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
2	1926.720
3 (Mid)	1924.992
4	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.

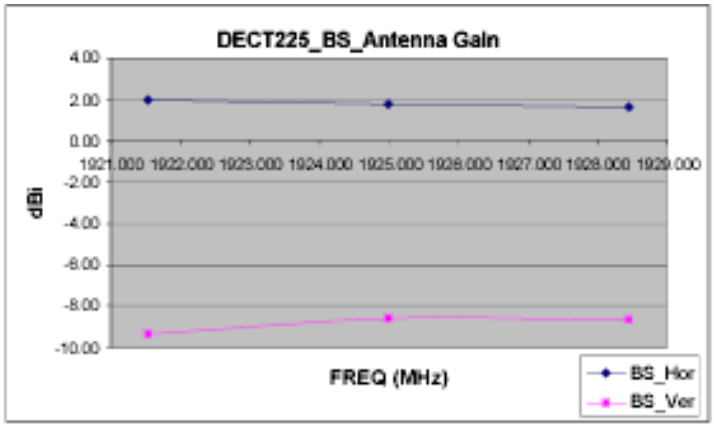
Spec of Antenna: As follows
Antenna transmit gain = 1.6 ~ 2.0 dBi (1.446 ~ 1.585 numeric) across the band

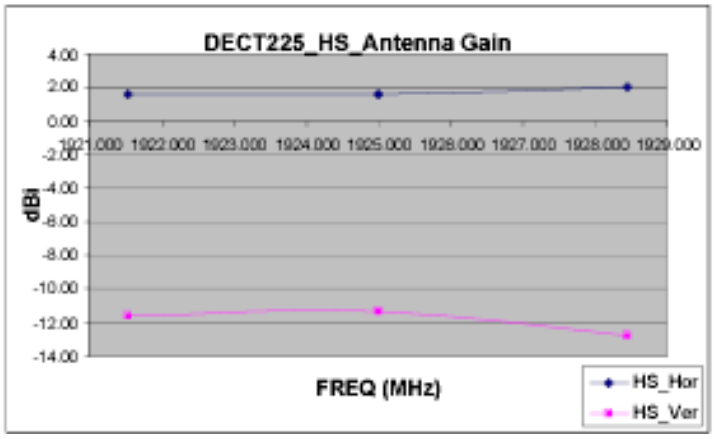
Result: As antenna gain < 3 dBi, no correction factor necessary to be applied to subsequent radiation measurement readings.

GAIN

MODEL DECT225 Antenna Gain

	CHANNEL	1	3	5
	FREQ (MHz)	1928.448	1924.992	1921.536
BASE	Hor	1.64	1.74	2.00
	Ver	-8.70	-8.60	-9.35
HANDSET	Hor	2.00	1.59	1.64
	Ver	-12.82	-11.32	-11.56





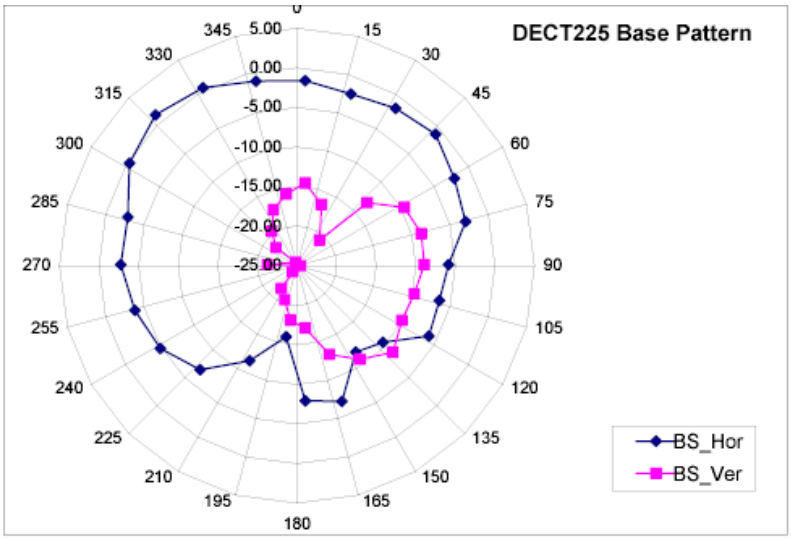
POLARIZATION PATTERN

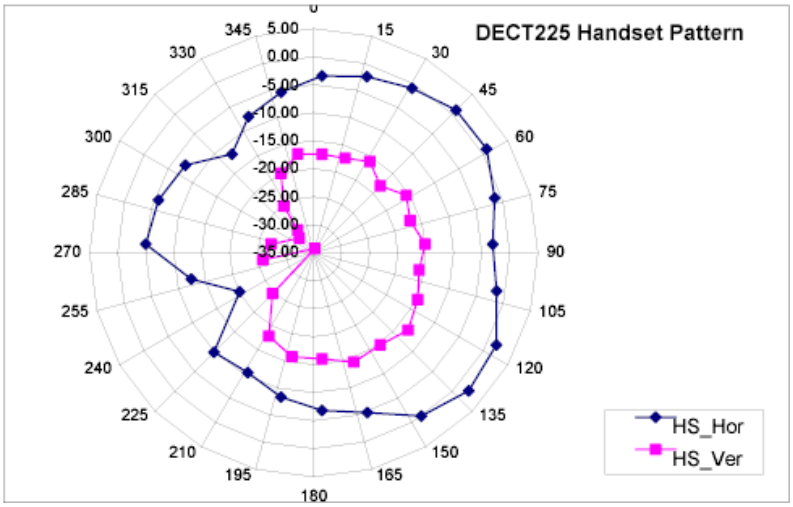
MODEL DECT225

Antenna Polarization Pattern

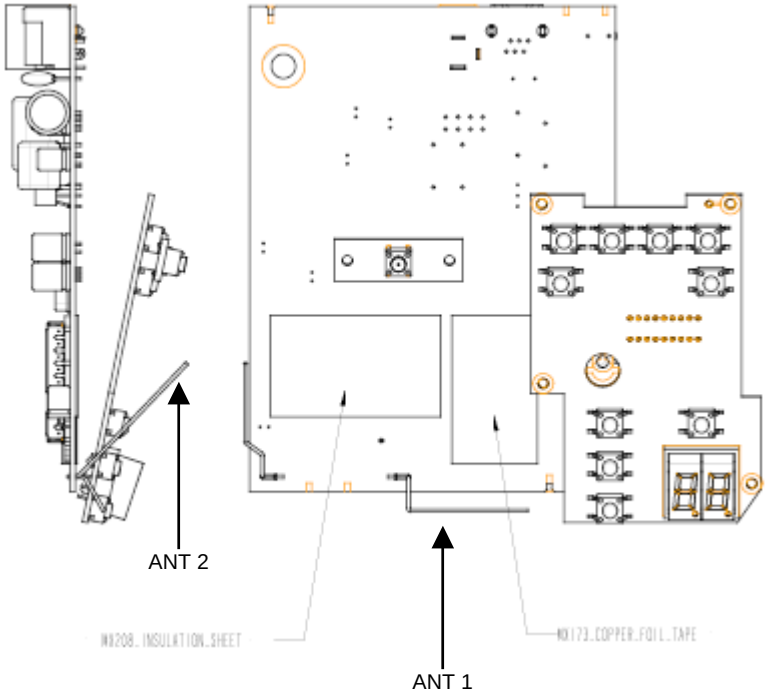
Degree	BS Hor (dBi)	BS Ver (dBi)	HS Hor (dBi)	HS Ver (dBi)
0	-1.74	-14.70	-4.96	-18.98
15	-2.68	-17.12	-4.05	-19.11
30	-2.17	-21.42	-2.89	-17.96
45	-1.72	-13.94	-1.18	-20.27
60	-3.26	-10.54	-1.06	-17.64
75	-4.05	-9.81	-3.10	-18.70
90	-6.90	-9.98	-4.52	-16.62
105	-7.50	-10.74	-2.77	-17.07
120	-6.97	-10.93	0.94	-15.30
135	-11.10	-9.35	2.00	-13.34
150	-12.23	-11.20	0.40	-14.22
165	-7.11	-13.25	-3.86	-13.22
180	-7.80	-16.98	-5.31	-14.52
195	-15.57	-17.73	-6.76	-14.20
210	-10.97	-19.84	-8.50	-16.03
225	-6.19	-20.73	-7.76	-22.52
240	-3.88	-23.15	-18.02	-33.48
255	-2.71	-24.38	-10.81	-24.02
270	-1.69	-20.20	-3.52	-25.90
285	-1.79	-23.76	-4.77	-30.83
300	0.63	-20.71	-6.85	-29.99
315	1.77	-19.01	-12.26	-25.40
330	0.84	-16.99	-8.72	-20.41
345	-0.99	-15.77	-6.92	-18.30
360	-1.53	-16.14	-5.21	-18.88

Max (dBm)	2.00	-9.35	2.00	-12.82
Min (dBm)	-15.75	-25.31	-19.71	-35.00
Diff (dB)	17.75	15.96	21.71	22.18

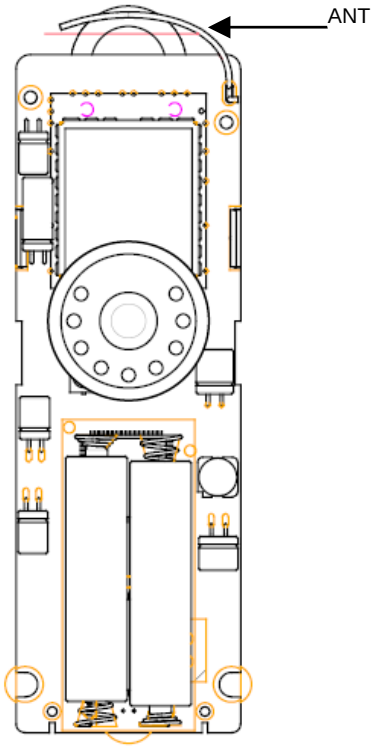




BASE ANTENNA ASSEMBLY



HANDSET ANTENNA ASSEMBLY



3 EMISSION BANDWIDTH

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

Requirement: 50 kHz < B < 2.5 MHz

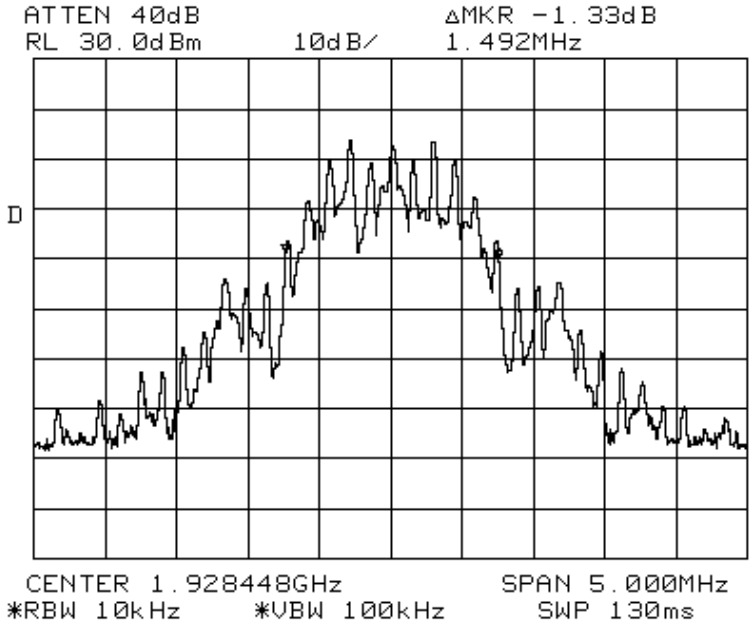
SA Setting: RBW 1 % of Emission BW (or 0.5 % < RBW < 2 % for fixed setting)
ANSI 6.1.3 VBW ≥ 3 x RBW
Span ≥ 2 x B
Sweep: Sufficient to stabilize trace
Detection: Peak hold

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)
1	5	1921.536	1483
2	3	1924.992	1483
3	1	1928.448	**1492**

Worst-case plot follows:

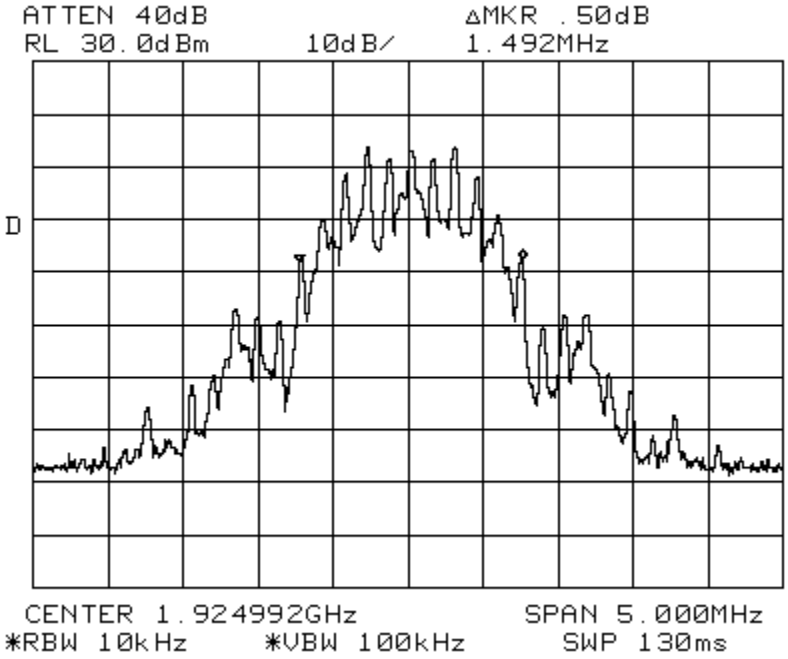


Base emission BW at High-freq Channel

3.2 Handset

Test Mode	Channel No.	Frequency (MHz)	26 dB Bandwidth (kHz)
1	1	1928.448	1475
2	3	1924.992	**1492**
3	5	1921.536	1483

Worst-case plot follows:



Handset emission BW at Mid-freq Channel

4 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

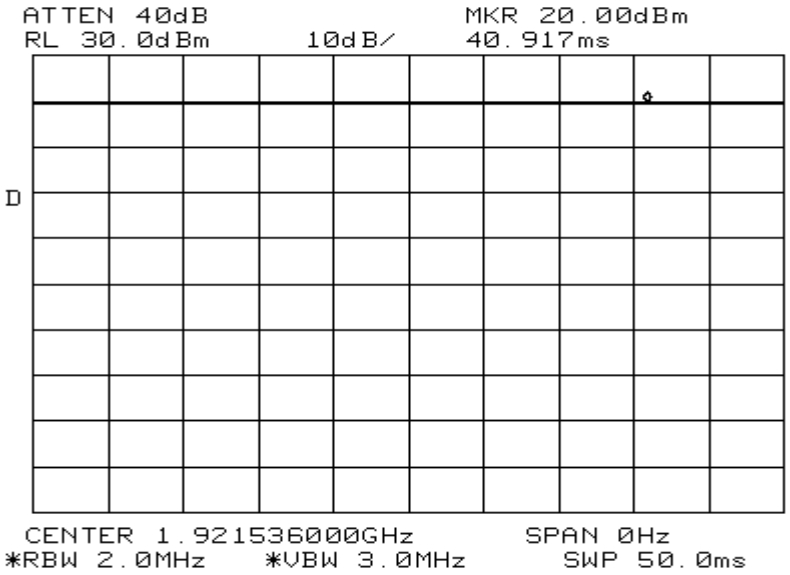
SA Setting: RBW ≥ Emission BW (or increased until no more than 0.5 dB change in power)
ANSI 6.1.2 VBW ≥ 3 x RBW
Span = zero, centered on channel center
Sweep: fast enough to resolve transmit pulse
Detection: Peak

Test Result: Base: 20.80 dBm (120 mW)
Handset: 20.80 dBm (120 mW)

4.1 Base

Test Mode	Chan. No.	Freq. (MHz)	Reading (dBm)	Cable (dB)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
1	5	1921.536	**20.00**	0.8	20.80	20.8	**0.00**
2	3	1924.992	19.83	0.8	20.63	20.8	0.17
3	1	1928.448	20.00	0.8	20.80	20.8	0.00

Worst-case plot follows:

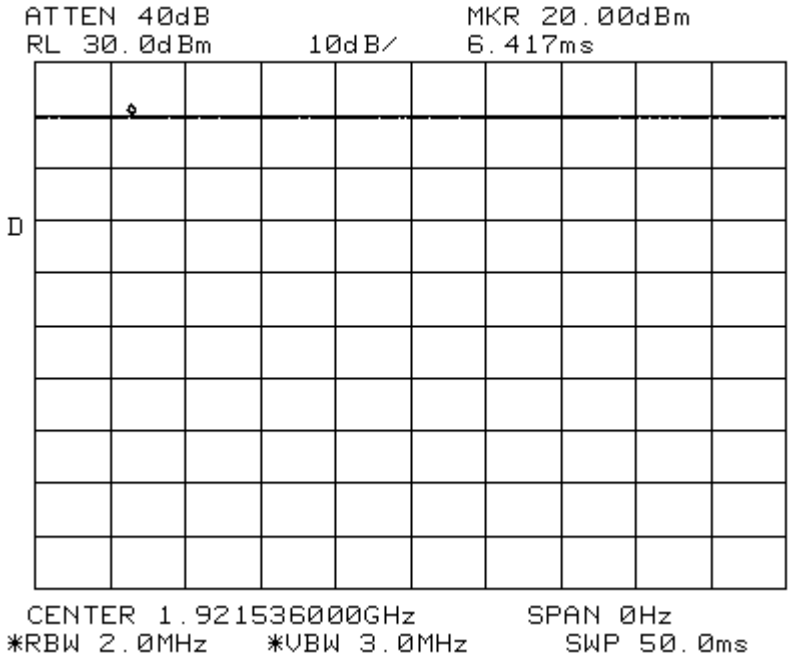


Base peak power at Low-freq Channel

4.2 Handset

Test Mode	Chan. No.	Freq. (MHz)	Reading (dBm)	Cable (dB)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
1	1	1928.448	19.83	0.8	20.63	20.8	0.17
2	3	1924.992	19.83	0.8	20.63	20.8	0.17
3	5	1921.536	**20.00**	0.8	20.80	20.8	**0.00**

Worst-case plot follows:



Handset peak power at Low-freq Channel

5 RADIATED PEAK POWER

6 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
= 70.15 / $4\pi(20)^2$ = 0.014 mW/cm^2 < 1 mW/cm^2 limit

6.2 Handset SAR

Refer to separate SAR testing report by Celltech.

Measurement of radiated power of SAR EUT

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)	1928.55	79.90	7.52	28.5 H	0	115.92	18.92	78.00
3 (MID)	1925.22	79.11	7.52	28.5 H	0	115.13	18.13	65.00
5 (LOW)	1921.70	78.50	7.52	28.5 H	0	114.52	17.52	56.50

Note 2: Horn antenna in Horizontal (H) or Vertical (V) polarization
Note 3: 97 dB taken as factor to convert Field Strength to Radiated Power in numerical value
Note 5: EUT raised up by at least 5 cm to minimize reflection of RF emissions by test table

7 DUTY CYCLE CORRECTION FACTOR

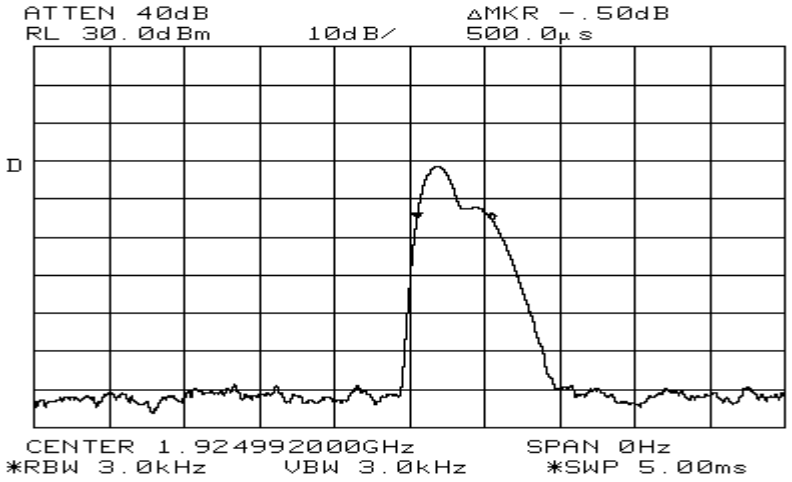
Clause: **N/A**

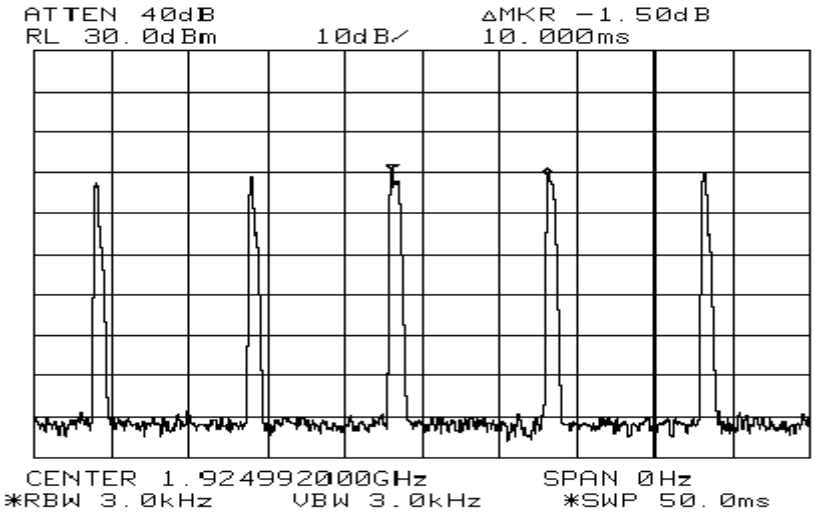
Max. Allowed: 6 dB per IC clause 8.2.3

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/100 ms) for power in dBm
= 10 log (500 μs x 5 / 50 ms) from timing plots below
= –13.0 dB => –6 dB maximum allowed



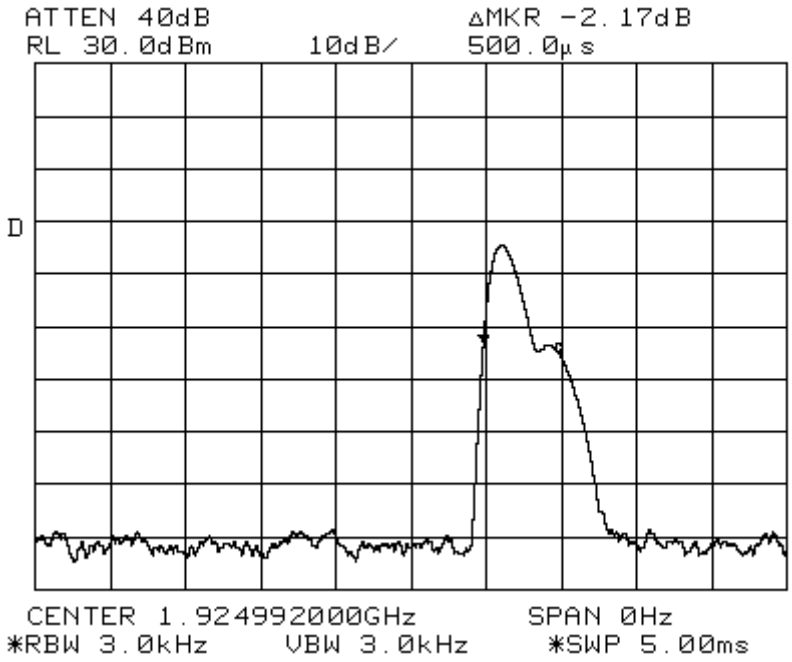


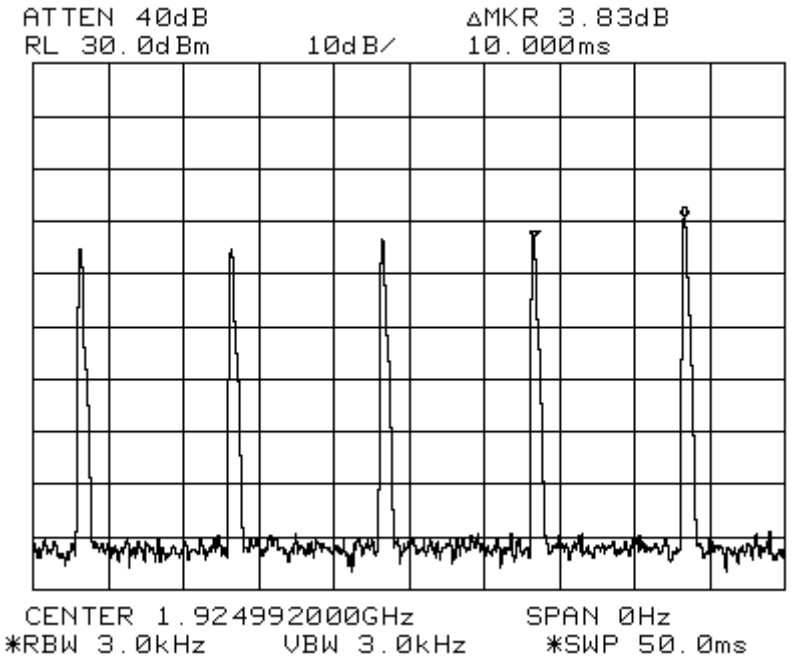
7.2 Base with multi-handset

DCF_BS = 10 log (4 x 500 μs x 5 / 50 ms) for up to 4 time slots occupied
= –7.0 dB => –6 dB maximum allowed

7.3 Handset

DCF_HS = –6 dB maximum allowed (only single-pulse operation in TDMA)





8 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

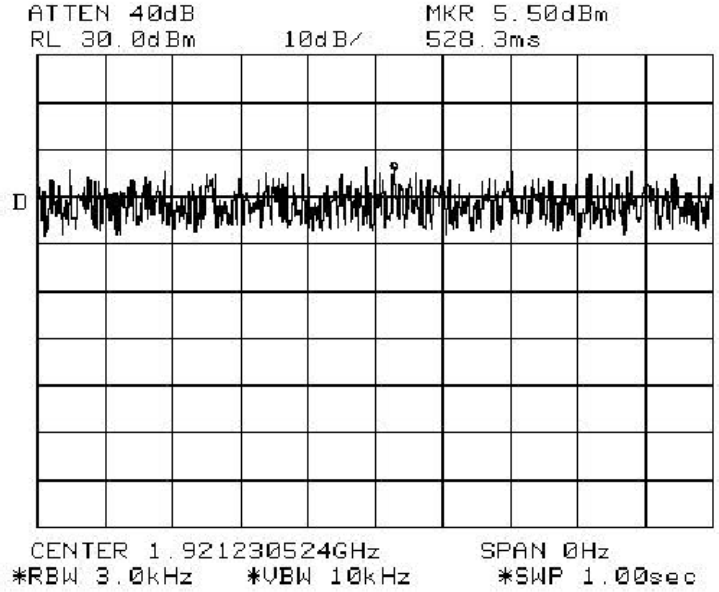
SA Setting: RBW = 3 kHz
ANSI 6.1.5 VBW = RBW
Span = B first to locate peak, then 10 kHz to read power within 3 kHz
Sweep: slow enough for at least 2 bursts to occur in each 3 kHz of span swept; e.g. 10 s sweep captures 1000 bursts of 10 ms-burst-rate signal while sweeping across 1.5 MHz, for 2 bursts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

Test Result: Base: 0.30 dBm (1.07 mW)
by peak-hold Handset: 1.63 dBm (1.46 mW)

8.1 Base

Test Mode	Chan. No.	Freq. (MHz)	Reading (dBm)	Cable (dB)	DCF (dB)	PSD (dBm)	Limit (dBm)	Margin (dB)
1	5	1921.536	**5.50**	0.8	–6.0	0.30	4.77	**4.47**
2	3	1924.992	5.17	0.8	–6.0	-0.03	4.77	4.80
3	1	1928.448	4.83	0.8	–6.0	-0.37	4.77	5.14

Worst-case plot follows:

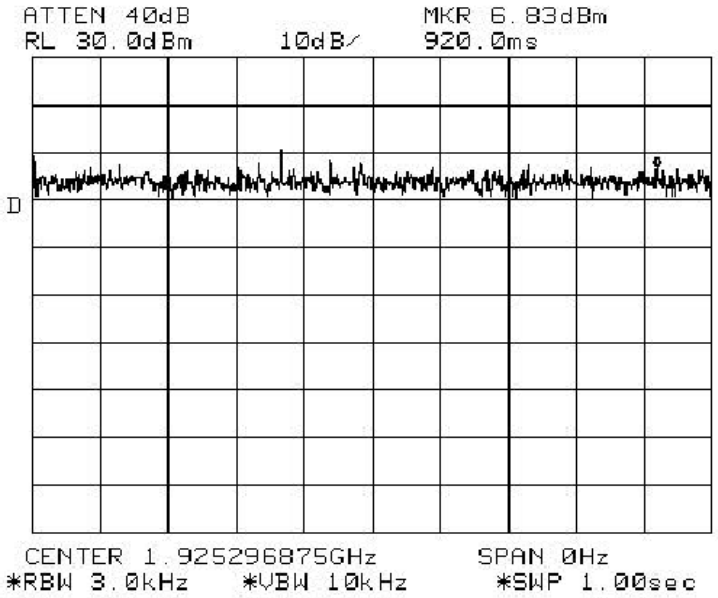


Base PSD at Low-freq Channel

8.2 Handset

Test Mode	Chan. No.	Freq. (MHz)	Reading (dBm)	Cable (dB)	DCF (dB)	PSD (dBm)	Limit (dBm)	Margin (dB)
1	1	1928.448	6.33	0.8	–6.0	1.13	4.77	3.64
2	3	1924.992	**6.83**	0.8	–6.0	1.63	4.77	**3.14**
3	5	1921.536	6.50	0.8	–6.0	1.3	4.77	3.47

Worst-case plot follows:



Handset PSD at Mid-freq Channel

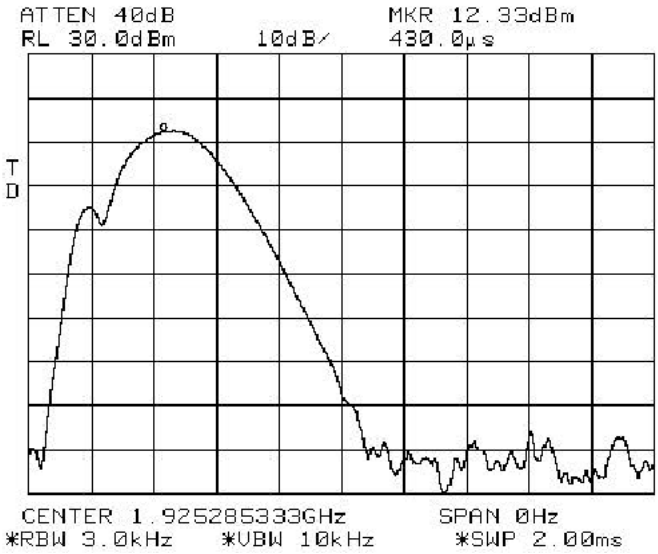
Alternative estimation of PSD by CAT method per ANSI Clause 6.1.5

Test Result: Base: -13.20 dBm (0.048 mW)
Handset: -13.53 dBm (0.044 mW)

8.3 Base (Alternative)

Test Mode	Chan. No.	Freq. (MHz)	Reading (dBm)	Cable (dB)	Av. CF (dB)	PSD (dBm)	Limit (dBm)	Margin (dB)
1	5	1921.536	12.10	0.8	–26.33	-13.43	4.77	-18.20
2	3	1924.992	**12.33**	0.8	–26.33	-13.20	4.77	**-17.97**
3	1	1928.448	12.05	0.8	–26.33	-13.48	4.77	-18.25

Worst-case of sample pulse follows:



Base Pulse Sample at Mid Channel
With Ext. Trigger from TX_ON

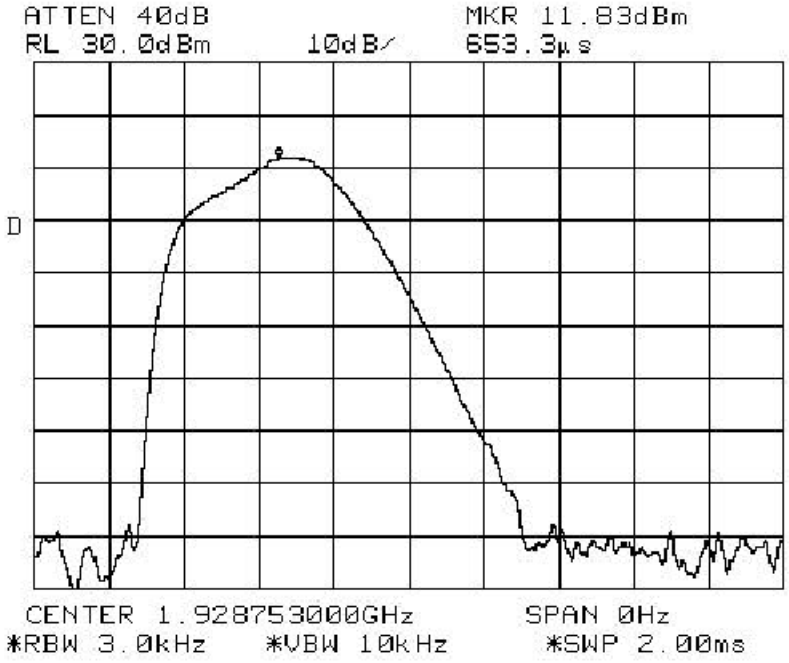
Power summation within 20 dBc = 1.09E+03 mW (by peak detection)
Summation sample points = 170
Mean power summation = 1.09E+03 / 170 = 6.41 mW
Pulse sampling frequency = 600 / 2 ms = 300 kHz
Pulse duration within 20 dBc = 563 µs
Averaged PSD = 6.41 mW / 300 kHz x 563 µs
= 0.038 mW –14 dBm

Peak power reading = 12.33 dBm
Average conversion factor = –14 – 12.33 = –26.33 (taken as representative)

8.4 Handset (Alternative)

Test Mode	Chan. No.	Freq. (MHz)	Reading (dBm)	Cable (dB)	Av. CF (dB)	PSD (dBm)	Limit (dBm)	Margin (dB)
1	1	1928.448	**11.83**	0.8	–25.33	-12.70	4.77	**-17.47**
2	3	1924.992	11.52	0.8	–25.33	-13.01	4.77	-17.78
3	5	1921.536	11.62	0.8	–25.33	-12.91	4.77	-17.68

Worst-case of sample pulse follows:



Handset Pulse Sample at High Channel
With Ext. Trigger from TX_ON

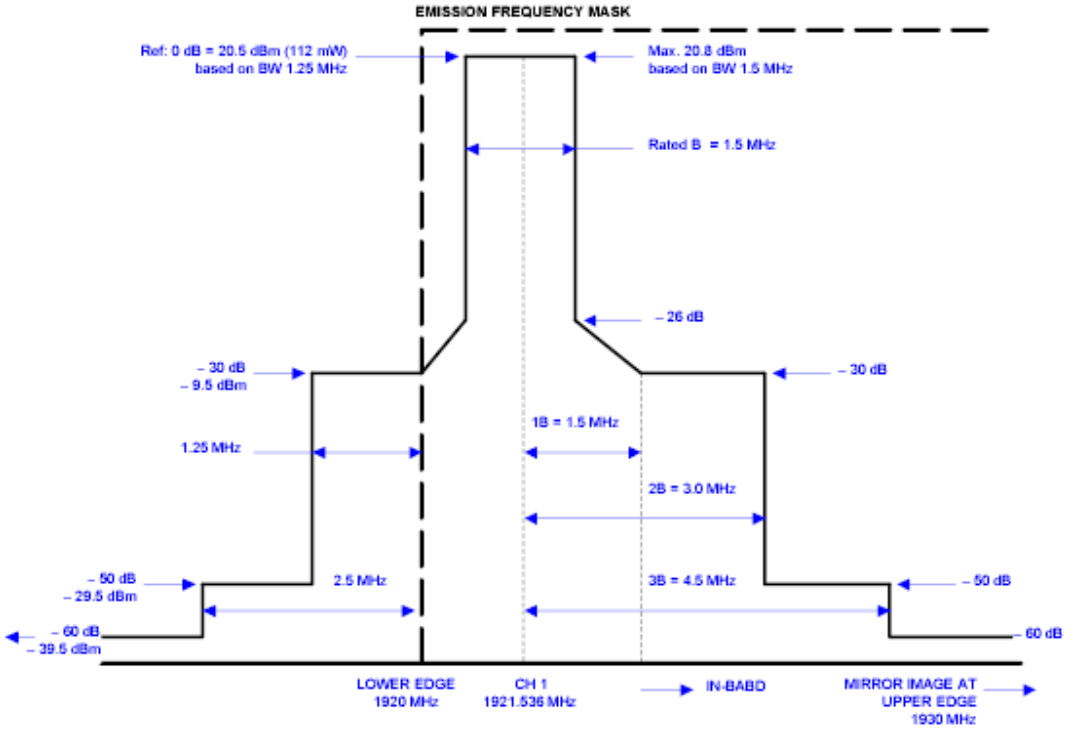
Power summation within 20 dBc = 1.26E+03 mW (by peak detection)
Summation sample points = 172
Mean power summation = 1.26E+03 / 172 = 7.32 mW
Pulse sampling frequency = 600 / 2 ms = 300 kHz
Pulse duration within 20 dBc = 570 µs
Averaged PSD = 7.32 mW / 300 kHz x 570 µs
= 0.043 mW –13.5 dBm

Peak power reading = 11.83 dBm
Average conversion factor = –13.5 – 11.83 = –25.33 (taken as representative)

9 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

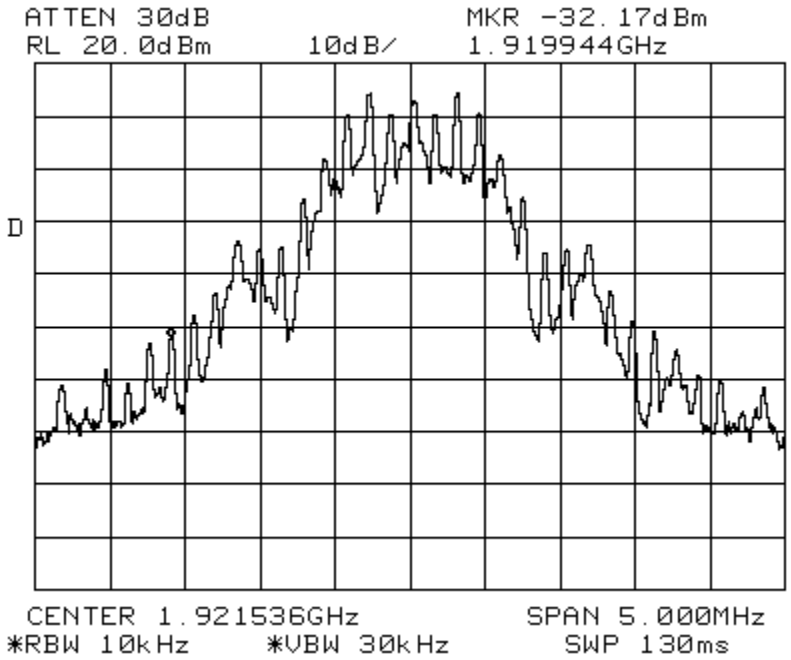
Test Result: Base: –75.83 dBc (worst at lower band edge)
Handset: –77.83 dBc (worst at lower band edge)

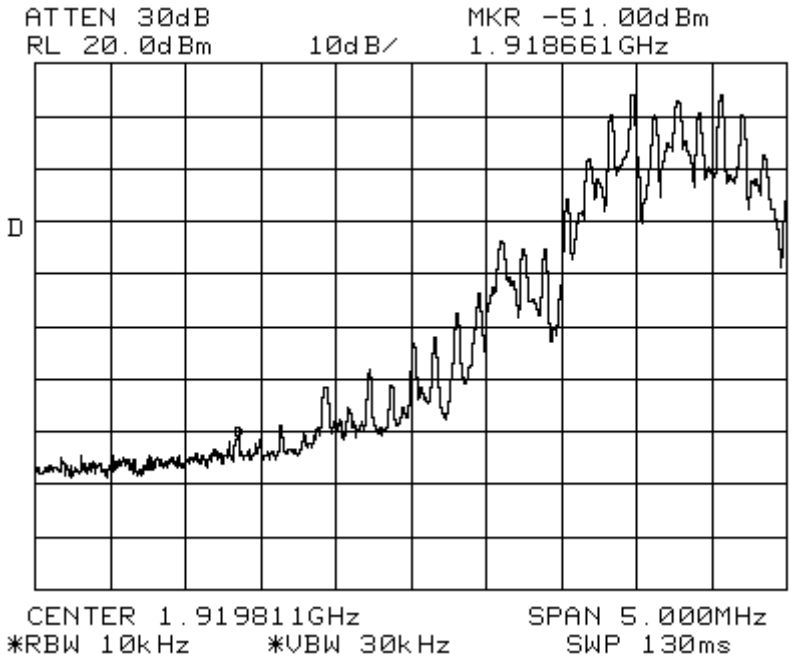
For in-band out-of-channel emissions, since emission bandwidth B is greater than out-band step bandwidth 1.25 MHz and occupied bandwidth is symmetrical about channel center, compliance in out-band emissions will automatically lead to compliance in in-band out-of-channel.

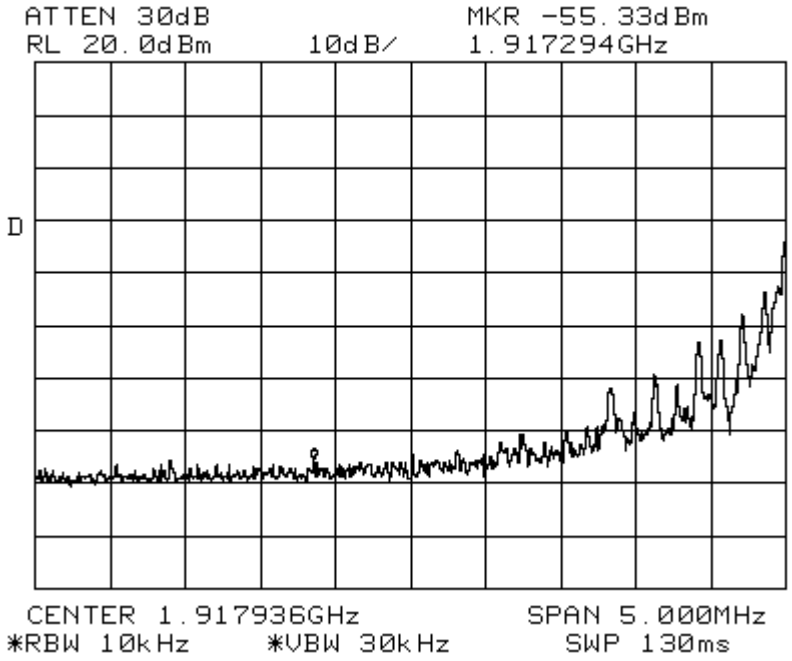
9.1 Base Near Band Edge

Test Mode	Chan. No.	Freq. (MHz)	Freq. Range (MHz)	Reading (dBm)	Rel. Att. (dBc)	Limit (dBc)	Margin (dB)
1	5	1921.536	Lower Edge	20.50	0. 00	---	---
		1919.944	1918.75 ~1920	-32.17	-52.67	–30	22.67
		1918.661	1917.5 ~1918.75	-51.00	-71.50	–50	21.50
		1917.294	Down ~1917.5	**-55.33**	-75.83	–60	**15.83**
3	1	1928.448	Upper edge	20.50	0. 00	--	---
		1930.073	1930 ~1931.25	-32.00	-52.50	–30	22.50
		1931.365	1931.25 ~1932.5	-50.00	-70.50	–50	20.50
		1932.840	1932.5 ~ up	-55.50	-76.00	–60	16.00

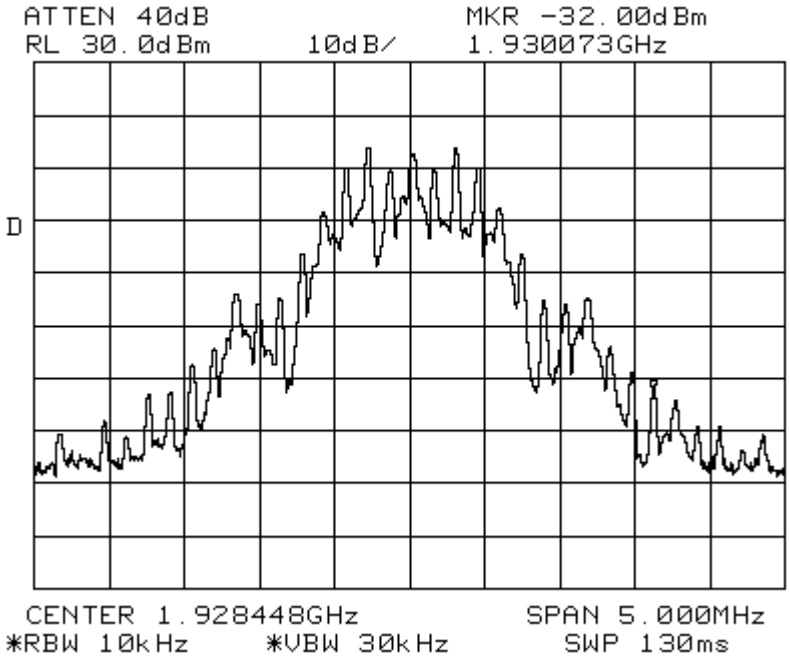
Lower out-band plots follow:

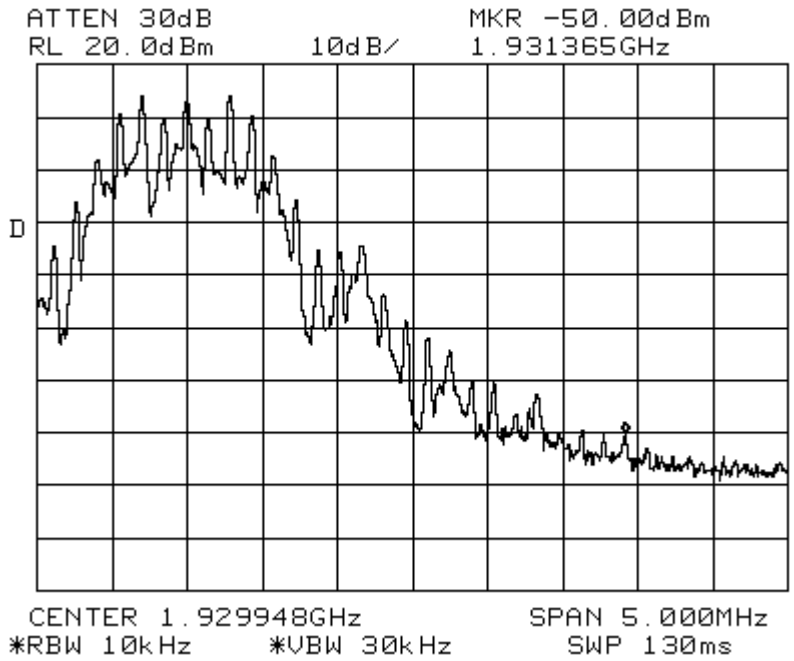


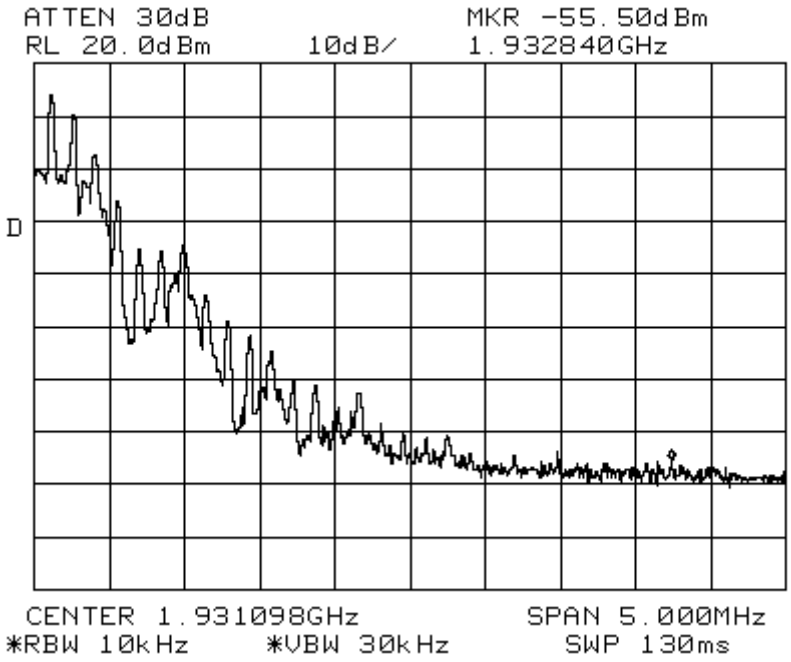




Upper out-band plots follow:





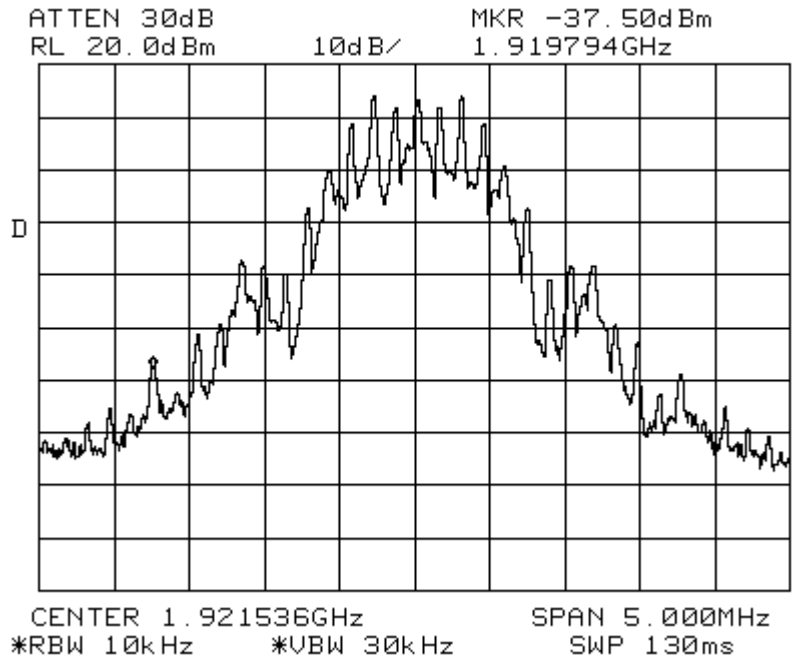


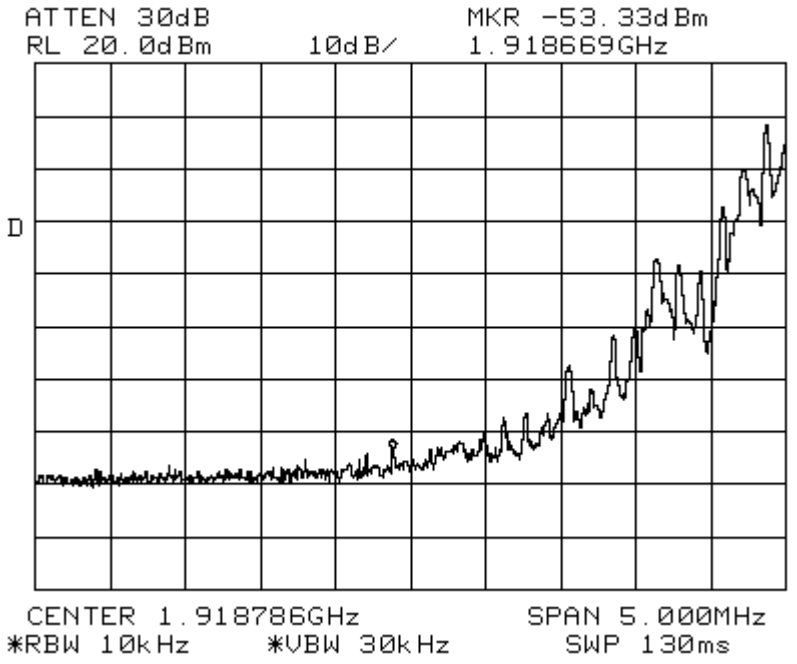
9.2 Base Tx Harmonics

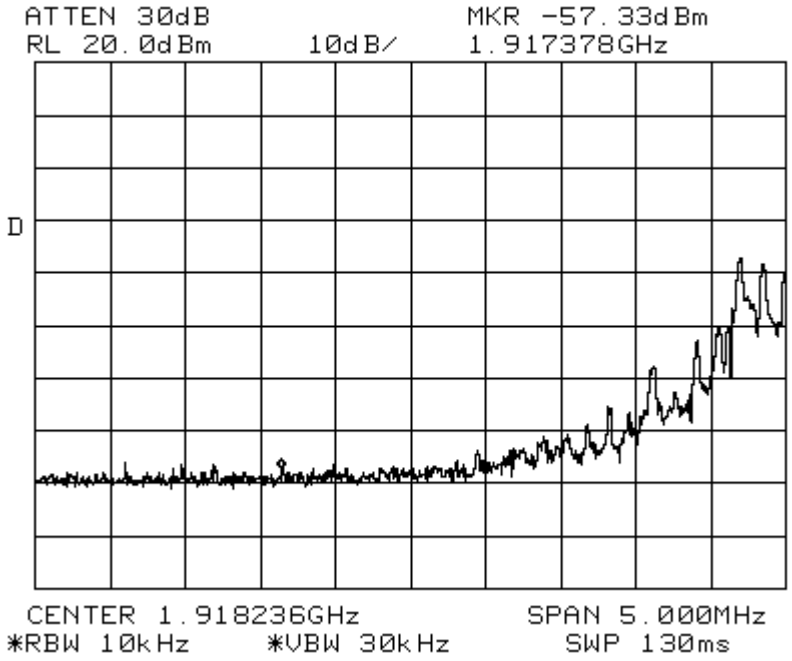
9.3 Handset Near Band Edge

Test Mode	Chan. No.	Freq. (MHz)	Freq. Range (MHz)	Reading (dBm)	Rel. Att. (dBc)	Limit (dBc)	Margin (dB)
3	5	1921.536	Lower Edge	20.50	0. 0	--	---
		1919.794	1918.75 ~1920	-37.50	-58.00	–30	28.00
		1918.669	1917.5 ~1918.75	-53.33	-73.83	–50	23.83
		1917.378	Down ~1917.5	**-57.33**	-77.83	–60	**17.83**
1	1	1928.448	Upper edge	20.50	0. 0	---	---
		1930.231	1930 ~1931.25	-37.83	-58.33	–30	28.33
		1931.381	1931.25 ~1932.5	-56.00	-76.50	–50	26.50
		1932.740	1932.5 ~ up	-57.50	-78.00	–60	18.00

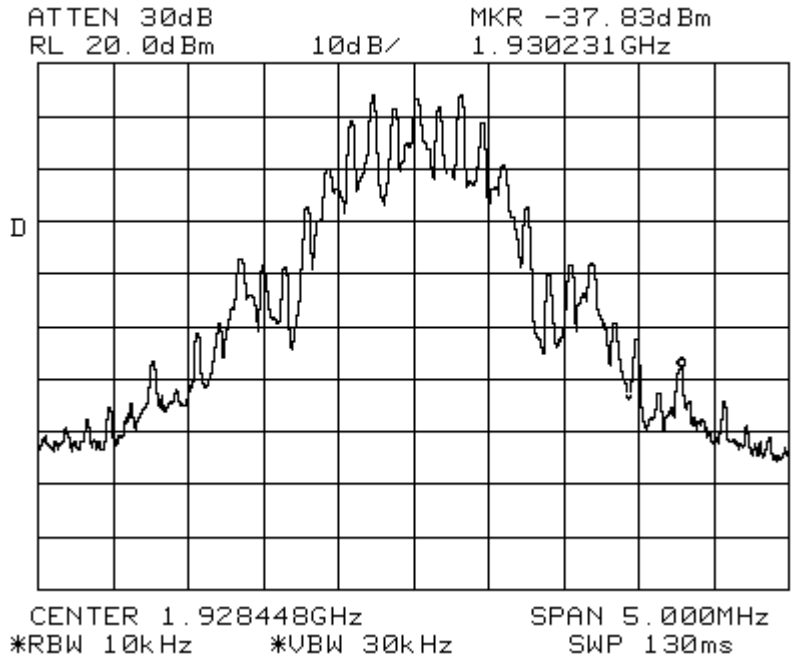
Lower out-band plots follow:

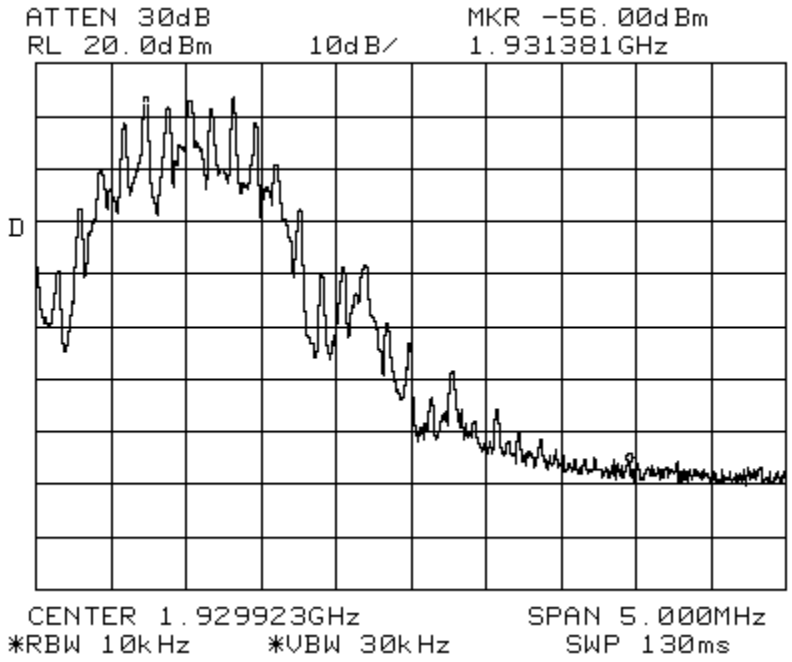


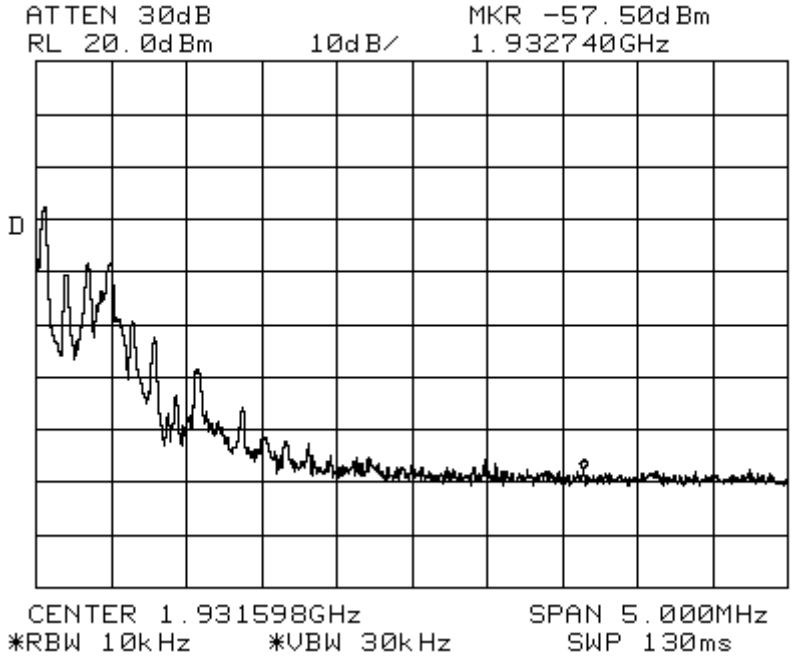




Upper out-band plots follow:







9.4 Handset Tx Harmonics

10 RADIATED SPURIOUS EMISSIONS

11 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
THERMOTRON Environmental Chamber MODEL SM-4S-SL
S/N 23060

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

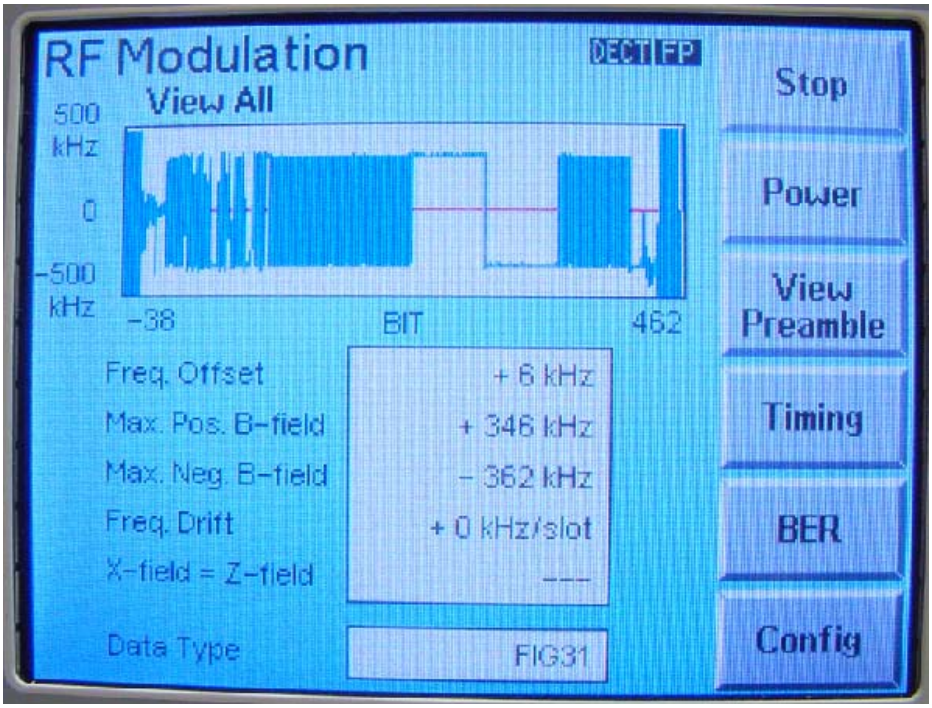
11.1 Base

11.1.1 Frame Frequency Drift and Jitter

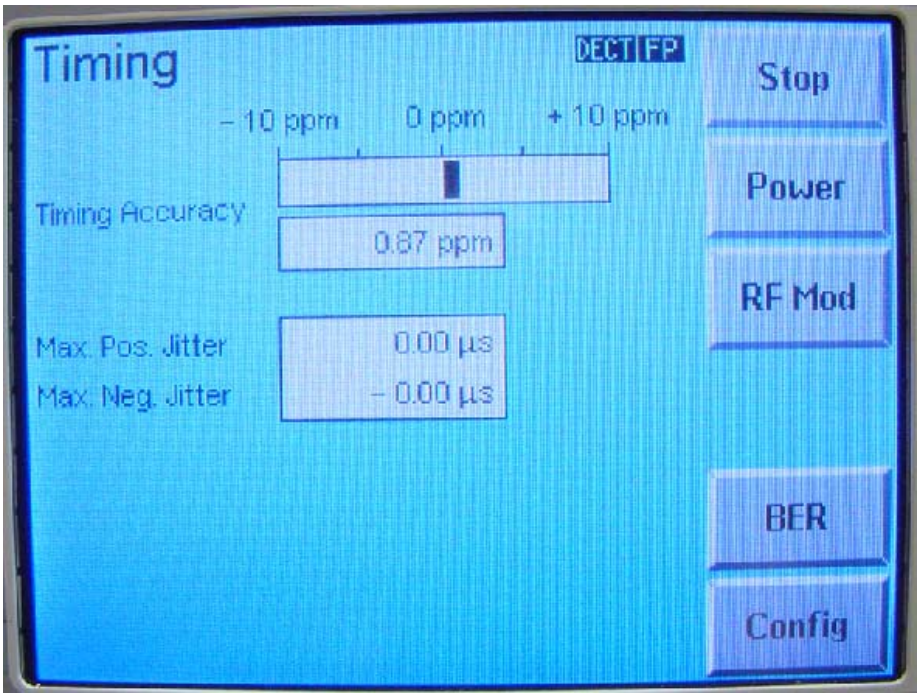
Test Mode	Channel No.	Frequency (kHz / slot)		Jitter (μs)	
		Drift	Limit	Meas.	Limit
TBR6	5	0.00	19.2	0.00	25
TBR6	3	**0.00**	19.2	**0.00**	25
TBR6	1	0 .00	19.2	0.00	25

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

11.1.2 Carrier Frequency Stability with Supply voltage

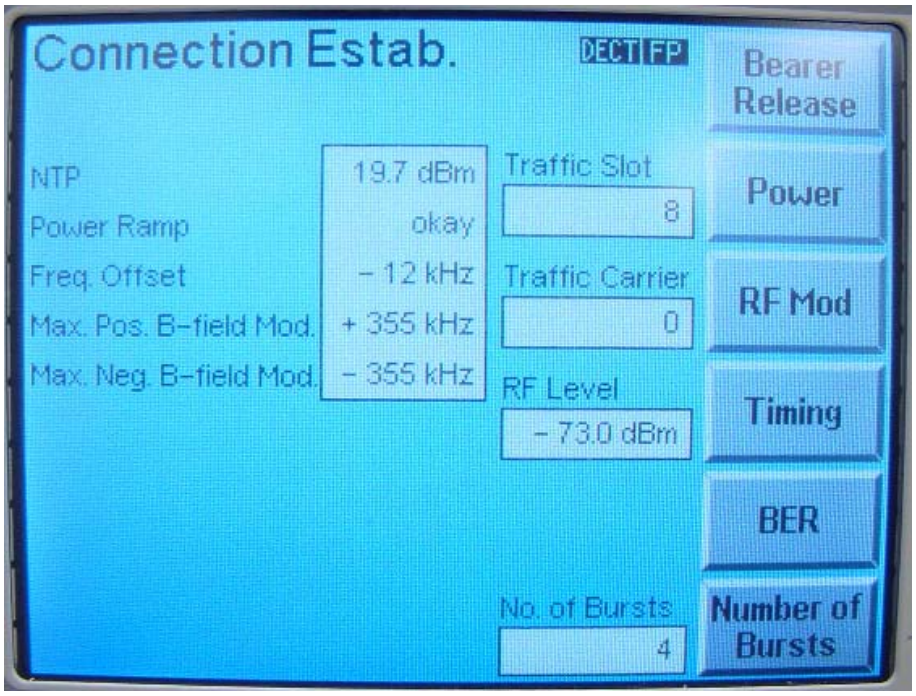
Test Mode	Channel No.	Frequency (kHz / slot)			Limit (kHz / slot)
		4.25 V (85%)	5 V (Norm.)	5.75 V (115%)	
TBR6	5	-10	-11	-11	19.2
TBR6	3	-12	-11	-12	19.2
TBR6	1	-9	-8	-8	19.2

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 (kHz)
		–20 ^{0}C	25 ^{0}C	50 ^{0}C	
TBR6	5	**-12.0**	6.0	-9.0	± 19.2
TBR6	3	-3.0	5.0	-8.0	± 19.2
TBR6	1	-9.0	4.0	-5.0	± 19.2

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



Base Carrier Frequency Offset with Temperature

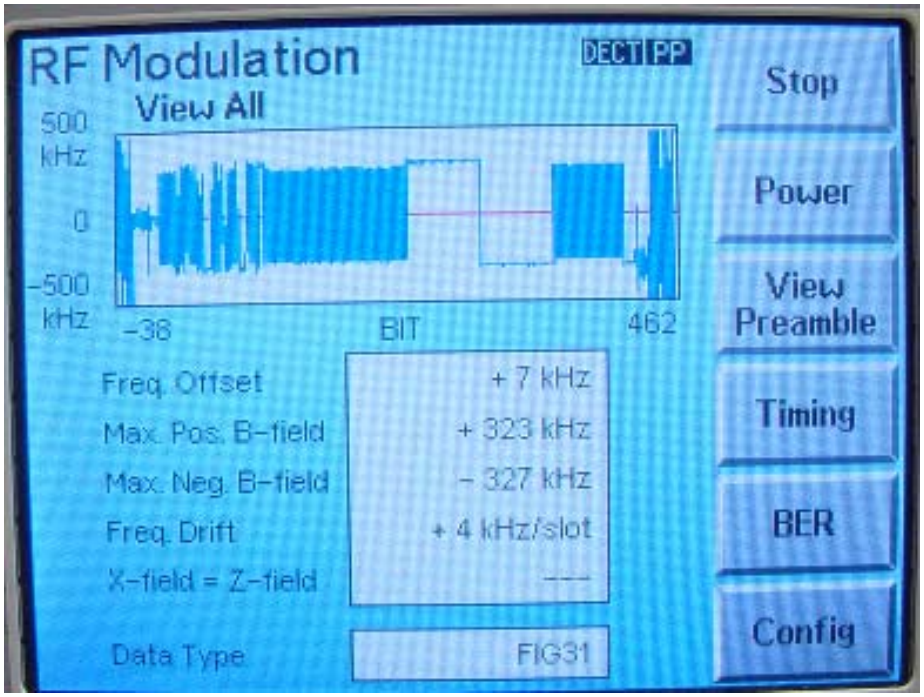
11.2 Handset

11.2.1 Frame Frequency Drift and Jitter

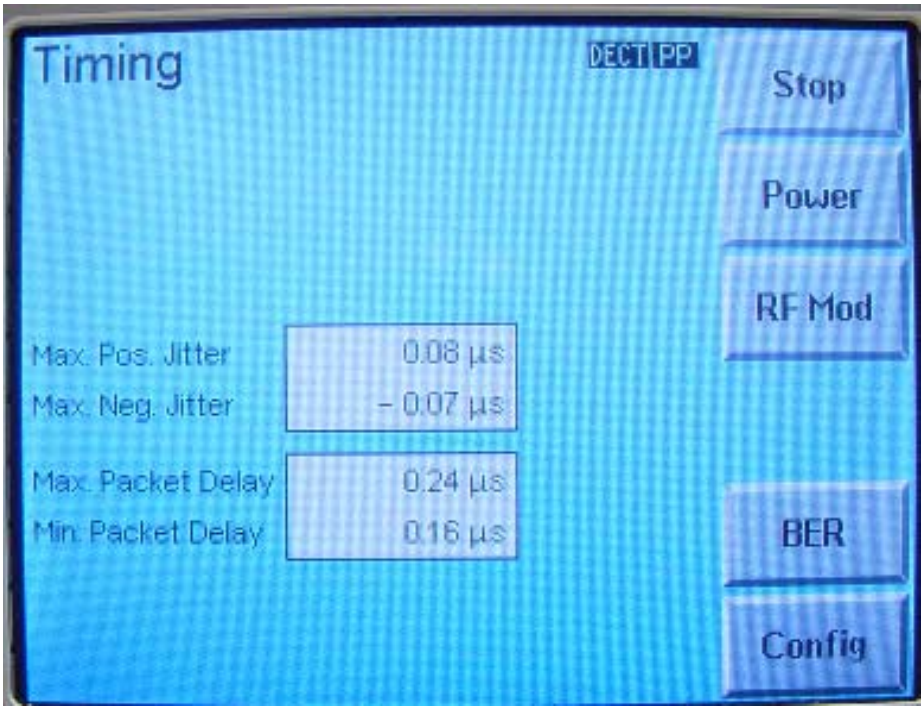
Test Mode	Channel No.	Frequency (kHz / slot)		Jitter (μs)	
		Drift	Limit	Meas.	Limit
TBR6	1	4.00	19.2	0.00	25
TBR6	3	**4.00**	19.2	**0.08**	25
TBR6	5	3.00	19.2	0.00	25

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:



Handset Frequency Drift at Mid Channel



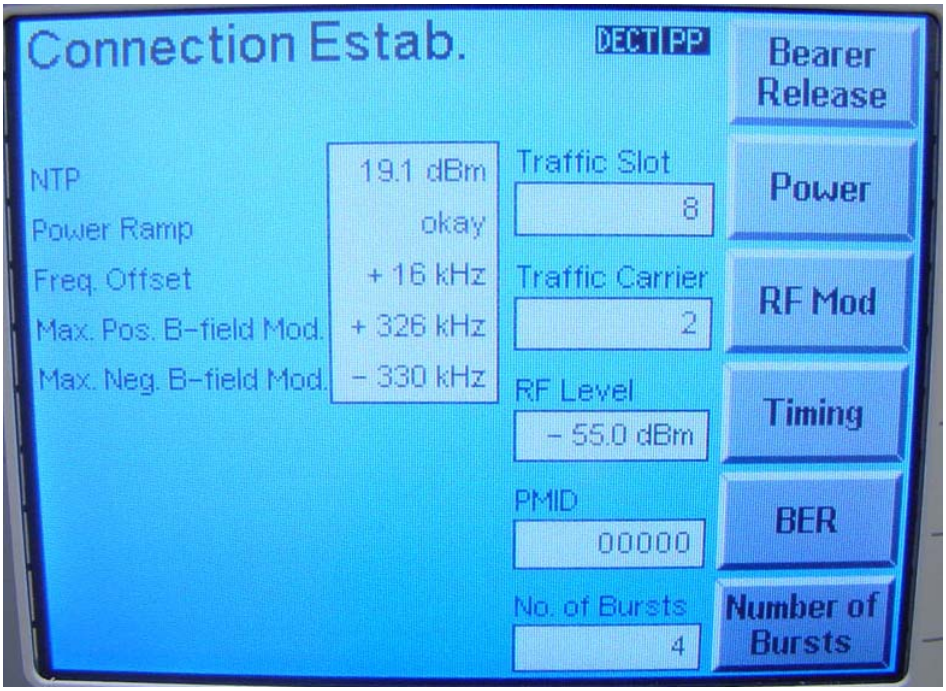
Handset TDMA Frame Jitter

11.2.2 Carrier Frequency Stability with Temperature and Time

Test Mode	Channel No.	Frequency Offset (kHz)			Limit (kHz)
		–20 ^{0}C	25 ^{0}C	50 ^{0}C	
TBR6	5	10.0	3.0	0.0	± 19.2
TBR6	3	**16.0**	7.0	0.0	± 19.2
TBR6	1	11.0	6.0	0.0	± 19.2

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. Photo of worst-case display follows:



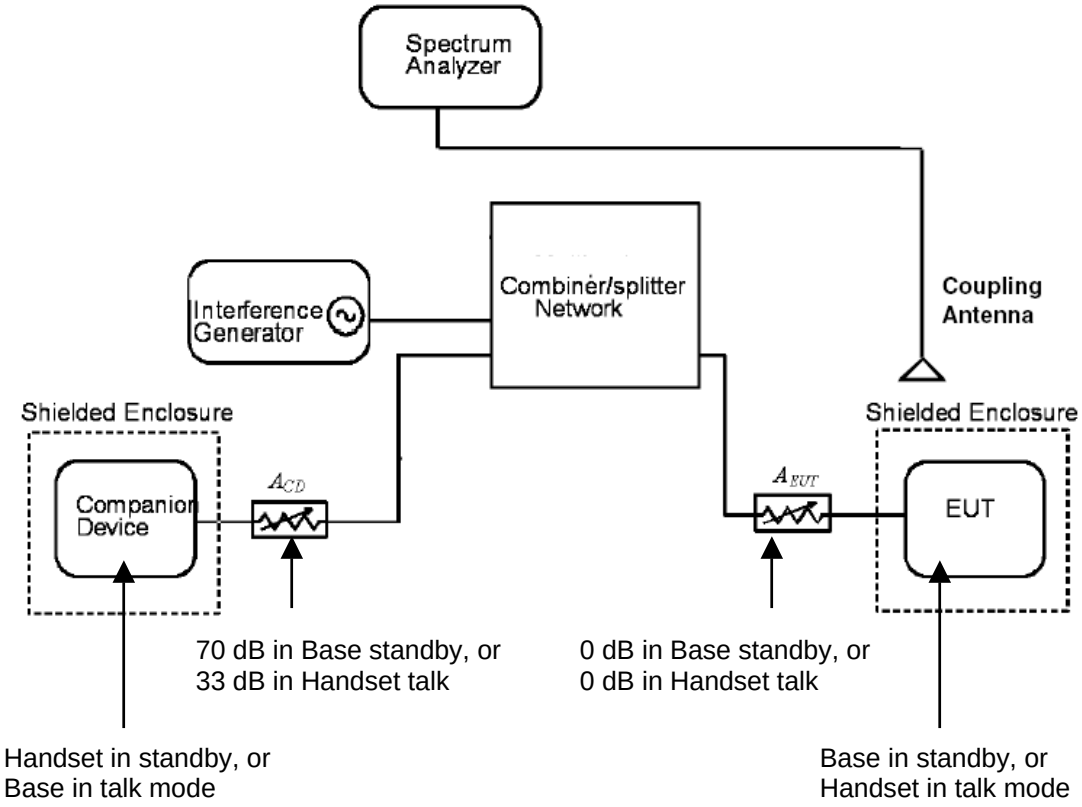
Handset Carrier Frequency Offset with Temperature

12 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

Base and handset are in standby or talk mode as in normal functional operation.

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
= –66.0 – 6.4
= –72.4 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 = –62.0 – 6.4
= –68.4 dBm