Test: Peak Power Spectral Density

Ref.: FCC Part 15.247 (d)

Criteria: The power spectral density averaged over any one-second interval shall not be greater than 8.0 dBm in any 3 kHz bandwidth within the pass bands.
For a direct sequence system, it is defined as the peak power spectral density conducted from the intentional radiator to the antenna measured during any time interval of continuous transmission.

Set-up: See Figure 4

Condition: Radiated Test

Equipment: See Appendix A

Methodology: Because the antenna is integrated within the DUI the Power Spectral Density of radiated signal was measured and then converted into Power Spectral Density conducted from the transmitter by applying the antenna gain provided by manufacturer. The measurement was performed by using the *Direct Method* in which the measurement is carried within a calibrated set-up and the readings from the spectrum analyzer are corrected by a factor comprised of *Cable Loss and Antenna Factor*. The test was repeated with two different sets of settings on the spectrum analyzer - narrow and wide span. Results obtained from both measurements are presented in the report (Graphs 1 to 6 and tables 1 and 2). Testing was performed with the spectrum analyzer settings as shown below (the peak signal was located and the span was reduced and the sweep time increased in a manner to maintain calibration and to keep the peak emission in the display after which the reading was taken).

1) Spectrum-Analyzer settings – narrow span:

Res. Bandwidth:	3 kHz
Video Bandwidth:	30 kHz
Span:	15 kHz
Ref. Level:	-20 dBm
Sweep:	5 seconds

2) Spectrum-Analyzer settings – wide span:

Res. Bandwidth:	3 kHz
Video Bandwidth:	30 kHz
Span:	3 MHz
Ref. Level:	-10 dBm

Sweep: 1000 seconds

The DUI was positioned on the turn-table and received signal was **maximized** by rotating the turntable and adjusting the height of the receiving antenna.

Power Spectral Density of the received signal (from the receiving antenna) was measured on the spectrum analyzer and recorded. The actual Conducted Peak Power Spectral Density on the DUI was obtained from the recorded reading in a following manner:

Sample Calculation:

Reading recorded on spectrum analyzer:

$$PPSD_{Spec.Analyzer} = -76.3\ dBm/Hz$$

So for 3kHz BW,

$$P_{3kHz} = -76.31dBm + 34.8dB = -41.51\ dBm$$

Converted to Voltage Reading:

$$V = P_{3kHz} + 107\ dBmV/dBm = 65.49\ dBmV$$

E-field at receive antenna (3 m from DUI):

$$E_{ANT} = V + Cable\ Loss + Antenna\ Factor$$
$$= 65.49 + 5.7\ dB + 32.2\ dB/m$$
$$= 103.39\ dBmV/m$$
$$= 0.148\ V/m$$

Conducted Power Spectral Density at DUI:

Since $P = (E_{ANT} * d)^2 / (30 * G)$

And $G = 4dBi = 2.51$

So

$$P = (0.148 * 3)^2 / (30 * 2.51)$$
$$= 0.00261\ W$$
$$= 4.2\ dBm$$

Test Results: See Test Data, See Graphs 1 - 6

Recalculated

Table 1a: **Base Unit** – Conducted Power Spectral Density Test Data - Calculation

Channel #	Frequency (MHz)	Reading on Spectr.An. (dBm/Hz)	PPSD for 3kHz BW (dBm)	Voltage on Spectr. An. (dBµV)	E-field @ 3m (dBµV/m)	E-field @ 3m (V/m)	Conducted Power @ DUI (dBm)
1	5742.980	-76.31	-41.51	65.49	103.39	0.148	4.2
18	5788.880	-79.35	-44.55	62.45	100.35	0.104	1.1
35	5794.280	-82.33	-47.53	59.47	97.37	0.074	-1.9

Table 1b: **Base Unit** – Conducted Power Spectral Density Test Data – Results and Limits

Channel #	Frequency (MHz)	Conducted Power @ 3kHz Bandwidth (dBm)	Limit (dBm)	Margin (dB)	Pass/Fail
1	5742.980	4.2	8.0	3.8	Pass
18	5788.880	1.1	8.0	6.9	Pass
35	5794.280	-1.9	8.0	9.9	Pass

Test performed by: _____ **Date:** June , 2002

Test Results: See Test Data, See Graphs 1 - 6

Recalculated

Table 2a: **Handset** – Conducted Power Spectral Density Test Data - Calculation

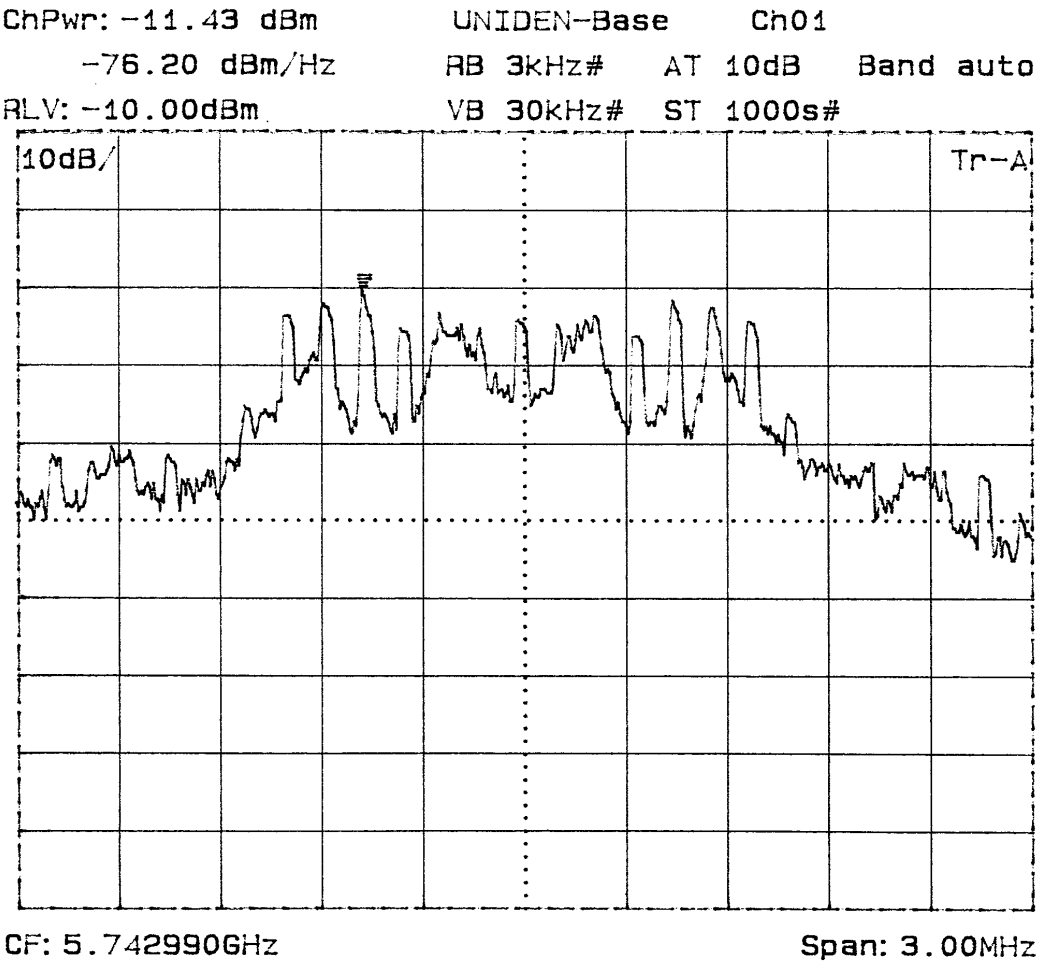
Channel #	Frequency (MHz)	Reading on Spectr.An. (dBm/Hz)	PPSD for 3kHz BW (dBm)	Voltage on Spectr. An. (dBµV)	E-field @ 3m (dBµV/m)	E-field @ 3m (V/m)	Conducted Power @ DUI (dBm)
1	5742.980	-75.55	-40.75	66.25	104.15	0.161	4.9
18	5788.880	-78.55	-43.75	63.25	101.15	0.114	1.9
35	5794.280	-79.91	-45.11	61.89	99.79	0.098	0.6

Table 2b: **Handset** – Conducted Power Spectral Density Test Data – Results and Limits

Channel #	Frequency (MHz)	Conducted Power @ 3kHz Bandwidth (dBm)	Limit (dBm)	Margin (dB)	Pass/Fail
1	5742.980	4.9	8.0	3.1	Pass
18	5788.880	1.9	8.0	6.1	Pass
35	5794.280	0.6	8.0	7.4	Pass

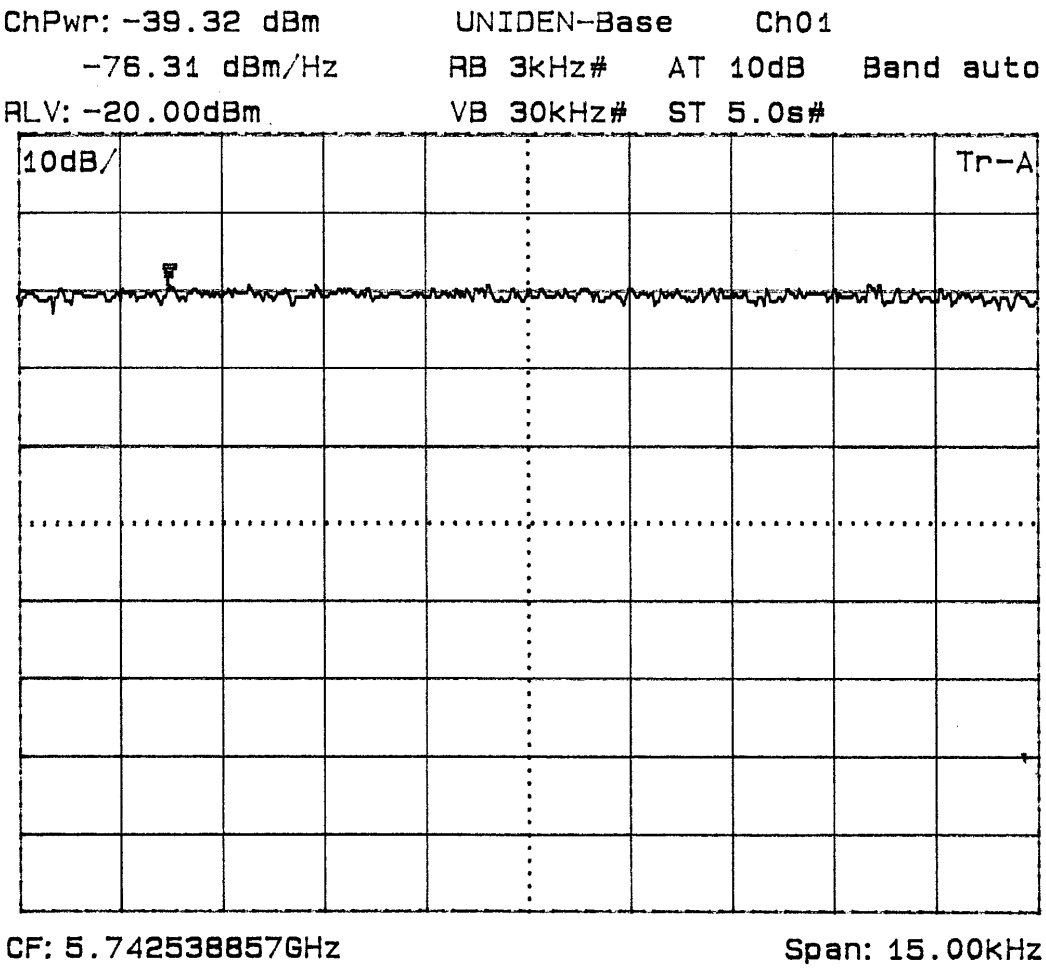
Test performed by: _____ **Date:** June , 2002

Graph 1a



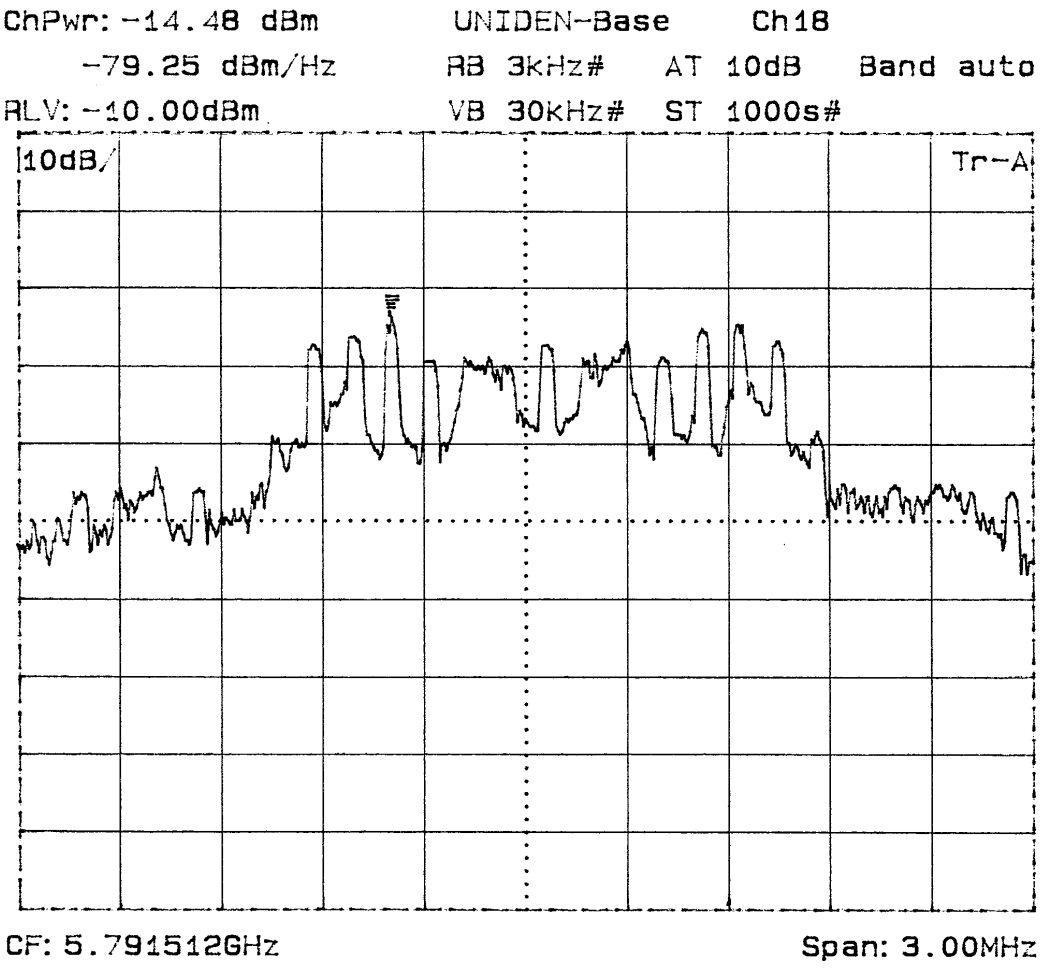
Peak Power Spectral Density
UNIDEN – Base Unit
Channel: 01
Transmitting Frequency: 5742.980 MHz
Resolution Bandwith: 3.0 kHz
Video Bandwith: 30.0 kHz
Span: 3.0 MHz
Sweep Time: 1000 seconds

Graph 1b



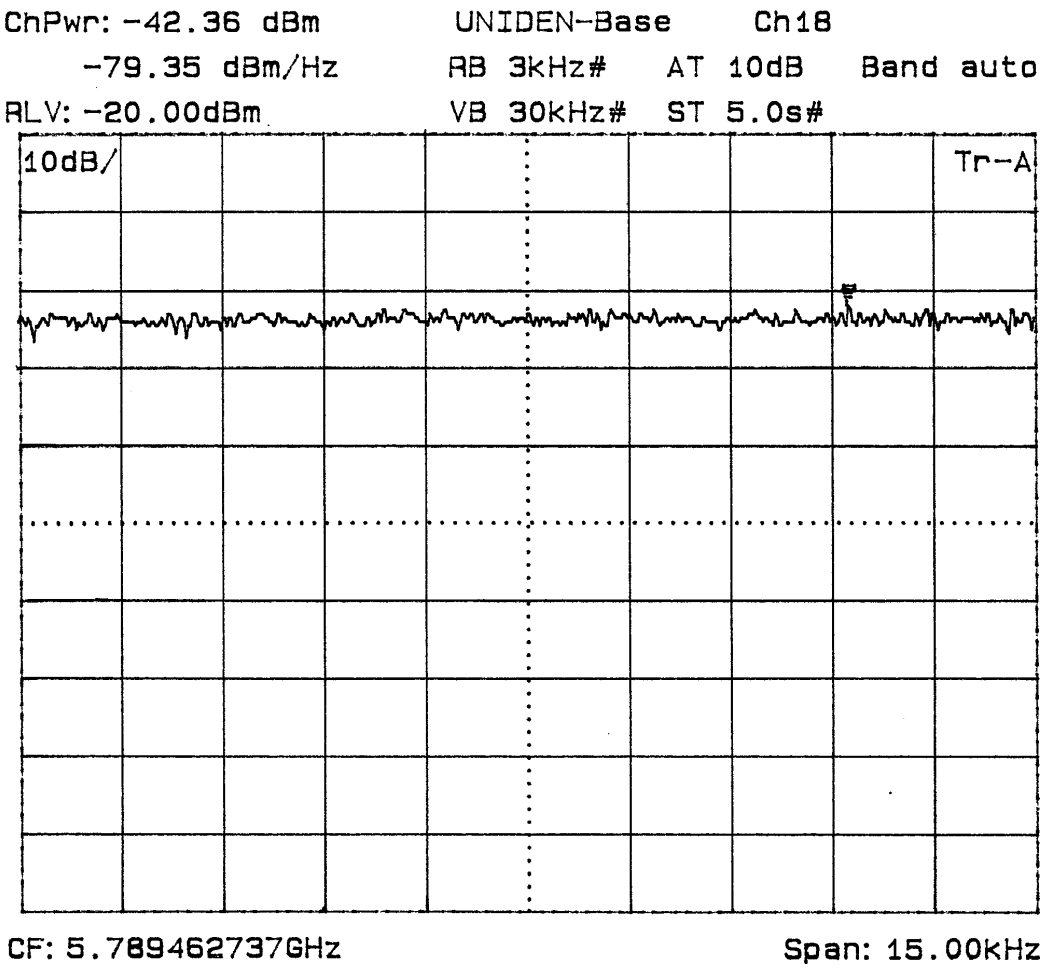
Peak Power Spectral Density
UNIDEN – Base Unit
Channel: 01
Transmitting Frequency: 5742.980 MHz
Resolution Bandwith: 3.0 kHz
Video Bandwith: 30.0 kHz
Span: 15.0 kHz
Sweep Time: 5 seconds

Graph 2a



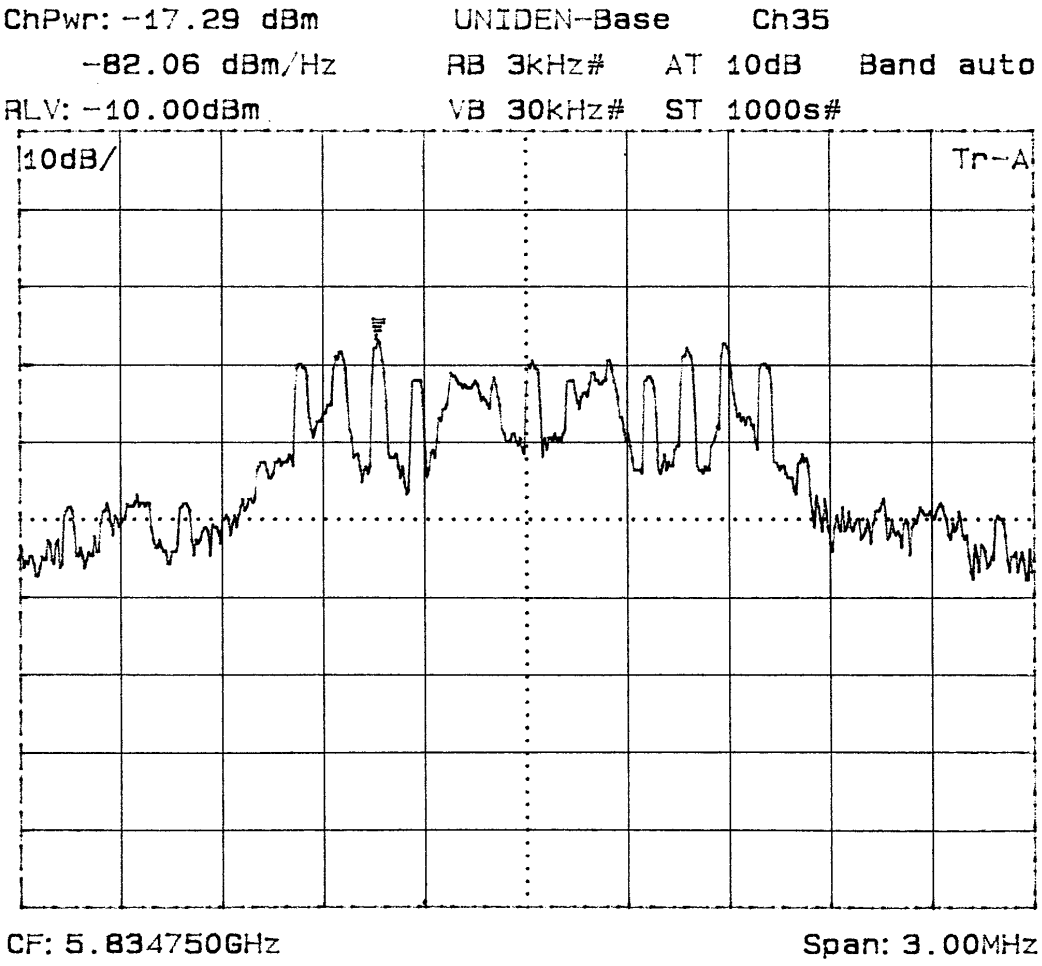
Peak Power Spectral Density
UNIDEN – Base Unit
Channel: 18
Transmitting Frequency: 5788.880 MHz
Resolution Bandwith: 3.0 kHz
Video Bandwith: 30.0 kHz
Span: 3.0 MHz
Sweep Time: 1000 seconds

Graph 2b



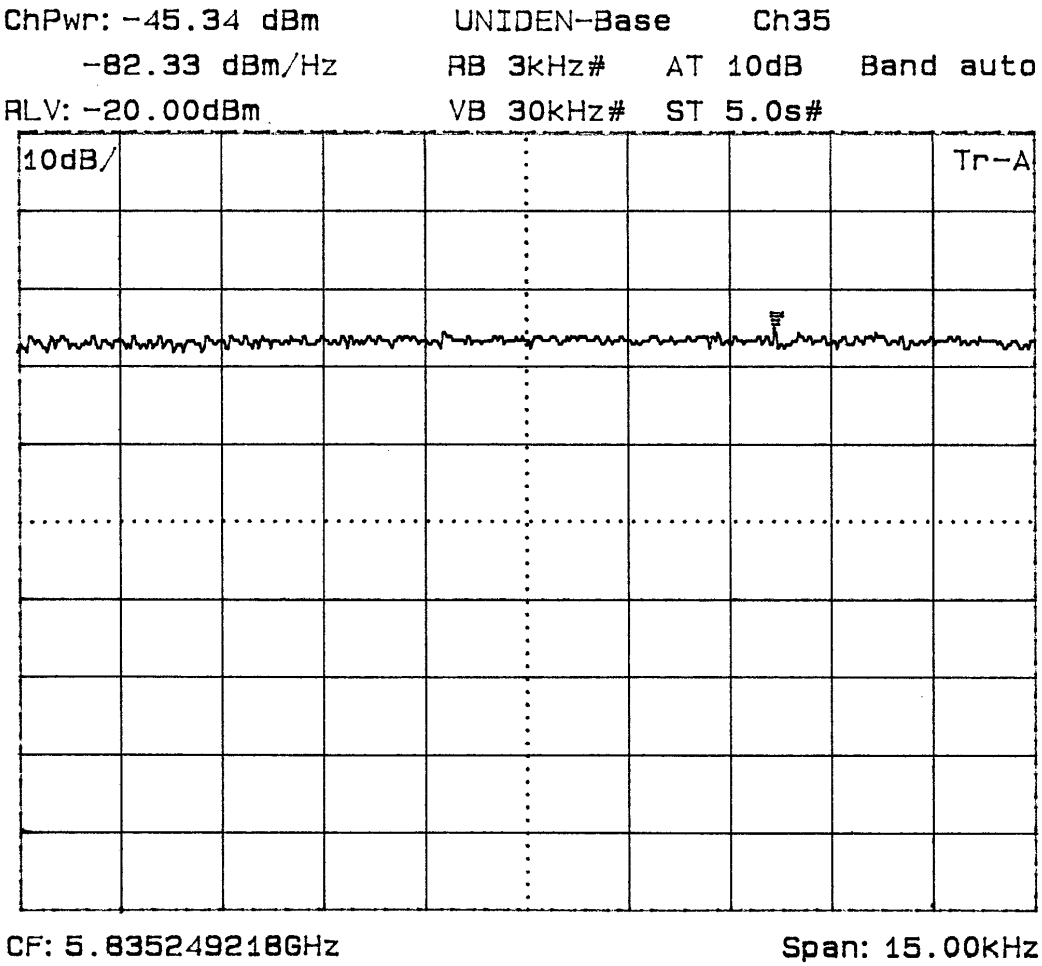
Peak Power Spectral Density
UNIDEN – Base Unit
Channel: 18
Transmitting Frequency: 5788.880 MHz
Resolution Bandwith: 3.0 kHz
Video Bandwith: 30.0 kHz
Span: 15.0 kHz
Sweep Time: 5 seconds

Graph 3a



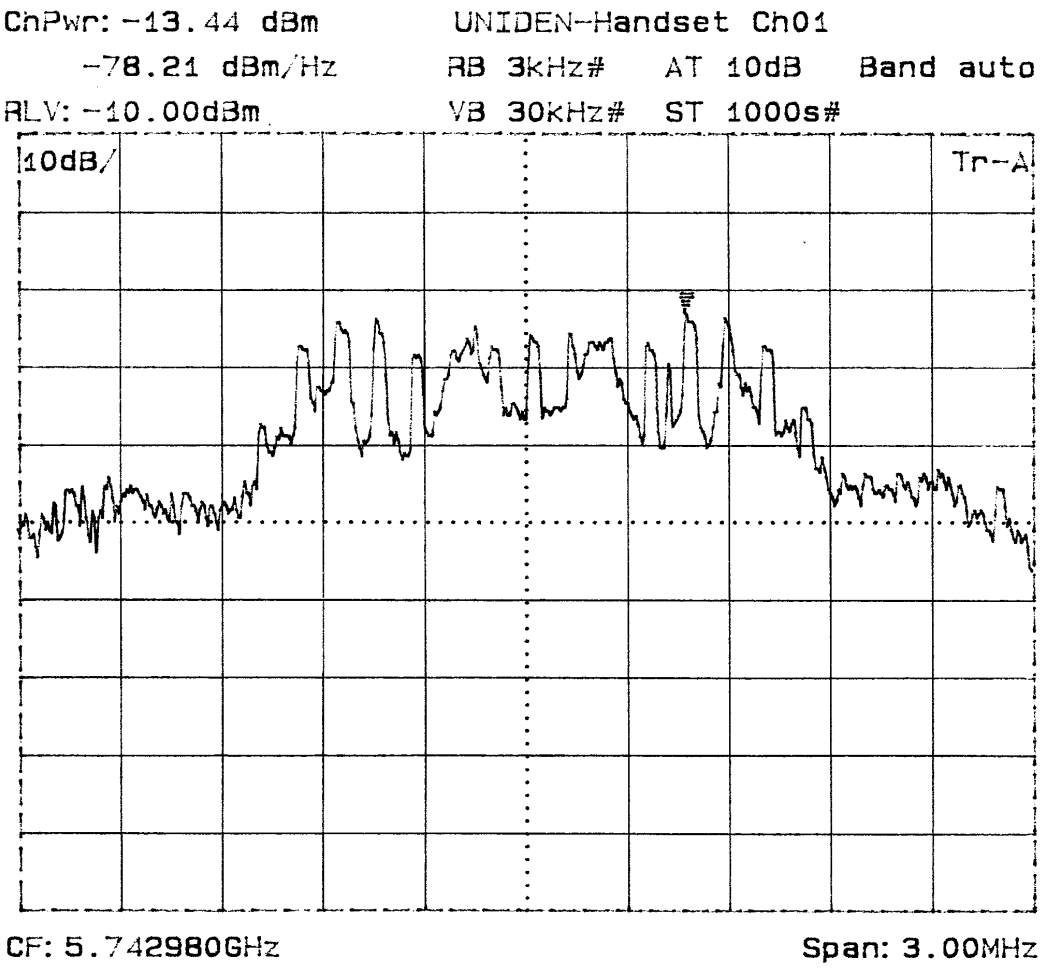
Peak Power Spectral Density
UNIDEN – Base Unit
Channel: 35
Transmitting Frequency: 5834.780 MHz
Resolution Bandwith: 3.0 kHz
Video Bandwith: 30.0 kHz
Span: 3.0 MHz
Sweep Time: 1000 seconds

Graph 3b



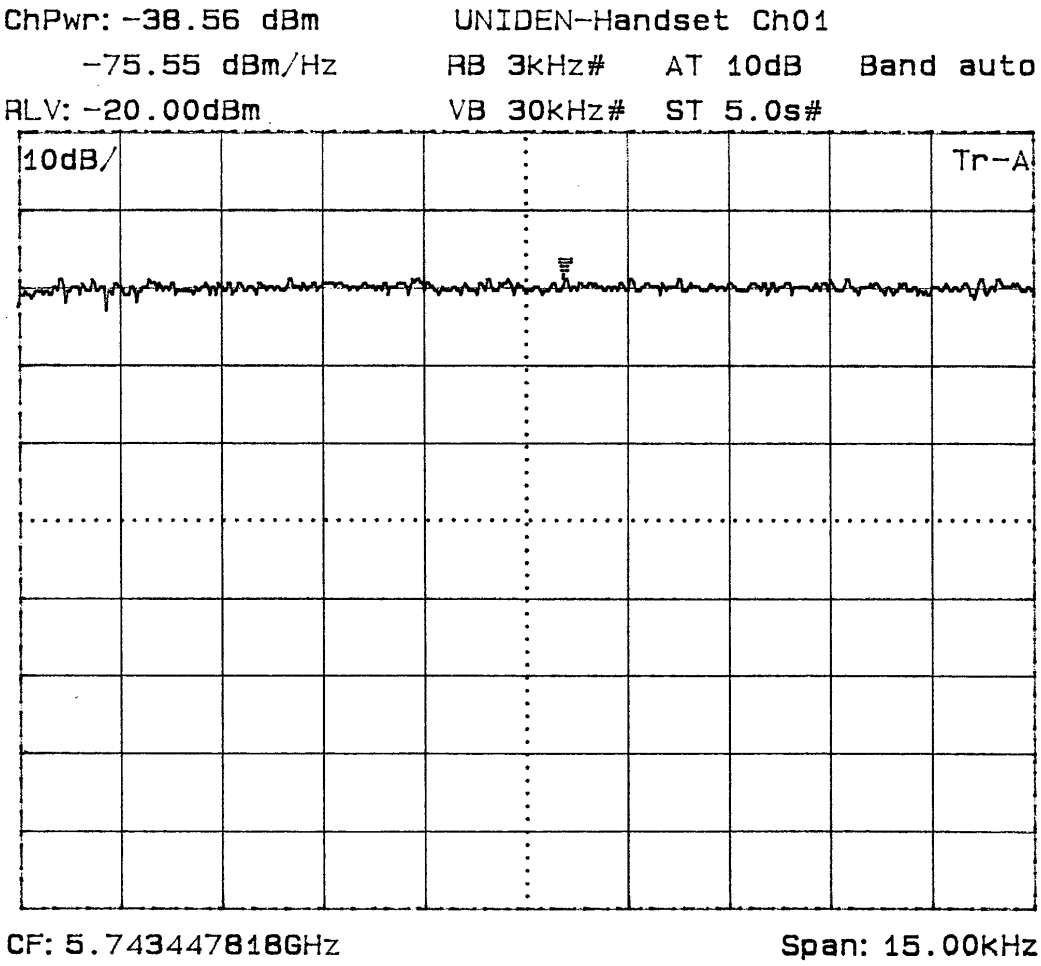
Peak Power Spectral Density
UNIDEN – Base Unit
Channel: 35
Transmitting Frequency: 5834.780 MHz
Resolution Bandwith: 3.0 kHz
Video Bandwith: 30.0 kHz
Span: 15.0 kHz
Sweep Time: 5 seconds

Graph 4a



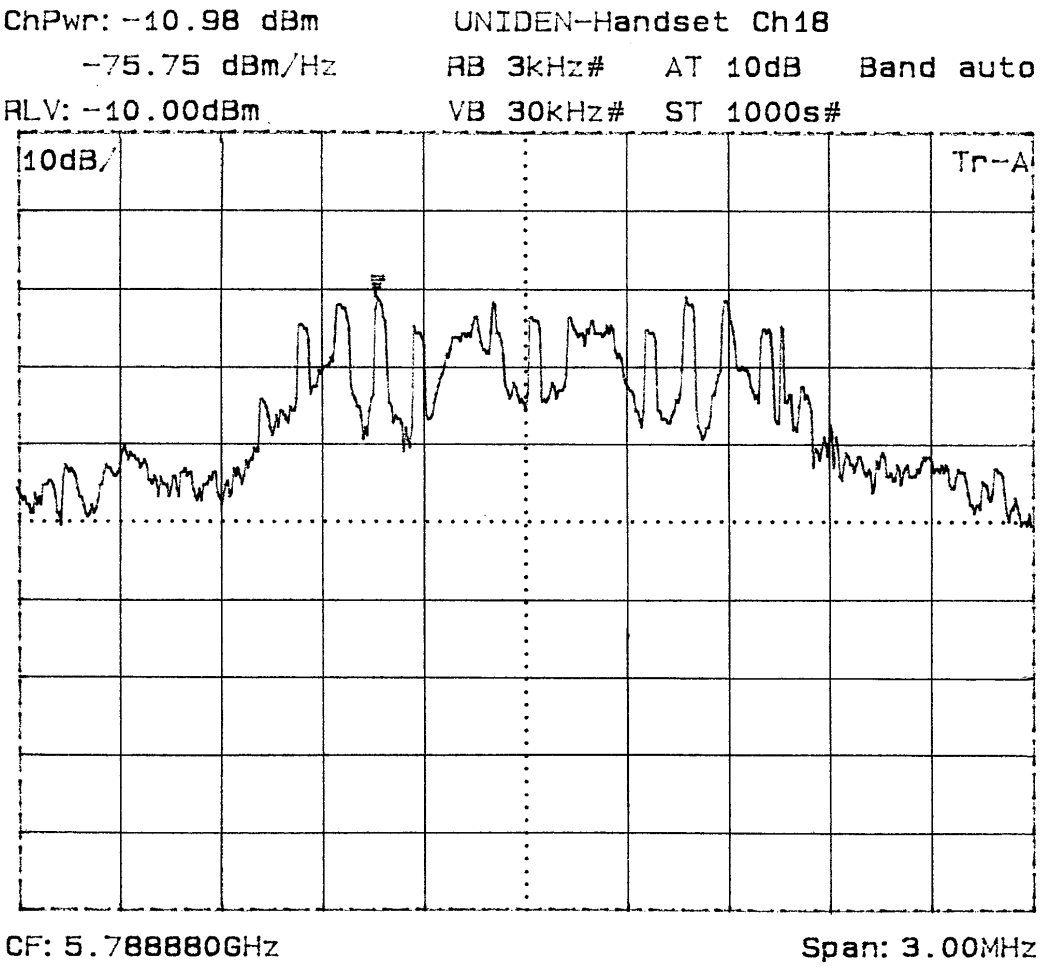
Peak Power Spectral Density
UNIDEN – Handset
Channel: 01
Transmitting Frequency: 5742.980 MHz
Resolution Bandwith: 3.0 kHz
Video Bandwith: 30.0 kHz
Span: 3.0 MHz
Sweep Time: 1000 seconds

Graph 4b



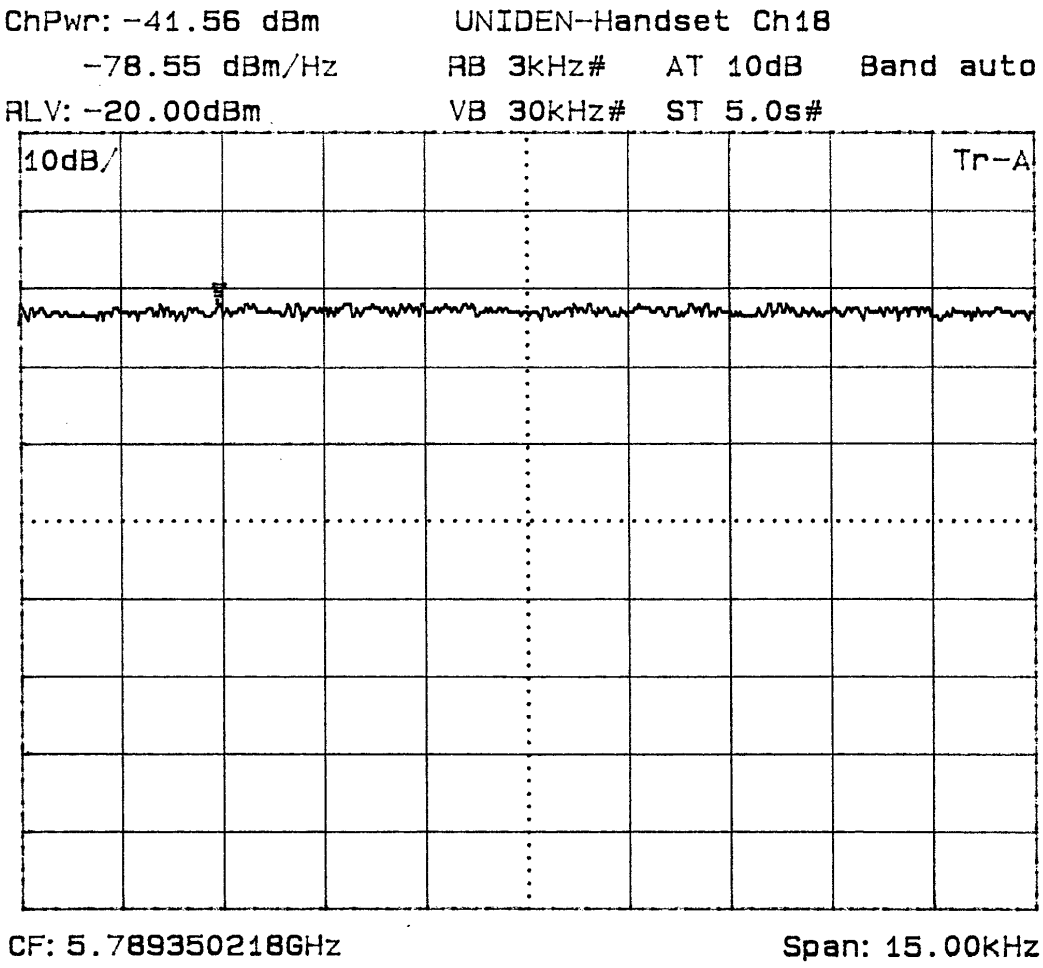
Peak Power Spectral Density
UNIDEN – Handset
Channel: 01
Transmitting Frequency: 5742.980 MHz
Resolution Bandwith: 3.0 kHz
Video Bandwith: 30.0 kHz
Span: 15.0 kHz
Sweep Time: 5 seconds

Graph 5a



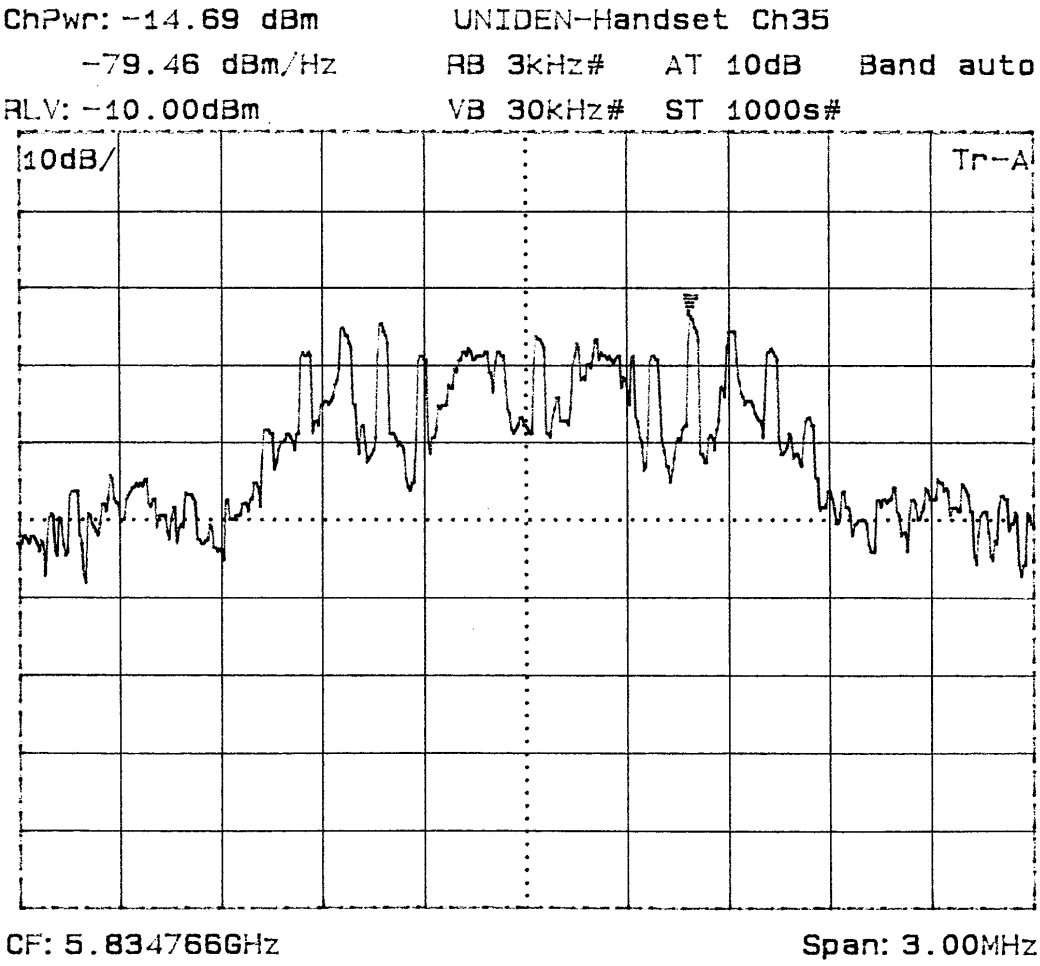
Peak Power Spectral Density
UNIDEN – Handset
Channel: 18
Transmitting Frequency: 5788.880 MHz
Resolution Bandwith: 3.0 kHz
Video Bandwith: 30.0 kHz
Span: 3.0 MHz
Sweep Time: 1000 seconds

Graph 5b



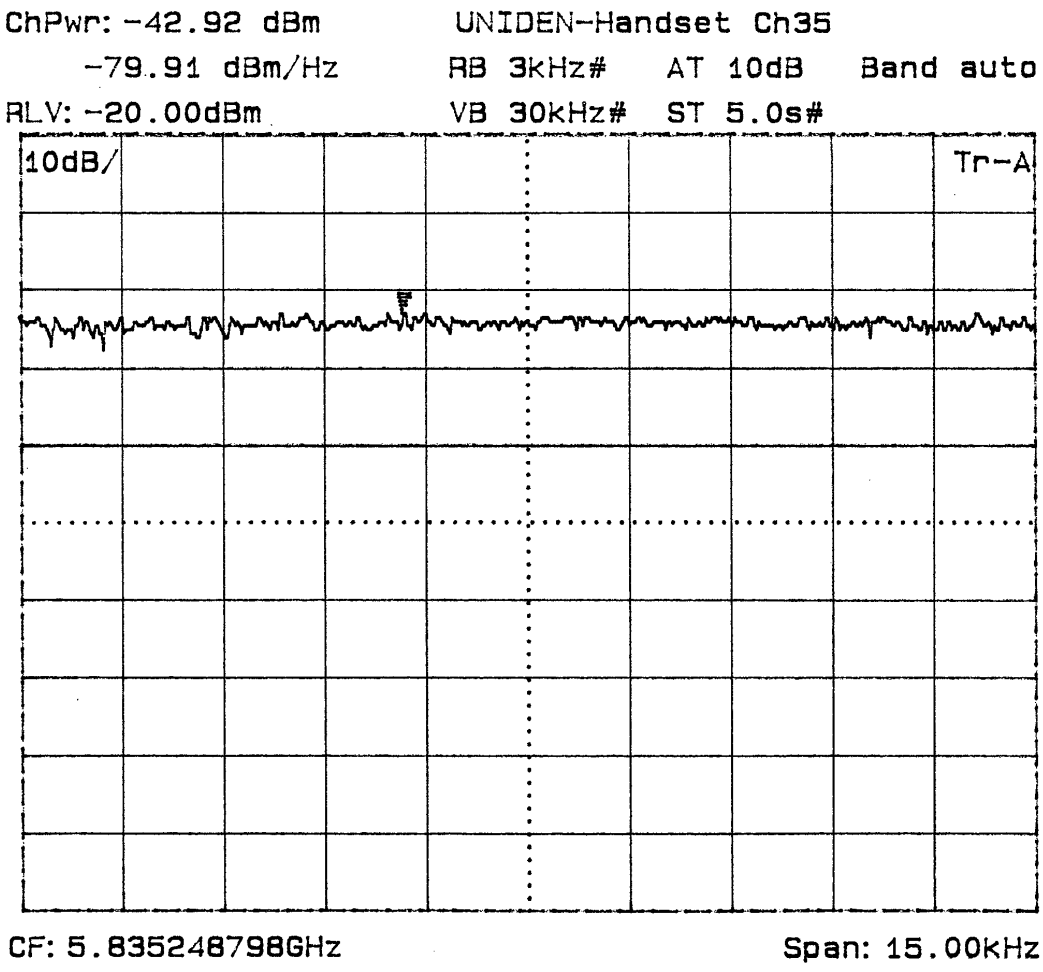
Peak Power Spectral Density
UNIDEN – Handset
Channel: 18
Transmitting Frequency: 5788.880 MHz
Resolution Bandwith: 3.0 kHz
Video Bandwith: 30.0 kHz
Span: 15.0 kHz
Sweep Time: 5 seconds

Graph 6a



Peak Power Spectral Density
UNIDEN – Handset
Channel: 35
Transmitting Frequency: 5834.780 MHz
Resolution Bandwith: 3.0 kHz
Video Bandwith: 30.0 kHz
Span: 3.0 MHz
Sweep Time: 1000 seconds

Graph 6b



Peak Power Spectral Density
UNIDEN – Handset
Channel: 35
Transmitting Frequency: 5834.780 MHz
Resolution Bandwith: 3.0 kHz
Video Bandwith: 30.0 kHz
Span: 15.0 kHz
Sweep Time: 5 seconds

Conclusion: Pass.

Block Diagram

Pictures of the testing set-up:

Uniden - Base unit
Testing Peak Power Spectral Density - Radiated

Uniden - Handset
Testing Peak Power Spectral Density - Radiated