



FCC RF Test Report

Product Name: Mobile WiFi

Model Number: HWD31

Report No: SYBH(Z-RF)035102014-2005

FCC ID: QISHWD31

Reliability Laboratory of Huawei Technologies Co., Ltd.

Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang
District, Shenzhen, 518129, P.R.C
Tel: +86 755 28780808 Fax: +86 755 89652518

Notice

1. The laboratory has Passed the accreditation by China National Accreditation Service for Conformity Assessment (CNAS). The accreditation number is L0310.
2. The laboratory has Passed the accreditation by The American Association for Laboratory Accreditation (A2LA). The accreditation number is 2174.01.
3. The laboratory has been listed by the US Federal Communications Commission to perform electromagnetic emission measurements. The site recognition number is 97456.
4. The laboratory has been listed by Industry Canada to perform electromagnetic emission measurements. The recognition numbers of test site are 6369A-1.
5. The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.
6. The test report is invalid if there is any evidence of erasure and/or falsification.
7. The test report is only valid for the test samples.
8. Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.
1. The laboratory has Passed the accreditation by China National Accreditation Service for Conformity Assessment (CNAS). The accreditation number is L0310.

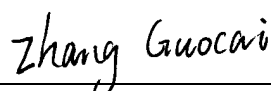


Applicant: Huawei Technologies Co., Ltd.
Address: Administration Building, Headquarters of Huawei Technologies Co., Ltd.,
Bantian, Longgang District, Shenzhen, 518129, P.R.C

Date of Receipt Sample: 2014-11-28
Start Date of Test: 2014-11-28
End Date of Test: 2014-12-08

Test Result: Pass

Approved by Senior Engineer:	2014-12-11	Liu Chunlin	
	Date	Name	Signature

Prepared by:	2014-12-11	Zhang Guocai	
	Date	Name	Signature

CONTENT

1	General Information.....	5
1.1	Applied Standard.....	5
1.2	Test Location	5
1.3	Test Environment Condition.....	5
2	Description of the Equipment under Test (EUT).....	6
2.1	General Description	6
2.2	EUT Identity	6
3	General Test Conditions / Configurations.....	8
3.1	Mode of Operation:	8
4	U-NII DFS RULE REQUIREMENTS.....	8
4.1	WORKING MODES ANF REQUIRED TEST ITEMS	8
4.2	Requirements.....	9
4.3	DFS Detection Threshold Values.....	10
4.4	Parameters of DFS Test Signals.....	11
4.5	Procedure	12
5	Test Equipment	14
6	TEST RESULTS.....	15
6.1	SUMMARY OF TEST RESULT	15
6.2	DETELED TEST RESULTS.....	15



1 General Information

1.1 Applied Standard

Applied Rules: 47 CFR FCC Part 2, Subpart J 2013
47 CFR FCC Part 15, Subpart E 2013

Test Method: FCC KDB 789033 D01 General UNII Test Procedures v01r03
FCC KDB 662911 D01 Multiple Transmitter Output v02
ANSI C63.10-2009, American National Standard for Testing Unlicensed Wireless Devices

1.2 Test Location

Test Location 1: Reliability Laboratory of Huawei Technologies Co., Ltd.
Address: Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C

1.3 Test Environment Condition

Temperature: 15 to 30 °C (Ambient)
Relative Humidity: 20 to 85 % (Ambient)
Atmospheric Pressure: Not applicable

2 Description of the Equipment under Test (EUT)

2.1 General Description

HWD31 is a LTE/UMTS mode and 2*2 WiFi Wireless mobile WiFi; it can be used as a WiFi hotspot based on standard of IEEE802.11a/b/g/n/ac. It supports 3G WCDMA and 4G FDD/TDD LTE wireless internet accessing function. About 3G WCDMA wireless mode, it supports WCDMA and HSDPA/HSUPA/HSPA+/DC-HSPA+, operating in Band1 、 Band2、 Band5 ； and the 4G LTE, operating in Band11、 Band3、 Band18、 Band17、 Band41.The WiFi is 2X2 and the frequency are 2.4GHz/5GHz.

HWD31 supports 1Tx2Rx for 3G WCDMA and 4G LTE, WiFi only supports2Tx2Rx.

Test result included in this report is only the DFS Slave Mode part of the product.

2.2 EUT Identity

NOTE: Unless otherwise noted in the report, the functional boards installed in the units shall be selected from the below list, but not means all the functional boards listed below shall be installed in one unit.



2.2.1 Board

Board		
Software Version	Hardware Version	Description
Main Board	CL1KD02UM	11.411.03.05.824

2.2.2 Sub-Assembly

Name	Manufacture	Description
Adapter	Huawei Technologies Co., Ltd.	Model:HW-050200U3W Adapter,-10degC,45degC,100V,240V,5.0V/2.0 A,UL 2PIN,DC USB 2.0,DOE V,PSE,DOCO MO LOGO, white, Terminal Dedicated
Rechargeable Li	Huawei Technologies Co., Ltd.	Battery Model: HB414790EBW Rechargeable Battery, Li-polymer Battery,HB 414790EBW,3.8V,2.3Ah,Single Cell,MAX4.03* 46.54*90mm
USB Cable(Black)	Huawei Technologies Co., Ltd.	Terminal Accessory, Data Cable, Usb A Male to Micro Usb 120cm ,Black no Braid 360 Degree Rotate Test Standard ,Terminal Dedicated

3 General Test Conditions / Configurations

3.1 Mode of Operation:

Parameters of EUT	
Frequency	5250 – 5350 MHz & 5470 – 5725 MHz
Operational Mode	Slave
Modulation:	OFDM
Channel Bandwidth:	20 MHz , 40 MHz, 80 MHz

Note: This device was functioned as a ☐ Master ☒ Slave device during the DFS

4 U-NII DFS RULE REQUIREMENTS

4.1 WORKING MODES AND REQUIRED TEST ITEMS

The manufacturer shall whether the UUT is capable of operating as a Master and a Client. If the UUT is capable of operating in more than one operating mode then each operating mode shall be tested separately.

Table. DFS Applicability

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
U-NII Detection Bandwidth	Yes	Not required	Yes

Table. DFS Applicability During Normal Operation

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

4.2 Requirements

Per FCC 06-96 the following are the requirements for Client Devices:

- a) A Client Device will not transmit before having received appropriate control signals from a Master Device.
- b) A Client Device will stop all its transmissions whenever instructed by a Master Device to which it is associated and will meet the Channel Move Time and Channel Closing Transmission Time requirements. The Client Device will not resume any transmissions until it has again received control signals from a Master Device.
- c) If a Client Device is performing In-Service Monitoring and detects a Radar Waveform above the DFS Detection Threshold, it will inform the Master Device. This is equivalent to the Master Device detecting the Radar Waveform and d) through f) of section 5.1.1 apply.
- d) Irrespective of Client Device or Master Device detection the Channel Move Time and Channel Closing Transmission Time requirements remain the same.

Channel Move Time and Channel Closing Transmission Time requirements are listed in the following table.

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 Notes 1 and 2.
U-NII 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.	



Parameter	Value
q	

4.3 DFS Detection Threshold Values

The DFS detection thresholds are defined for Master devices and Client Devices with In-service monitoring. These detection thresholds are listed in the following table.

Table: Detection Thresholds for Master Devices and Client Devices with Radar Detection

Maximum Transmit Power	Value (See Notes 1 and 2)
≥ 200 milliwatt	-64 dBm
< 200 milliwatt	-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.	

4.4 Parameters of DFS Test Signals

As the EUT is a Client Device with no Radar Detection only one type radar pulse is required for the testing. Radar Pulse type 1 was used in the evaluation of the Client device for the purpose of measuring the Channel Move Time and the Channel Closing Transmission Time. Table 3-5 lists the parameters for the Short Pulse Radar Waveforms. A plot of the Radar Pulse Type 1 used for testing is included in Section 5.0 of this report.

Table 3-5: Parameters for Short Pulse Radar 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

Table 3-6. Parameters for Long Pulse Radar 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	5 -20	1 -3	8 -20	60%	30

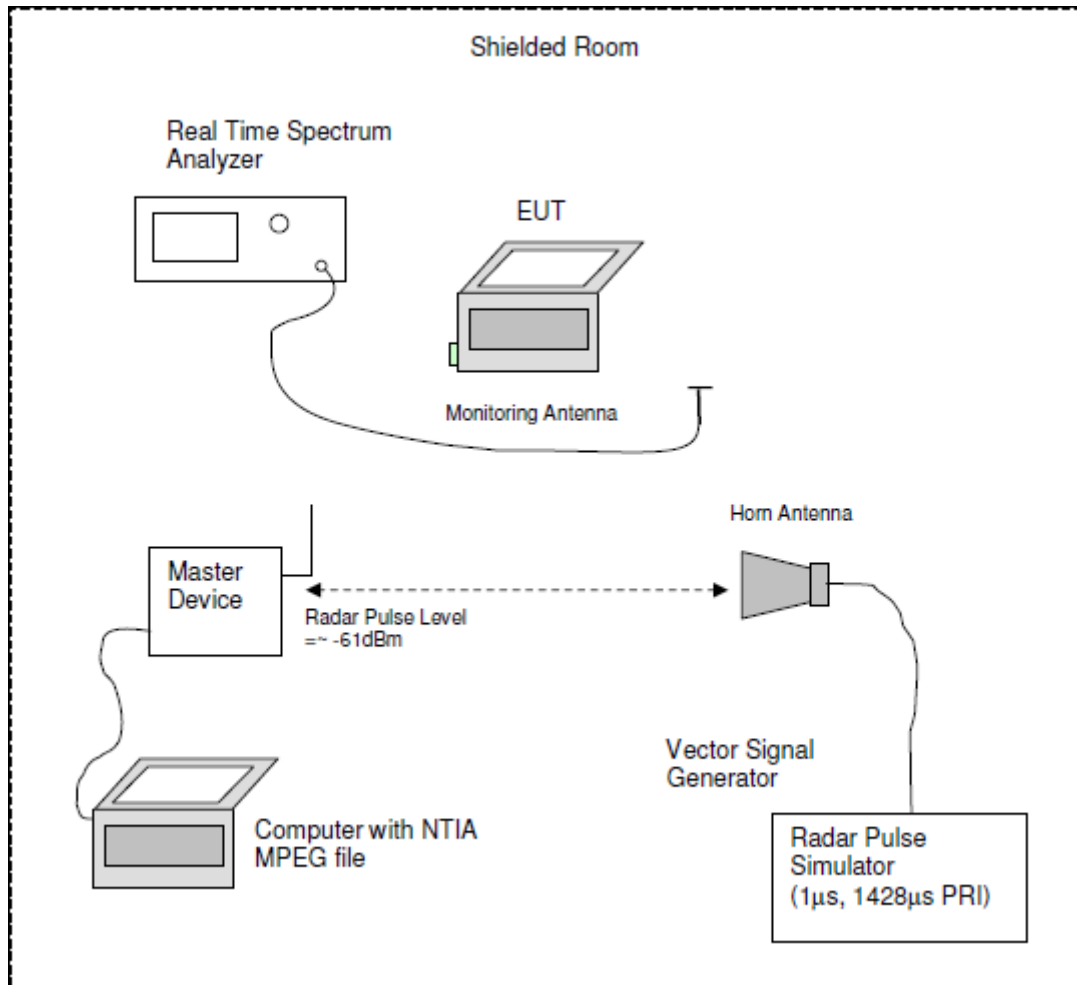
Table 3-7. Parameters for Frequency Hopping Radar Waveforms

Radar Type	Pulse Width (μsec)	PRI (μsec)	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

4.5 Procedure

The FCC 06-96 describes a radiated test setup and a conducted test setup. A radiated test setup was used for this testing. Figure 3-1 shows the typical test setup. One channel selected between 5260 and 5350 MHz is chosen for the testing.

Figure 3-1. Radiated Test Setup for DFS



1. The radar pulse generator is setup to provide a pulse at the frequency that the Master and Client are operating. A Type 1 radar pulse with a 1s pulse width and a 1428s PRI is used for the testing.
2. The vector signal generator is adjusted to provide the radar burst (18 pulses) at a level of approximately -62dBm at the antenna of the Master device.
3. A trigger is provided from the pulse generator to the DFS monitoring system in order to capture the Traffic and the occurrence of the radar pulse.
4. The Client Device (EUT) is set up per the diagram in Figure 3-1 and communications between the

Master device and the Client is established.

5. The MPEG file specified by the FCC ("*6 ½ Magic Hours*") is streamed from the "file computer" through The Master to the Slave Device and played in full motion video using Media Player Classic Ver. 6.4.8.6 in order to properly load the network.

6. The real time spectrum analyzer is set to record a 16sec window to any transmissions occurring up to and after 10sec.

7. The system is again setup and the monitoring time is shortened in order to capture the Channel Closing Transmission Time. This time is measured to insure that the Client ceases transmission within 200ms and the aggregate of emissions occurring after 200ms up to 10 sec do not exceed 60ms.

(Note: the channel may be different since the Master and Client have changed channels due to the detection of the initial radar pulse.)

8. After the initial radar burst the channel is monitored for 30 minutes to insure no transmissions or beacons occur. A second monitoring setup is used to verify that the Master and Client have both moved to different channels.

9. after the 30 minutes has elapsed both the master and client (EUT) units are powered off. The client is then powered on, while the master remains off, and monitored for 30 minutes to ensure no beacons are transmitted."



5 Test Equipment

Equipment	Model	Manufacturer	S/N	Cal. Date
MXG X-Series Vector Signal Generator	N5182B	Aglient	MY53050647	2014/3/19
EXA Signal Analyzer	N9010A	Aglient	MY53470504	2014/3/28
Peripherals	Brand	Model No.	Serial No.	Description of Data Cable
MacBook Air	Apple	A1465	C02N45AEG083	unshielded
AP	Netgear	R6300V2	3GM13A7EA1BF2	unshielded

6 TEST RESULTS

6.1 SUMMARY OF TEST RESULT

Clause	Test Parameter	Remarks	Pass/Fail
15.407	DFS Detection Threshold	No Applicable	N/A
15.407	Channel Availability Check time	No Applicable	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	No Applicable	N/A
15.407	U-NII Detection Bandwidth	No Applicable	N/A

6.2 DETELED TEST RESULTS

Clause	Test Parameter	Remarks	Pass/Fail
15.407	DFS Detection Threshold	No Applicable	N/A
15.407	Channel Availability Check time	No Applicable	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	No Applicable	N/A
15.407	U-NII Detection Bandwidth	No Applicable	N/A

6.2.1 TEST MODE: DEVICE OPERATING IN MASTER MODE

The EUT is slave equipment, it need a master device when testing.

Master with injection at the Master. (Radar Test Waveforms are injected into the Master)

6.2.2 DFS DETECTION THRESHOLD

Calibration:

The EUT is slave equipment and it with a max gain is 2.58 dBi.

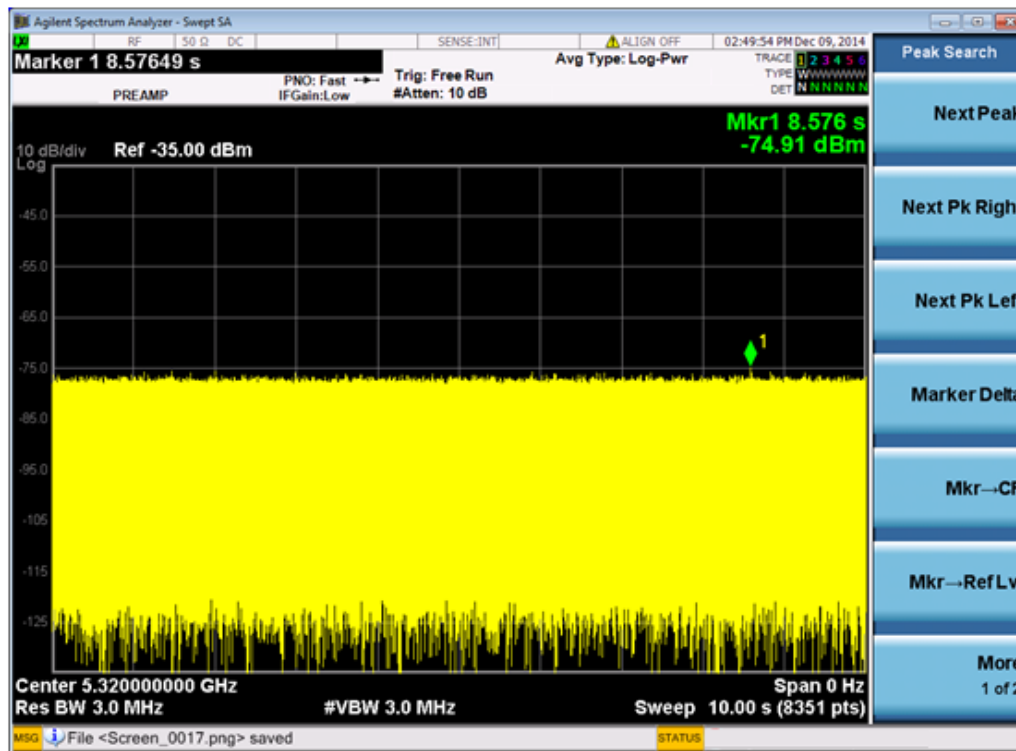
For a detection threshold level of -62dBm and master antenna gain is 5.47 dBi, required detection threshold is -56.53dBm $(=-62+5.47)$ 。

Note: Maximum Transmit Power is less than 200 milliwatt in this report, so detection threshold level is -62dBm.

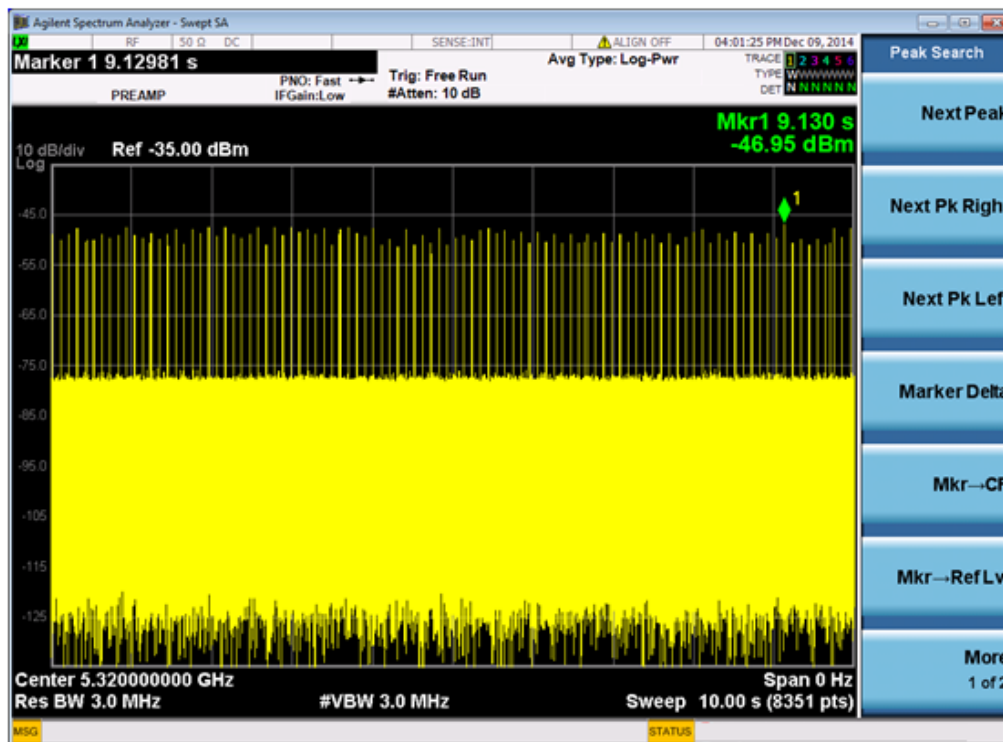
6.2.3 CHANNEL CLOSING TRANSMISSION AND CHANNEL MOVE TIME WLAN TRAFFIC

TX (11a mode)

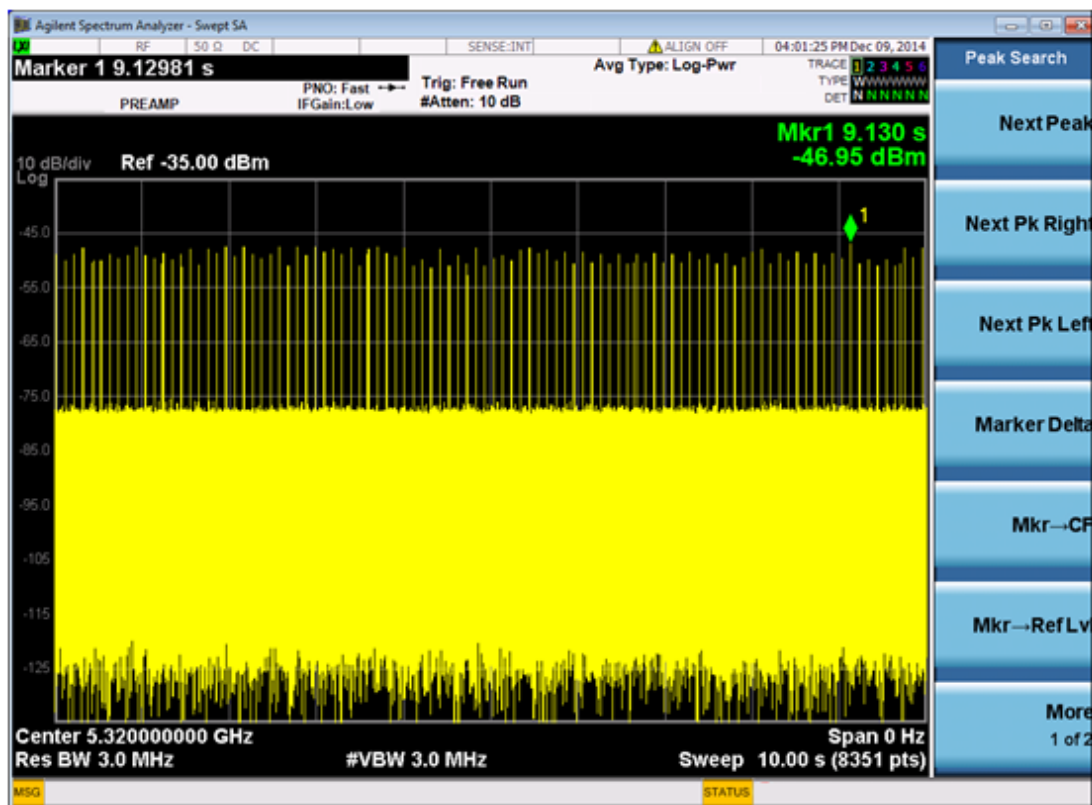
Without data Traffic Plot(Noise Plot) @ 5320MHz



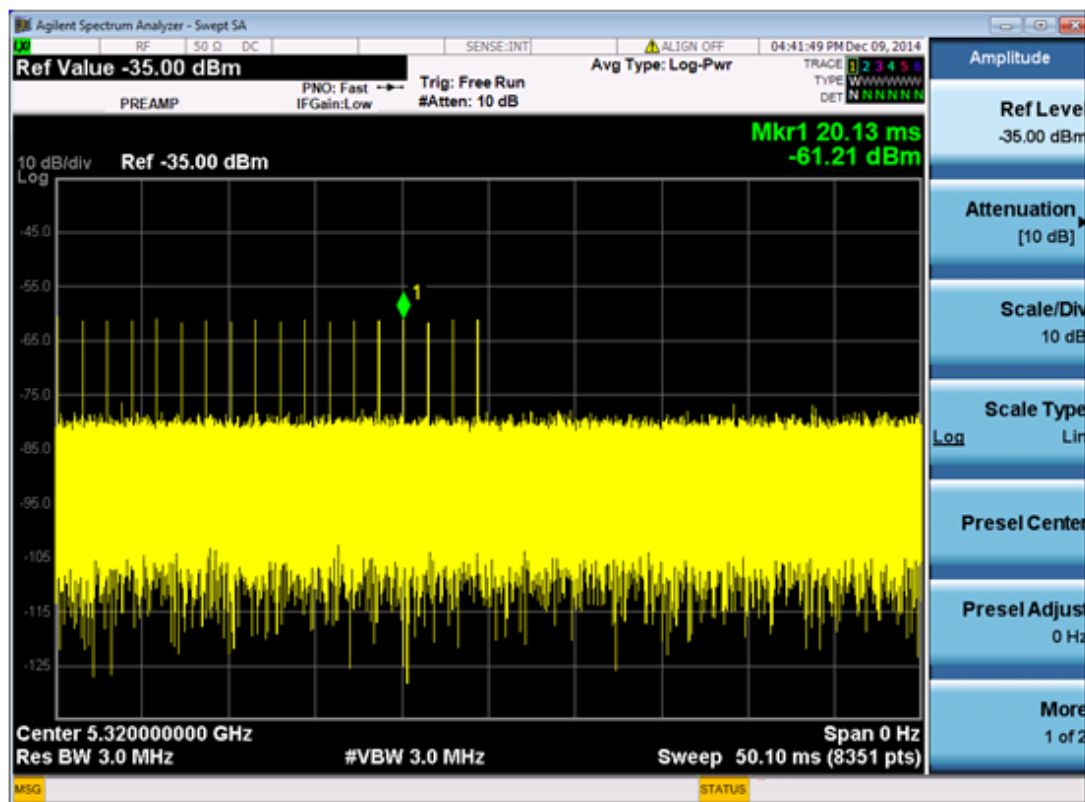
Master Data Traffic Plot @ 5320MHz



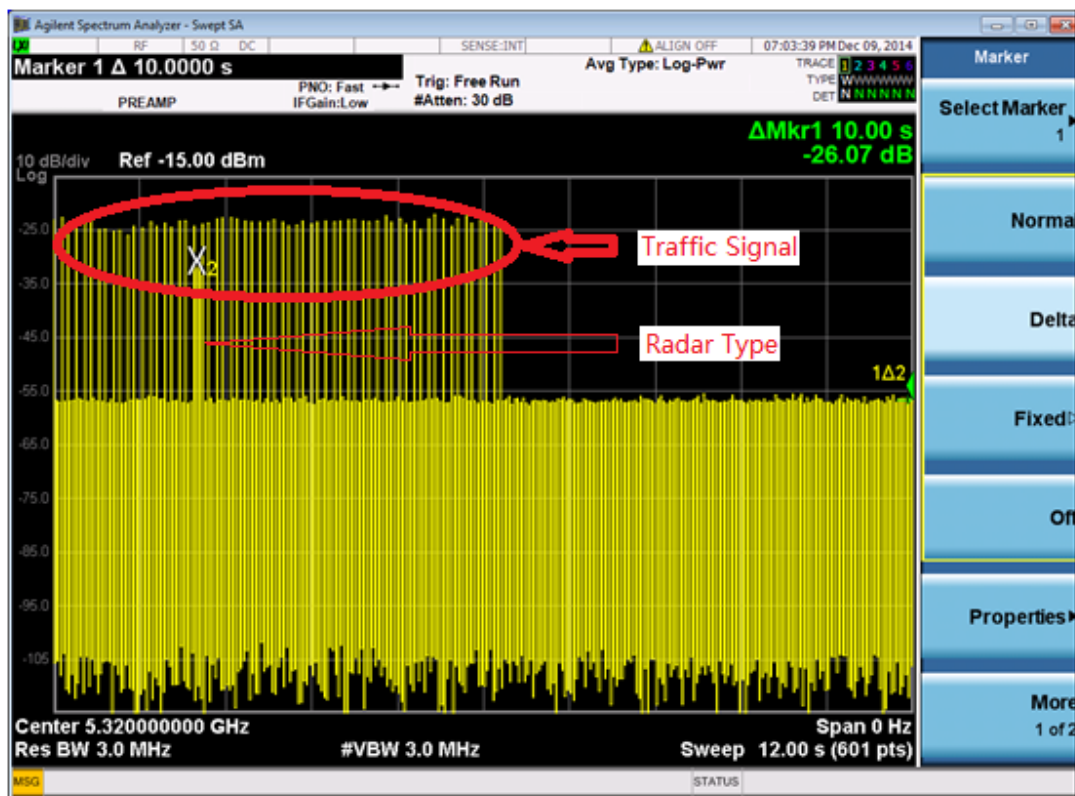
Client(EUT) Data Traffic Plot @ 5320MHz



Calibration Radar Type 1 @ 5320MHz



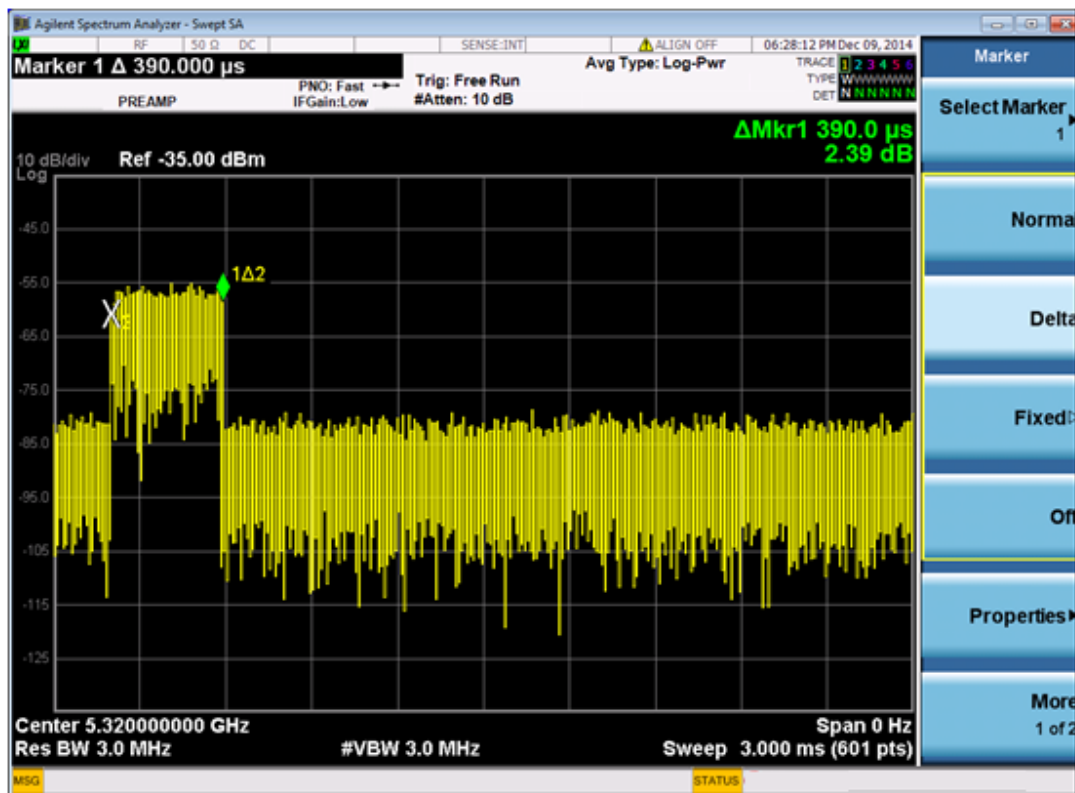
Channel Move Time @ 5320MHz



Channel Closing Transmission Time @ 5320MHz(Radar Type 1)



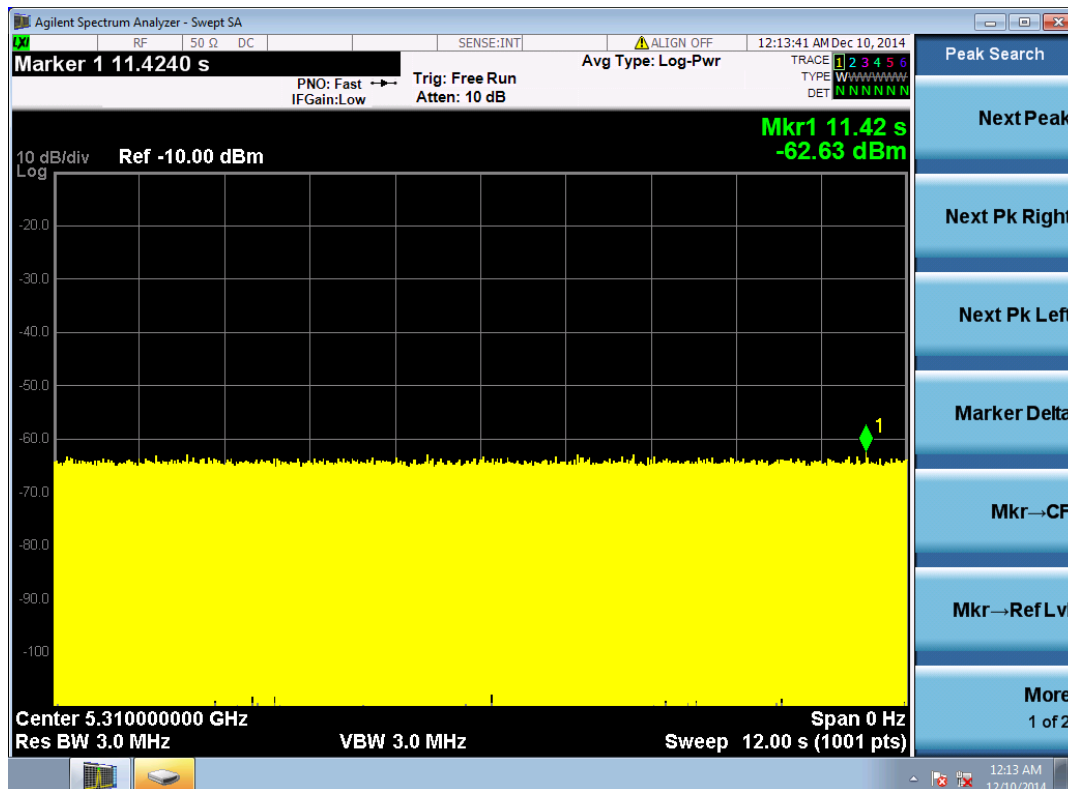
Channel Closing Transmission Time @ 5320MHz(Beacom Time)



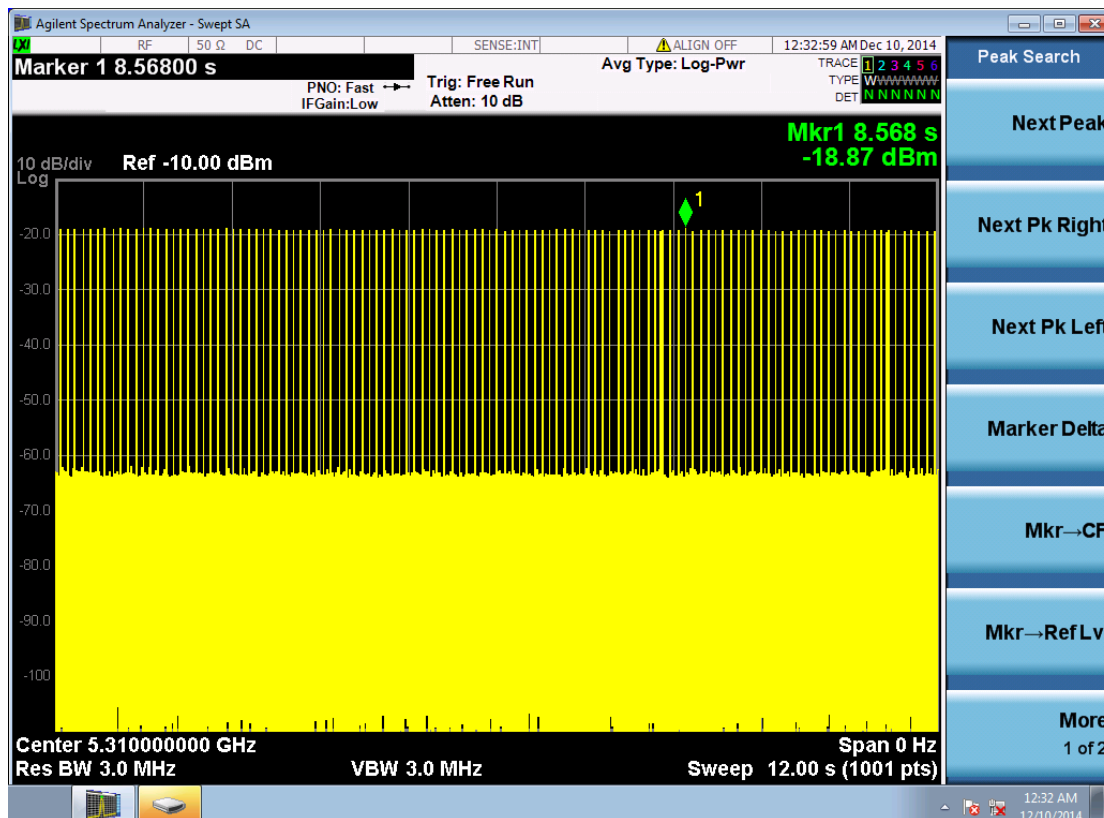
Closing Time: $0.390 \text{ ms} \times 42 = 16.38 \text{ ms}$

TX (11n 40MHz mode)

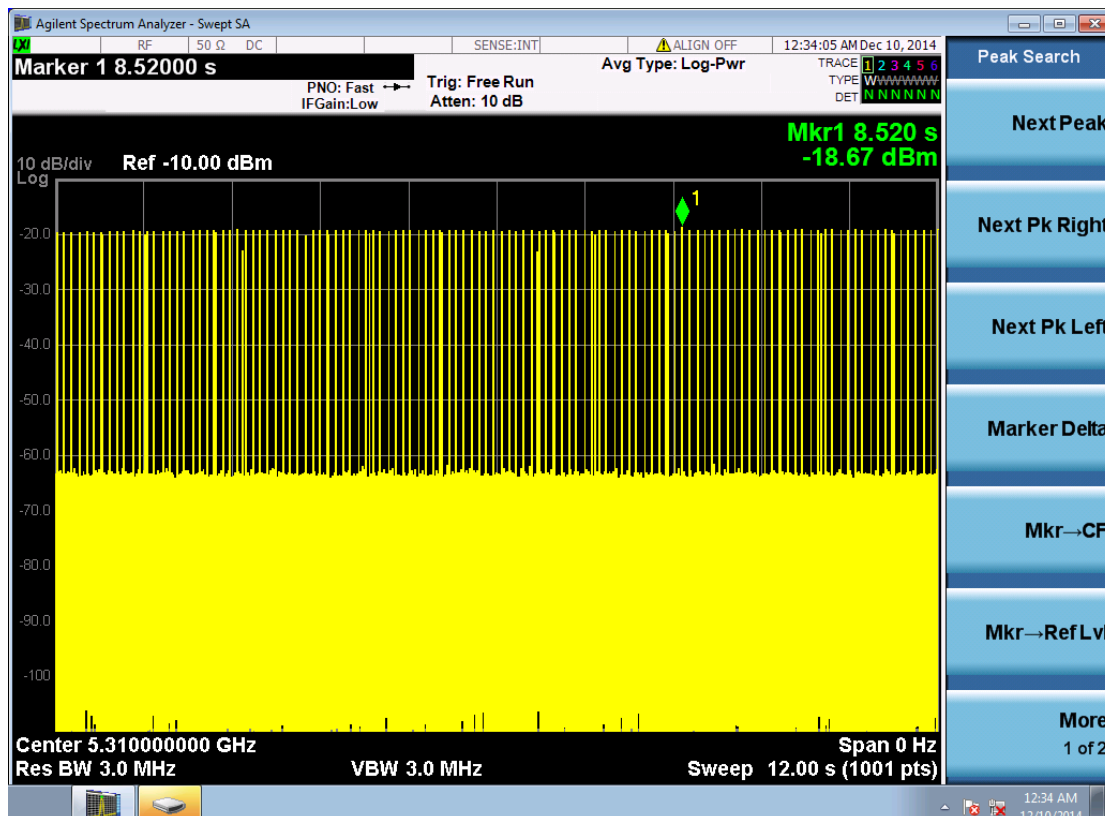
Without data Traffic Plot (Noise Plot) @ 5310MHz



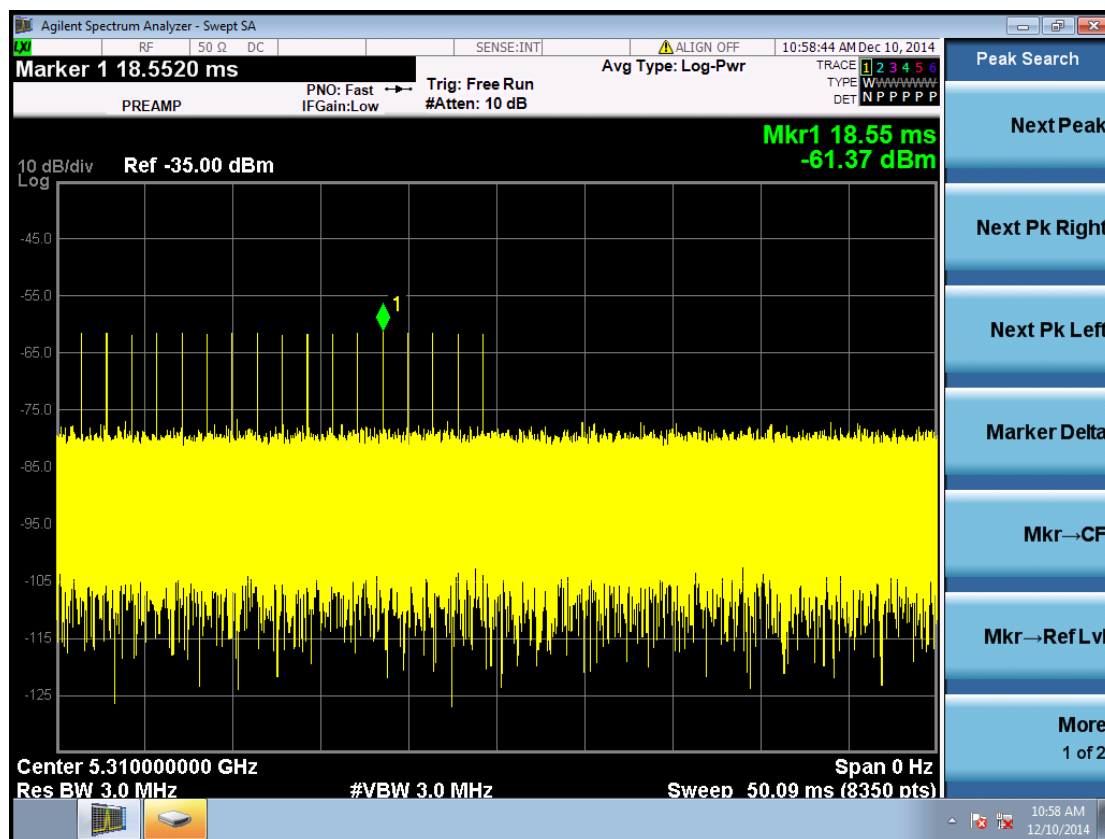
Master Data Traffic Plot @ 5310MHz



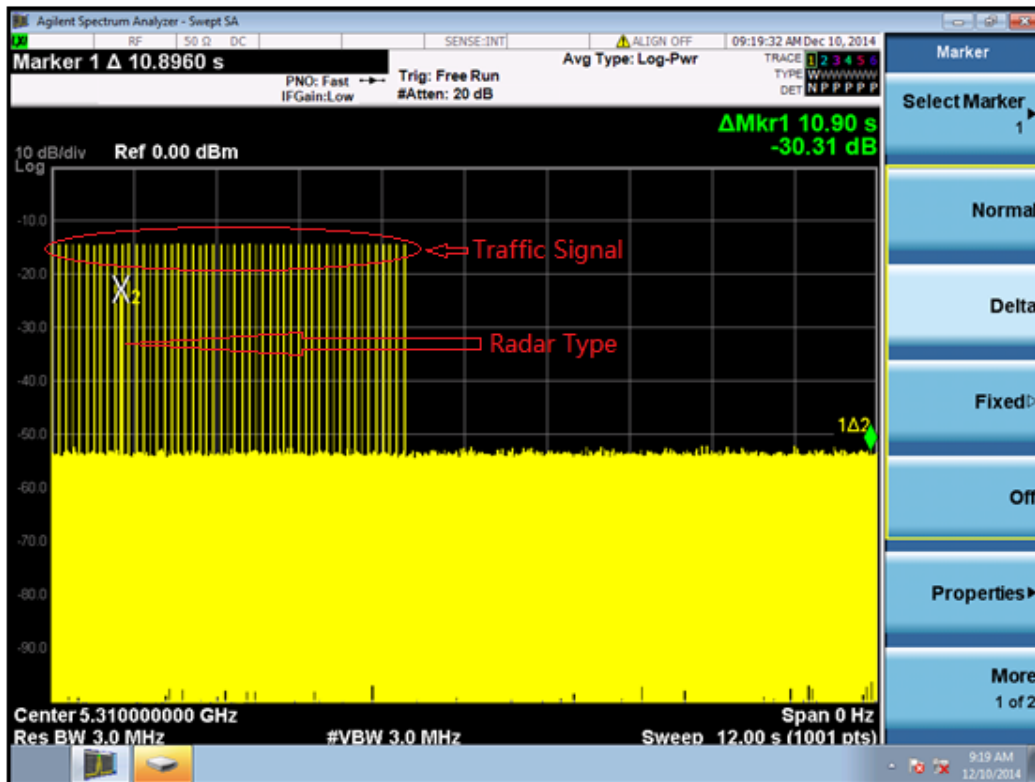
Client (EUT) Data Traffic Plot @ 5310MHz



Calibration Radar Type 1 @ 5310MHz



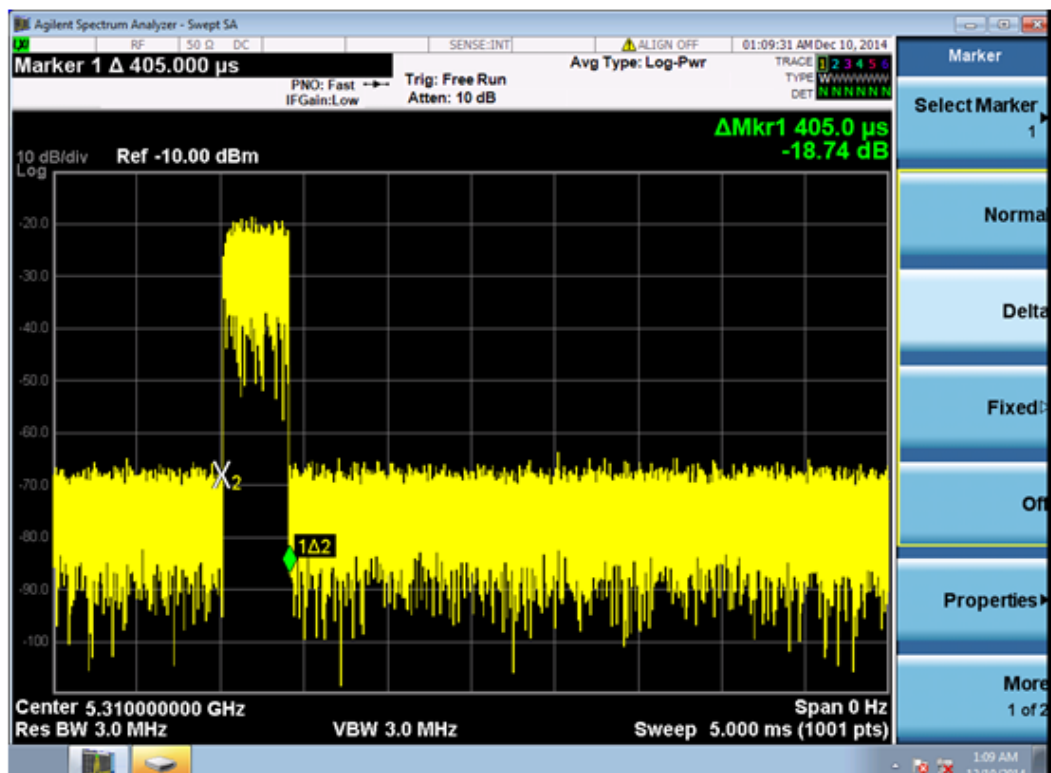
Channel Move Time @ 5310MHz



Channel Closing Transmission Time @ 5310MHz (Radar Type 1)



Channel Closing Transmission Time @ 5310MHz (Beacom Time)



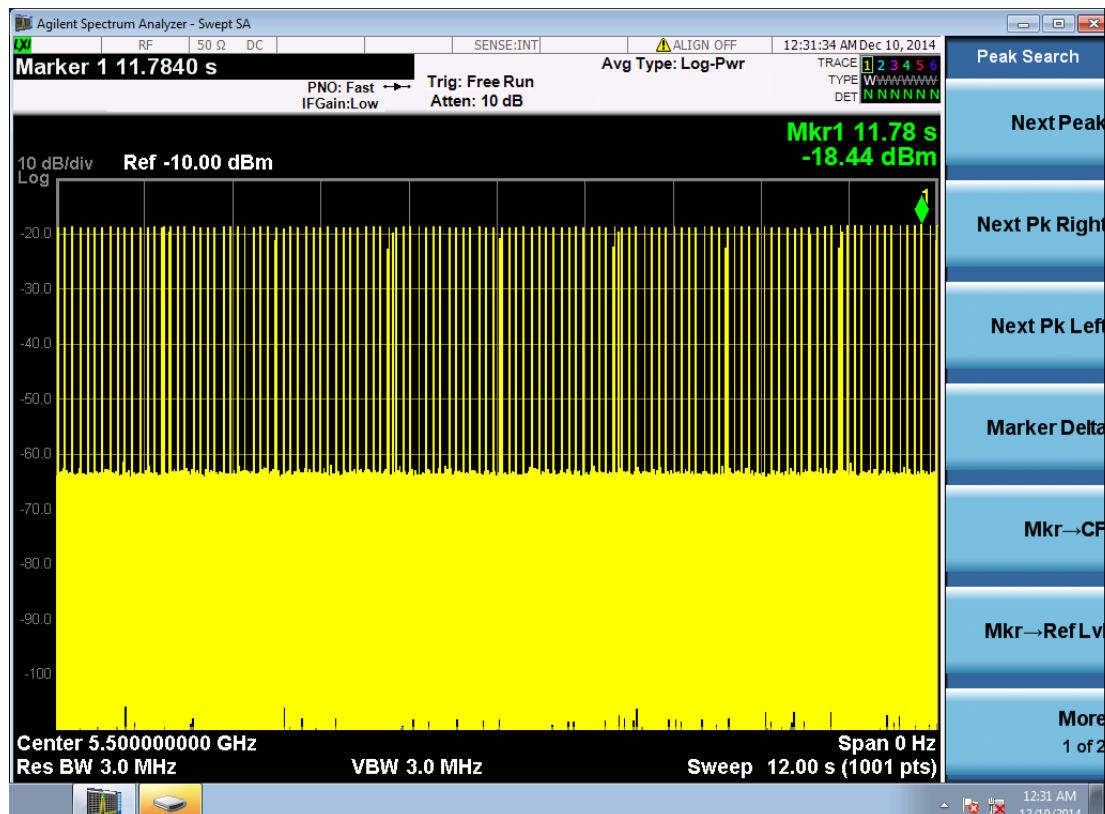
Closing Time Transmission Time: $0.405 \text{ ms} \times 41 = 16.61 \text{ ms}$

TX (11n 40MHz mode)

Without data Traffic Plot(Noise Plot) @ 5500MHz

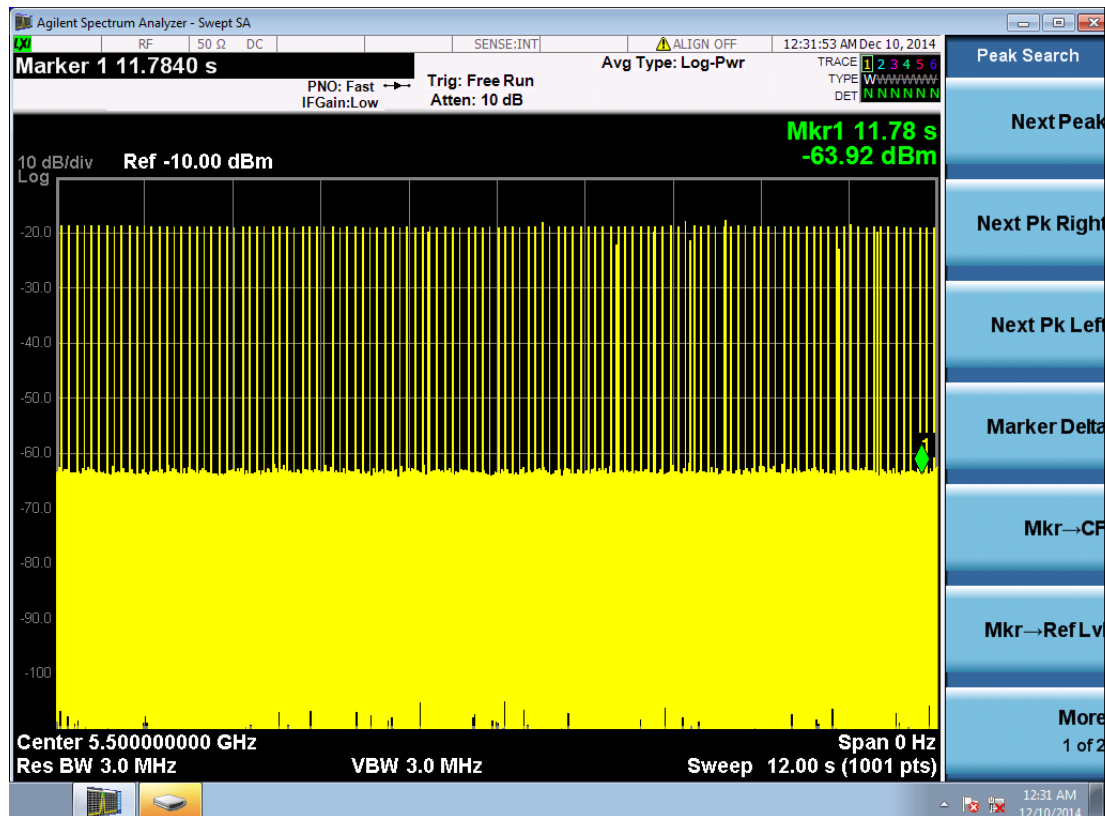


Master Data Traffic Plot @ 5500MHz

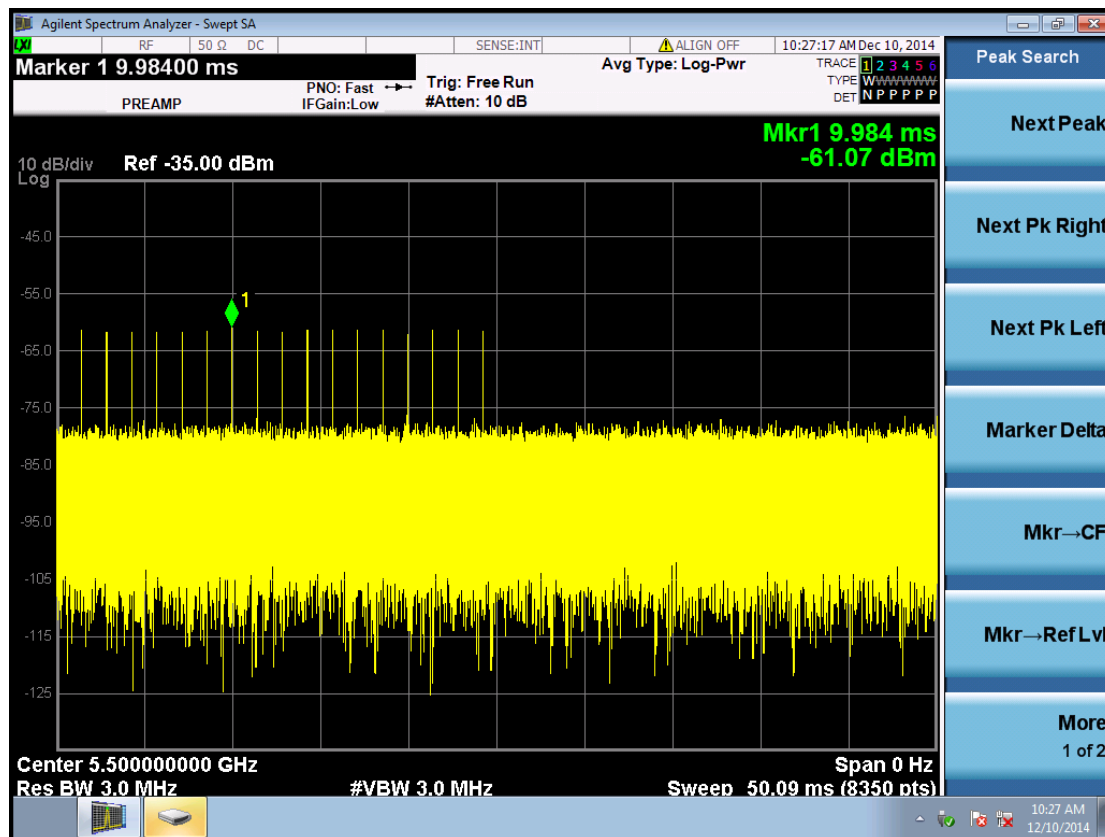




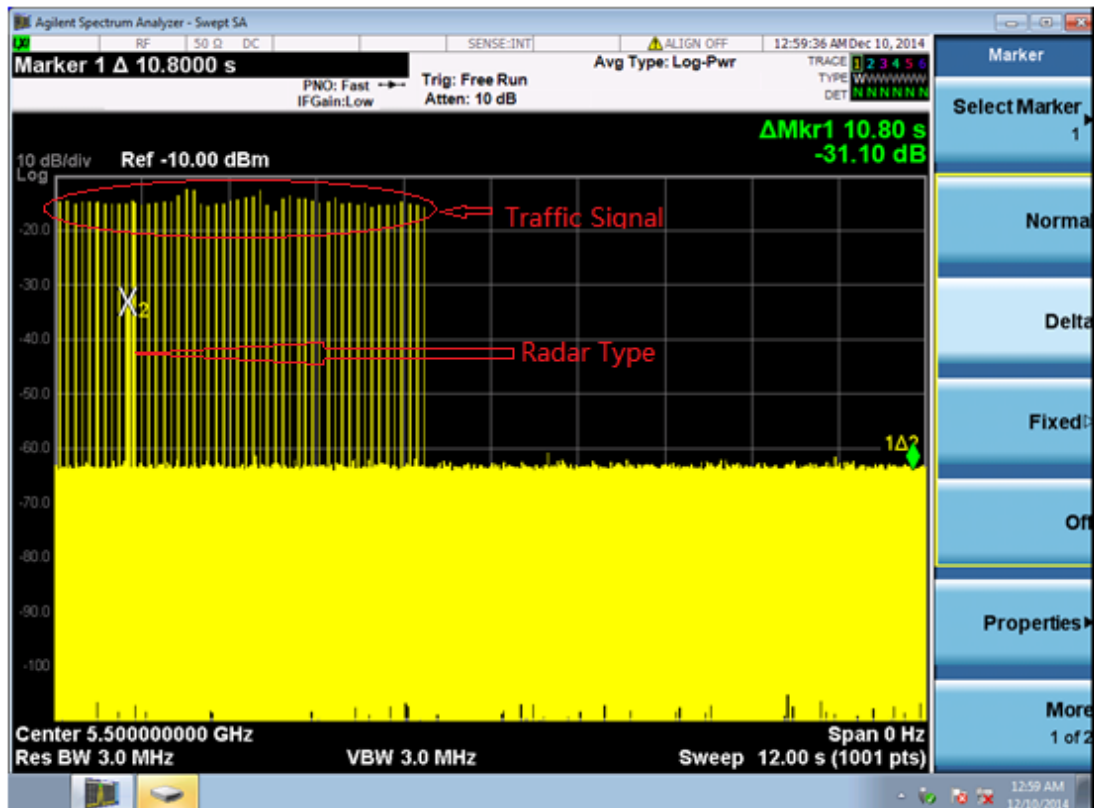
Client(EUT) Data Traffic Plot @ 5500MHz



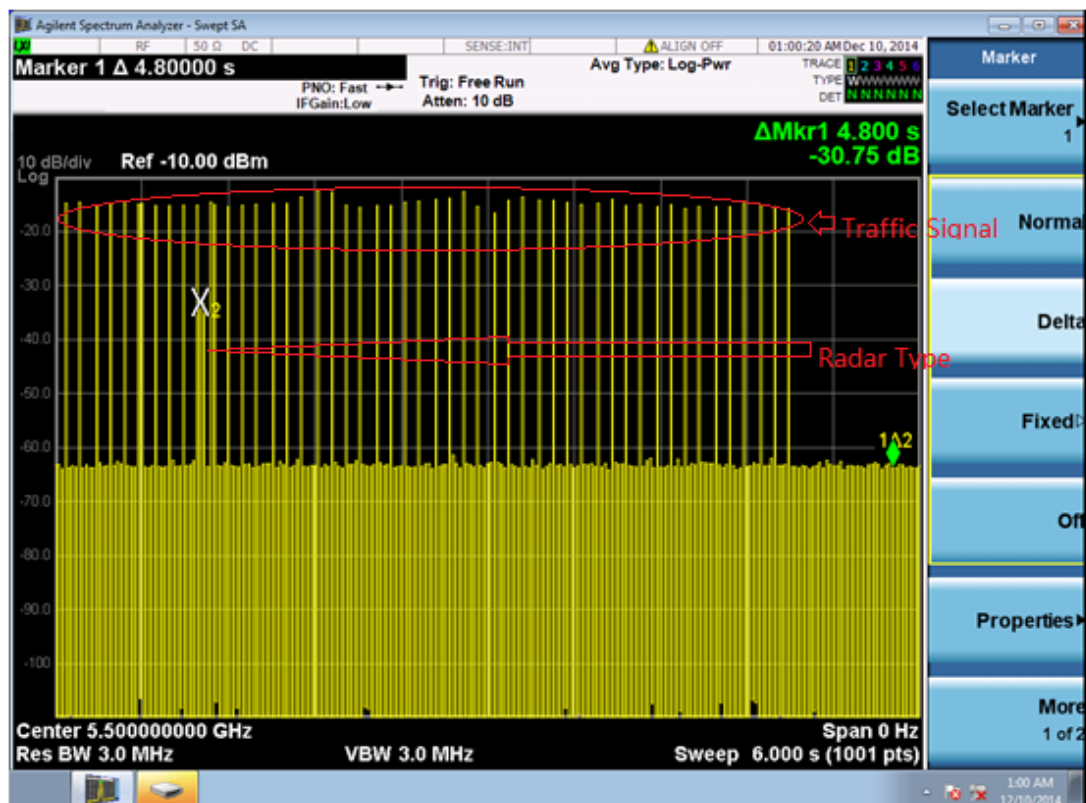
Calibration Radar Type 1 @ 5500MHz



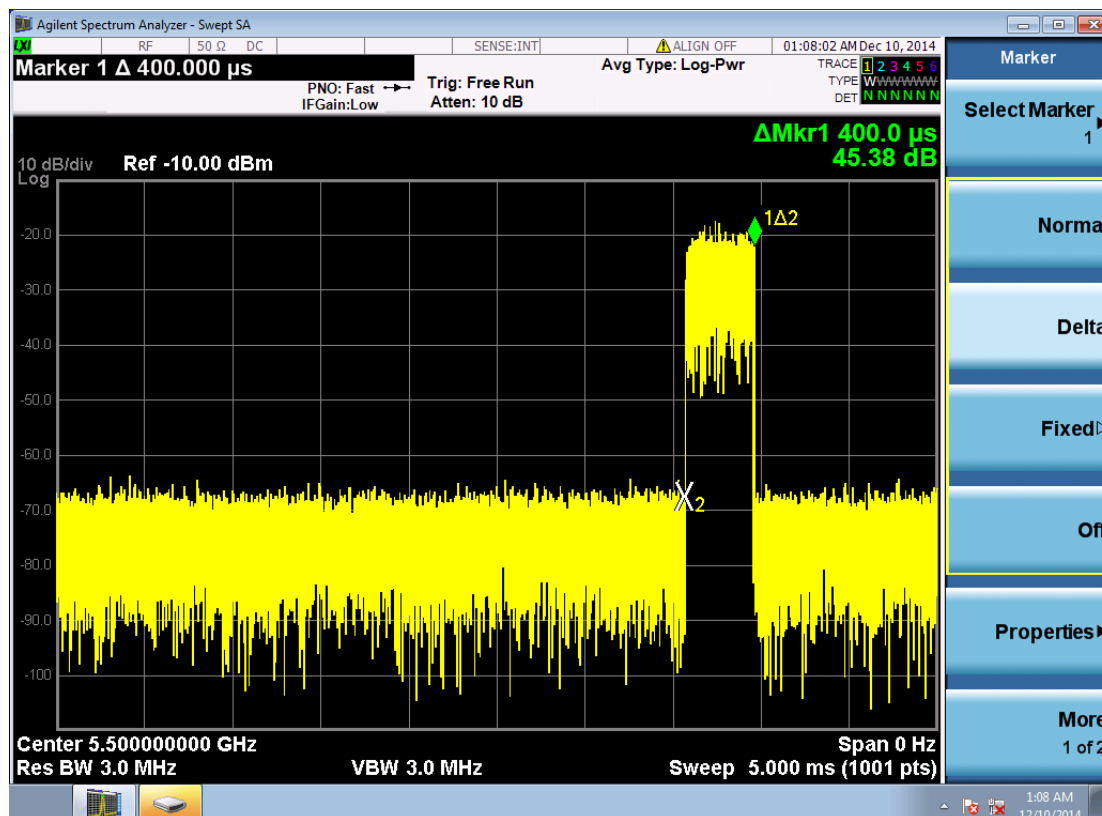
Channel Move Time @ 5500MHz



Channel Closing Transmission Time @ 5500MHz(Radar Type 1)



Channel Closing Transmission Time @ 5500MHz(Beacom Time)

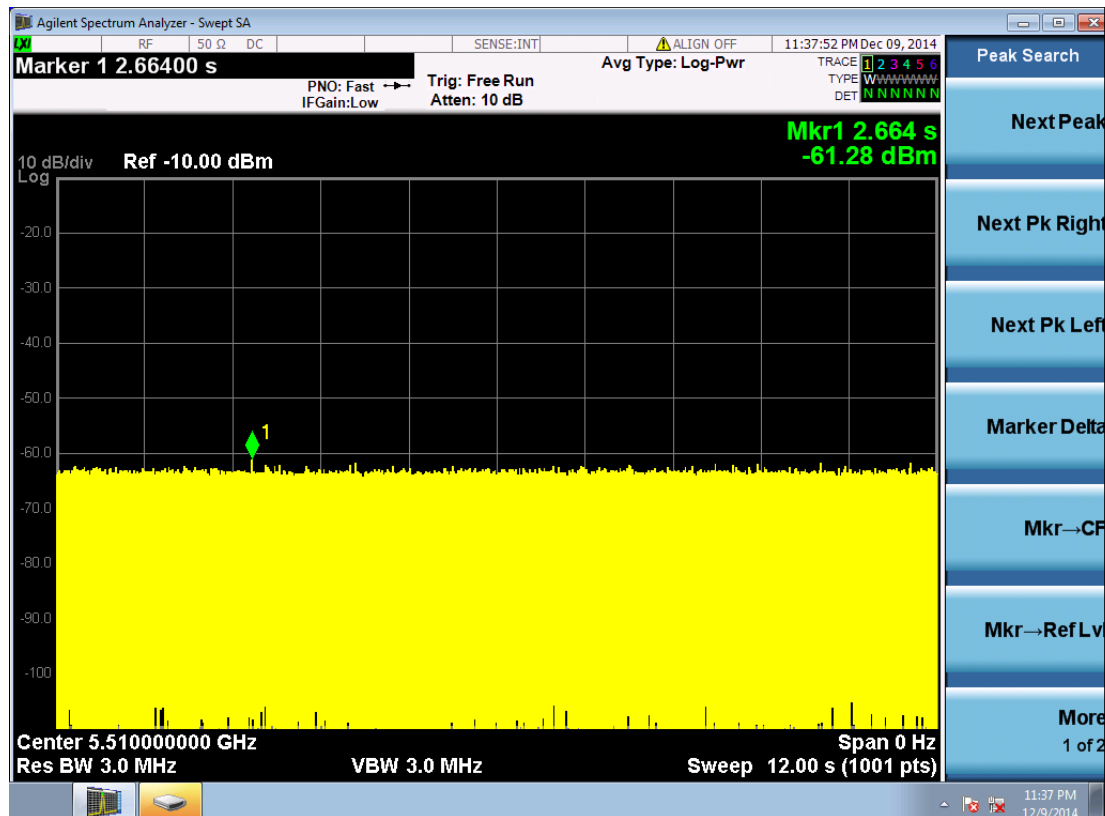


Closing Time Transmission Time: $0.400 \text{ ms} \times 41 = 16.4 \text{ ms}$

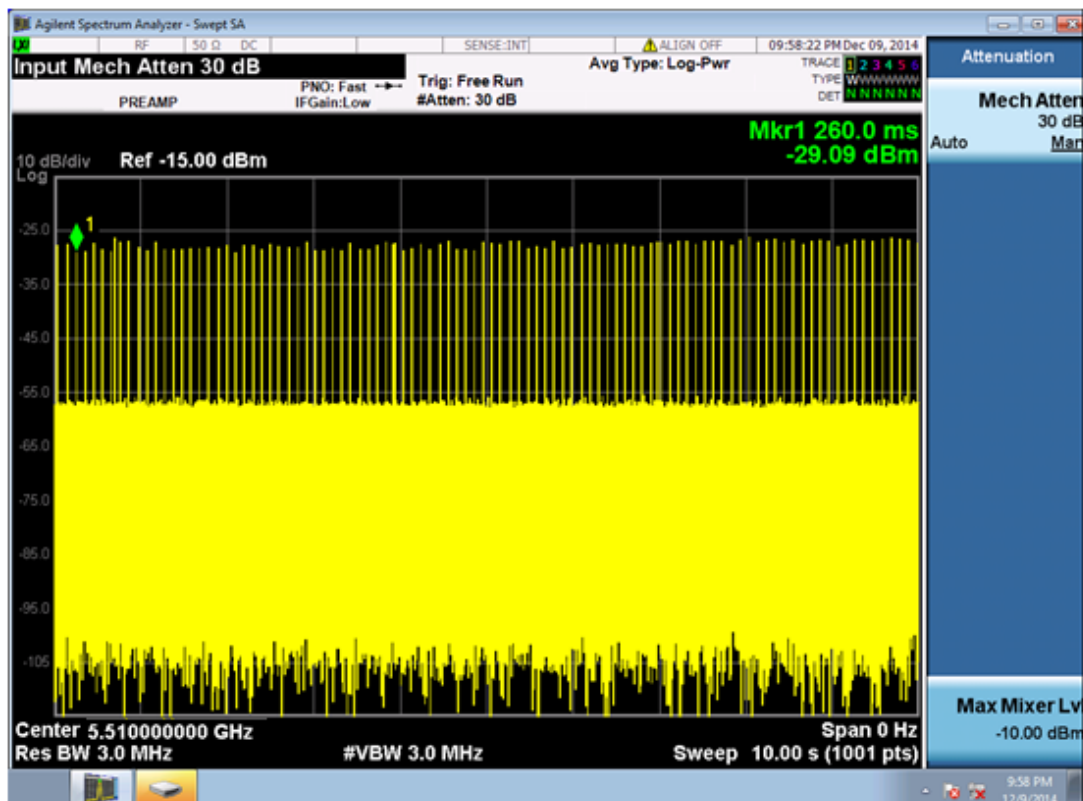


TX (11n 40MHz mode)

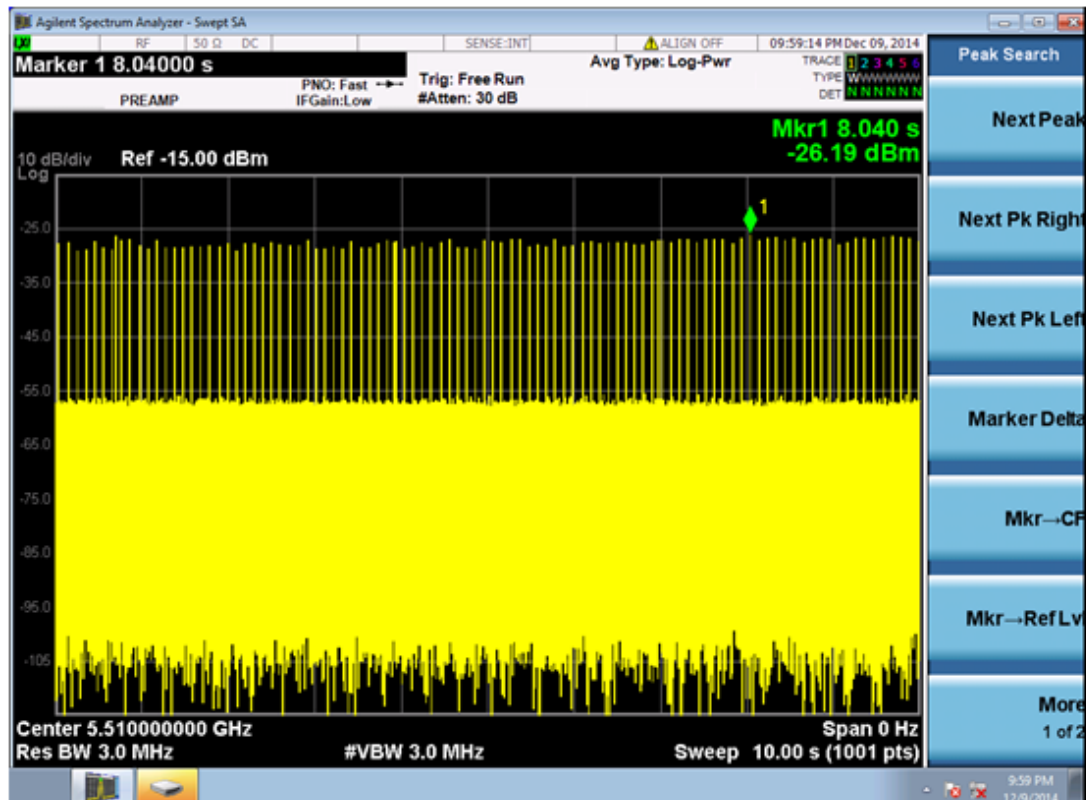
Without data Traffic Plot(Noise Plot) @ 5510MHz



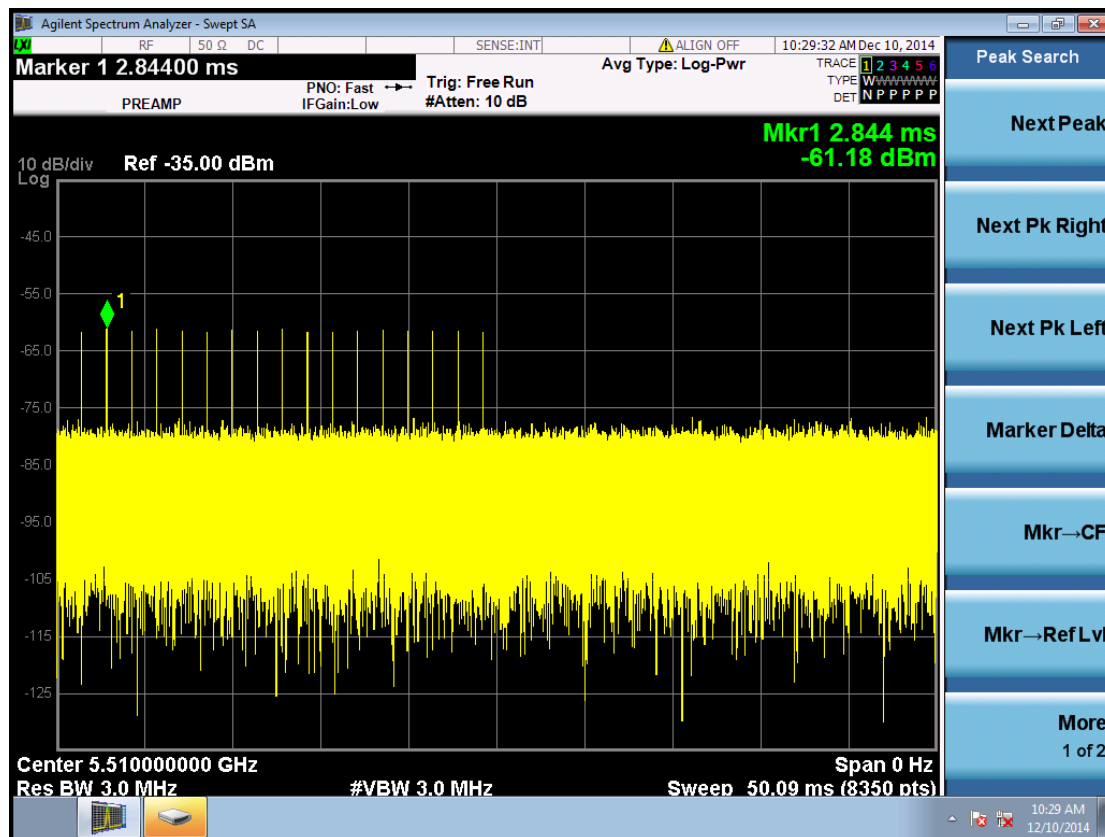
Master Data Traffic Plot @ 5510MHz



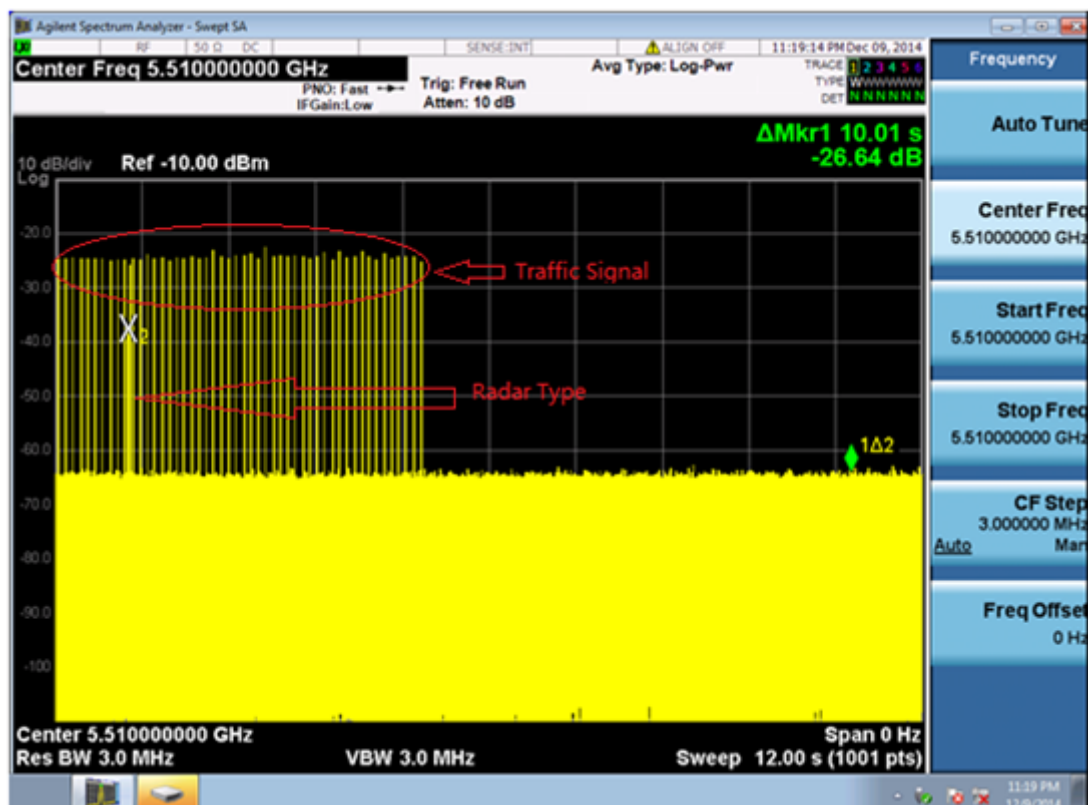
Client(EUT) Data Traffic Plot @ 5510MHz



Calibration Radar Type 1 @ 5510MHz



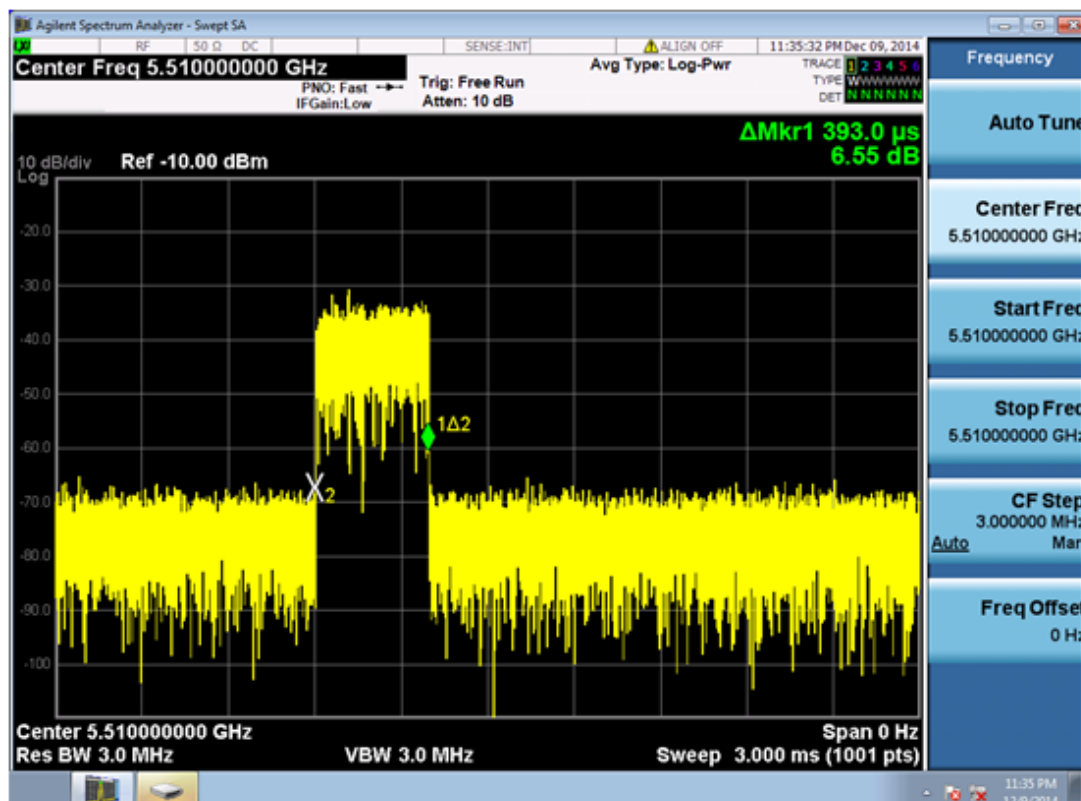
Channel Move Time @ 5510MHz



Channel Closing Transmission Time @ 5510MHz(Radar Type 1)



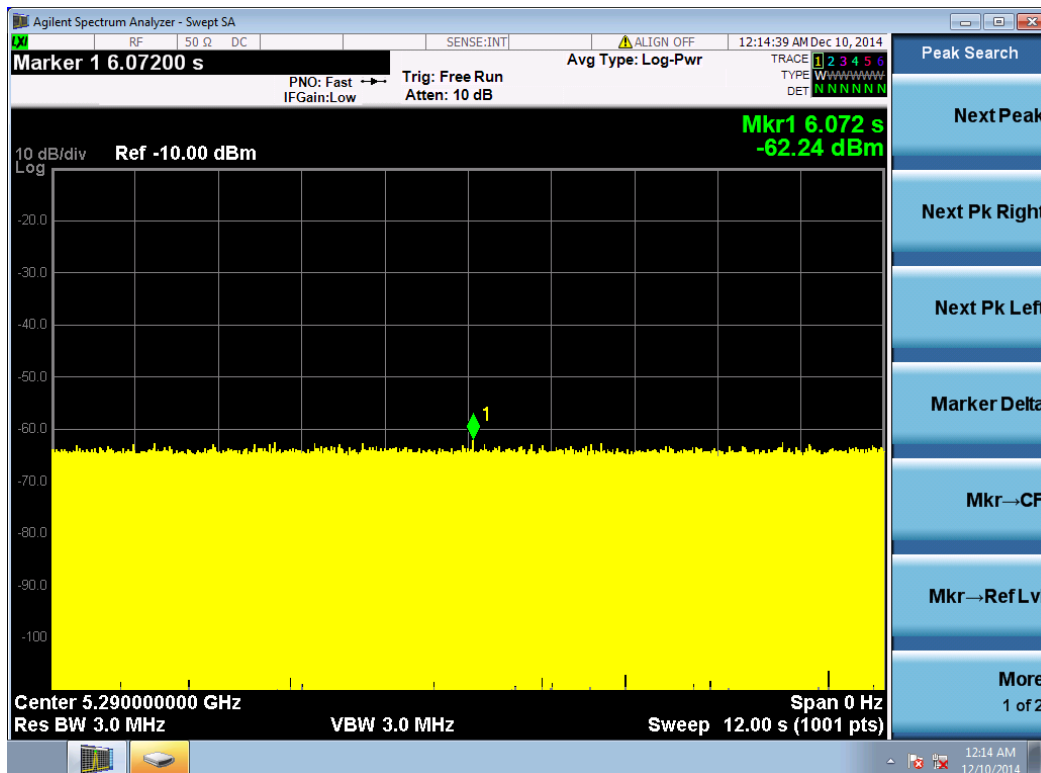
Channel Closing Transmission Time @ 5510MHz(Beacom Time)



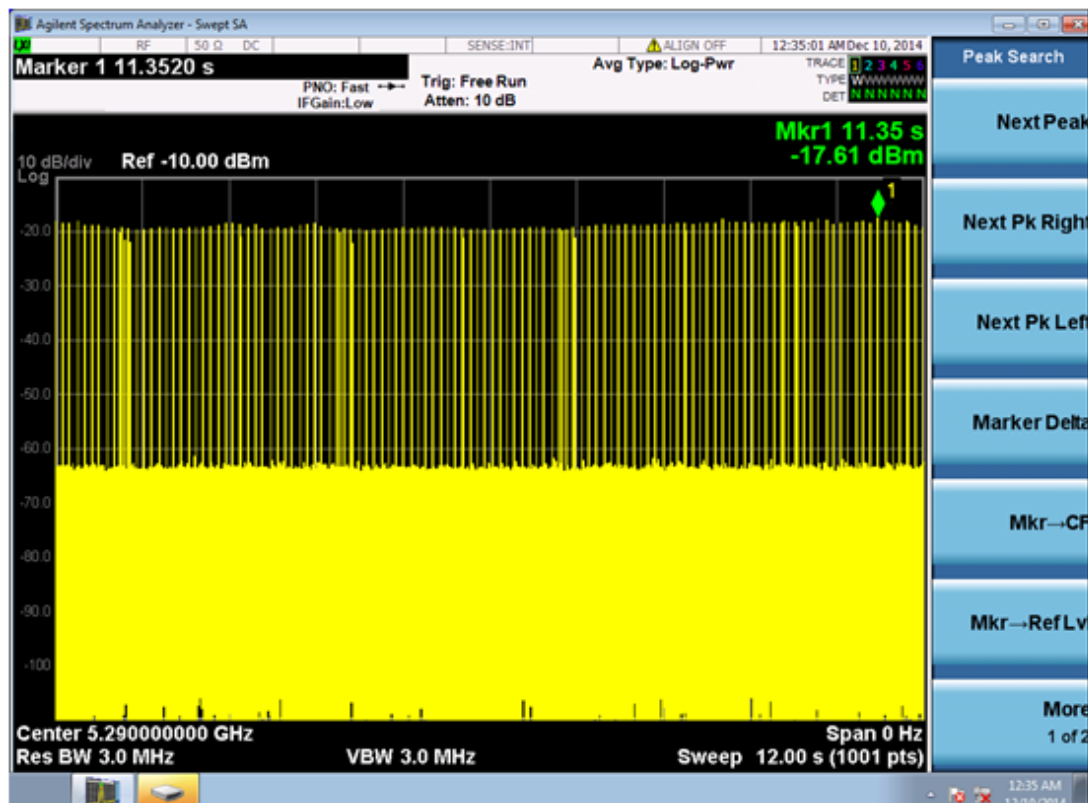
Closing Time Transmission Time: $0.393 \text{ ms} \times 41 = 16.11 \text{ ms}$

TX (11ac 80MHz mode)

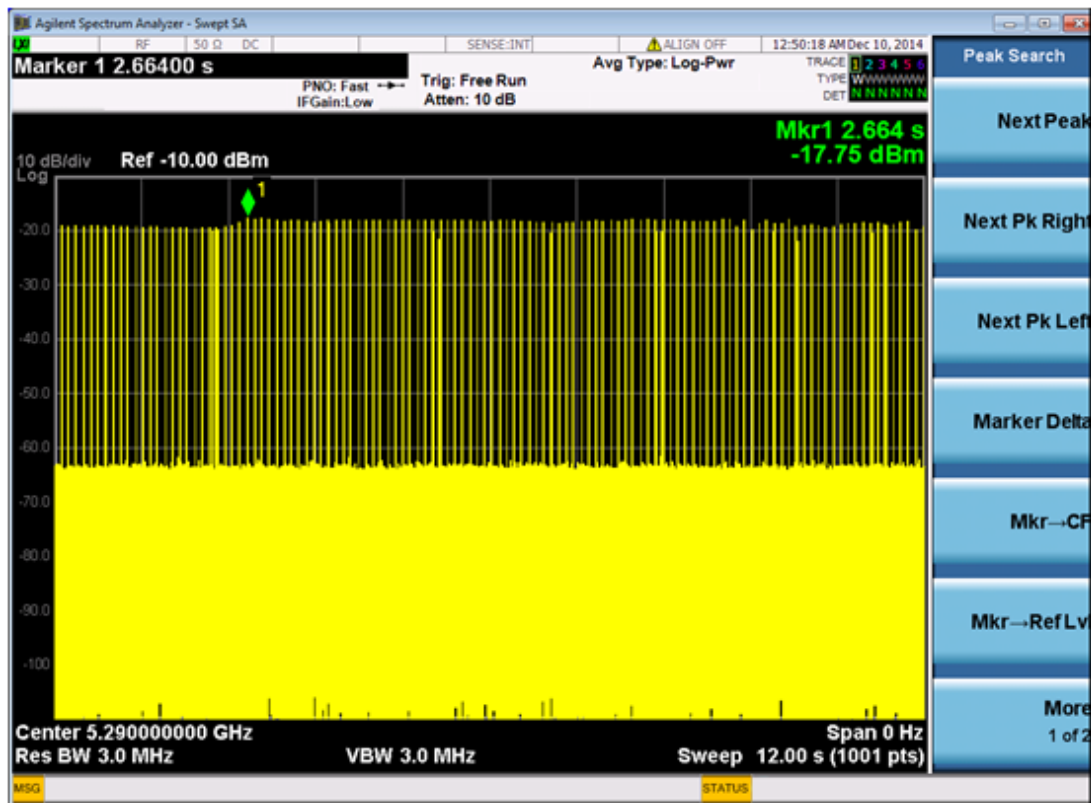
Without data Traffic Plot(Noise Plot) @ 5290MHz



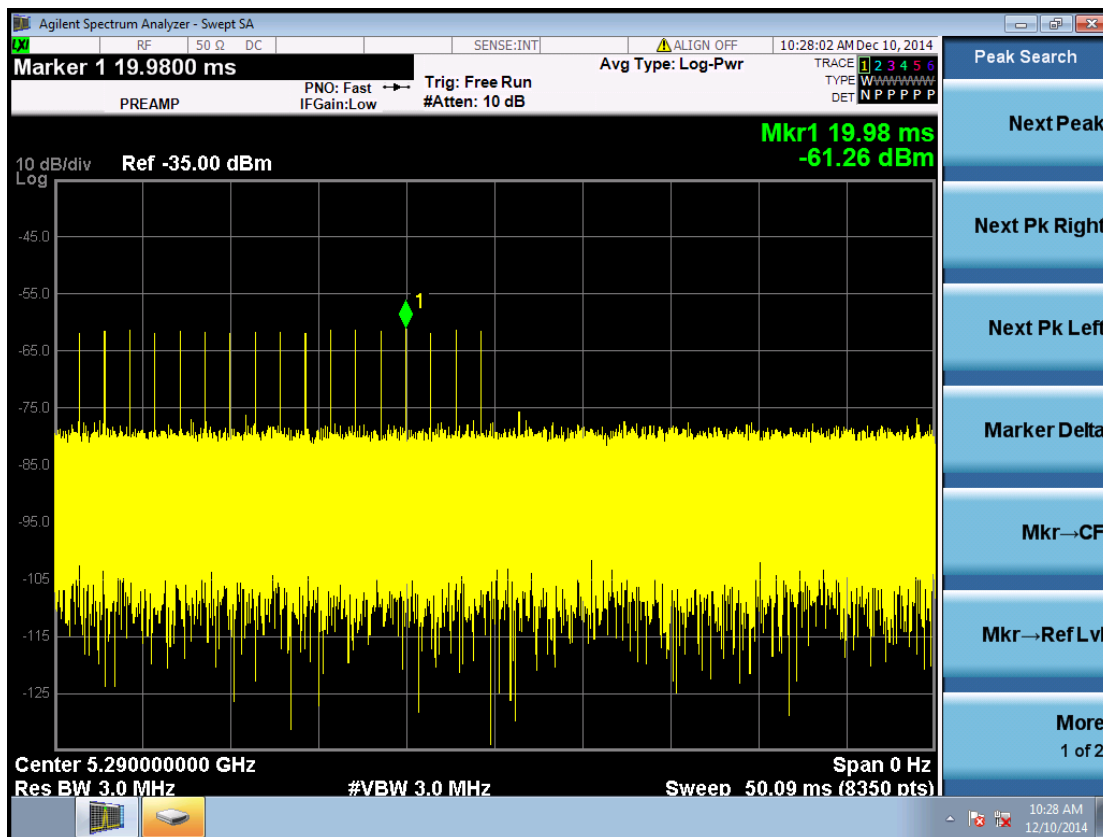
Master Data Traffic Plot @ 5290MHz



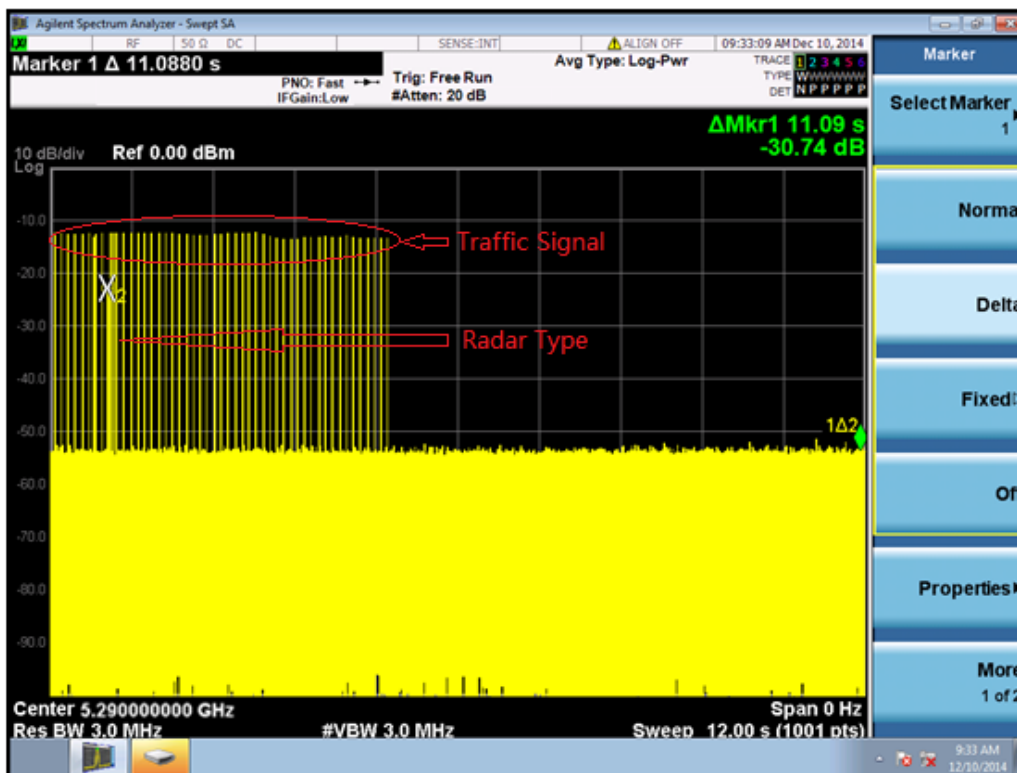
Client(EUT) Data Traffic Plot @ 5290MHz



Calibration Radar Type 1 @ 5290MHz



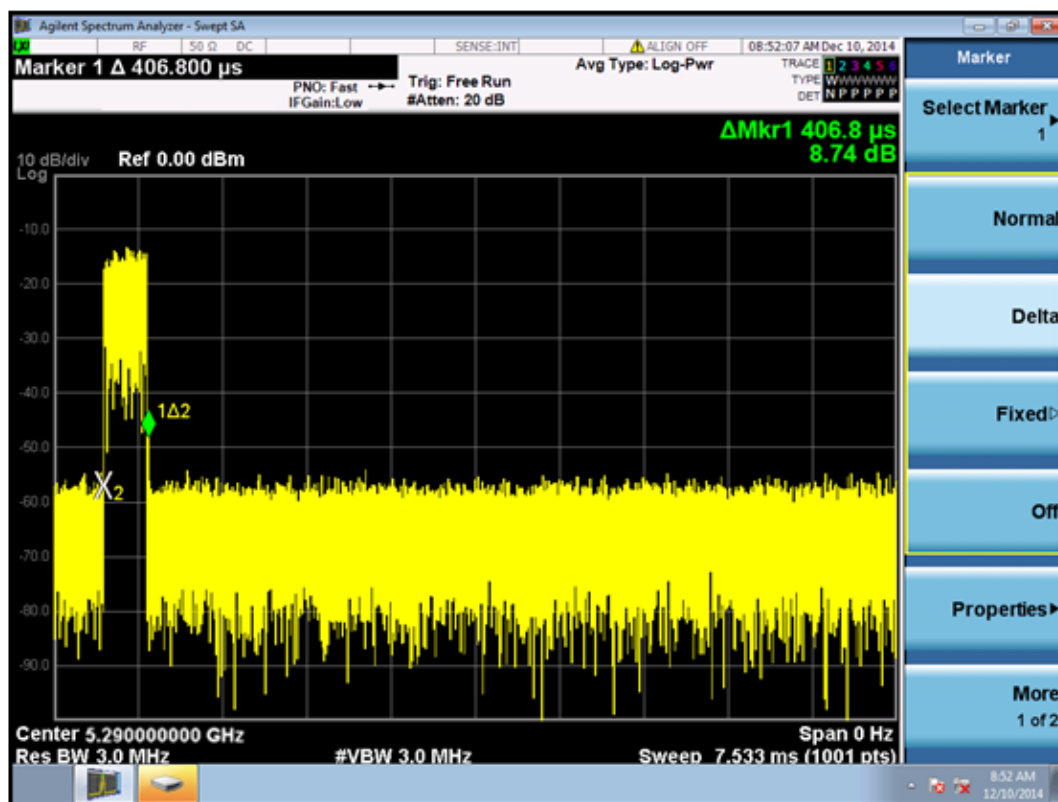
Channel Move Time @ 5290MHz



Channel Closing Transmission Time @ 5290MHz(Radar Type 1)



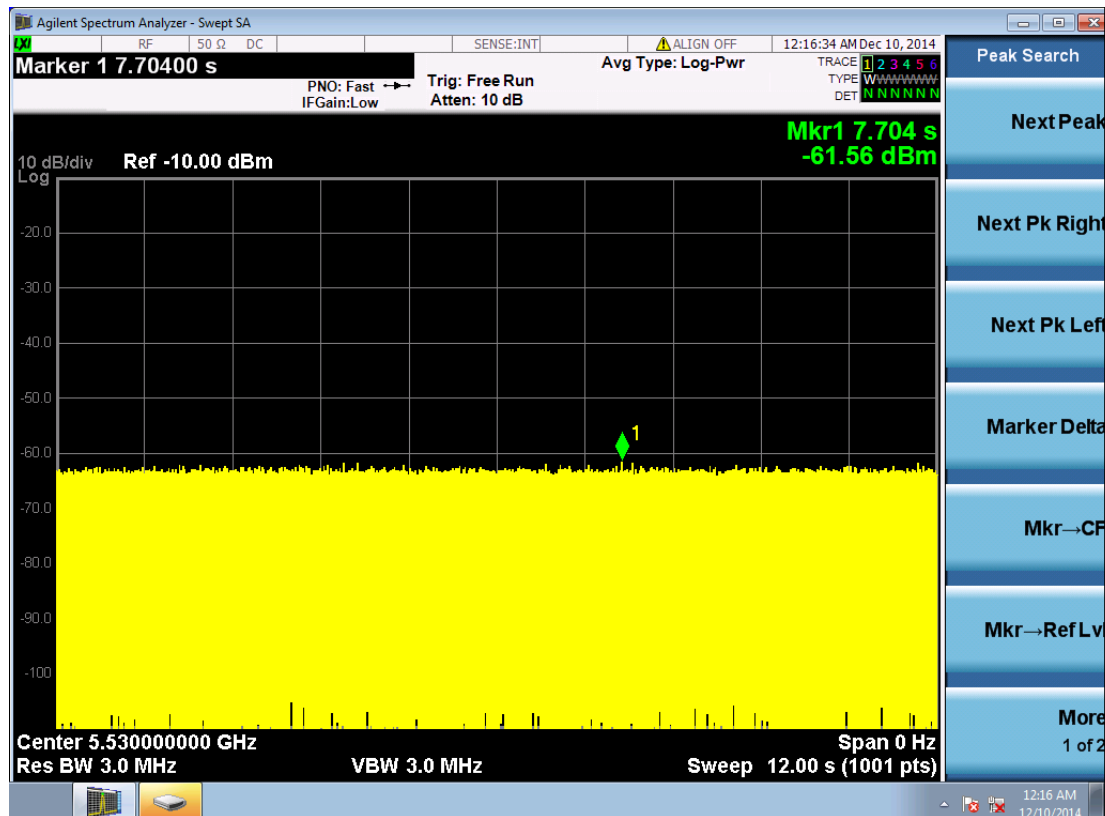
Channel Closing Transmission Time @ 5290MHz(Beacom Time)



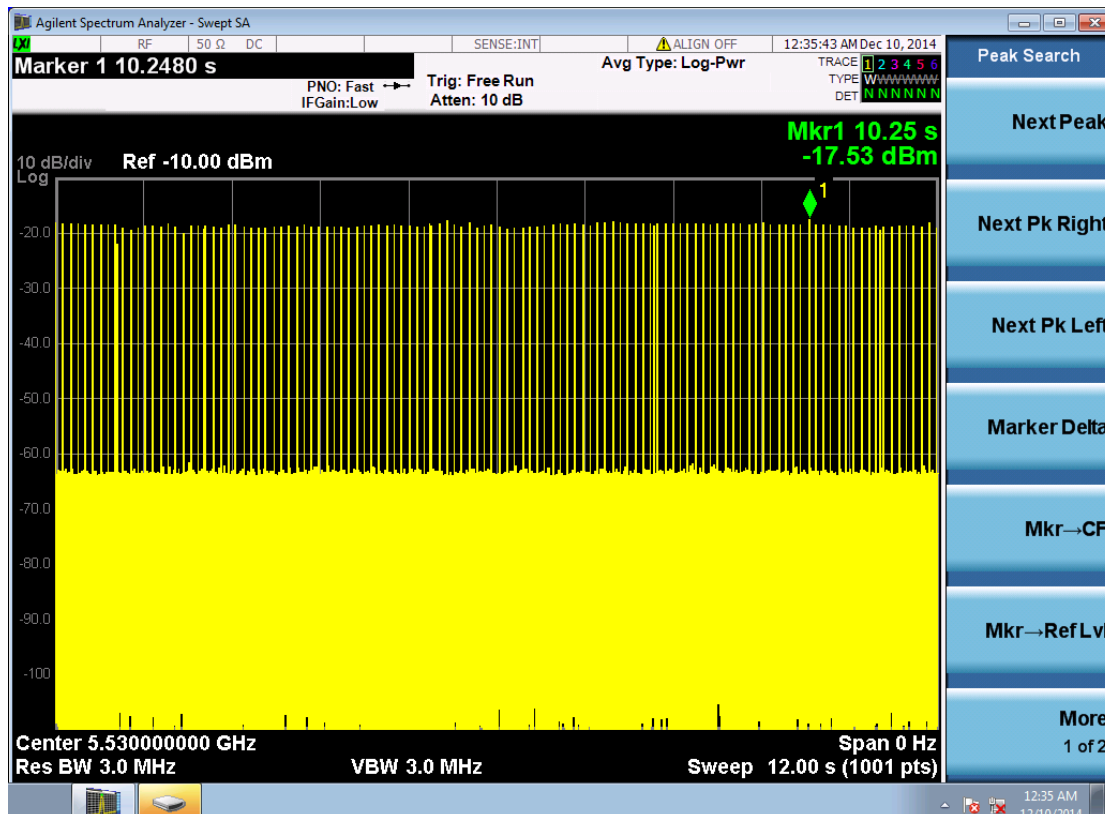
Closing Time Transmission Time: $0.4068 \text{ ms} * 42 = 17.09 \text{ ms}$

TX (11ac 80MHz mode)

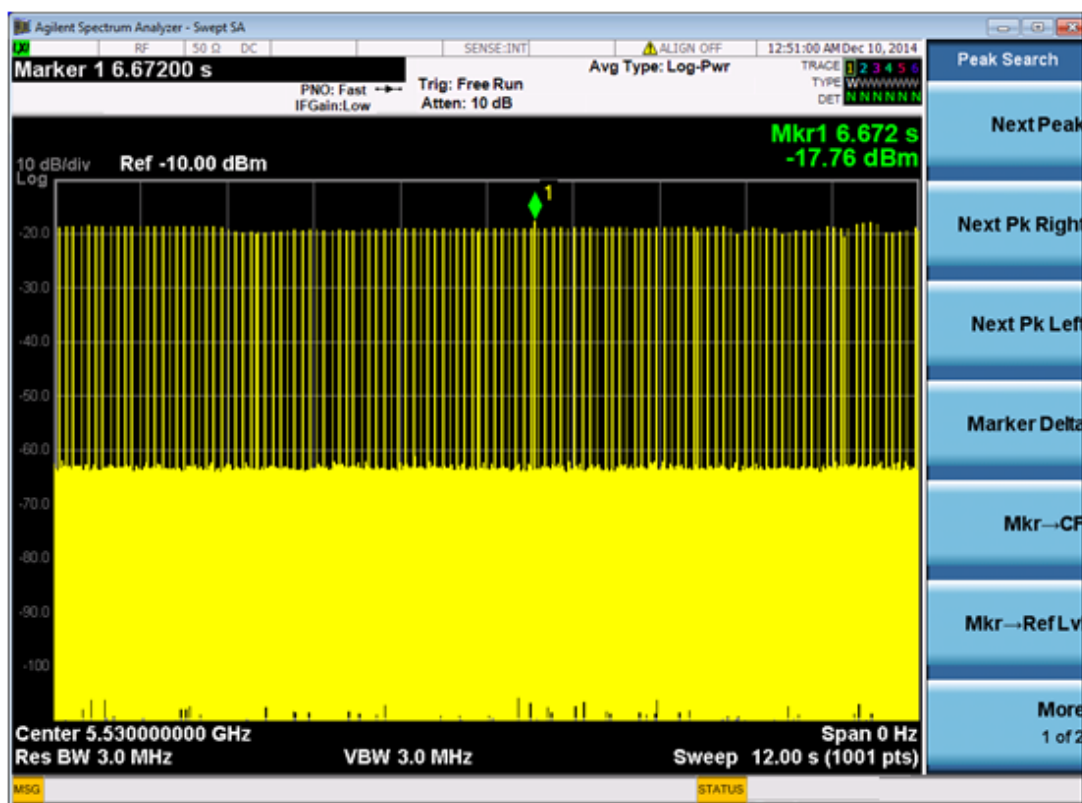
Without data Traffic Plot(Noise Plot) @ 5530MHz



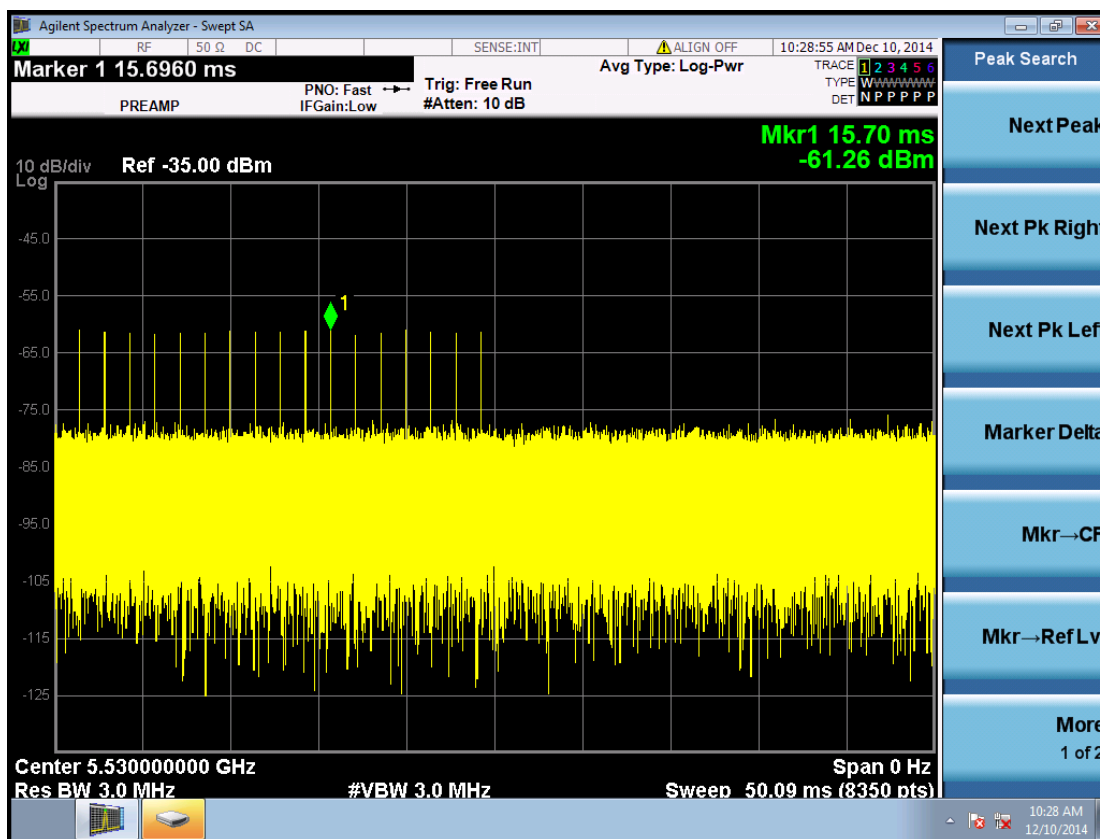
Master Data Traffic Plot @ 5530MHz



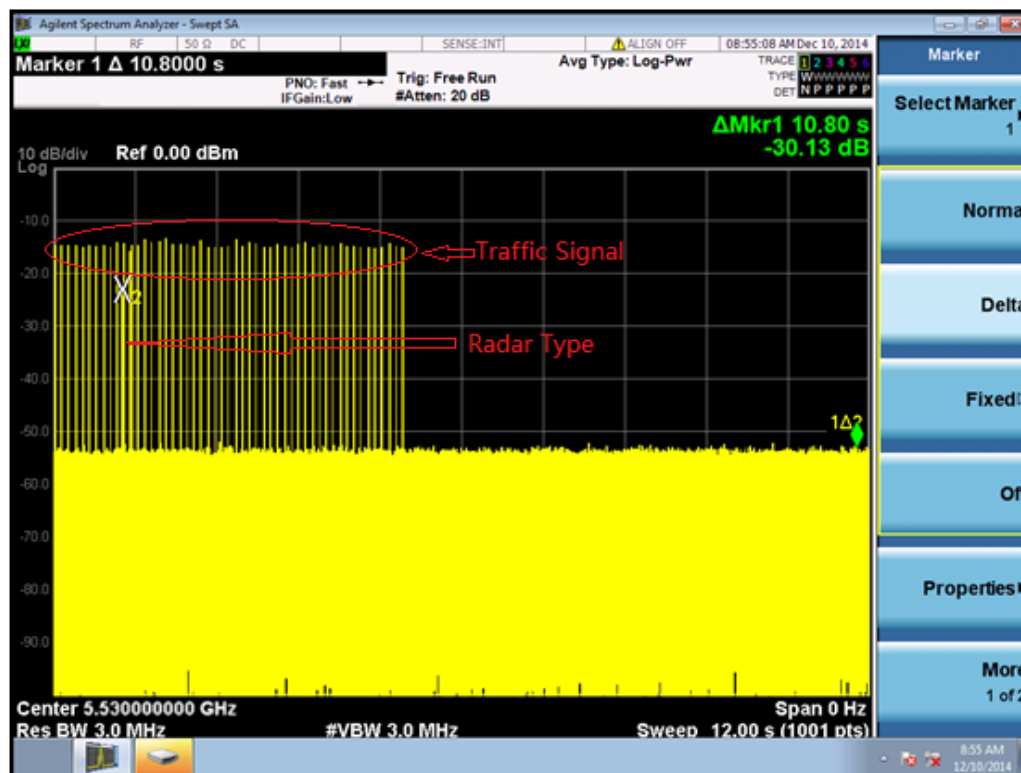
Client(EUT) Data Traffic Plot @ 5530MHz



Calibration Radar Type 1 @ 5530MHz



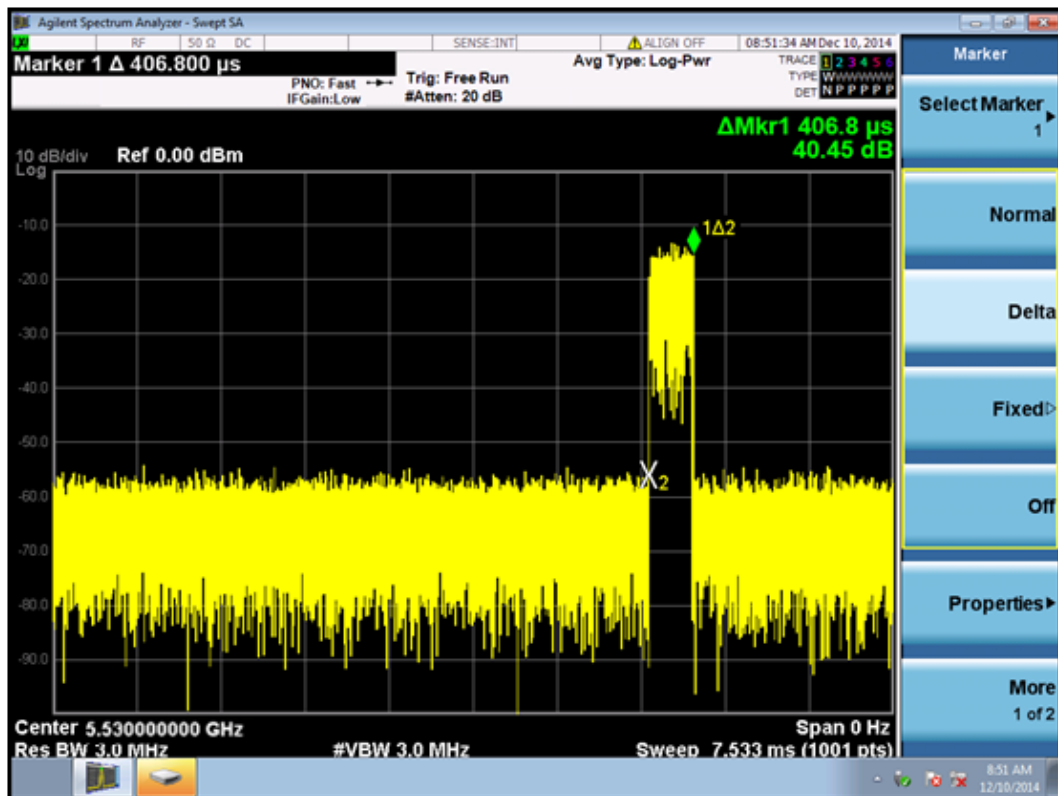
Channel Move Time @ 5530MHz



Channel Closing Transmission Time @ 5530MHz(Radar Type 1)



Channel Closing Transmission Time @ 5530MHz(Beacom Time)



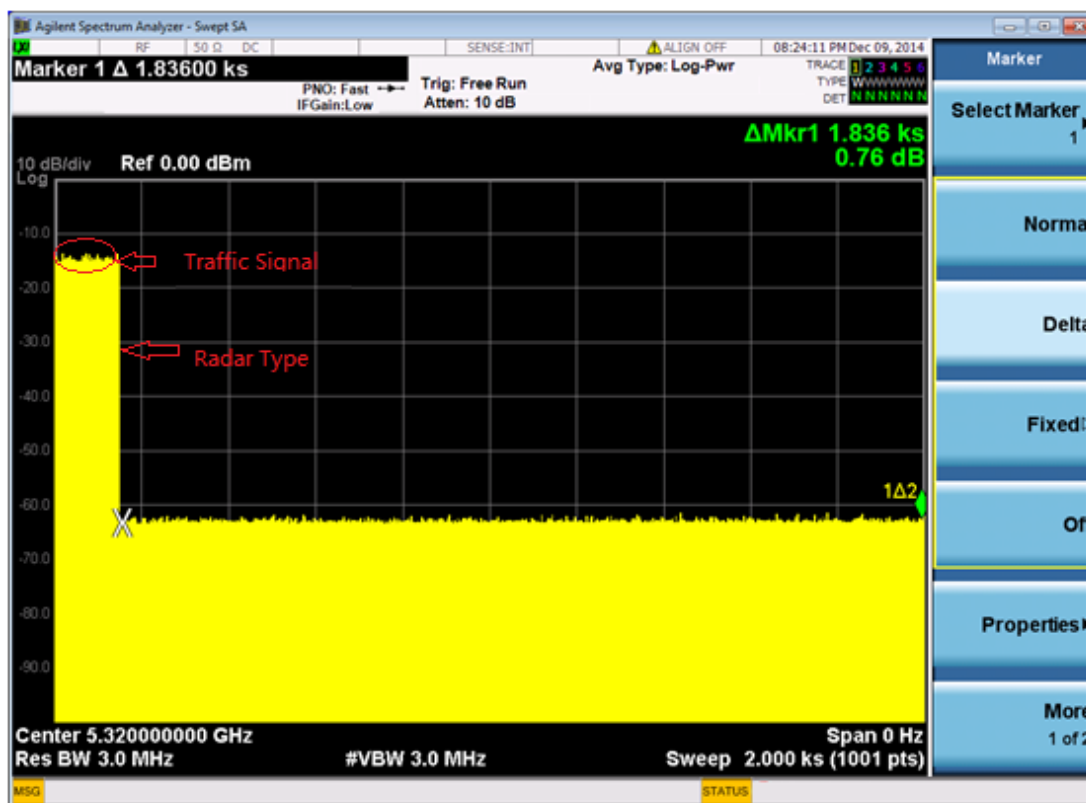
Closing Time Transmission Time: $0.4068 \text{ ms} * 41 = 16.68 \text{ ms}$

6.2.4 NON- OCCUPANCY PERIOD

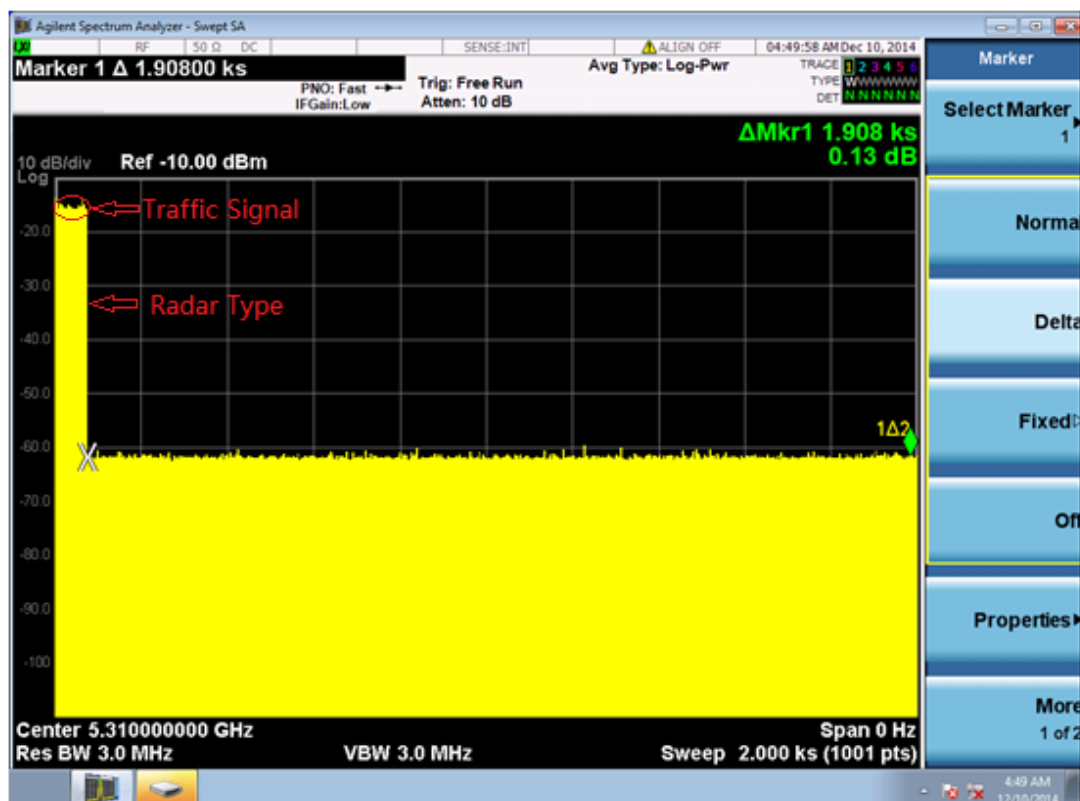
During the 30 minutes observation time, UUT did not make any transmissions on a channel after a radar signal was detected on that channel by either the Channel Availability Check or the In-Service Monitoring.

TX(11a mode)

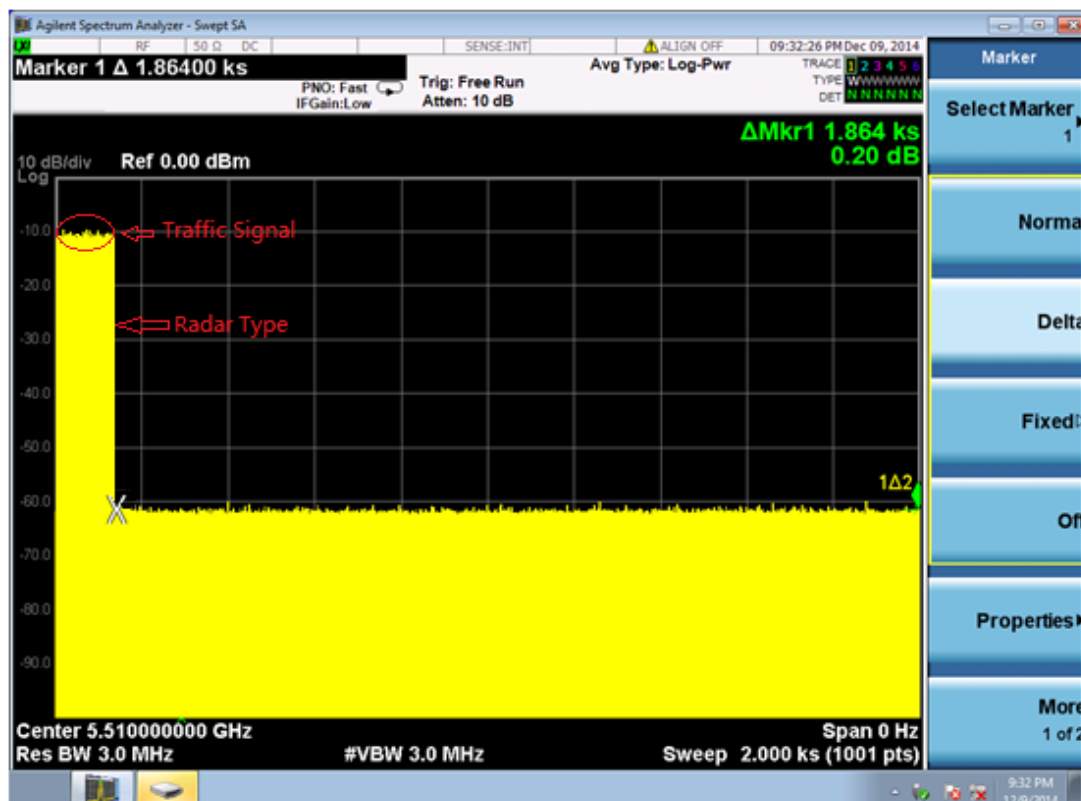
Non-Occupancy Period @ 5320MHz



TX(11n 40MHz mode)
Non-Occupancy Period @ 5310MHz

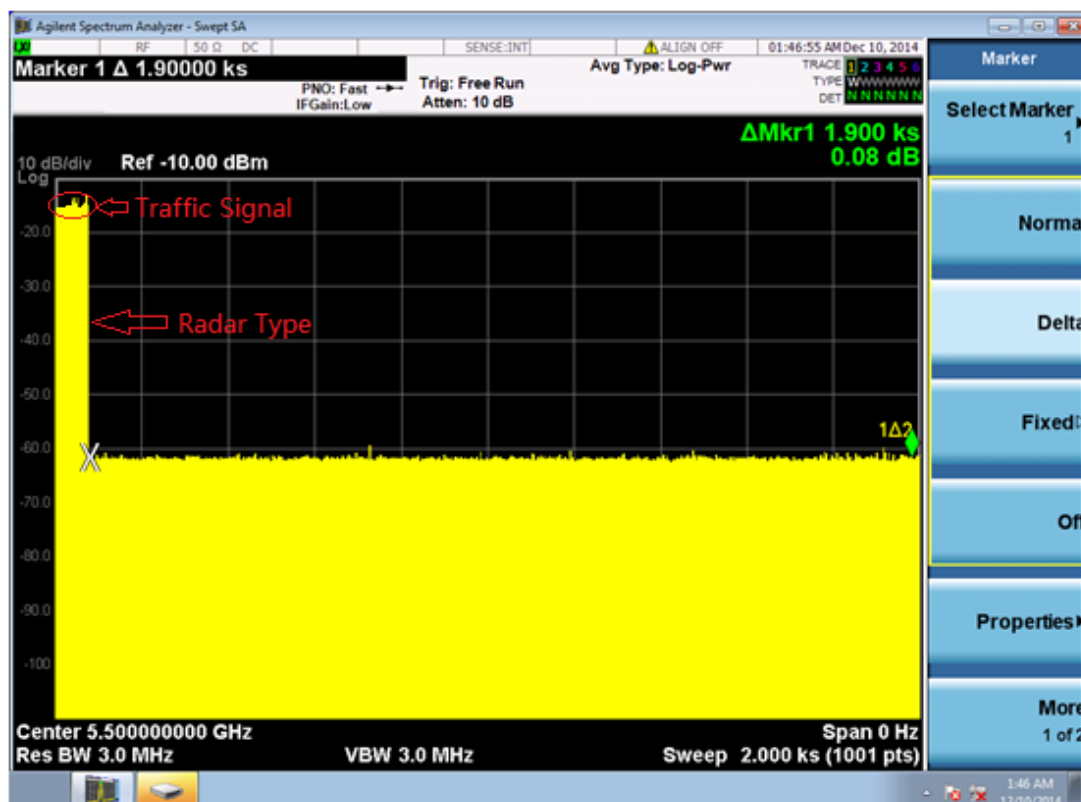


TX(11n 40MHz mode)
Non-Occupancy Period @ 5510MHz

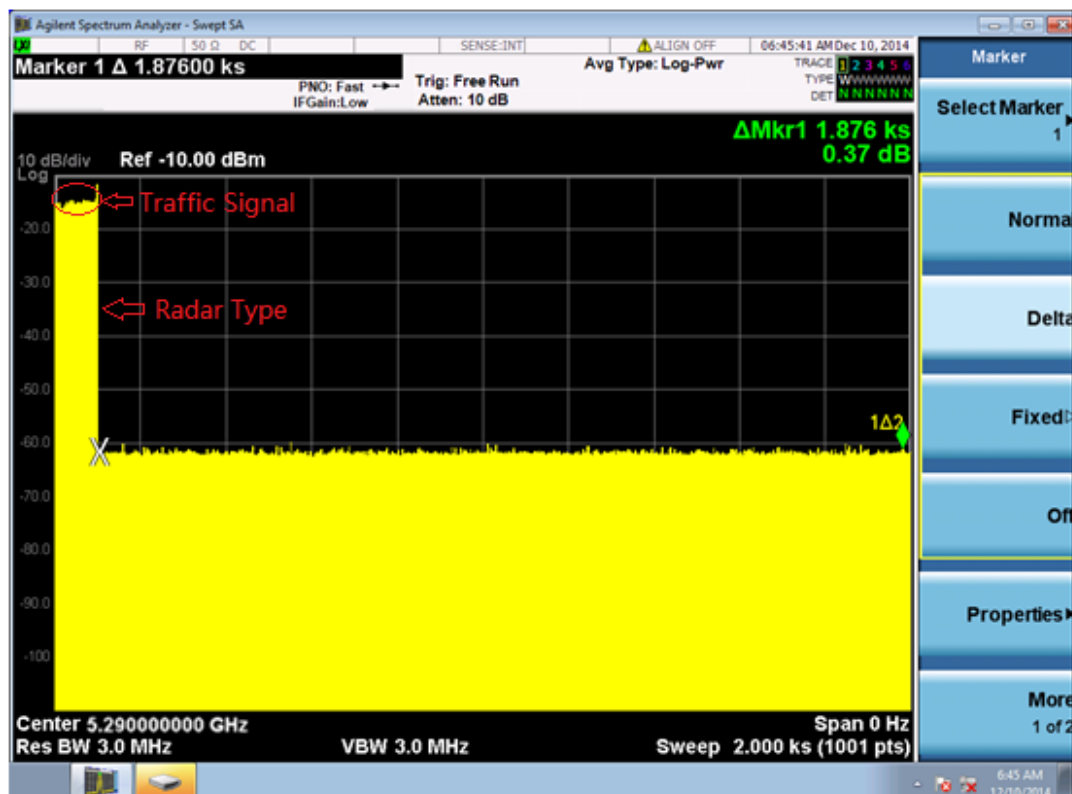


TX(11n 40MHz mode)

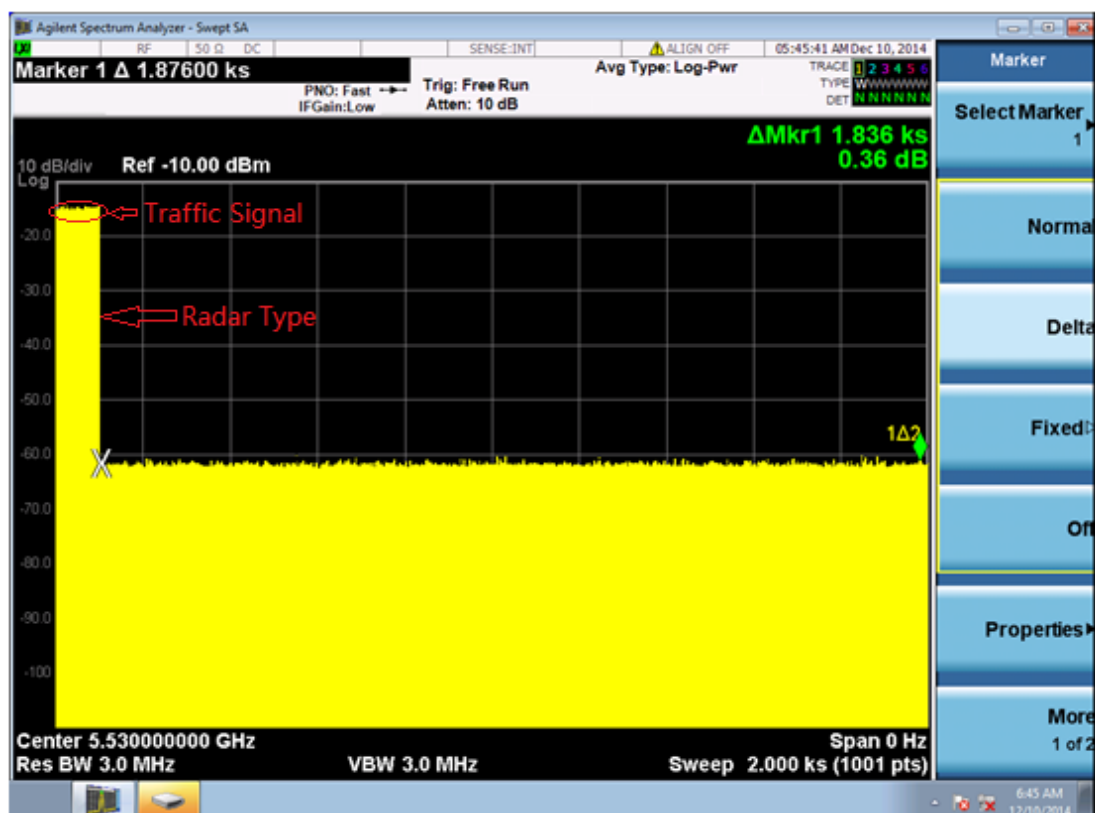
Non-Occupancy Period @ 5500MHz



TX(11ac 80MHz mode)
Non-Occupancy Period @ 5290MH



TX(11ac 80MHz mode)
Non-Occupancy Period @ 5530MHz



END