Prüfbericht-Nr.: *Test Report No.:*	60335508-002	**Auftrags-Nr.:** *Order No.:*	23870248
Kunden Referenz-Nr.: Client Reference No.:		**Auftragsdatum** *Order date:*	2019-08-14
Auftraggeber: *Client:*	Sensative AB Mobilvägen 10 223 62 Lund Sweden	Mr. Lars Jonsson Email: lars.jonsson@sensative.com Phone: +46703023767	
Prüfgegenstand: *Test item:*	Smart home multi sensor for Z-Wave systems		
Bezeichnung / Typ-Nr.: *Identification / Type No.:*	FCC ID: 2AHIR-003 Model: 1101022		
Auftrags-Inhalt: *Order content:*	FCC Compliance testing – z-wave radio		
Prüfgrundlage: *Test specification:*	FCC Part 15.209 and 15.249 ANSI C63.10-2013		
Wareneingangsdatum: *Date of receipt:*	2019-10-15		
Prüfmuster-Nr.: *Test sample No.:*	A000244330-001		
Prüfzeitraum: *Testing period:*	2019-10-14 to 2019-11-25		
Ort der Prüfung: *Place of testing:*	Lund, Sweden		
Prüflaboratorium: *Testing laboratory:*	TÜV Rheinland Sweden		
Prüfergebnis: *Test results:*	Pass		

Geprüft von *Tested by:*	Fariborz Abasi Test Engineer		**Kontrolliert von** *Reviewed by:*	Per Isacsson Lab Manager	
2020-02-13			2020-02-13		
Datum *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*

Sontiges /*Other:*

Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden.
This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts.

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Revisions ***Revisions***			
Revision Revision	**Datum** Date	**Anmerkung** Remark	**Verfasser** Author
001	2020-02-04	First Release	Fariborz Abasi
002	2020-02-13	Band edge plots updated with 50 dB limit info and editorial corrections	Fariborz Abasi
Note: Latest revision report will replace all previous reports			

Summary of Test Results

FCC Rule Part	Test item	Result	Remarks
15.203	Antenna requirements	Pass	Integrated antenna Antenna gain: 2.3 dBi
15.249(a)	Transmitter Fundamental Field Strength	Pass	
15.215 (c)	20 dB Bandwidth	Pass	
15.249(a)(d)(e) 15.209(a)	Transmitter Radiated Emissions	Pass	
15.249(d) / 15.209(a)	Transmitter Band Edge Radiated Emissions	Pass	

Possible test case verdicts:

- test case does not apply to the test object ....: N/A
- test object does meet the requirement .....: PASS
- test object does not meet the requirement ....: FAIL
- test case not performed on the test object ....: n.p.

Table of contents

1 TEST SITES

Testing facility

TÜV Rheinland Sweden AB
Mobilvägen 10
223 62 Lund
Sweden

FCC Test Firm Registration Number: 517458

2 PRODUCT INFORMATION

2.1 General description

Model name:	Strips by Sensative
Manufacturer:	Sensative AB
Model number / Marketing name:	1101022
FCC ID:	2AHIR-003
Description:	Smart home multi sensor for Z-Wave systems
Supported Radio Technologies:	Z-Wave radio – 908.4 – 916 MHz
Antenna type	Internal PCB antenna
Antenna gain	2.3 dBi
Supply Voltage to Product:	Built-in LiMnO2 battery (3 volt)
Highest internal frequency source:	916 MHz
Ancillary Equipment:	See section 1.4

2.2 Radio specific details

2.2.1 Z-Wave radio

Region	Channel	Frequency	Data rate	Channel Width	Modulation
United State of America	f_{US1}	916.00 MHz	100 kbit/s	400 kHz	GFSK (BT=0.6)
	f_{US2}	908.40 MHz	40 kbit/s	300 kHz	FSK (NRZ)
			9.6 kbit/s	300 kHz	FSK (Manchester)

2.3 Equipment Under Test (EUT) identification

TÜV Rheinland ID	S/N	HW	SW	Remarks
A000244330-001	5051792	PBA 11 01 022	SWG 11 01 022	Used for radiated measurements
A000244330-003	5051791	PBA 11 01 022	SWG 11 01 022	Used for conducted measurements

2.4 Ancillary equipment for verification purposes

TÜV Rheinland ID	Type	Model	Manufacturer
A000244330-004	Battery 3.0V 480mAh	CP2012120	HCB
A000244330-005	Battery 3.0V 480mAh	CP2012120	HCB
A000244330-006	Battery 3.0V 480mAh	CP2012120	HCB
A000244330-007	Battery 3.0V 480mAh	CP2012120	HCB
A000244330-010	Battery 3.0V 480mAh	CP2012120	HCB

3 TEST METHODS AND OPERATION MODES

3.1 Test Methods

The following standards/references has been considered for the testing

Reference Standards	
Standard	**Description**
FCC Part 15 (Subpart C)	§15.249 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHZ, and 24.0-24.25 GHz.
FCC Part 15 (Subpart C)	§15.209 Radiated emission limits; general requirements
FCC Part 15 (Subpart C)	§15.203 Antenna Requirement
ANSI C63.4:2014	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10:2013	American National Standard for Testing Unlicensed Wireless Devices

3.2 EUT Operation modes

Operation Mode	Description
#1	Transmitting at maximum power with a modulated signal on channel 1 or 2 as required, using the supported data rates.

A PC was used in order to set the EUT in the different required operations modes.

4 TEST RESULTS - TRANSMITTER FUNDAMENTAL FIELD STRENGTH

4.1 Transmitter Fundamental field strength – Test summary

Result	Pass
Equipment under Test	A000244330-001
Test period	2019-10-15 and 2019-11-04
Test Engineer	Fariborz Abasi
Test Specification	FCC part 15 Subpart C 15.249 (a)
Test Method	ANSI C 63.10 - 2013
Measurement Location	Semi Anechoic Chamber
Measuring Distance	3 m
Detector	Quasi Peak Detector
EUT Operation mode	#1
Ancillary equipment	See section 1.4
Environmental conditions	Temperature: + 18 - 20 °C Relative Humidity: 20 - 40 %

4.2 Transmitter Fundamental field strength – Test Setup

Measurement was performed in a Semi Anechoic Chamber as per details described in section 5.2.
Both data rates were tested at 908.4 MHz and the same fundamental field strength was measured with each.
Therefore only results for 908.4 MHz with data rate of 40 kbit/s are included in the results table shown below.

4.3 Transmitter Fundamental field strength – Test details

4.3.1 Quasi-Peak / 908.4MHz / 40kBit/s

Transmitter Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
908.400	Horizontal	92.08	94	1.92	Compliant

4.3.2 916 MHz / 100kBit/s

Transmitter Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
916.0	Horizontal	91.87	94	2.13	Compliant

5 TEST RESULTS - TRANSMITTER 20 DB BANDWIDTH

5.1 Transmitter 20 dB Bandwidth – Test summary

Result	Pass
Equipment under Test	A000244330-003
Test period	2019-12-04
Test Engineer	Per Isacsson
Test Specification	FCC part 15 Subpart C Section 15.215 and FCC Part 2.1049
Test Method	ANSI C 63.10 - 2013
Measurement Location	Shielded room
Measuring Distance	Conducted measurement on antenna port
Detector	Quasi Peak
Requirement	
EUT Operation mode	#1
Ancillary equipment	See section 1.4
Environmental conditions	Temperature: + 18 - 20 °C Relative Humidity: 20 - 40 %

5.2 Transmitter 20 dB Bandwidth – Test setup

Measurement was performed according to ANSI C63.10 section 6.9.2.

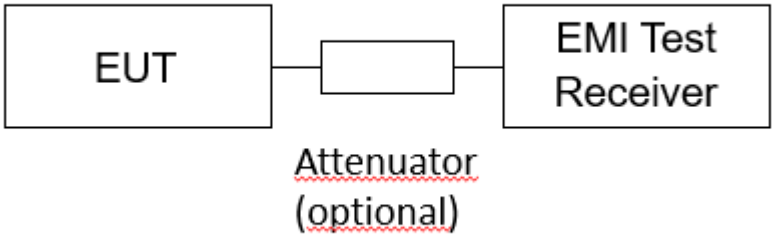
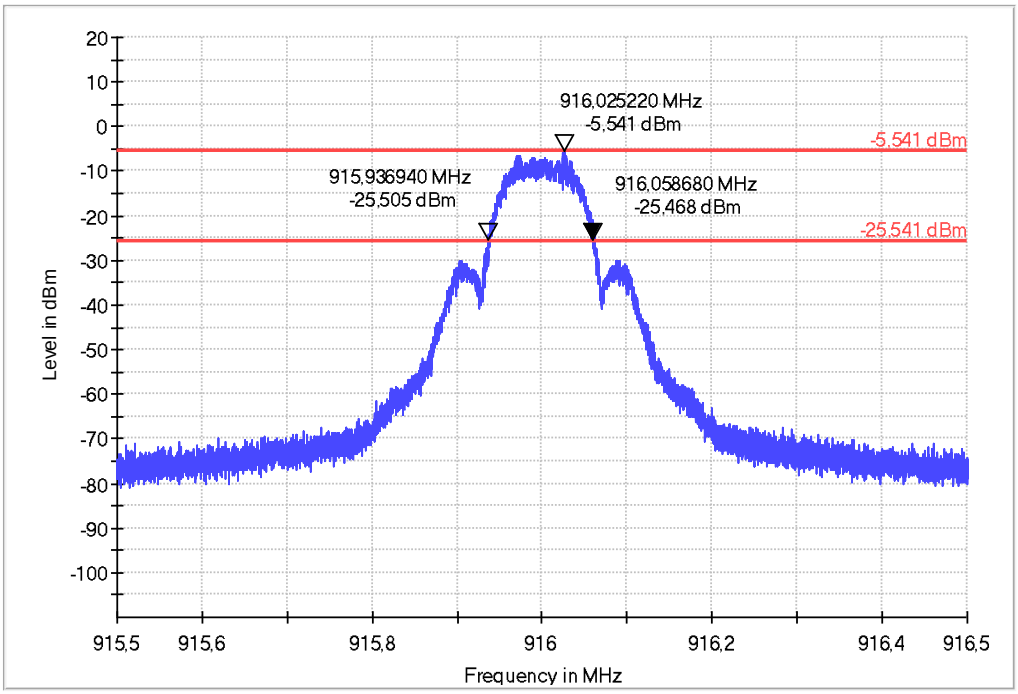


Figure: Test setup – Transmitter 20 dB Bandwidth

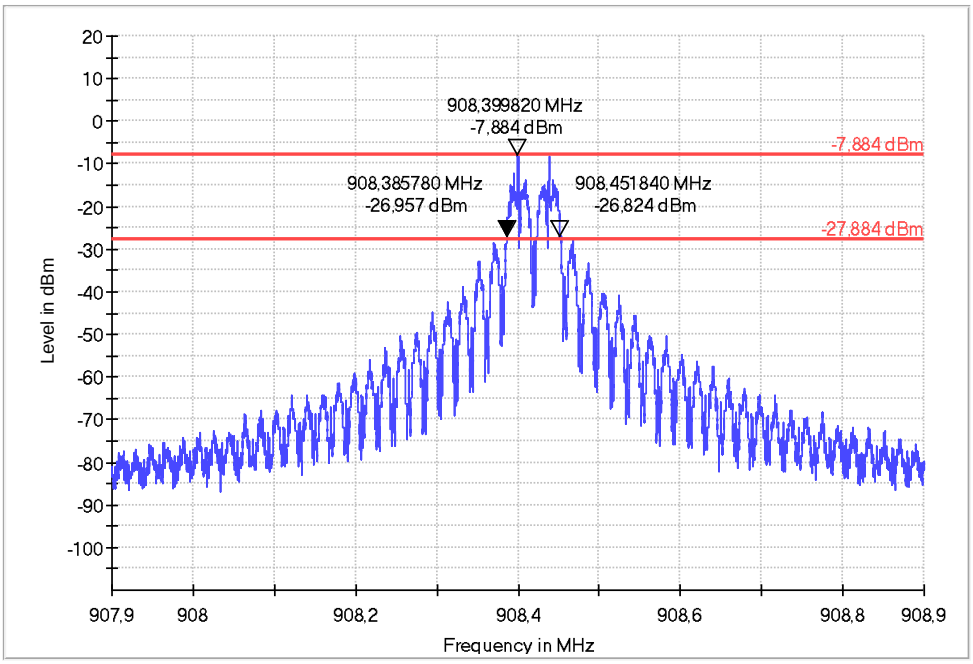
5.3 Transmitter 20 dB Bandwith – Test details

Transmitter Frequency (MHz)	TX Data Rate (kbit/s)	20 db Bandwidth (kHz)
908.4	9.6	122
908.4	40	66
916.0	100	79

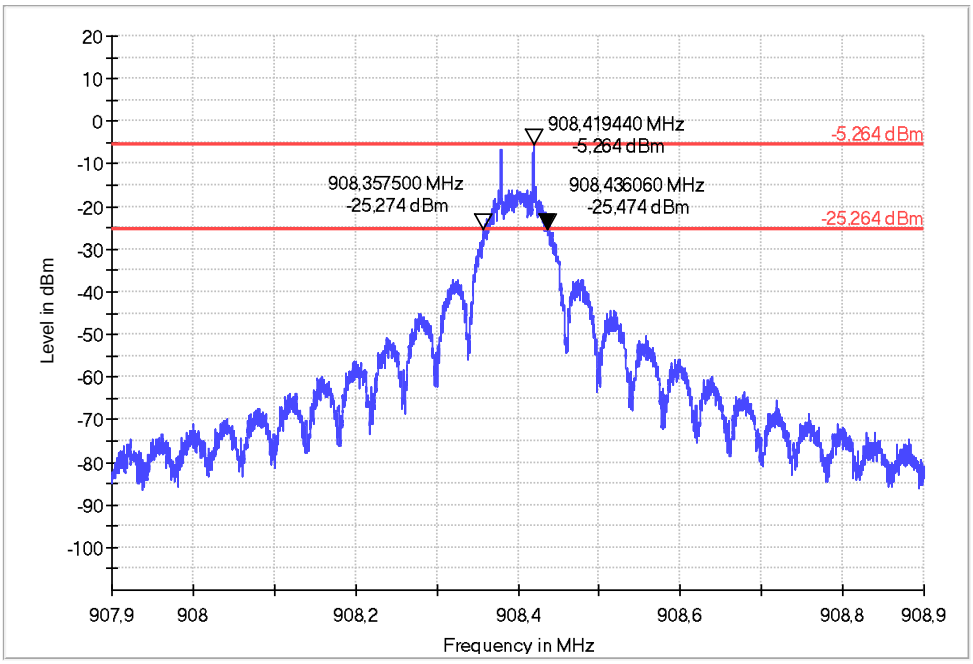
5.3.1 916.000MHz 100kBit/s



5.3.2 908.400MHz 9,6kBit/s



5.3.3 908.400MHz 40kBit/s



6 TEST RESULTS - RADIATED EMISSIONS

6.1 Radiated emissions - Test summary

Result	Pass
Equipment under Test	A000244330-001
Test period	2019-10-14 to 2019-11-25
Test Engineer	Faroborz Abasi
Test Specification	FCC part 15 Subpart C Section Part 15.205, 15.209, 15.249
Test Method	ANSI C 63.10 - 2013
Measurement Location	Semi Anechoic Chamber
Measuring Distance	3 m
Detector	QP for frequencies below 1 GHz, average for frequencies above 1 GHz
Requirement	As per the limits in the below table
EUT Operation mode	#1
Ancillary equipment	See section 2.4
Environmental conditions	Temperature: + 18 - 20 °C Relative Humidity: 20 - 40 %

Frequency (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Distance of Measurement (m)
0.009 – 0.490	2400/F(kHz)	48.50 – 13.80	300*
0.490 – 1.705	24000/F(kHz)	33.80 – 23.00	30*
1.705 -30	30	29.54	30*
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Remark: * The limit shows in the table above of frequency range 0.009 – 0.490, 0.490 – 1.705 MHz and 1.705-30MHz is at 300 meter, 30 meter and 3 meter range respectively, which corresponds to 128.51 – 93.80, 73.80 – 62.96 and 69.54 dBµV/m at 3m range by extrapolation calculation and the measurement of loop antenna.

For measurements above 18GHz the measurement was performed at 1m distance, the limit line has been adjusted for this using the following formula: Extrapolation (dB) = 20log (3meter / 1meter) = +9,54db

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector

6.2 Radiated Emissions - Chamber setup

The radiated emission measurement was performed according to the procedures in ANSI C63.10-2013. The equipment under test (EUT) was placed at the middle of the turntable on an 80cm high table for below 1 GHz & 1.5 m height for above 1 GHz measurement, for frequencies up to 18GHz the EUT is 3 meters far from the measuring antenna, above 18GHz the distance is 1 meter. The turntable was rotated 360° for obtaining the maximum emission. The height of the measuring antennas was scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained. The measurements above 1000 MHz was performed by 3 different horn antennas, the measurement below 30 MHz was performed by loop antenna and measurement from 30 MHz to 1 GHz was performed by Log-Periodic Antenna.

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Test Setup Configuration

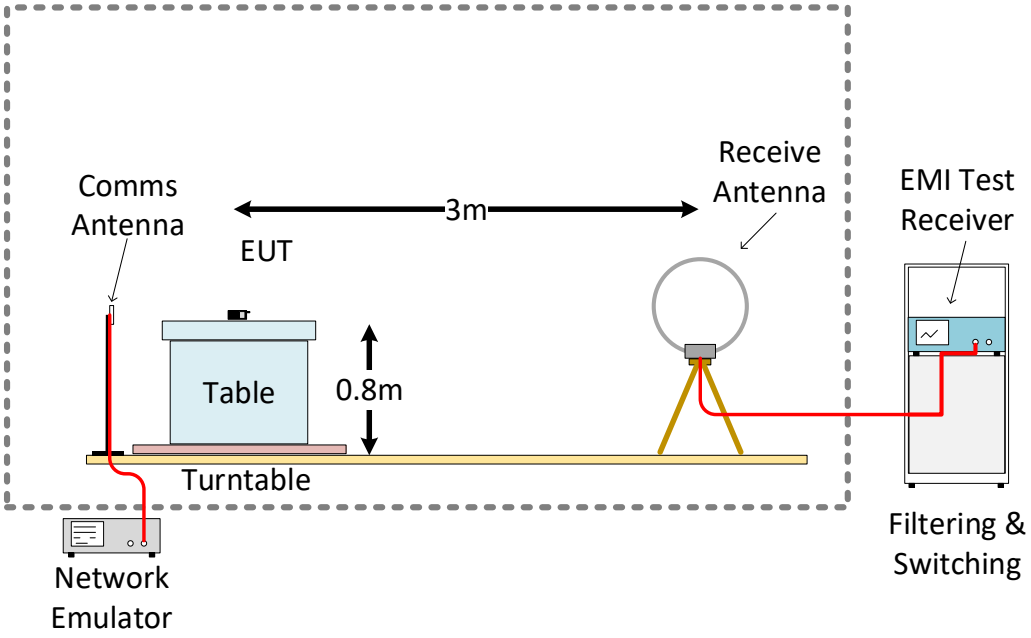


Figure 1: Frequency range 9 KHz – 30 MHz

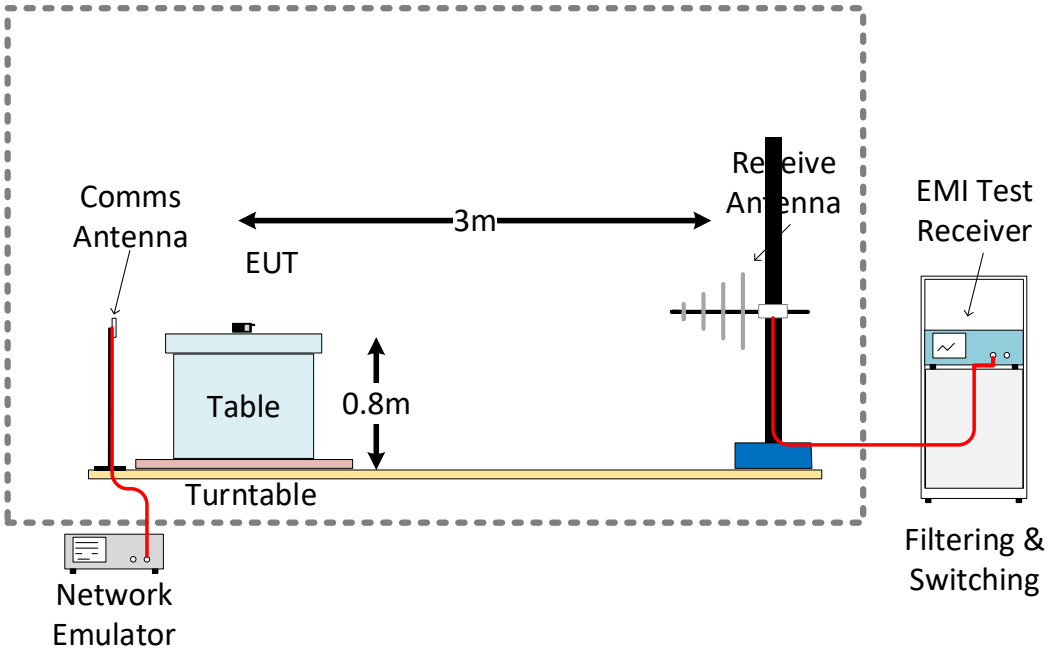


Figure 2: Frequency range 30 MHz – 1 GHz

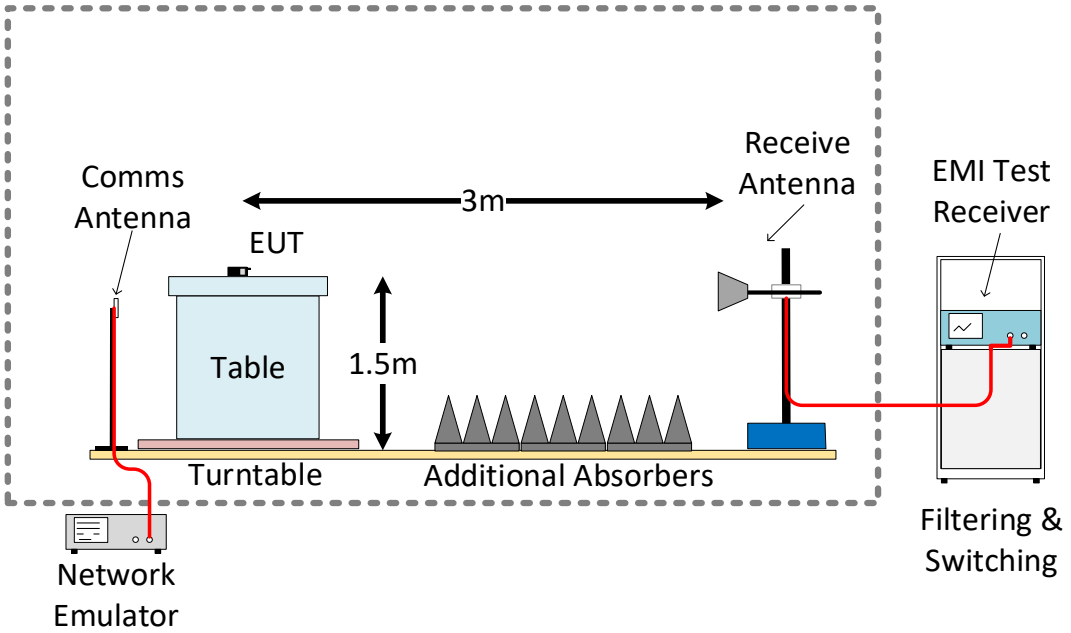
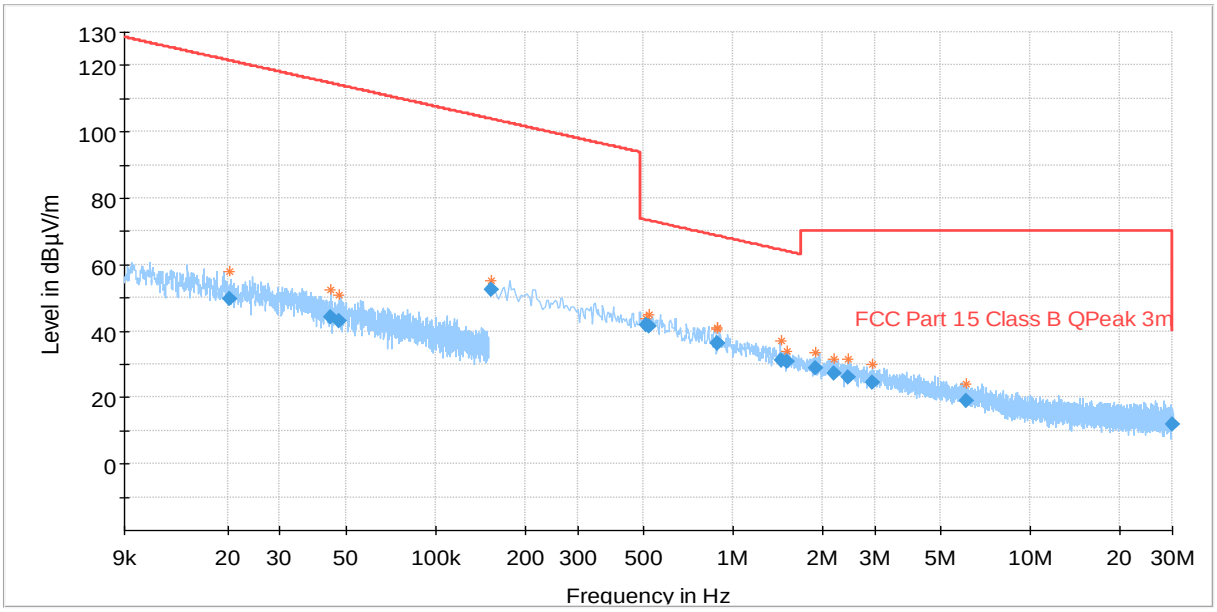


Figure 3: Frequency range 1 GHz – 18 GHz

6.3 Radiated Emissions – Test result details

6.3.1 Detailed test results_ Z-Wave 908,4MHz / 9,6kBit/s

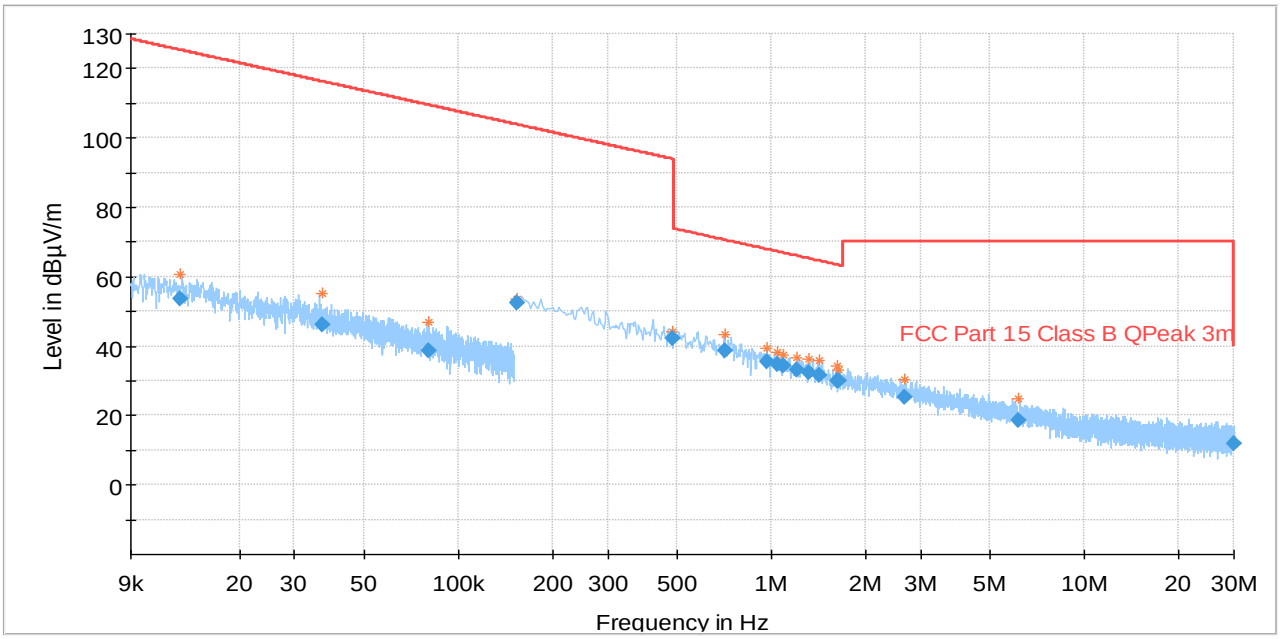
Test mode condition	Traffic (TX)	
Antenna orientation	parallel to floor	
Channel frequency	Z-Wave 908,4MHz / 9,6kBit/s	
Sweep frequency	9 KHz – 30 MHz	
Standard	FCC Part 15 subpart C	
EUT	A000244330-001	
Ancillary Equipment	- A000244330-004 Holder - A000244330-007 Battery	
Test Engineer	Joel Efraimsson	Date: 2019-10-21
Environmental conditions	Temperature: 20,9 ^{0}C	Humidity: 53,9 %
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



Preview Result 2-AVG
Critical_Freqs AVG
FCC Part 15 Class B QPeak 3m
Final_Result AVG
Preview Result 1-PK+
Critical_Freqs PK+
Final_Result QPK

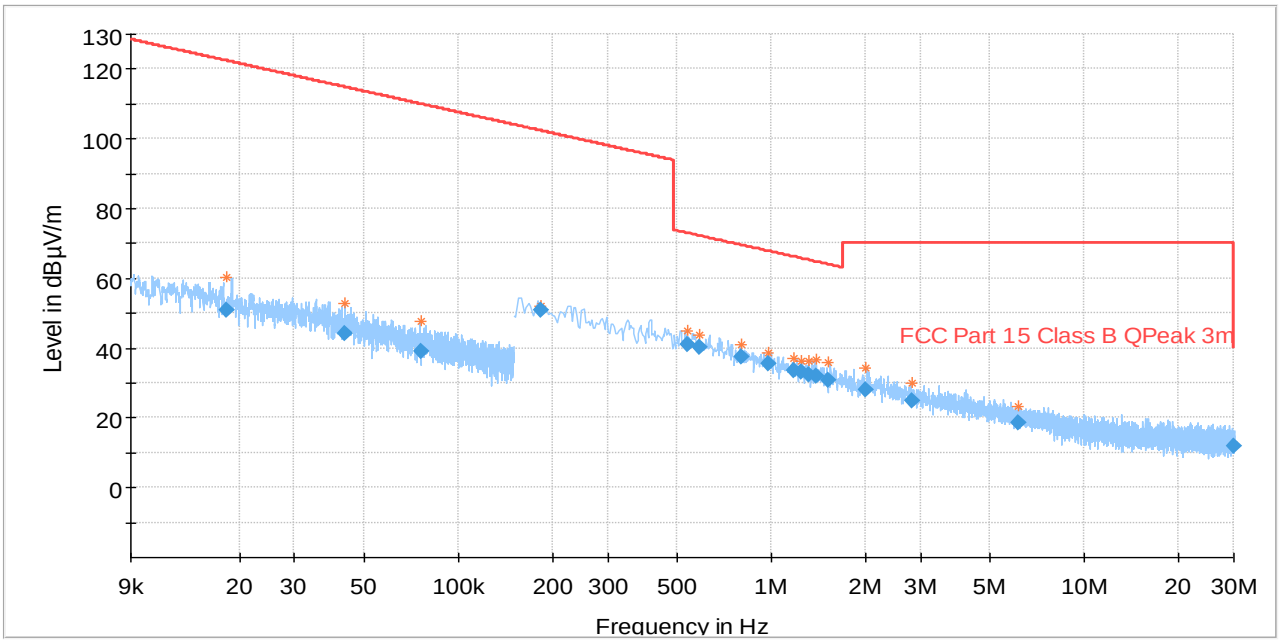
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (KHz)	Height (cm)	Azimuth (deg)
0.512706	41.63	73.41	31.77	1000.0	9.000	100.0	315.0
0.523161	41.51	73.23	31.73	1000.0	9.000	100.0	157.0
0.884364	36.39	68.69	32.29	1000.0	9.000	100.0	22.0
0.886797	36.45	68.66	32.21	1000.0	9.000	100.0	72.0
1.454193	31.30	64.38	33.08	1000.0	9.000	100.0	247.0
1.517178	30.82	64.01	33.19	1000.0	9.000	100.0	22.0

Test mode condition	Traffic (TX)	
Antenna orientation	Perpendicular to axis	
Channel frequency	Z-Wave 908,4MHz / 9,6kBit/s	
Sweep frequency	9 KHz – 30 MHz	
Standard	FCC Part 15 subpart C	
EUT	A000244330-001	
Ancillary Equipment	- A000244330-004 Holder - A000244330-007 Battery	
Test Engineer	Joel Efraimsson	Date: 2019-10-22
Environmental conditions	Temperature: 20,7 ^{0}C	Humidity: 52,4 %
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



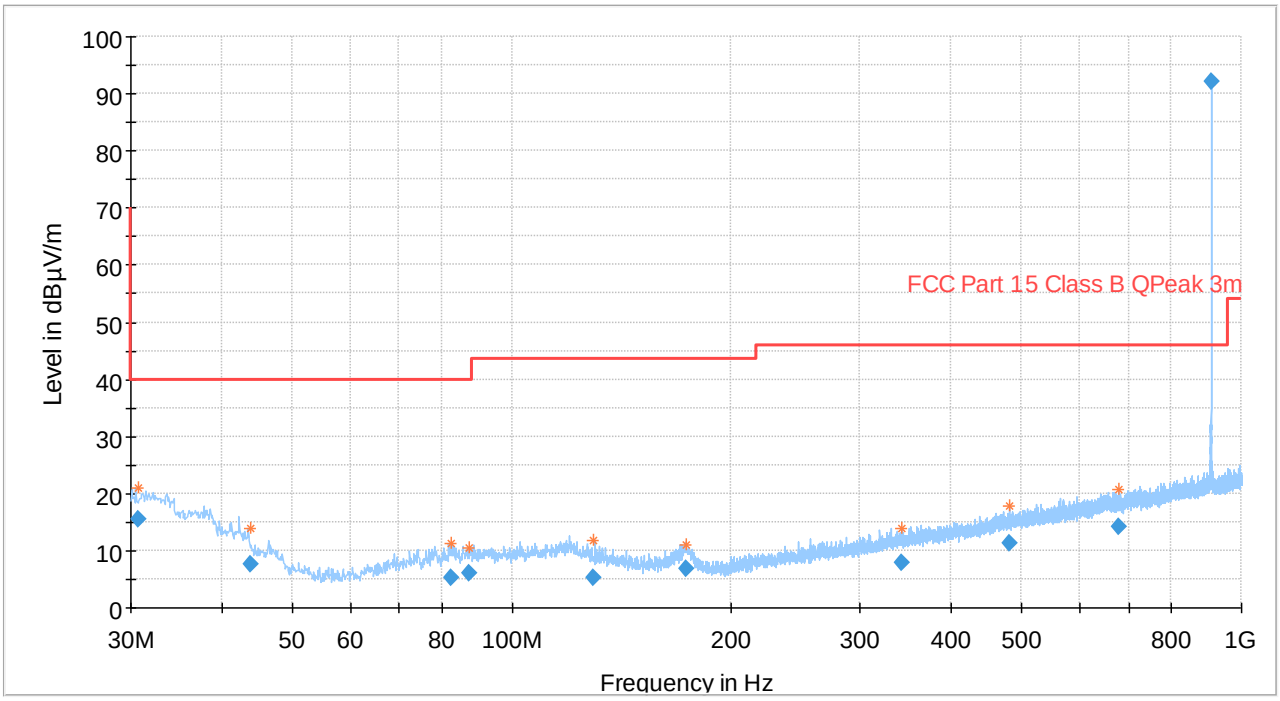
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (KHz)	Height (cm)	Azimuth (deg)
0.708384	38.69	70.61	31.92	1000.0	9.000	100.0	22.0
0.971841	35.57	67.87	32.30	1000.0	9.000	100.0	112.0
1.043091	34.76	67.26	32.50	1000.0	9.000	100.0	296.0
1.091145	34.25	66.87	32.61	1000.0	9.000	100.0	251.0
1.206594	33.15	66.00	32.84	1000.0	9.000	100.0	247.0
1.318797	32.31	65.23	32.91	1000.0	9.000	100.0	110.0

Test mode condition	Traffic (TX)	
Antenna orientation	Parallel to axis	
Channel frequency	Z-Wave 908,4MHz / 9,6kBit/s	
Sweep frequency	9 KHz – 30 MHz	
Standard	FCC Part 15 subpart C	
EUT	A000244330-001	
Ancillary Equipment	- A000244330-004 Holder - A000244330-007 Battery	
Test Engineer	Joel Efraimsson	Date: 2019-10-22
Environmental conditions	Temperature: 20,7 ^{0}C	Humidity: 52,4 %
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (KHz)	Height (cm)	Azimuth (deg)
0.542403	41.08	72.92	31.84	1000.0	9.000	100.0	157.0
0.592710	40.35	72.15	31.80	1000.0	9.000	100.0	112.0
0.801507	37.34	69.54	32.20	1000.0	9.000	100.0	273.0
0.979953	35.34	67.80	32.46	1000.0	9.000	100.0	91.0
1.184166	33.37	66.16	32.79	1000.0	9.000	100.0	298.0
1.242102	32.97	65.74	32.77	1000.0	9.000	100.0	22.0

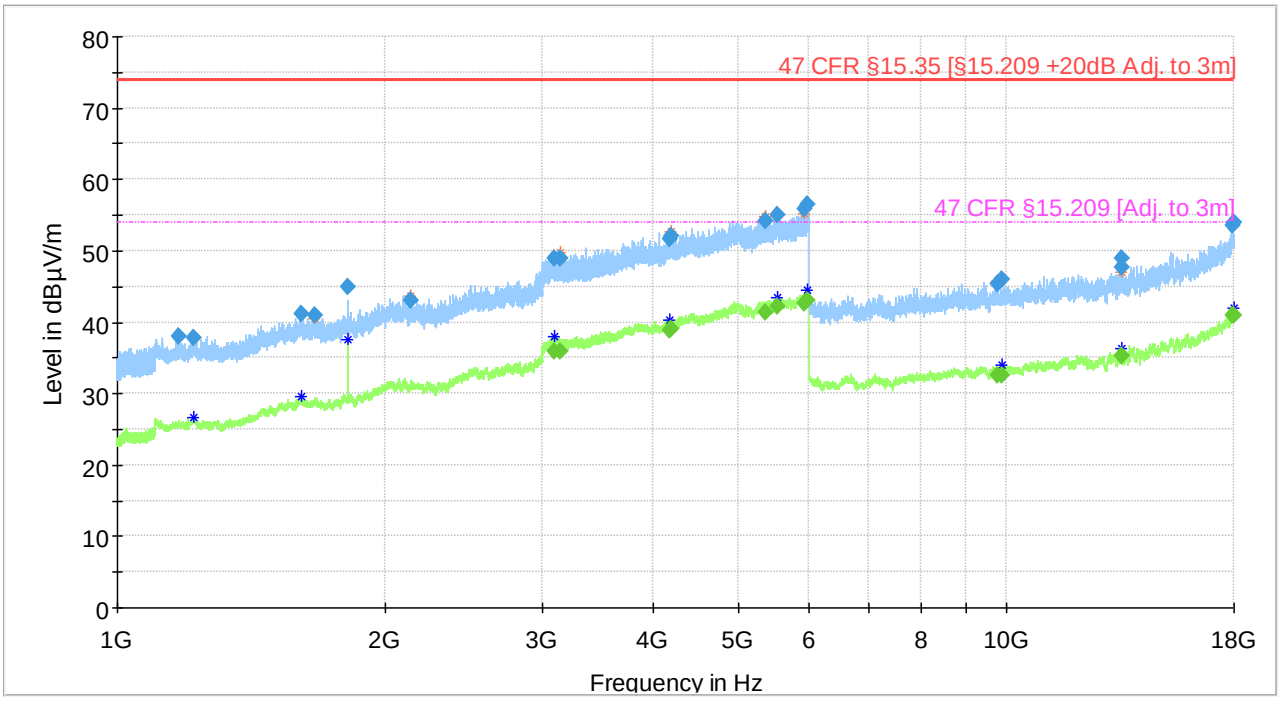
Test mode condition	Traffic (TX)	
Antenna orientation	Horizontal and Vertical	
Channel frequency	Z-Wave 908,4MHz / 9,6kBit/s	
Sweep frequency	30 MHz – 1 GHz	
Standard	FCC Part 15 subpart C	
EUT	A000244330-001	
Ancillary Equipment	- A000244330-004 Holder - A000244330-005 Battery	
Test Engineer	Joel Efraimsson	Date: 2019-10-15
Environmental conditions	Temperature: 22,1 ^{0}C	Humidity: 45,0 %
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



Preview Result 2-AVG
Critical_Freqs AVG
FCC Part 15 Class B QPeak 3m
Final_Result AVG
Preview Result 1-PK+
Critical_Freqs PK+
Final_Result QPK

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (KHz)	Height (cm)	Pol	Azimuth (deg)
30.752773	15.39	40.00	24.61	1000.0	120.000	175.0	V	202.0
43.782360	7.60	40.00	32.40	1000.0	120.000	325.0	V	17.0
82.327560	5.35	40.00	34.65	1000.0	120.000	375.0	H	157.0
87.331440	5.97	40.00	34.03	1000.0	120.000	375.0	H	89.0
481.744760	11.40	46.00	34.60	1000.0	120.000	279.0	V	224.0
679.468080	14.19	46.00	31.81	1000.0	120.000	375.0	V	67.0

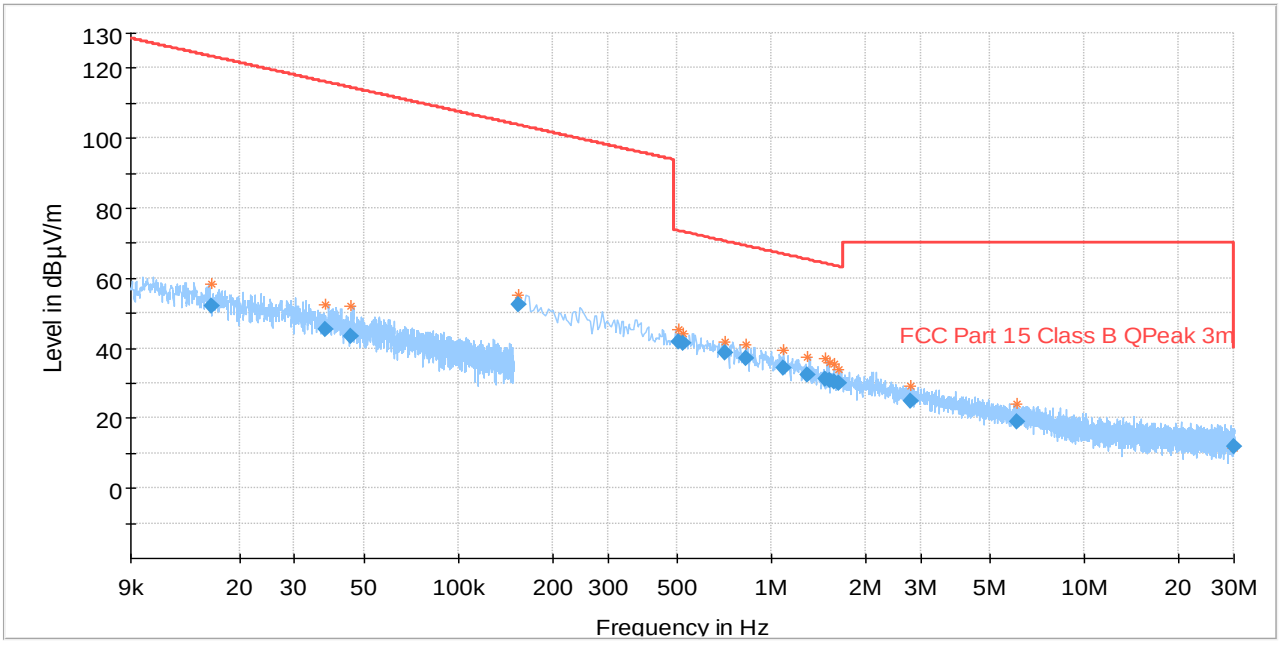
Test mode condition	Traffic (TX)	
Antenna orientation	Horizontal and Vertical	
Channel frequency	Z-Wave 908,4MHz / 9,6kBit/s	
Sweep frequency	1 GHz – 18 GHz	
Standard	FCC Part 15 subpart C	
EUT	A000244330-001	
Ancillary Equipment	- A000244330-004 Holder - A000244330-007 Battery	
Test Engineer	Fariborz Abasi	Date: 2019-11-05
Environmental conditions	Temperature: 18,6 °C	Humidity: 46,0 %
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
5356.149000	---	41.33	53.98	12.65	1000.0	1000.000	188.0	V	217.0
5530.744000	---	42.10	53.98	11.88	1000.0	1000.000	185.0	V	278.0
5917.116000	---	42.58	53.98	11.39	1000.0	1000.000	198.0	V	40.0
5975.106000	---	43.12	53.98	10.86	1000.0	1000.000	165.0	H	52.0
17927.579000	---	40.94	53.98	13.04	1000.0	1000.000	100.0	V	140.0
17994.890000	---	41.03	53.98	12.95	1000.0	1000.000	135.0	V	217.0

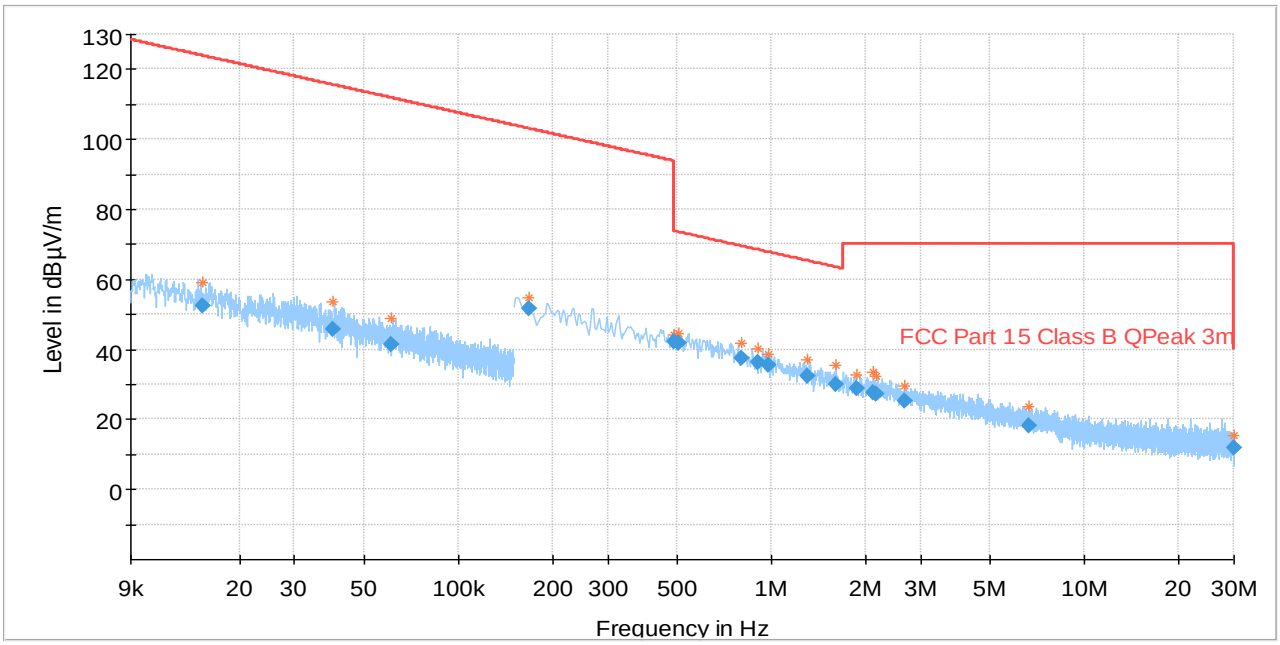
6.3.2 Detailed test results_ Z-Wave 908,4MHz / 40kBit/s

Test mode condition	Traffic (TX)	
Antenna orientation	parallel to floor	
Channel frequency	Z-Wave 908,4MHz / 40kBit/s	
Sweep frequency	9 KHz – 30 MHz	
Standard	FCC Part 15 subpart C	
EUT	A000244330-001	
Ancillary Equipment	- A000244330-004 Holder - A000244330-007 Battery	
Test Engineer	Joel Efraimsson	Date: 2019-10-21
Environmental conditions	Temperature: 20,9 °C	Humidity: 53,9 %
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



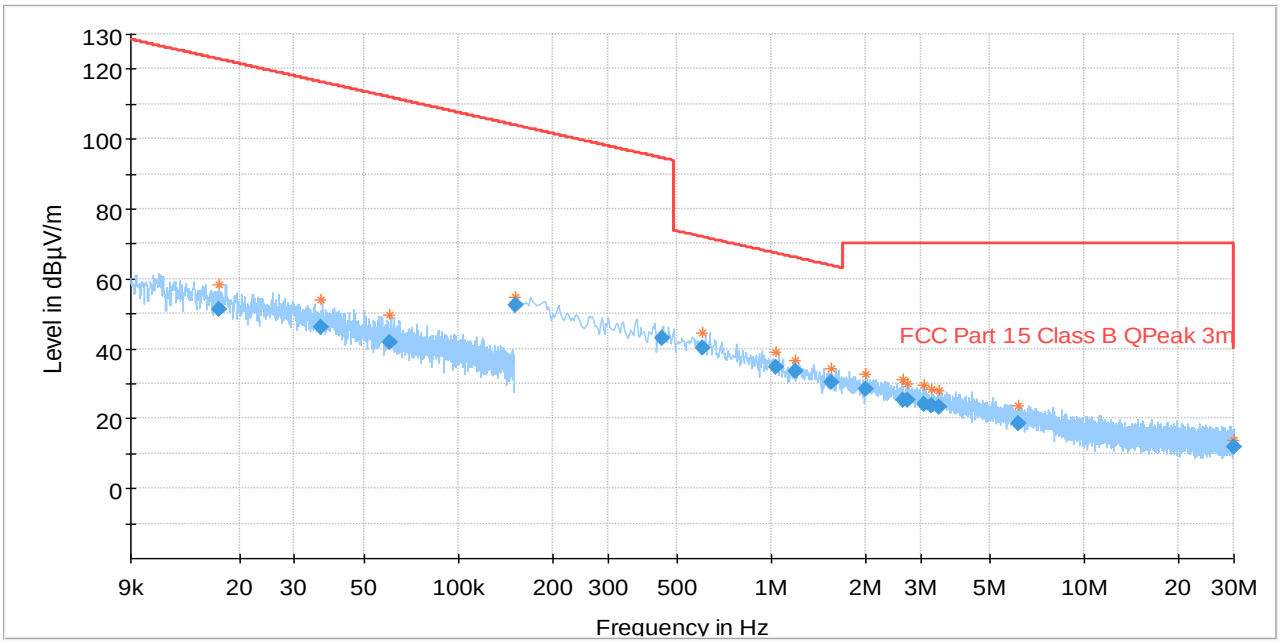
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (KHz)	Height (cm)	Azimuth (deg)
0.505776	41.87	73.53	31.66	1000.0	9.000	100.0	107.0
0.523959	41.54	73.22	31.68	1000.0	9.000	100.0	202.0
0.708123	38.68	70.61	31.93	1000.0	9.000	100.0	46.0
0.832335	37.01	69.21	32.20	1000.0	9.000	100.0	67.0
1.087788	34.30	66.89	32.59	1000.0	9.000	100.0	202.0
1.302882	32.51	65.33	32.82	1000.0	9.000	100.0	161.0

Test mode condition	Traffic (TX)	
Antenna orientation	Perpendicular to axis	
Channel frequency	Z-Wave 908,4MHz / 40kBit/s	
Sweep frequency	9 KHz – 30 MHz	
Standard	FCC Part 15 subpart C	
EUT	A000244330-001	
Ancillary Equipment	- A000244330-004 Holder - A000244330-007 Battery	
Test Engineer	Joel Efraimsson	Date: 2019-10-22
Environmental conditions	Temperature: 20,7 ^{0}C	Humidity: 52,4 %
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (KHz)	Height (cm)	Azimuth (deg)
0.503925	42.00	73.56	31.56	1000.0	9.000	100.0	-19.0
0.802872	37.52	69.52	32.00	1000.0	9.000	100.0	182.0
0.903096	36.24	68.50	32.26	1000.0	9.000	100.0	163.0
0.978546	35.39	67.81	32.42	1000.0	9.000	100.0	94.0
1.303713	32.45	65.32	32.88	1000.0	9.000	100.0	247.0
1.607481	30.11	63.51	33.40	1000.0	9.000	100.0	245.0

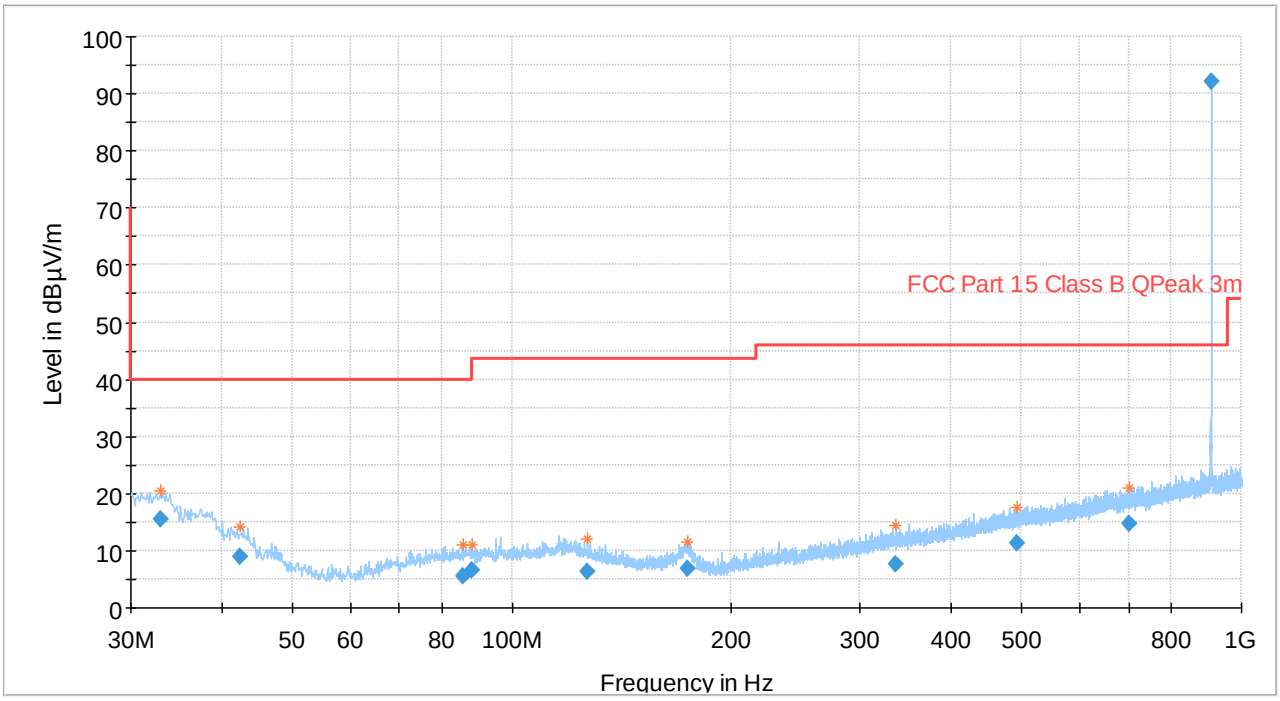
Test mode condition	Traffic (TX)	
Antenna orientation	Parallel to axis	
Channel frequency	Z-Wave 908,4MHz / 40kBit/s	
Sweep frequency	9 KHz – 30 MHz	
Standard	FCC Part 15 subpart C	
EUT	A000244330-001	
Ancillary Equipment	- A000244330-004 Holder - A000244330-007 Battery	
Test Engineer	Joel Efraimsson	Date: 2019-10-22
Environmental conditions	Temperature: 20,7 ^{0}C	Humidity: 52,4 %
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



Preview Result 2-AVG
Critical_Freqs AVG
FCC Part 15 Class B QPeak 3m
Final_Result AVG
Preview Result 1-PK+
Critical_Freqs PK+
Final_Result QPK

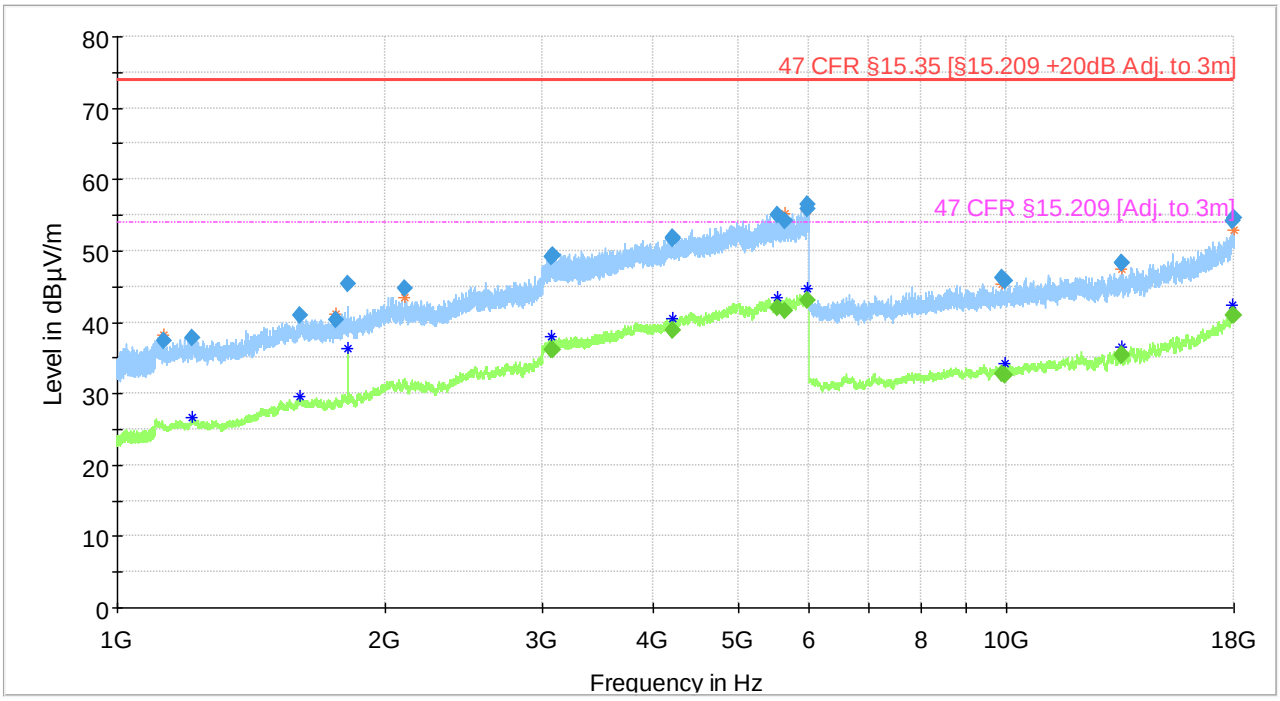
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (KHz)	Height (cm)	Azimuth (deg)
0.603147	40.20	72.00	31.80	1000.0	9.000	100.0	22.0
1.032762	34.88	67.34	32.46	1000.0	9.000	100.0	296.0
1.190328	33.51	66.11	32.61	1000.0	9.000	100.0	291.0
1.560210	30.39	63.77	33.38	1000.0	9.000	100.0	-23.0
1.991088	28.26	70.10	41.84	1000.0	9.000	100.0	22.0
2.623023	25.40	70.10	44.70	1000.0	9.000	100.0	137.0

Test mode condition	Traffic (TX)	
Antenna orientation	Horizontal and Vertical	
Channel frequency	Z-Wave 908,4MHz / 40kBit/s	
Sweep frequency	30 MHz – 1 GHz	
Standard	FCC Part 15 subpart C	
EUT	A000244330-001	
Ancillary Equipment	- A000244330-004 Holder - A000244330-005 Battery	
Test Engineer	Erik Ingemarsson	Date: 2019-11-04
Environmental conditions	Temperature: 22,1 °C	Humidity: 41,1 %
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (KHz)	Height (cm)	Pol	Azimuth (deg)
33.023160	15.46	40.00	24.54	1000.0	120.000	325.0	H	65.0
42.357960	8.89	40.00	31.11	1000.0	120.000	280.0	V	202.0
85.836480	5.52	40.00	34.48	1000.0	120.000	175.0	H	112.0
87.990400	6.62	40.00	33.38	1000.0	120.000	375.0	V	22.0
492.612960	11.36	46.00	34.64	1000.0	120.000	175.0	V	153.0
702.502440	14.60	46.00	31.40	1000.0	120.000	175.0	V	67.0

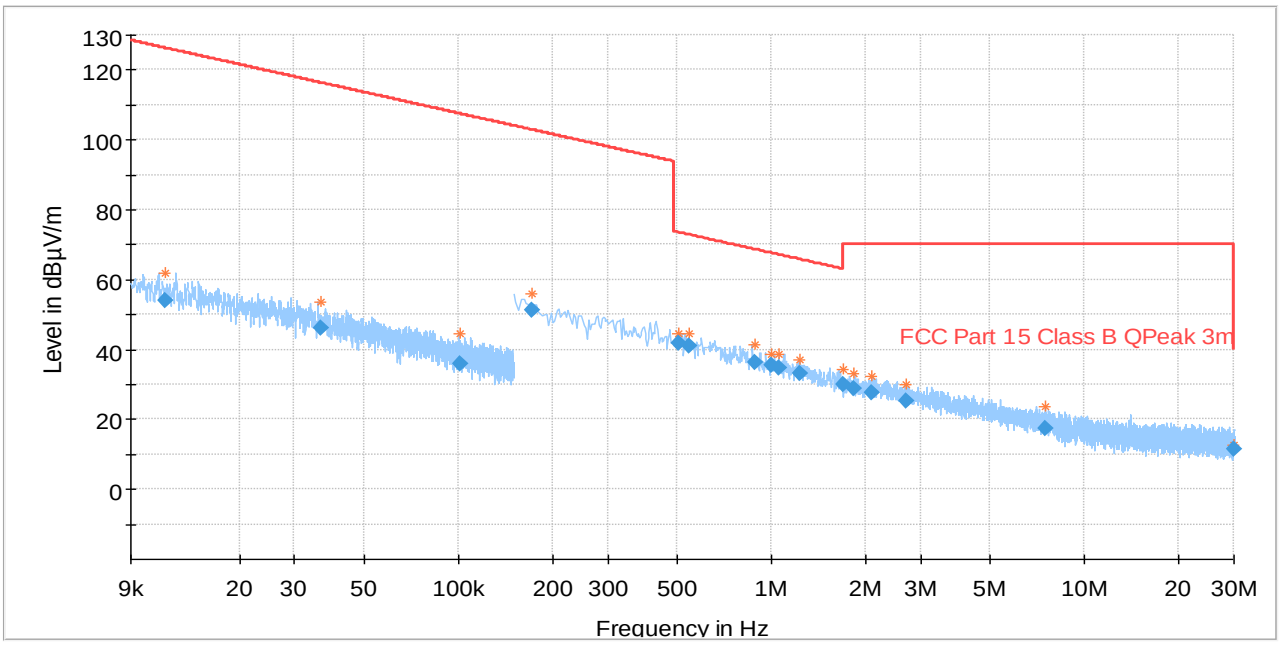
Test mode condition	Traffic (TX)	
Antenna orientation	Horizontal and Vertical	
Channel frequency	Z-Wave 908,4MHz / 40kBit/s	
Sweep frequency	1 GHz – 18 GHz	
Standard	FCC Part 15 subpart C	
EUT	A000244330-001	
Ancillary Equipment	- A000244330-004 Holder - A000244330-007 Battery	
Test Engineer	Niall Forrester	Date: 2019-11-05
Environmental conditions	Temperature: 18,6 ^{0}C	Humidity: 46,0 %
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
5524.542000	---	41.95	53.98	12.03	1000.0	1000.000	165.0	V	321.0
5637.736000	---	41.57	53.98	12.41	1000.0	1000.000	196.0	V	262.0
5970.273000	---	43.04	53.98	10.94	1000.0	1000.000	101.0	V	262.0
5973.904000	---	43.08	53.98	10.90	1000.0	1000.000	158.0	H	217.0
17962.073000	---	40.87	53.98	13.11	1000.0	1000.000	137.0	H	172.0
17975.179000	---	41.04	53.98	12.94	1000.0	1000.000	165.0	V	322.0

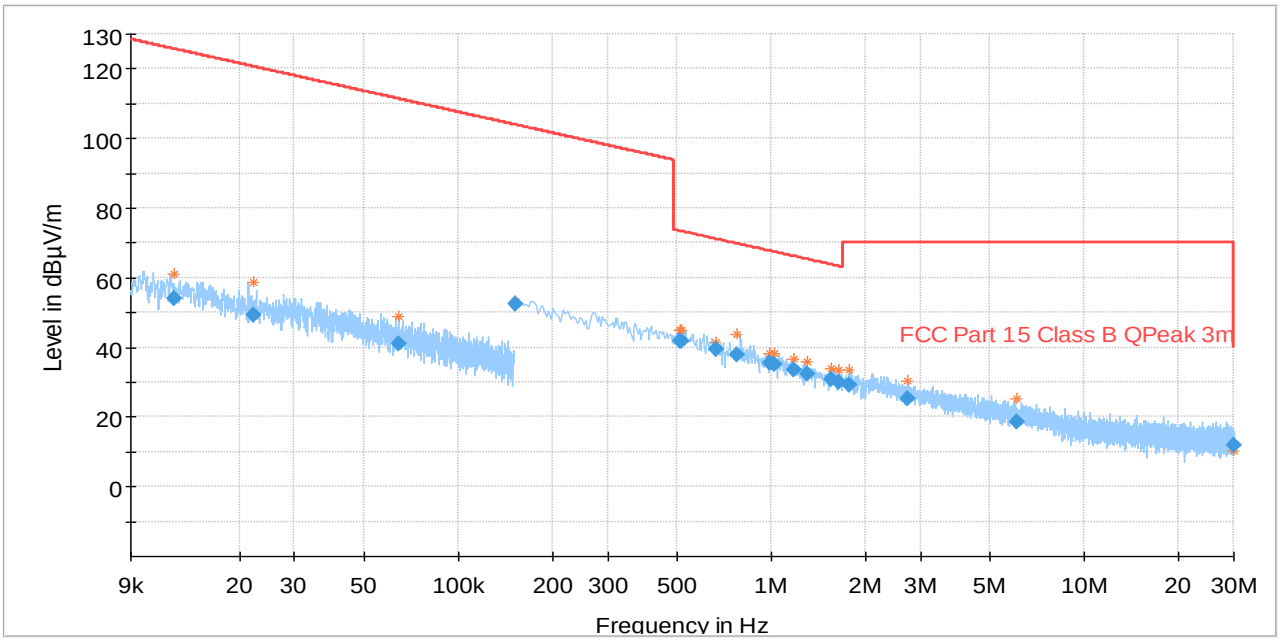
6.3.3 Detailed test results_ Z-Wave 916 MHz / 100kBit/s

Test mode condition	Traffic (TX)	
Antenna orientation	parallel to floor	
Channel frequency	Z-Wave 916 MHz / 100kBit/s	
Sweep frequency	9 KHz – 30 MHz	
Standard	FCC Part 15 subpart C	
EUT	A000244330-001	
Ancillary Equipment	- A000244330-004 Holder - A000244330-007 Battery	
Test Engineer	Joel Efraimsson	Date: 2019-10-21
Environmental conditions	Temperature: 20,9 ^{0}C	Humidity: 53,9 %
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (KHz)	Height (cm)	Azimuth (deg)
0.503949	41.83	73.56	31.73	1000.0	9.000	100.0	288.0
0.548052	41.15	72.83	31.68	1000.0	9.000	100.0	244.0
0.885912	36.48	68.67	32.19	1000.0	9.000	100.0	161.0
1.000740	35.33	67.62	32.28	1000.0	9.000	100.0	245.0
1.053612	34.68	67.17	32.49	1000.0	9.000	100.0	161.0
1.228245	33.05	65.84	32.79	1000.0	9.000	100.0	338.0

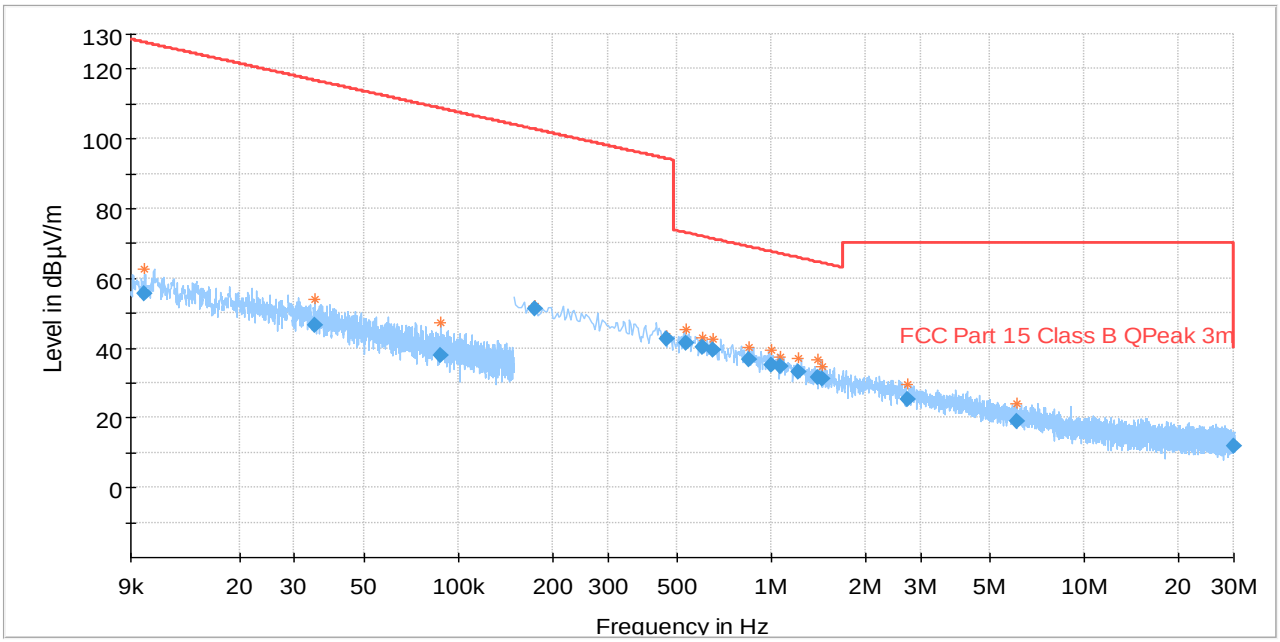
Test mode condition	Traffic (TX)	
Antenna orientation	Perpendicular to axis	
Channel frequency	Z-Wave 916 MHz / 100kBit/s	
Sweep frequency	9 KHz – 30 MHz	
Standard	FCC Part 15 subpart C	
EUT	A000244330-001	
Ancillary Equipment	- A000244330-004 Holder - A000244330-007 Battery	
Test Engineer	Joel Efraimsson	Date: 2019-10-22
Environmental conditions	Temperature: 20,7 ^{0}C	Humidity: 52,4 %
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



Preview Result 2-AVG
Critical_Freqs AVG
FCC Part 15 Class B QPeak 3m
Final_Result AVG
Preview Result 1-PK+
Critical_Freqs PK+
Final_Result QPK

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (KHz)	Height (cm)	Azimuth (deg)
0.518436	41.70	73.31	31.61	1000.0	9.000	100.0	113.0
0.509955	41.65	73.45	31.81	1000.0	9.000	100.0	2.0
0.663741	39.30	71.17	31.87	1000.0	9.000	100.0	26.0
0.774249	37.76	69.84	32.07	1000.0	9.000	100.0	292.0
0.985383	35.42	67.75	32.33	1000.0	9.000	100.0	200.0
1.024518	35.05	67.41	32.36	1000.0	9.000	100.0	296.0

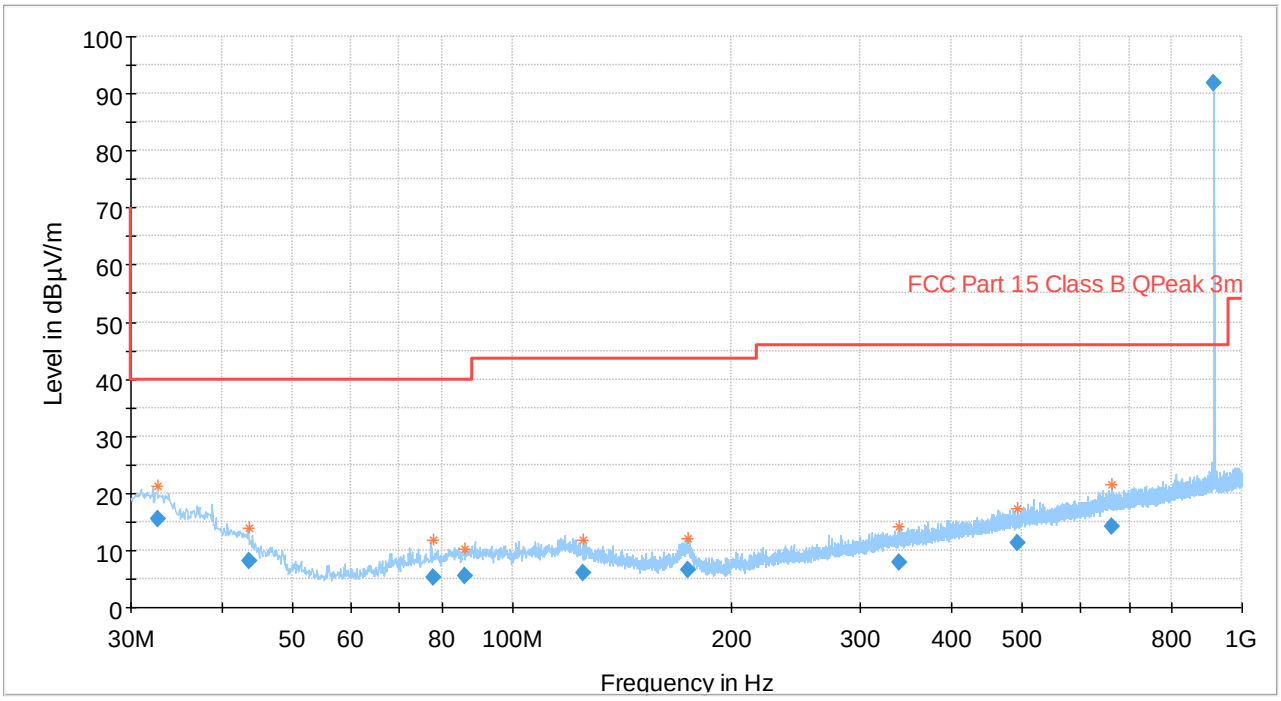
Test mode condition	Traffic (TX)	
Antenna orientation	Parallel to axis	
Channel frequency	Z-Wave 916 MHz / 100kBit/s	
Sweep frequency	9 KHz – 30 MHz	
Standard	FCC Part 15 subpart C	
EUT	A000244330-001	
Ancillary Equipment	- A000244330-004 Holder - A000244330-007 Battery	
Test Engineer	Joel Efraimsson	Date: 2019-10-22
Environmental conditions	Temperature: 20,7 ^{0}C	Humidity: 52,4 %
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



Preview Result 2-AVG
Critical_Freqs AVG
FCC Part 15 Class B QPeak 3m
Final_Result AVG
Preview Result 1-PK+
Critical_Freqs PK+
Final_Result QPK

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (KHz)	Height (cm)	Azimuth (deg)
0.532635	41.35	73.08	31.73	1000.0	9.000	100.0	157.0
0.601089	40.28	72.03	31.75	1000.0	9.000	100.0	292.0
0.650109	39.40	71.35	31.96	1000.0	9.000	100.0	138.0
0.850551	36.76	69.02	32.27	1000.0	9.000	100.0	72.0
1.002408	35.18	67.60	32.42	1000.0	9.000	100.0	67.0
1.073322	34.57	67.01	32.44	1000.0	9.000	100.0	110.0

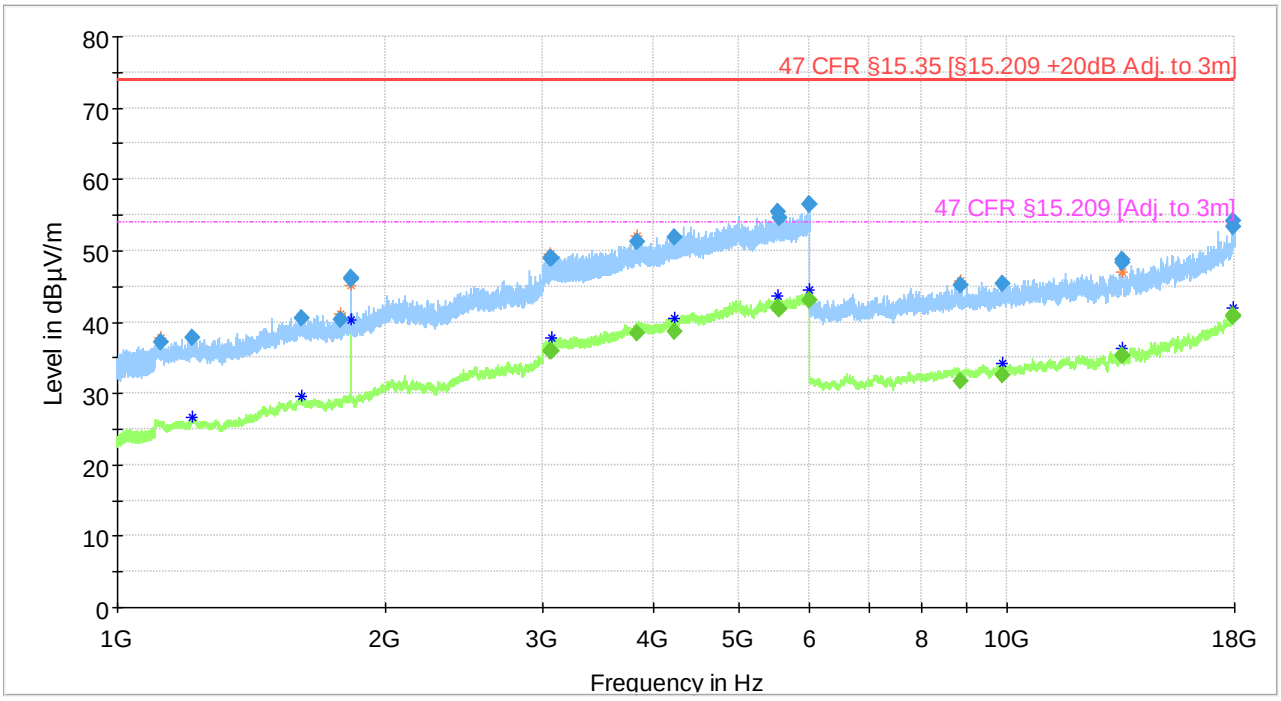
Test mode condition	Traffic (TX)	
Antenna orientation	Horizontal and Vertical	
Channel frequency	Z-Wave 916 MHz / 100kBit/s	
Sweep frequency	30 MHz – 1 GHz	
Standard	FCC Part 15 subpart C	
EUT	A000244330-001	
Ancillary Equipment	- A000244330-004 Holder - A000244330-005 Battery	
Test Engineer	Joel Efraimsson	Date: 2019-10-15
Environmental conditions	Temperature: 22,1 ^{0}C	Humidity: 45,0 %
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



Preview Result 2-AVG
Critical_Freqs AVG
FCC Part 15 Class B QPeak 3m
Final_Result AVG
Preview Result 1-PK+
Critical_Freqs PK+
Final_Result QPK

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (KHz)	Height (cm)	Pol	Azimuth (deg)
32.66284	15.37	40	24.63	1000	120	375	V	67
43.50888	8.04	40	31.96	1000	120	275	H	113
86.10628	5.6	40	34.4	1000	120	229	V	17
491.63304	11.32	46	34.68	1000	120	175	H	113
661.45748	14.18	46	31.82	1000	120	358	V	160
915.97176	91.87	46	-45.87	1000	120	100	H	206

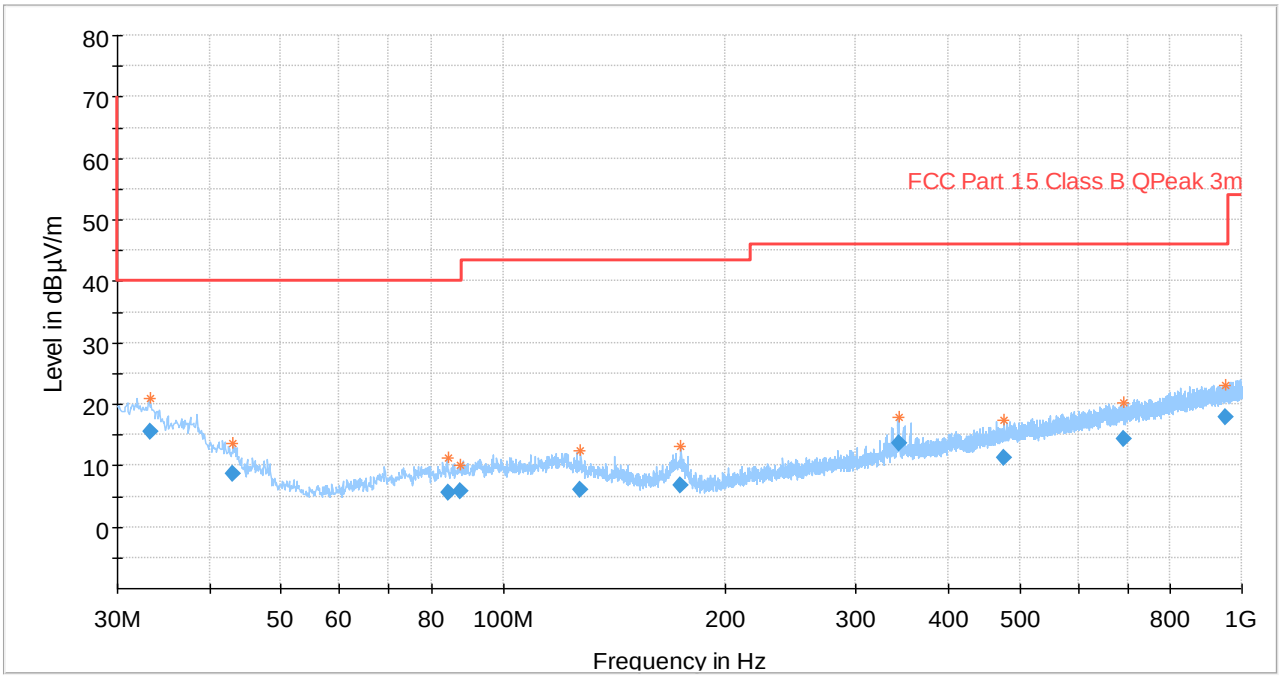
Test mode condition	Traffic (TX)	
Antenna orientation	Horizontal and Vertical	
Channel frequency	Z-Wave 916 MHz / 100kBit/s	
Sweep frequency	1 GHz – 18 GHz	
Standard	FCC Part 15 subpart C	
EUT	A000244330-001	
Ancillary Equipment	- A000244330-004 Holder - A000244330-007 Battery	
Test Engineer	Niall Forrester	Date: 2019-11-04
Environmental conditions	Temperature: 18,6 ^{0}C	Humidity: 46,5 %
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
5529.691	---	42.05	53.98	11.93	1000	1000	115	H	265
5542.314	---	41.82	53.98	12.16	1000	1000	115	V	142
5978.074	---	43.12	53.98	10.86	1000	1000	115	V	96
5985.262	---	42.95	53.98	11.03	1000	1000	187	H	130
17897.249	---	40.79	53.98	13.19	1000	1000	101	V	220
17930.574	---	40.84	53.98	13.14	1000	1000	146	H	5

6.3.4 Detailed test results_ Idle mode

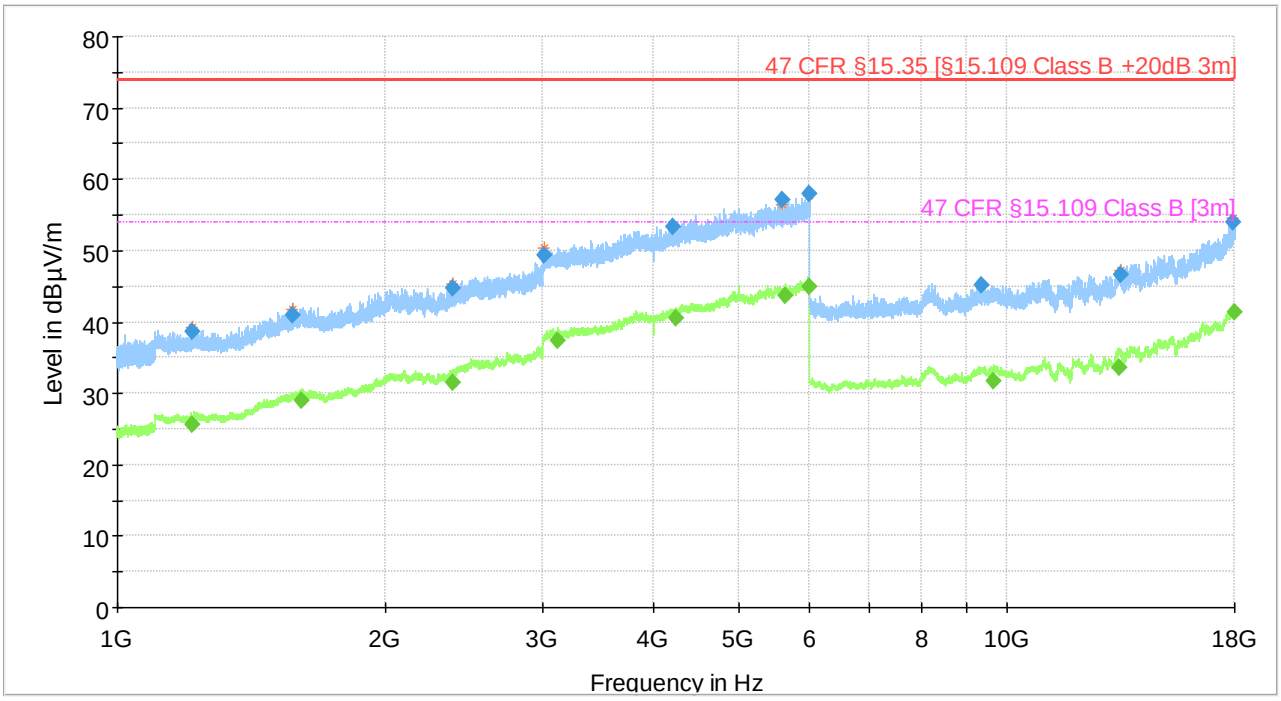
Test mode condition	Idle mode	
Antenna orientation	Horizontal and Vertical	
Channel frequency	--	
Sweep frequency	30 MHz – 1 GHz	
Standard	FCC Part 15 subpart B	
EUT	A000244330-001	
Ancillary Equipment	- A000244330-004 Holder - A000244330-006 Battery	
Test Engineer	Joel Efraimsson	Date: 2019-10-18
Environmental conditions	Temperature: 20,9 ^{0}C	Humidity: 53,9 %
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



Preview Result 2-AVG
Critical_Freqs AVG
FCC Part 15 Class B QPeak 3m
Final_Result AVG
Preview Result 1-PK+
Critical_Freqs PK+
Final_Result QPK

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (KHz)	Height (cm)	Pol	Azimuth (deg)
33.27752	15.54	40	24.46	1000	120	178	V	338
42.899	8.59	40	31.41	1000	120	330	V	113
87.3128	5.9	40	34.1	1000	120	325	H	338
342.94168	13.65	46	32.35	1000	120	100	H	19
690.17768	14.43	46	31.57	1000	120	128	V	71
948.18756	17.87	46	28.13	1000	120	100	H	336

Test mode condition	Idle mode	
Antenna orientation	Horizontal and Vertical	
Channel frequency	--	
Sweep frequency	1 GHz – 18 GHz	
Standard	FCC Part 15 subpart B	
EUT	A000244330-001	
Ancillary Equipment	- A000244330-004 Holder - A000244330-010 Battery	
Test Engineer	Niall Forrester	Date: 2019-11-25
Environmental conditions	Temperature: 18,4 ^{0}C	Humidity: 42,7 %
Chamber details	Chamber: SAC 5	Measurement distance: 3 meter



Preview Result 2-AVG
Critical_Freqs AVG
47 CFR §15.35 [§15.109 Class B +20dB 3m]
Final_Result PK+
Preview Result 1-PK+
Critical_Freqs PK+
47 CFR §15.109 Class B [3m]
Final_Result AVG

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
1213.745	38.64	---	73.98	35.34	1000	1000	259	H	142
4235.474	---	40.45	53.98	13.53	1000	1000	100	V	7
5631.22	---	43.6	53.98	10.38	1000	1000	185	V	220
5978.277	---	44.87	53.98	9.11	1000	1000	135	H	127
5987.846	58.04	---	73.98	15.94	1000	1000	235	V	127
17987.948	---	41.45	53.98	12.53	1000	1000	285	V	37

7 TRANSMITTER BAND EDGE RADIATED EMISSIONS

7.1 Transmitter Band Edge Radiated Emissions – Test summary

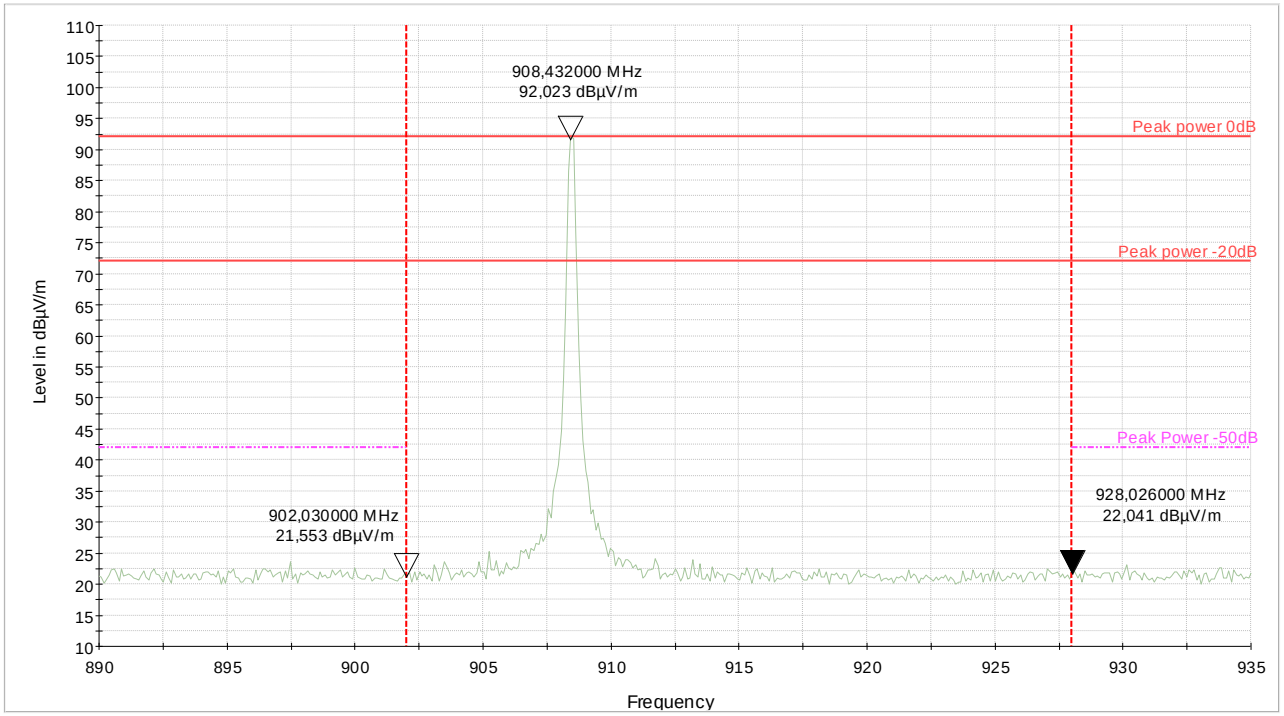
Result	Pass
Equipment under Test	A000244330-001
Test period	2019-10-15
Test Engineer	Fariborz Abasi
Test Specification	FCC part 15 Subpart C 15.209 and 15.249 (d)
Test Method	ANSI C 63.10 - 2013
Measurement Location	Semi Anechoic Chamber
Measuring Distance	3 m
Detector	Quasi Peak Detector
EUT Operation mode	#1
Ancillary equipment	See section 1.4
Environmental conditions	Temperature: + 18 - 20 °C Relative Humidity: 20 - 40 %

7.2 Transmitter Band Edge Radiated Emissions – Test Setup

Measurement was performed in a Semi Anechoic Chamber as per details described in section 5.2.

7.3 Transmitter Band Edge Radiated Emissions – Test details

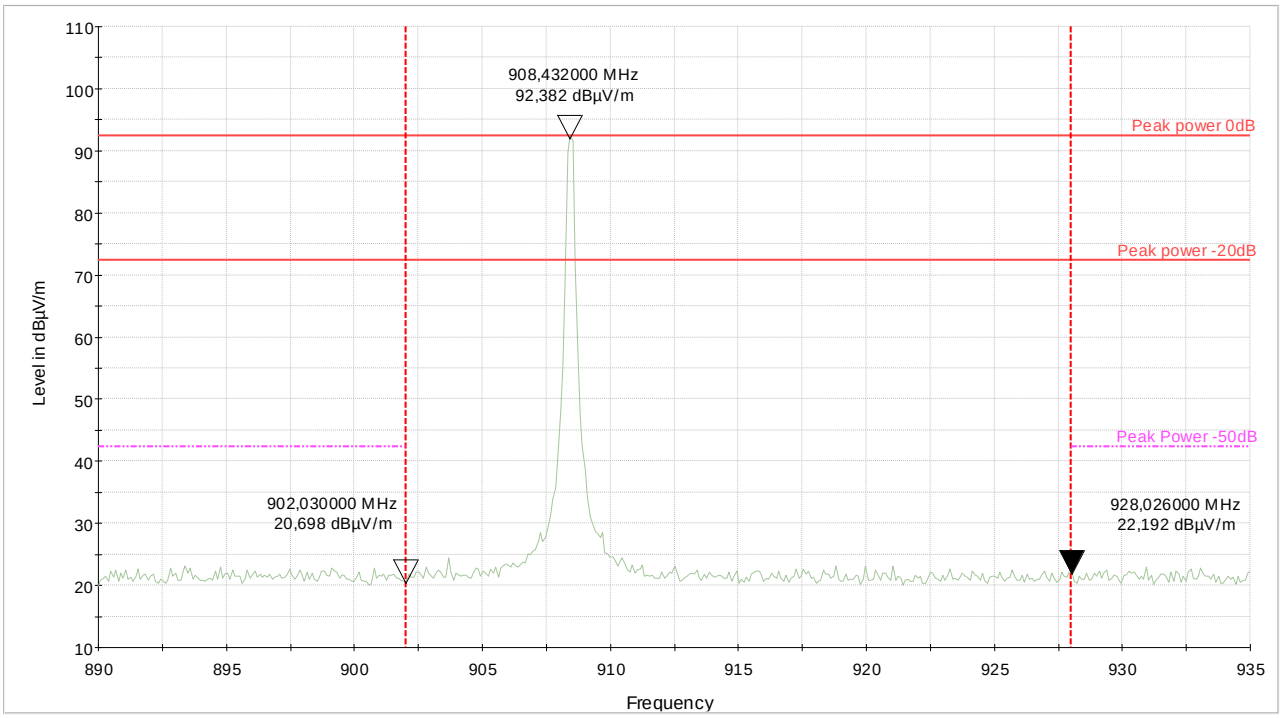
7.3.1 908.4MHz / 9.6 kBit/s



PK+_CLRWR@Test 4_23870248_FCC Part 15 C_Tx_908.4MHz 9.6kBbits_30MHz to 1GHz
AVG_CLRWR@Test 4_23870248_FCC Part 15 C_Tx_908.4MHz 9.6kBbits_30MHz to 1GHz
Peak power 0dB
Peak power -20dB
47 CFR §15.249 - 902MHz Band edge lower
47 CFR §15.249 - 928MHz Band edge upper
Peak Power -50dB

Transmitter Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	-50 dBc Limit (dBµV/m)	Margin (dB)	Result
902	Vertical	21.5	42.0	20.5	Compliant
928	Vertical	22.0	42.0	20.0	Compliant

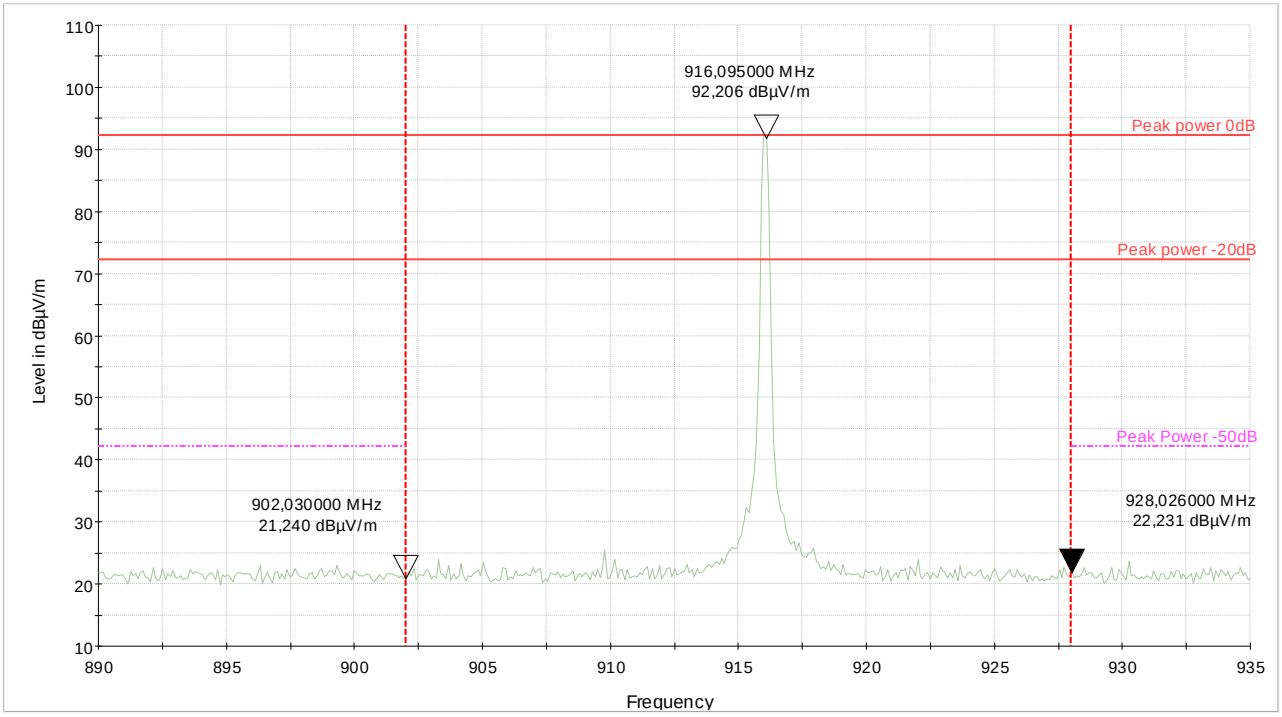
7.3.2 908.4MHz / 40 kBit/s



PK+_CLRWR@Test 2_FCC Part 15 C_Tx_908-4MHz 40kBbits_30MHz to 1GHz
AVG_CLRWR@Test 2_FCC Part 15 C_Tx_908-4MHz 40kBbits_30MHz to 1GHz
Peak power 0dB
Peak power -20dB
47 CFR §15.249 - 902MHz Band edge lower
47 CFR §15.249 - 928MHz Band edge upper
Peak Power -50dB

Transmitter Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	-50 dBc Limit (dBµV/m)	Margin (dB)	Result
902	Horizontal	22.7	42.4	19.7	Compliant
928	Horizontal	22.2	42.4	20.2	Compliant

7.3.3 916 MHz / 100 kbit/s



PK+_CLRWR@Test 3_23870248_FCC Part 15 C_Tx_916MHz 100kBbits_30MHz to 1GHz
AVG_CLRWR@Test 3_23870248_FCC Part 15 C_Tx_916MHz 100kBbits_30MHz to 1GHz
Peak power 0dB
Peak power -20dB
47 CFR §15.249 - 902MHz Band edge lower
47 CFR §15.249 - 928MHz Band edge upper
Peak Power -50dB

Transmitter Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	-50 dBc Limit (dBµV/m)	Margin (dB)	Result
902	Vertical	21.2	42.2	21.0	Compliant
928	Vertical	22.2	42.2	20.0	Compliant

8 TEST EQUIPMENT LIST

8.1 Radiated Emission SAC 5 chamber

SAC 5 – Radiated emissions						
Type:	**Manufacturer**	**Model**	**Serial Number**	**GTEM ID**	**Calibration date**	**Calibration Due:**
EMI Test Receiver	Rohde & Schwarz	ESU26	100359	2703557	03.07.2019	03.07.2020
Active Loop Antenna	EMCO	6502	9206-2775	2759035	09.07.2019	09.07.2020
Ultra Broadband Antenna	Rohde & Schwarz	HL562E	100988	2823181	23.07.2019	23.07.2021
Double Ridged Waveguide Horn Antenna	Rohde & Schwarz	HF907	102678	2823164	15.07.2019	15.07.2021
Control device	Maturo	NCD	NCD/393/2372.01	2884216	N/A	N/A
Open Switch & Control Unit	Rohde & Schwarz	OSP150	100081	2884198	01.04.2019	01.04.2020
Open Switch & Control Unit	Rohde & Schwarz	OSP120	100084	2761253	01.04.2019	01.04.2020
Shielded Filter Unit	Rohde & Schwarz	OSP-F Extension 1	101333	2761265	01.04.2019	01.04.2020
Shielded Filter Unit	Rohde & Schwarz	OSP-F Extension 2	101335	2761266	01.04.2019	01.04.2020
Shielded Filter Unit	Rohde & Schwarz	OSP-F Base Unit	101330	2761262	01.04.2019	01.04.2020
Humidity Temperature Probe	Rotronic	HF532-DG1XX21X	0061829280	2926379	14.08.2018	14.08.2020

8.2 20 dB Bandwidth

20 dB Bandwidth – Test setup						
Type:	**Manufacturer**	**Model**	**Serial Number**	**GTEM ID**	**Calibration date**	**Calibration Due:**
EMI Test Receiver	Rohde & Schwarz	ESR3	101674	2704016	03.07.2019	03.07.2020

9 MEASUREMENT UNCERTAINTY

Measurement uncertainty has been calculated according to the principles contained in CISPR 16-4-2

9.1 Radiated Emission SAC 5

Measurement Uncertainty for Radiated Emission (Coverage Factor k=2)	
Parameter	**Uncertainty**
Field Strength 10 Hz -9 kHz	3,38 dB
Field Strength 9 kHz -30 MHz	3,38 dB
Field Strength 30 MHz -1000 MHz	3,38 dB
Field Strength 1 GHz -18 GHz	4,88 dB
Field Strength 18 GHz - 40 GHz	5,14 dB

9.2 20 dB Bandwidth

Measurement Uncertainty for Radiated Emission (Coverage Factor k=2)	
Parameter	**Uncertainty**
Frequency (Hz)	5,81E-06 %