Radio Intentional EMC Test Report: EDCS - 651967

For

C3205WMIC-A-K9

Against the following Specifications :

47CFR15

RSS-210

Cisco Systems

EMC Laboratory

170 West Tasman Drive

San Jose, CA 95134

ACCREDITED

Certificate Number : 1178-01

Author: Donald Foster
Approved By:
Title:

This report replaces any previously entered test report under EDCS - 651967

This test report has been electronically authorized and archived using the CISCO Engineering Document Control system.

Section 1: Overview

Test Summary

The samples were assessed against the tests detailed in section 3 under the requirements of the following standards:

Emission		
Specification	**Type**	**Applied To**
CFR47 Part 15.247(a)	Conducted Emissions	RF Ports
CFR47 Part 15.247(a)(2)	Conducted Emissions	RF Ports
CFR47 Part 15.247b3 (LP0002 3.10.1.2)	Conducted Emissions	RF Ports
CFR47 Part 15.407(a)6	Conducted Emissions	RF Ports
CFR47 Part 15.407a (LP0002 4.7.2, RSS210)	Conducted Emissions	RF Ports
Conducted Spurious Emissions	Conducted Emissions	RF Ports
Radiated Spurious Emissions	Radiated Emissions	Enclosure
Restricted Bandedge Measurements	Radiated Emissions	Enclosure

Immunity		
Specification	**Type**	**Applied To**
N/A	N/A	N/A

Notes:

1) Where a specification listed on the front cover of this report has deviations from the basic standards listed above, the additional technical requirements of the specification were also assessed.
2) Measurements were made in accordance with FCC docket #: DA-00705, DA-02-2138A1 & measurement method of spurious emission tolerance to the International Telecommunication Union (ITU) Recommendation SM329
3) Where appropriate, Cisco may have substituted a later revision of a basic standard to those referenced in the specification on the front sheet of this test report. This decision was based upon improved test methodology and repeatability and/or where the newer revision represented a more stringent test.

Section 2: Assessment Information

2.1 General

The testing was performed by and for the use of Cisco systems Inc. This report must not be used to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the federal Government.

This report may contain data that is not enveloped by the scope of the A2LA accreditation (A2LA certificate number1178-01). Please refer to Appendix C for further details.

With regard to this assessment, the following points should be noted:

a) The results contained in this report relate only to the items tested and were obtained in the period between the date of the initial assessment and the date of issue of the report. Manufactured products will not necessarily give identical results, due to production tolerances and measurement uncertainties.

b) The apparatus was set up and exercised using the configuration and modes of operation defined in this report only.

c) Where relevant, the apparatus was only assessed using the susceptibility criteria defined in this report and the Test Assessment Plan (TAP).

d) All testing was performed under the following environmental conditions:

Temperature	15°C to 35°C (54°F to 95°F)
Atmospheric Pressure	860mbar to 1060mbar (25.4" to 31.3")
Humidity	10% to 75*%

e) All AC testing was performed at one or more of the following supply voltages:
110V 60 Hz (+/-20%)
220V 50 Hz (+/-20%)

f) Cisco Systems, Inc. is accredited by the American Association for Laboratory Accreditation (A2LA). The scope of accreditation, certificate number1178-01 is referenced in appendix C, along with further details.

2.2 Start Date of Testing

29-Jan-2008

2.3 Report Issue Date

Cisco Systems, Inc. uses an electronic system to issue, store and control the revision of test reports. This system is called the Engineering Document Control System (EDCS). The actual report issue date is embedded into the original file on EDCS. Any copies of this report, either electronic or paper, that are not on EDCS must be considered uncontrolled

2.4 Testing facilities

This assessment was performed by:

Testing Laboratory

Cisco Systems, Inc.,
170 West Tasman Drive
San Jose, CA 95134,
USA

Registration Numbers for Industry Canada

Cisco System Site	Site Identifier
Building P, 10m Chamber	Company #: 4624-2
Building P, 5m Chamber	Company #: 4624-1
Building N, 5m Chamber	Company #: 6111
Building I, 5m Chamber	Company #: 6112

Test Engineers

Donald Foster

2.5 Equipment Assessed (EUT)

C3205WMIC-A-K9

2.6 EUT Description

The C3205WMIC-A-K9 is a standalone A radio module that is installed in the 3200 series mobile router. The end user can stack several of these radios into a single chassis and build a poit to point to point network with association to both client and Master devices.

2.7 Justification of the worst case test configuration and mode of operation

This configuration meets the requirements for testing to the applicable countries

2.8 Scope of Assessment

Tests have been performed in accordance with the relevant Test and Assessment Plan (TAP), a copy of which is contained in Appendix F of this report, and the relevant Cisco Systems, Inc. radio test procedures (EDCS-420238). This test report may not cover all of the tests highlighted in the test plan.

2.9 Units of Measurement

The units of measurements defined in the appendices are reported in specific terms, which are test dependent. Where radiated measurements are concerned these are defined at a particular distance. Basic voltage measurements are defined in units of [dBuV]

As an example, the basic calculation for all measurements is as follows:

Emission level [dBuV] = Indicated voltage level [dBuV] + Cable Loss [dB] + Other correction factors [dB]

The combinations of correction factors are dependent upon the exact test configurations [see test equipment lists for further details] and may include:-

Antenna Factors, Pre Amplifier Gain, LISN Loss, Pulse Limiter Loss and Filter Insertion Loss..

Note: to convert the results from dBuV/m to uV/m use the following formula:-

Level in uV/m = Common Antilogarithm [(X dBuV/m)/20] = Y uV/m

2.10 Report Template Control No.

Revision: SJRIA 7.0

Section 3: Result Summary

3.1 Results Summary Table

Conducted emissions

Test Number (Spec Id)	Basic Standard	Freq Range	Test Details / Comments	Mode	Systems Tested	Result
30202 (651)	CFR47 Part 15.247(a) **Applied to:** RF Ports **Class:** N/A	2400MHz - 5850MHz	26dB Bandwidth also complies wiht RSS 210, LP0002, HKTA1039	1	1	Pass
30414 (649)	CFR47 Part 15.407(a)6 **Applied to:** RF Ports **Class:** N/A	5150MHz - 5725MHz	Peak Excursion also complies with LP0002, RSS 210, HKTA1039	1	1	Pass
30382 (474)	CFR47 Part 15.407a (LP0002 4.7.2, RSS210) **Applied to:** RF Ports **Class:** N/A	5150MHz - 5725MHz	Peak Power Spectral Density (LP0002 limit 4dBm from 5250-5350MHz)Also complies withHKTA1039	1	1	Pass
30380 (478)	CFR47 Part 15.407a (LP0002 4.7.2, RSS210) **Applied to:** RF Ports **Class:** N/A	5150MHz - 5725MHz	Peak Transmit Power (LP0002 limit 17dBm or formula from 5250-5350MHz), Also complieswith HKTA1039	1	1	Pass
30379 (652)	Conducted Spurious Emissions **Applied to:** RF Ports **Class:** N/A	30MHz - xGHz	Also complies with RSS 210, LP0002, HKTA1039	1	1	Pass

Radiated emissions

Test Number (Spec Id)	Basic Standard	Freq Range	Test Details / Comments	Mode	Systems Tested	Result
30416 (966)	Radiated Spurious Emissions **Applied to:** Enclosure **Class:** N/A	30MHz - 40GHz	CFR47 Part 15.109, CFR47 Part 15.407, RSS-210, LP0002 HKTA1039	1	3	Pass

30418 (648)	Restricted Bandedge Measurements **Applied to:** Enclosure **Class:** B	2.4GHz - 5.825GHz	CFR47 Part 15.205,CFR47 Part 15.209,LP002, RSS210HKTA1039	1	3,4	Pass

Section 4: Sample Details

Note: Each sample was evaluated to ensure that its condition was suitable to be used as a test sample prior to the commencement of testing. Please also refer to the "Justification for worst Case test Configuration" section of this report for further details on the selection of EUT samples.

4.1 Sample Details

Sample Number	Equipment Details	Serial Number	Part Number
S01	C3205WMIC-A-K9	FOC11384LT8	74-5121-02 01
S02	IBM laptop	78-WAYM9 00/01	n/a
S03	AC power adapter	11S02K6657Z1Z0ZR0645N9	02k6657
S04	Mini-PCI extender card	eng proto	proto
S05	*AIR-ANT5175V-N 7.5dbi omni	n/a	74-4283-01
S06	*AIR-ANT5114P-N 14dbi patch	n/a	n/a

The following antennas are to be used with the C3205WMIC-A-K9 radio the highest gain for each antenna type is the test subject in this report.

AIR-ANT5114P-N 14dbi patch
AIR-ANT5195P-R 9.5dbi patch
AIR-ANT5170P-R 7dbi patch
AIR-ANT 5180V-N 7.5dbi omni
AIR-ANT5175V-N 7.5dbi omni
AIR-ANT5160V-R 6dbi omni

4.2 System Details

System #	Description	Samples
1	Conducted testing configuration	S01
2	Support equipment	S02, S03 and S04

3	Radiated testing for the 7.5 Omni antenna	S01 and S05
4	Radiated testing for the 14dbi patch	S01 and S06

4.3 Mode of Operation Details

Mode#	Description	Comments
1	Continuous Transmit	The system will be brought up in a continuous transmit mode via the ART diag program

Section 5: Modifications

5.1 Sample Modifications Performed During Assessment

The firmware was adjusted to block the 5600-5640 range no hardware changes were made

Appendix A: Formal Test Results

During the course of the testing it was decided that the radios operation in the 5500-5700 range would be limited to exclude the channels in the 5600-5640 range these have been permanently blocked in the radios firmware and can not be enabled by the end user.

Operational Frequency range: 5250-5350 5470-5580 5660-5725

Average Output Power

Freq. in Mhz.	Data Rate	Average Output Power (dbm)
5260	36	11
5300	36	11.5
5320	36	10.9
5500	36	11.7
5600	36	10.5
5700	36	11.3

Conducted emissions

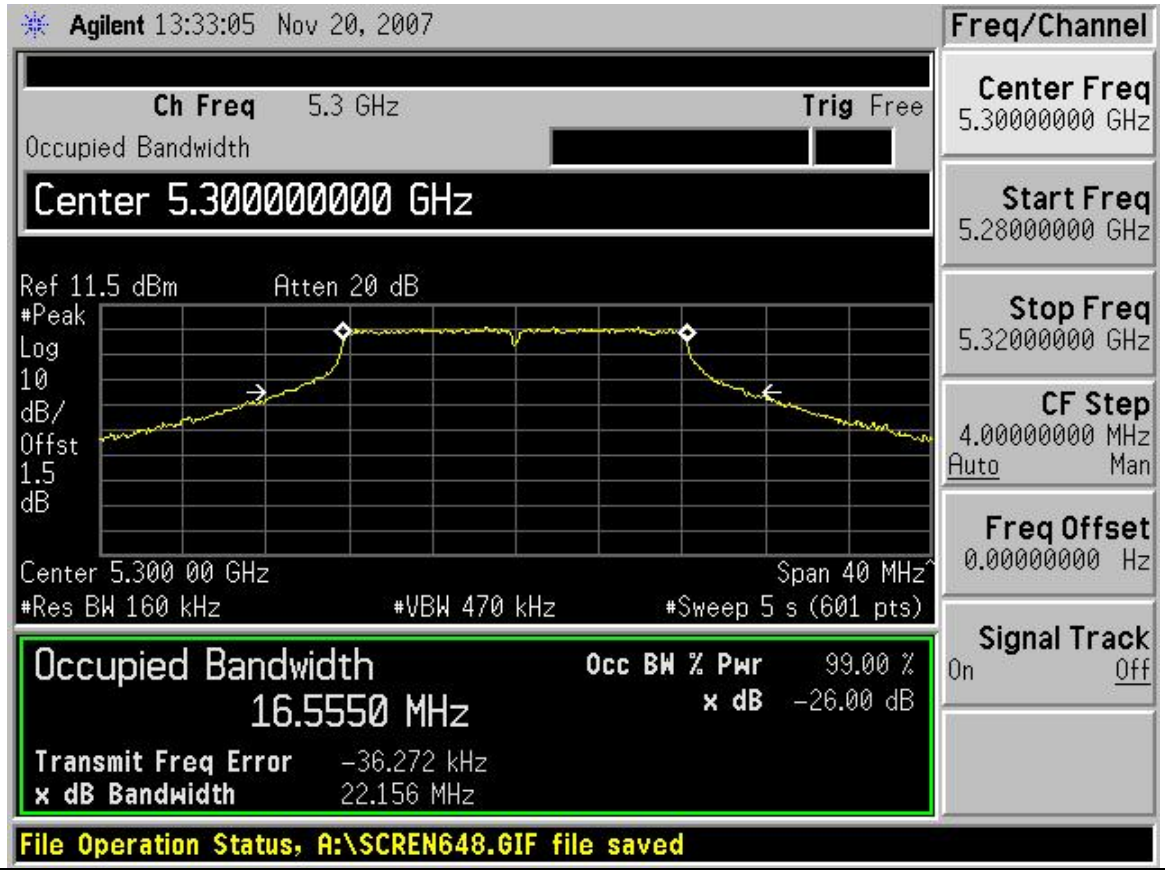
Test Number: 30202 **Spec ID:** 651				
Basic Standard	**Applied to**	**Class**	**Freq Range**	**Test Details / Comments**
CFR47 Part 15.247(a)	RF Ports	N/A	2400MHz - 5850MHz	26dB Bandwidth also complies wiht RSS 210, LP0002, HKTA1039
Operating Mode	**Mode :** 1, Continuous Transmit			
Power Input	5, DC (+/-20%)			
Overall Result	Pass			
Comments	No further comments			
Deviation	There were no deviations from the specification			

System Number	**Description**	**Samples**	**System under test**	**Support equipment**
1	Conducted testing configuration	S01	☑	☐
2	Support equipment	S02, S03 and S04	☐	☑

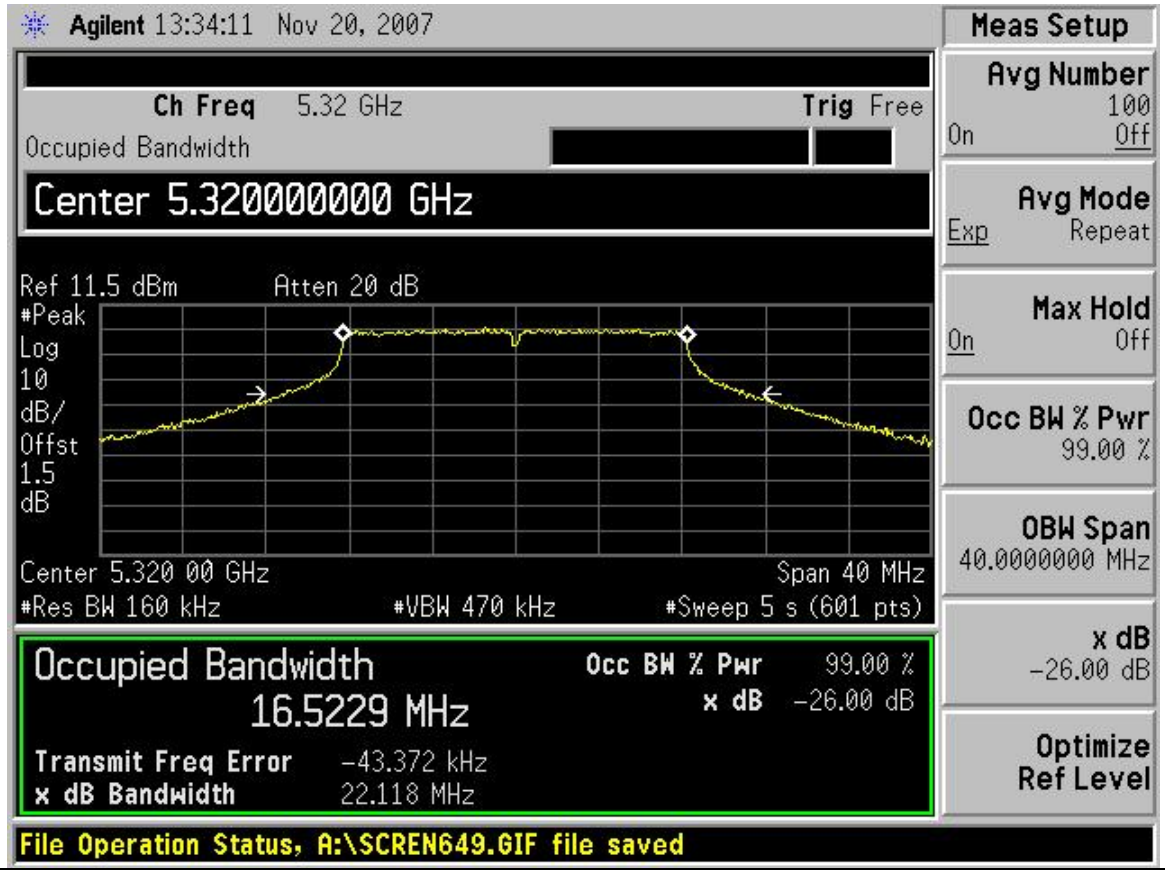
Subtest Number: 30202 - 1	**Subtest Date:** 29-Jan-2008
Engineer	Donald Foster
Lab Information	Building P, Shield Room 3
Subtest Results	
Line Under Test	[A] Antenna port
Transducer	Direct
Subtest Result	Pass
Highest Frequency	N/A
Lowest Frequency	N/A
Comments on the above Test Results	No further comments

Graphical Test Results
Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'.
Please refer to the results table for the detectors used during formal measurements

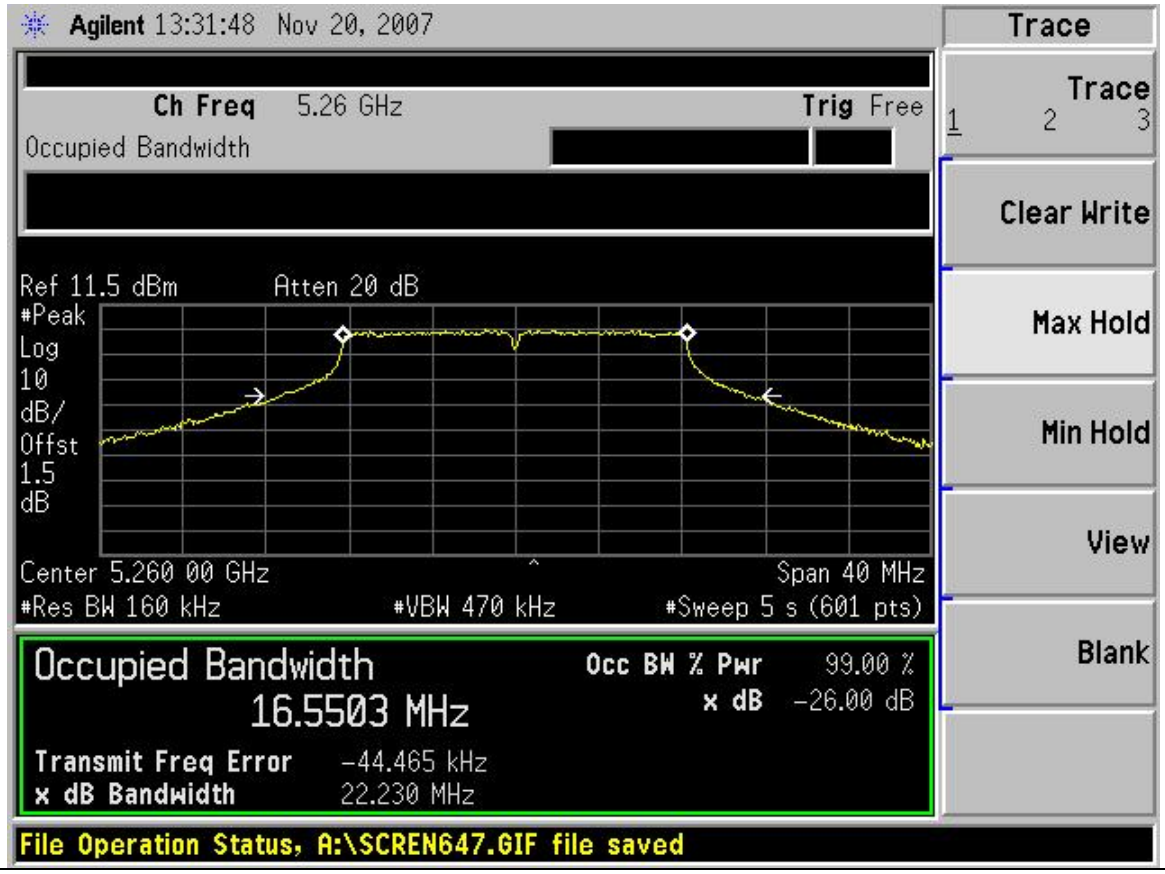
Freq in MHz.	Data Rate	99% Occupied Bandwidth	26db Bandwidth
5260	36	16.55	22.23
5300	36	16.55	22.15
5320	36	16.52	22.11
5500	36	16.55	22.26
5600	36	16.54	22.22
5700	36	16.54	22.22



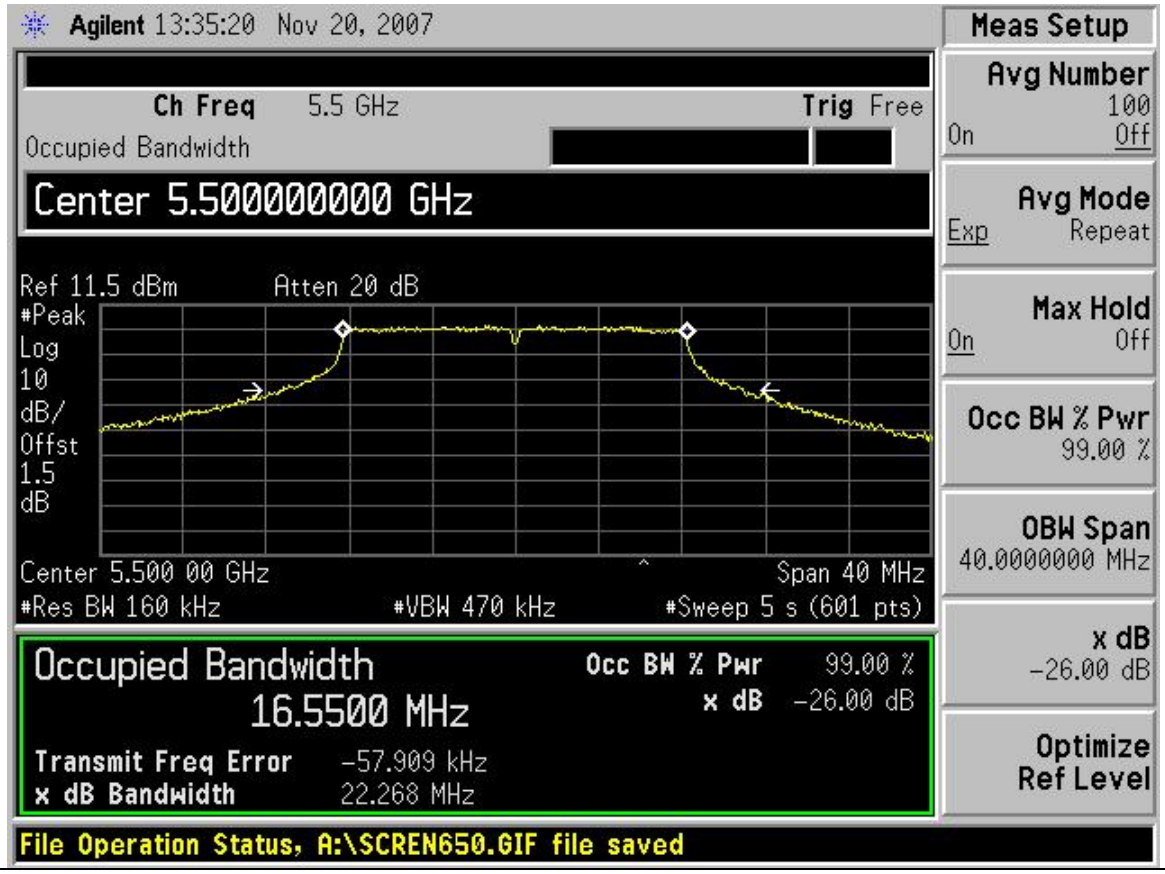
Title: 26db Bandwidth @ 5300MHz.



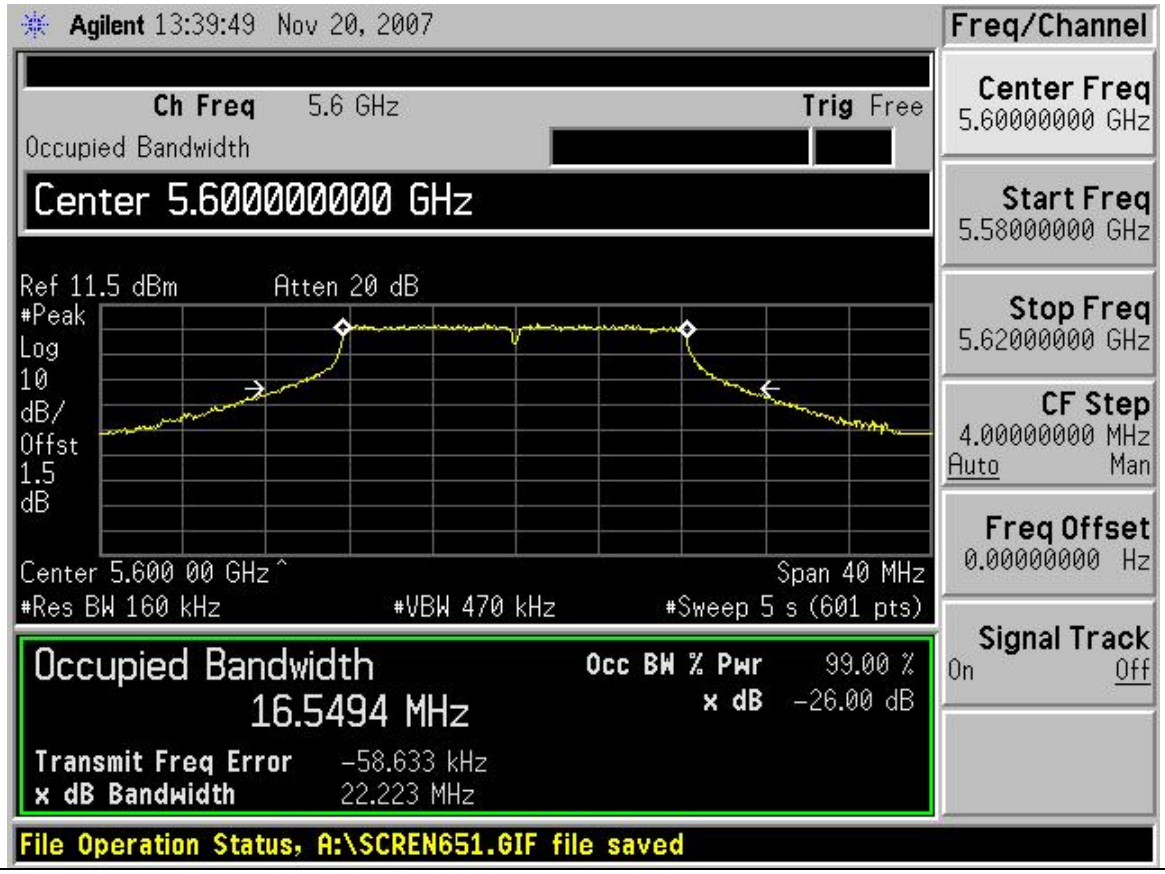
Title: 26db Bandwidth @ 5320MHz.



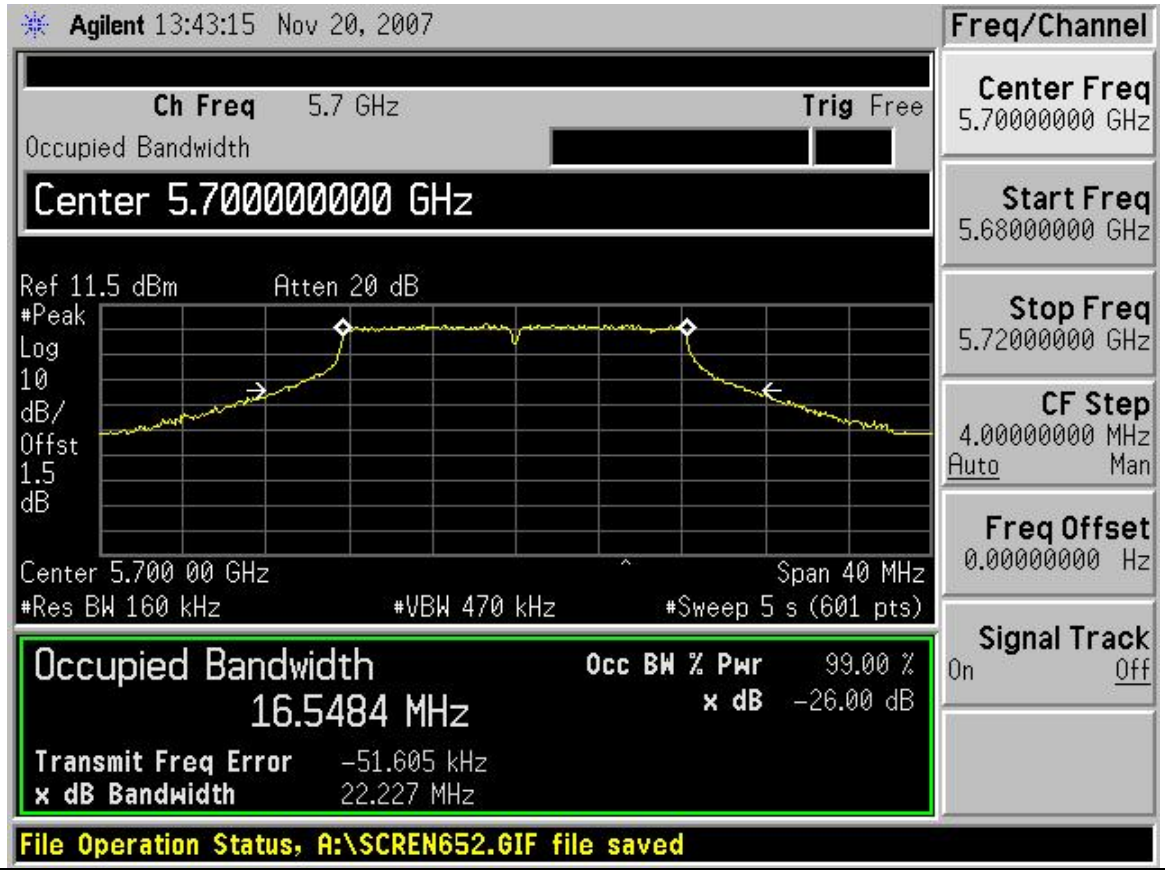
Title: 26db Bandwidth @ 5260Mhz.



Title: 26db Bandwidth @ 5500 MHz.

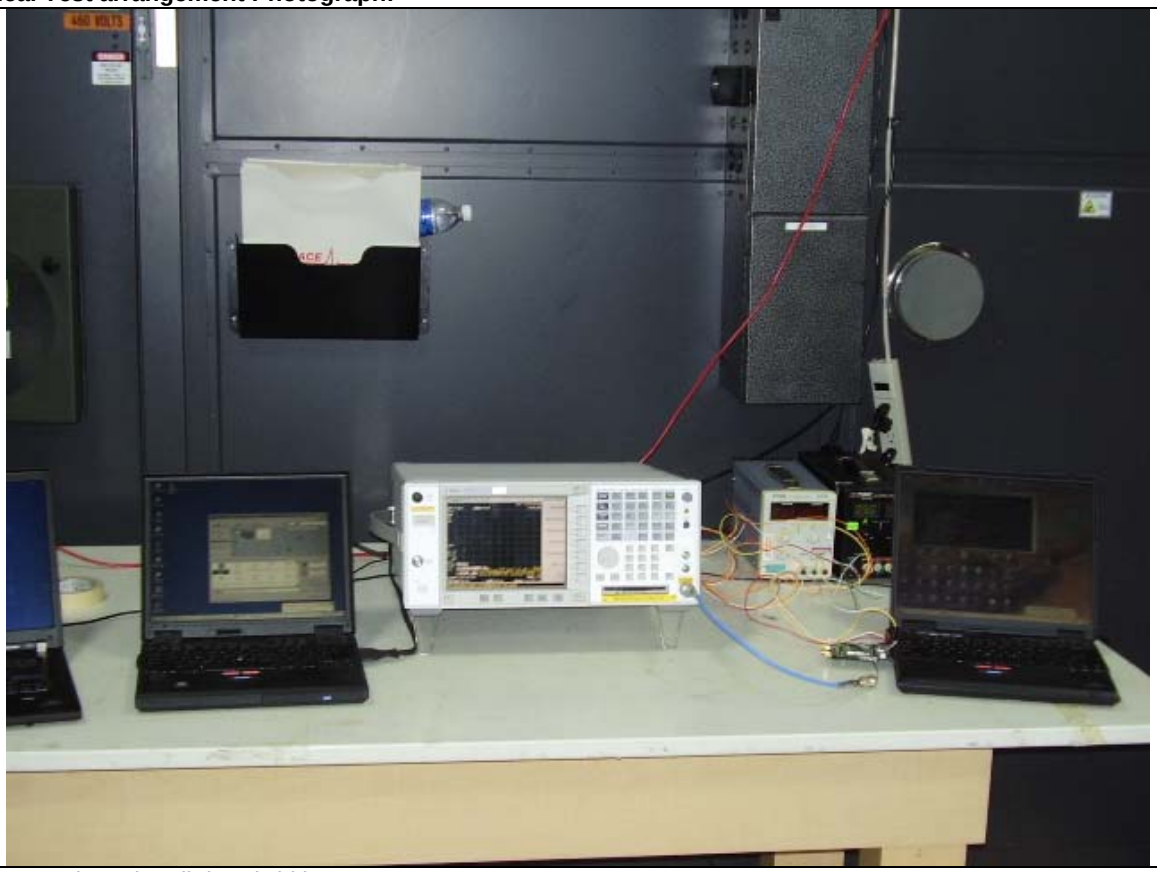


Title: 26db Bandwidth 5600 MHz.

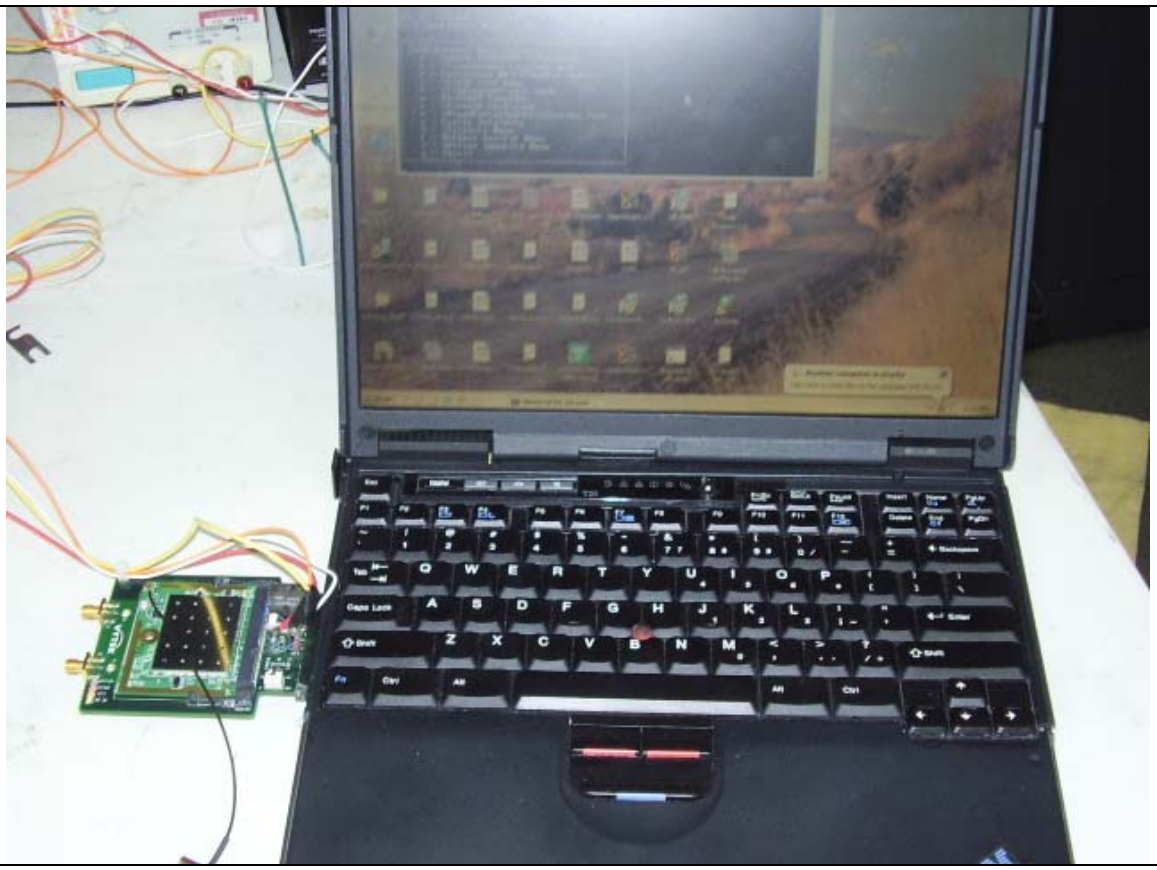


Title: 26db Bandwidth @5700 MHz.

Physical Test arrangement Photograph:



Title: Conducted 26db bandwidth test setup



Title: Conducted 26db bandwidth test setup

Comments on the above Photograph:

No further comments

Conducted emissions

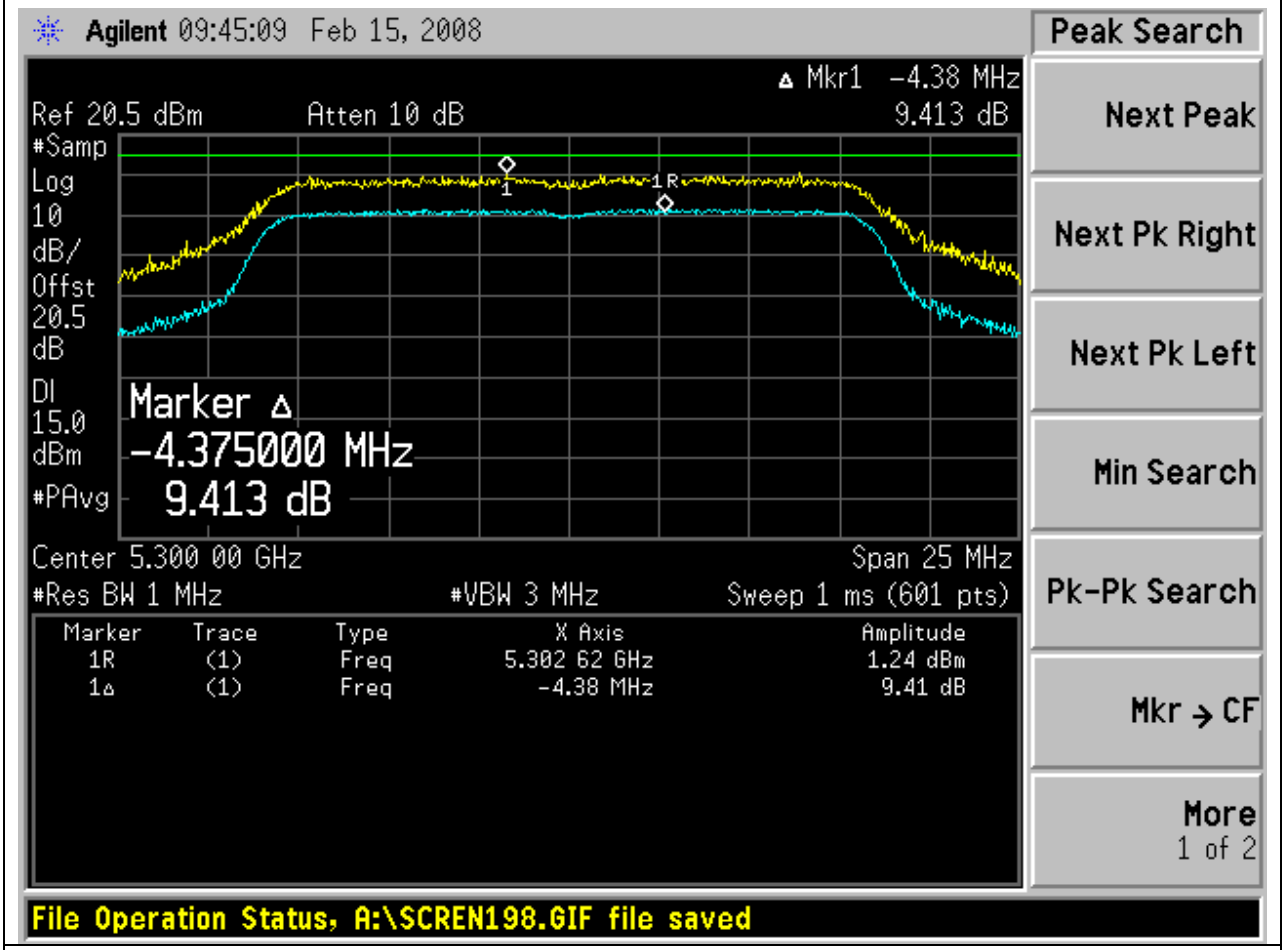
Test Number: 30414 **Spec ID:** 649				
Basic Standard	**Applied to**	**Class**	**Freq Range**	**Test Details / Comments**
CFR47 Part 15.407(a)6	RF Ports	N/A	5150MHz - 5725MHz	Peak Excursion also complies with LP0002, RSS 210, HKTA1039
Operating Mode	**Mode :** 1, Continuous Transmit			
Power Input	5, DC (+/-20%)			
Overall Result	Pass			
Comments	No further comments			
Deviation	There were no deviations from the specification			

System Number	**Description**	**Samples**	**System under test**	**Support equipment**
1	Conducted testing configuration	S01	☑	☐
2	Support equipment	S02, S03 and S04	☐	☑

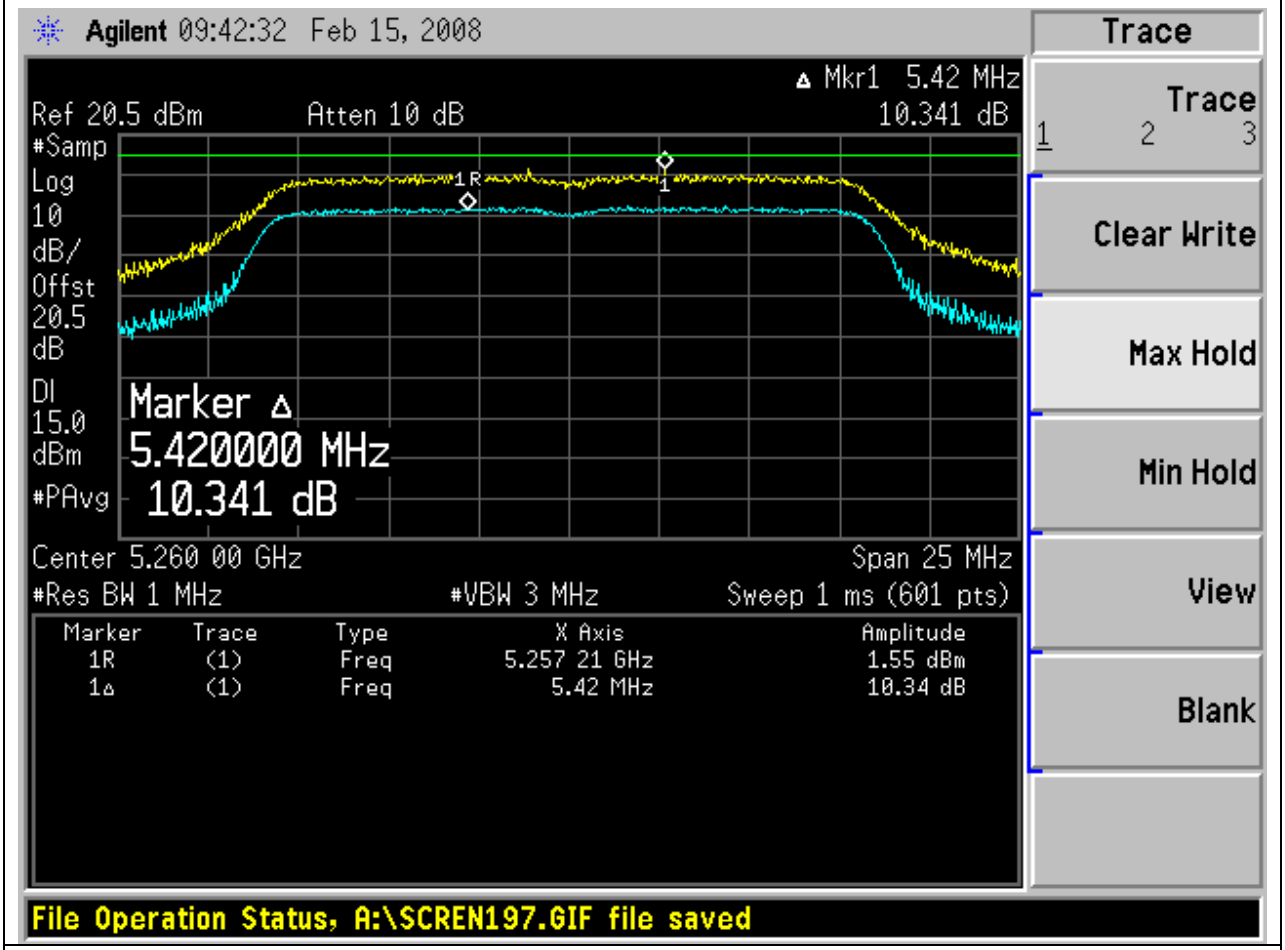
Subtest Number: 30414 - 1	**Subtest Date:** 15-Feb-2008
Engineer	Donald Foster
Lab Information	Building P, Shield Room 3
Subtest Results	
Line Under Test	[A] Antenna port
Transducer	Direct
Subtest Result	Pass
Highest Frequency	N/A
Lowest Frequency	N/A
Comments on the above Test Results	No further comments

15.407: The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

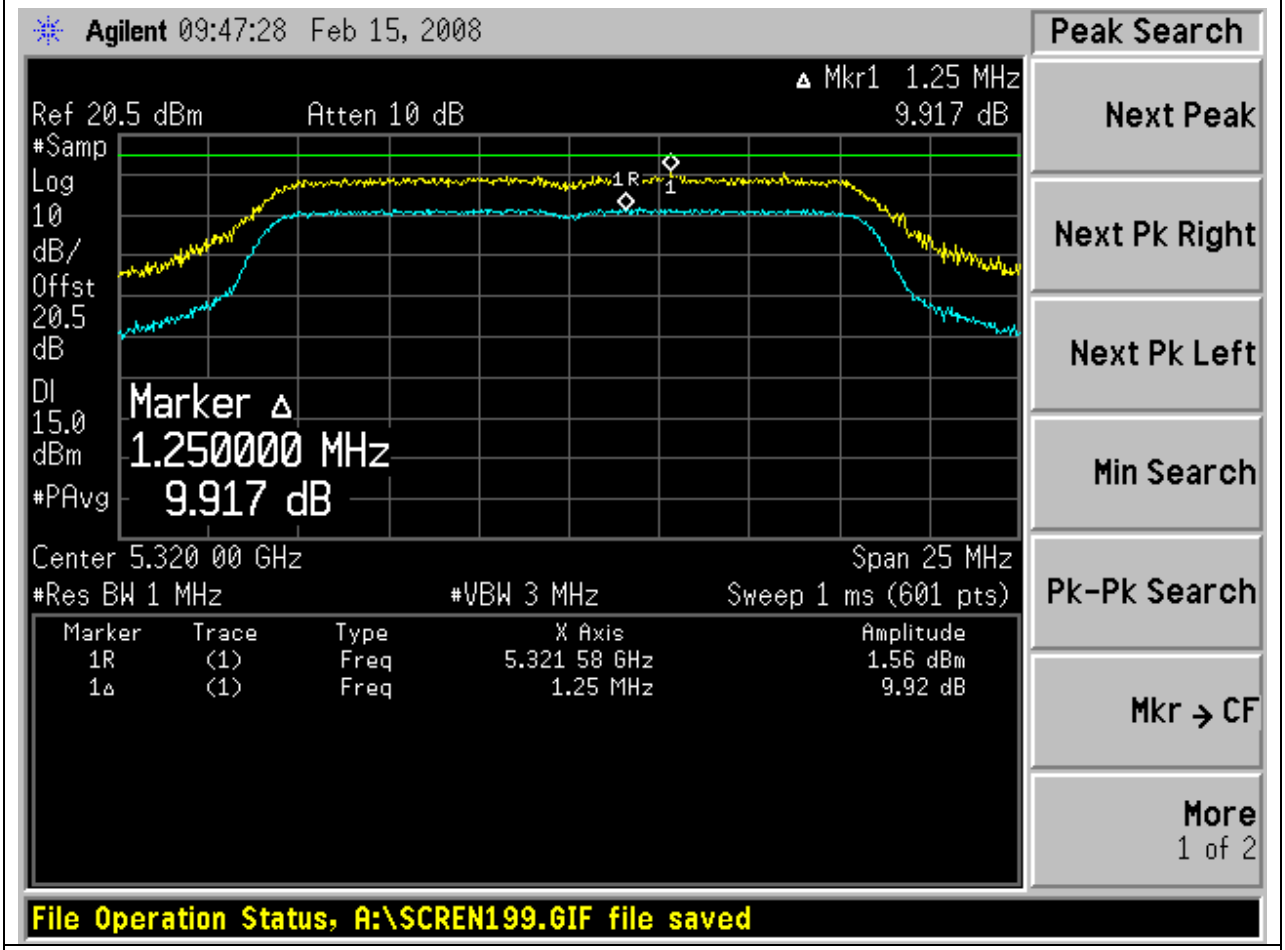
Freq. in MHz.	Data rate	Peak Excursion (dbm)	Limit (dbm)	Margin
5260	36	10.34	13	2.66
5300	36	9.41	13	3.59
5320	36	9.92	13	3.08
5500	36	8.8	13	4.2
5600	36	9.38	13	3.62
5700	36	10.19	13	2.81



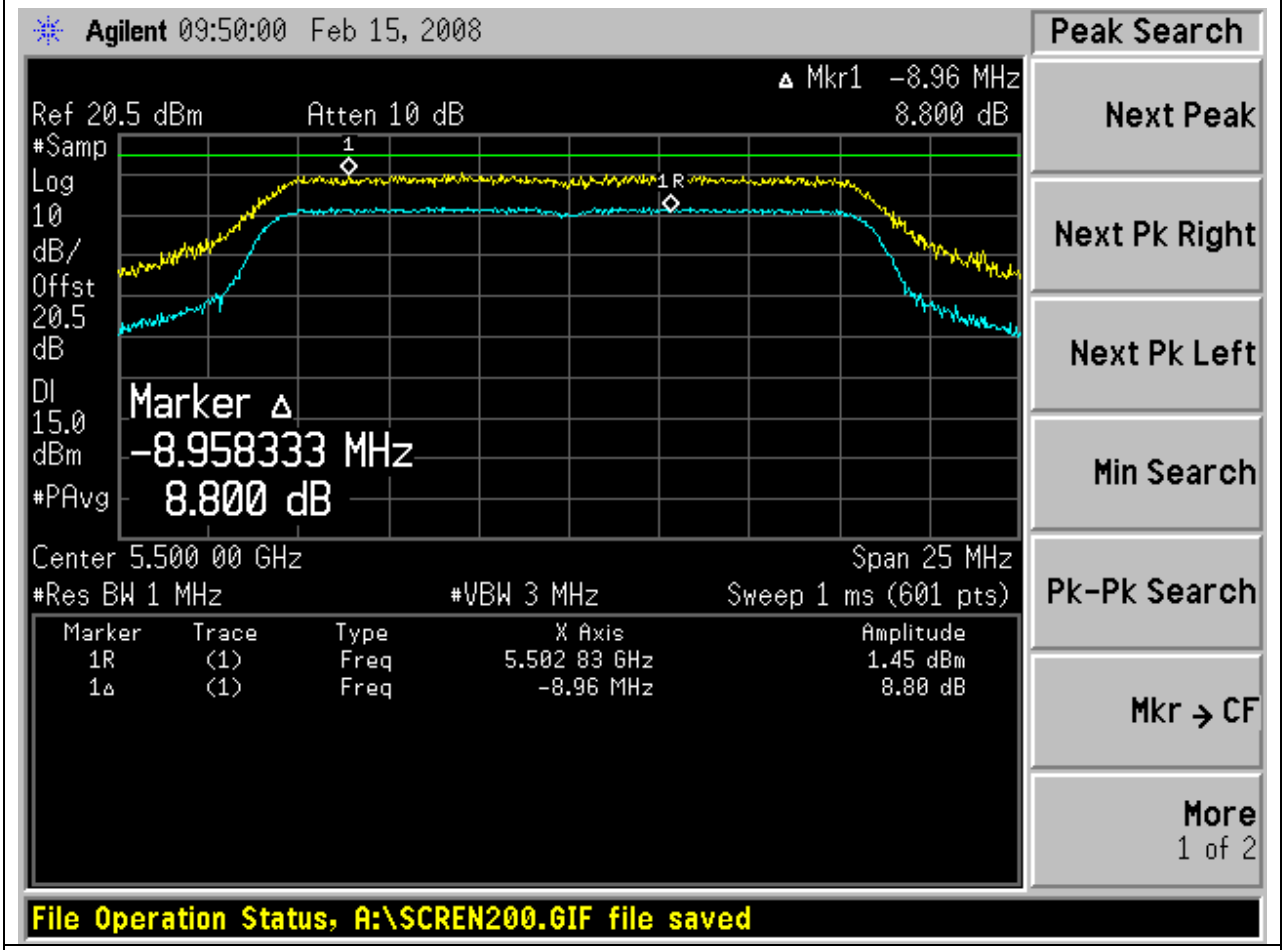
Title: Peak Excursion at 36mbps and 16dbm for channel 5300



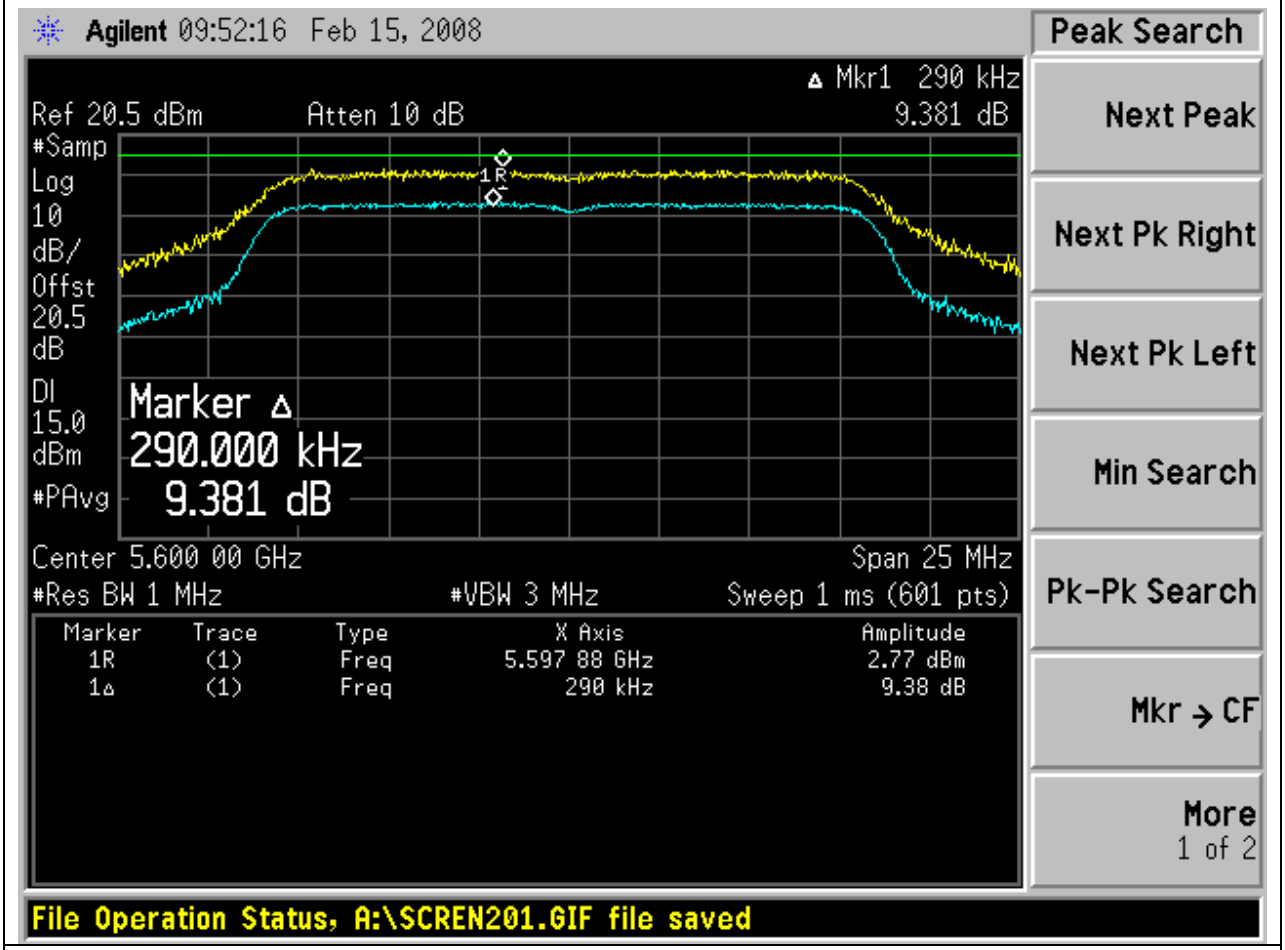
Title: Peak Excursion at 36mbps and 16dbm for channel 5260



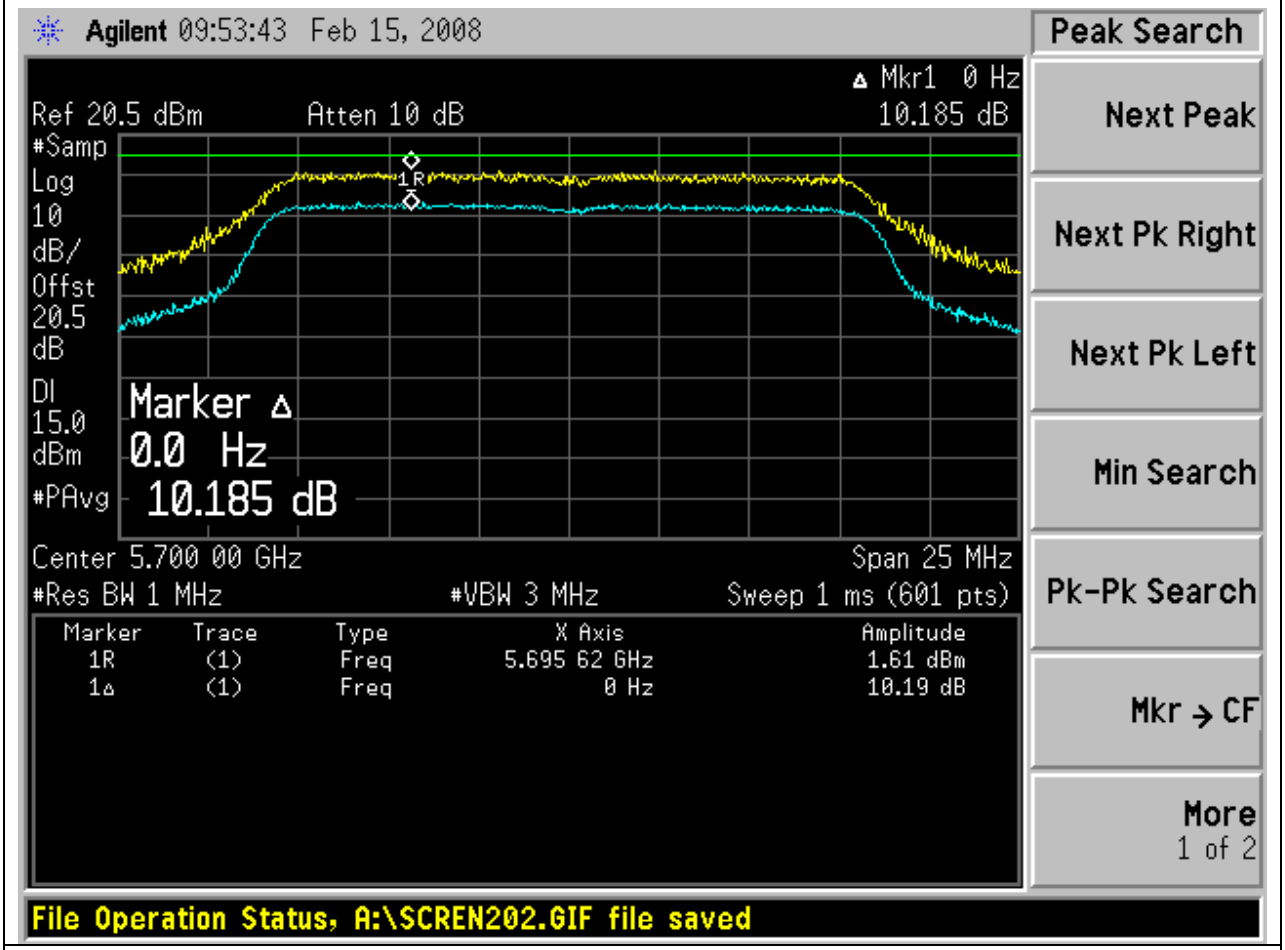
Title: Peak Excursion at 36mbps and 16dbm for channel 5320



Title: Peak Excursion at 36mbps and 16dbm for channel 5500

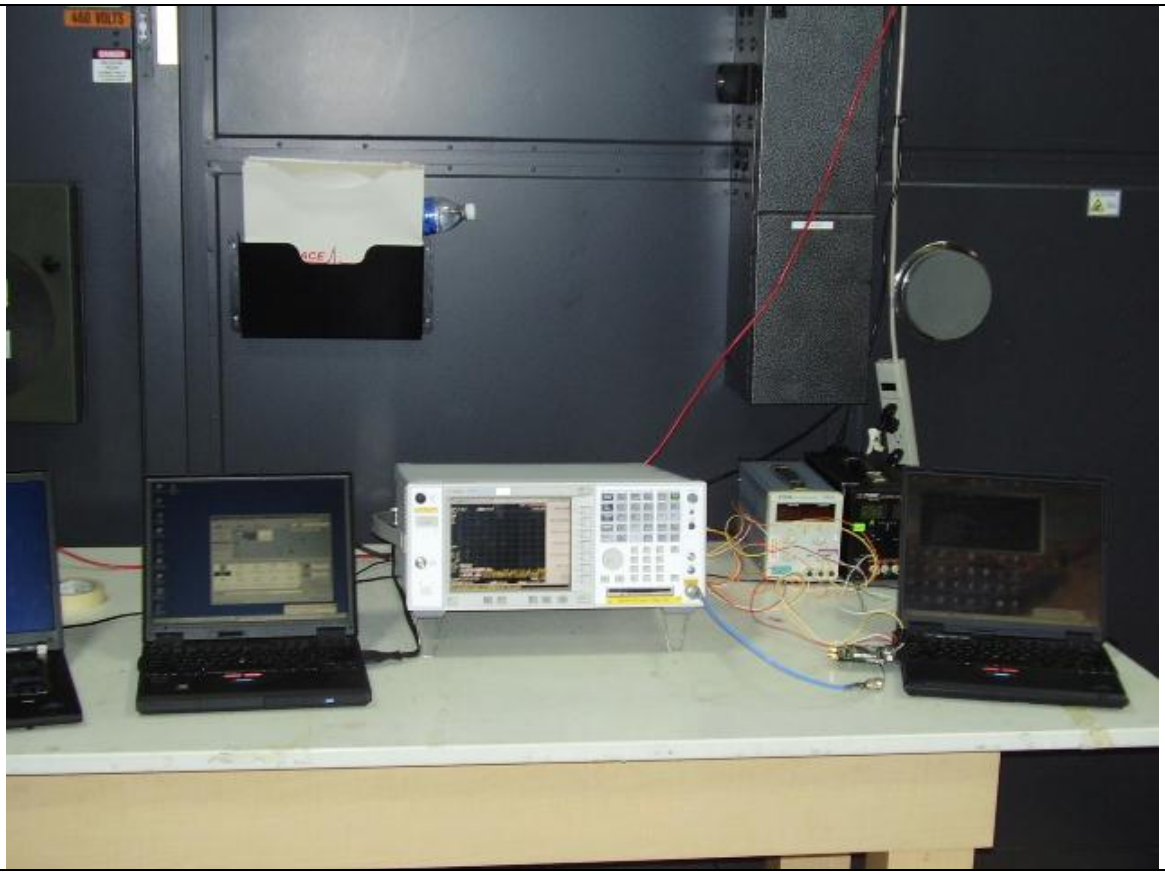


Title: Peak Excursion at 36mbps and 16dbm for channel 5600

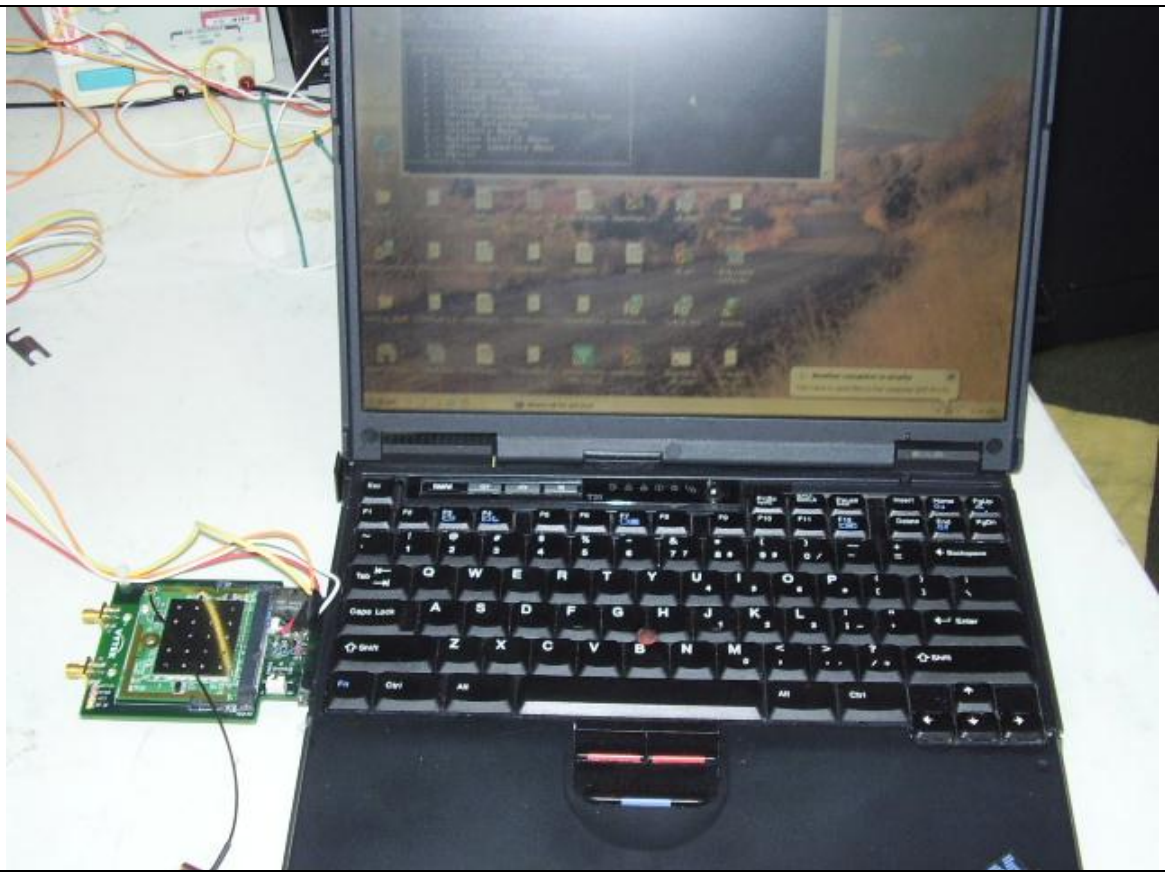


Title: Peak Excursion at 36mbps and 16dbm for channel 5700

Physical Test arrangement Photograph:



Title: Conducted measurement test setup



Title: Conducted measurement test setup

Conducted emissions

Test Number: 30382 **Spec ID:** 474				
Basic Standard	**Applied to**	**Class**	**Freq Range**	**Test Details / Comments**
CFR47 Part 15.407a (LP0002 4.7.2, RSS210)	RF Ports	N/A	5150MHz - 5725MHz	Peak Power Spectral Density
Operating Mode	**Mode :** 1, Continuous Transmit			
Power Input	5, DC (+/-20%)			
Overall Result	Pass			
Comments	No further comments			
Deviation	There were no deviations from the specification			

System Number	**Description**	**Samples**	**System under test**	**Support equipment**
1	Conducted testing configuration	S01	☑	☐
2	Support equipment	S02, S03 and S04	☐	☑

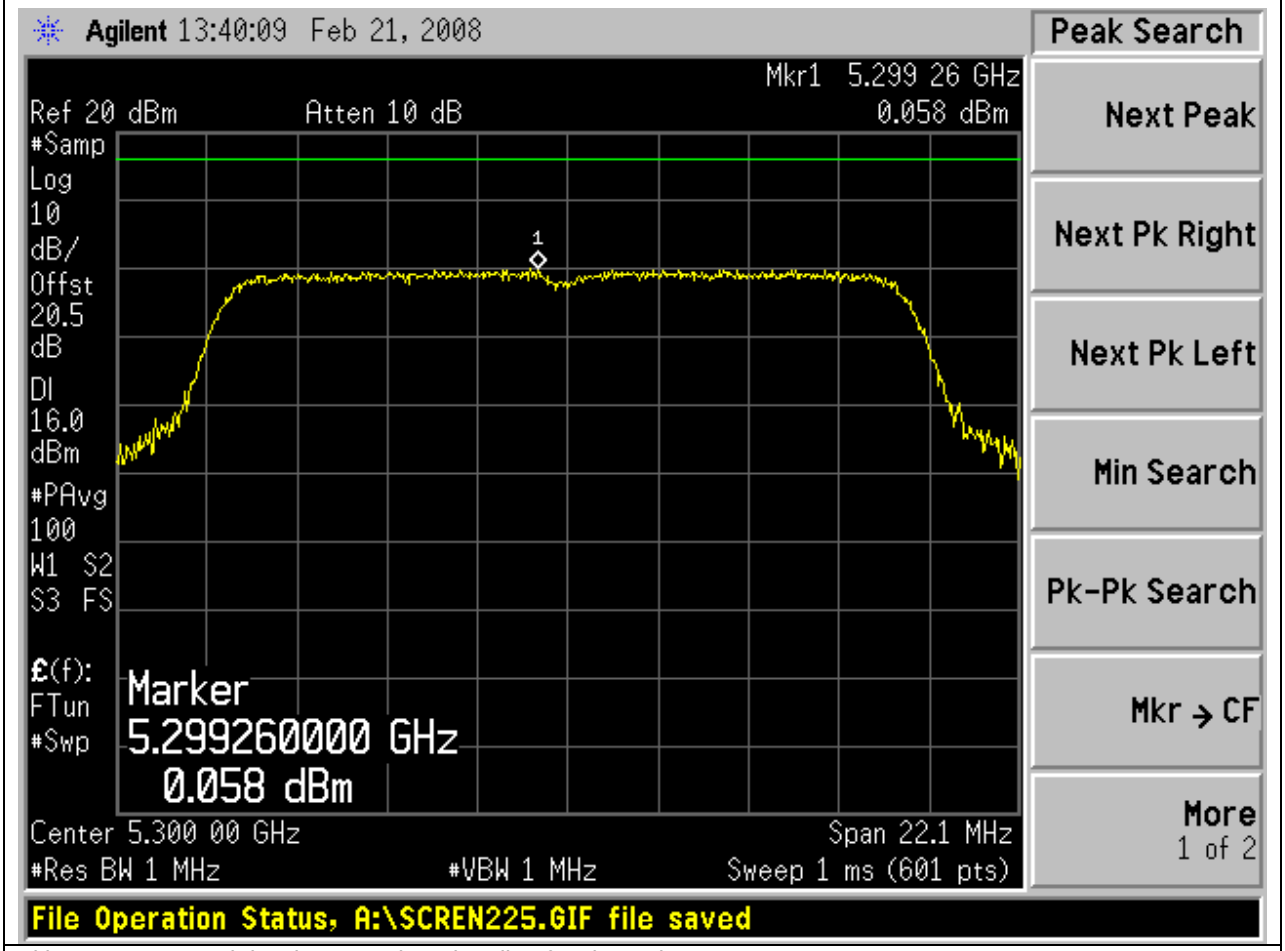
Subtest Number: 30382 - 1	**Subtest Date:** 12-Feb-2008
Engineer	Donald Foster
Lab Information	Building P, Shield Room 3
Subtest Results	
Line Under Test	[A] Antenna port
Transducer	Direct
Subtest Result	Pass
Highest Frequency	N/A
Lowest Frequency	N/A
Comments on the above Test Results	No further comments

15.407: For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

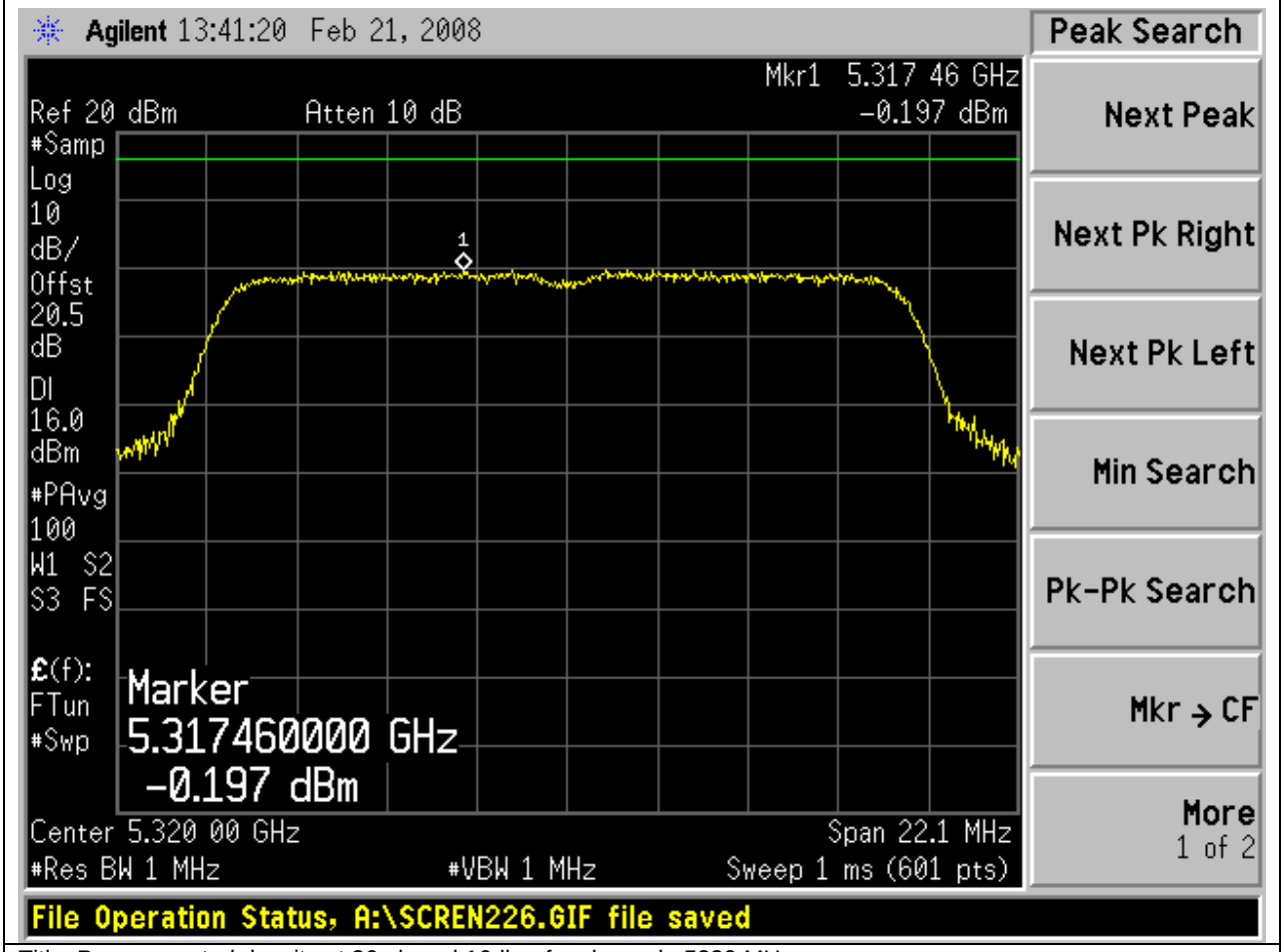
The maximum supported antenna gain is 14 dBi. Therefore the maximum allowable peak power spectral density must be reduced by 14dBi-6dbi = 8dBi.

Freq. in MHz.	Data Rate	PPSD (dbm)	Limit (dbm)	Margin
5260	36	0.5	3	2.5
5300	36	0.05	3	2.95
5320	36	-0.19	3	3.81

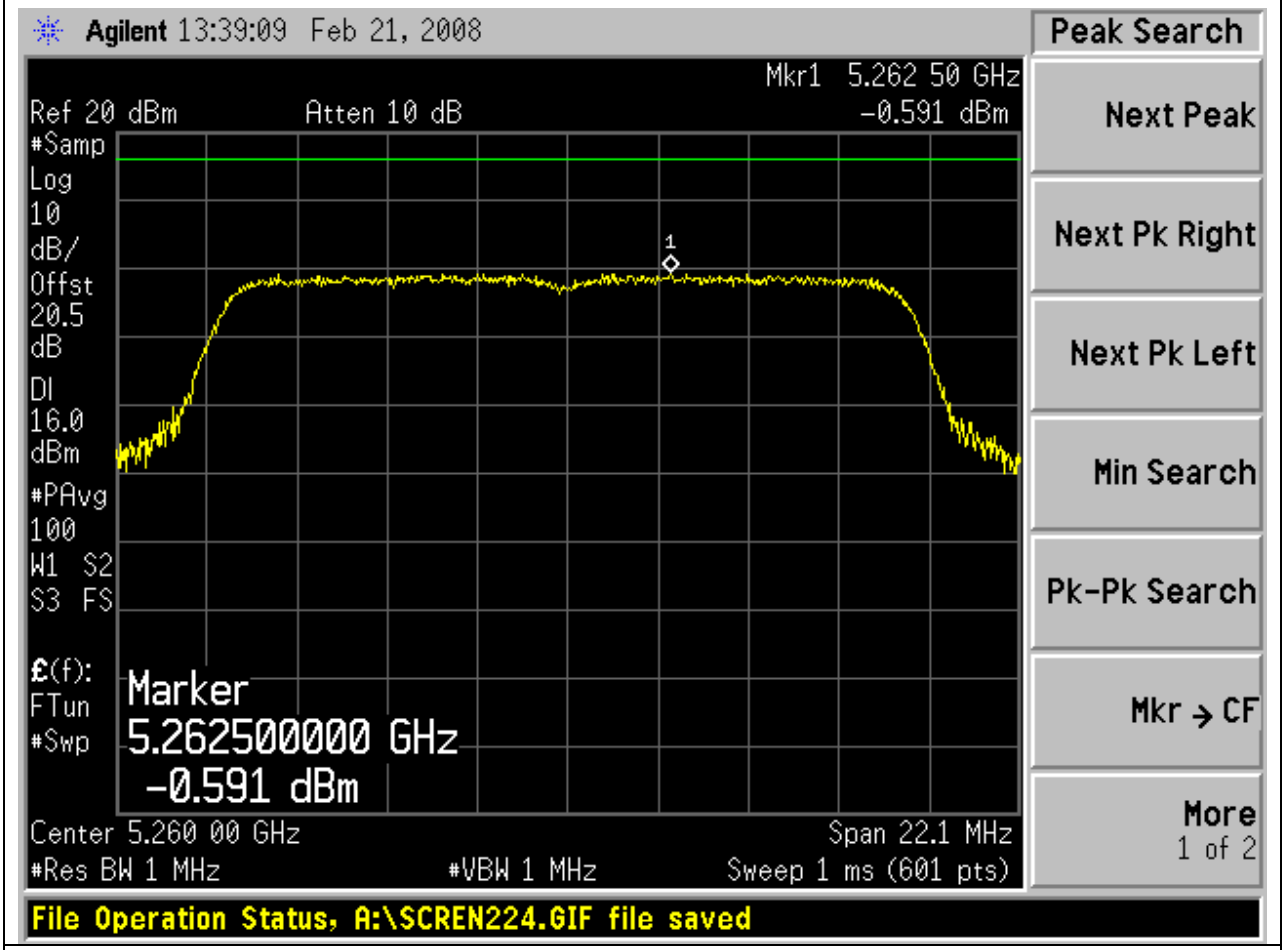
5500	36	0.39	3	3.61
5600	36	0.32	3	2.68
5700	36	1.17	3	1.83



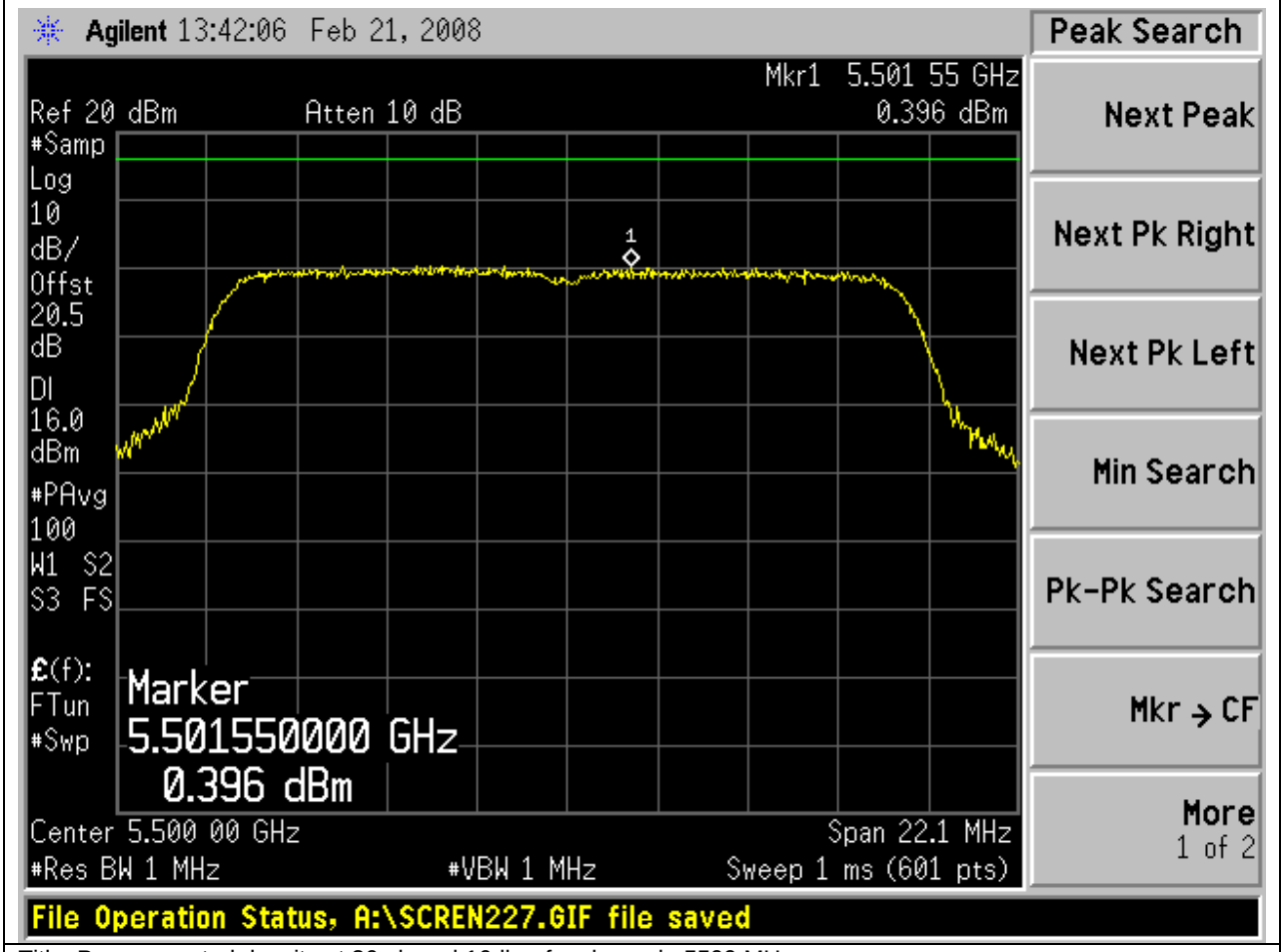
Title: Power spectral density at 36mb and 16dbm for channel 5300 MHz.



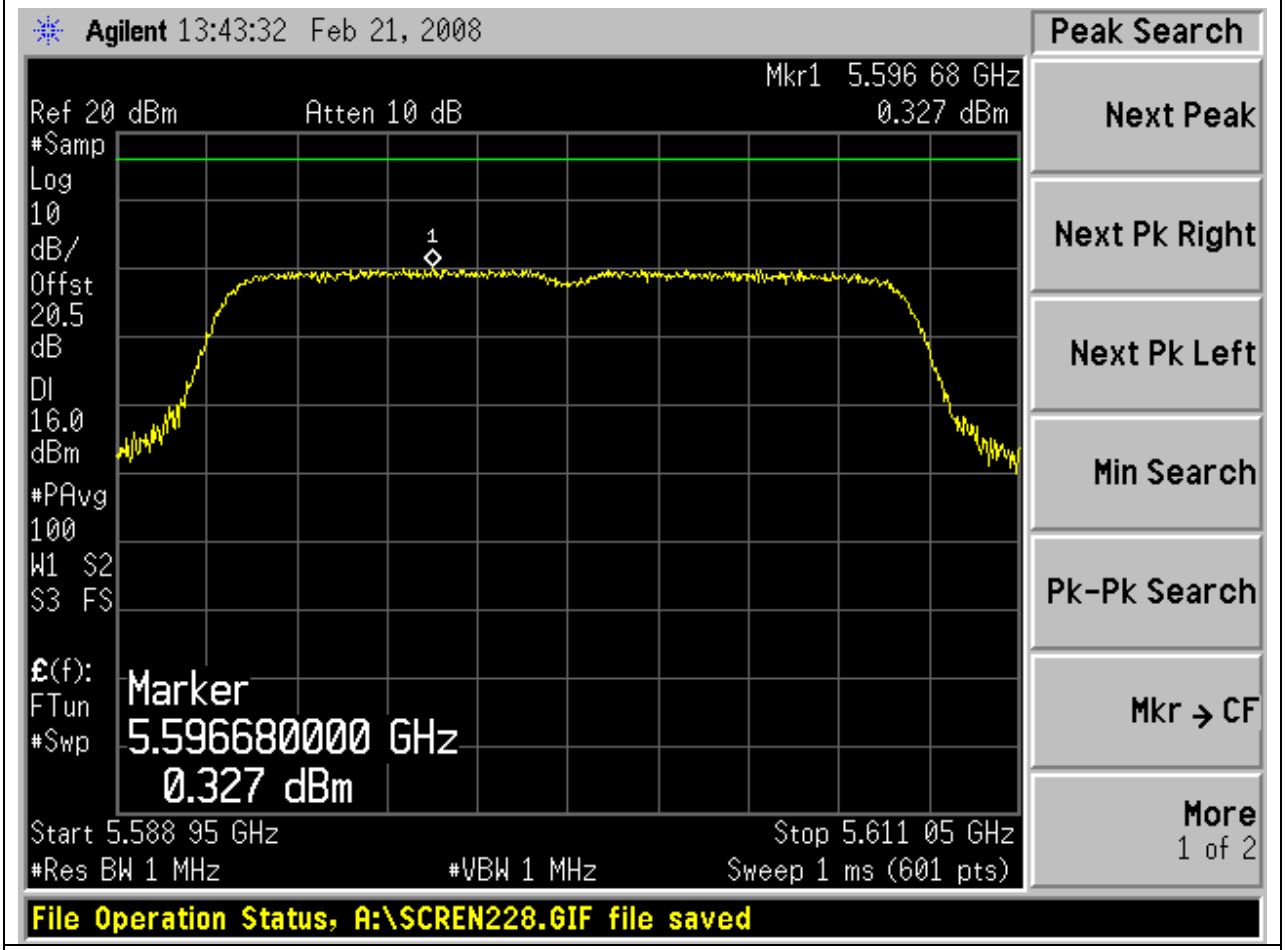
Title: Power spectral density at 36mb and 16dbm for channel 5320 MHz.



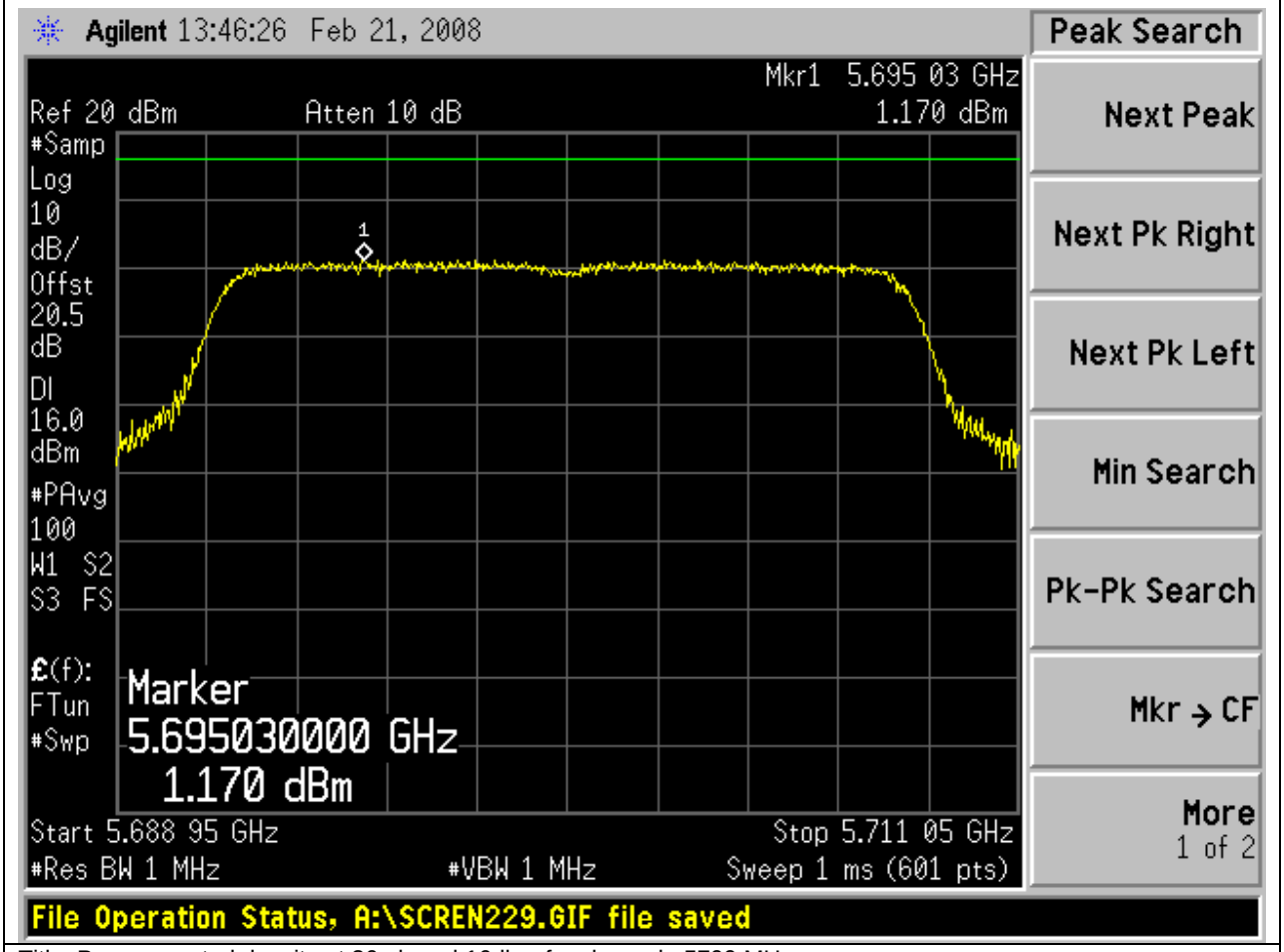
Title: Power spectral density at 36mb and 16dbm for channel 5260 MHz.



Title: Power spectral density at 36mb and 16dbm for channel 5500 MHz.

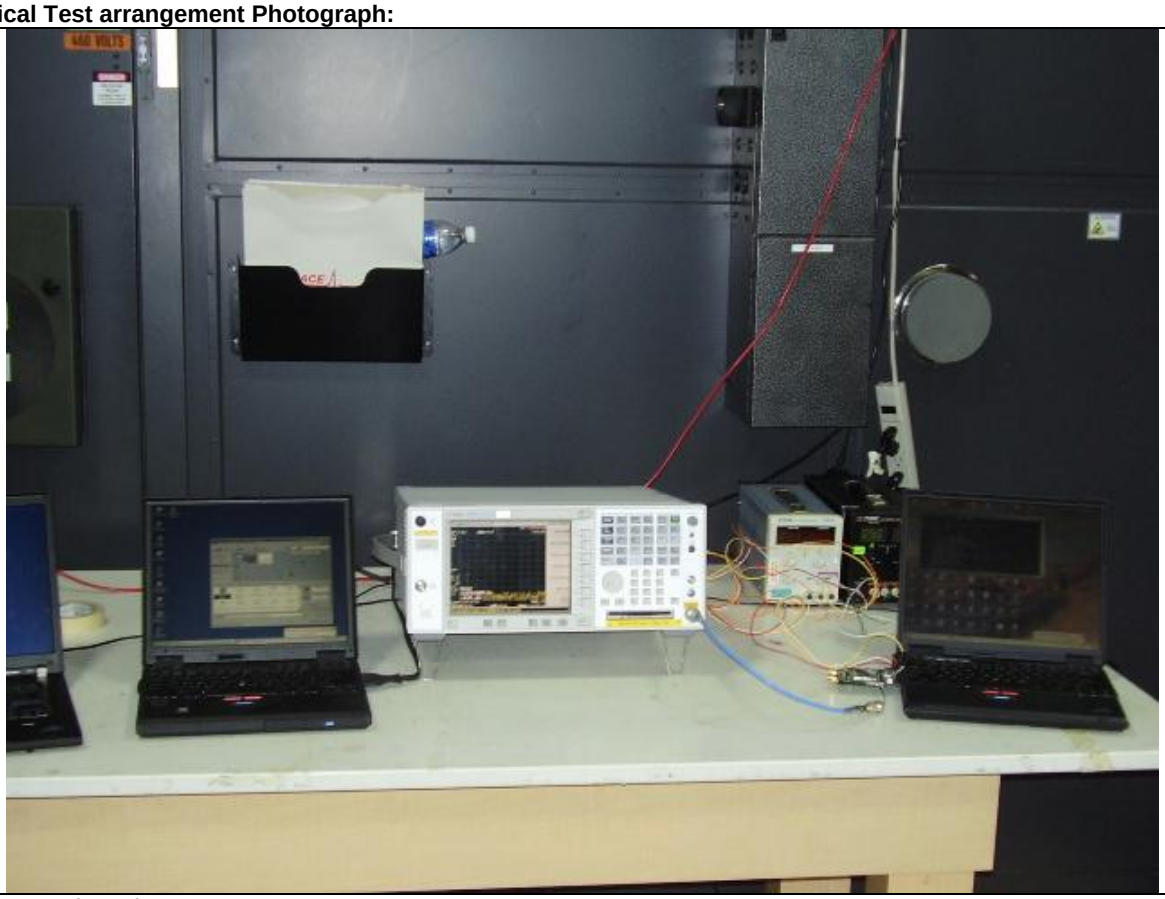


Title: Power spectral density at 36mb and 16dbm for channel 5600 MHz.

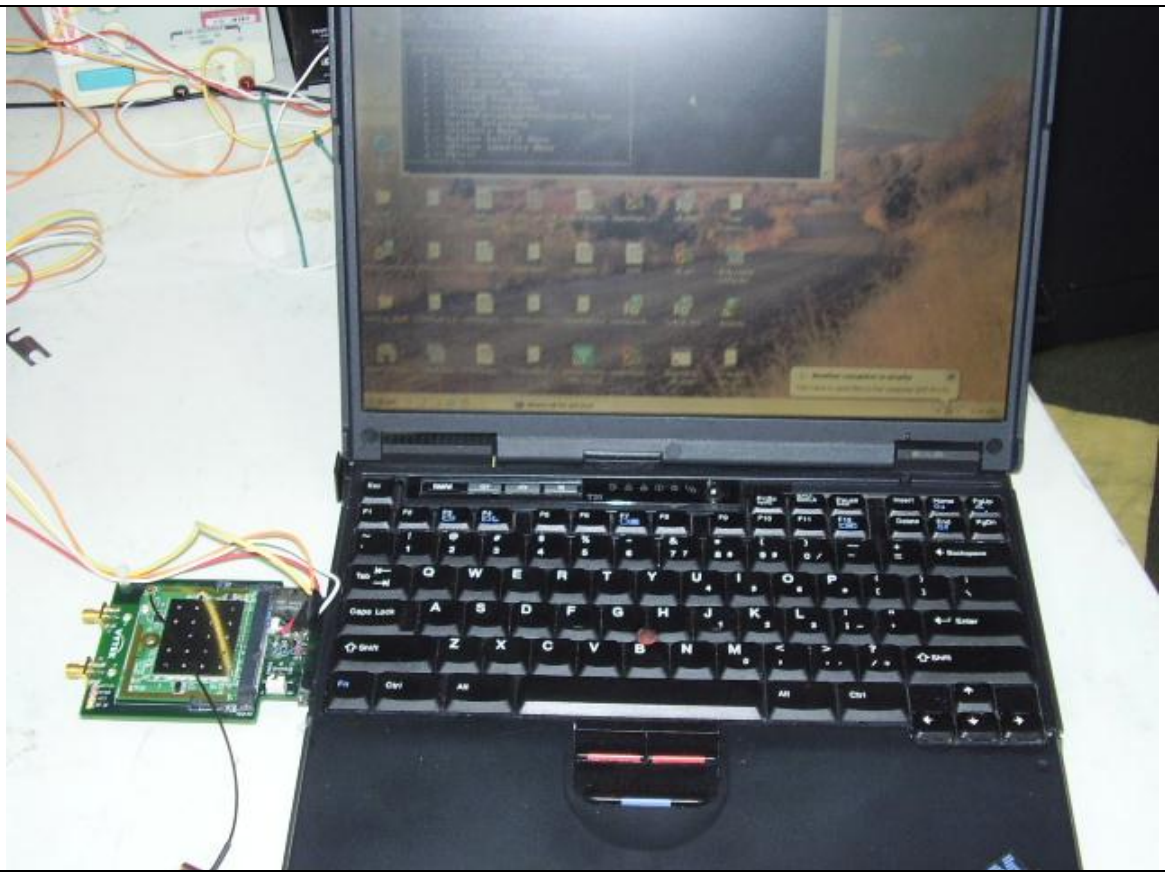


Title: Power spectral density at 36mb and 16dbm for channel 5700 MHz.

Physical Test arrangement Photograph:



Title: Conducted measurement test setup



Title: Conducted measurement test setup

Conducted emissions

Test Number: 30380 **Spec ID:** 478				
Basic Standard	**Applied to**	**Class**	**Freq Range**	**Test Details / Comments**
CFR47 Part 15.407a (LP0002 4.7.2, RSS210)	RF Ports	N/A	5150MHz - 5725MHz	Peak Transmit Power (LP0002 limit 17dBm or formula from 5250-5350MHz), Also complieswith HKTA1039
Operating Mode	**Mode :** 1, Continuous Transmit			
Power Input	5, DC (+/-20%)			
Overall Result	Pass			
Comments	No further comments			
Deviation	There were no deviations from the specification			

System Number	**Description**	**Samples**	**System under test**	**Support equipment**
1	Conducted testing configuration	S01	☑	☐
2	Support equipment	S02, S03 and S04	☐	☑

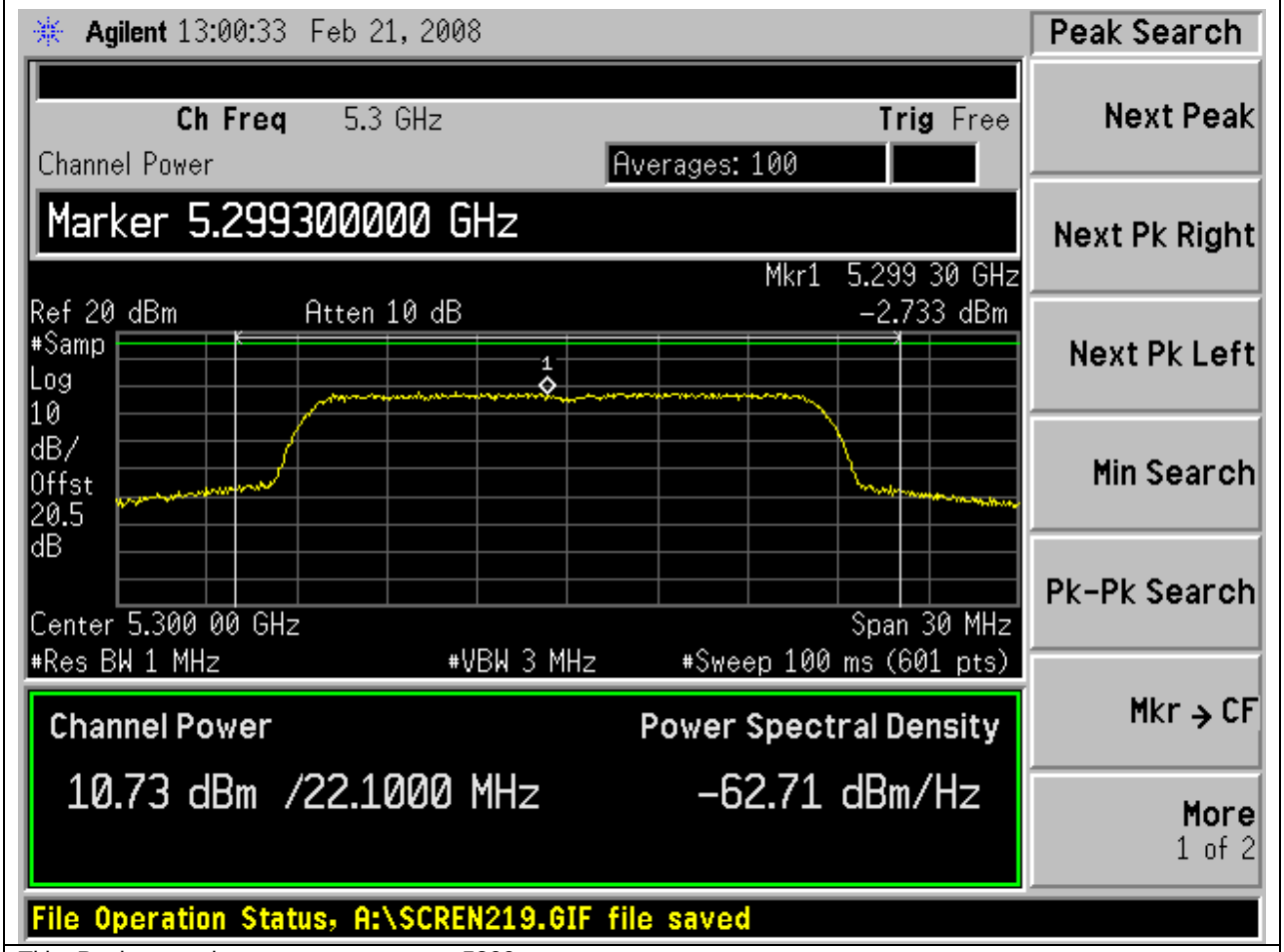
Subtest Number: 30380 - 1	**Subtest Date:** 12-Feb-2008
Engineer	Donald Foster
Lab Information	Building P, Shield Room 3
Subtest Results	
Line Under Test	[A] Antenna port
Transducer	Direct
Subtest Result	Pass
Highest Frequency	N/A
Lowest Frequency	N/A
Comments on the above Test Results	No further comments

15.407: For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

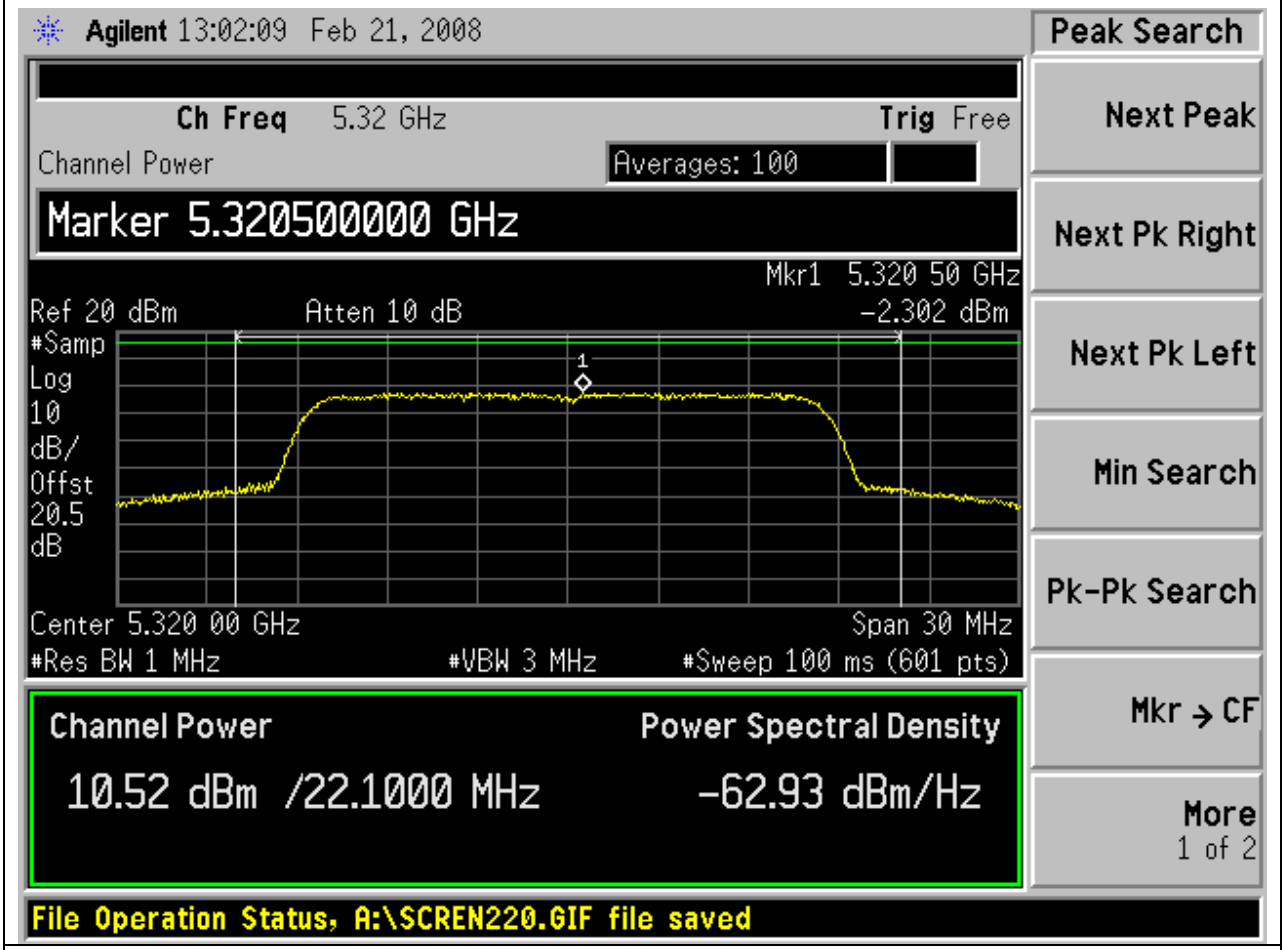
The smallest 26dB bandwidth for all channels is 22.1 MHz. The maximum conducted output power is calculated as 11dBm+10*log(22.1MHz) = 24.4dBm therefore the limit of 24dbm shall be used

The maximum supported antenna gain for all bands is 14dBi. Therefore the maximum allowable output power for all bands must be reduced by 14dBi-6dbi = 8dBi.

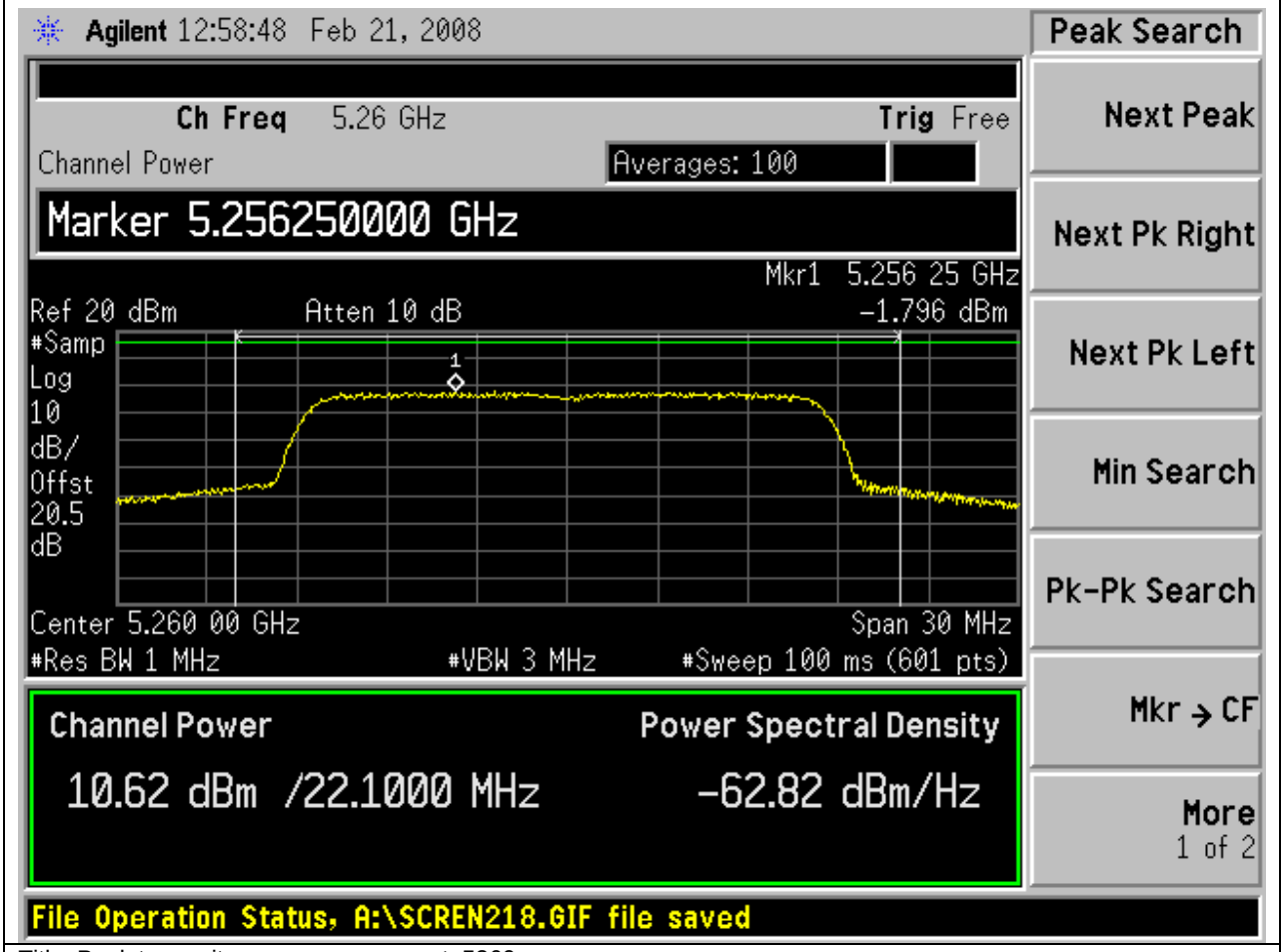
Frequency (MHz)	Data Rate (Mbps)	Peak Output Power (dBm)	Limit (dBm)	Margin (dB)
5260	36	10.62	16	5.38
5300	36	10.73	16	5.27
5320	36	10.52	16	5.48
5500	36	11.09	16	4.91
5600	36	11.98	16	4.02
5700	36	11.73	16	4.27



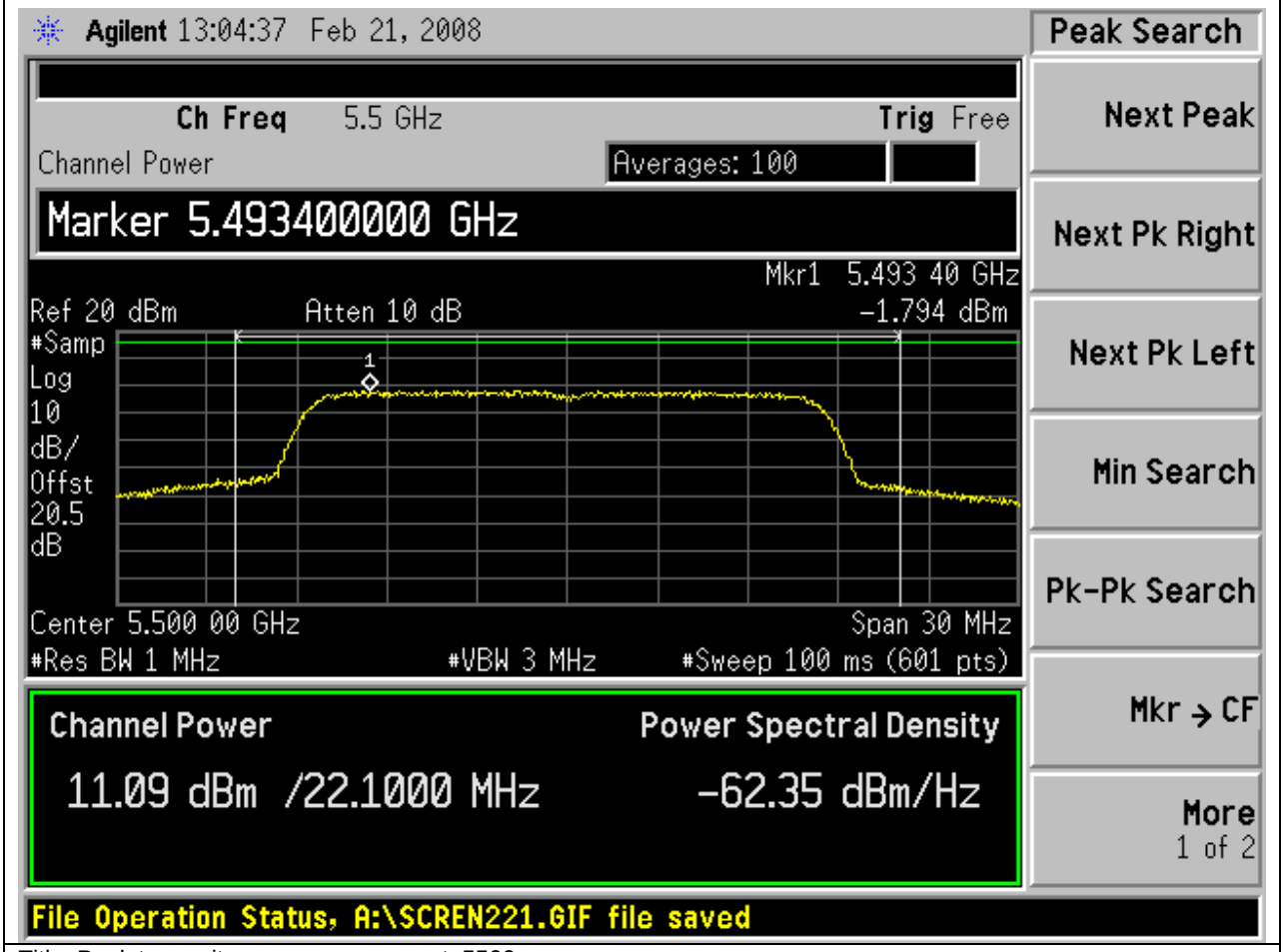
Title: Peak transmit power measurement 5300



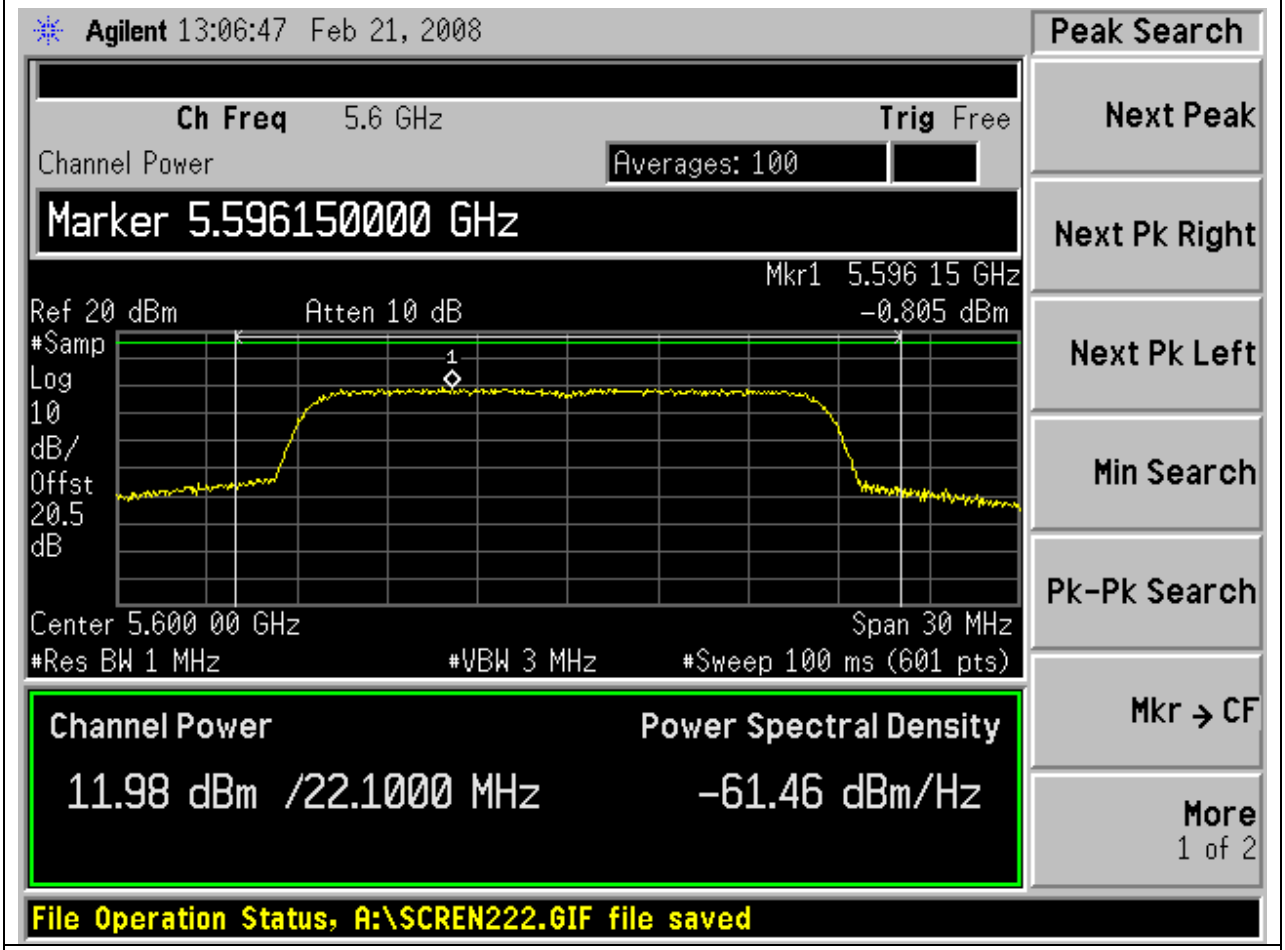
Title: Peak transmit power measurement 5320



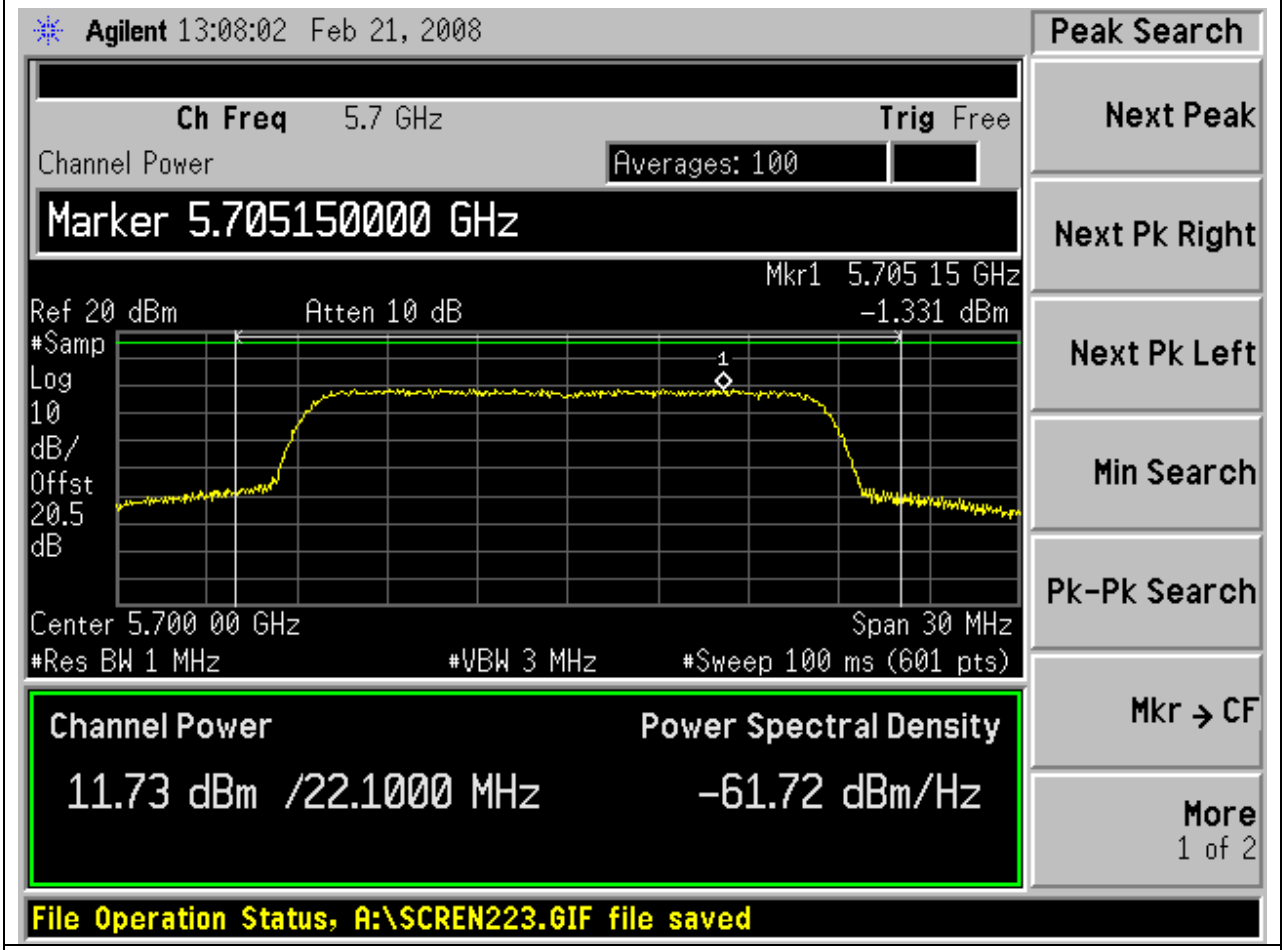
Title: Peak transmit power measurement 5260



Title: Peak transmit power measurement 5500

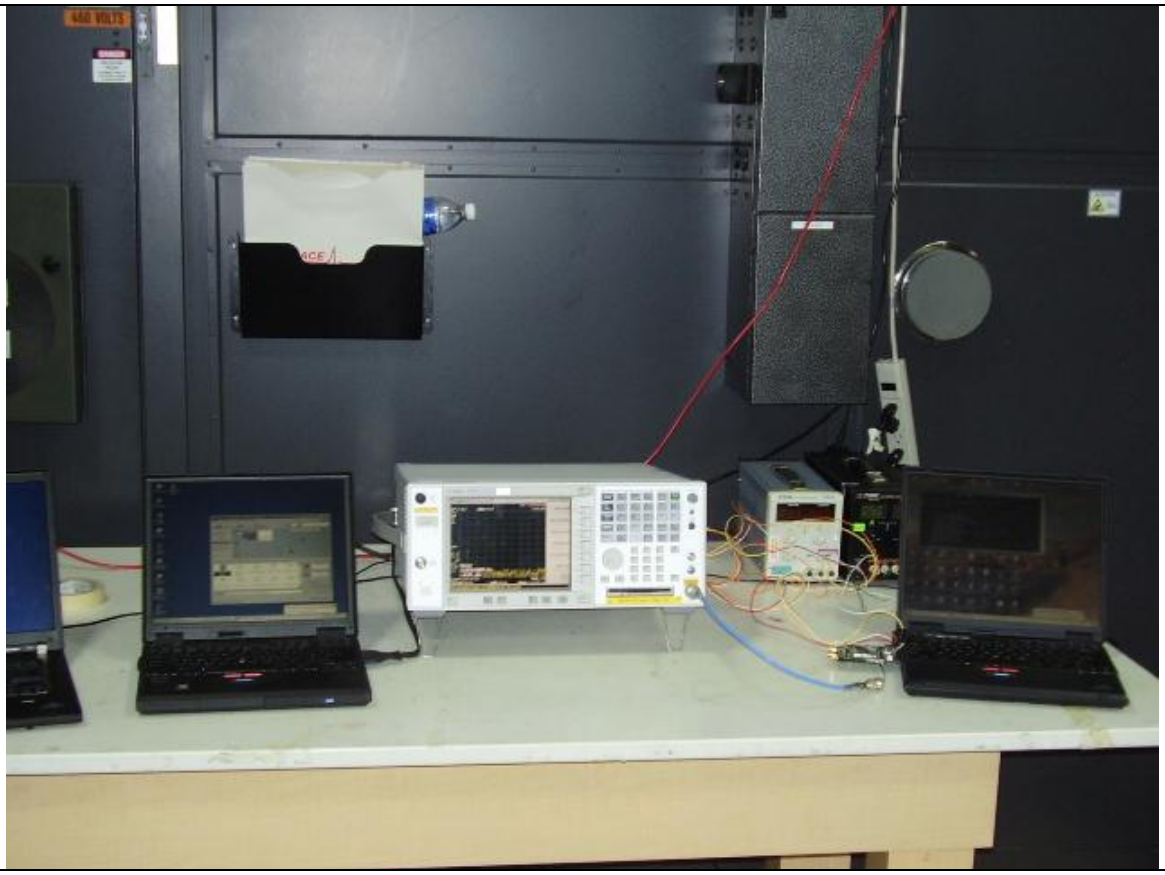


Title: Peak transmit power measurement 5600



Title: Peak transmit power measurement 5700

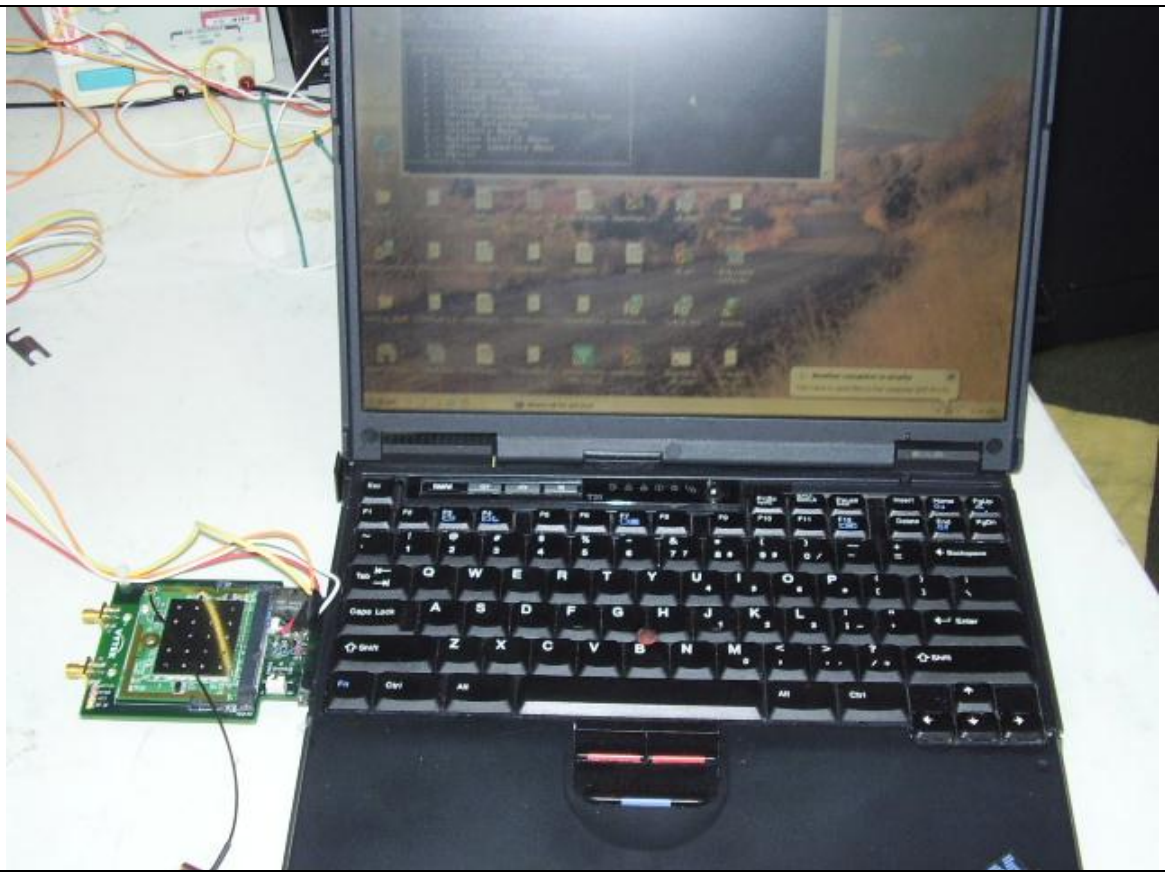
Physical Test arrangement Photograph:



Title: Conducted measurement test setup

Comments on the above Photograph:

No further comments



Title: Conducted measurement test setup

Comments on the above Photograph:

No further comments

Conducted emissions

Test Number: 30379 **Spec ID:** 652				
Basic Standard	**Applied to**	**Class**	**Freq Range**	**Test Details / Comments**
Conducted Spurious Emissions	RF Ports	N/A	30MHz - xGHz	Also complies with RSS 210, LP0002, HKTA1039
Operating Mode	**Mode :** 1, Continuous Transmit			
Power Input	5, DC (+/-20%)			
Overall Result	Pass			
Comments	No further comments			
Deviation	There were no deviations from the specification			

System Number	**Description**	**Samples**	**System under test**	**Support equipment**
1	Conducted testing configuration	S01	☑	☐
2	Support equipment	S02, S03 and S04	☐	☑

Subtest Number: 30379 - 1	**Subtest Date:** 12-Feb-2008
Engineer	Donald Foster
Lab Information	Building P, Shield Room 3
Subtest Results	
Line Under Test	[A] Antenna port
Transducer	Direct
Subtest Result	Pass
Highest Frequency	N/A
Lowest Frequency	N/A
Comments on the above Test Results	No further comments

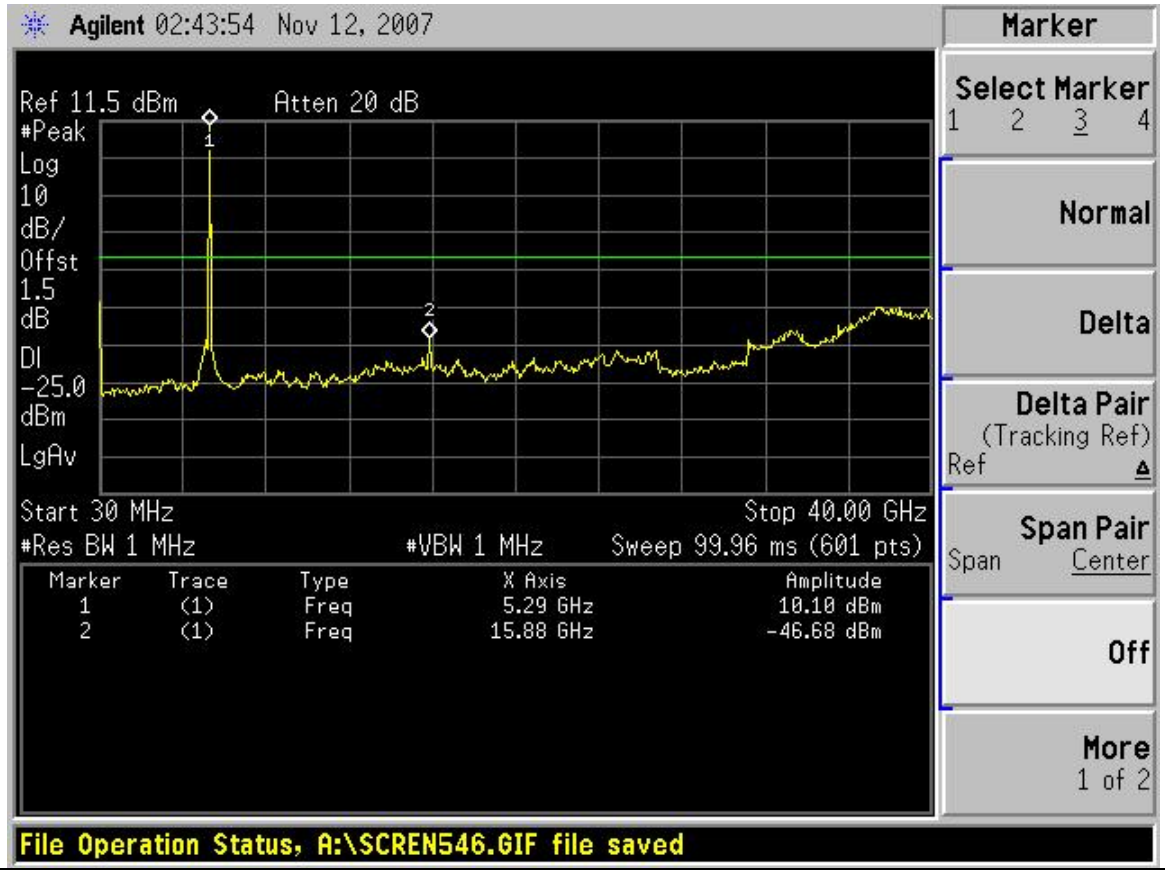
Conducted Spurious Emissions

15.407: For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27dBm/MHz. Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.

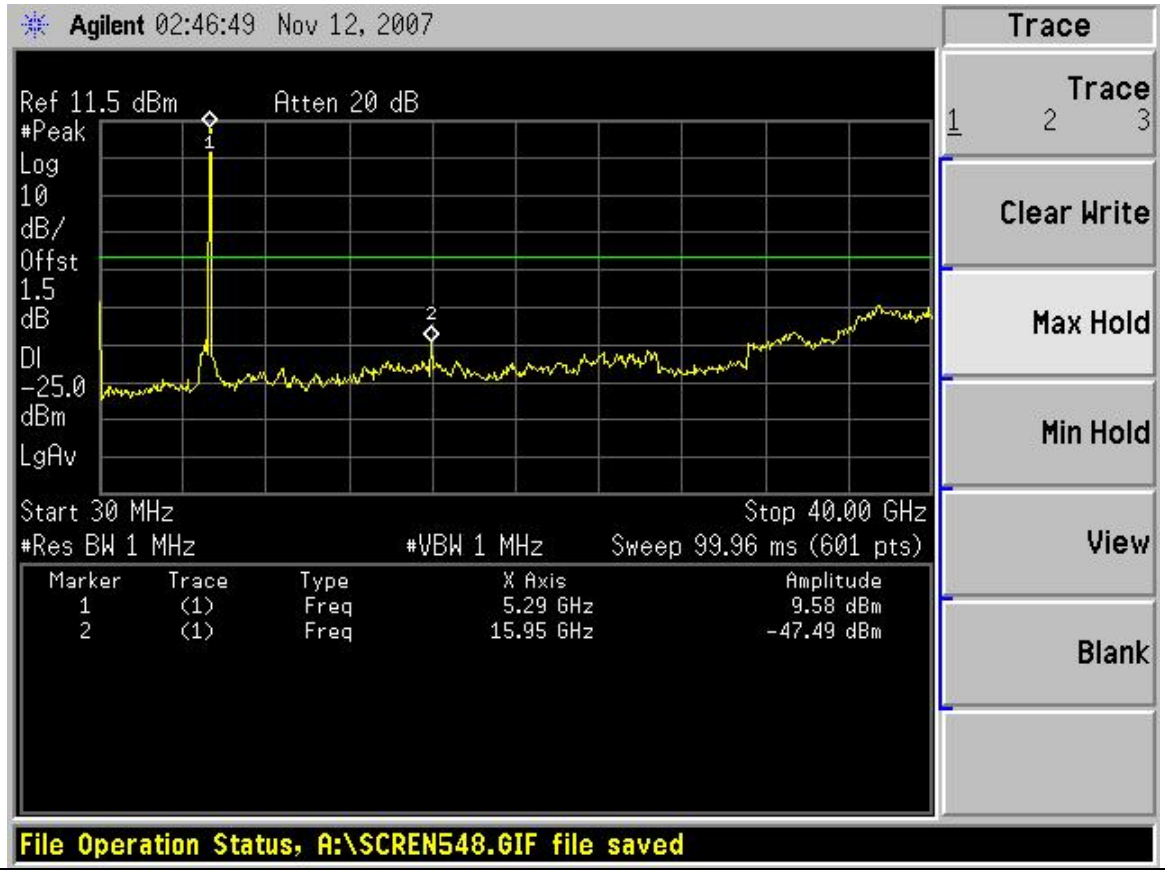
For transmitters operating in the 5.47-5.725 GHz band: all emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of -27dBm/MHz.

The maximum supported antenna gain for all bands is 14dBi. Therefore the maximum allowable conducted spurious emissions for all bands is
-27dBm/MHz-14dBi = -41dbm/MHz.

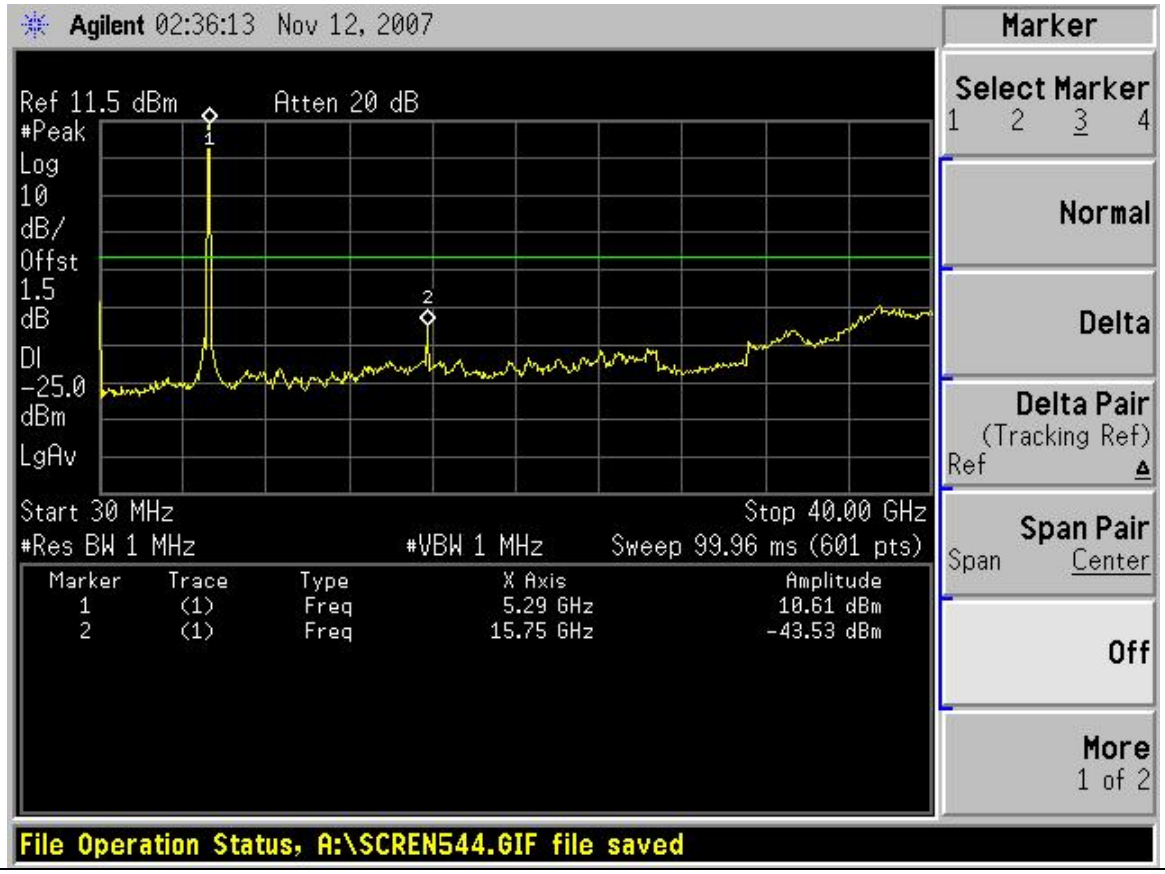
Channel	Data Rate	Max Emission	Limit	Margin
5260	36	-46.6	-41	5.6
5300	36	-47.4	-41	6.4
5320	36	-43.5	-41	2.5
5500	36	-44.5	-41	3.5
5600	36	-45.3	-41	4.3
5700	36	-47.0	-41	6.0



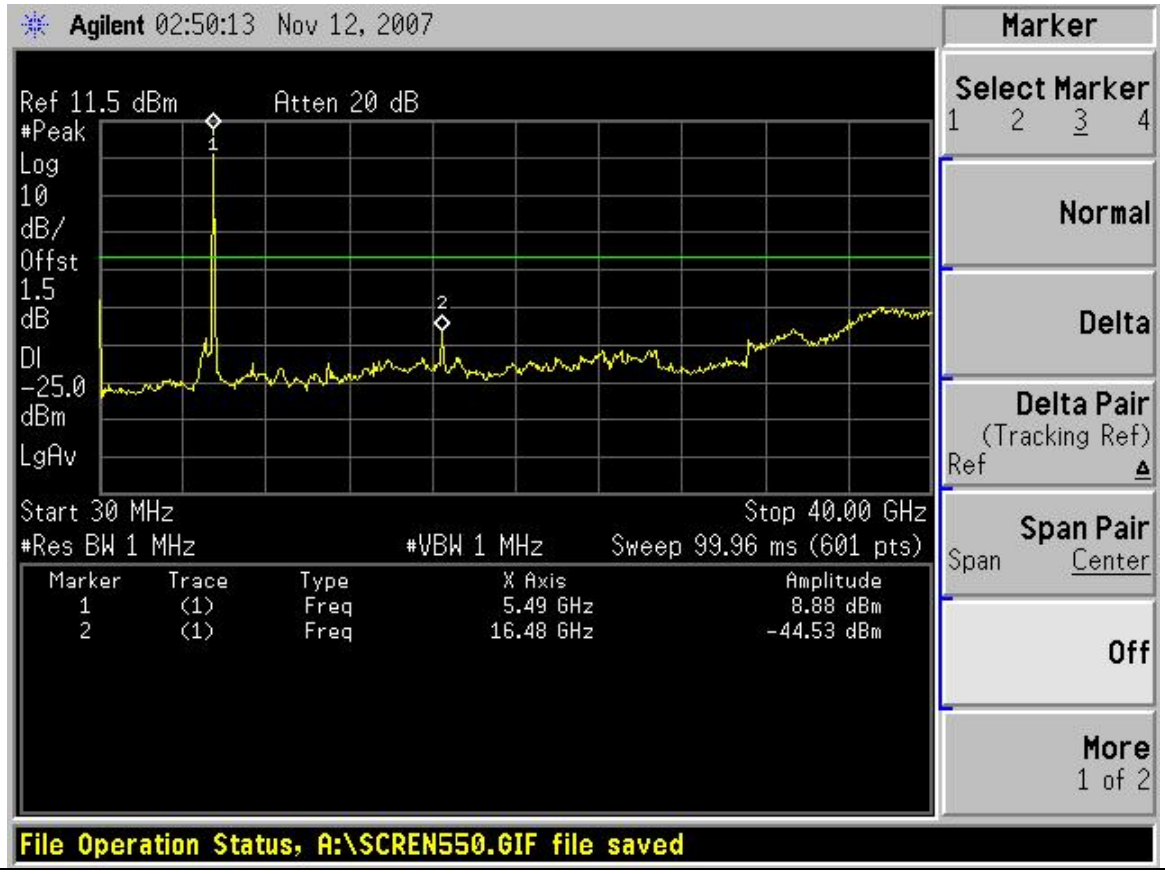
Title: conducted spurious emissions at 36 mbps and 16dbm for channel 5260



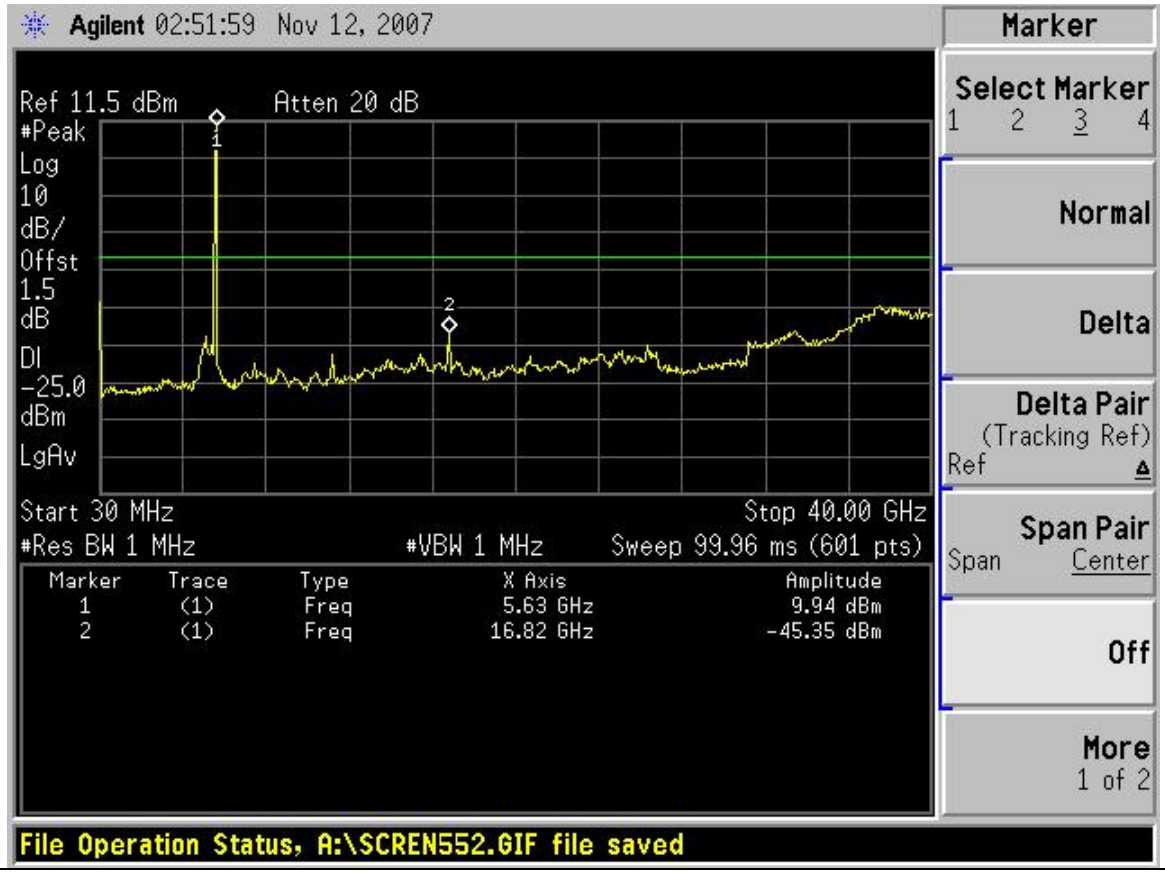
Title: conducted spurious emissions at 36 mbps and 16dbm for channel 5300



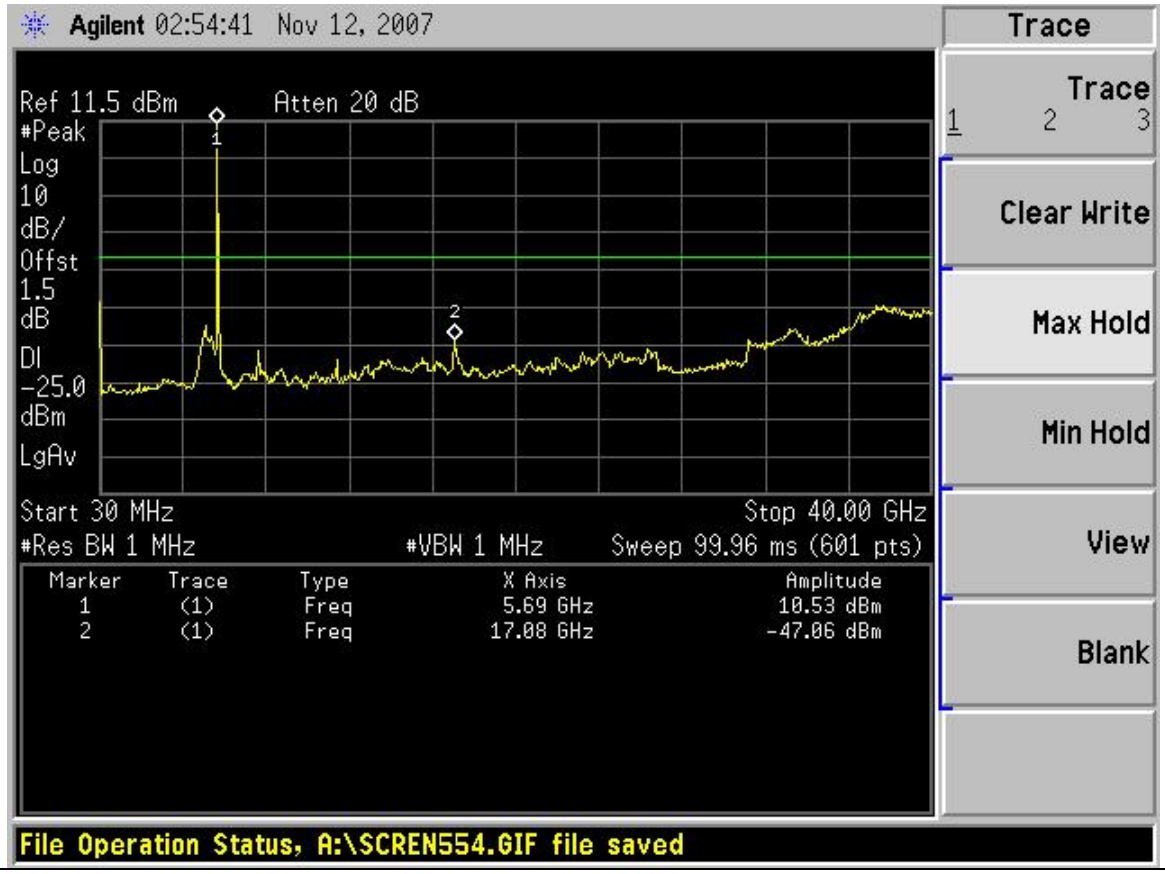
Title: conducted spurious emissions at 36 mbps and 16dbm for channel 5320



Title: conducted spurious emissions at 36 mbps and 16dbm for channel 5500

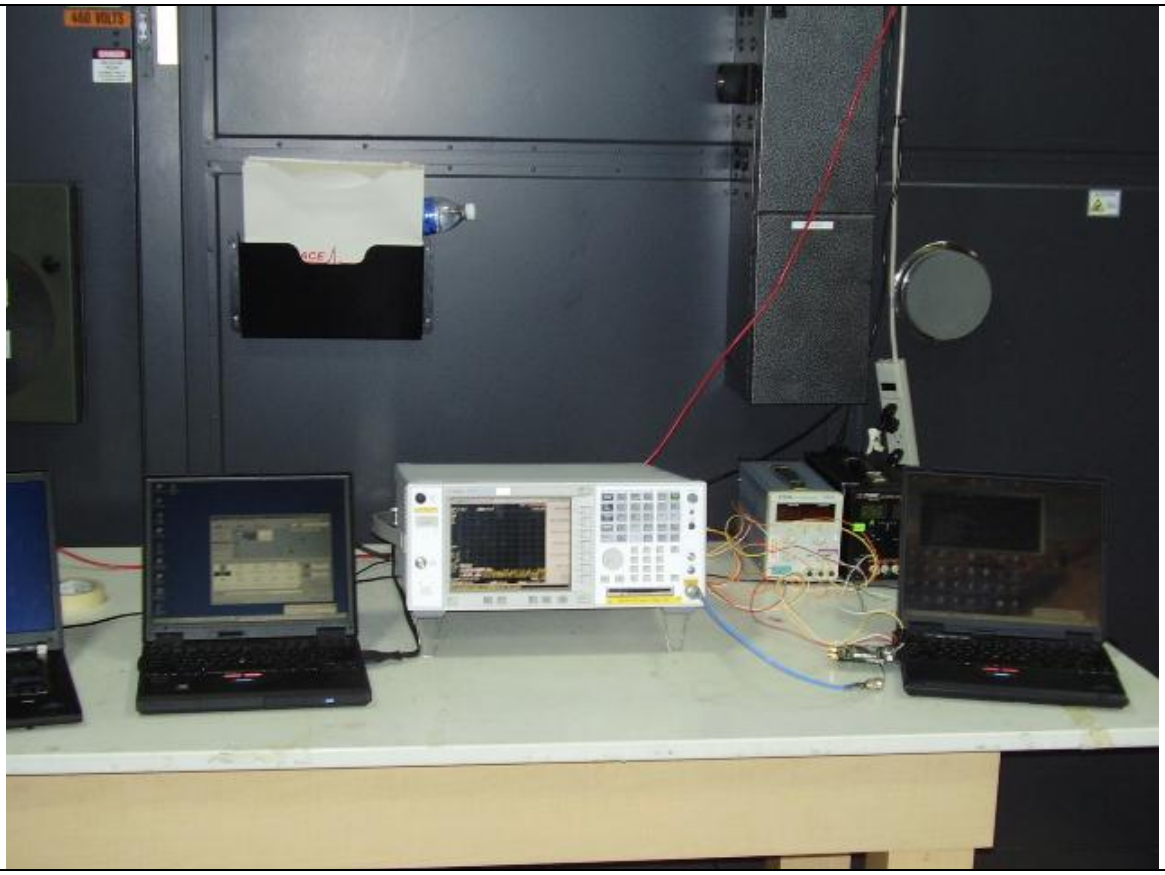


Title: conducted spurious emissions at 36 mbps and 16dbm for channel 5600



Title: conducted spurious emissions at 36 mbps and 16dbm for channel 5700

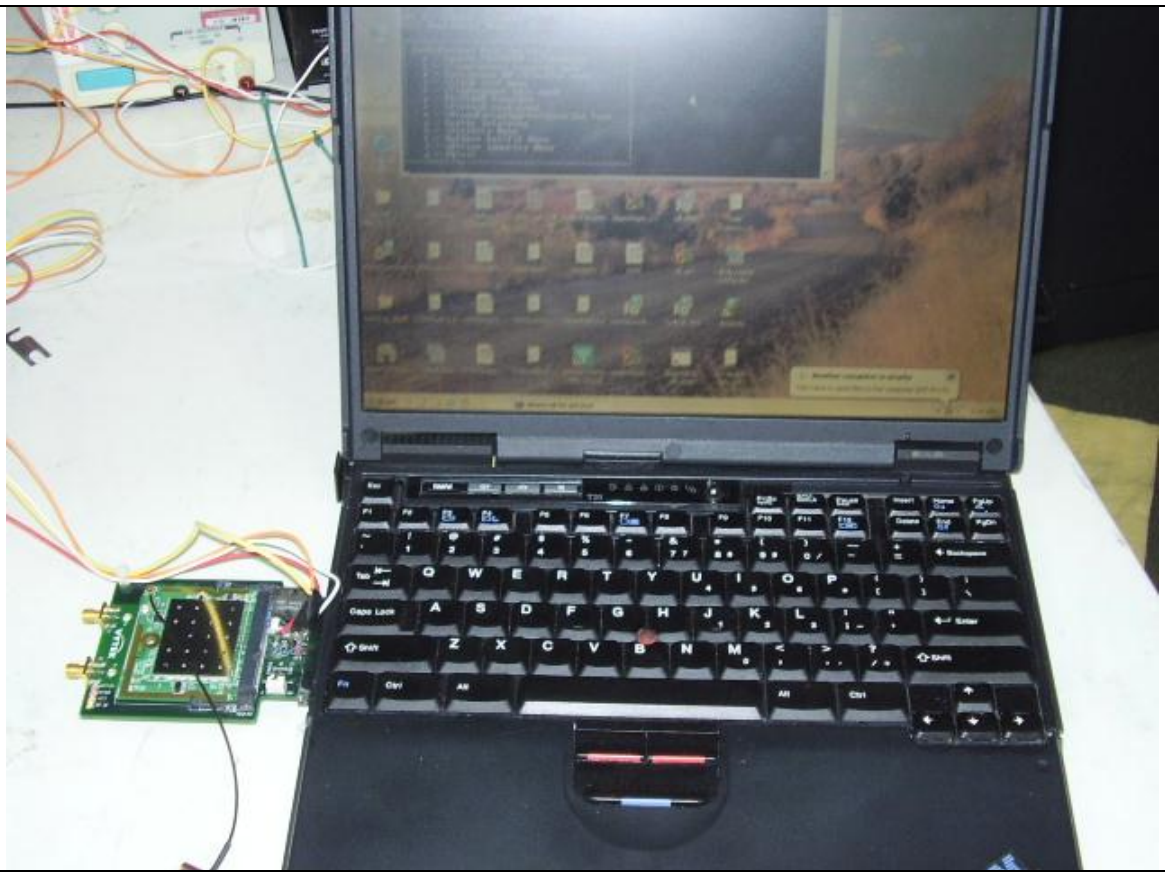
Physical Test arrangement Photograph:



Title: Conducted emissions test setup

Comments on the above Photograph:

No further comments



Title: Conducted emissions test setup