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

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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
Director, EMC Operations
NVLAP Signatory

Date

DIRECTORY

3.0 MEASUREMENTS AT THE ANTENNA OUTPUT PORT

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.

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 Power and Non-Linearity	RSS-131: 1996	Manufacturer rating must not exceed mean output power	Uplink (dBm) GSM = 35.9	Downlink (dBm) GSM = 35.8	Pass	30
Intermodulation	FCC Part 24 RSS-131: 1996	Intermodulation tone level no greater than –13 dBm	Uplink (dBm) GSM = -36.0	Downlink (dBm) GSM = -36.0	Pass	33–36
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

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 ± 1.2 dB. The radiated test system has a combined standard uncertainty of ± 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.

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.

2.0 MEASUREMENTS AT THE ENCLOSURE PORT

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 non-conductive 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} 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.

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

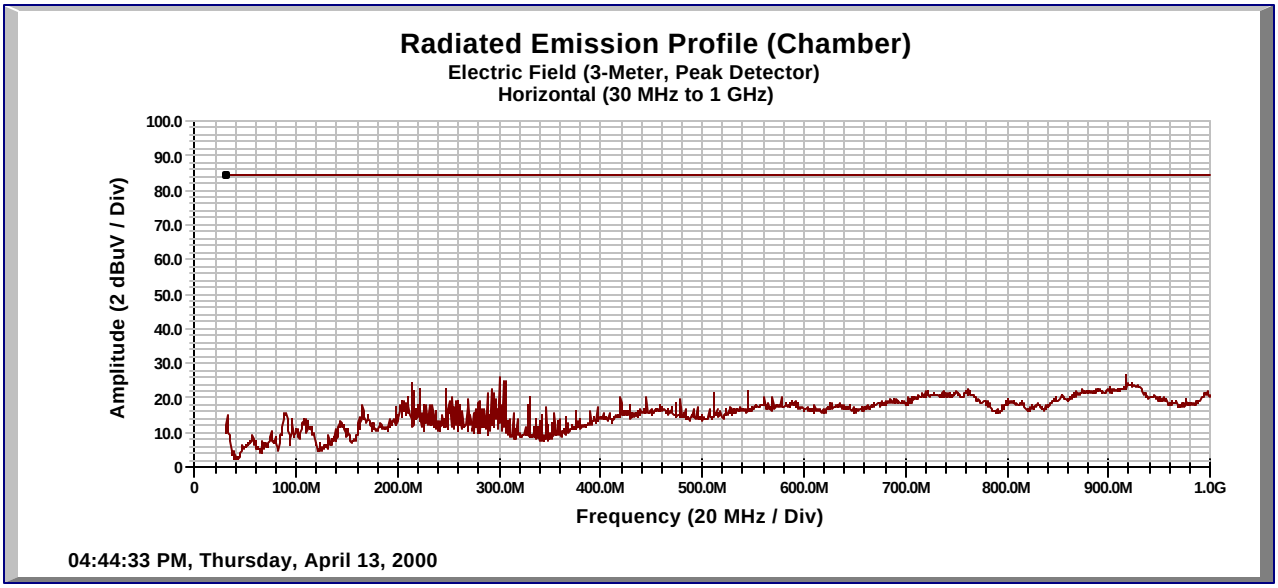
Graphs of the EUT's RF emissions are contained in the following pages. The graphs show peak emissions (corrected to yield a value approximating measurement on OATS) in both horizontal and vertical polarization's and the corresponding limit. The data is evaluated to select worst case modes of configuration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

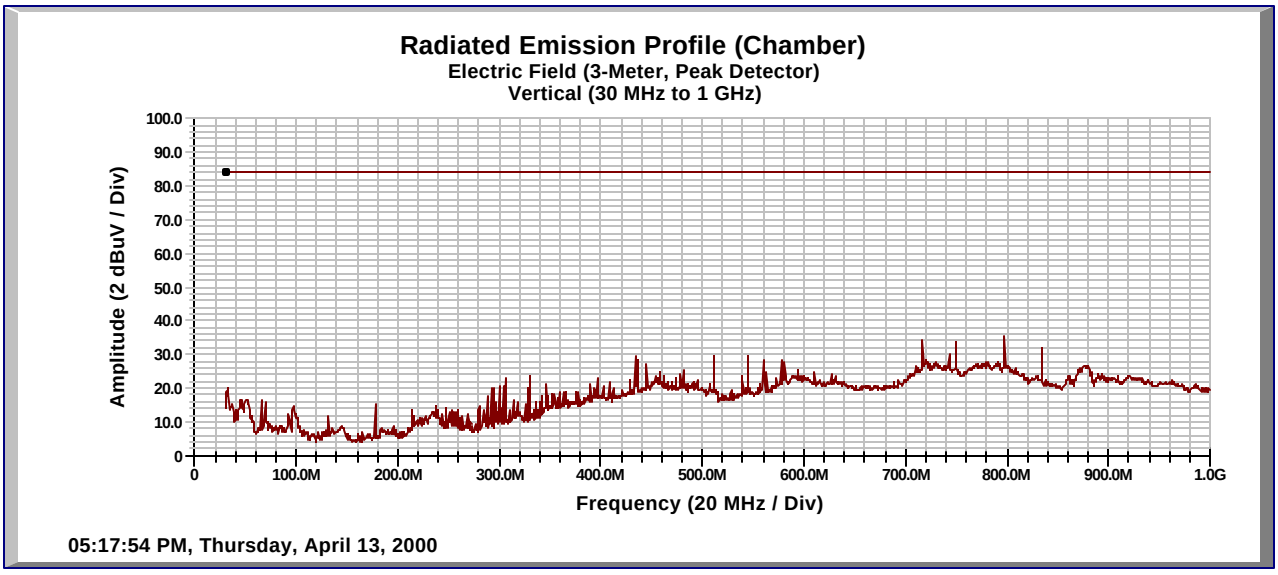
Radiated Emissions

Tracking # 0503ALL Page 1 of 5

Manufacturer	Allen Telecom	**Date**	13 April, 2000
Witness	None	**Temp / Hum**	73 deg. F / 36 %rh
EUT Name	PCS1900 Channel Selective Repeater	**Line AC / Freq**	120 VAC / 60 Hz
EUT Model	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)		



Configuration	Low Channel Duplexers, Downlink no ICE, Input (CW @ -31 dBm)

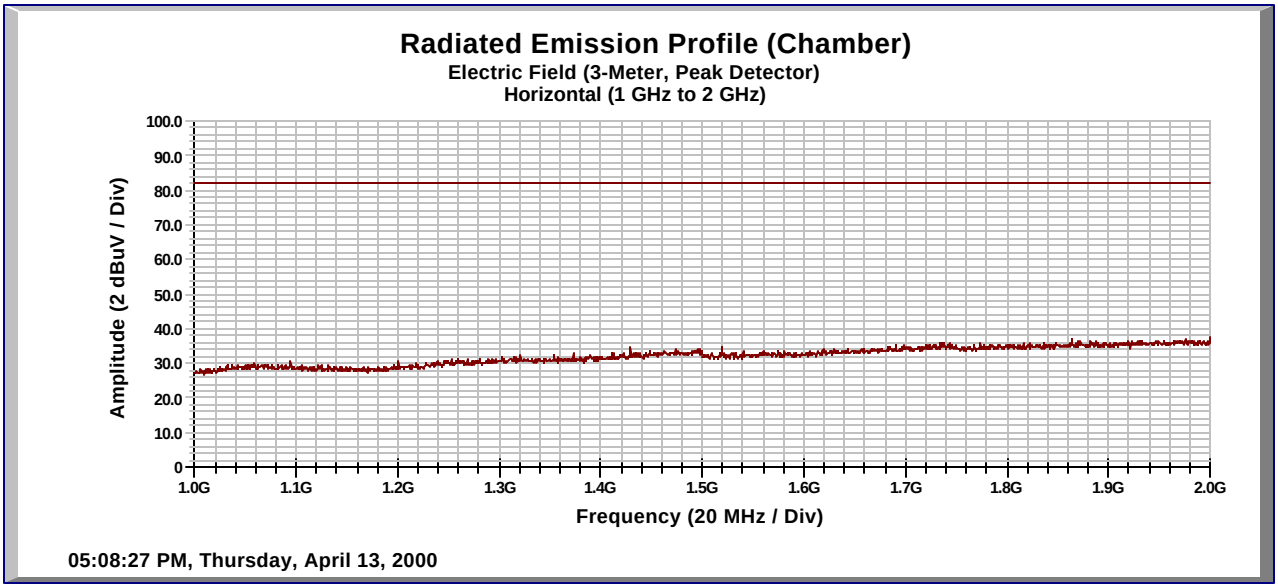


Radiated Emissions

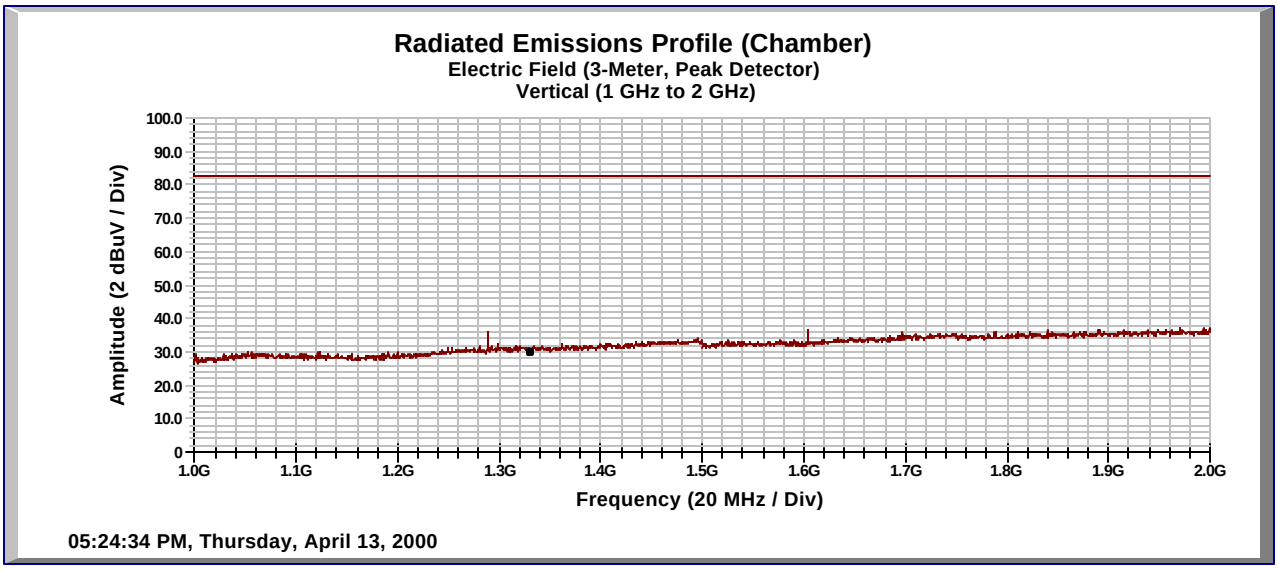
Tracking # 0503ALL Page 2 of 5

Manufacturer	Allen Telecom	**Date**	13 April, 2000
Witness	None	**Temp / Hum**	73 deg. F / 36 %rh
EUT Name	PCS1900 Channel Selective Repeater	**Line AC / Freq**	120 VAC / 60 Hz
EUT Model	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)



Configuration Low Channel Duplexers, Downlink no ICE, Input (CW @ -31 dBm)



Radiated Emissions

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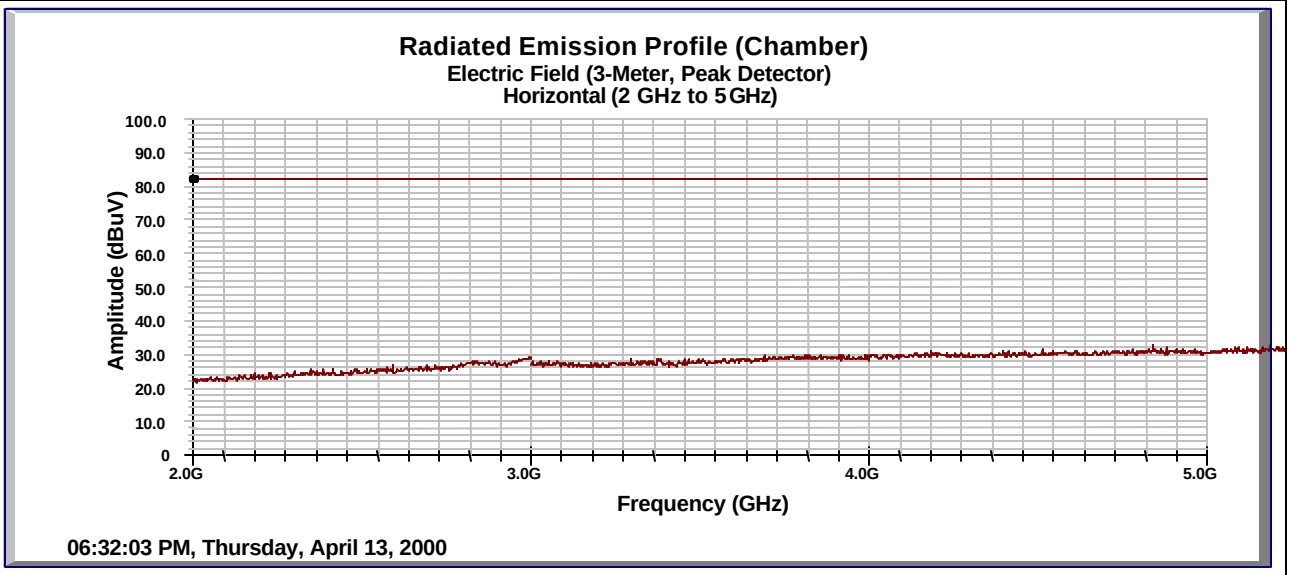
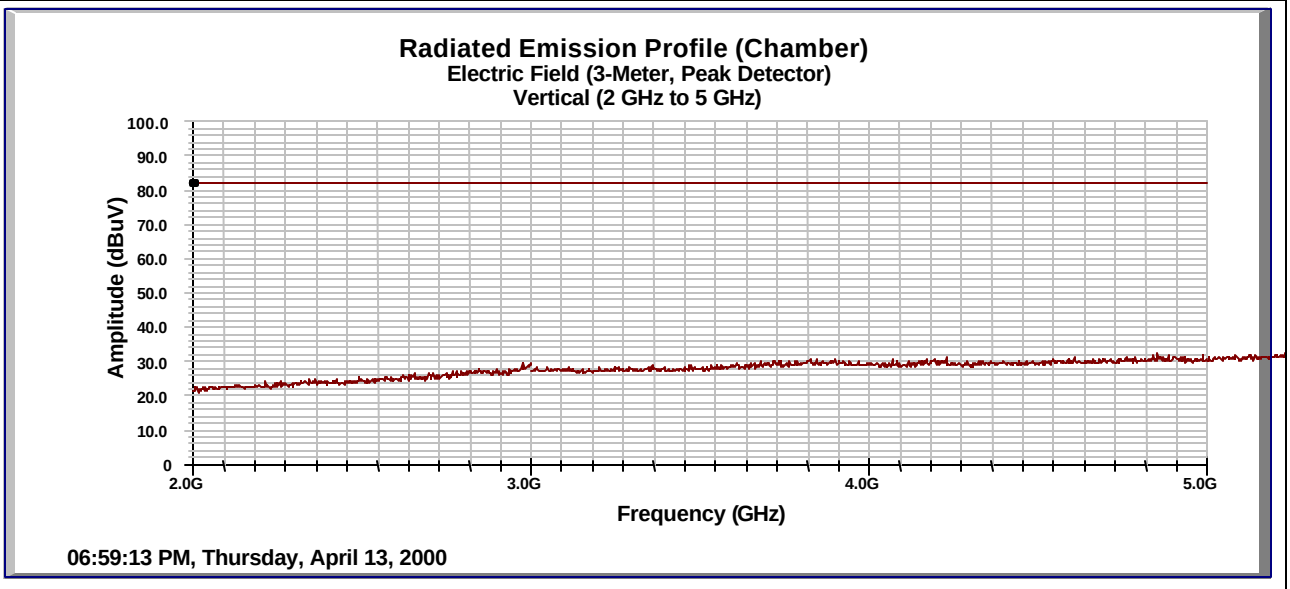
Manufacturer	Allen Telecom	**Date**	13 April, 2000
Witness	None	**Temp / Hum**	73 deg. F / 36 %rh
EUT Name	PCS1900 Channel Selective Repeater	**Line AC / Freq**	120 VAC / 60 Hz
EUT Model	MR741	**RBW / VBW**	30 kHz / 300 kHz
EUT Serial		**Attenuation**	0
Specification	FCC Part 24 Subpart E, ISC RSP-100	**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)		



Configuration	Low Channel Duplexers, Downlink no ICE, Input (CW @ -31 dBm)



Radiated Emissions

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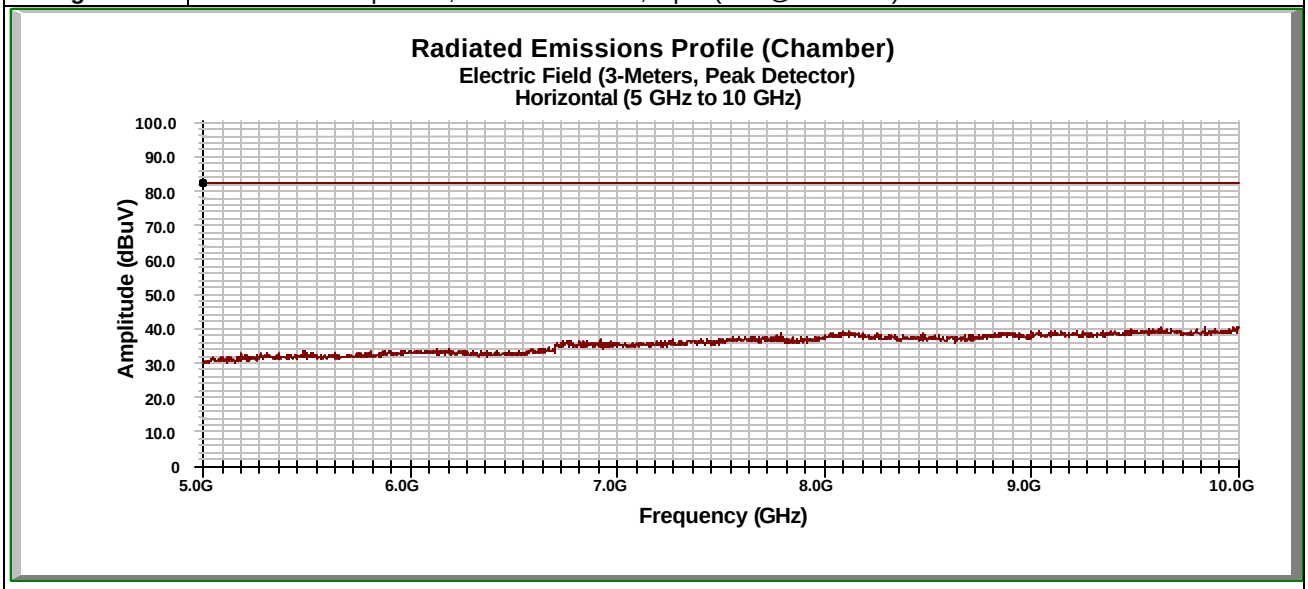
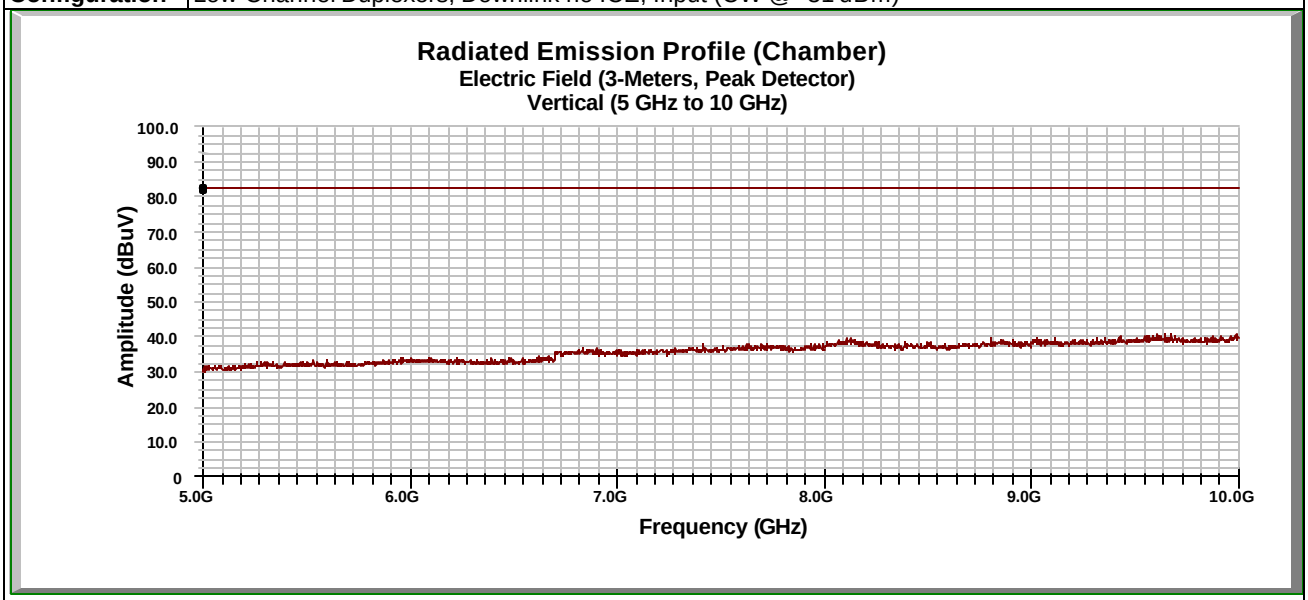
Manufacturer	Allen Telecom	**Date**	13 April, 2000
Witness	None	**Temp / Hum**	73 deg. F / 36 %rh
EUT Name	PCS1900 Channel Selective Repeater	**Line AC / Freq**	120 VAC / 60 Hz
EUT Model	MR741	**RBW / VBW**	30 kHz / 300 kHz
EUT Serial		**Attenuation**	0
Specification	FCC Part 24 Subpart E, ISC RSP-100	**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)		



Configuration	Low Channel Duplexers, Downlink no ICE, Input (CW @ -31 dBm)



Radiated Emissions

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Manufacturer	Allen Telecom	**Date**	17 April, 2000
Witness	None	**Temp / Hum**	74 deg. F / 42% rh
EUT Name	PCS1900 Channel Selective Repeater	**Line AC / Freq**	120 VAC / 60 Hz
EUT Model	MR741	**RBW / VBW**	120 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

Emission Freq (GHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	3 Meter Limit (dBuV/m)	Spec Margin (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	H	1.0	BR	44.84	26.47	5.23	12.76	36.37	84.4	-48.03
304.00	H	1.0	BR	44.08	26.50	5.27	13.01	35.86	84.4	-48.54
511.50	H	3.0	BL	29.20	27.94	7.23	18.35	26.84	84.4	-57.56

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y) = \pm 1.6$dB Expanded Uncertainty $U = ku_c(y)$ $k = 2$ for 95% confidence

Notes:

Performed by Steve O'Steen (Name / Signature) Date 17 April, 2000

EMC Supervisor Dale Albright (Name / Signature) Date 17 April, 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 (dBμV/m) = FIM - AMP + CBL + ACF + CCF

Where: FIM = Field Intensity Meter (dBμV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB)

CCF = Chamber Correction Factor (dB)

μV/m = Common Antilog [(dBμV/m)/20)]

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

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

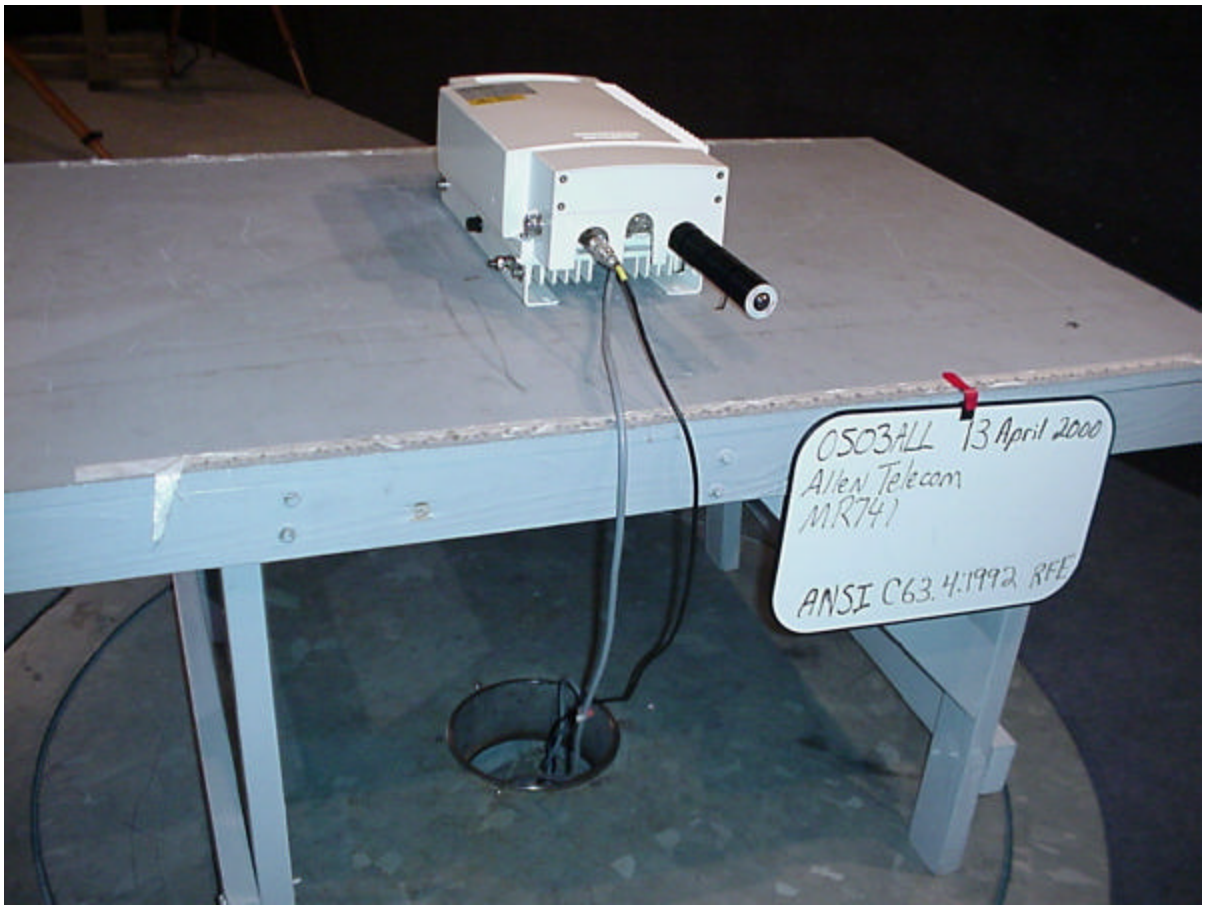
$E_{v/m} = \sqrt{30GP} / R$.

G = 1.64 (dipole gain for emissions ≤ 1 GHz)
G = 1.0 (isotropic gain for emissions > 1 GHz)
$P = 10^{-5}$ Watts
R = 3 meters

For emissions ≤ 1 GHz, the limit = 84.4 dBuV/m.

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

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



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

2.1.6-3 Photograph of Test Setup: Radiated Spurious Emissions, OATS (Front)

2.1.6-4 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.

Passband Gain and Bandwidth

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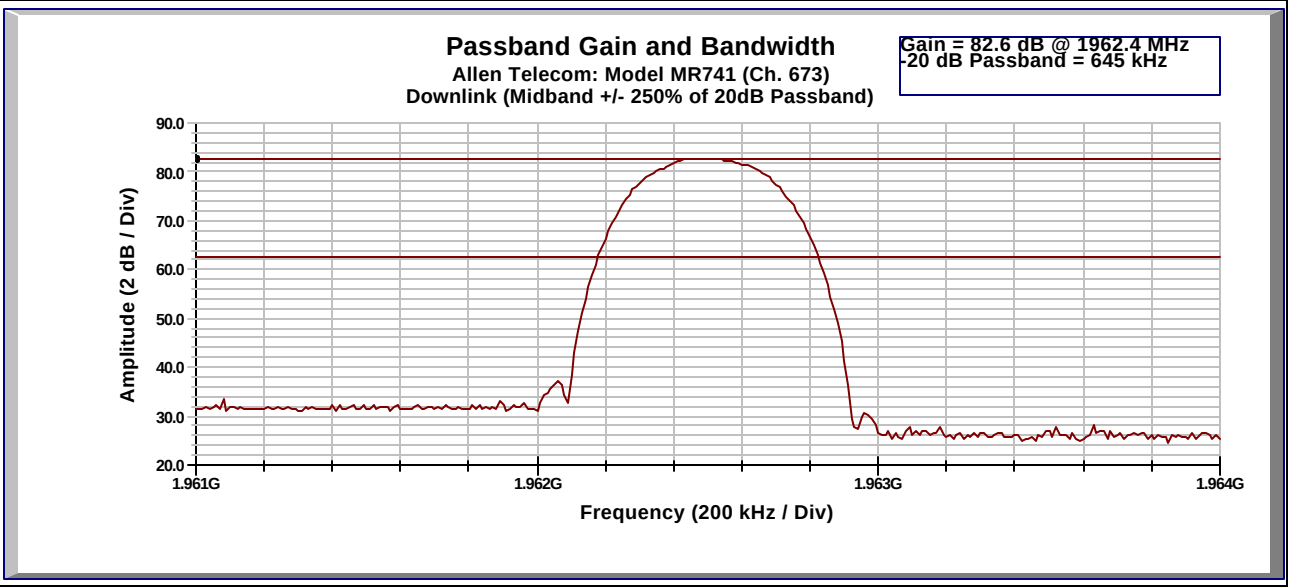
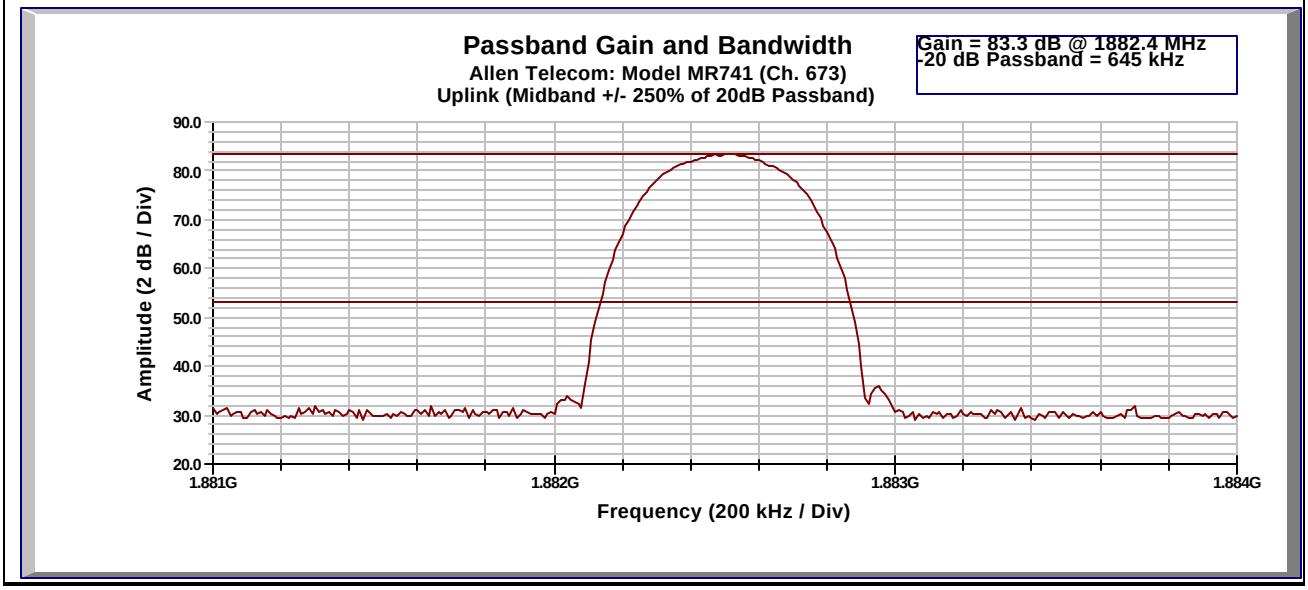
Manufacturer	Allen Telecom	**Date**	22 March, 2000
Witness	None	**Temp / Hum**	73 deg F / 34%
EUT Name	PCS1900 Channel Selective Repeater	**Line AC / Freq**	120 VAC / 60 Hz
EUT Model	MR741	**RBW / VBW**	100 kHz / 100 kHz
EUT Serial		**Attenuation**	50 dB internal
Specification	ISC RSP-100	**Detector**	Peak
Test Method	RSS-131:1996	**Freq Step**	10 kHz
Configuration	High Channel Duplexers, Downlink with ICE, Input (CW @ -32 dBm)		



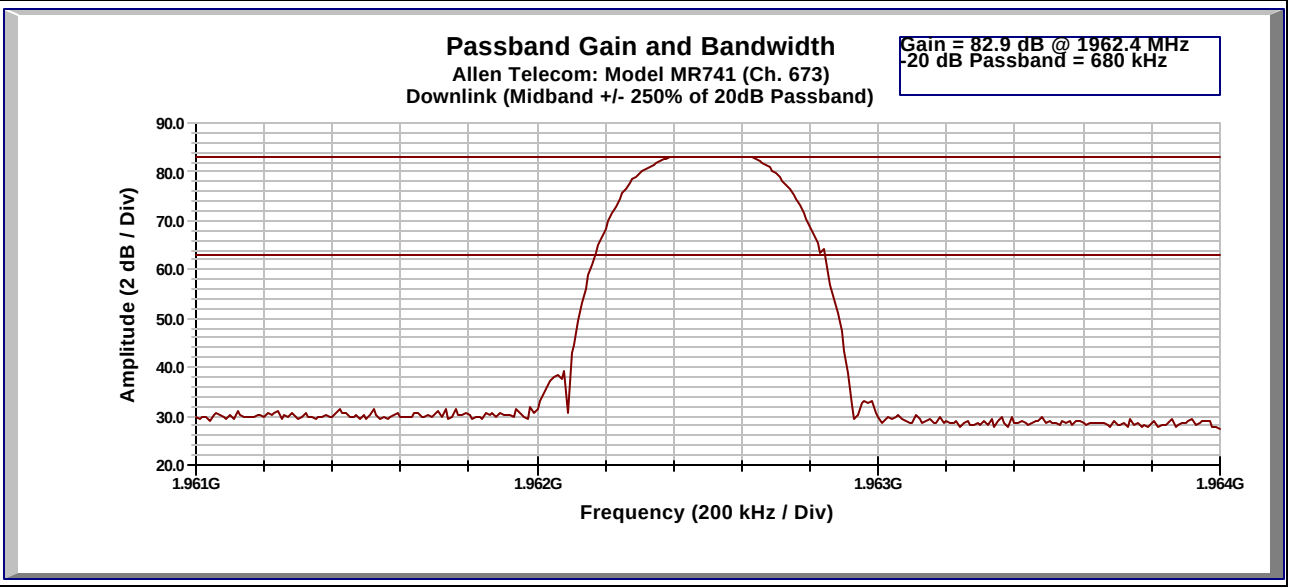
Configuration	High Channel Duplexers, Uplink with ICE, Input (CW @ -32 dBm)



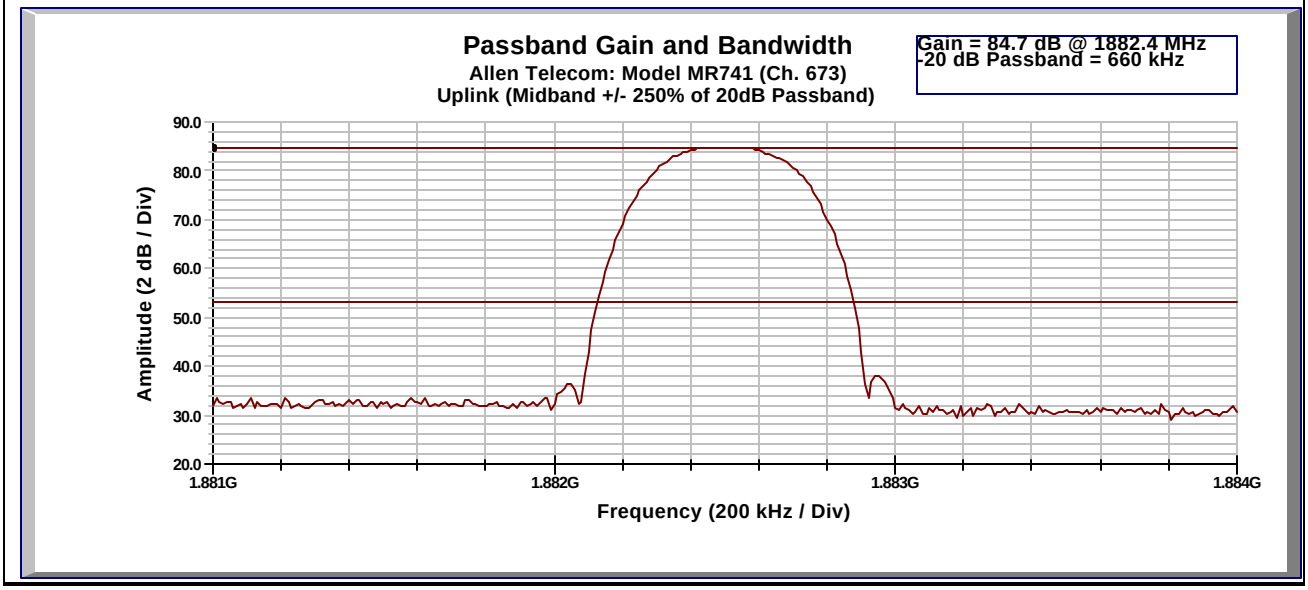
Passband Gain and Bandwidth

Tracking # 0503ALL Page 2 of 2

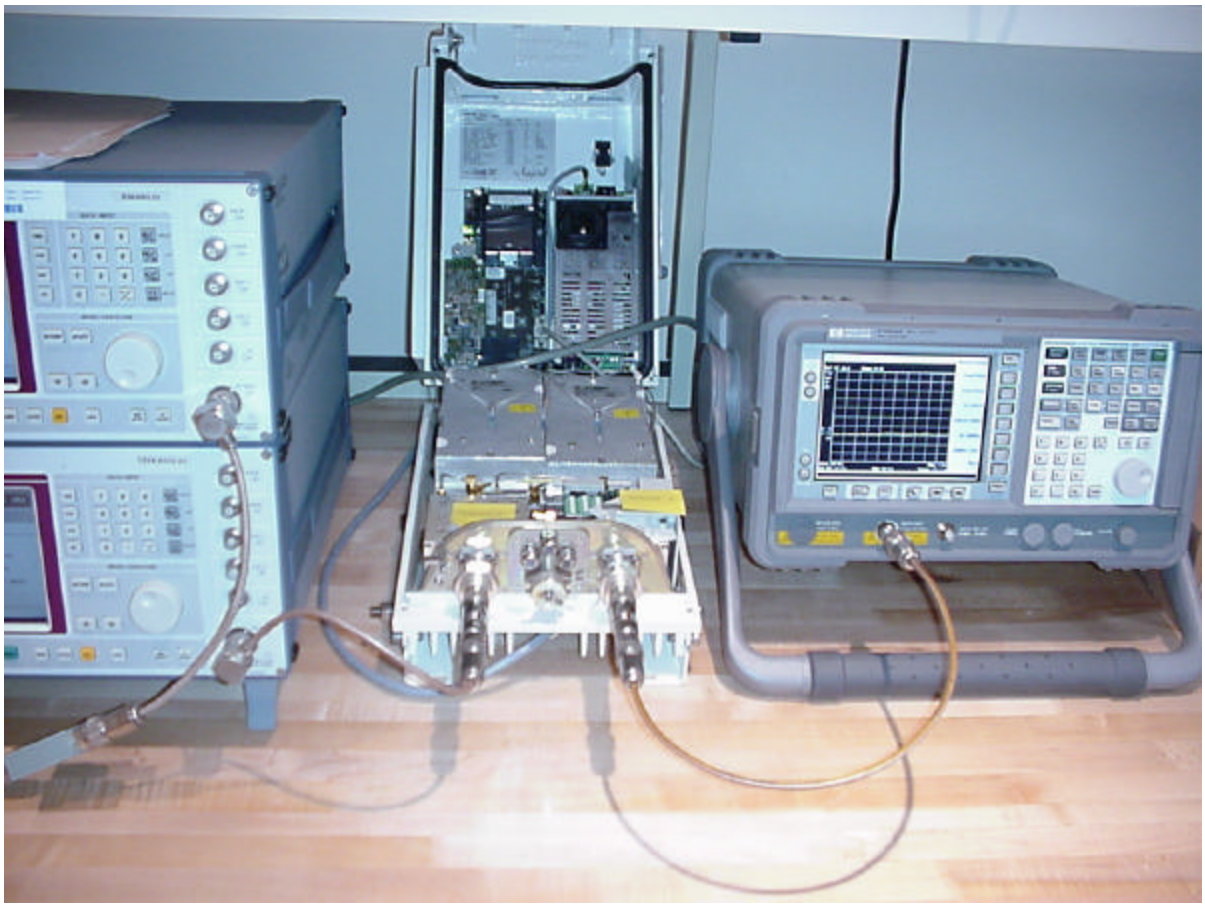
Manufacturer	Allen Telecom	**Date**	22 March, 2000
Witness	None	**Temp / Hum**	73 deg F / 34%
EUT Name	PCS1900 Channel Selective Repeater	**Line AC / Freq**	120 VAC / 60 Hz
EUT Model	MR741	**RBW / VBW**	100 kHz / 100 kHz
EUT Serial		**Attenuation**	50 dB internal
Specification	ISC RSP-100	**Detector**	Peak
Test Method	RSS-131:1996	**Freq Step**	10 kHz
Configuration	High Channel Duplexers, Downlink no ICE, Input (CW @ -32 dBm)		



Configuration	High Channel Duplexers, Uplink no ICE, Input (CW @ -32 dBm)



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



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.

Signal Integrity

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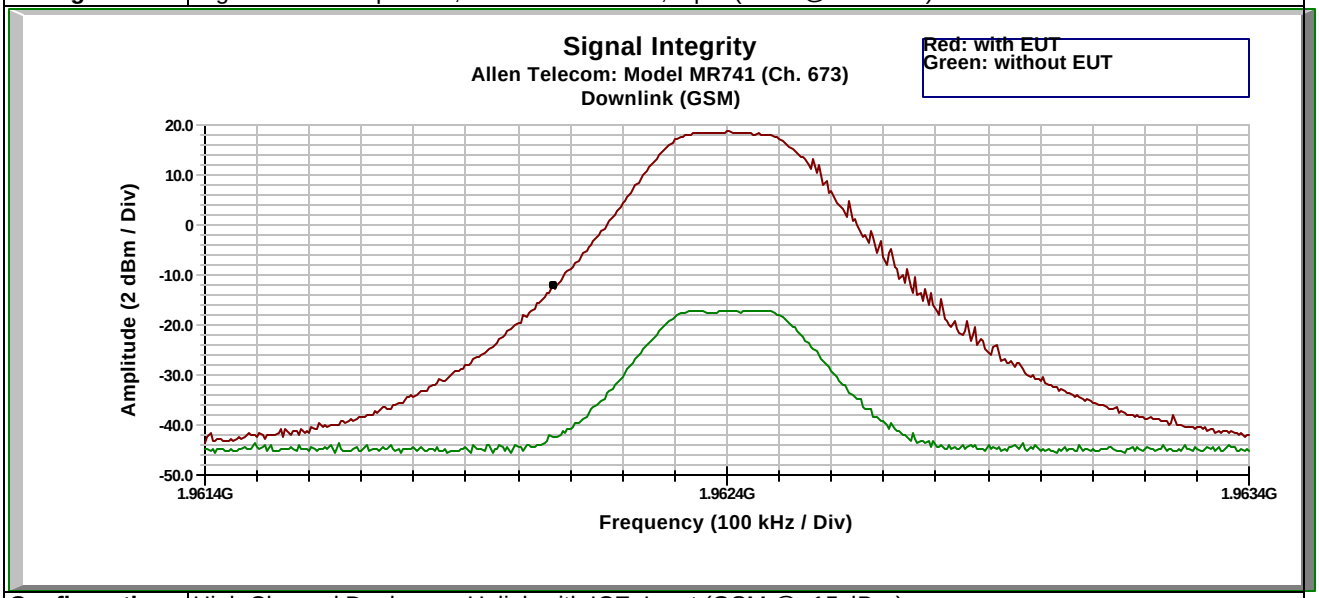
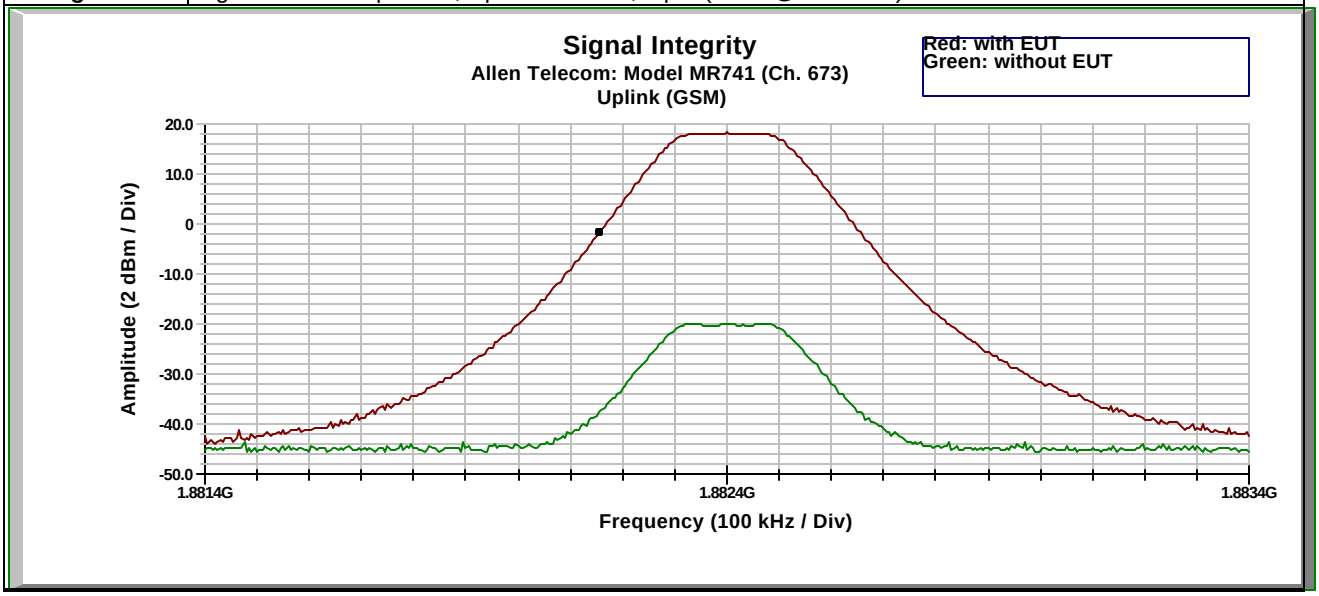
Manufacturer	Allen Telecom	**Date**	22 March, 2000
Witness	None	**Temp / Hum**	73 deg F / 34%
EUT Name	PCS1900 Channel Selective Repeater	**Line AC / Freq**	120 VAC / 60 Hz
EUT Model	MR741	**RBW / VBW**	100 kHz / 100 kHz
EUT Serial		**Attenuation**	50 dB internal
Specification	ISC RSP-100	**Detector**	Peak
Test Method	RSS-131:1996	**Freq Step**	10 kHz
Configuration	High Channel Duplexers, Downlink with ICE, Input (GSM @ -15 dBm)		



Configuration	High Channel Duplexers, Uplink with ICE, Input (GSM @ -15 dBm)



Signal Integrity

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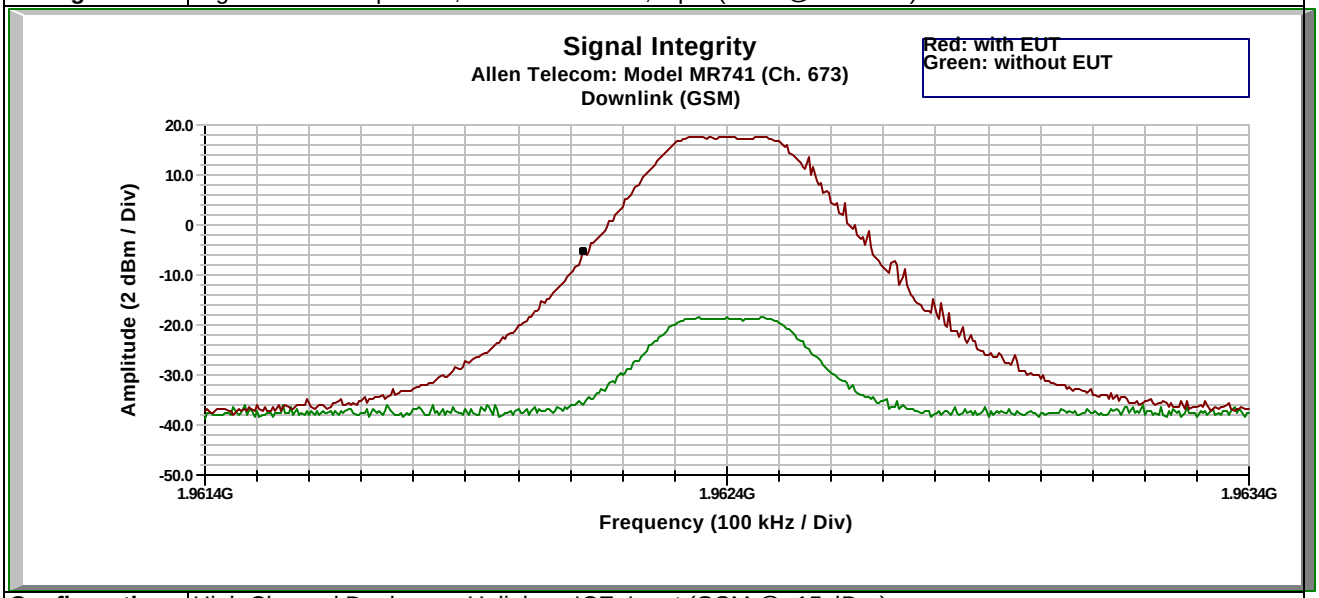
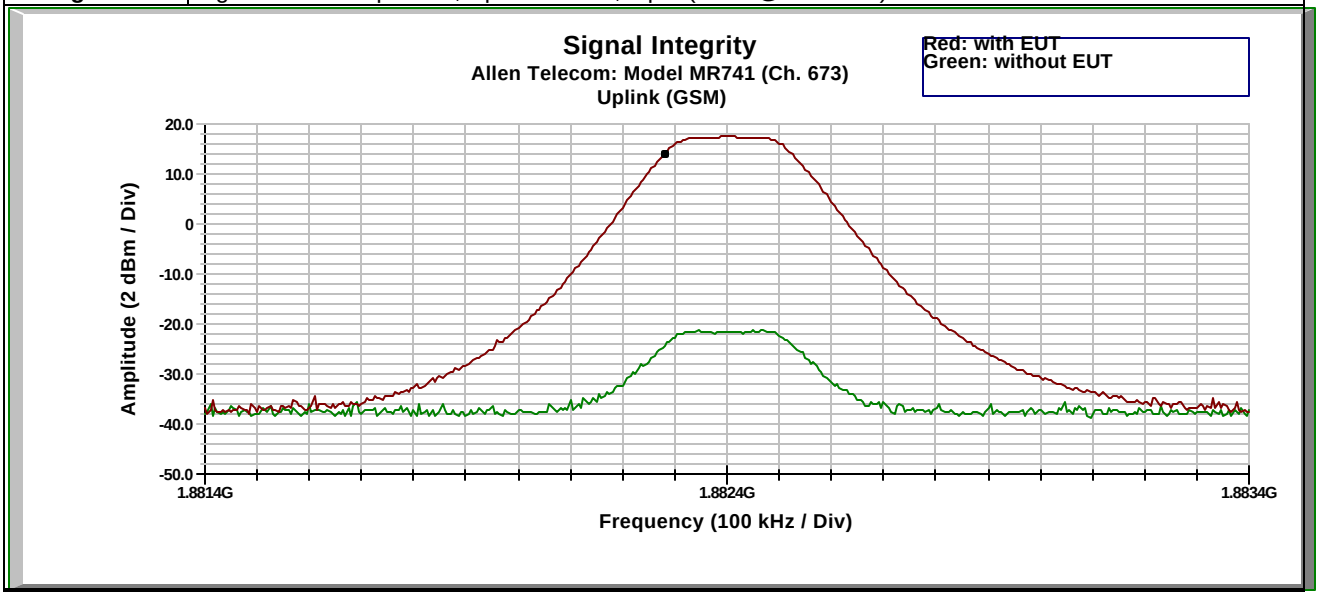
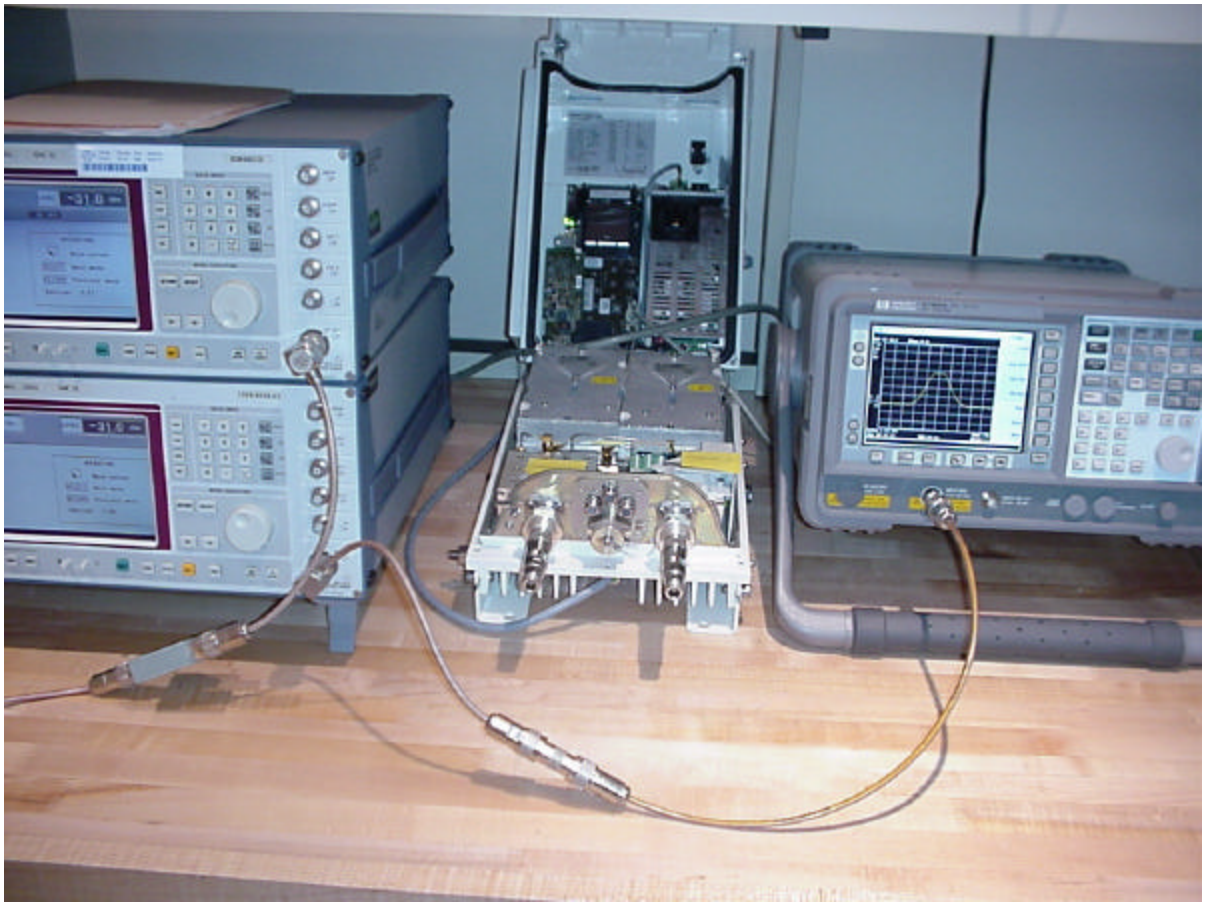
Manufacturer	Allen Telecom	**Date**	22 March, 2000
Witness	None	**Temp / Hum**	73 deg F / 34%
EUT Name	PCS1900 Channel Selective Repeater	**Line AC / Freq**	120 VAC / 60 Hz
EUT Model	MR741	**RBW / VBW**	100 kHz / 100 kHz
EUT Serial		**Attenuation**	50 dB internal
Specification	ISC RSP-100	**Detector**	Peak
Test Method	RSS-131:1996	**Freq Step**	10 kHz
Configuration	High Channel Duplexers, Downlink no ICE, Input (GSM @ -15 dBm)		



Configuration	High Channel Duplexers, Uplink no ICE, Input (GSM @ -15 dBm)



3.2.5-1 Photograph of Test Setup: Signal Integrity



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

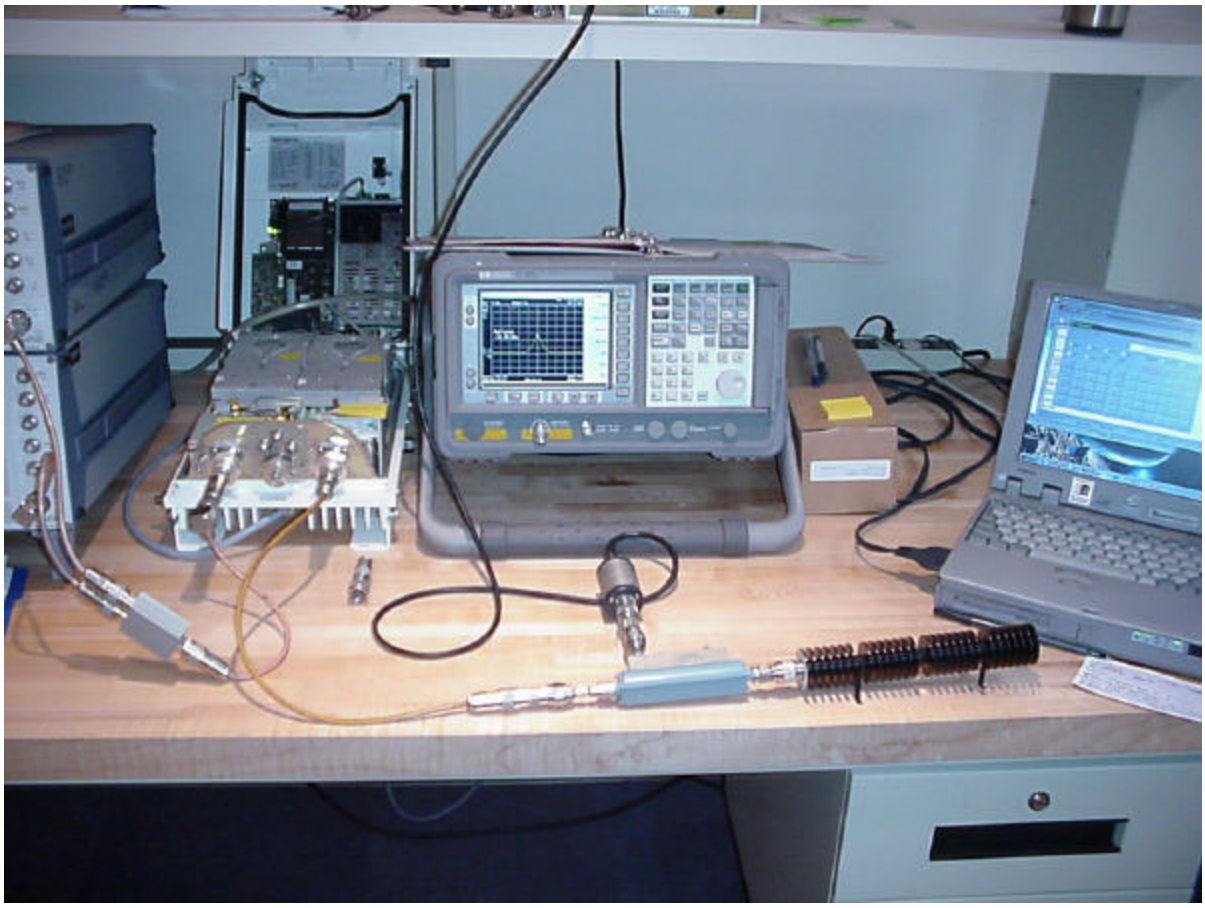
The signal generator frequencies f_1 and f_2 were selected so that their third order intermodulation product frequencies f_3 ($2f_1 - f_2$) and f_4 ($2f_2 - f_1$) were all within the passband of the duplexer. The input level to the EUT was increased until either of the intermodulation tone levels (P_{03} or P_{04}) 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

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



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).

Intermodulation

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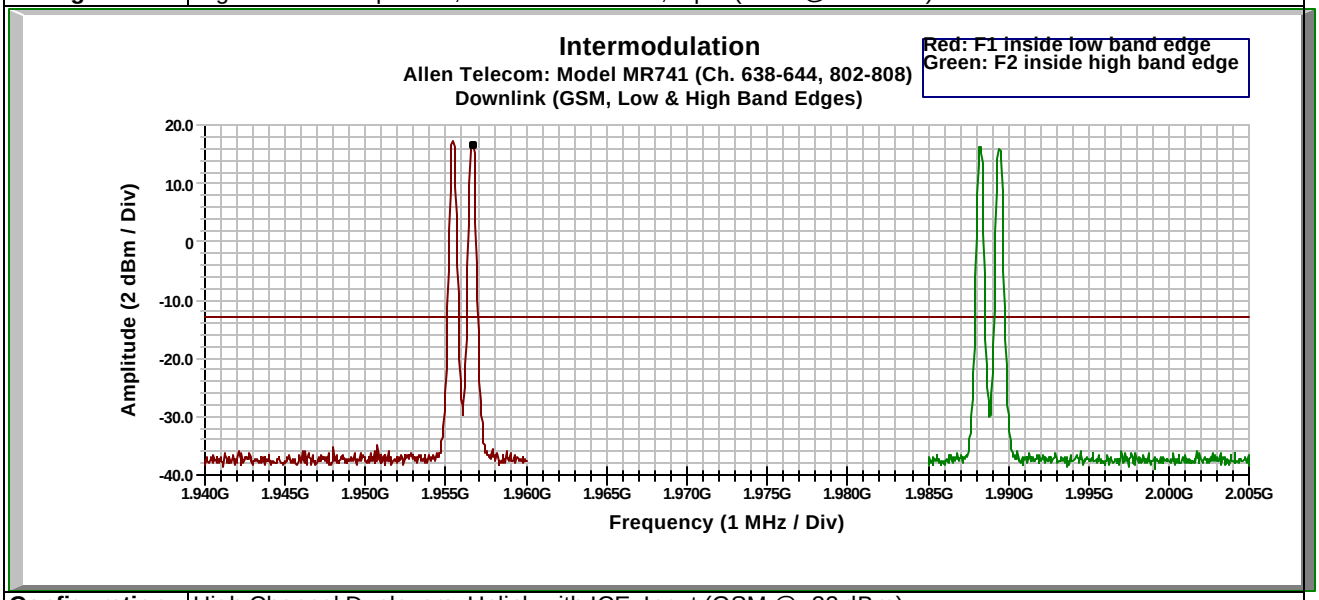
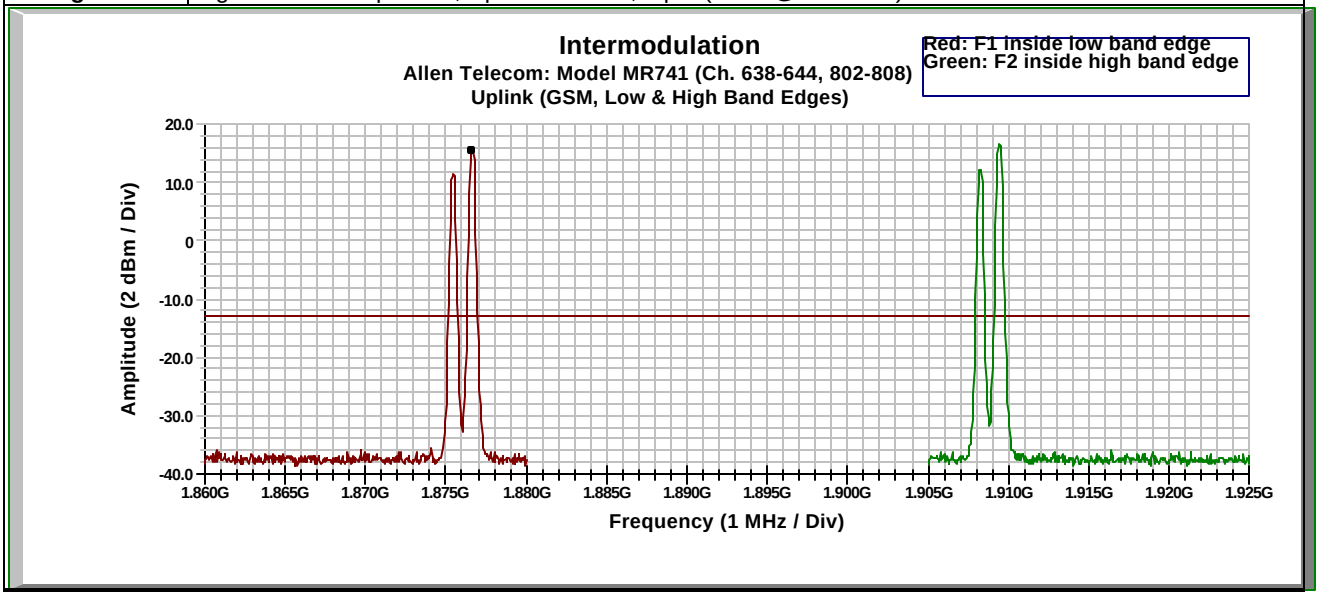
Manufacturer	Allen Telecom	**Date**	28 March, 2000
Witness	None	**Temp / Hum**	73 deg F / 31%
EUT Name	PCS1900 Channel Selective Repeater	**Line AC / Freq**	120 VAC / 60 Hz
EUT Model	MR741	**RBW / VBW**	100 kHz / 100 kHz
EUT Serial		**Attenuation**	50 dB internal
Specification	ISC RSP-100	**Detector**	Peak
Test Method	RSS-131:1996	**Freq Step**	Sweep

Configuration High Channel Duplexers, Downlink with ICE, Input (GSM @ -32 dBm)



Configuration High Channel Duplexers, Uplink with ICE, Input (GSM @ -32 dBm)



Intermodulation

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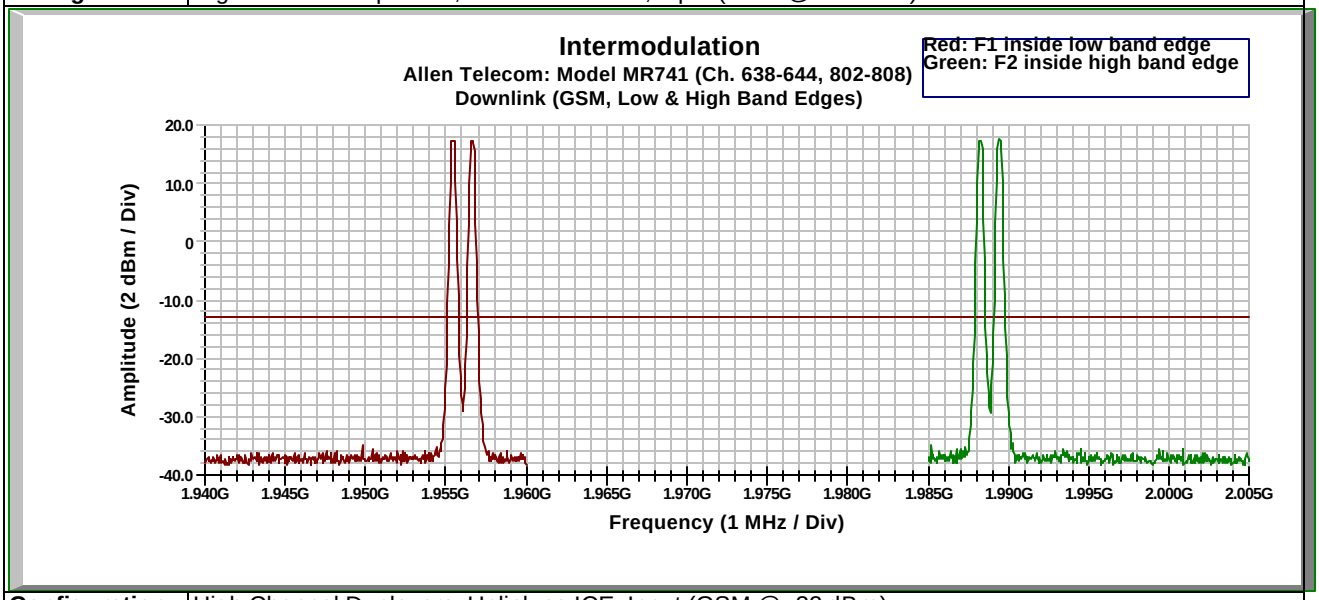
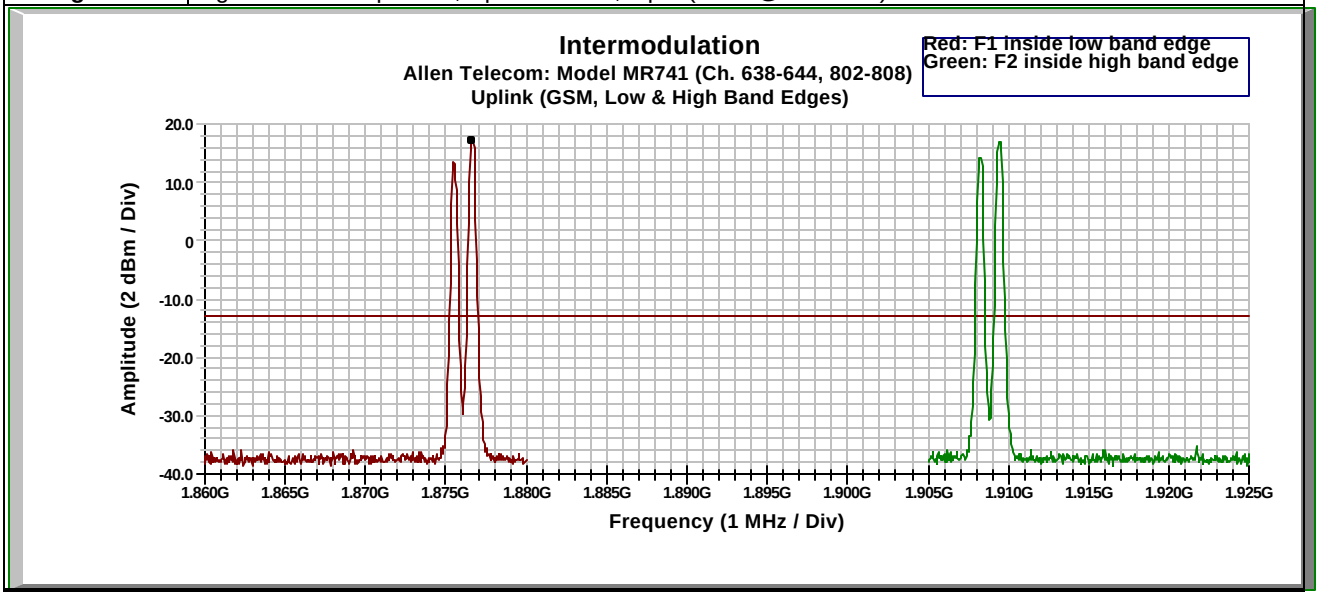
Manufacturer	Allen Telecom	**Date**	28 March, 2000
Witness	None	**Temp / Hum**	73 deg F / 31%
EUT Name	PCS1900 Channel Selective Repeater	**Line AC / Freq**	120 VAC / 60 Hz
EUT Model	MR741	**RBW / VBW**	100 kHz / 100 kHz
EUT Serial		**Attenuation**	50 dB internal
Specification	ISC RSP-100	**Detector**	Peak
Test Method	RSS-131:1996	**Freq Step**	Sweep
Configuration	High Channel Duplexers, Downlink no ICE, Input (GSM @ -32 dBm)		



Configuration	High Channel Duplexers, Uplink no ICE, Input (GSM @ -32 dBm)



Intermodulation

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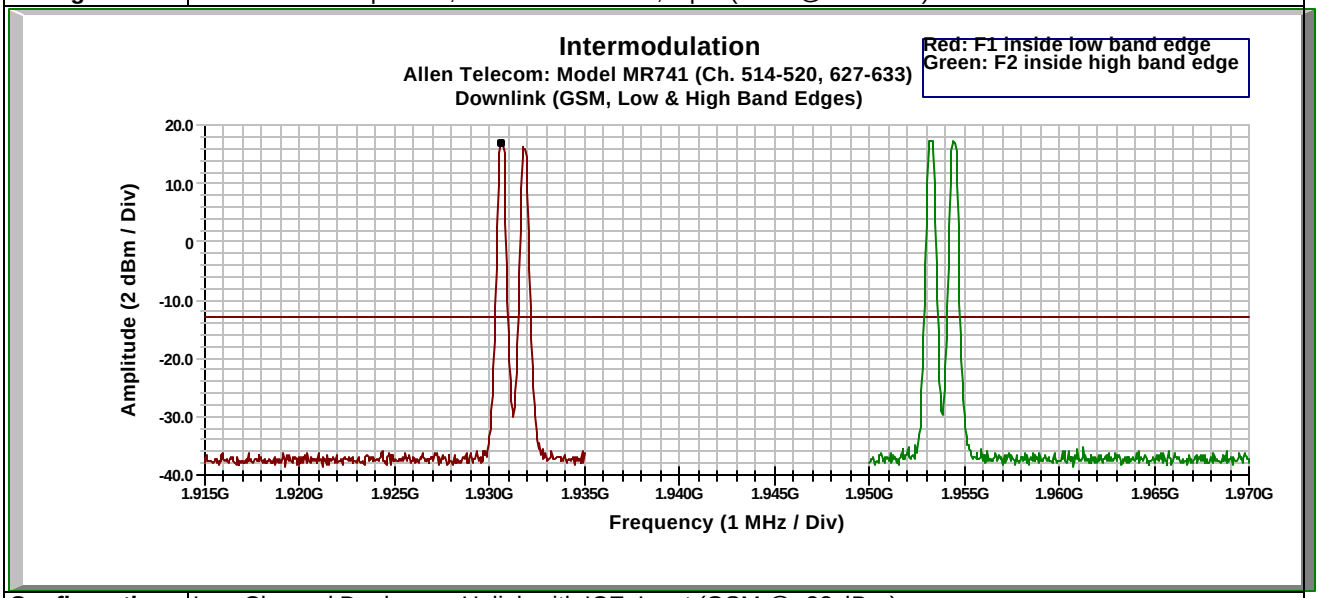
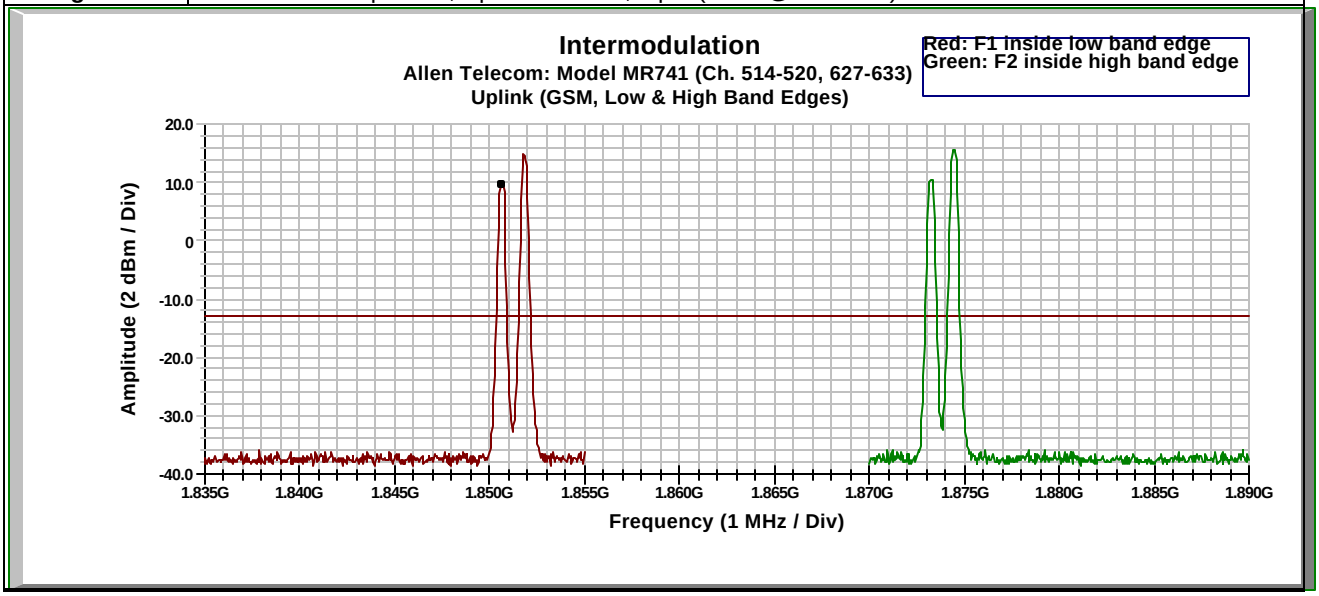
Manufacturer	Allen Telecom	**Date**	29 March, 2000
Witness	None	**Temp / Hum**	74 deg F / 28%
EUT Name	PCS1900 Channel Selective Repeater	**Line AC / Freq**	120 VAC / 60 Hz
EUT Model	MR741	**RBW / VBW**	100 kHz / 100 kHz
EUT Serial		**Attenuation**	50 dB internal
Specification	ISC RSP-100	**Detector**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



Configuration	Low Channel Duplexers, Uplink with ICE, Input (GSM @ -32 dBm)



Intermodulation

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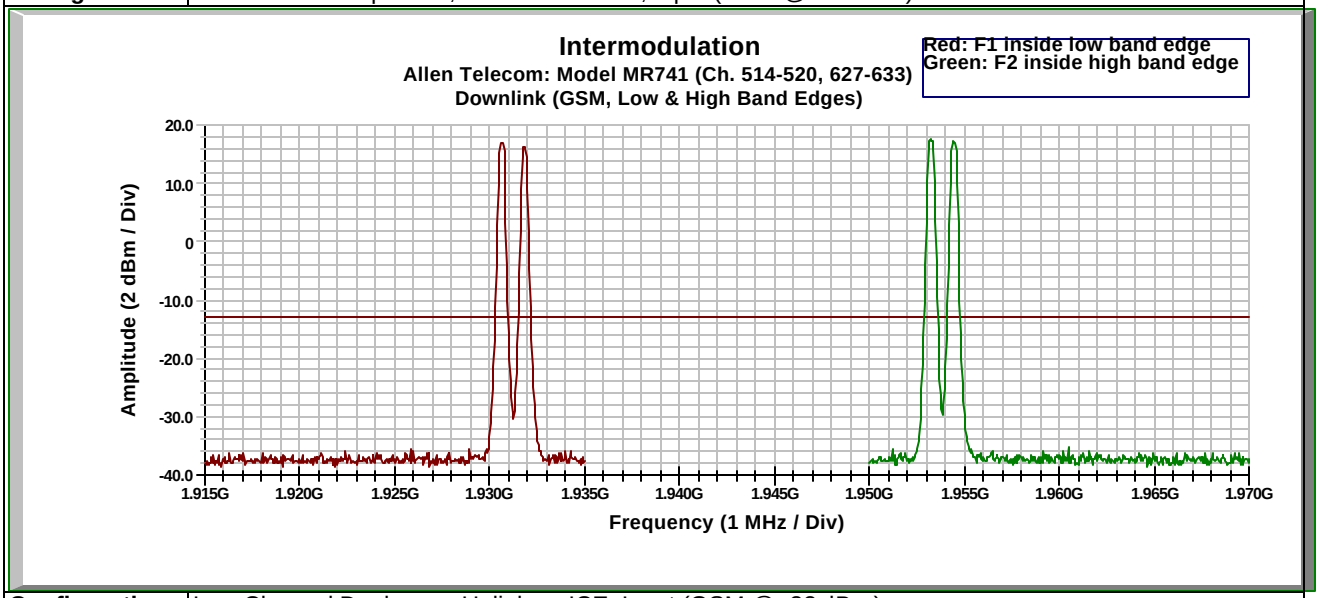
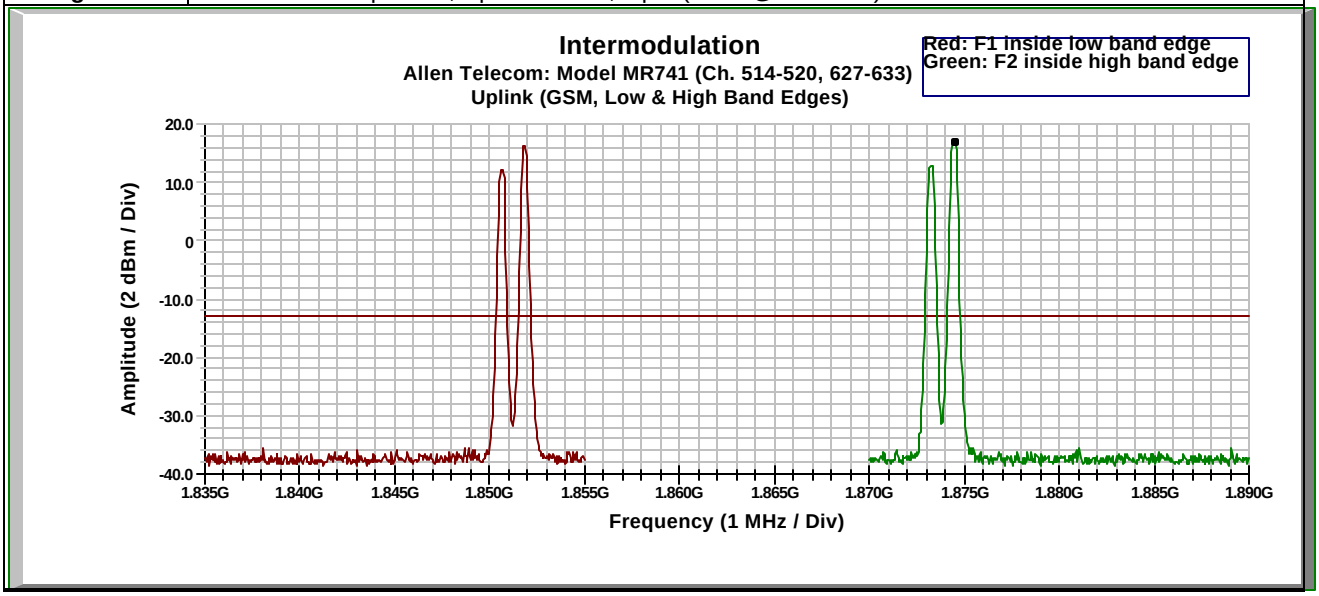
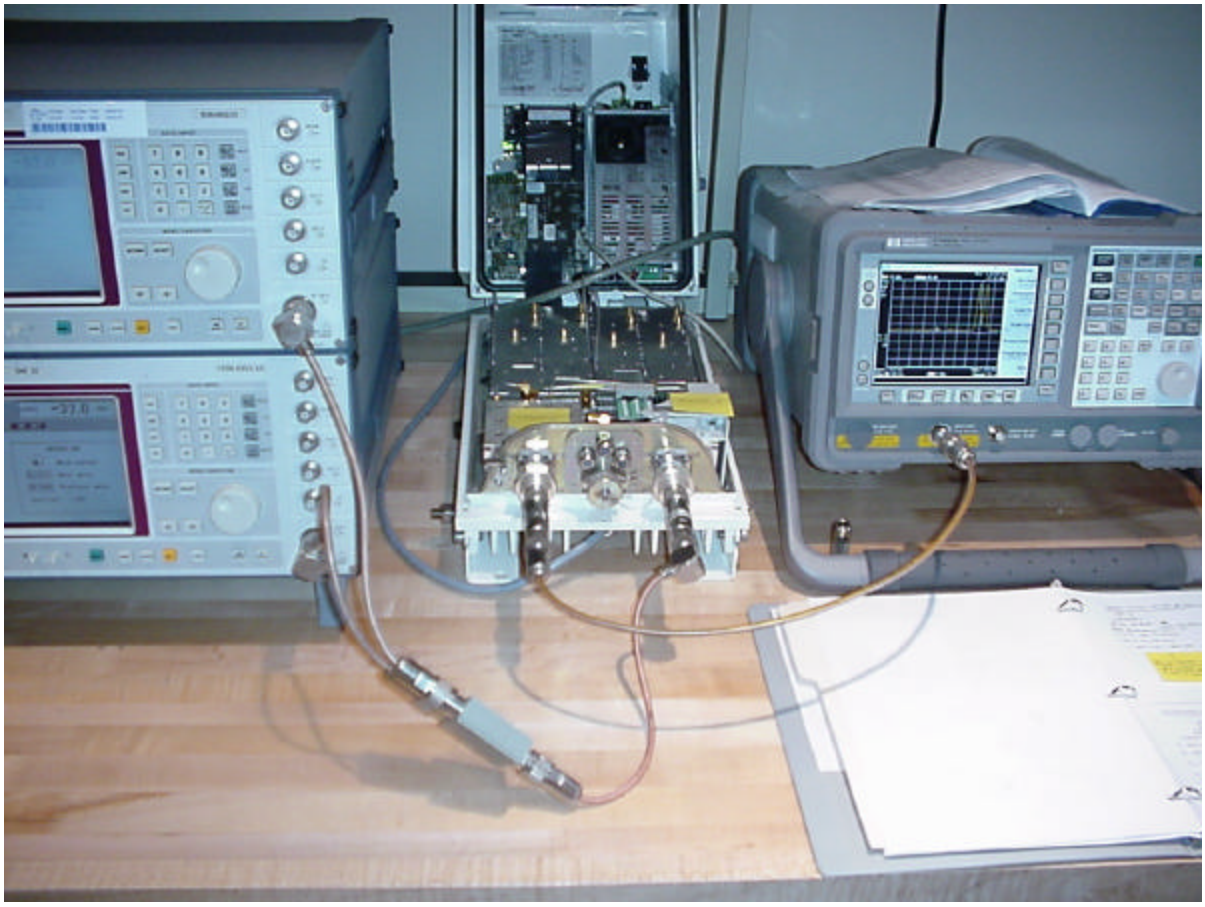
Manufacturer	Allen Telecom	**Date**	29 March, 2000
Witness	None	**Temp / Hum**	73 deg F / 28%
EUT Name	PCS1900 Channel Selective Repeater	**Line AC / Freq**	120 VAC / 60 Hz
EUT Model	MR741	**RBW / VBW**	100 kHz / 100 kHz
EUT Serial		**Attenuation**	50 dB internal
Specification	ISC RSP-100	**Detector**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



Configuration	Low Channel Duplexers, Uplink no ICE, Input (GSM @ -32 dBm)



3.4.5-1 Photograph of Test Setup: Intermodulation



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.

Conducted Spurious Emissions

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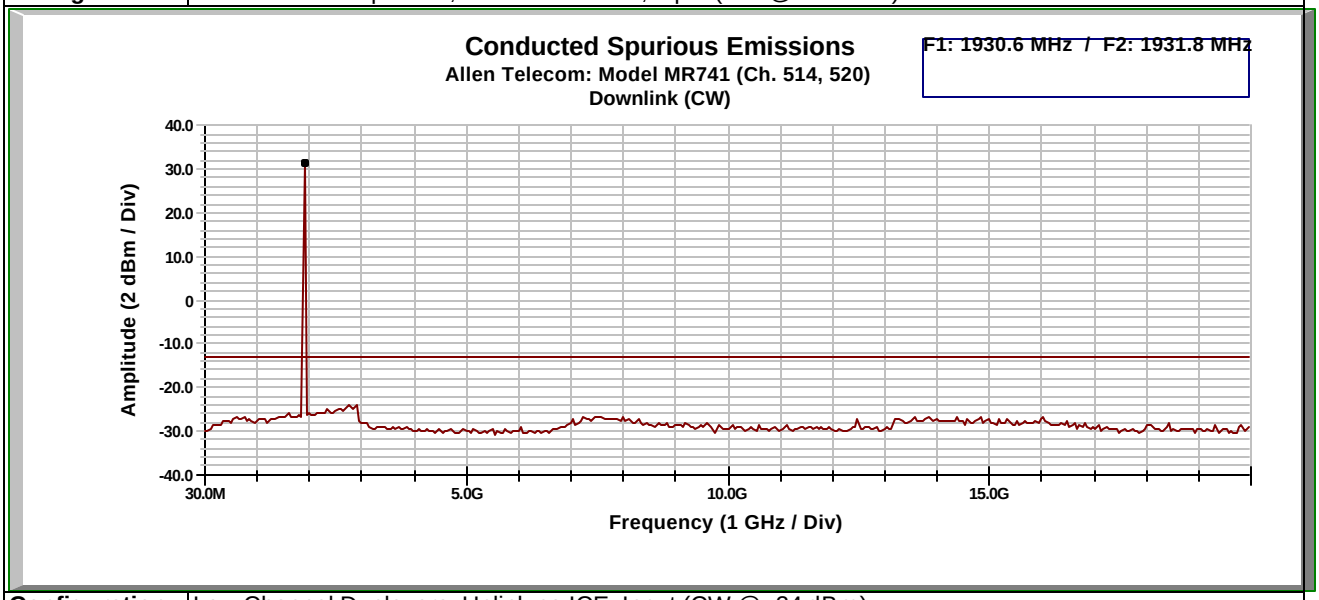
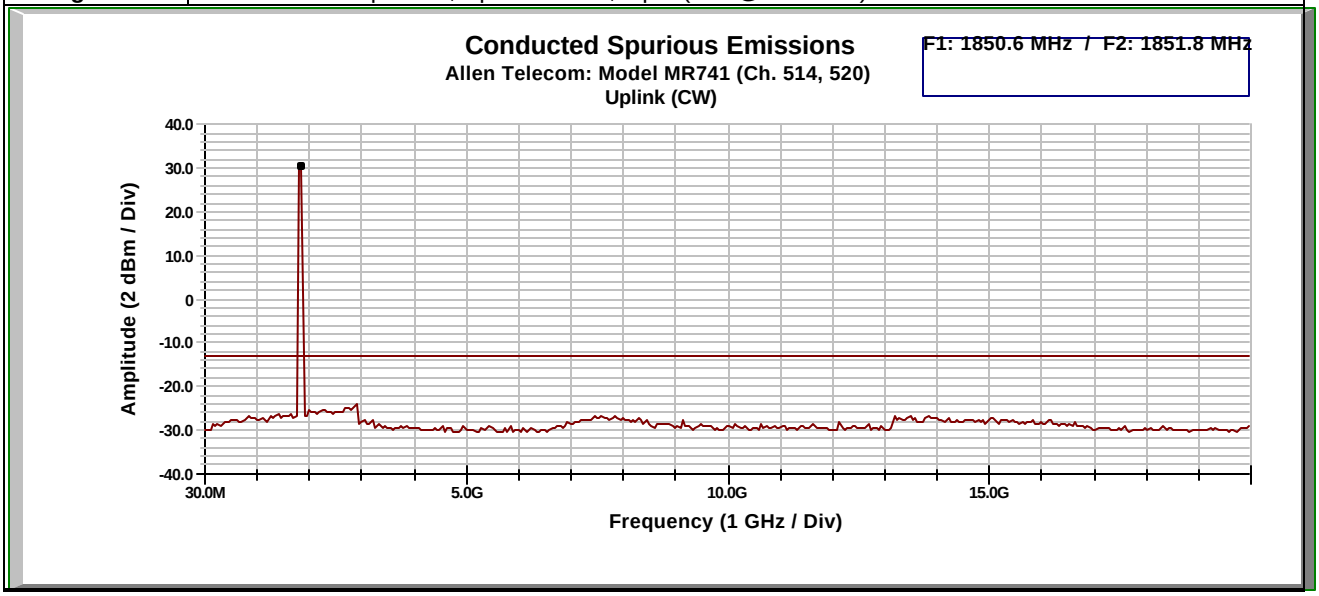
Manufacturer	Allen Telecom	**Date**	11 April, 2000
Witness	None	**Temp / Hum**	73 deg F / 44%
EUT Name	PCS1900 Channel Selective Repeater	**Line AC / Freq**	120 VAC / 60 Hz
EUT Model	MR741	**RBW / VBW**	1 MHz / 3 MHz
EUT Serial		**Attenuation**	10dB int. 30dB ext.
Specification	FCC Part 24	**Detector**	Peak
Test Method	RSS-131:1996	**Freq Step**	Sweep
Configuration	Low Channel Duplexers, Downlink no ICE, Input (CW @ -31 dBm)		



Configuration	Low Channel Duplexers, Uplink no ICE, Input (CW @ -24 dBm)



3.5.5-1 Photograph of Test Setup: Conducted Spurious Emissions