High Speed Power Measurement

Oct.20.2011

Outline:

This is a sample software where RF signal parameters are measured with external PC by using OPTION:53-56 (Time Domain Analysis). As a result, 7 or 8 times the speed measurement can be expected compared with standard SPA. (SPA: Spectrum Analyzer)

Measurement items:

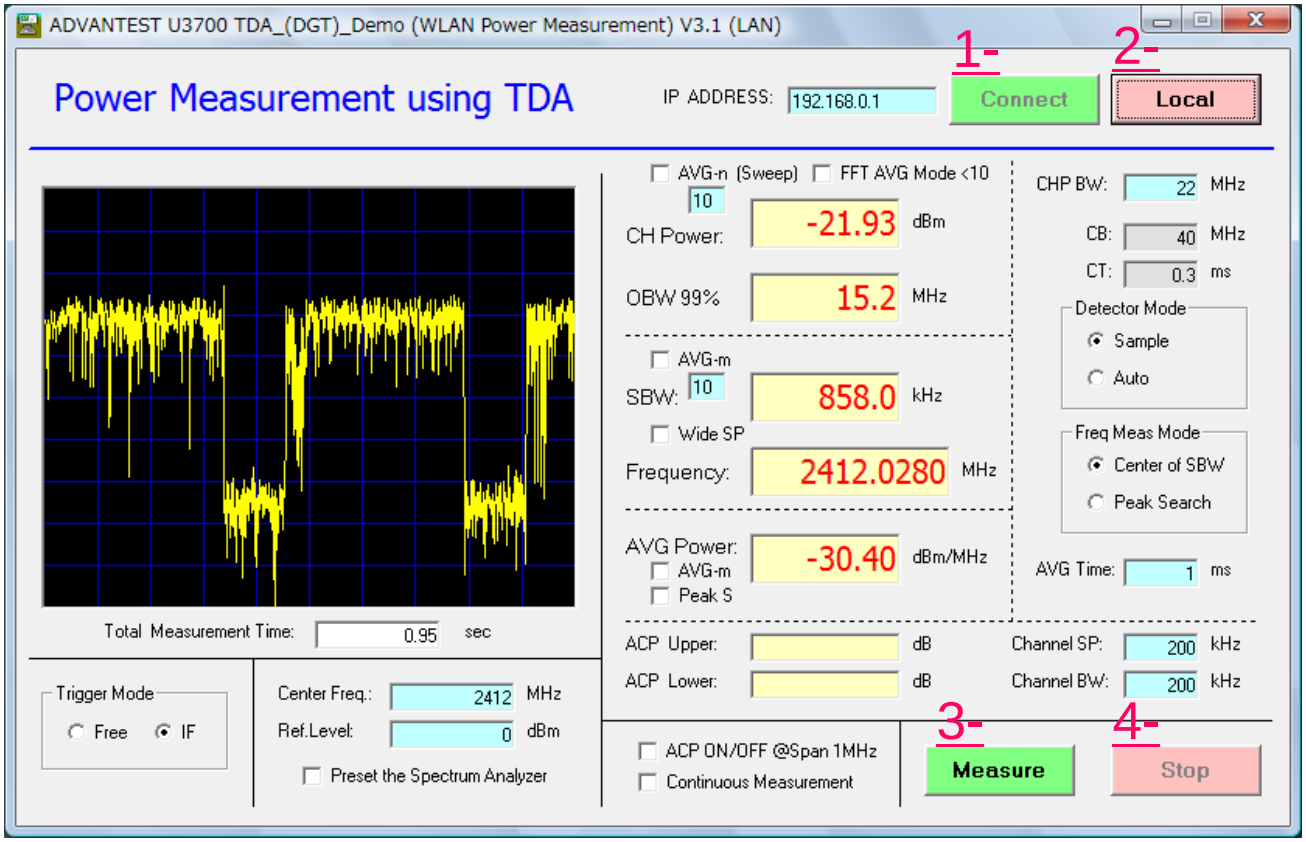
The measurement items refer the high performance small electric power data communications system of TELEC. (Telecom Engineering Center)
(Note: No Spurious, No EVM measurement)

Measurement method:

Set carrier frequency and band width of the power measurement.
Other measurements are measured with SPAN(CB) 1MHz.

*The measurement signal makes 11b_cck_5.5Mbps an example.
*When the pulse width is 1ms or less in other standards, we might need to change the software.
*The measuring range can correspond from special small systems to WLAN.
*The sample software is only an EXE file usually.
*There is an offered service of source file (VB6) by the user registration.

1. Panel image and Main key



1- **Connect** is pushed, it connects to SPA. Other keys are the prohibitions until the connection is completed.

2- **Local** is pushed, the connection with SPA is released. SPA becomes the local mode.

3- **Measure** is pushed, the measurement begins. The continuous measurement is also possible by check.

4- **Stop** is pushed, the measurement is ended. LAN is a waiting state like the opening.

2. Measurement method and Detail

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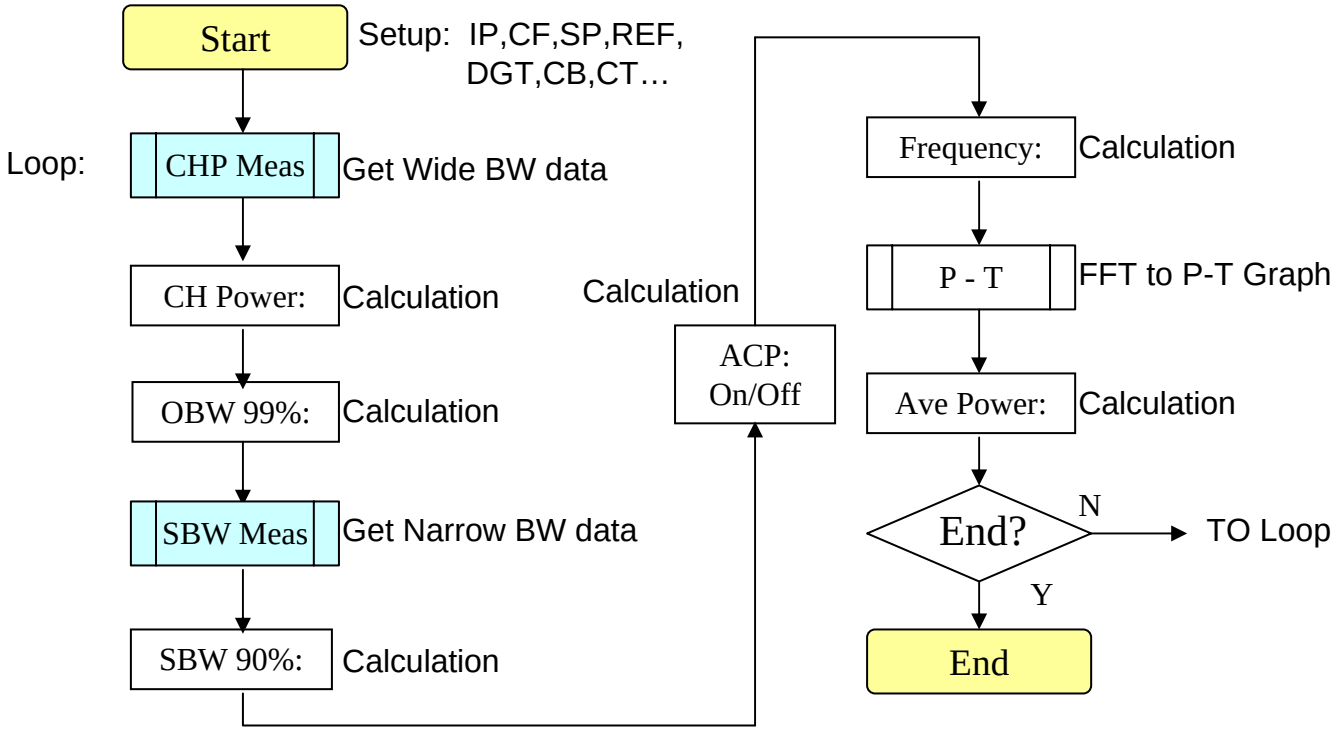
Startup and Measurement:

a. Execution of the Software. (Select the U3700 TDA PowerMeas from the START)
b. IP Address is confirmed or it changes. (Default:192.168.0.1)
c. When the Connect button is pushed, it is connected with SPA.
d. BW of CH Power is confirmed or is set. (CB and CT are the automatic settings)
e. Select the Trigger Mode. Averaging On/Off is possible while measuring it.
f. Additionally, when a necessary condition is set, and the Measure button is pushed, the measurement is begun.
g. The end of program pushes the Local, and shuts the Window.

Measurement details of each items:

CH Power:	DGT and FFT mode, set C-Freq. CB uses the value about twice CHP-BW. After other conditions are set and Cap B and Cap T are displayed, and measuring. CH Power is calculated on specified CHP-BW from the measured waveform.
OBW 99%:	OBW is calculated from the waveform of FFT mode of CH Power.
SBW 90%:	SBW is calculated from the waveform of FFT at CB 1MHz and CT 5ms.
Frequency:	After SBW is calculated, the center frequency is calculated. When PS is set, it searches for the peak from the waveform and the frequency is calculated.
Ave Power: (BW 1MHz)	After frequency is calculated, it converts to P-T graph, and the Average Power is calculated. (In this example, CT is 5ms and AVG Power is 1ms.)
ACP: Low/Up (Span 1MHz)	ACP is calculated from the SBW measurement data if ACP measurement ON. (C-SP and C-BW are input.)

3. Measurement Flow



Note1: Trigger: Free Run actually uses SI. Sweep End is detected while seeing STB.

Note2: GHz, MHz, kHz, and Hz use a fixed unit for the unit of the display.

Note3: The continuous measurement is enabled.

Note4: Width and Span are up to Max 40MHz.

4. Power Measurement Formula

Formula of Channel Power

(Details: See U3700 series User's Guide)

Note: Advantest uses PBW=RBW*1.06

$$P_{CH} = 10\log\left[\sum_{n=X1}^{X2}\left(10^{\frac{P(n)}{10}}\right) \times \frac{1}{PBW} \times \frac{SPAN}{(X2 - X1)}\right]$$

P_{CH}:	Channel power to be obtained
P(n):	Displayed data at each trace point (dBm)
SPAN:	Channel Width setting value
PBW:	Noise power bandwidth
X1:	Trace point at the window's left edge
X2:	Trace point at the window's right edge

Formula of Average Power

(Details: See U3700 series User's Guide)

$$P_{AVG} = 10\log\left[\sum_{n=X1}^{X2}\left(10^{\frac{P(n)}{10}}\right) \times \frac{1}{1001}\right]$$

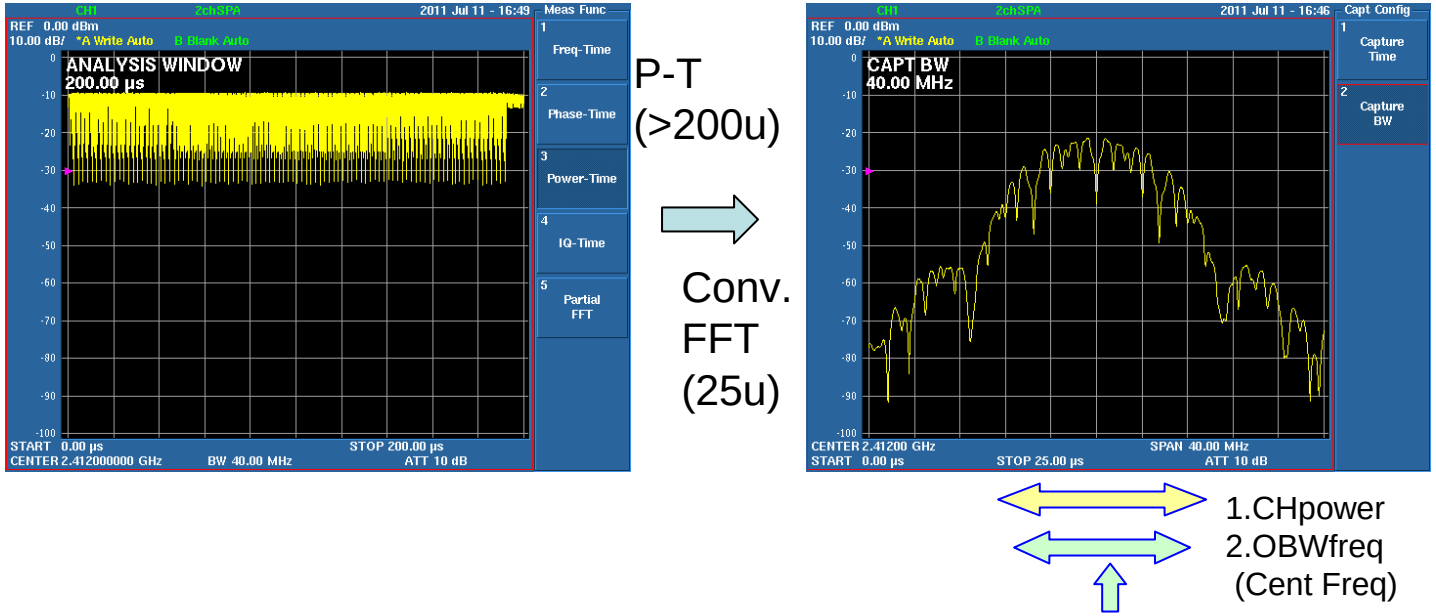
P_{AVG}:	Average power to be obtained
P(n):	Displayed data at each trace point (dBm)
X1:	1
X2:	1001

5. Measurement item and Module:1

Example Signal: 11b_cck_5.5Mbps

1. Channel Power (Total Power) BW 22MHz
2. OBW 99%

Measurement**1**: DGT CB:40MHz, CT:0.3ms, Data(25us):FFT

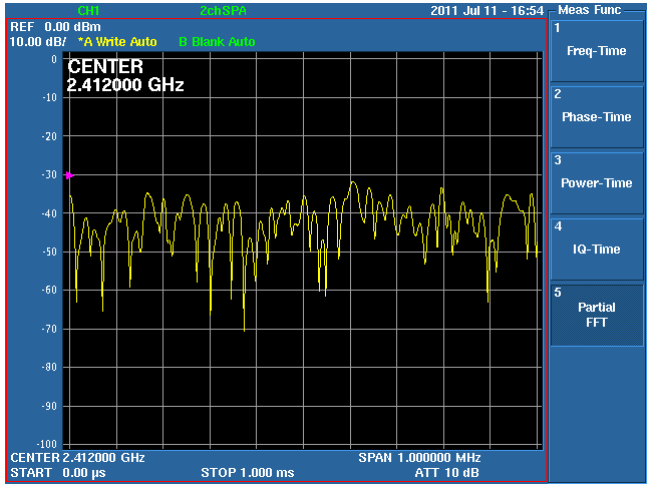


1. GetCHPpower CHPstart, CHPstop, MeasCHPCB, CHpower
2. GetOBWfreq 99, MeasCHPCB, OBWfreq, CentFreq

6. Measurement item and Module:2

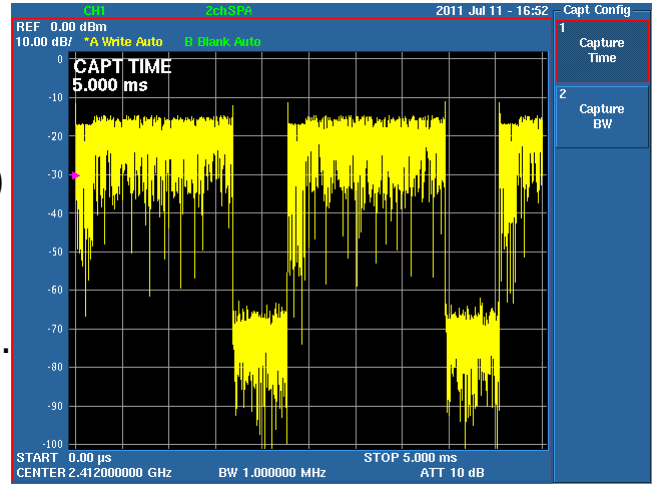
3. SBW 90%
4. Frequency
5. AVG Power (1MHz RBW, 1ms)

Measurement2: DGT CB:1MHz, CT:5ms, Data(1ms):FFT



P-T (>5m) Conv. FFT(1m)

Conv. P-T



OBW freq (3.SBW)
Cent Freq (4.Freq)

5.AVGpower

3. 4. GetOBWfreq 90, SBWSpan, OBWfreq, CentFreq

Convert the data FFT(Level-F) to P-T(Level-Time)

5. GetAVGpower AVGpower

7. Change the measuring conditions

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Example Signal: 11b_cck_5.5Mbps, Other: See table

The pulse width of the WLAN was measured for sample software U3700 PowerMeasDGT.
It is necessary to change AVG time and internal constant value according to each standard.

		(bps)	Pulse (~ms)	Offset	AVG time
				(Internal)	(Menu)
11b	DSSS	1M	8.3ms	250us	1ms
	DSSS	2M	4.2ms	250us	1ms
	CCK	5.5M	1.7ms	250us	1ms
	CCK	11M	1.0ms	250us	0.7ms
11g	DSSS_OFDM	6M	1.5ms	250us	1ms
		9M	1.0ms	250us	0.8ms
		12M	0.87ms	50us	0.7ms
		18M	0.65ms	50us	0.5ms
		24M	0.54ms	50us	0.4ms
		36M	0.42ms	50us	0.3ms
		48M	0.38ms	50us	0.25ms
		54M	0.38ms	50us	0.25ms

Note(Green)

1. It is necessary to use Cap-RBW 3MHz, (Software-->SBWspan=3)
   because the pulse width becomes a range where FFT cannot be narrowly done.
2. Cap-Time uses 1ms, because the pulse width is narrow. (Software-->SBWswp=1)
   (Offset in calculation start point automatically becomes 50us.)
3. The measurement used 3MHzBW. But the standard is 1MHzBW,
   the correction or the reinvestigation is necessary.

8. Averaging Function Addition (V3.0)

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Averaging is added to each measurement

1. Channel Power (Total Power), 2. OBW 99%

>AVG-n (Sweep) is checked, it becomes AVG ON.
The AVG number puts the numerical value in the input column.
It is sweep method. (sweep: 2 to 30 times)

>When the check is put in FFT AVG Mode, AVG is done from one time base measurement. More FFT is done from one time base measurement and AVG is done. (FFT: 2 to 10 times)

3. SBW, 4. Frequency

>AVG-m is checked, it becomes AVG ON.
The AVG number puts the numerical value in the input column.
It is sweep method.

5. AVG Power(dBm/1MHz)

>AVG-m is checked, it becomes AVG ON. It is sweep method.
The AVG number uses the same numerical value as SBW.

9. Update SBW, AVG Power (V3.1)

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Detail Functions are added to SWB, AVG-Power

1. SBW

>When Wide SP is checked, the measuring span of SBW is widely changed. After OBW99% is calculated from wide span used when Channel Power is measured,
SBW (90%) is calculated.

2. AVG Power(dBm/1MHz)

>If Peak S is checked, it becomes Peak Search ON.
When Channel Power is measured, it searches for the utmost level from Freq axial waveform. And, the time base data is measured at that frequency and mean power calculated.