
TEST REPORT

In support of the Application for Grant of Equipment Authorisation of the
UbiNetics GM401 900/1900MHz Module

FCC ID: PK5

February 2002

Equipment: GM401

FCC ID: PK5

Specification: 47 CFR 2 & 47 CFR 24

Applicant: UbiNetics
Cambridge Technology Centre
Melbourn
Herts.
SG8 6DP

Manufacturer: As above

Manufacturer's Representative: Mr Gary Burniston

Approved by:



M JENKINS
Wireless Group Leader

Dated: 21st February 2002

Start of Test: 14th January 2002

Completion of Test: 18th January 2002

Report Distribution:	Ubinetics	Mr G Burniston	Copy No. 1
	BABT		Copy No's. 2 & 3
			Copy No:

ENGINEERING STATEMENT

I ATTEST: the measurements shown in this report were made in accordance with the procedures indicated, and that the emissions from this equipment were found to be within the applicable limits. I assume full responsibility for the accuracy and completeness of these measurements. On the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 2, Part 15 and Part 24 of the FCC Rules under normal use and maintenance.


Simon Bennett
Test Manager

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Introduction

The information contained within this report is intended to show verification of compliance of the UbiNetics GM401 900/1900MHz Module, to the requirements of 47 CFR 2 and 47 CFR 24.

Location Of Testing

All testing was conducted at the premises of BABT, Segensworth Road, Fareham, Hampshire, PO15 5RH, by BABT Personnel, Simon Bennett and Tony Hubbard. Radiated Emissions measurements were performed on a 3 metre open area test site (OATS). A complete site description is on file with the FCC Laboratory Division, Registration Number: 90987. See Annex A.

Test Equipment and Ancillaries Used For Test

No	Instrument/Ancillary	Type	Manufacturer	Serial No.	Cal Due
1	Thermohygrograph	1-1000	Rotronic	182615	26/9/02
2	Digital Multimeter	79III	Fluke	74970620	27/11/02
3	Power Supply	TS39233	Thandar	132 937	TU
4	Universal Radio Communications Tester	CMU 200	Rohde and Schwarz	20-68508	30/3/02
5	Spectrum Analyser	FSEM	Rohde and Schwarz	827285/006	28/12/02
6	Attenuator	23-10-34	Weinschel Corp	BG4169	30/4/02
7	Combiner	1506A	Weinschel	KE136	23/8/02
8	Spectrum Analyser	8568B	Hewlett Packard	184	24/2/02
9	Quasi-Peak Adaptor	85650A	Hewlett Packard	1302	24/2/02
10	RF Preselector	85685A	Hewlett Packard	1370	24/2/02
11	Turntable & Controller	1060	Emco	1322	TU
12	Antenna Mast & Controller	1050	Emco	1321	TU
13	Computer	310	Hewlett Packard	-	TU
14	Printer	Think Jet	Hewlett Packard	-	TU
15	Low Noise Amplifier (1-8 GHz)	AMF-3D-001080-18-13P	Miteq	2457	TU
16	Low Noise Amplifier (8-18 GHz)	AMF-4E-080180-15-10P	Miteq	2430	TU
17	Spectrum Analyser	8562A	Hewlett Packard	2282	25/5/02
18	Horn	3115	Emco	2397	26/5/02
19	Signal Generator	SMR40	Rohde & Schwartz	2768	29/1/02
20	Test Receiver	ESH3	Rohde & Schwartz	1020	5/6/02



No	Instrument/Ancillary	Type	Manufacturer	Serial No.	Cal Due
21	Spectrum Monitor	EZM	Rohde & Schwartz	1416	TU
22	Plotter	7550A	Hewlett Packard	-	TU
23	Transient Limiter	11947A	Hewlett Packard	-	5/6/02
24	Three Phase LISN	ESH2-Z5	Rohde & Schwartz	1915	5/6/02
25	Low Noise Amplifier	-	Avantek	2072	TU
26	Horn	2024/20	FMI	1396	TU
27	Probe	20093SF40	FMI	-	TU

Note(s)

- 1) All items are calibrated annually , except where labelled T/U (Traceability Unscheduled). These items are calibrated within the test configurations using calibrated equipment.
- 2) Throughout the test report the test equipment used for each test is referenced using the number indicated in the table above.

Description of Equipment Under Test Configuration

The equipment under test is made up of the following component parts.

<u>Module</u>	<u>Vendor</u>	<u>Kit Number</u>	<u>Serial Number</u>
GSM 900/1800/1900	UbiNetics	GM401	00000078
Test Board	UbiNetics	UNPC8000501A	0018

TABLE 1

List of Performed Measurements using the configuration in Table 1

- i) Power Output
- ii) Modulation Characteristics
- iii) Occupied Bandwidth
- iv) Band Edge Measurements
- v) Frequency Stability –
Temperature Variations
- vi) Frequency Stability –
Voltage Variations

<u>Module</u>	<u>Vendor</u>	<u>Kit Number</u>	<u>Serial Number</u>
GSM 900/1800/1900	UbiNetics	GM401	-

TABLE 2

List of Performed Measurements using the configuration in Table 2

- i) Radiated Emissions
- vi) Conducted Emissions



Test Case : Radiated Emissions
Test Date : 9th January 2002
Rule Parts : 24.238

Measurement Method

The GM401 Module was set-up simulating a call on the Open Field Test Site, then tested in accordance with the specification.

Radiated Emission testing was carried out with the GSM1900 transceivers transmitting on channels 512, 700 and 812.

A preliminary profile of the Radiated Electric Field Emissions was obtained by operating the Equipment Under Test (EUT) on a remotely controlled turntable within a semi-anechoic chamber; measurements were taken at a 3m distance. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst case emissions together with the EUT azimuth and antenna polarisation

The EUT was then transferred to the Open Field Site and placed on a remotely controlled turntable. Using the information from the preliminary profiling of the EUT, a search was made in the frequency range 30MHz to 18000MHz. The list of worst case emissions was then confirmed or updated under Open Site conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth. Emission levels were then formally measured using a Quasi-Peak Detector which met the CISPR requirements. The details of the worst case emissions were then recorded in the Job Log Book. Details of the worst case emissions are presented in Table 1.

Radiated Electric Field Emission measurements were made using a Hewlett Packard 8542E EMI Receiver in the frequency range 30MHz to 1000MHz and a Hewlett Packard 8562A Spectrum Analyser in the frequency range 1000MHz to 20000MHz. Measurements in the range 30MHz to 1000MHz were made using a Quasi-Peak Detector and measurements above 1GHz were made using a Peak Detector.

The EUT was connected to a 3.6V DC supply.

Determination of Spurious Emissions Limit

Power into antenna = -37.0dBm
Gain over dipole = 6.02dB
Equivalent power into dipole = $-37.0 + 6.02 = -30.98\text{dBm}$
Declared output from EUT = 1W = 30dBm
Difference = 60.98dB
Level on analyser = 67.33dB μ V
Antenna Factor = 27.73dB
Cable loss = 228.67dB
Field strength = 66.39dB μ V/m
Equivalent EUT field strength = 127.37dB μ V/m

Limit = $127.37 - (43 + 10\log_{10}(W)) = 84.37\text{dB}\mu\text{V/m}$



Test Case : Radiated Emissions (continued)

Test Date : 9th January 2002

Rule Parts : 24.238

Open Field Site Results : The levels of the six highest emissions measured in accordance with the specification are presented below :-

Frequency	Pol	Hgt	Azm	Level at 3m	Cable Loss	Antenna Factor	F.S at 3m	Spec Limit
MHz	H/V	cm	deg	dBμV	dB	dB	dBμV/m	dBμV/m
3700.44	V	163	197	60.67	-31.16	32.66	62.17	84.37
3775.57	V	117	213	53.33	-31.00	32.95	55.28	84.37
5550.39	V	178	203	64.50	-30.50	34.92	68.92	84.37
5663.40	V	162	256	61.83	-30.50	34.82	66.15	84.37
5729.16	V	181	149	62.33	-30.50	34.17	66.00	84.37
7639.52	V	171	299	50.83	-29.00	36.93	58.76	84.37

The margin between the specification requirements and all other emissions was 26dB or more below the specification limit.

ABBREVIATIONS FOR ABOVE TABLE

ERP Effective Radiated Power
H Horizontal Polarisation

V Vertical Polarisation

Procedure Test Performed in accordance with ANSI C63.4.



Test Case : Radiated Emissions
Test Date : 9th January 2002
Rule Parts : 15 Subpart B

RADIATED ELECTRIC FIELD EMISSIONS TEST PROCEDURE

Receive mode

A preliminary profile of the Radiated Electric Field Emissions was obtained by operating the Equipment Under Test (EUT) on a remotely controlled turntable within a Characterisation Chamber; measurements were taken at a 3m distance. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst case emissions together with the EUT azimuth and antenna polarisation

The EUT was then transferred to the Open Field Site and placed on a remotely controlled turntable. Using the information from the preliminary profiling of the EUT, a search was made in the frequency range 30MHz to 10000MHz. The list of worst case emissions was then confirmed or updated under Open Site conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth. Emission levels were then formally measured using a Quasi-Peak Detector which met the CISPR requirements in the frequency range 30MHz to 1000MHz and with a Peak detector in the frequency range 1000MHz to 10000MHz. The details of the worst case emissions were then recorded and are presented in Table 3.

The Radiated Electric Field Emissions measurements were made using a Hewlett Packard Spectrum Analyser, Preselector and Quasi-Peak Adaptor in the frequency range 30MHz to 1000MHz and a Hewlett Packard 8562A Spectrum Analyser in the frequency range 1000MHz to 10000MHz.

The test was performed in accordance with ANSI C63.4.

RADIATED ELECTRIC FIELD TEST RESULTS

Receive mode

The EUT met the Class B requirements of FCC Part 15 Subpart B for Radiated Electric Field Emissions.

The emissions were measured at 3m.

Open Field Site Results: No EUT emissions were detected greater than the measurement system noise floor which was at least 5.4dB below the specification limit.

Procedure Test Performed in accordance with ANSI C63.4

Performed by A R Hubbard, EMC Engineer.



Test Case : RF Output Power
 Test Date : 14th January 2002
 Rule Parts : 2.1046, 24.232

Measurement Method

Using a spectrum analyser and attenuator(s), the output power of the EUT was measured at the antenna terminals. The carrier was modulated by it's normal GMSK modulation with all time slots active.

The spectrum analyser RBW and VBW were set to 1MHz and the path loss measured and entered as a reference level offset.

Results

Maximum Power

Frequency (MHz)	Output Power (dBm)	Path Loss (dB)	Result (dBm)	Result (W)
1850.2	9.2	20.2	29.4	0.871
1880.0	7.0	20.0	27.0	0.501
1909.8	8.0	20.0	28.0	0.631

Minimum Power

Frequency (MHz)	Output Power (dBm)	Path Loss (dB)	Result (dBm)	Result (mW)
1850.2	-16.0	20.2	4.2	2.630
1880.0	-18.3	20.0	1.7	1.479
1909.8	-17.1	20.0	2.9	1.950

Limit	<100W or <+50dBm
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Remarks

EUT complies with CFR 47 2.1046 and 24.232(b). The EUT does not exceed 2W or +33dBm at the measured frequencies.

Test Equipment Used:

1, 2, 3, 4, 5, 6, 7

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Test Case : Modulation Characteristics

Test Date : 15th January 2002

Rule Parts : 2.1047(d)

Description Of Modulation Technique

The modulation scheme used in GSM is called Guassian Minimum Shift Keying (GMSK). GMSK facilitates the use of narrow bandwidth and allows for both coherent and non coherent detection capabilities. It is a scheme in which the transitions from One to Zero or Zero to One do not occur quickly, but over a period of time. If pulses are transmitted quickly harmonics are transmitted. The power spectrum for a square wave is rich in harmonics, and the power within the side lobes is wasted, and can be a cause of potential interference.

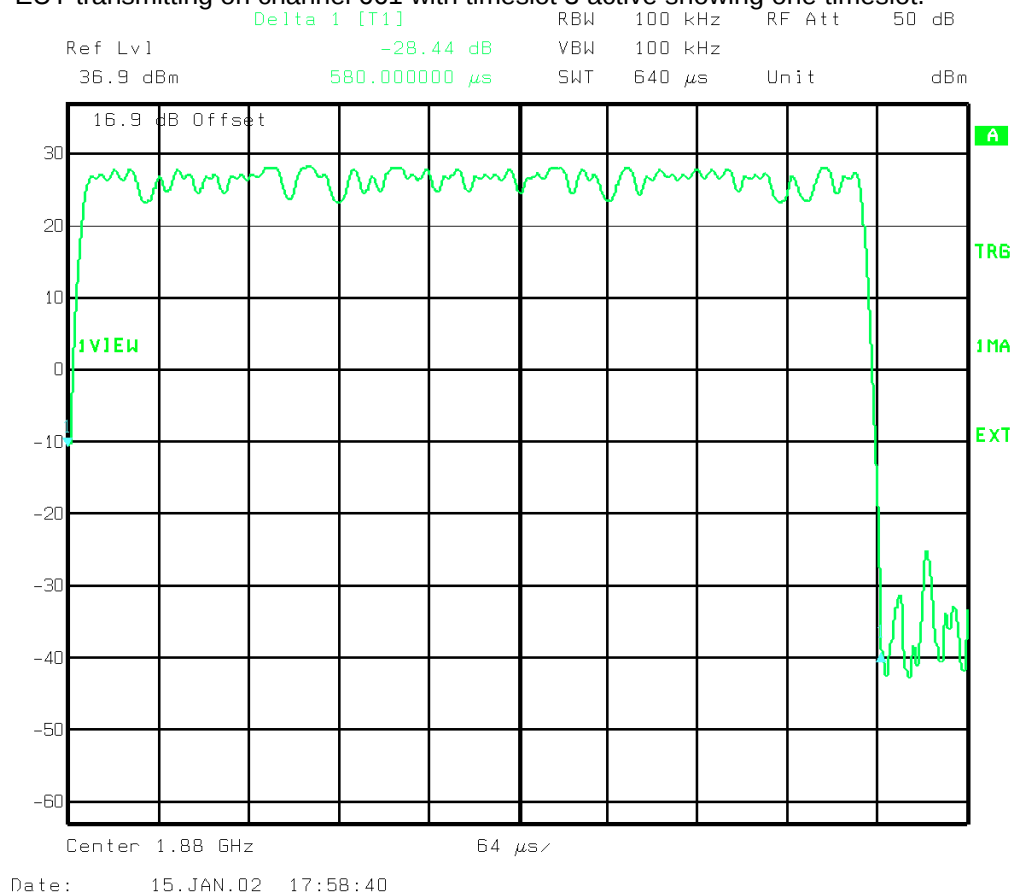
A method to reduce the harmonics is to round off the edges of the pules thus lowering the spectral components of the signal. In GSM this is done by using a Guassian pre-filter which typically has a bandwidth of 81.25KHz. The output from the Guassian filter then phase modulates the carrier. As there are no dramatic phase transitions of the carrier this gives a constant envelope, and low spectral component output from the transmitter.

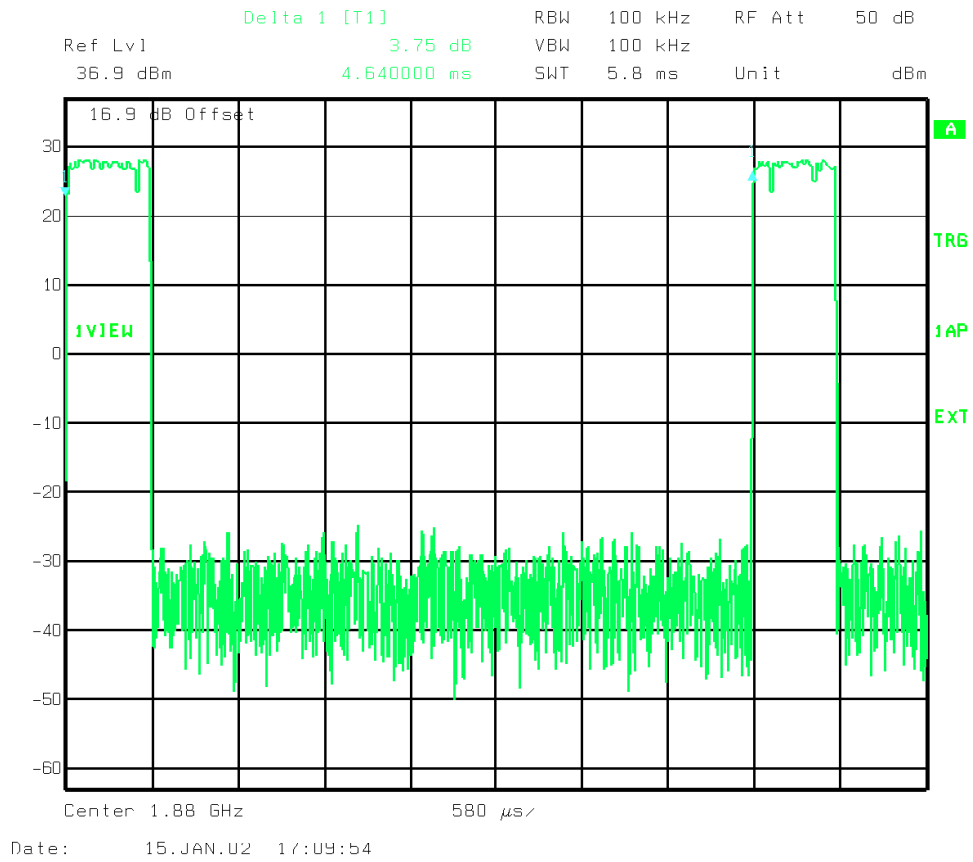
The spectral efficiency is calculated by

bit rate / Channel bandwidth = 270.83333 Kbit/s / 200 KHz = 1.354 bit/s/Hz.

The bandwidth product BT = Bandwidth x bit duration = 81.25 KHz x 3.6923 micros = 0.3

- 1) EUT transmitting on channel 661 with timeslot 3 active showing one complete frame.
- 2) EUT transmitting on channel 661 with timeslot 3 active showing one timeslot.





Plot (2)



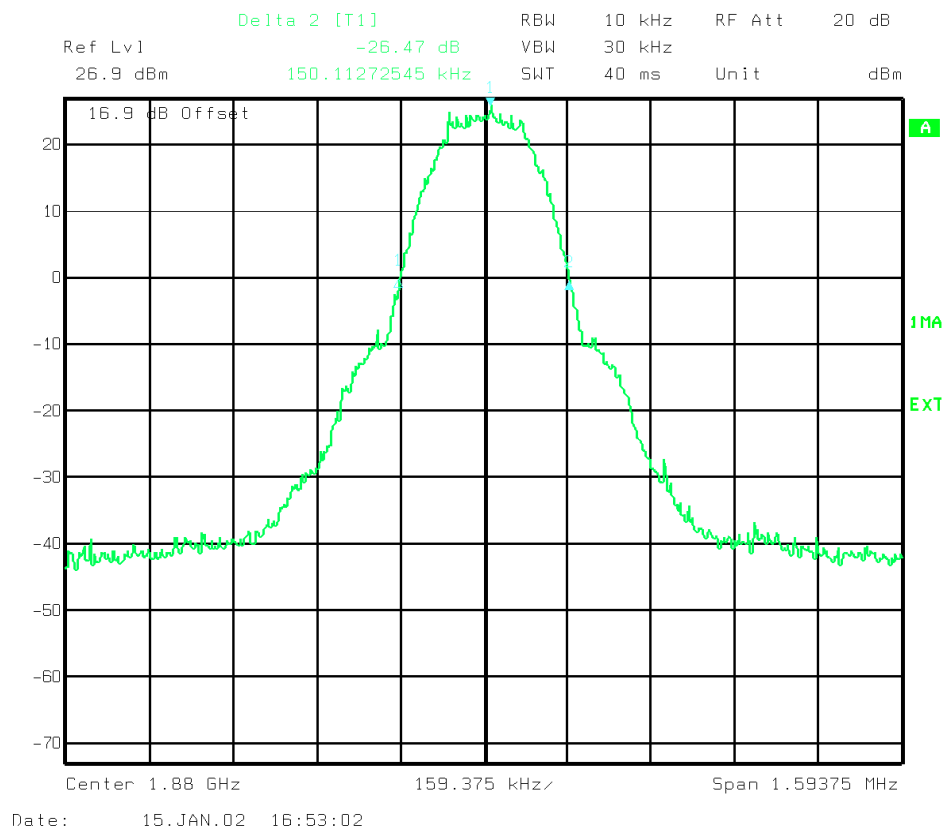
Test Case : Occupied Bandwidth

Test Date : 15th January 2002

Rule Parts : 2.1049, 24.238(b)

Measurement Method

Occupied Bandwidth As Defined By The - 26dBc Points



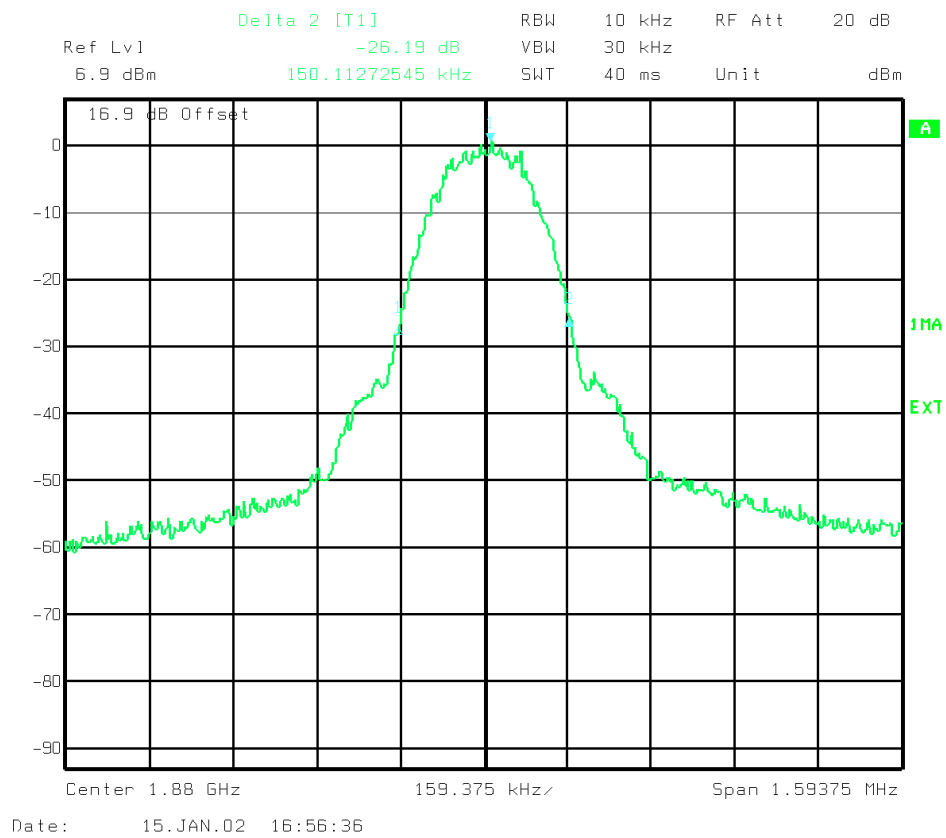
Maximum Power

Test Equipment Used:

1, 2, 3, 4, 5, 6, 7

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Minimum Power

Test Equipment Used:

1, 2, 3, 4, 5, 6, 7

.....

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Test Case : Spurious Emissions At Antenna Terminals (+/-1MHz)

Test Date : 14th and 15th January 2002

Rule Parts : 2.1049, 24.238(b)

Measurement Method

Below are the Frequency Blocks the EUT was tested against along with the tested channels.

Frequency Block (MHz)	Lower Block Edge Test Channels/Frequencies	Upper Block Edge Test Channels/Frequencies
A	Channel : 512 Frequency : 1850.2 MHz	Channel : 585 Frequency : 1864.8 MHz
B	Channel : 612 Frequency : 1870.2 MHz	Channel : 685 Frequency : 1884.8 MHz
C	Channel : 737 Frequency : 1895.2 MHz	Channel : 810 Frequency : 1909.8 MHz
D	Channel : 587 Frequency : 1865.2 MHz	Channel : 610 Frequency : 1869.8 MHz
E	Channel : 687 Frequency : 1885.2 MHz	Channel : 710 Frequency : 1889.8 MHz
F	Channel : 712 Frequency : 1890.2 MHz	Channel : 735 Frequency : 1894.8 MHz

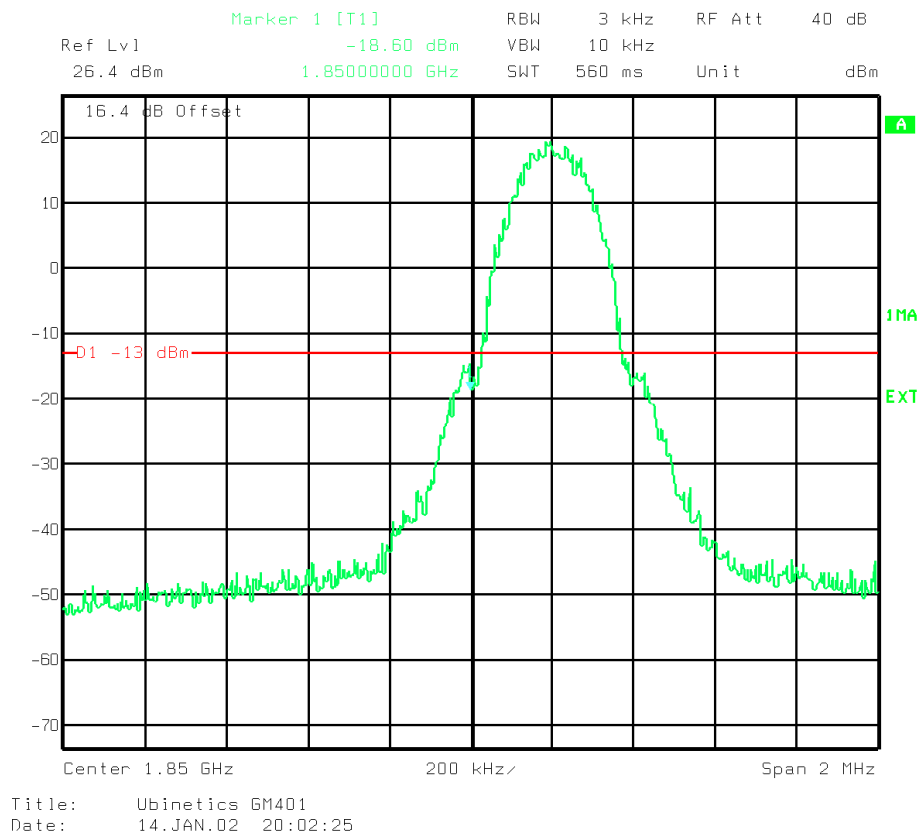
Remarks

The measurement plots are shown on the following pages.



Test Case : Spurious Emissions At Antenna Terminals (+/-1MHz)
 Test Date : 14th and 15th January 2002
 Rule Parts : 2.1049, 24.238(b)

Block Edge Measurement with EUT Transmitting on full power on Channel 512, (1850.2MHz)



Remarks

All emissions are below -13dBm up to 1MHz away from the block edge.

Test Equipment Used:

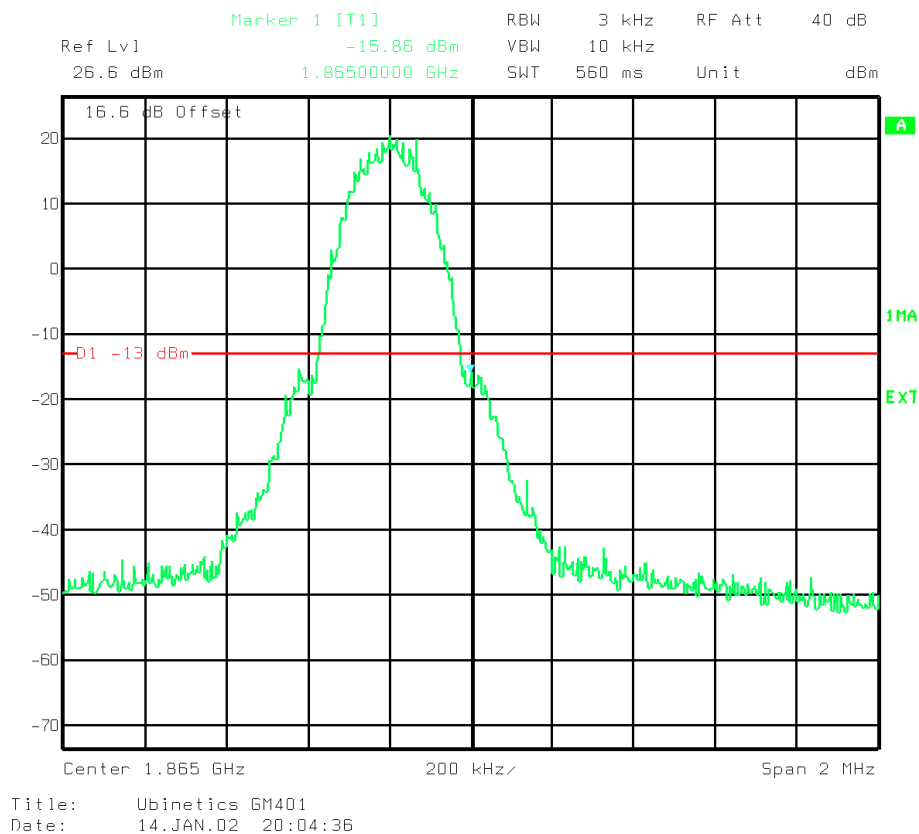
1, 2, 3, 4, 5, 6, 7

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Test Case : Spurious Emissions At Antenna Terminals (+/-1MHz)
 Test Date : 14th January 2002
 Rule Parts : 2.1049a, 24.238(b)

Block Edge Measurement with EUT Transmitting on full power on Channel 585, (1864.8MHz)



Remarks

All emissions are below -13 dBm up to 1MHz away from the block edge.

Test Equipment Used:

1, 2, 3, 4, 5, 6, 7

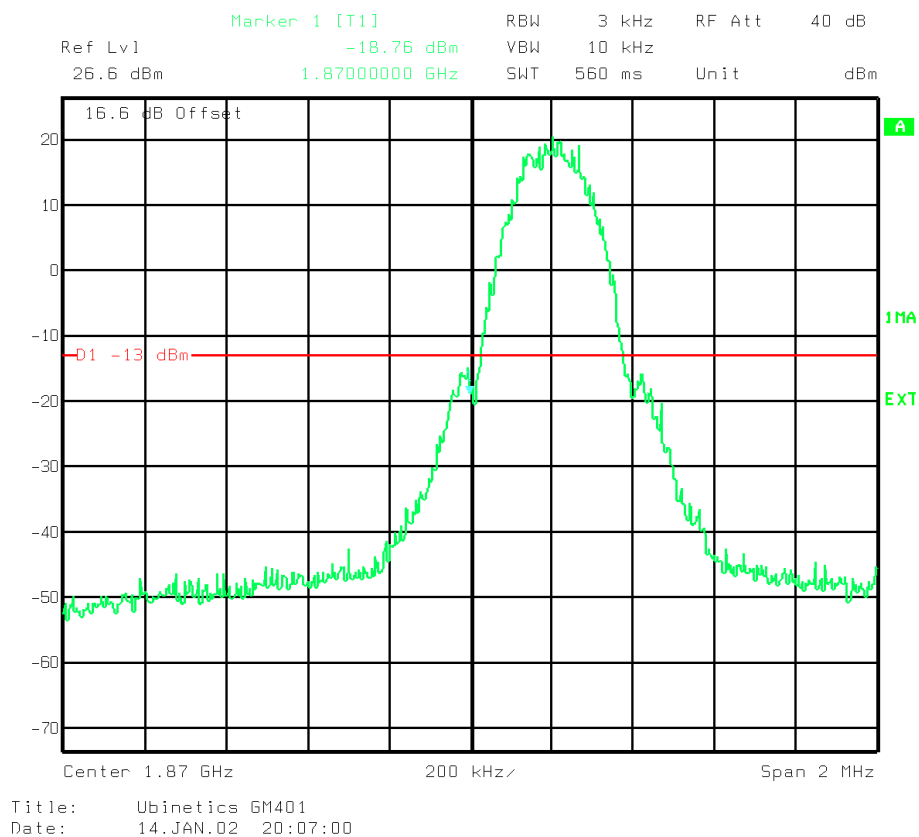
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REPORT NUMBER RO608941



Test Case : Spurious Emissions At Antenna Terminals (+/-1MHz)
 Test Date : 14th January 2002
 Rule Parts : 2.1049a, 24.238(b)

Block Edge Measurement with EUT Transmitting on full power on Channel 612, (1870.2MHz)



Remarks

All emissions are below -13dBm up to 1MHz away from the block edge.

Test Equipment Used:

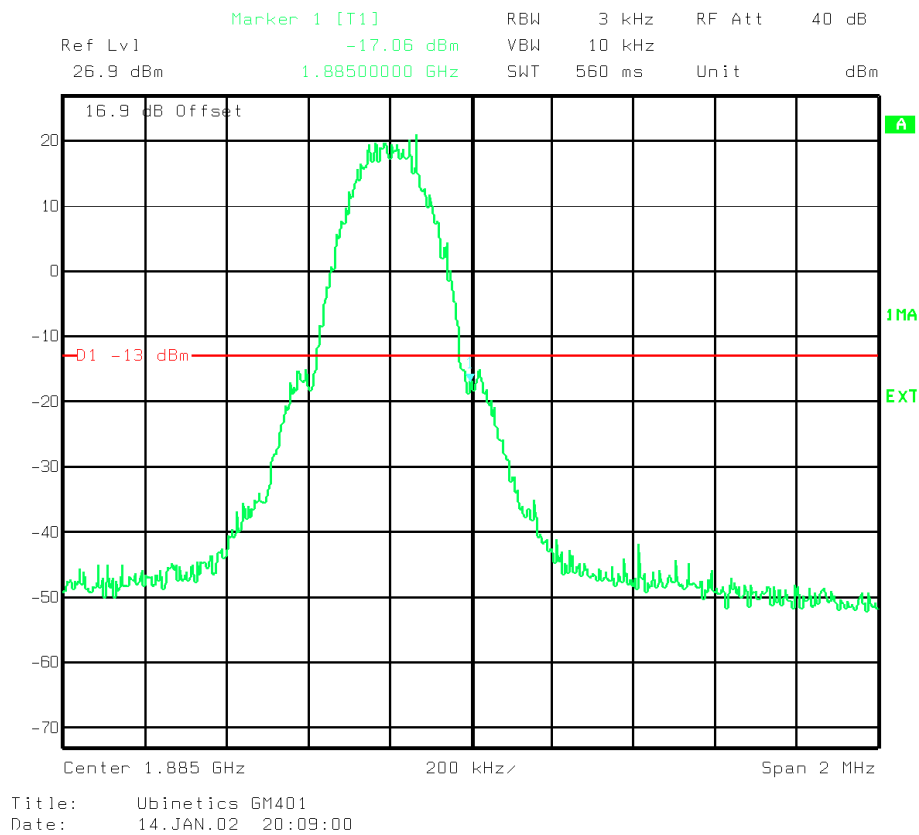
1, 2, 3, 4, 5, 6, 7

.....



Test Case : Spurious Emissions At Antenna Terminals (+/-1MHz)
 Test Date : 14th January 2002
 Rule Parts : 2.1049a, 24.238(b)

Block Edge Measurement with EUT Transmitting on full power on Channel 685, (1884.8MHz)



Remarks

All emissions are below -13dBm up to 1MHz away from the block edge.

Test Equipment Used:

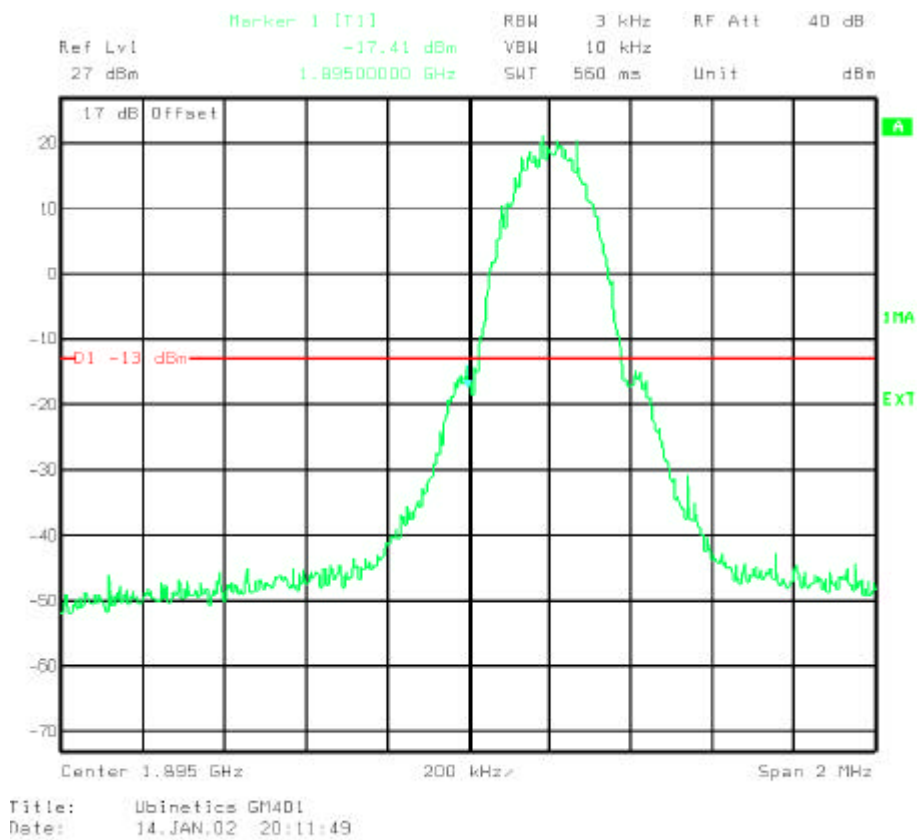
1, 2, 3, 4, 5, 6, 7

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Test Case : Spurious Emissions At Antenna Terminals (+/-1MHz)
 Test Date : 14th January 2002
 Rule Parts : 2.1049a, 24.238(b)

Block Edge Measurement with EUT Transmitting on full power on Channel 737, (1895.2MHz)



Remarks

All emissions are below -13dBm up to 1MHz away from the block edge.

Test Equipment Used:

1, 2, 3, 4, 5, 6, 7

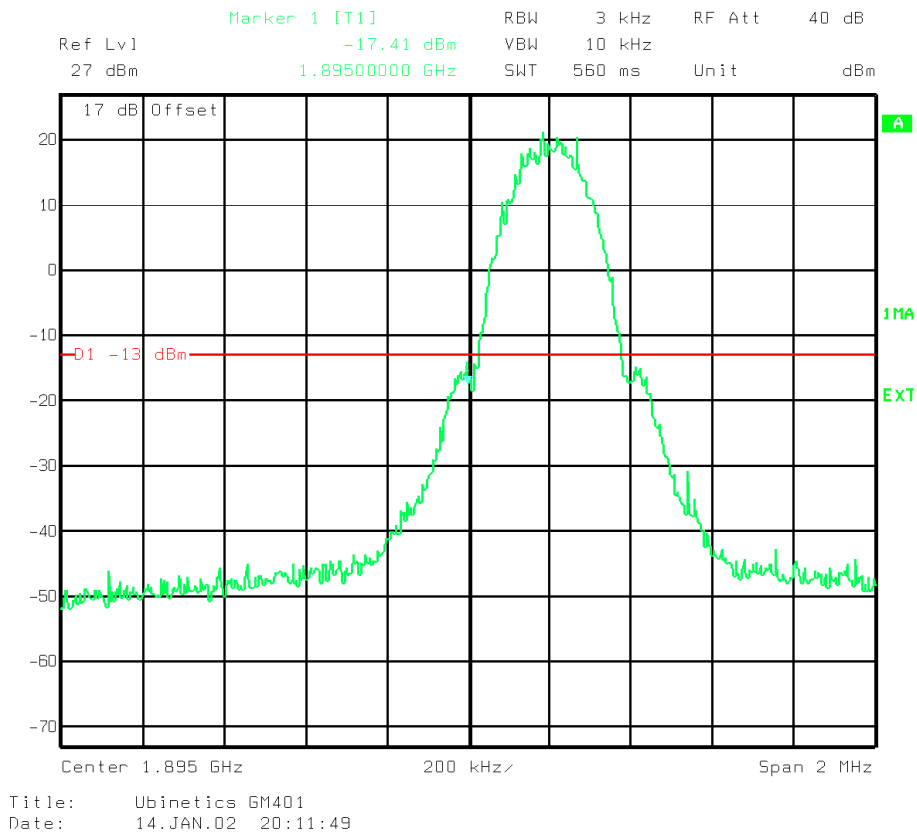
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REPORT NUMBER RO608941



Test Case : Spurious Emissions At Antenna Terminals (+/-1MHz)
 Test Date : 14th January 2002
 Rule Parts : 2.1049a, 24.238(b)

Block Edge Measurement with EUT Transmitting on full power on Channel 810, (1909.8MHz)



Remarks

All emissions are below -13dBm up to 1MHz away from the block edge.

Test Equipment Used:

1, 2, 3, 4, 5, 6, 7

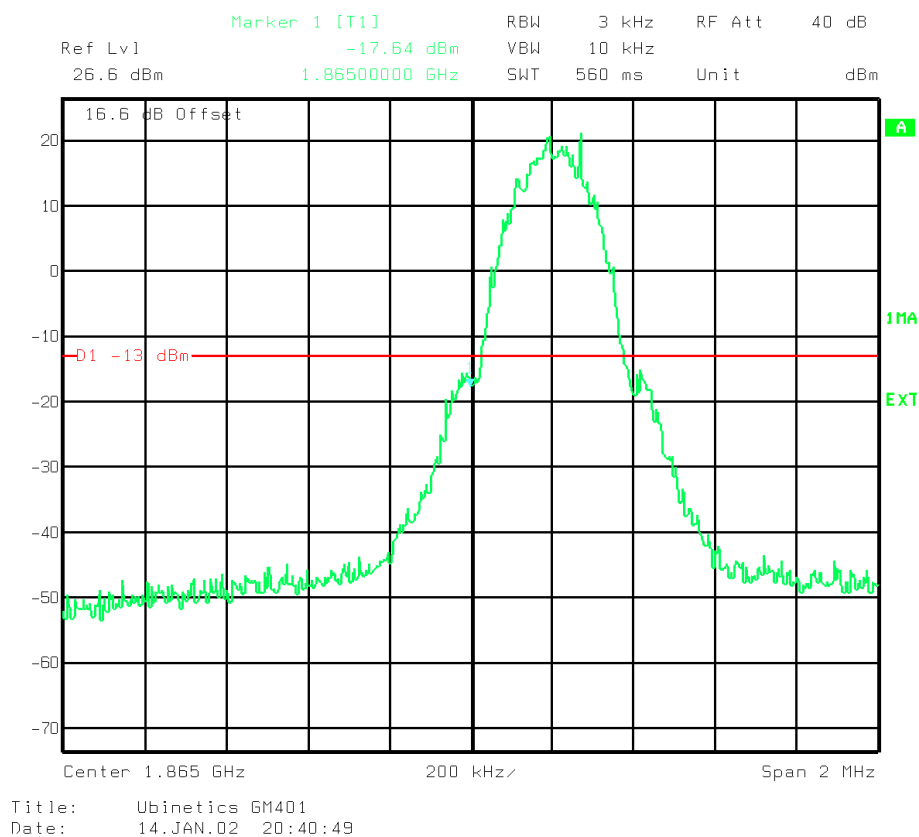
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REPORT NUMBER RO608941



Test Case : Spurious Emissions At Antenna Terminals (+/-1MHz)
 Test Date : 15th January 2002
 Rule Parts : 2.1049a, 24.238(b)

Block Edge Measurement with EUT Transmitting on full power on Channel 587, (1865.2MHz)



Remarks

All emissions are below -13dBm up to 1MHz away from the block edge.

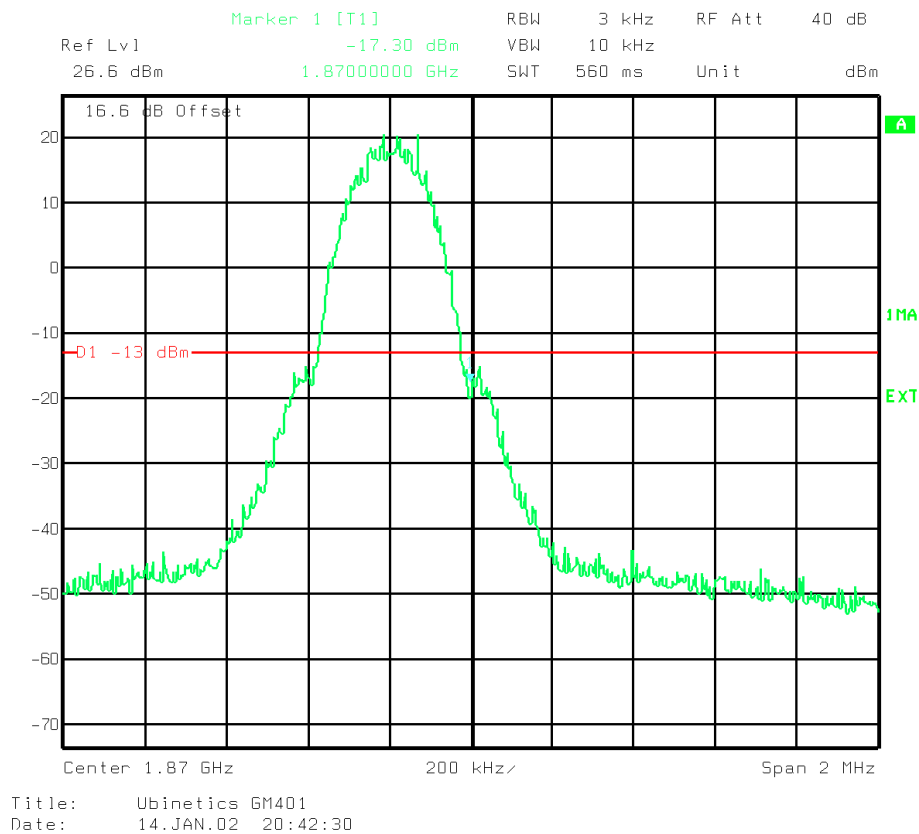
Test Equipment Used:
 1, 2, 3, 4, 5, 6, 7

REPORT NUMBER RO608941



Test Case : Spurious Emissions At Antenna Terminals (+/-1MHz)
 Test Date : 15th January 2001
 Rule Parts : 2.1049a, 24.238(b)

Block Edge Measurement with EUT Transmitting on full power on Channel 610, (1869.8MHz)



Remarks

All emissions are below -13dBm up to 1MHz away from the block edge.

Test Equipment Used:

1, 2, 3, 4, 5, 6, 7

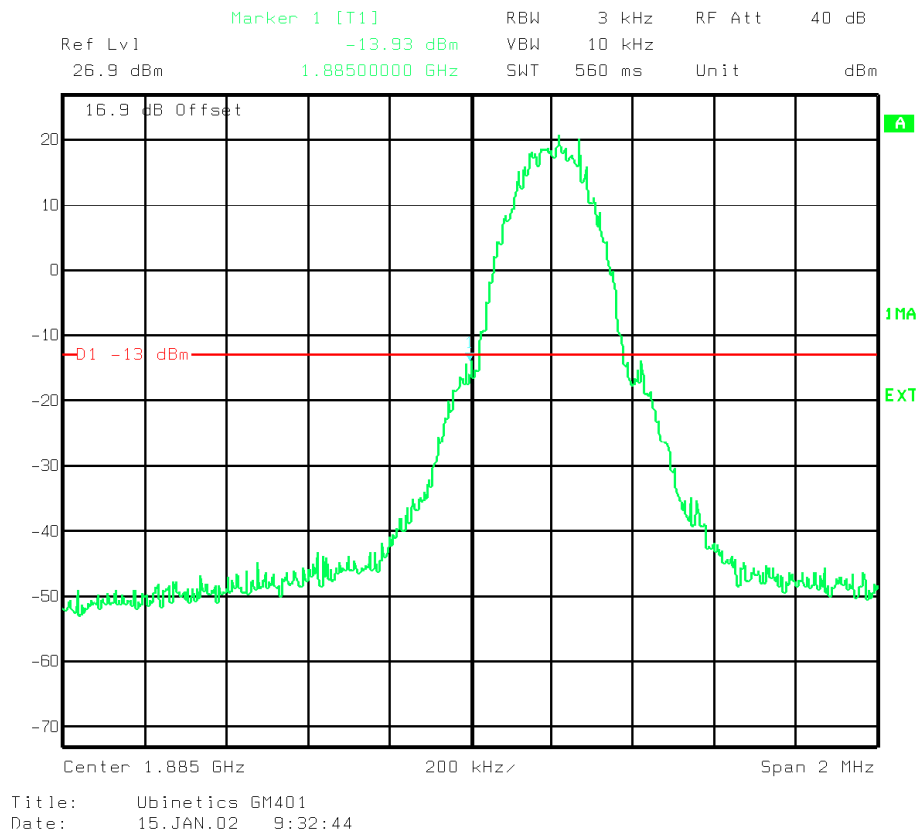
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REPORT NUMBER RO608941



Test Case : Spurious Emissions At Antenna Terminals (+/-1MHz)
 Test Date : 15th January 2001
 Rule Parts : 2.1049a, 24.238(b)

Block Edge Measurement with EUT Transmitting on full power on Channel 687, (1885.2MHz)



Remarks

All emissions are below -13dBm up to 1MHz away from the block edge.

Test Equipment Used:

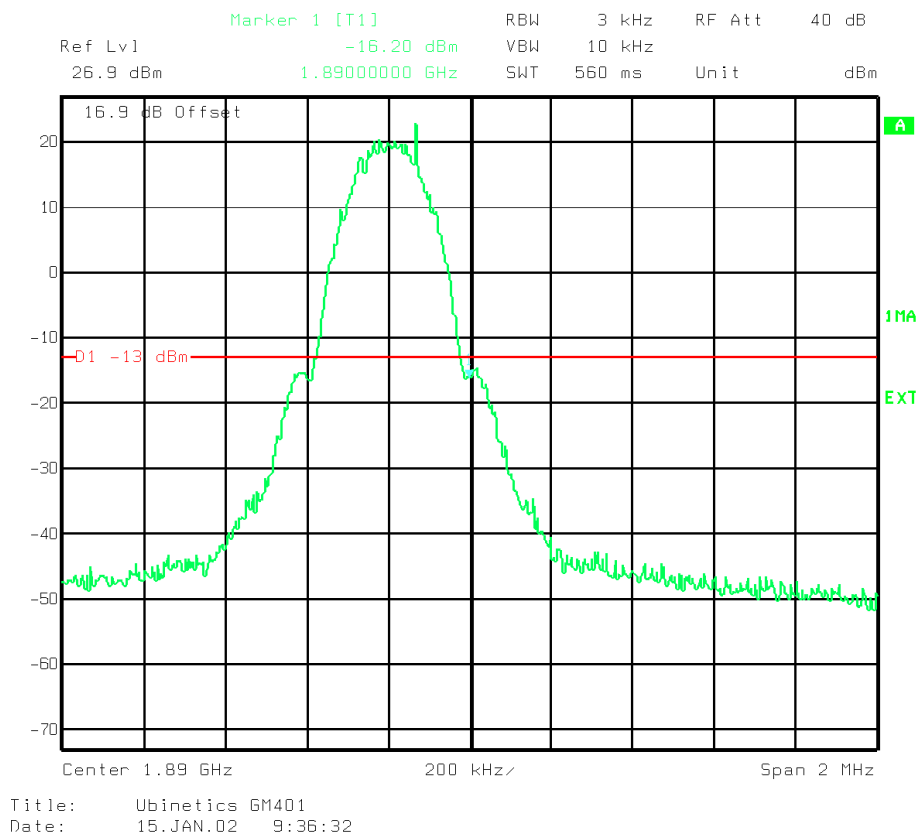
1, 2, 3, 4, 5, 6, 7

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Test Case : Spurious Emissions At Antenna Terminals (+/-1MHz)
 Test Date : 15th January 2001
 Rule Parts : 2.1049a, 24.238(b)

Block Edge Measurement with EUT Transmitting on full power on Channel 710 (1889.8MHz)



Remarks

All emissions are below -13dBm up to 1MHz away from the block edge.

Test Equipment Used:

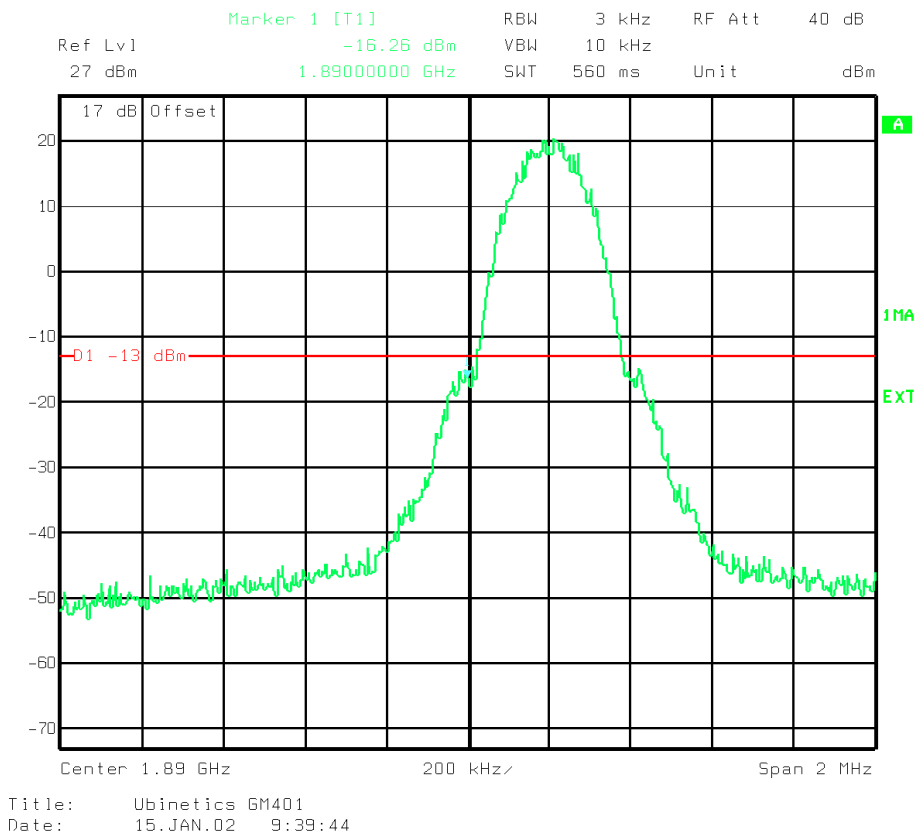
1, 2, 3, 4, 5, 6, 7

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Test Case : Spurious Emissions At Antenna Terminals (+/-1MHz)
 Test Date : 15th January 2001
 Rule Parts : 2.1049a, 24.238(b)

Block Edge Measurement with EUT Transmitting on full power on Channel 712, (1890.2MHz)



Remarks

All emissions are below -13dBm up to 1MHz away from the block edge

Test Equipment Used:

1, 2, 3, 4, 5, 6, 7

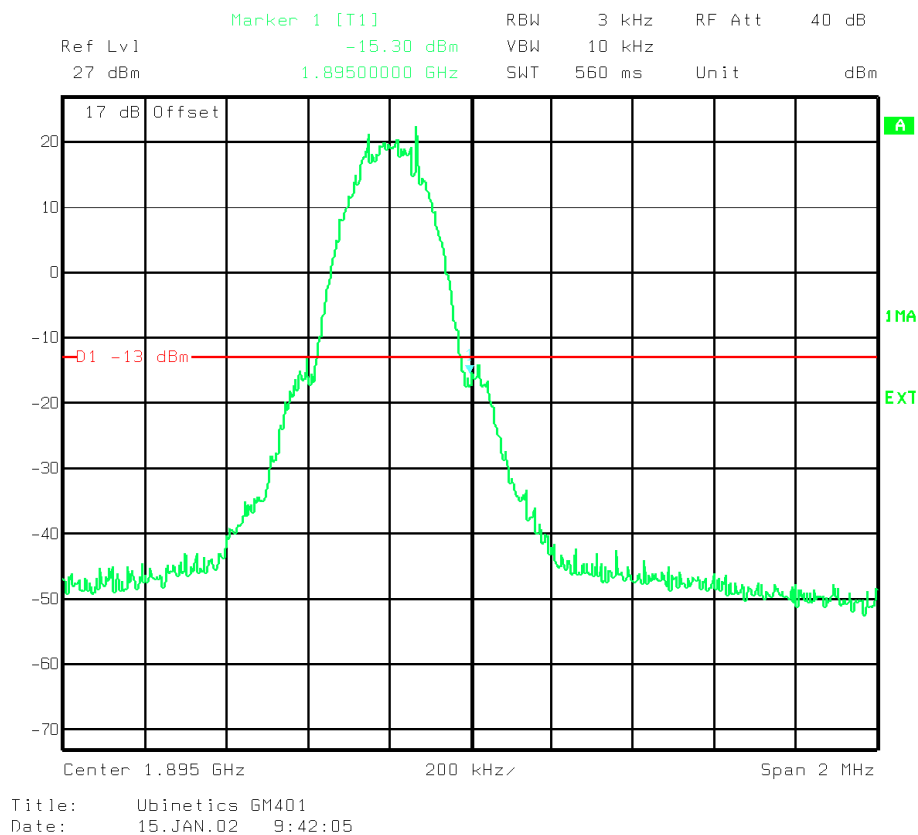
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REPORT NUMBER RO608941



Test Case : Spurious Emissions At Antenna Terminals (+/-1MHz)
 Test Date : 15th January 2002
 Rule Parts : 2.1049a, 24.238(b)

Block Edge Measurement with EUT Transmitting on full power on Channel 735, (1894.8MHz)



Remarks

All emissions are below -13dBm up to 1MHz away from the block edge.

Test Equipment Used:

1, 2, 3, 4, 5, 6, 7

.....



Test Case : Spurious Emissions
Test Date : 16th January 2002
Rule Parts : 2.1051, 24.238(a)

Measurement Method

In accordance with Part 2.1051, the spurious emissions from the antenna terminal were measured. The transmitter output power was attenuated using a combination of filters and attenuators and the frequency spectrum investigated from 9kHz to 20 GHz. The EUT was set to transmit on full power with all timeslots active and minimum power with all timeslots active. The EUT was tested on Bottom, Middle and Top channels for both power levels. The resolution and video bandwidths were set to 1MHz in accordance with Part 24.238. The spectrum analyser detector was set to Max Hold.

For measuring the range 9kHz to 4GHz, on maximum power, a 10dB attenuator was used in conjunction with an attenuator. This was to reduce saturation effects in the spectrum analyser. From 4 to 20GHz, attenuators and a high pass filter were used.

The maximum path loss across the measurement band was used as the reference level offset to ensure worst case

In addition, measurements were made up to the 10th harmonic of the fundamental.

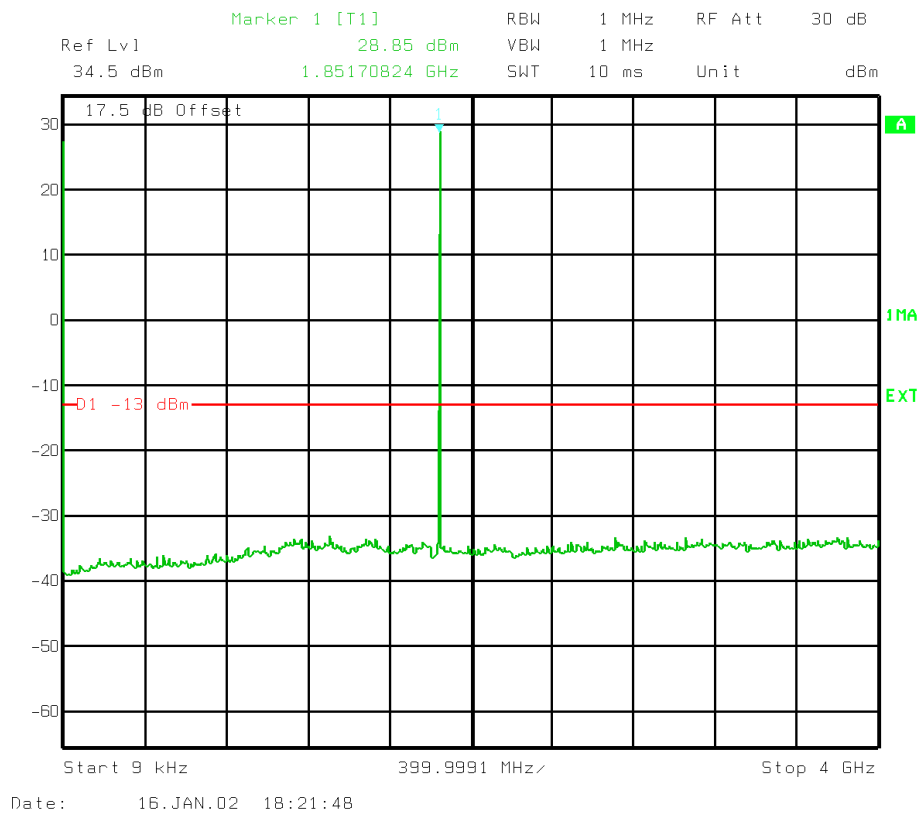
Summary Of Results

No emissions, other than the harmonics shown on pages 57 to 60, were within 20dB of the limit. The EUT passed the requirements laid out in 24.238. The plots on the following pages show the frequency spectrum from 9kHz to 20GHz of the EUT.



Test Case : Spurious Emissions
 Test Date : 16th January 2002
 Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (9kHz – 4GHz)
Channel 512 (1850.2MHz) - Maximum Power



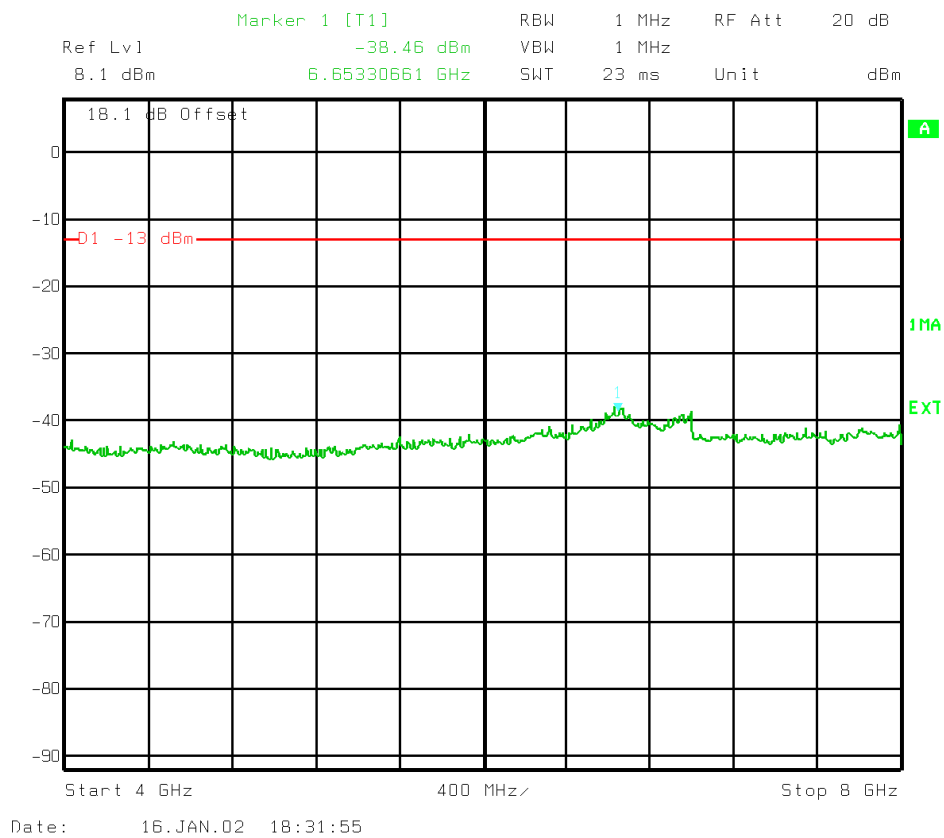
Test Equipment Used:
 1, 2, 3, 4, 5, 6, 7

REPORT NUMBER RO608941



Test Case : Spurious Emissions
 Test Date : 16th January 2002
 Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (4GHz – 8GHz)
Channel 512 (1850.2MHz) – Maximum Power



Test Equipment Used:

1, 2, 3, 4, 5, 6, 7

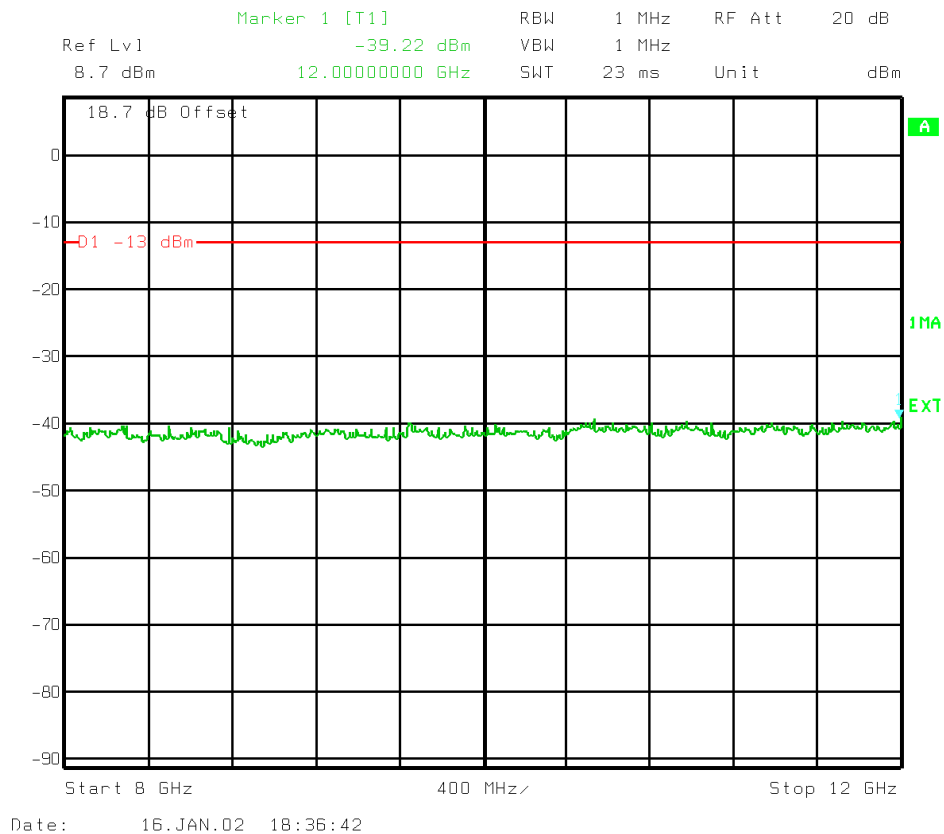
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Test Case : Spurious Emissions
 Test Date : 16th January 2002
 Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (8GHz – 12GHz)
Channel 512 (1850.2MHz) – Maximum Power



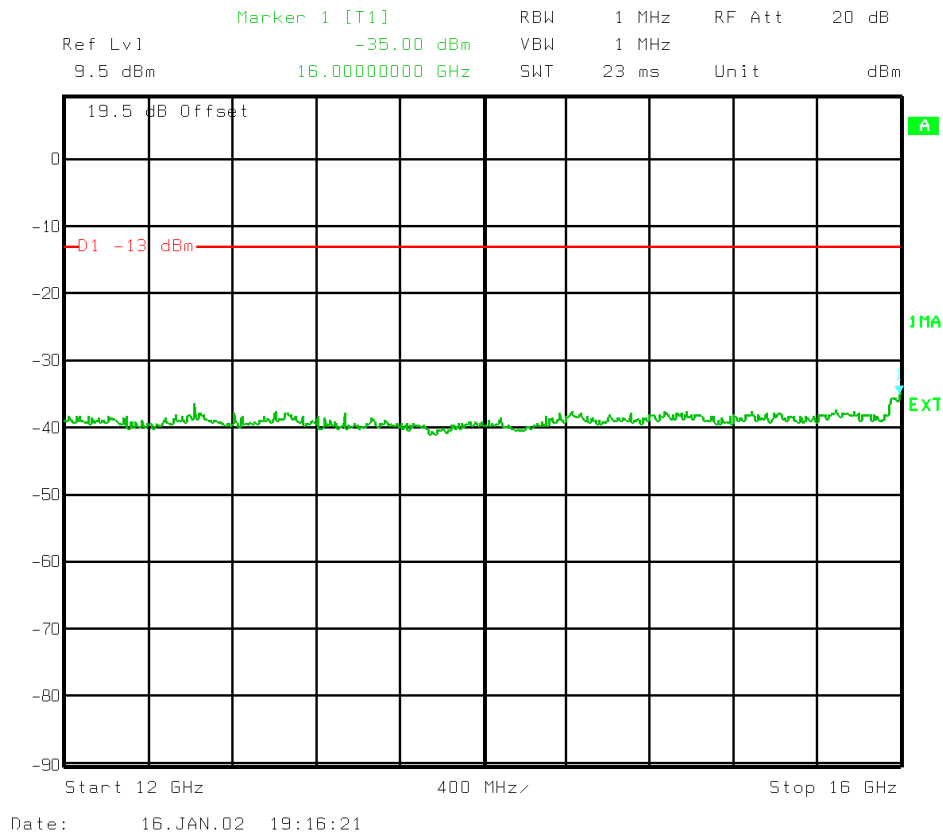
Test Equipment Used:
 1, 2, 3, 4, 5, 6, 7

REPORT NUMBER RO608941



Test Case : Spurious Emissions
 Test Date : 16th January 2002
 Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (12GHz – 16GHz)
Channel 512 (1850.2MHz) – Maximum Power



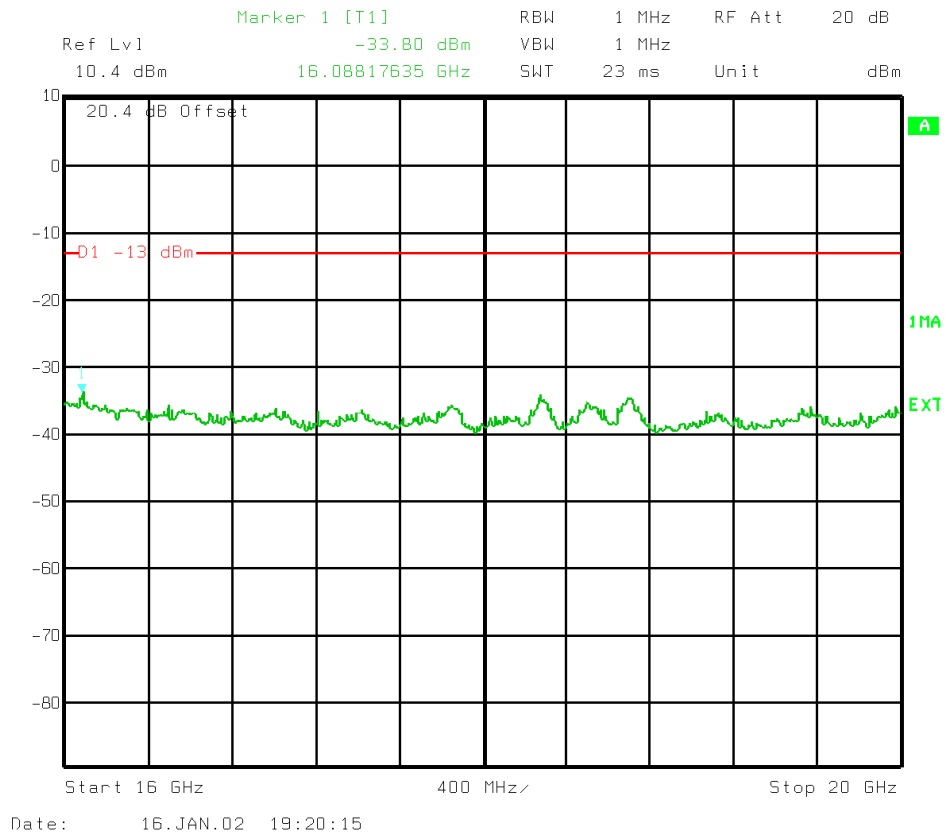
Test Equipment Used:
 1, 2, 3, 4, 5, 6, 7

REPORT NUMBER RO608941



Test Case : Spurious Emissions
 Test Date : 16th January 2002
 Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (16GHz – 20GHz)
Channel 512 (1850.2MHz) – Maximum Power

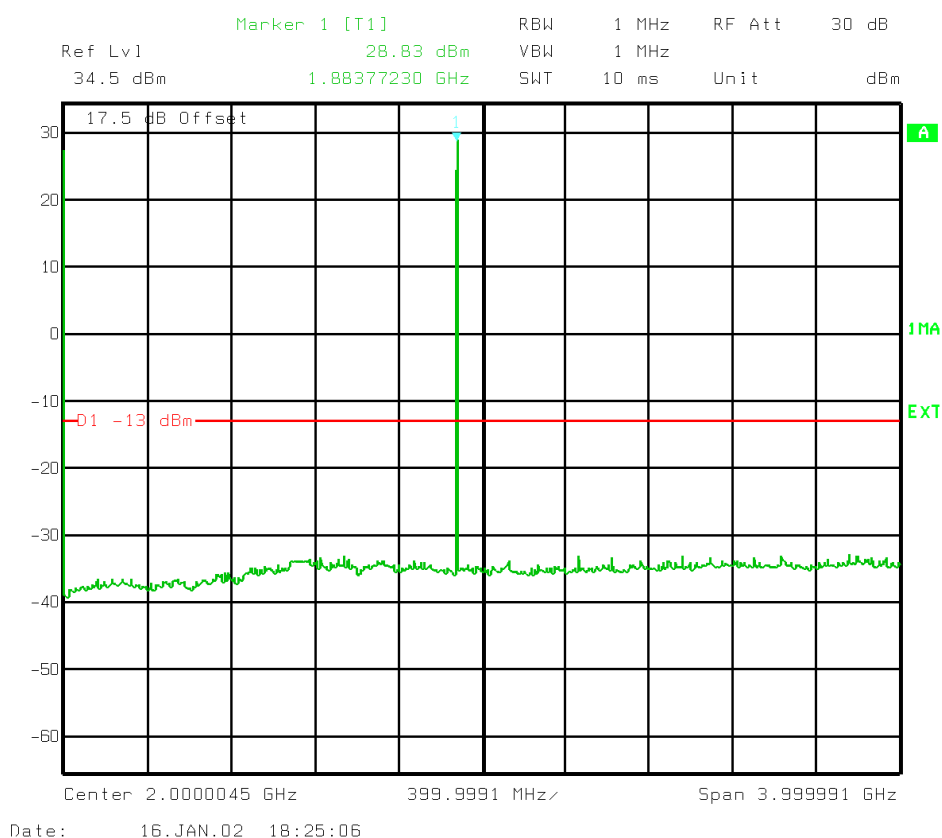


Test Equipment Used:
 1, 2, 3, 4, 5, 6, 7

REPORT NUMBER RO608941

Test Equipment Used:
1, 2, 3, 4, 5, 6, 7

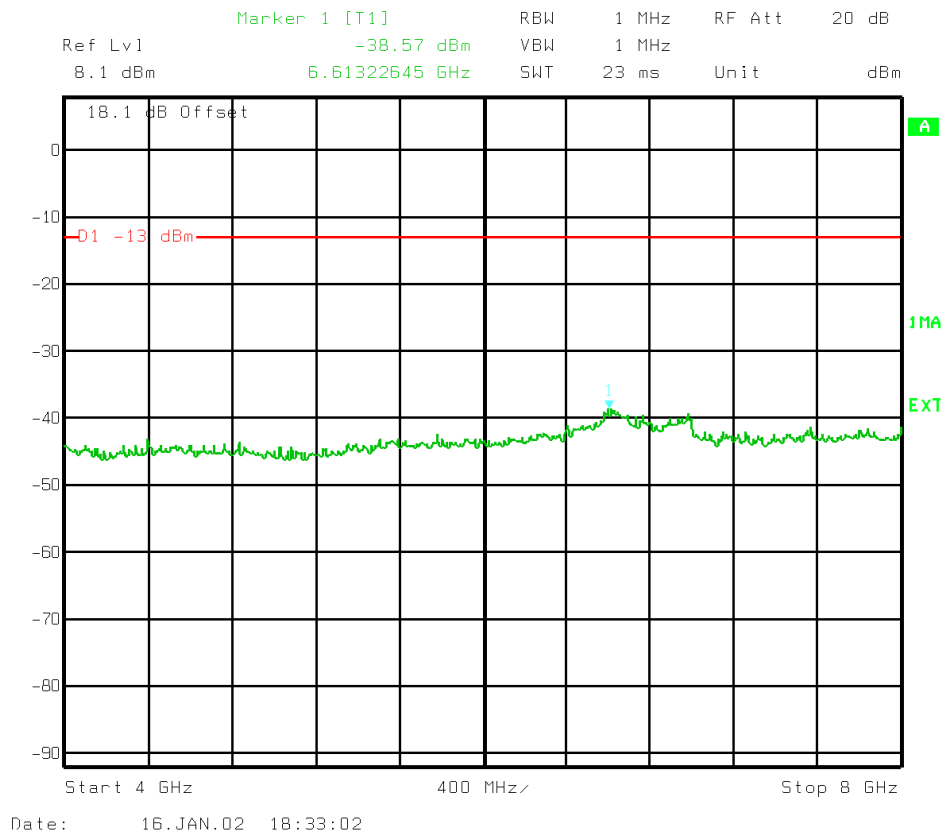
REPORT NUMBER RO608941





Test Case : Spurious Emissions
 Test Date : 16th January 2002
 Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (4GHz - 8GHz)
Channel 661 (1880.0MHz) – Maximum Power



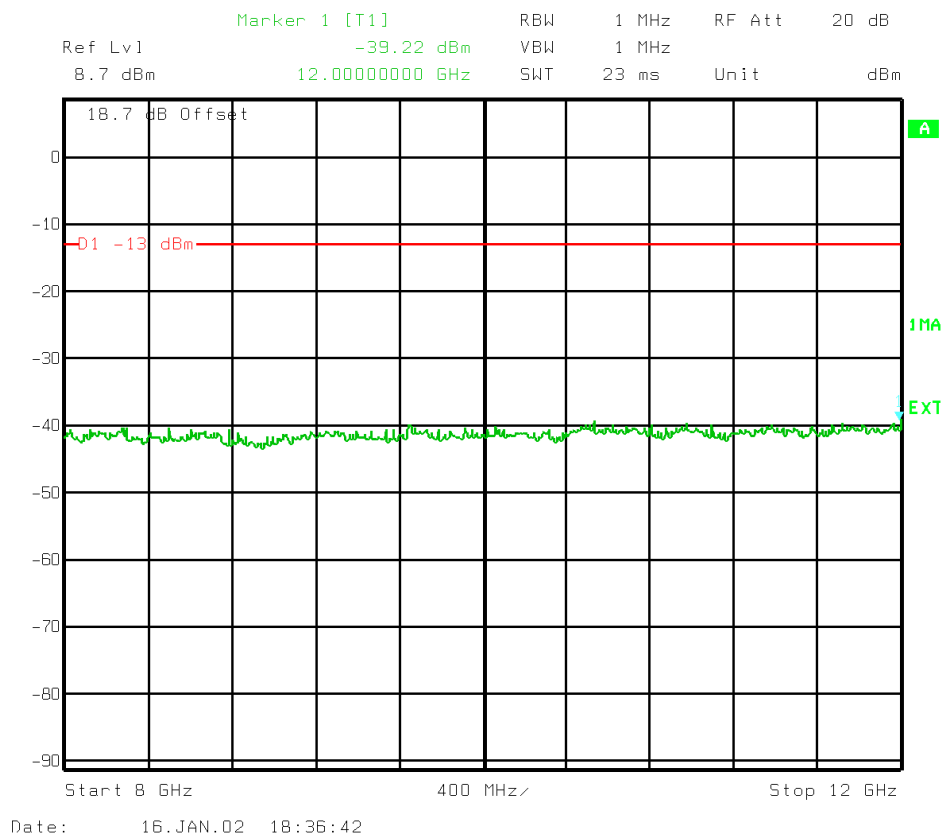
Test Equipment Used:
 1, 2, 3, 4, 5, 6, 7

REPORT NUMBER RO608941



Test Case : Spurious Emissions
Test Date : 16th January 2002
Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (8GHz – 12GHz)
Channel 661 (1880.0MHz) – Maximum Power



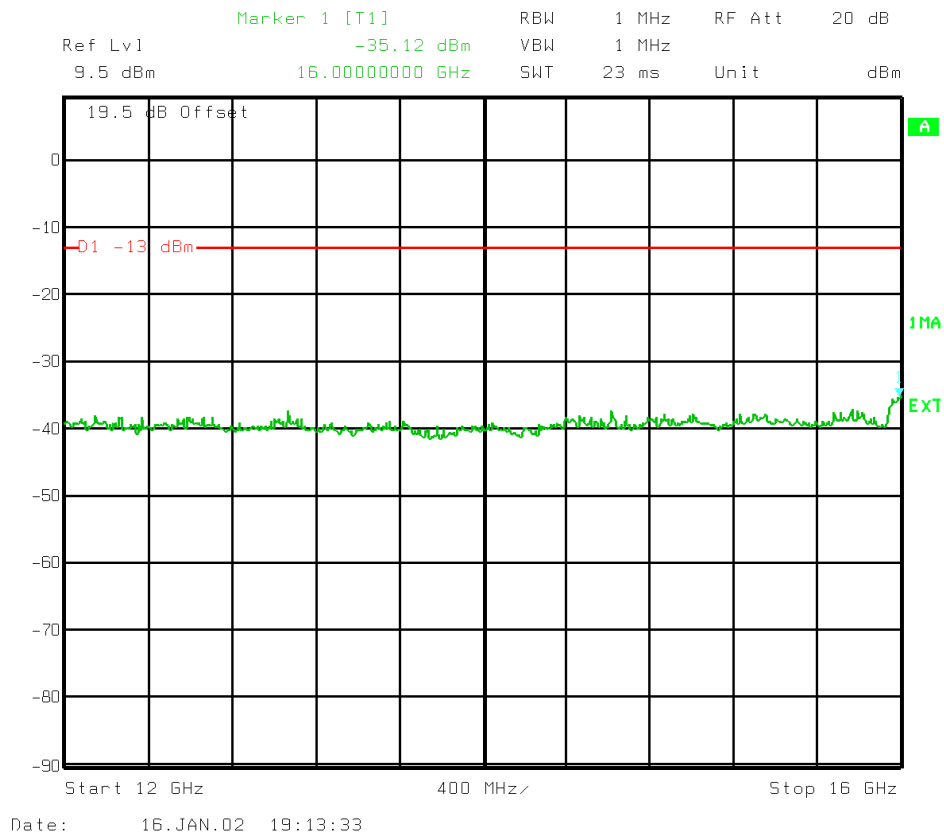
Test Equipment Used:
1, 2, 3, 4, 5, 6, 7

.....
REPORT NUMBER RO608941



Test Case : Spurious Emissions
Test Date : 16th January 2002
Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (12GHz – 16GHz)
Channel 661 (1880.0MHz) – Maximum Power



Test Equipment Used:

1, 2, 3, 4, 5, 6, 7

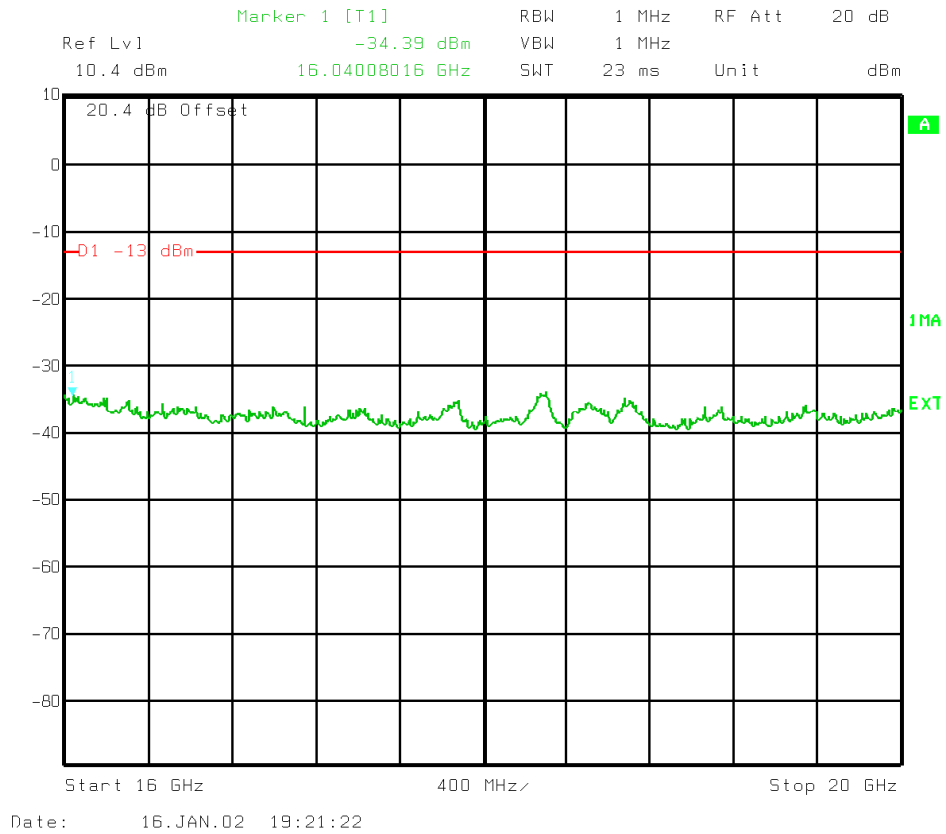
.....

REPORT NUMBER RO608941



Test Case : Spurious Emissions
 Test Date : 16th January 2002
 Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (16GHz – 20GHz)
Channel 661 (1880.0MHz) – Maximum Power



Test Equipment Used:
 1, 2, 3, 4, 5, 6, 7

REPORT NUMBER RO608941

Rule Parts : 2.1051, 24.238(a)

REPORT NUMBER RO608941

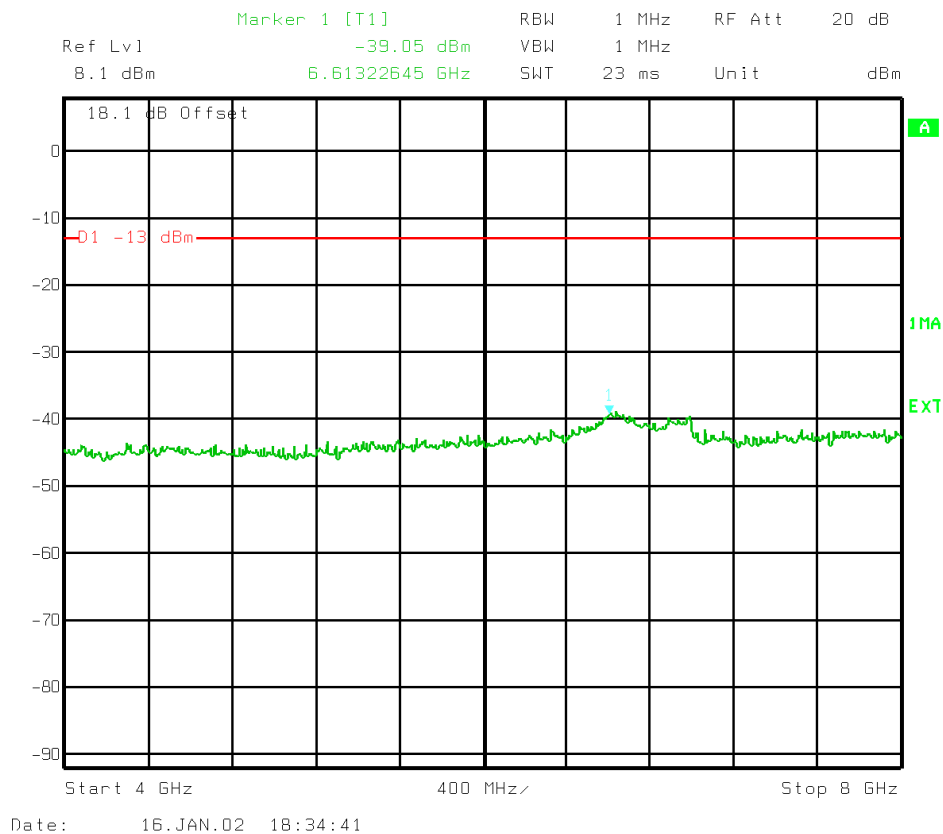


Test Case : Spurious Emissions

Test Date : 16th January 2002

Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (4GHz – 8GHz)
Channel 810 (1909.8MHz) – Maximum Power



Test Equipment Used:

1, 2, 3, 4, 5, 6, 7

.....

REPORT NUMBER RO608941

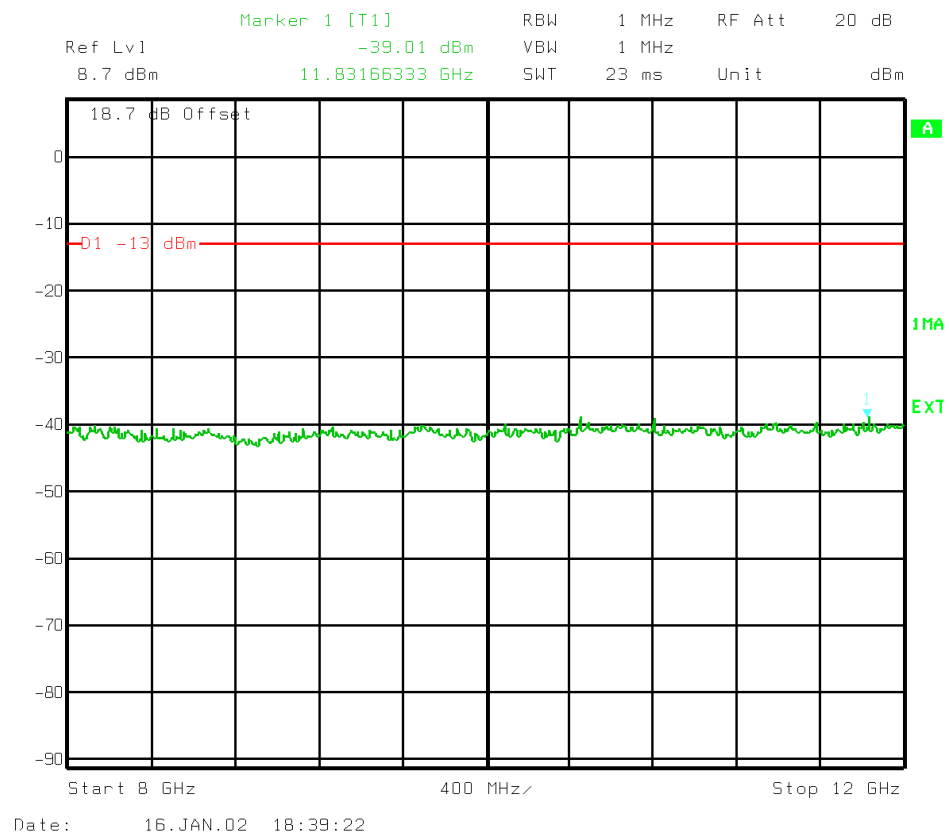


Test Case : Spurious Emissions

Test Date : 16th January 2002

Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (8GHz – 12GHz)
Channel 810 (1909.8MHz) – Maximum Power



Test Equipment Used:

1, 2, 3, 4, 5, 6, 7

.....

REPORT NUMBER RO608941

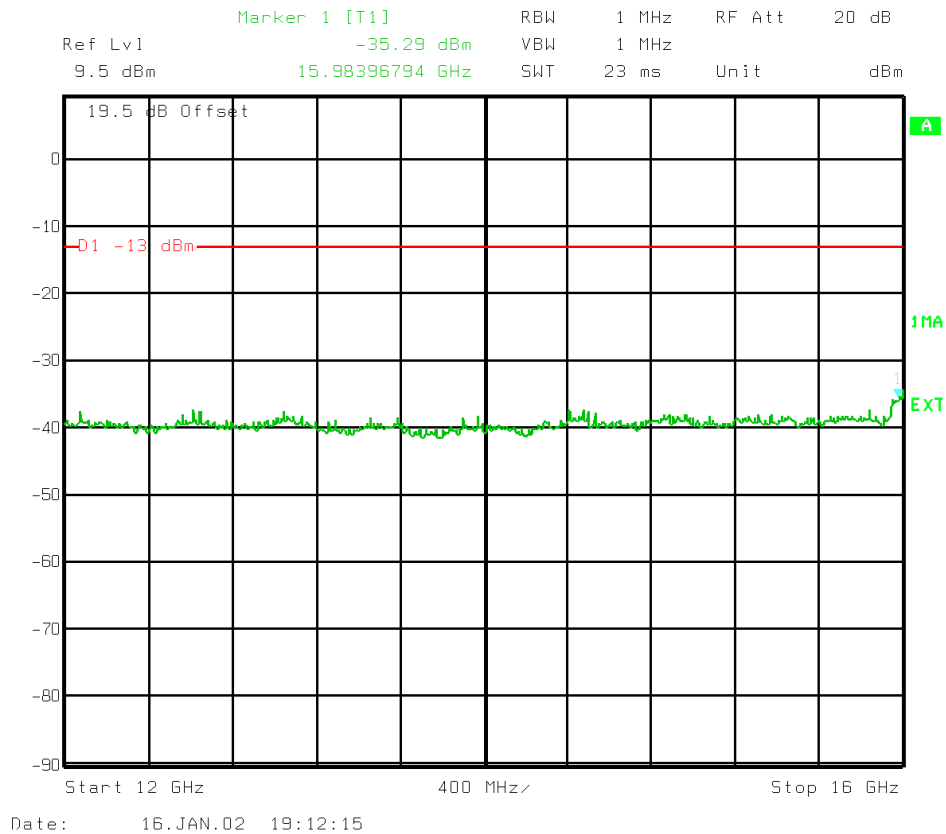


Test Case : Spurious Emissions

Test Date : 16th January 2002

Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (12GHz – 16GHz)
Channel 810 (1909.8MHz) – Maximum Power



Test Equipment Used:

1, 2, 3, 4, 5, 6, 7

.....

REPORT NUMBER RO608941

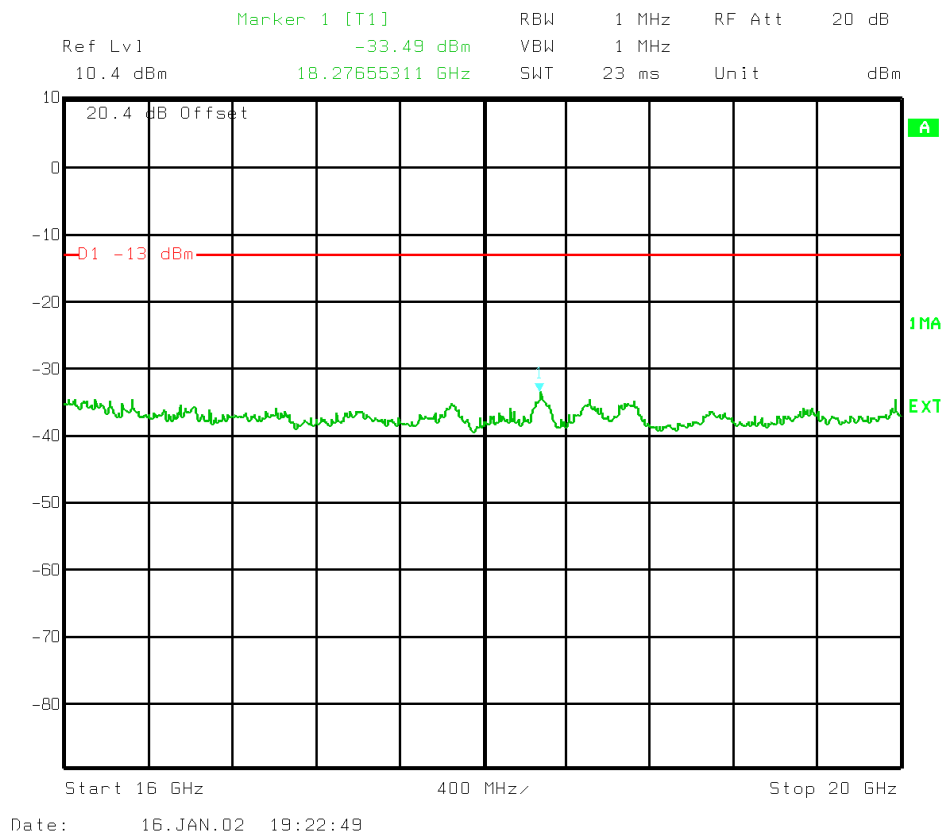


Test Case : Spurious Emissions

Test Date : 16th January 2002

Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (16GHz – 20GHz)
Channel 810 (1909.8MHz) – Maximum Power



Test Equipment Used:

1, 2, 3, 4, 5, 6, 7

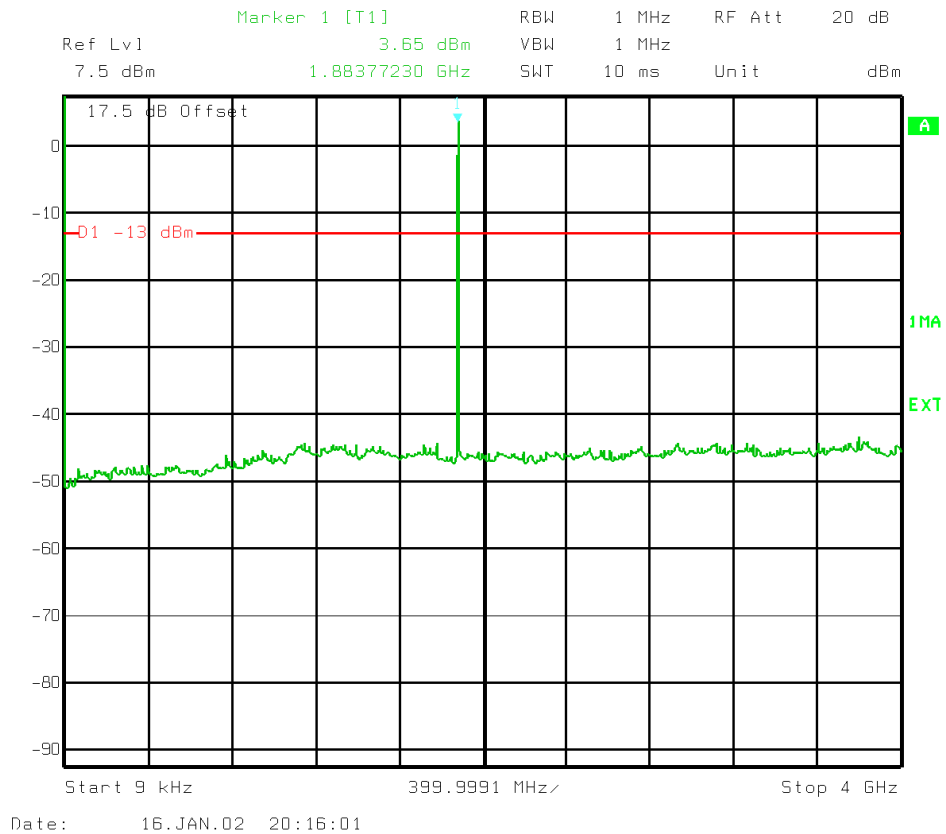
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REPORT NUMBER RO608941



Test Case : Spurious Emissions
 Test Date : 16th January 2002
 Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (9kHz – 4GHz)
Channel 512 (1850.2MHz) – Minimum Power



Test Equipment Used:
 1, 2, 3, 4, 5, 6, 7

REPORT NUMBER RO608941

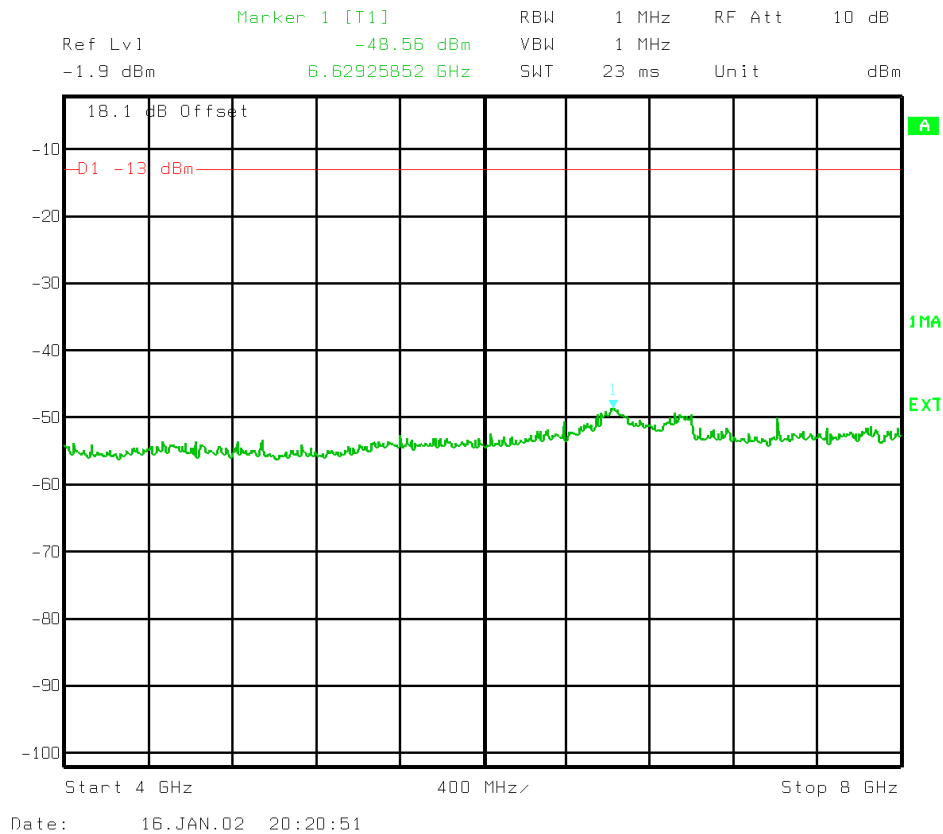


Test Case : Spurious Emissions

Test Date : 16th January 2002

Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (4GHz – 8GHz)
Channel 512 (1850.2MHz) – Minimum Power



Test Equipment Used:

1, 2, 3, 4, 5, 6, 7

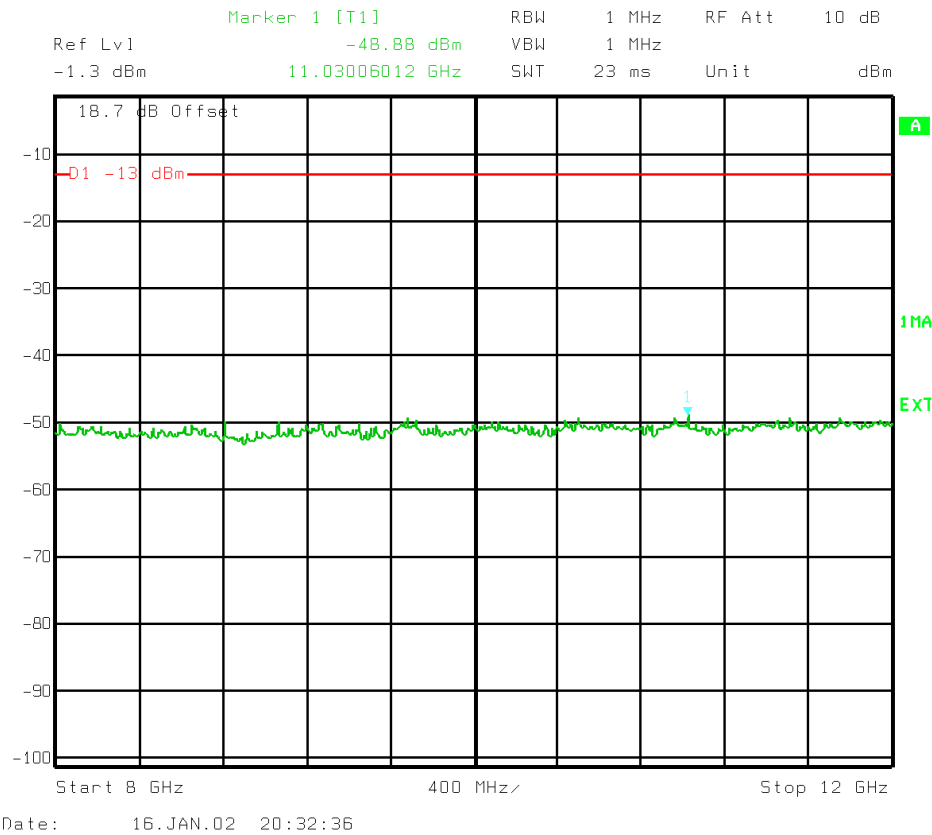
.....

REPORT NUMBER RO608941



Test Case : Spurious Emissions
Test Date : 16th January 2002
Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (8GHz-12GHz)
Channel 512 (1850.2MHz) – Minimum Power





Test Equipment Used:

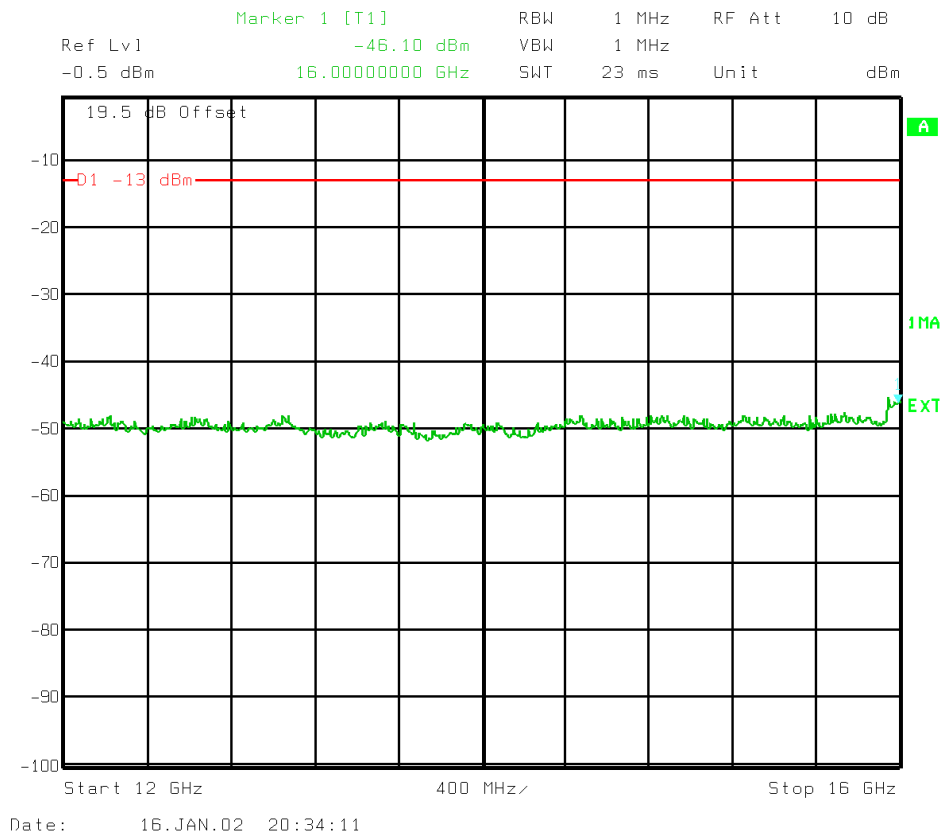
1, 2, 3, 4, 5, 6, 7

.....



Test Case : Spurious Emissions
 Test Date : 16th January 2002
 Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (12GHz – 16GHz)
Channel 512 (1850.2MHz) – Minimum Power



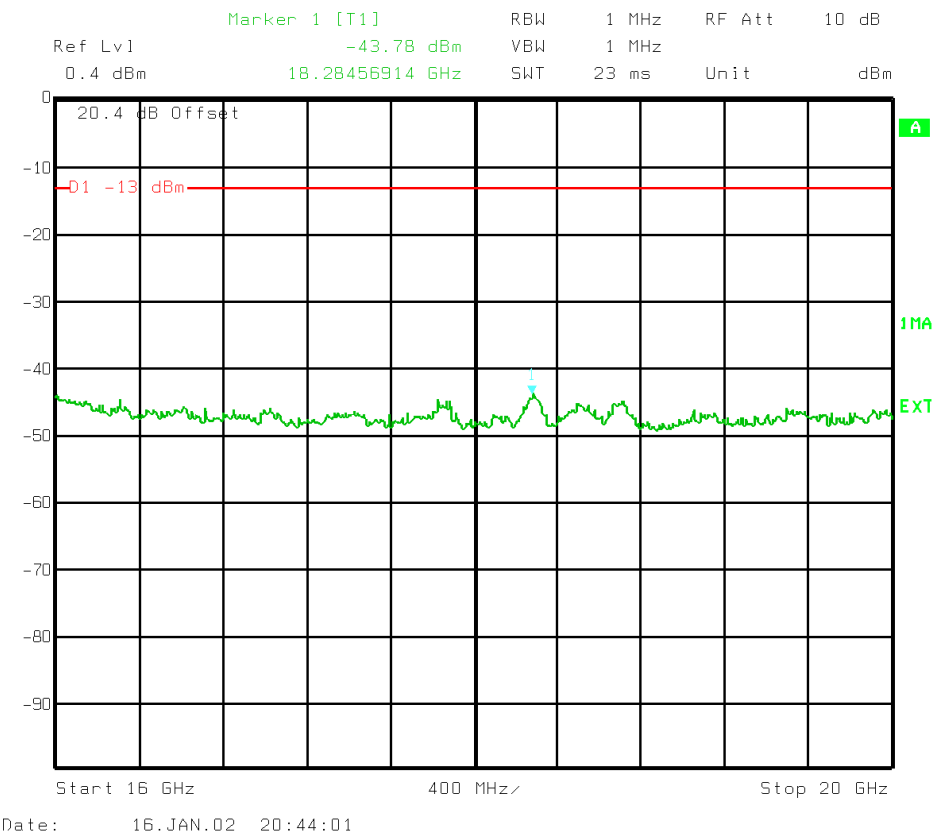
Test Equipment Used:
 1, 2, 3, 4, 5, 6, 7

.....



Test Case : Spurious Emissions
Test Date : 16th January 2002
Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (16GHz – 20GHz)
Channel 512 (1850.2MHz) – Minimum Power





Test Equipment Used:

1, 2, 3, 4, 5, 6, 7

.....

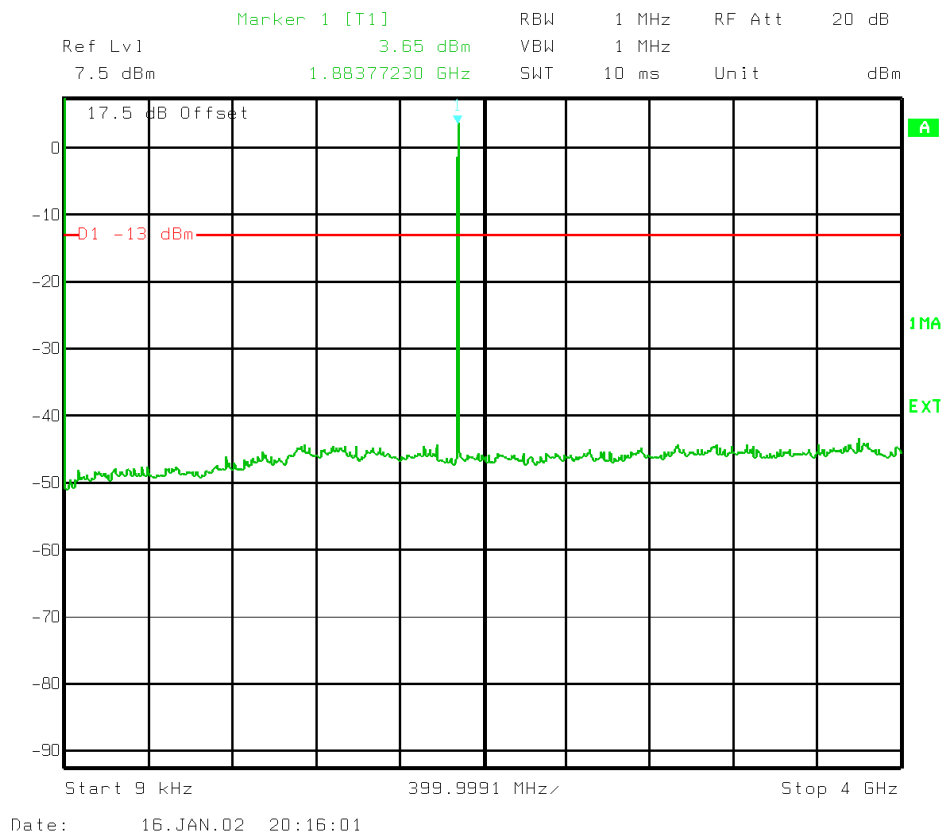


Test Case : Spurious Emissions

Test Date : 16th January 2002

Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (9kHz – 4GHz)
Channel 661 (1880.0MHz) – Minimum Power



Test Equipment Used:

1, 2, 3, 4, 5, 6, 7

.....

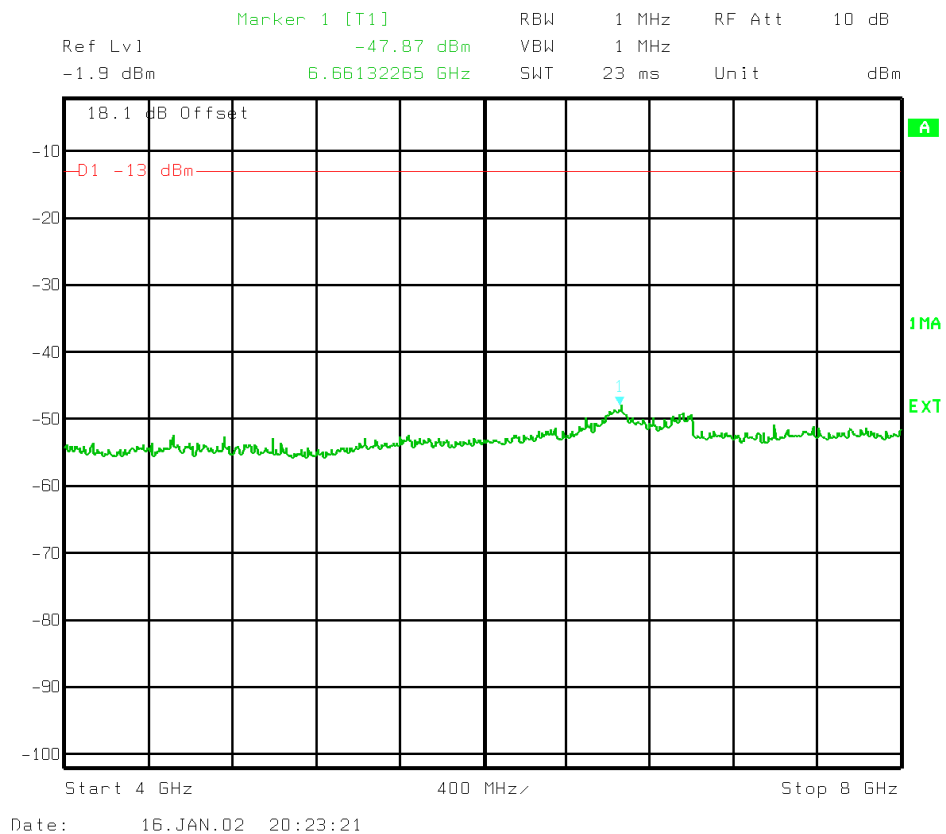


Test Case : Spurious Emissions

Test Date : 16th January 2002

Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (4GHz – 8GHz)
Channel 661 (1880.0MHz) – Minimum Power



Test Equipment Used:

1, 2, 3, 4, 5, 6, 7

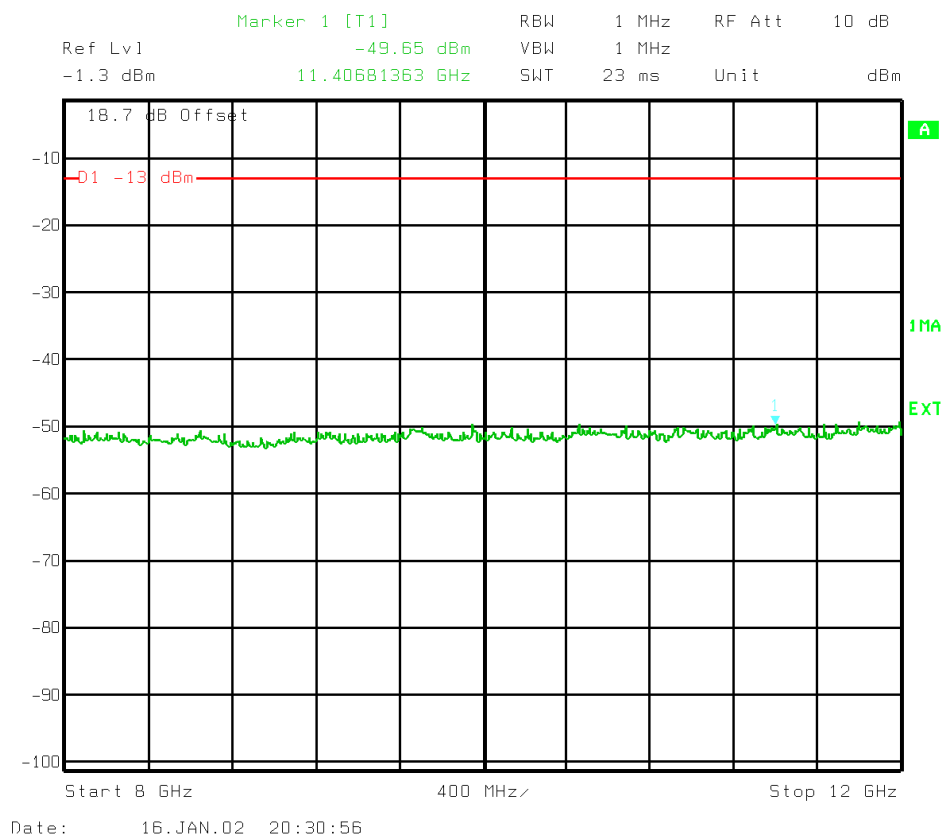
.....

REPORT NUMBER RO608941



Test Case : Spurious Emissions
Test Date : 16th January 2002
Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (8GHz – 12GHz)
Channel 661 (1880.0MHz) – Minimum Power



Test Equipment Used:
1, 2, 3, 4, 5, 6, 7

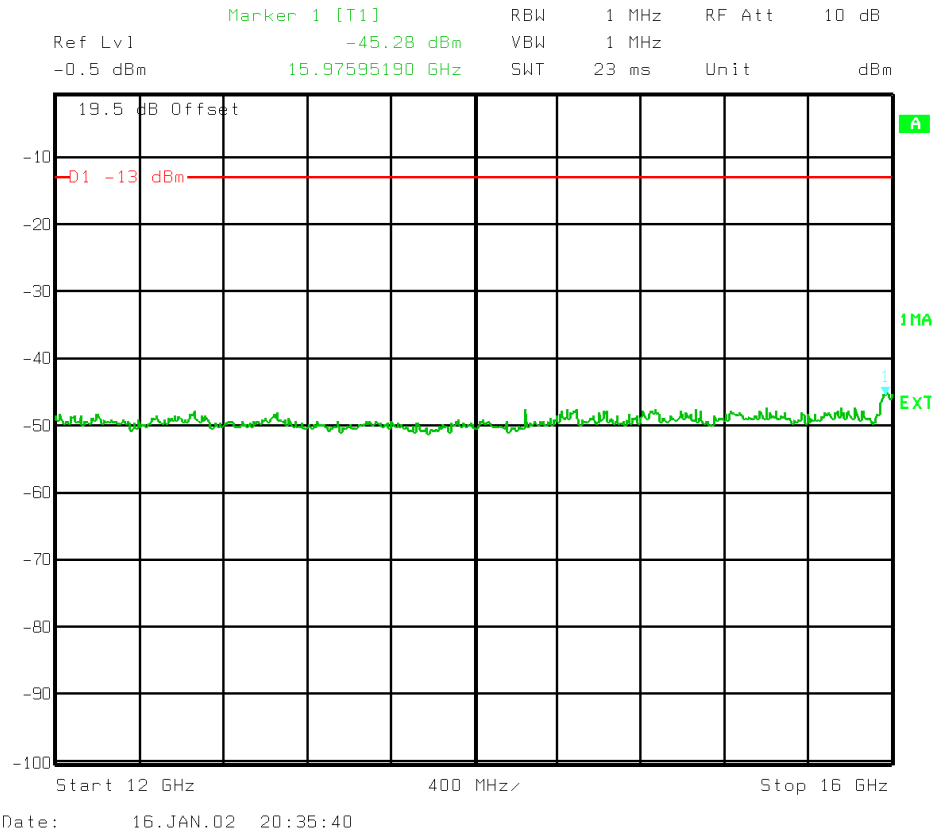
REPORT NUMBER RO608941



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Test Case : Spurious Emissions
Test Date : 16th January 2002
Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (12GHz – 16GHz)
Channel 661 (1880.0MHz) – Minimum Power





Test Equipment Used:

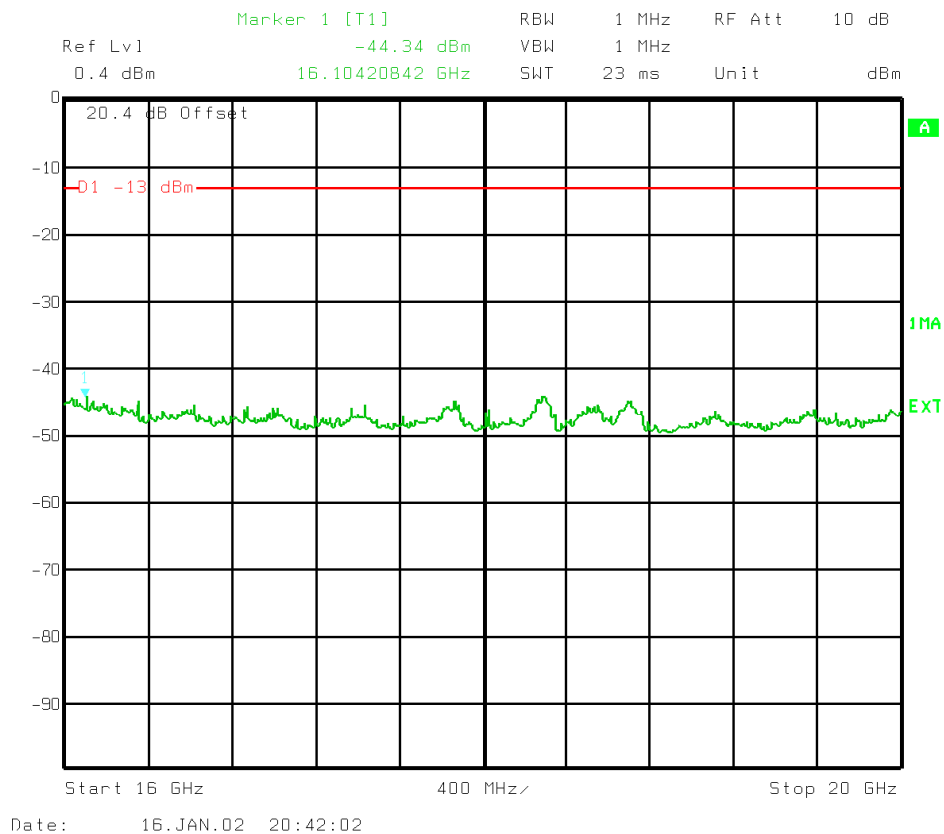
1, 2, 3, 4, 5, 6, 7

.....



Test Case : Spurious Emissions
 Test Date : 16th January 2002
 Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (16GHz – 20GHz)
Channel 661 (1880.0MHz) – Minimum Power



Test Equipment Used:

1, 2, 3, 4, 5, 6, 7

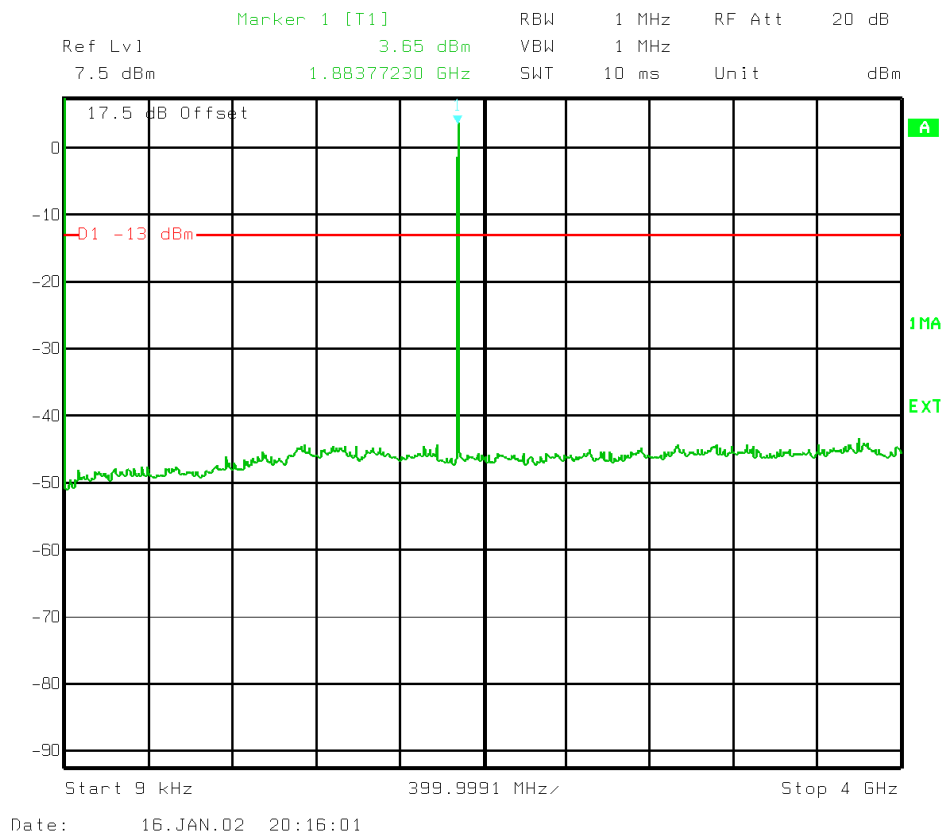
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REPORT NUMBER RO608941



Test Case : Spurious Emissions
 Test Date : 16th January 2002
 Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (9kHz – 4GHz)
Channel 810 (1909.8MHz) – Minimum Power



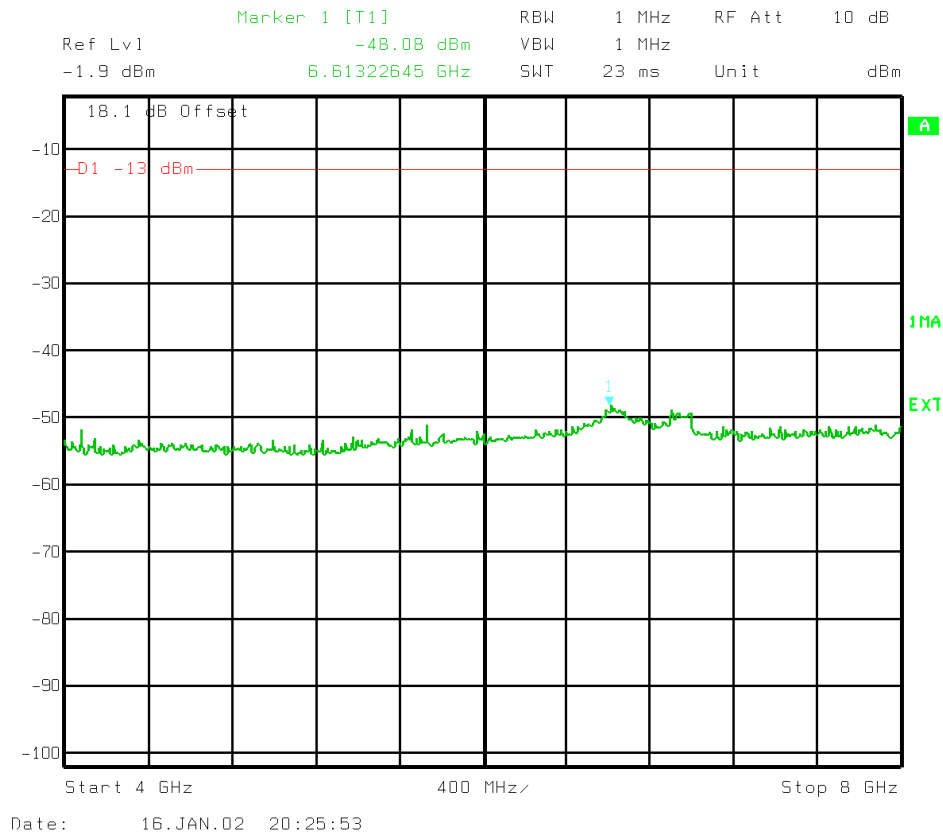
Test Equipment Used:
 1, 2, 3, 4, 5, 6, 7

REPORT NUMBER RO608941



Test Case : Spurious Emissions
 Test Date : 16th January 2002
 Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (4GHz – 8GHz)
Channel 810 (1909.8MHz) – Minimum Power



Test Equipment Used:

1, 2, 3, 4, 5, 6, 7

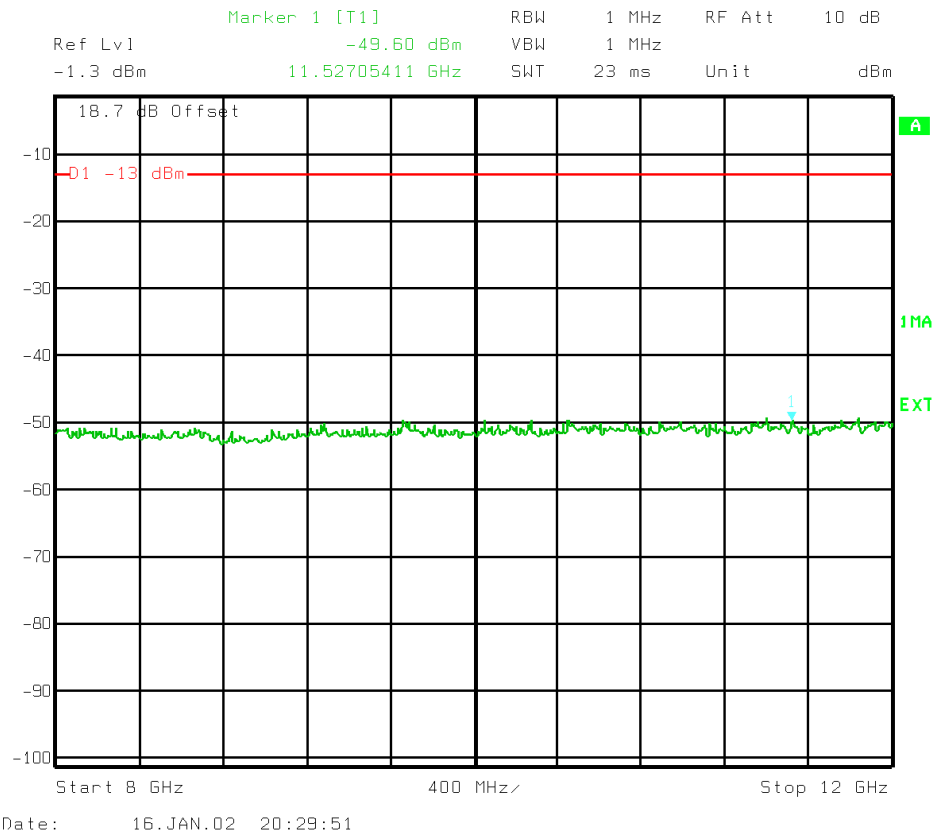
.....

REPORT NUMBER RO608941



Test Case : Spurious Emissions
Test Date : 16th January 2002
Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (8GHz – 12GHz)
Channel 810 (1909.8MHz) – Minimum Power



Test Equipment Used:

REPORT NUMBER RO608941



1, 2, 3, 4, 5, 6, 7

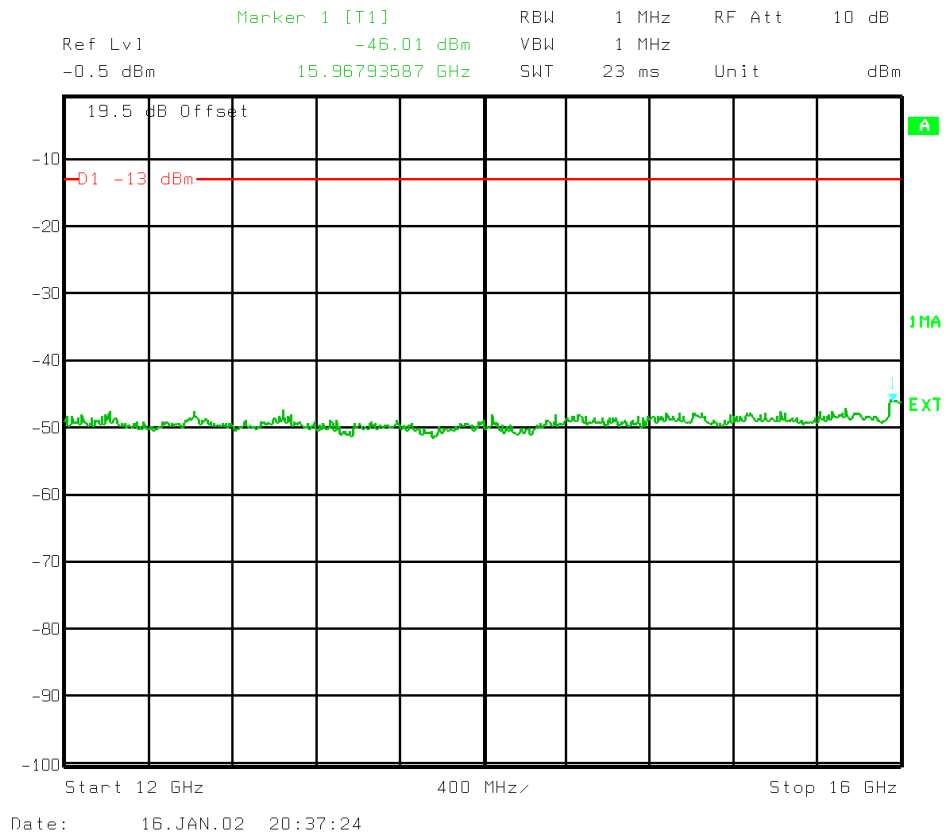
.....

Test Case : Spurious Emissions

Test Date : 16th January 2002

Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (12GHz – 16GHz)
Channel 810 (1909.8MHz) – Minimum Power





Test Equipment Used:

1, 2, 3, 4, 5, 6, 7

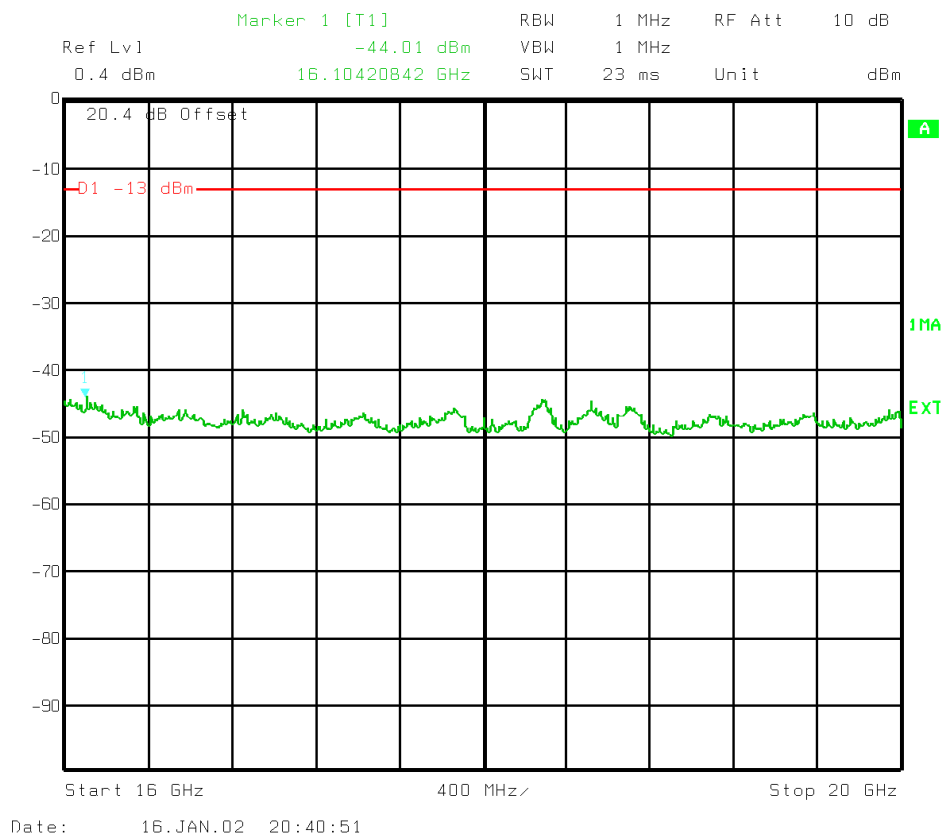
.....

Test Case : Spurious Emissions

Test Date : 16th January 2002

Rule Parts : 2.1051, 24.238(a)

Spurious Emissions (16GHz – 20GHz)
Channel 810 (1909.8MHz) – Minimum Power





Test Equipment Used:

1, 2, 3, 4, 5, 6, 7

.....



Test Case : Spurious Emissions
 Test Date : 16th January 2002
 Rule Parts : 2.1051, 24.238(a)

Harmonic Emissions

Channel 512 (1850.2MHz) – Maximum Power

Frequency (GHz)	Raw Result (dBm)	Path Loss (dB)	Corrected Result (dBm)	Limit (dBm)
3.7004	- 66.1	- 12.5	- 53.6	-13
5.5506	- 65.1	- 11.5	- 53.6	-13
7.4008	- 61.3	- 15.5	- 45.8	-13
9.2510	- 52.5	- 9.16	- 43.34	-13
11.1012	- 74.4	- 13.9	- 60.5	-13
12.9514	- 72.4	- 10.7	- 61.7	-13
14.8016	- 71.1	- 10.0	- 61.1	-13
16.6068	- 72.7	- 10.3	- 62.4	-13
18.4120	- 72.0	- 13.0	- 59.0	-13

*Instrumentation Noise Floor

Harmonic Emissions

Channel 661 (1880.0MHz)– Maximum Power

Frequency (GHz)	Raw Result (dBm)	Path Loss (dB)	Corrected Result (dBm)	Limit (dBm)
3.760	- 55.3	- 7.8	- 47.5	- 13
5.640	- 61.0	- 12.4	- 48.6	- 13
7.520	- 66.0	-13.3	- 52.7	- 13
9.400	- 59.6	- 12.3	- 47.3	- 13
11.280	- 74.3	- 10.8	- 63.5	- 13
13.160	- 73.2	- 11.1	- 62.1	- 13
15.040	- 70.9	- 11.1	- 59.8	- 13
16.920	- 71.5	- 12.1	- 59.4	- 13
18.800	- 67.9	- 13.1	- 54.8	- 13

*Instrumentation Noise Floor



Test Case : Spurious Emissions (continued)

Test Date : 16th January 2002

Harmonic Emissions

Channel 810 (1909.8MHz) – Maximum Power

Frequency (GHz)	Raw Result (dBm)	Path Loss (dB)	Corrected Result (dBm)	Limit (dBm)
3.8196	- 60.20	- 12.6	- 47.6	-13
5.7294	- 61.50	- 18.3	- 43.2	-13
7.6392	- 59.4	- 15.0	- 44.4	-13
9.5490	- 55.6	- 10.0	- 45.6	-13
11.4588	- 74.6	- 9.3	- 65.3	-13
13.3686	- 71.50	- 11.4	- 60.1	-13
15.2784	- 72.0	- 10.4	- 61.6	-13
17.1882	-72.1	- 11.9	- 60.2	-13
19.0980	- 66.5	- 15.1	- 51.4	-13

Test Equipment Used:

1, 2, 3, 4, 5, 6, 7

.....



Test Case : Spurious Emissions

Test Date : 16th January 2002

Rule Parts : 2.1051, 24.238(a)

Harmonic Emissions

Channel 512 (1850.2MHz) – Minimum Power

Frequency (GHz)	Raw Result (dBm)	Path Loss (dB)	Corrected Result (dBm)	Limit (dBm)
3.7004	- 75.3	- 12.5	- 62.8	-13
5.5506	- 71.1	- 11.5	- 59.6	-13
7.4008	- 67.1	- 15.5	- 51.6	-13
9.2510	- 72.1	- 9.6	- 62.5	-13
11.1012	- 74.9	- 13.9	- 61.0	-13
12.9514	- 72.7	- 10.7	- 62.0	-13
14.8016	- 71.0	- 10.0	- 61.0	-13
16.6068	- 72.2	- 10.3	- 61.9	-13
18.4120	- 72.1	- 13.0	- 59.1	-13

*Instrumentation Noise Floor

Harmonic Emissions

Channel 661 (1880.0MHz) – Minimum Power

Frequency (GHz)	Raw Result (dBm)	Path Loss (dB)	Corrected Result (dBm)	Limit (dBm)
3.760	- 71.0	- 7.8	- 63.2	- 13
5.640	- 75.0	- 12.4	- 62.6	- 13
7.520	- 68.2	- 13.3	- 54.9	- 13
9.400	- 72.0	- 12.3	- 59.7	- 13
11.280	- 74.9	- 10.8	- 64.1	- 13
13.160	- 73.0	- 11.1	- 61.9	- 13
15.040	- 70.3	- 11.1	- 59.2	- 13
16.920	- 71.5	- 12.1	- 59.4	- 13
18.800	- 67.2	- 14.1	- 53.1	- 13

*Instrumentation Noise Floor



Test Case : Spurious Emissions (continued)

Test Date : 16th January 2002

Harmonic Emissions

Channel 810 (1909.8MHz) – Minimum Power

Frequency (GHz)	Raw Result (dBm)	Path Loss (dB)	Corrected Result (dBm)	Limit (dBm)
3.8196	- 67.7	- 12.6	- 55.1	- 13
5.7294	- 68.6	- 18.3	- 50.3	- 13
7.6392	- 70.6	- 15.0	- 55.6	- 13
9.5490	- 68.9	- 10.0	- 58.9	- 13
11.4588	- 75.9	- 9.3	- 66.6	- 13
13.3686	- 70.8	- 11.4	- 59.4	- 13
15.2784	- 71.9	- 10.4	- 61.5	- 13
17.1882	- 70.6	- 11.9	- 58.7	- 13
19.0980	- 68.1	- 15.1	- 53.0	- 13

Test Equipment Used:

1, 2, 3, 4, 5, 6, 7

.....



Test Case : Frequency Stability Under Temperature Variations
Test Date : 16th January 2002
Rule Parts : 2.1055, 24.135(a)

Measurement Method

Results

Temperature Interval(°C)	Test Frequency (GHz)	Deviation (Hz)	Limit (kHz)
- 30	1.88	- 28	± 1.96
- 20	1.88	- 25	± 1.96
- 10	1.88	- 24	± 1.96
0	1.88	- 23	± 1.96
+ 10	1.88	- 27	± 1.96
+ 20	1.88	- 32	± 1.96
+ 30	1.88	- 38	± 1.96
+ 40	1.88	- 48	± 1.96
+ 50	1.88	- 54	± 1.96

Limit	±0.0001% or 1ppm
-------	------------------

Remarks

EUT complies with CFR 47 Part 24.135(a). The EUT does not exceed ±1.96kHz at the measured frequency at any temperature interval across the measured range.

Test Equipment Used:

1, 2, 3, 4

.....



Test Case : Frequency Stability Under Voltage Variations

Test Date : 16th January 2002

Rule Parts : 24.135(a)

Measurement Method

Results

DC Voltage (V)	Test Frequency (GHz)	Deviation (Hz)	Deviation Limit (kHz)
3.30	1.88	- 46	± 1.96
3.60	1.88	- 32	± 1.96
4.50	1.88	- 43	± 1.96

Limit	±0.0001% or 1ppm
-------	------------------

Remarks

EUT complies with CFR 47 Part 24.135(a). The EUT does not exceed ±1.96kHz at the measured frequency either at nominal or voltage variation.



Test Equipment Used:

1, 2, 3, 4

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