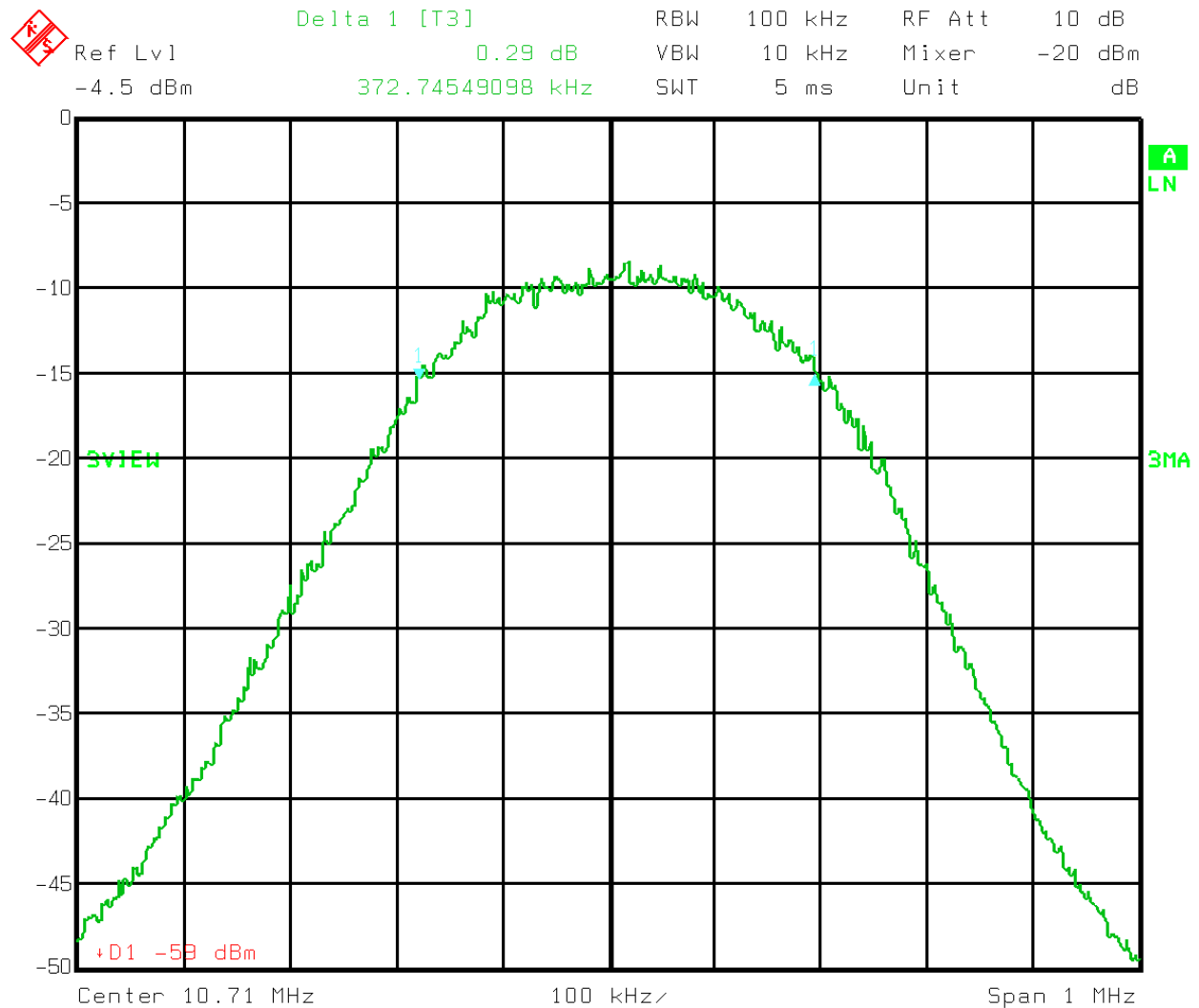
Title: 6 dB BW of Transmitted Signal (Base RF Out)

Date: 13.AUG.1999 11:13:30

EQUIPMENT: 2400 Base Data Radio(P/N 385700-3000-001)

FCC ID:

### Processing Gain Data (Mobile IF)



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)

FCC ID:

**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

*EQUIPMENT: Base Data Radio*  
*FCC ID:*

---

**ANNEX A**  
**TEST METHODOLOGIES**



*EQUIPMENT: Base Data Radio*

*FCC ID:*

---

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 $\mu$ V (48 dB $\mu$ V) across 50 ohms.

*EQUIPMENT: Base Data Radio**FCC ID:*

---

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: &gt;RBW

LOG dB/div.: 2 dB

Sweep: Auto

Number of channels tested:

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

*EQUIPMENT: Base Data Radio**FCC ID:*

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: Base Data Radio

FCC ID:

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 10<sup>th</sup> harmonic.*

**Method Of Measurement:****Upper Band Edge**

RBW: At least 1% of span/div.

VBW: &gt;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: &gt;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: Base Data Radio

FCC ID:

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 10<sup>th</sup> 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: Base Data Radio**FCC ID:*

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: &gt;3 kHz

Span: =&gt; 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  $\leq 3$  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: Base Data Radio**FCC ID:*

---

NAME OF TEST: Processing Gain

PARA. NO.: 15.247(e)

**Minimum Standard:** The processing gain shall be at least 10 dB.**Method Of Measurement:** The plot was taken of the spectrum of the RF transmitter and compared to a plot of the IF spectrum measured at the output of the correlator.**Calculation Of Processing Gain:**

The processing gain was determined by measuring the jamming margin of the E.U.T. and using the following formula:

$$\text{Jamming Margin} = G_p - (S/N)_{\text{out}} - L_{\text{sys}}$$

For a receiver using non-coherent detection the value  $(S/N)_{\text{out}}$  is calculated using the formula:

$P_e = (1/2)\text{EXP}\{-E/2N_o\}$  where  $P_e$  is the probability of error (minimum Bit Error Rate required for proper operation).

$E/N_o$  is  $(S/N)_{\text{out}}$

for example, for a bit error rate of  $10^{-4}$  a S/N ratio of 12.3 dB is required.

$L_{\text{sys}}$  (system losses) is assumed to be 2 dB.

Therefore  $G_p = M_j + (S/N)_{\text{out}} + L_{\text{sys}}$

Measurement performed at 915 MHz.

*EQUIPMENT:*  
*FCC ID:*

---

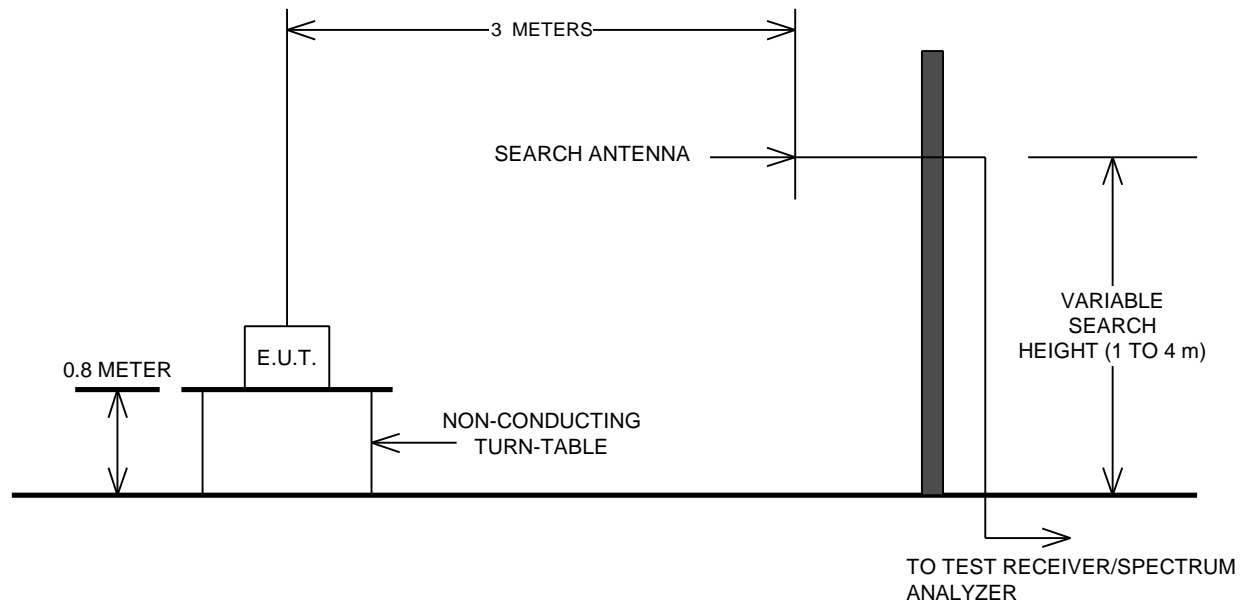
**ANNEX B**  
**BLOCK DIAGRAMS**



*EQUIPMENT:*

*FCC ID:*

## 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

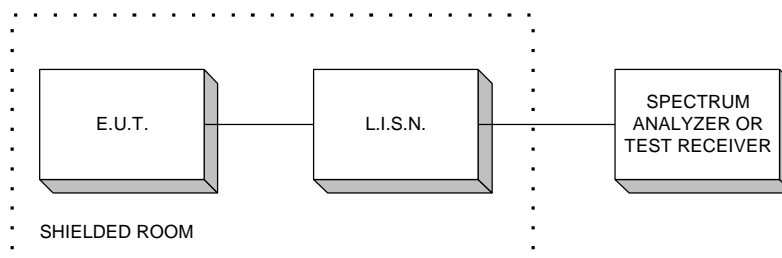
### Above 1 GHz For Average Emission Levels

Peak detector

RBW = 1 MHz

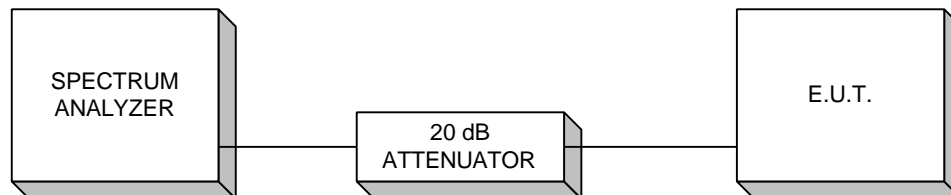
VBW = 10 Hz

## Conducted Emissions

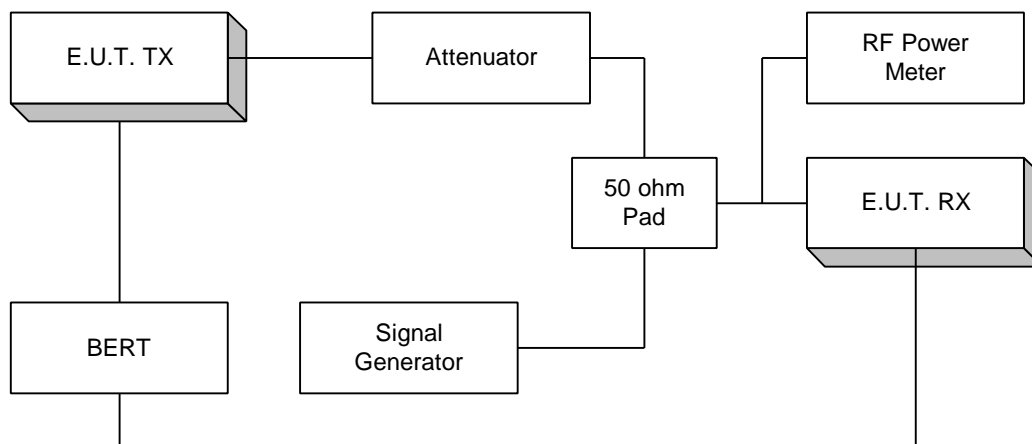


*EQUIPMENT:**FCC ID:*

---

**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**

NOTE: This is a typical setup. The setup may vary slightly since many devices have BER test functions built into the device.