KTL Test Report:	9L0022RUS
Applicant:	Andrew Corporation 2601 Telecom Parkway Richardson, Tx.
Equipment Under Test:	2400 Mobile Data Radio and 385700-4000-001 4 Port Line Amplifier.
FCC ID:	KUWMDL2400MDR
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:	51

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Section 1. Summary Of Test Results

Manufacturer: Andrew Corporation

Model No.: 2400 Mobile Data Radio and 385700-4000-001 4 Port Line Amplifier

Serial No.: DL

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: 100351-0

TESTED BY: Ron Gaytan DATE: 8/10/99-10/27/99

Summary Of Test Data:

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT
Powerline Conducted Emissions	15.207 (a)	48 dBµV	42 dBµV	Complies
Occupied Bandwidth	15.247 (a)(2)	≥500 kHz	12.3246 MHz	Complies
Peak Power Output	15.247 (b)	1 Watt	1Watt	Complies
Spurious Emissions (Antenna Conducted)	15.247 (c)	-20 dBc	-20.88 dBm	Complies
Spurious Emissions (Radiated)	15.247 (c)	Table 15.209 (a)	61.8 dBuV/m	Complies
Transmitter Power Density	15.247 (d)	≤ +8 dBm	1.33 dBm	Complies
Processing Gain	15.247 (e)	≥ 10 dB	15.9 dB	Complies

Footnotes:

Test Conditions:

Indoor Temperature: 22°C
Humidity: 36%

Outdoor Temperature: 28°C
Humidity: 48%

Section 2. General Equipment Specification

Transmitter:

Power Input:	**18-56 VDC**	
Frequency Range:	**2400-2483.5 GHz**	
Tunable Bands:	**Not Applicable**	
6 dB Bandwidth:	**13.6347 MHz**	
Type of Modulation	**GPSK**	
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):	**1 Watt**	
Duty Cycle:	**Up to 100%**	
Channel Spacing:	**Not Applicable**	
Operator Selection of Operating Frequency:	**Not Applicable**	
Power Output Adjustment Capability:	**Computer controlled <32 dBm**	

Receiver:

Frequency Range:	**2400-2483.5 GHz**
Tunable Bands:	**Not Applicable**
1st IF:	**2276.352 MHz**
2nd IF:	**129.6 MHz**
Bandwidth:	**12.3246 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

Description of Modification for Modification Filing:

1.) Properly shielded Data 1 And Data 2 ports at both ends of the cables on 3-2400 base station.

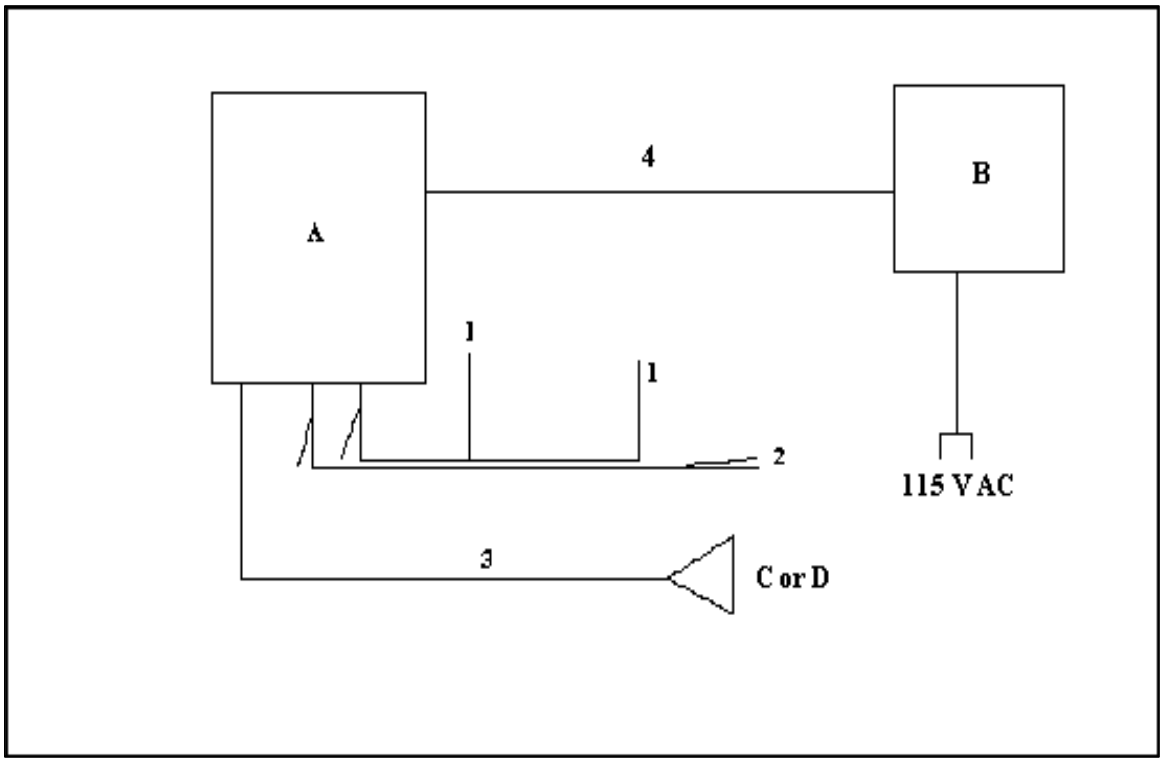
Family List Rational:

Not Applicable

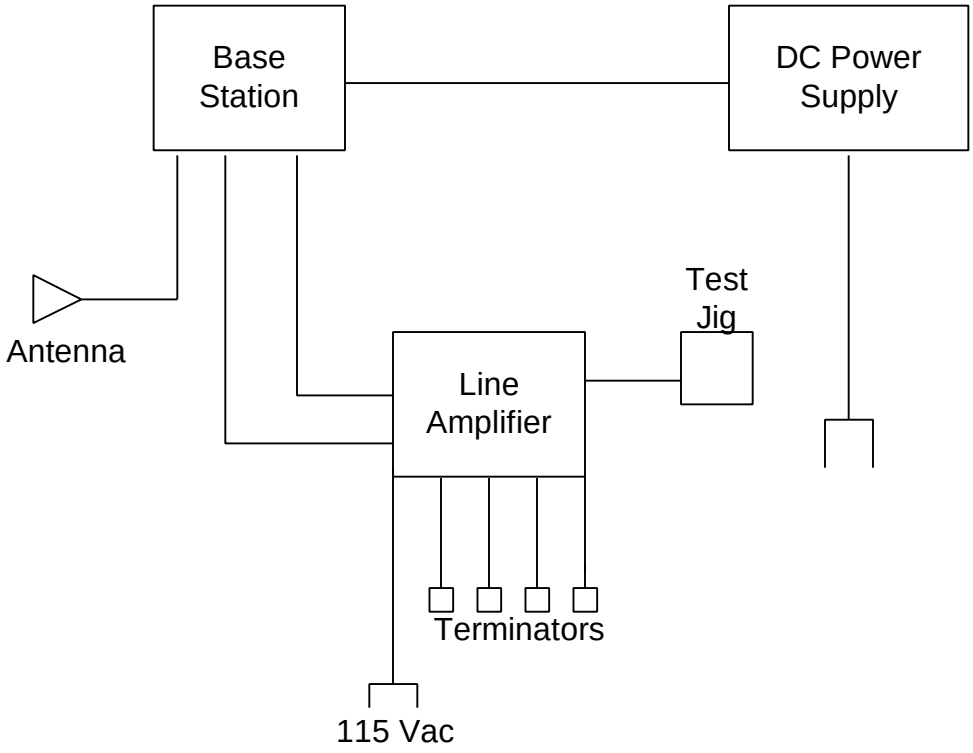
Theory of Operation:

The Mobile Data Radio is a full duplex transceiver. The unit received 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: Base Station Setup



System Diagram: Line Amplifier Setup



Section 3. Powerline Conducted Emissions

NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a)
TESTED BY: Ron GaytanTom Tidwell / Debbie Jensen	DATE: 12/20/99

Test Results: Complies. See attached data.

Measurement Data: See attached data. Next page.

Powerline Conducted Emissions Test # CE-2:

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

Complete X
Preliminary

Page 1 of 2

Client: Andrew Coporation W.O.#: 9L0025R Date: 12/20/99

EUT: 385700-4000-001 S/N: None Specification: CFR47 part 15.207

Tech: Ron Gaytan Test #: CE-2 Lab: 3 Photo ID: 9L0025 CE-2

Equipment Used: G2634-G2408-C21-G1605-G1705

Configuration: Tx into 50 ohms

IF Bandwidth: 10 kHz Video Bandwidth: 10 kHz Detector: Peak X CISPR

Ambient Temperature: 23 C
Relative Humidity: 40 %
Atmospheric Pressure: 999 mbar

EUT Power: X 115 V.A.C. X 60 Hz X 1 Phase
230 V.A.C. 50 Hz 3 Phase
Other

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	

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

Powerline Conducted Emissions Test # CE-2 (Continued):

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

Complete X
Preliminary

Page 2 of 2

Client: Andrew Coporation W.O.#: 9L0025R Date: 12/20/99

EUT: 385700-4000-001 S/N: None Specification: CFR47 part 15.207

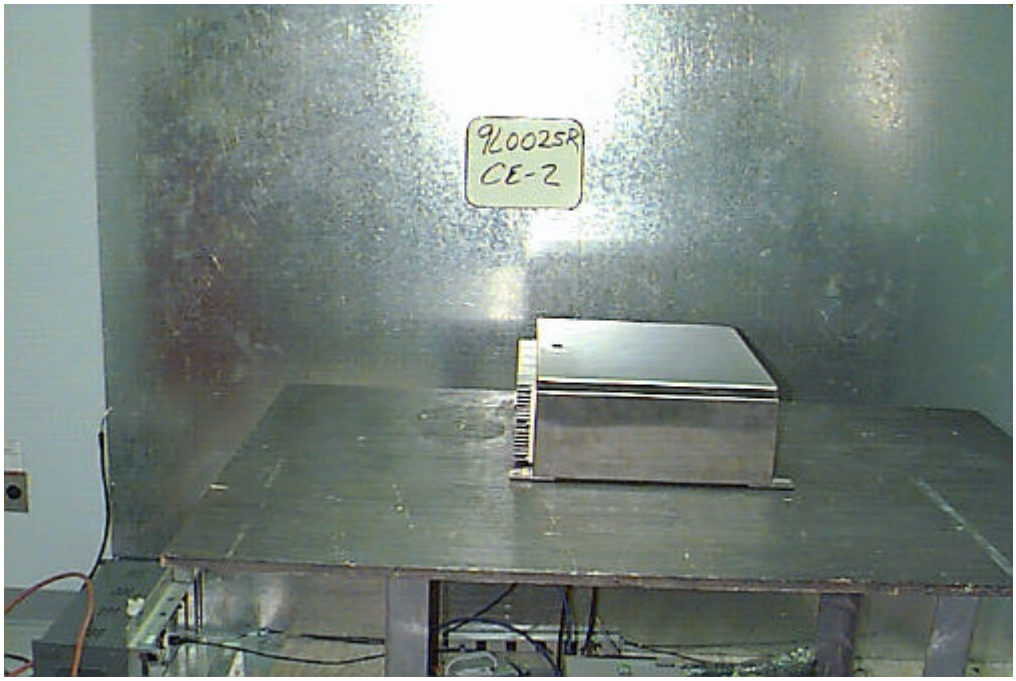
Tech: Ron Gaytan Test #: CE-2 Lab: 3 Photo ID: 9L0025 CE-2

Freq. (MHz)	Meter Reading (dBuV)	Attn. (dB)	Cable Loss (dB)	Probe Factor (dB)	Corrected Reading (dBuV)	CISPR Spec.limit (dBuV)	Pol.	Comments:
18.368	25.2	0	0	0	25.2	48	N	
29.924	31.6	0	0	0	31.6	48	N	
								Scanned from 450 kHz to 30 MHz.

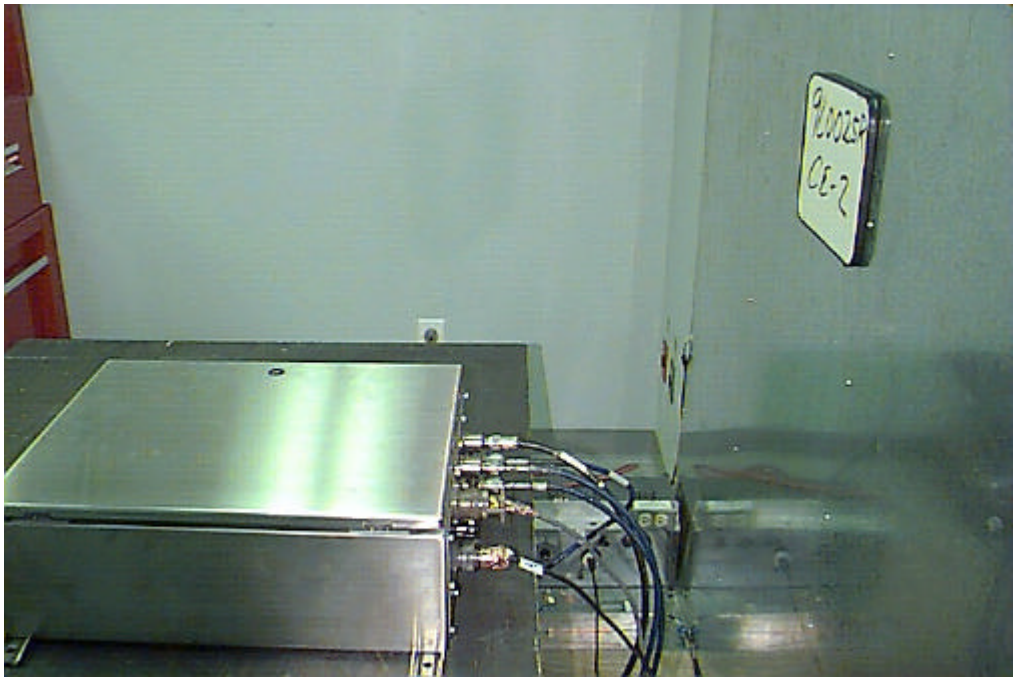
Note:Verify that the IF Bandwidth is in the proper setting.

Powerline Conducted Emissions Photographs

SIDE VIEW:



SIDE VIEW:



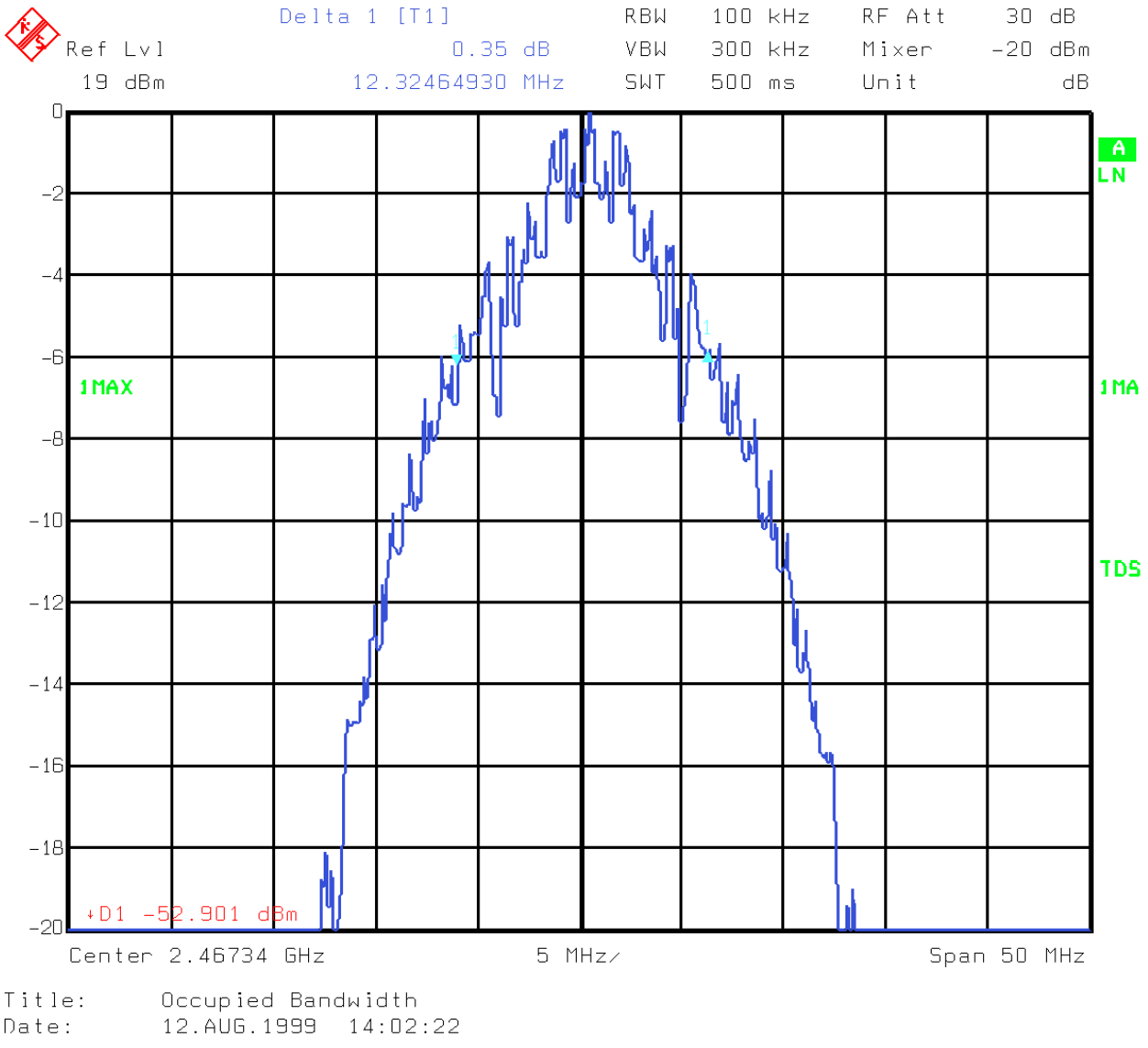
Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.247(a)(2)
TESTED BY: Ron Gaytan Tom Tidwell / Debbie Jensen	DATE: 8/12/99

Test Results: Complies. The 6 dB bandwidth is 12.3246 MHz.

Measurement Data: See attached graph.

Occupied Bandwidth:



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: 8/10/99

Test Results: Complies. The maximum peak power output of the transmitter is 1.00 watts The system is professionally installed and the installer is instructed to reduce the power output at the antenna port to +24 dBm when using the 12 dBi gain antenna.

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: 0.251watts.
Field Strength: 129.0 dBµV/m @ 3m or 2.8 V/m @ 3m.

Peak Power Output (Field Strength):

Microwave Radiated Emissions Data

Complete X Preliminary ___ Page 1 of 1

Client: Andrew Corporation Test #: ERP-1 W.O.#: 9L0022R

EUT: 2400 Mobile Transceiver S/N: None Photo ID: 9L0022R

Technician: Ron Gaytan Specification: CFR 47 Part 15.247 Lab: ANC1 Date: 8/13/99

Equipment Used: G2626-G2200-CF31-G2034

Configuration: Tx @ 24 dBm with 12 dBi ISM Panel Antenna

Bandwidth: 1 MHz Video Bandwidth: 1 MHz Antenna Distance 3 m Detector:

Climatic Conditions:
Temperature: 23 C
Relative Humidity: 38 %
Atmospheric Pressure: 998 mbar

EUT Power: X 115 V.A.C. X 60 Hz X Peak
___ 208 V.A.C. ___ 50 Hz ___ Average
___ 230 V.A.C.
___ Other ___ ___ 1 Phase ___ 3 Phase

Freq. (MHz)	Meter Reading (dBm)	Antenna Factor (dB)	Cable Loss (dB)	RF Gain (dB)	Conver. Factor	Corrected Reading (dBuV/m)	ERP (mW)	ERP (dBm)	Pol.	Comments:
2.467	-28.2	28.4	3.1	0	107	110.3	32.15	15.07	H	
2.467	-9.5	28.4	3.1	0	107	129	2383	33.77	V	

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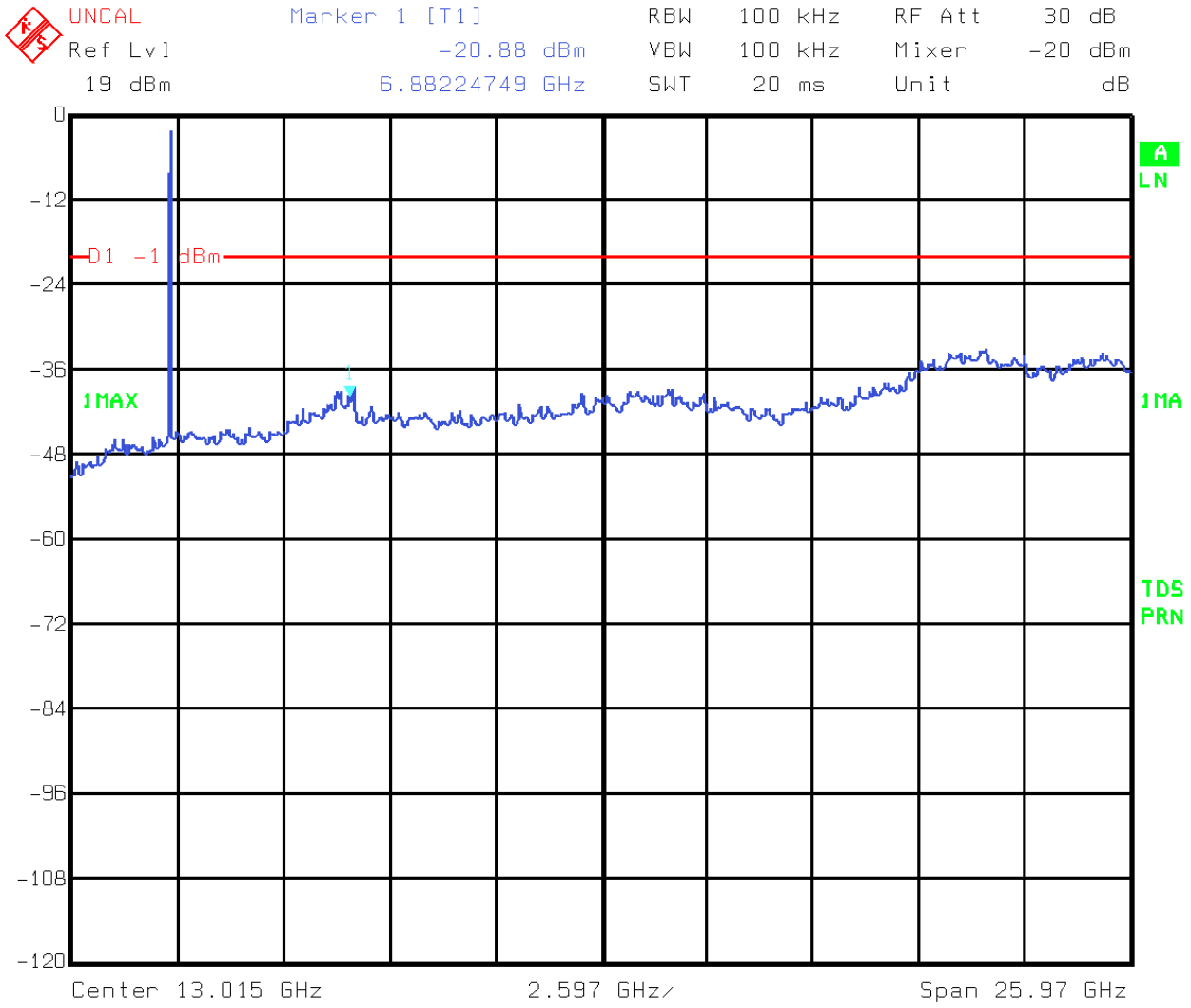
Section 6. Spurious Emissions (Antenna Conducted)

NAME OF TEST: Spurious Emissions (Antenna Conducted)	PARA. NO.: 15.247(c)
TESTED BY: Ron Gaytan Tom Tidwell / Debbie Jensen	DATE:8/12/99, 10/26/99

Test Results: Complies. The worst-case emission level is –20.88 dBm at 6.8822 GHz. This is 7.88 dB below the specification limit.

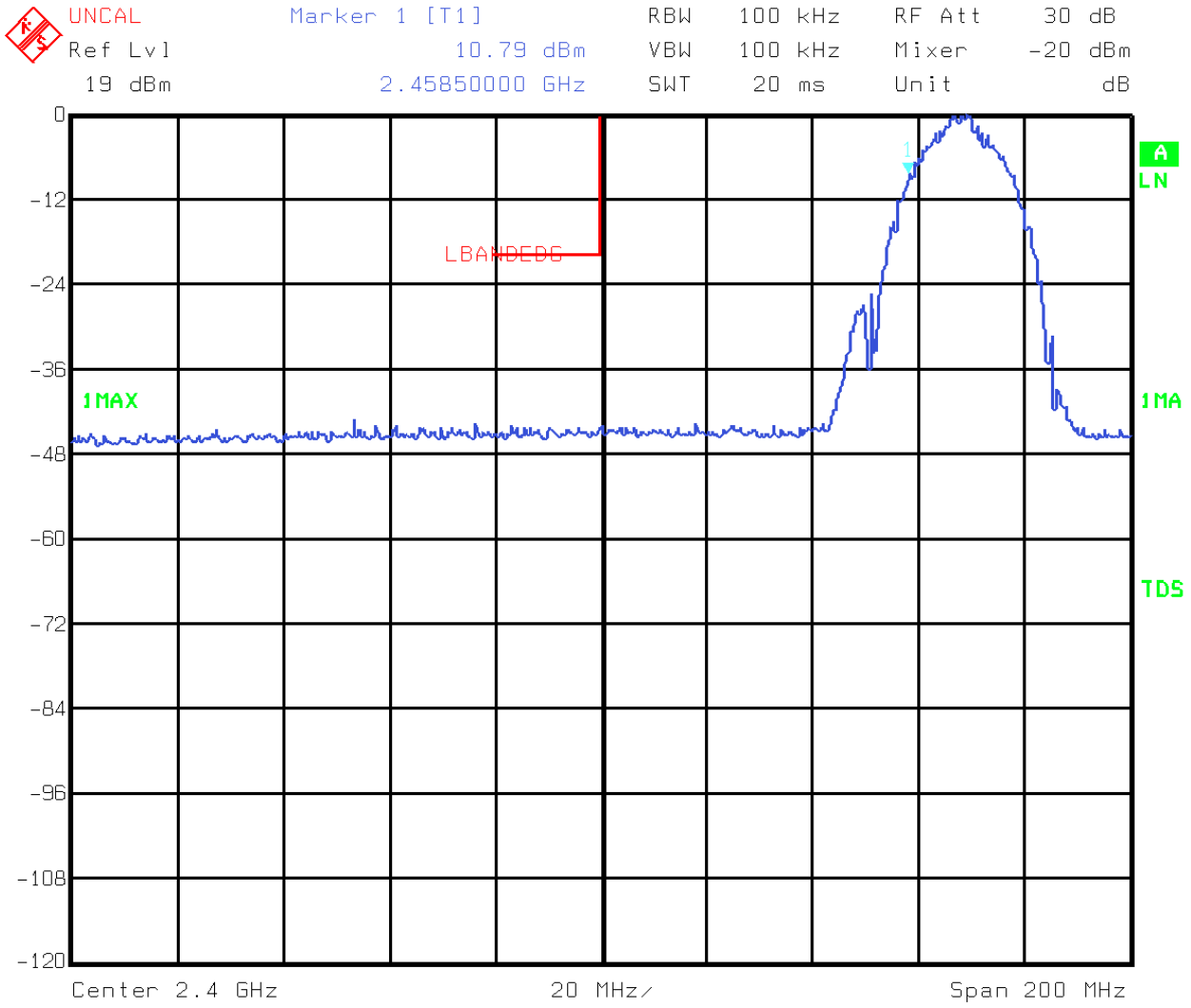
Measurement Data: See attached graphs.

Antenna Port Spurious Emissions:



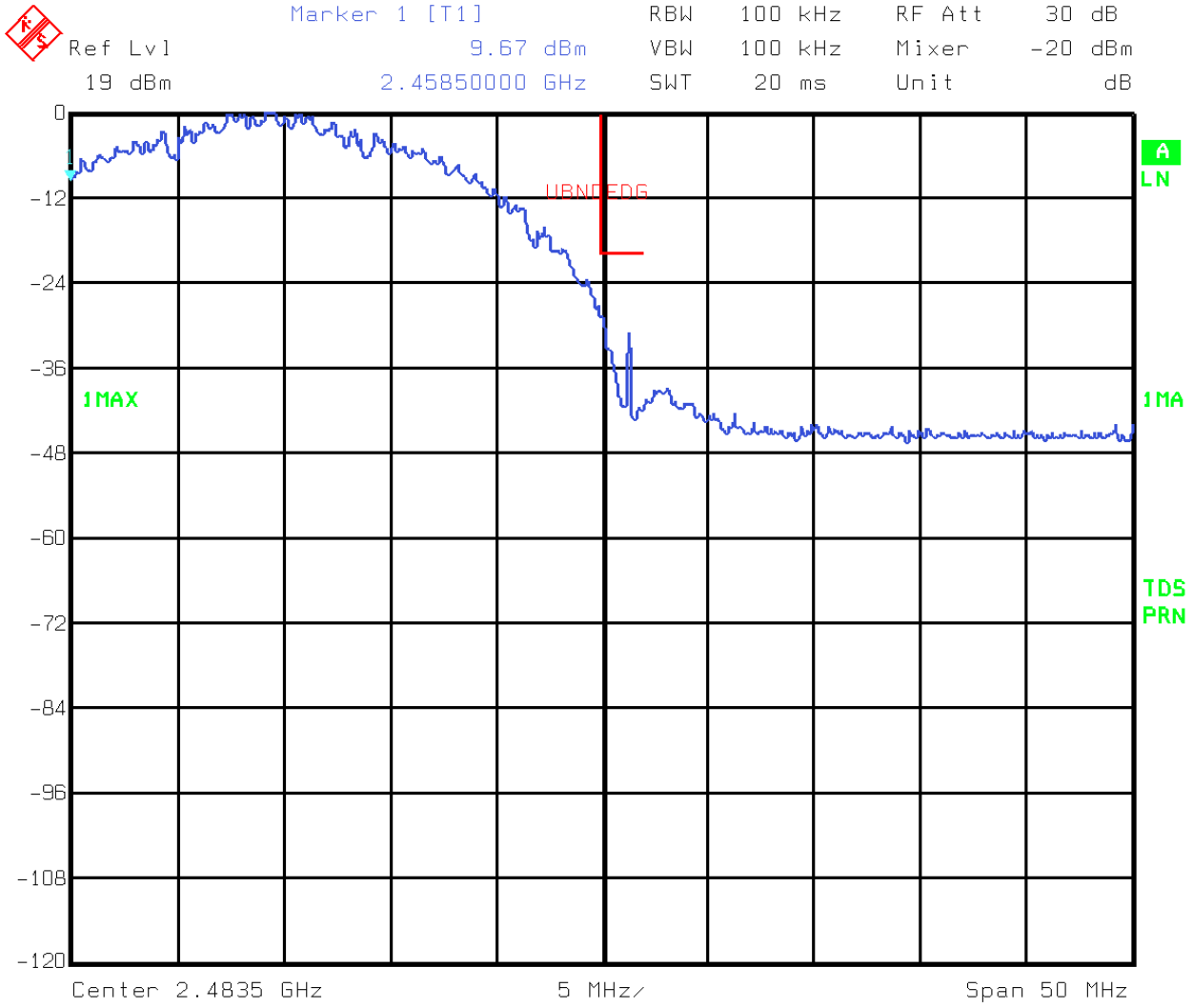
Title: Lower Band Edge
Date: 12.AUG.1999 14:43:02

Lower Band Edge:



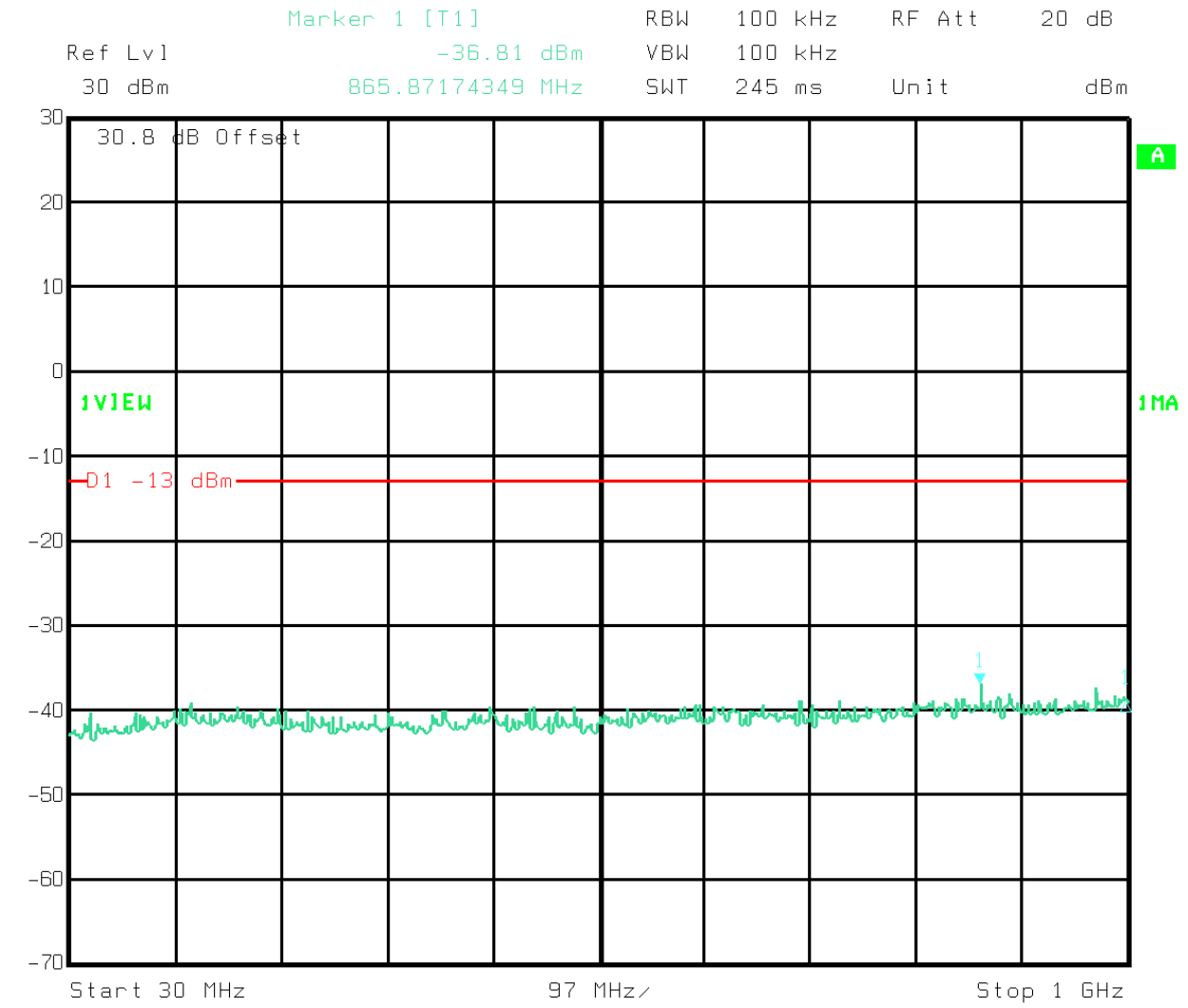
Title: Lower Band Edge
Date: 12.AUG.1999 14:39:53

Upper Band Edge:



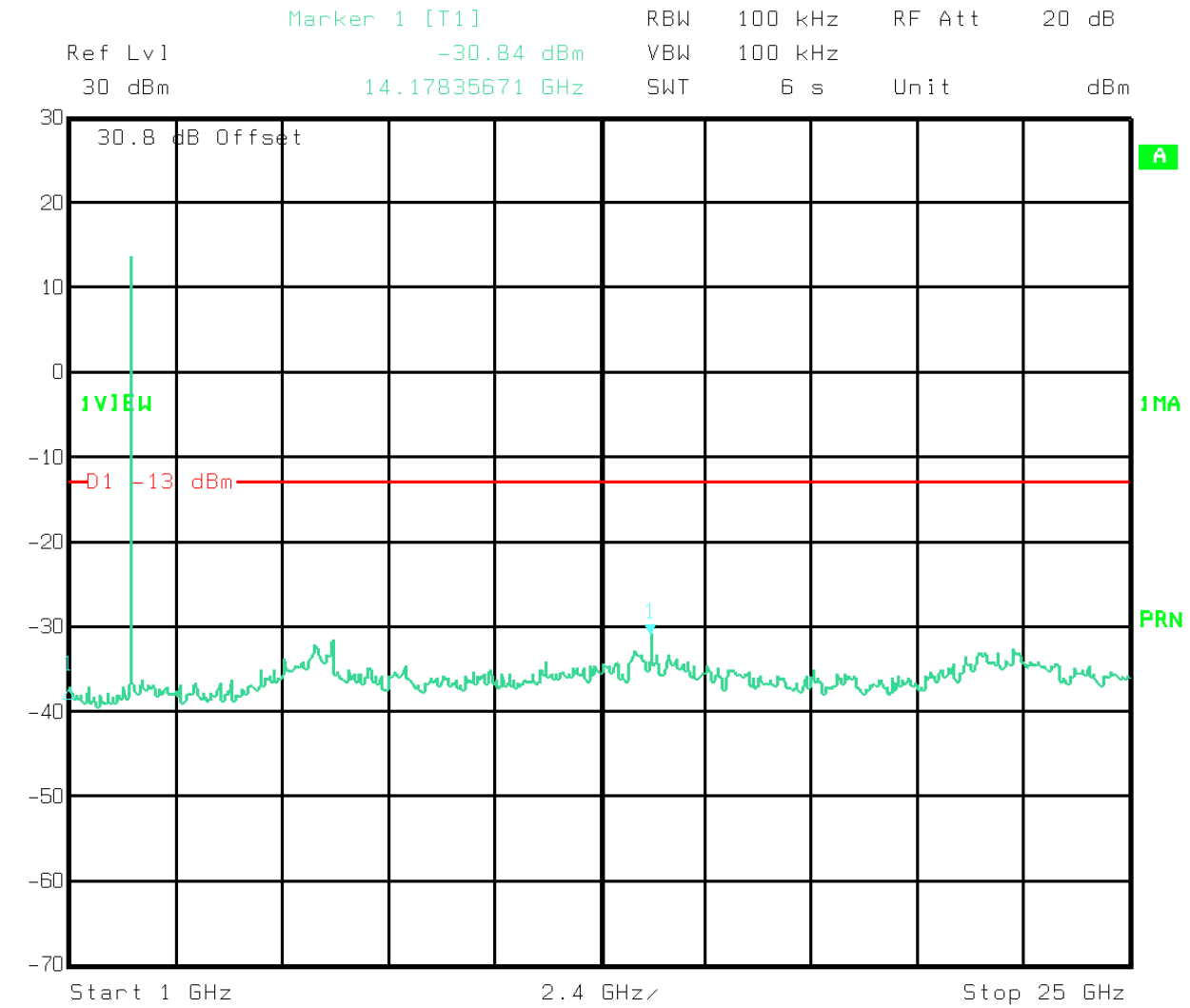
Title: Upper Band Edge
Date: 12.AUG.1999 14:35:25

Base Station:



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

Base Station:



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

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, 10/26-27/99

Test Results: Complies. The worst-case noise floor emission level is 61.3 dBµV/m @ 3m at 4.935 GHz. This is 4.2 dB Below the specification limit.

Measurement Data: See attached graphs.

Test Data - Radiated Emissions (PEAK/AVERAGE):

Microwave Radiated Emissions Data

Complete ___ Preliminary _X_ Page _1_ of _2_

Client: Andrew Corporation Test #: MW-2 W.O.#: 9L0022R

EUT: 2400 Mobile Transceiver S/N: None Photo ID: 9L022R MW-2

Technician: Ron Gaytan Specification: CFR 47 Part 15.247 Lab: ANC1 Date: 8/12/99

Equipment Used: G2626-CF31-G2200-G2034-934-677-G2235

Configuration: Tx Mode

Bandwidth: 1 MHz Video Bandwidth: 1 MHZ Antenna Distance 3 m Detector:

Climatic Conditions:
Temperature: 23 C
Relative Humidity: 42 %
Atmospheric Pressure: 998 mbar

EUT Power: _X_ 115 V.A.C. _X_ 60 Hz _X_ Peak
___ 208 V.A.C. ___ 50 Hz ___ Average
___ 230 V.A.C.
___ Other _____ _X_ 1 Phase ___ 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:
2.468	63.3	28.4	3.1	31.8	63	N/A	V	Fundamental Freq.
2.276	54.1	28.2	3.0	31.9	53.4	54	V	Refer to Average Det.
2.276	52.1	28.2	3.0	31.9	51.4	54	V	Average Detector
4.935	**47.2**	**33.2**	**4.6**	**29.5**	**55.5**	**54**	**V**	**Refer to Average Det.**
4.935	**41.5**	**33.2**	**4.6**	**29.5**	**49.8**	**54**	**V**	**Average Detector**
7.401	37.6	36.1	5.8	34.2	45.3	109	V	**Avg. Det. Noise Floor**
9.869	38.1	37.6	6.9	33.3	49.3	109	V	Avg. Det. Noise Floor
12.336	**37.3**	**39**	**8.0**	**32.8**	**51.5**	**54**	**V**	**Avg. Det. Noise Floor**
								KTL # 677
12.336	**5**	**39**	**8.0**	**32.8**	**19.2**	**54**	**V**	**Avg. Det. Noise Floor**
14.803	39.3	42.0	8.7	30.7	59.3	109	V	Avg. Det. Noise Floor
17.27	39.3	44.2	9.6	31.3	61.8	109	V	Avg. Det. Noise Floor
2.468	54.5	28.4	3.1	31.8	54.2	N/A	H	Fundamental Freq.
2.276	51.9	28.2	3.0	31.9	51.2	54	H	**Refer to Average Det.**
2.276	49.5	28.2	3.0	31.9	48.8	54	H	**Average Detector**
4.935	**44.3**	**33.2**	**4.6**	**29.5**	52.6	54	**H**	**Refer to Average Det.**
4.935	**37.4**	**33.2**	**4.6**	**29.5**	**45.7**	**54**	**H**	**Average Detector**
7.401	37.6	36.1	5.8	34.2	45.3	109	H	**Avg. Det. Noise Floor**
9.869	38.1	37.6	6.9	33.3	49.3	109	H	Avg. Det. Noise Floor

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Test Data - Radiated Emissions (PEAK/AVERAGE) (Continued):

Microwave Radiated Emissions Data
Continuation Page

Complete X Preliminary ___ Page 2 of 2

Client: Andrew Corporation Test #: MW-2 W.O.#: 9L0022R

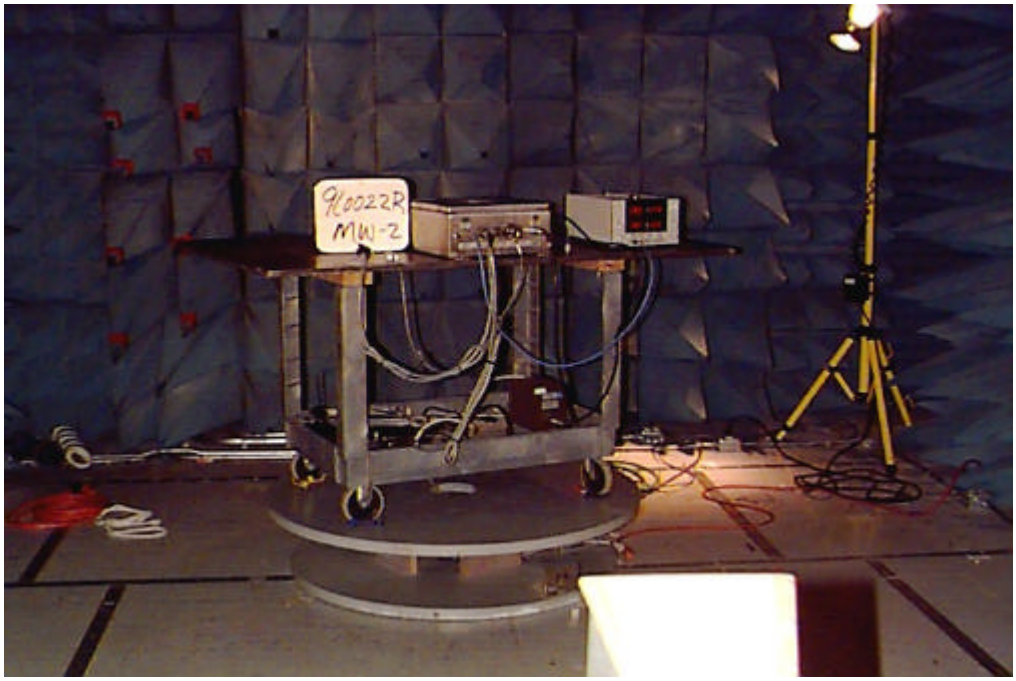
EUT: 2400 Mobile Transceiver S/N: None Photo ID: 9L0022R MW-2

Technician: Ron Gaytan Specification: CFR 47 Part 15.247 Lab: ANC1 Date: 8/13/99

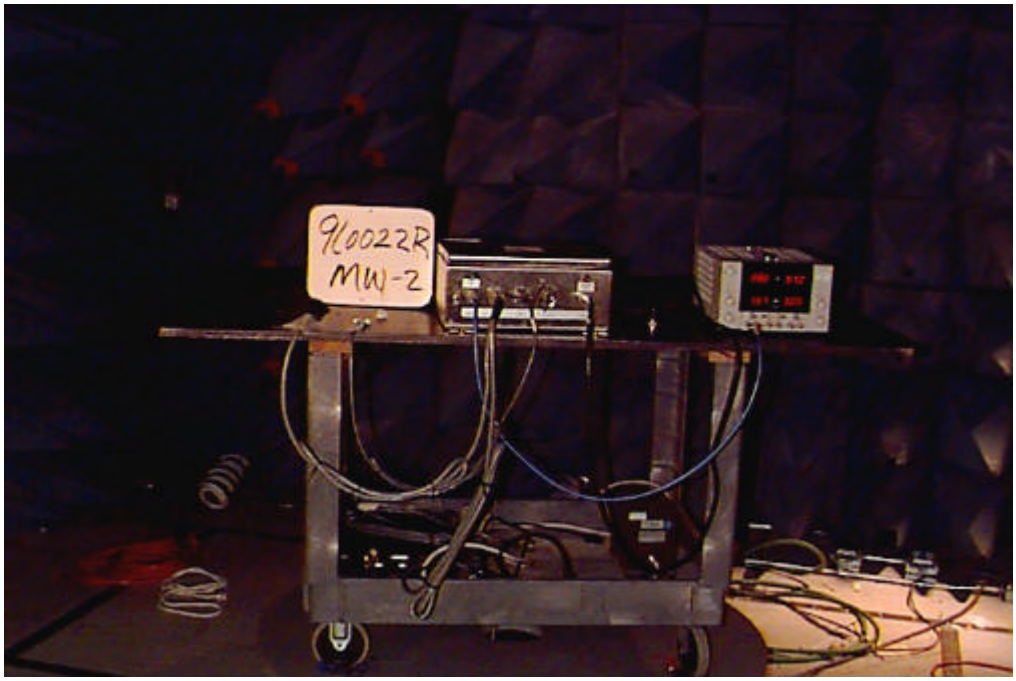
Freq. (GHz)	Meter Reading (dBm)	Antenna Factor (dB)	Cable Loss (dB)	RF Gain (dB)	Corrected Reading (dBuV/m)	Spec. Limit (dBuV/m)	Pol.	Comments:
12.336	37.3	39	8.0	32.8	51.5	54	H	Avg. Det. Noise Floor
								KTL # 677
12.336	**5**	**39**	**8.0**	**32.8**	**19.2**	**54**	**H**	**Avg. Det. Noise Floor**
14.803	39.3	42.0	8.7	30.7	59.3	109	H	Avg. Det. Noise Floor
17.27	39.3	44.2	9.6	31.3	61.8	109	H	Avg. Det. Noise Floor
								Scanned 1 GHz to 25 GHz

Radiated Photographs (Worst Case Configuration):

FRONT VIEW:



FRONT VIEW:



Test Data - Microwave Radiated Emissions (MW-2):

Microwave Radiated Emissions Data

Complete___ Preliminary X Page 1 of 1

Client: Andrew Corporation Test #: MW-2 W.O.#: 9L0025R

EUT: 385700-4000-001 S/N: None Photo ID: 9L0025R

Technician: Ron Gaytan Specification: CFR 47 Part 15.247 Lab: D OATS Date: 10/26/99

Equipment Used: 677-G2016-CF31-EM2200

Configuration: TX MAX POWER

Bandwidth: 1 MHz Video Bandwidth: 1 MHz Antenna Distance 3 m Detector:

Climatic Conditions:
Temperature: 19 C
Relative Humidity: 42 %
Atmospheric Pressure: 998 mbar

EUT Power: X 115 V.A.C. X 60 Hz X Peak
__ 208 V.A.C. ___ 50 Hz ___ Average
__ 230 V.A.C.
__ Other ___ 1 Phase ___ 3 Phase

Freq. (MHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	RF Gain (dB)	Conver. Factor	Corrected Reading (dBuV/m)	Spec. limit (dBuv/m)	Pol.	Comments:
2.421	51	27.6	3.1	0	0	81.7	N/A	V	
4.805	11.4	34	4.6	0	0	50	54	V	
4.835	19	34	4.6	0	0	57.6	54	V	
4.835	8	34	4.6	0	0	46.6	54	V	Average Det.
7.248	7	37.2	5.7	0	0	49.9	67.7	V	Avg Det. N.F
12.08	4	39.6	8.0	33.5	0	18.1	54	V	Avg Det. N.F
2.421	62	27.6	3.1	0	0	92.7	N/A	H	
4.805	11.4	34	4.6	0	0	50	54	H	
4.835	13	34	4.6	0	0	51.6	54	H	
4.835	2	34	4.6	0	0	40.6	54	H	Average Det.
7.248	7	37.2	5.7	0	0	49.9	67.7	H	Avg Det. N.F
12.08	4	39.6	8.0	33.5	0	18.1	54	H	Avg Det. N.F
									Scanned 1-18 GHz

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Microwave Radiated Emissions Photographs:

SIDE VIEW:

SIDE VIEW:

Test Data - Microwave Radiated Emissions (MW-3):

Microwave Radiated Emissions Data

Complete X Preliminary ___ Page 1 of 1

Client: Andrew Corporation Test #: MW-3 W.O.#: 9L0024R

EUT: 385700-4000-001 S/N: None Photo ID: 9L0024R MW-3

Technician: Ron Gaytan Specification: CFR 47 Part 15.247 Lab: A OATS Date: 10/27/99

Equipment Used: 677-2023-CF31

Configuration: Tx Max Power (Low Channel)

Bandwidth: 1 MHz Video Bandwidth: 1 MHz Antenna Distance 3 m Detector:

Climatic Conditions:
Temperature: 22 C
Relative Humidity: 42 %
Atmospheric Pressure: 998 mbar

EUT Power: X 115 V.A.C. X 60 Hz X Peak
___ 208 V.A.C. ___ 50 Hz ___ Average
___ 230 V.A.C.
___ Other _____ ___ 1 Phase ___ 3 Phase

Freq. (GHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	RF Gain (dB)	Conver. Factor	Corrected Reading (dBuV/m)	Spec. Limit (dBuV/m)	Pol.	Comments:
2.421	84	27.6	3.1	0	0	115	N/A	V	Fundamental
4.835	16	34	4.6	0	0	54.6	54	V	
4.835	4	34	4.6	0	0	42.6	54	V	Average Det.
7.248	7	37.2	5.7	0	0	49.9	67.7	V	Avg Det. N.F
12.08	4	39.6	8.0	0	0	51.6	54.0	V	Avg Det. N.F
2.421	104	27.6	3.1	0	0	135	N/A	H	Fundamental
4.835	16	34	4.6	0	0	54.6	54	H	
4.835	2	34	4.6	0	0	40.6	54	H	Average Det.
7.248	7	37.2	5.7	0	0	49.9	67.7	H	Avg Det. N.F
12.08	4	39.6	8.0	0	0	51.6	54.0	H	Avg Det. N.F
									Scanned 1-18 GHz

Microwave Radiated Emissions Photographs:

FRONT VIEW:

SIDE VIEW:

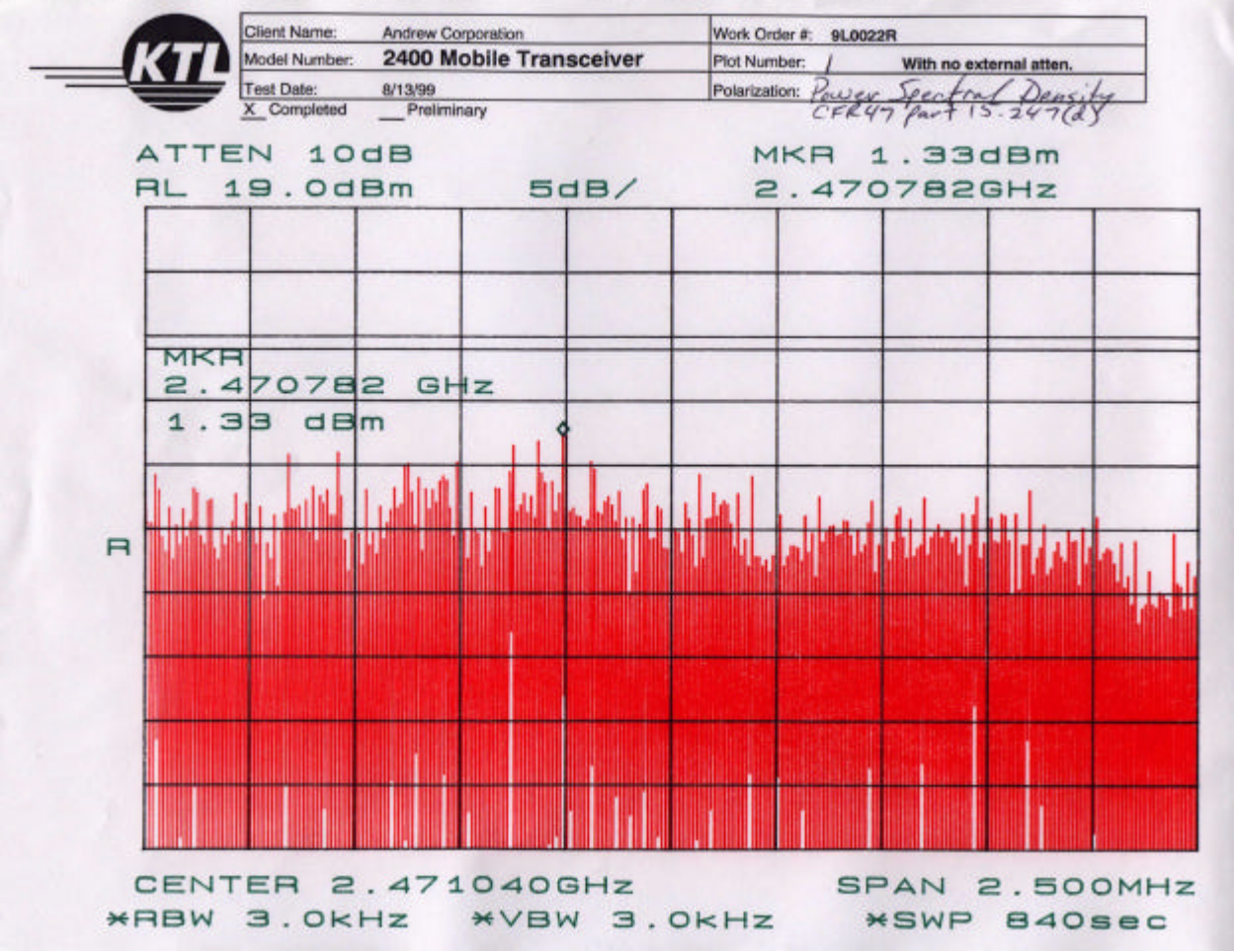
Section 8. Transmitter Power Density

NAME OF TEST: Transmitter Power Density	PARA. NO.: 15.247(d)
TESTED BY: Ron Gaytan Tom Tidwell / Debbie Jensen	DATE: 8/13/99, 10/26/99

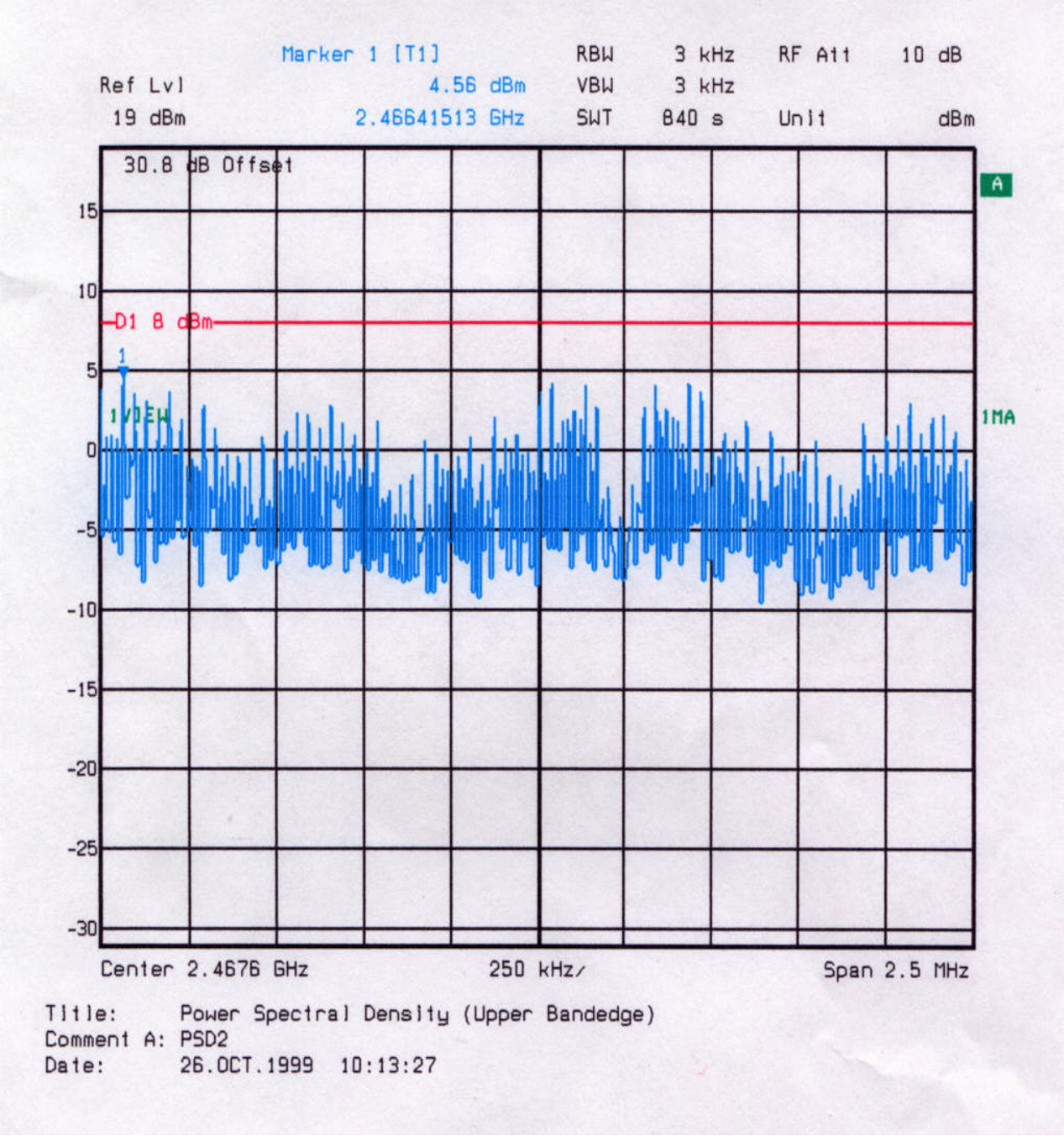
Test Results: Complies.

Measurement Data: See attached graphs.

Power Spectral Density Data:



Base Station:



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.

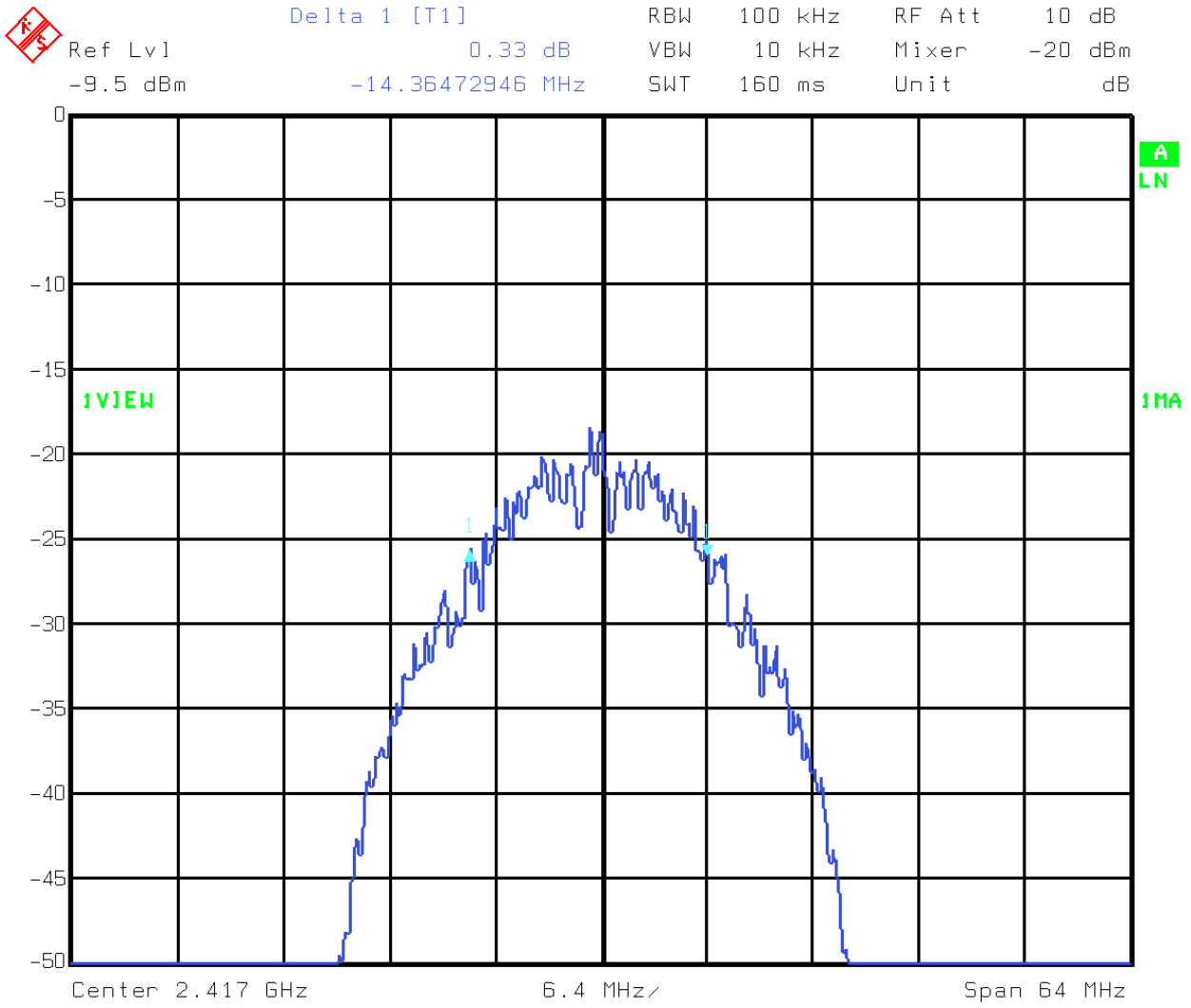
Measurement Data: See attached data.

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.

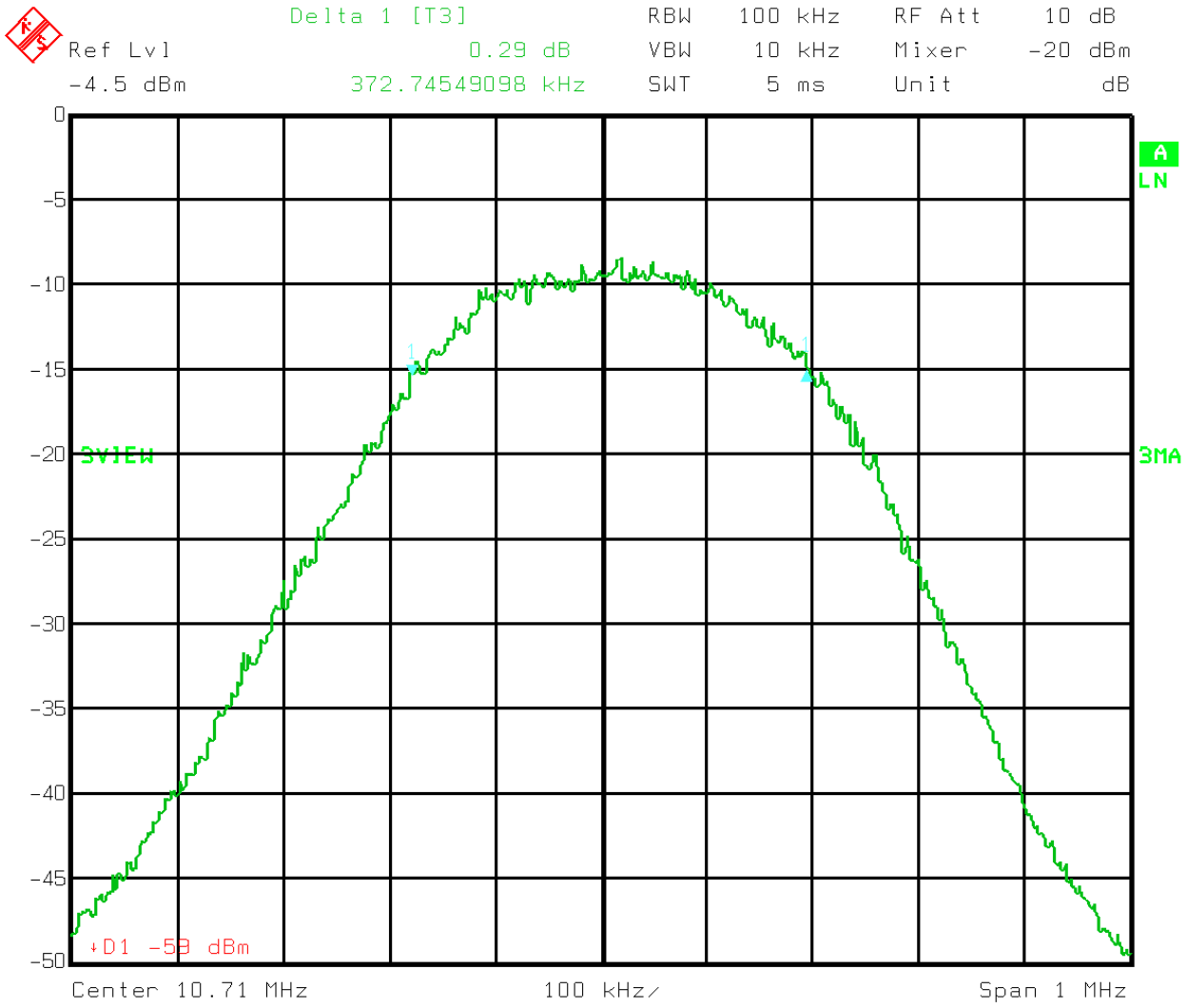
Gp=10 Log(RF bandwidth/De-correlated BW)
Gp=10 Log(14.36/.373)
Gp=15.85 dB

Processing Gain Data (Base RF Out):



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

Processing Gain Data (Mobile IF):



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

Section 10. Test Equipment List

KTL ID	Description	Manufacturer Model Number	Serial Number	Calibration Date
CF31	Cable, 7.6m	KTL Semi-Flex, Storm	N/A	01/29/99
677	RECEIVER, 1-18 GHz	ELECTRO METRICS EMC 50	185	08/26/98
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
G2626	SPECTRUM ANALYZER	HEWLETT PACKARD 8566B	2618A02843	04/21/99
	Anchoic Chamber #1			

Calibration interval 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 measurement equipment is subjected to in-service checks prior to use. TKL shall notify clients promptly, in writing, of identification of defective measuring equipment that casts doubt on the validity of results in this report.

LEGEND:

CNR CALIBRATION NOT REQUIRED
N/A NOT APPLICABLE
CBU CALIBRATED BEFORE USE

ANNEX A

TEST METHODOLOGIES

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 250µV (48 dBµV) across 50 ohms.

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

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

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

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

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

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:

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

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

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

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

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

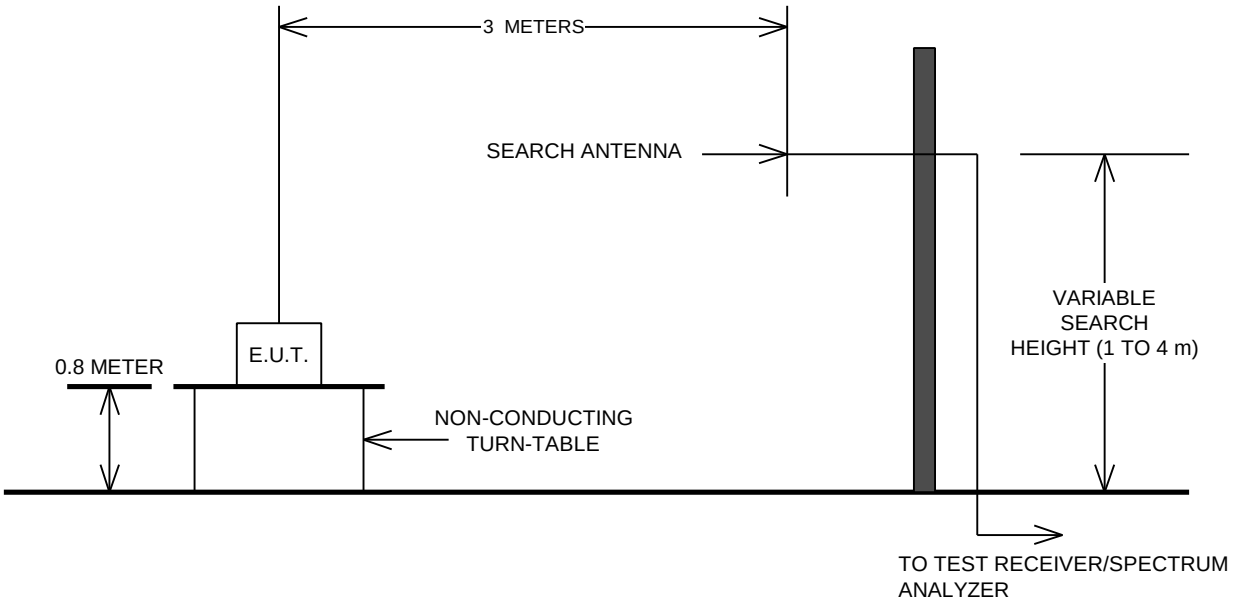
Therefore $G_p = Mj + (S/N)_{out} + L_{sys}$

Measurement performed at 915 MHz.

ANNEX B

BLOCK DIAGRAMS

Test Site For Radiated Emissions

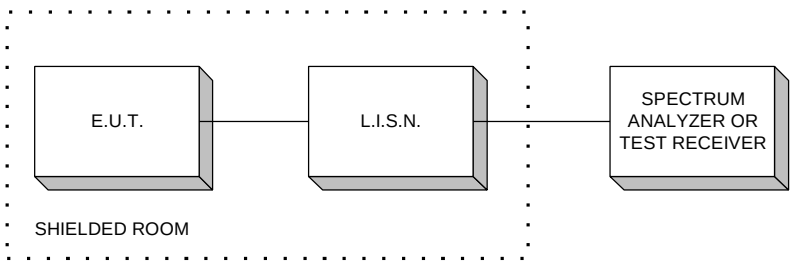


Below 1 GHz
Peak detector.
RBW = 100 kHz

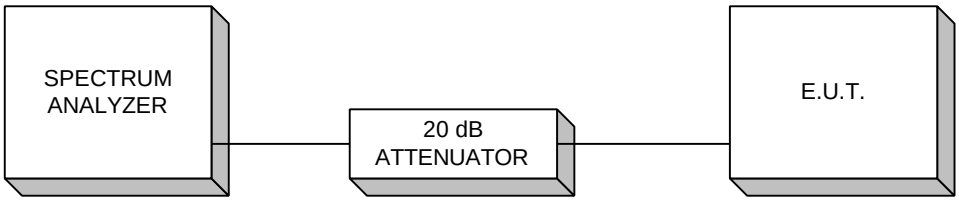
Above 1 GHz For Peak Emission Levels
Peak detector
RBW = 1 MHz
VBW = >RBW

Above 1 GHz For Average Emission Levels
Peak detector
RBW = 1 MHz
VBW = 10 Hz

Conducted Emissions

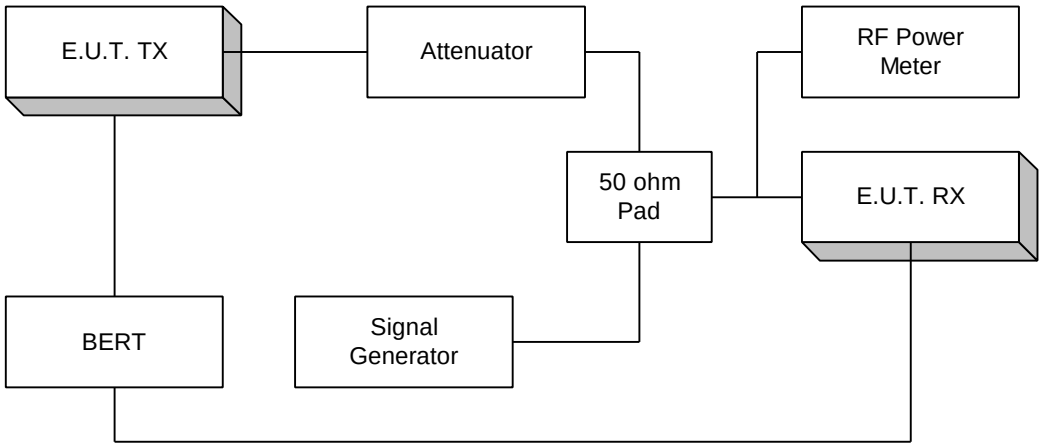


Transmitter Power Density & Peak Power At Antenna Terminals



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.