ACME TESTING INC., 2002 VALLEY HWY, P.O. BOX 3, ACME, WASHINGTON 98220-0003 888-226-3837.

REPORT OF MEASUREMENTS
PART 15C - INTENTIONAL RADIATOR

DEVICE:	1 CHANNEL 2.4 GHZ DIRECT SEQUENCE SPREAD SPECTRUM TRANSCEIVER
MODEL:	inFOREmer HANDSET
MANUFACTURER:	INFORETECH GOLF TECHNOLOGY 2000 INC.
ADDRESS:	SUITE 214, 5500 – 152ND STREET SURREY BRITISH COLUMBIA CANADA V3S 8E7

THE DATA CONTAINED IN THIS REPORT WAS
COLLECTED ON 7 DECEMBER 1999 AND COMPILED BY:

PAUL G. SLAVENS
CHIEF EMC ENGINEER

WORK ORDER: 30003

1. General

1.1 Purpose

The purpose of this report is to show compliance to the FCC regulations for spread spectrum unlicensed devices operating under section 15.247 of the Code of Federal Regulations title 47.

1.2 Manufacturer

Company Name:	Inforetech Golf Technology 2000 Inc.
Contact:	Jennifer McKinley
Street Address:	Suite 214, 5500 – 152nd Street
City/Province:	Surrey British Columbia
Country/Postal Code:	Canada V3S 8E7
Telephone:	604 576-7442
Fax:	604 576-7460
E-mail:	jenn@inforetech.com

1.3 Test location

Company:	Acme Testing Inc.
Street Address:	2002 Valley Highway
Mailing Address:	PO Box 3
City/State/Zip:	Acme WA 98220-0003
Laboratory:	Test Site 2
Telephone:	888 226-3837
Fax:	360 595-2722
E-mail:	acmetest@acmetesting.com
Web:	www.acmetesting.com
Receipt of EUT:	23 December 1999

1.4 Test Personnel

Paul G. Slavens

2. Test Results Summary

Summary of Test Results
1 Channel 2.4 GHz Direct Sequence Spread Spectrum Transceiver, model inFOREmer Handset

Requirement	CFR Section	Test Result
Radiated Spurs < 15.209	15.205(b)	PASS
Conducted Emissions < 48.0 dBuV	15.207	PASS
6 dB BW > 500 kHz	15.247(a2)	PASS
Max Output Power < 1 W	15.247(a2b)	PASS
Conducted Spurious >-20 dBc	15.247(a2c)	PASS
Power Density < 8dBm in 3 kHz	15.247(a2d)	PASS
Process Gain > 10 dB	15.247(a2e)	PASS

The signed original of this report, supplied to the client, represents the only "official" copy. Retention of any additional copies (electronic or non-electronic media) is at Acme Testing's discretion to meet internal requirements only. The client has made the determination that EUT Condition, Characterization, and Mode of Operation are representative of production units, and meet the requirements of the specifications referenced herein.

Consistent with Industry practice, measurement and test equipment not directly involved in obtaining measurement results but having an impact on measurements (such as cable loss, antenna factors, etc.) is factored into the "Correction Factor" documented in certain test results. Instrumentation employed for testing meets tolerances consistent with known Industry Standards and Regulations.

The measurements contained in this report were made in accordance with the referenced standards and all applicable Public Notices received prior to the date of testing. Acme Testing assumes responsibility only for the accuracy and completeness of this data as it pertains to the sample tested.

_____ _____

Paul G. Slavens Date of Issuance
Chief EMC Engineer

3. Description of Equipment and Peripherals

3.1 Equipment Under Test (EUT)

Device:	1 Channel 2.4 GHz Direct Sequence Spread Spectrum Transceiver
Model Number:	inFOREmer Handset
Serial Number:	none
FCC ID:	OXKinFOREmer2000
Power:	Internal Battery
Grounding:	A/C
Antenna Distance:	3 meters

3.2 EUT Peripherals

None, the EUT is a stand alone device.

3.3 Description of Interface Cables

None, the EUT is a stand alone device.

3.4 Mode of Operation During Tests

EUT was constantly transmitting a modulated signal during testing. The EUT was tested at only one frequency, as it is a one-channel device.

3.5 Modifications Required for Compliance

1. None.

4. Antenna requirement

4.1 Regulation

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

4.2 Result

The EUT uses a reverse threaded SMA connector designed specifically for FCC Part 15 compliance.

5. Conducted Emissions Tests

Test Requirement: FCC CFR47, Part 15C

Test Procedure: ANSI C63.4:1992

5.1 Test Equipment

⇒ Spectrum Analyzer: Hewlett-Packard 8566B, Serial Number 2410A-00168, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

⇒ RF Preselector: Hewlett-Packard 85685, Serial Number 2648A-00519, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

⇒ Quasi Peak Adapter: Hewlett-Packard 85650A, Serial Number 2043A-00327, Calibrated: 17 March 1999, Calibration due Date: 17 March 2000

⇒ Line Impedance Stabilization Network: Rhode & Schwarz ESH2-Z5, Serial Number ACMERS1, Calibrated: 1 September 1999, Calibration due Date: 01 September 2000

5.2 Purpose

The purpose of this test is to evaluate the level of conducted noise the EUT imposes on the AC mains.

5.3 Test Procedures

For tabletop equipment, the EUT is placed on a 1 meter by 1.5 meters wide and 0.8 meter high nonconductive table that is placed above the groundplane. Floor standing equipment is placed directly on the groundplane. Any supplemental grounding mechanisms are connected, if appropriate. The EUT is connected to its associated peripherals, with any excess I/O cabling bundled to approximately 1 meter. The EUT is connected to a dedicated LISN and all peripherals are connected to a second separate LISN circuit. The LISNs are bonded to the groundplane.

Preview tests are performed to determine the "worst case" mode of operation. With the EUT operating in "worst case" mode, final conducted measurements are taken. Conducted measurements are made on each current carrying conductor with respect to ground.

Conducted Emissions Test Characteristics	
Frequency range	0.45 MHz - 30.0 MHz
Test instrumentation resolution bandwidth	9 kHz
Lines Tested	Line 1/Line 2

5.4 Test Results

Not applicable, the EUT is DC Powered.

6. 6 dB Bandwidth

6.1 Regulation

15.247(a2) For direct sequence systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

6.2 Test Equipment

⇒ Spectrum Analyzer: Hewlett-Packard 8566B, Serial Number 2410A-00168, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

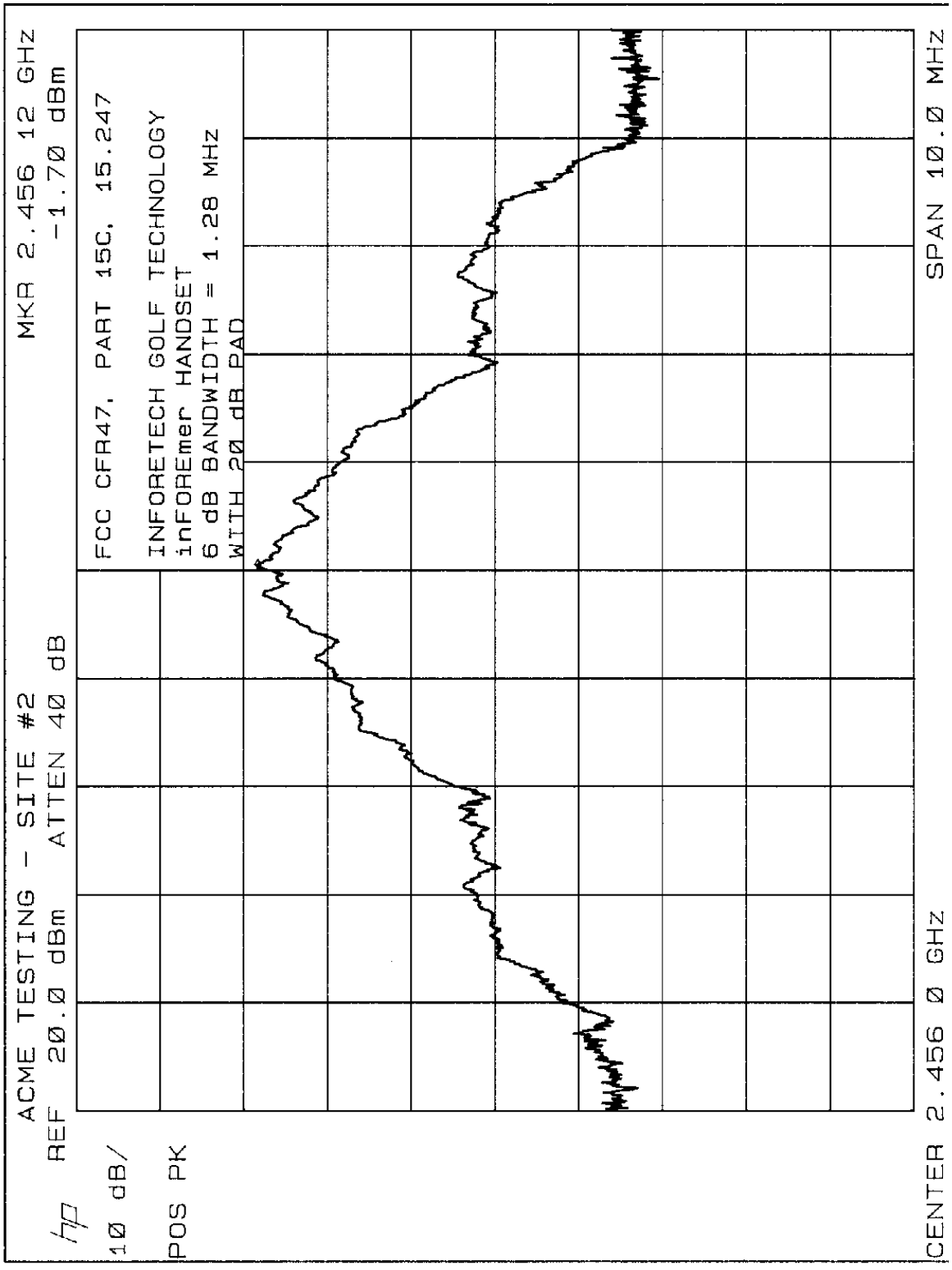
⇒ RF Preselector: Hewlett-Packard 85685, Serial Number 2648A-00519, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

6.3 Test Procedures

The RF output of the EUT is connected to the RF input port of the RF preselector through a 10 dB pad. The following measurements were made with a RBW = 100 kHz and VBW = 300 KHz.

6.4 Test Results

The 6 dB bandwidth is 1.28 MHz.


ACME TESTING - SITE #2
MKR 2.456 12 GHz
-1.70 dBm
REF 20.0 dBm
ATTEN 40 dB
10 dB/
POS PK
FCC CFR47, PART 15C, 15.247
INFORETECH GOLF TECHNOLOGY
inFOREmer HANDSET
6 dB BANDWIDTH = 1.28 MHz
WITH 20 dB PAD
CENTER 2.456 0 GHz
SPAN 10.0 MHz

7. Power Output

7.1 Regulation

15.247(b1) The maximum peak output power of the intentional radiator shall not exceed the following: For frequency hopping systems operating in the 2400-2483.5 MHz or 5725-5850 MHz band and for all direct sequence systems: 1 watt.

7.2 Test Equipment

⇒ Spectrum Analyzer: Hewlett-Packard 8566B, Serial Number 2410A-00168, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

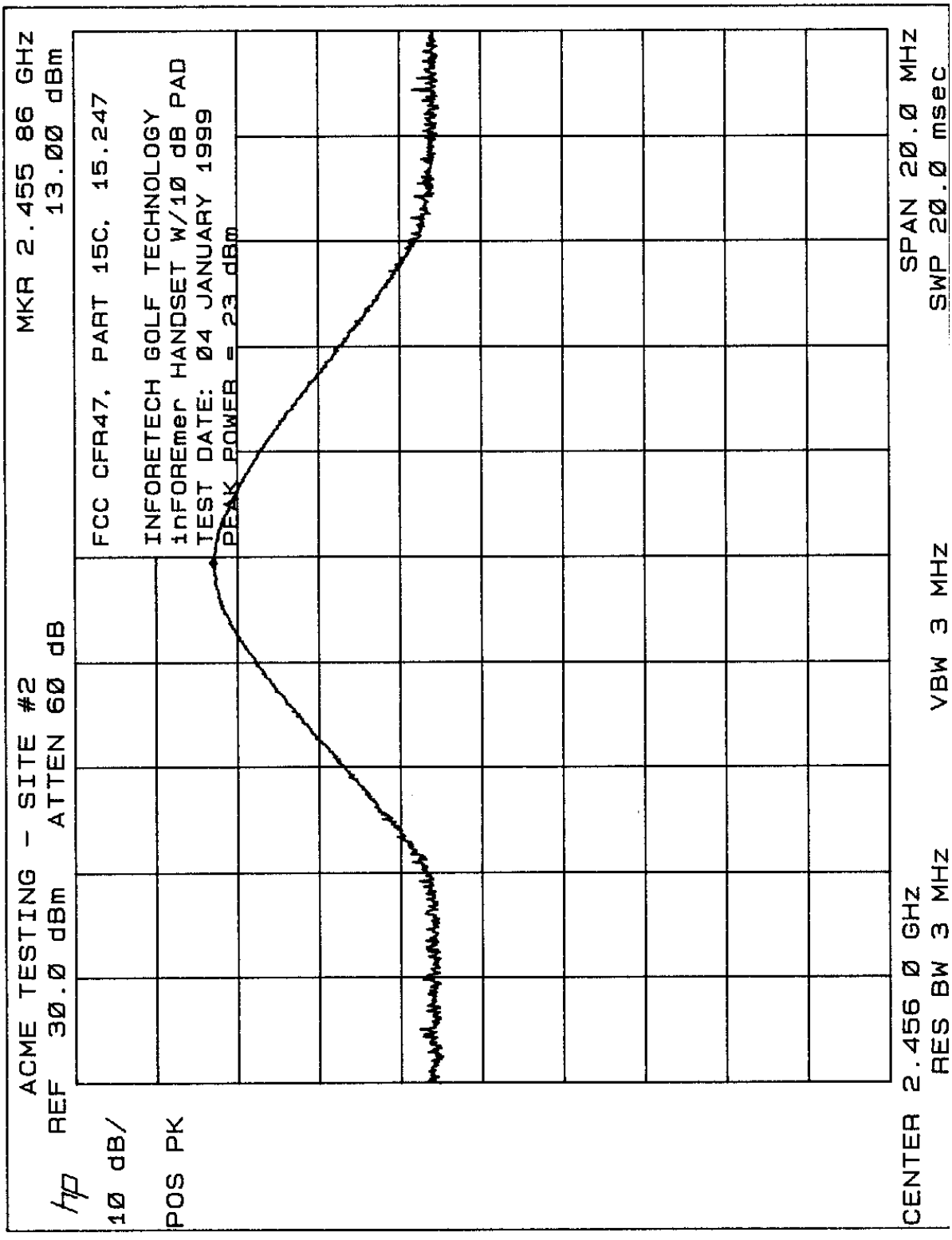
⇒ RF Preselector: Hewlett-Packard 85685, Serial Number 2648A-00519, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

7.3 Test Procedures

The RF output of the EUT is connected to the RF input port of the RF preselector through a 10 dB pad. The following measurements were made with a RBW = 3 MHz and VBW = 3 MHz.

7.4 Test Results

Measured maximum Peak Envelope Power was 23.0 dBm.


ACME TESTING - SITE #2
REF 30.0 dBm ATTEN 60 dB
10 dB/
POS PK
MKR 2.455 86 GHz
13.00 dBm
FCC CFR47, PART 15C, 15.247
INFORETECH GOLF TECHNOLOGY
inFOREmer HANDSET W/10 dB PAD
TEST DATE: 04 JANUARY 1999
PEAK POWER = 23 dBm
CENTER 2.456 0 GHz
RES BW 3 MHz
VBW 3 MHz
SPAN 20.0 MHz
SWP 20.0 msec

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8. Antenna gain requirements

8.1 Regulation

15.247(b3) Except as shown below, if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the above stated values by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(i) Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

(ii) Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

(iii) Fixed, point-to-point operation, as used in paragraphs (b)(3)(i) and (b)(3)(ii) of this section, excludes the use of point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

8.2 Result

The EUT uses a standard ¼ wave monopole with a gain of 2.2 dBi.

9. Radio Frequency exposure

9.1 Regulation

15.247(b4) Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See §1.1307(b)(1) of this Chapter.

9.2 Result

According to par 1.1307b(1), the inFOREmer Handset does not require an environmental evaluation.

1. This equipment classification is not present within table 1 of part 1.1307 and is not listed in section 1.1307b(2).
2. The inFOREmer Handset categorically exempt from routine environmental evaluation per section 2.1093.

Included are calculations that determine that minimum distance (R) from the transmitter antenna that will ensure an exposure limit at or below the guidelines given in table 1 of part 1.1310 for the general population. The formula for these calculations are taken from OET Bulletin 65, edition 97-01, August 1997; "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields".

9.3 CALCULATIONS

Per Table 1 of Section 1.1310 the limit for general population exposure at 2.4 GHz is 1.0 mW/cm^2

Per OET Bulletin 65, edition 97-01 the formula for calculating power density is:
$S = P*G/4\pi R^2$
with
Power = 23.0 dBm = 199.5 mW
Gain of Antenna = 2.15 dBi or a numeric gain of 1.64
therefore
Solving for R gives a minimum safe distance of 6.4 cm

9.4 CONCLUSION

Holding the handset places the user's wrist approximately 20 cm from the antenna port. The user has no control over transmitter on time (the unit responds to the associated base station) and the "worst case" on time is 10 milliseconds every two seconds. This translates to a 0.5% duty cycle and applied to the 6.4 cm safe distance averaged over 30 seconds reduces 0.32 mm safe distance from the antenna.

10. Conducted Spurious Emissions

10.1 Regulation

15.247 (c) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

10.2 Test Equipment

⇒ Spectrum Analyzer: Hewlett-Packard 8566B, Serial Number 2410A-00168, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

⇒ RF Preselector: Hewlett-Packard 85685, Serial Number 2648A-00519, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

⇒ Quasi Peak Adapter: Hewlett-Packard 85650A, Serial Number 2043A-00327, Calibrated: 17 March 1999, Calibration due Date: 17 March 2000

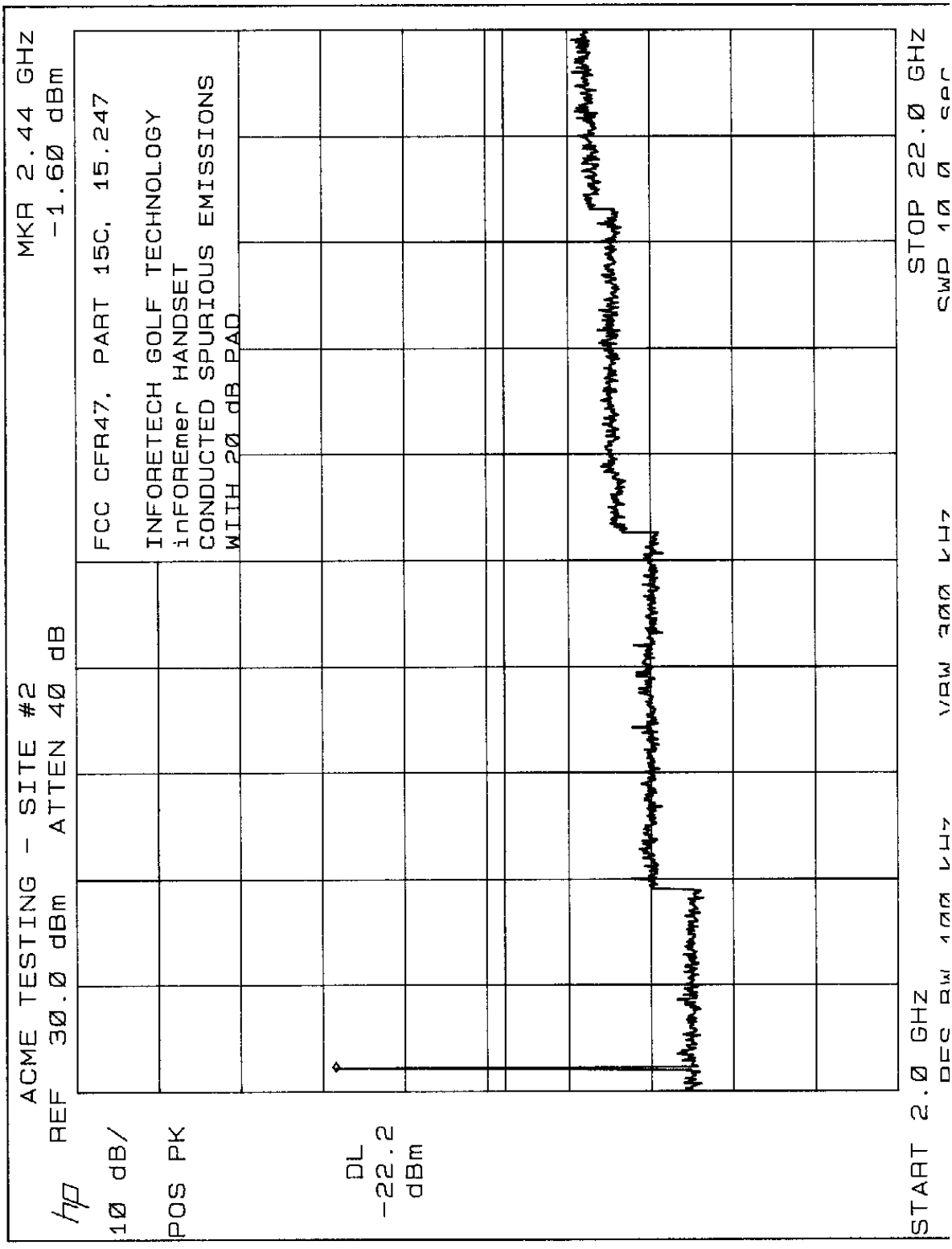
10.3 Test Procedures

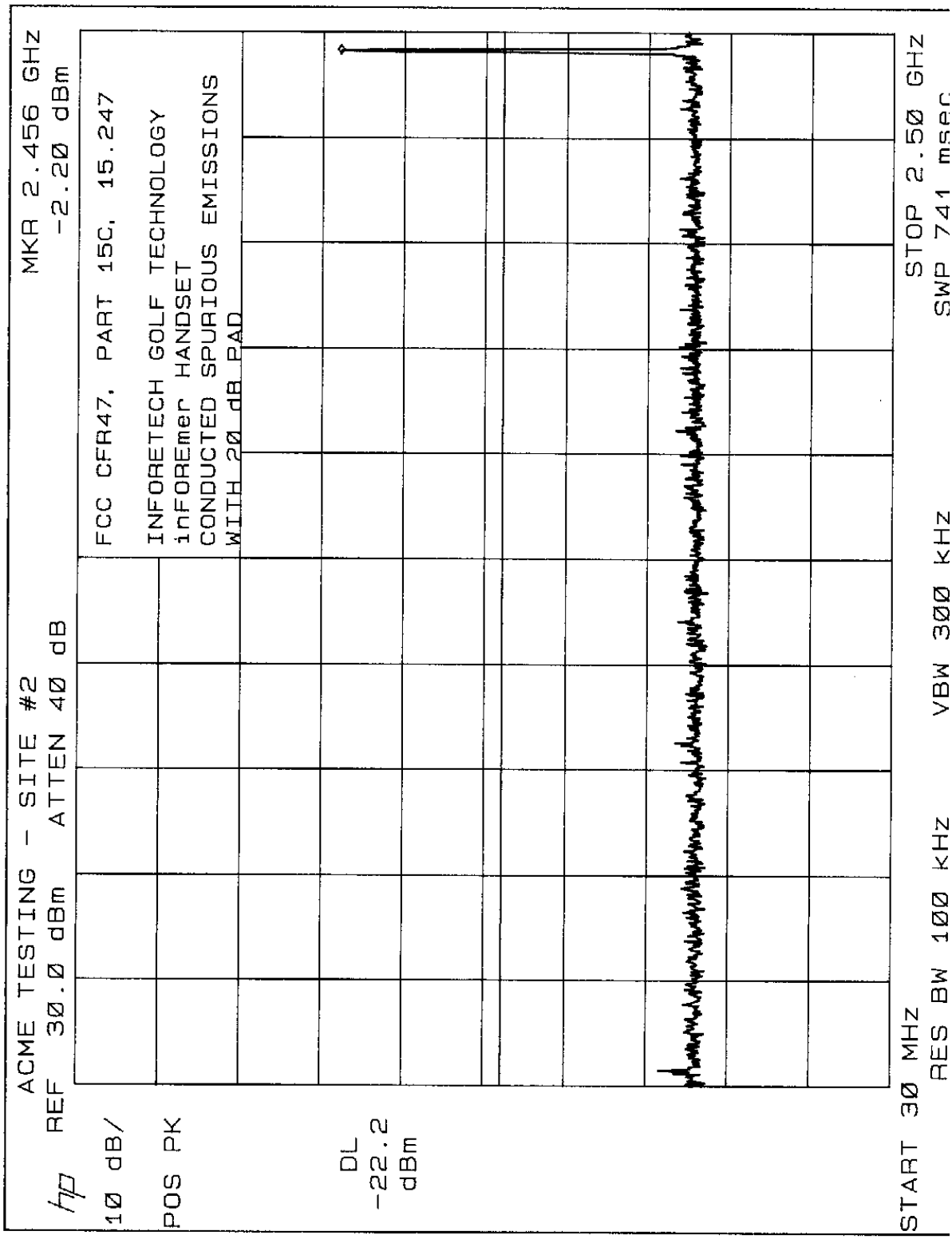
The RF output of the EUT is connected to the RF input port of the RF preselector through a 10 dB pad. The following measurements were made with a RBW = 100 kHz and VBW = 300 kHz.

10.4 Test Results

No out of band conducted emissions detected see plots

(Results continued on next page)


ACME TESTING - SITE #2
REF 30.0 dBm ATTEN 40 dB
MKR 2.44 GHz
-1.60 dBm
10 dB/
POS PK
DL
-22.2
dBm
FCC CFR47, PART 15C, 15.247
INFORETECH GOLF TECHNOLOGY
inFOREmer HANDSET
CONDUCTED SPURIOUS EMISSIONS
WITH 20 dB PAD
START 2.0 GHz
STOP 22.0 GHz


ACME TESTING - SITE #2
REF 30.0 dBm ATTEN 40 dB
MKR 2.456 GHz
-2.20 dBm
FCC CFR47, PART 15C, 15.247
INFORETECH GOLF TECHNOLOGY
inFOREmer HANDSET
CONDUCTED SPURIOUS EMISSIONS
WITH 20 dB PAD
10 dB/
POS PK
DL
-22.2
dBm
START 30 MHz
RES BW 100 kHz
VBW 300 kHz
STOP 2.50 GHz
SWP 741 msec

11. Radiated Spurious Emissions

11.1 Regulation

15.247 (c) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

11.2 Test Equipment

⇒ Spectrum Analyzer: Hewlett-Packard 8566B, Serial Number 2410A-00168, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

⇒ RF Preselector: Hewlett-Packard 85685, Serial Number 2648A-00519, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

⇒ Quasi Peak Adapter: Hewlett-Packard 85650A, Serial Number 2043A-00327, Calibrated: 17 March 1999, Calibration due Date: 17 March 2000

⇒ Line Impedance Stabilization Network: Rhode & Schwarz ESH2-Z5, Serial Number ACMERS1, Calibrated: 1 September 1999, Calibration due Date: 01 September 2000

⇒ Broadband Biconical Antenna (20 MHz to 200 MHz): EMCO 3110, Serial Number 1115, Calibrated: 28 December 1999, Calibration due Date: 28 December 2000

⇒ Broadband Log Periodic Antenna (200 MHz to 1000 MHz): EMCO 3146, Serial Number 2853, Calibrated: 28 December 1999, Calibration due Date: 28 December 2000

⇒ Pyramidal Horn Antenna: EMCO 3160-09, Serial Number 9701-1071, Calibration Not Required.

⇒ EUT Turntable Position Controller: EMCO 1061-3M, Serial Number 9003-1441, No Calibration Required

⇒ Antenna Mast: EMCO 1051, Serial Number 9002-1457, No Calibration Required

⇒ 2 GHz to 10 GHz Low Noise Preamplifier: Milliwave 593-2898, Serial Number 2494, No Calibration Required

⇒ Double Ridge Guide Horn Antenna: EMCO 3115, Serial Number 9807-5534, Calibrated: 30 December 1999, Calibration due Date: 30 December 2000

⇒ 8 GHz to 22 GHz Low Noise Preamplifier: Miteq AFS4-35LN, Serial Number 484280, Calibrated: 28 December 1998, Calibration due Date: 28 December 1999

11.3 Test Procedures

For tabletop equipment, the EUT is placed on a 1 meter by 1.5 meters wide and 0.8 meter high nonconductive table that sits on a flush mounted metal turntable. Floor standing equipment is placed directly on the flush mounted metal turntable. The EUT is connected to its associated peripherals with any excess I/O cabling bundled to approximately 1 meter.

Preview tests are performed to determine the "worst case" mode of operation. With the EUT operating in "worst case" mode, emissions from the unit are maximized by adjusting the polarization and height of the receive antenna and rotating the EUT on the turntable. Manipulating the system cables also maximizes EUT emissions.

Radiated Emissions Test Characteristics	
Frequency range	30 MHz - 22000 MHz **15.205 RESTRICTED BANDS ONLY**
Test distance	3 m
Test instrumentation resolution bandwidth	120 kHz (30 MHz – 10,000 MHz) 1 MHz (10,000 MHz - 22000 MHz)
Receive antenna scan height	1 m - 4 m
Receive antenna polarization	Vertical/Horizontal

11.4 Test Results

ALL DETECTABLE AVERAGE PRODUCT EMISSIONS

No	EMISSION FREQUENCY MHz	SPEC LIMIT dBuV/m	MEASUREMENTS ABS	dLIM dB	MODE	POL	SITE HGT cm	AZM deg	CORR FACTOR dB
1	4912.00	54.0	49.2	-4.8	AVG	V	100	304	14.7

ALL DETECTABLE PEAK PRODUCT EMISSIONS

No	EMISSION FREQUENCY MHz	SPEC LIMIT dBuV/m	MEASUREMENTS ABS	dLIM dB	MODE	POL	SITE HGT cm	AZM deg	CORR FACTOR dB
1	4912.00	74.0	53.2	-20.8	PK	V	100	304	14.7

12. Peak Power Spectral Density

12.1 Regulation

For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

12.2 Test Equipment

⇒ Spectrum Analyzer: Hewlett-Packard 8566B, Serial Number 2410A-00168, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

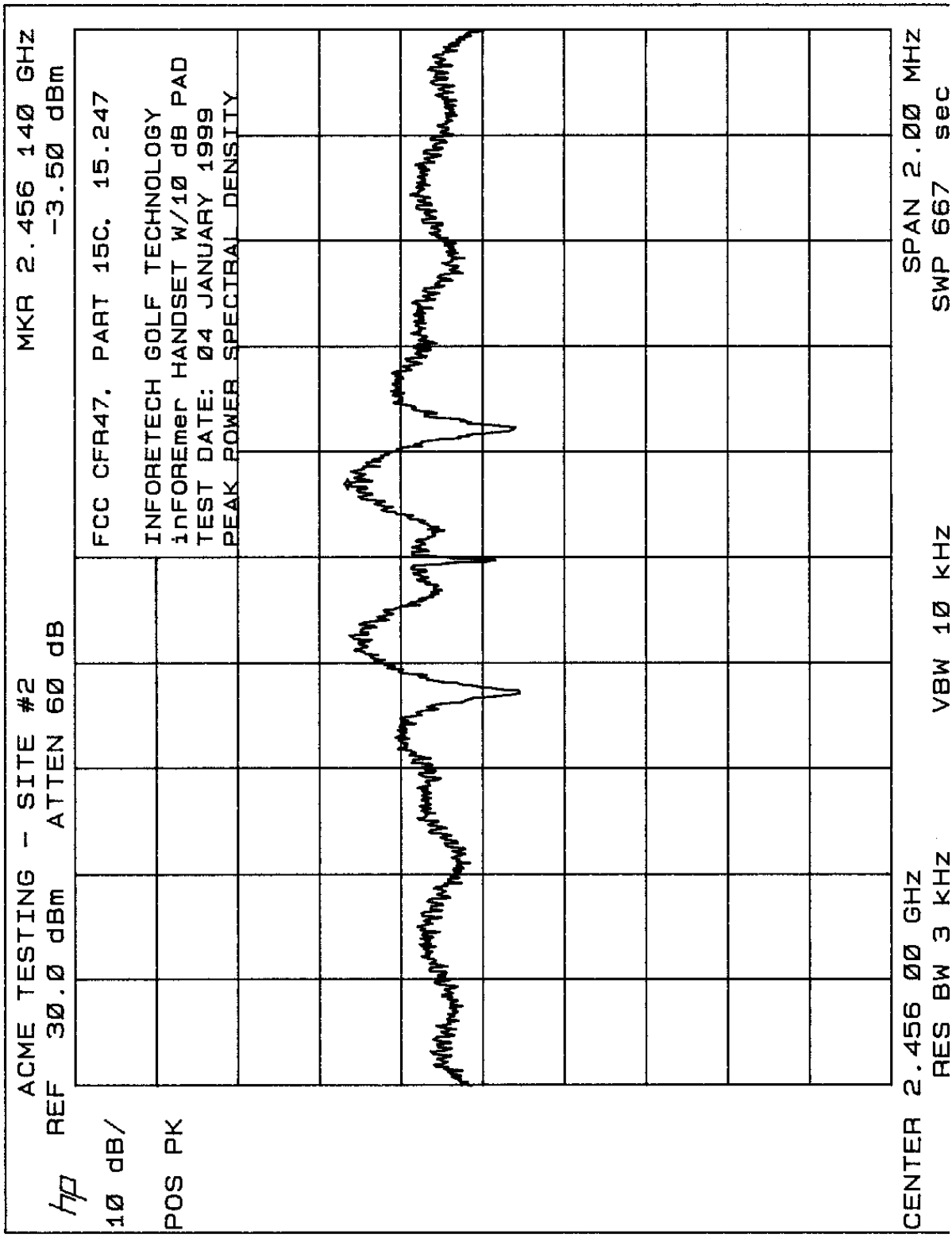
⇒ RF Preselector: Hewlett-Packard 85685, Serial Number 2648A-00519, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

12.3 Test Procedures

The RF output of the EUT is connected to the RF input port of the RF preselector through a 10 dB pad. The following measurements were made with a RBW = 3 kHz, VBW = 10 kHz and Sweep Time = 666 seconds.

12.4 Test Results

Maximum peak power spectral density is 6.5 dBm


ACME TESTING - SITE #2
MKR 2.456 140 GHz
-3.50 dBm
REF 30.0 dBm ATTEN 60 dB
10 dB/
POS PK
FCC CFR47, PART 15C, 15.247
INFORETECH GOLF TECHNOLOGY
inFOREmer HANDSET W/10 dB PAD
TEST DATE: 04 JANUARY 1999
PEAK POWER SPECTRAL DENSITY
CENTER 2.456 00 GHz
RES BW 3 kHz
VBW 10 kHz
SPAN 2.00 MHz
SWP 667 sec

13. Process gain requirements

13.1 Regulation

The processing gain of a direct sequence system shall be at least 10 dB. The processing gain represents the improvement to the received signal-to-noise ratio, after filtering to the information bandwidth, from the spreading/despreading function. The processing gain may be determined using one of the following methods:

(1) As measured at the demodulated output of the receiver: the ratio in dB of the signal-to-noise ratio with the system spreading code turned off to the signal-to-noise ratio with the system spreading code turned on.

(2) As measured using the CW jamming margin method: a signal generator is stepped in 50 kHz increments across the passband of the system, recording at each point the generator level required to produce the recommended Bit Error Rate (BER). This level is the jammer level. The output power of the intentional radiator is measured at the same point. The jammer to signal ratio (J/S) is then calculated, discarding the worst 20% of the J/S data points. The lowest remaining J/S ratio is used to calculate the processing gain as follows: Gp = (S/N)o + Mj + Lsys, where Gp = processing gain of the system, (S/N)o = signal-to-noise ratio required for the chosen BER, Mj = J/S ratio, and Lsys = system losses. Note that total losses in a system, including intentional radiator and receiver, should be assumed to be no more than 2 dB.

13.2 Result

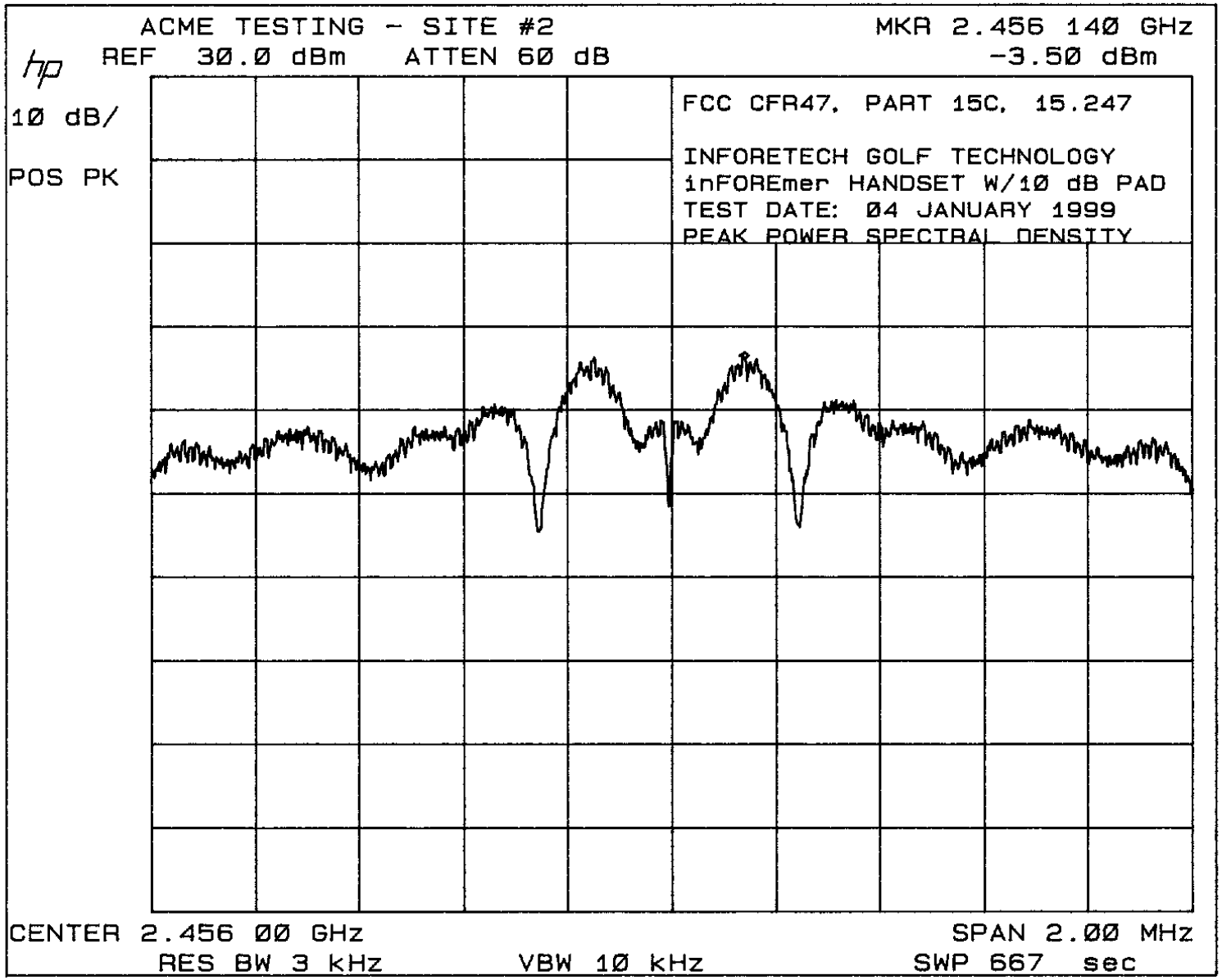
The original designers of the product performed the process gain measurement. The process gain of the product exceeds 10 dB.

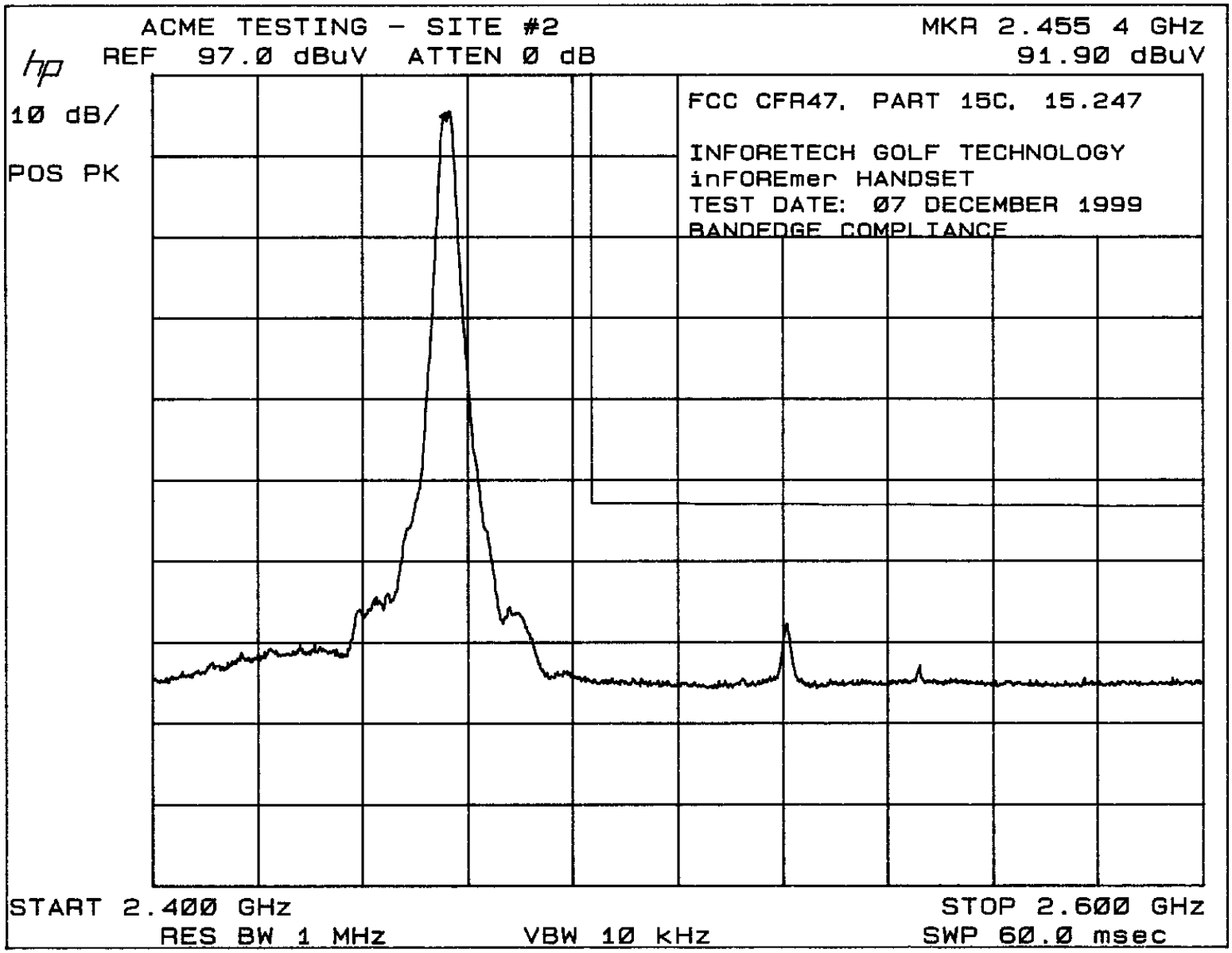
14. Miscellaneous Comments and Notes

1. None.

15. Attachments

1. Peak Power Spectral Density Plot. (1)
2. Bandedge Compliance Plot. (1)


ACME TESTING - SITE #2
MKR 2.456 140 GHz
REF 30.0 dBm
ATTEN 60 dB
-3.50 dBm
10 dB/
POS PK
FCC CFR47, PART 15C, 15.247
INFORETECH GOLF TECHNOLOGY
inFOREmer HANDSET W/10 dB PAD
TEST DATE: 04 JANUARY 1999
PEAK POWER SPECTRAL DENSITY
CENTER 2.456 00 GHz
SPAN 2.00 MHz
RES BW 3 kHz
VBW 10 kHz
SWP 667 sec


ACME TESTING - SITE #2
MKR 2.455 4 GHz
REF 97.0 dBuV ATTEN 0 dB
91.90 dBuV
10 dB/
POS PK
FCC CFR47, PART 15C, 15.247
INFORETECH GOLF TECHNOLOGY
inFOREmer HANDSET
TEST DATE: 07 DECEMBER 1999
BANDEDGE COMPLIANCE
START 2.400 GHz
STOP 2.600 GHz
RES BW 1 MHz
VBW 10 kHz
SWP 60.0 msec