



TEST REPORT

Test Report No. : UL-RPT-RP-12741851-416-FCC

Manufacturer : Workaround GmbH
Model No. : Mark 2 MR
FCC ID : 2AOJL-MARK-2
Technology : Short Range Devices (915 MHz)
Test Standard(s) : FCC Parts 15.209(a) & 15.249
For details of applied tests refer to test result summary

1. This test report shall not be reproduced in full or partial, without the written approval of UL International Germany GmbH.
2. The results in this report apply only to the sample tested.
3. The test results in this report are traceable to the national or international standards.
4. Test Report Version 1.0
5. Result of the tested sample: **PASS**

Prepared by: Krume, Ivanov
Title: Laboratory Engineer
Date: 28 May 2019

Approved by: Ajit, Phadtare
Title: Lead Test Engineer
Date: 28 May 2019



Deutsche
Akkreditierungsstelle
D-PL-19381-02-00

This laboratory is accredited by DAkkS.
The tests reported herein have been
performed in accordance with its' terms of
accreditation.

UL INTERNATIONAL GERMANY GMBH

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1. Customer Information

1.1. Applicant Information

Company Name:	Workaround GmbH
Company Address:	Rupert-Mayer-Str. 44, 81379 Munich, GERMANY
Contact Person:	Daniel Castillo
Contact E-Mail Address:	daniel.castillo@proglove.de

1.2. Manufacturer Information

Company Name:	Workaround GmbH
Company Address:	Rupert-Mayer-Str. 44, 81379 Munich, GERMANY
Contact Person:	Daniel Castillo
Contact E-Mail Address:	daniel.castillo@proglove.de

2. Summary of Testing

2.1. General Information

Applied Standards

Specification Reference:	47CFR15.249
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.249
Specification Reference:	47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) – Section 15.209
Test Firm Registration:	399704

Location

Location of Testing:	UL International Germany GmbH Hedelfinger Str. 61 70327 Stuttgart Germany
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Date information

Order Date:	21 February 2019
EUT arrived:	12 March 2019
Test Dates:	12 March 2019 to 29 March 2019
EUT returned:	-/-

2.2. Summary of Test Results

Clause	Measurement	Complied	Did not comply	Not performed	Not applicable
Part 15.207	Transmitter AC Conducted Emissions ⁽¹⁾	☐	☐	☐	☒
Part 15.249(a)(e)	Transmitter Fundamental Field Strength	☒	☐	☐	☐
Part 2.1049	Transmitter 20 dB Bandwidth	☒	☐	☐	☐
Part 15.249(a)(d)(e)/ 15.209(a)	Transmitter Radiated Emissions	☒	☐	☐	☐
Part 15.249(d)/ 15.209(a)	Transmitter Band Edge Radiated Emissions	☒	☐	☐	☐

Note:

1. Not applicable as EUT does not support 915 MHz transmit or receive modes whilst charging.

2.3. Methods and Procedures

Reference:	ANSI C63.10-2013
Title:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

2.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	ProGlove
Model Name or Number:	MARK 2 MR
Test Sample Serial Number:	M2MR101000236 / M2MR101000237 (<i>Radiated sample</i>)
Hardware Version Number:	1010
Firmware Version Number:	1.0.1, FCC branch
FCC ID:	2AOJL-MARK-2

3.2. Description of EUT

The equipment under test was a wireless wearable bar-code reader supporting SRD (915 MHz).

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Technology Tested:	Short Range Device (915 MHz)		
Type of Unit:	Transceiver		
Channel Spacing:	752 kHz		
Modulation:	2FSK		
Data Rate:	152.34 Kbps		
Power Supply Requirement(s):	Nominal	5 V DC	
Power Supply Type:	Internal Rechargeable Battery		
Power Supply Detail(s):	Sunny Electronics Corp Model: SYS 1561-1105-W2E		
Maximum measured radiated Transmitter Fundamental Field Strength @ 3m:	80.54 dBμV/m		
Maximum Antenna Gain:	-12 dBi		
Antenna Type:	Custom wire Antenna		
Antenna Details:	DigiKey Model No.: A119645-ND Version: 2.4.1		
Transmit Frequency Range:	902 MHz to 928 MHz		
Transmit Channels Tested:	Channel ID	RF Channel	Channel Frequency (MHz)
	Bottom	0	902.97
	Middle	32	915.00
	Top	62	926.28

3.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

A. In-house

Item	Description	Brand Name	Model Name or Number	Serial Number
1	Laptop PC	HP	HP ProBook 650 G1	5CG6143YWB

B. Manufacturer supplied

Item	Description	Brand Name	Model Name or Number	Serial Number
1	Power Supply, AC/DC ADAPTER	Shenzhen Yingyuan electronics Co.	SAW06D-050-1200GB	Not stated
2	USB Type-A to Type-C cable	Not stated	Not stated	Not stated
3	Mark 2 Charger Station S	ProGlove	Not stated	Not stated
4	Glove with button to trigger Mark	ProGlove	Long Life	Not stated
5	Glove with button to trigger Mark	ProGlove	Glove	Not stated
6	Glove with button to trigger Mark	ProGlove	Index Trigger	Not stated

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):

☒ Modulated Carrier with maximum power Transmitting Mode with maximum duty cycle.

4.2. Configuration and Peripherals

The EUT was tested in the following configurations:

- The EUT was powered via internal rechargeable battery.
- The test modes were activated using "Mark 2 Certification Helper.pdf" supplied by customer.
- The test modes were selected by scanning the QR codes in the document "Mark 2 Certification Helper.pdf".
- The EUT radiated samples were used for 20 dB bandwidth, maximum peak output power, radiated emissions.
- Before starting final radiated measurements "worst case verification" with EUT in Standing & EUT in Laying position was performed by Lab.
- EUT in Standing position found to be the worst case therefore this report includes relevant results.

5. Measurements, Examinations and Derived Results

5.1. General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to Section 6 *Measurement Uncertainty* for details.

In accordance with DAkkS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

5.2. Test Results

5.2.1. Transmitter Fundamental Field Strength

Test Summary:

Test Engineer:	Krume Ivanov	Test Date:	15 March 2019
Test Sample Serial Number:	M2MR101000236		
Test Site Identification	SR 1/2		

FCC Reference:	Part 15.249(a)
Test Method Used:	ANSI C63.10 Section 6.5

Environmental Conditions:

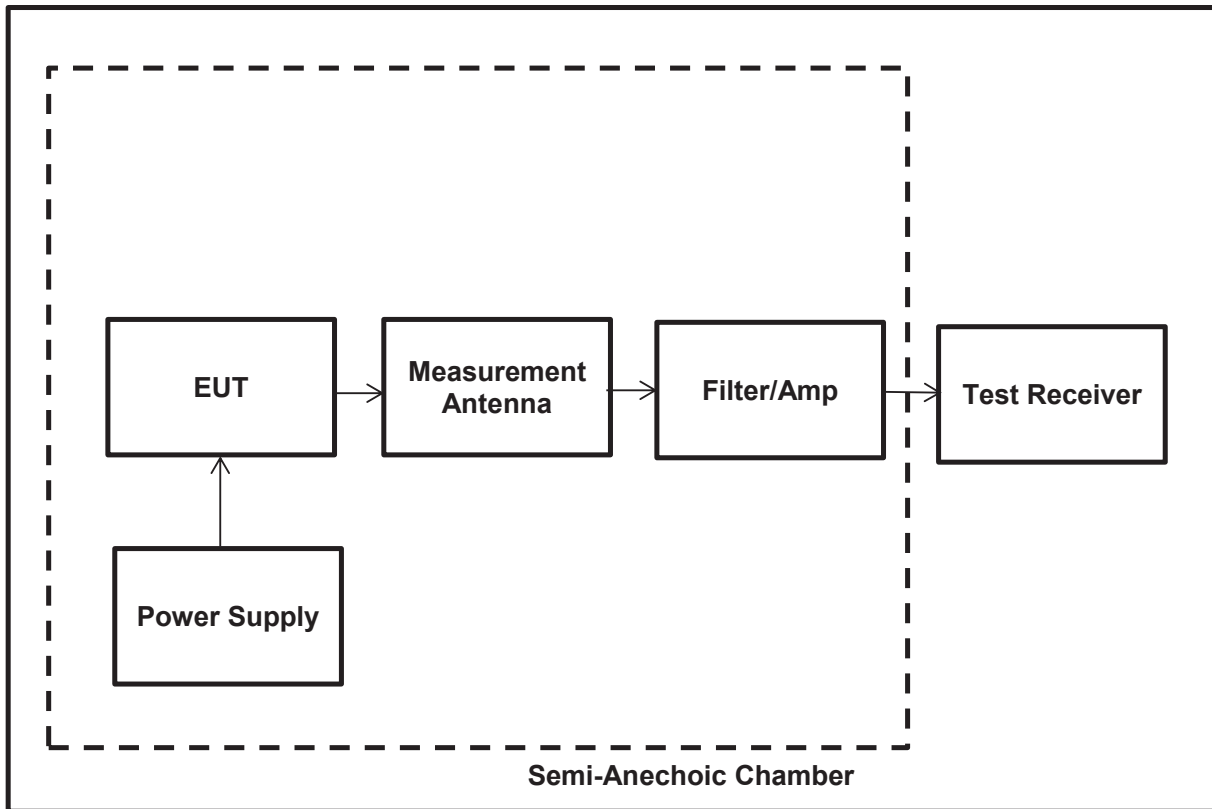
Temperature (°C):	21
Relative Humidity (%):	21

Settings of the Instrument

RBW/VBW	500 kHz/ 2 MHz
Span	1.75 MHz
Sweep time	Auto
Detector	Peak

Note(s):

1. The final measured value in the table below incorporates the calibrated antenna factor and cable loss.
2. The plots of the fundamental shown on the following page were performed using a peak detector with final measurements being made with a quasi-peak detector.

Transmitter Fundamental Field strength test setup

Results: Bottom Channel

Frequency (MHz)	Antenna Polarization	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
902.97	Horizontal	80.25	93.97	13.72	Complied

Results: Middle Channel

Frequency (MHz)	Antenna Polarization	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
915.00	Horizontal	80.54	93.97	13.43	Complied

Results: Top Channel

Frequency (MHz)	Antenna Polarization	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
926.28	Horizontal	74.81	93.97	19.16	Complied

Result: Pass

Transmitter Fundamental Field strength (continued)**Bottom Channel****Middle Channel****Top Channel**

5.2.2. Transmitter 20 dB Bandwidth**Test Summary:**

Test Engineer:	Krume Ivanov	Test Date:	15 March 2019
Test Sample Serial Number:	M2MR101000236		
Test Site Identification	SR 1/2		

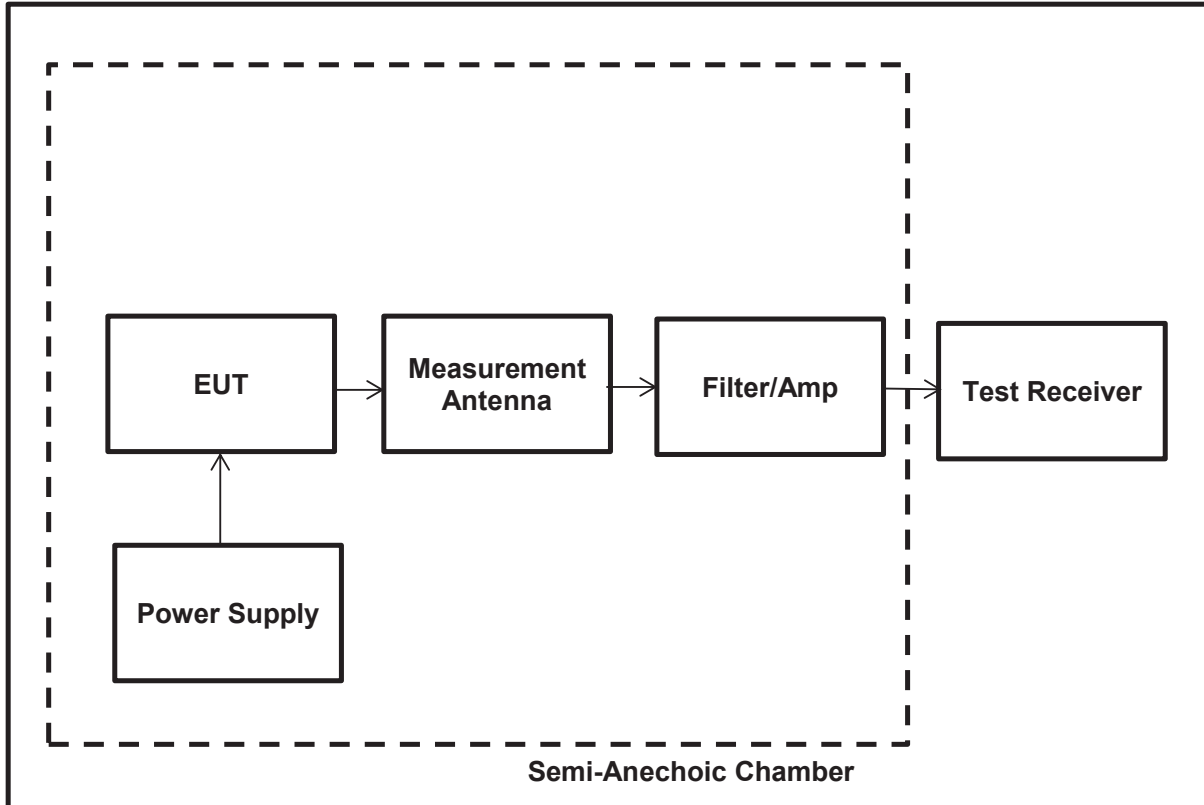
FCC Reference:	Part 2.1049
Test Method Used:	ANSI C63.10 Section 6.9.2

Environmental Conditions:

Temperature (°C):	21
Relative Humidity (%):	21

Settings of the Instrument

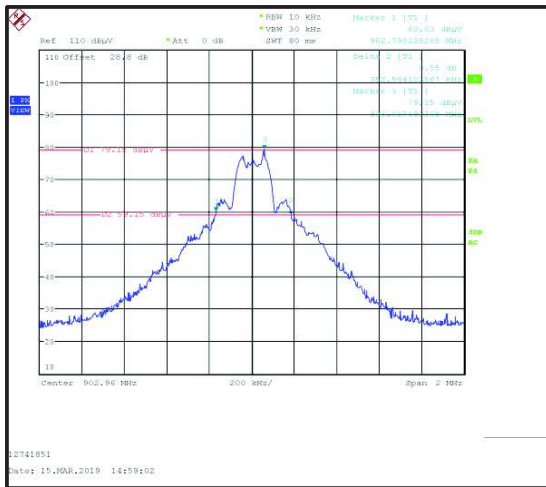
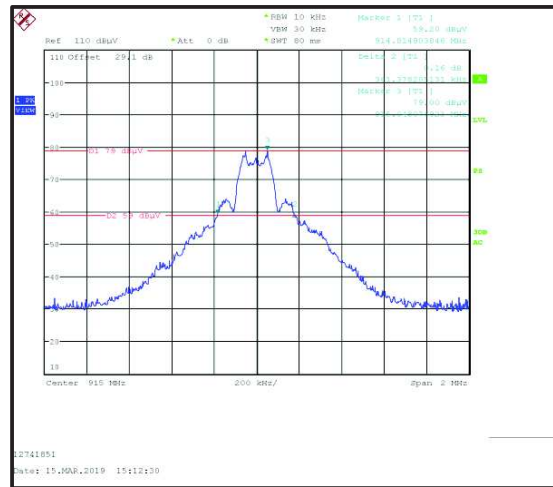
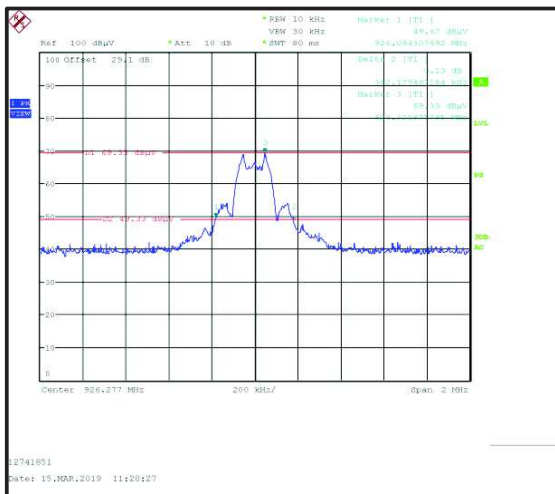
RBW/VBW	10 kHz/ 30 kHz
Span	2 MHz
Sweep time	Auto
Detector	Peak

Test setup:

Results:

Channel	20 dB Bandwidth (kHz)
Bottom	352.564
Middle	361.378
Top	326.179

Result: Pass

Transmitter 20 dB Bandwidth (continued)**Bottom Channel****Middle Channel****Top Channel**

5.2.3. Transmitter Radiated Emissions**Test Summary:**

Test Engineer:	Krume Ivanov	Test Date:	13 & 14 March 2018
Test Sample Serial Number:	M2MR101000236 / M2MR101000237		
Test Site Identification	SR 1/2		

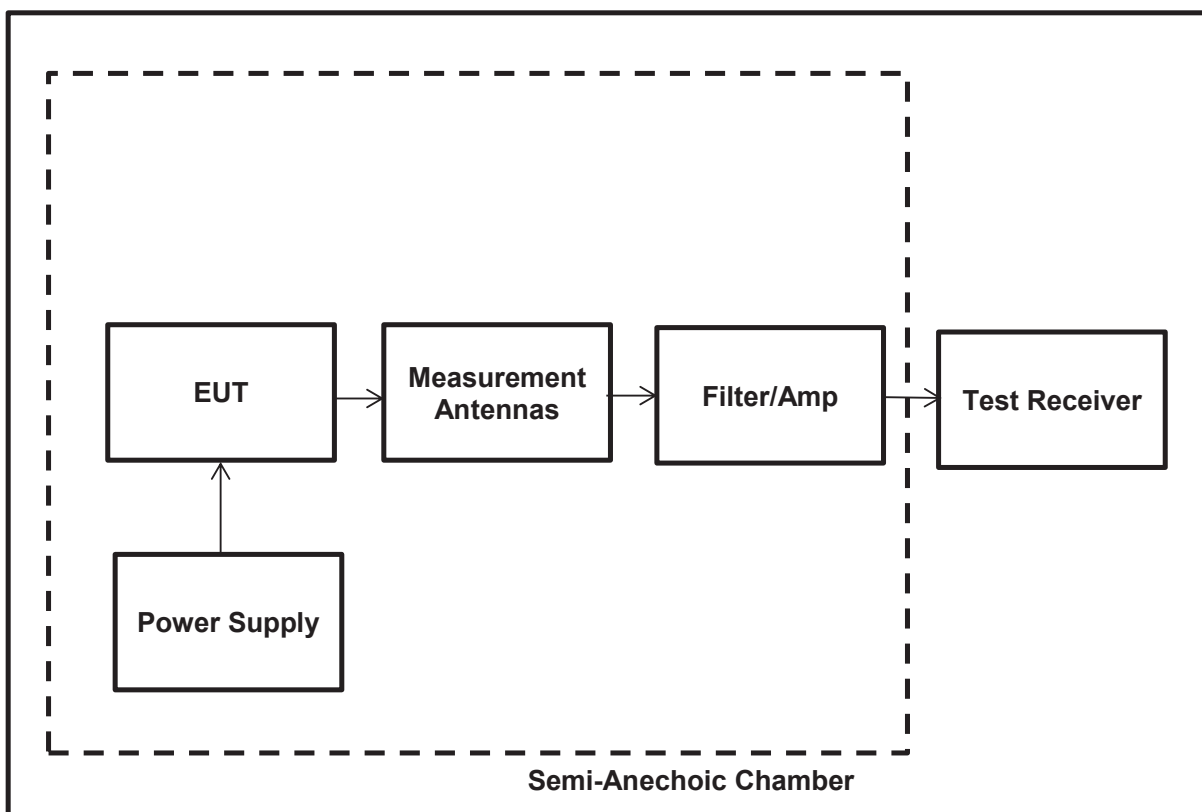
FCC Reference:	Parts 15.249(a)(d)(e) & 15.209(a)
Test Method Used:	ANSI C63.10 Sections 6.3 and 6.5
Frequency Range	30 MHz to 1000 MHz

Environmental Conditions:

Temperature (°C):	21
Relative Humidity (%):	21

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The emissions shown on the 30 MHz to 1 GHz plot is the EUT fundamental at 902.97 MHz, 915 MHz and 926.28 MHz. Only the spurious emissions found are the ones recorded in the result table.
3. Measurements below 1 GHz were performed in a semi-anechoic chamber at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

Test Setup:

Results: Peak/ Bottom Channel

Frequency (MHz)	Antenna Polarization	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
158.565	Horizontal	15.92	43.50	27.58	Complied

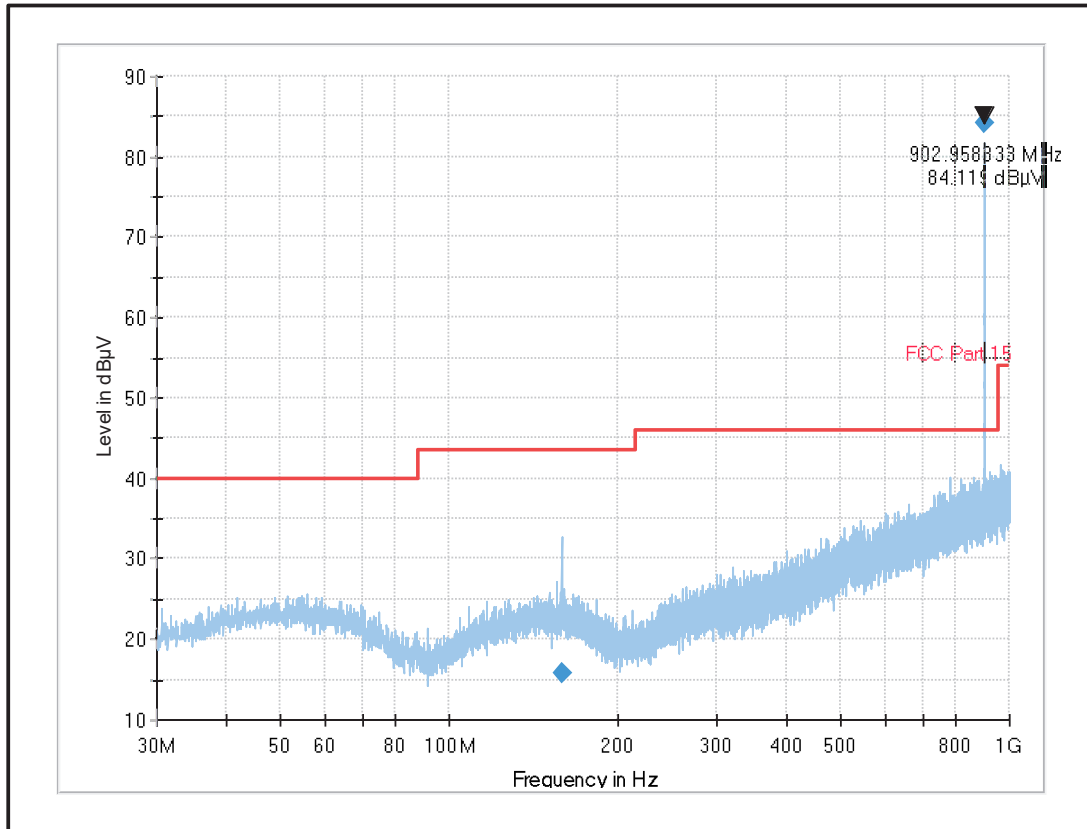
Results: Peak/ Middle Channel

Frequency (MHz)	Antenna Polarization	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
64.515	Vertical	24.70	40.00	15.30	Complied

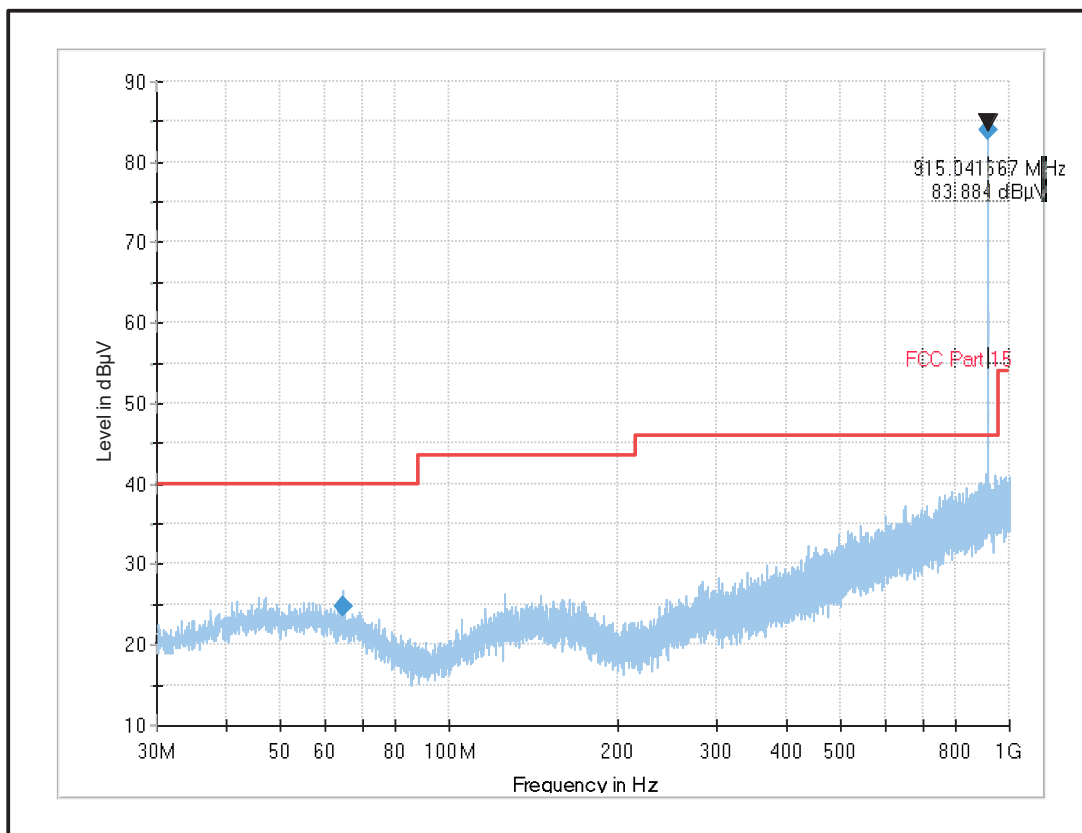
Results: Peak/ Top Channel

Frequency (MHz)	Antenna Polarization	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
177.555	Vertical	30.39	43.50	13.11	Complied

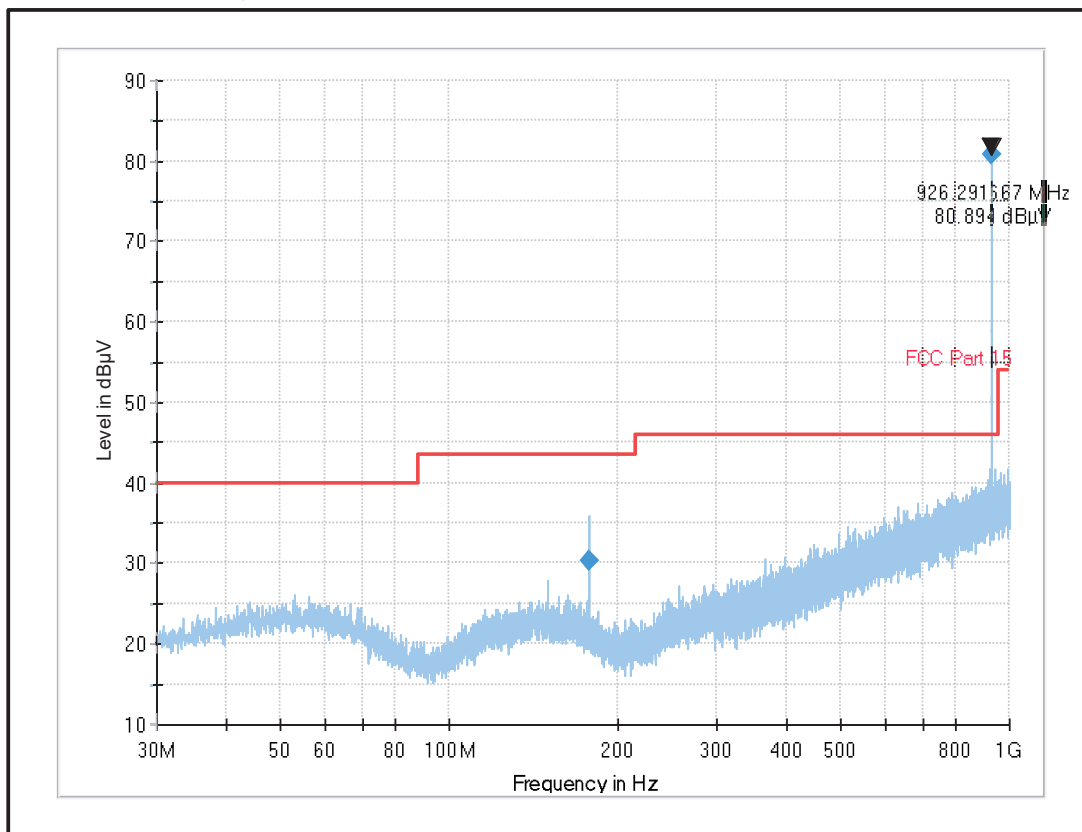
Result: Pass

Transmitter Radiated Emissions**Plot: 30 MHz – 1GHz / Bottom channel**

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Plot: 30 MHz – 1GHz / Middle Channel

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Plot: 30 MHz – 1GHz / Top Channel

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Test Summary:

Test Engineer:	Krume Ivanov	Test Date:	13 & 14 March 2018
Test Sample Serial Number:	M2MR101000236 / M2MR101000237		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.249(a)(d)(e) & 15.209(a)
Test Method Used:	ANSI C63.10 Sections 6.3 and 6.6
Frequency Range	1 GHz to 10 GHz

Environmental Conditions:

Temperature (°C):	21
Relative Humidity (%):	21

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. Measurements above 1 GHz were performed in a semi-anechoic chamber at a distance of 3 metres. The EUT was placed at a height of 150 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
3. Pre-scans were performed and a marker placed on the highest measured level of the appropriate plot. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. The sweep time was set to auto.
4. *In accordance with ANSI C63.10 Section 6.6.4.3, if the peak measured value complies with the average limit, it is unnecessary to perform an average measurement.

Results: Peak / Bottom Channel

Frequency (MHz)	Antenna Polarization	Peak Level (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)	Result
1806.000	Vertical	40.77	54.00	13.23	Complied
2708.850	Vertical	46.02	54.00	7.98	Complied
3611.975	Vertical	50.86	54.00	3.14	Complied

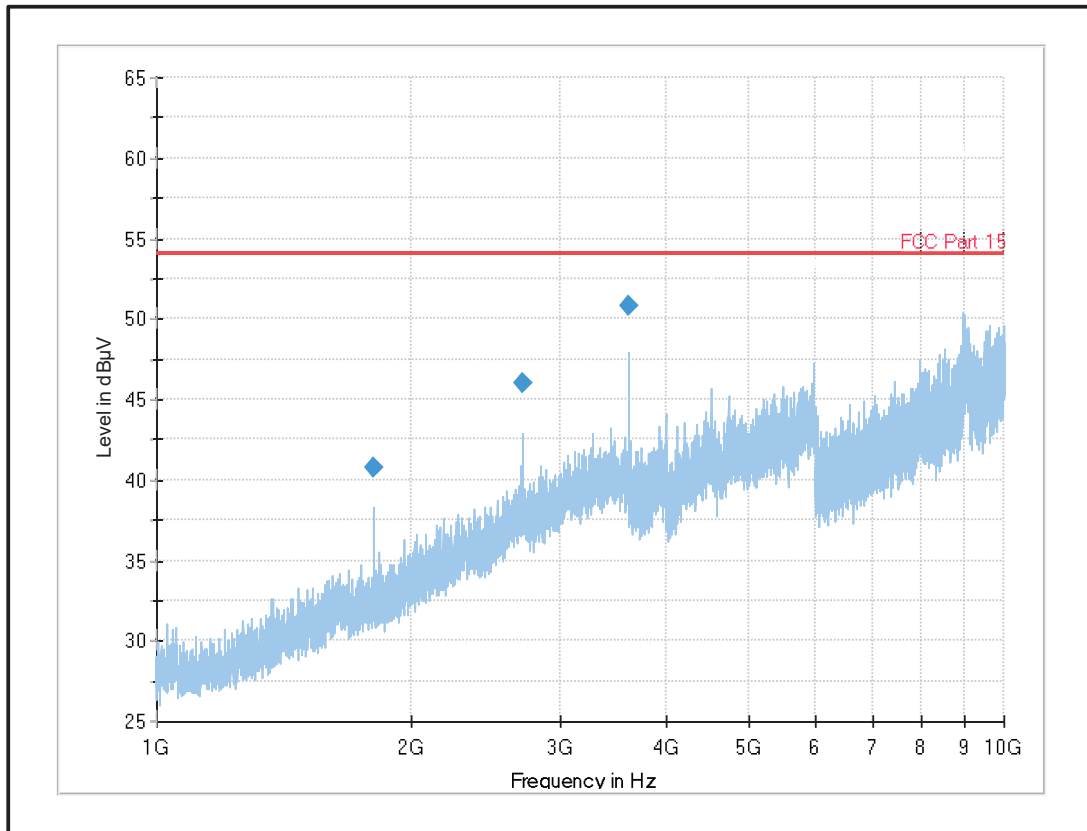
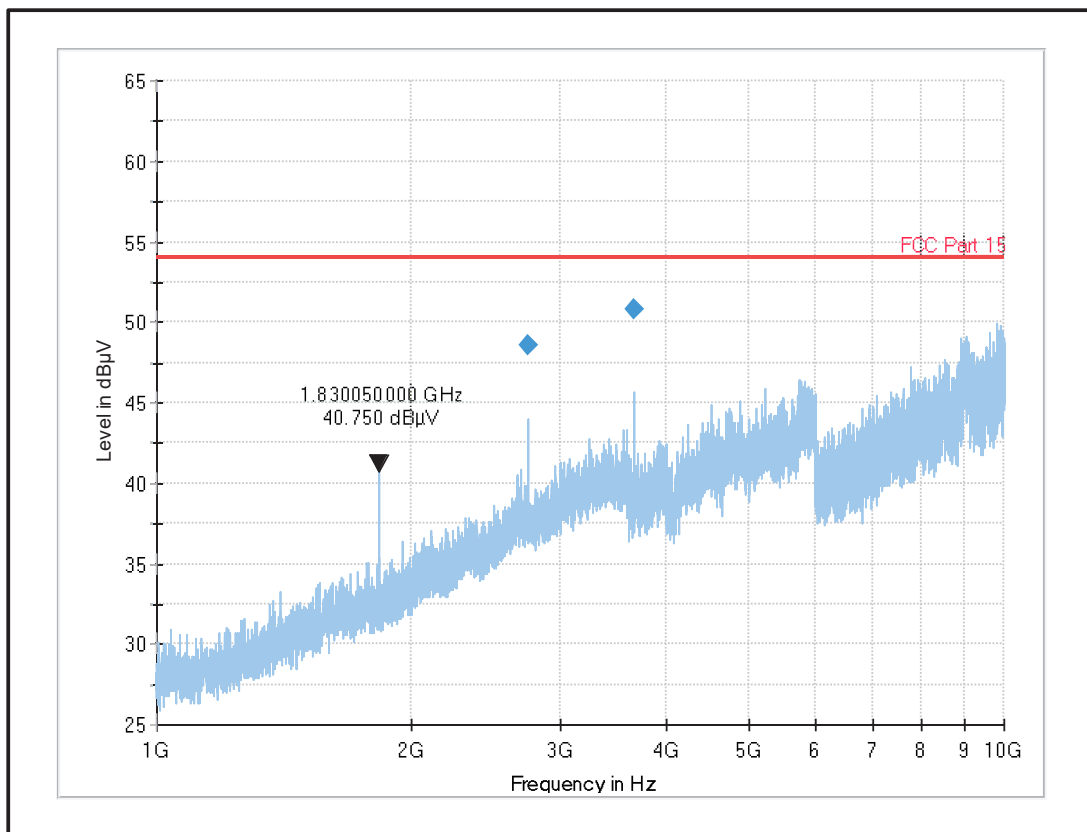
Results: Peak / Middle Channel

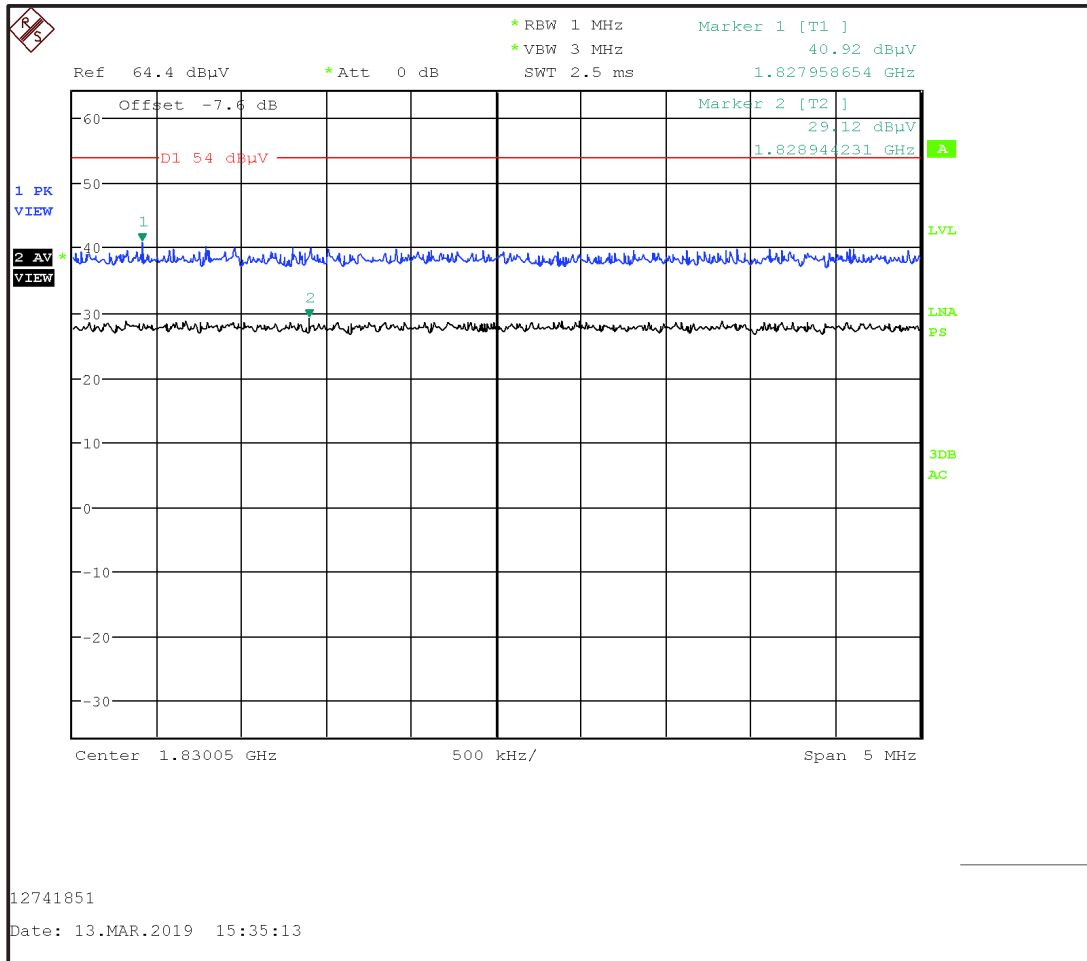
Frequency (MHz)	Antenna Polarization	Peak Level (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)	Result
1827.95	Vertical	40.92	54.00	13.08	Complied
2744.97	Vertical	48.57	54.00	5.43	Complied
3660.42	Vertical	50.79	54.00	3.21	Complied

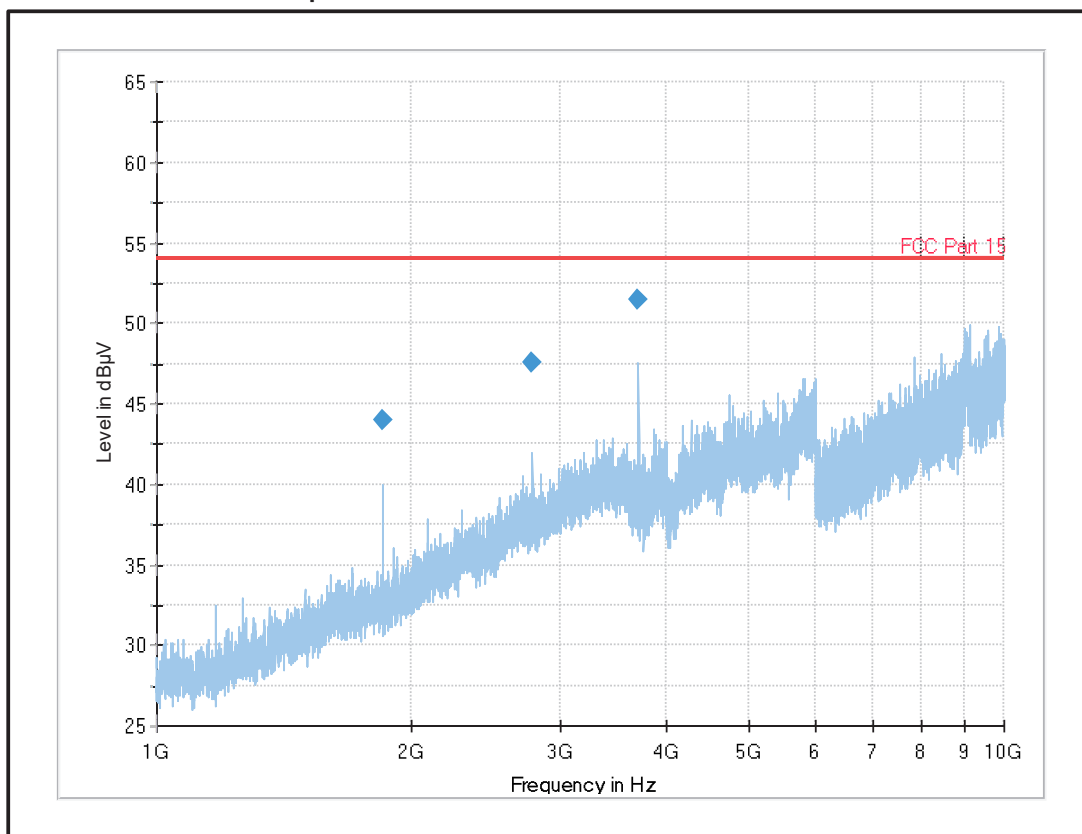
Results: Peak / Top Channel

Frequency (MHz)	Antenna Polarization	Peak Level (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)	Result
1852.475	Vertical	44.01	54.00	9.99	Complied
2778.550	Vertical	47.62	54.00	6.38	Complied
3705.475	Vertical	51.50	54.00	2.50	Complied

Result: Pass

Transmitter Radiated Emissions (Continued)**Plot: 1 GHz – 10 GHz / Bottom Channel****Plot: 1 GHz – 10 GHz / Middle Channel**

Plot: RMS Measurements @ 1.83 GHz (middle channel)

Plot: 1 GHz – 10 GHz / Top Channel

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

5.2.4. Transmitter Band Edge Radiated Emissions**Test Summary:**

Test Engineer:	Krume Ivanov	Test Date:	13 & 14 March 2018
Test Sample Serial Number:	M2MR101000236 / M2MR101000237		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.249(d) & 15.209
Test Method Used:	ANSI C63.10 Section 6.10.4 & 6.10.5

Environmental Conditions:

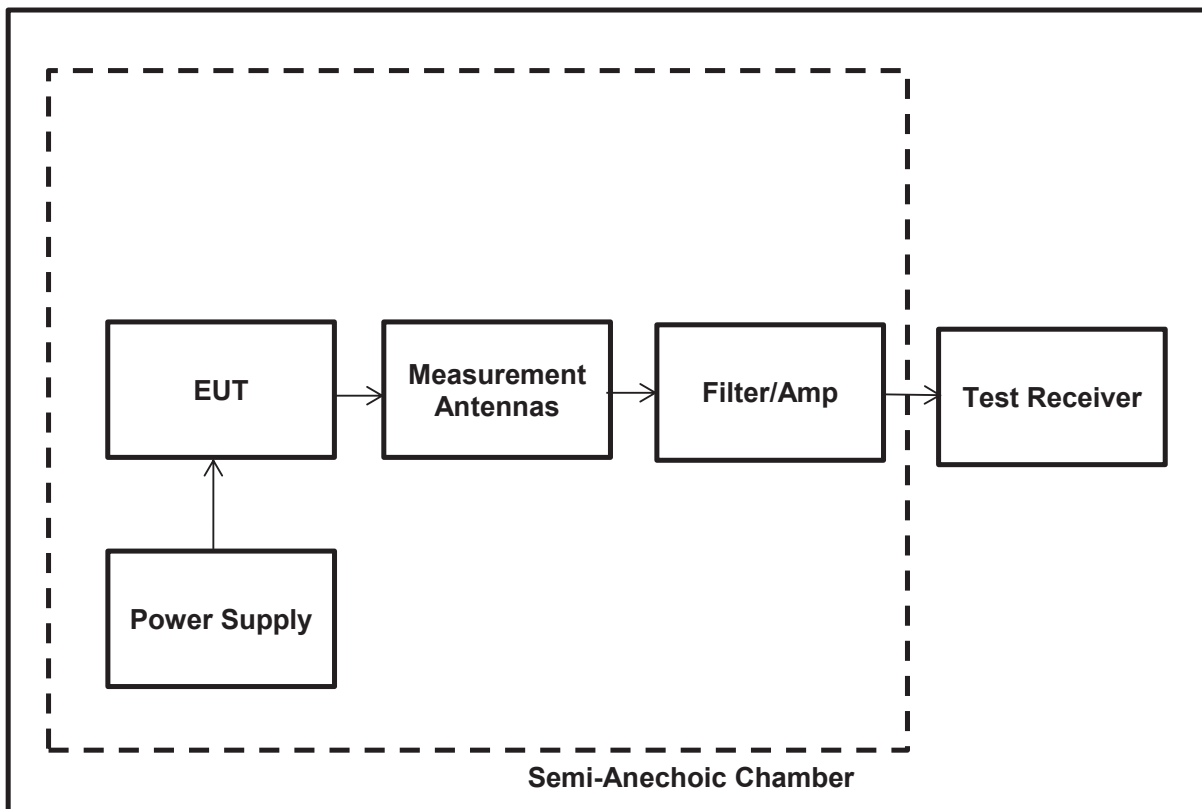
Temperature (°C):	21
Relative Humidity (%):	21

Settings of the Instrument

RBW/VBW	100 kHz/ 300 kHz
Span	10 MHz
Sweep time	Auto
Detector	Peak

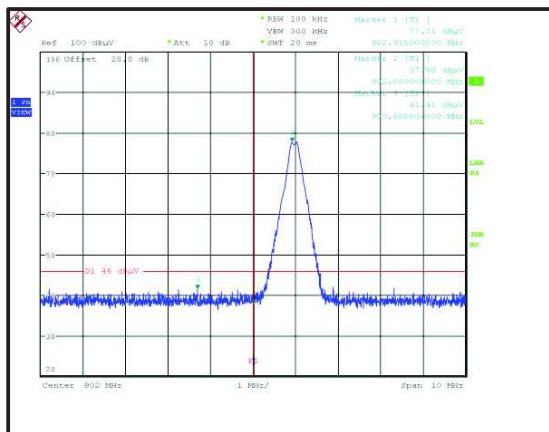
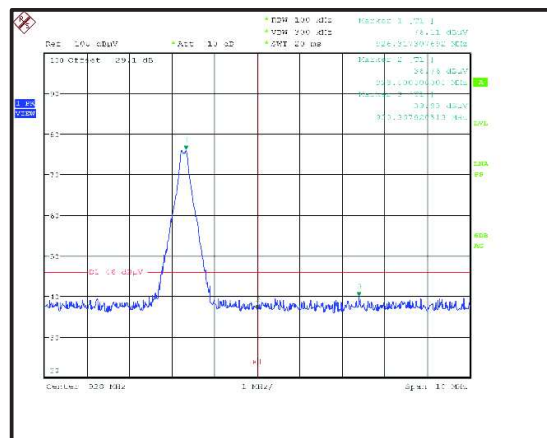
Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The plots shown on the following page were performed using a peak detector with final measurements being made with a quasi-peak detector.

Test Setup:

Results:

Frequency (MHz)	Antenna Polarization	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
902	Horizontal	37.68	46.00	8.32	Complied
928	Horizontal	36.76	46.00	9.24	Complied

Result: Pass**Lower Band Edge Quasi Peak Measurement****Upper Band Edge Quasi Peak Measurement**

6. Measurement Uncertainty

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document "approximately" is interpreted as meaning "effectively" or "for most practical purposes".

Measurement Type	Confidence Level (%)	Calculated Uncertainty
Transmitter Fundamental Field Strength	95%	± 3.10 dB
Radiated Spurious Emissions	95%	± 3.10 dB
Band Edge Radiated Emissions	95%	± 3.10 dB
20 dB Bandwidth	95%	± 0.87 %

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

7. Used equipment

Test site: SR 1/2

ID	Manufacturer	Type	Model	Serial No.	Calibration Date	Cal. Cycle
377	BONN Elektronik	Amplifier, Low Noise Pre	BLMA 0118-1A	025294B	7/12/2018	12
383	Rohde & Schwarz	Antenna, Rod	HFH2-Z1	890151/11	7/14/2017	24
423	Bonn Elektronik	Amplifier, Low Noise Pre	BLMA 1840-1A	055929	7/12/2018	12
424	EMCO	Antenna, Horn	EMCO 3116	00046537	7/28/2016	24
460	Deisl	Turntable	DT 4250 S		n/a	n/a
465	Schwarzbeck	Antenna, Trilog Broadband	VULB 9168	9168-240	8/8/2016	36
495	Rohde & Schwarz	Antenna, Log.- Periodical	HL050	100296	7/20/2016	36
587	Maturo	antenna mast, tilting	TAM 4.0-E	011/7180311	n/a	n/a
588	Maturo	Controller	NCD	029/7180311	n/a	n/a
591	Rohde & Schwarz	Receiver	ESU 40	100244/040	7/12/2018	12
608	Rohde & Schwarz	Switch Matrix	OSP 120	101227	4/8/2014	60
615	Wainwright Instruments	Highpass Filter 1GHz	WHKX12-	3	Lab verification	n/a
620	Bonn Elektronik	pre-amplifier	BLNA 0110-01N	1510111	7/12/2017	24
628	Maturo	Antenna mast	CAM 4.0-P	224/19590716	n/a	n/a
629	Maturo	Kippeinrichtung	KE 2.5-R-M	MAT002	n/a	n/a

8. Report Revision History

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	-	-	Initial Version