

RAPPORTO DI PROVA

TEST REPORT

Rif. / Ref. n.	FCCTR_178523-1	Data Emissione / Issue Date:	10/05/2021	Pagine / Pages:	57
Scopo delle prove Test object	Prove di tipo in accordo alla Norma Type test according to standards 47 CFR FCC part 15.247				
Richiedente Applicant	Paradox Engineering SA Via Passeggiata 7 – 6883 Novazzano – CH Tel.: +41 912330100				
Marchio commerciale Trade mark					
Fabbricante Manufacturer	MinebeaMitsumi Inc. 3-9-6 Mita, Minato-ku, Tokyo 108-8330 Tel.: 81-3-6758-6711				
Prodotto Product	Multi radio gateway				
Modello testato Testing model	GWWG001US (PE Mini IoT Gateway)				
Identificativo FCC FCC ID	2AKPQGWG001				
Data ricevimento campioni Date of test samples receipt	24/02/2021				
Campioni verificati No. of tested samples	1 – Sampled by the manufacturer				
Data verifiche Testing date	From 24/02/2021 to 03/03/2021				
Sito di prova Testing site	PRSLAB S.r.l. Unipersonale - Via Campagna 92 - 22020 Faloppio - Como - Italy				
Esito delle valutazioni Assessment results	CONFORME / COMPLIANT				
Verifiche effettuate da Verifications carried out by	Daniele AOSANI Tecnico laboratorio EMC & RADIO EMC & RADIO Test Engineer				
Approvato Approved by	Riccardo PFEIFFER Responsabile laboratori EMC & RADIO EMC & RADIO Laboratory manager				

I risultati delle prove riportati nel presente rapporto di prova si riferiscono solo ai campioni esaminati.

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

Il campione è stato fornito dal cliente ed i risultati si riferiscono al campione così come ricevuto

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

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0. RELEASE CONTROL RECORD

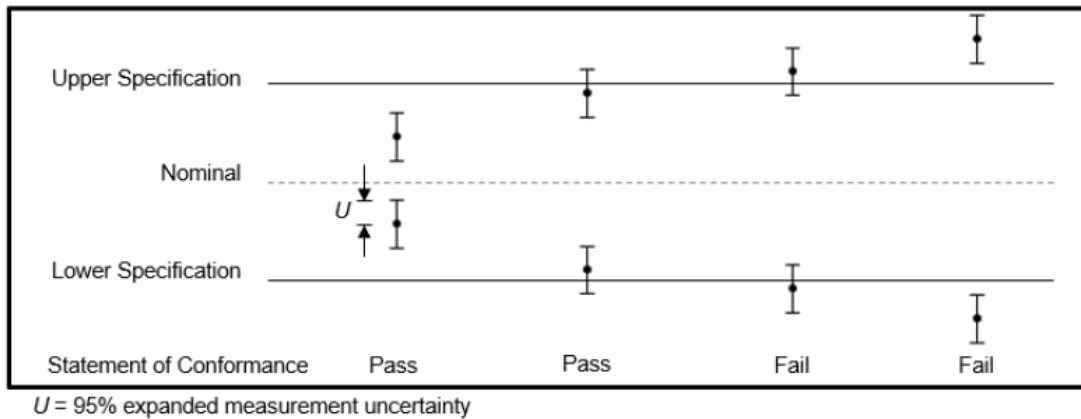
TEST REPORT NUMBER	REASON OF CHANGE	DATE OF ISSUE
FCCTR_178523_0	Original release	05/03/2021
FCCTR_178523_1	Add correct test method section	10/05/2021

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. INFORMATION PROVIDED BY CUSTOMER


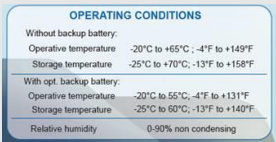
- None

3. GENERAL REMARKS



- The EUT has been tested with the internal welding (on the radio module screen) done in spots, the complete welding of the screen has the same results.

4. TECHNICAL INFORMATION OF EQUIPMENT UNDER TEST (EUT)

4.1 EUT Identification

DESCRIPTION	Multi radio gateway
MODEL NAME	GWWG001US (PE Mini IoT Gateway)
FCC ID	2AKPQGWWG001
SERIAL NO.	N/A
PRSLAB IDENTIFICATION	BC 68/2021 1/1
TRADEMARK	
MANUFACTURER	MinebeaMitsumi Inc.
COUNTRY OF MANUFACTURER	Japan
SINGLE UNIT OR SYSTEM	Single
POWER SOURCE	AC main
	PoE supply
SUPPLY VOLTAGE	115V ~ 60Hz
	48 Vdc from PoE
MAX POWER or MAX ABSORBED CURRENT	30 W
HW VERSION	ELB-PED-0145-04
FW VERSION	3.14
OPERATING TEMPERATURE	
DIMENSIONS	See photographic documentation
EUT STANDING	Wall or pole mounting

4.2 Radio module technical data

CHIP MANUFACTURER	
CHIP MODEL	S2-LP_ST (ELC-ICS-0157)
RADIO CATEGORY	Short Range Device
FREQUENCY BAND	902.42 ÷ 927.58MHz FHSS
NUMBER OF CHANNELS	75
CHANNELS SPACING	340kHz
OCW	200kHz
TYPE OF MODULATION	GFSK
DATA RATE	100kbps
SENSITIVITY	-99dBm @ BER<1%
ANTENNA TYPE	Chip antenna
ANTENNA GAIN	1.59dBi
ANTENNA MODEL	ANT1204F005R0915A (ELC-OTH-0150)
ANTENNA MANUFACTURER	

4.3 Ports identification

PORT	DESCRIPTION	CONNECTION	NOTES
<input checked="" type="checkbox"/> Enclosure	Plastic	Screws	---
<input checked="" type="checkbox"/> AC Power input	115V ~ 60Hz	Plug	---
<input checked="" type="checkbox"/> DC Power input	PoE	RJ45	>3mt
<input checked="" type="checkbox"/> Signal / Control port	Environmental sensor	cable	>3mt
<input checked="" type="checkbox"/> Telecomm. port	2x Ethernet port	RJ45	>3mt
<input checked="" type="checkbox"/> Antenna port:	1x Dipole antenna 3x Chip antenna	SMA ---	---

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

- Personal computer model AH532, manufacturer by Fujitsu, with software Radio Tester 1.12.3, to set channels.

5. OPERATING 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 1
#2	Continuous transmission, modulated carrier, on channel 37
#3	Continuous transmission, modulated carrier, on channel 75
#4	Continuous transmission, pseudorandom modulated, Hopping mode

Special Test Software: Special software by the Applicant to operate the EUT at each channel frequency continuously. For example, the transmitter will be operated at each of the lowest, middle and highest frequencies individually continuously during testing.

Special Hardware Used: None

Transmitter Test Antenna: The EUT has been tested with the antenna fitted in a manner typical of normal intended

6. REFERENCE STANDARDS

REFERENCE STANDARD	DESCRIPTION
Cfr 47 part 15 subpart C par. 15.247	Radio Frequency Devices – Intentional Radiators Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz
ANSI C63.10:2013	American National Standard for Testing Unlicensed Wireless Devices
Title 47 Part 1 Subpart I § 1.1310	Procedures Implementing the National Environmental Policy Act of 1969. Radiofrequency radiation exposure limits.
Title 47 Part 2 Subpart J § 2.1091	Radiofrequency radiation exposure evaluation: mobile devices.
ANSI C63.4:2014	American National Standard for Methods of Measuring of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz – 40 GHz

7. SUMMARY OF TEST RESULTS

EUT PORT	DESCRIPTION OF PHENOMENA	BASIC STANDARD	OPERATING CONDITION	RESULTS
Enclosure	Radiated Emissions	FCC Part 15 §15.205 §15.209 §15.247 (d)	#1, #2, #3	Within the limits
AC power input	Conducted Emissions	FCC Part 15 §15.207 §15.247 (c)	#4	Within the limits
Antenna port	Antenna requirement	FCC Part 15 §15.203	---	Compliant
	Maximum Peak Output Power	FCC Part 15 §15.247 (b) (2)	#1, #2, #3	Within the limits
	20 dB Bandwidth 99% BW	FCC Part 15 §15.247 (a) (2)	#1, #2, #3	Within the limits
	Band-Edge	FCC Part 15 § 15.247 (d)	#1, #2, #4	Within the limits
	Number of Hopping Frequency	FCC Part 15 § 15.247 (d)	#4	Within the limits
	Channel Separation	FCC Part 15 § 15.247 (d)	#4	Within the limits
	Number of Dwell Time	FCC Part 15 § 15.247 (d)	#4	Within the limits
	RF radiated Spurious Emissions at the Transmitter Antenna Terminal	FCC Part 15 § 15.247 (d)	#1, #2, #3	Within the limits

8. UNITS OF MEASUREMENTS

Conducted EMI Data is in dB μ V; dB referenced to one microvolt

Radiated EMI Data is in dB μ V/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 (dB μ V/m @ 3m) = FSM (dB μ V) + A.F. (dB/m) - Gain (dB)

9. LIST OF INSTRUMENTS USED

Instrument	Manufacturer	Model	Serial n°	Calibrated on	Due to
MXE Emi Receiver	Keysight	N9038A	MY57290150	06/2020	06/2021
Stabilized Power Supply	Spitzenberger+Spies	PAS5000	A154201/00595	03/2020	03/2021
Loop antenna	Rohde & Schwarz	HFH 2-Z2	841801/012	03/2020	03/2023
Bi-log antenna	Chase	CBL6111C	2717	03/2019	03/2022
Horn antenna	Electro Metrics	EM-6961	100437	10/2020	10/2023
High pass filter	Wainwright	WHK 1,3/15G	9	03/2019	03/2021
LISN	Rohde & Schwarz	ESH3-Z5	838576/009	11/2019	11/2020
Power sensor	Keysight	U2022XA + U2032A	MY57030003	06/2020	06/2022
Semi-Anechoic Chamber	Siemens	B83117-D6019-T232	003-005-134/94C	02/2021	02/2022
Software EMC	Rohde & Schwarz	EMC32-E	V 8.40.0	N.A.	

10. TEST RESULTS

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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) (2)

For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

• TEST SETUP	ANSI C63.10
• TEST LOCATION	Semi-anechoic chamber Radio test area
• TEST METHOD	ANSI C63.10 section 7.8.5
• TEST EQUIPMENT USED FOR TEST	Stabilized Power Supply Spitzenberger+Spies mod. PAS5000 MXE Emi Receiver Keysight mod. N9038A Horn antenna Electro Metrics mod. EM-6961 Power sensor Keysight mod. U2022XA + U2032A
• TEST PERFORMED BY	Daniele Aosani

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

Measured 20dB BW	220kHz
Resolution bandwidth	200kHz
Video bandwidth	1MHz
Span	1MHz
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.

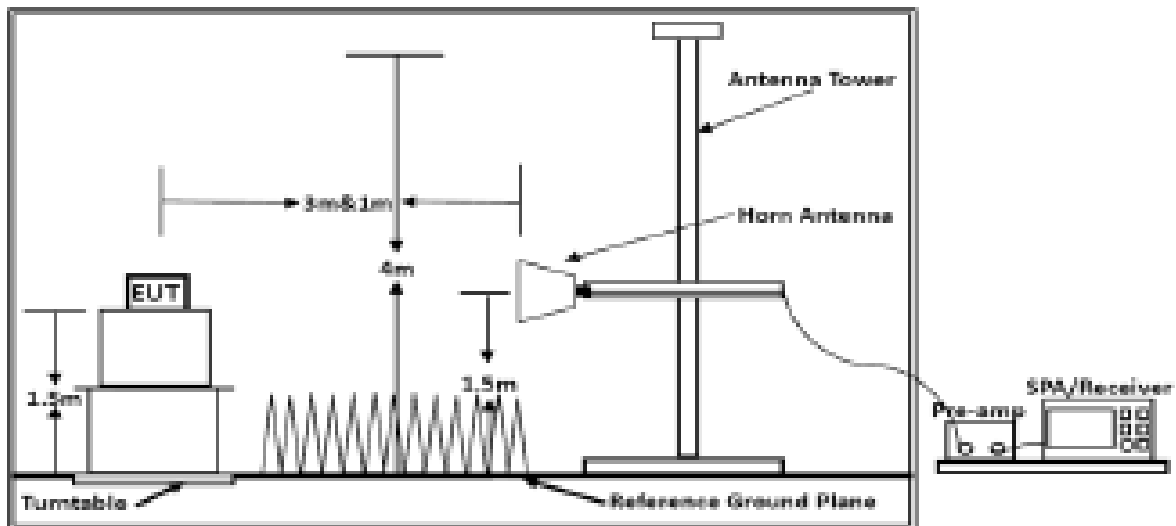
The EUT is placed at test table.

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



Above 1GHz

MEASUREMENT RESULT

Channel	Frequency (MHz)	EIRP (dBm)	Antenna Gain	Max Conducted Output power (dBm)	Limit (dBm)	Result
1	902.42	25.09	+1.59	23.50	30	WITHIN THE LIMITS
37	915.00	25.98	+1.59	24.39		
75	927.58	24.76	+1.59	23.17		
Note: ---						

TEST 3.	20dB CHANNEL BANDWIDTH 99% BW
REFERENCE DOCUMENT	<p>According to §15,247(a)(1)(i)</p> <p>For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.</p>

• TEST SETUP	ANSI C63.10
• TEST LOCATION	Radio test area
• TEST METHOD	ANSI C63.10:2013 section 7.8.7
• TYPE OF MEASUREMENT	Radiated
• TEST EQUIPMENT USED FOR TEST	Stabilized Power Supply Spitzenberger+Spies mod. PAS5000 MXE Emi Receiver Keysight mod. N9038
• TEST PERFORMED BY	Daniele Aosani

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	1kHz
Video bandwidth	5kHz
Span	1MHz
Sweep time	Auto couple
Detector	Peak
Trace-Mode	Max. hold

TEST DESCRIPTION

The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down/99%BW one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

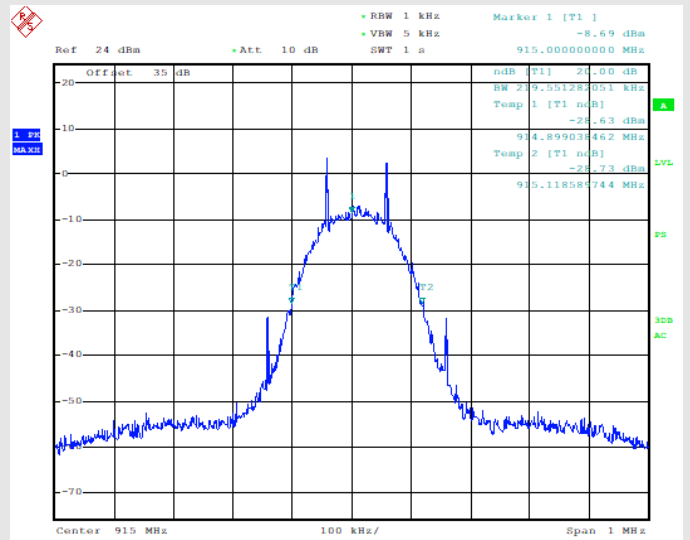
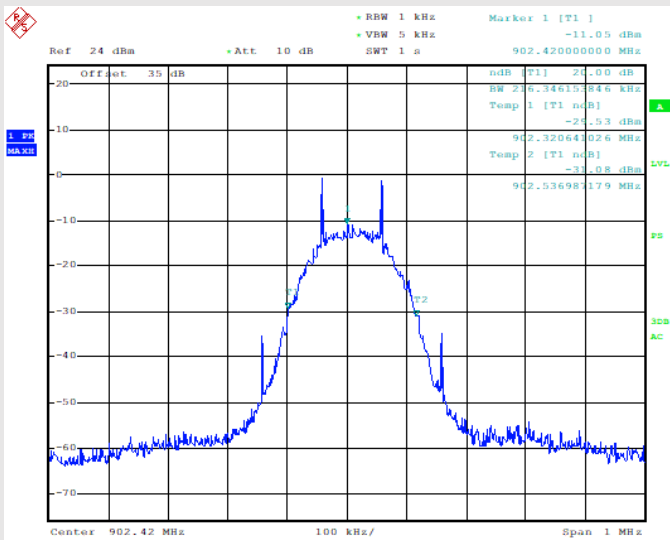
MEASUREMENT RESULT

Channel	Frequency (MHz)	20dB Bandwidth (kHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Verdict
1	902.42	216.35	177.88	500	Within the limits
37	915.00	219.55	181.09	500	
75	927.58	214.74	176.28	500	

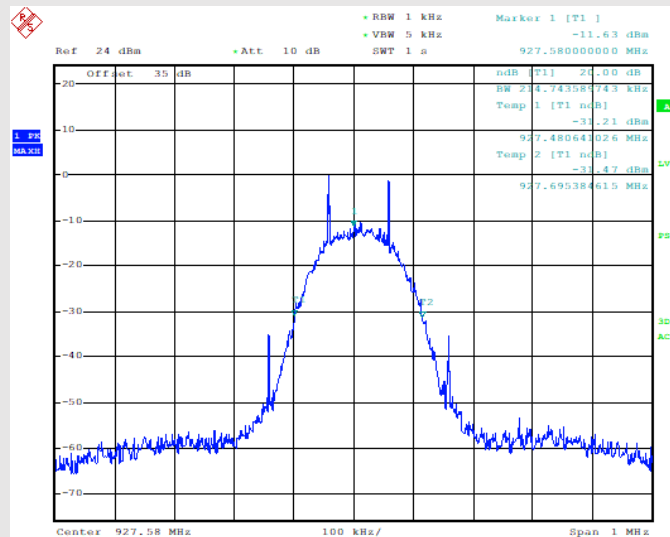
20dB Bandwidth

Channel 1

Channel 37



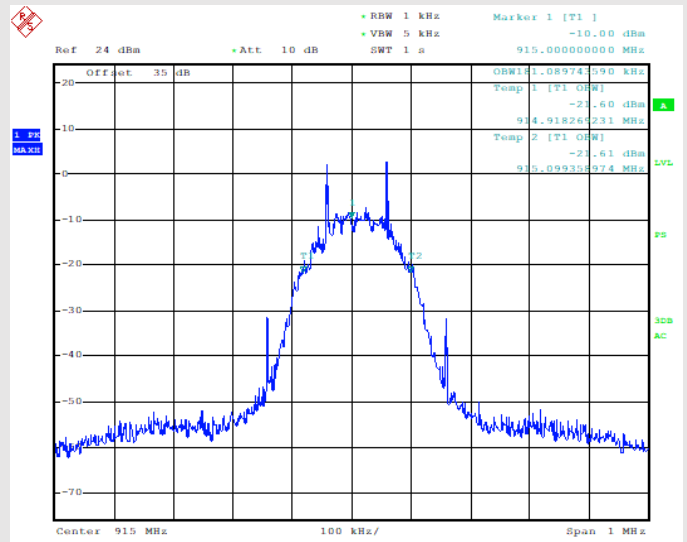
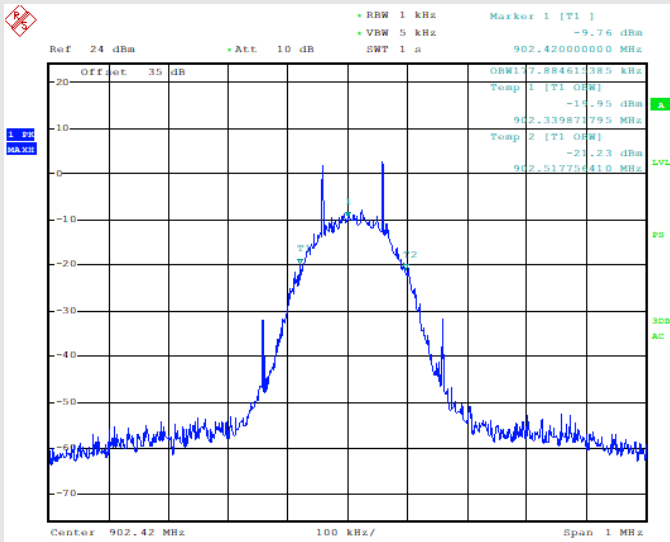
Channel 75



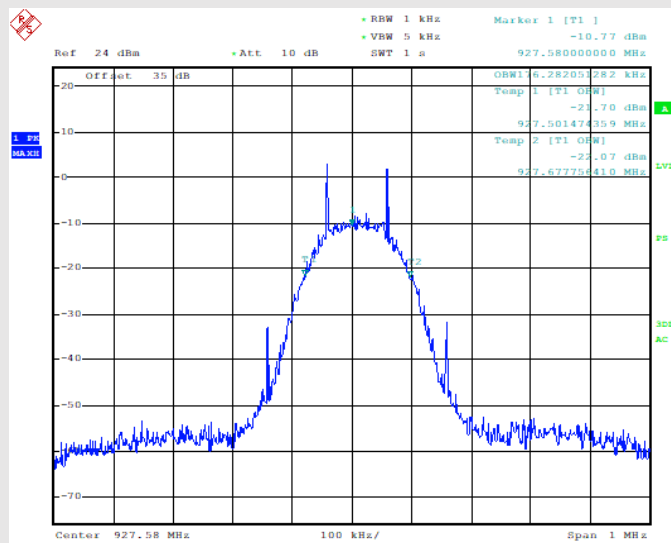
Occupied Bandwidth

Channel 1

Channel 37



Channel 75



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 SETUP	Acc. to reference document
• TEST LOCATION	Radio test area
• TEST METHOD	ANSI C63.10:2013 section 7.8.6
• TYPE OF MEASUREMENT	Radiated
• TEST EQUIPMENT USED FOR TEST	Stabilized Power Supply Spitzenberger+Spies mod. PAS5000 MXE Emi Receiver Keysight mod. N9038
• TEST PERFORMED BY	Daniele Aosani

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

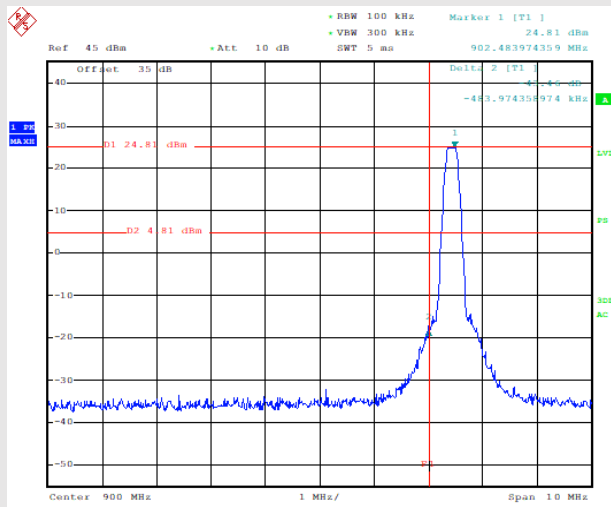
OPERATING CONDITION :#1, #3, #4

RESULT: **WITHIN THE LIMITS**

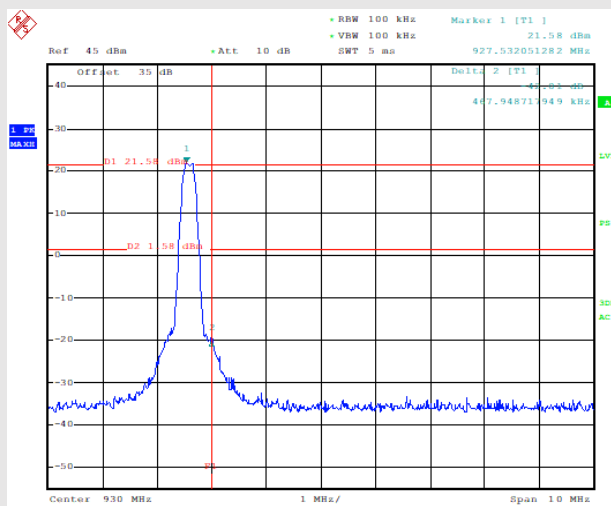
MEASUREMENT PARAMETER	
Resolution bandwidth	100kHz
Video bandwidth	300kHz
Span	10MHz for single channel 40MHz for hopping mode
Sweep time	Auto couple
Detector	Peak
Trace-Mode	Max. hold

MEASUREMENT RESULT

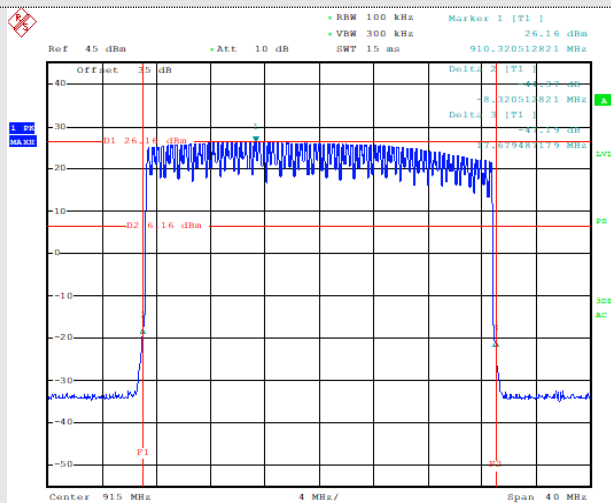
**LOWER BAND-EDGE
CH 1**



**UPPER BAND-EDGE
CH 75**



HOPPING BAND-EDGE



NOTE: In this test the Peak detector was used and all emissions detected are below the Quasi-Peak limits.

TEST 5.

NUMBER OF HOPPING FREQUENCY

REFERENCE DOCUMENT

According to §15,247) (a)(1)(i)

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz

• TEST SETUP	Acc. to reference document
• TEST LOCATION	Radio test area
• TEST METHOD	ANSI C63.10:2013 section 7.8.3
• TYPE OF MEASUREMENT	Radiated
• TEST EQUIPMENT USED FOR TEST	Stabilized Power Supply Spitzenberger+Spies mod. PAS5000 MXE Emi Receiver Keysight mod. N9038
• TEST PERFORMED BY	Daniele Aosani

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: #4

RESULT: **WITHIN THE LIMITS**

MEASUREMENT PARAMETER

Resolution bandwidth	200kHz
Video bandwidth	500kHz
Span	15MHz
Sweep time	Auto couple
Detector	Peak
Trace-Mode	Max. hold

TEST DESCRIPTION

Allow the trace to stabilize. It may prove necessary to break the span up to sections, in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

MEASUREMENT RESULT

<p>FREQUENCY RANGE 900-915MHz</p>		
<p>FREQUENCY RANGE 915-930MHz</p>		
<p>NUMBER OF HOPPING CHANNELS</p>	<p>75</p>	<p>PASS</p>

TEST 6.

CHANNEL SEPARATION

REFERENCE DOCUMENT

According to §15,247) (a) (1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

• TEST SETUP	Acc. to reference document
• TEST LOCATION	Radio test area
• TEST METHOD	ANSI C63.10:2013
• TYPE OF MEASUREMENT	Radiated
• TEST EQUIPMENT USED FOR TEST	Stabilized Power Supply Spitzenberger+Spies mod. PAS5000 MXE Emi Receiver Keysight mod. N9038
• TEST PERFORMED BY	Daniele Aosani

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: #4

RESULT: **WITHIN THE LIMITS**

MEASUREMENT PARAMETER

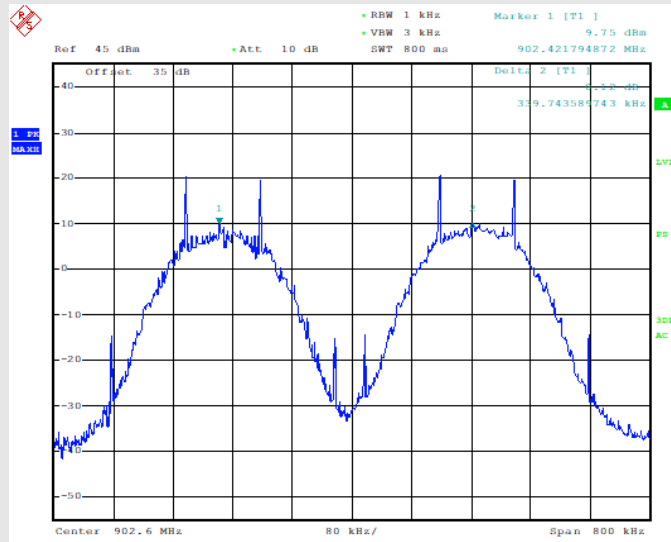
Resolution bandwidth	1kHz
Video bandwidth	3kHz
Span	800kHz
Sweep time	Auto couple
Detector	Peak
Trace-Mode	Max. hold

TEST DESCRIPTION

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section. Submit this plot.

MEASUREMENT RESULT

CHANNEL SEPARATION



MEASURED CHANNEL SEPARATION

339.74kHz

PASS

TEST 7.

NUMBER OF DWELL TIME

REFERENCE DOCUMENT

According to §15,247) (a) (1) (III)

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz

• TEST SETUP	Acc. to reference document
• TEST LOCATION	Radio test area
• TEST METHOD	ANSI C63.10:2013 section 7.8.4
• TYPE OF MEASUREMENT	Radiated
• TEST EQUIPMENT USED FOR TEST	Stabilized Power Supply Spitzenberger+Spies mod. PAS5000 MXE Emi Receiver Keysight mod. N9038
• TEST PERFORMED BY	Daniele Aosani

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: #4

RESULT: **WITHIN THE LIMITS**

MEASUREMENT PARAMETER

Resolution bandwidth	1kHz
Video bandwidth	5kHz
Span	Zero
Sweep time	Auto couple
Detector	Peak
Trace-Mode	Max. hold

TEST DESCRIPTION

Enable gating and trigger function of spectrum analyzer to measure burst on time.

MEASUREMENT RESULT

Channel	Frequency (MHz)	Length of Transmission Time (ms)	Number of Transmission in 20s	Results (s)	Limit (s)
1	902.42	376	1	0,376	0.4
37	915.00	385	1	0,385	0.4
75	927.58	390	1	0,390	0.4

TEST 8.

RADIATED EMISSION 9kHz ÷ 10th HARMONIC

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 §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 reference document
• TEST LOCATION	Semi-anechoic chamber with measure distance at 3 meters
• TYPE OF MEASUREMENT	Radiated
• TEST METHOD	ANSI C63.10:2013 section 6.11
• TEST EQUIPMENT USED FOR TEST	Stabilized Power Supply Spitzenberger+Spies mod. PAS5000 MXE Emi Receiver Keysight mod. N9038 Loop Antenna Rohde & Schwarz mod. HFH 2-Z2 Bi-log antenna Chase mod. CBL6111C Horn antenna Electro Metrics mod. EM-6961 High pass filter Wainwright mod. WHK 1,3/15G SW Rohde & Schwarz EMC32-E
• TEST PERFORMED BY	Daniele Aosani
• UNCERTAINTY OF MEASURE:	Level of confidence = 95% (k=2) Expanded uncertainty 9kHz – 30MHz = 4,24 dB Expanded uncertainty 30MHz – 1GHz = 5,86 dB Expanded uncertainty 1GHz – 10GHz = 5,3 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 9kHz – 30MHz

Resolution bandwidth:	200Hz
Video bandwidth:	1kHz
Span:	See plots below
Sweep time	Auto couple
Detector:	Peak
Trace-Mode:	Max. hold

MEASUREMENT PARAMETER 30MHz – 1GHz

Resolution bandwidth:	100kHz
Video bandwidth:	300kHz
Span:	See plots below
Sweep time	Auto couple
Detector:	Peak
Trace-Mode:	Max. hold

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.

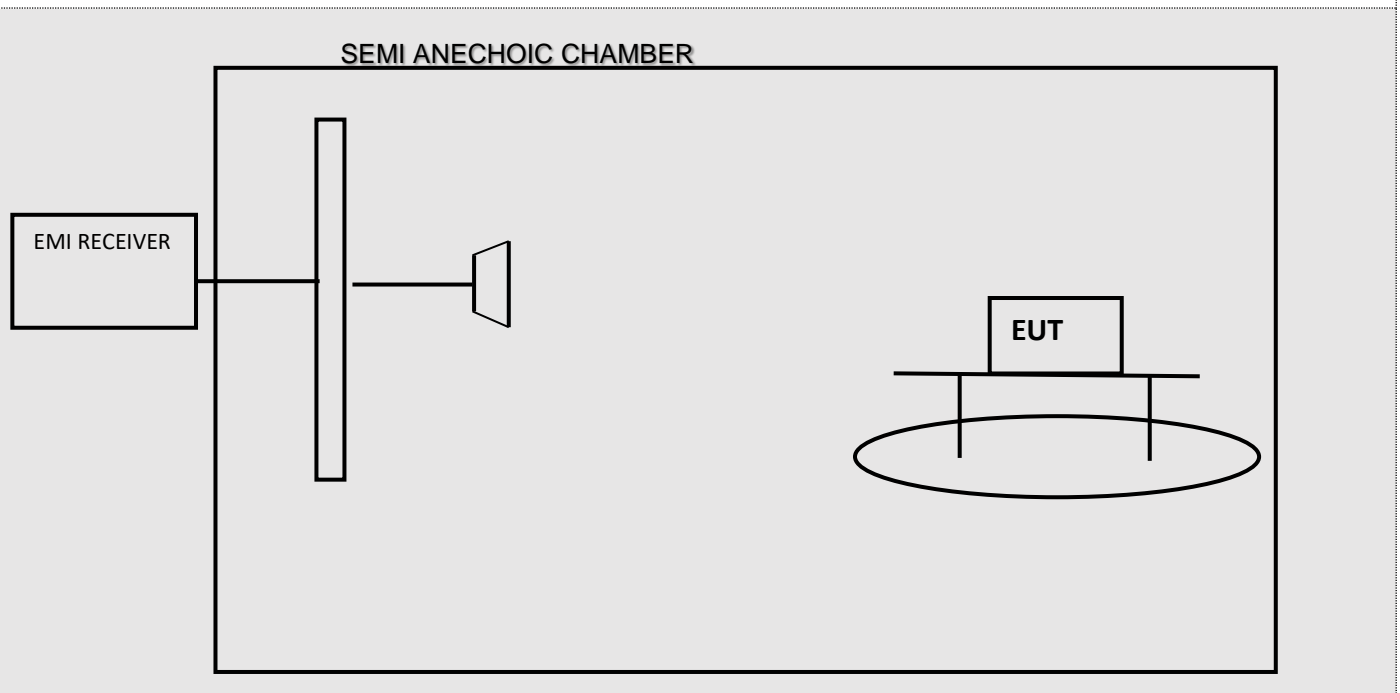
The EUT is placed at test table.

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.

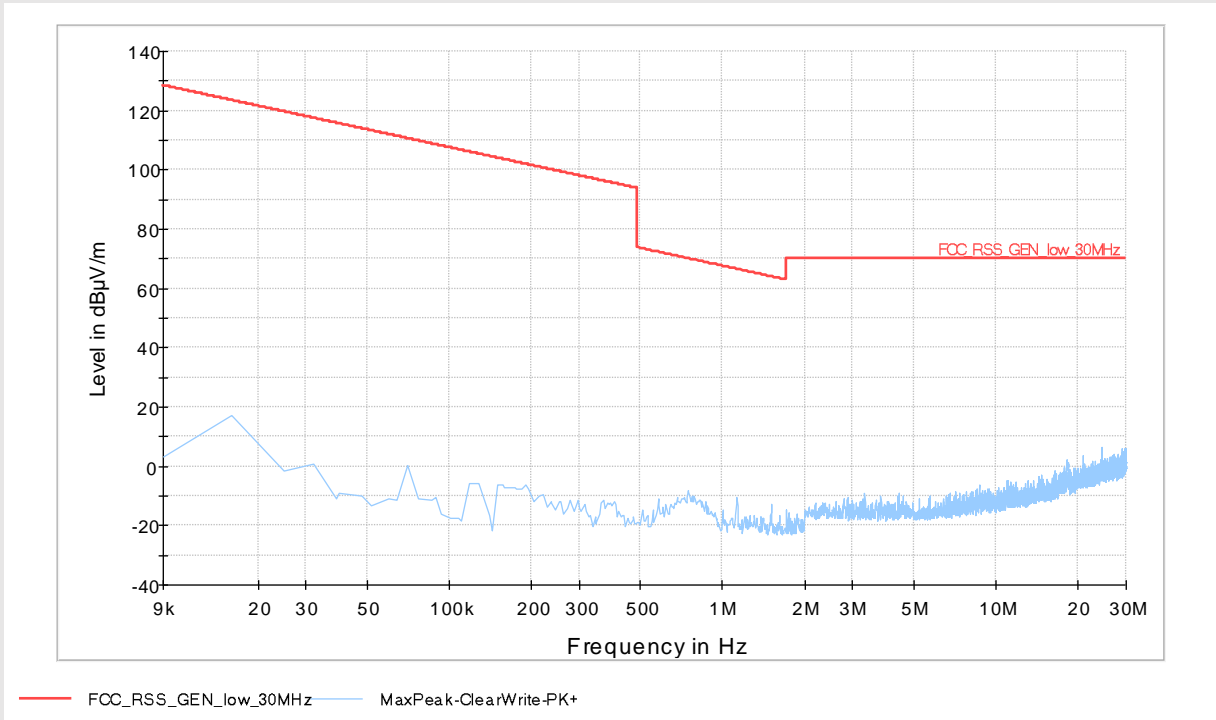
This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

TEST SETUP BLOCK DIAGRAM



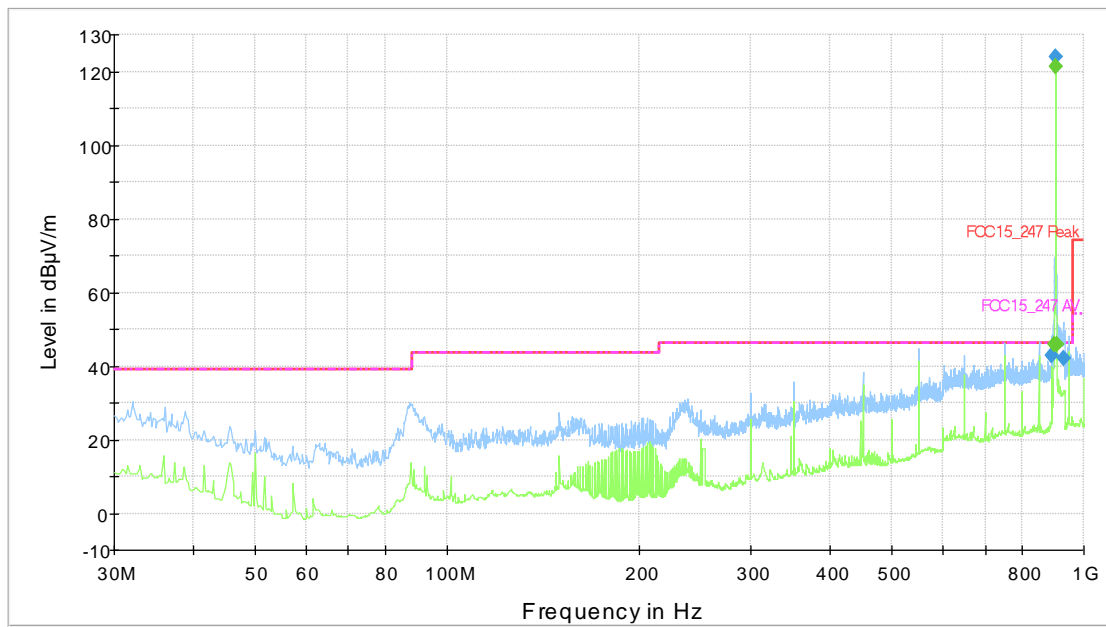
MEASUREMENT RESULT

Operating Frequency	902.42MHz
Frequency Range	9kHz – 30MHz



Frequency Range 30MHz – 1GHz

Polarization Vertical



— FCC 15_247 Peak-CAR - - - FCC 15_247 AV-CAR — MaxPeak-ClearWrite-PK+
— Average-ClearWrite-AVG ◆ Final Result 1-PK+ ◆ Final Result 2-AVG

Final Result Peak

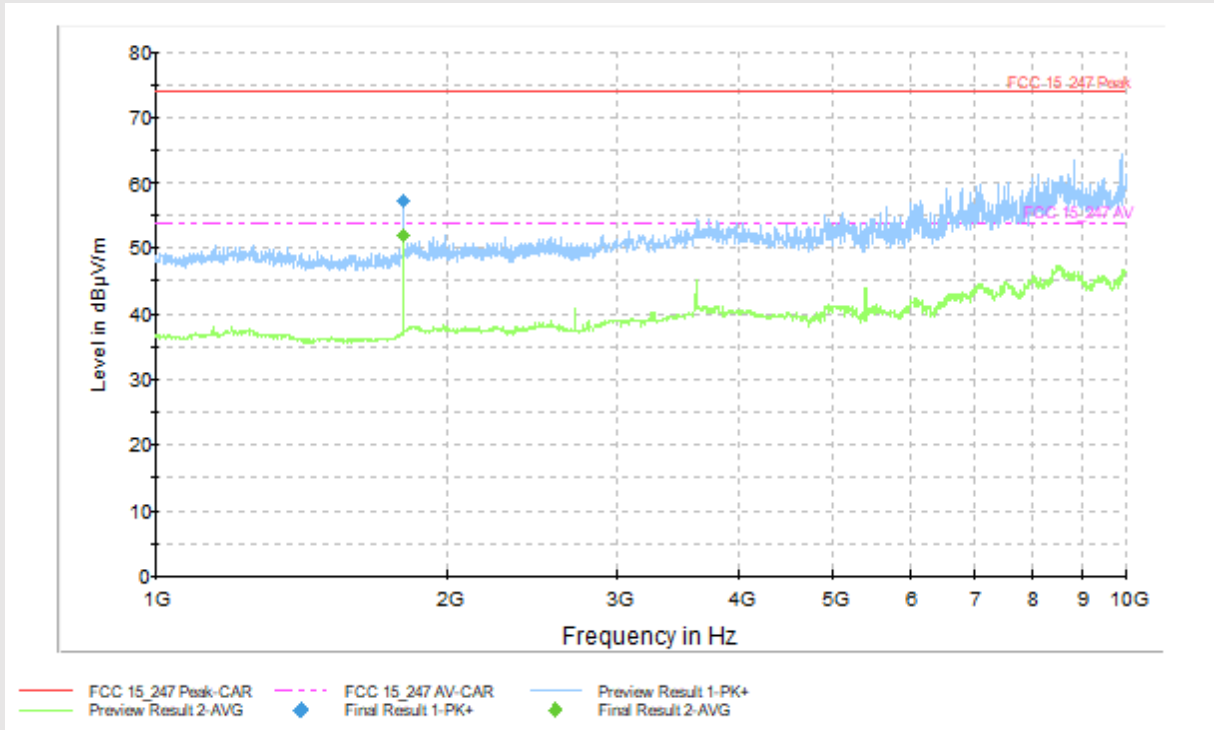
Frequency (MHz)	MaxPeak (dBµV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
889.230000	42.7	97.4	277.0	3.70	46.40
902.370000	123.9	115.6	262.0	-77.50	46.40
927.630000	42.1	179.9	277.0	4.30	46.40

Final Result Average

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
896.970000	46.0	104.7	277.0	0.40	46.40
902.430000	121.5	115.6	262.0	-75.10	46.40
907.890000	45.8	97.4	262.0	0.60	46.40

NOTE: Peak out of limits is due to Radio carrier.

Frequency Range	1GHz – 10GHz
Polarization	Vertical



Final Result Peak

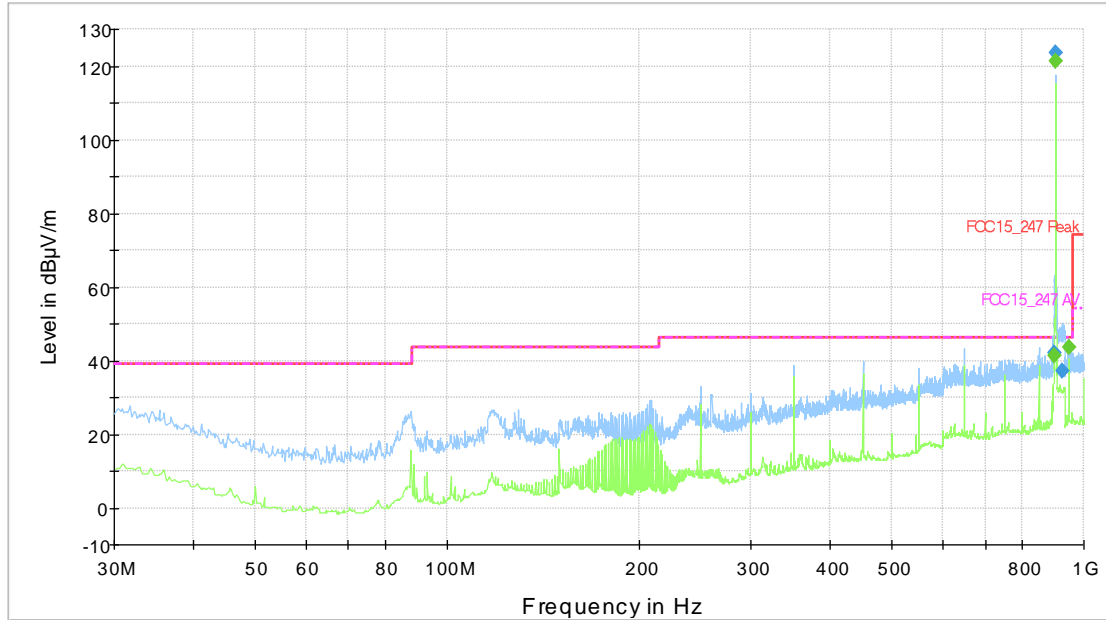
Frequency (MHz)	MaxPeak (dBµV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
1805.000000	57.4	224.6	262.0	16.60	74.00

Final Result Average

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
1805.000000	52.0	224.6	270.0	2.00	54.00

Frequency Range 30MHz – 1GHz

Polarization Horizontal



— FCC 15_247 Peak-CAR — FCC 15_247 AV-CAR — MaxPeak-ClearWrite-PK+
— Average-ClearWrite-AVG ◆ Final Result1-PK+ ◆ Final Result2-AVG

Final Result Peak

Frequency (MHz)	MaxPeak (dBµV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
897.000000	42.0	222.5	187.0	4.40	46.40
902.370000	123.6	223.5	187.0	-77.20	46.40
923.790000	37.1	200.5	7.0	9.30	46.40

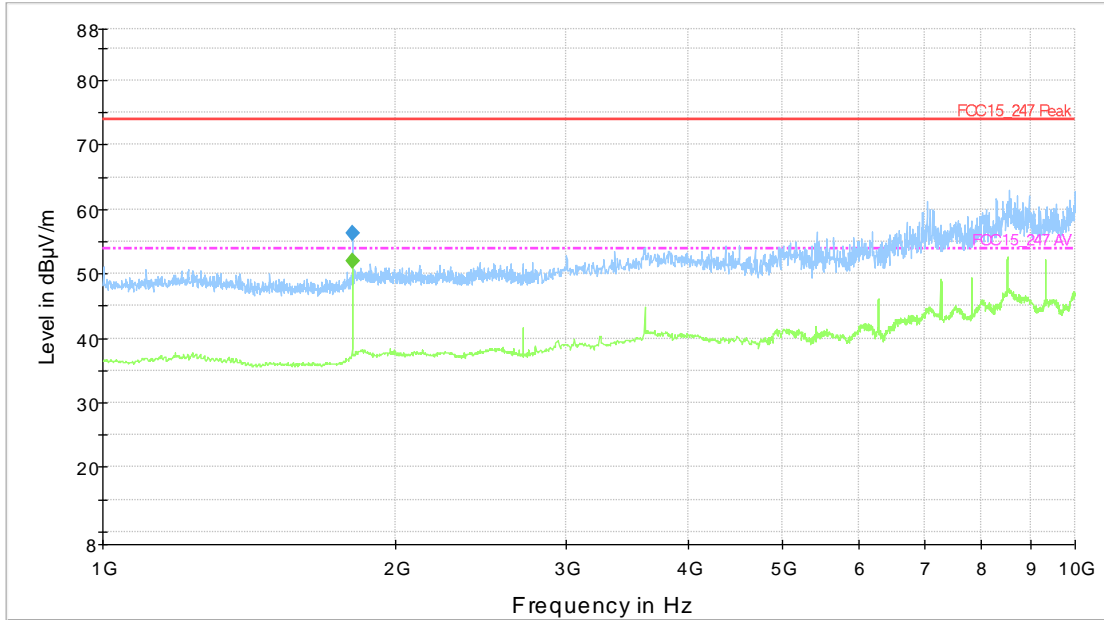
Final Result Average

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
896.970000	41.4	226.6	187.0	5.00	46.40
902.430000	121.2	224.6	187.0	-74.80	46.40
949.980000	43.5	116.7	187.0	2.90	46.40

NOTE: Peak out of limits is due to Radio carrier.

Frequency Range 1GHz – 10GHz

Polarization Horizontal



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

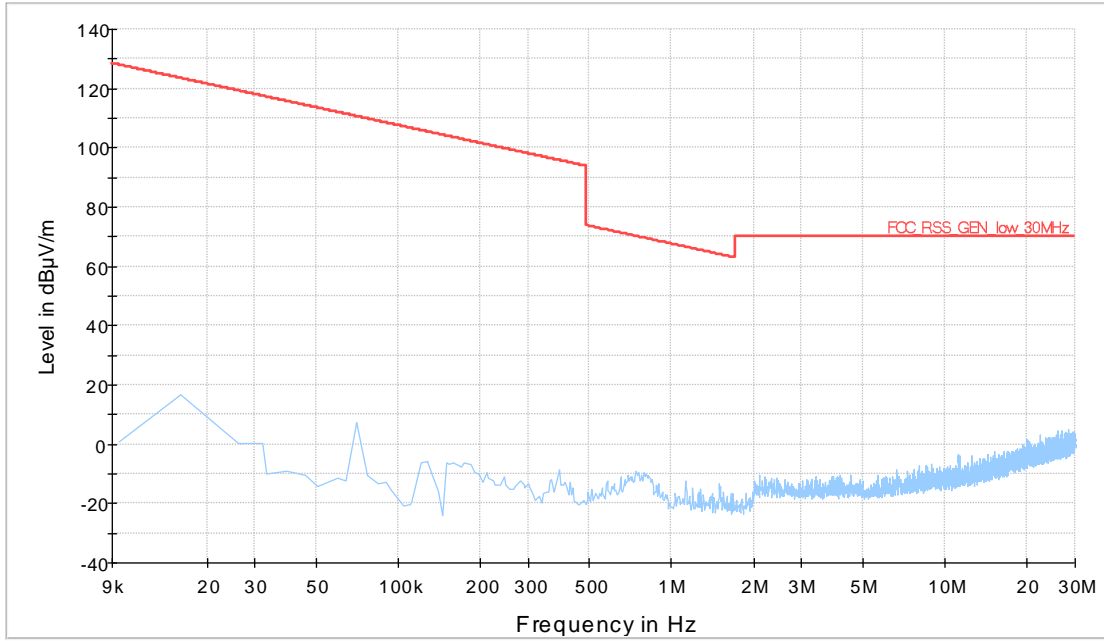
Final Result Peak

Frequency (MHz)	MaxPeak (dBµV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
1805.000000	56.2	106.8	277.0	17.80	74.00

Final Result Average

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
1805.000000	52.0	106.9	277.0	2.00	54.00

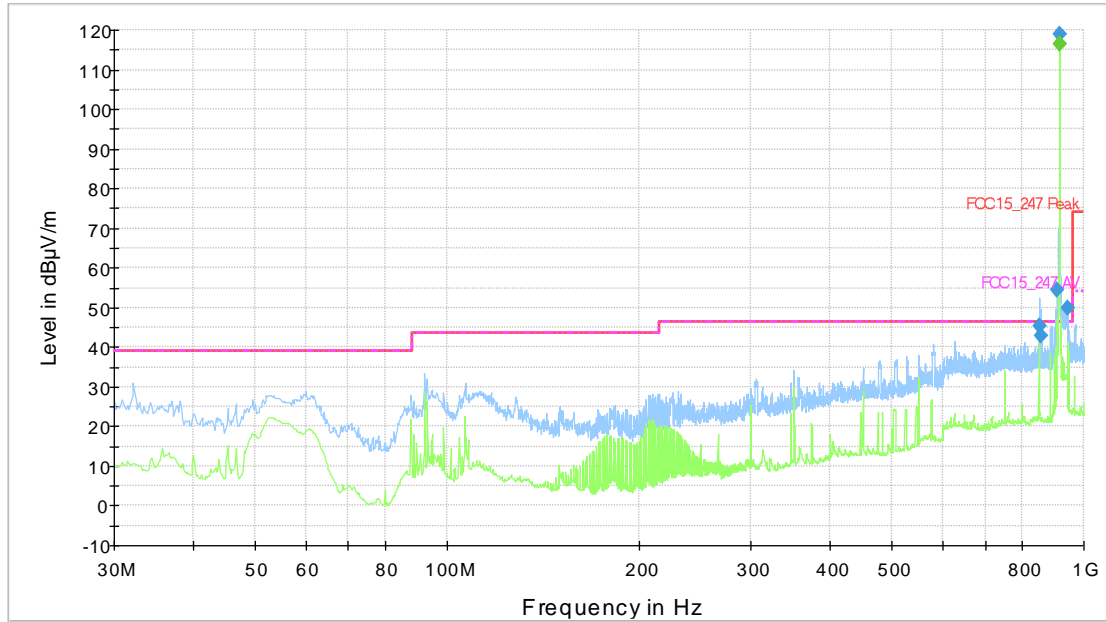
Operating Frequency	915MHz
Frequency Range	9kHz – 30MHz



— FCC_RSS_GEN_low_30MHz — MaxPeak-ClearWrite-PK+ ◆ Final Result1-PK+

Frequency Range 30MHz – 1GHz

Polarization Vertical



— FCC 15_247 Peak-CAR - - - - - FCC 15_247 AV-CAR — MaxPeak-ClearWrite-PK+
— Average-ClearWrite-AVG ◆ Final Result1-PK+ ◆ Final Result2-AVG

Final Result Peak

Frequency (MHz)	MaxPeak (dBµV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
852.810000	45.2	321.8	264.0	1.20	46.40
857.340000	42.9	179.6	277.0	3.50	46.40
909.570000	54.5	97.5	187.0	-8.10	46.40
915.060000	118.9	97.4	187.0	-72.50	46.40
944.430000	50.0	104.7	187.0	-3.60	46.40

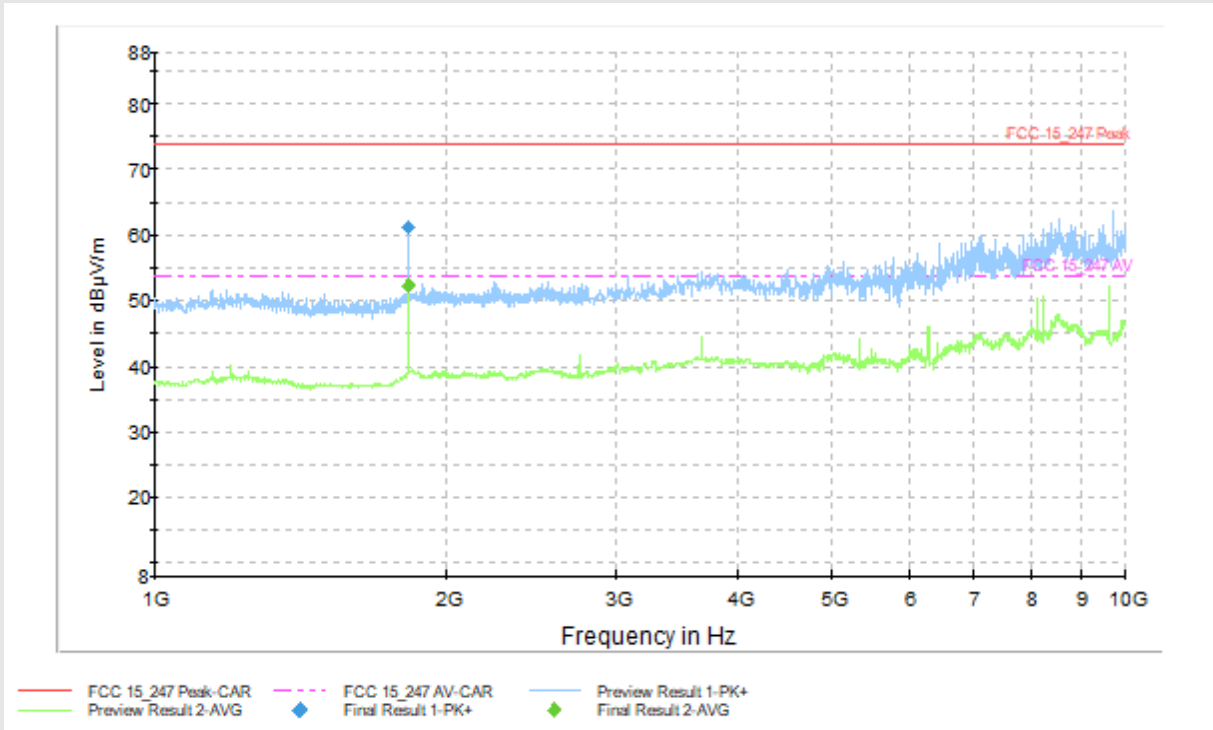
Final Result Average

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
915.000000	116.4	97.5	187.0	-70.00	46.40

NOTE: Peak out of limits is due to Radio carrier.

Frequency Range 1GHz – 10GHz

Polarization Vertical



Final Result Peak

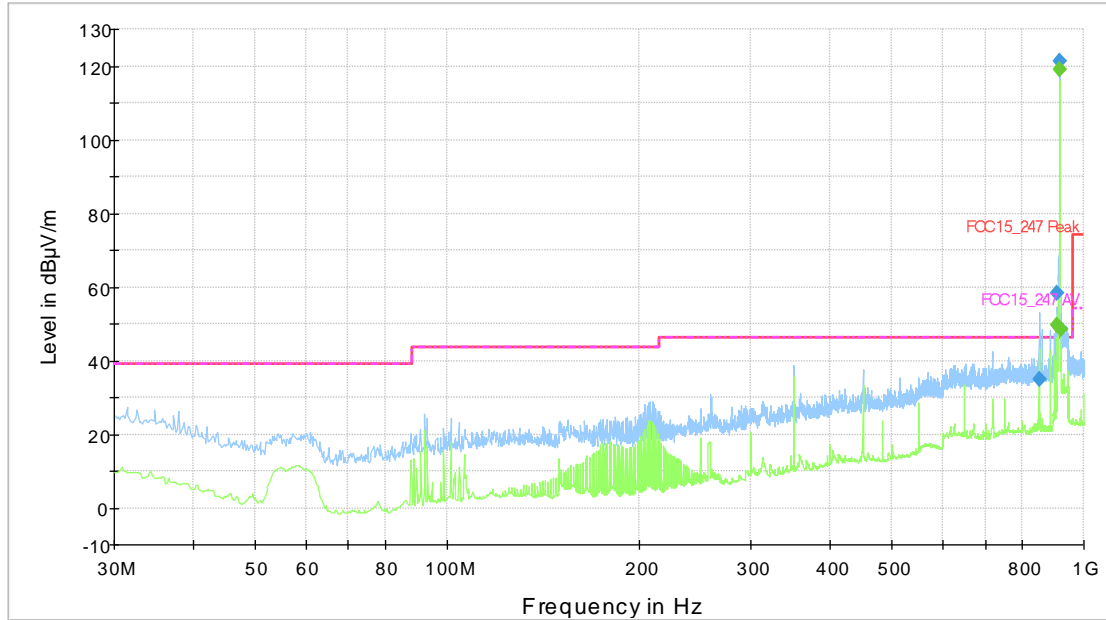
Frequency (MHz)	MaxPeak (dBµV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
1830.000000	61.2	206.8	265.0	12.80	74.00

Final Result Average

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
1830.000000	53.0	230.7	262.0	1.00	54.00

Frequency Range 30MHz – 1GHz

Polarization Horizontal



— FCC 15_247 Peak-CAR — FCC 15_247 AV-CAR — MaxPeak-ClearWrite-PK+
— Average-ClearWrite-AVG ◆ Final Result1-PK+ ◆ Final Result2-AVG

Final Result Peak

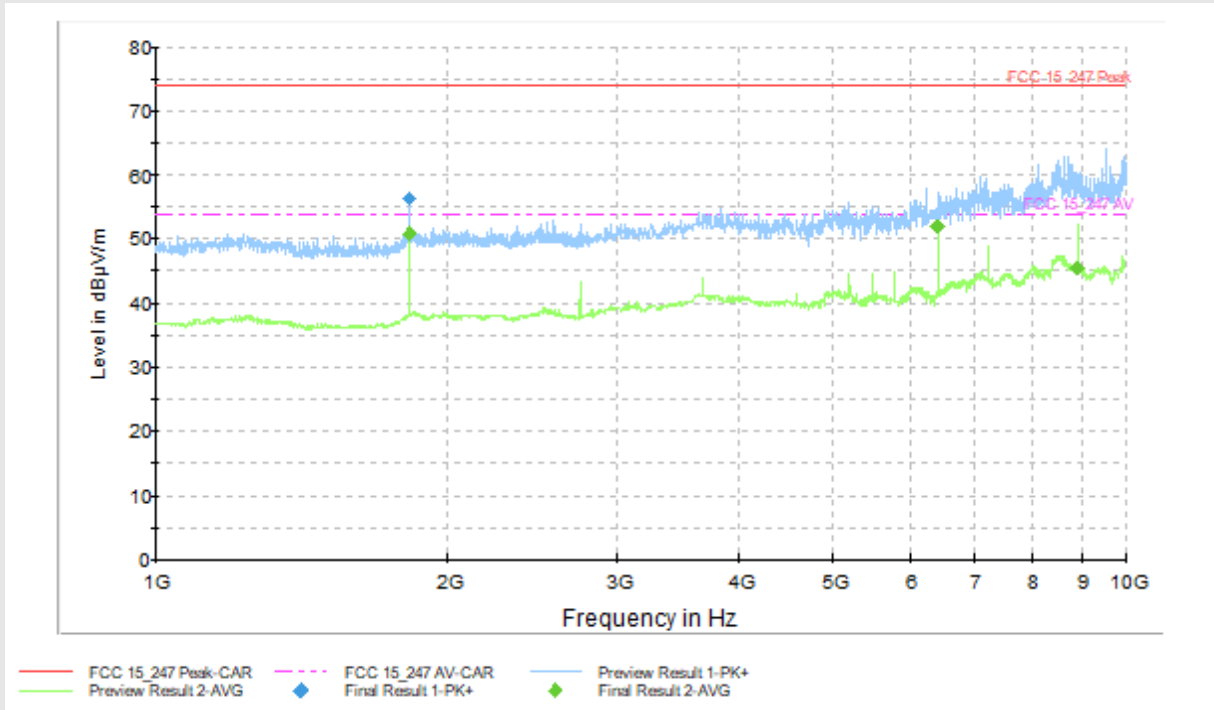
Frequency (MHz)	MaxPeak (dBµV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
852.540000	35.1	97.5	-8.0	11.30	46.40
909.510000	58.2	223.5	187.0	-11.80	46.40
915.060000	121.4	221.5	187.0	-75.00	46.40

Final Result Average

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
909.540000	49.6	225.6	187.0	-3.20	46.40
915.000000	119.1	223.6	187.0	-72.70	46.40
920.460000	48.6	223.5	187.0	-2.20	46.40

NOTE: Peak out of limits is due to Radio carrier.

Frequency Range	1GHz – 10GHz
Polarization	Horizontal



Final Result Peak

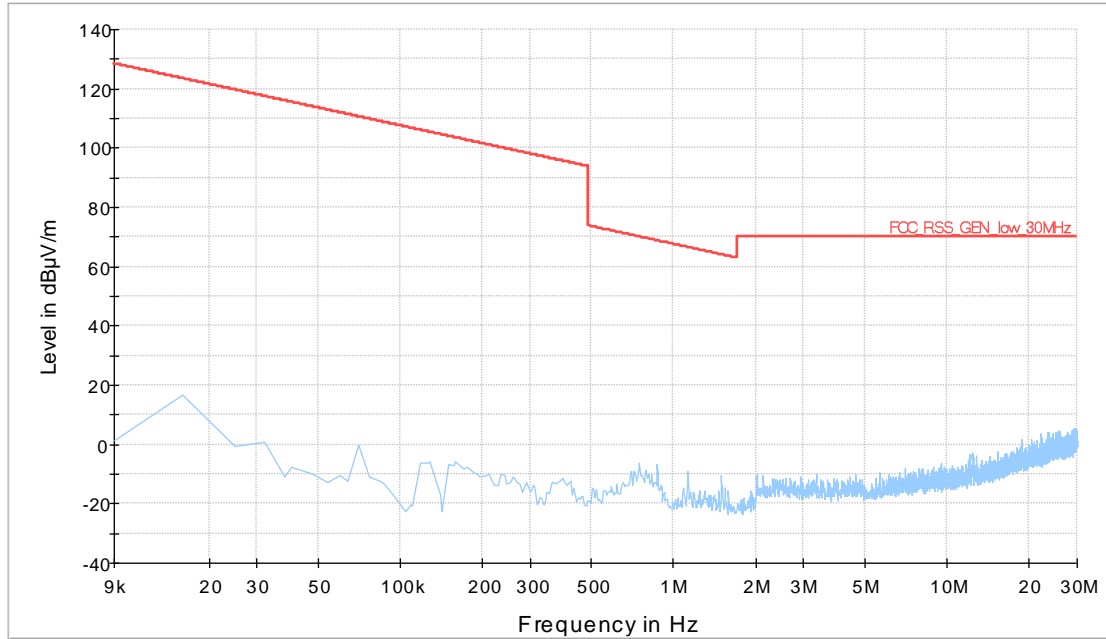
Frequency (MHz)	MaxPeak (dBµV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
1830.000000	56.2	106.9	7.0	17.80	74.00

Final Result Average

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
1830.000000	50.9	106.9	1.0	3.10	54.00
6405.000000	52.5	221.6	97.0	1.50	54.00
8915.000000	45.5	149.9	277.0	8.50	54.00

Operating Frequency 927.58MHz

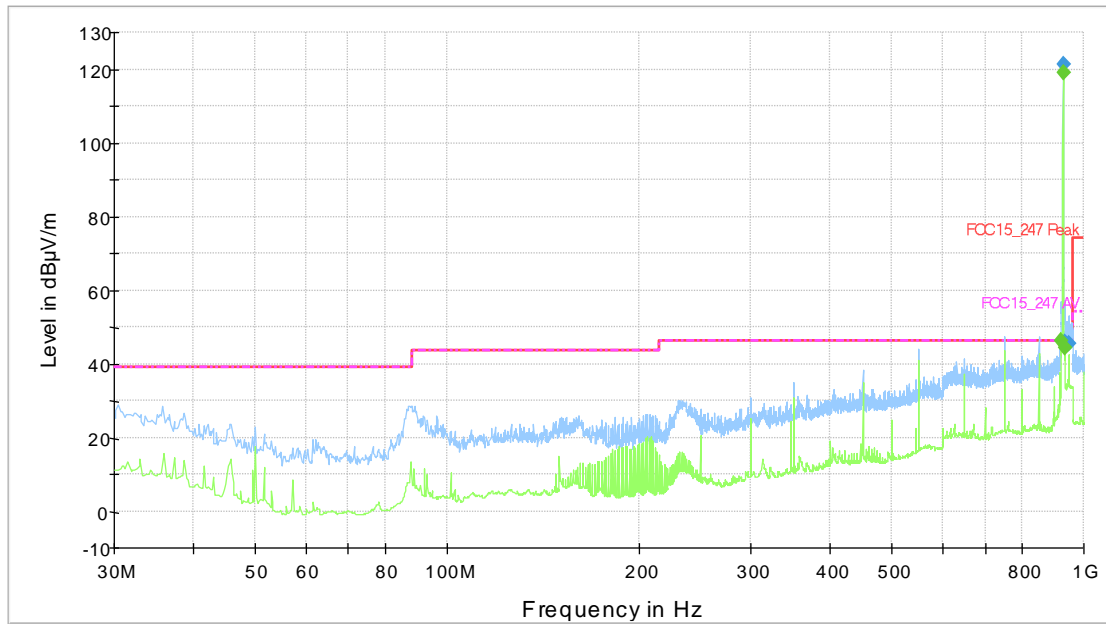
Frequency Range 9kHz – 30MHz



FCC_RSS_GEN_low_30MHz MaxPeak-ClearWrite-PK+

Frequency Range 30MHz – 1GHz

Polarization Vertical



— FCC 15_247 Peak-CAR
 - - - FCC 15_247 AV-CAR
 — MaxPeak-ClearWrite-PK+
— Average-ClearWrite-AVG
 ◆ Final Result 1-PK+
 ◆ Final Result 2-AVG

Final Result Peak

Frequency (MHz)	MaxPeak (dBµV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
927.540000	121.5	97.4	262.0	-75.10	46.40
933.120000	46.0	97.4	277.0	0.40	46.40
948.630000	45.3	97.4	270.0	1.10	46.40

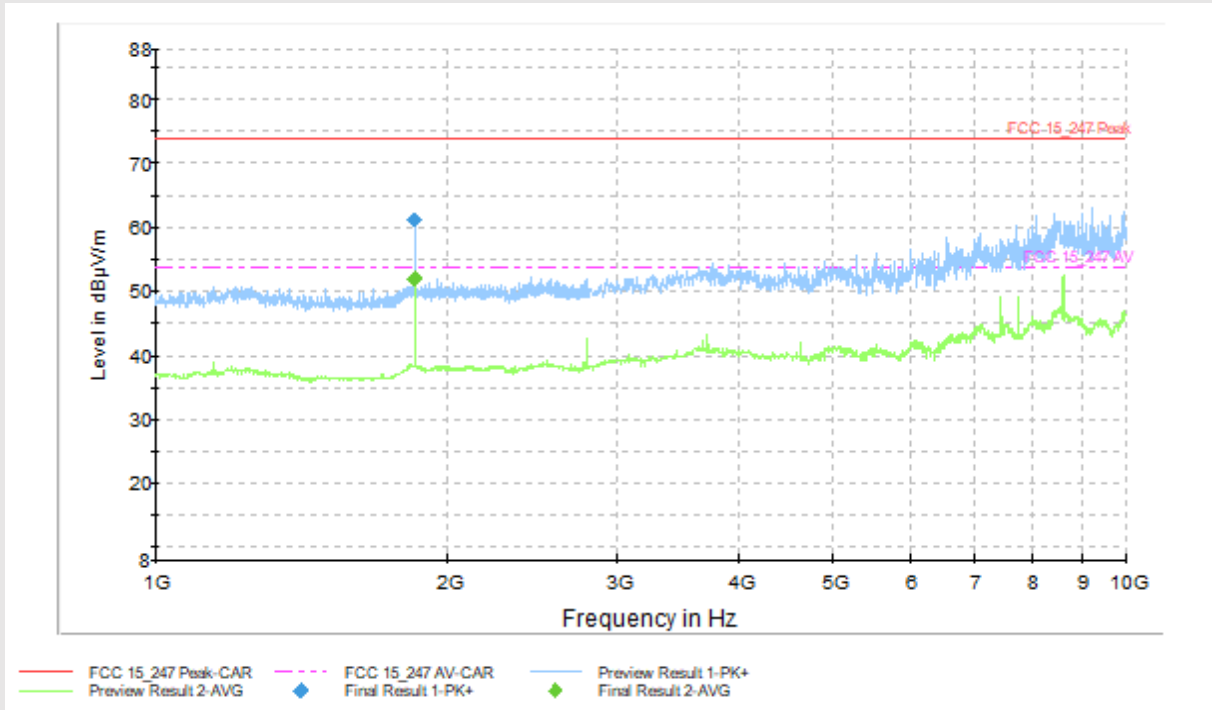
Final Result Average

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
922.110000	46.3	116.7	262.0	0.10	46.40
927.600000	119.0	97.4	262.0	-72.60	46.40
933.060000	44.2	97.4	262.0	2.20	46.40

NOTE: Peak out of limits is due to Radio carrier.

Frequency Range 1GHz – 10GHz

Polarization Vertical



Final Result Peak

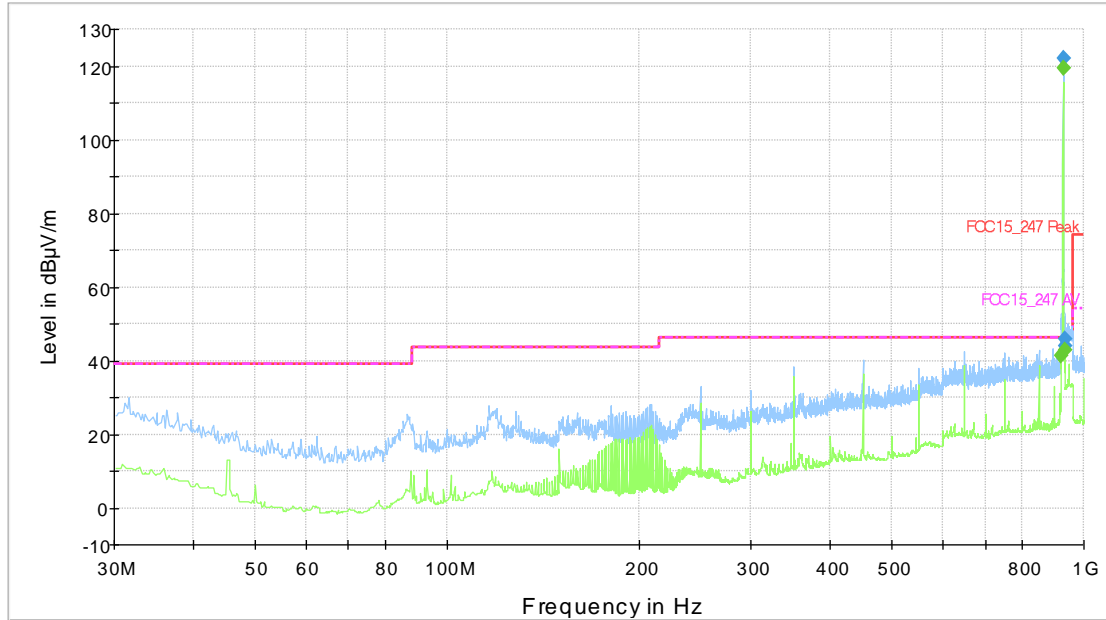
Frequency (MHz)	MaxPeak (dBµV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
1855.000000	61.3	245.5	262.0	12.70	74.00

Final Result Average

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
1855.000000	52.5	249.5	262.0	1.50	54.00

Frequency Range 30MHz – 1GHz

Polarization Horizontal



— FCC 15_247 Peak-CAR - - - - FCC 15_247 AV-CAR — MaxPeak-ClearWrite-PK+
— Average-ClearWrite-AVG ◆ Final Result1-PK+ ◆ Final Result2-AVG

Final Result Peak

Frequency (MHz)	MaxPeak (dBµV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
927.540000	122.1	117.7	187.0	-75.70	46.40
932.970000	44.1	117.7	187.0	2.30	46.40
935.100000	45.8	179.8	182.0	0.60	46.40

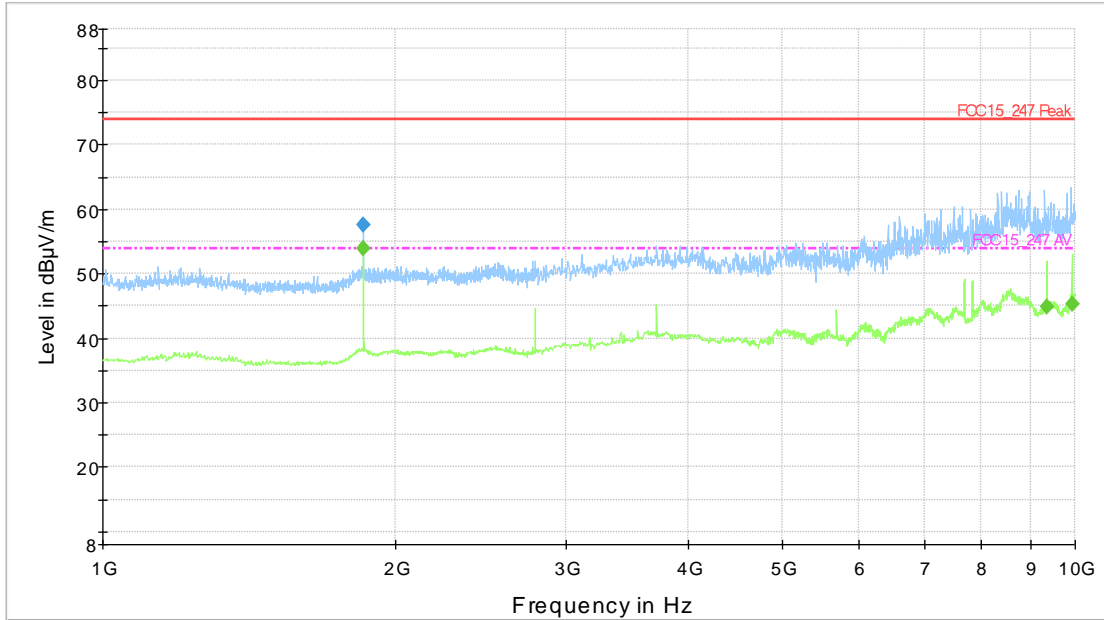
Final Result Average

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
922.110000	41.4	140.6	187.0	5.00	46.40
927.600000	119.6	117.6	187.0	-73.20	46.40
933.060000	42.8	115.7	187.0	3.60	46.40

NOTE: Peak out of limits is due to Radio carrier.

Frequency Range 1GHz – 10GHz

Polarization Horizontal



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

Final Result Peak

Frequency (MHz)	MaxPeak (dBµV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
1855.000000	57.6	124.8	-5.0	16.40	74.00

Final Result Average

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)
1855.000000	53.9	126.2	-4.0	0.10	54.00
9355.000000	44.9	106.8	86.0	9.10	54.00
9930.000000	45.3	148.0	187.0	8.70	54.00

TEST 9.

RF RADIATED SPURIOUS EMISSIONS AT THE TRANSMITTER ANTENNA TERMINAL

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 §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 reference document
• TEST LOCATION	Semi-anechoic chamber with measure distance at 3 meters
• TYPE OF MEASUREMENT	Radiated
• TEST METHOD	ANSI C63.10:2013 section 7.8.8
• TEST EQUIPMENT USED FOR TEST	EMI Receiver Rodhe & Schwarz mod. ESU40 Horn antenna Electro Metrics mod. EM-6961
• TEST PERFORMED BY	Daniele Aosani

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 9kHz-10GHz

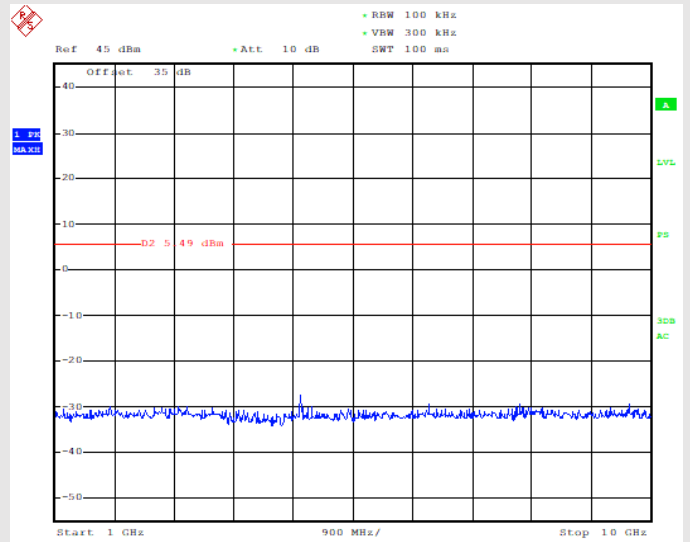
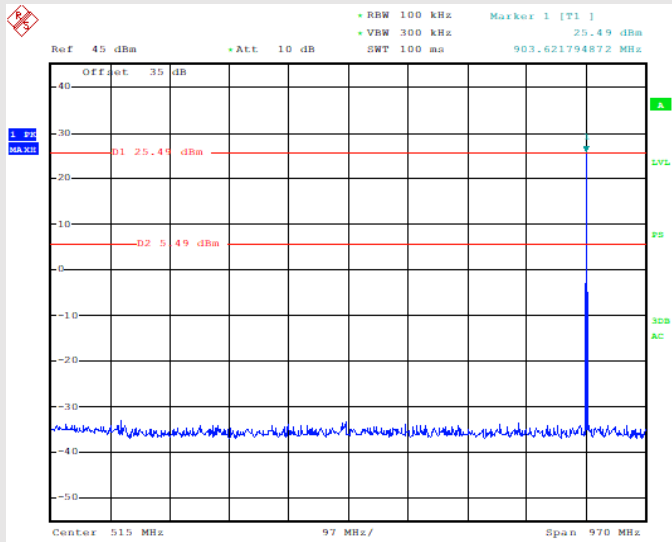
Resolution bandwidth	100kHz
Video bandwidth	300kHz
Span	See plots below
Sweep time	Auto couple
Detector	Peak
Trace-Mode	Max. hold

MEASUREMENT RESULT

Channel 1 – 902.42MHz

Frequency range: 30MHz-1GHz

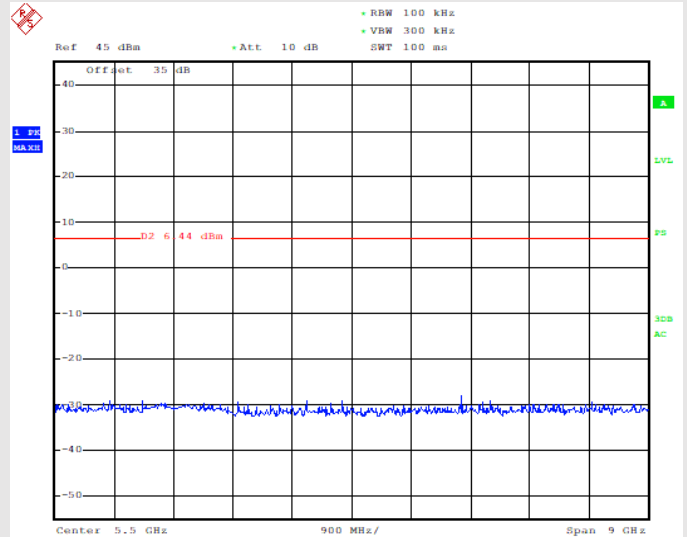
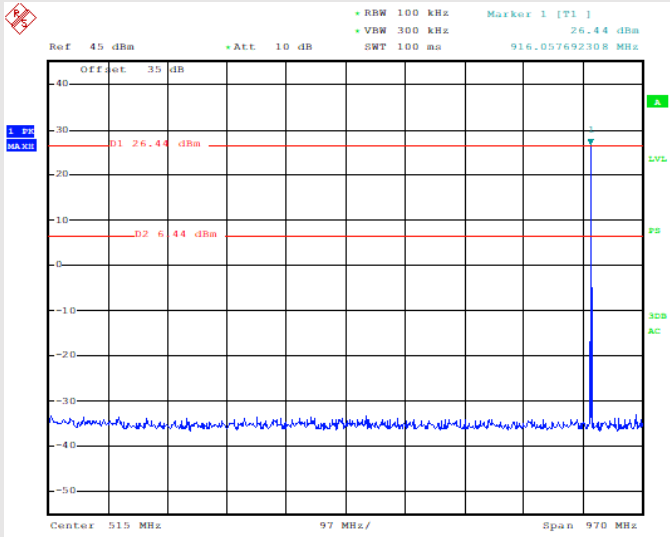
Frequency range: 1GHz-10GHz



Channel 37 – 915MHz

Frequency range: 30MHz-1GHz

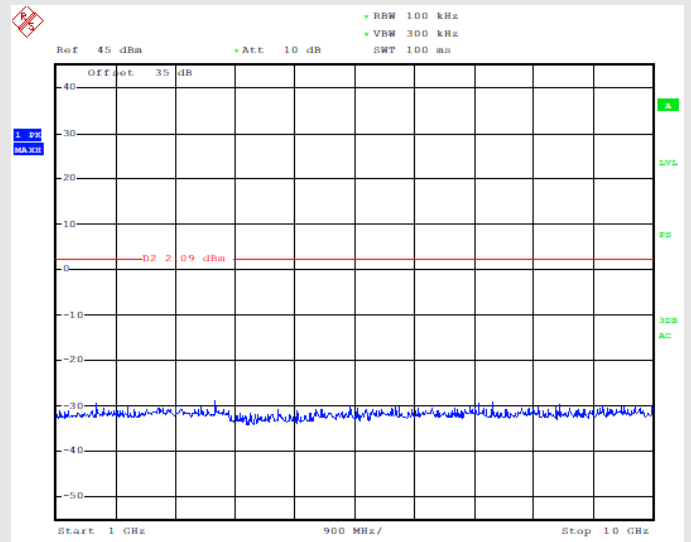
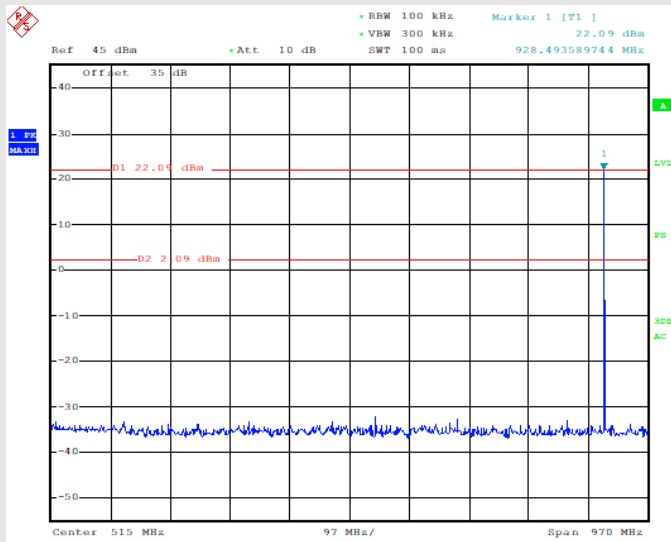
Frequency range: 1GHz-10GHz



Channel 75 – 927.58MHz

Frequency range: 30MHz-1GHz

Frequency range: 1GHz-10GHz



TEST 10.

CONDUCTED EMISSIONS

REFERENCE DOCUMENT

FCC Cfr 47 part 15 - Subpart C - §15.207

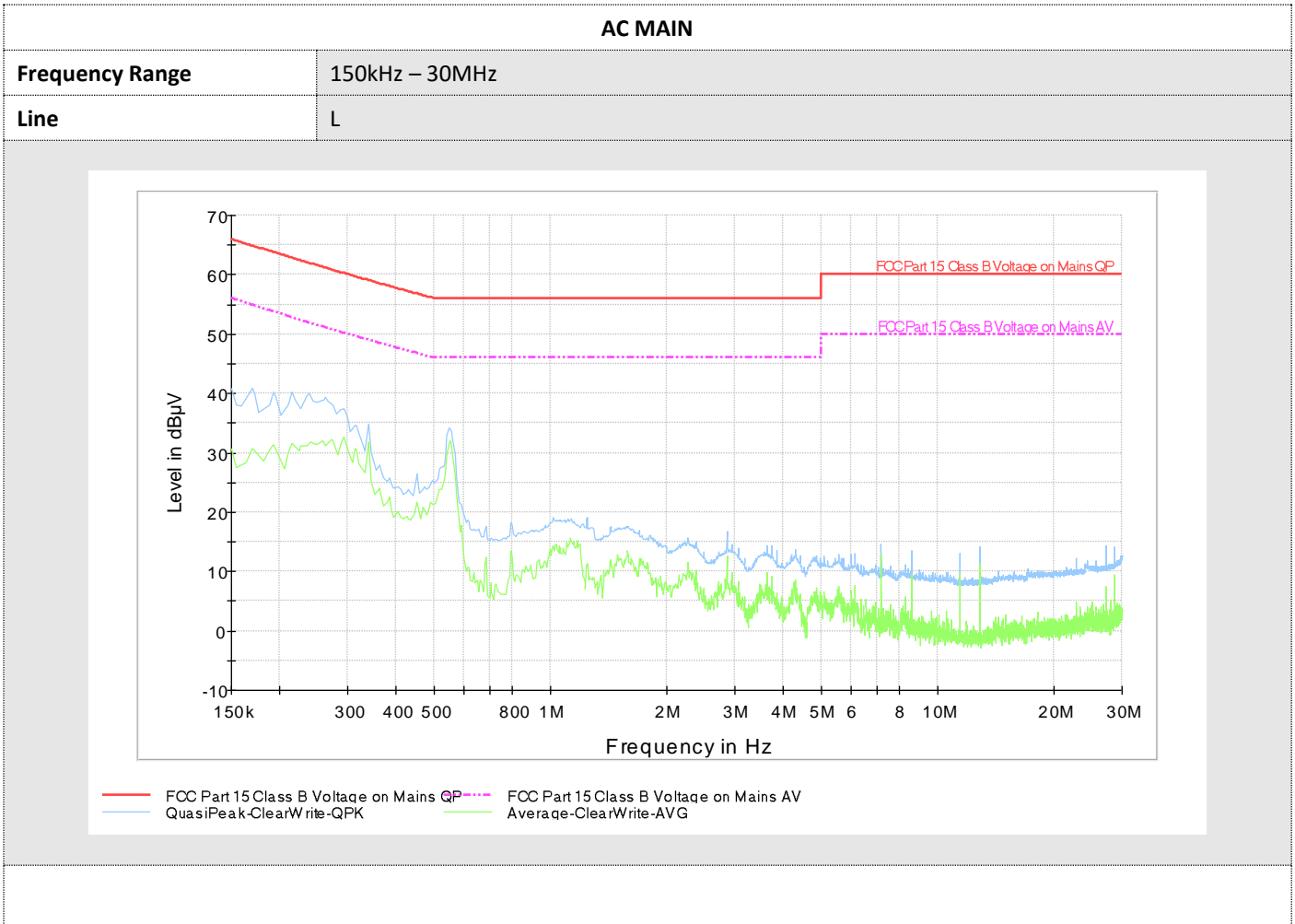
• TEST SETUP	Acc. To ref. Std.
• TEST LOCATION	Semi-anechoic chamber
• TEST EQUIPMENT USED FOR TEST	Network simulator Spitzenberger+Spies mod. PAS5000 MXE Emi Receiver Keysight mod. N9038A LISN Rohde & Schwarz mod. ESH3-Z5
• TESTED PORT	AC input power port
• FREQUENCY RANGE	150kHz - 30MHz
• LIMITS	Acc. To ref. Std.
• UNCERTAINTY OF MEASURE	Level of confidence = 95% (k=2) Expanded uncertainty 150kHz - 30MHz = 3,28 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
Voltage		AC main: 115V ~ 60Hz PoE powered at 115V ~ 60Hz

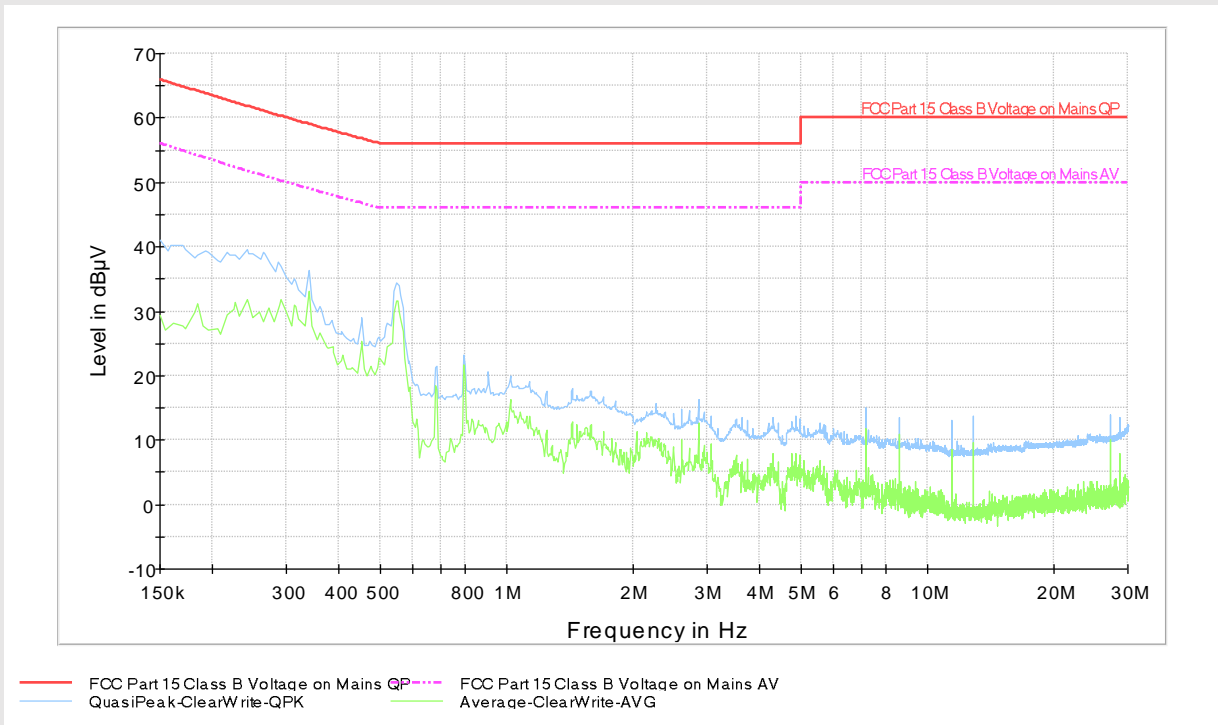
OPERATING CONDITION: #4

RESULT: **WITHIN THE LIMITS**

TEST RESULTS



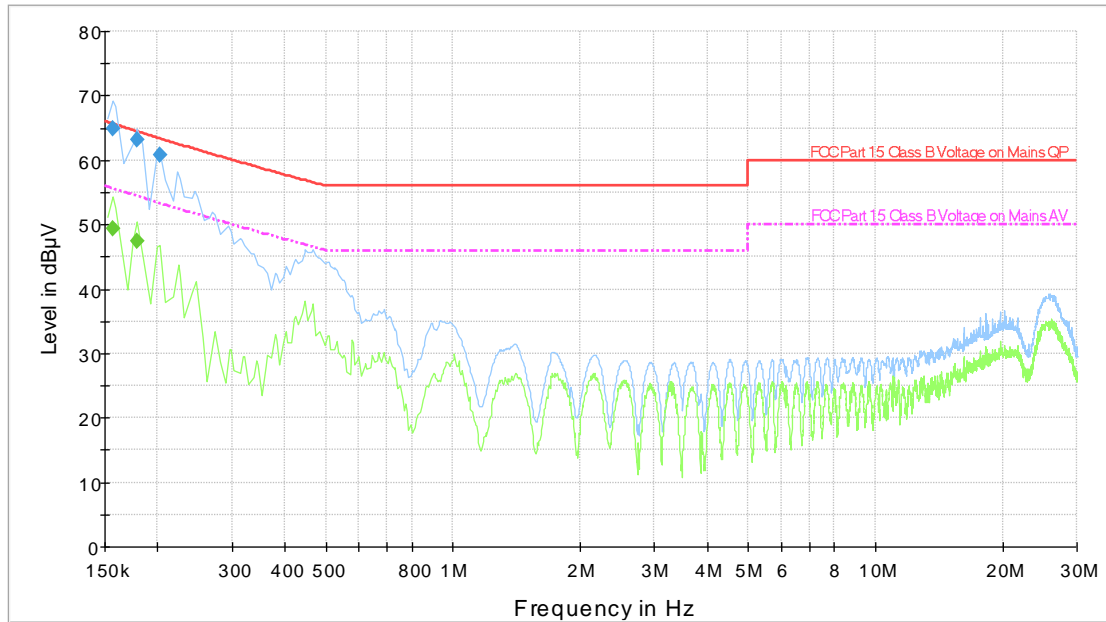
Frequency Range	150kHz – 30MHz
Line	N



POWERED BY PoE

Frequency Range 150kHz – 30MHz

Line L



— FCC Part 15 Class B Voltage on Mains QP — FCC Part 15 Class B Voltage on Mains AV — QuasiPeak-ClearWrite-QPK
— Average-ClearWrite-AVG ◆ Final Result1-QPK ◆ Final Result2-AVG

Final Result Quasi Peak

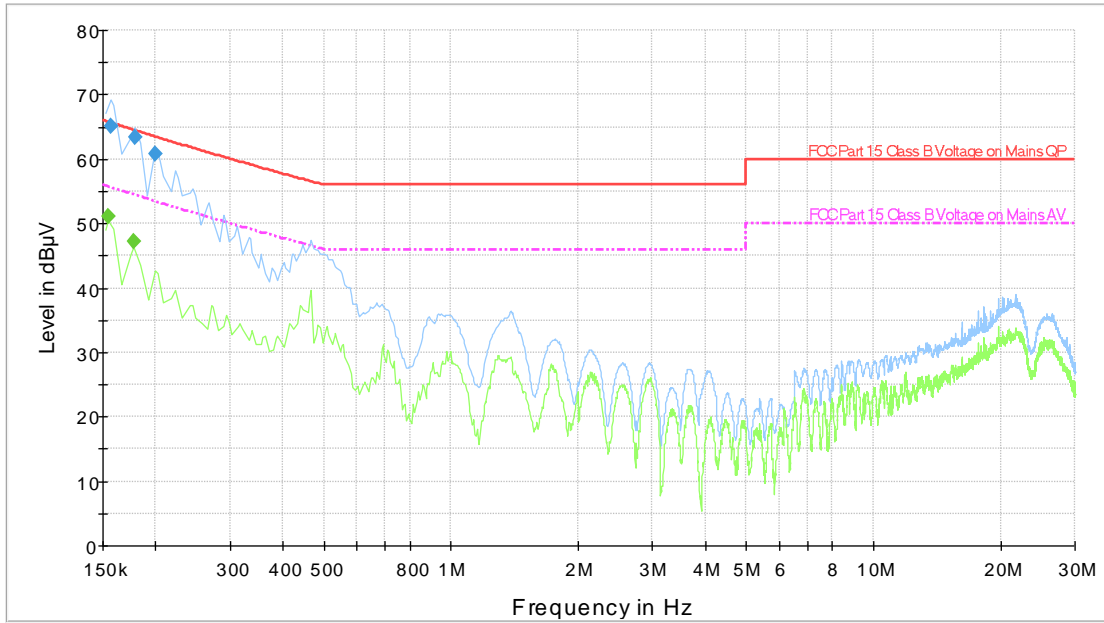
Frequency (MHz)	QuasiPeak (dBµV)	PE	Margin (dB)	Limit (dBµV)
0.156750	65.0	GND	0.6	65.6
0.179250	63.2	GND	1.2	64.4
0.201750	60.8	GND	2.6	63.4

Final Result Average

Frequency (MHz)	Average (dBµV)	PE	Margin (dB)	Limit (dBµV)
0.156750	49.4	GND	6.2	55.6
0.179250	47.4	GND	7.0	54.4

Frequency Range 150kHz – 30MHz

Line N



— FCC Part 15 Class B Voltage on Mains QP — FCC Part 15 Class B Voltage on Mains AV — QuasiPeak-ClearWrite-QPK
— Average-ClearWrite-AVG ◆ Final Result1-QPK ◆ Final Result2-AVG

Final Result Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	PE	Margin (dB)	Limit (dBµV)
0.156750	65.2	GND	0.4	65.6
0.179250	63.5	GND	0.9	64.4
0.199500	60.8	GND	2.7	63.5

Final Result Average

Frequency (MHz)	Average (dBµV)	PE	Margin (dB)	Limit (dBµV)
0.154500	51.1	GND	4.6	55.7
0.177000	47.3	GND	7.2	54.5

END OF TEST REPORT