

FCC Test Report Test report no.: EMC_831FCC15.407_2005_FC_PA

FCC Part 15.407 for UNII Devices / CANADA RSS-210 Issue 5 for LELEAN Devices

EUT: WLAN Model: BCM94318MPAGH HOST: Test Fixture (Modular Approval) (C2P Change to add Fairchild PA) FCC ID: QDS-BRCM1017 IC ID: 4324A-BRCM1017 (This test report covers freq. 5180-5320MHz)



Accredited according to ISO/IEC 17025



Bluetooth Qualification Test Facility (BQTF)



FCC listed # 101450

IC recognized # 3925

CETECOM Inc.

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- 1.1 Notes

The test results of this test report relate exclusively to the test item specified in 1.5. The CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM Inc USA.

TEST REPORT PREPARED BY: EMC Engineer: Harpreet Sidhu

1.2 Testing laboratory
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1.3 Details of applic	ant				
Name	:	Broadcom corporation			
Street	:	190 Mathilda Place			
City / Zip Code	:	Sunnyvale, CA 94086			
Country	:	USA			
Contact	:	Dan Lawless			
Telephone	:	408-922-5870			
Tele-fax	:	408-543-3399			
e-mail	:	dlawless@broadcom.com			
1.4 Application deta	ils				
Date of receipt test item	ı :	2005-03-14			
Date of test	:	2005-03-14/15/17/18/22			
1.5 Test item					
Manufacturer	:	Applicant			
Model No. (EUT)	:	BCM94318MPAGH			
Host	:	Test Fixture			
Description	:	WLAN MiniPCI Multiband card incorporating 2.4GHz and 5GHz radios			
FCC ID	:	QDS-BRCM1017			
IC ID	:	4324A-BRCM1017			
Additional information	1				
Frequency	:	2412MHz – 2472MHz for 2.4GHz band (not covered in this test report) 5180MHz – 5320MHz for 5GHz band (covered in this test report) 5745MHz – 5825MHz for 5GHz band (not covered in this test report)			
Type of modulation	:	DSSS / OFDM (orthogonal frequency division multiplexing)			
Number of channels	:	13 for 2.4GHz band 13 for 5GHz band			
Antenna	:	5.1dBi max. gain Stamped metal sheet antenna for			
		5180-5320GHz band (Hitachi model HFT17-DL03)			
Power supply	:	3.3 VDC from Host			
Output power	:	12.77dBm (18.93mW) conducted power for 5150-5250GHz			
		14.22dBm (26.43mW) conducted power for 5250-5350GHz			
Extreme temp. Toleranc	e :	0° C to $+70^{\circ}$ C			
1.6 Test standa	rds:	FCC Part 15 §15.407 / CANADA RSS-210 Measurements done as per DA 02-2138			



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PROJECT OVERVIEW:

This test report carries all radiated measurements required as per FCC 15.407 for doing a class-2 permissive change on WLAN mini PCI card model# BCM94318MPAGH tested in test fixture as per DA001407 & FCC04-165 requirements for modular transmitter approval. Conducted power was measured and found within limits of C2P change rules.

Following are the changes filed under this application;

Change #1 Adding alternate Fairchild power amp. The associated layout and filter circuitry is the same. The average power in packet is maintained the same as the original filing.

All measurements are done with under-mentioned max gain antennas for each band. WLAN was tested for spurious emissions at different data rates. Test report shows only worst-case test results of all data rates with following power levels.

802.11a Mode: Channels 36-48:12.0dBm Channels 52-64:15.0dBm Channel 149-165:15.0dBm

Antenna Manufacturer	Antenna Type	Model	Peak gain @ 2400-2483.5MHz	Peak gain 5150-5350MHz	Peak gain @ 5725-5850
WNC	Stamped metal sheet	81.ED415.002	3.24dBi (Main)	1.51dBi (Main)	Main -0.35dBi
Hitachi	Stamped metal sheet	HFT17-DL03	Main 1.5 (H)	Main 5.1 (V)	Main 5.7 (V+H)

For more information on antennas covered under this C2P change please refer to BCM94318MPAGH_C2P_Fairchild_PA_Declaration_worst_case_antenna





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2 **Technical test**

2.1 **Summary of test results**

No deviations from the technical specification(s) were ascertained in the course of the tests Performed				
Final Verdict: (Only "passed" if all single measurements are "passed")	Passed			

Technical responsibility for area of testing:

Section	Name	Signature	
EMC & Radio	Lothar Schmidt (Technical Manager)	ldunich	

N

Responsible for test report and project leader:

Jort.

Harpreet Sidhu (EMC Engineer) 2005-04-08 EMC & Radio

Date

2005-04-08

Date

Section

Name

Signature



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2.2 Test report

TEST REPORT

Test report no.: EMC_831FCC15.407_2005_FC_PA

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TEST REPORT REFERENCE

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PEAK OUTPUT POWER

§ 15.407 (a)(1)(2)

(Conducted) (Data rate – 54Mbps) 54Mbps is found to be worst-case for peak output power.

Test Procedure: DA02-2138 Method-3.

Test Results

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)			
Frequency (MHz)		5180		5260	5320
T _{nom} (23)°C	V _{nom} (3.3) VDC	Pk	12.77	14.22	14.20
Measurement uncertainty		±0.5dBm			

LIMIT

SUBCLAUSE § 15.407 (a)(1)(2)

Frequency range (GHz)	Conducted Peak Power
5.15 - 5.25	17dBm
5.25 - 5.35	24dBm



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MAXIMUM PEAK OUTPUT POWER§ 15.407 (a)(1)(2)(RADIATED)(Data rate - 54Mbps)54Mbps is found to be worst-case for peak output power.EIRP:

Test Results

TEST CONDITIONS		MAXIMUM I	PEAK OUTPUT P	OWER (dBm)
Frequen	Frequency (MHz)		5260	5320
T _{nom} (23)°C	V _{nom} (3.3) VDC	*17.87	*19.32	*19.3
Measurement uncertainty			±0.5dBm	

*Note: EIRP is calculated based on 5.1Bi antenna gain and conducted peak power measurements.

LIMIT

SUBCLAUSE § 15.407 (a)(1)(2)

Frequency range (GHz)	Conducted Peak Power				
5.15 - 5.25	17dBm				
5.25 - 5.35	24dBm				
If transmitting antennas of directional gain greater than 6dBi are used, both the peak transmit					
power and the peak spectral density shall be reduced	by the amount in dB that the directional				

gain of the antenna exceeds 6dBi

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Hitachi Stamped metal sheet antenna (Freq. band: 5180-5320MHz, Gain: 5.1dBi, Model HFT17-DL03)



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§15.407 (b)(1)(2)(4)(6)

BAND EDGE COMPLIANCE §15.407 (Data rate – 6Mbps) Low frequency section (spurious in the restricted band 4500 – 5150 MHz) (Average measurement)

Antenna: EUT plane:		Horizontal Horizontal				
Operating con SWEEP TAB Limit Line ho Limit Line ve	ndition BLE prizontal prtical	: : :	Tx at 5180M "FCC15.407 54dBµV 5150MHz	Hz LBE_AVG"		
Start Frequency 4.5 GHz	Stop Frequency 5.19 GHz	Detector Time MaxPeak	Meas. Bandw. Coupled	RBW 1 MHz	VBW 10Hz	Transducer #326 horn (dBi)





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§15.407 (b)(1)(2)(4)(6)

BAND EDGE COMPLIANCE§15.407(Data rate - 54Mbps)Low frequency section (spurious in the restricted band 4500 - 5150 MHz)(Peak measurement)

Antenna: EUT plane:		Horizontal Horizontal				
Operating con SWEEP TAB Limit Line ho Limit Line ve	ndition BLE prizontal prtical	:	Tx at 5180M "FCC15.407 74dBμV 5150MHz	Hz LBE_Pk"		
Start Frequency 4.5 GHz	Stop Frequency 5.19 GHz	Detector Time MaxPeak	Meas. Bandw. Coupled	RBW 1MHz	VBW 1MHz	Transducer #326 horn (dBi)





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§15.407 (b)(1)(2)(4)(6)

BAND EDGE COMPLIANCE§15.407 ((Data rate – 6Mbps)High frequency section (spurious in the restricted band 5350 – 5460 MHz)(Average measurement)

Antenna: EUT plane:		Horizontal Horizontal				
Operating con SWEEP TAB Limit Line ho Limit Line ve	ndition BLE prizontal prtical	: : :	Tx at 5320M "FCC15.407 54dBµV 5350MHz	Hz HBE_AVG"		
Start Frequency 5.28 GHz	Stop Frequency 5.46 GHz	Detector Time MaxPeak	Meas. Bandw. Coupled	RBW 1 MHz	VBW 10Hz	Transducer #326 horn (dBi)





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BAND EDGE COMPLIANCE§15.407 (b)(1)(2)(4)(6)(Data rate - 54Mbps)High frequency section (spurious in the restricted band 5350 - 5460 MHz)(Peak measurement)

Antenna: EUT plane:		Horizontal Horizontal				
Operating condition SWEEP TABLE Limit Line horizontal Limit Line vertical		: : :	Tx at 5320MHz "FCC15.407 HBE_Pk" 74dBµV 5350MHz			
Start Frequency 5.28 GHz	Stop Frequency 5.46 GHz	Detector Time MaxPeak	Meas. Bandw. Coupled	RBW 1 MHz	VBW 1MHz	Transducer #326 horn (dBi)



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EMISSION LIMITATIONS Transmitter (Radiated) (Data rate – 54Mbps) § 15.407 (b)(1)(2)(4)(6)

Limits		§ 15.209 / § 15.407
Freq. (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)
0.009-0.490	2400/F (kHz)	
0.490-1.750	24000/F (kHz)	
1.705-30.0	30	29.54
30-88	100	40.00
88-216	150	43.52
216-960	200	46.02
Above 960*	500	53.97
1000-40000**	2013.8	66.08

*) Limit in restricted bands

**) Limit outside restricted bands

NOTE:

1. The radiated emissions were done with different settings, using the relevant pre-amplifiers for the relevant frequency ranges. This is the reason that the graphs show different noise levels. In the range between 3 and 40 GHz very short cable connections to the antenna was used to minimize the noise level.

2. All measurements are done in peak mode unless specified with the plots.



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Transmit a	t Lowest channel	Frequency 5180MHz							
Frequency (MHz)	Level (dBµV/m)								
	Peak	Quasi-Peak	Average						
	SEE PLOTS								
 Transmit a	t Middle channel]	Frequency 5260MHz							
Frequency (MHz)	Level (dBµV/m)								
	Peak	Quasi-Peak	Average						
	SEE PLOT	ſS							
Transmit a	t Highest channel	Frequency 5320MHz	Z						
Frequency (MHz)		Level (dBµV/m)							
	Peak	Quasi-Peak	Average						
SEE PLOTS									



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§ 15.407 (b)(1)(2)(4)(6)

EMISSION LIMITATIONS - Radiated (Transmitter) Lowest Channel (5180MHz): 30MHz – 1GHz (Data rate – 54Mbps)

Note:

- 1. This plot is valid for low, mid, high channels (worst-case plot valid for all antennas)
- 2. All significant peaks were confirmed originating from test fixture, see plots on next pages with test fixture tested alone with no WLAN card

Antenna:		Vertical				
EUT plane:		Horizontal with screen vertical @ 90°				
SWEEP TABLE:		"FCC 15.407				
Start	Stop	Detector	Meas.	RBW	Transducer	
Frequency	Frequency		Time	VBW		
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	3141-#1186	



10

30M

50M

70M

100M

Frequency [Hz]

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200M

300M

500M

700M

1G

§ 15.247 (d)

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EMISSION LIMITATIONS - Radiated (Transmitter) 30MHz – 1GHz

Antenna: Vertical

Test Fixture only (no WLAN card)

§ 15.247 (c) (1)

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EMISSION LIMITATIONS - Radiated (Transmitter) 30MHz – 1GHz Antenna: Horizontal Test Fixture only (no WLAN card)

Page 21 (39) Test report no.: EMC_831FCC15.407_2005_FC_PA Issue date: 2005-04-08 **EMISSION LIMITATIONS - Radiated (Transmitter)** § 15.407 (b)(1)(2)(4)(6) Lowest Channel (5180MHz): 1GHz - 7GHz (Average) (Data rate – 54Mbps) Antenna: Horizontal EUT plane: Horizontal with screen vertical @ 90° Note: The peak above the limit line is the carrier freq. "FCC 15.407 1-7G" SWEEP TABLE: Start Detector Meas. RBW Transducer Stop Frequency VBW Frequency Time 1GHz 7.0 GHz MaxPeak Coupled 1MHz 10Hz 326 horn Marker: 3.452905812 GHz 50.51 dBµV/m Level [dBµV/m] 120 100 80 60 40 20 0 -20 1G 2G 3G 4G 5G 6G 7G Frequency [Hz]

Test report no.: EMC_831FCC15.407_2005_FC_PA Issue date: 2005-04-08 Page 23 (39) **EMISSION LIMITATIONS - Radiated (Transmitter)** § 15.407 (b)(1)(2)(4)(6) Lowest Channel (5260MHz): 1GHz - 7GHz (Average) (Data rate – 54Mbps) Antenna: Horizontal EUT plane: Horizontal Note: The peak above the limit line is the carrier freq. "FCC 15.407 1-7G" SWEEP TABLE: Start Detector Meas. RBW Transducer Stop Frequency VBW Frequency Time 7.0 GHz 1GHz MaxPeak Coupled 1MHz 10Hz 326 horn Marker: 3.501002004 GHz 44.22 dBµV/m Level [dBµV/m] 120 100 80 60 40 20 0 -20 1G 2G 3G 4G 5G 6G 7G

Frequency [Hz]

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EMISSION LIMITATIONS - Radiated (Transı Lowest Channel (5320MHz): 1GHz – 7GHz (Data rate – 54Mbps) (Average) Antenna: Horizontal EUT plane: Horizontal with screen vertica					9 r) 0 *	§ 15.4(07 (b)(1)(2)(4)(6)	
Note: The SWEEP TA Start Frequency 1GHz	e peak abov ABLE: Stop Frequency 7.0 GHz	v e the limit "FCC 15.40 Detector MaxPeak	line is the of 7 1-7G" Meas. Time Coupled	c arrier fre RBW 1MHz	q. VBW 10Hz	Transdu 326 horr	cer n		
Marker: Level [c	: dBµV/m]	3.549098196 (GHz		45.48 dBµV	//m			
120									
100									
80									
60									
40				m		- Jamman	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Im	
20	~~~M	mm		- · ·					
0									

Page 27 (39) Test report no.: EMC_831FCC15.407_2005_FC_PA Issue date: 2005-04-08 **EMISSION LIMITATIONS - Radiated (Transmitter)** § 15.407 (b)(1)(2)(4)(6) 18GHz – 26.5GHz (Data rate – 54Mbps) Antenna: Horizontal **EUT plane:** Horizontal with screen vertical @ 90° Note: This plot is valid for low, mid, high channels (worst-case plot for all antenna types) SWEEP TABLE: "FCC 15.407 18-26.5G" Start Stop Detector Meas. RBW Transducer Frequency Frequency Time VBW 18GHz 26.5 GHz Coupled 3160-09 horn MaxPeak 1MHz

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EMISSION LIM	TATIONS - Radiated (Transm	itter) §15	.407 (b)(1)(2)(4)(6)
26.5GHz - 40GHz	Z		
(Data rate – 54M)	bps)		
Antenna:	Horizontal		
EUT plane:	Horizontal with screen vertical	@ 90 °	
Note: This plot is	valid for low, mid, high channe	ls (worst-case plot for	all antenna types)
SWEED TADEE.	"ECC 15 407 26 5 40C"	· •	

SWEEP TAE	OLE:	FCC 15.407	20.3-40G		
Start	Stop	Detector	Meas.	RBW	Transducer
Frequency	Frequency		Time	VBW	
26.5GHz	40 GHz	MaxPeak	Coupled	1MHz	3160-10 horn

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CONDUCTED EMISSIONS Measured with AC/DC power adapter

-

SWEEP TABLE: "55022 cond"								
Short Description:		EN 55022 for 150KHz-30MHz						
Start	Stop	Detector	Meas	IF	Transducer			
Frequency	Frequency		Time	Bandw.				
150.0 kHz	30.0 MHz	MaxPeak	Coupled	10 kHz	None			

Technical specification: 15.107 / 15.207 (Revised as of August 20, 2002) Limit

Frequency of Emission (MHz)	Conducted Limit (dBµV)		
	Quasi-Peak	Average	
0.15 - 0.5	66 to 56*	56 to 46*	
0.5 – 5	56	46	
5 - 30	60	50	

* Decreases with logarithm of the frequency

ANALYZER SETTINGS: RBW = 10KHz

VBW = 10KHz

§ 15.107/207

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RECEIVER SPURIOUS RADIATION

§ 15.209

Limits

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

NOTE:

The radiated emissions were done with different settings, using the relevant pre-amplifiers for the relevant frequency ranges. This is the reason that the graphs show different noise levels. In the range between 3 and 40GHz very short cable connections to the antenna was used to minimize the noise level.

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RECEIVER SPURIOUS RADIATION

(Data rate - 54Mbps)

Antenna:VerticalEUT plane:HorizontalNote:

SWEED TADLE. "WI AN Source he 20 1C"

1. This plot is valid for low, mid, high channels (worst-case plot valid for all antennas)

2. All significant peaks were confirmed originating from test fixture, see next pages with test fixture tested alone with no WLAN card

SWEEF TABLE. WLAN Sputhi 30-10								
Start	Stop	Detector	Meas.	RBW	Transducer			
Frequency	Frequency		Time	VBW				
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	3141-#1186			

§ 15.209

0

30M

50M

100M

Frequency [Hz]

70M

														1	- Carlos				
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REC Anten EUT I Test	EIVER na: blane: Fixture	SPUR only (LIOU ve H no W	S RA ertica orizo 'LA]	ADI d ontal N ca	AT	10	N						Ş	15.2	09			
SWEEP Start Frequen 30.0 MF	TABLE: "V St cy Fr Iz 1.0	VLAN Spi op equency) GHz	uri hi 30 De M)-1G" etector axPeal	c	M Ti Ca	eas. me ouple	ed	RBW VBW 100 kF	Iz :	Tran 3141	sducer -#1186							
Mar	ker:		218	.5571	14 N	1Hz				* 6	64.6	6 dBµV/m	1						
Lev	/el [dBµV/	m]									\langle	>							
60																			
50												1				1			
40									Λ										
								N	$\left \right _{\Lambda}$										L. Jak
30							Λ		1						-	hun	Mult	Jowlanna -	rvwya r
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									V			www.							
10																			

200M

300M

500M

700M

1G

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RECEIVER SPURIOUS RADIATION 1GHz – 7GHz

Antenna: EUT plane:		Horizontal Horizontal with screen vertical @ 90°							
SWEEP TAI	BLE:	"WLAN Sp	ouri hi 1-7G"						
Start	Stop	Detector	Meas.	RBW		Transducer			
Frequency	Frequency	Time	Bandw.		VBW				
1.0 GHz	7.0 GHz	MaxPeak	Coupled	1 MHz	1MHz	#326 horn (dBi)			

18 GHz

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#141 horn (dBi)

§ 15.209

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RECEIVER SPURIOUS RADIATION 18GHz – 26.5GHz

26.5 GHz

Antenna: EUT plane:		Horizontal Horizontal with screen vertical @ 90°						
SWEEP TA	BLE:	"WLAN Sp						
Start	Stop	Detector	Meas.	RBW	Transducer			
Frequency	Frequency	Time	Bandw.	VBW				

Coupled

MaxPeak

1 MHz

40 GHz

26.5 GHz

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3160-10 horn

§ 15.209

RECEIVER SPURIOUS RADIATION 26.5GHz – 40GHz

Antenna: EUT plane:		Horizontal Horizontal with screen vertical @ 90°					
SWEEP TAI	BLE:	"WLAN Sp	uri hi 26.5-40)G"			
Start	Stop	Detector	Meas.	RBW	Transducer		
Frequency	Frequency	Time	Bandw.	VBW			

Coupled

MaxPeak

1 MHz

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TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

No	Instrument/Ancillary	Туре	Manufacturer	Serial No.
01	Spectrum Analyzer	ESIB 40	Rohde & Schwarz	100107
02	Spectrum Analyzer	FSEM 30	Rohde & Schwarz	826880/010
03	Biconilog Antenna	3141	EMCO	0005-1186
04	Horn Antenna (700M-18GHz)	SAS-200/571	AH Systems	325
05	Horn Antenna (18-26.5GHz)	3160-09	EMCO	1240
06	Horn Antenna (26.5-40GHz)	3160-10	EMCO	1156
07	2-3GHz Band reject filter	BRM50701	Microtronics	6
08	Power-Meter	NRVD	Rohde & Schwarz	0857.8008.02
09	Pre-Amplifier	TS-ANA	Rohde & Schwarz	
10	Pre-Amplifier	JS4-00102600	Miteq	00616

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Radiated Testing

ANECHOIC CHAMBER