Wireless Door/Window Sensor
FCC ID: U5X-RE207
Certification Test Report

December 24, 2018

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1. Introduction

There will be two models listed under FCC ID: U5X-RE207. These models are RE207 and RE207T.

The RE207 and RE207T are wireless door/window sensors. The sensors send open and closed signals to a home security system when a door or window is changed from open to closed or closed to open. The two models (RE207 and RE207T) are identical in every respect except that each group sends a slightly different RF transmission format. The RE207/RE207T board measures 3.03" x 1.08" x 0.8" and weighs 0.6 oz. The full door/window enclosure measures 3.87" x 1.5" x 1.56" and weighs 3.3 oz. with the CR123A battery.

The RE207/RE207T uses a magnetic reed and a magnet or external contacts to determine if a door, window, or gate is open or closed. When the magnet is pulled away from the sensor or if the external contacts are shorted to the common terminal, an open signal is sent to a home security system. When a magnet is brought close to the sensor or if the external contacts are disconnected from the common terminal, a closed signal is sent to a home security system. The RE207/RE207T also sends a tamper signal if the enclosure is opened.

The external contacts can also be used for two types of PIR motion detectors. Both PIR motion detectors operate the same way but have different detection lenses for a narrow and wide-angle beam. The narrow beam PIR enclosure measures 7" x 2.63" x 2.1". The wide-angle beam PIR enclosure measures 7.16" x 2.8" x 2.54". When the RE207/RE207T is used in one of the PIR motion detectors, the external inputs are used for a motion input and a tamper input. If motion is detected, an alarm signal is set to a home security system. The RE207/RE207T in a PIR also sends a tamper signal if the enclosure is opened. The reed in this configuration is disabled. All other functions operate the same.

A microcontroller on the RE207/RE207T is powered by a 3VDC CR123A battery. Open/closed packets are sent by the RE207/RE207T only upon valid alarm conditions. The transmitted packet is OOK modulated and has an on-time of 9.55ms. Precautions are taken in the firmware to ensure there is at least 100ms between packets, and that the transmission ends within 5 seconds. In the absence of motion, a set of four supervision transmissions are sent by the RE207/RE207T daughter board once per hour.

The transmitter circuit consists of a 10.78MHz crystal and a Micrel MICRF113YM6 PLL Chip. This chip multiplies the crystal frequency to 345MHz and allows OOK modulation of the 345MHz signal. A coil antenna on the PCB radiates the RF signal.

Certification is requested under FCC Rules, Part 15, Subpart C, Paragraph 15.231.

2. Statement of Compliance

Specific sections of FCC Rules Part 2 that require information or listing are given below.

2.1. FCC Part 2 §2.907

This is an application for certification of original equipment

2.2. FCC Part 2 §2.911

a) This application has been filed electronically using form 731.
b) All required information has been supplied in this application and its attachments.
c) This application has been electronically signed by an officer of Alula.
d) The technical test data has been signed by the agency performing the testing.
e) Signature supplied in appropriate block on form 731.
f) Processing fee has been paid.
g) Signatures have been supplied electronically.

2.3. FCC Part 2 §2.913

a) This application has been filed electronically.
b) Appropriate fees have been filed electronically.
c) Equipment samples shall be supplied as requested.

2.4. FCC Part 2 §2.915

We are requesting a grant of certification. This application shows compliance with the technical standards.

2.5. FCC Part 2 §2.925

A label shall be affixed to each piece of equipment, showing the FCC identifier. The label shall read "FCC ID: U5X-RE207". See Exhibit B for a photograph showing the label and location on the device.

2.6. FCC Part 2 §2.943, 2.945

Sample production equipment shall be submitted to the FCC upon request.

2.7. FCC Part 2 §2.947

a) Measurement procedure follows ANSI C63.4: 2009.
b) A description of utilized test equipment is contained in the report.

2.8. FCC Part 2 §2.948

Radiated measurements were taken at the following FCC-approved facility:

Rhein Tech Laboratories, Inc.
360 Herndon Parkway, Suite 1400
Herndon, VA 20170 USA
Contact: Rick McMurray
703-689-0368

Photographs of the test site are shown in Exhibit J.

2.9. FCC Part 2 §2.1033

a) Form 731 has been filed electronically.
b) The technical report, along with its exhibits, contains the information as follows:
   (1) full name and mailing address of the manufacturer of the device and the applicant for certification:
   Alula
   1402 Heggen St.
   Hudson, WI 54016
   (2) FCC Identifier is U5X-RE207
   (3) Copy of the installation/user instructions is furnished as Exhibit E.
   (4) A brief description of the device and operation is furnished in Exhibit F. Schematic is furnished in Exhibit G.
   (5) Block diagram furnished in Exhibit H.
   (6) This document constitutes a technical test report.
   (7) Internal and external photographs have been furnished in Exhibits A and C.
   (8) Descriptions of the host devices are furnished in Exhibit F.
   (9) This application not pursuant to the transition rules of section 15.37
   (10) Not applicable. This device does not include a scanning receiver.
   (11) Not applicable.
   (12) Not applicable.
c) Not applicable. This device shall operate under Part 15 of the rules.
d) Not applicable.
e) Not applicable. This is not a composite system.

3. Discussion of Laboratory Measurements and Rules Compliance

3.1. FCC Part 15 §15.231(a)(1)

The RE207/RE207T door/window sensor monitors a magnetic reed switch and two external inputs. When any of these inputs or the tamper switch is triggered, an alarm condition is present. Eight transmission packets are sent by the device upon all valid alarm conditions. The transmitted packets are 16.65mS in length. The spacing between each packet is randomized from 100mS to 240mS. In addition, there is a 1 second space between the 4th and 5th packets. After transmission is complete, the device will go into a sleep

mode and not transmit again until another alarm condition is detected. If there are no activations for an hour, four supervisory packets are sent with the same spacing given above.

3.2. FCC Part 15 §15.231(a)(2)

Precautions are taken in the firmware to ensure that all transmission end within 5 seconds after activation as shown in Exhibit I.

3.3. FCC Part 15 §15.231(a)(3)

If no activations have been received for a period of one hour, four supervision packets are transmitted. These supervision packets are then transmitted every hour in the absence of alarm activations. The total transmission time resulting from these supervision transmissions is well under the allowed 2 seconds per hour. They conclude within the 5-second window.

3.4. FCC Part 15 §15.231(a)(4)

Device does not continue transmitting beyond the packets resulting from each activation.

3.5. FCC Part 15 §15.231(a)(5)

There is no setup information transmitted with this device.

3.6. FCC Part 15 §15.231(b)

3.6.1. Raw Field Strength Limits

The table that follows shows the emission limits as determined by interpolation of the data in §15.231(b), the requirements of §15.35(b) regarding peak emission limits, and the requirements of §15.205/§15.209 regarding restricted bands and their limits.

	Average Emission Limit (dBuV/m)	Peak Emission Limit (dBuV/m)
Fundamental (345 MHz)	77.25	97.25
Spurious	57.25	77.25
Restricted Band	54.00	74.00

3.6.2. Duty Cycle Correction Factor and Resulting Limits

The RE207/RE207T transmitter uses OOK modulation. 64 bits are transmitted in each packet, and the “on” time for each bit is 135uS. The resulting “on” time per packet is 8.64mS. The transmitted packets are limited to one packet in a 100mS period. The transmitter duty cycle over a 100ms period is therefore 8.64/100 = 8.64%.

Thus, the average emission level, as given in §15.35(c), is calculated as follows:

$$\text{Average Emission Level} = \text{Peak Measurement} + 20\log(8.64\text{mS}/100\text{mS})$$

3.6.3. Measured Radiated Field Strength Data

Radiated fundamental and spurious emissions were tested at three meters. The EUT was tested in the three orthogonal planes with the receive antenna in both polarities. The emissions were maximized per ANSI C63.4:2003 8.3.1.2; that is, the measurement antenna height was varied between 1 and 4m, and the EUT was rotated through 360 degrees on a rotating turntable until the maximum emissions were found. Both horizontal and vertical measurement antenna polarizations were used. A resolution bandwidth of 120kHz was used for frequencies less than 1000MHz, and a resolution bandwidth of 1MHz was used for frequencies greater than or equal to 1000MHz. The video bandwidth was set to a value at least three times greater than the resolution bandwidth. All spurious emissions in the applicable frequency range were investigated. The EUT was adapted to continuously transmit for testing purposes. Further details of measured radiated field strength are shown in Exhibit I.

The tables below show peak and average emissions, limits, resulting margins, and pass/fail results in each enclosure.

Emission Frequency (MHz)	Peak Emissions (RE207/RE207T)				Average Emissions (RE207/RE207T)			
	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Test Result	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Test Result
345.0	89.3	97.3	-8.0	PASS	68.0	77.3	-9.2	PASS
690.0	63.0	77.3	-14.3	PASS	41.7	57.3	-15.5	PASS
1035.0	44.7	74.0	-29.3	PASS	23.4	54.0	-30.6	PASS
1380.0	48.1	74.0	-25.9	PASS	26.8	54.0	-27.2	PASS
1725.0	45.8	77.3	-31.5	PASS	24.5	57.3	-32.7	PASS
2070.0	42.0	77.3	-35.3	PASS	20.7	57.3	-36.5	PASS
2415.0	31.0	77.3	-46.3	PASS	9.7	57.3	-47.5	PASS
2760.0	49.8	74.0	-24.2	PASS	28.5	54.0	-25.5	PASS
3105.0	44.0	77.3	-33.3	PASS	22.7	57.3	-34.5	PASS
3450.0	46.1	77.3	-31.2	PASS	24.8	57.3	-32.4	PASS

Emission Frequency (MHz)	Peak Emissions (RE253/RE253T)				Average Emissions (RE253/RE253T)			
	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Test Result	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Test Result
345.0	94.5	97.3	-2.8	PASS	73.2	77.3	-4.0	PASS
690.0	63.7	77.3	-13.6	PASS	42.4	57.3	-14.8	PASS
1035.0	47.4	74.0	-26.6	PASS	26.1	54.0	-27.9	PASS
1380.0	46.7	74.0	-27.3	PASS	25.4	54.0	-28.6	PASS
1725.0	51.3	77.3	-26.0	PASS	30.0	57.3	-27.2	PASS
2070.0	44.2	77.3	-33.1	PASS	22.9	57.3	-34.3	PASS
2415.0	45.0	77.3	-32.3	PASS	23.7	57.3	-33.5	PASS
2760.0	54.1	74.0	-19.9	PASS	32.8	54.0	-21.2	PASS
3105.0	49.6	77.3	-27.7	PASS	28.3	57.3	-28.9	PASS
3450.0	49.2	77.3	-28.1	PASS	27.9	57.3	-29.3	PASS

Emission Frequency (MHz)	Peak Emissions (RE260/RE260T)				Average Emissions (RE260/RE260T)			
	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Test Result	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Test Result
345.0	87.7	97.3	-9.6	PASS	66.4	77.3	-10.8	PASS
690.0	56.0	77.3	-21.3	PASS	34.7	57.3	-22.5	PASS
1035.0	46.0	74.0	-28.0	PASS	24.7	54.0	-29.3	PASS
1380.0	49.7	74.0	-24.3	PASS	28.4	54.0	-25.6	PASS
1725.0	49.1	77.3	-28.2	PASS	27.8	57.3	-29.4	PASS
2070.0	48.5	77.3	-28.8	PASS	27.2	57.3	-30.0	PASS
2415.0	50.4	77.3	-26.9	PASS	29.1	57.3	-28.1	PASS
2760.0	53.1	74.0	-20.9	PASS	31.8	54.0	-22.2	PASS
3105.0	55.0	77.3	-22.3	PASS	33.7	57.3	-23.5	PASS
3450.0	53.4	77.3	-23.9	PASS	32.1	57.3	-25.1	PASS

3.7. FCC Part 15 §15.231(c)

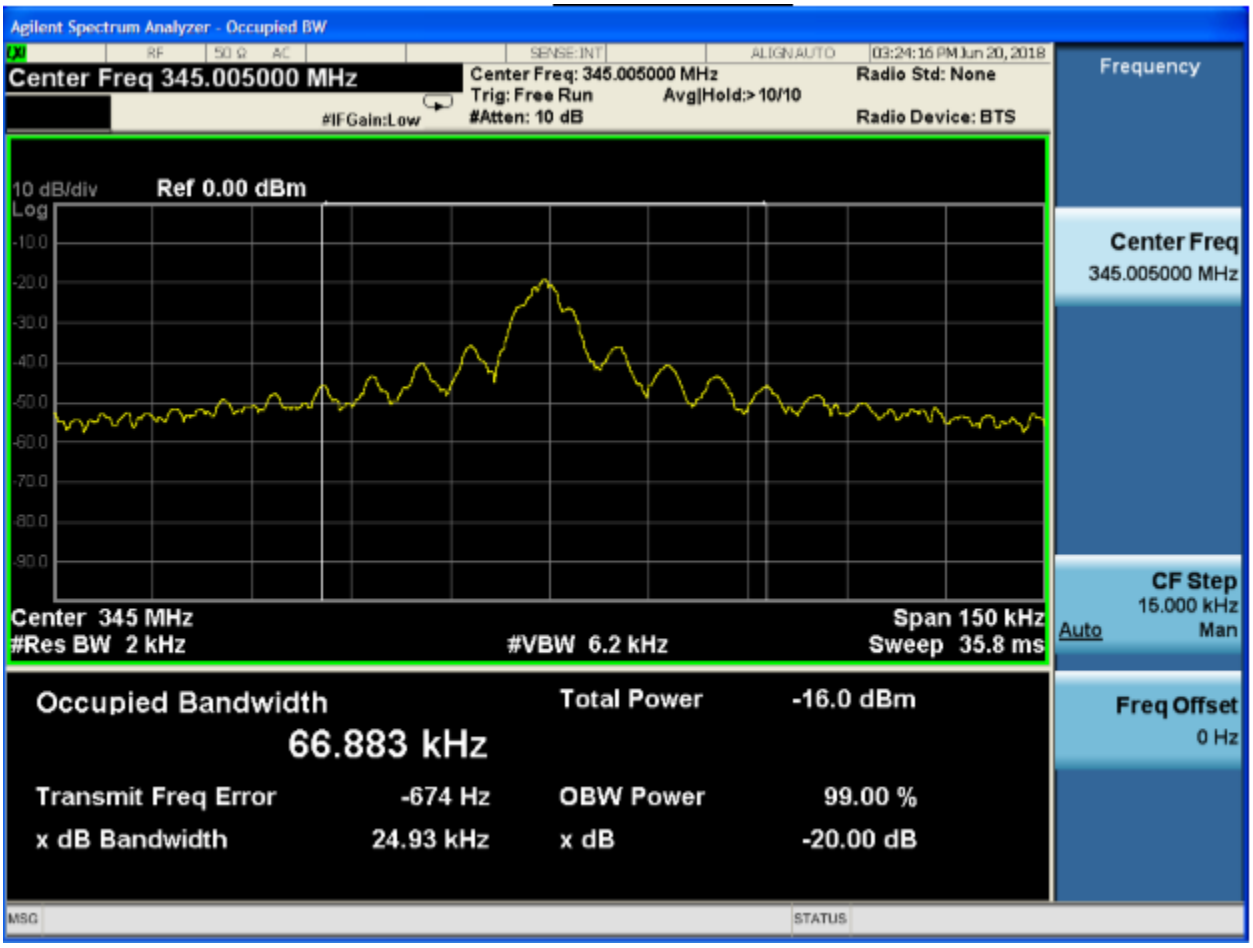
Allowed 20dB bandwidth of the transmitted signal is 0.25% of the carrier frequency.
BW Limit = 0.0025*345MHz = 0.8625MHz

Bandwidth measurements were taken at the following FCC-approved facility:

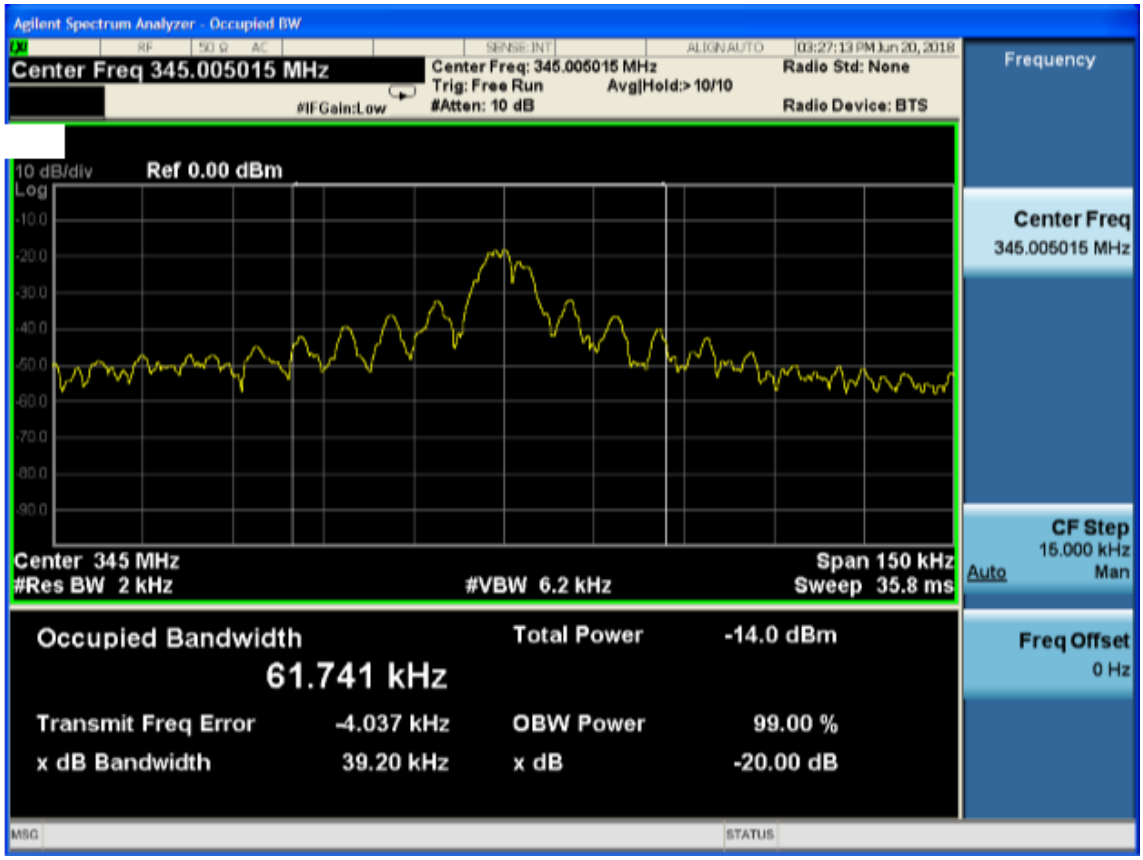
Rhein Tech Laboratories, Inc.
360 Herndon Parkway, Suite 1400
Herndon, VA 20170 USA
Contact: Rick McMurray
703-689-0368

The plots below show the modulated signal for the door/window and motion detector sensor types. The highest measured 20dB bandwidth of the modulated signal is 34kHz or 0.034MHz. These measurements show compliance with the bandwidth requirements.

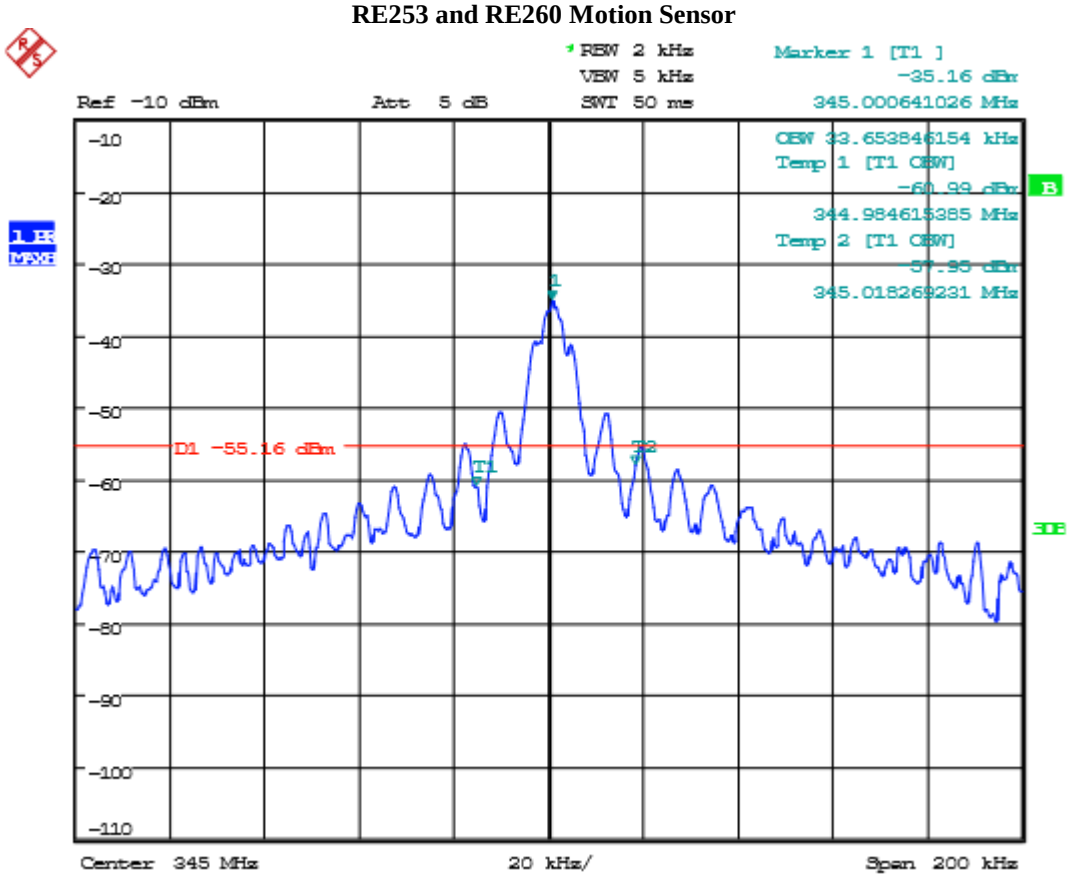
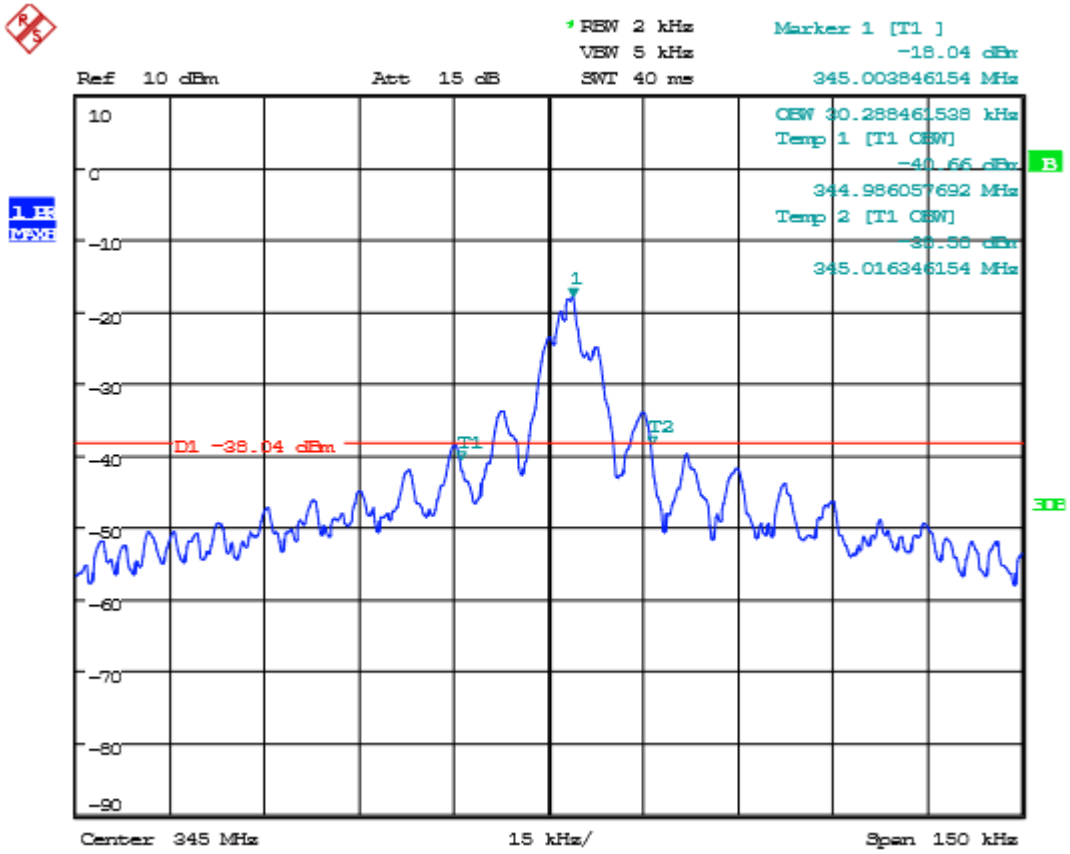
RE207 Door/Window



RE207T Door/Window



RE253 and RE260 Motion Sensor



RE253T and RE260T Motion Sensor