



# TEST REPORT

<p><b>KCTL Inc.</b>                  65, Sinwon-ro, Yeongtong-gu,                  Suwon-si, Gyeonggi-do, 16677, Korea                  TEL: 82-31-285-0894 FAX: 82-505-299-8311  <a href="http://www.kctl.co.kr">www.kctl.co.kr</a></p>	<p>Report No.:                  KR20-SRF0052-A                  Page (1) of (16)</p>	
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**1. Client**

- Name : HYUNDAI MOBIS CO., LTD.
- Address : 203, Teheran-ro, Gangnam-gu, Seoul, 06141, Korea
- Date of Receipt : 2019-09-20

**2. Use of Report** : Certification

**3. Name of Product and Model** : WIDE AVN / ATC32HYAN

**4. Manufacturer and Country of Origin** : Hyundai Mobis., Ltd. / Korea

**5. FCC ID** : TQ8-ATC32HYAN

**6. Date of Test** : 2019-10-01 to 2019-10-31

**7. Test Standards** : FCC Part 15 Subpart E, 15.407

**8. Test Results** : Refer to the test result in the test report

Affirmation	Tested by  Name : MyeongJun Kwon (Signature)	Technical Manager  Name : Heesu Ahn (Signature)
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2020-02-24

**KCTL Inc.**

As a test result of the sample which was submitted from the client, this report does not guarantee the whole product quality. This test report should not be used and copied without a written agreement by KCTL Inc.

**KCTL Inc.**

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**Report revision history**

Date	Revision	Page No
2020-02-09	Initial report	-
2020-02-24	Updated	12,14

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Note. The report No. KR20-SRF0052 is superseded by the report No. KR20-SRF0052-A.



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## 1. General information

Client : HYUNDAI MOBIS CO., LTD.  
Address : 203, Teheran-ro, Gangnam-gu, Seoul, 06141, Korea  
Manufacturer : Hyundai Mobis Co., Ltd.  
Address : 95, Sayang 2-Gil, Munbaek-Myeon, Jincheon-Gun, Chungcheongbuk-Do  
27862 Korea  
Laboratory : KCTL Inc.  
Address : 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea  
Accreditations : FCC Site Designation No: KR0040, FCC Site Registration No: 687132  
VCCI Registration No. : R-20080, G-20078, C-20059, T-20056  
Industry Canada Registration No. : 8035A  
KOLAS No.: KT231

## 2. Device information

Equipment under test : WIDE AVN  
Model : ATC32HYAN  
Derivative model : ATC32HCAN, ATC35HCAN  
Frequency range : 2 402 MHz ~ 2 480 MHz (Bluetooth(BDR/EDR))  
2 412 MHz ~ 2 462 MHz (802.11b/g/n\_HT20)  
UNII-1: 5 180 MHz ~ 5 240 MHz (802.11a/n\_HT20/ac\_VHT20)  
UNII-1: 5 190 MHz ~ 5 230 MHz (802.11n\_HT40/ac\_VHT40)  
UNII-1: 5 210 MHz (802.11ac\_VHT80)  
UNII-2A: 5 260 MHz ~ 5 320 MHz (802.11a/n\_HT20/ac\_VHT20)  
UNII-2A: 5 270 MHz ~ 5 310 MHz (802.11n\_HT40/ac\_VHT40)  
UNII-2A: 5 290 MHz (802.11ac\_VHT80)  
UNII-2C: 5 500 MHz ~ 5 720 MHz (802.11a/n\_HT20/ac\_VHT20)  
UNII-2C: 5 510 MHz ~ 5 710 MHz (802.11n\_HT40/ac\_VHT40)  
UNII-2C: 5 530 MHz ~ 5 690 MHz (802.11ac\_VHT80)  
UNII-3: 5 745 MHz ~ 5 825 MHz (802.11a/n\_HT20/ac\_VHT20)  
UNII-3: 5 755 MHz ~ 5 795 MHz (802.11n\_HT40/ac\_VHT40)  
UNII-3: 5 775 MHz (802.11ac\_VHT80)  
Modulation technique : Bluetooth(BDR/EDR)\_ GFSK,  $\pi$ /4DQPSK, 8DPSK  
WIFI(802.11a/b/g/n20/n40/ac20/ac40/ac80)\_DSSS, OFDM  
Number of channels : Bluetooth(BDR/EDR)\_79ch  
2.4GHz WIFI (802.11b/g/n\_HT20)\_11ch  
UNII-1: 4 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)  
UNII-2A: 4 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)  
UNII-2C: 9 ch (20 MHz), 5 ch (40 MHz), 2 ch (80 MHz)  
UNII-3: 5 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)  
Power source : DC 14.4 V

Antenna specification : WIFI/Bluetooth(BDR/EDR)\_Pattern Antenna  
 Antenna gain : 2.4GHz WIFI (802.11b/g/n\_HT20) : -0.70 dBi  
 Bluetooth(BDR/EDR) : 0.29 dBi  
 UNII-1 :3.51 dBi, UNII-2A : 3.12 dBi  
 UNII-2C : 2.28 dBi, UNII-3 : -0.84 dBi  
 Software version : MQ4.USA.0000.V028.001.190821  
 Hardware version : MQ4.USA.STD\_AVN\_G5\_WIDE.004.001  
 Test device serial No. : N/A  
 Operation temperature : -20 °C ~ 70 °C

## 2.1. Frequency/channel operations

This device contains the following capabilities:

WIFI(2.4GHz band 802.11b/g/n(HT20), 5GHz band 802.11a/n(HT20/HT40)/ac(VHT/20/40/80)),  
 Bluetooth(BDR/EDR)

**UNII-2A**

Ch.	Frequency (MHz)
52	5 260
56	5 280
64	5 320

**UNII-2C**

Ch.	Frequency (MHz)
100	5 500
116	5 580
144	5 720

Table 2.1.1. 802.11a/n/ac\_HT20/VHT20 mode

**UNII-2A**

Ch.	Frequency (MHz)
54	5 270
62	5 310

**UNII-2C**

Ch.	Frequency (MHz)
102	5 510
110	5 550
142	5 710

Table 2.1.2. 802.11n/ac\_HT40/VHT40 mode

**UNII-2A**

Ch.	Frequency (MHz)
58	5 290

**UNII-2C**

Ch.	Frequency (MHz)
106	5 530
138	5 690

Table 2.1.3. 802.11ac\_VHT80 mode

### Notes:

1. The device supports DFS bands between UNII-2A and UNII-2C and operates as a slave device controlled by master.

## 2.2. Information about derivative model

The difference between basic model and derivative models is:

The derivative models have a different product identification number.

ATC32HCAN(96560 P4720), ATC35HCAN(96560 P4920)

## 3. Summary of tests

FCC Part section(s)	Parameter	Test results
15.407(h)	DFS -Channel closing transmission time -Channel move time -Non occupied period	Pass

### Notes:

- The test procedure(s) in this report were performed in accordance as following.
  - KDB 905462 D02 UNII DFS compliance procedure new rules .
  - KDB 905462 D03 UNII client without radar detection new rules.



## 4 Test results

### 4.1. DFS (Dynamic Frequency Selection)

#### Test description

#### - 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
U-NII Detection Bandwidth	Yes	Not required	Yes

#### - Applicability of DFS requirements during normal operation

Requirement	Operational Mode	
	Master Device or Client with Radar Detection	Client Without Radar Detection
DFS Detection Threshold	Yes	Not required
Channel Closing Transmission Time	Yes	<u>Yes</u>
Channel Move Time	Yes	<u>Yes</u>
Bandwidth	Yes	Not required

Additional requirements for devices with multiple bandwidth modes	Master Device or Client with Radar Detection	Client Without Radar Detection
U-NII Detection Bandwidth and Statistical Performance Check	All BW modes must be tested	Not required
Channel Move Time and Channel Closing Transmission Time	Test using widest BW mode available	<u>Test using the widest BW mode available for the link</u>
All other tests	Any single BW mode	Not required

**Note:** Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.

**- Requirements of 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.
- e) The client test frequency must be monitored to ensure no transmission of any type has occurred for 30 minutes. Note: If the client moves with the master, the device is considered compliant if nothing appears in the client non-occupancy

**- DFS Response requirement values**

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.
<p>Note 1: Channel Move Time and the Channel Closing Transmission Time should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst.</p> <p>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.</p>	



**- Interference Threshold values, Master or Client incorporating In-Service Monitoring**

Maximum Transmit Power	Value (see note)
≥ 200 milliwatt	-64 dBm
<u>&lt; 200 milliwatt</u> <u>power spectral density &lt; 10 dBm/MHz</u>	-62 dBm
EIRP < 200 milliwatt that do not meet the power spectral density requirement	-64 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.  
 Note3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.

**- Radar test waveforms**

Type	Pulse Width (µsec)	PRI (µsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Number of Trials
<u>0</u>	<u>1</u>	<u>1428</u>	<u>18</u>	<u>See Note 1</u>	<u>See Note 1</u>
1	1	Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a  Test B: 15 unique PRI values randomly selected within the range of 518-3066 µsec, with a minimum increment of 1 µsec, excluding PRI values selected in Test A	$\text{Roundup}\left\{\left(\frac{1}{360}\right) \cdot \left(\frac{19 \cdot 10^6}{PRI_{\mu sec}}\right)\right\}$	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

Note 1: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.

Note 2: This report was applied Short Pulse Radar Type 0.

\*Short Pulse Radar Test Waveforms

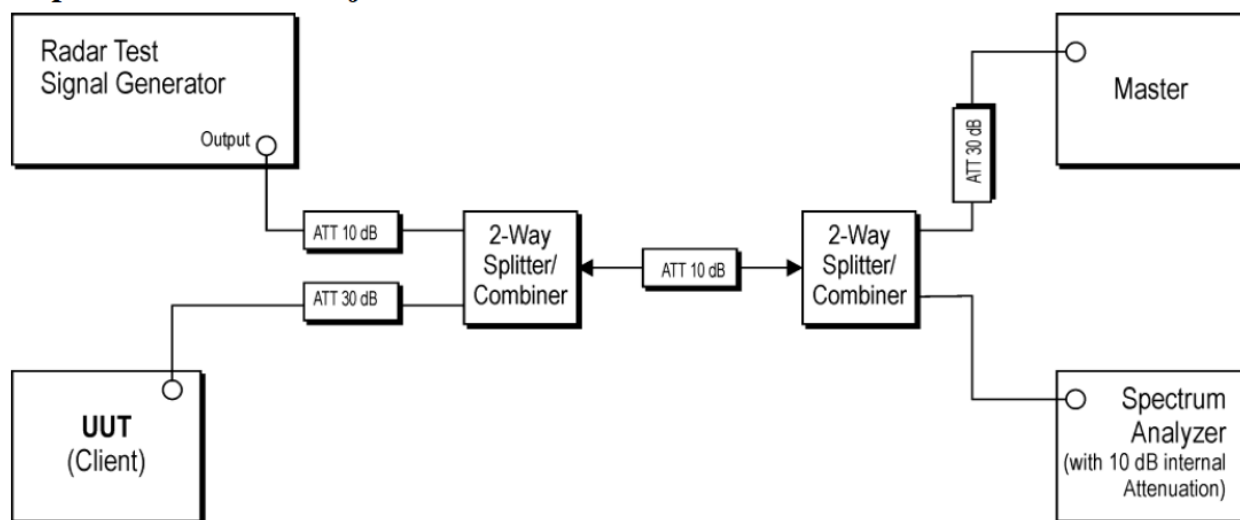
Radar Type	Pulse Width (μs)	Chirp Width (MHz)	PRI (μs)	Number of Pulses per Burst	Number of Bursts	Minimum percentage of Successful Detection	Minimum Number of Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

\*Long Pulse Radar Test Waveform

Radar Waveform	Pulse Width (μsec)	PRI (μsec)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (μs)	Minimum Percentage of Successful Detection	Minimum Trials
6	1	333	9	0.333	300	70%	30

\*Frequency Hopping Radar Test Waveform



**Test setup****- Setup for Client with injection at the Master****- Spectrum analyzer setting parameter**

This setting parameter is shown below and it according to the 905462 D02 UNII DFS Compliance Procedures New Rules.

- 1) RBW/VBW  $\geq 3$  MHz
- 2) Detector = peak
- 3) Span = zero span

**- Conducted test procedure**

- 1) One frequency will be chosen from the Operating Channels of the UUT within the 5 250-5 350 MHz or 5 470-5 725 MHz bands.
- 2) The Client Device (EUT) is set up the above diagram and communications between the Master device and the Client is established.
- 3) Stream the channel loading test file from the Master Device to the Client Device on the test Channel for the entire period of the test.
- 4) An additional 1 dB is added to the radar test signal to ensure it is at or above the DFS Detection Threshold, accounting for equipment variations/errors.
- 5) Observe the transmissions of the UUT at the end of the Burst on the Operating Channel for duration greater than 12 seconds for Radar Type 0 to ensure detection occurs.
- 6) After the initial radar burst the channel is monitored for 30 minutes to ensure no transmissions or beacons occur. A second monitoring setup is used to verify that the Master and Client have both moved to different channels.

**- Master device information**

Equipment Name	Manufacturer	Model No.	Serial No.
Access Point	ASUSTeK Computer Inc	RT-AX88U	J9IAHP000993

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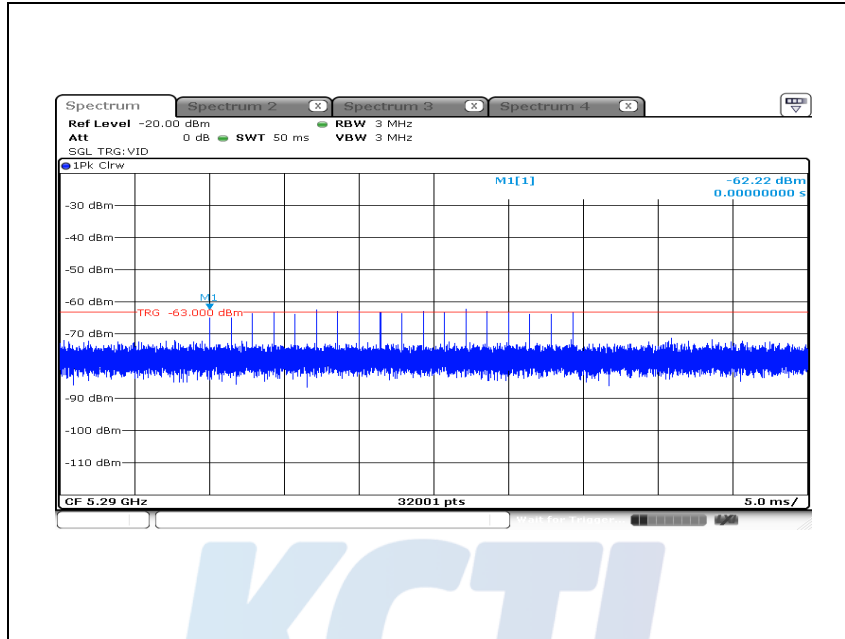
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# KCTL

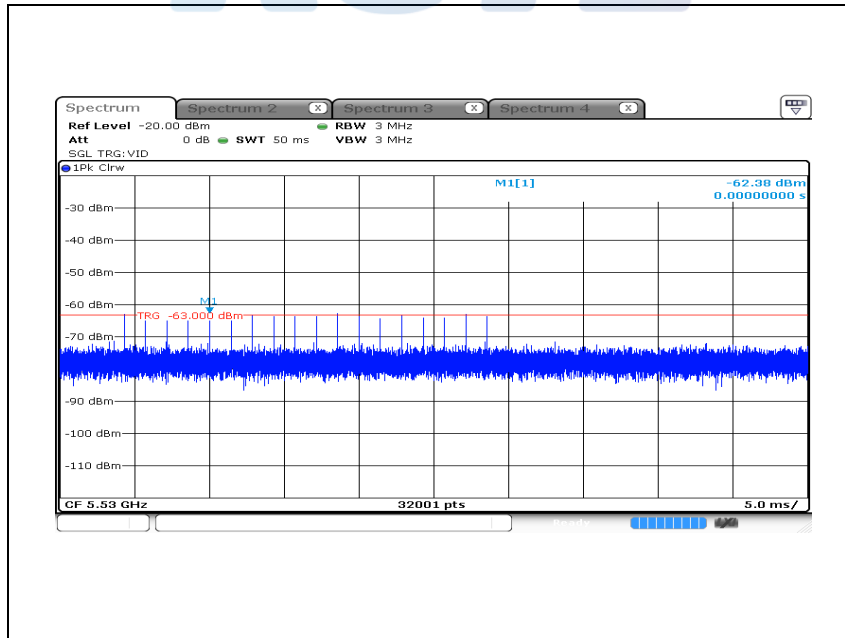
## Test result

### Type0: Plot of radar waveform

5 290 MHz

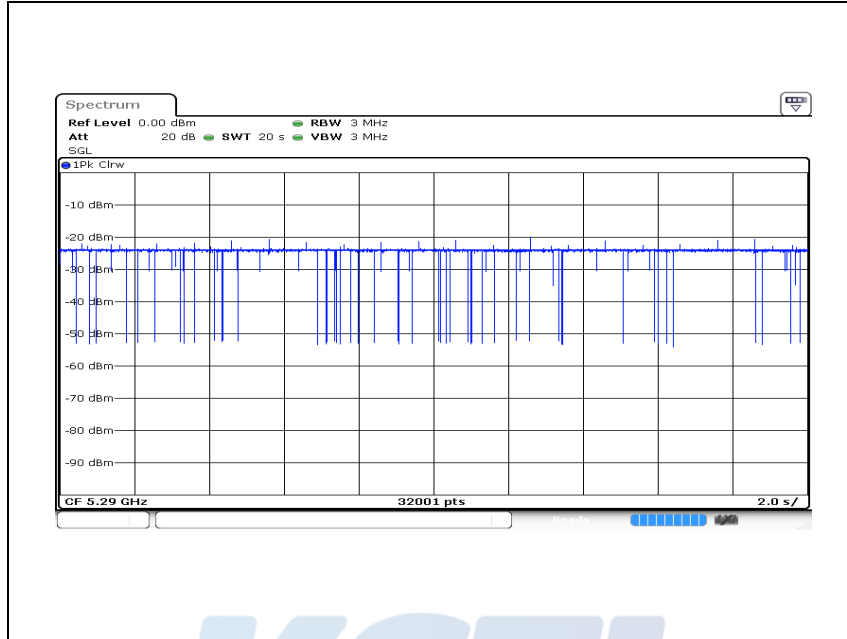


5 530 MHz

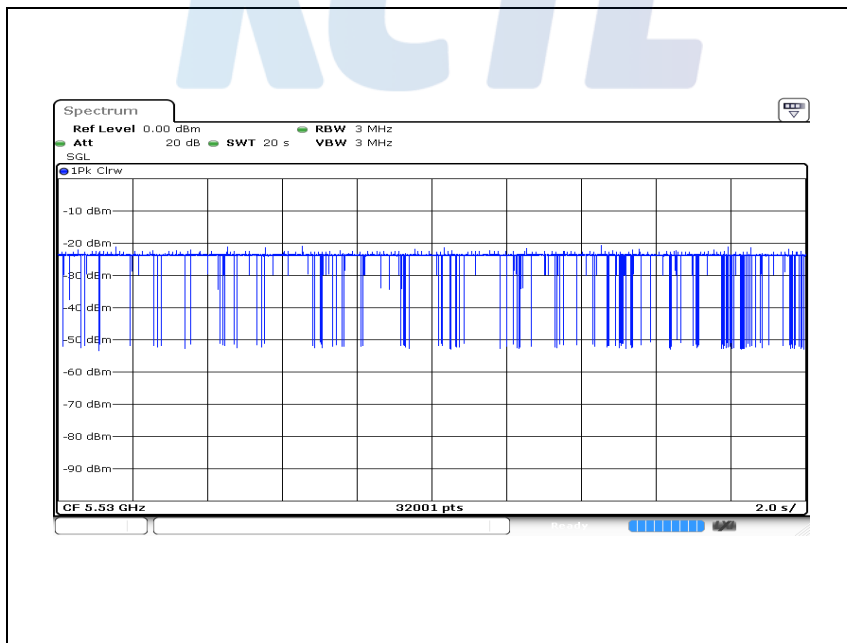


**Plot of LAN traffic**

**5 290 MHz**

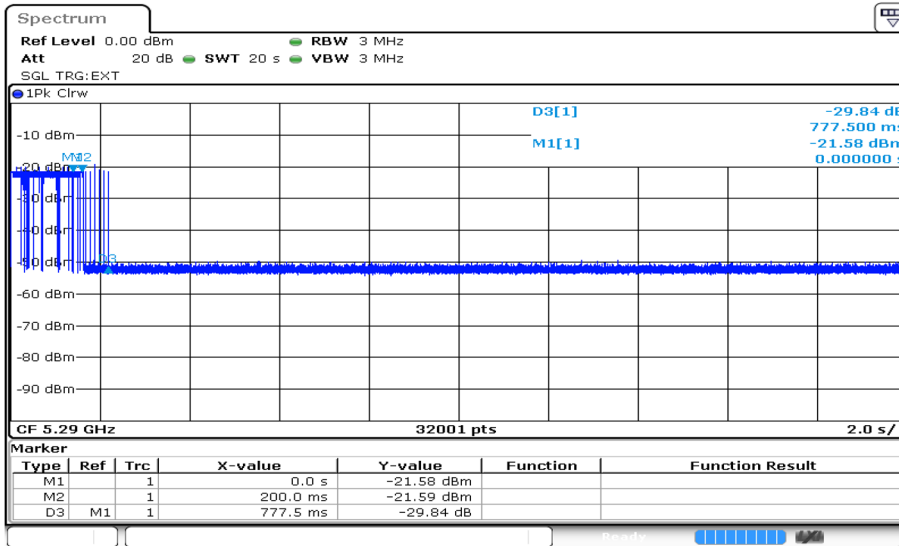


**5 530 MHz**



Plot of channel move time and aggregate time

**UNII-2A : 802.11 ac VHT80, 5 290 MHz**

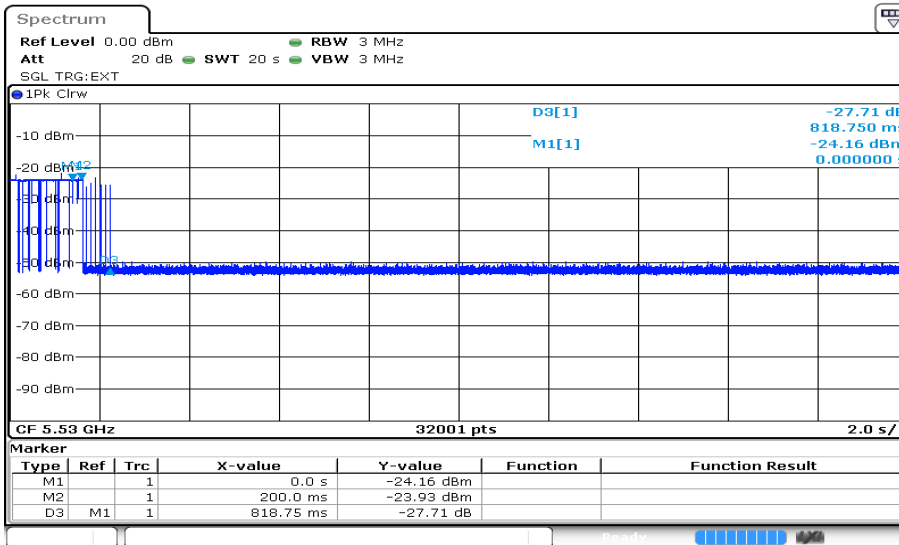


Channel move time = 0.777 500 s

Closing time = 0.000 625 s x 57 = 0.035 625 s (limit 60 ms)

(Closing time : Burst unit time(20 s / 32 001 points) \* Number of burst(between 2 markers))

**UNII-2C : 802.11 ac VHT80, 5 530 MHz**



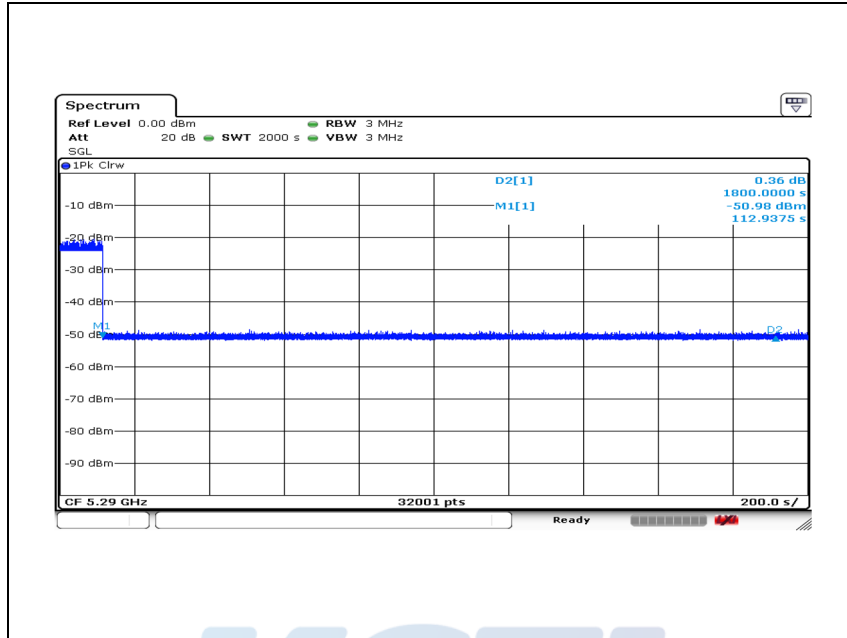
Channel move time = 0.818 750 s

Closing time = 0.000 625 s x 58 = 0.036 250 s (limit 60 ms)

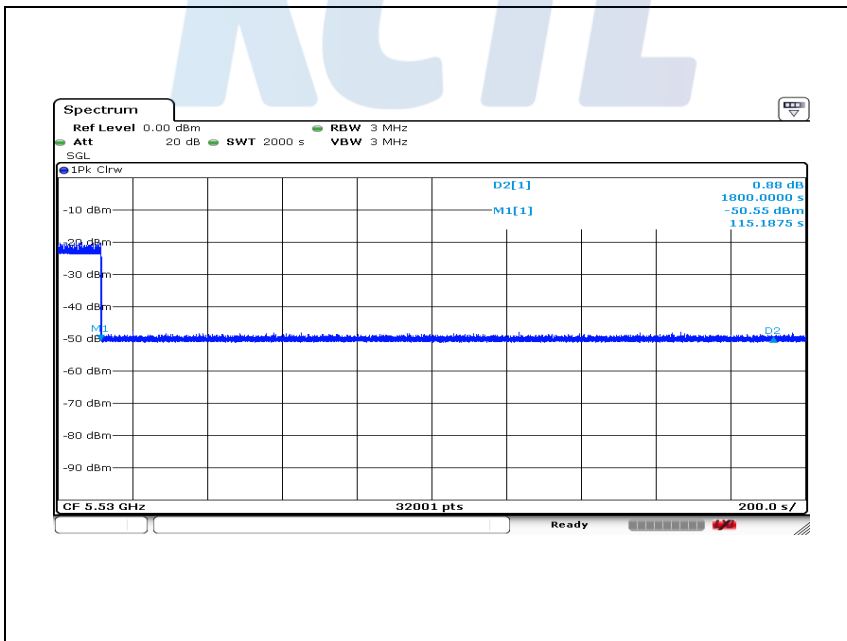
(Closing time : Burst unit time(20 s / 32 001 points) \* Number of burst(between 2 markers))

**Plot of Non-occupancy period**

5 290 MHz



5 530 MHz



## 5. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
Spectrum Analyzer	R&S	FSV40	100989	20.01.14
Power divider	Aeroflex/ Weinschel, Inc	1580-1	SC571	20.08.01
SPLITTER	Mini-Circuits	ZX10-2-98-S	1635-1	20.01.25
SPLITTER	Mini-Circuits	ZX10-2-98-S	1635-2	20.01.25
Attenuator	API Inmet	40AH2W-10	17	20.05.15
Attenuator	HP	8491B	20205	20.01.25
Step Attenuator	HP	8496A	3308A16640	20.07.30
Vector Signal Generator	R&S	SMBV100A	257566	20.01.04

**End of test report**

