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**DATE: 17 September 2019**

# I.T.L. (PRODUCT TESTING) LTD.

# FCC Radio Test Report

**For**

# Pal Electronics Systems

**Equipment under test:**

# Smart Gate

**SG334GA**

Tested by: _____
M. Zohar

Approved by: _____
D. Shidlowsky

# Measurement/Technical Report for

Pal Electronics Systems

Smart Gate

SG334GA

## FCC ID: 2AUD3-SG334G

| | | |
|---|---|---|
| This report concerns: | Original Grant: | X |
| | Class I Change: | |
| | Class II Change: | |

| | |
|---|---|
| Equipment type: | DSS Part 15 Spread Spectrum Transmitter |
| Limits used: | 47CFR15 Section 15.247 |

Measurement procedures used are KDB 558074 D01 v05r02, ANSI C63.10: 2013


Application for Certification
prepared by:
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Applicant for this device:
(different from "prepared by")
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Pal electronics systems
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Tel: +972-52-317-9977
Email: litbak@pal-es.com

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# 1. General Information

## *1.1 Administrative Information*

| | |
|---|---|
| Manufacturer: | Pal Electronics Systems |
| Manufacturer's Address: | Hata'asiya 25 Street<br>Ra'anana, 4365413<br>Israel<br>Tel: +972-52-317-9977 |
| Manufacturer's Representative: | Arie Litbak |
| Equipment Under Test (E.U.T): | Smart Gate |
| Model: | SG334GA |
| Equipment Serial No.: | RD300100275 |
| Date of Receipt of E.U.T: | September 02, 2019 |
| Start of Test: | September 02, 2019 |
| End of Test: | September 03, 2019 |
| Test Laboratory Location: | I.T.L (Product Testing) Ltd.<br>1 Batsheva St.,<br>Lod<br>ISRAEL 7120101 |
| Test Specifications: | FCC, Part 15, Subpart C, Section 15.247 |

### *1.2 List of Accreditations*

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), FCC Designation No. IL1005.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. Department of Innovation, Science and Economic Development (ISED) Canada, CAB identifier: IL1002

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

## 1.3 Product Description

SG334GA is a new long-range RFID reader featuring compact dimension. This innovative integrated reader is an all-in-one device that operates at a frequency range of 902-928 MHz and is an ideal solution for applications such as intelligent parking management and access control.

| | |
|---|---|
| Working voltage | 12VDC |
| Mode of operation | Transceiver |
| Modulation | ASK |
| Assigned Frequency Range | 902-928MHz |
| Operating Frequency Range | 902.75-927.25MHz |
| Transmit power(conducted) | ~25.0dBm |
| Antenna Gain | 8.57 dBi max gain |
| Modulation BW | ~ 100kHz |

## 1.4 Test Methodology

Radiated testing was performed according to the procedures in KDB 558074 D01 v05r02 and ANSI C63.10: 2013. Radiated testing was performed at an antenna to EUT distance of 3 meters.

## 1.5 Test Facility

Emissions tests were performed at I.T.L.'s testing facility in Lod, Israel. I.T.L.'s EMC Laboratory is accredited by A2LA, certificate No. 1152.01 and its FCC Designation Number is IL1005.

## 1.6 Measurement Uncertainty

### Conducted Emission

Conducted Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) 0.15 – 30 MHz:

Expanded Uncertainty (95% Confidence, K=2):

± 3.6 dB

### Radiated Emission

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) for open site:

30-1000MHz:
Expanded Uncertainty (95% Confidence, K=2):
± 4.96 dB

1 GHz to 6 GHz
Expanded Uncertainty (95% Confidence, K=2):
±5.19 dB

>6 GHz
Expanded Uncertainty (95% Confidence, K=2):
±5.51 dB

# 2. System Test Configuration

## 2.1 Justification

1. The E.U.T contains a sub 1GHz transceiver.
2. The unit was evaluated while transmitting at the low channel (902.75MHz), the mid channel (915.25MHz) and the high channel (927.25MHz).
3. Final radiated emission test was performed after exploratory emission testing that was performed on the E.U.T in 3 orthogonal polarities to determine the "worst case" radiation (antenna polarity was in fixed position as defined by the customer)
4. According to the below results the "worst case" was the Z axis

| Orientation | Frequency (MHz) | 2nd Harmonic (dBuV/m) | 3rd Harmonic (dBuV/m) | Band Edge (dBuV/m) |
|---|---|---|---|---|
| X axis | 902.75 | 52.5 | 54.2 | 52.2 |
| | 915.25 | 52.5 | 54.4 | - |
| | 927.25 | 52.3 | 54.1 | 52.6 |
| Y axis | 902.75 | 53.4 | 55.0 | 52.4 |
| | 915.25 | 53.8 | 55.9 | - |
| | 927.25 | 53.6 | 55.2 | 52.7 |
| Z axis | 902.75 | 54.0 | 58.0 | 52.4 |
| | 915.25 | 54.1 | 60.3 | - |
| | 927.25 | 54.7 | 62.5 | 53.0 |

**Figure 1. Screening Results**

5. Conducted emission tests were performed with the E.U.T. antenna terminal connected by a RF cable to the Spectrum Analyzer through a 30dB external attenuator.

## 2.2 EUT Exercise Software

No special exercise software was used.

## 2.3 Special Accessories

No special accessories were needed in order to achieve compliance.

## 2.4 Equipment Modifications

No modifications were needed in order to achieve compliance.

## 2.5 Configuration of Tested System

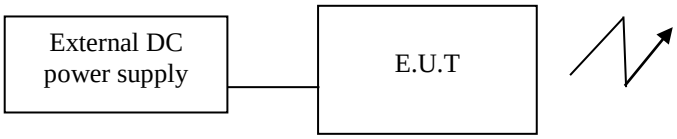


**Figure 2. Configuration of Tested System – Radiated**

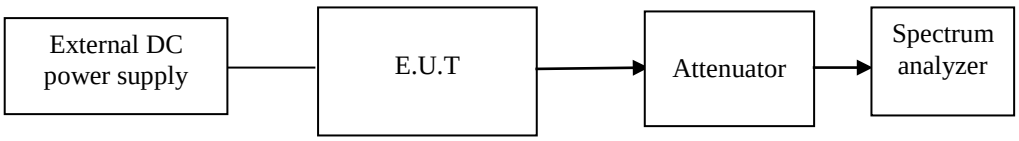


**Figure 3. Configuration of Tested System – Conducted**

# 3. Conducted & Radiated Measurement Test Set-Up Photos

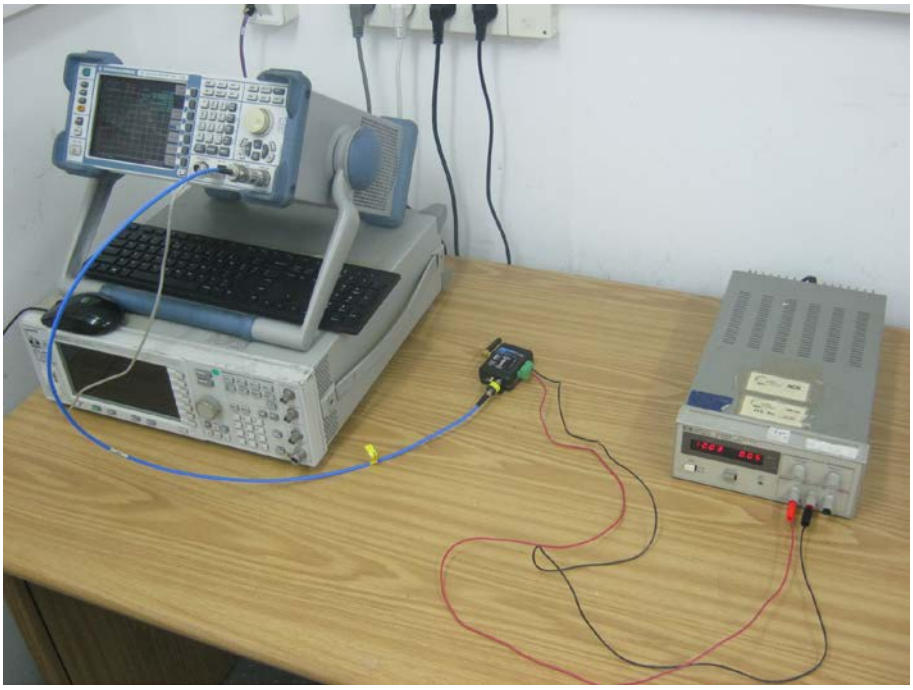

**Figure 4. Conducted Emission from Antenna Port**

**Figure 5. Radiated Emission Test, 0.009-30MHz**

**Figure 6. Radiated Emission Test, 30-200MHz**

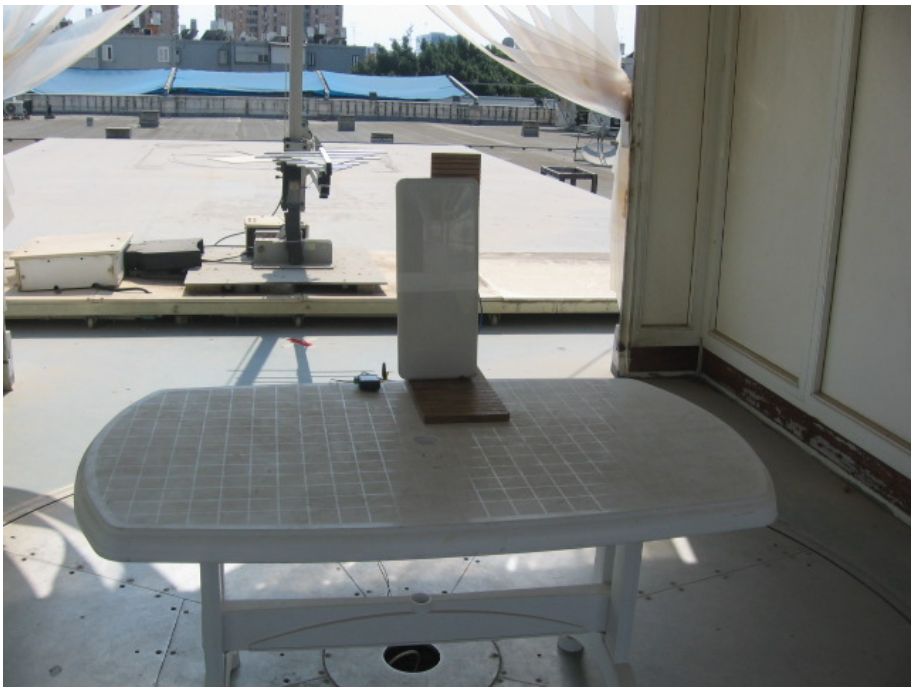

**Figure 7. Radiated Emission Test, 200-1000MHz**

**Figure 8. Radiated Emission Test, 1-10GHz**

# 4. 20dB Minimum Bandwidth

## 4.1 Test Specification

FCC, Part 15, Subpart C, Section 15.247(a)(1)

## 4.2 Test Procedure

(Temperature (20°C)/ Humidity (59%RH))
The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable. The transmitter unit operated with normal modulation.
The spectrum analyzer was set to the following parameters:
Span = ~ 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
RBW ≥ 1% of the 20 dB bandwidth
Detector Function: Peak, Trace: Maximum Hold.

## 4.3 Test Limit

N/A

## 4.4 Test Results

| Modulation | Operation Frequency (MHz) | Bandwidth Reading (kHz) |
|---|---|---|
| ASK | 902.75 | 160.7 |
| | 915.25 | 152.7 |
| | 927.25 | 156.7 |

**Figure 9 Test Results**

JUDGEMENT: Passed

For additional information see *Figure 10* to *Figure 12.*

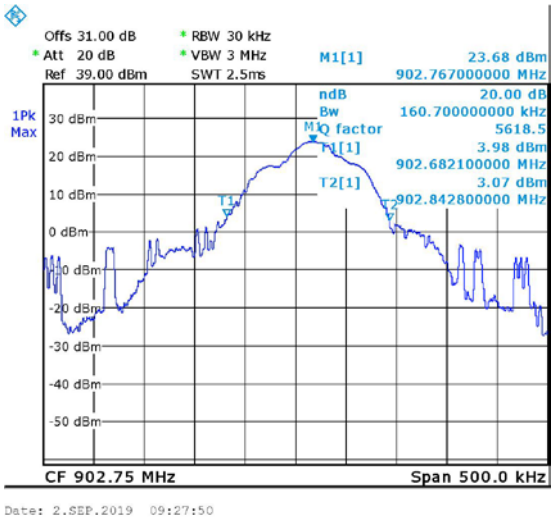


**Figure 10. 902.75MHz,**

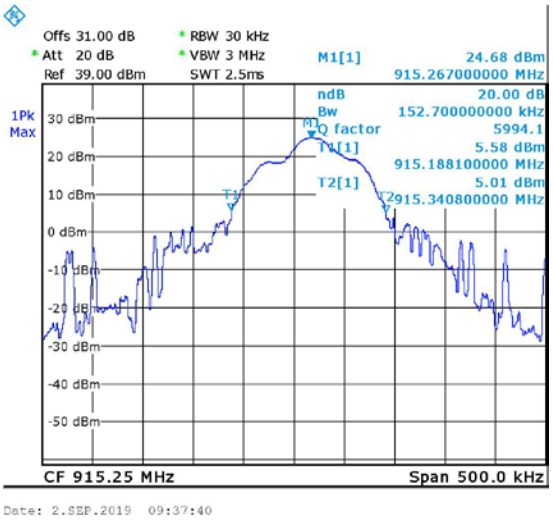


**Figure 11. 915.25MHz,**

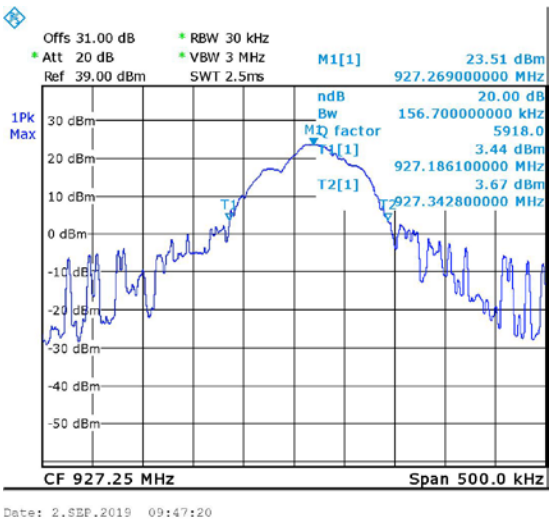


**Figure 12. 927.25MHz**

### *4.5 Test Equipment Used, 20 dB Minimum Bandwidth*

| Instrument | Manufacturer | Model | Serial Number | Last Calibration Date | Next Calibration Due |
|---|---|---|---|---|---|
| Spectrum Analyzer | Rohde & Schwarz | FSL6 | 100194 | March 24, 2019 | March 31, 2020 |
| 30dB Attenuator | MCL | BW-S30W5 | 533 | December 24, 2018 | December 31, 2019 |
| RF Cable | EIM | 705A009301EIM | - | December 24, 2018 | December 31, 2019 |

**Figure 13 Test Equipment Used**

# 5. Occupied Bandwidth

## 5.1 Test Specification

FCC, Part 15, Subpart C, Section 2.1048

## 5.2 Test Procedure

(Temperature (20°C)/ Humidity (60%RH))
The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable. The transmitter unit operated with normal modulation.
The spectrum analyzer was set to the following parameters:
Span = ~ 3 times the OBW, centered on a hopping channel
RBW = 1-5%of the OBW
99% occupied bandwidth function was set on.

## 5.3 Test Limit

N/A

## 5.4 Test Results

| Modulation | Operation Frequency (MHz) | Bandwidth Reading (kHz) |
|---|---|---|
| ASK | 902.75 | 109.5 |
| | 915.25 | 106.0 |
| | 927.25 | 105.4 |

**Figure 14 Test Results**

JUDGEMENT: Passed

For additional information see *Figure 15* to *Figure 17.*

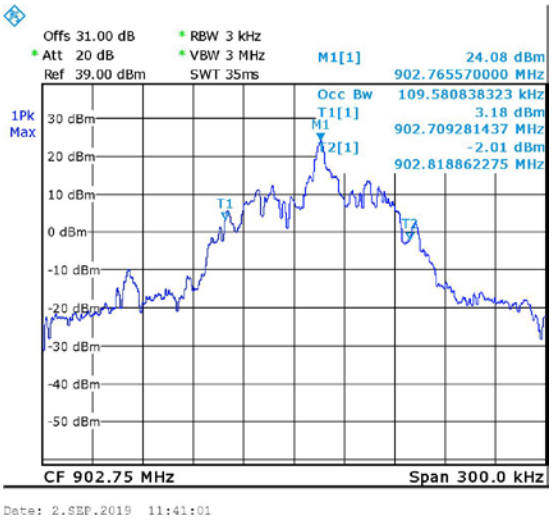


**Figure 15. 902.75MHz,**

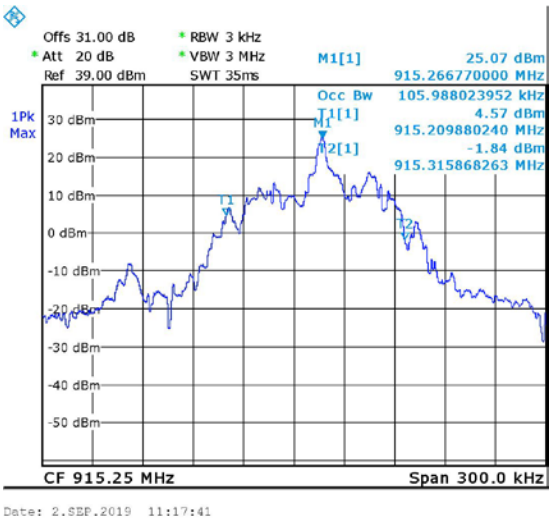


**Figure 16. 915.25MHz,**

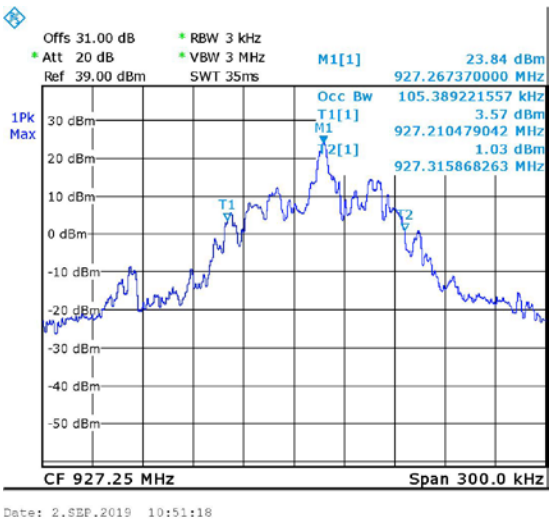


**Figure 17. 927.25MHz**

### *5.5 Test Equipment Used, Occupied Bandwidth*

| Instrument | Manufacturer | Model | Serial Number | Last Calibration Date | Next Calibration Due |
|---|---|---|---|---|---|
| Spectrum Analyzer | Rohde & Schwarz | FSL6 | 100194 | March 24, 2019 | March 31, 2020 |
| 30dB Attenuator | MCL | BW-S30W5 | 533 | December 24, 2018 | December 31, 2019 |
| RF Cable | EIM | 705A009301EIM | - | December 24, 2018 | December 31, 2019 |

**Figure 18 Test Equipment Used**

# 6. Number of Hopping Frequencies

## 6.1 Test Specification

FCC, Part 15, Subpart C Section 15.247(a)(1)(iii)

## 6.2 Test Procedure

(Temperature (20°C)/ Humidity (60%RH))
The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable.

The E.U.T. was set to hopping mode.
The spectrum analyzer was set to the following parameters:

Band of operation: 902M-928 MHz
RBW: 100 kHz
Detector Function: Peak, Trace: Maximum Hold

## 6.3 Test Limit

Frequency hopping systems in the 902.0928-.0 MHz band shall use at least 50 Channels.

## 6.4 Test Results

| Modulation | Number of Hopping Frequencies | Limit |
|---|---|---|
| **ASK** | 50 | ≥50 |

**Figure 19 Test Results**

JUDGEMENT: Passed

For additional information see *Figure 20.*

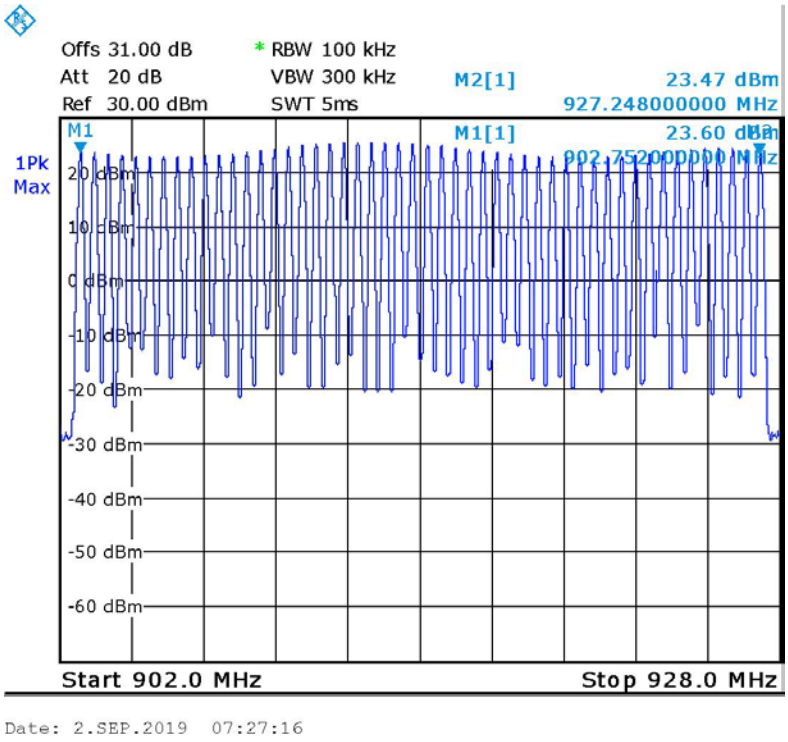


**Figure 20. Number of Channels**

## *6.5 Test Equipment Used, Number of Hopping Frequencies*

| Instrument | Manufacturer | Model | Serial Number | Last Calibration Date | Next Calibration Due |
|---|---|---|---|---|---|
| Spectrum Analyzer | Rohde & Schwarz | FSL6 | 100194 | March 24, 2019 | March 31, 2020 |
| 30dB Attenuator | MCL | BW-S30W5 | 533 | December 24, 2018 | December 31, 2019 |
| RF Cable | EIM | 705A009301EIM | - | December 24, 2018 | December 31, 2019 |

**Figure 21 Test Equipment Used**

# 7. Channel Frequency Separation

## 7.1 Test Specification

FCC Part 15, Subpart C, 15.247(a) (1)

## 7.2 Test Procedure

(Temperature (21°C)/ Humidity (60%RH))
The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable.

The E.U.T. was set to hopping mode.

The spectrum analyzer was set to the following parameters:
Span = wide enough to capture two adjacent channels RBW=100kHz
Detector Function: Peak, Trace: Maximum Hold.

## 7.3 Test Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

## 7.4 Test Results

| Modulation | Channel Frequency Separation | Limit |
|---|---|---|
| | (kHz) | (kHz) |
| ASK | 497.0 | ≥160.7 |

**Figure 22 Test Results**

JUDGEMENT: Passed by 336.3 kHz

For additional information see *Figure 23.*

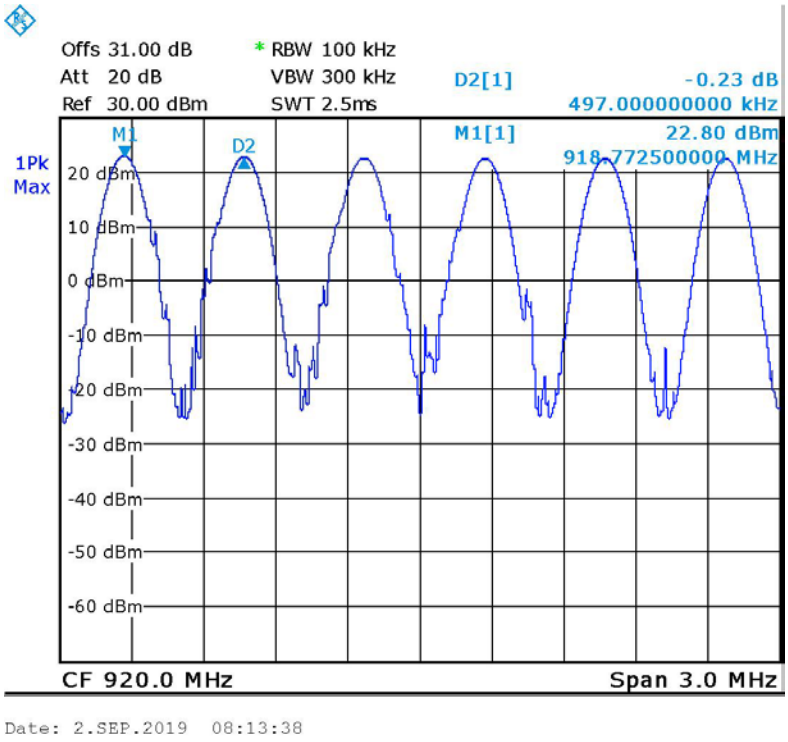


**Figure 23. Channel Frequency Separation**

## *7.5 Test Equipment Used, Channel Frequency Separation*

| Instrument | Manufacturer | Model | Serial Number | Last Calibration Date | Next Calibration Due |
|---|---|---|---|---|---|
| Spectrum Analyzer | Rohde & Schwarz | FSL6 | 100194 | March 24, 2019 | March 31, 2020 |
| 30dB Attenuator | MCL | BW-S30W5 | 533 | December 24, 2018 | December 31, 2019 |
| RF Cable | EIM | 705A009301EIM | - | December 24, 2018 | December 31, 2019 |

**Figure 24 Test Equipment Used**

# 8. Peak Output Power

## 8.1 Test Specification

FCC Part 15, Subpart C: section 15.247(b)(1)

## 8.2 Test Procedure

(Temperature (20°C)/ Humidity (60%RH))
The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (total loss= 31.0dB).
The spectrum analyzer was set to the following parameters:
Span = ~5 times the 20 dB bandwidth, centered on a hopping channel
RBW ≥ of the 20 dB bandwidth of the emission being measured
Detector Function: Peak, Trace: Maximum Hold.

## 8.3 Test Limit

For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels. (The limits above applies to antenna gain until 6dBi).

## 8.4 Test Results

| Operation Frequency | Power | Power | Limit * | Margin |
|---|---|---|---|---|
| (MHz) | (dBm) | (mW) | (mW) | (mW) |
| 902.75 | 23.7 | 234.42 | 640.0 | -405.58 |
| 915.25 | 24.7 | 295.12 | 640.0 | -344.88 |
| 927.25 | 23.5 | 223.87 | 640.0 | -416.13 |

*Note: from original limit reduced 2dB because the E.U.T antenna gain is 8dBi*

**Figure 25 Radiated Power Output Test Results**

JUDGEMENT: Passed by 344.88 mW

For additional information see *Figure 26* to *Figure 28.*

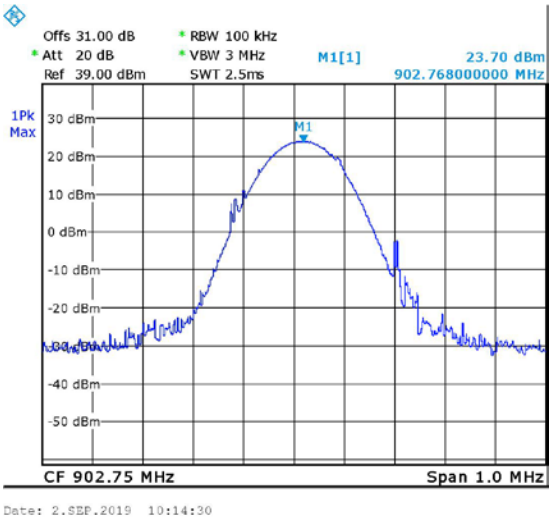


**Figure 26. 902.75MHz,**

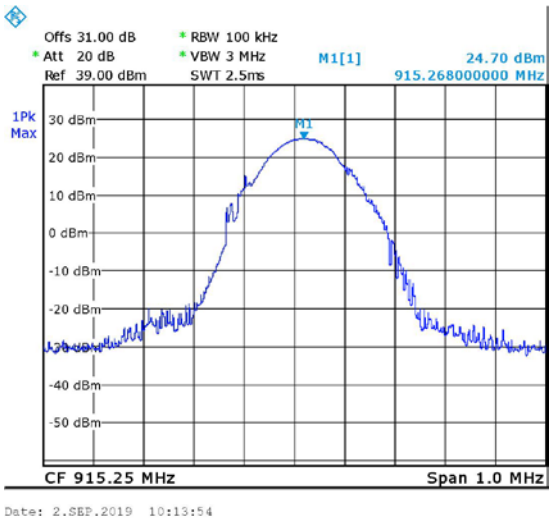


**Figure 27. 915.25MHz,**

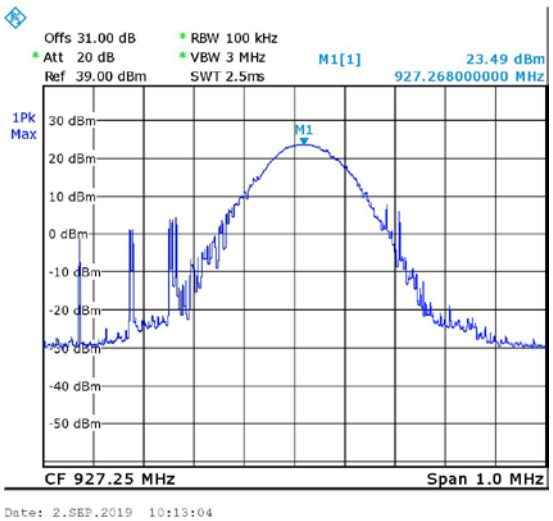


**Figure 28. 927.25MHz**

## *8.5 Test Equipment Used, Peak Output Power*

| Instrument | Manufacturer | Model | Serial Number | Last Calibration Date | Next Calibration Due |
|---|---|---|---|---|---|
| Spectrum Analyzer | Rohde & Schwarz | FSL6 | 100194 | March 24, 2019 | March 31, 2020 |
| 30dB Attenuator | MCL | BW-S30W5 | 533 | December 24, 2018 | December 31, 2019 |
| RF Cable | EIM | 705A009301EIM | - | December 24, 2018 | December 31, 2019 |

**Figure 29 Test Equipment Used**

# 9. Dwell Time on Each Channel

## 9.1 Test Specification

FCC Part 15, Part C, Section 15.247(a)(1)(iii)

## 9.2 Test Procedure

(Temperature (20°C)/ Humidity (60%RH))
The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable.
The E.U.T. was set to hopping mode.
The spectrum analyzer was set to the following parameters:
Span = zero span, centered on a hopping channel

## 9.3 Test Limit

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

## 9.4 Test Results

JUDGEMENT: Passed

The E.U.T met the requirements of the FCC Part 15, Section 15.247(d) and RSS, Issue 2, Section 5.1(d)

Additional information of the results is given in *Figure 30* to *Figure 31*.

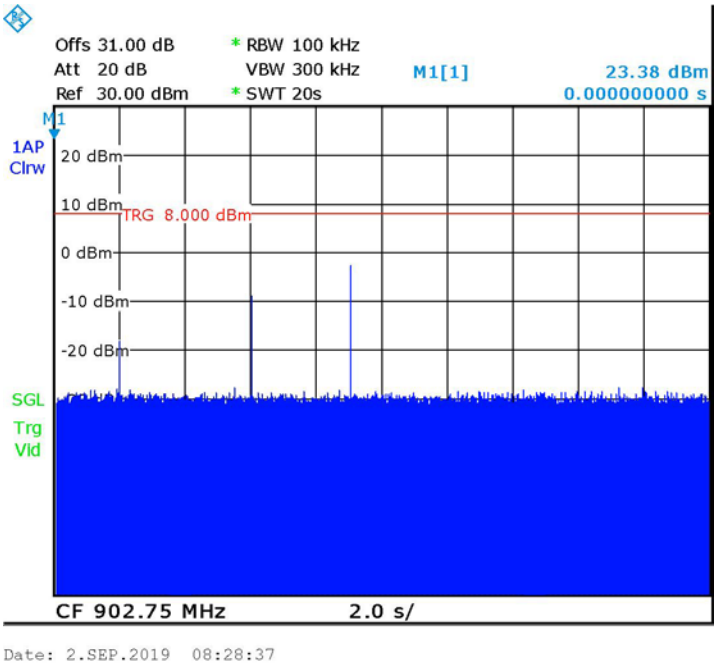


**Figure 30 Number of Bursts in 20 sec=1**

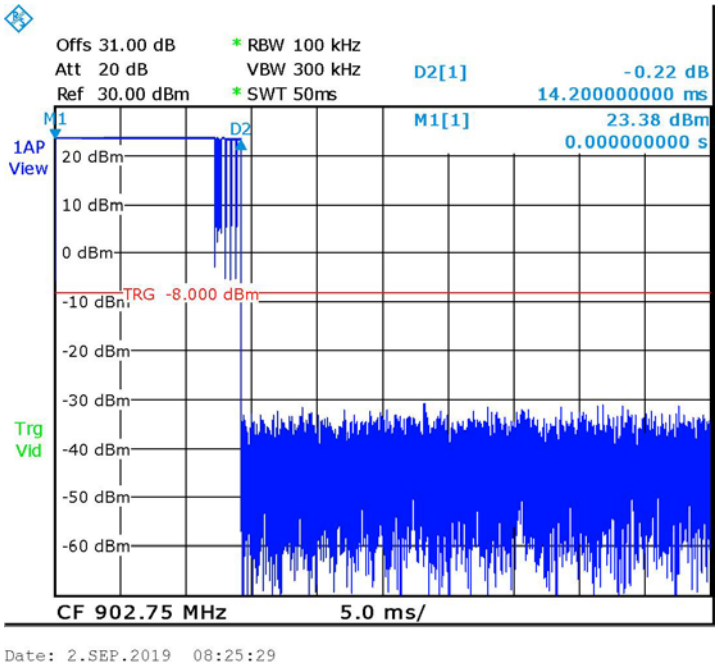


**Figure 31 Burst Duration =14.2msec**

**DWELL TIME = 1*14.2m= 14.2msec<400msec**

## *9.5 Test Equipment Used, Dwell Time on Each Channel*

| Instrument | Manufacturer | Model | Serial Number | Last Calibration Date | Next Calibration Due |
|---|---|---|---|---|---|
| Spectrum Analyzer | Rohde & Schwarz | FSL6 | 100194 | March 24, 2019 | March 31, 2020 |
| 30dB Attenuator | MCL | BW-S30W5 | 533 | December 24, 2018 | December 31, 2019 |
| RF Cable | EIM | 705A009301EIM | - | December 24, 2018 | December 31, 2019 |

**Figure 32 Test Equipment Used**

# 10. Band Edge

## 10.1 Test Specification

FCC Part 15, Section 15.247(d)

## 10.2 Test Procedure

(Temperature (20°C)/ Humidity (60%RH))
The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable.
The transmitter unit operated in 2 modes: hopping enabled and hopping disabled.
The RBW was set to 100 kHz.

The EMI receiver was adjusted to the transmission channel at the maximum level. The display line was set to 20 dBc and the EMC analyzer was set to the band edge frequencies.

The E.U.T. was tested at the lower and the upper channels.

## 10.3 Test Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

## 10.4 Test Results

| Modulation | Mode | Operation Frequency (MHz) | Band Edge Frequency (MHz) | Spectrum Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|
| ASK | Hopping | 902.75-927.25 | 902.0 | -17.6 | 3.5 | -21.1 |
| | | | 928.0 | -28.4 | 4.1 | -32.5 |
| | Non-Hopping | 902.75 | 902.0 | -16.3 | 3.7 | -20.0 |
| | | 927.25 | 928.0 | -14.6 | 3.5 | -18.1 |

**Figure 33 Band Edge Test Results**

JUDGEMENT: Passed by 18.1 dB

For additional information see *Figure 34* to *Figure 37*.

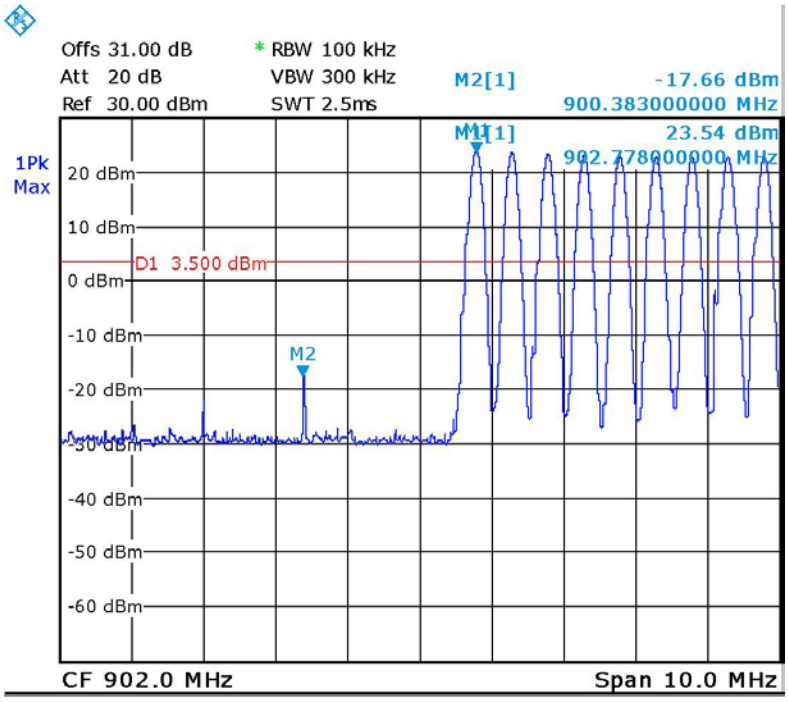


**Figure 34 Hopping, Band Edge - Low**

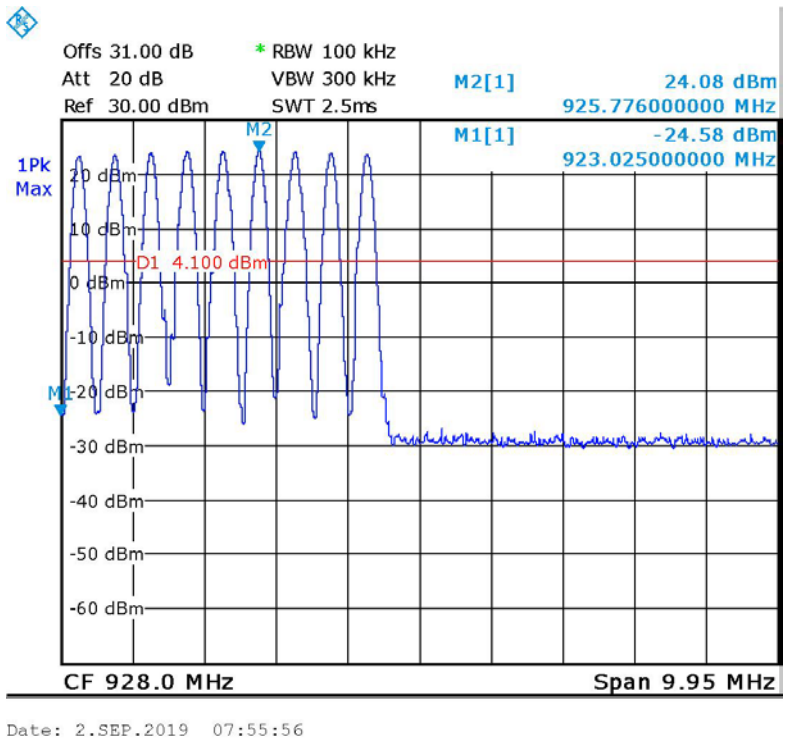


**Figure 35 Hopping, Band Edge - High**

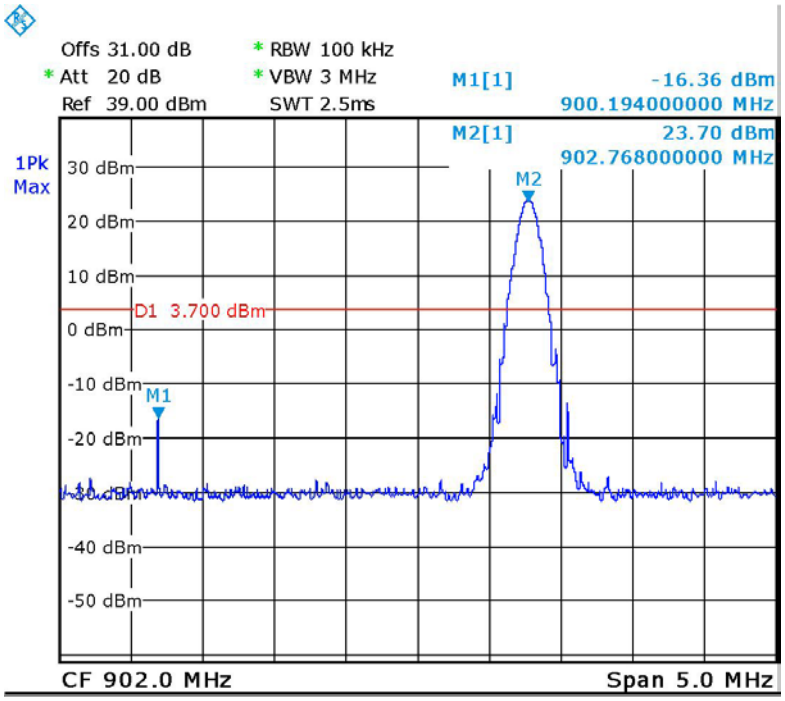


**Figure 36 Non-Hopping, Band Edge - Low**

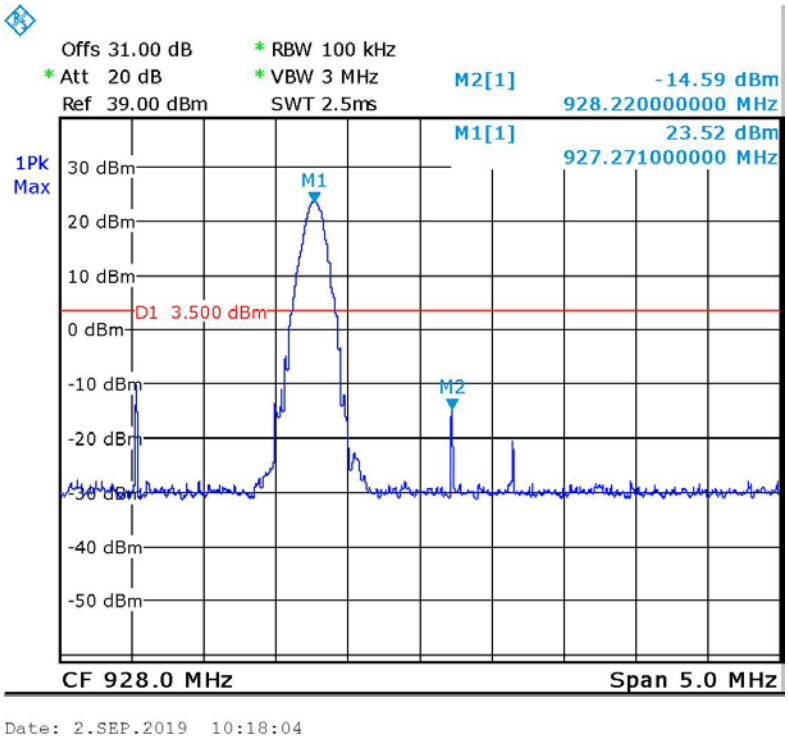


**Figure 37 Non-Hopping, Band Edge - High**

### *10.5 Test Equipment Used, Band Edge*

| Instrument | Manufacturer | Model | Serial Number | Last Calibration Date | Next Calibration Due |
|---|---|---|---|---|---|
| Spectrum Analyzer | Rohde & Schwarz | FSL6 | 100194 | March 24, 2019 | March 31, 2020 |
| 30dB Attenuator | MCL | BW-S30W5 | 533 | December 24, 2018 | December 31, 2019 |
| RF Cable | EIM | 705A009301EIM | - | December 24, 2018 | December 31, 2019 |

**Figure 38 Test Equipment Used**

# 11. Emissions in Non-Restricted Frequency Bands

## *11.1 Test Specification*

FCC, Part 15, Subpart C, Section 247(d)

## *11.2 Test Procedure*

(Temperature (20°C)/ Humidity (60%RH))
The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable.

The frequency range 0.009-10,000.0 MHz was scanned to find other emissions that don't fall in the restricted band.
RBW was set to 100 kHz, detector set to max peak and trace to "max hold".
These frequencies were measured using a peak detector.

## *11.3 Test Limit*

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

## *11.4 Test Results*

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 247 (d) specification.

For additional information see *Figure 39* to *Figure 41*.

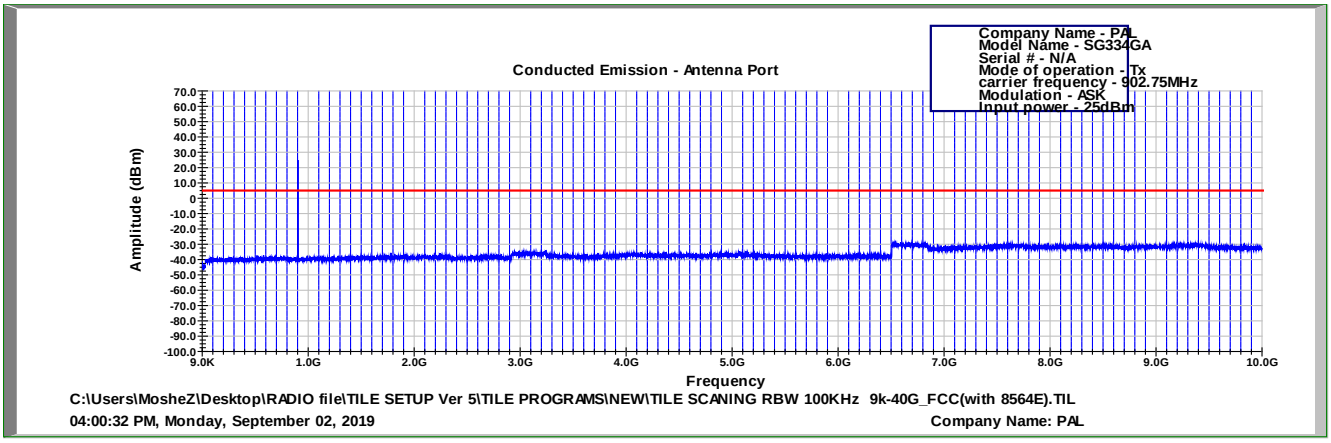


**Figure 39 Conducted Spurious Emission – 902.75MHz**

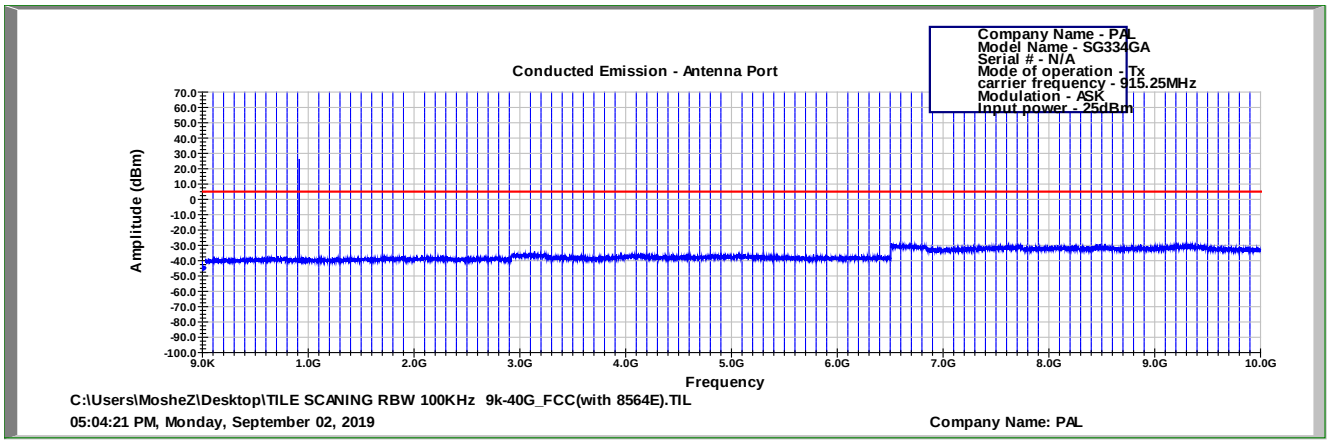


**Figure 40 Conducted Spurious Emission – 915.25MHz**

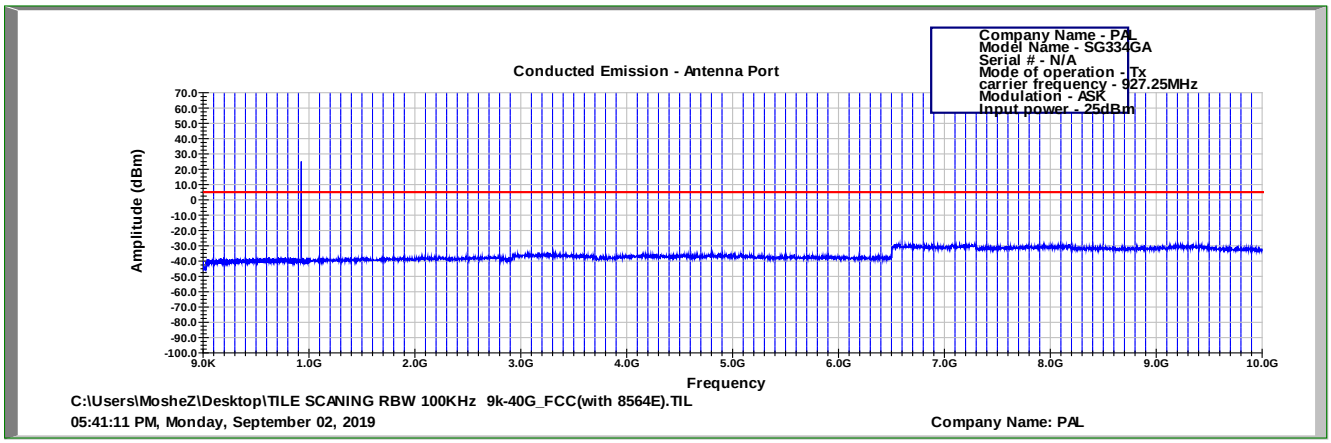


**Figure 41 Conducted Spurious Emission – 927.25MHz**

### *11.5 Test Equipment Used, Emissions in Non-Restricted Frequency Bands*

| Instrument | Manufacturer | Model | Serial Number | Last Calibration Date | Next Calibration Due |
|---|---|---|---|---|---|
| EMC Analyzer | HP | 8593 EM | 3826A00265 | February 26, 2019 | February 28, 2020 |
| 30dB Attenuator | MCL | BW-S30W5 | 533 | December 24, 2018 | December 31, 2019 |
| RF Cable | EIM | 705A009301EIM | - | December 24, 2018 | December 31, 2019 |

**Figure 42 Test Equipment Used**

# 12. Emissions in Restricted Frequency Bands

## *12.1 Test Specification*

FCC, Part 15, Subpart C, Sections 247(d), 15.205, 15.209

## *12.2 Test Procedure*

(Temperature (20°C)/ Humidity (60%RH))
The E.U.T. operation mode and test set-up are as described in Section 2 of this report.

**For measurements between 0.009MHz-30MHz:**

The E.U.T was tested inside the shielded room at a distance of 3 meters and the E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The frequency range 0.009MHz-30MHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

**For measurements between 30.0MHz-1.0GHz**:
A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The frequency range 30.0MHz -1.0GHz was scanned and the list of the highest emissions was verified and updated accordingly.
The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

**For measurements between 1.0GHz-10.0GHz:**

The E.U.T was tested inside the shielded room at a distance of 3 meters and the E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The frequency range 1.0GHz -10.0GHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

## 12.3 Test Limit

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

| Frequency (MHz) | Field strength (microvolts/meter) | Measurement distance (meters) | Field strength* (dBµV/m) | Field strength* (dBµV/m)@3m |
|---|---|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 | 48.5-13.8 | 128.5-73.8 |
| 0.490-1.705 | 24000/F(kHz) | 30 | 33.8-23.0 | 73.8-63.0 |
| 1.705-30.0 | 30 | 30 | 29.5 | 69.5 |
| 30-88 | 100 | 3 | 40.0 | 40.0 |
| 88-216 | 150 | 3 | 43.5 | 43.5 |
| 216-960 | 200 | 3 | 46.0 | 46.0 |
| Above 960 | 500 | 3 | 54.0 | 54.0 |

*The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector. For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

## 12.4 Test Results

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 209 specification.

For additional information see *Figure 43.*

# Radiated Emission

E.U.T Description Smart Gate
Type SG334GA
Serial Number: RD300100275

Specification: FCC, Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d);

Antenna Polarization: Horizontal/Vertical Frequency Range: 9 kHz to 10.0 GHz
Modulation: ASK Detector: Peak, Average

| Operation Frequency | Freq. | Pol. | Peak Reading | Peak Limit | Peak Margin | Average Reading | Average Limit | Average Margin |
|---|---|---|---|---|---|---|---|---|
| (MHz) | (MHz) | (H/V) | (dBµV/m) | (dBµV/m) | (dB) | (dBµV/m) | (dBµV/m) | (dB) |
| 902.75 | 2708.25 | V | 56.8 | 74.0 | -17.2 | 39.9 | 54.0 | -14.1 |
| | 2708.25 | H | 57.8 | 74.0 | -16.2 | 40.9 | 54.0 | -13.1 |
| 915.25 | 2745.75 | V | 58.0 | 74.0 | -16.0 | 41.1 | 54.0 | -12.9 |
| | 2745.75 | H | 60.1 | 74.0 | -13.9 | 43.2 | 54.0 | -10.8 |
| 927.25 | 2781.75 | V | 59.8 | 74.0 | -14.2 | 42.9 | 54.0 | -11.1 |
| | 2781.75 | H | 61.9 | 74.0 | -12.1 | 45.0 | 54.0 | -9.0 |

**Figure 43. Radiated Emission Results**

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Amp" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

### *12.5 Test Equipment Used, Emissions in Restricted Frequency Bands*

| Instrument | Manufacturer | Model | Serial No. | Last Calibration Date | Next Calibration Due |
|---|---|---|---|---|---|
| EMI Receiver | R&S | ESCI7 | 100724 | February 27, 2019 | February 28, 2019 |
| EMI Receiver | HP | 8542E | 3906A00276 | February 28, 2019 | February 28, 2020 |
| RF Filter Section | HP | 85420E | 3705A00248 | February 28, 2019 | February 28, 2020 |
| Spectrum Analyzer | HP | 8593EM | 3536A00120 ADI | February 26, 2019 | February 28, 2020 |
| Active Loop Antenna | EMCO | 6502 | 9506-2950 | October 19, 2017 | October 31, 2019 |
| Biconical Antenna | EMCO | 3110B | 9912-3337 | May 21, 2019 | May 31, 2020 |
| Log Periodic Antenna | EMCO | 3146 | 9505-4081 | May 31, 2018 | May 31, 2020 |
| Horn Antenna | ETS | 3115 | 29845 | May 31, 2018 | May 31, 2021 |
| MicroWave System Amplifier | HP | 83006A | 3104A00589 | December 24, 2018 | December 31, 2019 |
| Low Noise Amplifier 1GHz-18GHz | Miteq | AFSX4-02001800-50-8P | - | December 24, 2018 | December 31, 2019 |
| RF Cable Chamber | Commscope ORS | 0623 WBC-400 | G020132 | December 24, 2018 | December 31, 2019 |
| RF Cable Oats | EIM | RG214-11N(X2) | | May 26, 2019 | May 31. 2020 |
| Semi Anechoic Civil Chamber | ETS | S81 | SL 11643 | NCR | NCR |
| Antenna Mast | ETS | 2070-2 | 9608-1497 | NCR | NCR |
| Turntable | ETS | 2087 | - | NCR | NCR |
| Mast & Table Controller | ETS/EMCO | 2090 | 9608-1456 | NCR | NCR |

**Figure 44 Test Equipment Used**

# 13. Avg. Factor Calculation

1. Pulse period = 1 (worst scenario)
2. Pulse duration = 1 (worst scenario)
3. Burst duration = 14.2msec

4. $$\text{Average Factor} = 20\log\left[\frac{\text{Pulse duration}}{\text{Pulse period}} \times \frac{\text{burst duration}}{\text{100msec}} \times \text{Num of burst within 100msec}\right]$$

5. Average factor = -16.9dB

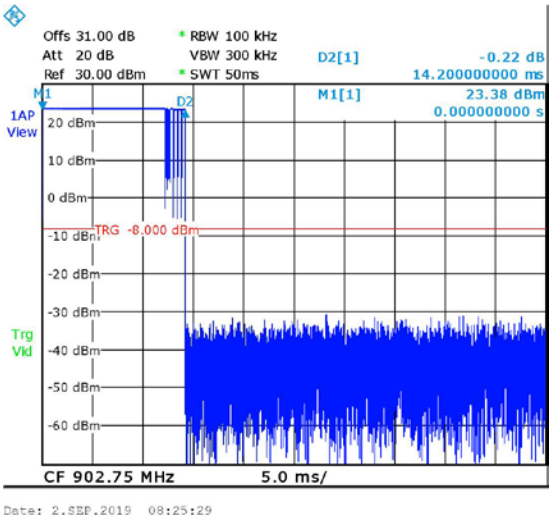


**Figure 45. Burst Duration**

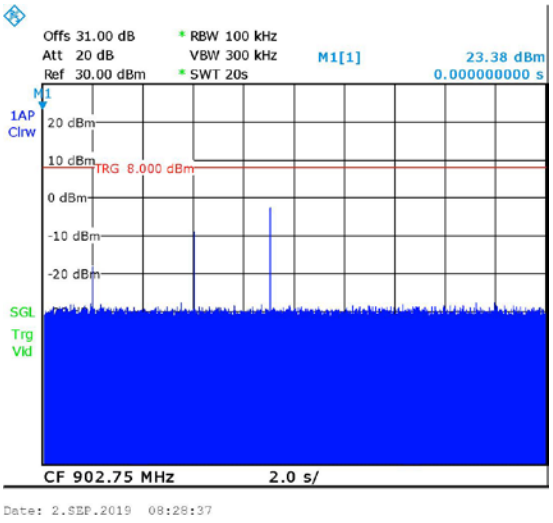


**Figure 46. Number of Bursts in 100msec=1**

### *13.1 Test Equipment Used, Average Factor*

| Instrument | Manufacturer | Model | Serial Number | Last Calibration Date | Next Calibration Due |
|---|---|---|---|---|---|
| Spectrum Analyzer | Rodhe & Schwarz | FSL6 | 100194 | March 24, 2019 | March 31, 2020 |

**Figure 47 Test Equipment Used**

# 14. Antenna Gain/Information

Dual RHCP+LHCP Reader Antenna
Max antenna gain 8.57dBi

# 15. R.F Exposure/Safety

The typical placement of the E.U.T. is on a parking garage gate. The typical distance between the E.U.T. and the user is at least 20cm.

Calculation of Maximum Permissible Exposure (MPE)

Based on 47CFR1 Section 1.1307(b)(1) Requirements

(a) FCC Limit at 915.25 MHz is: f/1500 = 0.61mW/cm$^2$

Using Table 1 of 47CFR1 Section 1.1310 limit for general population/uncontrolled exposures, the above levels are an average over 30 minutes.

(b) The power density produced by the E.U.T. is:

$$S = \frac{P_t G_t}{4\pi R^2}$$

$P_t$ = Calculated Transmitted Power 24.7dBm = 295.12 mW

$G_t$ = Antenna Gain 8.57Bi = 7.19 numeric

R = Distance From Transmitter 20 cm

(c) The peak power density produced by the E.U.T. is:
(295.12 x 7.19)/(4)(π)(20$^2$) =0.42 mW/cm$^2$

(d) This is below the FCC limit.

# 16. APPENDIX A - CORRECTION FACTORS

## *16.1 Correction factors for RF OATS Cable 35m ITL #1911*

| Frequency (MHz) | loss (dB) |
|---|---|
| 30.0 | 1.3 |
| 50.0 | 1.7 |
| 100.0 | 2.6 |
| 200.0 | 3.7 |
| 300.0 | 4.7 |
| 400.0 | 5.5 |
| 500.0 | 6.3 |
| 600.0 | 7.0 |
| 700.0 | 7.6 |
| 800.0 | 8.4 |
| 900.0 | 9.0 |
| 1000.0 | 9.6 |

## *16.2 Correction Factors for RF Cable for Anechoic Chamber ITL #1840*

| FREQ (MHz) | LOSS (dB) |
|---|---|
| 1000.0 | 1.5 |
| 2000.0 | 2.1 |
| 3000.0 | 2.7 |
| 4000.0 | 3.1 |
| 5000.0 | 3.5 |
| 6000.0 | 4.1 |
| 7000.0 | 4.6 |
| 8000.0 | 4.9 |
| 9000.0 | 5.7 |
| 10000.0 | 5.7 |
| 11000.0 | 6.1 |
| 12000.0 | 6.1 |
| 13000.0 | 6.2 |
| 14000.0 | 6.7 |
| 15000.0 | 7.4 |
| 16000.0 | 7.5 |
| 17000.0 | 7.9 |
| 18000.0 | 8.1 |
| 19000.0 | 8.8 |
| 20000.0 | 9.1 |

*NOTES:*

*1. The cable is manufactured by Commscope*

*2. The cable type is 0623 WBC-400, serial # G020132 and 10m long*

## *16.3 Correction Factors for Active Loop Antenna ITL # 1075*

| F(MHz) | AF(dB/m) |
|---|---|
| 0.01 | 18.4 |
| 0.02 | 14.3 |
| 0.03 | 13.3 |
| 0.05 | 11.7 |
| 0.1 | 11.4 |
| 0.2 | 11.2 |
| 0.3 | 11.2 |
| 0.5 | 11.2 |
| 0.7 | 11.2 |
| 1 | 11.4 |
| 2 | 11.5 |
| 3 | 11.5 |
| 4 | 11.4 |
| 5 | 11.3 |
| 6 | 11.1 |
| 7 | 11.1 |
| 8 | 11.1 |
| 9 | 11 |
| 10 | 11 |
| 20 | 10 |
| 30 | 8 |

## *16.4 Correction Factors for Biconical Antenna ITL #1356, EMCO 3110B 9912-3337*

| Frequency [MHz] | AF [dB/m] |
|---|---|
| 30 | 13.00 |
| 35 | 10.89 |
| 40 | 10.59 |
| 45 | 10.63 |
| 50 | 10.12 |
| 60 | 9.26 |
| 70 | 7.74 |
| 80 | 6.63 |
| 90 | 8.23 |
| 100 | 11.12 |
| 120 | 13.16 |
| 140 | 13.07 |
| 160 | 14.80 |
| 180 | 16.95 |
| 200 | 17.17 |

## *16.5 Correction Factors for Log Periodic Antenna ITL # 1349, EMCO 3146 s/n 9505-4081*

| Frequency [MHz] | AF [dB/m] |
|---|---|
| 200 | 11.58 |
| 250 | 12.04 |
| 300 | 14.76 |
| 400 | 15.55 |
| 500 | 17.85 |
| 600 | 18.66 |
| 700 | 20.87 |
| 800 | 21.15 |
| 900 | 22.32 |
| 1000 | 24.22 |

## *16.6 Correction Factors for Double – Ridged Waveguide Horn Antenna - 3m range*

### *ITL # 1352, ETS 3115 s/n 29845*

| FREQUENCY (GHz) | AFE (dB/m) | FREQUENCY (GHz) | AFE (dB/m) |
|---|---|---|---|
| 0.75 | 25.0 | 9.5 | 38.0 |
| 1.0 | 23.5 | 10.0 | 38.5 |
| 1.5 | 26.0 | 10.5 | 38.5 |
| 2.0 | 29.0 | 11.0 | 38.5 |
| 2.5 | 27.5 | 11.5 | 38.5 |
| 3.0 | 30.0 | 12.0 | 38.0 |
| 3.5 | 31.5 | 12.5 | 38.5 |
| 4.0 | 32.5 | 13.0 | 40.0 |
| 4.5 | 32.5 | 13.5 | 41.0 |
| 5.0 | 33.0 | 14.0 | 40.0 |
| 5.5 | 35.0 | 14.5 | 39.0 |
| 6.0 | 36.5 | 15.0 | 38.0 |
| 6.5 | 36.5 | 15.5 | 37.5 |
| 7.0 | 37.5 | 16.0 | 37.5 |
| 7.5 | 37.5 | 16.5 | 39.0 |
| 8.0 | 37.5 | 17.0 | 40.0 |
| 8.5 | 38.0 | 17.5 | 42.0 |
| 9.0 | 37.5 | 18.0 | 42.5 |