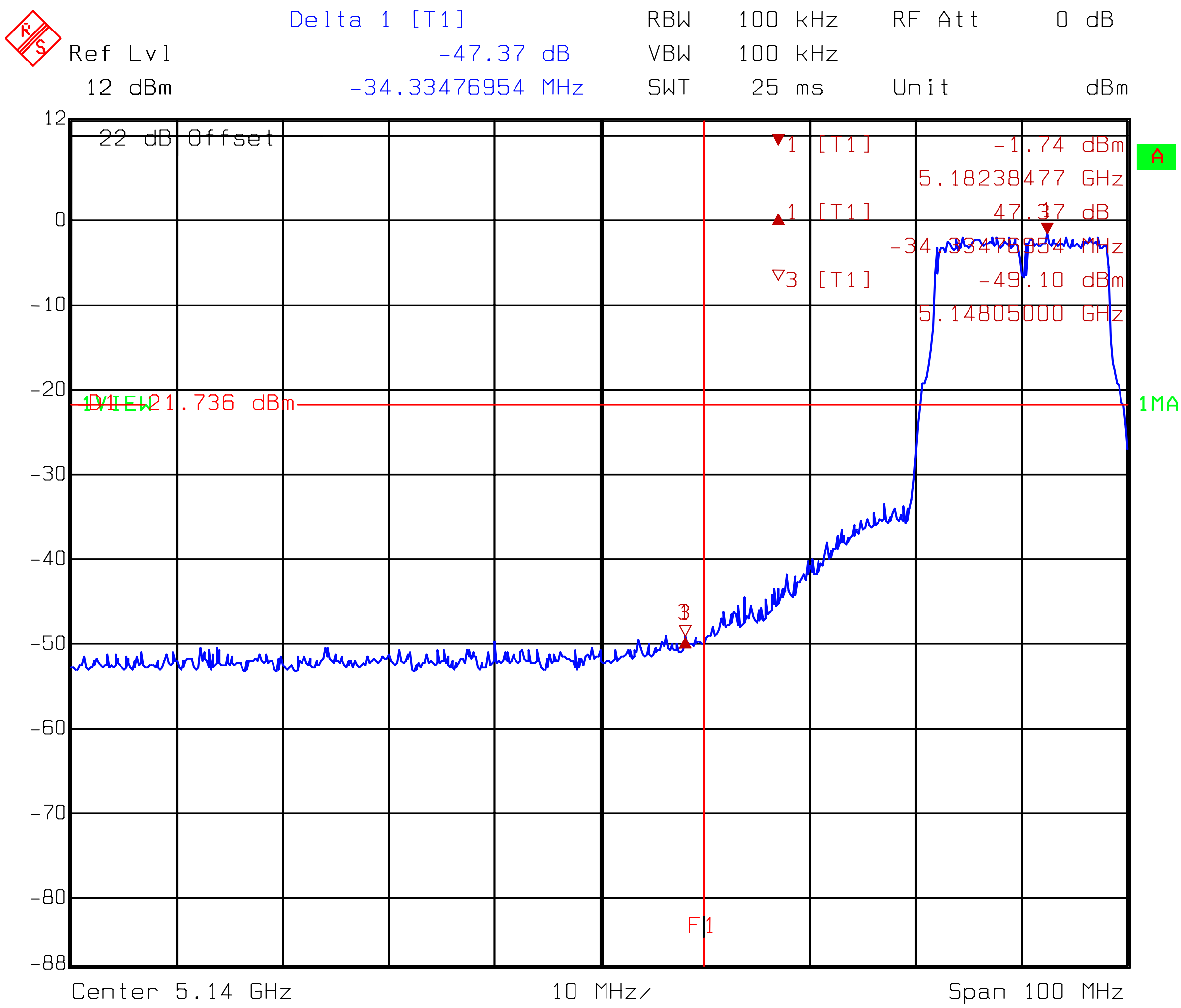
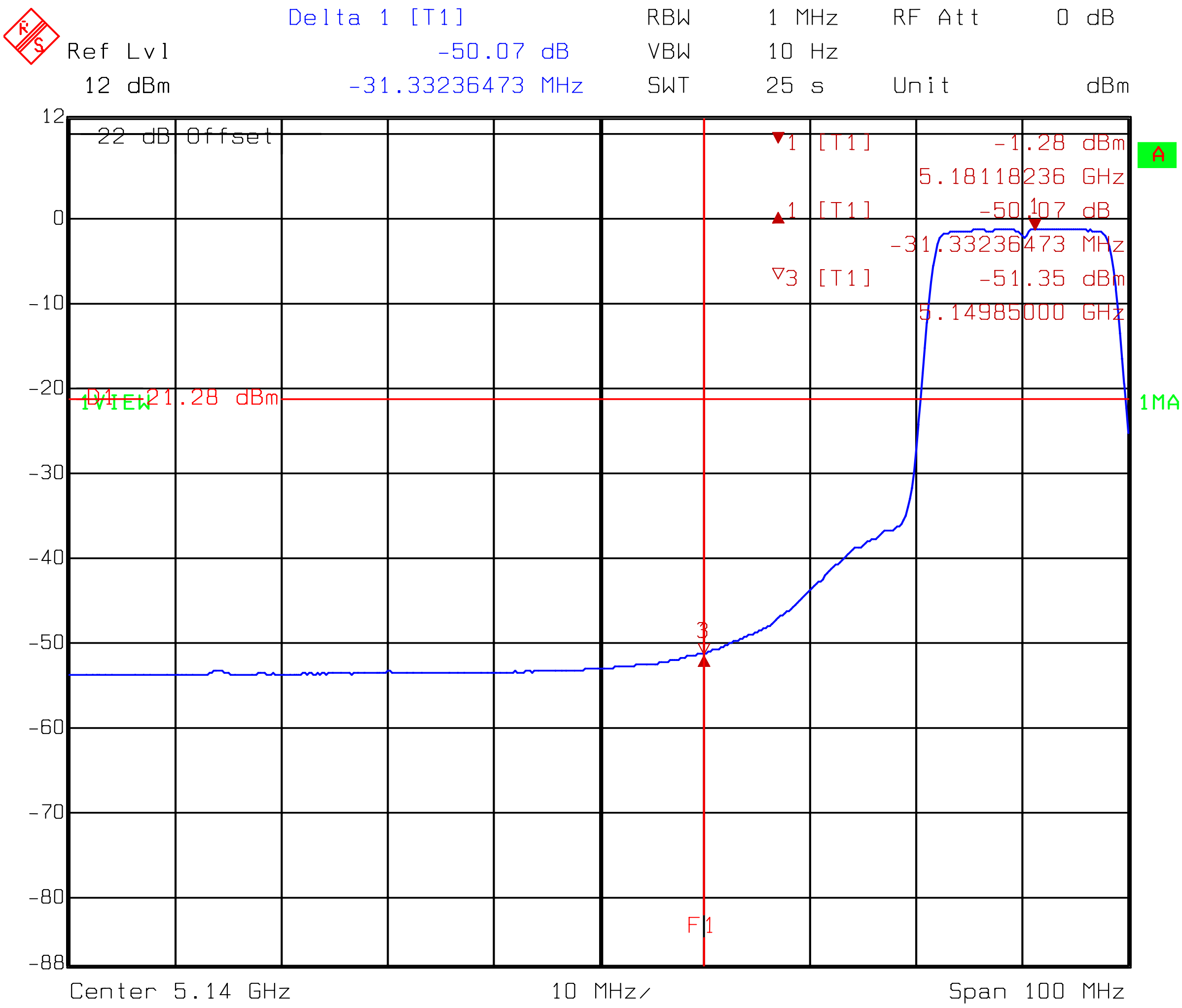
7.4 Conducted method test plots

DACA: 802.11a CH36 PK



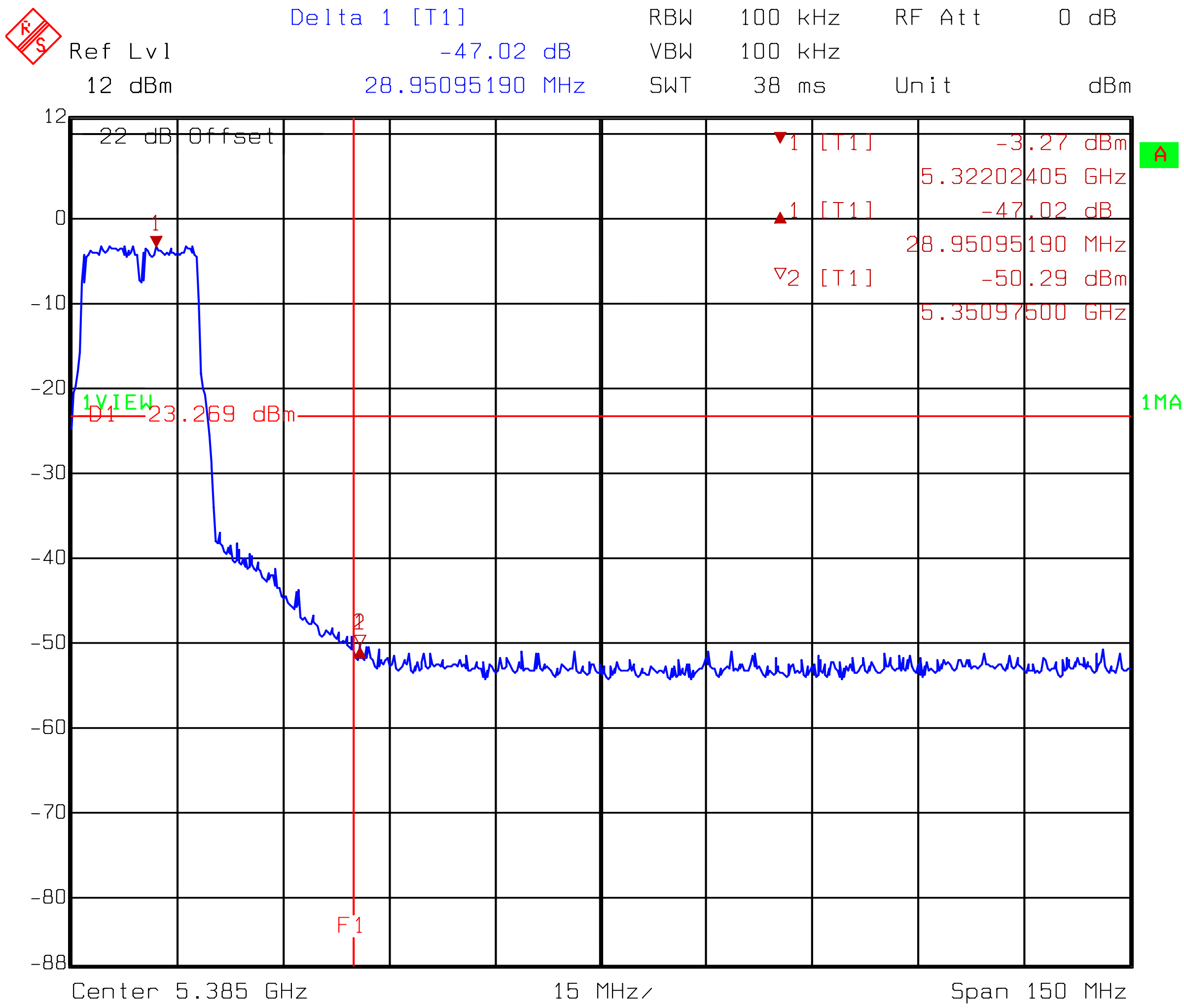
Title: Band Edge
Comment A: CH 36 at 802.11a mode
Date: 14.NOV.2007 15:54:22

DACA: 802.11a CH36 AV



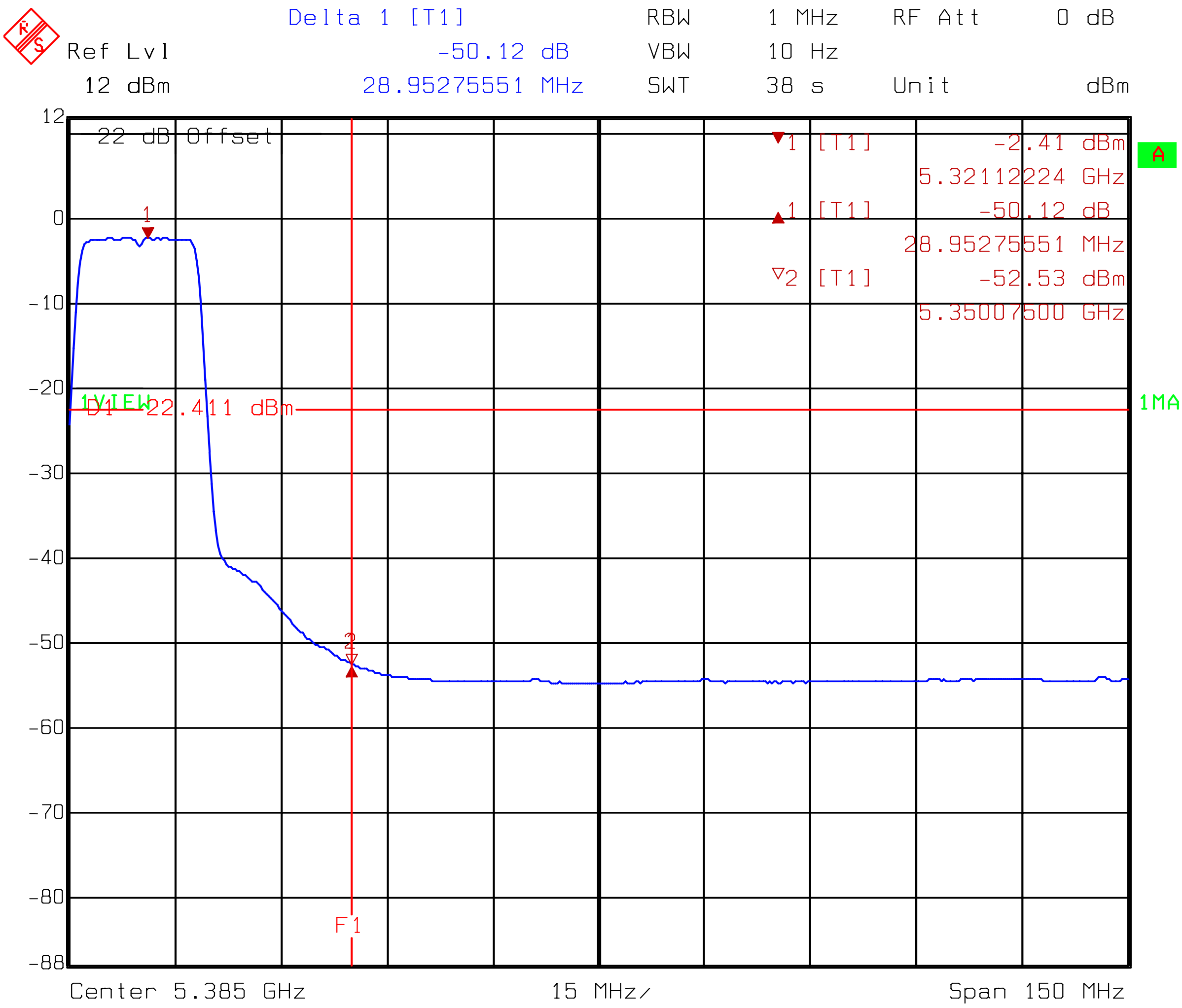
Title: Band Edge
Comment A: CH 36 at 802.11a mode
Date: 14.NOV.2007 15:55:44

DACA: 802.11a CH64 PK



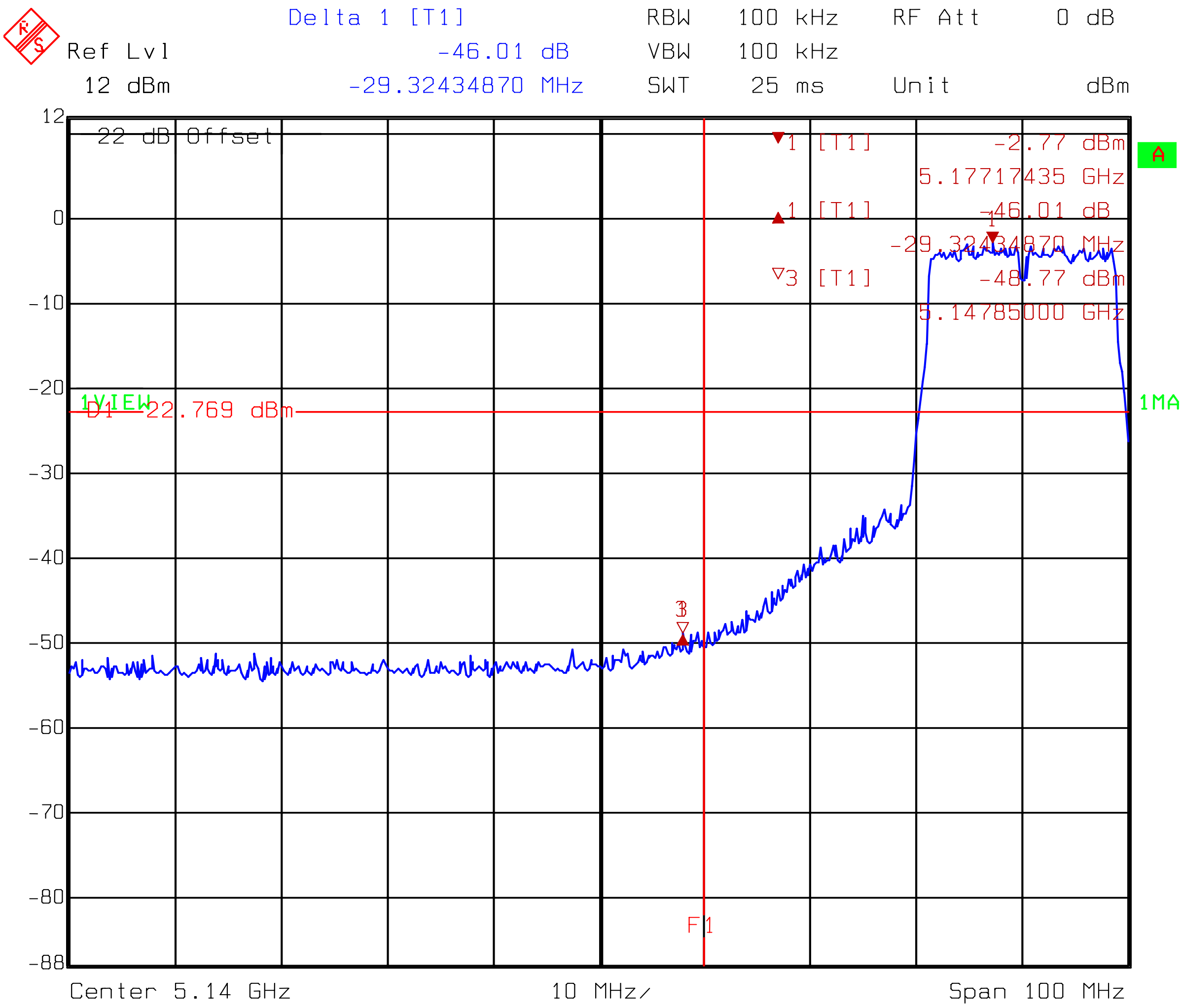
Title: Band Edge
Comment A: CH 64 at 802.11a mode
Date: 14.NOV.2007 15:59:04

DACA: 802.11a CH64 AV



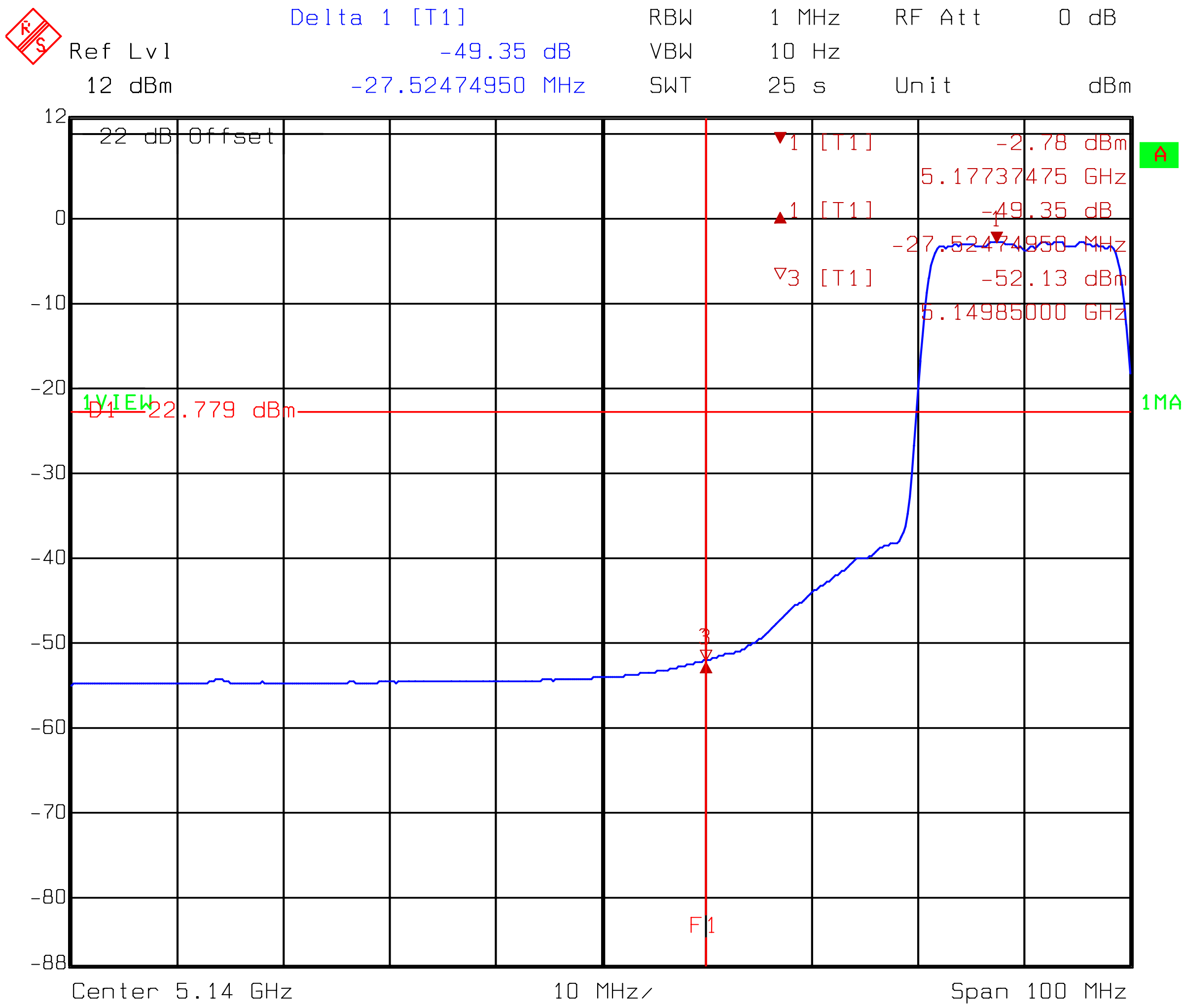
Title: Band Edge
Comment A: CH 64 at 802.11a mode
Date: 14.NOV.2007 16:00:43

DACA: 802.11n 20MHz CH36 PK



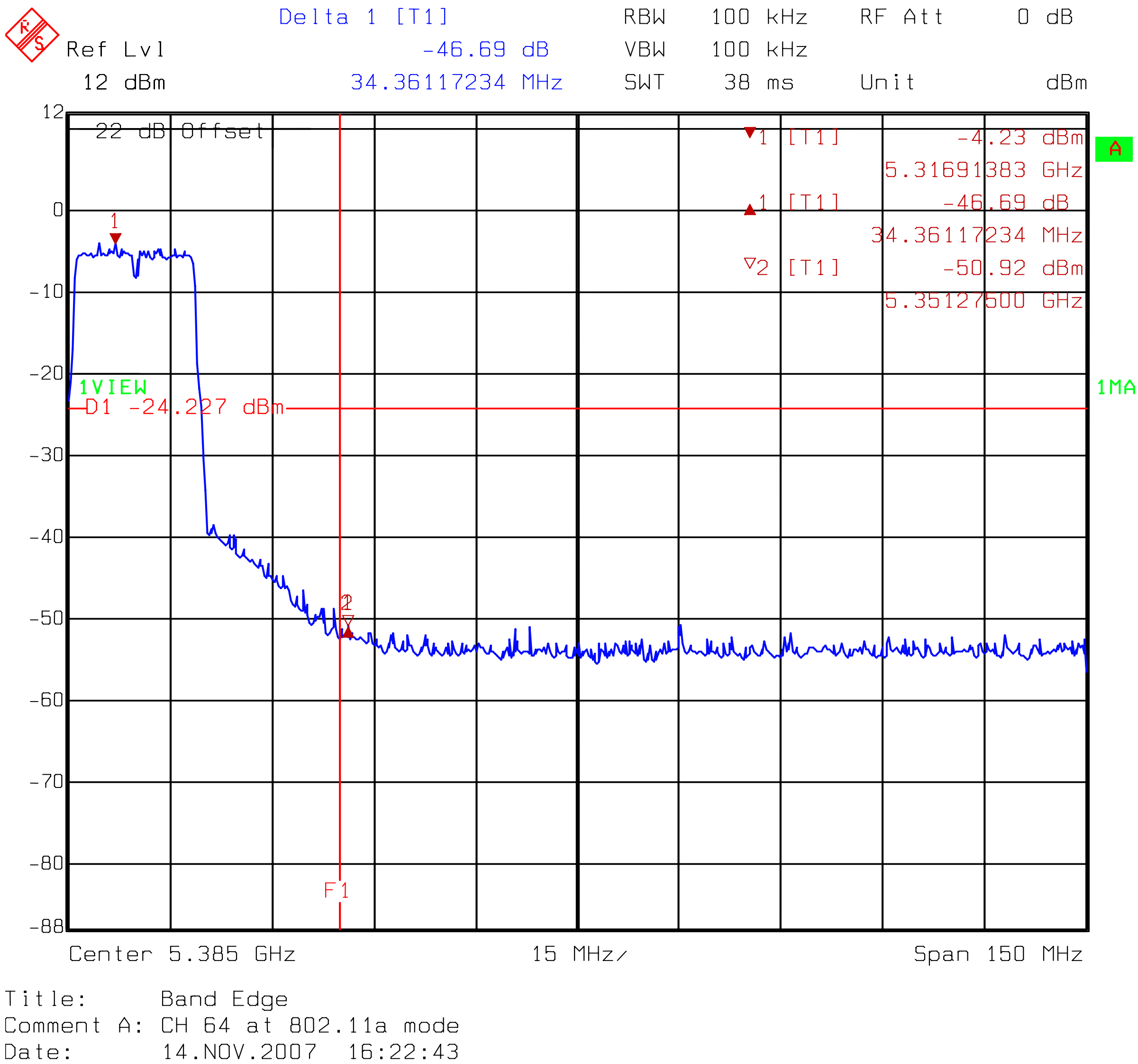
Title: Band Edge
Comment A: CH 36 at 802.11a mode
Date: 14.NOV.2007 16:26:41

DACA: 802.11n 20MHz CH36 AV

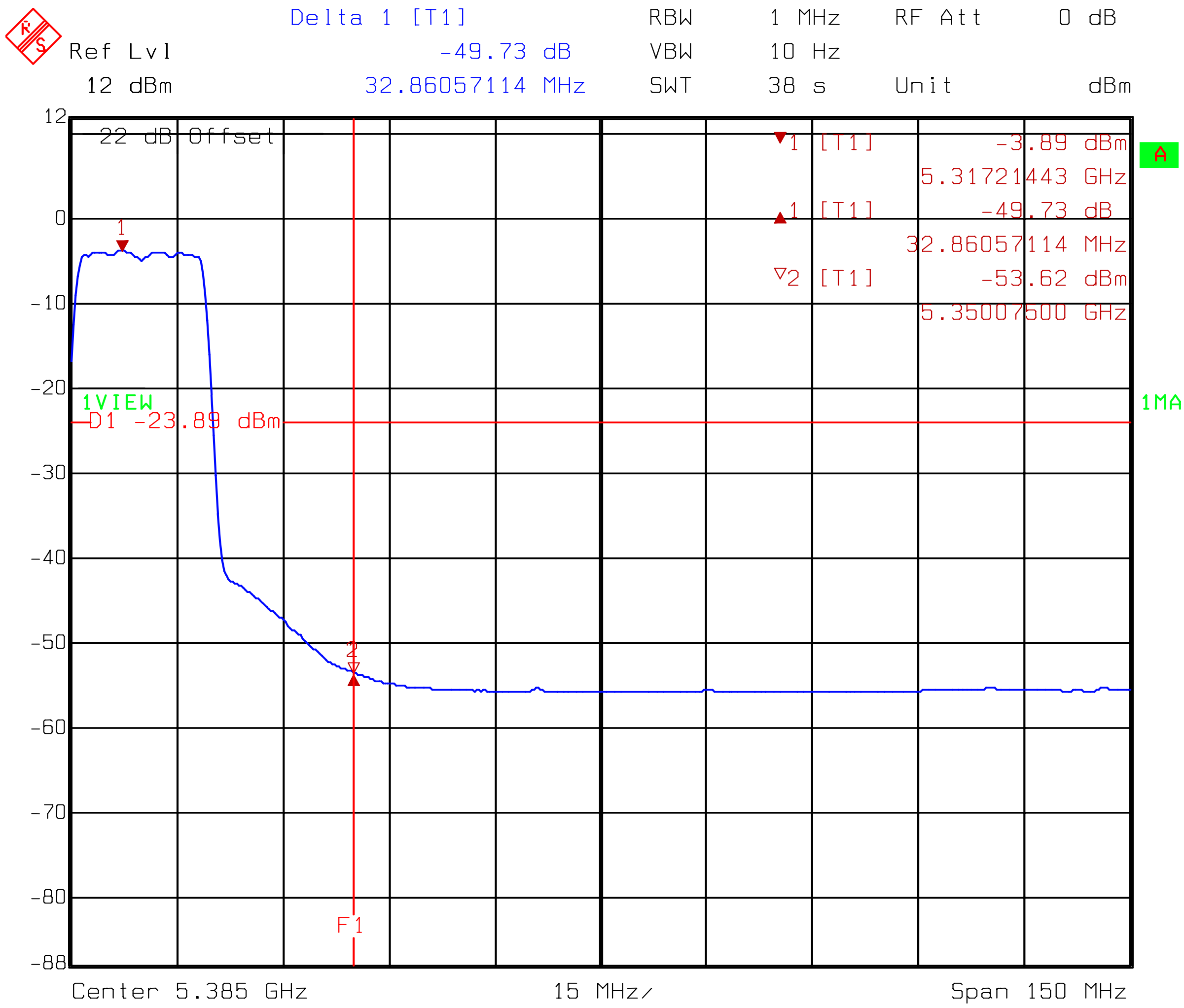


Title: Band Edge
Comment A: CH 36 at 802.11a mode
Date: 14.NOV.2007 16:27:57

DACA: 802.11n 20MHz CH64 PK

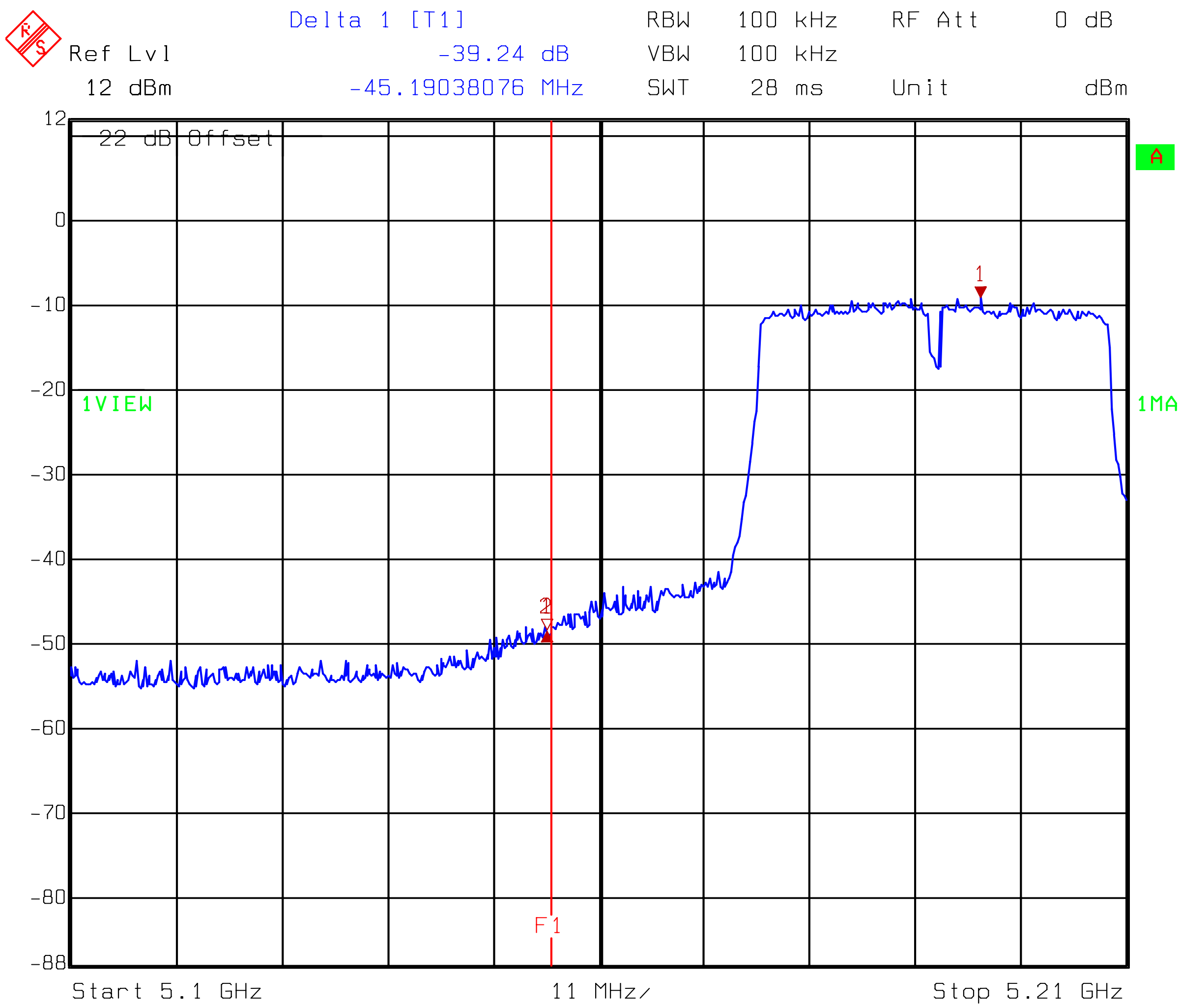


DACA: 802.11n 20MHz CH64 AV



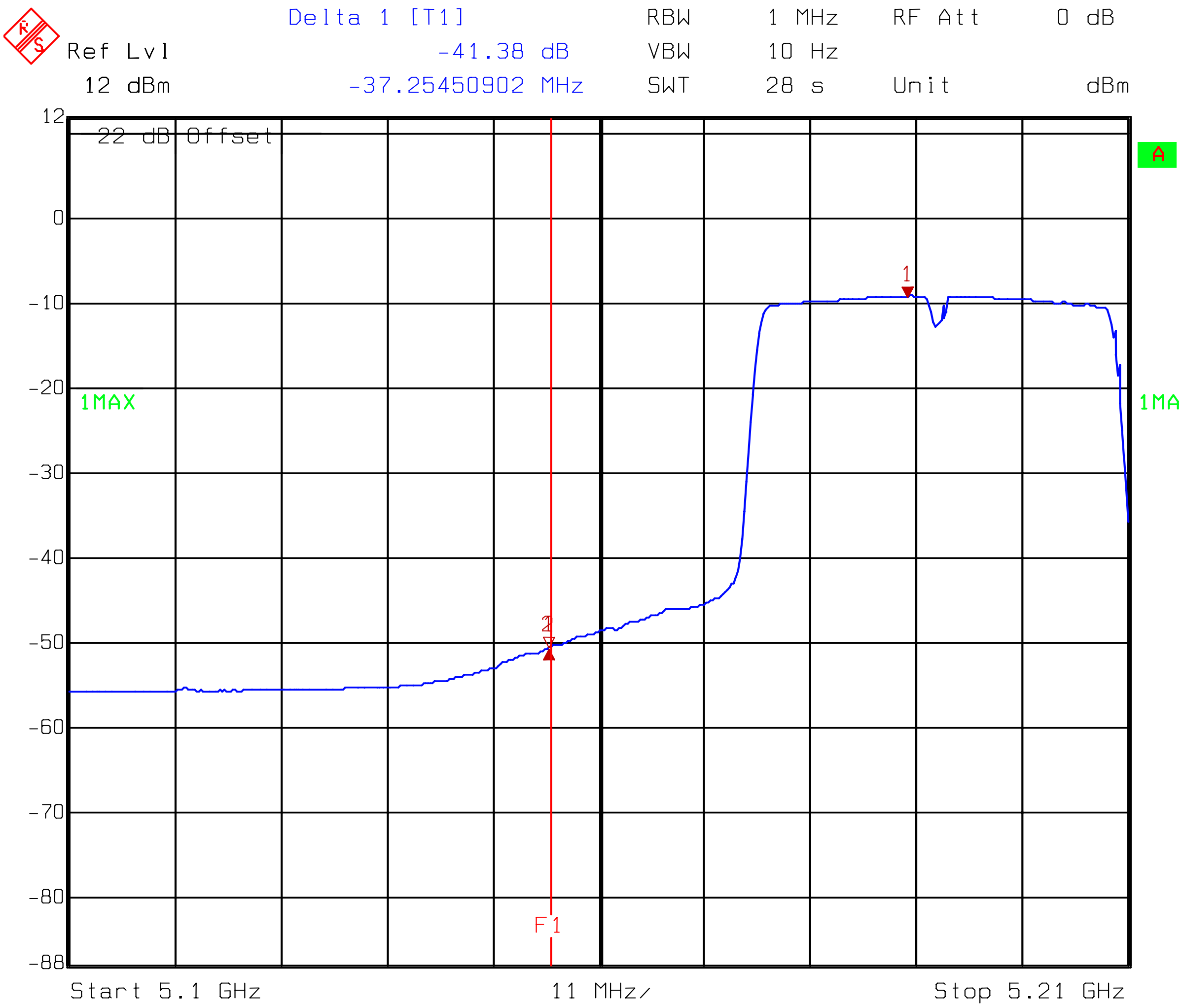
Title: Band Edge
Comment A: CH 64 at 802.11a mode
Date: 14.NOV.2007 16:24:30

DACA: 802.11n 40MHzCH38 PK



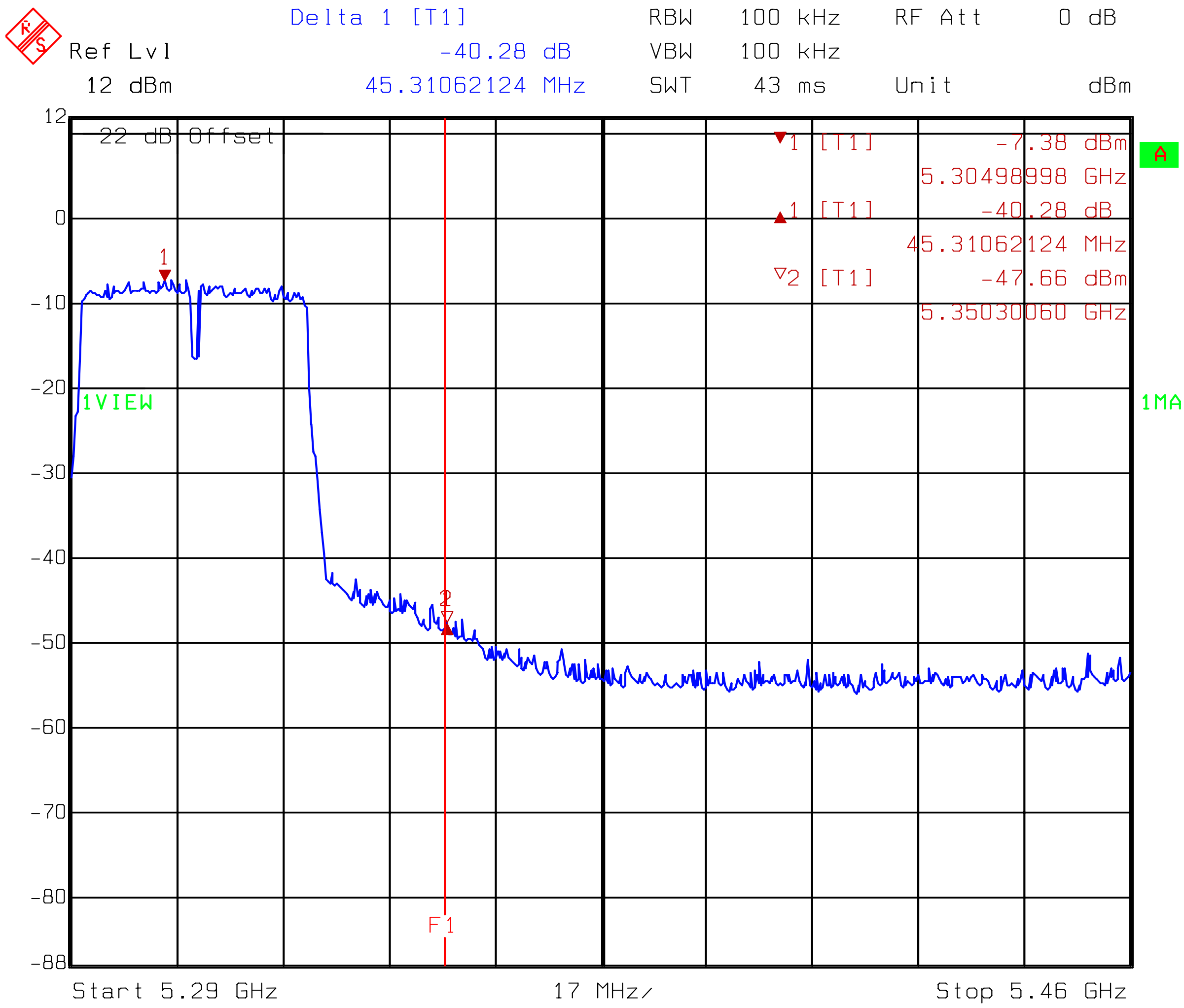
Title: Band-Edge
Comment A: CH38 at 802.11n 40MHZ mode
Date: 16.NOV.2007 14:52:03

DACA: 802.11n 40 MHz CH38 AV



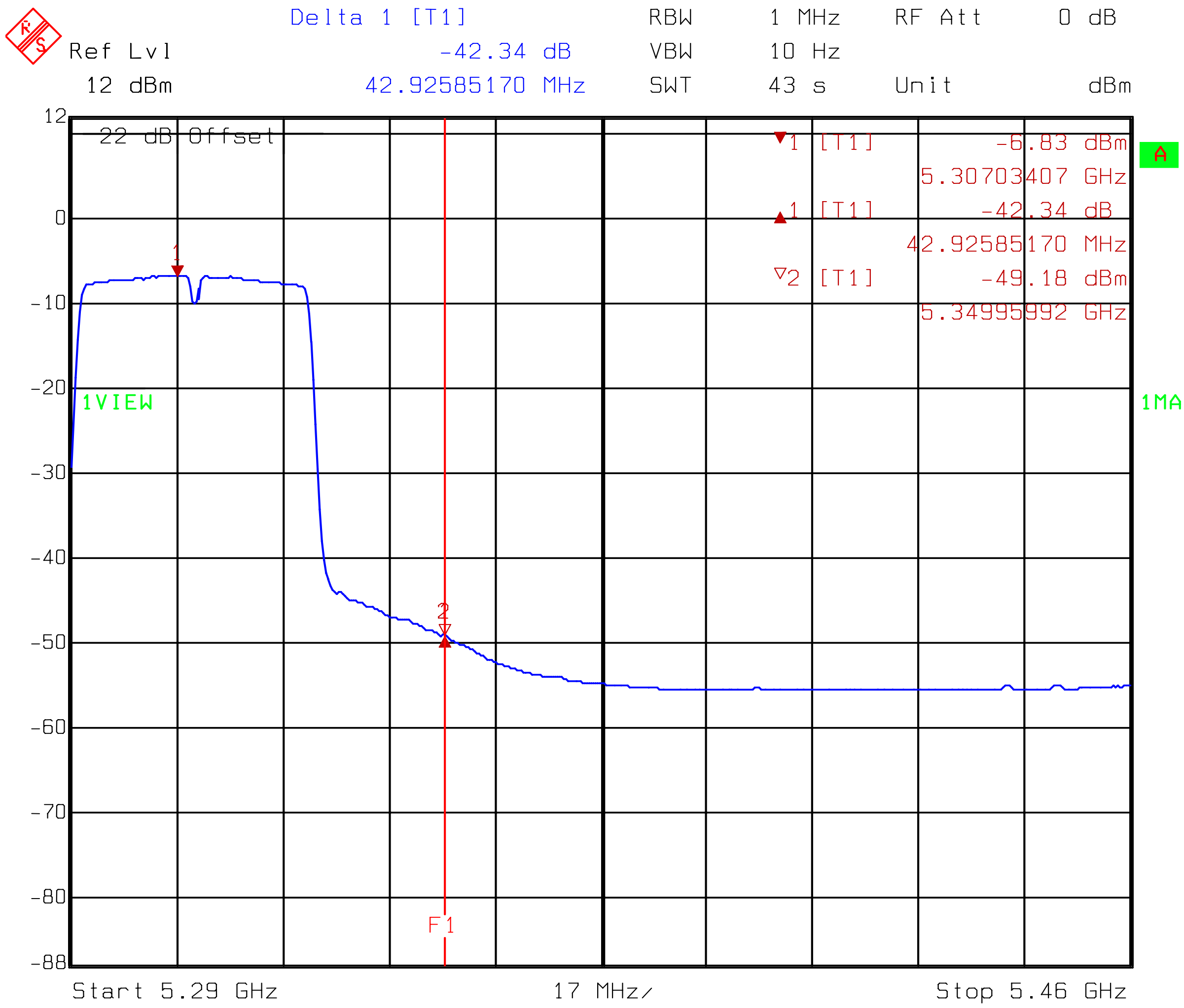
Title: Band-Edge
Comment A: CH38 at 802.11n 40MHZ mode
Date: 16.NOV.2007 14:54:14

DACA: 802.11n 40MHzCH62 PK



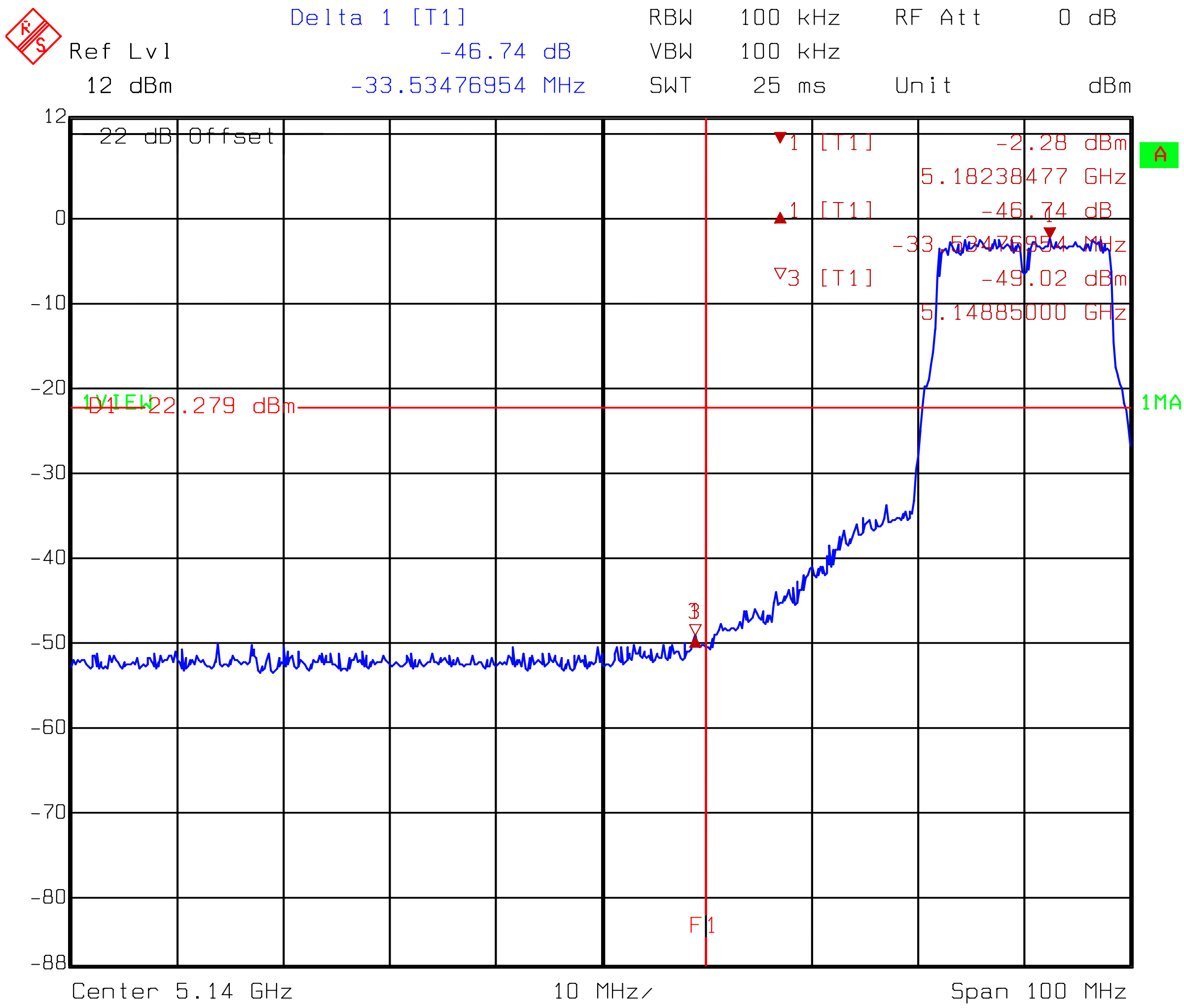
Title: Band-Edge
Comment A: CH62 at 802.11n 40MHZ mode
Date: 14.NOV.2007 17:07:43

DACA: 802.11n 40 MHz CH62 AV



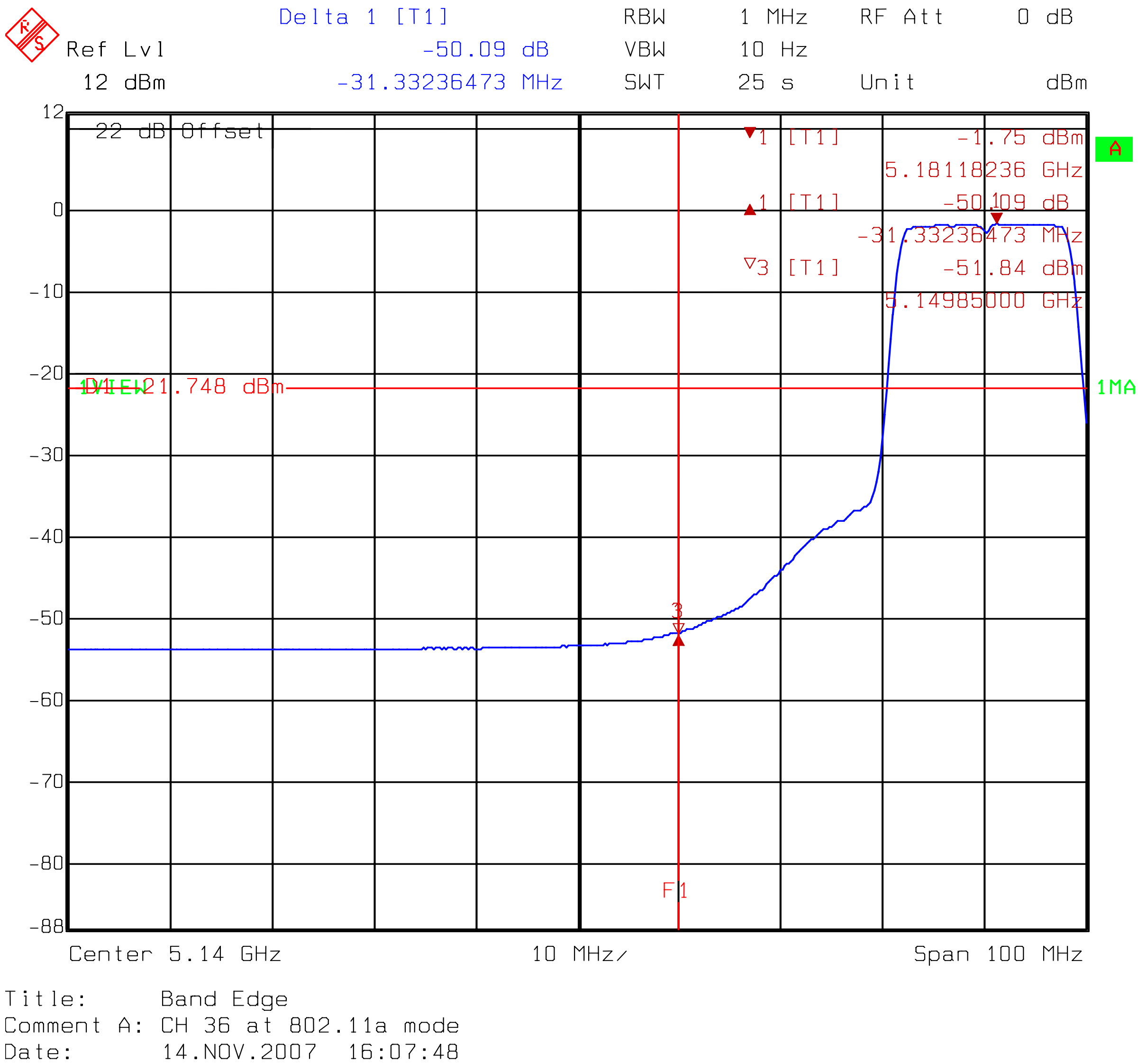
Title: Band-Edge
Comment A: CH62 at 802.11n 40MHZ mode
Date: 14.NOV.2007 17:15:03

DACB: 802.11a CH36 PK

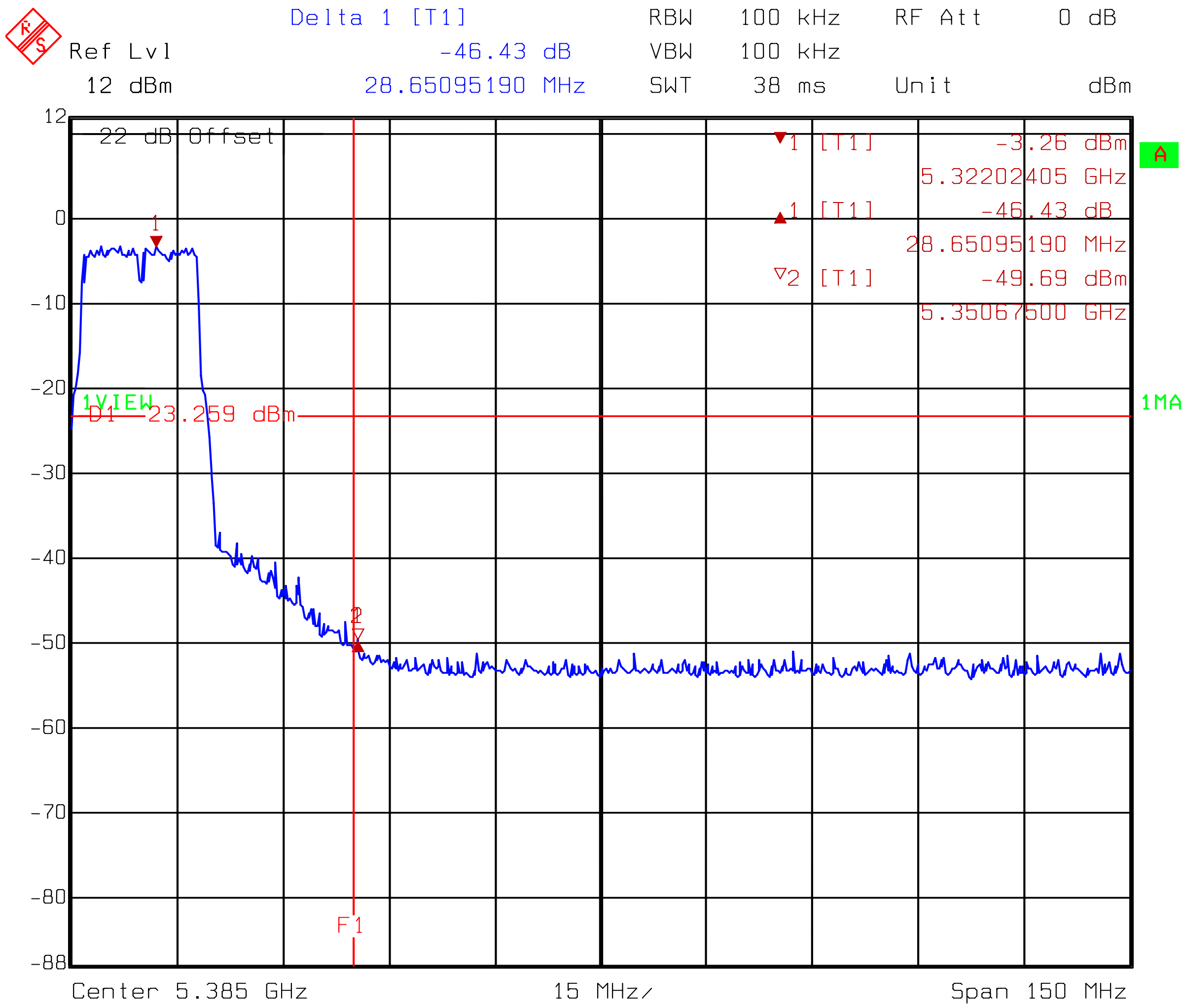


Title: Band Edge
Comment A: CH 36 at 802.11a mode
Date: 14.NOV.2007 16:06:34

DACB: 802.11a CH36 AV

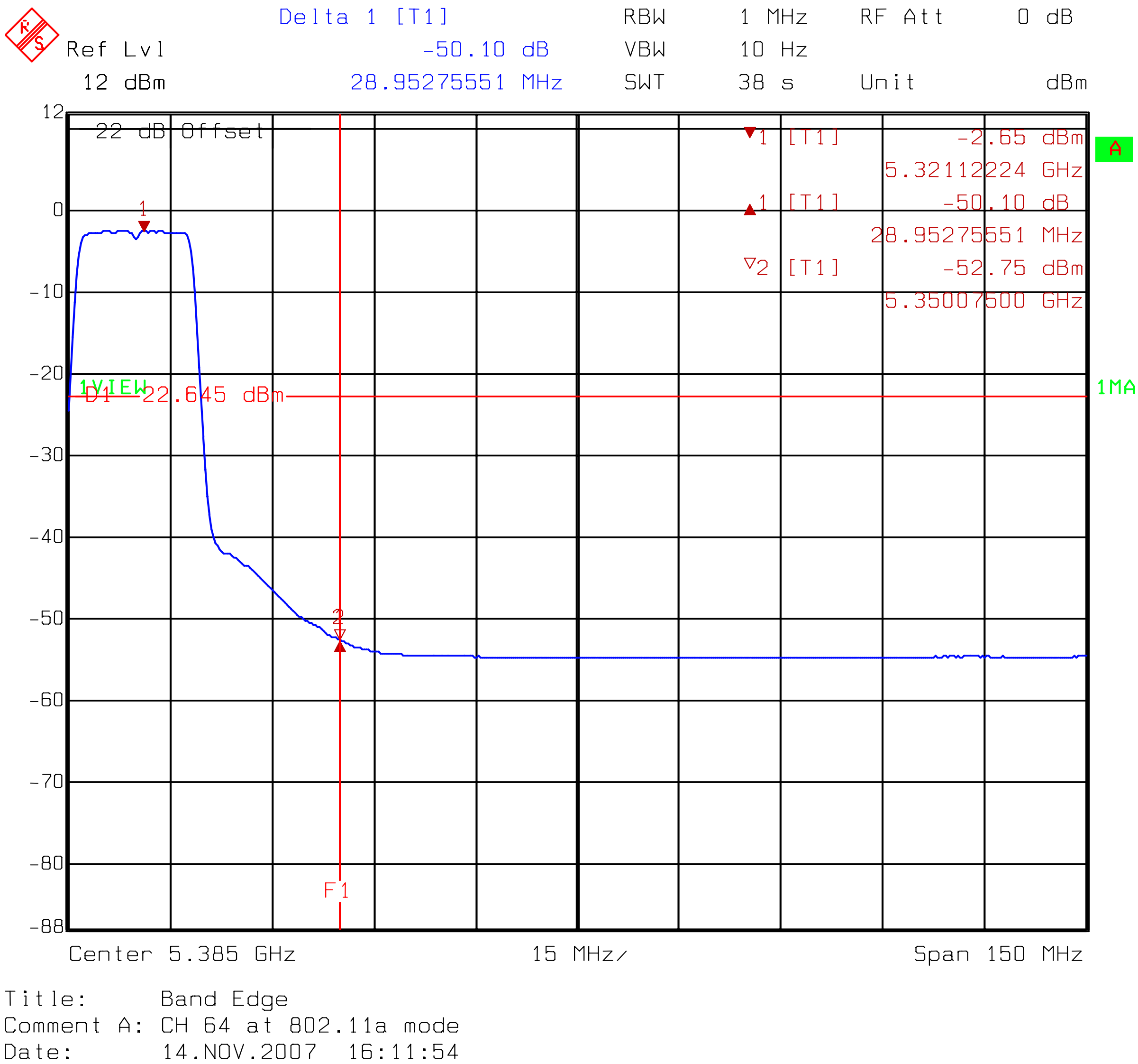


DACB: 802.11a CH64 PK

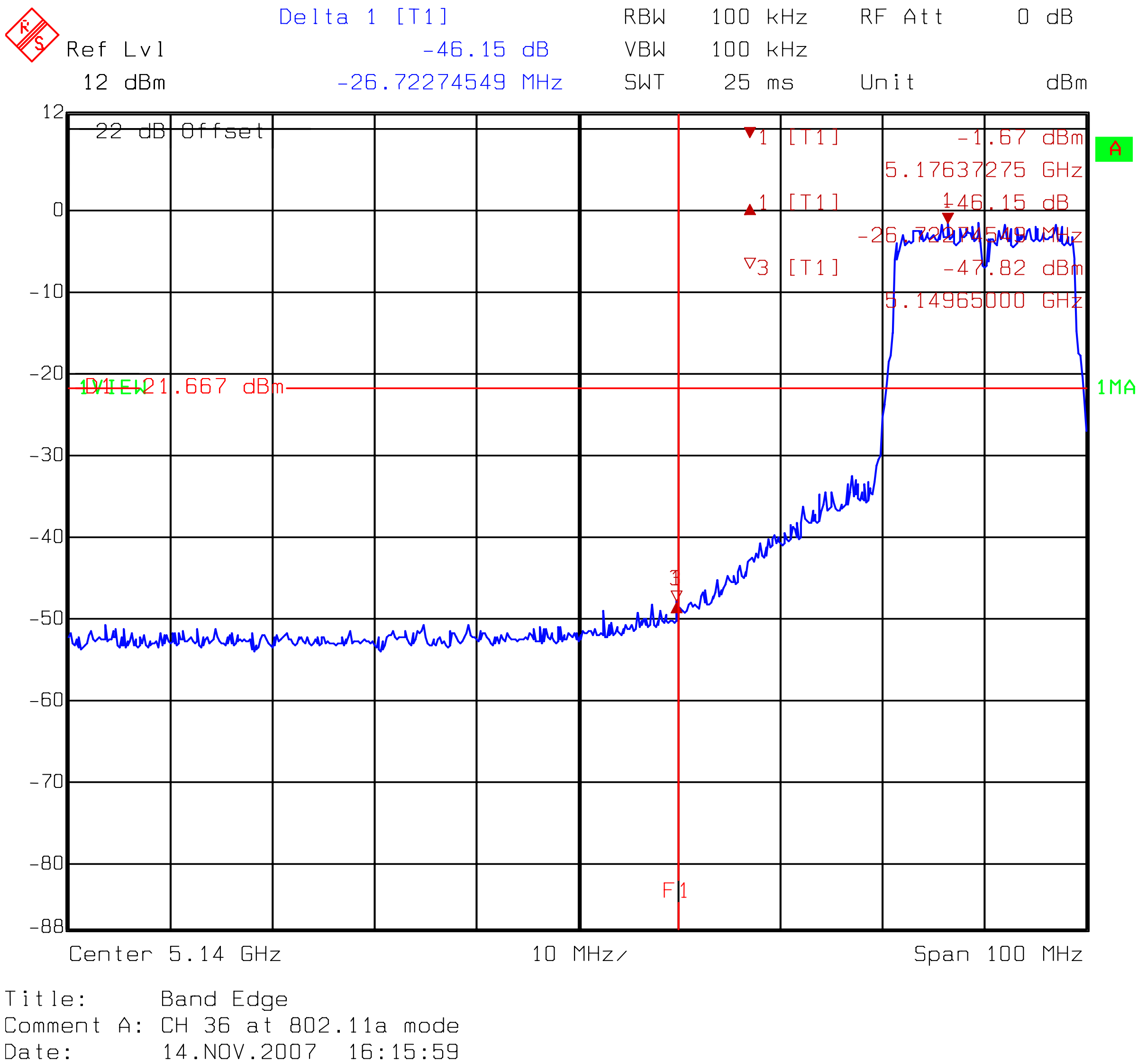


Title: Band Edge
Comment A: CH 64 at 802.11a mode
Date: 14.NOV.2007 16:10:15

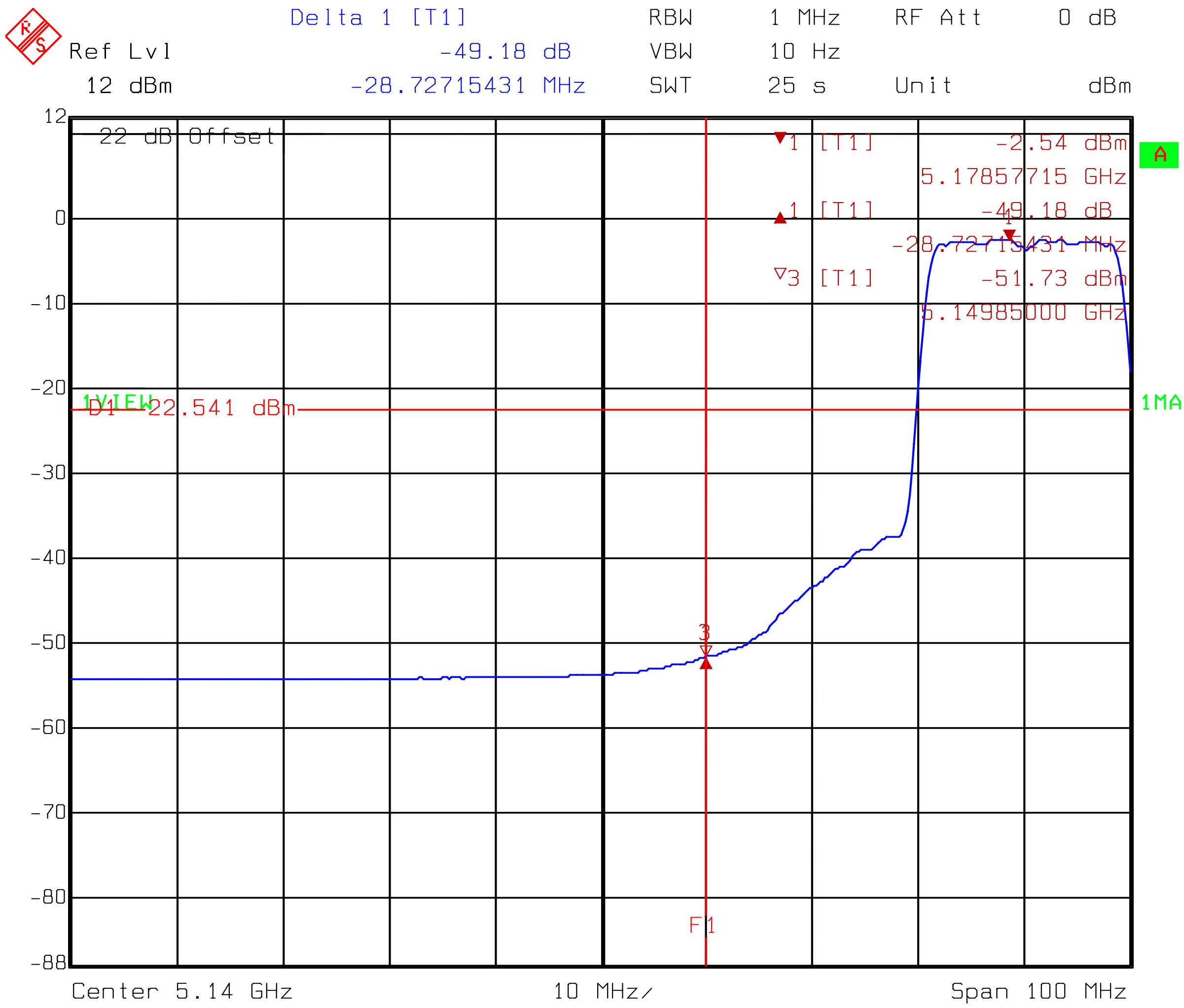
DACB: 802.11a CH64 AV



DACB: 802.11n 20MHz CH36 PK

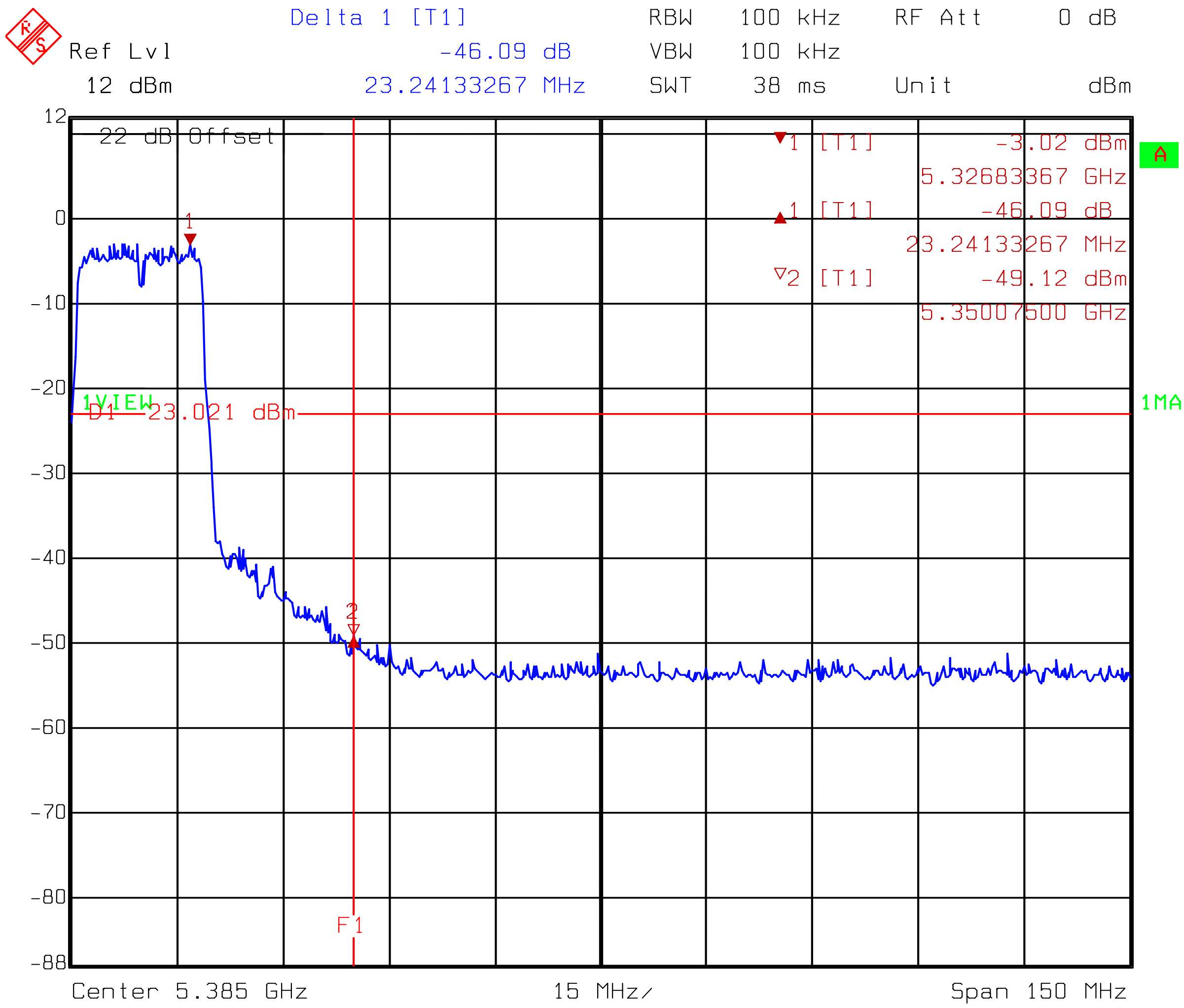


DACB: 802.11n 20MHz CH36 AV



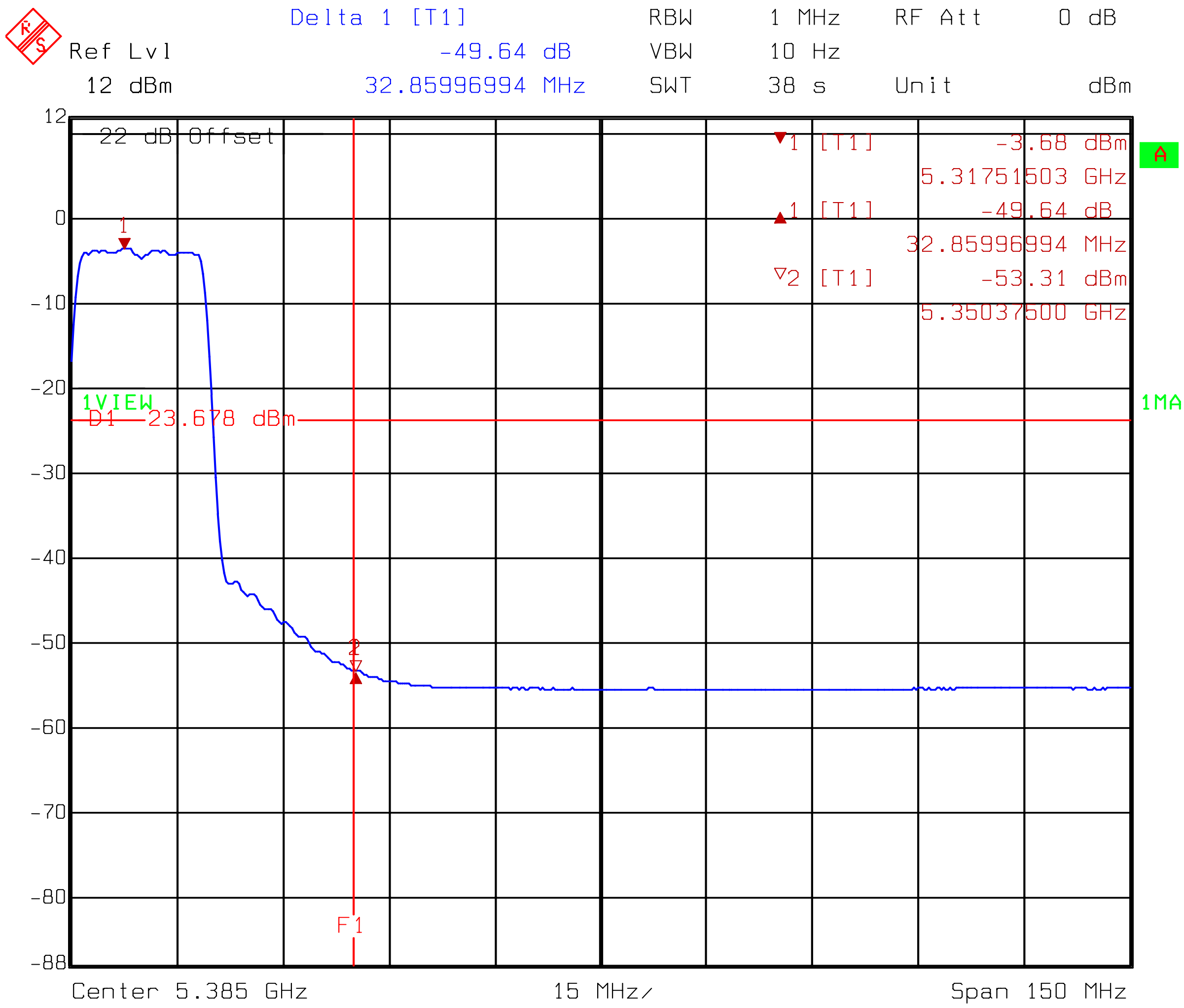
Title: Band Edge
Comment A: CH 36 at 802.11a mode
Date: 14.NOV.2007 16:17:12

DACB: 802.11n 20MHz CH64 PK



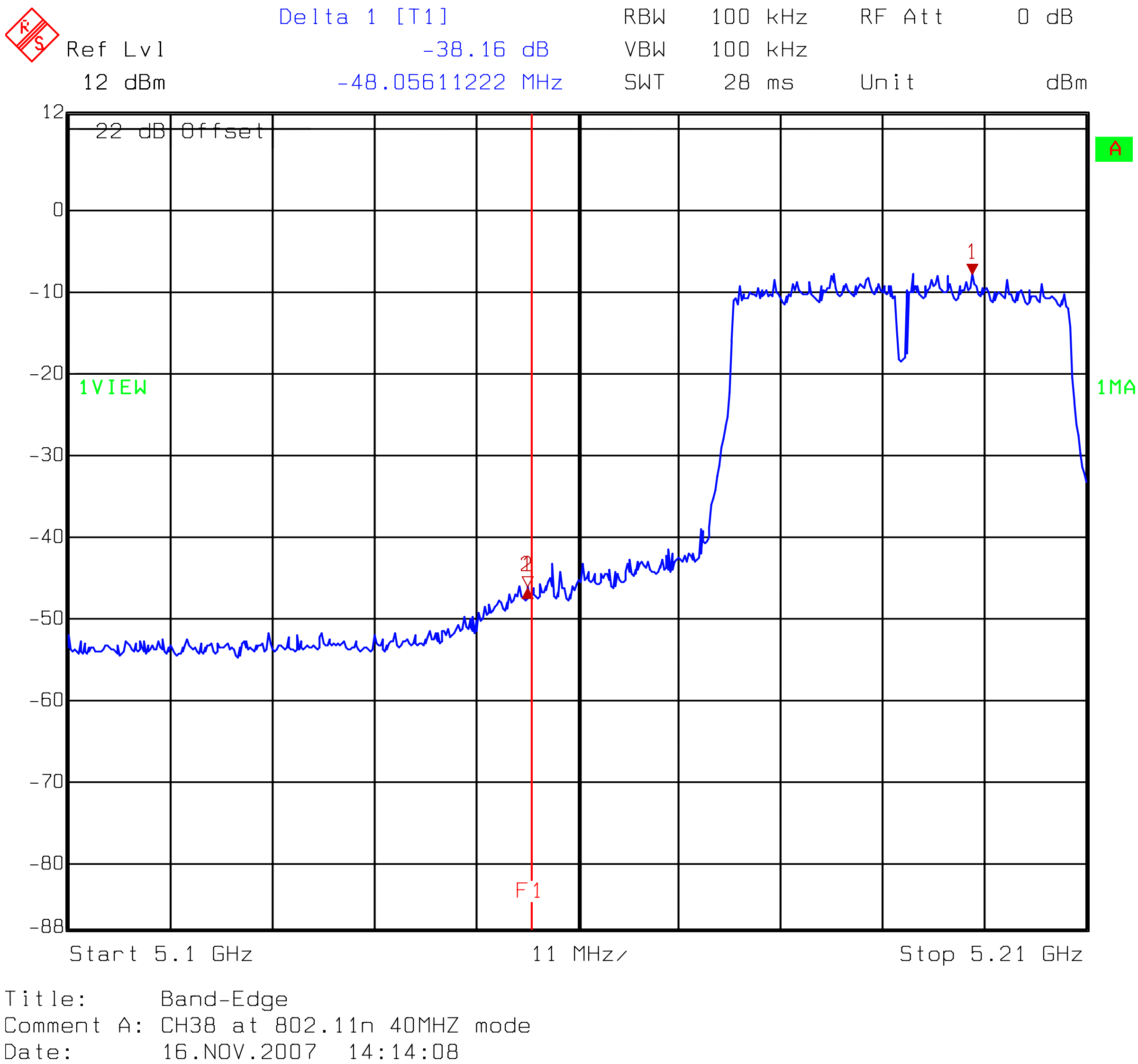
Title: Band Edge
Comment A: CH 64 at 802.11a mode
Date: 14.NOV.2007 16:19:21

DACB: 802.11n 20MHz CH64 AV

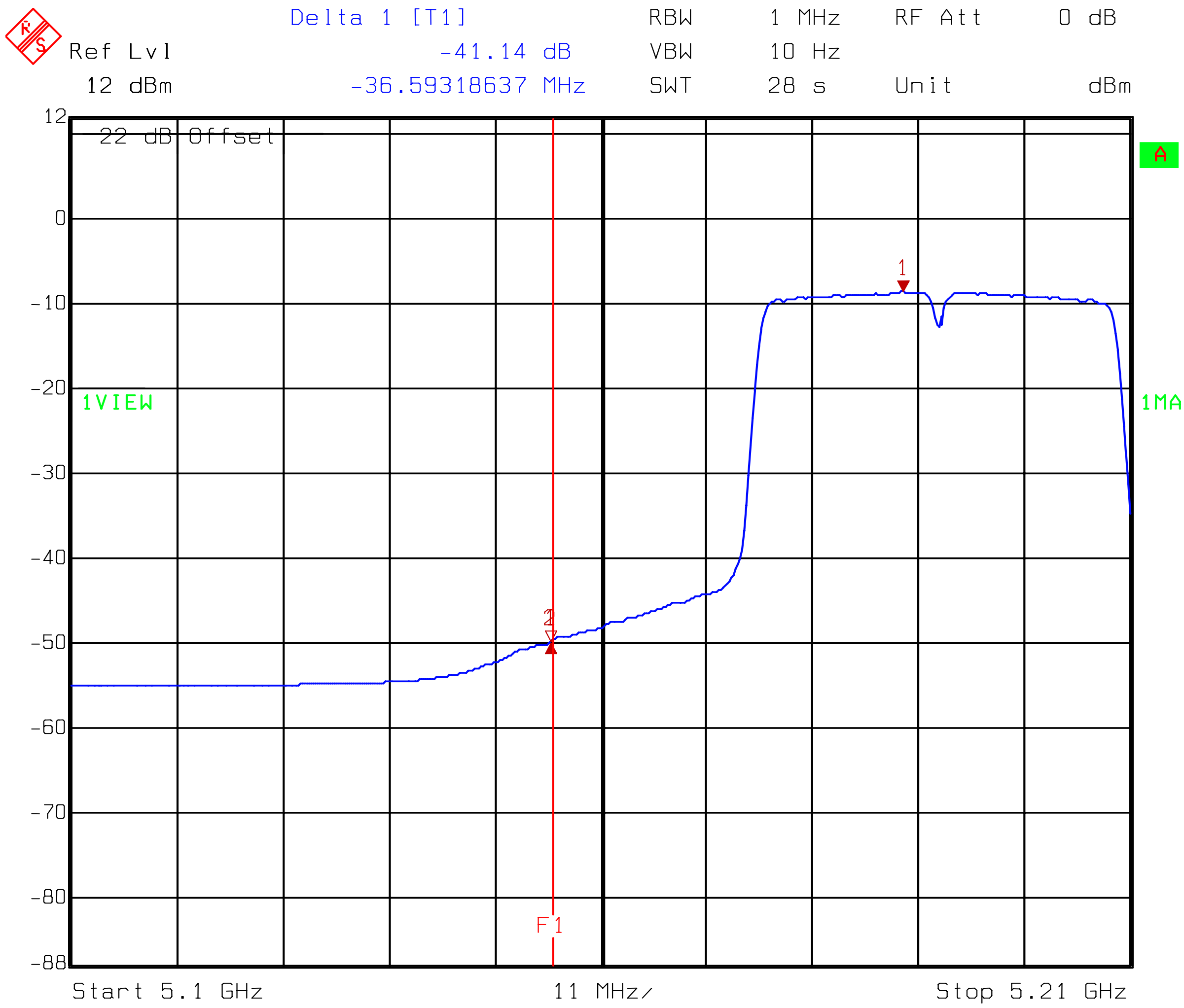


Title: Band Edge
Comment A: CH 64 at 802.11a mode
Date: 14.NOV.2007 16:21:08

DACB: 802.11n 40MHz CH38 PK

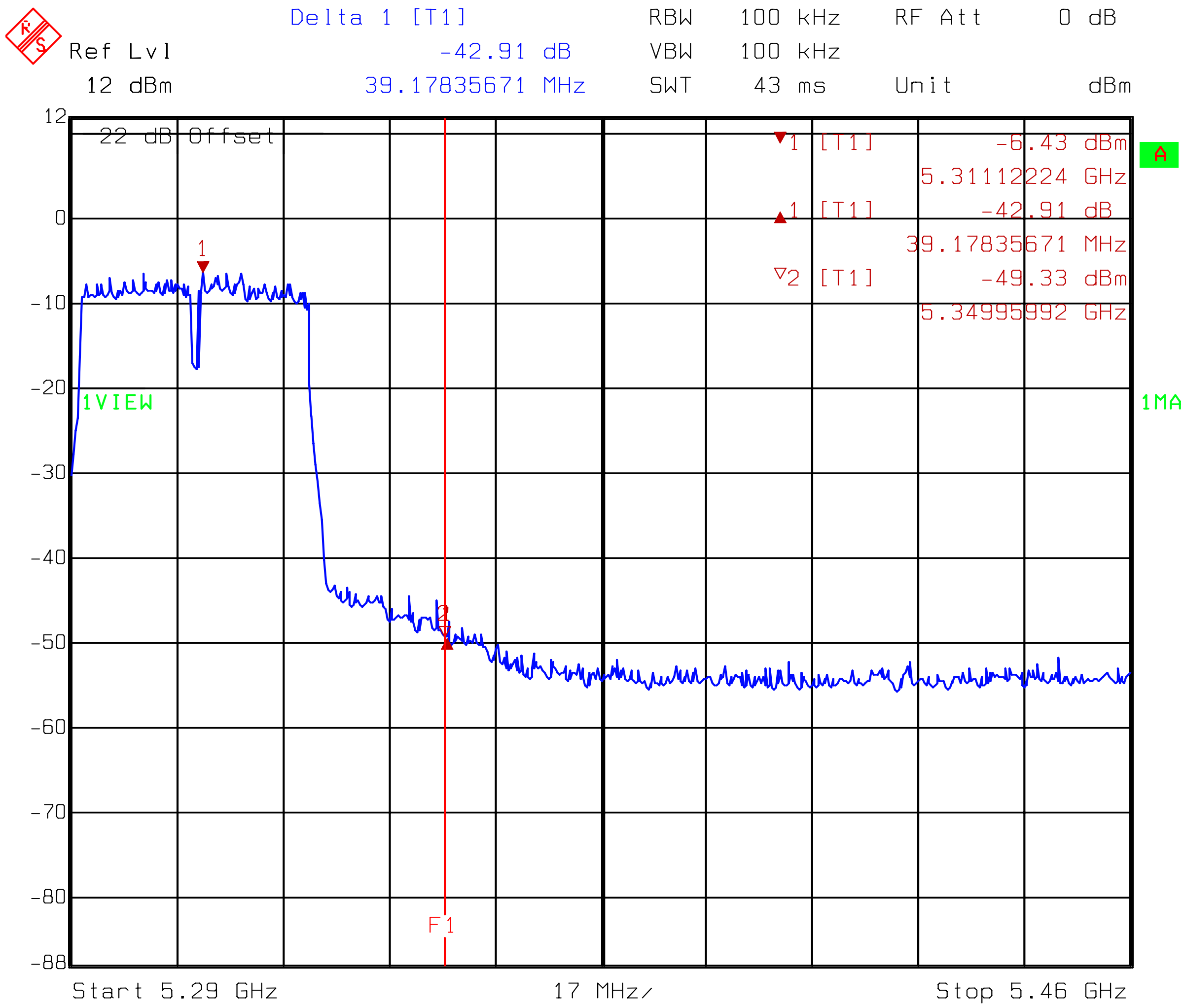


DACB: 802.11n 40 MHz CH38 AV



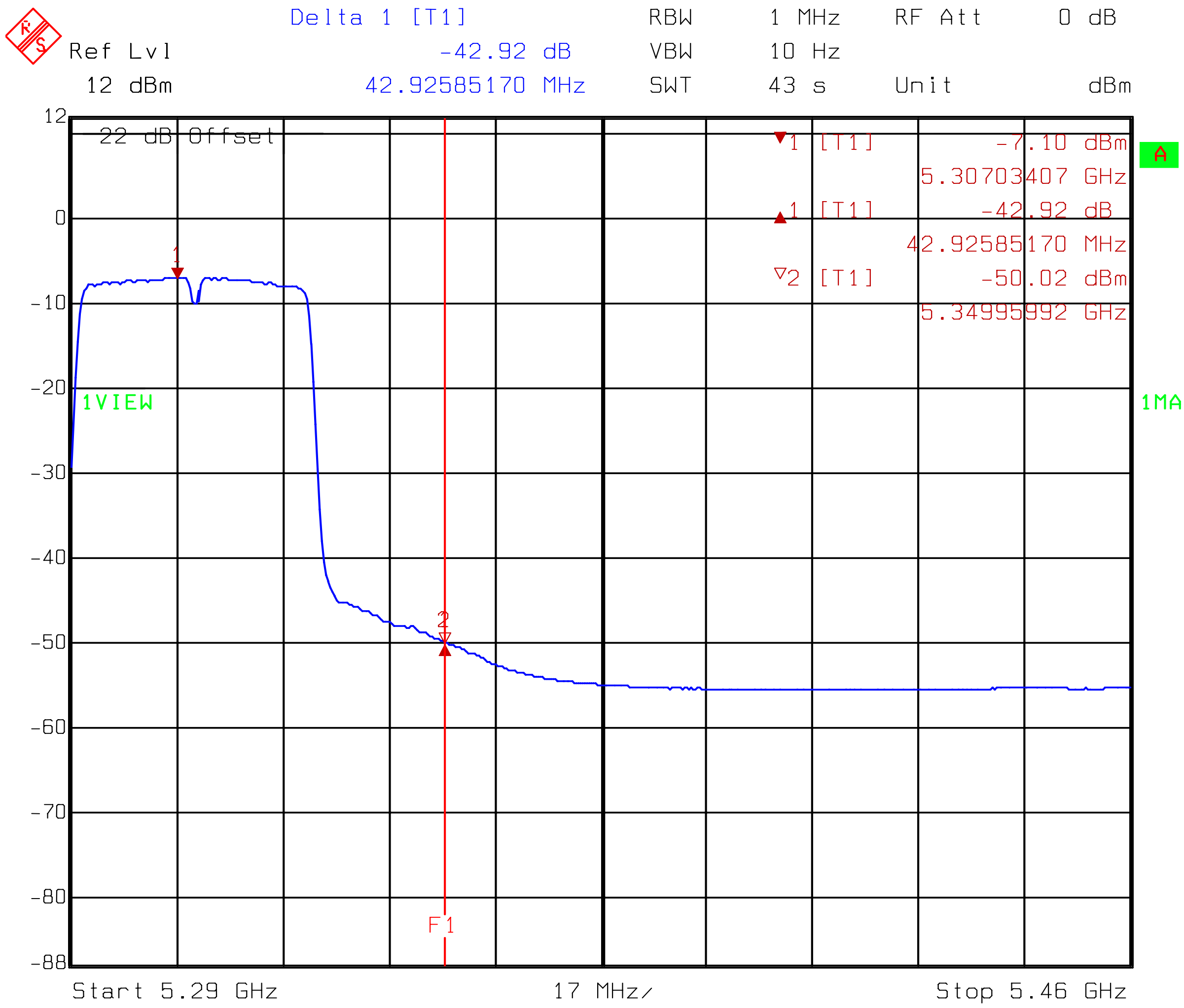
Title: Band-Edge
Comment A: CH38 at 802.11n 40MHZ mode
Date: 16.NOV.2007 15:38:57

DACB: 802.11n 40MHzCH62 PK



Title: Band-Edge
Comment A: CH62 at 802.11n 40MHZ mode
Date: 14.NOV.2007 17:21:36

DACB: 802.11n 40 MHz CH62 AV



Title: Band-Edge
Comment A: CH62 at 802.11n 40MHZ mode
Date: 14.NOV.2007 17:18:31

8. Dynamic Frequency Selection (DFS) test

8.1 Operating environment

Temperature:	23	℃
Relative Humidity:	58	%
Atmospheric Pressure	1023	hPa

1. There is a RF module (WLN-1310) inside the DSM-750 that operates in the following UNII band:
   a. 5150-5250 MHz
   b. 5250-5350 MHz
   b. 5470-5725 MHz

2. Operating mode:

   The RF module was defined as the client without radar detection function.
   There are no "ad-hoc" or "peer-to-peer" mode for this device (please refer the declaration letter).

   Associating peripheral:
   The device was set up to associate with the master device (AIR-AP1242AG-A-K9, FCC ID: LDK102056).

3. The maximum EIRP of this device is 21.44dBm for UNII bands. This device doesn't exceed 27dBm EIRP, so no transmit power control is implemented.

4. Below are the available 50 ohm antenna assemblies and their corresponding gains. 0dBi gain was used to set the -61dBm threshold level (-62dBm+1dB) during calibration of the conducted test setup.

   Antenna type: Dipole,
   Antenna gain: 1.71dBi for 5G bands

5. Information regarding the parameters of the detected Radar Waveforms is not available to the end user.

8.2 Operating mode

The module (WLN-1310) of the EUT was measured at on an active frequency of 5320MHz.
One notebook PC was connected to the AP via wire Ethernet cable.
Power on all the equipments, the AP and the station transmit output levels are set to normal operating condition during DFS testing.
System architectures were used under **IP based mode**.

8.3 Test Protocol and Requirements

For a Master Device, the DFS conformance requirements will be verified utilizing one short pulse radar type. Additionally, the Channel Move Time and Channel Closing Transmission Time requirements will be verified utilizing the long pulse radar type. The statistical performance check will be verified utilizing all radar type.

For a Client Device without DFS, the channel move time and channel closing transmission time requirements will be verified with one short pulse radar type.

For testing a Client Device with In-Service Monitoring, two configurations must be tested.

a. The Client Device detects the radar waveform:
   The channel move time and channel closing transmission time requirements will be verified utilizing short pulse radar type and the long pulse radar type. The statistical performance check will be verified utilizing all radar types.
b. The Master Device detects the radar waveform:
   The channel move time and channel closing transmission time requirements will be verified utilizing short pulse radar type.

A UNII network will employ a DFS function to:
- detect signals from radar systems and to avoid co-channel operation with these systems
- provide on aggregate a Uniform Spreading of the Operating Channels across the entire band. This applies to the 5250-5350 MHz and/ or 5470-5725 MHz bands.

Within the context of the operation of the DFS function, a UNII device will operate in either Master Mode or Client Mode. UNII devices operating in Client Mode can only operate in a network controlled by a UNII device operating in Master Mode.
The tables as below summarize the information contained.

Applicability of DFS Requirements Prior to Use of a Channel

Requirement	Operational Mode		
	Master	Client Without Radar Detection	Client With Radar Detection
Non-Occupancy Period	Yes	Not required	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required
Uniform Spreading	Yes	Not required	Not required
UNII Detection Bandwidth	Yes	Not required	Yes

Applicability of DFS requirements during normal operation

Requirement	Operational Mode		
	Master	Client Without Radar Detection	Client With Radar Detection
DFS Detection Threshold	Yes	Not required	Yes
Channel Closing Transmission Time	Yes	Yes	Yes
Channel Move Time	Yes	Yes	Yes
UNII Detection Bandwidth	Yes	Not required	Yes

8.4 DFS Detection Thresholds and Limitations of each Parameter

Maximum Transmit Power	Value (See Notes 1 and 2)
≧ 200 mW	-64 dBm
≦ 200 mW	-62 dBm
Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna. Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.	

Parameter	Value
Non-occupancy Period	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds (See Note 1)
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period (See Note 1 and 2)
UNII Detection Bandwidth	Minimum 80% of the UNII 99% transmission power bandwidth. (See Note 3)
Note 1: The instant that the Channel Move Time and the Channel Closing Transmission Time begins is as follows: • For the Short Pulse Radar Test Signals this instant is the end of the Burst. • For the Frequency Hopping radar Test Signal, this instant is the end of the last radar Burst generated. • For the Long Pulse Radar Test Signal this instant is the end of the 12 second period defining the Radar Waveform. Note 2: The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required to facilitate a Channel move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions. Note 3: During the U-NII Detection Bandwidth detection test, radar type 1 is used and for each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.	

8.5 Radar Test Waveforms

This section provides the parameters for required test waveforms, minimum percentage of successful detections, and the minimum number of trials that must be used for determining DFS conformance. Step intervals of 0.1 microsecond for Pulse Width, 1 microsecond for PRI, 1 MHz for chirp width and 1 for the number of pulses will be utilized for the random determination of specific test waveforms.

Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (µsec)	PRI (µsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Number of Trials
1	1	1428	18	60%	30
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120

A minimum of 30 unique waveforms are required for each of the Short Pulse Radar Type 2 through 4. For Short Pulse Radar Type 1, the same waveform is used a minimum of 30 times. If more than 30 waveforms are used for Short Pulse Radar Type 2 through 4, then each additional waveform must also be unique and not repeated from the previous waveforms.

The aggregate is the average of the percentage of successful detections of Short Pulse Radar Type 1-4.

Long Pulse Radar Test Waveforms

Radar Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Number of Pulses per Burst	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Number of Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

The parameters for this waveform are randomly chosen. Thirty unique waveforms are required for the Long Pulse radar test signal. If more than 30 waveforms are used for the Long Pulse radar test signal, then each additional waveform must also be unique and not repeated from the previous waveforms.

Each waveform is defined as follows:

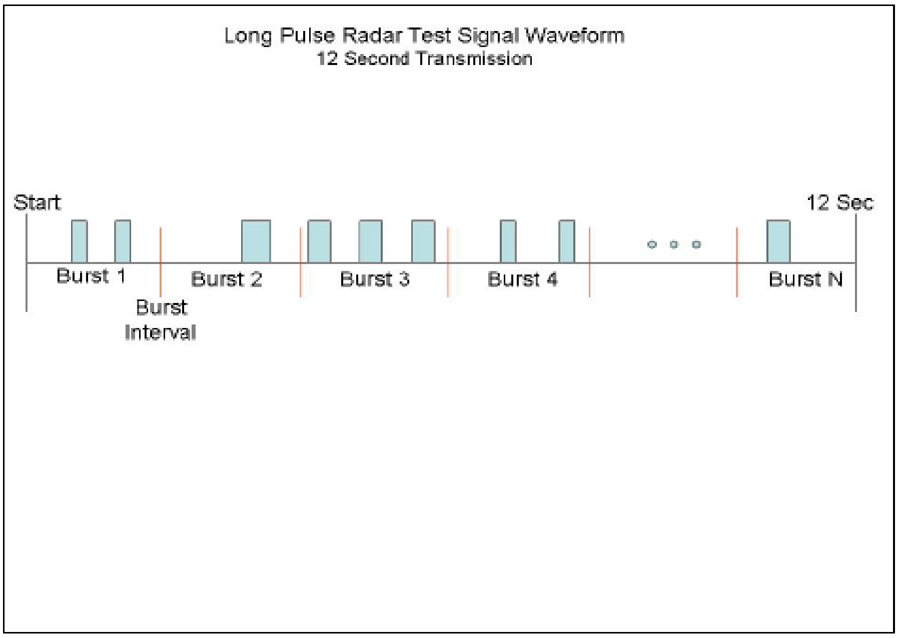
1) The transmission period for the Long Pulse Radar test signal is 12 seconds.
2) There are a total of 8 to 20 Bursts in the 12 second period, with the number of Bursts being randomly chosen. This number is Burst_Count.
3) Each Burst consists of 1 to 3 pulses, with the number of pulses being randomly chosen. Each Burst within the 12 second sequence may have a different number of pulses.
4) The pulse width is between 50 and 100 microseconds, with the pulse width being randomly chosen. Each pulse within a Burst will have the same pulse width. Pulses in different Bursts may have different pulse widths.
5) Each pulse has a linear FM chirp between 5 and 20 MHz, with the chirp width being randomly chosen. Each pulse within a Burst will have the same chirp width. Pulses in different Bursts may have different chirp widths. The chirp is centered on the pulse. For example, with a radar frequency of 5300 MHz and a 20 MHz chirped signal, the chirp starts at 5290 MHz and ends at 5310 MHz.
6) If more than one pulse is present in a Burst, the time between the pulses will be between 1000 and 2000 microseconds, with the time being randomly chosen. If three pulses are present in a Burst, the time between the first and second pulses is chosen independently of the time between the second and third pulses.
7) The 12 second transmission period is divided into even intervals. The number of intervals is equal to Burst_Count. Each interval is of length (12,000,000 / Burst_Count) microseconds. Each interval contains one Burst. The start time for the Burst, relative to the beginning of the interval, is between 1 and [(12,000,000 / Burst_Count) – (Total Burst Length) + (One Random PRI Interval)] microseconds, with the start time being randomly chosen. The step interval for the start time is 1 microsecond. The start time for each Burst is chosen independently.

A representative example of a Long Pulse radar test waveform:

1) The total test signal length is 12 seconds.
2) 8 Bursts are randomly generated for the Burst_Count.
3) Burst 1 has 2 randomly generated pulses.
4) The pulse width (for both pulses) is randomly selected to be 75 microseconds.

5) The PRI is randomly selected to be at 1213 microseconds.
6) Bursts 2 through 8 are generated using steps 3 – 5.
7) Each Burst is contained in even intervals of 1,500,000 microseconds. The starting location for Pulse 1, Burst 1 is randomly generated (1 to 1,500,000 minus the total Burst 1 length + 1 random PRI interval) at the 325,001 microsecond step. Bursts 2 through 8 randomly fall in successive 1,500,000 microsecond intervals (i.e. Burst 2 falls in the 1,500,001 – 3,000,000 microsecond range).

Graphical Representation of a Long Pulse radar Test Waveform



Frequency Hopping Radar Test Waveforms

Radar Type	Pulse Width (μ sec)	PRI (μ sec)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (msec)	Minimum Percentage of Successful Detection	Minimum Number of Trials
6	1	333	9	0.333	300	70%	30

For the Frequency Hopping Radar Type, the same *Burst* parameters are used for each waveform.

The hopping sequence is different for each waveform and a 100-length segment is selected1 from the hopping sequence defined by the following algorithm:

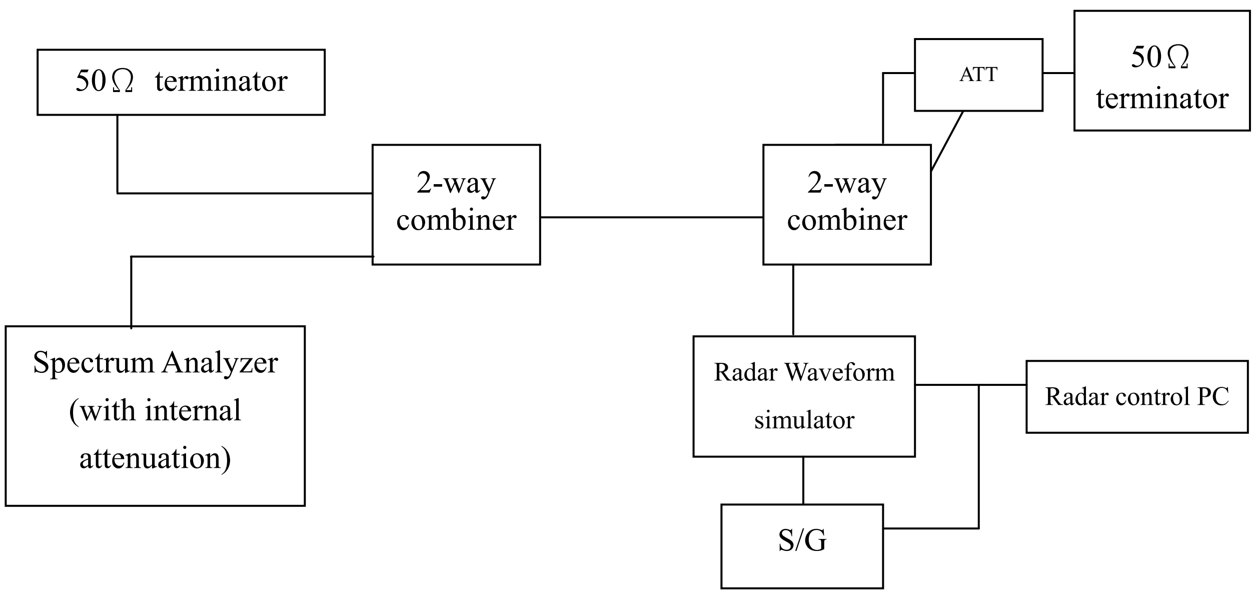
The first frequency in a hopping sequence is selected randomly from the group of 475 integer frequencies from 5250 – 5724 MHz. Next, the frequency that was just chosen is removed from the group and a frequency is randomly selected from the remaining 474 frequencies in the group. This process continues until all 475 frequencies are chosen for the set. For selection of a random frequency, the frequencies remaining within the group are always treated as equally likely.

8.6 Radar Waveform Calibration

The following equipment setup was used to calibrate the conducted radar waveform. A spectrum analyzer is used to establish the test signal level for each radar type. During this process, there were no transmissions by either Master or Client device. The spectrum analyzer was switched to the zero span (time domain) mode ate the frequency of the radar waveform generator. The peak detection was utilized. The spectrum analyzer RBW and VBW were set to at least 3MHz.
The signal generator amplitude and/ or step attenuators were set so that the power level measured at the spectrum analyzer was equal to the DFS detection threshold that is required for the tests.

The signal generator amplitude was set so that the power level measured at the spectrum analyzer was -63dBm.

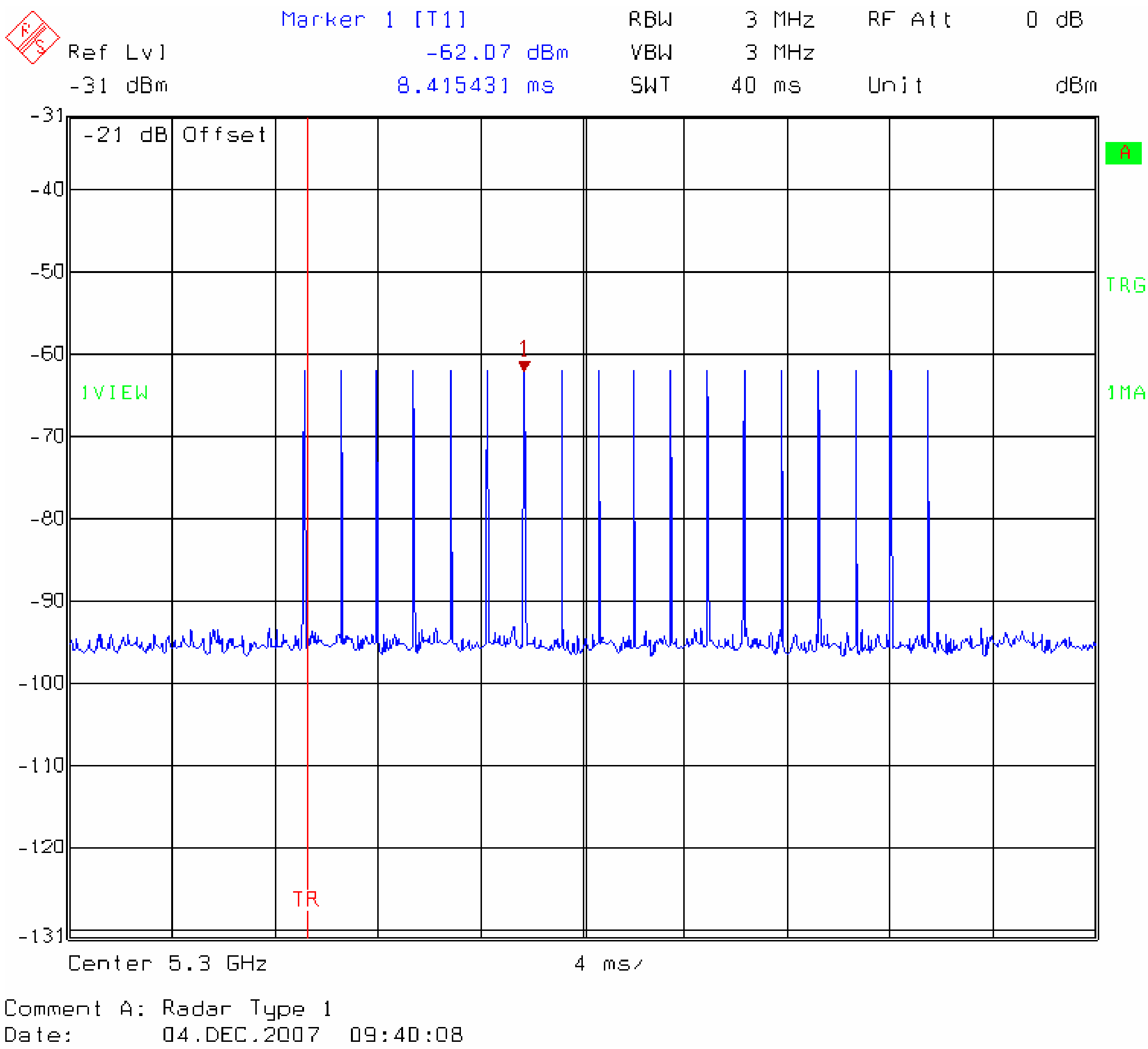
Conducted calibrated setup diagram:



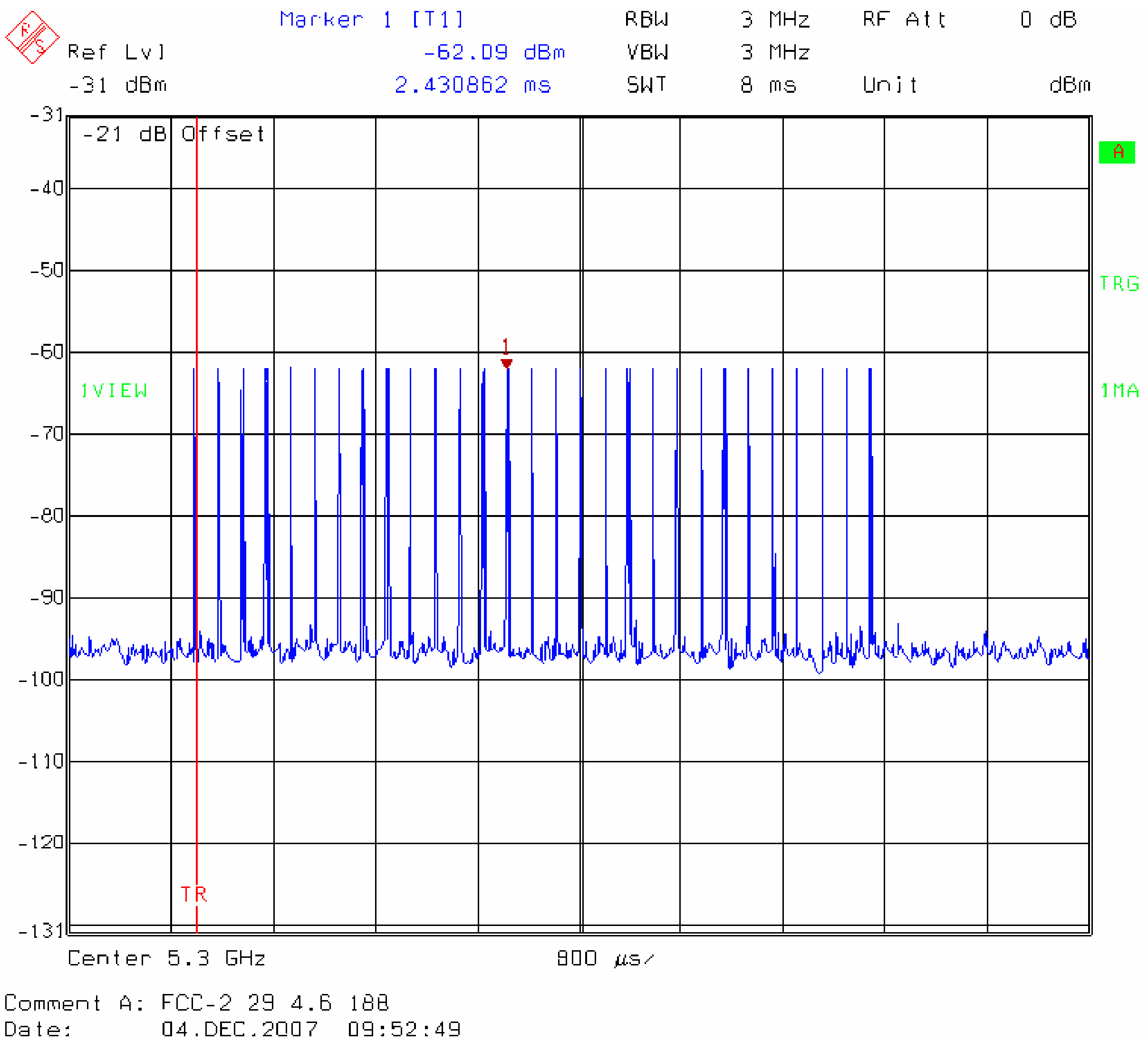
8.6.1 Radar Waveform Calibration Plots

The following are the calibration plots for radar waveform of testing required.

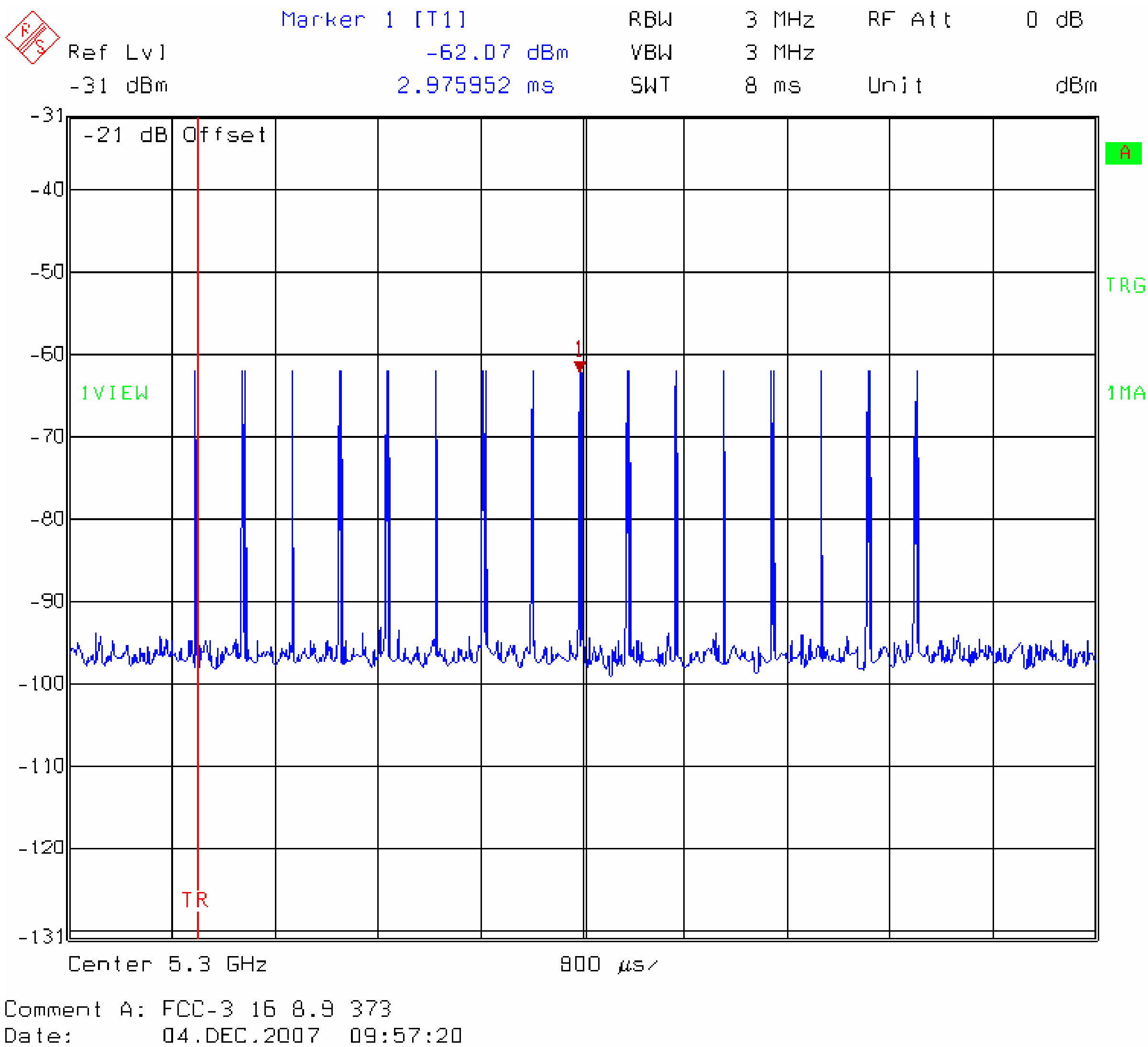
Type 1 Rader Calibration



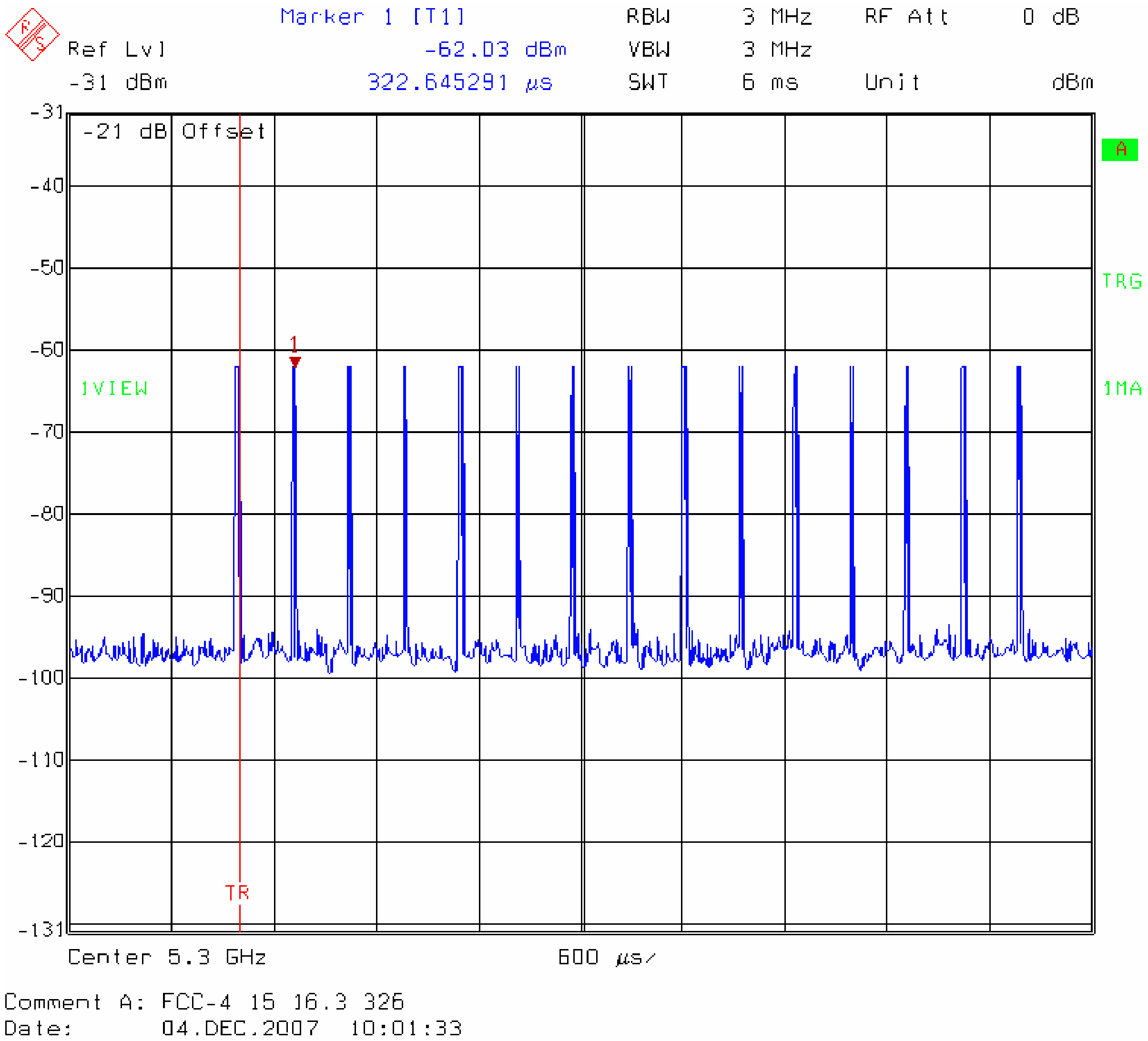
Type 2 Rader Calibration



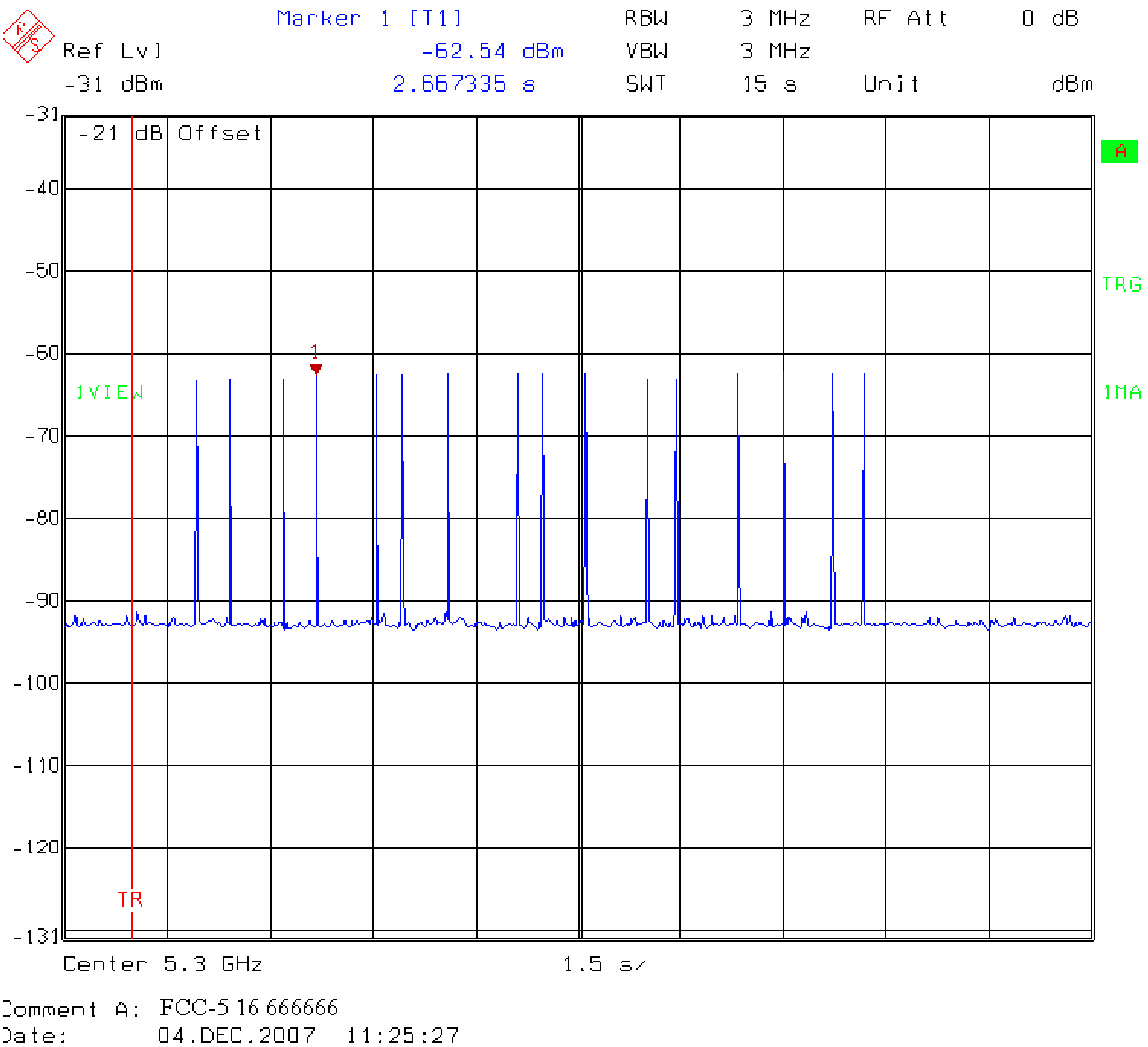
Type 3 Rader Calibration



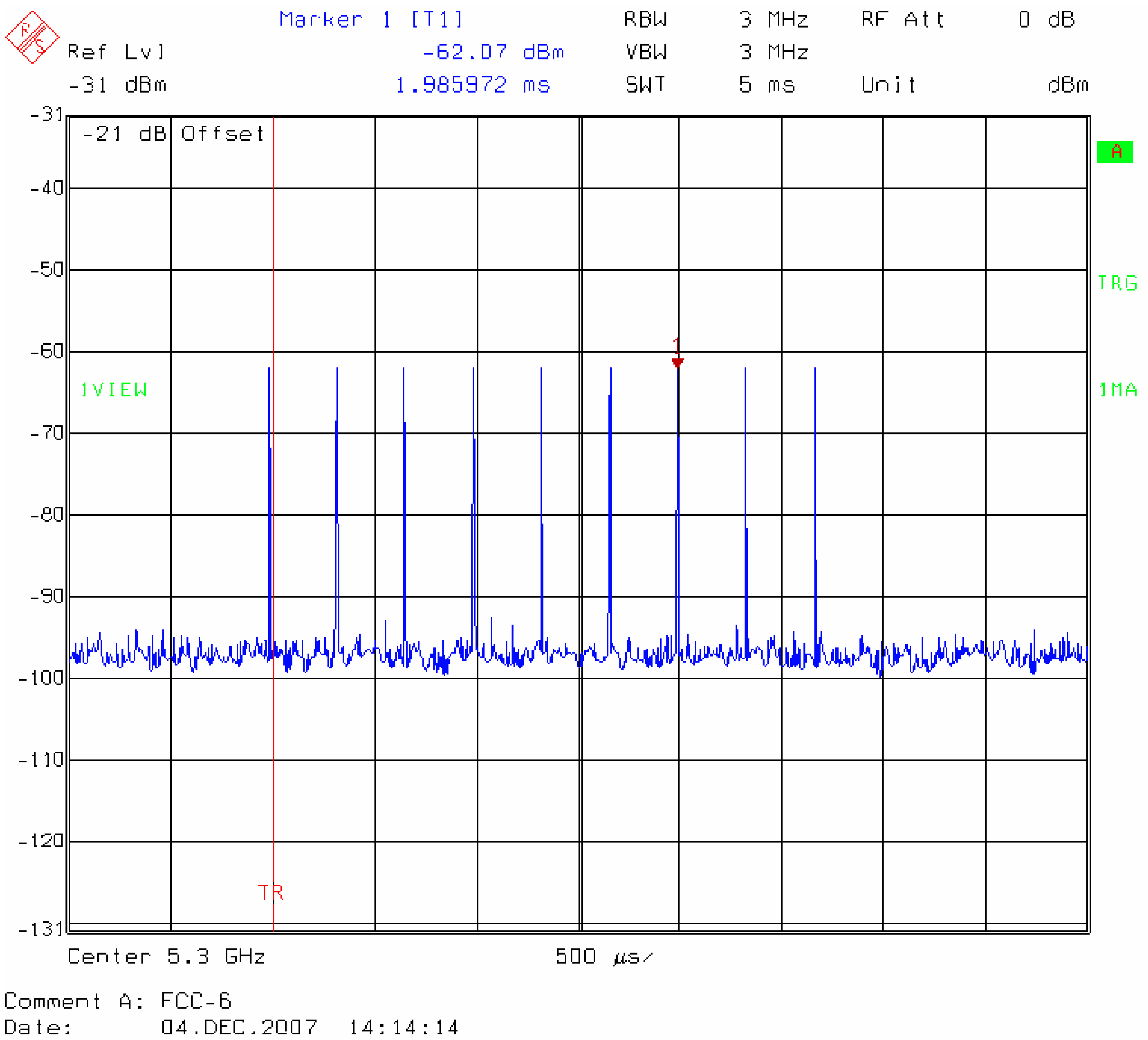
Type 4 Rader Calibration



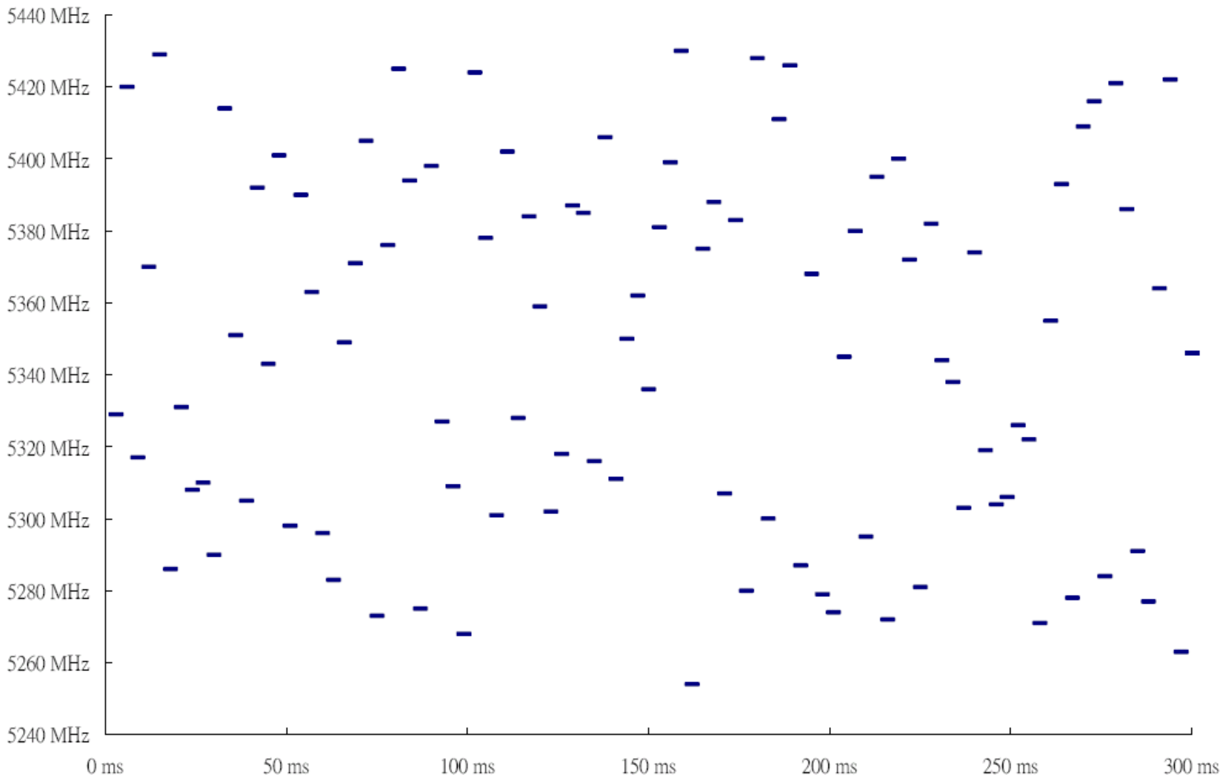
Type 5 Rader Calibration



Type 6 Rader Calibration



Type 6 Rader Calibration



8.7 Test instruments and setup

8.7.1 Test instruments

Intertek ID No.	Equipment	Brand	Model No.	Calculation Due
EC353	Spectrum Analyzer	Rohde & Schwarz	FSP 30	08/15/2008
EC365	Spectrum Analyzer	Rohde & Schwarz	FSEK 30	11/12/2008
-	Rader waveform simulator	-	-	-
EC395	Synthesizer Signal Generator	Anritsu	MG3691A	11/22/2007

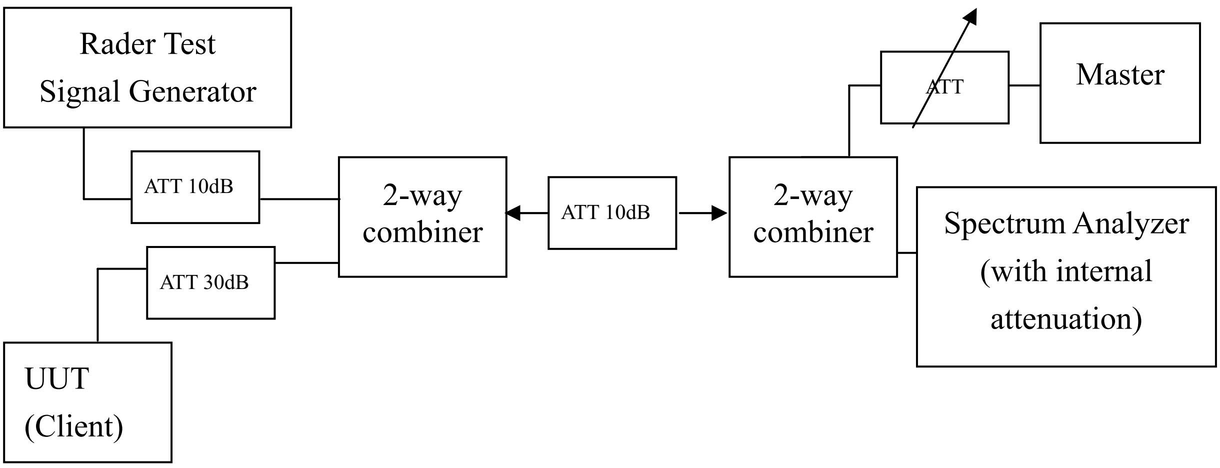
Note: 1. The above equipments are within the valid calibration period.

8.7.1.1 Deviation about the radar waveform

No deviation.

8.7.2 Test setup

Client with injection at the Master



8.8 DFS test results

8.8.1 Test summary

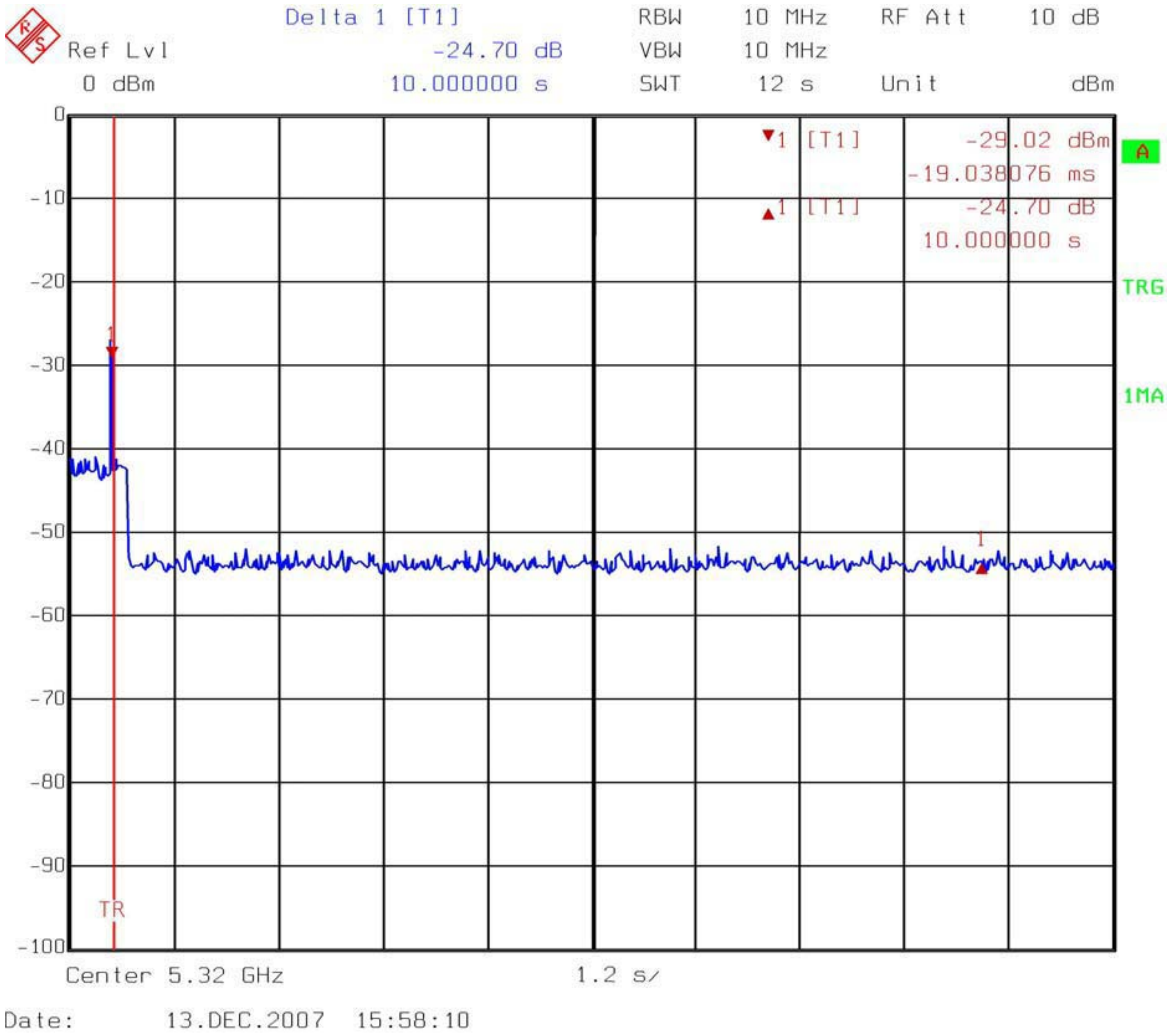
This EUT was defined as the Client without DFS detection.

Clause	Parameter	Required	Pass/ Fail
15.407	DFS Detection Threshold	Not Required	N/A
15.407	Channel Availability Check Time	Not Required	N/A
15.407	Channel Move Time	Applicable	Pass
15.407	Channel Closing Transmission Time	Applicable	Pass
15.407	Non-Occupancy Period	Applicable	Pass
15.407	Uniform Spreading	Not Required	N/A
15.407	UNII Detection Bandwidth	Not Required	N/A

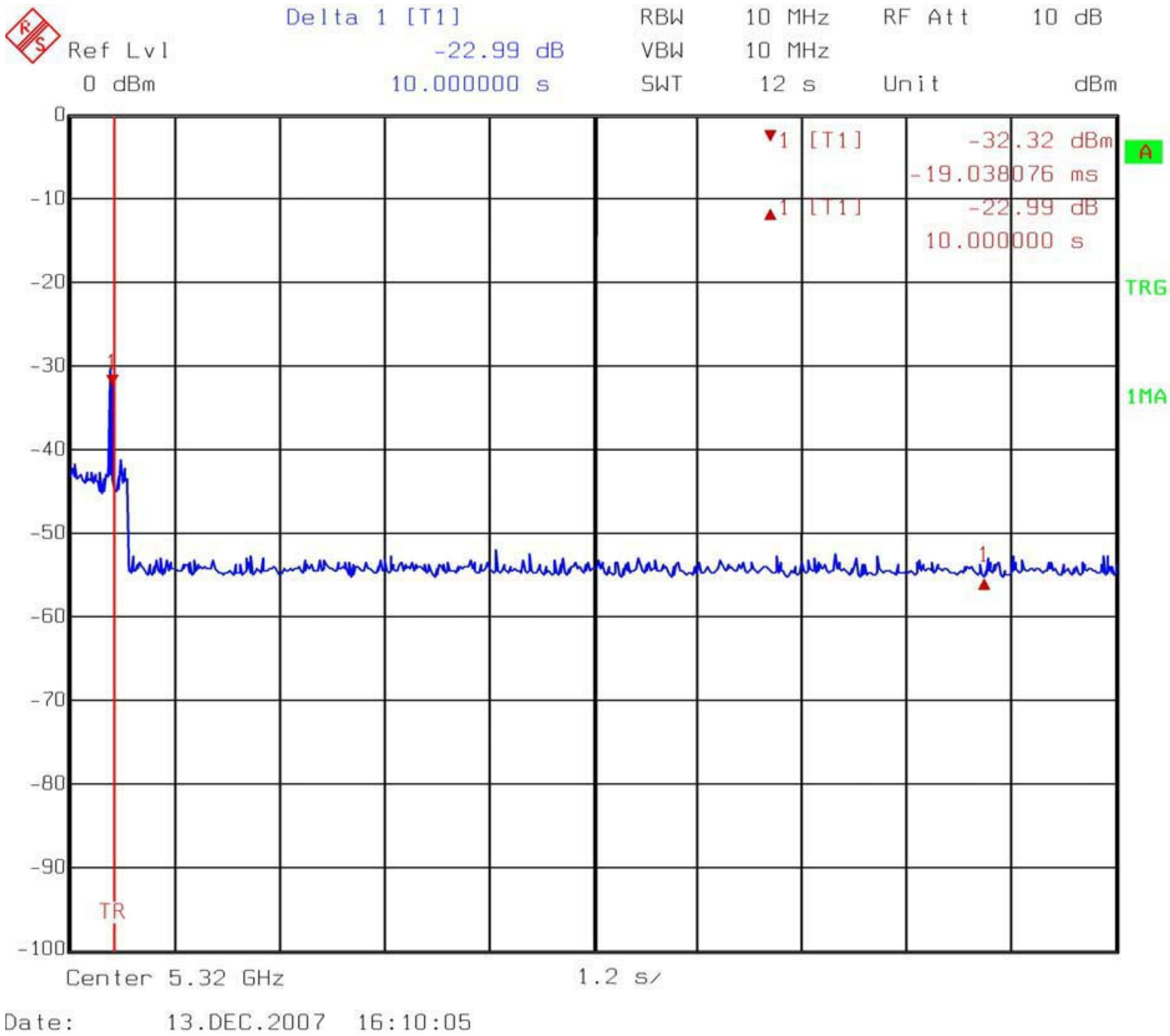
8.8.1 DFS test result

8.8.1.1 Channel Move time

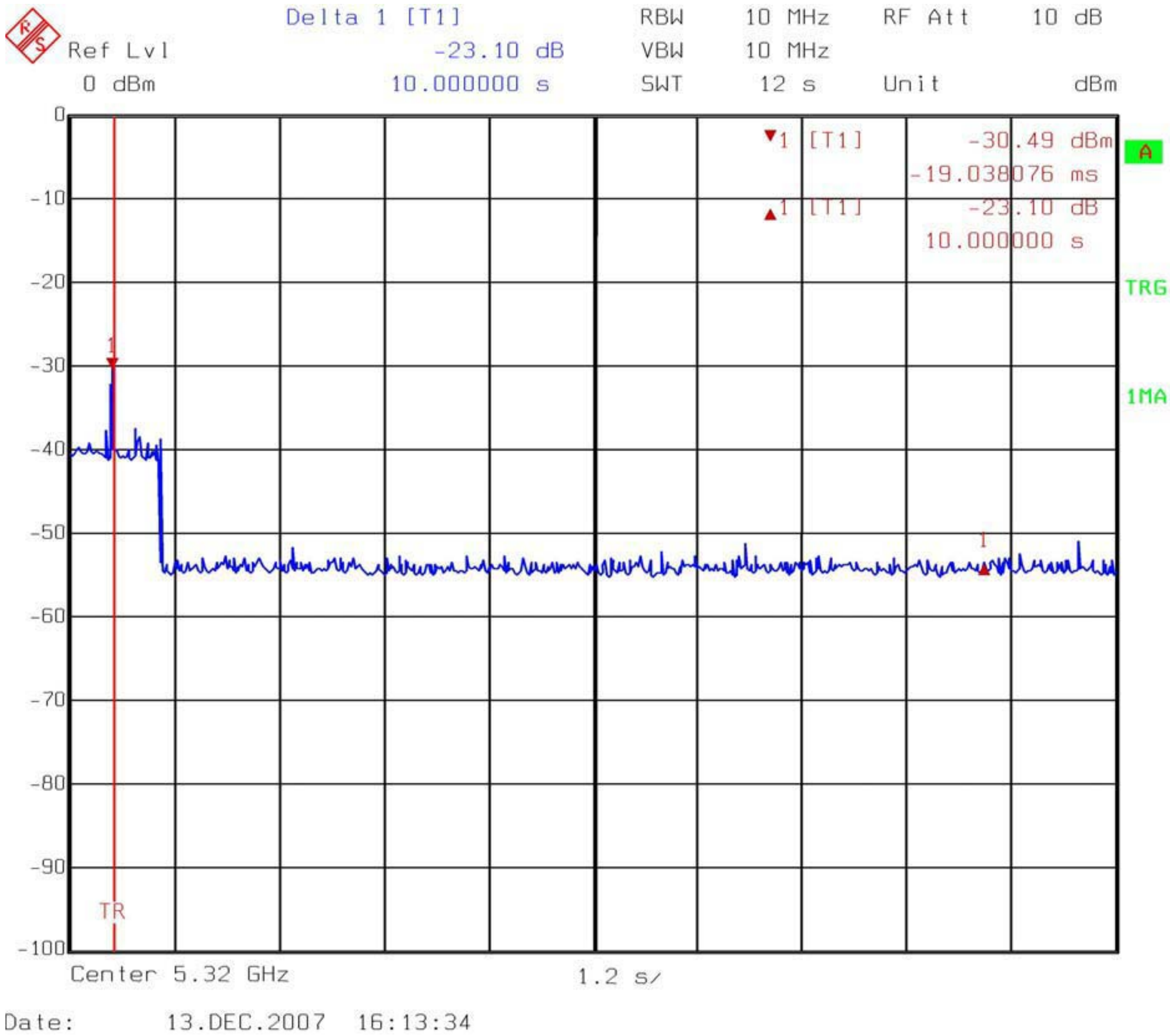
Rader Type 1 (5320MHz)



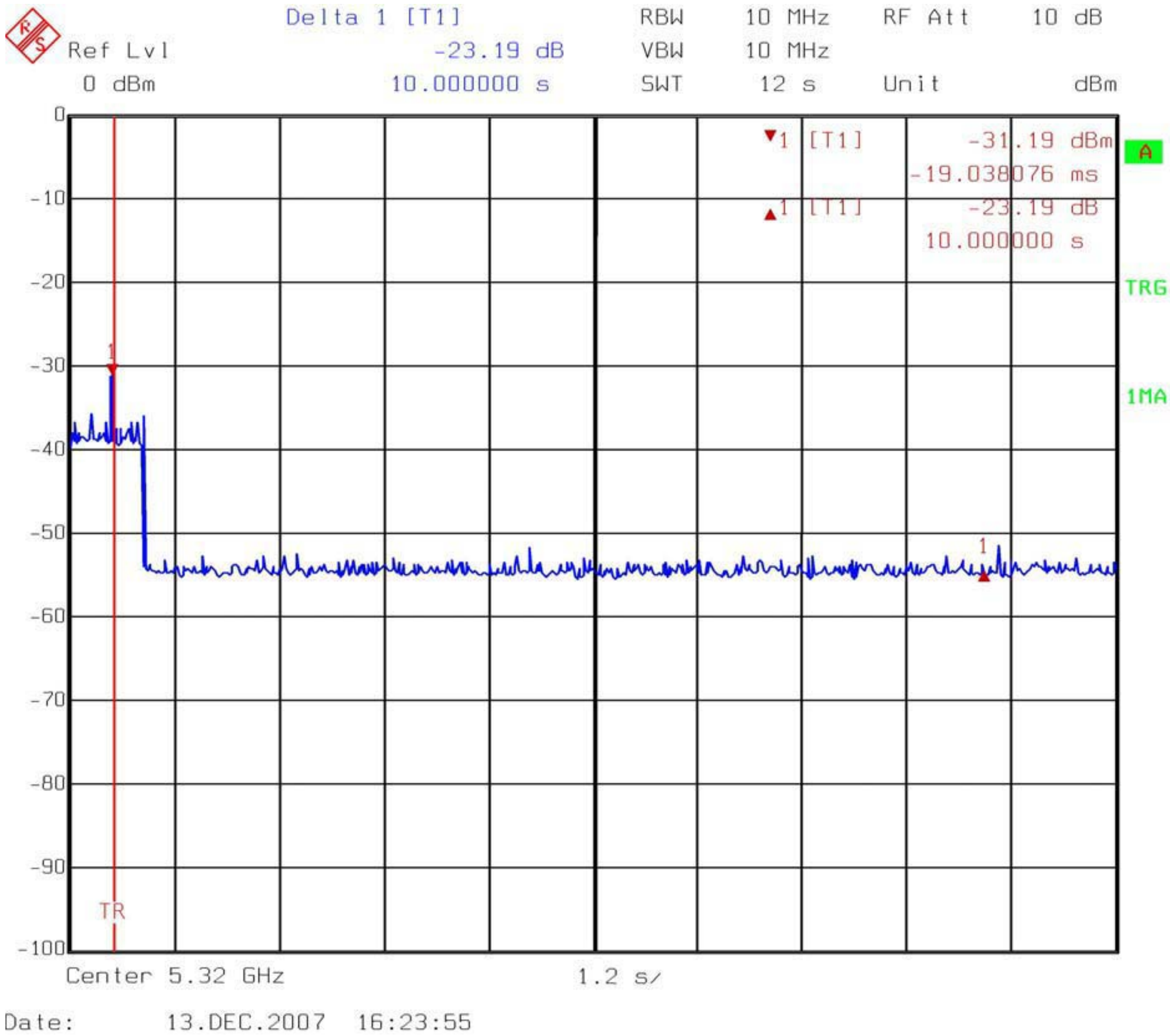
Rader Type 2 (5320MHz)



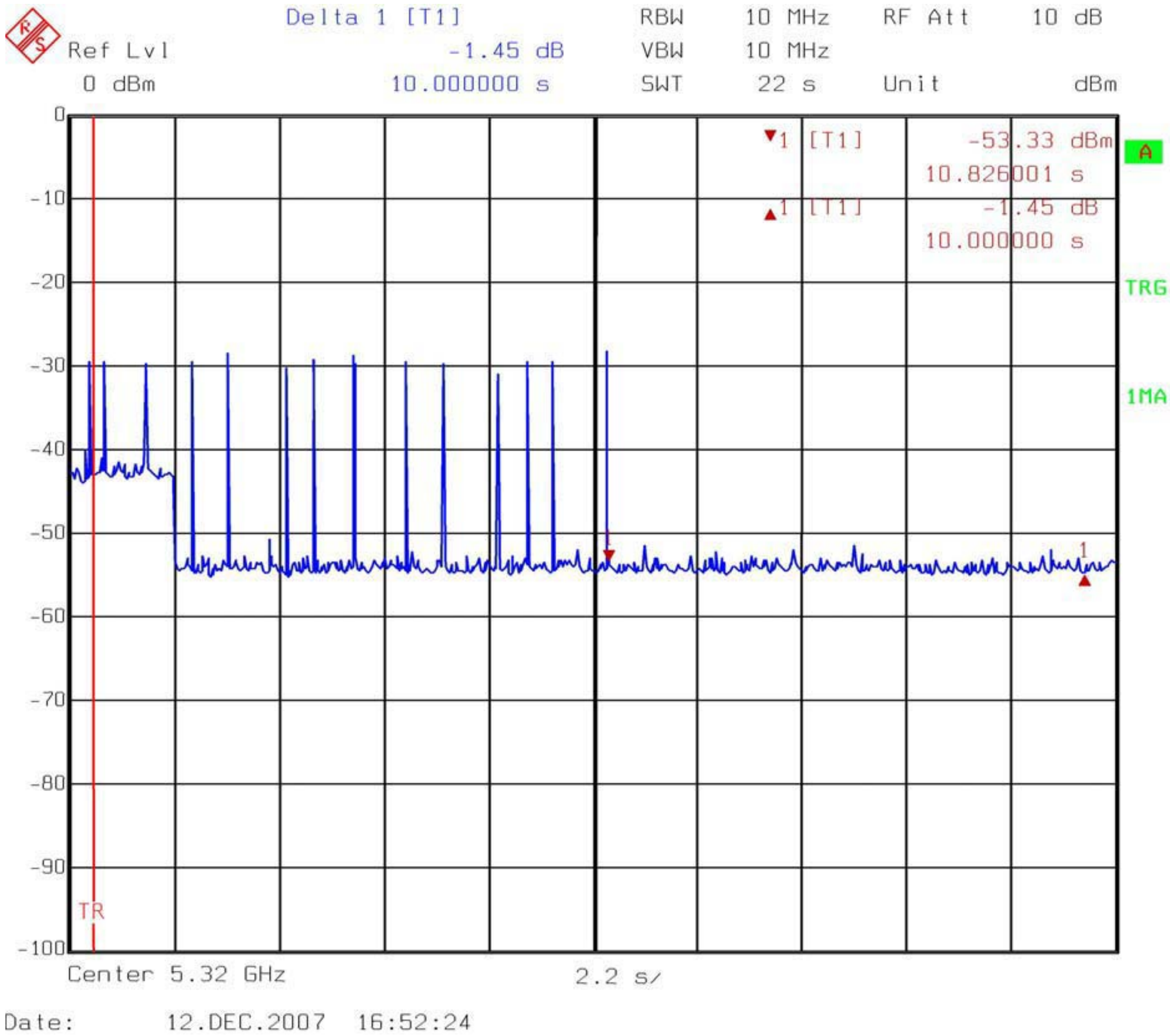
Rader Type 3 (5320MHz)



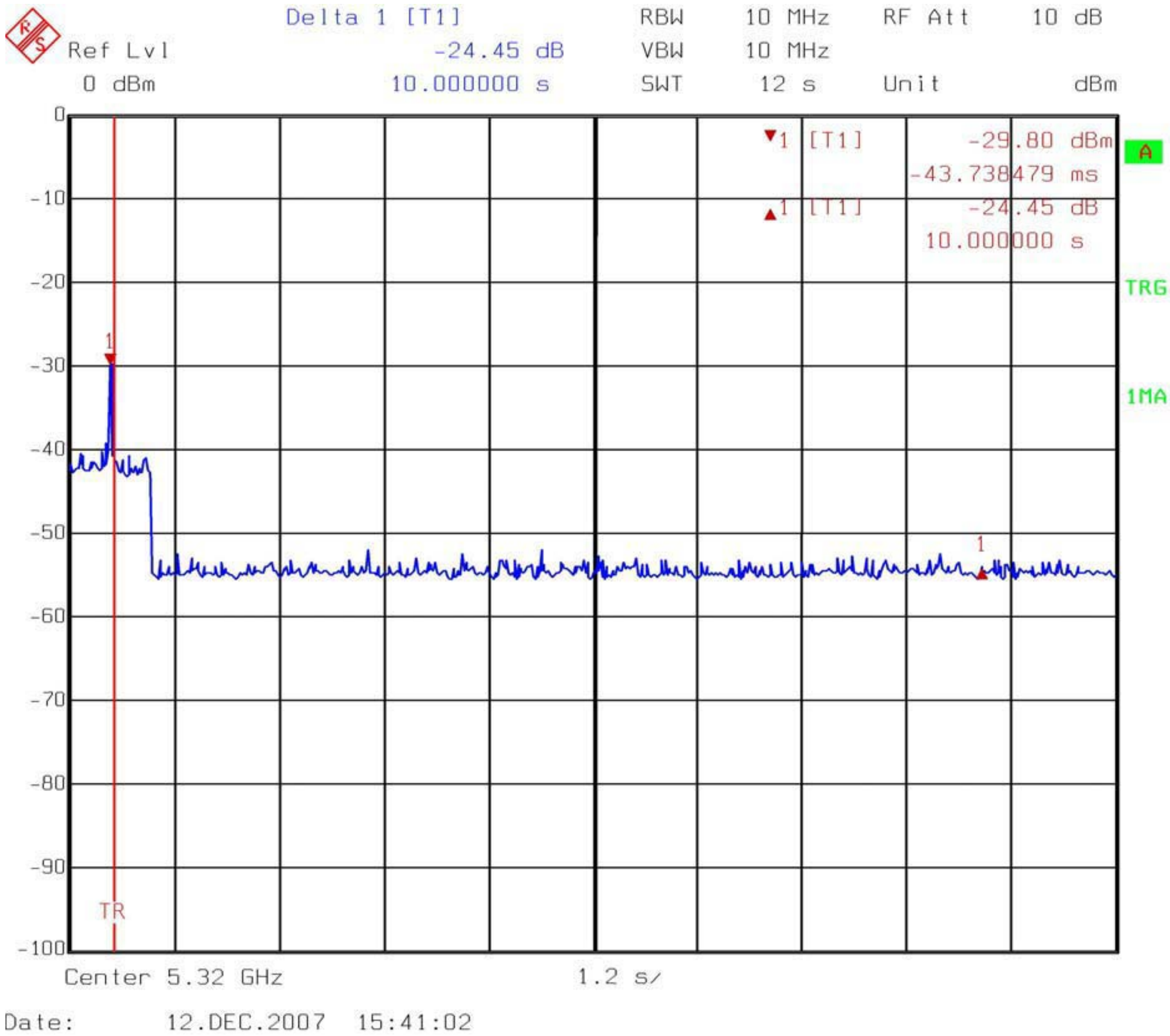
Rader Type 4 (5320MHz)



Rader Type 5 (5320MHz)

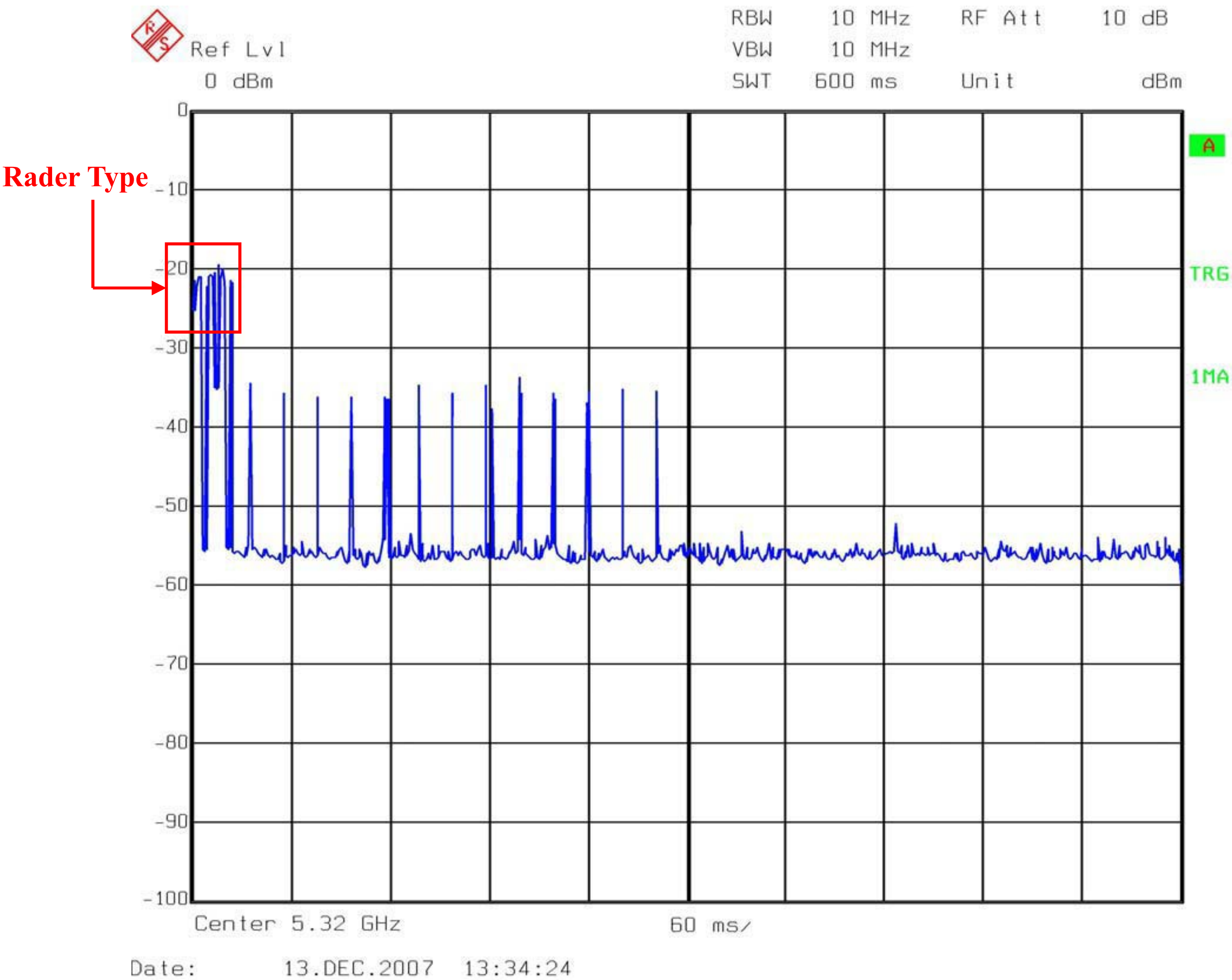


Rader Type 6 (5320MHz)

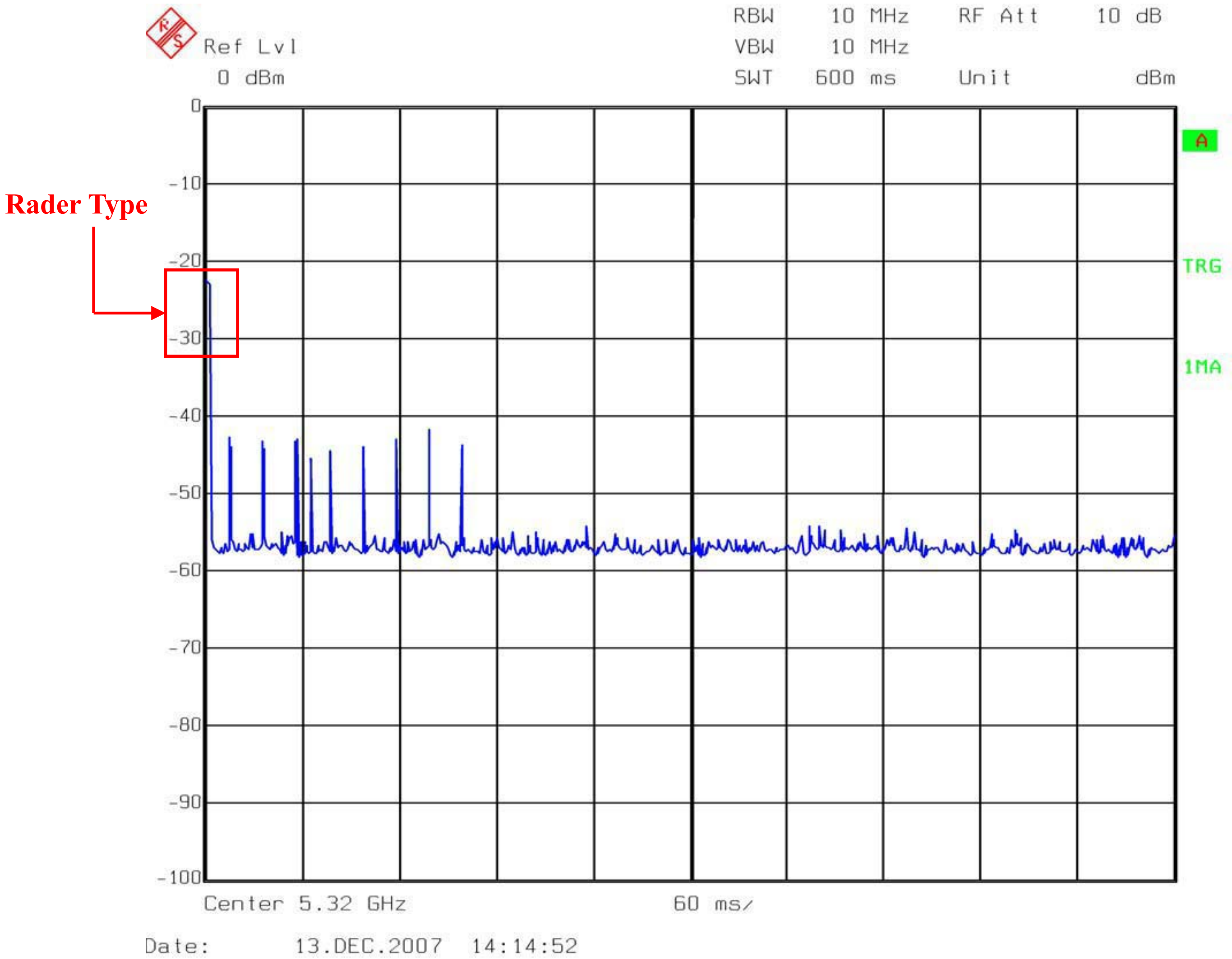


8.8.1.2 Channel Closing Transmission Time

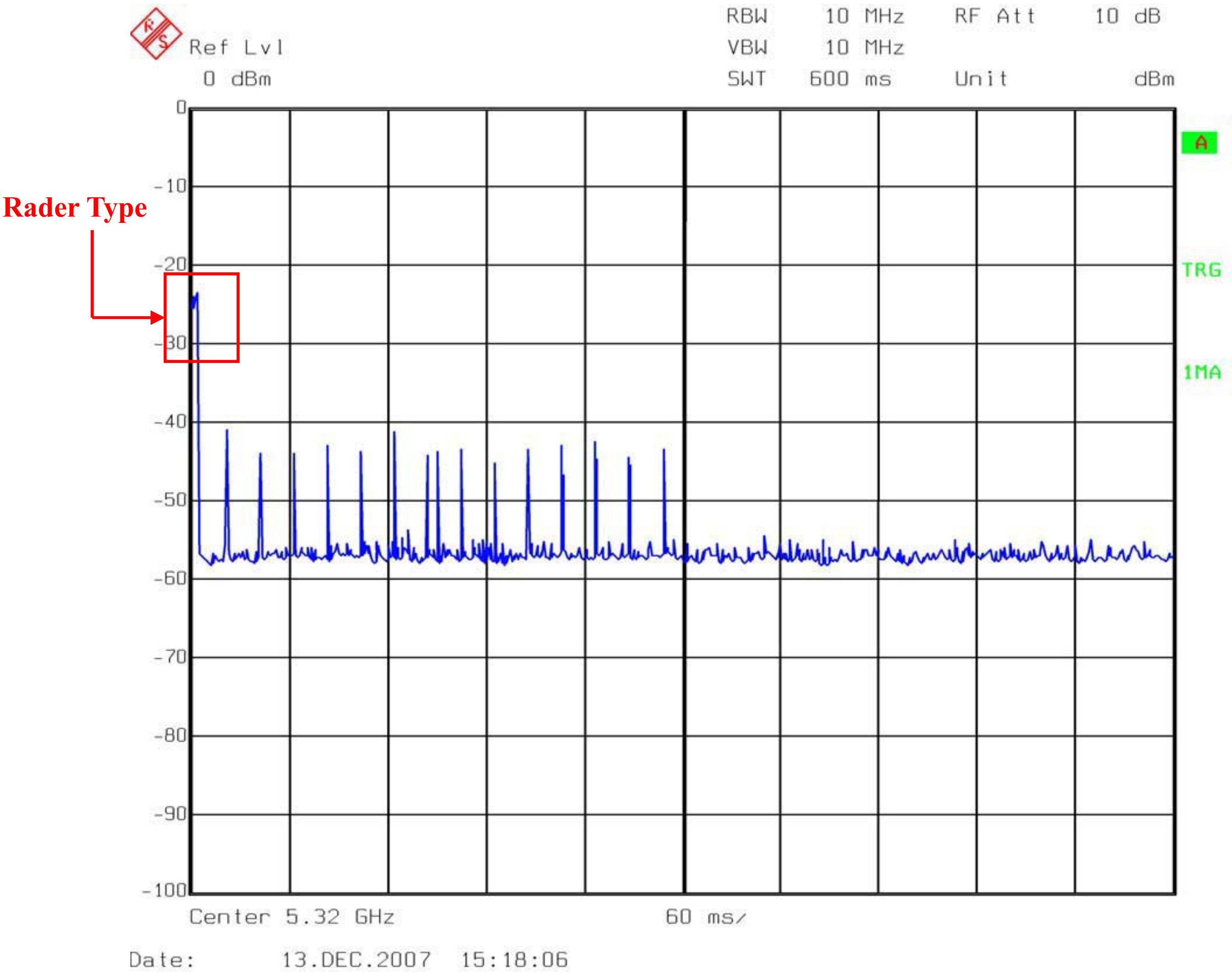
Rader Type 1 (5320MHz)



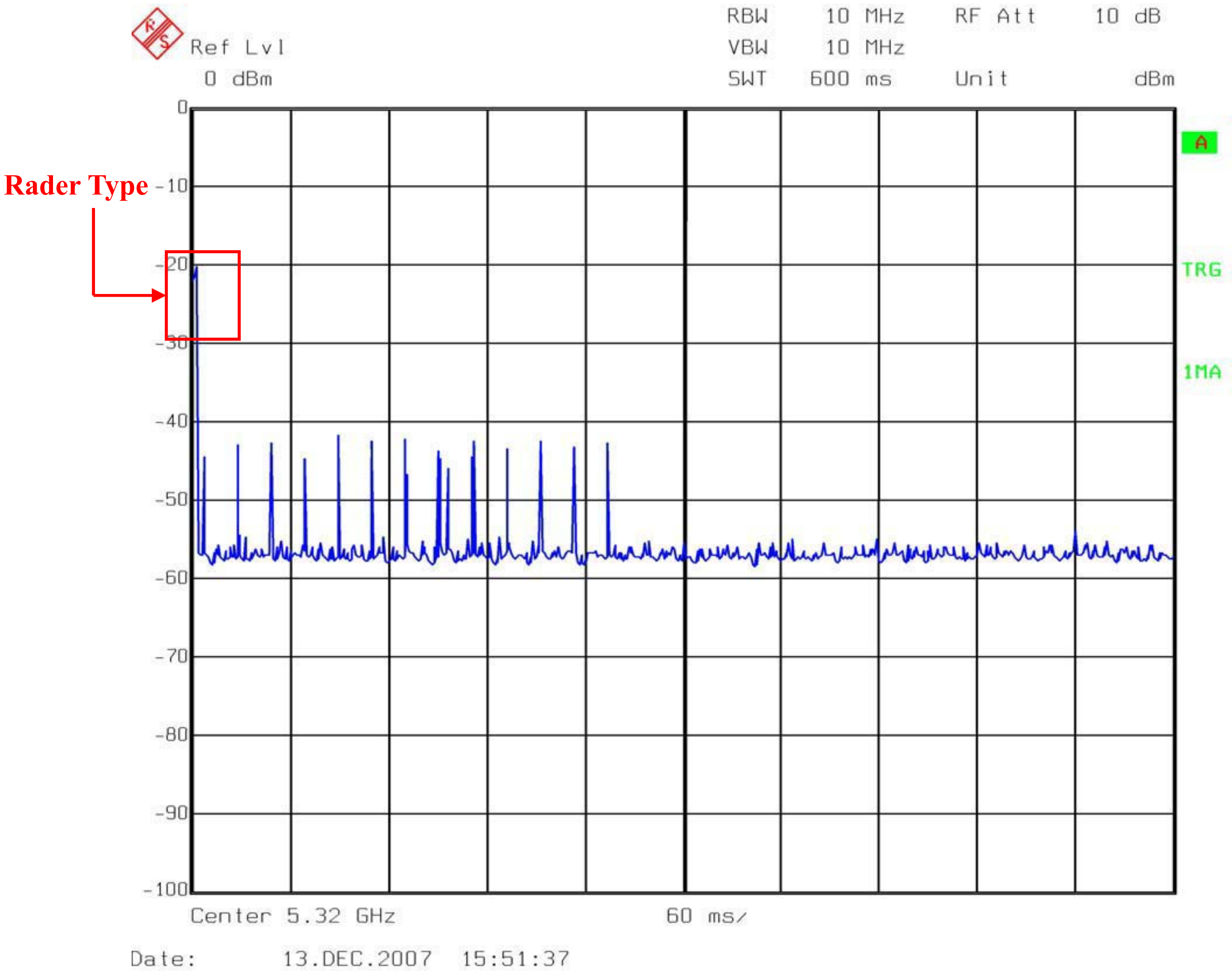
Rader Type 2 (5320MHz)



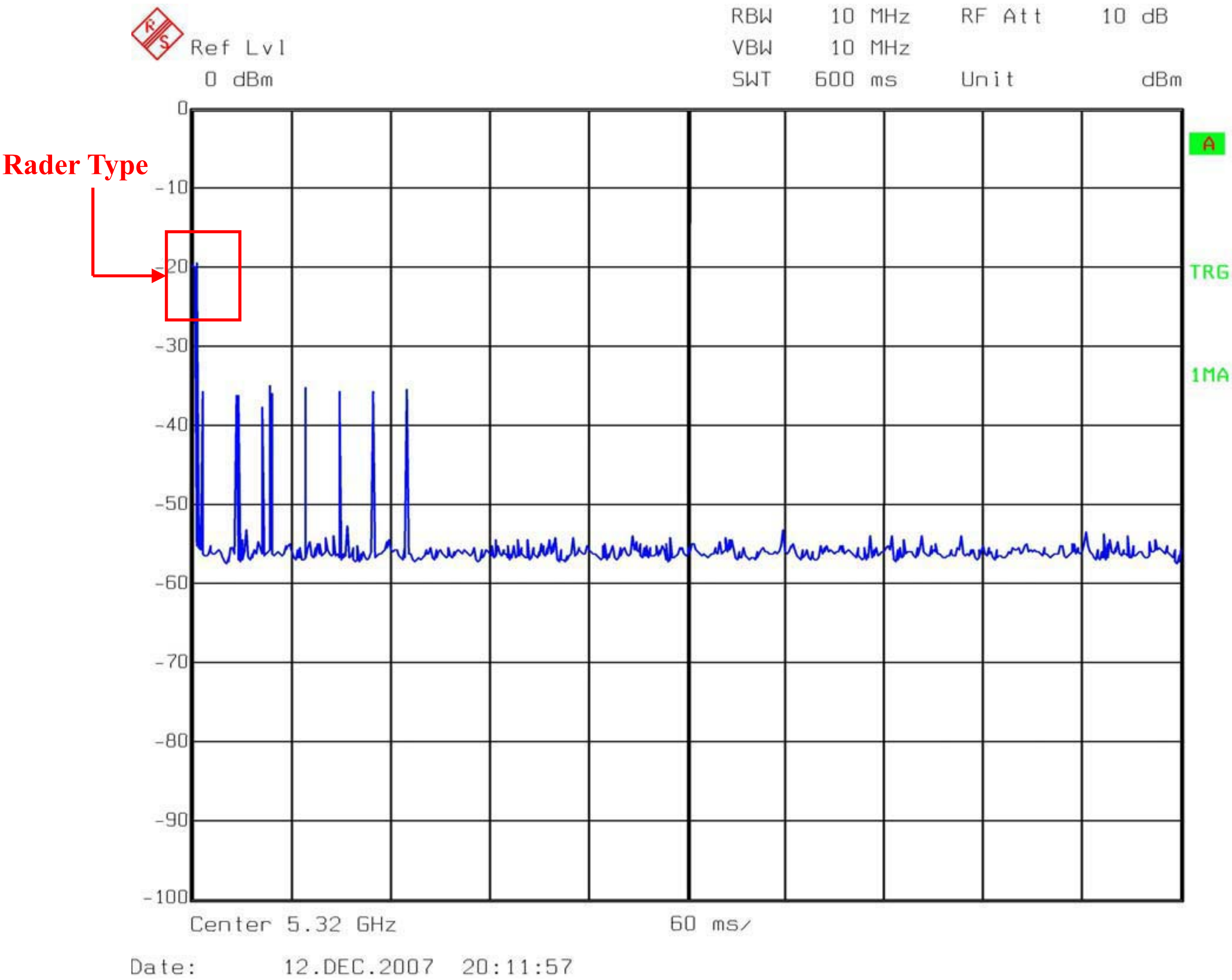
Rader Type 3 (5320MHz)



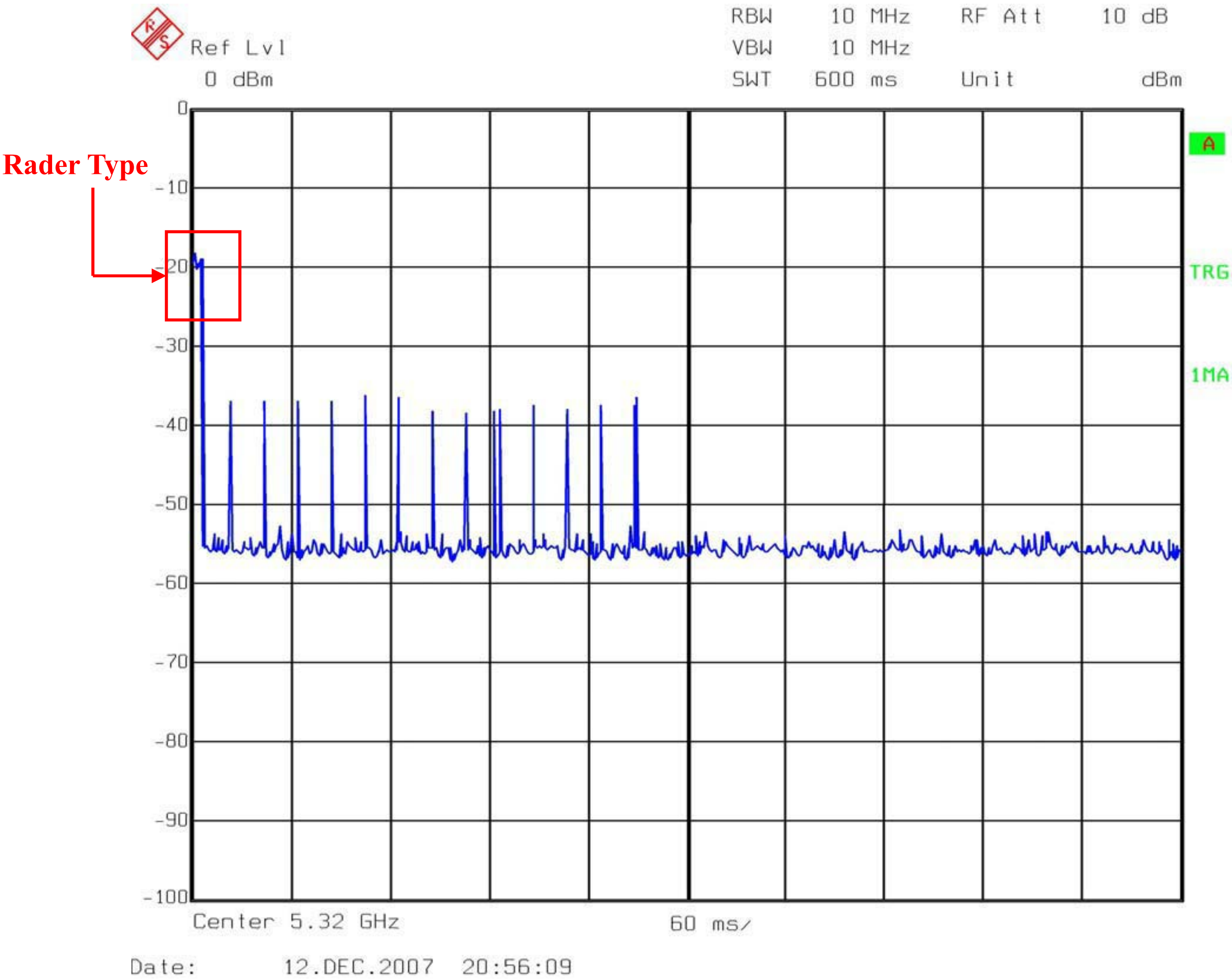
Rader Type 4 (5320MHz)



Rader Type 5 (5320MHz)

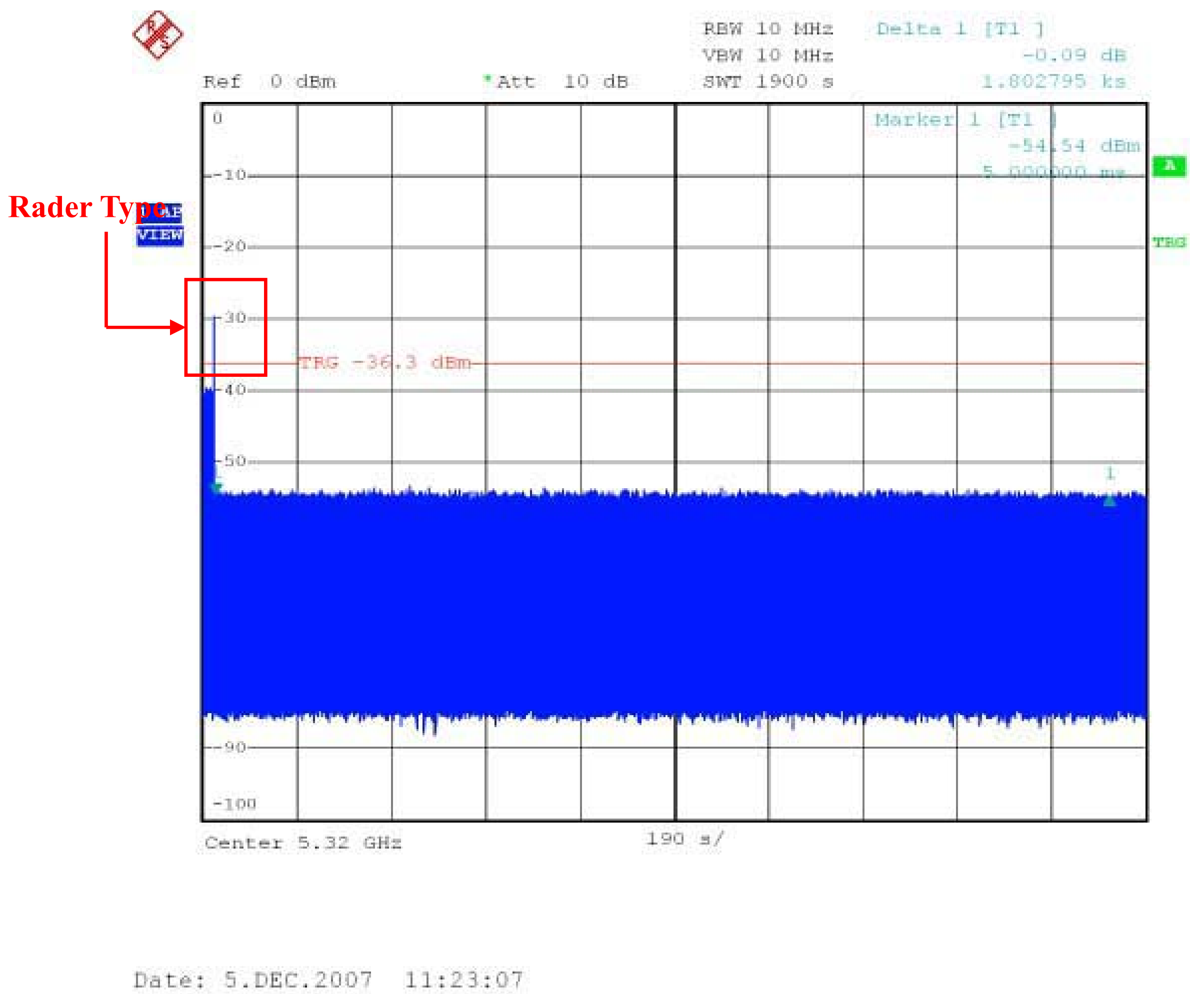


Rader Type 6 (5320MHz)



8.8.1.3 Non-Occupancy Period

No transmissions were observed on the previously active channel during 30 minutes observation time for the EUT.

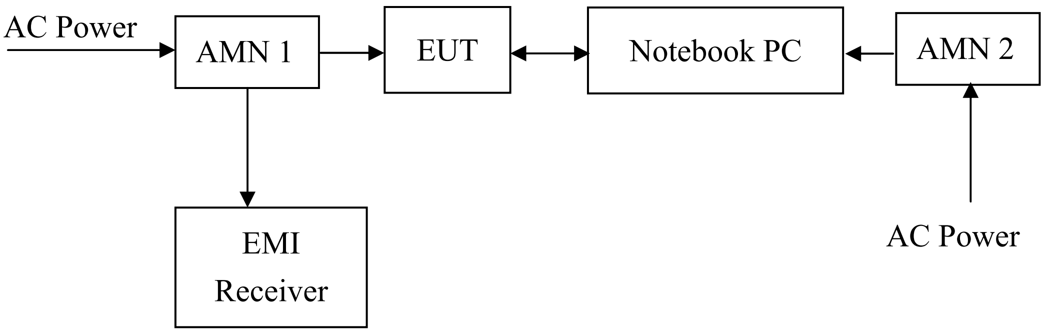


9. Power Line Conducted Emission test §FCC 15.207

9.1 Operating environment

Temperature:	23	℃
Relative Humidity:	58	%
Atmospheric Pressure	1023	hPa

9.2 Test setup & procedure



The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a 50 ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination.
Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4/2003 on conducted measurement. The bandwidth of the field strength meter (R & S Test Receiver ESCS 30) is set at 9kHz.

The EUT configuration please refer to the “Conducted set-up photo.pdf”.

9.3 Emission limit

Freq. (MHz)	Conducted Limit (dBuV)	
	Q.P.	Ave.
0.15~0.50	66 – 56*	56 – 46*
0.50~5.00	56	46
5.00~30.0	60	50

*Decreases with the logarithm of the frequency.

9.4 Uncertainty of Conducted Emission

Expanded uncertainty (k=2) of conducted emission measurement is ±2.26 dB.

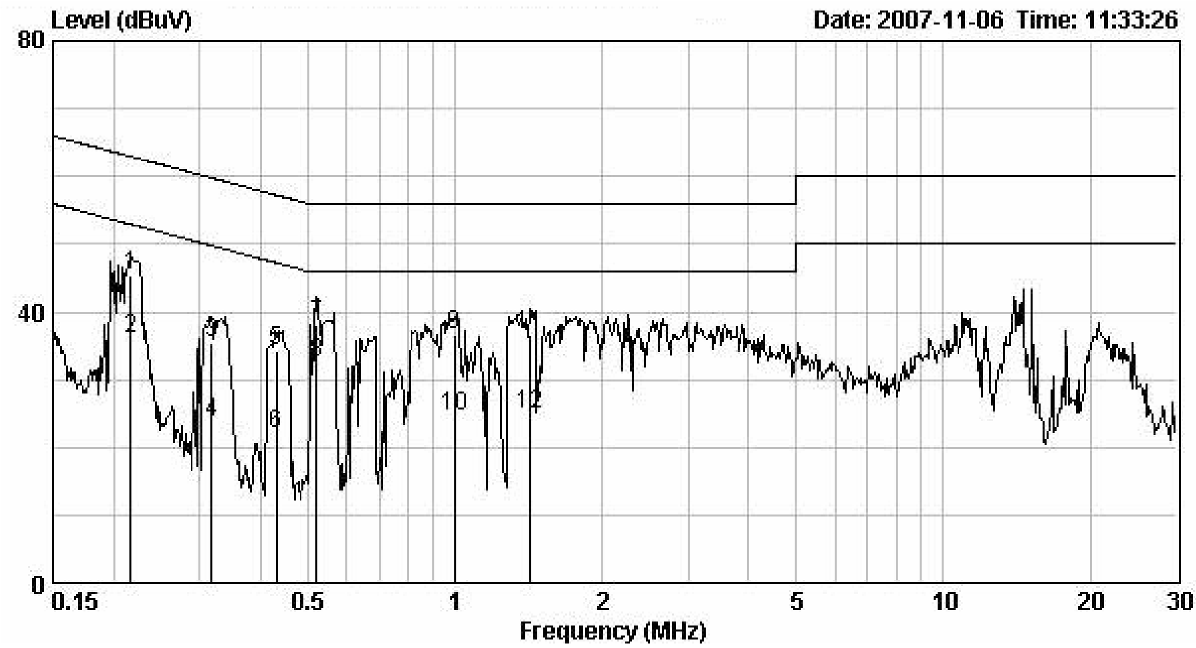
9.5 Power Line Conducted Emission test data

The test was performed on EUT under 802.11a/b/g/n continuously transmitting mode. The worst case occurred at 802.11b Tx at channel 1.

Phase:	Line
Model No.:	DSM-750
Worst Case:	802.11b Tx at channel 1

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level AV (dBuV)	Limit Av (dBuV)	Margin (dB) Qp	Margin (dB) Av
0.216	0.72	45.36	62.96	36.09	52.96	-17.60	-16.87
0.317	0.33	35.33	59.78	23.72	49.78	-24.45	-26.06
0.429	0.10	34.34	57.26	22.11	47.26	-22.92	-25.15
0.520	0.10	38.02	56.00	32.52	46.00	-17.98	-13.48
0.999	0.10	36.65	56.00	24.71	46.00	-19.35	-21.29
1.430	0.12	36.66	56.00	24.89	46.00	-19.34	-21.11

Remark:
1. Corr. Factor (dB)= LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)



Phase: Neutral
Model No.: DSM-750
Worst Case: 802.11b Tx at channel 1

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level AV (dBuV)	Limit Av (dBuV)	Margin (dB) Qp	Av
0.211	0.10	48.68	63.15	37.07	53.15	-14.47	-16.08
0.328	0.10	39.15	59.51	30.10	49.51	-20.36	-19.41
0.524	0.10	37.41	56.00	35.48	46.00	-18.59	-10.52
14.652	0.49	34.55	60.00	32.33	50.00	-25.45	-17.67
15.245	0.50	40.94	60.00	36.80	50.00	-19.06	-13.20
17.882	0.50	34.09	60.00	30.17	50.00	-25.91	-19.83

Remark:
1. Corr. Factor (dB)= LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)