

Radio test report

20134514300

based on:

- FCC part 15, subpart C; sections 15.231, 15.249 & 15.207 (10-1-12 edition)
- FCC part 15, subpart B; sections 15.107 & 15.109 (10-1-12 edition)

Protocol exchanger between 2.4GHz Coulissee protocol
and BTX 433.92MHz protocol
TransferBox
ABC-22

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Main module

1 Introduction

This report contains the result of tests performed by:

Telefication B.V.
Edisonstraat 12a
6902 PK Zevenaar
The Netherlands

Telefication complies with the accreditation criteria for test laboratories as laid down in ISO/IEC 17025:2005. The accreditation covers the quality system of the laboratory as well as the specific activities as described in the authorized annex bearing the accreditation number L021 and is granted on 30 November 1990 by the Dutch Council For Accreditation (RvA: Raad voor Accreditatie)

Telefication is designated by the FCC as an Accredited Test Firm for compliance testing of equipment subject to Certification under Parts 15 & 18. The Registration Number is: 282250.

The Industry Canada number for the Open Area Test Site of Telefication is: 4173A-1.

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Ordering party:

Company name : Coulisse B.V.
Address : Vonderweg 48
Zipcode : 7468 DC
City/town : Enter
Country : The Netherlands
Date of order : 3 October 2013

2 Product

A sample of the following product was submitted for testing:

Product description	:	Protocol exchanger between 2.4GHz Coulissee protocol and BTX 433.92MHz protocol
Manufacturer	:	Coulisse BV
Trade mark	:	TransferBox
Type designation	:	ABC-22
FCC ID	:	ZY4ABC22
Hardware version	:	--
Software release	:	--
Serial number	:	--

3 Test schedule

Tests were carried out in accordance with the specification detailed in chapter 7 “Summary” of this report.

Tests were carried out at the following location:

- Telefication, Zevenaar (registered as an accredited test laboratory with designation number NL0001 under the US-EU MRA)

The sample of the product was received on:

- 8 November 2013

Tests were carried out between:

- 8 and 11 November 2013

4 Product documentation

For production of this report the following product documentation was used:

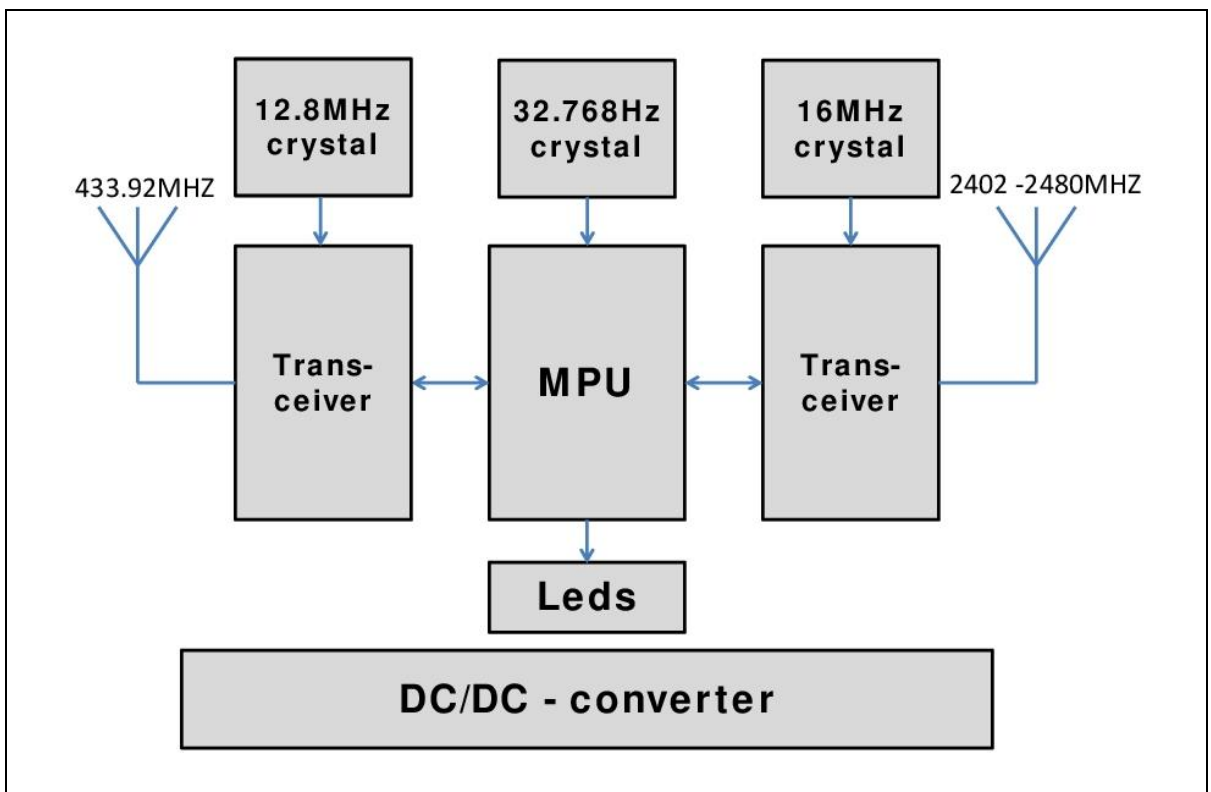
Identification	Date
Transferbox BTX block.pdf	2012 12 05
Transferbox schematic + PCB.pdf	2012 12 05

The above-mentioned documentation will be filed at Telefication for a period of 10 years following the issue of this test report.

5 Observations and comments

The applicant, Coulisse B.V. has issued the following operational description of the Transferbox:

This product is designed as a protocol exchanger between the Coulisse protocol and the BTX protocol. The MPU-module controls all other modules and is powered by a DC/DC converter. The device has two transceivers. One transceiver is able to send and receive packets in the 2402 to 2480MHz band upon user request. The transceiver module uses a 16MHz crystal as base for generating the 2402 to 2480MHz carrier signal. The transceiver sends packets of around 1ms in length with GFSK modulation. The second transceiver is able to send and receive packets on 433.92MHz upon user request. This transceiver module uses a 12.8MHz crystal as base for generating the 433.92MHz carrier signal. The transceiver sends packets of around 50ms in length with CW modulation. The 2.4GHz transceiver is coding and decoding the Coulisse protocol. The 433MHz transceiver is coding and decoding the BTX-protocol. The moment a user operates a Coulisse remote, the device will decode the signal on 2.4GHz and retransmit it on 433MHz. The same applies if the user operates a BTX remote, in this case the device will decode the signal on 433MHz and retransmit it on 2.4GHz. The transmitters are only operated if it detects a valid Coulisse remote or BTX remote signal. In all other circumstances it is in receive mode. The entire module is powered by a DC-supply from 12 to 24V. The DC-supply is down-converted to 3V by means of a DC/DC converter.



The ABC-22 Protocol exchanger has been tested in combination with a Delta Elektronika AC mains power supply.

6 Modifications to the sample

No modifications were made to the sample.

7 Summary

The product is intended for use in the following application areas:

INTENTIONAL RADIATOR OPERATING IN THE FREQUENCY BAND ABOVE 70 MHz

INTENTIONAL RADIATOR OPERATING IN THE FREQUENCY BAND 2400 – 2483.5 MHz

The sample was tested according to the following specification(s):

FCC part 15, subpart C; sections 15.231, 15.249 & 15.207 (10-1-12 edition)

FCC part 15, subpart B; sections 15.107 & 15.109 (10-1-12 edition)

8 Conclusions

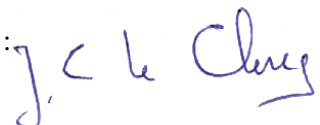
The samples of the product showed **NO NON-COMPLIANCES** to the specifications stated in Chapter 7 of this report.

The results of the tests as stated in this report are exclusively applicable to the product item as identified in this test report. Telefication accepts no responsibility for any stated properties of product items in this test report, which are not supported by the tests as specified in Chapter 7 “*Summary*”.

All tests are performed by:

name : ing. J.C. le Clercq

function : Test Engineer

signature : 

Review of test methods and report by:

name : ing. P.A. Suringa

function : Senior Test Engineer

signature : 

The above conclusions have been verified by the following signatory:

date : 17 December 2013

name : ing. A. van der Valk

function : Manager Laboratory

signature : 

Test results module

1 General information

1.1 Equipment information

Operating frequency	433.92 MHz
Rated RF output power	n.a., integral antenna
Rated radiated RF power	0.00014 W
Operating frequency	2402 - 2480 MHz
Rated RF output power	n.a., integral antenna
Rated radiated RF power	0.001 W
FCC ID	ZY4ABC22

1.2 Summary of tests

Clause	Description	Pass/fail
15.107 (a)	Conducted emissions on AC mains	Pass
15.109 (a)	Unwanted emissions unintentional radiator	Pass
15.207 (a)	Conducted emissions on AC mains	Pass
15.231 (a) (1)	Manual operation	Pass
15.231 (b)	Field strength	Pass
15.231 (c)	20 dB bandwidth	Pass
15.249 (a)	Field strength	Pass

Radiated emissions in the frequency range 30 – 1000 MHz have been measured in a Semi Anechoic Room.

Radiated emissions in the frequency range 1 – 26 GHz have been measured in a Full Anechoic Chamber.

The formula for conversion from power to field strength in free space is:

$$FS \text{ (dB}\mu\text{V/m)} = \text{EIRP (dBm)} + 95.2 \text{ dB.}$$

In accordance with Rec. ITU-R SM.329-12 Annex 1, a site gain of 4 dB has been applied in order to validate the measurements in the Full Anechoic Chamber :

$$FS \text{ (dB}\mu\text{V/m)} = \text{EIRP (dBm)} + 99.2 \text{ dB.}$$

2.2 Field strength of intentional signal (2.4 GHz)

Compliance standard : FCC part 15, subpart C, section 15.249 (a) & (e)
 Method of test : FCC part 15, subpart A, section 15.31(d), 15.31(m), 15.33, 15.35, ANSI C63.10: 2009, sections 6.6, 7.5
 EUT condition : Continuously transmitting
 Test results :

Peak field strength of fundamental:

Frequency (MHz)	Test result dBm (eirp)	Test result @ 3 m distance (dBµV/m)	Polarisation	Limit (dBµV/m)
2402	-09.09	90.11	V	114
2402	-11.45	87.75	H	114
2441	-07.38	91.82	V	114
2441	-10.17	89.03	H	114
2480	-06.66	92.54	V	114
2480	-06.58	92.62	H	114

The formula for conversion from power to field strength is: $FS (dBµV/m) = EIRP (dBm) + 99.2 \text{ dB}$.

Average field strength of fundamental:

Frequency (MHz)	Test result @ 3 m distance (dBµV/m)	Polarisation	Limit (dBµV/m)
2402	-09.09	90.11	94
2402	-11.45	87.75	94
2441	-07.38	91.82	94
2441	-10.17	89.03	94
2480	-06.66	92.54	94
2480	-06.58	92.62	94

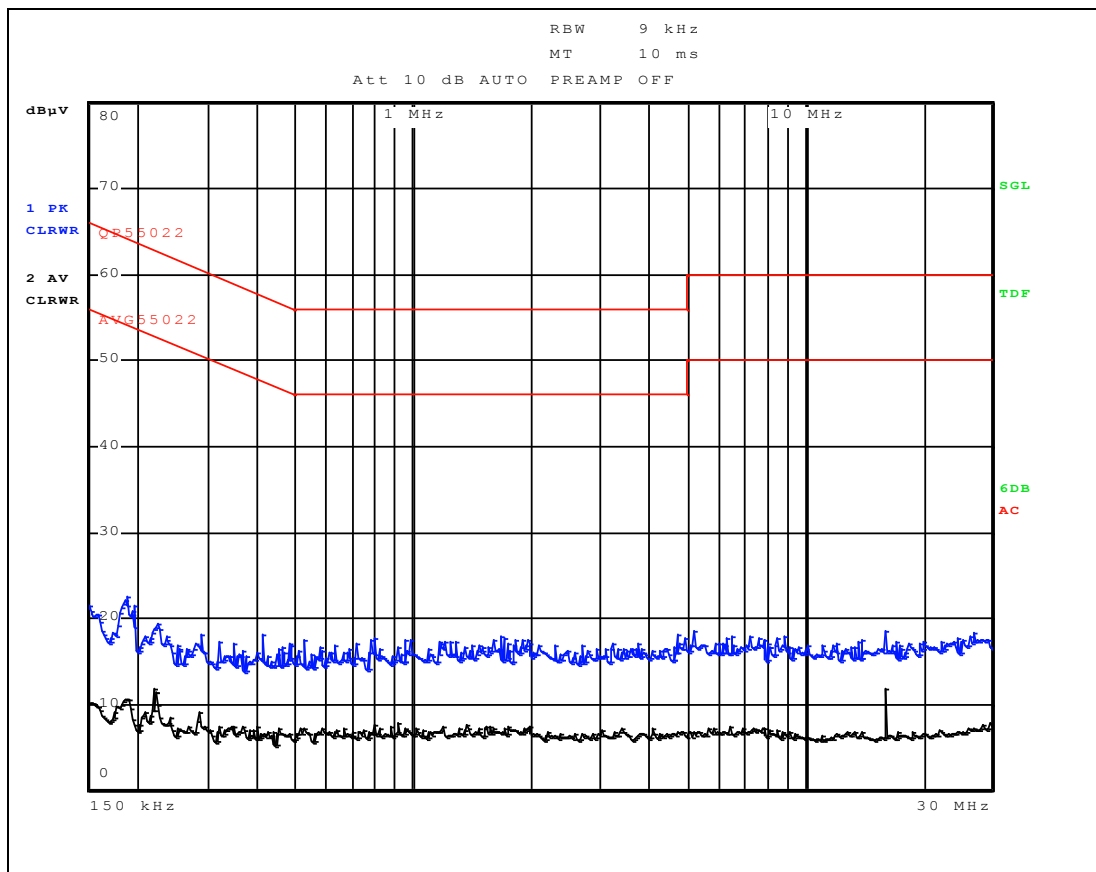
Measurement uncertainty	+4.5/-6.1 dB
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Measurement equipment used (item numbers refer to section “used test equipment”)	2, 24, 42, 47, 48, 49.
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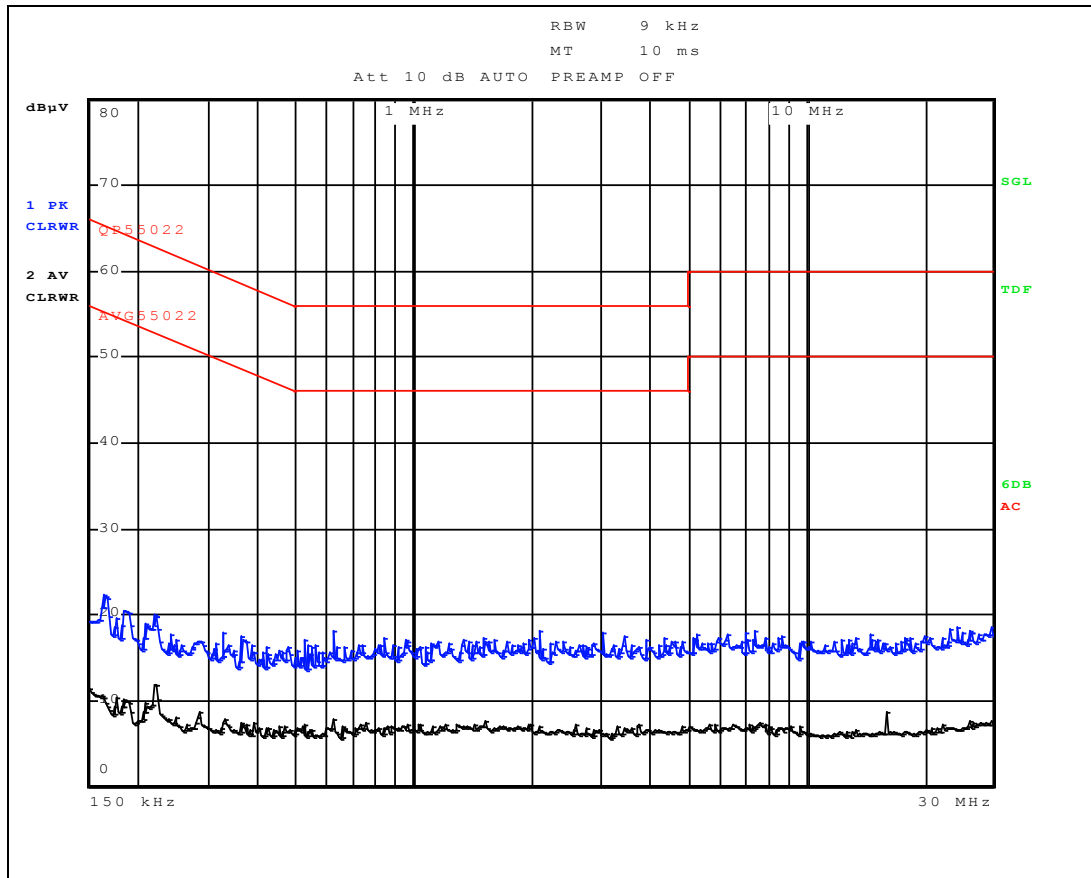
2.3 Conducted disturbance measurements

Compliance standard : FCC part 15, subpart C, section 15.207(a).
 Method of test : ANSI C63.10: 2009, section 6.2
 Port : AC mains
 Mode : Continuously transmitting
 Configuration : The sample was continuously activated
 Atmospheric pressure : Between 86 kPa and 106 kPa
 Temperature : 23 °C
 Relative humidity : 35 %
 Test results : Plots

Type ABC-22, neutral wire, plot



Type ABC-22, live wire, plot



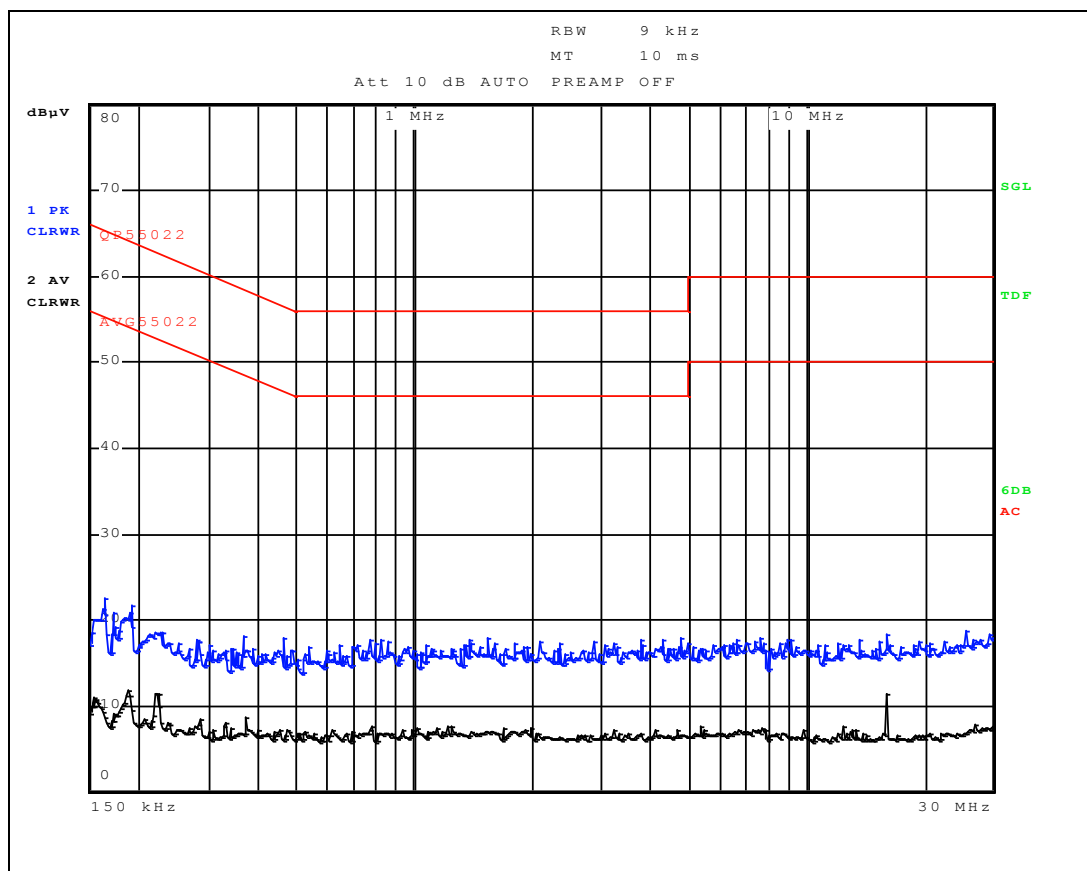
Result : Pass

Measurement uncertainty : +/- 3.6 dB. The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approx. 95%, but excluding the effect of measurement system repeatability.

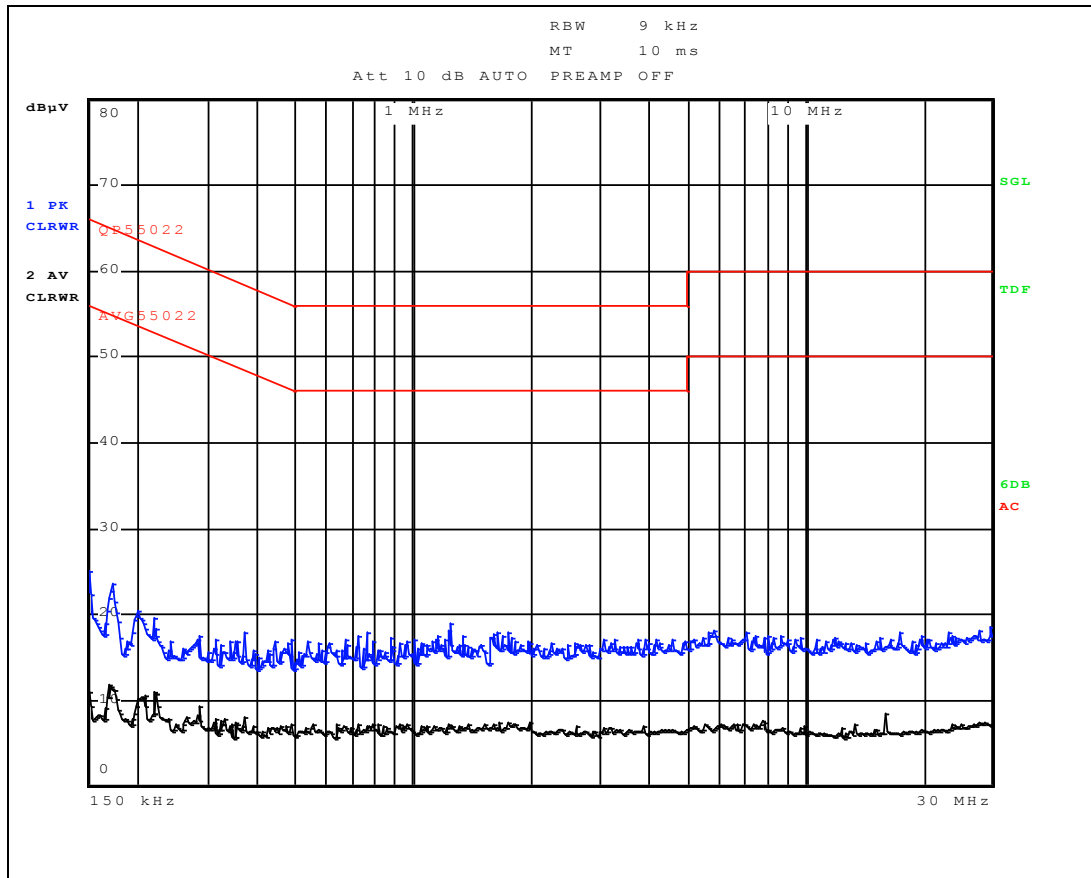
Measurement equipment : 43, 55, 56. (the numbers listed refer to the module 'Used test equipment').

Compliance standard : FCC part 15, subpart C, section 15.107(a).
 Method of test : ANSI C63.10: 2009, section 6.2
 Port : AC mains
 Mode : Continuously receiving
 Configuration : The sample was continuously activated
 Atmospheric pressure : Between 86 kPa and 106 kPa
 Temperature : 23 °C
 Relative humidity : 35 %
 Test results : Plots

Type ABC-22, neutral wire, plot



Type ABC-22, live wire, plot



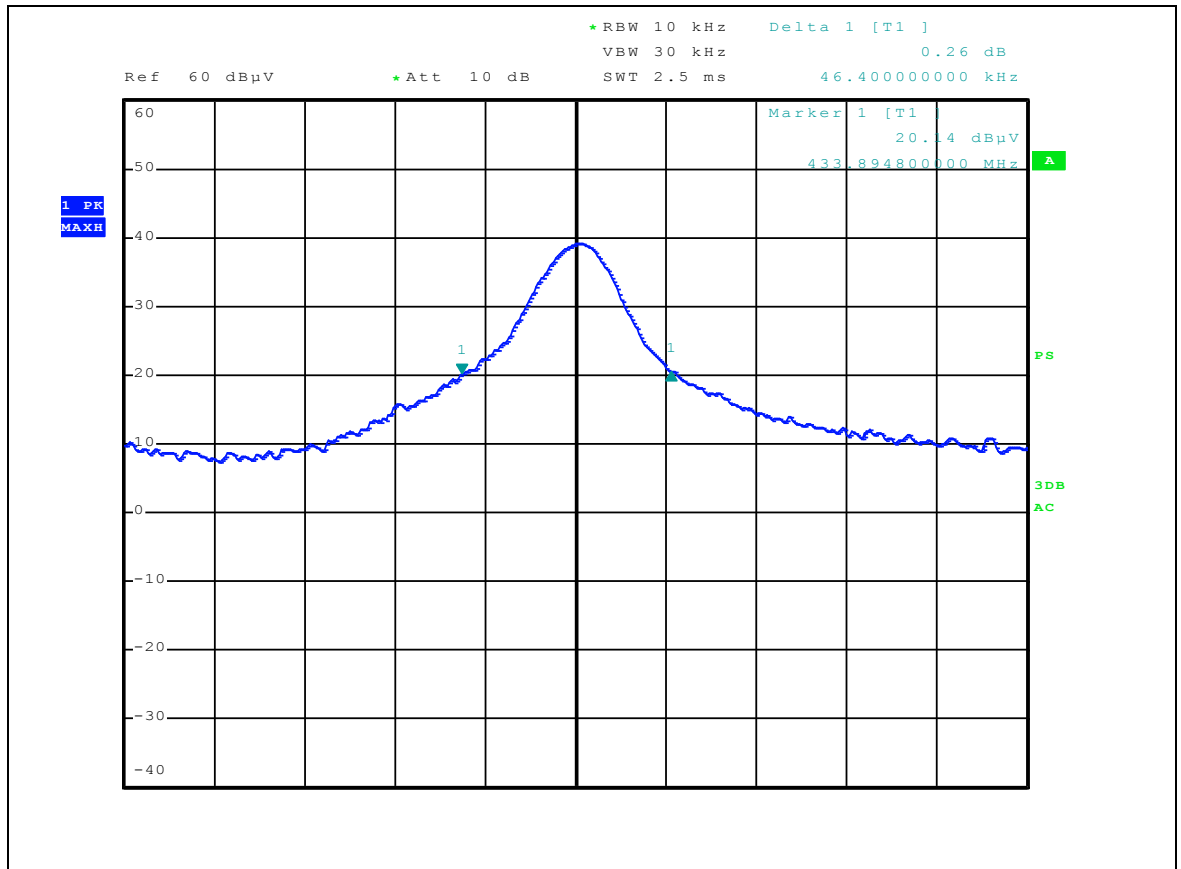
Result : Pass

Measurement uncertainty : +/- 3.6 dB. The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approx. 95%, but excluding the effect of measurement system repeatability.

Measurement equipment : 43, 55, 56. (the numbers listed refer to the module 'Used test equipment').

2.4 Bandwidth of the emissions (433 MHz)

Compliance standard : FCC part 15, subpart C, section 15.231 (c).
 Method of test : FCC part 15, subpart A, section 15.31(m), 15.33, 15.35.
 ANSI C63.10, section 6.9
 EUT condition : Continuous transmitting on 433.92 MHz
 Test results :



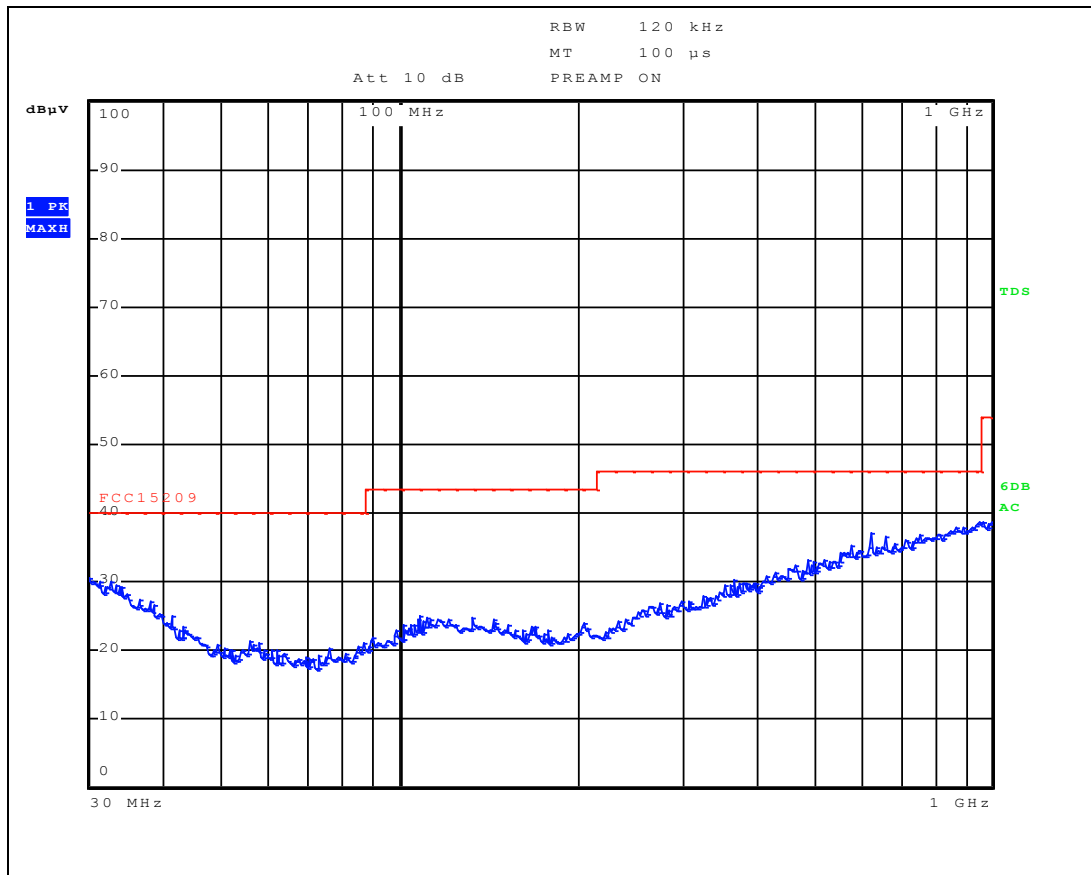
Limit (MHz)	The bandwidth of the system shall be no wider than 0.25 % of the central frequency.
Limit (MHz)	$(0.25/100) * 433.92 = 1.0848$ MHz for this EUT
Measured value	0.0464 MHz
Measurement uncertainty	±5.1 kHz

Measurement equipment used (item numbers refer to section “used test equipment”	34, 36, 43, 50, 51
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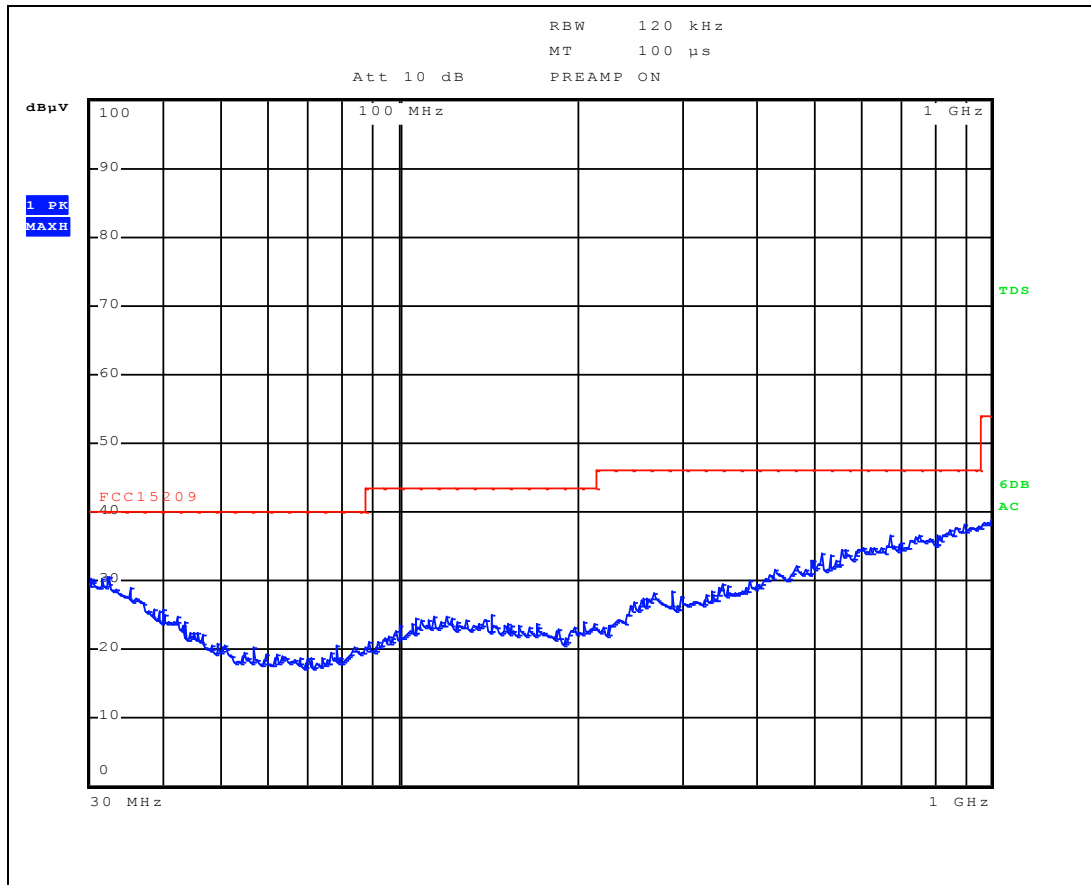
2.5 Field strength of spurious emissions 30 - 1000 MHz (433 MHz)

Compliance standard : FCC part 15, subpart C, section 15.231 (b).
 Method of test : FCC part 15, subpart A, section 15.31(d), 15.31(m), 15.33, 15.35.
 ANSI C63.10: 2009, sections 6.5, 7.5
 EUT condition : Continuously transmitting on 433.92 MHz
 Test results :

Vertical polarization 30 – 1000 MHz



Horizontal polarization: 30 - 1000 MHz



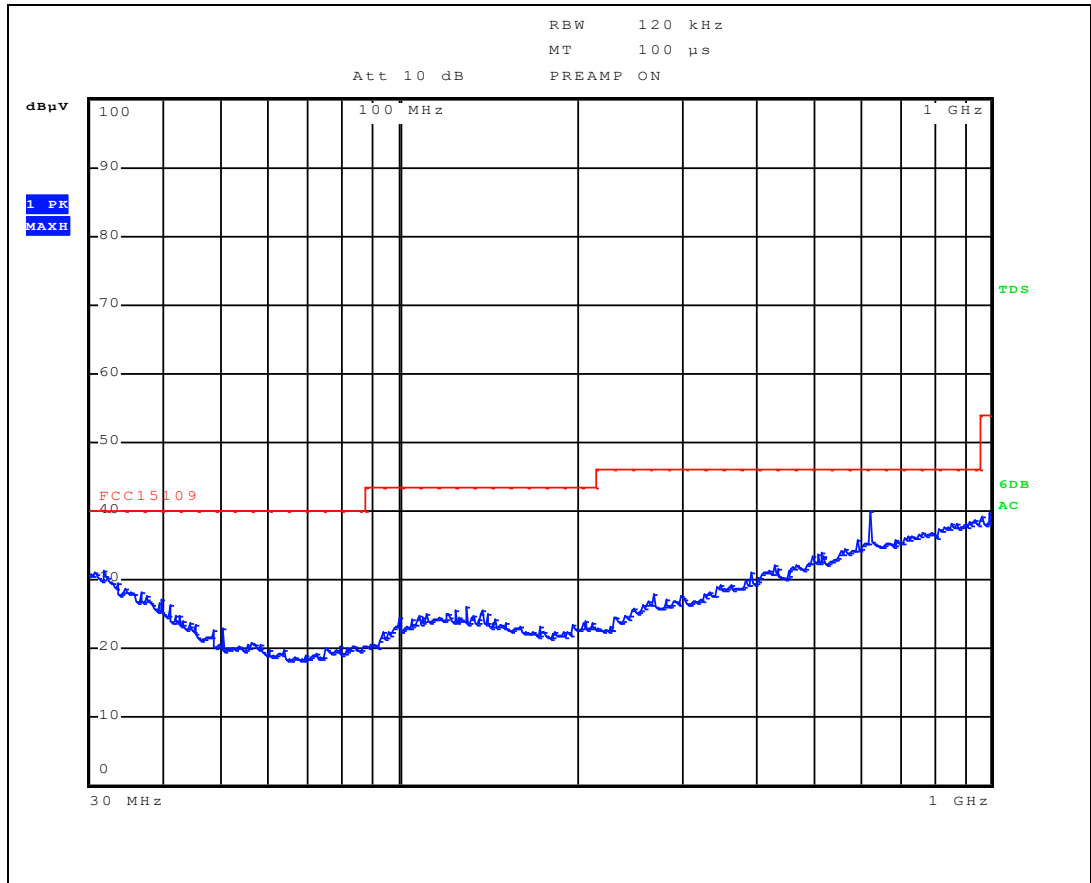
Limit ($\mu\text{V}/\text{m}$)	40.66 – 40.70 MHz: 225; 70 -130 MHz: 125; 130-174 MHz: 125 to 375 ¹⁾ ; 174– 260 MHz: 375; 260– 470: 375 to 1250 ¹⁾ ; >470 MHz: 1250 ¹⁾ Linear interpolations
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Measurement uncertainty	Horizontal polarization	
	30 – 200 MHz	4.5 dB
	200 – 1000 MHz	3.6 dB
	Vertical polarization	
	30 – 200 MHz	5.4 dB
	200 – 1000 MHz	4.6 dB

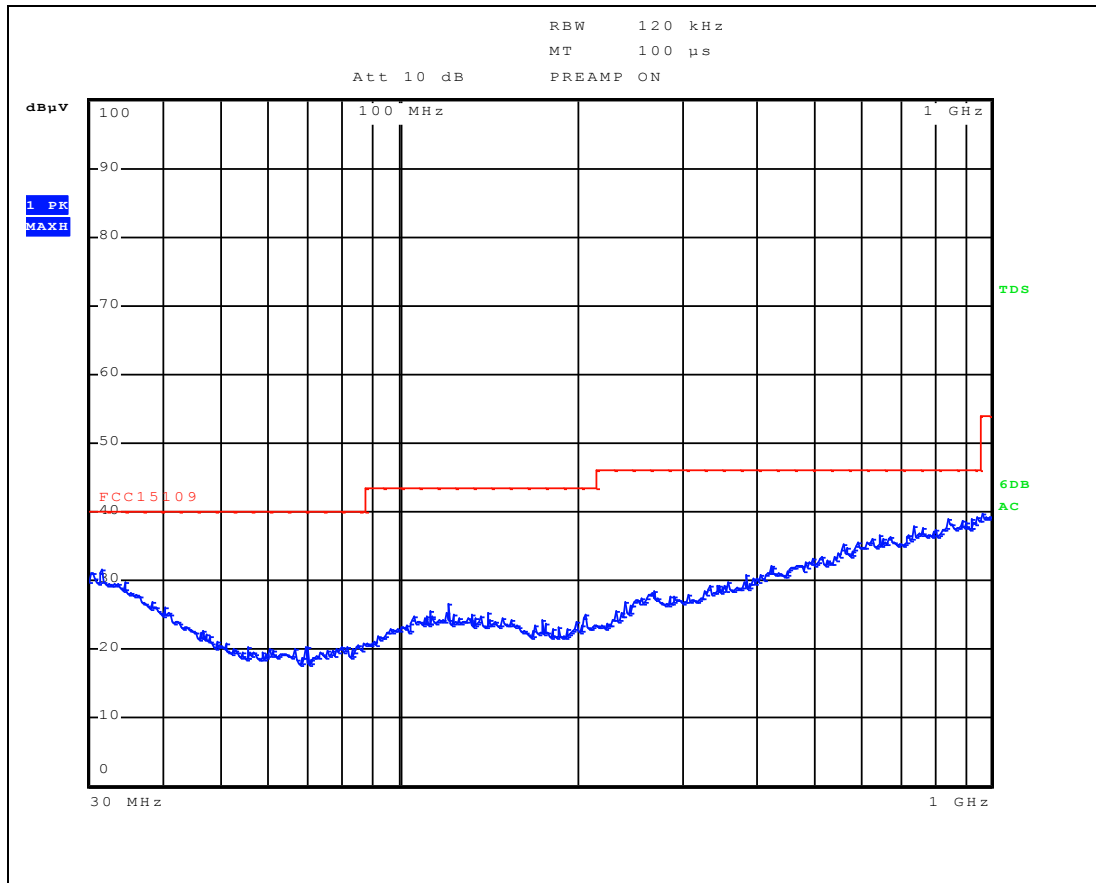
Measurement equipment used (item numbers refer to section “used test equipment”)	34, 36, 43, 50, 51.
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Compliance standard : FCC part 15, subpart C, section 15.109 (a)
 Method of test : FCC part 15, subpart A, section 15.31(m), 15.33, 15.35.
 ANSI C63.10: 2009, sections 6.5, 7.5
 EUT condition : Continuously receiving on 433.92 MHz
 Test results :

Vertical polarization 30 – 1000 MHz



Horizontal polarization: 30 - 1000 MHz



Limit ($\mu\text{V}/\text{m}$)	40.66 – 40.70 MHz: 225; 70 -130 MHz: 125; 130-174 MHz: 125 to 375 ¹⁾ ; 174– 260 MHz: 375; 260– 470: 375 to 1250 ¹⁾ ; >470 MHz: 1250 ¹⁾ Linear interpolations
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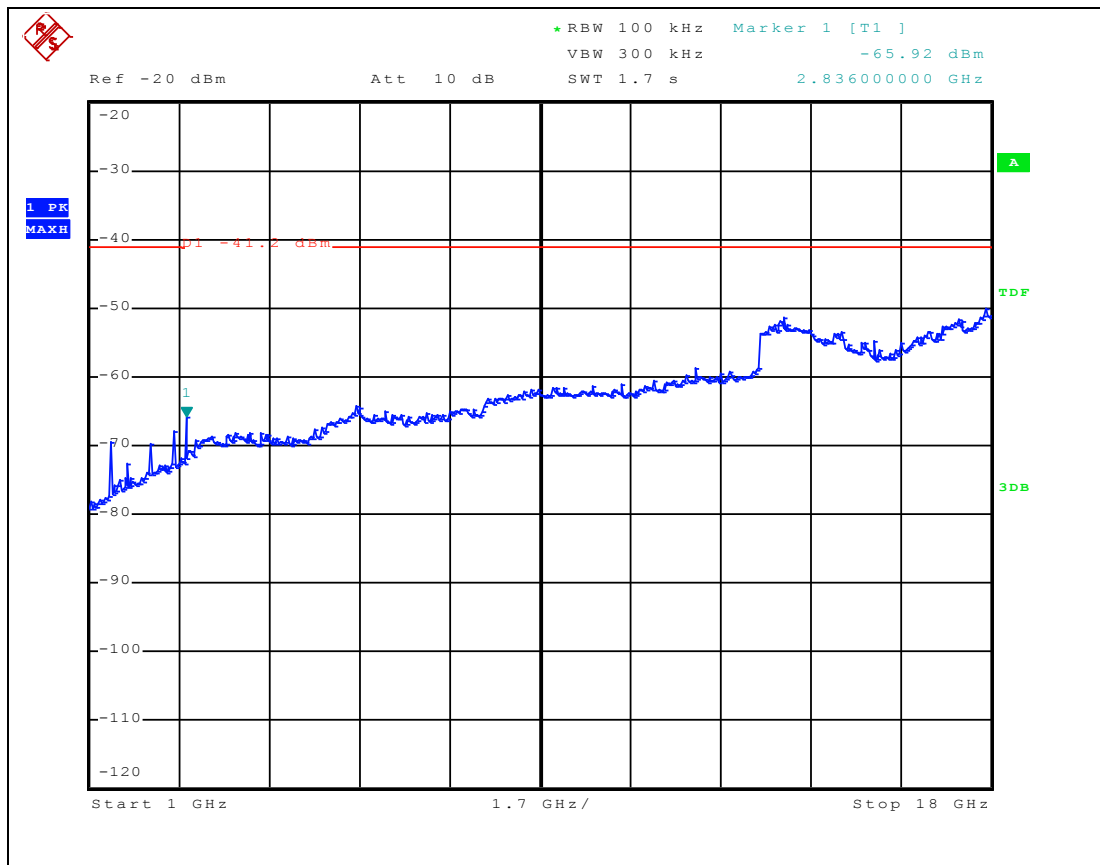
Measurement uncertainty	Horizontal polarization	
	30 – 200 MHz	4.5 dB
	200 – 1000 MHz	3.6 dB
	Vertical polarization	
	30 – 200 MHz	5.4 dB
	200 – 1000 MHz	4.6 dB

Measurement equipment used (item numbers refer to section “used test equipment”)	34, 36, 43, 50, 51.
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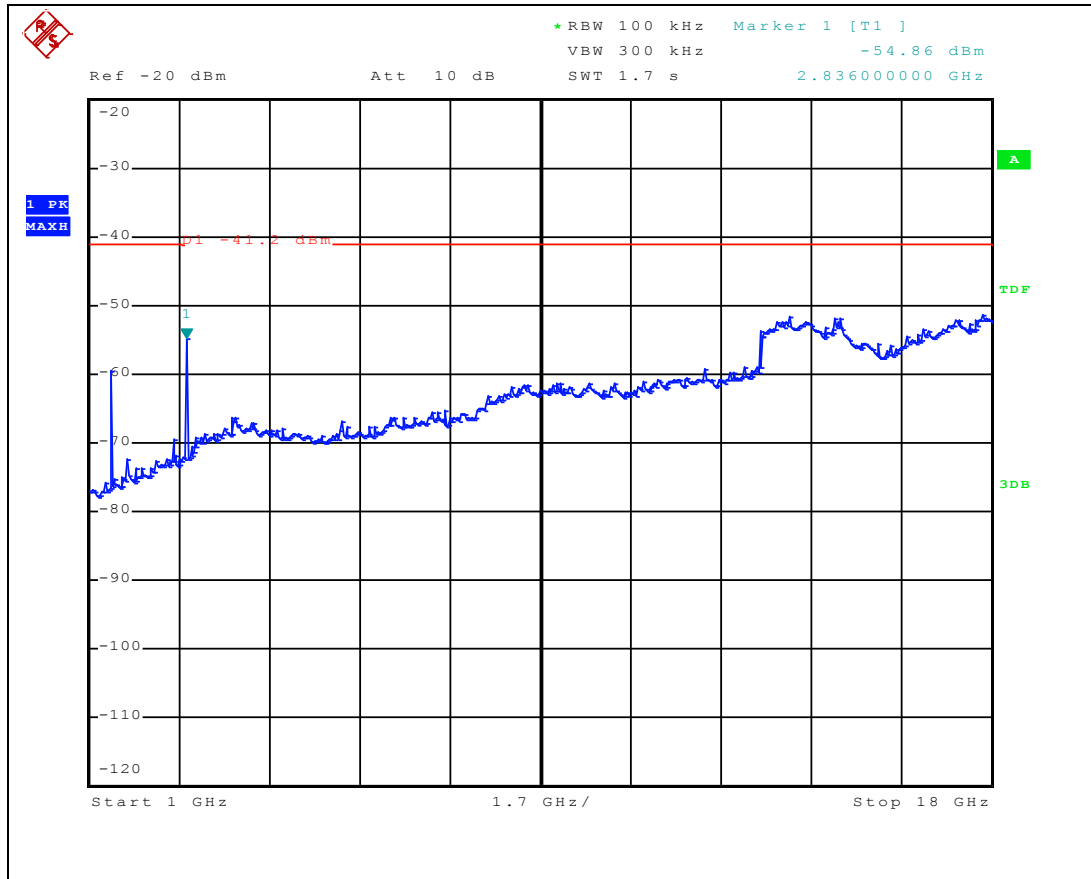
2.6 Field strength of spurious emissions > 1000 MHz (433 MHz)

Compliance standard : FCC part 15, subpart C, section 15.205 (a), (b) & (c), 15.209 (a), 15.231(b)
 Method of test : FCC part 15, subpart A, section 15.31(d), 15.31(m), 15.33, 15.35.
 ANSI C63.10: 2009, sections 6.6, 7.5.
 EUT condition : Continuously transmitting on 433.92 MHz
 Test results :

Polarisation: vertical, (1-18 GHz)



Polarisation: horizontal, (1-18 GHz)



Peak field strength of harmonics:

Frequency (GHz)	Test result dBm (eirp)	Test result @ 3 m distance (dBµV/m)	Polarisation	Limit (dBµV/m)
2.836	-65.92	33.28	V	74
2.836	-54.86	44.34	H	74

Note: Only peak power was measured. The formula for conversion from power to field strength at 3 meter distance is:

$$FS \text{ (dB}\mu\text{V/m)} = \text{EIRP (dBm)} + 99.2 \text{ dB.}$$

Average field strength of harmonics:

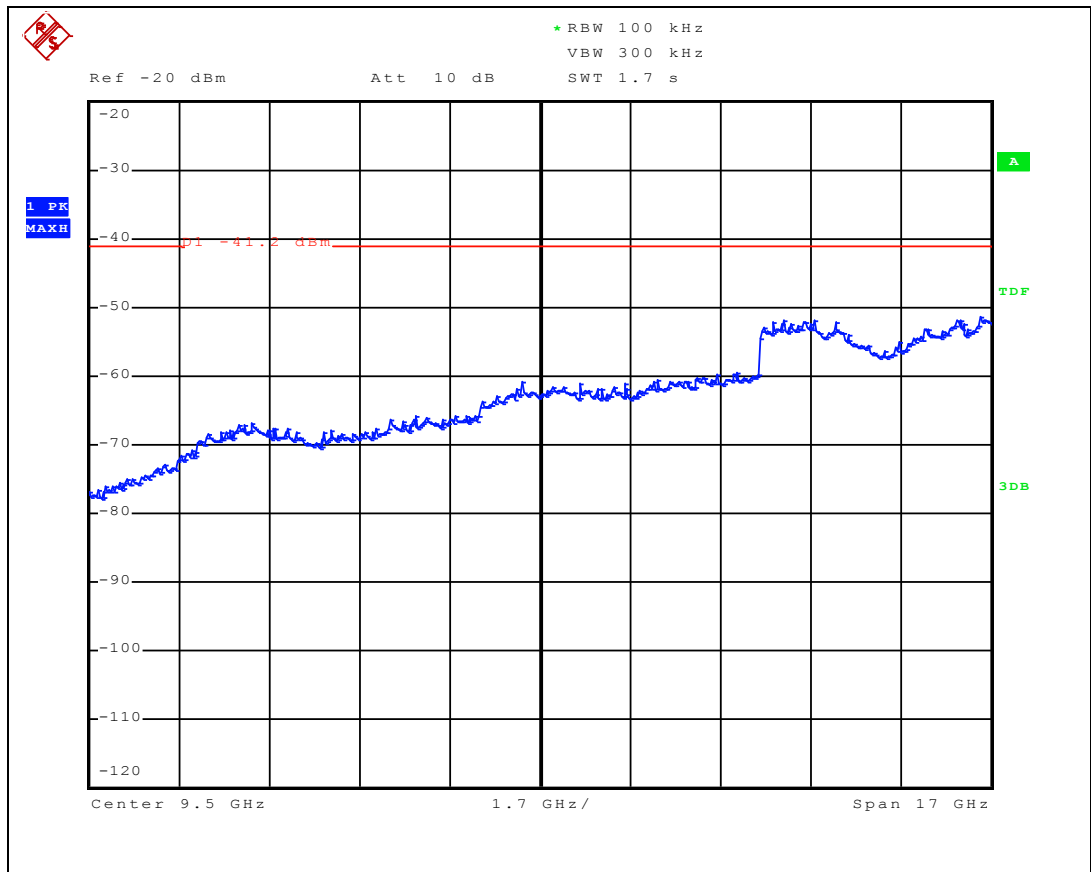
Frequency (GHz)	Test result @ 3 m distance (dB μ V/m)	Polarisation	Limit (dB μ V/m)
2.836	33.28	V	54
2.836	44.34	H	54

Measurement uncertainty	+4.5/-6.1 dB
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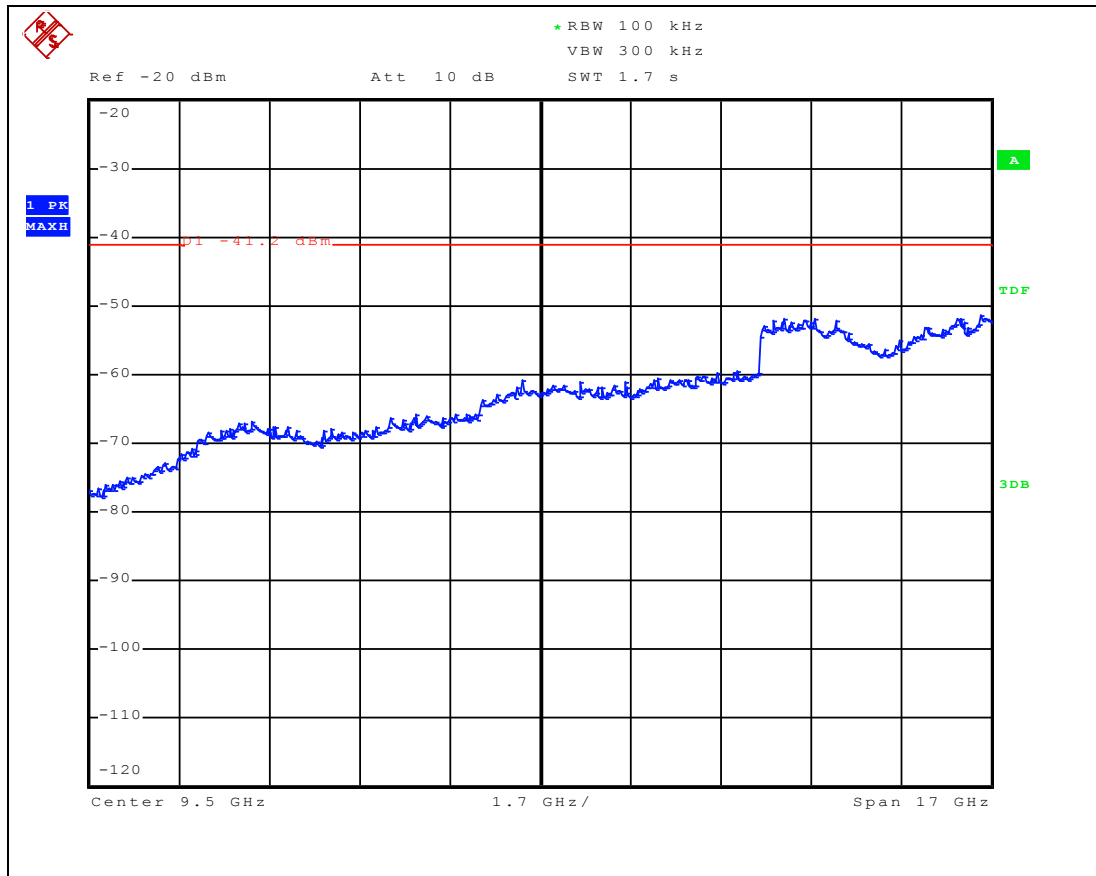
Measurement equipment used (item numbers refer to section "used test equipment")	2, 24, 31, 42, 45, 47, 48, 49.
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Compliance standard : FCC part 15, subpart C, section 15.109 (a),
 Method of test : FCC part 15, subpart A, section 15.31(d), 15.31(m), 15.33,
 15.35.
 ANSI C63.10: 2009, sections 6.6, 7.5..
 EUT condition : Continuously receiving on 433.92 MHz
 Test results :

Polarisation: vertical, (1-18 GHz)



Polarisation: horizontal, (1-18 GHz)



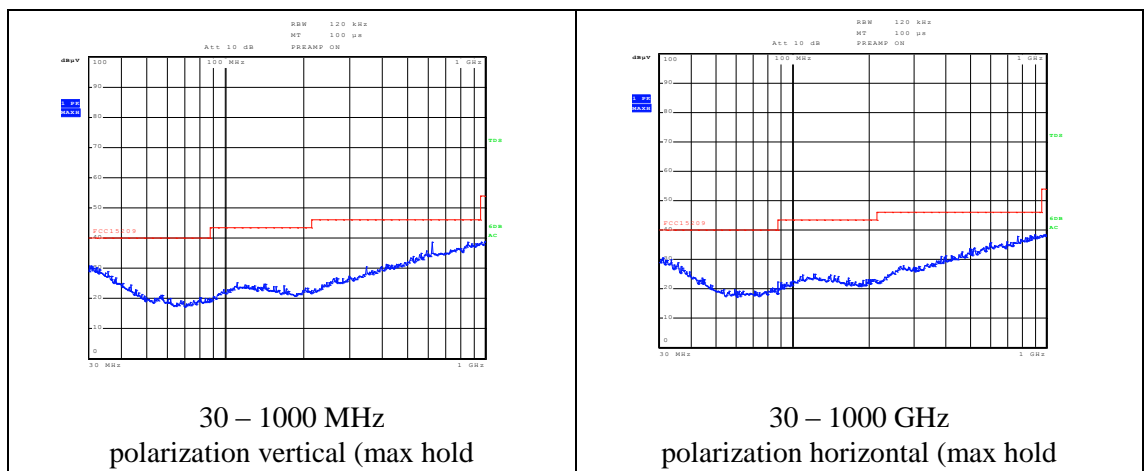
Note: The formula for conversion from power to field strength at 3 meter distance is:
 $FS (dB\mu V/m) = EIRP (dBm) + 99.2 \text{ dB}$.

Measurement uncertainty	+4.5/-6.1 dB
Measurement equipment used (item numbers refer to section “used test equipment”)	2, 24, 31, 42, 45, 47, 48, 49.

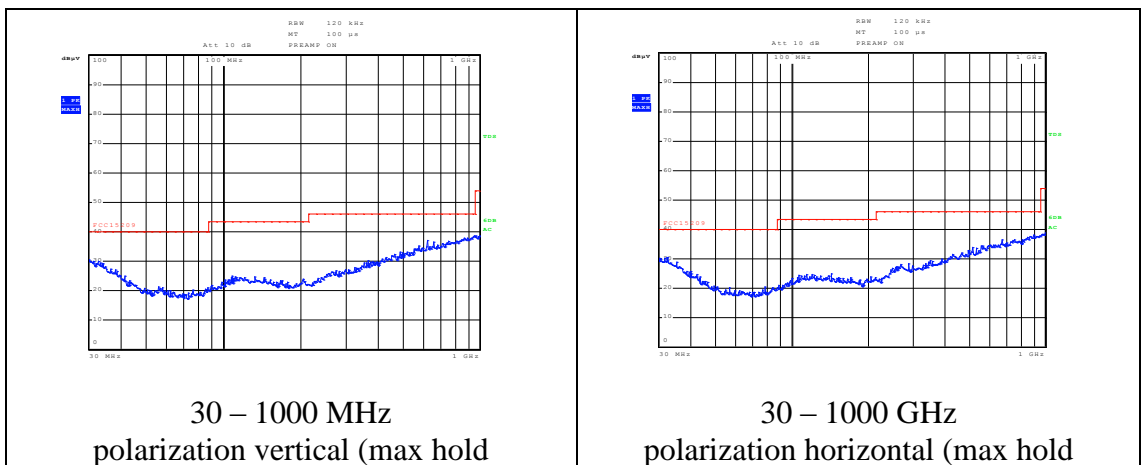
2.7 Field strength of spurious emissions 30 - 1000 MHz (2.4 GHz)

Compliance standard : FCC part 15, subpart C, section 15.205(a), (b) & (c), 15.209(a), 15.249(d)
 Method of test : FCC part 15, subpart A, section 15.31(d), 15.31(m), 15.33, 15.35.
 ANSI C63.10-2009, sections 6.5, 7.5.
 EUT condition : Continuously transmitting in the 2.4 GHz band
 Test results :

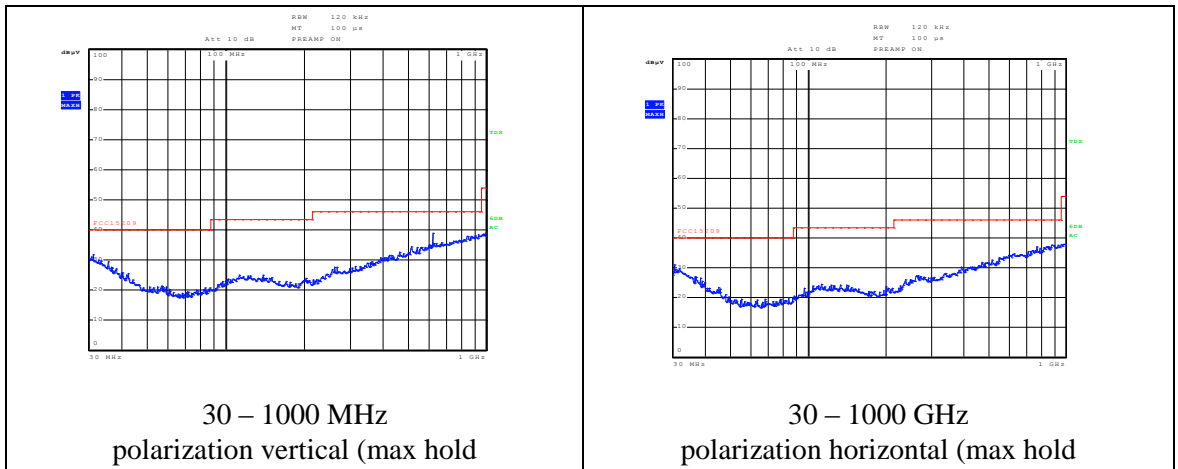
Low channel (2402 MHz)



Mid channel (2440 MHz)



High channel (2480 MHz)

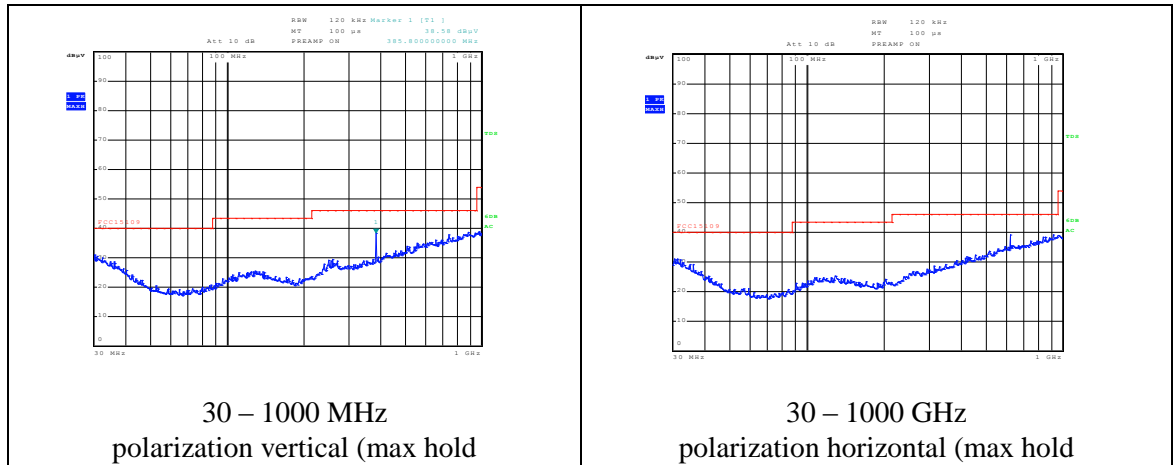


Measurement uncertainty	Vertical polarisation:	
	30 – 200 MHz	5.4 dB
	200 -1000 MHz	4.6 dB
	Horizontal polarisation:	
	30 – 200 MHz	4.5 dB
	200 -1000 MHz	3.6 dB

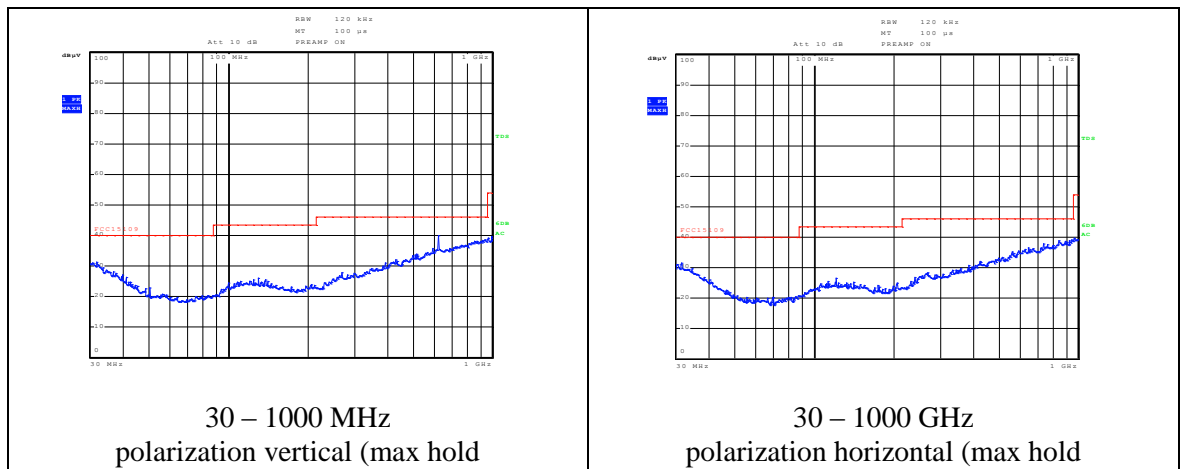
Measurement equipment used (item numbers refer to section “used test equipment”)	34, 36, 43, 50, 51
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Compliance standard : FCC part 15, subpart C, section 15.109(a)
 Method of test : FCC part 15, subpart A, section 15.31(m), 15.33, 15.35.
 ANSI C63.10-2009, sections 6.5, 7.5
 EUT condition : Continuously receiving in the 2.4 GHz band
 Test results :

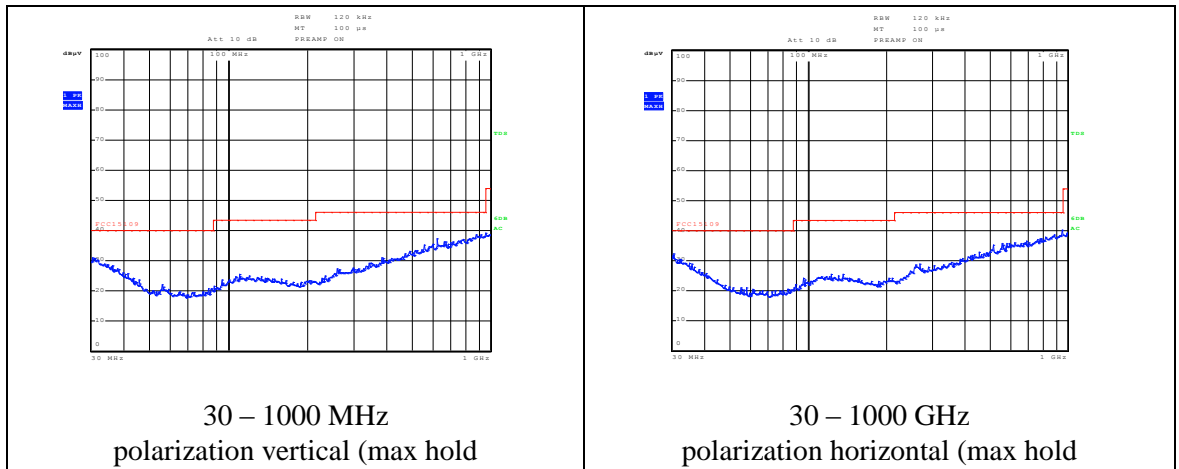
Low channel (2402 MHz)



Mid channel (2440 MHz)



High channel (2480 MHz)



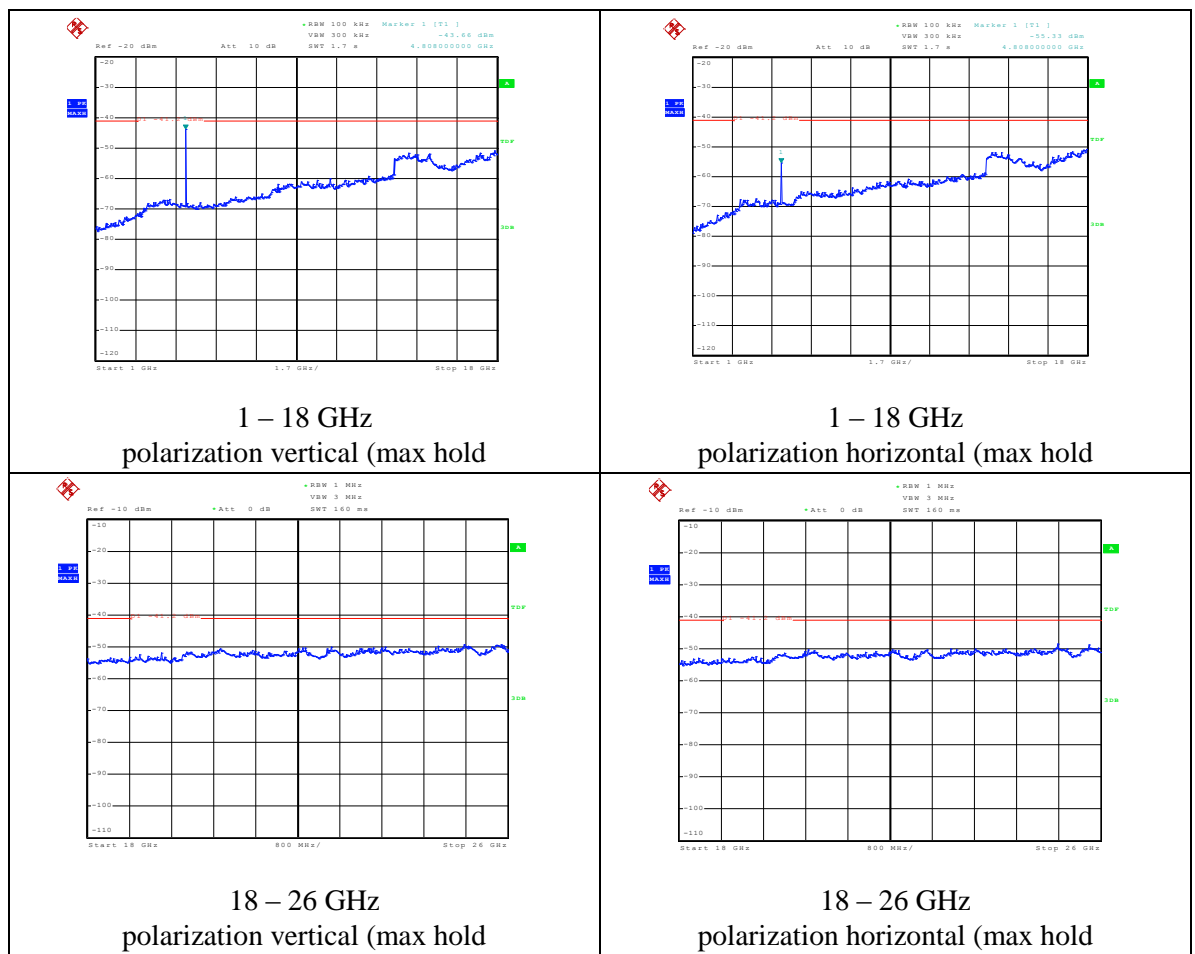
Measurement uncertainty	Vertical polarisation:	
	30 – 200 MHz	5.4 dB
	200 -1000 MHz	4.6 dB
	Horizontal polarisation:	
	30 – 200 MHz	4.5 dB
	200 -1000 MHz	3.6 dB

Measurement equipment used (item numbers refer to section “used test equipment”)	34, 36, 43, 50, 51
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2.8 Field strength of spurious emissions > 1000 MHz (2.4 GHz)

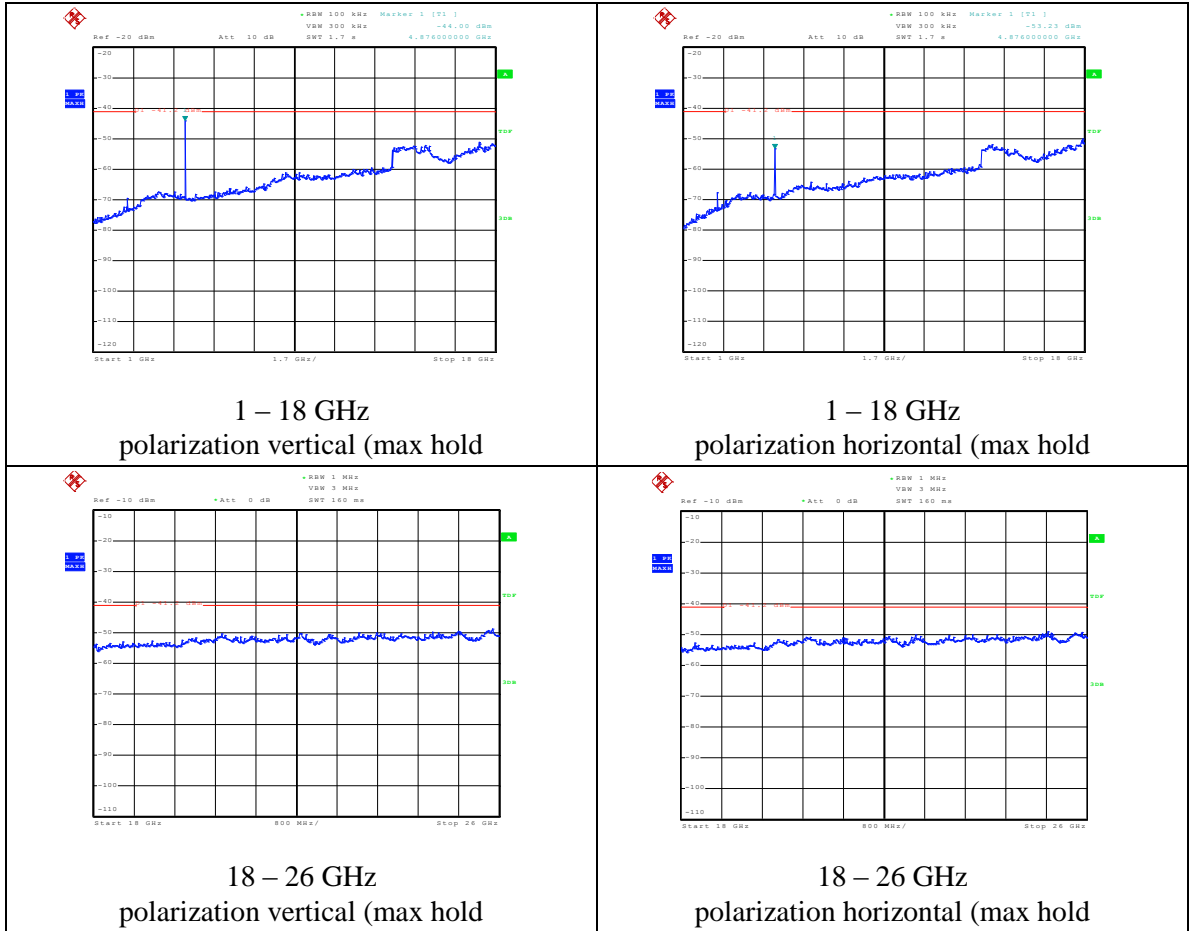
Compliance standard : FCC part 15, subpart C, section 15.205 (a), (b) & (c), 15.209 (a), 15.231(b) & 15.249 (a) & (e)
 Method of test : FCC part 15, subpart A, section 15.31(m), 15.33, 15.35.
 ANSI C63.10: 2009, sections 6.6, 7.5
 EUT condition : Continuously transmitting in the 2.4 GHz band
 Test results :

Low channel (2402 MHz)



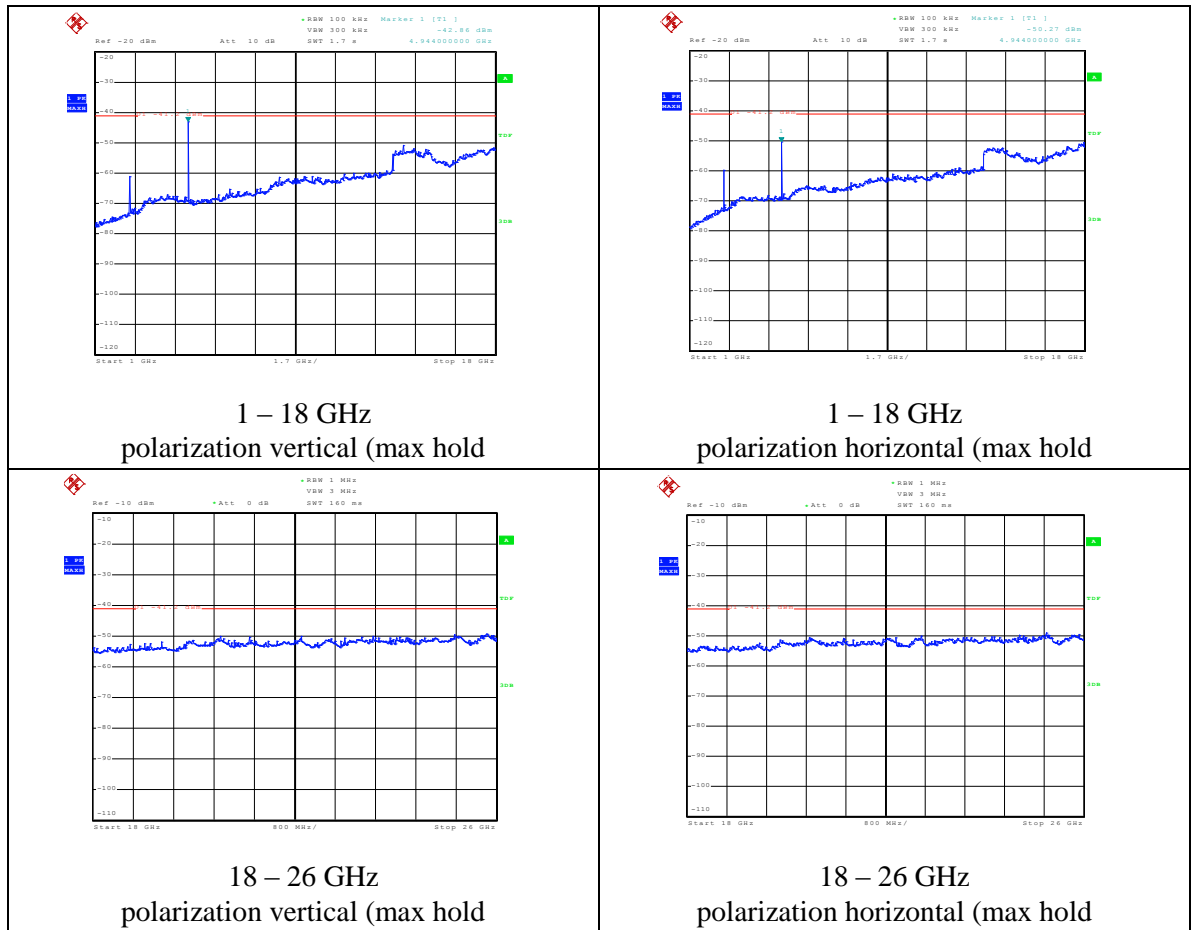
Note: The formula for conversion from power to field strength at 3 meter distance is:
 $FS (dB\mu V/m) = EIRP (dBm) + 99.2 \text{ dB}$.

Mid channel (2440 MHz)



Note: The formula for conversion from power to field strength at 3 meter distance is:
 $FS \text{ (dB}\mu\text{V/m)} = \text{EIRP (dBm)} + 99.2 \text{ dB.}$

High channel (2480 MHz)



Note: The formula for conversion from power to field strength at 3 meter distance is:
 $FS \text{ (dB}\mu\text{V/m)} = \text{EIRP (dBm)} + 99.2 \text{ dB.}$

Peak field strength of harmonics:

Frequency (GHz)	Test result dBm (eirp)	Test result @ 3 m distance (dB μ V/m)	Polarisation	Limit (dB μ V/m)
4.808	-43.66	55.54	V	74
4.808	-55.33	43.87	H	74
4.876	-44.00	55.20	V	74
4.876	-53.22	45.98	H	74
4.944	-42.86	56.34	V	74
4.944	-50.27	48.93	H	74

Note: Only peak power was measured. The formula for conversion from power to field strength at 3 meter distance is:

$$FS \text{ (dB}\mu\text{V/m)} = \text{EIRP (dBm)} + 99.2 \text{ dB.}$$

Average field strength of harmonics:

Frequency (GHz)	Test result dBm (eirp)	Duty cycle correction factor (dB)	Test result @ 3 m distance (dB μ V/m)	Polarisation V/H	Limit (dB μ V/m)
4.808	-43.66	6	49.54	V	54
4.808	-55.33	6	37.87	H	54
4.876	-44.00	6	49.20	V	54
4.876	-53.22	6	39.98	H	54
4.944	-42.86	6	50.34	V	54
4.944	-50.27	6	42.93	H	54

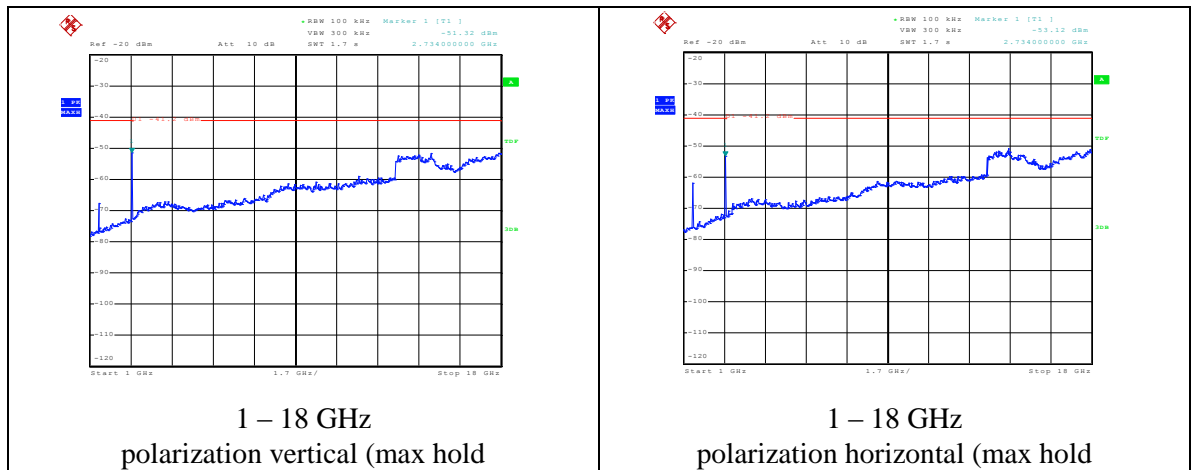
Measurement uncertainty	+4.5/-6.1 dB
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Measurement equipment used (item numbers refer to section "used test equipment")	2, 24, 31, 42, 45, 47, 48, 49.
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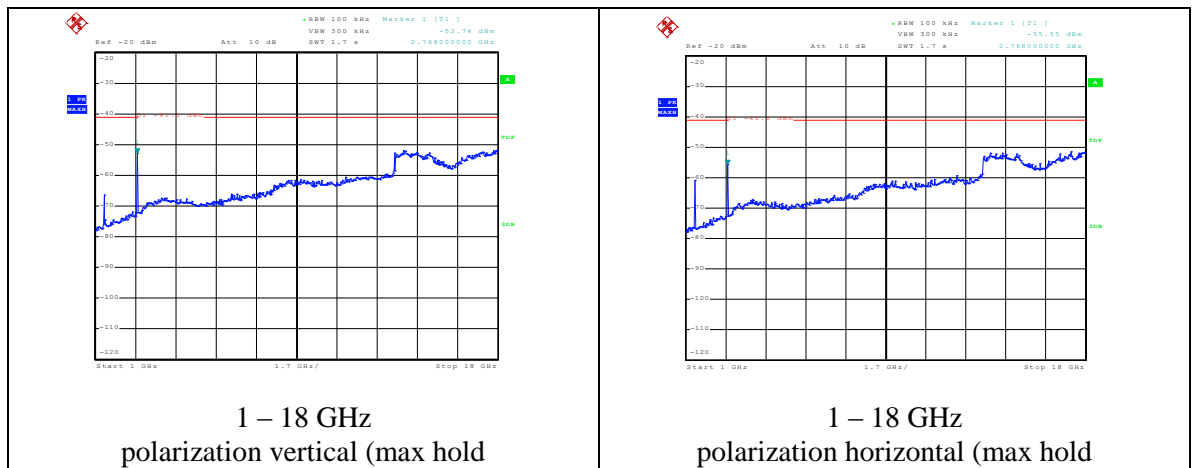
Compliance standard : FCC part 15, subpart C, section 15.109 (a)
 Method of test : FCC part 15, subpart A, section 15.31(m), 15.33, 15.35.
 ANSI C63.10: 2009, sections 6.6, 7.5
 EUT condition : Continuously receiving in the 2.4 GHz band
 Test results :

Unwanted emissions receiver (peak values)

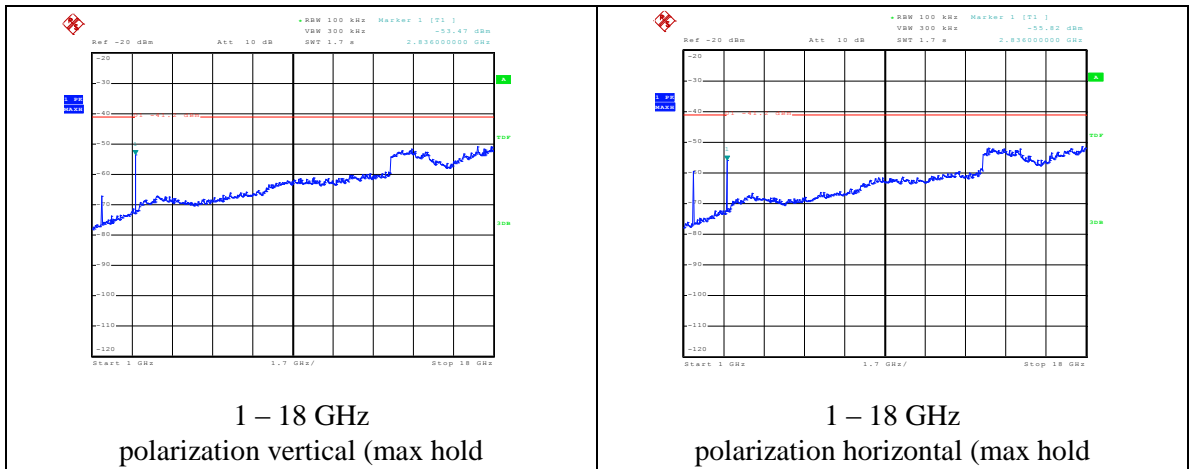
Low channel (2402 MHz)



Mid channel (2440 MHz)



High channel (2480 MHz)



Note: Only peak power was measured. The formula for conversion from power to field strength is: $FS \text{ (dB}\mu\text{V/m)} = \text{EIRP (dBm)} + 99.2 \text{ dB}$.

Measurement uncertainty	+4.5/-6.1 dB
Measurement equipment used (item numbers refer to section “used test equipment”)	2, 24, 31, 42, 45, 47, 48, 49.

Used test equipment module

Item	Description	Manufacturer	Type	ID
1	Signal generator	Marconi	2042	TE 00030
2	Preamplifier 1 – 26.5 GHz	HP	8449B	TE 00092
3	Preamplifier 1 – 26.5 GHz	HP	8449B	TE 00093
4	Pre-amplifier 10 dB	R & S	ESV-Z3	TE 00097
5	Pre-amplifier 10 dB	R & S	ESV-Z3	TE 00098
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7	Microwave amplifier	HP	HP8349A	TE 00124
8	Digital multimeter	HP	34401A	TE 00143
9	Digital multimeter	HP	3438A	TE 00215
10	Step attenuator	HP	8494A	TE 00233
11	Step attenuator	HP	8496A	TE 00234
12	Power sensor	HP	8484A	TE 00245
13	Power meter	HP	435B	TE 00249
14	Power meter	HP	437B	TE 00354
15	Power sensor	HP	8481A	TE 00355
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17	Audio analyzer	HP	8903A	TE 00373
18	Signal generator	Marconi	2042	TE 00379
19	Digital thermometer	Fluke	51	TE 00388
20	Step attenuator	HP	8491A	TE 00403
21	Signal generator	HP	8642B	TE 00424
22	Signal generator	Marconi	2042	TE 00427
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24	Horn antenna	EMCO	3115	TE 00531
25	Horn antenna	EMCO	3116	TE 00533
26	Biconilog antenna	EMCO	3143	TE 00700
27	Climate chamber	CTS	C-40/350	TE 00741
28	Active loop antenna	R & S	HFH2-Z2	TE 00746

Item	Description	Manufacturer	Type	ID
29	Horn antenna	Quinstar	QWH-1900-AA	TE 00747
30	Step attenuator	HP	8491A	TE 00787
31	Standard gain horn	Flann	20240-25	TE 00818
32	Power supply for amplifier	R & S	HZ-9	TE 00830
33	Power supply	Delta Elektronika	E030-1	TE 00851
34	Semi Anechoic Room	Comtest	--	TE 00861
35	Power supply	Delta Elektronika	MST030-10	TE 00886
36	Biconilog antenna	Chase	CBL6112A	TE 00967
37	Anechoic chamber	Euroshield	RFB-F-100	TE 01064
38	Triple loop antenna	Telefication	--	TE 01066
39	Temp / RH logger	ATAL	EPD-TRH-EMT	TE 01228
40	Broadband resistive power divider	Weinschel	1506A	TE 01120
41	Broadband resistive power divider	Weinschel	1506A	TE 01122
42	Spectrum analyser	R & S	FSP 40	TE 11125
43	EMI test receiver	R & S	ESCI	TE 11128
44	Radio Communication Service Monitor	R & S	CMS54	TE 11129
45	Pre-amplifier	Miteq	JS4-18004000	TE 11131
46	Low noise amplifier	Miteq	AFS42-041001800	TE 11132
47	Antenna tower	Heinrich Deisel	AS 620P	ANEC
48	Turntable	Heinrich Deisel	DS-412	ANEC
49	Turntable controller	Heinrich Deisel	HD-050	ANEC
50	Antenna mast	EMCO	1070	SAR
51	Turn table	EMCO	1060-2M	SAR
52	Near field probe	--	--	--
53	Highpass Filter	Wainwright	WHKX 3.0/18G-10EF	TE 01140
54	Standard Gain Horn	SA	12A-26	TE 00609
55	Artificial Mains Network	R & S	ESH3-Z5	TE 00208
56	Pulse limiter	R & S	ESH3-Z2	TE 00756

Revision history

REVISION	DATE	REMARKS	REVISED BY
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