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RADIO REPORT

FCC 47 CFR Part 15C
ISED Canada RSS-247

Digital transmission systems operating within the 2400 – 2483.5 MHz band

Report Reference No	G0M-1806-7488-TFC247BL-V01
Testing Laboratory	Eurofins Product Service GmbH
Address	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation	A2LA Accredited Testing Laboratory, Certificate No.: 1983.01 FCC Test Firm Designation Number: DE0008 IC Testing Laboratory site: 3470A-2
Applicant	Atlas Copco Industrial Technique AB
Address	Sickla Industriväg 19 10523 Stockholm Sweden
Test Specification	According to FCC/ISED rules
Standard	47 CFR Part 15C RSS-247, Issue 2, 2017-02
Non-Standard Test Method	None
Equipment under Test (EUT):	
Product Description	Industrial Location Tethering - Positioning System
Model(s)	IL-R
Additional Model(s)	None
Brand Name(s)	None
Hardware Version(s)	1
Software Version(s)	1.0.1
FCC-ID	2AQ8P-ILR1
IC	24224-ILR1
Test Result	**PASSED**

Possible test case verdicts:		
required by standard but not tested	N/T	
not required by standard	N/R	
not applicable to EUT	N/A	
test object does meet the requirement	P(PASS)	
test object does not meet the requirement	F(FAIL)	
Testing:		
Test Lab Temperature	20 - 23 °C	
Test Lab Humidity	32 – 38 %	
Date of receipt of test item	2018-08-15	
Report:		
Compiled by	Abdullah Al Jamal	
Tested by (+ signature) (Responsible for Test)	Abdullah Al Jamal	
Approved by (+ signature) (Head of Lab)	Christian Weber	
Date of Issue	2018-11-20	
Total number of pages	103	
General Remarks:		
The test results presented in this report relate only to the object tested. **The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.** This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.		
Additional Comments:		
None		

VERSION HISTORY

Version History			
Version	Issue Date	Remarks	Revised By
01	2018-11-20	Initial Release	

ABBREVIATIONS AND ACRONYMS

Acronyms	
Acronym	Description
EUT	Equipment Under Test
FCC	Federal Communications Commission
ISED	Innovation, Science and Economic Development Canada
RBW	Resolution bandwidth
RMS	Root mean square
VBW	Video bandwidth
V_{NOM}	Nominal supply voltage

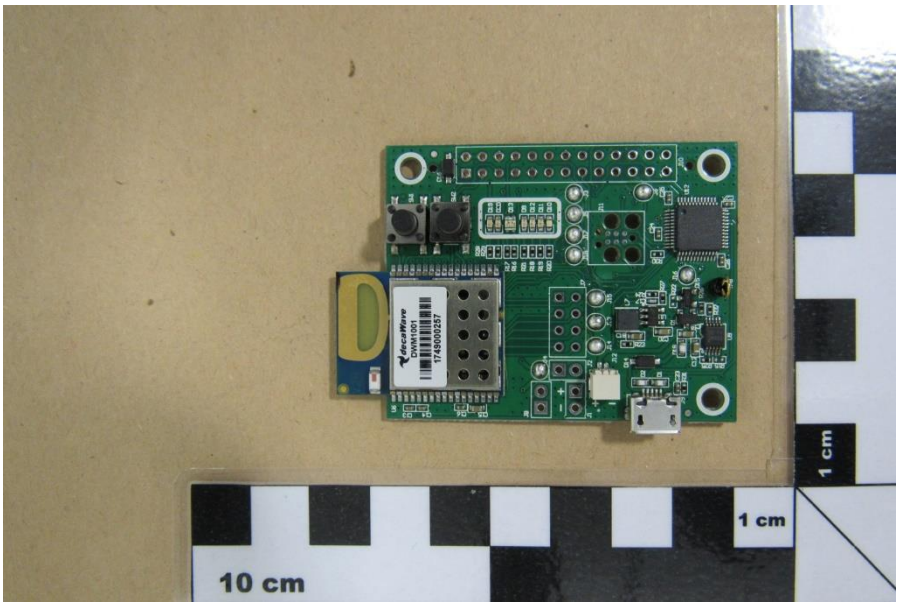
REPORT INDEX

1 Equipment (Test Item) Under Test

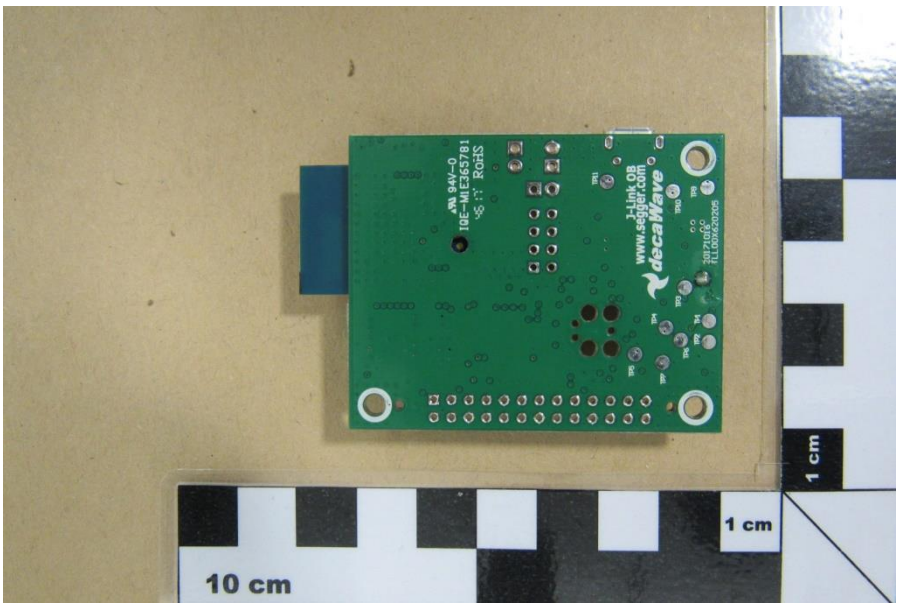
Description	Industrial Location Tethering - Positioning System	
Model	IL-R	
Additional Model(s)	None	
Brand Name(s)	None	
Serial Number(s)	Not specified	
Hardware Version(s)	1	
Software Version(s)	1.0.1	
PMN	Industrial Location Radio Module (IL-R)	
HVIN	1	
FVIN	1	
HMN	N/A	
FCC-ID	2AQ8P-ILR1	
IC	24224-ILR1	
Equipment type	End Product	
Radio type	Transceiver	
Assigned frequency bands	2400 - 2483.5 MHz	
Radio technology	Bluetooth LE	
Modulation	GFSK	
Number of antenna ports	1	
Antenna	Type	Integrated antenna
	Model	AT3216-B2R7HAAT
	Manufacturer	ACX
	Gain	0.5 dBi (declared by manufacturer)
Supply Voltage	V_{NOM}	3.3 VDC
Operating Temperature	T_{NOM}	25 °C
AC/DC-Adaptor	Model	N/A
	Vendor	N/A
	Input	N/A
	Output	N/A
Manufacturer	Atlas Copco Industrial Technique AB Sickla Industriväg 19 10523 Stockholm Sweden	

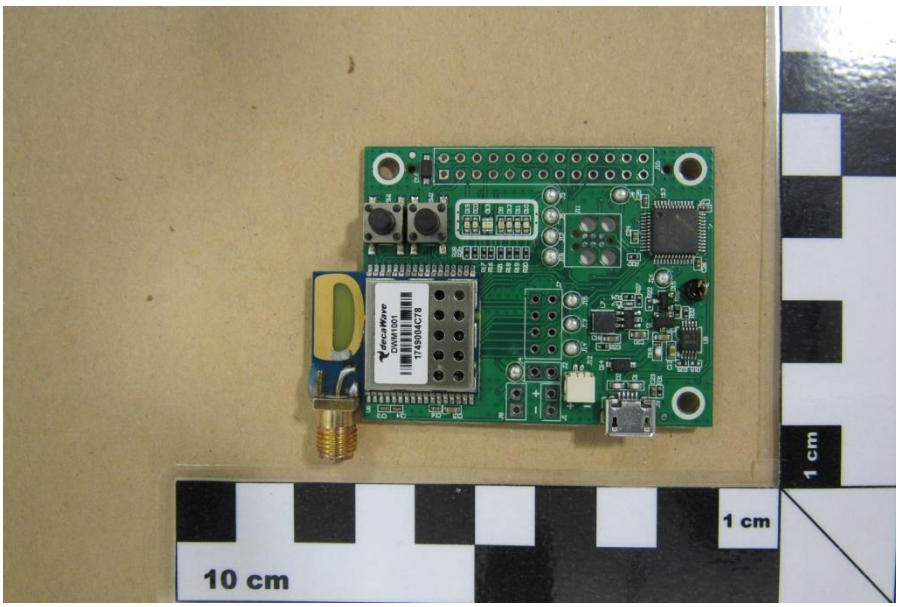
1.1 Photos – Equipment External

RADIATED SAMPLE – VIEW (A)



RADIATED SAMPLE – VIEW (B)



CONDUCTED SAMPLE – VIEW (A)


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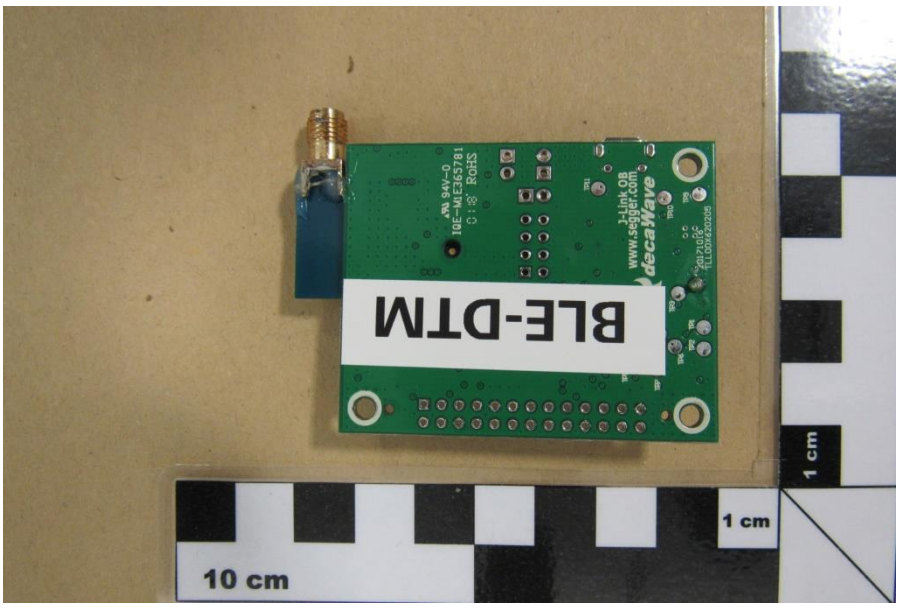
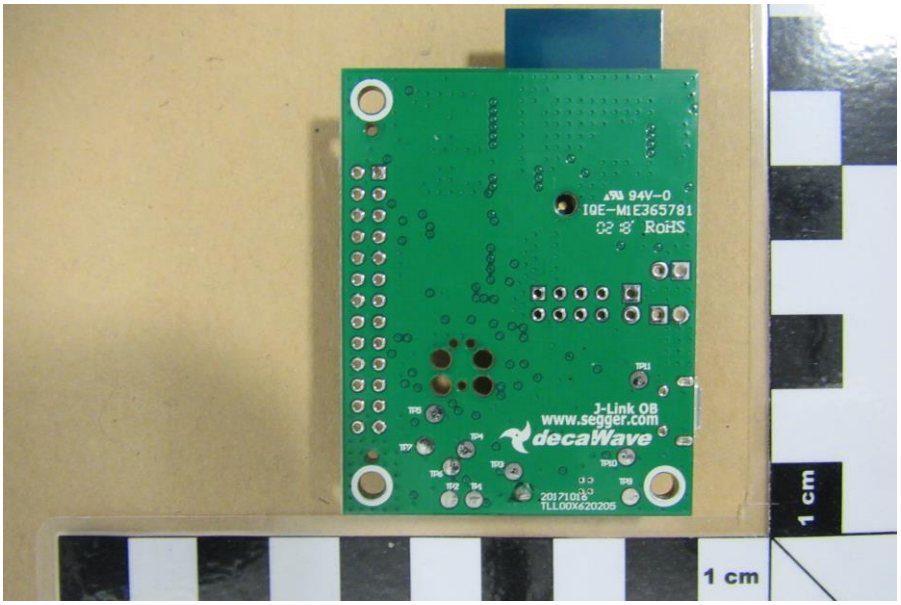
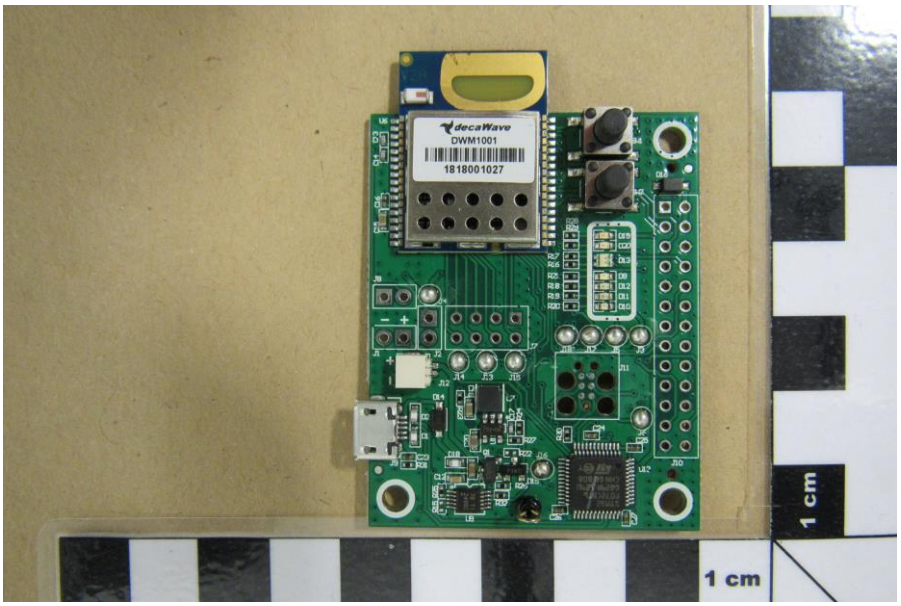
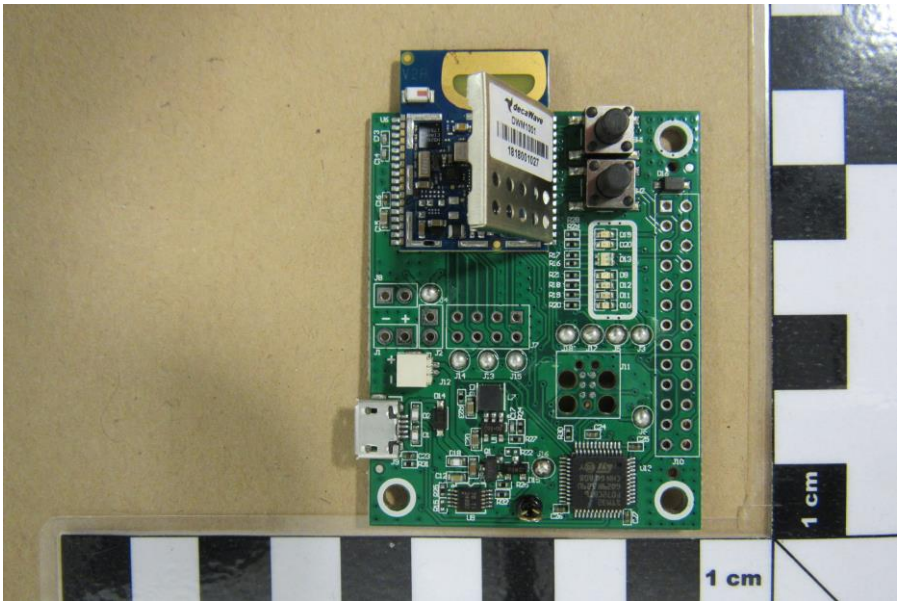


1.2 Photos – Equipment Internal

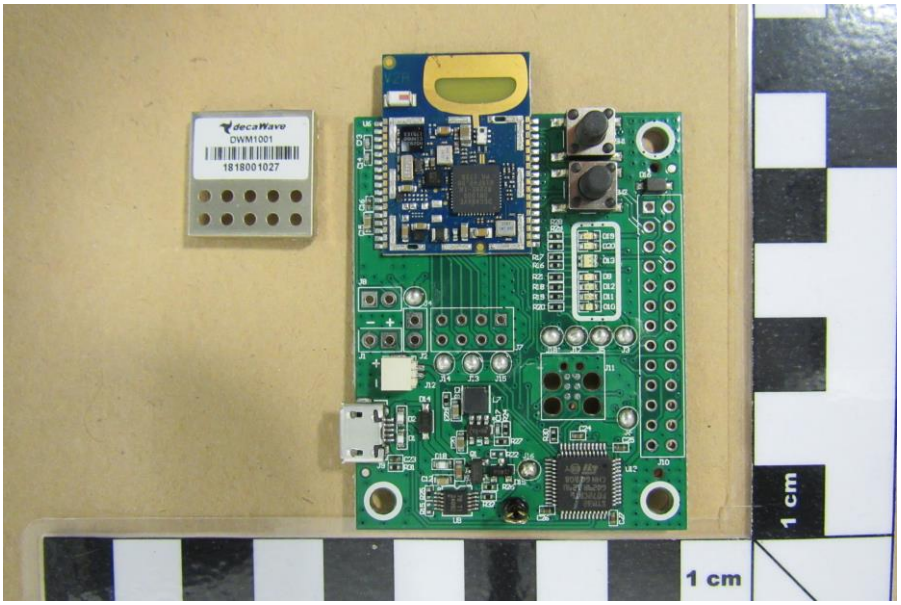
INTERNAL VIEW (A)


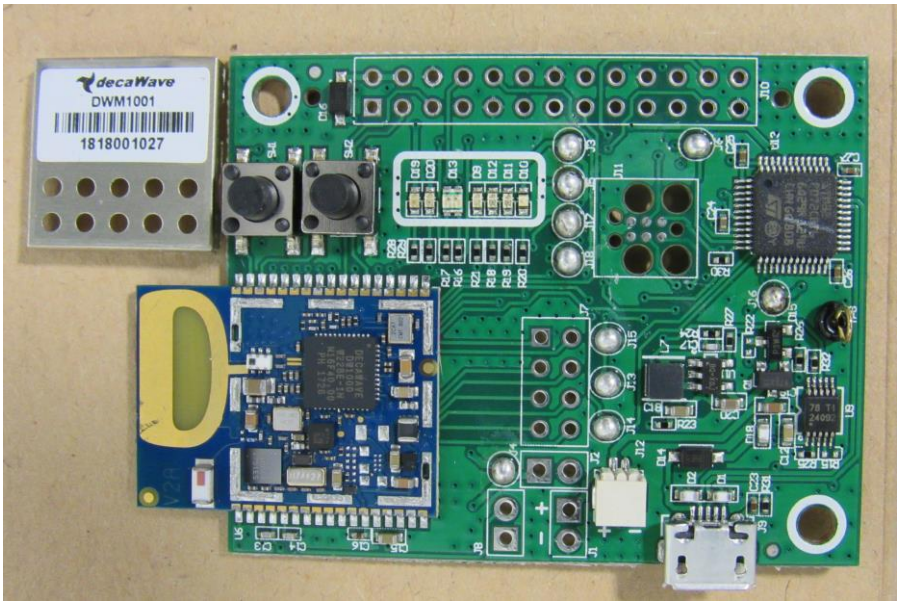
INTERNAL VIEW (B)


INTERNAL VIEW (C)

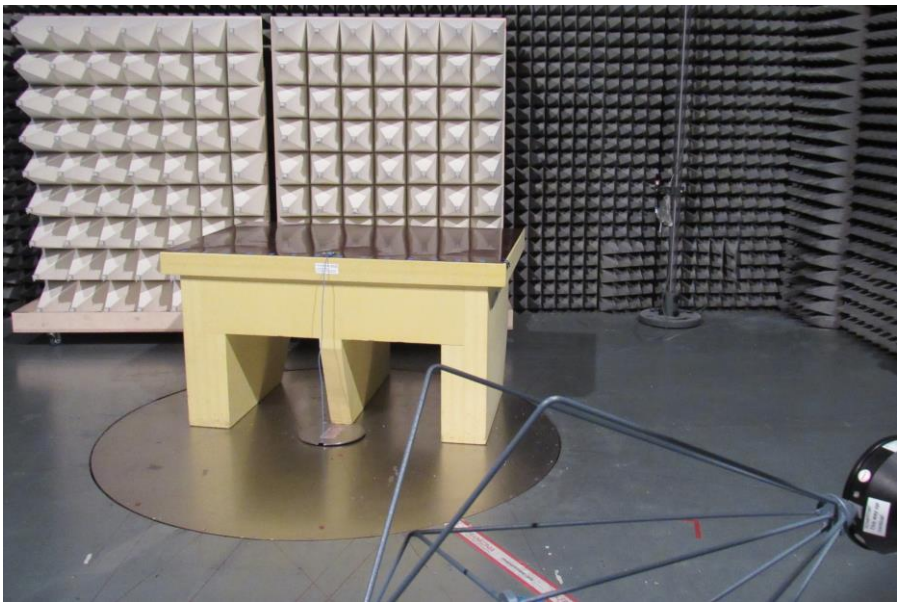


INTERNAL VIEW (D)



INTERNAL VIEW (E)


1.3 Photos – Test Setup

TEST SETUP RADIATED


TEST SETUP CONDUCTED (AC POWER LINE)


1.4 Support Equipment

Product Type	Device	Manufacturer	Model	Comment
AE1	Laptop	Dell	Latitude E6430	S/N 4MX5TY1
AE2	Power Supply	Dell	LA65NS2-01	S/N 6TM1C
AE3	FT232RL FTDI USB to TTL Converter Adapter Modul 5V 3.3V	Not specified	Not specified	Not specified
Description:				
AE1 – AE3	Auxiliary Equipment			
SIM	Simulator			
CBL	Connecting Cable			
Comment: None				

1.5 Test Modes

Mode	Description
GFSK	Mode = Transmit Modulation = GFSK Spreading = None Duty cycle = 64%
Receive	Mode = Receive
Comment: None	

1.6 Test Frequencies

Designator	Mode	Channel	Frequency [MHz]
F1	Tx / Rx	0	2402
F2	Tx / Rx	19	2440
F3	Tx / Rx	39	2480

1.7 Sample emission level calculation

The following is a description of terms and a sample calculation, as appears in the radiated emissions data table. The numbers used in the calculation are for example only. There is no direct correlation to the specific data taken for the product described in this document:

Reading:

This is the reading obtained on the spectrum analyzer in dBµV. Any external preamplifiers used are taken into account through internal analyzer settings.

A.F.:

This is the antenna factor for the receiving antenna. It is a conversion factor, which converts electric fields strengths to voltages, which can be measured directly on the spectrum analyzer. It is treated as a loss in dB. Cable losses have been included with the A.F. to simplify the calculations. The antenna factor is used in calculations as follows:

Reading on Analyzer (dBµV) + A.F. (dB/m) = Net field strength (dBµV/m)

Net:

This is the net field strength measurement (as shown above).

Limit:

This is the FCC Class B radiated emission limit (in units of dBµV/m). The FCC limits are given in units of µV/m. The following formula is used to convert the units of µV/m to dBµV/m:

Limit (dBµV/m) = 20*log (µV/m)

Margin:

This is the margin of compliance below the FCC limit. The units are given in dB. A negative margin indicates the emission was below the limit. A positive margin indicates that the emission exceeds the limit.

Example only:

Reading + AF	= Net Reading	:	Net reading - FCC limit	= Margin
+21.5 dBµV + 26 dB/m	= 47.5 dBµV/m	:	47.5 dBµV/m - 57.0 dBµV/m	= -9.5 dB

2 Result Summary

FCC 47 CFR Part 15C, ISED RSS-247				
Product Standard Reference	**Requirement**	**Reference Method**	**Result**	**Remarks**
ISED RSS-Gen, Issue 5 (section 6.6)	Occupied Bandwidth	ANSI C63.10-2013	N/R	Informational only
FCC § 15.247(a)(2) ISED RSS-247, Issue 2 (section 5.2)	6 dB Bandwidth	ANSI C63.10-2013	PASS	
FCC § 15.247(b)(1) ISED RSS-247, Issue 2 (section 5.4)	Maximum peak conducted power	ANSI C63.10-2013	PASS	
FCC § 15.247(e) ISED RSS-247, Issue 2 (section 5.2)	Power spectral density	ANSI C63.10-2013	PASS	
FCC § 15.207 ISED RSS-247, Issue 2 (section 3.1)	AC power line conducted emissions	ANSI C63.10-2013	PASS	
FCC § 15.247(d) ISED RSS-247, Issue 2 (section 5.5)	Band edge compliance	ANSI C63.10-2013	PASS	
FCC § 15.247(d) ISED RSS-247, Issue 2 (section 5.5)	Conducted spurious emissions	ANSI C63.10-2013	PASS	
FCC § 15.247(d) FCC § 15.209 ISED RSS-Gen, Issue 5 (section 6.13)	Transmitter radiated spurious emissions	ANSI C63.10-2013	PASS	
ISED RSS-247, Issue 2 (section 3.1)	Receiver radiated spurious emissions	ANSI C63.10-2013	PASS	
Comment: None				

Possible Test Case Verdicts	
PASS	Test object does meet the requirements
FAIL	Test object does not meet the requirements
N/T	Required by standard but not tested
N/R	Not required by standard for the test object

3 Test Conditions and Results

3.1 Test Conditions and Results - Occupied bandwidth

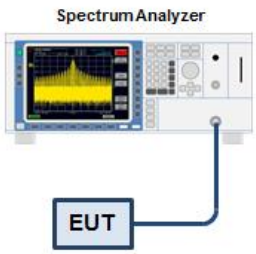
3.1.1 Information

Test Information	
Reference	ISED RSS-Gen, Issue 5 (section 6.6)
Measurement Method	ANSI C63.10 6.9.3
Operator	Abdullah Al Jamal
Date	2018-08-16

3.1.2 Limits

Limits
None (Informational only)

3.1.3 Setup

Test Setup


3.1.4 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSU 3	EF00241	2017-07	2019-07

3.1.5 Procedure

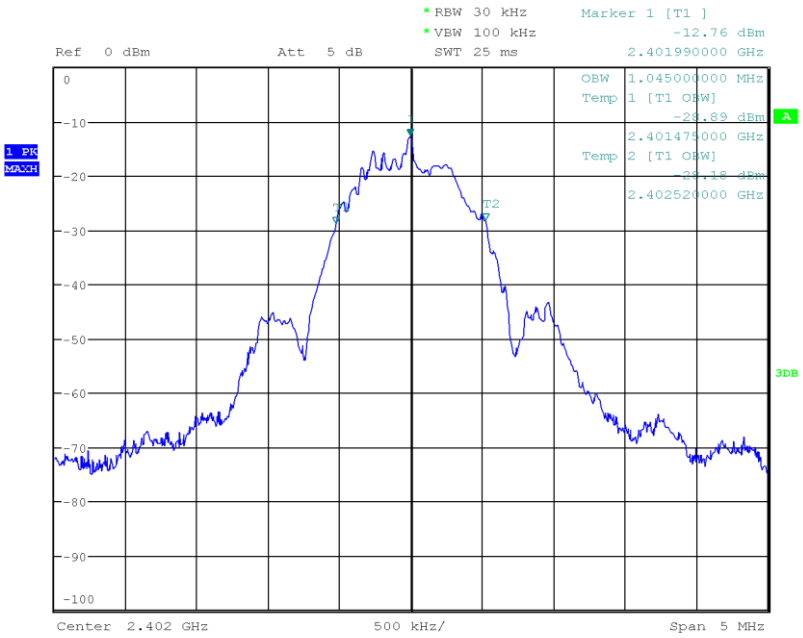
Test Procedure
1. EUT transmitter is activated in test mode under normal conditions 2. The spectrum analyzer is set to peak detection and maximum hold with a span twice the emission spectrum 3. The resolution bandwidth is set to the range of 1 % to 5 % of the occupied bandwidth 4. The occupied bandwidth is measured with the build-in analyzer function

3.1.6 Results

Test Results		
Mode	Frequency [MHz]	Bandwidth [MHz]
GFSK	2402	1.045
GFSK	2440	1.045
GFSK	2480	1.050

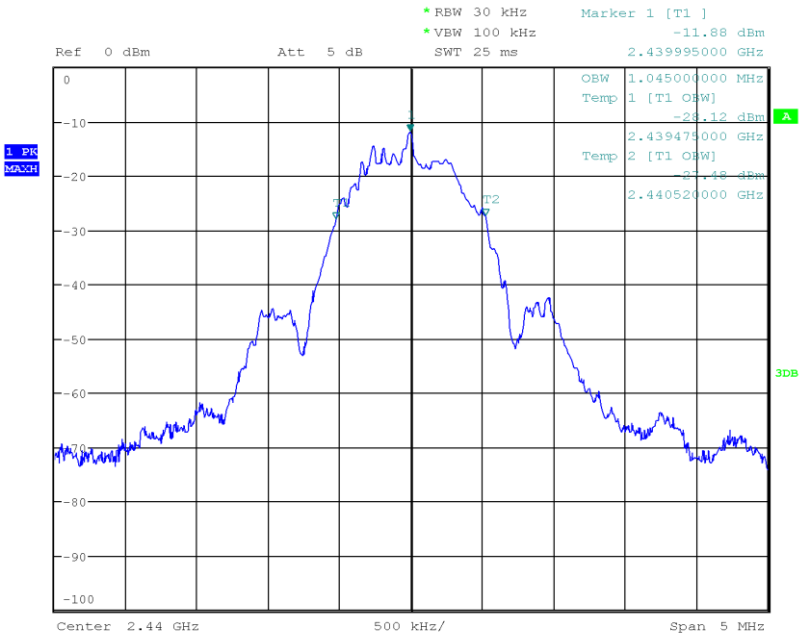
Occupied Bandwidth

Project Number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
Model Description:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Sample ID:	19861
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 6.9.3
Operational Mode:	GFSK, Channel: 0, 2402 MHz
Operating Conditions:	Tnom/Vnom
Operator:	A. Al Jamal
Test Site:	Eurofins Product Service GmbH
Test Date:	2018-08-16
Occupied Bandwidth [MHz]:	1.045



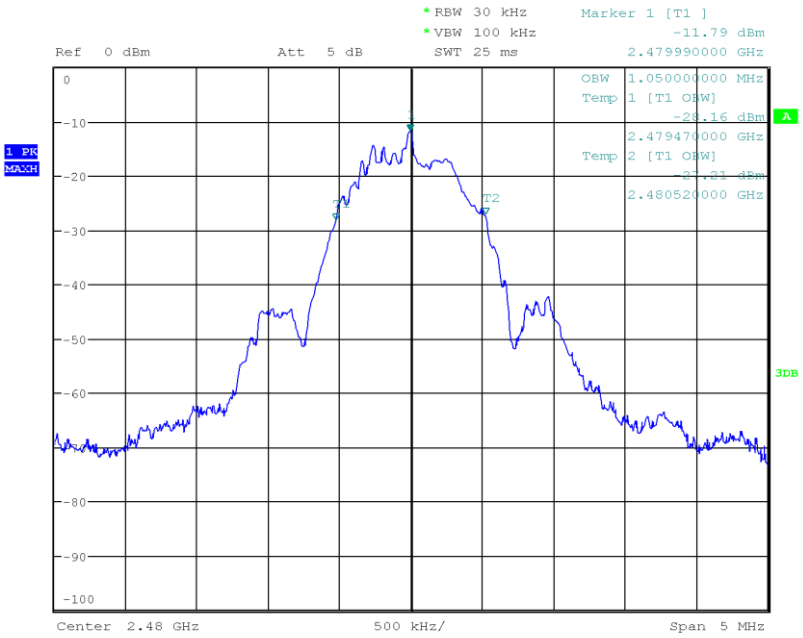
Occupied Bandwidth

Project Number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
Model Description:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Sample ID:	19861
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 6.9.3
Operational Mode:	GFSK, Channel: 19, 2440 MHz
Operating Conditions:	Tnom/Vnom
Operator:	A. Al Jamal
Test Site:	Eurofins Product Service GmbH
Test Date:	2018-08-16
Occupied Bandwidth [MHz]:	1.045



Occupied Bandwidth

Project Number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
Model Description:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Sample ID:	19861
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 6.9.3
Operational Mode:	GFSK, Channel: 39, 2480 MHz
Operating Conditions:	Tnom/Vnom
Operator:	A. Al Jamal
Test Site:	Eurofins Product Service GmbH
Test Date:	2018-08-16
Occupied Bandwidth [MHz]:	1.050



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3.2 Test Conditions and Results - 6 dB bandwidth

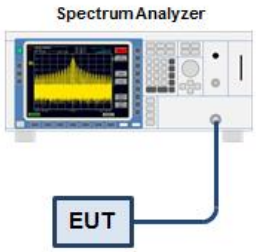
3.2.1 Information

Test Information	
Reference	FCC § 15.247(a)(2); ISED RSS-247, Issue 2 (section 5.2)
Measurement Method	ANSI C63.10 11.8
Operator	Abdullah Al Jamal
Date	2018-08-16

3.2.2 Limits

Limits
≥ 500kHz

3.2.3 Setup

Test Setup


3.2.4 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSU 3	EF00241	2017-07	2019-07

3.2.5 Procedure

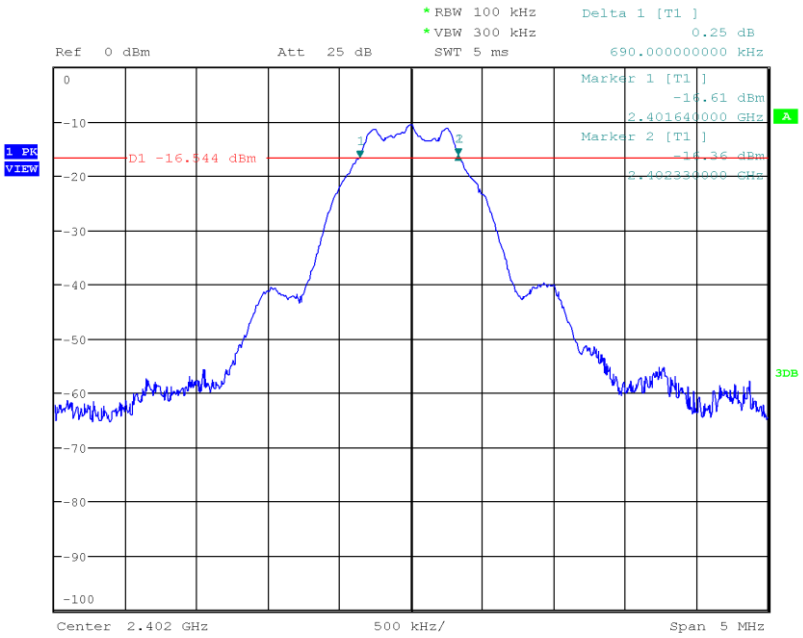
Test Procedure
1. EUT set to test mode 2. Span set to at least twice the emission spectrum 3. Detector set to peak and max hold and RBW is set to 100 kHz 4. Envelope peak value of emission spectrum is selected 5. Marker on envelope of spectrum is set to level of -6 dB to the left of the peak 6. Marker on envelope of spectrum is set to level of -6 dB to the right of the peak 7. 6 dB Bandwidth is determined by marker frequency separation

3.2.6 Results

Test Results				
Mode	Frequency [MHz]	Bandwidth [kHz]	Limit [kHz]	Verdict
GFSK	2402	690	500	PASS
GFSK	2440	700	500	PASS
GFSK	2480	695	500	PASS

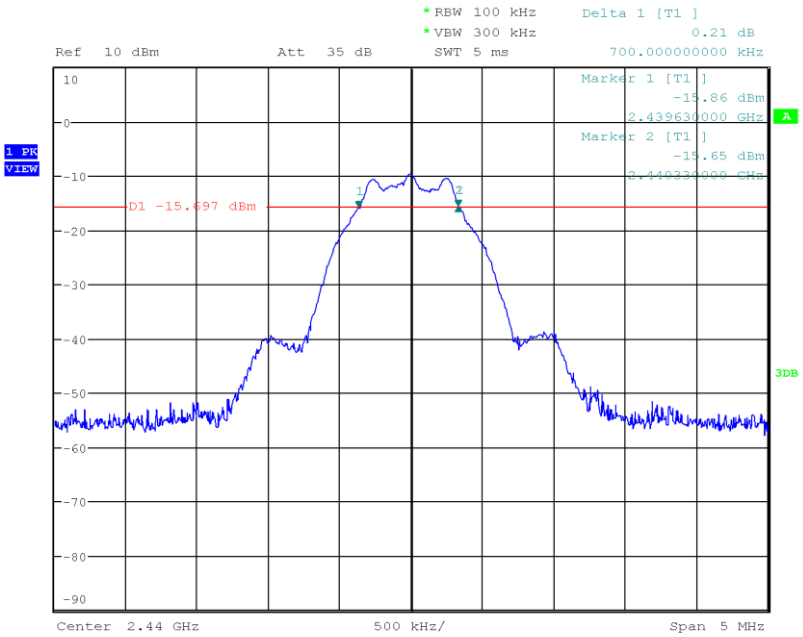
DTS (6 dB) Bandwidth

Project Number:	G0M-1806-4788
Applicant:	Atlas Copco Industrial Technique AB
Model Description:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Sample ID:	19845
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 11.8.1 Option 1
Operational Mode:	GFSK, Channel: 0, 2402 MHz
Operating Conditions:	Tnom/Vnom
Operator:	Abdullah Al Jamal
Test Site:	Eurofins Product Service GmbH
Test Date:	2018-08-16
Lower Frequency [MHz]:	2401.640
Upper Frequency [MHz]:	2402.330
6 dB Bandwidth [kHz]:	690



DTS (6 dB) Bandwidth

Project Number:	G0M-1806-4788
Applicant:	Atlas Copco Industrial Technique AB
Model Description:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Sample ID:	19845
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 11.8.1 Option 1
Operational Mode:	GFSK, Channel: 19, 2440 MHz
Operating Conditions:	Tnom/Vnom
Operator:	Abdullah Al Jamal
Test Site:	Eurofins Product Service GmbH
Test Date:	2018-08-16
Lower Frequency [MHz]:	2439.630
Upper Frequency [MHz]:	2440.330
6 dB Bandwidth [kHz]:	700



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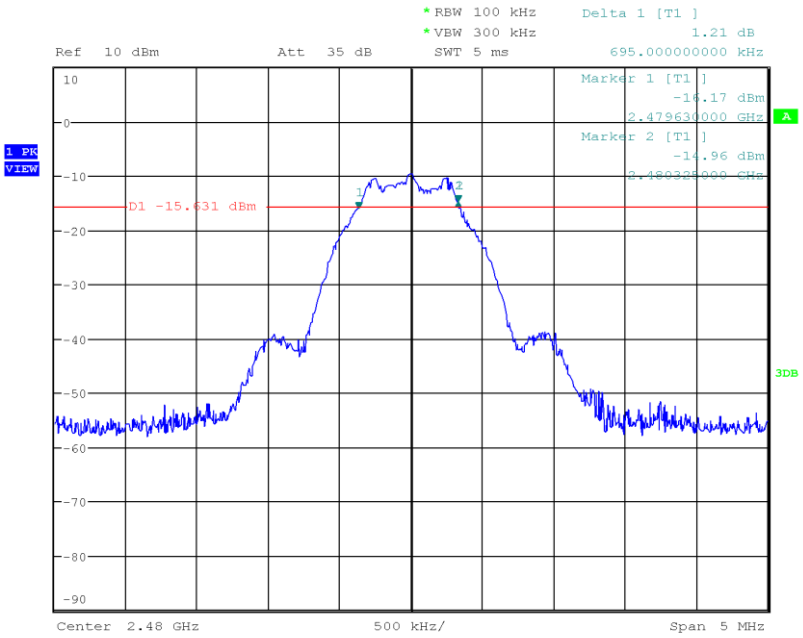
DTS (6 dB) Bandwidth

Project Number:	G0M-1806-4788
Applicant:	Atlas Copco Industrial Technique AB
Model Description:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Sample ID:	19845
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 11.8.1 Option 1
Operational Mode:	GFSK, Channel: 39, 2480 MHz
Operating Conditions:	Tnom/Vnom
Operator:	Abdullah Al Jamal
Test Site:	Eurofins Product Service GmbH
Test Date:	2018-08-16
Lower Frequency [MHz]:	2479.630
Upper Frequency [MHz]:	2480.325
6 dB Bandwidth [kHz]:	695



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3.3 Test Conditions and Results - Maximum peak conducted output power

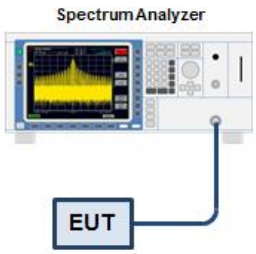
3.3.1 Information

Test Information	
Reference	FCC § 15.247(b)(1); ISED RSS-247, Issue 2 (section 5.4)
Measurement Method	ANSI C63.10 11.9.1
Operator	Abdullah Al Jamal
Date	2018-08-16

3.3.2 Limits

Limits
1 W (30 dBm)
The conducted output power limit specified above is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in the table, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.3.3 Setup

Test Setup


3.3.4 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSU 3	EF00241	2017-07	2019-07

3.3.5 Procedure

Test Procedure
1. EUT set to test hopping mode (Communication tester is used if needed) 2. Analyzer resolution bandwidth is set ≥ DTS bandwidth 3. Detector set to peak and max hold 4. Sweep time is set to auto 5. After the trace has stabilized a marker is set to peak of envelope

3.3.6 Results

Test Results				
Channel [MHz]	Power [dBm]	Power [W]	Limit [W]	Verdict
2402	-3.051	0.0005	1.0	PASS
2440	-2.196	0.0006	1.0	PASS
2480	-2.068	0.0006	1.0	PASS

3.4 Test Conditions and Results - Power spectral density

3.4.1 Information

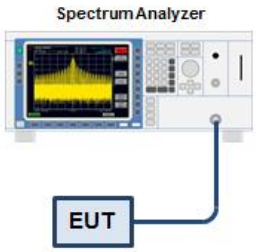
Test Information	
Reference	FCC § 15.247(e); ISED RSS-247, Issue 2 (section 5.2)
Measurement Method	ANSI C63.10 11.10.2, 14.3.2
Operator	Abdullah Al Jamal
Date	2018-08-16

3.4.2 Limits

Limits
8 dBm / 3 kHz

3.4.3 Setup

Test Setup



3.4.4 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSU 3	EF00241	2017-07	2019-07

3.4.5 Procedure

Test Procedure

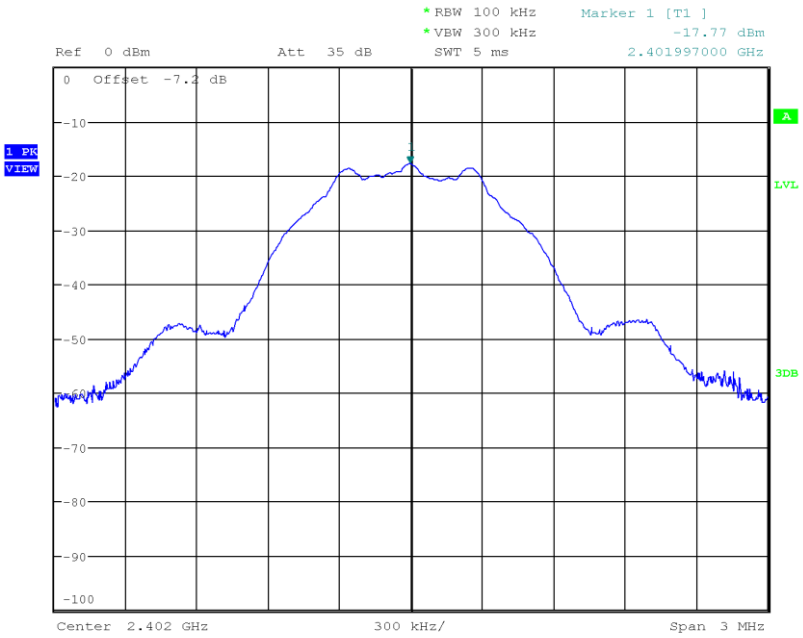
1. EUT set to test mode
2. The analyzer is set to DTS channel center frequency with a span of 1.5 times the DTS bandwidth
3. The RBW is set to 100 kHz with VBW ≥ RBW and the detector is set to peak with max hold
4. After the trace has stabilized a marker is set to the envelope maximum
5. If the power spectral density is above the limit the RBW is reduced (not lower than 3 kHz) and the measurement is repeated
6. If the EUT has more than one transmit chain the procedure is repeated for each transmit chain

3.4.6 Results

Test Results			
Channel [MHz]	PSD [dBm/RBW]	Limit [dBm/3kHz]	Verdict
2402	-17.772	8.0	PASS
2440	-16.907	8.0	PASS
2480	-16.779	8.0	PASS
RBW = 100 kHz			

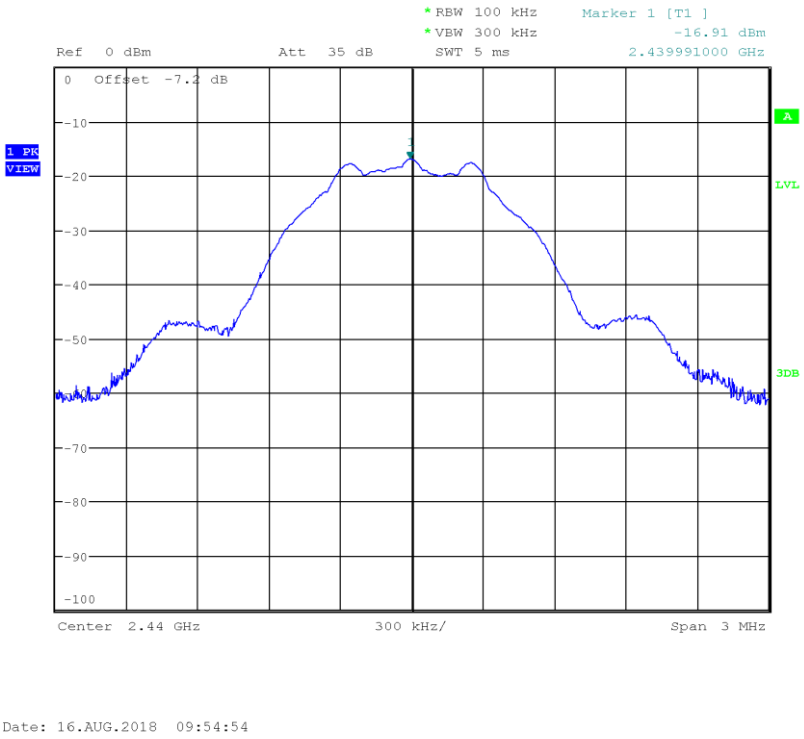
Peak Power Spectral Density

Project Number:	G0M-1806-4788
Applicant:	Atlas Copco Industrial Technique AB
Model Description:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Sample ID:	19845
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 11.10.2
Operational Mode:	GFSK, Channel: 0, 2402 MHz
Operating Conditions:	Tnom/Vnom
Operator:	Abdullah Al Jamal
Test Site:	Eurofins Product Service GmbH
Test Date:	2018-08-16
Peak Frequency [MHz]:	2401.997
Spectral Density [dBm/RBW]:	-17.772
Resolution Bandwidth [kHz]:	100 kHz



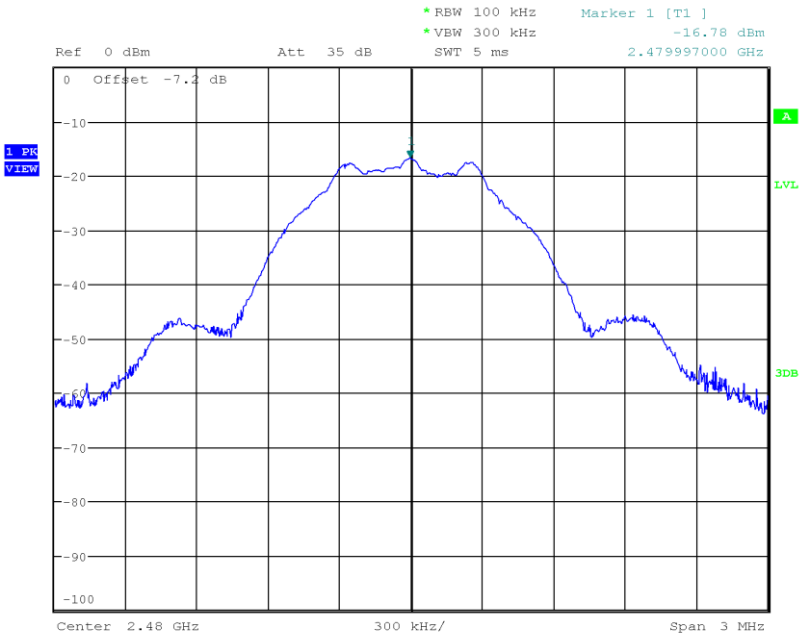
Peak Power Spectral Density

Project Number:	G0M-1806-4788
Applicant:	Atlas Copco Industrial Technique AB
Model Description:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Sample ID:	19845
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 11.10.2
Operational Mode:	GFSK, Channel: 19, 2440 MHz
Operating Conditions:	Tnom/Vnom
Operator:	Abdullah Al Jamal
Test Site:	Eurofins Product Service GmbH
Test Date:	2018-08-16
Peak Frequency [MHz]:	2439.991
Spectral Density [dBm/RBW]:	-16.907
Resolution Bandwidth [kHz]:	100 kHz



Peak Power Spectral Density

Project Number:	G0M-1806-4788
Applicant:	Atlas Copco Industrial Technique AB
Model Description:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Sample ID:	19845
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 11.10.2
Operational Mode:	GFSK, Channel: 39, 2480 MHz
Operating Conditions:	Tnom/Vnom
Operator:	Abdullah Al Jamal
Test Site:	Eurofins Product Service GmbH
Test Date:	2018-08-16
Peak Frequency [MHz]:	2479.997
Spectral Density [dBm/RBW]:	-16.779
Resolution Bandwidth [kHz]:	100 kHz



Date: 16.AUG.2018 09:55:59

3.5 Test Conditions and Results - AC powerline conducted emissions

3.5.1 Information

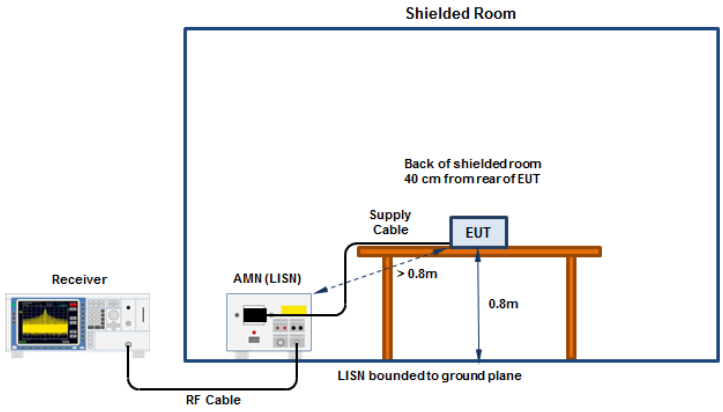
Test Information	
Reference	FCC § 15.207; ISED RSS-247, Issue 2 (section 3.1)
Measurement Method	ANSI C63.10 6.2
Operator	Abdullah Al Jamal
Date	2018-09-04

3.5.2 Limits

Limits		
Frequency [MHz]	Quasi-Peak [dBµV]	Average [dBµV]
0.15 - 0.5	66 - 56*	56 - 46*
0.5 - 5	56	46
5 - 30	60	50
* Limit decreases linearly with the logarithm of the frequency		

3.5.3 Setup

Test Setup



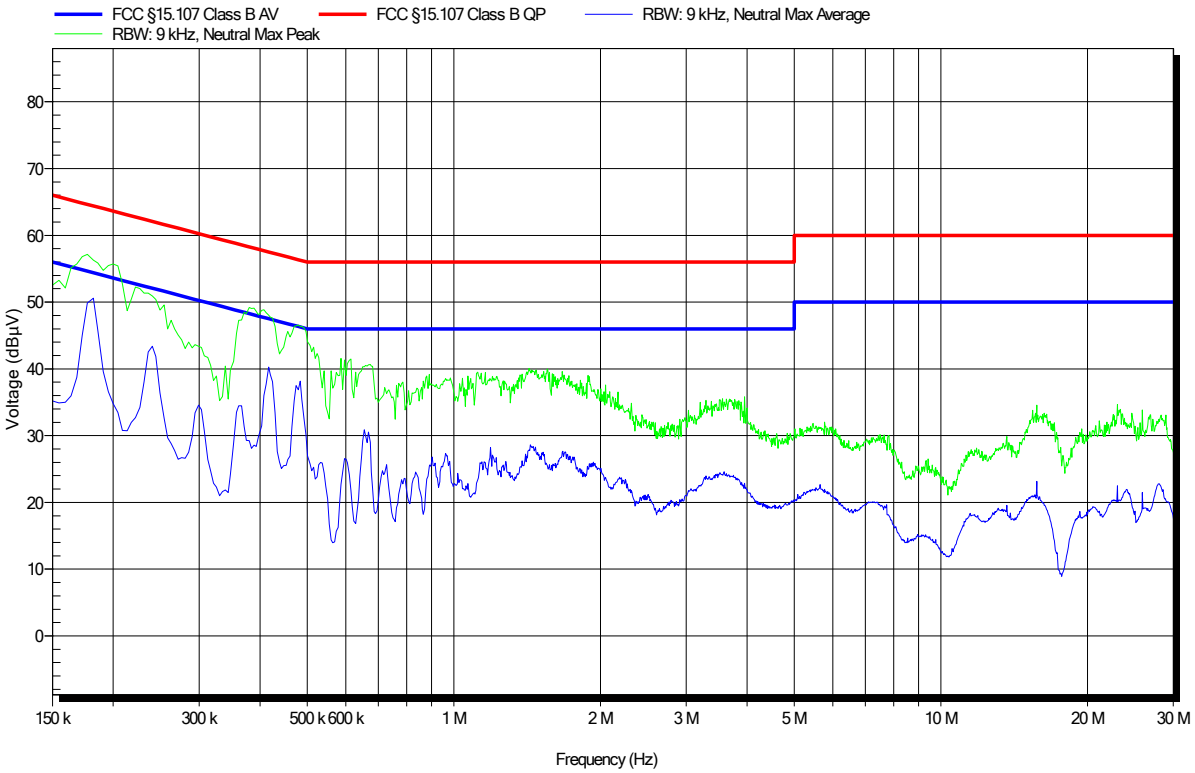
3.5.4 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
EMI Test Receiver	R&S	ESCS 30	EF00295	2018-07	2019-07
LISN	R&S	ESH2-Z5	EF00182	2017-01	2019-01

EMI voltage test in the ac-mains according to FCC Part C 15.207

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 23.9°C, Vnom: 3.3 VDC
LISN:	ESH2-Z5 N
Mode:	LE (2402 MHz)
Test Date:	2018-09-04
Note:	

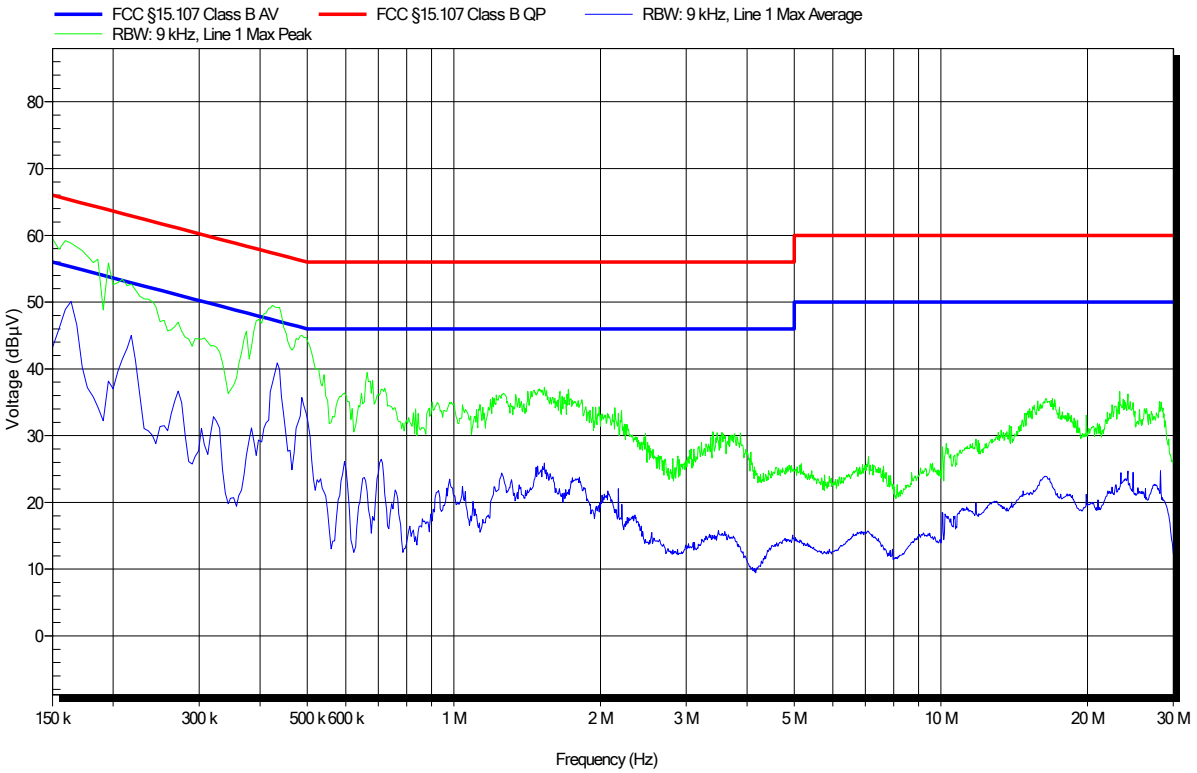
Index 2



EMI voltage test in the ac-mains according to FCC Part C 15.207

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 23.9°C, Vnom: 3.3 VDC
LISN:	ESH2-Z5 L
Mode:	LE (2402 MHz)
Test Date:	2018-09-04
Note:	

Index 3



3.6 Test Conditions and Results - Band-edge compliance

3.6.1 Information

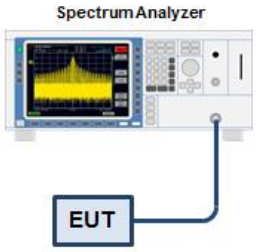
Test Information	
Reference	FCC § 15.247(d); ISED RSS-247, Issue 2 (section 5.5)
Measurement Method	ANSI C63.10 11.13
Operator	Abdullah Al Jamal
Date	2018-08-16

3.6.2 Limits

Limits	
Power Measurement	Out-of-band attenuation [dB]
Peak	20
RMS	30

3.6.3 Setup

Test Setup



3.6.4 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSU 3	EF00241	2017-07	2019-07

3.6.5 Procedure

Test Procedure

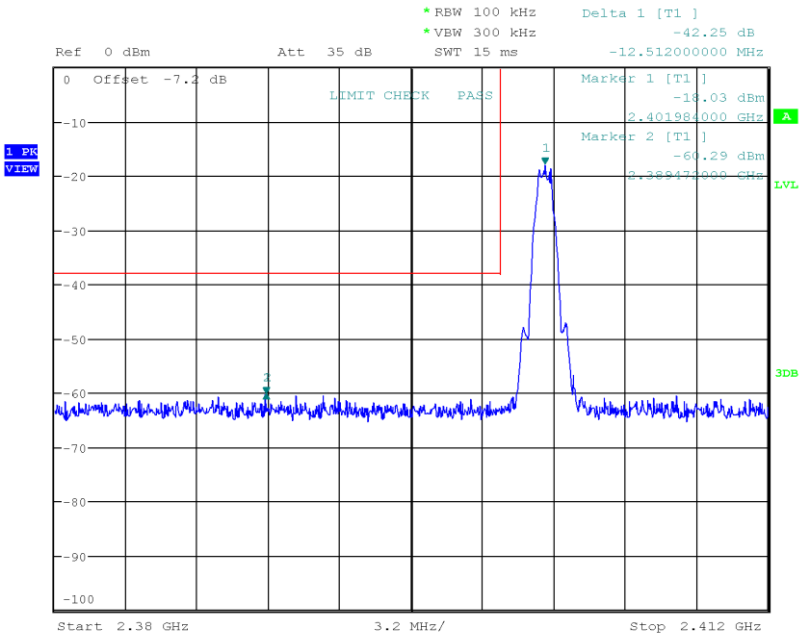
1. EUT set to test mode (Communication tester is used if needed)
2. Span set around lower band edge and detector is set to peak and max hold
3. Resolution bandwidth is set to 100 kHz
4. Markers are set to peak emission levels within frequency band and outside frequency band
5. Band edge attenuation is determined from level difference

3.6.6 Results

Test Results				
Mode	Channel [MHz]	Out-of-band Attenuation [dB]	Limit [dB]	Verdict
GFSK	2402	-42.25	-20	PASS
GFSK	2480	-41.77	-20	PASS

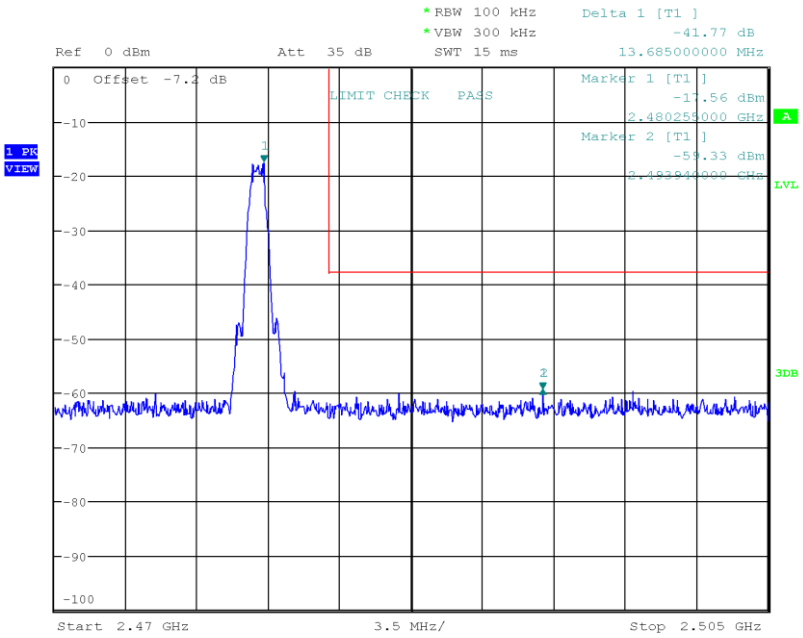
Band-edge Compliance

Project Number:	G0M-1806-4788
Applicant:	Atlas Copco Industrial Technique AB
Model Description:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Sample ID:	19845
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 7.8.6, 6.10.4
Operating Conditions:	Tnom/Vnom
Operator:	Abdullah Al Jamal
Test Site:	Eurofins Product Service GmbH
Test Date:	2018-08-16
Band-edge	Lower
In-band Frequency [MHz]:	2401.984
Max. in-band Level [dBm/100 kHz]:	-18.033
Out-of-band Frequency [MHz]:	2389.472
Max. out-of-band Level [dBm/100 kHz]:	-60.286
Attenuation [dB]:	-42.25



Band-edge Compliance

Project Number:	G0M-1806-4788
Applicant:	Atlas Copco Industrial Technique AB
Model Description:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Sample ID:	19845
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 7.8.6, 6.10.4
Operating Conditions:	Tnom/Vnom
Operator:	Abdullah Al Jamal
Test Site:	Eurofins Product Service GmbH
Test Date:	2018-08-16
Band-edge	Upper
In-band Frequency [MHz]:	2480.255
Max. in-band Level [dBm/100 kHz]:	-17.561
Out-of-band Frequency [MHz]:	2493.94
Max. out-of-band Level [dBm/100 kHz]:	-59.328
Attenuation [dB]:	-41.77



3.7 Test Conditions and Results - Conducted spurious emissions

3.7.1 Information

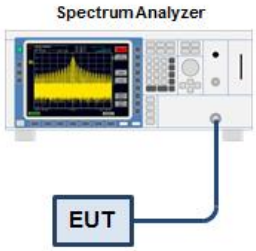
Test Information	
Reference	FCC § 15.247(d); ISED RSS-247, Issue 2 (section 5.5)
Measurement Method	ANSI C63.10 11.11
Operator	Abdullah Al Jamal
Date	2018-08-16

3.7.2 Limits

Limits	
Power Measurement	Out-of-band attenuation [dB]
Peak	20
RMS	30

3.7.3 Setup

Test Setup



3.7.4 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSU 3	EF00241	2017-07	2019-07

3.7.5 Procedure

Test Procedure

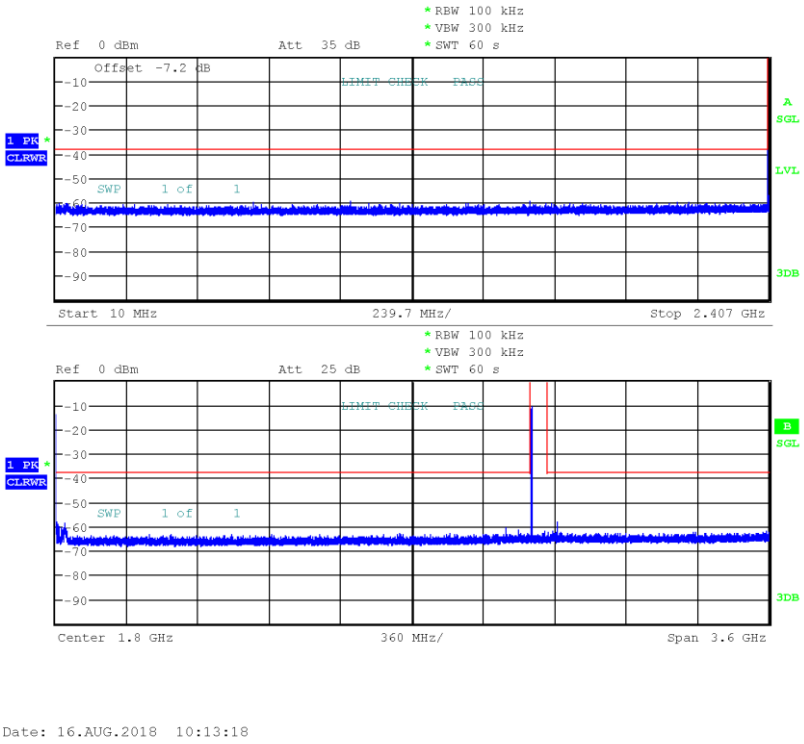
1. EUT set to test mode (Communication tester is used if needed)
2. Span set around lower band edge and detector is set to peak and max hold
3. Resolution bandwidth is set to 100 kHz
4. Markers are set to peak emission levels within frequency band and outside frequency band
5. Band edge attenuation is determined from level difference

3.7.6 Results

Test Results		
Mode	Channel [MHz]	Verdict
GFSK	2402	PASS
GFSK	2440	PASS
GFSK	2480	PASS

Conducted Spurious Emissions

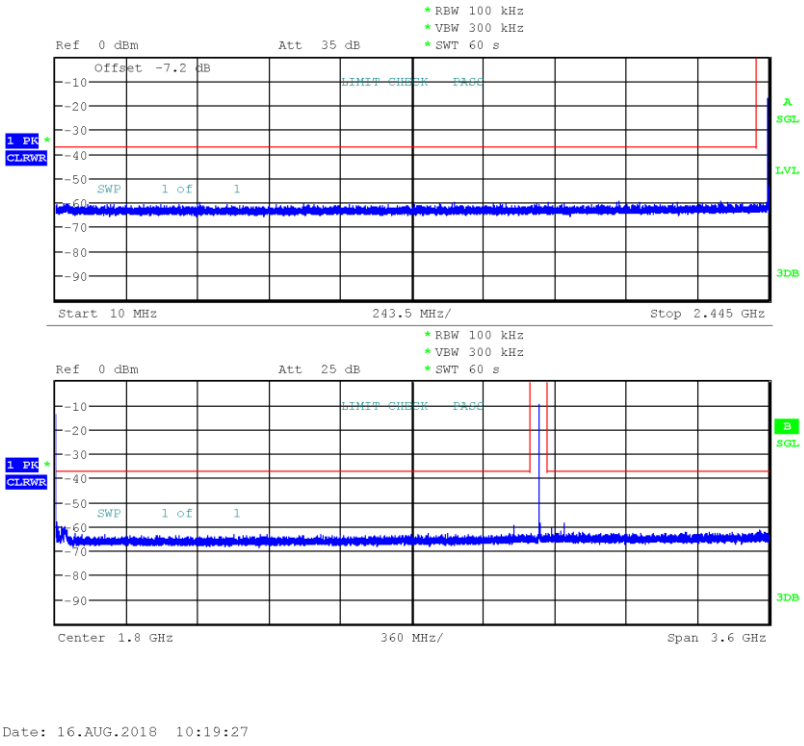
Project Number:	G0M-1806-4788
Applicant:	Atlas Copco Industrial Technique AB
Model Description:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Sample ID:	19845
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 11.11
Operational Mode:	GFSK, Channel: 0, 2402 MHz
Operating Conditions:	Tnom/Vnom
Operator:	Christian Weber
Test Site:	Eurofins Product Service GmbH
Test Date:	2018-08-16
Max. in-band Frequency [MHz]:	2402.0
Max. in-band Level [dBm/100 kHz]:	-17.8
Out-of-band Limit [dBm/100 kHz]:	-37.8



Date: 16.AUG.2018 10:13:18

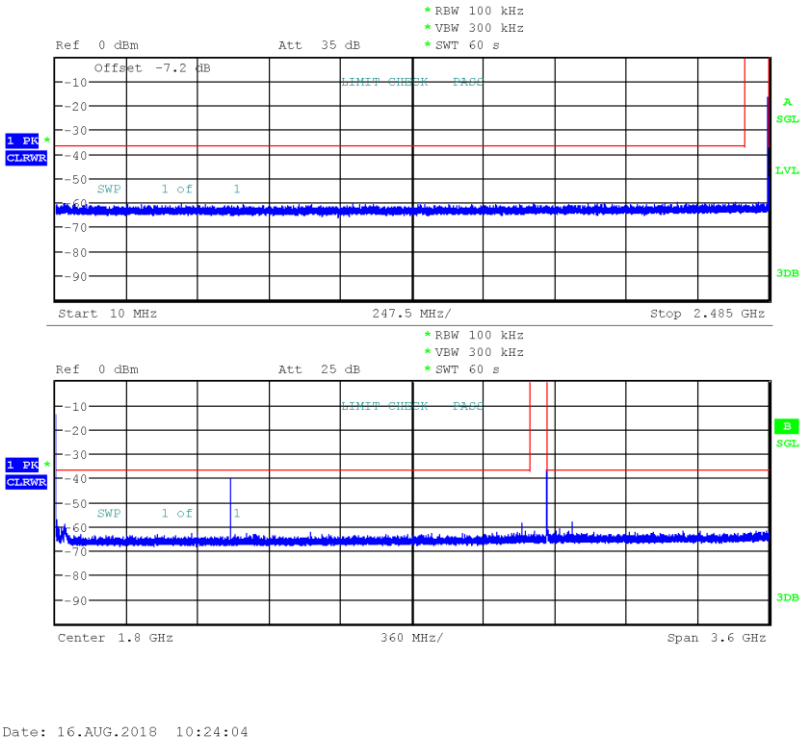
Conducted Spurious Emissions

Project Number:	G0M-1806-4788
Applicant:	Atlas Copco Industrial Technique AB
Model Description:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Sample ID:	19845
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 11.11
Operational Mode:	GFSK, Channel: 19, 2440 MHz
Operating Conditions:	Tnom/Vnom
Operator:	Christian Weber
Test Site:	Eurofins Product Service GmbH
Test Date:	2018-08-16
Max. in-band Frequency [MHz]:	2440.0
Max. in-band Level [dBm/100 kHz]:	-17.0
Out-of-band Limit [dBm/100 kHz]:	-37.0



Conducted Spurious Emissions

Project Number:	G0M-1806-4788
Applicant:	Atlas Copco Industrial Technique AB
Model Description:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Sample ID:	19845
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 11.11
Operational Mode:	GFSK, Channel: 39, 2480 MHz
Operating Conditions:	Tnom/Vnom
Operator:	Christian Weber
Test Site:	Eurofins Product Service GmbH
Test Date:	2018-08-16
Max. in-band Frequency [MHz]:	2480.0
Max. in-band Level [dBm/100 kHz]:	-16.8
Out-of-band Limit [dBm/100 kHz]:	-36.8



3.8 Test Conditions and Results - Transmitter radiated emissions

3.8.1 Information

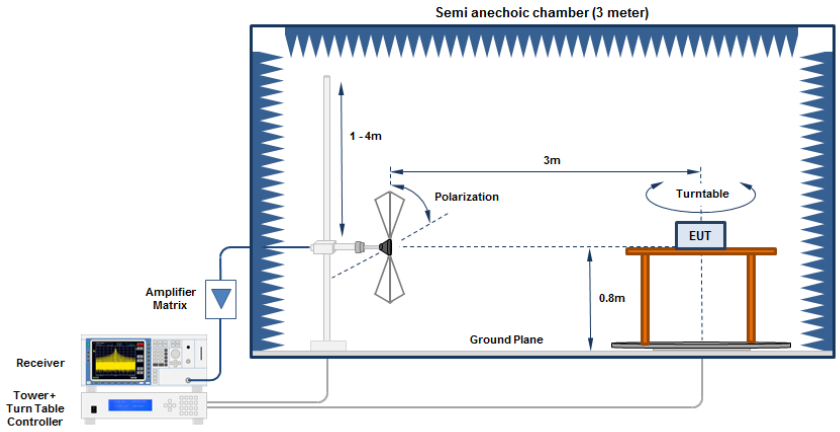
Test Information	
Reference	FCC § 15.247(d); FCC § 15.209; ISED RSS-Gen, Issue 5 (section 6.13)
Measurement Method	ANSI C63.10 6.4, 6.5, 6.6, 11.12
Operator	Abdullah Al Jamal
Date	2018-08-17

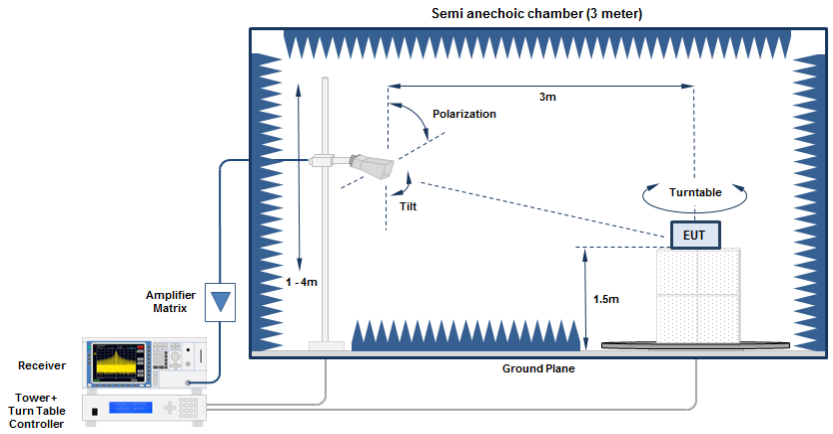
3.8.2 Limits

Limits			
Frequency [MHz]	Detector	Field strength [µV/m]	Measurement distance [m]
0.009 - 0.09	Average	2400/F[kHz]	300
0.09 - 0.110	Quasi-Peak	2400/F[kHz]	300
0.110 - 0.490	Average	2400/F[kHz]	300
0.490 - 1.705	Quasi-Peak	24000/F[kHz]	30
1.705 - 30.0	Quasi-Peak	30	30
30 - 88	Quasi-Peak	100	3
88 - 216	Quasi-Peak	150	3
216 - 960	Quasi-Peak	200	3
960 - 1000	Quasi-Peak	500	3
>1000	Average	500	3

3.8.3 Setup

Test Setup 30 - 1000 MHz



Test Setup > 1 GHz


3.8.4 Equipment

Test Software			
Description	Manufacturer	Name	Version
EMC Software	DARE Instruments	RadiMation	2015.2.4

Test Equipment 30 - 1000 MHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF00910	2017-03	2020-03
Measurement Receiver	R&S	ESU 26	EF00887	2018-08	2019-08
Antenna	R&S	HK 116	EF00887	2018-08	2019-08
Antenna	R&S	HL 223	EF01070	2017-08	2018-08

Test Equipment > 1 GHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF00062	2017-02	2020-02
Measurement Receiver	R&S	ESU 26	EF00887	2018-08	2019-08
Antenna	R&S	BBHA 9120D	EF00019	2016-09	2018-09
Antenna	Amplifier Research	AT4560	EF01152	2017-10	2018-10

3.8.5 Procedure

Test Procedure 30 - 1000 MHz
1. EUT is placed on a non conducting support at the center of a turn table 0.8 m above the ground
2. EUT set to test mode
3. The receiver is set to peak detection with max hold
4. The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m
5. All significant emissions are measured again using the corresponding final detector

Test Procedure > 1 GHz
1. EUT is placed on a non conducting support at the center of a turn table 1.5 m above the ground
2. EUT set to test mode
3. The receiver is set to peak detection with max hold
4. The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m
5. All significant emissions are measured again using the corresponding final detector

3.8.6 Results

Test Results						
Channel [MHz]	Emission [MHz]	Level [dBµV/m]	Det.	Pol.	Limit [dBµV/m]	Margin [dB]
2402	128.501	36.56	pk	ver	43.52	-06.96
2440	128.841	36.91	pk	ver	43.52	-06.61
2480	129.351	36.69	pk	ver	43.52	-06.83
2480	170.619	34.06	pk	hor	43.52	-09.46

3.9 Test Conditions and Results - Receiver radiated emissions

3.9.1 Information

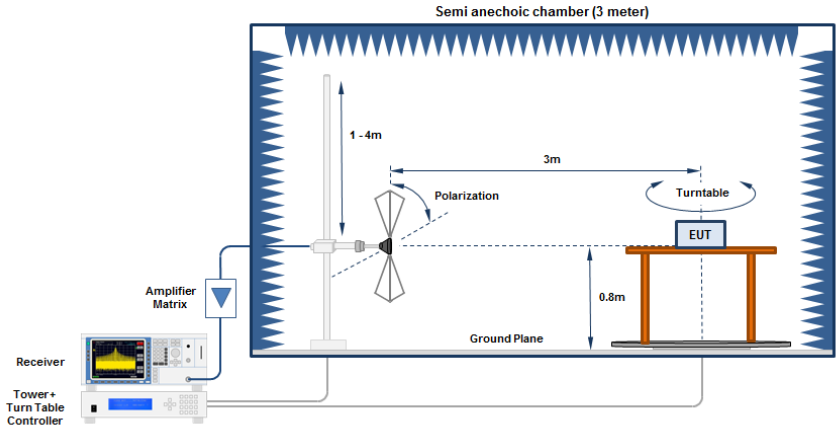
Test Information	
Reference	ISED RSS-247, Issue 2 (section 3.1)
Measurement Method	ANSI C63.10 6.5, 6.6, 11.12
Operator	Abdullah Al Jamal
Date	2018-08-17

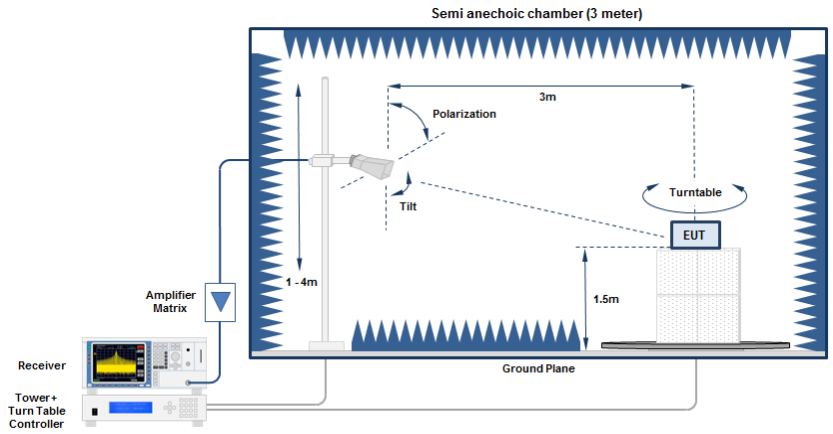
3.9.2 Limits

Limits			
Frequency [MHz]	Detector	Field strength [dBµV/m]	Measurement distance [m]
30 - 88	Quasi-Peak	100	3
88 - 216	Quasi-Peak	150	3
216 - 960	Quasi-Peak	200	3
960 - 1000	Quasi-Peak	500	3
>1000	Average	500	3

3.9.3 Setup

Test Setup 30 - 1000 MHz



Test Setup > 1 GHz


3.9.4 Equipment

Test Software			
Description	Manufacturer	Name	Version
EMC Software	DARE Instruments	RadiMation	2015.2.4

Test Equipment 30 - 1000 MHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF00062	2017-02	2020-02
Measurement Receiver	R&S	ESU 26	EF00887	2018-08	2019-08
Antenna	R&S	HK 116	EF00013	2018-06	2020-06
Antenna	R&S	HL 223	EF00187	2016-05	2019-05

Test Equipment > 1 GHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF00062	2017-02	2020-02
Measurement Receiver	R&S	ESU 26	EF00887	2018-08	2019-08
Antenna	R&S	BBHA 9120D	EF00019	2016-09	2018-09
Antenna	Amplifier Research	AT4560	EF01152	2017-10	2018-10

3.9.5 Procedure

Test Procedure 30 - 1000 MHz
1. EUT is placed on a non conducting support at the center of a turn table 0.8 m above the ground
2. EUT set to test mode
3. The receiver is set to peak detection with max hold
4. The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m
5. All significant emissions are measured again using the corresponding final detector

Test Procedure > 1 GHz
1. EUT is placed on a non conducting support at the center of a turn table 1.5 m above the ground
2. EUT set to test mode
3. The receiver is set to peak detection with max hold
4. The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m
5. All significant emissions are measured again using the corresponding final detector

3.9.6 Results

Test Results						
Channel [MHz]	Emission [MHz]	Level [dBµV/m]	Det.	Pol.	Limit [dBµV/m]	Margin [dB]
2440	30.509	33.34	pk	hor	40.00	-06.66
2440	54.465	36.42	pk	ver	40.00	-03.58
2440	54.465	31.51	qpk	ver	40.00	-08.49
2440	68.22	38.21	pk	ver	40.00	-01.79
2440	68.22	33.29	qpk	ver	40.00	-06.71
2440	92.213	35.60	pk	ver	43.50	-07.90
2440	92.213	31.01	qpk	ver	43.50	-12.49
2440	227.972	30.92	pk	hor	46.00	-15.08
2440	4958	51.09	pk	hor	53.98	-02.89
2440	4958	47.92	avg	hor	53.98	-06.06
2440	4958	48.68	pk	ver	53.98	-05.30
2440	4958	43.61	avg	ver	53.98	-10.37
2440	7976	49.52	pk	ver	53.98	-04.46
2440	7976	37.68	avg	ver	53.98	-16.30
2440	10990	44.91	pk	hor	53.98	-09.07

ANNEX A Transmitter spurious emissions

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3 m
Mode:	TX; LE; 2402 MHz
Test Date:	2018-08-17
Note:	

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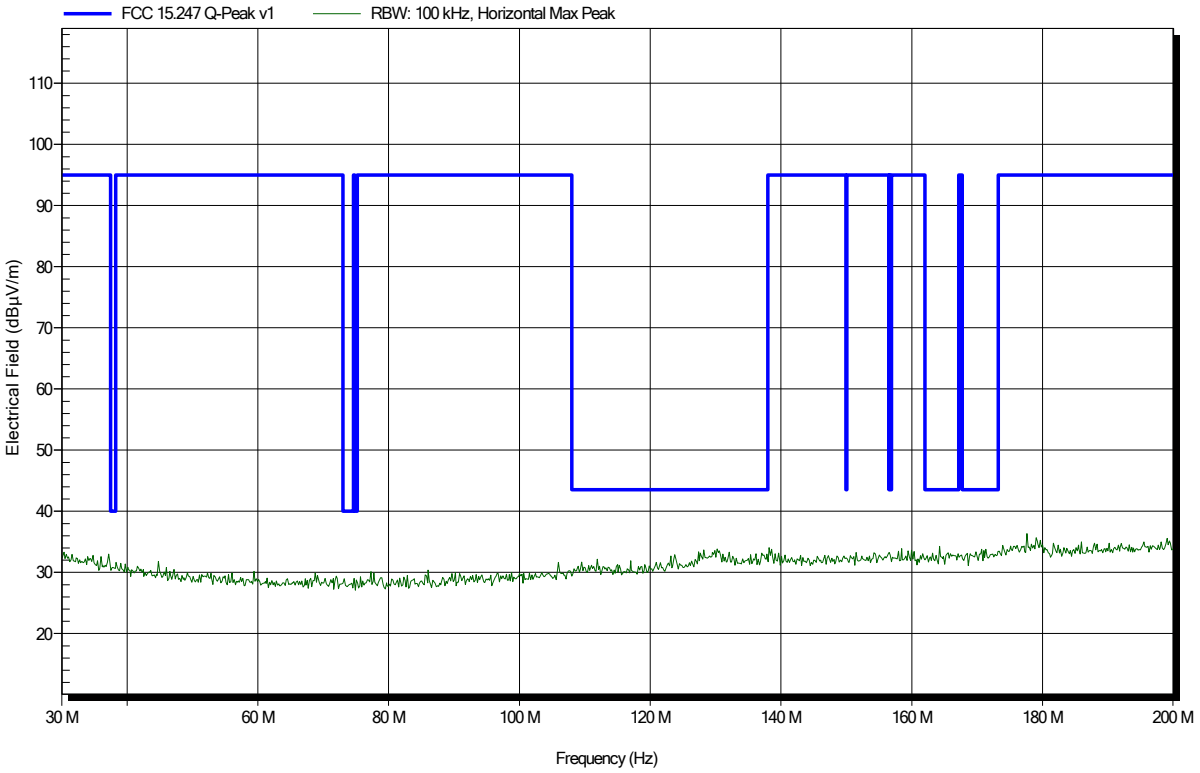

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3 m
Mode:	TX; LE; 2402 MHz
Test Date:	2018-08-17
Note:	

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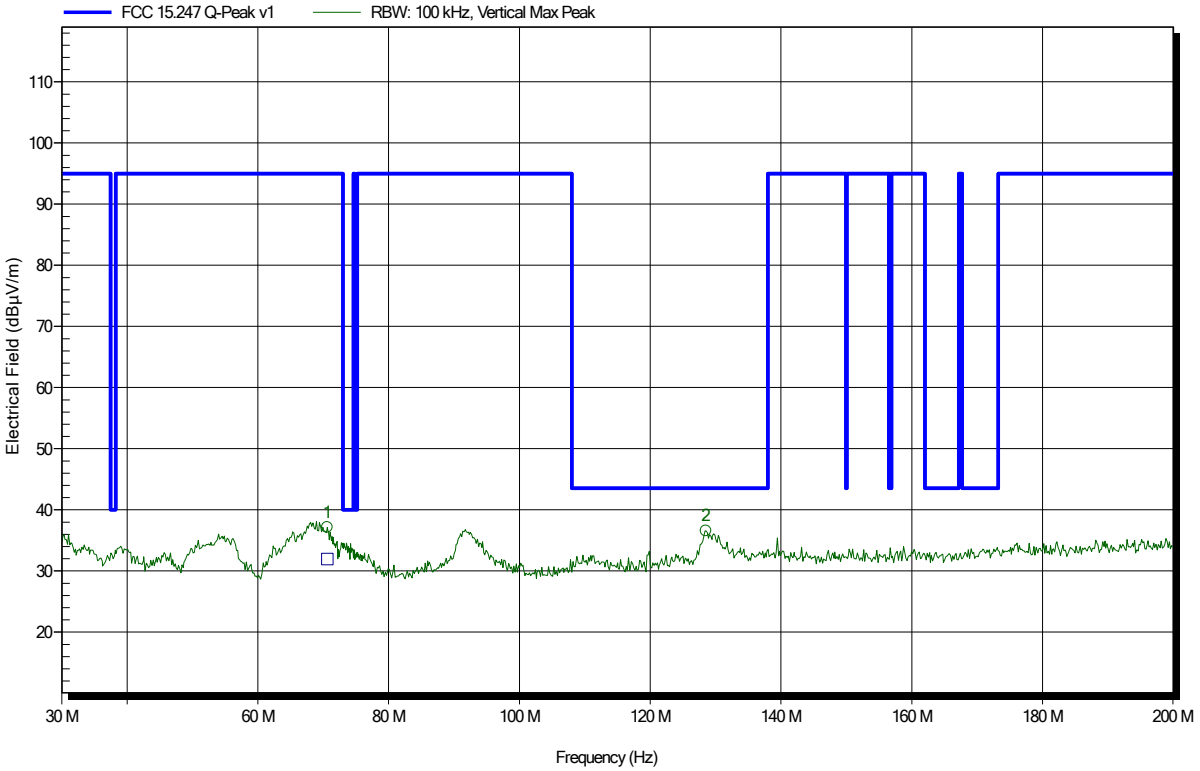

Frequency	Peak	Peak Limit	Peak Difference	Peak Status
128.501 MHz	36.56 dBµV/m	43.52 dBµV/m	-6.96 dB	Pass
70.615 MHz	37.13 dBµV/m	95 dBµV/m	-57.87 dB	Pass

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3 m
Mode:	TX; LE; 2402 MHz
Test Date:	2018-08-17
Note:	

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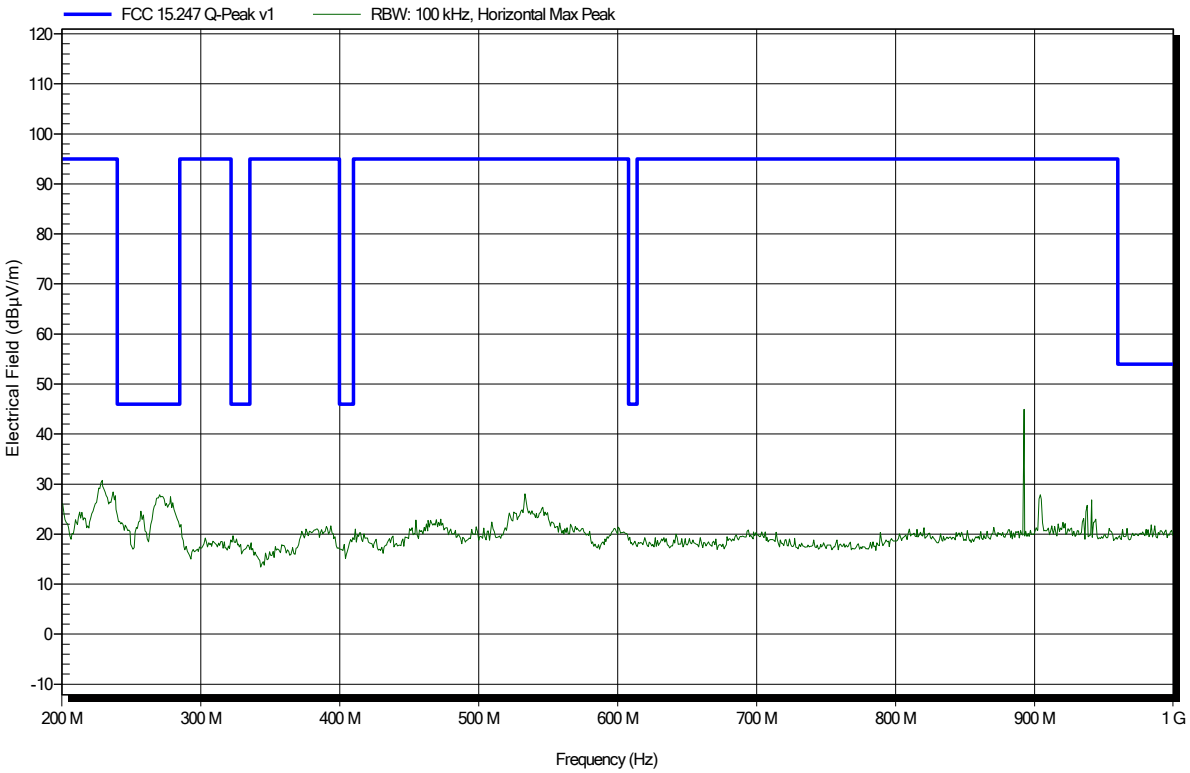

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement distance:	3 m
Mode:	TX; LE; 2402 MHz
Test Date:	2018-08-17
Note:	

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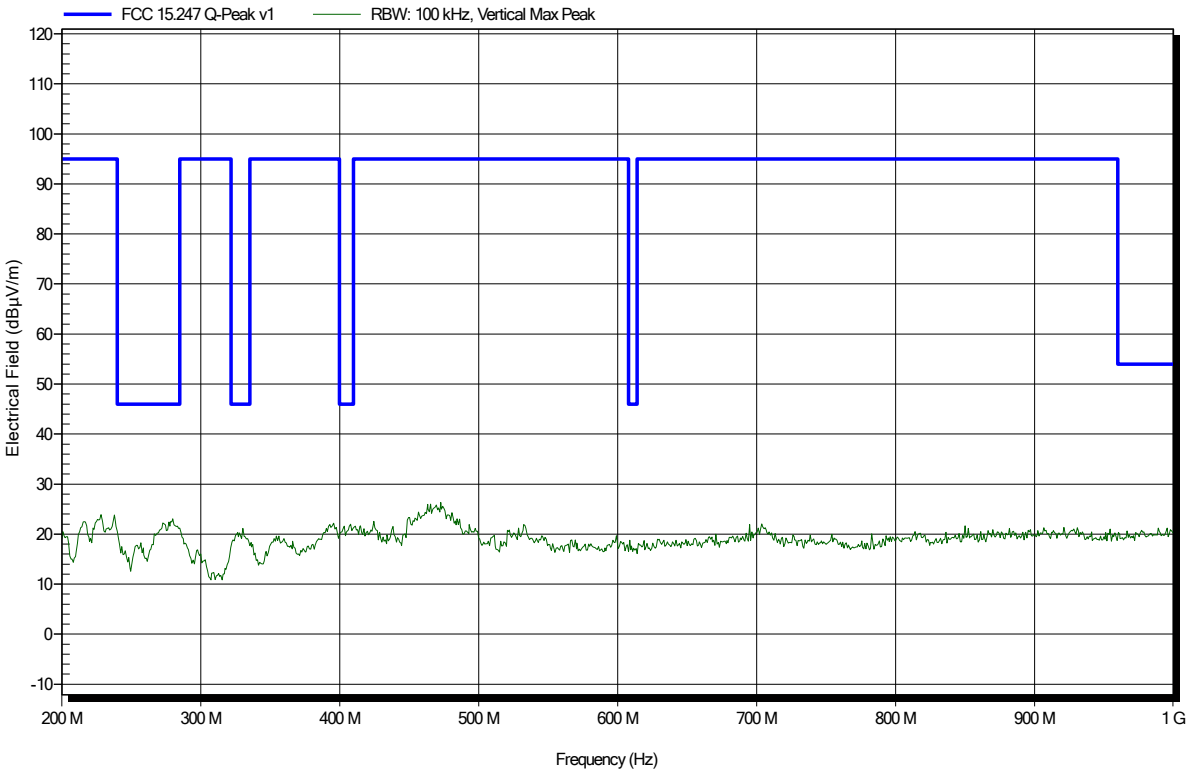

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2402 MHz
Test Date:	2018-08-17
Note:	

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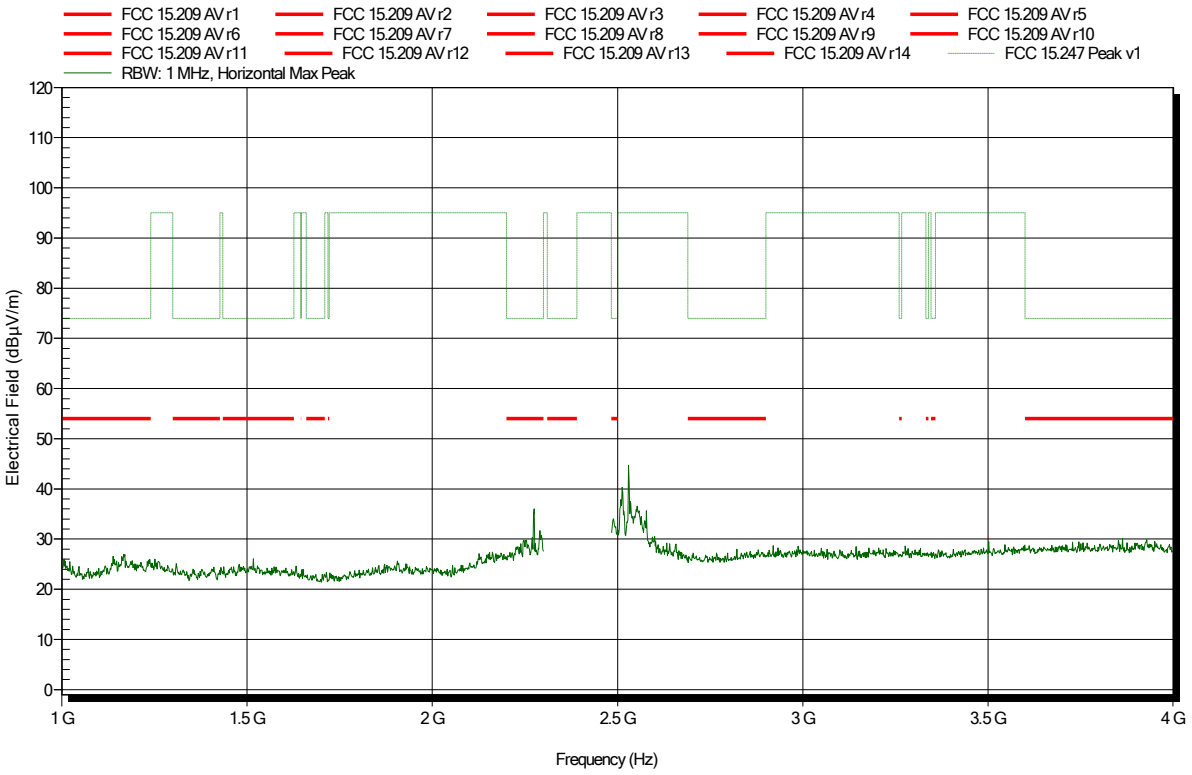

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2402 MHz
Test Date:	2018-08-17
Note:	

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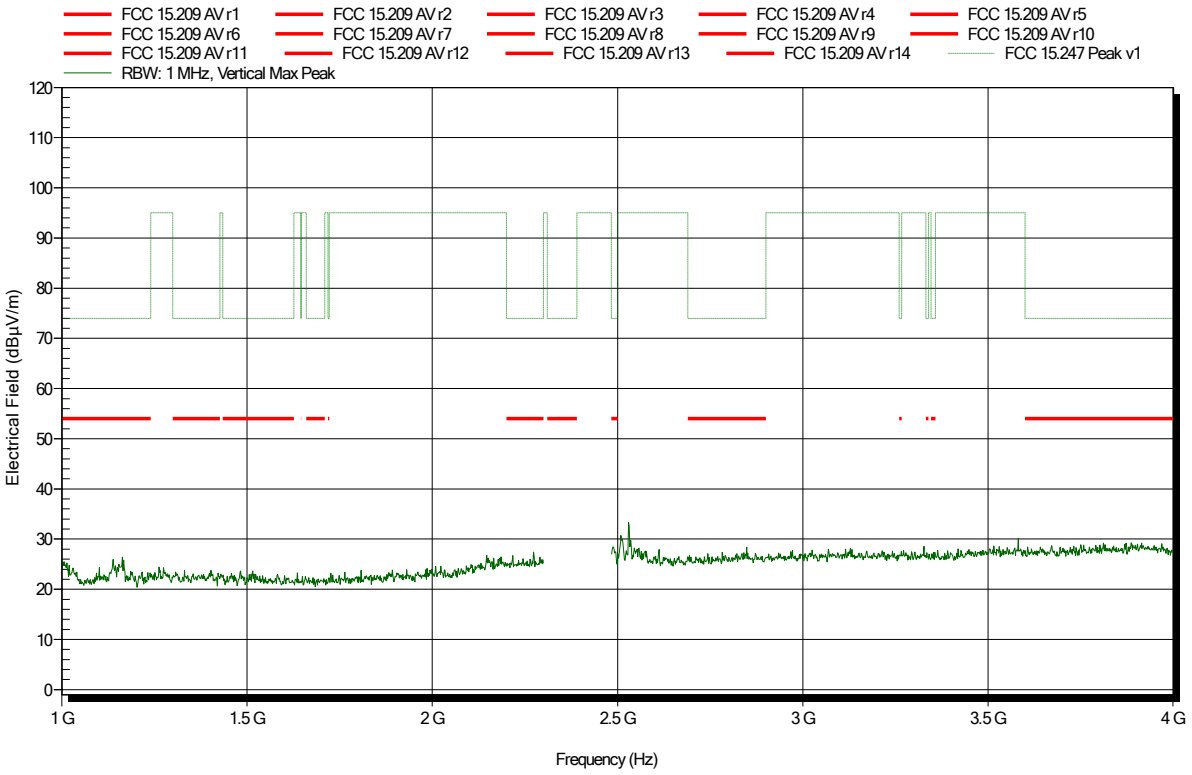

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2402 MHz
Test Date:	2018-08-17
Note:	lower bandedge

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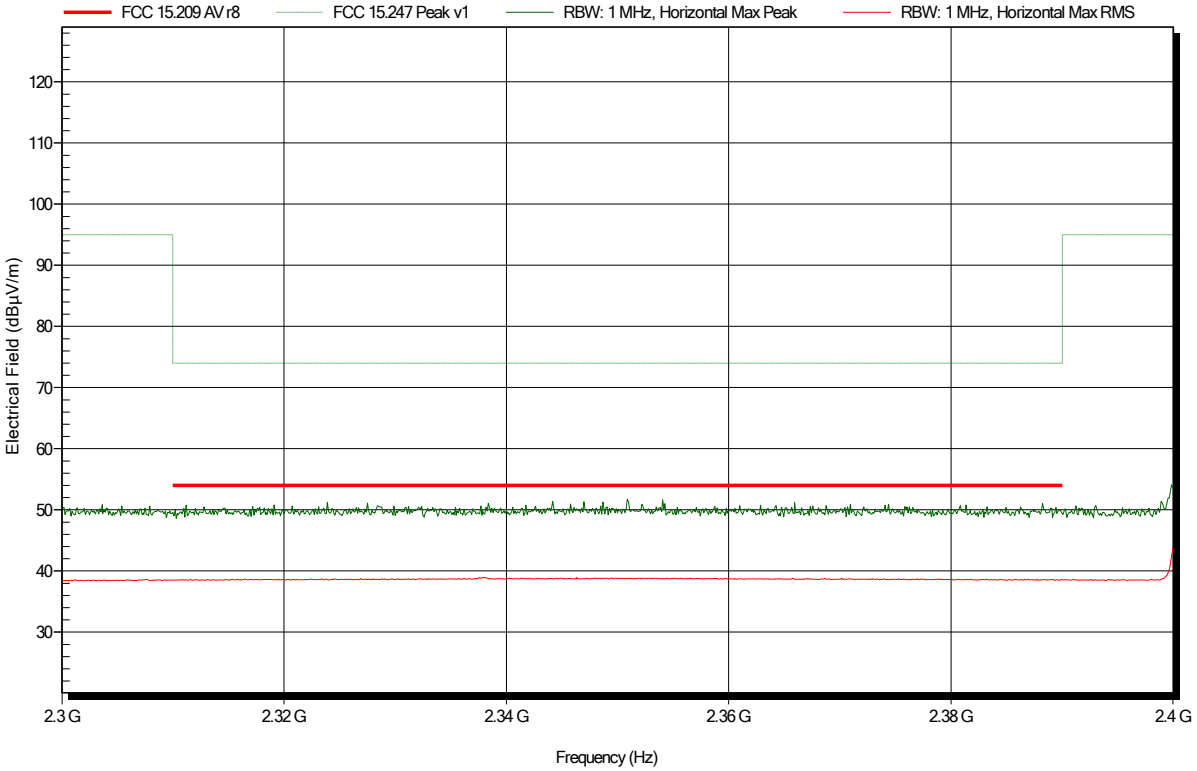

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2402 MHz
Test Date:	2018-08-17
Note:	lower bandedge

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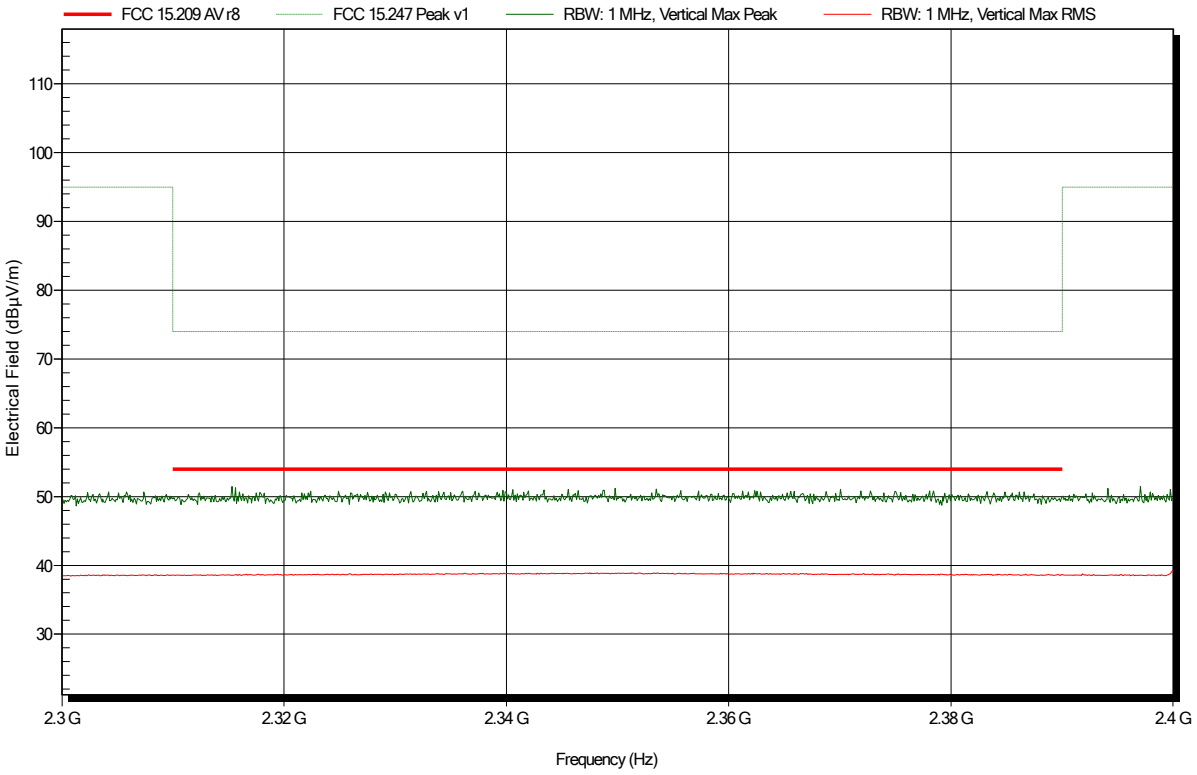
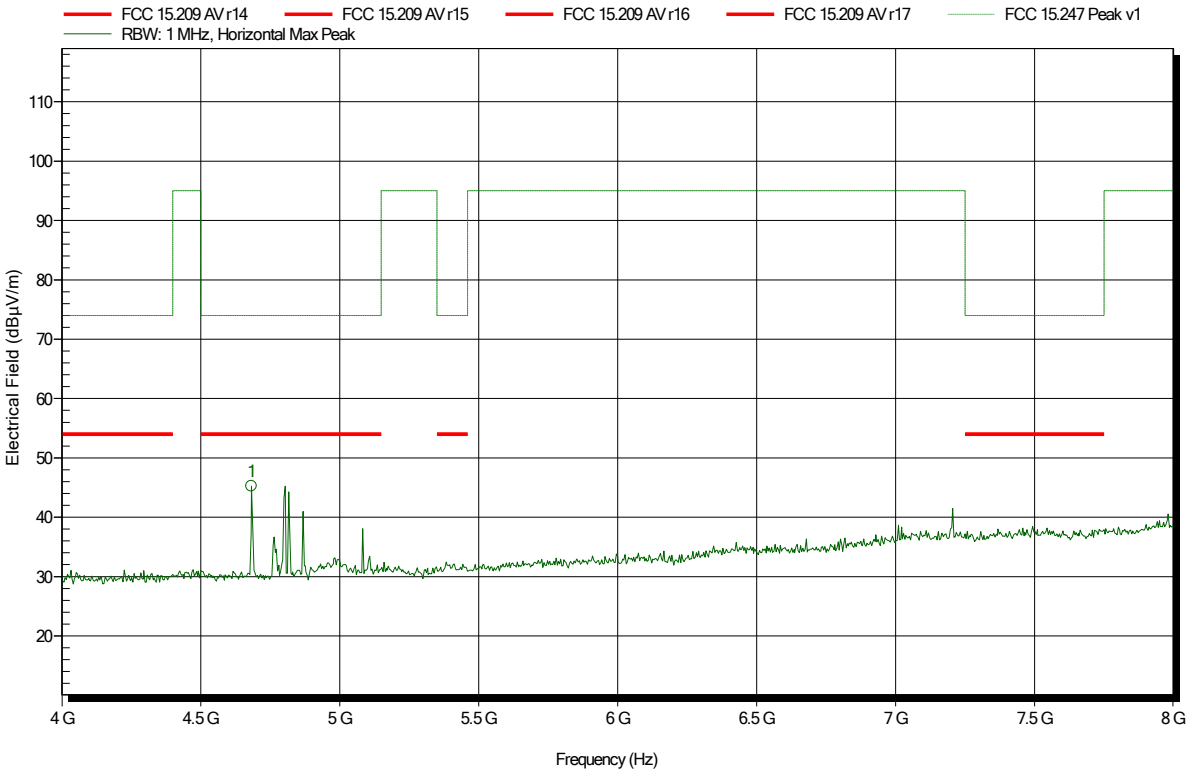


Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2402 MHz
Test Date:	2018-08-17
Note:	

Index 2



Frequency	Peak	Peak Limit	Peak Difference	Peak Status
4.683 GHz	45.24 dBµV/m	74 dBµV/m	-28.76 dB	Pass

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2402 MHz
Test Date:	2018-08-17
Note:	

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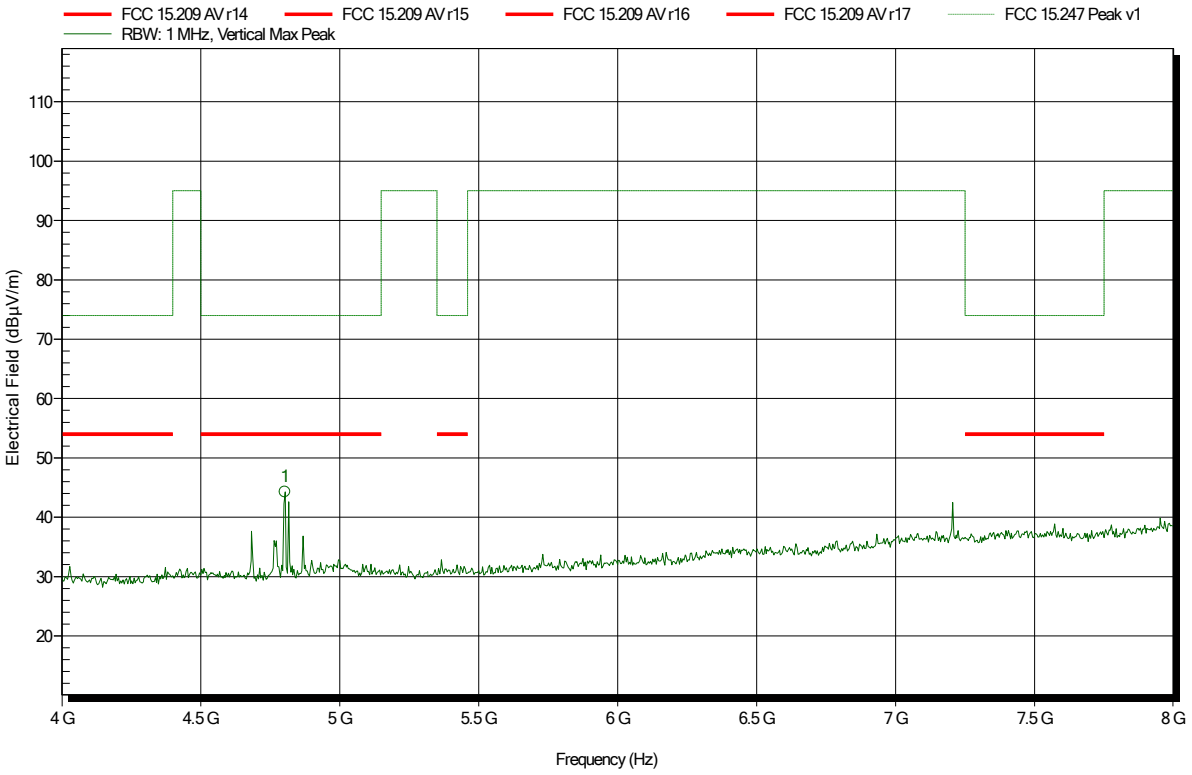

Frequency	Peak	Peak Limit	Peak Difference	Peak Status
4.803 GHz	44.28 dBµV/m	74 dBµV/m	-29.72 dB	Pass

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2402 MHz
Test Date:	2018-08-17
Note:	

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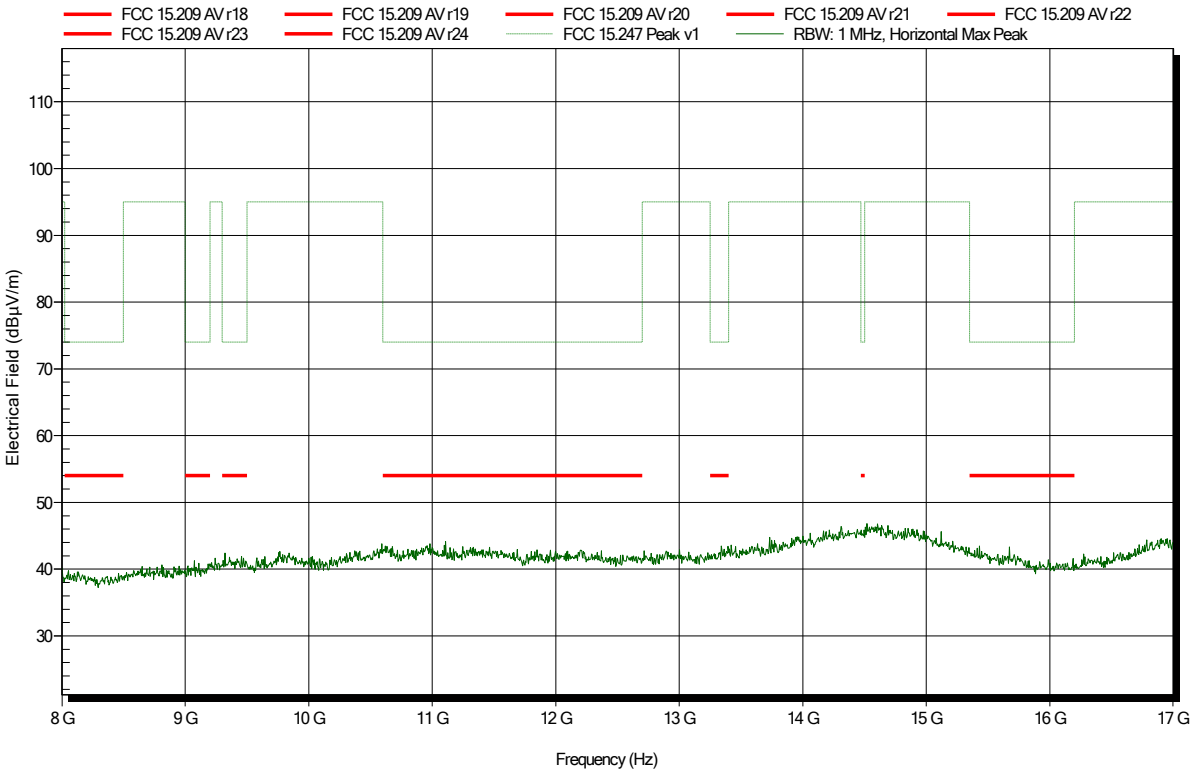

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2402 MHz
Test Date:	2018-08-17
Note:	

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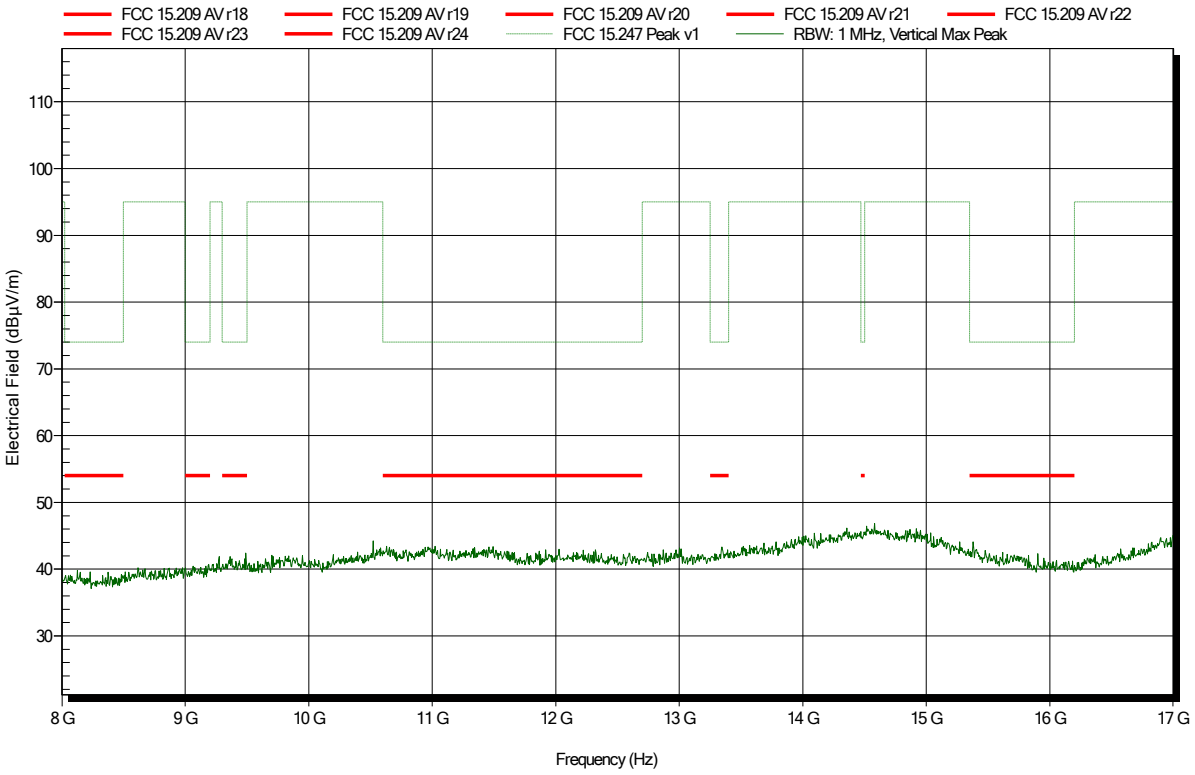

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Amplifier Research AT 4560 (old name) / ATH18G40 (new name), Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2402 MHz
Test Date:	2018-08-17
Note:	

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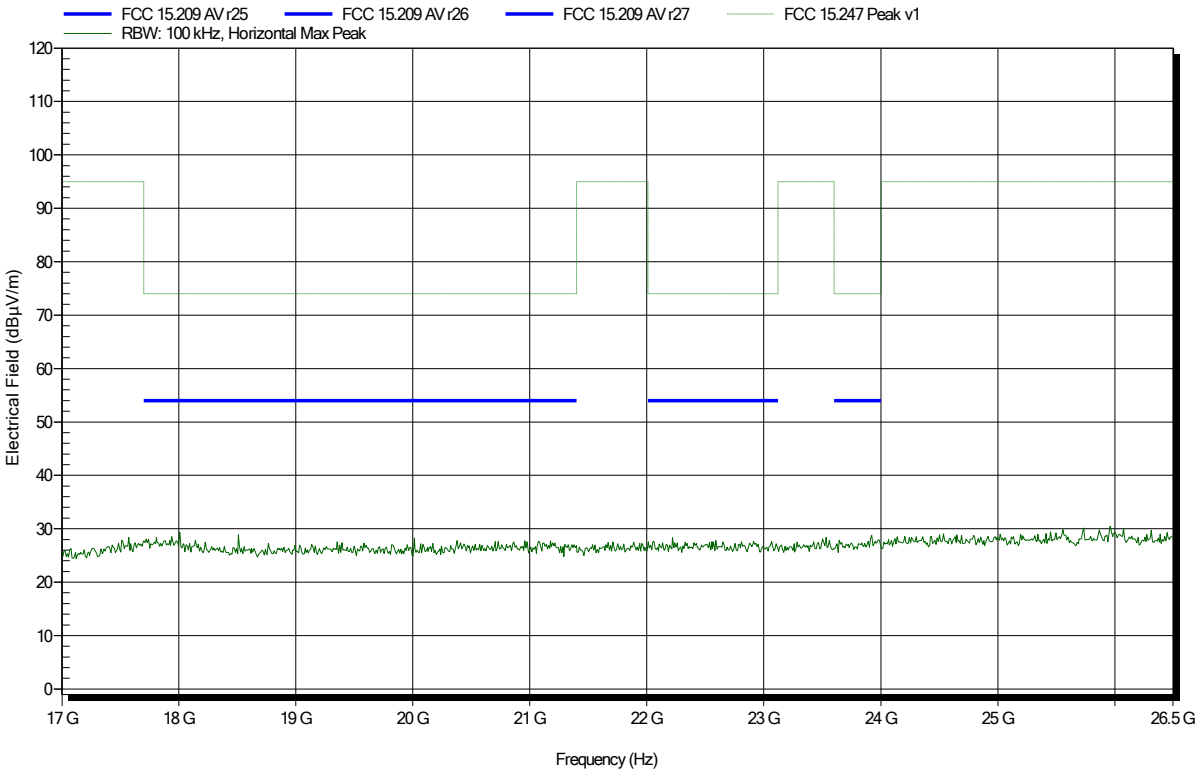

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Amplifier Research AT 4560 (old name) / ATH18G40 (new name), Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2402 MHz
Test Date:	2018-08-17
Note:	

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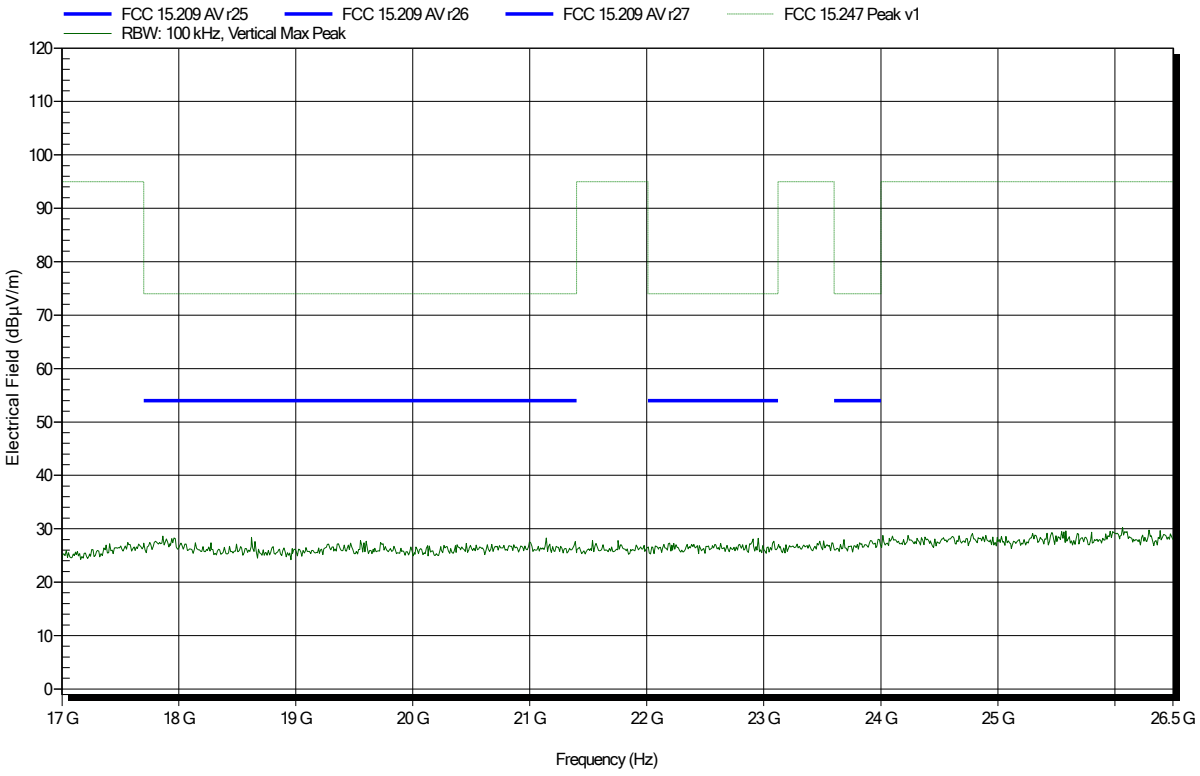

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3 m
Mode:	TX; LE; 2440 MHz
Test Date:	2018-08-17
Note:	

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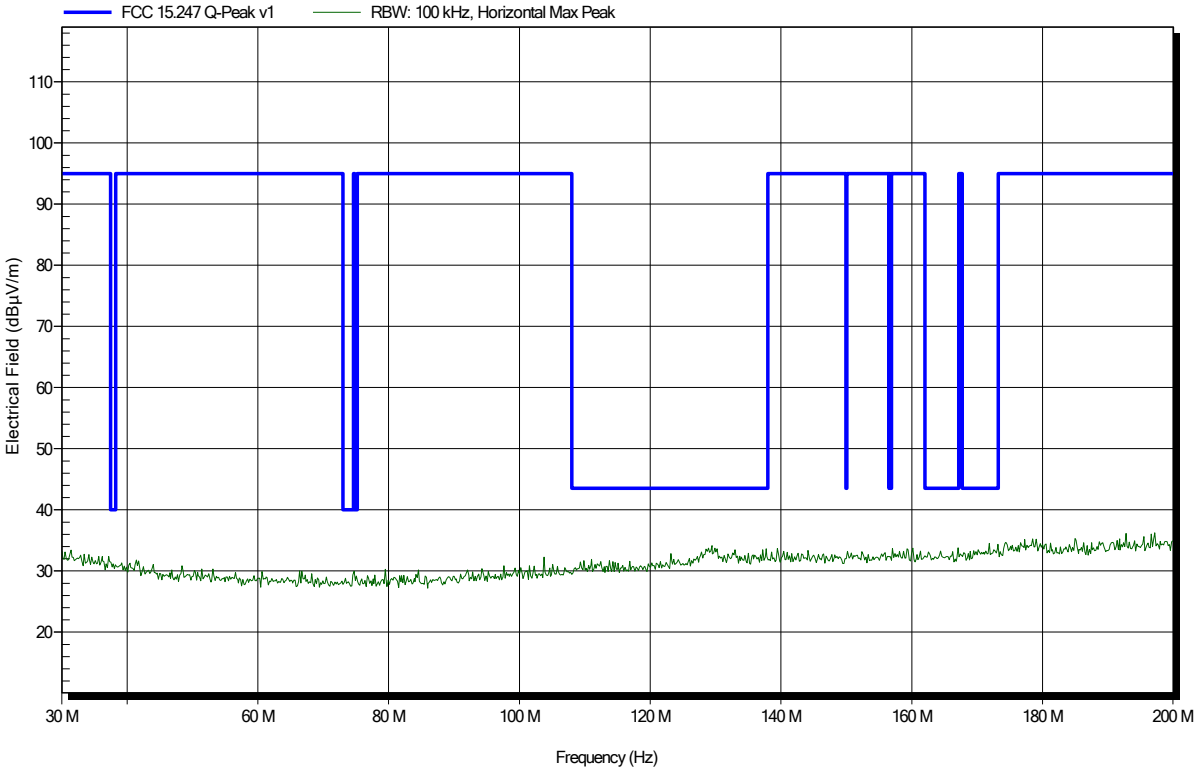

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3 m
Mode:	TX; LE; 2440 MHz
Test Date:	2018-08-17
Note:	

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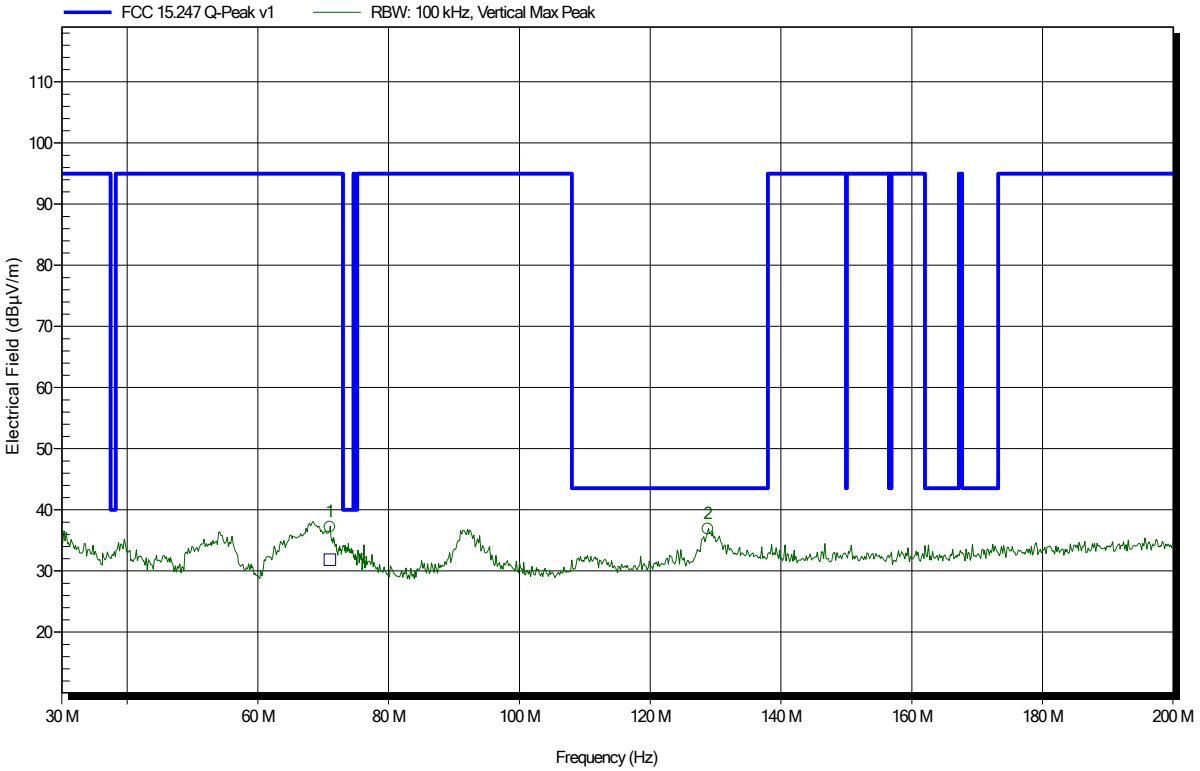

Frequency	Peak	Peak Limit	Peak Difference	Peak Status
128.841 MHz	36.91 dBµV/m	43.52 dBµV/m	-6.61 dB	Pass
71.026 MHz	37.18 dBµV/m	95 dBµV/m	-57.82 dB	Pass

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3 m
Mode:	TX; LE; 2440 MHz
Test Date:	2018-08-17
Note:	

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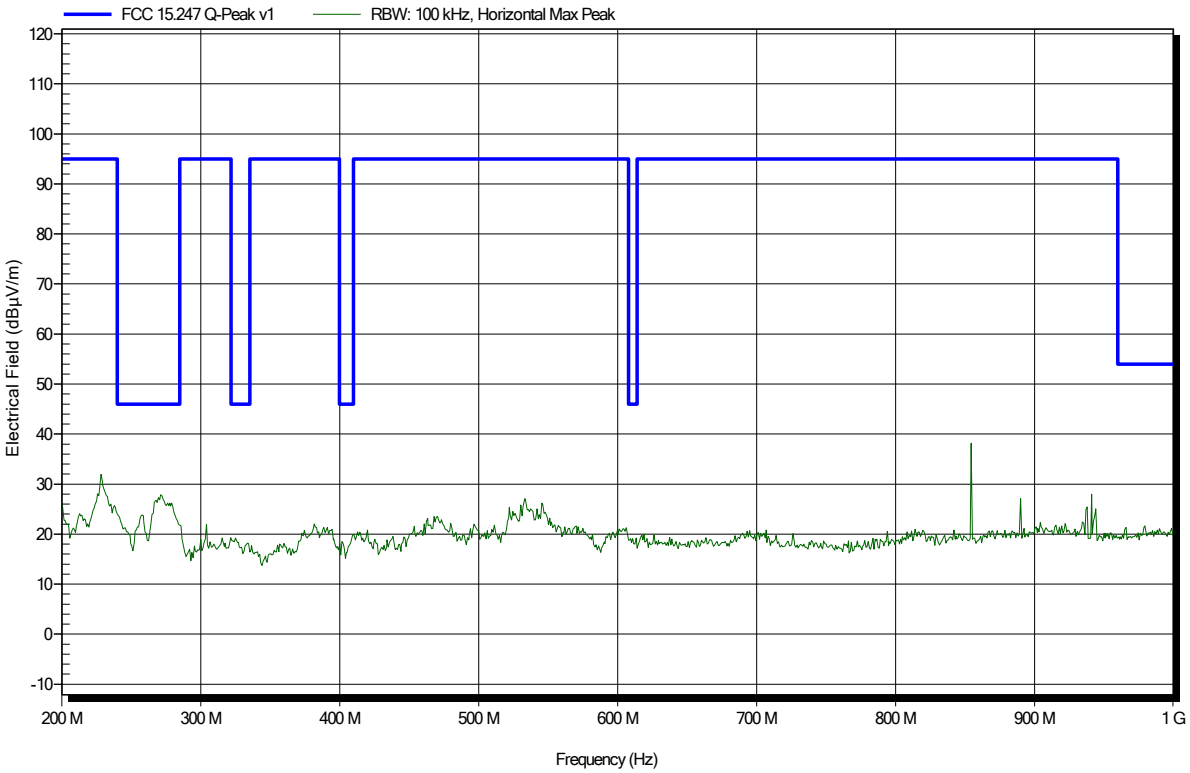

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement distance:	3 m
Mode:	TX; LE; 2440 MHz
Test Date:	2018-08-17
Note:	

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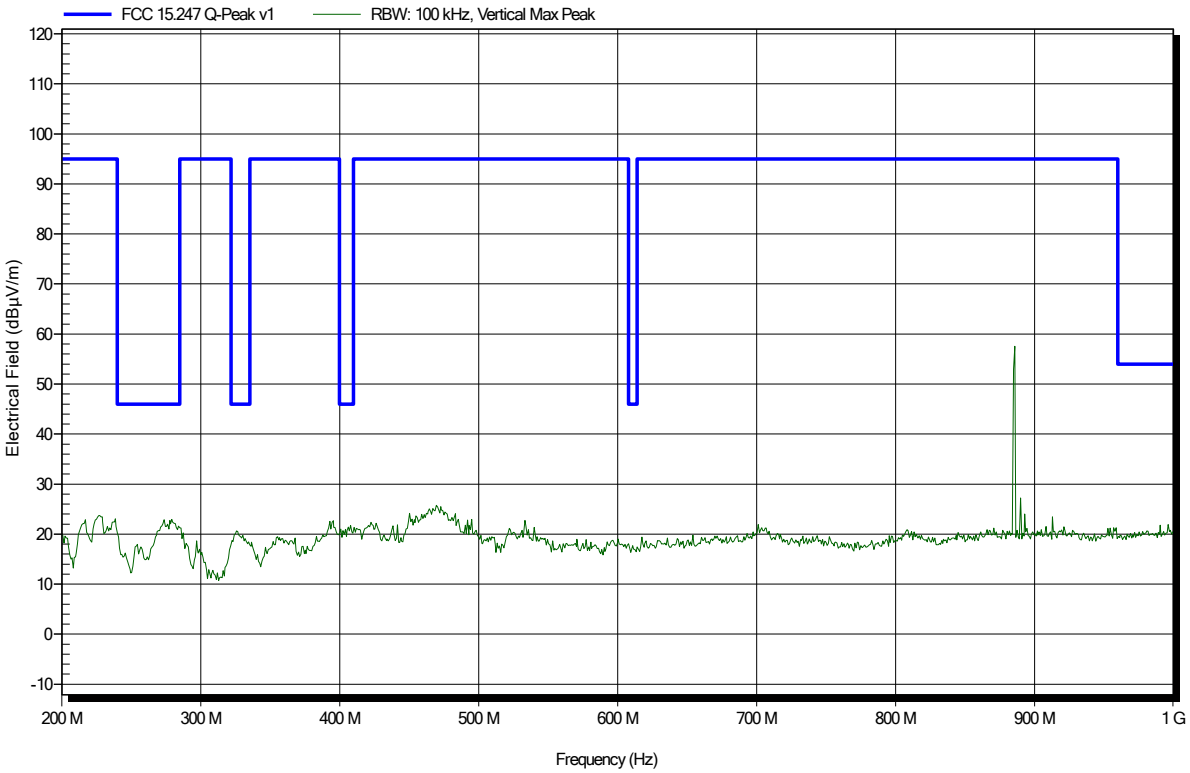

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2440 MHz
Test Date:	2018-08-17
Note:	

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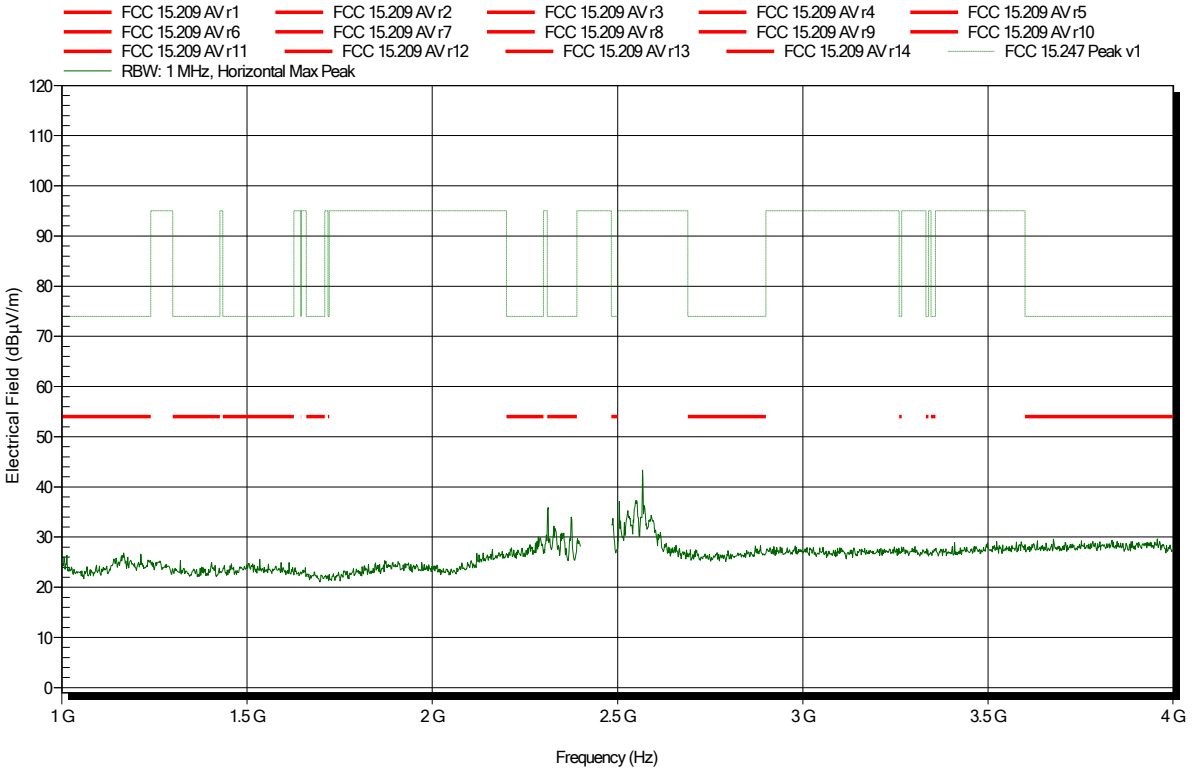

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2440 MHz
Test Date:	2018-08-17
Note:	

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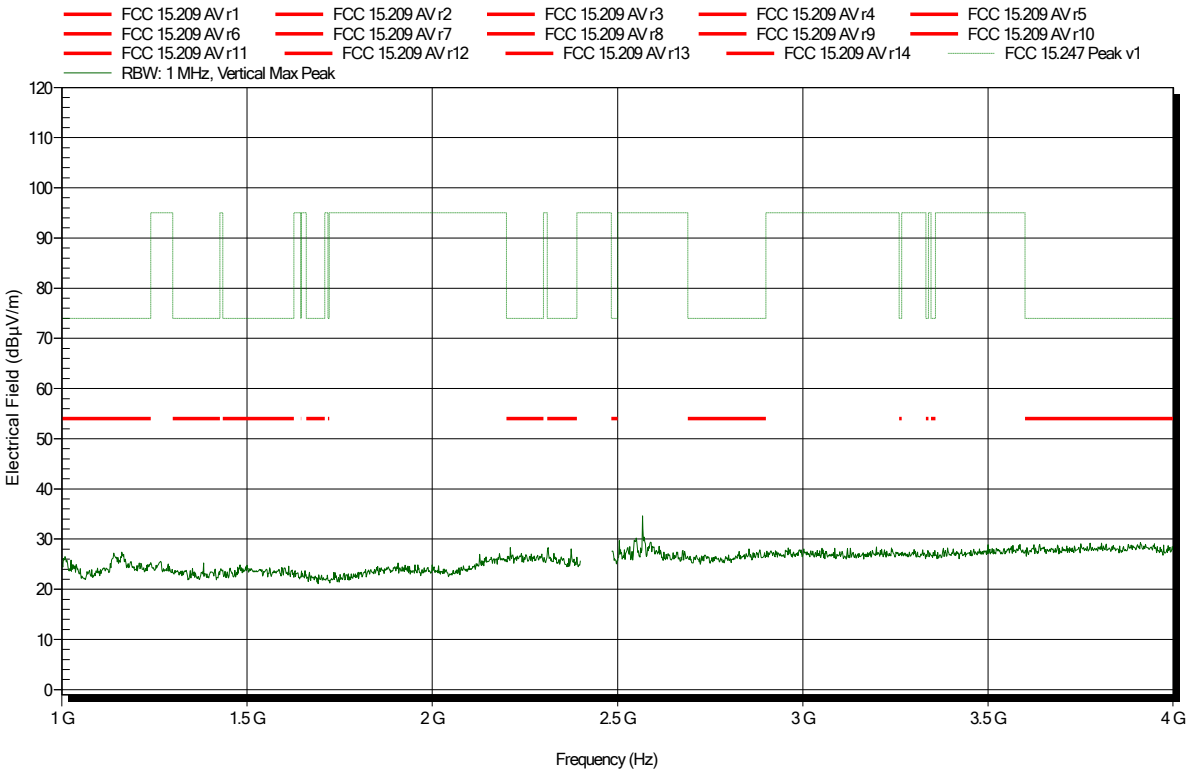

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2440 MHz
Test Date:	2018-08-17
Note:	

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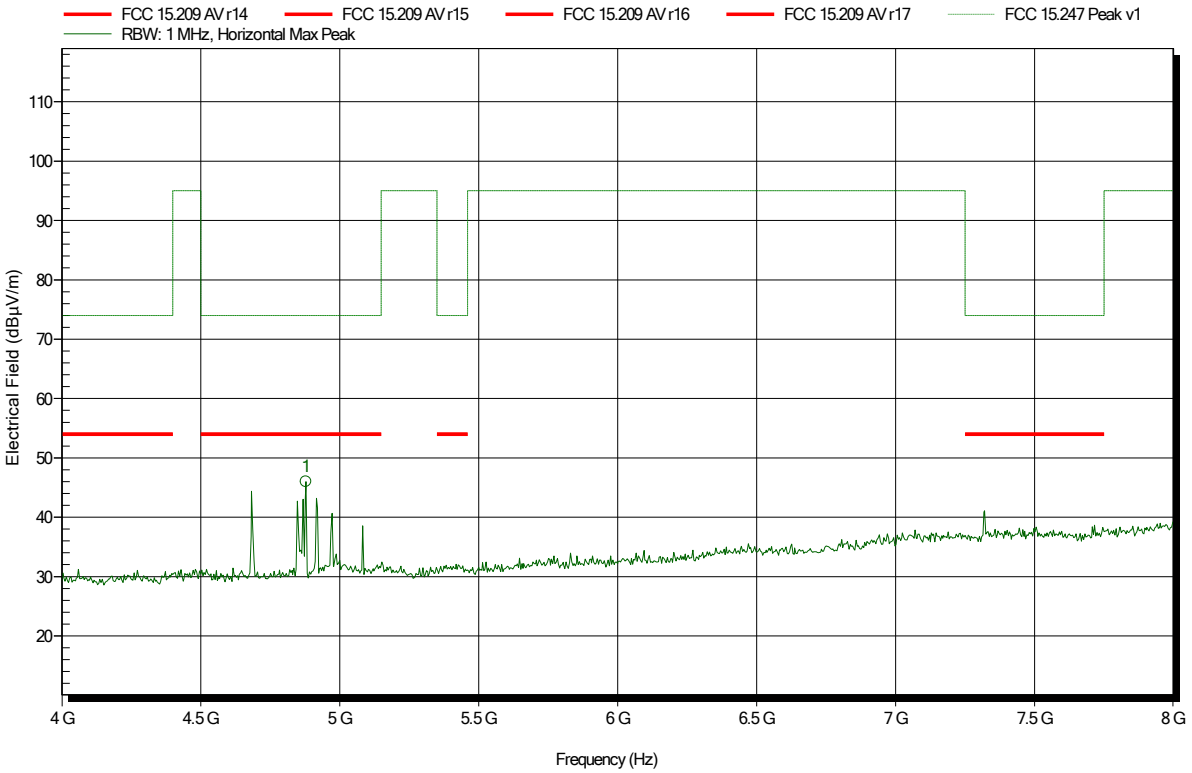

Frequency	Peak	Peak Limit	Peak Difference	Peak Status
4.879 GHz	46.01 dBµV/m	74 dBµV/m	-27.99 dB	Pass

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2440 MHz
Test Date:	2018-08-17
Note:	

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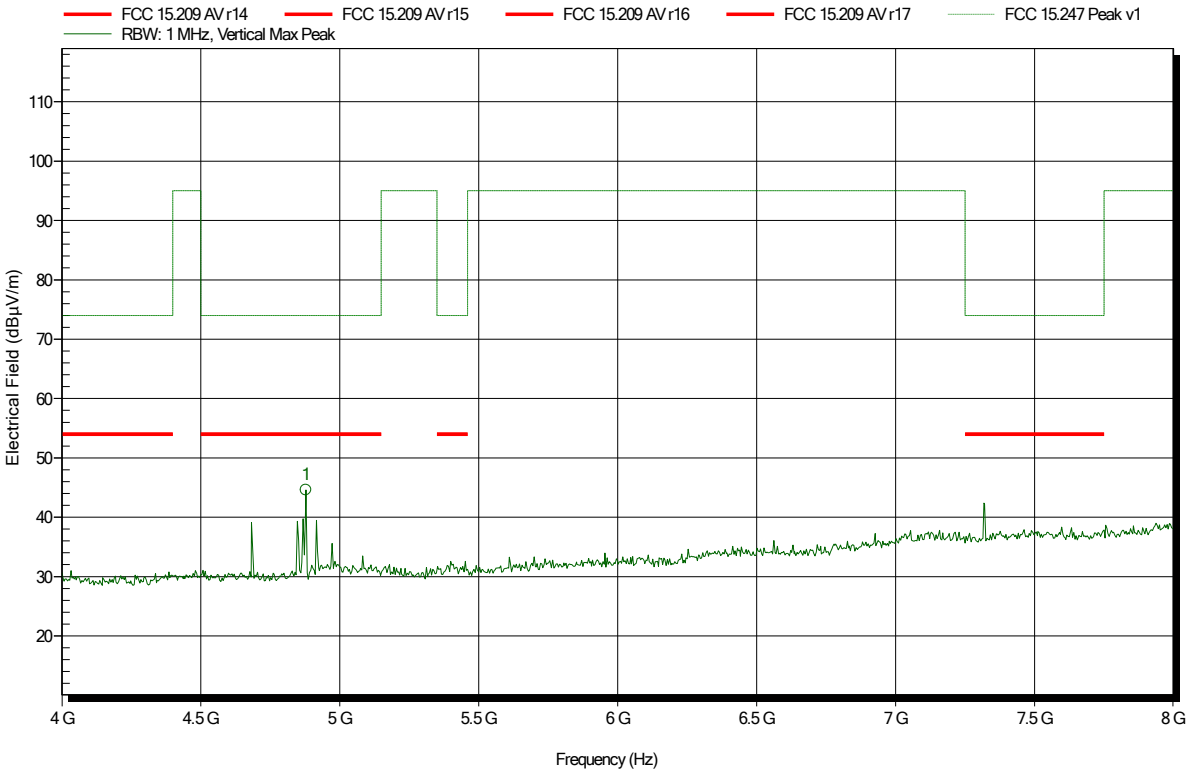

Frequency	Peak	Peak Limit	Peak Difference	Peak Status
4.879 GHz	44.61 dBµV/m	74 dBµV/m	-29.39 dB	Pass

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2440 MHz
Test Date:	2018-08-17
Note:	

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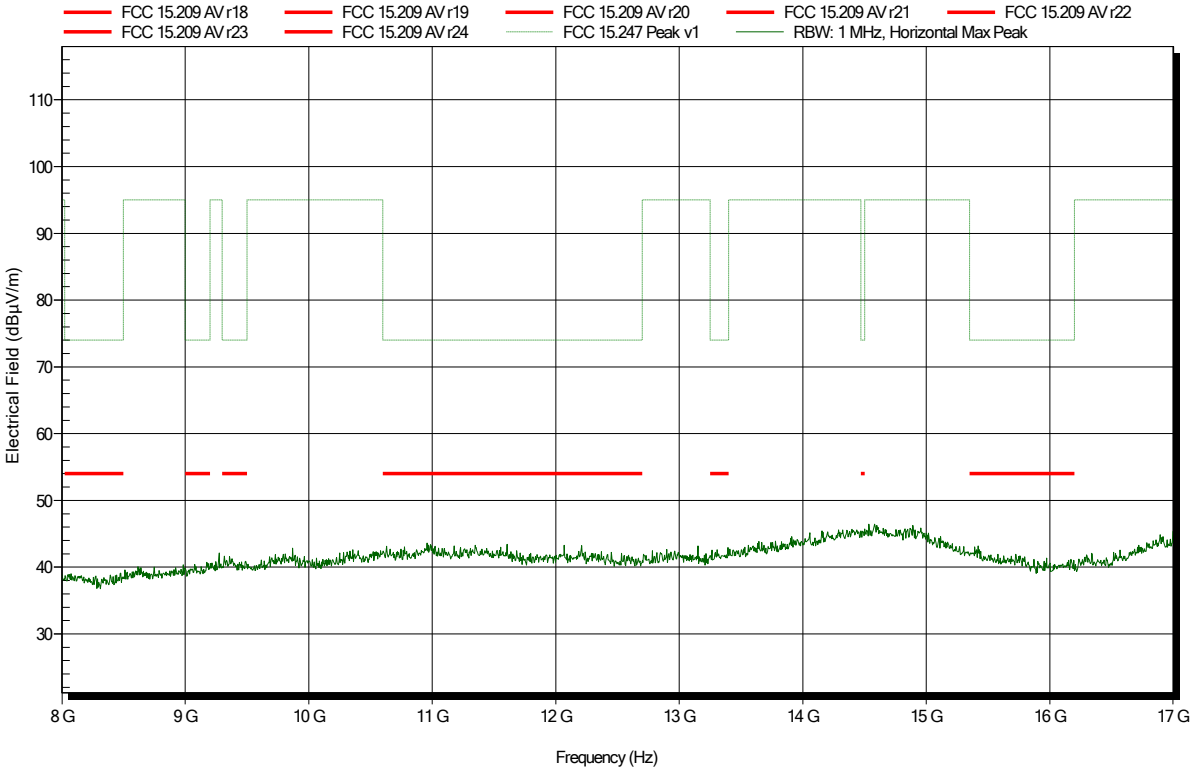

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2440 MHz
Test Date:	2018-08-17
Note:	

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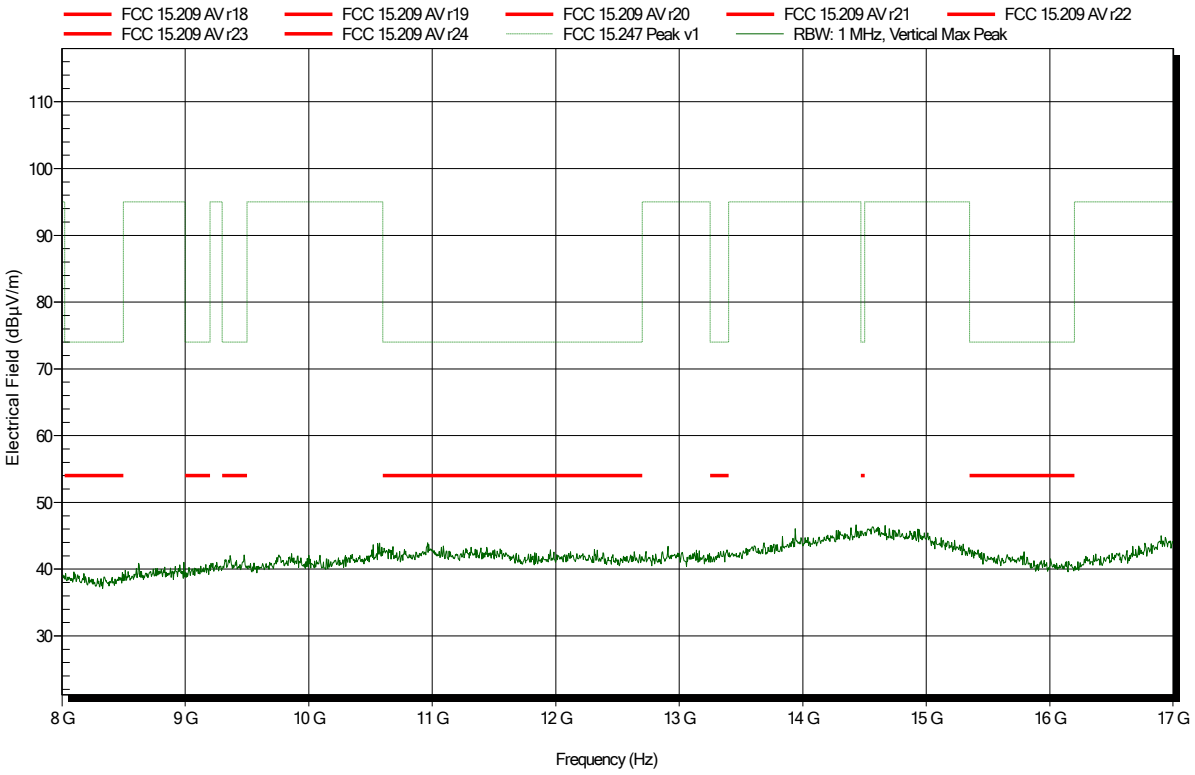

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Amplifier Research AT 4560 (old name) / ATH18G40 (new name), Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2440 MHz
Test Date:	2018-08-17
Note:	

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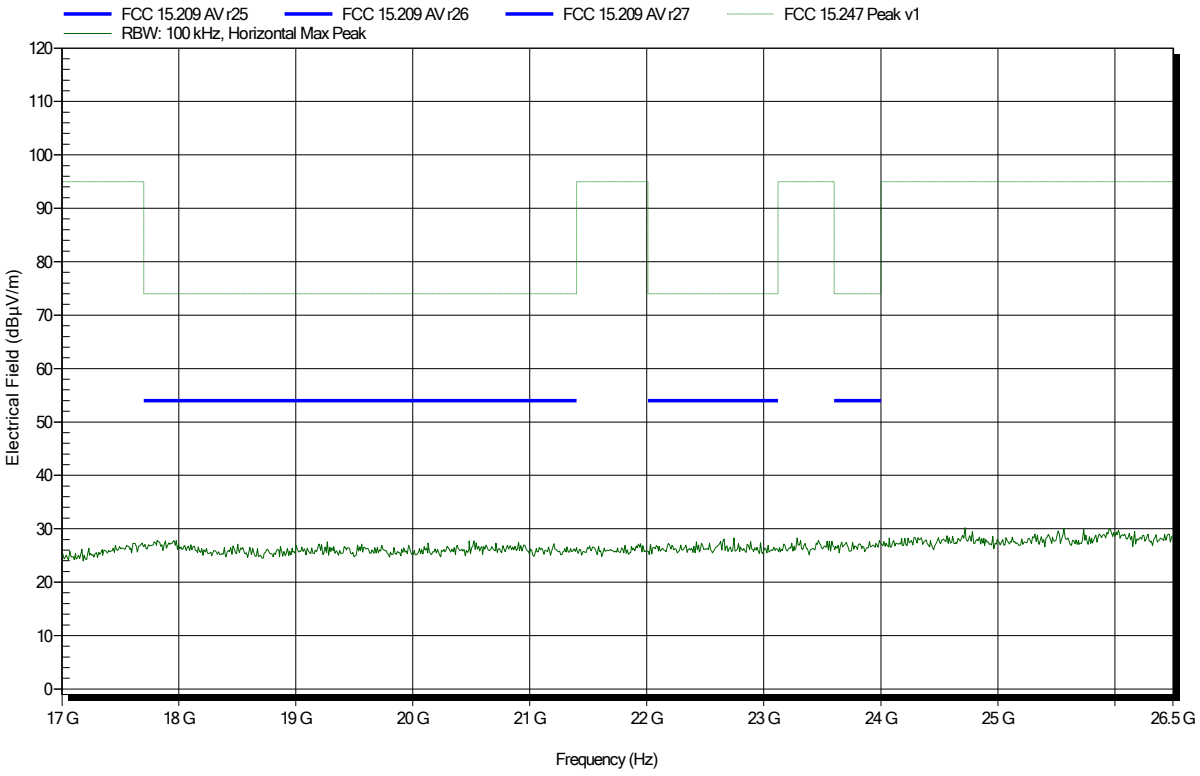

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Amplifier Research AT 4560 (old name) / ATH18G40 (new name), Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2440 MHz
Test Date:	2018-08-17
Note:	

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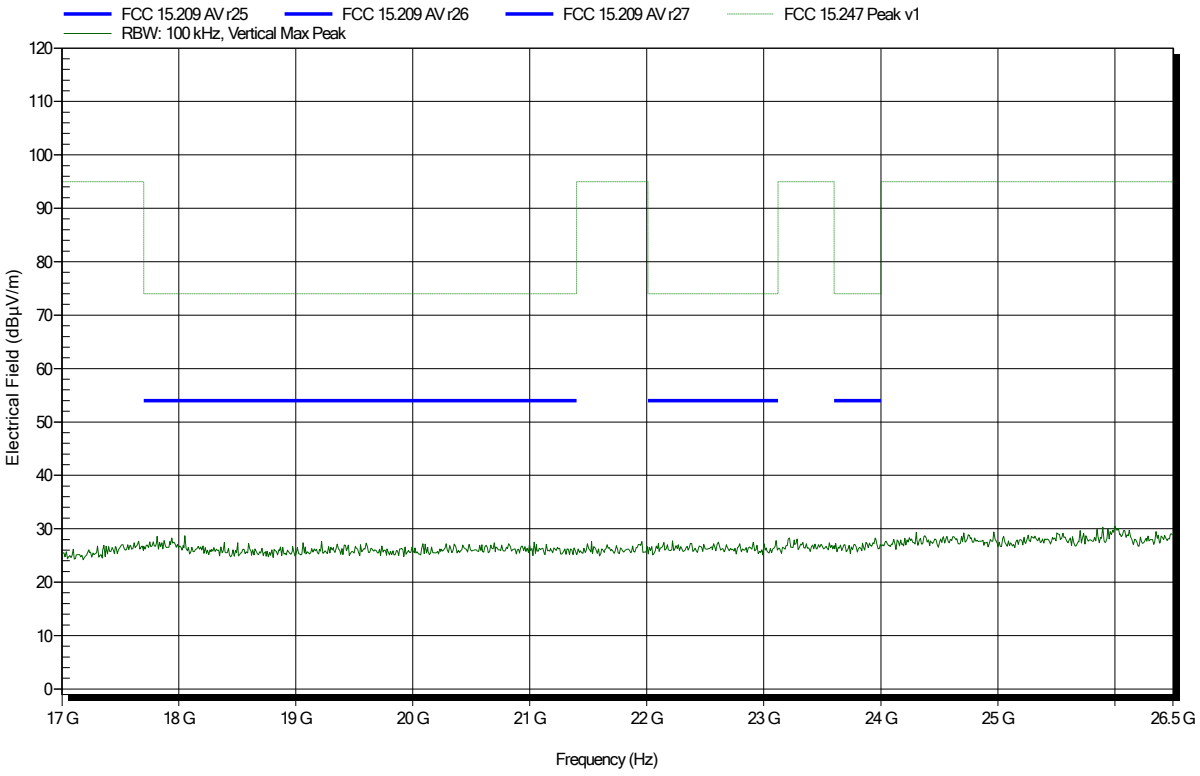

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3 m
Mode:	TX; LE; 2480 MHz
Test Date:	2018-08-17
Note:	

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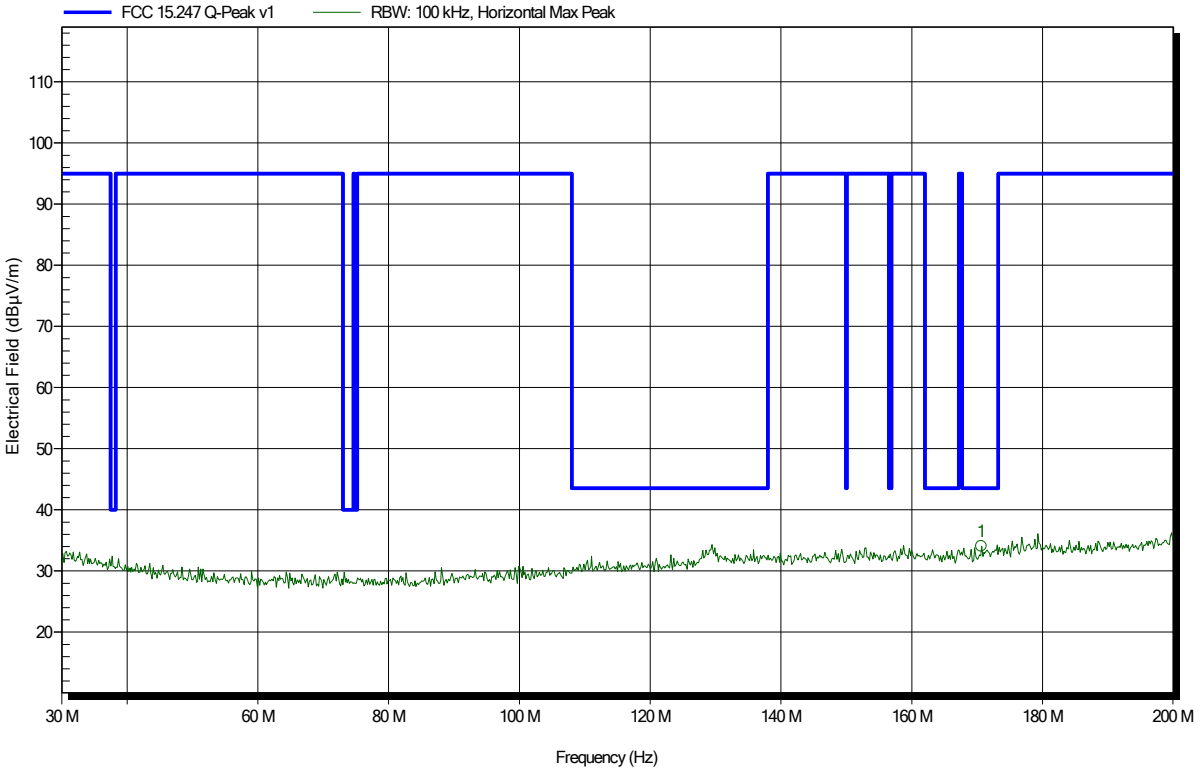

Frequency	Peak	Peak Limit	Peak Difference	Peak Status
170.619 MHz	34.06 dBµV/m	43.52 dBµV/m	-9.46 dB	Pass

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3 m
Mode:	TX; LE; 2480 MHz
Test Date:	2018-08-17
Note:	

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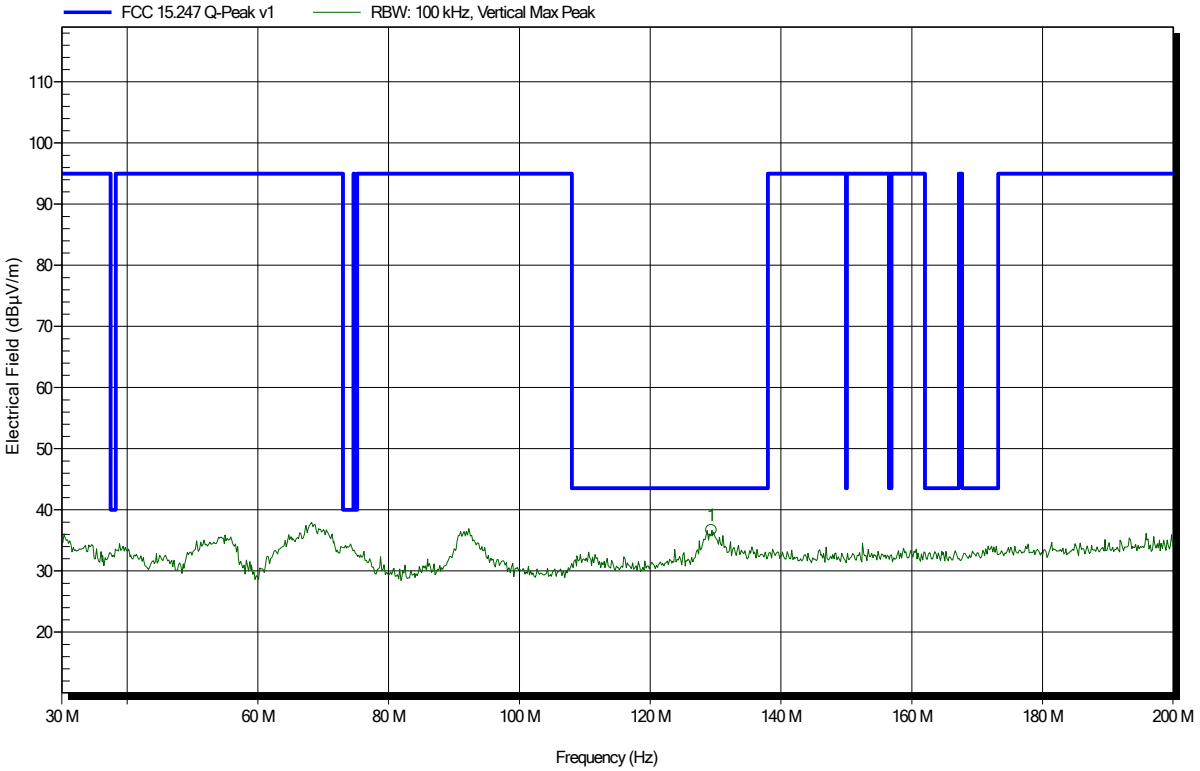

Frequency	Peak	Peak Limit	Peak Difference	Peak Status
129.351 MHz	36.69 dBµV/m	43.52 dBµV/m	-6.83 dB	Pass

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3 m
Mode:	TX; LE; 2480 MHz
Test Date:	2018-08-17
Note:	

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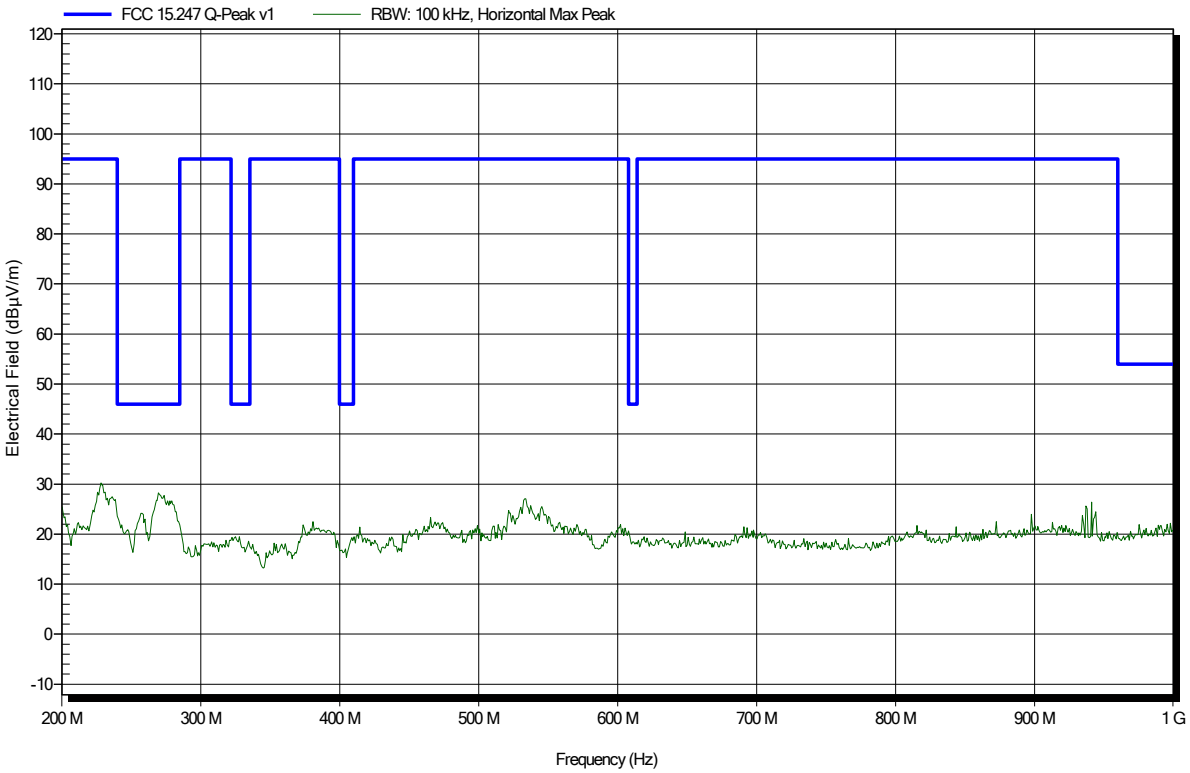

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement distance:	3 m
Mode:	TX; LE; 2480 MHz
Test Date:	2018-08-17
Note:	

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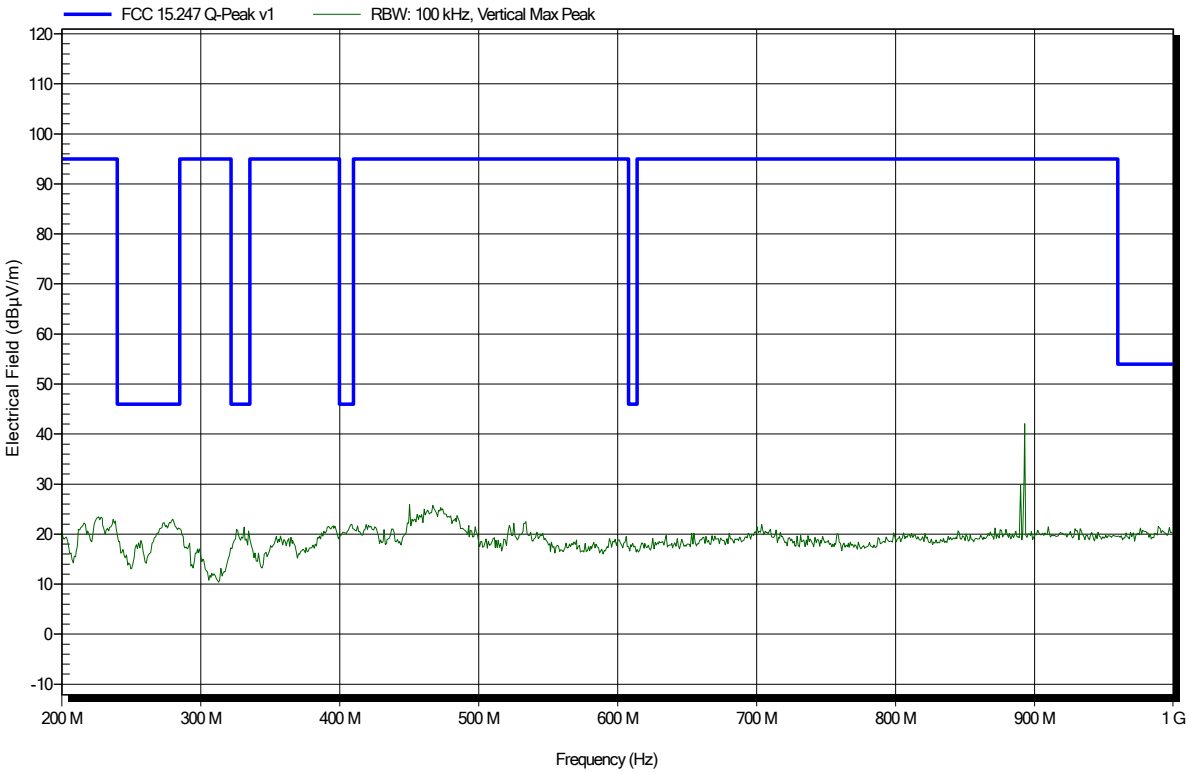

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2480 MHz
Test Date:	2018-08-17
Note:	

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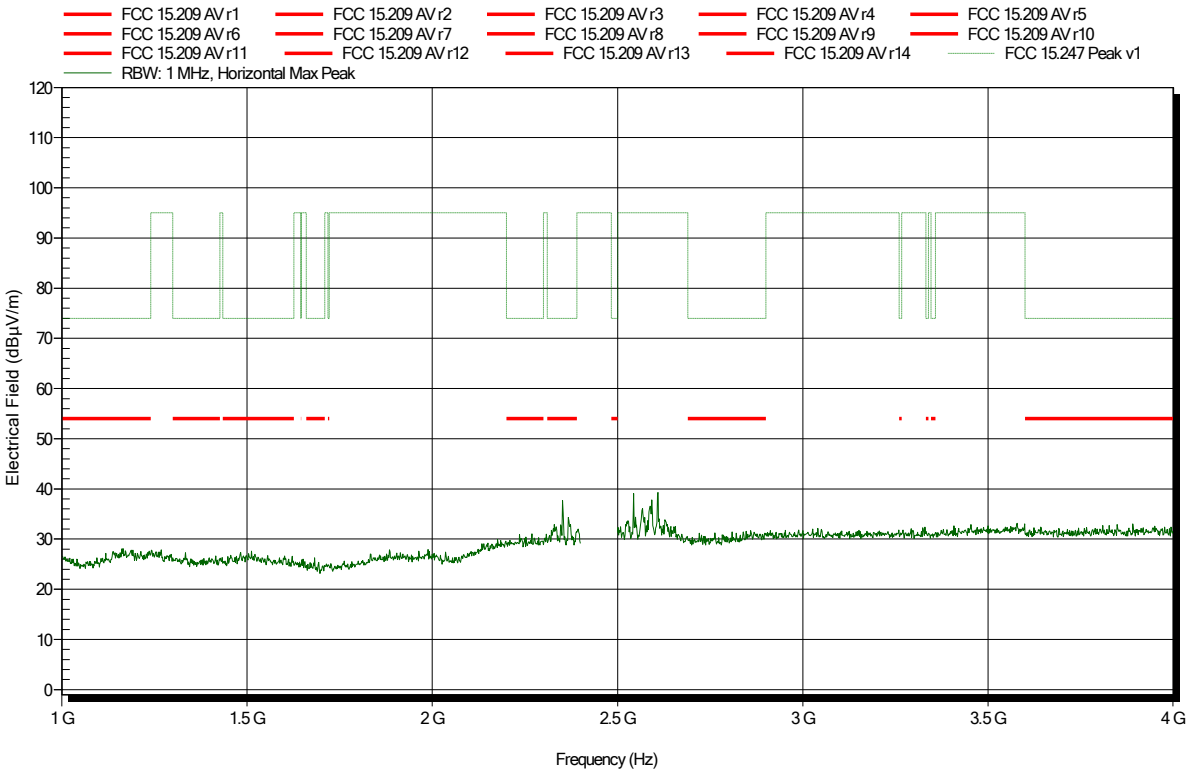

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2480 MHz
Test Date:	2018-08-17
Note:	

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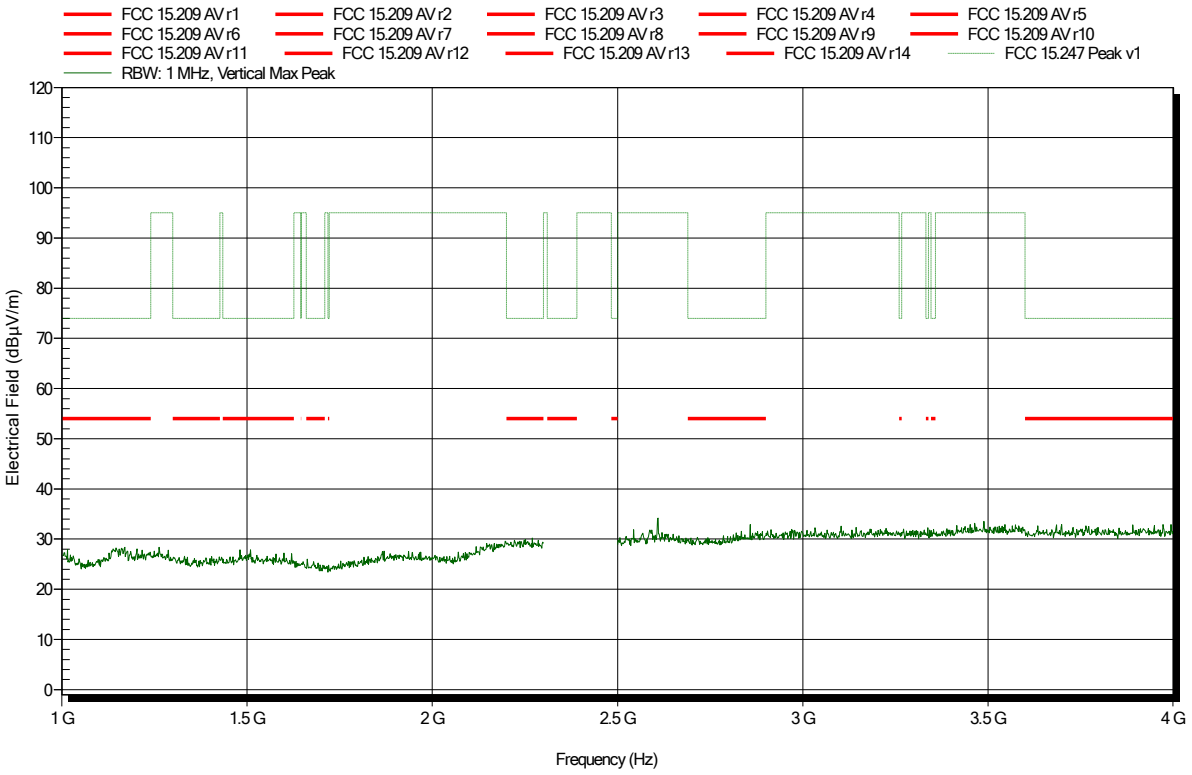

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2480 MHz
Test Date:	2018-08-17
Note:	upper bandedge

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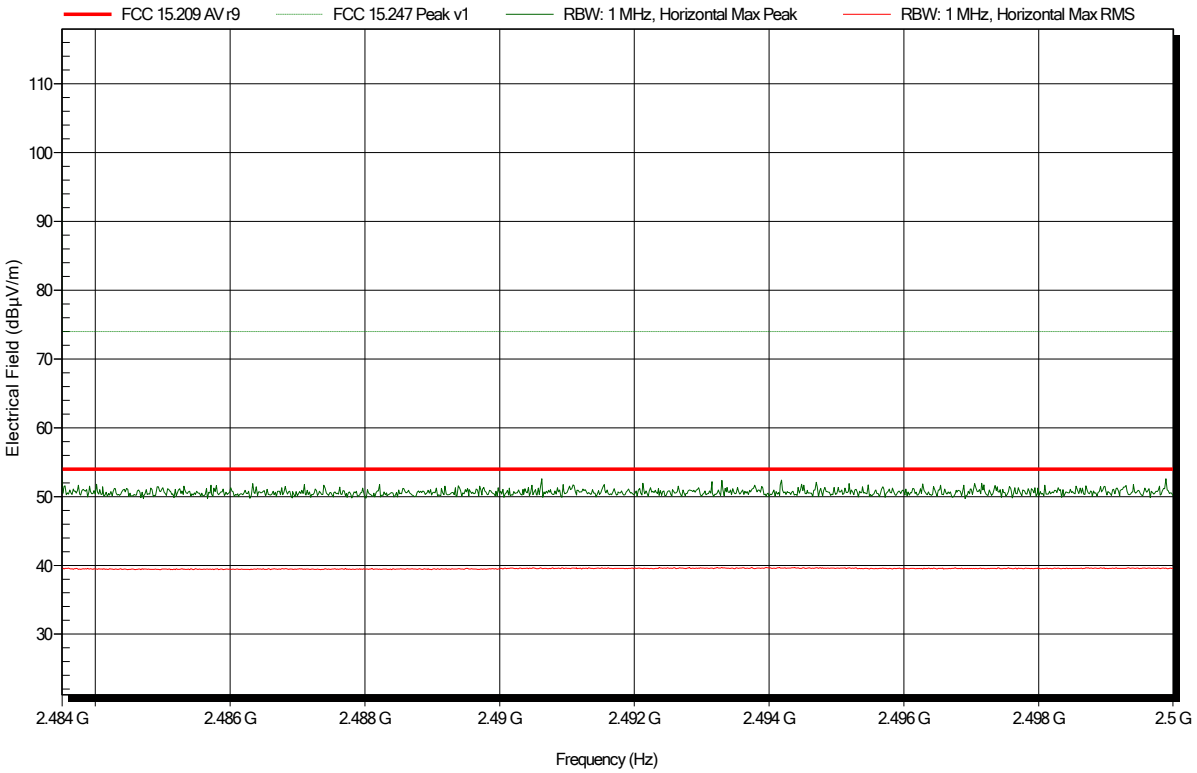

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2480 MHz
Test Date:	2018-08-17
Note:	upper bandedge

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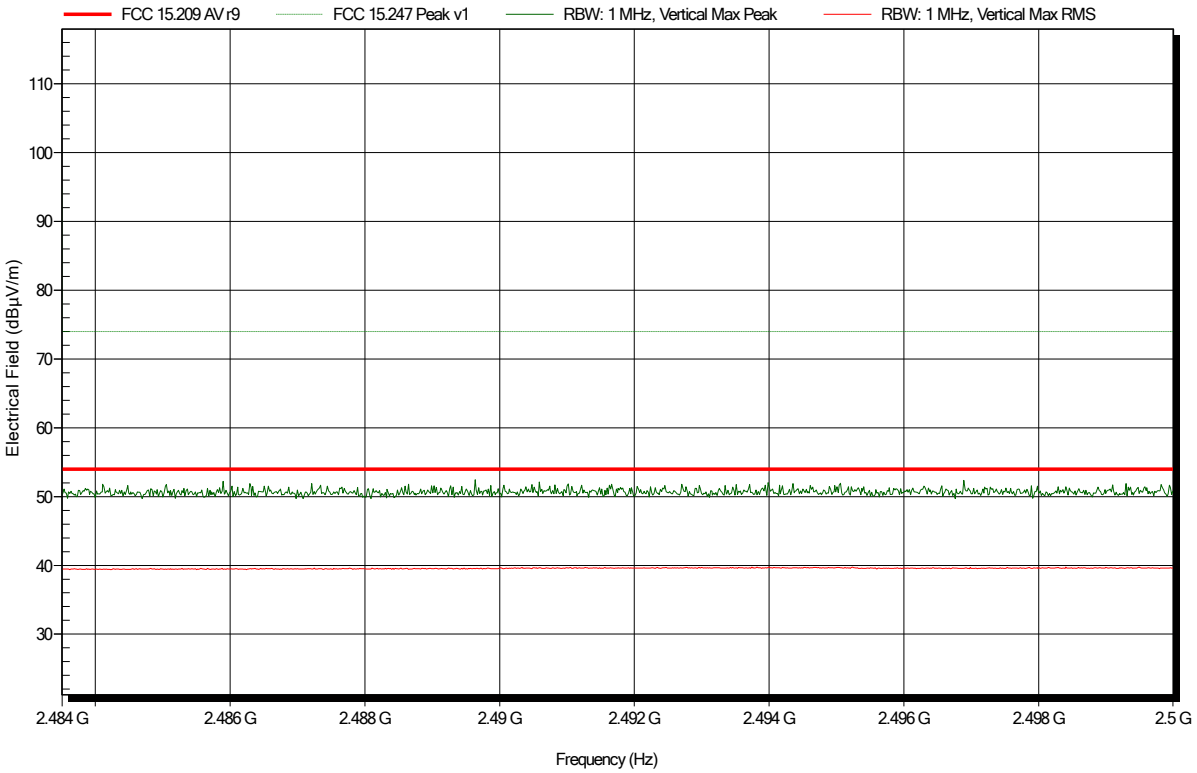

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2480 MHz
Test Date:	2018-08-17
Note:	

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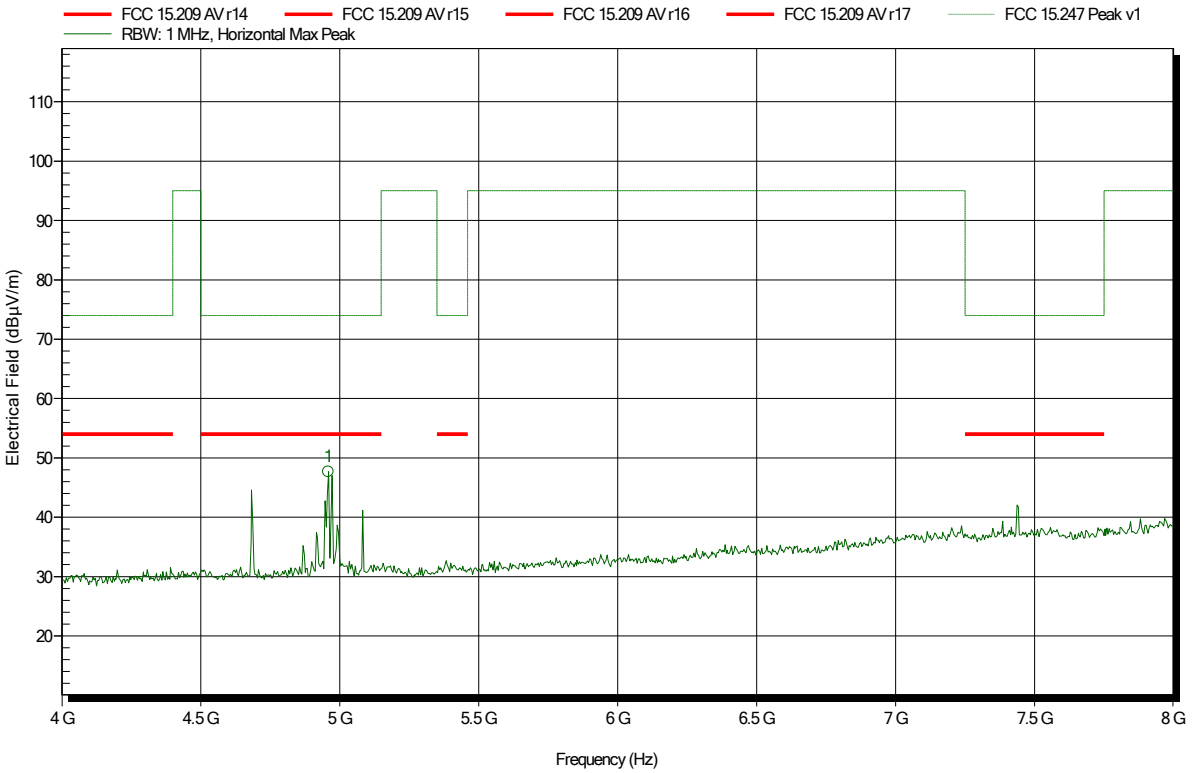

Frequency	Peak	Peak Limit	Peak Difference	Peak Status
4.959 GHz	47.64 dBµV/m	74 dBµV/m	-26.36 dB	Pass

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2480 MHz
Test Date:	2018-08-17
Note:	

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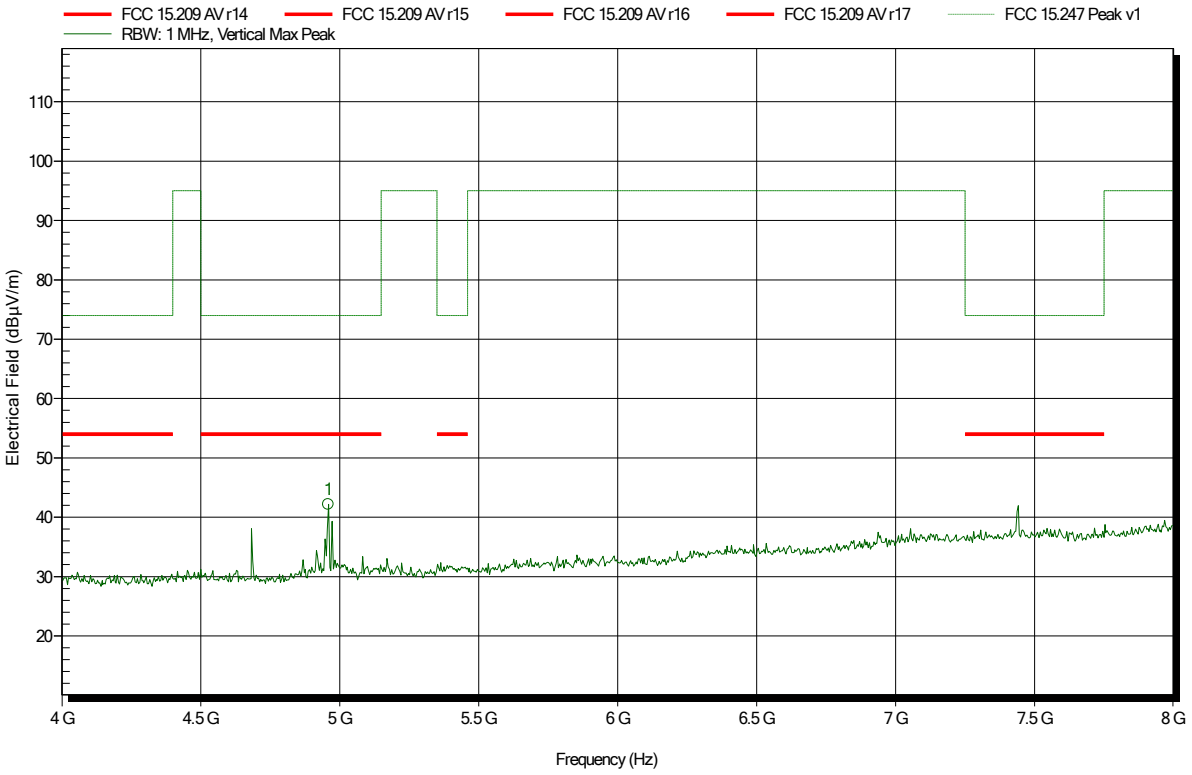

Frequency	Peak	Peak Limit	Peak Difference	Peak Status
4.959 GHz	42.15 dBµV/m	74 dBµV/m	-31.85 dB	Pass

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2480 MHz
Test Date:	2018-08-17
Note:	

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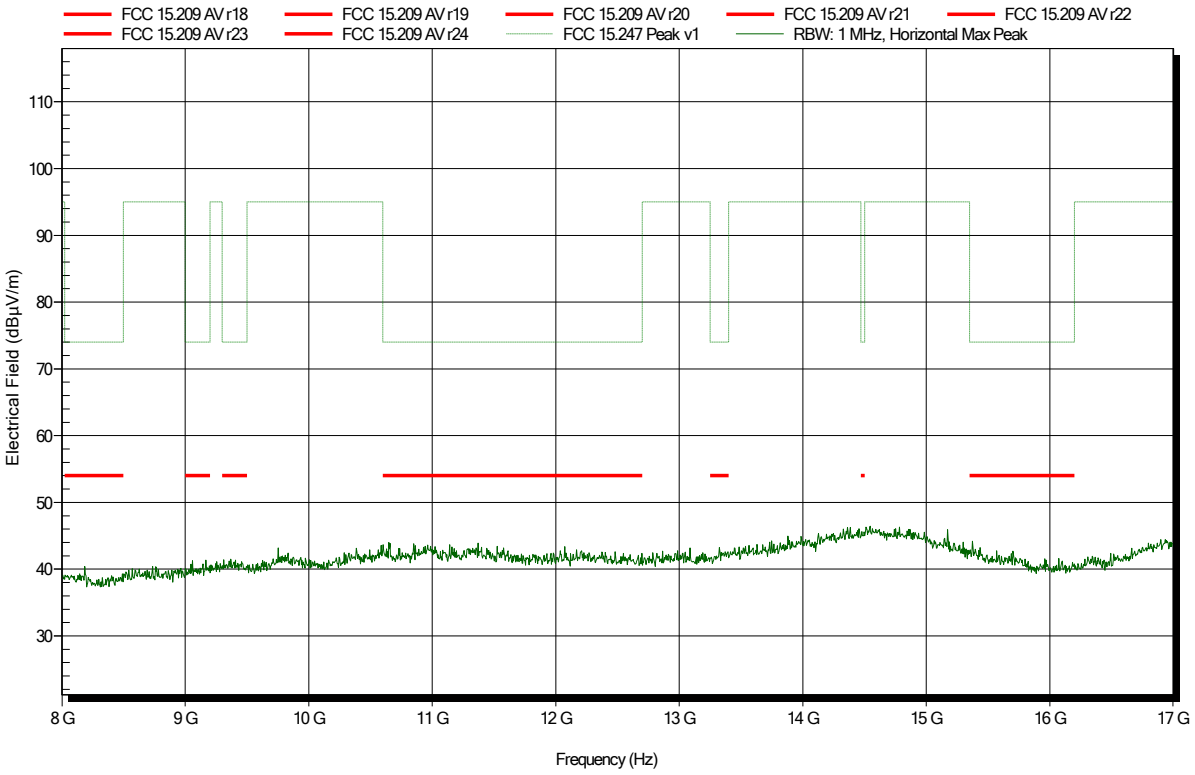

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2480 MHz
Test Date:	2018-08-17
Note:	

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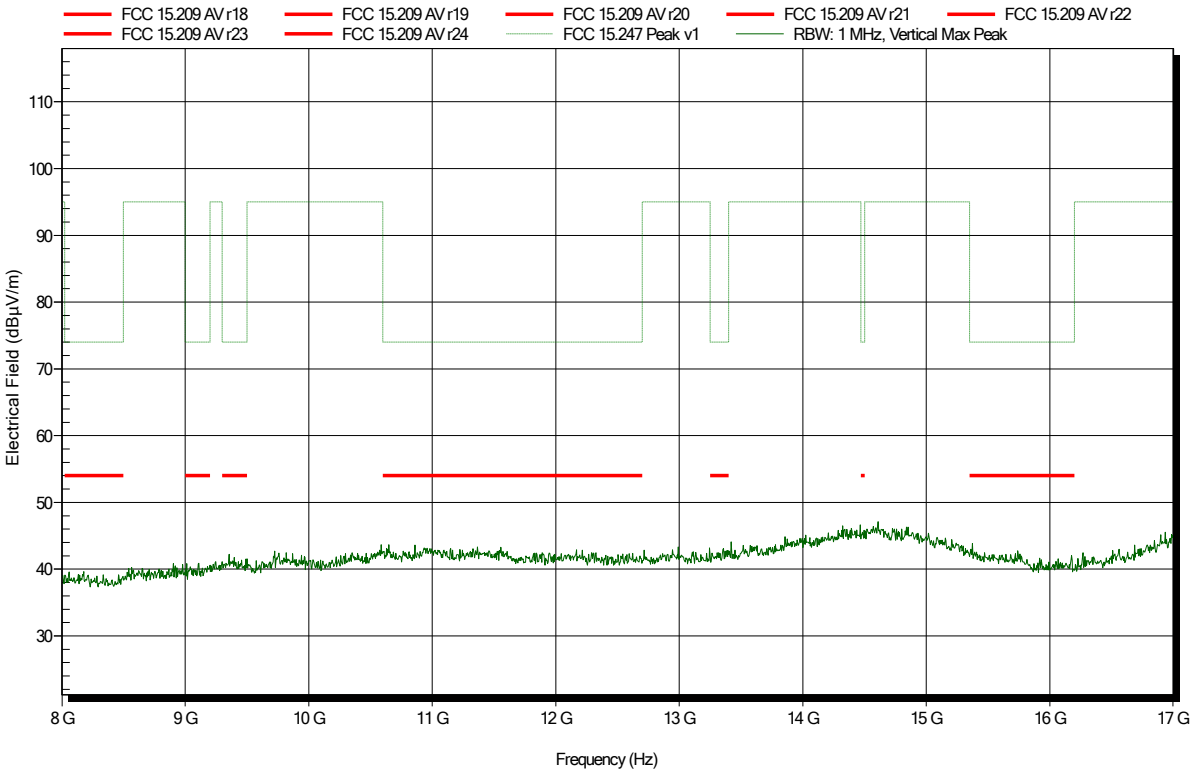

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Amplifier Research AT 4560 (old name) / ATH18G40 (new name), Horizontal
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2480 MHz
Test Date:	2018-08-17
Note:	

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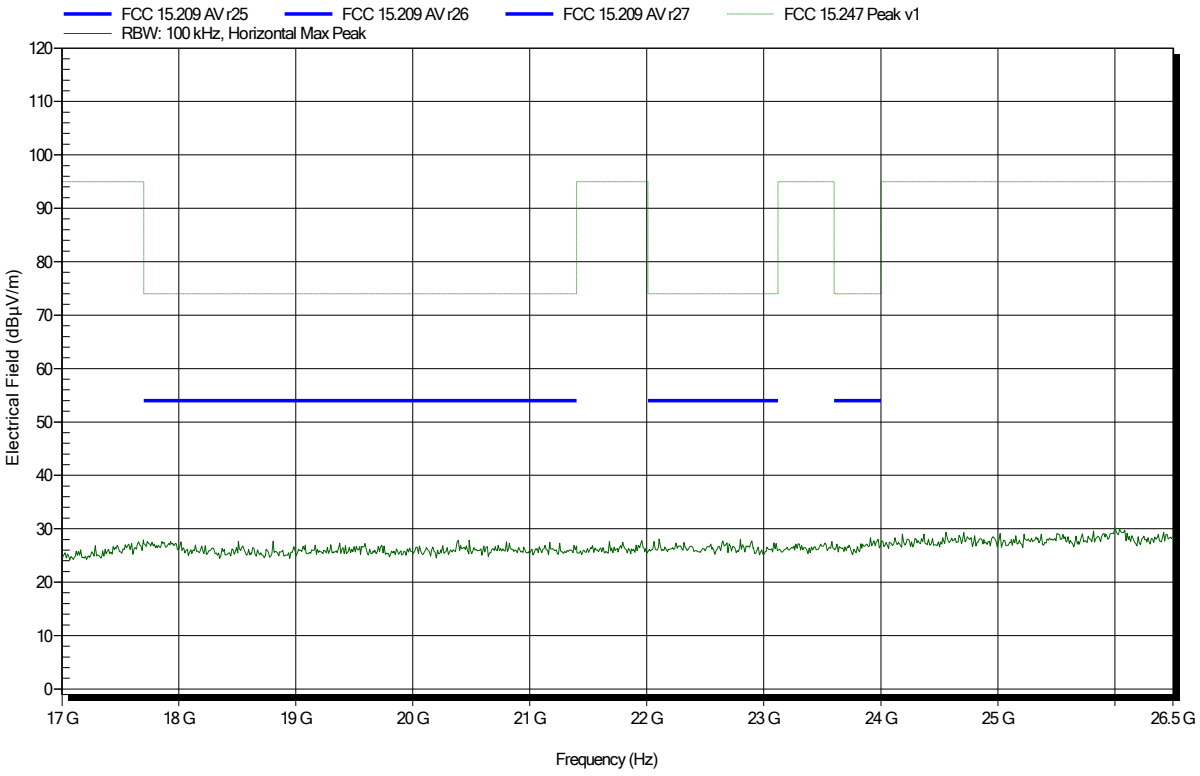

Spurious emissions according to FCC 47 e-CFR §15.247

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 49.9°C, Vnom: 3.3 VDC
Antenna:	Amplifier Research AT 4560 (old name) / ATH18G40 (new name), Vertical
Measurement distance:	1 m converted to 3m
Mode:	TX; LE; 2480 MHz
Test Date:	2018-08-17
Note:	

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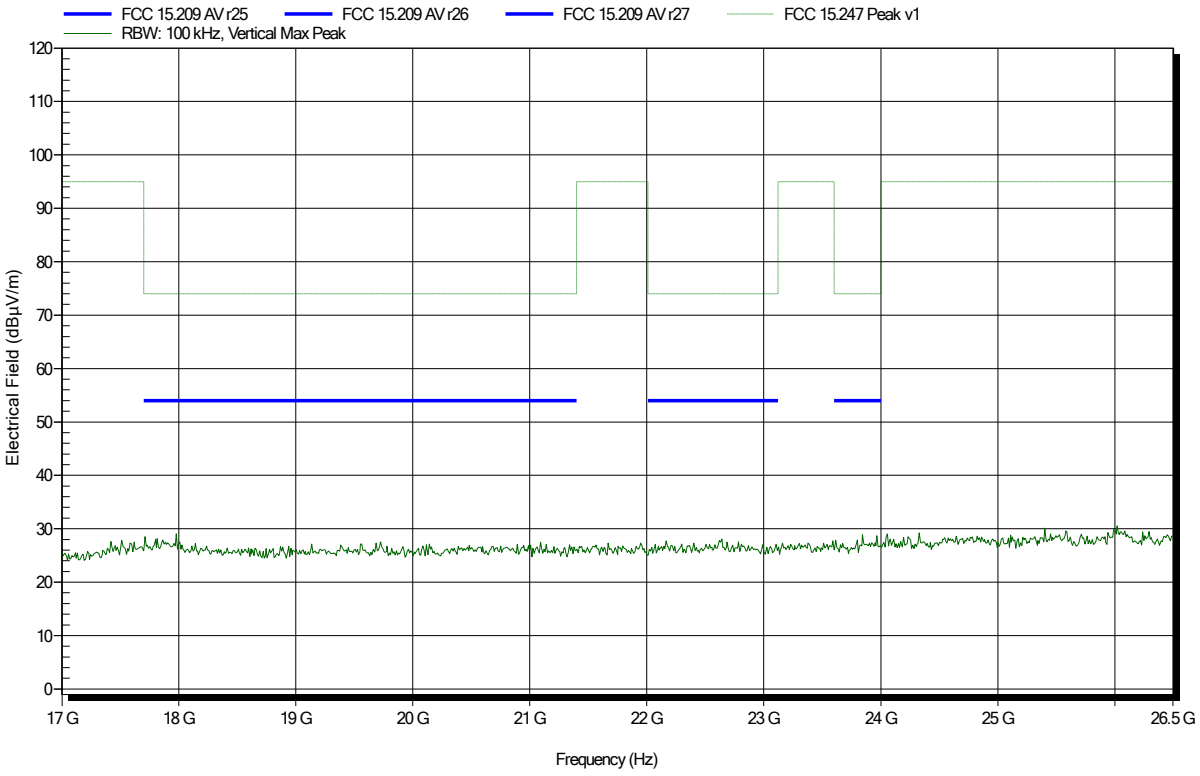

ANNEX B Receiver spurious emissions

Spurious emissions according to ISED RSS-Gen Issue 5 (April 2018)

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 24.1°C, Vnom: 3.3 VDC
Antenna:	Rohde & Schwarz HK 116, Horizontal
Measurement distance:	3 m
Mode:	RX; LE; 2440 MHz
Test Date:	2018-08-17
Note:	

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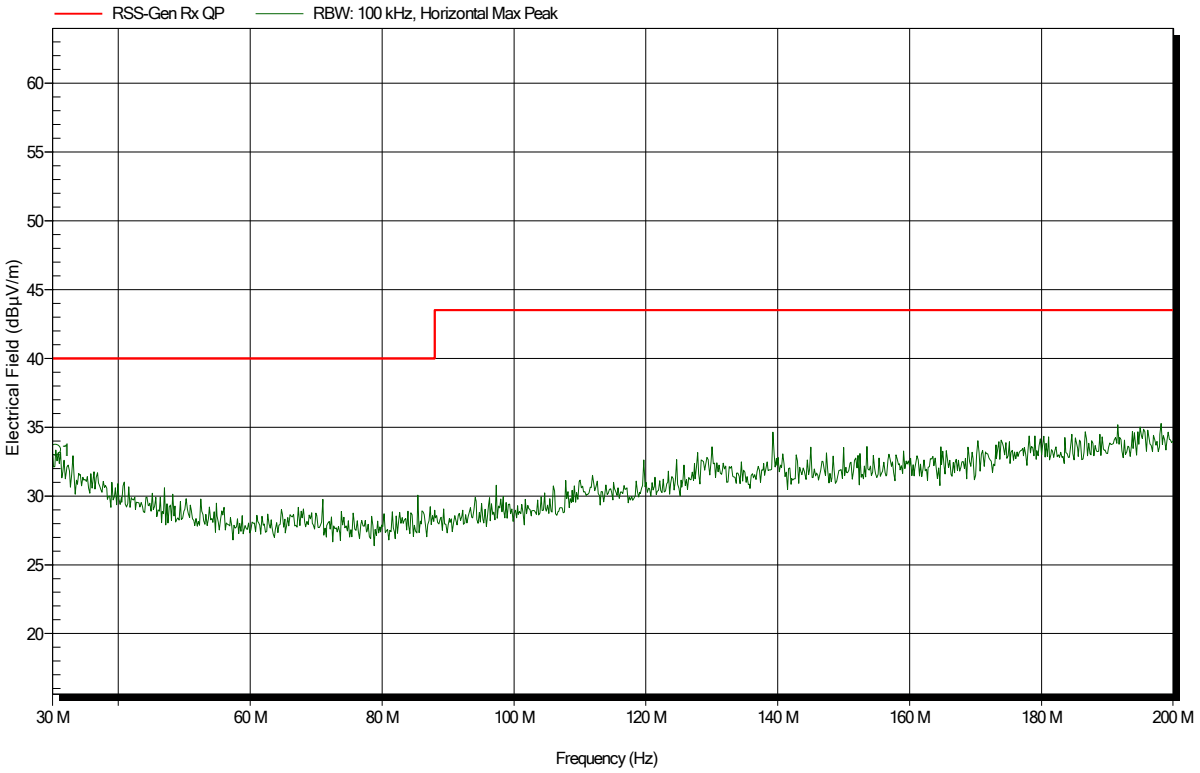

Frequency	Peak	Peak Limit	Peak Difference	Status	Angle	Height
30.509 MHz	33.34 dBµV/m	40 dBµV/m	-6.66 dB	Pass	90 Degree	1.2 m

Spurious emissions according to ISED RSS-Gen Issue 5 (April 2018)

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 24.1°C, Vnom: 3.3 VDC
Antenna:	Rohde & Schwarz HK 116, Vertical
Measurement distance:	3 m
Mode:	RX; LE; 2440 MHz
Test Date:	2018-08-17
Note:	

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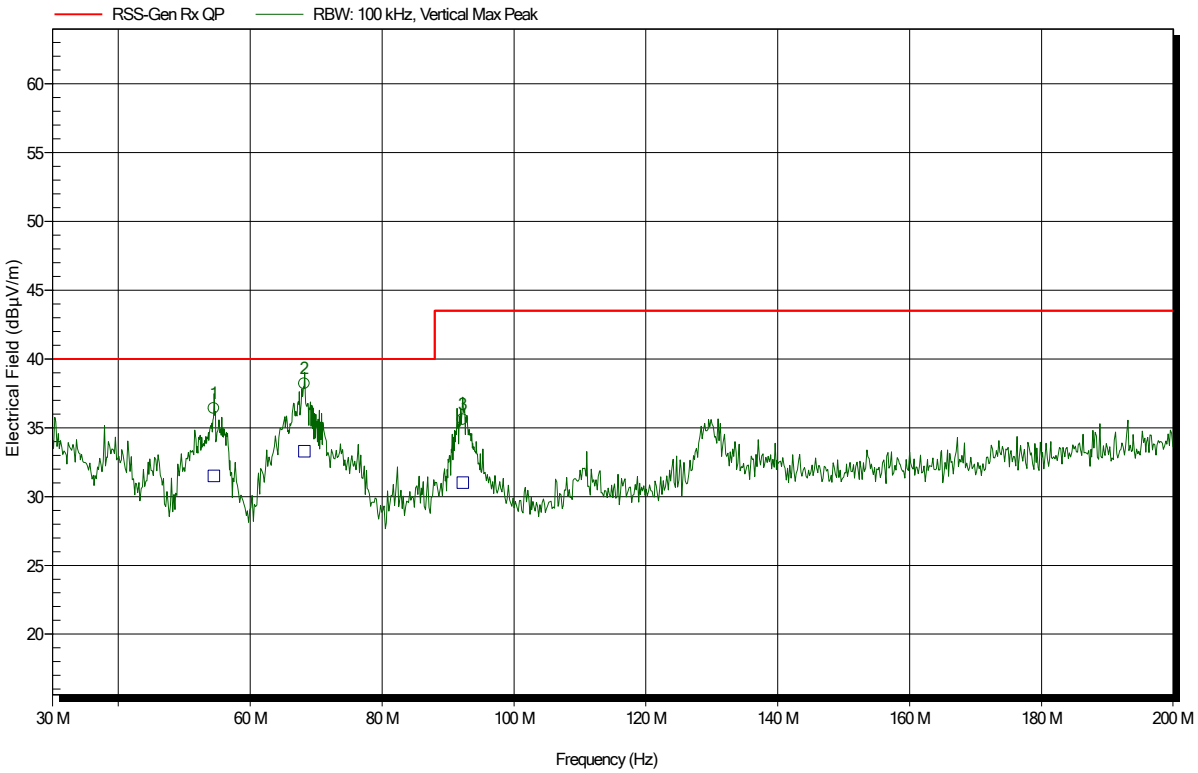

Frequency	Peak	Peak Limit	Peak Difference	Status	Angle	Height
54.465 MHz	36.42 dBµV/m	40 dBµV/m	-3.58 dB	Pass	290 Degree	1.2 m
68.22 MHz	38.21 dBµV/m	40 dBµV/m	-1.79 dB	Pass	291 Degree	1.2 m
92.213 MHz	35.6 dBµV/m	43.5 dBµV/m	-7.9 dB	Pass	44 Degree	1.2 m

Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height
54.465 MHz	31.51 dBµV/m	40 dBµV/m	-8.49 dB	Pass	290 Degree	1.2 m
68.22 MHz	33.29 dBµV/m	40 dBµV/m	-6.71 dB	Pass	291 Degree	1.2 m
92.213 MHz	31.01 dBµV/m	43.5 dBµV/m	-12.49 dB	Pass	44 Degree	1.2 m

Spurious emissions according to ISED RSS-Gen Issue 5 (April 2018)

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 24.1°C, Vnom: 3.3 VDC
Antenna:	Rohde & Schwarz HL 223, Horizontal
Measurement distance:	3 m
Mode:	RX; LE; 2440 MHz
Test Date:	2018-08-17
Note:	

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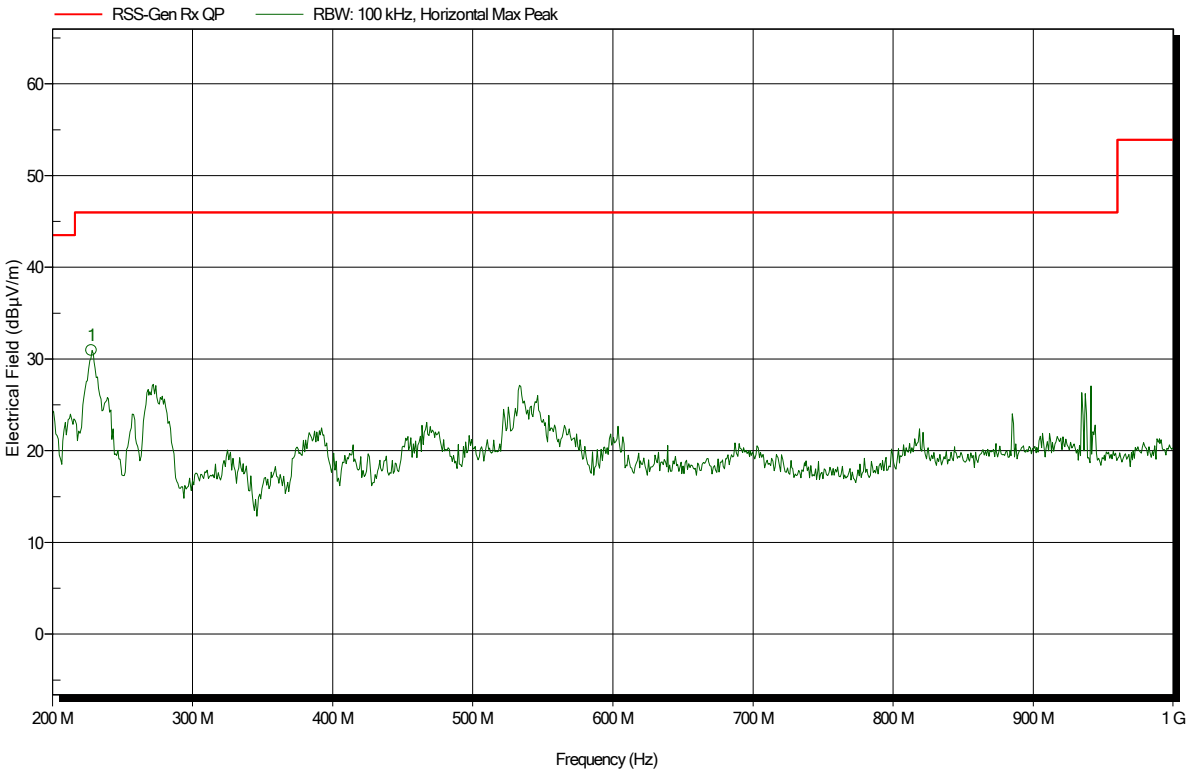

Frequency	Peak	Peak Limit	Peak Difference	Status	Angle	Height
227.972 MHz	30.92 dBµV/m	46 dBµV/m	-15.08 dB	Pass	337 Degree	1.2 m

Spurious emissions according to ISED RSS-Gen Issue 5 (April 2018)

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 24.1°C, Vnom: 3.3 VDC
Antenna:	Rohde & Schwarz HL 223, Vertical
Measurement distance:	3 m
Mode:	RX; LE; 2440 MHz
Test Date:	2018-08-17
Note:	

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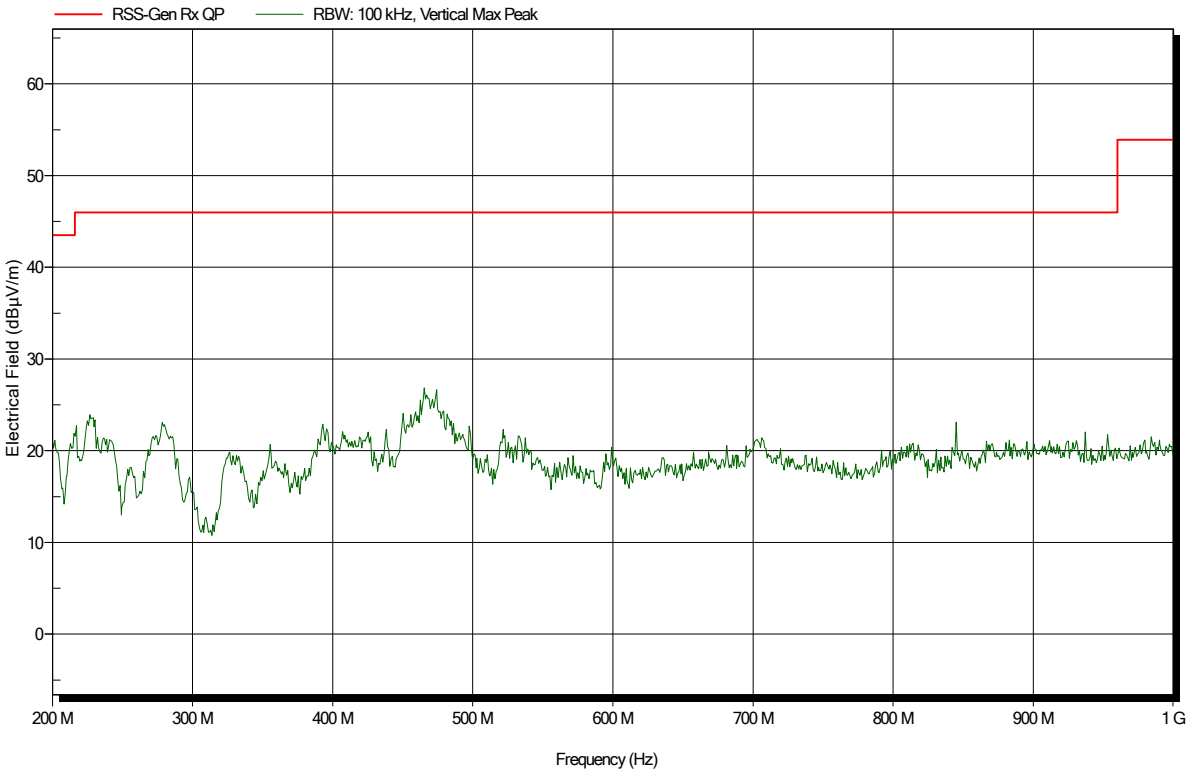

Spurious emissions according to ISED RSS-Gen Issue 5 (April 2018)

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 24.1°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	3 m
Mode:	RX; LE; 2440 MHz
Test Date:	2018-08-17
Note:	

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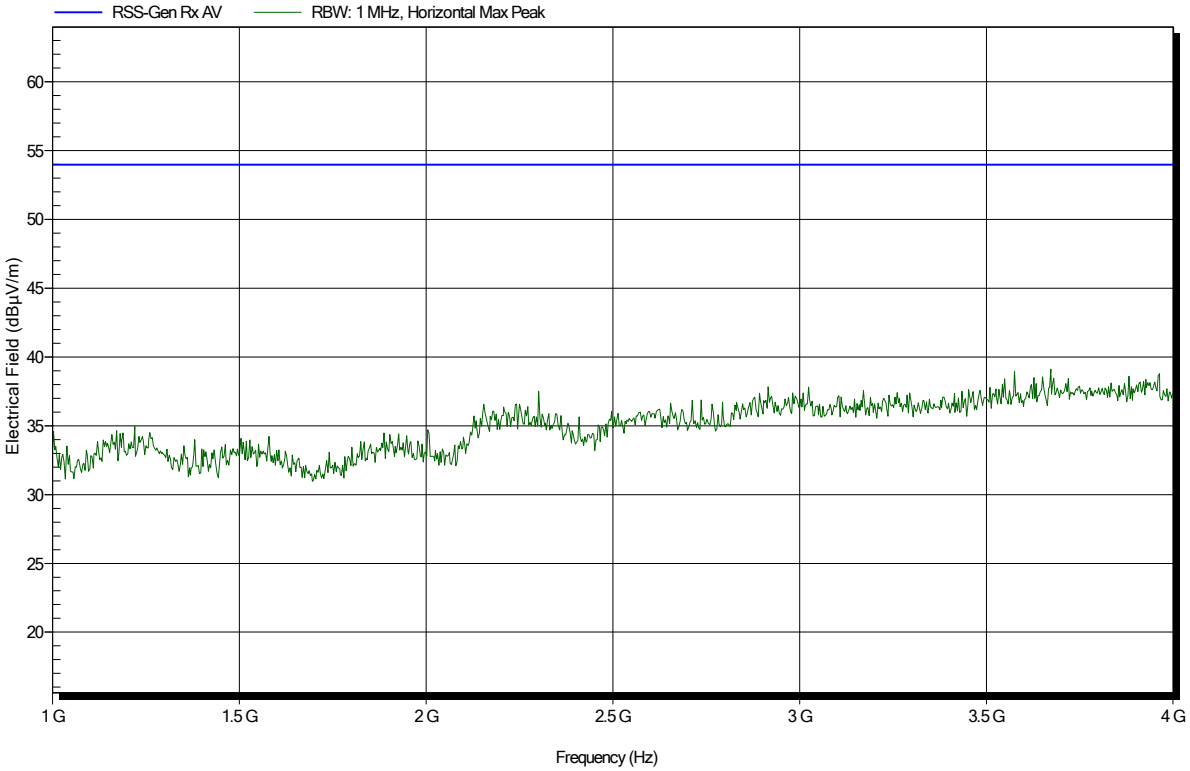

Spurious emissions according to ISED RSS-Gen Issue 5 (April 2018)

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 24.1°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3 m
Mode:	RX; LE; 2440 MHz
Test Date:	2018-08-17
Note:	

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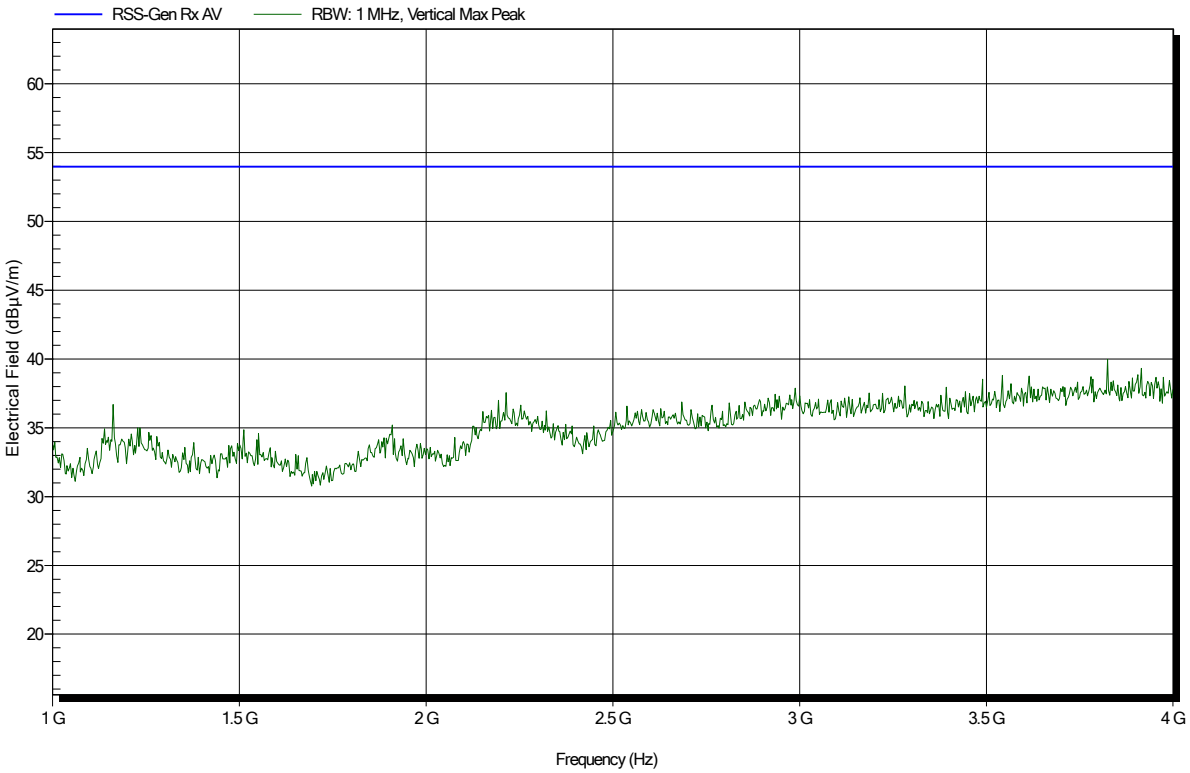

Spurious emissions according to ISED RSS-Gen Issue 5 (April 2018)

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 24.1°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	3 m
Mode:	RX; LE; 2440 MHz
Test Date:	2018-08-17
Note:	

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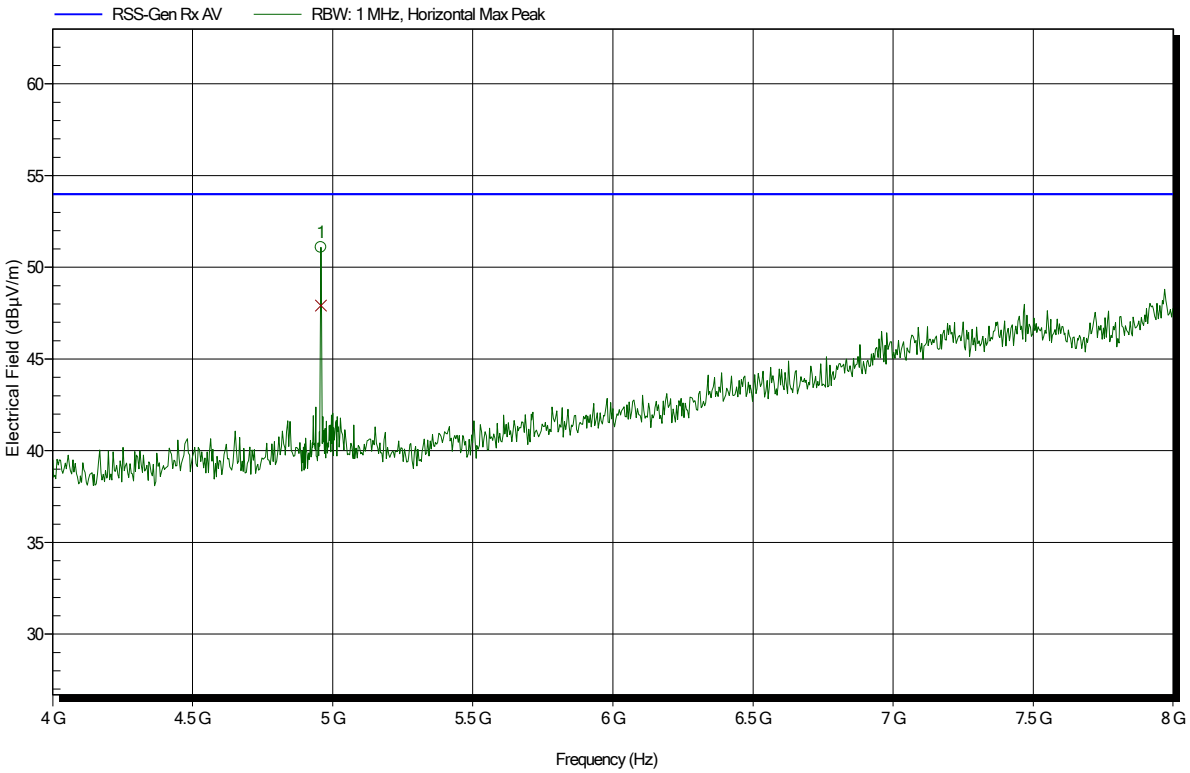

Frequency	Peak	Peak Limit	Peak Difference	Peak Status
4.958 GHz	51.09 dBµV/m	53.98 dBµV/m	-2.89 dB	Pass

Frequency	Average	Average Limit	Average Difference	Average Status
4.958 GHz	47.92 dBµV/m	53.98 dBµV/m	-6.06 dB	Pass

Spurious emissions according to ISED RSS-Gen Issue 5 (April 2018)

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 24.1°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	3 m
Mode:	RX; LE; 2440 MHz
Test Date:	2018-08-17
Note:	

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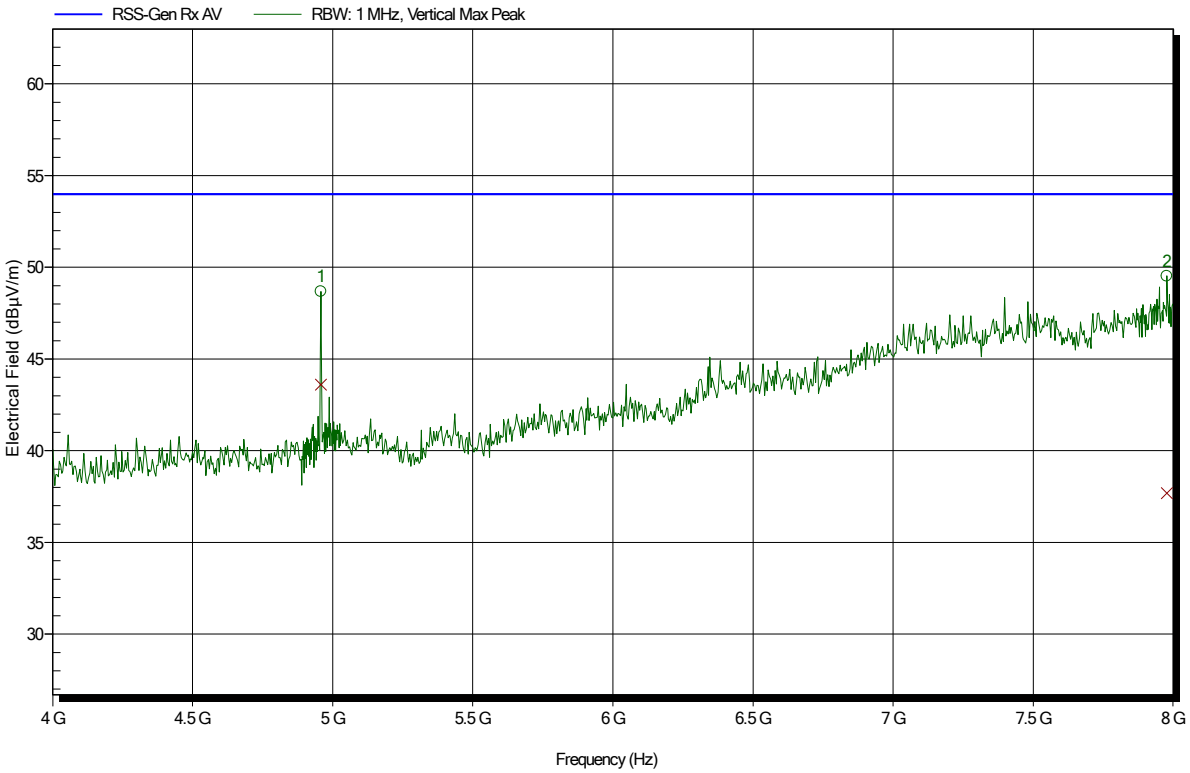


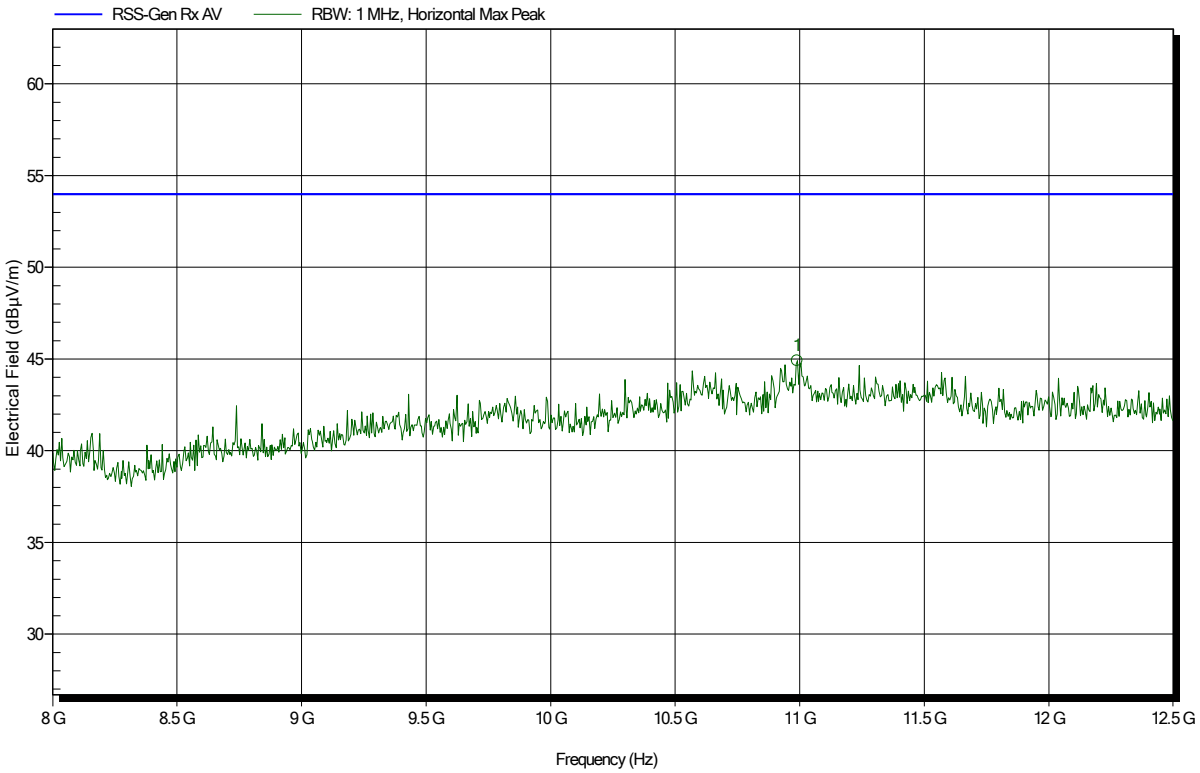
Frequency	Peak	Peak Limit	Peak Difference	Peak Status
4.958 GHz	48.68 dBµV/m	53.98 dBµV/m	-5.3 dB	Pass
7.976 GHz	49.52 dBµV/m	53.98 dBµV/m	-4.46 dB	Pass

Frequency	Average	Average Limit	Average Difference	Average Status
4.958 GHz	43.61 dBµV/m	53.98 dBµV/m	-10.37 dB	Pass
7.976 GHz	37.68 dBµV/m	53.98 dBµV/m	-16.3 dB	Pass

Spurious emissions according to ISED RSS-Gen Issue 5 (April 2018)

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 24.1°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	RX; LE; 2440 MHz
Test Date:	2018-08-17
Note:	

Index 1



Frequency	Peak	Peak Limit	Peak Difference	Status
10.99 GHz	44.91 dBµV/m	53.98 dBµV/m	-9.07 dB	Pass

Spurious emissions according to ISED RSS-Gen Issue 5 (April 2018)

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 24.1°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	RX; LE; 2440 MHz
Test Date:	2018-08-17
Note:	

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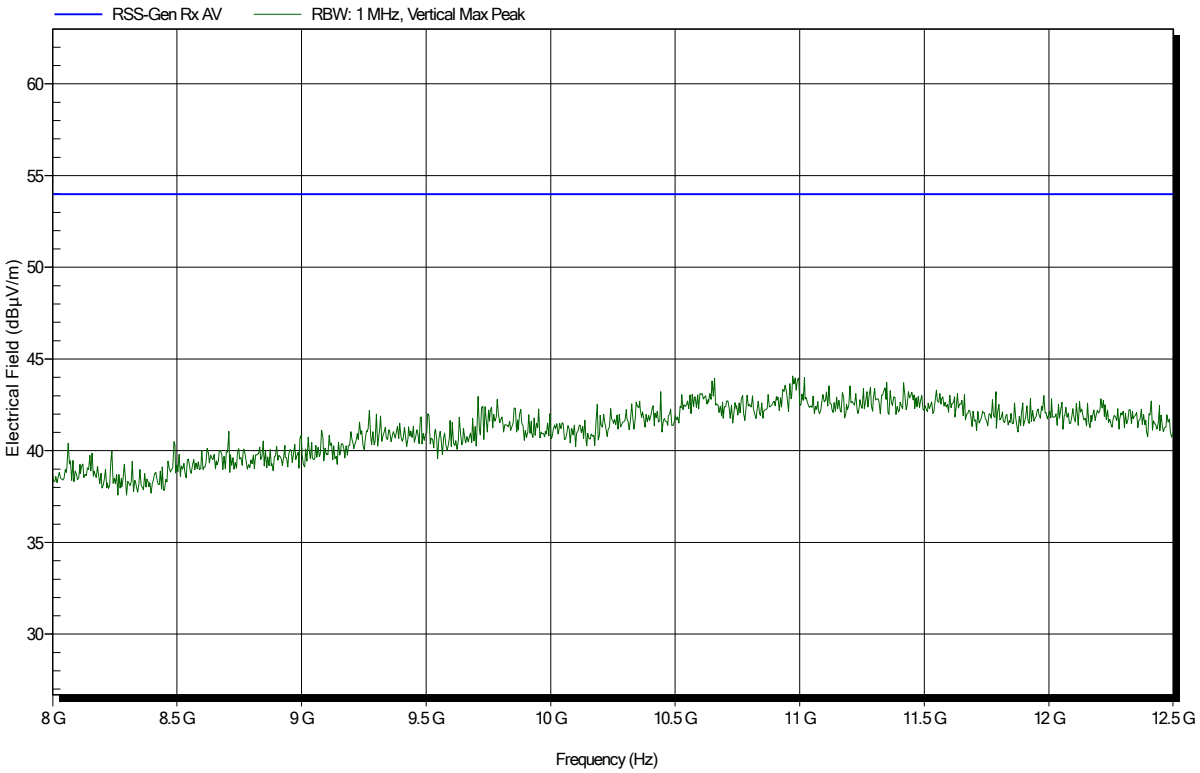

Spurious emissions according to ISED RSS-Gen Issue 5 (April 2018)

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 24.1°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Horizontal
Measurement distance:	1 m converted to 3m
Mode:	RX; LE; 2440 MHz
Test Date:	2018-08-17
Note:	

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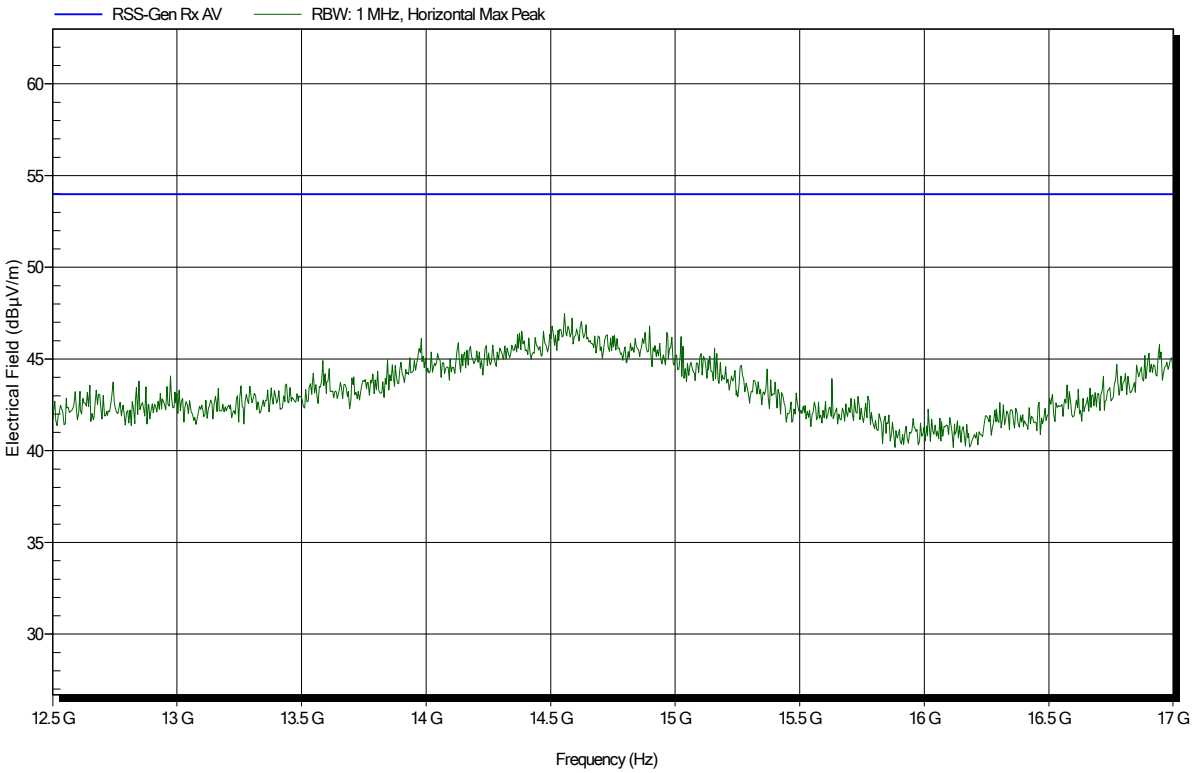

Spurious emissions according to ISED RSS-Gen Issue 5 (April 2018)

Project number:	G0M-1806-7488
Applicant:	Atlas Copco Industrial Technique AB
EUT Name:	Industrial Location Tethering - Positioning System
Model:	IL-R
Test Site:	Eurofins Product Service GmbH
Operator:	Abdullah Al Jamal
Test Conditions:	Tnom: 24.1°C, Vnom: 3.3 VDC
Antenna:	Schwarzbeck BBHA 9120D, Vertical
Measurement distance:	1 m converted to 3m
Mode:	RX; LE; 2440 MHz
Test Date:	2018-08-17
Note:	

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