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TEST REPORT

FCC ID: Base: **PBWDT19R42**
Handset: **PBWDT19R42H**

IC: **3842A-B209**
Model: B209, B209H

Equipment Under Test: **1.9 GHz DECT Telephone (UPCS / LE-PCS Device)**

EUT S/N:	TS060413028	Conducted measurement
	TS060413003	Radiated measurement
	TS060413013	Spare for Radiated measurement
	TS060413008	Odd-channel Threshold test
	TS060413029	Even-channel Threshold test
	TS060413002	SAR measurement
	TS060413015	SAR measurement

In Accordance With: **FCC Part 15, Subparts B, C & D**
IC RSS-213, RSS-Gen, & ICES-003
For UPCS / LE-PCS Isochronous Device
Base & Handset: **1921.536 – 1928.448 MHz**

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

Tested By: **Bill / Ronnie**

Reviewed By: **Kevin Yau**

Date: **December 8, 2006**

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1 CHANNEL FREQUENCIES

Clause: 15.303 (d) & (g) / 1

Requirement: Within 1920 – 1930 MHz band for isochronous devices

U-/LE-PCS 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 Test Mode Procedure.

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2 ANTENNA REQUIREMENT

Clause: 15.317 (15.203) / 4.1 (e), RSS-Gen 7.1.4

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

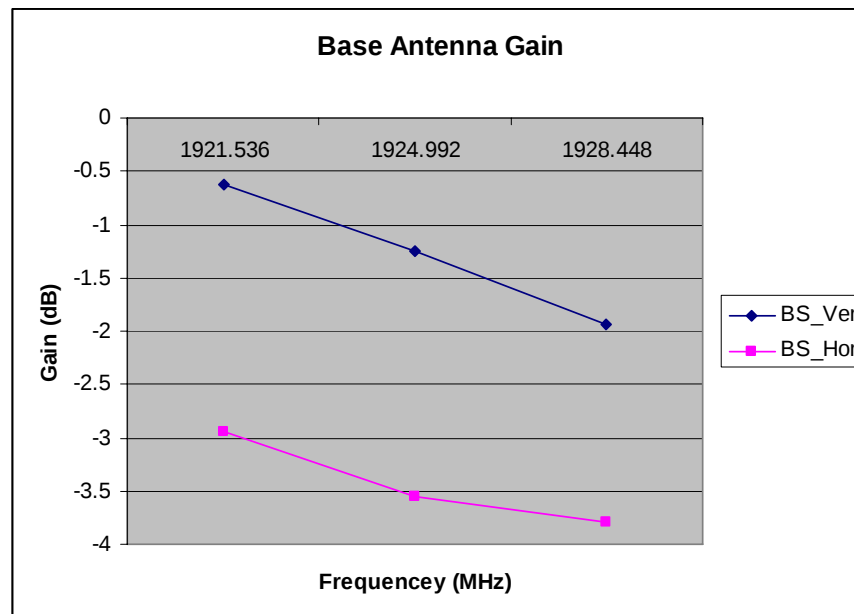
Observation: Base and Handset have each a pre-formed wire antenna permanently attached on the PCB; it is not user replaceable. Base has an additional internal antenna for receive diversity configuration. There is no external antenna or connector provided on the base or handset for the user to use antenna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

Spec of Antenna: Base antenna Tx gain across the band = -0.62 ~ -3.79 dBi (0.87 ~ 0.42 numeric)
Handset antenna Tx gain across band = 0.92 ~ -1.37 dBi (1.24 ~ 0.73 numeric)

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

2.1 Base

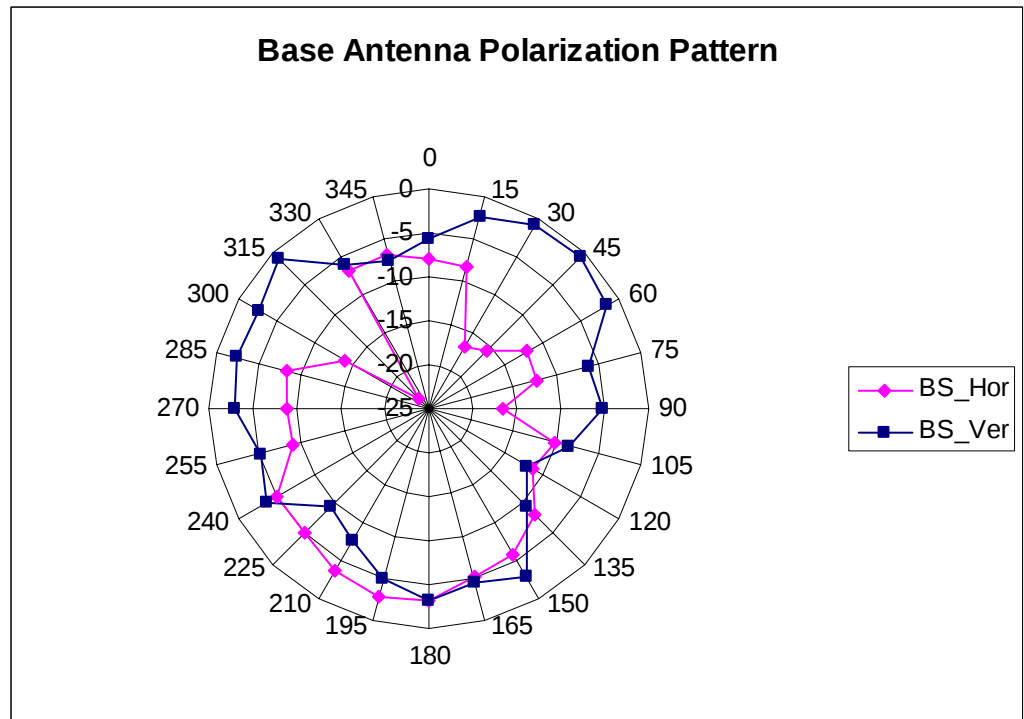
2.1.1 Gain



	Channel	5	3	1
	Freq (MHz)	1921.536	1924.992	1928.448
Polarization	Vertical	-0.62	-1.24	-1.94
	Horizontal	-2.95	-3.55	-3.79

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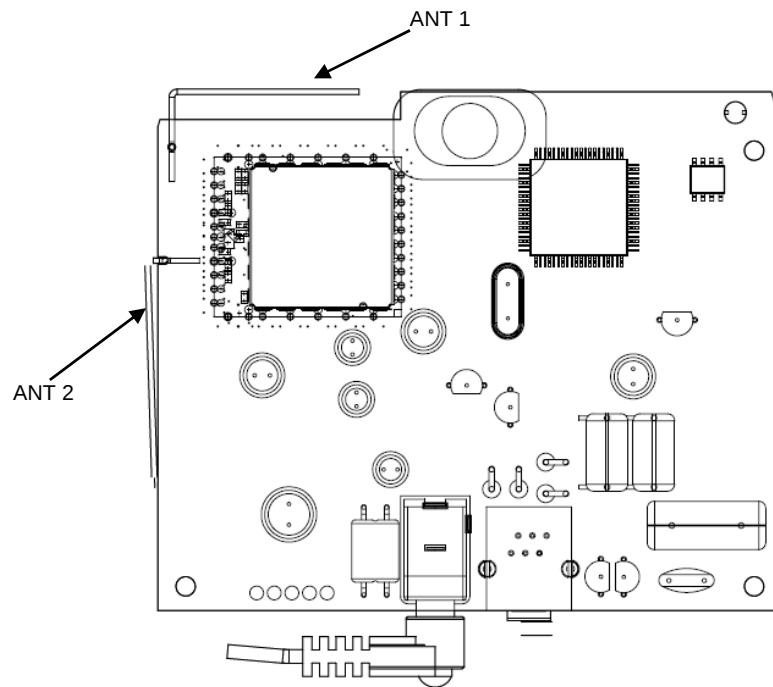
2.1.2 Polarization



Deg	Horizontal (dBi)	Vertical (dBi)	Deg	Horizontal (dBi)	Vertical (dBi)
0	-7.97	-5.64	210	-3.86	-7.76
15	-8.51	-2.41	225	-5.09	-9.1
30	-16.83	-0.9	240	-4.95	-3.92
45	-15.66	-0.63	255	-9.05	-5.13
60	-11.96	-1.51	270	-8.79	-2.9
75	-12.3	-6.03	285	-8.16	-2.48
90	-16.67	-5.18	300	-14.15	-2.73
105	-10.15	-8.62	315	-23.37	-0.87
120	-11.46	-12.01	330	-6.87	-6.25
135	-7.98	-9.1	345	-6.85	-7.51
150	-5.87	-2.98			
165	-5.23	-4.53	Max	-2.94	-0.63
180	-3.25	-3.18	Min	-23.37	-12.01
195	-2.94	-5.03	Diff	20.43	11.38

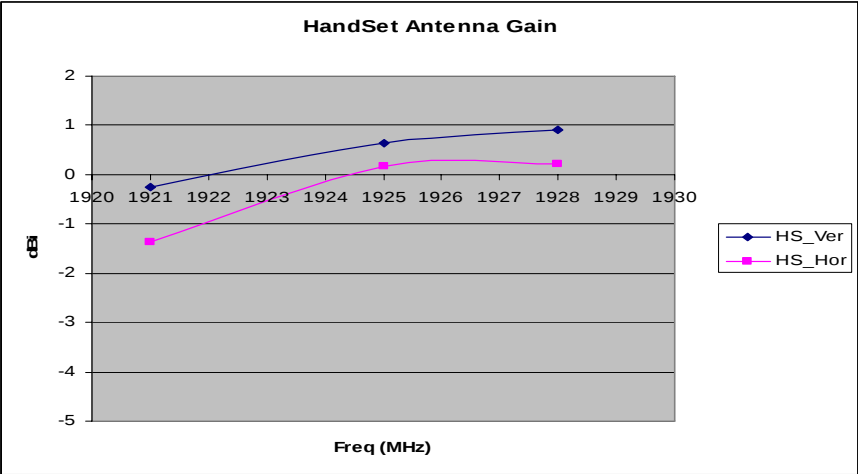
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2.1.3 Antenna Assembly



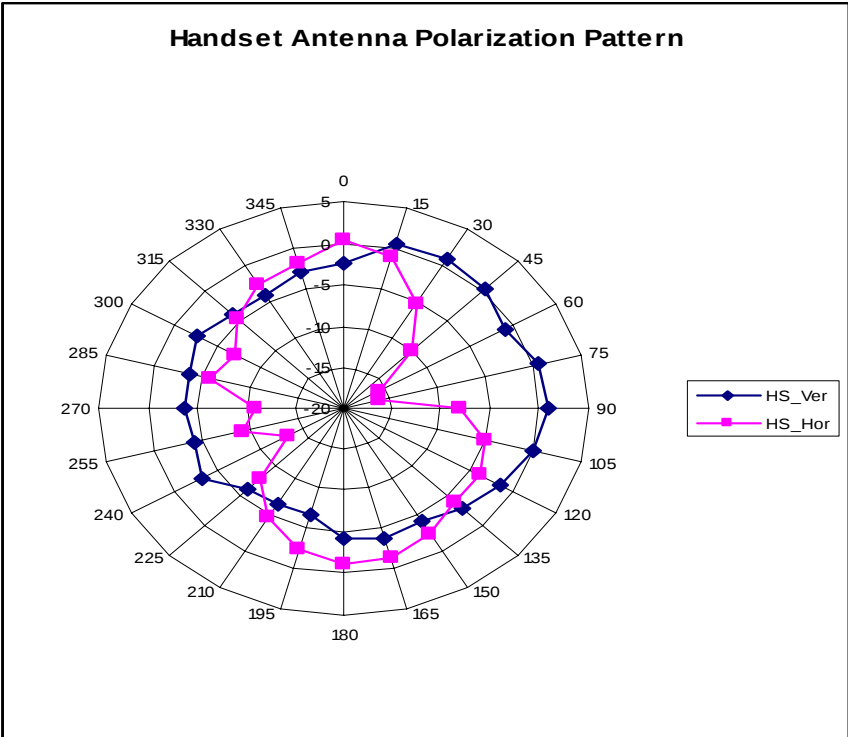
2.2 Handset

2.2.1 Gain



	Channel	5	3	1
	Freq (MHz)	1921.536	1924.992	1928.448
Polarization	Vertical	-0.24	0.63	0.92
	Horizontal	-1.37	0.17	0.21

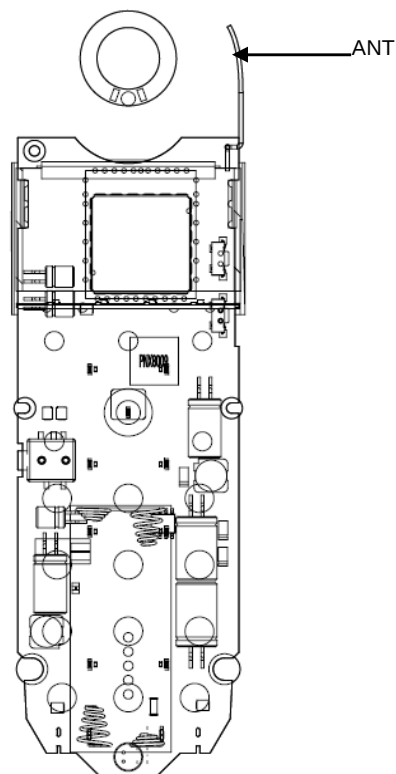
2.2.2 Polarization



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Deg	Horizontal (dBi)	Vertical (dBi)	Deg	Horizontal (dBi)	Vertical (dBi)
0	0.3	-2.56	210	-4.78	-6.67
15	-1.05	0.55	225	-8.04	-6.05
30	-5.27	0.91	240	-13.45	-3.32
45	-10.3	0.38	255	-9.5	-4.39
60	-15.75	-0.85	270	-10.94	-3.66
75	-16.05	0.73	285	-5.91	-3.73
90	-8.1	0.86	300	-7.16	-2.68
105	-4.97	0.09	315	-4.41	-4.05
120	-3.97	-1.53	330	-2.76	-4.32
135	-4.04	-3.08	345	-2.05	-2.96
150	-2.36	-4.27			
165	-1.32	-3.85	Max	0.3	0.91
180	-1.21	-4.25	Min	-16.05	-6.67
195	-2.52	-6.65	Diff	16.49	7.58

2.2.3 Antenna Assembly



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3 MONITORING THRESHOLD

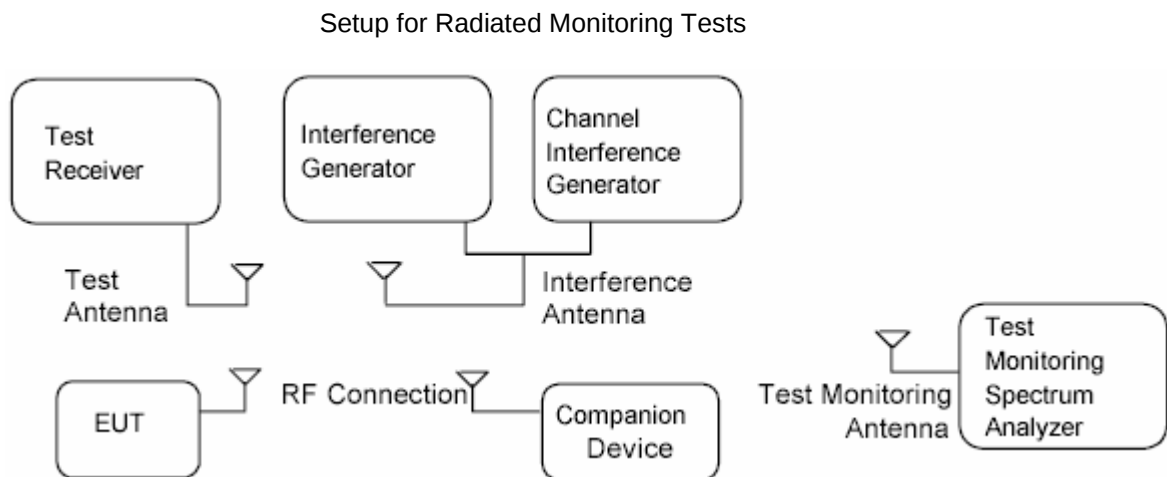
Clause: 15.323 (c)(5) / 4.3.4 (b)

Requirement: ≤ -61 dBm for 1.5 MHz BW and 20.5 dBm Tx power derived from formula as follows:
Upper limit = $15 \log B - 184 + 50 - P$ as per ANSI 63.17 Sec. 7.2.1
Threshold Resolution within 6 dB

Test Result: Threshold < -61 dBm
Resolution within 2 dB

3.1 Radiated Method

Test Setup: As shown below per Fig. 7 of 7.1.1 in ANSI C63.17

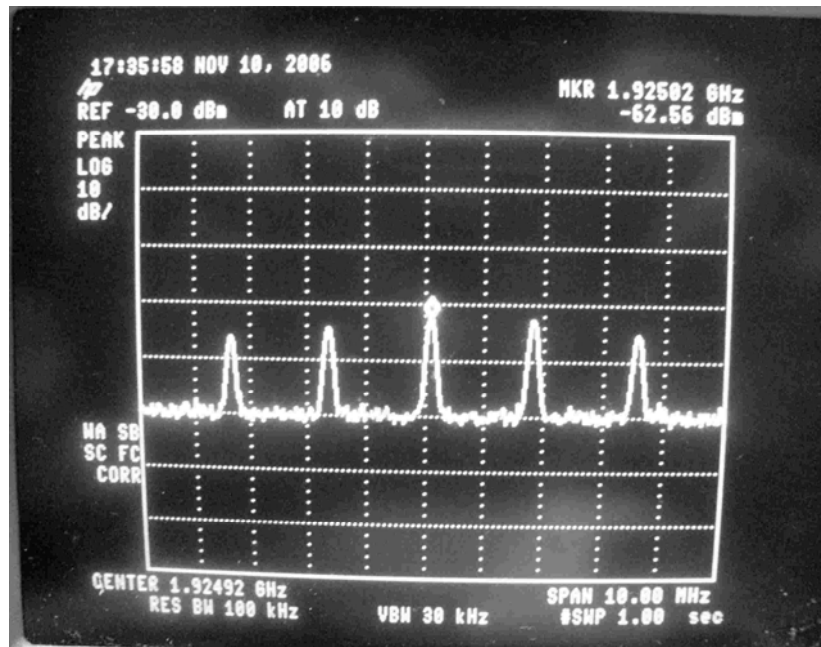


SA displays and data follow.

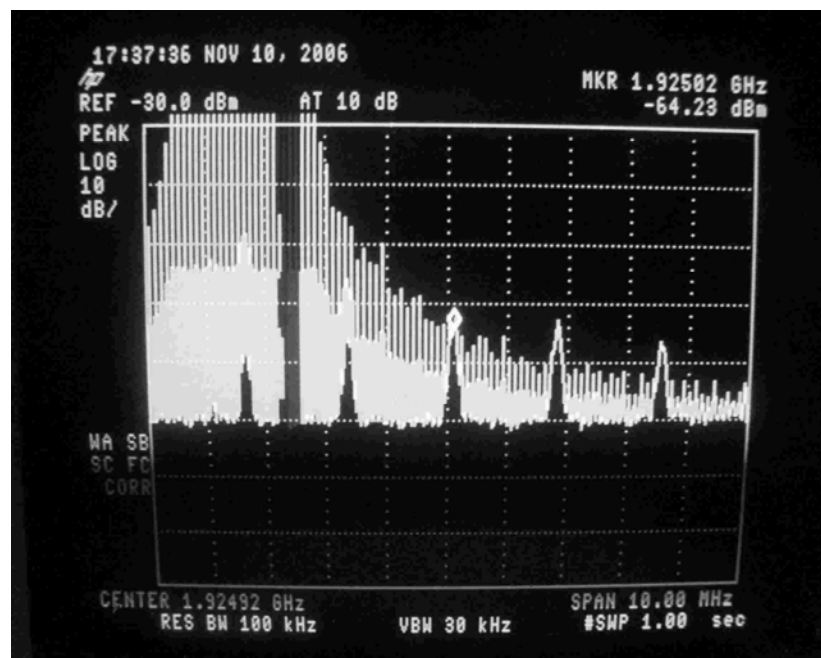
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3.1.1 Threshold Level

As in-channel interference lowered from higher to lower than monitoring threshold



No TX at interference of -62.56 dBm (within $T_U + U_M + 10$ dB)



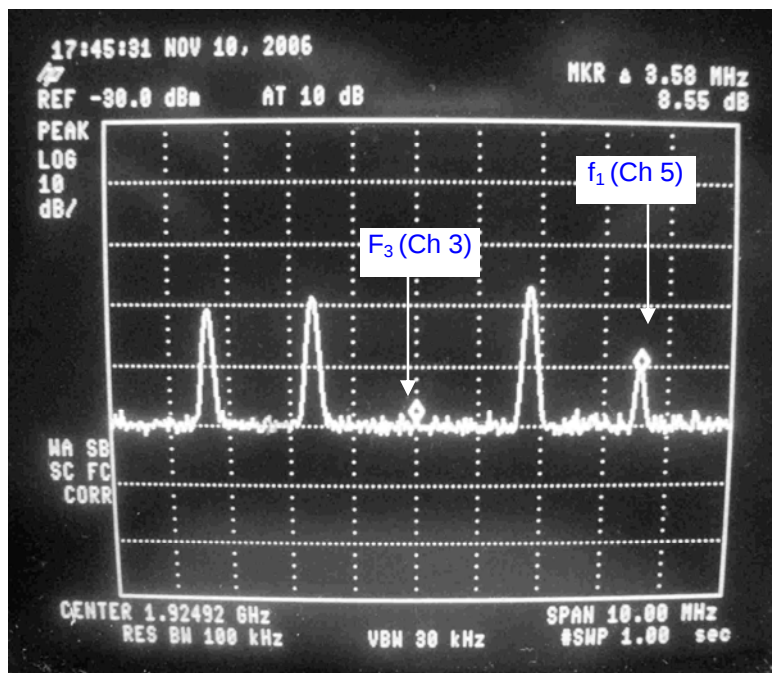
TX at interference of -64.23 dBm ($< T_U + U_M$)

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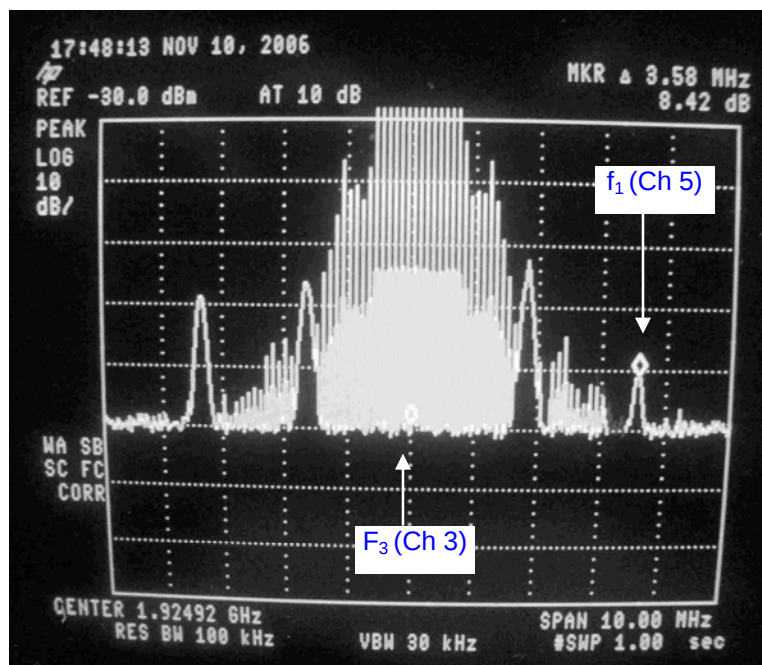
3.1.2 Threshold Resolution

1. Allow EUT TX on only two carrier frequencies per 7.3.3. in ANSI C63.17
2. Standby with interference:

$T_L + U_M + 7$	on f_1	1928.448 MHz	Ch 5
dB			
$T_L + U_M$	on f_3	1924.992 MHz	Ch 3

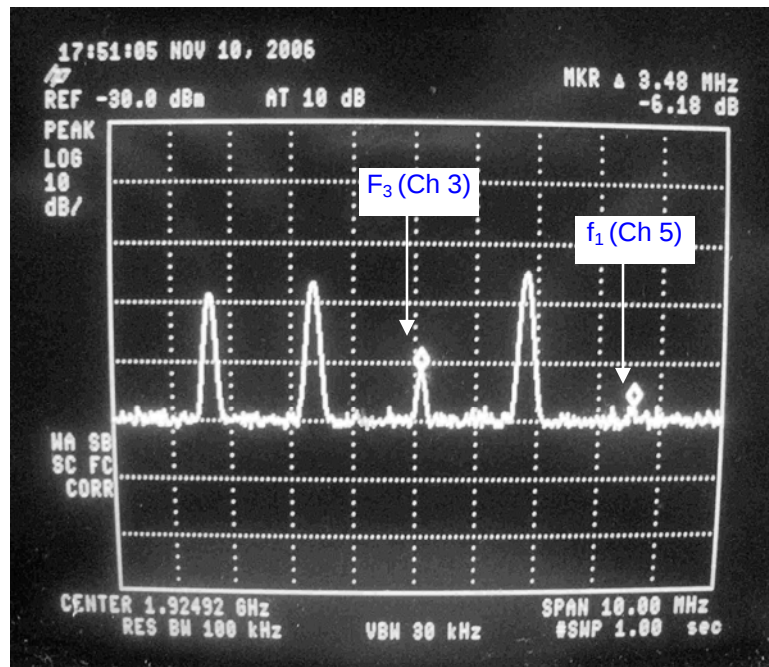


3. TX on f_3 with same interferences present

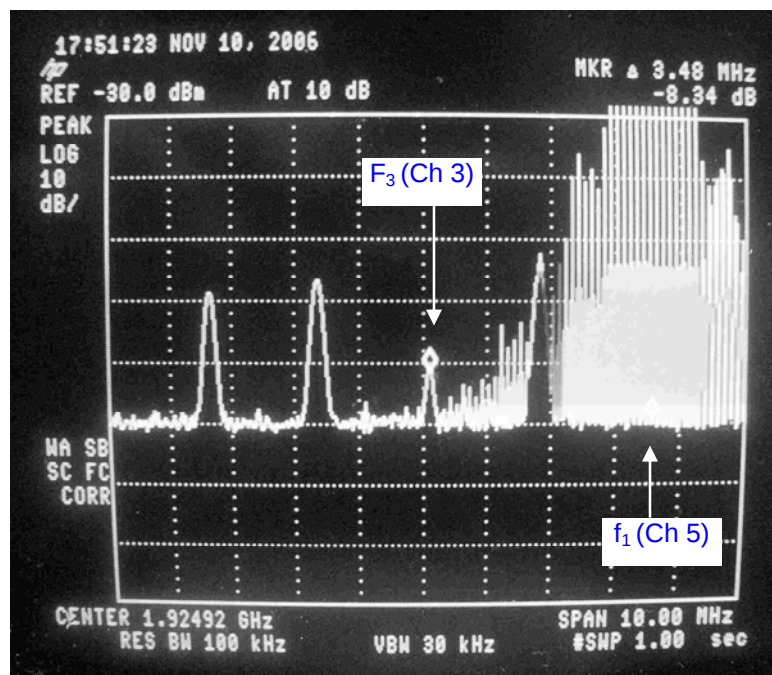


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4. Standby with interference: $T_L + U_M$ on f_1 1928.448 MHz Ch 5
 $T_L + U_M + 7$ dB on f_3 1924.992 MHz Ch 3

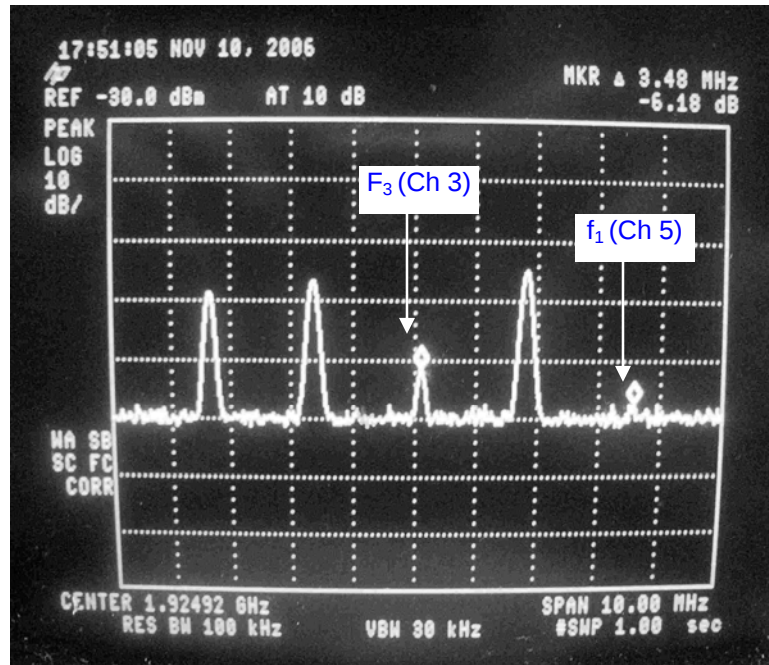


5. TX on f_1 with same interferences present

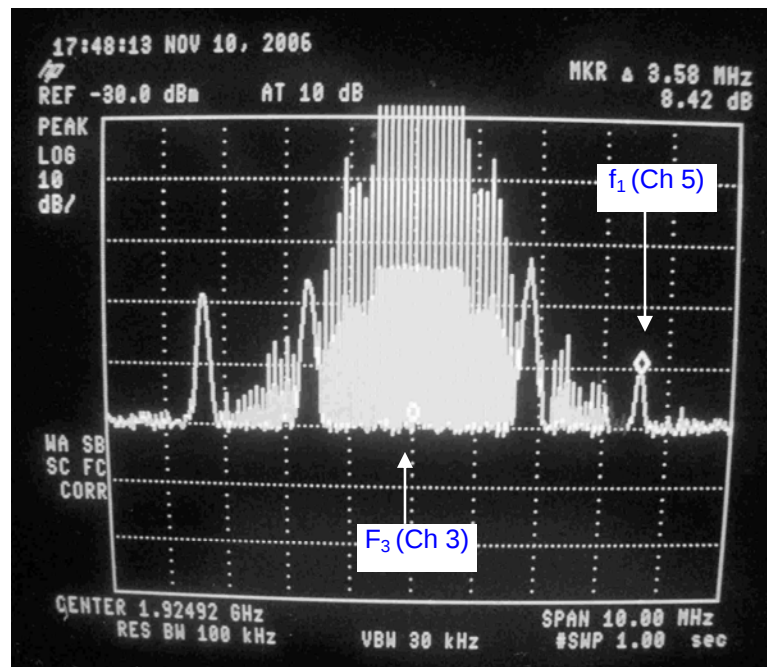


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6. Standby with interference: $T_L + U_M + 1$ dB on f_1 1928.448 MHz Ch 5
 $T_L + U_M - 6$ dB on f_3 1924.992 MHz Ch 3

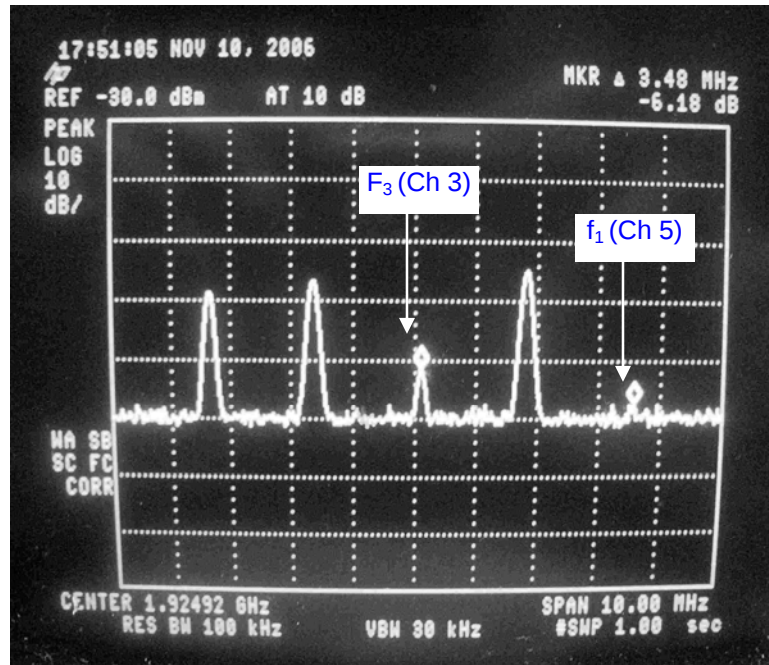


7. TX on f_3 with same interferences present

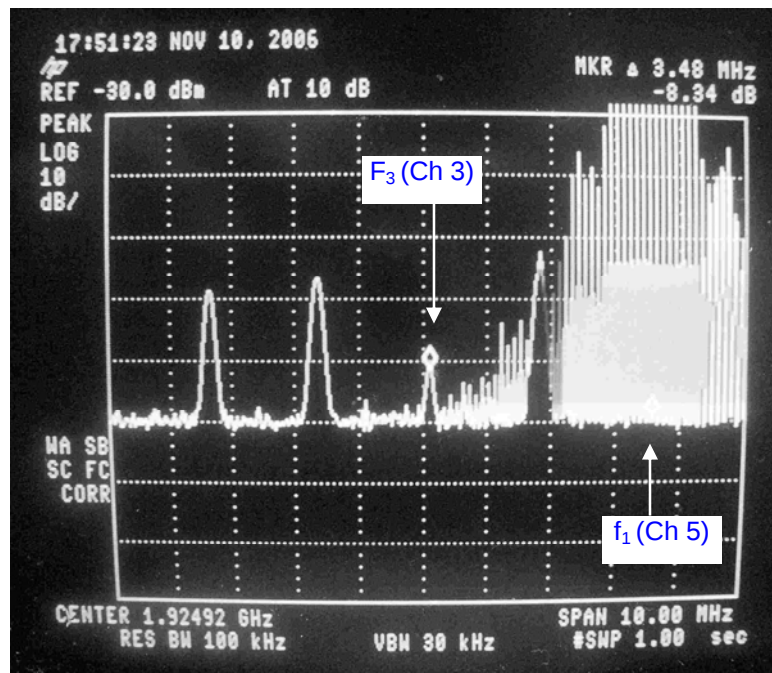


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8. Standby with interference: $T_L + U_M - 6$ dB on f_1 1928.448 MHz Ch 5
 $T_L + U_M + 1$ dB on f_3 1924.992 MHz Ch 3



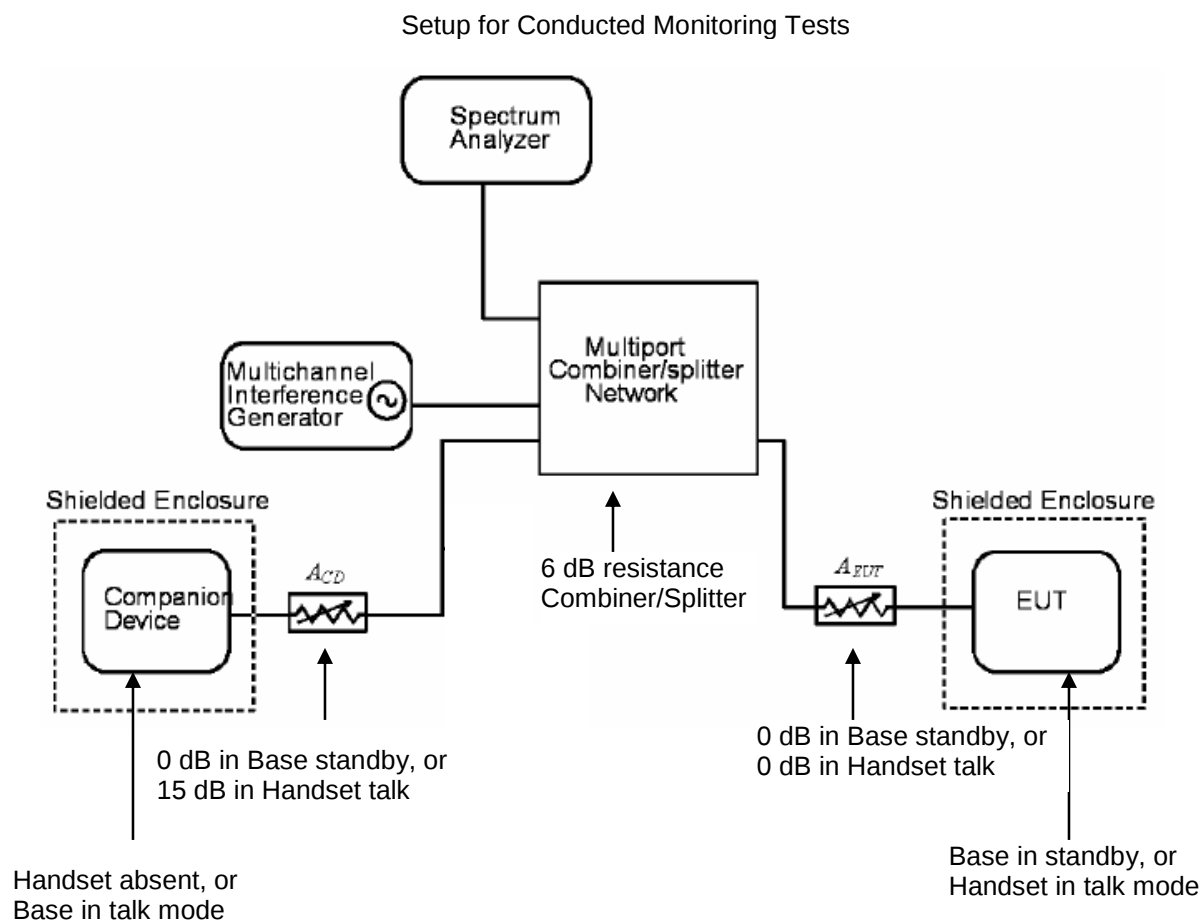
9. TX on f_1 with same interferences present



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3.2 Conducted Method (Alternative)

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



EUT (Base and Handset) modified in

- Tx power purposely reduced by about 55 dB to reduce requirement on external attenuators A_{EUT} and A_{CD}
- Limited 2-channel operation by EEPROM setting

Base alone in standby or complete set in talk mode as in normal functional operation.

Mode	EUT	A_{EUT} (dB)	Companion Device	A_{CD} (dB)
Standby	Base	0	Handset absent	0
Talk	Handset	0	Base	15

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3.2.1 Standby

Note:

- Base is left alone power-up without handset nearby or any power whatsoever supplied to the latter.
- Main deciding factor in protocol is signal strength RSSI.

Combiner / Coupler insertion loss = 6 dB

Cable loss 1 = 0.5 dB

Cable loss 2 = 0.5 dB

Total insertion loss = 7 dB

Measured threshold = Sig Gen reading – Insertion loss
= –65 – 7 (Sig Gen reading: –65 ~ –63 dBm)
= –72 dBm (Resolution within 2 dB)

3.2.2 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 = –66 - 7 (Sig Gen reading: –66 ~ –64 dBm)
= –73 dBm (Resolution within 2 dB)

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4 FREQUENCY STABILITY AND JITTER

Clause: 15.323 (e), 15.323 (f) / 4.3.4 (c), 6.2

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 of 19.2 kHz for 1920 MHz carrier)
- Frame jitter ≤ 25 μ s
- Carrier frequency stability over -20 to $+50$ $^{\circ}$ 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
THERMOTRON Environmental Chamber MODEL SM-4S-SL

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

4.1 Base

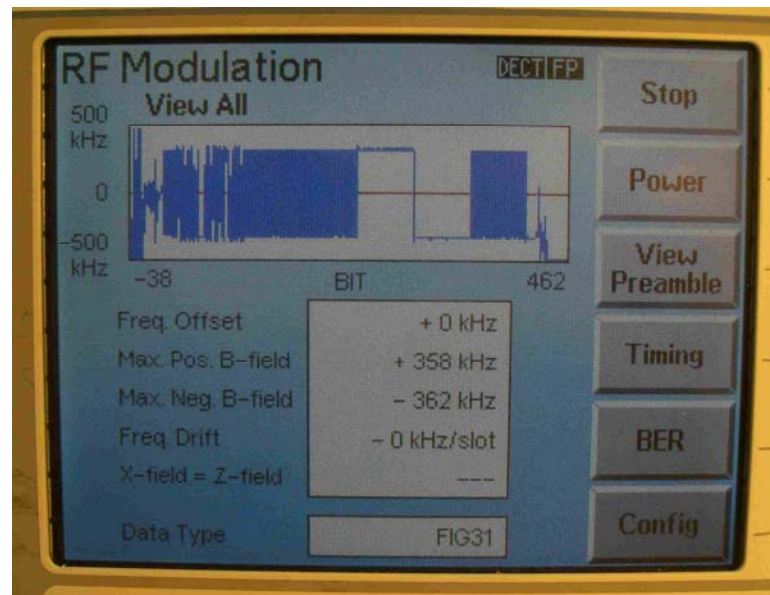
4.1.1 Frame Frequency Drift and Jitter

Test Mode	Channel No.	Frequency (kHz / slot)		Jitter (μ s)	
		Drift	Limit	Meas.	Limit
TBR6	5	0.00	19.2	0.09	25
TBR6	3	0.00	19.2	0.09	25
TBR6	1	0.00	19.2	0.09	25

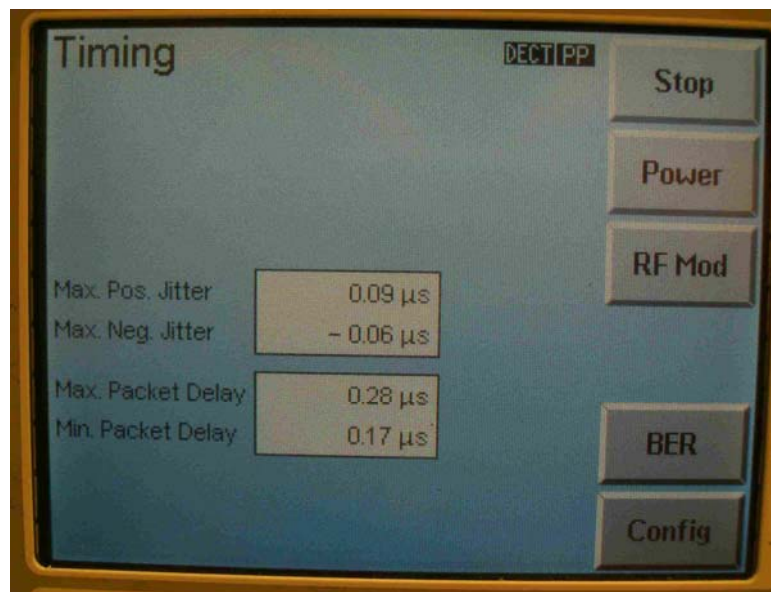
Note: Test Mode TBR6 is built-in per ETSI standard and resides in firmware apart from the FCC test mode in Test Mode Menu.

Photos of worst-case display follow:

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Base Frequency Drift at Mid Channel



Base TDMA Frame Jitter at Mid Channel

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4.1.2 Carrier Frequency Stability with Supply voltage

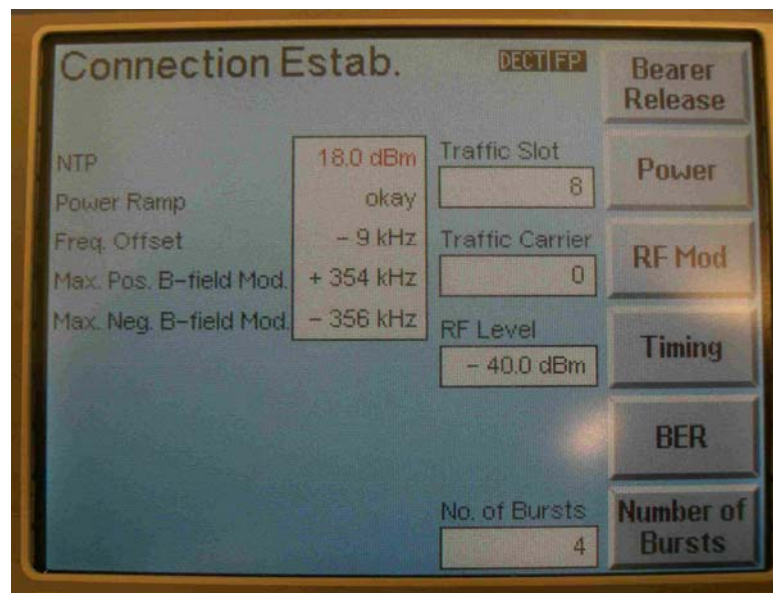
Test Mode	Channel No.	Frequency (kHz)			Limit (kHz)
		102 Vac (85%)	120 Vac (Norm.)	138 Vac (115%)	
TBR6	5	-1	-1	-1	19.2
TBR6	3	-3	-3	-3	19.2
TBR6	1	-2	-2	-2	19.2

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

4.1.3 Carrier Frequency Stability with Temperature and Time

Test Mode	Channel No.	Frequency Offset (kHz)			Limit (kHz)
		-20 °C	25 °C	50 °C	
TBR6	5	-4.0	-1.0	8.0	± 19.2
TBR6	3	-7.0	0	5.0	± 19.2
TBR6	1	-9.0	-1.0	4.0	± 19.2

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



Base Carrier Frequency Offset with Temperature

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4.2 Handset

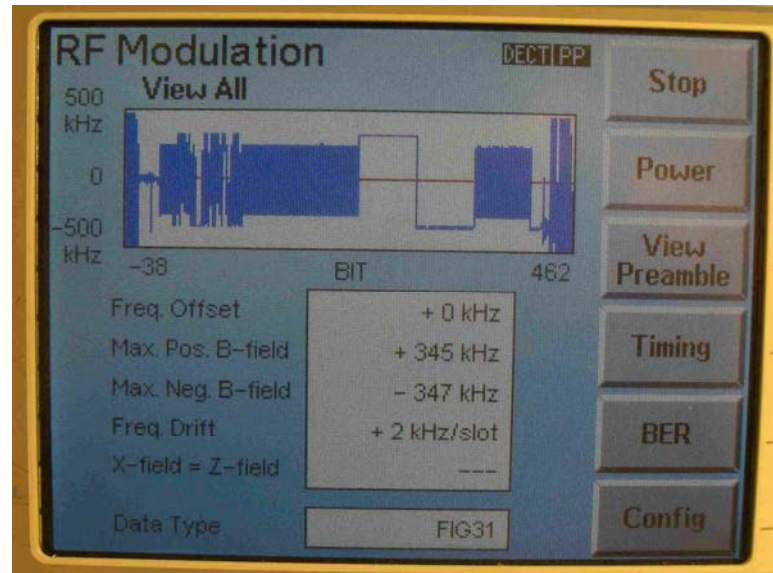
4.2.1 Frame Frequency Drift and Jitter

Test Mode	Channel No.	Frequency (kHz / slot)		Jitter (μs)	
		Drift	Limit	Meas.	Limit
TBR6	1	2.00	19.2	0.09	25
TBR6	3	1.00	19.2	0.09	25
TBR6	5	1.00	19.2	0.09	25

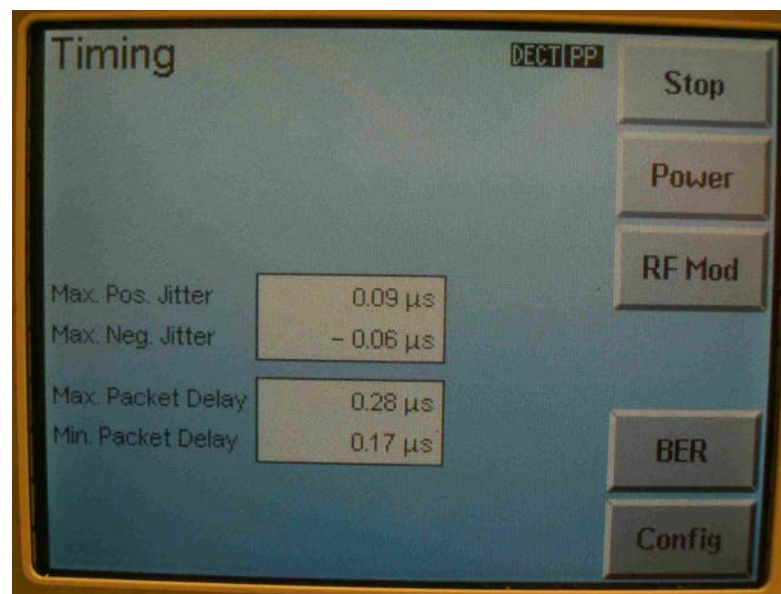
Note: Test Mode TBR6 is built-in per ETSI standard and resides in firmware apart from the FCC test mode in Test Mode Menu.

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Photos of worst-case display follow:



Handset Frequency Drift at High-freq Channel



Handset TDMA Frame Jitter

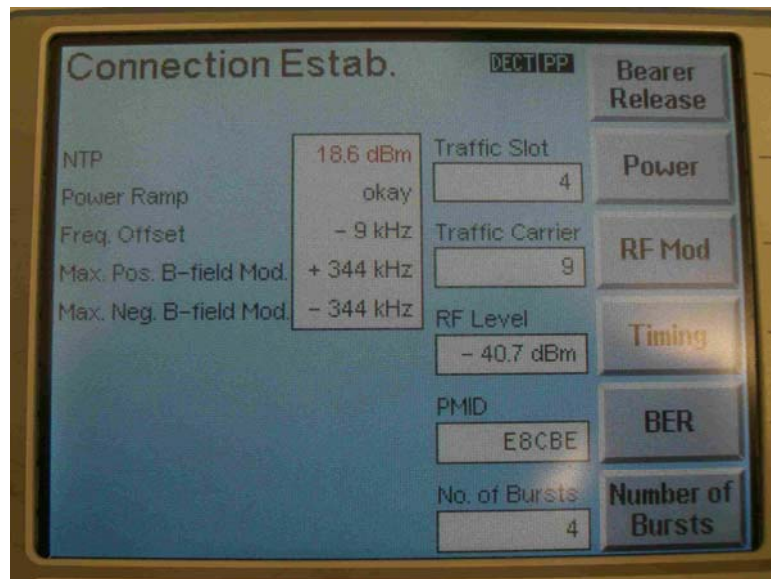
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4.2.2 Carrier Frequency Stability with Temperature and Time

Test Mode	Channel No.	Frequency Offset (kHz)			Limit (kHz)
		-20 °C	25 °C	50 °C	
TBR6	5	-9	2	-2	± 19.2
TBR6	3	-7	1	0.0	± 19.2
TBR6	1	-4	-1	2.0	± 19.2

Note: Test Mode TBR6 is built-in per ETSI standard and resides in firmware apart from 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

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5 EMISSION BANDWIDTH

Clause: 15.323 (a) / 6.4

Requirement: $50 \text{ kHz} < B < 2.5 \text{ MHz}$

SA Setting: $\text{RBW} \approx 1 \% \text{ of Emission BW (or } 0.5 \% < \text{RBW} < 2 \% \text{ for fixed setting)}$

ANSI 6.1.3 $\text{VBW} \geq 3 \times \text{RBW}$

$\text{Span} \geq 2 \times B$

Sweep: Sufficient to stabilize trace

Detection: Peak hold

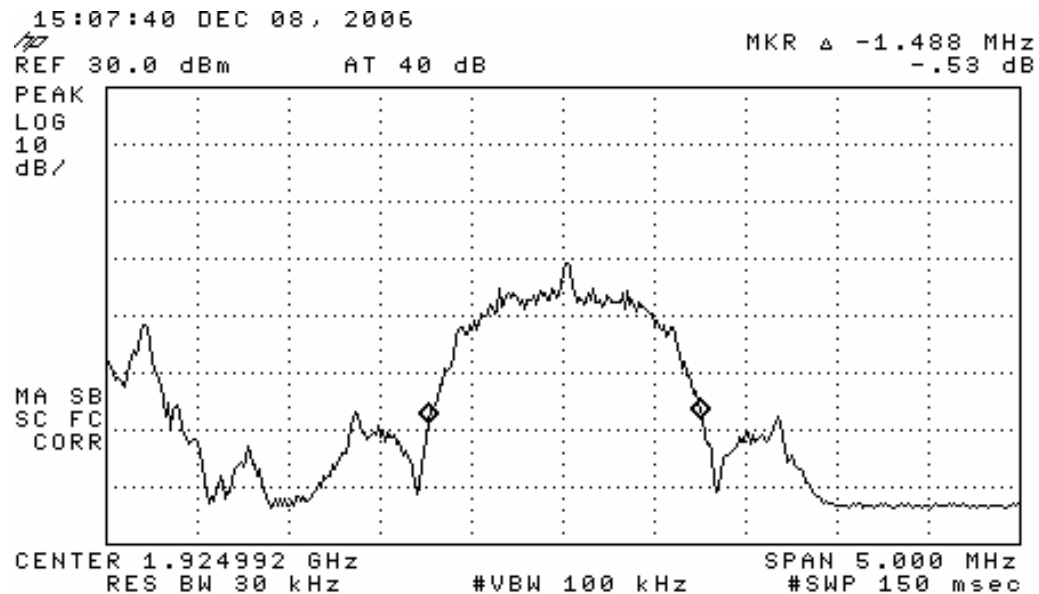
Test Result: Base: 1.488 MHz < Limit 2.5 MHz

Handset: 1.375 MHz < Limit 2.5 MHz

5.1 Base

Channel No.	Frequency (MHz)	26 dB Bandwidth (kHz)
5	1921.536	1476
3	1924.992	1488
1	1928.448	1476

Worst-case plot follows:



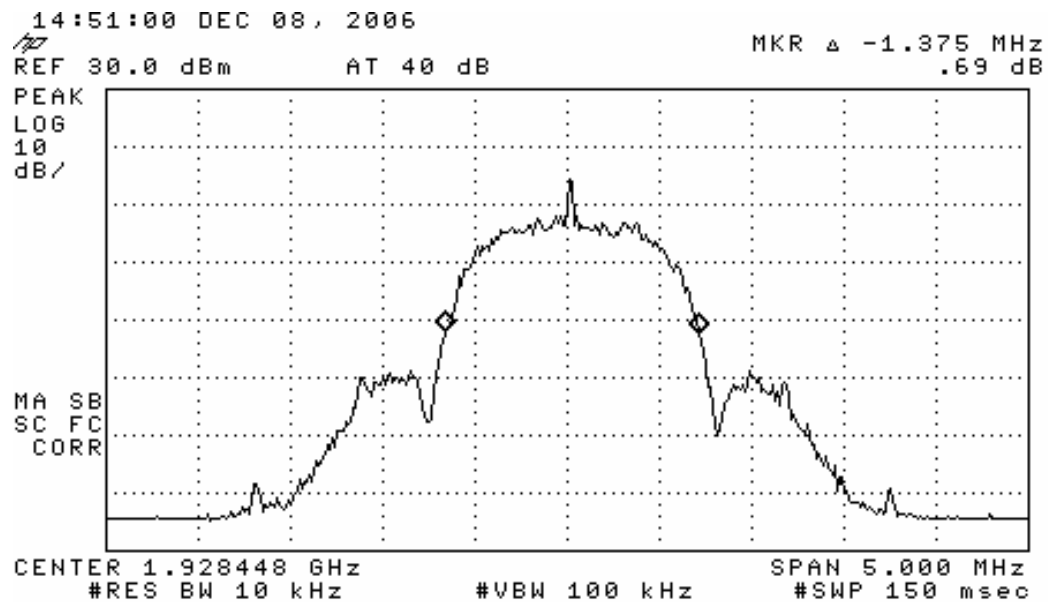
Base emission BW at Mid-freq Channel

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5.2 Handset

Channel No.	Frequency (MHz)	26 dB Bandwidth (kHz)
5	1921.536	1363
3	1924.992	1363
1	1928.448	1375

Worst-case plot follows:



Handset emission BW at High-freq Channel

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6 CONDUCTED PEAK TRANSMIT POWER

Clause: 15.319 (c) / 6.5

Requirement: $\leq 100 \mu\text{W} \times \sqrt{B} = 5 \log B - 10 \text{ dBm} = 20.8 \text{ dBm}$, where B rated 1.5 MHz

SA Setting: RBW $\geq$ Emission BW (or increased until no more than 0.5 dB change in power)

ANSI 6.1.2 VBW $\geq 3 \times$ RBW

Span = zero, centered on channel center

Sweep: fast enough to resolve transmit pulse

Detection: Peak

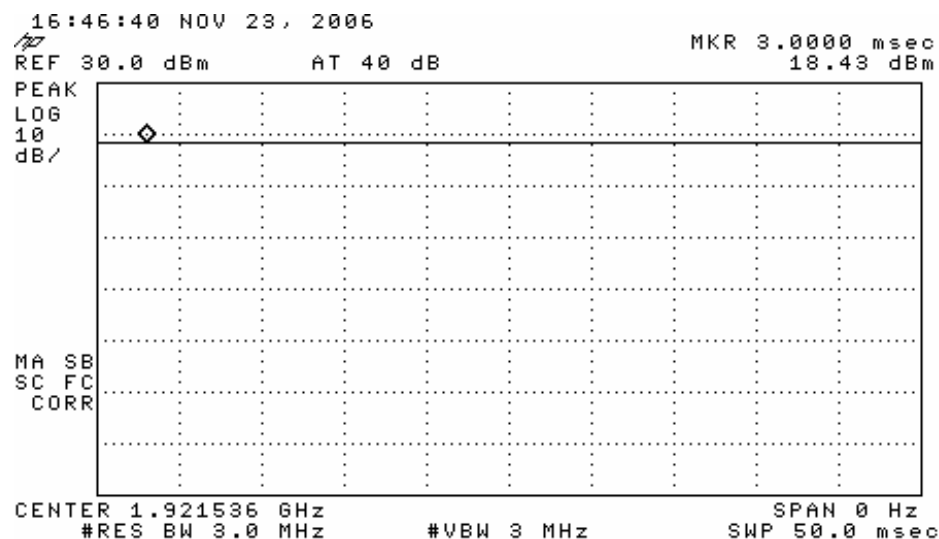
Test Result: Base: 19.03 dBm (80 mW)

Handset: 18.94 dBm (78 mW)

6.1 Base

Chan. No.	Freq. (MHz)	Reading (dBm)	Cable (dB)	Pk Power (dBm)	Margin (dBm)	Orig. (dBm)	Diff. (dB)
5	1921.536	18.43	0.6	19.03	1.77	19.03	0.00
3	1924.992	18.30	0.6	18.90	1.90	79.98	
1	1928.448	18.20	0.6	18.80	2.00	(mW)	

Worst-case plot follows:



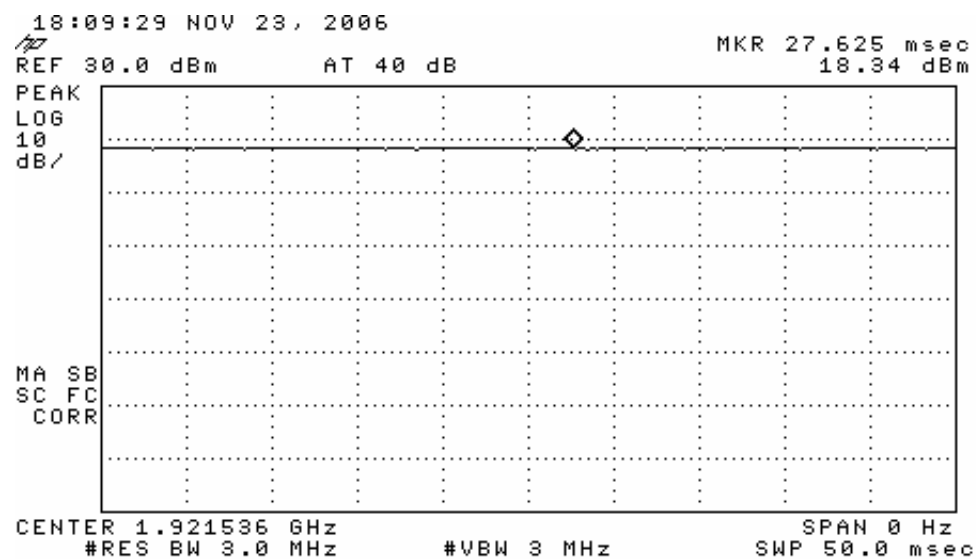
Base peak power at Low-freq Channel

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6.2 Handset

Chan. No.	Freq. (MHz)	Reading (dBm)	Cable (dB)	Pk Power (dBm)	Margin (dBm)	Orig. (dBm)	Diff. (dB)
5	1921.536	18.34	0.6	18.94	1.86	18.94	0.00
3	1924.992	18.21	0.6	18.81	1.99	78.34	
1	1928.448	18.19	0.6	18.79	2.01	(mW)	

Worst-case plot follows:



Handset peak power at Low-freq Channel

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7 DUTY CYCLE CORRECTION FACTOR

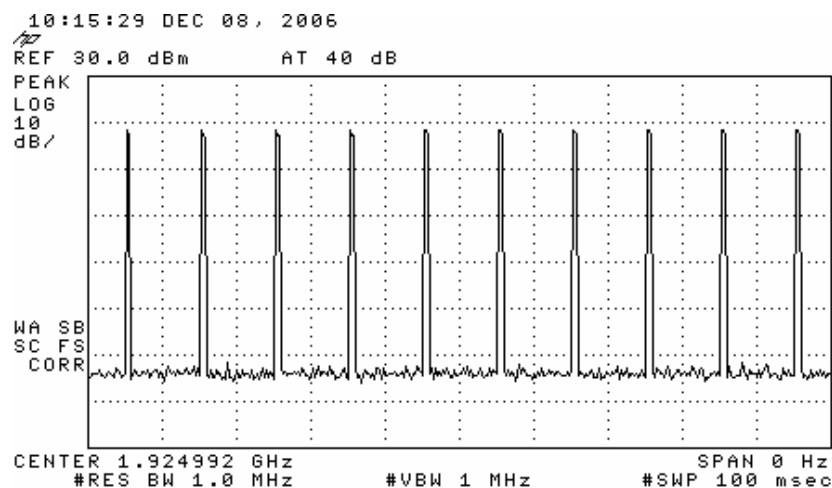
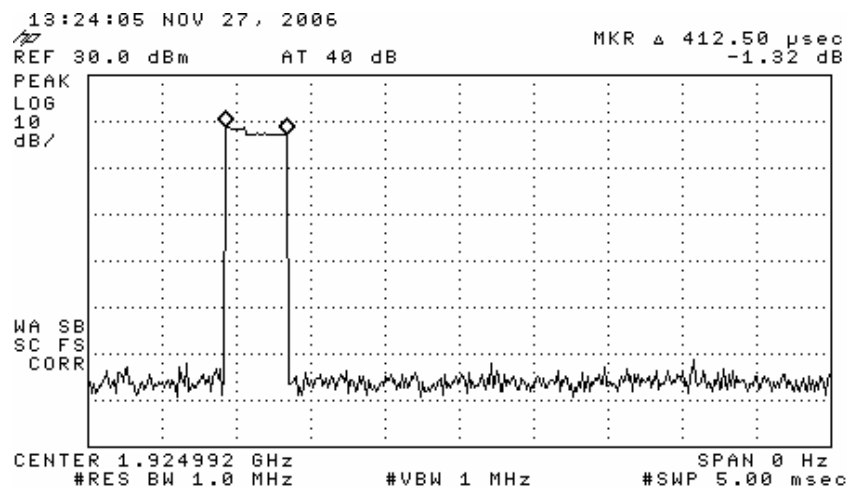
Clause: RSS-Gen 4.3, RSS-213 6.6

Max. Allowed: 6 dB

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 = $10 \log (\text{TX-on Time} / 100 \text{ ms})$ for power in dBm
 = $10 \log (412.50 \mu\text{s} \times 10 / 100 \text{ ms})$ from timing plots below
 = $-13.9 \text{ dB} \Rightarrow -6 \text{ dB}$ maximum allowed



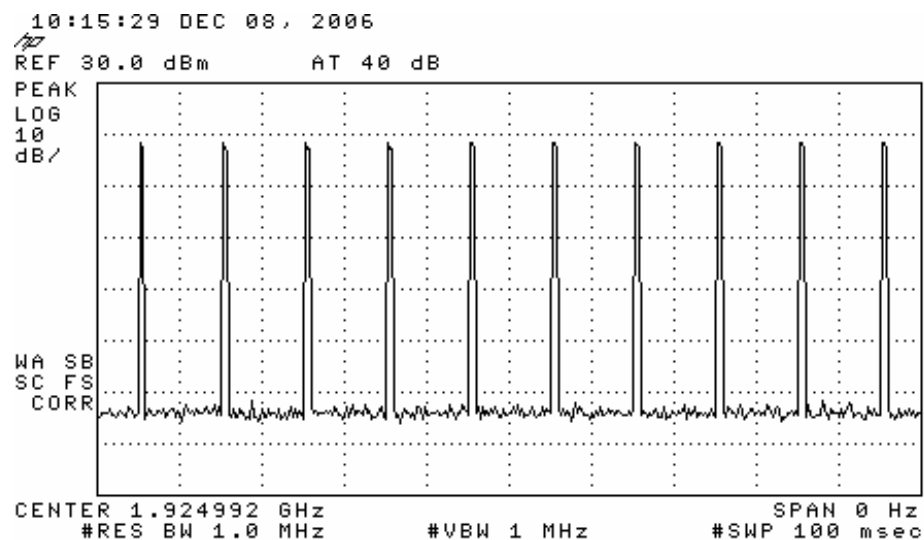
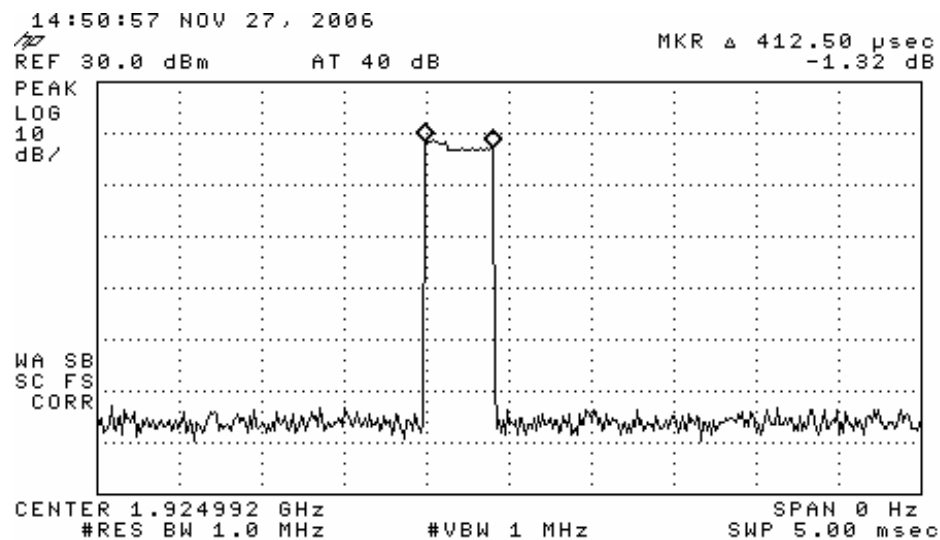
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7.2 Base with multi-handset

DCF_BS = $10 \log (4 \times 412.5 \mu\text{s} \times 10 / 100 \text{ ms})$ for up to 4 time slots occupied
= -7.8 dB => -6 dB maximum allowed

7.3 Handset

DCF_HS = $10 \log (\text{TX-on Time} / 100 \text{ ms})$ for power in dBm
= $10 \log (412.50 \mu\text{s} \times 10 / 100 \text{ ms})$ from timing plots below
= -13.9 dB (4.0%) (only one-slot operation in TDMA)
=> -6 dB maximum allowed



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8 POWER SPECTRAL DENSITY

Clause: 15.319 (d) / 6.6

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 = Zero 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)

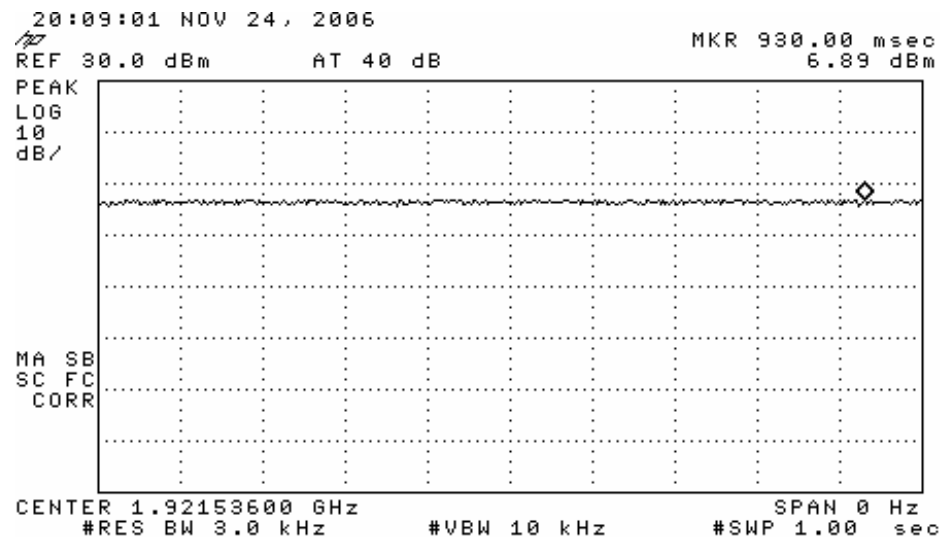
Test Result: Base: 1.49 dBm (1.41 mW)

By peak-hold Handset: 0.48 dBm (1.12 mW)

8.1 Base

Chan. No.	Freq. (MHz)	Reading (dBm)	Cable (dB)	DCF (dB)	PSD (dBm)	Limit (dBm)	Margin (dBm)
5	1921.536	6.89	0.6	-6.0	1.49	4.77	3.28
3	1924.992	6.87	0.6	-6.0	1.47	4.77	3.30
1	1928.448	6.71	0.6	-6.0	1.31	4.77	3.46

Worst-case plot follows:



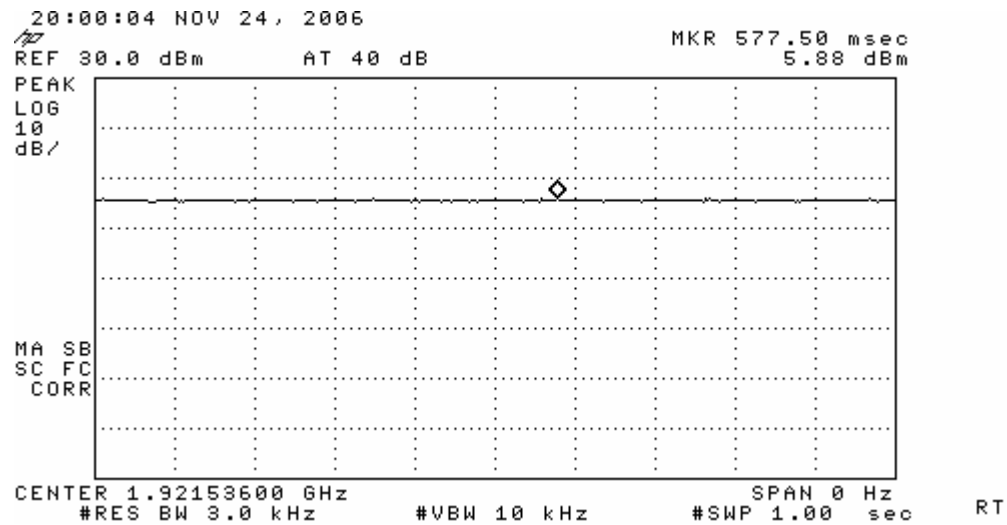
Base PSD at Low-freq Channel

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8.2 Handset

Chan. No.	Freq. (MHz)	Reading (dBm)	Cable (dB)	DCF (dB)	PSD (dBm)	Limit (dBm)	Margin (dBm)
5	1921.536	5.88	0.6	-6.0	0.48	4.77	4.29
3	1924.992	5.84	0.6	-6.0	0.44	4.77	4.33
1	1928.448	5.77	0.6	-6.0	0.37	4.77	4.40

Worst-case plot follows:



Handset PSD at Low-freq Channel

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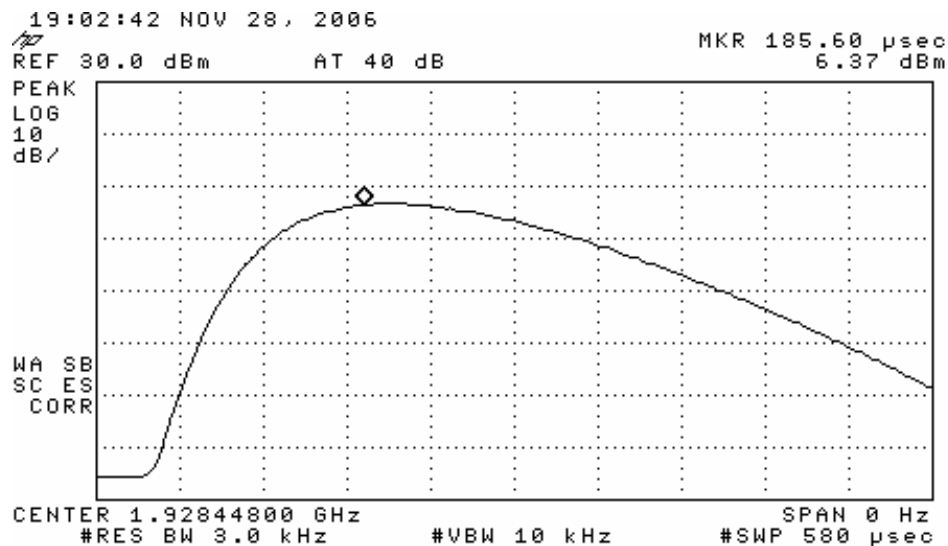
Alternative estimation of PSD by CAT method per ANSI Clause 6.1.5

Test Result: Base: -21.60 dBm (0.006 mW)
Handset: -22.20 dBm (0.006 mW)

8.3 Base (Alternative)

Chan. No.	Freq. (MHz)	Reading (dBm)	Cable (dB)	Av. CF (dB)	PSD (dBm)	Limit (dBm)	Margin (dBm)
5	1921.536	6.22	0.6	-28.57	-21.75	4.77	26.52
3	1924.992	6.26	0.6	-28.57	-21.71	4.77	26.48
1	1928.448	6.37	0.6	-28.57	-21.60	4.77	26.37

Worst-case of sample pulse follows:



Base Pulse Sample at High-freq Channel
With Ext. Trigger from TX_ON

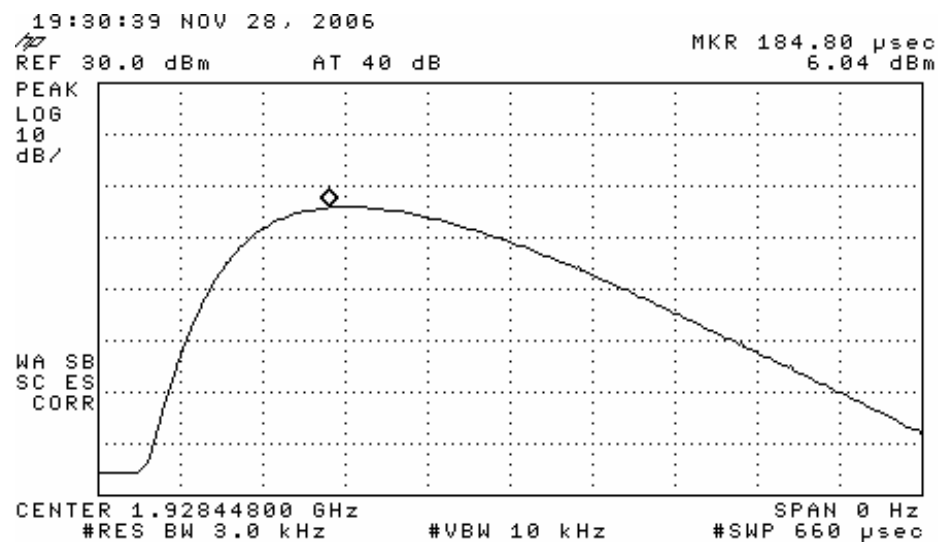
Power summation within 20 dBc, Ps	(peak detect)	=	481	mW
Summation sample points, Ns		=	263	
Mean power summation, Psm	= Ps/Ns	=	1.83	mW
Pulse span, Tsp		=	0.5	ms
Sampling points within span, Nsp		=	400	
Pulse sampling frequency, Fs	= Nsp/Tsp	=	800	kHz
Pulse duration within 20 dBc, Tps		=	380.0	μs
Averaged PSD, PsdAv	= Psm/Fs*Tps	=	0.006	mW
		=	-22.20	dBm
Peak power reading, Ppk		=	6.37	dBm
Average conversion factor, Av. CF	= PsdAv - Ppk	=	-28.57	dB (representative)

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8.4 Handset (Alternative)

Chan. No.	Freq. (MHz)	Reading (dBm)	Cable (dB)	Av. CF (dB)	PSD (dBm)	Limit (dBm)	Margin (dBm)
5	1921.536	5.91	0.6	-28.84	-22.33	4.77	27.10
3	1924.992	5.97	0.6	-28.84	-22.27	4.77	27.04
1	1928.448	6.04	0.6	-28.84	-22.20	4.77	26.97

Worst-case of sample pulse follows:



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

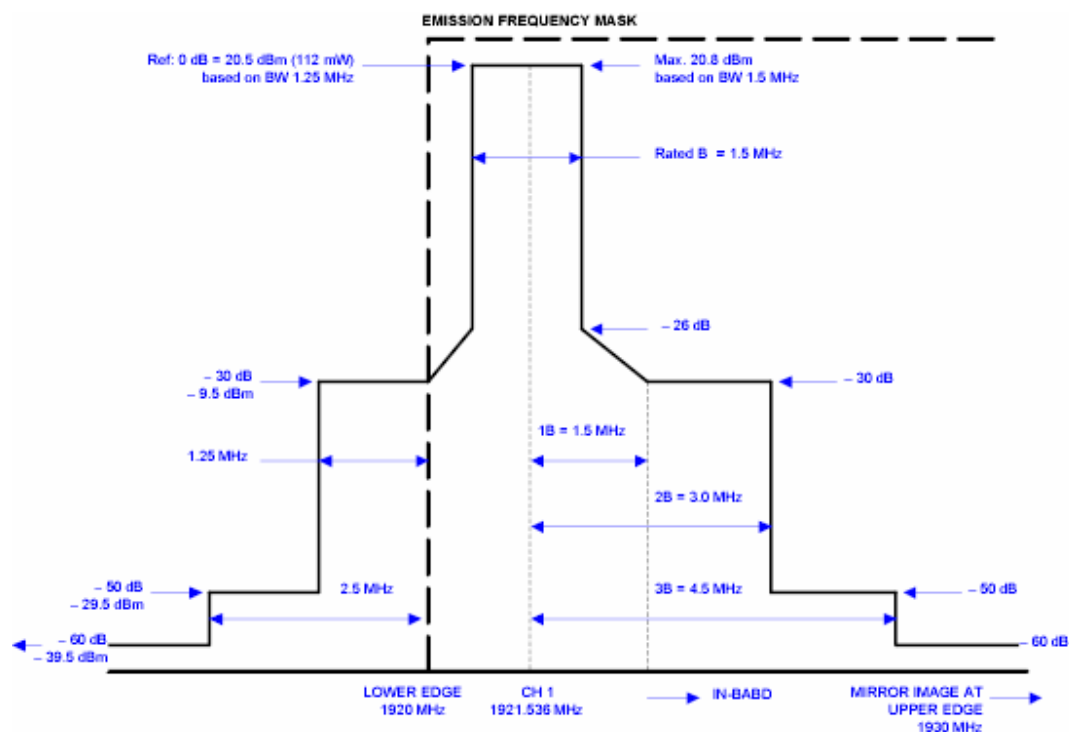
Power summation within 20 dBc, Ps	(peak detect)	=	361	mW
Summation sample points, Ns		=	229	
Mean power summation, Psm	= Ps/Ns	=	1.58	mW
Pulse span, Tsp		=	0.5	ms
Sampling points within span, Nsp		=	400	
Pulse sampling frequency, Fs	= Nsp/Tsp	=	800	kHz
Pulse duration within 20 dBc, Tps		=	376	°s
Averaged PSD, PsdAv	= Psm/Fs*Tps	=	0.005	mW
		=	-22.80	dBm
Peak power reading, Ppk		=	6.04	dBm
Average conversion factor, Av. CF	= PsdAv - Ppk	=	-28.84	dB (representative)

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9 EMISSIONS AT BAND EDGE

Clause: 15.323 (d) / 6.7

Requirement: As shown in diagram of Emission Mask



SA Setting: RBW $\approx$ 1 % of Emission BW (or 0.5 % < RBW < 2 % for fixed setting)
ANSI 6.1.6.2 VBW = 3 x RBW
Span $\geq$ 3.5 x B
Sweep: Sufficient to stabilize trace ($\geq$ pulse repetitive interval x no. of trace elements)
Detection: Peak hold

Test Result: Base: -74.02 dBc (worst at lower band edge)
Handset: -73.42 dBc (worst at upper band edge)

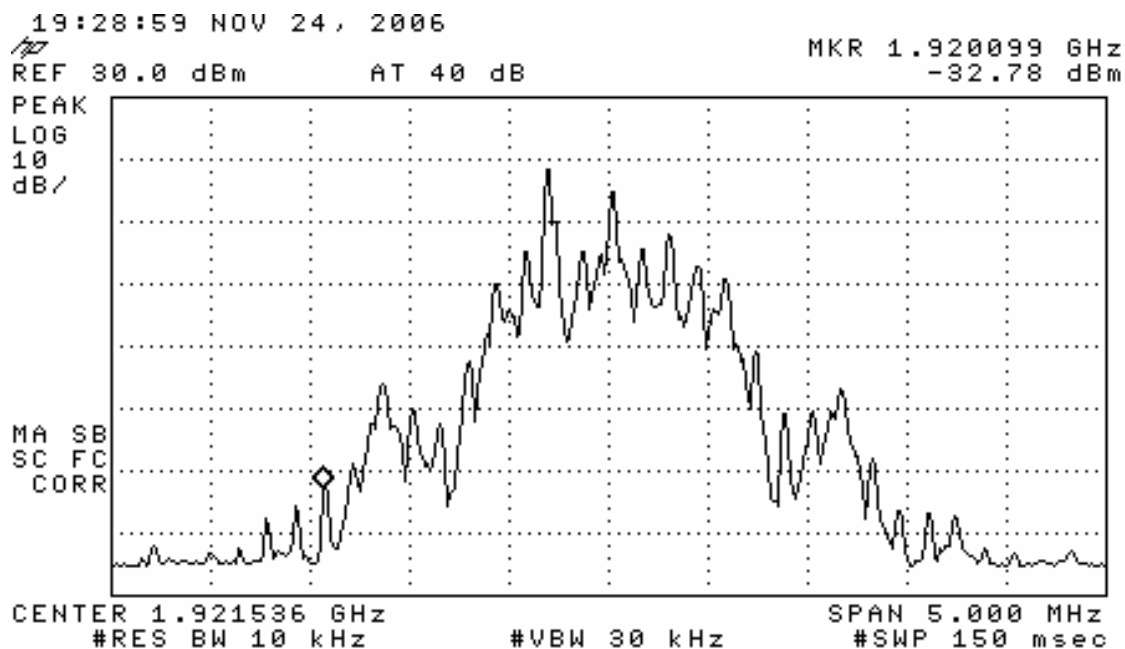
For in-band out-of-channel emissions, since emission bandwidth B is greater than out-band step bandwidth 1.25 MHz and occupied bandwidth is symmetrical about channel center, compliance in out-band emissions will automatically lead to compliance in in-band out-of-channel.

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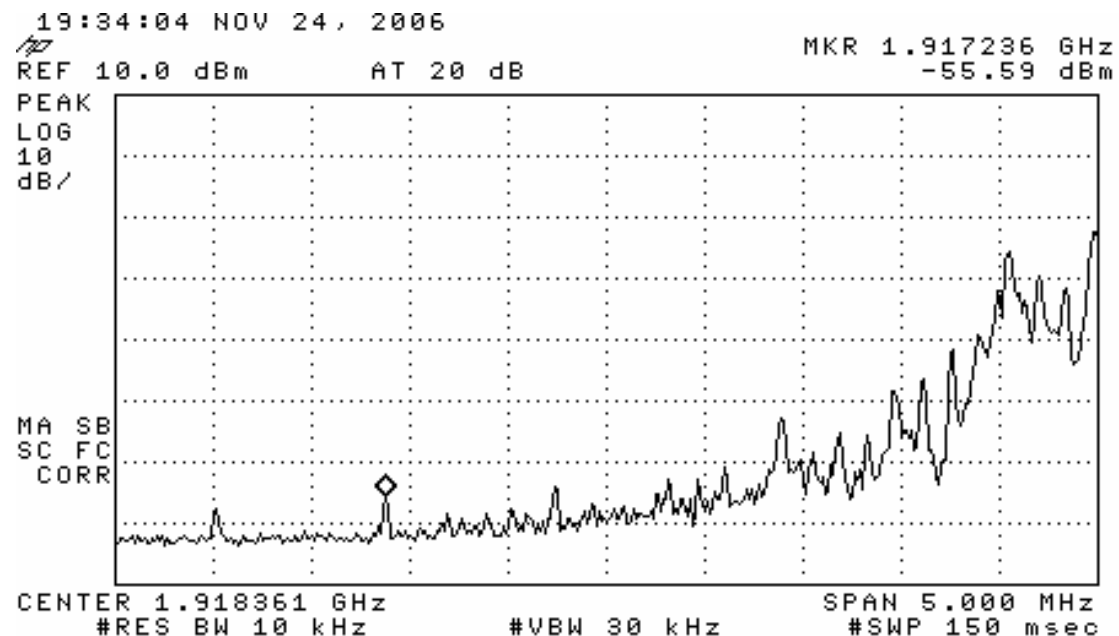
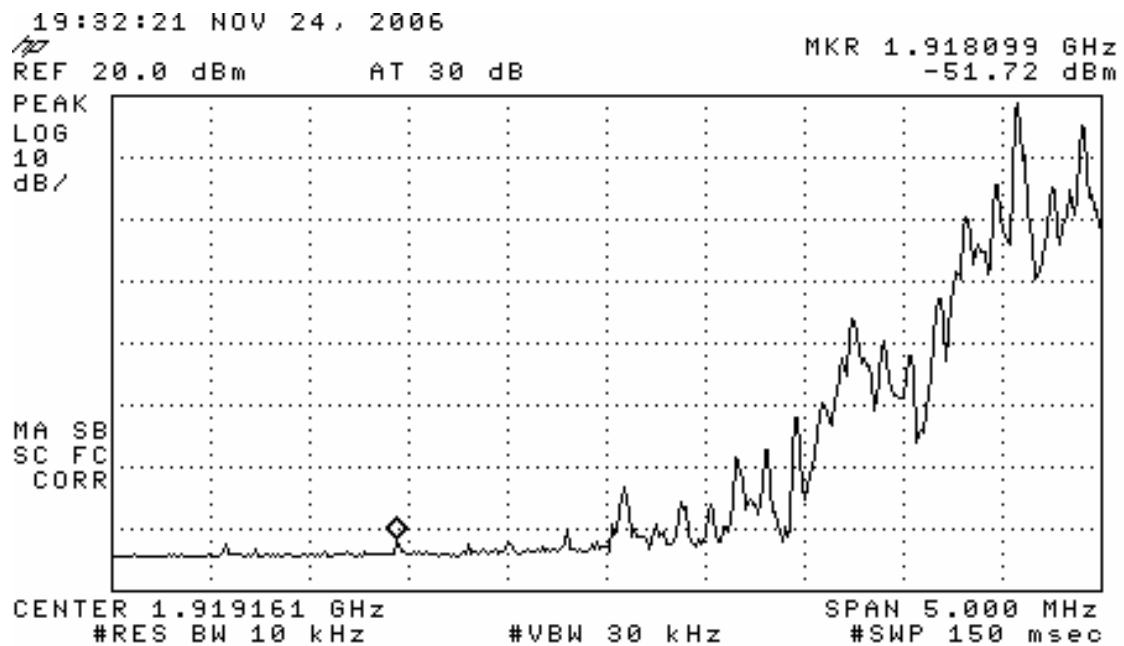
9.1 Base Near Band Edge

Chan. No.	Freq. (MHz)	Freq. Range (MHz)	Reading (dBm)	Rel. Att. (dBc)	Limit (dBc)	Margin (dB)
5	1921.536	Lower Edge	18.43	0.0	---	---
	1919.786	1918.75 ~1920	-32.78	-51.21	-30	21.21
	1918.444	1917.5 ~1918.75	-51.72	-70.15	-50	20.15
	1916.619	Down ~1917.5	-55.59	-74.02	-60	14.02
1	1928.448	Upper edge	18.20	0.0	---	---
	1930.231	1930 ~1931.25	-37.22	-55.42	-30	25.42
	1932.031	1931.25 ~1932.5	-52.33	-70.53	-50	20.53
	1933.131	1932.5 ~ up	-57.50	-75.70	-60	15.70

Lower out-band plots follow:

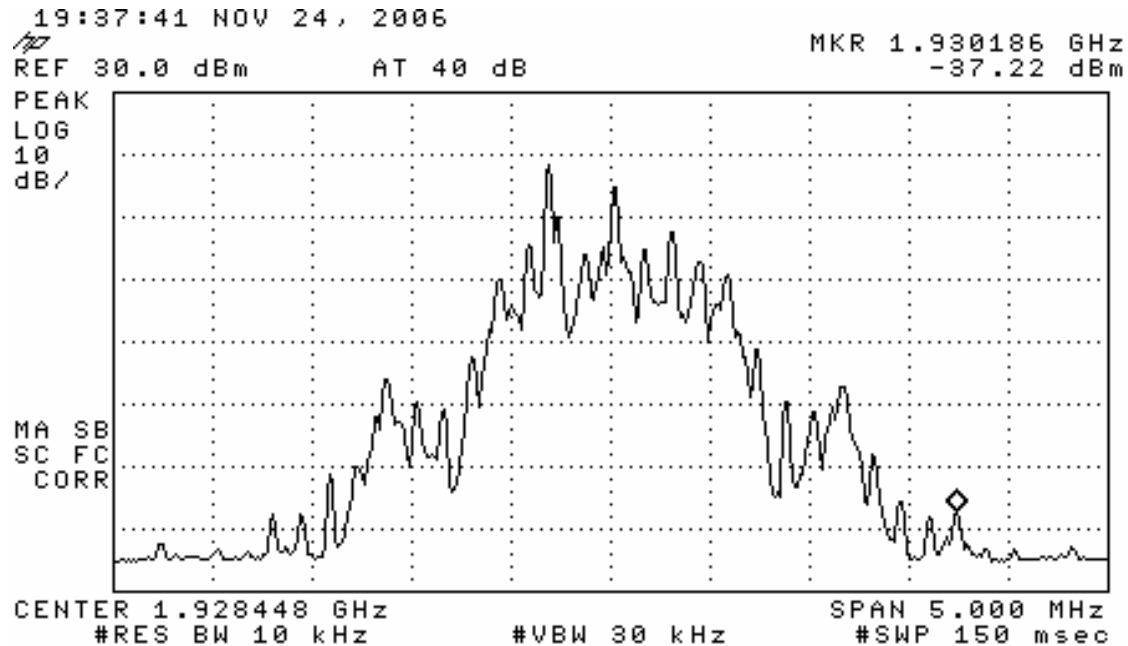


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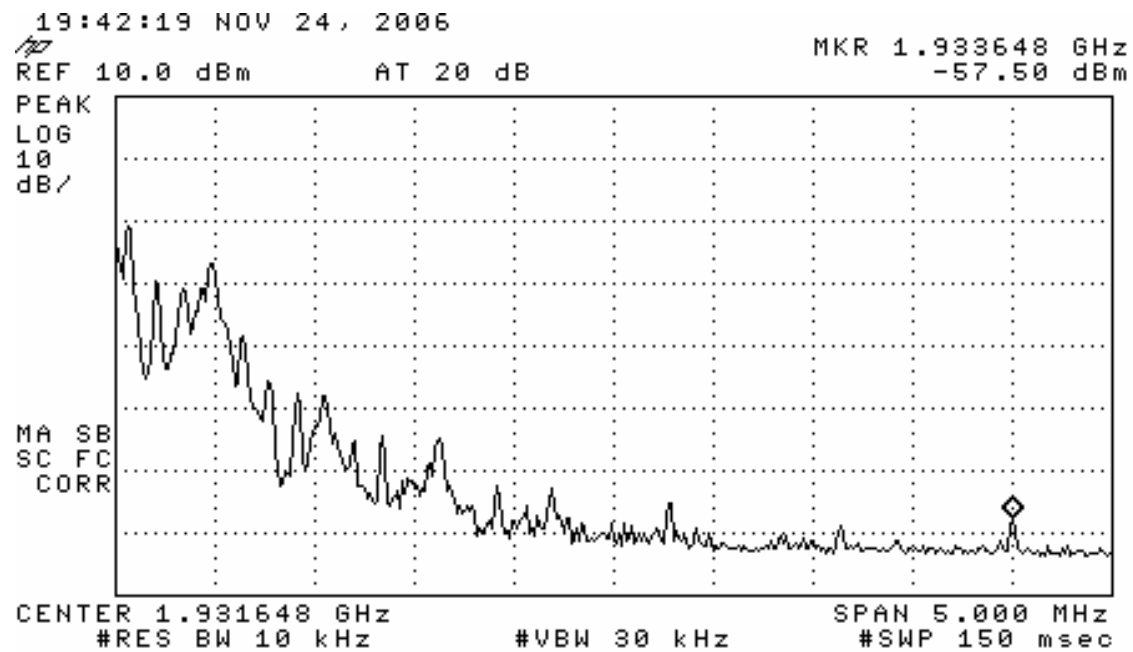


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Upper out-band plots follow:



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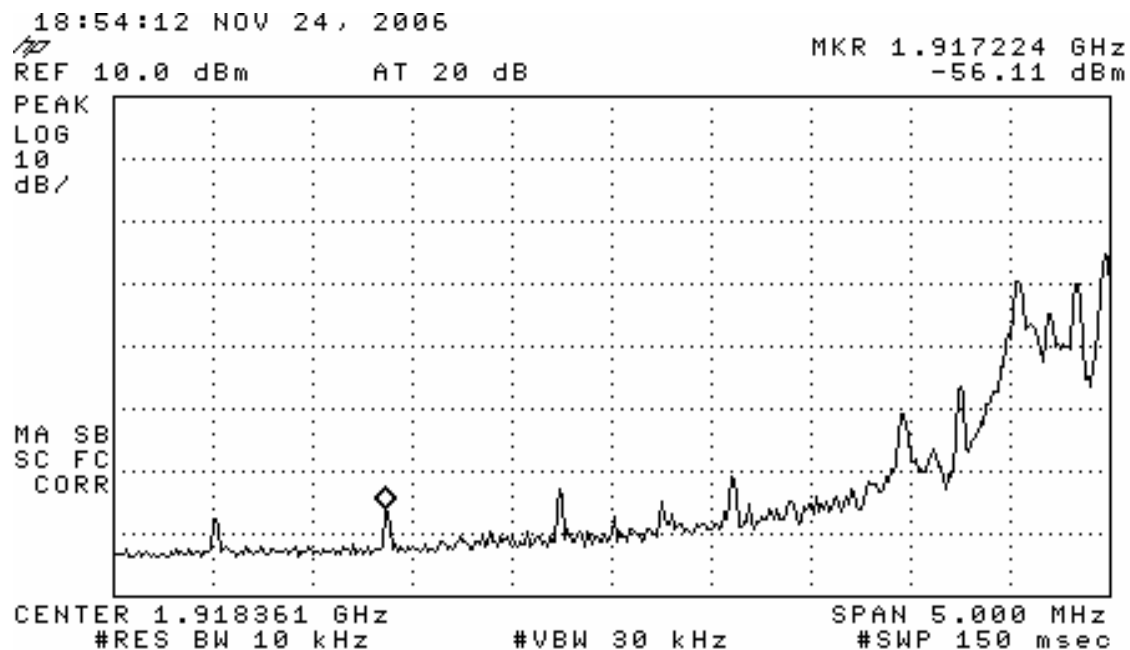
9.2 Handset Near Band Edge

Freq. (MHz)	Freq. Range (MHz)	Reading (dBm)	Rel. Att. (dBc)	Limit (dBc)	Margin (dB)
1921.536	Lower Edge	18.34	0.0	---	---
1919.794	1918.75 ~1920	-35.98	-54.32	-30	24.32
1918.078	1917.5 ~1918.75	-51.93	-70.27	-50	20.27
1917.261	Down ~1917.5	-56.11	-74.45	-60	14.45
1928.448	Upper edge	18.19	0.0	---	---
1930.215	1930 ~1931.25	-41.80	-59.99	-30	29.99
1931.306	1931.25 ~1932.5	-52.40	-70.59	-50	20.59
1932.681	1932.5 ~ up	-55.23	-73.42	-60	13.42

Lower out-band plots follow:

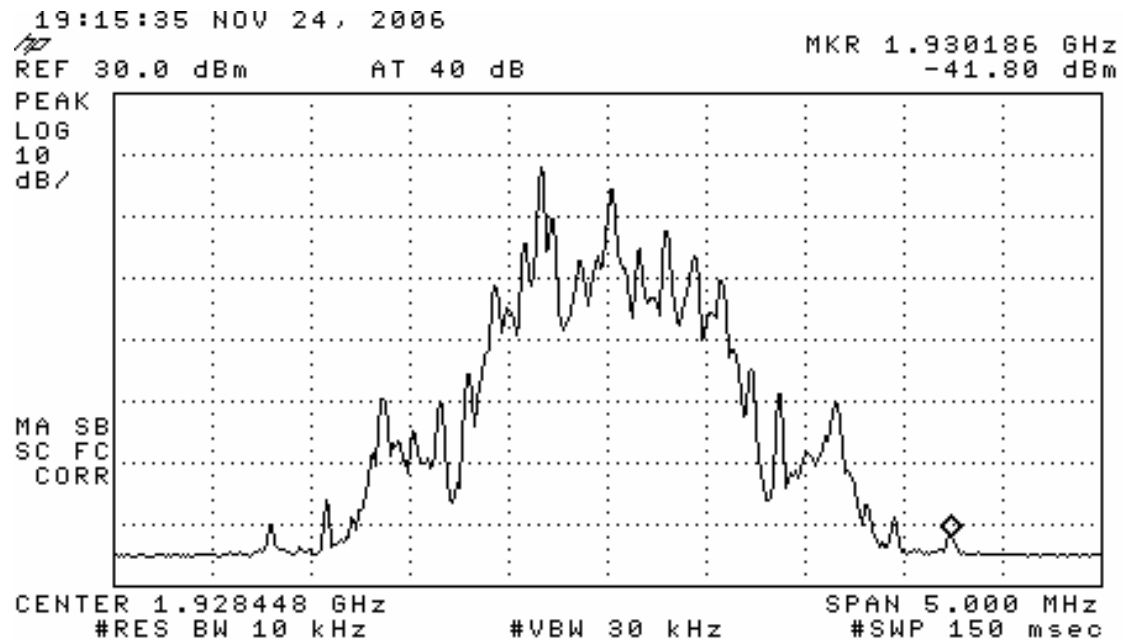


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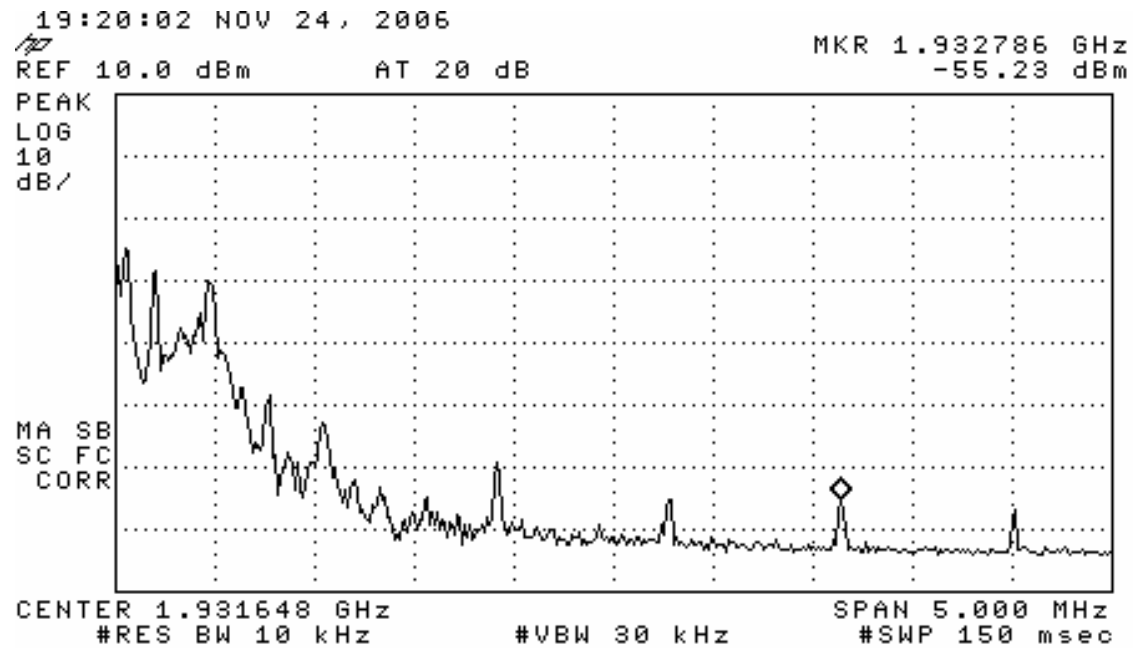


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Upper out-band plots follow:



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10 RF EXPOSURE

Clause: 15.319 / RSS-Gen 5.5

Requirement: 1.1307(b), 2.1091 and 2.1093 / RSS-102

$MPE \leq 1 \text{ mW/cm}^2$ at 20 cm

given by Power density $S = EIRP / 4\pi R^2$, where R is distance 20 cm.

For $S = 1 \text{ mW/cm}^2$

Maximum permissible $P = 4\pi R^2 = 4\pi(20)^2 = 5026 \text{ mW} = 37 \text{ dBm}$

$SAR \leq 1.6 \text{ W/kg}$ over any 1 g of tissue

Reference: OET Bulletin 65 for General Population / Uncontrolled Exposure

Test Result: Base: Compliant
Handset: Compliant

10.1 Base MPE

From worst case in Radiated Peak Power

Chan. No.	Freq. (MHz)	Radiated Power (mW)	EIRP (dBm)	MPE Power Limit (dBm)	Margin from Limit (dBm)
5	1928.88	60.81	17.84	37	19.16

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10.2 Handset SAR

Refer to SAR testing report by Celltech.

Measurement of SAR EUT radiated power

EUT # 1

Chan. No.	Freq. (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)
5	1921.38	78.59	7.52	28.3 V	0	114.41	18.21	66.22
3	1924.75	78.63	7.52	28.3 V	0	114.45	18.25	66.83
1	1928.88	78.77	7.52	28.3 V	0	114.59	18.39	69.02

EUT # 2

Chan. No.	Freq. (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)
5	1921.38	78.64	7.52	28.3 V	0	114.46	18.26	66.99
3	1924.75	78.73	7.52	28.3 V	0	114.55	18.35	68.39
1	1928.88	78.81	7.52	28.3 V	0	114.63	18.43	69.66

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

Note 3: 96.2 dB taken as factor to convert Field Strength to Radiated Power in numerical value

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- 11 RADIATED PEAK POWER**
- 12 EMISSIONS BEYOND BAND EDGE**
- 13 RADIATED SPURIOUS EMISSIONS**
- 14 POWER LINE CONDUCTED EMISSIONS**

See TIMCO test reports in file, Ref: 3246UT6 (base), 3247UT6 (Handset).
Following pages 45 – 60 are deleted from this report.

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11 RADIATED PEAK POWER

Clause: 15.319 (c) / 6.5

Requirement: $\leq 100 \mu\text{W} \times \sqrt{B} = 5 \log B - 10 \text{ dBm} = 20.8 \text{ dBm}$ for $B = 1.5 \text{ MHz}$ max.
 $\leq 116 \text{ dB}\mu\text{V/m}$ at 3m for base / $115 \text{ dB}\mu\text{V/m}$ for handset
 by radiated measurement derived from Friis formula as follows

For base:

$$\text{Field Strength } E = \frac{\sqrt{30PG}}{d} = \frac{\sqrt{30 * 0.122 * 0.87}}{3} \text{ V/m} = 94.7 + P \text{ dBm} = 115.5 \text{ dB}\mu\text{V/m}$$

For handset:

$$\text{Field Strength } E = \frac{\sqrt{30PG}}{d} = \frac{\sqrt{30 * 0.122 * 1.24}}{3} \text{ V/m} = 96.2 + P \text{ dBm} = 117 \text{ dB}\mu\text{V/m}$$

where $P = 0.122 \text{ W}$ (20.8 dBm)

$G = \text{Numeric gain of TX antenna} = 0.87$ for BS (1.24 for HS) worst-case

$d = 3 \text{ m}$

SA Setting: RBW $\geq$ Emission BW (or increased until no more than 0.5 dB change in power)

ANSI 6.1.2 VBW $\geq 3 \times$ RBW

Span = zero, centered on channel center

Sweep: fast enough to resolve transmit pulse

Detection: Peak

Test Result: Base: 17.84 dBm (60.81 mW)
 Handset: 18.39 dBm (69.02 mW) SAR units

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11.1 Base

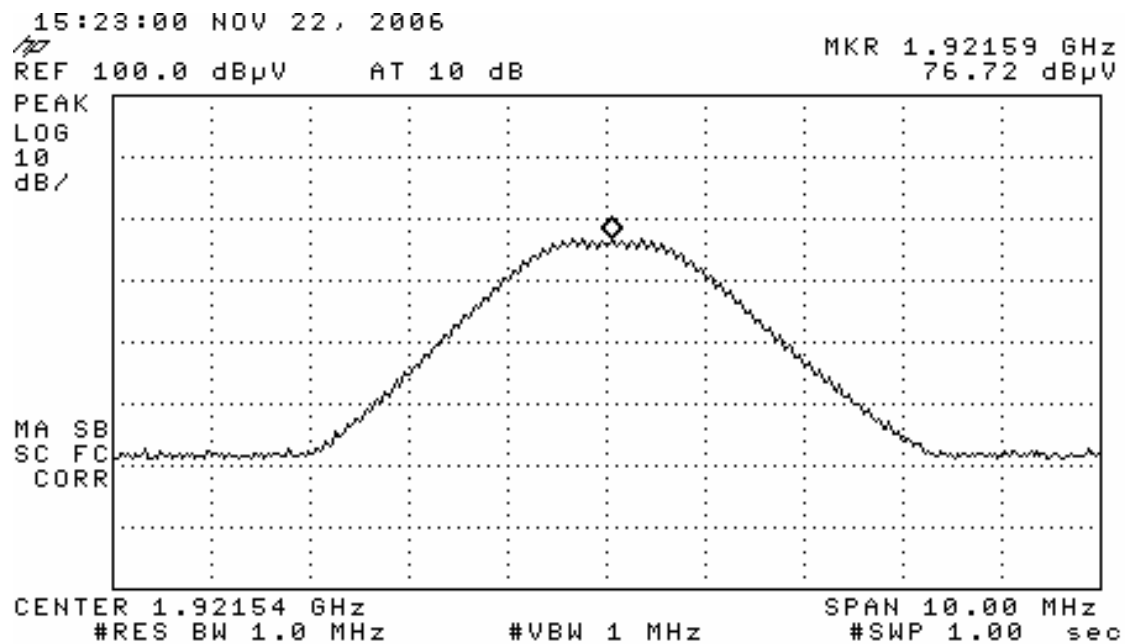
Chan. No.	Freq. (MHz)	Meter Peak Reading (dBμV)	Coax Loss (dB)	Antenna Factor (Note 2) (dB)	Pre-amp Gain (dB)	Field Strength at 3m (dBμV/m)	Radiated Power (Note 3) (dBm)	EIRP (mW)
5	1921.40	76.72	7.52	28.3 V	0	112.54	17.84	60.81
3	1924.90	76.10	7.52	28.3 V	0	111.92	17.22	52.72
1	1928.53	75.40	7.52	28.3 V	0	111.22	16.52	44.87

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

Note 3: 94.7 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

Worst-case plot follows.



Radiated Field Strength at Low-freq Channel

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11.2 Handset 1

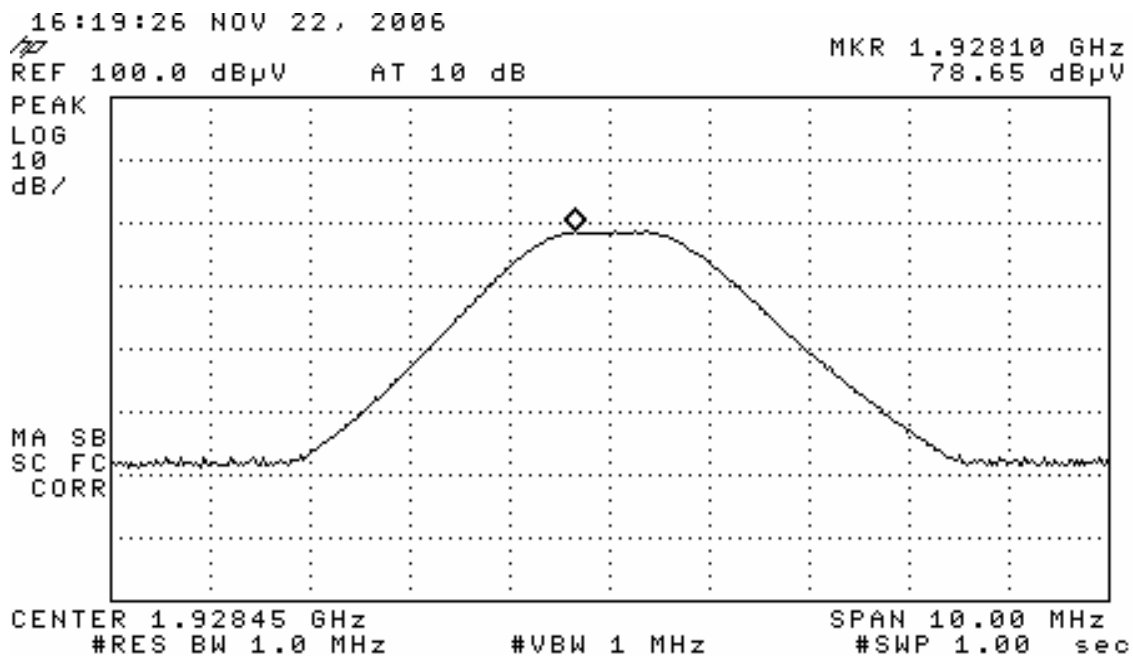
Chan. No.	Freq. (MHz)	Meter Peak Reading (dBμV)	Coax Loss (dB)	Antenna Factor (Note 2) (dB)	Pre-amp Gain (dB)	Field Strength at 3m (dBμV/m)	Radiated Power (Note 3) (dBm)	EIRP (mW)
5	1921.38	77.49	7.52	28.3 V	0	113.31	17.11	51.40
3	1924.75	78.36	7.52	28.3 V	0	114.18	17.98	62.81
1	1928.88	78.65	7.52	28.3 V	0	114.47	18.27	67.14

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

Note 3: 96.2 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

Worst-case plot follows.



Radiated Field Strength at High-freq Channel

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11.3 Handset 2

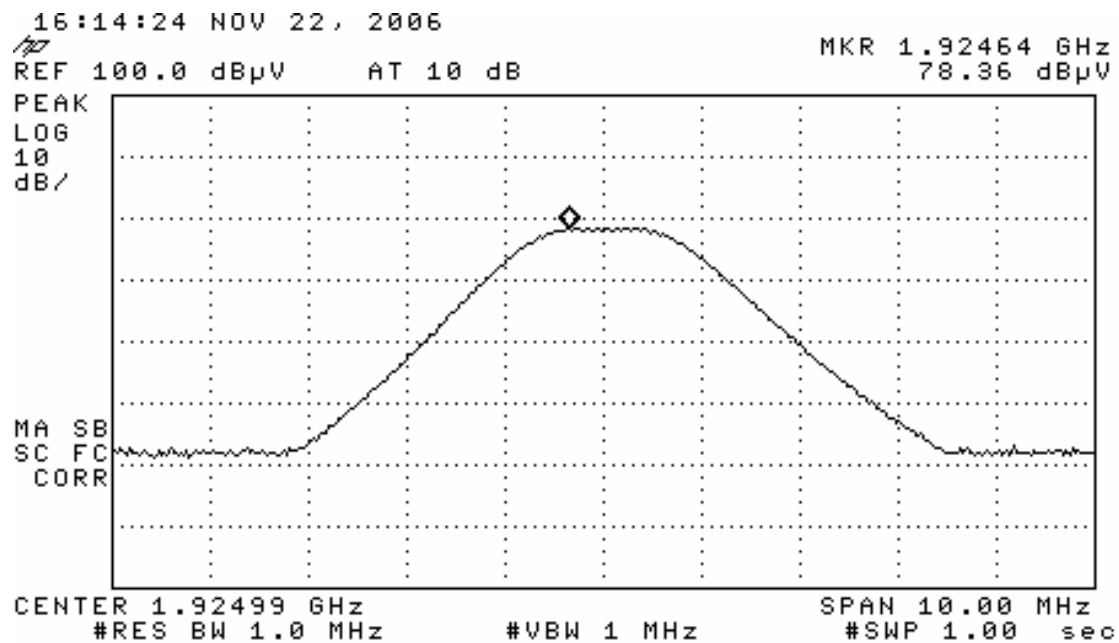
Chan. No.	Freq. (MHz)	Meter Peak Reading (dBμV)	Coax Loss (dB)	Antenna Factor (Note 2) (dB)	Pre-amp Gain (dB)	Field Strength at 3m (dBμV/m)	Radiated Power (Note 3) (dBm)	EIRP (mW)
5	1921.38	78.27	7.52	28.3 V	0	114.09	17.89	61.52
3	1924.64	78.36	7.52	28.3 V	0	114.18	17.98	62.81
1	1928.63	78.22	7.52	28.3 V	0	114.04	17.84	60.81

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

Note 3: 96.2 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

Worst-case plot follows.



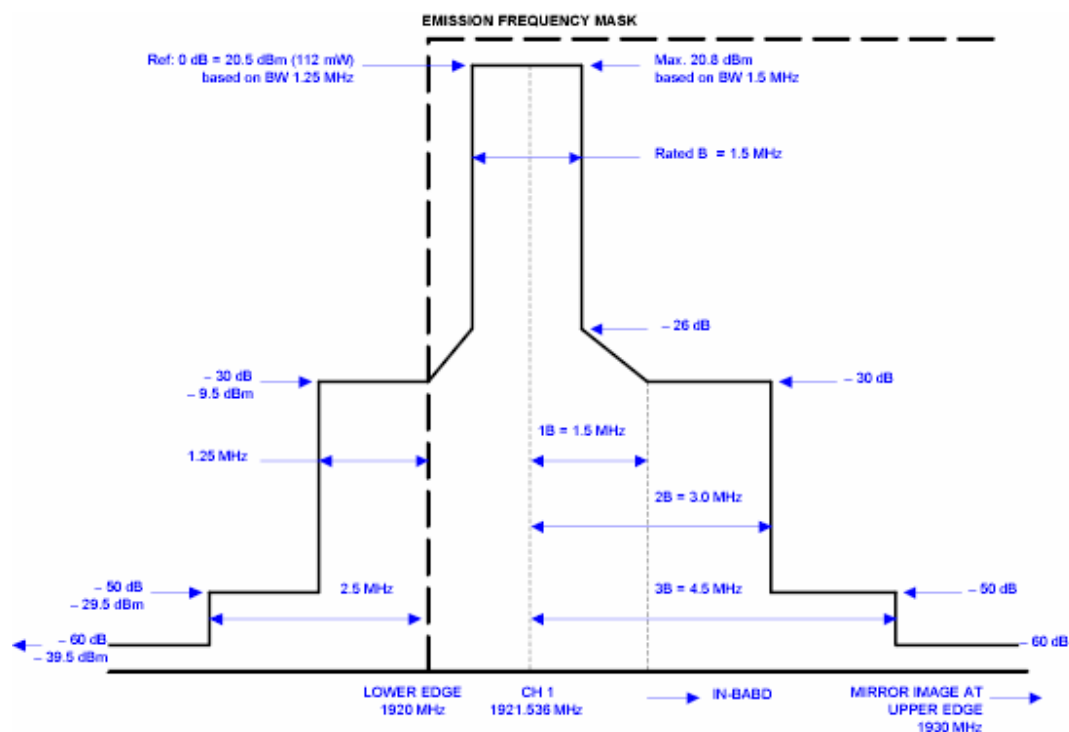
Radiated Field Strength at Mid-freq Channel

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12 EMISSIONS BEYOND BAND EDGE

Clause: 15.323 (d) / 6.7

Requirement: As shown in diagram of Emission Mask



SA Setting: RBW $\approx$ 1 % of Emission BW (or 0.5 % < RBW < 2 % for fixed setting)
ANSI 6.1.6.2 VBW = 3 x RBW
Span $\geq$ 3.5 x B
Sweep: Sufficient to stabilize trace ($\geq$ pulse repetitive interval x no. of trace elements)
Detection: Peak hold

Test Result: Base: -66.57 dBc (worst at low channel 4th harmonic)
Handset: -66.07 dBc (worst at mid channel 3rd harmonic)

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12.1 Base Tx Harmonics

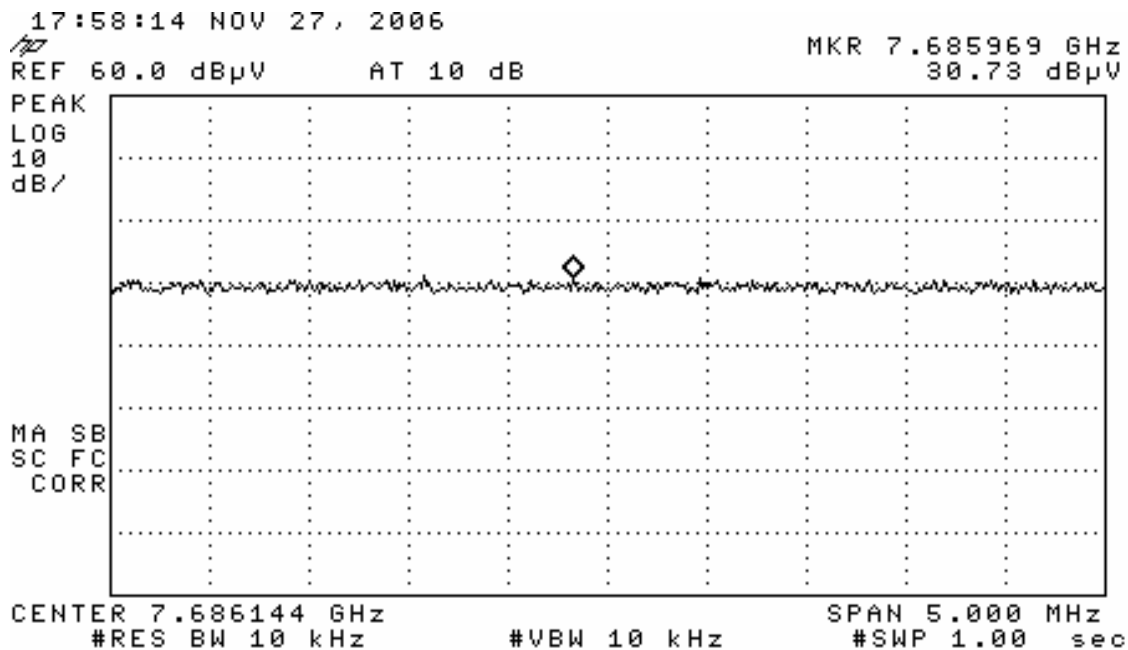
Chan. (fc) No.	Freq. (MHz)	Meter Peak Reading (dB/V)	Coax Loss (dB)	Antenna Factor (Note 2) (dB)	Pre-amp Gain (dB)	Field Strength at 3m (dB/V/m)	Relative Level (dBc)	Rule Limit (dBc)	Margin from Limit (dB)
5	1921.536					114.50	0.0	--	--
2x fc	3843.20	31.55	10.5	32 V	-35	39.05	-75.45	-60	15.45
3x fc	5766.30	31.22	11.7	35 V	-35	42.92	-71.58	-60	11.58
4x fc	7686.88	30.73	15.2	37 H	-35	47.93	-66.57	-60	6.57
3	1924.992					114.50	0.0	--	--
2x fc	3849.50	31.27	10.5	32 V	-35	38.77	-75.73	-60	15.73
3x fc	5775.30	31.34	11.7	35 V	-35	43.04	-71.46	-60	11.46
4x fc	7699.05	29.55	15.2	37 H	-35	46.75	-67.75	-60	7.75
1	1928.448					114.50	0.0	--	--
2x fc	3855.86	31.04	10.5	32 V	-35	38.54	-75.96	-60	15.96
3x fc	5784.89	30.95	11.7	35 V	-35	42.65	-71.85	-60	11.85
4x fc	7713.92	29.43	15.2	37 H	-35	46.63	-67.87	-60	7.87

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

Note 3: Referenced to 112mW (20.5dBm) for 1.5MHz BW corresponding to $94 + 20.5 = 114.5\text{dBuV/m}$ at 3m

Note 4: EUT raised up by at least 5 cm to minimize reflection of RF emissions by test table

Worst-case plot follows:



Base 4th Harmonic at Low-freq Channel

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12.2 Handset 1 Tx Harmonics

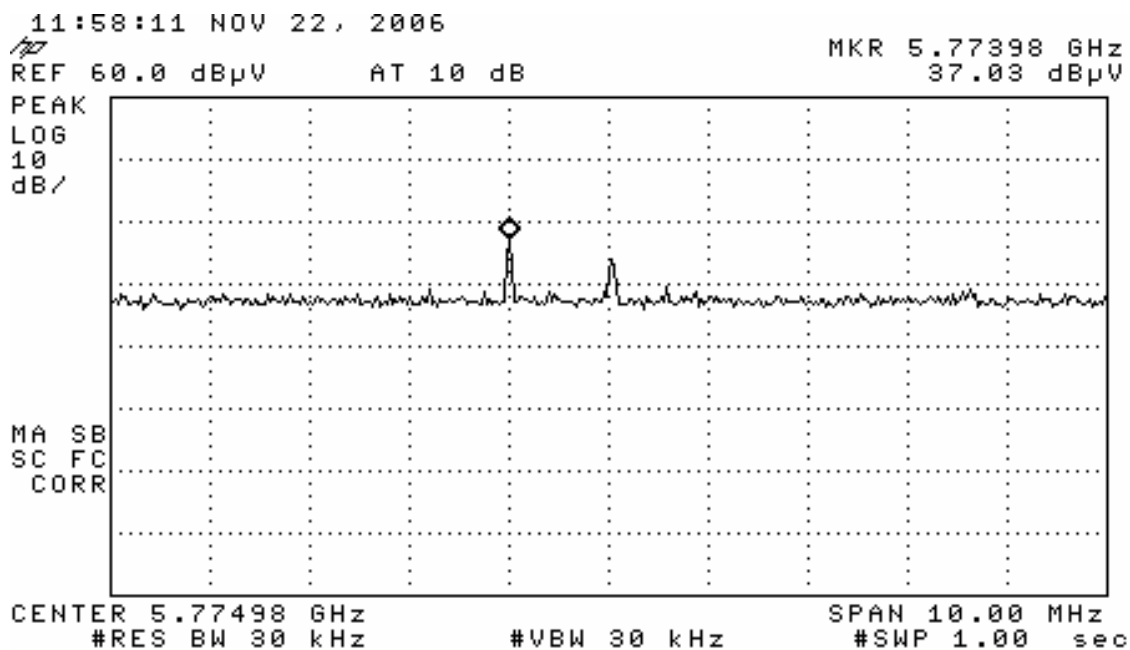
Chan. (fc)	Freq.	Meter Peak Reading	Coax Loss	Antenna Factor (Note 2)	Pre-amp Gain	Field Strength at 3m	Relative Level	Rule Limit	Margin from Limit
No.	(MHz)	(dBμV)	(dB)	(dB)	(dB)	(dBμV/m)	(dBc)	(dBc)	(dB)
5	1921.536					115.50	0.0	--	--
2x fc	3842.45	30.34	10.5	32.0 V	-35	37.84	-77.66	-60	17.66
3x fc	5763.80	34.07	11.7	35.7 H	-35	46.47	-69.03	-60	9.03
4x fc	7687.10	30.24	15.2	37.0 V	-35	47.44	-68.06	-60	8.06
3	1924.992					115.50	0.0	--	--
2x fc	3849.45	30.16	10.5	32.0 V	-35	37.66	-77.84	-60	17.84
3x fc	5774.15	37.03	11.7	35.7 H	-35	49.43	-66.07	-60	6.07
4x fc	7700.70	30.11	15.2	37.0 V	-35	47.31	-68.19	-60	8.19
1	1928.448					115.50	0.0	--	--
2x fc	3856.40	30.21	10.5	32.0 V	-35	37.71	-77.79	-60	17.79
3x fc	5784.50	35.65	11.7	35.7 H	-35	48.05	-67.45	-60	7.45
4x fc	7714.95	28.93	15.2	37.0 V	-35	46.13	-69.37	-60	9.37

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

Note 3: Referenced to 112mW (20.5dBm) for 1.5MHz BW corresponding to $95 + 20.5 = 115.5\text{dBuV/m}$ at 3m

Note 4: EUT raised up by at least 5 cm to minimize reflection of RF emissions by test table

Worst-case plot follows:



Handset 3rd Harmonic at Mid-freq Channel

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12.3 Handset 2 Tx Harmonics

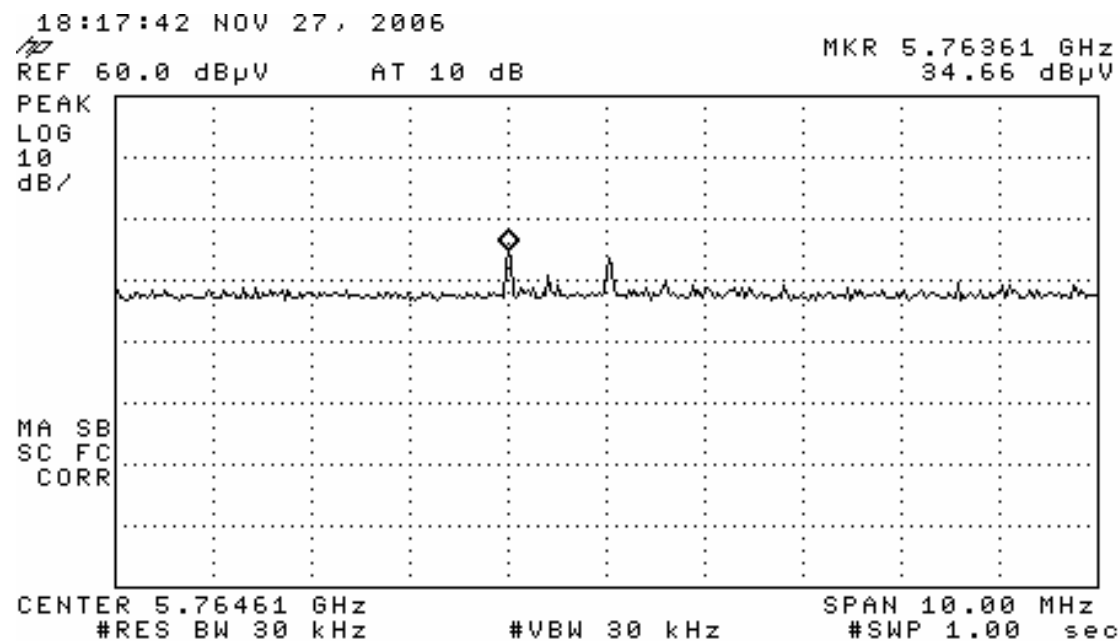
Chan. (fc) No.	Freq. (MHz)	Meter Peak Reading (dBμV)	Coax Loss (dB)	Antenna Factor (Note 2) (dB)	Pre-amp Gain (dB)	Field Strength at 3m (dBμV/m)	Relative Level (dBc)	Rule Limit (dBc)	Margin from Limit (dB)
5	1921.536					115.50	0.0	--	--
2x fc	3843.30	30.67	10.5	32.0 V	-35	38.17	-77.33	-60	17.33
3x fc	5763.61	34.66	11.7	35.7 H	-35	47.06	-68.44	-60	8.44
4x fc	7687.60	29.29	15.2	37.0 V	-35	46.49	-69.01	-60	9.01
3	1924.992					115.50	0.0	--	--
2x fc	3849.55	30.71	10.5	32.0 V	-35	38.21	-77.29	-60	17.29
3x fc	5774.20	34.31	11.7	35.7 H	-35	46.71	-68.79	-60	8.79
4x fc	7699.05	28.87	15.2	37.0 V	-35	46.07	-69.43	-60	9.43
1	1928.448					115.50	0.0	--	--
2x fc	3856.35	30.43	10.5	32.0 V	-35	37.93	-77.57	-60	17.57
3x fc	5784.60	34.26	11.7	35.7 H	-35	46.66	-68.84	-60	8.84
4x fc	7714.42	28.41	15.2	37.0 V	-35	45.61	-69.89	-60	9.89

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

Note 3: Referenced to 112mW (20.5dBm) for 1.5MHz BW corresponding to $95 + 20.5 = 115.5\text{dBuV/m}$ at 3m

Note 4: EUT raised up by at least 5 cm to minimize reflection of RF emissions by test table

Worst-case plot follows:



Handset 3rd Harmonic at Low-freq Channel

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13 RADIATED SPURIOUS EMISSIONS

Clause: 15.205 (a), 15.205 (c), 15.209 (a) / RSS-Gen 6

Limits:

Emission Frequency (MHz)	Field Strength		At Distance (m)	Detector Type
	(μ V/m)	(dB μ V/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 $\geq$ 100 kHz for $f < 1$ GHz, 1 MHz for $f \geq 1$ GHz
DA 00-705 VBW $\geq$ RBW
Span = to fully capture emission being measured
Sweep = auto

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

13.1 Base

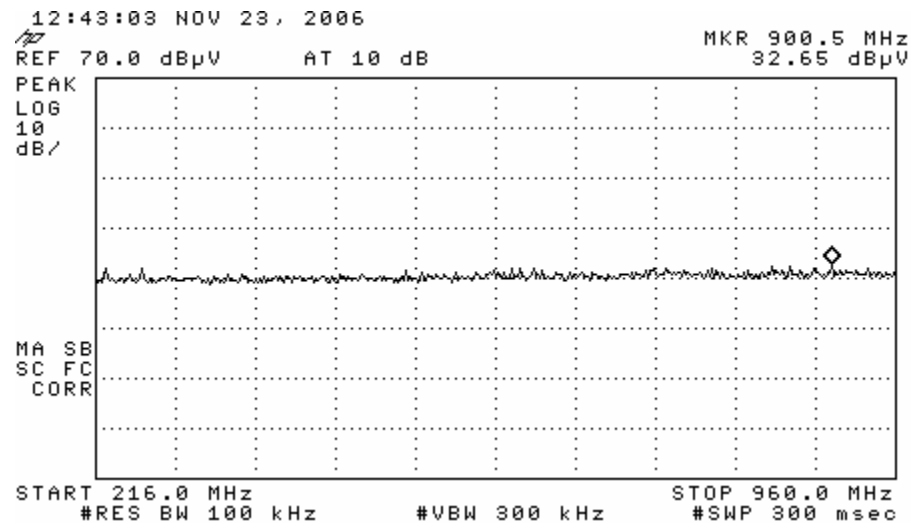
- 13.1.1 Band 9 kHz – 30 MHz
- 13.1.2 Band 30 – 88 MHz
- 13.1.3 Band 88 – 216 MHz
- 13.1.4 Band 216 – 960 MHz

Band (MHz)	Freq. (MHz)	Meter Peak Reading (dB0V)	Coax Loss (dB)	Antenna Factor (Note 1) (dB)	Pre- amp Gain (dB)	Field Strength at 3m (dB0V/m)	Rule Limit (dB0V/m)	Margin from Limit (dB)
0.009–30		N/A						N/A
30 – 88	42.5	35.29	2.0	12.9 BV	-23.5	26.69	40	13.31
88 – 216	105.9	31.86	2.5	11.2 BV	-23.5	22.06	43.5	21.44
216–960	900.5	32.65	3.5	23.7 LV	-23.5	36.35	46	9.65

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

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Worst-case plot follows:



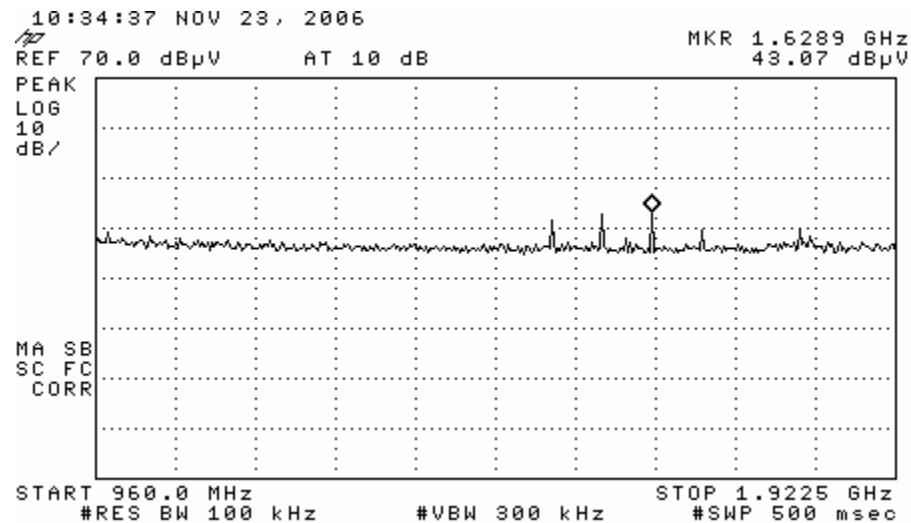
Base spurious emission $\leq$ 960 MHz

13.1.5 Band above 960 MHz

Chan. No.	Freq. (MHz)	Meter Peak Reading (dB- μ V)	Coax Loss (dB)	Antenna Factor (Note 2) (dB)	Pre-amp Gain (dB)	Field Strength at 3m (dB- μ V/m)	Rule Limit (dB- μ V/m)	Margin from Limit (dB)
1	1628.9	43.07	6.28	26.5 V	-35	40.85	54	13.15

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

Worst-case plot follows:



Base spurious emission $>$ 960 MHz

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13.2 Handset 1

13.2.1 Band 9 kHz – 30 MHz

13.2.2 Band 30 – 88 MHz

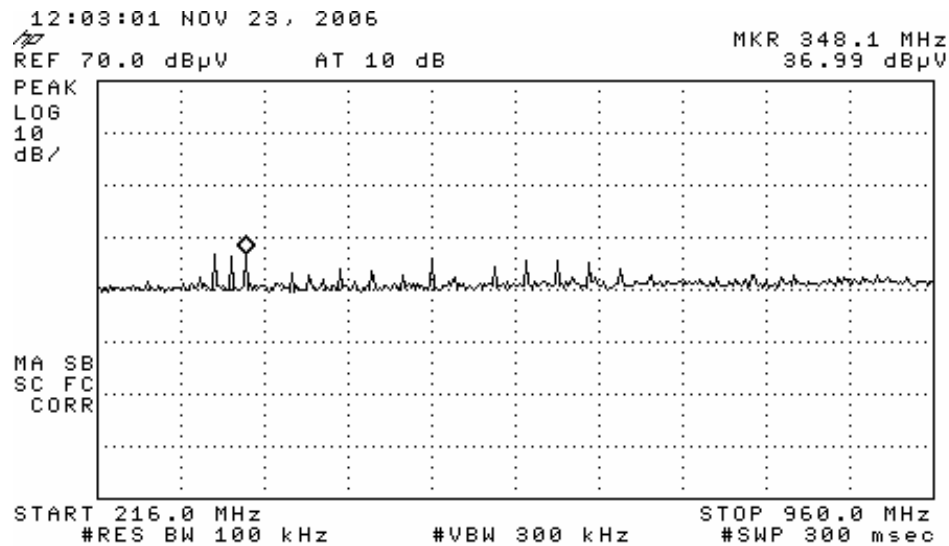
13.2.3 Band 88 – 216 MHz

13.2.4 Band 216 – 960 MHz

Band (MHz)	Freq. (MHz)	Meter Peak Reading (dB μ V)	Coax Loss (dB)	Antenna Factor (Note 1) (dB)	Pre- amp Gain (dB)	Field Strength at 3m (dB μ V/m)	Rule Limit (dB μ V/m)	Margin from Limit (dB)
0.009–30		N/A						N/A
30 – 88	55.52	36.72	2.0	10.4 BV	-23.5	25.62	40	14.38
88 – 216	193.9	34.76	2.5	15.1 BV	-23.5	28.86	43.5	14.64
216–960	348.1	36.99	3.5	21.5 LV	-23.5	38.49	46	7.51

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

Worst-case plot follows:



Handset spurious emission $\leq$ 960 MHz

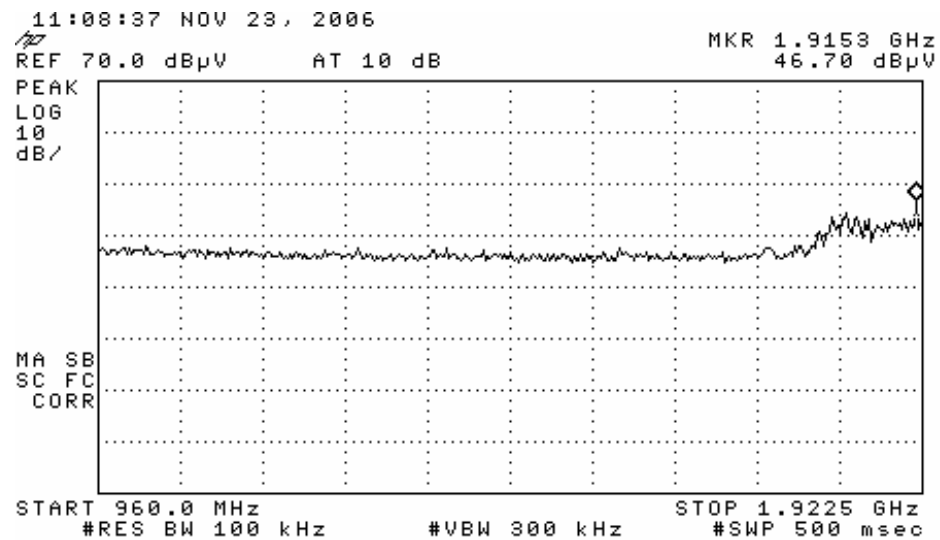
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13.2.5 Band above 960 MHz

Chan. No.	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)
1	1915.3	46.70	7.00	28.5 V	-35	47.20	54	6.80

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

Worst-case plot follows:



Base spurious emission > 960 MHz

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13.3 Handset 2

13.3.1 Band 9 kHz – 30 MHz

13.3.2 Band 30 – 88 MHz

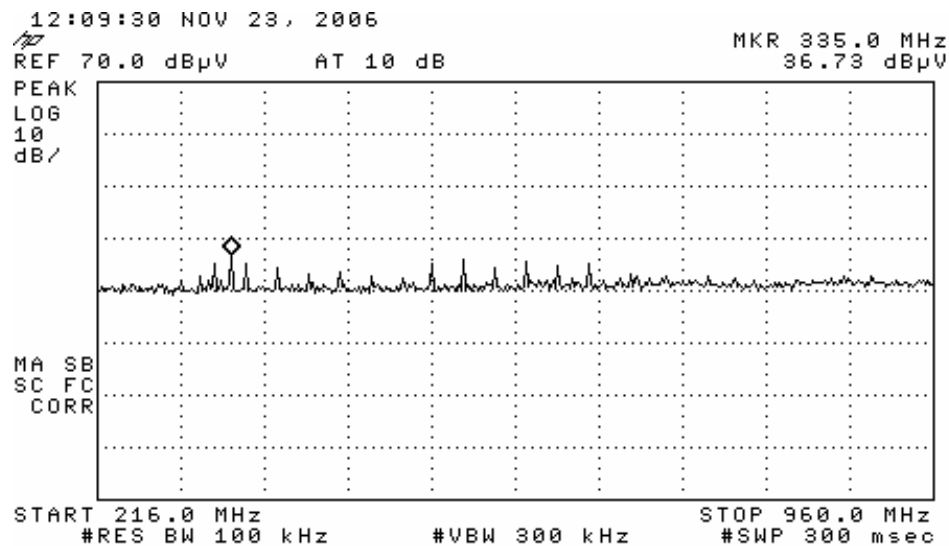
13.3.3 Band 88 – 216 MHz

13.3.4 Band 216 – 960 MHz

Band (MHz)	Freq. (MHz)	Meter Peak Reading (dB\ V)	Coax Loss (dB)	Antenna Factor (Note 1) (dB)	Pre- amp Gain (dB)	Field Strength at 3m (dB\ V/m)	Rule Limit (dB\ V/m)	Margin from Limit (dB)
0.009–30		N/A						N/A
30 – 88	55.52	35.46	2.0	10.4 BV	-23.5	24.36	40	15.64
88 – 216	193.9	34.5	2.5	15.1 BV	-23.5	28.60	43.5	14.90
216–960	335	36.73	3.5	21.5 LV	-23.5	38.23	46	7.77

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

Worst-case plot follows:



Handset spurious emission $\leq$ 960 MHz

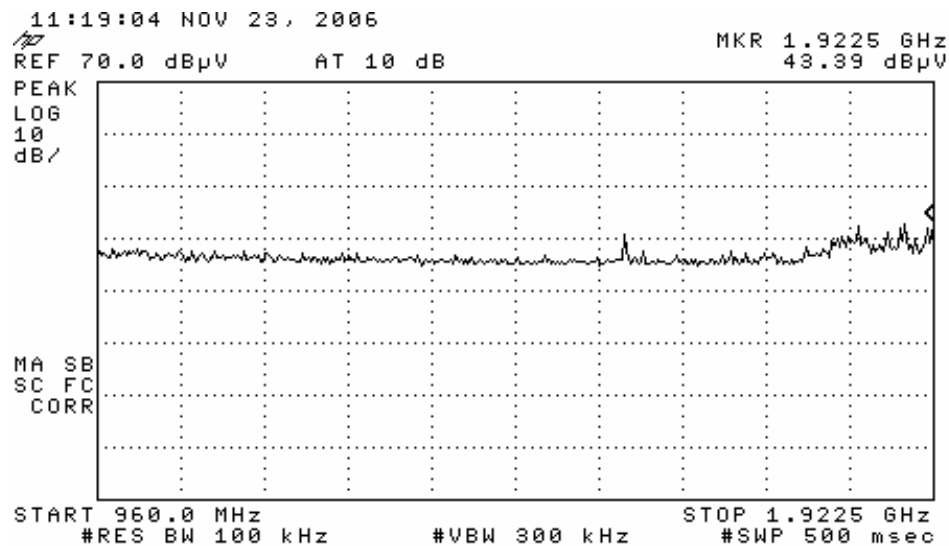
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13.3.5 Band above 960 MHz

Chan. No.	Freq. (MHz)	Meter Peak Reading (dB+V)	Coax Loss (dB)	Antenna Factor (Note 2) (dB)	Pre- amp Gain (dB)	Field Strength at 3m (dB+V/m)	Rule Limit (dB+V/m)	Margin from Limit (dB)
1	1922.5	43.39	6.28	28.5 V	-35	43.17	54	10.83

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

Worst-case plot follows:



Base spurious emission > 960 MHz

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14 POWER LINE CONDUCTED EMISSIONS

Clause: 15.315, 15.207 (a), 15.107 (a) / RSS-Gen 7.2.2

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 complies

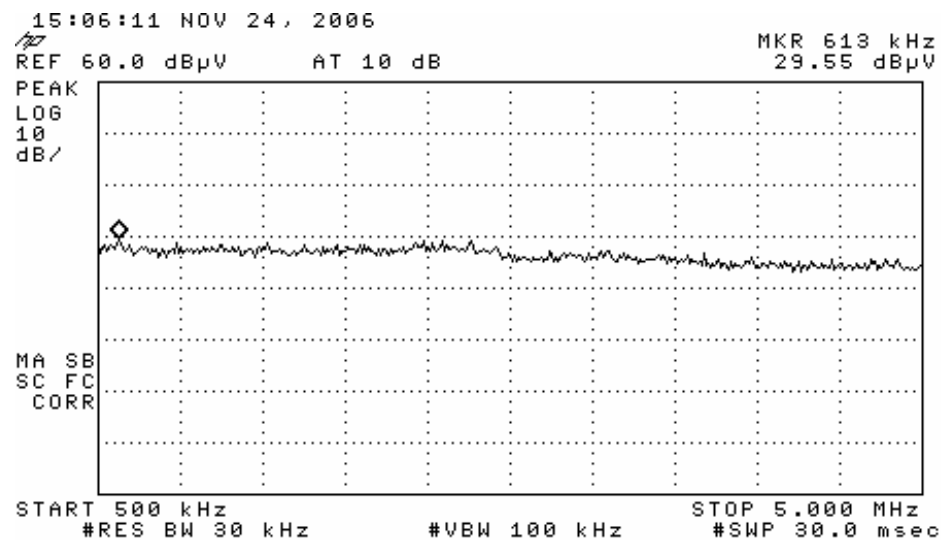
14.1 Base

Base Tx at Low, Mid or High channel set by Test Mode

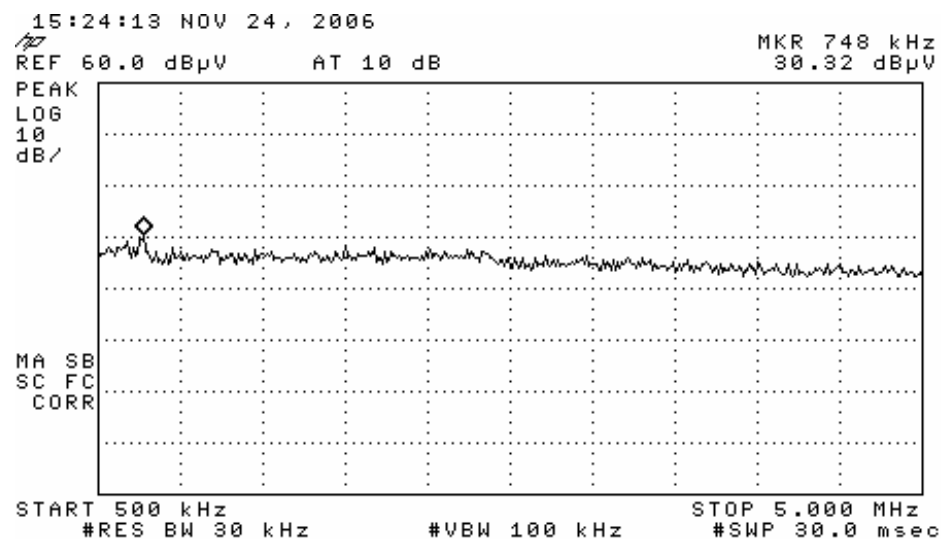
Line	Band (MHz)	Freq. (MHz)	Reading QP (dBμV)	Loss (dB)	Emission (dBμV)	Limit (dBμV)	Margin (dB)
Live	0.15 - 0.5	0.1500	30.03	20	50.03	66	15.97
	0.5 – 5	0.613	29.55	20	49.55	56	6.45
	5 – 30	7.06	30.38	20	50.38	60	9.62
Neutral	0.15 - 0.5	0.1561	30.5	20	50.5	66	15.5
	0.5 – 5	0.748	30.32	20	50.32	56	5.68
	30.47	5.13	30.73	20	50.73	60	9.27

Worst-case plots follow for base TX at mid channel.

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Emission from LIVE conductor



Emission from NEUTRAL conductor

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APPENDIX TEST SETUP

Equipment List

ITEM	EQUIPMENT	MAKE	MODEL	S/N	LAST CAL.
1.	Spectrum Analyzer	AGILENT	8560E	A1429	07 April 2003
2.	Spectrum Analyzer	AGILENT	8596E	4105A01873	09 April 2004
3.	Pre-amplifier	AGILENT	8449B	A8135	N/A
4.	Pre-amplifier	AGILENT	87405A	3207A01735	30 May 2004
5.	High-pass Filter	In-house built	2.4 GHz cut-off	N/A	N/A
6.	Biconical Antenna	A.H. SYSTEMS	SAS-200/540	457	27 April 1994
7.	Log Periodic Antenna	A.H. SYSTEMS	SAS-200/512	319	27 April 1994
8.	Horn Antenna	EMC TEST SYS.	3115	6328	09 June 2001
9.	Digital Radio Tester	ROHDE & SCHWARZ	CTS60	100407	20 July 2004
10.	Selectable Attenuator	KAY ELEMETRICS	839	20902-34	N/A
11.	Attenuator	In-house built	Fixed 15 dB	N/A	N/A
12.	Attenuator	In-house built	Fixed 22 dB	N/A	N/A
13.	Attenuator	In-house built	Fixed 33 dB	N/A	N/A
14.	Line Impedance Stabilization Network (LISN)	WAYNE KERR	LSN0930A	322A288	30 Sep 1998
15.	3 m Semi-Anechoic Chamber	RAYPROOF (ETS-LINDGREN)	Series 81	A1393	27 Nov 2003
16.	Environmental Chamber	THERMOTRON	SM-4S-SL	23060	N/A

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Radiation Test Set-up & Procedure

Reference	ANSI Standard C63.4- 2000: Section 8.1, 8.2.3 and 8.3
Set-up	- Take the Base or Handset as separate EUT. - For AC operated device (e.g. base unit), the EUT is operated from a 120 Vac mains supply via an AC adapter unless power source stated otherwise in owner's manual. - For battery operated device (e.g. handset), the EUT is powered by the battery type stated in the owner's manual. - Terminal equipment, if applicable, is terminated with loop simulator (or telephone analyzer) such as TELTONE TLS-5. - Arrange the EUT and its peripherals to minimize crossing of connecting wires.
Procedures	- Setup and connect the EUT as shown in Figures 1 and 2. - Put EUT into Test Mode. - Monitor the frequency spectrum for different modes of operation with variations in antenna height (1 m through 4 m), antenna polarization (horizontal and vertical), EUT azimuth and cable or wire placement.

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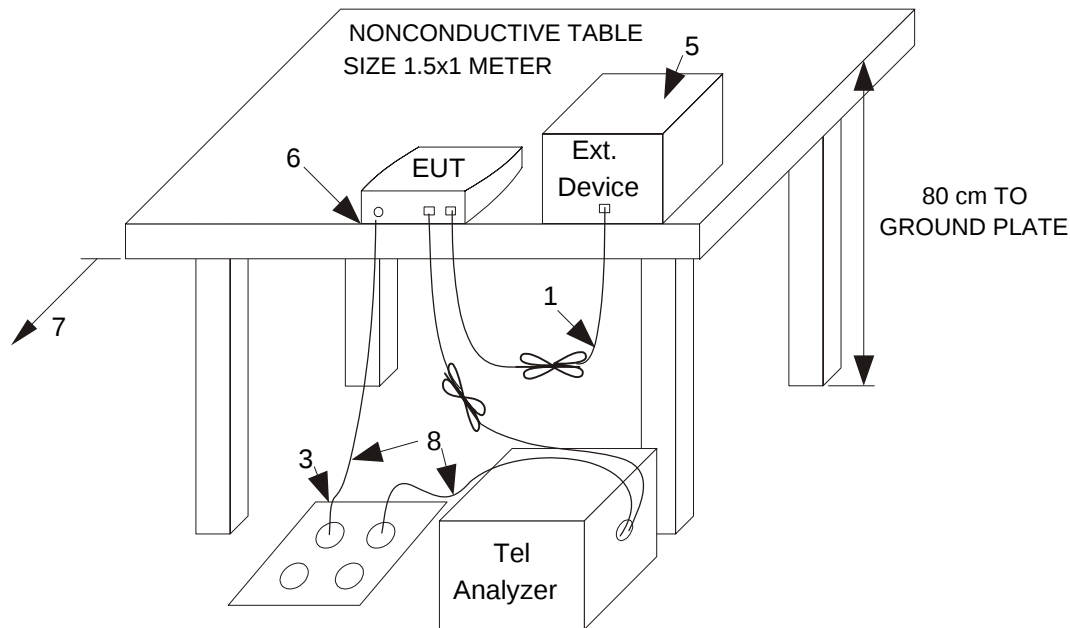


Figure 1. Test Configuration – Radiated Emissions Test

LEGEND:

1. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth forming a bundle 30 to 40 cm long, hanging approximately in the middle between ground plane and table.
2. I/O cables that are connected to a peripheral shall be bundle in center. The end of the cable may be terminated if required using correct terminating impedance. The total length shall not exceed 1 m.
3. If Line Impedance Stabilization Networks (LISN) are kept in the test setup for radiated emissions, it is preferred that they be installed under the ground plane with the receptacle flush with the ground plane.
4. Cables of hand-operated devices, such as keyboards, mice, etc., have to be placed as close as possible to the host.
5. Non-EUT components being tested.
6. Rear of EUT, including peripherals, shall be all aligned and flush with rear of tabletop.
7. No vertical conducting wall is used.
8. Power cords drape to the floor and are routed over to receptacle.

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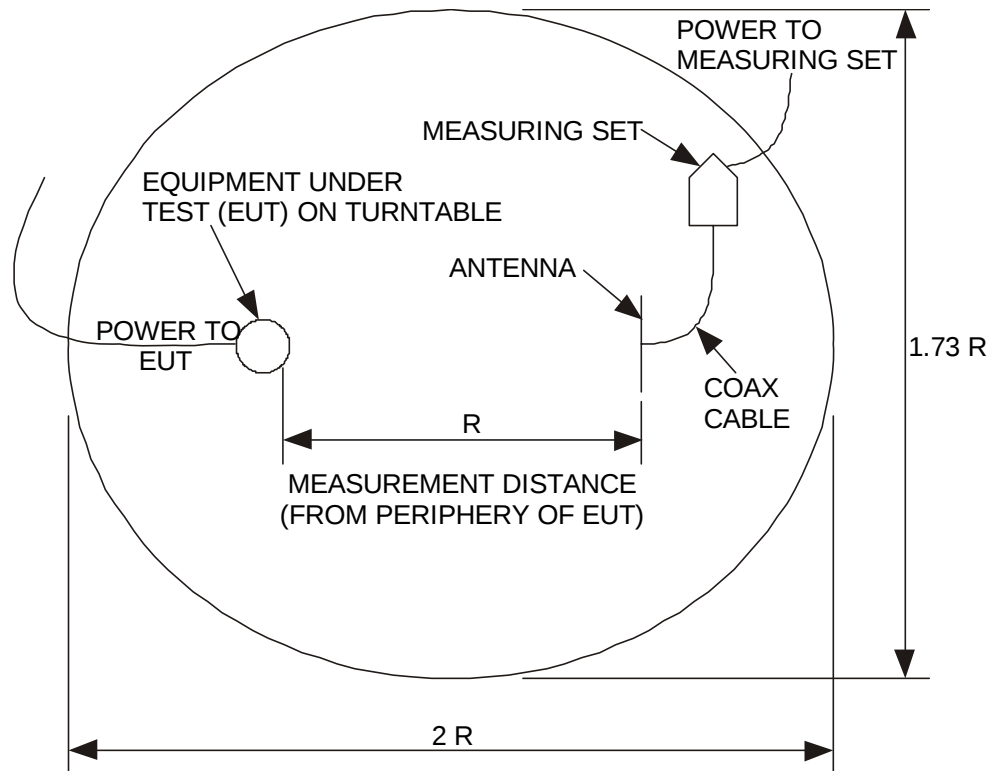


Figure 2. Radiated Emissions Measurement – Free Area for Site with a Turntable
Area dimensions with $R = 3\text{m}$ is $6\text{m} \times 5.2\text{m}$, with $R = 10\text{m}$ is $20\text{m} \times 17.3\text{m}$