

Nemko Test Report: 1L0486RUS1

Applicant: Enfora
661 East 18th Street
Plano, TX 75074-5601

Equipment Under Test: Alpine GPRS 919

In Accordance With: **FCC Part 24, Subpart E**
Broadband PCS Subscriber Station

Tested By: Nemko Dallas Inc.
802 N. Kealy
Lewisville, TX
75057-3136

Authorized By:



Tom Tidwell, RF Group Manager

Date: 10/25/01

Total Number of Pages: 35

EQUIPMENT: **Alpine GPRS 919** PROJECT NO.: **1L0486RUS1**

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EQUIPMENT: **Alpine GPRS 919** **PROJECT NO.:** **1L0486RUS1**

Section 1. Summary of Test Results

Manufacturer: Enfora

Model No.: Alpine GPRS 919

Serial No.: 1

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 24, Subpart E.



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

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This report applies only to the items tested.

EQUIPMENT: **Alpine GPRS 919** **PROJECT NO.:** **1L0486RUS1**

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	RESULT
RF Power Output	24.232	100W	Complies
Occupied Bandwidth (GPRS)	24.238	Not Specified	Included for information
Spurious Emissions at Antenna Terminals	24.238(a)	-13 dBm	Complies
Field Strength of Spurious Emissions	24.238(a)	-13 dBm E.I.R.P.	Complies
Frequency Stability	24.235	± 0.05 ppm	Complies

EQUIPMENT: **Alpine GPRS 919** **PROJECT NO.:** **1L0486RUS1**

Section 2. General Equipment Specification

Supply Voltage Input:	3.3 - 5 Vdc
Frequency Bands:	☒ Block A : 1850 – 1865 MHz ☒ Block B : 1865 – 1870 MHz ☒ Block C : 1870 – 1885 MHz ☒ Block D : 1885 – 1890 MHz ☒ Block E : 1890 – 1895 MHz ☒ Block F : 1895 – 1910 MHz
Type of Modulation and Designator:	GPRS 200K0G7W ☒
Output Impedance:	50 ohms
RF Output (Rated):	1 Watt

*EQUIPMENT:***Alpine GPRS 919**PROJECT NO.: **1L0486RUS1**

System Description

The GSM communication system, in general, is standardized to operate in multiple bands, primarily, the 900 MHz band which is assigned PGSM, EGSM, RGSM for short, 1800 MHz band which is assigned DCS and the 1900 MHz band which is assigned PCS. Both the GSM and DCS band are used globally for mobile voice communication. The PCS 1900 is used in North, Central and South America. The GSM 900 band is disabled for these markets.

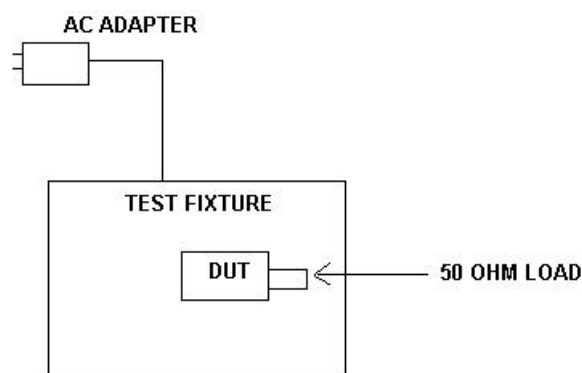
Although the GSM digital voice standard has existed for well over a decade, it wasn't until recently that the demand for wireless data capability has increased. GPRS is a protocol within the GSM standard, which was developed to address the need for data only transmission. Although the GSM voice protocol does support data transmission, it is limited in data rate due to overhead within the voice protocol. What the GPRS allows is a faster data rate that is adaptive as well as being packet based.

The Enabler transceiver design is based on a proprietary chip set that complements size, cost and power consumption. Enabler-G919 is a dual band EGSM 900 MHz and PCS 1900 MHz design in a 1.7" x 2.7" x 0.2" housing. It communicates via an RF antenna port and a multiple pin digital connector. The RF and digital processors are design to operate at 3.8V. The band is selected at the front end via a high power RF Switch. This signal is then prefiltered to remove large out-of-band signals from compressing the LNA. It is then filtered again to prevent the down converter from converting unwanted signal into the IF band. An IF filter is used to set the channel BW to about 200 KHz. This high selectivity IF filter will allow the Enabler to operate through a high dynamic range. The AGC amplifier in conjunction with the DSP chip will automatically adjust the gain to maintain a constant baseband signal. The I&Q demodulator converts the RF signal into 2 baseband signals called Rx I & Q. This prefiltered I&Q signal is sent to the DSP processor where it is digitized for signal processing.

On the transmit section, the post filtered I & Q baseband signal is connected to the I&Q modulator. Using an open loop PLL, the dual band transmit VCO is modulated directly using the charge pump from the modulator section. The advantage of such methodology is an improved carrier and sideband suppression. The modulated RF signal is injected into the power amplifier where it is amplified to its respective level. An RF power detector circuit is used to control the RF level at the antenna port.

The primary function of the Enabler SDK is to allow the module to communicate with external peripherals. It provides pre-voltage regulation, serial interface and mechanical support for the Enabler module. It also allows probing and monitoring of digital signal traffic in and out of the Enabler module.

System Diagram



EQUIPMENT: **Alpine GPRS 919** **PROJECT NO.:** **1L0486RUS1**

Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.1046
TESTED BY: David LightTom Tidwell & Debbie Jensen	DATE:10/12/2001

Test Results: Complies.**Measurement Data:**

Modulation Type	Channel	Output Power (dBm)	Output Power (W)
GPRS	662	29.6	0.912
GPRS	512	29.4	0.871
GPRS	810	29.3	0.851

EQUIPMENT: **Alpine GPRS 919** PROJECT NO.: **1L0486RUS1**

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth (GPRS)	PARA. NO.: 2.1047
TESTED BY: David LightTom Tidwell & Debbie Jensen	DATE:10/12/2001

Test Results: Complies.

Test Data: See attached plots.

EQUIPMENT:

Alpine GPRS 919

PROJECT NO.: 1L0486RUS1

Test Data – Occupied Bandwidth



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Data Plot

Occupied Bandwidth

Page 1 of 3

Job No.: 1L0486R Date: 10/12/2001

Specification: PART 24 Temperature(°C): 22

Tested By: David Light Relative Humidity(%) 45

E.U.T.: ALPINE GPRS 919

Configuration: TRANSMIT - OPERATING IN TEST FIXTURE

Sample Number: 1

Location: Lab 1 RBW: Refer to plots

Detector Type: Peak VBW: Refer to plots

Complete X
Preliminary _____

Test Equipment Used

Antenna: _____ Directional Coupler: _____

Pre-Amp: _____ Cable #1: 1627

Filter: _____ Cable #2: _____

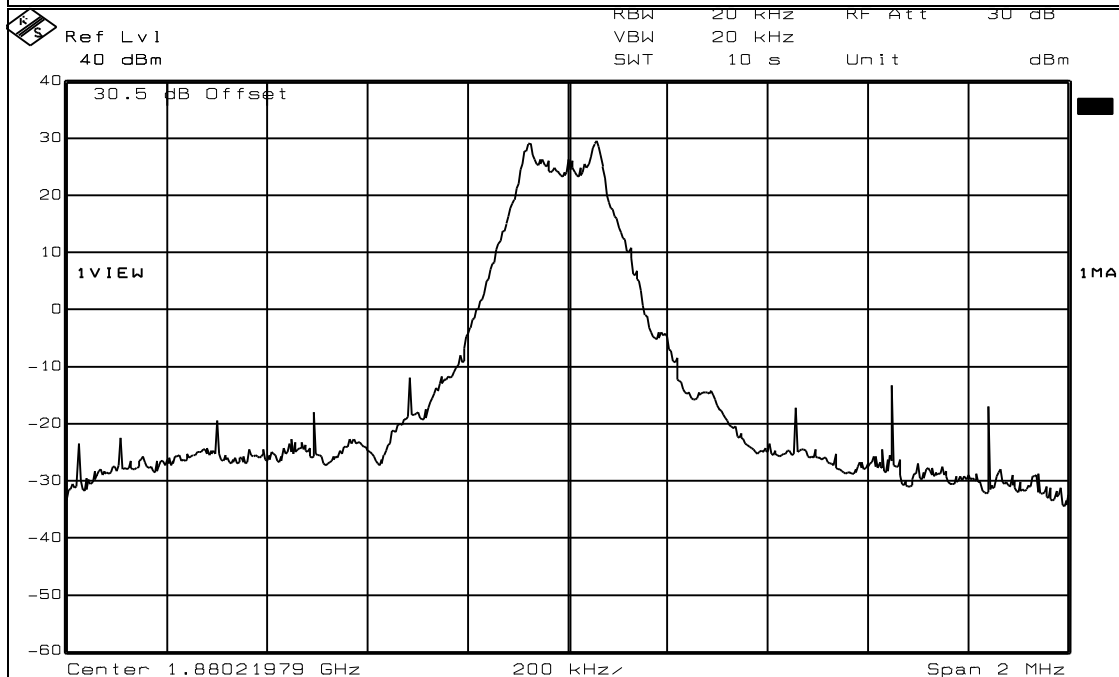
Receiver: 1036 Cable #3: _____

Attenuator #1: 1470 Cable #4: _____

Attenuator #2: 1478 Mixer: _____

Additional equipment used: _____

Measurement Uncertainty: +/-3.6 dB



Date: 12.OCT.2001 12:52:36

Notes: CHANNEL 662

EQUIPMENT:

Alpine GPRS 919

PROJECT NO.: 1L0486RUS1

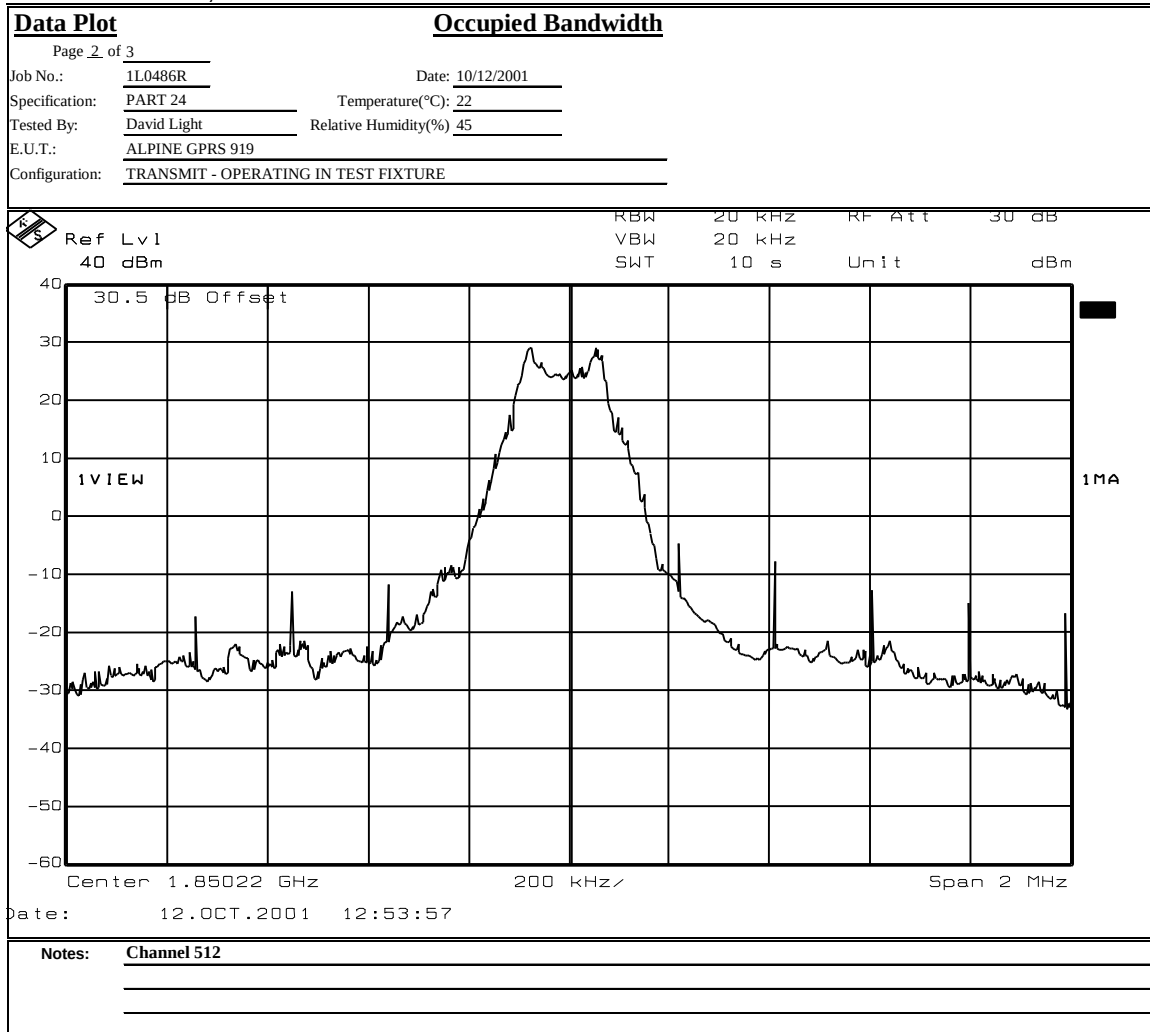
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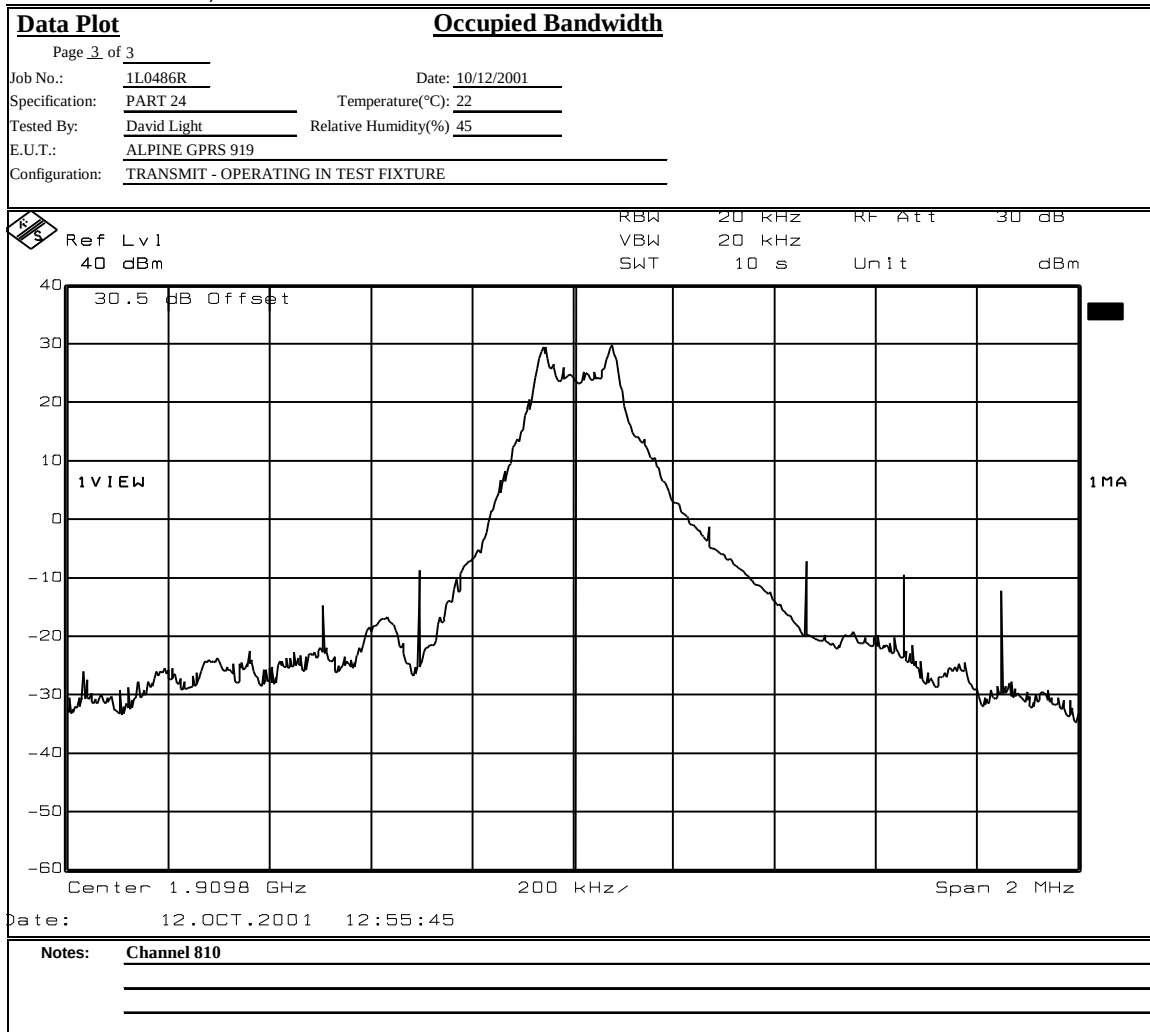
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EQUIPMENT: **Alpine GPRS 919** **PROJECT NO.:** **1L0486RUS1**

Test Data – Occupied Bandwidth

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EQUIPMENT: **Alpine GPRS 919** PROJECT NO.: **1L0486RUS1**

Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.1051
TESTED BY: David LightTom Tidwell & Debbie Jensen	DATE:10/12/2001

Test Results: Complies.

Test Data: See attached plots

EQUIPMENT:

Alpine GPRS 919

PROJECT NO.: 1L0486RUS1

Test Data – Spurious Emissions at Antenna Terminals



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Data Plot

Page 1 of 2

Job No.: 1L0486R

Date: 10/12/2001

Specification: PART 24

Temperature(°C): 22

Tested By: David Light

Relative Humidity(%) 45

E.U.T.: ALPINE GPRS 919

Configuration: TRANSMIT - OPERATING IN TEST FIXTURE

Sample Number: 1

Location: Lab 1

RBW: Refer to plots

Detector Type: Peak

VBW: Refer to plots

Complete X

Preliminary

Test Equipment Used

Antenna:

Directional Coupler:

Pre-Amp:

Cable #1: 1627

Filter:

Cable #2:

Receiver: 1036

Cable #3:

Attenuator #1: 1470

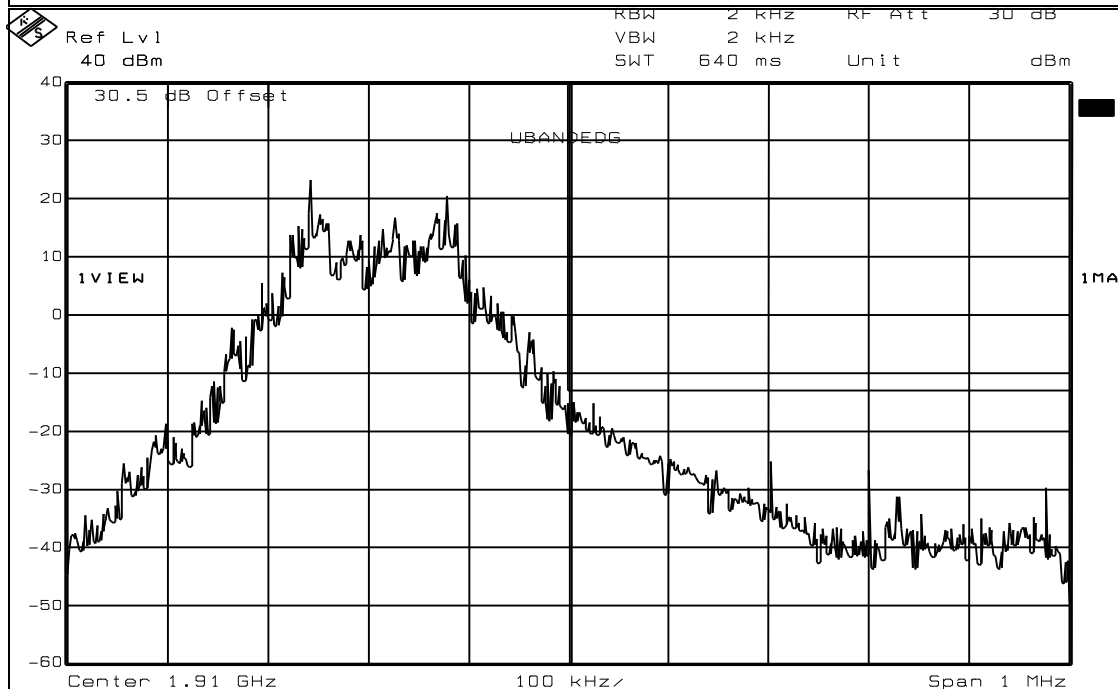
Cable #4:

Attenuator #2: 1478

Mixer:

Additional equipment used:

Measurement Uncertainty: +/-3.6 dB



Date: 12.OCT.2001 13:00:03

Notes: Channel 810

EQUIPMENT:

Alpine GPRS 919

PROJECT NO.: 1L0486RUS1

Test Data – Spurious Emissions at Antenna Terminals



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Data Plot

Page 2 of 2

Job No.: 1L0486R Date: 10/12/2001
Specification: PART 24 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 45
E.U.T.: ALPINE GPRS 919
Configuration: TRANSMIT - OPERATING IN TEST FIXTURE

Bandedges



Date: 12.OCT.2001 13:02:00

Notes:

EQUIPMENT:

Alpine GPRS 919

PROJECT NO.: 1L0486RUS1

Test Data – Spurious Emissions at Antenna Terminals



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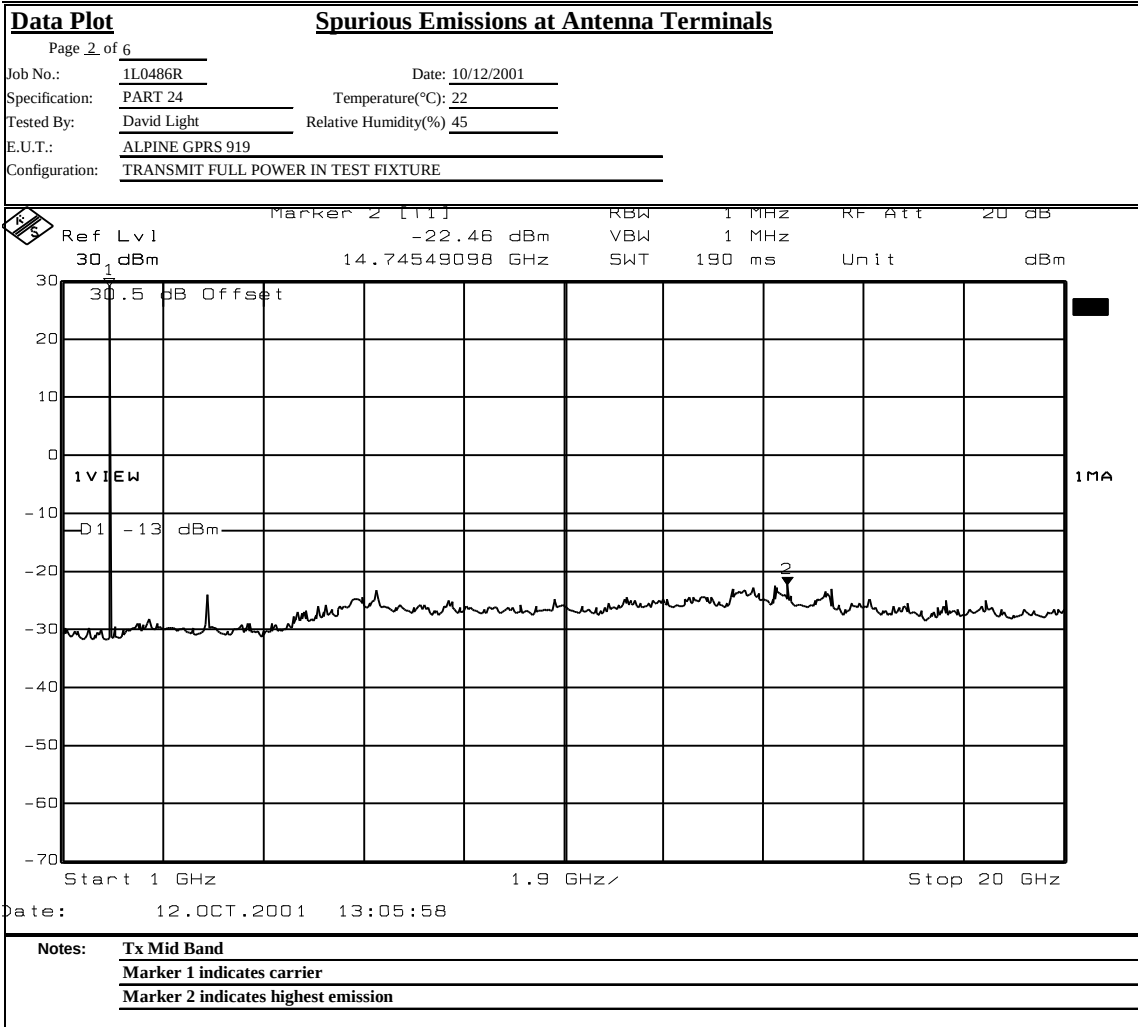
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Data Plot		Spurious Emissions at Antenna Terminals																						
Page 1 of 6		Complete <u>X</u> Preliminary _____																						
Job No.: 1L0486R	Date: 10/12/2001																							
Specification: PART 24	Temperature(°C): 22																							
Tested By: David Light	Relative Humidity(%) 45																							
E.U.T.: ALPINE GPRS 919																								
Configuration: TRANSMIT FULL POWER IN TEST FIXTURE																								
Sample Number: 1																								
Location: Lab 1	RBW: Refer to plots																							
Detector Type: Peak	VBW: Refer to plots																							
Test Equipment Used																								
Antenna: _____	Directional Coupler: _____																							
Pre-Amp: _____	Cable #1: 1627																							
Filter: _____	Cable #2: _____																							
Receiver: 1036	Cable #3: _____																							
Attenuator #1: 1470	Cable #4: _____																							
Attenuator #2: 1478	Mixer: _____																							
Additional equipment used: _____																								
Measurement Uncertainty: +/-3.6 dB																								
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Ref</th> <th>Lvl</th> <th>Marker 1 [11]</th> <th>RBW</th> <th>100 kHz</th> <th>RF Att</th> <th>30 dB</th> </tr> </thead> <tbody> <tr> <td>40</td> <td>dBm</td> <td>-28.31 dBm</td> <td>VBW</td> <td>100 kHz</td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td>840.60120240 MHz</td> <td>SWT</td> <td>245 ms</td> <td>Unit</td> <td>dBm</td> </tr> </tbody> </table>				Ref	Lvl	Marker 1 [11]	RBW	100 kHz	RF Att	30 dB	40	dBm	-28.31 dBm	VBW	100 kHz					840.60120240 MHz	SWT	245 ms	Unit	dBm
Ref	Lvl	Marker 1 [11]	RBW	100 kHz	RF Att	30 dB																		
40	dBm	-28.31 dBm	VBW	100 kHz																				
		840.60120240 MHz	SWT	245 ms	Unit	dBm																		
Date: 12.OCT.2001 13:04:31																								
Notes: Tx Mid Band																								

EQUIPMENT: **Alpine GPRS 919** **PROJECT NO.:** **1L0486RUS1**

Test Data – Spurious Emissions at Antenna Terminals

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EQUIPMENT:

Alpine GPRS 919

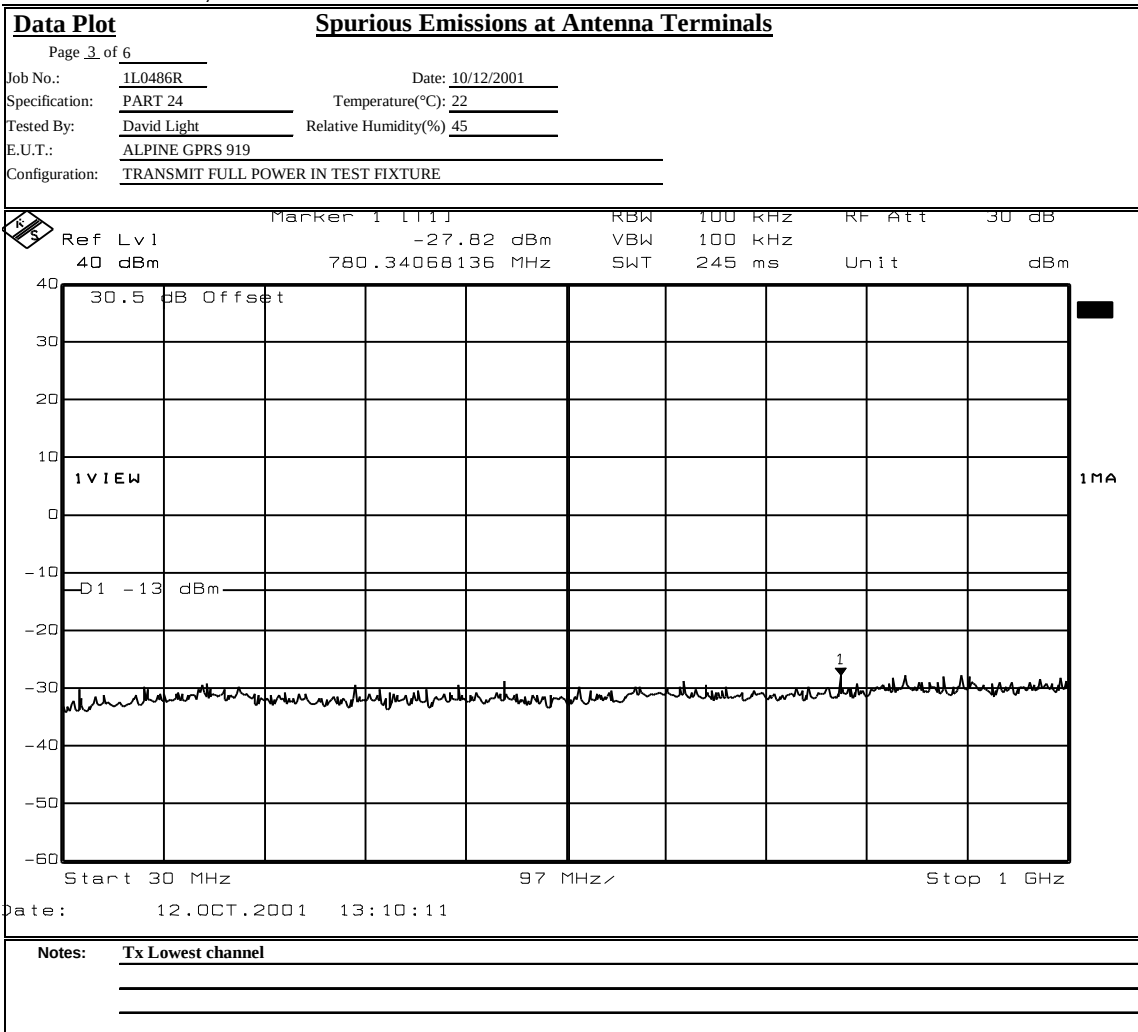
PROJECT NO.: 1L0486RUS1

Test Data – Spurious Emissions at Antenna Terminals



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EQUIPMENT:

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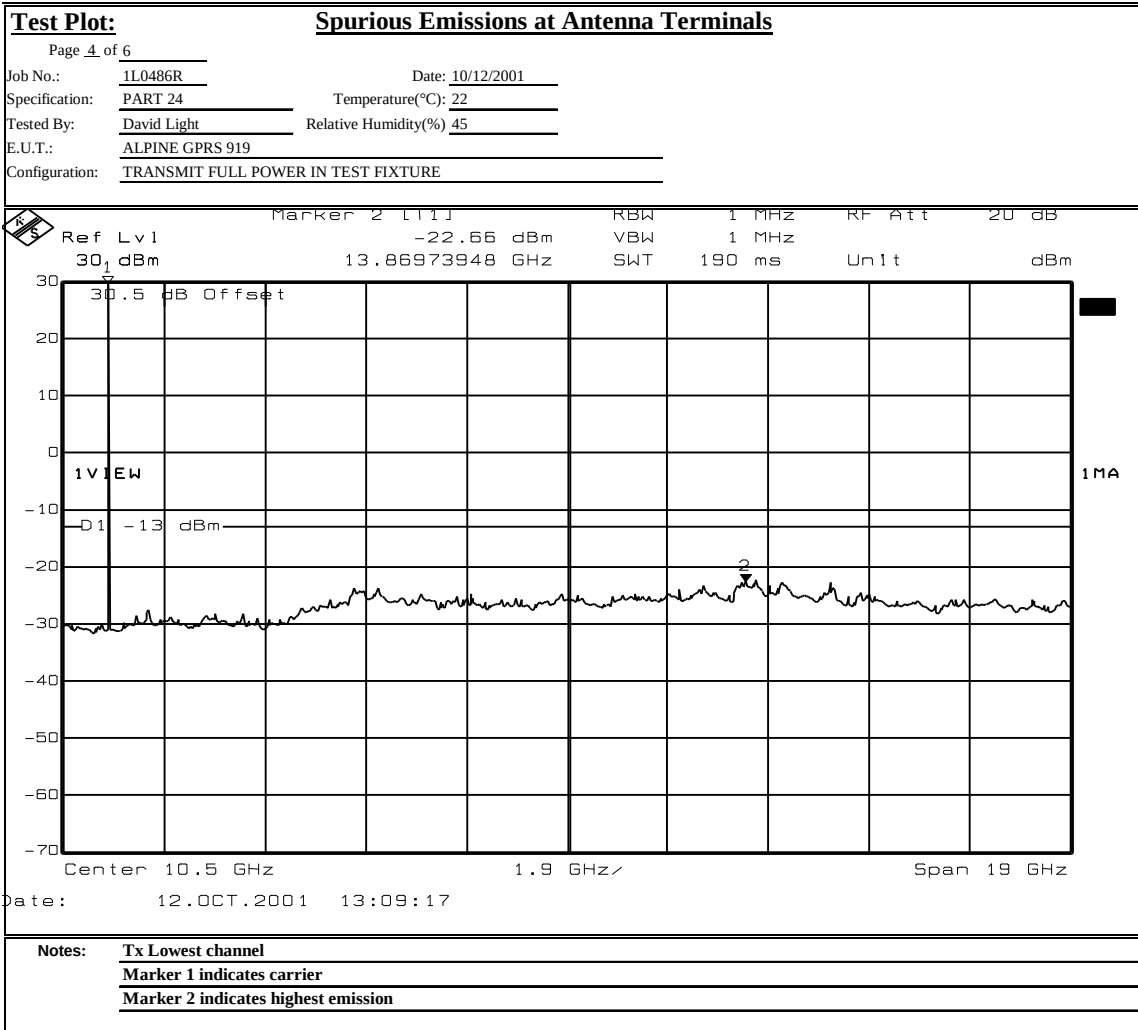
PROJECT NO.: 1L0486RUS1

Test Data – Spurious Emissions at Antenna Terminals



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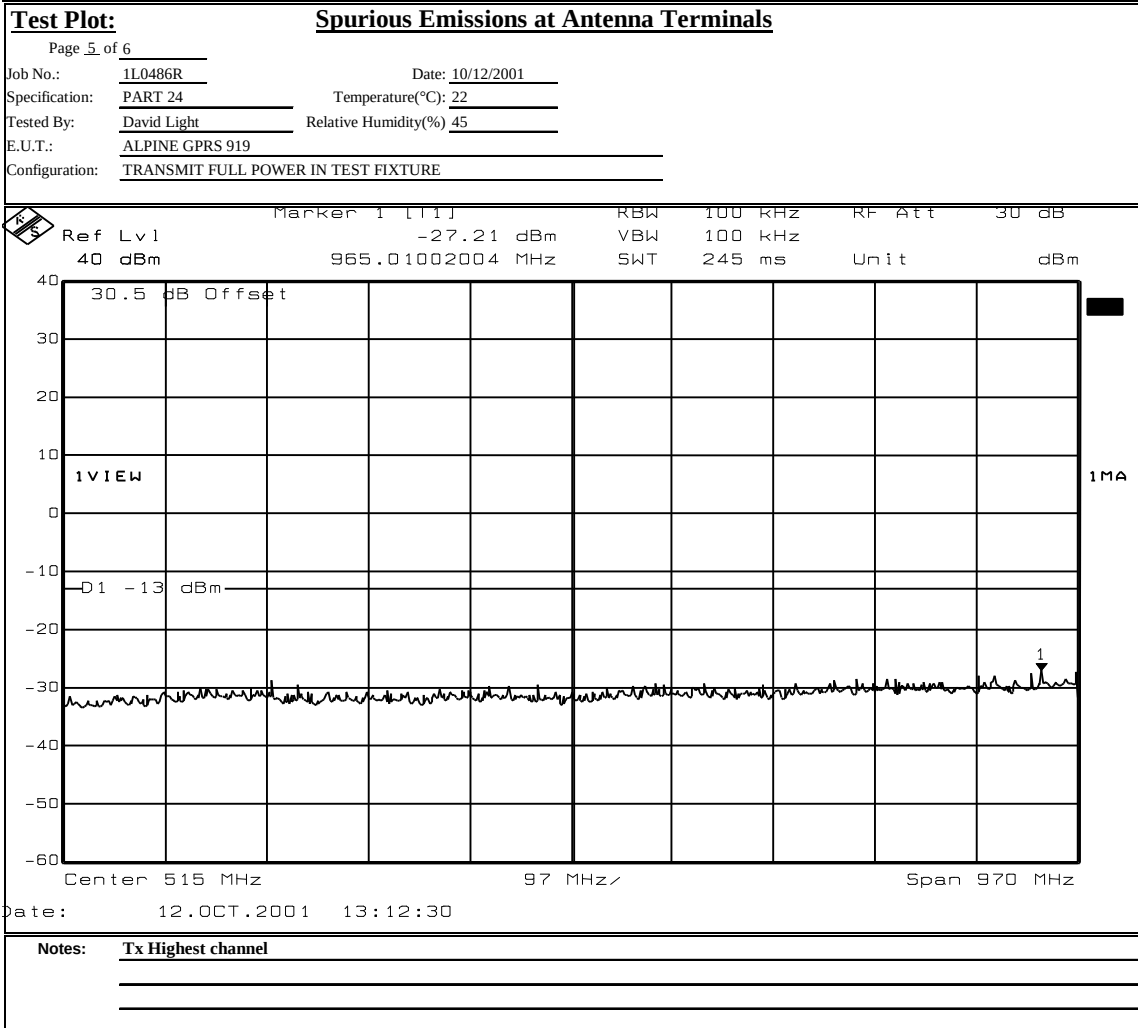
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EQUIPMENT: **Alpine GPRS 919** **PROJECT NO.:** **1L0486RUS1**

Test Data – Spurious Emissions at Antenna Terminals

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EQUIPMENT:

Alpine GPRS 919

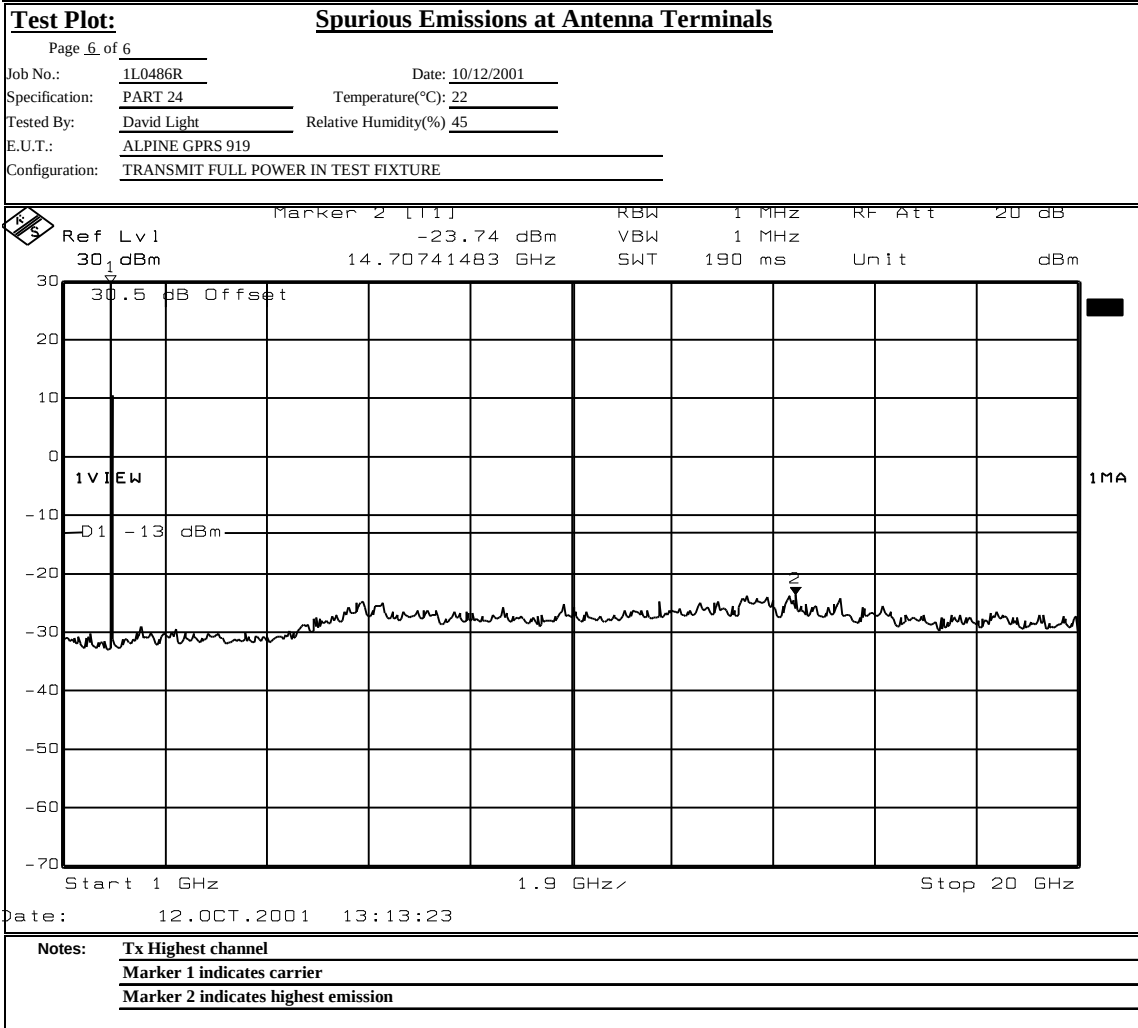
PROJECT NO.: 1L0486RUS1

Test Data – Spurious Emissions at Antenna Terminals



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EQUIPMENT: **Alpine GPRS 919** PROJECT NO.: **1L0486RUS1**

Section 6. Field Strength of Spurious

NAME OF TEST: Field Strength of Spurious	PARA. NO.: 2.1053
TESTED BY: David LightTom Tidwell & Debbie Jensen	DATE:10/12/2001

Test Results: Complies.

Test Data: See attached table.

EQUIPMENT:

Alpine GPRS 919

PROJECT NO.: 1L0486RUS1

Test Data - Radiated Emissions



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Field Strength of Spurious Emissions

Page 1 of 1

Job No.: 1L0486R Date: 10/12/2001 Complete _____
 Specification: Part 24 Temperature(°C): 22 Preliminary X
 Tested By: Tom Tidwell Relative Humidity(%) 45
 E.U.T.: ALPINE GPRS 919
 Configuration: transmit full power in test fixture
 Sample No: 1
 Location: AC 3 RBW: 1 MHz Measurement
 Detector Type: Peak VBW: 1 MHz Distance: 3 m

Test Equipment Used

Antenna: _____ Directional Coupler: _____
 Pre-Amp: _____ Cable #1: 1484
 Filter: 1481 Cable #2: 1485
 Receiver: 1464 Cable #3: _____
 Attenuator #1: _____ Cable #4: _____
 Attenuator #2: _____ Mixer: _____
 Additional equipment used: _____
 Measurement Uncertainty: +/-3.6 dB

Frequency (MHz)	Meter Reading (dBm)	Correction Factor (dB)		Pre-Amp Gain (dB)	Substitution Antenna Gain (dBd)		ERP (dBm)	ERP (mW)	Polarity	Comments
3760	-40.0	34.3		33.7	8.0		-31.4	0.000729	H	S/N 1
5640	-56.3	36.0		33.5	9.1		-44.7	0.000034	H	
7521	-55.7	39.8		33	9.4		-39.5	0.000113	H	
9400	-56.8	41.4		35.7	10.1		-41.1	0.000078	H	
11280	-65.0	44.4		35.8	11.1		-45.3	0.000029	H	
3760	-31.5	40.4		33.7	8.0		-16.8	0.020797	V	
5640	-50.5	38.5		33.5	9.1		-36.4	0.000227	V	
7521	-49.3	40.4		33	9.4		-32.4	0.000570	V	
9400	-49.5	39.3		35.7	10.1		-35.9	0.000258	V	
11280	-56.5	42.0		35.8	11.1		-39.3	0.000119	V	

Notes: Scanned to the 10th Harmonic of carrier

EQUIPMENT: **Alpine GPRS 919** PROJECT NO.: **1L0486RUS1**

Photographs of Test Setup

FRONT VIEW



REAR VIEW



EQUIPMENT: **Alpine GPRS 919** **PROJECT NO.:** **1L0486RUS1**

Section 7. Frequency Stability**NAME OF TEST:** Frequency Stability **PARA. NO.:** 24.235**TESTED BY:** Tom Tidwell & Debbie Jensen **DATE:****Test Results:** Complies.**Measurement Data:** Standard Test Frequency: 1880.131 MHz
Standard Test Voltage: 115 VAC**Frequency Stability**Client: ENFORAW.O.# 1L0486REUT: ALPINE GPRS 919S/N: 1Date: 10/15/2001Tech: LIGHT

Test Equipment used: 1026-283

Temperature	Voltage	Frequency Error (Hz)
20 °C	115 VAC	0
20 °C	98 VAC	+10
20 °C	132 VAC	+12
10 °C	115 VAC	+233
0 °C	115 VAC	+544
-10 °C	115 VAC	+642
-20 °C	115 VAC	+426
-30 °C	115 VAC	N/A
30 °C	115 VAC	+33
40 °C	115 VAC	+486
50 °C	115 VAC	-560

EQUIPMENT: **Alpine GPRS 919** **PROJECT NO.:** **1L0486RUS1**

Section 8. Test Equipment List

ASSET	Description	Manufacturer Model Number	Serial Number	Cal. Date	Cal. Due
1029	PEAK POWER METER	HP 8900D	3303U0012	03/12/01	03/12/02
1030	PEAK POWER SENSOR	HP 84811A	2539A03573	03/12/01	03/12/02
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	09/17/01	09/18/03
1470	10 db Attenuator DC 18 Ghz	MCL Inc. BW-S10W2 10db-2WDC	NONE	CBU	N/A
1478	20db Attenuator DC 18 Ghz	MCL Inc. BW-S20W6	NONE	CBU	N/A
1627	CABLE, 5 ft	MEGAPHASE 10312 1GVT4	N/A	CBU	N/A
1481	Microwave Highpass Filter	K & L 3DH1-2000/T8000-0/0	4	Cal B4 Use	N/A
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/02/01	01/02/02
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	06/01/01	06/01/02
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	06/01/01	06/01/02
993	Horn antenna	A.H. Systems SAS-200/571	XXX	07/16/99	10/15/01
1026	FREQUENCY COUNTER	HEWLETT PACKARD 5350B	8232A01493	08/14/01	08/14/02
283	ENVIROMENTAL CHAMBER	ENVIROTRONICS SH27	129010083	05/02/01	05/02/02

EQUIPMENT:

Alpine GPRS 919

PROJECT NO.: **1L0486RUS1**

Annex A - Test Methodologies

EQUIPMENT: **Alpine GPRS 919** **PROJECT NO.:** **1L0486RUS1**

NAME OF TEST: RF Power Output**PARA. NO.: 2.985**

Minimum Standard: Para. No.24.232. Base stations are limited to 1640 watts peak E.I.R.P. with an antenna height up to 300 meters HAAT. In no case may the peak output power of a base station transmitter exceed 100 watts.

Method Of Measurement: CDMA Per ANSI/J-STD-008
TDMA Per ANSI/J-STD-010
PCS 1900 Per ANSI/J-STD-007

Detachable Antenna:

The peak power at antenna terminals is measured using an in-line peak power meter or a spectrum analyzer.

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

EQUIPMENT: **Alpine GPRS 919** **PROJECT NO.:** **1L0486RUS1**

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
---	-------------------------

Minimum Standard: Para. No. 24.238(b). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB.

Method Of Measurement:CDMA Per ANSI/J-STD-008

Spectrum analyzer settings:

RBW: 30 kHz

VBW: $\geq$ RBW

Span: 5 MHz

Sweep: Auto

GSM Per ANSI/J-STD-007

RBW: 3 kHz

VBW: $\geq$ RBW

Span: 2 MHz

Sweep: Auto

NADC Per IS-136

RBW: 1 kHz

VBW: $\geq$ RBW

Span: 1 MHz

Sweep: Auto

EQUIPMENT: **Alpine GPRS 919** PROJECT NO.: **1L0486RUS1**

NAME OF TEST: Spurious Emission at Antenna Terminals	PARA. NO.: 2.991
---	-------------------------

Minimum Standard: Para. No.24.238(a). On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power by at least $43 + 10 \log (P)$ dB.

Method Of Measurement:

Spectrum analyzer settings:

CDMA Per ANSI/J-STD-008

RBW: 1 MHz (> 1 MHz from Band Edge)
RBW: 20 kHz (< 1MHz from Band Edge)
VBW: $\geq$ RBW
Sweep: Auto
Video Avg: 6 Sweeps

GSM Per ANSI/J-STD-007

RBW: 1 MHz (> 1 MHz from Band Edge)
RBW: 3 kHz (< 1 MHz from Band Edge)
VBW: $\geq$ RBW
Sweep: Auto
Video Avg: Disabled

NADC Per IS-136

RBW: 1 MHz (> 1 MHz from Band Edge)
RBW: 1 kHz (< 1 MHz from Band Edge)
VBW: $\geq$ RBW
Sweep: Auto
Video Avg: Disabled

To demonstrate compliance at band edges the frequency of the input signal is set to the lowest and highest assigned channel and the center frequency of the spectrum analyzer is set to the upper and lower edges of the appropriate frequency block.

EQUIPMENT: **Alpine GPRS 919** **PROJECT NO.:** **1L0486RUS1**

NAME OF TEST: Field Strength of Spurious Radiation	PARA. NO.: 2.993
---	-------------------------

Minimum Standard: Para. No.24.238(a). On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power by at least $43 + 10 \log (P)$ dB.

Test Method: TIA/EIA-603-1992, Section 2.2.12

The antenna substitution method was used to determine the equivalent radiated power at spurious frequencies. The spurious emissions were measured at a distance of 3 meters. The EUT was then replaced with a reference substitution antenna with a known gain referenced to a dipole. This antenna was fed with a signal at the spurious frequency. The level of the signal was adjusted to repeat the previously measured level. The resulting erp is the signal level fed to the reference antenna corrected for gain referenced to a dipole.

EQUIPMENT: **Alpine GPRS 919** **PROJECT NO.:** **1L0486RUS1**

NAME OF TEST: Frequency Stability	PARA. NO.: 2.995
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Minimum Standard: Para. No. 24.235. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Method Of Measurement: CDMA Per ANSI/J-STD-008
TDMA Per ANSI/J-STD-007
NADC Per IS-136

Frequency Stability With Voltage Variation

The E.U.T. is placed in an environmental chamber and allowed to stabilize at +20 degrees Celsius for at least 15 minutes. With the voltage input to the E.U.T. set to 85% S.T.V., the frequency is measured in 30 second intervals for a period of 5 minutes. This procedure is repeated at 100% S.T.V. and 115% S.T.V.

Frequency Stability With Temperature Variation

The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a period of 5 minutes.

Digitally Modulated Signals

Equipment that produces a digitally modulated carrier is tested using a vector modulation analyzer. Frequency accuracy and rho are measured over the specified environmental extremes.

EQUIPMENT:

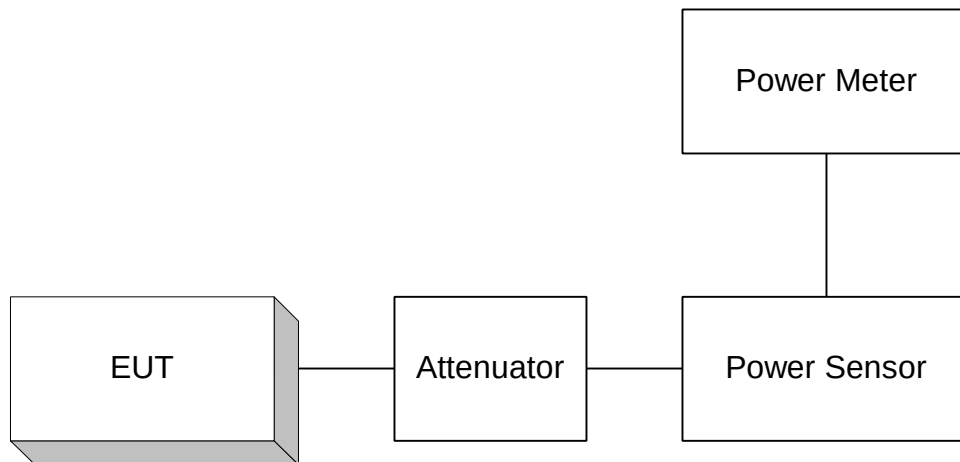
Alpine GPRS 919

PROJECT NO.: **1L0486RUS1**

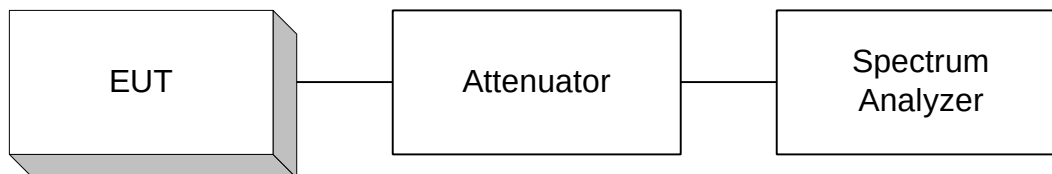
Annex B - Test Diagrams

EQUIPMENT: **Alpine GPRS 919** PROJECT NO.: **1L0486RUS1**

Para. No. 2.985 - R.F. Power Output

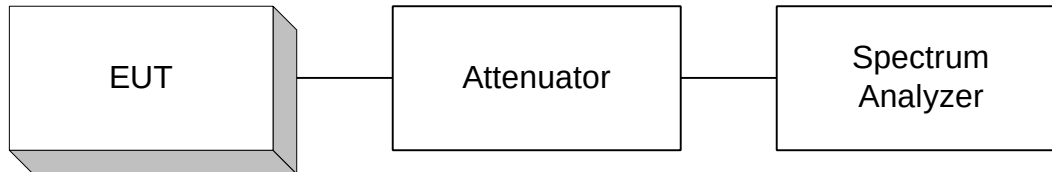


Para. No. 2.989 - Occupied Bandwidth

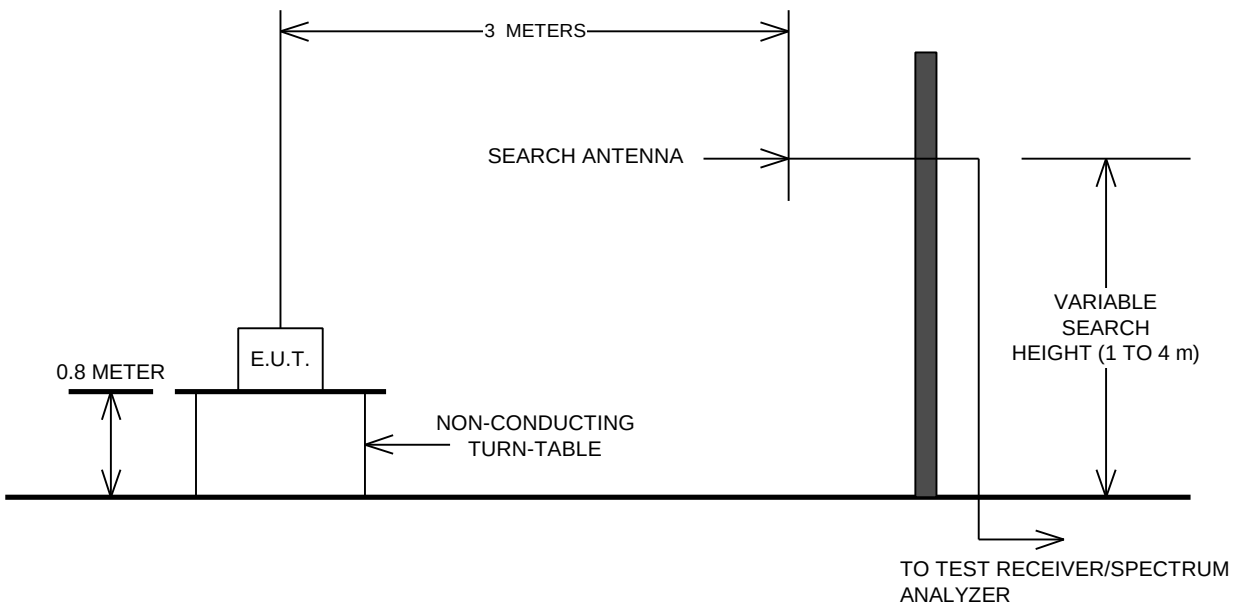


EQUIPMENT: **Alpine GPRS 919** PROJECT NO.: **1L0486RUS1**

Para. No. 2.991 Spurious Emissions at Antenna Terminals



Para. No. 2.993 - Field Strength of Spurious Radiation



EQUIPMENT: **Alpine GPRS 919** PROJECT NO.: **1L0486RUS1**

Para. No. 2.995 - Frequency Stability

