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**DATE: 23 December 2018**

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

# **FCC/IC Radio Test Report**

**For**

**Magos Systems Ltd.**

**Equipment under test:**

## **Outdoor Radar Based Perimeter Security Sensor**

**SR500 , SR250\***

\*See customer declaration on page 5

Tested by:

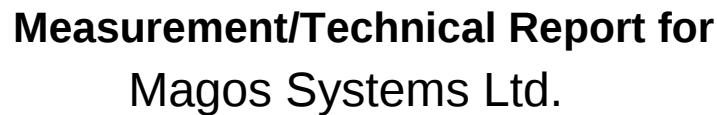
  
M. Zohar

Approved by:

  
D. Shidlowsky

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This report relates only to items tested.



# Outdoor Radar Based Perimeter Security Sensor

SR500 , SR250\*

**FCC ID: 2AFHU-SR500F**

**IC: 22587-SR500**

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

Equipment type: FCC: DSS Part 15 Spread Spectrum Transmitter  
IC: Low Power Device (5725-5875MHz)  
Radar Device  
Security Device/Alarm System

Limits used: 47CFR15 Section 15.247  
RSS 247, Issue 2, February 2017, Section 5  
RSS-Gen, Issue 5, April 2018

Measurement procedures used are KDB 558074 D01 v05, and ANSI C63.10: 2013.

|                                               |                                                              |
|-----------------------------------------------|--------------------------------------------------------------|
| Application for Certification<br>prepared by: | Applicant for this device:<br>(different from "prepared by") |
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## 1. General Information

### 1.1 Administrative Information

|                                |                                                                                                              |
|--------------------------------|--------------------------------------------------------------------------------------------------------------|
| Manufacturer:                  | Magos Systems Ltd.                                                                                           |
| Manufacturer's Address:        | 13 Gad Feinstein St.,<br>Rehovot, 7638517<br>Israel<br>Tel: +972-77-414-0155<br>Fax: +972-77-414-0165        |
| Manufacturer's Representative: | Amit Isserof                                                                                                 |
| Equipment Under Test (E.U.T):  | Outdoor Radar Based Perimeter Security Sensor                                                                |
| Equipment PMN:                 | SR500 , SR250* (*See declaration on following page)                                                          |
| Equipment Serial No.:          | Not designated                                                                                               |
| HVIN:                          | SR500F                                                                                                       |
| Date of Receipt of E.U.T:      | July 10, 2018                                                                                                |
| Start of Test:                 | July 10, 2018                                                                                                |
| End of Test:                   | July 15, 2018                                                                                                |
| Test Laboratory Location:      | I.T.L (Product Testing) Ltd.<br>1 Batsheva St.,<br>Lod<br>ISRAEL 7120101                                     |
| Test Specifications:           | FCC, Subpart C, Section 15.247<br>RSS 247, Issue 2, February 2017, Section 5<br>RSS-Gen, Issue 5, April 2018 |



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Date: June 13, 2018

To ITL

Our company is in the process of launching a new product labeled "SR250".  
We hereby declare that the SR250 is identical to the SR500 in terms of:

- 1) electrical schematics,
- 2) HW components,
- 3) RF behavior: transmit power, transmit frequency, emitted radiation, susceptibility etc.
- 4) Power consumption
- 5) External enclosure
- 6) PCB layout
- 7) All mechanical components

In fact the SR250 and the SR500 are one and the same product. The only difference between them is that SR250 SW is limited to process and produce detections only up to roughly 300m, while the SR500 is limited to 700m.

Sincerely,

Amit Isseroff  
VP R&D  
Magos Ltd.



## **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. Industry Canada (Canada), IC File No.: 46405-4025; Site Nos. IC 4025A-1, IC 4025A-2.

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**

#### **High Resolution Short-Range Ground Surveillance Radar**

The SR-500 is the most cost effective perimeter protection solution for both rural and more saturated environments, without compromising detection performance.

By utilizing state of the art MIMO & Digital beam forming technology the SR-500 covers

an area of more than 250,000m<sup>2</sup>(>61acres) with a detection range of 400m for Walker and 600m for vehicle/boat, and yet consumes extremely low power (<5W) and small form factor.

The SR-500 boasts an ultra-high range resolution of 0.4m giving it excellent performance in cluttered environments. Its small size, low power consumption and low weight make it simple to install and renders it ideal as a deployable system.

|                           |                              |
|---------------------------|------------------------------|
| Working voltage           | 48VDC via POE                |
| Mode of operation         | Transceiver                  |
| Modulation                | N/A                          |
| Assigned Frequency Range  | 5725.0-5850.0MHz             |
| Operating Frequency Range | 5726.0-5849.0MHz             |
| Transmit power(conducted) | ~ 17.0dBm                    |
| Antenna Gain              | +9dBi integral Patch antenna |
| Modulation BW             | N/A(CW mode)                 |
| Bit rate (Mbit/s)         | N/A                          |

### 1.4 **Test Methodology**

Radiated testing was performed according to the procedures in KDB 558074 D01 v05 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):  
 $\pm 4.96$  dB

1 GHz to 6 GHz

Expanded Uncertainty (95% Confidence, K=2):  
 $\pm 5.19$  dB

>6 GHz

Expanded Uncertainty (95% Confidence, K=2):  
 $\pm 5.51$  dB

## 2. System Test Configuration

### 2.1 Justification

1. The E.U.T contains a 5.7GHz transceiver.
2. Some evaluations were performed in hopping mode and some in non-hopping mode in the low channel (5726MHz), mid channel (5787MHz) and high channel (5849MHz).
3. Testing was performed with the E.U.T in installation orientation position.

### 2.2 EUT Exercise Software

No special exercise software was used.

### 2.3 Special Accessories

| Equipment            | Manufacturer                  | Part Number | Serial Number |
|----------------------|-------------------------------|-------------|---------------|
| Laptop               | Lenovo                        | 2518-R8G    | R8-0YHG8      |
| AC/DC Laptop Charger | Lenovo                        | ADLX90NLT3A | N/A           |
| POE Injector         | TP-LINK TECHNOLOGIES CO, LTD. | TL-POE150S  | 2166533000679 |
| AC/DC Power Supply   | TP-LINK TECHNOLOGIES CO, LTD. | T480050-2C1 | N/A           |

### 2.4 Equipment Modifications

No modifications were needed in order to achieve compliance.

### 2.5 Configuration of Tested System

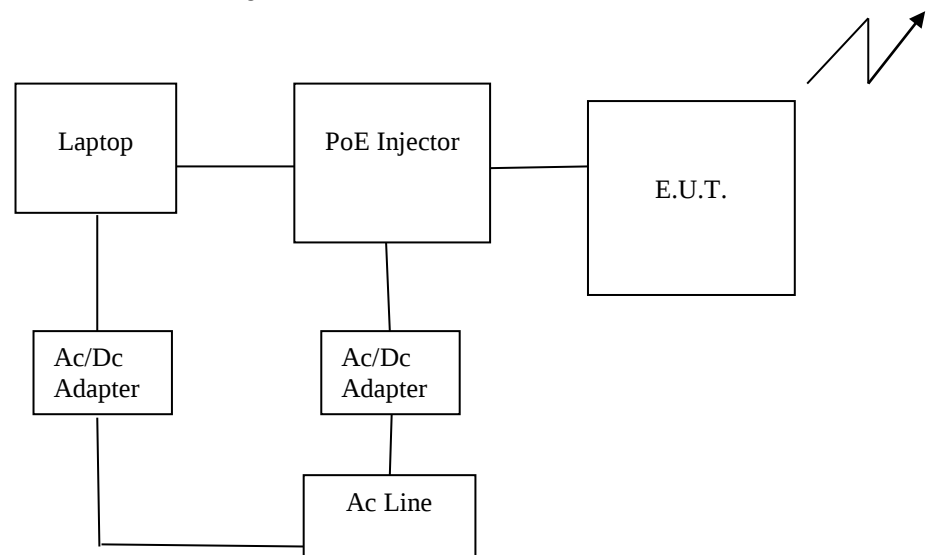


Figure 1. Configuration of Tested System

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



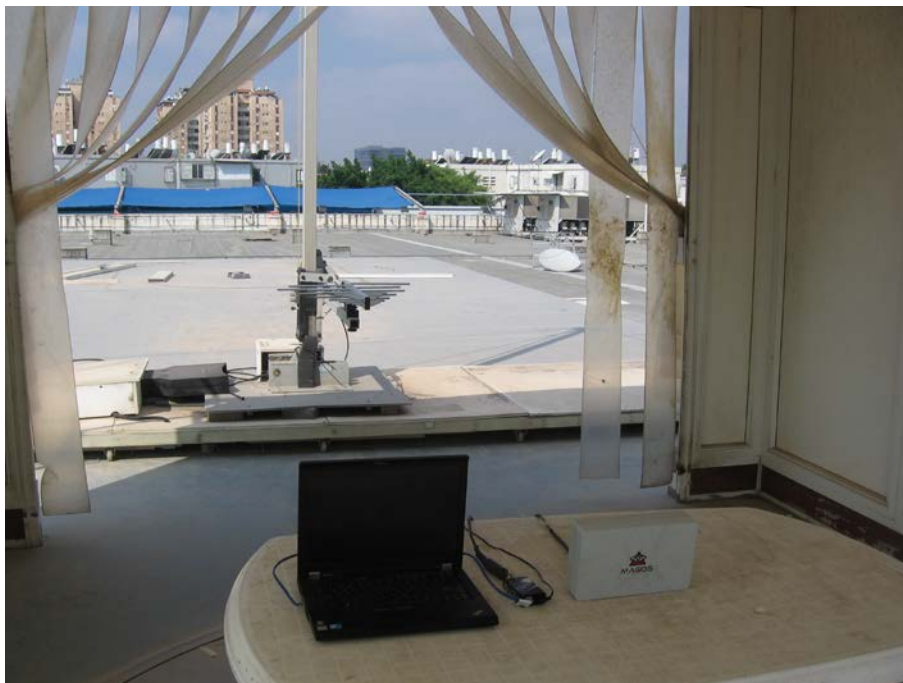
Figure 2. Conducted Emission From AC Mains



Figure 3. Radiated Emission Test, 0.009-30MHz band



**Figure 4. Radiated Emission Test, 30-200MHz band**



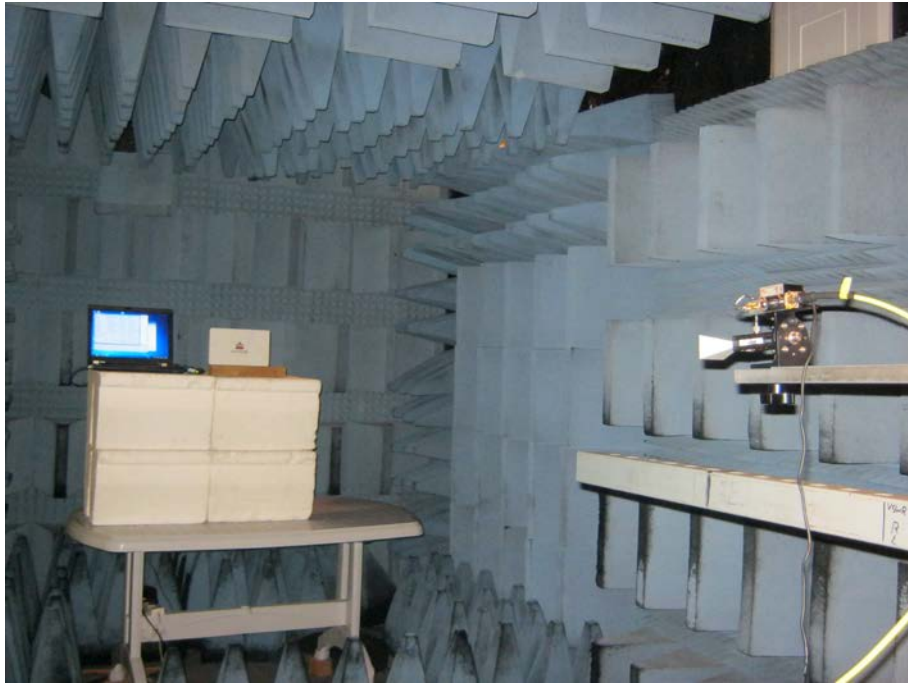
**Figure 5. Radiated Emission Test, 200-1000MHz band**



**Figure 6. Radiated Emission Test, 1000-18,000MHz band**



**Figure 7. Radiated Emission Test, 18,000-26,500MHz band**



**Figure 8. Radiated Emission Test, 26,500-40,000MHz band**

## 4. Conducted Emission From AC Mains

### 4.1 Test Specification

FCC Part 15, Subpart C, Section 15.207  
RSS Gen, Issue 5, Section 8.8

### 4.2 Test Procedure

(Temperature (22°C)/ Humidity (55%RH))

The E.U.T operation mode and test setup are as described in Section 2 of this report. In order to minimize background noise interference, the conducted emission testing was performed inside a shielded room, with the E.U.T placed on a 0.8 meter high wooden table, 0.4 meter from the room's vertical wall. In the case of a floor-standing E.U.T., it was placed on the horizontal ground plane.

The E.U.T was powered from 115 V AC / 60 Hz via 50 Ohm / 50  $\mu$ Hn Line Impedance Stabilization Network (LISN) on the phase and neutral lines. The LISN's were grounded to the shielded room ground plane (floor), and were kept at least 0.8 meters from the nearest boundary of the E.U.T.

The center of the E.U.T.'s AC cable was folded back and forth, in order to form a bundle less than 0.40 meters and a total cable length of 1 meter.

The effect of varying the position of the cables was investigated to find the configuration that produces maximum emission. The configuration tested is shown in the photograph, *Figure 2. Conducted Emission From AC Mains*.

The emission voltages at the LISN's outputs were measured using a computerized receiver, complying with CISPR 16 requirements. The specification limits are loaded to the receiver and are displayed on the receiver's spectrum display.

The E.U.T was evaluated in TX operation mode.

A frequency scan between 0.15 and 30 MHz was performed at 9 kHz I.F. band width, using peak detection.

The spectral components having the highest level on each line were measured using a quasi-peak and average detector.

### 4.3 Test Limit

| Frequency of emission (MHz) | Conducted limit (dB $\mu$ V) |           |
|-----------------------------|------------------------------|-----------|
|                             | Quasi-peak                   | Average   |
| 0.15-0.5                    | 66 to 56*                    | 56 to 46* |
| 0.5-5                       | 56                           | 46        |
| 5-30                        | 60                           | 50        |

\* Decreases with the logarithm of the frequency.



#### 4.4 **Test Results**

JUDGEMENT: Passed by 6.9 dB

The margin between the emission levels and the specification limit is, in the worst case, 7.7 dB for the phase line at 0.53 MHz and 6.9 dB at 0.51 MHz for the neutral line.

The EUT met the F.C.C. Part 15, Subpart C and RSS-Gen, Issue 5, clause 8.8 specification requirements.

The details of the highest emissions are given in *Figure 9* to *Figure 12*.



## Conducted Emission

E.U.T Description Outdoor Radar Based  
Perimeter Security Sensor  
Type SR500  
Serial Number: Not designated

Specification: FCC Part 15, Subpart C;  
RSS-Gen, Issue 5, clause 8.8

Lead: Phase

Detectors: : Peak, Quasi-peak, Average

Power Operation POE

| EDIT PEAK LIST (Final Measurement Results) |           |            |                |
|--------------------------------------------|-----------|------------|----------------|
| Trace1:                                    | CE22BQF   |            |                |
| Trace2:                                    | CE22BAP   |            |                |
| Trace3:                                    | ---       |            |                |
| TRACE                                      | FREQUENCY | LEVEL dBμV | DELTA LIMIT dB |
| 1 Quasi Peak                               | 158 kHz   | 46.23      | -19.33         |
| 2 Average                                  | 158 kHz   | 29.66      | -25.90         |
| 2 Average                                  | 186 kHz   | 26.37      | -27.83         |
| 1 Quasi Peak                               | 194 kHz   | 41.84      | -22.02         |
| 2 Average                                  | 194 kHz   | 26.59      | -27.26         |
| 1 Quasi Peak                               | 254 kHz   | 35.79      | -25.83         |
| 1 Quasi Peak                               | 526 kHz   | 45.09      | -10.90         |
| 2 Average                                  | 526 kHz   | 38.34      | -7.65          |
| 2 Average                                  | 1.086 MHz | 26.73      | -19.26         |
| 1 Quasi Peak                               | 1.102 MHz | 32.01      | -23.98         |
| 1 Quasi Peak                               | 1.41 MHz  | 30.91      | -25.08         |
| 2 Average                                  | 1.734 MHz | 26.47      | -19.52         |
| 1 Quasi Peak                               | 1.818 MHz | 31.24      | -24.75         |
| 2 Average                                  | 2.426 MHz | 25.94      | -20.05         |
| 1 Quasi Peak                               | 2.502 MHz | 31.10      | -24.89         |
| 2 Average                                  | 6.974 MHz | 24.74      | -25.25         |
| 2 Average                                  | 7.162 MHz | 24.69      | -25.30         |
| 2 Average                                  | 7.67 MHz  | 24.49      | -25.50         |
| 1 Quasi Peak                               | 8.054 MHz | 30.59      | -29.40         |

Date: 15.JUL.2018 08:32:15

**Figure 9. Detectors: Peak, Quasi-peak, Average**

*Note: QP Delta/Av Delta 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.*

## Conducted Emission

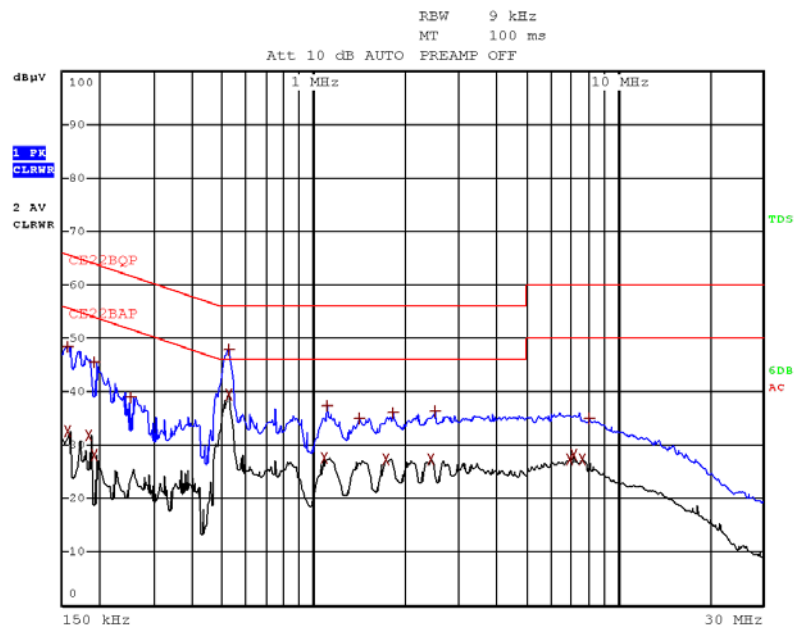
E.U.T Description Outdoor Radar Based  
Perimeter Security Sensor  
Type SR500  
Serial Number: Not designated

Specification: FCC Part 15, Subpart C  
RSS-Gen, Issue 5, clause 8.8

Lead: Phase

Detectors: Peak, Quasi-peak, Average

Power Operation POE



Date: 15.JUL.2018 08:30:46

**Figure 10. Detectors: Peak, Quasi-peak, Average**



## Conducted Emission

E.U.T Description Outdoor Radar Based Perimeter  
Security Sensor  
Type SR500  
Serial Number: Not designated

Specification: FCC Part 15, Subpart C  
RSS-Gen, Issue 5, clause 8.8  
Lead: Neutral  
Detectors: Peak, Quasi-peak, Average  
Power Operation POE

| EDIT PEAK LIST (Final Measurement Results) |           |            |                |  |
|--------------------------------------------|-----------|------------|----------------|--|
| Trace1:                                    | CE22BQP   |            |                |  |
| Trace2:                                    | CE22BAP   |            |                |  |
| Trace3:                                    | ---       |            |                |  |
| TRACE                                      | FREQUENCY | LEVEL dBμV | DELTA LIMIT dB |  |
| 1 Quasi Peak                               | 150 kHz   | 47.31      | -18.68         |  |
| 2 Average                                  | 150 kHz   | 32.87      | -23.12         |  |
| 1 Quasi Peak                               | 178 kHz   | 43.48      | -21.09         |  |
| 1 Quasi Peak                               | 190 kHz   | 42.40      | -21.63         |  |
| 2 Average                                  | 190 kHz   | 27.48      | -26.55         |  |
| 2 Average                                  | 202 kHz   | 25.21      | -28.31         |  |
| 1 Quasi Peak                               | 206 kHz   | 39.88      | -23.48         |  |
| 1 Quasi Peak                               | 238 kHz   | 36.18      | -25.97         |  |
| 2 Average                                  | 514 kHz   | 39.14      | -6.85          |  |
| 1 Quasi Peak                               | 522 kHz   | 45.83      | -10.17         |  |
| 1 Quasi Peak                               | 1.122 MHz | 31.65      | -24.34         |  |
| 1 Quasi Peak                               | 1.494 MHz | 30.85      | -25.14         |  |
| 1 Quasi Peak                               | 1.818 MHz | 31.24      | -24.75         |  |
| 1 Quasi Peak                               | 5.198 MHz | 31.66      | -28.33         |  |
| 2 Average                                  | 6.406 MHz | 25.54      | -24.45         |  |
| 2 Average                                  | 6.518 MHz | 25.35      | -24.64         |  |
| 2 Average                                  | 6.65 MHz  | 25.37      | -24.63         |  |
| 2 Average                                  | 6.706 MHz | 25.41      | -24.58         |  |
| 2 Average                                  | 7.338 MHz | 25.26      | -24.73         |  |
| 2 Average                                  | 7.414 MHz | 25.37      | -24.62         |  |

Date: 15.JUL.2018 08:40:23

**Figure 11. Detectors: Peak, Quasi-peak, Average**

*Note: QP Delta/Av Delta 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.*

## Conducted Emission

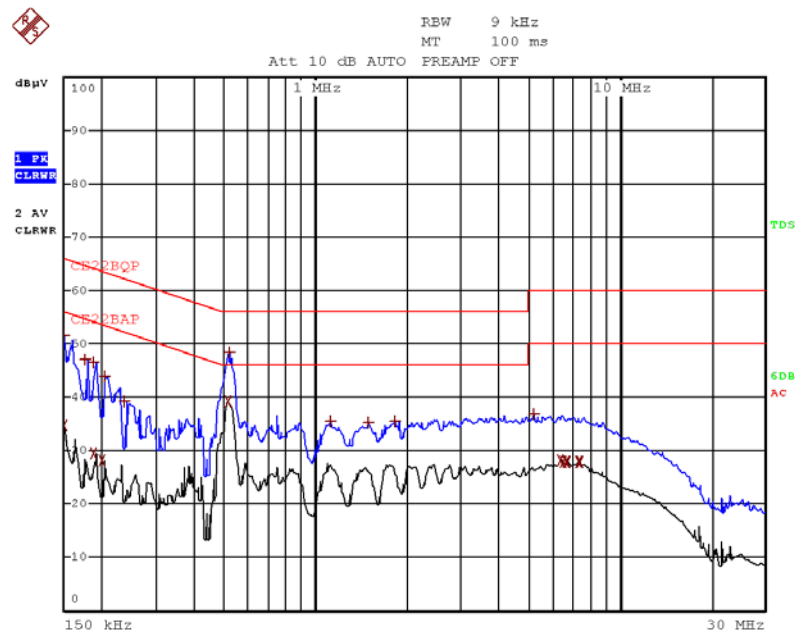
E.U.T Description Outdoor Radar Based  
Perimeter Security Sensor  
Type SR500  
Serial Number: Not designated

Specification: FCC Part 15, Subpart C  
RSS-Gen, Issue 5, clause 8.8

Lead: Neutral

Detectors: Peak, Quasi-peak, Average

Power Operation POE



Date: 15.JUL.2018 08:39:00

Figure 12 Detectors: Peak, Quasi-peak, Average



#### 4.5 Test Equipment Used; Conducted Emission from AC Mains

| Instrument               | Manufacturer        | Model        | Serial No. | Last Calibration Date | Next Calibration Due |
|--------------------------|---------------------|--------------|------------|-----------------------|----------------------|
| LISN                     | Fischer             | FCC-LISN-25A | 127        | July 20, 2017         | July 20, 2018        |
| Transient Limiter        | HP                  | 11947A       | 3107A03041 | June 25, 2018         | June 25, 2019        |
| EMI Receiver             | Rohde & Schwarz     | ESCI7        | 100724     | February 19, 2018     | February 19, 2019    |
| Cable CE Chamber 3M + 3M | Testline 18 + RJ214 | 11556        | -          | March 31, 2018        | March 31, 2019       |

Figure 13 Test Equipment Used

## 5. 20dB Minimum Bandwidth

### 5.1 Test Specification

FCC Part 15, Subpart C, section 15.247(a)(1)  
RSS 247, Issue 2, Section 5.1(a)

### 5.2 Test Procedure

(Temperature (22°C)/ Humidity (58%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was tested in the chamber, and placed on a remote-controlled turntable.

The E.U.T was placed on a non-metallic table, 1.5 meters above the ground and 3 meter distance from testing antenna.

The spectrum analyzer was set to the following parameters:

Span = ~ 2 to 3 times the 20 dB bandwidth, centered on a hopping channel

RBW  $\geq$  1% of the 20 dB bandwidth

Detector Function: Peak, Trace: Maximum Hold.

### 5.3 Test Limit

The maximum 20 dB bandwidth of the hopping channel is 1 MHz.

### 5.4 Test Results

| Operation<br>Frequency<br>(MHz) | Bandwidth<br>Reading<br>(kHz) |
|---------------------------------|-------------------------------|
| 5,726.0                         | 78.2                          |
| 5,787.0                         | 77.8                          |
| 5,849.0                         | 77.8                          |

Figure 14 — Test Results

JUDGEMENT: Passed

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

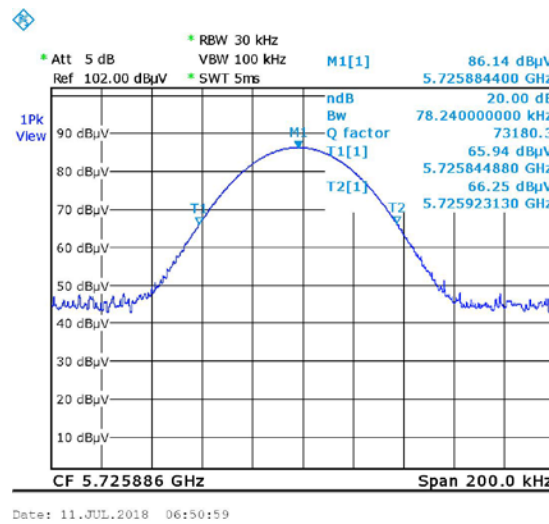


Figure 15. Low Channel

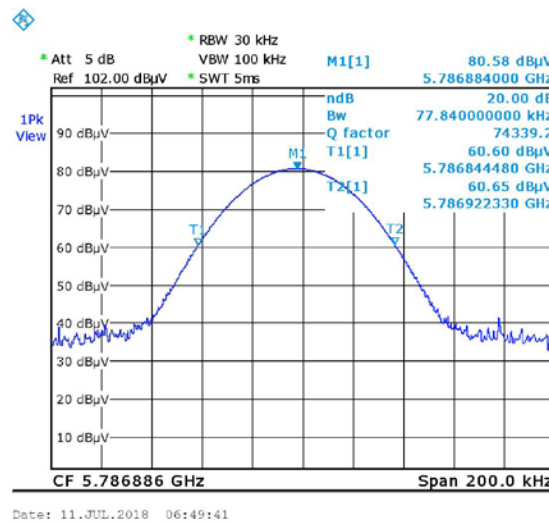


Figure 16. Mid Channel

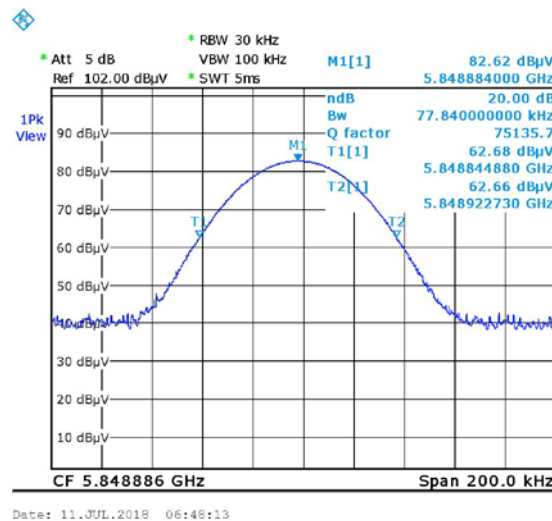


Figure 17. High Channel



### 5.5 Test Equipment Used, 20 dB Minimum Bandwidth

| Instrument                  | Manufacturer  | Model           | Serial No. | Last Calibration Date | Next Calibration Due |
|-----------------------------|---------------|-----------------|------------|-----------------------|----------------------|
| EMI Receiver                | R&S           | ESCI7           | 100724     | February 19, 2018     | February 19, 2019    |
| Horn Antenna                | ETS           | 3115            | 6142       | May 31, 2018          | May 31, 2021         |
| RF Cable                    | Commscope ORS | 0623<br>WBC-400 | G020132    | October 1, 2017       | October 1, 2018      |
| Semi Anechoic Civil Chamber | ETS           | S81             | SL 11643   | NCR                   | NCR                  |

Figure 18 Test Equipment Used

## 6. Occupied Bandwidth

### 6.1 Test Specification

FCC Part 15, Subpart C: section 2.1048  
RSS Gen, Issue 5, Section 6.6

### 6.2 Test Procedure

(Temperature (22°C)/ Humidity (55%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was tested in the chamber, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground and a 3 meter distance from testing antenna. The spectrum analyzer was set to the following parameters:

Span = ~ 2 to 3 times the occupied bandwidth, centered on a hopping channel

Detector Function: Peak, Trace: Maximum Hold.

99% Occupied bandwidth function was turn on.

### 6.3 Test Limit

N/A

### 6.4 Test Results

| Operation<br>Frequency<br>(MHz) | Bandwidth<br>Reading<br>(kHz) |
|---------------------------------|-------------------------------|
| 5,726.0                         | 65.8                          |
| 5,787.0                         | 66.2                          |
| 5,849.0                         | 66.2                          |

Figure 19 Test Results

JUDGEMENT: Passed

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

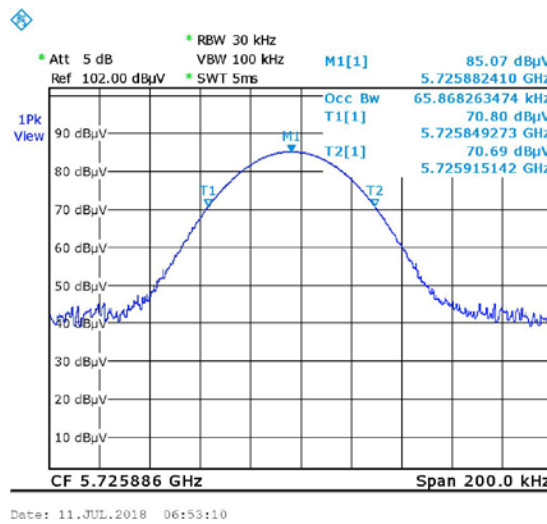


Figure 20. Low Channel

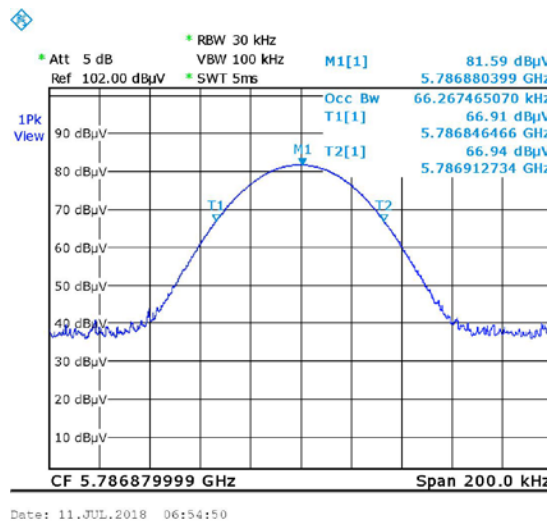


Figure 21. Mid Channel

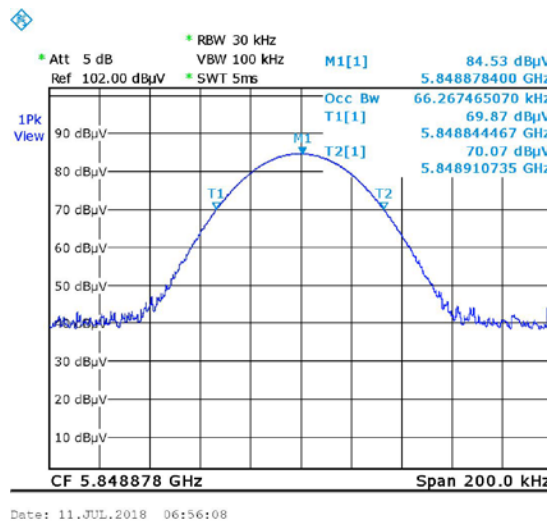


Figure 22. High Channel



### 6.5 Test Equipment Used, Occupied Bandwidth

| Instrument                     | Manufacturer     | Model           | Serial No. | Last Calibration Date | Next Calibration Due |
|--------------------------------|------------------|-----------------|------------|-----------------------|----------------------|
| EMI Receiver                   | R&S              | FSL6            | 100194     | February 19, 2018     | February 19, 2019    |
| Horn Antenna                   | ETS              | 3115            | 6142       | May 31, 2018          | May 31, 2021         |
| RF Cable                       | Commscope<br>ORS | 0623<br>WBC-400 | G020132    | October 1, 2017       | October 1, 2018      |
| Semi Anechoic<br>Civil Chamber | ETS              | S81             | SL 11643   | NCR                   | NCR                  |

**Figure 23 Test Equipment Used**

## 7. Number of Hopping Frequencies

### 7.1 Test Specification

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

RSS 247, Issue 2, Section 5.1(e)

### 7.2 Test Procedure

(Temperature (22°C)/ Humidity (62%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was tested in the chamber, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground and a 3 meter distance from testing antenna.

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

The spectrum analyzer was set to the following parameters:

RBW: 30 kHz, VBW: 100 kHz

Detector Function: Peak, Trace: Maximum Hold.

### 7.3 Test Limit

Frequency hopping systems operating in the 5725-5850 MHz band shall use at least 75 hopping frequencies.

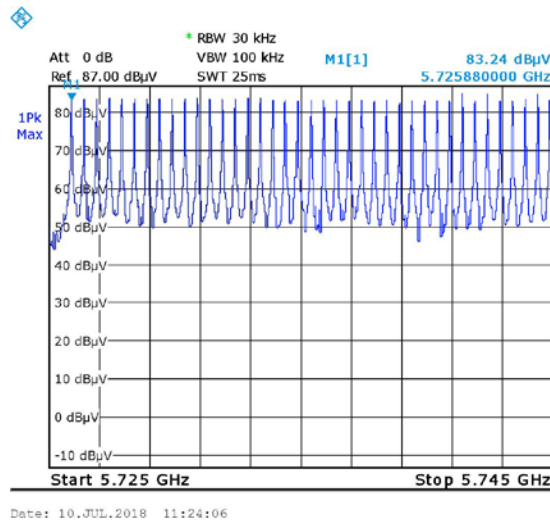
### 7.4 Test Results

| Number of Hopping Frequencies | Specification |
|-------------------------------|---------------|
| 247                           | $\geq 75$     |

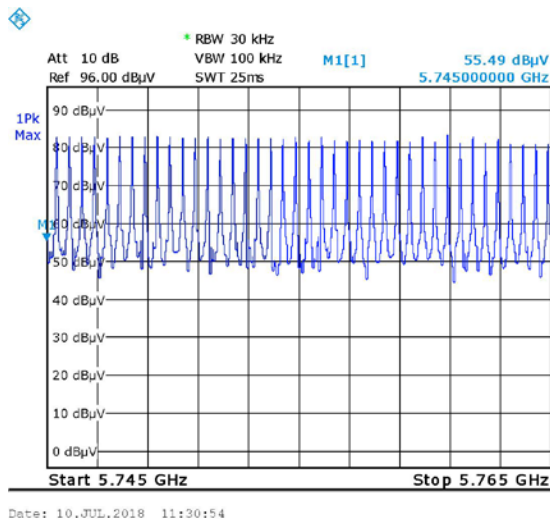
Figure 24 Test Results

JUDGEMENT: Passed

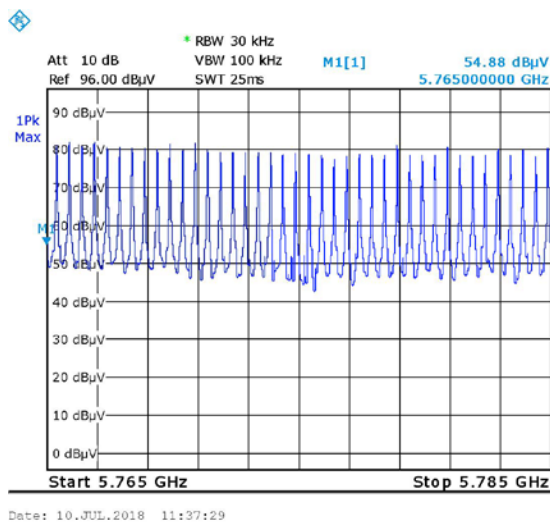
For additional information see *Figure 25 to Figure 30*.



**Figure 25. Number of Channels 5725-5745MHz band**



**Figure 26. Number of Channels 5745-5765MHz band**



**Figure 27. Number of Channels 5765-5785MHz band**

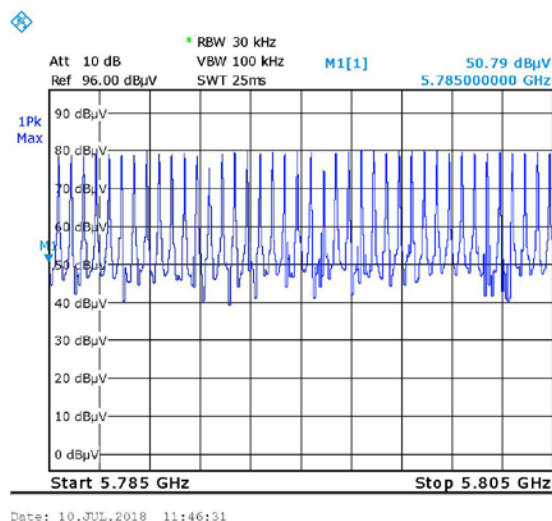


Figure 28. Number of Channels 5785-5805MHz band

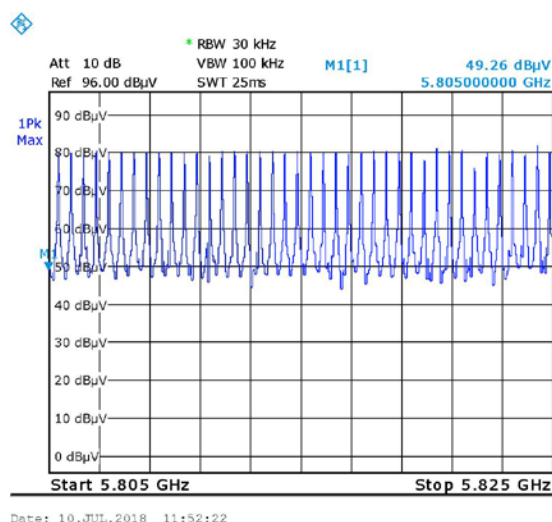


Figure 29. Number of Channels 5805-5825MHz band

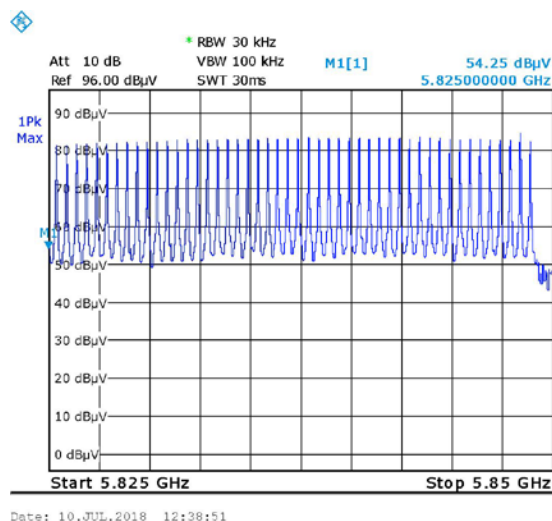


Figure 30. Number of Channels 5825-5850MHz band



### 7.5 Test Equipment Used, Number of Hopping Frequencies

| Instrument                  | Manufacturer  | Model           | Serial No. | Last Calibration Date | Next Calibration Due |
|-----------------------------|---------------|-----------------|------------|-----------------------|----------------------|
| EMI Receiver                | R&S           | FSL6            | 100194     | February 19, 2018     | February 19, 2019    |
| Horn Antenna                | ETS           | 3115            | 6142       | May 31, 2018          | May 31, 2021         |
| RF Cable                    | Commscope ORS | 0623<br>WBC-400 | G020132    | October 1, 2017       | October 1, 2018      |
| Semi Anechoic Civil Chamber | ETS           | S81             | SL 11643   | NCR                   | NCR                  |

**Figure 31 Test Equipment Used**

## 8. Channel Frequency Separation

### 8.1 Test Specification

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

RSS 247. Issue 2, Section 5.1(b)

### 8.2 Test Procedure

(Temperature (22°C)/ Humidity (55%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was tested in the chamber, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground and a 3 meter distance from testing antenna.

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  $\geq$  1% of the span

Detector Function: Peak, Trace: Maximum Hold.

### 8.3 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.

### 8.4 Test Results

| Channel<br>Frequency Separation<br>(kHz) | Limit<br>(kHz) |
|------------------------------------------|----------------|
| 499.0                                    | 77.8           |

Figure 32 Test Results

JUDGEMENT: Passed

For additional information see *Figure 33*.

## Channel Frequency Separation

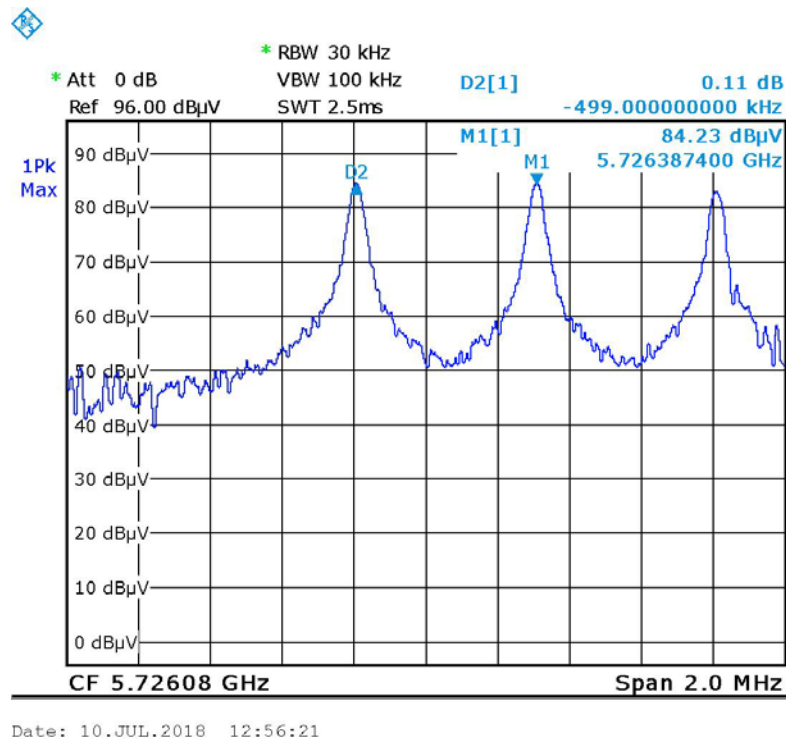


Figure 33. Channel Frequency Separation



### 8.5 Test Equipment Used, Channel Frequency Separation

| Instrument                     | Manufacturer     | Model           | Serial No. | Last Calibration Date | Next Calibration Due |
|--------------------------------|------------------|-----------------|------------|-----------------------|----------------------|
| EMI Receiver                   | R&S              | ESCI7           | 100724     | February 19, 2018     | February 19, 2019    |
| Horn Antenna                   | ETS              | 3115            | 6142       | May 31, 2018          | May 31, 2021         |
| RF Cable                       | Commscope<br>ORS | 0623<br>WBC-400 | G020132    | October 1, 2017       | October 1, 2018      |
| Semi Anechoic<br>Civil Chamber | ETS              | S81             | SL 11643   | NCR                   | NCR                  |

Figure 34 Test Equipment Used

## 9. Peak Output Power

### 9.1 Test Specification

FCC Part 15, Subpart C, Section 15.247(b)(1)  
RSS, Issue 2, Section 5.4(c)

### 9.2 Test Procedure

(Temperature (22°C)/ Humidity (55%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was tested in the chamber, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground and a 3 meter distance from testing antenna.

The spectrum analyzer was set to the following parameters:

Span = ~5 times the 20 dB bandwidth, centered on a hopping channel RBW  $\geq$  of the 20 dB bandwidth of the emission being measured.

Detector Function: Peak, Trace: Maximum Hold.

Radiated output power levels were measured at selected operation frequencies and the results were converted to power level according to the formula as shown below:

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} \quad [W]$$

E - Field Strength (V/m)

d – Distance from transmitter (m)

G – Antenna gain

P – Peak power (W)

### 9.3 Test Limit

The maximum peak conducted output power for all frequency hopping systems in the 5725-5850 MHz band: 1 watt.

#### 9.4 Test Results

| Operation Frequency (MHz) | Polarization (V/H) | Field Strength (dBuV/m) | EIRP (dBm) | Antenna Gain (dBi) | Conducted Power (dBm) | Conducted Power (mW) | Limit* (mW) | Margin (mW) |
|---------------------------|--------------------|-------------------------|------------|--------------------|-----------------------|----------------------|-------------|-------------|
| 5726.0                    | V                  | 123.3                   | 28.1       | 9.0                | 19.1                  | 81.3                 | 500.0       | -418.7      |
|                           | H                  | 107.7                   | 12.5       | 9.0                | 3.5                   | 2.2                  | 500.0       | -497.8      |
| 5787.0                    | V                  | 122.9                   | 27.7       | 9.0                | 18.7                  | 74.1                 | 500.0       | -425.9      |
|                           | H                  | 108.2                   | 13.0       | 9.0                | 4.0                   | 2.5                  | 500.0       | -497.5      |
| 5849.0                    | V                  | 123.3                   | 28.1       | 9.0                | 19.1                  | 81.3                 | 500.0       | -418.7      |
|                           | H                  | 111.1                   | 15.9       | 9.0                | 6.9                   | 4.9                  | 500.0       | -495.1      |

\*Note – Limit value reduced by 3dBi because antenna gain exceeds 6dBi by 3dB.

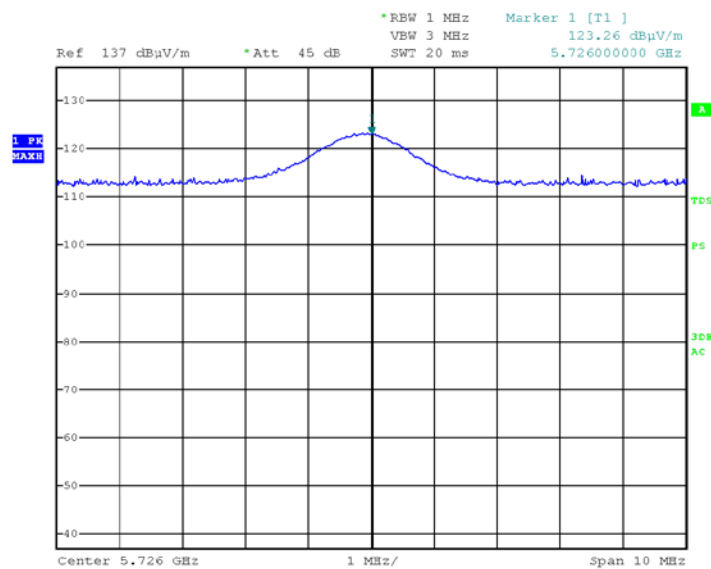
**Figure 35 Radiated Power Output Test Results**

JUDGEMENT: Passed by 419 mW

For additional information see *Figure 36 to Figure 41*.

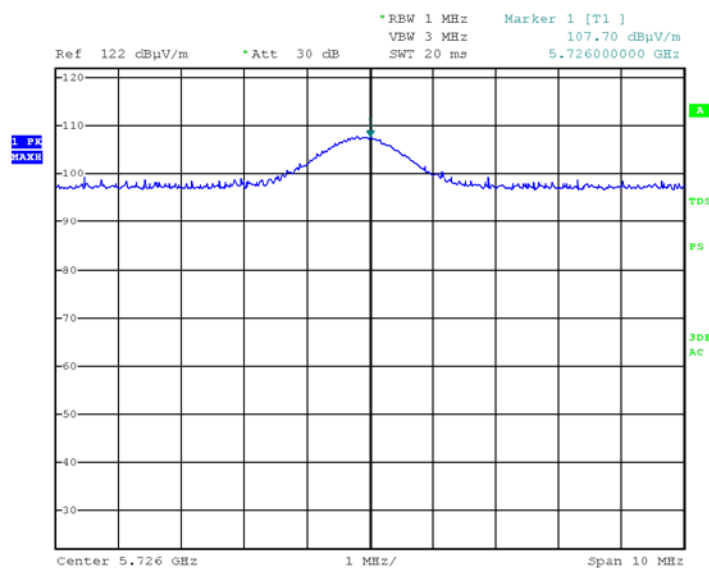
## Peak Output Power

E.U.T Description Outdoor Radar Based  
Perimeter Security Sensor  
Type SR500  
Serial Number: Not designated



Date: 10.JUL.2018 08:52:35

Figure 36 Low, Vertical



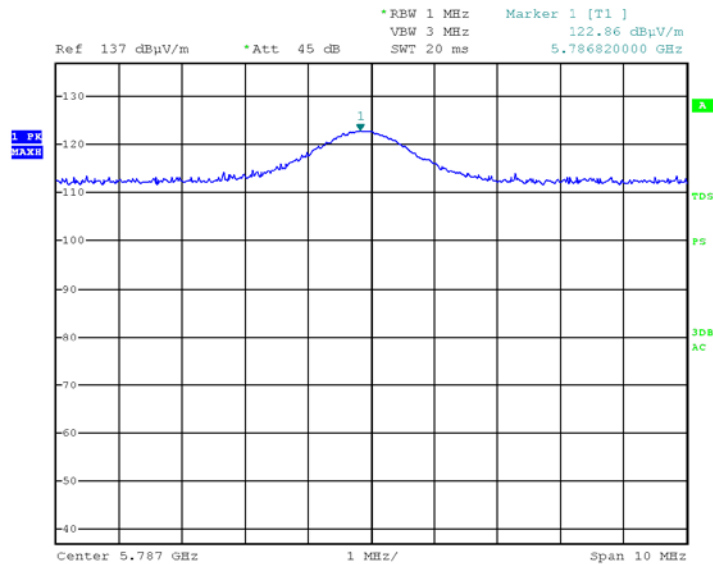
Date: 10.JUL.2018 08:58:01

Figure 37 Low, Horizontal



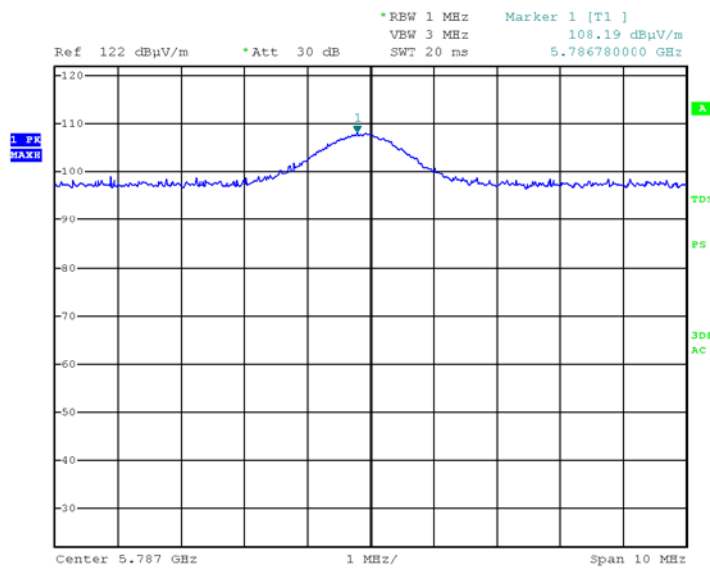
## Peak Output Power

E.U.T Description Outdoor Radar Based  
Perimeter Security Sensor  
Type SR500  
Serial Number: Not designated



Date: 10.JUL.2018 09:03:26

Figure 38 Mid, Vertical



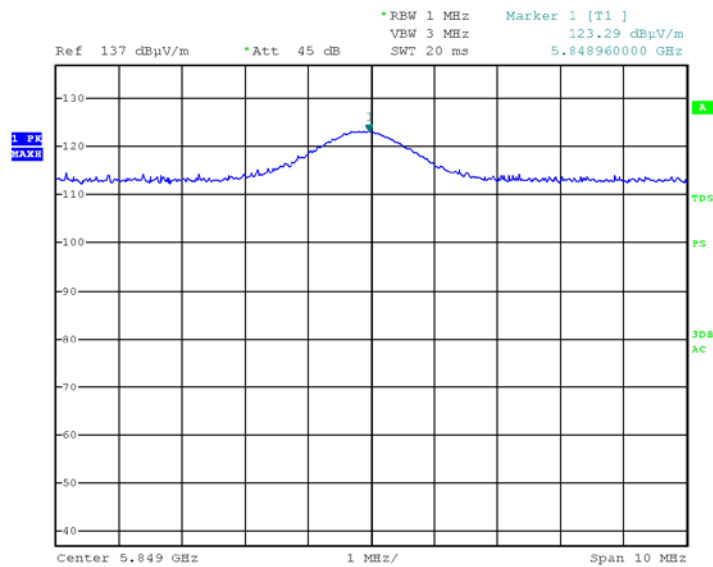
Date: 10.JUL.2018 09:00:36

Figure 39 Mid, Horizontal



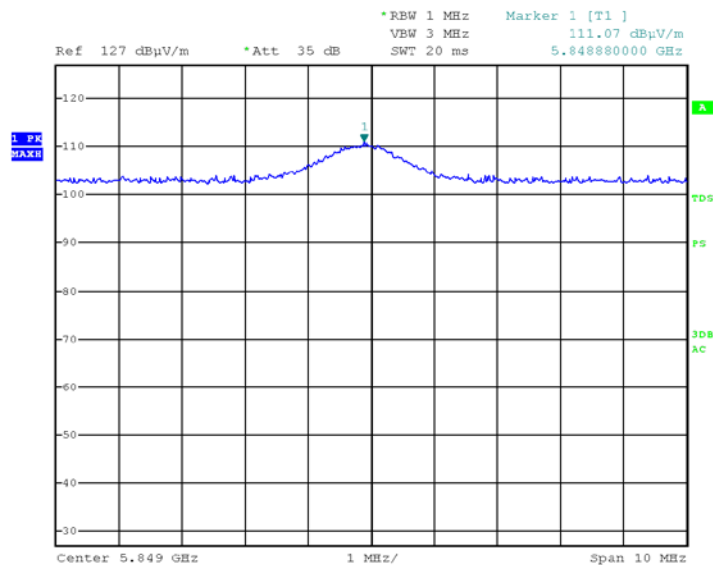
## Peak Output Power

E.U.T Description Outdoor Radar Based  
Perimeter Security Sensor  
Type SR500  
Serial Number: Not designated



Date: 10.JUL.2018 09:07:57

Figure 40 High, Vertical



Date: 10.JUL.2018 09:12:09

Figure 41 High, Horizontal



### 9.5 Test Equipment Used, Peak Output Power

| Instrument                  | Manufacturer  | Model           | Serial No. | Last Calibration Date | Next Calibration Due |
|-----------------------------|---------------|-----------------|------------|-----------------------|----------------------|
| EMI Receiver                | R&S           | ESCI7           | 100724     | February 19, 2018     | February 19, 2019    |
| Horn Antenna                | ETS           | 3115            | 6142       | May 31, 2018          | May 31, 2021         |
| RF Cable                    | Commscope ORS | 0623<br>WBC-400 | G020132    | October 1, 2017       | October 1, 2018      |
| Semi Anechoic Civil Chamber | ETS           | S81             | SL 11643   | NCR                   | NCR                  |

Figure 42 Test Equipment Used

## 10. Dwell Time on Each Channel

## 10.1 Test Specification

FCC Part 15, sub part C, Section 15.247(a)(1)(ii)

RSS 247, Issue 2, Section 5.1(e)

## 10.2 Test Procedure

(Temperature (22°C)/ Humidity (55%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was tested in the chamber, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground and 3 meter distance from testing antenna.

The spectrum analyzer was set to the following parameters:

Span = zero span, centered on a hopping channel, RBW  $\geq 1$  MHz

Detector Function: Peak, Trace: Maximum Hold

### 10.3 Test Limit

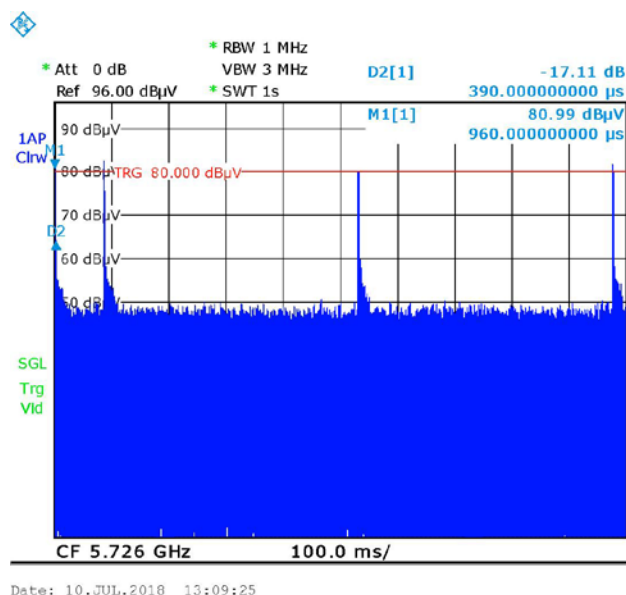
The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

## 10.4 Test Results

**JUDGEMENT:** Passed

The E.U.T met the requirements of the FCC Part 15, Section 15.247(a)(1)(ii) and RSS 247, Issue 2, clause 5.1(e).

Additional information of the results is given in *Figure 43* to *Figure 45*.



**Figure 43 — Number of Bursts in 1sec=4, in 30sec=120**

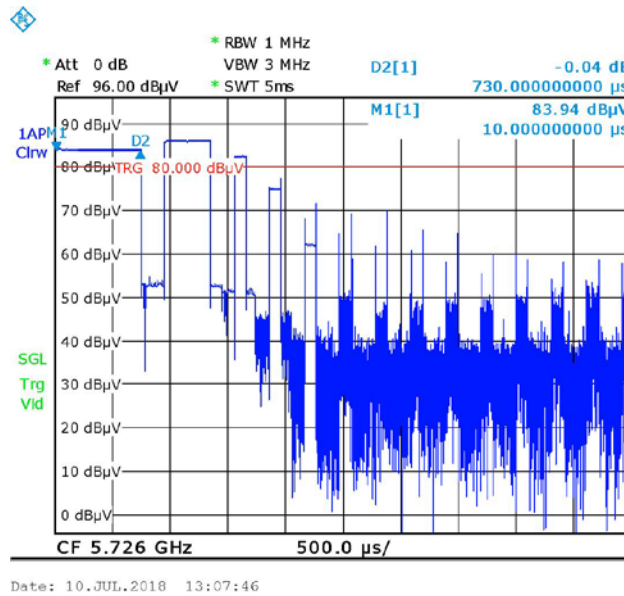


Figure 44 — Burst Duration1 =0.73ms

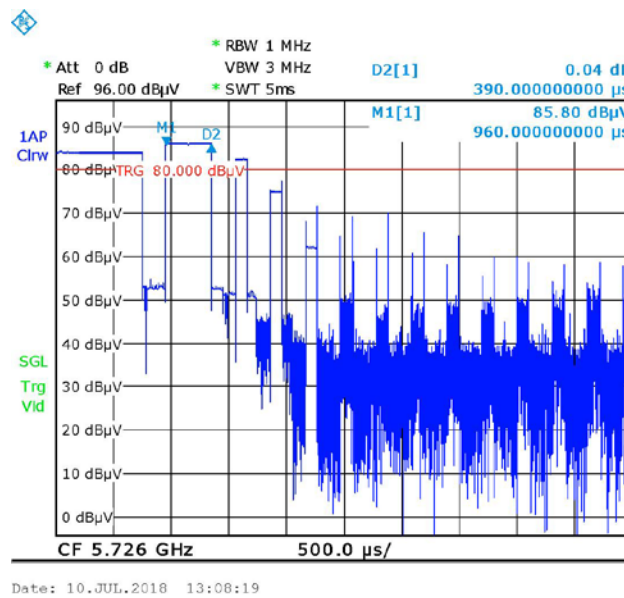


Figure 45 — Burst Duration2 =0.39ms

$$\text{DWELL TIME} = (0.73+0.39)\text{msec} \times 120 = 134\text{msec} < 0.4\text{s}$$



### 10.5 Test Equipment Used, Dwell Time on Each Channel

| Instrument                  | Manufacturer  | Model           | Serial No. | Last Calibration Date | Next Calibration Due |
|-----------------------------|---------------|-----------------|------------|-----------------------|----------------------|
| EMI Receiver                | R&S           | ESCI7           | 100724     | February 19, 2018     | February 19, 2019    |
| Horn Antenna                | ETS           | 3115            | 6142       | May 31, 2018          | May 31, 2021         |
| RF Cable                    | Commscope ORS | 0623<br>WBC-400 | G020132    | October 1, 2017       | October 1, 2018      |
| Semi Anechoic Civil Chamber | ETS           | S81             | SL 11643   | NCR                   | NCR                  |

**Figure 46 Test Equipment Used**

## 11. Band Edge

### 11.1 Test Specification

FCC Part 15, Section 15.247(d)

RSS 247, Issue 2, Section 5.5

### 11.2 Test Procedure

(Temperature (22°C)/ Humidity (55%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was tested in the chamber, and placed on a remote-controlled turntable.

The E.U.T was placed on a non-metallic table, 1.5 meters above the ground and a 3 meter distance from testing antenna.

The transmitter unit operated in 2 modes: hopping enabled and hopping disabled.

The RBW was set to 100 kHz.

The display line was set to 20 dBc

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

### 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 20dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

### 11.4 Test Results

| Mode         | Operation Frequency | Band Edge Frequency | Spectrum Level | Limit    | Margin |
|--------------|---------------------|---------------------|----------------|----------|--------|
|              | (MHz)               | (MHz)               | (dBuV/m)       | (dBuV/m) | (dB)   |
| Hopping      | 5726.0              | 5725.0              | 59.1           | 62.5     | -3.4   |
|              | 5849.0              | 5850.0              | 56.6           | 61.3     | -4.7   |
| Non- Hopping | 5726.0              | 5725.0              | 38.9           | 64.3     | -25.4  |
|              | 5849.0              | 5850.0              | 38.5           | 62.3     | -23.8  |

Figure 47 Band Edge Test Results

JUDGEMENT: Passed by 3.4 dB

For additional information see *Figure 48 to Figure 51*.

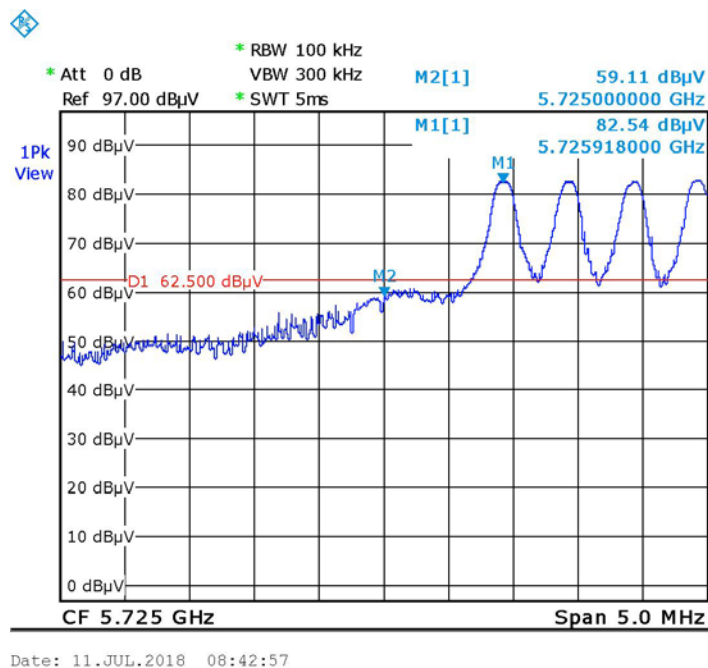


Figure 48 Hopping, Lower Band Edge

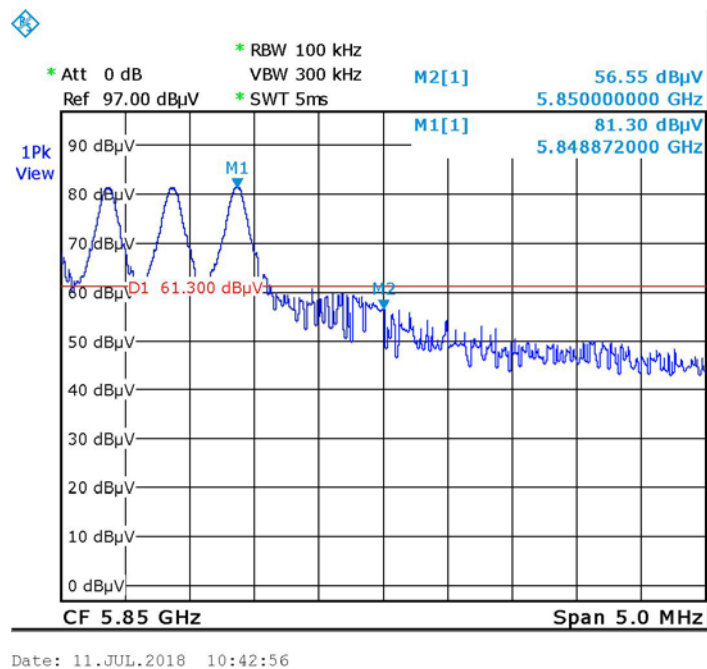
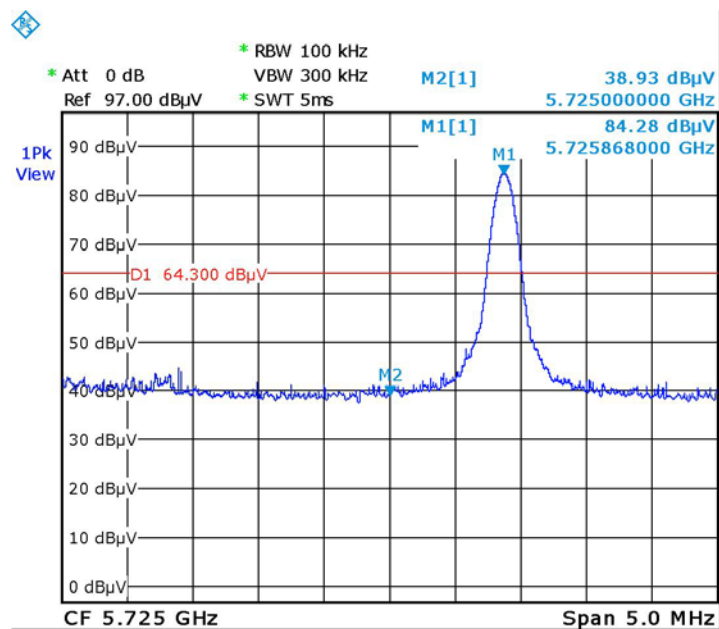
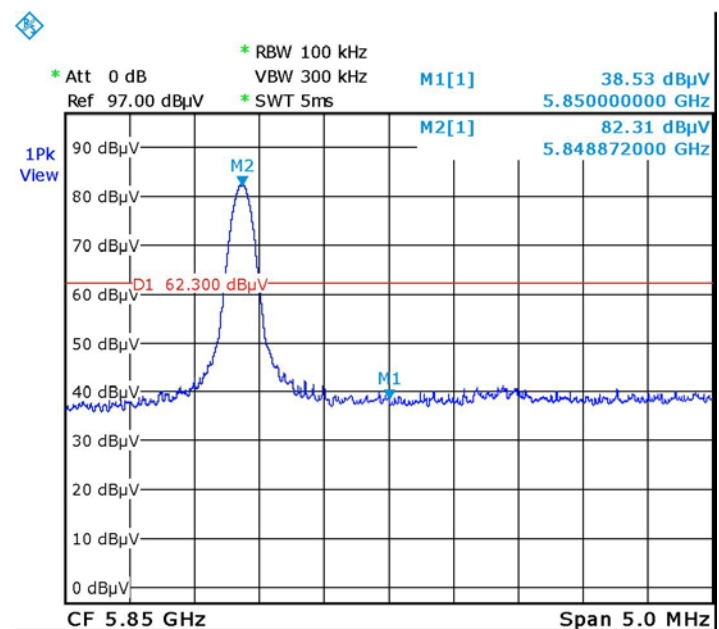


Figure 49 Hopping, Higher Band Edge



Date: 11.JUL.2018 10:45:59

Figure 50 Non-Hopping, Lower Band Edge



Date: 11.JUL.2018 10:44:37

Figure 51 Non-Hopping, Higher Band Edge



### 11.5 Test Equipment Used, Band Edge

| Instrument                     | Manufacturer  | Model           | Serial No. | Last Calibration Date | Next Calibration Due |
|--------------------------------|---------------|-----------------|------------|-----------------------|----------------------|
| EMI Receiver                   | R&S           | ESCI7           | 100724     | February 19, 2018     | February 19, 2019    |
| Horn Antenna                   | ETS           | 3115            | 6142       | May 31, 2018          | May 31, 2021         |
| RF Cable                       | Commscope ORS | 0623<br>WBC-400 | G020132    | October 1, 2017       | October 1, 2018      |
| Semi Anechoic<br>Civil Chamber | ETS           | S81             | SL 11643   | NCR                   | NCR                  |

Figure 52 Test Equipment Used

## 12. Emissions in Non-Restricted Frequency Bands

### 12.1 Test Specification

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

RSS 247, Issue 2, Section 5.5

### 12.2 Test Procedure

(Temperature (22°C)/ Humidity (55%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 and placed on a non-metallic table, 0.8 meters above the ground. The emissions were measured at a distance of 3 meters. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The frequency range 0.009MHz-30MHz was scanned.

#### **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 emissions were measured at a distance of 3 meters. The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization. The frequency range 30.0MHz -1.0GHz was scanned and the list of the highest emissions was verified and updated accordingly.

#### **For measurements between 1.0GHz-40.0GHz:**

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

The frequency range 1.0GHz -40.0GHz was scanned.

RBW was set to 100 kHz and detector set to max peak and trace to “max hold”.

### 12.3 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.



#### **12.4 Test Results**

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 247 (d) and RSS 247, Issue 2, Section 5.5 specification.

All detected emissions were greater than 20dBc below the fundamental level.



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

| Instrument                      | Manufacturer    | Model                | Serial No.        | Last Calibration Date | Next Calibration Due |
|---------------------------------|-----------------|----------------------|-------------------|-----------------------|----------------------|
| EMI Receiver                    | R&S             | ESCI7                | 100724            | February 19, 2018     | February 19, 2019    |
| Spectrum Analyzer               | HP              | 8593EM               | 3536A00120<br>ADI | February 20, 2018     | February 20, 2019    |
| EMI Receiver                    | HP              | 8542E                | 3906A00276        | February 19, 2018     | February 19, 2019    |
| RF Filter Section               | HP              | 85420E               | 3705A00248        | February 19, 2018     | February 19, 2019    |
| Spectrum Analyzer               | HP              | 8564E                | 3442A00275        | February 28, 2018     | February 28, 2019    |
| Biconical Antenna               | EMCO            | 3110B                | 9912-3337         | May 15, 2017          | May 15, 2019         |
| Log Periodic Antenna            | EMCO            | 3146                 | 9505-4081         | May 31, 2018          | May 31, 2019         |
| Horn Antenna                    | ETS             | 3115                 | 6142              | May 31, 2018          | May 31, 2021         |
| Horn Antenna                    | ARA             | SWH-28               | 1007              | December 31, 2017     | December 31, 2020    |
| Horn Antenna Ka Band            | OSR Electronics | PE9850R-20           | J202021732        | February 1, 2018      | February 28, 2021    |
| Active Loop Antenna             | EMCO            | 6502                 | 9506-2950         | October 19, 2017      | October 19, 2018     |
| MicroWave System Amplifier      | HP              | 83006A               | 3104A00589        | October 1, 2017       | October 1, 2018      |
| Low noise amplifier 1GHz-18GHz  | Miteq           | AFSX4-02001800-50-8P | -                 | October 1, 2017       | October 1, 2018      |
| Low noise amplifier 13GHz-32GHz | Narda           | DBS-0411N313         | 13                | October 1, 2017       | October 1, 2018      |
| RF Cable                        | Commscope ORS   | 0623 WBC-400         | G020132           | October 1, 2017       | October 1, 2018      |
| RF Cable (OATS)                 | EIM             | RG214-11N(X2)        |                   | August 13, 2017       | August 13, 2018      |
| Filter Band pass 8-16 GHz       | Serno           | MFR01341-HI-3816JJ-1 | 322               | October 1, 2017       | October 1, 2018      |
| 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 53 Test Equipment Used**

## 13. Emissions in Restricted Frequency Bands

### 13.1 Test Specification

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

RSS 247, Issue 2, section 3.3

RSS Gen, Issue 5, Section 8.10

### 13.2 Test Procedure

(Temperature (22°C)/ Humidity (54%RH))

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

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

The frequency range 0.009MHz-30MHz was scanned.

#### **For measurements between 30-1000MHz:**

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 emissions were measured at a distance of 3 meters. The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization. The frequency range 30MHz -1000MHz was scanned and the list of the highest emissions was verified and updated accordingly.

#### **For measurements between 1GHz-40GHz:**

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

The frequency range 1GHz -40GHz was scanned.

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.

### 13.3 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.

### 13.4 Test Results

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C 209 and RSS Gen, Issue 5, Section 8.10 specification.

For additional information see Figure 54.



## Radiated Emission

E.U.T Description Outdoor Radar Based Perimeter  
Security Sensor  
Type SR500  
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d);  
RSS Gen, Issue 5, Section 8.10

Antenna Polarization: Horizontal/Vertical Frequency Range: 9kHz to 40.0 GHz  
Protocol type: CW 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)           |
| 5726.0              | 11,452.0 | V     | 66.5         | 74.0       | -7.5        | 33.5            | 54.0          | -20.5          |
|                     | 11,452.0 | H     | 71.8         | 74.0       | -2.2        | 38.8            | 54.0          | -15.2          |
|                     | 22,904.0 | V     | 63.5         | 74.0       | -10.5       | 30.5            | 54.0          | -23.5          |
|                     | 22,904.0 | H     | 64.3         | 74.0       | -9.7        | 31.3            | 54.0          | -22.7          |
| 5787.0              | 11,574.0 | V     | 65.6         | 74.0       | -8.4        | 32.6            | 54.0          | -21.4          |
|                     | 11,574.0 | H     | 69.7         | 74.0       | -4.3        | 36.7            | 54.0          | -17.3          |
| 5849.0              | 11,698.0 | V     | 62.7         | 74.0       | -11.3       | 29.7            | 54.0          | -24.3          |
|                     | 11,698.0 | H     | 71.7         | 74.0       | -2.3        | 38.7            | 54.0          | -15.3          |

**Figure 54. 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



### 13.5 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 19, 2018     | February 19, 2019    |
| Spectrum Analyzer              | HP               | 8593EM               | 3536A00120<br>ADI | February 20, 2018     | February 20, 2019    |
| EMI Receiver                   | HP               | 8542E                | 3906A00276        | February 19, 2018     | February 19, 2019    |
| RF Filter Section              | HP               | 85420E               | 3705A00248        | February 19, 2018     | February 19, 2019    |
| Spectrum Analyzer              | HP               | 8564E                | 3442A00275        | February 28, 2018     | February 28, 2019    |
| Biconical Antenna              | EMCO             | 3110B                | 9912-3337         | May 15, 2017          | May 15, 2019         |
| Log Periodic Antenna           | EMCO             | 3146                 | 9505-4081         | May 31, 2018          | May 31, 2021         |
| Horn Antenna                   | ETS              | 3115                 | 6142              | May 31, 2018          | May 31, 2021         |
| Horn Antenna                   | ARA              | SWH-28               | 1007              | December 31, 2017     | December 31, 2020    |
| Horn Antenna Ka Band           | OSR Electronics  | PE9850R-20           | J202021732        | February 1, 2018      | February 28, 2021    |
| Active Loop Antenna            | EMCO             | 6502                 | 9506-2950         | October 19, 2017      | October 19, 2018     |
| MicroWave System Amplifier     | HP               | 83006A               | 3104A00589        | October 1, 2017       | October 1, 2018      |
| Low noise amplifier 1GHz-18GHz | Miteq            | AFSX4-02001800-50-8P | -                 | October 1, 2017       | October 1, 2018      |
| High Pass Band Filter          | Meuro            | MFL040120H50         | 902252            | October 1, 2017       | October 1, 2018      |
| RF Cable                       | Commscope<br>ORS | 0623 WBC-400         | G020132           | October 1, 2017       | October 1, 2018      |
| RF Cable (OATS)                | EIM              | RG214-11N(X2)        |                   | August 13, 2017       | August 13, 2018      |
| 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 55 Test Equipment Used

## 14. Avg. Factor Calculation

1. Pulse period = 1 (worst scenario)
2. Pulse duration = 1 (worst scenario)
3. Burst duration = 0.85msec

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

$$\text{Average Factor} = 20 \log [1 * (0.73 + 0.39) * 2 / 100] = -33.0$$

5. Average Factor = -33.0dB

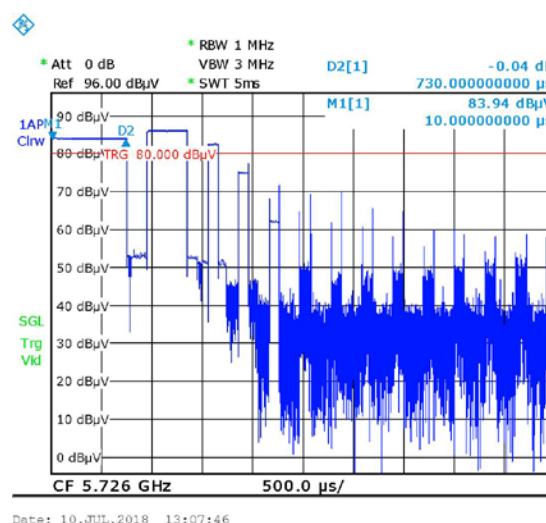


Figure 56 — Burst Duration1 =0.73ms

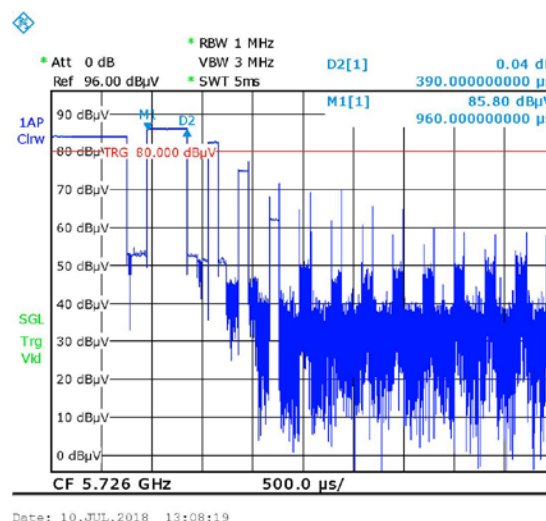


Figure 57 — Burst Duration2 =0.39ms

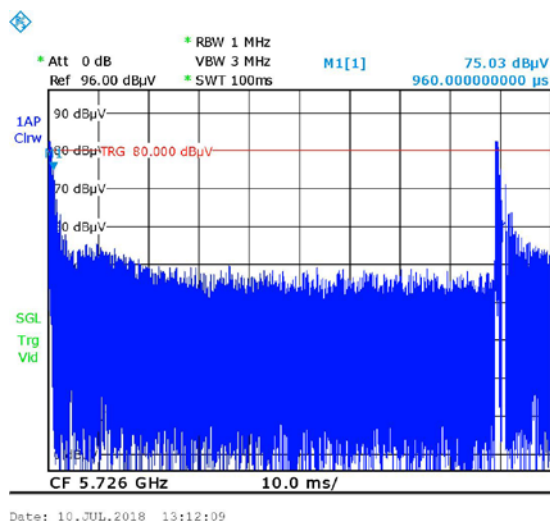


Figure 58. Number of Bursts in 100msec=2

#### 14.1 Test Equipment Used, Average Factor

| Instrument                     | Manufacturer     | Model           | Serial No. | Last Calibration Date | Next Calibration Due |
|--------------------------------|------------------|-----------------|------------|-----------------------|----------------------|
| EMI Receiver                   | R&S              | ESCI7           | 100724     | February 19, 2018     | February 19, 2019    |
| Horn Antenna                   | ETS              | 3115            | 6142       | May 31, 2018          | May 31, 2021         |
| RF Cable                       | Commscope<br>ORS | 0623<br>WBC-400 | G020132    | October 1, 2017       | October 1, 2018      |
| Semi Anechoic<br>Civil Chamber | ETS              | S81             | SL 11643   | NCR                   | NCR                  |

Figure 59 Test Equipment Used



## 15. Antenna Gain/Information

The antenna gain is 9 dBi, patch.



## 16. R.F Exposure/Safety

The typical placement of the E.U.T. is wall mounted. 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) and RSS 102 Issue 5, Table 4 Requirements

- (a) FCC Limit at 5726 MHz is:  $1 \frac{mW}{cm^2}$

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

- (b) ISED Limit:  $300-6000MHz = 0.02619f^{0.6834} W/m^2 =$   
 $0.02619 \times 5726^{0.6834} = 0.02619 \times 369.93 = 9.69 W/m^2 = 0.969 mW/cm^2$

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

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

$P_t$  = Conducted Transmitted Power 19.1 dBm = 81.3 mW

$G_t$  = Antenna Gain 9dBi = 7.9 numeric

$R$  = Distance From Transmitter 20 cm

- (d) The peak power density produced by the E.U.T. is:

$$S = 81.3 * 7.9 / 4\pi(20)^2 = 0.128 mW/cm^2$$

- (e) This is below the FCC/ISED limit.



## 17. APPENDIX A - CORRECTION FACTORS

### 17.1 Correction factors for RF OATS Cable 35m

**ITL #1911**

| Frequency (MHz) | Ref&cable loss (dBm) | Ref loss (dBm) | Cable loss (dB) |
|-----------------|----------------------|----------------|-----------------|
| 1.00            | 0.7                  | 0.2            | 0.5             |
| 10.00           | 1.3                  | 0.3            | 1               |
| 20.00           | 1.7                  | 0.3            | 1.34            |
| 30.00           | 2.0                  | 0.5            | 1.5             |
| 50.00           | 2.3                  | 0.5            | 1.83            |
| 100.00          | 3.0                  | 0.3            | 2.67            |
| 150.00          | 3.7                  | 0.5            | 3.17            |
| 200.00          | 4.3                  | 0.5            | 3.83            |
| 250.00          | 4.5                  | 0.3            | 4.17            |
| 300.00          | 5.0                  | 0.5            | 4.5             |
| 350.00          | 5.7                  | 0.5            | 5.17            |
| 400.00          | 6.0                  | 0.5            | 5.5             |
| 450.00          | 6.5                  | 0.7            | 5.83            |
| 500.00          | 6.8                  | 0.5            | 6.33            |
| 550.00          | 7.2                  | 0.5            | 6.67            |
| 600.00          | 7.5                  | 0.7            | 6.83            |
| 650.00          | 7.7                  | 0.5            | 7.17            |
| 700.00          | 8.3                  | 0.7            | 7.66            |
| 750.00          | 8.5                  | 0.7            | 7.83            |
| 800.00          | 8.8                  | 0.7            | 8.16            |
| 850.00          | 9.0                  | 0.5            | 8.5             |
| 900.00          | 9.5                  | 0.7            | 8.83            |
| 950.00          | 9.7                  | 0.8            | 8.84            |
| 1000.00         | 9.7                  | 0.7            | 9               |



## 17.2 Correction factor for RF cable for Anechoic Chamber

ITL #1841

| FREQ<br>(MHz) | LOSS<br>(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



**17.3 Correction factors for Active Loop Antenna**

**Model 6502 S/N 9506-2950**

**ITL # 1075:**

| f(MHz) | MAF(dBs/m) | AF(dB/m) |
|--------|------------|----------|
| 0.01   | -33.1      | 18.4     |
| 0.02   | -37.2      | 14.3     |
| 0.03   | -38.2      | 13.3     |
| 0.05   | -39.8      | 11.7     |
| 0.1    | -40.1      | 11.4     |
| 0.2    | -40.3      | 11.2     |
| 0.3    | -40.3      | 11.2     |
| 0.5    | -40.3      | 11.2     |
| 0.7    | -40.3      | 11.2     |
| 1      | -40.1      | 11.4     |
| 2      | -40        | 11.5     |
| 3      | -40        | 11.5     |
| 4      | -40.1      | 11.4     |
| 5      | -40.2      | 11.3     |
| 6      | -40.4      | 11.1     |
| 7      | -40.4      | 11.1     |
| 8      | -40.4      | 11.1     |
| 9      | -40.5      | 11       |
| 10     | -40.5      | 11       |
| 20     | -41.5      | 10       |
| 30     | -43.5      | 8        |



**17.4 Correction factors for biconical antenna**  
**ITL #1356**  
**Model: EMCO 3110B**  
**Serial No.: 9912-3337**

| Frequency | AF     |
|-----------|--------|
| [MHz]     | [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  |



**17.5 Correction factors for log periodic antenna**  
**ITL # 1349**  
**Model:EMCO 3146**  
**Serial No.: 9505-4081**

| Frequency | AF     |
|-----------|--------|
| [MHz]     | [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  |



**17.6 Correction factors for Double –Ridged Waveguide Horn ANTENNA**

**Model: 3115**

**Serial number:6142**

**3 meter range; ITL # 1354**

| Frequency | Antenna #1: ITL 1354 AF1 |
|-----------|--------------------------|
| [MHz]     | [dB/m]                   |
| 1000      | 23.64                    |
| 1500      | 26.14                    |
| 2000      | 27.20                    |
| 2500      | 28.20                    |
| 3000      | 29.63                    |
| 3500      | 31.28                    |
| 4000      | 31.97                    |
| 4500      | 32.25                    |
| 5000      | 33.34                    |
| 5500      | 33.67                    |
| 6000      | 34.63                    |
| 6500      | 35.71                    |
| 7000      | 35.92                    |
| 7500      | 36.34                    |
| 8000      | 37.21                    |
| 8500      | 37.28                    |
| 9000      | 37.24                    |
| 9500      | 37.28                    |
| 10000     | 37.37                    |
| 10500     | 37.77                    |
| 11000     | 37.96                    |
| 11500     | 38.55                    |
| 12000     | 38.52                    |
| 13000     | 39.30                    |
| 14000     | 40.75                    |
| 15000     | 40.32                    |
| 16000     | 42.51                    |
| 17000     | 42.35                    |
| 18000     | 41.58                    |



## CALIBRATION DATA

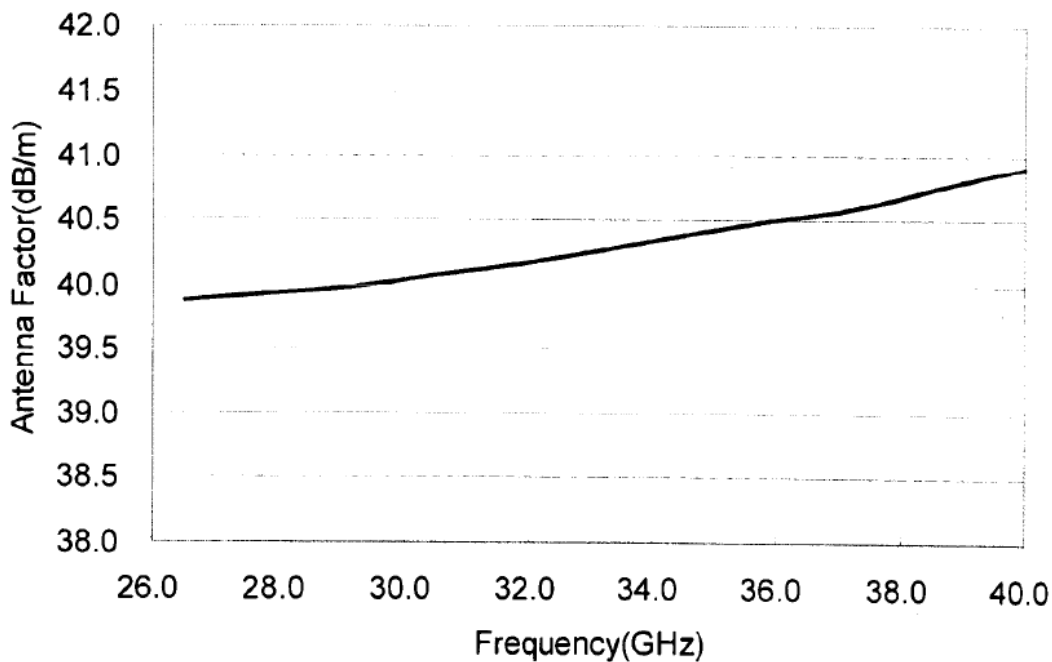
3 m distance

| Frequency, MHz | Measured antenna factor, dB/m <sup>1)</sup> |
|----------------|---------------------------------------------|
| 18000          | 32.4                                        |
| 18500          | 32.0                                        |
| 19000          | 32.3                                        |
| 19500          | 32.4                                        |
| 20000          | 32.3                                        |
| 20500          | 32.8                                        |
| 21000          | 32.8                                        |
| 21500          | 32.7                                        |
| 22000          | 33.1                                        |
| 22500          | 33.0                                        |
| 23000          | 33.1                                        |
| 23500          | 33.8                                        |
| 24000          | 33.5                                        |
| 24500          | 33.5                                        |
| 25000          | 33.8                                        |
| 25500          | 33.9                                        |
| 26000          | 34.2                                        |
| 26500          | 34.7                                        |

<sup>1)</sup> The antenna factor shall be added to receiver reading in dB $\mu$ V to obtain field strength in dB $\mu$ V/m.

### 17.7 Correction factors for Horn Antenna Model: SWH-28

**17.8 Correction factors for Horn Antenna Ka Band  
Model: PE9850R-20**



| Frequency(GHz) | Gain(dB) | Antenna Factor(dB/m) |
|----------------|----------|----------------------|
| 26.50          | 18.80    | 39.87                |
| 27.85          | 19.18    | 39.93                |
| 29.20          | 19.53    | 39.99                |
| 30.55          | 19.83    | 40.08                |
| 31.90          | 20.12    | 40.17                |
| 33.25          | 20.37    | 40.28                |
| 34.60          | 20.60    | 40.39                |
| 35.95          | 20.82    | 40.50                |
| 37.30          | 21.05    | 40.59                |
| 38.65          | 21.20    | 40.75                |
| 40.00          | 21.34    | 40.91                |



| Frequency | Low Signal Gain (dB) | Noise Figure | Supply Current |
|-----------|----------------------|--------------|----------------|
| 20.0 GHz  | 47.7                 | 2.9 dB       | 0.37A          |
| 20.5 GHz  | 50.1                 | 2.9 dB       | 0.37A          |
| 21.0 GHz  | 50.5                 | 2.9 dB       | 0.37A          |
| 21.5 GHz  | 51.2                 | 2.9 dB       | 0.37A          |
| 22.0 GHz  | 50.8                 | 2.9 dB       | 0.37A          |
| 22.5 GHz  | 50.4                 | 2.9 dB       | 0.37A          |
| 23.0 GHz  | 50.0                 | 2.9 dB       | 0.37A          |
| 23.5 GHz  | 50.0                 | 2.9 dB       | 0.37A          |
| 24.0 GHz  | 50.0                 | 2.9 dB       | 0.37A          |
| 24.5 GHz  | 50.6                 | 2.9 dB       | 0.37A          |
| 25.0 GHz  | 51.3                 | 2.9 dB       | 0.37A          |
| 25.5 GHz  | 51.5                 | 2.9 dB       | 0.37A          |
| 26.0 GHz  | 52.0                 | 2.9 dB       | 0.37A          |
| 26.5 GHz  | 51.5                 | 2.9 dB       | 0.37A          |
| 27.0 GHz  | 52.2                 | 2.9 dB       | 0.37A          |
| 27.5 GHz  | 52.5                 | 2.9 dB       | 0.37A          |
| 28.0 GHz  | 52.1                 | 2.9 dB       | 0.37A          |
| 28.5 GHz  | 51.8                 | 2.9 dB       | 0.37A          |
| 29.0 GHz  | 52.0                 | 2.9 dB       | 0.37A          |
| 29.5 GHz  | 52.2                 | 2.9 dB       | 0.37A          |
| 30.0 GHz  | 52.0                 | 2.9 dB       | 0.37A          |
| 30.5 GHz  | 51.5                 | 2.9 dB       | 0.37A          |
| 31.0 GHz  | 51.3                 | 2.9 dB       | 0.37A          |
| 31.5 GHz  | 50.5                 | 2.9 dB       | 0.37A          |
| 32.0 GHz  | 49.3                 | 2.9 dB       | 0.37A          |
| 32.5 GHz  | 49.2                 | 2.9 dB       | 0.37A          |
| 33.0 GHz  | 48.2                 | 2.9 dB       | 0.37A          |
| 33.5 GHz  | 48.5                 | 2.9 dB       | 0.37A          |
| 34.0 GHz  | 47.7                 | 2.9 dB       | 0.37A          |
| 34.5 GHz  | 48.1                 | 2.9 dB       | 0.37A          |
| 35.0 GHz  | 47.9                 | 2.9 dB       | 0.37A          |
| 35.5 GHz  | 48.2                 | 2.9 dB       | 0.37A          |
| 36.0 GHz  | 47.8                 | 2.9 dB       | 0.37A          |
| 36.5 GHz  | 48.4                 | 2.9 dB       | 0.37A          |
| 37.0 GHz  | 48.3                 | 2.9 dB       | 0.37A          |
| 37.5 GHz  | 48.6                 | 2.9 dB       | 0.37A          |
| 38.0 GHz  | 47.8                 | 2.9 dB       | 0.37A          |
| 38.5 GHz  | 47.0                 | 2.9 dB       | 0.37A          |
| 39.0 GHz  | 47.1                 | 2.9 dB       | 0.37A          |
| 39.5 GHz  | 47.1                 | 2.9 dB       | 0.37A          |
| 40.0 GHz  | 48.3                 | 2.9 dB       | 0.37A          |