Permit but Ask Application 10th June 2009

Intel 5150 Combo WLAN/WiMAX

Dell Tiger 5438/5439

FCCID: PD9512ANXHD

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802.16e/WiMAX/WiFi

Table 1: 802.16e/WiMAX Device and System Operating Parameters for Dell Tiger

Description	Parameter	Lab/Intel Comment
FCC ID	PD9512ANXHD	Updating the original mobile application to include portable application SAR.
Radio Service	Part 27M	
Transmit Frequency Range (MHz)	2501-2685 MHz (10 MHz channel BW) 2498.5-2687.5 MHz (5 MHz channel BW)	Based on 802.16e
System/Channel Bandwidth (MHz)	5 MHz and 10 MHz	Based on product specification/capability
System Profile	Release 1.0 (Revision 1.7.1 2008) Band Class 3 Radio Profile 3A	Defined by WiMAX Forum. Based on product specification/capability.
Modulation Schemes	16QAM and QPSK	
Sampling Factor	28/25	System parameter
Sampling Frequency (MHz)	10 MHz Channel BW: 11.2 MHz 5 MHz Channel BW: 5.6 MHz	(Fs)
Sample Time (ns)	89 ns for 10 MHz BW 178 ns for 5 MHz BW	(1/Fs)
FFT Size (NFFT)	512(5MHz); 1024(10MHz)	(NFFT)
Sub-Carrier Spacing (kHz)	10MHz BW:10.94kHz 5 MHz BW:10.94kHz	(Δf)
Useful Symbol time (μs)	Symbol timing (NOT including guard time): 91.43us	(Tb=1/Δf)
Guard Time (μs)	1/8 symbol:11.43us	(Tg=Tb/cp); cp = cyclic prefix
OFDMA Symbol Time (μs)	102.857us	(Ts=Tb+Tg)
Frame Size (ms)	5ms	System parameter
TTG + RTG (μs or number of symbols)	TTG+RTG=165.58us	Idle time, System parameter
Number of DL OFDMA Symbols per Frame	Max.:35; Min: 26. For both 10 MHz and 5 MHz Channel BW. Ref Page 5	Based on product specification/capability
Number of UL OFDMA Symbols per Frame	Max.: 21; Min: 12. For both 10 MHz and 5 MHz Channel BW. Ref Page 5	

Description	Parameter		Lab Comment
DL:UL Symbol Ratio	Max. 29:18 for 5 MHz Channel BW (UL Duty Factor: 1.851/5ms=37%) Max. 26:21 for 10 MHz Channel BW (UL Duty Factor: 2.160/5ms=43%)		1) UL symbols shown in total on time over the total frame size in ms. The 3 UL control symbols are on but have been converted to data symbols to keep output power constant over total UL "on" time using all UL symbols. The worst case DL:UL modes are shown per Channel BW which would yield the most conservative SAR value.
Power Class (dBm)	Power Class 2 16QAM: 21 <= PTx,max < 25 QPSK: 23 <= PTx,max < 27		Comes from 802.16e
Wave1 / Wave2	Wave 2: two antennas. Antenna1 (main) is TX/RX diversity antenna, Antenna2(aux) is receiving only antenna		Based on product specification/capability
UL Zone Types (FUSC, PUSC, OFUSC, OPUSC, AMC, TUSC1, TUSC2)	PUSC only. UL AMC is not used in the current profile.		Based on product specification/capability
Maximum Number of UL Sub-Carriers	10 MHz BW	5 MHz BW	Values measured for UL Burst Maximum Average Power is a measured value which was measured using a spectrum analyzer gated to measure the power only during the TX "on" state. SAR submitted correlates to the measured power from the original FCC Grant of Authorization. The 3 UL control symbols are on but have been converted to data symbols to keep output power constant over total burst. This will be included in the final submitted SAR test report.
	Null Sub-Carriers=184 Pilot Sub-Carriers=280 Data Sub-Carriers=560	Null Sub-Carriers=104 Pilot Sub-Carriers=136 Data Sub-Carrier=272	
UL Burst Maximum Average Power	10 MHz/16QAM: 23.1 dBm 5 MHz:/QPSK: 24.1 dBm see comment (2)&(3)		
Number and type of DL/UL Control Symbols	7 for DL control overhead and 3 for UL control overhead (see comment (1 & 2)) and 1 for TTG		
UL Control Symbol Maximum Average Power	Not applicable see comment (1 & 2)		

Description	Parameter	Lab Comment
UL Burst Peak-to-Average Power Ratio (PAR)	With DL: UL Ratio= 26;21 Peak- to-Average Ratio for 10 MHz Channel BW is between 5.0-5.4dbm With DL: UL Ratio= 29;18 Peak- to-Average Ratio for 5 MHz Channel BW is between 5.2-5.9dbm	Modulated waveforms have been used with different bandwidths and scaled power so as to ensure the probe and electronics are measuring adequately e.g. Max/Mid/Min (above noise floor) has been assessed to prove linearity. This is described in the final submitted SAR report.
Frame Averaged UL Transmission Duty Factor (%)	For 10 MHz channel BW, the duty cycle is 42%. Crest Factor is 2.38 with 26:21 DL:UL Ratio For 10MHz channel BW QPSK the duty cycle is 23.3%. Crest factor is 4.29 with a 35:12 DL:UL Ratio. For 5 MHZ channel BW, the duty cycle is 37%. Crest Factor is 2.7 with 29:18 DL: UL Ratio.	Modulated waveforms have been used with different bandwidths and scaled power so as to ensure the probe and electronics are measuring adequately e.g. Max/Mid/Min (above noise floor) has been assessed to prove linearity. This is described in the final submitted SAR report.

1. Product/ PBA Description

a). The Intel WiMAX/Wi-Fi Link 5150 is an embedded IEEE 802.16e and 802.11a/b/g/n wireless network adapter that operates in the 2.4 GHz and 5 GHz spectrum for WiFi and 2.6 GHz spectrum for WiMAX. The adapter is capable of delivering up to 300 Mbps Tx/Rx over WiFi and up to 4 Mbps UL/10 Mbps DL over WiMAX.

b). The Intel WiMAX/Wi-Fi Link 5150 transmits on 5 ms frames using 5 MHz and 10 MHz channels. The 10MHz channel bandwidth uses 1024 sub-carriers and 35 sub-channels, with 184 null sub-carriers and 840 available for transmission, consisting of 560 data sub-carriers and 280 pilot sub-carriers. The 5 MHz channel bandwidth uses 512 sub-carriers and 17 sub-channels, with 104 null sub-carriers and 408 available for transmission, consisting 272 data sub-carriers and 136 pilot sub-carriers.

c.) The Intel WiMAX/Wi-Fi Link 5150 received single module approval on 11/06/2008.

d.) FCC Permit-But-Ask Category:

i. 1)b)iii) 802.16e Device and 1)b)vii) Test Procedure for SAR - devices for which an acceptable SAR test procedure has not been established.

e.) WiMAX and 802.11 a/b/g/n co-location conditions:

i. The 802.16e WiMAX and 802.11 a/b/g/n WiFi radio will not transmit simultaneously. When the 512ANXHD is installed in the typical laptop computer, once the network is chosen by the end user during WiMAX/WiFi network, only the WiMAX radio or WiFi radio will transmit.

f) Class II permissive change application:

i. This PBA is requested with the Intel WiMAX/Wi-Fi Link 5150 combo module installed in the laptop computer.

2. WiMAX Zone Types: (*DL/UL symbol ratio supported by EUT*)

The device and its system are both transmitting using only PUSC zone type. This enables multiple users to transmit simultaneously within the system. FUSC, AMC and other zone types are not used by The Intel WiMAX/Wi-Fi Link 5150 for uplink transmission. The maximum DL:UL symbol ratio can be determined according to the PUSC requirements. The system transmits an odd number of symbols using DL-PUSL consisting of even multiples of traffic and control symbols plus one symbol for the preamble. Multiples of three symbols are transmitted by the device using UL- PUSC. The OFDMA symbol time allows up to 48 downlink and uplink symbols in each 5 ms frame. TTG and RTG are also included in each frame as DL/UL transmission gaps; therefore, the system can only allow 47 or less symbols per frame. The maximum DL:UL symbol ratio is determined according to these PUSC parameters for evaluating SAR compliance.

Description	Down Link	Up Link
Number of OFDM Symbols in Down Link and Up Link for 5 MHz and 10 MHz Bandwidth	35	12
	34	13
	32	15
	31	16
	30	17
	29	18
	28	19
	27	20
	26	21

3. Duty Factor Considerations (*WiMAX SAR PBA Procedure*)

Although the chipset can supply higher downlink-to-uplink (DL/UL) symbol ratios, the Intel WiMAX/Wi-Fi Link 5150 is only supplied to BRS/EBS WiMAX operators with agreements to transmit at a maximum DL/UL symbol ratio of 29:18. The Intel WiMAX/Wi-Fi Link 5150 is limited by firmware and the corresponding WiMAX system to operate at or below this maximum duty factor. Therefore, the maximum transmission duty factor supported by the chipset is not applicable for this device. The system can transmit up to 48 OFDMA symbols in each 5 ms frame, TTG and RTG are also included in each frame as DL/UL transmission gaps; therefore, the system can only allow 47 or less symbols per frame. With a maximum of 18 uplink symbols transmitting at the maximum power, the duty factor is estimated to be 1.851/5ms=37%.

Test Vector File Name	BW	DL/UL Symbols	DL/UL Cycle	Crest Factor	DL Modulation	UL Modulation
DQ4_12_UQ16_12_10M	10MHz	35/12	23.3%	4.29	QPSK R1/2	QAM16 R3/4
DQ64_UQ4_12_21s_10M	10 MHz	26/21	42%	2.38	QAM64 R5/6	QPSK R1/2
DQ4_12_UQ16_34_5M	5 MHz	29/18	36.7%	2.72	QPSK R1/2	QAM16 R3/4
DQ64_56_UQ4_12_5M	5 MHz	29/18	36.7%	2.72	QAM64 R5/6	QPSK R1/2

Crest factor is determined and inserted into the software so as to set the dynamic burst average algorithm used by the data acquisition electronics and issue a statement for the linearization algorithm. These values are based on the physical value measured in the time domain for each waveform.

SAR evaluations were performed by using test vector waveform file loaded in the Vector Signal Generator.

For 10MHz bandwidth, test vector waveform file with 12 UL symbol and control symbols not allocated nor active, each burst contains 12 traffic symbols. For an in-network / end-user DL:UL symbol ratio of 29:18, the duty factor scaling formula is:

{(ctrl_symb_power x 3 + traffic_symb_max_power x 15) / (actual_power x 12)}

The control channels may occupy up to 5 slots during normal operation. A slot is a sub-channel with the duration of 3 symbols. There are a total of 35 slots in the 10MHz channel configuration.

**
The actual highest measured output power is 23.0dBm/200mW for 10MHz BW/QPSK @ 2685MHz.
Control Symbol power is calculated as: 200 x 5/35=28.57mW. 23.0dBm is the highest output power for 10MHz BW/QPSK modulation.

Since the control symbols are not allocated nor active, the measured burst power is equal to traffic symbol power = 200mW.
(28.57mW x 3 + 200 x 15) / (200mW x 21) = 0.734 (duty factor scaling factor for 10MHz BW/QPSK @ 2593MHz).

**
The actual highest measured power is 23.1dBm/204.2mW for 10MHz BW/16QAM @ 2685MHz
The highest output power for 10MHz BW/16QAM is 23.1dBm/204.2mW which will be used as traffic symbol maximum power.
Control Symbol power is calculated as: 204.2 x 5/35 = 29.17mW.

Since the control symbols are not allocated nor active, the measured burst power is equal to the maximum traffic symbol power = 204.2mW
(29.17mW x 3 + 204.2mW x 15) / (204.2mW x 12) = 1.286 (duty factor scaling factor for 10MHz BW/16QAM @ 2685MHz).

***
For 5MHz bandwidth, test vector waveform file with 18 UL symbol and control symbols not allocated nor active, each burst contains 18 traffic symbols. For an in-network / end-user DL:UL symbol ratio of 29:18, the duty factor scaling formula is:

{(ctrl_symb_power x 3 + traffic_symb_max_power x 15) / (actual_power x 18)}

The control channels may occupy up to 5 slots during normal operation. A slot is a sub-channel with the duration of 3 symbols. There are a total of 17 slots in the 5MHz channel configuration.

**
The actual highest measured output power is 24.1dBm/257mW for 5MHz BW/QPSK @ 2593MHz.
The maximum measured output power for 5MHz BW/QPSK is 24.1dBm/257mW which is used as traffic symbol maximum power.

Control Symbol power is calculated as: 257 x 5/17 = 75.6mW.
Since the control symbols are not allocated nor active, the measured burst power is equal to traffic symbol power = 257mW.

(75.6mW x 3 + 257mW x 15) / (257mW x 18) = 0.88 (duty factor scaling factor for 5MHz BW/QPSK @ 2593MHz).

**
The actual lowest measured output power is 24.1dBm/257mW for 5MHz BW/16QAM @ 2593MHz.
The highest measured output power for 5MHz BW/16QAM is 24.1dBm/257mW which is used as traffic symbol maximum power.
Control Symbol power is calculated as: 257 x 5/17 = 75.6mW.

Since the control symbols are not allocated nor active, the measured burst power is equal to traffic symbol power = 257mW.

(75.6mW x 3 + 257mW x 15) / (257mW x 18) = 0.88 (duty factor scaling factor for 5MHz BW/16QAM @ 2593MHz).

**
The measured SAR must be scaled to the 29:18 in network / end-user DL:UL ratio.

**
Duty Factor and Crest Factor: Since control symbols are not allocated nor active in the SAR measurement. All UL symbols are counted. A duty factor = (number of uplink symbols x 102.857us)/5000us. Crest Factor = 1/(duty factor) for this periodic pulse signal device.

Test Vector File Name	BW	DL/UL Symbols	UL duty Cycle Measured	Actual Power(mW)-Maximum power is used among L/M/H	Duty Cycle Compensation Factor
DQ4_12_UQ16_12_10M	10MHz	35/12	23.3%	204.2	1.286
DQ64_UQ4_12_21s_10M	10 MHz	26/21	42%	200 mW	0.734
DQ4_12_UQ16_34_5M	5 MHz	29/18	36.7%	257 mW	0.88
DQ64_56_UQ4_12_5M	5 MHz	29/18	36.7%	257 mW	0.88

4. Test Software

The Test tool is a diagnostic software tool that works in conjunction with the WiMAX simulated base station waveforms loaded in the ESG (Vector Signal Generator) to operate the client card at power originally tested and approved in the various modes:

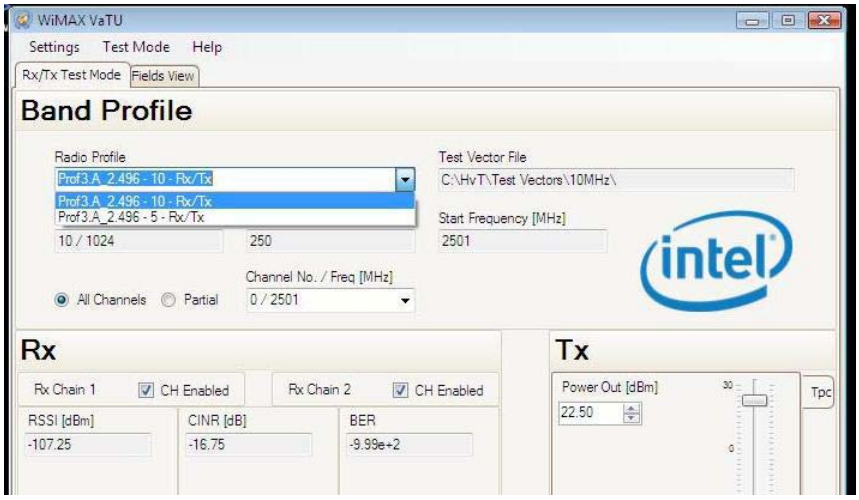
10MHz Channel BW QPSK

10MHz Channel BW 16QAM

5MHz Channel BW 16QAM

5MHz Channel BW QPSK

The test software tool (WiMAX VaTU SW application) is installed on the laptop computer to configure the test device, Intel WiMAX/Wi-Fi Link 5150, to transmit at maximum output power. During normal operation, the output power of Intel WiMAX/Wi-Fi Link 5150 client module is controlled by a WiMAX base station, which also determines the characteristics of the transmission. For testing purposes, the device output power is kept at the required power using WiMAX VATU SW application loaded in the laptop. The uplink transmission is maintained at a stable condition by the radio profile loaded in Vector signal generator. This enables the Intel WiMAX/Wi-Fi Link 5150 module to transmit at maximum power with a constant duty factor according to the specific radio profile as documented in this application. The test software serves only one purpose, to configure the Intel WiMAX/Wi-Fi Link 5150 module and set to transmit at the max required power during SAR measurement.

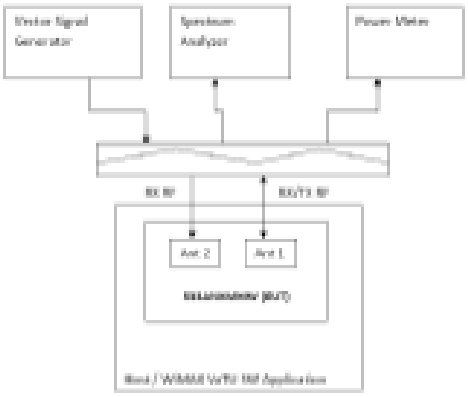


5. Signal Generator Details

Frame Profile loaded in Vector Signal Generator:

Test Vector File Name	BW	DL/UL Symbols	UL duty Cycle Measured	Actual Power(mW)- Lowest power is used among L/M/H	Duty Factor Compensation Factor As per FCC
DQ4_12_UQ16_12_10M	10MHz	35/12	23.3%	190.5	1.286
DQ64_UQ4_12_21s_10M	10 MHz	26/21	42%	182	0.734
DQ4_12_UQ16_34_5M	5 MHz	29/18	36.7%	234.4	0.88
DQ64_56_UQ4_12_5M	5 MHz	29/18	36.7%	234.4	0.88

Connection Diagram:



Agilent ESG Vector Signal Generator / Model :E4438C is used in conjunction with Intel supplied radio profile to configure the Intel WiMAX/Wi-Fi Link 5150 module for the SAR evaluation. ESG Vector Signal Generator is loaded with the downlink signal, containing the respective FCH, DL- MAP and UL-MAP required by the test device to configure the uplink transmission. The waveform is configured for a DL:UL symbol ratio of 26:21 for 10 MHz and 29:18 for 5 MHz using Intel Signal Waveform Software for 802.16e WiMAX, on the PC and downloaded to the VSG. The test device can synchronize itself to the signal received from VSG, both in frequency and time. It then modulates the DL-MAP and UL-MAP transmitted in the downlink sub-frame and determine the DL:UL symbol ratio. The downlink burst is repeated in each frame, every 5 ms, to simulate the normal transmission from a WiMAX base station. The UL-MAP received by the device is used to configure the uplink burst with all data symbols and sub-channels active.

For TDD systems, both uplink and downlink transmissions are at the same frequency. The output power of the VSG is kept at least 80dB lower than the test device to avoid interfering with the SAR measurements. The ESG is connected directly into the WiMAX card so as to allow the card to enter into transmit mode.

6. Communication Test Set Details

Modulation and channel bandwidth selection is loaded to Vector Signal Generator. For example, when evaluating QPSK with 10 MHz channel Bandwidth, radio profile name "DQ64_UQ4_12_21s_10M" is active on the Vector Signal Generator.

Parameter Value	Frame definition for 10 MHz RC10		
	Test Vector Name		
	DQ64_UQ4_12_21s_10M	DQ4_12_UQ16_12_10M	Remark
Band Width	10MHz	10MHz	
FFT size	1024	1024	
DL/UL ratio	26/21	35/12	
Down link			
Zone profiles	Zone 1 – PUSC	Zone 1 – PUSC	single zone
Burst profile / MCS	MCS: QAM64 R5/6	MCS : QPSK R1/2	Single DIUC
Up Link			
Duty Cycle power compensation factor	5.54dbm	5.4dbm	
Zone profiles	Zone 1 – PUSC	Zone 1 – PUSC	single zone
Burst profile / MCS	MCS: QPSK R1/2	MCS : QAM16 R3/4	Single DIUC

Parameter Value	Frame definition for 5 MHz RCT		
	Test Vector Name		
	DQ64_56_UQ4_12_5M	DQ4_12_UQ16_34_5M	Remark
Band Width	5MHz	5MHz	
FFT size	512	512	
DL/UL ratio	29/18	29/18	
Down link			
Zone profiles	Zone 1 – PUSC	Zone 1 – PUSC	single zone
Burst profile / MCS	MCS : QAM64 R5/6	MCS : QPSK R1/2	Single DIUC
Up Link			
Duty Cycle power compensation factor	5.8dB	5.8dB	
Zone profiles	Zone 1 – PUSC	Zone 1 – PUSC	single zone
Burst profile / MCS	MCS : QPSK R1/2	MCS : QAM16 R3/4	Single DIUC

7. Power Measurement (*PAR verification through measurement*)

The maximum average conducted output power is measured for the uplink burst for the appropriate modulation and channel bandwidth. Conducted average output power was measured with the module inserted into the host Dell laptop with a communication link to a Vector Signal generator. The average output power is measured for the uplink bursts through triggering and gating on a spectrum analyser. Peak conducted power is measured using the same signal generator and verified on a power meter. SAR measurements are made with the card connected to the VSG on the input stage and the appropriate antenna(s) within the host laptop connected to the output stage. A software setting of which yielded the closest power measured on the original grant using the Intel proprietary software was selected and each channel was independently measured. The average output power for each channel never deviated more than +/-0.1dBm.

Mode	Channel Band-Width (MHz)	Channel Number	R(MHz)	Conducted Power (dBm)		Peak to Average Ratio	Duty Cycle %	Target Ave Power
				Peak	Average			
16QAM	10	0	2501	28.2	22.8	5.4	23.3	22.80
		386	2593	28.4	23.0	5.4		22.95
		736	2685	28.1	23.1	5.0		23.10

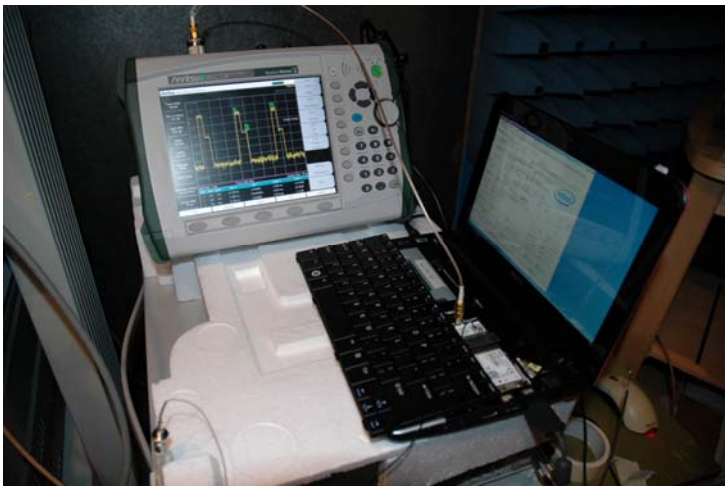
Mode	Channel Band-Width (MHz)	Channel Number	R(MHz)	Conducted Power (dBm)		Peak to Average Ratio	Duty Cycle %	Target Ave Power
				Peak	Average			
QPSK (4QAM)	10	0	2501	28.6	22.6	6.0	42	22.58
		386	2593	28.9	22.7	6.2		22.69
		736	2685	28.7	23.0	5.7		22.94

Mode	Channel Band-Width (MHz)	Channel Number	R(MHz)	Conducted Power (dBm)		Peak to Average Ratio	Duty Cycle %	Target Ave Power
				Peak	Average			
16QAM	5	0	2498.5	29.6	23.7	5.9	37	23.71
		378	2593.0	29.8	24.1	5.7		24.05
		756	2687.5	29.8	24.0	5.8		24.02

Mode	Channel Band-Width (MHz)	Channel Number	R(MHz)	Conducted Power (dBm)		Peak to Average Ratio	Duty Cycle %	Target Ave Power
				Peak	Average			
QPSK (4QAM)	5	0	2498.5	29.1	23.7	5.4	37	23.68
		378	2593.0	29.3	24.1	5.2		24.05
		756	2687.5	29.7	23.9	5.8		23.94

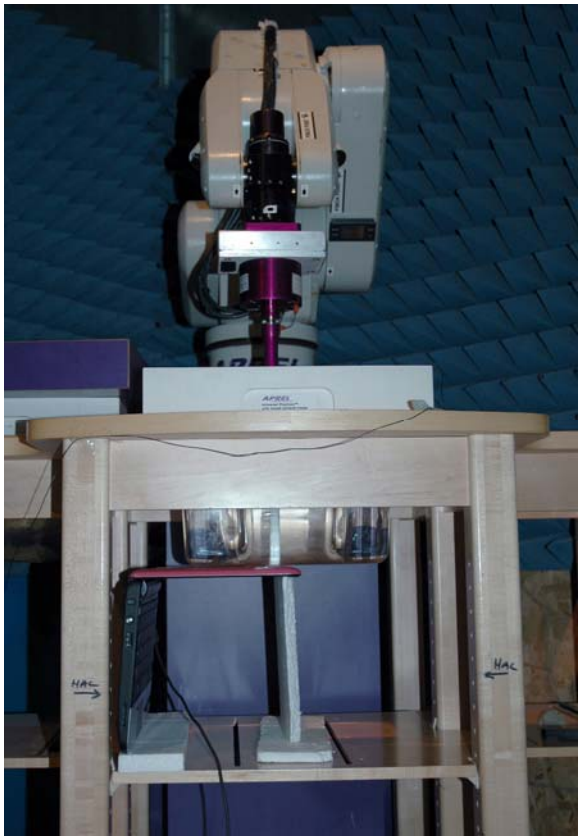
Note: Spectrum Analyser with Channel Power function and Gate On Peak power: RBW=100 kHz; VBW = 300 kHz with Peak detection, sweep time = 1 s Average power: RBW=100 kHz; VBW = 300 kHz with Average detection, sweep time = 1 s

The power measurement setup is presented in the following pictures.



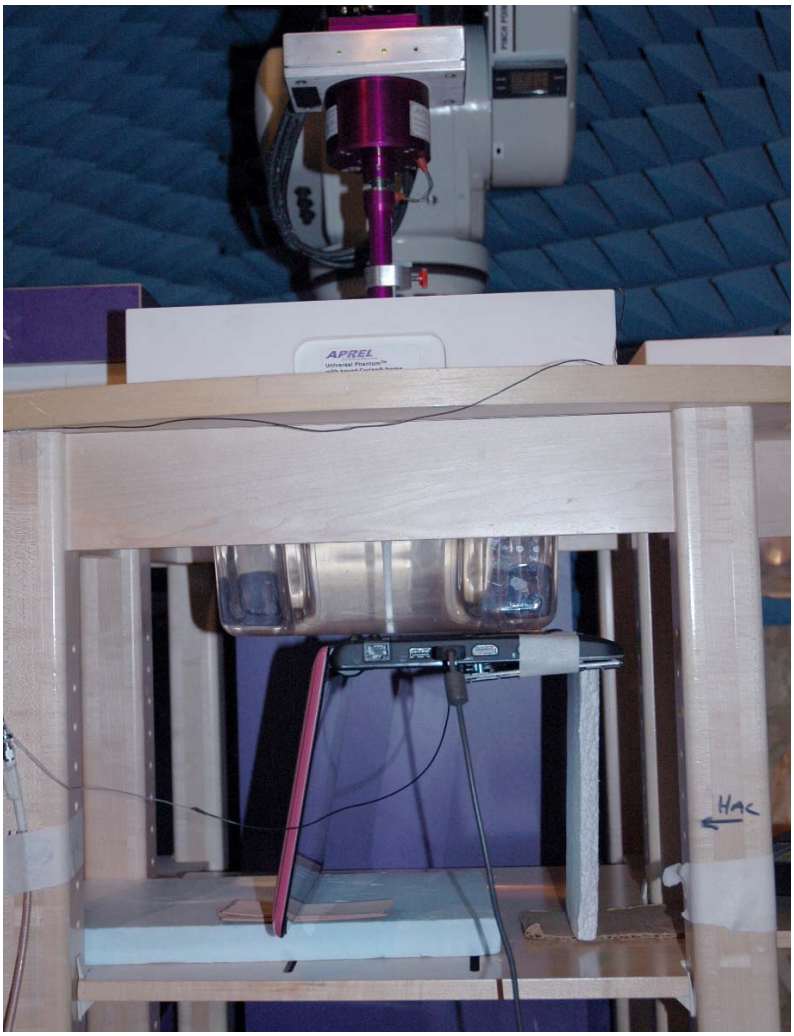
SAR Measurement

SAR measurements were conducted on the maximum measured average power with the maximum duty factor for the waveform. Due to the value of SAR being close to the noise floor on some channels we evaluated the device in a worst case scenario where there was 5mm separation from the device to the phantom exactly above the antenna.



5mm Separation Above Tx Antenna

After the worst case SAR value is assessed the system is tested in the normal use position and the worst case SAR is recorded.



Normal Use Position

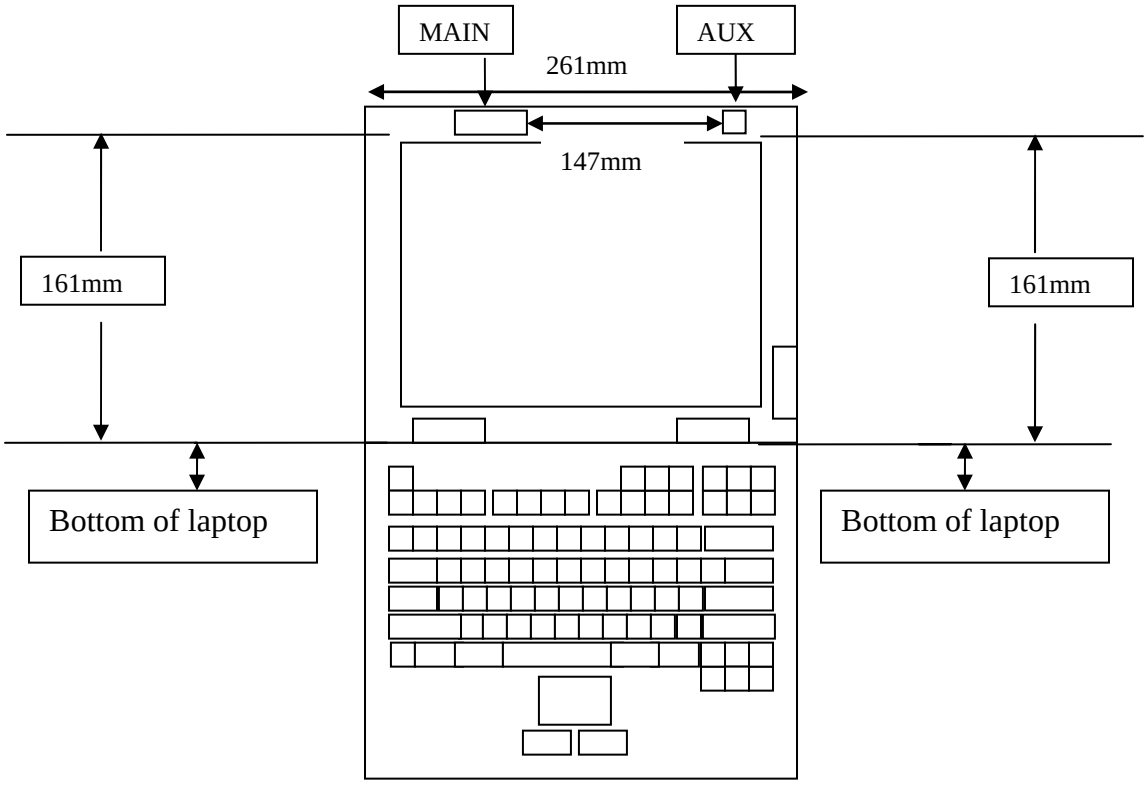
As the host is a Dell laptop computer the FCC KDB 447498 procedures is used while performing SAR evaluation.

Duty Factor Correction: Max. Duty Cycle for 10 MHz channel BW: 26:21=42%

Test Vector File Name	BW	DL/UL Symbols	UL duty Cycle Measured	Actual Power(mW)-Lowest power is used among L/M/H	Duty Cycle Compensation Factor
DQ4_12_UQ16_12_10M	10MHz	29/18	23.3%	190.5	1.286

1) Laptop Mode: Lap-held with the display open at 90° to the keyboard.

Mode	Ch. No.	Freq. (MHz)	1g. SAR (mW/g)	Duty Cycle Compensation Factor	Corrected 1g. SAR (mW/g)	Limit
WiMAX	736	2685	0.108	1.286	0.138	1.6

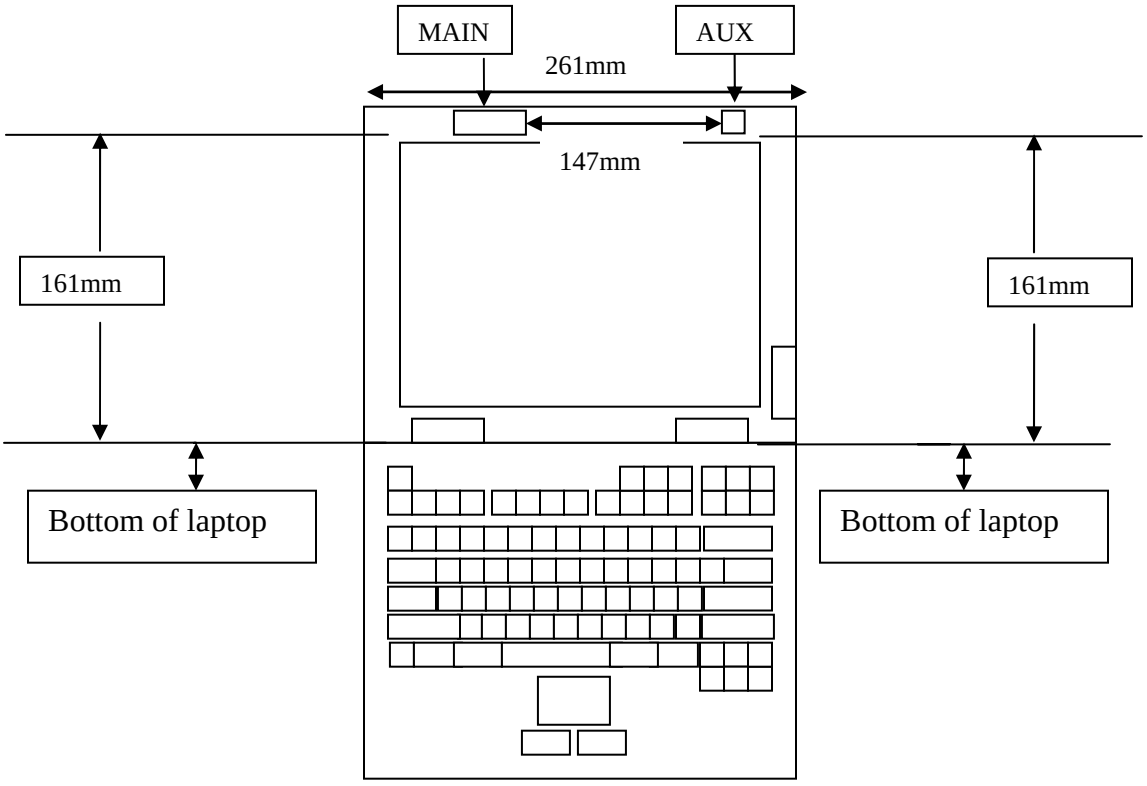


Duty Factor Correction: Max. Duty Cycle for 5 MHz channel BW: 29/18=42%

Test Vector File Name	BW	DL/UL Symbols	UL duty Cycle Measured	Actual Power(mW)-Lowest power is used among L/M/H	Duty Cycle Compensation Factor
DQ64_56_UQ4_12_5M	5 MHz	29/18	36.7%	234.4	0.88

2) Laptop Mode: Lap-held with the display open at 90° to the keyboard.

Mode	Ch. No.	Freq. (MHz)	1g. SAR (mW/g)	Duty Cycle Compensation Factor	Corrected 1g. SAR (mW/g)	Limit
WiMAX	0	2498.8	0.079	0.88	0.069	1.6



The SAR probe used for the measurements is calibrated with a sinusoidal CW signal. Since the DL:UL symbol ratio configuration allows a periodic uplink burst, the duty factor can be compensated by selecting the correct crest factor (CF) for the SAR measurement.

It is also calibrated with a modulated signal at 1/25 and 1/40. This provides a combined uncertainty of the probe for special modulation types and gives a good representation of WiMax signals.

Since this device is transmitting periodic uplink burst, crest Factor is based upon the duty cycle measurement.

SAR Probe

2600 ±50/± 100 Body 52.4± 5% 2.15± 5%

All measurements were taken at 2600MHz

Measured with dipole and CW signal
100 mW 3.4%
200 mW 3.6%
500 mW 3.6%

Measured with dipole and 25% signal of 20MHz channel
100 mW 4.1%
200 mW 5.2%
500 mW 5.1%

Measured with dipole and 40% signal of 20MHz channel
100 mW 6.21%
200 mW 6.8%
500 mW 6.93%

In the normal use condition the SAR is mostly measured close to or in the noise floor. This makes it difficult to show linearity for SAR measurements. Additional measurements were made on the laptop with the LCD facing the phantom using the waveform and power setting which gave the highest SAR. Additional measurements were made to reduce the power by 50% to show linearity.

Waveform	Channel	Frequency	Target Average Power	Average Power mW	Delta Power %	Measured 1g SAR
DQ4_12_UQ16_12_10M	736	2685	190.5	190.5	0	0.565
DQ4_12_UQ16_12_10M	736	2685	92.2	95.0	3.1	0.289
DQ4_12_UQ16_12_10M	736	2685	47.6	51.2	7.7	0.156

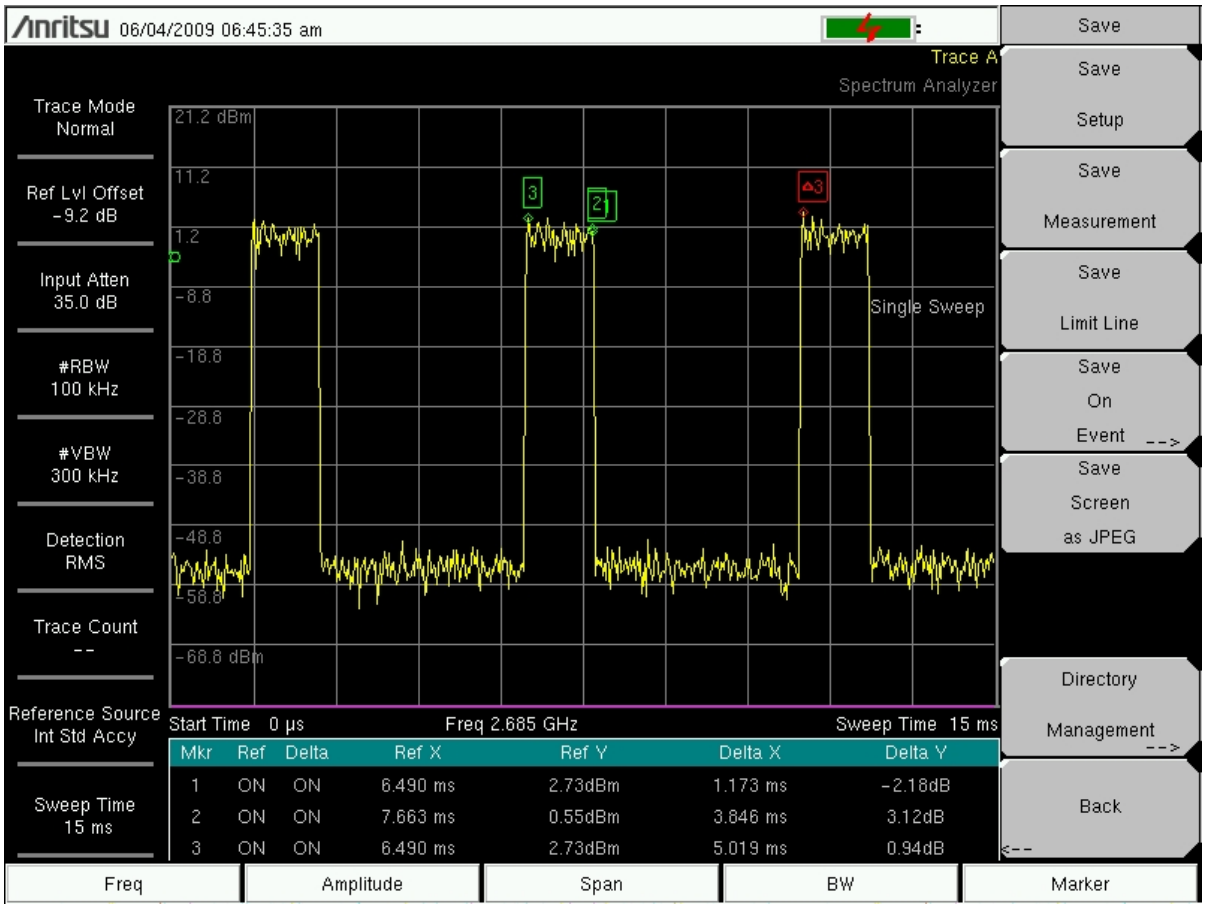
Waveform	Channel	Frequency	Target Average Power	Target SAR	Delta Power %	Corrected Target SAR
DQ4_12_UQ16_12_10M	736	2685	190.5	0.565	0	0.565
DQ4_12_UQ16_12_10M	736	2685	92.2	0.282	3.1	0.273
DQ4_12_UQ16_12_10M	736	2685	47.6	0.141	7.7	0.130

Waveform	Channel	Frequency	Target Average Power	Target SAR Corrected to Power Delta	Corrected SAR	Delta SAR %
DQ4_12_UQ16_12_10M	736	2685	190.5	0.565	0.565	-
DQ4_12_UQ16_12_10M	736	2685	92.2	0.273	0.280	2.6
DQ4_12_UQ16_12_10M	736	2685	47.6	0.130	0.144	10.7

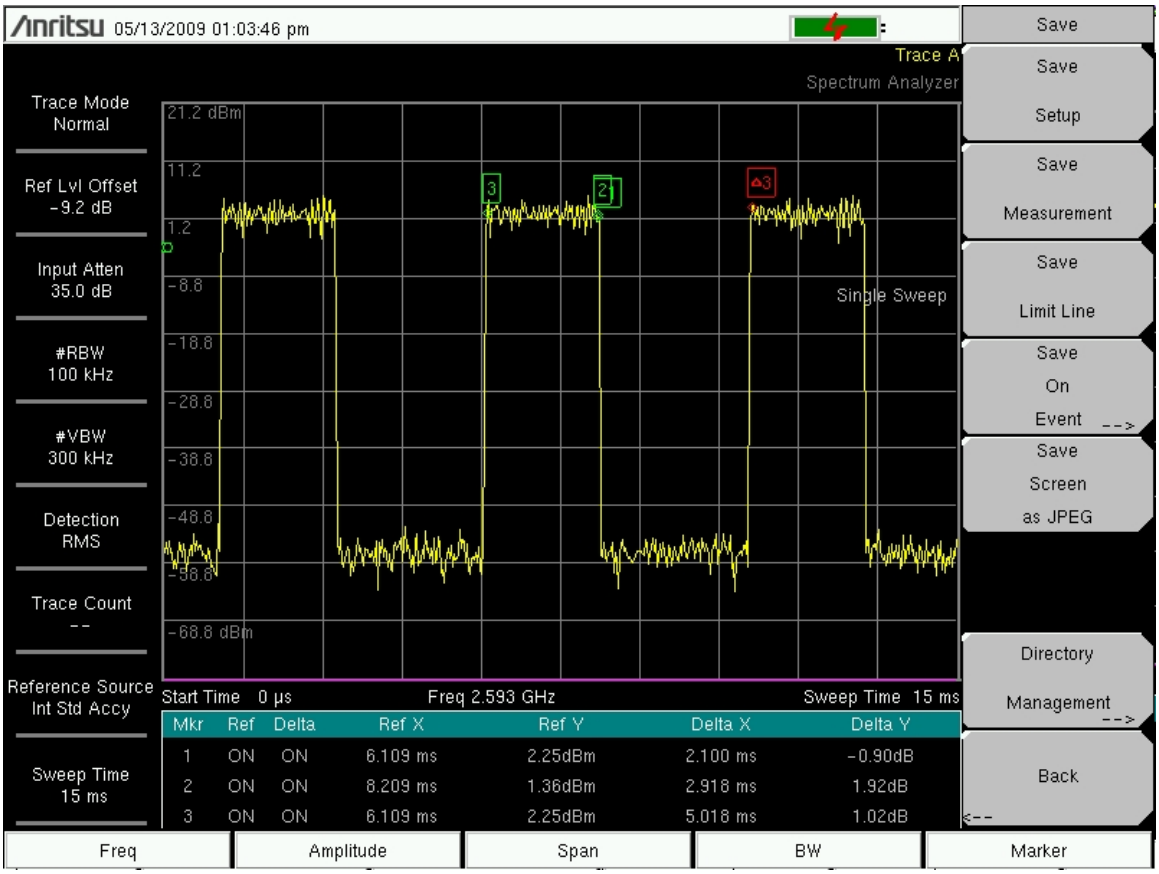
NOTE:

Errors due to positioning of the laptop have not been taken into account.

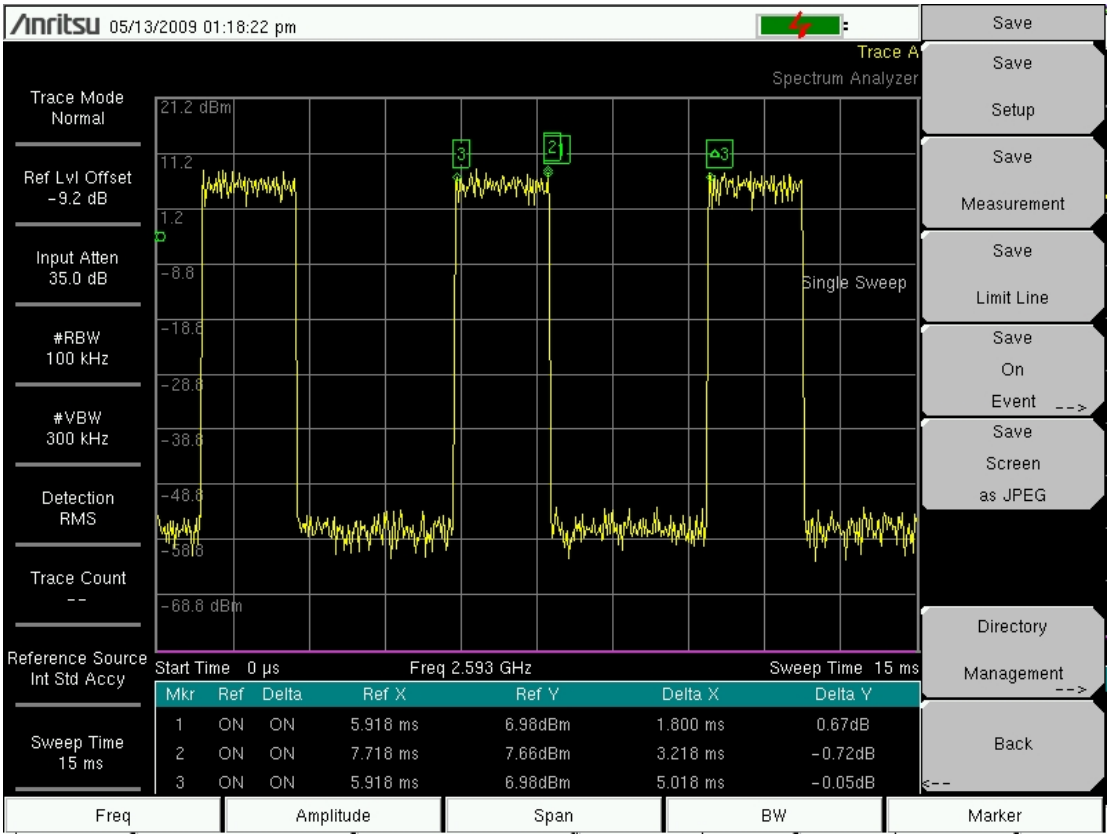
Time Domain Plots



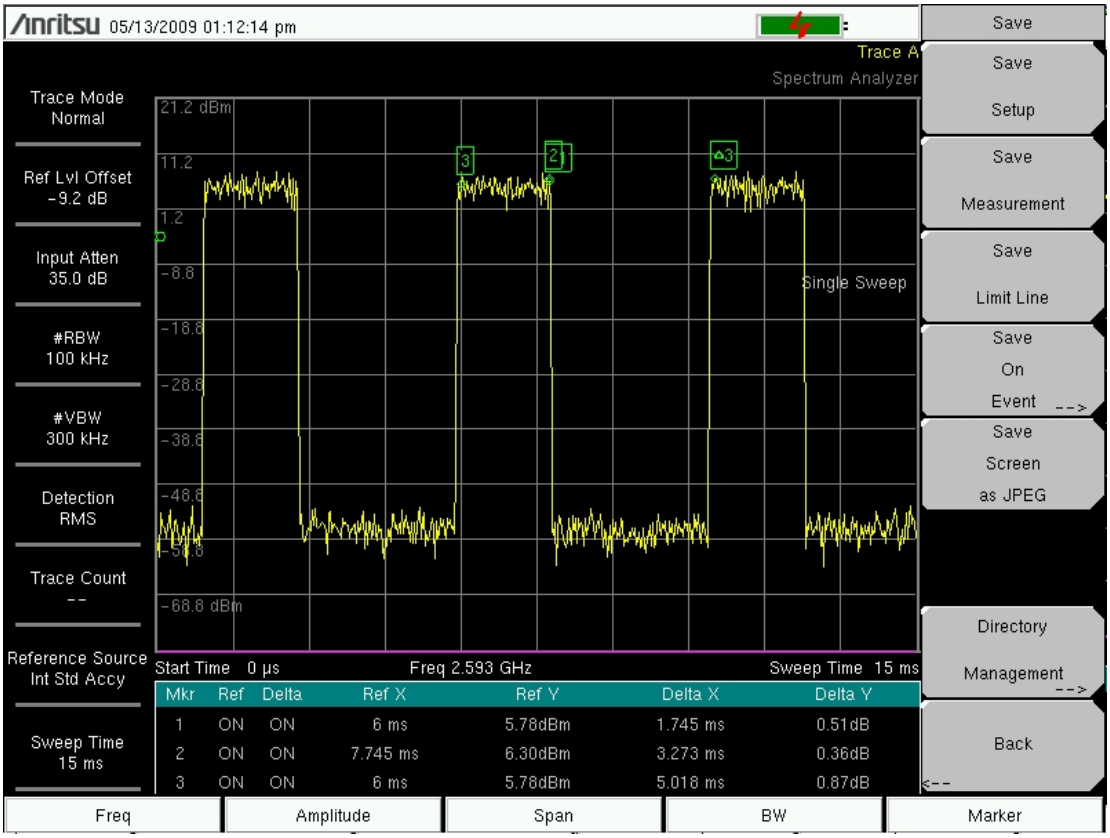
Duty Factor Measurement DQ4_12_UQ16_12_10M



DQ64_UQ4_12_21S_10M



DQ64_56_UQ4_12_5M



DQ4_12_UQ16_34_5M