TEST REPORT

ON

2 GHz TO 18 GHz

HIGH BAND DIRECTION FINDING MODULE

WITH INTEGRATED
GAIN LEVELING AMPLIFIER, DF/LEVELING ATTENUATOR, POWER AMPLIFIER, SWITCHED FILTER BANK AND PULSE MODULATOR

PMI MODEL No:

HBDFM-218-BD-DP

Series Number: PM408515

DESIGNED
BY
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TESTED
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YU RONG, Ph.D

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ISO9001 : 2000 CERTIFIED

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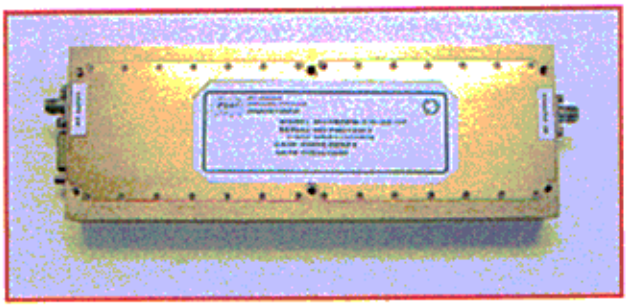
  - S/N: PM408515, PM408516, PM408520, PM405323, PM405324, PM405325, PM405326, PM405327, PM403067, PM403067, PM407470, PM407473, PM403284, PM403285, PM403286, PM403287, PM403288

2 To 18 GHz HIGHBAND DIRECTION FINDING MODULE

KEY FEATURES:

- **2 TO 18 GHz Frequency Range**
- **+19 dBm min Output Power**
- **700 ns 8 Bit 64dB Attenuator**
- **10 ns 60dB Pulse Modulator**
- **Better than 60dBc spurious**



SPECIFICATIONS:

Frequency Range	2.0-18.0 GHz
RF Input Signal Level Range	0 dBm to +3 dBm Typ., +6 dBm Max
RF Input Spectral Purity	Input Spurious Levels - 60 dBc Max. Input Harmonic Levels - 10 dBc Max.
RF Input Signal-To-Noise Ratio	70 dB Min.
RF Output Power Level and Gain Compression	Power Out = +21 dBm Min. at all frequencies with Input Power = +0 dBm and Attenuation set at minimum, Gain Compression at 0.9 dB maximum under these conditions
RF Output Spectral Purity	-60 dBc Max. for Spurious Signals and Harmonic Signals
Noise Figure	8.5 dB Max @ Min Attenuation
Macro-Gain Flatness Amplitude Taper	8.0 dB Max Peak-To-Peak @ -10 dBm Input
Fine-Grain Gain Flatness	3.0 dB Max Peak-To-Peak for any 40 MHz Bandwidth @ -10 dBm Input
VSWR	2.0:1, RF Input, RF Output

Pulse Modulator Switch:

Control	TTL Logic "0"=Insertion Loss, "1"=Isolation
Isolation	60 dBc Minimum
Switching Speed	
Rise Time	10 nS Max (10% RF to 90% RF)
Fall Time	10 nS Max (90% RF to 10% RF)
Delay Symmetry	Delay Symmetry between on/off to be 10 nS Max
P-Pod Video Generation	-60 dBm Max @ Pulsing to TTL "0" for 25 nS at a 2 MHz Rate

DF/Level Attenuator:

Attenuation Range	64 dB
Number of Bits	8
LSB	0.25 dB

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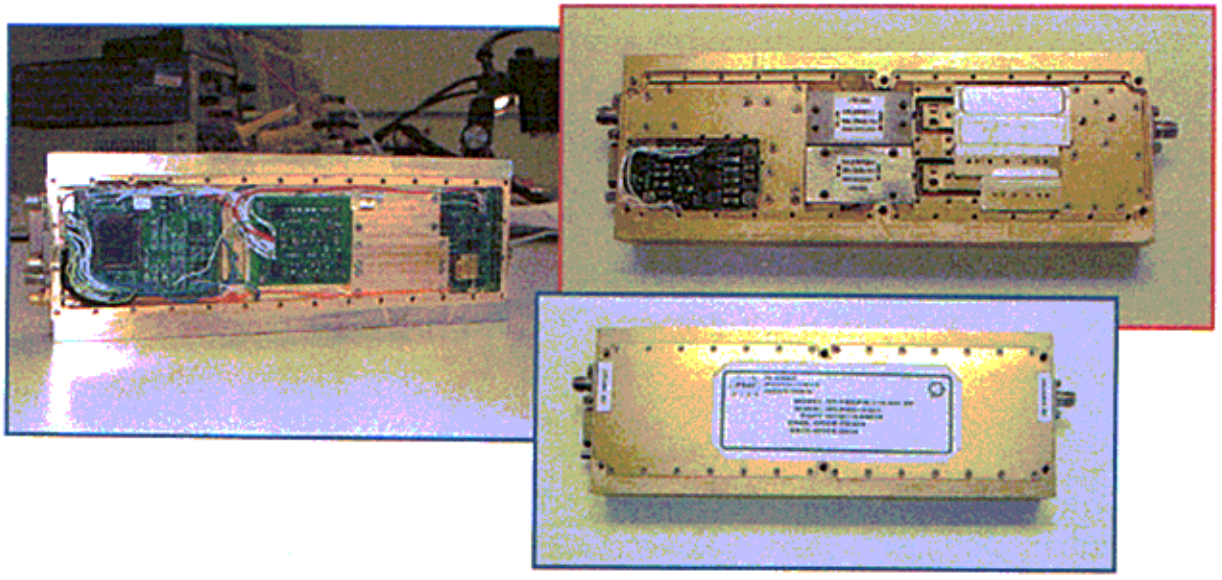
• Control	TTL, Positive-True
• Resolution	0.25 dB (LSB)
• Commands	0 dB = 0OH, 64 dB = FFh
• Switching Time	700 nS Max to ±1 dB of Final Attenuation Value
• Repeatability	0.125 dB Max

Switched Filters:

• Switching Speed	700 nS Max
• DC Power Inputs	+5 VDC ±3% @ 250 mA Max. +12 VDC ±5% @ 3,333 mA Max. -15 VDC ±5% @ 250 mA Max. DCV Ripple: Up to 250 mV Peak-To-Peak @ 40 KHz to 40 MHz

ENVIRONMENTAL RATINGS:

• Ambient Temperature	+20°C to +40°C (Operating) -20°C to +70°C (Storage)
• Humidity	20 to 50% Non-Condensing (Operating) 0 to 85% Non-Condensing (Storage)
• Drop-Test Survival Height	0 (Operating) 0 (Storage)
• Vibration	As experienced by interior rack mount equipment (Operating), As experienced by commercial land and aircraft cargo (Storage
• Altitude	0 to 10,000 Feet Above Mean Sea Level (Operating) 0 to 40,000 Feet Above Mean Sea Level (Survival)
• Heat Sink	+25 to +35°C Mounting Surface comprised of 2 Oz. Copper Clad Fiber or 0.052 Inch Thick Aluminum Plate
• Air Flow	10 CFM Minimum Continuous Forced Air (Operating)
• Warm-Up Time	10 Minutes with DC Power Applied, RF Off (Operating)



PRODUCT FEATURE

DESCRIPTION

PMI MODEL NUMBER HBDFM-218-BD-DP, IS A HIGH BAND DIRECTION FINDING MODULE FROM 2.0 TO 18.0 GHz, UNI-DIRECTIONAL, MULTI-FUNCTION DEVICE THAT ROUTES THE SIGNAL PRESENT AT THE RF INPUT CONNECTOR THROUGH ONE OF ITS FOUR CHANNELS TO THE RF OUTPUT CONNECTOR, TO AMPLITUDE MODULATE THE INPUT SIGNAL. THE INPUT AND OUTPUT PORTS CAN BE SWITCHED TO INTERNAL 50 OHM TERMINATIONS TO ENSURE MATCHED SOURCE AND LOAD IMPEDANCE FOR INTERFACING DEVICES DURING OFF-TIMES AND ISOLATION OR VSWR TESTS.

SPECIFICATIONS

- FREQUENCY RANGE — 2.0 - 18.0 GHz
- RF INPUT SIGNAL LEVEL RANGE — 0 dBm TO +3 dBm TYPICAL; +6 dBm MAXIMUM
- RF INPUT SPECTRAL PURITY — INPUT SPURIOUS LEVELS -60 dBc MAXIMUM; INPUT HARMONIC LEVELS -10 dBc MAXIMUM
- RF INPUT SIGNAL-TO-NOISE RATIO — 70 dB MINIMUM
- RF OUTPUT POWER LEVEL AND GAIN COMPRESSION — POWER OUT = +21 dBm MINIMUM AT ALL FREQUENCIES WITH INPUT POWER = +0 dBm AND ATTENUATION SET AT MINIMUM, GAIN COMPRESSION 0.5 dB MAXIMUM UNDER THESE CONDITIONS
- RF OUTPUT SPECTRAL PURITY — -60 dBc MAXIMUM FOR SPURIOUS SIGNALS AND HARMONIC SIGNALS
- NOISE FIGURE — 8.5 dB MAXIMUM @ MINIMUM ATTENUATION
- MACRO-GAIN FLATNESS: 8.0 dB MAXIMUM PEAK-TO-PEAK @ -10 dBm INPUT
- AMPLITUDE TAPER: 3.0 dB MAXIMUM PEAK-TO-PEAK FOR ANY 40 MHz BANDWIDTH @ -10 dBm INPUT
- FINE-GRAIN GAIN FLATNESS: RF INPUT; RF OUTPUT
- VSWR = 2.0:1

PULSE MODULATOR SWITCH

- CONTROL: TTL LOGIC; "0" = INSERTION LOSS; "1" = ISOLATION
- ISOLATION: 60 dBc MINIMUM
- SWITCHING SPEED: RISE TIME 10 nS MAXIMUM (10% RF TO 90% RF); FALL TIME 10 nS MAXIMUM (90% RF TO 10% RF)
- DELAY SYMMETRY: DELAY SYMMETRY BETWEEN ON/OFF TO BE 10 nS MAXIMUM
- P-POD VIDEO GENERATION: -60 dBm MAXIMUM @ PULSING TO TTL "0" FOR 25 nS AT A 2MHz RATE

DIGITAL ATTENUATOR

- ATTENUATION RANGE: 64 dB
- NUMBER OF BITS: 8
- LSB: 0.25 dB
- CONTROL: TTL POSITIVE-TRUE
- RESOLUTION: 0.25 dB (LSB); 0 dB = 00H, 64 dB = FFh
- COMMANDS: 700 nS MAXIMUM TO +/- 1 dB OF FINAL ATTENUATION VALUE
- SWITCHING TIME:
- REPEATABILITY: 0.125 dB MAXIMUM

ATTENUATION (dB)	FLATNESS (MAX +/- dB)	ACCURACY (MAX +/- dB)
0 - 10	1.0	1.0
10 - 20	2.0	1.5
20 - 40	3.0	2.0
40 - 64	4.0	3.0

SWITCHED FILTERS

- SWITCHING SPEED: 700 nS MAXIMUM
- DC POWER INPUTS:
  - +5 VDC +/- 3% AT 250 MILLIAMPERES MAXIMUM
  - +12 VDC +/- 5% AT 3,333 MILLIAMPERES MAXIMUM
  - -15 VDC +/- 5% AT 250 MILLIAMPERES MAXIMUM
  - DC RIPPLE: UP TO 250 MILLIVOLTS PEAK-TO-PEAK AT 40 kHz TO 40 MHz

BAND CONTROLS

LOGIC CENT PIN 12	LOGIC F1 PIN 14	LOGIC F0 PIN 13	BAND	PASSBAND (GHz)	FC (GHz)	LOW SIDE REJ FREQ (GHz)	LOW SIDE REJ LEVEL (dBc)	HIGH SIDE REJ FREQ (GHz)	HIGH SIDE REJ FREQ (GHz)
0	0	0	1	2.0 - 3.6	2.8	1.8	-20	4.0 - 7.2	7.2-18.5
0	0	1	2	3.5 - 6.1	4.8	2.0 - 3.05	-20	7.0 - 12.2	12.2-18.5
0	1	0	3	6.0 - 10.5	8.25	2.0 - 5.25	-20	12.0 - 18.5	N/A
0	1	1	4	10.4 - 18.0	14.2	2.0 - 5.20	-20	N/A	N/A

PLANAR MONOLITHICS INDUSTRIES
FREDERICK, MARYLAND

PRODUCT FEATURE
HBDFM-218-BD-DP
HDF DIRECTION FINDING MODULE

A 02X28 100-6548

SHEET 1 of 3

NOTE: THE ABOVE SPECIFICATIONS ARE SUBJECT TO CHANGE OR REVISION

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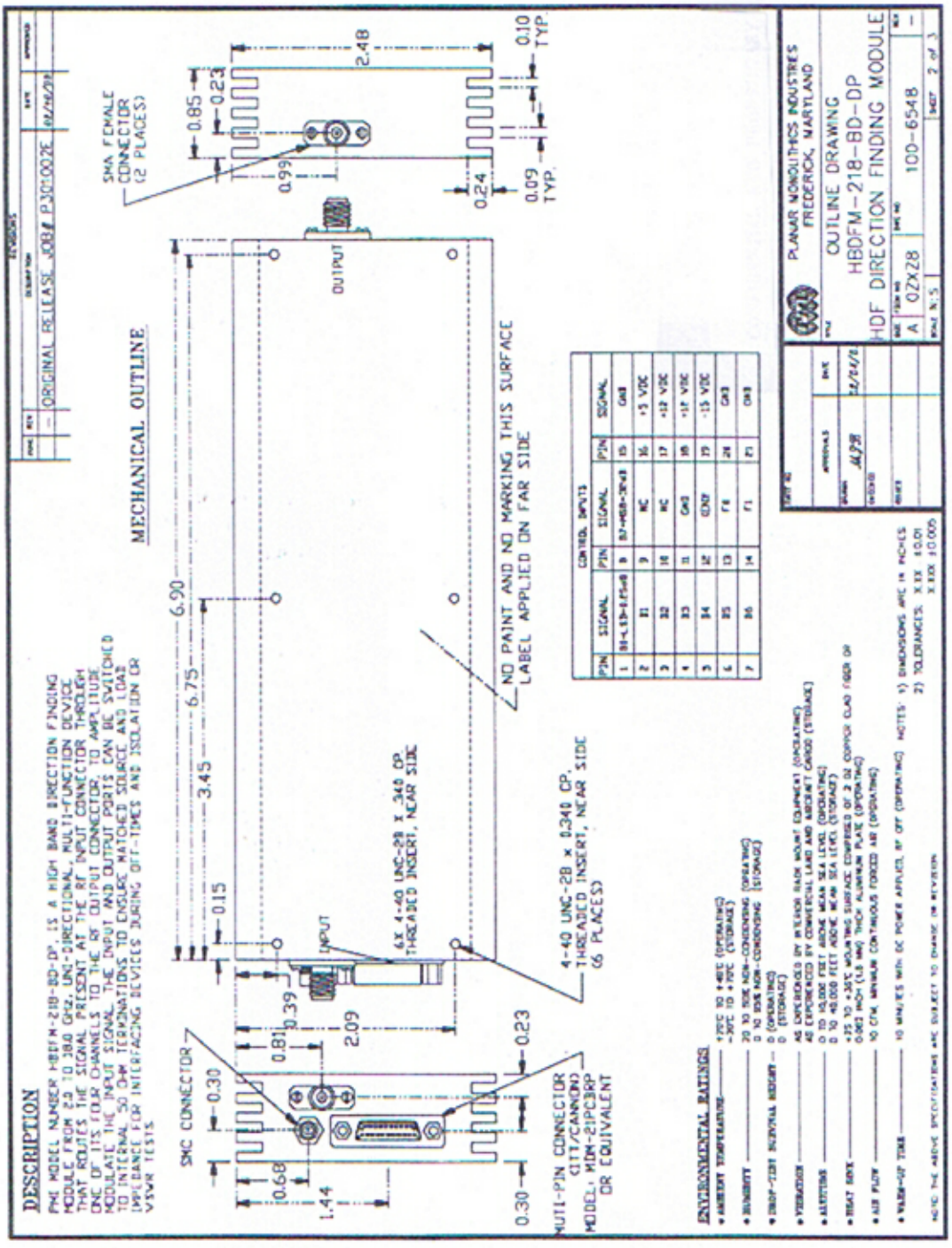
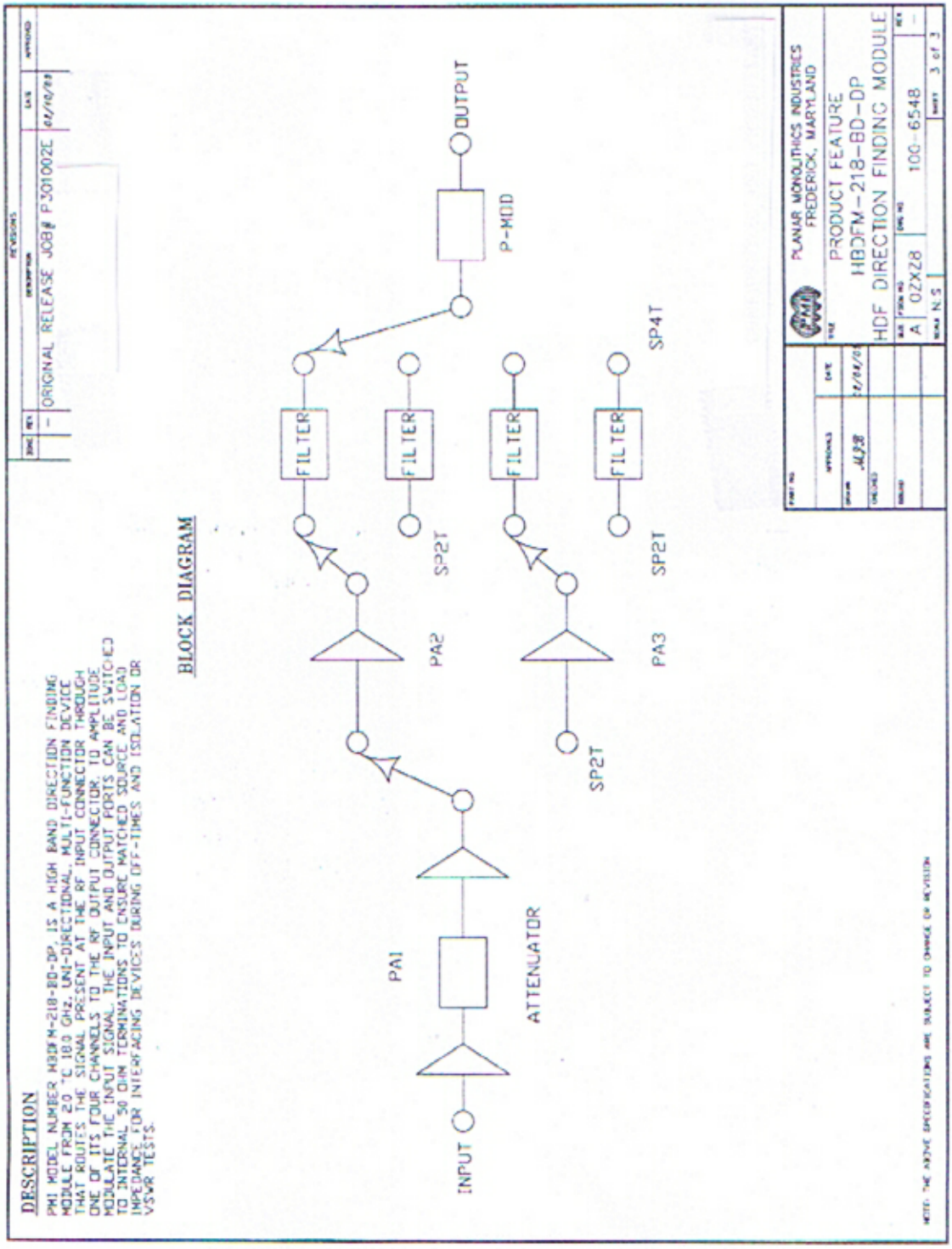
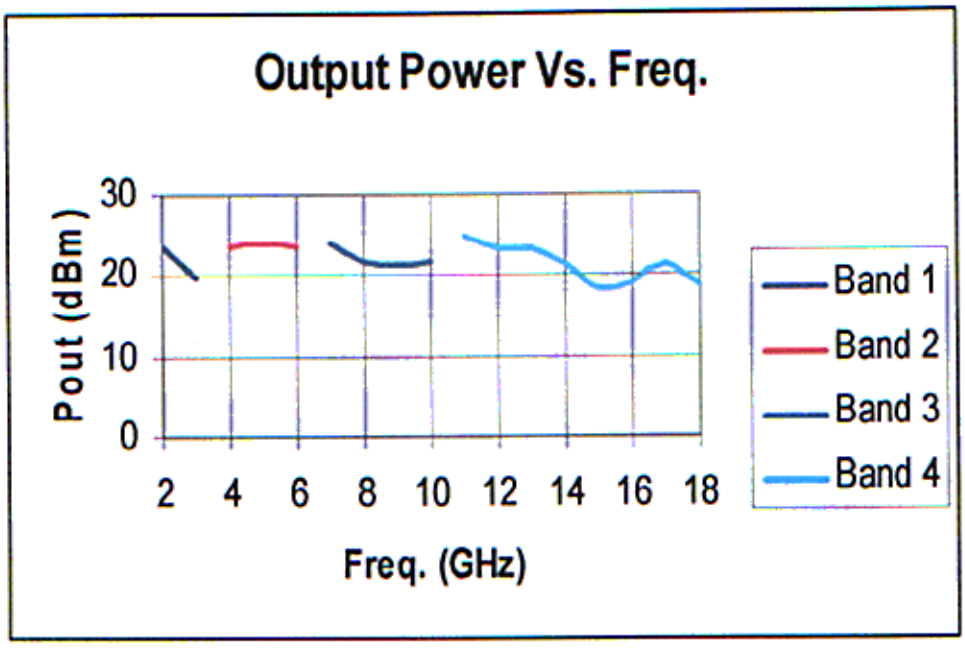
OUTLINE DRAWING



FUNCTIONAL SCHEMATIC



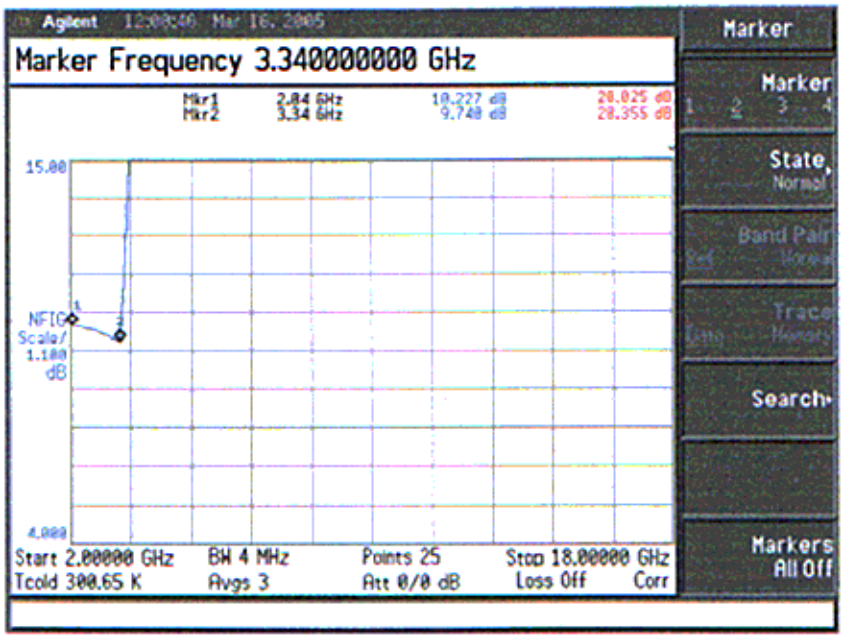
RF POWER OUTPUT



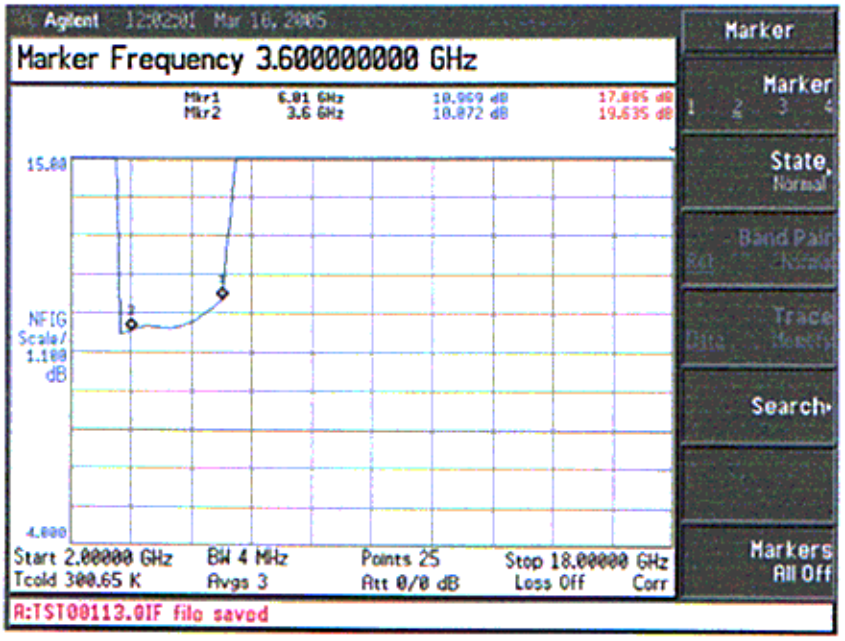
Band 1	2 GHz	23.68 dBm
Band 1	3 GHz	19.68 dBm
Band 2	4 GHz	23.52 dBm
Band 2	5 GHz	23.81 dBm
Band 2	6 GHz	23.68 dBm
Band 3	7 GHz	23.87 dBm
Band 3	8 GHz	21.74 dBm
Band 3	9 GHz	21.44 dBm
Band 3	10 GHz	21.82 dBm
Band 4	11 GHz	24.64 dBm
Band 4	12 GHz	23.28 dBm
Band 4	13 GHz	23.16 dBm
Band 4	14 GHz	21.11 dBm
Band 4	15 GHz	18.28 dBm
Band 4	16 GHz	18.82 dBm
Band 4	17 GHz	21.12 dBm
Band 4	18 GHz	18.43 dBm

NOISE FIGURE

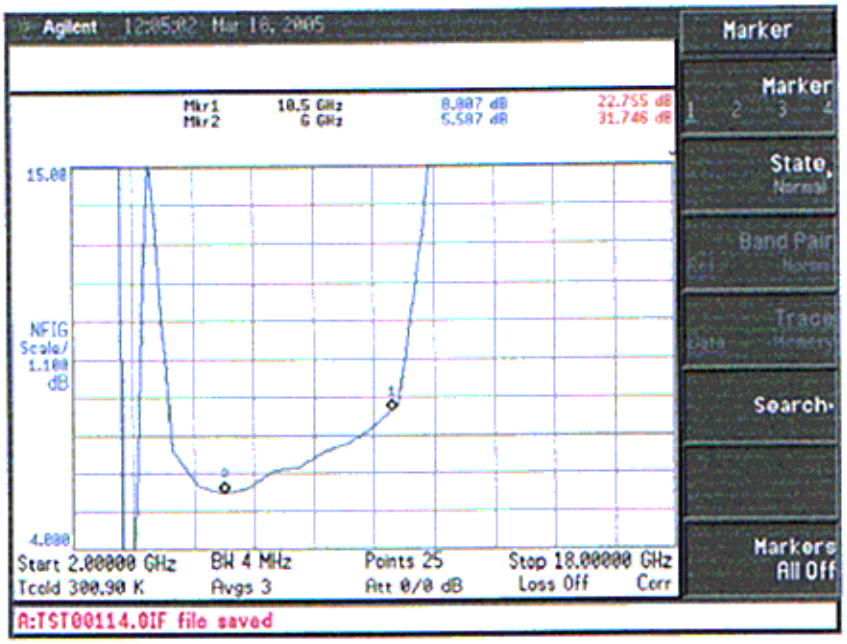
Band 1:


Agilent
Marker Frequency 3.340000000 GHz
Mkr1 2.84 GHz 10.227 dB 20.025 dB
Mkr2 3.34 GHz 9.748 dB 20.355 dB
15.00
NFIG
Scale/
1.100
dB
4.000
Start 2.00000 GHz
Tcold 300.65 K
BW 4 MHz
Avgs 3
Points 25
Att 0/0 dB
Stop 18.00000 GHz
Loss Off
Corr
Marker
Marker
State
Normal
Search
Markers
All Off

Band 2:


Agilent
Marker Frequency 3.600000000 GHz
Mkr1 6.01 GHz 10.969 dB 17.005 dB
Mkr2 3.6 GHz 10.872 dB 19.635 dB
15.00
NFIG
Scale/
1.100
dB
4.000
Start 2.00000 GHz
Tcold 300.65 K
BW 4 MHz
Avgs 3
Points 25
Att 0/0 dB
Stop 18.00000 GHz
Loss Off
Corr
A:TST00113.0IF file saved
Marker
Marker
State
Normal
Search
Markers
All Off

Band 3:


Agilent 12:05:02 Mar 16, 2005
Mkr1 10.5 GHz 8.807 dB 22.755 dB
Mkr2 6 GHz 5.587 dB 31.746 dB
15.00
NFIG
Scale/
1.100
dB
4.000
Start 2.00000 GHz
Tcold 300.90 K
BW 4 MHz
Avgs 3
Points 25
Att 0/0 dB
Stop 18.00000 GHz
Loss Off
Corr
Marker
Marker
State
Normal
Band Pair
Trace
Search
Markers
All Off
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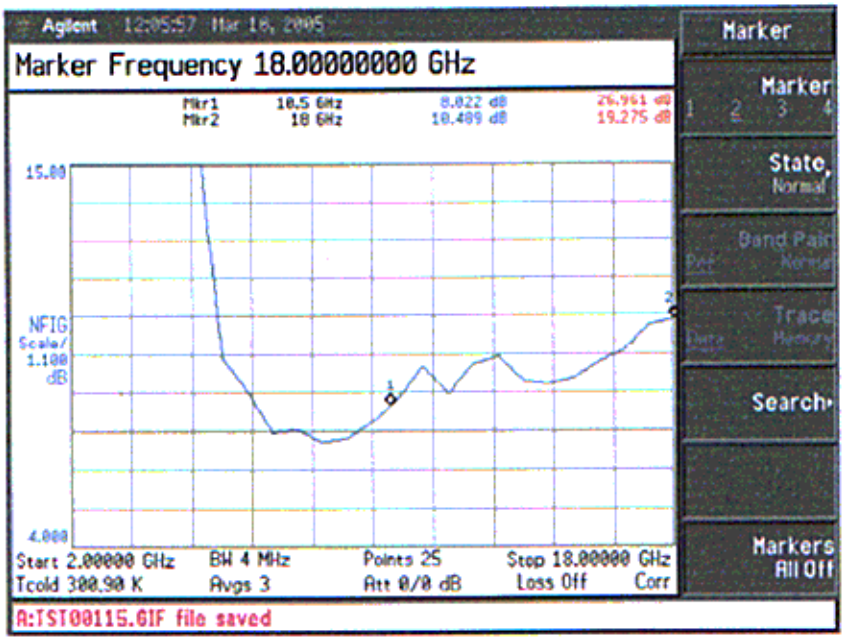
Band 4:


Agilent 12:05:57 Mar 16, 2005
Marker Frequency 18.00000000 GHz
Mkr1 10.5 GHz 8.022 dB 26.961 dB
Mkr2 18 GHz 10.409 dB 19.275 dB
15.00
NFIG
Scale/
1.100
dB
4.000
Start 2.00000 GHz
Tcold 300.90 K
BW 4 MHz
Avgs 3
Points 25
Att 0/0 dB
Stop 18.00000 GHz
Loss Off
Corr
Marker
Marker
State
Normal
Band Pair
Trace
Search
Markers
All Off
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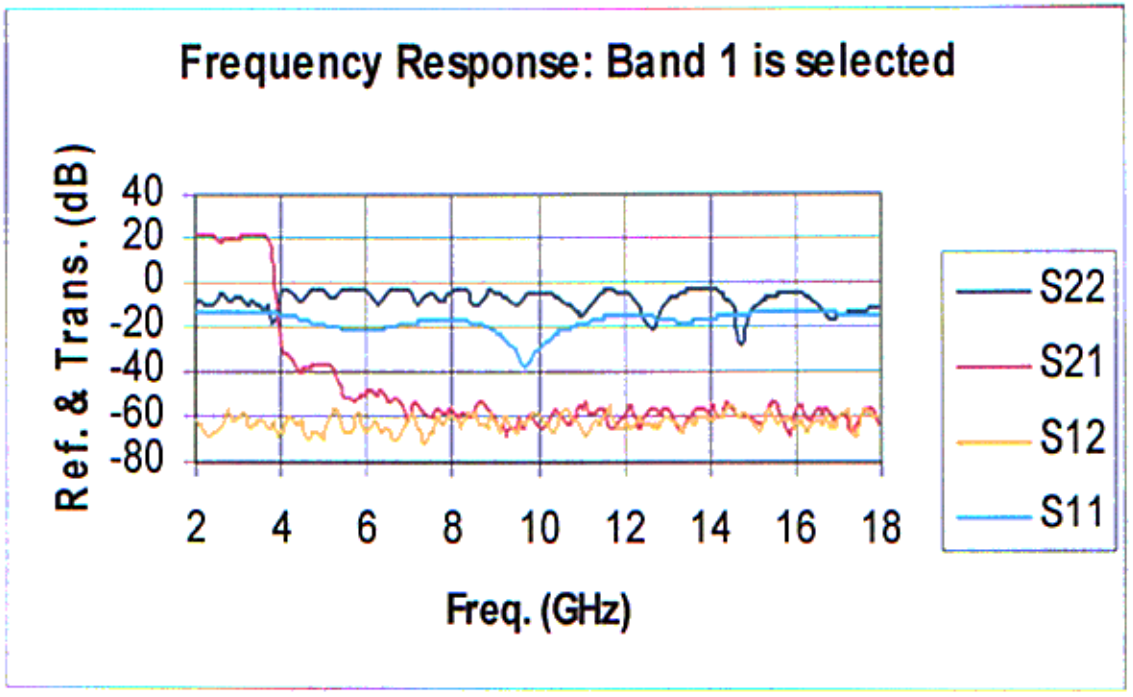
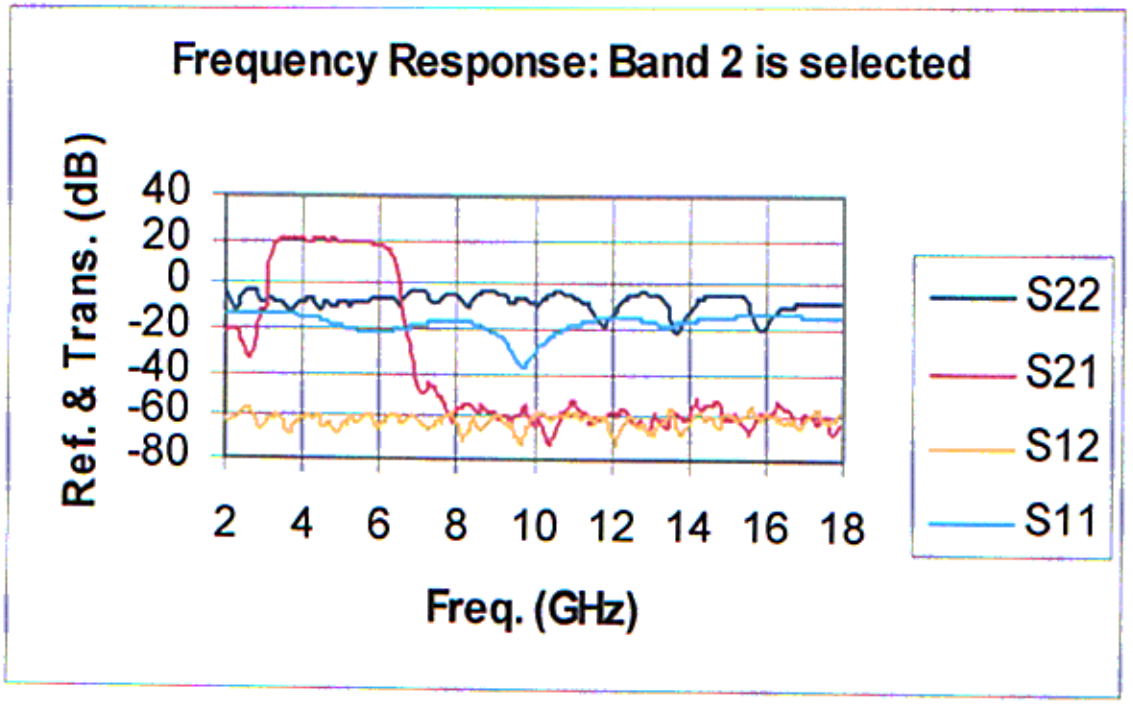
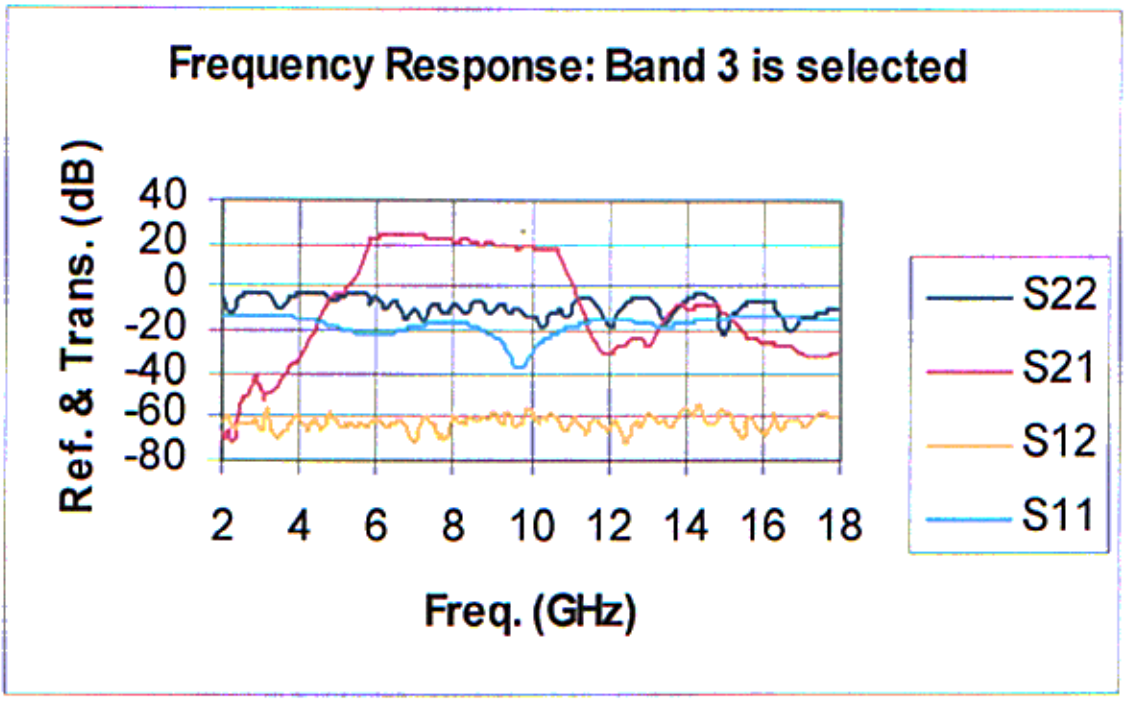
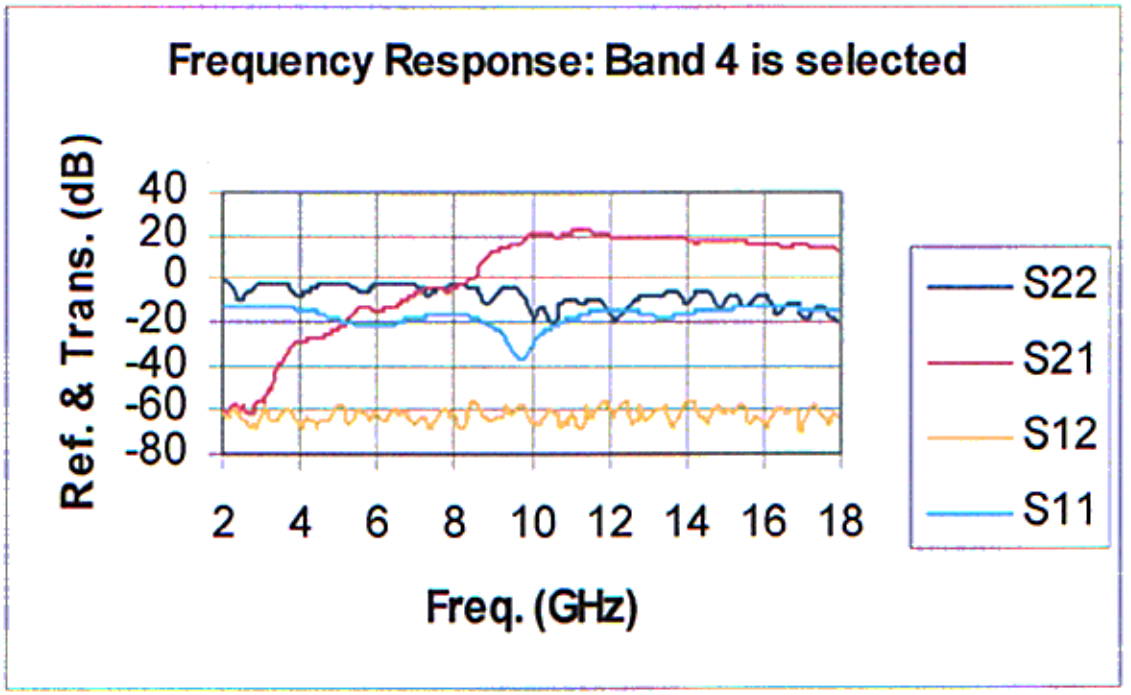
FREQUENCY RESPONSES


Frequency Response: Band 1 is selected
Ref. & Trans. (dB)
40
20
0
-20
-40
-60
-80
2
4
6
8
10
12
14
16
18
Freq. (GHz)
S22
S21
S12
S11


Frequency Response: Band 2 is selected
Ref. & Trans. (dB)
40
20
0
-20
-40
-60
-80
2
4
6
8
10
12
14
16
18
Freq. (GHz)
S22
S21
S12
S11


Frequency Response: Band 3 is selected
Ref. & Trans. (dB)
40
20
0
-20
-40
-60
-80
2
4
6
8
10
12
14
16
18
Freq. (GHz)
S22
S21
S12
S11

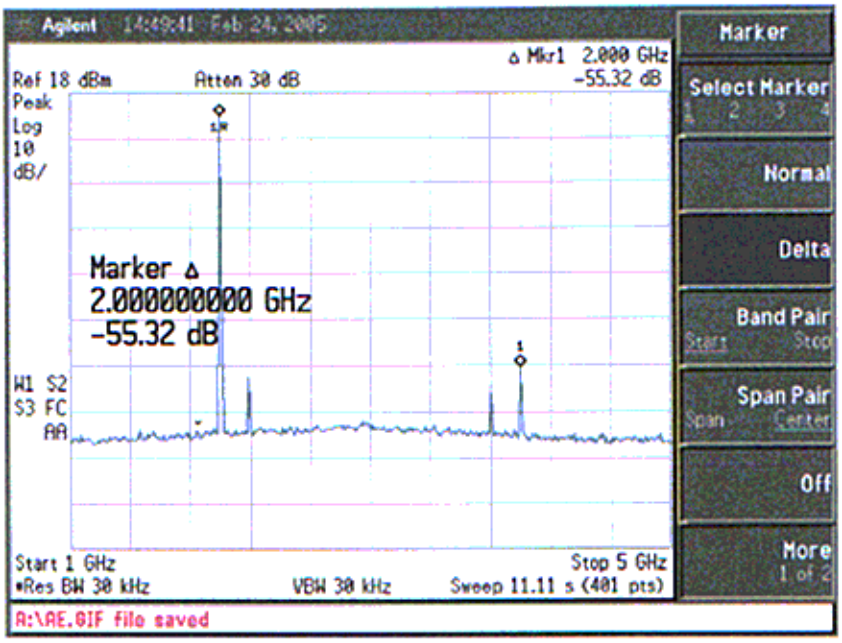

Frequency Response: Band 4 is selected
Ref. & Trans. (dB)
40
20
0
-20
-40
-60
-80
2
4
6
8
10
12
14
16
18
Freq. (GHz)
S22
S21
S12
S11

HARMONIC PERFORMANCE

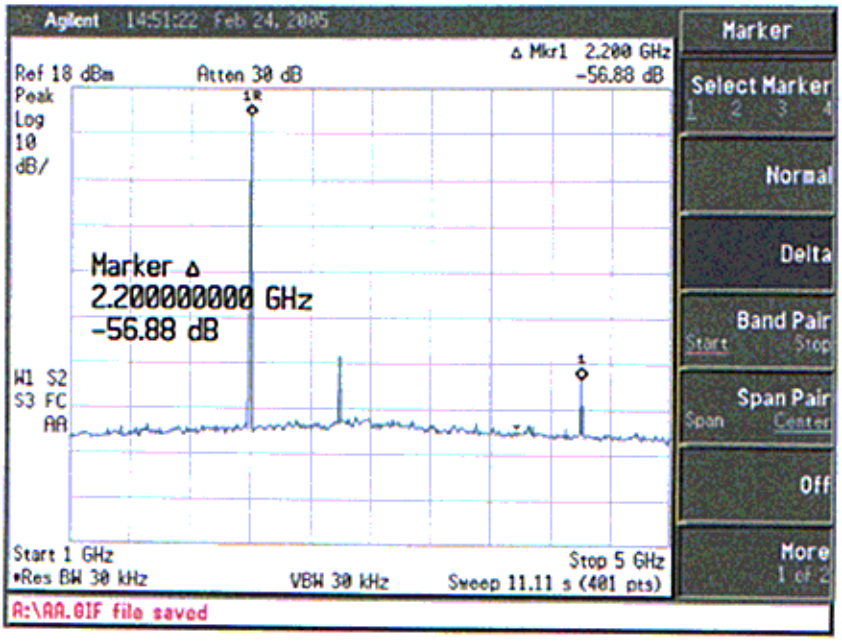
Test Condition:
Input Signal level: 0 to 3dBm
Harmonic Signal: -10dBc
Spurious Signal: -60dBc

Note: The spurs on the screen in this section are from the source.

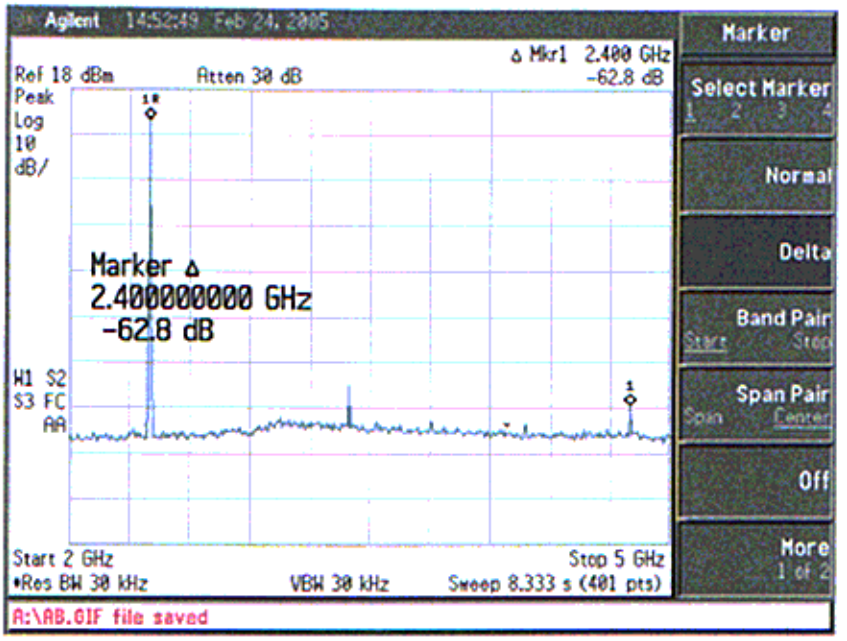
At 2GHz in Band 1:



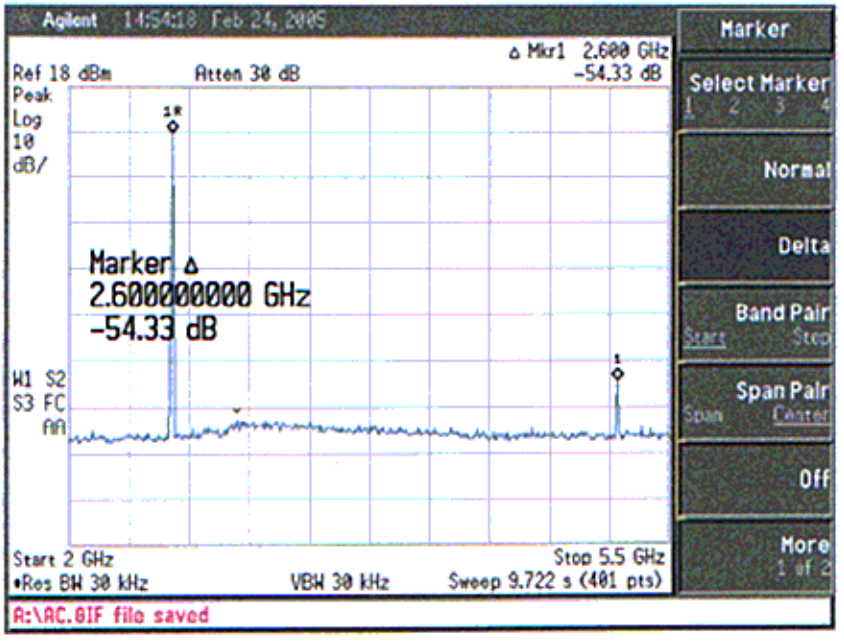
At 2.2 GHz in Band 1:



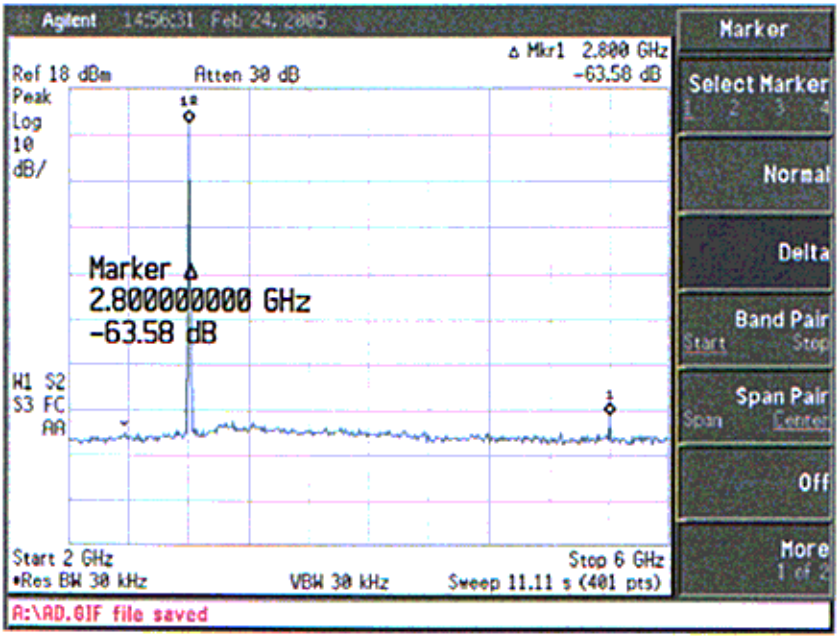
At 2.4 GHz in Band 1:



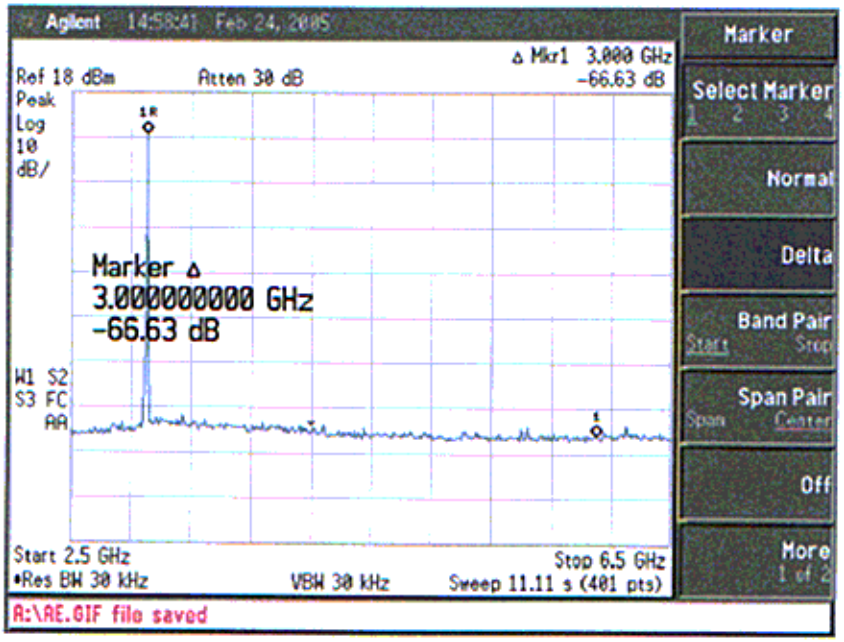
At 2.6 GHz in Band 1:



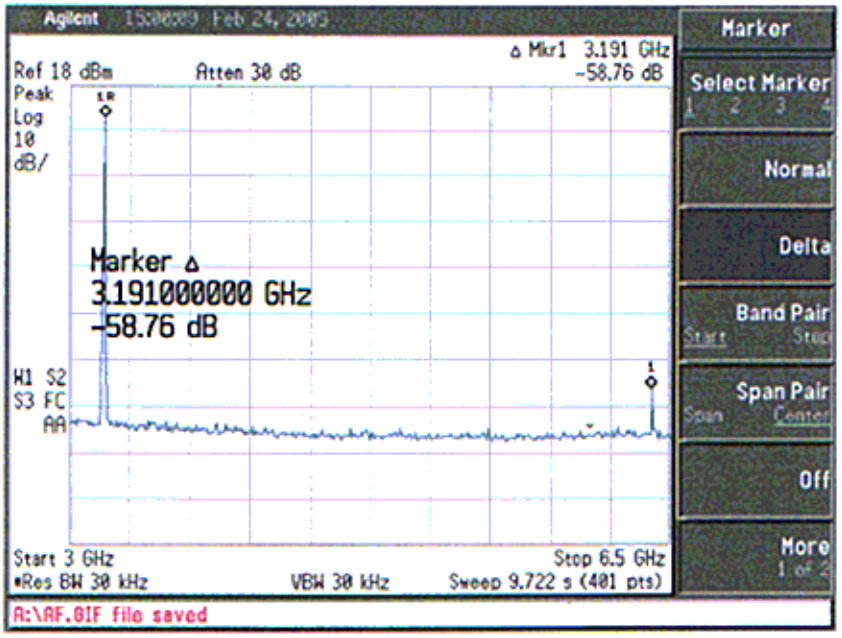
At 2.8 GHz in Band 1:



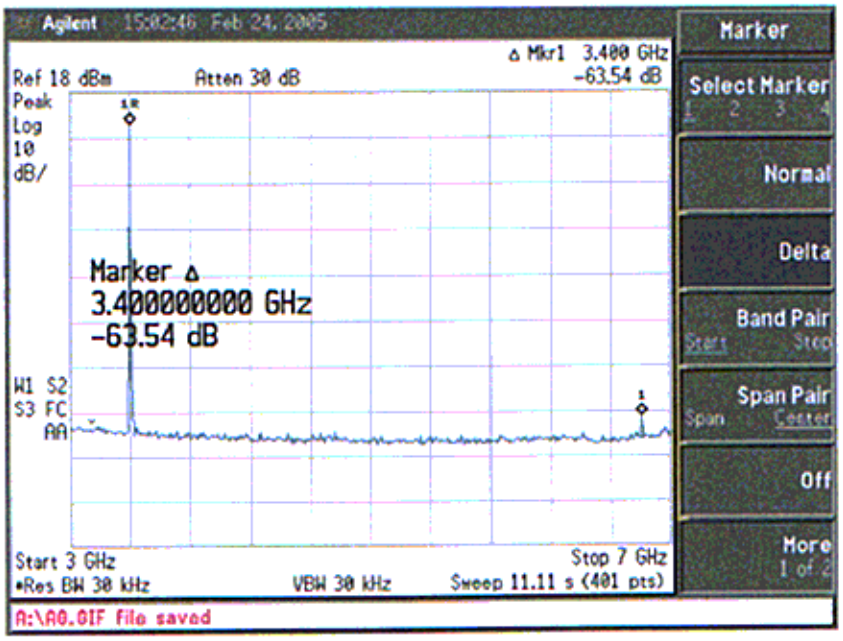
At 3.0 GHz in Band 1:



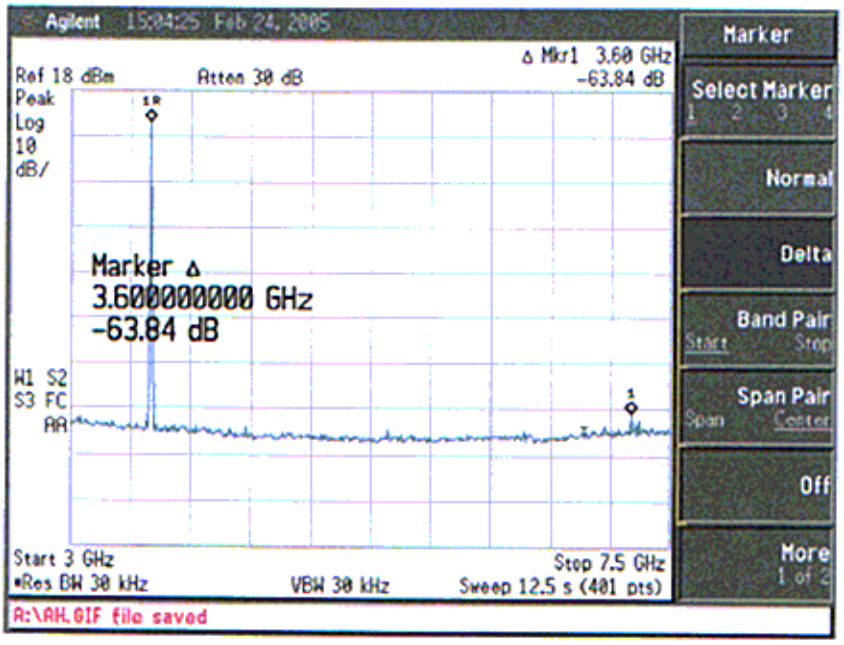
At 3.2 GHz in Band 1:



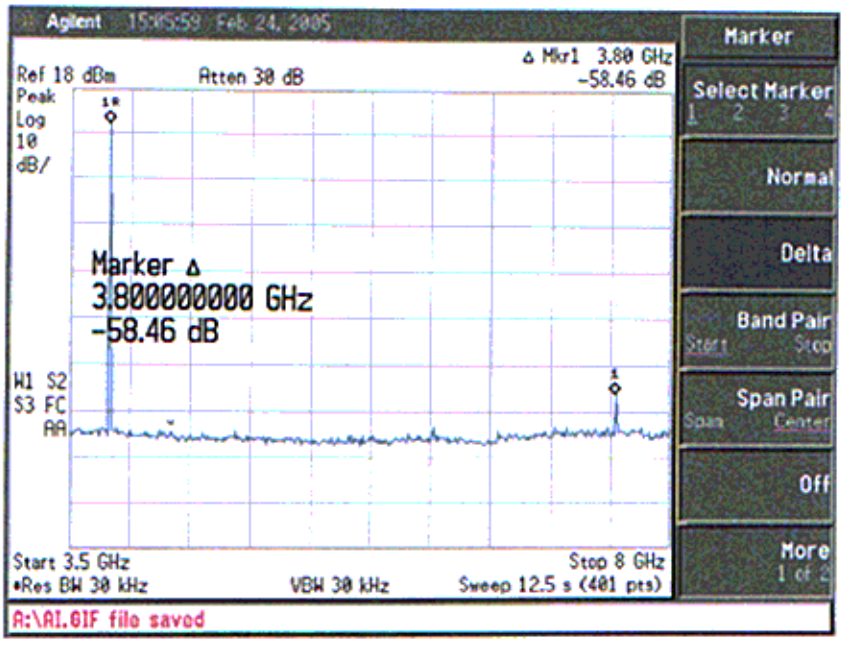
At 3.4 GHz in Band 1:



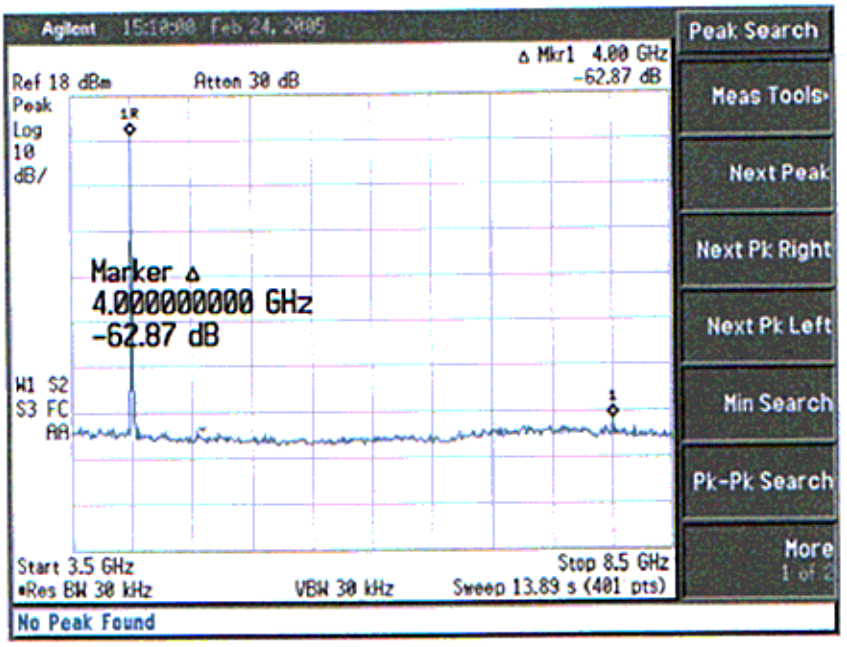
At 3.6 GHz in Band 1:



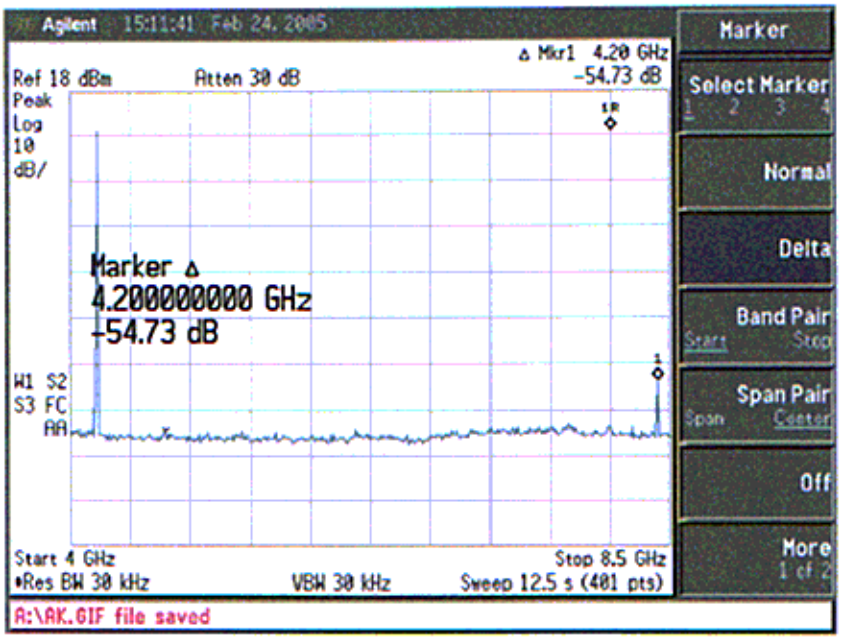
At 3.8 GHz in Band 2:



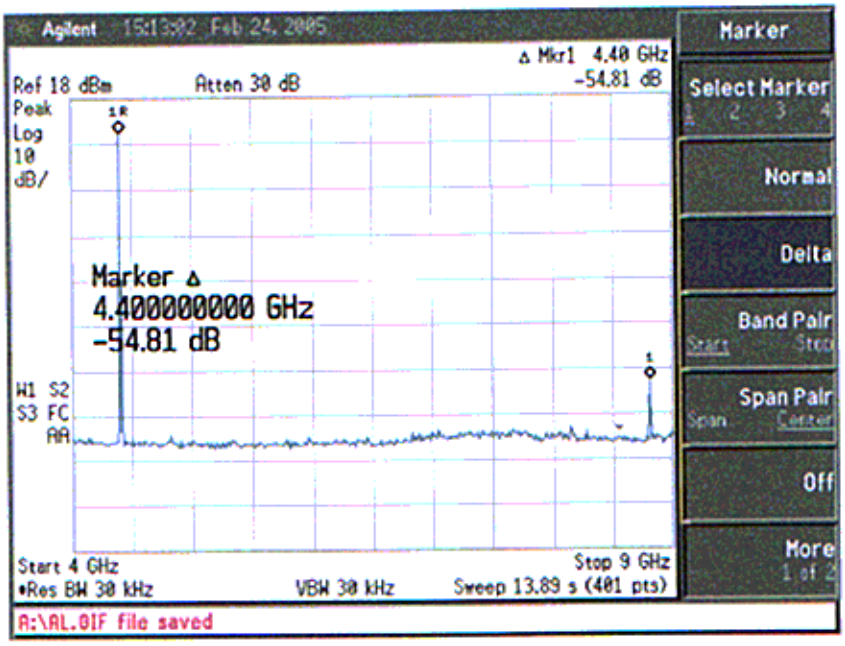
At 4.0 GHz in Band 2:



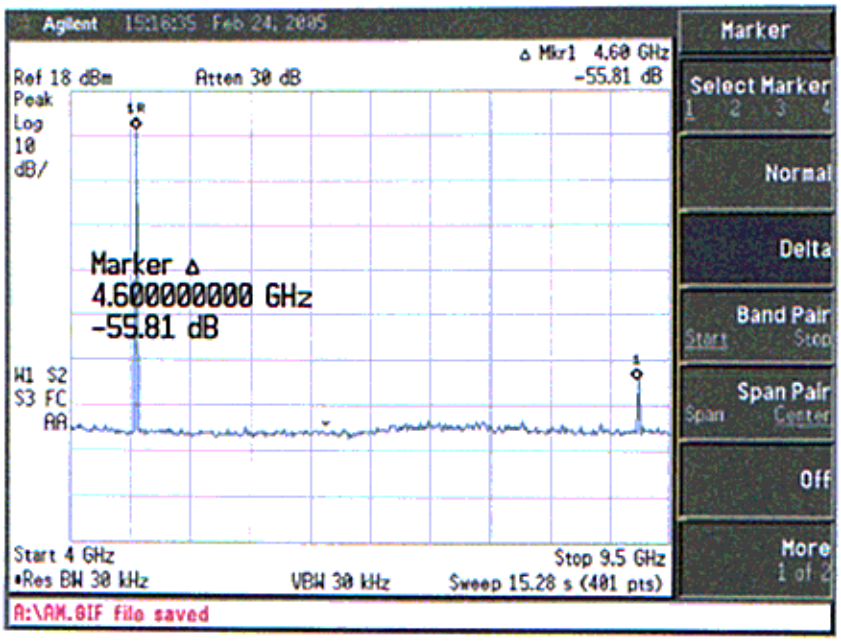
At 4.2 GHz in Band 2:



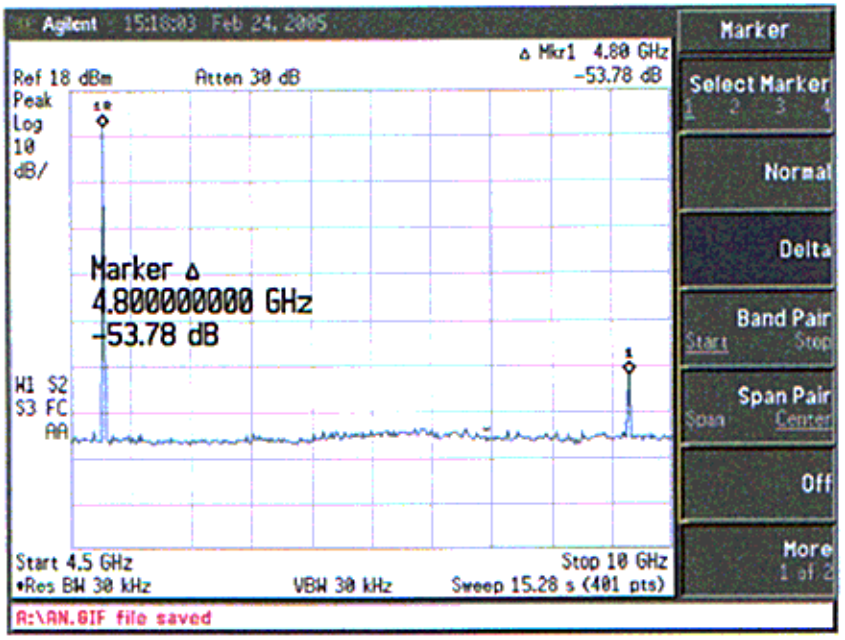
At 4.4 GHz in Band 2:



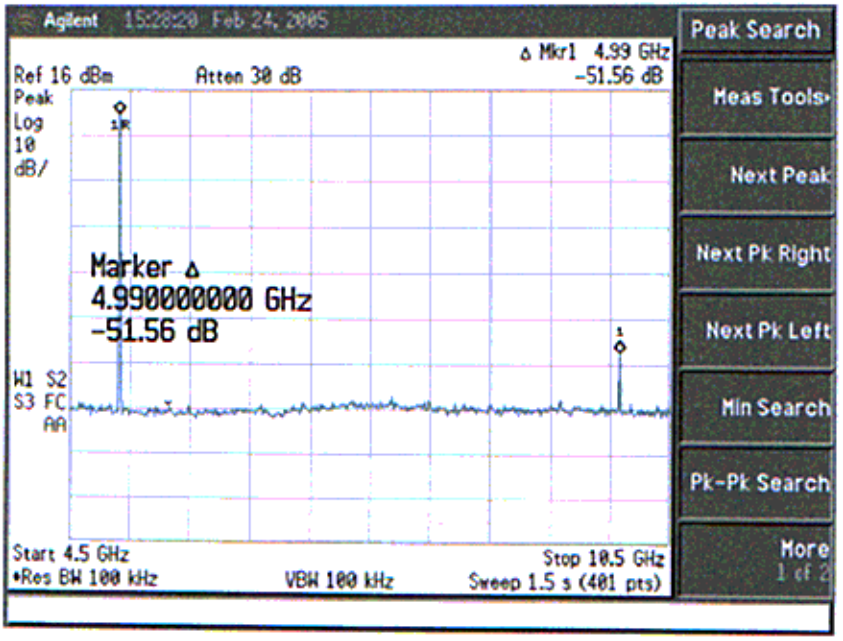
At 4.6 GHz in Band 2:



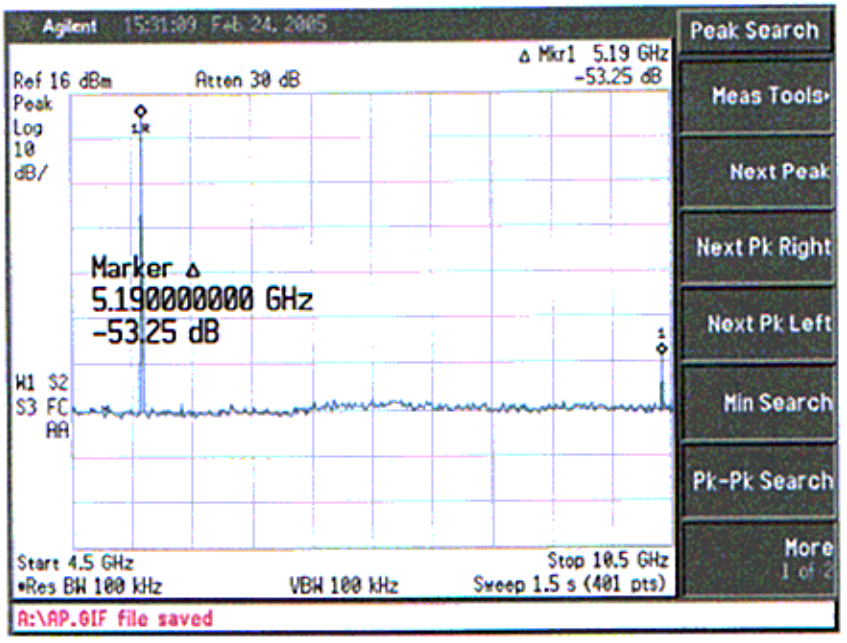
At 4.8 GHz in Band 2:



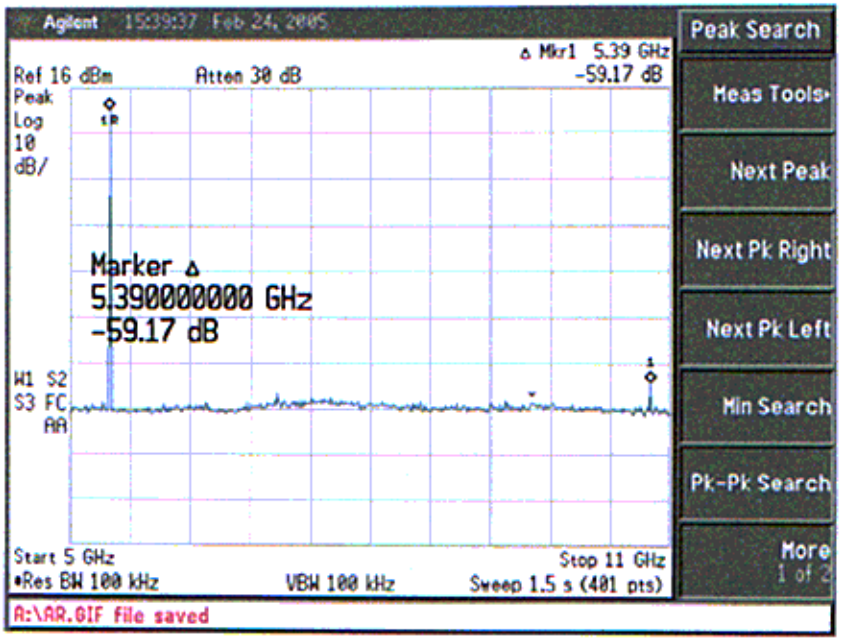
At 5.0 GHz in Band 2:



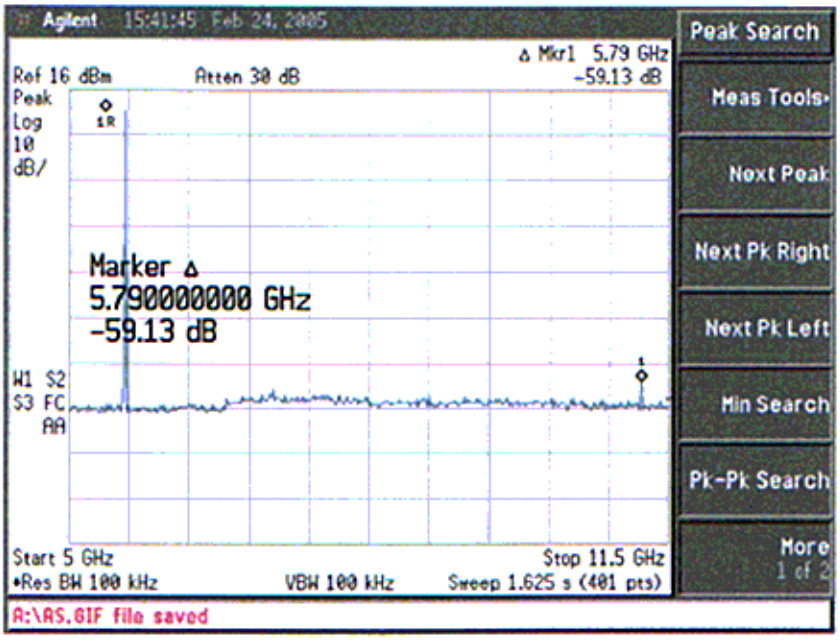
At 5.2 GHz in Band 2:



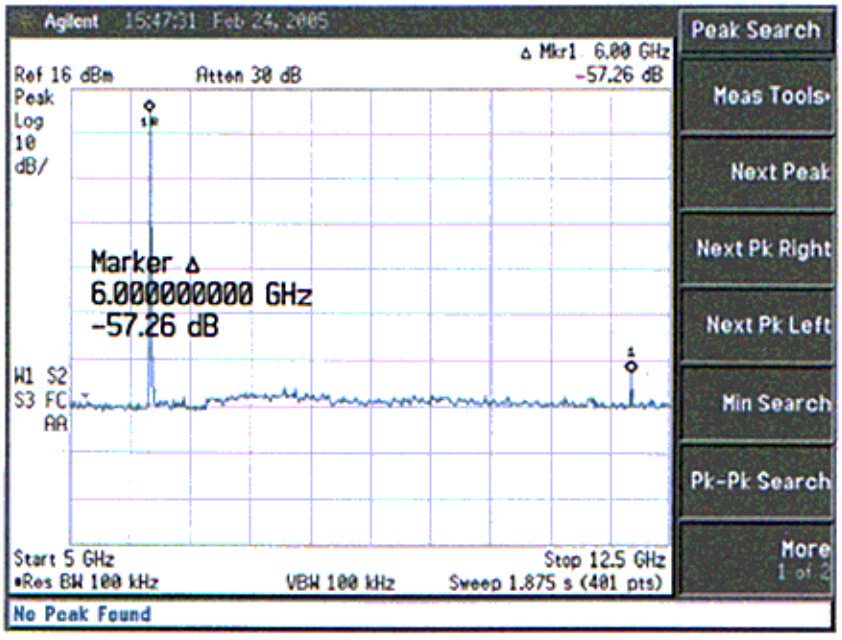
At 5.4 GHz in Band 2:



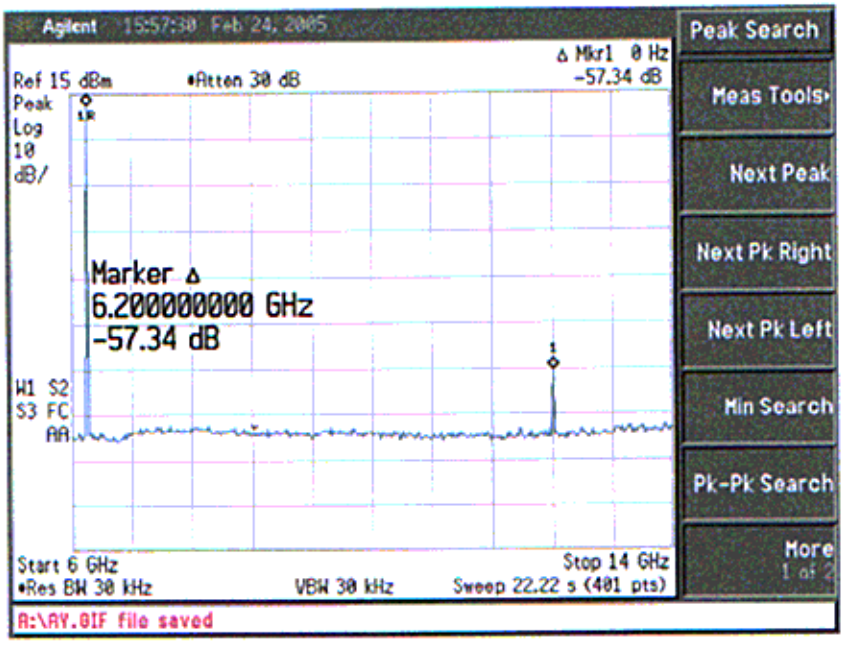
At 5.8 GHz in Band 2:



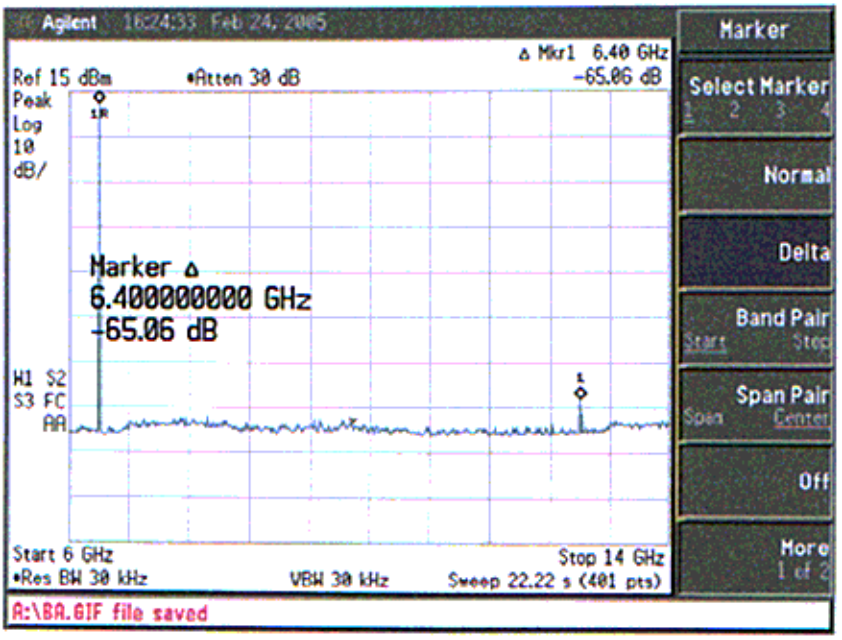
At 6.0 GHz in Band 2:



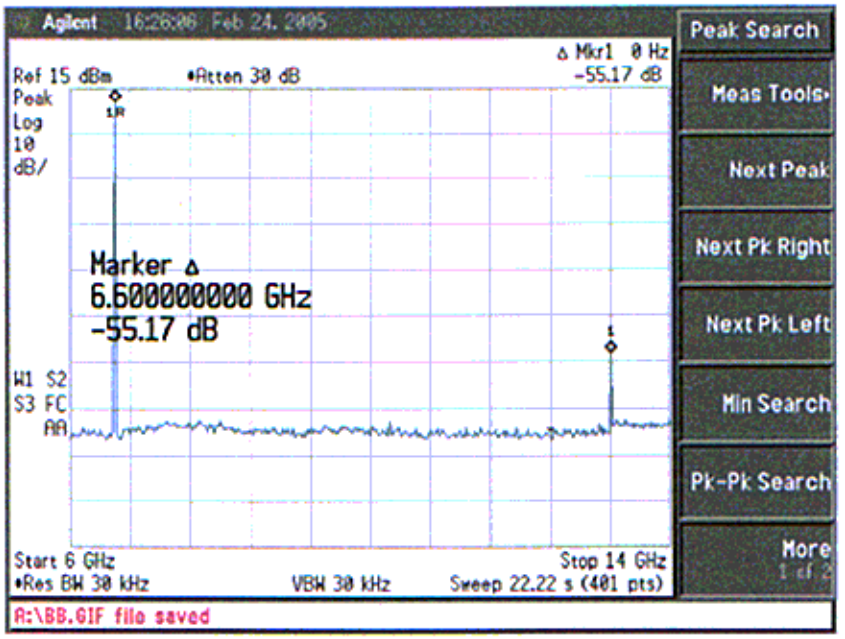
At 6.2 GHz in Band 2:



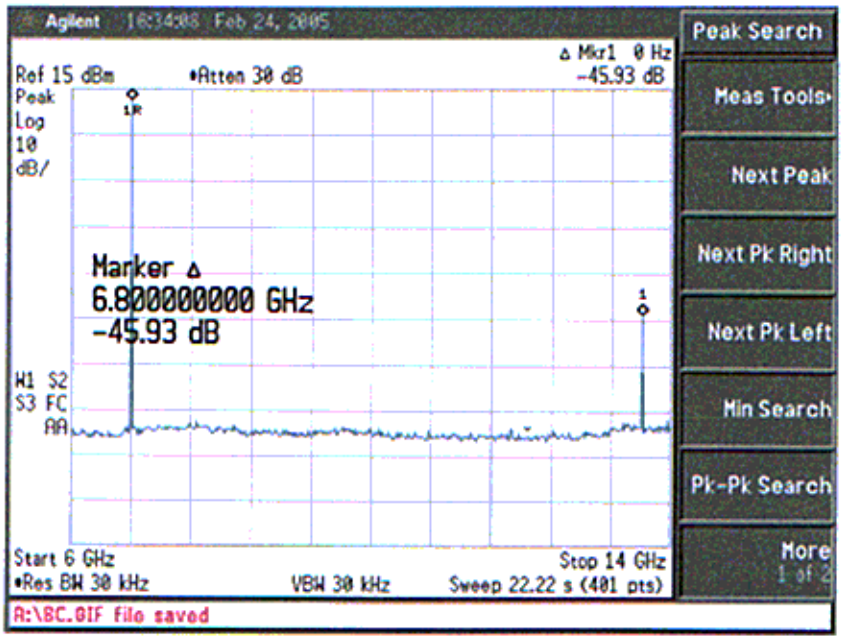
At 6.4 GHz in Band 2:



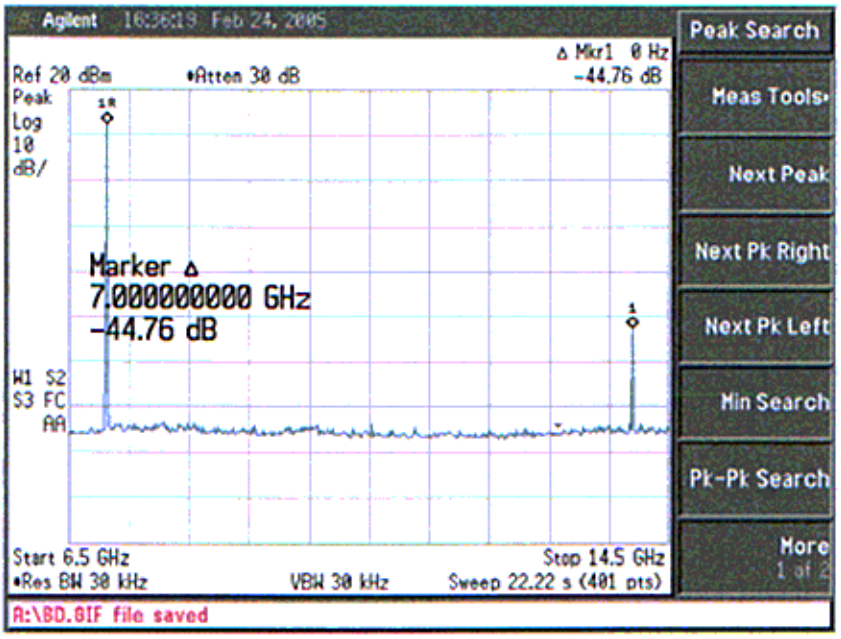
At 6.6 GHz in Band 3:



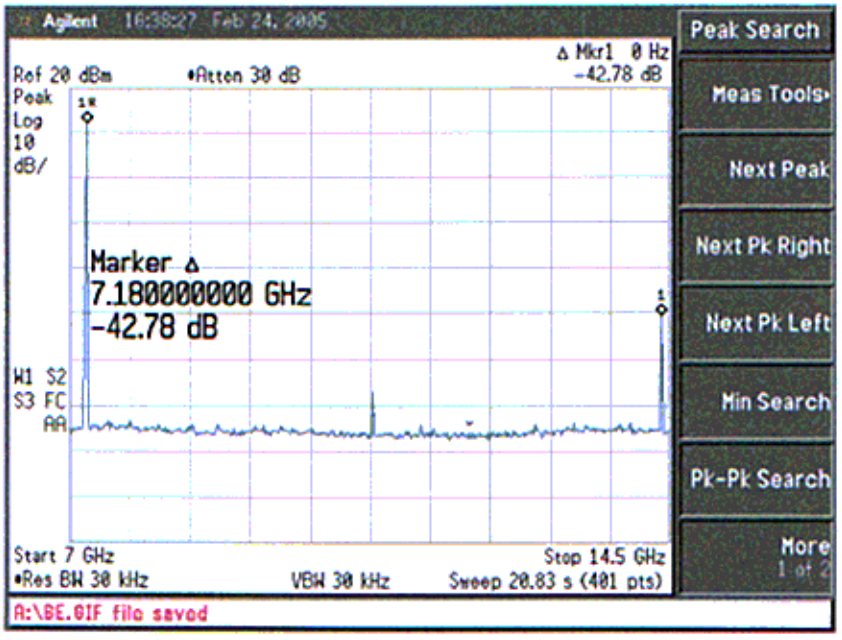
At 6.8 GHz in Band 3:



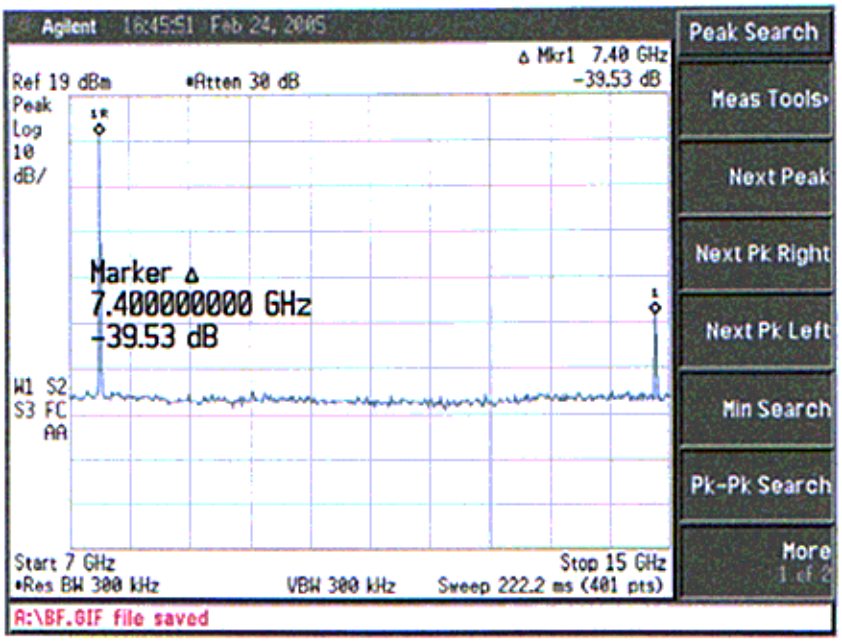
At 7.0 GHz in Band 3:



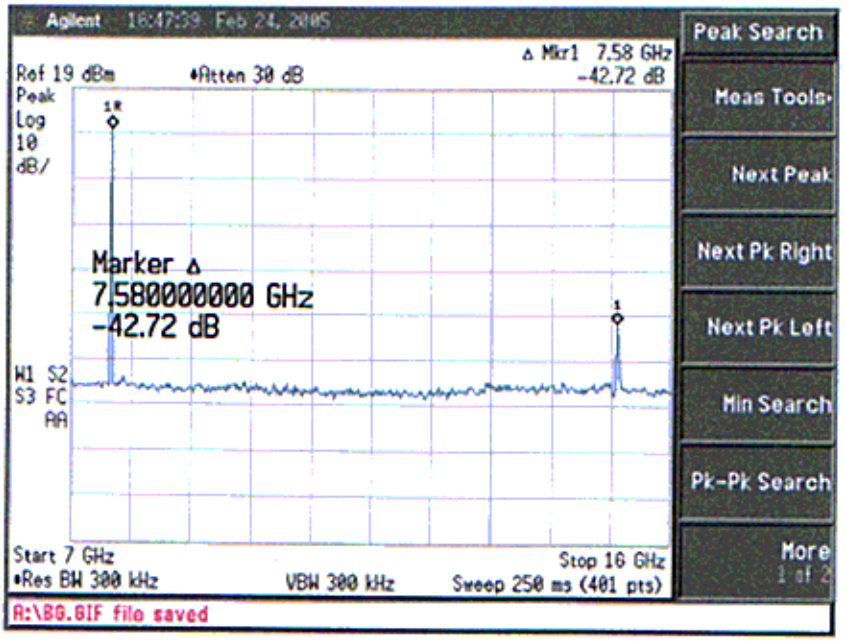
At 7.2 GHz in Band 3:



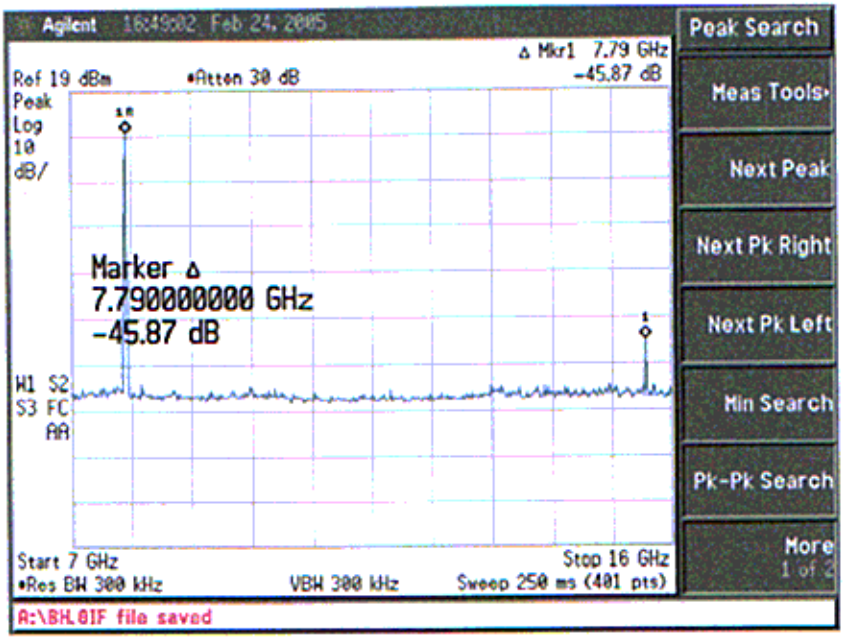
At 7.4 GHz in Band 3:



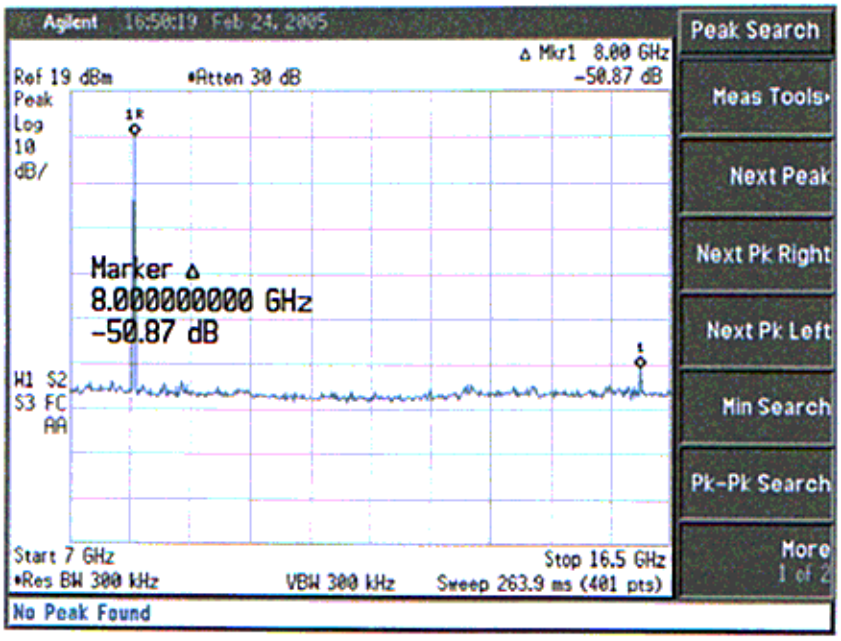
At 7.6 GHz in Band 3:



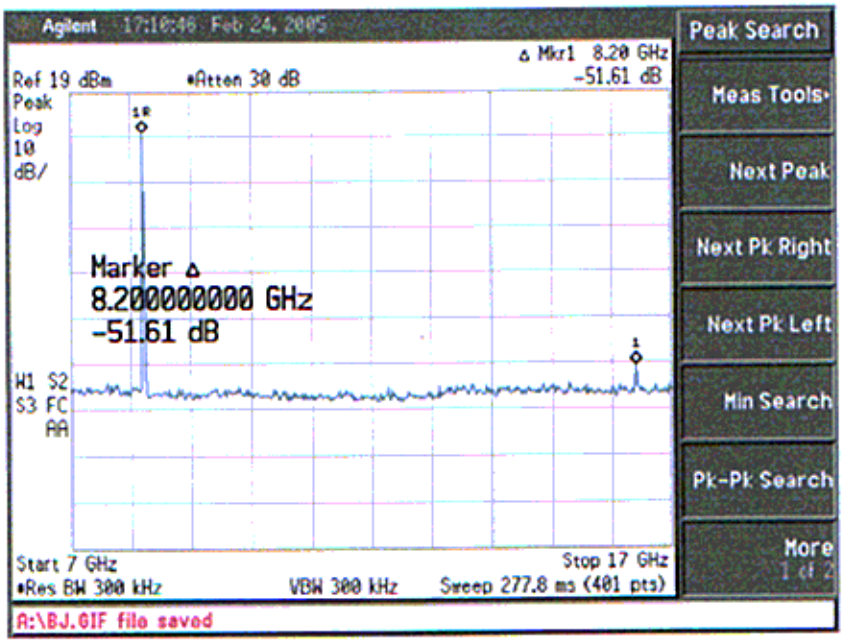
At 7.8 GHz in Band 3:



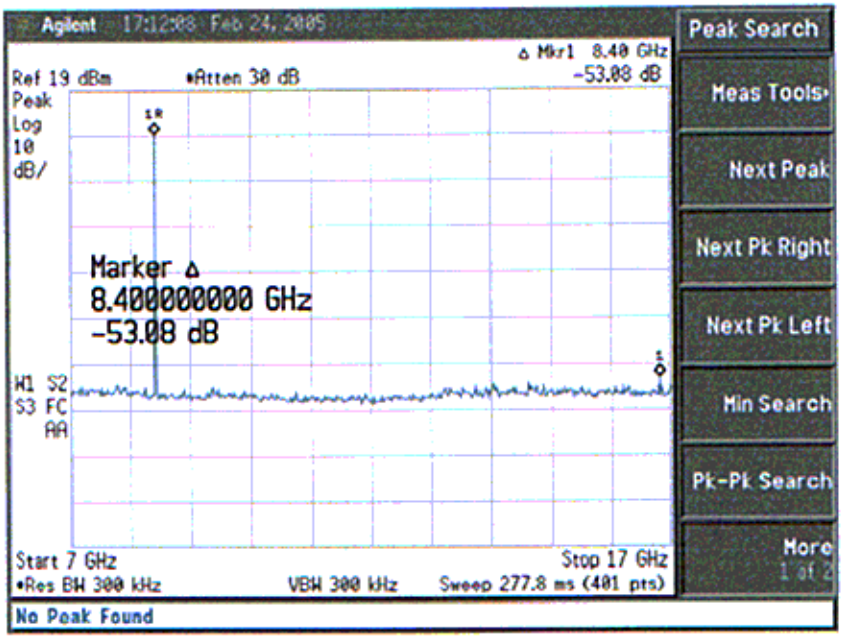
At 8.0 GHz in Band 3:



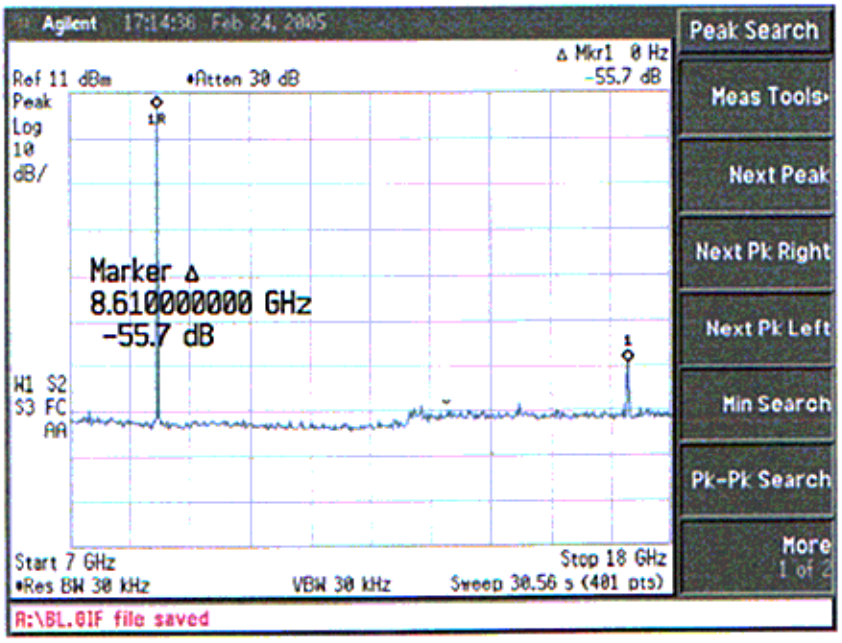
At 8.2 GHz in Band 3:



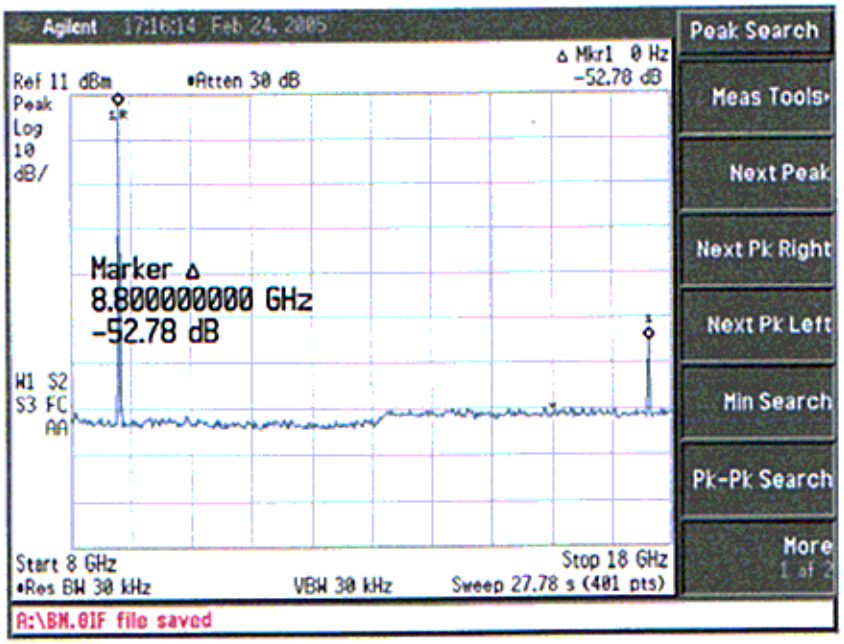
At 8.4 GHz in Band 3:



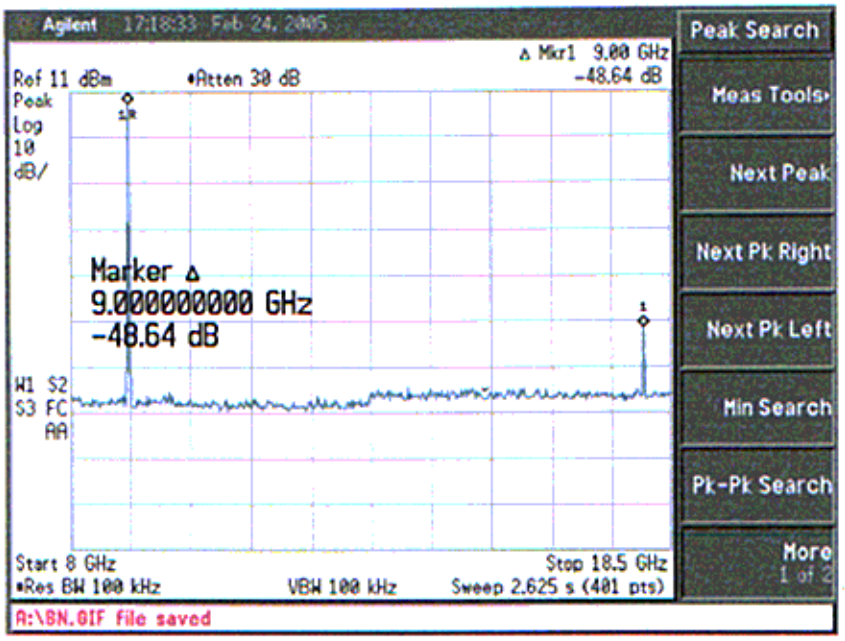
At 8.0 GHz in Band 3:



At 8.8 GHz in Band 3:



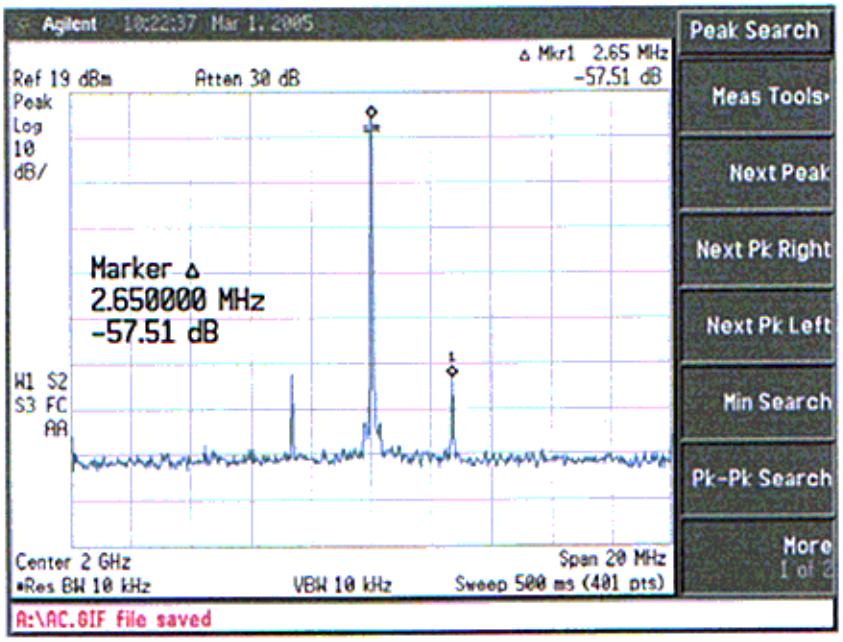
At 9.0 GHz in Band 3:



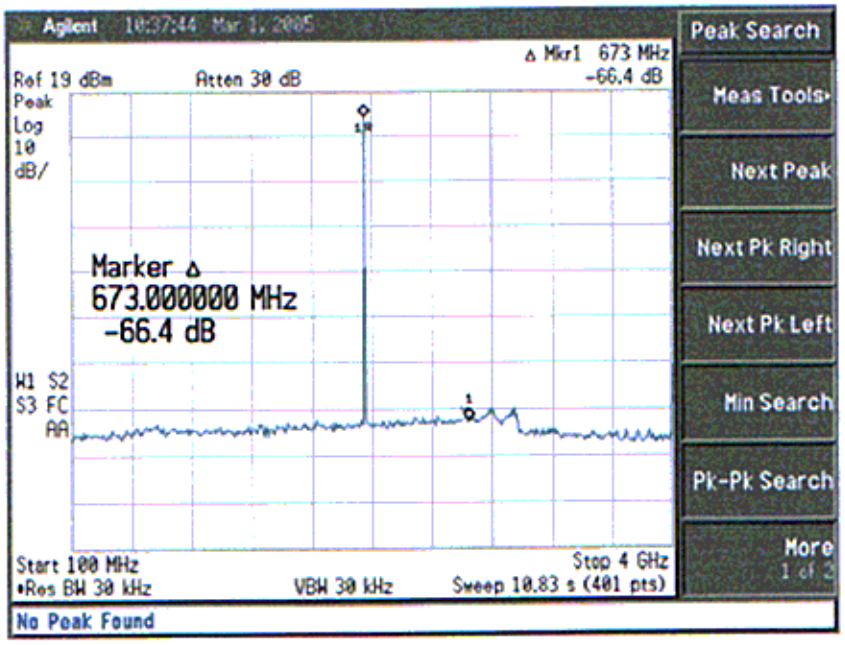
SPURIOUS PERFORMANCE

Test Condition:
Input Signal level: 0 to 3 dBm
Spurious Signal: -60dBc
Harmonic Signal: -60dBc

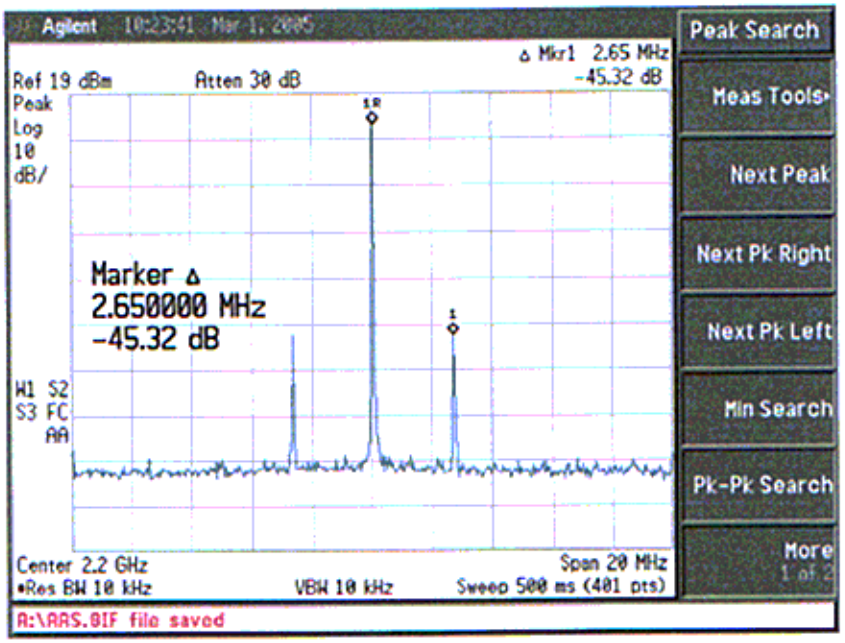
At 2.00 GHz in Band 1



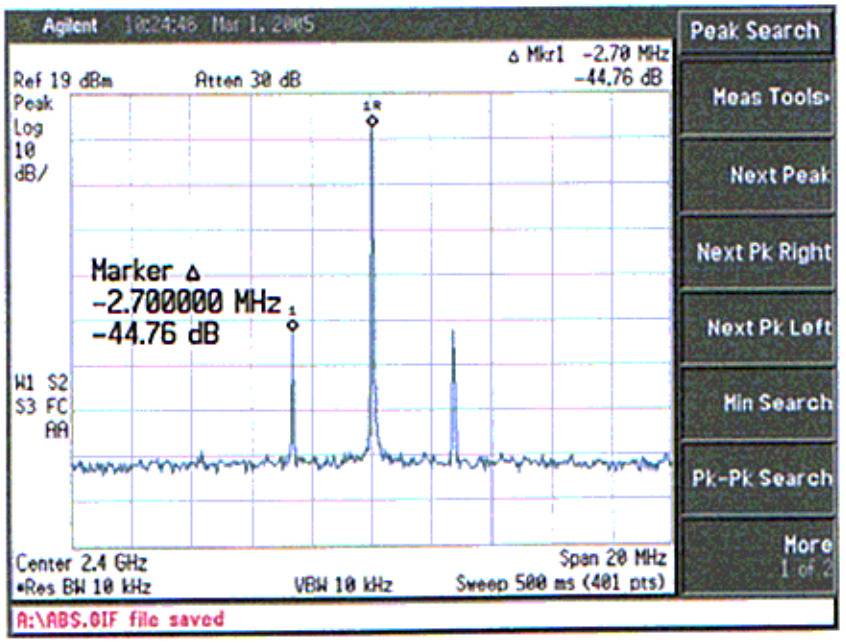
At 2.0 GHz in Band 1 (large Span)



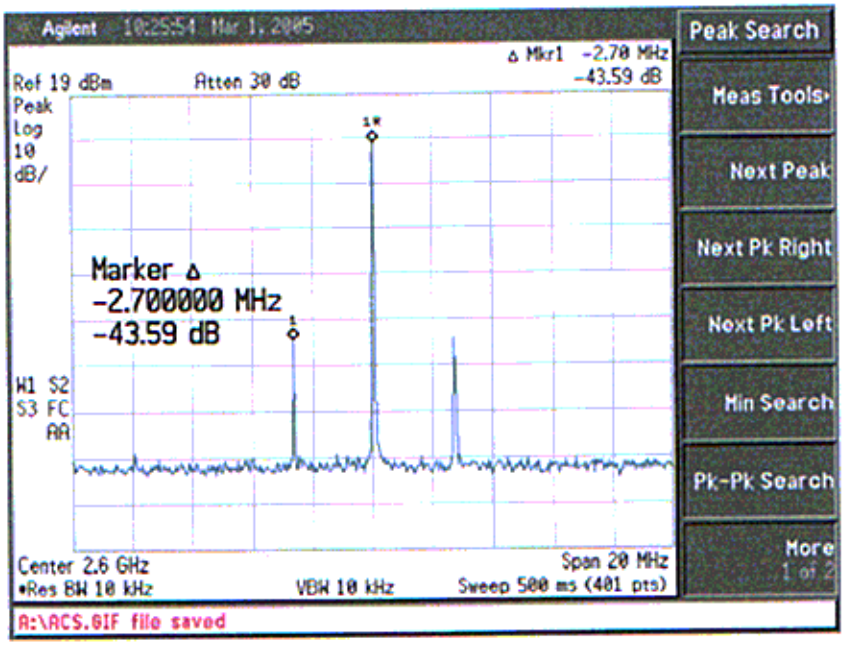
At 2.2 GHz in Band 1



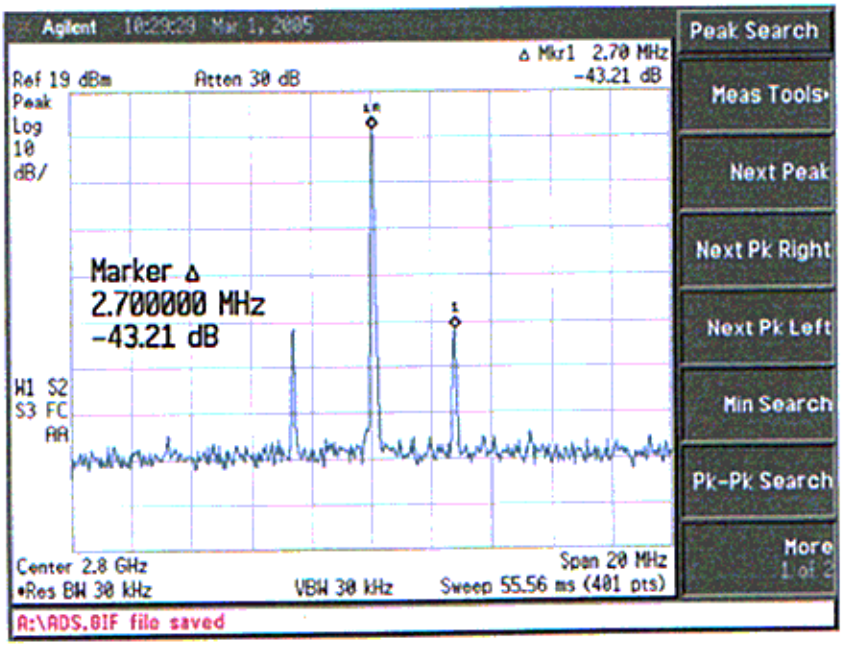
At 2.40 GHz in Band 1



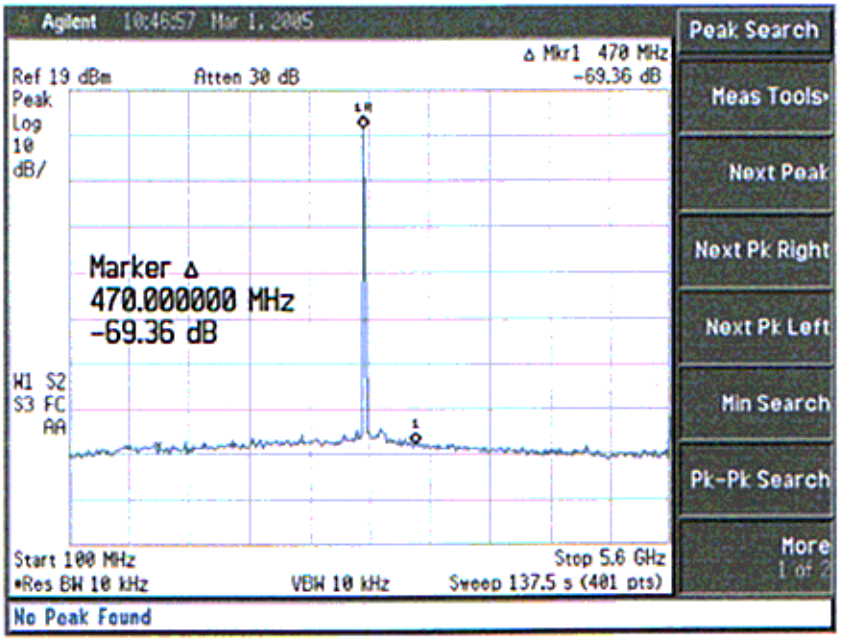
At 2.6 GHz in Band 1



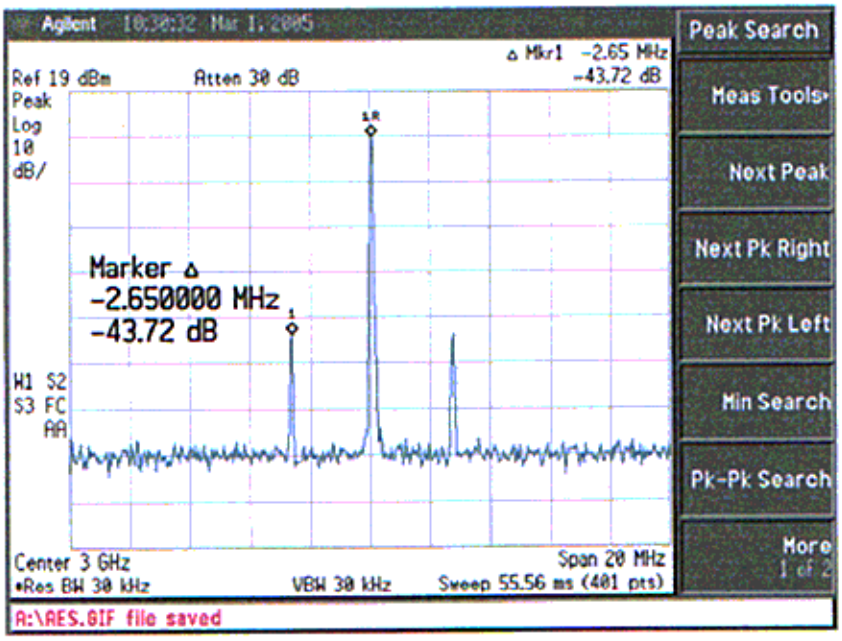
At 2.8 GHz in Band 1



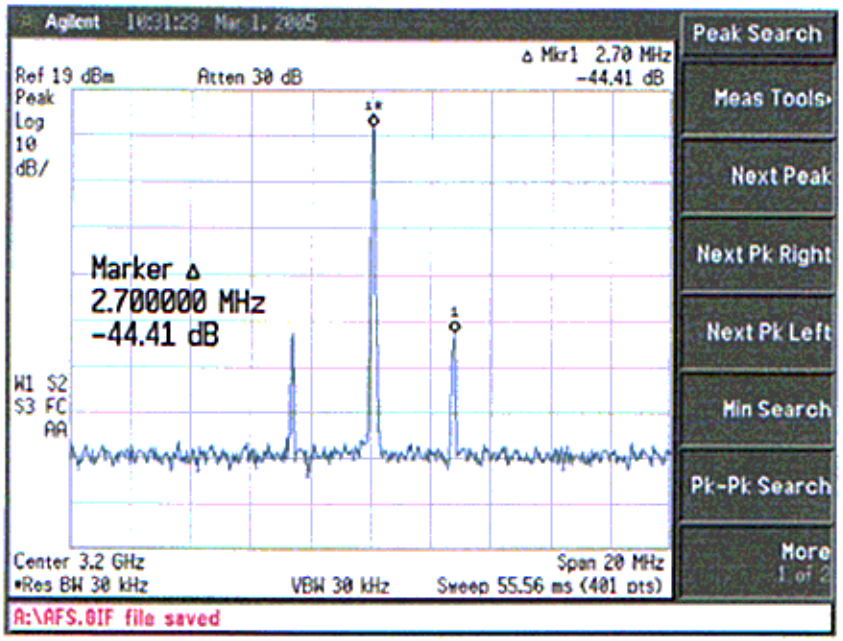
At 2.8 GHz in Band 1 (Large Span)



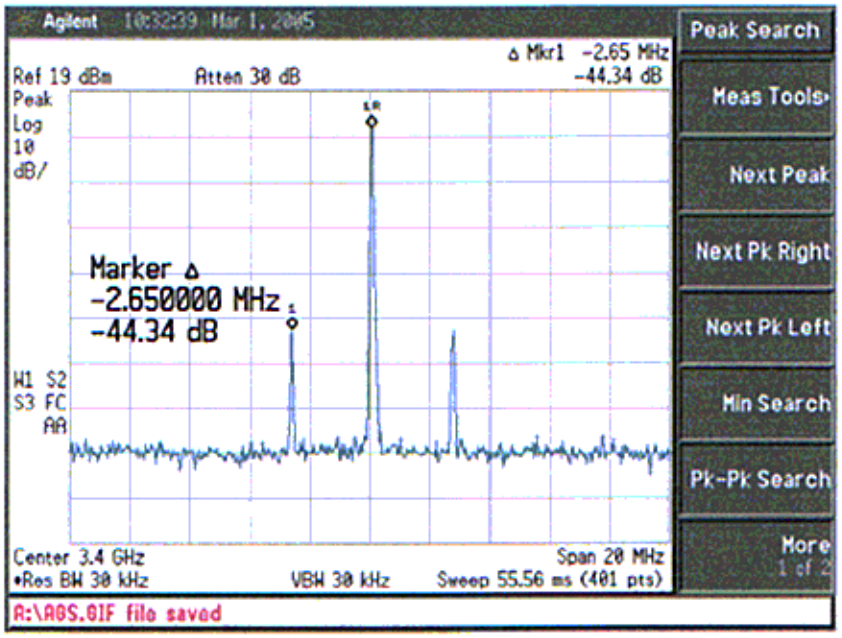
At 3.0 GHz in Band 1



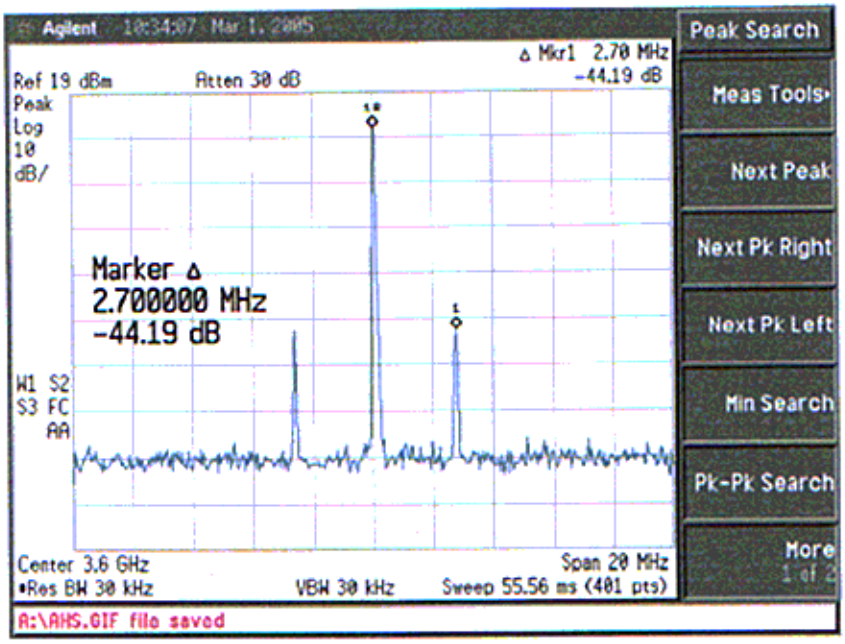
At 3.2 GHz in Band 1



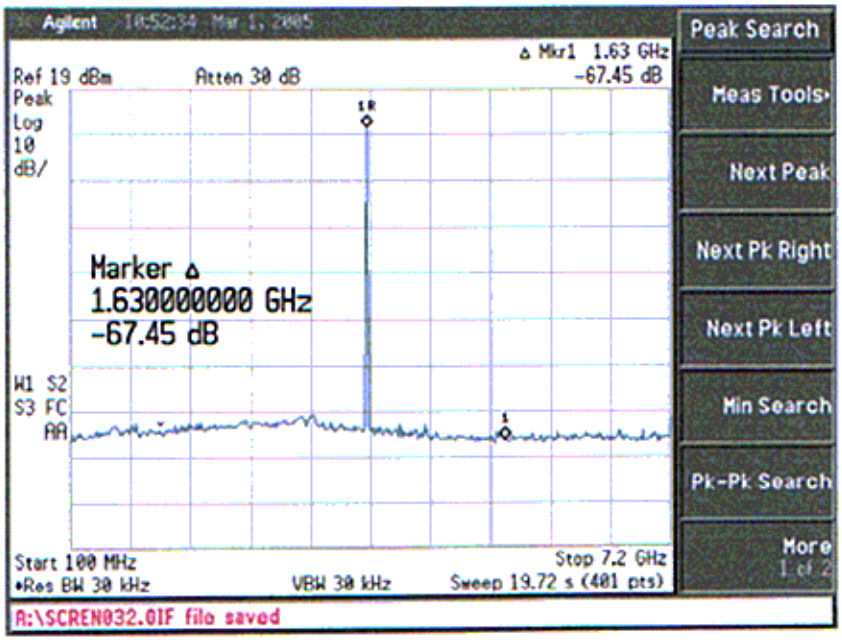
At 3.4 GHz in Band 1



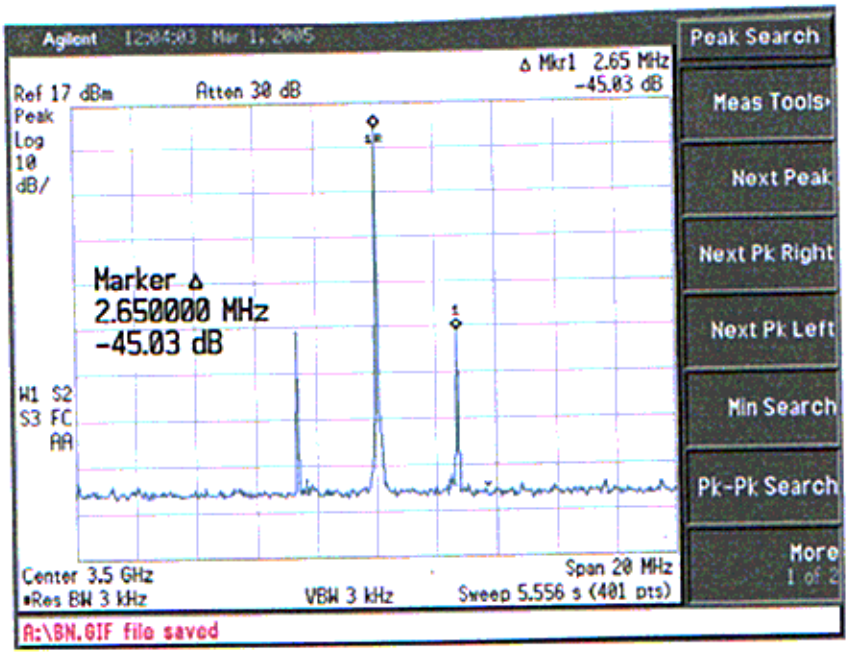
At 3.6 GHz in Band 1



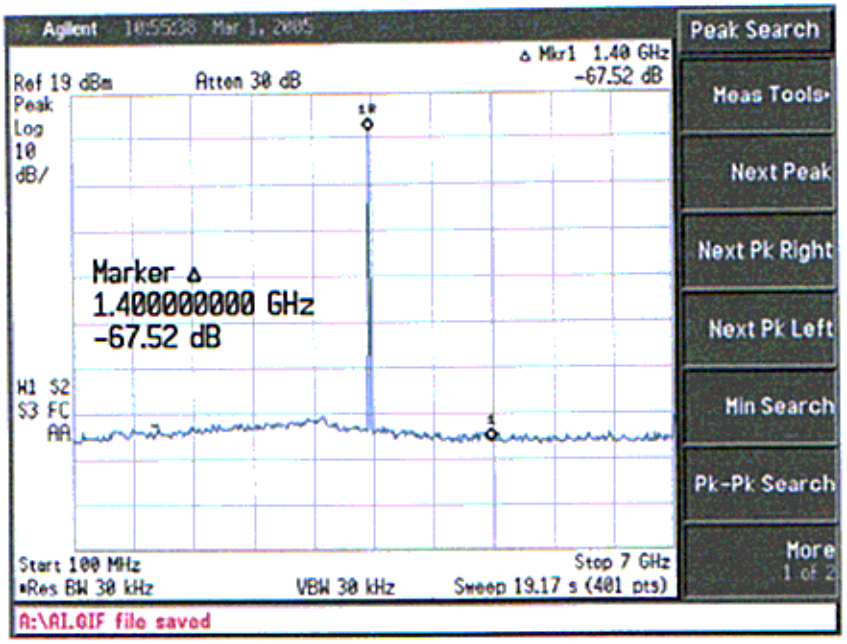
At 3.6 GHz in Band 1 (Large Span)



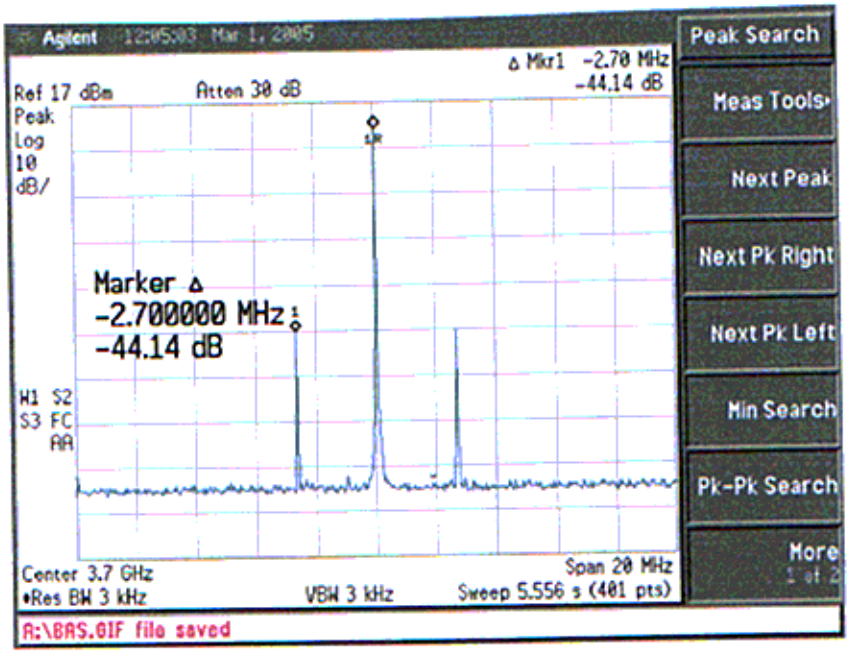
At 3.5 GHz in Band 2



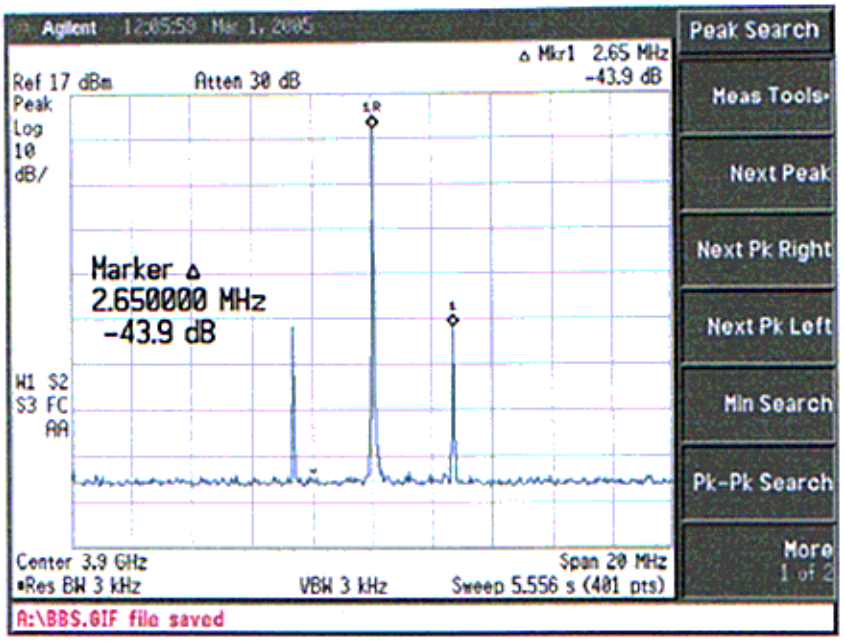
At 3.5 GHz in Band 2 (Large Span)



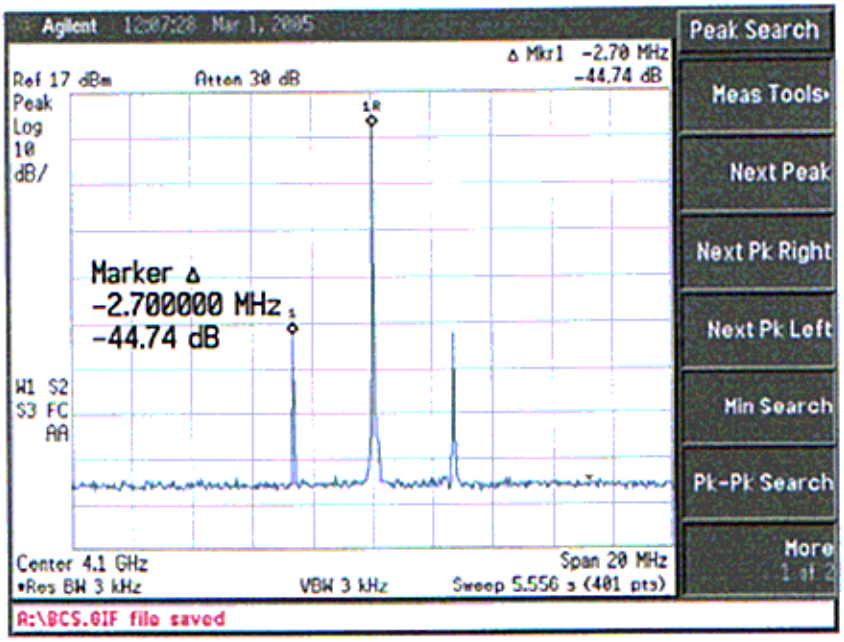
At 3.7 GHz in Band 2



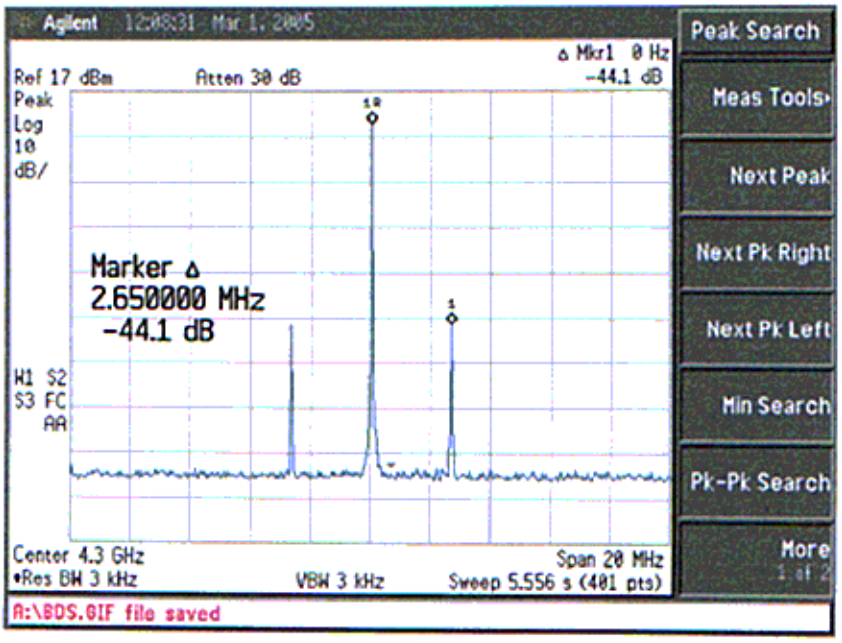
3.9 GHz in Band 2



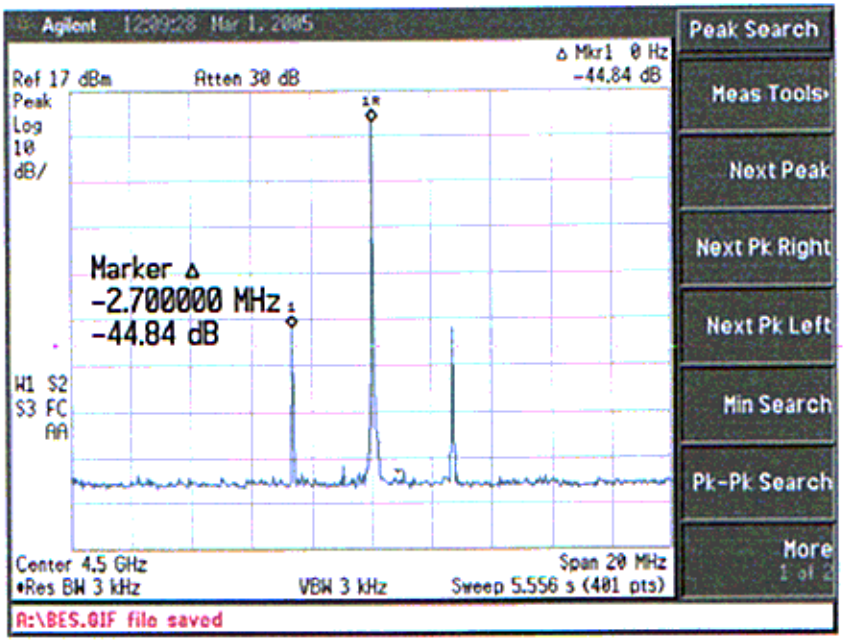
At 4.1 GHz in Band 2



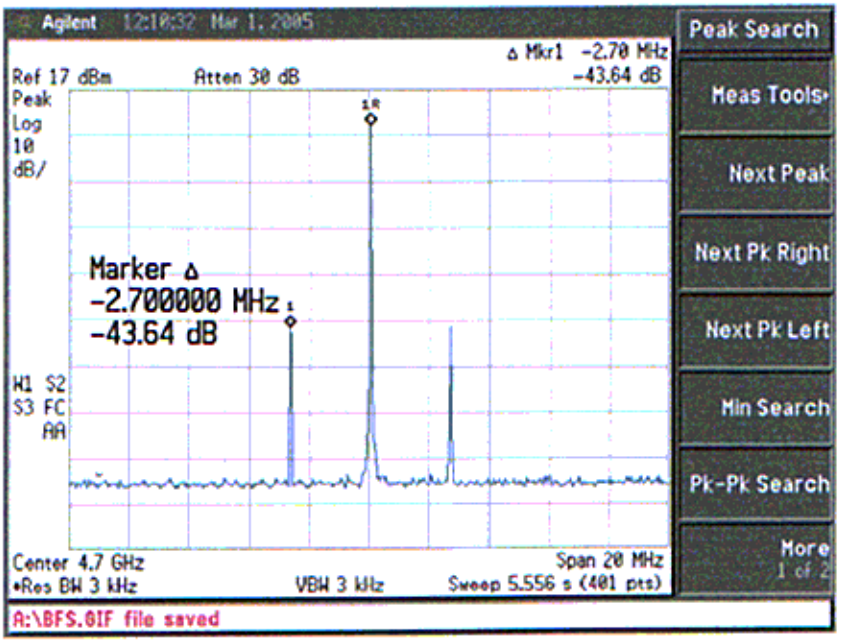
At 4.3 GHz in Band 2



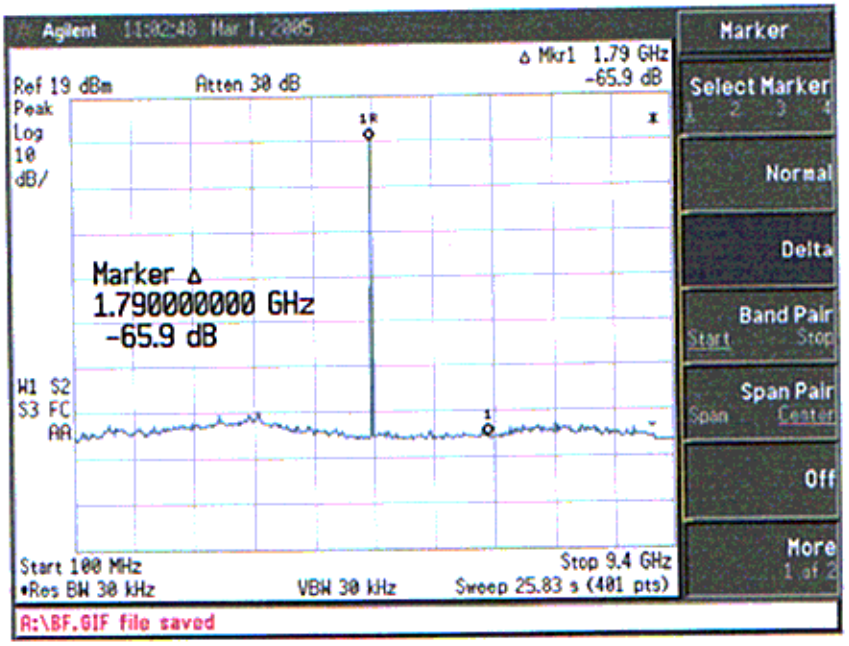
At 4.5 GHz in Band 2



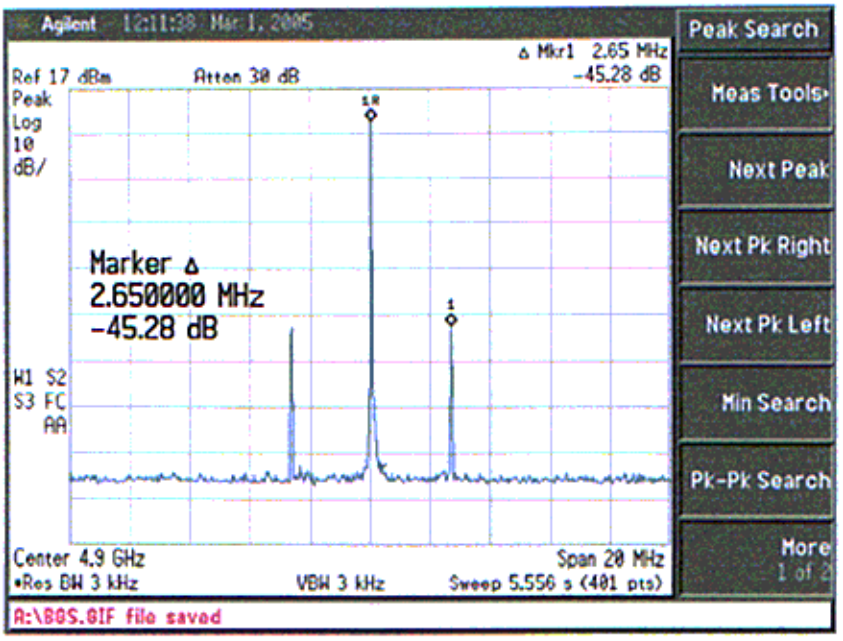
At 4.7 GHz in Band 2



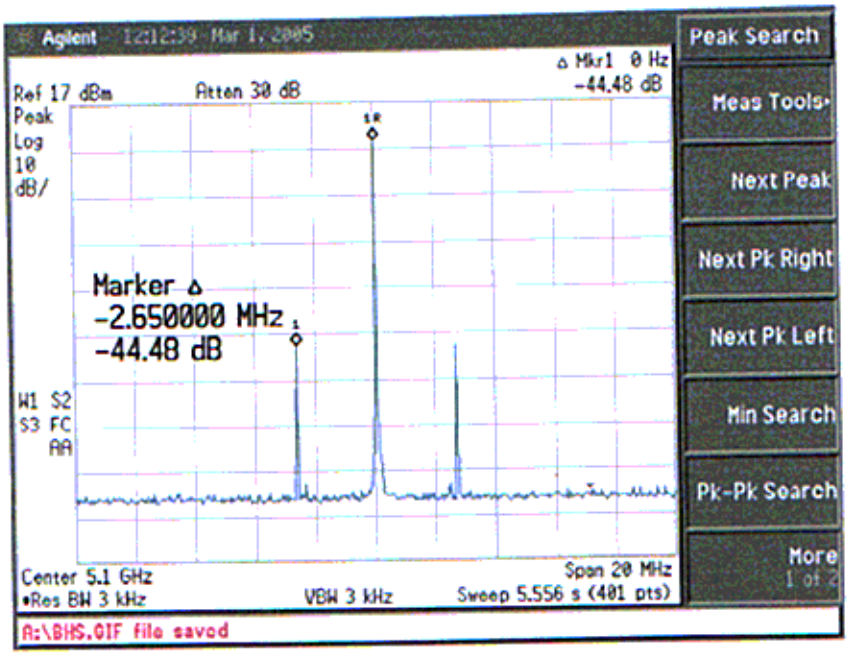
At 4.7 GHz in Band 2 (Large Span)



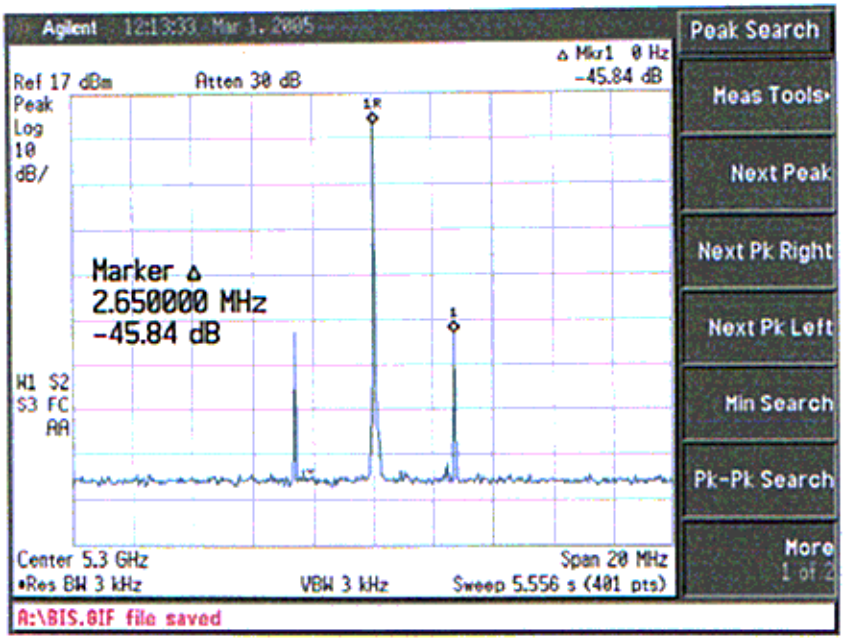
At 4.9 GHz in Band 2



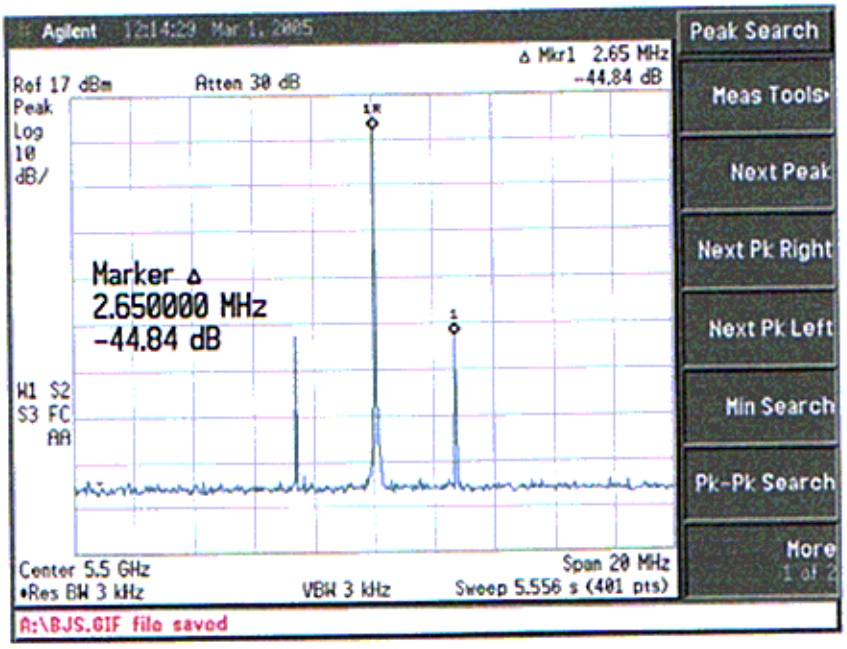
At 5.1 GHz in Band 2



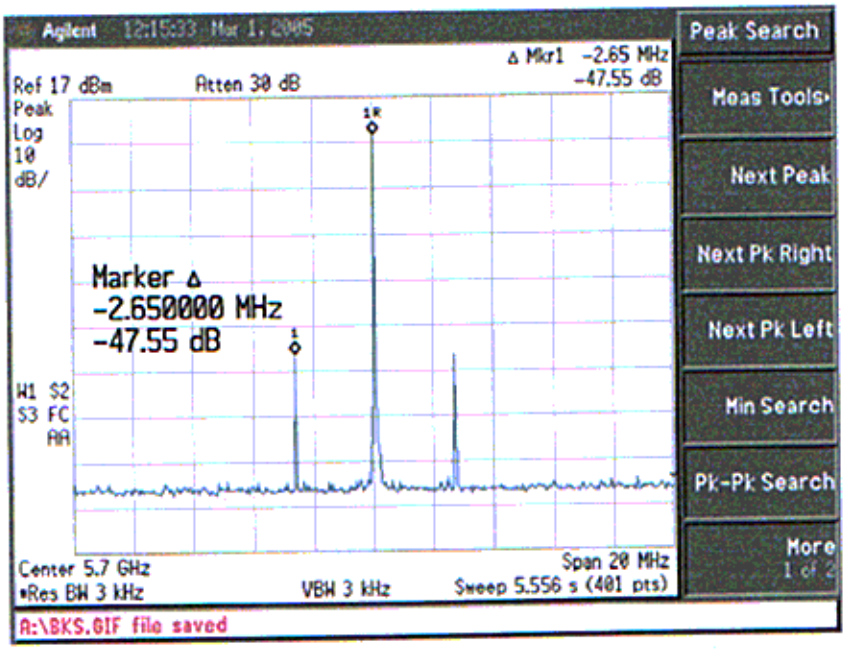
At 5.3 GHz in Band



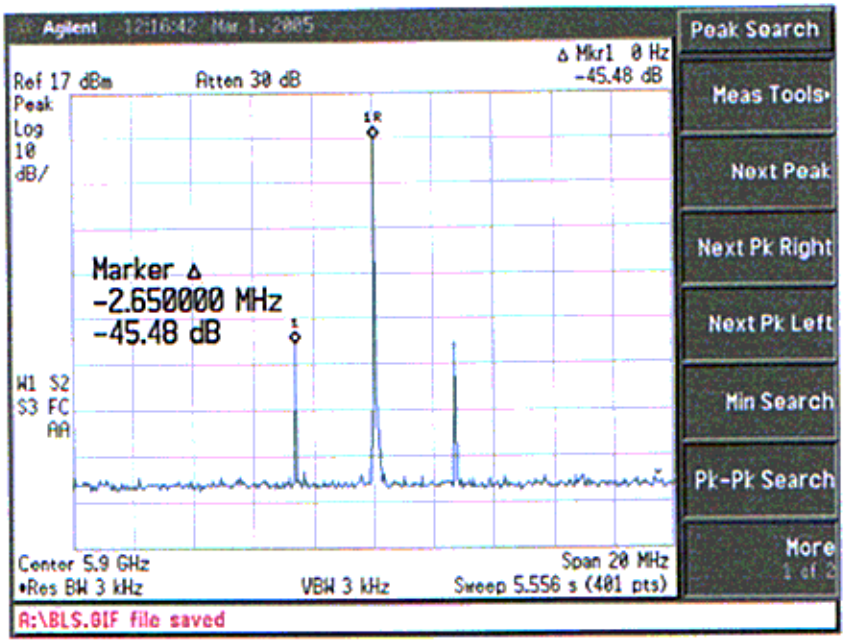
At 5.5 GHz in Band 2



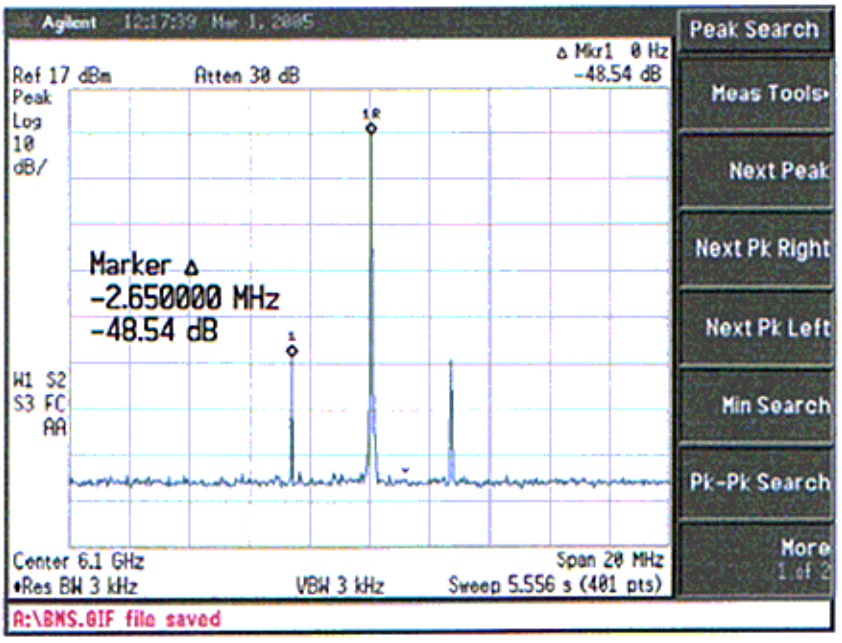
At 5.7 GHz in Band 2



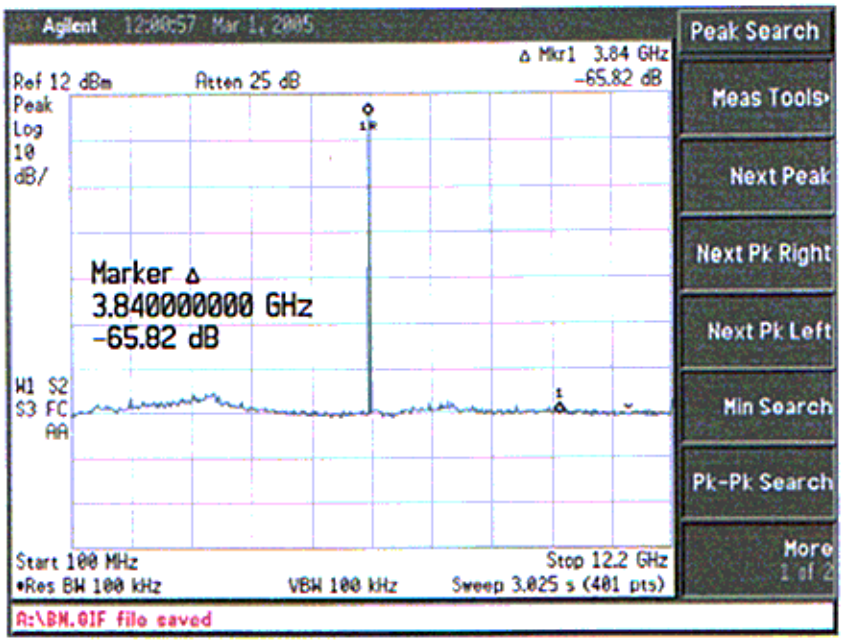
At 5.9 GHz in Band 2



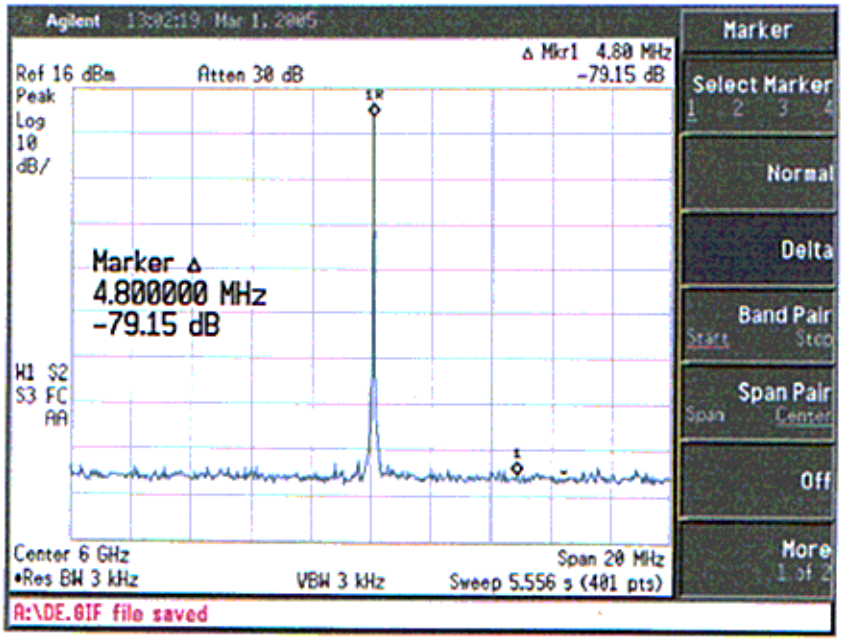
At 6.1 GHz in Band 2



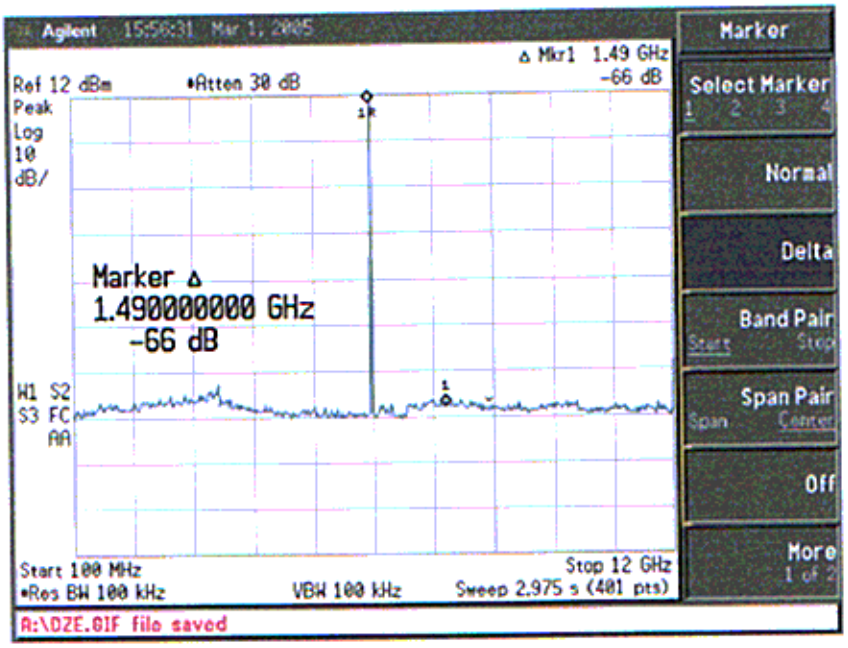
At 6.1 GHz in Band 2



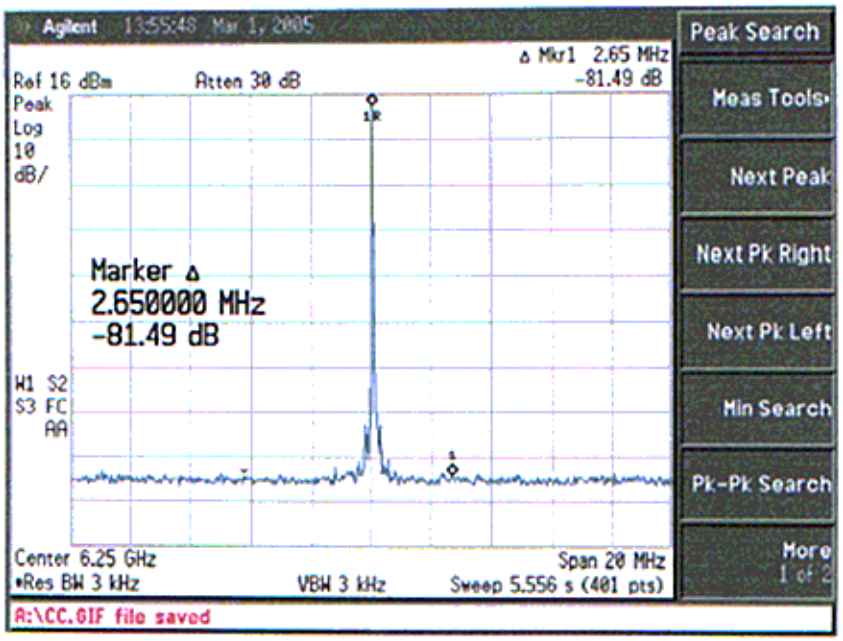
At 6.0 GHz in Band 3



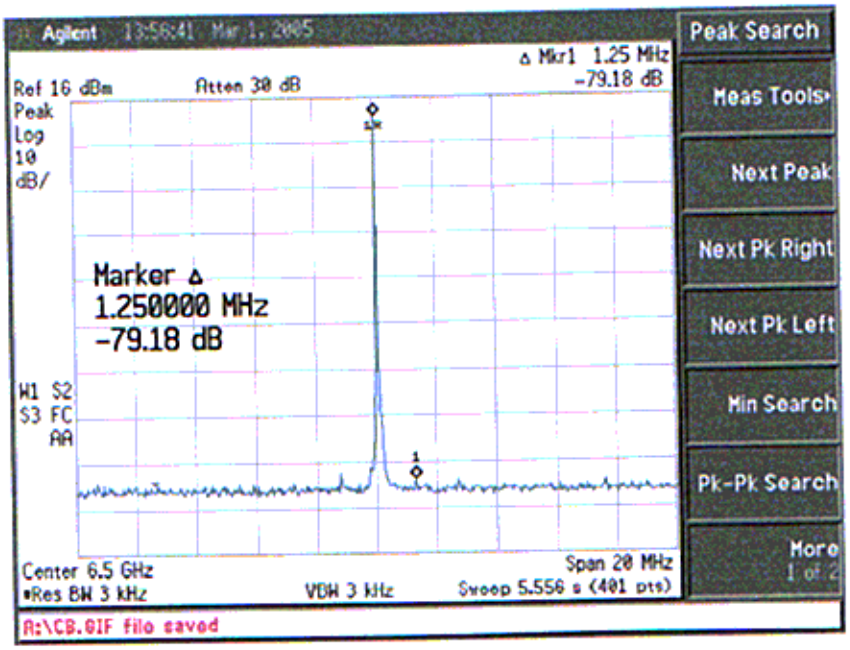
At 6.0 GHz in Band 3 (Large Span)



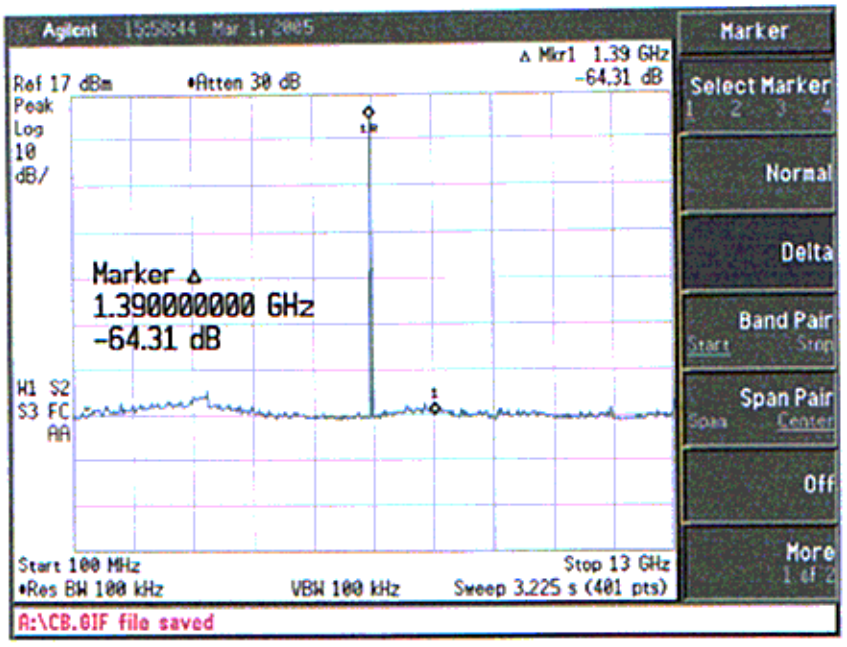
At 6.25 GHz in Band 3



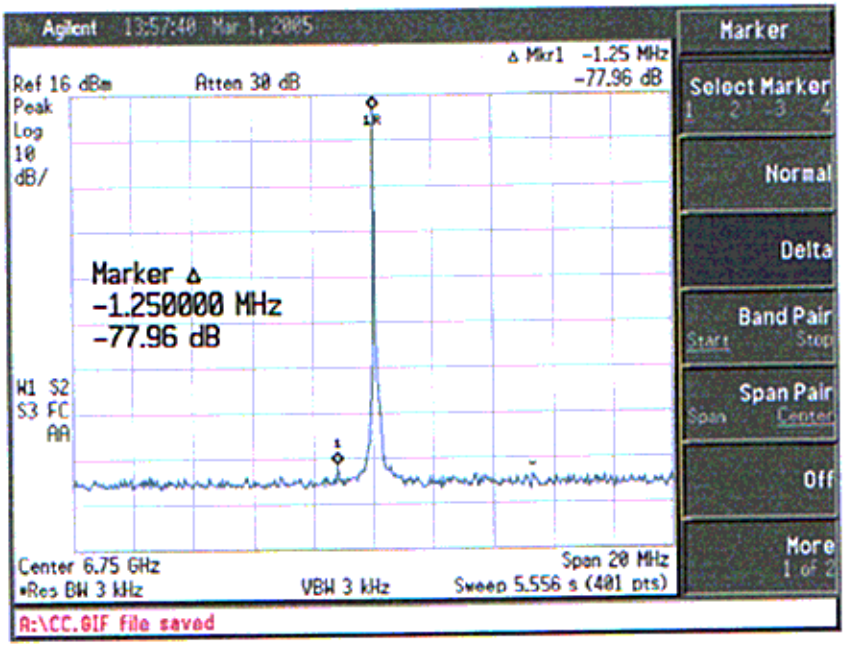
At 6.5 GHz in Band 3



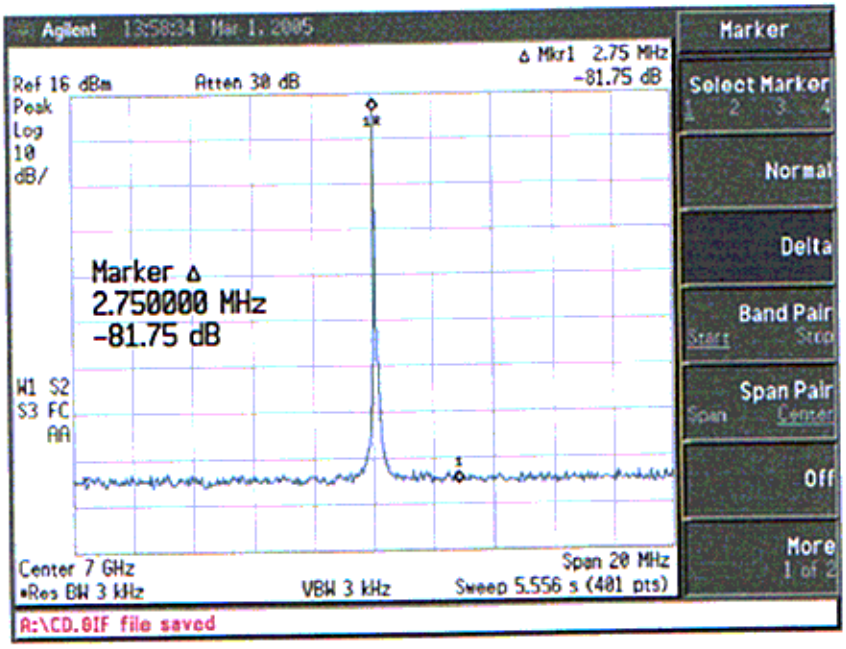
At 6.5 GHz in Band 3 (Large Span)



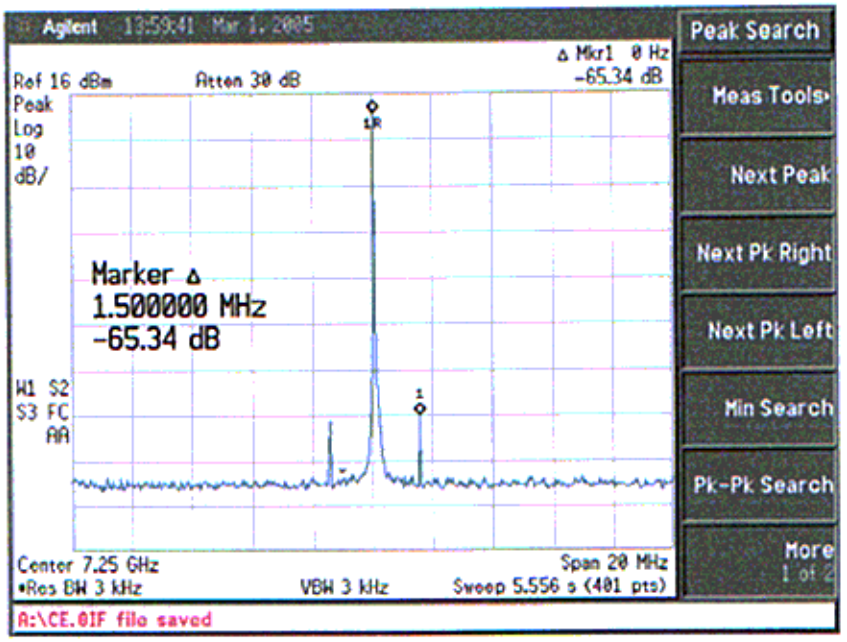
At 6.75 GHz in Band 3



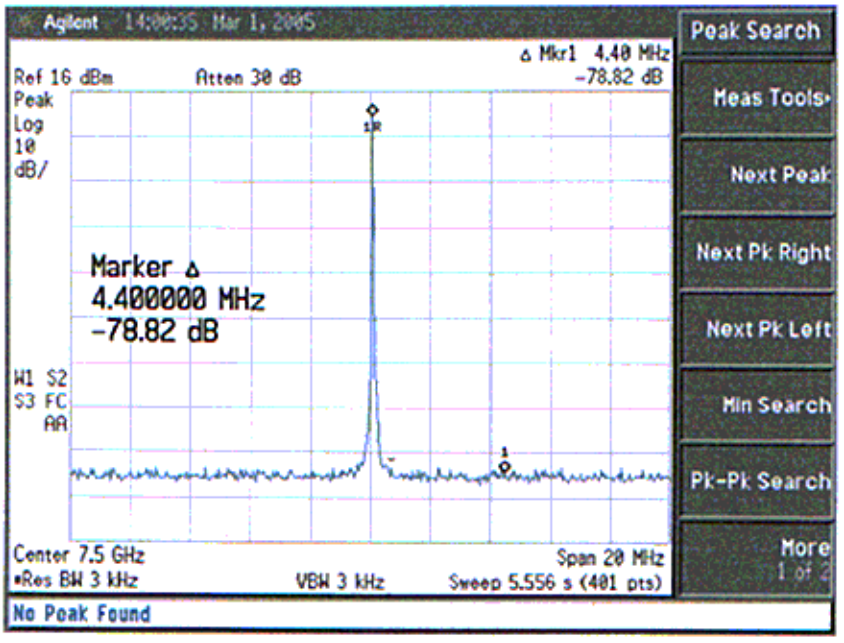
At 7.0 GHz in Band 3



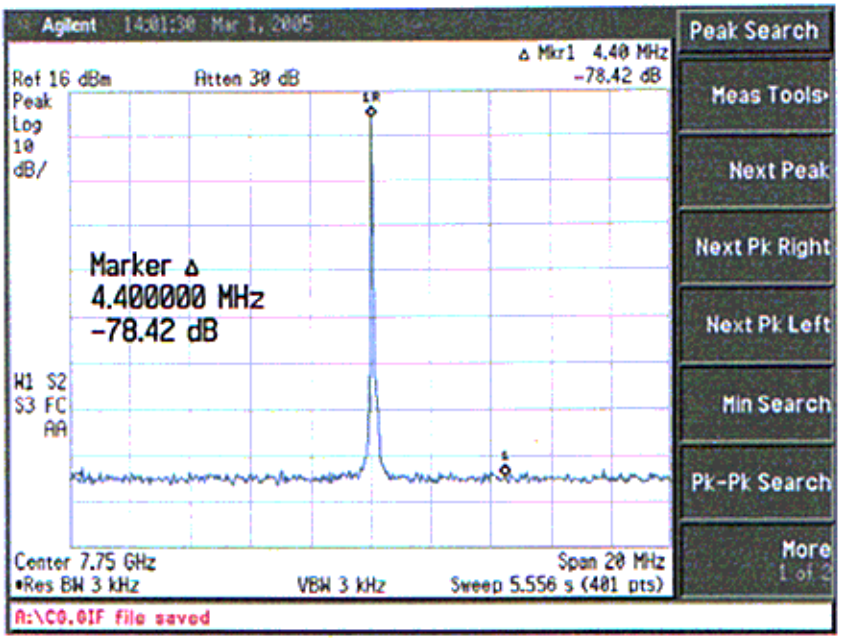
At 7.25 GHz in Band 3



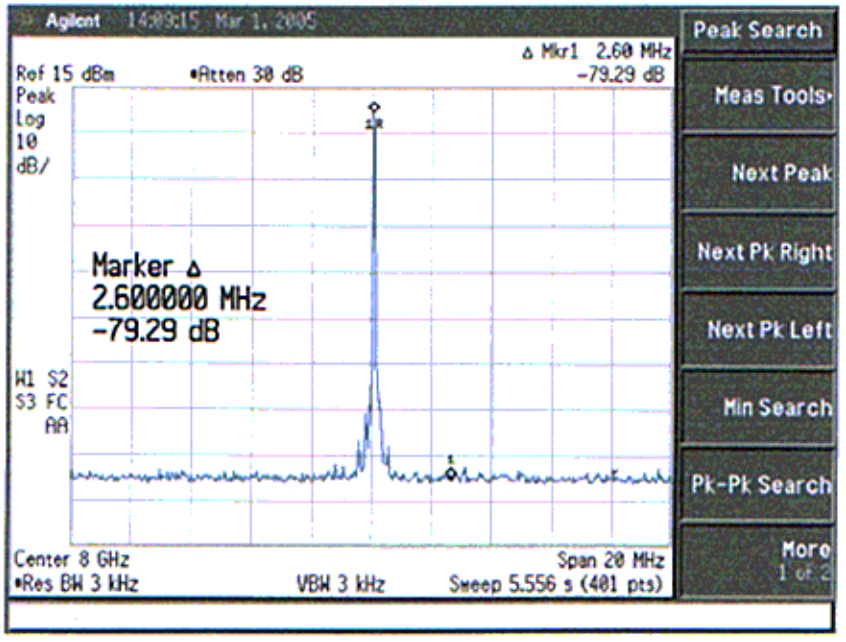
At 7.5 GHz in Band 3



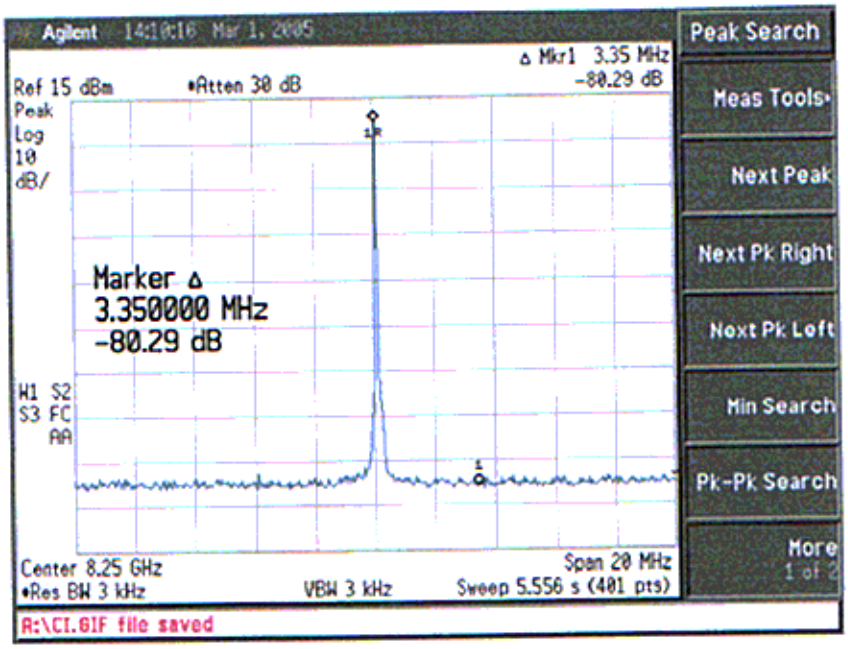
At 7.75 GHz in Band 3



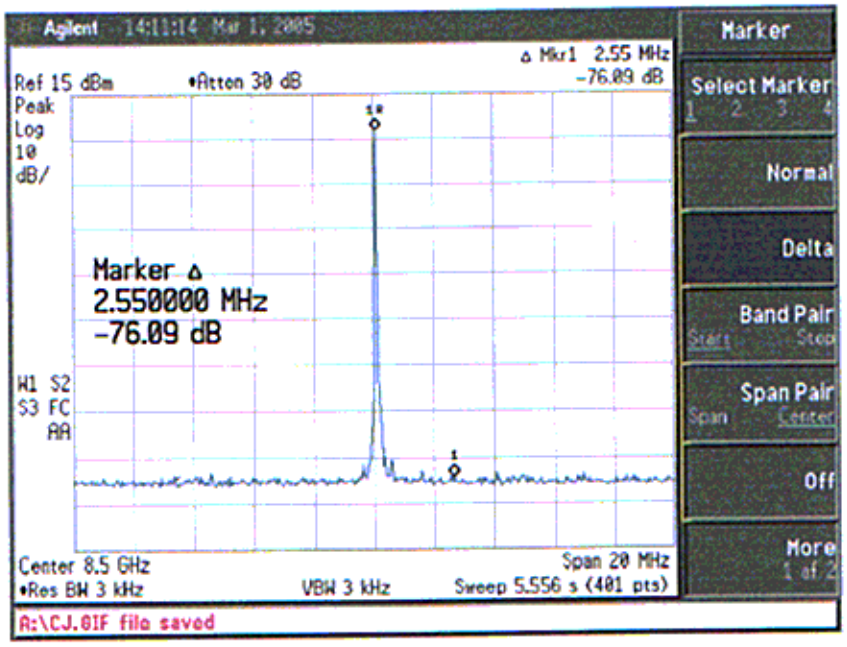
At 8.0 GHz in Band 3



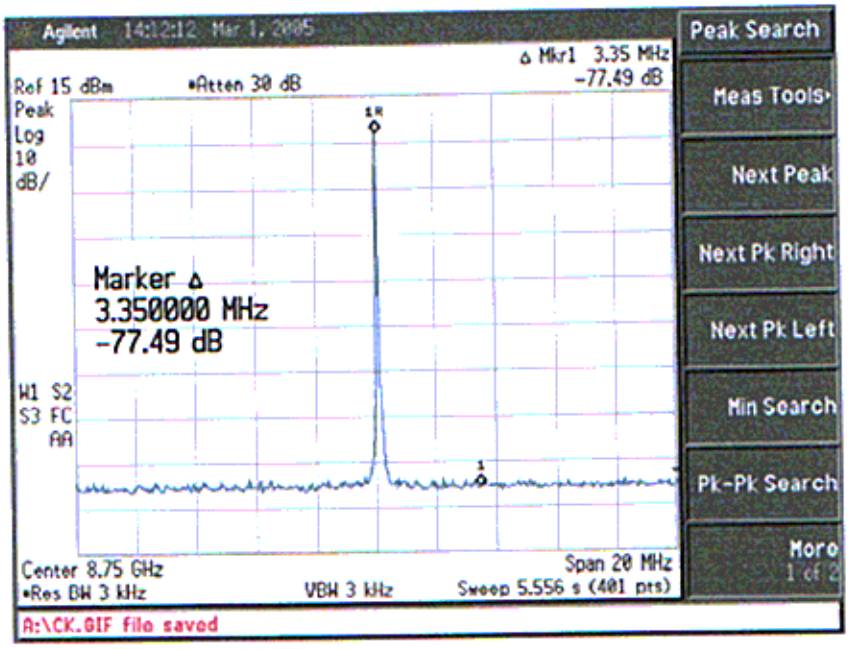
At 8.25 GHz in Band 3



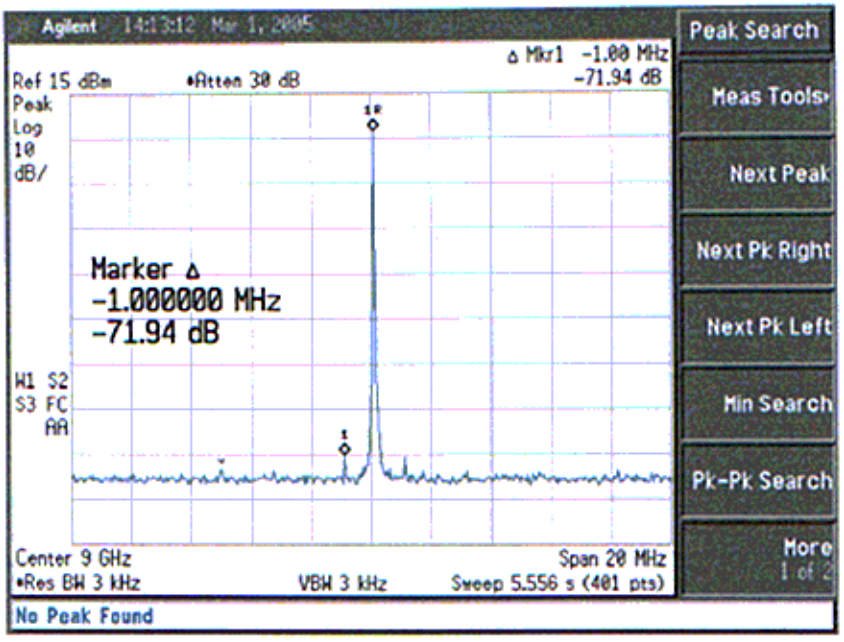
At 8.5 GHz in Band 3



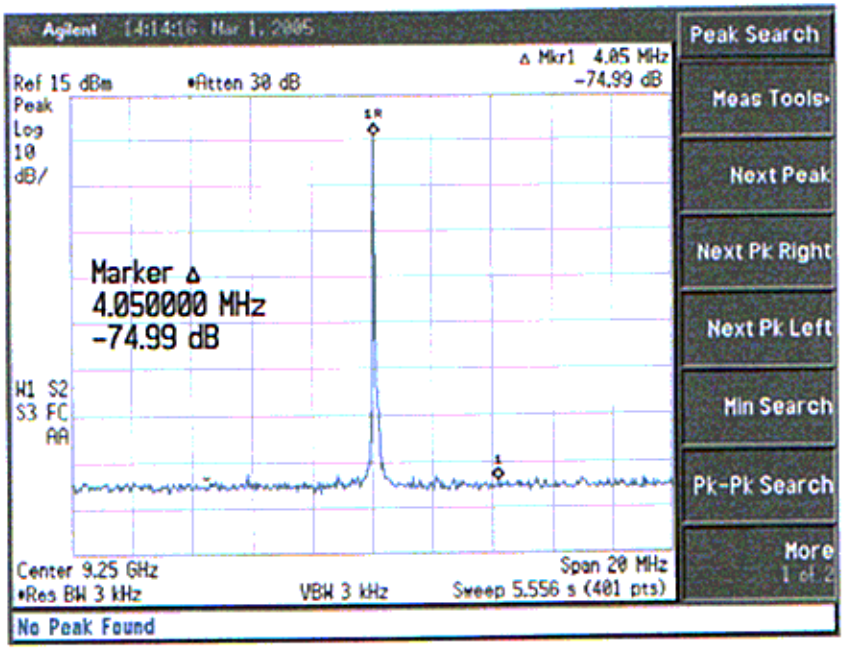
At 8.75 GHz in Band 3



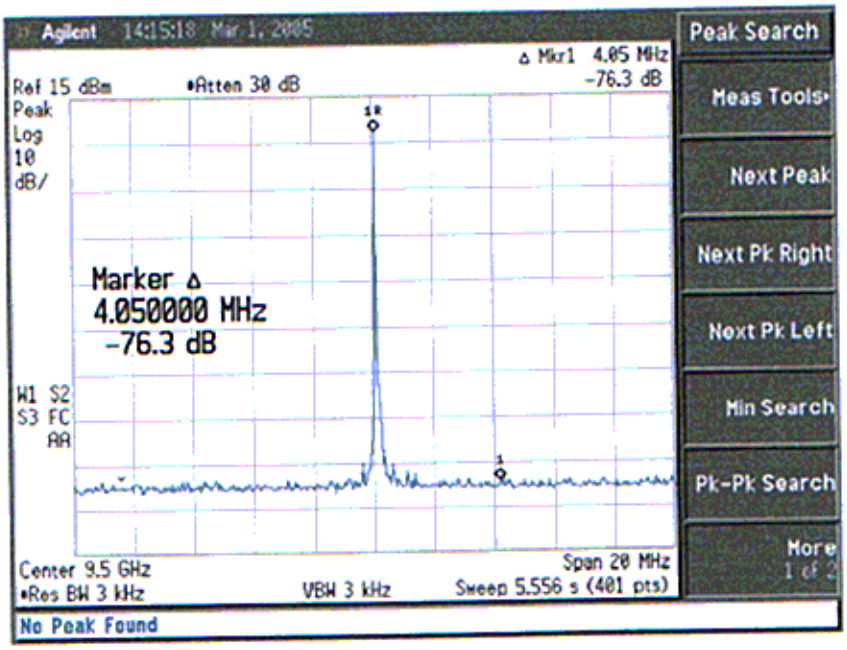
At 9.0 GHz in Band 3



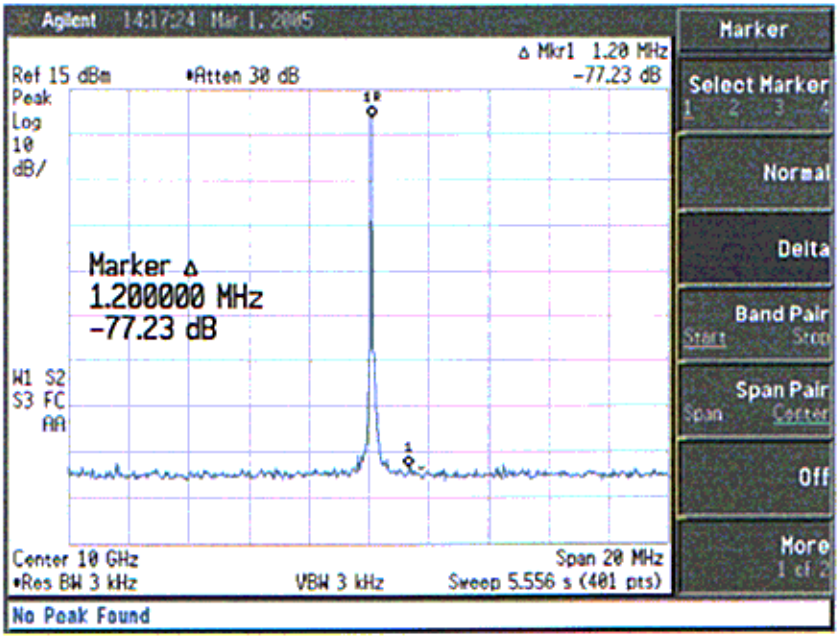
At 9.25 GHz in Band 3



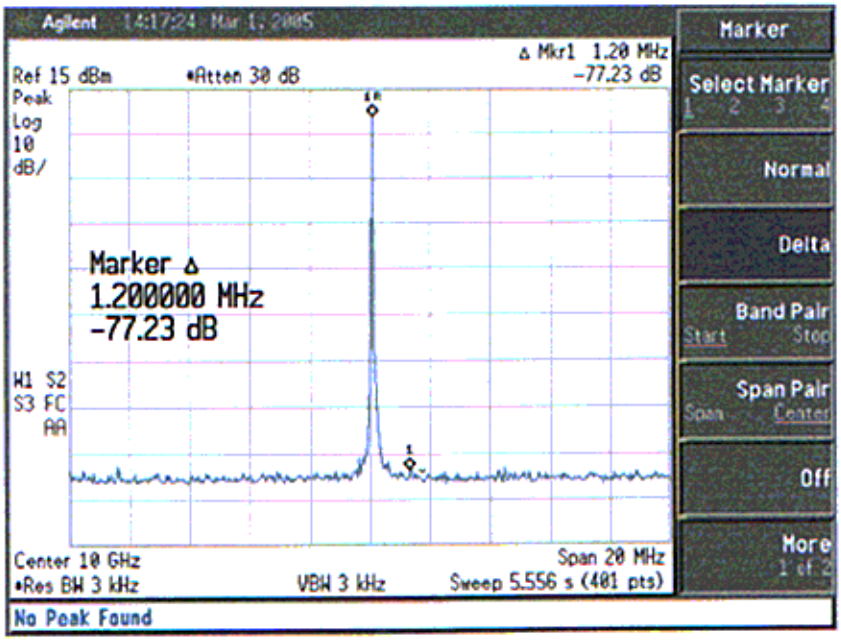
At 9.5 GHz in Band 3



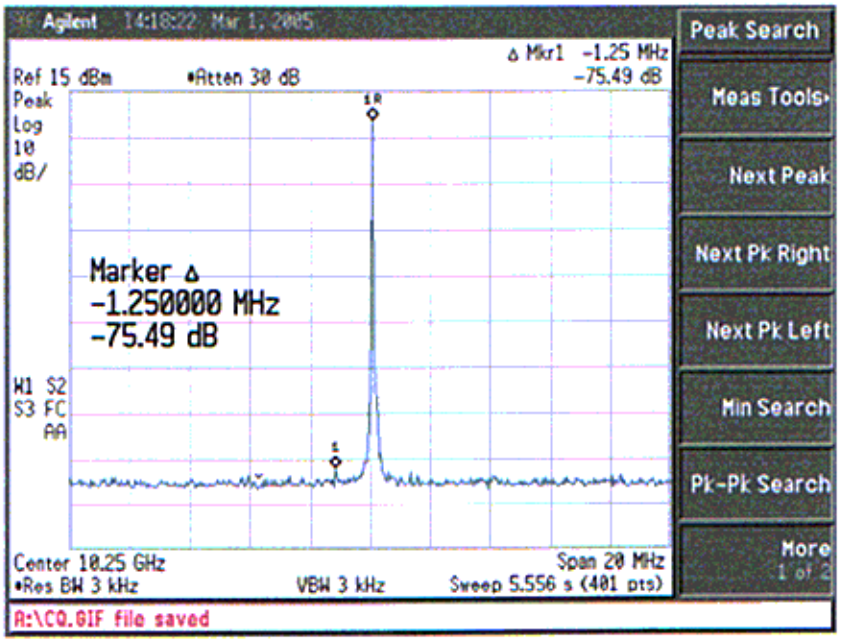
At 9.75 GHz in Band 3



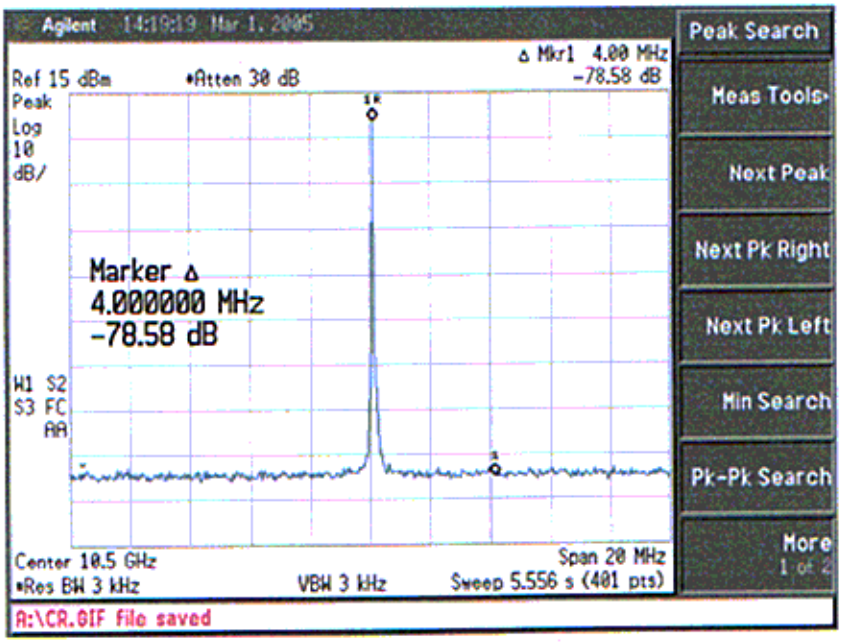
At 10.0 GHz in Band 3



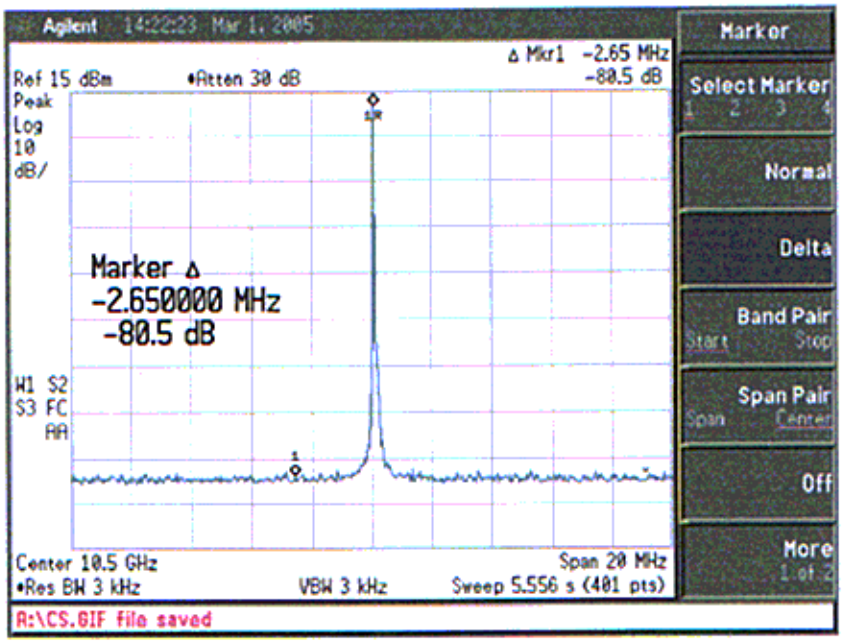
At 10.25 GHz in Band 3



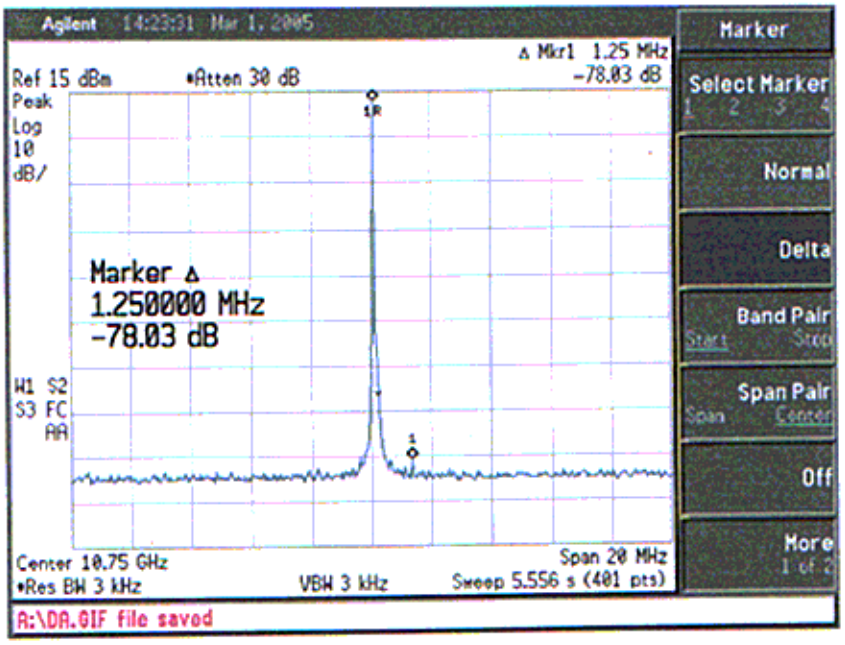
At 10.5 GHz in Band 3



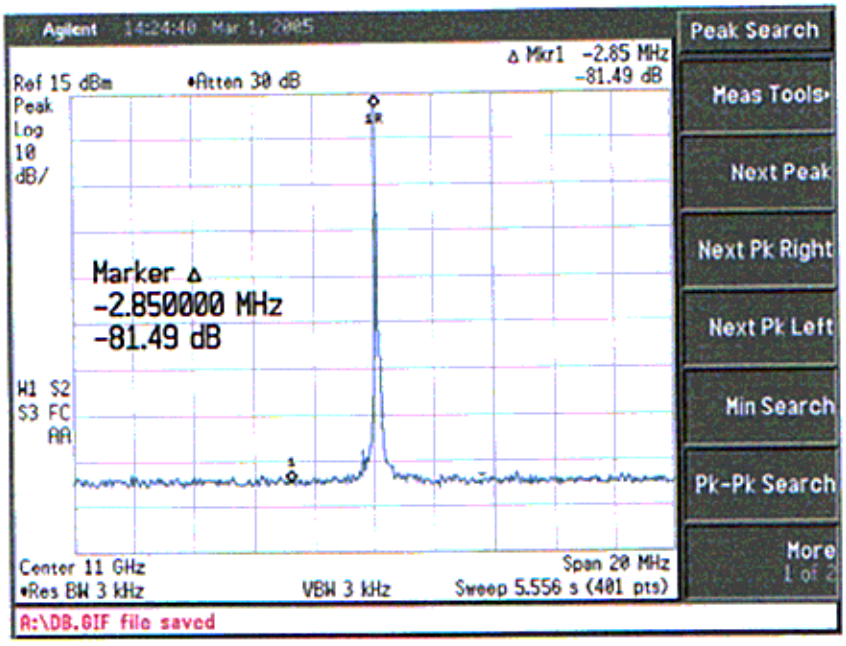
At 10.5 GHz in Band 4



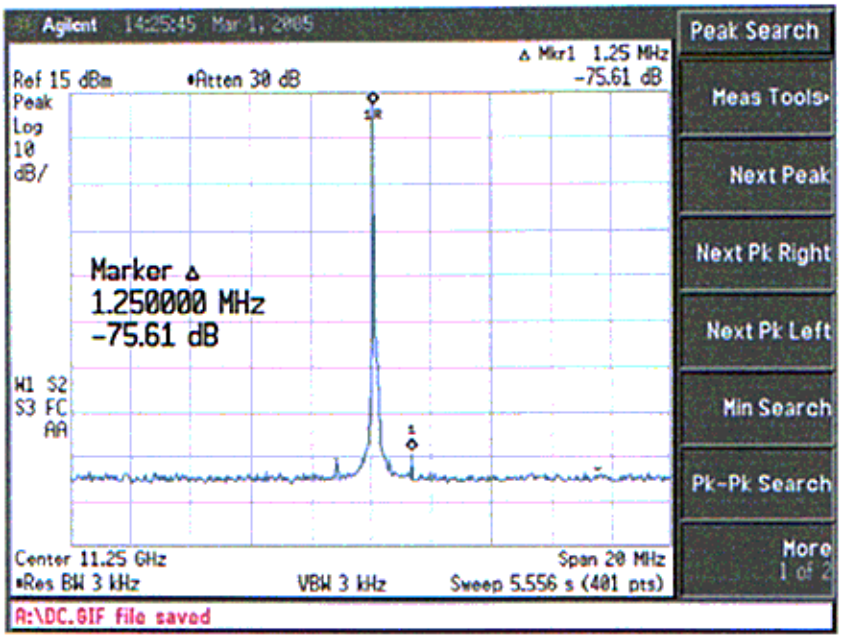
At 10.75 GHz in Band 4



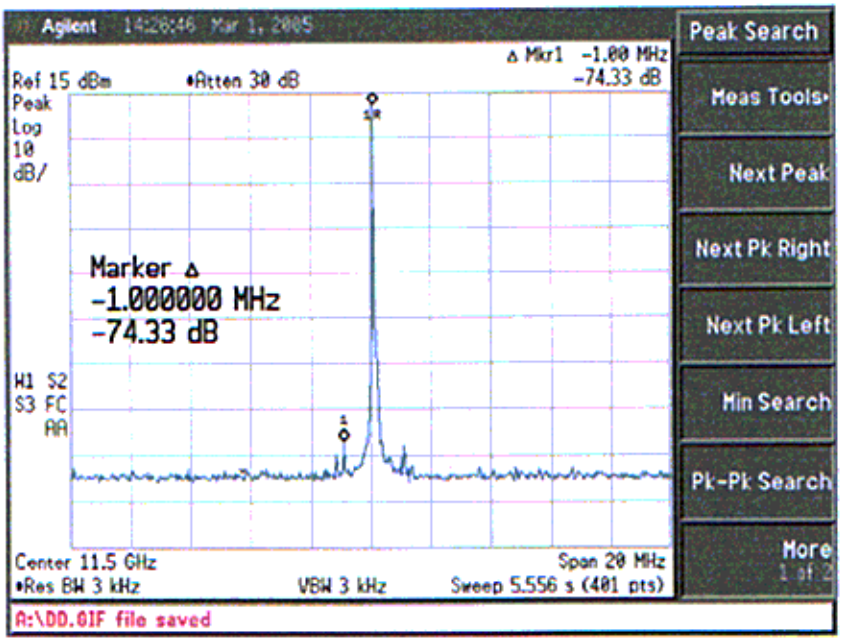
At 11.0 GHz in Band 4



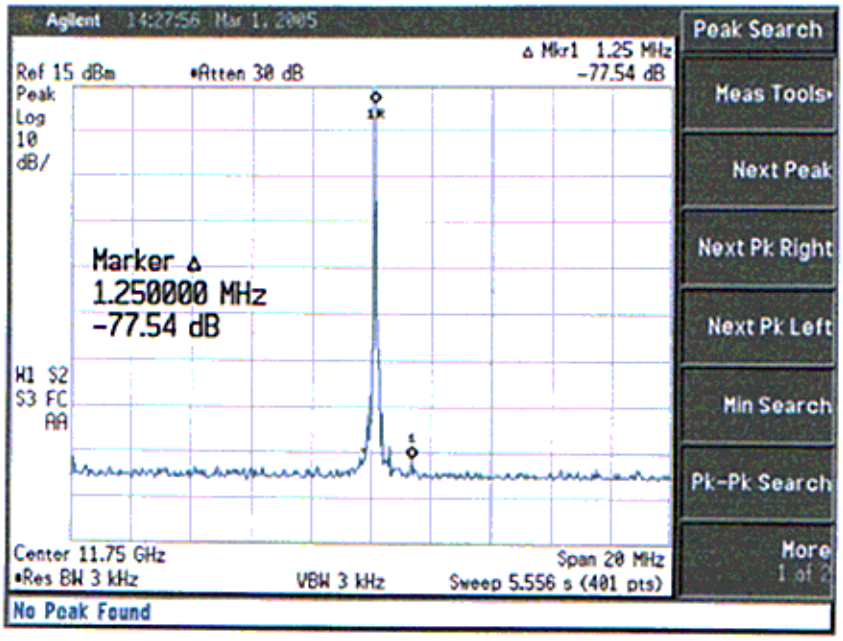
At 11.25 GHz in Band 4



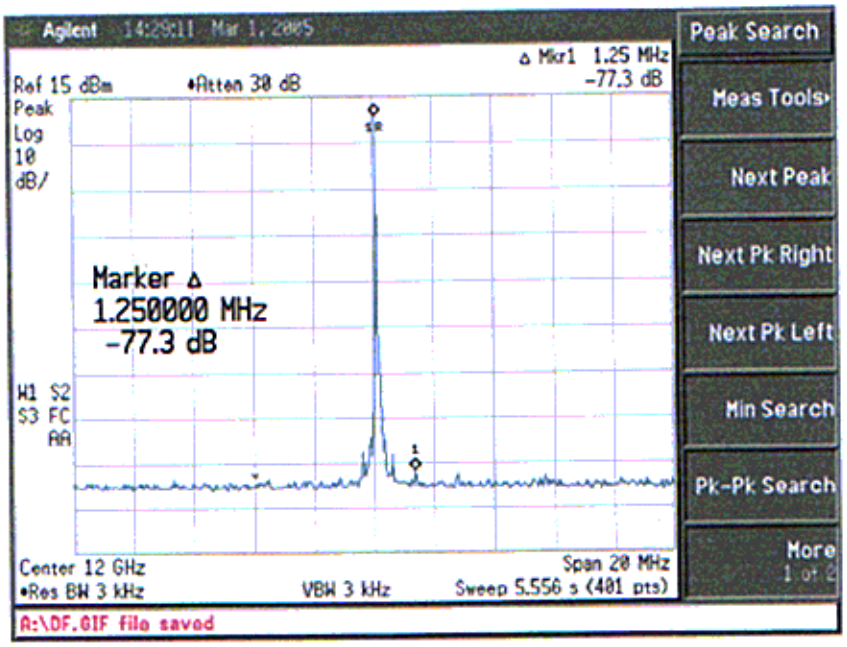
At 11.5 GHz in Band 4



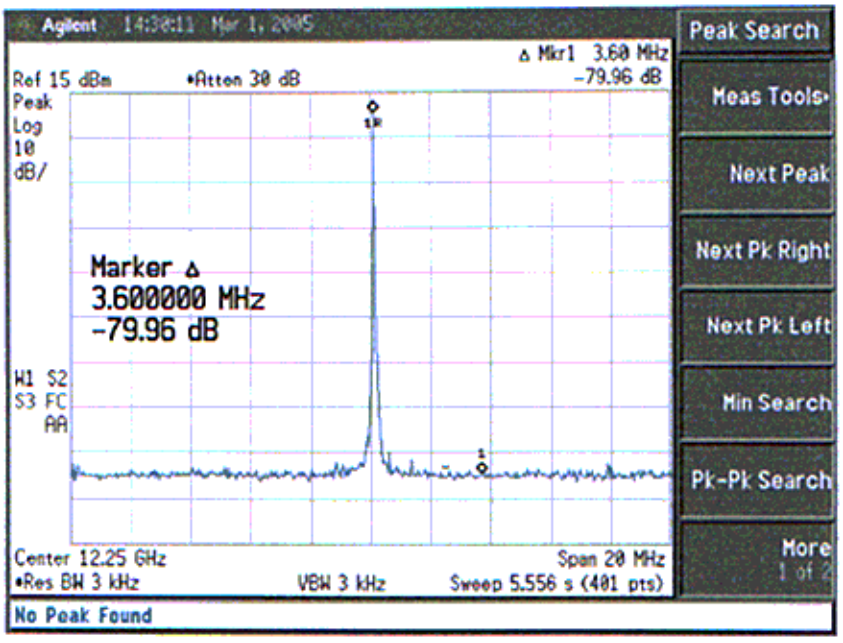
At 11.75 GHz in Band 4



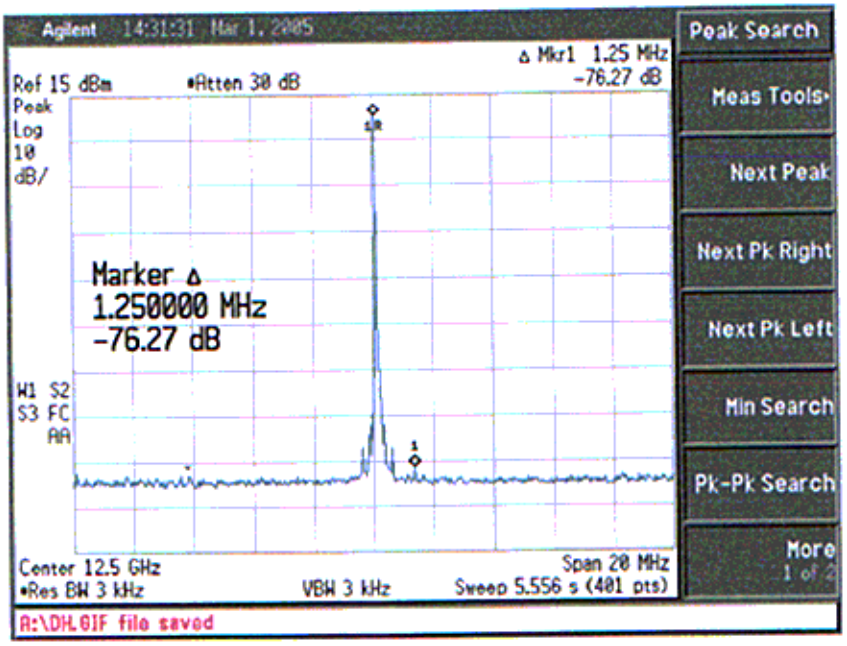
At 12.0 GHz in Band 4



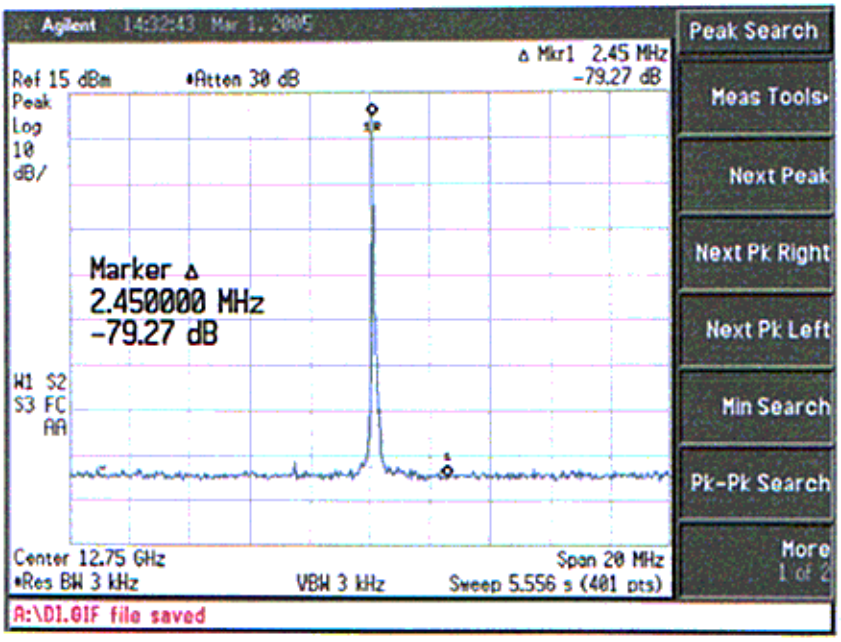
At 12.25 GHz in Band 4



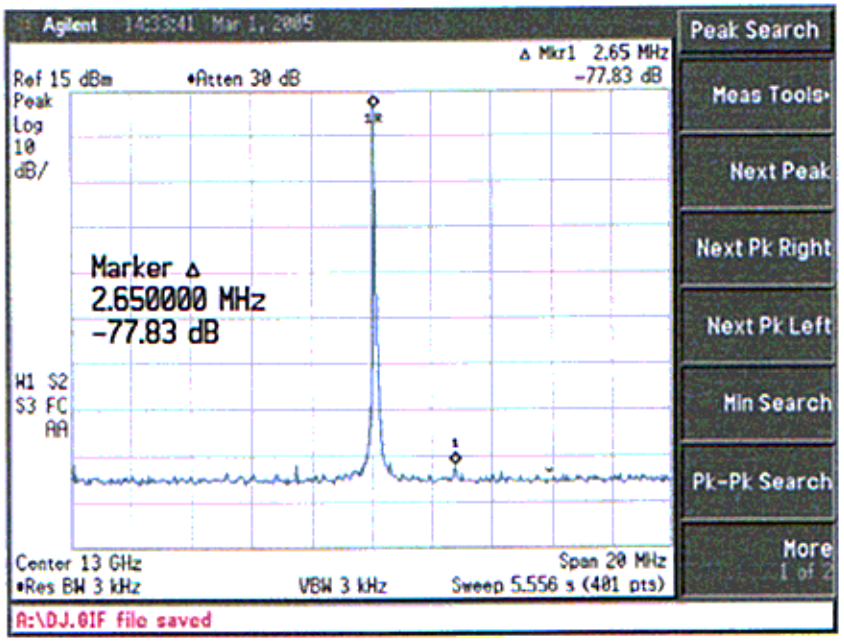
At 12.5 GHz in Band 4



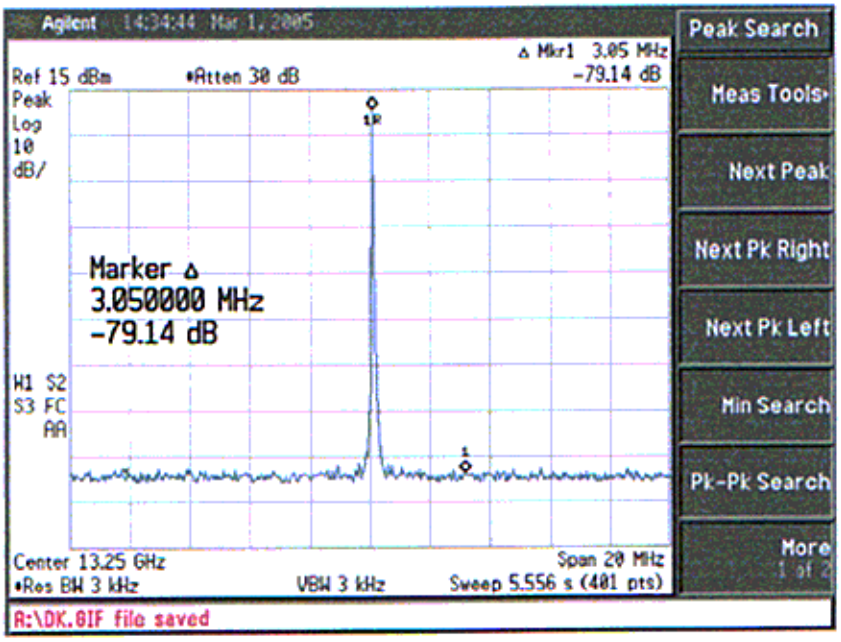
At 12.75 GHz in Band 4



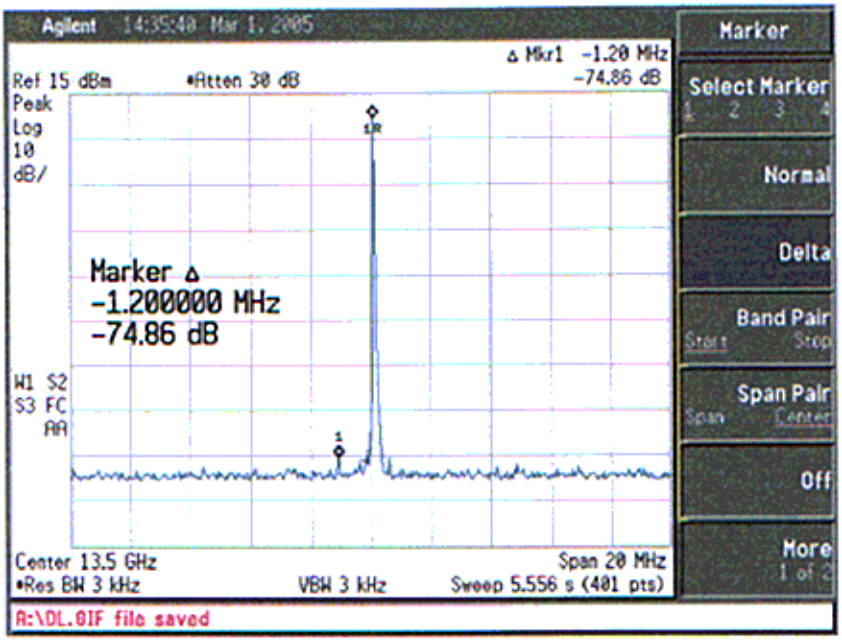
At 13.0 GHz in Band 4



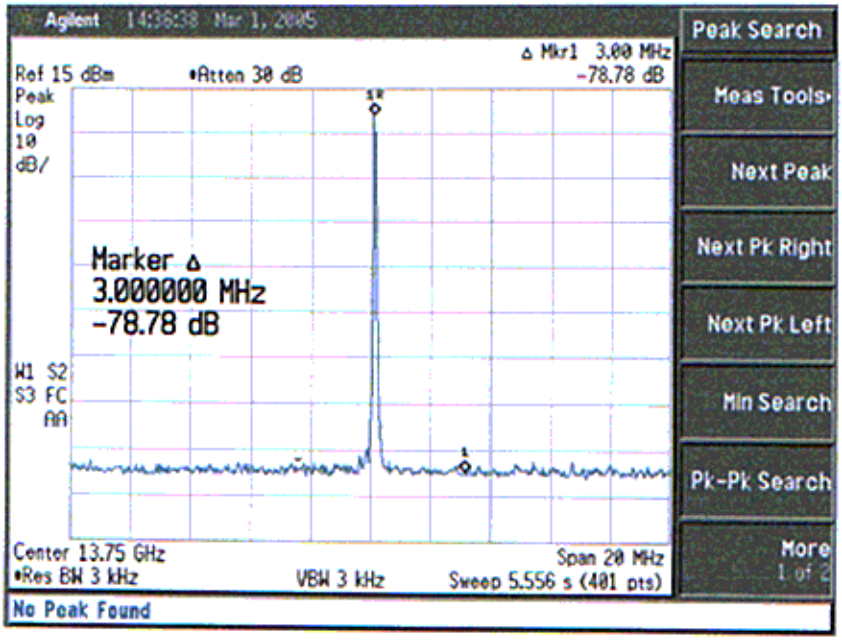
At 13.25 GHz in Band 4



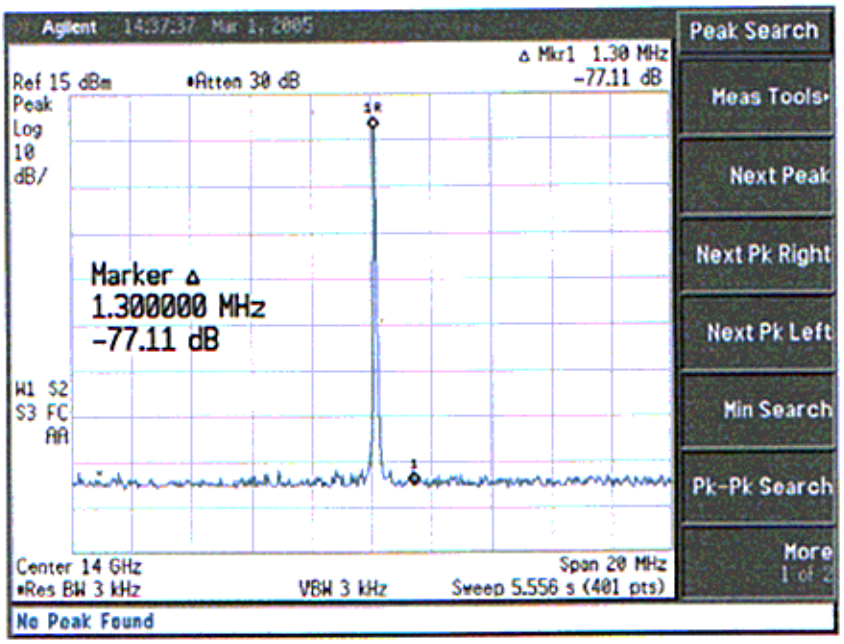
At 13.5 GHz in Band 4



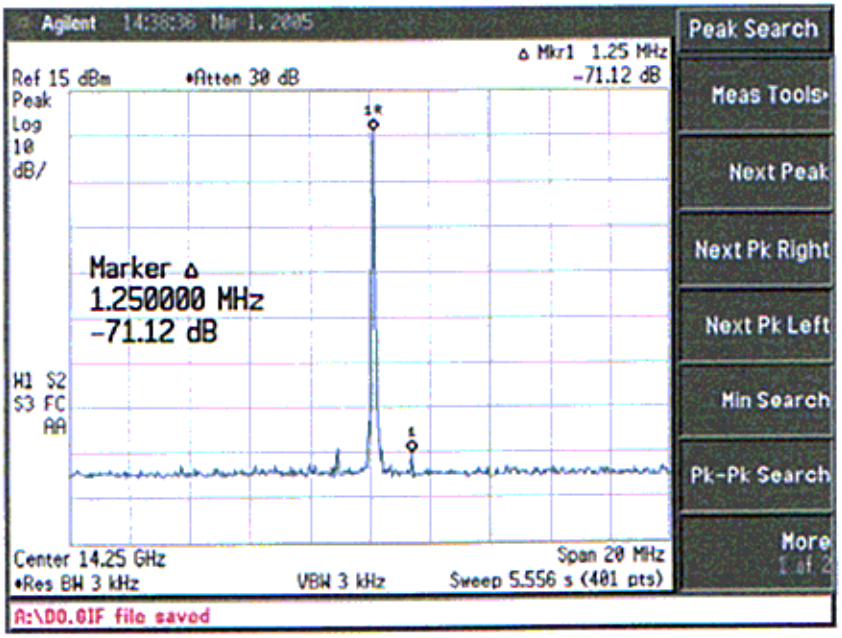
At 13.75 GHz in Band 4



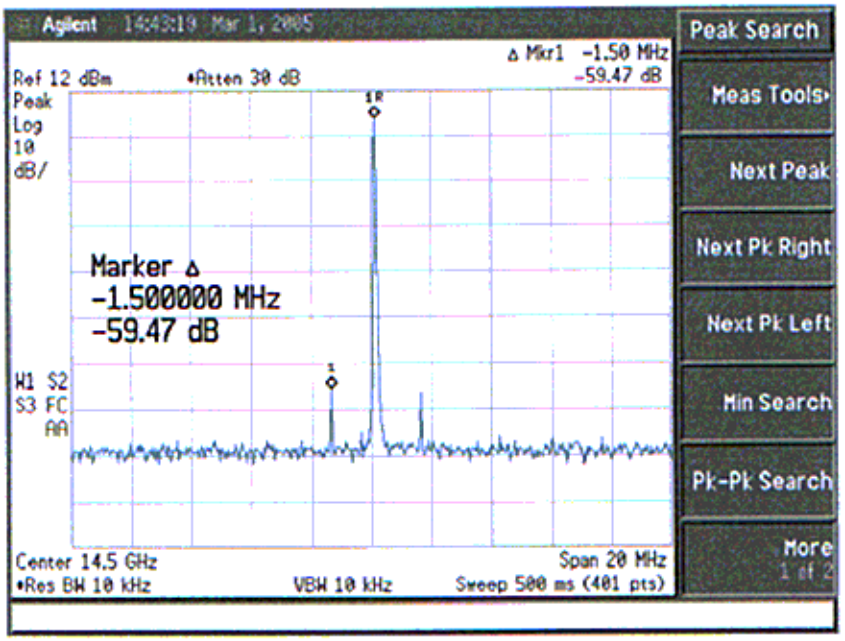
At 14.0 GHz in Band 4



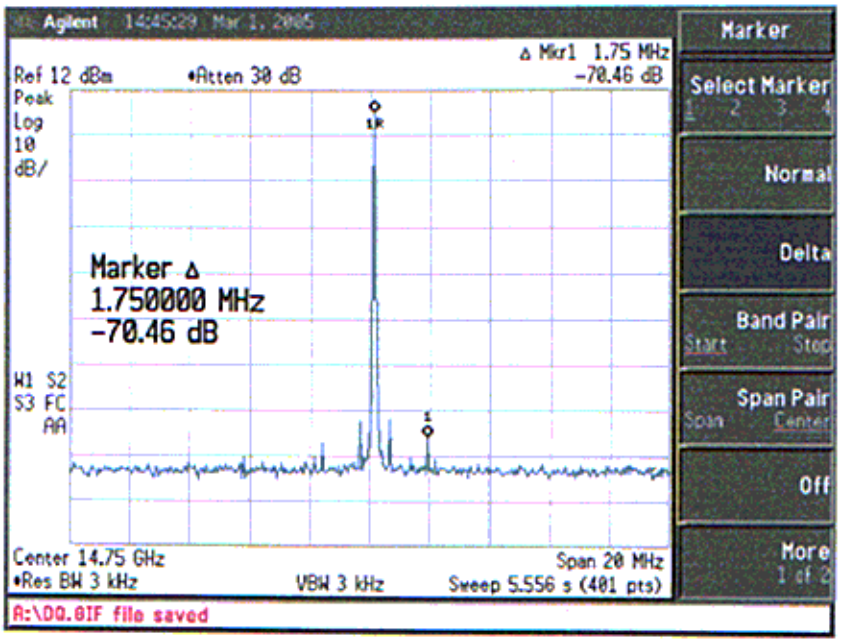
At 14.25 GHz in Band 4



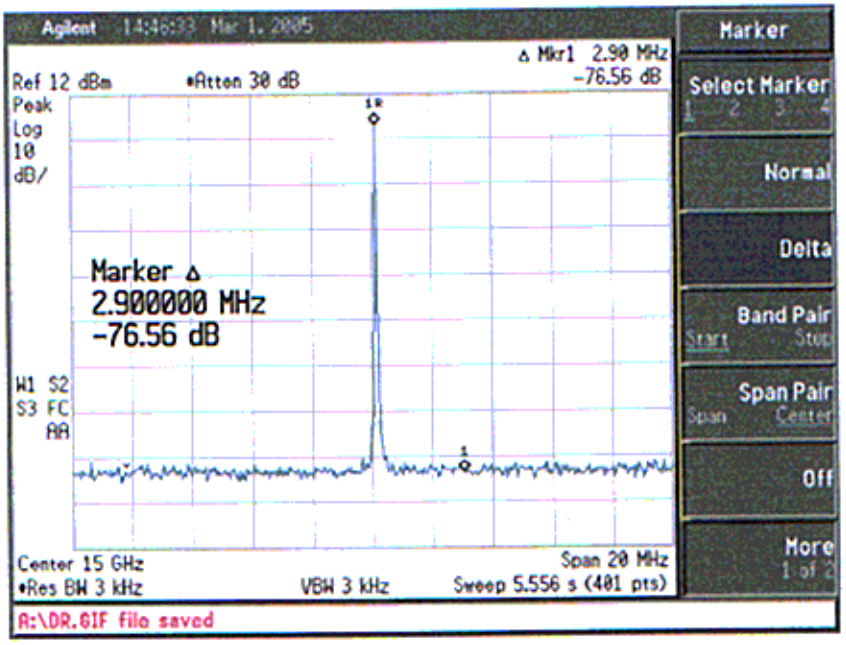
At 14.5 GHz in Band 4



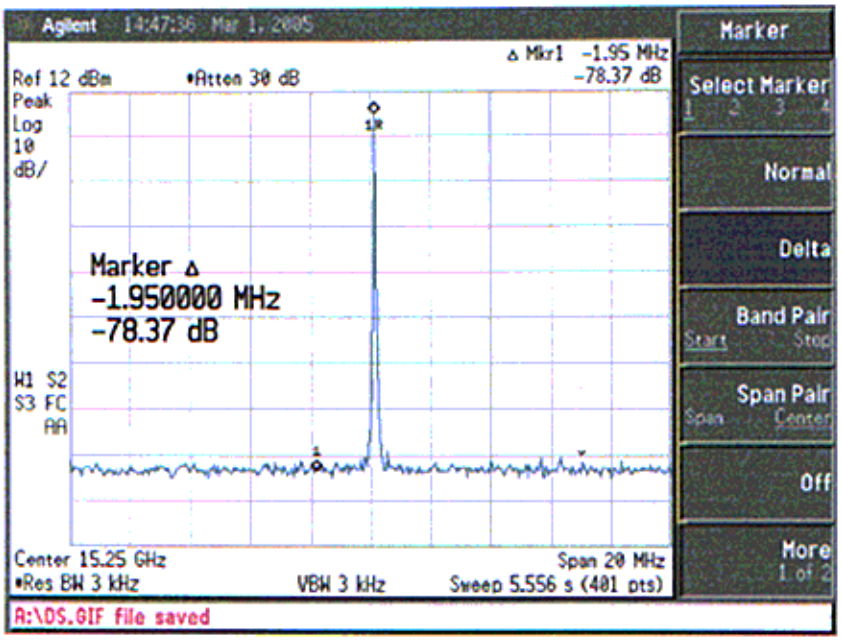
At 14.75 GHz in Band 4



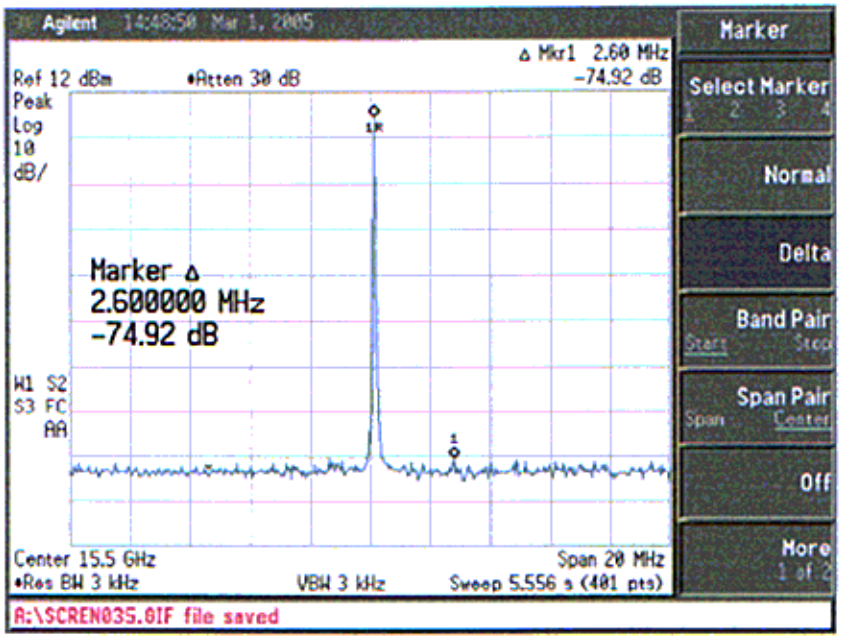
At 15.0 GHz in Band 4



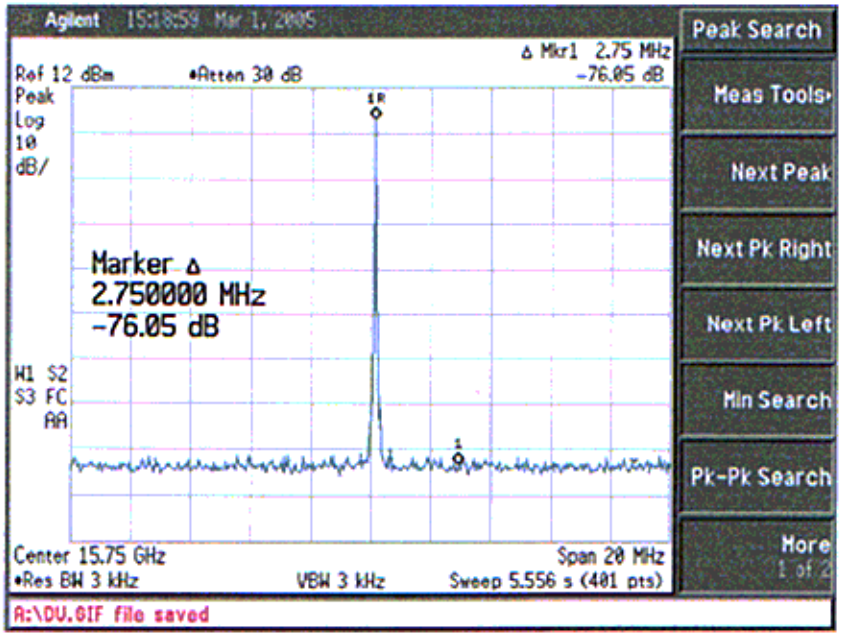
At 15.25 GHz in Band 4



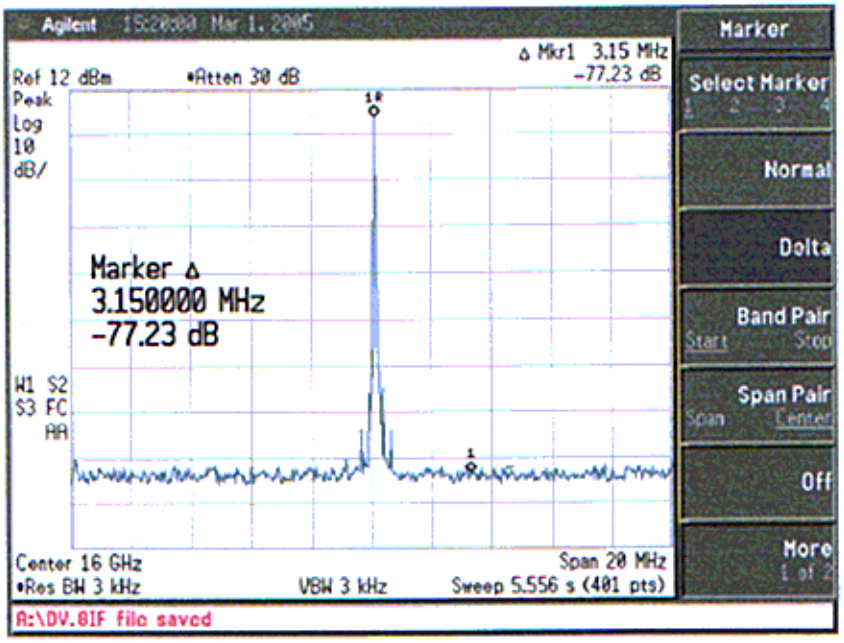
At 15.5 GHz in Band 4



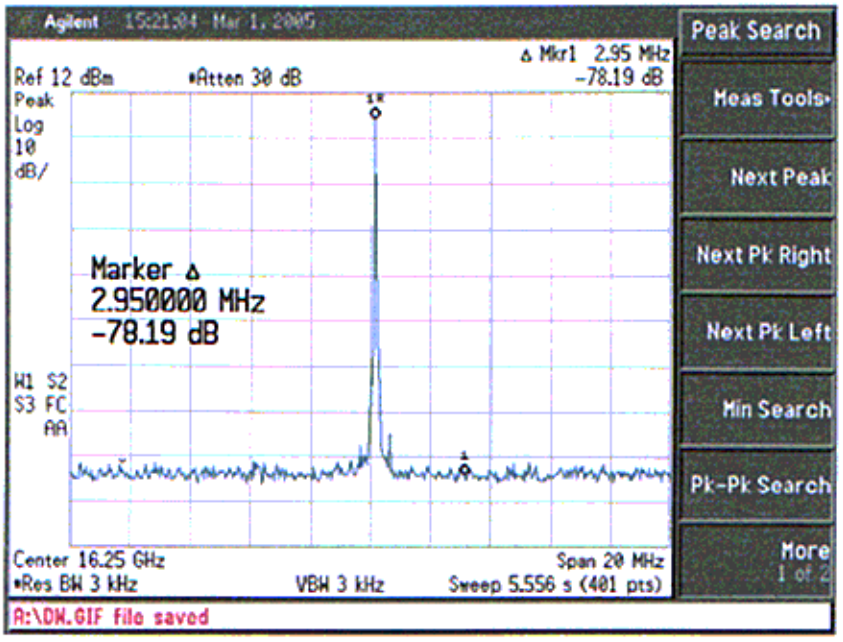
At 15.75 GHz in Band 4



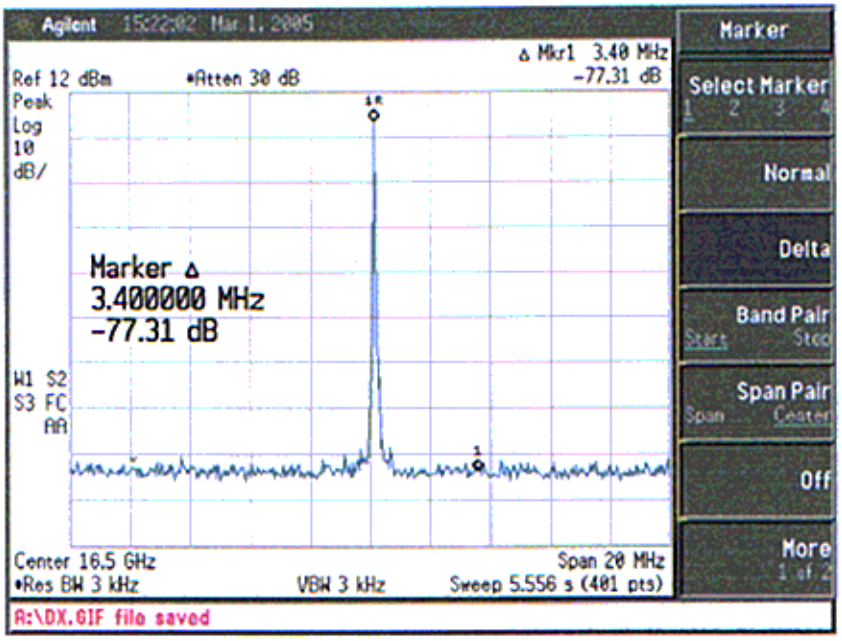
At 16.0 GHz in Band 4



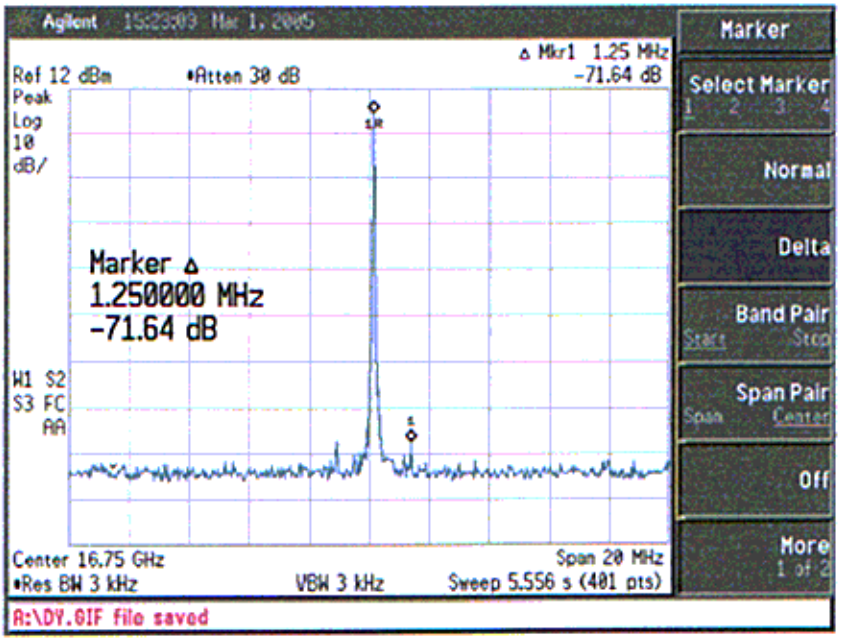
At 16.25 GHz in Band 4



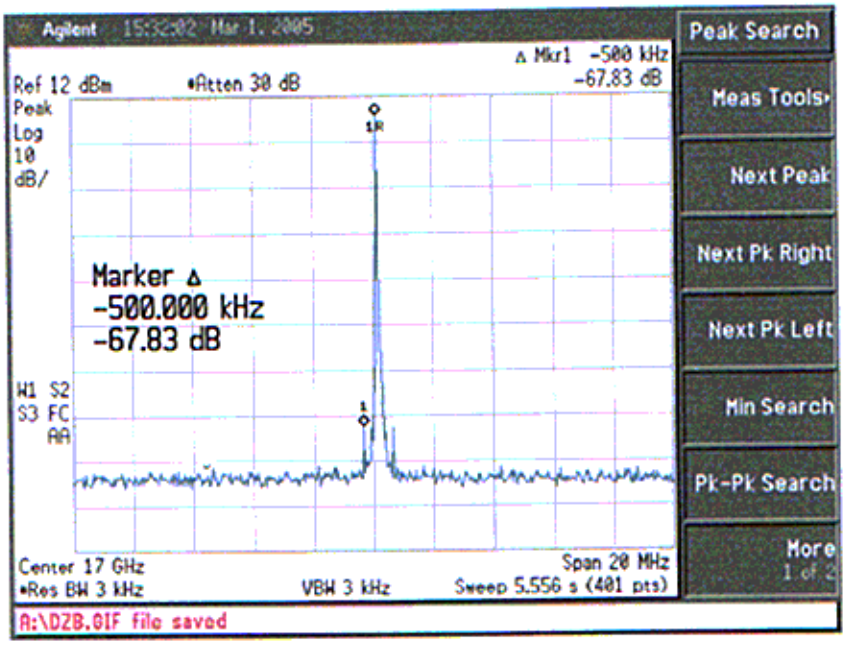
At 16.5 GHz in Band 4



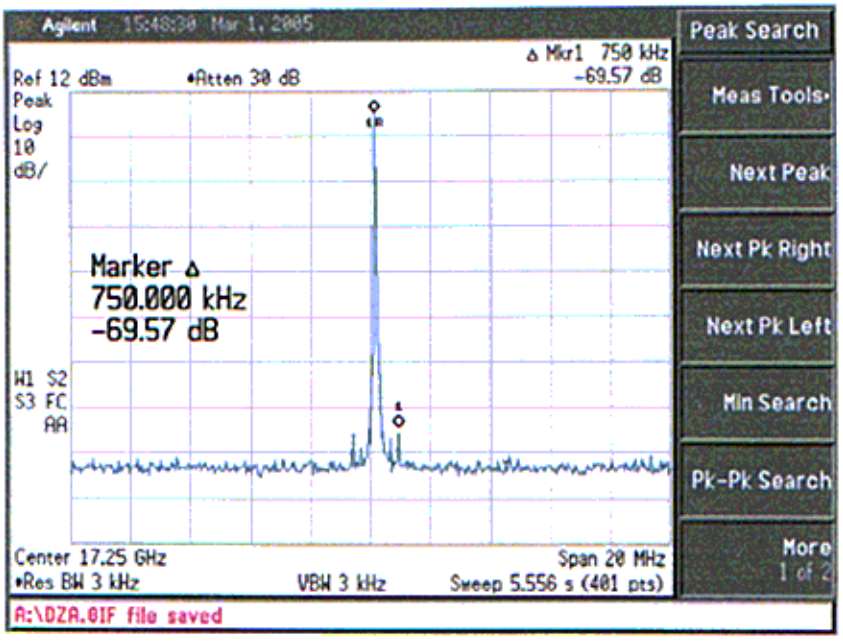
At 16.75 GHz in Band 4



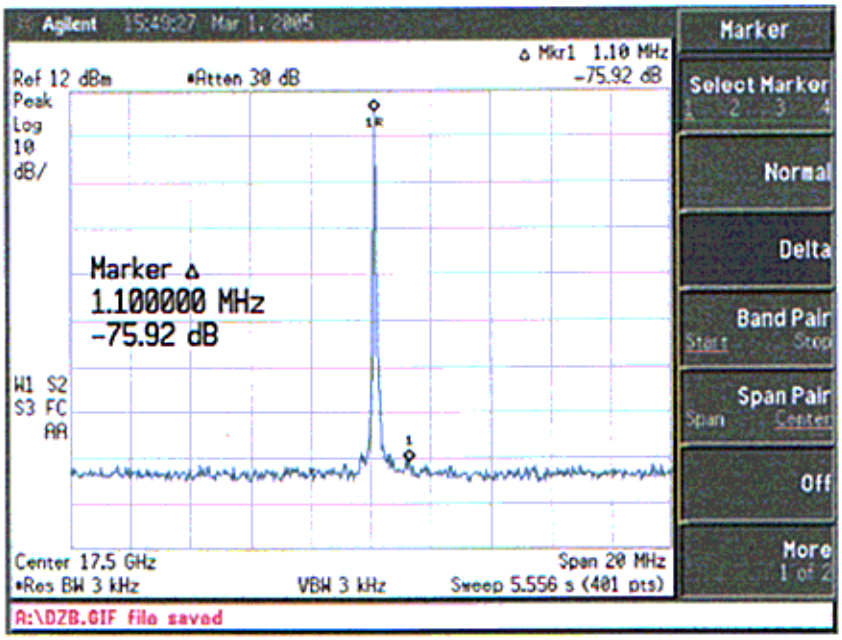
At 17.0 GHz in Band 4



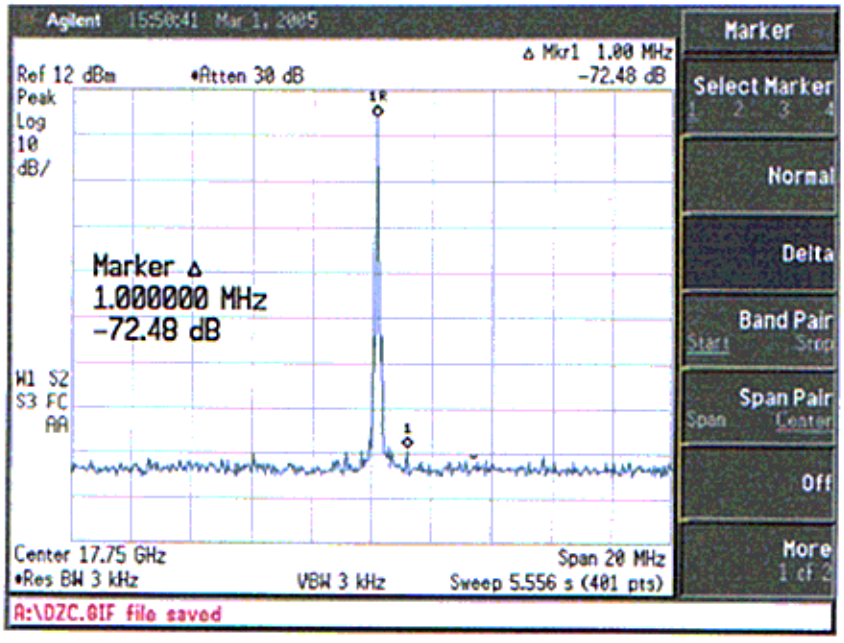
At 17.25 GHz in Band 4



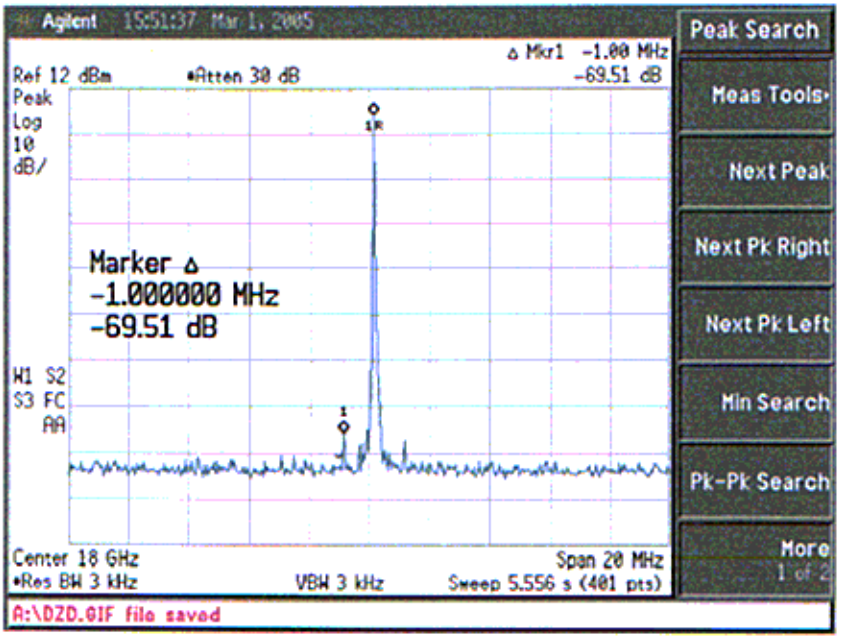
At 17.5 GHz in Band 4



At 17.75 GHz in Band 4



At 18.0 GHz in Band 4

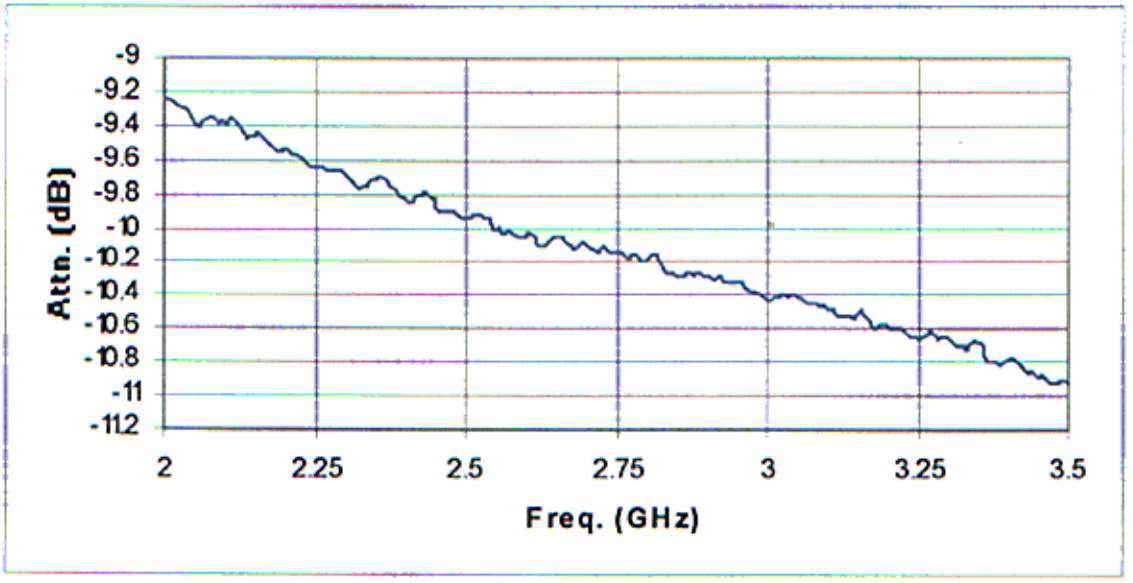


8 BIT DIGITALLY CONTROLLED ATTENUATOR

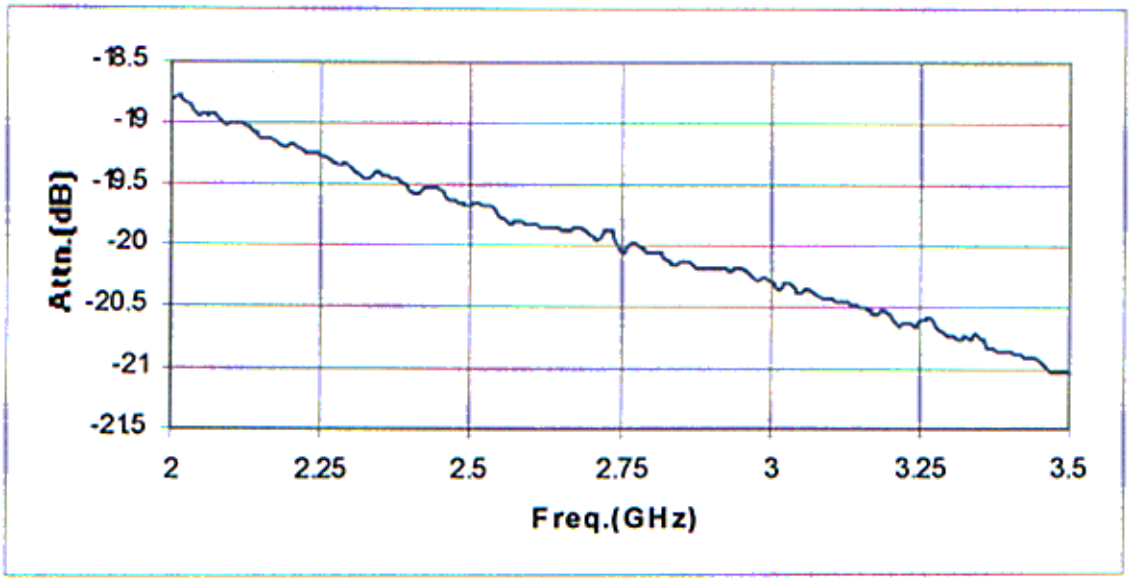
ATTENUATION PERFORMANCE

PLANAR MONOLITHICS INDUSTRIES, INC., 7311-G Grove Road, Frederick, MD 21704
Tel: 301-662-4700 • Fax: 301-662-4938 • Email: sales@planarmonolithics.com
Website: http://www.planarmonolithics.com

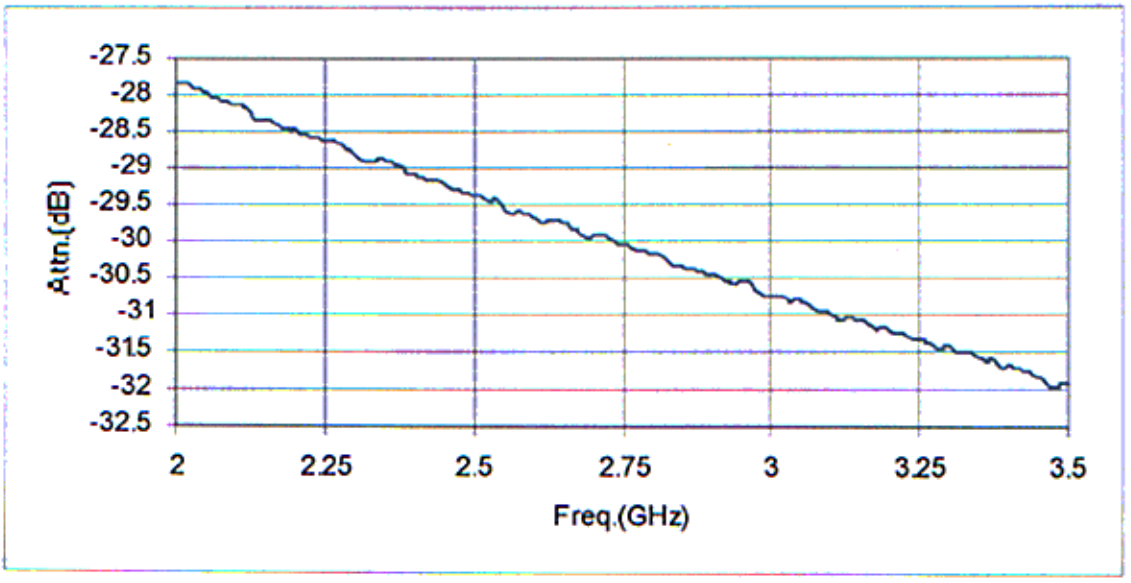
Band 1: 10dB Attenuation



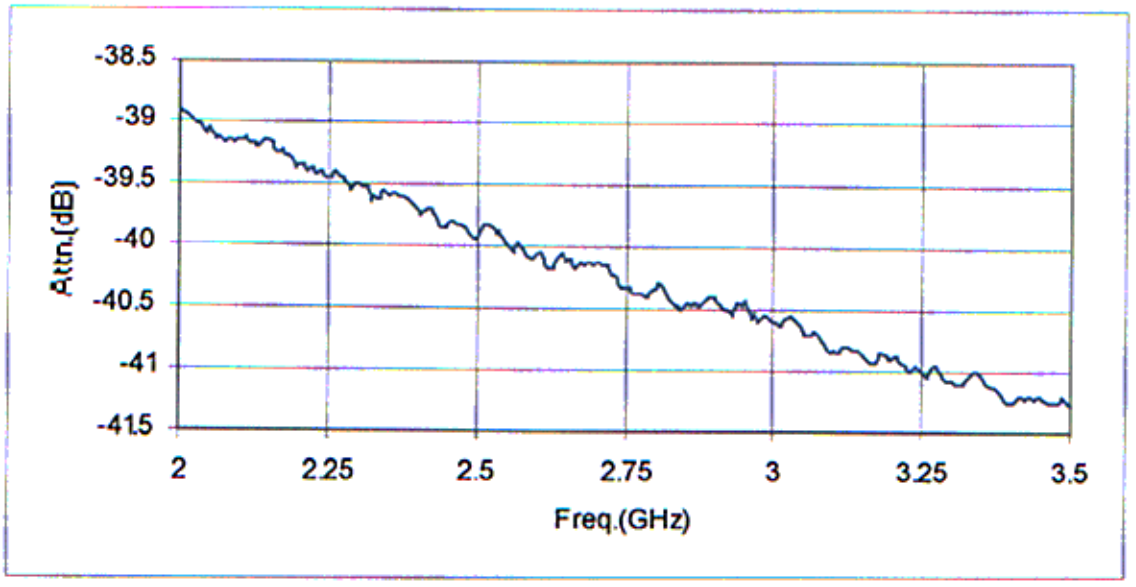
Band 1: 20dB Attenuation



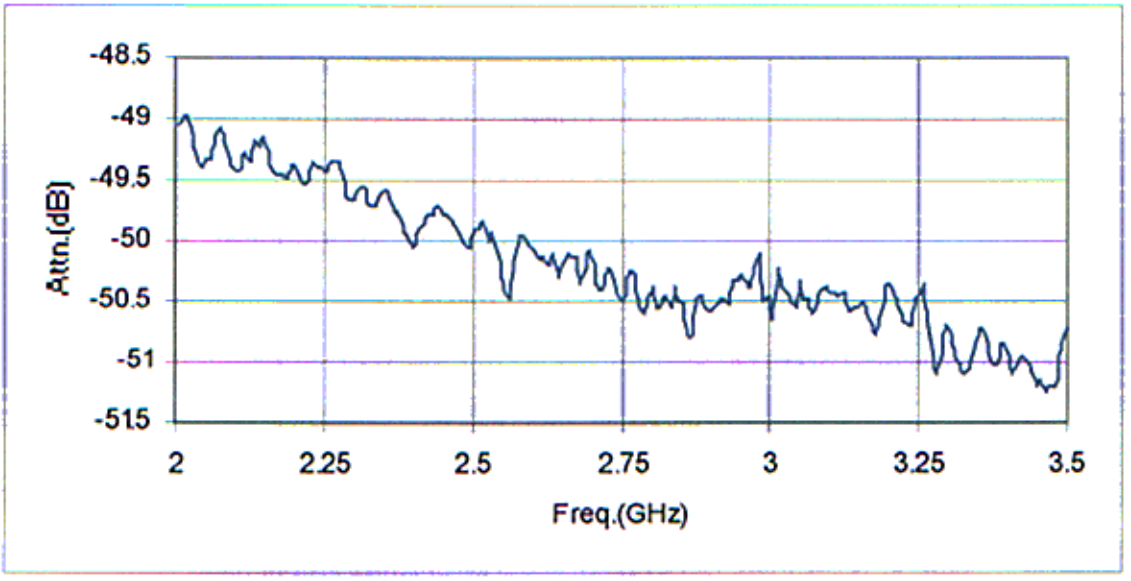
Band 1: 30dB Attenuation



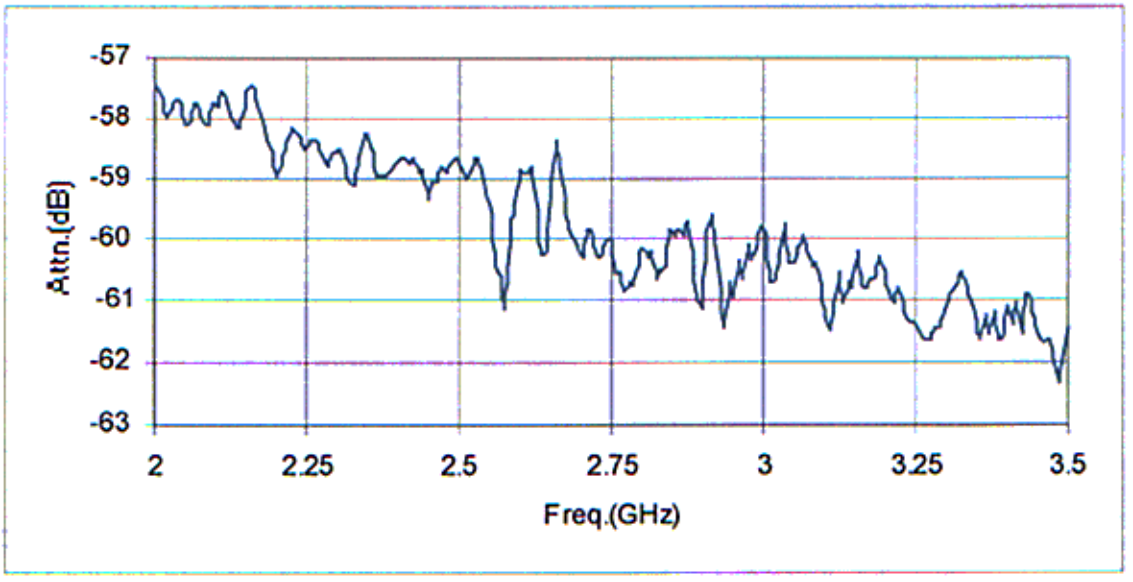
Band 1: 40dB Attenuation



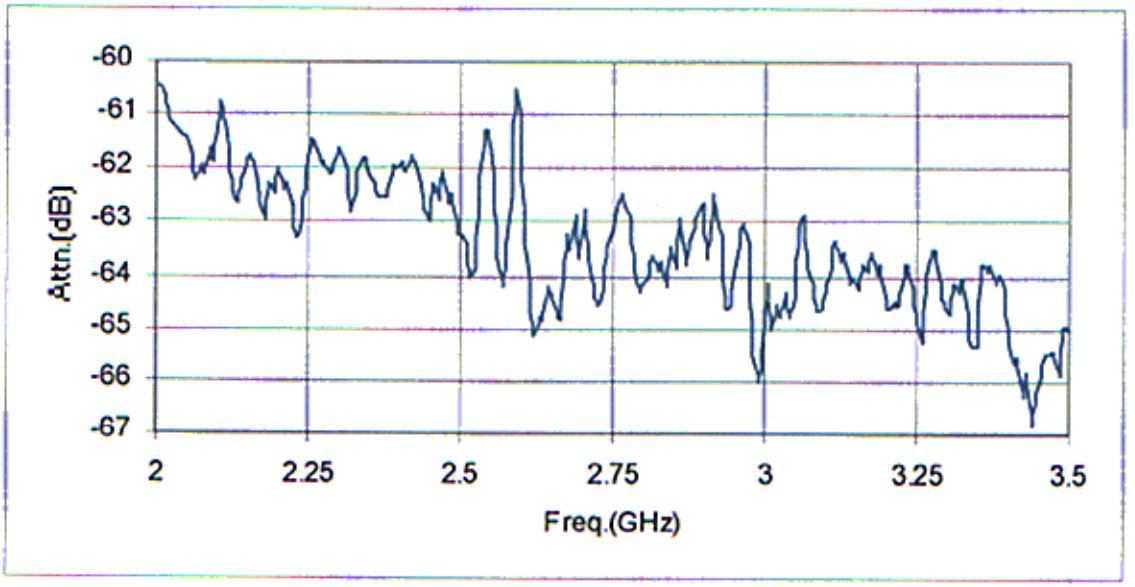
Band 1: 50dB Attenuation



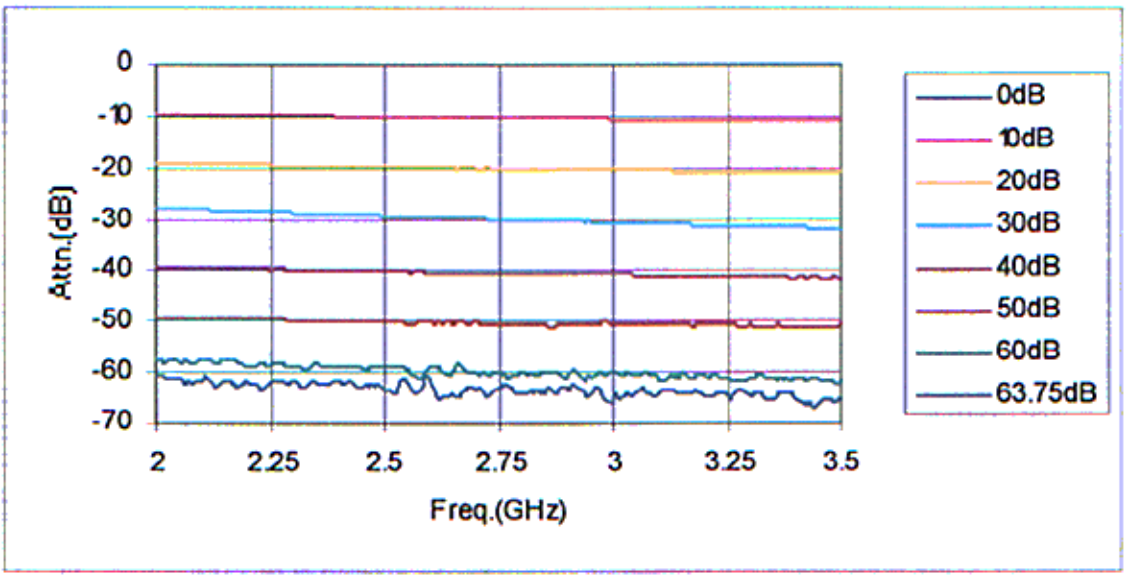
Band 1: 60dB Attenuation



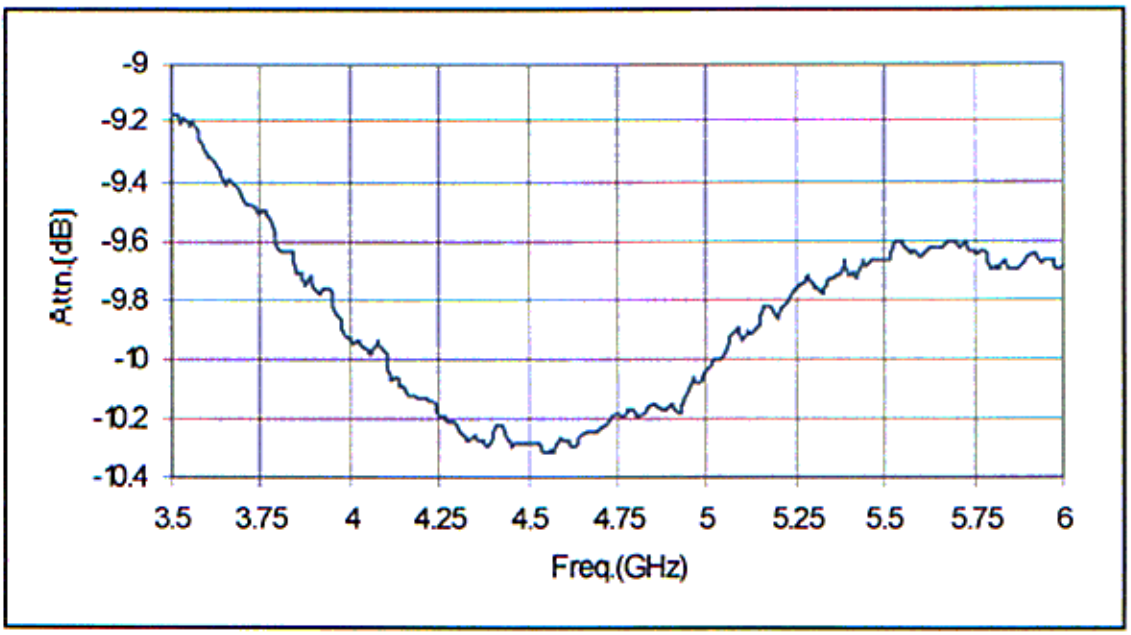
Band 1: 63.75dB Attenuation



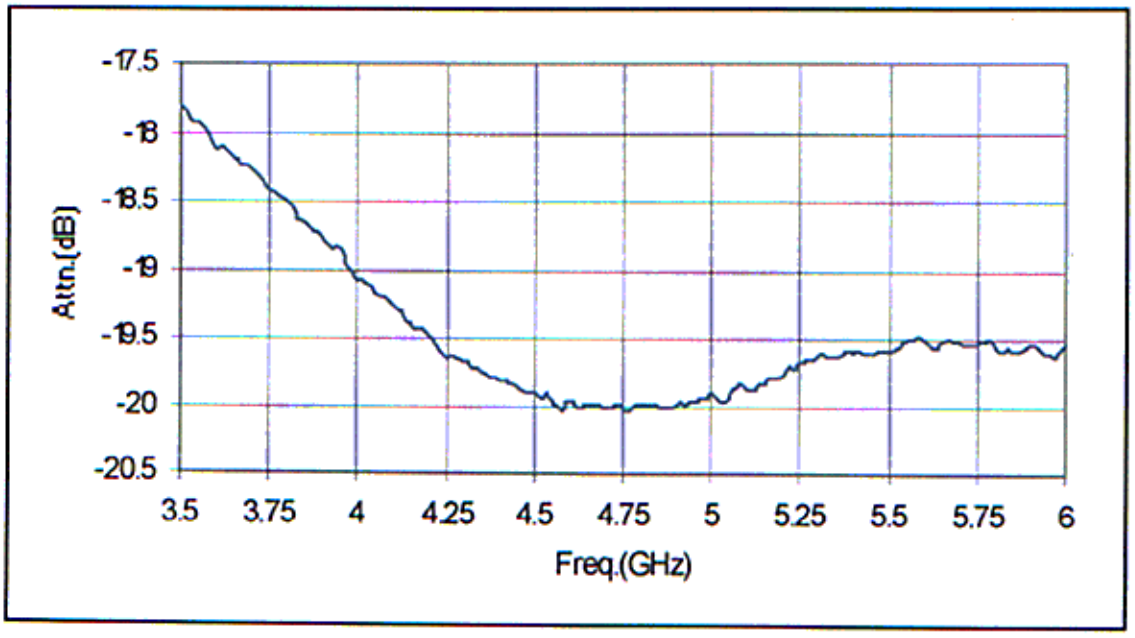
Band 1: All Attenuations



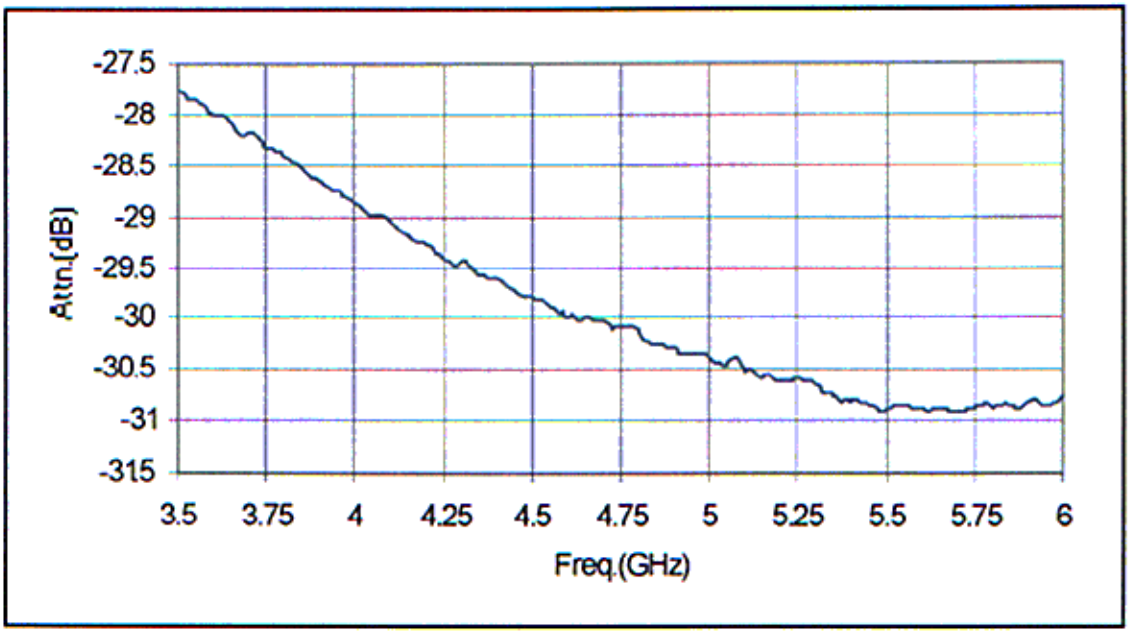
Band 2: 10dB Attenuation



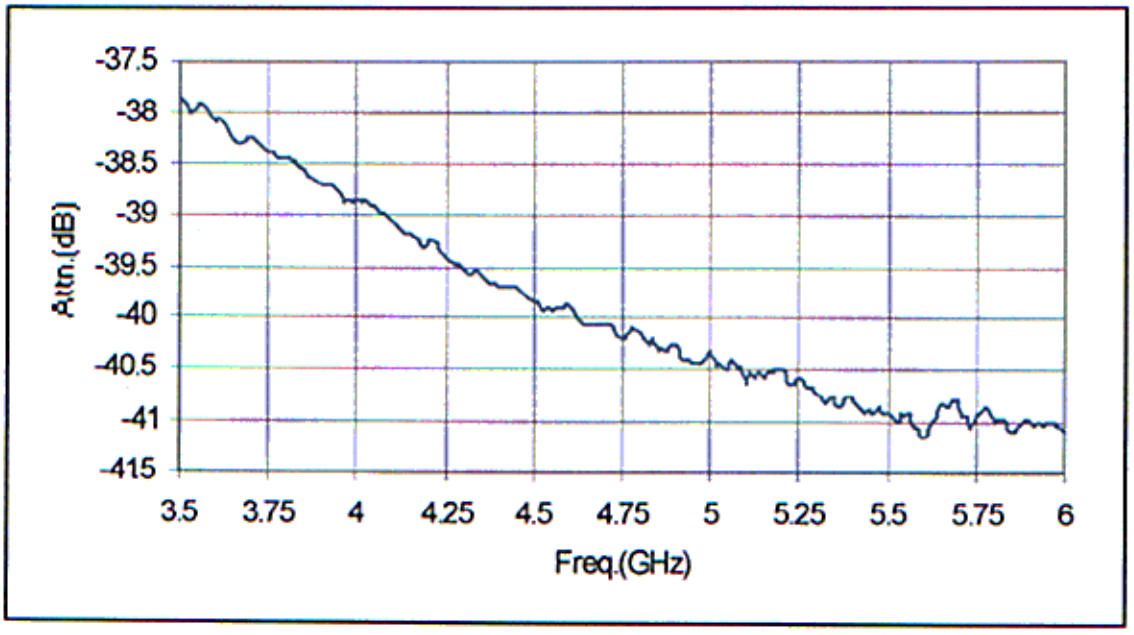
Band 2: 20dB Attenuation



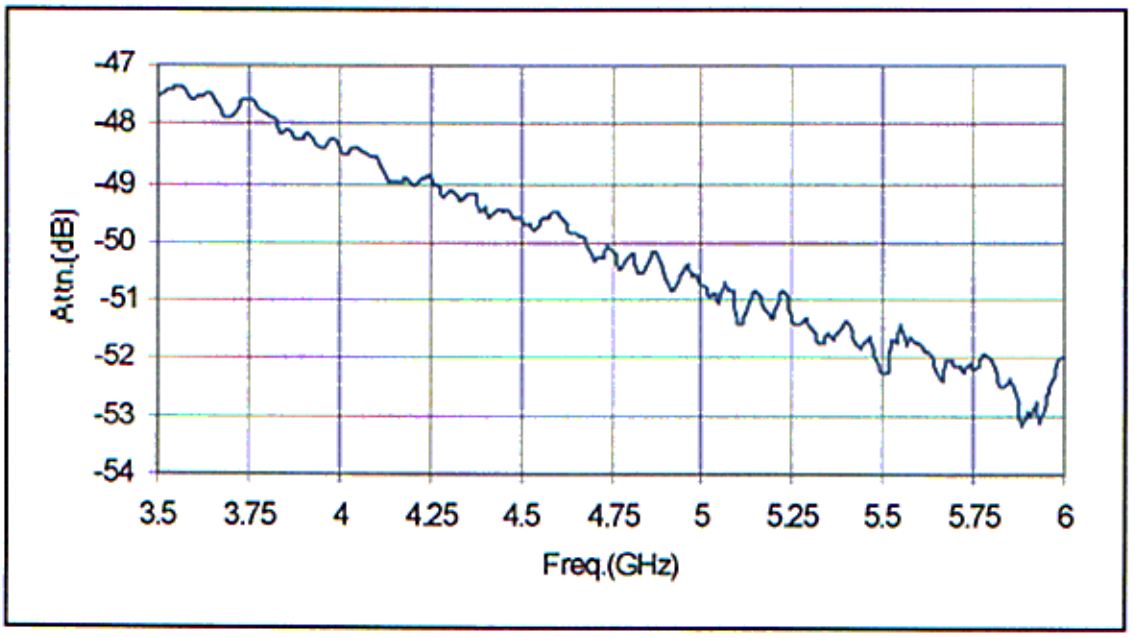
Band 2: 30dB Attenuation



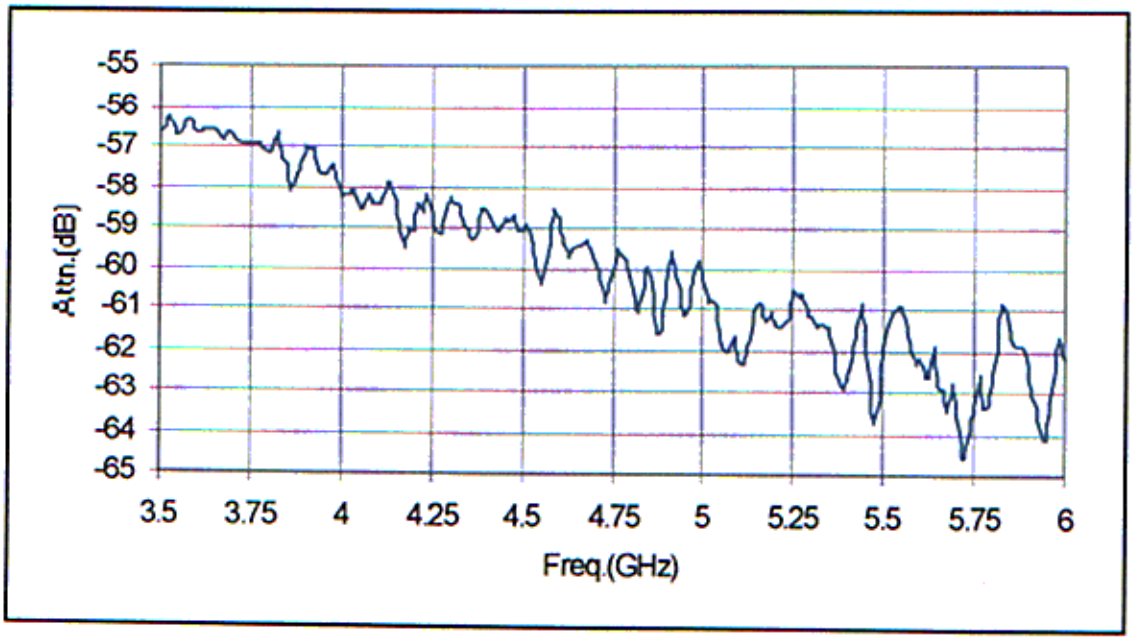
Band 2: 40dB Attenuation



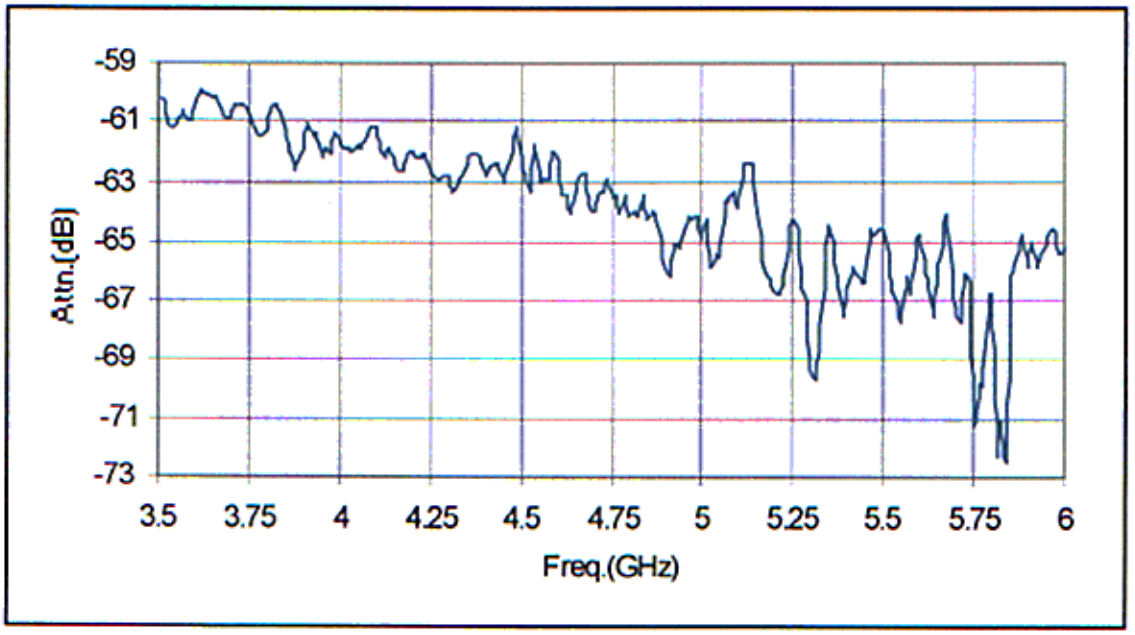
Band 2: 50dB Attenuation



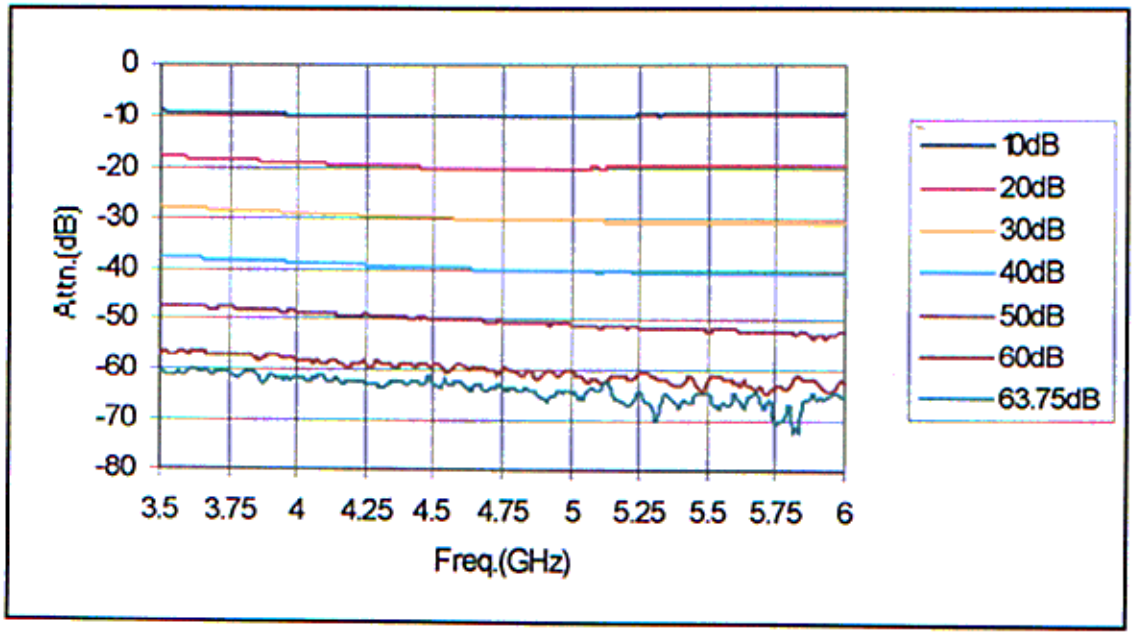
Band 2: 60dB Attenuation



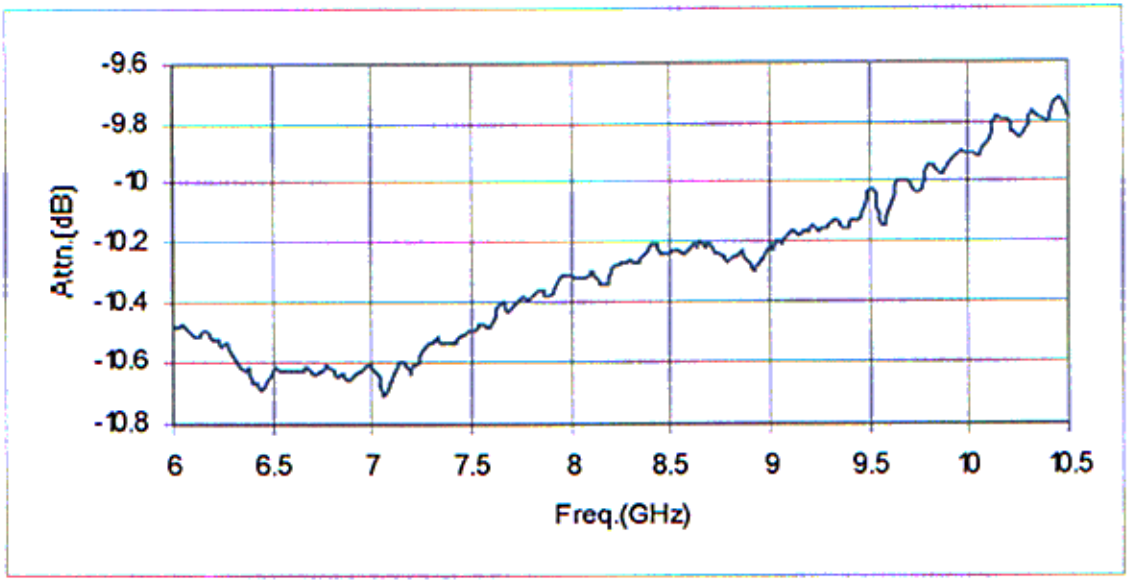
Band 2: 63.75dB Attenuation



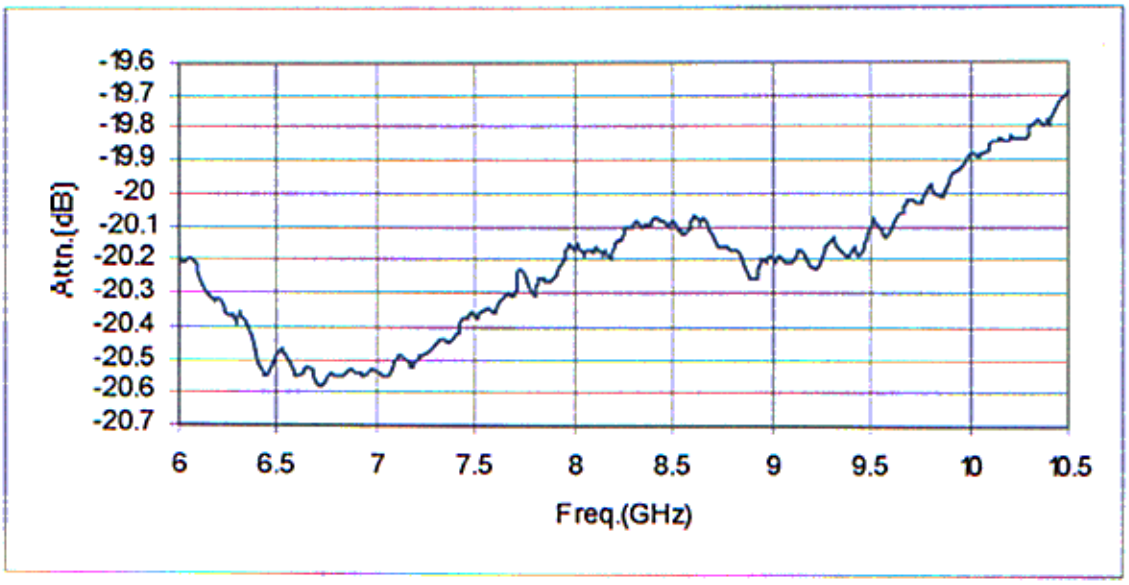
Band 2: All Attenuation Levels



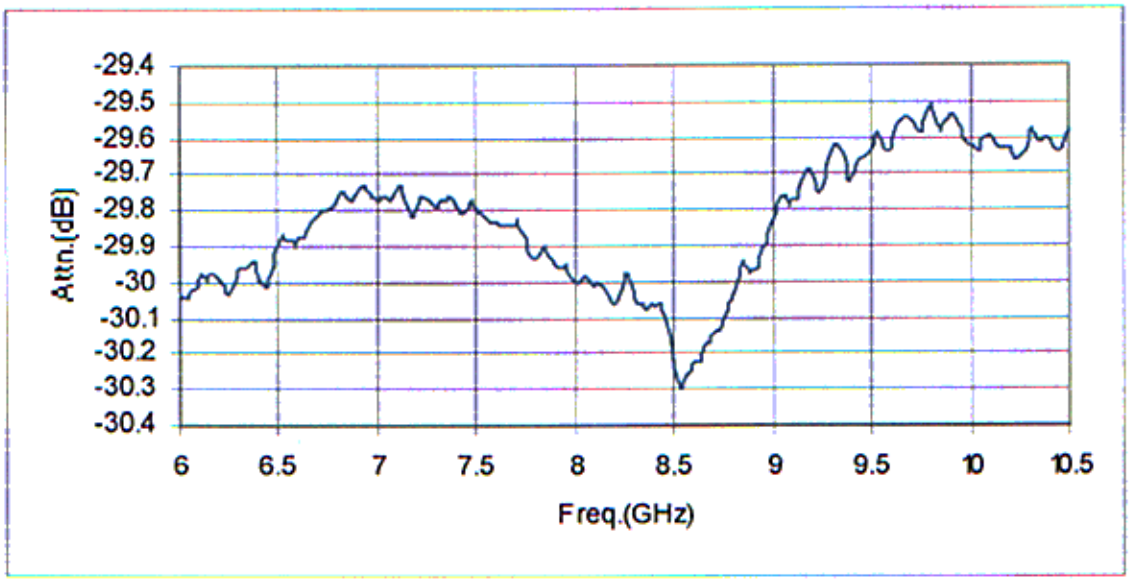
Band 3: 10dB Attenuation



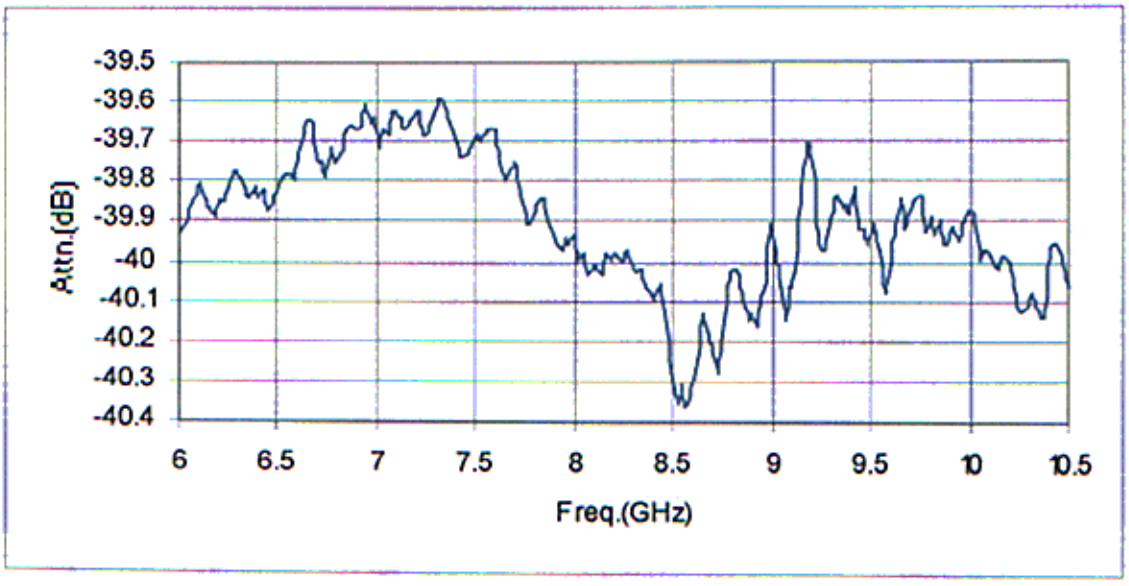
Band 3: 20dB Attenuation



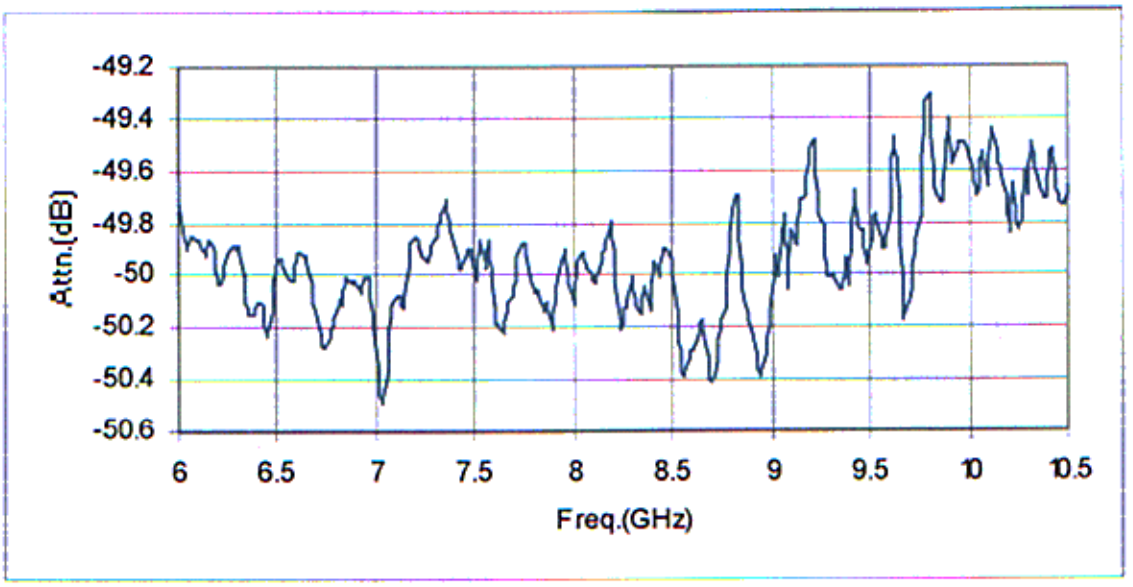
Band 3: 30 dB Attenuation



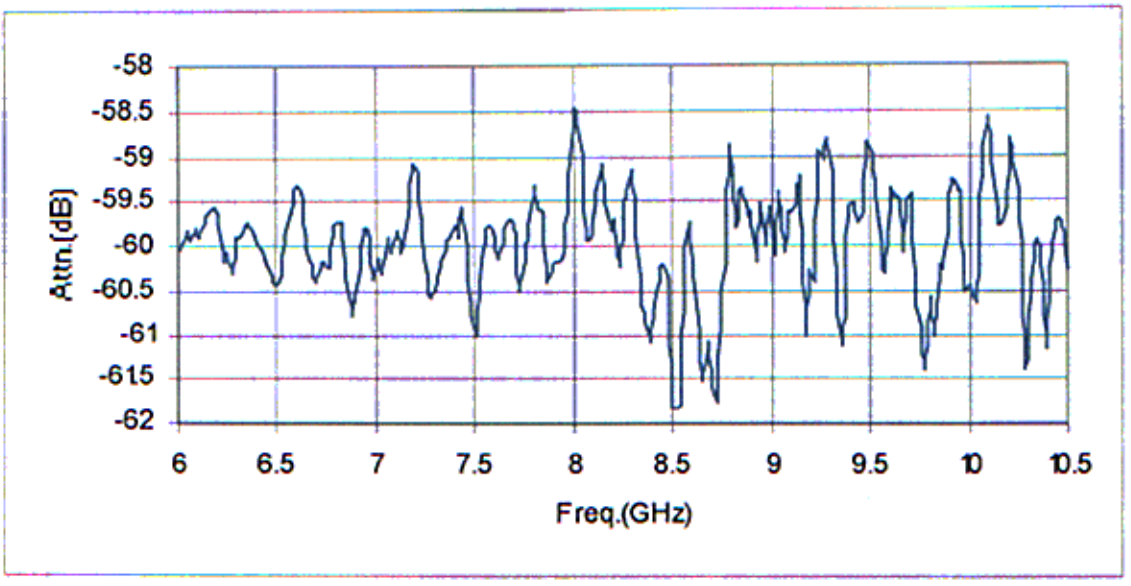
Band 3: 40 dB Attenuation



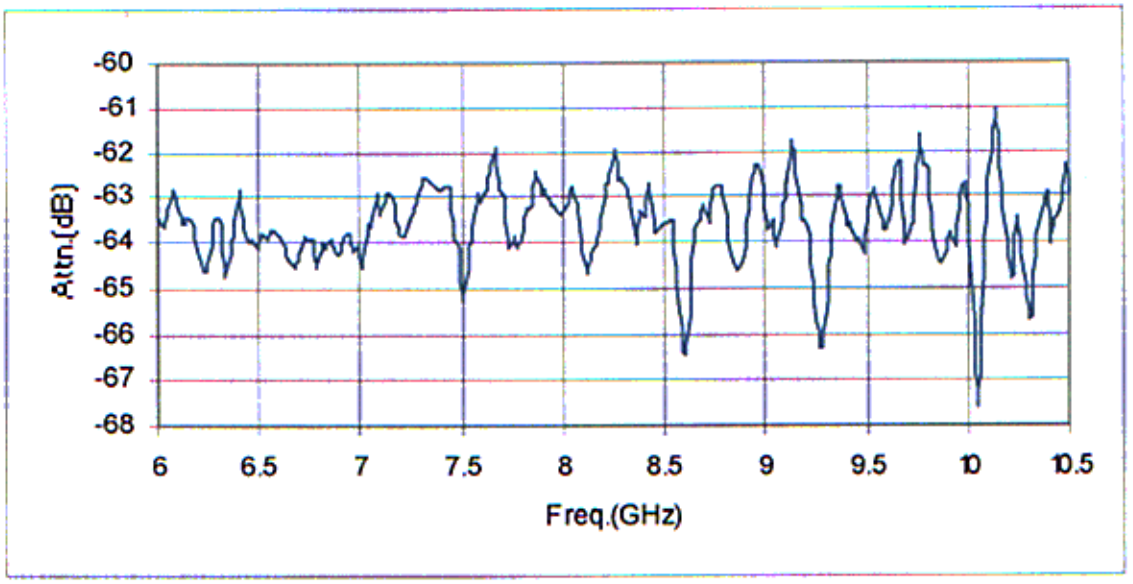
Band 3: 50 dB Attenuation



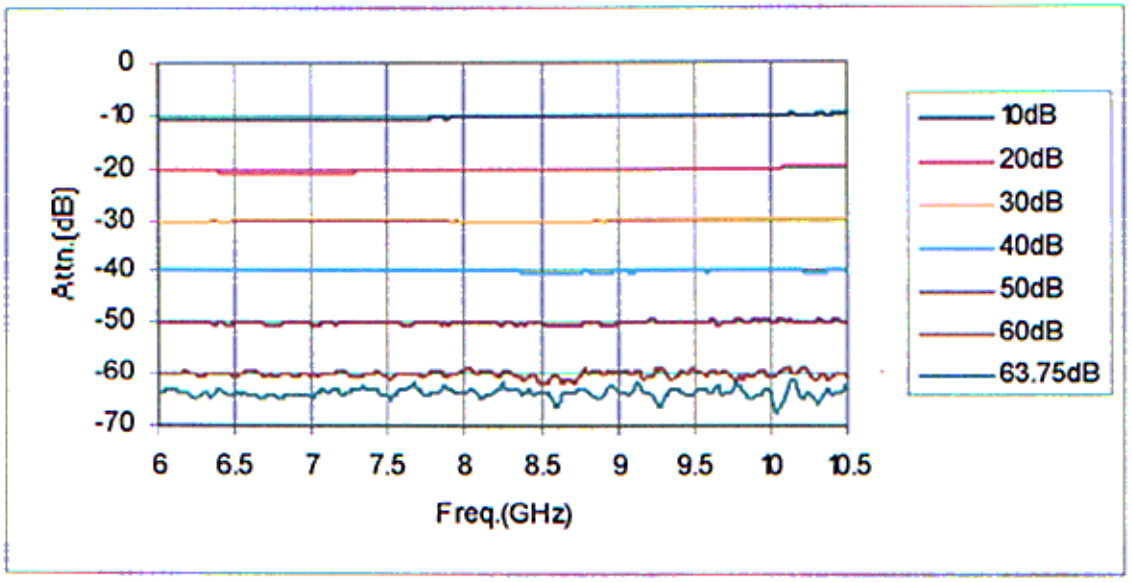
Band 3: 60 dB Attenuation



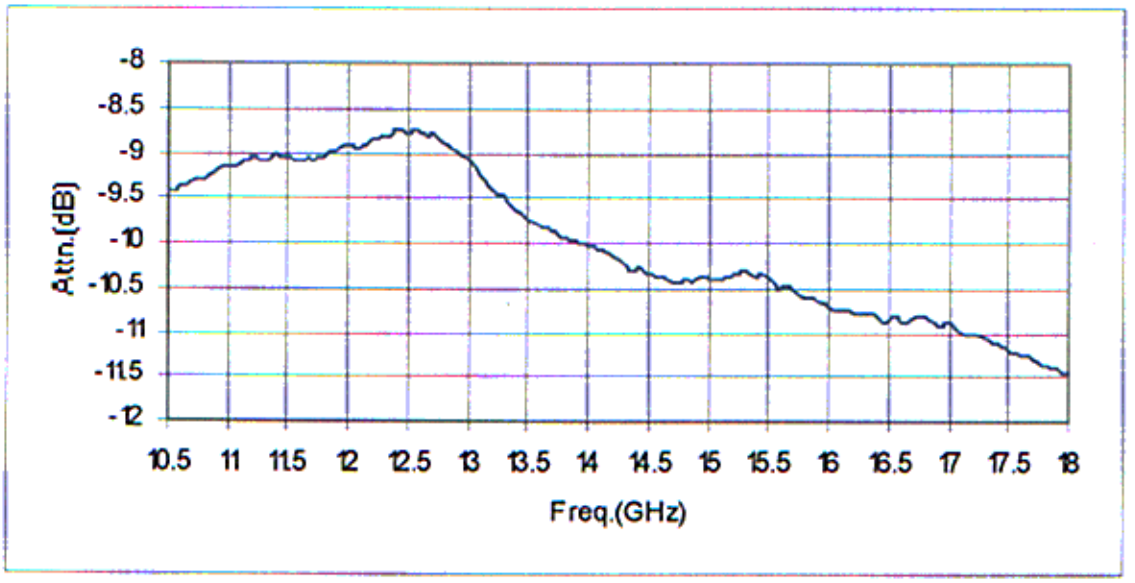
Band 3: 63.75dB Attenuation



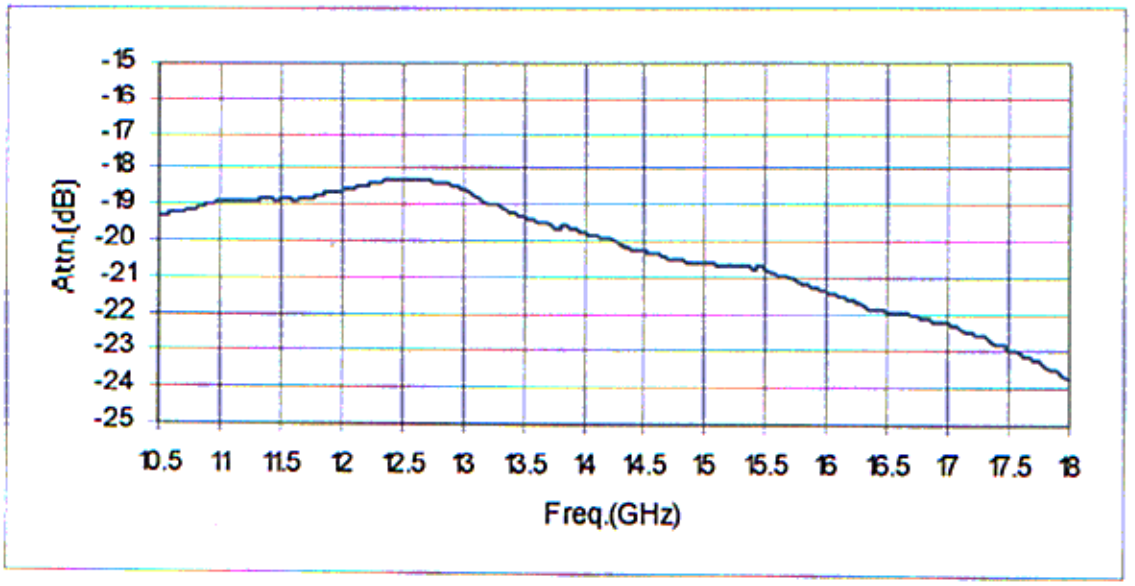
Band 3: All Attenuation Levels



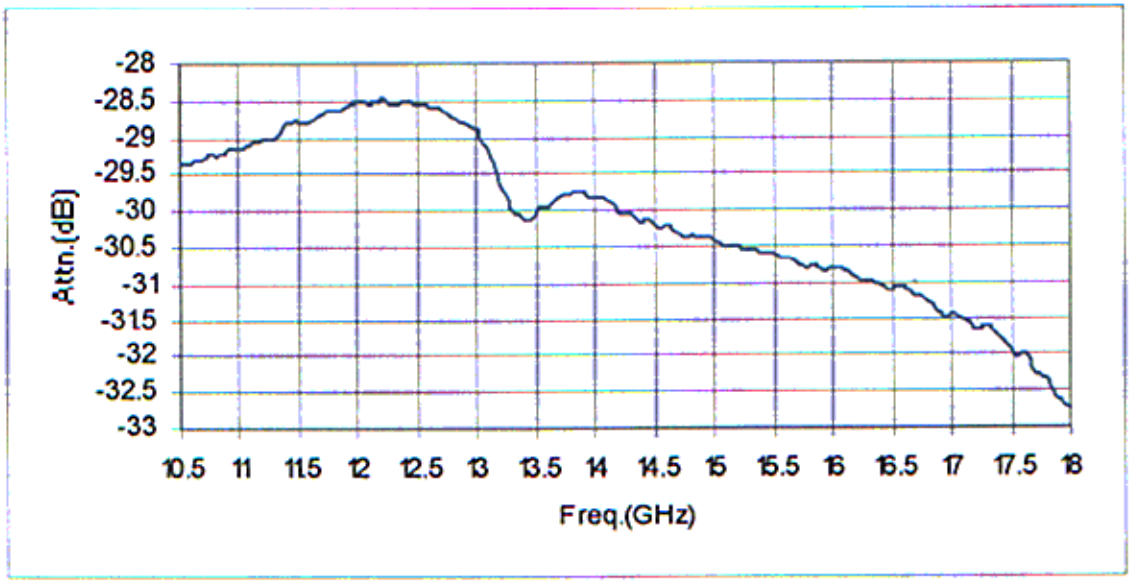
Band 4: 10 dB Attenuation



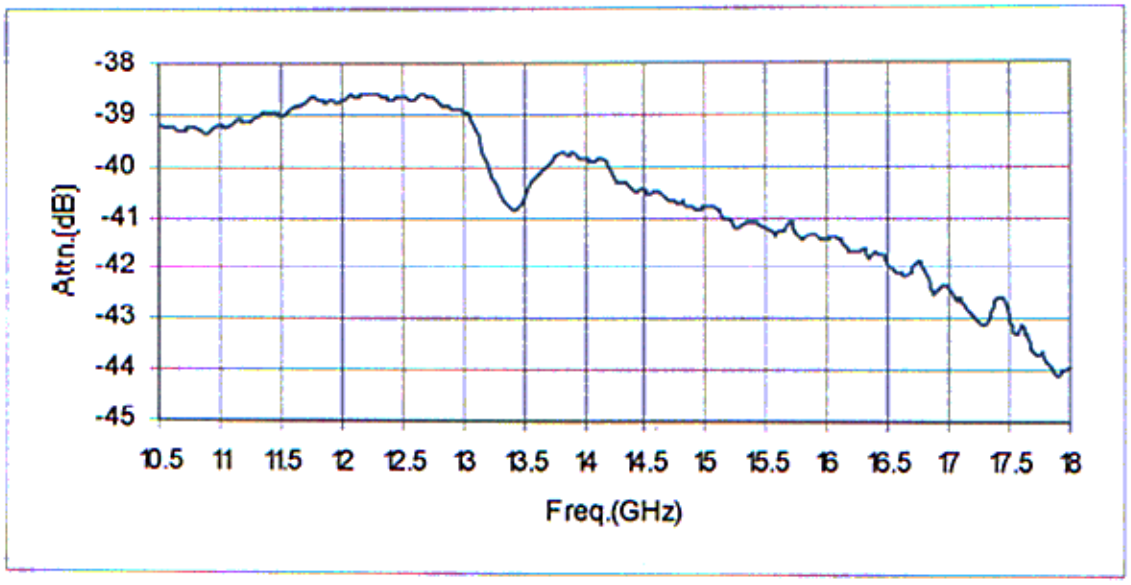
Band 4: 20 dB Attenuation



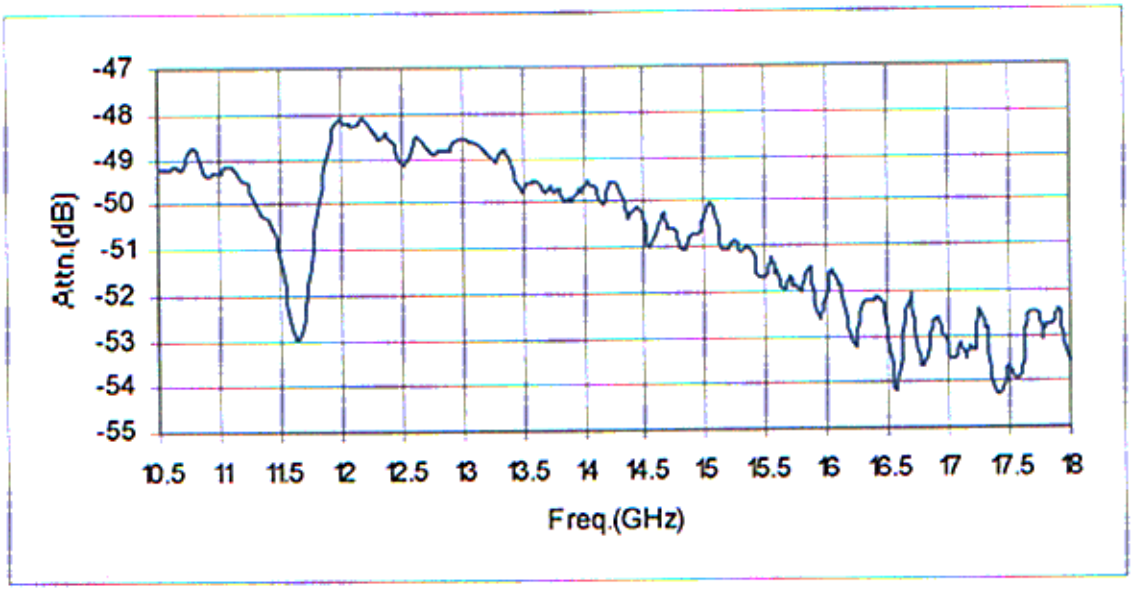
Band 4: 30 dB Attenuation



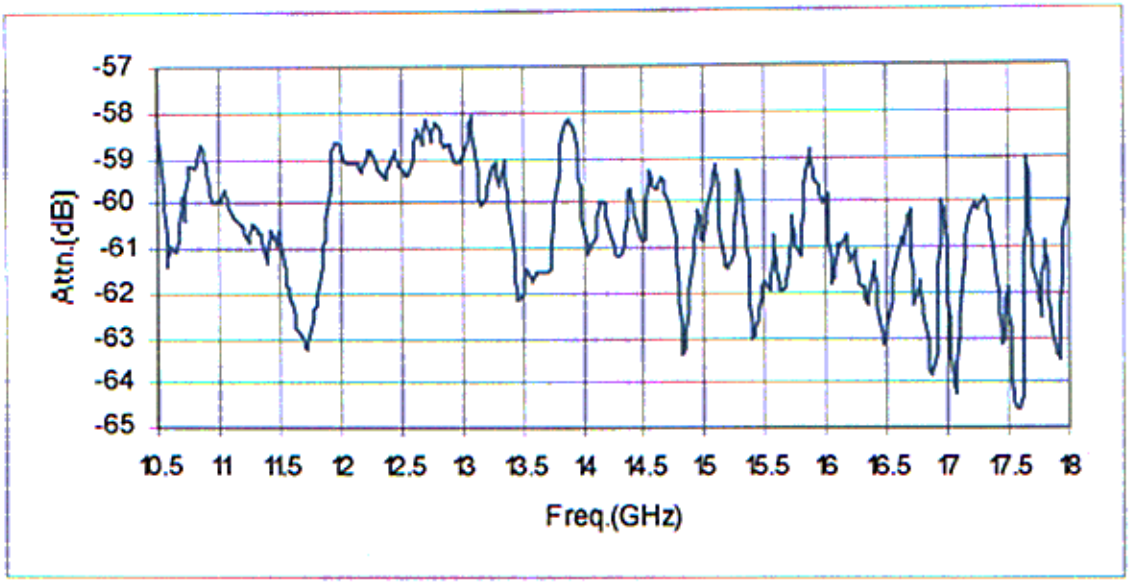
Band 4: 40 dB Attenuation



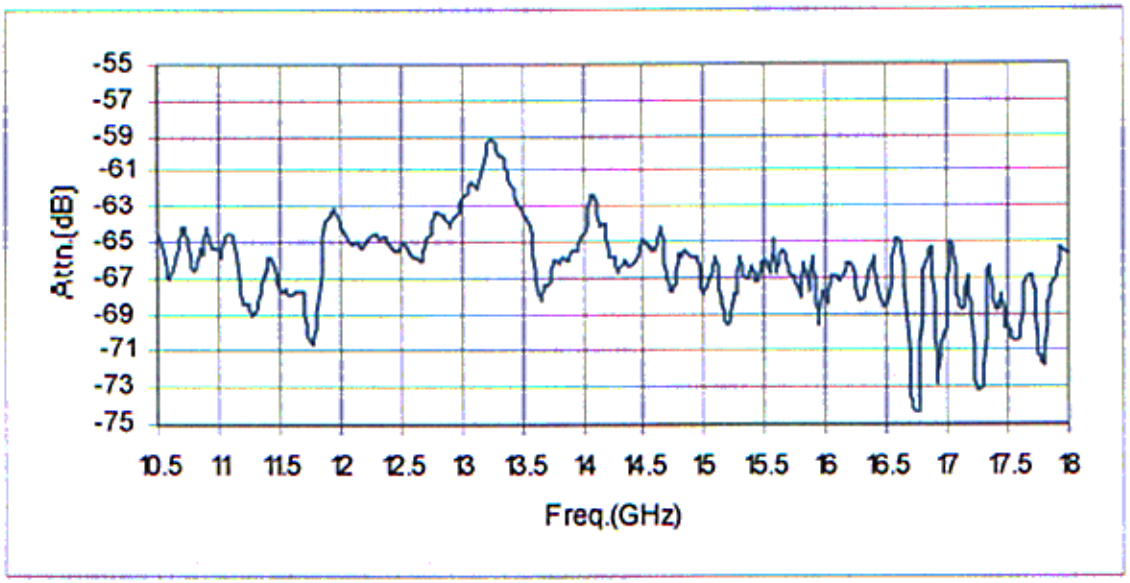
Band 4: 50 dB Attenuation



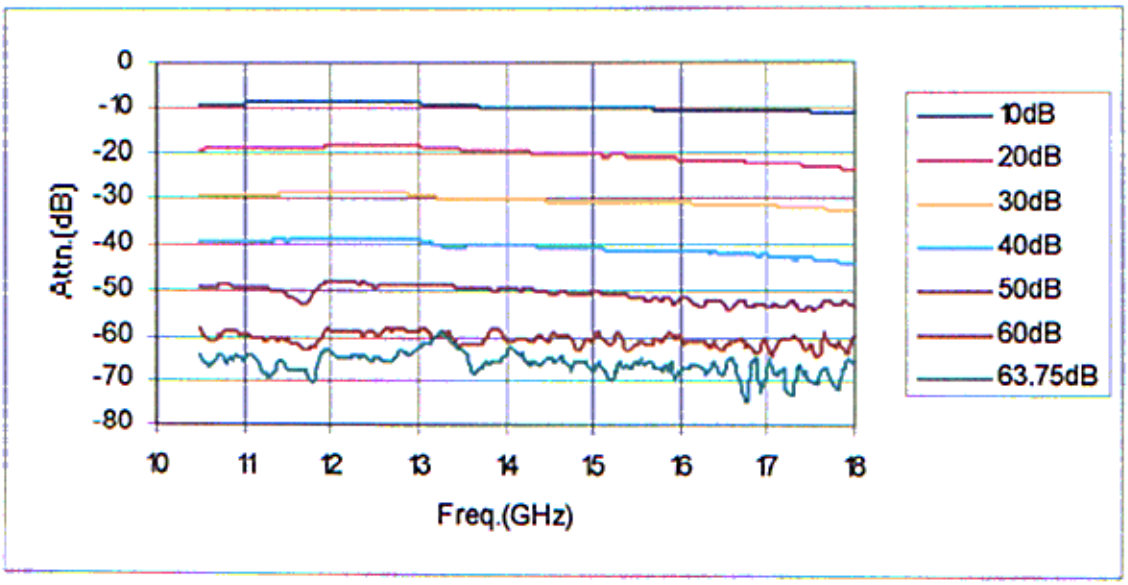
Band 4: 60 dB Attenuation



Band 4: 63.75dB Attenuation

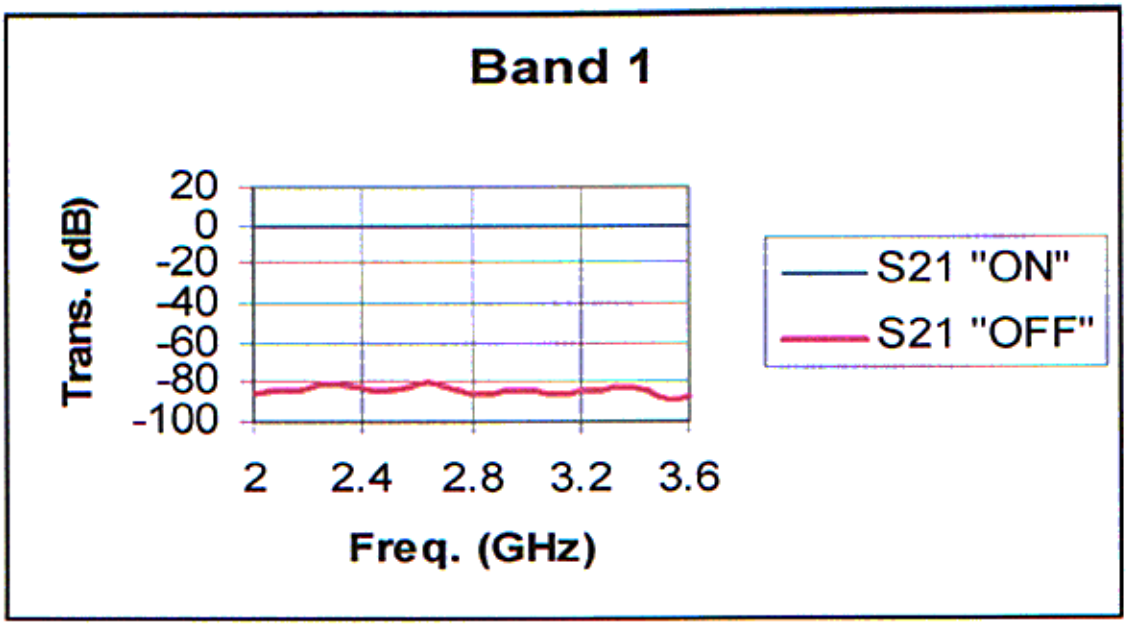


Band 4: All Attenuation Levels

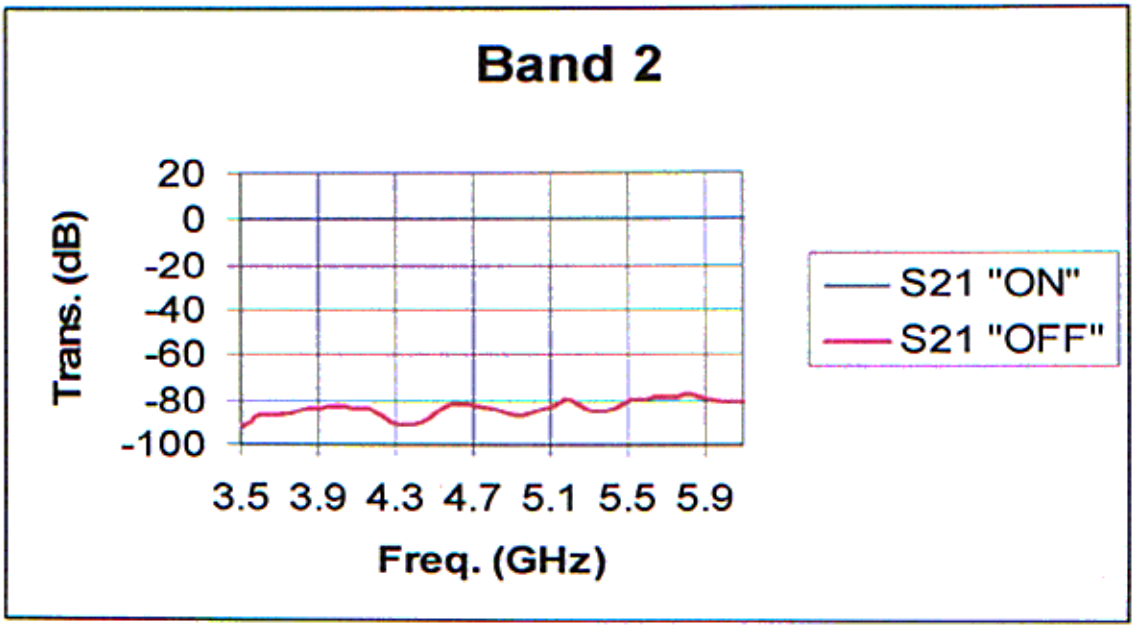


PULSE MODULATOR

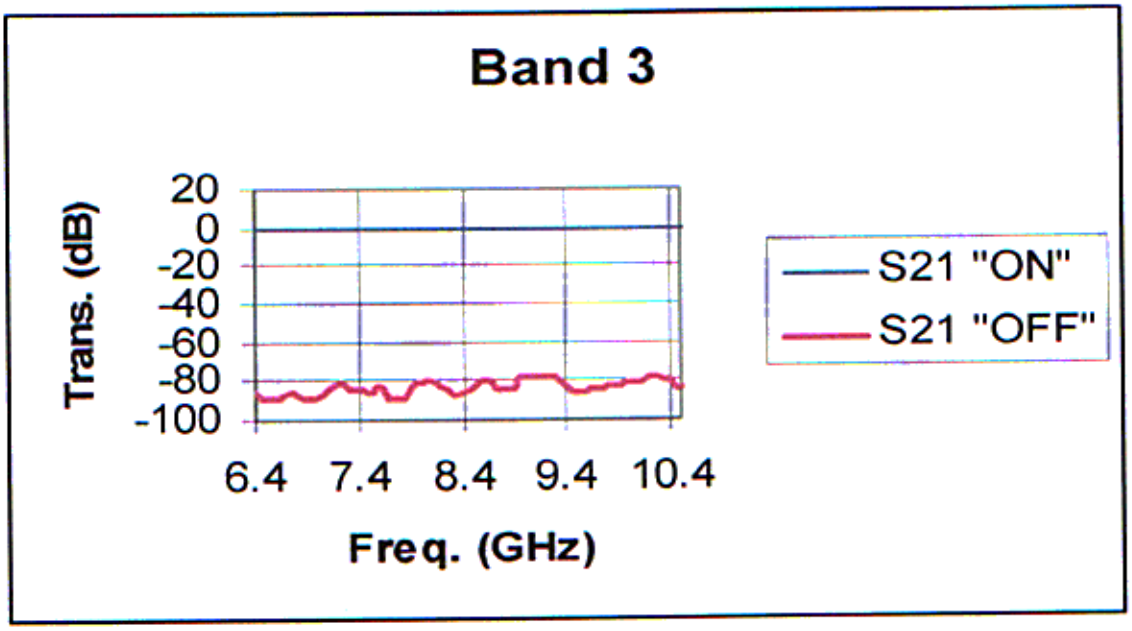
Band 1


Band 1
Trans. (dB)
20
0
-20
-40
-60
-80
-100
2
2.4
2.8
3.2
3.6
Freq. (GHz)
S21 "ON"
S21 "OFF"

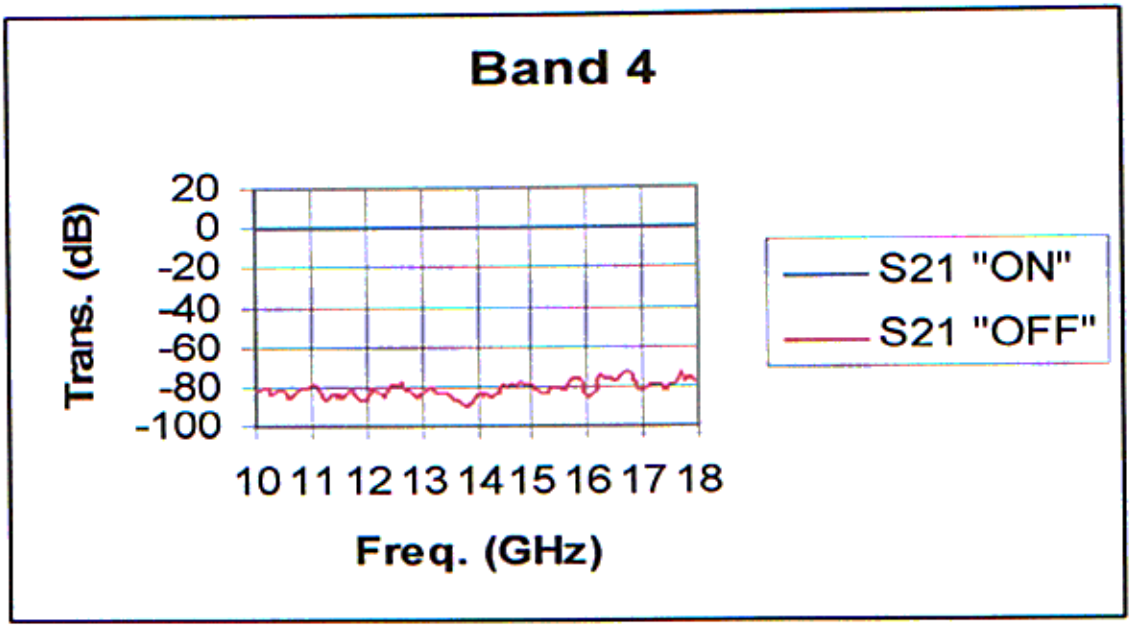
Band 2


Band 2
Trans. (dB)
20
0
-20
-40
-60
-80
-100
3.5
3.9
4.3
4.7
5.1
5.5
5.9
Freq. (GHz)
S21 "ON"
S21 "OFF"

Band 3


Band 3
Trans. (dB)
20
0
-20
-40
-60
-80
-100
6.4
7.4
8.4
9.4
10.4
Freq. (GHz)
S21 "ON"
S21 "OFF"

Band 4


Band 4
Trans. (dB)
20
0
-20
-40
-60
-80
-100
10 11 12 13 14 15 16 17 18
Freq. (GHz)
S21 "ON"
S21 "OFF"

SWITCHING SPEEDS

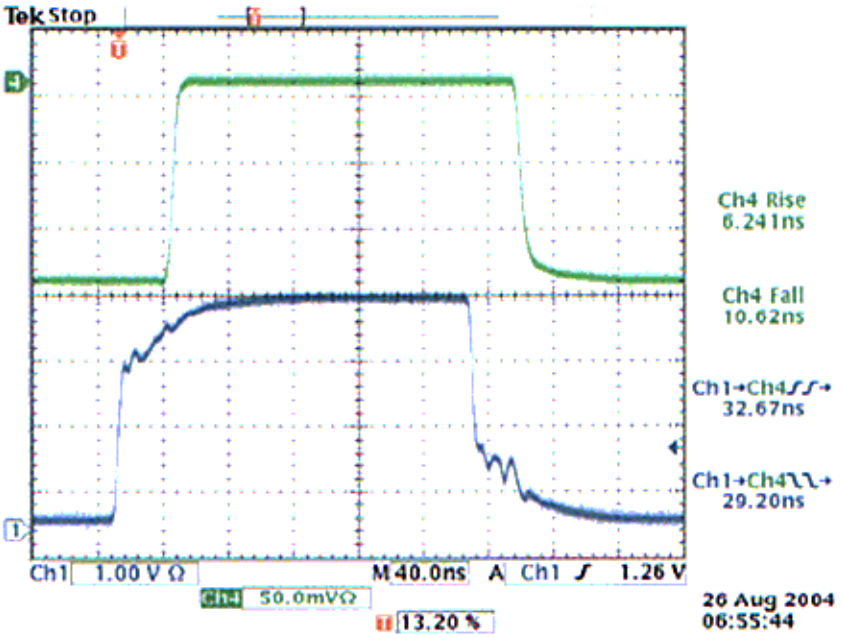
PULSE MODULATOR

SP4T BAND SWITCH

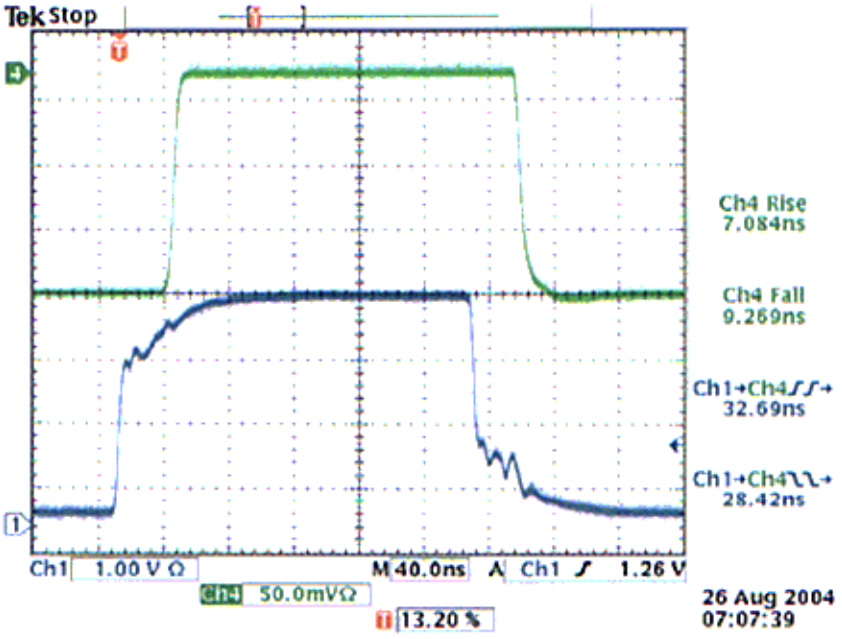
ATTENUATOR

(Green Trace: Output of High Band Module through a Diode Detector)
(Blue Trace: TTL Signal)

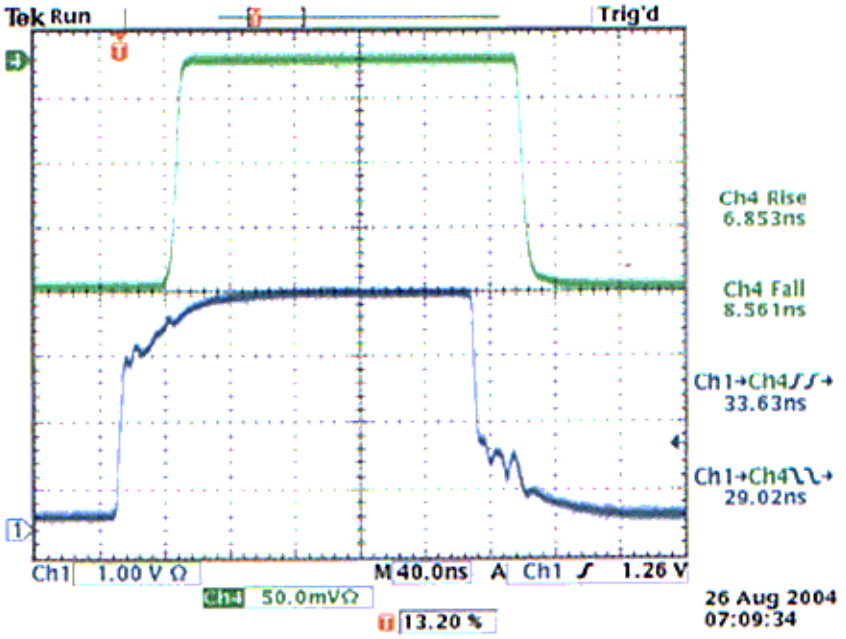
PULSE MODULATOR SWITCHING SPEED AT 2GHz (BAND 1)



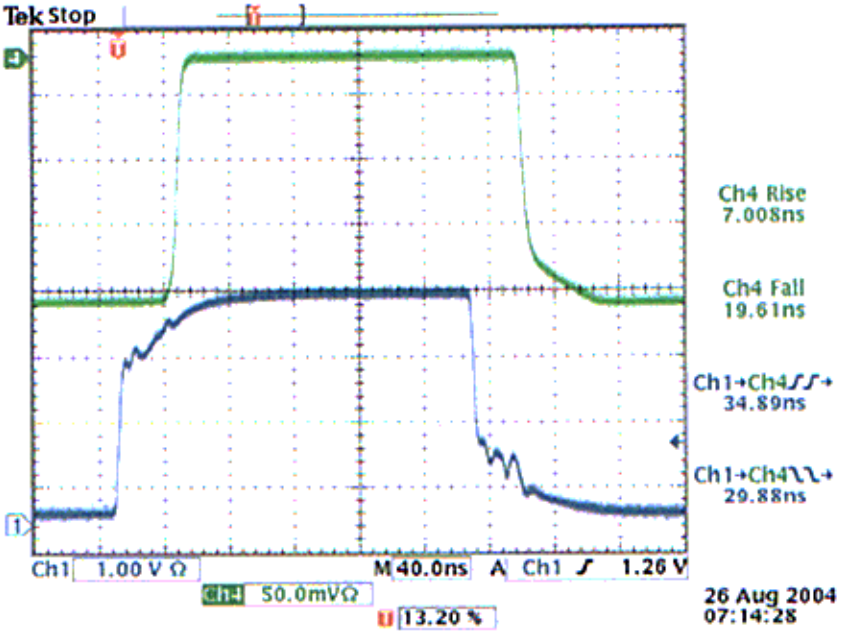
PULSE MODULATOR SWITCHING SPEED AT 6GHz (BAND 3)



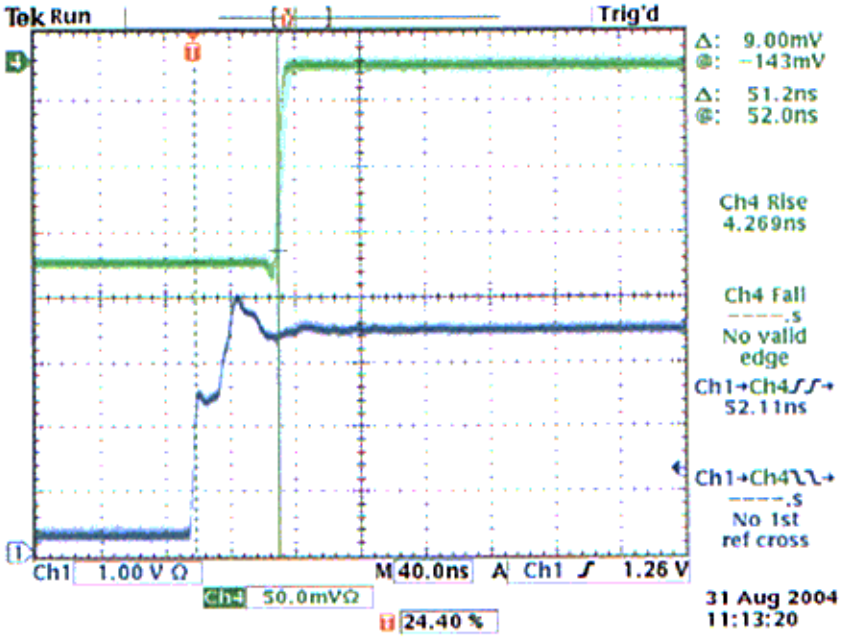
PULSE MODULATOR SWITCHING SPEED AT 10.5GHz (BAND 3)



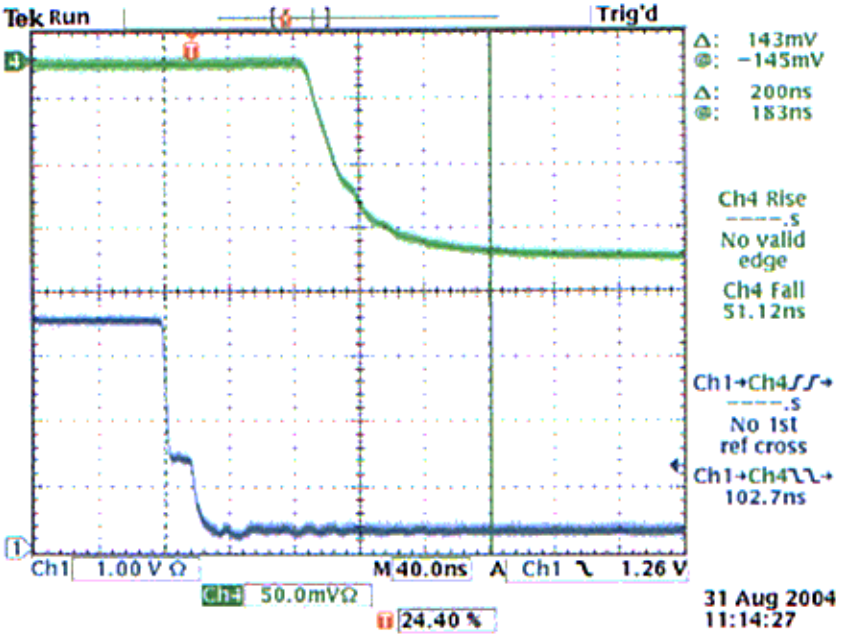
PULSE MODULATOR SWITCHING SPEED AT 18GHz (BAND 4)



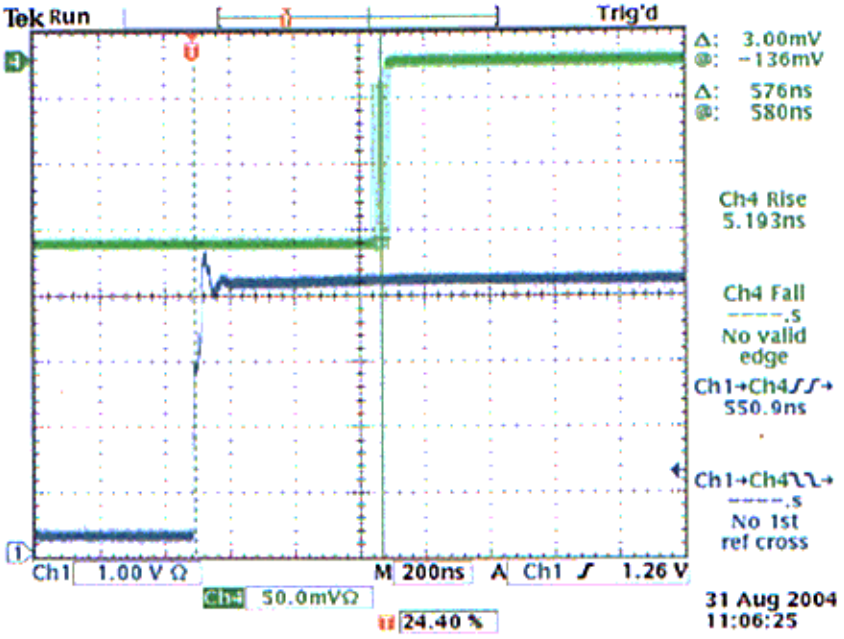
BAND SELECT SWITCHING SPEED

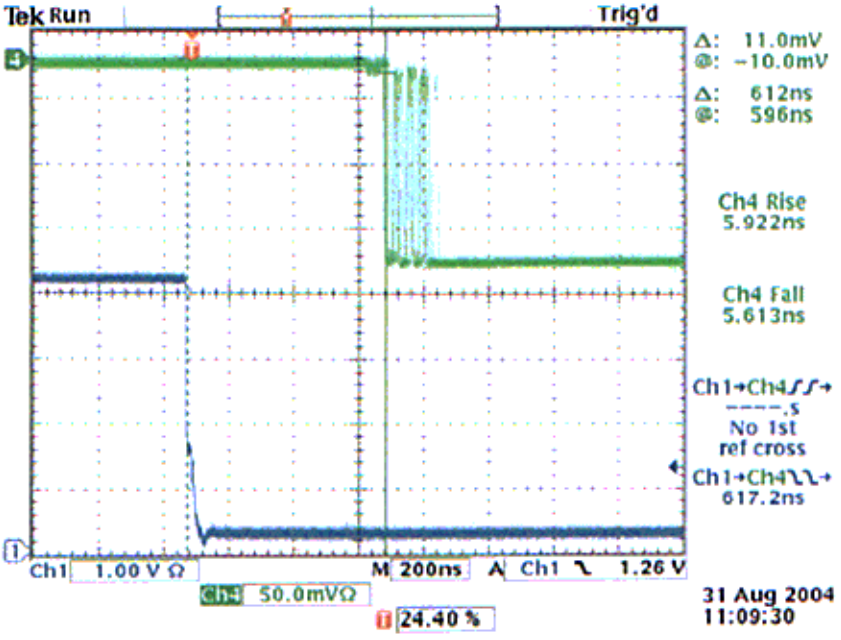


BAND SELECT SWITCHING SPEED



ATTENUATOR SWITCHING SPEED (0 dB TO 63.75dB)





SUMMARY TEST DATA

AS

PRESENTED TO CUSTOMER

On Serial No: PM408515, PM408516, PM408520, PM405323, PM405324, PM405325, PM405326, PM405327, PM403067, PM407470, PM407473, PM403284, PM403285, PM403286, PM403287, PM403288

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FORM: HBDFM-FINAL-DTA

PLANAR MONOLITHICS INDUSTRIES
7311-G GROVE ROAD, FREDERICK, MD 21704
TEL: 301-631-1379 FAX: 301-663-2829
URL: WWW.PLANARMONOLITHICS.COM
EMAIL: SALES@PLANARMONOLITHICS.COM

SUMMARY TEST DATA
ON
HIGH BAND DIRECTION FINDING MODULE (HBDFM)

CUSTOMER:	CUBIC DEFENSE SYSTEMS, INC.	JOB NO:	P301002E
MODEL NO:	HBDFM-218-BD-DP	TESTED BY:	D.VESCUSO/R.AFABLE
PART NO:	62-9115A0028-0001	TEMPERATURE:	+25°C
SERIAL NO:	PM408515	DATE:	6/31/04

Table 1 - Standard Test Conditions

PARAGRAPH	PARAMETER	VALUE	UNITS
3.1	Frequency Range	2.0 – 18.0	GHz
3.2	RF Input Power	0 to +3	dBm
3.3	Spurious RF Input	-60	dBc Maximum
3.3	Harmonic RF Input	-10	dBc Maximum
3.4	Input Signal / Noise	70	dB Minimum

Table 2 – Test Results

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.5	With +5dBm Input and P(out) CP ≤ 0.9 dB	+21.0	dBm Minimum	+19 dBm	ULL
3.6	Output Spurious	-60	dBc Maximum	>-60 dBc	
3.6	Output Harmonics	-60	dBc Maximum	>-60 dBc	
3.7	Noise Figure	8.5	dB Maximum	8.5 dB	
3.8	Amplitude Taper	8.0	dB p-p Maximum	7.1 dB	
3.9	Fine Grain Flatness	3.0	dB p-p Maximum	1.0 dB	
3.10	VSWR Input / Output	2.0:1	Ratio Maximum	1.8:1	
3.11.1	P-Mod Control	Low=Loss	TTL "0" = Low	"0" =LOW	
3.11.2	P-Mod Isolation	-60	dBc Maximum	-70 dBc	
3.11.3	P-Mod Rise/Fall Time	10	Nanosec Maximum	7 nS/12 nS	OUL
3.11.4	P-Mod Delay Time	N/A	Not Specified	-	
3.11.5	P-Mod Delay Sym	10	Nanosec Maximum	5 nS	
3.11.6	P-Mod Video Gen.	-60	dBm Maximum	>-60 dBm	
3.12.1	Atten. Range	64	dB Mean	64 dB	
3.12.2	Number of Bits	8	Absolute	8	
3.12.3	LSB Value	0.25	dB Nominal	0.25	
3.12.4	TTL Control (+ True)	b0=LSB	Absolute	b0=LSB	
3.12.5	Resolution	0.25	dB Absolute	0.25 dB	
3.12.6	Commands	0=00h	dB Relative	0=00h	
3.12.7	0 – 20dB Flatness	± 1.0	dB Maximum	± 2.17 dB	@ 20dB
3.12.7	20 – 40dB Flatness	± 2.0	dB Maximum	± 2.66 dB	@ 40dB
3.12.7	40 – 60dB Flatness	± 3.0	dB Maximum	± 3.28 dB	@ 60dB
3.12.7	60 – 64dB Flatness	± 4.0	dB Maximum	± 3.50 dB	

Page 1 of 2

SERIAL NO: PM408515

MODEL NO: HBDFM-218-BD-DP PART NO: 62-9115A0028-0001

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.12.8	0 – 20dB Accuracy	± 1.0	dB Maximum	± 0.18 dB	
3.12.8	20 – 40dB Accuracy	± 1.5	dB Maximum	± 0.24 dB	
3.12.8	40 – 60dB Accuracy	± 2.0	dB Maximum	± 0.42 dB	
3.12.8	60 – 64dB Accuracy	± 3.0	dB Maximum	± 1.17 dB	
3.12.9	Atten. Switching Time	700	Nanosec Maximum	700 nS	
3.12.10	Atten. Repeat (1 dB)	0.125	dB Maximum	<0.125 dB	
3.12.10	Atten Repeat (32 dB)	0.125	dB Maximum	<0.125 dB	
3.13.2	Band Switching Time	700	Nanosec Maximum	<300 nS	
3.14	+5 VDC Current	250	Milliamps Maximum	400 mA	OUL
3.14	+12 VDC Current	3000	Milliamps Maximum	1.9 A	
3.14	-15 VDC Current	250	Milliamps Maximum	170 mA	
3.14	DCV Ripple ((p-p)	250	MV 40kHz – 40 MHz	250 mV	
4.0	Mechanical	In Accordance With (IAW) Fig. 2		YES	
5.0	Environmental	N/A			
6.0	Test Data	IAW Contract		YES	
7.0	Reparability	IAW Contract or This SCD		YES	

PRODUCTION MANAGER APPROVAL: M Neviaser DATED: 8/31/04

QA / QC APPROVAL: K. Vogler DATED: 8/31/04

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SUMMARY TEST DATA
ON
HIGH BAND DIRECTION FINDING MODULE (HBDFM)

CUSTOMER:	CUBIC DEFENSE SYSTEMS, INC.	JOB NO:	P301002E
MODEL NO:	HBDFM-218-BD-DP	TESTED BY:	D.VESCUSO/R.AFABLE
PART NO:	62-9115A0028-0001	TEMPERATURE:	+25°C
SERIAL NO:	PM408516	DATE:	6/26/04

Table 1 - Standard Test Conditions

PARAGRAPH	PARAMETER	VALUE	UNITS
3.1	Frequency Range	2.0 – 18.0	GHz
3.2	RF Input Power	0 to +3	dBm
3.3	Spurious RF Input	-60	dBc Maximum
3.3	Harmonic RF Input	-10	dBc Maximum
3.4	Input Signal / Noise	70	dB Minimum

Table 2 – Test Results

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.5	With +5dBm Input and P(out) CP ≤ 0.9 dB	+21.0	dBm Minimum	+19 dBm	ULL
3.6	Output Spurious	-60	dBc Maximum	>-70 dBc	
3.6	Output Harmonics	-60	dBc Maximum	>-60 dBc	
3.7	Noise Figure	8.5	dB Maximum	8.0 dB	
3.8	Amplitude Taper	8.0	dB p-p Maximum	7.81 dB	
3.9	Fine Grain Flatness	3.0	dB p-p Maximum	1.0 dB	
3.10	VSWR Input / Output	2.0:1	Ratio Maximum	1.85:1	
3.11.1	P-Mod Control	Low=Loss	TTL "0" = Low	"0" =LOW	
3.11.2	P-Mod Isolation	-60	dBc Maximum	-72 dBc	
3.11.3	P-Mod Rise/Fall Time	10	Nanosec Maximum	9 nS/10 nS	
3.11.4	P-Mod Delay Time	N/A	Not Specified	-	
3.11.5	P-Mod Delay Sym	10	Nanosec Maximum	9 nS	
3.11.6	P-Mod Video Gen.	-60	dBm Maximum	>-60 dBm	
3.12.1	Atten. Range	64	dB Mean	64 dB	
3.12.2	Number of Bits	8	Absolute	8	
3.12.3	LSB Value	0.25	dB Nominal	0.25	
3.12.4	TTL Control (+ True)	b0=LSB	Absolute	b0=LSB	
3.12.5	Resolution	0.25	dB Absolute	0.25 dB	
3.12.6	Commands	0=00h	dB Relative	0=00h	
3.12.7	0 – 20dB Flatness	± 1.0	dB Maximum	± 2.2 dB	@ 20dB
3.12.7	20 – 40dB Flatness	± 2.0	dB Maximum	± 2.8 dB	@ 40dB
3.12.7	40 – 60dB Flatness	± 3.0	dB Maximum	± 4.5 dB	@ 60dB
3.12.7	60 – 64dB Flatness	± 4.0	dB Maximum	± 4.4 dB	@ 64dB

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SERIAL NO: PM408516

MODEL NO: HBDFM-218-BD-DP PART NO: 62-9115A0028-0001

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.12.8	0 – 20dB Accuracy	± 1.0	dB Maximum	± 0.31 dB	
3.12.8	20 – 40dB Accuracy	± 1.5	dB Maximum	± 0.31 dB	
3.12.8	40 – 60dB Accuracy	± 2.0	dB Maximum	± 1.59 dB	
3.12.8	60 – 64dB Accuracy	± 3.0	dB Maximum	± 0.72 dB	
3.12.9	Atten. Switching Time	700	Nanosec Maximum	700 nS	
3.12.10	Atten. Repeat (1 dB)	0.125	dB Maximum	<0.125 dB	
3.12.10	Atten Repeat (32 dB)	0.125	dB Maximum	<0.125 dB	
3.13.2	Band Switching Time	700	Nanosec Maximum	<700 nS	
3.14	+5 VDC Current	250	Milliamps Maximum	400 mA	OUL
3.14	+12 VDC Current	3000	Milliamps Maximum	2.0 A	
3.14	-15 VDC Current	250	Milliamps Maximum	170 mA	
3.14	DCV Ripple ((p-p)	250	MV 40kHz – 40 MHz	250 mV	
4.0	Mechanical	In Accordance With (IAW) Fig. 2		YES	
5.0	Environmental	N/A			
6.0	Test Data	IAW Contract		YES	
7.0	Reparability	IAW Contract or This SCD		YES	

PRODUCTION MANAGER APPROVAL: M Norusin DATED: 8/31/04

QA / QC APPROVAL: K. Voc DATED: 8/31/04

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SUMMARY TEST DATA
ON
HIGH BAND DIRECTION FINDING MODULE (HBDFM)

CUSTOMER:	CUBIC DEFENSE SYSTEMS, INC.	JOB NO:	P301002E
MODEL NO:	HBDFM-218-BD-DP	TESTED BY:	R.AFABLE
PART NO:	62-9115A0028-0001	TEMPERATURE:	+25°C
SERIAL NO:	PM408520	DATE:	8/02/04

Table 1 - Standard Test Conditions

PARAGRAPH	PARAMETER	VALUE	UNITS
3.1	Frequency Range	2.0 – 18.0	GHz
3.2	RF Input Power	0 to +3	dBm
3.3	Spurious RF Input	-60	dBc Maximum
3.3	Harmonic RF Input	-10	dBc Maximum
3.4	Input Signal / Noise	70	dB Minimum

Table 2 – Test Results

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.5	With +5dBm Input and P(out) CP ≤ 0.9 dB	+21.0	dBm Minimum	+19.7 dBm	UL L
3.6	Output Spurious	-60	dBc Maximum	>-70 dBc	
3.6	Output Harmonics	-60	dBc Maximum	>-60 dBc	
3.7	Noise Figure	8.5	dB Maximum	7.5 dB	
3.8	Amplitude Taper	8.0	dB p-p Maximum	7.5 dB	
3.9	Fine Grain Flatness	3.0	dB p-p Maximum	1.0 dB	
3.10	VSWR Input	2.0:1	Ratio Maximum	1.69:1	
3.11.1	P-Mod Control	Low=Loss	TTL "0" = Low	"0" =LOW	
3.11.2	P-Mod Isolation	-60	dBc Maximum	-81 dBc	
3.11.3	P-Mod Rise/Fall Time	10	Nanosec Maximum	6 nS/10 nS	
3.11.4	P-Mod Delay Time	N/A	Not Specified	-	
3.11.5	P-Mod Delay Sym	10	Nanosec Maximum	4 nS	
3.11.6	P-Mod Video Gen.	-60	dBm Maximum	>-60 dBm	
3.12.1	Atten. Range	64	dB Mean	64 dB	
3.12.2	Number of Bits	8	Absolute	8	
3.12.3	LSB Value	0.25	dB Nominal	0.25	
3.12.4	TTL Control (+ True)	b0=LSB	Absolute	b0=LSB	
3.12.5	Resolution	0.25	dB Absolute	0.25 dB	
3.12.6	Commands	0=00h	dB Relative	0=00h	
3.12.7	0 – 20dB Flatness	± 1.0	dB Maximum	± 1.7 dB	@ 20dB
3.12.7	20 – 40dB Flatness	± 2.0	dB Maximum	± 1.8 dB	@ 40dB
3.12.7	40 – 60dB Flatness	± 3.0	dB Maximum	± 3.4 dB	@ 60dB
3.12.7	60 – 64dB Flatness	± 4.0	dB Maximum	± 3.4 dB	

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SERIAL NO: PM405324

MODEL NO: HBDFM-218-BD-DP PART NO: 62-9115A0028-0001

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.12.8	0 – 20dB Accuracy	± 1.0	dB Maximum	± 0.25 dB	
3.12.8	20 – 40dB Accuracy	± 1.5	dB Maximum	± 0.47 dB	
3.12.8	40 – 60dB Accuracy	± 2.0	dB Maximum	± 0.94 dB	
3.12.8	60 – 64dB Accuracy	± 3.0	dB Maximum	± 0.84 dB	
3.12.9	Atten. Switching Time	700	Nanosec Maximum	600 nS	
3.12.10	Atten. Repeat (1 dB)	0.125	dB Maximum	0.1 dB	
3.12.10	Atten Repeat (32 dB)	0.125	dB Maximum	0.1 dB	
3.13.2	Band Switching Time	700	Nanosec Maximum	400 nS	
3.14	+5 VDC Current	250	Milliamps Maximum	420 mA	OUL
3.14	+12 VDC Current	3000	Milliamps Maximum	2.1 A	
3.14	-15 VDC Current	250	Milliamps Maximum	170 mA	
3.14	DCV Ripple i(p-p)	250	MV 40kHz – 40 MHz	250 mV	
4.0	Mechanical	In Accordance With (IAW) Fig. 2			
5.0	Environmental	N/A			
6.0	Test Data	IAW Contract			
7.0	Reparability	IAW Contract or This SCD			

PRODUCTION MANAGER APPROVAL: W Neviaser DATED: 8/5/04

QA / QC APPROVAL: R. Vogl DATED: 8/5/04

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SUMMARY TEST DATA ON HIGH BAND DIRECTION FINDING MODULE (HBDFM)

CUSTOMER:	CUBIC DEFENSE SYSTEMS, INC.	JOB NO:	P301002E
MODEL NO:	HBDFM-218-BD-DP	TESTED BY:	D.VESCUSO/R.AFABLE
PART NO:	62-9115A0028-0001	TEMPERATURE:	+25°C
SERIAL NO:	PM405323	DATE:	5/5/04

Table 1 - Standard Test Conditions

PARAGRAPH	PARAMETER	VALUE	UNITS
3.1	Frequency Range	2.0 – 18.0	GHz
3.2	RF Input Power	0 to +3	dBm
3.3	Spurious RF Input	-60	dBc Maximum
3.3	Harmonic RF Input	-10	dBc Maximum
3.4	Input Signal / Noise	70	dB Minimum

Table 2 – Test Results

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.5	With +5dBm Input and P(out) CP ≤ 0.9 dB	+21.0	dBm Minimum	+19 dBm	OUL
3.6	Output Spurious	-60	dBc Maximum	>-70 dBc	
3.6	Output Harmonics	-60	dBc Maximum	>-60 dBc	
3.7	Noise Figure	8.5	dB Maximum	7.5 dB	
3.8	Amplitude Taper	8.0	dB p-p Maximum	8 dB	
3.9	Fine Grain Flatness	3.0	dB p-p Maximum	0.9 dB	
3.10	VSWR Input / Output	2.0:1	Ratio Maximum	1.95:1	
3.11.1	P-Mod Control	Low=Loss	TTL "0" = Low	"0" =LOW	
3.11.2	P-Mod Isolation	-60	dBc Maximum	-78 dBc	
3.11.3	P-Mod Rise/Fall Time	10	Nanosec Maximum	9 nS/8 nS	
3.11.4	P-Mod Delay Time	N/A	Not Specified	-	
3.11.5	P-Mod Delay Sym	10	Nanosec Maximum	4 nS	
3.11.6	P-Mod Video Gen.	-60	dBm Maximum	>-60 dBm	
3.12.1	Atten. Range	64	dB Mean	64 dB	
3.12.2	Number of Bits	8	Absolute	8	
3.12.3	LSB Value	0.25	dB Nominal	0.25	
3.12.4	TTL Control (+ True)	b0=LSB	Absolute	b0=LSB	
3.12.5	Resolution	0.25	dB Absolute	0.25 dB	
3.12.6	Commands	0=00h	dB Relative	0=00h	
3.12.7	0 – 20dB Flatness	± 1.0	dB Maximum	± 1.65 dB	OUL
3.12.7	20 – 40dB Flatness	± 2.0	dB Maximum	± 2.1 dB	OUL
3.12.7	40 – 60dB Flatness	± 3.0	dB Maximum	± 2.5 dB	
3.12.7	60 – 64dB Flatness	± 4.0	dB Maximum	± 3.5 dB	

Page 1 of 2

SERIAL NO: PM405323

MODEL NO: HBDFM-218-BD-DP PART NO: 62-9115A0028-0001

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.12.8	0 – 20dB Accuracy	± 1.0	dB Maximum	± 0.3 dB	
3.12.8	20 – 40dB Accuracy	± 1.5	dB Maximum	± 0.5 dB	
3.12.8	40 – 60dB Accuracy	± 2.0	dB Maximum	± 1.0 dB	
3.12.8	60 – 64dB Accuracy	± 3.0	dB Maximum	± 1.8 dB	
3.12.9	Atten. Switching Time	700	Nanosec Maximum	600 nS	
3.12.10	Atten. Repeat (1 dB)	0.125	dB Maximum	0.05 dB	
3.12.10	Atten Repeat (32 dB)	0.125	dB Maximum	0.08 dB	
3.13.2	Band Switching Time	700	Nanosec Maximum	400 nS	
3.14	+5 VDC Current	250	Milliamps Maximum	480 mA	OCC
3.14	+12 VDC Current	3000	Milliamps Maximum	2.15 A	
3.14	-15 VDC Current	250	Milliamps Maximum	220 mA	
3.14	DCV Ripple ((p-p)	250	MV 40kHz – 40 MHz	250 mV	
4.0	Mechanical	In Accordance With (IAW) Fig. 2			
5.0	Environmental	N/A			
6.0	Test Data	IAW Contract			
7.0	Reparability	IAW Contract or This SCD			

PRODUCTION MANAGER APPROVAL: M Morgan DATED: 5/5/04

QA / QC APPROVAL: K. Voglor DATED: 5/5/04

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SUMMARY TEST DATA
ON
HIGH BAND DIRECTION FINDING MODULE (HBDFM)

CUSTOMER:	CUBIC DEFENSE SYSTEMS, INC.	JOB NO:	P301002E
MODEL NO:	HBDFM-218-BD-DP	TESTED BY:	D.VESCUSO/R.AFABLE
PART NO:	62-9115A0028-0001	TEMPERATURE:	+25°C
SERIAL NO:	PM405324	DATE:	6/14/04

Table 1 - Standard Test Conditions

PARAGRAPH	PARAMETER	VALUE	UNITS
3.1	Frequency Range	2.0 – 18.0	GHz
3.2	RF Input Power	0 to +3	dBm
3.3	Spurious RF Input	-60	dBc Maximum
3.3	Harmonic RF Input	-10	dBc Maximum
3.4	Input Signal / Noise	70	dB Minimum

Table 2 – Test Results

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.5	With +5dBm Input and P(out) CP ≤ 0.9 dB	+21.0	dBm Minimum	+18.5 dBm	
3.6	Output Spurious	-60	dBc Maximum	>-70 dBc	
3.6	Output Harmonics	-60	dBc Maximum	>-60 dBc	
3.7	Noise Figure	8.5	dB Maximum	7.0 dB	
3.8	Amplitude Taper	8.0	dB p-p Maximum	7.8 dB	
3.9	Fine Grain Flatness	3.0	dB p-p Maximum	1.0 dB	
3.10	VSWR Input / Output	2.0:1	Ratio Maximum	1.8:1	
3.11.1	P-Mod Control	Low=Loss	TTL "0" = Low	"0" =LOW	
3.11.2	P-Mod Isolation	-60	dBc Maximum	-81 dBc	
3.11.3	P-Mod Rise/Fall Time	10	Nanosec Maximum	10 nS/5 nS	
3.11.4	P-Mod Delay Time	N/A	Not Specified	-	
3.11.5	P-Mod Delay Sym	10	Nanosec Maximum	3 nS	
3.11.6	P-Mod Video Gen.	-60	dBm Maximum	>-60 dBm	
3.12.1	Atten. Range	64	dB Mean	64 dB	
3.12.2	Number of Bits	8	Absolute	8	
3.12.3	LSB Value	0.25	dB Nominal	0.25	
3.12.4	TTL Control (+ True)	b0=LSB	Absolute	b0=LSB	
3.12.5	Resolution	0.25	dB Absolute	0.25 dB	
3.12.6	Commands	0=00h	dB Relative	0=00h	
3.12.7	0 – 20dB Flatness	± 1.0	dB Maximum	± 1.5 dB	OOL
3.12.7	20 – 40dB Flatness	± 2.0	dB Maximum	± 1.8 dB	
3.12.7	40 – 60dB Flatness	± 3.0	dB Maximum	± 2.4 dB	
3.12.7	60 – 64dB Flatness	± 4.0	dB Maximum	± 3.0 dB	

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SERIAL NO: PM405324

MODEL NO: HBDFM-218-BD-DP PART NO: 62-9115A0028-0001

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.12.8	0 – 20dB Accuracy	± 1.0	dB Maximum	± 0.4 dB	
3.12.8	20 – 40dB Accuracy	± 1.5	dB Maximum	± 0.8 dB	
3.12.8	40 – 60dB Accuracy	± 2.0	dB Maximum	± 0.9 dB	
3.12.8	60 – 64dB Accuracy	± 3.0	dB Maximum	± 1.0 dB	
3.12.9	Atten. Switching Time	700	Nanosec Maximum	600 nS	
3.12.10	Atten. Repeat (1 dB)	0.125	dB Maximum	0.06 dB	
3.12.10	Atten Repeat (32 dB)	0.125	dB Maximum	0.08 dB	
3.13.2	Band Switching Time	700	Nanosec Maximum	400 nS	
3.14	+5 VDC Current	250	Milliamps Maximum	320 mA	OUT
3.14	+12 VDC Current	3000	Milliamps Maximum	2.2 A	
3.14	-15 VDC Current	250	Milliamps Maximum	230 mA	
3.14	DCV Ripple ((p-p)	250	MV 40kHz – 40 MHz	250 mV	
4.0	Mechanical	In Accordance With (IAW) Fig. 2			
5.0	Environmental	N/A			
6.0	Test Data	IAW Contract			
7.0	Reparability	IAW Contract or This SCD			

PRODUCTION MANAGER APPROVAL: N/A DATED:

QA / QC APPROVAL: K. Dolan DATED: 6/14/05

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SUMMARY TEST DATA ON HIGH BAND DIRECTION FINDING MODULE (HBDFM)

CUSTOMER:	CUBIC DEFENSE SYSTEMS, INC.	JOB NO:	P301002E
MODEL NO:	HBDFM-218-BD-DP	TESTED BY:	D.VESCUSO/R.AFABLE
PART NO:	62-9115A0028-0001	TEMPERATURE:	+25°C
SERIAL NO:	PM405325	DATE:	6/15/04

Table 1 - Standard Test Conditions

PARAGRAPH	PARAMETER	VALUE	UNITS
3.1	Frequency Range	2.0 – 18.0	GHz
3.2	RF Input Power	0 to +3	dBm
3.3	Spurious RF Input	-60	dBc Maximum
3.3	Harmonic RF Input	-10	dBc Maximum
3.4	Input Signal / Noise	70	dB Minimum

Table 2 – Test Results

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.5	With +5dBm Input and P(out) CP ≤ 0.9 dB	+21.0	dBm Minimum	+21 dBm	
3.6	Output Spurious	-60	dBc Maximum	>-70 dBc	
3.6	Output Harmonics	-60	dBc Maximum	>-60 dBc	
3.7	Noise Figure	8.5	dB Maximum	7.0 dB	
3.8	Amplitude Taper	8.0	dB p-p Maximum	8 dB	
3.9	Fine Grain Flatness	3.0	dB p-p Maximum	1.0 dB	
3.10	VSWR Input / Output	2.0:1	Ratio Maximum	1.78:1	
3.11.1	P-Mod Control	Low=Loss	TTL "0" = Low	"0" =LOW	
3.11.2	P-Mod Isolation	-60	dBc Maximum	-80 dBc	
3.11.3	P-Mod Rise/Fall Time	10	Nanosec Maximum	9 nS/5 nS	
3.11.4	P-Mod Delay Time	N/A	Not Specified	-	
3.11.5	P-Mod Delay Sym	10	Nanosec Maximum	4 nS	
3.11.6	P-Mod Video Gen.	-60	dBm Maximum	>-60 dBm	
3.12.1	Atten. Range	64	dB Mean	64 dB	
3.12.2	Number of Bits	8	Absolute	8	
3.12.3	LSB Value	0.25	dB Nominal	0.25	
3.12.4	TTL Control (+ True)	b0=LSB	Absolute	b0=LSB	
3.12.5	Resolution	0.25	dB Absolute	0.25 dB	
3.12.6	Commands	0=00h	dB Relative	0=00h	
3.12.7	0 – 20dB Flatness	± 1.0	dB Maximum	± 1.5 dB	
3.12.7	20 – 40dB Flatness	± 2.0	dB Maximum	± 2.0 dB	
3.12.7	40 – 60dB Flatness	± 3.0	dB Maximum	± 2.7 dB	
3.12.7	60 – 64dB Flatness	± 4.0	dB Maximum	± 3.4 dB	

Page 1 of 2

SERIAL NO: PM405325

MODEL NO: HBDFM-218-BD-DP PART NO: 62-9115A0028-0001

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.12.8	0 – 20dB Accuracy	± 1.0	dB Maximum	± 0.3 dB	
3.12.8	20 – 40dB Accuracy	± 1.5	dB Maximum	± 0.8 dB	
3.12.8	40 – 60dB Accuracy	± 2.0	dB Maximum	± 1.2 dB	
3.12.8	60 – 64dB Accuracy	± 3.0	dB Maximum	± 1.8 dB	
3.12.9	Atten. Switching Time	700	Nanosec Maximum	600 nS	
3.12.10	Atten. Repeat (1 dB)	0.125	dB Maximum	0.09 dB	
3.12.10	Atten Repeat (32 dB)	0.125	dB Maximum	0.1 dB	
3.13.2	Band Switching Time	700	Nanosec Maximum	400 nS	
3.14	+5 VDC Current	250	Milliamps Maximum	400 mA	OUL
3.14	+12 VDC Current	3000	Milliamps Maximum	2.1 A	
3.14	-15 VDC Current	250	Milliamps Maximum	170 mA	
3.14	DCV Ripple ((p-p)	250	MV 40kHz – 40 MHz	250 mV	
4.0	Mechanical	In Accordance With (IAW) Fig. 2			
5.0	Environmental	N/A			
6.0	Test Data	IAW Contract			
7.0	Reparability	IAW Contract or This SCD			

PRODUCTION MANAGER APPROVAL: M Nevirasu DATED: 5/5/04

QA / QC APPROVAL: K. Vogel DATED: 5/4/04

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FORM: HBDFM-FINAL-DTA

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SUMMARY TEST DATA
ON
HIGH BAND DIRECTION FINDING MODULE (HBDFM)

CUSTOMER:	CUBIC DEFENSE SYSTEMS, INC.	JOB NO:	P301002E
MODEL NO:	HBDFM-218-BD-DP	TESTED BY:	D.VESCUSO/R.AFABLE
PART NO:	62-9115A0028-0001	TEMPERATURE:	+25°C
SERIAL NO:	PM405326	DATE:	5/5/04

Table 1 - Standard Test Conditions

PARAGRAPH	PARAMETER	VALUE	UNITS
3.1	Frequency Range	2.0 – 18.0	GHz
3.2	RF Input Power	0 to +3	dBm
3.3	Spurious RF Input	-60	dBc Maximum
3.3	Harmonic RF Input	-10	dBc Maximum
3.4	Input Signal / Noise	70	dB Minimum

Table 2 – Test Results

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.5	With +5dBm Input and P(out) CP ≤ 0.9 dB	+21.0	dBm Minimum	+19 dBm	ULL
3.6	Output Spurious	-60	dBc Maximum	>-70 dBc	
3.6	Output Harmonics	-60	dBc Maximum	>-60 dBc	
3.7	Noise Figure	8.5	dB Maximum	7.0 dB	
3.8	Amplitude Taper	8.0	dB p-p Maximum	8 dB	
3.9	Fine Grain Flatness	3.0	dB p-p Maximum	0.8 dB	
3.10	VSWR Input / Output	2.0:1	Ratio Maximum	1.9:1	
3.11.1	P-Mod Control	Low=Loss	TTL "0" = Low	"0" =LOW	
3.11.2	P-Mod Isolation	-60	dBc Maximum	-75 dBc	
3.11.3	P-Mod Rise/Fall Time	10	Nanosec Maximum	10 nS/8 nS	
3.11.4	P-Mod Delay Time	N/A	Not Specified	-	
3.11.5	P-Mod Delay Sym	10	Nanosec Maximum	8 nS	
3.11.6	P-Mod Video Gen.	-60	dBm Maximum	>-60 dBm	
3.12.1	Atten. Range	64	dB Mean	64 dB	
3.12.2	Number of Bits	8	Absolute	8	
3.12.3	LSB Value	0.25	dB Nominal	0.25	
3.12.4	TTL Control (+ True)	b0=LSB	Absolute	b0=LSB	
3.12.5	Resolution	0.25	dB Absolute	0.25 dB	
3.12.6	Commands	0=00h	dB Relative	0=00h	
3.12.7	0 – 20dB Flatness	± 1.0	dB Maximum	± 1.55 dB	OUL
3.12.7	20 – 40dB Flatness	± 2.0	dB Maximum	± 2.0 dB	
3.12.7	40 – 60dB Flatness	± 3.0	dB Maximum	± 2.5 dB	
3.12.7	60 – 64dB Flatness	± 4.0	dB Maximum	± 2.7 dB	

Page 1 of 2

SERIAL NO: PM405326

MODEL NO: HBDFM-218-BD-DP PART NO: 62-9115A0028-0001

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.12.8	0 – 20dB Accuracy	± 1.0	dB Maximum	± 0.4 dB	
3.12.8	20 – 40dB Accuracy	± 1.5	dB Maximum	± 0.7 dB	
3.12.8	40 – 60dB Accuracy	± 2.0	dB Maximum	± 1.2 dB	
3.12.8	60 – 64dB Accuracy	± 3.0	dB Maximum	± 1.5 dB	
3.12.9	Atten. Switching Time	700	Nanosec Maximum	600 nS	
3.12.10	Atten. Repeat (1 dB)	0.125	dB Maximum	0.05 dB	
3.12.10	Atten Repeat (32 dB)	0.125	dB Maximum	0.05 dB	
3.13.2	Band Switching Time	700	Nanosec Maximum	400 nS	
3.14	+5 VDC Current	250	Milliamps Maximum	490 mA	OOL
3.14	+12 VDC Current	3000	Milliamps Maximum	2.1 A	
3.14	-15 VDC Current	250	Milliamps Maximum	180 mA	
3.14	DCV Ripple ((p-p)	250	MV 40kHz – 40 MHz	250 mV	
4.0	Mechanical	In Accordance With (IAW) Fig. 2			
5.0	Environmental	N/A			
6.0	Test Data	IAW Contract			
7.0	Reparability	IAW Contract or This SCD			

PRODUCTION MANAGER APPROVAL: M Kovjasin DATED: 5/5/04

QA / QC APPROVAL: K. Vogler DATED: 5/4/04

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SUMMARY TEST DATA
ON
HIGH BAND DIRECTION FINDING MODULE (HBDFM)

CUSTOMER:	CUBIC DEFENSE SYSTEMS, INC.	JOB NO:	P301002E
MODEL NO:	HBDFM-218-BD-DP	TESTED BY:	D.VESCUSO/R.AFABLE
PART NO:	62-9115A0028-0001	TEMPERATURE:	+25°C
SERIAL NO:	PM405327	DATE:	5/5/04

Table 1 - Standard Test Conditions

PARAGRAPH	PARAMETER	VALUE	UNITS
3.1	Frequency Range	2.0 – 18.0	GHz
3.2	RF Input Power	0 to –3	dBm
3.3	Spurious RF Input	-60	dBc Maximum
3.3	Harmonic RF Input	-10	dBc Maximum
3.4	Input Signal / Noise	70	dB Minimum

Table 2 – Test Results

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.5	With +5dBm Input and P(out) CP ≤ 0.9 dB	+21.0	dBm Minimum	+19.5 dBm	OOL
3.6	Output Spurious	-60	dBc Maximum	>-70 dBc	
3.6	Output Harmonics	-60	dBc Maximum	>-60 dBc	
3.7	Noise Figure	8.5	dB Maximum	7.0 dB	
3.8	Amplitude Taper	8.0	dB p-p Maximum	8 dB	
3.9	Fine Grain Flatness	3.0	dB p-p Maximum	0.5 dB	
3.10	VSWR Input / Output	2.0:1	Ratio Maximum	1.8:1	
3.11.1	P-Mod Control	Low=Loss	TTL "0" = Low	"0" =LOW	
3.11.2	P-Mod Isolation	-60	dBc Maximum	-75 dBc	
3.11.3	P-Mod Rise/Fall Time	10	Nanosec Maximum	8 nS/8 nS	
3.11.4	P-Mod Delay Time	N/A	Not Specified	-	
3.11.5	P-Mod Delay Sym	10	Nanosec Maximum	5 nS	
3.11.6	P-Mod Video Gen.	-60	dBm Maximum	>-60 dBm	
3.12.1	Atten. Range	64	dB Mean	64 dB	
3.12.2	Number of Bits	8	Absolute	8	
3.12.3	LSB Value	0.25	dB Nominal	0.25	
3.12.4	TTL Control (+ True)	b0=LSB	Absolute	b0=LSB	
3.12.5	Resolution	0.25	dB Absolute	0.25 dB	
3.12.6	Commands	0=00h	dB Relative	0=00h	
3.12.7	0 – 20dB Flatness	± 1.0	dB Maximum	± 1.5 dB	OOL
3.12.7	20 – 40dB Flatness	± 2.0	dB Maximum	± 1.5 dB	
3.12.7	40 – 60dB Flatness	± 3.0	dB Maximum	± 2.0 dB	
3.12.7	60 – 64dB Flatness	± 4.0	dB Maximum	± 3.0 dB	

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SERIAL NO: PM405327

MODEL NO: HBDFM-218-BD-DP PART NO: 62-9115A0028-0001

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.12.8	0 – 20dB Accuracy	± 1.0	dB Maximum	± 0.5 dB	
3.12.8	20 – 40dB Accuracy	± 1.5	dB Maximum	± 0.9 dB	
3.12.8	40 – 60dB Accuracy	± 2.0	dB Maximum	± 1.0 dB	
3.12.8	60 – 64dB Accuracy	± 3.0	dB Maximum	± 1.5 dB	
3.12.9	Atten. Switching Time	700	Nanosec Maximum	600 nS	
3.12.10	Atten. Repeat (1 dB)	0.125	dB Maximum	0.05 dB	
3.12.10	Atten Repeat (32 dB)	0.125	dB Maximum	0.05 dB	
3.13.2	Band Switching Time	700	Nanosec Maximum	400 nS	
3.14	-5 VDC Current	250	Milliamps Maximum	490 mA	OUL
3.14	+12 VDC Current	3000	Milliamps Maximum	2.05 A	
3.14	-15 VDC Current	250	Milliamps Maximum	180 mA	
3.14	DCV Ripple ((p-p)	250	MV 40kHz – 40 MHz	250 mV	
4.0	Mechanical	In Accordance With (IAW) Fig. 2			
5.0	Environmental	N/A			
6.0	Test Data	IAW Contract			
7.0	Reparability	IAW Contract or This SCD			

PRODUCTION MANAGER APPROVAL: M. Neuman DATED: 5/5/04

QA / QC APPROVAL: K. Vance DATED: 5/5/04

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SUMMARY TEST DATA ON HIGH BAND DIRECTION FINDING MODULE (HBDFM)

CUSTOMER:	CUBIC DEFENSE SYSTEMS, INC.	JOB NO:	P301002E
MODEL NO:	HBDFM-218-BD-DP	TESTED BY:	D.V
PART NO:	62-9115A0028-0001	TEMPERATURE:	-20°C TO +40°C
SERIAL NO:	PM 403 067	DATE:	3/1/04

Table 1 - Standard Test Conditions

PARAGRAPH	PARAMETER	VALUE	UNITS
3.1	Frequency Range	2.0 – 18.0	GHz
3.2	RF Input Power	0 to +3	dBm (TBD)
3.3	Spurious RF Input	-60	dBc Maximum
3.3	Harmonic RF Input	-10	dBc Maximum
3.4	Input Signal / Noise	70	dB Minimum

Table 2 – Test Results

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.5	With +5dBm Input and P(out) CP ≤ 0.9 dB	+21.0	dBm Minimum	>21 BAND 1,2,3 >20 BAND 4	
3.6	Output Spurious	-60	dBc Maximum	>60 dBc	
3.6	Output Harmonics	-60	dBc Maximum	SEE RPTS	
3.7	Noise Figure	8.5	dB Maximum	8.0	
3.8	Amplitude Taper	8.0	dB p-p Maximum	7.0 dB	SEE RPTS
3.9	Fine Grain Flatness	3.0	dB p-p Maximum	SEE RPTS	
3.10	VSWR Input / Output	2.0:1	Ratio Maximum	SEE RPTS	
3.11.1	P-Mod Control	Low=Loss	TTL "0" = Low	OK	
3.11.2	P-Mod Isolation	-60	dBc Maximum	> 70 dBc	(SEE RPT)
3.11.3	P-Mod Rise/Fall Time	10	Nanosec Maximum	9 ns FALL 10 ns RISE	
3.11.4	P-Mod Delay Time	N/A	Not Specified		
3.11.5	P-Mod Delay Sym	10	Nanosec Maximum	8.5 ns	
3.11.6	P-Mod Video Gen.	-60	dBm Maximum	SEE RPT	
3.12.1	Atten. Range	64	dB Mean	OK SEE RPTS	
3.12.2	Number of Bits	8	Absolute	OK	
3.12.3	LSB Value	0.25	dB Nominal	OK	
3.12.4	TTL Control (+ True)	b0=LSB	Absolute	OK	
3.12.5	Resolution	0.25	dB Absolute	OK	
3.12.6	Commands	0=00h	dB Relative		
3.12.7	0 – 20dB Flatness	± 1.0	dB Maximum	SEE RPTS	
3.12.7	20 – 40dB Flatness	± 2.0	dB Maximum	SEE RPTS	
3.12.7	40 – 60dB Flatness	± 3.0	dB Maximum	SEE RPTS	
3.12.7	60 – 64dB Flatness	± 4.0	dB Maximum	SEE RPTS	

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MODEL NO: HBDFM-218-BD-DP PART NO: 62-9115A0028-0001

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.12.8	0 – 20dB Accuracy	± 1.0	dB Maximum	SEE PLOTS	
3.12.8	20 – 40dB Accuracy	± 1.5	dB Maximum	SEE PLOTS	
3.12.8	40 – 60dB Accuracy	± 2.0	dB Maximum	SEE PLOTS	
3.12.8	60 – 64dB Accuracy	± 3.0	dB Maximum	SEE PLOTS	
3.12.9	Atten. Switching Time	700	Nanosec Maximum	600 ns	
3.12.10	Atten. Repeat (1 dB)	0.125	dB Maximum	.02 dB	
3.12.10	Atten Repeat (32 dB)	0.125	dB Maximum	.02 dB	
3.13.2	Band Switching Time	700	Nanosec Maximum	400 ns	
3.14	+5 VDC Current	250	Milliamps Maximum	590/420 mA	
3.14	+12 VDC Current	3000	Milliamps Maximum	1.96 A	
3.14	-15 VDC Current	250	Milliamps Maximum	260 mA	
3.14	DCV Ripple ((p-p)	250	MV 40kHz – 40 MHz	0 B	
4.0	Mechanical	In Accordance With (IAW) Fig. 2		OK	
5.0	Environmental	N/A			
6.0	Test Data	IAW Contract			
7.0	Reparability	IAW Contract or This SCD			

PRODUCTION MANAGER APPROVAL: Martha Nerasen DATED: 3/1/04

QA / QC APPROVAL: # Kurt Vogler DATED: 3/1/04

FOR FUNCTIONAL TESTING AT NEXT HIGHER ASSEMBLY TO DETERMINE SPECIFICATION REQUIREMENTS.

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SUMMARY TEST DATA
ON
HIGH BAND DIRECTION FINDING MODULE (HBDFM)

CUSTOMER:	CUBIC DEFENSE SYSTEMS, INC.	JOB NO:	P301002E
MODEL NO:	HBDFM-218-BD-DP	TESTED BY:	D.VESCUSO/R.AFABLE
PART NO:	62-9115A0028-0001	TEMPERATURE:	+25°C
SERIAL NO:	PM407470	DATE:	7/15/04

Table 1 - Standard Test Conditions

PARAGRAPH	PARAMETER	VALUE	UNITS
3.1	Frequency Range	2.0 – 18.0	GHz
3.2	RF Input Power	0 to +3	dBm
3.3	Spurious RF Input	-60	dBc Maximum
3.3	Harmonic RF Input	-10	dBc Maximum
3.4	Input Signal / Noise	70	dB Minimum

Table 2 – Test Results

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.5	With +5dBm Input and P(out) CP ≤ 0.9 dB	+21.0	dBm Minimum	+19.0 dBm	ULL
3.6	Output Spurious	-60	dBc Maximum	>-60 dBc	
3.6	Output Harmonics	-60	dBc Maximum	>-60 dBc	
3.7	Noise Figure	8.5	dB Maximum	8.5 dB	
3.8	Amplitude Taper	8.0	dB p-p Maximum	7 dB	
3.9	Fine Grain Flatness	3.0	dB p-p Maximum	2.0 dB	
3.10	VSWR Input / Output	2.0:1	Ratio Maximum	1.72:1	
3.11.1	P-Mod Control	Low=Loss	TTL "0" = Low	"0" =LOW	
3.11.2	P-Mod Isolation	-60	dBc Maximum	-65 dBc	
3.11.3	P-Mod Rise/Fall Time	10	Nanosec Maximum	6.5nS/27nS	
3.11.4	P-Mod Delay Time	N/A	Not Specified	-	
3.11.5	P-Mod Delay Sym	10	Nanosec Maximum	45 nS	OUL
3.11.6	P-Mod Video Gen.	-60	dBm Maximum	>-60 dBm	
3.12.1	Atten. Range	64	dB Mean	64 dB	
3.12.2	Number of Bits	8	Absolute	8	
3.12.3	LSB Value	0.25	dB Nominal	0.25	
3.12.4	TTL Control (+ True)	b0=LSB	Absolute	b0=LSB	
3.12.5	Resolution	0.25	dB Absolute	0.25 dB	
3.12.6	Commands	0=00h	dB Relative	0=00h	
3.12.7	0 – 20dB Flatness	± 1.0	dB Maximum	± 2.70 dB	OUL
3.12.7	20 – 40dB Flatness	± 2.0	dB Maximum	± 2.51 dB	OUL
3.12.7	40 – 60dB Flatness	± 3.0	dB Maximum	± 3.36 dB	OUL
3.12.7	60 – 64dB Flatness	± 4.0	dB Maximum	± 3.67 dB	

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SERIAL NO: PM407470

MODEL NO: HBDFM-218-BD-DP PART NO: 62-9115A0028-0001

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.12.8	0 – 20dB Accuracy	± 1.0	dB Maximum	± 0.5 dB	
3.12.8	20 – 40dB Accuracy	± 1.5	dB Maximum	± 0.75 dB	
3.12.8	40 – 60dB Accuracy	± 2.0	dB Maximum	± 1.0 dB	
3.12.8	60 – 64dB Accuracy	± 3.0	dB Maximum	± 1.4 dB	
3.12.9	Atten. Switching Time	700	Nanosec Maximum	<700 nS	
3.12.10	Atten. Repeat (1 dB)	0.125	dB Maximum	<0.125 dB	
3.12.10	Atten Repeat (32 dB)	0.125	dB Maximum	<0.125 dB	
3.13.2	Band Switching Time	700	Nanosec Maximum	<400 nS	
3.14	+5 VDC Current	250	Milliamps Maximum	450 mA	OUL
3.14	+12 VDC Current	3000	Milliamps Maximum	2.10 A	
3.14	-15 VDC Current	250	Milliamps Maximum	200 mA	
3.14	DCV Ripple (p-p)	250	MV 40kHz – 40 MHz	250 mV	
4.0	Mechanical	In Accordance With (IAW) Fig. 2			
5.0	Environmental	N/A			
6.0	Test Data	IAW Contract			
7.0	Reparability	IAW Contract or This SCD			

PRODUCTION MANAGER APPROVAL: M Heviazin DATED: 07/15/04

QA / QC APPROVAL: K. Voller DATED: 7/15/04

EXCEPTIONS NOTED

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SUMMARY TEST DATA
ON
HIGH BAND DIRECTION FINDING MODULE (HBDFM)

CUSTOMER:	CUBIC DEFENSE SYSTEMS, INC.	JOB NO:	P301002E
MODEL NO:	HBDFM-218-BD-DP	TESTED BY:	R.AFABLE RA
PART NO:	62-9115A0028-0001	TEMPERATURE:	+25°C
SERIAL NO:	PM407473	DATE:	7/23/04

Table 1 - Standard Test Conditions

PARAGRAPH	PARAMETER	VALUE	UNITS
3.1	Frequency Range	2.0 – 18.0	GHz
3.2	RF Input Power	0 to +3	dBm
3.3	Spurious RF Input	-60	DBc Maximum
3.3	Harmonic RF Input	-10	DBc Maximum
3.4	Input Signal / Noise	70	dB Minimum

Table 2 – Test Results

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.5	With +5dBm Input and P(out) CP ≤ 0.9 dB	+21.0	dBm Minimum	+18.0 dBm	ULL
3.6	Output Spurious	-60	dBc Maximum	>-60 dBc	
3.6	Output Harmonics	-60	dBc Maximum	>-55 dBc	
3.7	Noise Figure	8.5	dB Maximum	8.5 dB	
3.8	Amplitude Taper	8.0	dB p-p Maximum	10.5 dB	
3.9	Fine Grain Flatness	3.0	dB p-p Maximum	1.0 dB	
3.10	VSWR Input / Output	2.0:1	Ratio Maximum	1.72:1	
3.11.1	P-Mod Control	Low=Loss	TTL "0" = Low	"0" =LOW	
3.11.2	P-Mod Isolation	-60	dBc Maximum	-70 dBc	
3.11.3	P-Mod Rise/Fall Time	10	Nanosec Maximum	4nS/10nS	
3.11.4	P-Mod Delay Time	N/A	Not Specified	-	
3.11.5	P-Mod Delay Sym	10	Nanosec Maximum	28 nS	OUL
3.11.6	P-Mod Video Gen.	-60	dBm Maximum	>-60 dBm	
3.12.1	Atten. Range	64	dB Mean	64 dB	
3.12.2	Number of Bits	8	Absolute	8	
3.12.3	LSB Value	0.25	dB Nominal	0.25	
3.12.4	TTL Control (+ True)	b0=LSB	Absolute	b0=LSB	
3.12.5	Resolution	0.25	dB Absolute	0.25 dB	
3.12.6	Commands	0=00h	dB Relative	0=00h	
3.12.7	0 – 20dB Flatness	± 1.0	dB Maximum	± 1.60 dB	@ 20dB
3.12.7	20 – 40dB Flatness	± 2.0	dB Maximum	± 2.10 dB	@ 40dB
3.12.7	40 – 60dB Flatness	± 3.0	dB Maximum	± 3.65 dB	@ 60dB
3.12.7	60 – 64dB Flatness	± 4.0	dB Maximum	± 4.10 dB	OUL

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SERIAL NO: PM407473

MODEL NO: HBDFM-218-BD-DP PART NO: 02-9115A0028-0001

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.12.8	0 – 20dB Accuracy	± 1.0	dB Maximum	± 1.0 dB	
3.12.8	20 – 40dB Accuracy	± 1.5	dB Maximum	± 0.45 dB	
3.12.8	40 – 60dB Accuracy	± 2.0	dB Maximum	± 0.43 dB	
3.12.8	60 – 64dB Accuracy	± 3.0	dB Maximum	± 0.53 dB	
3.12.9	Atten. Switching Time	700	Nanosec Maximum	<700 nS	
3.12.10	Atten. Repeat (1 dB)	0.125	dB Maximum	<0.125 dB	
3.12.10	Atten Repeat (32 dB)	0.125	dB Maximum	<0.125 dB	
3.13.2	Band Switching Time	700	Nanosec Maximum	<400 nS	
3.14	+5 VDC Current	250	Milliamps Maximum	420 mA	OUL
3.14	+12 VDC Current	3000	Milliamps Maximum	2.00 A	
3.14	-15 VDC Current	250	Milliamps Maximum	180 mA	
3.14	DCV Ripple ((p-p)	250	MV 40kHz – 40 MHz	250 mV	
4.0	Mechanical	In Accordance With (IAW) Fig. 2			
5.0	Environmental	N/A			
6.0	Test Data	IAW Contract			
7.0	Reparability	IAW Contract or This SCD			

PRODUCTION MANAGER APPROVAL: M Weirman DATED: 7/23/04

QA / QC APPROVAL: K. Voyler DATED: 7/23/04
(EXCEPTION IS NOTED)

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MODEL NO: HBDFM-218-BD-DP PART NO: 62-9115A0028-0001

FORM: HBDFM-FINAL-DTA

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SUMMARY TEST DATA ON HIGH BAND DIRECTION FINDING MODULE (HBDFM)

CUSTOMER:	CUBIC DEFENSE SYSTEMS, INC.	JOB NO:	P301002E
MODEL NO:	HBDFM-218-BD-DP	TESTED BY:	DAN VESCUSO
PART NO:	62-9115A0028-0001	TEMPERATURE:	25°C
SERIAL NO:	PM403284	DATE:	4/7/04

Table 1 - Standard Test Conditions

PARAGRAPH	PARAMETER	VALUE	UNITS
3.1	Frequency Range	2.0 – 18.0	GHz
3.2	RF Input Power	0 to +3	dBm
3.3	Spurious RF Input	-60	dBc Maximum
3.3	Harmonic RF Input	-10	dBc Maximum
3.4	Input Signal / Noise	70	dB Minimum

Table 2 – Test Results

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.5	With +5dBm Input and P(out) CP ≤ 0.9 dB	+21.0	dBm Minimum	19.0 dBm	
3.6	Output Spurious	-60	dBc Maximum	> 70 dBc	
3.6	Output Harmonics	-60	dBc Maximum	> 60 dBc*	*-58 dBc @ 7-7.4 GHz
3.7	Noise Figure	8.5	dB Maximum	7 dB	
3.8	Amplitude Taper	8.0	dB p-p Maximum	10 dB p-p	
3.9	Fine Grain Flatness	3.0	dB p-p Maximum	0.5 dB p-p	
3.10	VSWR Input / Output	2.0:1	Ratio Maximum	1.8:1 In / 2.2 Out*	*3.0 @ 8.8 GHz *3.7 @ 18 GHz
3.11.1	P-Mod Control	Low=Loss	TTL "0" = Low	PASS	
3.11.2	P-Mod Isolation	-60	dBc Maximum	-70 dBc	
3.11.3	P-Mod Rise/Fall Time	10	Nanosec Maximum	35 ns	
3.11.4	P-Mod Delay Time	N/A	Not Specified	Not Measured	
3.11.5	P-Mod Delay Sym	10	Nanosec Maximum	15 ns	
3.11.6	P-Mod Video Gen.	-60	dBm Maximum	> 70 @ >500 MHz	
3.12.1	Atten. Range	64	dB Mean	PASS	
3.12.2	Number of Bits	8	Absolute	PASS	
3.12.3	LSB Value	0.25	dB Nominal	PASS	
3.12.4	TTL Control (+ True)	b0=LSB	Absolute	PASS	
3.12.5	Resolution	0.25	dB Absolute	PASS	

MODEL NO: HBDFM-218-BD-DP PART NO: 62-9115A0028-0001

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.12.6	Commands	0–00h	dB Relative	PASS	
3.12.7	0 – 20dB Flatness	± 1.0	dB Maximum	± 0.2	
3.12.7	20 – 40dB Flatness	± 2.0	dB Maximum	± 1.75	
3.12.7	40 – 60dB Flatness	± 3.0	dB Maximum	± 2.2	
3.12.7	60 – 64dB Flatness	± 4.0	dB Maximum	± 4.0	
3.12.8	0 – 20dB Accuracy	± 1.0	dB Maximum	± 0.2	
3.12.8	20 – 40dB Accuracy	± 1.5	dB Maximum	± 0.1	
3.12.8	40 – 60dB Accuracy	± 2.0	dB Maximum	± 0.5	
3.12.8	60 – 64dB Accuracy	± 3.0	dB Maximum	± 1.0	
3.12.9	Atten. Switching Time	700	Nanosec Maximum	600 ns	
3.12.10	Atten. Repeat (1 dB)	0.125	dB Maximum	0.05 dB	
3.12.10	Atten Repeat (32 dB)	0.125	dB Maximum	0.05 dB	
3.13.2	Band Switching Time	700	Nanosec Maximum	400 ns	
3.14	+5 VDC Current	250	Milliamps Maximum	420 mA / 590 mA*	*Park Mode
3.14	+12 VDC Current	3000	Milliamps Maximum	1.95 A	
3.14	-15 VDC Current	250	Milliamps Maximum	170 mA	
3.14	DCV Ripple ((p-p)	250	MV 40kHz – 40 MHz	PASS	
4.0	Mechanical	In Accordance With (IAW) Fig. 2		PASS	
5.0	Environmental	N/A			
6.0	Test Data	IAW Contract			
7.0	Reparability	IAW Contract or This SCD			

PRODUCTION MANAGER APPROVAL: M Noriasu DATED: 4/7/04

QA / QC APPROVAL: R. Dow DATED: 4/7/04

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MODEL NO: HBDFM-218-BD-DP PART NO: 62-9115A0028-0001

FORM: HBDFM-FINAL-DTA

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SUMMARY TEST DATA ON HIGH BAND DIRECTION FINDING MODULE (HBDFM)

CUSTOMER:	CUBIC DEFENSE SYSTEMS, INC.	JOB NO:	P301002E
MODEL NO:	HBDFM-218-BD-DP	TESTED BY:	DAN VESCUSO
PART NO:	62-9115A0028-0001	TEMPERATURE:	25°C
SERIAL NO:	PM403285	DATE:	4/7/04

Table 1 - Standard Test Conditions

PARAGRAPH	PARAMETER	VALUE	UNITS
3.1	Frequency Range	2.0 – 18.0	GHz
3.2	RF Input Power	0 to +3	dBm
3.3	Spurious RF Input	-60	dBc Maximum
3.3	Harmonic RF Input	-10	dBc Maximum
3.4	Input Signal / Noise	70	dB Minimum

Table 2 – Test Results

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.5	With +5dBm Input and P(out) CP ≤ 0.9 dB	+21.0	dBm Minimum	20.0 dBm	
3.6	Output Spurious	-60	dBc Maximum	> 70 dBc	
3.6	Output Harmonics	-60	dBc Maximum	> 60 dBc*	*-58 dBc @ 7-7.4 GHz
3.7	Noise Figure	8.5	dB Maximum	7 dB	
3.8	Amplitude Taper	8.0	dB p-p Maximum	10 dB p-p	
3.9	Fine Grain Flatness	3.0	dB p-p Maximum	0.5 dB p-p	
3.10	VSWR Input / Output	2.0:1	Ratio Maximum	2.0:1 In / 2.5 Out	
3.11.1	P-Mod Control	Low=Loss	TTL "0" = Low	PASS	
3.11.2	P-Mod Isolation	-60	dBc Maximum	-70 dBc	
3.11.3	P-Mod Rise/Fall Time	10	Nanosec Maximum	10 ns	
3.11.4	P-Mod Delay Time	N/A	Not Specified	Not Measured	
3.11.5	P-Mod Delay Sym	10	Nanosec Maximum	4 ns	
3.11.6	P-Mod Video Gen.	-60	dBm Maximum	> 70 @ >500 MHz	
3.12.1	Atten. Range	64	dB Mean	PASS	
3.12.2	Number of Bits	8	Absolute	PASS	
3.12.3	LSB Value	0.25	dB Nominal	PASS	
3.12.4	TTL Control (+ True)	b0=LSB	Absolute	PASS	
3.12.5	Resolution	0.25	dB Absolute	PASS	

Page 1 of 2

MODEL NO: HBDFM-218-BD-DP PART NO: 62-9115A0028-0001

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.12.6	Commands	0=00h	dB Relative	PASS	
3.12.7	0 – 20dB Flatness	± 1.0	dB Maximum	± 0.5	
3.12.7	20 – 40dB Flatness	± 2.0	dB Maximum	± 3.5	
3.12.7	40 – 60dB Flatness	± 3.0	dB Maximum	± 4.0	
3.12.7	60 – 64dB Flatness	± 4.0	dB Maximum	± 3.5	
3.12.8	0 – 20dB Accuracy	± 1.0	dB Maximum	± 0.1	
3.12.8	20 – 40dB Accuracy	± 1.5	dB Maximum	± 0.5	
3.12.8	40 – 60dB Accuracy	± 2.0	dB Maximum	± 0.5	
3.12.8	60 – 64dB Accuracy	± 3.0	dB Maximum	± 1.0	
3.12.9	Atten. Switching Time	700	Nanosec Maximum	600 ns	
3.12.10	Atten. Repeat (1 dB)	0.125	dB Maximum	0.05 dB	
3.12.10	Atten Repeat (32 dB)	0.125	dB Maximum	0.05 dB	
3.13.2	Band Switching Time	700	Nanosec Maximum	400 ns	
3.14	+5 VDC Current	250	Milliamps Maximum	430 mA / 590 mA*	*Park Mode
3.14	+12 VDC Current	3000	Milliamps Maximum	2.1 A	
3.14	-15 VDC Current	250	Milliamps Maximum	170 mA	
3.14	DCV Ripple ((p-p)	250	MV 40kHz – 40 MHz	PASS	
4.0	Mechanical	In Accordance With (IAW) Fig. 2		PASS	
5.0	Environmental	N/A			
6.0	Test Data	IAW Contract			
7.0	Reparability	IAW Contract or This SCD			

PRODUCTION MANAGER APPROVAL: M Williams **DATED:** 4/7/04

QA / QC APPROVAL: R Dow **DATED:** 4/7/04

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MODEL NO: HBDFM-218-BD-DP PART NO: 62-9115A0028-0001

FORM: HBDFM-FINAL-DTA

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SUMMARY TEST DATA ON HIGH BAND DIRECTION FINDING MODULE (HBDFM)

CUSTOMER:	CUBIC DEFENSE SYSTEMS, INC.	JOB NO:	P301002E
MODEL NO:	HBDFM-218-BD-DP	TESTED BY:	DAN VESCUSO
PART NO:	62-9115A0028-0001	TEMPERATURE:	25°C
SERIAL NO:	PM403286	DATE:	4/7/04

Table 1 - Standard Test Conditions

PARAGRAPH	PARAMETER	VALUE	UNITS
3.1	Frequency Range	2.0 – 18.0	GHz
3.2	RF Input Power	0 to +3	dBm
3.3	Spurious RF Input	-60	dBc Maximum
3.3	Harmonic RF Input	-10	dBc Maximum
3.4	Input Signal / Noise	70	dB Minimum

Table 2 – Test Results

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.5	With +5dBm Input and P(out) CP ≤ 0.9 dB	+21.0	dBm Minimum	>19.0 dBm	
3.6	Output Spurious	-60	dBc Maximum	> 70 dBc	
3.6	Output Harmonics	-60	dBc Maximum	> 60 dBc*	*-58 dBc @ 7-7.4 GHz
3.7	Noise Figure	8.5	dB Maximum	7 dB	
3.8	Amplitude Taper	8.0	dB p-p Maximum	10 dB p-p	
3.9	Fine Grain Flatness	3.0	dB p-p Maximum	0.5 dB p-p	
3.10	VSWR Input / Output	2.0:1	Ratio Maximum	1.8:1 In / 2.0:1 Out*	4.0:1 @ 10 GHz
3.11.1	P-Mod Control	Low=Loss	TTL "0" = Low	PASS	
3.11.2	P-Mod Isolation	-60	dBc Maximum	-70 dBc	
3.11.3	P-Mod Rise/Fall Time	10	Nanosec Maximum	35 ns	
3.11.4	P-Mod Delay Time	N/A	Not Specified	Not Measured	
3.11.5	P-Mod Delay Sym	10	Nanosec Maximum	15 ns	
3.11.6	P-Mod Video Gen.	-60	dBm Maximum	> 70 @ >500 MHz	
3.12.1	Atten. Range	64	dB Mean	PASS	
3.12.2	Number of Bits	8	Absolute	PASS	
3.12.3	LSB Value	0.25	dB Nominal	PASS	
3.12.4	TTL Control (+ True)	b0=LSB	Absolute	PASS	
3.12.5	Resolution	0.25	dB Absolute	PASS	

Page 1 of 2

MODEL NO: HBDFM-218 "D-DP PART "O: 62-9115A0028-0001

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.12.6	Commands	0=00h	dB Relative	PASS	
3.12.7	0 – 20dB Flatness	± 1.0	dB Maximum	± 0.25	
3.12.7	20 – 40dB Flatness	± 2.0	dB Maximum	± 1.5	
3.12.7	40 – 60dB Flatness	± 3.0	dB Maximum	± 1.5	
3.12.7	60 – 64dB Flatness	± 4.0	dB Maximum	± 4.0	
3.12.8	0 – 20dB Accuracy	± 1.0	dB Maximum	± 0.1	
3.12.8	20 – 40dB Accuracy	± 1.5	dB Maximum	± 0.5	
3.12.8	40 – 60dB Accuracy	± 2.0	dB Maximum	± 0.5	
3.12.8	60 – 64dB Accuracy	± 3.0	dB Maximum	± 1.0	
3.12.9	Atten. Switching Time	700	Nanosec Maximum	600 ns	
3.12.10	Atten. Repeat (1 dB)	0.125	dB Maximum	0.05 dB	
3.12.10	Atten Repeat (32 dB)	0.125	dB Maximum	0.05 dB	
3.13.2	Band Switching Time	700	Nanosec Maximum	400 ns	
3.14	+5 VDC Current	250	Milliamps Maximum	420 mA / 730 mA*	*Park Mode
3.14	+12 VDC Current	3000	Milliamps Maximum	2.1 A	
3.14	-15 VDC Current	250	Milliamps Maximum	180 mA	
3.14	DCV Ripple ((p-p)	250	MV 40kHz – 40 MHz	PASS	
4.0	Mechanical	In Accordance With (IAW) Fig. 2		PASS	
5.0	Environmental	N/A			
6.0	Test Data	IAW Contract			
7.0	Reparability	IAW Contract or This SCD			

PRODUCTION MANAGER APPROVAL: M Nuriasin DATED: 4/7/04

QA / QC APPROVAL: R. Dan DATED: 4/7/04

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MODEL NO: HBDFM-218-BD-DP PART NO: 62-9115A0028-0001

FORM: HBDFM-FINAL-DTA

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SUMMARY TEST DATA ON HIGH BAND DIRECTION FINDING MODULE (HBDFM)

CUSTOMER:	CUBIC DEFENSE SYSTEMS, INC.	JOB NO:	P301002E
MODEL NO:	HBDFM-218-BD-DP	TESTED BY:	DAN VESCUSO
PART NO:	62-9115A0028-0001	TEMPERATURE:	25°C
SERIAL NO:	PM403287	DATE:	4/7/04

Table 1 - Standard Test Conditions

PARAGRAPH	PARAMETER	VALUE	UNITS
3.1	Frequency Range	2.0 – 18.0	GHz
3.2	RF Input Power	0 to +3	dBm
3.3	Spurious RF Input	-60	dBc Maximum
3.3	Harmonic RF Input	-10	dBc Maximum
3.4	Input Signal / Noise	70	dB Minimum

Table 2 – Test Results

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.5	With +5dBm Input and P(out) CP ≤ 0.9 dB	+21.0	dBm Minimum	>21.0 dBm	
3.6	Output Spurious	-60	dBc Maximum	> 70 dBc	
3.6	Output Harmonics	-60	dBc Maximum	> 60 dBc*	*-58 dBc @ 7-7.4 GHz
3.7	Noise Figure	8.5	dB Maximum	7 dB	
3.8	Amplitude Taper	8.0	dB p-p Maximum	10 dB p-p	
3.9	Fine Grain Flatness	3.0	dB p-p Maximum	2.0 dB p-p	
3.10	VSWR Input / Output	2.0:1	Ratio Maximum	1.85:1 In / 2.5:1 Out*	3.3:1 @ 10 GHz
3.11.1	P-Mod Control	Low=Loss	TTL "0" = Low	PASS	
3.11.2	P-Mod Isolation	-60	dBc Maximum	-62 dBc	
3.11.3	P-Mod Rise/Fall Time	10	Nanosec Maximum	9 ns RISE / 6 ns FALL	
3.11.4	P-Mod Delay Time	N/A	Not Specified	Not Measured	
3.11.5	P-Mod Delay Sym	10	Nanosec Maximum	4 ns	
3.11.6	P-Mod Video Gen.	-60	dBm Maximum	> 70 @ >500 MHz	
3.12.1	Atten. Range	64	dB Mean	PASS	
3.12.2	Number of Bits	8	Absolute	PASS	
3.12.3	LSB Value	0.25	dB Nominal	PASS	
3.12.4	TTL Control (+ True)	b0=LSB	Absolute	PASS	
3.12.5	Resolution	0.25	dB Absolute	PASS	

Page 1 of 2

MODEL NO: HBDFM-218-BD-DP PART NO: 62-9115A0028-0001

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.12.6	Commands	0=00h	dB Relative	PASS	
3.12.7	0 – 20dB Flatness	± 1.0	dB Maximum	± 1.0	
3.12.7	20 – 40dB Flatness	± 2.0	dB Maximum	± 3.0	
3.12.7	40 – 60dB Flatness	± 3.0	dB Maximum	± 2.5	
3.12.7	60 – 64dB Flatness	± 4.0	dB Maximum	± 3.5	
3.12.8	0 – 20dB Accuracy	± 1.0	dB Maximum	± 0.2	
3.12.8	20 – 40dB Accuracy	± 1.5	dB Maximum	± 0.2	
3.12.8	40 – 60dB Accuracy	± 2.0	dB Maximum	± 0.4	
3.12.8	60 – 64dB Accuracy	± 3.0	dB Maximum	± 0.5	
3.12.9	Atten. Switching Time	700	Nanosec Maximum	600 ns	
3.12.10	Atten. Repeat (1 dB)	0.125	dB Maximum	0.05 dB	
3.12.10	Atten Repeat (32 dB)	0.125	dB Maximum	0.05 dB	
3.13.2	Band Switching Time	700	Nanosec Maximum	400 ns	
3.14	+5 VDC Current	250	Milliamps Maximum	420 mA / 580 mA*	*Park Mode
3.14	+12 VDC Current	3000	Milliamps Maximum	2.1 A	
3.14	-15 VDC Current	250	Milliamps Maximum	170 mA	
3.14	DCV Ripple ((p-p)	250	MV 40kHz – 40 MHz	PASS	
4.0	Mechanical	In Accordance With (IAW) Fig. 2		PASS	
5.0	Environmental	N/A			
6.0	Test Data	IAW Contract			
7.0	Reparability	IAW Contract or This SCD			

PRODUCTION MANAGER APPROVAL: M Nyriasu DATED: 4/7/04

QA / QC APPROVAL: L. Doe DATED: 4/7/04

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MODEL NO: HBDFM-218-BD-DP PART NO: 62-9115A0028-0001

FORM: HBDFM-FINAL-DTA

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SUMMARY TEST DATA ON HIGH BAND DIRECTION FINDING MODULE (HBDFM)

CUSTOMER: CUBIC DEFENSE SYSTEMS, INC.
MODEL NO: HBDFM-218-BD-DP
PART NO: 62-9115A0028-0001
SERIAL NO: PM403288

JOB NO: P301002E
TESTED BY: DAN VESCUSO
TEMPERATURE: 25°C
DATE: 4/12/04

Table 1 - Standard Test Conditions

PARAGRAPH	PARAMETER	VALUE	UNITS
3.1	Frequency Range	2.0 – 18.0	GHz
3.2	RF Input Power	0 to +3	dBm
3.3	Spurious RF Input	-60	dBc Maximum
3.3	Harmonic RF Input	-10	dBc Maximum
3.4	Input Signal / Noise	70	dB Minimum

Table 2 – Test Results

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.5	With +5dBm Input and P(out) CP ≤ 0.9 dB	+21.0	dBm Minimum	>20.0 dBm	
3.6	Output Spurious	-60	dBc Maximum	> 70 dBc	
3.6	Output Harmonics	-60	dBc Maximum	> 60 dBc*	*>-57 dBc @ 7.35 GHz
3.7	Noise Figure	8.5	dB Maximum	7 dB	
3.8	Amplitude Taper	8.0	dB p-p Maximum	SEE PLOTS	
3.9	Fine Grain Flatness	3.0	dB p-p Maximum	0.2 dB p-p	
3.10	VSWR Input / Output	2.0:1	Ratio Maximum	1.8:1 In / Out*	*SEE PLOT
3.11.1	P-Mod Control	Low=Loss	TTL "0" = Low	PASS	
3.11.2	P-Mod Isolation	-60	dBc Maximum	-68 dBc	
3.11.3	P-Mod Rise/Fall Time	10	Nanosec Maximum	12 ns RISE / 5 ns FALL	
3.11.4	P-Mod Delay Time	N/A	Not Specified	Not Measured	
3.11.5	P-Mod Delay Sym	10	Nanosec Maximum	5 ns	
3.11.6	P-Mod Video Gen.	-60	dBm Maximum	70 dBm @ >500 MHz	
3.12.1	Atten. Range	64	dB Mean	PASS	
3.12.2	Number of Bits	8	Absolute	PASS	
3.12.3	LSB Value	0.25	dB Nominal	PASS	
3.12.4	TTL Control (+ True)	b0=LSB	Absolute	PASS	
3.12.5	Resolution	0.25	dB Absolute	PASS	

Page 1 of 2

MODEL NO: HBDFM-21* BD-DP PART NO: 62-9115A0028-0001

PARA.	PARAMETER	LIMIT(S)	UNITS	ACTUAL	REMARKS QA/QC
3.12.6	Commands	0=00h	dB Relative	PASS	
3.12.7	0 – 20dB Flatness	± 1.0	dB Maximum	± 0.7	
3.12.7	20 – 40dB Flatness	± 2.0	dB Maximum	± 2.5	
3.12.7	40 – 60dB Flatness	± 3.0	dB Maximum	± 2.2	
3.12.7	60 – 64dB Flatness	± 4.0	dB Maximum	± 3.7	
3.12.8	0 – 20dB Accuracy	± 1.0	dB Maximum	± 0.2	
3.12.8	20 – 40dB Accuracy	± 1.5	dB Maximum	± 0.5	
3.12.8	40 – 60dB Accuracy	± 2.0	dB Maximum	± 0.5	
3.12.8	60 – 64dB Accuracy	± 3.0	dB Maximum	± 0.6	
3.12.9	Atten. Switching Time	700	Nanosec Maximum	600 ns	
3.12.10	Atten. Repeat (1 dB)	0.125	dB Maximum	0.05 dB	
3.12.10	Atten Repeat (32 dB)	0.125	dB Maximum	0.05 dB	
3.13.2	Band Switching Time	700	Nanosec Maximum	400 ns	
3.14	+5 VDC Current	250	Milliamps Maximum	420 Ma / 590 mA*	*Park Mode
3.14	+12 VDC Current	3000	Milliamps Maximum	1.96 A	
3.14	-15 VDC Current	250	Milliamps Maximum	170 mA	
3.14	DCV Ripple (p-p)	250	MV 40kHz – 40 MHz	PASS	
4.0	Mechanical	In Accordance With (IAW) Fig. 2		PASS	
5.0	Environmental	N/A			
6.0	Test Data	IAW Contract			
7.0	Reparability	IAW Contract or This SCD			

PRODUCTION MANAGER APPROVAL: M Nuriasm DATED: 4/12/04

QA / QC APPROVAL: K. Vogler DATED: 4/12/04

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