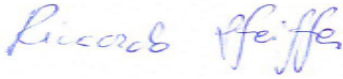


RAPPORTO DI PROVA

TEST REPORT

Rif. / Ref. n.	FCCTR_181667-0	Data Emissione / Issue Date:	28/10/2022	Pagine / Pages:	58
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Scopo delle prove <i>Test object</i>	Prove di tipo in accordo alla Norme <i>Type test according to Standards</i> 47 CFR FCC part 15 - Subpart C - §15.247 ISED – RSS 247				
Richiedente <i>Applicant</i>	Italtractor ITM S.p.a. Via confortino 30, 40053 Valsamoggia (BO) loc. Crespellano				
Marchio commerciale <i>Trade mark</i>					
Fabbricante <i>Manufacturer</i>	Italtractor ITM S.p.a. Via confortino 30, 40053 Valsamoggia (BO) loc. Crespellano				
Prodotto <i>Product</i>	Sensor BLE				
Modello testato <i>Testing model</i>	TCKT50000				
Identificativo FCC <i>FCC ID</i>	2A845000TCKTX				
Data ricevimento campioni <i>Date of test samples receipt</i>	30/06/2022				
Campioni verificati <i>No. of tested samples</i>	1 – Sampled by the applicant				
Data verifiche <i>Testing date</i>	From 07/07/2022 to 30/08/2022				
Sito di prova <i>Testing site</i>	PRSLAB S.r.l. Unipersonale - Via Campagna 92 - 22020 Faloppio - Como - Italy				
Identificativo FCC del sito di prova <i>FCC designation number</i>	IT0012				
Esito delle valutazioni <i>Assessment results</i>	CONFORME / COMPLIANT				
Verifiche effettuate da <i>Verifications carried out by</i>	Daniele AOSANI Tecnico Laboratorio <i>Laboratory Engineer</i>				
Approvato <i>Approved by</i>	Riccardo PFEIFFER Responsabile di Laboratorio <i>Laboratory Manager</i>				

The test results reported in this test report shall refer only to the samples tested.

The sample has been provided by the customer and the results apply to the sample as received

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PRSLAB refuses any responsibility about information provided by the customer contained in this test report.

CONTENUTO

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0. RELEASE CONTROL RECORD

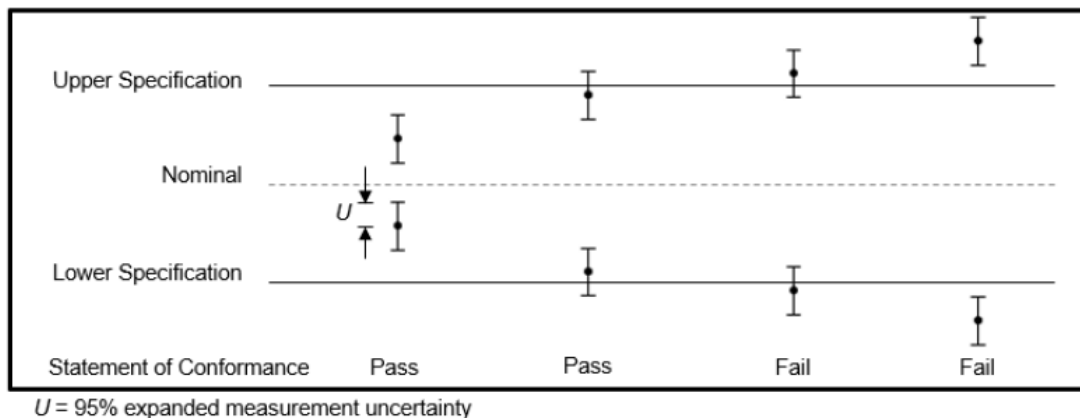
TEST REPORT NUMBER	REASON OF CHANGE	DATE OF ISSUE
FCCTR_181667-0	Original release	28/10/2022

This document is valid in last revision that deletes and replaces the previous one

1. DECISION RULE

PRs LAB specifies that, if the decision rules of conformity of the test results are not indicated in detail in the standard/s object of tests, it takes as a decision rule for the declaration of conformity the simple binary system ($w = 0$) stated in the ILAC-G8-09:2019 document.

The decision rule is applicable for all parts of standard



Statements of conformity are reported as:

- Pass: the measured value is below the acceptance limit, $AL=TL$.
- Fail: the measured value is above the acceptance limit, $AL=TL$.

Definitions

- Guard Band (w): interval between a tolerance limit and a corresponding acceptance limit where length $w=|TL-AL|$.
- Tolerance Limit (TL) (Specification Limit): specified upper or lower bound of permissible values of a property.
- Acceptance Limit (AL): specified upper or lower bound of permissible measured quantity values.

2. GENERAL REMARKS

- None

3. INFORMATION PROVIDED BY CUSTOMER

According to Manufacturer declaration, the tested model is the most representative and the most complex. The differences between the tested one and his variants are described in the table below and are declared by Manufacturer.

	Model	Microprocessor	Accelerometer	Battery	Resin	Shell type	Position	Magnet	Connector #1 & Pins number	Connector #2	NTC & len
Tested model	TCKT50050	nRF52811	✓	3V CR2450	Elan-tron_PU314_PH114	Rubber	Inside Roller	✗	2	✗	50 mm
Variant	TCKT00000	nRF52811	✗	3V CR2450	Elan-tron_PU314_PH114	Rubber	Inside Roller	✗	2	✗	✗
Variant	TCKT00050	nRF52811	✗	3V CR2450	Elan-tron_PU314_PH114	Rubber	Inside Roller	✗	2	✗	50 mm
Variant	TCKT00110	nRF52811	✗	3V CR2450	Elan-tron_PU314_PH114	Rubber	Inside Roller	✗	2	✗	110 mm
Variant	TCKT00170	nRF52811	✗	3V CR2450	Elan-tron_PU314_PH114	Rubber	Inside Roller	✗	2	✗	170 mm
Variant	TCKT00230	nRF52811	✗	3V CR2450	Elan-tron_PU314_PH114	Rubber	Inside Roller	✗	2	✗	230 mm
Variant	TCKT00260	nRF52811	✗	3V CR2450	Elan-tron_PU314_PH114	Rubber	Inside Roller	✗	2	✗	260 mm
Variant	TCKT10000	nRF52811	✗	3V CR2450	Elan-tron_PU314_PH114	Rubber	Inside Roller	✗	✗	✗	SMD
Variant	TCKT20000	nRF52811	✗	3V CR2450	Elan-tron_PU314_PH114	✗	Inside Roller	✗	✗	✗	SMD
Variant	TCKT30000	nRF52811	✓	3V CR2450	Elan-tron_PU314_PH114	Rubber	Inside Roller	✗	2	✗	✗
Variant	TCKT40000	nRF52811	✓	3V CR2450	Elan-tron_PU314_PH114	Rubber	Inside Roller	✗	2	✗	✗
Variant	TCKT50000	nRF52811	✓	3V CR2450	Elan-tron_PU314_PH114	Rubber	Inside Roller	✗	2	✗	✗
Variant	TCKT50110	nRF52811	✓	3V CR2450	Elan-tron_PU314_PH114	Rubber	Inside Roller	✗	2	✗	110 mm
Variant	TCKT50170	nRF52811	✓	3V CR2450	Elan-tron_PU314_PH114	Rubber	Inside Roller	✗	2	✗	170 mm
Variant	TCKT50230	nRF52811	✓	3V CR2450	Elan-tron_PU314_PH114	Rubber	Inside Roller	✗	2	✗	230 mm
Variant	TCKT50260	nRF52811	✓	3V CR2450	Elan-tron_PU314_PH114	Rubber	Inside Roller	✗	2	✗	260 mm
Variant	TCKT60000	nRF52811	✓	3V CR2450	Elan-tron_PU314_PH114	Rubber	Inside Roller	✗	3	2	✗
Variant	TCKT70000	nRF52811	✓	3V CR2450	Elan-tron_PU314_PH114	Aluminium	Outside Roller	✓	✗	2	35 mm
Variant	TCKT80000	nRF52811	✓	3V CR2450	Elan-tron_PU314_PH114	✗	Inside Roller	✗	✗	✗	✗
Variant	TCKT80050	nRF52811	✓	3V CR2450	Elan-tron_PU314_PH114	✗	Inside Roller	✗	✗	✗	50 mm
Variant	TCKT80110	nRF52811	✓	3V CR2450	Elan-tron_PU314_PH114	✗	Inside Roller	✗	✗	✗	110 mm
Variant	TCKT80170	nRF52811	✓	3V CR2450	Elan-tron_PU314_PH114	✗	Inside Roller	✗	✗	✗	170 mm
Variant	TCKT80230	nRF52811	✓	3V CR2450	Elan-tron_PU314_PH114	✗	Inside Roller	✗	✗	✗	230 mm
Variant	TCKT80260	nRF52811	✓	3V CR2450	Elan-tron_PU314_PH114	✗	Inside Roller	✗	✗	✗	260 mm
Variant	TCKT90000	nRF52811	✓	3V CR2450	Elan-tron_PU314_PH114	✗	Inside Roller	✗	✗	✗	35 mm

4. TECHNICAL INFORMATION OF EQUIPMENT UNDER TEST (EUT)

4.1 EUT Identification

DESCRIPTION	Sensor BLE
TESTED MODEL	TCKT50050
SERIAL NO.	Prototype
PRSLAB INTERNAL REFERENCE	BC 205/2022 2/3
TRADEMARK	
MANUFACTURER	Italtractor ITM S.p.a
COUNTRY OF MANUFACTURER	Italy
SINGLE UNIT OR SYSTEM	Single
POWER SOURCE	Internal battery (CR2450A, Lithium battery)
POWER SUPPLY NOMINAL VOLTAGE	3Vdc
BATTERY CAPACITY	560mAh
OPERATING TEMPERATURE	-40°C ÷ +85°C
MAX FREQUENCY	>1GHz
FIRMWARE VERSION (Information provided by Customer)	1.3V
DIMENSIONS	See photographic section.
EUT STANDING	Vehicle

4.2 Bluetooth Low Energy module technical data

CHIP MANUFACTURER	 NORDIC SEMICONDUCTOR
CHIP TYPE	nRF52811
ETS CATEGORY	Bluetooth Low Energy
FREQUENCY BAND	Unlicensed 2.4GHz ISM band at 2400-2483.5 MHz
NUMBER OF CHANNELS	40
CHANNEL BANDWIDTH	2MHz
CHANNEL SEPARATION	2MHz
TRANSFER RATE	1Mbps
SENSITIVITY	-97dBm
TYPE OF MODULATION	Frequency-shift Keying (FSK) modulation
ANTENNA	ACAG0301-2450-T
ANTENNA GAIN	5.19dBi
ANTENNA TYPE	SMD
ANTENNA MANUFACTURER	 ABRACON

4.2.1 Channel List Bluetooth Low Energy

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY	CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

4.3 Ports identification

	PORT	DESCRIPTION	CONNECTION	NOTES
☒	Enclosure	Plastic	Snaps	---
☐	AC Power input	Port not present	---	---
☐	DC Power input	Internal battery	---	---
☐	Signal/Control port	Port not present	---	---
☐	Telecomm. port	Port not present	---	---
☐	Antenna Port	Internal	---	---

Note:

During the tests all cables must be what provided the manufacturer or the same that used in the real employment of the EUT.

4.4 Modifications incorporated in E.U.T.

The following items are the modifications introduced in the equipment under test:

- None

4.5 Auxiliary equipment

- Laboratory laptop used to set BLE channels.

5. REFERENCE STANDARDS

CODE OF FEDERAL REGULATIONS	DESCRIPTION
Title 47 Part 15 Subpart C § 15.247	Radio Frequency Devices – Intentional Radiators Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz
ICES-003 Issue 7:2020	Information Technology Equipment (including Digital Apparatus)
ANSI C63.10:2013	American National Standard for Testing Unlicensed Wireless Devices

6. OPERATING TEST MODES AND TEST CONDITIONS

In the following table there are the operating conditions adopted during tests identified by an indicator (#) at which has been referred the item "Operating condition of the equipment under test"

OPERATING CONDITION	DESCRIPTION
#1	Continuous transmission, modulated carrier, on channel 0
#2	Continuous transmission, modulated carrier, on channel 12
#3	Continuous transmission, modulated carrier, on channel 39

7. SUMMARY OF TEST RESULTS

SUMMARY OF TEST RESULTS for Subpart C				
Port	Test ¹	Reference Standard	Operating Condition	Results
Enclosure	Transmitter radiated emissions	FCC Part 15 §15.205 §15.209 §15.247 (d)	#1, #2, #3	Within the limits
Antenna port	Antenna requirement	FCC Part 15 §15.203	---	Within the limits
	Maximum Peak Output Power	FCC Part 15 §15.247 (b) (3)	#1, #2, #3	Within the limits
	6 dB Bandwidth	FCC Part 15 §15.247 (a) (2)	#1, #2, #3	Within the limits
	Power Spectral Density	FCC Part 15 §15.247 (e)	#1, #2, #3	Within the limits
	Band-Edge	FCC Part 15 § 15.247 (d)	#1, #3	Within the limits
	RF radiated Spurious Emissions at the Transmitter Antenna Terminal	FCC Part 15 § 15.247 (d)	#1, #2, #3	Within the limits
Note: FCC classifies Bluetooth LE as a system using digital modulation techniques.				
¹ All tests are performed with the device in position shown in the photographic documentation.				

8. UNITS OF MEASUREMENTS

Conducted EMI Data is in dBμV; dB referenced to one microvolt

Radiated EMI Data is in dBμV/m; dB/m referenced to one microvolt per meter

Sample Calculation:

RFS = Radiated Field Strength,

FSM = Field Strength Measured,

A.F. = Receive antenna factor,

Gain = amplification gains and/or cable losses.

$$RFS \text{ (dB}\mu\text{V/m @ 3m)} = FSM \text{ (dB}\mu\text{V)} + A.F. \text{ (dB/m)} - \text{Gain (dB)}$$

9. TEST RESULTS

ANTENNA REQUIREMENTS	11
MAXIMUM PEAK OUTPUT POWER	12
6dB CHANNEL BANDWIDTH	15
BAND EDGE	19
POWER SPECTRAL DENSITY	21
RF RADIATED SPURIOUS EMISSIONS AT THE TRANSMITTER ANTENNA TERMINAL	24
TRANSMITTER RADIATED EMISSIONS < 1GHz	27
TRANSMITTER RADIATED EMISSIONS > 1GHz	38

TEST 1.	ANTENNA REQUIREMENTS
REFERENCE DOCUMENT	According to §15.203 / 15.204 An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sec. 15.211, Sec. 15.213, Sec. 15.217, Sec. 15.219, or Sec. 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Sec. 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded

Antenna Requirements
The EUT has an integrated chip antenna
RESULT: COMPLIANT

TEST 2.	MAXIMUM PEAK OUTPUT POWER
REFERENCE DOCUMENT	According to §15.247(b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

• TEST LOCATION	Semi-Anechoic Chamber					
• DISTANCE OF MEASUREMENT	3m					
• TYPE OF MEASUREMENT	Radiated					
• TEST EQUIPMENT USED FOR TEST	Instrument	Manufacturer	Model	Serial n°	Calibrated On	Due to
	Emi receiver	Rohde & schwarz	ESU40	100111	02/2022	02/2023
	Semi-Anechoic Chamber	Siemens	B83117-D6019-T232	003-005-134/94C	02/2021	02/2022
	Horn antenna	Electro Metrics	EM-6961	100437	10/2020	10/2023
	Software EMC	Rohde & Schwarz	EMC32-E	V 8.40.0	N.A.	
• TESTED PORT	Antenna					
• TEST METHOD	ANSI C63.10:2013 section 11.9					
• FREQUENCY RANGE	Carrier					
• UNCERTAINTY OF MEASURE	Level of confidence = 95% (k=2)					
	Expanded uncertainty = 3 dB					

TEST CONDITIONS	REQUIRED	MEASURED
Ambient temperature	23°C ± 5°C	24 °C
Ambient humidity	25 - 75%rH	45%
Pressure	85 - 106kPa (860mbar - 1060mbar)	960 mbar

OPERATING CONDITION: #1, #2, #3

RESULT: WITHIN THE LIMITS

MEASUREMENT PARAMETER

Resolution bandwidth	RBW $\geq$ DTS bandwidth
Video bandwidth	VBW $\geq$ 3 x RBW
Span	span $\geq$ 3 x RBW
Sweep time	Auto couple
Detector	Peak
Trace-Mode	Max. hold

TEST DESCRIPTION

Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously - rotating, remotely - controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency.

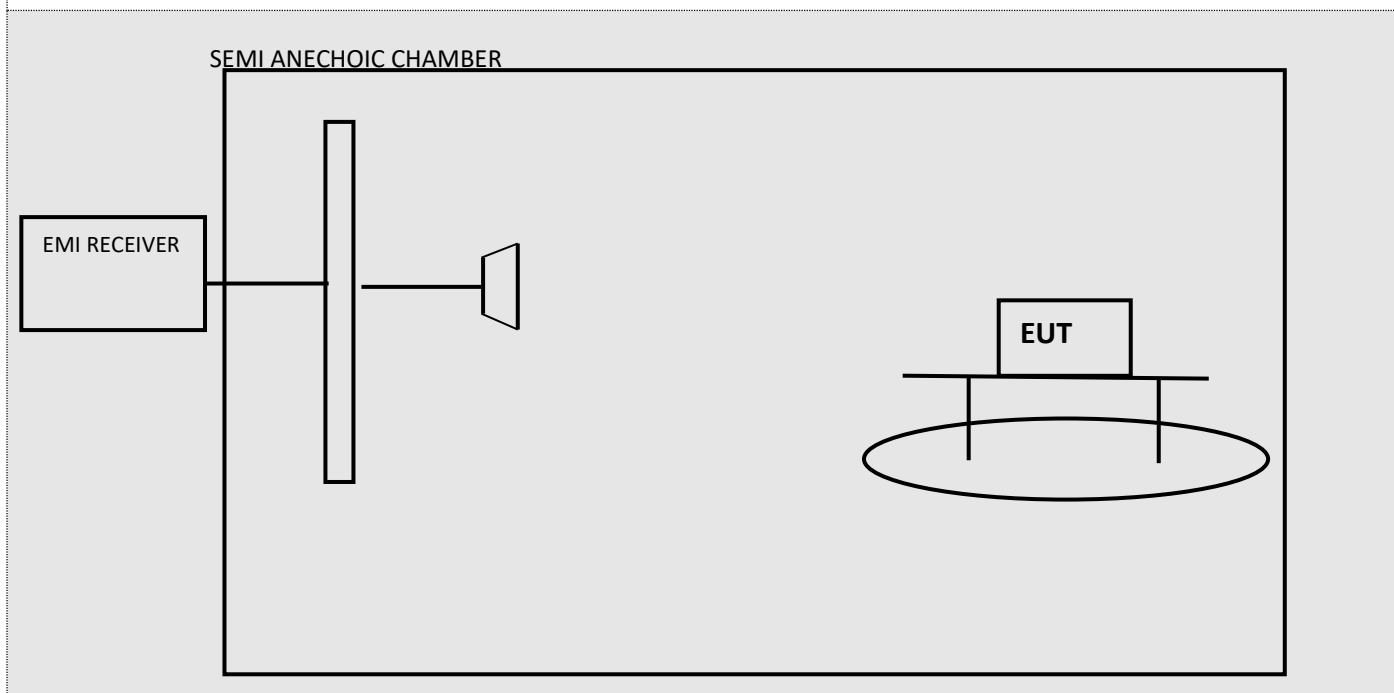
The EUT is placed at test table.

For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height is 1.5 m

Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m~4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3m.

This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

TEST SETUP BLOCK DIAGRAM



TEST RESULTS

Channel	Frequency (MHz)	EIRP (dBm)	Antenna Gain	Max Conducted Output power	Limit (dBm)	Result
0	2402	-4.93	5.19dBi	0.26	30	WITHIN THE LIMITS
12	2426	-4.08	5.19dBi	1.11		
39	2480	-2.94	5.19dBi	2.25		
Note: ---						

TEST 3.	6dB and OBW CHANNEL BANDWIDTH
REFERENCE DOCUMENT	According to §15,247(a)(II) & RSS 247 Issue 2:2017 § 5.2(a) Systems using digital modulation techniques may operate in the 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz bands, The minimum 6 dB bandwidth shall be at least 500 kHz.

• TEST LOCATION	Radio test area					
• TYPE OF MEASUREMENT	Radiated					
• TEST EQUIPMENT USED FOR TEST	Instrument	Manufacturer	Model	Serial n°	Calibrated On	Due to
	Emi receiver	Rohde & schwarz	ESU40	100111	02/2022	02/2023
• TESTED PORT	Antenna					
• TEST METHOD	ANSI C63.10:2013 section 6.9					
• FREQUENCY RANGE	Carrier					

TEST CONDITIONS	REQUIRED	MEASURED
Ambient temperature	23°C ± 5°C	24 °C
Ambient humidity	25 - 75%rH	45%
Pressure	85 - 106kPa (860mbar - 1060mbar)	960 mbar

OPERATING CONDITION: #1, #2, #3

RESULT: COMPLIANT

MEASUREMENT PARAMETER

Resolution bandwidth	100kHz
Video bandwidth	300kHz
Span	5MHz
Sweep time	Auto couple
Detector	Peak
Trace-Mode	Max. hold

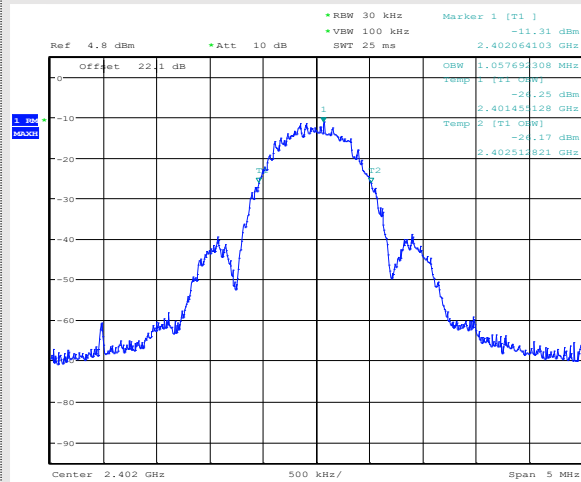
TEST DESCRIPTION

Allow the trace to stabilize.

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

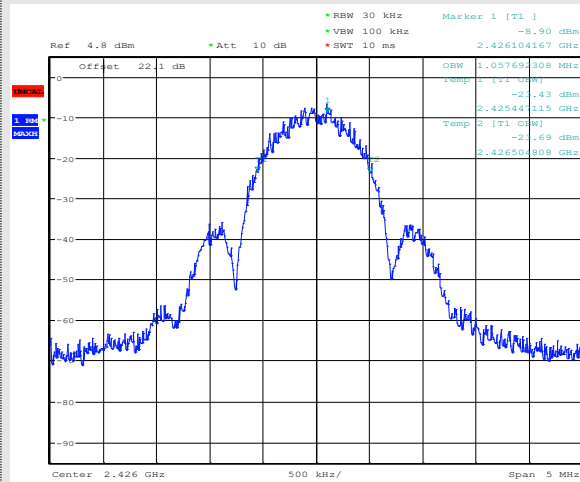
TEST RESULTS – 99% Occupied Bandwidth

Channel: 0



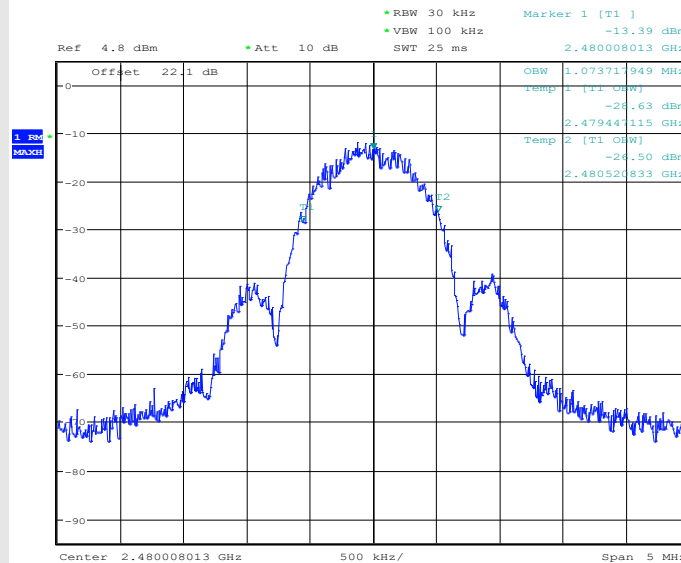
Date: 18.JUL.2022 16:49:39

Channel: 12



Date: 18.JUL.2022 16:44:43

Channel: 39



Date: 18.JUL.2022 16:47:55

TEST 4.	BAND EDGE
REFERENCE DOCUMENT	According to §15,247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Sec, 15,209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Sec, 15,205(a), must also comply with the radiated emission limits specified in Sec, 15,209(a) (see Sec, 15,205(c)).

• TEST LOCATION	Radio test area					
• TYPE OF MEASUREMENT	Radiated					
• TEST EQUIPMENT USED FOR TEST	Instrument	Manufacturer	Model	Serial n°	Calibrated On	Due to
	Emi receiver	Rohde & schwarz	ESU40	100111	02/2022	02/2023
• TESTED PORT	Antenna					
• TEST METHOD	ANSI C63.10:2013 section 6.10					
• FREQUENCY RANGE	Carrier					

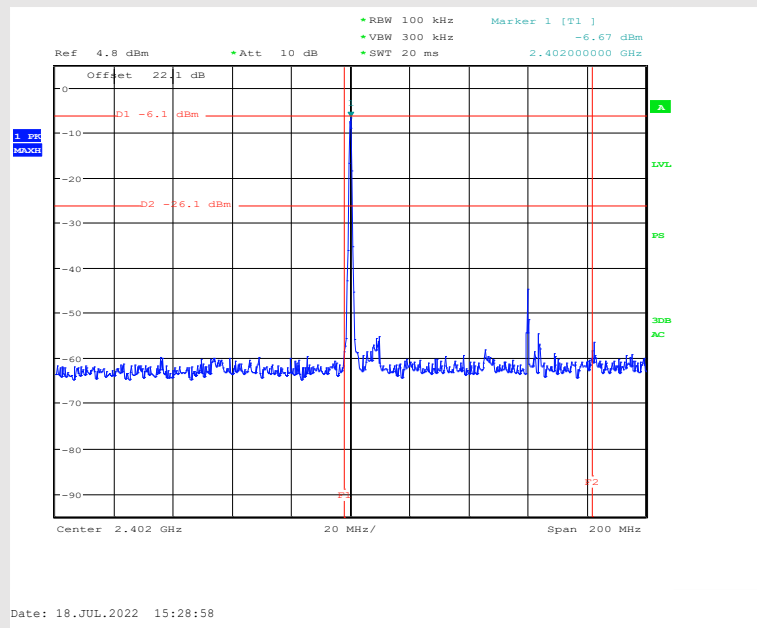
TEST CONDITIONS	REQUIRED	MEASURED
Ambient temperature	23°C ± 5°C	24 °C
Ambient humidity	25 - 75%rH	45%
Pressure	85 - 106kPa (860mbar - 1060mbar)	960 mbar

OPERATING CONDITION: #1, #2, #3

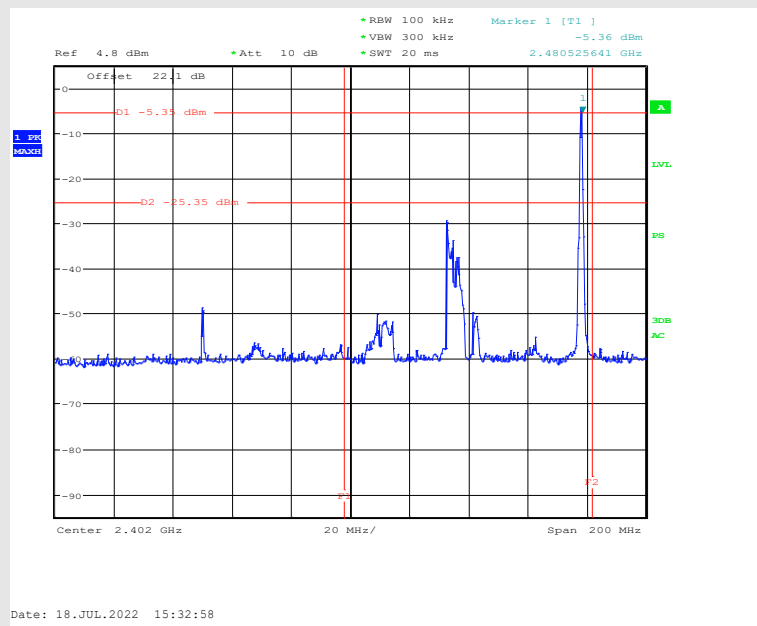
RESULT: COMPLIANT

TEST RESULTS

LOWER BAND-EDGE CH 0



UPPER BAND-EDGE CH 39



TEST 5.	POWER SPECTRAL DENSITY
REFERENCE DOCUMENT	According to §15,247) (e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

• TEST LOCATION	Radio test area					
• TYPE OF MEASUREMENT	Radiated					
• TEST EQUIPMENT USED FOR TEST	Instrument	Manufacturer	Model	Serial n°	Calibrated On	Due to
	Emi receiver	Rohde & schwarz	ESU40	100111	02/2022	02/2023
• TESTED PORT	Antenna					
• TEST METHOD	ANSI C63.10:2013 section 11.10					
• FREQUENCY RANGE	Carrier					

TEST CONDITIONS	REQUIRED	MEASURED
Ambient temperature	23°C ± 5°C	24 °C
Ambient humidity	25 - 75%rH	45%
Pressure	85 - 106kPa (860mbar - 1060mbar)	960 mbar

OPERATING CONDITION: #1, #2, #3

RESULT: COMPLIANT

MEASUREMENT PARAMETER

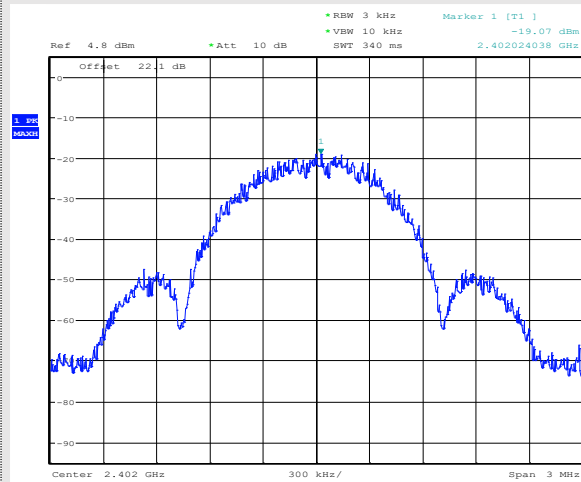
Resolution bandwidth	3kHz
Video bandwidth	10kHz
Span	2MHz
Sweep time	Auto couple
Detector	Peak
Trace-Mode	Max. hold

TEST DESCRIPTION

Allow trace to fully stabilize.
Use the peak marker function to determine the maximum amplitude level within the RBW.
If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat

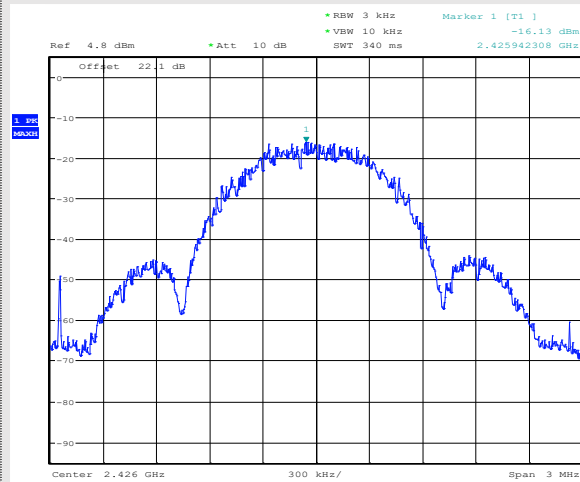
TEST RESULTS

Channel: 0



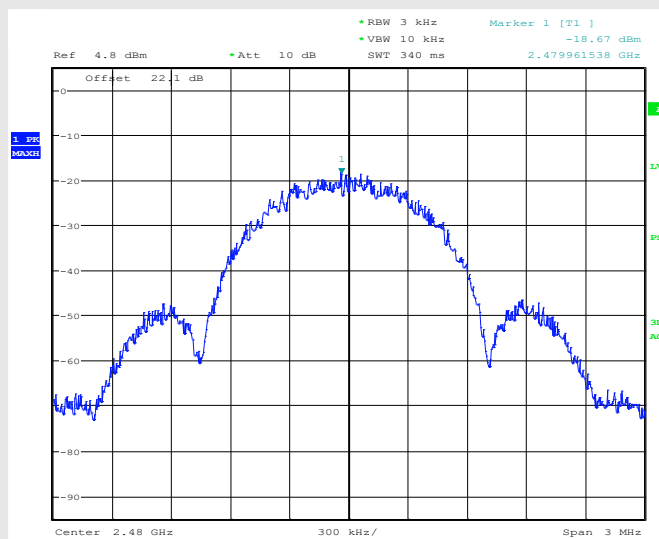
Date: 19.JUL.2022 09:58:41

Channel: 12



Date: 19.JUL.2022 10:02:19

Channel: 39



Date: 19.JUL.2022 10:04:37

Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)	Result
0	2402	-19.07	8	27.07	COMPLIANT
12	2426	-16.13	8	24.13	COMPLIANT
39	2480	-18.67	8	26.67	COMPLIANT

TEST 6.

RF RADIATED SPURIOUS EMISSIONS AT THE TRANSMITTER ANTENNA TERMINAL

REFERENCE DOCUMENT

According to § 15.247 (d) and § 15.209 (a)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 Db below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 Db instead of 20 Db. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

• TEST LOCATION	Radio test area					
• TYPE OF MEASUREMENT	Radiated					
• TEST EQUIPMENT USED FOR TEST	Instrument	Manufacturer	Model	Serial n°	Calibrated On	Due to
	Emi receiver	Rohde & schwarz	ESU40	100111	02/2022	02/2023
• TESTED PORT	Enclosure					
• TEST METHOD	ANSI C63.10:2013 section 6.5 and 6.6					
• FREQUENCY RANGE	9kHz – 1GHz					
• LIMITS	Acc. To ref. Std.					

TEST CONDITIONS	REQUIRED	MEASURED
Ambient temperature	23°C ± 5°C	24 °C
Ambient humidity	25 - 75%rH	45%
Pressure	85 - 106kPa (860mbar - 1060mbar)	960 mbar

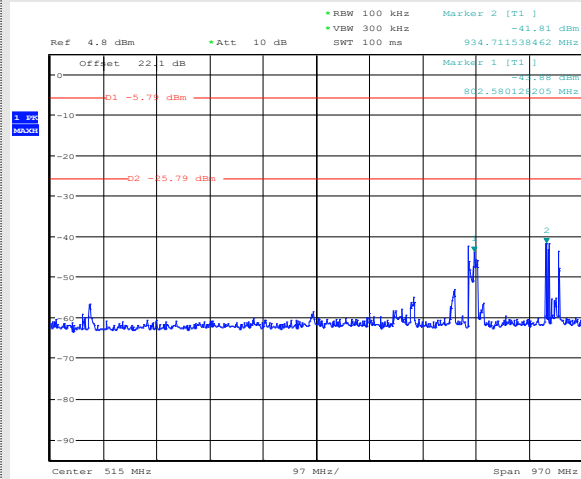
OPERATING CONDITION: #1, #2, #3

RESULT: **WITHIN THE LIMITS**

TEST RESULTS

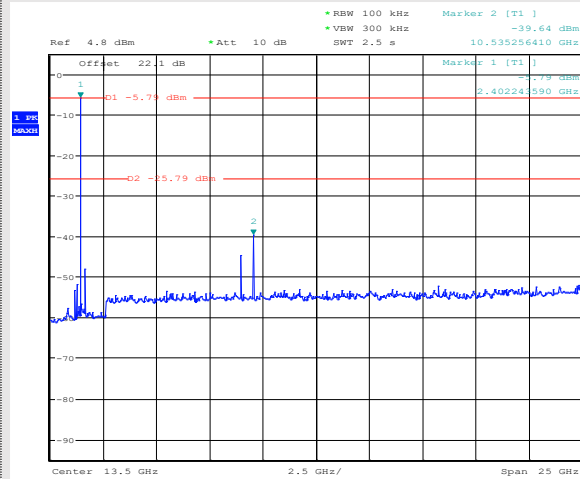
Channel: 0

Frequency range: 30MHz – 1GHz



Date: 18.JUL.2022 16:22:50

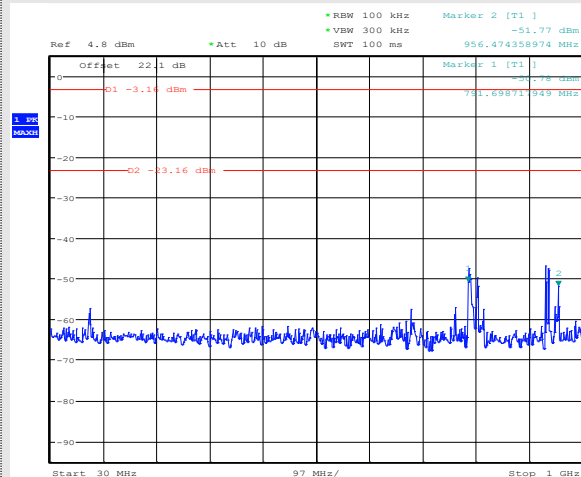
Frequency range: 1GHz – 26GHz



Date: 18.JUL.2022 16:19:58

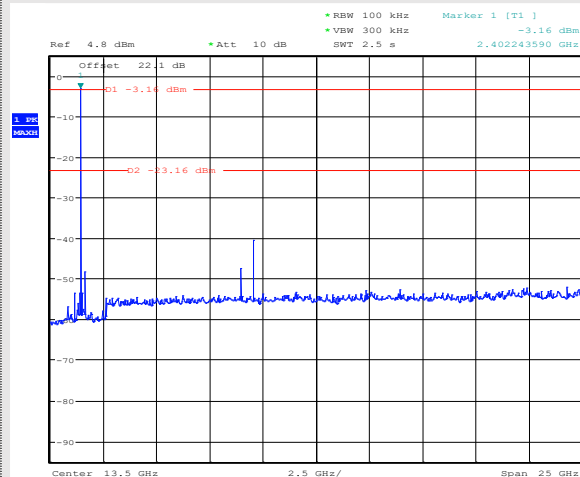
Channel: 12

Frequency range: 30MHz – 1GHz



Date: 18.JUL.2022 16:26:55

Frequency range: 1GHz – 26GHz

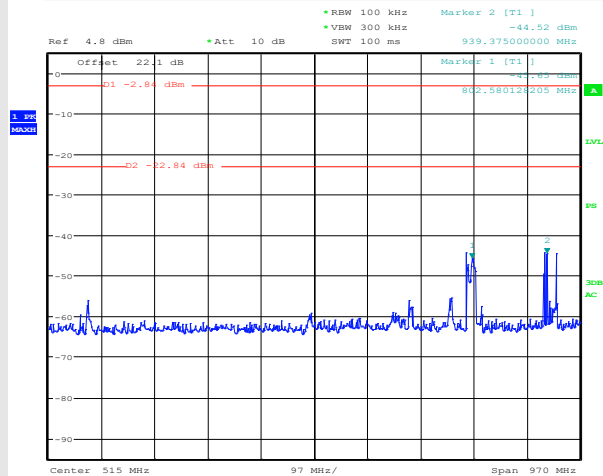


Date: 18.JUL.2022 16:25:49

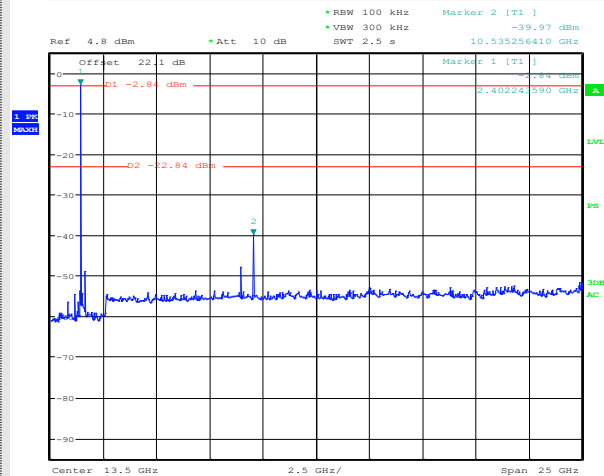
Channel: 39

Frequency range: 30MHz – 1GHz

Frequency range: 1GHz – 26GHz



Date: 18.JUL.2022 16:29:57



Date: 18.JUL.2022 16:28:46

TEST 7.	TRANSMITTER RADIATED EMISSIONS < 1GHZ
REFERENCE DOCUMENT	According to § 15.247 (d) and § 15.209 (a) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 Db below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 Db instead of 20 Db. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

• TEST LOCATION	Semi-Anechoic Chamber					
• DISTANCE OF MEASUREMENT	3m					
• TYPE OF MEASUREMENT	Radiated					
• TEST EQUIPMENT USED FOR TEST	Instrument	Manufacturer	Model	Serial n°	Calibrated On	Due to
	Emi receiver	Rohde & schwarz	ESU40	100111	02/2022	02/2023
	Semi-Anechoic Chamber	Siemens	B83117-D6019-T232	003-005-134/94C	02/2021	02/2022
	Loop antenna	Rohde & Schwarz	HFH 2-Z2	841801/012	03/2020	03/2023
	Bi-log antenna	Chase	CBL6111C	2717	03/2019	03/2022
	Software EMC	Rohde & Schwarz	EMC32-E	V 8.40.0	N.A.	
• TESTED PORT	Enclosure					
• TEST METHOD	ANSI C63.10:2013 section 6.5					
• FREQUENCY RANGE	9kHz – 1GHz					
• LIMITS	Acc. To ref. Std.					
• UNCERTAINTY OF MEASURE	Level of confidence = 95% (k=2)					
	Expanded uncertainty 9kHz – 30MHz = 4,24 dB					
	Expanded uncertainty 30MHz – 1GHz = 5,72 dB					

TEST CONDITIONS	REQUIRED	MEASURED
Ambient temperature	23°C ± 5°C	24 °C
Ambient humidity	25 - 75%rH	45%
Pressure	85 - 106kPa (860mbar - 1060mbar)	960 mbar

OPERATING CONDITION: #1, #2, #3

RESULT: **WITHIN THE LIMITS**

MEASUREMENT PARAMETER

Frequency Range:	9kHz – 30MHz	30MHz – 1GHz
Resolution bandwidth:	200Hz	100kHz
Video bandwidth:	1kHz	300kHz
Span:	See plots below	See plots below
Sweep time	Auto couple	Auto couple
Detector:	Peak	Peak
Trace-Mode:	Max. hold	Max. hold

TEST DESCRIPTION

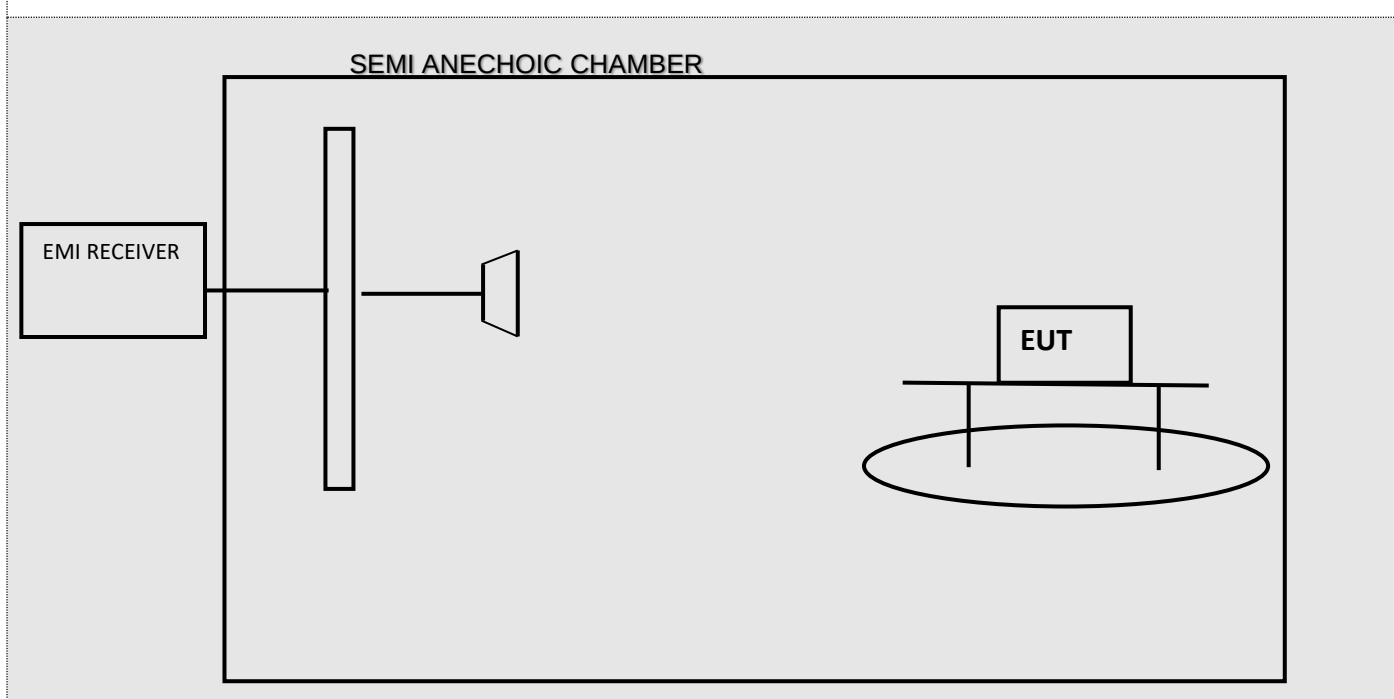
Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously - rotating, remotely - controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency.

The EUT is placed at test table height is 80 cm above the reference ground plane.

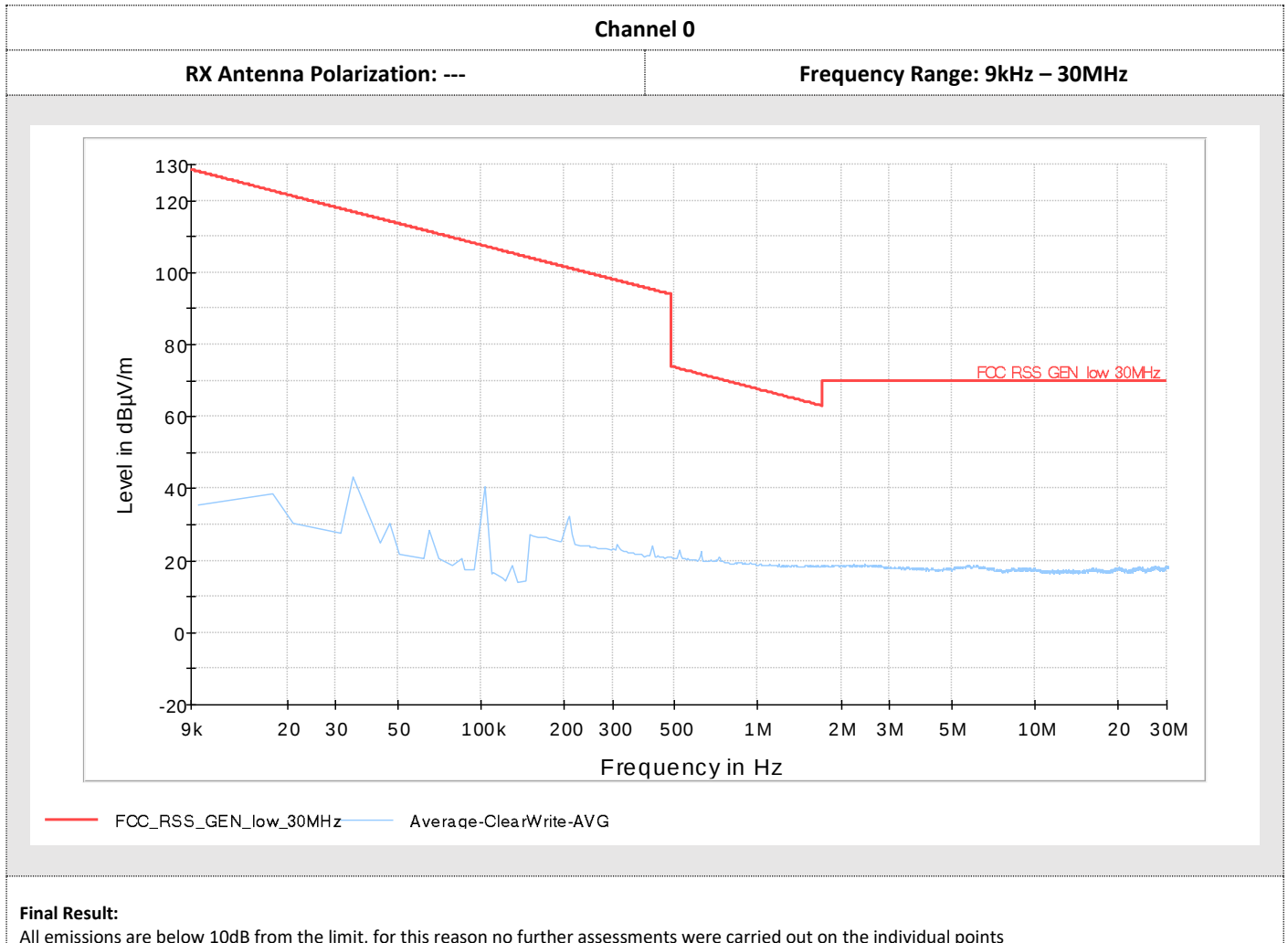
Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m~4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3m.

This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

TEST SETUP BLOCK DIAGRAM

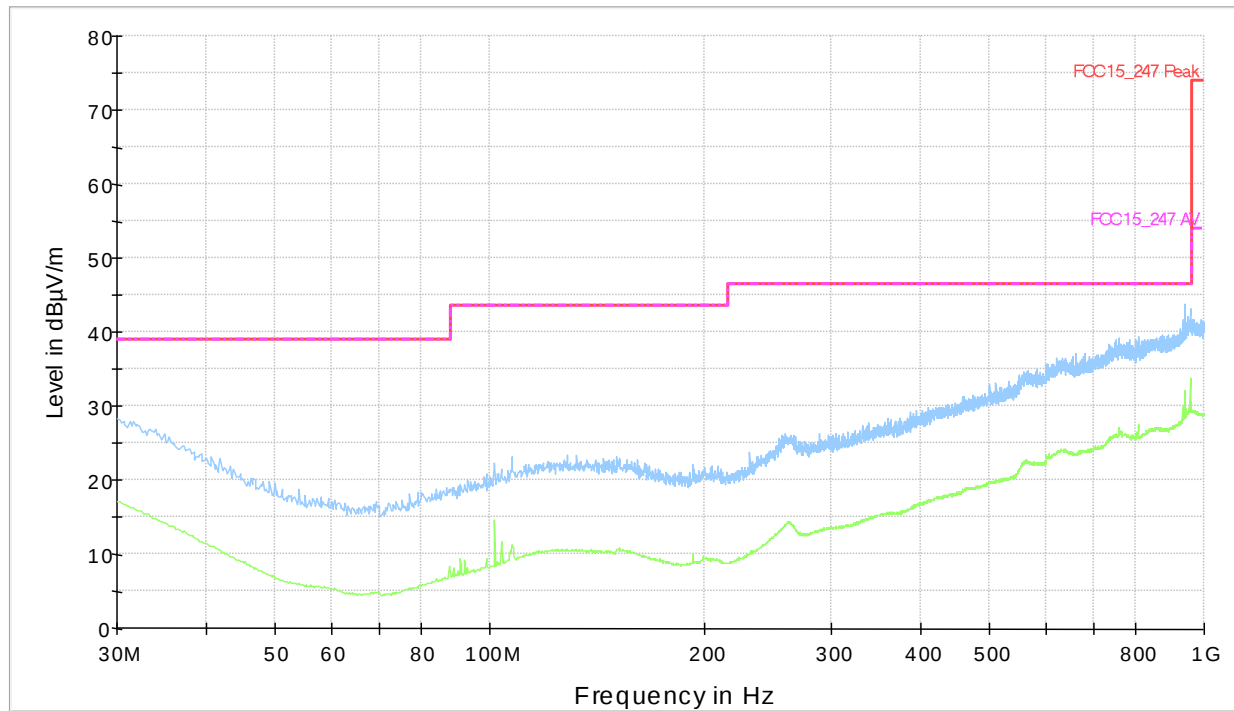


TEST RESULTS



RX Antenna Polarization: Vertical

Frequency Range: 30MHz – 1GHz



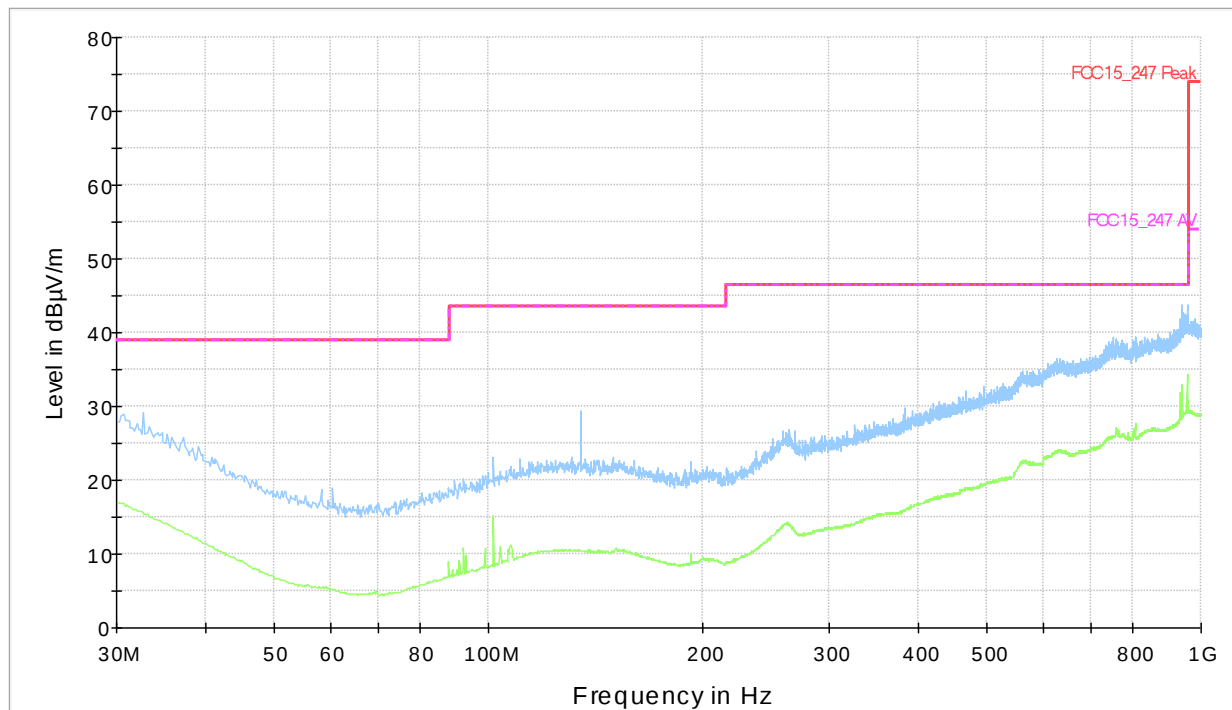
— FCC 15_247 Peak-CAR — FCC 15_247 AV-CAR — MaxPeak-ClearWrite-PK+ — Average-ClearWrite-AVG

Note:

All emissions are below 10dB from the limit, for this reason no further assessments were carried out on the individual points.

RX Antenna Polarization: Horizontal

Frequency Range: 30MHz – 1GHz



— FCC 15_247 Peak-CAR - - - - - FCC 15_247 AV-CAR — MaxPeak-ClearWrite-PK+ — Average-ClearWrite-AVG

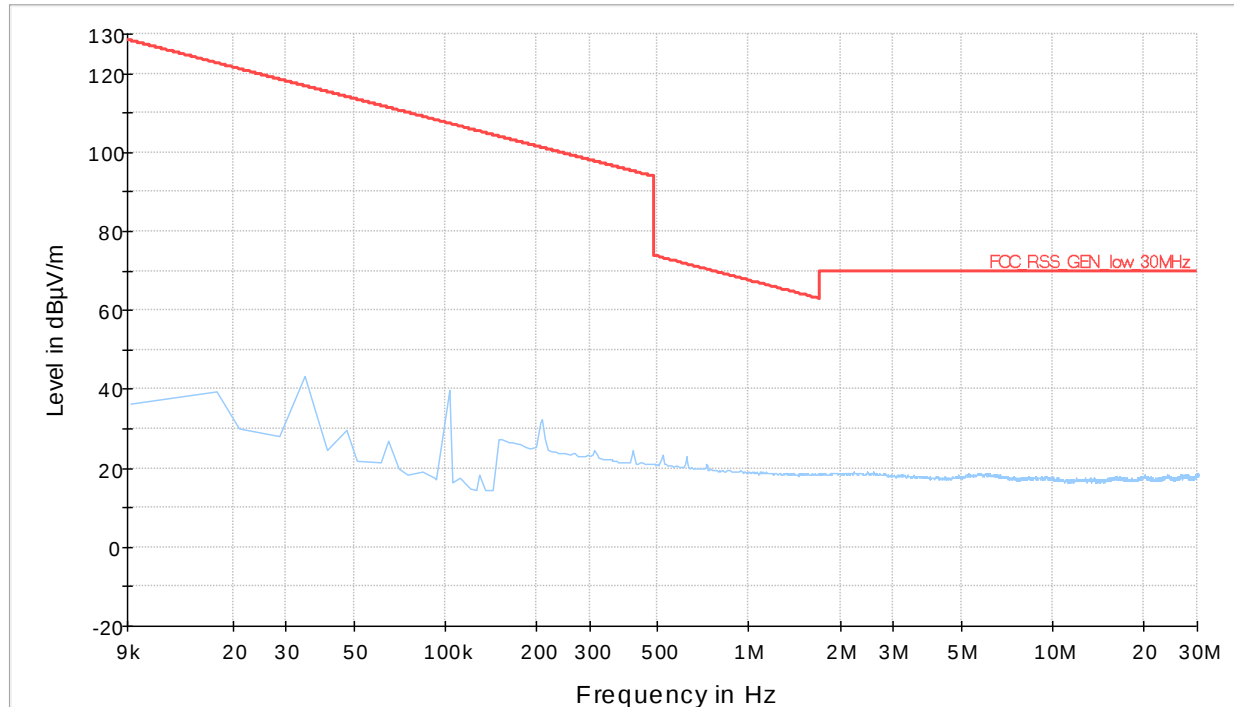
Note:

All emissions are below 10dB from the limit, for this reason no further assessments were carried out on the individual points.

Channel 12

RX Antenna Polarization: ---

Frequency Range: 9kHz – 30MHz



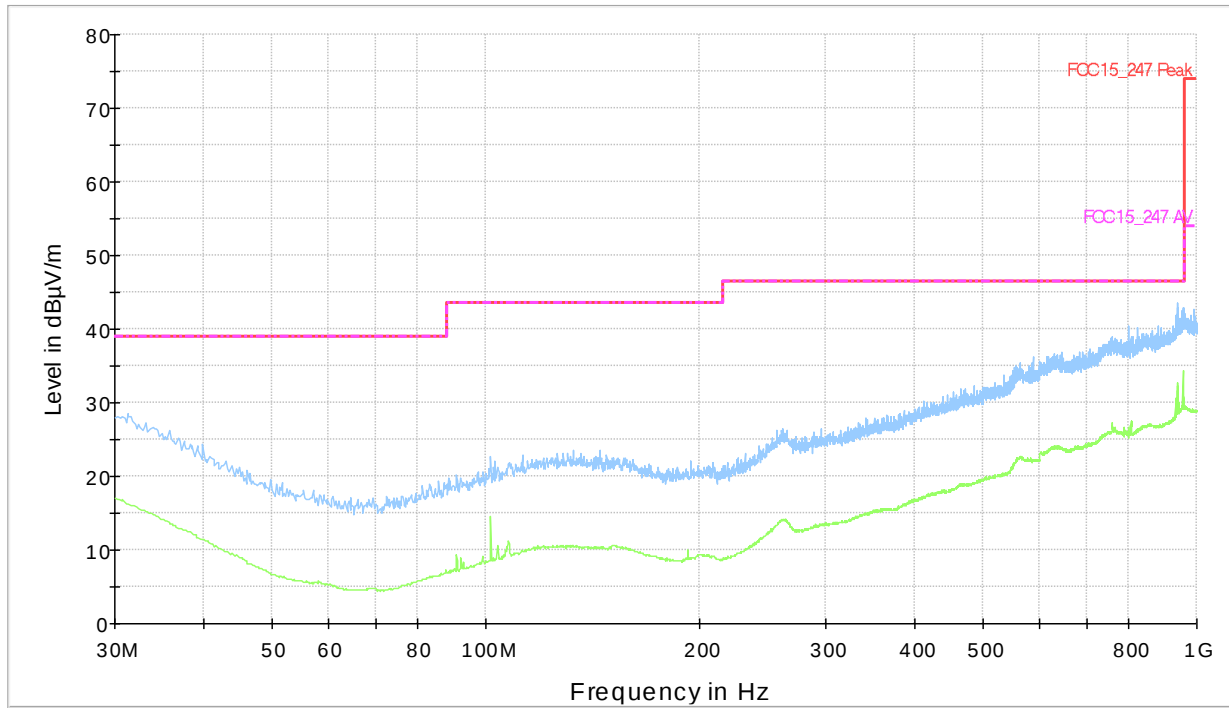
FCC_RSS_GEN_low_30MHz Average-ClearWrite-AVG * Data Reduction Result 1 [1]-AVG

Final Result:

All emissions are below 10dB from the limit, for this reason no further assessments were carried out on the individual points

RX Antenna Polarization: Vertical

Frequency Range: 30MHz – 1GHz



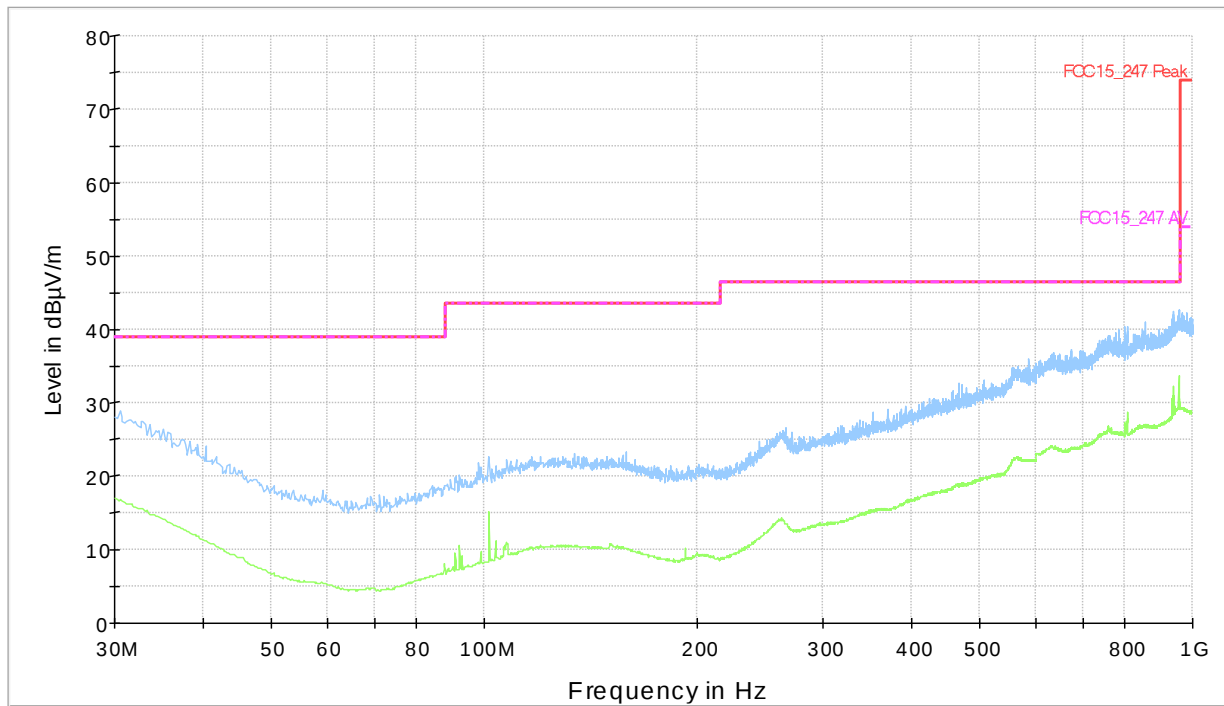
— FCC 15_247 Peak-CAR — FCC 15_247 AV-CAR — MaxPeak-ClearWrite-PK+ — Average-ClearWrite-AVG

Note:

All emissions are below 10dB from the limit, for this reason no further assessments were carried out on the individual points.

RX Antenna Polarization: Horizontal

Frequency Range: 30MHz – 1GHz



— FCC 15_247 Peak-CAR — FCC 15_247 AV-CAR — MaxPeak-ClearWrite-PK+ — Average-ClearWrite-AVG

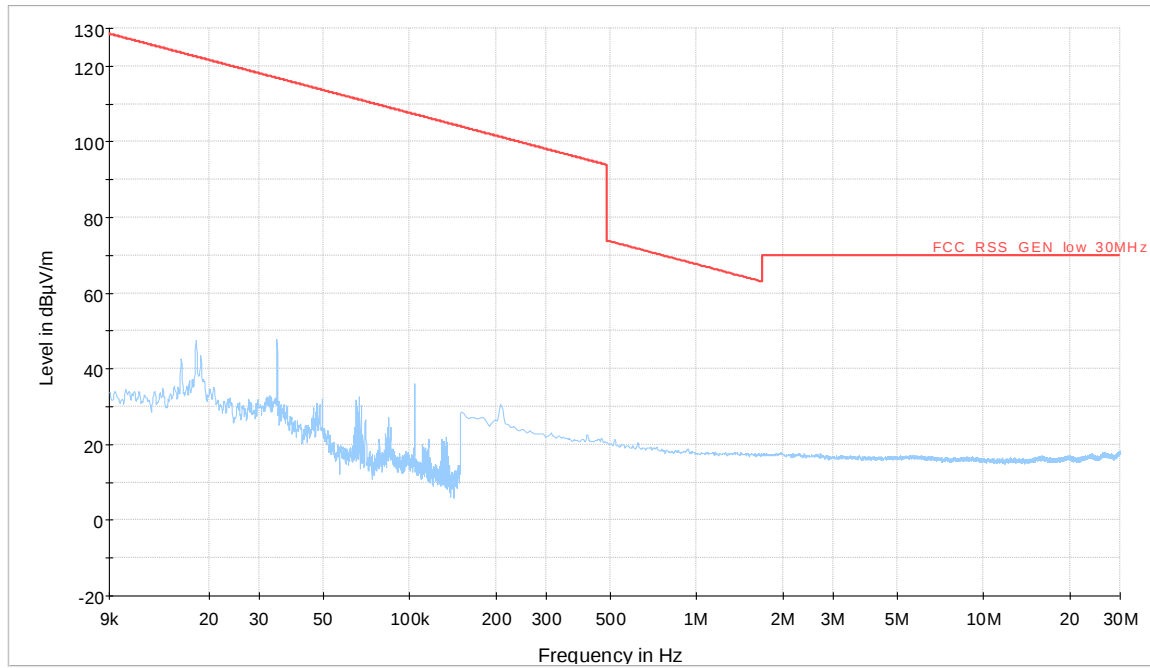
Note:

All emissions are below 10dB from the limit, for this reason no further assessments were carried out on the individual points.

Channel 39

RX Antenna Polarization: ---

Frequency Range: 9kHz – 30MHz



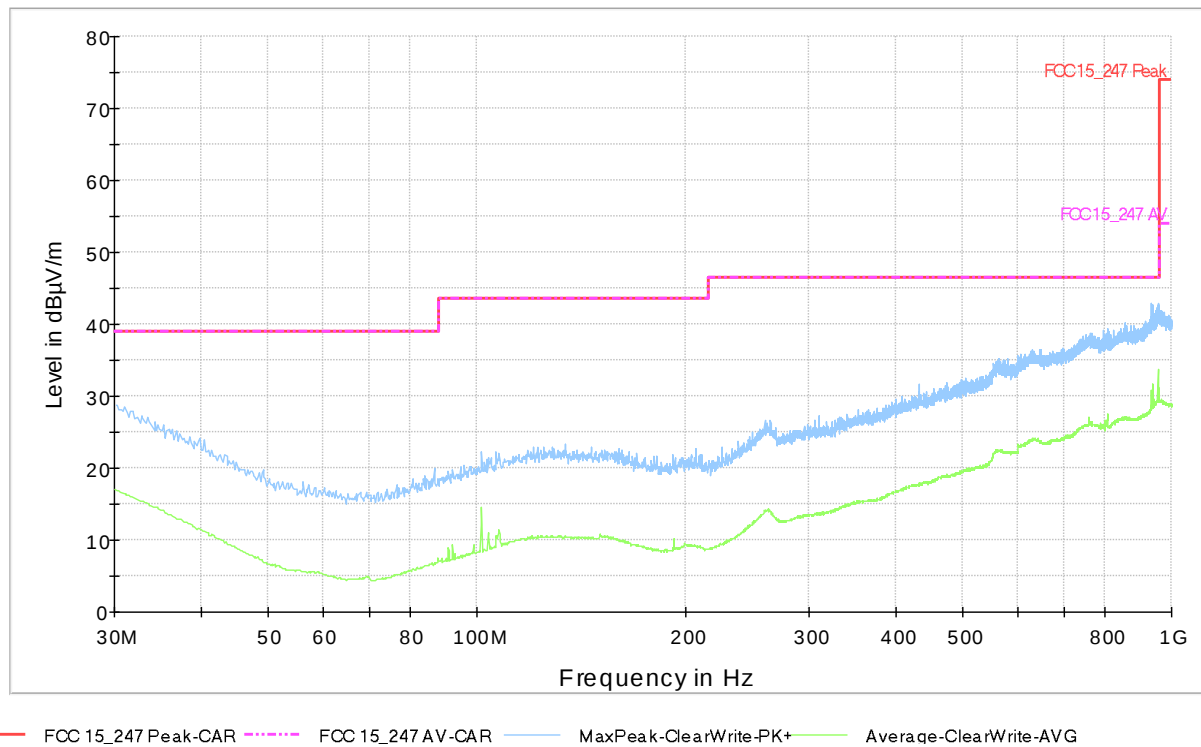
FCC_RSS_GEN_low_30MHz Average-ClearWrite-AVG

Final Result:

All emissions are below 10dB from the limit, for this reason no further assessments were carried out on the individual points

RX Antenna Polarization: Vertical

Frequency Range: 30MHz – 1GHz

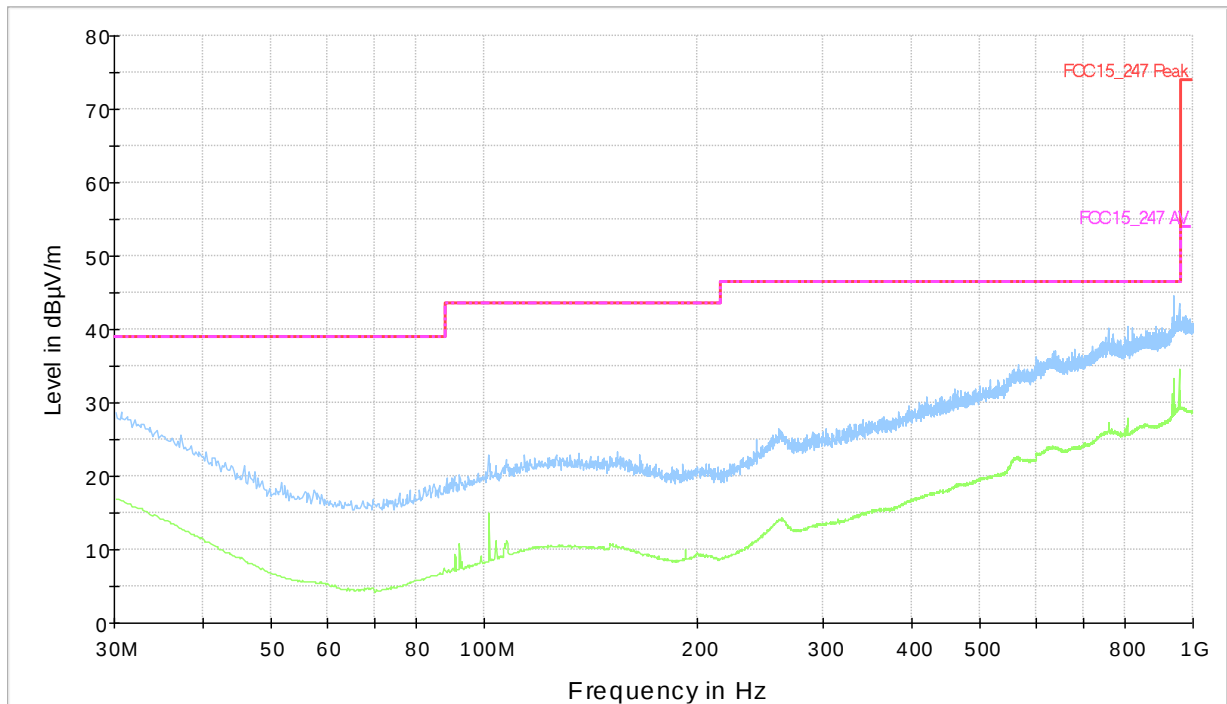


Note:

All emissions are below 10dB from the limit, for this reason no further assessments were carried out on the individual points.

RX Antenna Polarization: Horizontal

Frequency Range: 30MHz – 1GHz



— FCC 15_247 Peak-CAR — FCC 15_247 AV-CAR — MaxPeak-ClearWrite-PK+ — Average-ClearWrite-AVG

Note:

All emissions are below 10dB from the limit, for this reason no further assessments were carried out on the individual points.

TEST 8.	TRANSMITTER RADIATED EMISSIONS > 1GHZ
REFERENCE DOCUMENT	According to § 15.247 (d) and § 15.209 (a) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 Db below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 Db instead of 20 Db. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

• TEST SETUP	Acc. To ref. Std.					
• TEST LOCATION	Semi-Anechoic Chamber					
• DISTANCE OF MEASUREMENT	3m					
• TYPE OF MEASUREMENT	Radiated					
• TEST EQUIPMENT USED FOR TEST	Instrument	Manufacturer	Model	Serial n°	Calibrated On	Due to
	Emi receiver	Rohde & schwarz	ESU40	100111	02/2022	02/2023
	Semi-Anechoic Chamber	Siemens	B83117-D6019-T232	003-005-134/94C	02/2021	02/2022
	Horn antenna	Electro Metrics	EM-6961	100437	10/2020	10/2023
	Horn antenna + Low Noise Preamplifier	Bonn Elektronik	BLMA 1840-1A	262WL80452	04/2021	04/2023
	High pass filter	Waineright	WHK 2,8/15G	1	10/2021	10/2023
	Software EMC	Rohde & Schwarz	EMC32-E	V 8.40.0	N.A.	
• TESTED PORT	Antenna					
• TEST METHOD	ANSI C63.10:2013 section 6.6					
• FREQUENCY RANGE	1GHz – 10GHz					
• LIMITS	Acc. To ref. Std.					
• UNCERTAINTY OF MEASURE	Level of confidence = 95% (k=2)					
	Expanded uncertainty 1GHz – 18GHz = 5,15 dB					
	Expanded uncertainty 18GHz – 26GHz = 5,82 dB					

TEST CONDITIONS	REQUIRED	MEASURED
Ambient temperature	23°C ± 5°C	24 °C
Ambient humidity	25 - 75%rH	45%
Pressure	85 - 106kPa (860mbar - 1060mbar)	960 mbar

OPERATING CONDITION: #1, #2, #3

RESULT: WITHIN THE LIMITS

MEASUREMENT PARAMETER 1GHz - 10GHz

Resolution bandwidth:	1MHz
Video bandwidth:	3MHz
Span:	See plots below
Sweep time	Auto couple
Detector:	Peak
Trace-Mode:	Max. hold

TEST DESCRIPTION

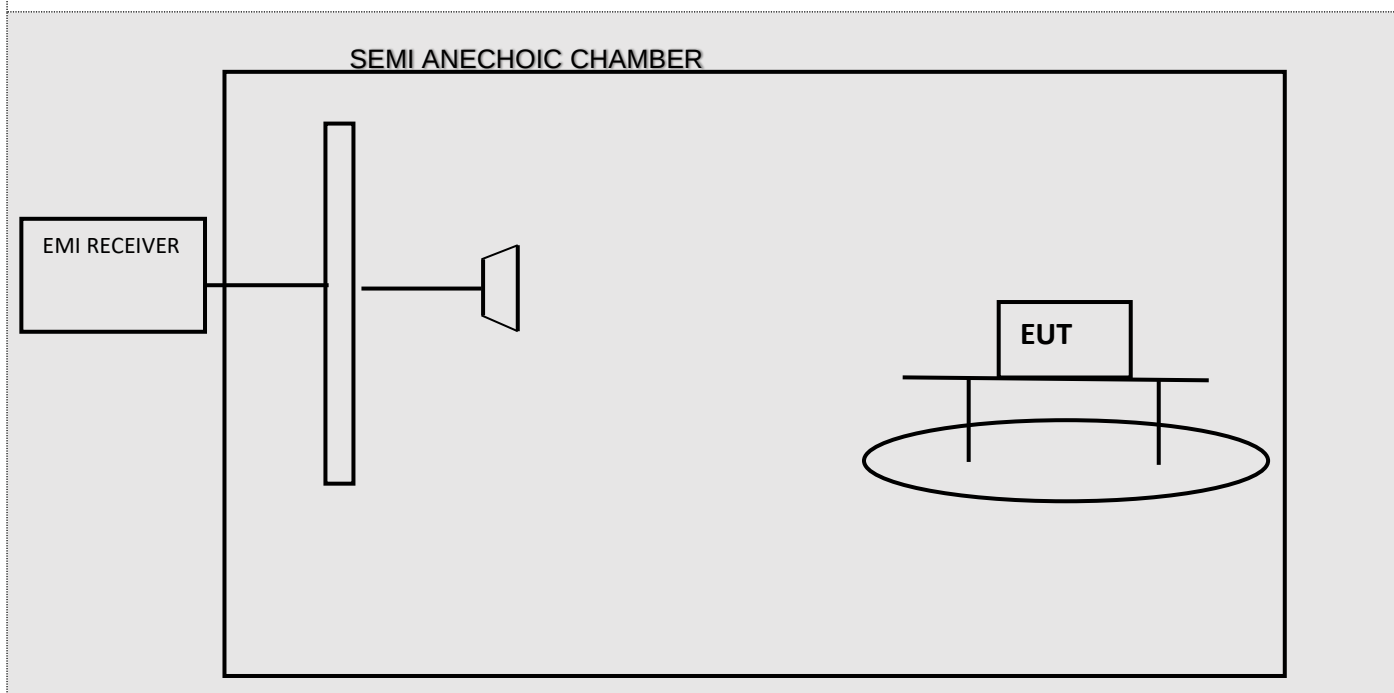
Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously - rotating, remotely - controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency.

The EUT is placed at test table height is 1.5 m

Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m~4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3m.

This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

TEST SETUP BLOCK DIAGRAM

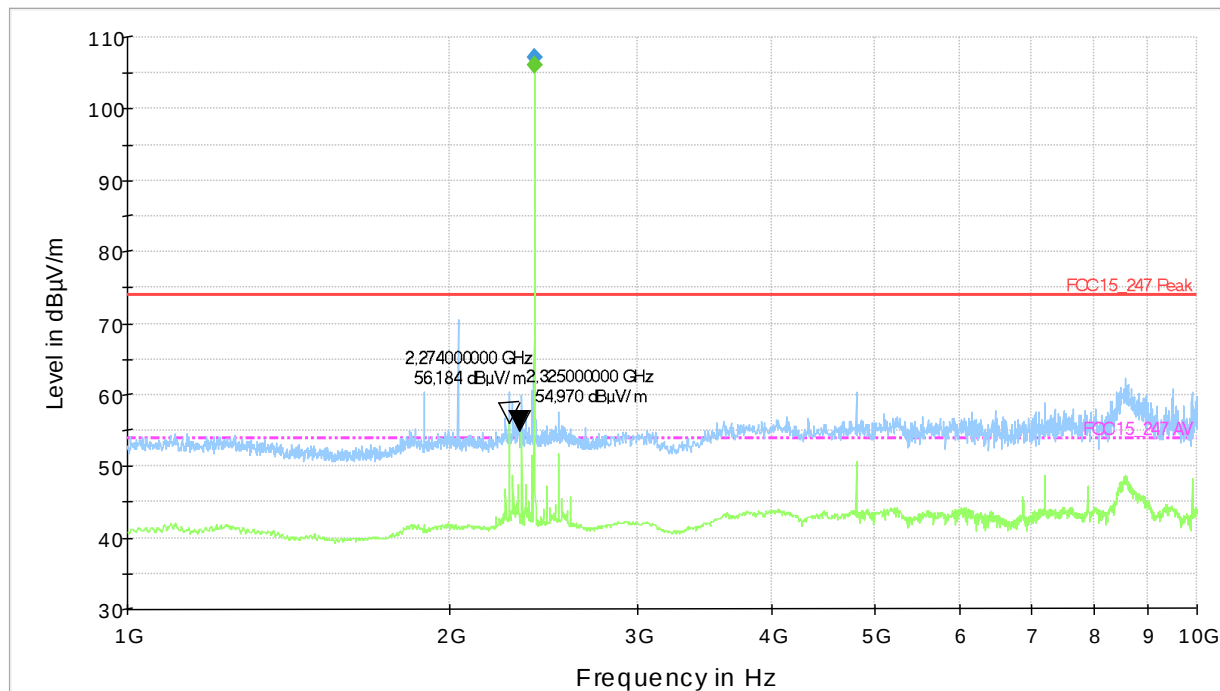


TEST RESULTS

Channel 0

RX Antenna Polarization: Vertical

Frequency Range: 1GHz – 10GHz



— FCC 15_247 Peak-CAR — FCC 15_247 AV-CAR — PreviewResult1-PK+
— PreviewResult2-AVG — Final Result1-PK+ — Final Result2-AVG

Final Result Peak:

Frequency (MHz)	MaxPeak (dBμV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBμV/m)
2402.000000	107.3	99.9	182.0	-33.30	74.00

Final Result Average:

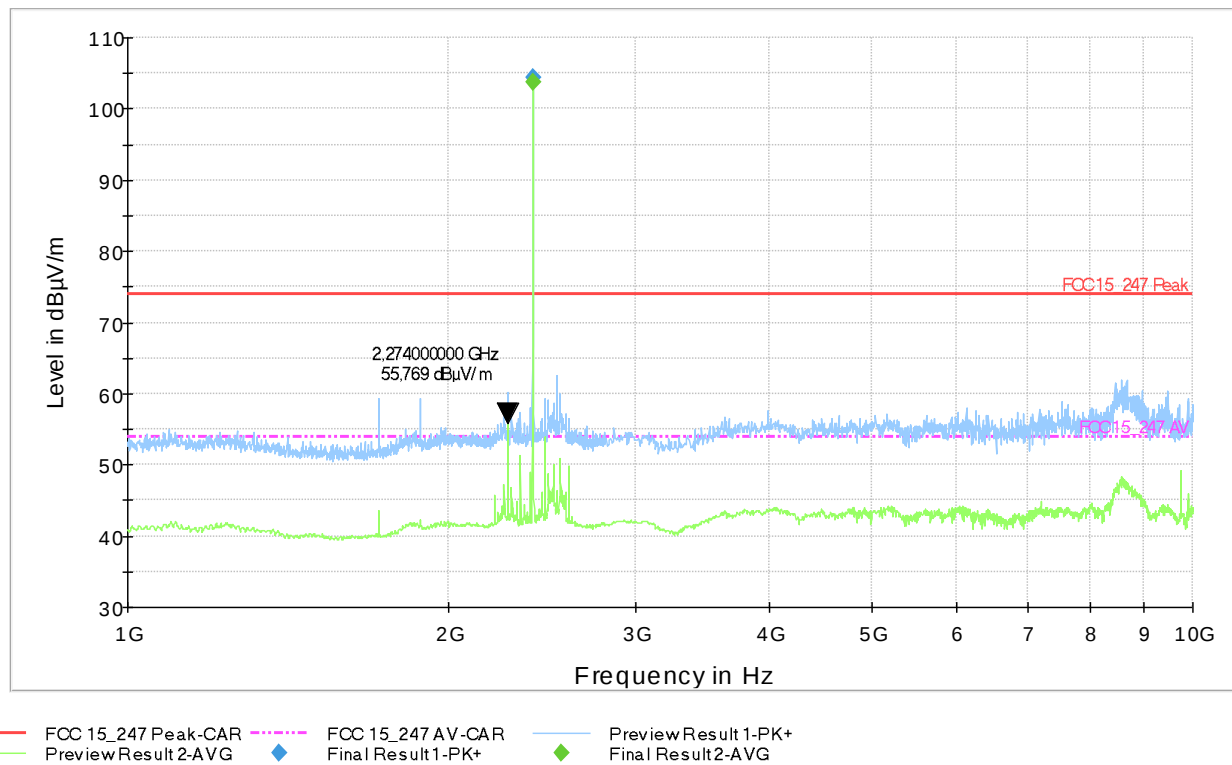
Frequency (MHz)	Average (dBμV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBμV/m)
2402.000000	106.1	99.8	176.0	-52.10	54.00

Note:

Peaks out of limits are due to exclusion bands in according at §15.205 Restricted bands of Operation.

RX Antenna Polarization: Horizontal

Frequency Range: 1GHz – 10GHz



Final Result Peak:

Frequency (MHz)	MaxPeak (dBμV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBμV/m)
2402.000000	104.4	99.9	2.0	-30.40	74.00

Final Result Average:

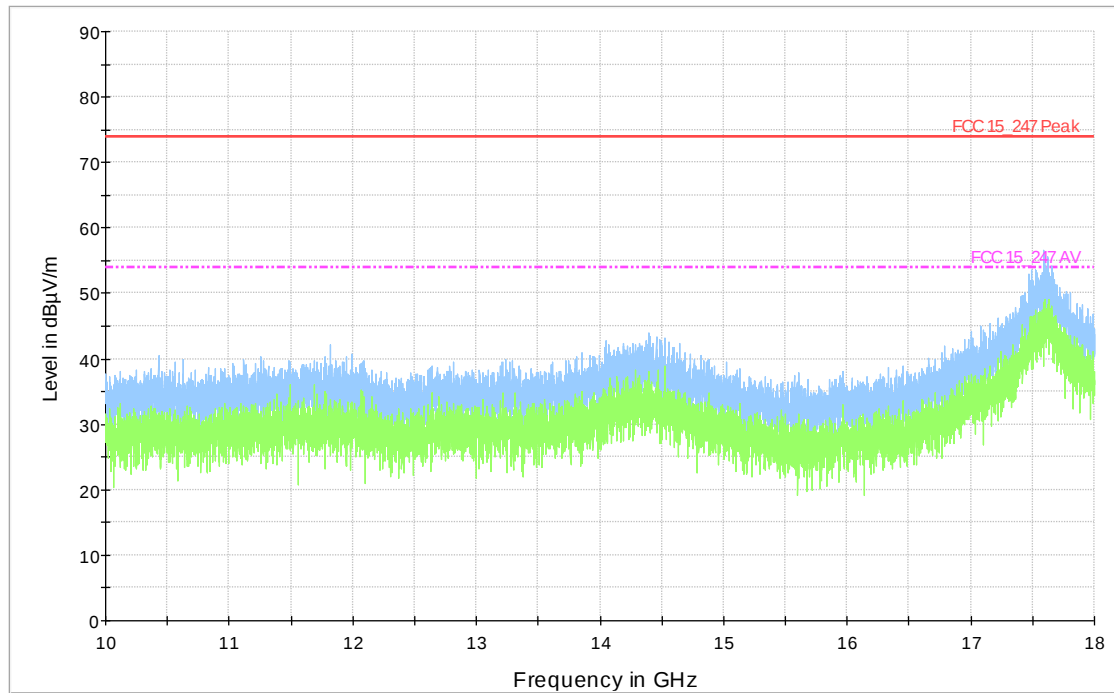
Frequency (MHz)	Average (dBμV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBμV/m)
2402.000000	103.7	99.8	2.0	-49.70	54.00

Note:

Peaks out of limits are due to exclusion bands in according at §15.205 Restricted bands of Operation.

RX Antenna Polarization: Vertical

Frequency Range: 10GHz – 18GHz

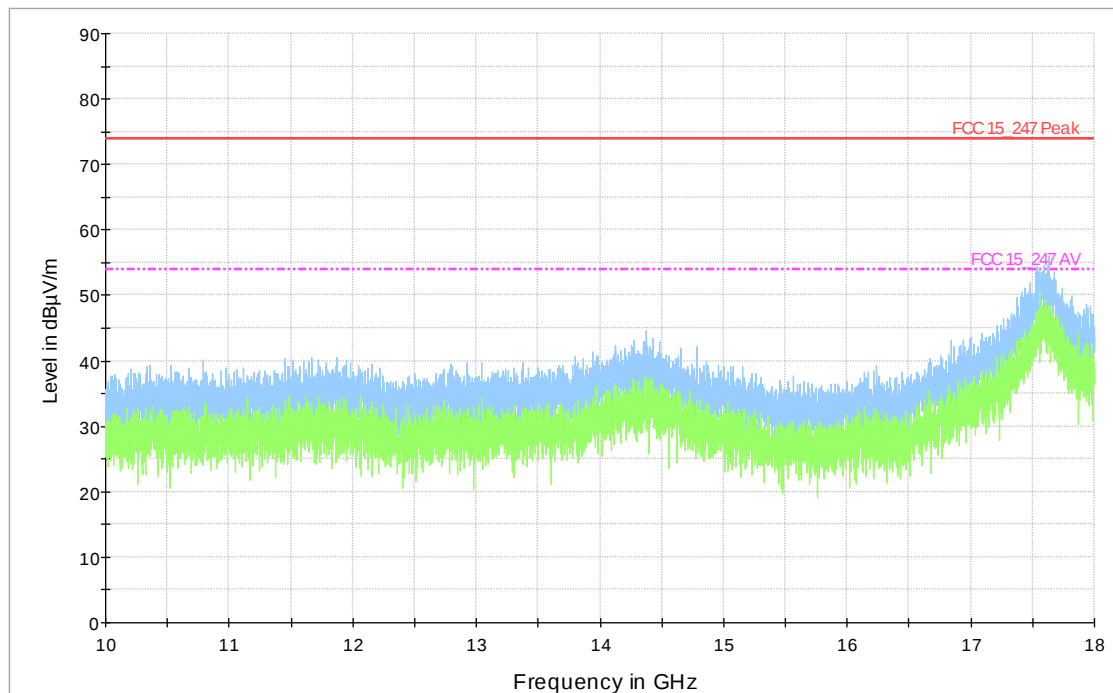


Final Result:

All emissions are below 10dB from the limit, for this reason no further assessments were carried out on the individual points

RX Antenna Polarization: Horizontal

Frequency Range: 10GHz – 18GHz

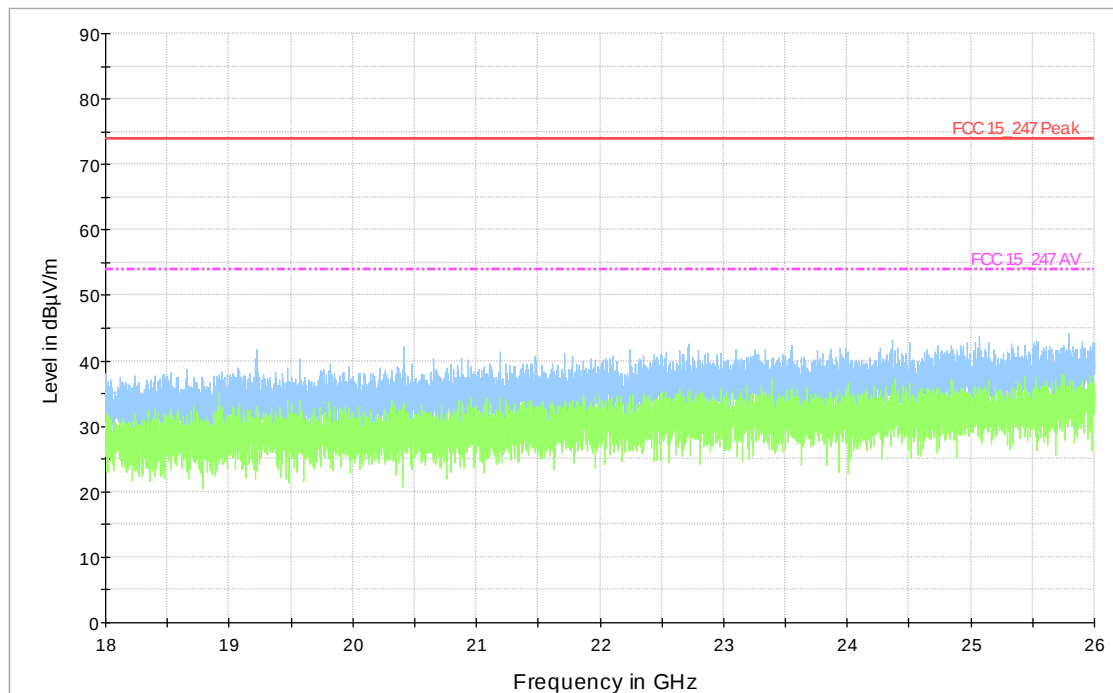


Final Result:

All emissions are below 10dB from the limit, for this reason no further assessments were carried out on the individual points

RX Antenna Polarization: Vertical

Frequency Range: 18GHz – 26GHz

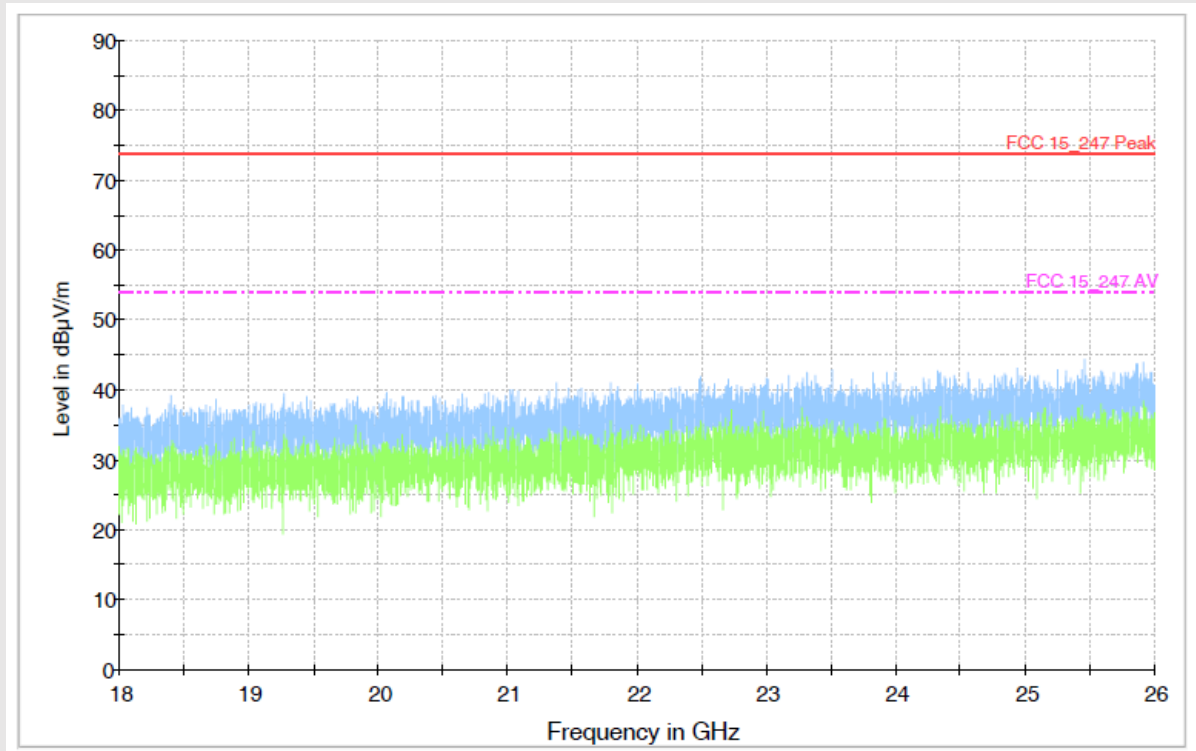


Final Result:

All emissions are below 10dB from the limit, for this reason no further assessments were carried out on the individual points

RX Antenna Polarization: Horizontal

Frequency Range: 18GHz – 26GHz



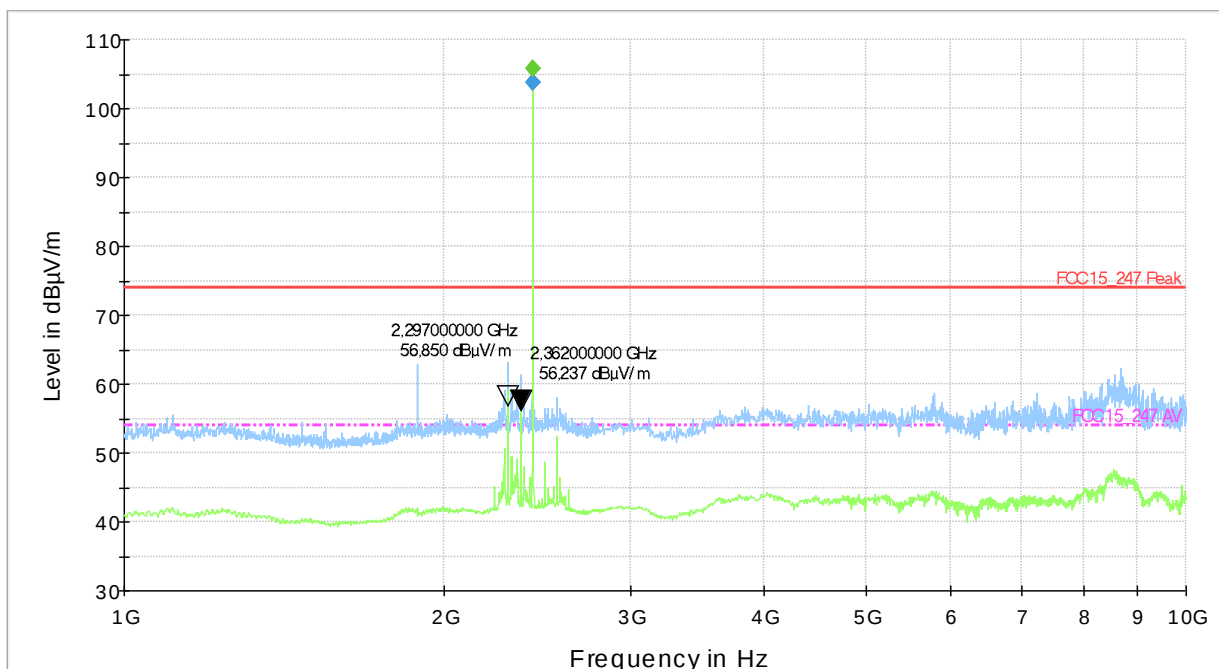
Final Result:

All emissions are below 10dB from the limit, for this reason no further assessments were carried out on the individual points

Channel 12

RX Antenna Polarization: Vertical

Frequency Range: 1GHz – 10GHz



— FCC 15_247 Peak-CAR
— PreviewResult 2-AVG
◆ Final Measurement Result 1-PK+
- - - FCC 15_247 AV-CAR
* Data Reduction Result 1 [3]-PK+
◆ Final Measurement Result 2-AVG
— PreviewResult 1-PK+
* Data Reduction Result 2 [3]-AVG

Final results MaxPeak:

Frequency (MHz)	MaxPeak (dBμV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBμV/m)
2426.000000	103.7	132.7	182.0	-29.7	74.00

Final results Average:

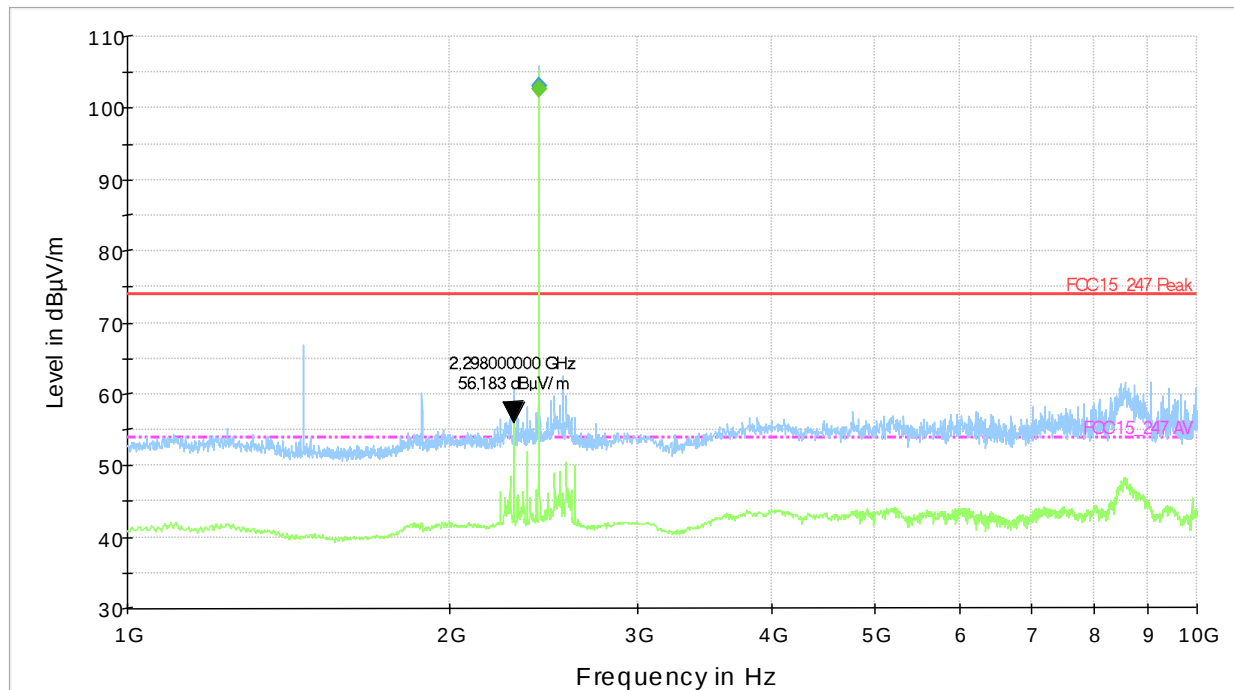
Frequency (MHz)	Average (dBμV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBμV/m)
2426.000000	105.7	99.7	187.0	-51.7	54.00

Note:

Peaks out of limits are due to exclusion bands in according at §15.205 Restricted bands of Operation.

RX Antenna Polarization: Horizontal

Frequency Range: 1GHz – 10GHz



Final Result Peak:

Frequency (MHz)	MaxPeak (dBμV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBμV/m)
2426.000000	103	125.8	180.0	19.90	74.00

Final Result Average:

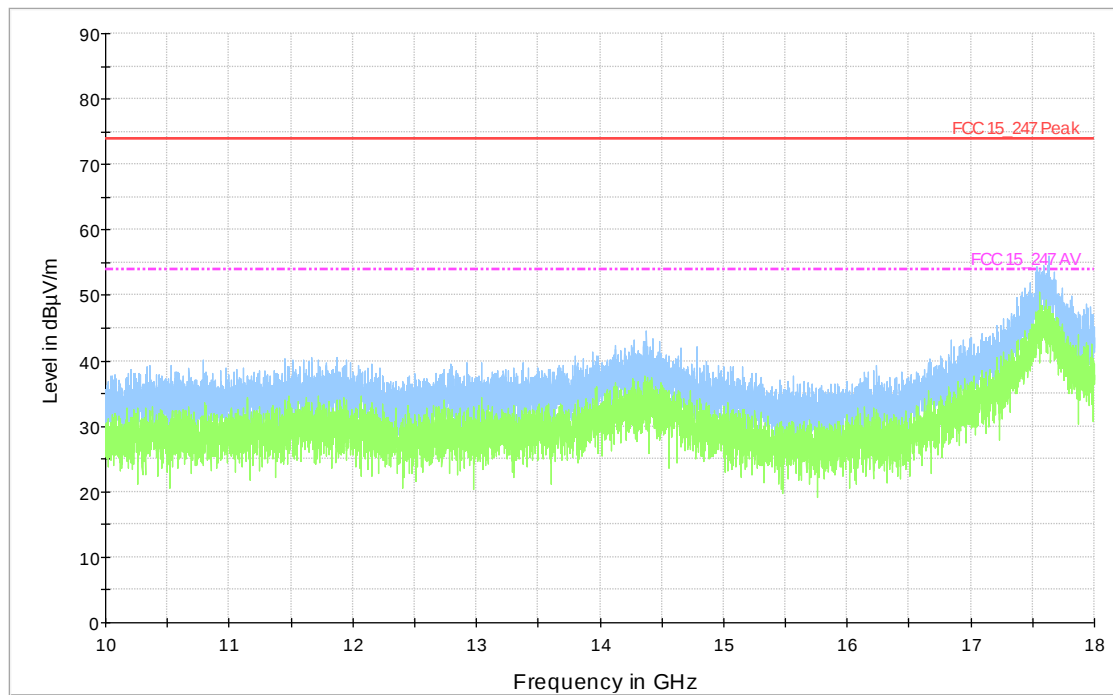
Frequency (MHz)	Average (dBμV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBμV/m)
2426.000000	102.7	180.2	187.0	10.30	54.00

Note:

Peaks out of limits are due to exclusion bands in according at §15.205 Restricted bands of Operation.

RX Antenna Polarization: Vertical

Frequency Range: 10GHz – 18GHz

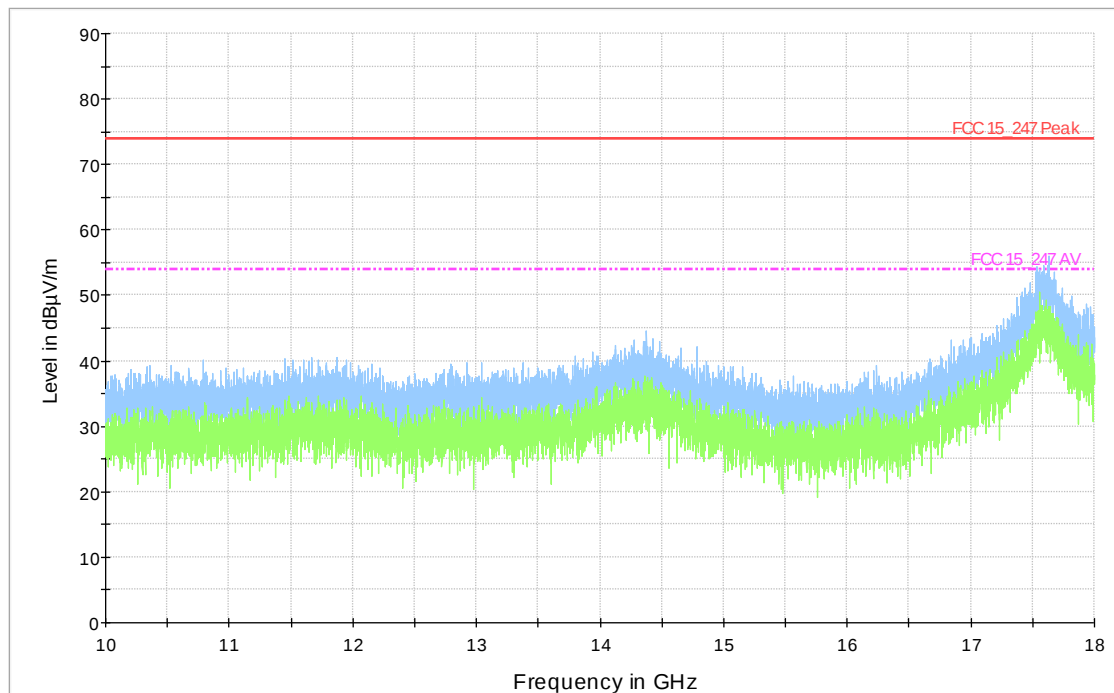


Final Result:

All emissions are below 10dB from the limit, for this reason no further assessments were carried out on the individual points

RX Antenna Polarization: Horizontal

Frequency Range: 10GHz – 18GHz

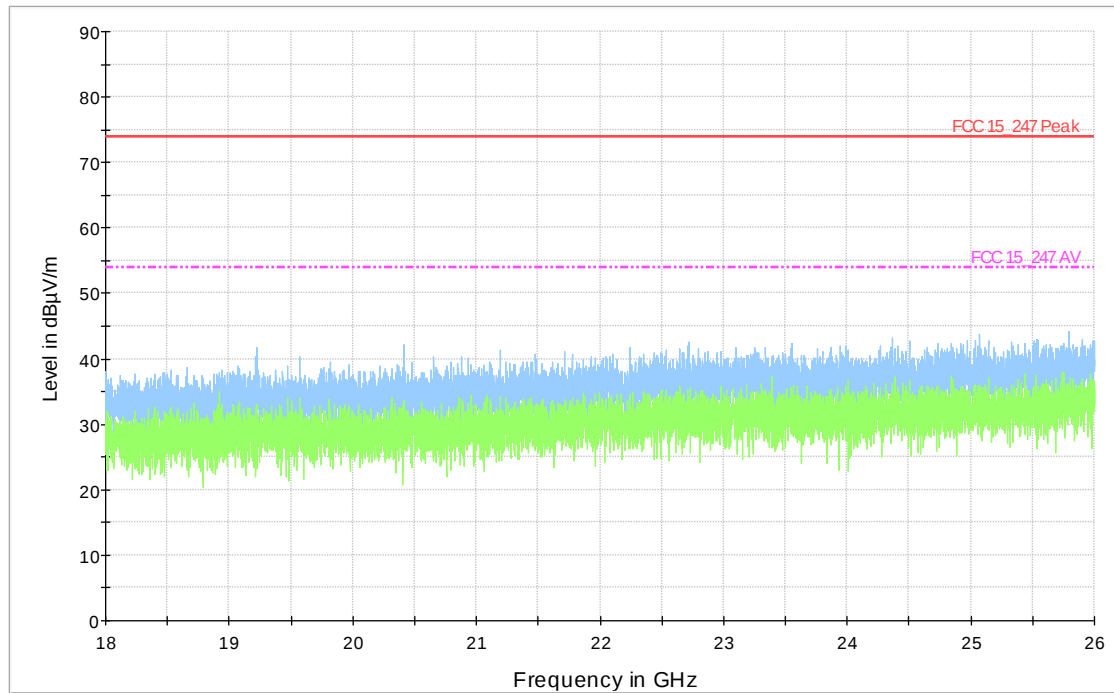


Final Result:

All emissions are below 10dB from the limit, for this reason no further assessments were carried out on the individual points

RX Antenna Polarization: Vertical

Frequency Range: 18GHz – 26GHz

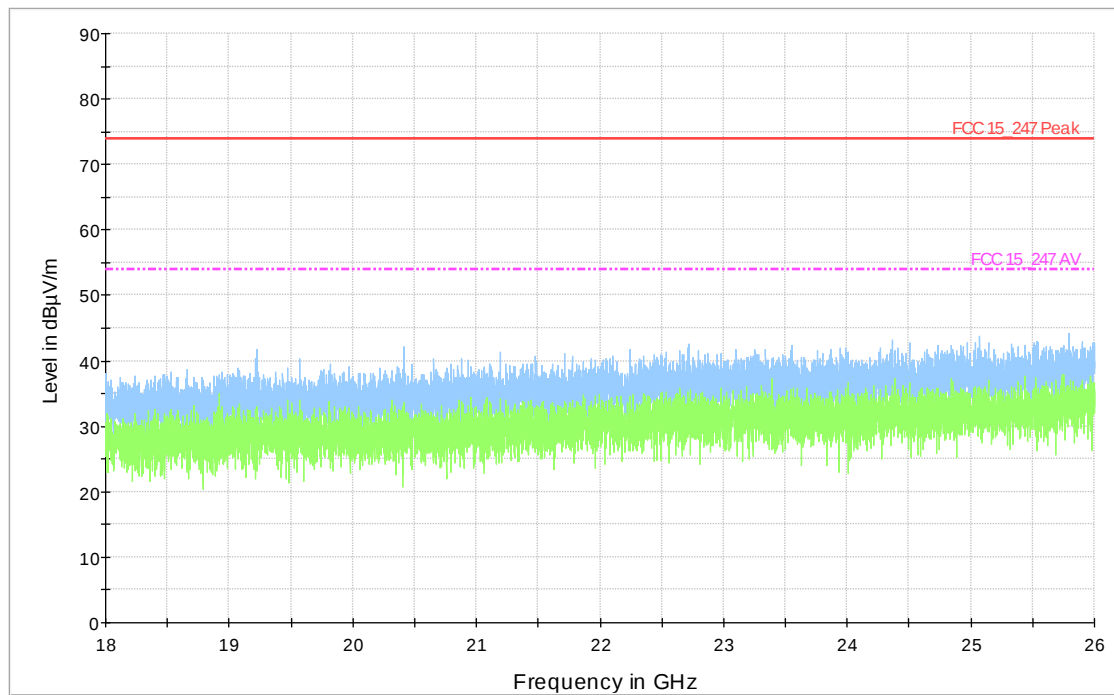


Final Result:

All emissions are below 10dB from the limit, for this reason no further assessments were carried out on the individual points

RX Antenna Polarization: Horizontal

Frequency Range: 18GHz – 26GHz



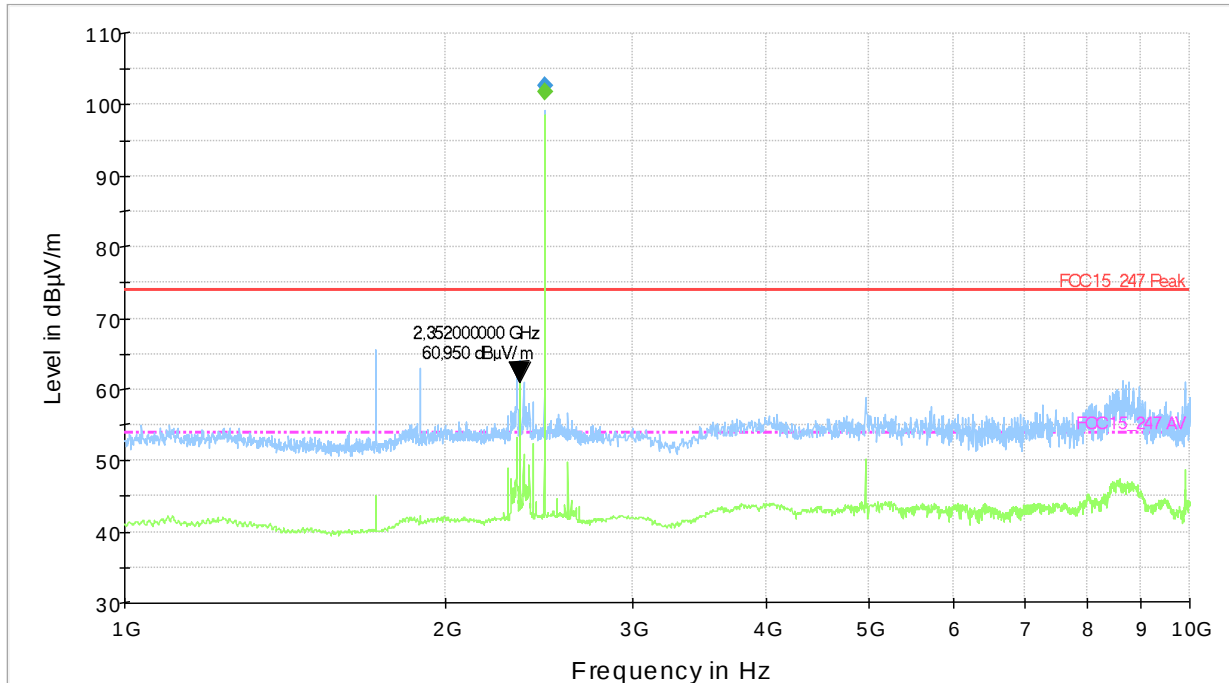
Final Result:

All emissions are below 10dB from the limit, for this reason no further assessments were carried out on the individual points

Channel 39

RX Antenna Polarization: Vertical

Frequency Range: 1GHz – 10GHz



— FCC 15_247 Peak-CAR - - - - - FCC 15_247 AV-CAR — Preview Result 1-PK+ ◆ Final Measurement Result 1-PK+ ◆ Final Measurement Result 2-AVG

Final Result Peak:

Frequency (MHz)	MaxPeak (dBμV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBμV/m)
2480.000000	102.7	99.8	172.0	-28.7	74.00

Final Result Average:

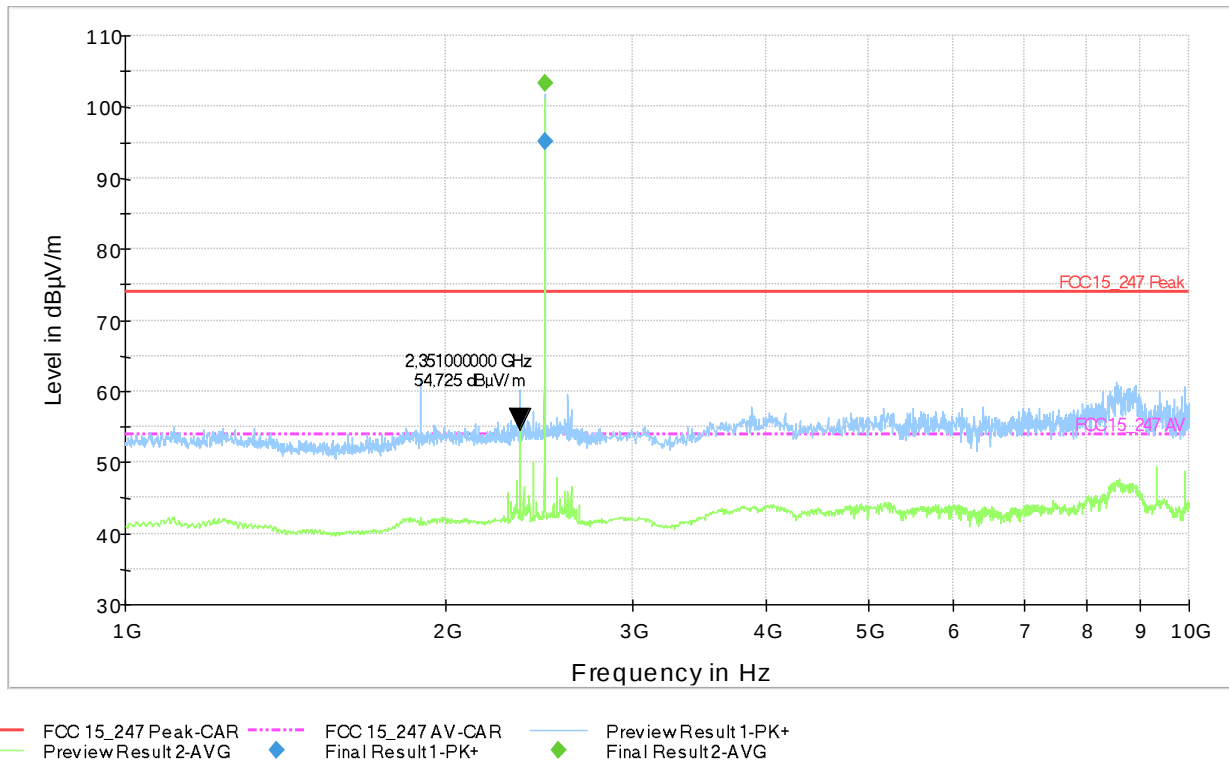
Frequency (MHz)	Average (dBμV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBμV/m)
2480.000000	101.9	99.8	172.0	-47.9	54.00

Note:

Peaks out of limits are due to exclusion bands in according at §15.205 Restricted bands of Operation.

RX Antenna Polarization: Horizontal

Frequency Range: 1GHz – 10GHz



Final Result Peak:

Frequency (MHz)	MaxPeak (dBμV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBμV/m)
2480.000000	95.1	153.7	187.0	-21.10	74.00

Final Result Average:

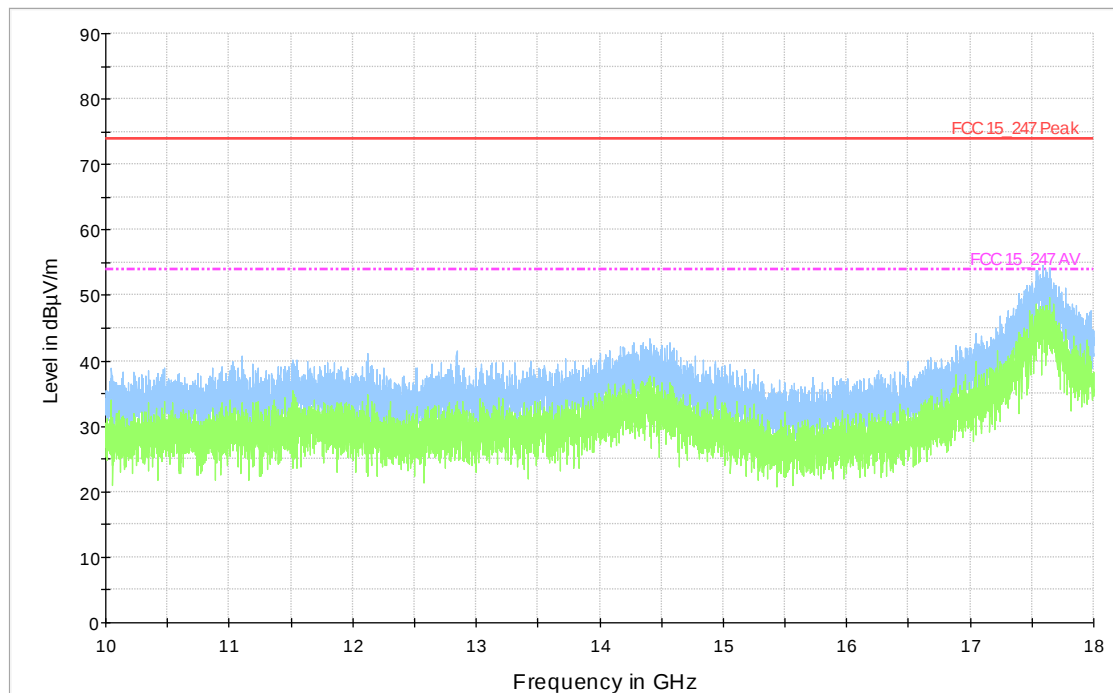
Frequency (MHz)	Average (dBμV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBμV/m)
2480.000000	103.4	127.8	187.0	-49.40	54.00

Note:

Peaks out of limits are due to exclusion bands in according at §15.205 Restricted bands of Operation.

RX Antenna Polarization: Vertical

Frequency Range: 10GHz – 18GHz

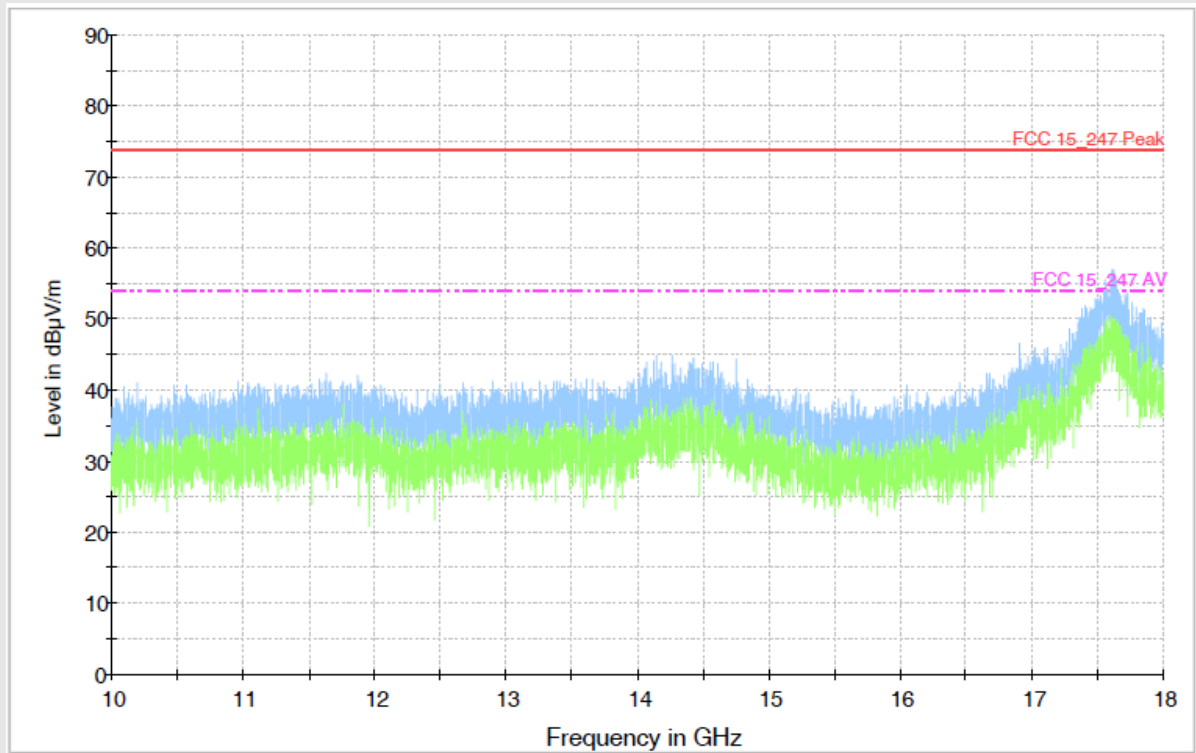


Final Result:

All emissions are below 10dB from the limit, for this reason no further assessments were carried out on the individual points

RX Antenna Polarization: Horizontal

Frequency Range: 10GHz – 18GHz

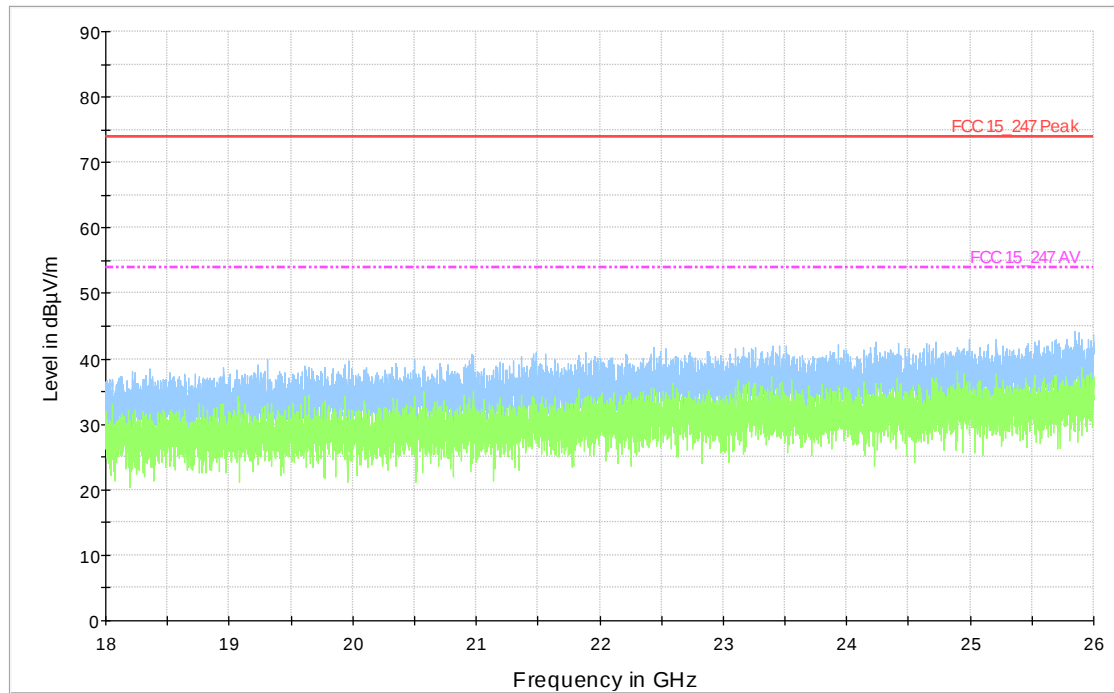


Final Result:

All emissions are below 10dB from the limit, for this reason no further assessments were carried out on the individual points

RX Antenna Polarization: Vertical

Frequency Range: 18GHz – 26GHz

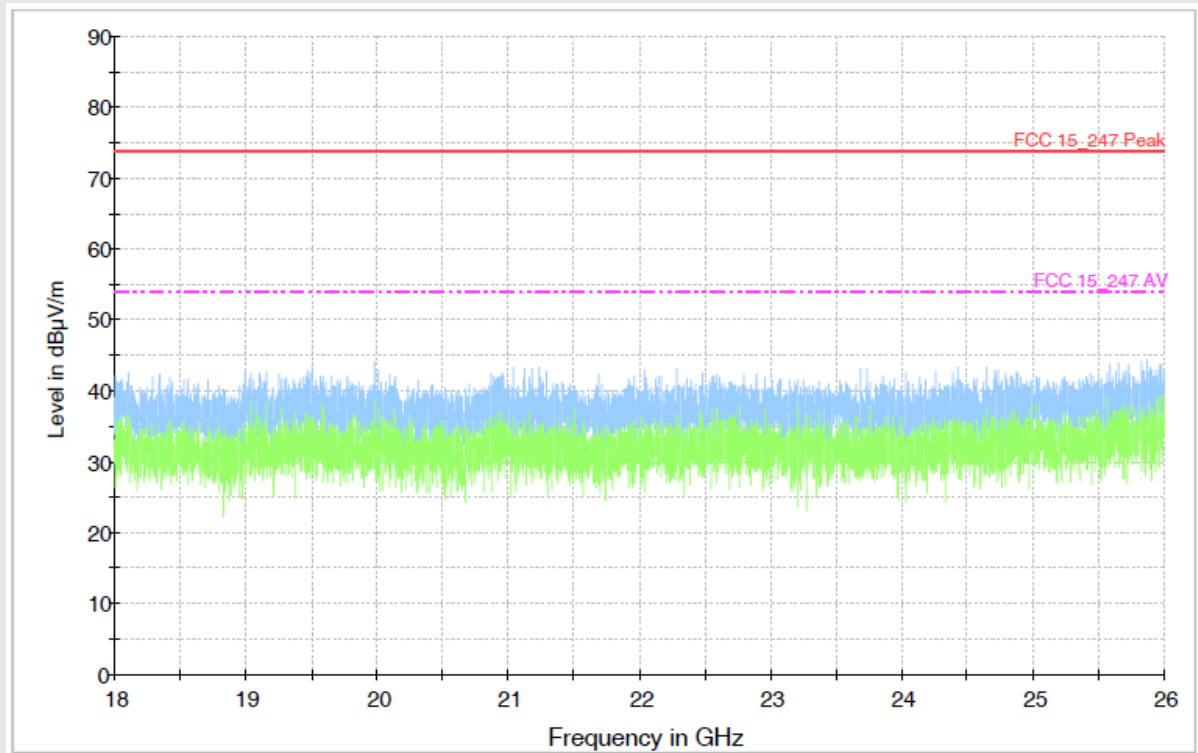


Final Result:

All emissions are below 10dB from the limit, for this reason no further assessments were carried out on the individual points

RX Antenna Polarization: Horizontal

Frequency Range: 18GHz – 26GHz



Final Result:

All emissions are below 10dB from the limit, for this reason no further assessments were carried out on the individual points

END OF TEST REPORT