



Test report No:
NIE: 63588RRF.002

Test report

USA FCC Part 15.249, 15.209

CANADA RSS-210, RSS-Gen

Radio Frequency Devices. Operation within the bands 902 - 928 MHz,
2400 -2483.5 MHz, and 5725 - 5850 MHz.

(*) Identification of item tested	Hearing aid
(*) Trademark	Phonak
(*) Model and /or type reference	Phonak Audéo P90-13T
(*) Derived model not tested	Phonak Audéo P90-312
Other identification of the product	HW version: 050-0770 SW version: 067-0438 FCC ID: KWC-MZP IC: 2262A-MZP
(*) Features	BT Classic, BLE, DM and Flora
Applicant	FCC: SONOVA USA INC. 4520 Weaver Parkway, 60555 Warrenville, IL, USA. IC: PHONAK CANADA LTD. 80 Courtneypark Dr West, Unit 1, Mississauga, ON, L5W 0B3, Canada.
Test method requested, standard	USA FCC Part 15.249 (10-1-18 Edition): Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, 5725 - 5875 MHz, and 24.0 – 24.25 GHz. USA FCC Part 15.209 (10-1-18 Edition): Radiated emission limits; general requirements. CANADA RSS-210 Issue 10 (December 2019). CANADA RSS-Gen Issue 5 (April 2018). ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Approved by (name / position & signature)	Rafael López Martín EMC Consumer & RF Lab. Manager  RAFAEL LÓPEZ MARTÍN 2020.04.07 08:17:05 +02'00'
Date of issue	2020-04-06
Report template No	FDT08_22 (*) "Data provided by the client"

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Competences and guarantees

DEKRA Testing and Certification S.A.U. is a testing laboratory accredited by the National Accreditation Body (ENAC -Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

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DEKRA Testing and Certification is an ISED-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report.

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The results presented in this Test Report apply only to the particular item under test established in this document.

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4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification S.A.U. and the Accreditation Bodies.

Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample of the model Mozart RIC 13T is a Hearing aid with wireless connectivity.
3. Derived model not tested. These models have been declared by the supplier of the sample as being the same as the model under test.

Date 10. March 2020

sonova
HEAR THE WORLD

To whom this may concern,

We, Sonova AG, hereby declare under our own responsibility that the products listed below have no differences in safety relevant design and no differences in the design of the radiofrequency relevant parts of the product (same radio chip, same antenna)

- Phonak Audéo P90-13T
- Phonak Audéo P90-312

The only difference between these three products is that the Phonak Audéo P90-312 has no telecoil mounted and is operated with a 312 size Zinc Air battery instead of size 13.

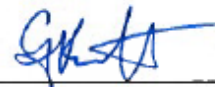
The schematic, PCB layout and block diagram of the devices are described in the technical construction files with the document ID:

- Phonak Audéo P90-13T: PDL-515
- Phonak Audéo P90-312: PDL-514

Faithfully,
2020.03.10 Stäfa



Laurent Vicari
Director Quality Management
& Regulatory Affairs



Glenn Borrett
Senior Regulatory Affairs Manager

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples undergoing test have been selected by: The client.

- Sample M/01 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
63588B/001	Hearing aid	Phonak Audéo P90-13T	--	2020/02/06

Sample M/01 has undergone the following test(s): All the Conducted tests indicated in Appendixes A, B, C, D.

- Sample M/02 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
63588B/004	Hearing aid	Phonak Audéo P90-13T	--	2020/02/06

Sample M/02 has undergone the following test(s): All the Radiated tests indicated in Appendixes A, B, C, D.

Test sample description

Ports..... :	Port name and description	Cable			
		Specified max length [m]	Attached during test	Shielded	Coupled to patient ⁽³⁾
	N/A		☐	☐	☐
Supplementary information to the ports..... :	-				
Rated power supply	Voltage and Frequency				
	☒	DC: Vnom : 1.4V Zinc Air Battery			
Rated Power	-				
Clock frequencies	-				
Other parameters..... :	-				
Software version	067-0438				
Hardware version..... :	050-0770				
Dimensions in cm (W x H x D).... :	-				
Mounting position..... :	☒	Other: Hearing Aid			

Modules/parts	Module/parts of test item	Type	Manufacturer
	N/A		
Accessories (not part of the test item)	Description	Type	Manufacturer
	N/A		
Documents as provided by the applicant.....	Description	File name	Issue date
	-		

Identification of the client

SONOVA AG
 Laubisruetistrasse 28, 8712 Staefa, Switzerland

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2020-02-14
Date (finish)	2020-02-18

Document history

Report number	Date	Description
63588RRF.002	2020-04-06	First release

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 35 %

Remarks and comments

The tests have been performed by the technical personnel: Nicolás Salguero, José Carlos Moreno, Cristina Calle.

Used instrumentation:

Conducted Measurements:

		Last Calibration	Due Calibration
1.	Shielded Room ETS LINDGREN S101	N.A.	N.A.
2.	Signal and Spectrum Analyzer 10 Hz - 40 GHz ROHDE AND SCHWARZ FSV40	2019/09	2021/09

Radiated Measurements:

		Last Calibration	Due Calibration
1.	Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N.A.	N.A.
2.	EMI Test Receiver ROHDE AND SCHWARZ ESR7	2019/10	2021/10
	Signal and Spectrum Analyzer 10Hz – 40GHz ROHDE AND SCHWARZ FSV40	2019/10	2021/10
3.	RF Pre-amplifier 40 dB, 10 MHz-6 GHz BONN ELEKTRONIK BLNA 0160-01N	2019/02	2020/08
4.	Biconical/Log Antenna ETS LINDGREN 3142E	2017/04	2020/04
5.	RF pre-amplifier 1-18 GHz Bonn Elektronik BLMA 0118-1M	2019/04	2020/04
6.	Broadband Horn antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2019/11	2022/11
7.	Broadband Horn antenna 18 - 40 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9170	2018/07	2021/07
8.	RF Pre-amplifier 30 dB, 18 GHz-40 GHz BONN ELEKTRONIK BLMA 1840-1M	2019/02	2021/02

Testing verdicts

Not applicable:	N/A
Pass:	P
Fail:	F
Not measured:	N/M

Summary

1. Bluetooth Low Energy

FCC PART 15 PARAGRAPH / RSS-210			
Requirement – Test case		Verdict	Remark
15.249 (a) / RSS-210 B.10 (a)	Field strength of fundamental and harmonic emissions	P	
15.249 (d) / RSS-210 B.10 (b)	Emissions radiated outside of the specific frequency bands	P	
<u>Supplementary information and remarks:</u> None.			

2. Bluetooth Basic Rate

FCC PART 15 PARAGRAPH / RSS-210			
Requirement – Test case		Verdict	Remark
15.249 (a) / RSS-210 B.10 (a)	Field strength of fundamental and harmonic emissions	P	
15.249 (d) / RSS-210 B.10 (b)	Emissions radiated outside of the specific frequency bands	P	
<u>Supplementary information and remarks:</u> None.			

3. Proprietary protocol DM 2.4 GHz

FCC PART 15 PARAGRAPH / RSS-210			
Requirement – Test case		Verdict	Remark
15.249 (a) / RSS-210 B.10 (a)	Field strength of fundamental and harmonic emissions	P	
15.249 (d) / RSS-210 B.10 (b)	Emissions radiated outside of the specific frequency bands	P	
<u>Supplementary information and remarks:</u> None.			

4. Proprietary protocol Flora 2.4 GHz

FCC PART 15 PARAGRAPH / RSS-210			
Requirement – Test case		Verdict	Remark
15.249 (a) / RSS-210 B.10 (a)	Field strength of fundamental and harmonic emissions	P	
15.249 (d) / RSS-210 B.10 (b)	Emissions radiated outside of the specific frequency bands	P	
<u>Supplementary information and remarks:</u> None.			

Appendix A: Test results. Bluetooth Low Energy

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15.249 (d) / RSS-210 B.10 (b) Emissions radiated outside of the specific frequency bands 17

TEST CONDITIONS

POWER SUPPLY (V) and ANTENNA:

V nominal: 1.4 Vdc
Type of Power Supply: DC Zinc Air Battery
Max. RF output power (e.i.r.p.): +0 dBm

Type of Antenna: Integral.
Declared Antenna Gain: -9.2 dBi

TEST FREQUENCIES:

Low Channel: 2402 MHz
Middle Channel: 2440 MHz
High Channel: 2480 MHz

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is connected to the spectrum analyser using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.



RADIATED MEASUREMENTS

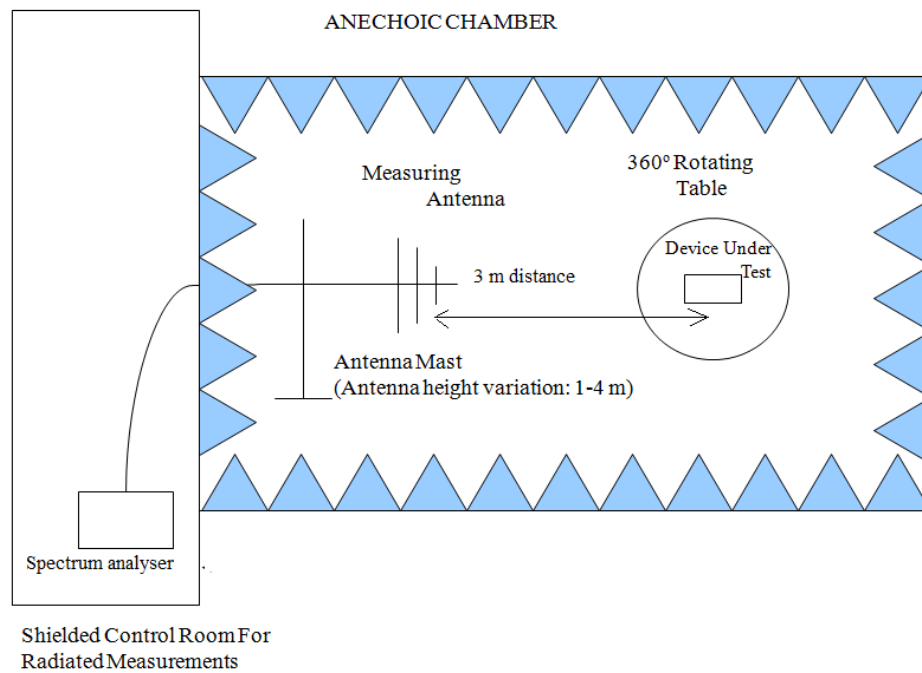
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1m for the frequency range 1 GHz-26 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

For radiated emissions in the range 1 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

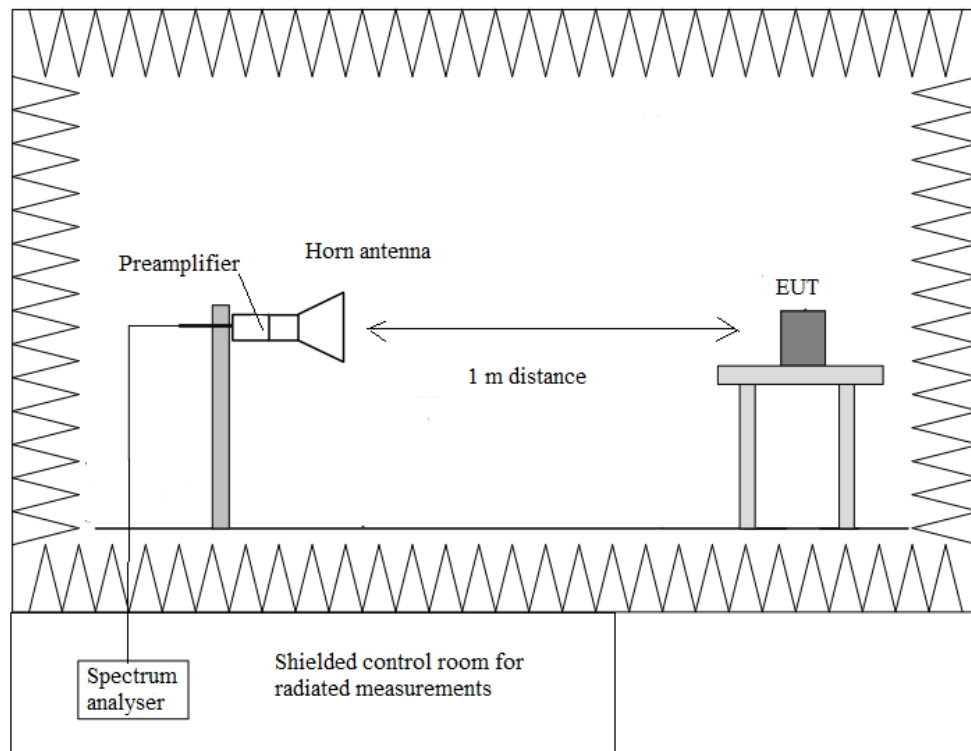
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

Radiated measurements setup $f < 1$ GHz:



Radiated measurements setup $f > 1$ GHz:



Occupied Bandwidth

RESULTS:

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
99% Bandwidth (MHz)	1.0251	1.0395	1.0578
Measurement Uncertainty (kHz)	<±5.00		

Verdict: PASS



<< SEE GRAPHICS IN THE ATTACHED FILE: 63588RRF002_Graphics.7z >>

15.249 (a) / RSS-210 B.10 (a) Field strength of fundamental and harmonics emissions

SPECIFICATION:

The field strength of emissions from intentional radiators shall comply with the following

Fundamental frequency (MHz)	Field strength of fundamental (mV/m)	Field strength (dBμV/m)	Measurement distance (m)
902 - 928	50	93.98	3
2400 – 2483.5	50	93.98	3
5725 - 5875	50	93.98	3
24000-24250	250	107.96	3

For frequencies above 1000 MHz, the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

RESULTS:

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Average Field Strength (dBμV/m)	80.32	85.64	83.41
Peak Field Strength (dBμV/m)	84.3	88.83	86.81
Measurement Uncertainty (dB)	<±3.05		

Verdict: PASS

<< SEE GRAPHICS IN THE ATTACHED FILE: 63588RRF002_Graphics.7z >>

15.249 (d) / RSS-210 B.10 (b) Emissions radiated outside of the specific frequency bands

SPECIFICATION:

The field strength of harmonics from intentional radiators shall comply with the following

Fundamental frequency (MHz)	Field strength of harmonics ($\mu\text{V/m}$)	Field strength of harmonics ($\text{dB}\mu\text{V/m}$)	Measurement distance (m)
902 - 928	500	54	3
2400 – 2483.5	500	54	3
5725 - 5875	500	54	3
24000-24250	2500	67.96	3

Emissions radiated outside of the specific frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of fundamental or to the general radiated emission limits specified in section 15.209:

Frequency Range (MHz)	Field strength ($\mu\text{V/m}$)	Field strength ($\text{dB}\mu\text{V/m}$)	Measurement distance (m)
0.009-0.490	$2400/F(\text{kHz})$	-	300
0.490-1.705	$24000/F(\text{kHz})$	-	30
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 25000	500	54	3

Whichever is the lesser attenuation.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-1000 MHz and at distance of 1m for the frequency range 1 GHz-26 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

RADIATED:

Frequency range 30 MHz - 1 GHz:

The spurious signals detected do not depend on the operating channel.

No spurious frequencies detected at less than 20 dB below the limit.

<< SEE GRAPHICS IN THE ATTACHED FILE: 63588RRF002_Graphics.7z >>

Frequency range 1 - 26 GHz:

The results in the next tables show the maximum measured levels in the 1-26 GHz range including the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz (see next plots).

Spurious signals with peak levels above the average limit (54 dB μ V/m at 3 m) are measured with average detector for checking compliance with the average limit.

- Low Channel (2402 MHz):

Spurious frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector	Measurement Uncertainty (dB)
4.80437	36.23	V	Peak	< $\pm$ 4.72
21.61981	44.93	H	Peak	< $\pm$ 3.34
24.02225	44.69	H	Peak	< $\pm$ 3.34

- Middle Channel (2440 MHz):

Spurious frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector	Measurement Uncertainty (dB)
4.87948	35.75	V	Peak	< $\pm$ 4.72
7.31931	39.47	V	Peak	< $\pm$ 4.72
21.96245	44.92	H	Peak	< $\pm$ 3.34
24.39749	43.55	H	Peak	< $\pm$ 3.34

- High Channel (2480 MHz):

Spurious frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector	Measurement Uncertainty (dB)
2.48352338	62.53	V	Peak	< $\pm$ 2.78
	36.88		Average	< $\pm$ 2.78
4.9593	38.44	V	Peak	< $\pm$ 4.72
22.31746	44.85	V	Peak	< $\pm$ 3.34
24.80225	46.68	H	Peak	< $\pm$ 3.34

Verdict: PASS

<< SEE GRAPHICS IN THE ATTACHED FILE: 63588RRF002_Graphics.7z >>

Appendix B: Test results. Bluetooth Basic Rate

TEST CONDITIONS	21
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15.249 (a) / RSS-210 B.10 (a) Field strength of fundamental and harmonics emissions	23
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TEST CONDITIONS

POWER SUPPLY (V) and ANTENNA:

V nominal: 1.4 Vdc
Type of Power Supply: DC Zinc Air Battery.
Max. RF output power (e.i.r.p.): +0 dBm

Type of Antenna: Integral.
Declared Antenna Gain: -9.2 dBi

TEST FREQUENCIES:

Low Channel: 2402 MHz
Middle Channel: 2441 MHz
High Channel: 2480 MHz

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is connected to the spectrum analyser using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.



RADIATED MEASUREMENTS

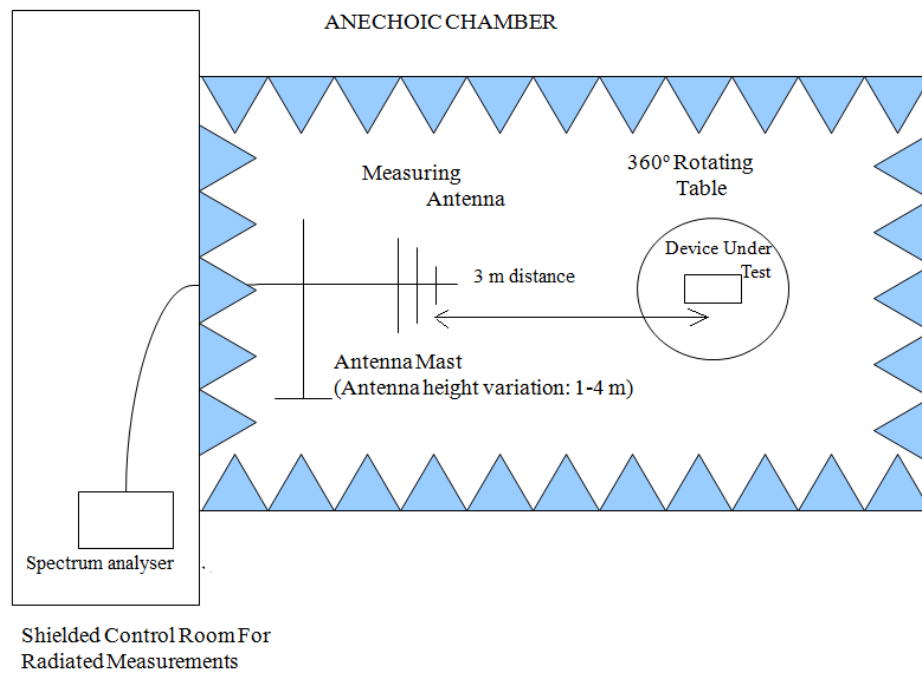
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1m for the frequency range 1 GHz-26 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

For radiated emissions in the range 1 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

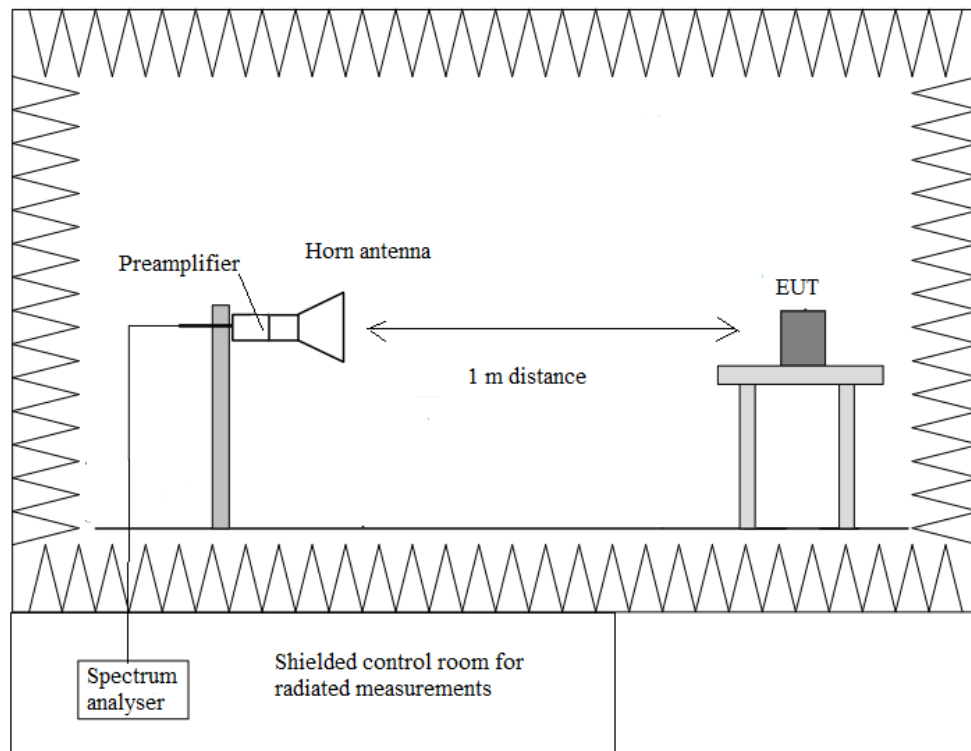
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

Radiated measurements setup $f < 1$ GHz:



Radiated measurements setup $f > 1$ GHz:



Occupied Bandwidth

RESULTS:

	Low Channel 2402 MHz	Middle Channel 2441 MHz	High Channel 2480 MHz
99% Bandwidth (MHz)	0.8724	0.8772	0.8736
Measurement Uncertainty (kHz)	<±5.00		

Verdict: PASS

<< SEE GRAPHICS IN THE ATTACHED FILE: 63588RRF002_Graphics.7z >>

15.249 (a) / RSS-210 B.10 (a) Field strength of fundamental and harmonics emissions

SPECIFICATION:

The field strength of emissions from intentional radiators shall comply with the following

Fundamental frequency (MHz)	Field strength of fundamental (mV/m)	Field strength (dBμV/m)	Measurement distance (m)
902 - 928	50	93.98	3
2400 – 2483.5	50	93.98	3
5725 - 5875	50	93.98	3
24000-24250	250	107.96	3

For frequencies above 1000 MHz, the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

RESULTS:

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Average Field Strength (dBμV/m)	82.89	87.82	85.96
Peak Field Strength (dBμV/m)	84.08	87.98	86.57
Measurement Uncertainty (dB)	<±3.05		

Verdict: PASS

<< SEE GRAPHICS IN THE ATTACHED FILE: 63588RRF002_Graphics.7z >>

15.249 (d) / RSS-210 B.10 (b) Emissions radiated outside of the specific frequency bands

SPECIFICATION:

The field strength of harmonics from intentional radiators shall comply with the following

Fundamental frequency (MHz)	Field strength of harmonics ($\mu\text{V/m}$)	Field strength of harmonics ($\text{dB}\mu\text{V/m}$)	Measurement distance (m)
902 - 928	500	54	3
2400 – 2483.5	500	54	3
5725 - 5875	500	54	3
24000-24250	2500	67.96	3

Emissions radiated outside of the specific frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of fundamental or to the general radiated emission limits specified in section 15.209:

Frequency Range (MHz)	Field strength ($\mu\text{V/m}$)	Field strength ($\text{dB}\mu\text{V/m}$)	Measurement distance (m)
0.009-0.490	$2400/F(\text{kHz})$	-	300
0.490-1.705	$24000/F(\text{kHz})$	-	30
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 25000	500	54	3

Whichever is the lesser attenuation.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-1000 MHz and at distance of 1m for the frequency range 1 GHz-26 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

RADIATED:

Frequency range 30 MHz - 1 GHz:

The spurious signals detected do not depend on the operating channel.

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Emission Level (dB μ V/m)	Polarization	Detector	Measurement Uncertainty (dB)
32.021	20.56	V	Quasi peak	< $\pm$ 3.81

<< SEE GRAPHICS IN THE ATTACHED FILE: 63588RRF002_Graphics.7z >>

Frequency range 1 - 26 GHz:

The results in the next tables show the maximum measured levels in the 1-26 GHz range including the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz (see next plots).

Spurious signals with peak levels above the average limit (54 dB μ V/m at 3 m) are measured with average detector for checking compliance with the average limit.

- Low Channel (2402 MHz):

Spurious frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector	Measurement Uncertainty (dB)
2.389324	47.9	V	Peak	< $\pm$ 2.78
4.8039	35.43	V	Peak	< $\pm$ 4.72
21.61925	46.62	V	Peak	< $\pm$ 3.34
24.02137	43.81	H	Peak	< $\pm$ 3.34

- Middle Channel (2440 MHz):

Spurious frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector	Measurement Uncertainty (dB)
4.88183	36.06	V	Peak	< $\pm$ 4.72
7.32316	38.27	V	Peak	< $\pm$ 4.72
21.96755	46.75	H	Peak	< $\pm$ 3.34
24.41129	45.18	H	Peak	< $\pm$ 3.34

- High Channel (2480 MHz):

Spurious frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector	Measurement Uncertainty (dB)
2.4857	57.47	V	Peak	< $\pm$ 2.78
	36.92		Average	< $\pm$ 2.78
2.48350633	62.81	V	Peak	< $\pm$ 2.78
	37.73		Average	< $\pm$ 2.78
2.48370873	62.42	V	Peak	< $\pm$ 2.78
	38.4		Average	< $\pm$ 2.78
2.48487788	59.87	V	Peak	< $\pm$ 2.78
	37.04		Average	< $\pm$ 2.78
2.48851252	55.59	V	Peak	< $\pm$ 2.78
	35.97		Average	< $\pm$ 2.78
4.96023	38.99	V	Peak	< $\pm$ 4.72
22.31855	45.4	H	Peak	< $\pm$ 3.34
24.80166	45.47	H	Peak	< $\pm$ 3.34

Verdict: PASS

<< SEE GRAPHICS IN THE ATTACHED FILE: 63588RRF002_Graphics.7z >>

Appendix C: Test results. Proprietary protocol DM 2.4 GHz

TEST CONDITIONS	30
Occupied Bandwidth	32
15.249 (a) / RSS-210 B.10 (a) Field strength of fundamental and harmonics emissions	33
15.249 (d) / RSS-210 B.10 (b) Emissions radiated outside of the specific frequency bands	34

TEST CONDITIONS

POWER SUPPLY (V) and ANTENNA:

V nominal: 1.4 Vdc
Type of Power Supply: DC Zinc Air Battery.
Max. RF output power (e.i.r.p.): 0 dBm

Type of Antenna: Integral.
Declared Antenna Gain: -9.2 dBi

TEST FREQUENCIES:

Low Channel: 2402 MHz
Middle Channel: 2440 MHz
High Channel: 2480 MHz

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is connected to the spectrum analyser using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.



RADIATED MEASUREMENTS

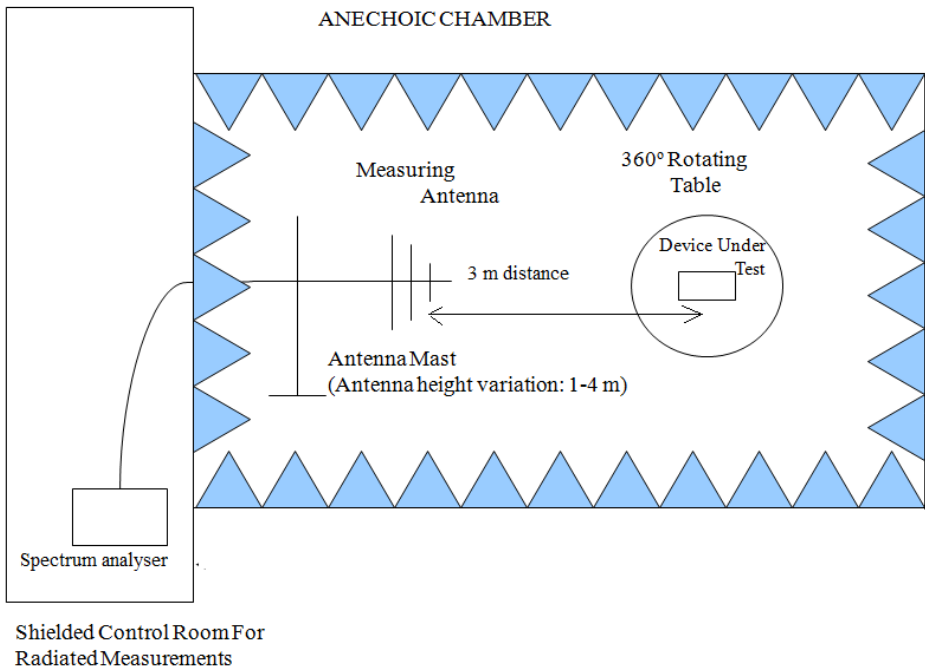
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1m for the frequency range 1 GHz-26 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

For radiated emissions in the range 1 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

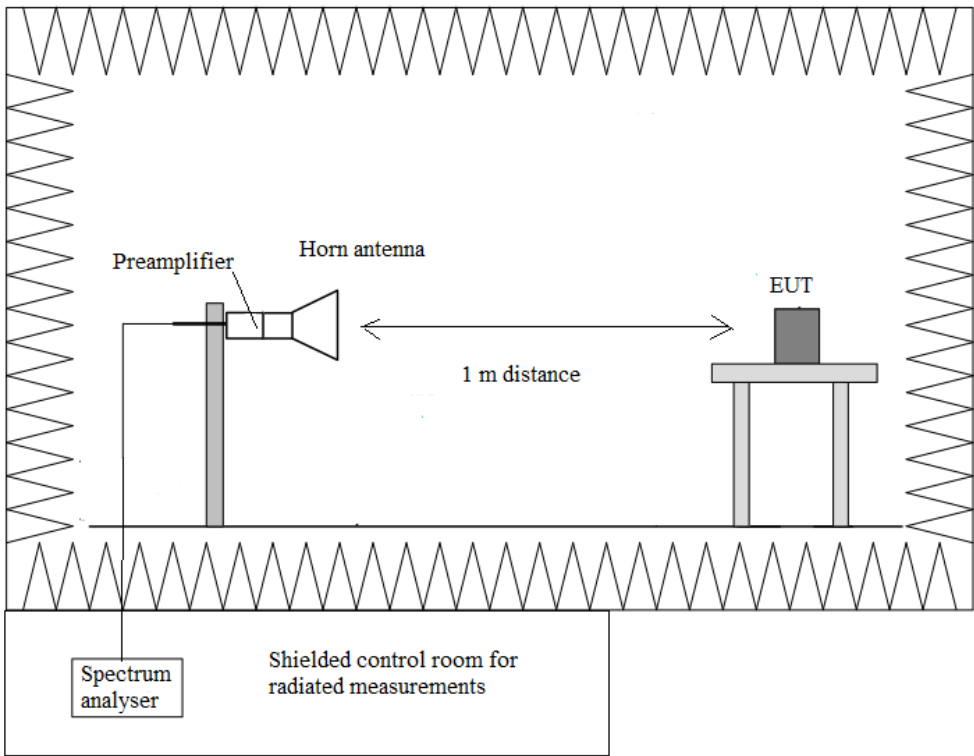
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

Radiated measurements setup $f < 1$ GHz:



Radiated measurements setup $f > 1$ GHz:



Occupied Bandwidth

RESULTS:

	Low Channel 2402 MHz	Middle Channel 2441 MHz	High Channel 2480 MHz
99% Bandwidth (MHz)	1.709	1.7095	1.7105
Measurement Uncertainty (kHz)	<±5.00		

Verdict: PASS

<< SEE GRAPHICS IN THE ATTACHED FILE: 63588RRF002_Graphics.7z >>

15.249 (a) / RSS-210 B.10 (a) Field strength of fundamental and harmonics emissions

SPECIFICATION:

The field strength of emissions from intentional radiators shall comply with the following

Fundamental frequency (MHz)	Field strength of fundamental (mV/m)	Field strength (dBμV/m)	Measurement distance (m)
902 - 928	50	93.98	3
2400 – 2483.5	50	93.98	3
5725 - 5875	50	93.98	3
24000-24250	250	107.96	3

For frequencies above 1000 MHz, the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

RESULTS:

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Average Field Strength (dBμV/m)	82.37	86.15	85.85
Peak Field Strength (dBμV/m)	83	86.44	86.23
Measurement Uncertainty (dB)	<±3.05		

Verdict: PASS

<< SEE GRAPHICS IN THE ATTACHED FILE: 63588RRF002_Graphics.7z >>

15.249 (d) / RSS-210 B.10 (b) Emissions radiated outside of the specific frequency bands

SPECIFICATION:

The field strength of harmonics from intentional radiators shall comply with the following

Fundamental frequency (MHz)	Field strength of harmonics ($\mu\text{V/m}$)	Field strength of harmonics ($\text{dB}\mu\text{V/m}$)	Measurement distance (m)
902 - 928	500	54	3
2400 – 2483.5	500	54	3
5725 - 5875	500	54	3
24000-24250	2500	67.96	3

Emissions radiated outside of the specific frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of fundamental or to the general radiated emission limits specified in section 15.209:

Frequency Range (MHz)	Field strength ($\mu\text{V/m}$)	Field strength ($\text{dB}\mu\text{V/m}$)	Measurement distance (m)
0.009-0.490	$2400/F(\text{kHz})$	-	300
0.490-1.705	$24000/F(\text{kHz})$	-	30
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 25000	500	54	3

Whichever is the lesser attenuation.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-1000 MHz and at distance of 1m for the frequency range 1 GHz-26 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

RADIATED:

Frequency range 30 MHz - 1 GHz:

The spurious signals detected do not depend on the operating channel.

No spurious frequencies detected at less than 20 dB below the limit.

<< SEE GRAPHICS IN THE ATTACHED FILE: 63588RRF002_Graphics.7z >>

Frequency range 1 - 26 GHz:

The results in the next tables show the maximum measured levels in the 1-26 GHz range including the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz (see next plots).

Spurious signals with peak levels above the average limit (54 dB μ V/m at 3 m) are measured with average detector for checking compliance with the average limit.

- Low Channel (2402 MHz):

Spurious frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector	Measurement Uncertainty (dB)
2.388347	47.22	V	Peak	< $\pm$ 2.78
2.3496013	47.48	H	Peak	< $\pm$ 2.78
4.80343	35.11	V	Peak	< $\pm$ 4.72
21.62075	44.47	H	Peak	< $\pm$ 3.34
24.01747	44.45	H	Peak	< $\pm$ 3.34

- Middle Channel (2440 MHz):

Spurious frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector	Measurement Uncertainty (dB)
4.8809	35.68	V	Peak	< $\pm$ 4.72
7.315	39.11	V	Peak	< $\pm$ 4.72
21.95705	44.27	H	Peak	< $\pm$ 3.34
24.39719	44.36	H	Peak	< $\pm$ 3.34

- High Channel (2480 MHz):

Spurious frequency (GHz)	Emission Level (dBμV/m)	Polarization	Detector	Measurement Uncertainty (dB)
2.48384018	62.14	V	Peak	<±2.78
	37.61		Average	<±2.78
2.48386438	61.1	V	Peak	<±2.78
	38.06		Average	<±2.78
2.48425873	60.78	V	Peak	<±2.78
	36.73		Average	<±2.78
2.48562658	58.3	V	Peak	<±2.78
	36.66		Average	<±2.78
4.95977	38.2	V	Peak	<±4.72
22.32275	46.08	H	Peak	<±3.34
24.80278	46.13	H	Peak	<±3.34

Verdict: PASS

<< SEE GRAPHICS IN THE ATTACHED FILE: 63588RRF002_Graphics.7z >>

Appendix D: Test results. Proprietary protocol Flora 2.4 GHz

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TEST CONDITIONS

POWER SUPPLY (V) and ANTENNA:

V nominal: 1.4 Vdc
Type of Power Supply: DC Zinc Air Battery.
Max. RF output power (e.i.r.p.): 0 dBm

Type of Antenna: Integral.
Declared Antenna Gain: -9.2 dBi

TEST FREQUENCIES:

Low Channel: 2402 MHz
Middle Channel: 2440 MHz
High Channel: 2480 MHz

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is connected to the spectrum analyser using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.



RADIATED MEASUREMENTS

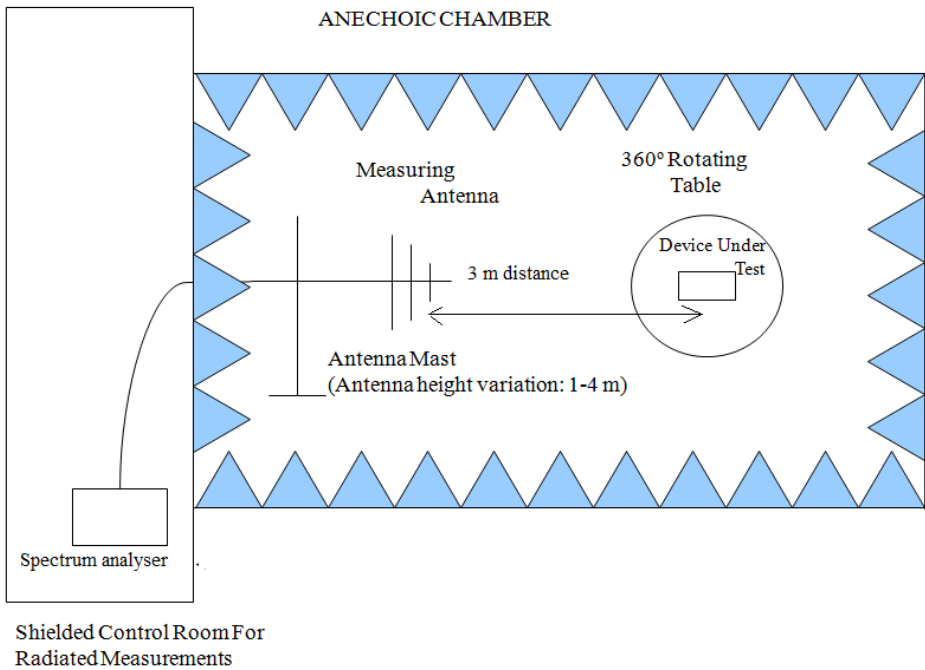
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1m for the frequency range 1 GHz-26 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

For radiated emissions in the range 1 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

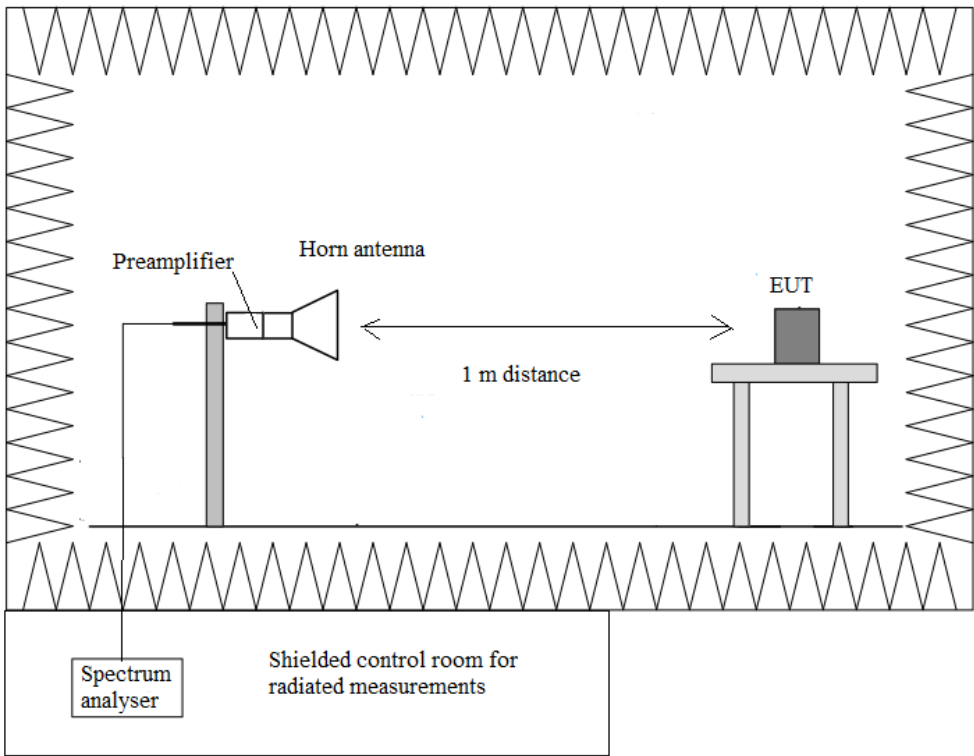
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

Radiated measurements setup $f < 1$ GHz:



Radiated measurements setup $f > 1$ GHz:



Occupied Bandwidth

RESULTS:

	Low Channel 2402 MHz	Middle Channel 2441 MHz	High Channel 2480 MHz
99% Bandwidth (MHz)	2.6635	2.6665	2.667
Measurement Uncertainty (kHz)	<±5.00		

Verdict: PASS

<< SEE GRAPHICS IN THE ATTACHED FILE: 63588RRF002_Graphics.7z >>

15.249 (a) / RSS-210 B.10 (a) Field strength of fundamental and harmonics emissions

SPECIFICATION:

The field strength of emissions from intentional radiators shall comply with the following

Fundamental frequency (MHz)	Field strength of fundamental (mV/m)	Field strength (dBμV/m)	Measurement distance (m)
902 - 928	50	93.98	3
2400 – 2483.5	50	93.98	3
5725 - 5875	50	93.98	3
24000-24250	250	107.96	3

For frequencies above 1000 MHz, the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

RESULTS:

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Average Field Strength (dBμV/m)	81.69	85.69	85.08
Peak Field Strength (dBμV/m)	82.51	86.26	85.68
Measurement Uncertainty (dB)	<±3.05		

Verdict: PASS

<< SEE GRAPHICS IN THE ATTACHED FILE: 63588RRF002_Graphics.7z >>

15.249 (d) / RSS-210 B.10 (b) Emissions radiated outside of the specific frequency bands

SPECIFICATION:

The field strength of harmonics from intentional radiators shall comply with the following

Fundamental frequency (MHz)	Field strength of harmonics ($\mu\text{V/m}$)	Field strength of harmonics ($\text{dB}\mu\text{V/m}$)	Measurement distance (m)
902 - 928	500	54	3
2400 – 2483.5	500	54	3
5725 - 5875	500	54	3
24000-24250	2500	67.96	3

Emissions radiated outside of the specific frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of fundamental or to the general radiated emission limits specified in section 15.209:

Frequency Range (MHz)	Field strength ($\mu\text{V/m}$)	Field strength ($\text{dB}\mu\text{V/m}$)	Measurement distance (m)
0.009-0.490	$2400/F(\text{kHz})$	-	300
0.490-1.705	$24000/F(\text{kHz})$	-	30
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 25000	500	54	3

Whichever is the lesser attenuation.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-1000 MHz and at distance of 1m for the frequency range 1 GHz-26 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

RADIATED:

Frequency range 30 MHz - 1 GHz:

The spurious signals detected do not depend on the operating channel.

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Emission Level (dBμV/m)	Polarization	Detector	Measurement Uncertainty (dB)
31.989	22.18	V	Quasi peak	<± 3.81

<< SEE GRAPHICS IN THE ATTACHED FILE: 63588RRF002_Graphics.7z >>

Frequency range 1 - 26 GHz:

The results in the next tables show the maximum measured levels in the 1-26 GHz range including the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz (see next plots).

Spurious signals with peak levels above the average limit (54 dBμV/m at 3 m) are measured with average detector for checking compliance with the average limit.

- Low Channel (2402 MHz):

Spurious frequency (GHz)	Emission Level (dBμV/m)	Polarization	Detector	Measurement Uncertainty (dB)
2.3784387	47.08	V	Peak	<±2.78
2.3367	47.07	H	Peak	<±2.78
4.80307	34.74	H	Peak	<±4.72
21.62364	43.8	H	Peak	<±3.34
24.01355	45.38	H	Peak	<±3.34

- Middle Channel (2440 MHz):

Spurious frequency (GHz)	Emission Level (dBμV/m)	Polarization	Detector	Measurement Uncertainty (dB)
4.87925	35.13	V	Peak	<±4.72
21.95468	44.84	H	Peak	<±3.34

- High Channel (2480 MHz):

Spurious frequency (GHz)	Emission Level (dBμV/m)	Polarization	Detector	Measurement Uncertainty (dB)
2.486767	55.09	V	Peak	<±2.78
	36.13		Average	<±2.78
2.48351238	61.88	V	Peak	<±2.78
	41.19		Average	<±2.78
2.48370873	62.45	V	Peak	<±2.78
	38.7		Average	<±2.78
2.48489948	58.96	V	Peak	<±2.78
	36.07		Average	<±2.78
2.48728067	55.75	V	Peak	<±2.78
	35.37		Average	<±2.78
4.96117	37.85	V	Peak	<±4.72
22.31465	47.32	H	Peak	<±3.34
24.793785	47.99	H	Peak	<±3.34

Verdict: PASS

<< SEE GRAPHICS IN THE ATTACHED FILE: 63588RRF002_Graphics.7z >>