TEST REPORT

CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9970
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Report No.: CTK-2019-04568

1. Client

◦ Name : BIXOLON Co.,Ltd.

◦ Address : 7th~8th FL, Miraeasset Venture Tower, 20, Pangyoyeok-ro241beon-gil, Bundang-gu Seongnam-si, Gyeonggi-do, Korea

◦ Date of Receipt : 2019-07-16

2. Manufacturer

◦ Name : BIXOLON Co.,Ltd.

◦ Address : 7th~8th FL, Miraeasset Venture Tower, 20, Pangyoyeok-ro241beon-gil, Bundang-gu Seongnam-si, Gyeonggi-do, Korea

3. Use of Report : For FCC & ISED Certification

4. Test Sample / Model: Thermal Label Printer / FCC : XQ-84*x
ISED : XQ-840

5. Date of Test : 2019-07-26 to 2019-11-19

6. Test Standard(method) used : FCC 47 CFR part 15 subpart E 15.407
RSS-247

7. Testing Environment: Temp.: (23 ± 1) ℃, Humidity: (48 ± 5) % R.H.

8. Test Results : Compliance

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This Test Report cannot be reproduced, except in full.

Affirmation	Tested by Gwanyong Kim: (Signature)	Technical Manager Young-taek Lee: (Signature)

2019-11-20

Republic of KOREA **CTK Co., Ltd.**

REPORT REVISION HISTORY

Date	Revision	Page No
2019-11-20	Issued (CTK-2019-04568)	all

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1 General Product Description

1.1 Client Information

Company	BIXOLON Co.,Ltd.
Contact Point	7th~8th FL, Miraeasset Venture Tower, 20, Pangyoyeok-ro241beon-gil, Bundang-gu Seongnam-si, Gyeonggi-do, Korea
Contact Person	Name : Ji-Sung Shin E-mail : jsshin@bixolon.com Tel : +82-31-218-5582

1.2 Product Information

FCC ID	U5MXQ840
Certification Number ISED	7962A-XQ840
Product Description	THERMAL LABEL PRINTER
Basic model (HVIN)	FCC : XQ-84*x (*: Alphanumeric, x: blank or Alphanumeric) ISED : XQ-840
Variant model	XQ-843 differs from the basic model in printing resolution ▶XQ-840 : 200 dpi ▶XQ-843 : 300 dpi
Device Type(DFS)	Client without radar detection(only support client mode)
TPC mechanism	support
Operating band	5 150 MHz - 5 250 MHz 5 250 MHz - 5 350 MHz 5 470 MHz - 5 725 MHz 5 725 MHz - 5 850 MHz
Channel bandwidth	IEEE 802.11a : 20 MHz IEEE 802.11n : 20 MHz, 40 MHz IEEE 802.11ac : 20 MHz, 40 MHz, 80 MHz
Number of Transmit chains	1
Antenna type	FPC Antenna
Antenna gain	3.41 dBi
Modulation	OFDM
S/N	STD000KS19050015

1.3 DFS Band Carrier Frequencies

Frequency Band	Channel No.	Frequency[MHz]	Channel No.	Frequency[MHz]
5 250 - 5 350 MHz Band 2	52	5 260	60	5 300
	54	5 270	62	5 310
	56	5 280	64	5 320
	58	5 290		
5 470 - 5 725 MHz Band 3	100	5 500	124	5 620
	102	5 510	126	5 630
	104	5 520	128	5 640
	106	5 530	132	5 660
	108	5 540	134	5 670
	110	5 550	136	5 680
	112	5 560	138	5 690
	116	5 580	140	5 700
	118	5 590	142	5 710
	120	5 600	144	5 720
	122	5 610		

1.4 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.
Access Point(Master)	Cisco Systems, Inc.	WAP371	6002-85030041R
AC ADAPTER	LITE-ON POWER TECHNOLOGY(DONGGUAN) CO.,LTD	PA-1041-71	L21432051723
Notebook Computer	HP	HP Probook 650	-
AC Adapter	HP	Series PPP019L-S	PA-1650-32HY
Vector Signal Generator	R&S	SMBV100A	258008
Note Computer	HP	15-bs563TU	CND7253R6P
AC/DC Adapter	HP	HSTNN-LA40	7628011101

2 Facility and Accreditations

2.1 Test Facility

The measurement facility is located at (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea.

2.2 Laboratory Accreditations and Listings

Country	Agency	Registration Number
USA	FCC	805871
CANADA	ISED	8737A-2
KOREA	NRRA	KR0025

2.3 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

3 Test Specifications

3.1 Standards

FCC Part Section(s)	Requirement(s)	Status (Note 1)	Test Condition
15.407(h)(2)(iii)	Channel move time and channel closing transmission time	C	Conducted
15.407(h)(2)(iv)	Non-Occupancy Period	C	Conducted
Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable			
Note 2: The data in this test report are traceable to the national or international standards.			

The following documents listed in this section are referred for testing.
KDB 905462 D02 : UNII DFS Compliance Procedures New Rules v02
KDB 905462 D03 : UNII Clients Without Radar Detection New Rules v01r02

3.2 Mode of operation during the test

The UUT is operated in a manner representative of the typical of the equipments.
During at testing, system components were manipulated within the confines of typical usage to maximize each emission. The results are only attached worst cases.

Test Frequency

IEEE Std.	Test Channel Freq.
802.11n (HT20)	5 500 MHz
802.11n (HT40)	5 510 MHz
802.11ac (VHT80)	5 530 MHz

3.3 Maximum Measurement Uncertainty

The value of the measurement uncertainty for the measurement of each parameter.
Coverage factor k = 2, Confidence levels of 95 %

Description	Uncertainty
Conducted emission	1.5 dB

4 Dynamic Frequency Selection(DFS) Test

4.1 General DFS Information

DFS Parameters

Parameter	Value
Non-occupancy period	Minimum 30 Minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds (Note 1)
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second periods (Note 1 and 2)
U-NII Detection Bandwidth	Minimum 100% of the U-NII 9% transmission power bandwidth (Note 3)

Note 1: Channel Move Time and the Channel Closing Transmission Time should be performed with Radar Type0. The measurement timing begins at the end of the Radar Type 0 burst.
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 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.

DFS Detection Thresholds

Maximum Transmit Power	Value (See note)
EIRP ≥ 200 mW	-64 dBm
EIRP < 200 mW and Power spectral density < 10 dBm/MHz	-62 dBm
EIRP < 200 mW 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.
Note 3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.

Applicability of DFS Requirements Prior Use of a Channel

Requirement	DFS Operational mode		
	Master	Client without radar detection	Client with radar detection
Non-Occupancy Period	Yes	Not required (See the note)	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

Note : According to KDB 905462 D03 Client Without DFS New Rules v01r02 (b) 6. "An analyzer plot that contains a single 30-minute sweep on the original channel"

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	Yes
Channel Move Time	Yes	Yes
U-NII Detection 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	Test using the widest BW mode available for the link
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.

Channel Loading/Data Streaming

☐	The data file (MPEG-4) has been transmitting in a streaming mode.
☒	Software to ping the client is permitted to simulate data transfer with random ping intervals.
☒	Minimum channel loading of approximately 17%
☐	Unicast protocol has been used.

▪ 4.2 RADAR 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
0	1	1428	18	See Note 1	See Note 1
1A	1	15 unique PRI in KDB 905462 D02 Table 5a	$\text{Roundup}\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot 10^6}{\text{PRI}_{\mu\text{sec}}}\right)\right\}$	60%	15
1B	1	15 unique PRI within 518-3066, Excluding 1A PRI		60%	15
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.

A minimum of 30 unique waveforms are required for each of the Short Pulse Radar Types 2 through 4. 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. If more than 30 waveforms are used for Short Pulse Radar Type 1, then each additional waveform is generated with Test B and must also be unique and not repeated from the previous waveforms in Tests A or B.

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

Each waveform is defined as follows:

- The transmission period for the Long Pulse Radar test signal is 12 seconds.
- 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.
- 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.
- 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.
- Each pulse has a linear frequency modulated chirp between 5 and 20 MHz, with the chirp width being randomly chosen. Each pulse within a transmission period will have the same chirp width. 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.
- 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.
- 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.

Frequency Hopping 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

The FCC Type 6 waveform uses a static waveform with 100 burst in the instruments ARB. In addition, the RF list mode is operated with a list containing 100 frequencies from a randomly generated list and it had be ensured that at least one of the random frequencies falls into the UNI Detection Bandwidth of the DUT. Each burst from the waveform file initiates a trigger pulse at the beginning that switches the RF list from one item to the next one.

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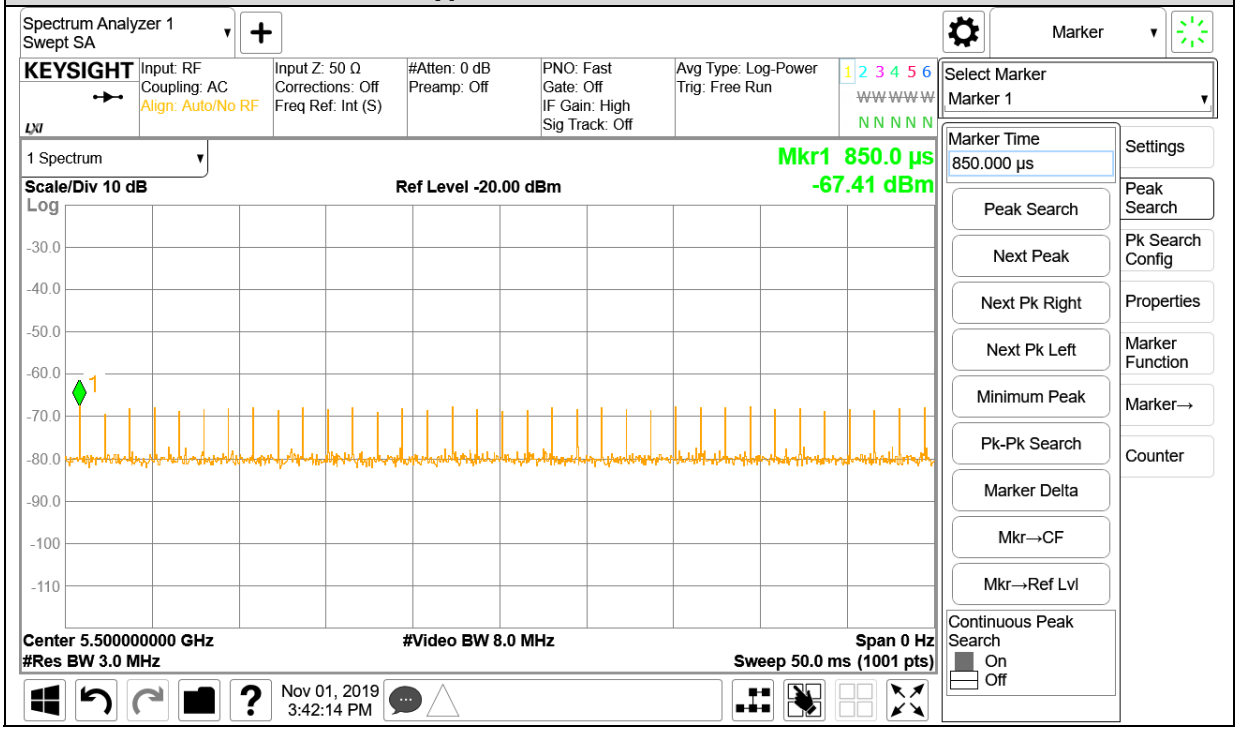
DFS Threshold Level

DFS Threshold Level	
DFS Threshold level: -63 dBm	☒ at the antenna connector
	☐ in front of the antenna
The Interference Radar Detection Threshold Level is -64dBm + 0[dBi] + 3.41dB = -61.59dBm. That had been taken into account the output power range and antenna gain.	

Radar Waveform calibration Plot

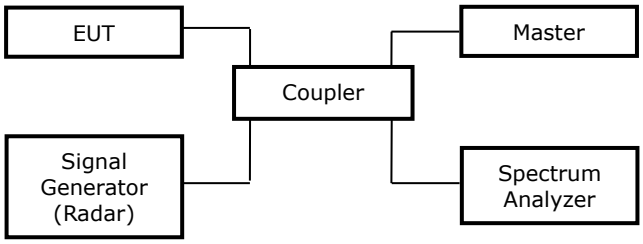
Radar Type 0 DFS detection threshold level



Test Setup

A spectrum analyzer is used a monitor to verify that the EUT has vacated the Channel within the Channel Closing Transmission Time and Channel Move Time, and does not transmit on a Channel during the Non-Occupancy Period after the detection and Channel move.

Client without Radar Detect Conducted Measurement



▪ 4.3 In-service Monitoring

In-service Monitoring Limit

In-service Monitoring Limit	
Channel Move Time	10sec
Channel Closing Transmission Time	200 ms + an aggregate of 60 ms over remaining 10 sec periods.
Non-occupancy period	Minimum 30 minutes

Measuring Instruments

Refer a test equipment and calibration data table in this test report.

Test Procedures

Test Method
☒ Verified during In-Service Monitoring; Channel Closing Transmission Time, Channel Move Time. Client Device will associate with the EUT. Observe the transmissions of the EUT at the end of the radar Burst on the Operating Channel for duration greater than 10 seconds. Measure and record the transmissions from the EUT during the observation time (Channel Move Time). Compare the Channel Move Time and Channel Closing Transmission Time limits.
☒ Verified during In-Service Monitoring; Channel Closing Transmission Time, Channel Move Time. One 12 sec plot needs to be reported for the Short Pulse Radar Types 0. And zoom-in a 60 ms plot verified c hannel closing time for the aggregate transmission time starting from 200ms after the end of the rad ar signal to the completion of the channel move.
☒ Verified during In-Service Monitoring; Non-Occupancy Period. Client Device will associate with the EUT. Observe the transmissions of the EUT at the end of the radar Burst on the Operating Channel for dur ation greater than 10 seconds. Measure and record the transmissions from the EUT during the observ ation time (Non- Occupancy Period). Compare the Occupancy Period limits.

Test Result of In-service Monitoring

Parameter	Test Result			Limit
Test Frequency [MHz]	5 500	5 510	5 530	-
Channel Move Time [sec.]	0.236	0.248	0.240	< 10s
Channel Closing Transmission Time [ms] (Note)	3	3	3	< 60ms
Non-Occupancy Period [min.]	≥ 30	≥ 30	≥ 30	≥ 30 min

Note: 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 seconds period. The aggregate duration of control signals will not count quiet periods in between transmissions.

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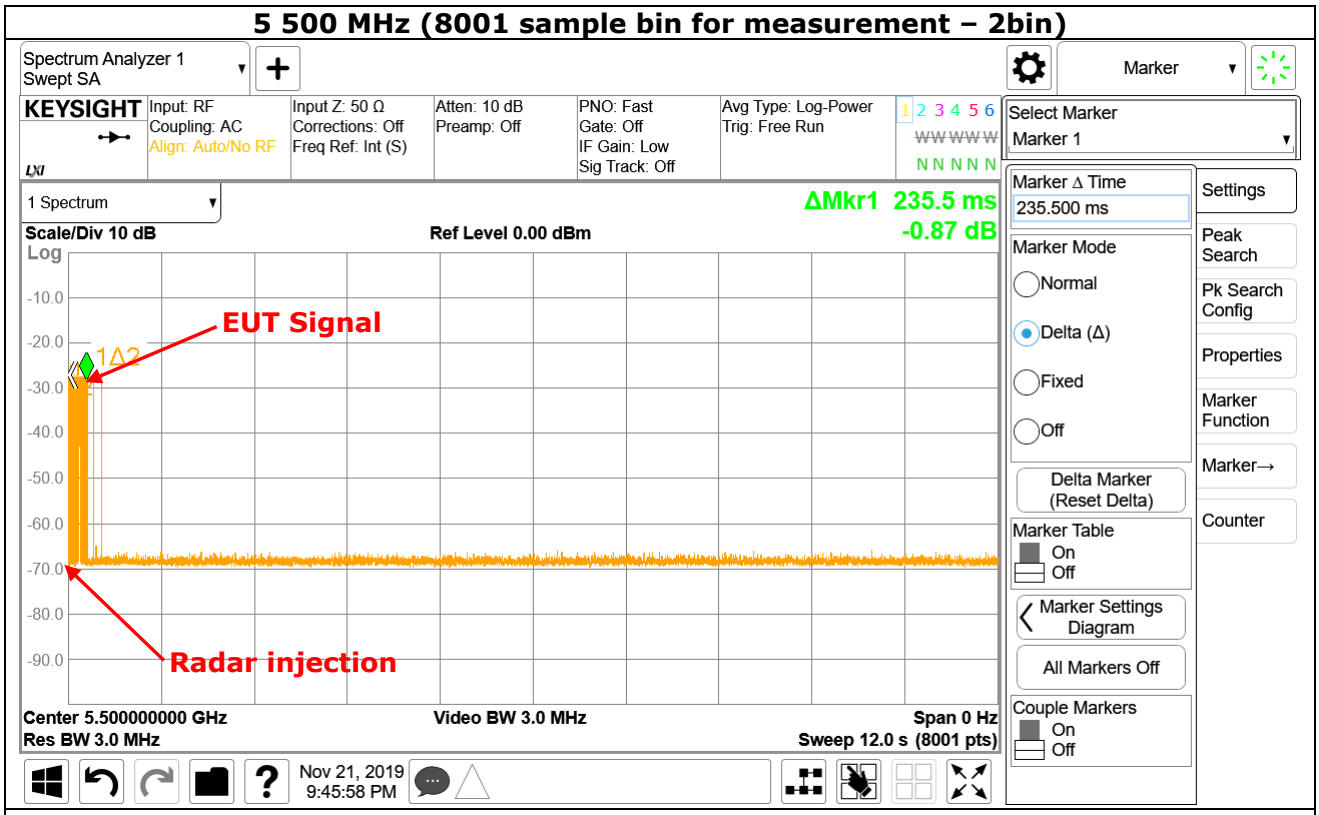
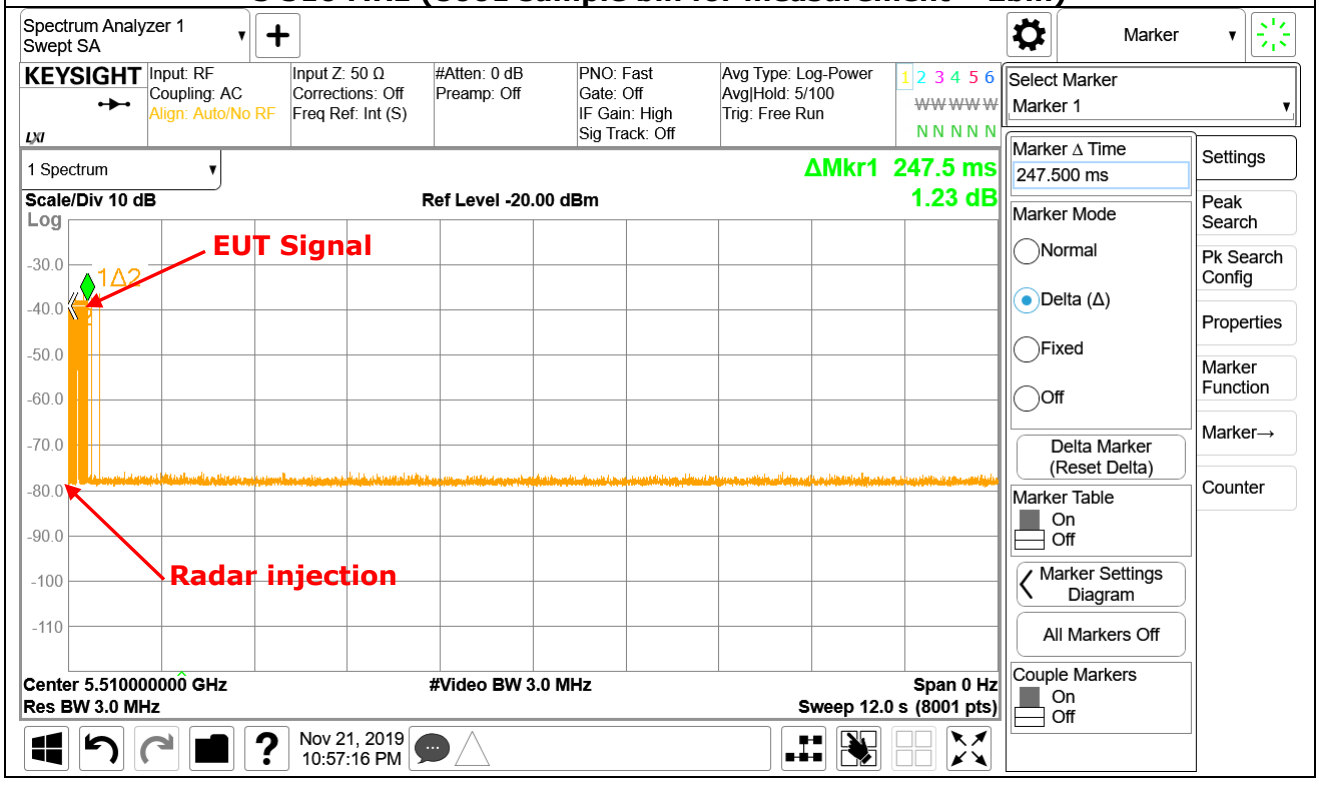
Test Plot of In-Service Monitoring for Channel Move Time & Channel Closing Transmission Time

5 500 MHz (8001 sample bin for measurement – 2bin)



5 510 MHz (8001 sample bin for measurement – 2bin)



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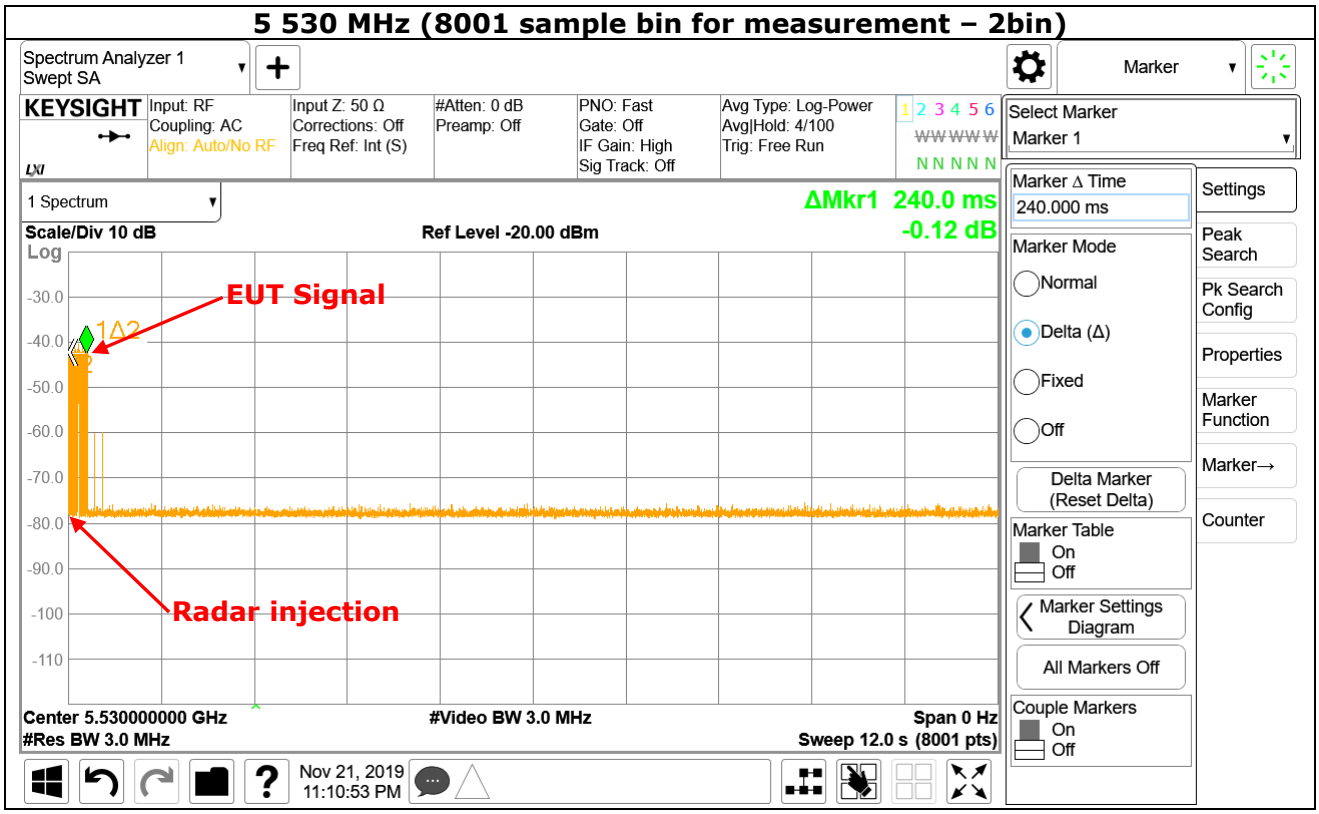
5 530 MHz (8001 sample bin for measurement – 2bin)



Remark :

1. Channel Closing Transmission Time =
   (sweep time / sweep point) * The number of channel bin from the end of radar pulse.

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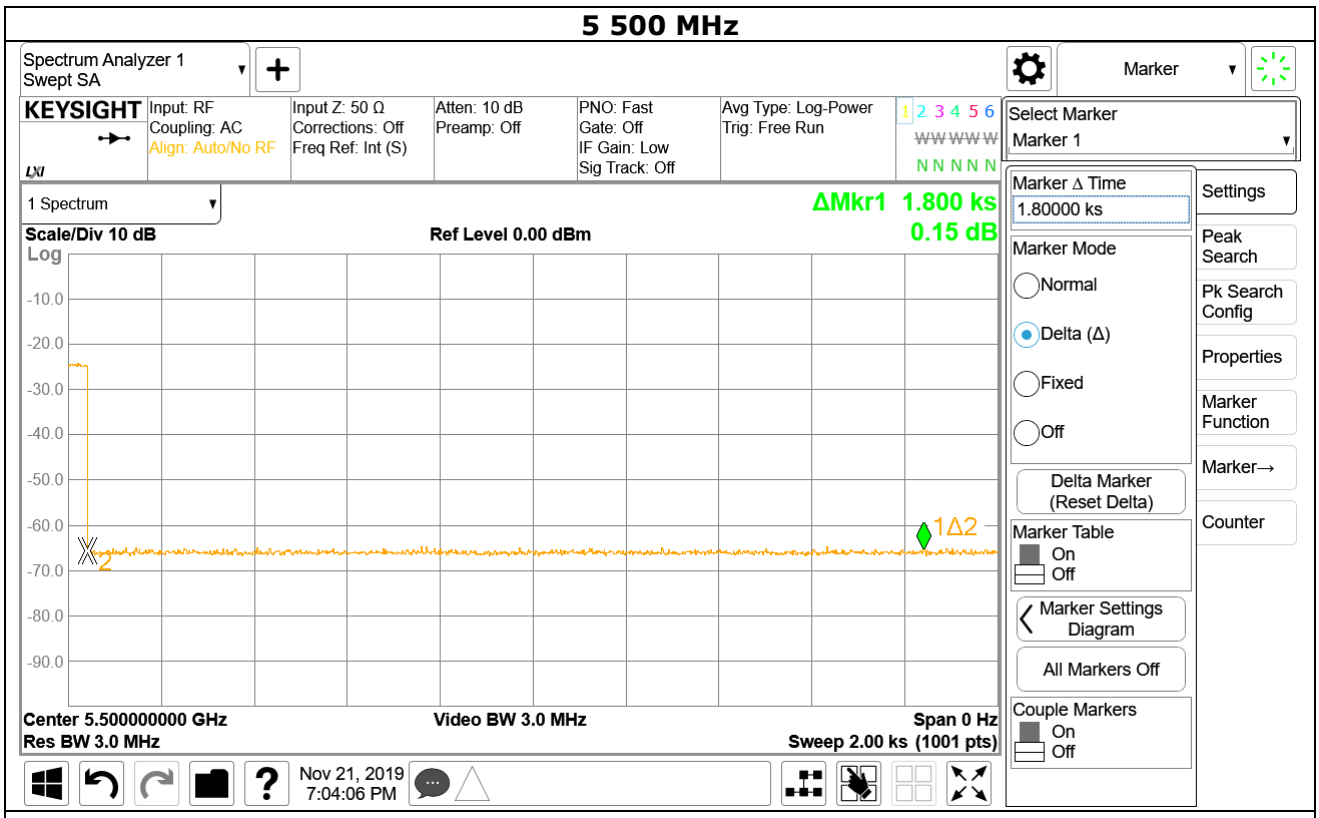
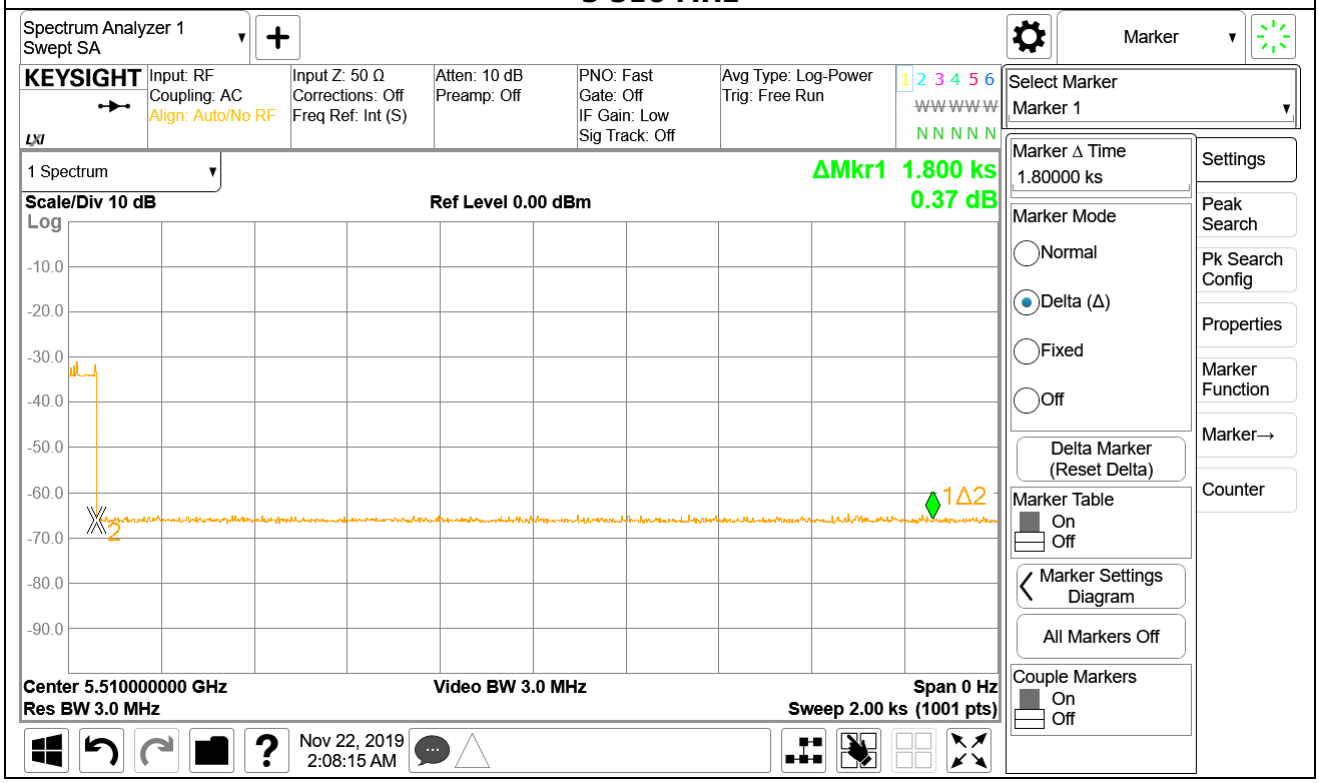
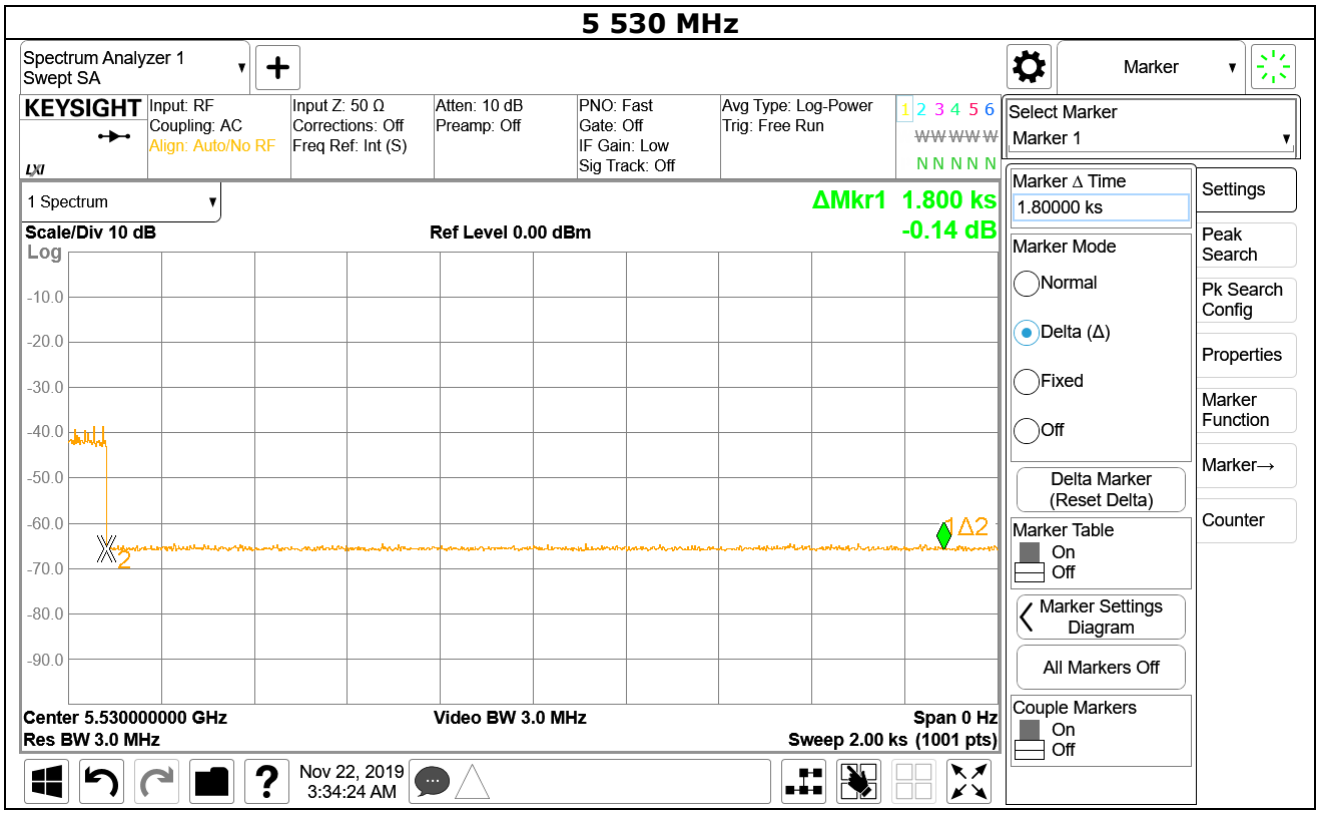
Test Plot of In-Service Monitoring for Non-Occupancy Period

5 500 MHz



5 510 MHz




5 530 MHz
Spectrum Analyzer 1
Swept SA
Marker
KEYSIGHT
Input: RF
Coupling: AC
Align: Auto/No RF
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
Atten: 10 dB
Preamp: Off
PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Trig: Free Run
Select Marker
Marker 1
1 Spectrum
ΔMkr1 1.800 ks
-0.14 dB
Scale/Div 10 dB
Ref Level 0.00 dBm
Log
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
1Δ2
Center 5.530000000 GHz
Res BW 3.0 MHz
Video BW 3.0 MHz
Span 0 Hz
Sweep 2.00 ks (1001 pts)
Nov 22, 2019
3:34:24 AM
Marker Δ Time
1.80000 ks
Marker Mode
Normal
Delta (Δ)
Fixed
Off
Delta Marker (Reset Delta)
Marker Table
On
Off
Marker Settings Diagram
All Markers Off
Couple Markers
On
Off
Settings
Peak Search
Pk Search Config
Properties
Marker Function
Marker→
Counter

APPENDIX A – Test Equipment Used For Tests

	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	MXA Signal Analyzer	Keysight	N9020B	MY57431080	2019-04-19	2020-04-19
2	Vector Signal Generator	Rohde & Schwarz	SMBV100A	258008	2019-01-28	2020-01-28
3	Dual Directional Coupler	HP	11692D	1212A03629	2019-10-17	2020-10-17