
TEST REPORT

In support of the Application for Grant of Equipment Authorization of the Marconi SEMS
Base Unit and SEMS Portable Unit

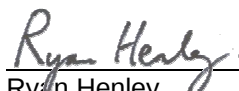
FCC ID: PW9R8060/PW9R8061

August 2002

Equipment:	Base Unit Portable Unit		
FCC ID:	PW9R8060 - Base Unit PW9R8061 - Portable Unit		
Specification:	47 CFR 2 & 47 CFR 90		
Applicant:	Marconi Applied Technologies Waterhouse Lane Chelmsford Essex CM1 2QU		
Manufacturer:	Marconi Applied Technologies Waterhouse Lane Chelmsford Essex CM1 2QU		
Manufacturer's Representative:	Mr Paul Newby		
Approved by:	 M JENKINS Wireless Group Leader		
Dated:	<u>2nd September 2002</u>		
Start of Test:	31 st January 2002		
Completion of Test:	1 st July 2002		
Report Distribution:	Marconi Applied Technologies	Mr P Newby	Copy No. 1
	BABT		Copy No. 2
			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 and Part 90 of the FCC Rules under normal use and maintenance.


Ryan Henley
Test Engineer

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47 CFR2.1046, 90.205	Power Output
47 CFR2.1047(d), 90.207	Modulation Characteristics
47 CFR2.1049(h), 90.209	Occupied Bandwidth
47 CFR2.1049(h), 90.210	Emission Masks
47 CFR2.1051, 90.210	Conducted Emissions
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Introduction

The information contained within this report is intended to show verification of compliance of the Marconi SEMS Base Unit and SEMS Portable Unit against the requirements of 47 CFR 2 and 47 CFR 90.

Location Of Testing

All testing was performed at TUV Product Service Ltd, Segensworth Road, Fareham, PO15 5RH. 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	Hygrometer	1 – 1000	Rotronic	182615	26/09/02
2	DC Power Supply	6267B	Hewlett Packard	2333A08847	T/U
3	Digital Voltmeter	70 III	Fluke	7230985	04/01/03
4	Attenuator	47-10-34	Weinschel	AT4937	
5	Spectrum Analyser	FSEM	Rohde & Schwarz	827285/006	28/12/02
6	RF Combiner	1506A	Weinschel Eng.	KA845	15/01/03
7	Signal Generator	SMY 01	Rohde & Schwarz	839957-055	15/08/02
8	Modulation Analyser	FAM 334.20	Rohde & Schwarz	881247/070	31/02/02
9	Oscilloscope	LC534AL	LeCroy	1147	11/02/02
10	High Freq Rejection Network	3013	Emco	2174	T/U
11	Attenuator	6534/4	Marconi	41901	11/07/02
12	Spectrum Anlayser	8568B	Hewlett Packard	1745A00160-00148	24/02/02
13	Quasi-Peak Adaptor	85650A	Hewlett Packard	2521A00849	24/02/02
14	RF Preselector	85685A	Hewlett Packard	2648A00442	24/02/02
15	Biconical Antenna	94455-1	Ailtech	0665	05/12/02
16	Log Periodic Antenna	AT1000	Amplifier Research	4573/035	16/11/02
17	Turntable & Controller	1060	Emco	-	T/U
18	Antenna Mast & Controller	1050	Emco	-	T/U
19	Computer	310	Hewlett Packard	-	T/U
20	Printer	Think Jet	Hewlett Packard	-	T/U
21	Low Noise Amplifier (1-8GHz)	AMF-3D-001080-18-13P	Miteq	UNK	T/U
22	Spectrum Analyser	8562A	Hewlett Packard	3029A05390	25/05/02
23	Horn	3115	Emco	97015079	26/05/02
24	Signal Generator	8672A	Hewlett Packard	2016A01097	22/12/02
25	Signal Generator	2031	Marconi	119530069	14/09/02

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 consists of two parts – a base unit and a mobile unit. Both units are identical with respect to the RF parameters. The main differences are the power supply and the intended use for each device. Therefore, complete testing has been carried out on the base unit. Limited testing has been carried out on the mobile unit. Thus, radiated emissions have been carried out on both the mobile and base unit along with frequency stability under voltage variation to cover both power supply scenarios. A PC was supplied with the EUT to enable setting of the channels for testing purposes.

List of Performed Measurements

i)	Power Output	47 CFR2.1046, 90.205
ii)	Modulation Characteristics	47 CFR2.1047(d), 90.207
iii)	Occupied Bandwidth	47 CFR2.1049(h), 90.209
iv)	Emission Masks	47 CFR2.1049(h), 90.210
v)	Frequency Stability – Temperature Variations	47 CFR2.1055, 90.213
vi)	Frequency Stability – Voltage Variations	47 CFR2.1055(d)(1), 90.213
vii)	Radiated Emissions	47CFR2.1053, 90.210 (d)
viii)	Transient Frequency Behaviour	47CFR 90.214



Test Case : Radiated Emissions
Test Date : 21st January 2002
Rule Parts : 90.210(d)

Measurement Method

Transmit 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 4700MHz. 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. Emissions levels were then formally measured using a Peak Detector. The details of the worst case emissions were then recorded and are presented in Table 1 for the Base Unit and in Table 2 for the Portable Unit.

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 4700MHz.

The EUT was powered by internal batteries.

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

Determination of Spurious Emissions Limit

The field strength at 3m of the Base Unit carrier for channel 0 at 460.6375MHz was measured. The limit was then calculated in accordance with FCC 47 CFR 90.210(d) using the manufacturers declared power level into the antenna.

Declared output from EUT = 229mW
Level on analyser = 100.6dB μ V
Antenna Factor = 17.3dB
Cable loss = 4.2dB
Field strength = 122.1dB μ V/m

Limit = Field strength – (50 + 10log(P)) where P is the power in Watts
Limit = 122.1 – (50 + 10log0.229(W)) = 78.5dB μ V/m



Test Case : Radiated Emissions (continued)
 Test Date : 21st January 2002
 Rule Parts : 90.210(d)

Base Unit transmit mode

The EUT met the requirements of FCC Part 90.210 for Radiated Electric Field Emissions.

The emissions were measured at 3m.

Open Field Site Results : The levels of the 6 highest emissions measured in accordance with the specification are presented in Table 1 below :-

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m	Specification Limit	Transmit channel
MHz	H/V	cm	deg	dB μ V/m	dB μ V/m	
442.332	V	138	171	47.6	78.5	2
449.925	V	108	355	49.5	78.5	0
454.829	V	108	171	50.0	78.5	1
906.050	V	138	127	55.9	78.5	2
921.228	V	108	219	64.8	78.5	0
931.246	V	104	211	67.5	78.5	1

Table 1

The margin between the specification requirements and all other emissions was 21dB or more below the specification limit.

ABBREVIATIONS FOR ABOVE TABLE

H Horizontal Polarisation
 Pol Polarisation
 deg degree

V Vertical Polarisation
 Hgt Height
 Azm Azimuth

Procedure Test Performed in accordance with ANSI C63.4.

Performed by A R Hubbard, EMC Engineer.



Test Case : Radiated Emissions (continued)

Test Date : 21st January 2002

Rule Parts : 90.210(d)

Portable Unit transmit mode

The EUT met the requirements of FCC Part 90.210 for Radiated Electric Field Emissions.

The emissions were measured at 3m.

Open Field Site Results : The levels of the 3 highest emissions measured in accordance with the specification are presented in Table 1 below :-

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m	Specification Limit	Transmit channel
MHz	H/V	cm	deg	dB μ V/m	dB μ V/m	
906.044	V	171	134	51.9	78.5	2
921.262	V	135	155	51.9	78.5	0
931.246	V	104	211	50.9	78.5	1

Table 1

The margin between the specification requirements and all other emissions was 21dB or more below the specification limit.

ABBREVIATIONS FOR ABOVE TABLE

H Horizontal Polarisation
Pol Polarisation
deg degree

V Vertical Polarisation
Hgt Height
Azm Azimuth

Procedure Test Performed in accordance with ANSI C63.4.

Performed by A R Hubbard, EMC Engineer.



Test Case : Radiated Emissions (continued)
Test Date : 21st January 2002
Rule Parts : 15 Subpart B

Measurement Method

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 2000MHz. 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. Emissions 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 2000MHz. The details of the worst case emissions were then recorded and are presented in Table 3 for the Base Unit and in Table 4 for the Portable Unit.

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 2000MHz.

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



Test Case : Radiated Emissions (continued)

Test Date : 21st January 2002

Rule Parts : 15 Subpart B

Base Unit 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 15dB below the specification limit.

Portable Unit 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 : The levels of the 3 highest emissions measured in accordance with the specification are presented in Table 1 below :-

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m	Specification Limit
MHz	H/V	cm	deg	dB μ V/m	dB μ V/m
72.746	H	254	183	16.7	40.0
74.210	H	254	198	13.9	40.0
106.646	H	310	200	23.4	43.4

Table 1

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

ABBREVIATIONS FOR ABOVE TABLE

H Horizontal Polarisation
Pol Polarisation
deg degree

V Vertical Polarisation
Hgt Height
Azm Azimuth

Procedure Test Performed in accordance with ANSI C63.4.

Performed by A R Hubbard, EMC Engineer.



Test Case : RF Output Power
 Test Date : 4th February 2002
 Rule Parts : 2.1046, 90.205, 90.238(e)

Measurement Method

Using a spectrum analyser and attenuator(s), the output power of the EUT was measured at the antenna terminal. The manufacturer's software was used to put the EUT into transmit with FSK modulation.

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)
453.0375	11.13	10.0	21.13	0.130
460.5875	11.15	10.0	21.15	0.130
465.6375	11.12	10.0	21.12	0.129

Limit	Dependant On HAAT
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Remarks

EUT complies with CFR 47 2.1046 and 90.238 The EUT does not exceed 2W or +33dBm at the measured frequencies.

Test Equipment Used:
 1, 2, 5, 6, 9, 10

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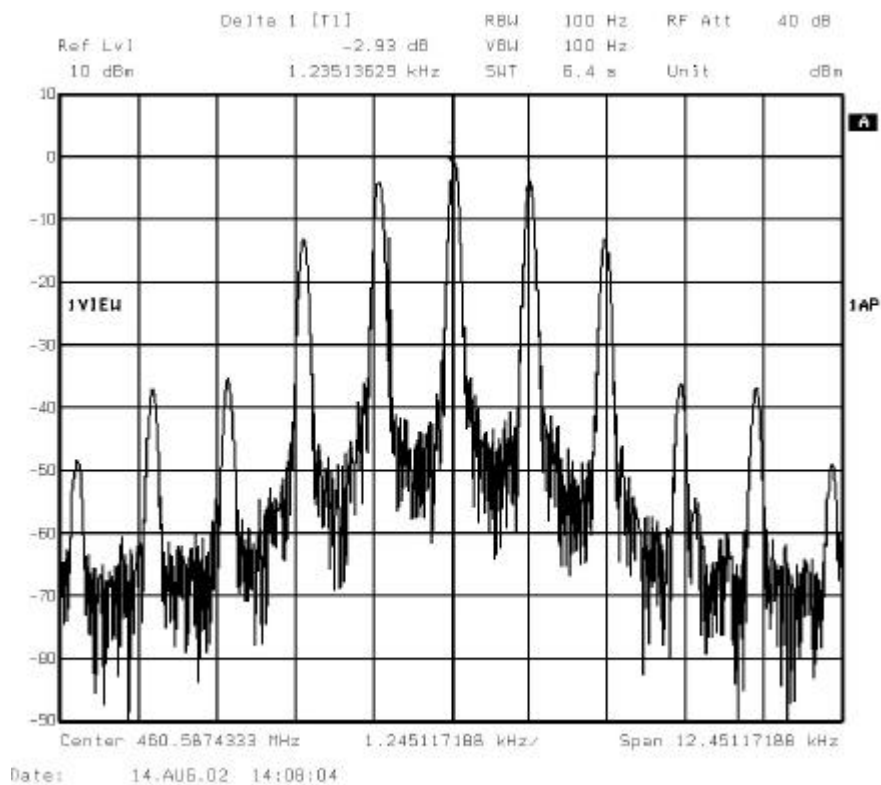


Test Case : Modulation Characteristics
Test Date : 4th February 2002
Rule Parts : 2.1047(d) / 90.207

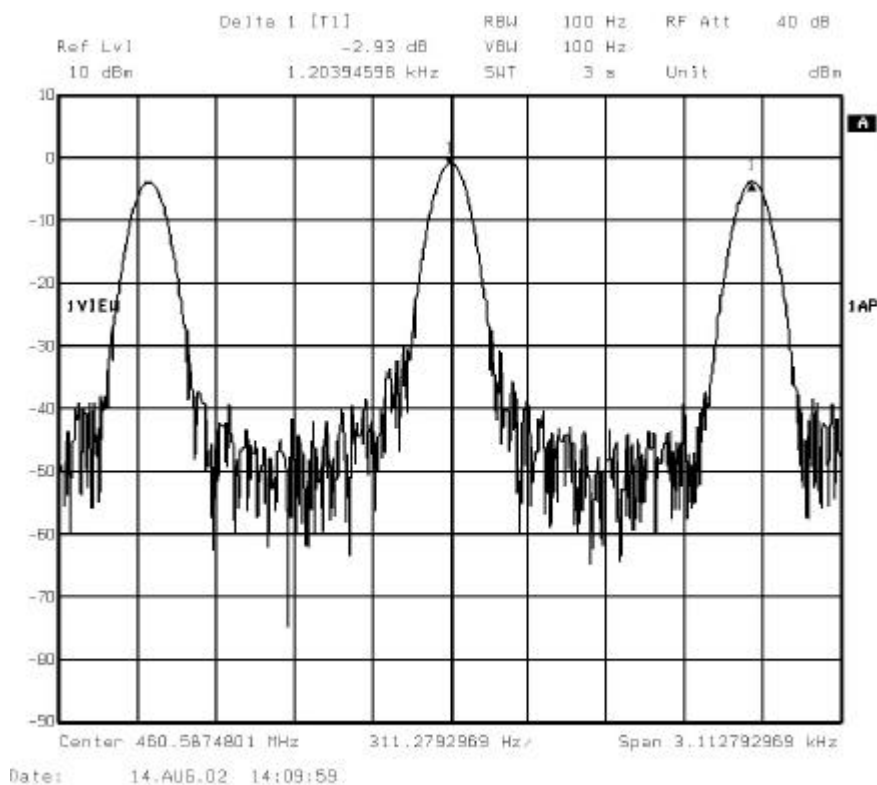
Description Of Modulation Technique

For the purposes of testing, the modulation was enabled or disabled via the test software provided by the manufacturer. The test mode used during the testing was with pre-amble, which was deemed to be worst case. The test software generates the data

The system is frequency modulated using Gaussian Minimum Shift Keying, (GMSK), with a data rate of 4800 bits per second. The two plots below show the EUT in its modulated mode.



Plot (1)



Plot (2)

Test Equipment Used:

1, 3, 9, 10

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Test Case : Occupied Bandwidth
 Test Date : 1st July 2002
 Rule Parts : 2.1049 / 90.209 / 90.210

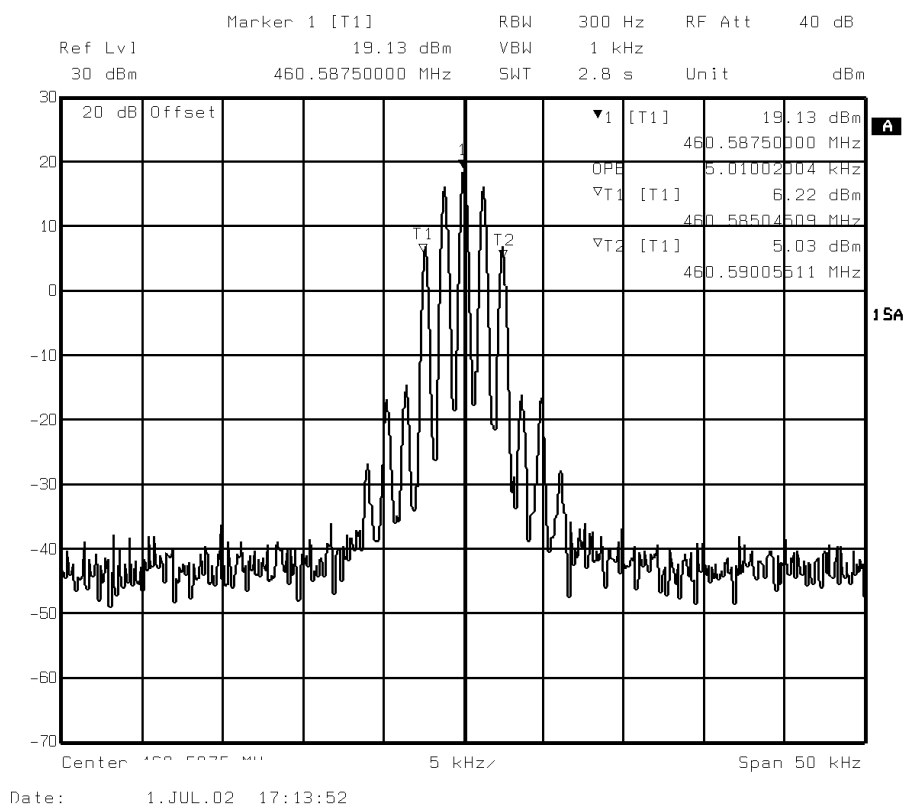
Measurement Method

The EUT was transmitted at maximum power, with modulation. Using a resolution bandwidth of 300Hz and a video bandwidth of 1kHz, the occupied bandwidth giving 99% of the power contained in the fundamental is shown.

The plot below, shows the resultant display from the Spectrum Analyser.

Occupied Bandwidth As Defined By 99% Of The Total Mean Power

Maximum Power



Test Equipment Used:
 1, 3, 9, 10

.....



Test Case : Emission Masks
 Test Date : 1st July 2002
 Rule Parts : 90.210

Measurement Method

The EUT was set to transmit unmodulated and the reference level was adjusted so that the peak of the fundamental was at the top of the screen. The RBW and VBW were set to 100Hz. The EUT was then set to transmit in it's modulated mode and the detector was set to max hold. A sufficient number of sweeps were completed before assessing the resulting plot against the emission mask specified in the table below. The EUT was tested at bottom, middle and top channels.

Emission Mask Characteristics

The EUT was declared as having a channel spacing of 12.5kHz and operating within the band 421 – 512MHz. With these characteristics, emission mask D was applied.

For the emissions up to ± 12.5 kHz away from the fundamental, RBW and VBW of 100Hz were used. For emissions $> \pm 12.5$ kHz up to the 10th harmonic, a RBW and VBW of 1MHz was applied.

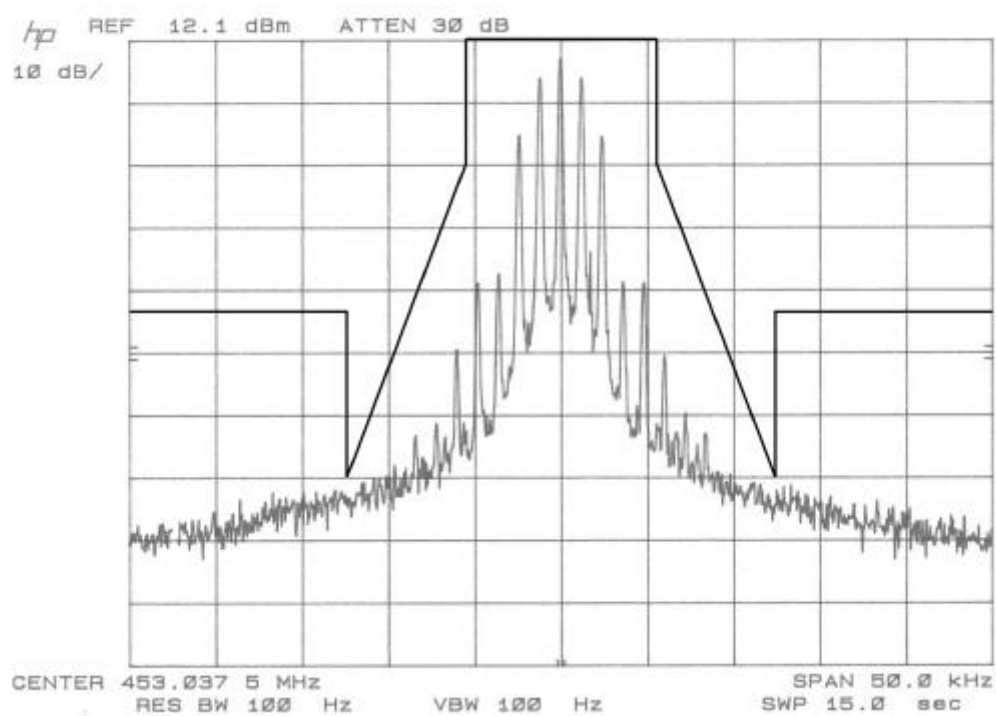
Emission Mask D

Displacement From Carrier (kHz)	Attenuation Below Fundamental Frequency (dBc)
± 5.625	0
± 5.625 to 12.5	-20.0 to 70.0
$> \pm 12.5$	-46.0



Test Case : Emission Masks
Test Date : 19th June 2002
Rule Parts : 90.210(d)

Channel 476, (453.0375MHz) – Maximum Power



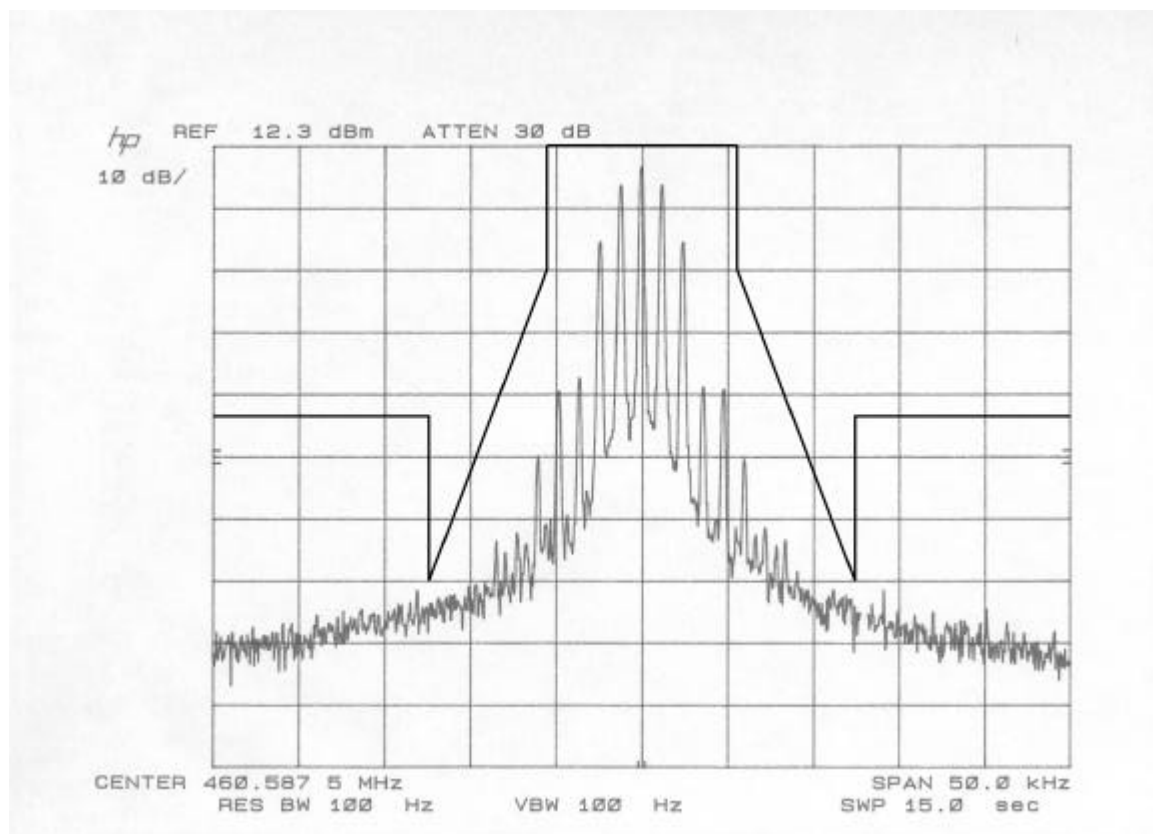


Test Case : Emission Masks

Test Date : 19th June 2002

Rule Parts : 90.210(d)

Channel 604, (460.5875MHz) – Maximum Power



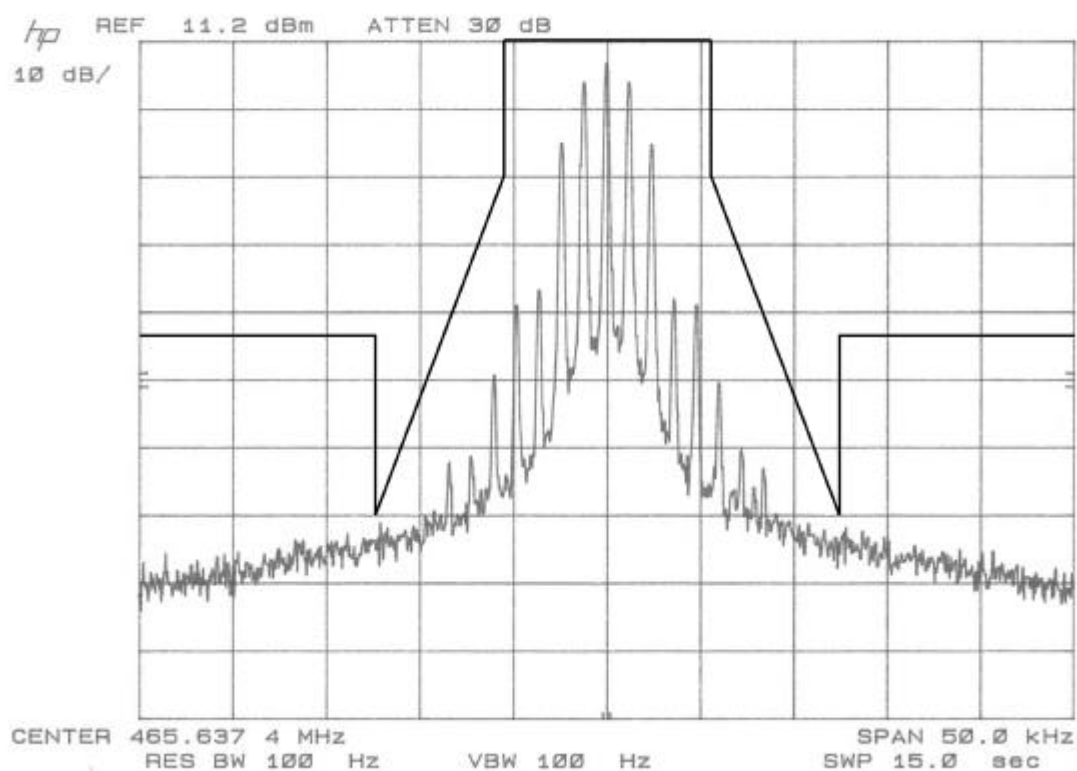


Test Case : Emission Masks

Test Date : 19th June 2002

Rule Parts : 90.210(d)

Channel 1008, (465.6375MHz) – Maximum Power





Test Case : Spurious Emissions

Test Date : 29th July 2002

Rule Parts : 2.1051, 90.210

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 5GHz. The EUT was set to transmit on full power with modulation and minimum power with modulation. The EUT was tested on Bottom, Middle and Top channels at maximum power. The resolution and video bandwidths were set to 1MHz meeting the requirements of Part 90.210(m). The spectrum analyser detector was set to Max Hold.

For measuring the range 9kHz to 5GHz, on maximum power, a 20dB attenuator was used. For measuring the harmonics, a high pass filter was added to the test set-up to reduce the measurement noise floor. The maximum path loss across the measurement band was used as the reference level offset to ensure worst case

Remarks

The EUT passed the requirements laid out in 90.210.

The plots on the following pages show the frequency spectrum from 9kHz to 5GHz of the EUT.

Test Equipment Used:

1, 3, 5, 6, 7, 8, 9, 10

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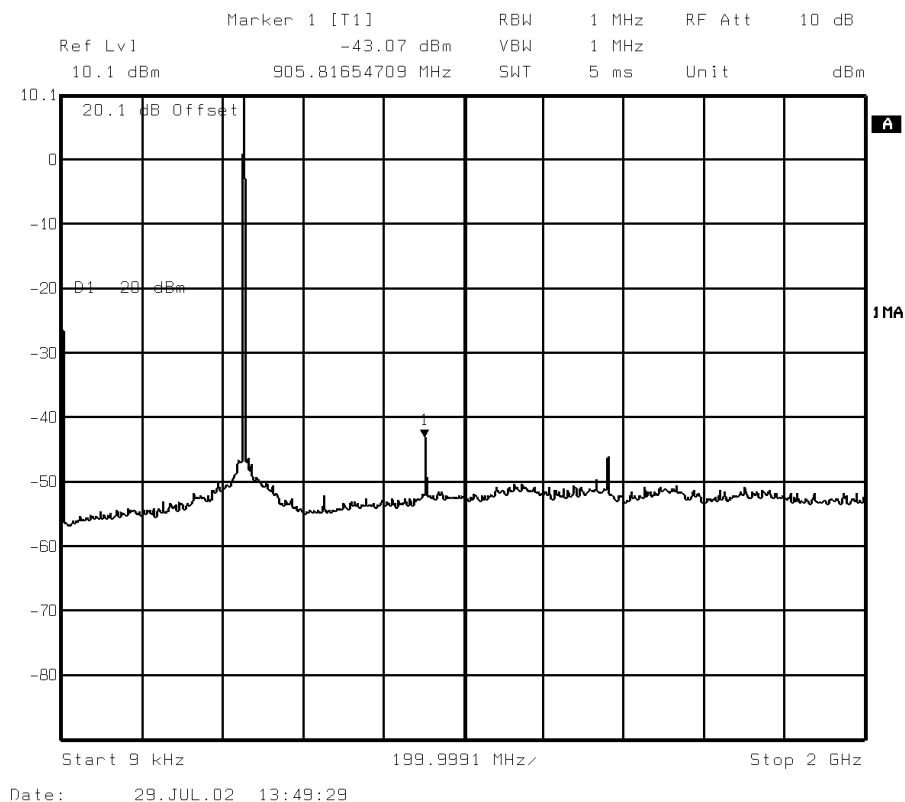
Test Case : Spurious Emissions

Test Date : 29th July 2002

Rule Parts : 2.1051, 90.210

Spurious Emissions (9kHz – 2GHz)

453.0375MHz– Maximum Power



Test Equipment Used:
 1, 3, 5, 6, 7, 11

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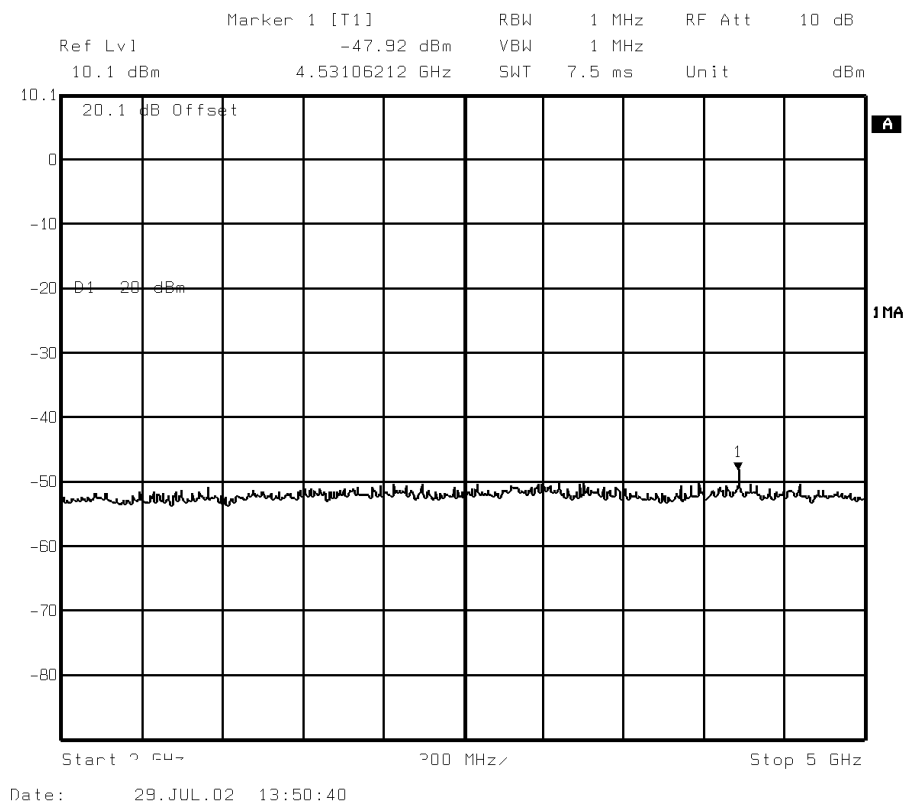
Test Case : Spurious Emissions

Test Date : 29th July 2002

Rule Parts : 2.1051, 90.210

Spurious Emissions (2GHz – 5GHz)

453.0375MHz – Maximum Power



Test Equipment Used:
 1, 3, 5, 6, 8, 9, 10

.....



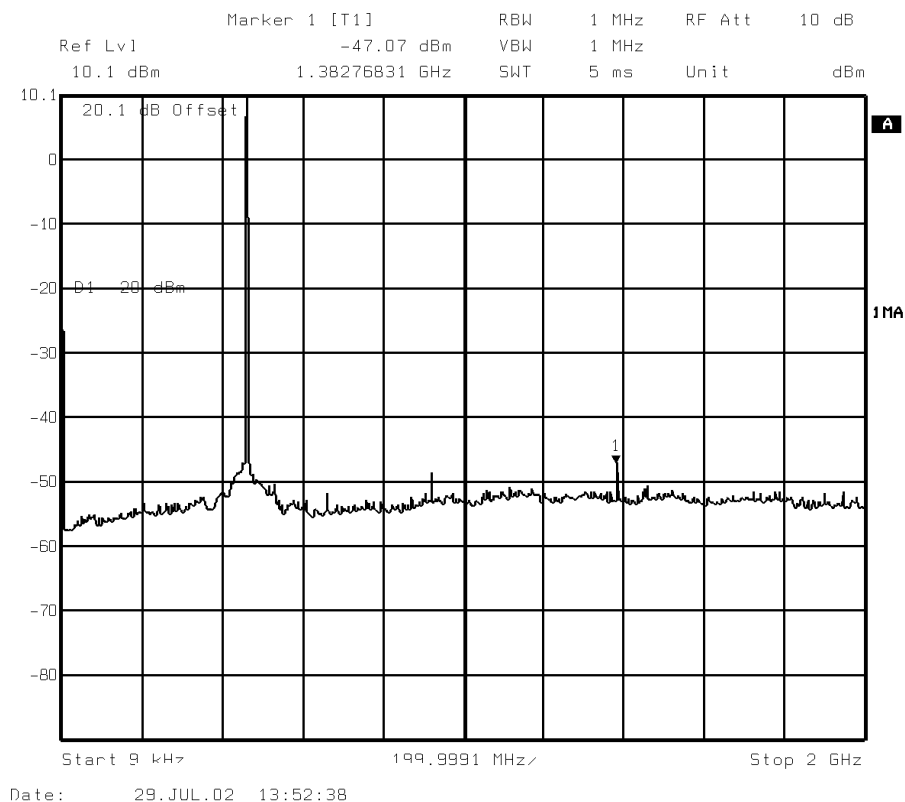
Test Case : Spurious Emissions

Test Date : 29th July 2002

Rule Parts : 2.1051, 90.210

Spurious Emissions (9kHz – 2GHz)

Channel 604, (460.5875MHz) – Maximum Power



Test Equipment Used:

1, 3, 5, 6, 8, 9, 10

.....



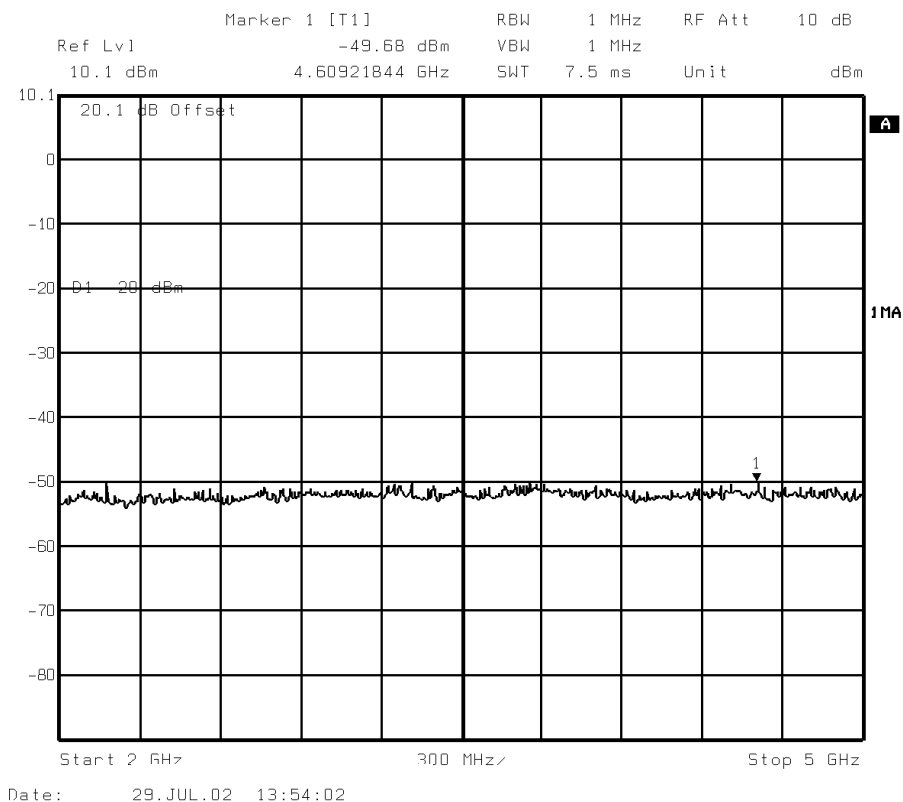
Test Case : Spurious Emissions

Test Date : 29th July 2002

Rule Parts : 2.1051, 90.210

Spurious Emissions (2GHz – 5GHz)

Channel 604, (460.5875MHz) – Maximum Power



Test Equipment Used:
 1, 3, 5, 6, 8, 9, 10

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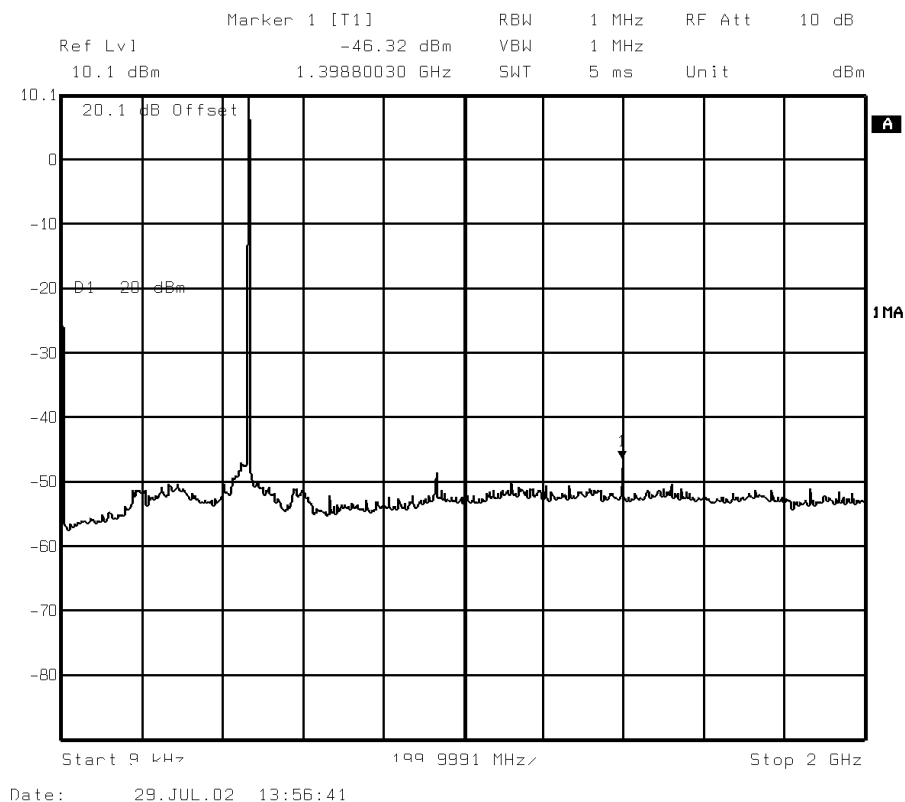
Test Case : Spurious Emissions

Test Date : 29th July 2002

Rule Parts : 2.1051, 90.210

Spurious Emissions (9kHz – 2GHz)

Channel 1008, (465.6375MHz) – Maximum Power



Test Equipment Used:

1, 3, 5, 6, 8, 9, 10

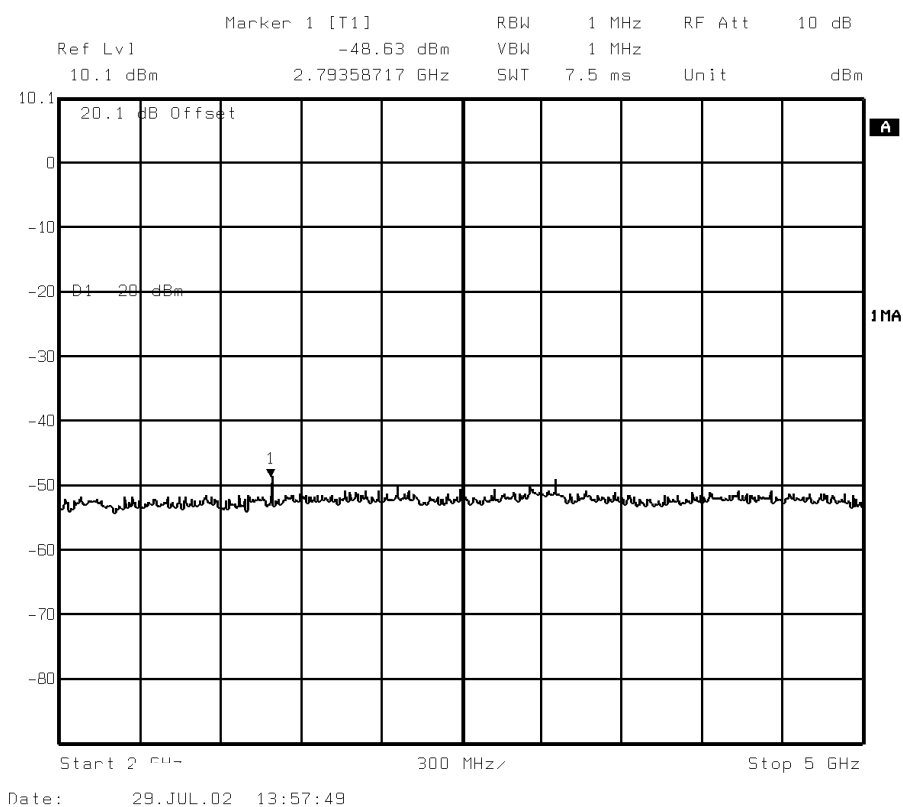
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Test Case : Spurious Emissions
 Test Date : 29th July 2002
 Rule Parts : 90.210

Spurious Emissions (2GHz – 5GHz)

Channel 1008, (465.6375MHz) – Maximum Power



Test Equipment Used:
 1, 3, 5, 6, 7, 11

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Test Case : Spurious Emissions

Test Date : 29th July 2002

Rule Parts : 2.1051, 90.210

Harmonic Emissions

Channel 476, (458.9875MHz)– Maximum Power

Frequency (GHz)	Raw Result (dBm)	Path Loss (dB)	Corrected Result (dBm)	Limit (dBm)
906.0750	-63.69	20.29	-43.40	-20
1359.1125	-73.68	20.37	-53.31	-20
1812.1500	-74.61	20.30	-54.31	-20
2265.1875	-75.60	20.83	-54.77	-20
2718.2250	-72.93	20.47	-52.46	-20
3171.2625	-75.11	21.20	-53.91	-20
3624.3000	-75.01	20.27	-54.74	-20
4077.3375	-75.35	21.51	-53.84	-20
4530.3750	-70.89	21.00	-49.89	-20

*Instrumentation Noise Floor

Harmonic Emissions

Channel 604, (460.5875MHz) – Maximum Power

Frequency (GHz)	Raw Result (dBm)	Path Loss (dB)	Corrected Result (dBm)	Limit (dBm)
921.1750	-74.29	20.34	-53.95	-20
1381.7625	-71.03	20.28	-50.75	-20
1842.3500	-73.60	20.55	-53.05	-20
2302.9375	-75.49	20.63	-54.86	-20
2763.5250	-72.84	20.57	-52.27	-20
3224.1125	-73.76	20.56	-53.20	-20
3684.7000	-75.03	20.68	-54.35	-20
4145.2875	-74.31	20.83	-53.48	-20
4605.8750	-73.25	21.39	-51.86	-20

*Instrumentation Noise Floor



Test Case : Spurious Emissions (continued)

Harmonic Emissions

Channel 1008, (465.6375MHz) – Maximum Power

Frequency (GHz)	Raw Result (dBm)	Path Loss (dB)	Corrected Result (dBm)	Limit (dBm)
931.275	-67.15	20.27	-46.88	-20
1396.9125	-70.58	20.20	-50.38	-20
1862.5500	-72.87	20.62	-52.25	-20
2328.1875	-76.03	20.82	-55.21	-20
2793.8250	-70.27	20.44	-49.83	-20
3259.4625	-72.38	20.49	-51.89	-20
3725.1000	-76.47	21.18	-55.29	-20
4190.2375	-74.098	21.10	-52.99	-20
4656.3750	-73.64	20.87	-52.77	-20

*Instrumentation Noise Floor

Test Equipment Used:

1, 3, 5, 6, 7, 8, 10

.....



Test Case : Frequency Stability Under Temperature Variations

Test Date : 31st January 2002

Rule Parts : 2.1055, 90.213

Measurement Method

The EUT was set to transmit on maximum power with modulation. A Spectrum Analyser, (FSEM), was used to measure the frequency error.

The temperature was adjusted between –30°C and +50°C in 10° steps as per 2.1055.

Results

Temperature Interval(°C)	Test Frequency (MHz)	Result (ppm)	Limit (ppm)
-30	460.6375	1.60	2.5
-20	460.6375	1.53	2.5
-10	460.6375	1.05	2.5
0	460.6375	0.66	2.5
+10	460.6375	0.22	2.5
+20	460.6375	0.02	2.5
+30	460.6375	0.15	2.5
+40	460.6375	0.28	2.5
+50	460.6375	0.44	2.5

Limit	2.5ppm
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Remarks

EUT complies with CFR 47 Parts 2.1055 and 90.213. The EUT does not exceed ± 1.152 kHz at the measured frequency at any temperature interval across the measured range.

Test Equipment Used:

2, 4, 5, 6, 11

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Test Case : Frequency Stability Under Voltage Variations
 Test Date : 31st January 2002
 Rule Parts : 90.213

Measurement Method

The EUT was set to transmit on maximum power with modulation. A Spectrum Analyser was used to measure the frequency error.

The voltage was reduced to the end point voltage as declared by the manufacturer using a variac in conjunction with a DVM.

Results – Base Unit

End Point Voltage (V)	Test Frequency (MHz)	Deviation (ppm)	Deviation Limit (ppm)
6.50	460.6375	-0.84	±2.5

Results – Mobile Unit

End Point Voltage (V)	Test Frequency (MHz)	Deviation (ppm)	Deviation Limit (ppm)
6.5	460.6375	0.39	±2.5

Limit	2.5ppm
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Remarks

EUT complies with CFR 47 Part 2.1055 and 90.213. The EUT does not exceed 2.5ppm at the measured frequency either at nominal or voltage variation.

Test Equipment Used:
 2, 5, 6

.....



Test Case : Transient Frequency Behaviour

Test Date : 4th February 2002

Rule Parts : 90.214

Measurement Method

Using the test software, the EUT was keyed on and off in an unmodulated mode. The frequency difference was monitored on a Digital Storage Oscilloscope over the time periods shown in the table below.

The EUT was tested on bottom, middle and top channels. As the equipment output is <6W, the frequency difference during period t_1 and t_3 can exceed 12.5kHz. Two plots were taken for each channel. One showing the transmitter being keyed on, the other showing the transmitter being keyed off.

Test Limits

Time Intervals	Maximum Frequency Difference, (kHz)	Time Period (ms)
t_1	± 12.5	10.0
t_2	± 6.25	25.0
t_3	± 12.5	10.0

Result

Transmitter Keyed On

During periods t_1 and t_2 , the transmitter remained within the limits defined in the above table.

After the period t_2 , the frequency difference remained within the frequency tolerance limits defined in 90.214.

Transmitter Keyed Off

Up to the point, t_3 , the transmitter frequency difference remained within the frequency stability requirements defined in 90.214.

During period t_3 , the transmitter remained within the limits defined in the table above.

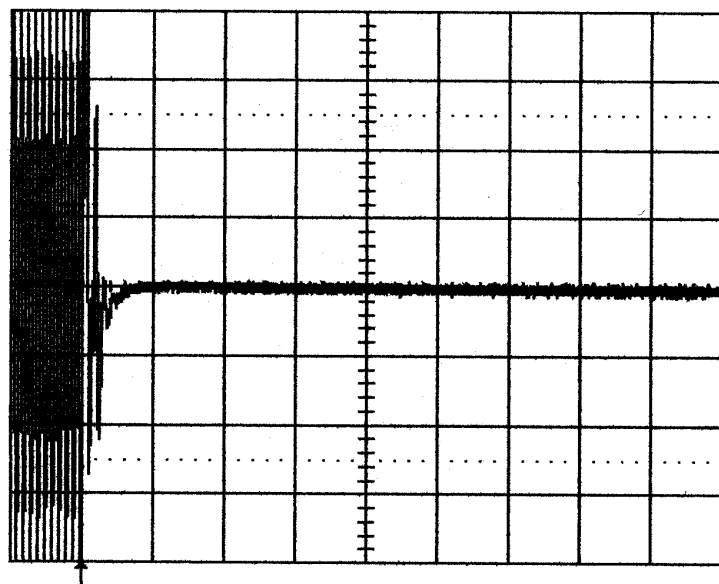


Test Case : Transient Frequency Behaviour (continued)
Test Date : 12th February 2002
Rule Parts : 90.214

Channel 476, (453.0375MHz) – Transmitter Keyed On

12-Feb-02
13:06:06

10 ms
168 mV



10 ms

1 .5 V 500
2 168 mV 500
3 .5 V AC
4 .2 V 500

1 DC 0.48 V

TRIGGER SETUP

SMART

trigger on
1 2 3 4 Ext
Ext10 Line

coupling 1
AC LFREJ
HFREJ HF

slope 1
Neg

holdoff
Time Evts

500 kS/s

STOPPED



Test Case : Transient Frequency Behaviour (continued)

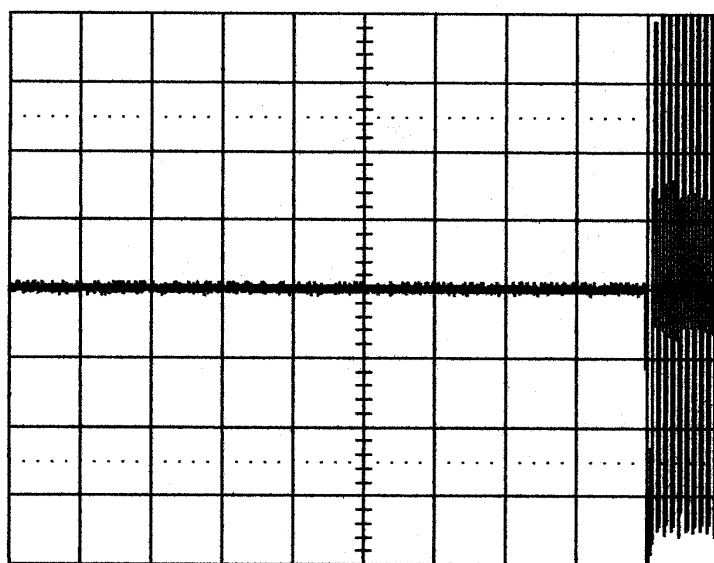
Test Date : 12th February 2002

Rule Parts : 90.214

Channel 476, (453.0375MHz) – Transmitter Keyed Off

12-Feb-02
13:14:46

10 ms
170mV



10 ms
1 .5 V 500
2 170mV 500
3 .5 V AC
4 .2 V 500



1 DC 0.48 V

TRIGGER SETUP

SMART

trigger on
1 2 3 4 Ext
Ext10 Line

coupling 1
AC LFREJ
HFREJ HF

slope 1
Pos

holdoff
Time Evts

500 kS/s

STOPPED



Test Case : Transient Frequency Behaviour(continued)

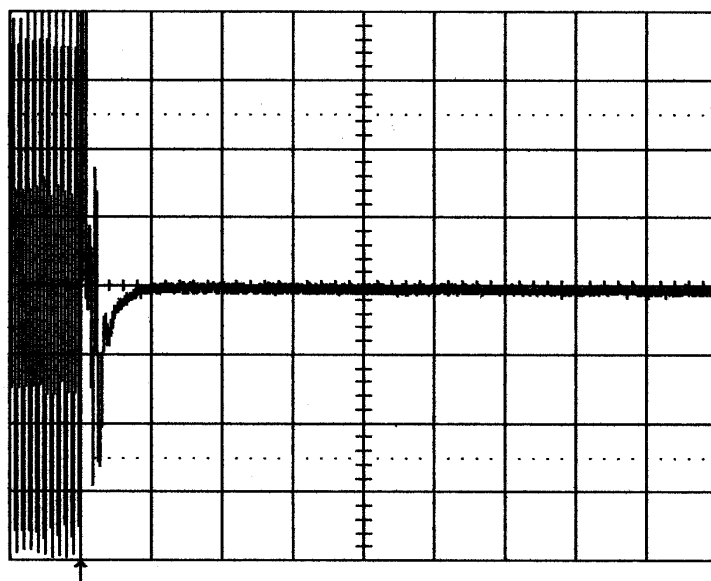
Test Date : 4th February 2002

Rule Parts : 90.214

Channel 604, (460.5875MHz) – Transmitter Keyed On

4-Feb-02
15:07:27

2
10 ms
172mV



10 ms

1 .5 V 50Ω
2 172mV 50Ω
3 .5 V AC
4 .2 V 50Ω

1 DC 1.01 V

TRIGGER SETUP

SMART

trigger on
1 2 3 4 Ext
Ext10 Line

coupling 1
AC LFREJ
HFREJ HF

slope 1
Neg

holdoff
Time Evts

500 kS/s

STOPPED



Test Case : Transient Frequency Behaviour (continued)

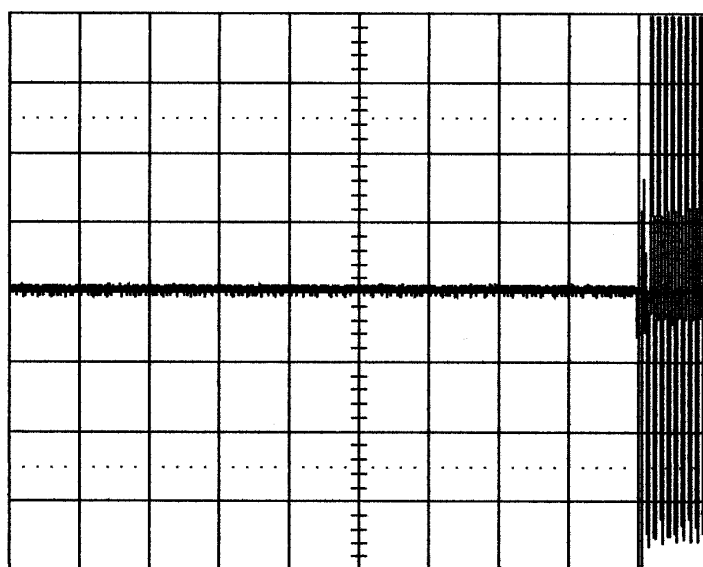
Test Date : 4th February 2002

Rule Parts : 90.214

Channel 604, (460.5875MHz) – Transmitter Keyed Off

4-Feb-02
15:30:32

2
10 ms
172mV



10 ms

1 .5 V 50Ω
2 172mV 50Ω
3 .5 V AC
4 .2 V 50Ω



1 DC 0.49 V

TRIGGER SETUP

Edge SMART

trigger on
1 2 3 4 Ext
Ext10 Line

coupling 1
AC LFREJ
HFREJ HF

slope 1
Pos

holdoff
Time Evts

500 kS/s

STOPPED



Test Case : Transient Frequency Behaviour (continued)

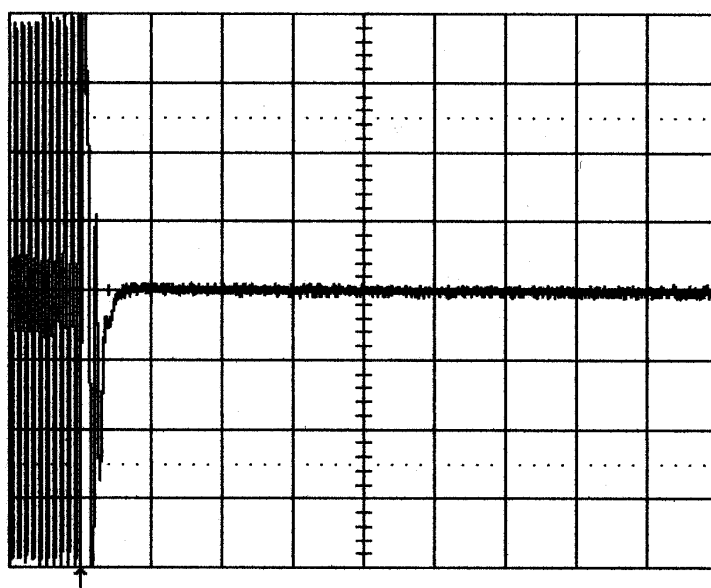
Test Date : 12th February 2002

Rule Parts : 90.214

Channel 1008, (465.6375MHz) – Transmitter Keyed On

12-Feb-02
12:39:07

10 ms
170mV



10 ms

1 .5 V 500
2 170mV 500
3 .5 V AC
4 .2 V 500



1 DC 0.48 V

TRIGGER SETUP

SMART

trigger on
1 2 3 4 Ext
Ext10 Line

coupling 1
AC LFREJ
HFREJ HF

slope 1
Neg

holdoff
Time Evts

500 kS/s

STOPPED



Test Case : Transient Frequency Behaviour (continued)

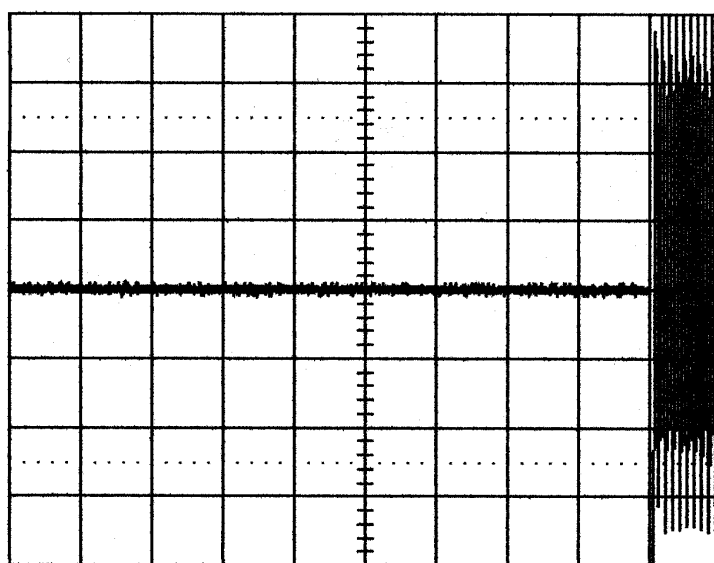
Test Date : 12th February 2002

Rule Parts : 90.214

Channel 1008, (465.6375MHz) – Transmitter Keyed Off

12-Feb-02
12:50:06

10 ms
172mV



10 ms
1 .5 V 500
2 172mV 500
3 .5 V AC
4 .2 V 500



1 DC 0.48 V

TRIGGER SETUP

SMART

trigger on
1 2 3 4 Ext
Ext10 Line

coupling 1
AC LFREJ
HFREJ HF

slope 1
Pos

holdoff
Time Evts

500 kS/s

STOPPED