# TEST REPORT

**FCC ID:** **PBWB187R26** (for Base)
**PBWB187R26H** (for Handset)

**IC:** **3842A-B187** (Base & Handset)

**Equipment Under Test: (EUT)**

**VoIP321XY/ZZ** (Base & Handset)
**VoIP321C** (Handset Charger)

S/N: MS000608010010 (TS05036610) (Conducted measurement)
S/N: MS000608010008 (TS05036602) (Radiated measurement)
S/N: MS000608010009 (TS05036615) (Radiated measurement)
S/N: MS000608010008 (TS05036602) (Charger)
S/N: MS000608010009 (TS05036615) (Charger)
S/N: MS000608010011 (B187060210001) (SAR)
S/N: MS000608010012 (B187060210002 (SAR)

**In Accordance With:**

**FCC Part 15, Subparts B, C & D / IC RSS-213 & ICES-003**
UPCS / LE-PCS Isochronous Device
Base & Handset: **1921.536 – 1928.448 MHz**
Charger: Unintentional radiator

**ANSI C63.17 – 1998** (or 2005 Draft where applicable)

**Tested By:** **Frank Ma / Jeffrey Yang**

**Date:** **Feb15, 2006**

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## 1 CHANNEL FREQUENCIES

**Clause:** **15.303 (d) & (g) / 8.0**

**Requirement:** Within 1920 – 1930 MHz band for isochronous devices

| UPCS CHANNEL | FREQUENCY (MHz) |
|---|---|
| Band Edge | 1930.000 |
| **1 (High)** | 1928.448 |
| 4 | 1926.720 |
| **3 (Mid)** | 1924.992 |
| 2 | 1923.264 |
| **5 (Low)** | 1921.536 |
| Band Edge | 1920.000 |

**Test Condition:** Refer to RF Communication Protocol or Test Mode Procedure for the selection of channel in normal and test modes of operation.

## 2 ANTENNA REQUIREMENT

**Clause:** **15.317 (15.203) / 5.5**

**Requirement:** No antenna other than that furnished by the responsible party shall be used with the device

**Observation:** Base and Handset have each a pre-formed wire antenna permanently attached on the PCB; it is not user replaceable. Base has an additional internal antenna for diversity configuration. There is no external antenna or connector provided on the base or handset for the user to use antenna other than that furnished originally.

**Spec of Antenna:** As follows
Antenna transmit gain = 1.6 – 2.0 dBi (1.446 – 1.585 numeric) across the band

**Result:** As antenna gain < 3 dBi, no correction factor necessary to be applied to subsequent radiation measurement readings.

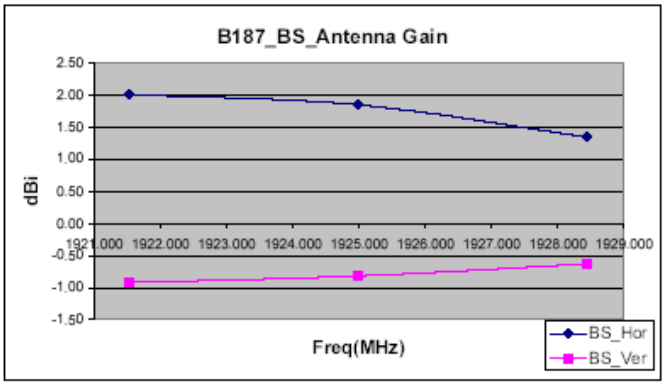
GAIN

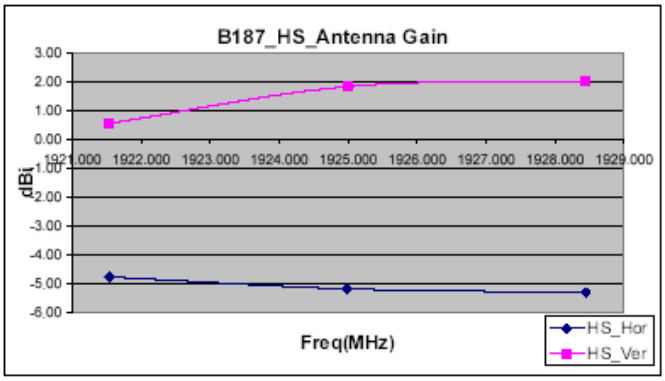
**B187 Antenna Gain for FCC Approval Sample**

Ascalade Technologies Inc.

Date: Jan 31, 2006

| | Channel | Ch 0 | Ch 2 | Ch 4 |
|---|---|---|---|---|
| | Freq(MHz) | 1928.448 | 1924.992 | 1921.536 |
| BS | Hor | 1.34 | 1.84 | 2.00 |
| | Ver | -0.63 | -0.82 | -0.92 |
| HS | Hor | -5.28 | -5.16 | -4.74 |
| | Ver | 2.00 | 1.82 | 0.55 |



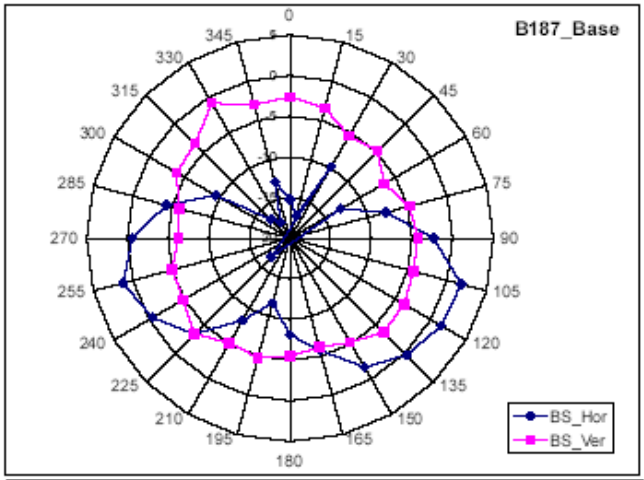
B187 Antenna Pattern for FCC Approval Sample

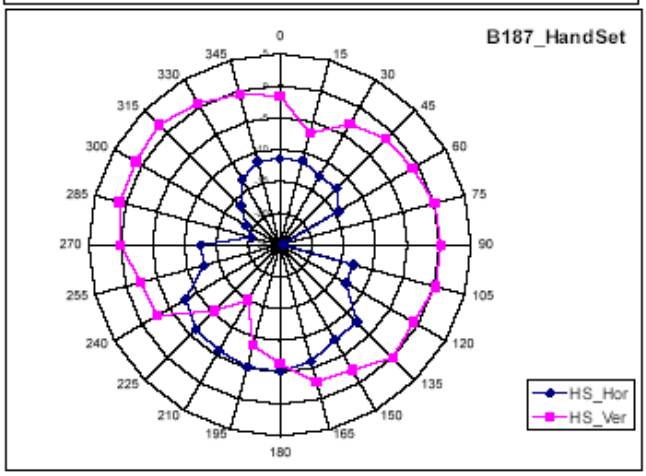
Ascalade Technologies Inc.

Date: Jan 31, 2006

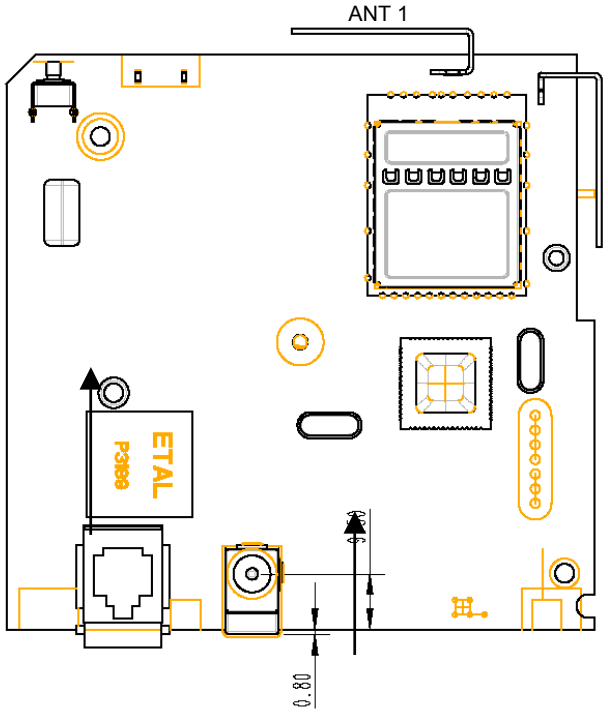
| Degree | BS_Hor (dBi) | BS_Ver (dBi) | HS_Hor (dBi) | HS_Ver (dBi) |
|---|---|---|---|---|
| 0 | -15.2 | -2.61 | -11.45 | -1.61 |
| 15 | -17.14 | -3.43 | -11.34 | -6.91 |
| 30 | -9.84 | -5.46 | -12.62 | -3.1 |
| 45 | -23.27 | -4.8 | -12.46 | -1.46 |
| 60 | -12.77 | -6.64 | -14.38 | -0.95 |
| 75 | -7.79 | -4.8 | -24.47 | 0.17 |
| 90 | -2.33 | -4.28 | -24.46 | 0.21 |
| 105 | 1.81 | -4.28 | -13.03 | 0.27 |
| 120 | 1.49 | -3.78 | -13.06 | -0.79 |
| 135 | 0.31 | -3.71 | -7.86 | -0.02 |
| 150 | -1.7 | -5.2 | -7.82 | -2.34 |
| 165 | -5.7 | -6.13 | -6.05 | -2.78 |
| 180 | -8.14 | -5.46 | -5.16 | -6.35 |
| 195 | -11.73 | -4.78 | -5.19 | -8.73 |
| 210 | -8.31 | -5.13 | -5.86 | -15 |
| 225 | -3.35 | -3.36 | -6.35 | -10.34 |
| 240 | -0.49 | -4.83 | -7.92 | -2.79 |
| 255 | 1.26 | -5.01 | -12.66 | -2.36 |
| 270 | -0.63 | -6.29 | -12.55 | -0.07 |
| 285 | -4.25 | -5.89 | -20.36 | 1.03 |
| 300 | -9.47 | -3.89 | -18.9 | 1.07 |
| 315 | -16.7 | -3.5 | -16.3 | 1.72 |
| 330 | -17.77 | -0.82 | -13.15 | 0.61 |
| 345 | -12.82 | -3.03 | -11.45 | -0.54 |
| 360 | -15.58 | -2.65 | -12.26 | -1.45 |

| | | | | |
|---|---|---|---|---|
| Max(dBi) | 1.81 | -0.82 | -5.16 | 1.72 |
| Min(dBi) | -23.27 | -6.64 | -24.47 | -15.00 |
| Diff(dB) | 25.08 | 5.82 | 19.31 | 16.72 |

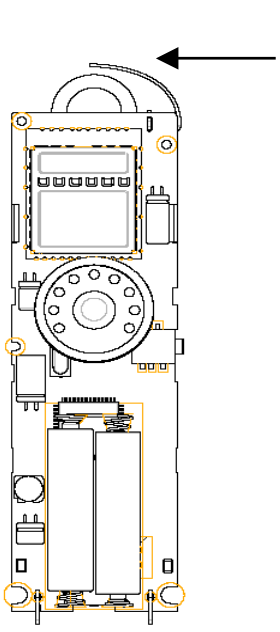


BASE ANTENNA ASSEMBLY




HANDSET ANTENNA ASSEMBLY



EMISSION BANDWIDTH

**Clause:** **15.323 (a) / 8.2**

**Requirement:** 50 kHz < B < 2.5 MHz

**SA Setting:** RBW ≈ 1 % of Emission BW (or 0.5 % < RBW < 2 % for fixed setting)

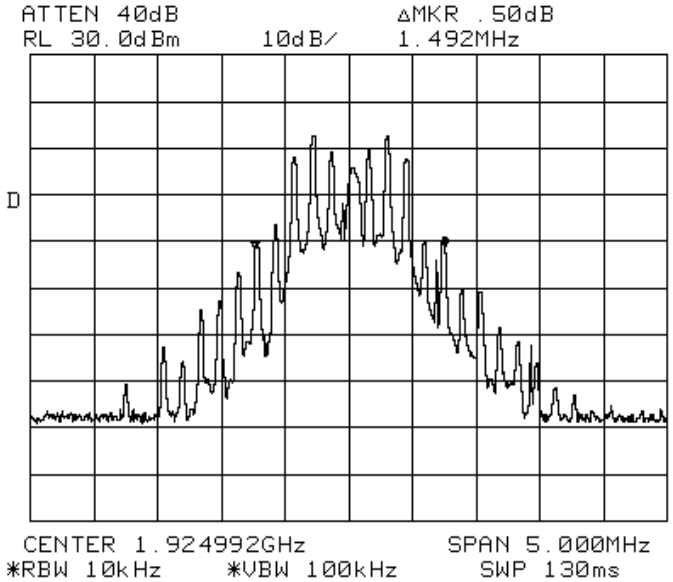
**ANSI 6.1.3** VBW ≥ 3 x RBW
Span ≥ 2 x B
Sweep: Sufficient to stabilize trace
Detection: Peak hold

**Test Result:** Base: 1.492 MHz < Limit 2.5 MHz
Handset: 1.492 MHz < Limit 2.5 MHz

### 3.1 Base

| Test Mode | Channel No. | Frequency (MHz) | 26 dB Bandwidth (kHz) |
|---|---|---|---|
| 4 | 1 | 1928.448 | 1483 |
| 5 | 3 | 1924.992 | **1492** |
| 6 | 5 | 1921.536 | 1467 |

Worst-case plot follows:

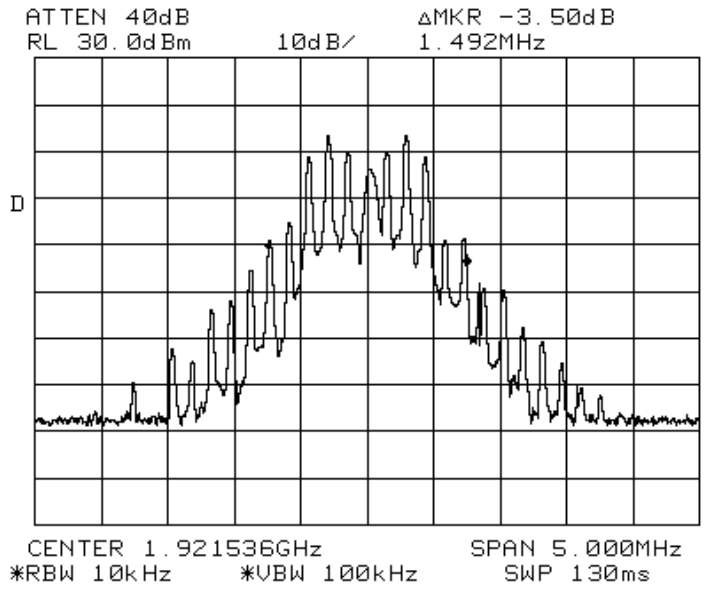



Base emission BW at Middle Channel

### 3.2 Handset

| Test Mode | Channel No. | Frequency (MHz) | 26 dB Bandwidth (kHz) |
|---|---|---|---|
| 1 (Mod ON), 2 (Ch 01) | 1 | 1928.448 | 1475 |
| 1 (Mod ON), 2 (Ch 03) | 3 | 1924.992 | 1483 |
| 1 (Mod ON), 2 (Ch 05) | 5 | 1921.536 | **1492** |

Worst-case plot follows:




Handset emission BW at Low Channel

## 3 CONDUCTED PEAK TRANSMIT POWER

**Clause:** **15.319 (c) / 8.1**

**Requirement:** ≤ 100 μW x $\sqrt{B}$ = 5 logB - 10 dBm = 20.8 dBm, where B rated 1.5 MHz maximum

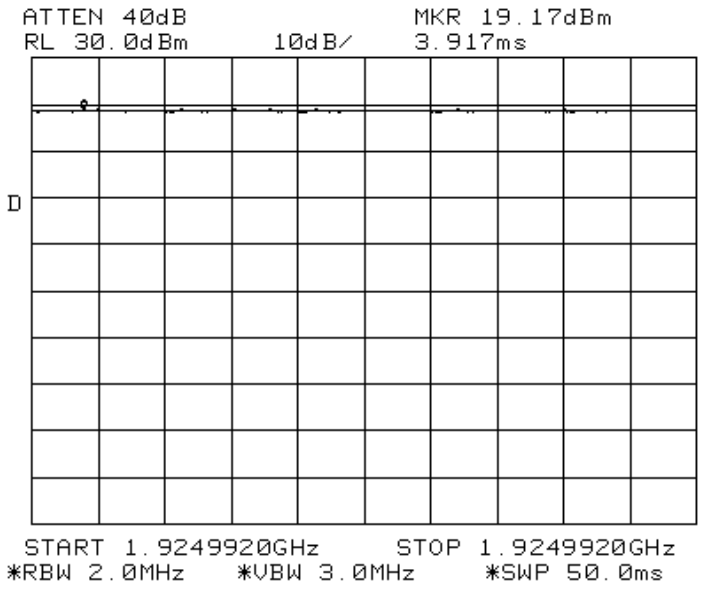
**SA Setting:** RBW ≥ Emission BW (or increased until no more than 0.5 dB change in power)
**ANSI 6.1.2** VBW ≥ 3 x RBW
Span = zero, centered on channel center
Sweep: fast enough to resolve transmit pulse
Detection: Peak

**Test Result:** Base: 19.30 dBm (worst case)
Handset: 18.97 dBm (worst case)

### 4.1 Base

| Test Mode | Chan. No. | Freq. (MHz) | Reading (dBm) | Cable (dB) | Peak Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| 4 | 1 | 1928.448 | 19.00 | 0.8 | 19.80 | 20.8 | 1.00 |
| 5 | 3 | 1924.992 | **19.17** | 0.8 | **19.97** | 20.8 | 0.83 |
| 6 | 5 | 1921.536 | 19.00 | 0.8 | 19.80 | 20.8 | 1.00 |

Worst-case plot follows:

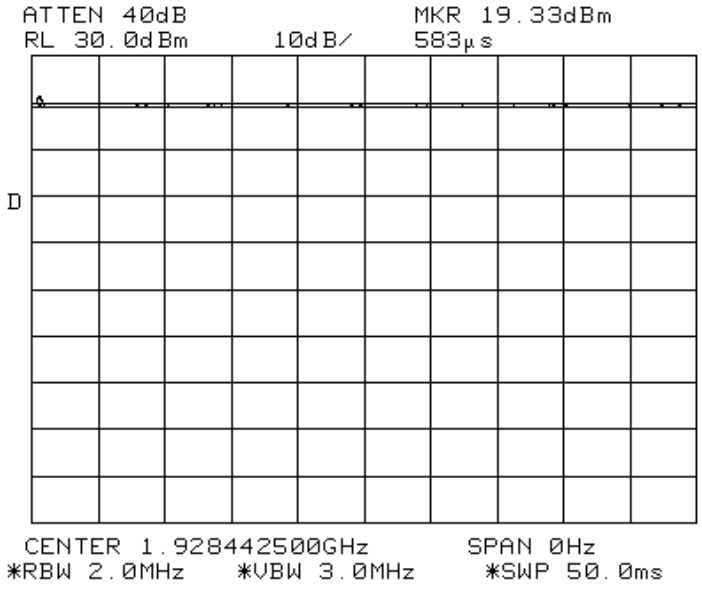



Base peak power at middle Channel

## 4.2 Handset

| Test Mode | Chan. No. | Freq. (MHz) | Reading (dBm) | Cable (dB) | Peak Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| 1, 2 | 1 | 1928.448 | **19.33** | 0.8 | **20.13** | 20.8 | 0.67 |
| 1, 2 | 3 | 1924.992 | 19.33 | 0.8 | 20.13 | 20.8 | 0.67 |
| 1, 2 | 5 | 1921.536 | 19.33 | 0.8 | 20.13 | 20.8 | 0.67 |

Worst-case plot follows:




Handset peak power at High Channel

## 4 RADIATED PEAK POWER

**Clause:** **15.319 (c) / 8.1**

**Requirement:** ≤ 100 μW x $\sqrt{B}$ = 5 logB - 10 dBm = 20.8 dBm for B = 1.5 MHz max.
≤ 118 dBμV/m at 3m by radiated measurement derived from Friis formula as follows

Field Strength $E = \frac{\sqrt{30PG}}{d} = \frac{\sqrt{30*0.122*1.585}}{3}$ V/m = 97.2 + P dBm = 118 dBμV/m

where P = 0.122 W (20.8 dBm from Sec. 4)
G = Numeric gain of TX antenna = 1.585 (2.0 dBi) worst-case across band
d = 3 m

**SA Setting:** RBW ≥ Emission BW (or increased until no more than 0.5 dB change in power)
**ANSI 6.1.2** VBW ≥ 3 x RBW
Span = zero, centered on channel center
Sweep: fast enough to resolve transmit pulse
Detection: Peak

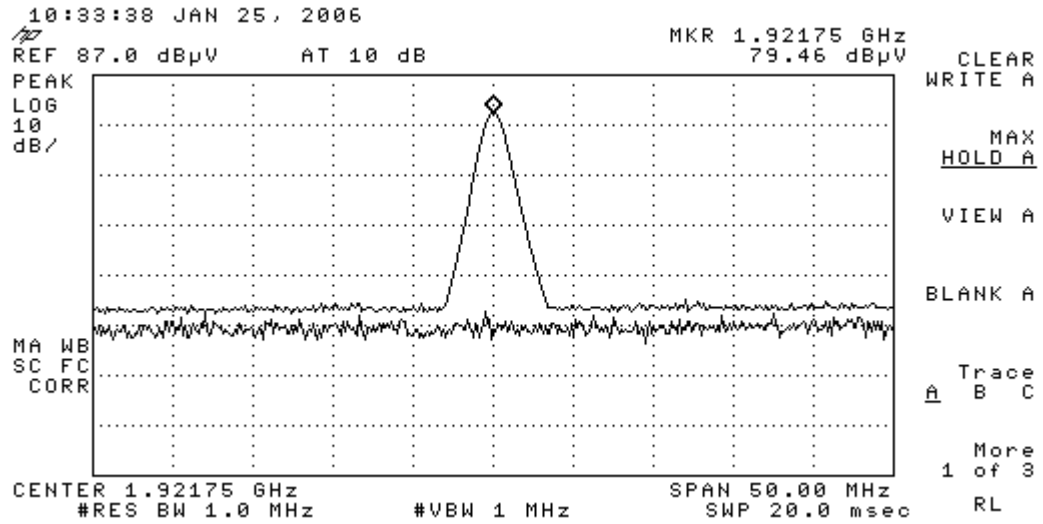
**Test Result:** Base: 18.48 dBm (worst case)
Handset: 14.37 dBm (worst case)

### 5.1 Base

| Chan. No. | Frequency (MHz) | Meter Peak Reading (dBμV) | Coax Loss (dB) | Antenna Factor (Note 2) (dB) | Pre-amp Gain (dB) | Field Strength at 3m (dBμV/m) | Radiated Power (Note 3) (dBm) | EIRP (mW) |
|---|---|---|---|---|---|---|---|---|
| 1 (HIGH) | 1928.63 | 77.52 | 7.52 | 28.7 V | 0 | 113.74 | 16.54 | 45.08 |
| 3 (MID) | 1925.13 | 78.24 | 7.52 | 28.7 V | 0 | 114.46 | 17.26 | 53.21 |
| 5 (LOW) | 1921.75 | **79.46** | 7.52 | 28.7 V | 0 | **115.68** | **18.48** | **70.46** |

Note 2: Horn antenna in Horizontal (H) or Vertical (V) polarization
Note 3: 97.2 dB taken as factor to convert Field Strength to Radiated Power in numerical value

Worst-case plot follows.



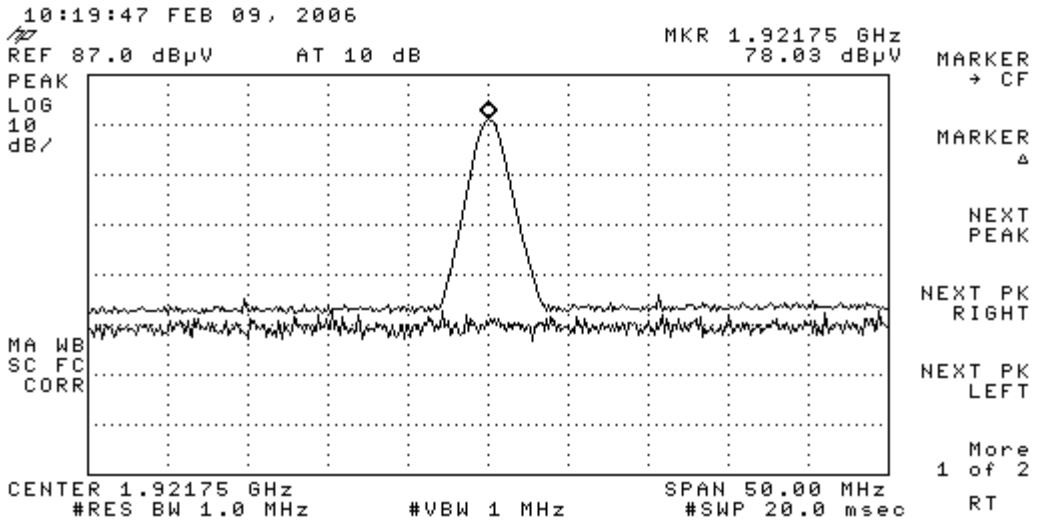

Radiated Field Strength at Mid Channel

### 5.2 Handset

| Chan. No. | Frequency (MHz) | Meter Peak Reading (dBµV) | Coax Loss (dB) | Antenna Factor (Note 2) (dB) | Pre-amp Gain (dB) | Field Strength at 3m (dBµV/m) | Radiated Power (Note 3) (dBm) | EIRP (mW) |
|---|---|---|---|---|---|---|---|---|
| 1 (HIGH) | 1928.63 | 77.36 | 7.52 | 28.7 V | 0 | 113.58 | 16.38 | 43.45 |
| 3 (MID) | 1925.13 | 76.92 | 7.52 | 28.7 V | 0 | 113.14 | 15.94 | 39.26 |
| 5 (LOW) | 1921.75 | **78.03** | 7.52 | 28.7 V | 0 | **114.25** | **17.05** | **50.69** |

Note 2: Horn antenna in Horizontal (H) or Vertical (V) polarization
Note 3: 97.2 dB taken as factor to convert Field Strength to Radiated Power in numerical value

Worst-case plot follows.




Radiated Field Strength at High Channel

## 5 RF EXPOSURE

**Clause:** **15.319 (i) / 12.0**

**Requirement:** **1.1307(b), 2.1091 and 2.1093 / RSS-102 as appropriate**
MPE ≤ 1 mW/cm$^2$ at 20 cm
SAR ≤ 1.6 W/kg over any 1 g of tissue

**Reference:** OET Bulletin 65 for General Population / Uncontrolled Exposure

**Test Result:** Base: Compliant
Handset: Compliant

### 6.1 Base MPE

Power density S = EIRP / $4\pi R^2$, where R is distance 20 cm
= 79.5 / $4\pi(20)^2$ = 0.016 mW/cm$^2$ < 1 mW/cm$^2$ limit

### 6.2 Handset SAR

Refer to separate SAR testing report by Celltech

## 6 DUTY CYCLE CORRECTION FACTOR

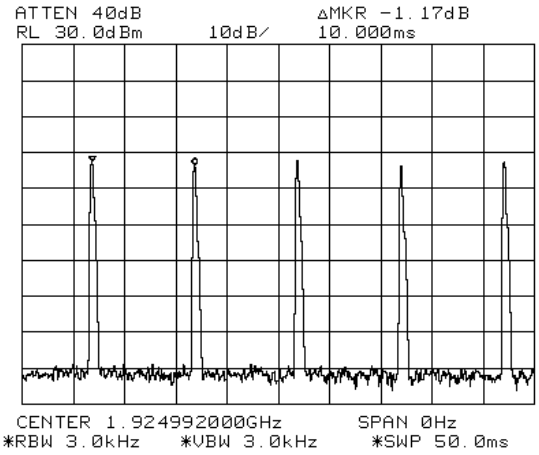
**Clause:** **N/A**

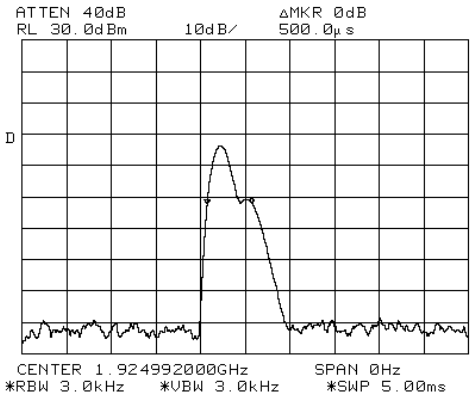
**Max. Allowed:** 6 dB per IC clause 8.2.3

**SA Setting:** RBW = 3 kHz
VBW = RBW
Sweep = 100 ms (or less for better resolution)
Span = zero, centered on channel center
Detection: Peak

### 7.1 Base

DCF_BS = 10 log (TX-on Time/10 ms) for power in dBm
= 10 log (0.5 ms x 5 /10 ms) from timing plots below
= –6.02 dB => –6 dB maximum allowed



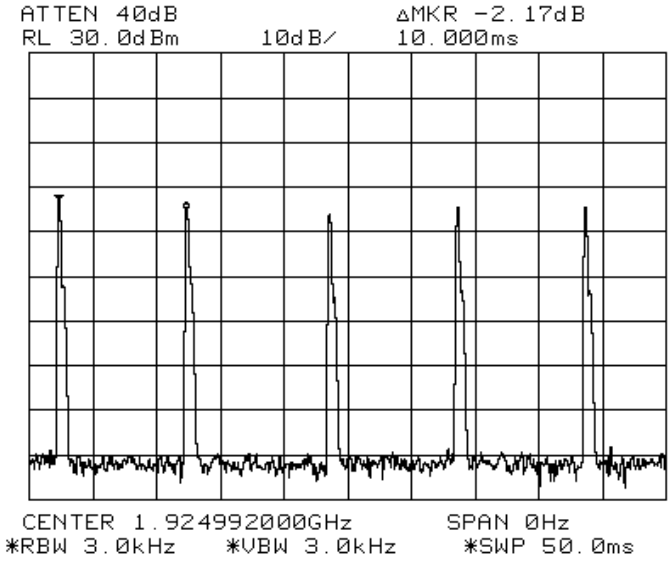

Base TX pulse width in 10 ms for 1time slot operation

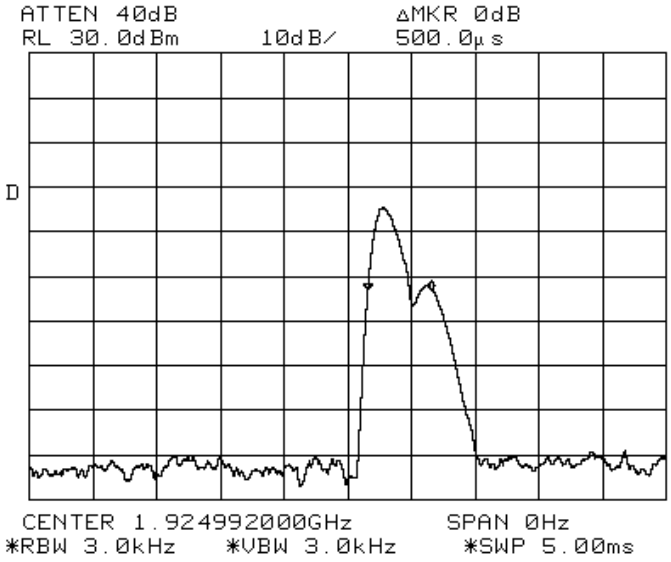
### 7.2 Handset

DCF_HS = –6 dB maximum allowed (same pulse operation in TDMA as base)

### 7.3 Single-Handset Operation

DCF = 10 log (TX-on Time/100 ms) for power in dBm
= 10 log (500 μs /10 ms) from timing plots below
= –13 dB => –6 dB maximum allowed




TX pulse width in 10 ms for 1 time slot in single-handset operation

## 7 POWER SPECTRAL DENSITY

**Clause:** **15.319 (d) / 8.2**

**Requirement:** ≤ 3 mW (4.77 dBm) by average detection or 12 mW (10.8 dBm) by peak-hold detection

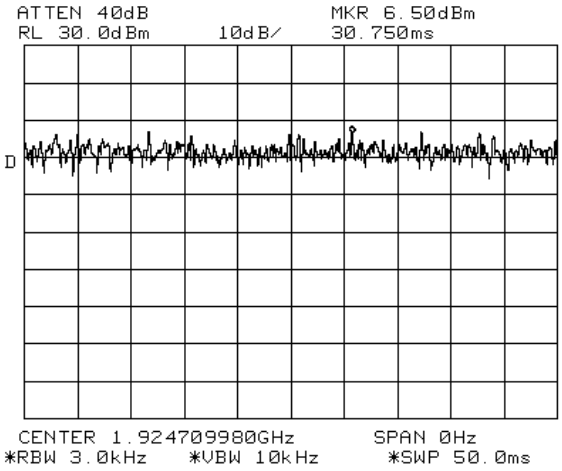
**SA Setting:** RBW = 3 kHz
**ANSI 6.1.5** VBW = RBW
Span = B first to locate peak, then 10 kHz to read power within 3 kHz
Sweep: slow enough for at least 2 bursts to occur in each 3 kHz of span swept; e.g. 10 s sweep captures 1000 bursts of 10 ms-burst-rate signal while sweeping across 1.5 MHz, for 2 bursts per 3 kHz interval
Detection: Average or Peak (see applicable limit above)

**Test Result:** Base: 0.13 dBm (worst case)
Handset: 0.63 dBm (worst case)

### 8.1 Base

| Test Mode | Chan. No. | Freq. (MHz) | Reading (dBm) | Cable (dB) | DC Factor | PSD (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 4 | 1 | 1928.448 | 6.33 | 0.8 | -6.0 | 1.13 | 4.77 | 3.64 |
| 5 | 3 | 1924.992 | **6.50** | 0.8 | -6.0 | **1.30** | 4.77 | 3.47 |
| 6 | 5 | 1921.536 | 6.33 | 0.8 | -6.0 | 1.13 | 4.77 | 3.64 |

Worst-case plot follows:

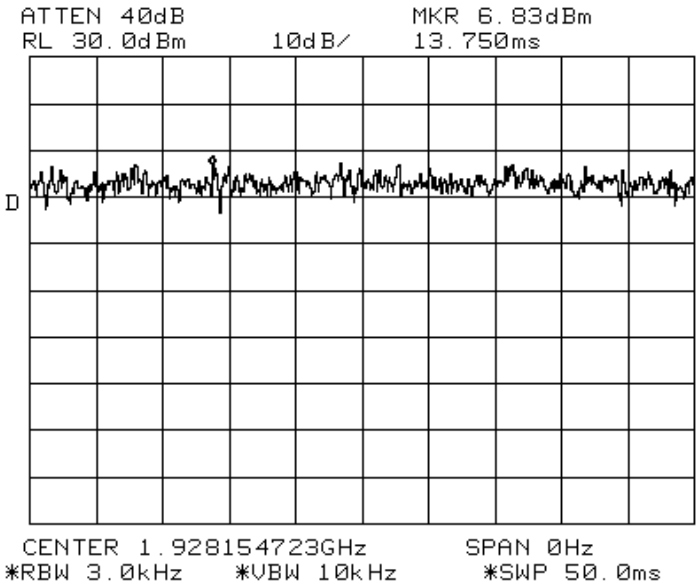



Base PSD at middle Channel

### 8.2 Handset

| Test Mode | Chan. No. | Freq. (MHz) | Reading (dBm) | Cable (dB) | DC Factor | PSD (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 1, 2 | 1 | 1928.448 | **6.83** | 0.8 | -6.0 | **1.63** | 4.77 | 3.14 |
| 1, 2 | 3 | 1924.992 | 6.00 | 0.8 | -6.0 | 0.80 | 4.77 | 3.97 |
| 1, 2 | 5 | 1921.536 | 6.67 | 0.8 | -6.0 | 1.47 | 4.77 | 3.30 |

Worst-case plot follows:

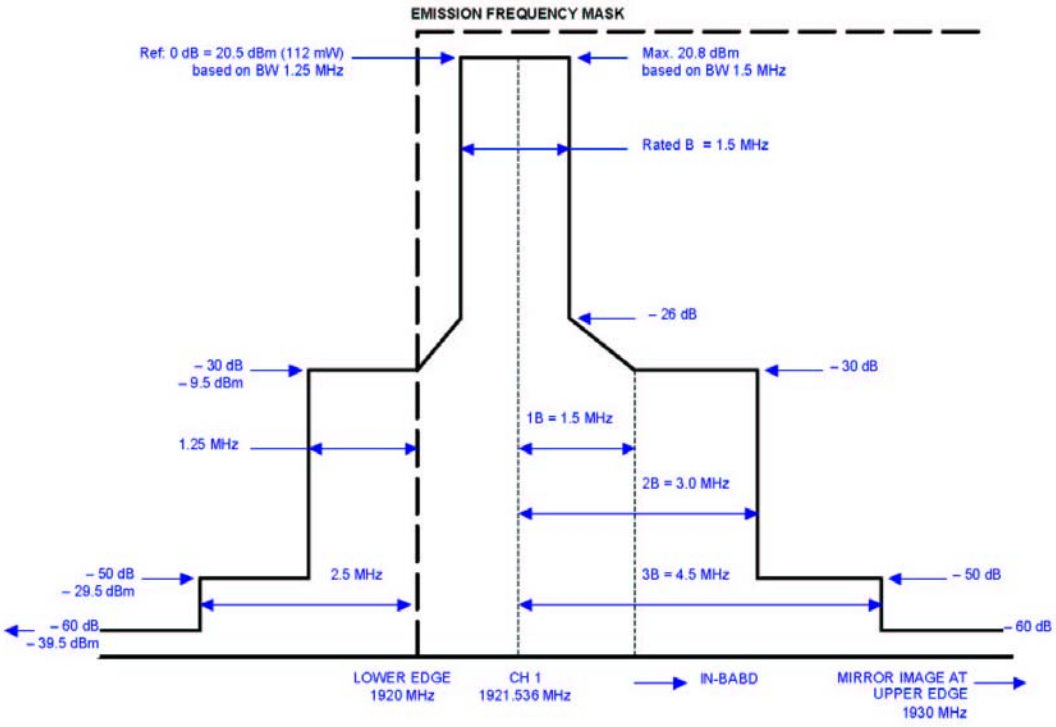



Handset PSD at High Channel

## 8 EMISSIONS AT BAND EDGE AND BEYOND

**Clause:** **15.323 (d) / 8.3.1**

**Requirement:** As shown in diagram of Emission Mask




**SA Setting:** RBW ≈ 1 % of Emission BW (or 0.5 % < RBW < 2 % for fixed setting)

**ANSI 6.1.6.2** VBW = 3 x RBW
Span ≥ 3.5 x B
Sweep: Sufficient to stabilize trace (≥ pulse repetitive interval x no. of trace elements)
Detection: Peak hold

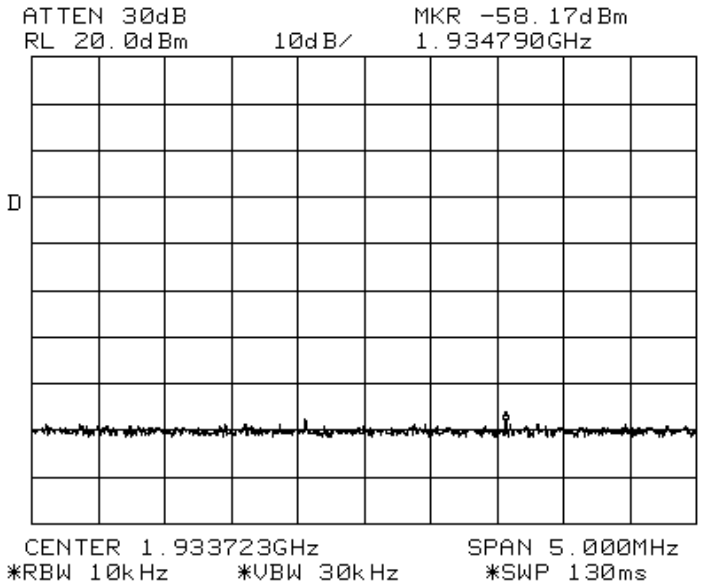
**Test Result:** Base: –65.6 dBc (worst case at lower band edge)
Handset: –66.0 dBc (worst case at upper band edge)

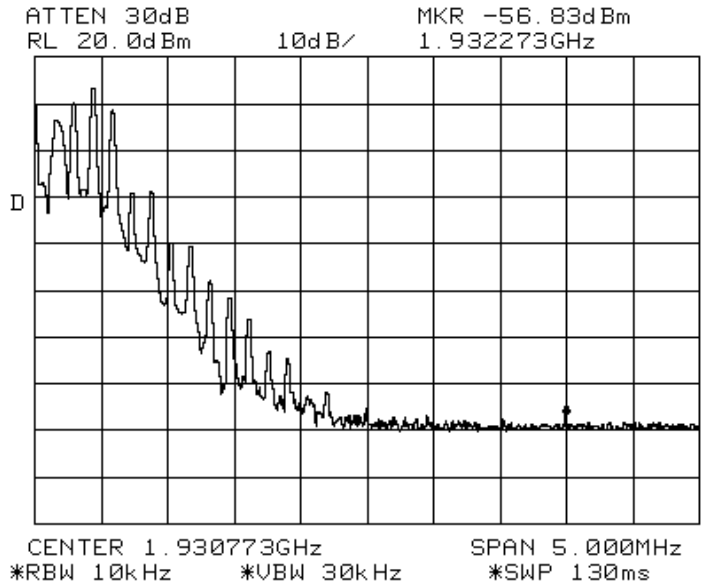
For in-band out-of-channel emissions, since emission bandwidth B is greater than out-band step bandwidth 1.25 MHz and occupied bandwidth is symmetrical about channel center, compliance in out-band emissions will automatically lead to compliance in in-band out-of-channel.

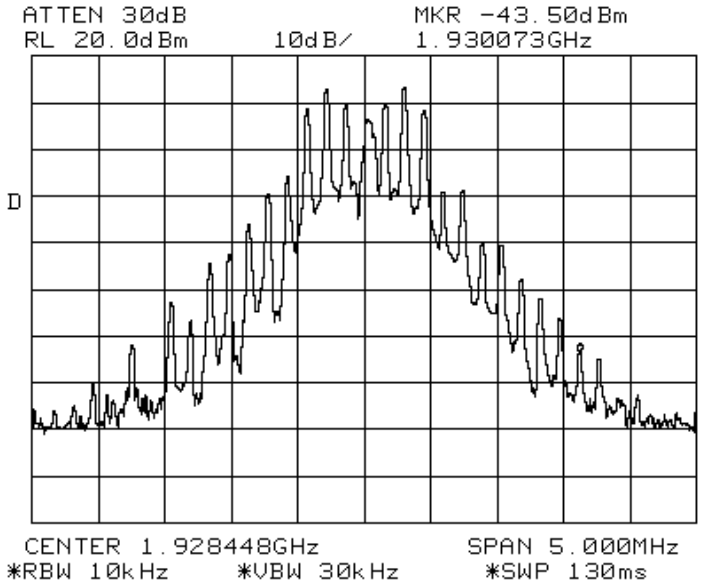
### 9.1 Base Near Band Edge

| Test Mode | Chan. No. | Freq. (MHz) | Freq. Range (MHz) | Reading (dBm) | Rel. Att. (dBc) | Limit (dBc) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| 4 | 1 | 1928.448 | Upper edge | 18.00 | 0. 00 | --- | --- |
| | | 1930.073 | 1930 ~1931.25 | -43.50 | -61.50 | -30 | 31.5 |
| | | 1932.273 | 1931.25 ~1932.5 | -56.83 | -74.83 | -50 | 24.83 |
| | | 1934.790 | 1932.5 ~ up | **-58.17** | -76.17 | -60 | **16.17** |
| 6 | 5 | 1921.536 | Lower Edge | 18.50 | 0. 00 | --- | --- |
| | | 1919.786 | 1918.75 ~1920 | -42.00 | -60.50 | -30 | 30.50 |
| | | 1918.378 | 1917.5 ~1918.75 | -57.83 | -76.33 | -50 | 26.33 |
| | | 1916.819 | Down ~1917.5 | **-58.67** | -77.17 | -60 | **17.17** |

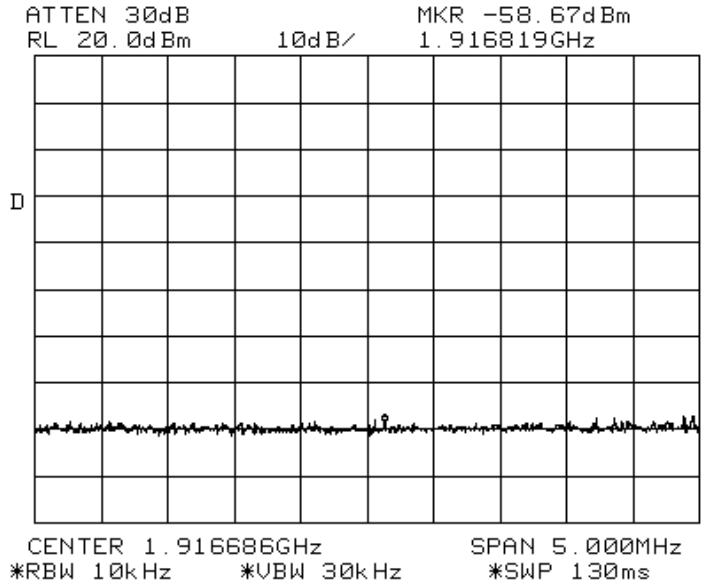
Upper out-band plots follow:

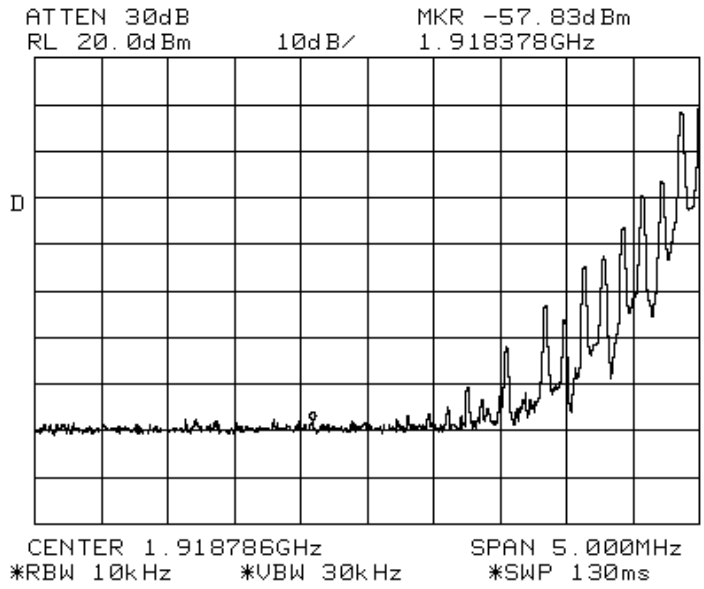


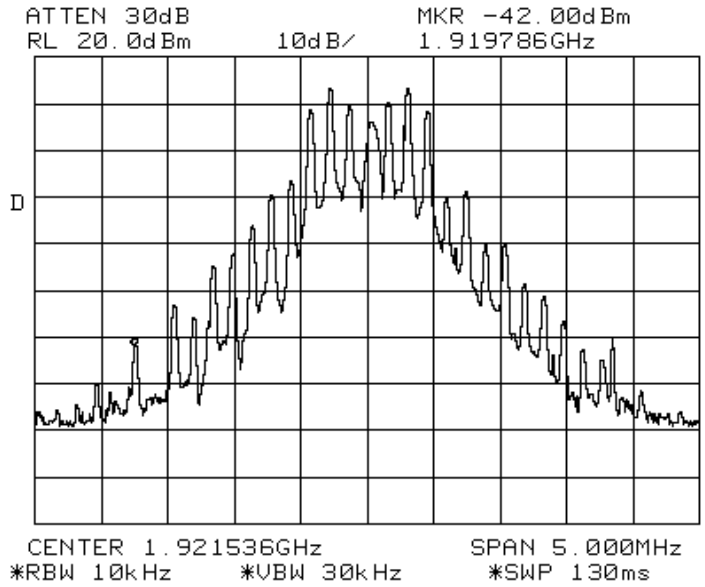


Lower out-band plots follow:



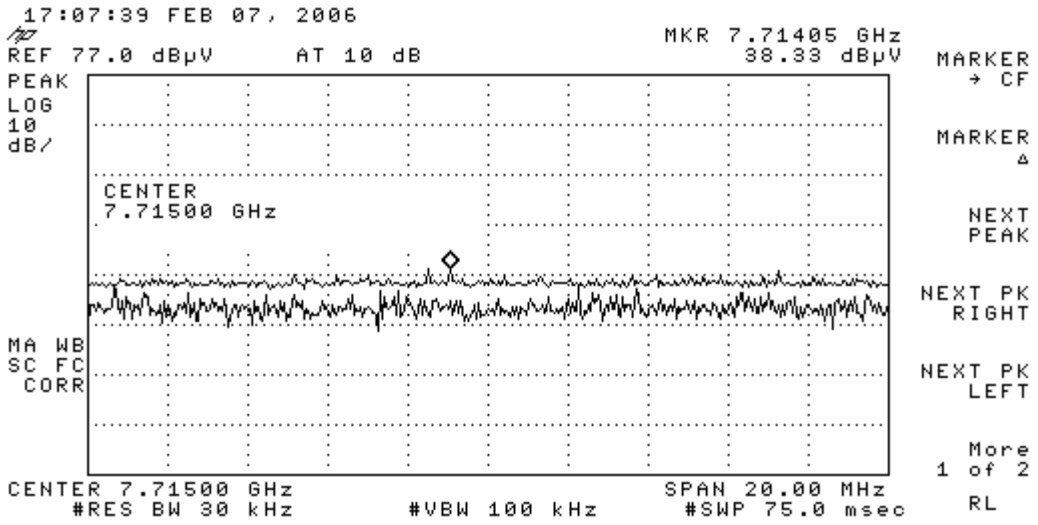


### 9.2 Base Tx Harmonics

| Chan. No. | Frequency (MHz) | Meter Peak Reading (dBμV) | Coax Loss (dB) | Antenna Factor (Note 2) (dB) | Pre-amp Gain (dB) | Field Strength at 3m (dBμV/m) | Rel. Level (dBc) | Rule Limit (dBc) | Margin from Limit (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 1 (HIGH) | 1928.448 | | | | | 115.68 (Note 4) | 0.00 | --- | --- |
| 2 x fc | 3857.71 | 40.65 | 10.5 | 33 V | -35 | 49.15 | -66.53 | -60 | 6.53 |
| 3 x | 5785.65 | 40.04 | 11.7 | 35 V | -35 | 51.74 | -63.94 | -60 | 3.94 |
| 4 x | 7714.05 | **38.33** | 15.2 | 37 H | -35 | **55.53** | **-60.15** | -60 | **0.15** |
| 3 (MID) | 1924.992 | | | | | 115.68 (Note 4) | 0.00 | --- | --- |
| 2 x fc | 3850.05 | 39.97 | 10.5 | 33 V | -35 | 48.47 | -67.21 | -60 | 7.21 |
| 3 x | 5775.15 | 40.61 | 11.7 | 35 V | -35 | 52.31 | 63.37 | -60 | 3.37 |
| 4 x | 7700.25 | 38.15 | 15.2 | 37 H | -35 | 55.15 | -60.53 | -60 | 0.53 |
| 5 (LOW) | 1921.536 | | | | | 115.68 (Note 4) | 0.00 | --- | --- |
| 2 x fc | 3843.30 | 41.34 | 10.5 | 33 V | -35 | 49.84 | -65.84 | -60 | 5.84 |
| 3 x | 5765.69 | 40.85 | 11.7 | 35 V | -35 | 52.55 | -63.13 | -60 | 3.13 |
| 4 x | 7686.45 | 37.75 | 15.2 | 37 H | -35 | 54.95 | -60.73 | -60 | 0.73 |

Note 2: Horn antenna in Horizontal (H) or Vertical (V) polarization
Note 4: Referenced to the maximum power measured above

Worst-case plot follows:

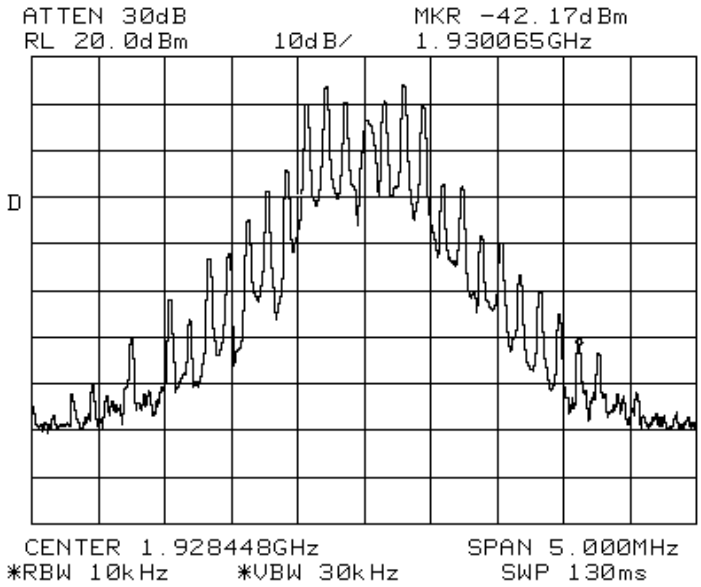


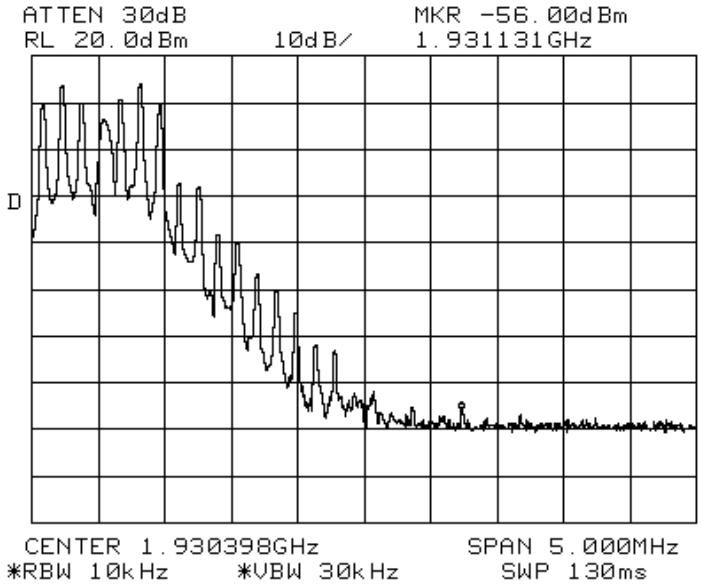

Base 4th Harmonic at High Channel

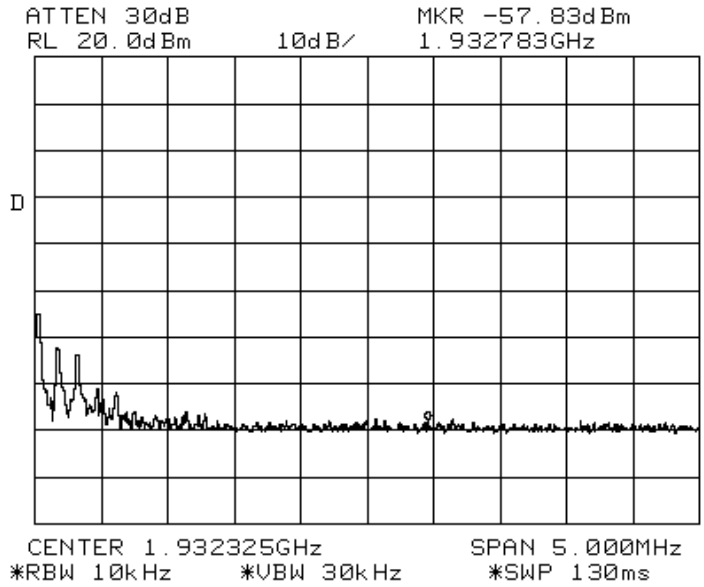
### 9.3 Handset Near Band Edge

| Test Mode | Chan. No. | Freq. (MHz) | Freq. Range (MHz) | Reading (dBm) | Rel. Att. (dBc) | Limit (dBc) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| 1, 2 | 1 | 1928.448 | Upper edge | 18.17 | 0. 0 | --- | --- |
| | | 1930.065 | 1930 ~1931.25 | -42.17 | -60.34 | -30 | 30.34 |
| | | 1931.131 | 1931.25 ~1932.5 | -56 | -74.17 | -50 | 24.17 |
| | | 1932.783 | 1932.5 ~ up | **-57.83** | -76.00 | -60 | **16.00** |
| 1, 2 | 5 | 1921.536 | Lower Edge | 18.17 | 0. 0 | --- | --- |
| | | 1919.786 | 1918.75 ~1920 | -40.50 | -58.67 | -30 | 28.67 |
| | | 1917.528 | 1917.5 ~1918.75 | -55.83 | -74 | -50 | 24 |
| | | 1917.203 | Down ~1917.5 | **-57.5** | -75.67 | -60 | **15.67** |

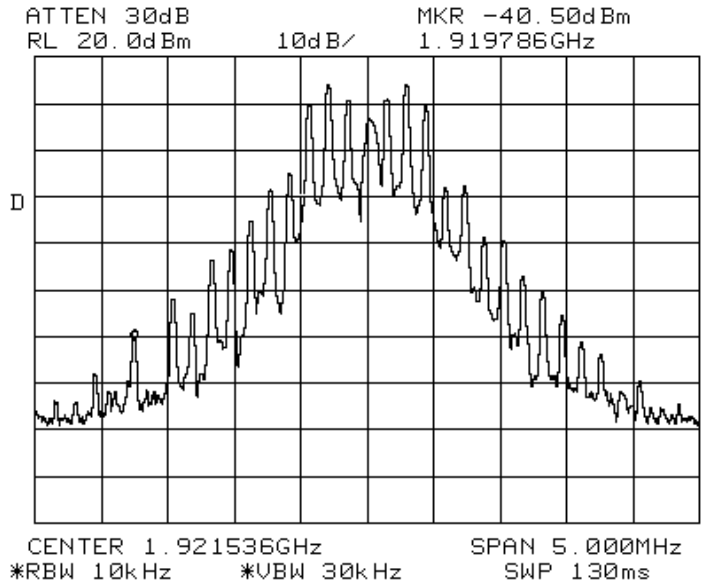
Upper out-band plots follow:

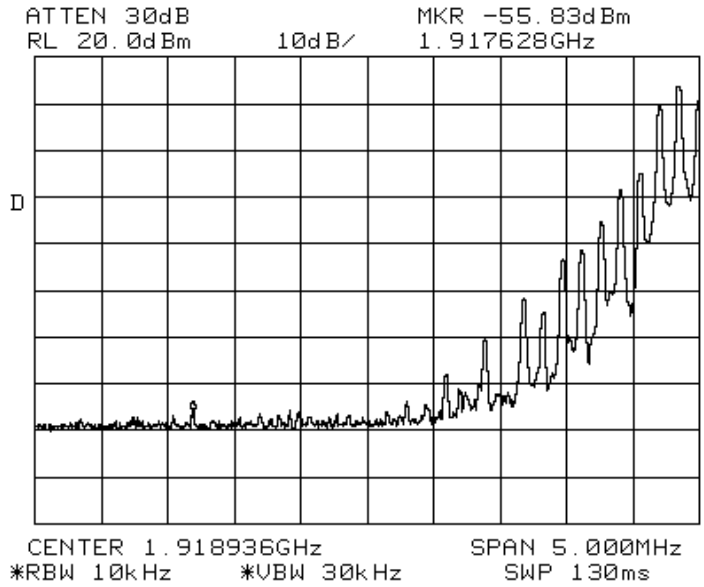


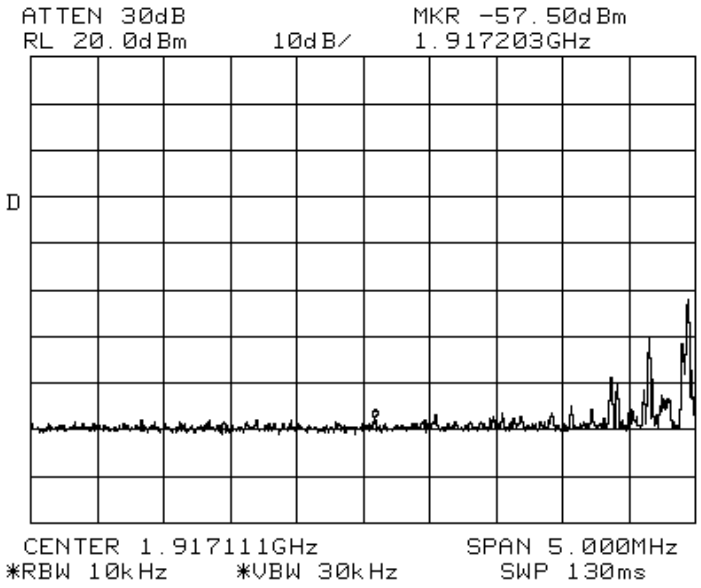






Lower out-band plots follow:





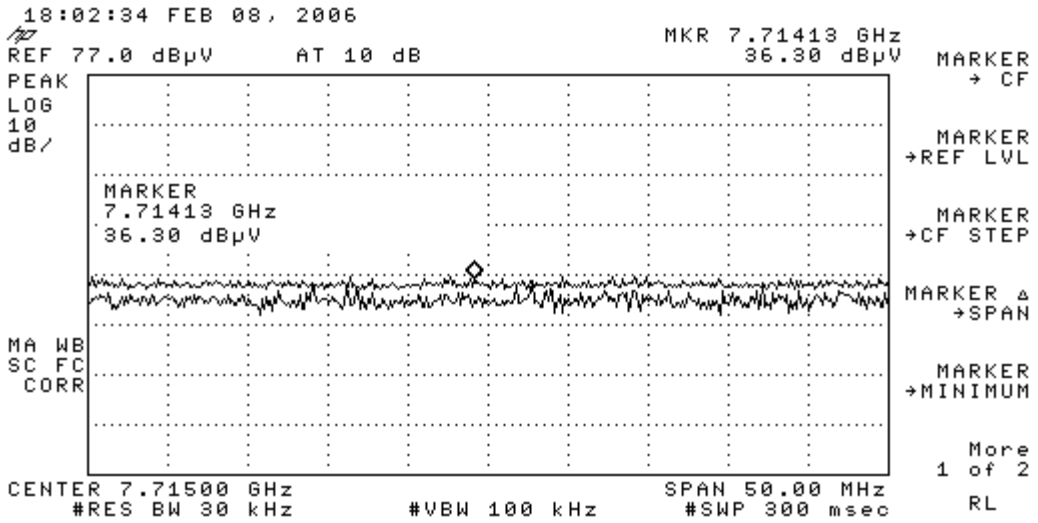



### 9.4 Handset Tx Harmonics

| Chan. No. | Frequency (MHz) | Meter Peak Reading (dBμV) | Coax Loss (dB) | Antenna Factor (Note 2) (dB) | Pre-amp Gain (dB) | Field Strength at 3m (dBμV/m) | Rel. Level (dBc) | Rule Limit (dBc) | Margin from Limit (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 1 (HIGH) | 1928.448 | | | | | 114.25 (Note 4) | 0.00 | --- | --- |
| 2 x fc | 3856.90 | 37.32 | 10.5 | 33 V | -35 | 45.82 | -68.43 | -60 | 8.43 |
| 3 x | 5785.75 | 39.15 | 11.7 | 35 V | -35 | 50.85 | -63.40 | -60 | 3.40 |
| 4 x | 7714.13 | **36.30** | 15.2 | 37 V | -35 | **53.50** | **-60.75** | -60 | **0.75** |
| 3 (MID) | 1924.992 | | | | | 114.25 (Note 4) | 0.00 | --- | --- |
| 2 x fc | 3850.08 | 38.29 | 10.5 | 33 V | -35 | 46.79 | -67.46 | -60 | 7.46 |
| 3 x | 5775.50 | 38.61 | 11.7 | 35 V | -35 | 50.31 | -63.94 | -60 | 3.94 |
| 4 x | 7700.38 | 36.12 | 15.2 | 37 V | -35 | 53.32 | -60.93 | -60 | 0.93 |
| 5 (LOW) | 1921.536 | | | | | 114.25 (Note 4) | 0.00 | --- | --- |
| 2 x fc | 3843.07 | 38.79 | 10.5 | 33 V | -35 | 47.29 | -66.96 | -60 | 6.96 |
| 3 x | 5765.00 | 37.20 | 11.7 | 35 V | -35 | 48.90 | -65.35 | -60 | 5.35 |
| 4 x | 7687.88 | 35.75 | 15.2 | 37 V | -35 | 52.95 | -61.30 | -60 | 1.30 |

Note 2: Horn antenna in Horizontal (H) or Vertical (V) polarization
Note 4: Referenced to the maximum power measured above

Worst-case plot follows:




Handset 4th Harmonic at Mid Channel

## 9 RADIATED SPURIOUS EMISSIONS

**Clause:** **15.205 (a), 15.205 (c), 15.209 (a) / 11.0**

**Limits:**

| Emission Frequency (MHz) | Field Strength | | At Distance (m) | Detector Type |
|---|---|---|---|---|
| | (µV/m) | (dBµV/m) | | |
| 0.009 – 0.490 | 2400/f (kHz) | 67.6 / kHz | 300 | AV (9-90 kHz, 110-490 kHz) QP (others) |
| 0.490 – 1.705 | 24000/f (kHz) | 87.6 / kHz | 30 | QP |
| 1.705 – 30.0 | 30 | 29.5 | 30 | QP |
| 30 – 88 | 100 | 40 | 3 | QP |
| 88 – 216 | 150 | 43.5 | 3 | QP |
| 216 – 960 | 200 | 46 | 3 | QP |
| > 960 | 500 | 54 | 3 | AV (> 1 GHz) |

**SA Setting:** RBW ≥ 100 kHz for f < 1 GHz, 1 MHz for f ≥ 1 GHz
**DA 00-705** VBW ≥ RBW
Span = to fully capture emission being measured
Sweep = auto

**Test Result:** Worst-case in each band (See separate section for band edge emission)

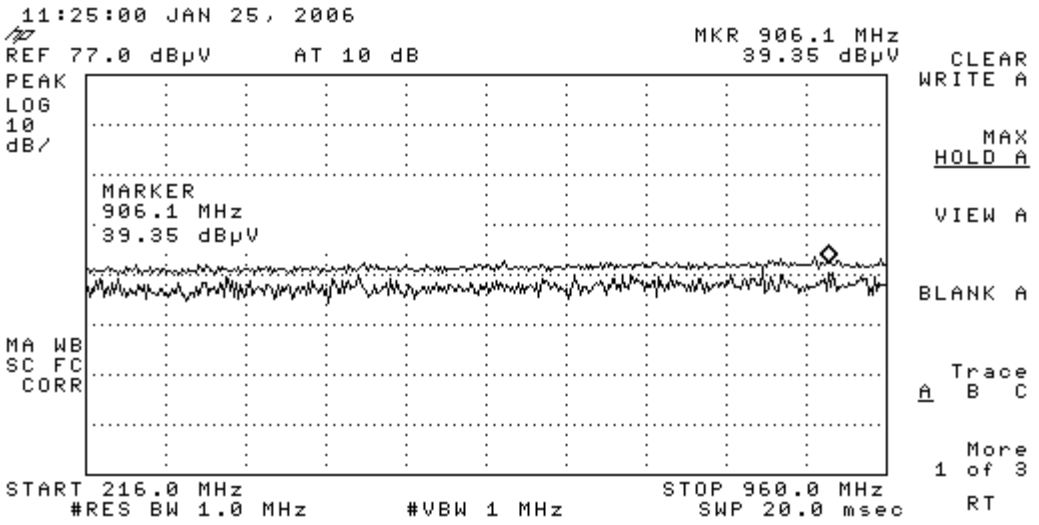
### 10.1 Base

10.1.1 Band 9 kHz – 30 MHz
10.1.2 Band 30 – 88 MHz
10.1.3 Band 88 – 216 MHz
10.1.4 Band 216 – 960 MHz

| Band (MHz) | Freq. (MHz) | Meter Peak Reading (dBμV) | Coax Loss (dB) | Antenna Factor (Note 1) (dB) | Pre-amp Gain (dB) | Field Strength at 3m (dBμV/m) | Rule Limit (dBμV/m) | Margin from Limit (dB) |
|---|---|---|---|---|---|---|---|---|
| 0.009–30 | | N/A | | | | | | N/A |
| 30 – 88 | 80.02 | 39.55 | 2.0 | 10.0 BV | -23.5 | 28.05 | 40 | 11.95 |
| 88–216 | 168.30 | 40.06 | 2.5 | 10.3 BV | -23.5 | 29.36 | 43.5 | 14.14 |
| 216–960 | 906.10 | **39.35** | 5.23 | 21.7 BH | -23.5 | **44.78** | 46 | **3.22** |

Note 1: Biconical (B) or Log-periodic (L) antenna in Horizontal (H) or Vertical (V) polarization

Worst-case plot follows:



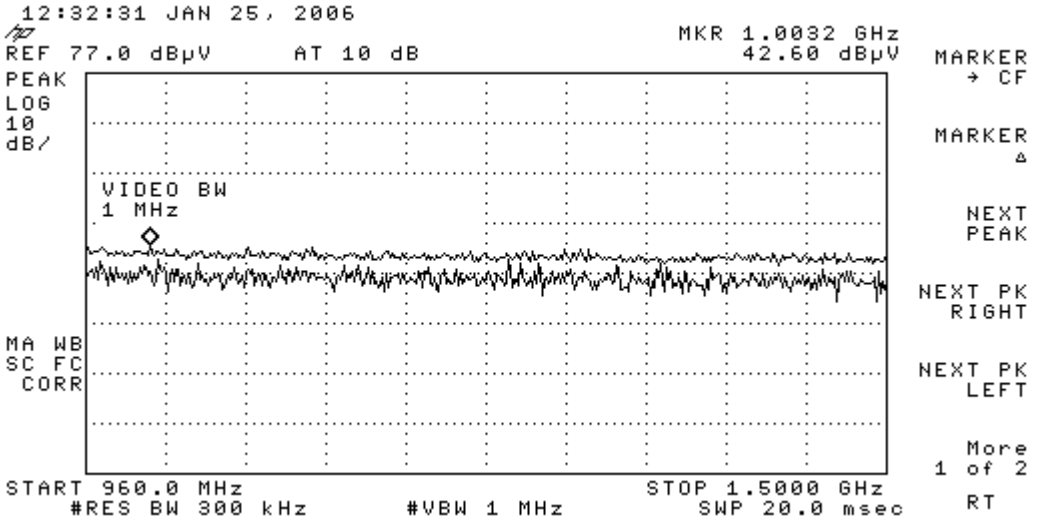

Base spurious emission ≤ 960 MHz

10.1.5 Band above 960 MHz

| Test Mode & Chan. | Frequency (MHz) | Meter Peak Reading (dBµV) | Coax Loss (dB) | Antenna Factor (Note 2) (dB) | Pre-amp Gain (dB) | Duty Cycle Factor (dB) | Field Strength at 3m (dBµV/m) | Rule Limit (dBµV/m) | Margin from Limit (dB) |
|---|---|---|---|---|---|---|---|---|---|
| TM | | | | | | | | | |
| 4, 5, 6 | 1003.20 | **42.60** | 5.71 | 25.7 H | -35 | N/A | 39.01 | 54 | **14.99** |
| | | | | | | | | | |

Note 2: Horn antenna in Horizontal (H) or Vertical (V) polarization

Worst-case plot follows:



Base spurious emission > 960 MHz

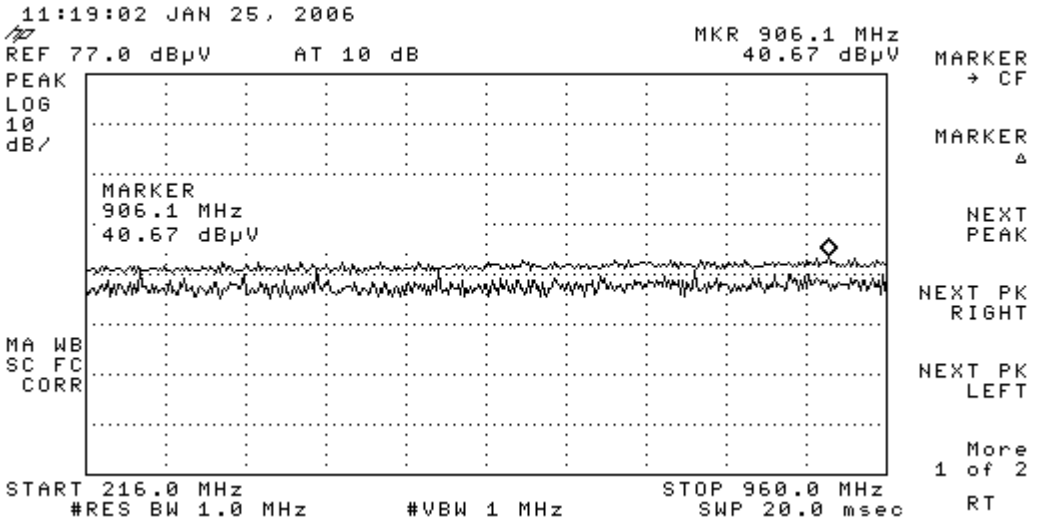
### 10.2 Handset

10.2.1 Band 9 kHz – 30 MHz
10.2.2 Band 30 – 88 MHz
10.2.3 Band 88 – 216 MHz
10.2.4 Band 216 – 960 MHz

| Band (MHz) | Freq. (MHz) | Meter Peak Reading (dBμV) | Coax Loss (dB) | Antenna Factor (Note 1) (dB) | Pre-amp Gain (dB) | Field Strength at 3m (dBμV/m) | Rule Limit (dBμV/m) | Margin from Limit (dB) |
|---|---|---|---|---|---|---|---|---|
| 0.009–30 | | N/A | | | | | | N/A |
| 30 – 88 | 86.40 | 39.36 | 2.0 | 9.6 BV | -23.5 | 27.46 | 40 | 12.54 |
| 88–216 | 139.80 | 39.26 | 2.5 | 12.6 BV | -23.5 | 30.86 | 43.5 | 12.64 |
| 216–960 | 906.1 | **40.67** | 5.23 | 21.7 BH | -23.5 | **44.10** | 46 | **1.90** |

Note 1: Biconical (B) or Log-periodic (L) antenna in Horizontal (H) or Vertical (V) polarization

Worst-case plot follows:



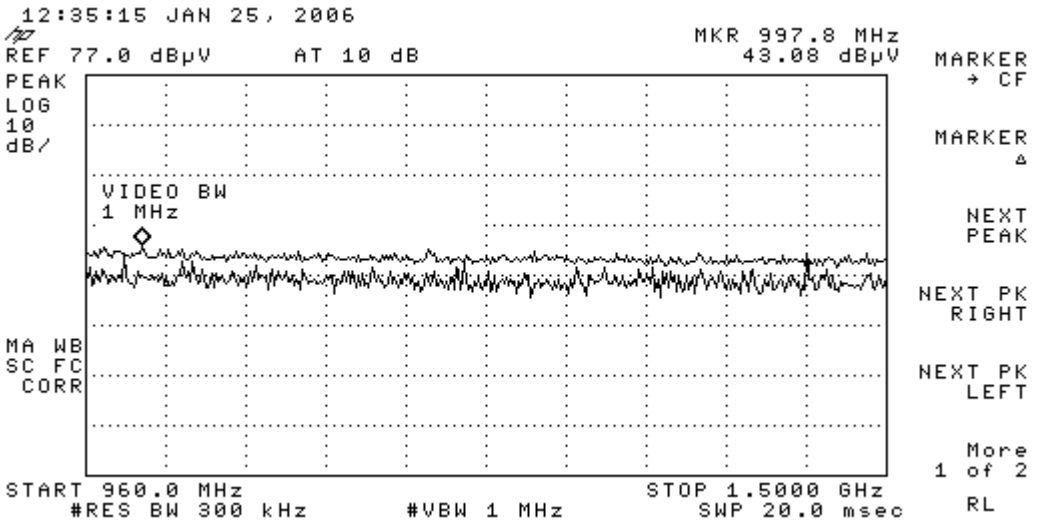

Handset spurious emission ≤ 960 MHz

10.2.5 Band above 960 MHz

| Test Mode & Chan. | Frequency (MHz) | Meter Peak Reading (dBμV) | Coax Loss (dB) | Antenna Factor (Note 2) (dB) | Pre-amp Gain (dB) | Duty Cycle Factor (dB) | Field Strength at 3m (dBμV/m) | Rule Limit (dBμV/m) | Margin from Limit (dB) |
|---|---|---|---|---|---|---|---|---|---|
| TM | | | | | | | | | |
| 1, 2 | 997.80 | **43.00** | 5.71 | 25.7 V | -35 | N/A | 39.41 | 54 | **14.59** |
| | | | | | | | | | |

Note 2: Horn antenna in Horizontal (H) or Vertical (V) polarization

Worst-case plot follows:




Base spurious emission > 960 MHz

## 10 FREQUENCY STABILITY AND JITTER

**Clause:** **15.323 (e), 15.323(f) / 9.0**

**Requirement:**

- Frame frequency stability ≤ 50 ppm
- TDMA frame frequency stability ≤ 10 ppm over 1 hour or interval between channel access monitoring, whichever is shorter
  (That translates to frequency drift of19.2 kHz for 1920 MHz carrier)
- Frame jitter ≤ 25 μs
- Carrier frequency stability over –20 to +50 $^0$C at normal supply voltage, and over 85% to 115% of rated supply voltage (voltage variation not required for battery operated device)

**Equipment:** ROHDE & SCHWARZ Digital Radio Tester MODEL CTS60
S/N 100407
Last calibrated 2004-7-20

**Eq. Setting:** Offset –18 (for UPCS frequency band)
Data Pattern = Fig 31 (specific for frequency drift and jitter tests), or
0000111100001111 for other stability tests
Attenuation 1 dB (to compensate for cable loss to antenna connector)

**Test Result:** Complies with requirements

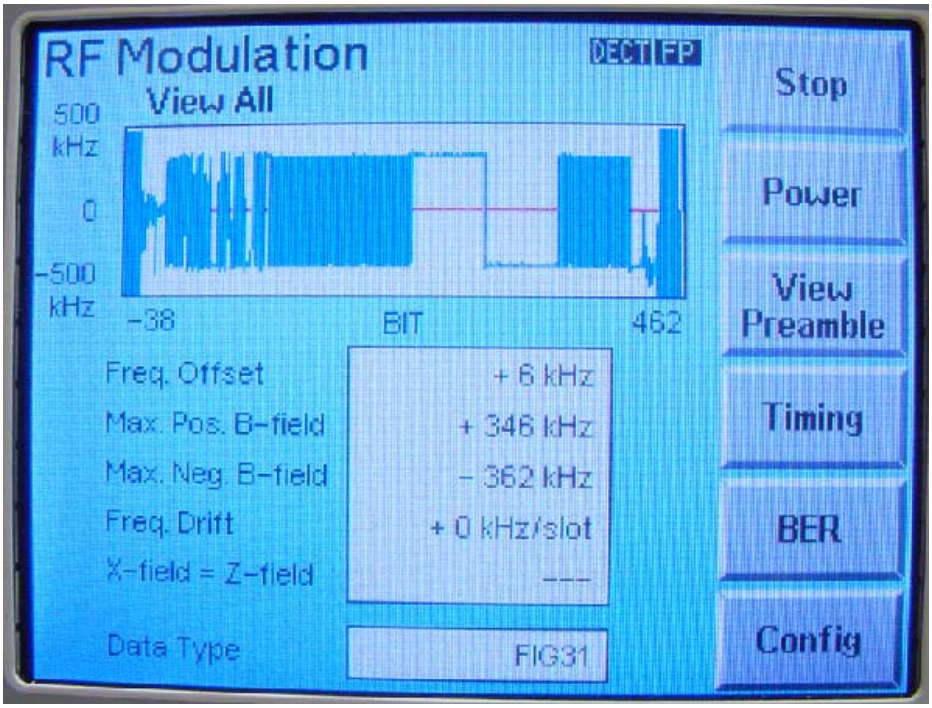
### 11.1 Base

11.1.1 Frame Frequency Drift and Jitter

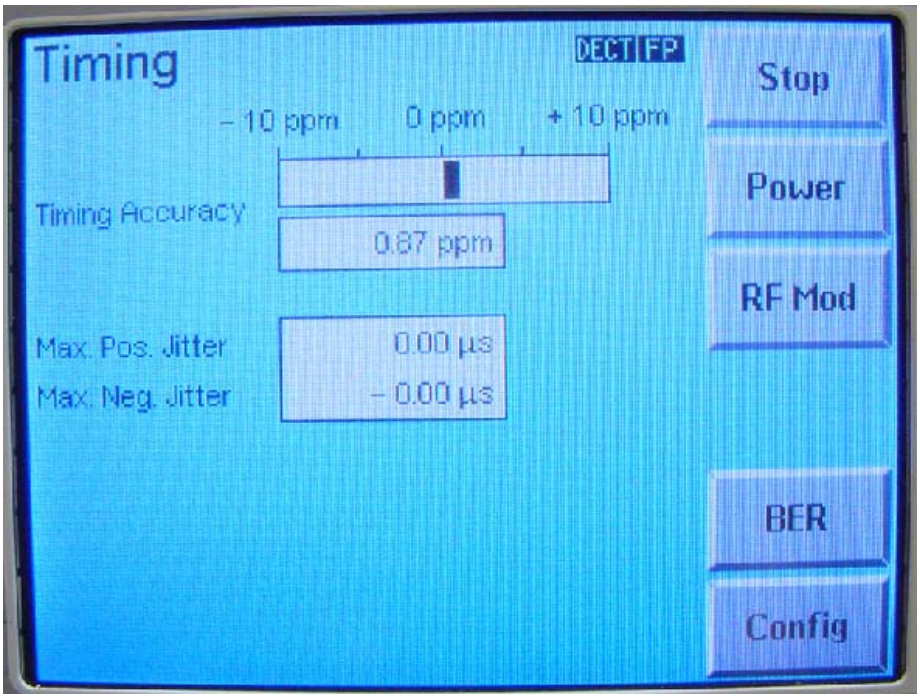
| Test Mode | Channel No. | Frequency (kHz / slot) | | Jitter (μs) | |
|---|---|---|---|---|---|
| | | Drift | Limit | Meas. | Limit |
| TBR6 | 5 | 0.00 | 19.2 | 0.00 | 25 |
| TBR6 | 3 | **0.00** | 19.2 | **0.00** | 25 |
| TBR6 | 1 | 0 .00 | 19.2 | 0.00 | 25 |

Note: Test Mode TBR6 is built-in per ETSI standard and resides in firmware preceding the FCC test mode in Test Mode Menu.

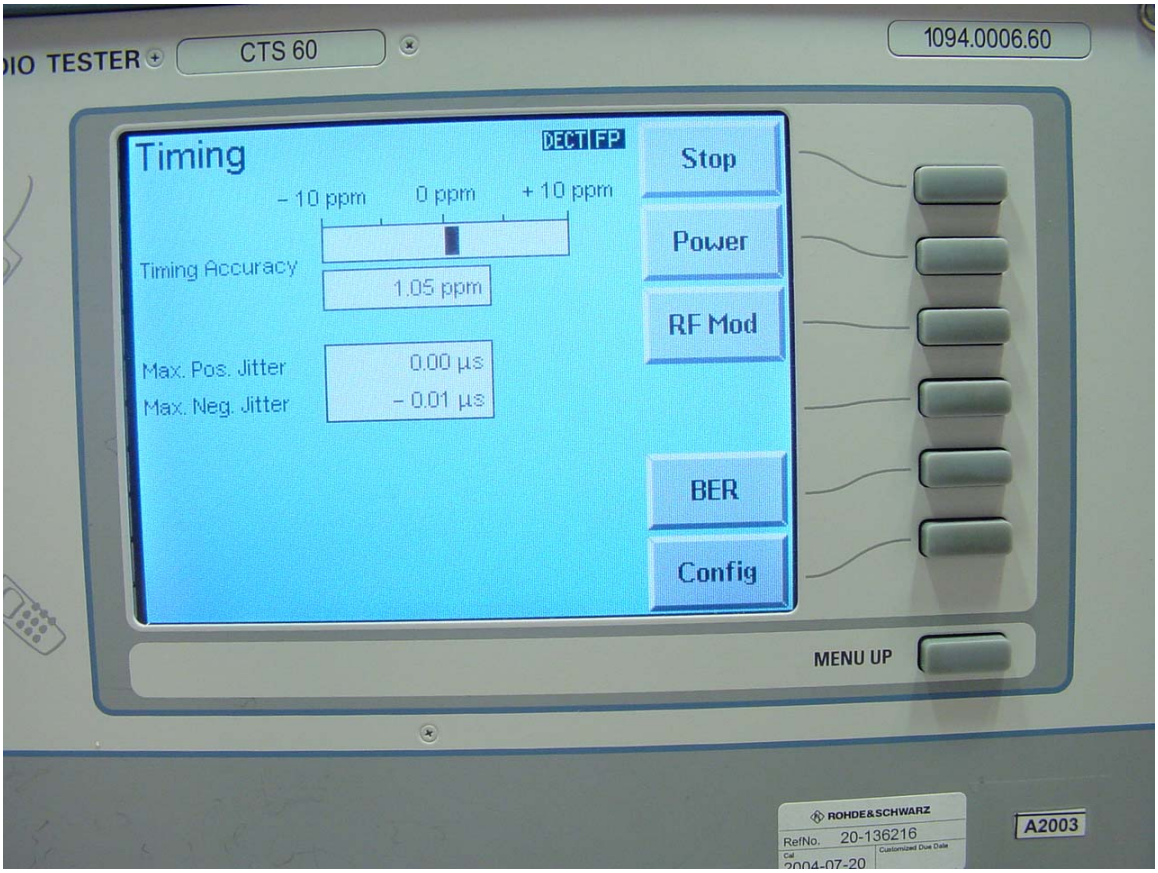
Photos of worst-case display follow:




Base Frequency Drift at Mid Channel




Base TDMA Frame Jitter at Mid Channel




(Enlarged View)

Base TDMA Frame Jitter

11.1.2 Carrier Frequency Stability with Supply voltage

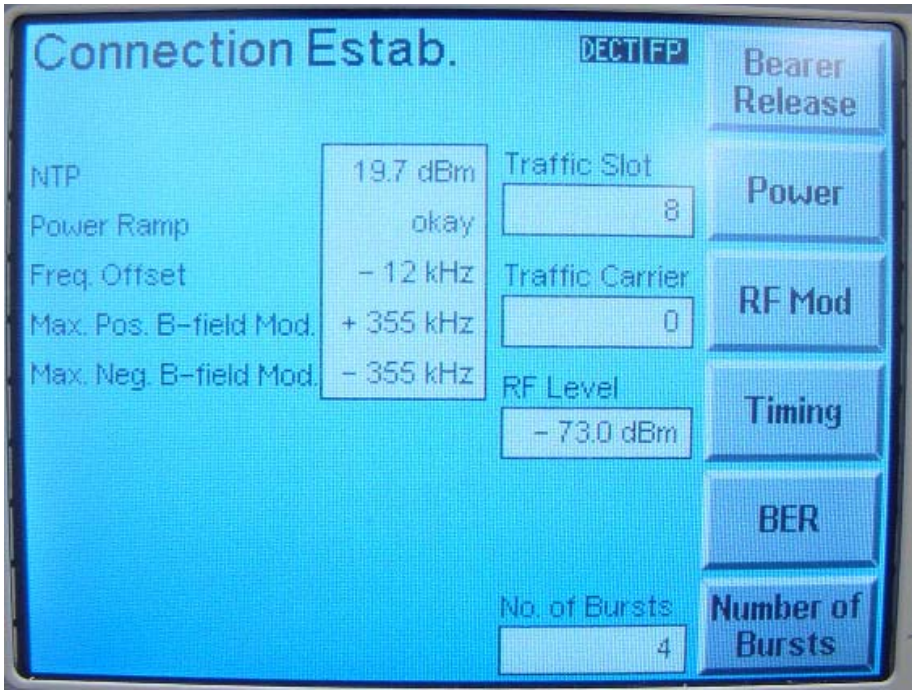
| Test Mode | Channel No. | Frequency (kHz / slot) | | | Limit No. |
|---|---|---|---|---|---|
| | | 4.25 V (85%) | 5 V (Norm.) | Mode | |
| TBR6 | 5 | -10 | -11 | TBR6 | 5 |
| TBR6 | 3 | -12 | -11 | TBR6 | 3 |
| TBR6 | 1 | -9 | -8 | TBR6 | 1 |

Note: Test Mode TBR6 is built-in per ETSI standard and resides in firmware preceding the FCC test mode in Test Mode Menu.

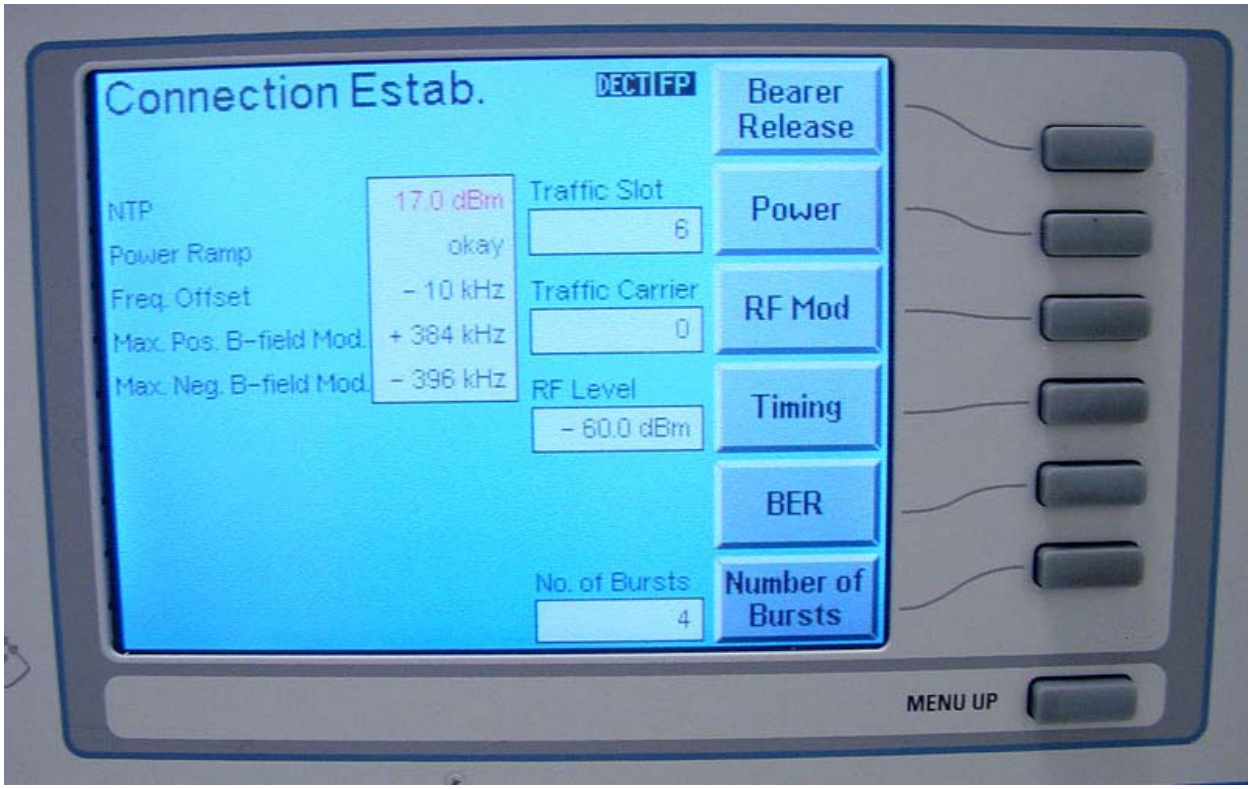
11.1.3 Carrier Frequency Stability with Temperature and Time

| Test Mode | Channel No. | Frequency Offset (kHz) | | | Limit No. |
|---|---|---|---|---|---|
| | | –20 $^0$C | 25 $^0$C | Mode | |
| TBR6 | 5 | **-12.0** | 6.0 | TBR6 | 5 |
| TBR6 | 3 | -3.0 | 5.0 | TBR6 | 3 |
| TBR6 | 1 | -9.0 | 4.0 | TBR6 | 1 |

Test was conducted for duration longer than 1 hour. Photos of worst-case display follow:



Base Carrier Frequency Offset with Temperature




(Enlarged View)

Base Carrier Frequency Offset with Temperature

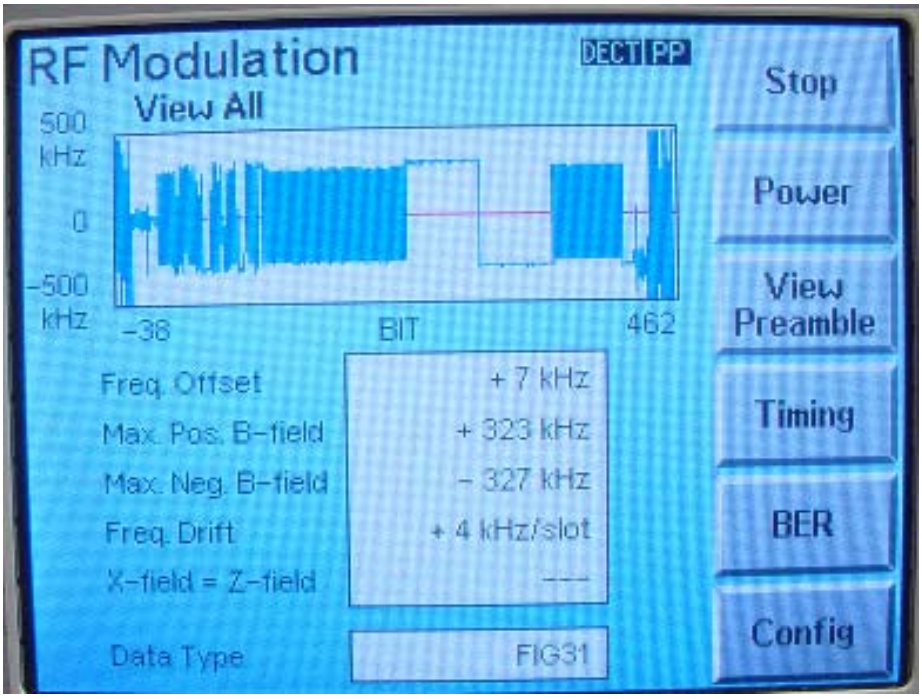
## 11.2 Handset

11.2.1 Frame Frequency Drift and Jitter

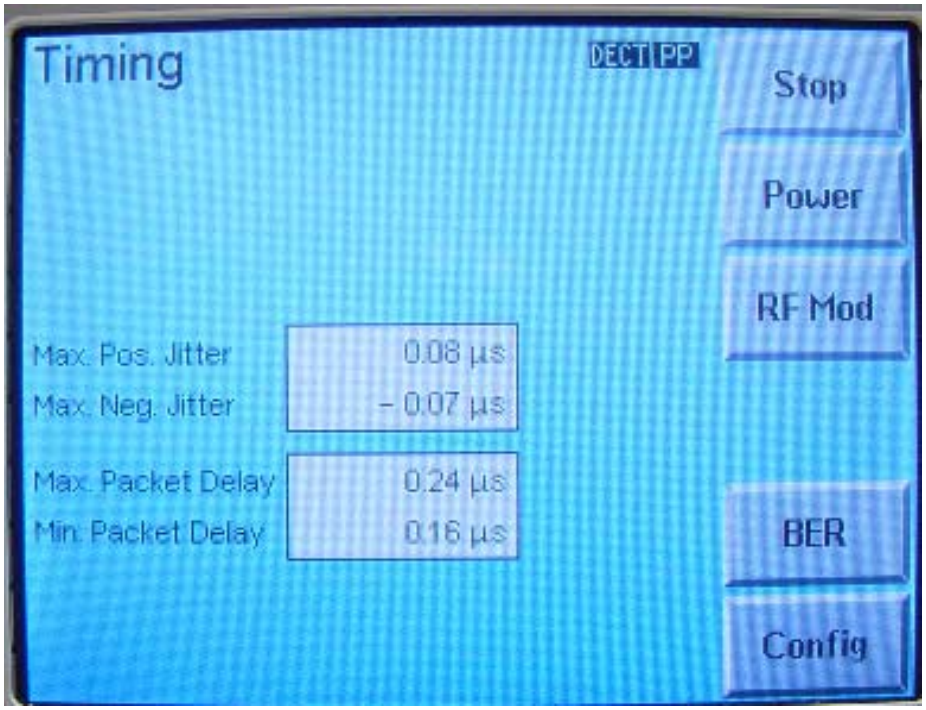
| Test Mode | Channel No. | Frequency (kHz / slot) | | Jitter (μs) | |
|---|---|---|---|---|---|
| | | Drift | Limit | Mode | No. |
| TBR6 | 5 | 4.00 | 19.2 | TBR6 | 1 |
| TBR6 | 3 | **4.00** | 19.2 | TBR6 | 3 |
| TBR6 | 1 | 3.00 | 19.2 | TBR6 | 5 |

Note: Test Mode TBR6 is built-in per ETSI standard and resides in firmware preceding the FCC test mode in Test Mode Menu.

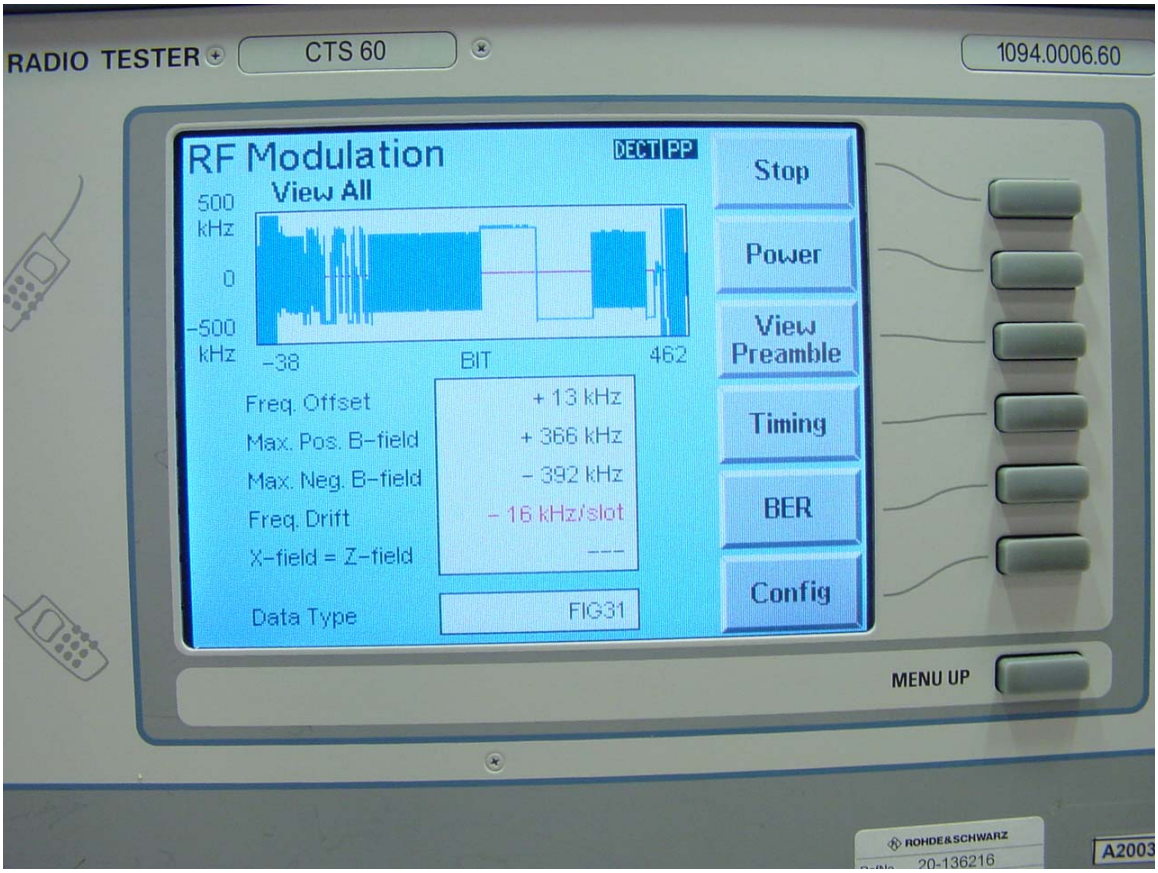
Photos of worst-case display follow:




Handset Frequency Drift at Mid Channel

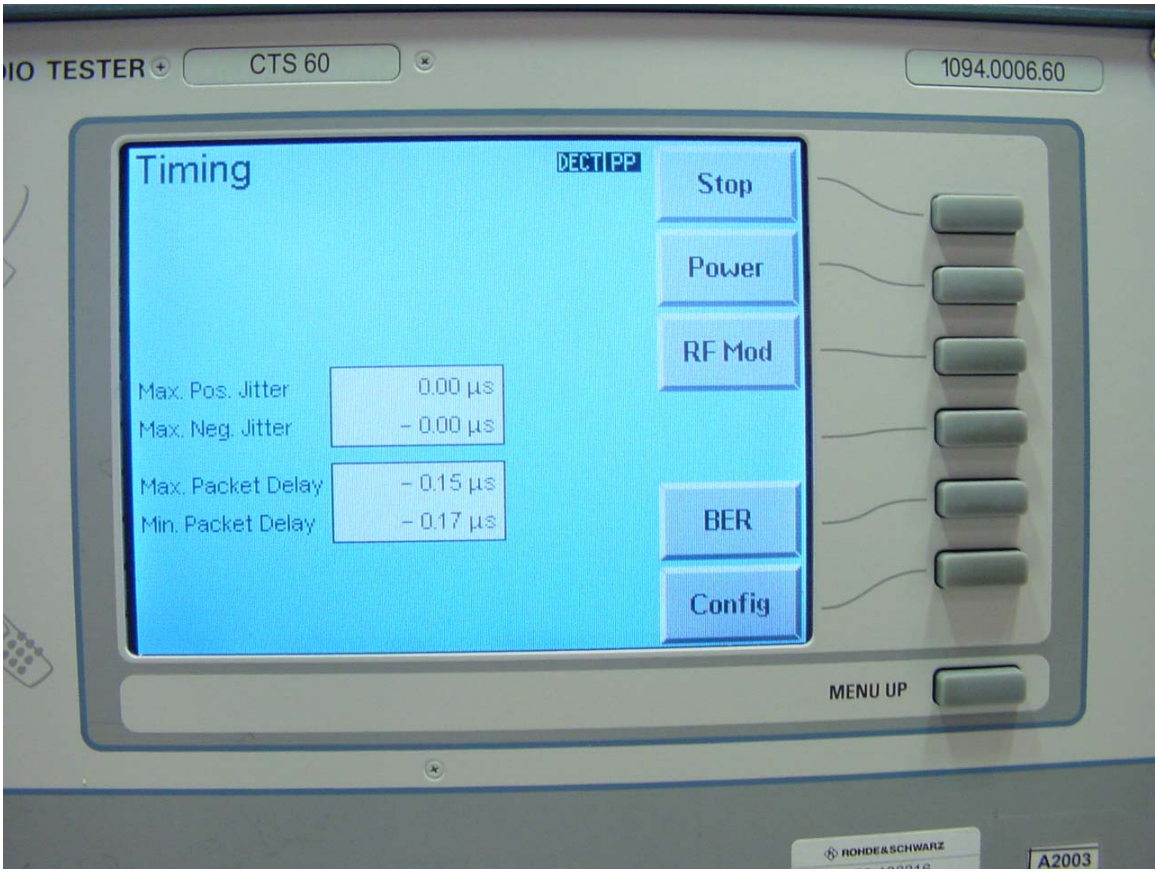



Handset TDMA Frame Jitter




(Enlarged View)

Handset Frequency Drift at Mid Channel




(Enlarged View)

Handset TDMA Frame Jitter

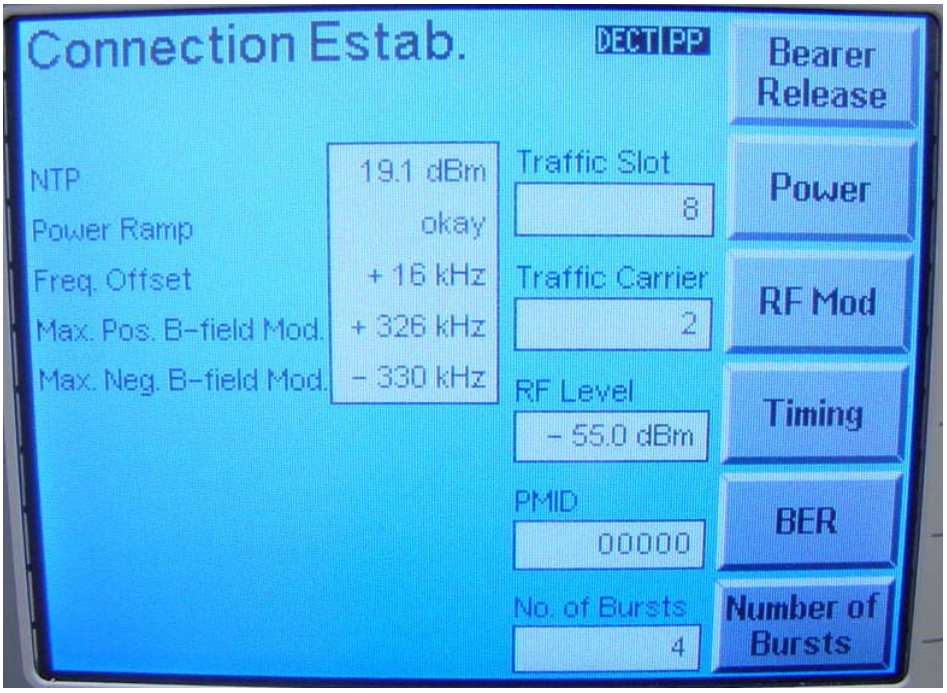
11.2.2 Carrier Frequency Stability with Temperature and Time

| Test Mode | Channel No. | Frequency Offset (kHz) | | | Limit No. |
|---|---|---|---|---|---|
| | | –20 $^0$C | 25 $^0$C | Mode | |
| TBR6 | 5 | 10.0 | 3.0 | TBR6 | 5 |
| TBR6 | 3 | **16.0** | 7.0 | TBR6 | 3 |
| TBR6 | 1 | 11.0 | 6.0 | TBR6 | 1 |

Note: Test Mode TBR6 is built-in per ETSI standard and resides in firmware preceding the FCC test mode in Test Mode Menu.

Test was conducted for duration longer than 1 hour. Photos of worst-case display follow:


Handset Carrier Frequency Offset with Temperature




(Enlarged View)

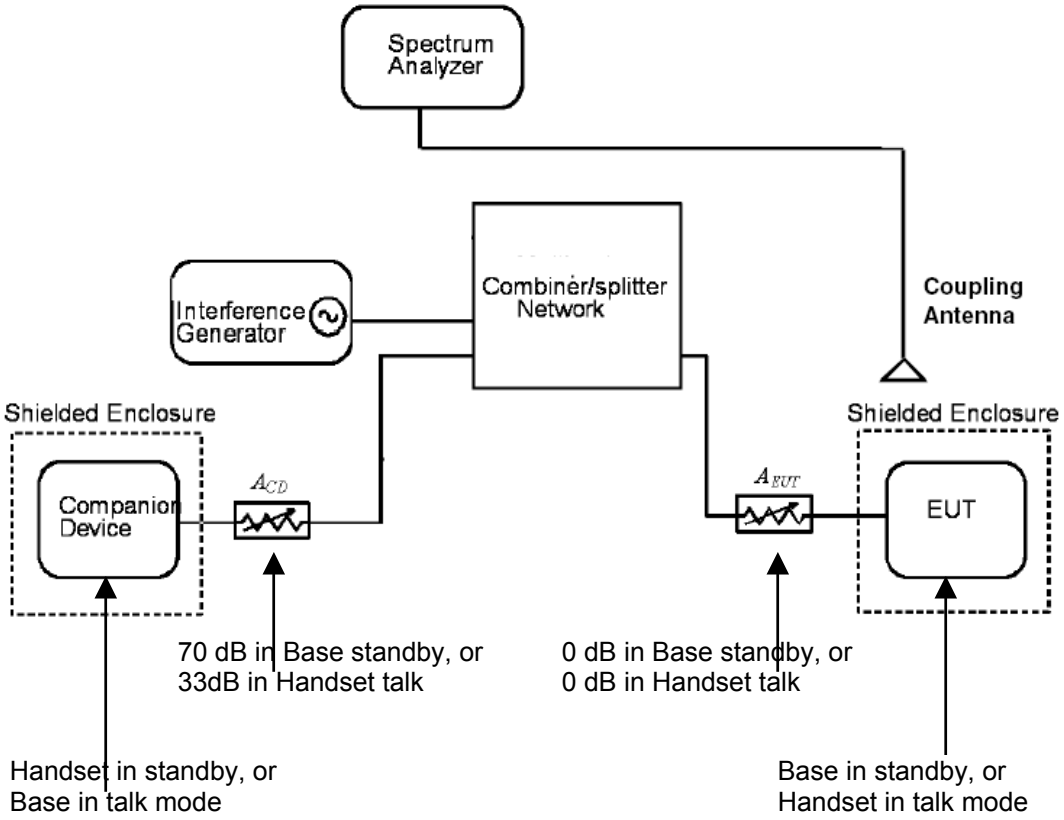
Handset Carrier Frequency Offset with Temperature

## 11 MONITORING THRESHOLD

**Clause:** **15.323 (c)(5) / 8.4 (c)(5)**

**Requirement:** ≤ –61 dBm for 1.5 MHz BW and 20.5 dBm Tx power derived from formula as follows:
Upper limit = 15 logB – 184 + 50 – P as per ANSI 63.17 Sec. 7.2.1

**Test Setup:** As shown below per Fig. 8 of 7.1.1 in ANSI C63.17 – 1998




EUT (Base and Handset) modified in

- Tx power purposely reduced by about 10 dB to reduce requirement on external attenuators $A_{EUT}$ and $A_{CD}$
- Limited 2-channel operation by EEPROM setting

| Mode | EUT | $A_{EUT}$ (dB) | Companion Device | $A_{CD}$ (dB) |
|---|---|---|---|---|
| Standby | Base | 0 | Handset | 70 |
| Talk | Handset | 0 | Base | 33 |

**Test Result:** Threshold < –61 dBm

### 12.1 Standby

Note:
- Base is the initiator; handset the responding device.
- Main deciding factor in protocol is signal strength RSSI.

Combiner / Coupler insertion loss = 4 dB
Cable loss 1 = 0.8 dB
Cable loss 2 = 1.6 dB
Total insertion loss = 6.4 dB

Measured threshold = Sig Gen reading – Insertion loss
= –65 – 6.4 = –71.4 dBm

## 12.2 Talk

Note:
- Handset is the initiator; base the responding device.
- Main deciding factors in protocol are CRC (or BER), sync pulse and clock jitter besides signal strength RSSI.
- Base conveys information on channel conditions to add to that detected by handset before handset decides on initiating channel change.

Measured threshold = –64.0 – 6.4 = –70.4 dBm

## 12 POWER LINE CONDUCTED EMISSIONS

**Clause:** **15.315, 15.207 (a), 15.107 (a) / 10.0**

**Limits:** **FCC**

| Emission Frequency (MHz) | Conducted Limit (dBμV) | |
|---|---|---|
| | Quasi-peak (QP) | Average (AV) |
| 0.15 - 0.5 | 66 to 56 * | 56 to 46 * |
| 0.5 - 5 | 56 | 46 |
| 5 - 30 | 60 | 50 |

* Decreases with the logarithm of the frequency.

**IC**
250 μV (48 dBμV) across 50 Ω at any frequency or within 0.45-30 MHz by CISPR measurement

**SA Setting:** RBW = 10 kHz

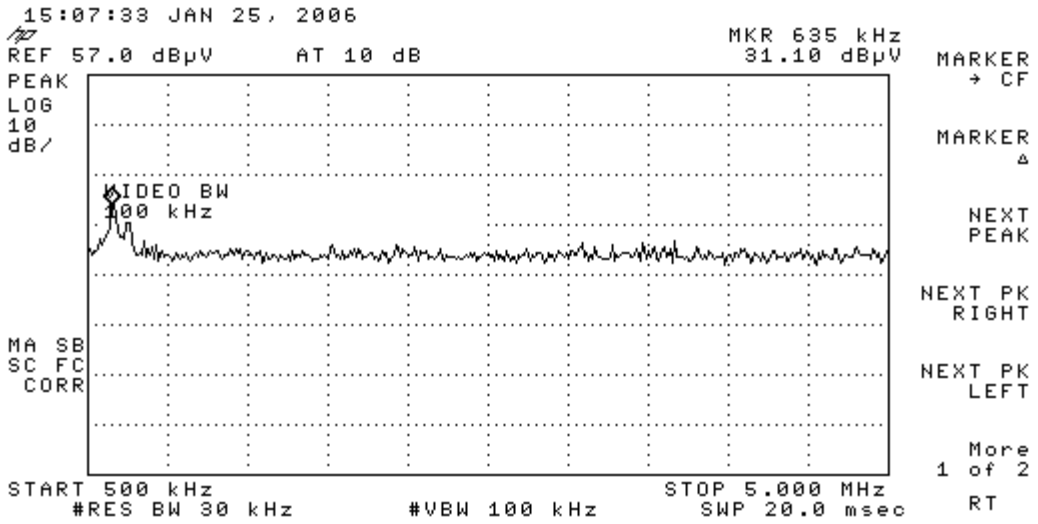
**Test Result:** Worst-case in each band

### 13.1 Charger stand-alone

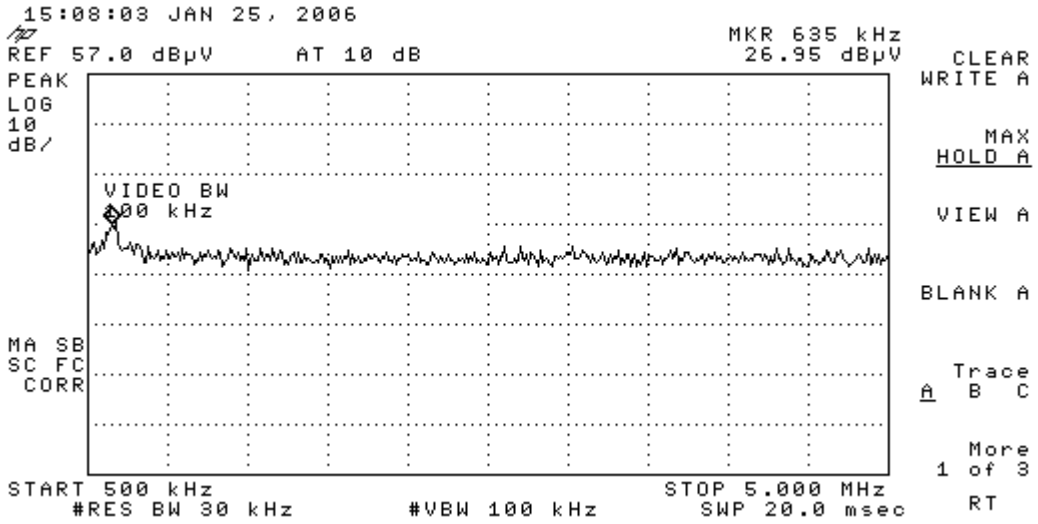
| **Line** | **Band** (MHz) | **Freq.** (MHz) | **Reading** QP (dBμV) | **Loss** (dB) | **Emission** (dBμV) | **Limit** (dBμV) | **Margin** (dB) |
|---|---|---|---|---|---|---|---|
| Live | 0.15 - 0.5 | 0.157 | 23.16 | 20 | 43.16 | 66 | 22.84 |
| | 0.5 - 5 | 0.635 | **31.10** | 20 | 51.10 | 56 | **4.90** |
| | 5 - 30 | 11.75 | 26.35 | 20 | 46.35 | 60 | 13.65 |
| Neutral | 0.15 - 0.5 | 0.171 | 24.99 | 20 | 44.99 | 64 | 19.01 |
| | 0.5 - 5 | 0.635 | **26.95** | 20 | 46.95 | 56 | **9.05** |
| | 5 - 30 | 11.75 | 30.33 | 20 | 50.33 | 60 | 9.67 |

Plots follow.

Emission from LIVE conductor



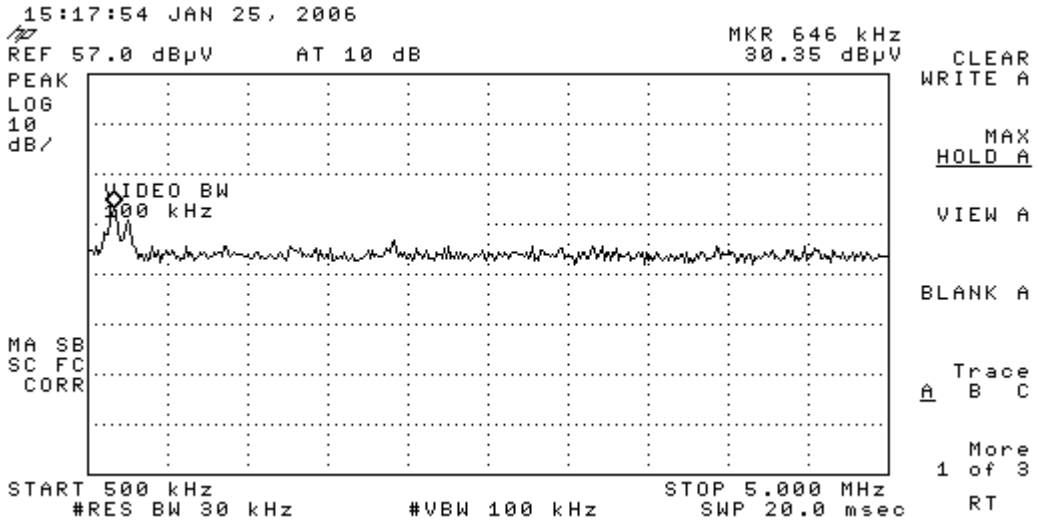

Emission from NEUTRAL conductor



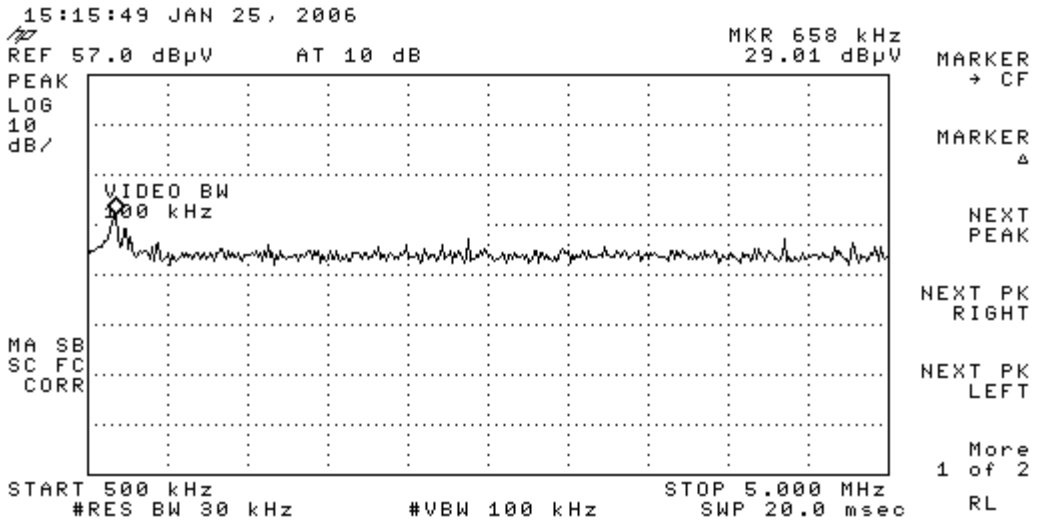
### 13.2 Charger with Handset in standby

| Line | Band (MHz) | Freq. (MHz) | Reading QP (dBμV) | Loss (dB) | Emission (dBμV) | Limit (dBμV) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Live | 0.15 - 0.5 | 0.160 | 22.97 | 20 | 42.97 | 64 | 21.03 |
| | 0.5 - 5 | 0.646 | **30.35** | 20 | 50.35 | 56 | **5.65** |
| | 5 - 30 | 9.50 | 29.87 | 20 | 49.87 | 60 | 10.13 |
| Neutral | 0.15 - 0.5 | 0.159 | 22.92 | 20 | 42.92 | 64 | 21.08 |
| | 0.5 - 5 | 0.658 | **29.01** | 20 | 49.01 | 56 | **6.99** |
| | 5 - 30 | 8.12 | 29.35 | 20 | 49.35 | 60 | 10.65 |

Worst-case plot follows.




Emission from LIVE conductor



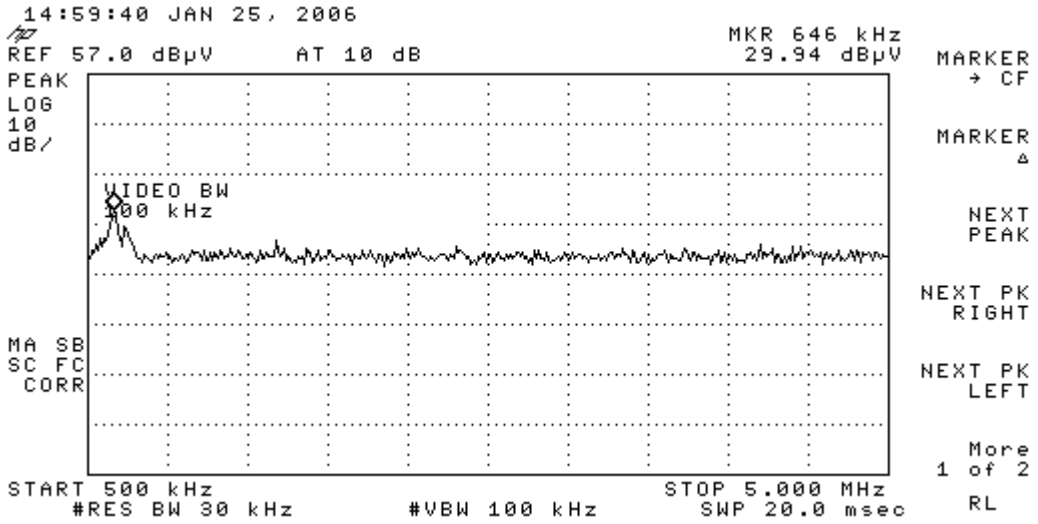

Emission from NEUTRAL conductor

### 13.3 Base in phone-on

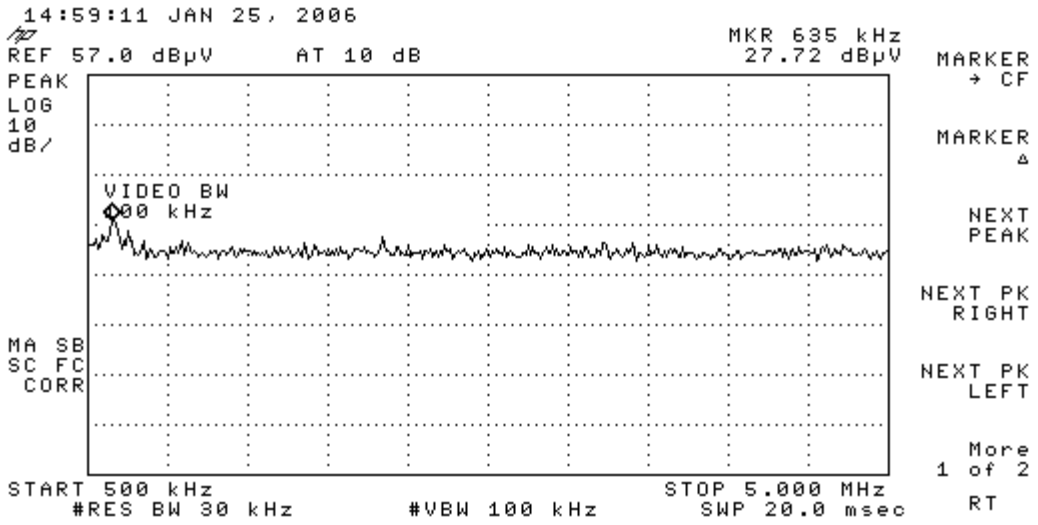
Handset Tx on Low, Mid or High channel set by Test Mode

| **Line** | **Band** (MHz) | **Freq.** (MHz) | **Reading** QP (dBμV) | **Loss** (dB) | **Emission** (dBμV) | **Limit** (dBμV) | **Margin** (dB) |
|---|---|---|---|---|---|---|---|
| Live | 0.15 - 0.5 | 0.170 | 23.44 | 20 | 43.44 | 64 | 20.56 |
| | 0.5 - 5 | **0.646** | **29.94** | 20 | 49.94 | 56 | **6.06** |
| | 5 - 30 | 24.00 | 29.68 | 20 | 49.68 | 60 | 10.32 |
| Neutral | 0.15 - 0.5 | 0.163 | 23.96 | 20 | 43.96 | 64 | 20.04 |
| | 0.5 - 5 | **0.635** | **27.72** | 20 | 47.72 | 56 | **8.28** |
| | 5 - 30 | 20.54 | 20.31 | 20 | 40.31 | 60 | 19.69 |

Worst-case plot follows.




Emission from LIVE conductor
(Base on Tx Mid Channel)




Emission from NEUTRAL conductor
(Base on Tx Mid Channel)

## 13 CHARGER RADIATED EMISSIONS

**SA Setting:** RBW ≥ 100 kHz for f < 1 GHz, 1 MHz for f ≥ 1 GHz
**DA 00-705** VBW ≥ RBW
Span = to fully capture emission being measured
Sweep = auto

### 13.1 Charger Stand-alone

**Clause: 15.109 (a) / 5.0 ICES-003**

**Limits:**

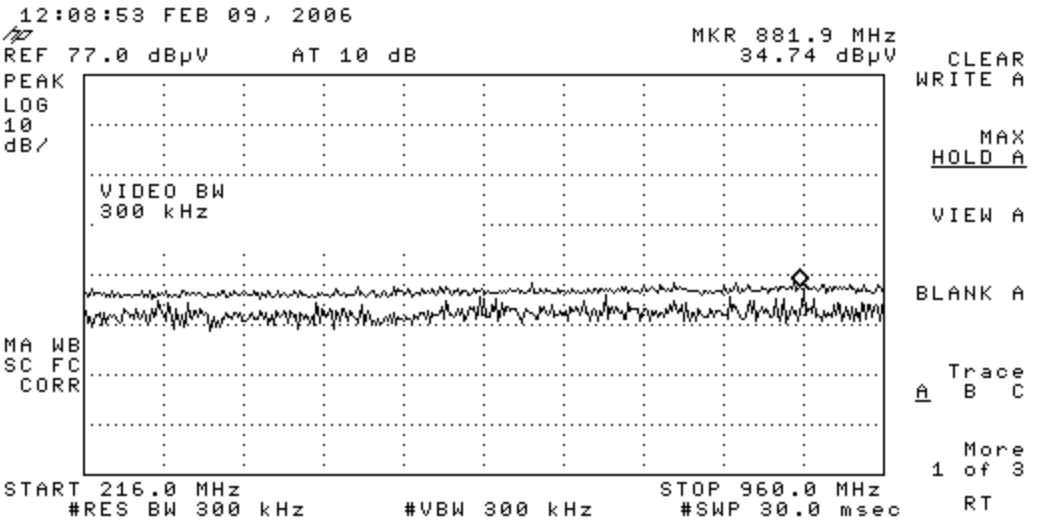
| Emission Frequency (MHz) | Class B Field Strength at 3 m | |
|---|---|---|
| | (μV/m) | (dBμV/m) |
| 30 – 88 | 100 | 40 |
| 88 – 216 | 150 | 43.5 |
| 216 – 960 | 200 | 46 |
| > 960 | 500 | 54 |

**Test Result:** Worst-case in each band

14.1.1 Band 30 – 88 MHz
14.1.2 Band 88 – 216 MHz
14.1.3 Band 216 – 960 MHz

| **Band** (MHz) | **Freq.** (MHz) | **Meter Peak Reading** (dBμV) | **Coax Loss** (dB) | **Antenna Factor** (Note 1) (dB) | **Pre-amp Gain** (dB) | **Field Strength at 3m** (dBμV/m) | **Rule Limit** (dBμV/m) | **Margin from Limit** (dB) |
|---|---|---|---|---|---|---|---|---|
| 30 – 88 | 33.48 | 31.81 | 2.0 | 14.5 | -23.5 | 24.81 | 40 | 15.19 |
| 88–216 | 168.60 | 40.75 | 3 | 13.5 | -23.5 | 33.75 | 43.5 | 9.75 |
| 216–960 | 881.90 | **34.74** | 5 | 23.3 | -23.5 | **39.54** | 46 | **6.46** |

Note 1: Biconical (B) or Log-periodic (L) antenna in Horizontal (H) or Vertical (V) polarization

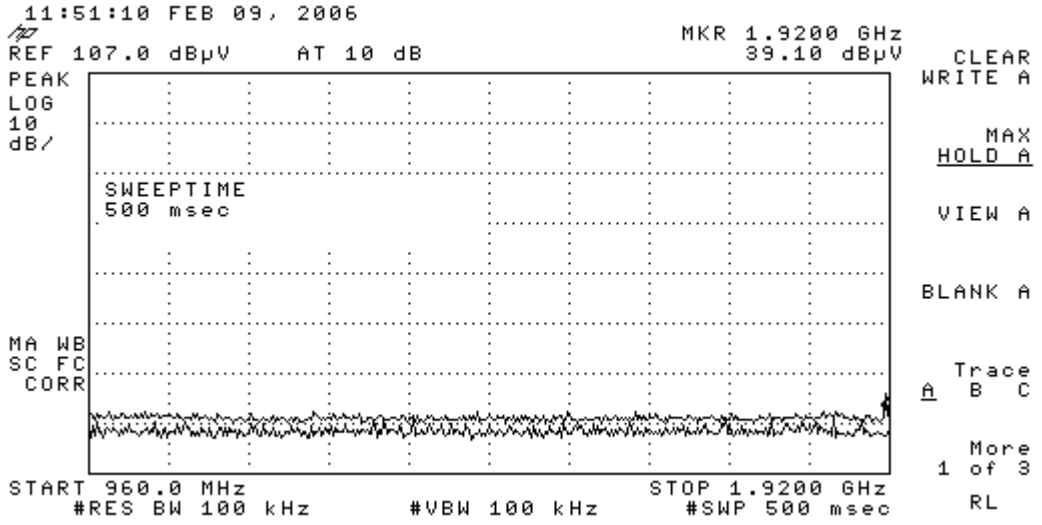



Spurious emission ≤ 960 MHz

14.1.4 Band above 960 MHz

| Freq. (MHz) | Meter Peak Reading (dBµV) | Coax Loss (dB) | Antenna Factor (Note 2) (dB) | Pre-amp Gain (dB) | Field Strength at 3m (dBµV/m) | Rule Limit (dBµV/m) | Margin from Limit (dB) |
|---|---|---|---|---|---|---|---|
| 1920 | **39.10** | 7.52 | 28.7H | -35 | **40.32** | 54 | **13.68** |

Note 2: Horn antenna in Horizontal (H) or Vertical (V) polarization



Spurious emission > 960 MHz

### 14.2 Charger with Handset in standby

**Clause: 15.205(a), 15.205(c), 15.209 (a) / 11.0**

**Limits:**

| Emission Frequency (MHz) | Field Strength | | At Distance | Detector Type |
|---|---|---|---|---|
| | (μV/m) | (dBμV/m) | (m) | |
| 0.009 - 0.490 | 2400/F(kHz) | 67.6 / kHz | 300 | AV (9-90 kHz, 110-490 kHz) QP (others) |
| 0.490 - 1.705 | 24000/F(kHz) | 87.6 / kHz | 30 | QP |
| 1.705 - 30.0 | 30 | 29.5 | 30 | QP |
| 30 – 88 | 100 | 40 | 3 | QP |
| 88 – 216 | 150 | 43.5 | 3 | QP |
| 216 – 960 | 200 | 46 | 3 | QP |
| > 960 | 500 | 54 | 3 | AV (> 1 GHz) |

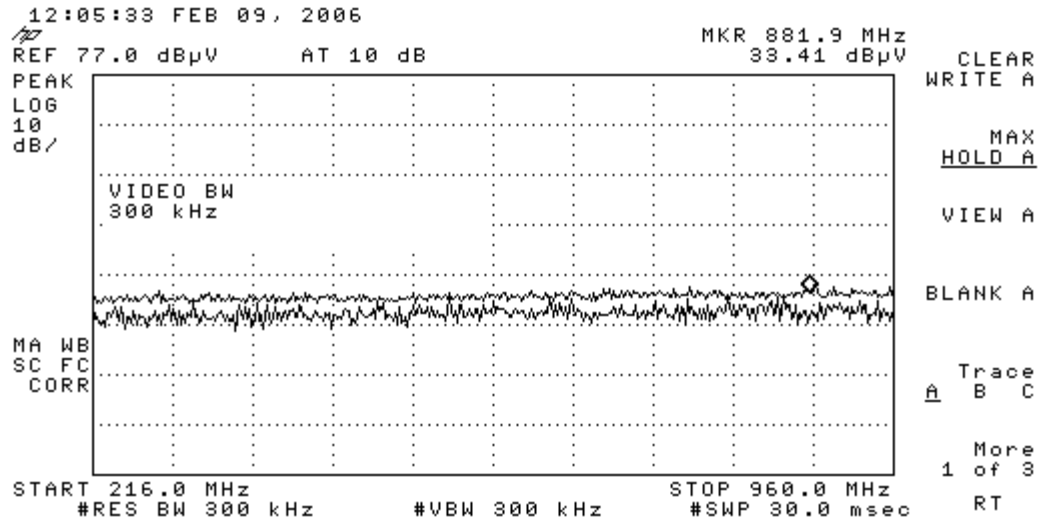
**Test Result:** Worst-case in each band

14.2.1 Band 9 kHz – 30 MHz
14.2.2 Band 30 – 88 MHz
14.2.3 Band 88 – 216 MHz
14.2.4 Band 216 – 960 MHz

| **Band (MHz)** | **Freq. (MHz)** | **Meter Peak Reading (dBμV)** | **Coax Loss (dB)** | **Antenna Factor** (Note 1) **(dB)** | **Pre-amp Gain (dB)** | **Field Strength at 3m (dBμV/m)** | **Rule Limit (dBμV/m)** | **Margin from Limit (dB)** |
|---|---|---|---|---|---|---|---|---|
| 0.009–30 | | N/A | | | | | | N/A |
| 30 – 88 | 32.61 | 39.09 | 2 | 14.5 BV | -23.5 | 32.09 | 40 | 7.90 |
| 88–216 | 168.6 | 36.30 | 3 | 13.5 BV | -23.5 | 29.30 | 43.5 | 14.20 |
| 216–960 | 881.9 | **33.41** | 5 | 23.3 LV | -23.5 | 38.21 | 46 | **7.79** |

Note 1: Biconical (B) or Log-periodic (L) antenna in Horizontal (H) or Vertical (V) polarization

Worst-case plot follows:



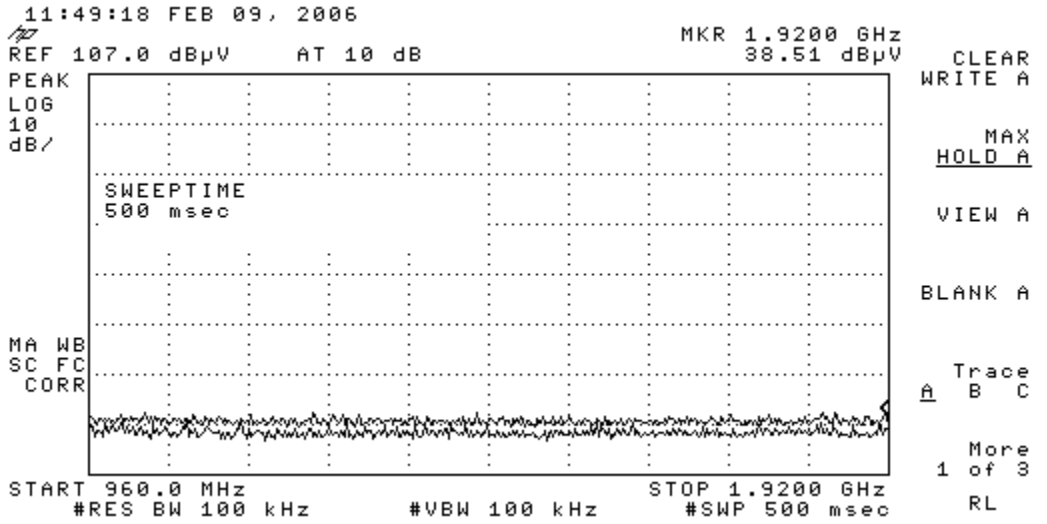

Spurious emission ≤ 960 MHz

14.2.5 Band above 960 MHz

| Freq. (MHz) | Meter Peak Reading (dBµV) | Coax Loss (dB) | Antenna Factor (Note 2) (dB) | Pre-amp Gain (dB) | Field Strength at 3m (dBµV/m) | Rule Limit (dBµV/m) | Margin from Limit (dB) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 1920.00 | **38.51** | 7.52 | 28.5 V | -35 | 39.53 | 54 | **14.47** |
| | | | | | | | |

Note 2: Horn antenna in Horizontal (H) or Vertical (V) polarization

Worst-case plot follows:



Spurious emission > 960 MHz