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FCC PART 24 E

TEST REPORT

APPLICANT	Wilson Electronics, Inc.
	3301 E. Deseret Drive
	St. George, Utah 84790 USA
	800.204.4104
FCC ID	PWO8013SB
MODEL NUMBER	801306
PRODUCT DESCRIPTION	In-Building Wireless PCS Smart Technology Amplifier
DATE SAMPLE RECEIVED	January 13, 2006
DATE TESTED	January 23, 2006
Tested By	Nam Nguyen
Approved By	Bruno Clavier 
TEST RESULTS	☒ PASS ☐ FAIL

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EXHIBITS INCLUDING:

BLOCK DIAGRAM
SCHEMATIC
PARTS LIST
USERS MANUAL
LABEL SAMPLE
LABEL LOCATION
EXTERNAL PHOTOGRAPHS
INTERNAL PHOTOGRAPHS
TUNING PROCEDURE
OPERATIONAL DESCRIPTION
TEST SET UP PHOTOGRAPHS

1. COMPLIANCE STATEMENT

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report and demonstrate that the equipment complies with the appropriate standards. No modifications were made to the equipment during testing in order to demonstrate compliance with these standards.

I attest that the necessary measurements were made, under my supervision, at TIMCO ENGINEERING, INC. located at 849 N.W. State Road 45, Newberry, Florida 32669.

Authorized Signatory Name: Bruno Clavier

Signature: 

Function: Chief Engineer

Date: 4/10/2006

Test engineer name: Nam Nguyen

Signature: Nam Nguyen

Date: 4/10/2006

2. GENERAL INFORMATION - PART 2.1033 (C)

2.1033(c)(1)AND(2)

Wilson electronics, inc. will manufacture the “in building wireless pcs smart amplifier”
FCC ID: PWO8013SB in quantity, for use under FCC rules part 24E.

2.1033(c) TECHNICAL DESCRIPTION

2.1033(c)(3) User Manual. See the exhibits.

2.1033(c)(4) Type of Emission: F9W (CDMA), GXW (GSM), F1D, and GXW (EDGE)

2.1033(c)(5) Frequency Range: Uplink 1850-1910MHz / Downlink 1930-1990MHz

2.1033(c)(6) Power Range and Controls: There are NO user Power controls.

2.1033(c)(7) Maximum Output and Input Power Rating per manufacturer specifications: 1Watt Uplink and 0.55Watt Downlink

Part 24.232: Max Power is: 2W EIRP

2.1033(c)(8) DC Voltages and Current into Final Amplifier:

POWER INPUT FINAL AMPLIFIER ONLY
Vcc = 5VDC, 1.2A at an RF output of 1 Watt.

2.1033(c)(9) Tune-up procedure. The tune-up procedure is given in the exhibits.

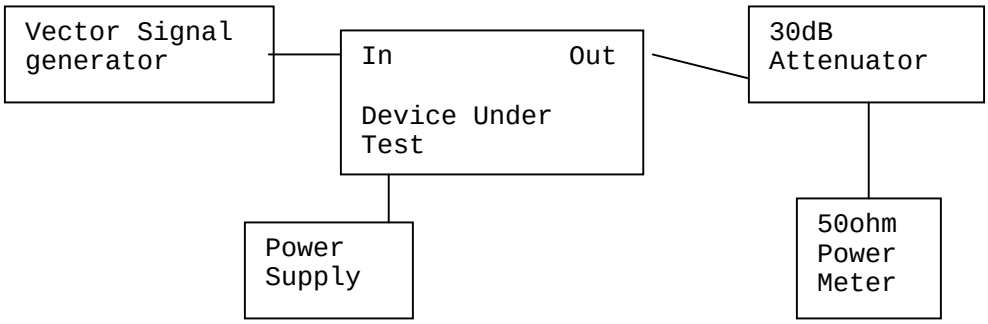
2.1033(c)(10) Complete Circuit Diagrams: Description of all circuitry and devices provided for determining and stabilizing frequency is included in the circuit description in the instruction manual. The circuit diagram and block diagram are included in the exhibits.

2.1033(c)(11)	A photograph or drawing of the equipment identification label is shown in the exhibits.
2.1033(c)(12)	Photographs of the equipment of sufficient clarity to reveal equipment construction and layout and label location are shown in the exhibits.
2.1033(c)(13)	For equipment employing digital modulation, a detail description of the modulation technique: N/A as this device is an amplifier
2.1033(c)(14)	Data required for 2.1046 to 2.1057 See Next Page.

3. PART 2.1046(A) RF POWER OUTPUT:

RF power is measured by connecting a 50 ohm, resistive wattmeter to the RF output connector. With a nominal voltage of 5 VDC using the AC/DC switched mode power supply specified with this device, and the amplifier properly adjusted the RF output measures:

METHOD OF MEASURING RF POWER OUTPUT



CONDUCTED POWER:

CDMA

Tuned Frequency (MHz)	Power Input (dBm)	Power Output (dBm)	Power Output (W)
1850.00	-22.5	29	0.79
1868.00	-22.5	30	1.00
1880.00	-22.5	28	0.63
1910.00	-22.5	28	0.63
1930.00	-15	25	0.32
1940.00	-23	27.4	0.55
1960.00	-17	27	0.50
1990.00	-15	25	0.32

Notes: the maximum power output value was obtained with CDMA modulation at 1868MHz and 1940MHz.

EDGE

Tuned Frequency (MHz)	Power Input (dBm)	Power Output (dBm)	Power Output (W)
1850.00	-23	25	0.32
1880.00	-24	26	0.40
1910.00	-23	23	0.20
1930.00	-15	21.5	0.14
1960.00	-15	25	0.32
1990.00	-14	22	0.16

GSM

Tuned Frequency (MHz)	Power Input (dBm)	Power Output (dBm)	Power Output (W)
1850.00	-23	25	0.32
1880.00	-22	25	0.32
1910.00	-22.5	23	0.20
1930.00	-14.5	21	0.13
1960.00	-13	23	0.20
1990.00	-15.5	21.5	0.14

CW

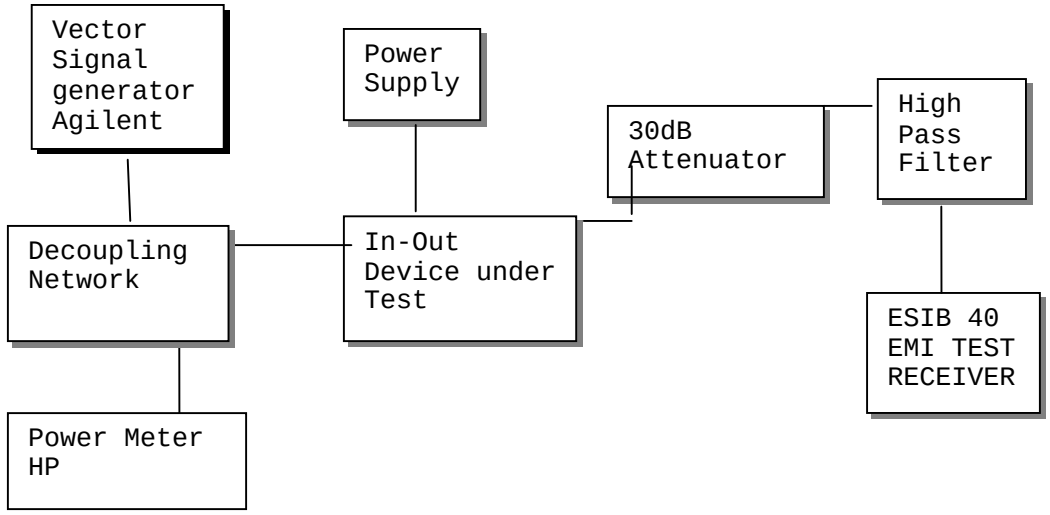
Tuned Frequency (MHz)	Power Input (dBm)	Power Output (dBm)	Power Output (W)
1850.00	-22.5	25	0.32
1880.00	-24.5	26	0.40
1910.00	-24	23	0.20
1930.00	-14.5	21	0.13
1960.00	-15.5	23.5	0.22
1990.00	-15.5	21.5	0.14

4. PART 2.1049,2.1051 INPUT/OUTPUT MODULATED AMPLITUDE COMPARISON AND BAND-EDGES COMPLIANCE

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

On the following plot, the Reference level was calibrated using a Resolution Bandwidth wider than the emission bandwidth. First the gain was measured for the maximum output power. Then for each frequency and type of modulation, an attenuation equals to the gain of the amplifier was added on the measurement side of the amplifier, as to overlay the input versus output modulated envelope.

METHOD OF MEASUREMENT



The following test equipment was used:

(1) Agilent E4438C: dual-mode baseband generator(arbitrary waveform and real-time I/Q) 250 kHz to 6 GHz

Band-edges compliance: Measurements were performed in accordance with Part 24.238

CDMA

Channel (MHz)	Band-edge Frequency (MHz)	Amplitude level at the band-edge (dBm)	Limit (dBm)	Margin (dB)
1851.25	1850	-16.24	-13	-3.24
1908.75	1910	-21.89	-13	-8.89
1931.25	1930	-16.12	-13	-3.12
1988.75	1990	-17.85	-13	-4.85

The Reference level on the following plots was calibrated using a 3MHz RBW=VBW.

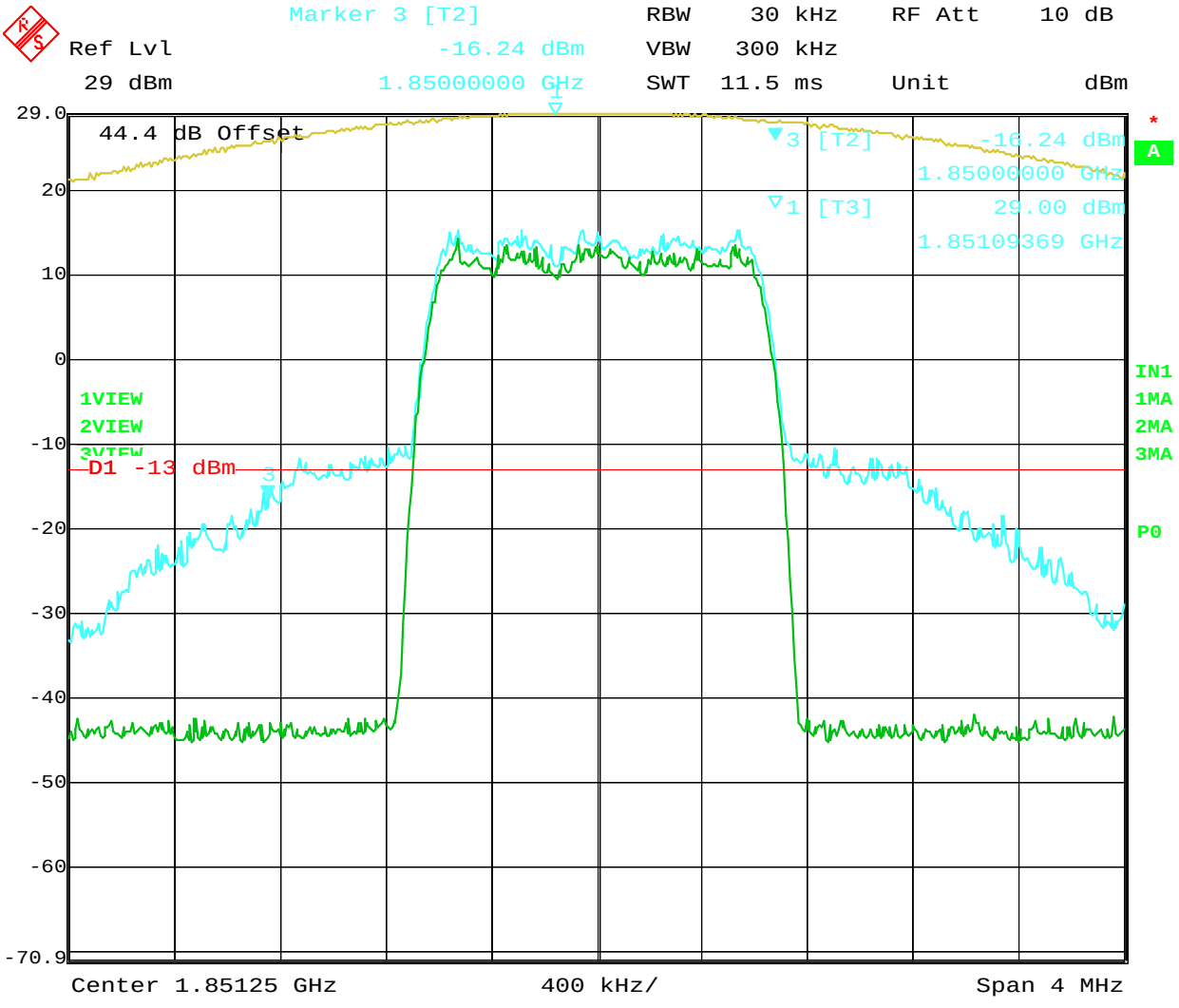


Figure 1: CDMA modulation – In vs. Out 1851.25MHz

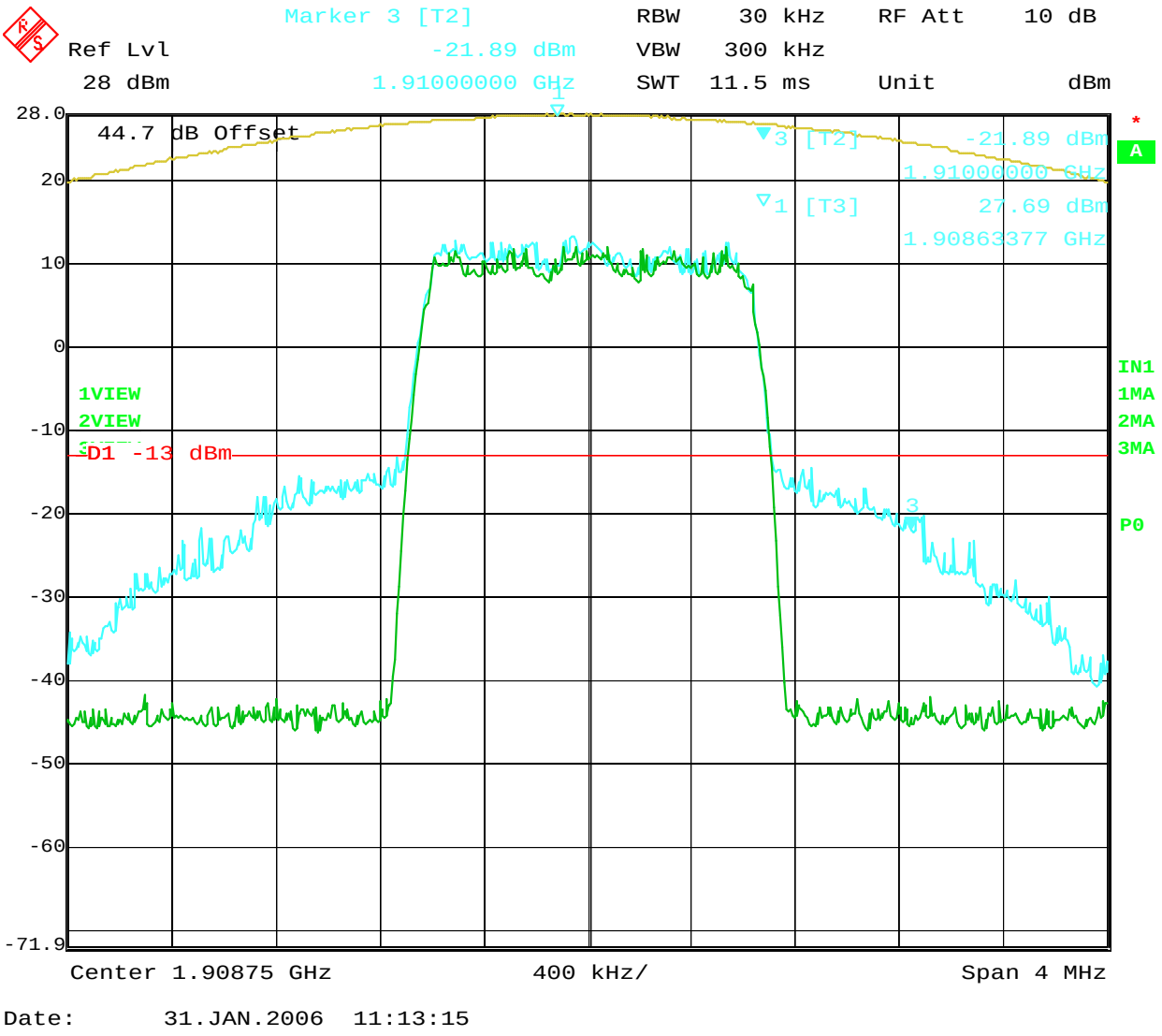


Figure 2: CDMA modulation – In vs. Out 1908.75MHz

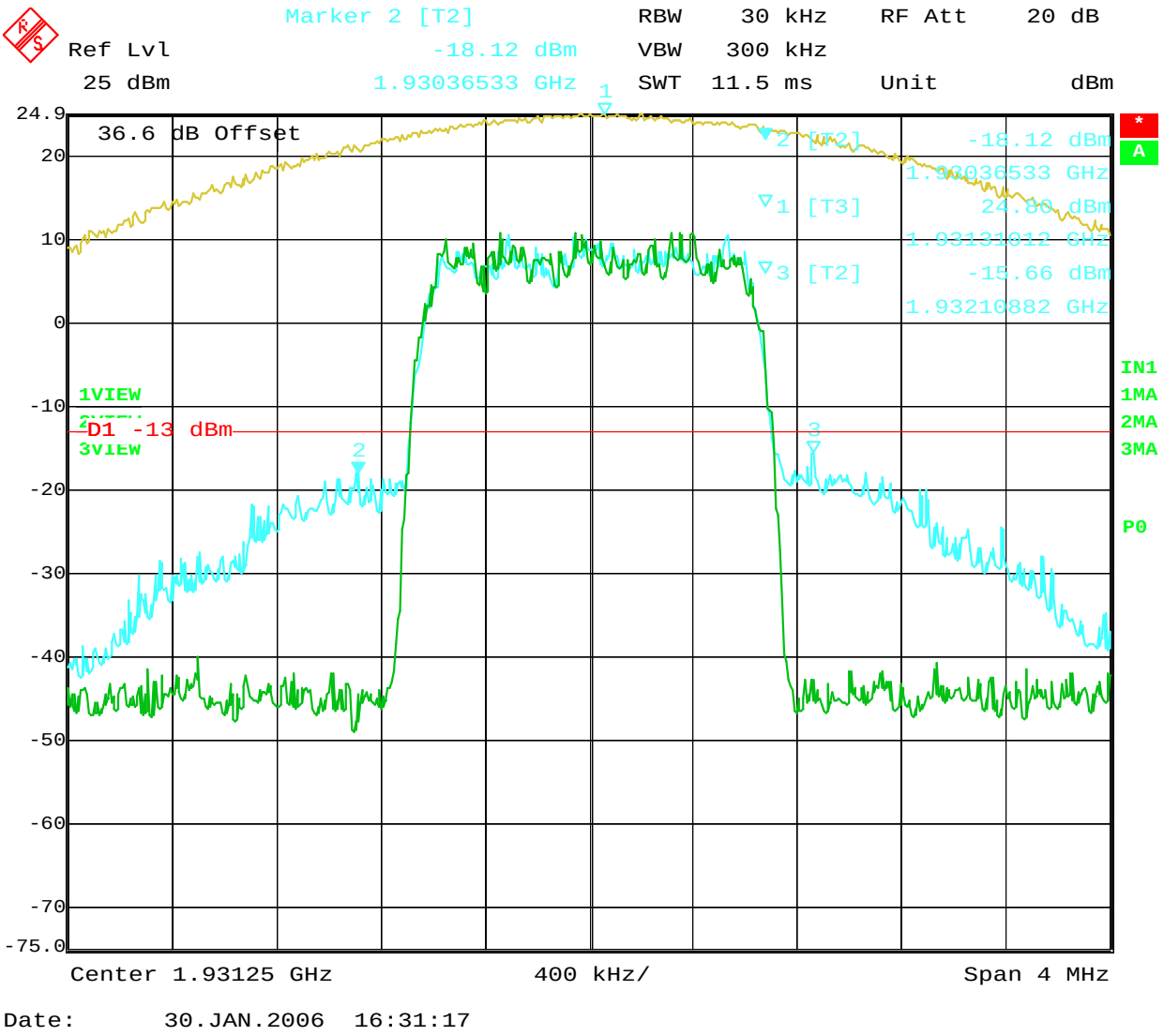


Figure 3: CDMA modulation – In vs. Out 1931.25MHz

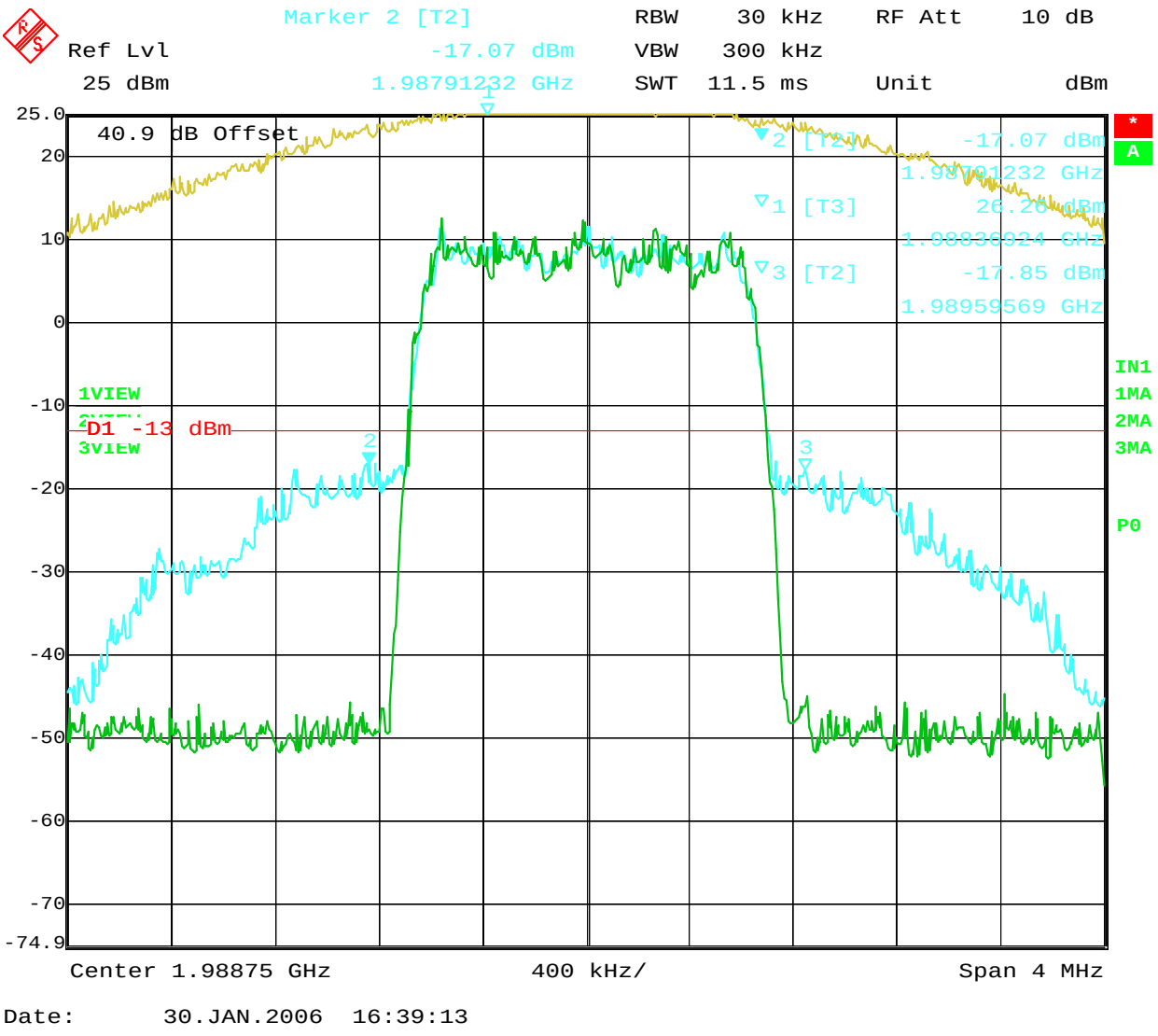


Figure 4: CDMA modulation – In vs. Out 1988.75MHz

EDGE

Channel (MHz)	Band-edge Frequency (MHz)	Amplitude level at the band-edge (dBm)	Limit (dBm)	Margin (dB)
1850.2	1850	-25.9	-13	-12.9
1909.8	1910	-32.37	-13	-19.37
1930.2	1930	-25.19	-13	-12.19
1989.8	1990	-29.19	-13	-16.19

The Reference level on the following plots was calibrated using a 3MHz RBW=VBW.

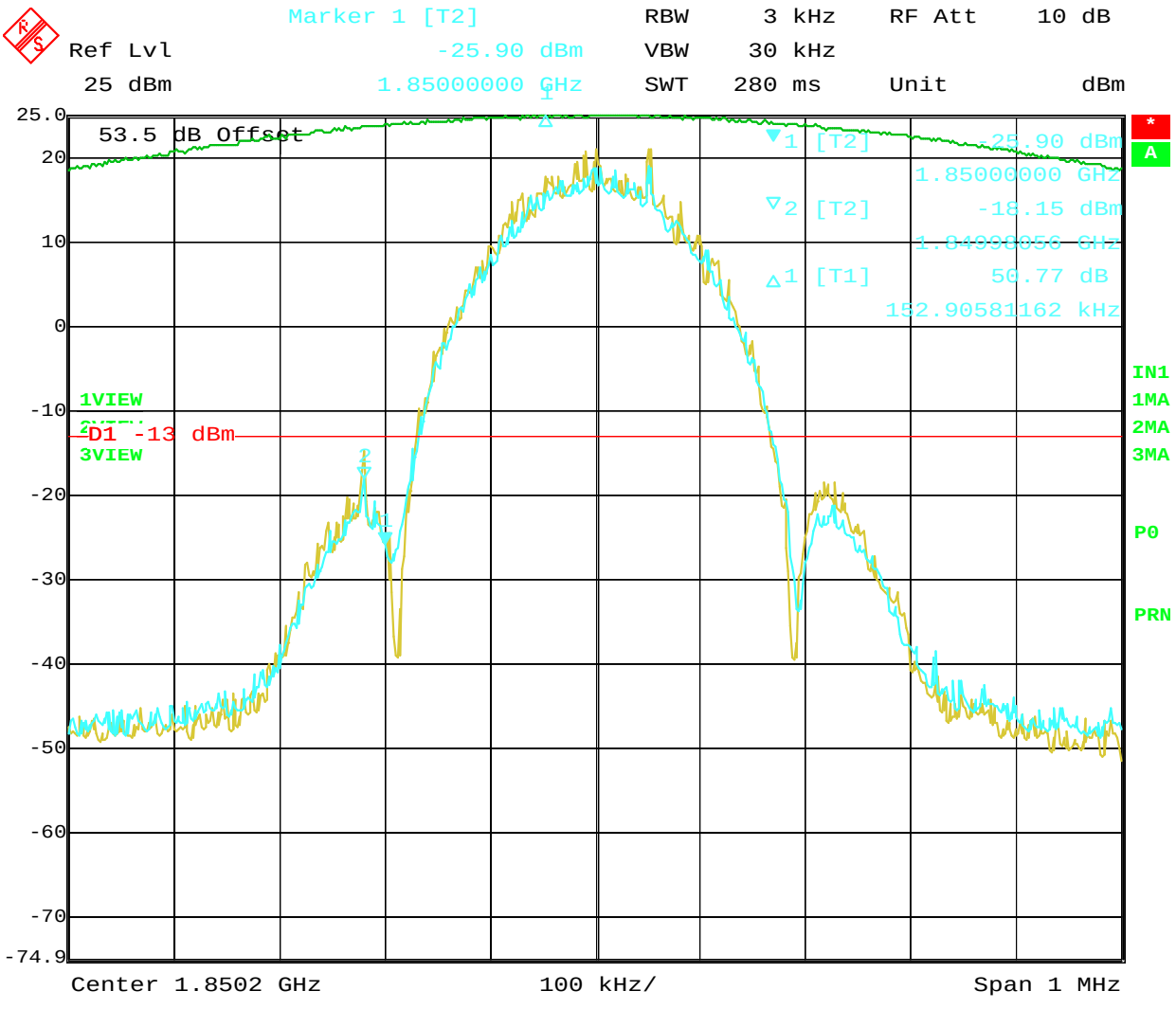


Figure 5: EDGE modulation – In vs. Out 1850.20MHz

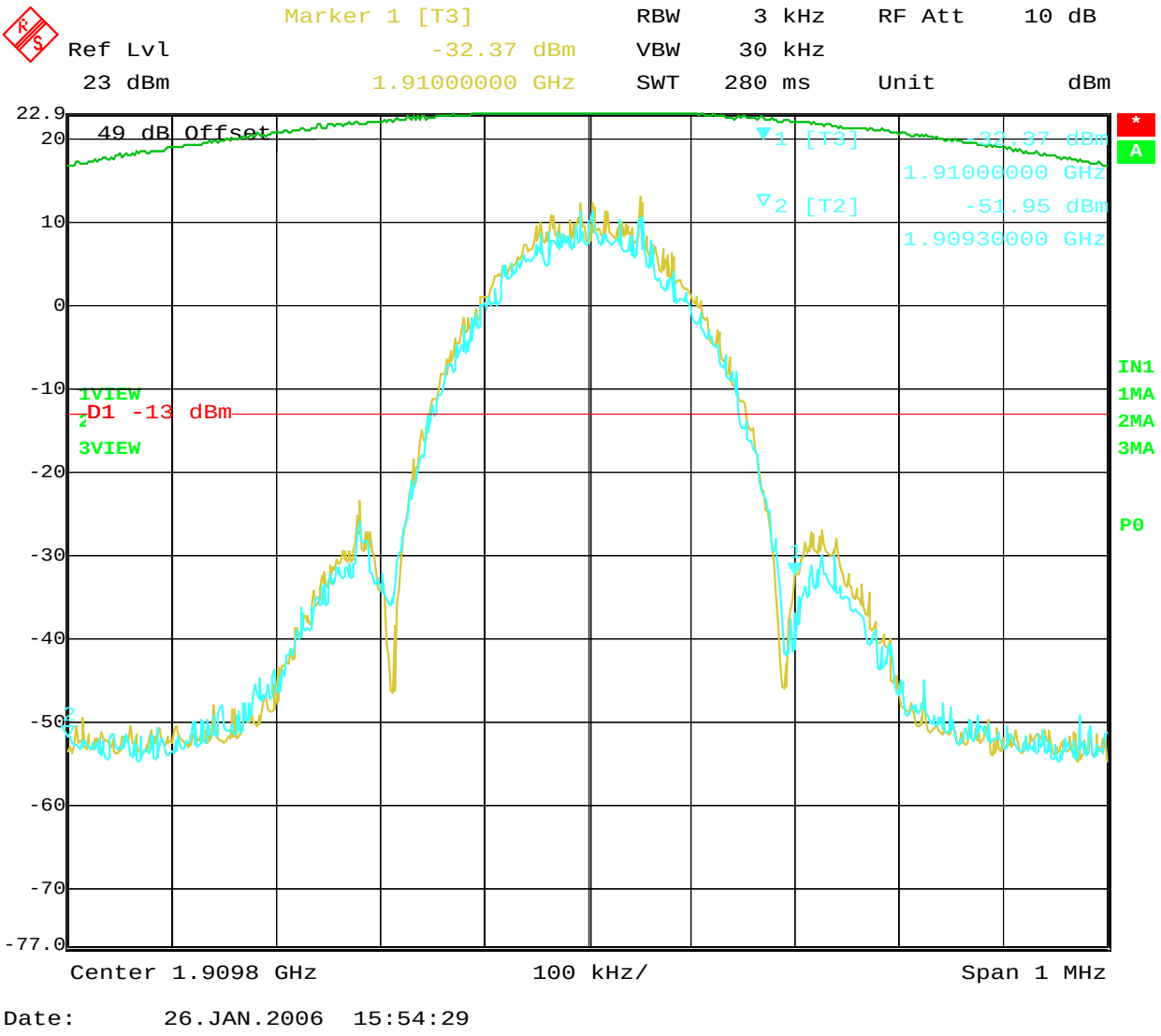


Figure 6: EDGE modulation – In vs. Out 1909.80MHz

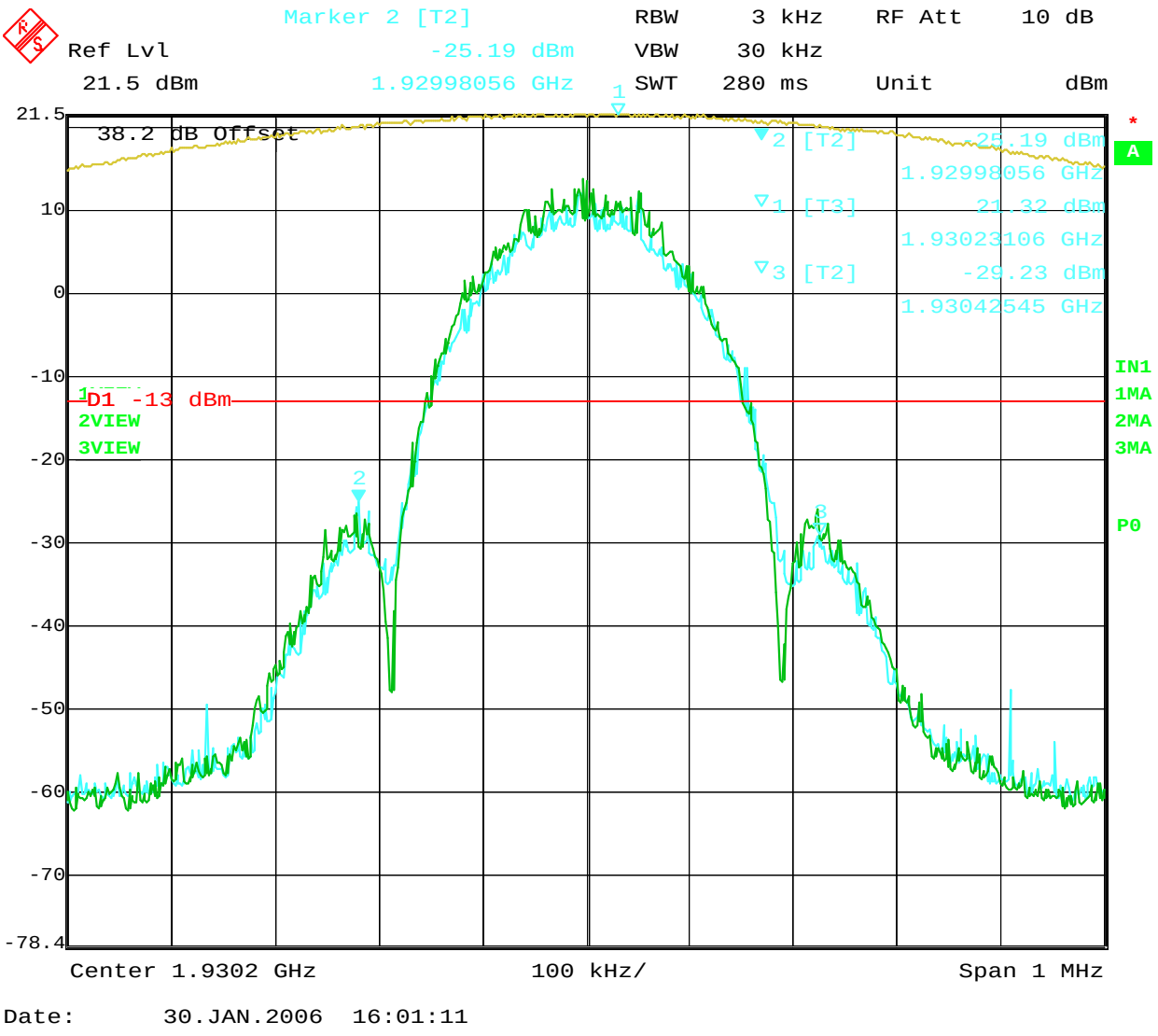


Figure 7: EDGE modulation – In vs. Out 1930.20MHz

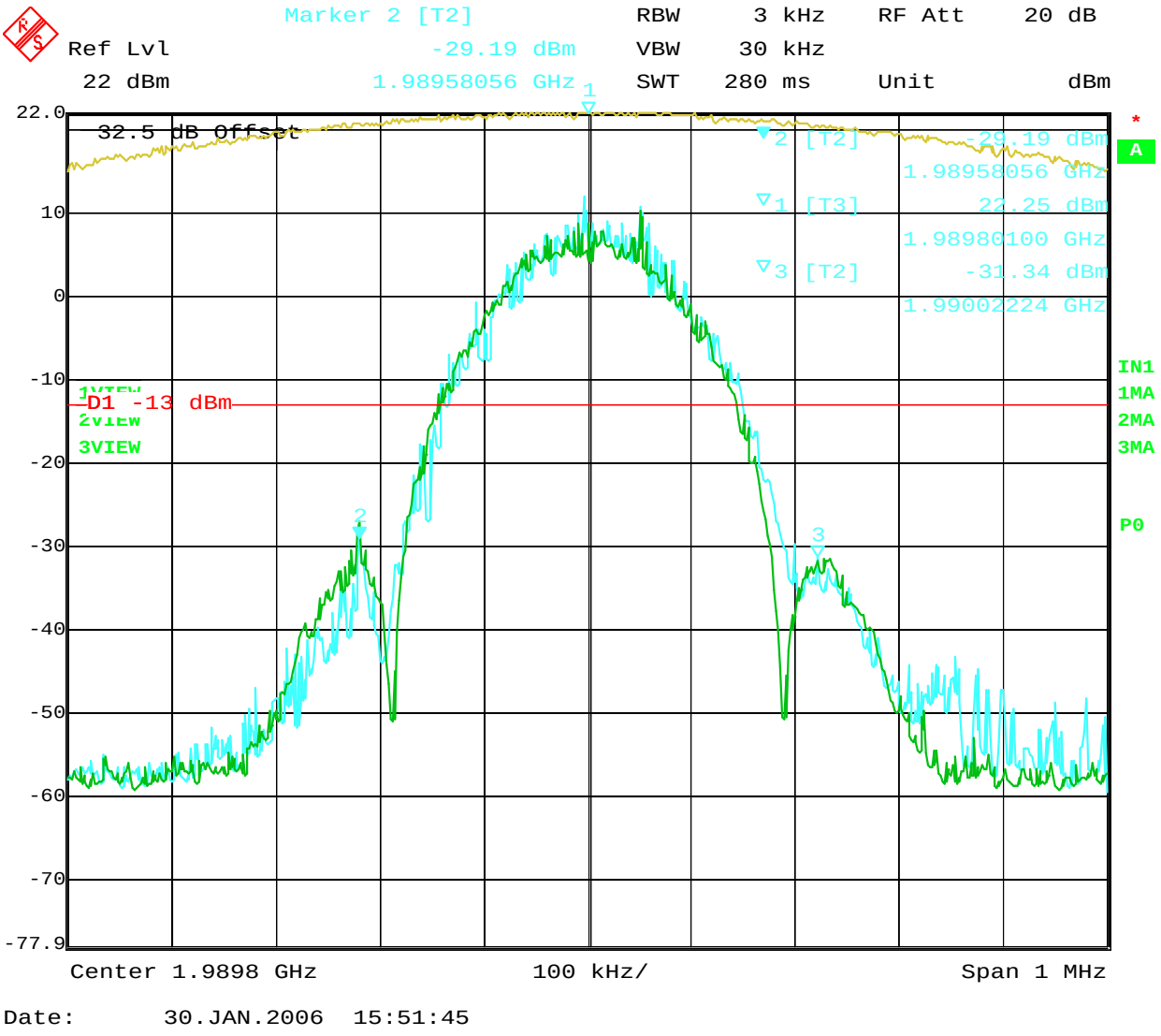


Figure 8: EDGE modulation – In vs. Out 1989.80MHz

GSM

Channel (MHz)	Band-edge Frequency (MHz)	Amplitude level at the band-edge (dBm)	Limit (dBm)	Margin (dB)
1850.2	1850	-24.68	-13	-11.68
1909.8	1910	-26.88	-13	-13.88
1930.2	1930	-22.58	-13	-9.58
1989.8	1990	-16.04	-13	-3.04

The Reference level on the following plots was calibrated using a 3MHz RBW=VBW.

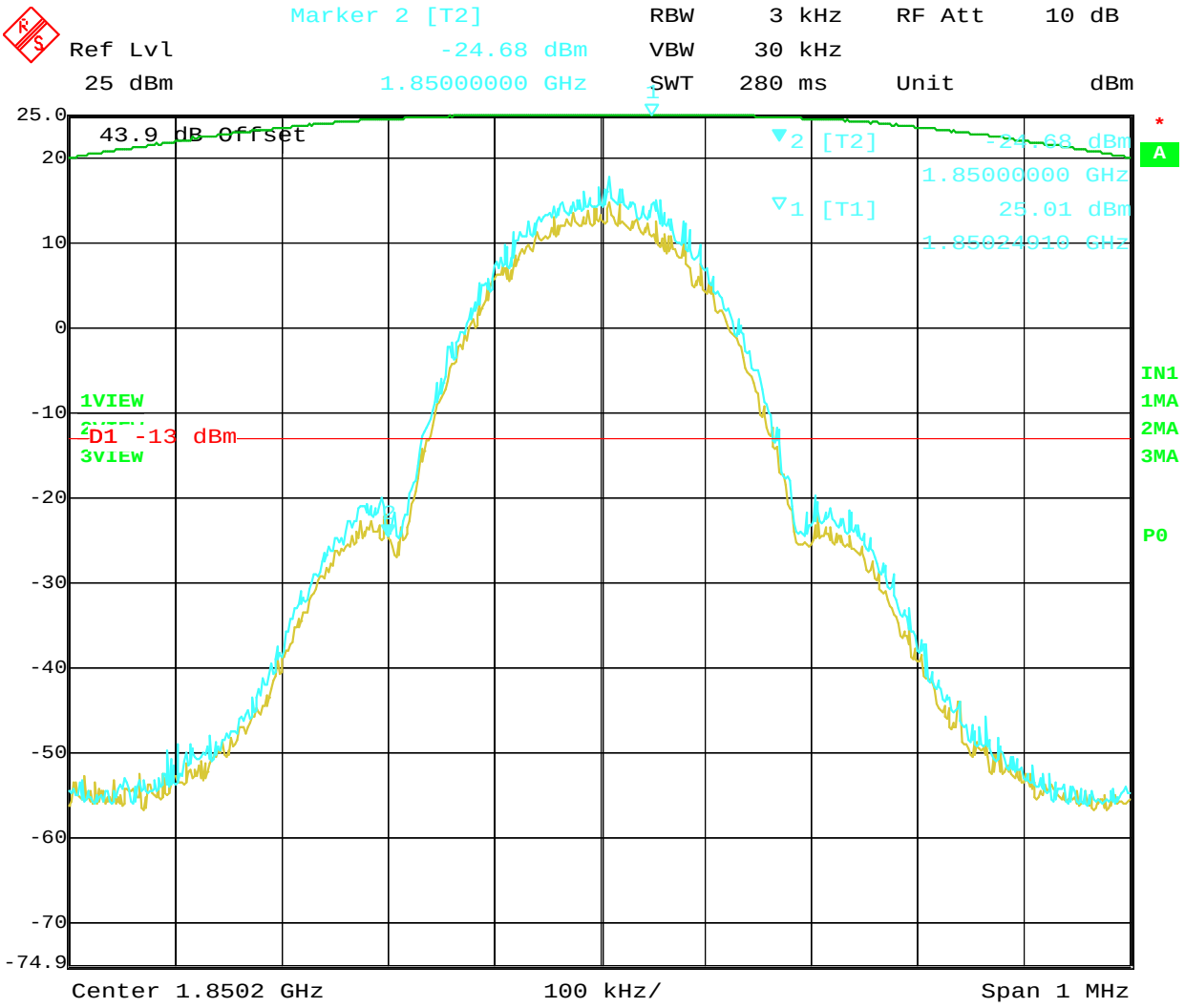


Figure 9: GSM modulation – In vs. Out 1850.20MHz

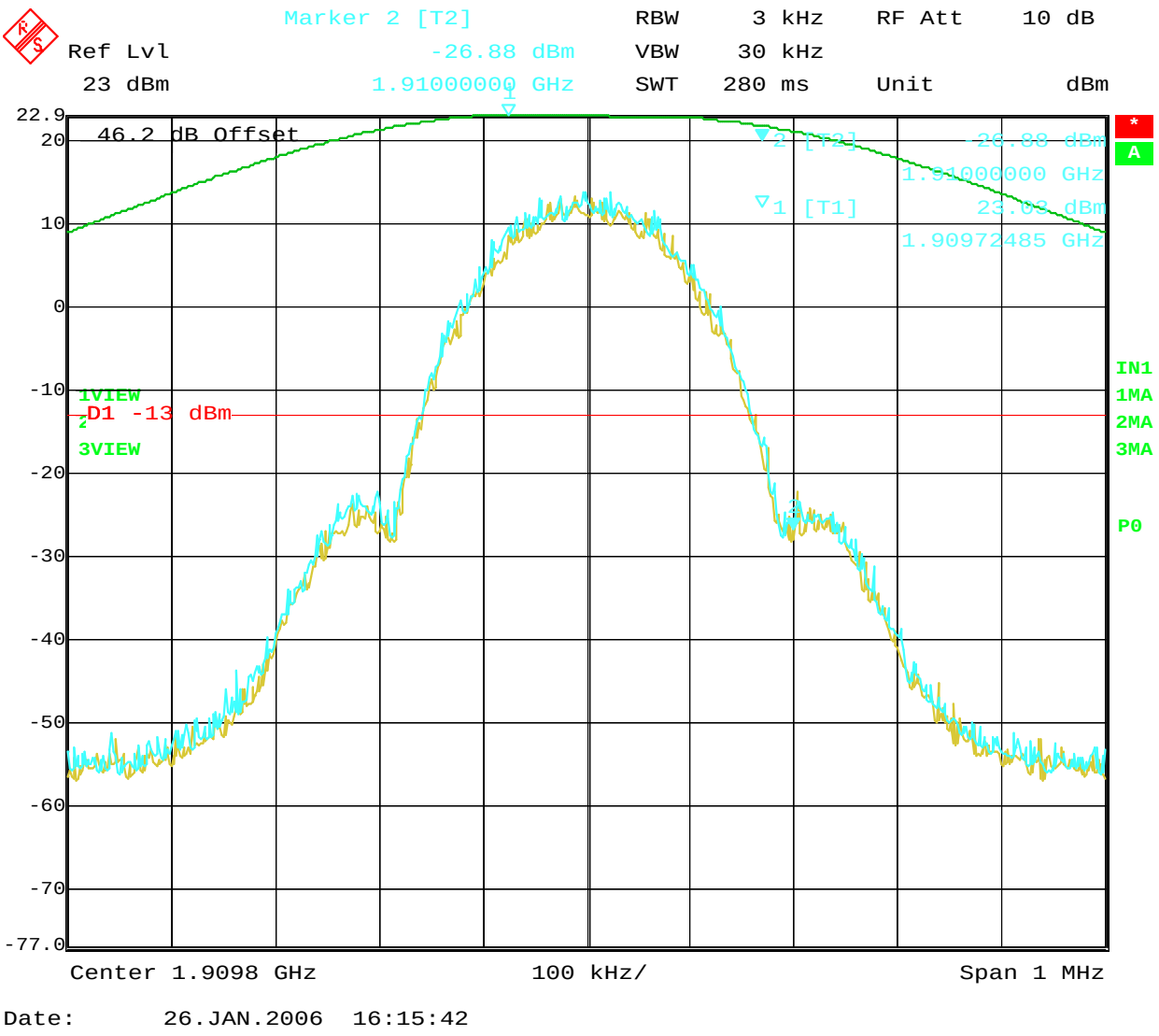


Figure 10: GSM modulation – In vs. Out 1909.80MHz

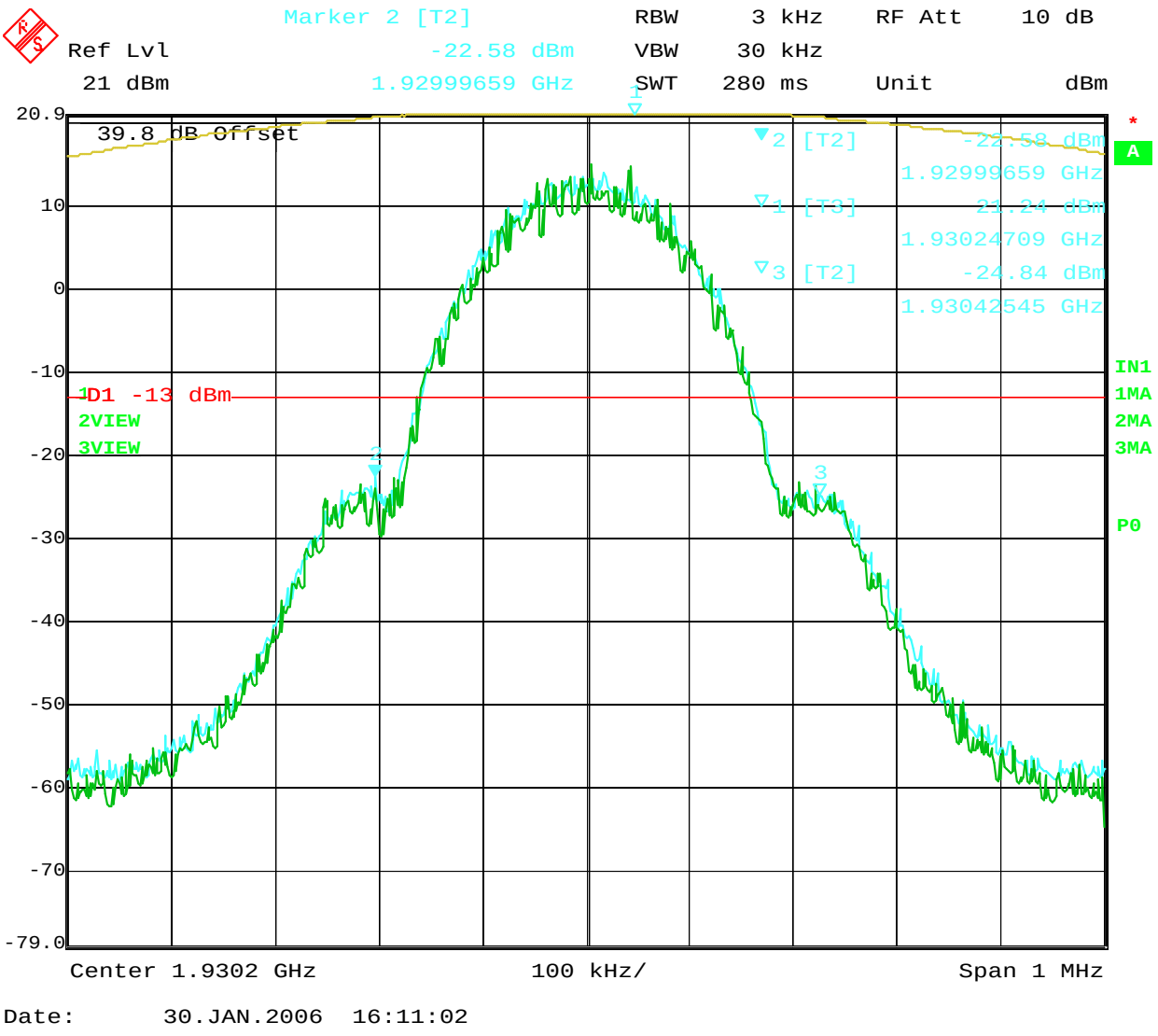


Figure 11: GSM modulation – In vs. Out 1930.20MHz

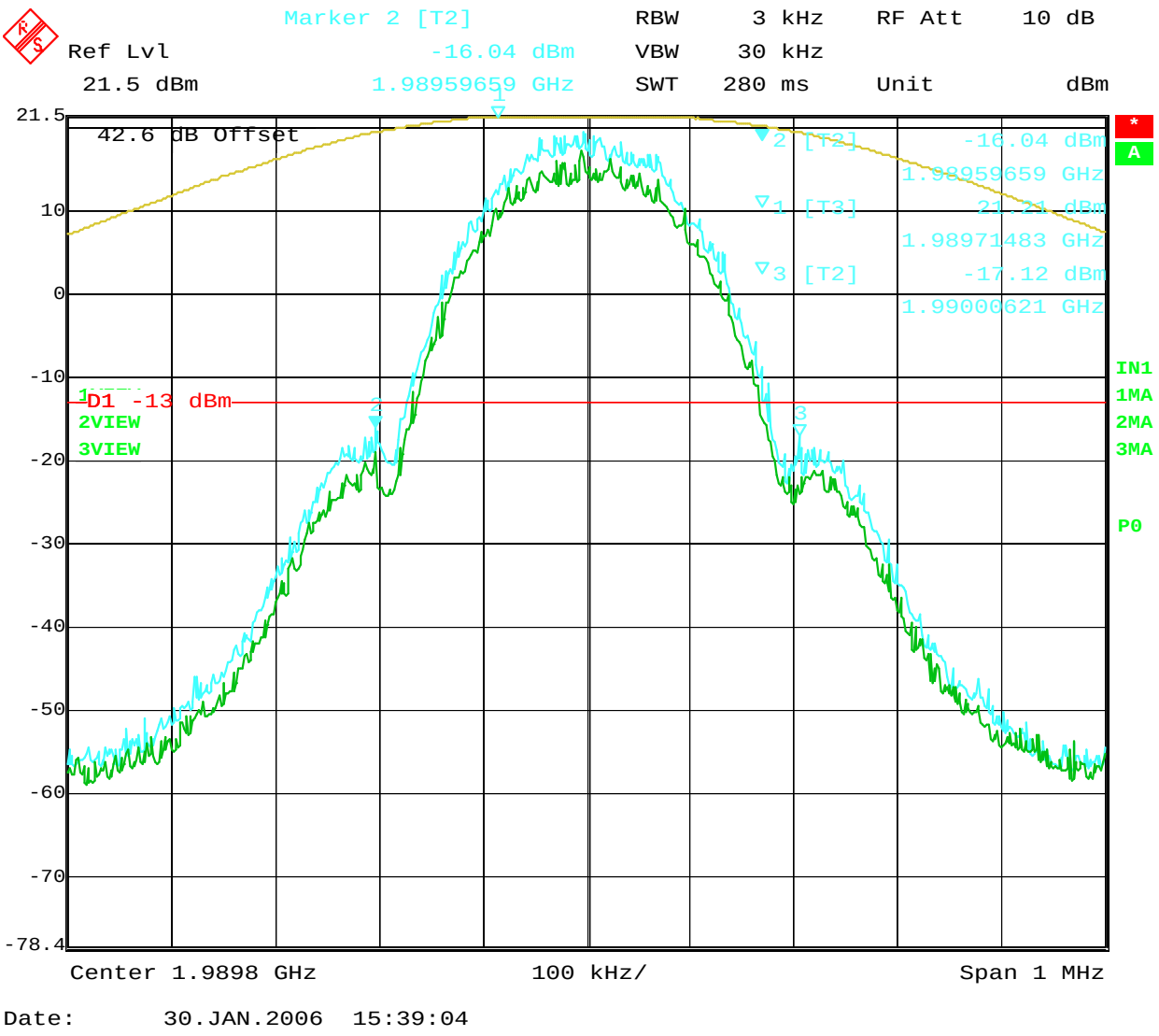


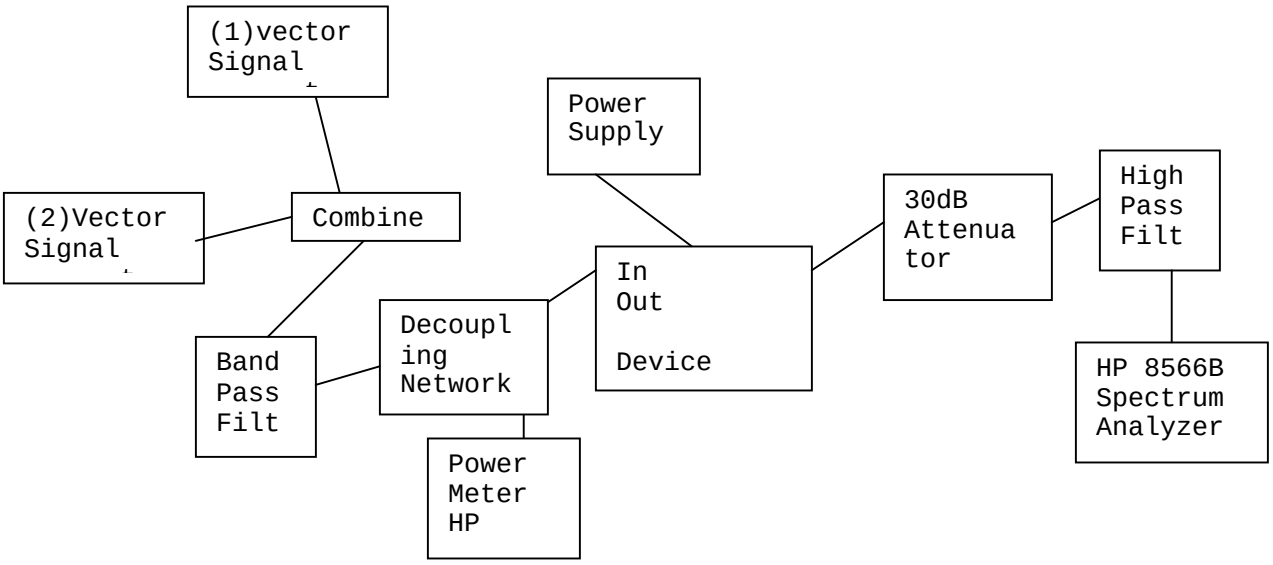
Figure 12: GSM modulation – In vs. Out 1989.80MHz

5. PART 2.1051 INTERMODULATION PRODUCT SPURIOUS EMISSIONS

All the modulation type (CDMA, GSM, EDGE, and FM) were tested using the three tones test method. A CW signal was use instead of GSM, EDGE, and F1D modulations. EDGE and GSM provided the same test results and only GSM data are presented in this report. The input power to the amplifier was set at maximum drive level by combining the three tones. The three tones were chosen in such a way (1)the third order intermodulation product frequencies are located within the pass band of the EUT and (2) they produce the worst-case emissions out of band.

REQUIREMENTS: Emissions must be 43 +10log(Po) dB below the mean power output of the transmitter or below the –13dBm

METHOD OF MEASURING CONDUCTED SPURIOUS EMISSIONS



The following specific test equipments were used:

(2) Agilent E4438C: dual-mode baseband generator(arbitrary waveform and real-time I/Q) 250 kHz to 6 GHz

(3) Agilent E4438C: dual-mode baseband generator(arbitrary waveform and real-time I/Q) 250 kHz to 6 GHz

METHOD OF MEASUREMENT: The procedure used was TIA/EIA-603 STANDARD. The spectrum was scanned from 9kHz to at least the tenth harmonic of the fundamental using a HP model 8566B spectrum analyzer. The measurements were made using the shielded room located at TIMCO ENGINEERING INC. 849 N.W. State Road 45, Newberry, Florida 32669.

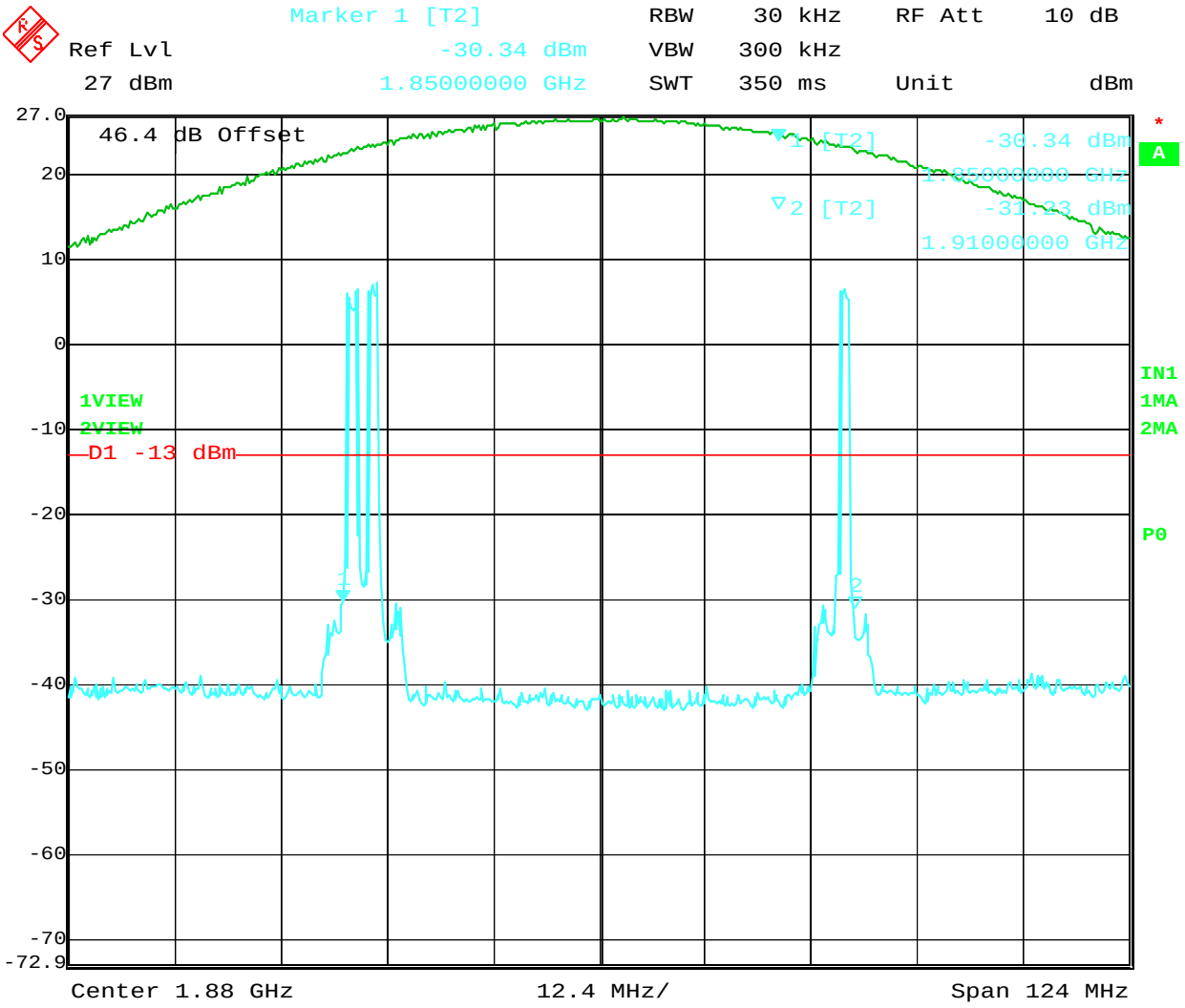


Figure 13: Intermodulation 3 tones spurious emissions CDMA up link.

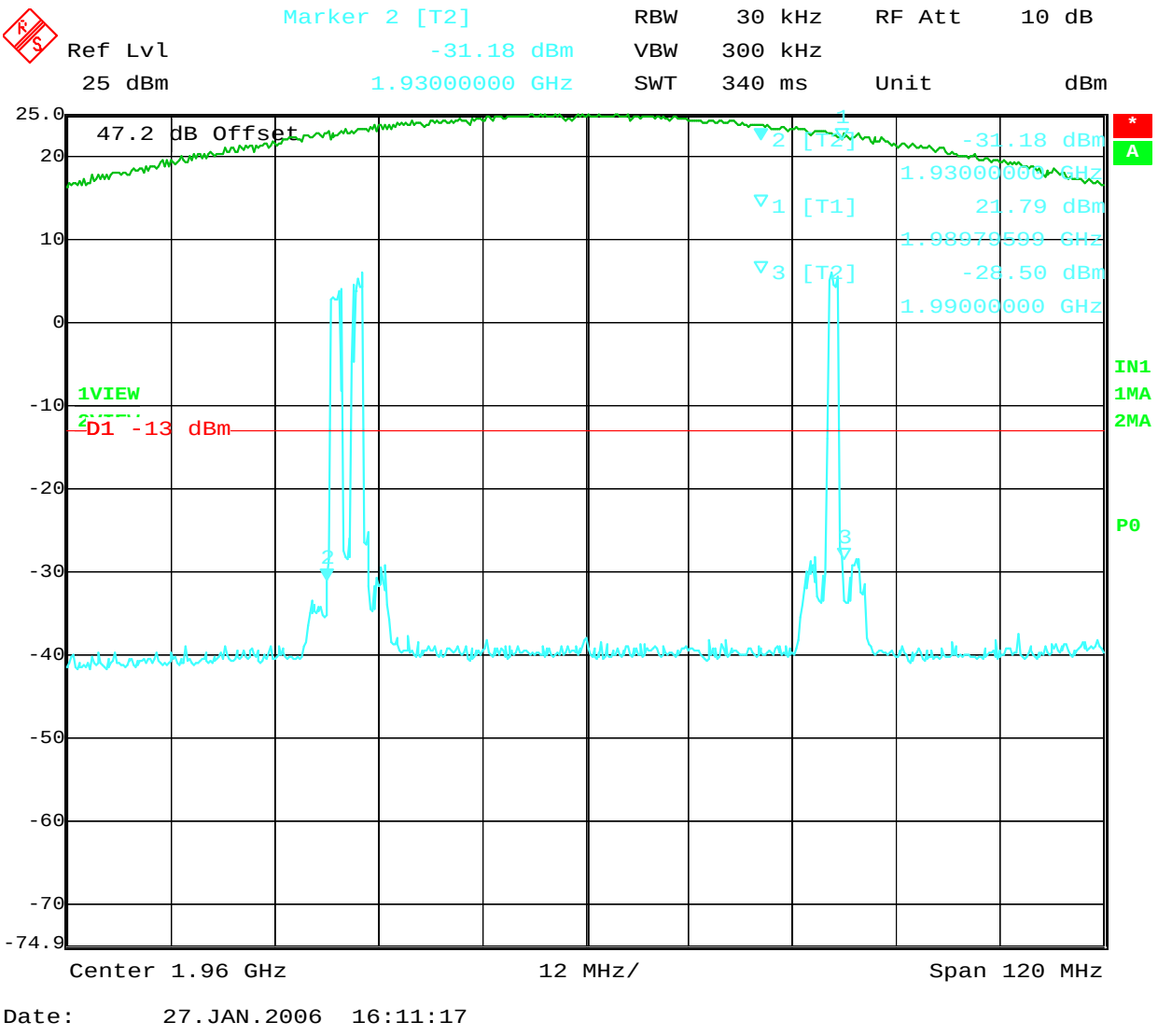


Figure 14: Intermodulation 3 tones spurious emissions CDMA down link.

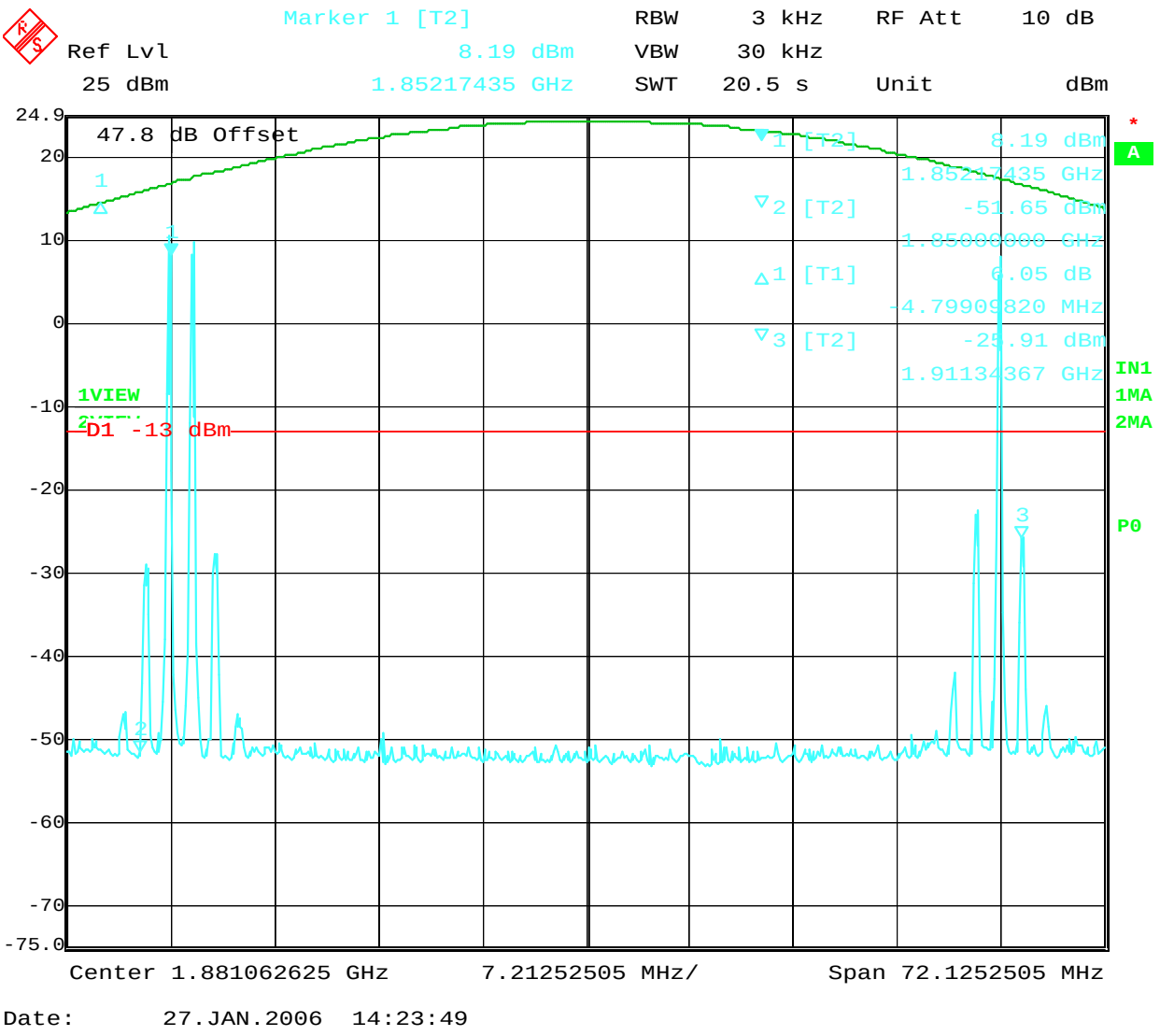


Figure 15: Intermodulation 3 tones sprurious emissions GSM up link.

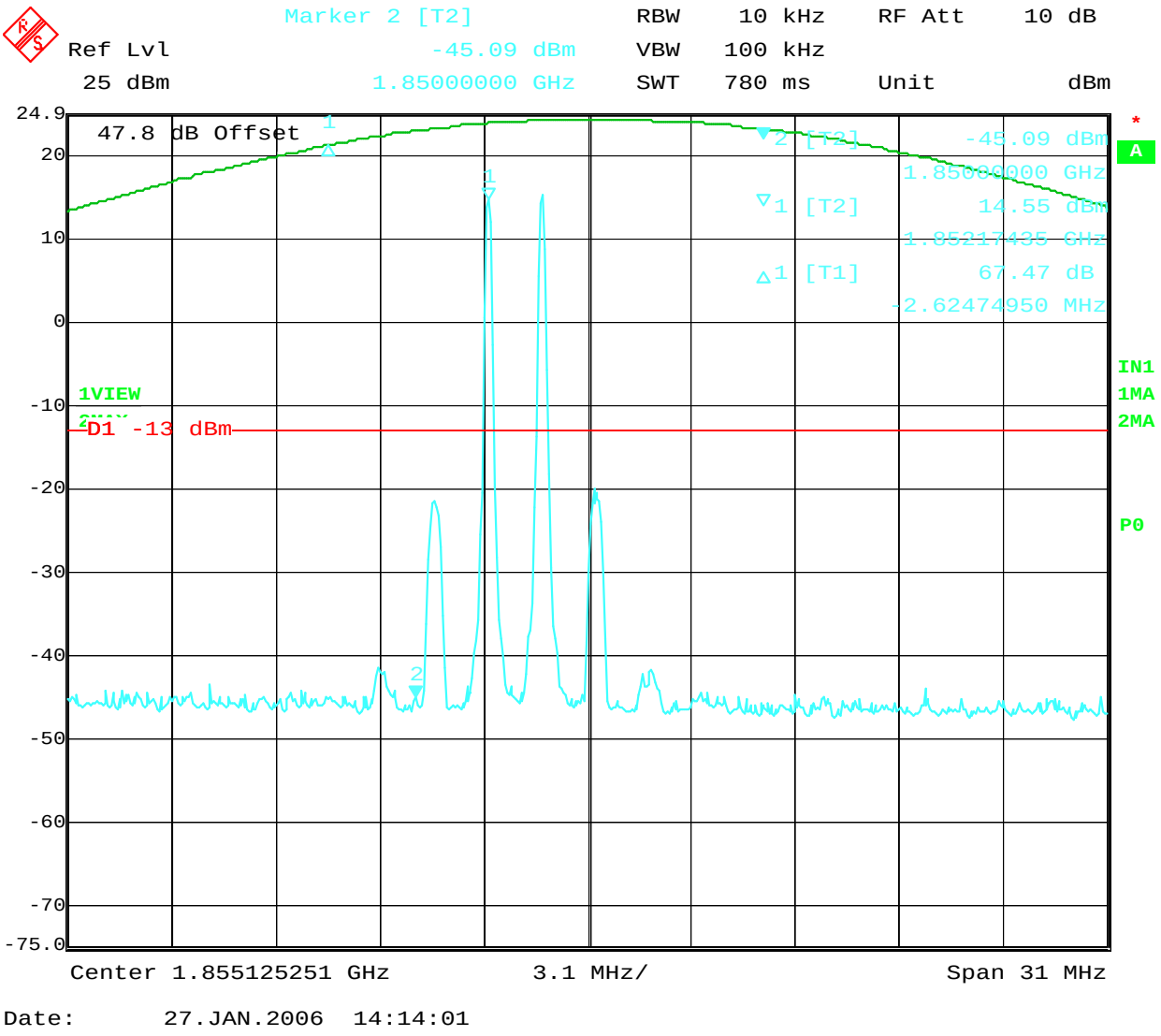


Figure 16: Intermodulation 3 tones sprurious emissions (zoom in) GSM up link.

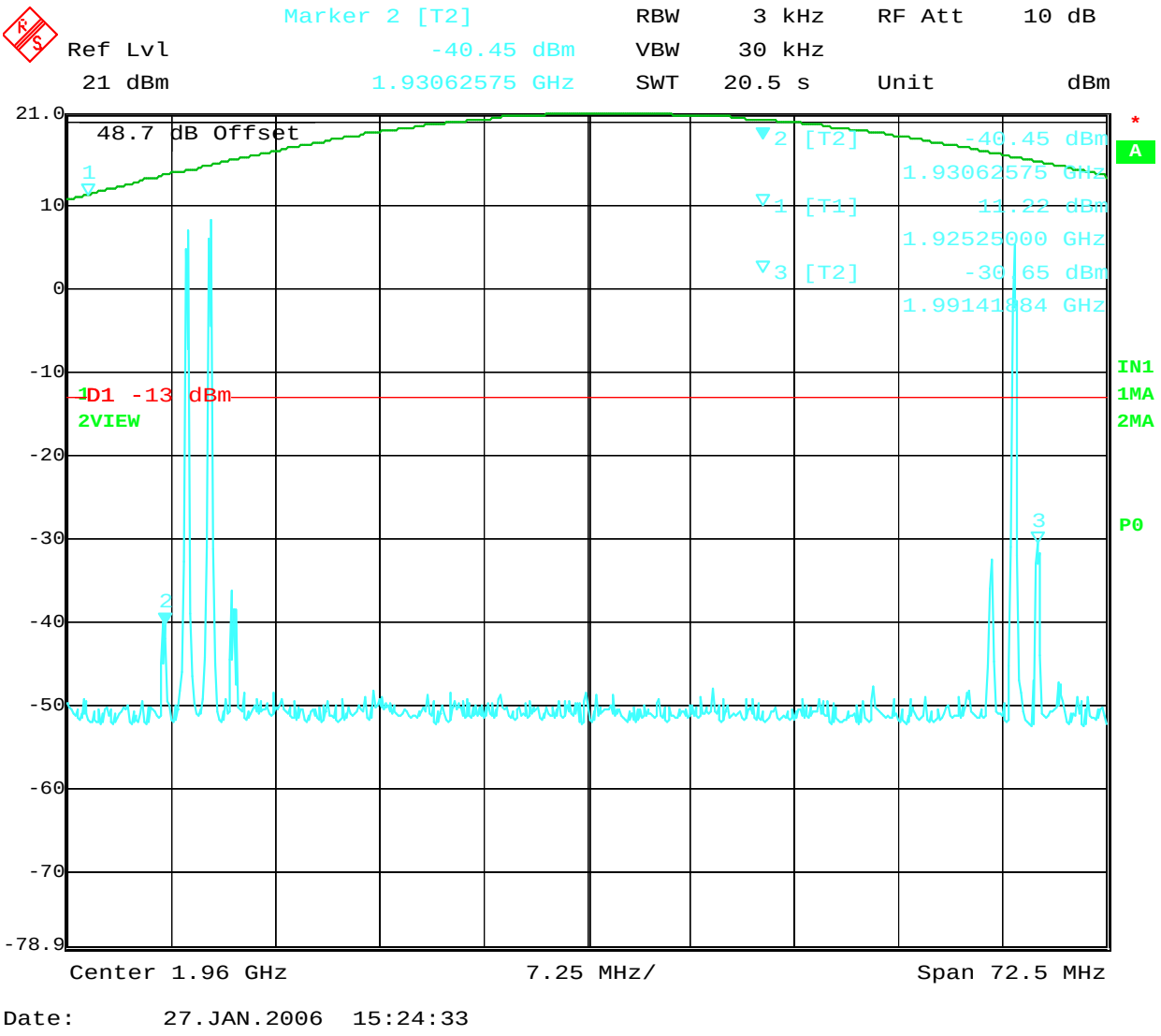


Figure 17: Intermodulation 3 tones sprurious emissions GSM down link.

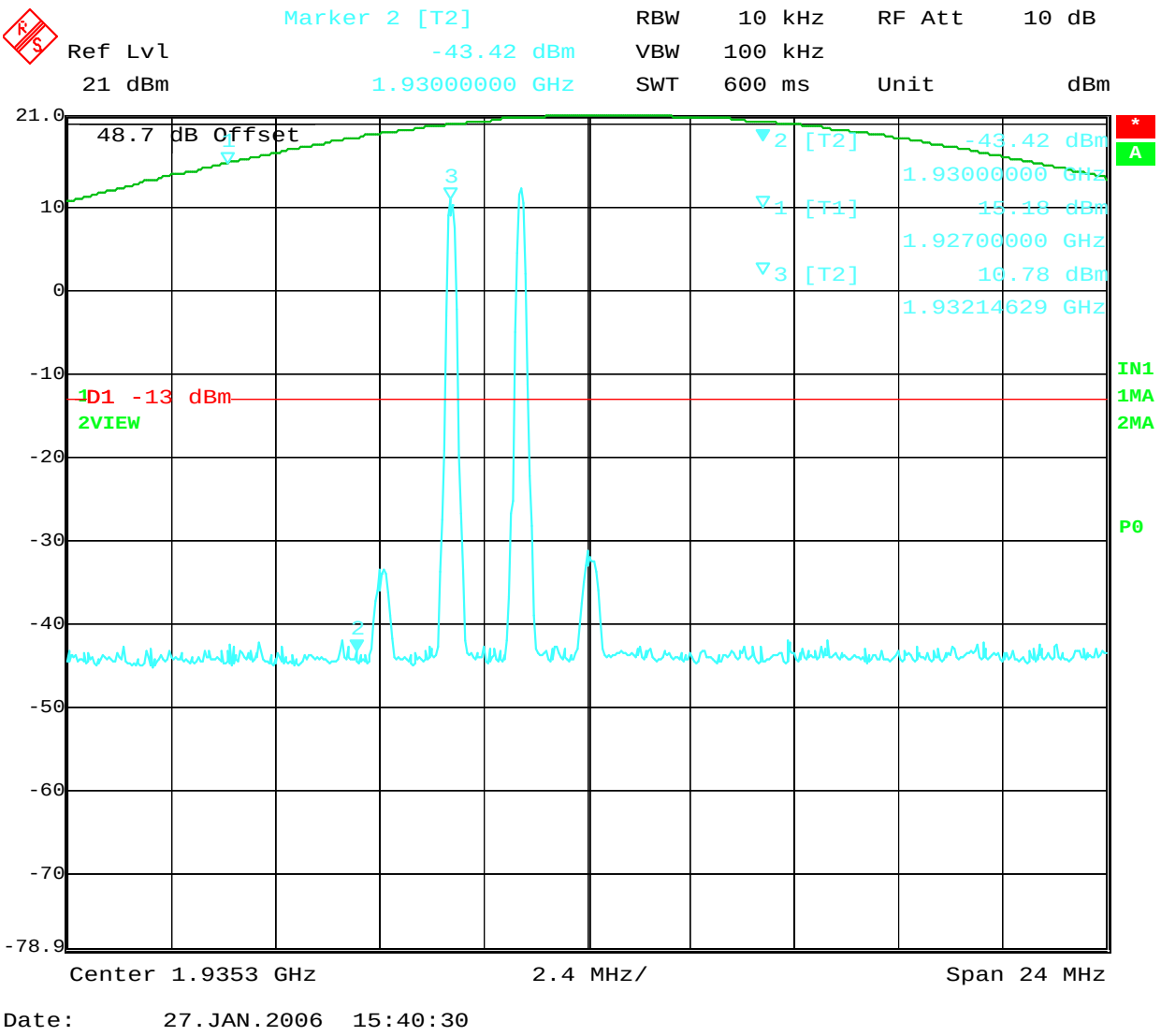


Figure 18: Intermodulation 3 tones sprurious emissions (zoom in) GSM down link.

6. PART 2.1051 SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Data on the following page shows the level of conducted spurious responses. For analog modulation, the carrier was modulated 100% using a 2500 Hz tone. For digital modulation, the carrier is modulated to its maximum extent. The spectrum was scanned from 9kHz to at least the 10th harmonic of the fundamental. The measurements were made in accordance with standard TIA/EIA-603. All the modulation types (CDMA, GSM, EDGE, and FM) were tested at a low, mid, and high channel in each band. CW (FM) was used in place of GSM and EDGE modulations. The maximum input power was set for each test.

REQUIREMENTS: Emissions must be 43 +10log(Po) dB below the mean power output of the transmitter:

43 + 10log(1.00) = 43 dBc

TEST DATA:

EMISSION FREQUENCY MHz	dB BELOW CARRIER (dBc)
1851.25	0
3702.50	82.52
5553.75	96.47
7405.00	>62.0
9256.25	>62.0
11107.50	>62.0
12958.75	>62.0
14810.00	>62.0
16661.25	>62.0
18512.50	>62.0
1880.00	0
3760.00	82.52
5640.00	110.34
7520.00	>62.0
9400.00	>62.0
11280.00	>62.0
13160.00	>62.0
15040.00	>62.0
16920.00	>62.0
18800.00	>62.0
1908.75	0
3817.50	85.96
5726.25	93.66
7635.00	>62.0
9543.75	>62.0
11452.50	>62.0

13361.25	>62.0
15270.00	>62.0
17178.75	>62.0
19087.50	>62.0

REQUIREMENTS: Emissions must be 43 +10log(Po) dB below the mean power output of the transmitter.

43 + 10log(1.00) = 43 dBc

TEST DATA:

EMISSION FREQUENCY MHz	dB BELOW CARRIER (dBc)
1931.25	0
3862.50	87.68
5793.75	92.63
7725.00	>60.0
9656.25	>60.0
11587.50	>60.0
13518.75	>60.0
15450.00	>60.0
17381.25	>60.0
19312.50	>60.0
1960.00	0
3920.00	86.67
5880.00	89.74
7840.00	>60.0
9800.00	>60.0
11760.00	>60.0
13720.00	>60.0
15680.00	>60.0
17640.00	>60.0
19600.00	>60.0
1988.75	0
3977.50	85.07
5966.25	91.83
7955.00	>60.0
9943.75	>60.0
11932.50	>60.0
13921.25	>60.0
15910.00	>60.0
17898.75	>60.0
19887.50	>60.0

REQUIREMENTS: Emissions must be 43 +10log(Po) dB below the mean power output of the transmitter.

43 + 10log(1.00) = 43 dBc

TEST DATA:

EMISSION FREQUENCY MHz	dB BELOW CARRIER (dBc)
1850.20	0
3700.40	82.10
5550.60	95.41
7400.80	>58.0
9251.00	>58.0
11101.20	>58.0
12951.40	>58.0
14801.60	>58.0
16651.80	>58.0
18502.00	>58.0
1880.00	0
3760.00	79.37
5640.00	98.99
7520.00	>58.0
9400.00	>58.0
11280.00	>58.0
13160.00	>58.0
15040.00	>58.0
16920.00	>58.0
18800.00	>58.0
1909.80	0
3819.60	85.16
5729.40	103.1
7639.20	>58.0
9549.00	>58.0
11458.80	>58.0
13368.60	>58.0
15278.40	>58.0
17188.20	>58.0
19098.00	>58.0

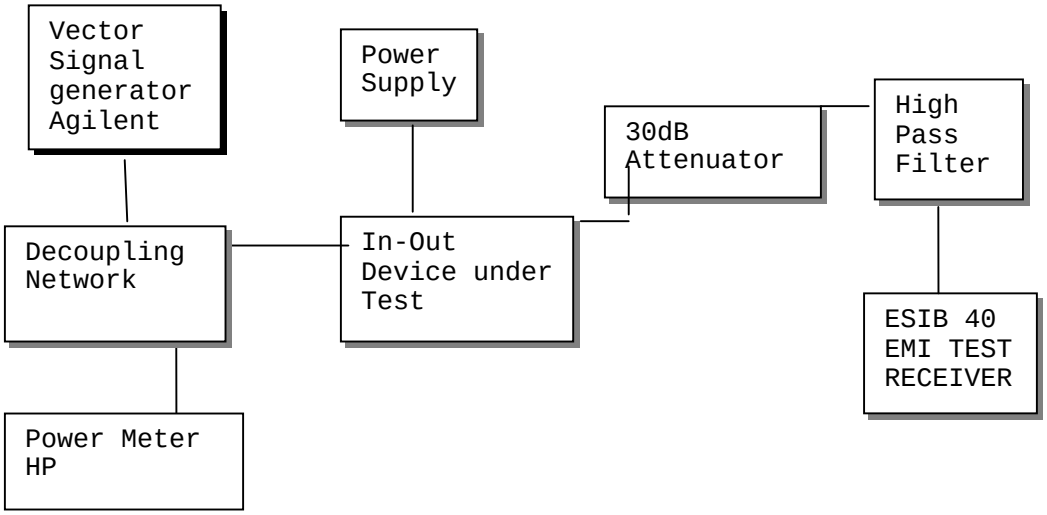
REQUIREMENTS: Emissions must be 43 +10log(Po) dB below the mean power output of the transmitter.

43 + 10log(1.00) = 43 dBc

TEST DATA:

EMISSION FREQUENCY MHz	dB BELOW CARRIER (dBc)
1930.20	0
3860.40	90.04
5790.60	106.6
7720.80	>56.0
9651.00	>56.0
11581.20	>56.0
13511.40	>56.0
15441.60	>56.0
17371.80	>56.0
19302.00	>56.0
1960.00	0
3920.00	85.42
5880.00	110.0
7840.00	>56.0
9800.00	>56.0
11760.00	>56.0
13720.00	>56.0
15680.00	>56.0
17640.00	>56.0
19600.00	>56.0
1989.80	0
3979.60	89.60
5969.40	104.24
7959.20	>56.0
9949.00	>56.0
11938.80	>56.0
13928.60	>56.0
15918.40	>56.0
17908.20	>56.0
19898.00	>56.0

METHOD OF MEASURING CONDUCTED SPURIOUS EMISSIONS



The following test equipment was used:

(4) Agilent E4438C: dual-mode baseband generator(arbitrary waveform and real-time I/Q) 250 kHz to 6 GHz

METHOD OF MEASUREMENT: The procedure used was TIA/EIA-603 STANDARD. The spectrum was scanned from 9kHz to at least the tenth harmonic of the fundamental using a HP model 8566B spectrum analyzer. The measurements were made using the shielded room located at TIMCO ENGINEERING INC. 849 N.W. State Road 45, Newberry, Florida 32669.

7. OUT OF BAND REJECTION: FREQUENCY RESPONSE PLOTS

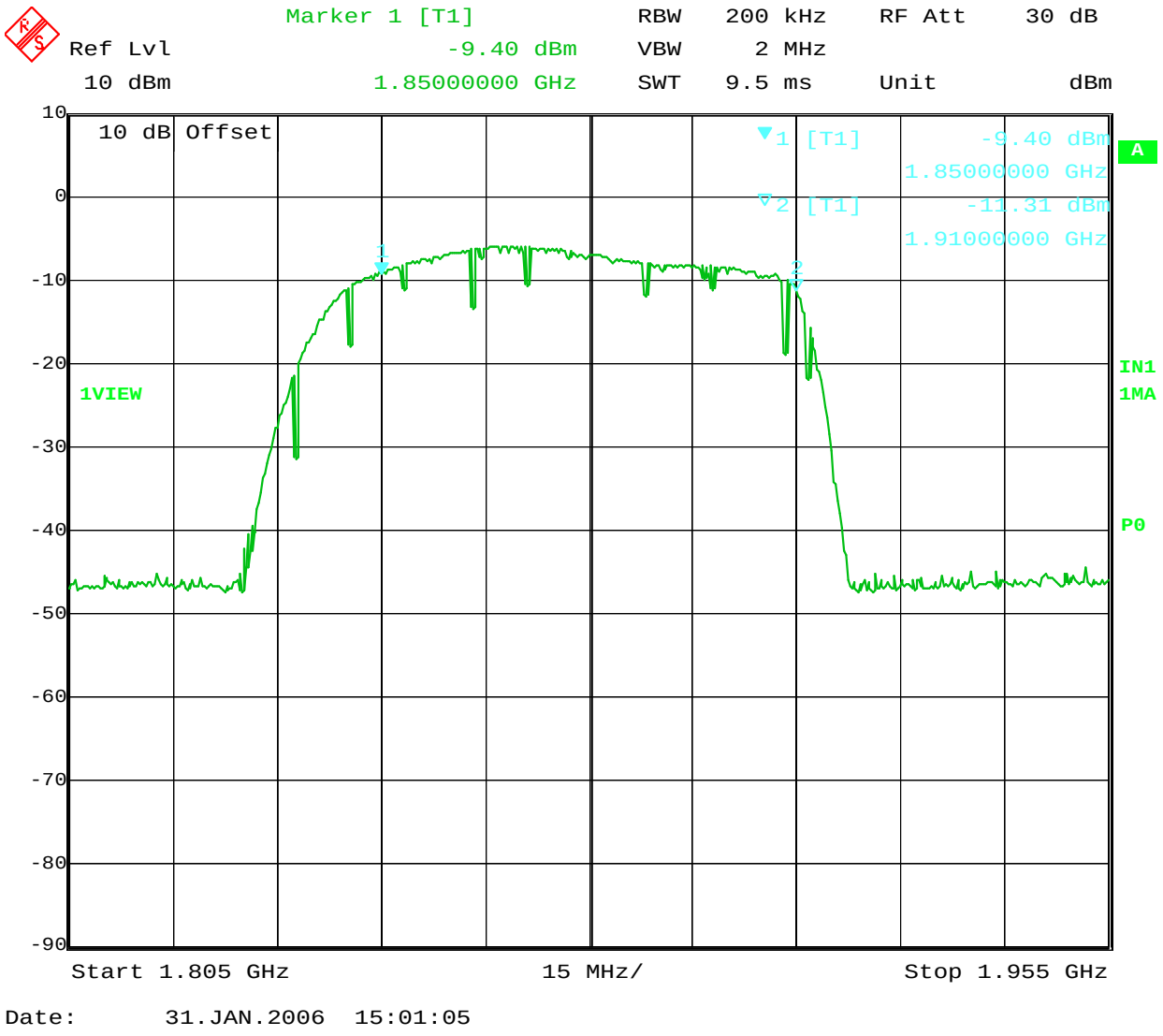


Figure 19. Filer frequency response 1850MHz band

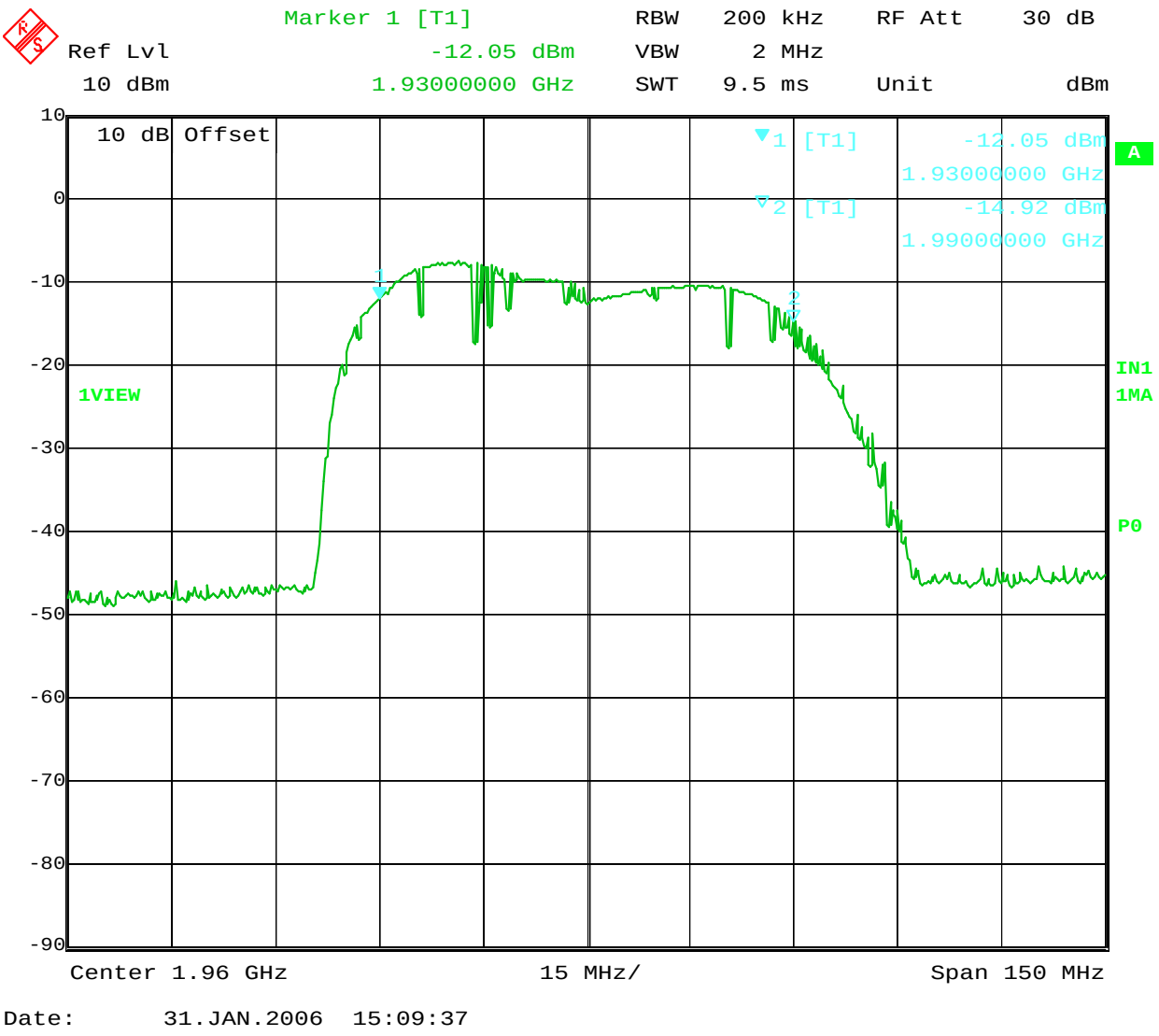


Figure 20. Filer frequency response 1930MHz band

8. PART 2.1053 FIELD STRENGTH OF SPURIOUS EMISSIONS

REQUIREMENTS: Emissions must be 43 +10log(Po) dB below the mean power output of the amplifier:

43 + 10log(1.00) = 43 dB
43 + 10log(0.55) = 40.4 dB
CW signal was used for this test.

TEST DATA:

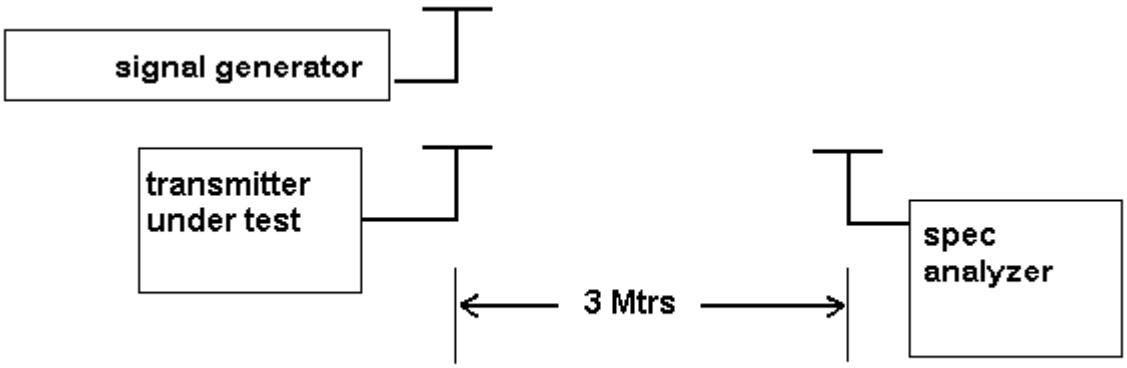
Emission Frequency (MHz)	Ant. Polarity (V/H)	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	dB Below Carrier (dBc)
1880.00	V	26.00	0	0	0
3760.00	H	-54.20	1.43	7.55	74.08
5640.00	V	-62.00	1.75	8.55	81.2
7520.00	V	-55.40	2.06	8.69	74.77
9400.00	V	-57.00	2.38	9.53	75.85
11280.00	V/H	*	*	*	*
13160.00	V/H	*	*	*	*
15040.00	V/H	*	*	*	*
16920.00	V/H	*	*	*	*
18800.00	V/H	*	*	*	*

Notes: *No other emissions were found up to the 10th harmonics - NOISE FLOOR

Emission Frequency (MHz)	Ant. Polarity (V/H)	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	dB Below Carrier (dBc)
1960.00	H	23.50	0	0	0
3920.00	V	-53.40	1.46	7.55	70.81
5880.00	V	-50.70	1.79	8.88	67.11
7840.00	V	-54.40	2.12	7.8	72.22
9800.00	V/H	*	*	*	*
11760.00	V/H	*	*	*	*
13720.00	V/H	*	*	*	*
15680.00	V/H	*	*	*	*
17640.00	V/H	*	*	*	*
19600.00	V/H	*	*	*	*

Notes: *No other emissions were found up to the 10th harmonics - NOISE FLOOR

METHOD OF MEASURING RADIATED SPURIOUS EMISSIONS



Equipment placed 80 cm above ground
on a rotating table platform.

METHOD OF MEASUREMENTS: The tabulated data shows the results of the radiated field strength emissions test. The spectrum was scanned from 30 MHz to at least the tenth harmonic of the fundamental. The CW signal was used to perform this test. This test was conducted per TIA/EIA STANDARD 603 using the substitution method. Measurements were made at the open field test site of TIMCO ENGINEERING, INC. located at 849 NW State Road 45, Newberry, FL 32669. The worst-case spurious emissions data are reported.

9. RF EXPOSURE EVALUATION

General information

Device category: Fixed Indoor and Outdoor
Environment: General Population/Uncontrolled Exposure

Outdoor antenna installation: The antenna(s) used for this transmitter must be fixed-mounted on outdoor permanent structures. RF exposure compliance is addressed at the time of licensing, as required by the responsible FCC Bureau(s), including antenna co-location requirements of §1.1307(b)(3).

Indoor antenna installation: Compliance with the power density limits of 1.1310 is required.

Antenna

This indoor antenna is intended to be fixed mounted on indoor permanent structures.

Configuration	Antenna p/n	Type	Max. Gain (dBi)
Fixed Indoor	*	*	8

Operating configuration and exposure conditions:

Output Power:

Frequency Band DONWLINK	Modulation	MAX Output power Uplink (dBm)	MAX Output power Downlink (dBm)
AMPS band	na	na	na
	na	na	na
	na	na	na
PCS band	GSM	na	23
	CDMA	na	27
	EDGE	na	25

The maximum conducted output power for the downlink bands is 500mW.

MPE Calculation

The minimum separation distance is calculated as follows:

$$E(V/m) = \frac{\sqrt{30 \times P \times G}}{d} \qquad \text{Power density: } P_d(mW/cm^2) = \frac{E^2}{3770}$$

The limit for general population/uncontrolled exposure environment above 1500MHz is 1mW/cm2 for the worst-case frequency at 1960MHz and modulation CDMA.

Power Density at 20 cm distance			Max. Antenna Gain (dBi) / Minimum Cable Loss (dB)		
			8dBi (indoor)/0dB	-	-
Freq (MHz)	Power EIRP (W)	Duty Cycle (%)	(mW/cm^2)	(mW/cm^2)	(mW/cm^2)
1960	3.16	100	0.63	-	-
-	-	-	-	-	-
-	-	-	-	-	-

Conclusion

The device complies with the MPE requirements by providing a safe separation distance of 20 cm between the antenna, including any radiating structure, and any persons when normally operated for indoor use.

The indoor antenna(s) used for this transmitter are to be fixed-mounted on indoor permanent structures providing a separation distance of at least 20 cm from all persons during normal operation. Users and installers must be provided with appropriate antenna installation instructions and transmitter operating conditions, including antenna co-location requirements of §1.1307(b)(3), for satisfying RF exposure compliance. RF exposure compliance may need to be addressed at the time of licensing, as required by the responsible FCC Bureau(s), including antenna co-location requirements of §1.1307(b)(3).

10. EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
3/10-Meter OATS	TEI	N/A	N/A	Listed 3/27/04	3/26/07
3-Meter OATS	TEI	N/A	N/A	Listed 1/11/06	1/10/09
Biconnical Antenna	Eaton	94455-1	1057	CAL 12/12/05	12/12/07
Biconnical Antenna	Eaton	94455-1	1096	CAL 8/17/04	8/17/06
Biconnical Antenna	Electro-Metrics	BIA-25	1171	CAL 4/29/05	4/29/07
Blue Tower Quasi-Peak Adapter	HP	85650A	2811A01279	CAL 4/13/05	4/13/07
Blue Tower RF Preselector	HP	85685A	2926A00983	CAL 9/5/05	9/5/07
Blue Tower Spectrum Analyzer	HP	8568B	2928A04729 2848A18049	CAL 4/13/05	4/13/07
LISN	Electro-Metrics	ANS-25/2	2604	CAL 8/27/04	8/27/06
LISN	Electro-Metrics	EM-7820	2682	CAL 4/28/05	4/28/07
Log-Periodic Antenna	Eaton	96005	1243	CAL 12/14/05	12/14/07
Passive Loop Antenna	EMC Test Systems	EMCO 6512	9706-1211	CHAR 7/10/04	7/10/06

Statement of Traceability: All calibrations have been performed per the NVLAP requirements traceable to the NIST.