

RF Power Output as Radiated (EIRP)
FCC Part 15.247(b)(1)
Of Direct Sequence Spread Spectrum System
UNIDEN America Corporation
Cordless Phone
TRU5885(xx)/UC789BH

Section c

APREL Project No.: UESB-TRU5885-cordless phone-3907

Test: Maximum Peak Output RF Power as Radiated (EIRP)

Ref.: FCC Part 15.247(b)(1)**Criteria:** The maximum peak output power shall not exceed 1 watt (30 dBm). If directional transmitting antennas with a gain of more than 6 dB are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dB.**Condition:** Radiated Test**Procedure:** Power Measurement by Radiated Method (EIRP):

The maximum peak output power was measured as radiated (using substitution method). The measurement was taken at APREL Laboratory's open area test site (OATS). This open area test site is calibrated to ANSI C63.4 document and a description of the measurement facility is on file with the Federal Communications Commission and is in compliance with the requirement of Section 2.948 of the Commissions rules and regulations. (FCC File No.: 90416)

The DUI was configured to operate at maximum power and placed on a turntable positioned 3 m away from the calibrated receiving horn antenna, which in turn was connected to the spectrum analyzer.

For each transmitting frequency, the received signal was maximised by rotating the turntable and adjusting the height of the receiving antenna. To obtain the actual Radiated Power, the DUI was then replaced with a calibrated reference antenna. The reference antenna (vertically polarised double-ridged-guide horn antenna with known gain: $G = 7.3 \text{ dBi} = 5.1 \text{ dBd}$ at 5.8 GHz) was placed precisely in the same location as the DUI and oriented with the maximum radiation in the direction of the receiving antenna. It was ensured that the orientation of the rotating table and the height of the receiving antenna were not changed. The signal generator level was adjusted until the peak reading on the spectrum analyzer was identical to that of obtained when the DUI was on the turntable. The two signals were matched by superimposing one signal to the other on the spectrum analyser screen. The reference substitute antenna was then disconnected and the power at the feed-point was measured using an RF power meter. The EIRP (Equivalent Isotropically Radiated Power) was obtained by using isotropic gain of the reference antenna to convert the reading from the power meter, as it was referenced to a horn antenna instead of an isotropic radiator. The process was repeated for two more channels. The measurement was carried out for both – Handheld and Base Unit and for both the highest level of power was measured.

Equipment: See Appendix A.

Set-up: See Figure No. c1.

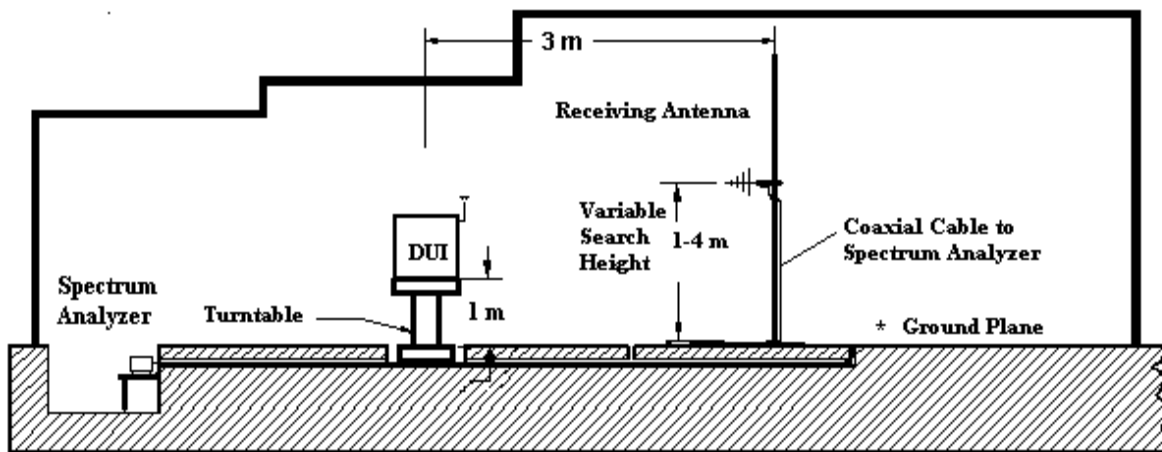


Figure c1: Test set up for the Radiated Power Measurement in OATS (not to scale)



Fig. c1: APREL's OATS (Open Area Test Site)

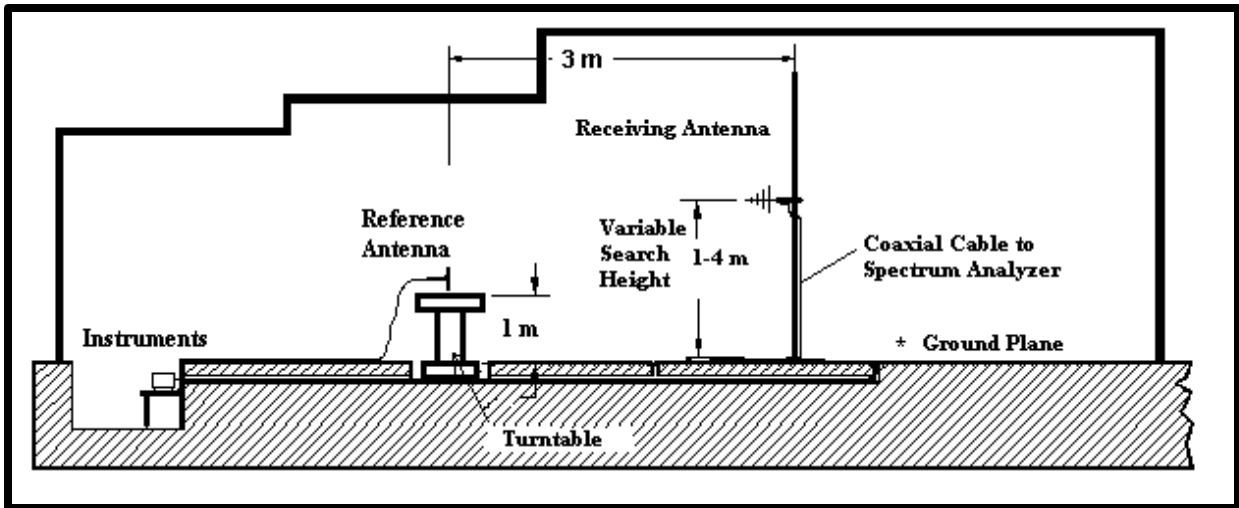


Figure c1 Test set up for the Radiated Power Measurement in OATS (not to scale)
The EUT is replaced by Reference Dipole Antenna.

Table c1.

Maximum Peak Output RF Power: EIRP
BASE UNIT

FREQ (MHz)	Channel	Power Output (dBm)	Power Output (W)	Limit (dBm)	Margin (dB)	Pass/Fail
5742.980	#1	21.2	0.132	30.0	8.8	Pass
5788.880	#18	16.0	0.040	30.0	14.0	Pass
5834.780	#35	13.8	0.024	30.0	16.2	Pass

Note : Measurement taken with Peak Power Meter

Table c2.

Maximum Peak Output RF Power: EIRP
HANDSET

FREQ (MHz)	Channel	Power Output (dBm)	Power Output (W)	Limit (dBm)	Margin (dB)	Pass/Fail
5742.980	#1	20.7	0.118	30.0	9.3	Pass
5788.880	#18	16.9	0.050	30.0	13.1	Pass
5834.780	#35	15.5	0.036	30.0	14.5	Pass

Note : Measurement taken with Peak Power Meter

Test performed by:



Date: June , 2002

Sample Calculation:

Power level of the signal measured at the feed-point of the reference antenna:

$$P_{TX} = 13.9 \text{ dBm}$$

Isotropic gain of the reference antenna: $G_{Isotr} = 7.3 \text{ dBi}$ (at 5.794 GHz)

Equivalent Isotropically Radiated Power:

$$EIRP = P_{TX} + G_{Isotr.}$$

$$EIRP = 13.9 \text{ dBm} + 7.3 \text{ dBi}$$

$$EIRP = 21.2 \text{ dBm} = 0.132 \text{ W}$$

Conclusion: Pass. Since the gain of the built-in antenna specified by manufacturer ($G_{ant} = 4.0 \text{ dBi}$) does not exceed 6.0 dBi there was no need to reduce the output power.

Pictures of Test Setup



**Uniden – Base Unit
EIRP Measurement at OATS**



**Uniden – Handset
EIRP Measurement at OATS**

Peak Power Spectral Density

FCC Part 15.247(d)

Of Direct Sequence Spread Spectrum System

UNIDEN America Corporation
Cordless Phone
TRU5885(xx)/UC789BH

Section d

APREL Project No.: UESB-TRU5885-cordless phone-3907

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 d1

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*, *Antenna Factor* and *Propagation Path Loss*. 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 d1 to d6 and tables d1 and d2). 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:

Spectrum Analyzer Readings:

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

Signal level at antenna port:

$$\begin{aligned} P_{ANT} &= P_{Spec.Analyzer} + \text{Cable Loss} \\ P_{ANT} &= -76.3 \text{ dBm/Hz} + 5.7 \text{ dB} = -70.6 \text{ dBm/Hz} \\ V_{ANT} &= P_{ANT} + 107 \text{ dB} = 36.4 \text{ dB}\mu\text{V}/\text{Hz} \end{aligned}$$

E-field at 3 m from DUI:

$$\begin{aligned} E &= V_{ANT} + \text{Antenna Factor} \\ E &= 36.4 \text{ (dB}\mu\text{V/m)/Hz} + 32.2 \text{ dB} = 68.6 \text{ (dB}\mu\text{V/m)/Hz} \end{aligned}$$

Isotropically Radiated Power Spectral Density on DUI:

$$\begin{aligned} EIRP &= E - 104.8 \text{ dB} + 20 \cdot \log_{10}(d=3\text{m}) \\ EIRP &= 68.6 \text{ (dB}\mu\text{V/m)/Hz} - 104.8 \text{ dB} + 9.5 \text{ dB} = -26.6 \text{ dBm/Hz} \end{aligned}$$

Conducted Peak Power Spectral Density (PPSD) on DUI:

$$PPSD_{Conducted} = EIRP - G_i = -26.6 \text{ dBm/Hz} - 4.0 \text{ dBi} = -30.6 \text{ dBm/Hz}$$

Correction for 3 kHz bandwidth:

$$\begin{aligned} PPSD_{Conducted} &= -30.6 \text{ dBm/Hz} + 10 \cdot \log_{10}(3000 \text{ Hz}) \\ PPSD_{Conducted} &= -30.6 \text{ dBm/Hz} + 34.8 \text{ dB} = 4.2 \text{ dBm/3 kHz} \end{aligned}$$

Test Results: See Test Data, See Graphs d1 - d6

**Power Spectral Density
Test Data**

Table d1: Base Unit

Channel #	Frequency (MHz)	Power Density Measurements (dBm/3kHz)	Limit (dBm/3kHz)	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	-1.8	8.0	9.8	Pass

**Power Spectral Density
Calculation for Above**

Table d2: Base Unit

Channel #	Frequency (MHz)	Reading on Spectr. An. (dBm/Hz)	Voltage @ Ant. Port (dBμV/Hz)	E-field @ 3m ((dBμV/m)/Hz)	EIRP PPSD (dBm/Hz)	Conducted PPSD (dBm/Hz)	Conducted PPSD (dBm/3kHz)
1	5742.980	-76.31	36.4	68.6	-26.6	-30.6	4.2
18	5788.880	-79.35	33.3	65.6	-29.6	-33.6	1.1
35	5794.280	-82.33	30.4	62.8	-32.6	-36.6	-1.8

Test performed by: K. Alise Roman Date: June, 2002

Test Results: See Test Data, See Graphs d7 - d12

**Power Spectral Density
Test Data**

Table d2: Handset

Channel #	Frequency (MHz)	Power Density Measurements (dBm/3kHz)	Limit (dBm/3kHz)	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

**Power Spectral Density
Calculation for above**

Table d3: Handset

Channel #	Frequency (MHz)	Reading on Spectr.An. (dBm/Hz)	Voltage @ Ant. Port (dB μ V/Hz)	E-field @ 3m ((dB μ V/m)/Hz)	EIRP PPSD (dBm/Hz)	Conducted PPSD (dBm/Hz)	Conducted PPSD (dBm/3kHz)
1	5742.980	-75.55	37.1	69.4	-25.8	-29.8	4.9
18	5788.880	-78.55	34.1	66.4	-28.8	-32.8	1.9
35	5794.280	-79.91	32.8	65.0	-30.2	-34.2	0.6

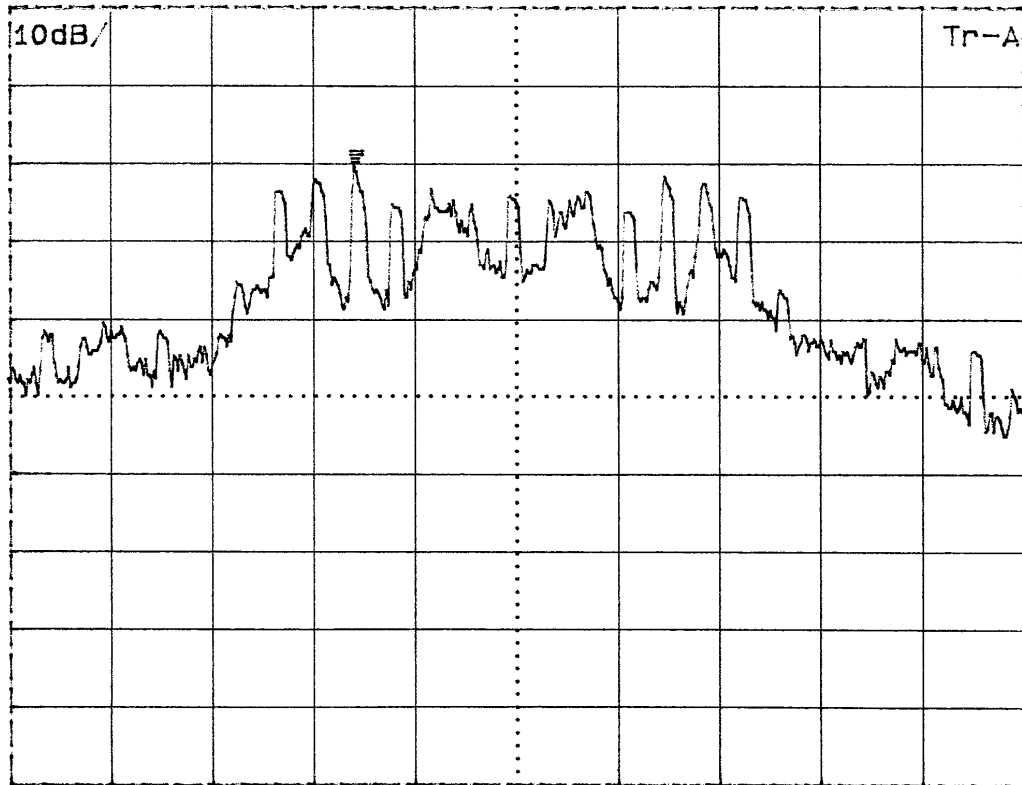
Test performed by:

Kulika Roman

Date: June, 2002

Graph d1

ChPwr: -11.43 dBm UNIDEN-Base Ch01
 -76.20 dBm/Hz RB 3kHz# AT 10dB Band auto
 RLV: -10.00dBm VB 30kHz# ST 1000s#



CF: 5.742990GHz

Span: 3.00MHz

Peak Power Spectral Density

UNIDEN – Base Unit

Channel: 01

Transmitting Frequency: 5742.980 MHz

Resolution Bandwidth: 3.0 kHz

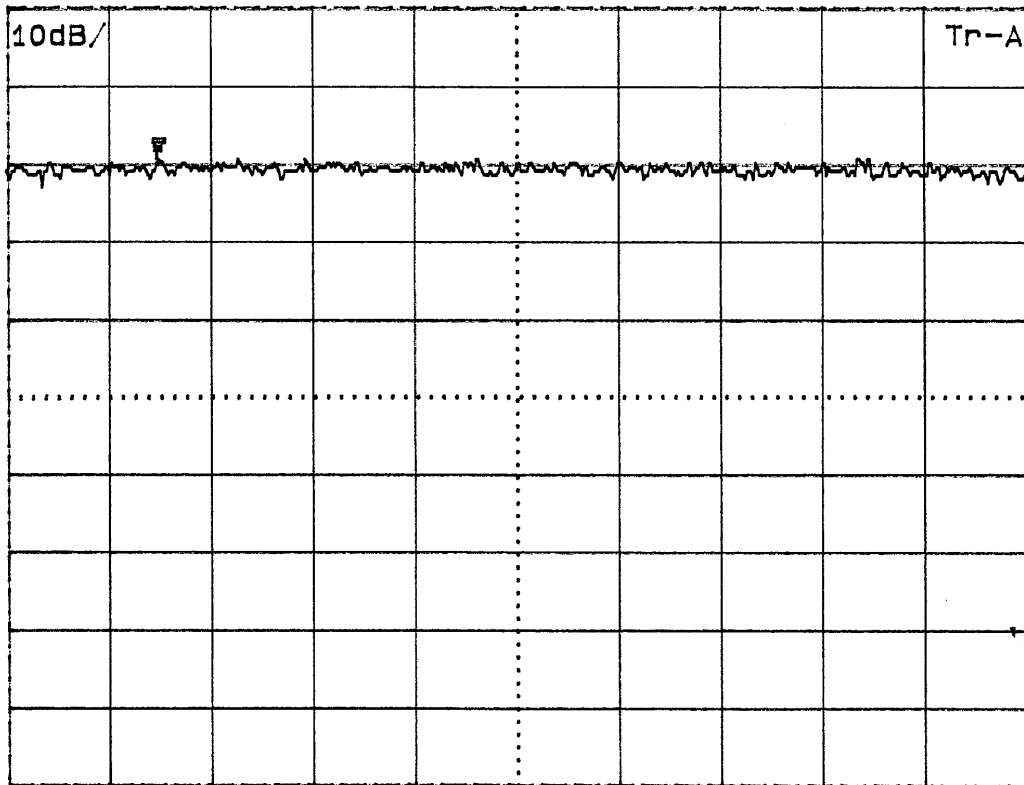
Video Bandwidth: 30.0 kHz

Span: 3.0 MHz

Sweep Time: 1000 seconds

Graph d2

ChPwr: -39.32 dBm UNIDEN-Base Ch01
 -76.31 dBm/Hz RB 3kHz# AT 10dB Band auto
 RLV: -20.00dBm VB 30kHz# ST 5.0s#



CF: 5.742538857GHz

Span: 15.00kHz

Peak Power Spectral Density

UNIDEN – Base Unit

Channel: 01

Transmitting Frequency: 5742.980 MHz

Resolution Bandwidth: 3.0 kHz

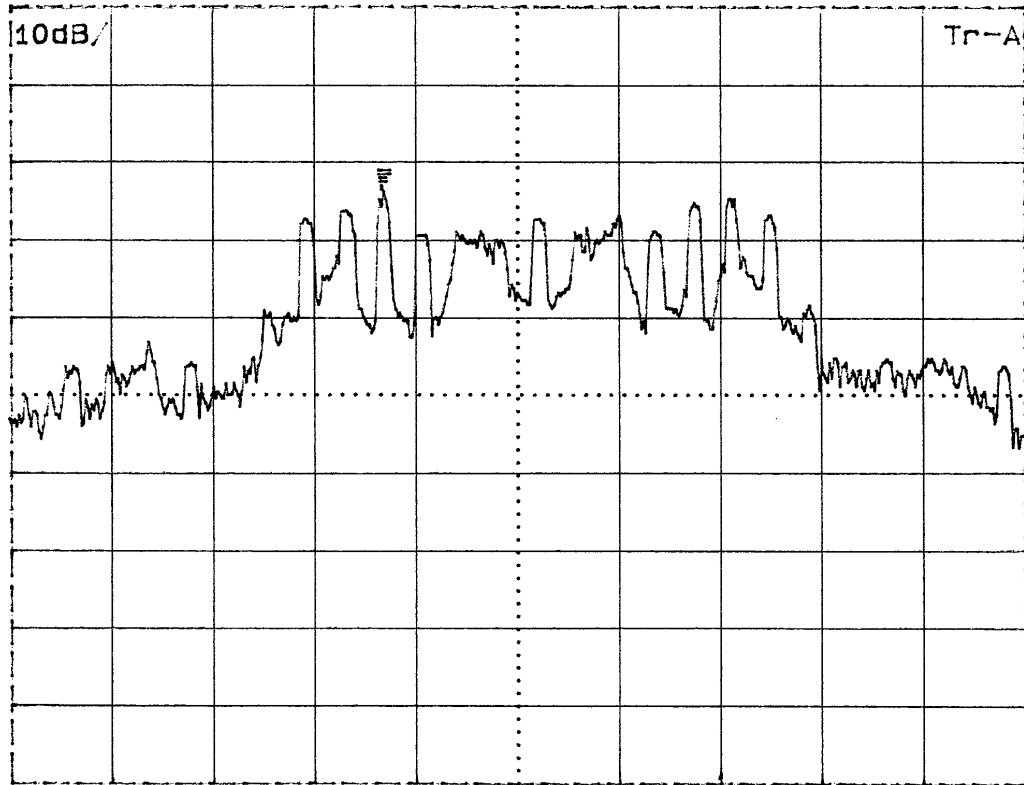
Video Bandwidth: 30.0 kHz

Span: 15.0 kHz

Sweep Time: 5 seconds

Graph d3

ChPwr: -14.48 dBm UNIDEN-Base Ch18
 -79.25 dBm/Hz RB 3kHz# AT 10dB Band auto
 RLV: -10.00dBm VB 30kHz# ST 1000s#



CF: 5.791512GHz

Span: 3.00MHz

Peak Power Spectral Density

UNIDEN – Base Unit

Channel: 18

Transmitting Frequency: 5788.880 MHz

Resolution Bandwidth: 3.0 kHz

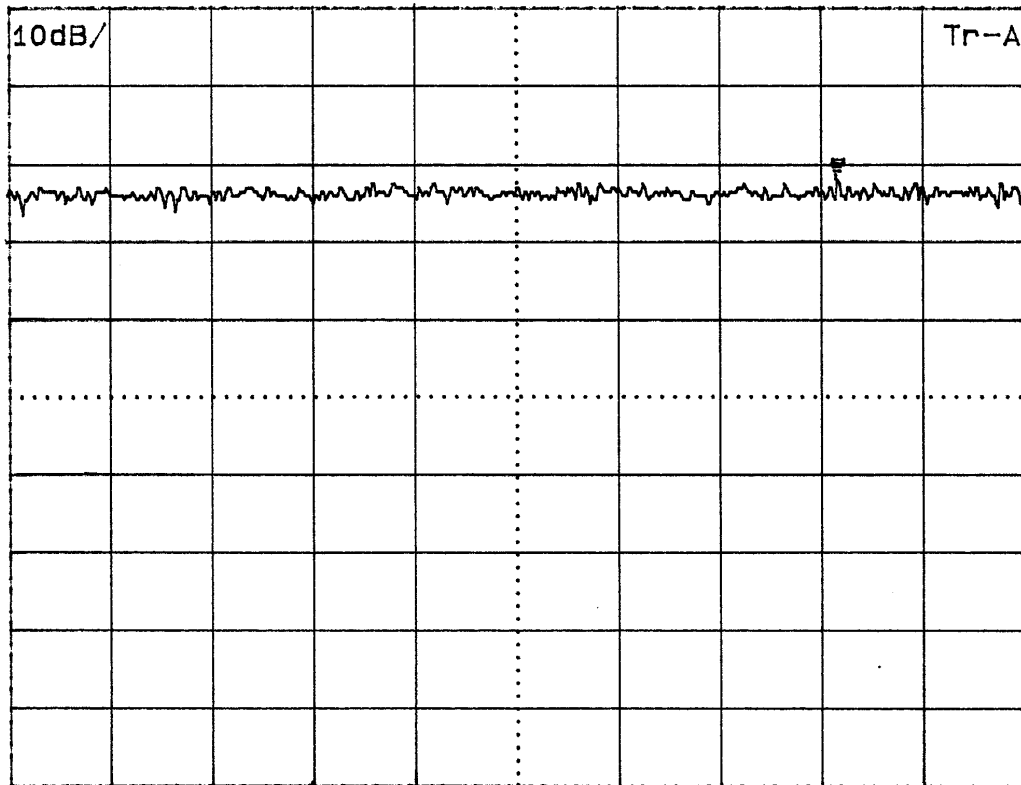
Video Bandwidth: 30.0 kHz

Span: 3.0 MHz

Sweep Time: 1000 seconds

Graph d4

ChPwr: -42.36 dBm UNIDEN-Base Ch18
 -79.35 dBm/Hz RB 3kHz# AT 10dB Band auto
 RLv: -20.00dBm VB 30kHz# ST 5.0s#



CF: 5.789462737GHz

Span: 15.00kHz

Peak Power Spectral Density

UNIDEN – Base Unit

Channel: 18

Transmitting Frequency: 5788.880 MHz

Resolution Bandwidth: 3.0 kHz

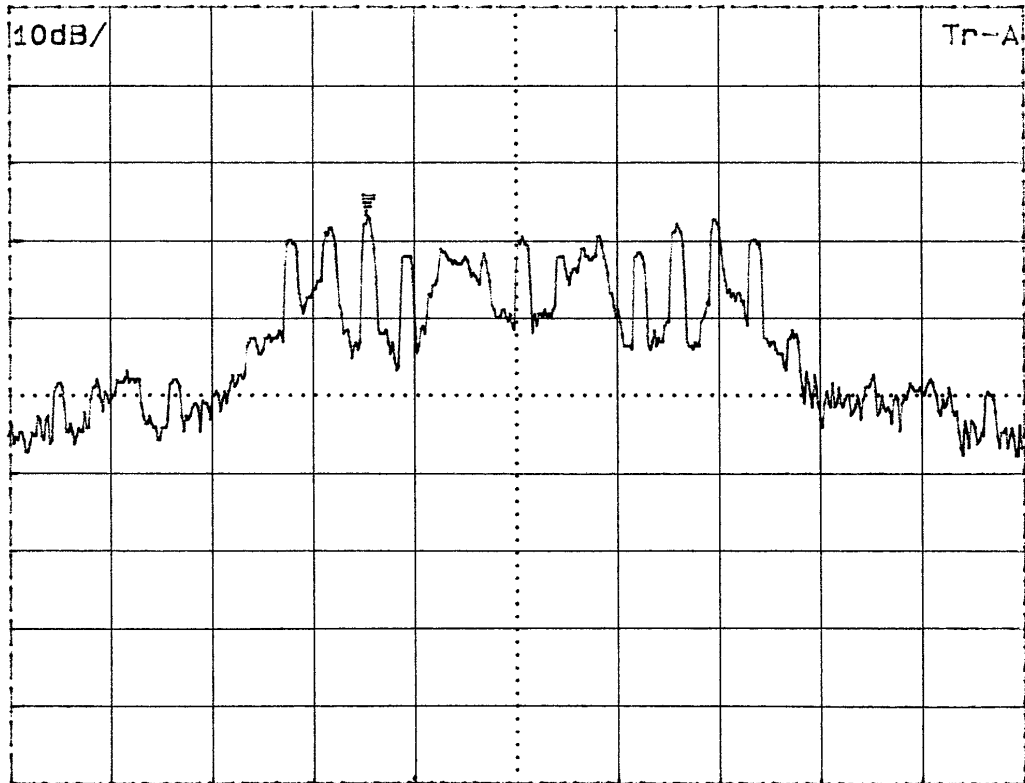
Video Bandwidth: 30.0 kHz

Span: 15.0 kHz

Sweep Time: 5 seconds

Graph d5

ChPwr: -17.29 dBm UNIDEN-Base Ch35
 -82.06 dBm/Hz RB 3kHz# AT 10dB Band auto
 RLV: -10.00dBm VB 30kHz# ST 1000s#



CF: 5.834750GHz

Span: 3.00MHz

Peak Power Spectral Density

UNIDEN – Base Unit

Channel: 35

Transmitting Frequency: 5834.780 MHz

Resolution Bandwidth: 3.0 kHz

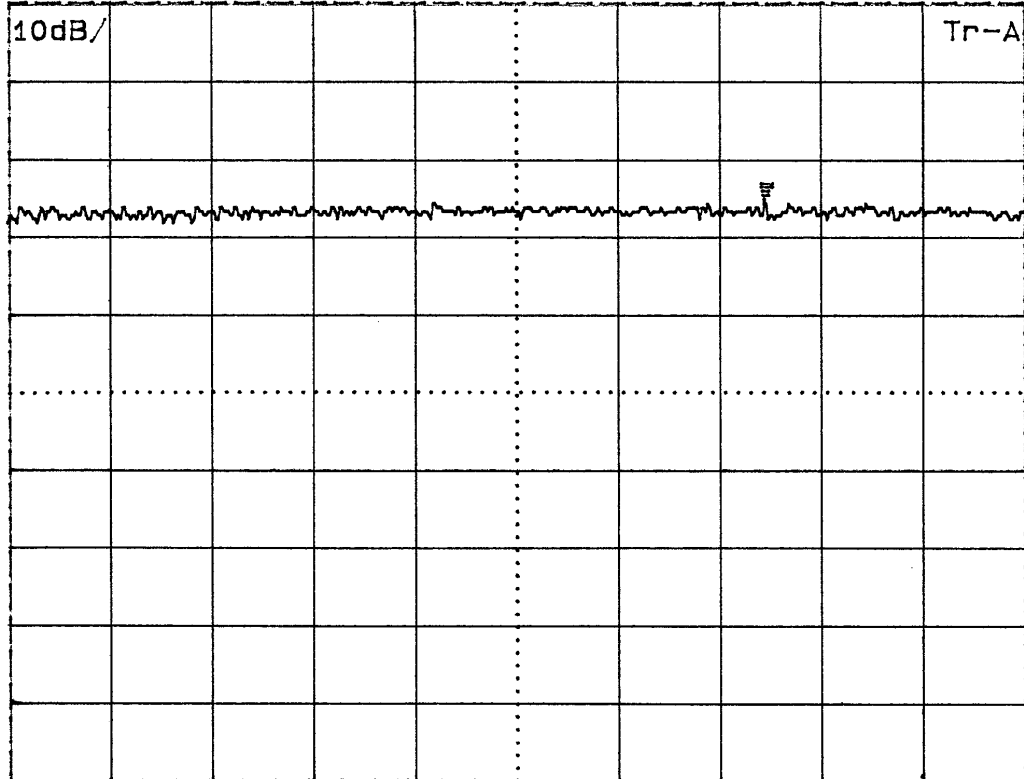
Video Bandwidth: 30.0 kHz

Span: 3.0 MHz

Sweep Time: 1000 seconds

Graph d6

ChPwr: -45.34 dBm UNIDEN-Base Ch35
 -82.33 dBm/Hz RB 3kHz# AT 10dB Band auto
 RLV: -20.00dBm VB 30kHz# ST 5.0s#



CF: 5.835249218GHz

Span: 15.00kHz

Peak Power Spectral Density

UNIDEN – Base Unit

Channel: 35

Transmitting Frequency: 5834.780 MHz

Resolution Bandwidth: 3.0 kHz

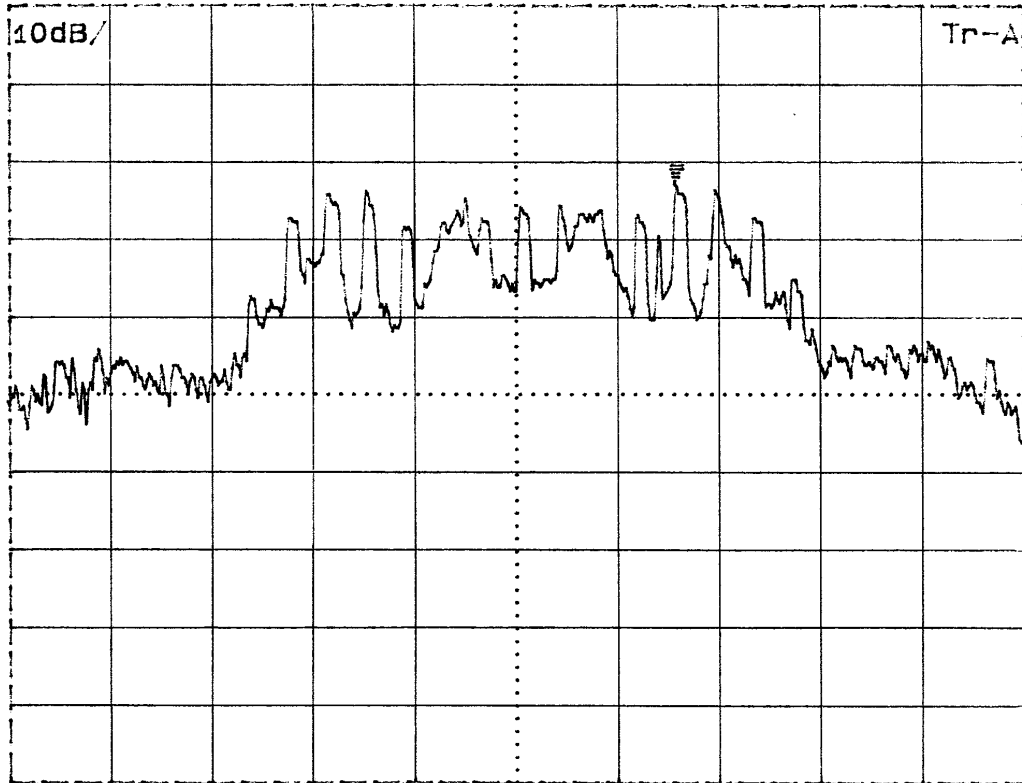
Video Bandwidth: 30.0 kHz

Span: 15.0 kHz

Sweep Time: 5 seconds

Graph d7

ChPwr: -13.44 dBm UNIDEN-Handset Ch01
 -78.21 dBm/Hz RB 3kHz# AT 10dB Band auto
 RLv: -10.00dBm VB 30kHz# ST 1000s#



CF: 5.742980GHz

Span: 3.00MHz

Peak Power Spectral Density

UNIDEN – Handset

Channel: 01

Transmitting Frequency: 5742.980 MHz

Resolution Bandwidth: 3.0 kHz

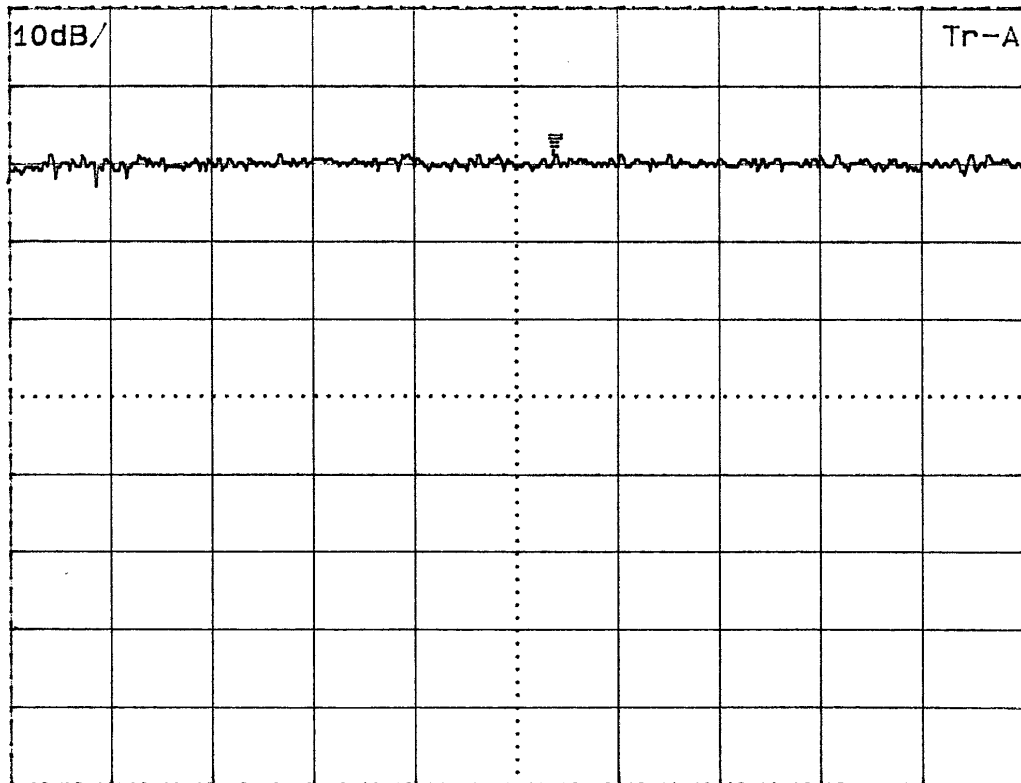
Video Bandwidth: 30.0 kHz

Span: 3.0 MHz

Sweep Time: 1000 seconds

Graph d8

ChPwr: -38.56 dBm UNIDEN-Handset Ch01
 -75.55 dBm/Hz RB 3kHz# AT 10dB Band auto
 RLV: -20.00dBm VB 30kHz# ST 5.0s#



CF: 5.743447818GHz

Span: 15.00kHz

Peak Power Spectral Density

UNIDEN – Handset

Channel: 01

Transmitting Frequency: 5742.980 MHz

Resolution Bandwidth: 3.0 kHz

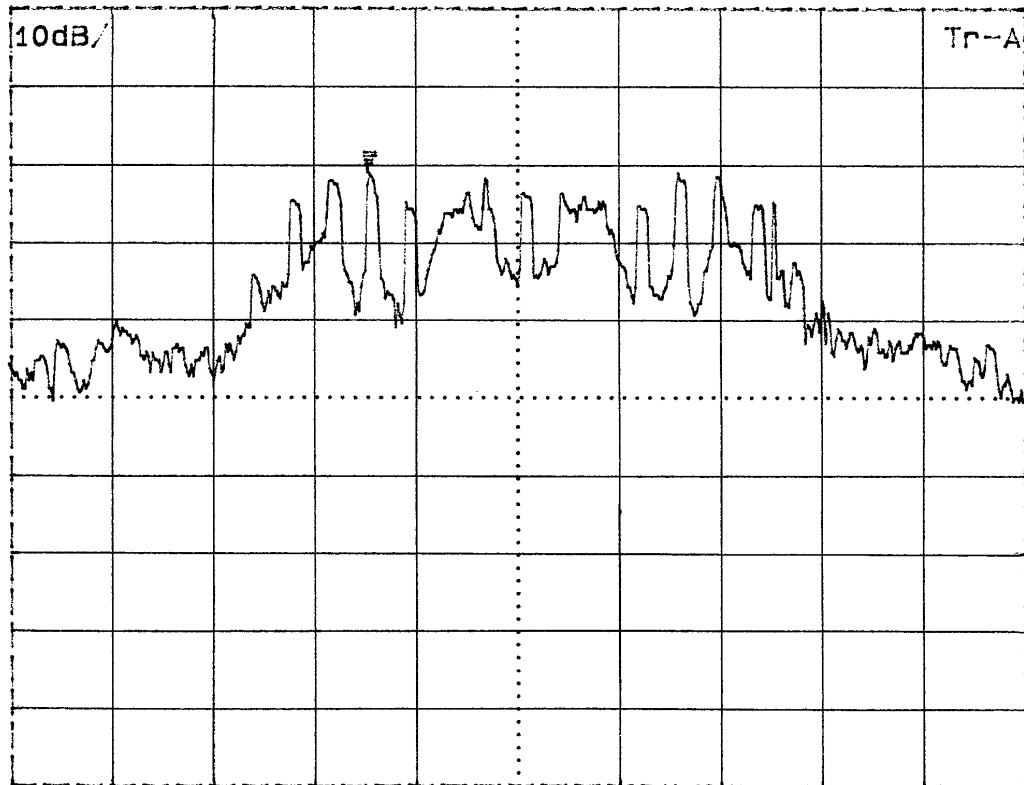
Video Bandwidth: 30.0 kHz

Span: 15.0 kHz

Sweep Time: 5 seconds

Graph d9

ChPwr: -10.98 dBm UNIDEN-Handset Ch18
 -75.75 dBm/Hz RB 3kHz# AT 10dB Band auto
 RLV: -10.00dBm VB 30kHz# ST 1000s#



CF: 5.788880GHz

Span: 3.00MHz

Peak Power Spectral Density

UNIDEN – Handset

Channel: 18

Transmitting Frequency: 5788.880 MHz

Resolution Bandwidth: 3.0 kHz

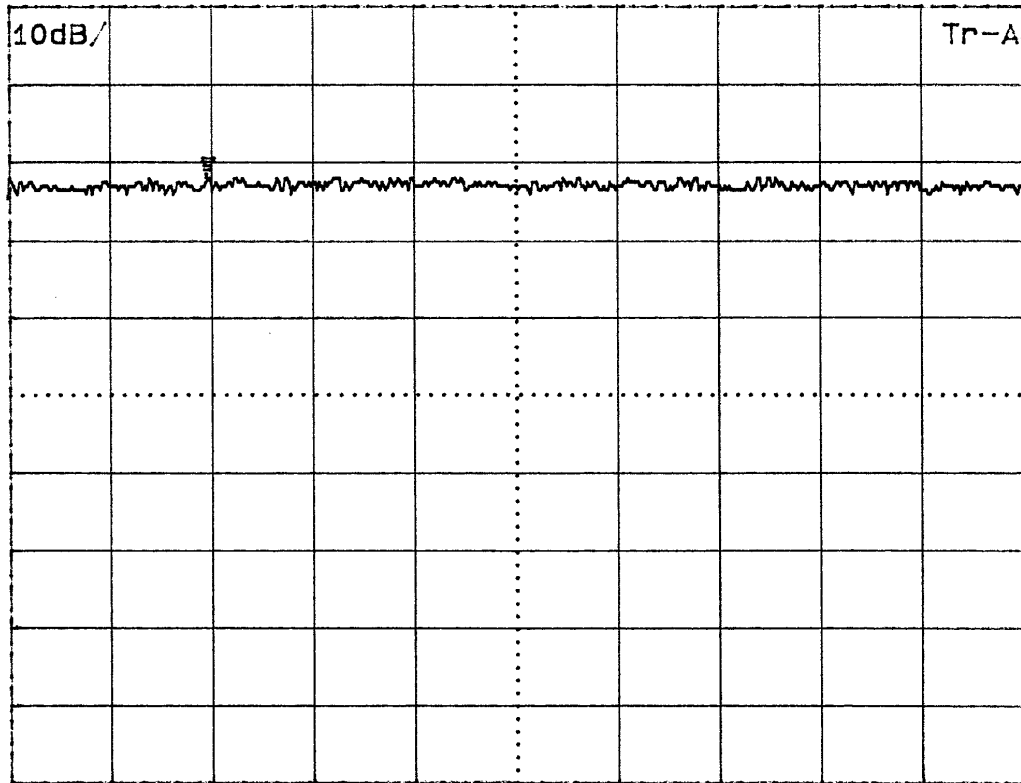
Video Bandwidth: 30.0 kHz

Span: 3.0 MHz

Sweep Time: 1000 seconds

Graph d10

ChPwr: -41.56 dBm UNIDEN-Handset Ch18
 -78.55 dBm/Hz RB 3kHz# AT 10dB Band auto
 RLV: -20.00dBm VB 30kHz# ST 5.0s#



CF: 5.789350218GHz

Span: 15.00kHz

Peak Power Spectral Density

UNIDEN – Handset

Channel: 18

Transmitting Frequency: 5788.880 MHz

Resolution Bandwidth: 3.0 kHz

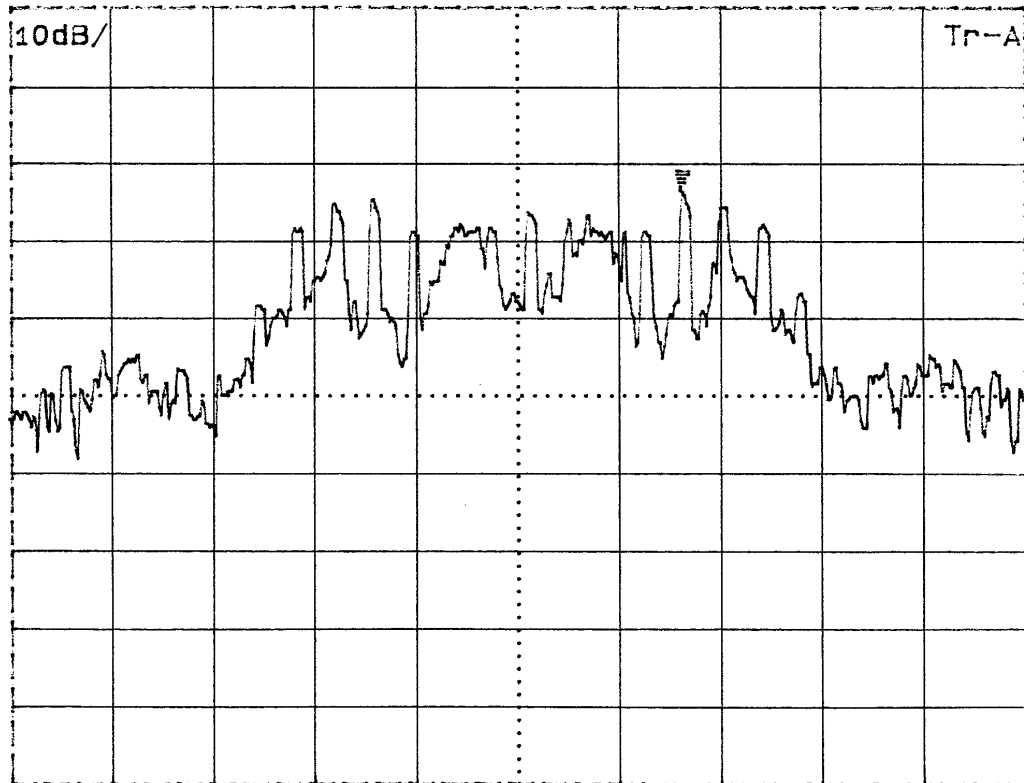
Video Bandwidth: 30.0 kHz

Span: 15.0 kHz

Sweep Time: 5 seconds

Graph d11

ChPwr: -14.69 dBm UNIDEN-Handset Ch35
 -79.46 dBm/Hz RB 3kHz# AT 10dB Band auto
 RLV: -10.00dBm VB 30kHz# ST 1000s#



CF: 5.834766GHz

Span: 3.00MHz

Peak Power Spectral Density

UNIDEN – Handset

Channel: 35

Transmitting Frequency: 5834.780 MHz

Resolution Bandwidth: 3.0 kHz

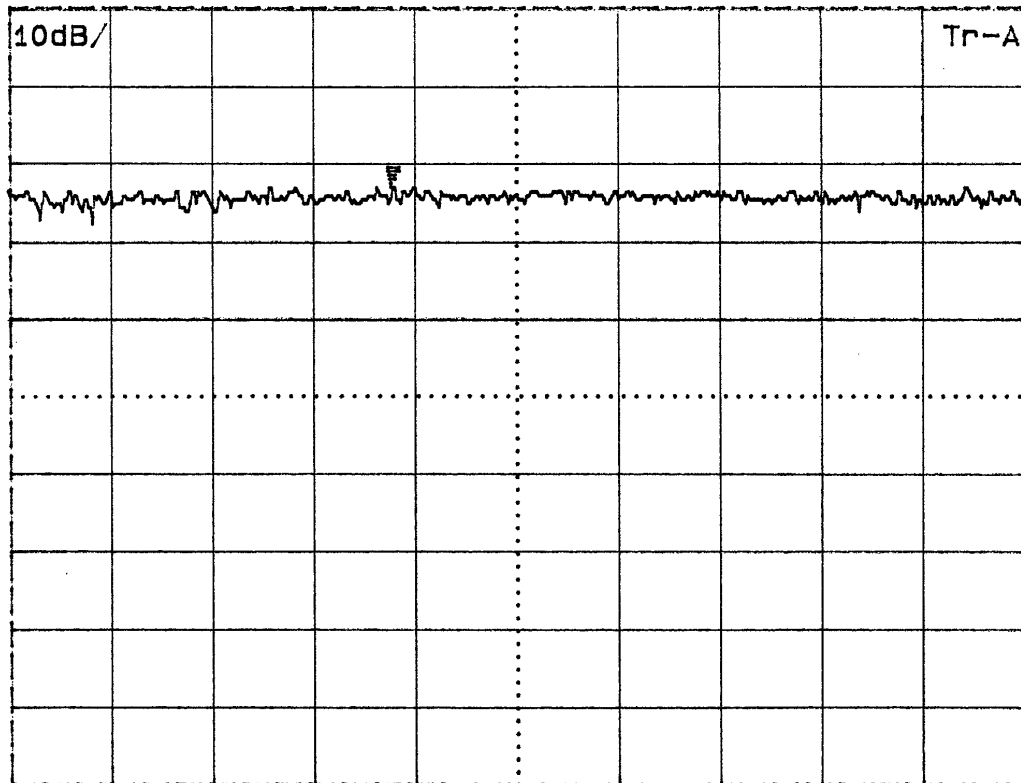
Video Bandwidth: 30.0 kHz

Span: 3.0 MHz

Sweep Time: 1000 seconds

Graph d12

ChPwr: -42.92 dBm UNIDEN-Handset Ch35
 -79.91 dBm/Hz RB 3kHz# AT 10dB Band auto
 RLv: -20.00dBm VB 30kHz# ST 5.0s#



CF: 5.835248798GHz

Span: 15.00kHz

Peak Power Spectral Density

UNIDEN – Handset

Channel: 35

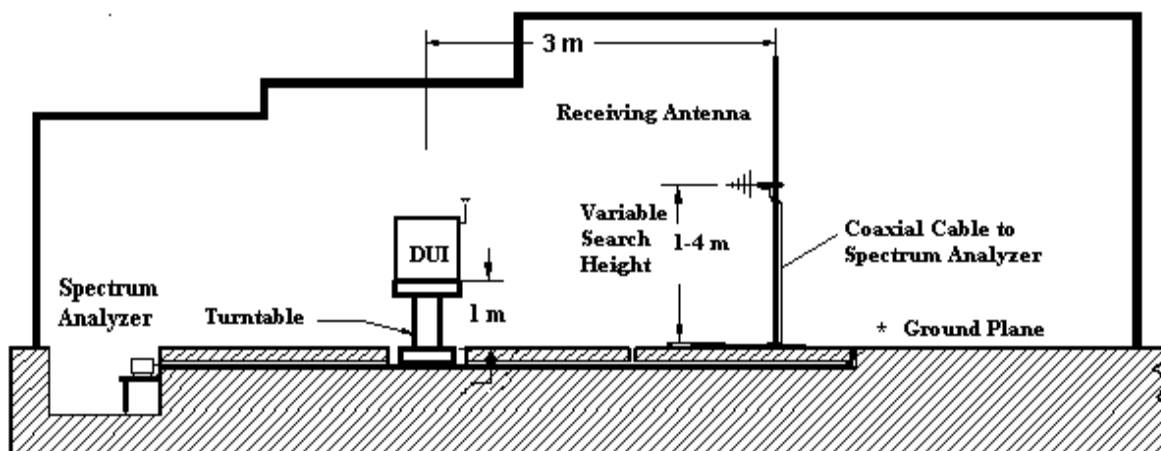
Transmitting Frequency: 5834.780 MHz

Resolution Bandwidth: 3.0 kHz

Video Bandwidth: 30.0 kHz

Span: 15.0 kHz

Sweep Time: 5 seconds



Block Diagram

Conclusion: Pass.

Pictures of the testing set-up:



Uniden - Base unit
Testing Peak Power Spectral Density - Radiated



Uniden - Handset
Testing Peak Power Spectral Density - Radiated