Nemko Korea Co., Ltd.

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FCC and IC EVALUATION REPORT FOR CLASS II PERMISSIVE CHANGE

Applicant :

Samsung Electronics Co., Ltd.
129, Samsung-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, Korea.
(Post code : 443-742)
Attn. : Mr. Dongwook. Shin

Dates of Issue : August 12, 2013
Test Report No. : NK-13-R-107-3
Test Site : Nemko Korea Co., Ltd.

FCC ID **IC**	**A3LWIDT30Q** **649E-WIDT30Q**
Brand Name	**SAMSUNG**
Contact Person	**Samsung Electronics Co., Ltd.** **129, Samsung-ro, Yeongtong-gu,** **Suwon-si, Gyeonggi-do, Korea, 443-742.** **Mr. Dongwook. Shin** **Telephone No. : +82-31-200-5698**

Applied Standard:	FCC 47 CFR Part 15.407 and IC RSS-210 Issue 8
Classification:	Unlicensed National Information Infrastructure (UNII)
EUT Type:	WiFi module

The device bearing the brand name and model specified above has been shown to comply with the applicable technical standards as indicated in the measurement. The client should not use it to claim product endorsement by TAF or any government agencies. The test results in the report only apply to the tested sample.

I attest to the accuracy of data and all measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Aug. 12, 2013
Tested By : Minchul Shin
Engineer

Aug 12. 2013
Reviewed By : Deokha Ryu
Technical Manager

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1. SCOPE

This report has been prepared to demonstrate compliance with the requirements for Dynamic Frequency Selection as stated in FCC 06-96. Testing was performed on the Samsung WiFi module "WIDT30Q" in accordance with the measurement procedure described in FCC 06-96. As the EUT does not have radar detection capability it was evaluated as a Client Only Device.

Responsible Party :	Samsung Electronics Co., Ltd.
Contact Person :	Mr. Jaywoo. Lee
Manufacturer :	Samsung Electronics Co., Ltd. 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea 443-742

- FCC ID: A3LWIDT30Q
- IC : 649E-WIDT30Q
- Model: WIDT30Q
- Brand Name: SAMSUNG
- EUT Type: WiFi module
- Classification: Unlicensed National Information Infrastructure (UNII)
- Applied Standard: FCC 47 CFR Part 15.407(h) and IC RSS-210 Issue 8, Annex 9
- Test Procedure(s): FCC guidance of FCC 06-96 June 30, 2006
- Dates of Test: June 17, 2013 ~ June 18, 2013
- Place of Tests: Nemko Korea Co., Ltd.

2. INFORMATION

2.1 Test facility :

Nemko Korea Co., Ltd.

155 & 159, Osan-Ro, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do 449-852 KOREA, REPULIC OF.

TEL: +82 31 330-1700

FAX: +82 31 322 2332

2.2 EUT Information

The EUT is the **Samsung WiFi module FCC ID: A3LWIDT30Q, IC: 649E-WIDT30Q.**

Operating Mode

☐	Master
☐	Client with radar detection
■	Client without radar detection

TPC is not required since the maximum EIRP is less than 500 mW (27 dBm)

EUT Specification:

Frequency of Operation	For Band II: 5260 MHz ~ 5320 MHz : 802.11a,n(20 MHz) 5270 MHz ~ 5310 MHz : 802.11n(40 MHz) For Band III 5500 MHz ~ 5700 MHz : 802.11a,n(20 MHz) 5510 MHz ~ 5670 MHz : 802.11n(40 MHz)
Power Output (Conducted)	For Band II: 15.22 dBm For Band III :16.17 dBm
Channels	For Band II 802.11a, n(20 MHz) : 4 CH 802.11n(40 MHz): 2 CH For Band III 802.11a, n(20 MHz) : 11 CH 802.11n(40 MHz): 5 CH

Antenna Gain (peak)	For Band II Ant 0 : -2.28 dBi, Ant1 : -7.77 dBi For Band III Ant 0 : -4.04 dBi, Ant1 : -8.42 dBi

2.3 Support Equipment

EUT	Samsung Electronics Co., Ltd. Model : WIDT30Q	FCC ID: A3LWIDT30Q S/N: N/A
Master device	Cisco Systems Model : AIR-AP1242AG-A-K9 Software Version : 12.3(8)JEA	FCC ID: LDK102056 S/N: FTX1117B0ZZ
Laptop Computer	Samsung Electronics Co., Ltd. Model : NT-P510	S/N : ZPIK93FZ400154Z
Laptop Computer	HP Model : G62-355TU	S/N : CNF0489WDT

2.4 Test Equipment

Equipment	Manufacturer	Model	Serial No.	Calibration Date	Calibration Interval
Vector Signal Generator	R&S	SMBV100A	257152	10/08/2012	1 year
Spectrum Analyzer	Agilent	E4440A	MY44022567	04/05/2013	1 year

3. SUMMARY OF TEST RESULTS

UNII BAND II : 5250 MHz – 5350 MHz			
Parameter	**Measured value**	**Limit**	**Result**
Channel Move Time	493 milliseconds	10 seconds	PASS
Channel Closing Transmission Time	< 200 milliseconds + 0.50 milliseconds	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period	PASS
Non-Occupancy Period	Over 30 minutes	Minimum 30 minutes	PASS
UNII BAND III : 5470 MHz – 5725 MHz			
Parameter	**Measured value**	**Limit**	**Result**
Channel Move Time	507 milliseconds	10 seconds	PASS
Channel Closing Transmission Time	< 200 milliseconds + 0.50 milliseconds	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period	PASS
Non-Occupancy Period	Over 30 minutes	Minimum 30 minutes	PASS

4. TECHNICAL REQUIREMENTS FOR DFS

4.1 DFS Overview

A U-NII 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 U-NII device will operate in either Master Mode or Client Mode. U-NII devices operating in Client Mode can only operate in a network controlled by a U-NII device operating in Master Mode.

Tables 1 and 2 shown below summarize the information contained in sections 4.2 and 4.3.

Table 1: 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
U-NII Detection Bandwidth	Yes	Not required	Yes

Table 2: 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	Not required
U-NII Detection Bandwidth	Yes	Not required	Not required

The operational behavior and individual DFS requirements that are associated with these modes are as follows

4.2 Master Devices

a) The Master Device will use DFS in order to detect Radar Waveforms with received signal strength above the DFS Detection Threshold in the 5250 - 5350 MHz and 5470 - 5725 MHz bands. DFS is not required in the 5150 - 5250 MHz or 5725 - 5825 MHz bands.

b) Before initiating a network on a Channel, the Master Device will perform a Channel Availability Check for a specified time duration (Channel Availability Check Time) to ensure that there is no radar system operating on the Channel, using DFS described under subsection a) above.

c) The Master Device initiates a U-NII network by transmitting control signals that will enable other U-NII devices to Associate with the Master Device.

d) During normal operation, the Master Device will monitor the Channel (In-Service Monitoring) to ensure that there is no radar system operating on the Channel, using DFS described under a).

e) If the Master Device has detected a Radar Waveform during In-Service Monitoring as described under d), the Operating Channel of the U-NII network is no longer an Available Channel. The Master Device will instruct all associated Client Device(s) to stop transmitting on this Channel within the Channel Move Time. The transmissions during the Channel Move Time will be limited to the Channel Closing Transmission Time.

f) Once the Master Device has detected a Radar Waveform it will not utilize the Channel for the duration of the Non-Occupancy Period. [1)]

g) If the Master Device delegates the In-Service Monitoring to a Client Device, then the combination will be tested to the requirements described under d) through f) above.

4.3 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 6.2 apply.

d) Irrespective of Client Device or Master Device detection the Channel Move Time and Channel Closing Transmission Time requirements remain the same.

Note:

[1)] Applies to detection during the Channel Availability Check or In-Service Monitoring.

4.4 DFS Detection Thresholds

Table 3 below provides the DFS Detection Thresholds for Master Devices as well as Client Devices incorporating In-Service Monitoring.

Table 3: DFS 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.	

4.5 Response Requirements

Table 4 provides the response requirements for Master and Client Devices incorporating DFS.

Table 4: 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.
U-NII Detection Bandwidth	Minimum 80% of the U-NII 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.	

4.6 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.

4.7 Short Pulse Radar Test Waveforms

Table 5 – 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 Types 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 Types 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 Types 1-4. For example, the following table indicates how to compute the aggregate of percentage of successful detections.

Radar Type	Number of Trials	Number of Successful Detections	Minimum Percentage of Successful Detection
1	35	29	82.9 %
2	30	18	60 %
3	30	27	90 %
4	50	44	88 %
Aggregate (82.9% + 60% + 90% + 88%)/4 = 80.2%			

4.8 Long Pulse Radar Test Waveform

Table 6 – Long Pulse Radar Test Waveform

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 Type waveforms. If more than 30 waveforms are used for the Long Pulse Radar Type waveforms, 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 frequency modulated 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 random time interval between the first and second pulses is chosen independently of

the random time interval 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 randomly.

4.9 Frequency Hopping Radar Test Waveform

Table 7 – Long Pulse Radar Test Waveform

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

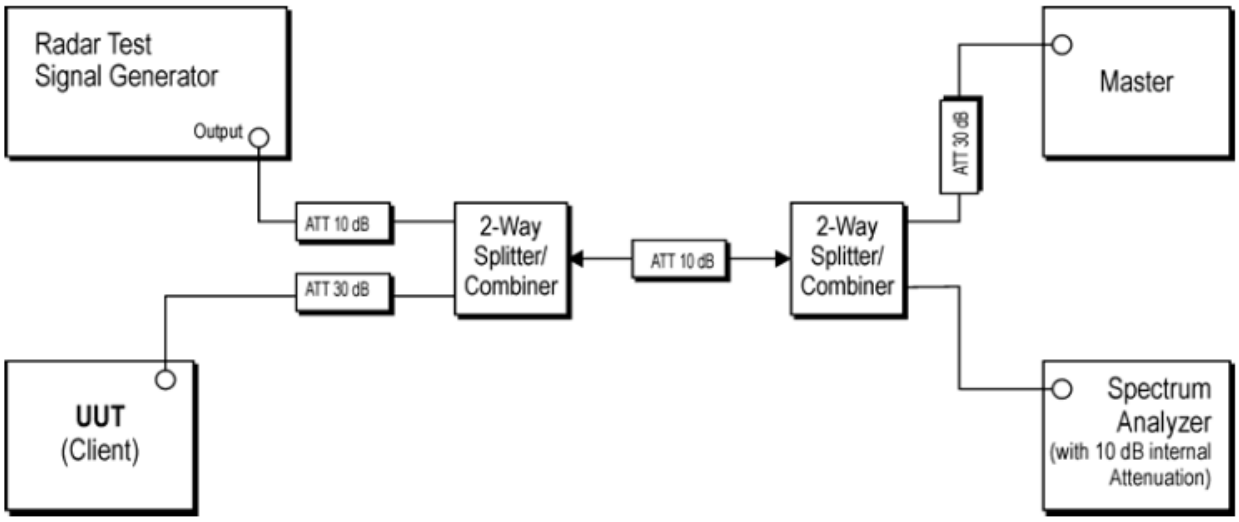
For the Frequency Hopping Radar Type, the same Burst parameters are used for each waveform. The hopping sequence is different for each waveform and a 100-length segment is selected from the hopping sequence defined by the following algorithm: [2)]

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.

Note:
[2)] If a segment does not contain at least 1 frequency within the U-NII Detection Bandwidth of the UUT, then that segment is not used.

5. DESCRIPTION OF TEST

5.1 Typical Test Setup for Conduction DFS test



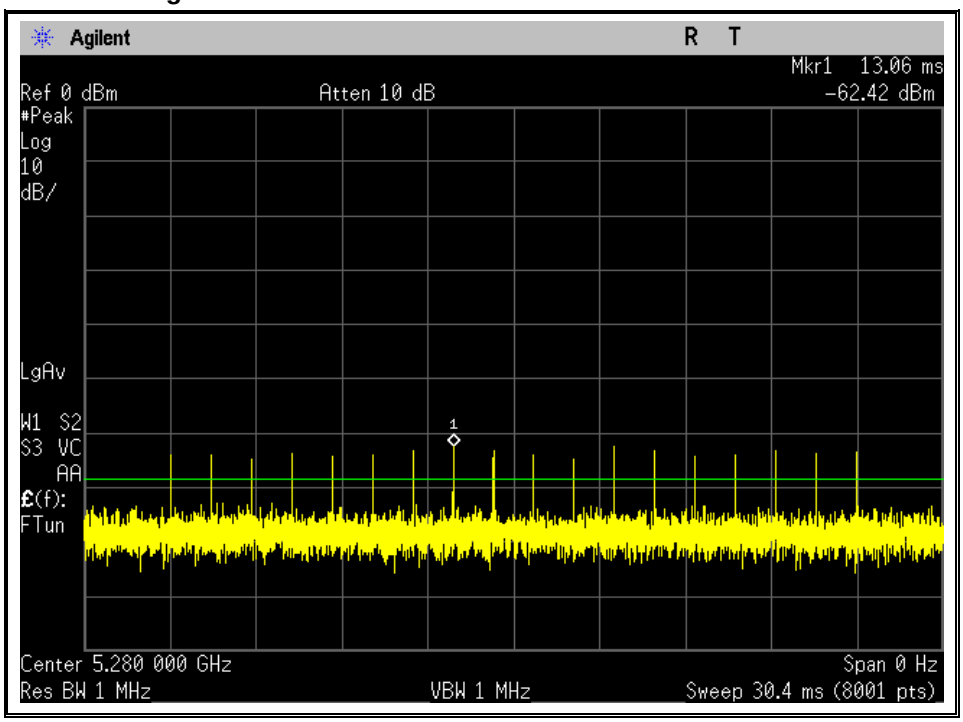
5.2 Test Procedure

1) The EUT is set up in accordance with “7.1 test setup for conduction DFS test”, and communicated with Master device.
2) Steam the MPEG test file (“6 1/2 Magic Hours”) which is located at http://ntiacsd.ntia.doc.gov/dfs/ from the Master to the Client device on the test channel.
3) The Vector Signal generator (R&S, VSMBV100A) is setup to provide the type 1 radar pulse.
4) A trigger is provided from the pulse generator to the monitoring system (Agilent, E4440A) in order to capture the traffic and occurrence of the radar pulse.
5) The monitoring system is set with 12 sec sweep time and 8001 sweep point to record the any transmissions occurring up to and after 10 sec.
6) As the master’s output power is < 200 mW and antenna gain is 0 dBi, the interference threshold level is set -62 dBm.
6) The system again 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 with 200 ms and the aggregate of emissions occurring after 200 ms up to 10 sec do not exceed 60 ms.
7) 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.

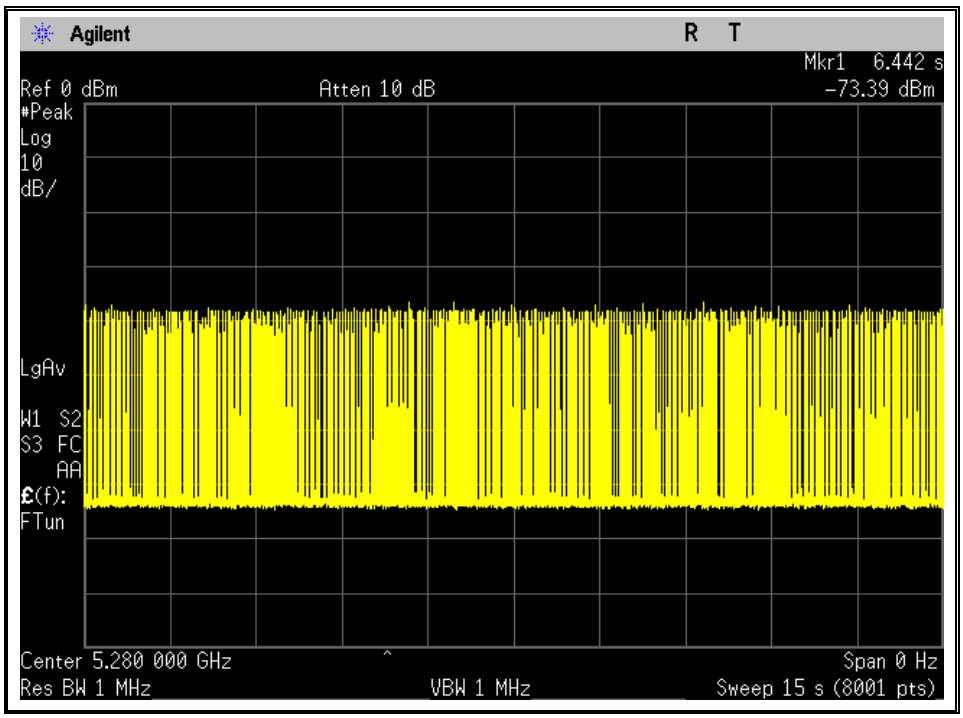
6. DFS TEST DATA

6.1 Test data of UNII Band II

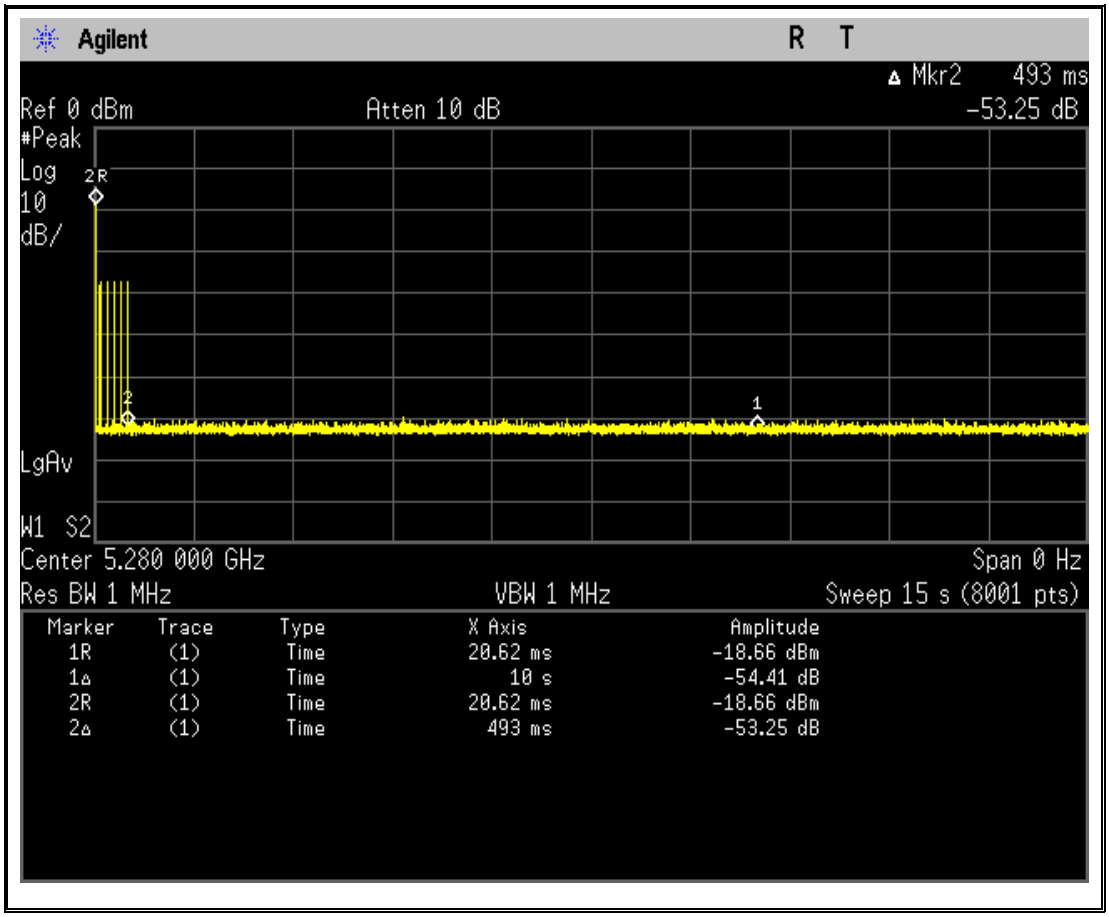
Radar test signal 1 threshold level at 5280 MHz



Data Traffic Plot at 5280 MHz



Channel Move Time for Radar test signal 1 at 5280 MHz

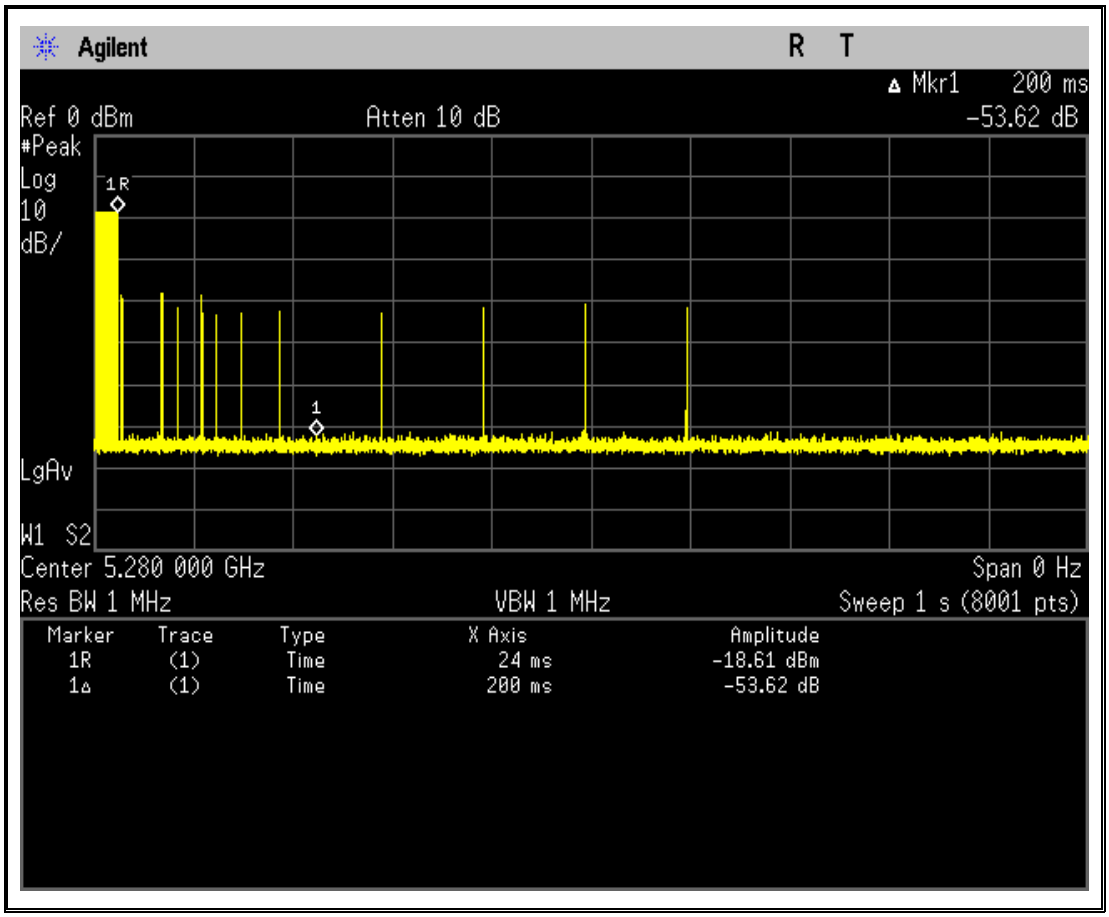


Test Item	Measured value	Limit	Result
Channel Move Time	493 milliseconds	10 seconds	Pass

Notes :

Marker 1R, 2R : End of Radar Burst
Marker 1Δ : 10 S from end of Burst
Marker 2Δ : Channel Move Time

Channel Closing Transmission Time for Radar test signal at 5280 MHz



Test Item	Measured value	Limit	Result
Channel Closing Transmission Time	**< 200 milliseconds + 0.87 milliseconds**	**200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period**	**Pass**

Aggregate Transmission Time from 200 ms to 10 sec after Radar Burst

= Number of pulses from the Client occurring x (Sweep time(ms) / Total number of bins)

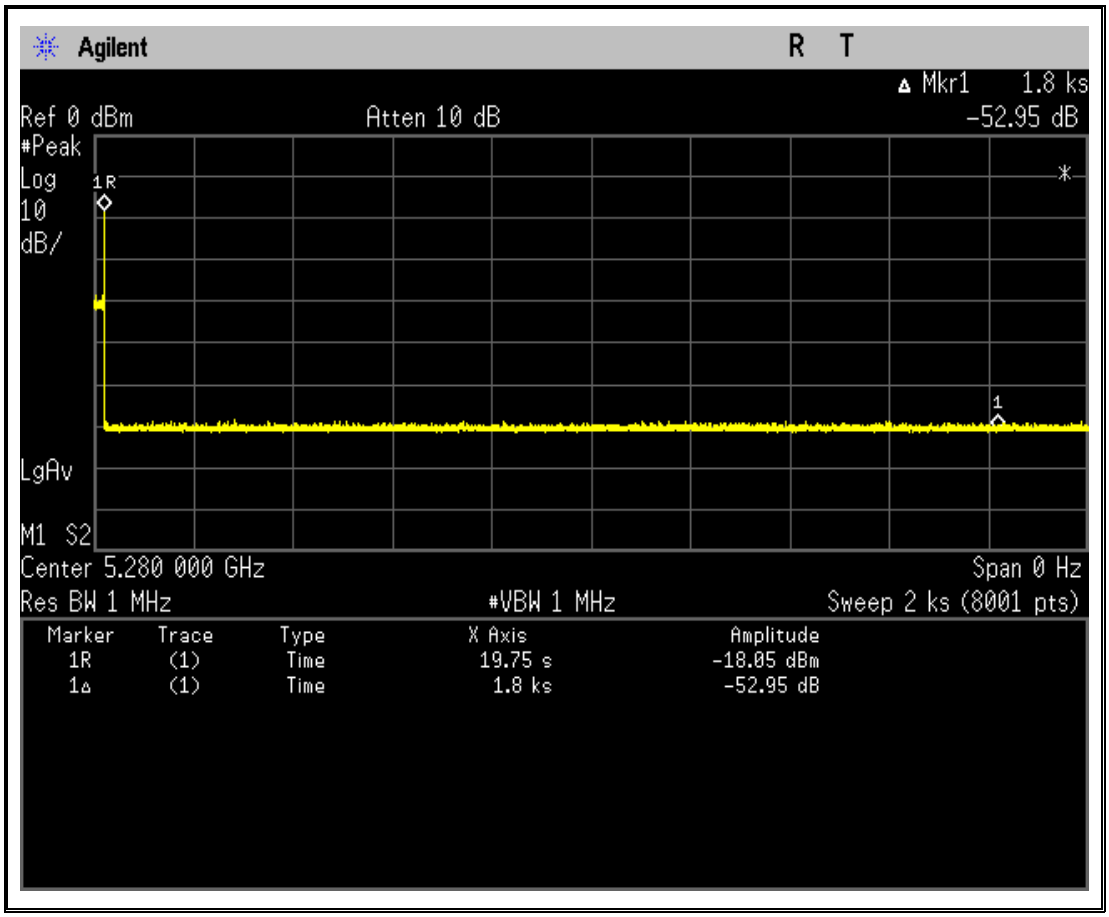
= 4 x (1000 / 8001) = 0.50 ms

Notes :

Marker 1R : End of Radar Burst

Marker 1Δ : 200 ms from end of Burst

Non- Occupancy Period for Radar test signal 1 at 5280 MHz



Test Item	Measured value	Limit	Result
Non-Occupancy Period	Over 30 minutes	Minimum 30 minutes	Pass

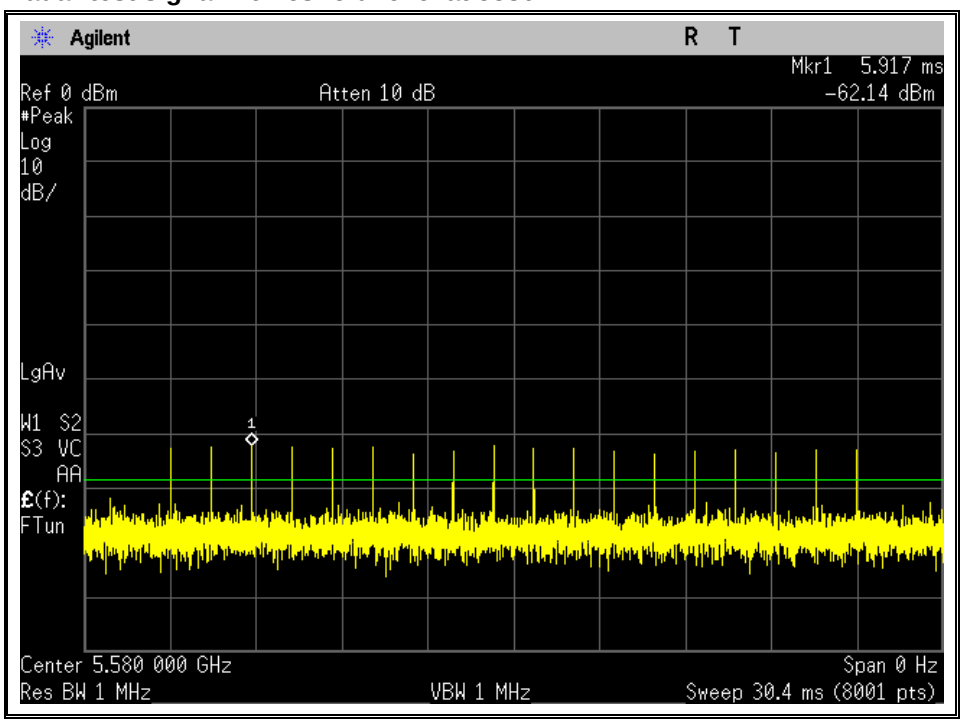
Notes :

Marker 1R : End of Radar Burst

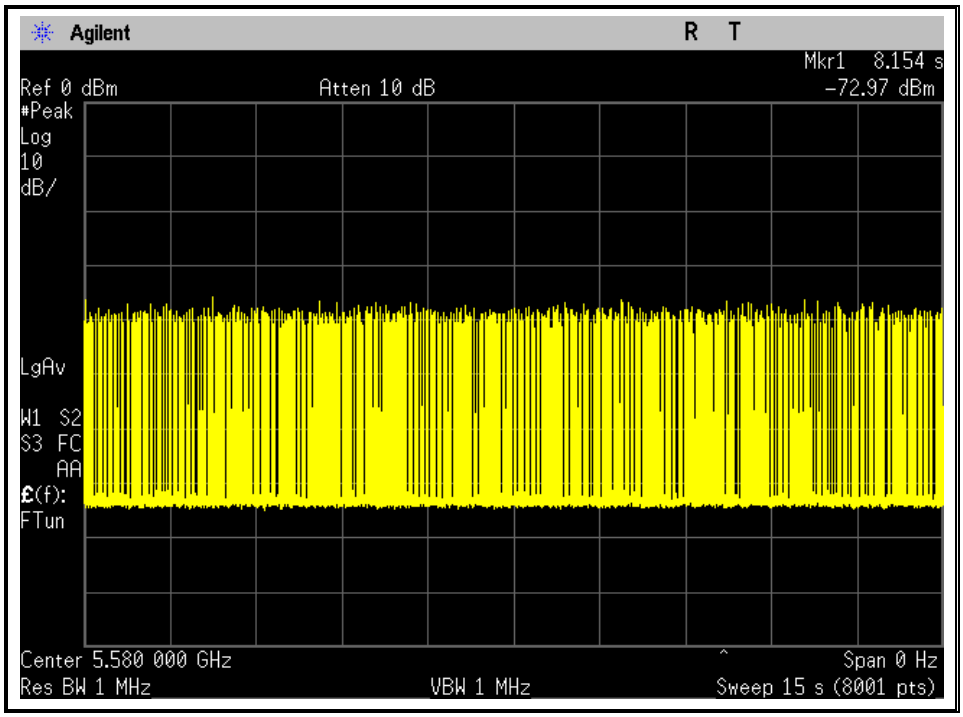
Marker 1Δ : Non-Occupancy Period

6.2 Test data of UNII Band III

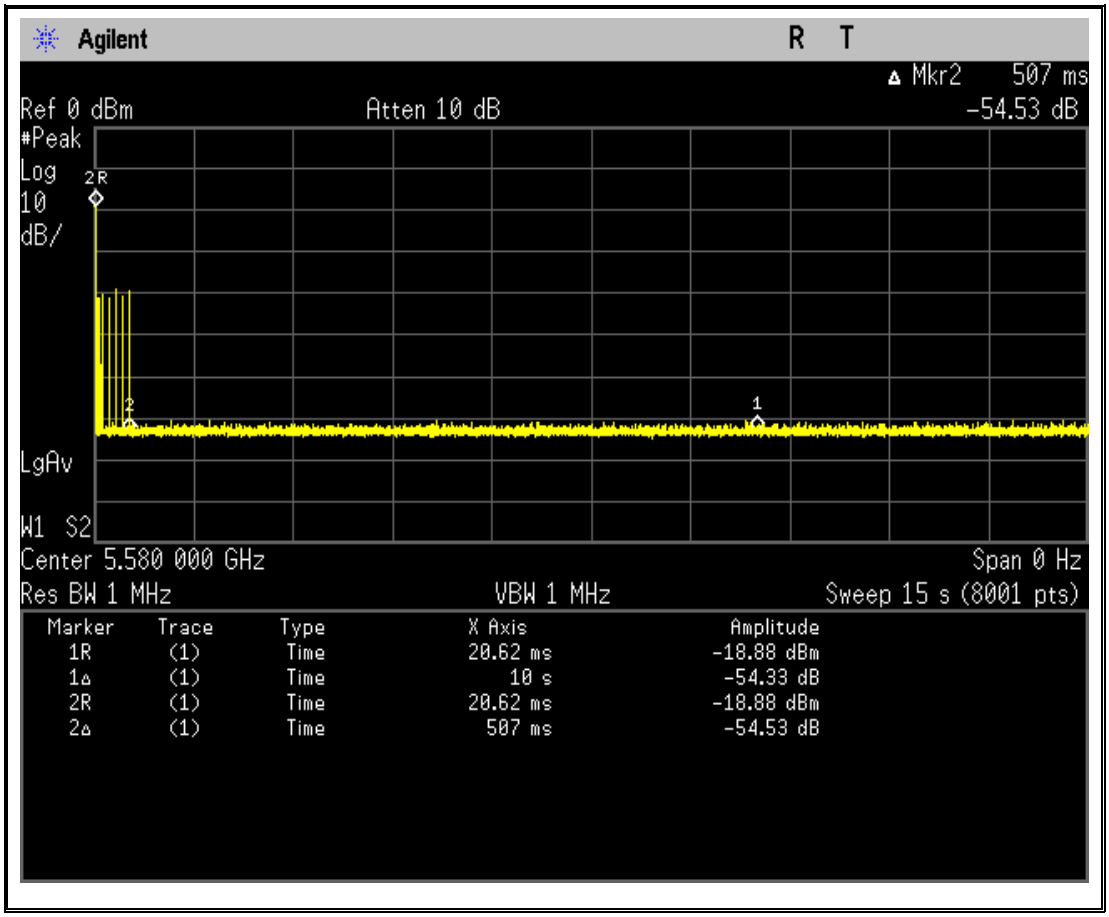
Radar test signal 1 threshold level at 5580 MHz



Data Traffic Plot at 5580 MHz



Channel Move Time for Radar test signal 1 at 5580 MHz

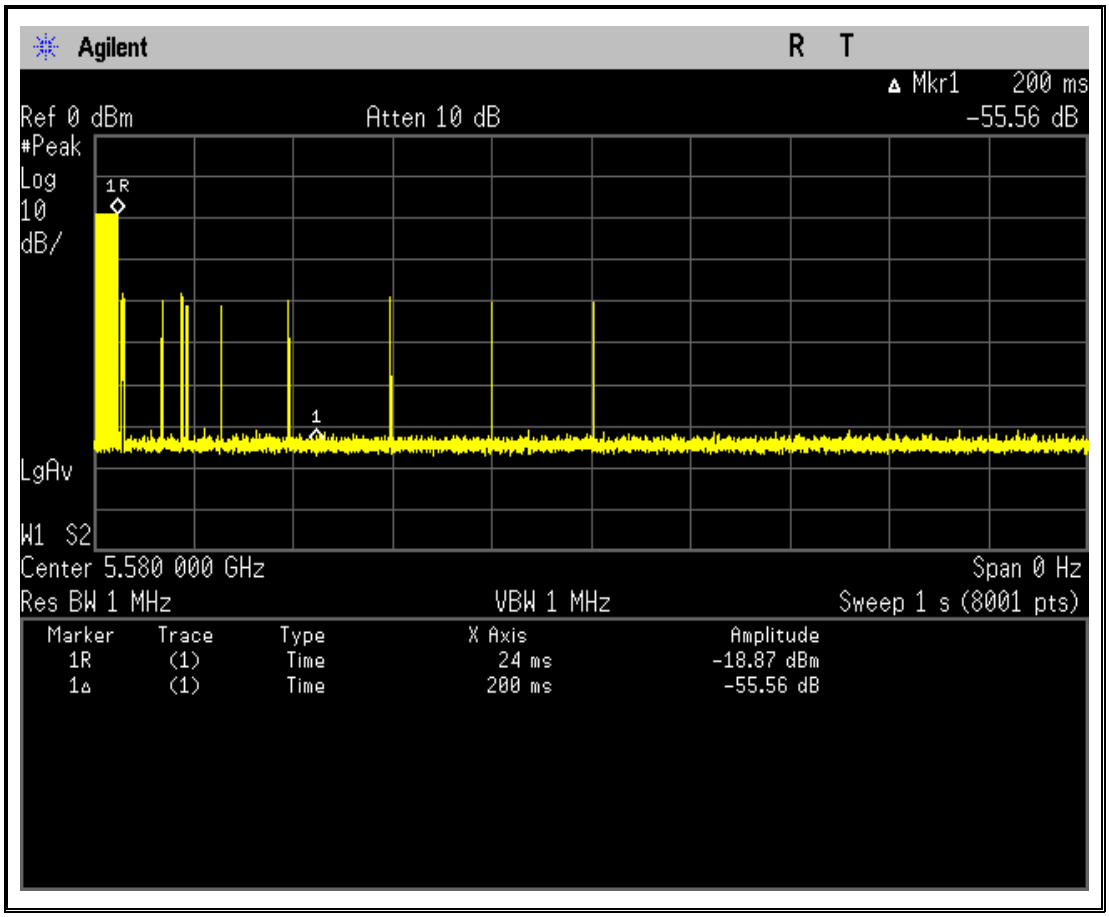


Test Item	Measured value	Limit	Result
Channel Move Time	507 milliseconds	10 second	Pass

Notes :

Marker 1R, 2R : End of Radar Burst
Marker 1Δ : 10 S from end of Burst
Marker 2Δ : Channel Move Time

Channel Closing Transmission Time for Radar test signal at 5580 MHz



Test Item	Measured value	Limit	Result
Channel Closing Transmission Time	**< 200 milliseconds + 1.00 milliseconds**	**200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period**	**Pass**

Aggregate Transmission Time from 200 ms to 10 sec after Radar Burst

= Number of pulses from the Client occurring x (Sweep time(ms) / Total number of bins)

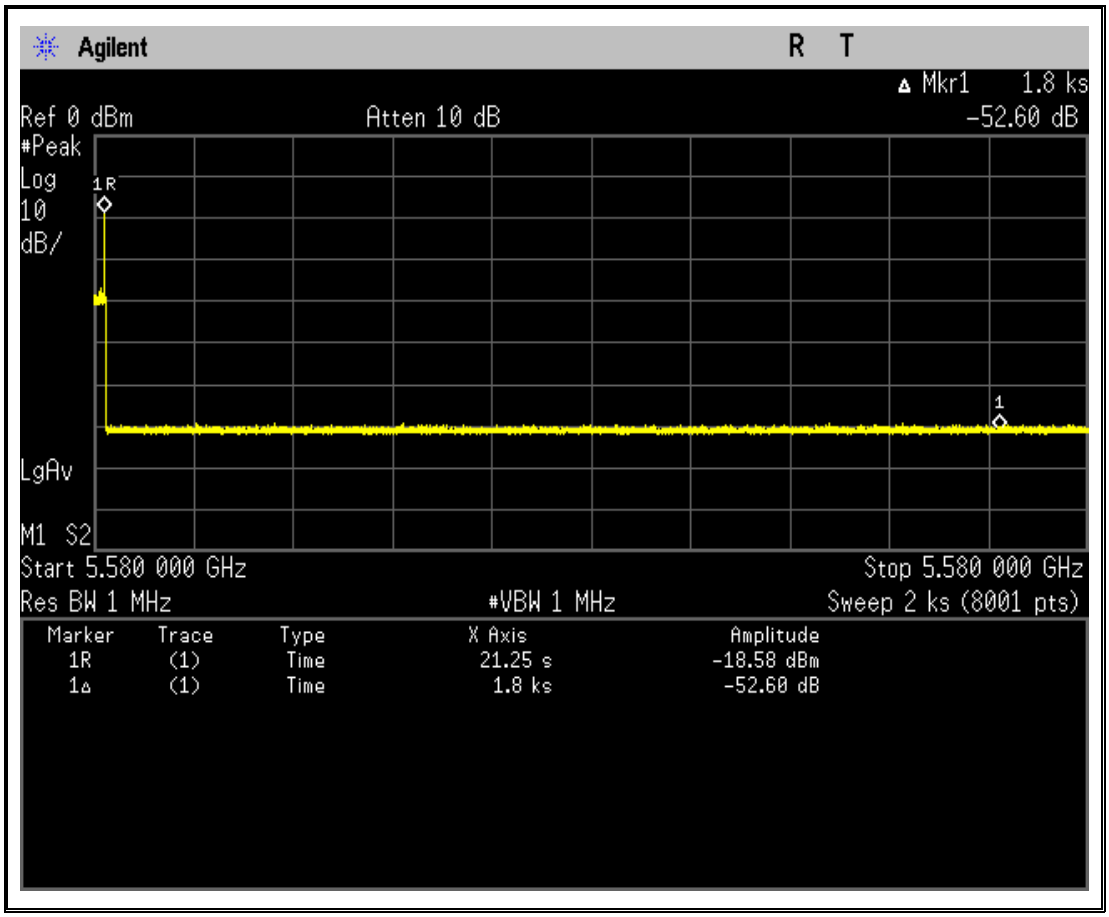
= 4 x (1000 / 8001) = 0.50 ms

Notes :

Marker 1R : End of Radar Burst

Martker 1Δ : 200 ms from end of Burst

Non- Occupancy Period for Radar test signal 1 at 5580 MHz



Test Item	Measured value	Limit	Result
Non-Occupancy Period	Over 30 minutes	Minimum 30 minutes	Pass

Notes :

Marker 1R : End of Radar Burst

Martker 1Δ : Non-Occupancy Period