# **EMC CONFORMANCE REPORT**

FCC Title 47 CFR, Part 24 Subpart E

testing for

Manufacturer Allen Telecom

Equipment Name PCS1900 Channel Selective Repeater

Equipment Model MR741

Report/Issue Date 12 February, 2000

Report Number 0503ALL

FCC ID BCR-RPT-MR741

## Prepared by

Flextronics EMC Laboratories (formally EMC International, Inc.) 762 Park Avenue Youngsville, NC 27596

33\_EME/I Rev 4 Report Number: 0503ALL

EUT: PCS1900 Channel Selective Repeater Model: MR741 Serial: None

Manufacturer	Allen Telecom
	140 Vista Centre Drive
	Forest, VA 24551
	USA
	804-386-5350
Requester / Applicant	Howard Gianopulos
Name of Equipment	PCS1900 Channel Selective Repeater
	Model No. MR741 Serial No. None
Type of Equipment	PCS Amplifier
Class of Equipment	Non-Residential (Class A)
Application of Regulation(s)	FCC Title 47 CFR Part 24 Subpart E
	RSP-100 Issue 7:1996
Application of Standard(s)	ANSI C63.4:1992
•	RSS-131 Issue 1:1996
Date Received 01 Feb. 2000	Date Initiated 01 Feb. 2000 Date Completed 17 Apr. 2000

The electromagnetic compatibility test and documented data described in this report has been performed and recorded by Flextronics EMC Laboratories, in accordance with the standards and procedures listed herein. As the responsible authorized agent, I hereby declare that the PCS1900 Channel Selective Repeater (Model No. MR741) has been shown to be capable of complying with the EMC requirements of the stated regulations and standards based on the results, special accessories and modifications listed in this report. This report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government. This report contains data that are not covered by NVLAP accreditation. This report shall not be reproduced except in full, without the written approval of the laboratory.

Dale Albright	Date
Director, EMC Operations	
NVLAP Signatory	

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Serial: None

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## 1.0 OVERVIEW

## 1.1 Introduction

#### 1.1.1 Scope

This report is intended to document conformance with the requirements of the *Federal Communications Commission and Industry Canada* based on the results of testing performed on *01 Feb. 2000* through *17 Apr. 2000* on the *PCS1900 Channel Selective Repeater* Model No. *MR741* manufactured by *Allen Telecom*. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout it's life cycle. All documentation will be included as a supplement.

#### 1.1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT and to submit the data for review and certification in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and standards listed in this report.

Serial: None

# 1.1.3 Summary

Test Type	Guidance Document	Requirements	Measured	Result	Page
Radiated Spurious Emissions	FCC Part 24	No greater than -13 dBm from 30 MHz to 20 GHz	48.0 dB under limit @ 300 MHz	Pass	16
	RSS-131: 1996	No greater than -13 dBm from 30 MHz to 10 GHz	48.0 dB under limit @ 300 MHz	Pass	16
Passband Gain	RSS-131: 1996	Passband gain shall not exceed nominal gain by more than 1 dB	Uplink gain = 84.7 dB Downlink gain = 82.9 dB	Pass	24
20dB Bandwidth	RSS-131: 1996	20 dB bandwidth shall not exceed nominal bandwidth stated by manufacturer	Uplink BW = 660 kHz Downlink BW = 680 kHz	Pass	24
Signal Integrity	FCC Part 24	Device must not change quality of signal input	Input Vs Output	Pass	27–28
Mean Output	RSS-131: 1996	Manufacturer rating must	Uplink (dBm) Downlink (dBm)	Pass	30
Power and Non-Linearity		not exceed mean output power	GSM = 35.9 GSM = 35.8		
Intermodulation	FCC Part 24	Intermodulation tone	Uplink (dBm) Downlink (dBm)	Pass	33–36
	RSS-131: 1996	level no greater than –13 dBm	GSM = -36.0 GSM = -36.0		
Conducted Spurious Emissions	FCC Part 24 RSS-131: 1996	No greater than -13 dBm from 30 MHz to 20 GHz	Less than -24.0 dBm	Pass	39

### 1.2 GENERAL INFORMATION

#### 1.2.1 Product Description

A description of the EUT and information for all equipment used in the tested system, including: descriptions of cables, clocks and input/output ports has been supplied by the manufacturer and is listed in Exhibit F and I.

Detailed photographs of the PCB showing component values and general assembly are included in Exhibit C and E.

Agency labels and the location of placement on the EUT are shown in Exhibit D.

#### 1.2.2 Test Facility

The Open Area Test Site and AC Line Conducted measurement facility used to collect the radiated and conducted data has been constructed in accordance with ANSI C63.7:1992. The site has been measured in accordance with and verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4:1992, at a test distance of 3 and 10 meters. This site has been described in reports dated May 12, 1997, submitted to the FCC, and accepted by letter dated June 25, 1997 (31040/SIT 1300F2). The site is listed with the FCC and accredited by NVLAP (code 200094-0).

## 1.2.3 Test Equipment

Equipment	Manufacturer	Model #	Serial/Inst. #	Last Cal dd/mm/yy	Next Cal dd/mm/yy
Amplifier, preamp	Hewlett Packard	8449B	3008A00268	30 Oct 99	30 Oct 00
Ant. BiconiLog	EMCO	3142	1006	02 Dec 99	02 Dec 00
Ant. Horn	EMCO	3115	5770	30 Mar 99	30 Sep 00
Cable, Heliax	Andrews	FSJ1-50A	03	14 Dec 99	14 Dec 00
Cable, Heliax	Andrews	FSJ1-50A	32	14 Dec 99	14 Dec 00
Cable, Heliax	Andrews	FSJ1-50A	33	14 Dec 99	14 Dec 00
Chamber, Anechoic	Universal Shielding	USC-26	241210	CNR	Condition II
Meter, Multi	Fluke	79-3	69200606	21 Sept 99	21 Sept 00
Meter, Temp/Humid/Barom	Fisher	02-400	01	21 Sept 99	24 Sept 00
Spectrum Analyzer	Hewlett Packard	E7405A	US39150117	15 Jul 99	15 Jul 00
Signal Generator	Hewlett Packard	E4432B	US39341884	19 Oct 99	19 Oct 00
Signal Generator	Hewlett Packard	E4432B	US39260159	19 Oct 99	19 Oct 00
Signal Combiner	Mini-Circuits	ZAPD-4	15542	CNR	Condition II

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### 1.2.4 Measurement Uncertainty

Two types of measurement uncertainty are expressed in this report, per ISO GUIDE TO THE EXPRESSION OF UNCERTAINTY IN MEASUREMENT. 1st addition 1995.

The Combined Standard Uncertainty is the standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities, equal to the positive square root of a sum of terms, the terms being the variances or co-variances of these other quantities weighted according to how the measurement result varies with changes in these quantities. The term standard uncertainty is the result of a measurement expressed as a standard deviation.

The Expanded Uncertainty defines an interval about the result of a measurement that may be expected to encompass a large fraction of the distribution of values that could reasonably be attributed to the measurand. The fraction may be viewed as the coverage probability or level of confidence of the interval.

The EMCI laboratory test system for conducted emissions is defined as the LISN, spectrum analyzer, coaxial cables, and pads. The test system for radiated emissions is defined as the antenna, spectrum analyzer, pre-amplifier, coaxial cables, and pads. The conducted test system has a combined standard uncertainty of  $\pm$  1.2 dB. The radiated test system has a combined standard uncertainty of  $\pm$  1.6 dB. The expanded uncertainty at a level of 95% confidence is obtained by multiplying the combined standard uncertainty by a coverage factor of 2. Compliance criteria is not based on measurement uncertainty.

#### 1.2.5 Calibration Traceability

All measurement instrumentation are traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Guide 25.

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#### 1.3 SYSTEM TEST CONFIGURATION

#### 1.3.1 Equipment Configuration

The EUT was tested as table top equipment and was configured and operated in a manner consistent with its intended use. A description of the equipment configurations is given in the following sections for each test performed. The EUT was connected to rated power and allowed to warm up to normal operating conditions before testing. The placement of the EUT system components was guided by the test standard and selected to represent typical installation conditions.

#### 1.3.2 Operation Mode

A description of the operation modes is given in the following sections for each test performed. Since the EUT operates on any channel within the frequency band using a set of high band and low band duplexers, that can be used with and without the ICE modules, then testing was performed at the band edges of each duplexer with and without ICE modules in both uplink and downlink mode.

#### 1.3.3 Special Accessories

No special accessories were added to achieve compliance.

## 1.3.4 Equipment Modifications

No modifications were made to achieve compliance.

20 FMF/I Day 4 Depart Number 0502411

Serial: None

#### MEASUREMENTS AT THE ENCLOSURE PORT 2.0

#### 2.1 **RADIATED SPURIOUS EMISSIONS**

#### 2.1.1 Test Methodology

Testing was performed according to the test methods listed in the report. This test evaluates the EUT's potential for causing radio frequency interference to other electronic devices. This test method is approved by NVLAP Scope of Laboratory Accreditation. There were no deviations from the test standard.

## 2.1.2 Test Configuration

Preliminary Test: Preliminary emission profile testing was performed inside the anechoic chamber. The EUT was placed at the center of a 1.0m x 1.5m non-conductive table 80cm above the floor. The signal generators were placed in the auxiliary equipment chamber. The output of the signal generators were connected to the inputs of the signal combiner with short lengths of RG-400U. The output of the signal combiner was connected to the input of the EUT with Heliax. The output of the EUT was terminated with a 50 Ohm load. The input cables were routed over the edge of the table. The power cable was routed over the edge of the table and bundled approximately 40cm from the ground plane. For measurements between 30 MHz to 1 GHz, the receiving antenna was placed at a distance of 3m at a fixed height of 1.5m. For measurements above 1 GHz, the receiving antenna was placed at a distance of 3m at a fixed height of 0.8m. Measurement equipment was located outside of the chamber. A video camera was placed inside the chamber to view the EUT.

Final Test: Final testing was performed on the OATS. The EUT was placed on a 1.0m x 1.5m nonconductive table 80cm above the ground plane. The placement of EUT and cables were the same as for preliminary testing. Testing was performed at an antenna to EUT distance of 3 meters. A photograph of the final test configuration is shown in the attached data.

### 2.1.3 Test Procedure

Preliminary Test: A test program that controls instrumentation and data logging was used to automate the test. The signal generator frequencies  $f_1$  and  $f_2$  were selected so that their third order intermodulation product frequencies  $f_3$  ( $2f_1 - f_2$ ) and  $f_4$  ( $2f_2 - f_1$ ) were all within the passband of the duplexer. The input level to the EUT was increased until either of the intermodulation tone levels  $(P_{03} \text{ or } P_{04})$  equaled -13 dBm or saturation occurred. The frequency range of interest was divided into sub-ranges such as to yield a data resolution of 600 kHz from 30 MHz to 2 GHz and provide a reading at each frequency for each 6.0° of turntable rotation. From 2 GHz to 18 GHz, the data resolution is 2.5 MHz and provides one reading per 1.2° of turntable rotation. For each frequency sub-range, the turntable was rotated 360° while peak emission data was recorded and plotted in horizontal and vertical antenna polarization's.

Serial: None

Model: MR741

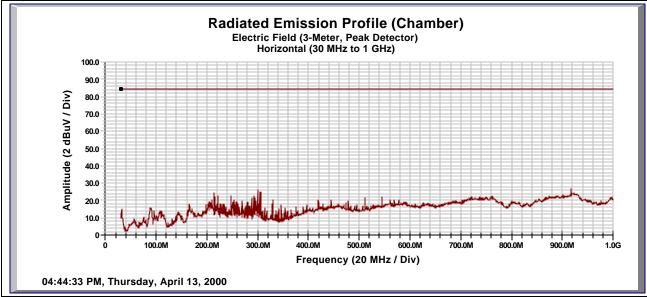
Final Test: For each frequency measured, the peak emission was maximized by manipulating the receiving antenna within 1 to 4 meters from the ground plane and placing it at the position which produced maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation. The six highest emissions relative to the limit were measured unless such emissions were more than 20 dB below the limit. If less than six emissions are within 20 dB of the limit, than the noise level of the receiver is measured at frequencies where emissions are expected. Multiples of all oscillator and microprocessor frequencies were also checked.

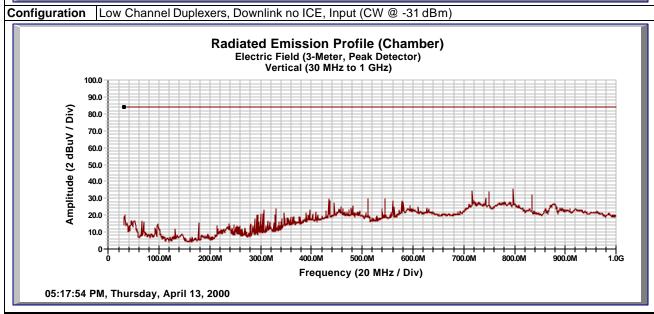
#### 2.1.4 Test Results

Graphs of the EUT's RF emissions are contained in the following pages. The graphs show peak emissions (corrected to yield a value approximating measurement on OATS) in both horizontal and vertical polarization's and the corresponding limit. The data is evaluated to select worst case modes of configuration and operation and to identify frequencies that require measurement on the OATS.

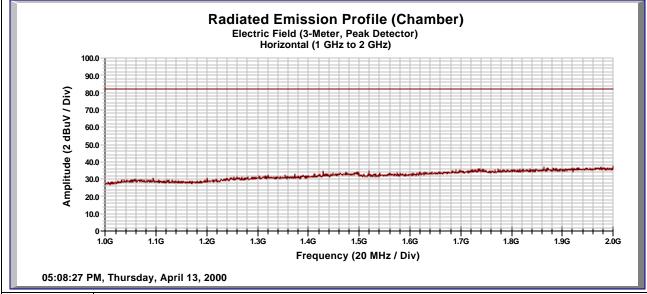
The EUT was found to be compliant to the requirements of the test standard, as originally tested. No modifications or special accessories were added to achieve compliance. The test data is listed in the **Radiated Emissions Data Records**.

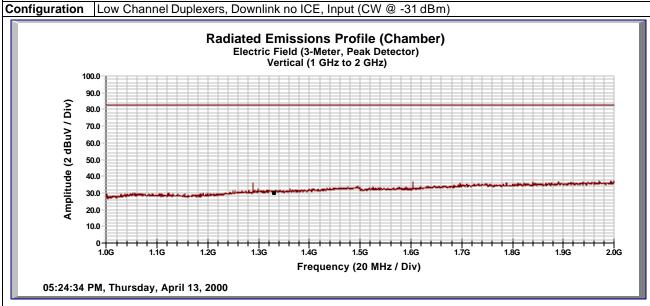
Radiated E	missions	Tracking # 050	3ALL Page 1 of 5
Manufacturer	Allen Telecom	Date	13 April, 2000
Witness	None	Temp / Hum	73 deg. F / 36 %rh
<b>EUT Name</b>	PCS1900 Channel Selective Repeater	Line AC / Freq	120 VAC / 60 Hz
<b>EUT Model</b>	MR741	RBW / VBW	30 kHz / 300 kHz
<b>EUT Serial</b>		Attenuation	0
Specification	FCC Part 24 Subpart E, ISC RSP-100	Detector	Quasi Peak
Test Method	ANSI C63.4:1992, RSS-131:1996	Distance	3 meters
Configuration	Low Channel Duplexers, Downlink no ICE, Input	(CW @ -31 dBm)	



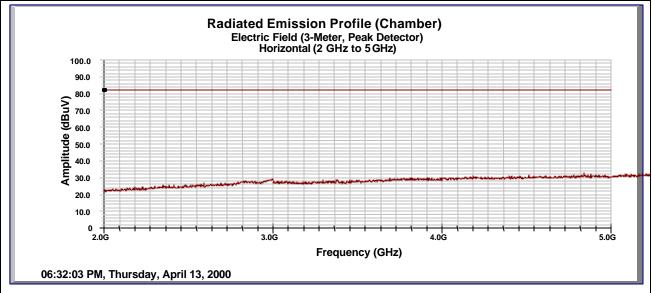


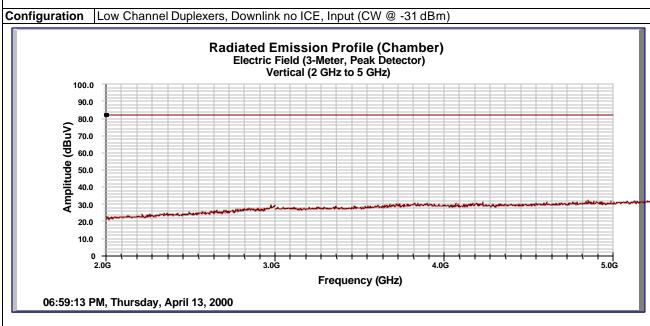
Radiated E	missions	Tracking # 050	3ALL Page 2 of 5
Manufacturer	Allen Telecom	Date	13 April, 2000
Witness	None	Temp / Hum	73 deg. F / 36 %rh
<b>EUT Name</b>	PCS1900 Channel Selective Repeater	Line AC / Freq	120 VAC / 60 Hz
<b>EUT Model</b>	MR741	RBW / VBW	30 kHz / 300 kHz
<b>EUT Serial</b>		Attenuation	0
Specification	FCC Part 24 Subpart E, ISC RSP-100	Detector	Quasi Peak
Test Method	ANSI C63.4:1992, RSS-131:1996	Distance	3 meters
Configuration	Low Channel Duplexers, Downlink no ICE, Input	t (CW @ -31 dBm)	



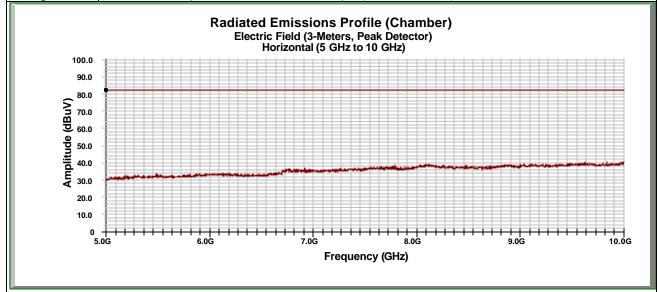


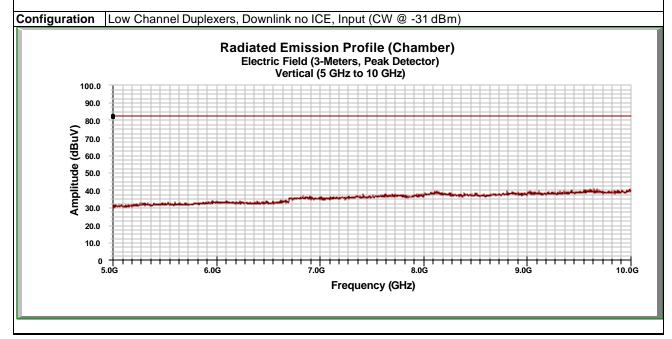
Radiated E	missions	Tracking # 0503	ALL Page 3 of 5
Manufacturer	Allen Telecom	Date	13 April, 2000
Witness	None	Temp / Hum	73 deg. F / 36 %rh
<b>EUT Name</b>	PCS1900 Channel Selective Repeater	Line AC / Freq	120 VAC / 60 Hz
<b>EUT Model</b>	MR741	RBW / VBW	30 kHz / 300 kHz
EUT Serial		Attenuation	0
Specification	FCC Part 24 Subpart E, ISC RSP-100	Detector	Quasi Peak
Test Method	ANSI C63.4:1992, RSS-131:1996	Distance	3 meters
Configuration	Low Channel Duplexers, Downlink no ICE, Input (CW	@ -31 dBm)	





Radiated E	missions	Tracking # 0503	ALL Page 4 of 5
Manufacturer	Allen Telecom	Date	13 April, 2000
Witness	None	Temp / Hum	73 deg. F / 36 %rh
<b>EUT Name</b>	PCS1900 Channel Selective Repeater	Line AC / Freq	120 VAC / 60 Hz
<b>EUT Model</b>	MR741	RBW / VBW	30 kHz / 300 kHz
EUT Serial		Attenuation	0
Specification	FCC Part 24 Subpart E, ISC RSP-100	Detector	Quasi Peak
Test Method	ANSI C63.4:1992, RSS-131:1996	Distance	3 meters
Configuration	Low Channel Duplexers, Downlink no ICE, Input (CW)	@ -31 dBm)	





Radiated E	miss	ions					Tracking #	0503ALL	Page	5 of 5
Manufacturer	_	Telecor	n				Date		April, 2000	
Witness	None						Temp / Hum		deg. F / 42%	
EUT Name			annel Sele	ective Repea	ater		Line AC / F		0 VAC / 60 F	
EUT Model	MR7	41					RBW / VBW		0 kHz / 300 kl	Hz
EUT Serial							Attenuation	_		
Specification	FCC	Part 24	Subpart E	, ISC RSP-	100		Detector	Qı	ıasi Peak	
Test Method	ANS	C63.4:	1992, RSS	S-131:1996			Distance	3 r	neters	
Emission	ANT	ANT	Table	FIM	Amp	Cable	ANT	E-Field	3 Meter	Spec
Freq	Polar	Pos	Pos	Value	Gain	Loss	Factor	Value	Limit	Margin
(GHz)	(H/V)	(m)	(deg)	(dBuV)	(dB)	(dB)	(dB/m)	(dBuV/m)		(dB)
511.50	V	1.0	BL	35.14	27.94	7.23	18.35	32.78	84.4	-51.62
749.40	V	1.0	Left	27.26	28.23	8.80	22.10	29.93	84.4	-54.47
434.10	V	1.0	BL	23.62	27.50	6.57	17.01	19.70	84.4	-64.7
330.00	V	1.0	Right	36.05	26.74	5.53	14.50	29.34	84.4	-55.06
300.00	Н	1.0	BR	44.84	26.47	5.23	12.76	36.37	84.4	-48.03
304.00	Н	1.0	BR	44.08	26.50	5.27	13.01	35.86	84.4	-48.54
511.50	Н	3.0	BL	29.20	27.94	7.23	18.35	26.84	84.4	-57.56
Spec Margin = E										
Combined Stand									95% confiden	
Notes:	ara one	Creamity	α <sub>c</sub> (γ) - ±	TOOLS EXPE	inded Officers		- Ku <sub>C</sub> (y)	N - 2101	30 / Commodifi	
Performed by	_	Steve O' (Name /	Steen Signature)	)			Date	<u>17 A</u>	pril, 2000	
EMC Supervise		Dale Alb Name /	right Signature)	)			Date	<u>17 A</u>	pril, 2000	

### 2.1.5 Sample Calculation

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss, Antenna Factor, and Chamber Correction to the measured reading. The basic equation is as follows:

```
Field Strength (dB\mu V/m) = FIM - AMP + CBL + ACF + CCF
```

Where:  $FIM = Field Intensity Meter (dB\mu V)$ 

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB)

CCF = Chamber Correction Factor (dB)

 $\mu V/m = Common Antilog [(dB\mu V/m)/20)]$ 

The limit is given as:  $43 + 10 \text{ Log(Pwatts)} = -13 \text{dBm} = 5.0 \text{E}^{-5} \text{ Watts}.$ 

The field strength limit is calculated by using the plane wave relation:  $GP / 4\pi R^2 = E^2 / 120\pi$ .

 $E_{v/m} = \sqrt{30GP / R}$ .

G = 1.64 (dipole gain for emissions  $\leq 1$  GHz)

G = 1.0 (isotropic gain for emissions > 1 GHz)

 $P = 10^{-5} \text{ Watts}$ 

R = 3 meters

For emissions  $\leq 1$  GHz, the limit = 84.4 dBuV/m.

For emissions > 1 GHz, the limit = 82.3 dBuV/m.

#### Photograph of Test Setup: Radiated Spurious Emissions, Chamber (Front) 2.1.6-1



# 2.1.6-2 Photograph of Test Setup: Radiated Spurious Emissions, Chamber (Back)



#### <u>2.1.6</u>-3 Photograph of Test Setup: Radiated Spurious Emissions, OATS (Front)



## <u>2.1.6-4</u> Photograph of Test Setup: Radiated Spurious Emissions, OATS (Back)



# 3.0 MEASUREMENTS AT THE ANTENNA OUTPUT PORT

### 3.1 PASSBAND GAIN AND BANDWIDTH

#### 3.1.1 Test Methodology

Testing was performed according to the test methods listed in the report. This test evaluates the EUT passband gain and occupied bandwidth to determine the maximum gain over frequency and the actual frequency band occupied by the EUT. There were no deviations from the test standard.

#### 3.1.2 Test Configuration

The EUT and signal generator was placed on a non-conductive table. The output of the signal generator was connected to the input of the EUT with a short length of RG-400U. The output of the EUT was connected to input of the spectrum analyzer with a short length of RG-400U. A test was made without the EUT in the circuit to verify the coax cable correction values. A photograph of the test configuration is shown in the attached data.

#### 3.1.3 Test Procedure

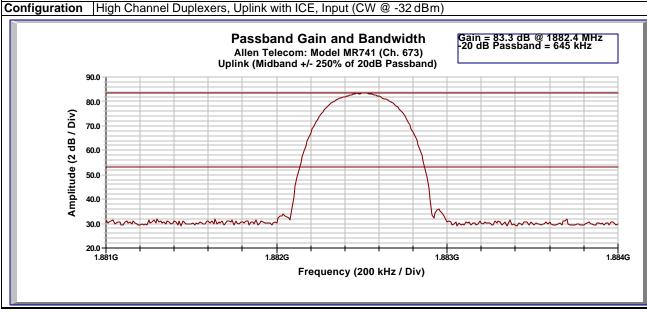
A test program that controls instrumentation and data logging was used to automate the test. The program accounted for the input drive level to the EUT and the attenuation of the coax cable. Manual measurements were first made using the internal functions of the spectrum analyzer to determine the frequencies of the upper and lower points at which the gain had fallen by 20dB. The program was then configured to cover the frequency range  $f_0 \pm 250\%$  of the 20dB bandwidth. The frequency range was stepped at 10 kHz with the signal generator connected directly to the spectrum analyzer and then repeated with the EUT in the circuit.

#### 3.1.4 Test Results

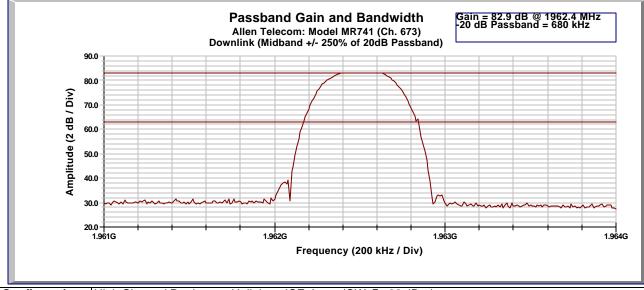
The EUT was found to comply with the requirements of the test standard, as originally tested. No modifications or special accessories were added to achieve compliance. The test data is listed in the **Passband Gain and Bandwidth Data Record**. The upper line of the graph indicates the point of highest gain. The lower line of the graph is 20dB less than the upper line and indicates the upper and lower frequency of the 20dB bandwidth.

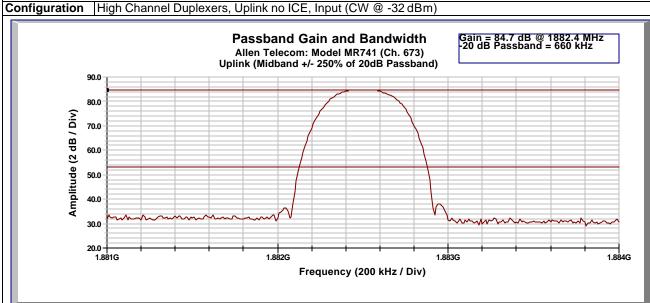
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/itness	•	lone								Tem	•			3 deg l		
JT Name		PCS190	00 Cha	nnel S	Selecti	ve Rep	eater			_		/ Freq		20 VA0		
UT Model	N	/IR741								RBV	/ / VE	3W		00 kHz		
JT Serial										Atte	nuat	ion	5	0 dB in	ternal	
pecification	T	SC RSI	P-100							Dete	ctor		P	eak		
est Method	F	RSS-13	1:1996	3						Fred	Ste	)	1	0 kHz		
onfiguration	ı	ligh Ch	annel	Duple	exers, [	Downlir	nk with	ICE, In	put (CV	V @ -3	2dB	m)				
	90.0								MR741 (0 6 of 20dE					6 dB @ sband =		
ude (2 dB / Div)																
Amplitude (2 dB / Div)	80.0 70.0 60.0															
Amplitude (2 dB / Div)	80.0 70.0 60.0 50.0 40.0 30.0										pand)				<i></i>	
Amplitude (2 dB / Div)	80.0 70.0 60.0 50.0 40.0 30.0					alink (M	dband	+/- 250%		3 Passh	() 1.9					1.96

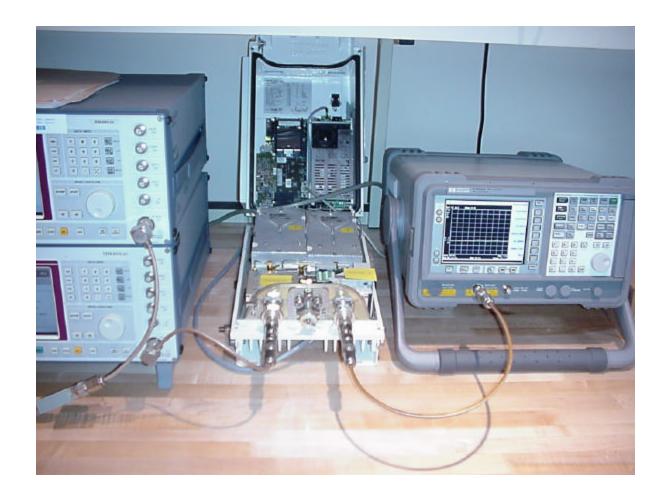


Passband (	Gain and Bandwidth	Tracking # 050	3ALL Page 2 of 2
Manufacturer	Allen Telecom	Date	22 March, 2000
Witness	None	Temp / Hum	73 deg F / 34%
EUT Name	PCS1900 Channel Selective Repeater	Line AC / Freq	120 VAC / 60 Hz
EUT Model	MR741	RBW / VBW	100 kHz / 100 kHz
EUT Serial		Attenuation	50 dB internal
Specification	ISC RSP-100	Detector	Peak
Test Method	RSS-131:1996	Freq Step	10 kHz
Configuration	High Channel Duplexers, Downlink no ICE, Inp	ut (CW @ -32 dBm)	
	Passband Gain an Allen Telecom: Model N Downlink (Midband +/- 250%	MR741 (Ch. 673)	82.9 dB @ 1962.4 MHz Passband = 680 kHz





#### Photograph of Test Setup: Passband Gain and Bandwidth 3.1.5-1



#### 3.2 **SIGNAL INTEGRITY**

### 3.2.1 Test Methodology

Testing was performed according to the test methods listed in the report. This test evaluates the quality of the signal output from the EUT compared to the signal input to the EUT. There were no deviations from the test standard.

### 3.2.2 Test Configuration

The EUT and signal generator was placed on a non-conductive table. The output of the signal generator was connected to the input of the EUT with a short length of RG-400U. The output of the EUT was connected to input of the spectrum analyzer with a short length of RG-400U. The test was repeated without the EUT in the circuit to show the input signal. A photograph of the test configuration is shown in the attached data.

#### 3.2.3 Test Procedure

A test program that controls instrumentation and data logging was used to automate the test. The program was configured to adjust the center frequency to the frequency of highest gain of the 20dB bandwidth measurements. For each configuration, the frequency range was swept.

#### 3.2.4 Test Results

The EUT was found to comply with the requirements of the test standard, as originally tested. No modifications or special accessories were added to achieve compliance. The test data is listed in the Signal Integrity Data Records. The green traces indicate measurements made with the signal generator connected to the spectrum analyzer. The red traces indicate measurements made with the EUT connected to the spectrum analyzer.

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Vitness         None         Temp / Hum         73 deg F / 34%													Tra	cking	<i>}</i> #	050	3ALI	_	Pa	ge	1 of	_
Vitness None PCS1900 Channel Selective Repeater Line AC / Freq RBW / VBW MR741 Specification Sest Method RSS-131:1996 Preq Step 10 kHz / 100 kHz /	Manufacturer	Allen	Telec	om									Dat	te			2	2 Ma	rch, :	2000		
EUT Name EUT Model EUT Serial EUT Serial Specification est Method RSS-131:1996 RSS-	Vitness											Ter	np / I	Hum		7						
EUT Model MR741 RBW / VBW Attenuation Detector Peak Detector Peak Detector Peak Signal Integrity Allen Telecom: Model MR741 (Ch. 673)  Configuration High Channel Duplexers, Uplink with ICE, Input (GSM @ -15 dBm)  Configuration High Channel Duplexers, Uplink with ICE, Input (GSM @ -15 dBm)  Configuration High Channel Duplexers, Uplink with ICE, Input (GSM @ -15 dBm)  Configuration High Channel Duplexers, Uplink with ICE, Input (GSM @ -15 dBm)  Configuration High Channel Duplexers, Uplink with ICE, Input (GSM @ -15 dBm)  Configuration High Channel Duplexers, Uplink with ICE, Input (GSM @ -15 dBm)  Configuration High Channel Duplexers, Uplink with ICE, Input (GSM @ -15 dBm)  Configuration High Channel Duplexers, Uplink with ICE, Input (GSM @ -15 dBm)  Configuration High Channel Duplexers, Uplink with ICE, Input (GSM @ -15 dBm)  Configuration High Channel Duplexers, Uplink with ICE, Input (GSM @ -15 dBm)  Configuration High Channel Duplexers, Uplink with ICE, Input (GSM @ -15 dBm)	UT Name	PCS	1900 (	Chan	nel S	elect	ive R	epea	ater					-								
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	grity								Trac	cking #	# 050	3ALL	F	Page	2	of 2
Manufacturer Witness EUT Name EUT Model EUT Serial	Allen Telecom None PCS1900 Channel Selective Repeater MR741									Date Temp / Hum Line AC / Freq RBW / VBW Attenuation		22 March, 2000 73 deg F / 34% 120 VAC / 60 Hz 100 kHz / 100 kHz 50 dB internal				
Specification		RSP-100							_	ector		Pe				
est Method		-131:1996		5	P	I I	OF 1			q Step		10	kHz			
onfiguration	High	Channel	Duplex	kers, D	owniin	ik no i	CE, Inp	out (GSI	VI @ -1	15 aBr	n)					
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onfiguration	0.0 High	Channel	Duple	kers, U	plink r	o ICE Sigr	, Input nal Int : Model	(GSM @egrity	@ -15 c	dBm)	Red: \Green	with Et: witho	JT out EU			1.96344
onfiguration  20 (\(\frac{10}{2}\) \(\frac{1}{2}\)	0.0   1.9614G   High	Channel	Duple	kers, U	plink r	o ICE Sigr	, Input nal Int : Model	(GSM @egrity	@ -15 c	dBm)	Red: v Green	with Et: witho	JT put EU			1.96344
onfiguration  20 (\(\frac{10}{2}\) \(\frac{1}{2}\)	0.0   1.9614G	Channel	Duplex	kers, U	plink r	o ICE Sigr	, Input nal Int : Model	(GSM @egrity	@ -15 c	dBm)	Red: v Green	with Et: witho	JT but EU			1.96344
onfiguration  20 (\(\frac{10}{2}\) \(\frac{1}{2}\)	0.0   1.9614G	Channel	Duplex	kers, U	plink r	o ICE Sigr	, Input nal Int : Model	(GSM @egrity	@ -15 c	dBm)	Red: v Green	with Et: witho	JT but EU			1.96344
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#### Photograph of Test Setup: Signal Integrity 3.2.5-1



Serial: None

#### 3.3 **OUTPUT POWER AND NON-LINEARITY**

## 3.3.1 Test Methodology

Testing was performed according to the test methods listed in the report. This test evaluates the EUT's mean output power and extent of in-band non-linearity of transmitted signals amplified by a non-linear device. There were no deviations from the test standard.

## 3.3.2 Test Configuration

The EUT and signal generators were placed on a non-conductive table. The output of the signal generators were connected to the signal combiner with a short length of RG-400U. The signal combiner was connected directly to the input of the EUT. The output of the EUT was connected directly to the spectrum analyzer. A power meter was also used. This test was performed with no ICE modules. A photograph of the test configuration is shown in the attached data.

#### 3.3.3 Test Procedure

The signal generator frequencies  $f_1$  and  $f_2$  were selected so that their third order intermodulation product frequencies  $f_3$  ( $2f_1 - f_2$ ) and  $f_4$  ( $2f_2 - f_1$ ) were all within the passband of the duplexer. The input level to the EUT was increased until either of the intermodulation tone levels (P<sub>03</sub> or P<sub>04</sub>) equaled -13 dBm or saturation occurred.

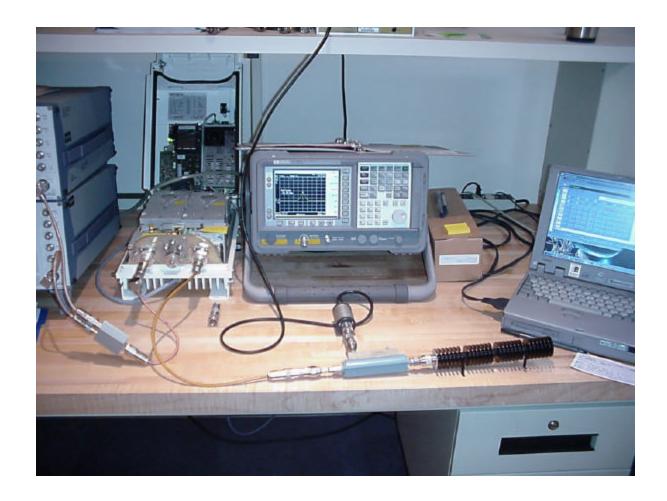
#### 3.3.4 Test Results

The EUT was found to comply with the requirements of the test standard, as originally tested. No modifications or special accessories were added to achieve compliance.

Uplink	Downlink
F1 = 1850.6 MHz (ch. 514)	F1 = 1930.6 MHz (ch. 514)
F2 = 1851.8 MHz (ch 520)	F2 = 1931.8 MHz (ch 520)
Signal input = -24 dBm (saturation)	Signal input = -31 dBm (saturation)
Signal output = + 4.86 dBm	Signal output = + 4.76 dBm
Directional coupler = -31 dBm	Directional coupler = -31 dBm
No output attenuation	No output attenuation
Output power = Signal output + Directional coupler = + 35.9 dBm	Output power = Signal output + Directional coupler = + 35.8 dBm

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#### Photograph of Test Setup: Output Power and Non-Linearity 3.3.5-1



### 3.4 Intermodulation

### 3.4.1 Test Methodology

Testing was performed according to the test methods listed in the report. This test evaluates the level of the EUT out-of-band intermodulation product frequencies that may cause interference to other electronic devices. There were no deviations from the test standard.

### 3.4.2 Test Configuration

The EUT and signal generators were placed on a non-conductive table. The output of the signal generators were connected to the signal combiner with a short length of RG-400U. The signal combiner was connected to the input of the EUT with a short length of RG-400U. The output of the EUT was connected to the spectrum analyzer with a short length of RG-400U. A photograph of the test configuration is shown in the attached data.

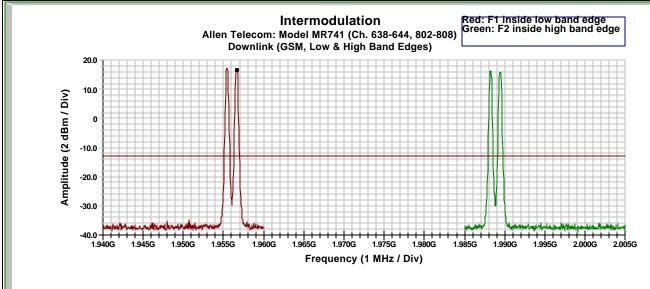
#### 3.4.3 Test Procedure

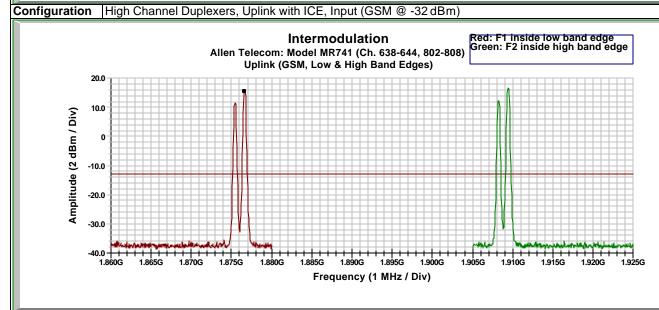
A test program that controls instrumentation and data logging was used to automate the test. The signal generator frequencies  $f_1$  and  $f_2$  were selected so that the lower frequency  $(f_1)$  was tuned to the lower band edge of the duplexer and the third order intermodulation product frequency  $f_3$   $(2f_1 - f_2)$  was outside of the duplexer. The input level to the EUT was adjusted to -32 dBm. The program was configured to sweep the 15 MHz band below the lower edge of the frequency up to the two tones. The test was repeated at the upper band edge with  $f_2$  tuned to the upper edge and  $f_4$   $(2f_2 - f_1)$  outside of the edge. The frequency range was scanned from the two tones up to the 15 MHz band above the upper edge. The procedure was repeated for each configuration.

#### 3.4.4 Test Results

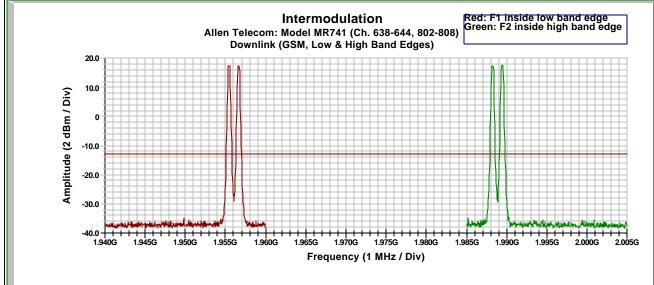
The EUT was found to comply with requirements of the test standard, as originally tested. No modifications or special accessories were added to achieve compliance. The test data is listed in the **Intermodulation Data Records.** The red traces indicate measurements made from the lower edge to 15 MHz less than the lower edge. The green traces indicate measurements made from the upper edge to 15 MHz higher than the upper edge. Both scans for each modulation mode are displayed on one graph for ease of evaluation. The limit line shows the –13dBm limit. Note: Because this is a channel system, the outside intermodulation tone is attenuated (not present).

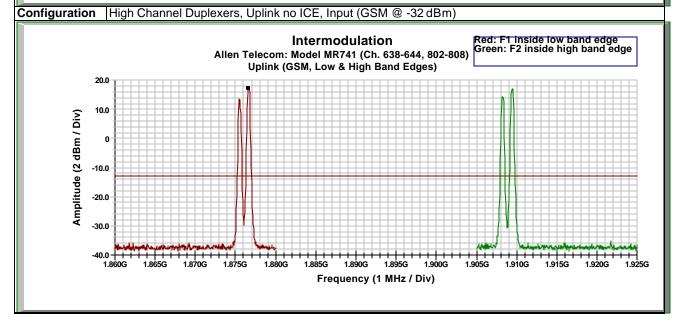
Intermodul	ation	Tracking # 0503	3ALL Page 1 of 4
Manufacturer	Allen Telecom	Date	28 March, 2000
Witness	None	Temp / Hum	73 deg F / 31%
<b>EUT Name</b>	PCS1900 Channel Selective Repeater	Line AC / Freq	120 VAC / 60 Hz
EUT Model	MR741	RBW / VBW	100 kHz / 100 kHz
EUT Serial		Attenuation	50 dB internal
Specification	ISC RSP-100	Detector	Peak
Test Method	RSS-131:1996	Freq Step	Sweep
Configuration	High Channel Duplexers, Downlink with ICE, Input	ut (GSM @ -32 dBm)	



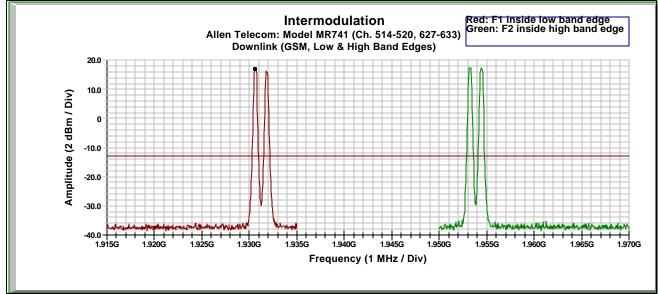


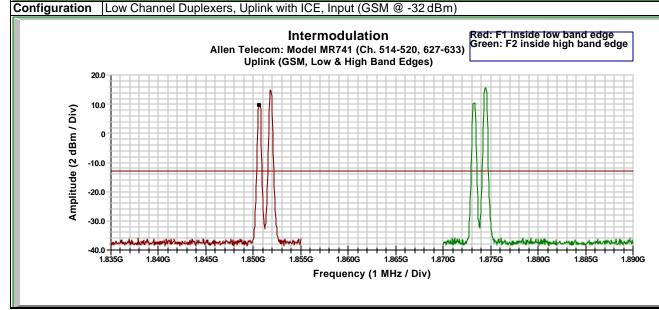
Intermodula	ation	Tracking # 050	3ALL Page 2 of 4
Manufacturer	Allen Telecom	Date	28 March, 2000
Witness	None	Temp / Hum	73 deg F / 31%
<b>EUT Name</b>	PCS1900 Channel Selective Repeater	Line AC / Freq	120 VAC / 60 Hz
<b>EUT Model</b>	MR741	RBW / VBW	100 kHz / 100 kHz
<b>EUT Serial</b>		Attenuation	50 dB internal
Specification	ISC RSP-100	Detector	Peak
Test Method	RSS-131:1996	Freq Step	Sweep
Configuration	High Channel Duplexers, Downlink no ICE, Inp	out (GSM @ -32 dBm)	



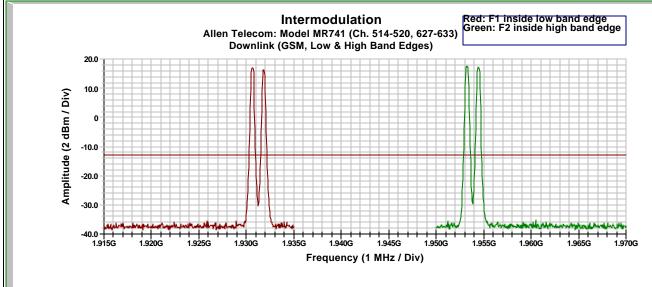


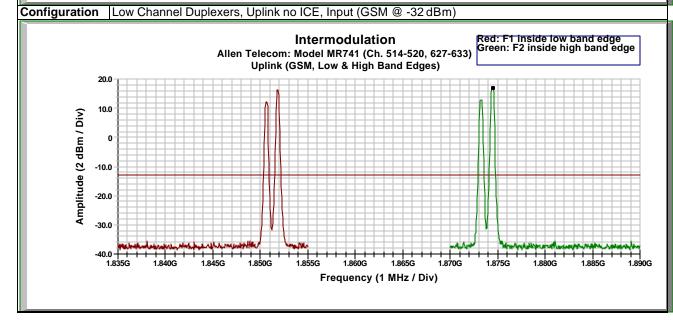
Intermodul	ation	Tracking # 050	3ALL Page 3 of 4
Manufacturer	Allen Telecom	Date	29 March, 2000
Witness	None	Temp / Hum	74 deg F / 28%
<b>EUT Name</b>	PCS1900 Channel Selective Repeater	Line AC / Freq	120 VAC / 60 Hz
EUT Model	MR741	RBW / VBW	100 kHz / 100 kHz
EUT Serial		Attenuation	50 dB internal
Specification	ISC RSP-100	Detector	Peak
Test Method	RSS-131:1996	Freq Step	Sweep
Configuration	Low Channel Duplexers, Downlink with ICE, Inpu	t (GSM @ -32 dBm)	



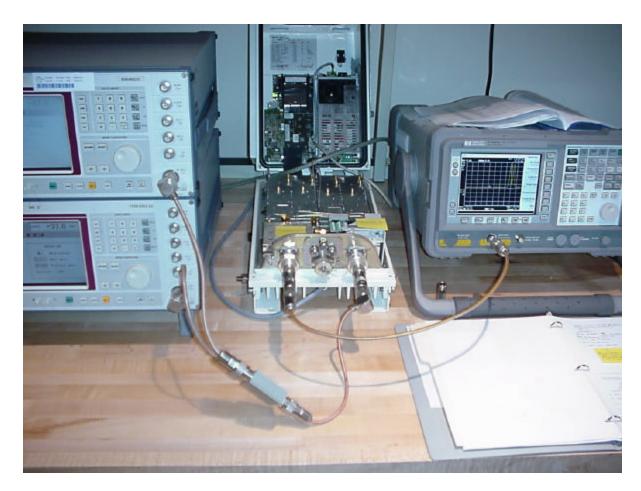


Intermodula	ation	Tracking # 050	3ALL Page 4 of 4
Manufacturer	Allen Telecom	Date	29 March, 2000
Witness	None	Temp / Hum	73 deg F / 28%
<b>EUT Name</b>	PCS1900 Channel Selective Repeater	Line AC / Freq	120 VAC / 60 Hz
EUT Model	MR741	RBW / VBW	100 kHz / 100 kHz
EUT Serial		Attenuation	50 dB internal
Specification	ISC RSP-100	Detector	Peak
<b>Test Method</b>	RSS-131:1996	Freq Step	Sweep
Configuration	Low Channel Duplexers, Downlink no ICE, Input	(GSM @ -32 dBm)	





#### Photograph of Test Setup: Intermodulation 3.4.5-1



#### 3.5 **CONDUCTED SPURIOUS EMISSIONS**

### 3.5.1 Test Methodology

Testing was performed according to the test methods listed in the report. This test evaluates the level of the EUT out-of-band spurious frequencies that may cause interference to other electronic devices. There were no deviations from the test standard.

### 3.5.2 Test Configuration

The EUT and signal generators were placed on a non-conductive table. The output of the signal generators were connected to the signal combiner with a short length of RG-400U. The signal combiner was connected directly to the input of the EUT. The output of the EUT was connected directly to the spectrum analyzer. A photograph of the test configuration is shown in the attached data.

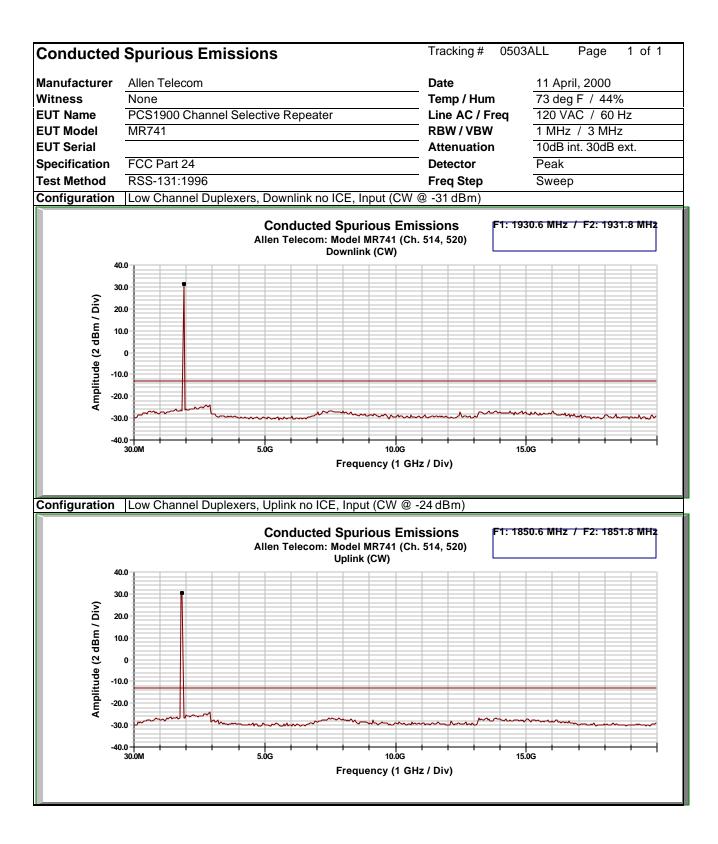
#### 3.5.3 Test Procedure

A test program that controls instrumentation and data logging was used to automate the test. The signal generator frequencies  $f_1$  and  $f_2$  were selected so that their third order intermodulation product frequencies  $f_3(2f_1 - f_2)$  and  $f_4(2f_2 - f_1)$  were all within the passband of the duplexer. The input level to the EUT was adjusted to the same level as the Output Power test. The frequency range was swept.

#### 3.5.4 **Test Results**

The EUT was found to comply with requirements of the test standard, as originally tested. No modifications or special accessories were added to achieve compliance. The test data is listed in the **Conducted Spurious Emissions Data Records.** The limit line shows the -13dBm limit.

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#### Photograph of Test Setup: Conducted Spurious Emissions <u>3.5.5</u>-1

