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Test Report: 2007 118189 MIMO FCC

Project number: 8189-1

Applicant: Solectek Corporation
6370 Nancy Ridge Road Suite 109
San Diego, CA 92121-3212

Equipment Under Test (EUT): 5.8GHz Broadband Wireless
Communication Platform

Model: MRS

FCC ID: KA358MRS1

In Accordance With: FCC Part 15 Subpart C, 15.247

Tested By: Nemko USA Inc.
11696 Sorrento Valley Road, Suite F
San Diego, CA 92121

Authorized By: 

Alan Laudani, RF/EMC Test Specialist

Date: January 2, 2008

Total Number of Pages: 63

2.1. Section 1. Summary of Test Results

General

All measurements are traceable to national standards

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15; Subpart C. Radiated tests were conducted in accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

The assessment summary is as follows:

Apparatus Assessed: 5.8GHz Broadband Wireless Communication Platform Model MRS

Specification: FCC Part 15 Subpart C, 15.247

Date Received in Laboratory: October 17, 2007

Compliance Status: Complies

Exclusions: None

Non-compliances: None

Report Release History:

REVISION	DATE	COMMENTS	
-	Jan. 2, 2008	Prepared By:	Ferdinand S. Custodio
-	Jan. 2, 2008	Initial Release:	Alan Laudani

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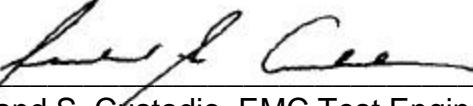
Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

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TESTED BY:


Ferdinand S. Custodio, EMC Test Engineer

Date: Jan. 2, 2008

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Section 2: Equipment Under Test

2.1 Product Identification

The Equipment Under Test is a Wireless Communication Platform called MRS (multiple input, multiple output) based on the client's technology of the same name. No user accessible configuration setting is available during testing other than the frequency channels. The EUT was assessed using the following frequencies:

Low Channel	= Channel 149 (5745 MHz)
Mid Channel	= Channel 153 (5765 MHz)
High Channel	= Channel 161 (5805 MHz)



2.2 Samples Submitted for Assessment

The following samples of the apparatus have been submitted for type assessment:

Sample No./Name	Description	Serial No.
MRS	Wireless Communication Platform	Engineering Sample
Antenna Assy	CUSHCRAFT Corporation SQ5153WP (x3)	Engineering Sample

2.4 Theory of Operation

The MRS is a wireless communication platform, which is a microprocessor imbedded system that collects, processes and stores train car and sub-system information to enhance maintenance, operational efficiency and safety. It will be permanently installed inside a rail car. When a train pulls into a station and using Solectek's advanced MRS (multiple input, multiple output) technology to minimize data errors and optimize throughput., each car will wirelessly transmit information to the base station, which then relays the information to a central control system that provides valuable data for the operator to optimize their rolling stock fleet. The MRS is professionally installed.

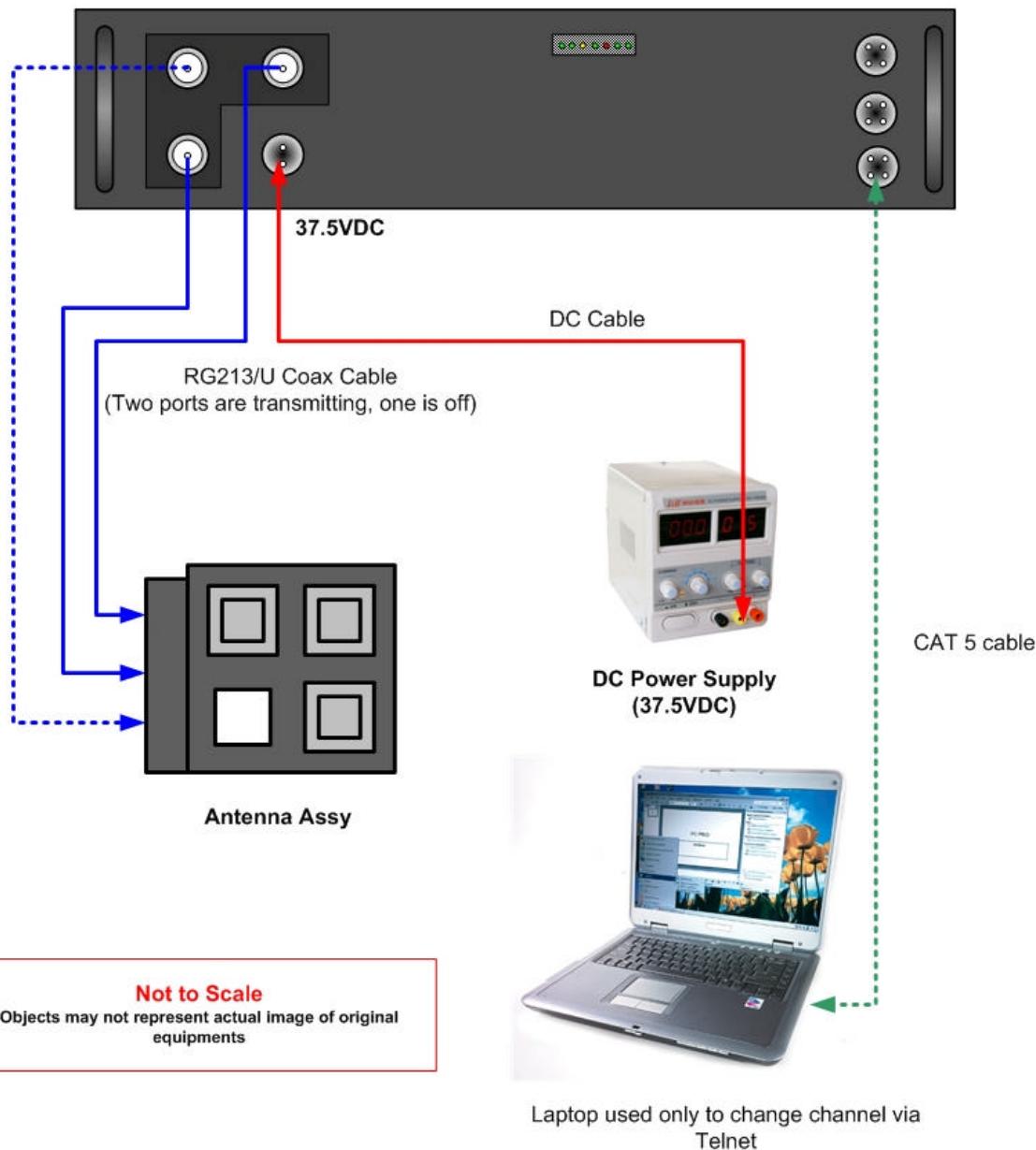
The unit was tested at 54 Mbits/sec which uses QAM64. This modulation produces the highest RF Peak-to-Average ratio (PAR) and therefore represents the worst case conditions for regulatory testing. The EUT transmits at two ports simultaneously while the third one is disabled by embedded software.

2.5 Technical Specifications of the EUT

Manufacturer:	Solectek Corporation
Operating Frequency:	5745 MHz to 5805 MHz in the 5725-5850 MHz Band
Rated Power:	51.414 mW
Modulation:	802.11a (OFDM)
Antenna Data:	CUSHCRAFT Corporation SQ5153WP 3 dBi at 5.150 to 5.875GHz
Antenna Connector:	SMA (F)
Power Source:	37.5VDC

2.5 Block Diagram

EUT – Solectek 5GHz MRS Wireless System



2.5 List of Accessories

DEVICE	MANUFACTURER MODEL # SERIAL #	POWER CABLE
Antenna Assy	Solectek Assy model number not available during testing (3 Cushcraft SQ5153WP12SMF 5.150-5.875 Wide-Band Ceiling Mount Squint Antenna) KOI C13515G01 0CDR (Assy)	NA
Coax Cable (x3)	Rockbestos Surprenant (2m, Type N, straight and elbow male)	NA
Laptop	IBM 2647-CU5 78-YX43W 01/02	DC cable from AC adapter
AC Adapter for Laptop	IBM 08K8205 11S08K8204Z1Z9V049YF6D Rev. 12	0.8m, unshielded, IEC type, 18AWGx2
Ethernet Cable	ELECOM Laneed 3m CAT5e 24AWG with custom connector to adapt to EUT	NA
DC Power Supply	Goldtool DPS-5050 L1507013614	1.2m, unshielded, IEC type, 18AWGx2

Section 3: Test Conditions

3.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 15 Subpart C, 15.247

Operation within the bands 902-928 MHz, 2400-2483.5 MHz,
5725-5850 MHz and 24.0-24.25 GHz bands.

3.2 Deviations From Laboratory Test Procedures

No deviations from Laboratory Test Procedure

3.3 Test Environment

All tests were performed under the following environmental conditions:

Temperature range	:	18.0 – 24 °C
Humidity range	:	14 - 68 %
Pressure range	:	86 - 106 kPa
Power supply range	:	+/- 1% of rated voltages

3.4 Test Equipment

Nemko ID	Device	Manufacturer	Model	Serial Number	Cal Date	Cal Due Date
N149	Environmental Chamber	Cincinnati Sub-Zero	ZPHS-32-2-2-H/AC	ZP0552665	5/30/2007	5/30/2008
317	Preamplifier	HP	8449A	2749A00167	2/9/2007	02/09/08
110	Antenna, LPA	Electrometrics	LPA-25	1217	12/18/2006	12/18/07
114	Antenna, Bicon	EMCO	3104	2997	12/20/2006	12/20/07
529	Antenna, DRWG	EMCO	3115	2505	8/27/2007	08/27/08
898/899	EMI Receiver & filter set	HP	8546A	3625A00348	1/18/2007	01/18/08
835	Spectrum Analyzer	Rohde & Schwarz	RHDFSEK	829058/005	6/20/2007	6/20/08
989	Harmonic Mixer	Hewlett Packard	11970U	2332A00116	Verified	
984	Pyramidal Horn	Millitech	SGH-19-RP000	50704	Verified	
837	Preamplifier	Spacek Labs Inc.	SLK-35-3	N/A	Verified	
838	Preamplifier	Spacek Labs Inc.	SLKa-35-4	3M13	Verified	
625	Antenna,Horn	EMCO	3116	9611-2325	Verified	
983	Preamplifier	KTL Dallas Inc	22837-493	N/A	Verified	

Section 4: Observations

4.1 Modifications Performed During Assessment

Clause 15.209(a) Radiated Emissions (General Requirements)

Added Fair Rite 2631665702 along side of the DC supply line inside the EUT. Using one ferrite with 2 (two) loops yielded the same result as using 2 (two) ferrites with one loop each. During testing, the configuration of the DC cable inside the EUT prevented the use of single ferrite with two loops. The single ferrite configuration however was verified outside the EUT



4.2 Record Of Technical Judgements

No technical judgements were made during the assessment.

4.3 EUT Parameters Affecting Compliance

The user of the apparatus could not alter parameters that would affect compliance.

4.4 Test Deleted

No Tests were deleted from this assessment.

4.5 Additional Observations

There were no additional observations made during this assessment.

Section 5: Results Summary

This section contains the following:

FCC Part 15 Subpart C and Subpart E: Test Results

The column headed "Required" indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

N No: not applicable / not relevant

Y Yes: Mandatory i.e. the apparatus shall conform to these test.

N/T Not Tested, mandatory but not assessed. (See section 4.4 Test deleted)

The results contained in this section are representative of the operation of the apparatus as originally submitted.

5.1 FCC Part 15 Subpart C and Subpart E: Test Results

Part 15	Test Description	Required	Result
15.247(b)(3)	Maximum peak output power of systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands	Y	Pass
15.209 (a)	Radiated Emissions Limits (General Requirements)	Y	Pass
15.247(a)(2)	Minimum 6dB RF Bandwidth	Y	Pass
15.247 (d)	Out-of-band Emissions	Y	Pass
15.247(e)	Power Spectral Density for Digitally Modulated Devices	Y	Pass
15.207	Transmitter and Receiver AC Power Lines Conducted Emission Limit	N	
15.205	Restricted Band of Operation	Y	Pass

Appendix A: Test Results

Clause 15.209(a) Radiated Emissions (General Requirements)

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (uV/meter)	Measurement Distance (meter)
0.009-0.490	2400/F (kHz)	300
0.490-1.705	24000/F (kHz)	30
1.705-30.0	30	3
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Sec. 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Sec. 15.205(a), must also comply with the radiated emission limits specified in Sec. 15.209(a) (see Sec. 15.205(c)).

Test Conditions:

Sample Number:	MRS	Temperature:	18.0°C
Date:	Oct. 30, 2007	Humidity:	68 %
Modification State:	High Channel	Tester:	FSCustodio
		Laboratory:	SOATS

Test Results:

EUT Complies. See Attached Plots.

Additional Observations:

The Spectrum was searched from 30MHz to the 10th Harmonic.

There are no emissions found that do not comply to the restricted bands defined in FCC Part 15 Subpart C, 15.205 or Part 15.247(d). The EUT (Antenna Assy) was measured on three orthogonal axes. Measurements below 1GHz were performed at 3m with a Quasi-Peak detector while Peak detector with duty cycle correction will be used above 1GHz, however no

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relevant spurious emissions were measured above 1GHz. RBW and VBW above 1GHz is 1MHz while bandwidth setting will be set to encompass the entire EBW of signal to be measured. Investigations above 1GHz were made at 3 meters.

Radiated Emissions 30 MHz to 10th Harmonic

Math: Corrected Reading = Max of Vertical or Horizontal measured + Antenna Factor + Cable Loss – preamplifier (if used).

CR/SL Dif = Limit – Corrected Reading. Pass if result is negative.

24.7 = 13.9 + 10.1 + 0.7 – (0) no preamp required.

24.7 – 40 = -15.3

Radiated Emissions Data

Job # :	8189-1	Date :	10-30-07	Page	1	of	1
NEX #:	94814	Time :	11:00AM				
		Staff :	FSC				
Client Name :	Solectek			EUT Voltage :	37.5VDC		
EUT Name :	MRS			EUT Frequency :			
EUT Model #:				Phase:			
EUT Serial #:				NOATS			
EUT Config. :	Transmitting @ Channel 149			SOATS	X		
Specification :	CFR47 Part 15, Subpart B, Class B			Distance < 1000 MHz:			
Loop Ant. #:	NA	Temp. (°C) :	18	Distance > 1000 MHz:	3 m		
Bicon Ant.#:	114	Humidity (%) :	68				
Log Ant.#:	110	Spec An.#:	899/898				
DRG Ant. #	NA	Spec An. Display #:	899/898				
Dipole Ant.#:	NA	QP #:	899/898				
Cable LF#:	SOATS	PreSelect#:	NA				
Cable HF#:	NA						
Preamp LF#:	NA						
Preamp HF#	NA						

Quasi-Peak RBW: 120 kHz
Video Bandwidth 300 kHz

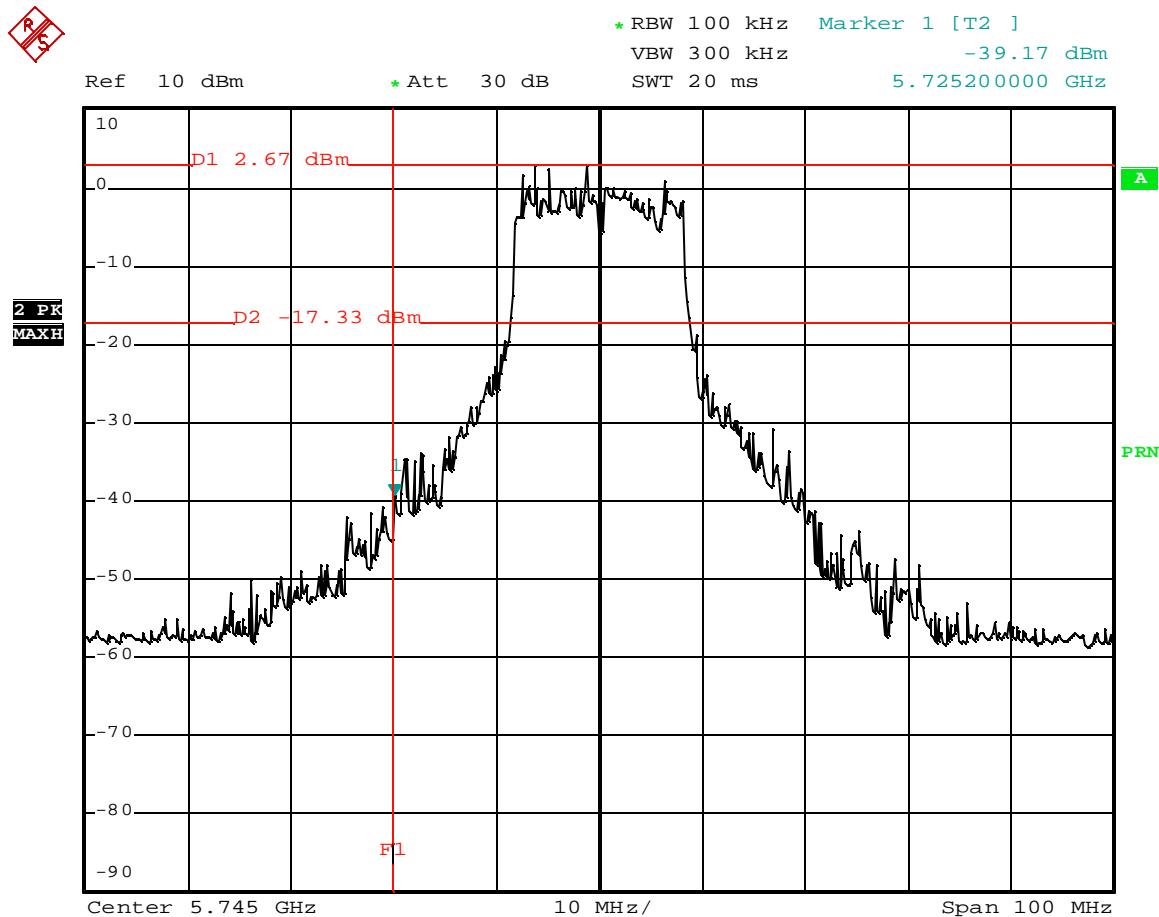
Peak RBW: 1 MHz
Video Bandwidth 3 MHz

Average RBW: 1 MHz
Video Bandwidth 10 Hz

Measurements below 1 GHz are Quasi-Peak values, unless otherwise stated.

Measurements above 1 GHz are Average values, unless otherwise stated.

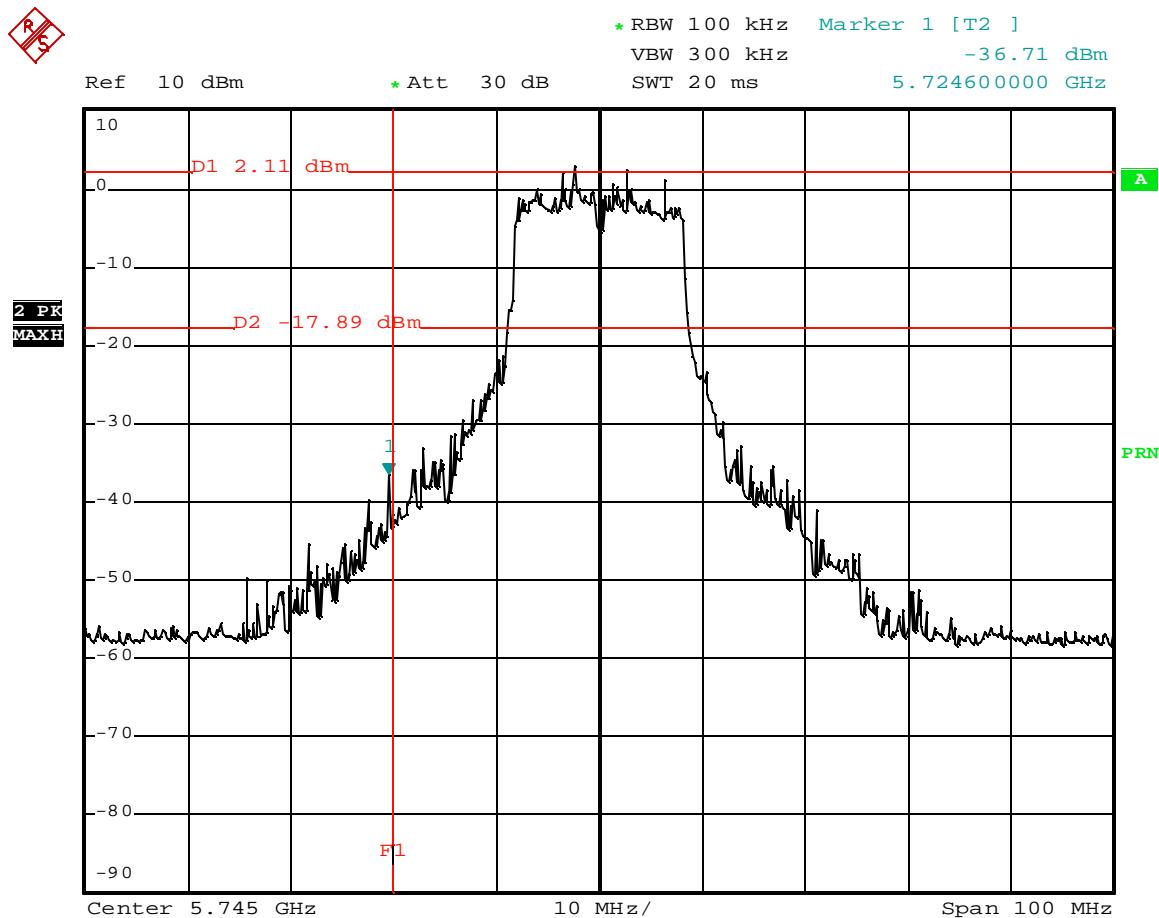
Meas. Freq. (MHz)	Meter Reading Vertical	Meter Reading Horizontal	Det.	EUT Side F/L/R/B	Ant. Height m	Max. Reading (dBuV)	Corrected Reading (dBuV/m)	Spec. limit (dBuV/m)	CR/SL Diff. (dB)	Pass Fail	Comment
40.69	13.9	8.3	Q	F	1.0	13.9	24.7	40.0	-15.3	Pass	
41.69	11.0	12.9	Q	F	1.0	12.9	23.7	40.0	-16.3	Pass	
43.72	17.7	17.4	Q	F	1.0	17.7	28.5	40.0	-11.5	Pass	
63.15	14.1	5.2	Q	F	1.0	14.1	25.7	40.0	-14.3	Pass	
65.71	21.8	8.0	Q	F	1.0	21.8	32.2	40.0	-7.8	Pass	
68.45	15.6	6.0	Q	F	1.0	15.6	26.0	40.0	-14.0	Pass	
130.90	18.9	20.0	Q	F	1.0	20	32.0	43.5	-11.5	Pass	
224.99	7.2	15.5	Q	F	1.0	15.5	27.7	46.0	-18.3	Pass	
285.00	4.5	7.1	Q	F	1.0	7.1	22.7	46.0	-23.4	Pass	Noise Floor
664.20	6.0	8.8	Q	F	1.0	8.8	32.3	46.0	-13.8	Pass	Ambient Noise

Bandedge Measurements

Date: 20 .DEC .2007 12:29:33

Low Channel 5745 MHz Port 1

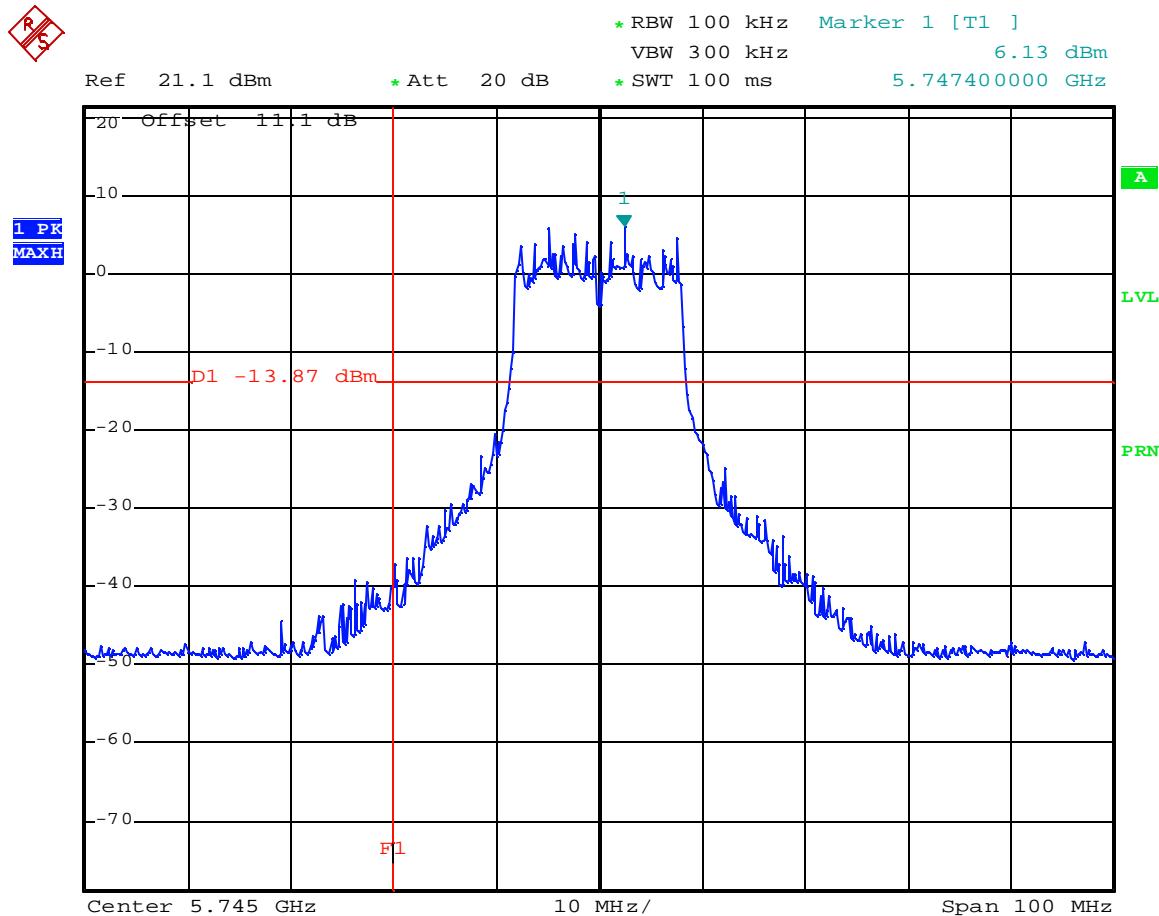
Frequency line is 5725MHz
Delta from peak to band edge is >40dB



Date: 20 . DEC . 2007 12:26:48

Low Channel 5745 MHz Port 2

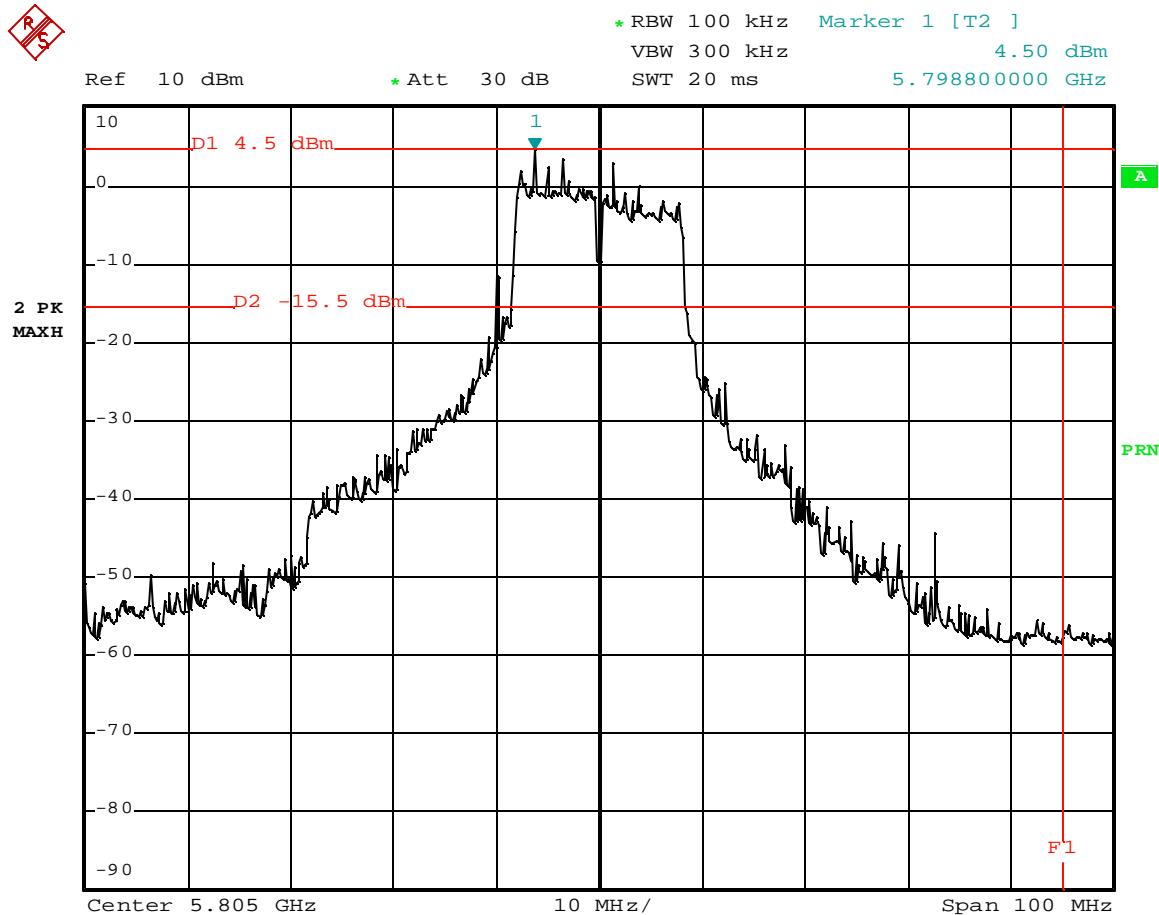
Frequency line is 5725MHz
Delta from peak to band edge is >38dB



Date: 28 .DEC. 2007 12:01:22

Low Channel 5745 MHz Port 1 and 2

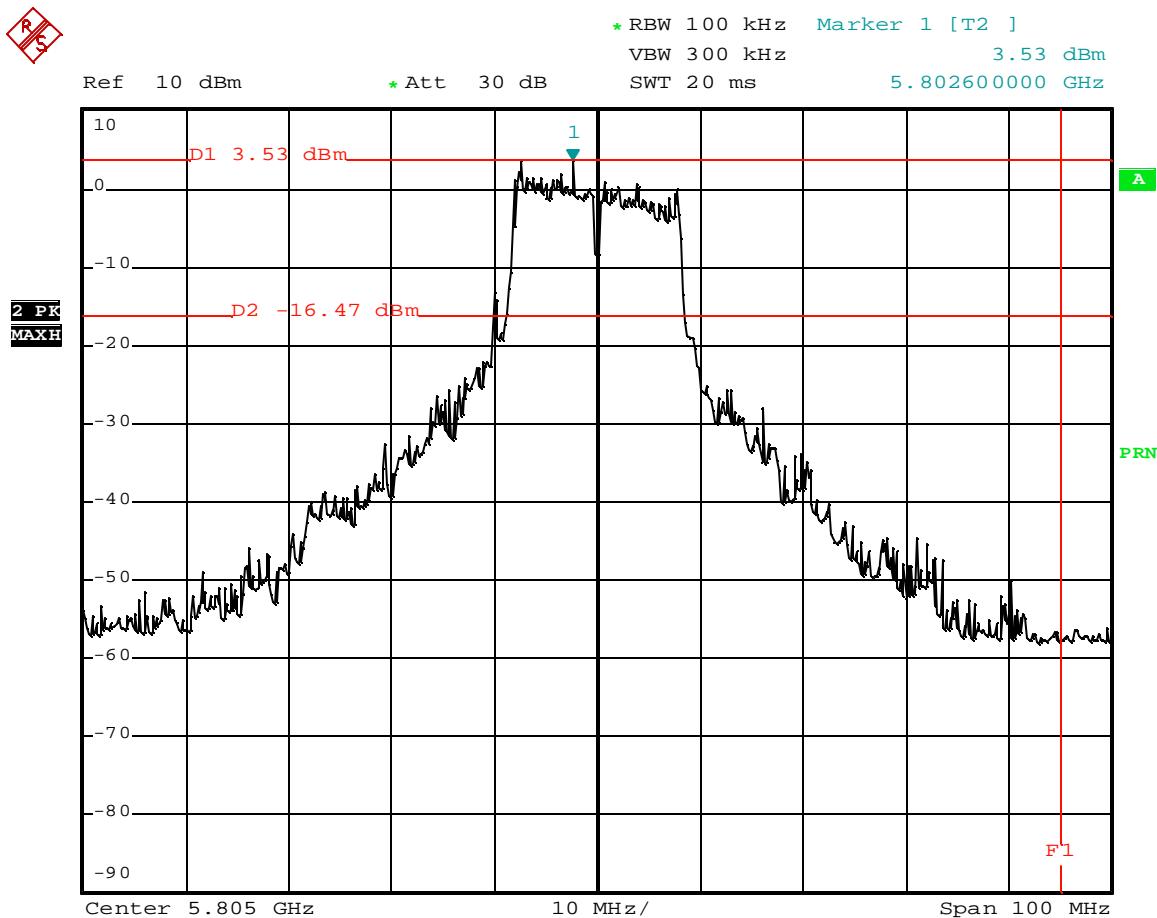
Frequency line is 5725MHz
 Delta from peak to band edge is >40dB



Date: 20.DEC.2007 11:20:15

High Channel 5805 MHz Port 1

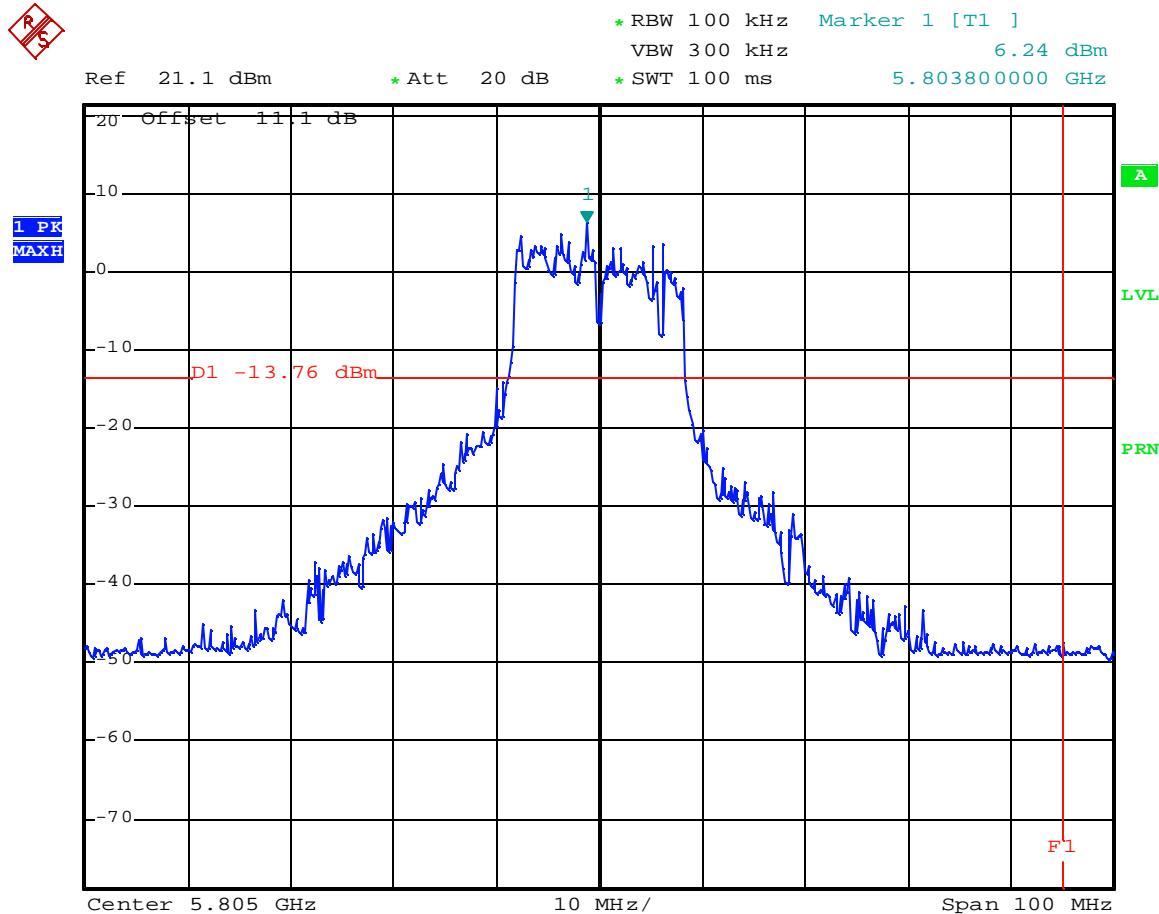
Frequency line is 5850MHz
Delta from peak to band edge is >40dB



Date: 20 . DEC . 2007 11:25:33

High Channel 5805 MHz Port 2

Frequency line is 5850MHz
 Delta from peak to band edge is >40dB



Date: 28 .DEC. 2007 11:55:50

High Channel 5805 MHz Port 1 and 2

Frequency line is 5850MHz
 Delta from peak to band edge is >40dB

Clause 15.247(a)(2) Minimum 6dB RF Bandwidth

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and **5725-5850** MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

Test Conditions:

Sample Number:	MRS	Temperature:	23.3°C
Date:	October 19, 2007	Humidity:	38%
Modification State:	Lo/Mid/High Channels	Tester:	Ferdinand Custodio
Laboratory:			Nemko

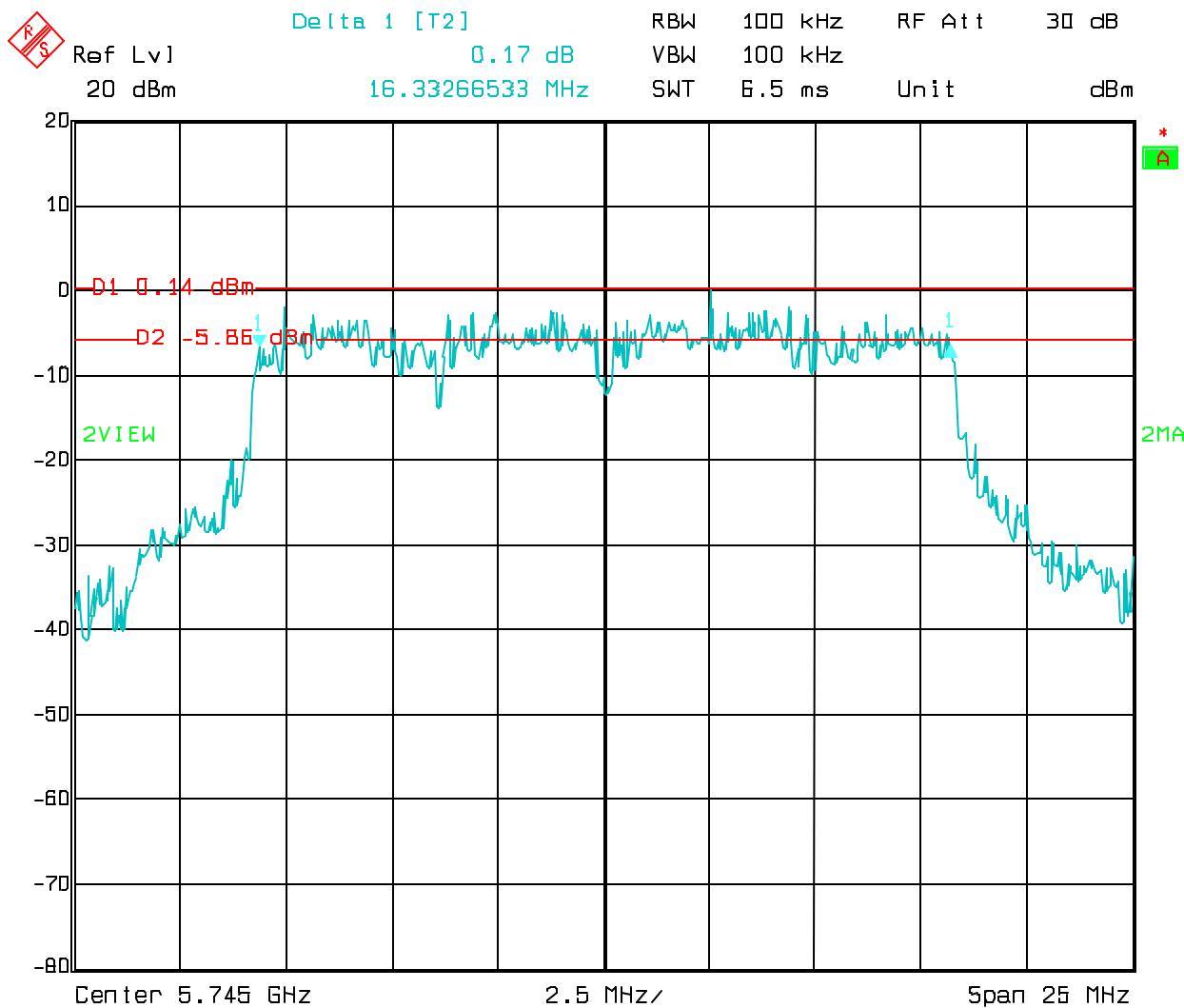
Test Results:

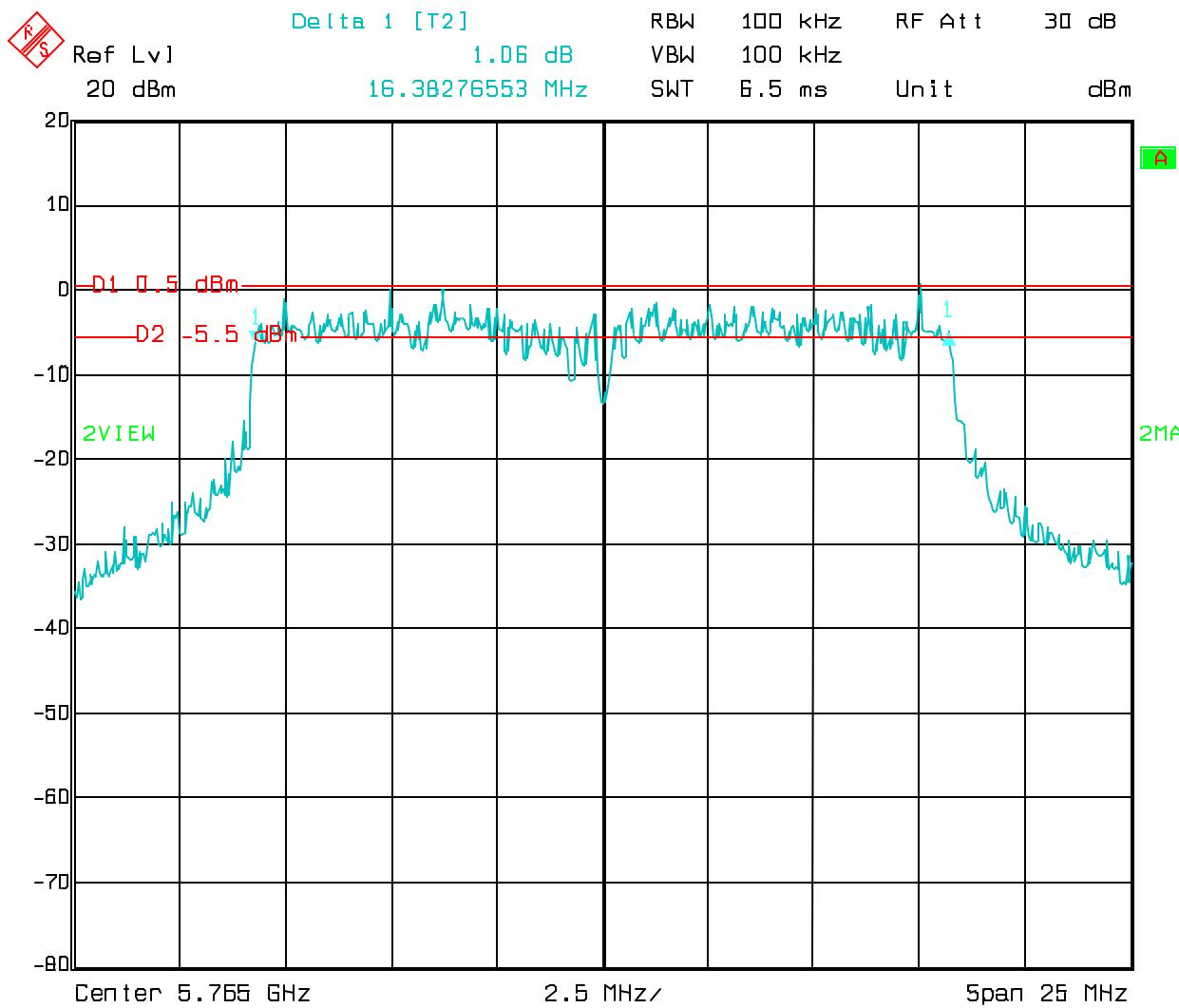
EUT Complies.

6dB Bandwidth:

One of the antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RES BW was set to 100 kHz. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 6 dB lower than PEAK level. The 6 dB bandwidth was determined from where the channel output spectrum intersected the display line.

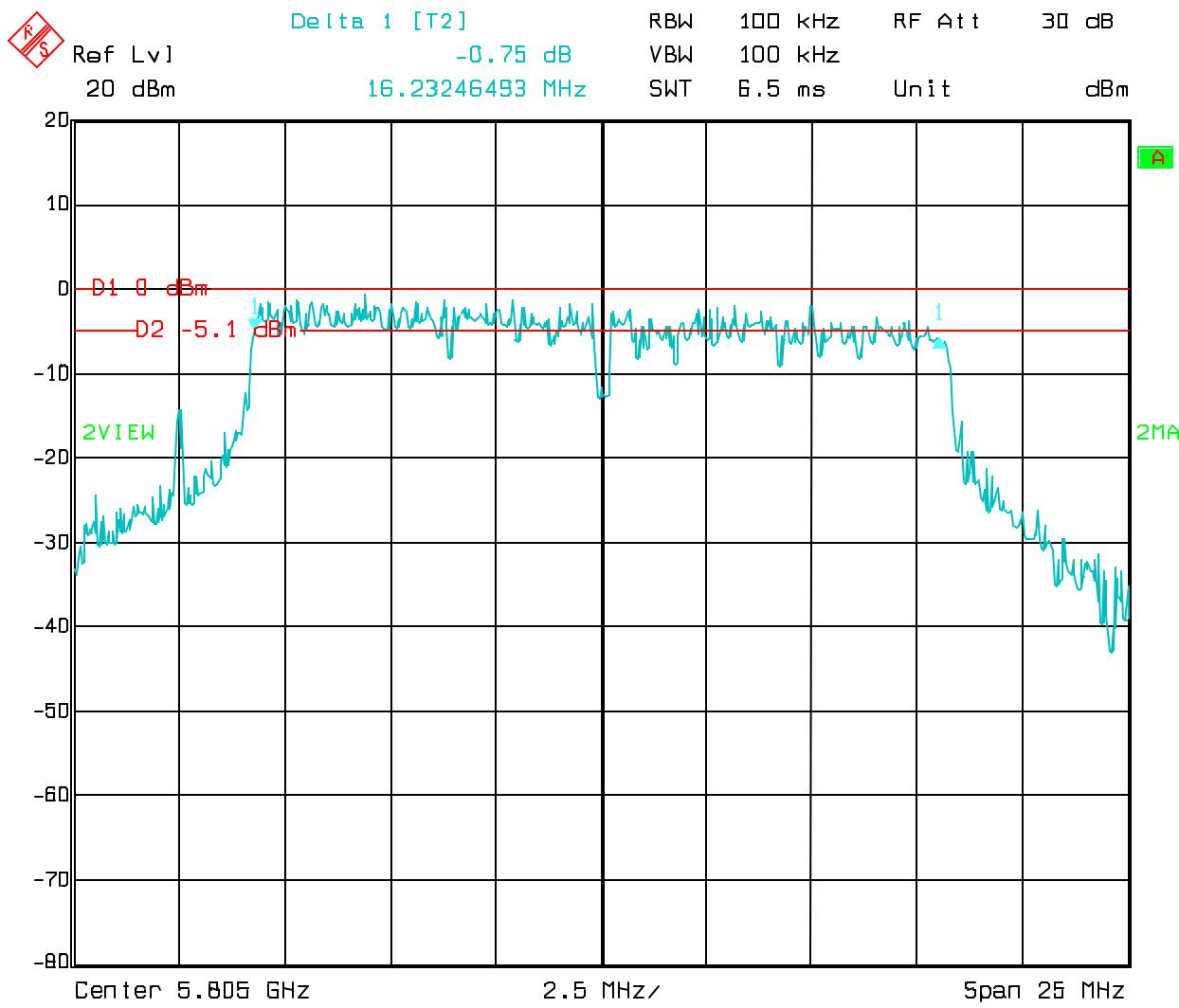
Channel Range	6 dB Bandwidth
Low (5745 MHz)	16.33 MHz
Mid (5765 MHz)	16.38 MHz
High (5805 MHz)	16.23 MHz

**Low Channel 5745 MHz**



Date: 19.SEP.2007 12:12:12

Mid Channel 5765 MHz

**High Channel 5805 MHz**

Clause 15.247(b)(3) Maximum peak output power of systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Test Conditions:

Sample Number:	MRS	Temperature:	18.8°C
Date:	December 28, 2007	Humidity:	19%
Modification State:	Lo/Mid/High Channels	Tester:	Ferdinand Custodio
Laboratory:			Nemko

Test Method: FCC Public Notice Ref: DA: 02-2138
Measurement Procedure for Peak Transmit Power in U-NII

Bands

Test Results:

EUT Complies.

Conducted Output Power:

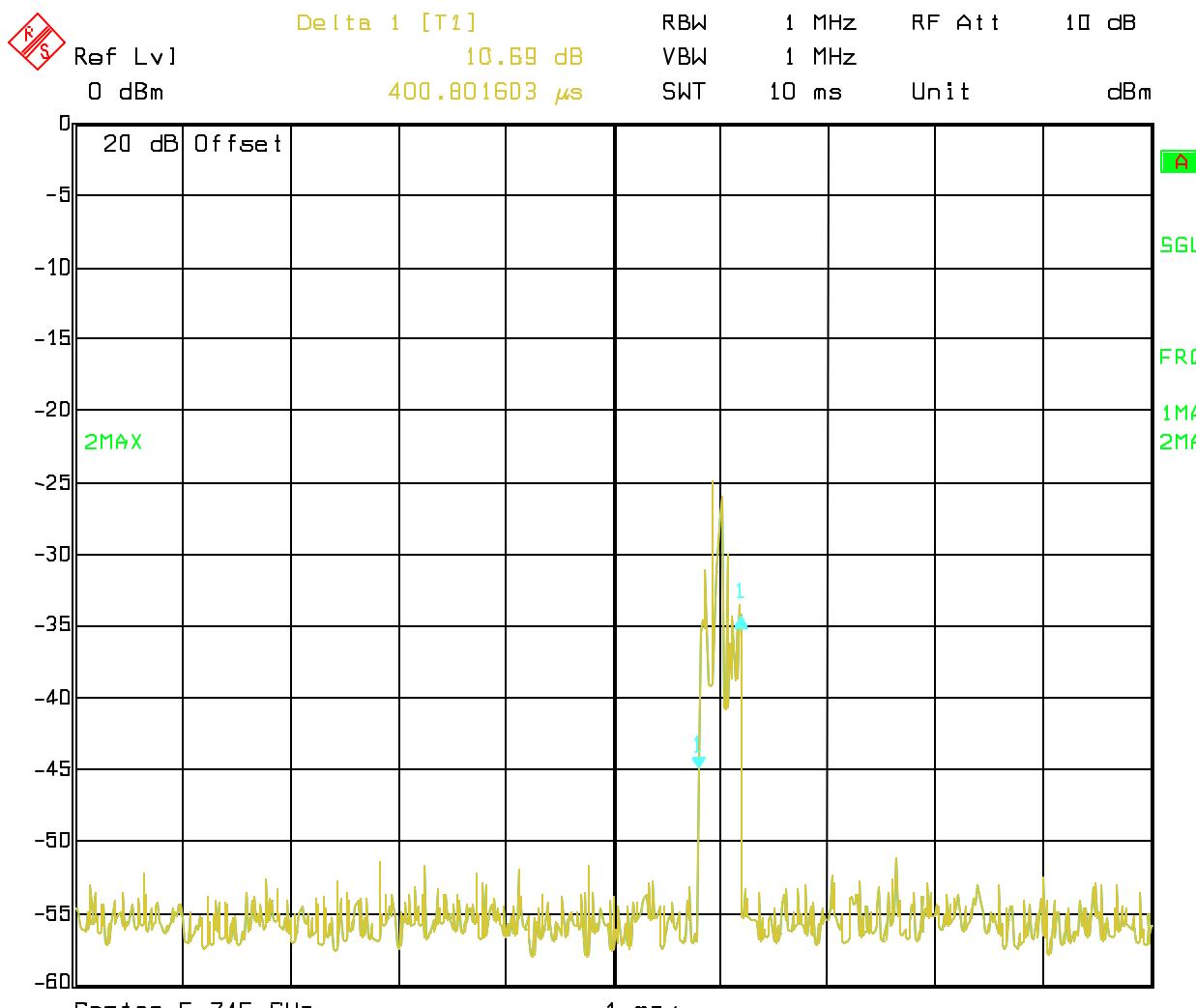
Channel	Frequency	Measured Output Power (W)/Port 1	Measured Output Power (W)/Port 2	Total Power of EUT (Port 1 + Port 2)
Low	Low (5745 MHz)	17.178 mW	16.845 mW	34.023 mW
Mid	Mid (5765 MHz)	25.020 mW	19.304 mW	44.324 mW
High	High (5805 MHz)	24.842 mW	26.572 mW	51.414 mW

Each of the antenna ports of the EUT was connected to the input of a spectrum analyzer. The transmission pulse duration ("T") over which the transmitter is on and transmitting at its maximum power control level is measured at 401 μ s (see attached table). RBW is set to 1MHz. Span was set to encompass the entire bandwidth (EBW) of the signal. Since sweep time is greater than T and the EBW is greater than the largest available RBW, the method for measuring the output power will be video averaging with max hold.:

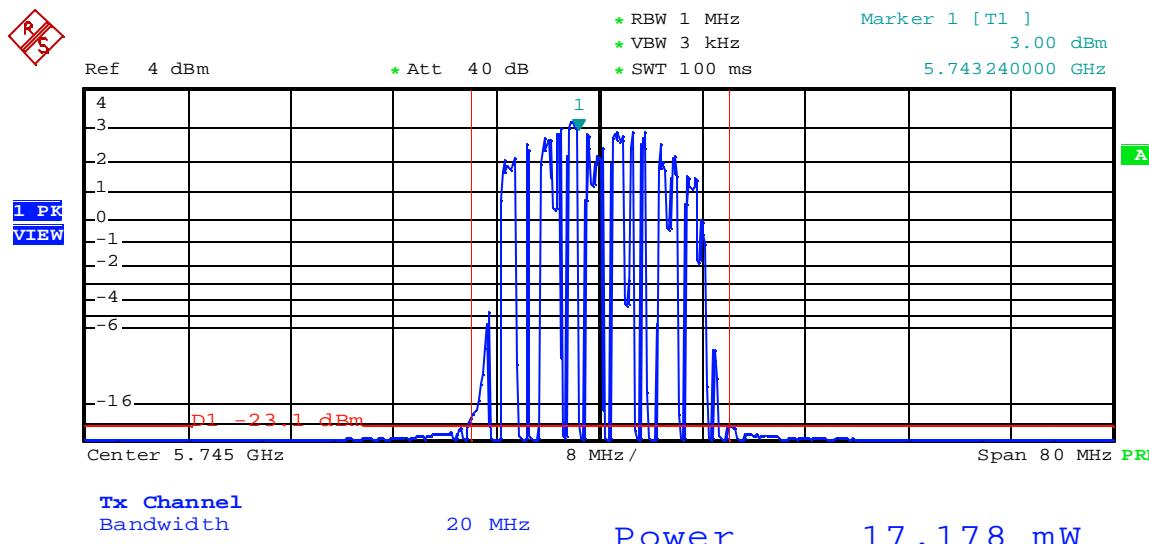
- Set sweep trigger to "free run"
- Set VBW to = 1/T = 5kHz

- Use linear display mode
- Use peak detector mode
- Set max hold
- Allow max hold to run for 60 seconds
- Measure power by integrating the spectrum across the 26 dB EBW using the spectrum analyzer's band power measurement function.
- Repeat measurement by varying input voltage to 85% and 115% of nominal.

During these measurements, only the worst cases are reported.

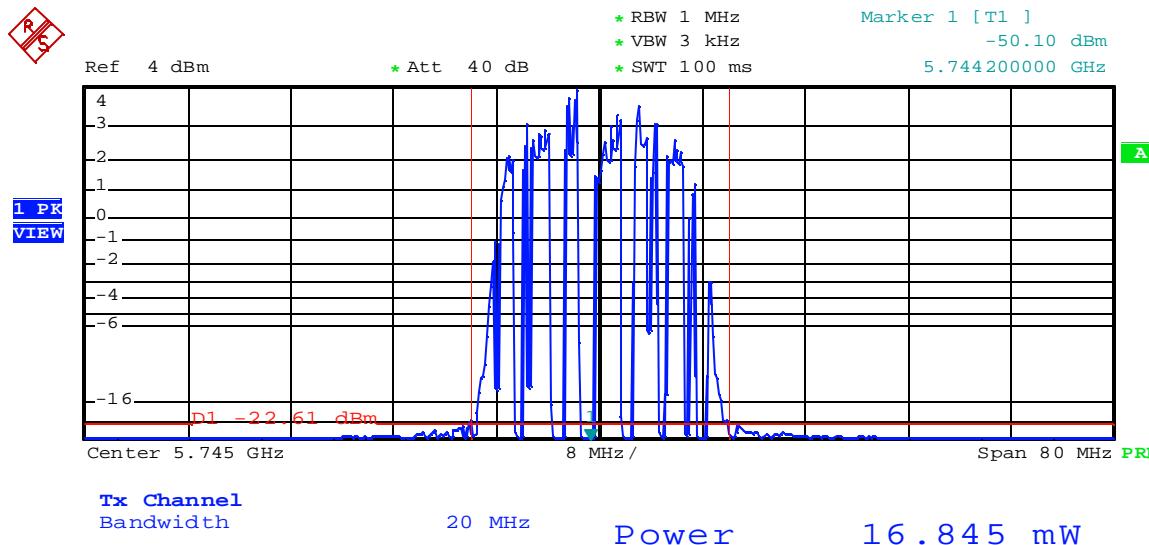


The transmission pulse duration ("T") over which the transmitter is on and transmitting at its maximum power control level = 401μs



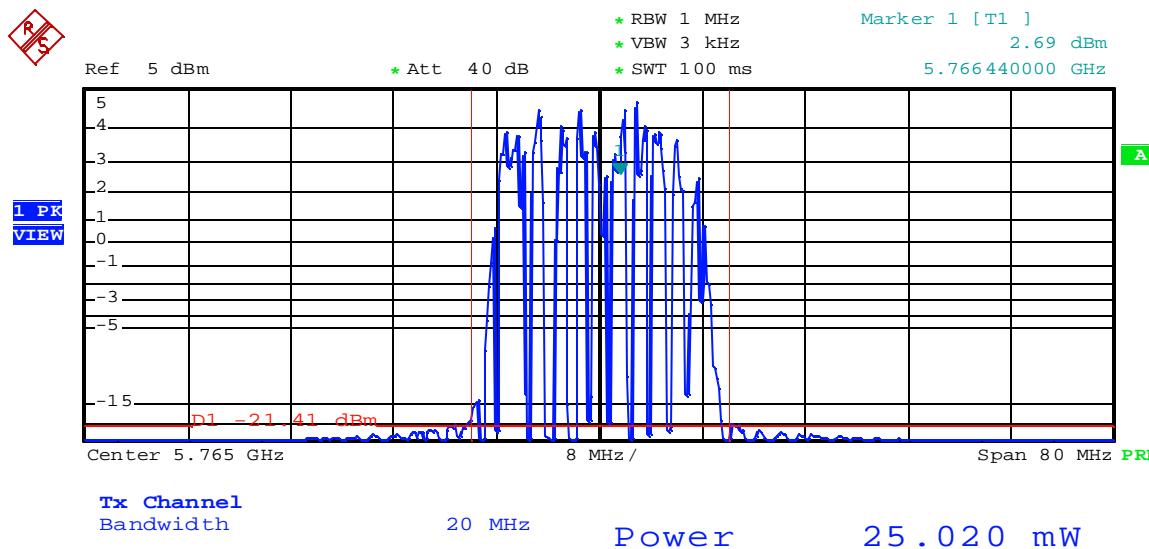
Date: 20 .DEC .2007 17:28:49

Low Channel Port 1



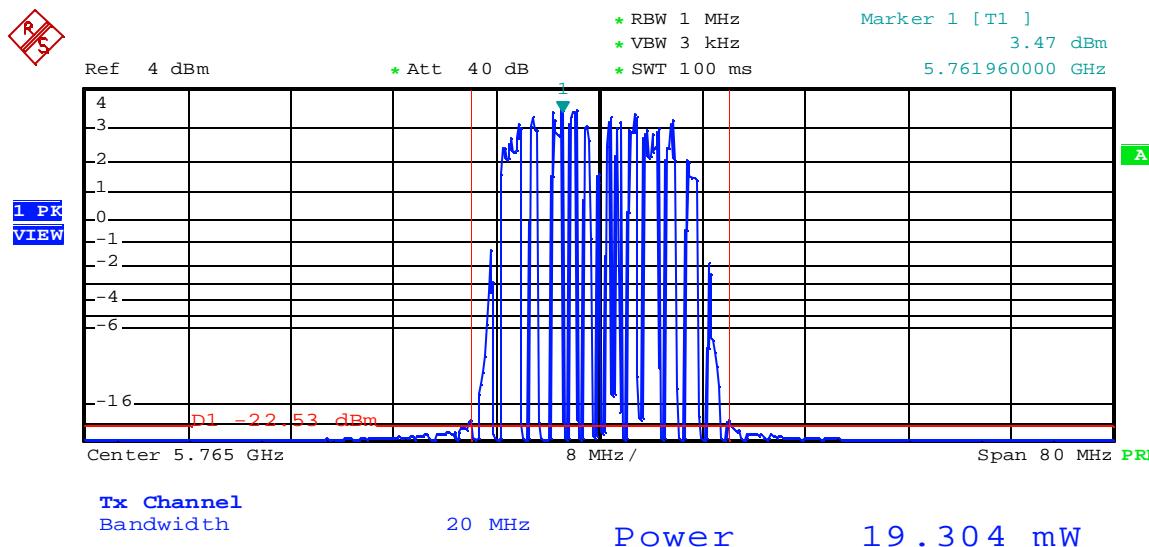
Date: 20.DEC.2007 16:05:15

Low Channel Port 2



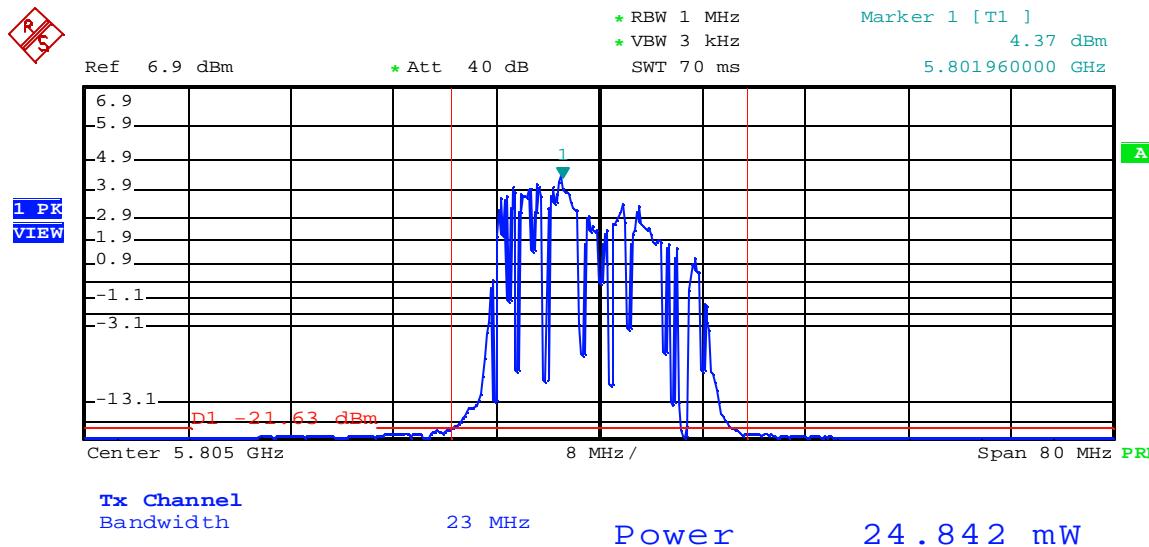
Date: 20 .DEC. 2007 17:24:25

Mid Channel Port 1



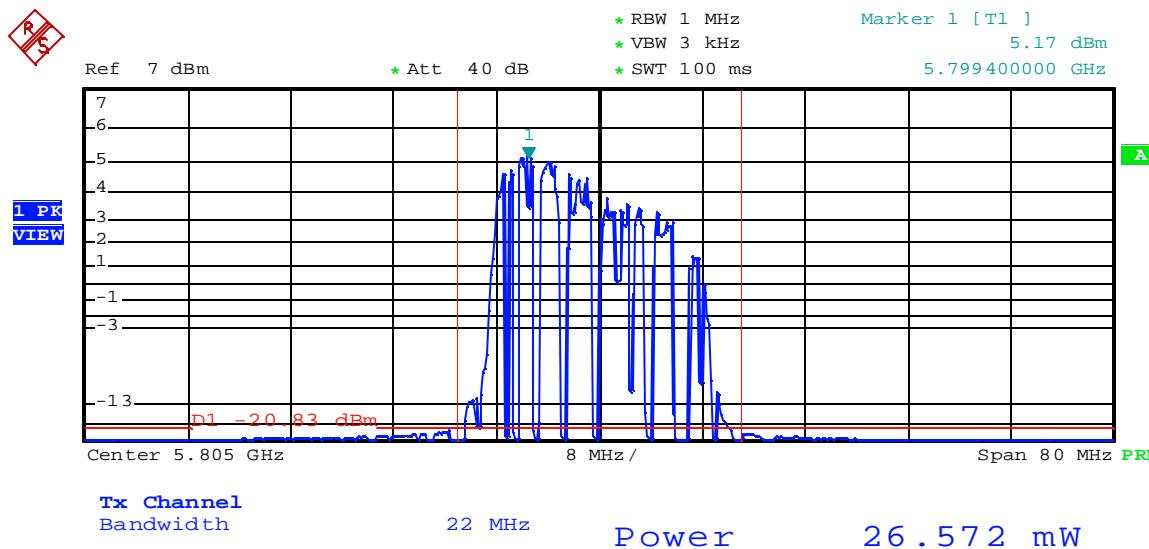
Date: 20.DEC.2007 16:09:48

Mid Channel Port 2



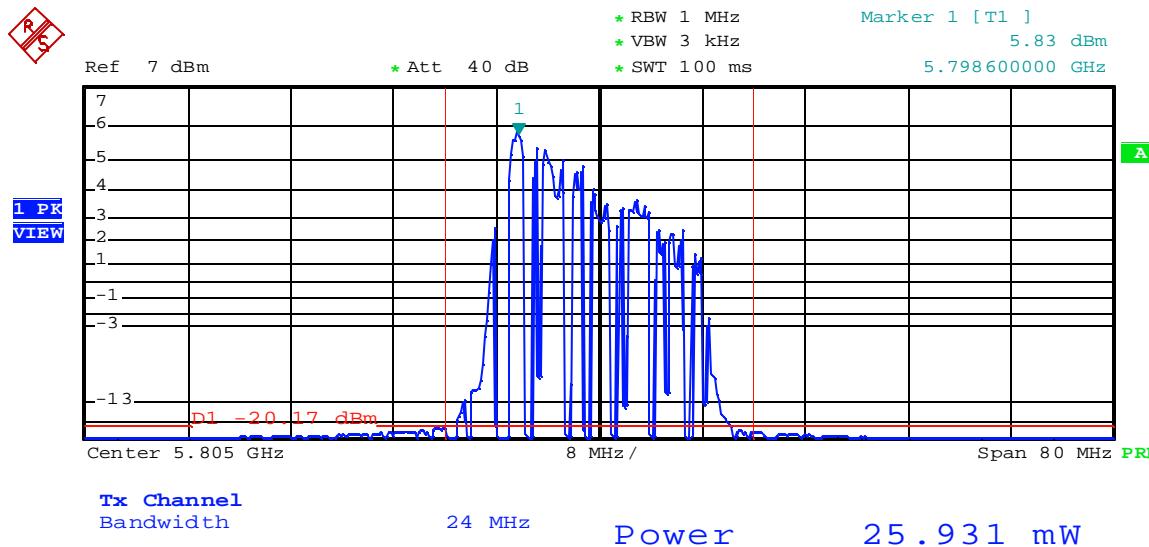
Date: 28.DEC.2007 11:10:53

Nominal Voltage High Channel Port 1



Date: 27.DEC.2007 17:36:02

Nominal Voltage High Channel Port 2



Date: 27.DEC.2007 17:32:18

85% Nominal Voltage High Channel Port 2

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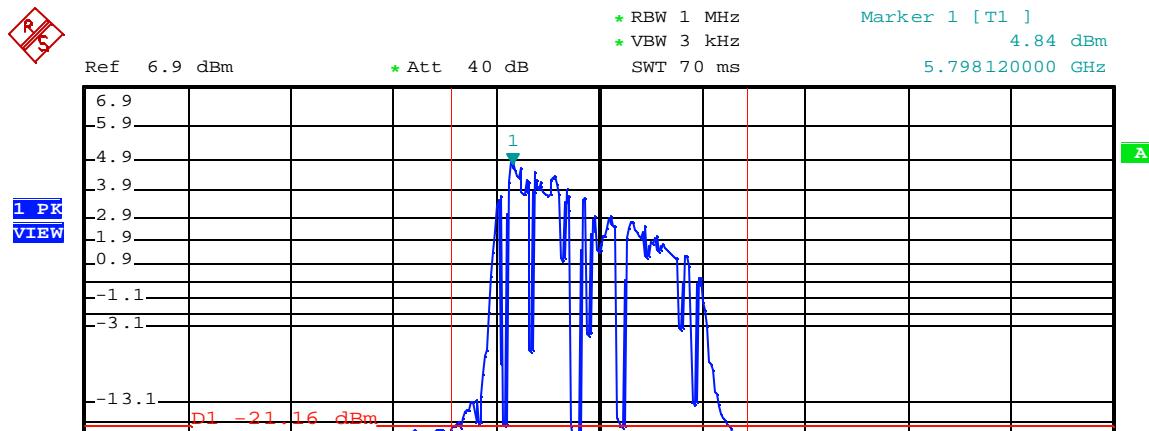
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Specification: FCC Part 15 Subpart C, 15.247

FCC ID: KA358MRS1



Tx Channel

23 MHz

Power

25.469 mW

Date: 28 .DEC. 2007 11:08:37

115% Nominal Voltage High Channel

Clause 15.247(d) Spurious Emissions (RF Antenna Conducted Test)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Conditions:

Sample Number:	MRS	Temperature:	23.3°C
Date:	December 21, 2007	Humidity:	38%
Modification State:	Lo/Mid/High Channels	Tester:	Ferdinand Custodio
		Laboratory:	Nemko

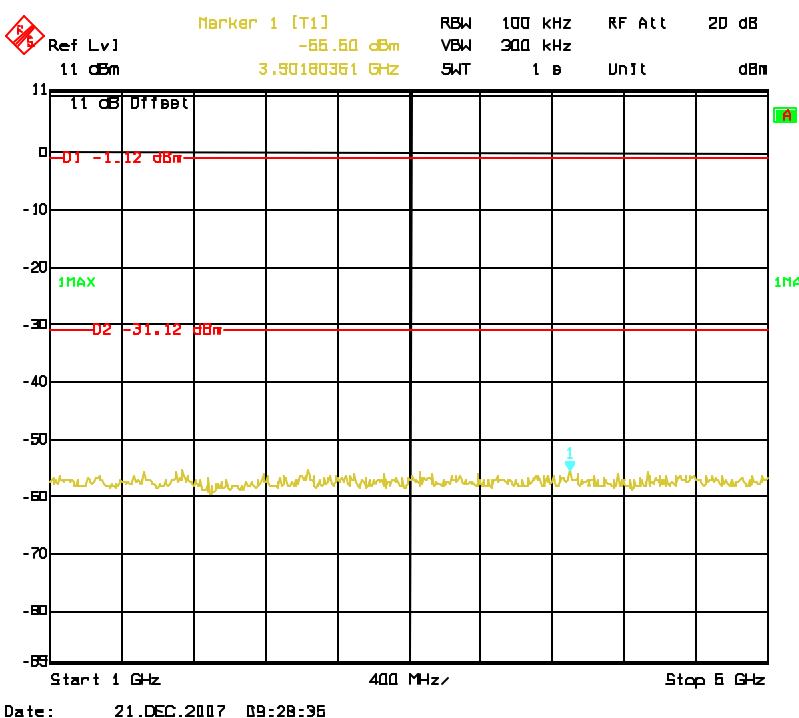
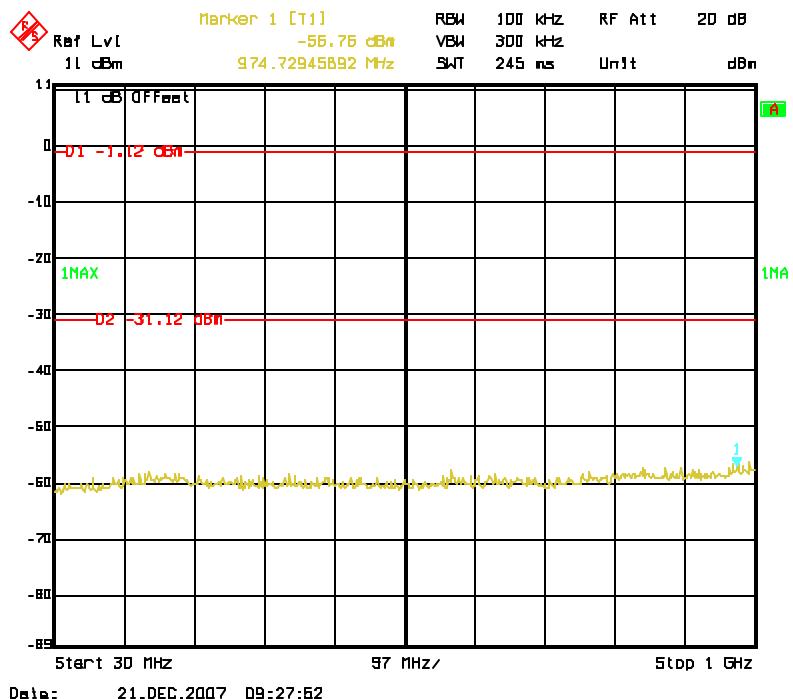
Test Results:

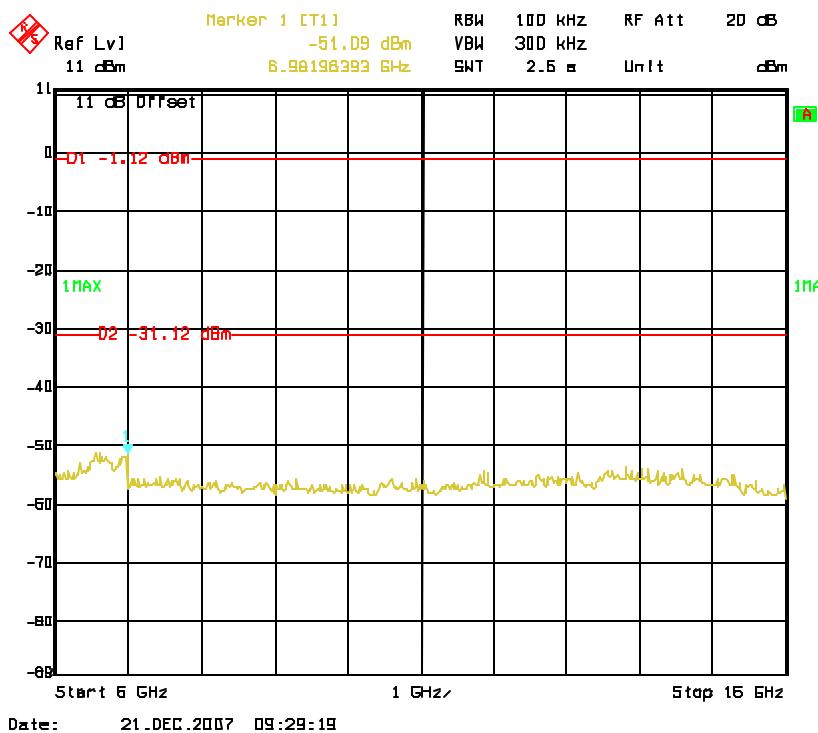
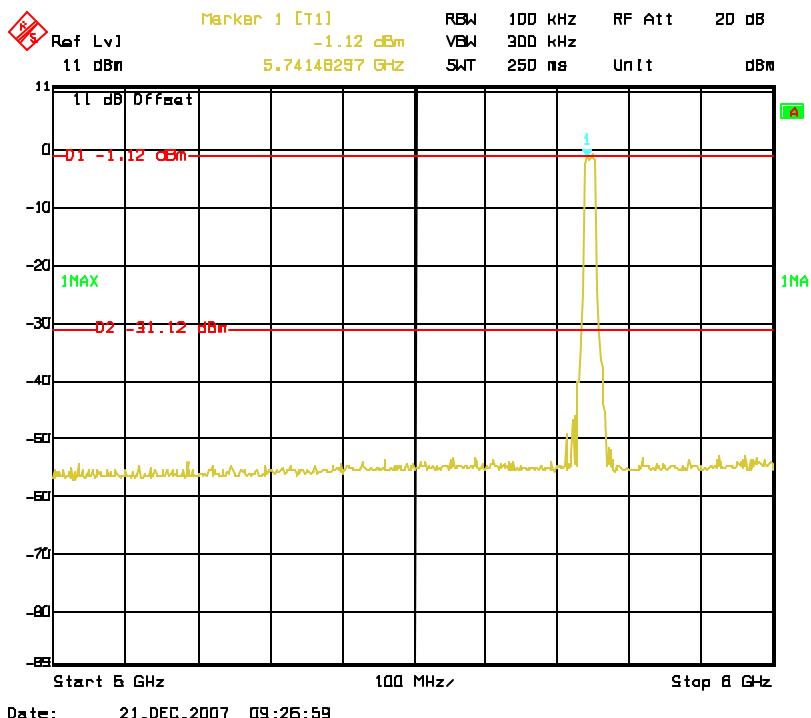
EUT Complies.
See Attached Plots.

The transmitter output ports were connected to the spectrum analyzer via a low loss cable. RBW was set to 100kHz and VBW to 300kHz with suitable frequency span and sweep time set to auto. Detector function is Peak with Max Hold.

For this test, the limit will be 30dB (worst case) below the highest level of the desired power within the band. The EUT was investigated for spurious emission on Low, Mid and High channels, Port 1, Port 2 and aggregated through a combiner. Results are similar and only worst case presented.

Low Channel Port 1 (5745 MHz)





Nemko USA, Inc.

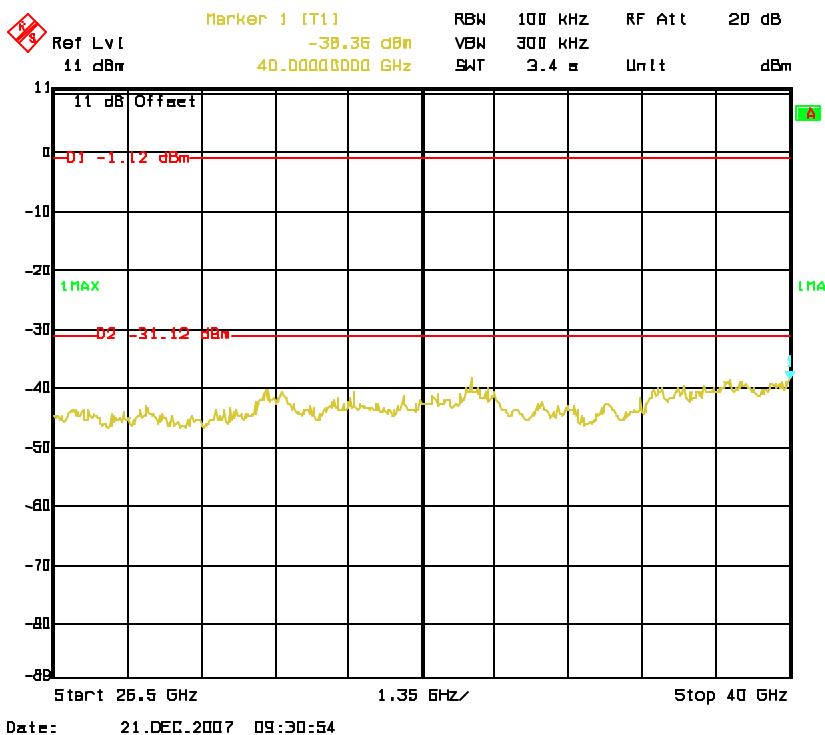
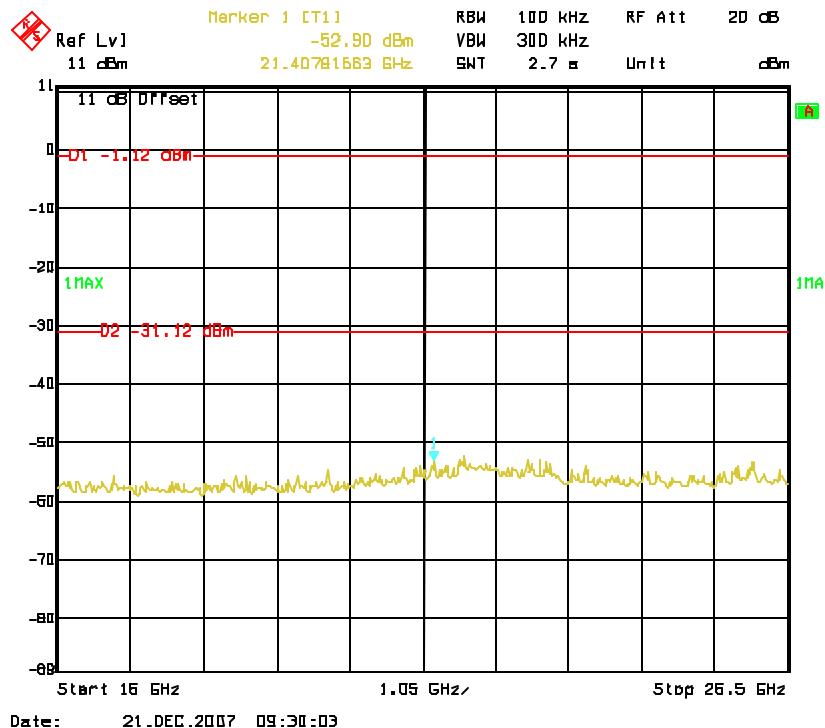
FCC ID: KA358MRS1

11696 Sorrento Valley Road, Suite F, San Diego, CA 92121

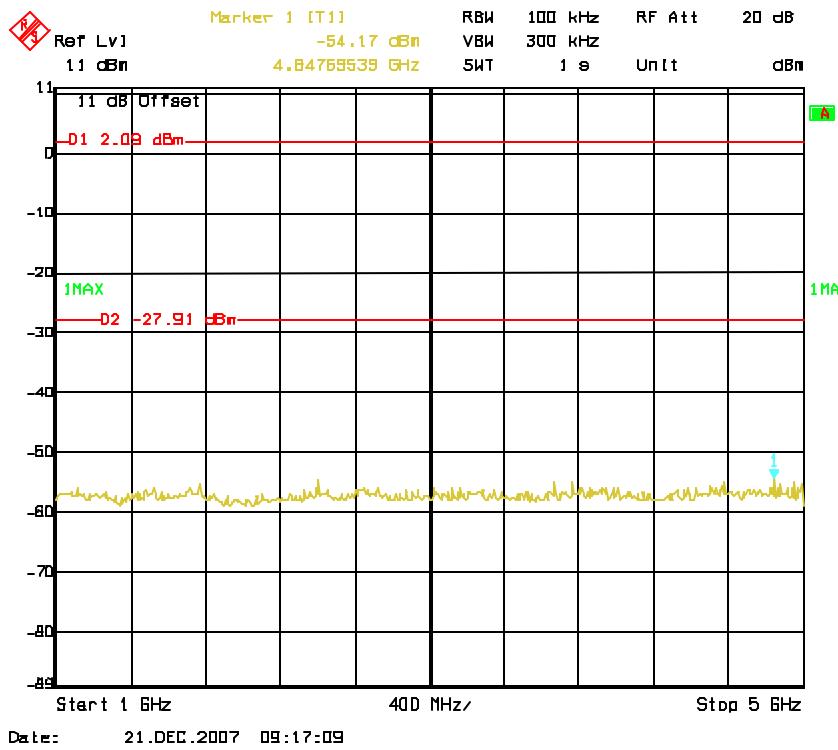
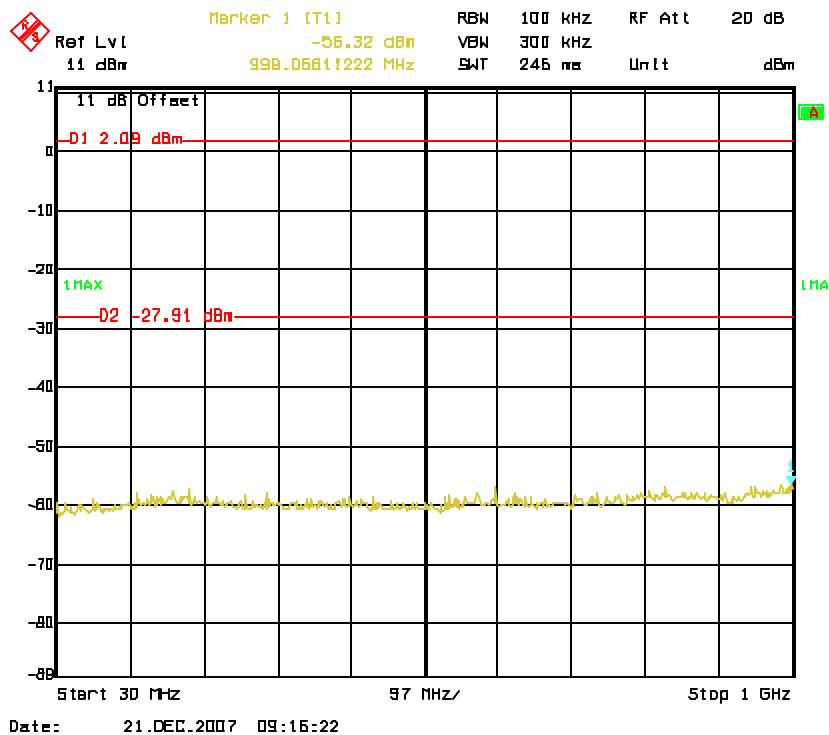
Phone (858) 755-5525 Fax (858) 452-1810

Report Number: 2007 118189 MIMO FCC

Specification: FCC Part 15 Subpart C, 15.247



Low Channel Port 2 (5745 MHz)



Nemko USA, Inc.

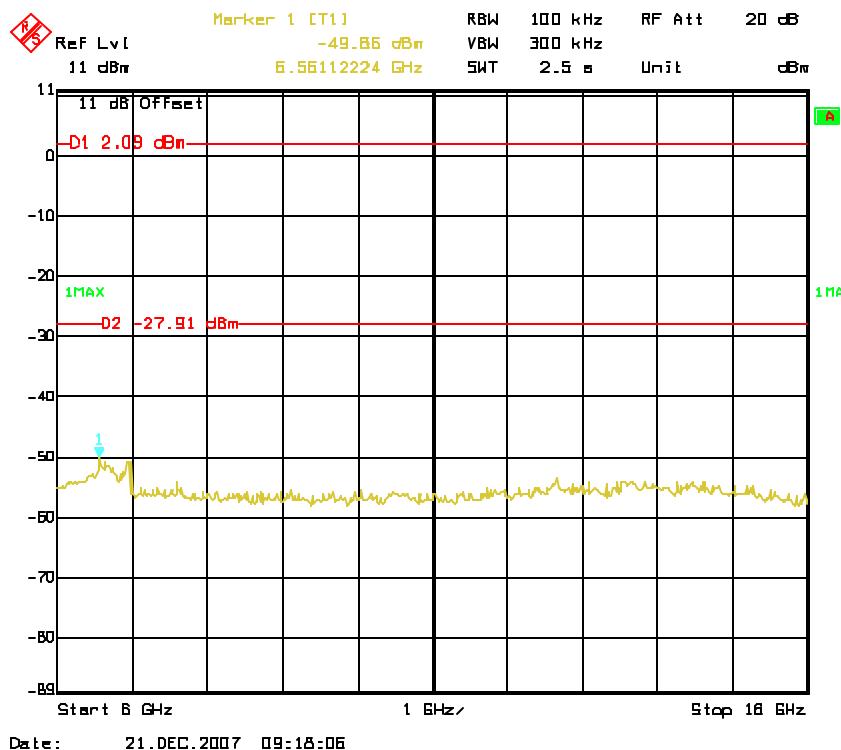
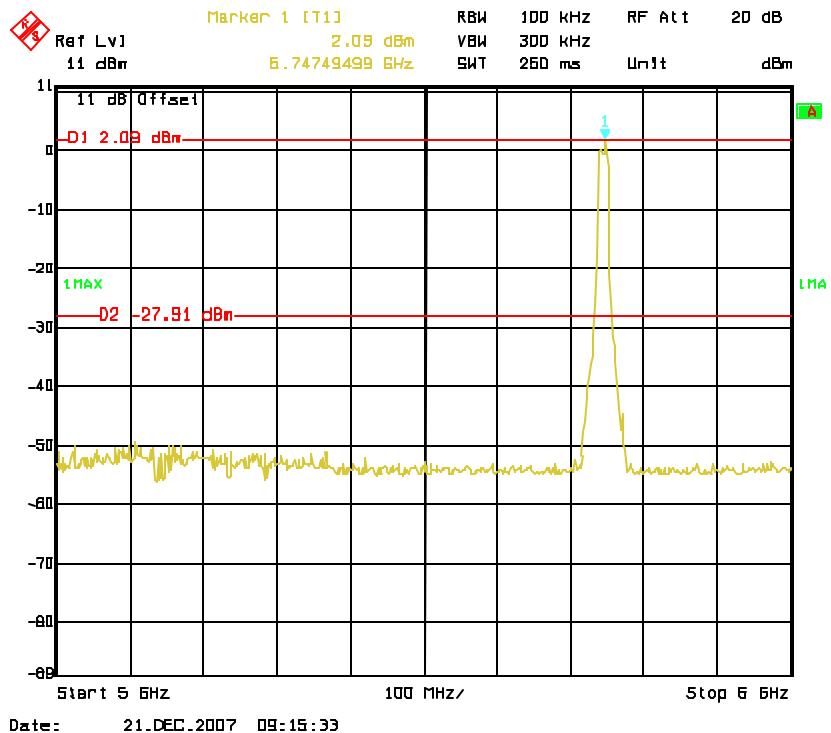
FCC ID: KA358MRS1

11696 Sorrento Valley Road, Suite F, San Diego, CA 92121

Phone (858) 755-5525 Fax (858) 452-1810

Report Number: 2007 118189 MIMO FCC

Specification: FCC Part 15 Subpart C, 15.247



Nemko USA, Inc.

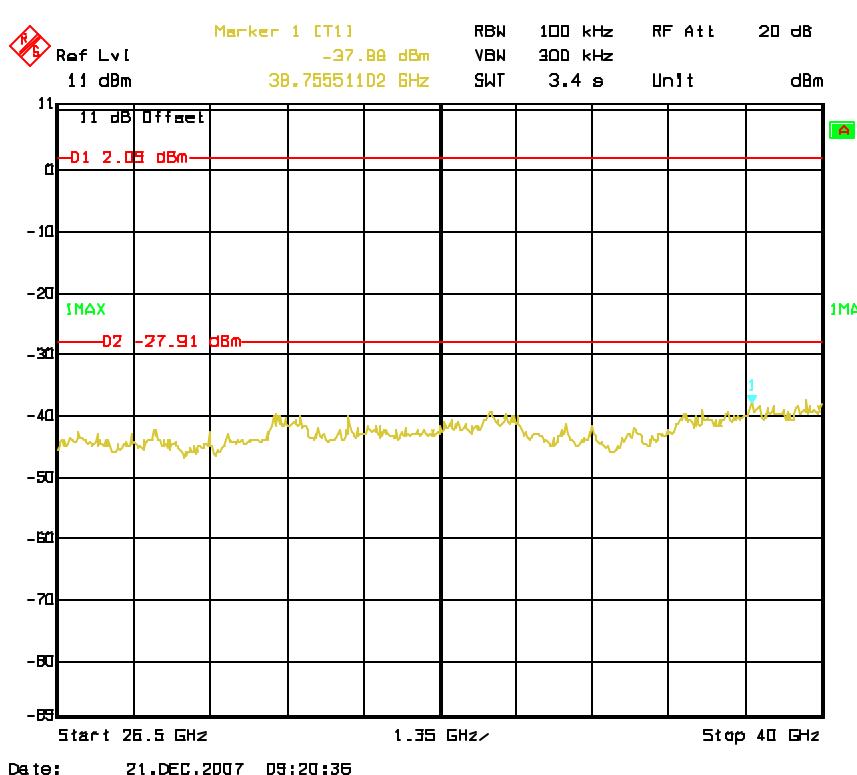
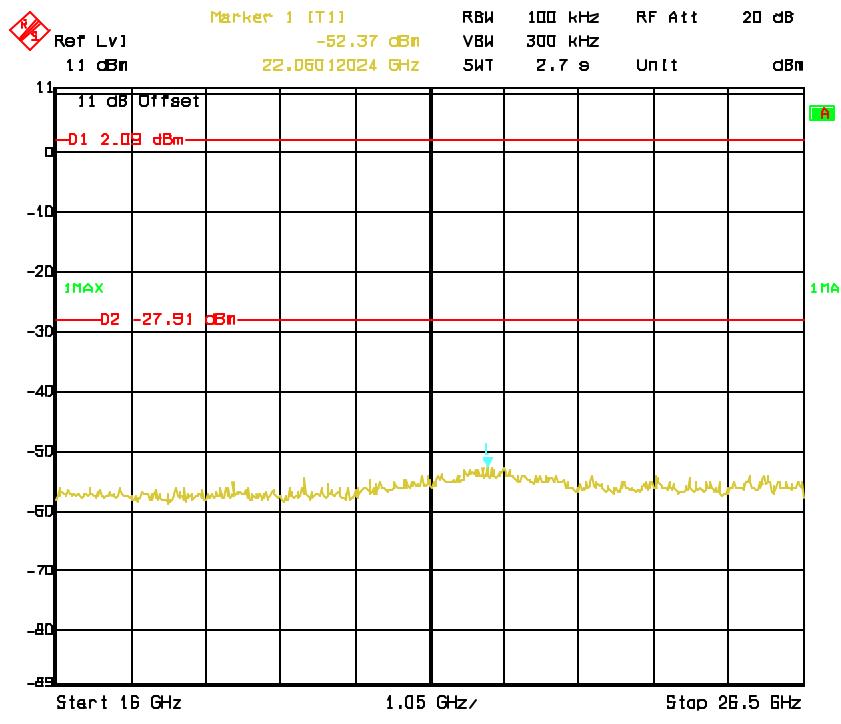
FCC ID: KA358MRS1

11696 Sorrento Valley Road, Suite F, San Diego, CA 92121

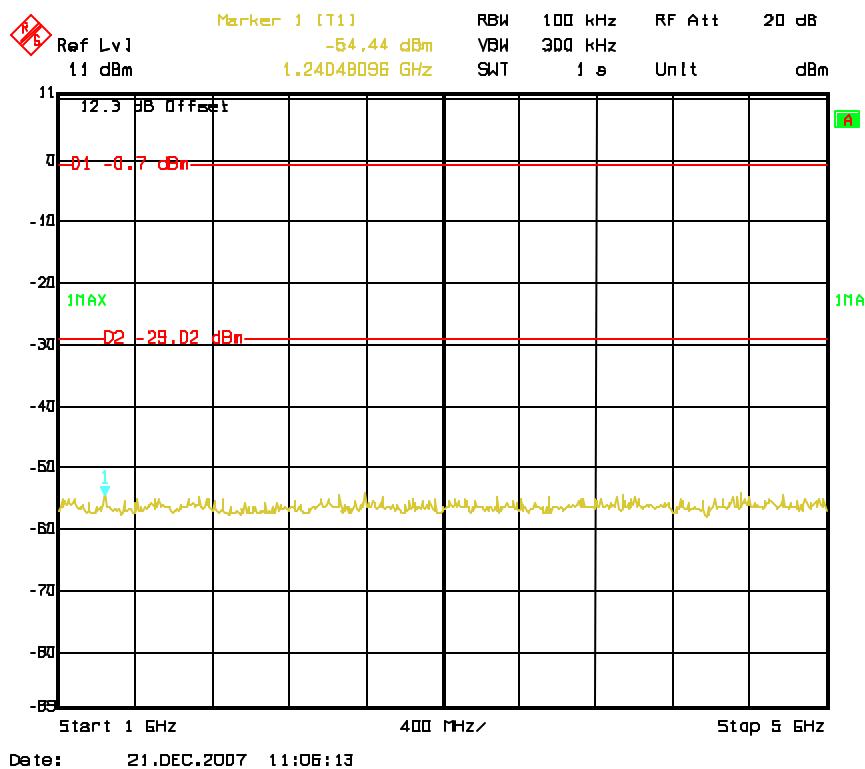
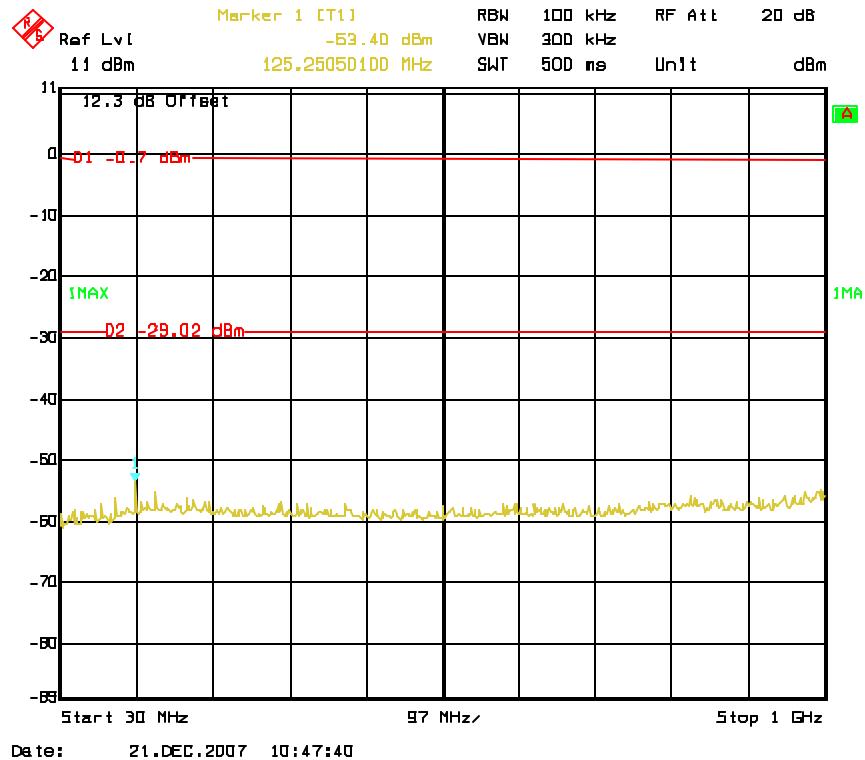
Phone (858) 755-5525 Fax (858) 452-1810

Report Number: 2007 118189 MIMO FCC

Specification: FCC Part 15 Subpart C, 15.247



Low Channel Port 1 and Port 2 Aggregated through a combiner (5745 MHz)



Nemko USA, Inc.

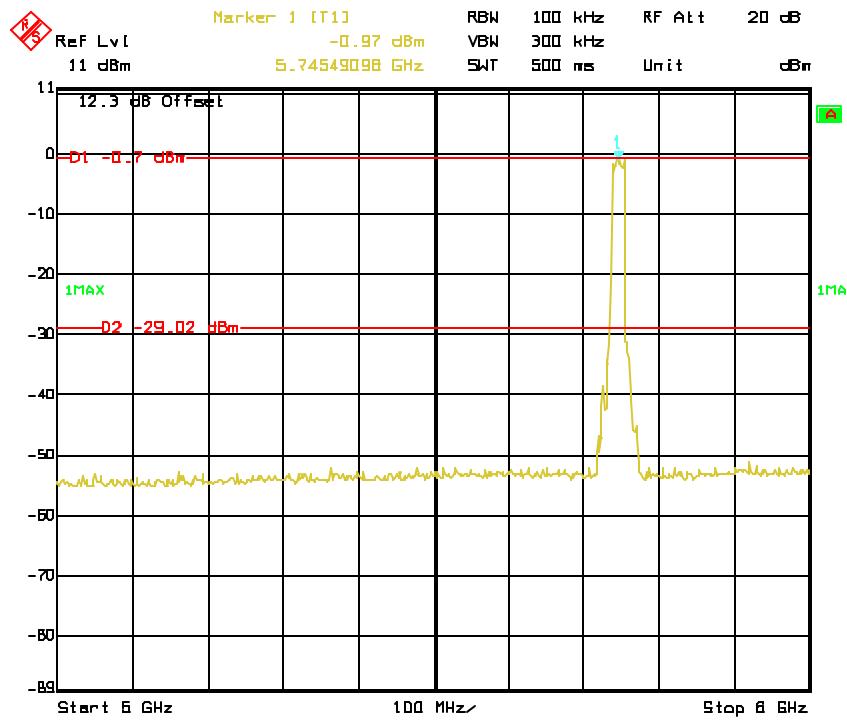
FCC ID: KA358MRS1

11696 Sorrento Valley Road, Suite F, San Diego, CA 92121

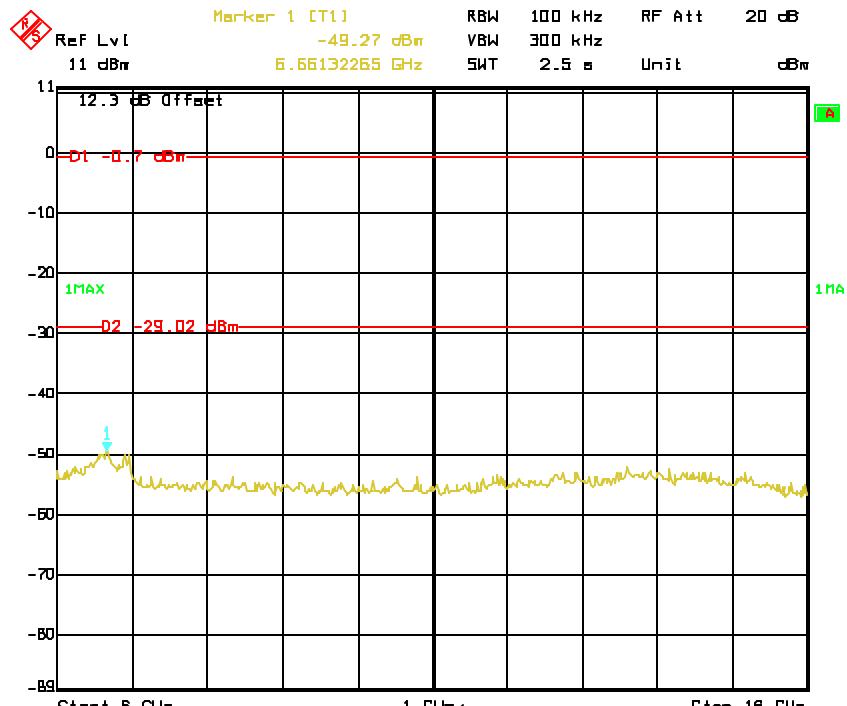
Phone (858) 755-5525 Fax (858) 452-1810

Report Number: 2007 118189 MIMO FCC

Specification: FCC Part 15 Subpart C, 15.247



Date: 21-DEC-2007 10:46:46



Date: 21-DEC-2007 10:49:34

Nemko USA, Inc.

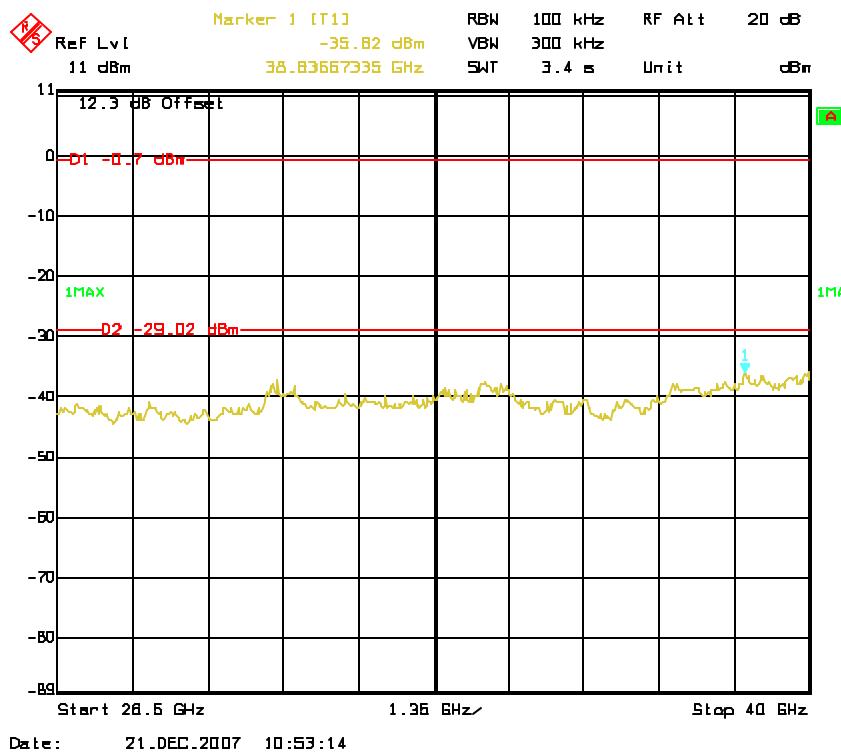
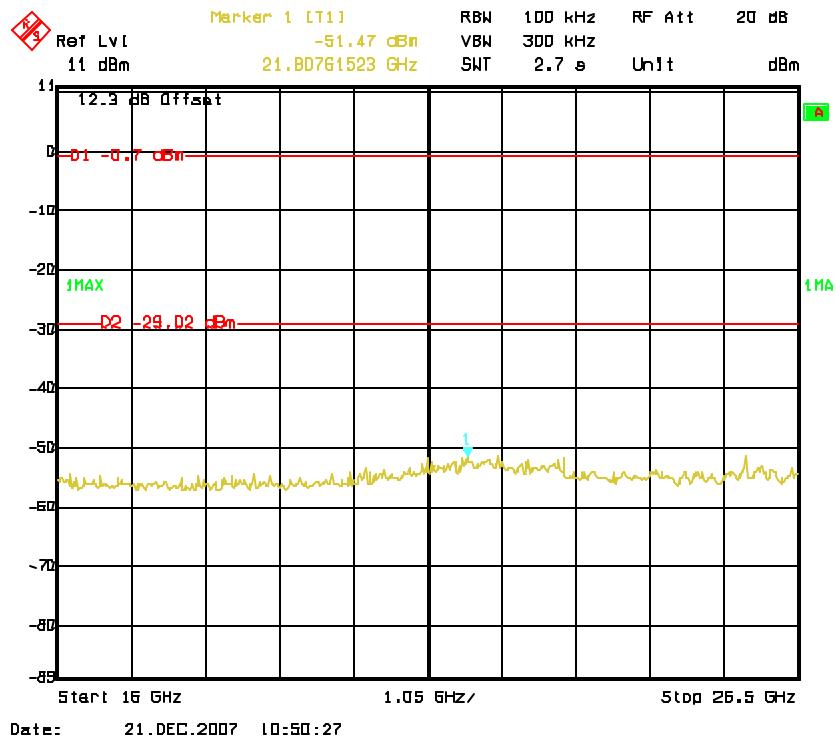
FCC ID: KA358MRS1

11696 Sorrento Valley Road, Suite F, San Diego, CA 92121

Phone (858) 755-5525 Fax (858) 452-1810

Report Number: 2007 118189 MIMO FCC

Specification: FCC Part 15 Subpart C, 15.247



Clause 15.247(e) Power Spectral Density for Digitally Modulated Devices

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test Conditions:

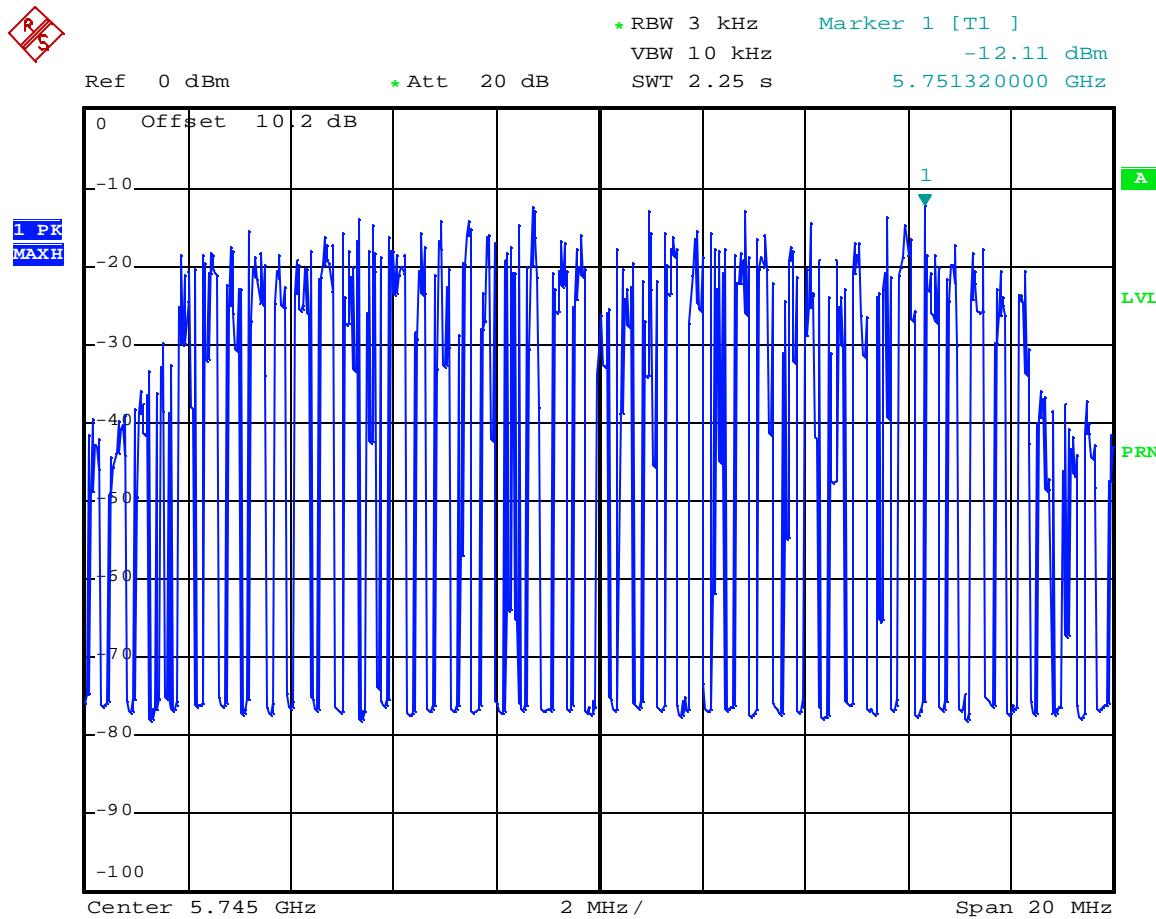
Sample Number:	MRS	Temperature:	18.8°C
Date:	December 28, 2007	Humidity:	19%
Modification State:	Lo/Mid/High Channels	Tester:	Ferdinand Custodio
Laboratory:			Nemko

Test Results:

EUT Complies.

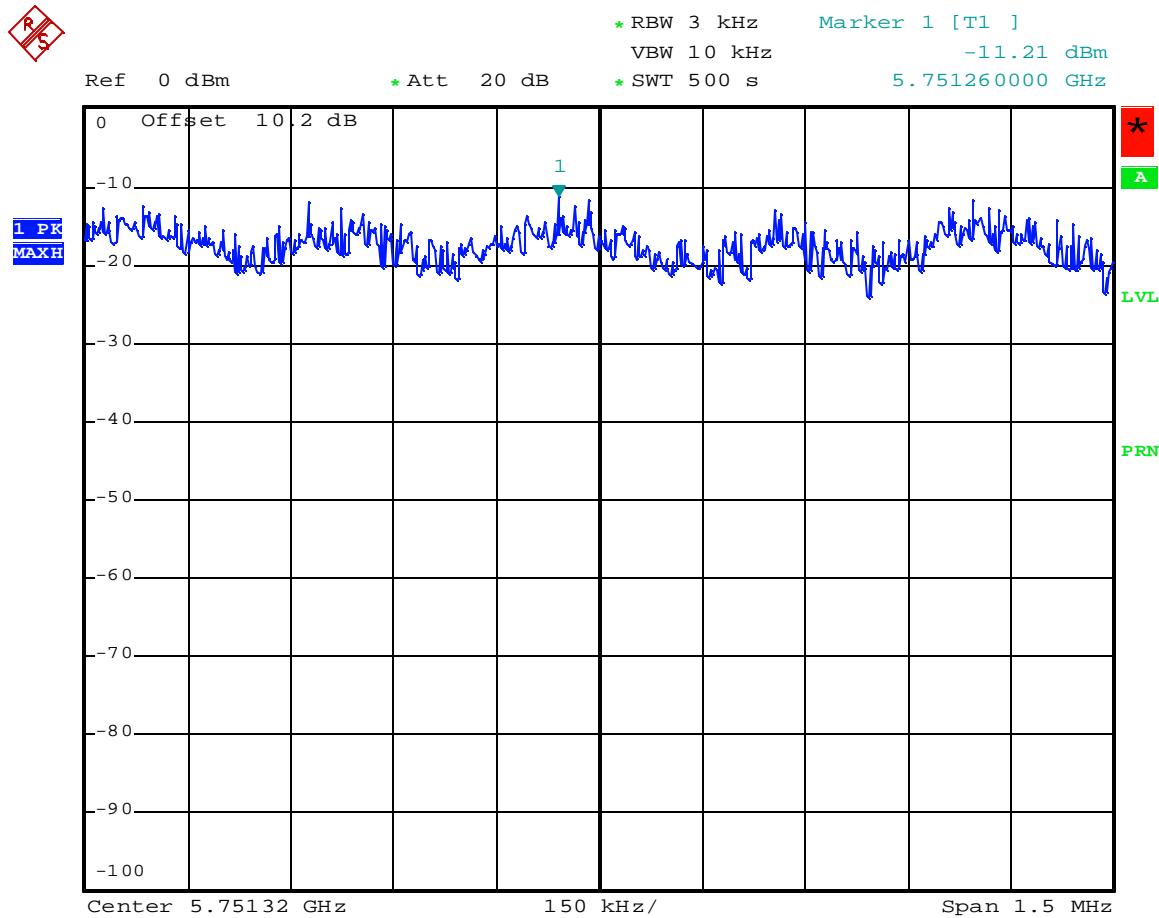
Using PSD option 1. Positive peak max hold detector, RBW 3kHz, VBW > RBW, sweep time = span / 3 kHz, zoom in on the peak in a 1.5 MHz span, set the sweep time to $1500/3 = 500$ seconds, set marker peak upon completion of sweep, record spectral plot. Measured the PSD at each antenna port and calculated the total PSD by summing the measured PSD's in terms of linear power units. *If the lesser output was equal to the greater output, combined power would be 6 dB higher and this theoretical level also complies.

Chan.	Channel Freq. (MHz)	Port 1RF Power Level in 3KHz BW	Port 2 RF Power Level in 3KHz BW	Total PSD (Linear Power - sum) mW	Total PSD (Linear Power - sum) dBm	Max. Limit (dBm)	PASS/ FAIL
LO	5745	-11.21	-12.29		-6.29*	8	Pass
		0.076 mW	0.059 mW	0.135 mW	-8.71	8	Pass
MID	5765	-9.10	-9.10		-3.10*	8	Pass
		0.123 mW	0.123 mW	0.246 mW	-6.09	8	Pass
HIGH	5805	-9.04	-9.60		-3.60*	8	Pass
		0.125 mW	0.110 mW	0.234mW	-6.30	8	Pass



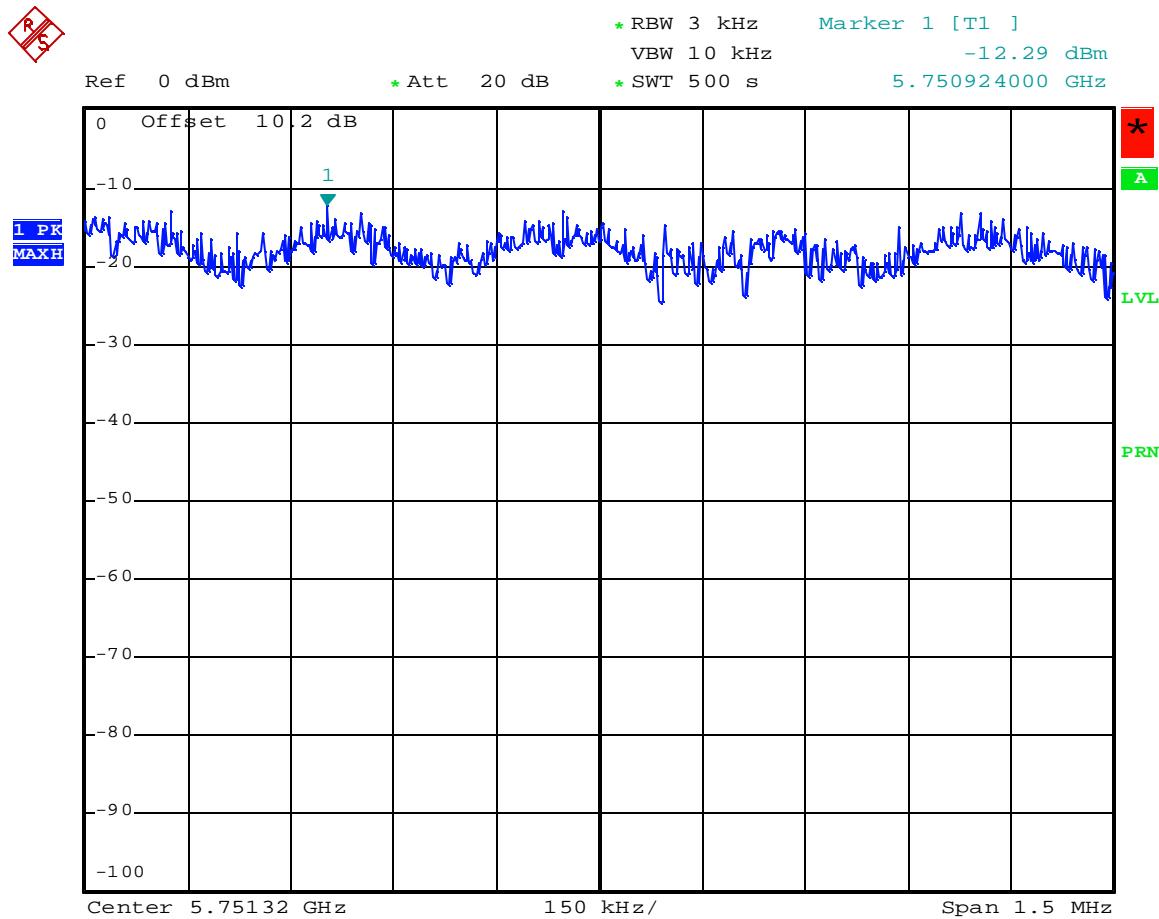
Date: 28.DEC.2007 12:19:27

Low Channel 5745 MHz



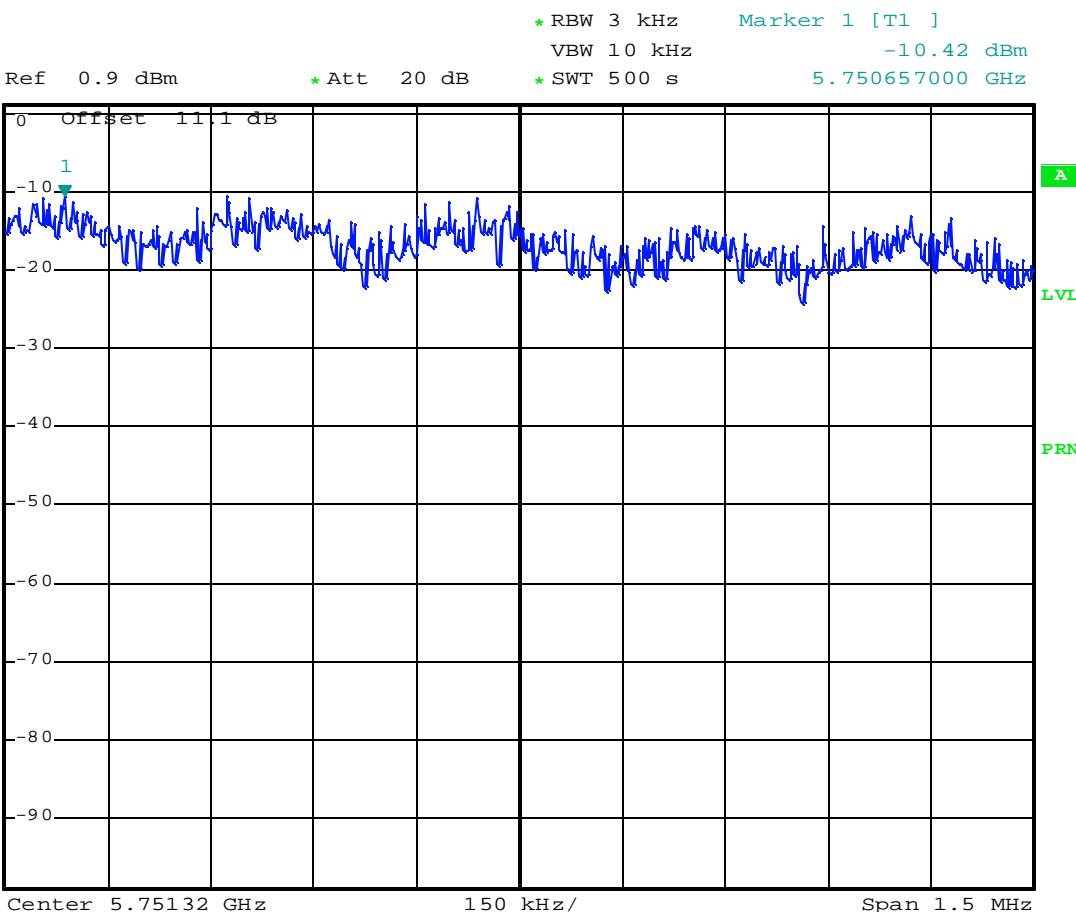
Date: 28 .DEC. 2007 12:30:04

Low Channel Port 1 zoomed in on the peak



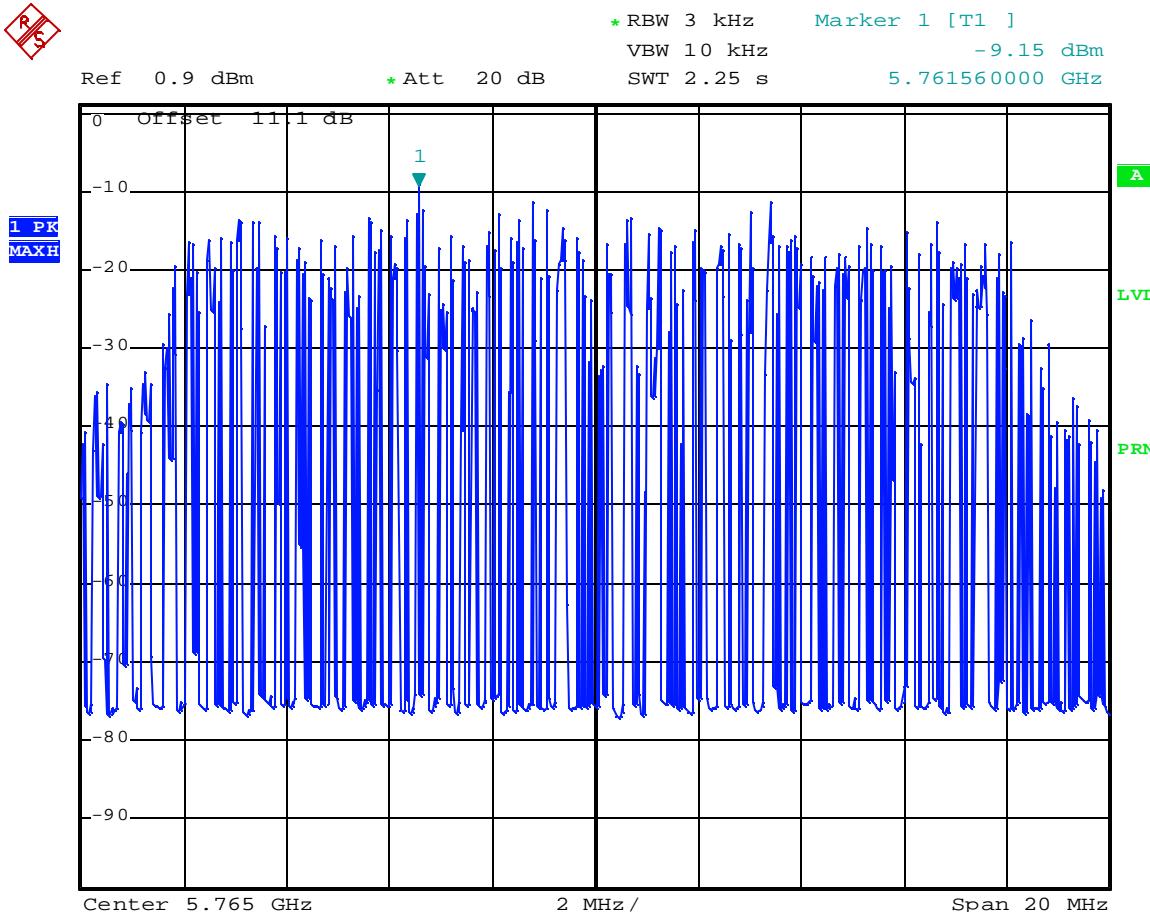
Date: 28 .DEC. 2007 12:39:36

Low Channel Port 2 zoomed in on the peak



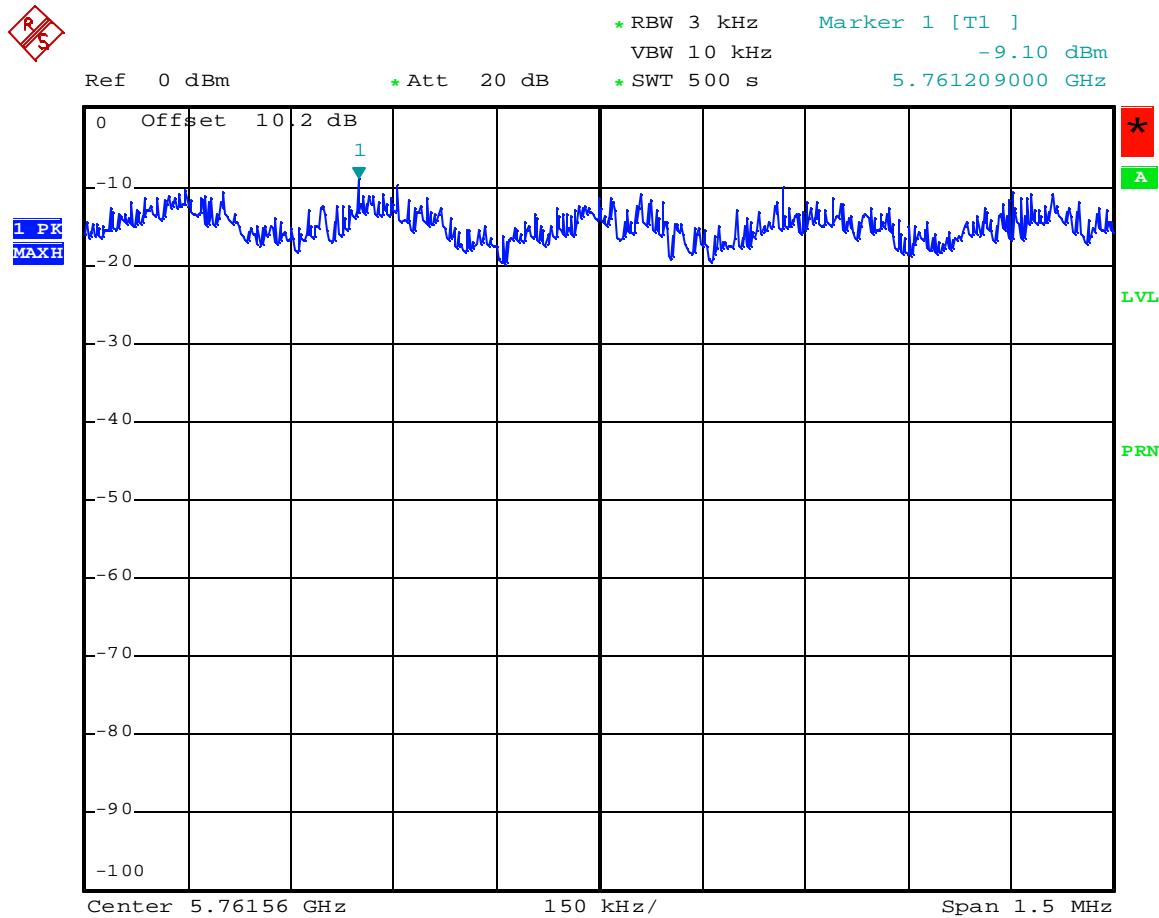
Date: 28.DEC.2007 12:51:57

Low Channel Port 1 and 2 aggregated through a combiner



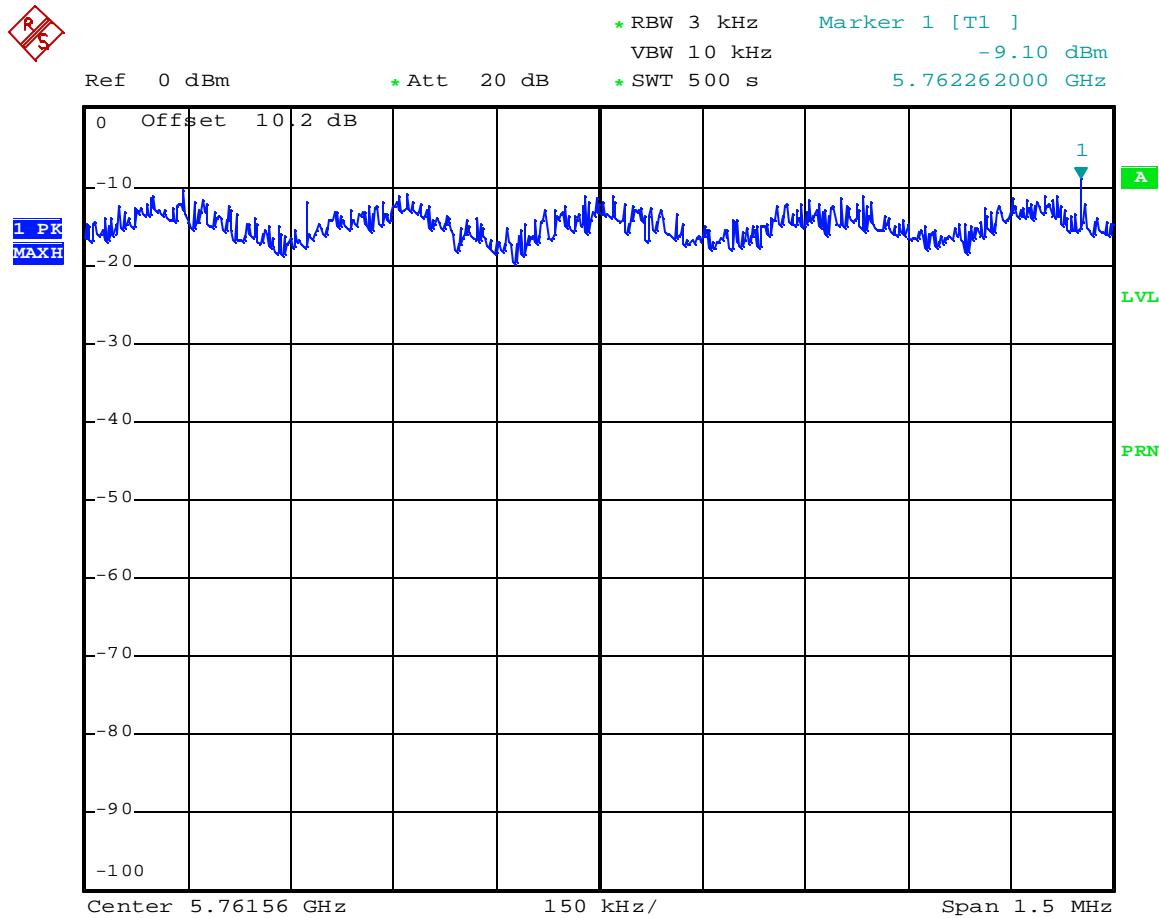
Date: 28 .DEC. 2007 12:53:56

Mid Channel 5765 MHz



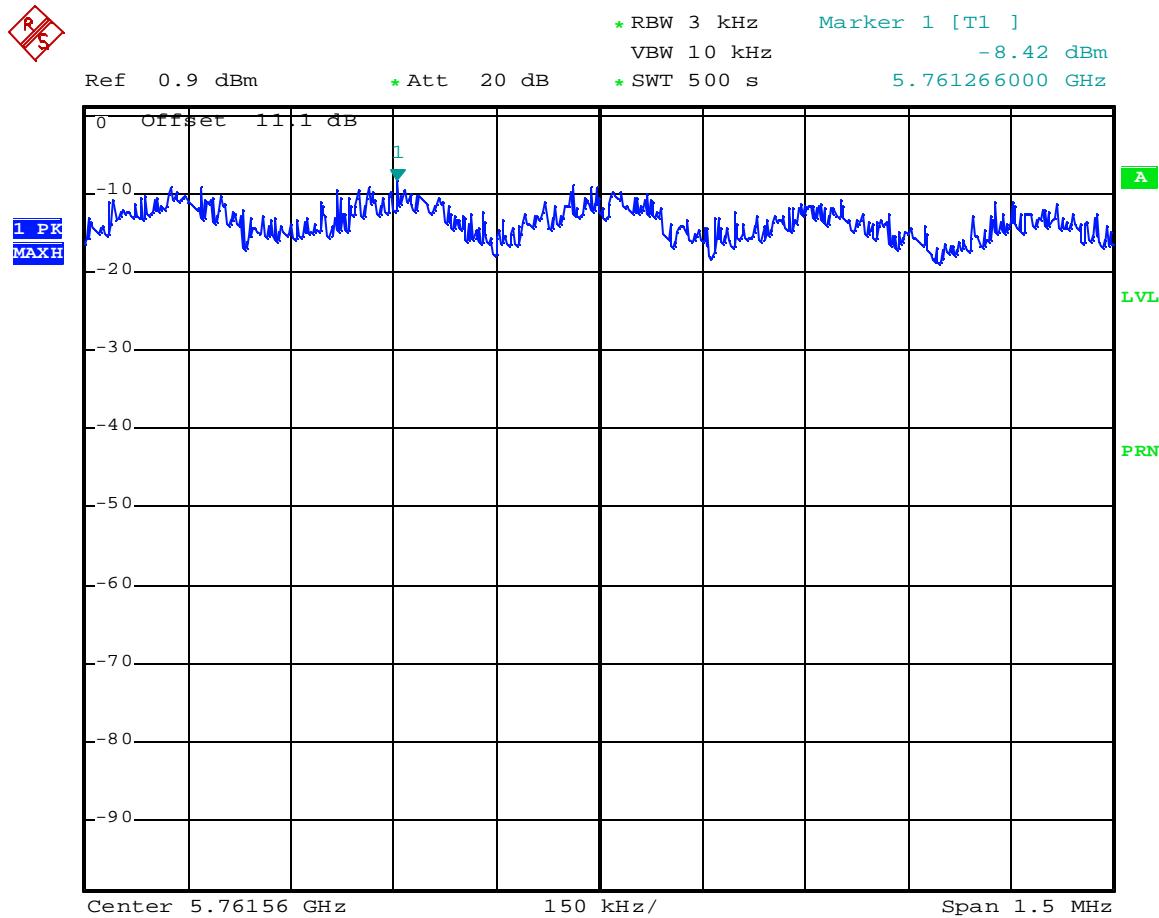
Date: 28 .DEC. 2007 13:54:57

Mid Channel Port 1 zoomed in on the peak



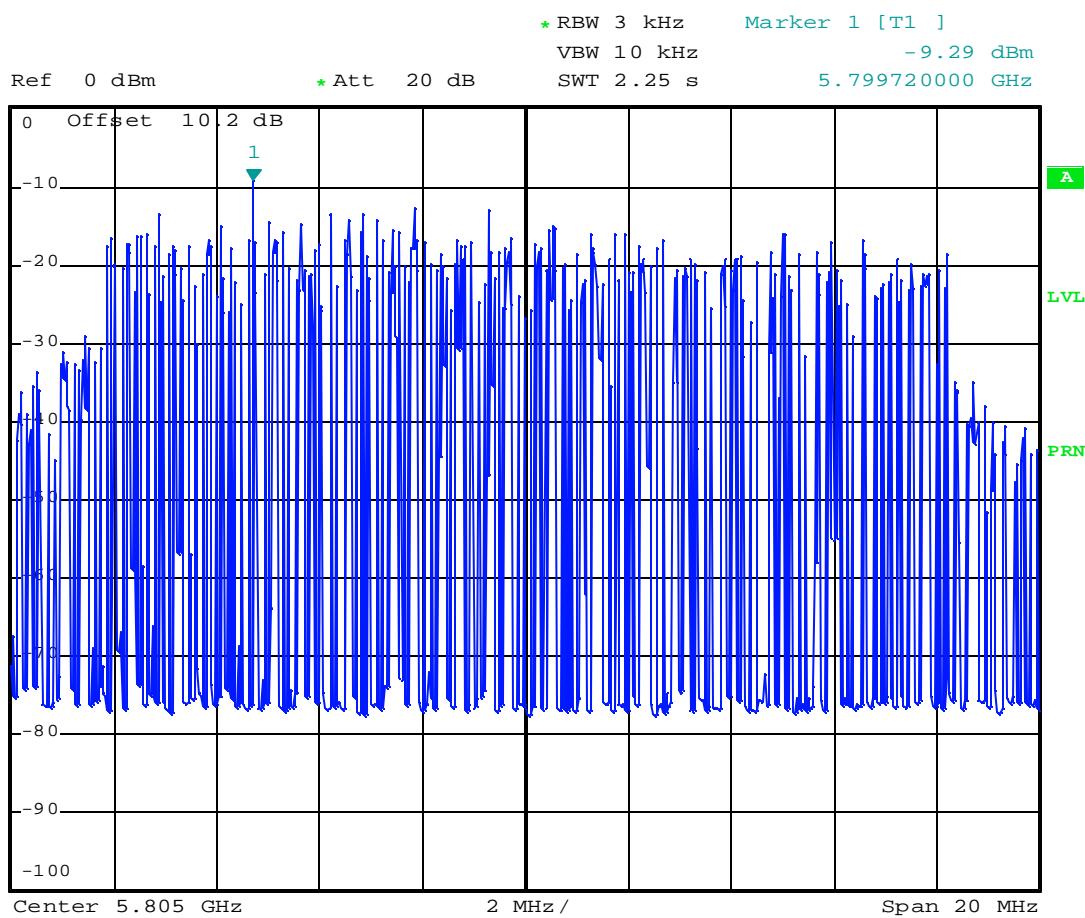
Date: 28 .DEC. 2007 13:43:21

Mid Channel Port 2 zoomed in on the peak



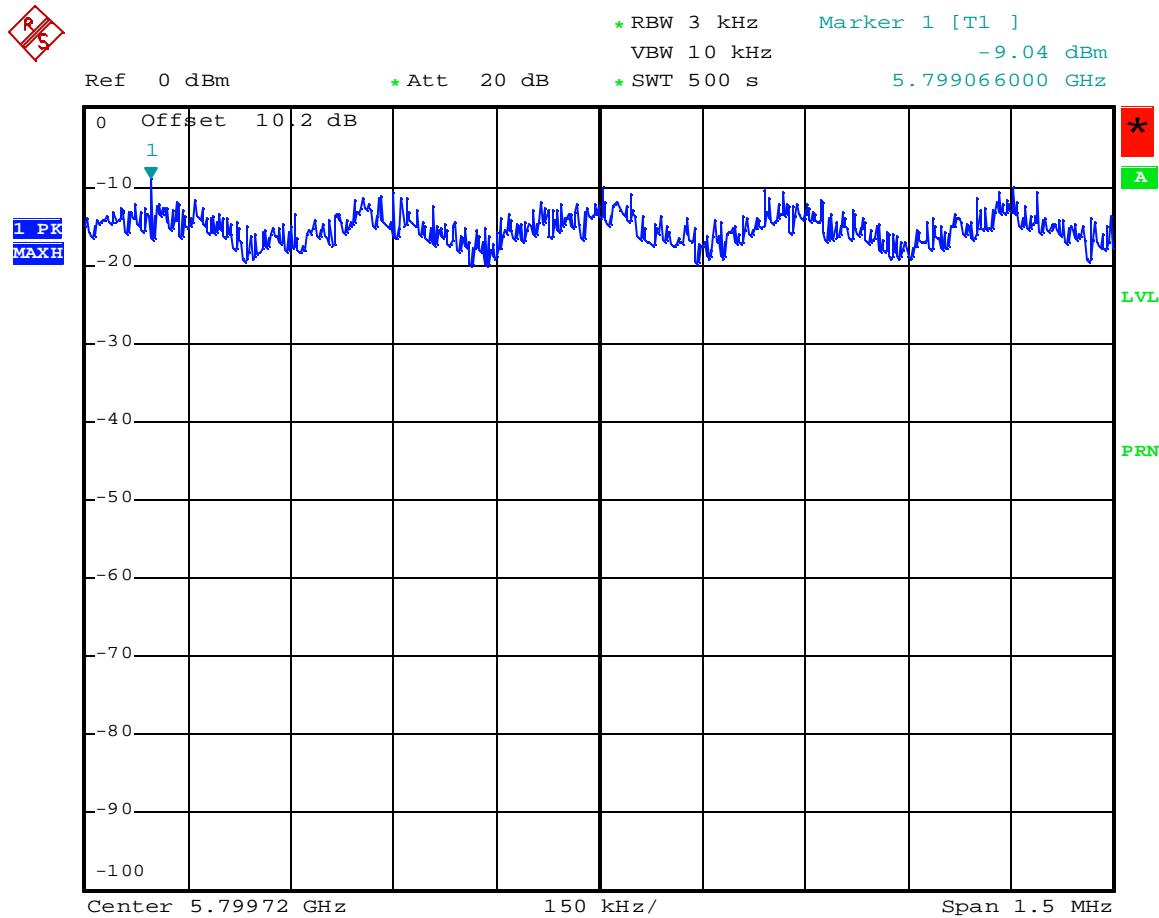
Date: 28 .DEC. 2007 13:24:26

Mid Channel Port 1 and 2 aggregated through a combiner



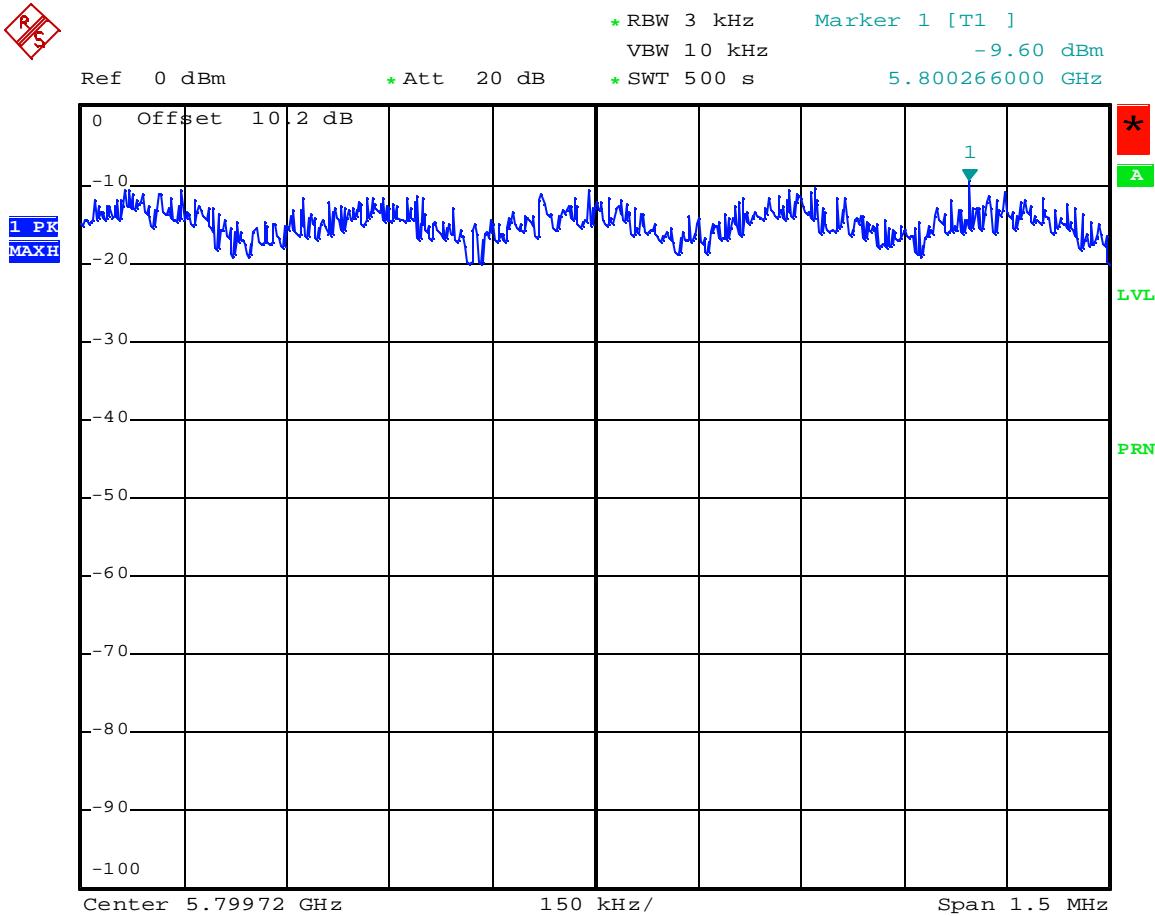
Date: 28 .DEC. 2007 14:01:26

High Channel 5805 MHz



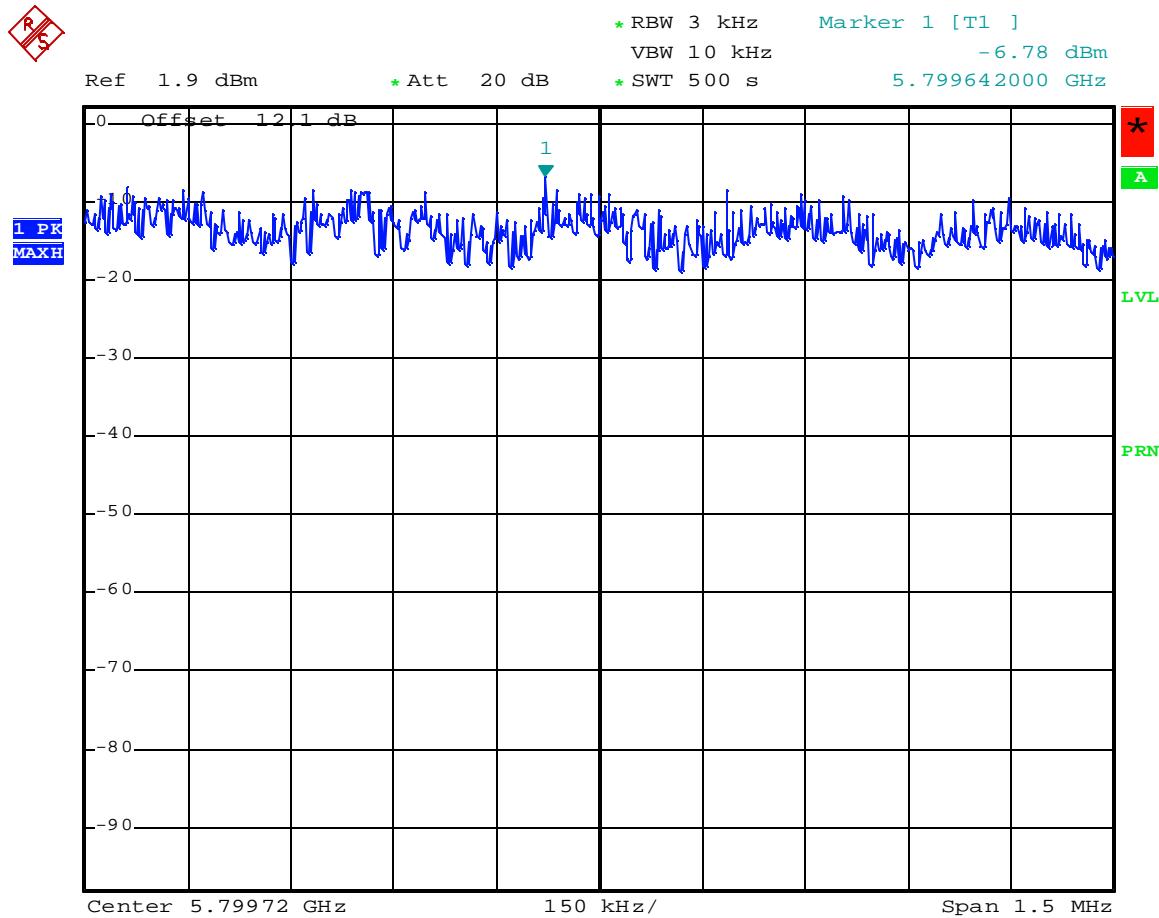
Date: 28 .DEC. 2007 14:20:25

High Channel Port 1 zoomed in on the peak



Date: 28 .DEC. 2007 14:10:38

High Channel Port 2 zoomed in on the peak



Date: 28 .DEC. 2007 14:30:35

High Channel Port 1 and 2 aggregated through a combiner

Clause 15.31(e) Supply Voltage Variation

(e) For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

Test Conditions:

Sample Number:	MRS	Temperature:	23.3°C
Date:	October 19, 2007	Humidity:	38%
Modification State:	Lo/Mid/High Channels	Tester:	Ferdinand Custodio
Laboratory:			Nemko

Test Results:

EUT Complies

Transmit output power was measured (please see test results under Clause 15.247(b)(3) Maximum peak output power of systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands) while supply voltage was varied from 31.875 VDC to 43.125 VDC (85% to 115% of the nominal rated supply voltage). No measurable change in transmit output power was observed.

Appendix B: Measurement Threshold of Sensitivity from 30MHz to 40GHz

Noise floors from 30MHz to 40GHZ were measured to show minimum level that can be detected during Radiated Emission testing. Points were chosen to represent the entire band, these measurements account all cable losses, amplifier gain and antenna factors.

Sample Computation: Antenna factor @ 195.6 is 16.5, cable loss is 1.5
(9+16.5+1.5=27)

 Nemko NEMKO USA, Inc.		San Diego Headquarters: 11696 Sorrento Valley Rd. San Diego, CA 92121 Tel: (858) 755-5525 Fax: (858) 452-1810																																																																																																																																																																					
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Staff:	FSC																																																																																																																																																																						
Client Name:	Measurement threshold of sensitivity					EUT Voltage:																																																																																																																																																																	
Range:	200MHz to 1000MHz					EUT Frequency:																																																																																																																																																																	
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					Distance > 1000 MHz:					3 m																																																																																																																																																													
Specification:	CFR47 Part 15, Subpart B, Class B																																																																																																																																																																						
Loop Ant. #:	NA										Quasi-Peak RBW: 120 kHz																																																																																																																																																												
Bicon Ant. #:	114					Temp. (°C): 20					Video Bandwidth 300 kHz																																																																																																																																																												
Log Ant. #:	110					Humidity (%): 14					Peak RBW: 1 MHz																																																																																																																																																												
DRG Ant. #:	NA					Spec An. #: 899/898					Video Bandwidth 3 MHz																																																																																																																																																												
Dipole Ant. #:	NA					Spec An. Display #: 899/898					Average RBW: 1 MHz																																																																																																																																																												
Cable LF#:	SOATS					QP #: 899/898					Video Bandwidth 10 Hz																																																																																																																																																												
Cable HF#:	NA					PreSelect#: NA																																																																																																																																																																	
Preamp LF#:	NA										Measurements below 1 GHz are Quasi-Peak values, unless otherwise stated.																																																																																																																																																												
Preamp HF#:	NA										Measurements above 1 GHz are Average values, unless otherwise stated.																																																																																																																																																												
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Meas. Freq. (MHz)</th> <th>Meter Reading Vertical</th> <th>Meter Reading Horizontal</th> <th>Det.</th> <th>EUT Side F/L/R/B</th> <th>Ant. Height m</th> <th>Max. Reading (dBuV)</th> <th>Corrected Reading (dBuV/m)</th> <th>Spec. limit (dBuV/m)</th> <th>CR/SL Diff. (dB)</th> <th>Pass Fail</th> <th>Comment</th> </tr> </thead> <tbody> <tr><td>202.70</td><td></td><td>6.5</td><td>Q</td><td></td><td>1.0</td><td>6.5</td><td>19.6</td><td>43.5</td><td>-23.9</td><td>Pass</td><td>Noise Floor</td></tr> <tr><td>403.30</td><td></td><td>5.3</td><td>Q</td><td></td><td>1.0</td><td>5.3</td><td>23.3</td><td>46.0</td><td>-22.8</td><td>Pass</td><td>Noise Floor</td></tr> <tr><td>603.30</td><td></td><td>7.9</td><td>Q</td><td></td><td>1.0</td><td>7.9</td><td>29.4</td><td>46.0</td><td>-16.6</td><td>Pass</td><td>Noise Floor</td></tr> <tr><td>750.20</td><td></td><td>5.0</td><td>Q</td><td></td><td>1.0</td><td>5</td><td>28.9</td><td>46.0</td><td>-17.2</td><td>Pass</td><td>Noise Floor</td></tr> <tr><td>820.20</td><td></td><td>5.0</td><td>Q</td><td></td><td>1.0</td><td>5</td><td>31.2</td><td>46.0</td><td>-14.8</td><td>Pass</td><td>Noise Floor</td></tr> <tr><td>995.40</td><td></td><td>5.7</td><td>Q</td><td></td><td>1.0</td><td>5.7</td><td>33.5</td><td>54.0</td><td>-20.5</td><td>Pass</td><td>Noise Floor</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </tbody> </table>												Meas. Freq. (MHz)	Meter Reading Vertical	Meter Reading Horizontal	Det.	EUT Side F/L/R/B	Ant. Height m	Max. Reading (dBuV)	Corrected Reading (dBuV/m)	Spec. limit (dBuV/m)	CR/SL Diff. (dB)	Pass Fail	Comment	202.70		6.5	Q		1.0	6.5	19.6	43.5	-23.9	Pass	Noise Floor	403.30		5.3	Q		1.0	5.3	23.3	46.0	-22.8	Pass	Noise Floor	603.30		7.9	Q		1.0	7.9	29.4	46.0	-16.6	Pass	Noise Floor	750.20		5.0	Q		1.0	5	28.9	46.0	-17.2	Pass	Noise Floor	820.20		5.0	Q		1.0	5	31.2	46.0	-14.8	Pass	Noise Floor	995.40		5.7	Q		1.0	5.7	33.5	54.0	-20.5	Pass	Noise Floor																																																																								
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995.40		5.7	Q		1.0	5.7	33.5	54.0	-20.5	Pass	Noise Floor																																																																																																																																																												

Sample Computation: Antenna factor @ 995.40 is 23, cable loss is 4.8
 $(5.7+23+4.8=33.5)$



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Radiated Emissions Data

Job # : 8189-1 Date : 1/2/2008
NEX # : 94814 Time : 8AM

Page 1 of 1

Client Name : Measurement threshold of sensitivity
Range : 18 to 40GHz

EUT Voltage :	_____
EUT Frequency :	_____
Phase:	_____
NOATS	_____
SOATS	_____ X
Distance < 1000 MHz:	_____
Distance > 1000 MHz:	_____ 3 m

Specification : CFR47 Part 15, Subpart B, Class B

Loop Ant. #:	NA	Temp. (°C) :	20
Bicon Ant.#:	NA	Humidity (%) :	14
Log Ant. #:	NA	Spec An.#:	835
DRG Ant. #	625	Spec An. Display #:	NA
Dipole Ant.#:	NA	QP #:	NA
Cable LF#:	SOATS	PreSelect#:	NA
Cable HF#:	Wireless		
Preamp LF#:	NA		
Preamp HF#	983		

Quasi-Peak	RBW: 120 kHz
	Video Bandwidth 300 kHz
Peak	RBW: 1 MHz
	Video Bandwidth 3 MHz
Average	RBW: 1 MHz
	Video Bandwidth 10 Hz

Measurements below 1 GHz are Quasi-Peak values, unless otherwise stated.

Measurements above 1 GHz are Average values, unless otherwise stated.

Sample Computation: Antenna factor @ 38.9GHz is 45.9, cable loss is 23.1, Pre-Amp gain is 54.3 (38.5+45.9+23.1-54.3=53.2)