



EXHIBIT 2A

Test Report Provided by Nortel Networks

Applicant: Nortel Networks

For Certification on:

AB6NT1900MFRM2



Test Report for FCC Equipment Authorization

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Publication History

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List of Consultants

The following people will reviewed this document prior to its release and are expected to provide recommendation for its approval:

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Decision Maker/Ratifier

The release of this document will be reviewed and approved for distribution and use by the following:

Ratifier's Name	Signature	Date
Jadran Lokas	via email	Feb. 14, 2003

Acronyms and Abbreviations

ASIC	Application Specific Integrated Circuit
BBW	Breathing, Blossoming and Wilting
BPF	Bandpass Filter
BTS	Base Station Transceiver Subsystem
BW	Bandwidth
CDMA	Code Division Multiple Access
dBFS	dB relative to Full Scale
DDS	Direct Digital Synthesizer
DPM	Duplexer Preselector Module
EEPROM	Electrically Erasable and Programmable ROM
EC	Engineering Change
ERLCE	Excess Reverse Link Capacity Estimate
HSSPC	High-Speed Serial Protocol Controller
HW	Hardware
IF	Intermediate Frequency
IIC	Inter-Integrated Circuit Bus
IS	Interim Standard
LO	Local Oscillator
LPF	Lowpass Filter
MCPA	Multi-Carrier Power Amplifier
MFRM	Multi-carrier Flexible Radio Module
MFRM2	Multi-carrier Flexible Radio Module 2
NF	Noise Figure
OCNS	Orthogonal Channel Noise Source
OH	OverHead
PA	Power Amplifier
PC	Personal Computer
PPR	Peak Power Reduction
PSA	Product Specification Agreement
RBW	Resolution BandWidth

RF	Radio Frequency
Rx	Receive
SA	Spectrum Analyzer
SFRM	Single Carrier Flexible Radio Module
SW	Software
TBD	To Be Determined
TM	Triplexer Module
TPTL	Transmit Power Tracking Loop
TRM	Transmitter Receiver Module
Tx	Transmit
uP	Microprocessor
VSA	Vector Signal Analyzer
XCVR	Transceiver

1 Introduction

This test report is submitted in accordance with the FCC Rules and Regulations, Part 2, Subpart J, Sections 2.1046 through 2.1057 for equipment authorization of Nortel Networks's CDMA 1900 MHz Multiple carrier Flexible Radio Module 2 (MFRM2).

The 1900 MHz MFRM2 is intended for use in the Domestic Public Cellular Radio Telecommunications Service and is designed in accordance with the following standards:

- *CFR 47, Part 24, Subpart E, Broadband Personal Communications Service [1]*
- *CFR 47, Part 2, Subpart J, Equipment Authorization Procedures - Equipment Authorization[2]*

1.1 Test Result Summary

Table 1 summarizes the measurement results¹ for the CDMA 1900 MHz MFRM2.

Table 1 : Test Results Summary

FCC Measurement Specification	FCC Limit Specification	Description	Results
2.1046	24.232	RF Power Output	Compliant
2.1047		Modulation Characteristics	Not Applicable
2.1049		Occupied Bandwidth	Compliant
2.1051, 2.1057	24.238	Spurious Emissions at Antenna Terminals	Compliant
2.1055	24.235	Frequency Stability	Compliant

1. This report presents measurement results for tests performed by Nortel Networks. Field Strength of Spurious Emissions measurement results along with requirements specified in 2.1033 are covered in a separate Product Integrity test report from C-MAC Engineering Canada.

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NORTEL

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Wireless Access



Test Report for FCC Equipment
Authorization
FCC ID : AB6NT1900MFRM2

2 Engineering Declaration

The CDMA 1900MHz Multiple Carrier Flexible Radio Module 2 has been tested in accordance with the requirements contained in the Federal Communications Commission Rules and Regulations Part 2 and 24.

To the best of my knowledge, these tests were performed in accordance with good engineering practices using measurement procedures consistent with industry or commission standards or previous Commission correspondence or guidance and demonstrate that this equipment complies with the appropriate standards. All tests were conducted on a representative sample of the equipment for which equipment authorization is sought.

Tested By:

Borislav Todorov
Systems Designer
Nortel Networks
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Signature

FEB. 14/2003
Date

Reviewed By:

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Signature

Feb 14, 2003
Date

Approved By:

Jadran Lotic
Systems Engineer
Nortel Networks
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Signature

Feb. 14/2003
Date

3 Equipment Authorization Application Requirements

3.1 Standard Test Conditions and Test Equipment

The MFRM2 was tested under the following standard test conditions unless otherwise noted:

- Ambient Temperature: 20 to 35 degrees C
- Ambient Humidity: 20 to 40%
- DC Supply Voltage: -48 Vdc (nominal)

3.2 EUT Identification List

Table 2 shows the identification of the components tested in this report.

Table 2 : EUT Identification List

Equipment Description	Model / Part Number	Release Number	Serial Number
1900 MHz Multiple Carrier Flexible Radio Module 2 System (comprised of the modules below)	N/A	N/A	N/A
a) 1900 MFRM2 Radio Module	NTGY32BA	03/02 ^a	NNTM533GRVAM
c) A/D Band DPM	NTGS53JA	M1	NNTM7400000E
d) B/E Band DPM	NTGS53KA	05	CLWVPP202JHG
e) C/F Band DPM	NTGS53LA	M1	NNTM7400000T

a. Radio Card and PA Pallet respectively

3.3 Test Equipment List

Table 3 shows the identification of the test equipment used in this report.

Table 3 : Test Equipment List

Description	Manufacturer	Model	Serial/Batch Number	Cal. Due Date
20 Hz to 26.5 GHz Spectrum Analyzer	Rohde&Schwarz	FSEM-30	DE25141	28/02/2003
RF Power Meter	HP	438A	3513U04479	12/03/2004
RF Power Sensor Head	HP	8481A	N/A	09/04/2004
30dB Attenuator	Weinschel Corp.	48-30-43	BJ6051	Verified
20 dB Attenuator	HUBER+SUHNER AG	6820.17.B	3666	Verified
6 dB Attenuator	MA-COM	2082-6192-06	96341	Verified
RF Cable	Andrew	FSJ4-50B	N/A	Verified

4 Transmitter Test and Measurement Results

4.1 RF Power Output

4.1.1 RF Power Output Requirements

FCC Part 2.1046

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune -up procedure to give the values of current and voltage on the circuit elements specified in 2.983(d)(5). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

FCC Limit (Part 24.232)

The maximum RF power from a base station must not exceed 100 Watts.

4.1.2 Test Method

The DE is setup via the BTS controller to enable the MFRM2 to transmit at maximum rated output power level. Measurements are made in one, two, and three carrier configurations. The RF power output is measured using the Channel Power feature of the SA.

4.1.3 Test Setup

The set-up used for the MFRM2 RF power output test is illustrated in Figure 1. RF power output measurements are referenced to the antenna port of the DPM.

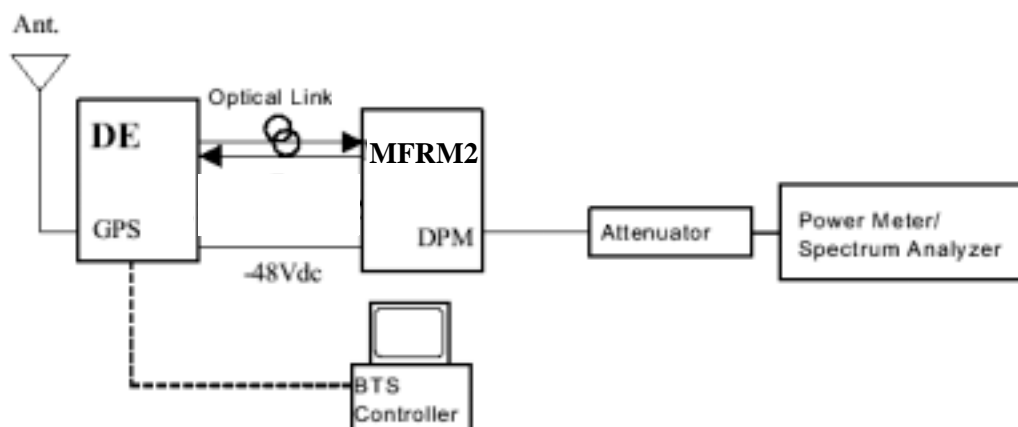


Figure 1 : Test Setup for RF Power Output Measurement

4.1.4 Test Results

The 1900 MHz MFRM2 complies with the requirement. The RF power output measured in one, two and three carrier configurations for each licensed band is shown in Table 4, Table 5 and Table 6. The maximum measured RF output power from the MFRM2 was 46.17 dBm.

Table 4 : RF Output Power of 1900 MHz MFRM2, 1 Carrier Mode

Channel Number (Band)	Frequency (MHz)	Measured RF Output Power (dBm)	Average Maximum Rated Power (dBm)	FCC Limit (dBm)
25 (A)	1931.25	45.82	46.0	50
375 (D)	1948.75	45.67	46.0	50
425 (B)	1951.25	45.70	46.0	50
775 (E)	1968.75	45.62	46.0	50
825 (F)	1971.25	45.73	46.0	50
1175 (C)	1988.75	45.53	46.0	50

Table 5 : RF Output Power of 1900 MFRM2, 2 Carrier Mode

Channel Number (Band)	Frequency (MHz)	Measured RF Output Power (dBm)	Average Maximum Rated Power (dBm)	FCC Limit (dBm)
25, 50 (A)	1931.25, 1932.5	46.05	46.0	50
350, 375 (D)	1947.5, 1948.75	45.99	46.0	50
425, 450 (B)	1951.25, 1952.5	45.99	46.0	50
750, 775 (E)	1967.5, 1968.75	46.10	46.0	50
825, 850 (F)	1971.25, 1972.5	46.03	46.0	50
1150, 1175 (C)	1987.5, 1988.75	45.87	46.0	50

Table 6 : RF Output Power of 1900 MFRM2, 3 Carrier Mode

Channel Number (Band)	Frequency (MHz) (centre channel)	Measured RF Output Power (dBm)	Average Maximum Rated Power (dBm)	FCC Limit (dBm)
25, 50, 75 (A)	1932.5	46.17	46.0	50
325, 350, 375 (D)	1947.5	45.86	46.0	50
425, 450, 475 (B)	1952.5	45.89	46.0	50
725, 750, 775 (E)	1967.5	45.91	46.0	50
825, 850, 875 (F)	1972.5	45.95	46.0	50
1125, 1150, 1175 (C)	1987.5	45.98	46.0	50

4.2 Occupied Bandwidth

4.2.1 Occupied Bandwidth Requirements

FCC Part 2.1049

The OBW, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable:

(g) Transmitter in which the modulating baseband comprises not more than three independent channels - when modulated by the full complement of signals for which the transmitter is rated. The level of modulation for each channel should be set to that prescribed in rule parts applicable to the services for which the transmitter is intended. If specific modulation levels are not set forth in the rules, the tests should provide the manufacturer's maximum rated condition.

(h) Transmitters employing digital modulation techniques - when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any devices used for modifying the spectrum when such devices are optional at discretion of the user.

4.2.2 Test Method

The DE is setup via the BTS controller to enable the MFRM2 to transmit at maximum rated output power level. The occupied bandwidth is measured using the 99% Channel Power feature of the SA.

4.2.3 Test Setup

The set-up used for the MFRM2 Occupied bandwidth test is illustrated in Figure 2.

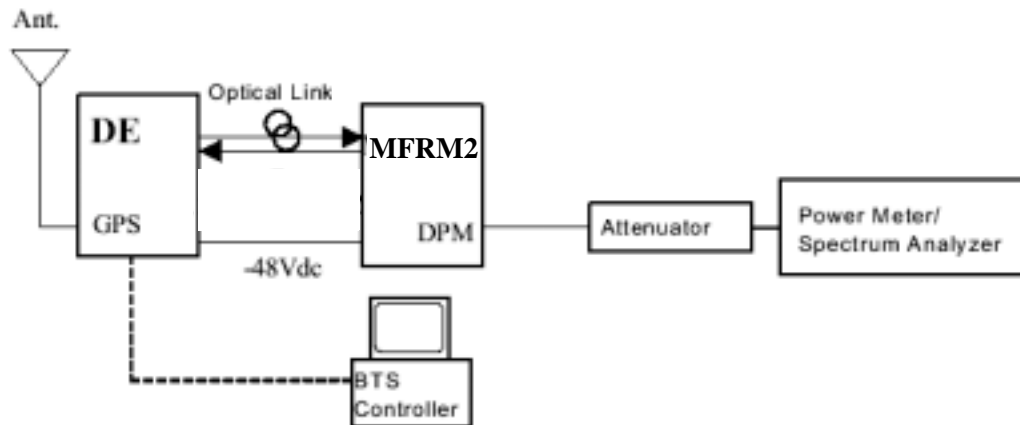


Figure 2 : Test Setup for Occupied Bandwidth Measurement

4.2.4 Test Results

The 1900 MHz MFRM2 complies with the requirement. The occupied bandwidth measured in one, two and three carrier configurations for each licensed band is shown in Table 7, Table 8 and Table 9. The plots that follow show the occupied bandwidth in one, two and three carrier configurations. Although plots were recorded for all channels tested, only one sample plot per carrier configuration is provided to reduce the number of figures.

Table 7 : Occupied Bandwidth, 1900 MFRM2, 1 Carrier Mode

Channel Number (Band)	Frequency (MHz)	Measured Occupied Bandwidth (kHz)
25 (A)	1931.25	1268.5
375 (D)	1948.75	1268.5
425 (B)	1951.25	1266.5
775 (E)	1968.75	1266.5
825 (F)	1971.25	1268.5
1175 (C)	1988.75	1268.5

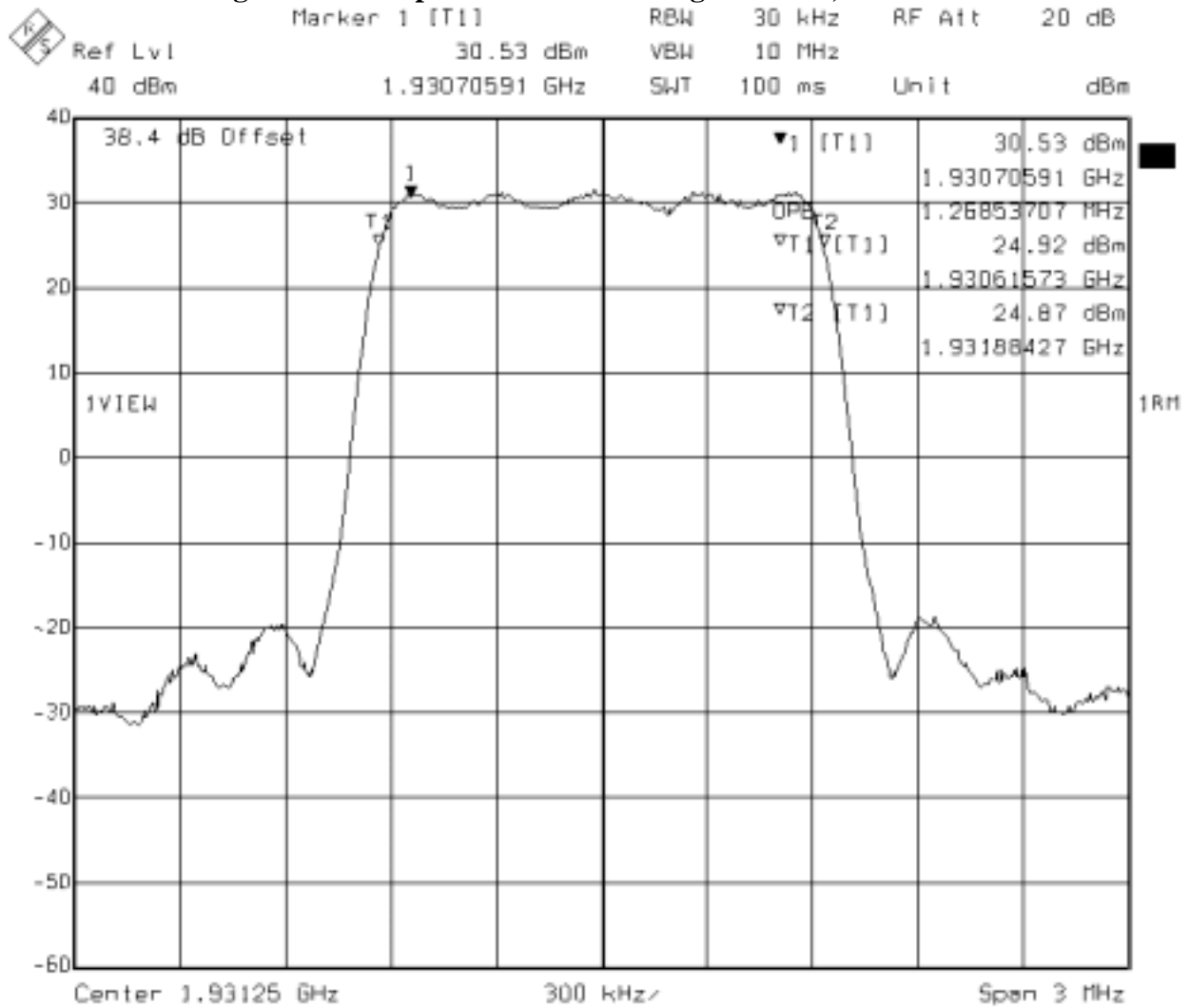
Table 8 : Occupied Bandwidth, 1900 MFRM2, 2 Carrier Mode

Channel Number (Band)	Frequency (MHz)	Measured Occupied Bandwidth (kHz)
25, 50 (A)	1931.25, 1932.5	2491.0
350, 375 (D)	1947.5, 1948.75	2480.0
425, 450 (B)	1951.25, 1952.5	2489.0
750, 775 (E)	1967.5, 1968.75	2480.0
825, 850 (F)	1971.25, 1972.5	2489.0
1150, 1175 (C)	1987.5, 1988.75	2480.0

Table 9 : Occupied Bandwidth, 1900 MFRM2, 3 Carrier Mode

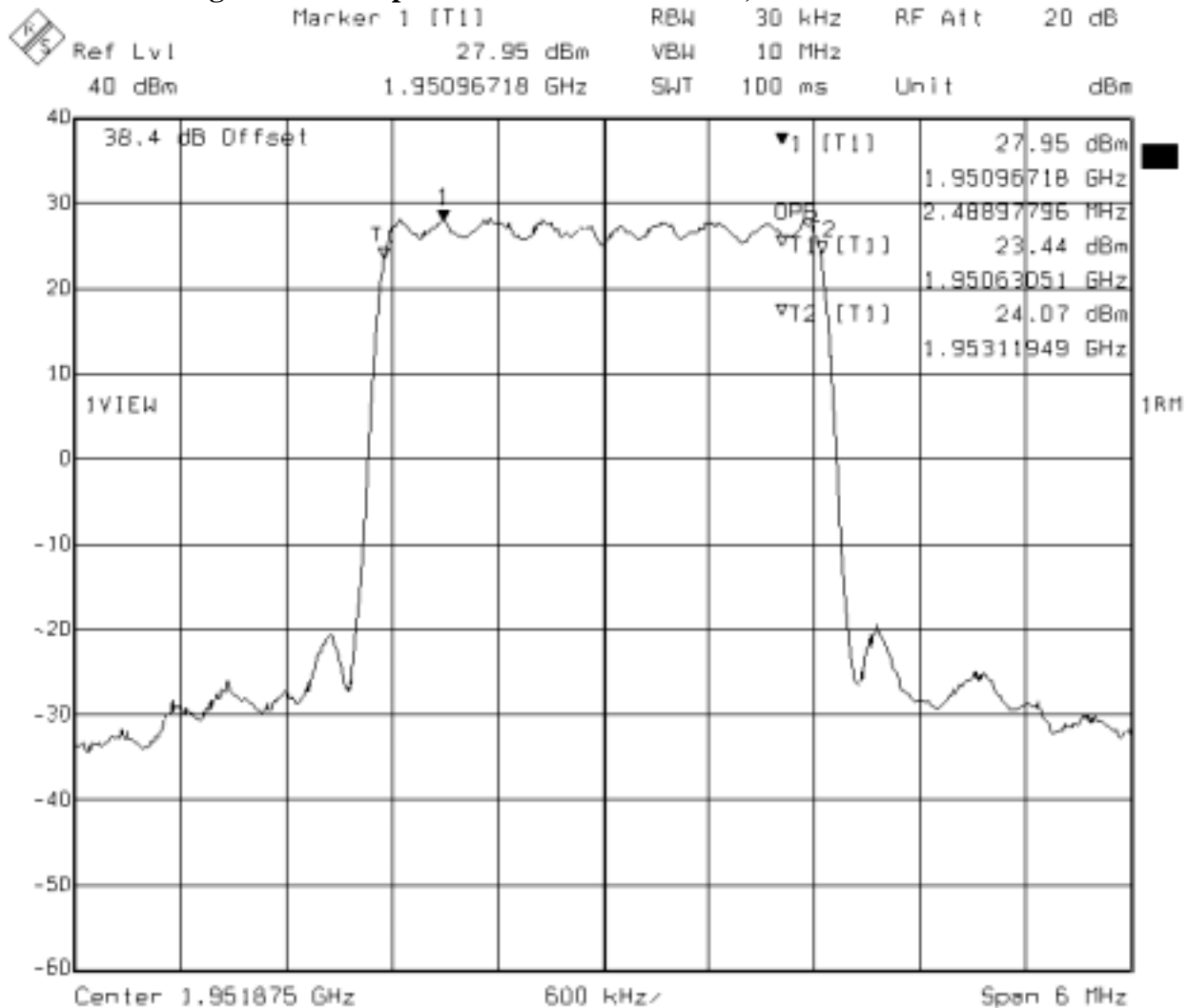
Channel Number (Band)	Frequency (MHz) (centre channel)	Measured Occupied Bandwidth (kHz)
25, 50, 75 (A)	1932.5	3735.5
325, 350, 375 (D)	1947.5	3735.5
425, 450, 475 (B)	1952.5	3735.5
725, 750, 775 (E)	1967.5	3733.5
825, 850, 875 (F)	1972.5	3733.5
1125, 1150, 1175 (C)	1987.5	3733.5

Figure 3 : Occupied Bandwidth - Single Carrier, Channel 25



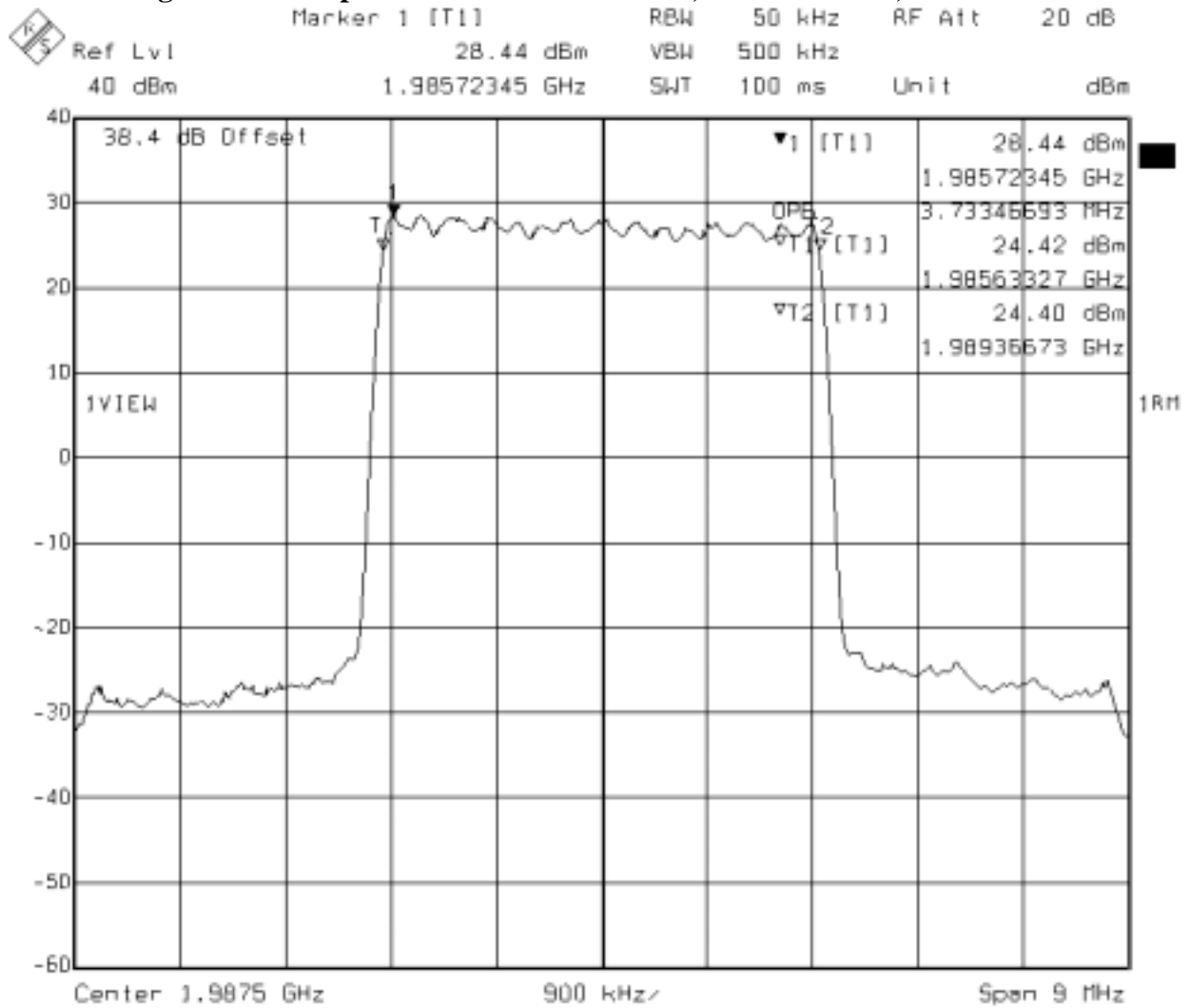
Title: MFRM-2, 1_car, ch 25, Occupied Bandwidth
 Comment A: Temp C 25, Normal Humidity
 Date: 09.FEB.2003 11:20:57

Figure 4 : Occupied Bandwidth - 2 Carrier, Channels 425 & 450



Title: MFRM-2, 2_car, ch 425, Occupied Bandwidth
 Comment A: Temp C 25, Normal Humidity
 Date: 08.FEB.2003 11:24:30

Figure 5 : Occupied Bandwidth - 3 Carrier, Channels 1125, 1150 & 1175



Title: MFRM-2, 3_car, ch 1175, Occupied Bandwidth
 Comment A: Temp C 25, Normal Humidity
 Date: 07.FEB.2003 13:38:28

4.3 Spurious Emissions at Antenna Terminals

4.3.1 Spurious Emissions Requirements

FCC Part 2.1051

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

FCC Part 2.1057 - Frequency Spectrum to be investigated

The spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency or to the highest frequency practicable in the present state of the art of measuring techniques, whichever is lower. Particular attention should be paid to harmonics and subharmonics of the carrier frequency. Radiation at the frequencies of multiplier stages should be checked. The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

FCC Part 24.238 Limit

(a) On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmit power (P) by at least $43 + 10 \log (P)$ dB.

(b) Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

(c) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.

(d) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

4.3.2 Test Method

The DE is setup via the BTS controller to enable the MFRM2 to transmit at maximum rated output power level. Measurements are made on channels at the bottom and top of the licensed subbands in one, two and three carrier configurations. The following spectrum analyzer settings are used for the measurement of the antenna port spurious emissions:

Adjacent 1MHz to indicated subband (Upper and Lower)

Resolution Bandwidth:	30 kHz (1 carrier, 2 carrier), 50 kHz (3 carrier)
Video Bandwidth:	300 kHz (1 carrier, 2 carrier), 500 kHz (3 carrier)
Video Average:	10 Averages
Span:	1 MHz
Attenuation:	20 dB
Ref. Level:	10 dBm
Ref. Level Offset:	38.4 dB

All spectrum analyzer settings are coupled as per the manufacturers recommendations to improve measurement time, without compromising data.

All other Spurious Emissions up to 20 GHz

Resolution Bandwidth:	1 MHz (1 carrier, 2 carrier, 3 carrier)
Video Bandwidth:	1 MHz (1 carrier, 2 carrier, 3 carrier)
Video Average:	10 Averages
Span:	Set accordingly
Attenuation:	Set accordingly
Ref. Level:	Set accordingly
Ref. Level Offset:	Set accordingly

4.3.3 Test Setup

The set-up used for the MFRM2 Antenna Port Spurious Emission test is illustrated in Figure 6 and consist of:

- Metro Cell Digital Enclosure shelf
- MFRM2 system --> MFRM2 Radio Module, DPM module, FAM module and cabling
- High power (100W), high frequency range (DC to 18 GHz) attenuator as per Table 3
- High frequency range (20 Hz to 26.5 GHz) Spectrum Analyzer as per Table 3
- High frequency range, low loss RF cabling
- Control PC

Spurious Emissions are measured on the SA, which for the purpose of filing the test report for FCC compliance, needs to be calibrated and meet to or exceed the FCC Part 2.1057 - Frequency Spectrum to be investigated requirements.

The high power, high frequency range attenuator will be verified for flatness across the frequency range specified in FCC Part 2.1057 - Frequency Spectrum to be investigated. Namely, for the 1900MHz MFRM2 the range is DC to 20 GHz.

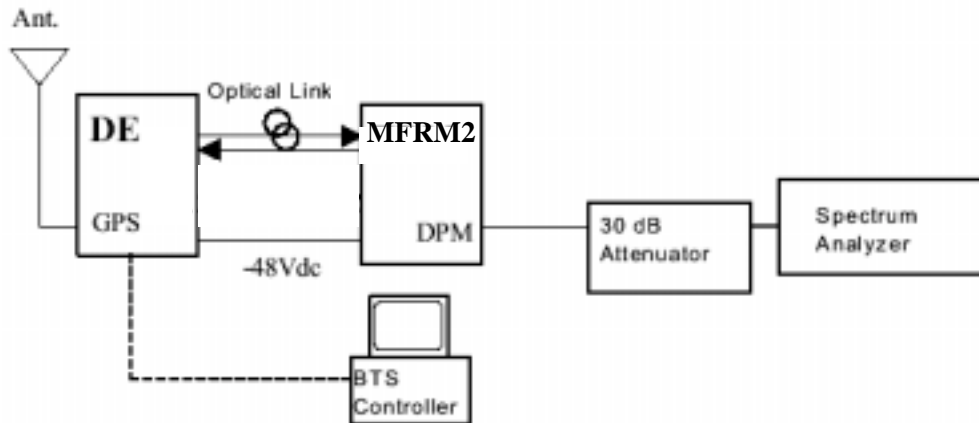


Figure 6 : Test Setup for Spurious Emissions Measurement

4.3.4 Test Results

The frequency spectrum from 1 MHz to 20 GHz is scanned for emissions using the spectrum analyzer settings outlined in 4.3.2. The MFRM2 complies with the limit of -13 dBm per 1 MHz of BW. Table 10, Table 11 and Table 12 show the spurious emissions at the antenna port of the MFRM2 for 1, 2 and 3 carrier modes. The plots that follow show the spurious emissions in one, two and three carrier configurations. Although plots were recorded for all channels tested, only one sample plot per carrier configuration is provided to reduce the number of figures.

Table 10 : Spurious Emissions at the 1900 MHz MFRM2 Antenna Port, 1 Carrier Mode

Channel Number (Band)	Frequency (MHz)	Worst Case Spurious Emissions Level (dBm)	Margin to FCC Limit of -13 dBm (dB)
25 (A)	1929 :- 1930 (lower adjacent MHz)	-29.9	16.9
	1950 :- 1951 (upper adjacent MHz)	-42.4	29.4
375 (D)	1929 :- 1930 (lower adjacent MHz)	-42.3	29.3
	1950 :- 1951 (upper adjacent MHz)	-28.3	15.3
425 (B)	1949 :- 1950 (lower adjacent MHz)	-28.8	15.8
	1970 :- 1971 (upper adjacent MHz)	-43.2	30.2
775 (E)	1949 :- 1950 (lower adjacent MHz)	-41.9	28.9
	1970 :- 1971 (upper adjacent MHz)	-28.4	15.4

Channel Number (Band)	Frequency (MHz)	Worst Case Spurious Emissions Level (dBm)	Margin to FCC Limit of -13 dBm (dB)
825 (F)	1969 :- 1970 (lower adjacent MHz)	-27.9	14.9
	1990 :- 1991 (upper adjacent MHz)	-43.6	30.6
1175 (C)	1969 :- 1970 (lower adjacent MHz)	-41.5	28.5
	1990 :- 1991 (upper adjacent MHz)	-26.8	13.8
N/A	0 :- lower adjacent MHz ^a (RBW=1 MHz)	-19.5	6.5 ^b
N/A	upper adjacent MHz :- 5000 ^a (RBW=1 MHz)	-24.3	11.3 ^b
N/A	5000 - 20000 ^a (RBW=1 MHz)	-37.0	24.0

- a. Emission levels given in these ranges represents the worst case value over all the tested channels
- b. Worst Case margin values determined by the emissions performance in the 1 MHz band immediately outside the lower/upper adjacent MHz

Table 11 : Spurious Emissions at the 1900 MHz MFRM2 Antenna Port, 2 Carrier Mode

Channel Numbers (Band)	Frequency (MHz)	Worst Case Spurious Emissions Level (dBm)	Margin to FCC Limit of -13 dBm (dB)
25, 50 (A)	1929 :- 1930 (lower adjacent MHz)	-26.3	13.3
	1950 :- 1951 (upper adjacent MHz)	-36.7	23.7
350, 375 (D)	1929 :- 1930 (lower adjacent MHz)	-36.4	23.4
	1950 :- 1951 (upper adjacent MHz)	-22.8	9.8
425, 450 (B)	1949 :- 1950 (lower adjacent MHz)	-26.0	13.0
	1970 :- 1971 (upper adjacent MHz)	-42.9	29.9
750, 775 (E)	1949 :- 1950 (lower adjacent MHz)	-36.6	23.6
	1970 :- 1971 (upper adjacent MHz)	-21.4	8.4
825, 850 (F)	1969 :- 1970 (lower adjacent MHz)	-25.8	12.8
	1990 :- 1991 (upper adjacent MHz)	-43.5	30.5

Channel Numbers (Band)	Frequency (MHz)	Worst Case Spurious Emissions Level (dBm)	Margin to FCC Limit of -13 dBm (dB)
1150, 1175 (C)	1969 :- 1970 (lower adjacent MHz)	-35.9	22.9
	1990 :- 1991 (upper adjacent MHz)	-22.1	9.1
N/A	0 :- lower adjacent MHz ^a (RBW=1 MHz)	-15.9	2.9 ^b
N/A	upper adjacent MHz :- 5000 ^a (RBW=1 MHz)	-16.5	3.5 ^b
N/A	5000 - 20000 ^a (RBW=1 MHz)	-37.0	24.0

- a. Emission levels given in these ranges represents the worst case value over all the tested channels
 b. Worst Case margin values determined by the emissions performance in the 1 MHz band immediately outside the lower/upper adjacent MHz

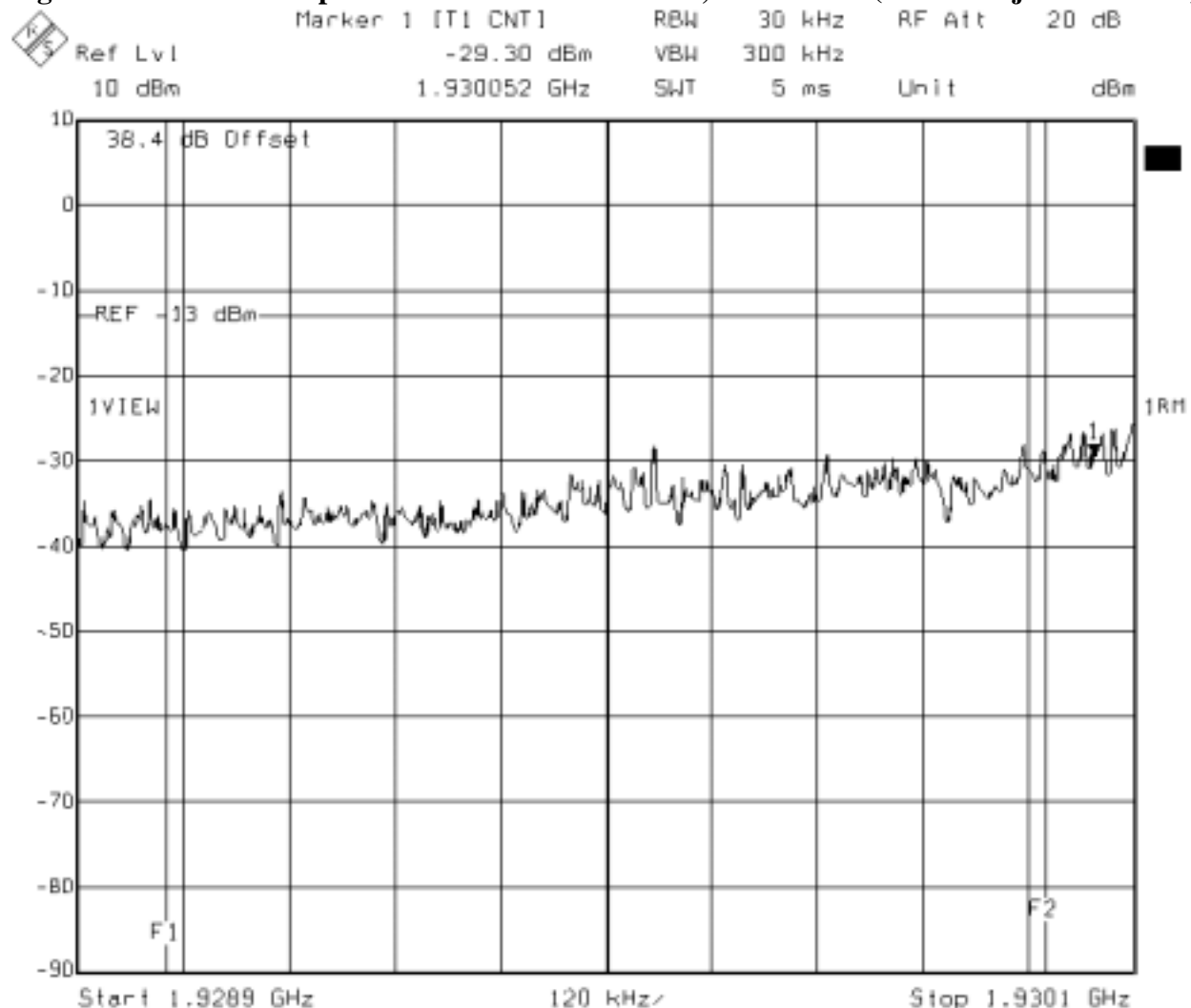
Table 12 : Spurious Emissions at the 1900 MHz MFRM2 Antenna Port, 3 Carrier Mode

Channel Numbers (Band)	Frequency (MHz)	Worst Case Spurious Emissions Level (dBm)	Margin to FCC Limit of -13 dBm (dB)
25, 50, 75 (A)	1929 :- 1930 (lower adjacent MHz)	-26.6	13.6
	1950 :- 1951 (upper adjacent MHz)	-36.2	23.2
325, 350, 375 (D)	1929 :- 1930 (lower adjacent MHz)	-36.1	23.1
	1950 :- 1951 (upper adjacent MHz)	-23.1	10.1
425, 450, 475 (B)	1949 :- 1950 (lower adjacent MHz)	-23.9	10.9
	1970 :- 1971 (upper adjacent MHz)	-37.0	24.0
725, 750, 775 (E)	1949 :- 1950 (lower adjacent MHz)	-36.2	23.2
	1970 :- 1971 (upper adjacent MHz)	-22.8	9.8
825, 850, 875 (F)	1969 :- 1970 (lower adjacent MHz)	-25.8	12.8
	1990 :- 1991 (upper adjacent MHz)	-37.6	24.6
1125, 1150, 1175 (C)	1969 :- 1970 (lower adjacent MHz)	-36.7	23.7
	1990 :- 1991 (upper adjacent MHz)	-25.6	12.6
N/A	0 :- lower adjacent MHz ^a (RBW=1 MHz)	-14.7	1.7 ^b

Channel Numbers (Band)	Frequency (MHz)	Worst Case Spurious Emissions Level (dBm)	Margin to FCC Limit of -13 dBm (dB)
N/A	upper adjacent MHz :- 5000 ^a (RBW=1 MHz)	-14.4	1.4 ^b
N/A	5000 - 20000 ^a (RBW=1 MHz)	-37.0	24.0

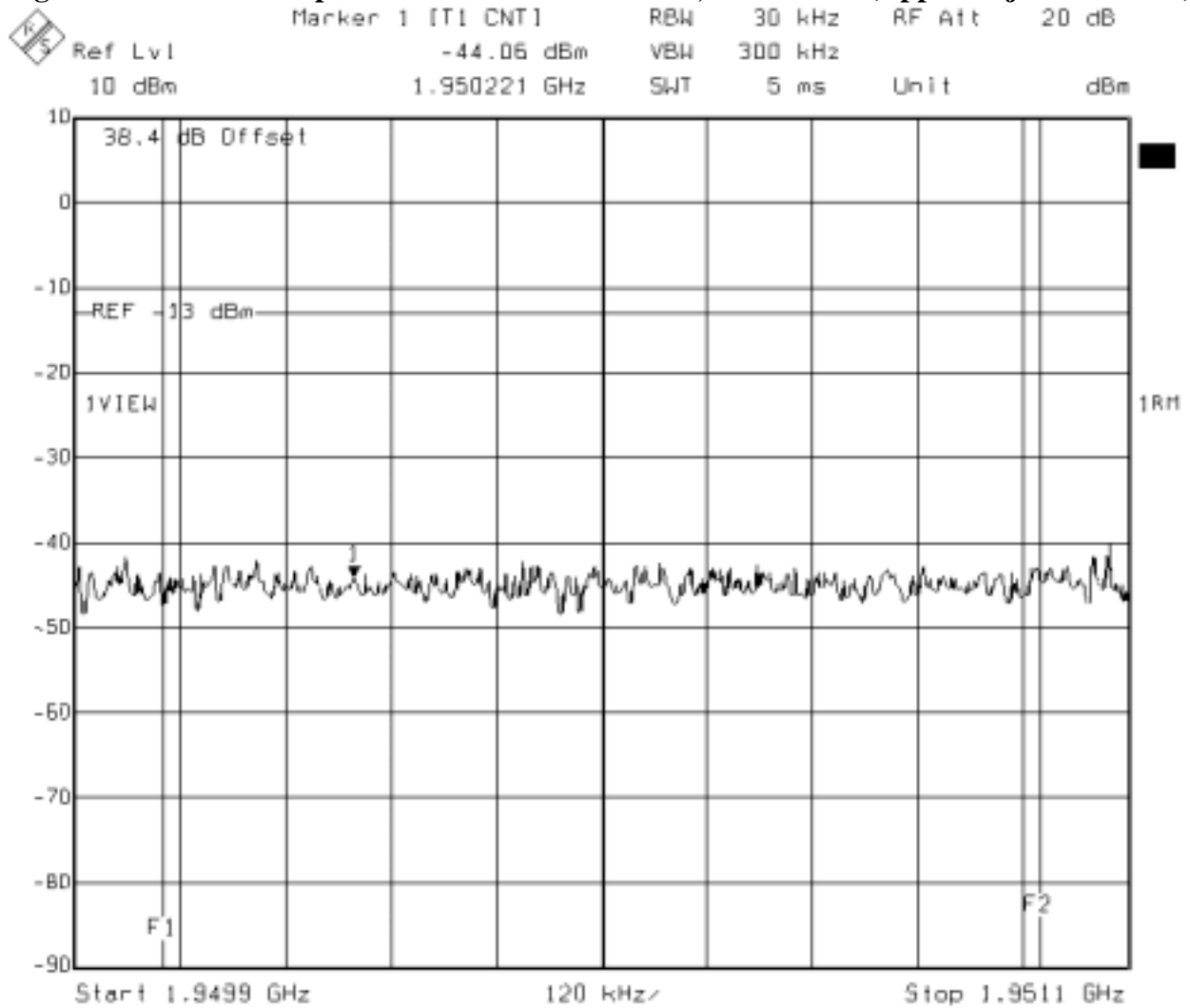
- a. Emission levels given in these ranges represents the worst case value over all the tested channels
- b. Worst Case margin values determined by the emissions performance in the 1 MHz band immediately outside the lower/upper adjacent MHz

Figure 7 : Conducted Spurious Emissions - 1 Carrier, Channel 25 (Lower Adjacent 1 MHz)



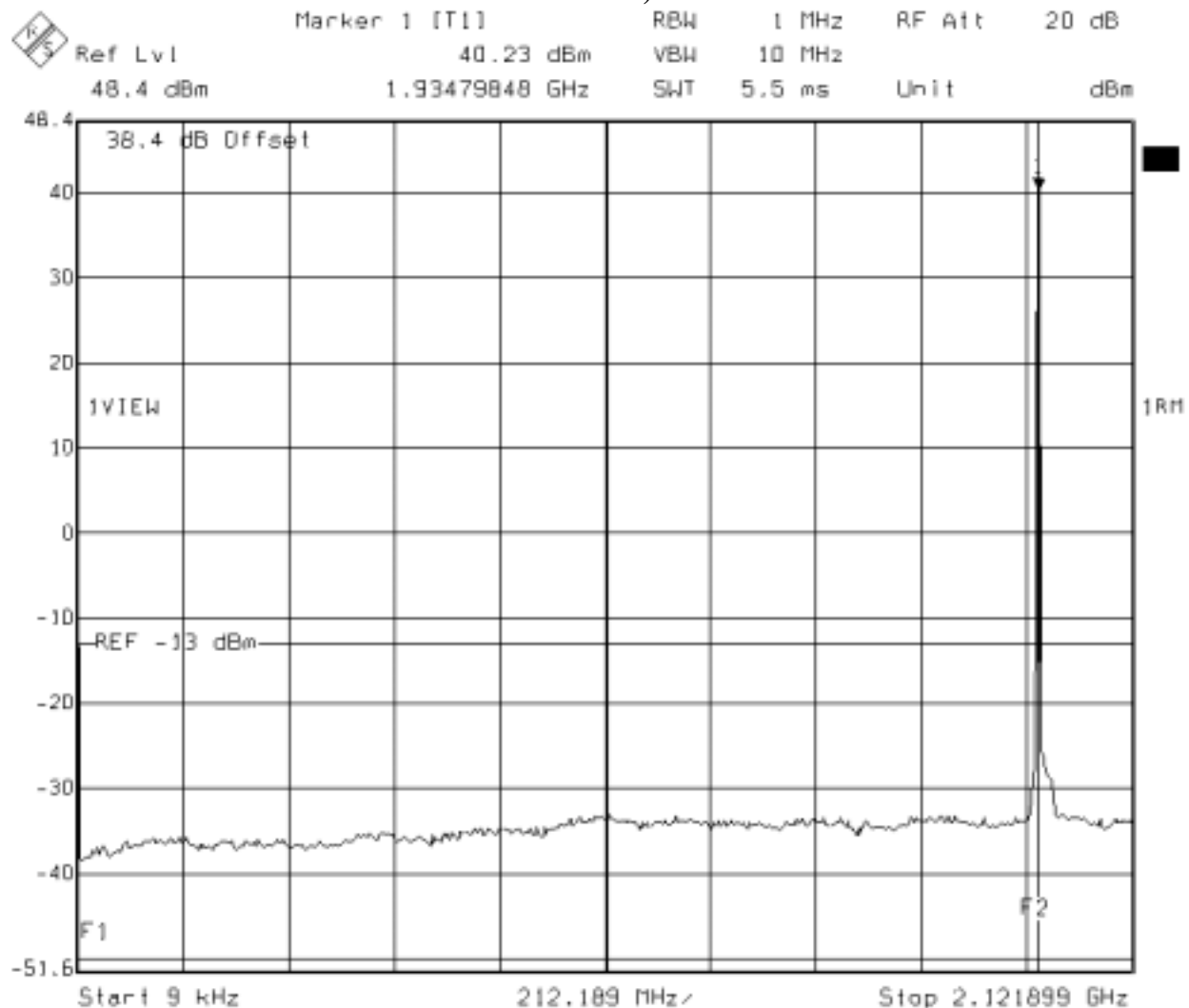
Title: MFRM-2, 1 carrier, ch 25, (Low edge-1.0MHz) to Low edge
Comment A: Temp C 25, Normal Humidity
Date: 09.FEB.1903 11:38:37

Figure 8 : Conducted Spurious Emissions - 1 Carrier, Channel 25 (Upper Adjacent 1 MHz)



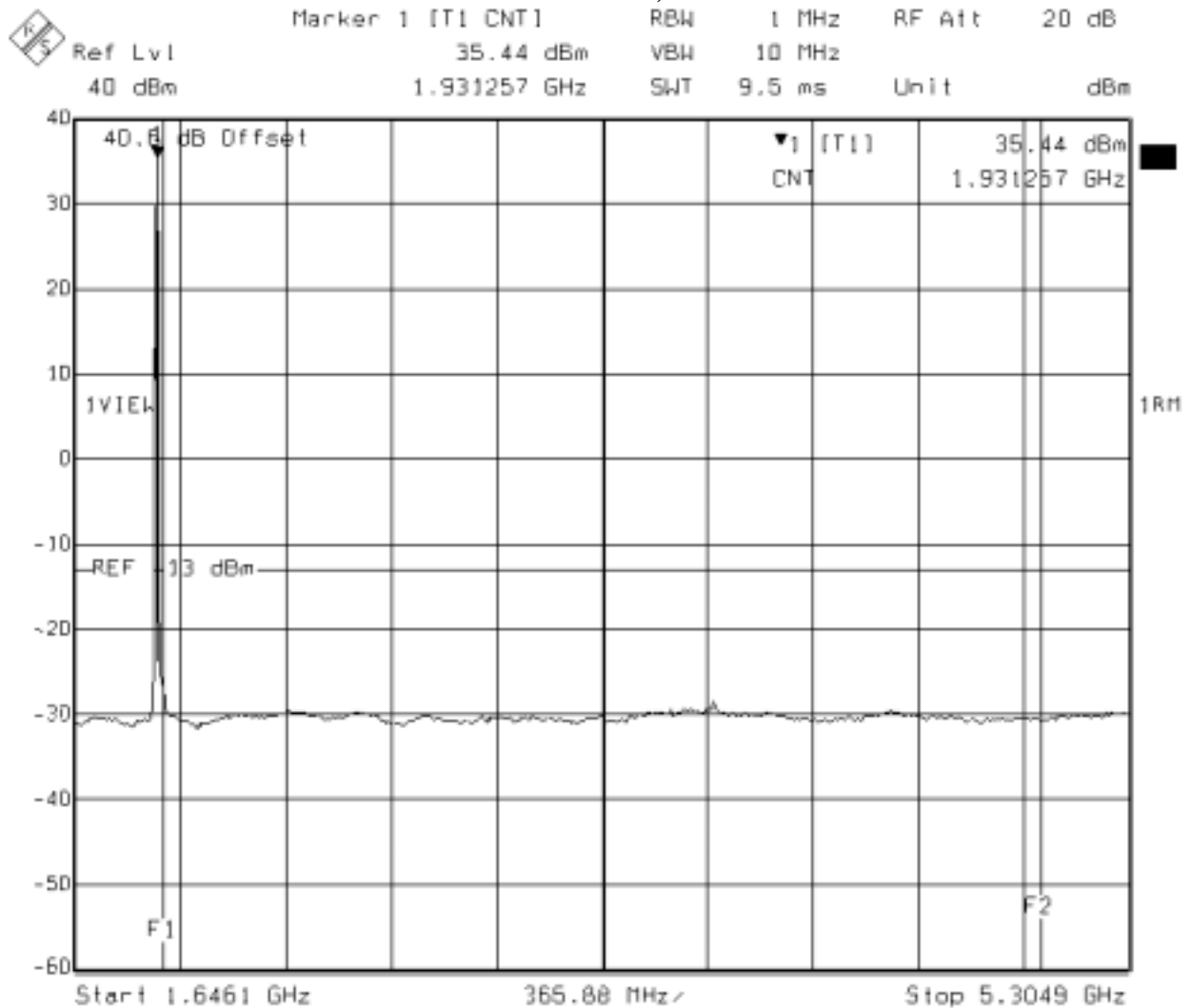
Title: MFRM-2, 1 carrier, ch 25, Upr edge to (Upr edge+1 MHz)
 Comment A: Temp C 25, Normal Humidity
 Date: 09.FEB.2003 11:39:49

Figure 9 : Conducted Spurious Emissions - 1 Carrier, Channel 25 (9kHz :- Lower Adjacent 1 MHz)



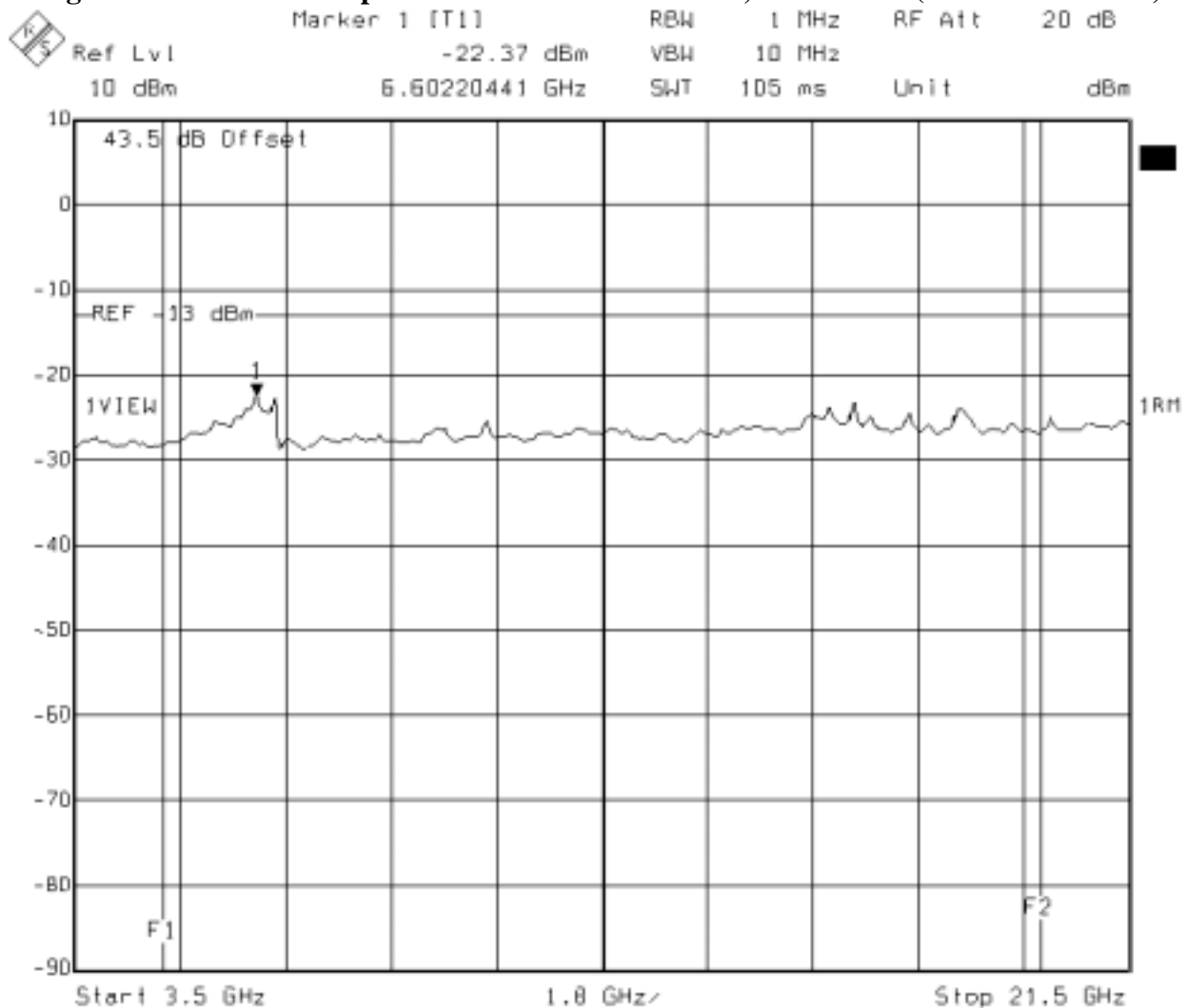
Title: MFRM-2, 1 carrier, ch 25, 9kHz_(Low edge-1.0MHz)
Comment A: Temp C 25, Normal Humidity
Date: 09.FEB.2003 11:37:24

**Figure 10 : Conducted Spurious Emissions - 1 Carrier, Channel 25 (Upper Adjacent 1 MHz
 :-: 5 GHz)**



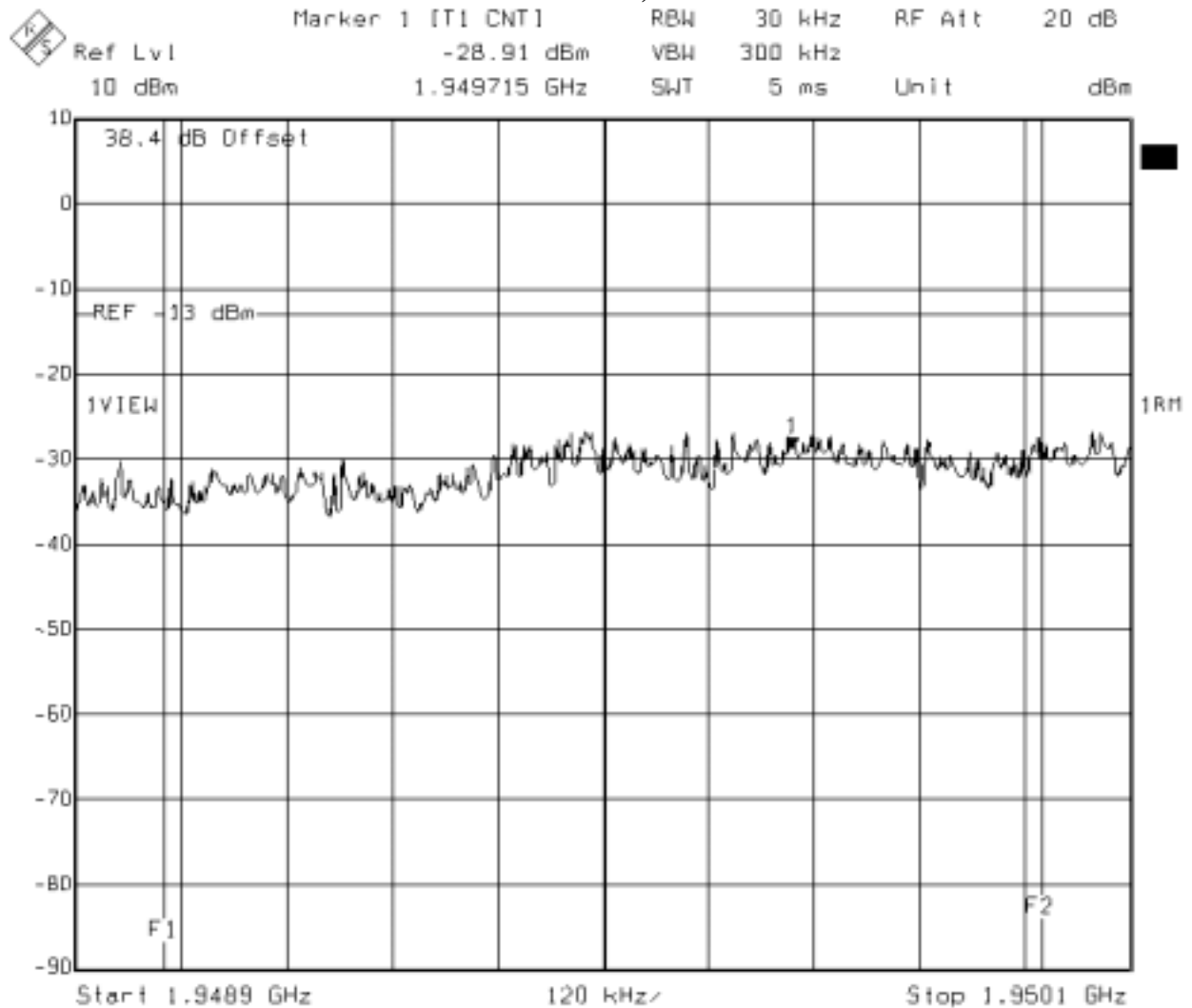
Title: MFRM-2, 1 carrier, ch 25, (Upper edge + 1 MHz) to 5 GHz
 Comment A: Temp C 25, Normal Humidity
 Date: 09.FEB.2003 12:23:43

Figure 11 : Conducted Spurious Emissions - 1 Carrier, Channel 25 (5 GHz :- 20 GHz)



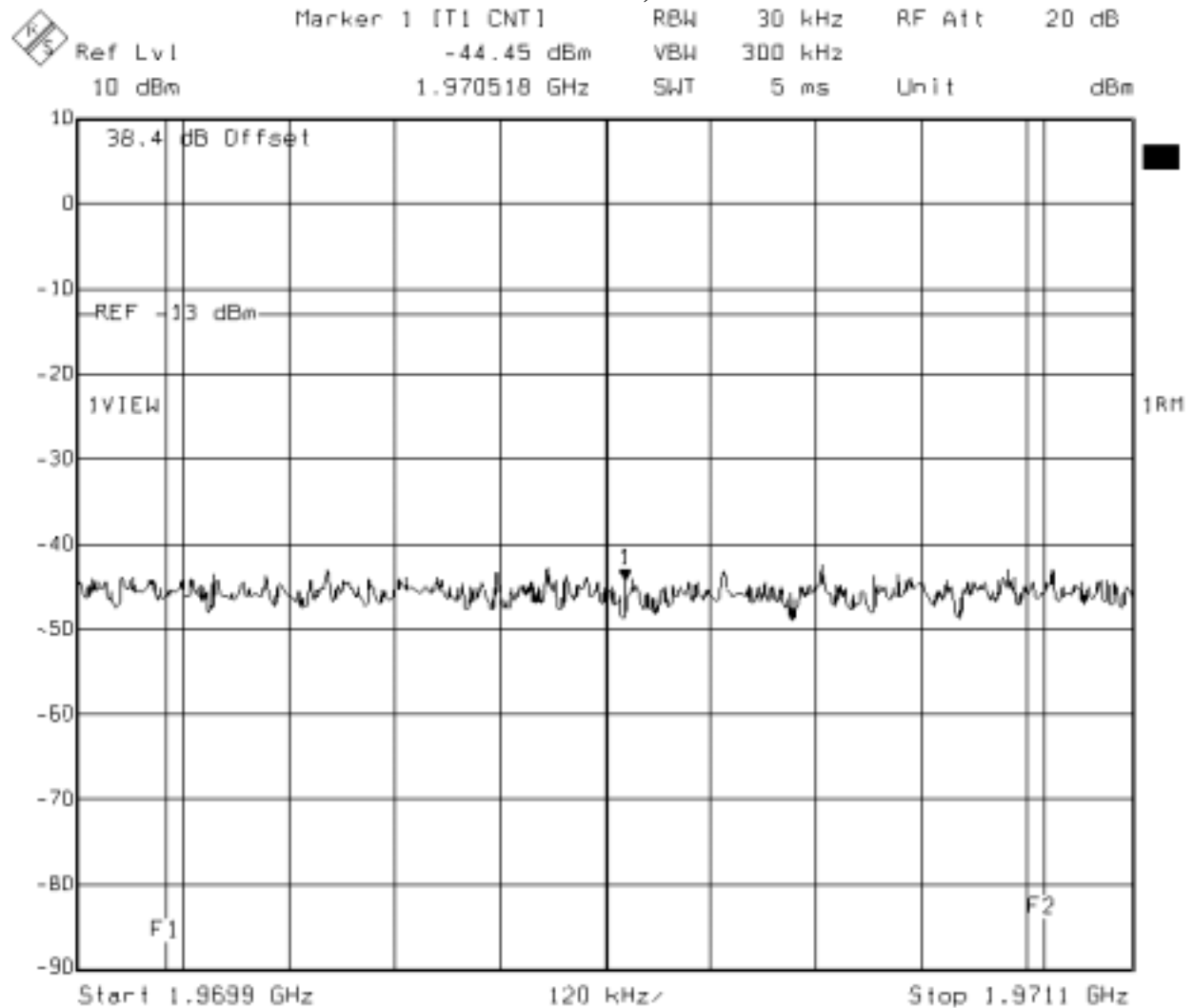
Title: MFRM-2, 1 carrier, ch 25, 5 GHz to 20 GHz
Comment A: Temp C 25, Normal Humidity
Date: 09.FEB.1903 12:24:47

Figure 12 : Conducted Spurious Emissions - 2 Carrier, Channels 425, 450 (Lower Adjacent 1 MHz)



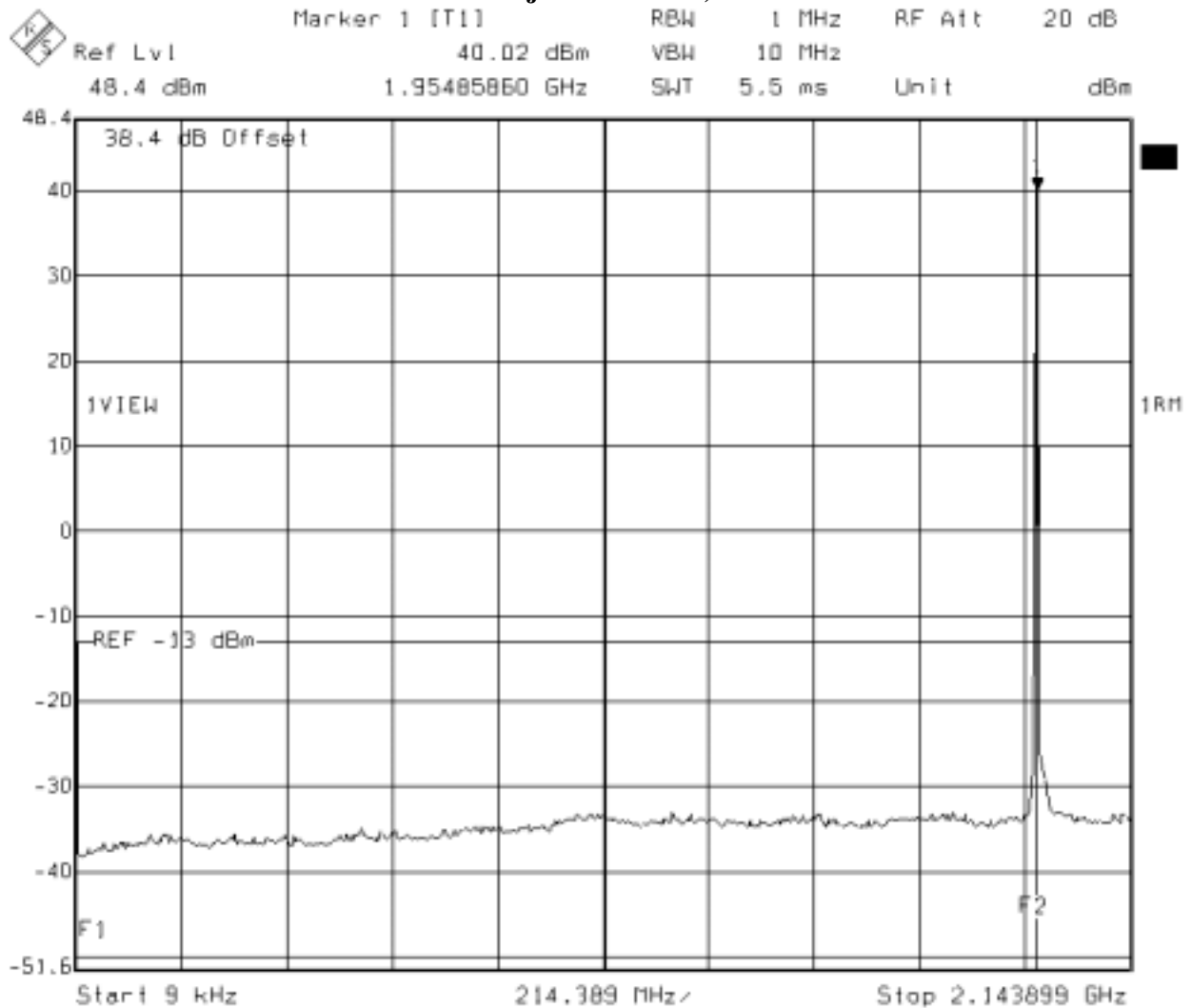
Title: MFRM-2, 2 carriers, ch 425, (Low edge-1.0MHz) to Low edge
 Comment A: Temp C 25, Normal Humidity
 Date: 08.FEB.2003 11:34:35

Figure 13 : Conducted Spurious Emissions - 2 Carrier, Channels 425, 450 (Upper Adjacent 1 MHz)



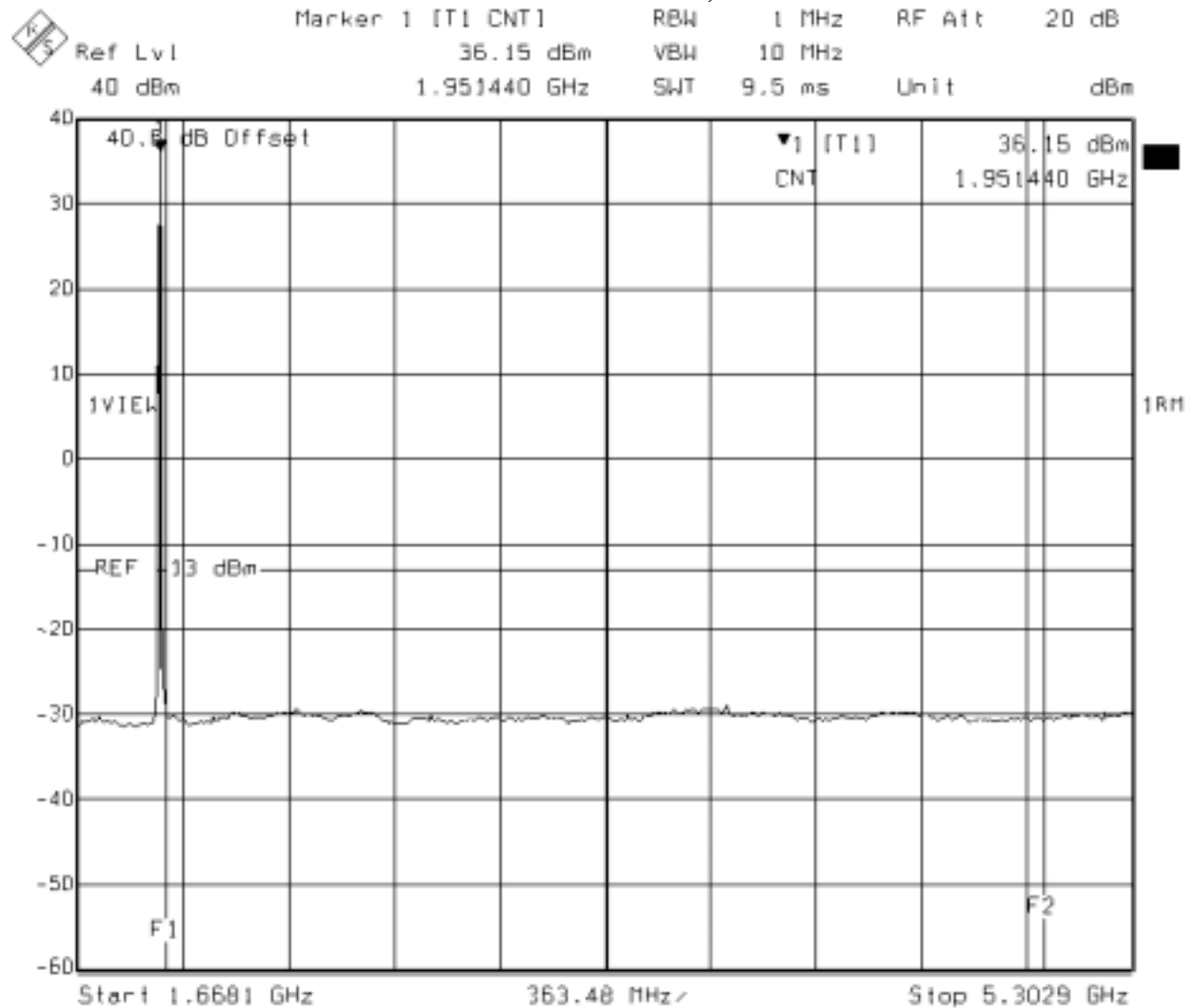
Title: MFRM-2, 2 carriers, ch 425, Upr edge to (Upr edge+1 MHz)
 Comment A: Temp C 25, Normal Humidity
 Date: 08.FEB.2003 11:35:46

Figure 14 : Conducted Spurious Emissions - 2 Carrier, Channels 425, 450 (9kHz :- Lower Adjacent 1 MHz)



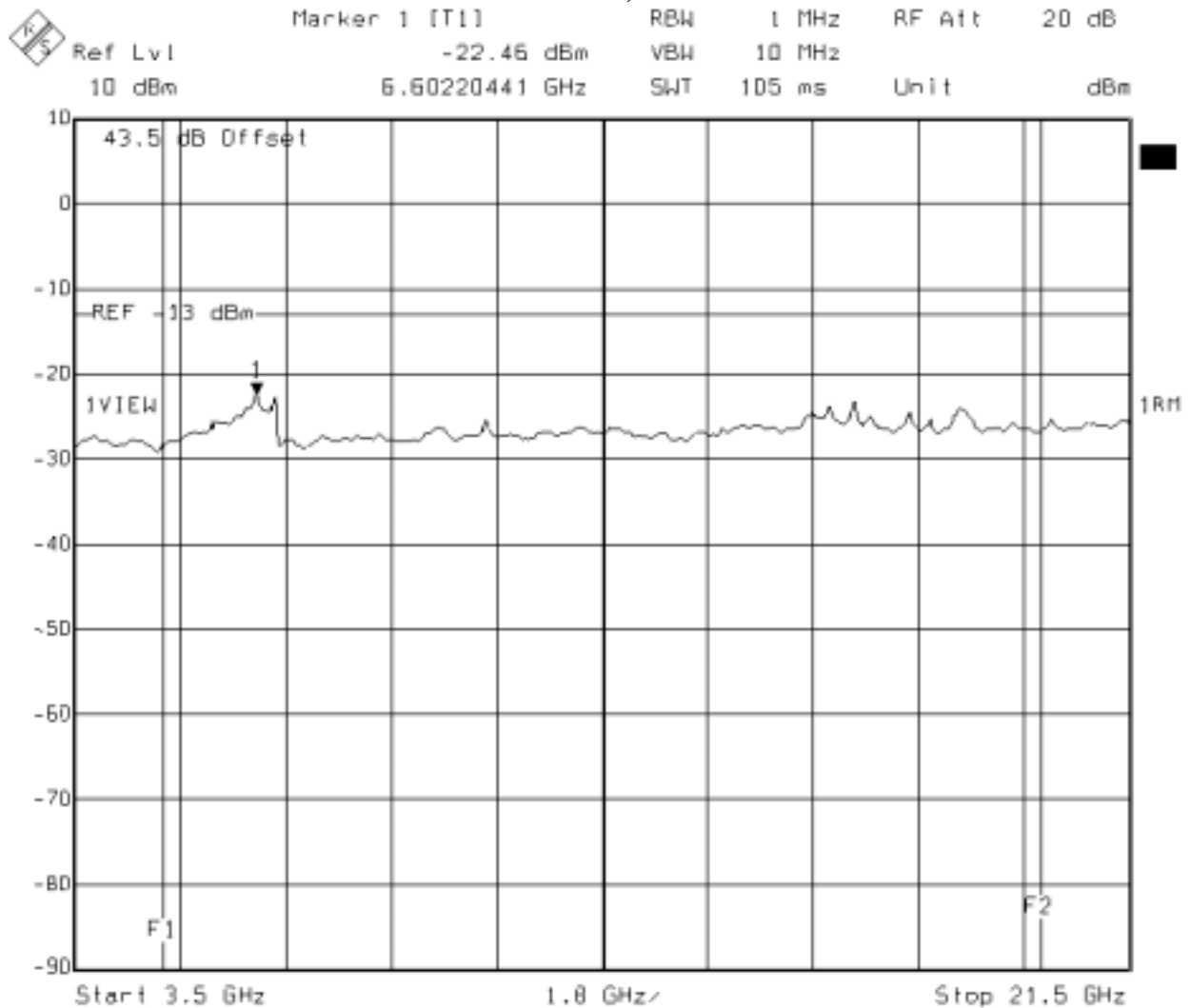
Title: MFRM-2, 2 carriers, ch 425, 9kHz_(Low edge-1.0MHz)
 Comment A: Temp C 25, Normal Humidity
 Date: 08.FEB.2003 11:33:22

**Figure 15 : Conducted Spurious Emissions - 2 Carrier, Channels 425, 450 (Upper Adjacent
1 MHz :- 5 GHz)**



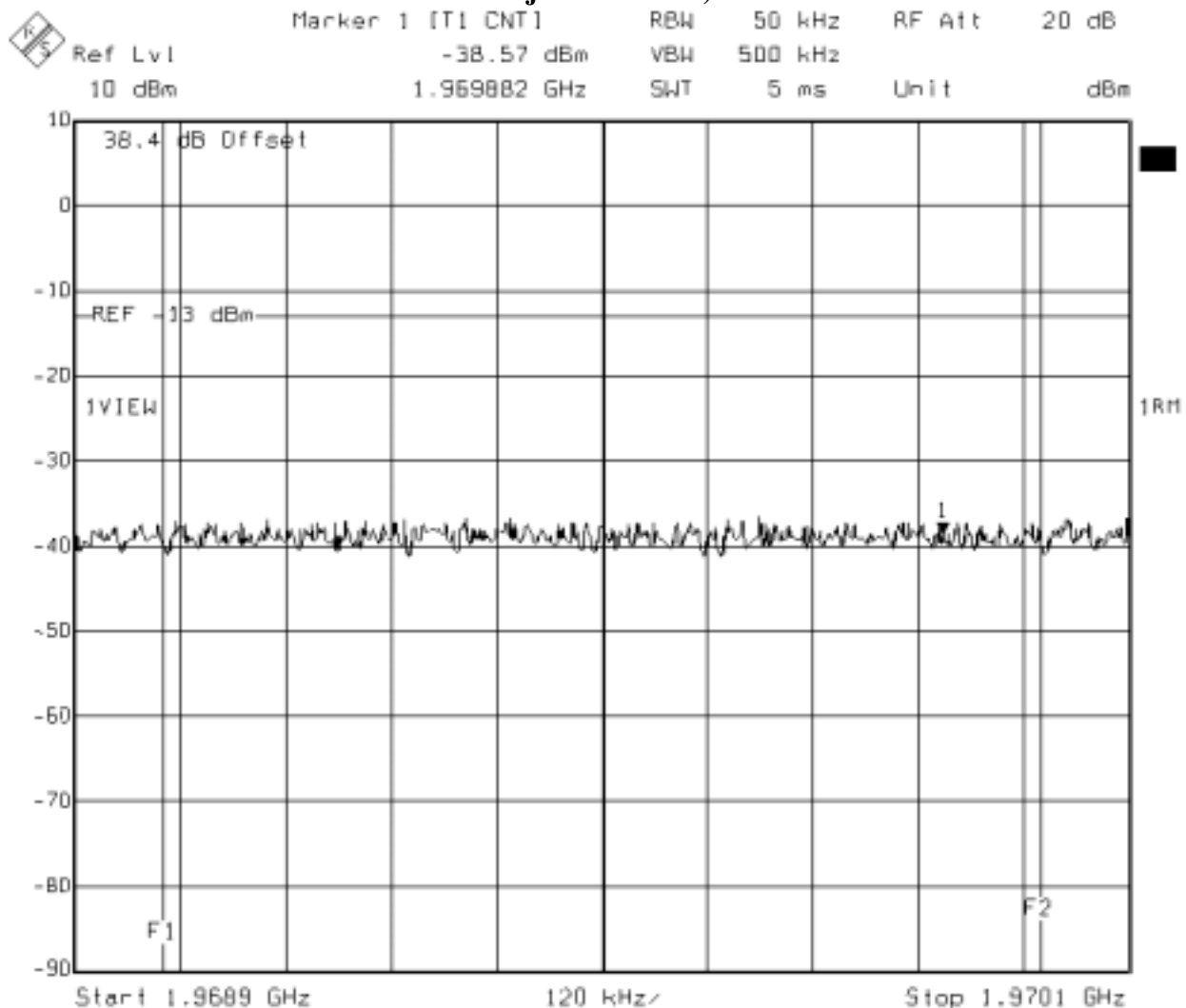
Title: MFRM-2, 2 carriers, ch 425, (Upper edge + 1 MHz) to 5 GHz
 Comment A: Temp C 25, Normal Humidity
 Date: 08.FEB.2003 14:29:45

Figure 16 : Conducted Spurious Emissions - 2 Carrier, Channels 425, 450 (5 GHz :- 20 GHz)



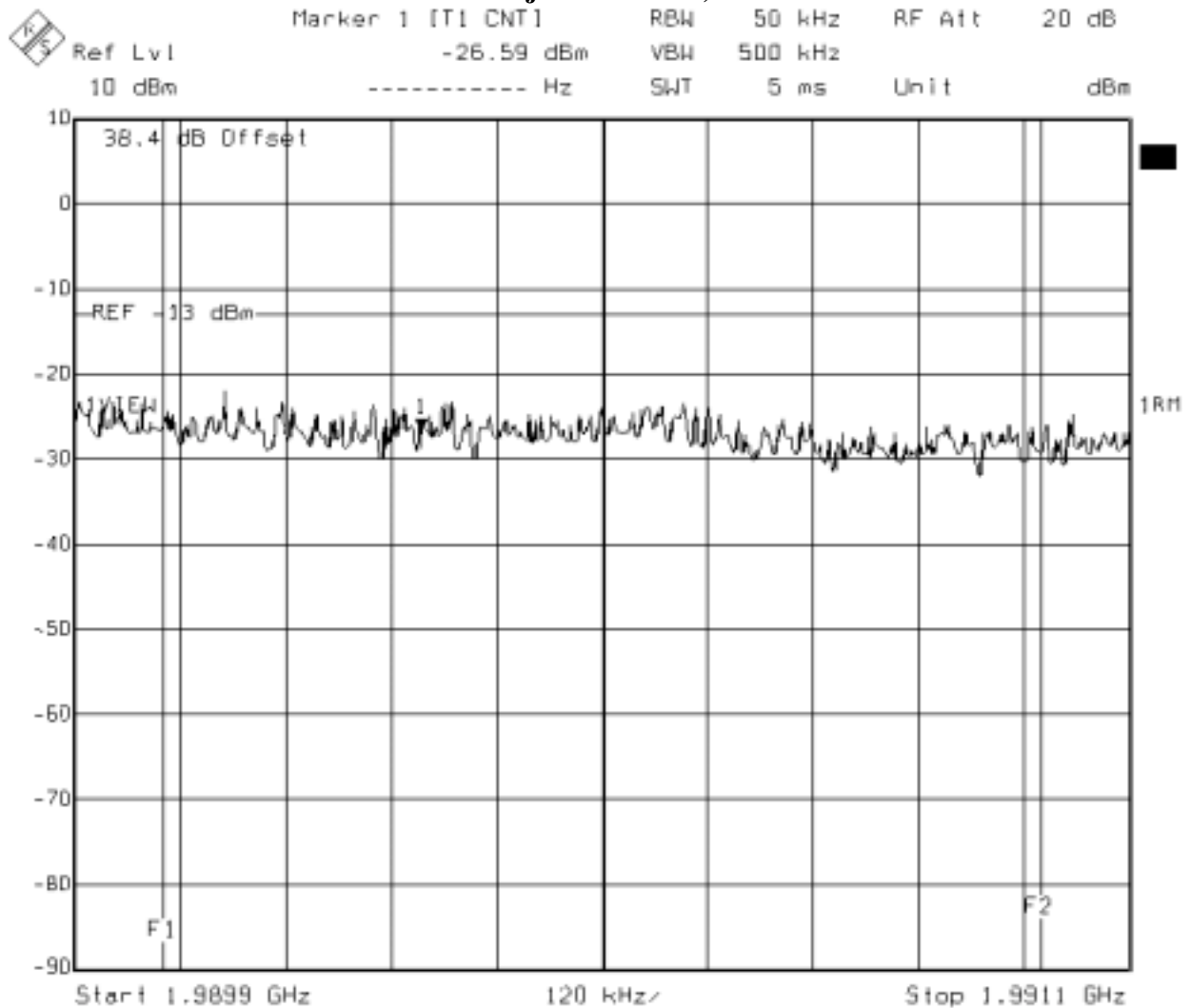
Title: MFRM-2, 2 carriers, ch 425, 5 GHz to 20 GHz
 Comment A: Temp C 25, Normal Humidity
 Date: 08.FEB.2003 14:30:49

Figure 17 : Conducted Spurious Emissions - 3 Carrier, Channels 1125, 1150, 1175 (Lower Adjacent 1 MHz)



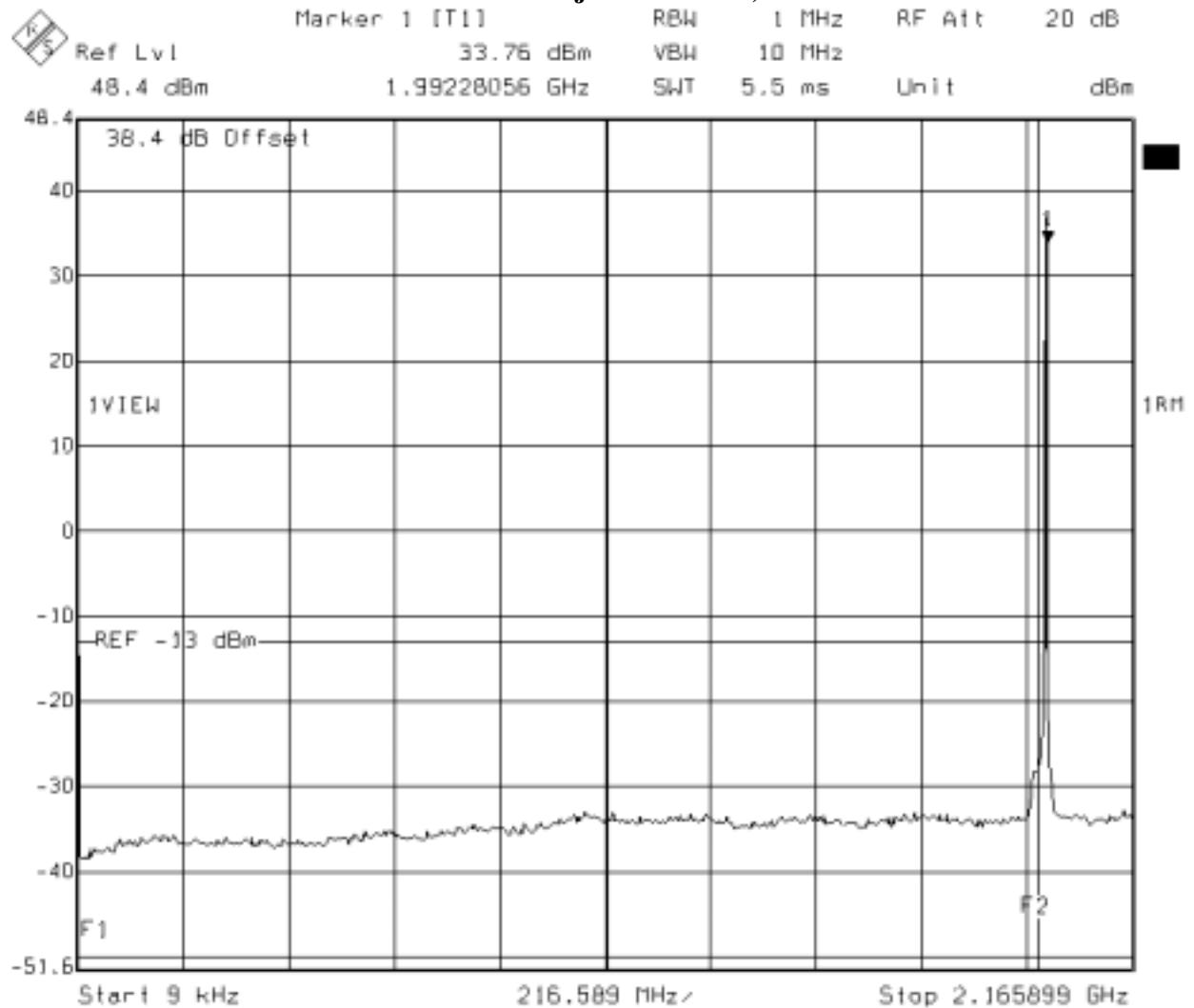
Title: MFRM-2, 3 carriers, ch 1175, (Low edge-1.0MHz) to Low edge
 Comment A: Temp C 25, Normal Humidity
 Date: 07.FEB.2003 13:48:37

Figure 18 : Conducted Spurious Emissions - 3 Carrier, Channels 1125, 1150, 1175 (Upper Adjacent 1 MHz)



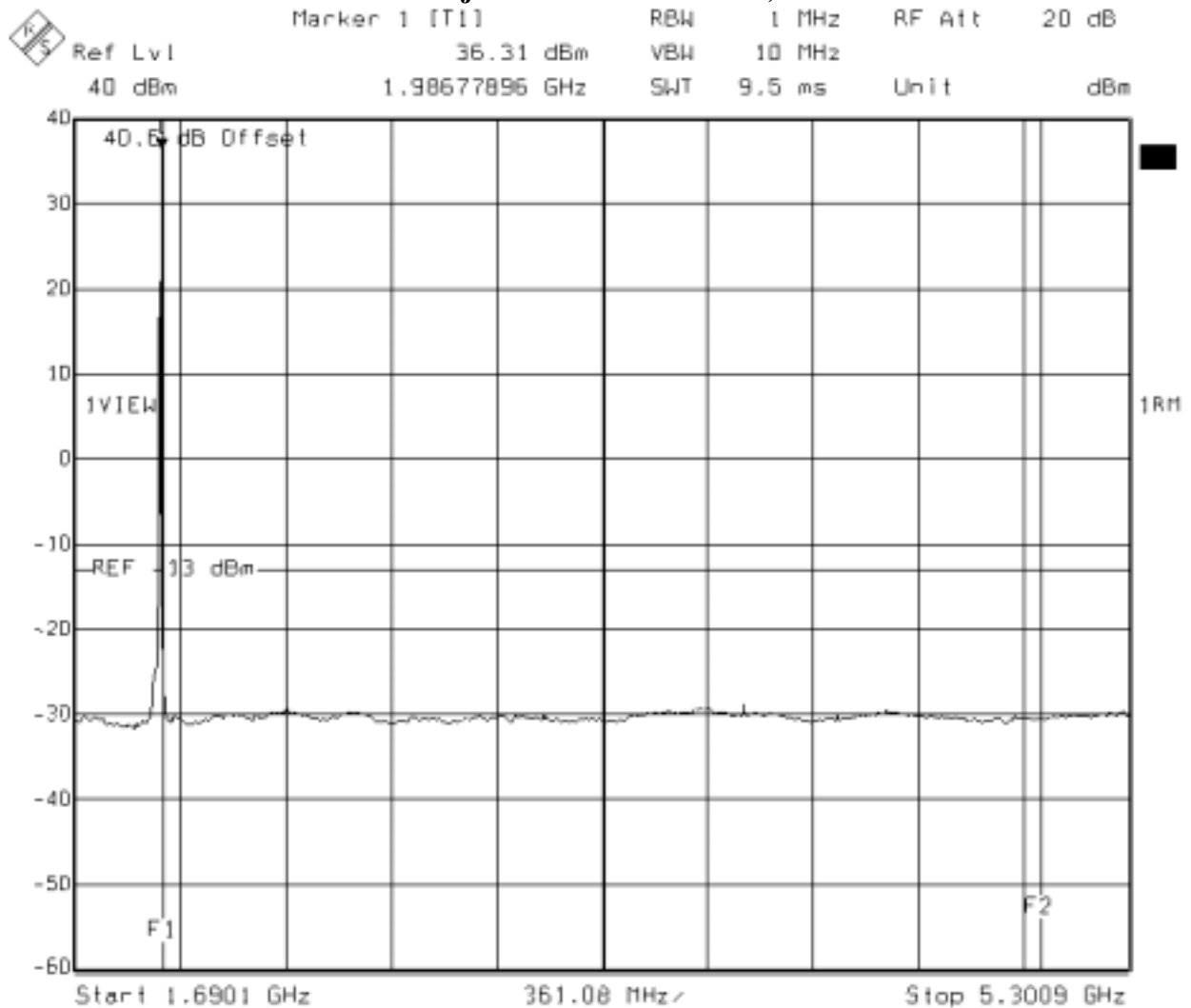
Title: MFRM-2, 3 carriers, ch 1175, Upr edge to (Upr edge+1 MHz)
 Comment A: Temp C 25, Normal Humidity
 Date: 07.FEB.2003 13:49:44

**Figure 19 : Conducted Spurious Emissions - 3 Carrier, Channels 1125, 1150, 1175 (9kHz :-
Lower Adjacent 1 MHz)**



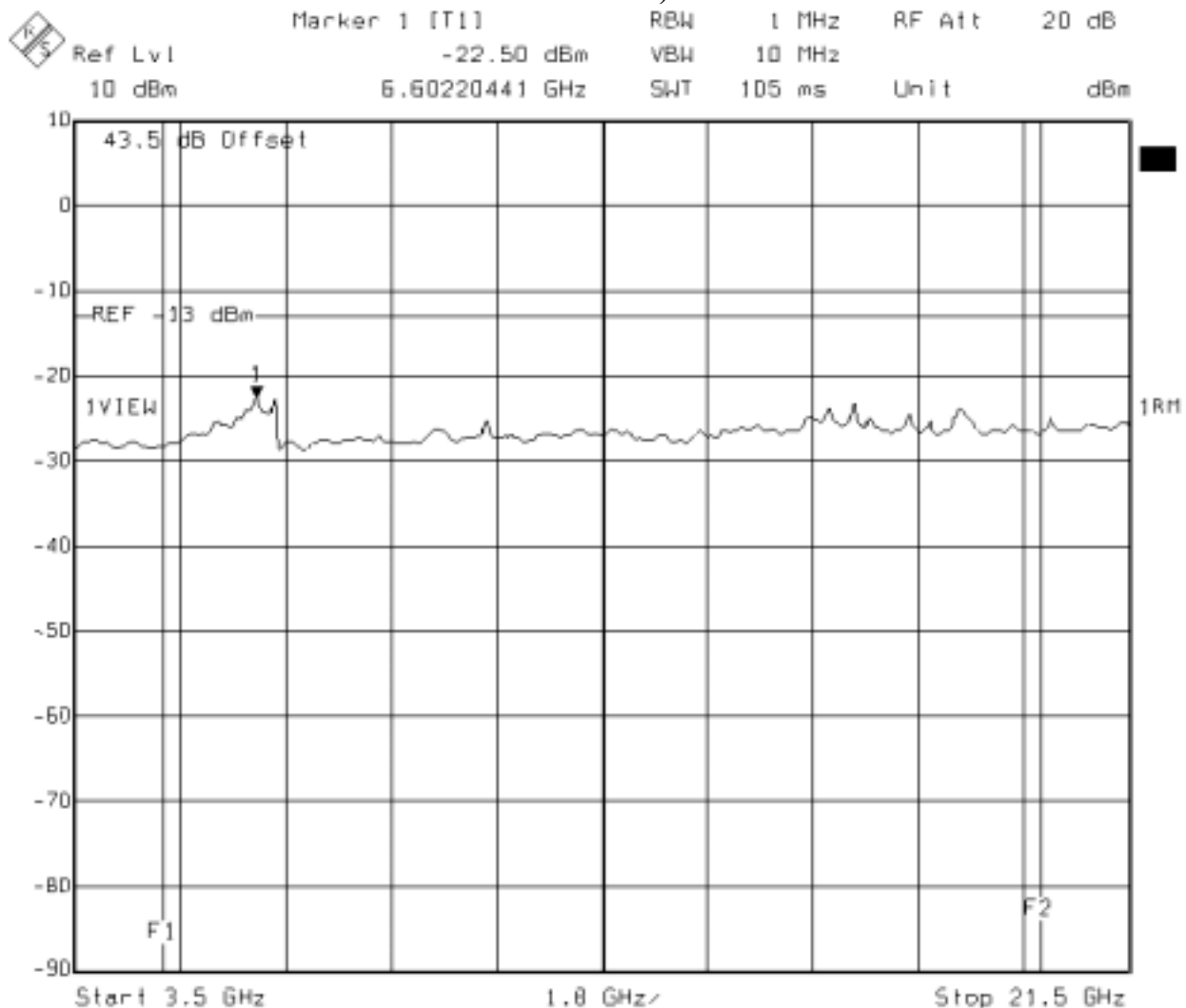
Title: MFRM-2, 3 carriers, ch 1175, 9kHz_(Low edge-1.0MHz)
 Comment A: Temp C 25, Normal Humidity
 Date: 07.FEB.2003 13:47:30

Figure 20 : Conducted Spurious Emissions - 3 Carrier, Channels 1125, 1150, 1175 (Upper Adjacent 1 MHz :- 5 GHz)



Title: MFRM-2, 3 carriers, ch 1175, (Upper edge + 1 MHz) to 5 GHz
 Comment A: Temp C 25, Normal Humidity
 Date: 07.FEB.1903 14:58:17

Figure 21 : Conducted Spurious Emissions - 3 Carrier, Channels 1125, 1150, 1175 (5 GHz - :- 20 GHz)



Title: MFRM-2, 3 carriers, ch 1175, 5 GHz to 20 GHz
 Comment A: Temp C 25, Normal Humidity
 Date: 07.FEB.2003 15:02:18

4.4 Frequency Stability

4.4.1 Frequency Stability Requirements

FCC Part 2.1055

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From -30 to +50 centigrade for all equipment except that specified in subparagraphs (2) and (3) of this paragraph.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10 centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

(3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

(e) When deemed necessary, the Commission may require tests of frequency stability under conditions in addition to those specifically set out in paragraphs (a), (b), (c) and (d) of this section. (For example, measurements showing the effect of proximity to large metal objects, or of various types of antennas, may be required for portable equipment.)

FCC Part 24.235 Limit

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

4.4.2 Test Method

The DE is configured via the BTS controller to enable the MFRM2 to transmit at nominal output power level. Measurements are made for three carrier configuration, channels 575, 600 & 625.

The MFRM2 System is subjected to ambient temperatures from -30° to $+50^{\circ}$ C at intervals of 10° C. A period of at least 2 hours is allowed prior to taking measurement to ensure that all of the oscillator circuit components have stabilized.

At each of the above specified temperatures, the average and maximum carrier deviation is recorded from the time the transmitter is keyed-on for a period of fifteen minutes using the HP 4406A VSA measurement system. Recorded data is based on processing 100 samples with 10 averages/sample.

At 25° C ambient temperature, measurements are made with the primary supply voltage set to 85%, 100% and 115% of the nominal value. The nominal primary supply voltage for the MFRM2 is -48 VDC. The same measurements will also be made for nominal primary supply voltage of +24 VDC.

4.4.3 Test Setup

The set-up used for the MFRM2 Frequency Stability test is illustrated in Figure 22. Frequency Stability measurements are referenced to the antenna port of the DPM.

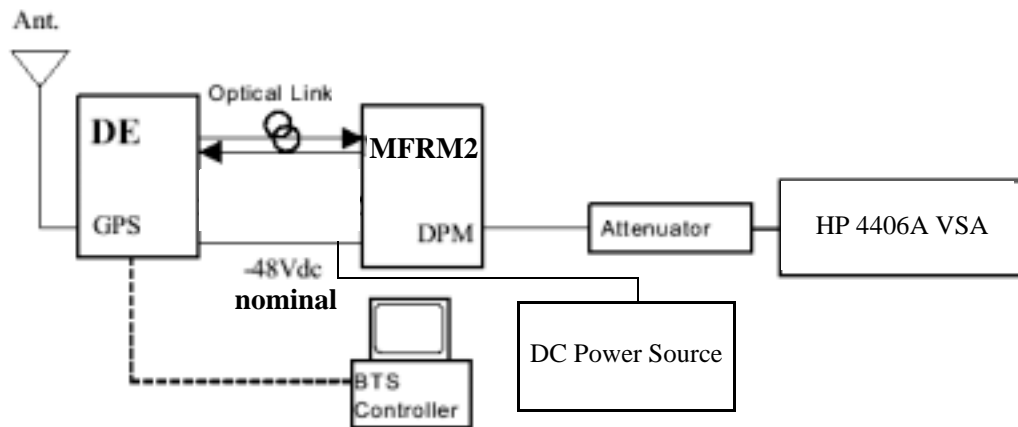


Figure 22 : Test Setup for Frequency Stability Measurement

4.4.4 Results

The MFRM2 System complies with the requirements. Table 13 shows the results for Frequency Stability versus Temperature Variation of the MFRM2 for 3 carrier configuration, channels 575, 600 & 625. Table 14 and Table 15 show the results for Frequency Stability versus Power Supply Voltage of the MFRM2 for 3 carrier configuration, channels 575, 600 & 625.

Table 13 : Frequency Stability versus Temperature Variation, 3 Carrier Mode

Temperature (°C)	Carrier Frequency Deviation (Hz)	
	Average	Maximum
-30	+0.74	+8.24
-20	+0.40	-7.08
-10	+0.13	+10.35
0	+1.17	+6.96
10	-0.31	+12.74
20	-1.64	-29.22
30	+1.36	+20.26
40	+1.90	+28.06
50	+1.66	+15.00

Table 14 : Frequency Stability versus Power Supply Voltage, 3 Carrier Mode, -48 VDC

Power Supply Voltage	Carrier Frequency Deviation (Hz)	
	Average	Maximum
-40.8 VDC	+0.44	+17.52
-48.0 VDC	+0.98	+19.06
-55.2 VDC	+1.57	+17.04

Table 15 : Frequency Stability versus Power Supply Voltage, 3 Carrier Mode, +24 VDC

Power Supply Voltage	Carrier Frequency Deviation (Hz)	
	Average	Maximum
+20.4 VDC	+1.08	+16.42
+24.0 VDC	+0.25	-11.28
+27.6 VDC	+0.16	+9.98

References

- [1] FCC Part 24 Subpart E, “Personal Communication Services”, http://www.access.gpo.gov/nara/cfr/waisidx_00/47cfr24_00.html
- [2] FCC Part 2 Subpart J, “Frequency allocations and radio treaty matters; general rules and regulations”, http://www.access.gpo.gov/nara/cfr/waisidx_00/47cfr2_00.html
- [3] TIA/EIA-97-D “Recommended Minimum Performance Standards for Base Stations Supporting Dual Mode Spread Spectrum Systems”, June 2001

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