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Report No.: SZEM160200065906
Page: 1 of 18

FCC DFS TEST REPORT

| | |
|-------------------------|--|
| Application No: | SZEM1602000659CR |
| Applicant: | Embest Technology Co., Ltd |
| Manufacturer: | Embest Technology Co., Ltd |
| Factory: | Embest Technology Co., Ltd |
| Product Name: | MCIMX7SABRE |
| Model No.(EUT): | MCIMX7SABRE |
| FCC ID: | 2AFLY-MCIMX7SABRE |
| Standards: | 47 CFR Part 15, Subpart E (2015) KDB 905462 D02 KDB 905462 D03 |
| Date of Receipt: | 2016-03-10 |
| Date of Test: | 2016-03-23 to 2016-04-06 |
| Date of Issue: | 2016-04-18 |
| Test Result: | Pass* |

*In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Authorized Signature:



Jack Zhang
EMC Laboratory Manager

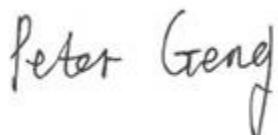
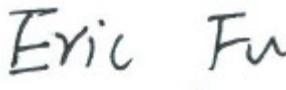
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2 Version

| Revision Record | | | | |
|-----------------|---------|------------|----------|----------|
| Version | Chapter | Date | Modifier | Remark |
| 00 | | 2016-04-18 | | Original |
| | | | | |
| | | | | |

| | | | |
|--------------------------|--|--|------------|
| Authorized for issue by: | | | |
| Tested By | |  (Peter Geng /Project Engineer) | 2016-04-06 |
| Prepared By | |  (Joyce Shi) /Clerk | 2016-04-18 |
| Checked By | |  (Eric Fu) /Reviewer | 2016-04-18 |

3 Test Summary

| Test Item | Test Requirement | Test method | Result |
|-----------------------------|------------------|----------------------------------|--------|
| Dynamic Frequency Selection | 15.407 (h)(2) | KDB 905462 D02 KDB 905462 D03 | PASS |

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5 General Information

5.1 Client Information

Applicant: Embest Technology Co., Ltd
Address of Applicant: Tower B 4/F, Shanshui Building, Nanshan Yungu Innovation Industry Park, Liuxian Ave, No,1183, Nanshan District, Shenzhen, Guangdong, China
Manufacturer: Embest Technology Co., Ltd
Address of Manufacturer: Tower B 4/F, Shanshui Building, Nanshan Yungu Innovation Industry Park, Liuxian Ave, No,1183, Nanshan District, Shenzhen, Guangdong, China
Factory: Embest Technology Co., Ltd
Address of Factory: Tower B 4/F, Shanshui Building, Nanshan Yungu Innovation Industry Park, Liuxian Ave, No,1183, Nanshan District, Shenzhen, Guangdong, China

5.2 General Description of E.U.T.

Product Name: MCIMX7SABRE
Model No.: MCIMX7SABRE

5.3 Technical Specifications

| Operation Frequency: | Band | Mode | Frequency Range(MHz) | Number of channels |
|---|--|-----------|----------------------|--------------------|
| UNII Band I | IEEE 802.11a | 5180-5240 | 4 | |
| | IEEE 802.11n 20MHz | 5180-5240 | 4 | |
| | IEEE 802.11n 40MHz | 5190-5230 | 2 | |
| | IEEE 802.11ac 80MHz | 5210 | 1 | |
| UNII Band II-A | IEEE 802.11a | 5260-5320 | 4 | |
| | IEEE 802.11n 20MHz | 5260-5320 | 4 | |
| | IEEE 802.11n 40MHz | 5270-5310 | 2 | |
| | IEEE 802.11ac 80MHz | 5290 | 1 | |
| UNII Band II-C | IEEE 802.11a | 5500-5700 | 11 | |
| | IEEE 802.11n 20MHz | 5500-5700 | 11 | |
| | IEEE 802.11n 40MHz | 5510-5670 | 5 | |
| | IEEE 802.11ac 80MHz | 5530-5610 | 3 | |
| UNII Band III | IEEE 802.11a | 5745-5825 | 5 | |
| | IEEE 802.11n 20MHz | 5745-5825 | 5 | |
| | IEEE 802.11n 40MHz | 5755-5795 | 2 | |
| | IEEE 802.11ac 80MHz | 5775 | 1 | |
| * The 5600-5650MHz can not be used in Canada. | | | | |
| Type of Modulation: | IEEE 802.11a: OFDM(BPSK/QPSK/16QAM/64QAM) IEEE 802.11n: OFDM(BPSK/QPSK/16QAM/64QAM) | | | |
| DFS mode | Client without radar detection | | | |
| Sample Type: | Fixed production | | | |
| Antenna Type: | Integral | | | |

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| | |
|---------------|---|
| Antenna Gain: | 0dBi |
| Power Supply | Model : WT0504000 INPUT: AC 100-240V, 50/60Hz OUTPUT: DC 5V, 4A |
| Test Voltage: | AC 120V/60Hz |

5.4 Description of Support Units

| Description | Manufacturer | Model No. | FCC ID |
|-----------------|----------------------|-----------|----------------|
| Wireless Router | Aruba Networks, Inc. | APIN0114 | Q9DAPINR15515P |

5.5 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch E&E Lab,
No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China.
518057.
Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

No tests were sub-contracted.

5.6 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS (No. CNAS L2929)**

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **A2LA (Certificate No. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

- **VCCI**

The 10m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-823, R-4188, T-1153 and C-2383 respectively.

- **FCC – Registration No.: 556682**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No.: 556682.

- **Industry Canada (IC)**

The 3m Semi-anechoic chambers and the 10m Semi-anechoic chambers of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-2, 4620C-3.

6 Dynamic Frequency Selection

6.1 Applicability of DFS requirements

Table 1: Applicability of DFS Requirements Prior to Use of a Channel

| Requirement | Operational Mode | | |
|---------------------------------|---------------------------------|--|--|
| | <input type="checkbox"/> Master | <input checked="" type="checkbox"/> Client Without Radar Detection | <input type="checkbox"/> 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 |

Table 2: Applicability of DFS requirements during normal operation

| Requirement | Operational Mode | |
|-----------------------------------|---|--|
| | <input type="checkbox"/> Master Device or Client with Radar Detection | <input checked="" type="checkbox"/> 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 | <input type="checkbox"/> Master Device or Client with Radar Detection | <input checked="" type="checkbox"/> 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. | | |

6.2 Limit

6.2.1 DFS Detection Thresholds

Table 3: DFS Detection Thresholds for Master Devices and Client Devices With Radar Detection

| Maximum Transmit Power | Value (See Notes 1, 2, and 3) |
|--|-------------------------------|
| EIRP \geq 200 milliwatt | -64 dBm |
| EIRP $<$ 200 milliwatt and power spectral density $<$ 10 dBm/MHz | -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.

6.2.2 DFS Response Requirements

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 100% of the U-NII 99% transmission power bandwidth. See Note 3. |

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.
 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 facilitating 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.

6.3 Parameters of 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.

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 |
|--|--------------------|------------|--|--|--------------------------|
| 0 | 1 | 1428 | 18 | See Note 1 | See Note 1 |
| 1 | 1 | Test A | Roundup $\left\lceil \left(\frac{1}{360} \cdot \frac{19 \cdot 10^6}{\text{PRI}_{\mu\text{sec}}} \right) \right\rceil$ | 60% | 30 |
| | | Test B | | | |
| 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. 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 | | | | | |

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.

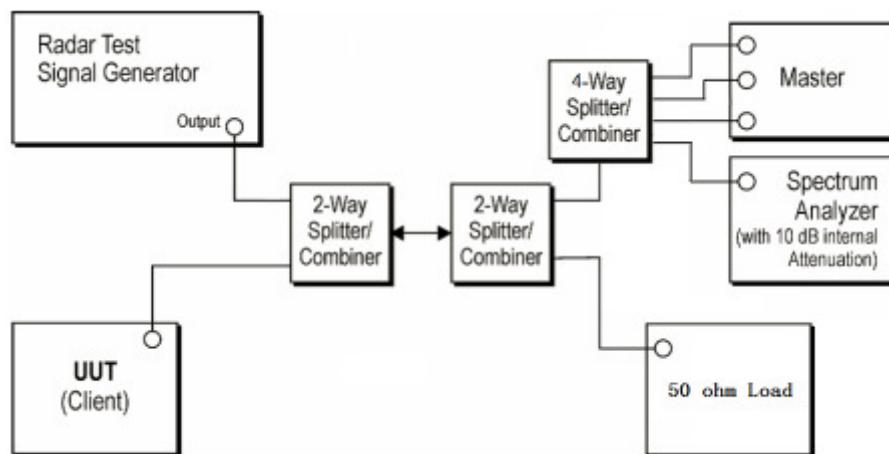
Test aggregate is average of the percentage of successful detections of short pulse radar types 1-4

6.4 Calibration of Radar Waveform

6.4.1 Radar Waveform Calibration Procedure

- 1) A 50 ohm load is connected in place of the spectrum analyzer, and the spectrum analyzer is connected to place of the master
- 2) The interference Radar Detection Threshold Level is $-62\text{dBm} + 0\text{dBi} + 1\text{dB} = -61\text{dBm}$ that had been taken into account the output power range and antenna gain.
- 3) The following equipment setup was used to calibrate the conducted radar waveform. A vector signal generator was utilized to establish the test signal level for radar type 0. During this process there were no transmissions by either the master or client device. The spectrum analyzer was switched to the zero spans (time domain) at the frequency of the radar waveform generator. Peak detection was used. The spectrum analyzer resolution bandwidth (RBW) and video bandwidth (VBW) were set to 3 MHz. The spectrum analyzer had offset -1.0dB to compensate RF cable loss 1.0dB.
- 4) The vector signal generator amplitude was set so that the power level measured at the spectrum analyzer was $-62\text{dBm} + 0\text{dBi} + 1\text{dB} = -61\text{dBm}$. Capture the spectrum analyzer plots on short pulse radar waveform.

6.4.2 Conducted Calibration Setup

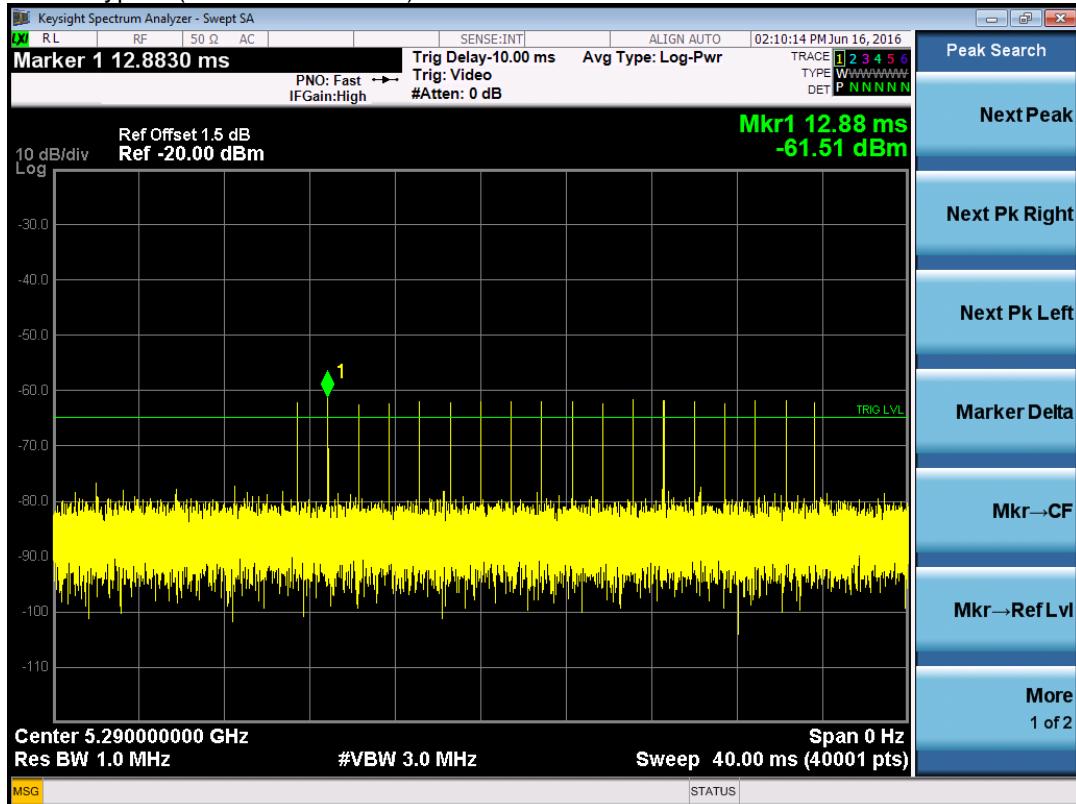


6.4.3 Calibration Deviation

There is no deviation with the original standard.

6.4.4 Radar Waveform Calibration Result

Radar Type 0 (80MHz / 5290MHz)



6.5 Test Procedure

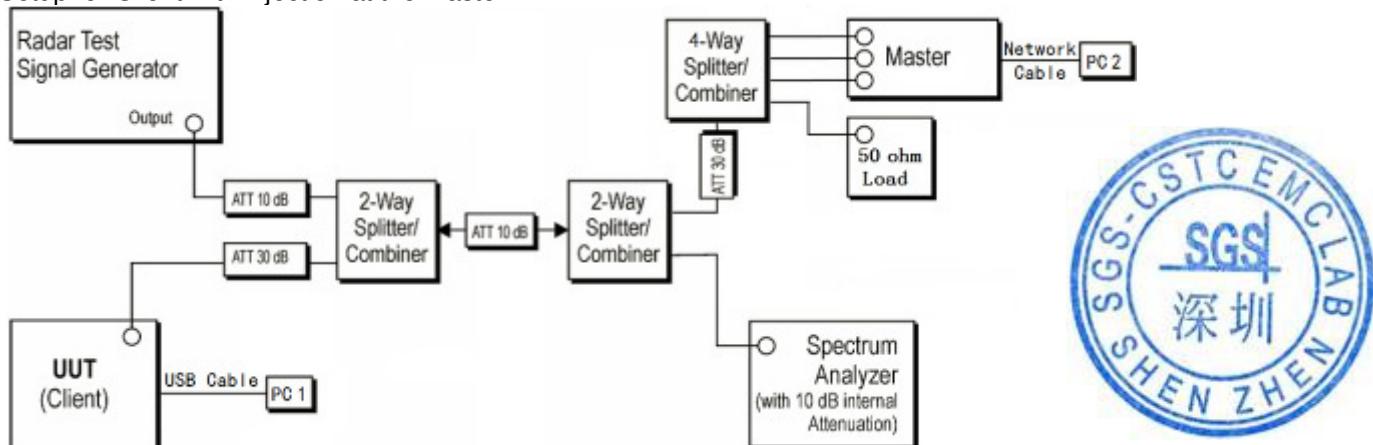
- 1) The radar pulse generator is setup to provide a pulse at frequency that the master and client are operating. A type 0 radar pulse with a 1us pulse width and a 1428us PRI is used for the testing.
- 2) The vector signal generator is adjusted to provide the radar burst (18 pulses) at the level of approximately -61dBm at the antenna port 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) EUT will associate with the master at channel. The file "iperf.exe" specified by the FCC is streamed from the PC 2 through the master and the client device to the PC 1 and played in full motion video using Media Player Classic Ver. 6.4.8.6 in order to properly load the network for the entire period of the test.
- 5) When radar burst with a level equal to the DFS Detection Threshold +1dB is generated on the operating channel of the U-NII device. At time T0 the radar waveform generator sends a burst of pulse of the radar waveform at Detection Threshold +1dB.
- 6) Observe the transmissions of the EUT at the end of the radar Burst on the Operating Channel. Measure and record the transmissions from the UUT during the observation time (Channel Move Time). One 15 seconds plot is reported for the Short Pulse Radar Type 0. The plot for the Short Pulse Radar Types start at the end of the radar burst. The Channel Move Time will be calculated based on the zoom in 600ms plot of the Short Pulse Radar Type.
- 7) Measurement of the aggregate duration of the Channel Closed Transmission Time method. With the spectrum analyzer set to zero span tuned to the center frequency of the EUT operating channel at the radar simulated frequency, peak detection, and max hold, the dwell time per bin is given by: Dwell (0.3ms) = S (12000ms) / B (4000); where Dwell is the dwell time per spectrum analyzer sampling bin, S is sweep time and B is the number of spectrum analyzer sampling bins. An upper bound of the aggregate duration of the intermittent control signals of Channel Closing Transmission Time is calculated by: C (ms) = N X Dwell (0.3ms); where C is the Closing Time, N is the number of spectrum analyzer sampling bins (intermittent control signals) showing a U-NII transmission and Dwell is the dwell time per bin.
- 8) Measurement the EUT for more than 30 minutes following the channel move time to verify that no transmission or beacons occur on this channel.

6.6 Test Equipment

| RF test system | | | | | | |
|----------------|-----------------------------|----------------------------|-------------|---------------|------------------------|---------------------------|
| Item | Test Equipment | Manufacturer | Model No. | Inventory No. | Cal. date (yyyy-mm-dd) | Cal.Due date (yyyy-mm-dd) |
| 1 | Power Sensor | Agilent Technologies | U2021XA Ch1 | SEL0320 | 2015-10-12 | 2016-10-12 |
| 2 | Power Sensor | Agilent Technologies | U2021XA Ch2 | SEL0321 | 2015-10-17 | 2016-10-17 |
| 3 | Power Sensor | Agilent Technologies | U2021XA Ch3 | SEL0322 | 2015-10-17 | 2016-10-17 |
| 4 | Power Sensor | Agilent Technologies | U2021XA Ch4 | SEL0323 | 2015-10-12 | 2016-10-12 |
| 5 | SGSREF, Adaptivity Unit | Top Precision Technologies | N/A | N/A | N/A | N/A |
| 6 | DAQ Device | Agilent Technologies | U2531A | SEL0325 | 2015-10-13 | 2016-10-13 |
| 7 | EXG Analog Signal Generator | KEYSIGHT | N5171B | SEL0326 | 2014-08-27 | 2017-08-27 |
| 8 | EXA Signal Analyzer | Agilent Technologies | N9010A | SEL0329 | 2015-07-18 | 2016-07-18 |
| 9 | ESG vector signal generator | Agilent Technologies | E4483C | SEL0330 | 2015-07-18 | 2016-07-18 |

6.7 Test Setup

Setup for Client with injection at the Master



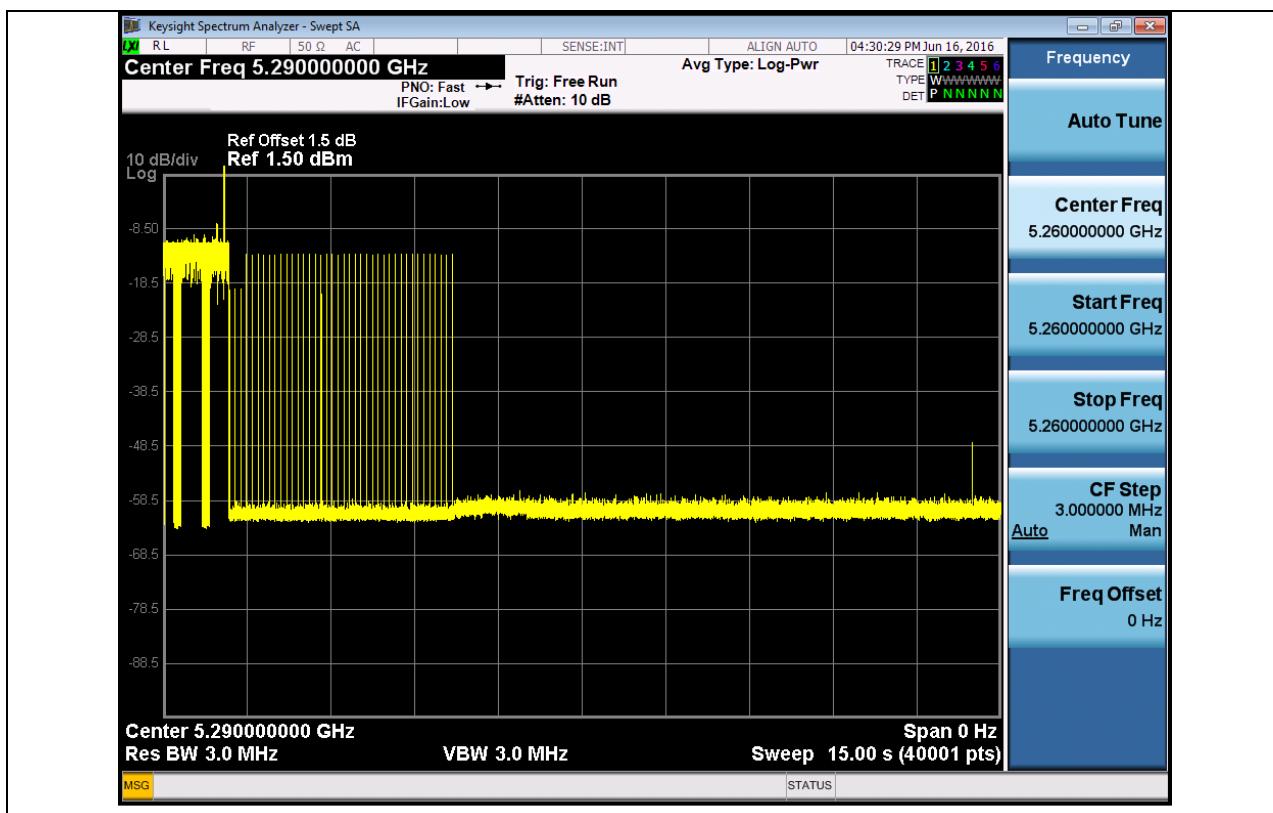
6.8 Test Result

Test Data:

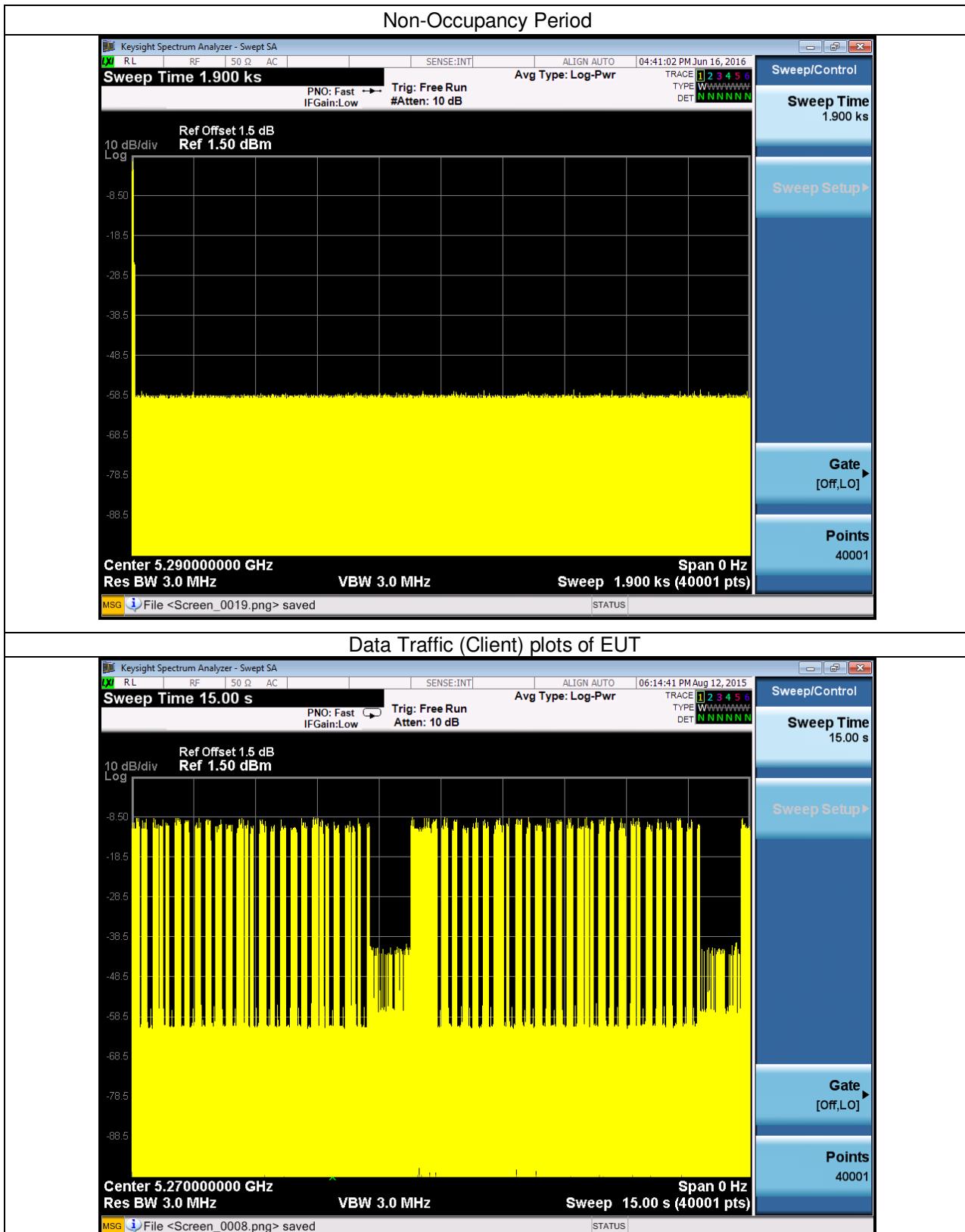
| BW/Channel | Test Item | Test Result | Limit | Results |
|---------------|-----------------------------------|-------------|------------|---------|
| 80MHz/5290MHz | Channel Move Time | 4.063s | <10s | Pass |
| | Channel Closing Transmission Time | 0.040s | <1s | Pass |
| | Non-Occupancy Period | ≥30 | ≥30minutes | Pass |

Test plots as follows:





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7 EUT Constructional Details

Refer to Appendix A - Photographs of EUT Constructional Details for SZEM1602000659CR.

--End of the Report--