TESTING LABORATORY
CERTIFICATE # 4821.01

FCC PART 15F

TEST REPORT

For

IntraNav GmbH

Frankfurter Str. 27, 65760 Eschborn, Germany

FCC ID: 2AWK8IN5200

Report Type:	**Product Type:**
Original Report	INTRANAV NODE

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	INTRANAV NODE
Tested Model	IN5200 (Art. No. 10111014 with WiFi)
Frequency Range	6179.9-6786.3MHz
Modulation Technique	Pulse Modulation
Antenna Specification	3.7dBi
Voltage Range	$48V_{DC}$ from PoE, 9-$36V_{DC}$ from DC port, $5.0V_{DC}$ from USB Type-C port
Date of Test	2019-07-31 to 2020-08-14
Sample serial number	RGMA190725002-RF-S1(Assigned by BACL, Shenzhen)
Received date	2019-07-25
Sample/EUT Status	Good condition

Objective

This report is prepared on behalf of *IntraNav GmbH* in accordance with Part 2-Subpart J, Part 15-Subparts A and F of the Federal Communication Commission's rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart F, and section 15.203, 15.205, 15.207, 15.209 and 15.517 rules.

Related Submittal(s)/Grant(s)

No Related Submittal(s)/Grant(s).

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		±5%
RF Output Power with Power meter		±0.73dB
RF conducted test with spectrum		±1.6dB
AC Power Lines Conducted Emissions		±1.95dB
Emissions, Radiated	Below 1GHz	±4.75dB
	Above 1GHz	±4.88dB
Temperature		±1℃
Humidity		±6%
Supply voltages		±0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 342867, the FCC Designation No.: CN1221.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062B.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing by manufacturer.

Channel List

Channel	Frequency (MHz)
5	6489.6

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

No exercise software was used.

Support Equipment List and Details

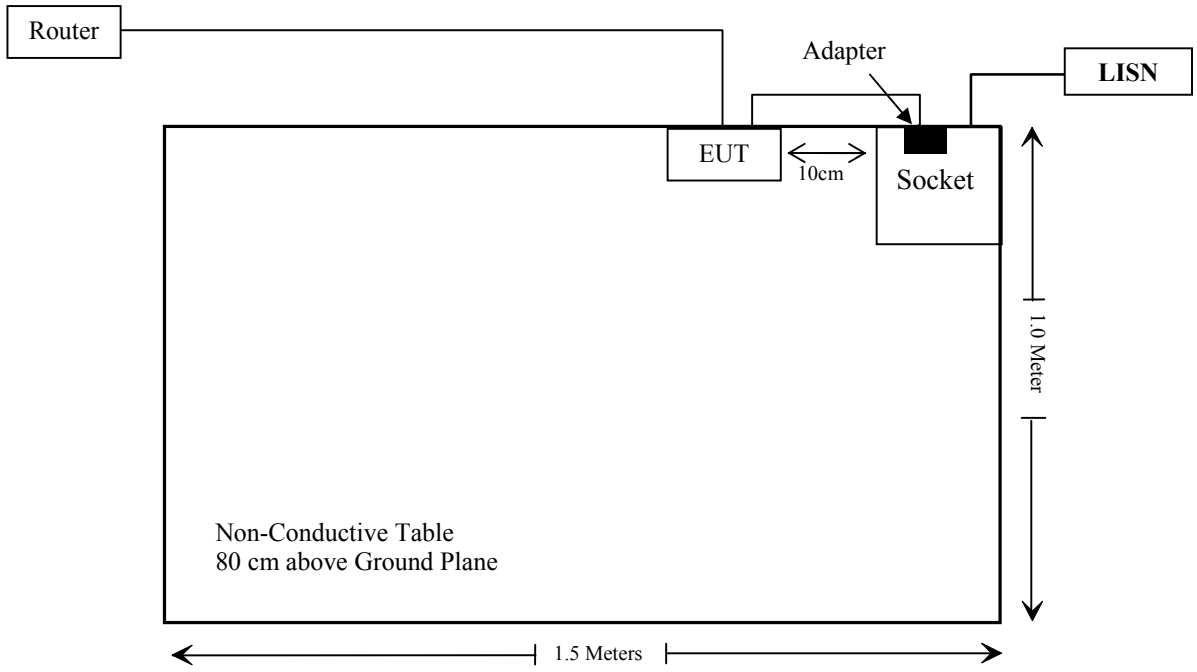
Manufacturer	Description	Model	Serial Number
iKu	Adapter	Y3	Y3201905001
BLU	Adapter	US-AH-1004	US-AH-1004
TP-Link	Router	TL-WR845N	1148388007860
Panasonic	Storage battery	P1224ST	P1224ST
FRECOM	Adapter	F18W8	F18W8
GOSPELL	POE	G0720-480-050	200200015

External I/O Cable

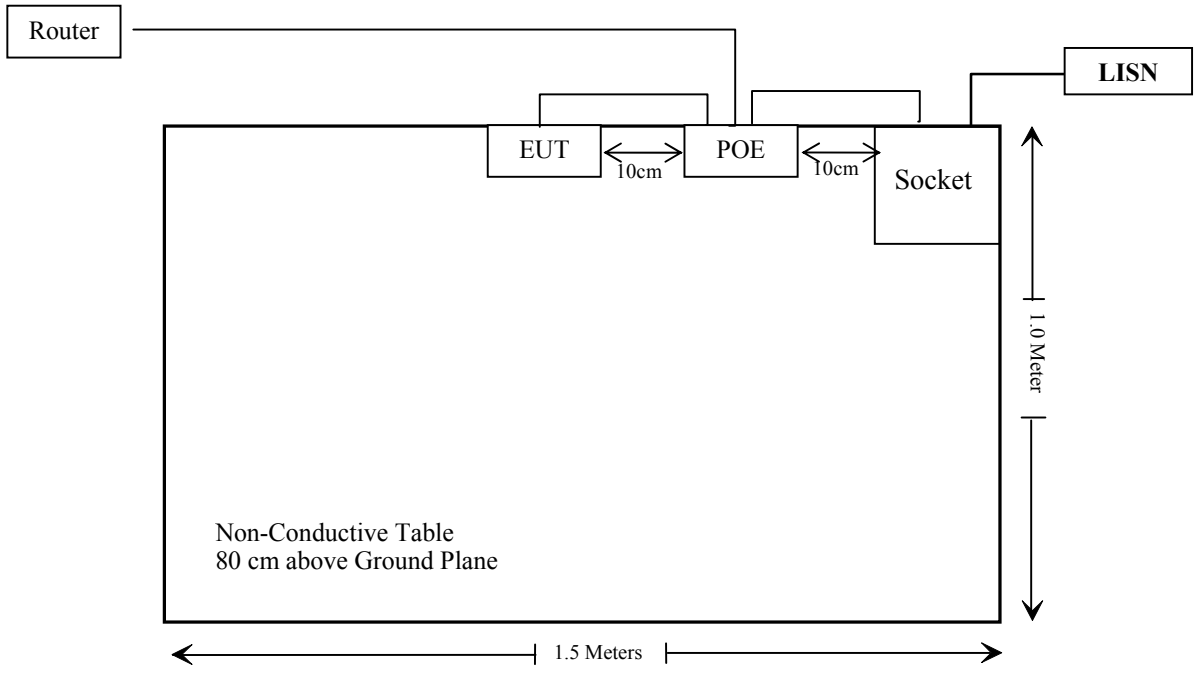
Cable Description	Length (m)	From/Port	To
Un-shield Detachable USB cable	1.0	EUT	Adapter
Un-shield Detachable RJ45 cable	10	EUT/POE	Router
Un-shield Detachable RJ45 cable	1.0	POE	EUT
Un-shield Detachable DC cable	1.2	EUT	Adapter

Block Diagram of Test Setup

Type-C/DC port:



Powered by POE:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1310, §2.1091	Maximum Permissible Exposure(MPE)	Compliance
§15.517 (a)	General Requirement	Compliance
§15.203, §15.517(a) (3)	Antenna Requirement	Compliance
§15.207(a)	AC Line Conducted Emissions	Compliance
§15.503 (a)(d), §15.517(b)	UWB Operation bandwidth	Compliance*
§15.209, §15.517(c)(d)	Radiated Emissions	Compliance*
§15.517(e)	Peak Emission in a 50 MHz bandwidth	Compliance*

Note*: the EUT have three different power supply, pre-scan with them, the worst case was powered by the PoE.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2019/7/9	2020/7/8
Rohde & Schwarz	LISN	ENV216	101613	2019/1/22	2020/1/21
Rohde & Schwarz	LISN	ENV216	101613	2020/1/22	2021/1/21
Rohde & Schwarz	Transient Limitor	ESH3Z2	DE25985	2018/11/29	2019/11/28
Rohde & Schwarz	Transient Limitor	ESH3Z2	DE25985	2019/11/29	2020/11/28
Unknown	CE Cable	CE Cable	UF A210B-1-0720-504504	2018/11/29	2019/11/28
Unknown	CE Cable	CE Cable	UF A210B-1-0720-504504	2019/11/29	2020/11/28
Rohde & Schwarz	CE Test software	EMC 32	V8.53.0	NCR	NCR
Radiated Emission Test					
R&S	EMI Test Receiver	ESR3	102455	2019/7/9	2020/7/8
Sonoma instrument	Pre-amplifier	310 N	186238	2019/4/20	2020/4/20
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017/12/22	2020/12/21
Unknown	Cable	Chamber Cable 1	F-03-EM236	2019/11/29	2020/11/28
Unknow	Cable	Chamber Cable 4	EC-007	2019/11/29	2020/11/28
Rohde & Schwarz	Auto test software	EMC 32	V9.10	NCR	NCR
Rohde & Schwarz	Spectrum Analyzer	FSV40-N	102259	2019/7/22	2020/7/21
Rohde & Schwarz	Spectrum Analyzer	FSV40-N	102259	2020/7/22	2021/7/21
COM-POWER	Pre-amplifier	PA-122	181919	2019/11/29	2020/11/28
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2019/11/29	2020/11/28
Sunol Sciences	Horn Antenna	DRH-118	A052604	2017/12/22	2020/12/21
Insulted Wire Inc.	RF Cable	SPS-2503-3150	02222010	2019/11/29	2020/11/28
Unknown	RF Cable	W1101-EQ1 OUT	F-19-EM005	2019/11/29	2020/11/28
Ducommun technologies	RF Cable	RG-214	1	2019-11-12	2020-11-12
Ducommun technologies	RF Cable	RG-214	2	2019-11-12	2020-11-12
Electro-Mechanics Co	Horn Antenna	3116	9510-2270	2019/10/13	2022/10/12

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

§1.1310, §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

According to Part 1.1310(e), the maximum exposure level to the public from the RF power of the EUT shall not exceed a power density, S as per the respective limits in the below table, at a distance, d, of 20 cm from the EUT.

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (Minutes)**
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

Reference method

KDB 447498 D01 General RF Exposure Guidance v06

OET Bulletin 65, Edition 97-01 Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields

Result

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm^2)
P = power input to the antenna (in appropriate units, e.g., mW).
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

Frequency (MHz)	Tune Up EIRP		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
	(dBm)	(mW)			
6489.6	-1.0	0.79	20	0.0002	1
2412-2462	23.5	223.87	20	0.0446	1

Note: 1. the tune up EIRP was declared by the applicant
2. the UWB can transmit at the same time with the Wi-Fi.

Simultaneous transmitting consideration:

The ratio=MPE_{DTS}/limit + MPE_{UWB}/limit=0.0446+0.0002=0.0448＜1.0

so simultaneous exposure is not required.

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliance

§15.517(a) - GENERAL REQUIREMENT

Applicable Standard

(a) Operation under the provisions of this section is limited to UWB transmitters employed solely for indoor operation.

(1) Indoor UWB devices, by the nature of their design, must be capable of operation only indoors. The necessity to operate with a fixed indoor infrastructure, e.g., a transmitter that must be connected to the AC power lines, may be considered sufficient to demonstrate this.

(2) The emissions from equipment operated under this section shall not be intentionally directed outside of the building in which the equipment is located, such as through a window or a doorway, to perform an outside function, such as the detection of persons about to enter a building.

(3) The use of outdoor mounted antennas, e.g., antennas mounted on the outside of a building or on a telephone pole, or any other outdoors infrastructure is prohibited.

(4) Field disturbance sensors installed inside of metal or underground storage tanks are considered to operate indoors provided the emissions are directed towards the ground.

(5) A communications system shall transmit only when the intentional radiator is sending information to an associated receiver.

Compliance, please see the below information:

(1) The EUT was used only indoors, it was powered by the PoE or USB-C port from the adapter which connects indirectly to the AC power line, please refer to the details in the user manual.

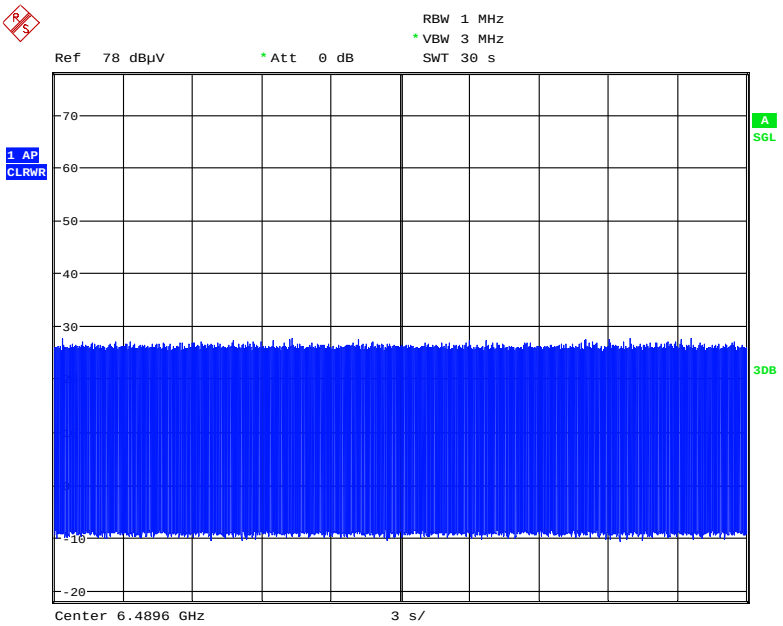
(2) The EUT was never used outdoors, as moisture or water can cause a short circuit. It was showed in the user manual.

(3) The EUT has an internal PCB antenna, please refer to the EUT photos.

(4) The EUT is not a field disturbance sensor.

(5) A communications system shall transmit only when the intentional radiator is sending information to an associated receiver. Please refer to the below test plots.

1: EUT is switched on, the associated receiver is switched off, no transmission



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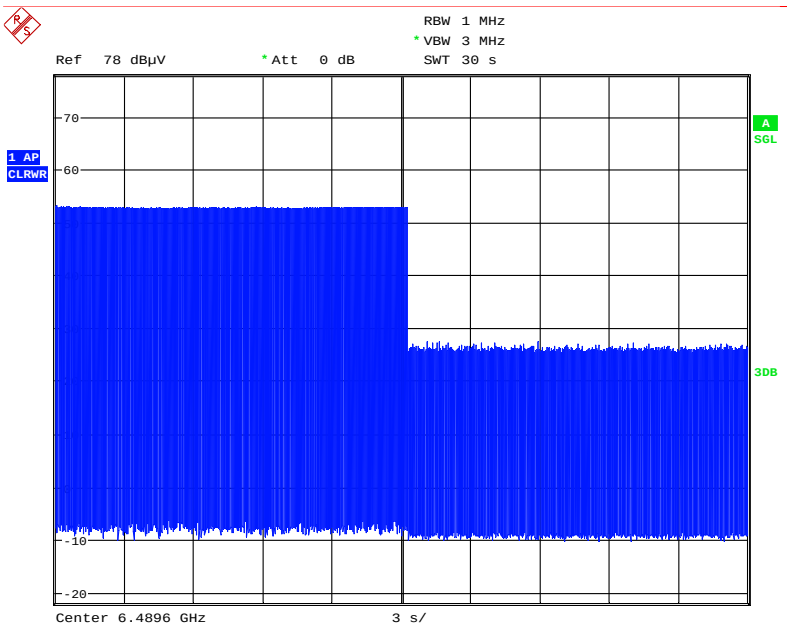
2: EUT is switched on, the associated receiver is switched on, TX sending information to RX, after about 15s the associated receiver is switched off, no transmission



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FCC §15.203, §15.517(a) (3) - ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203, 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 user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

(3) The use of outdoor mounted antennas, e.g., antennas mounted on the outside of a building or on a telephone pole, or any other outdoors infrastructure is prohibited.

Antenna Connector Construction

The EUT has internal PCB antenna arrangement, which was permanently attached and the antenna gain is 3.7dBi, fulfill the requirement of this section. Please refer to the EUT photos.

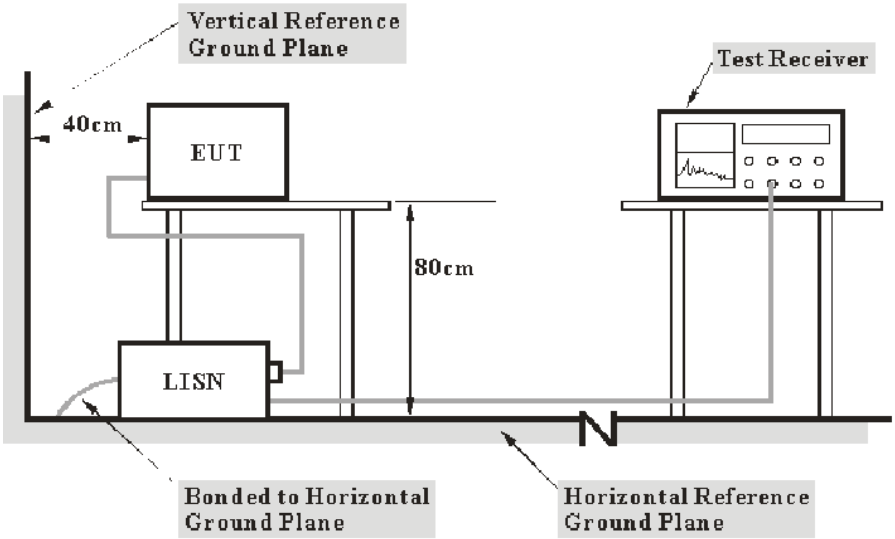
Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207(a)

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The measurement procedure of EUT setup is according with ANSI C63.10-2013. The related limit was specified in FCC Part 15.207.

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Correction Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207.

Test Data

Environmental Conditions

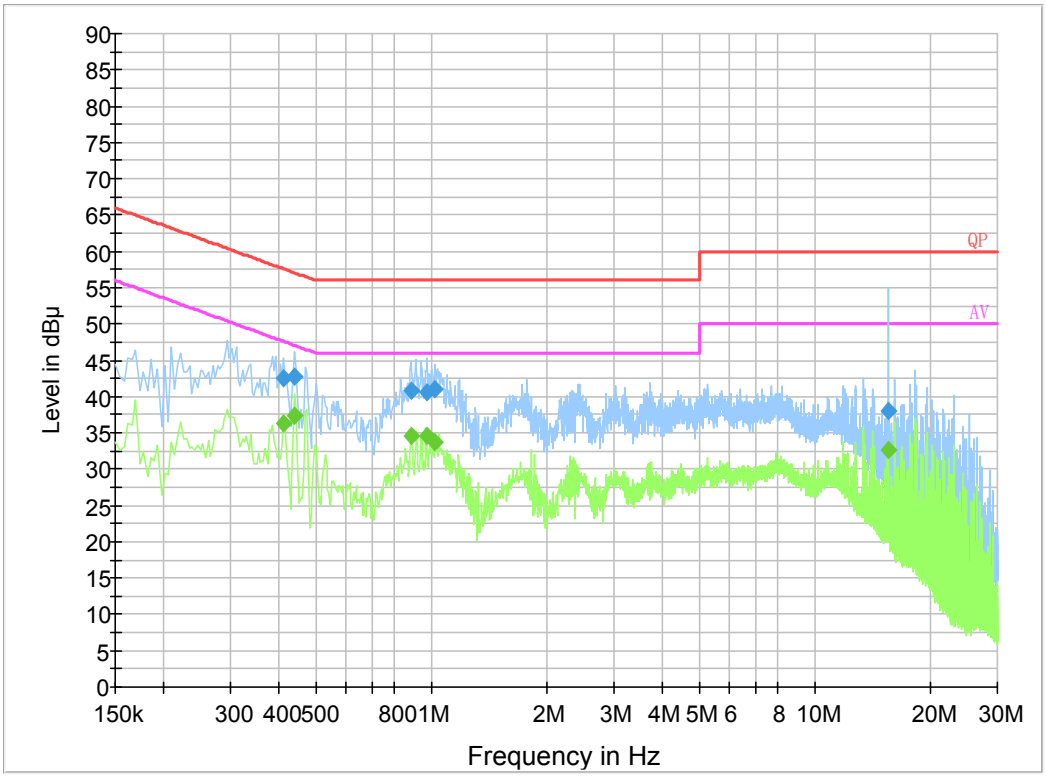
Temperature:	25 ℃
Relative Humidity:	65 %
ATM Pressure:	101.0 kPa

The testing was performed by Haiguo Li from 2019-07-31 to 2020-06-09.

EUT operation mode: Transmitting

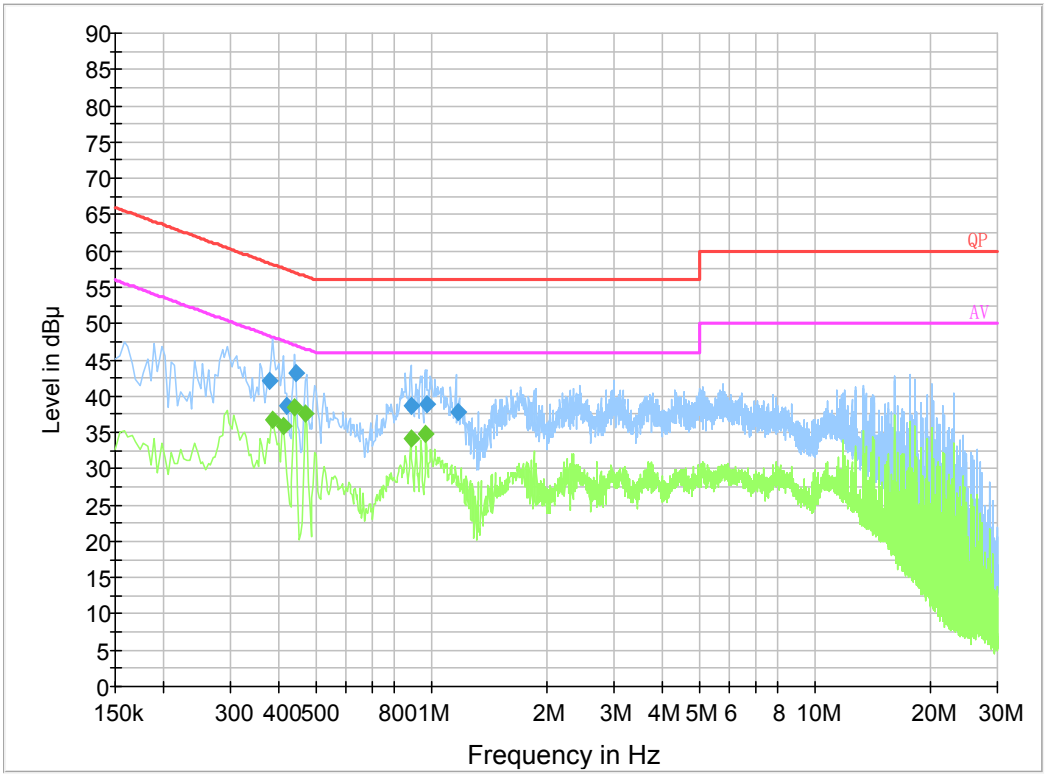
Powered by adapter (Type-C port):

AC 120V/60 Hz, Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.411790	42.5	19.9	57.6	15.1	QP
0.439370	42.8	19.8	57.1	14.3	QP
0.884710	40.8	19.8	56.0	15.2	QP
0.971330	40.6	19.9	56.0	15.4	QP
1.026610	40.9	19.9	56.0	15.1	QP
15.557050	38.0	20.0	60.0	22.0	QP
0.411790	36.3	19.9	47.6	11.3	Ave.
0.439370	37.3	19.8	47.1	9.8	Ave.
0.884710	34.6	19.8	46.0	11.4	Ave.
0.971330	34.6	19.9	46.0	11.4	Ave.
1.026610	33.8	19.9	46.0	12.2	Ave.
15.557050	32.7	20.0	50.0	17.3	Ave.

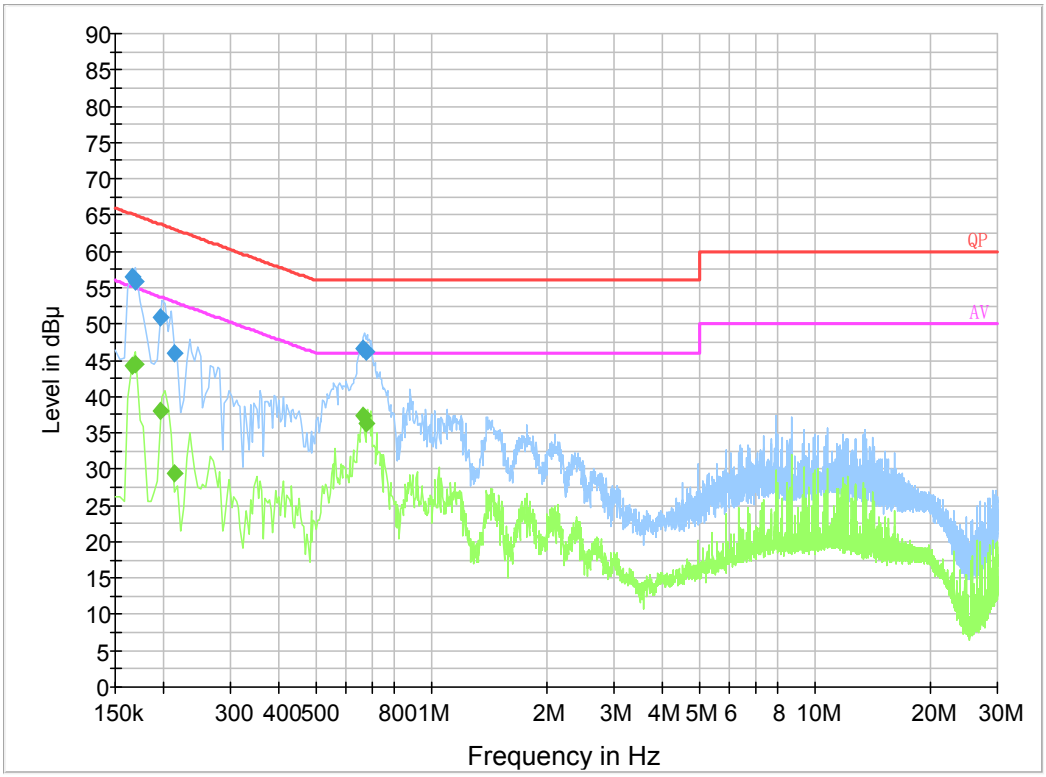
AC 120V/60 Hz, Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.380210	42.1	19.8	58.3	16.2	QP
0.419790	38.7	19.8	57.5	18.8	QP
0.443370	43.1	19.8	57.0	13.9	QP
0.888710	38.6	19.7	56.0	17.4	QP
0.975570	38.8	19.8	56.0	17.2	QP
1.176570	37.9	19.8	56.0	18.1	QP
0.386000	36.8	19.8	48.1	11.3	Ave.
0.414000	36.0	19.8	47.6	11.6	Ave.
0.442000	38.5	19.8	47.0	8.5	Ave.
0.470000	37.6	19.8	46.5	8.9	Ave.
0.886000	34.1	19.7	46.0	11.9	Ave.
0.970000	34.8	19.8	46.0	11.2	Ave.

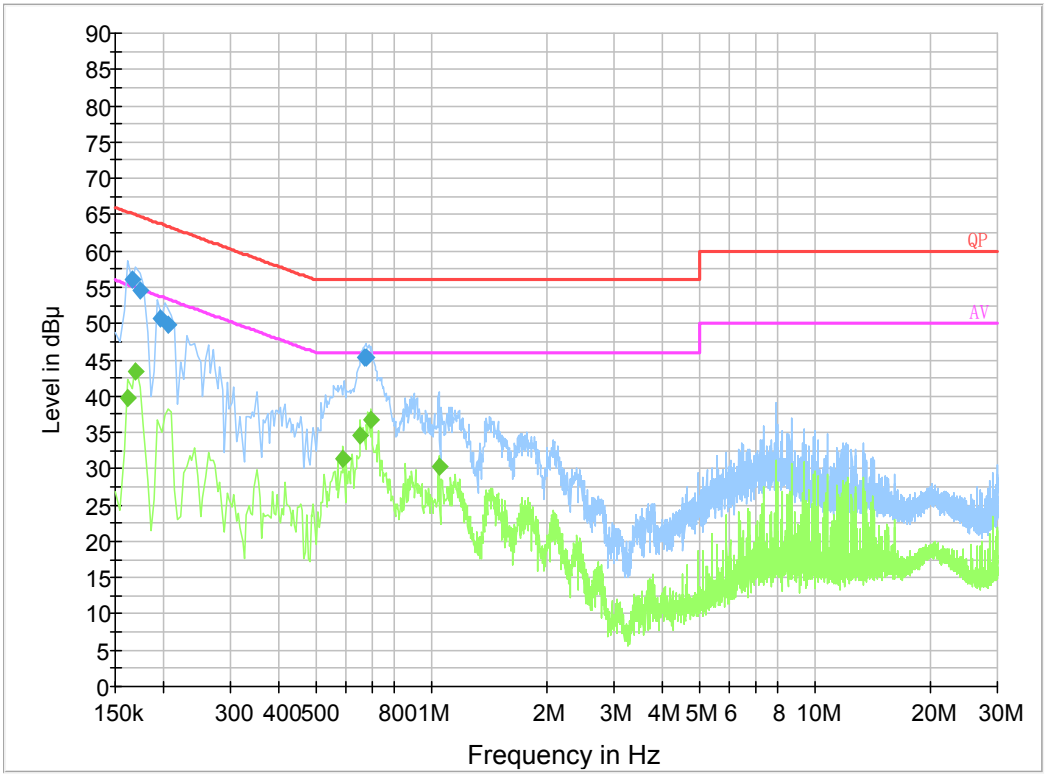
Powered by adapter (DC port):

AC 120V/60 Hz, Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.165500	56.5	19.9	65.2	8.7	QP
0.169500	56.0	19.9	65.0	9.0	QP
0.197500	50.9	19.8	63.7	12.8	QP
0.213500	46.1	19.8	63.1	17.0	QP
0.663810	46.5	19.8	56.0	9.5	QP
0.680050	46.1	19.8	56.0	9.9	QP
0.165500	44.2	19.9	55.2	11.0	Ave.
0.169500	44.5	19.9	55.0	10.5	Ave.
0.197500	38.0	19.8	53.7	15.7	Ave.
0.213500	29.4	19.8	53.1	23.7	Ave.
0.663810	37.3	19.8	46.0	8.7	Ave.
0.680050	36.3	19.8	46.0	9.7	Ave.

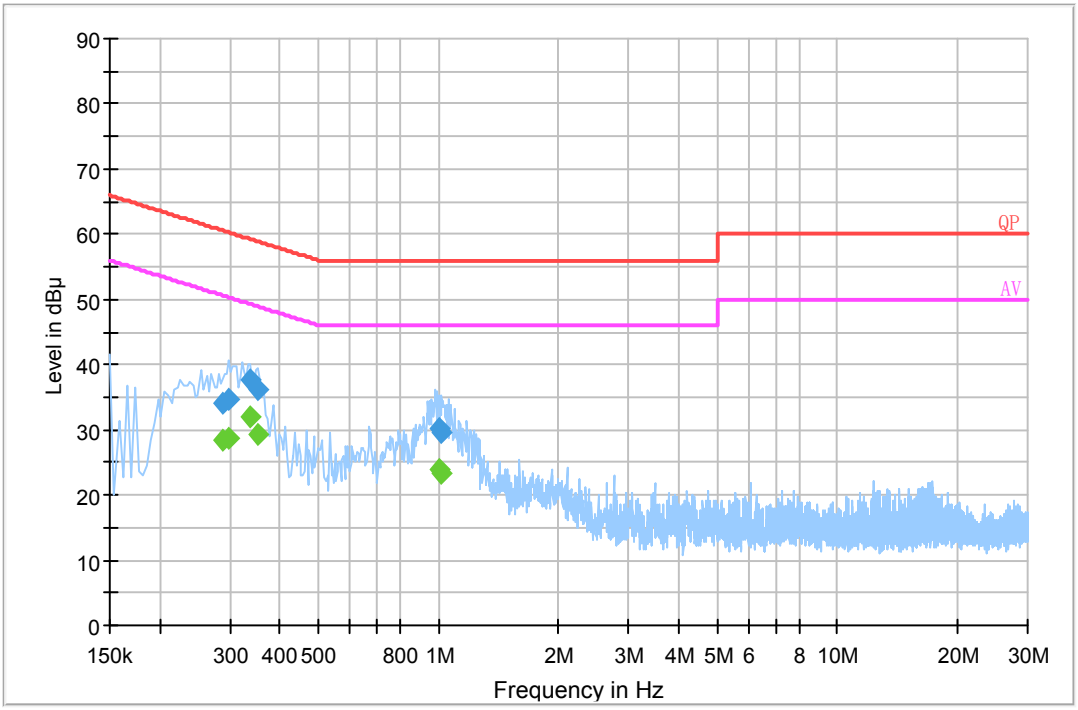
AC 120V/60 Hz, Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.165500	56.0	19.8	65.2	9.2	QP
0.174500	54.6	19.8	64.7	10.1	QP
0.197500	50.6	19.8	63.7	13.1	QP
0.205500	49.9	19.8	63.4	13.5	QP
0.667870	45.3	19.8	56.0	10.7	QP
0.679890	45.3	19.8	56.0	10.7	QP
0.162000	39.8	19.8	55.4	15.6	Ave.
0.170000	43.5	19.9	55.0	11.5	Ave.
0.590000	31.3	19.8	46.0	14.7	Ave.
0.654000	34.6	19.8	46.0	11.4	Ave.
0.698000	36.7	19.8	46.0	9.3	Ave.
1.050000	30.2	19.8	46.0	15.8	Ave.

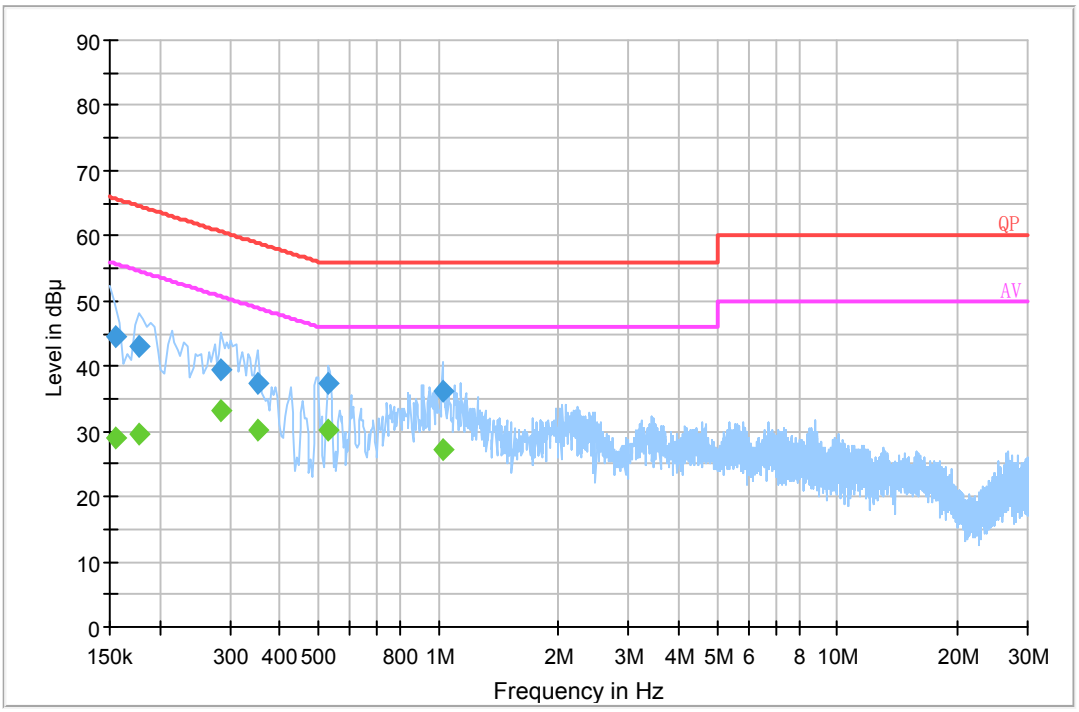
Powered by POE:

AC 120V/60 Hz, Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.286500	34.2	19.7	60.6	26.4	QP
0.297500	34.8	19.7	60.3	25.5	QP
0.336930	37.8	19.8	59.3	21.5	QP
0.352690	36.3	19.9	58.9	22.6	QP
0.999210	30.2	19.9	56.0	25.8	QP
1.018730	29.5	19.9	56.0	26.5	QP
0.286500	28.4	19.7	50.6	22.2	Ave.
0.297500	28.7	19.7	50.3	21.6	Ave.
0.336930	32.0	19.8	49.3	17.3	Ave.
0.352690	29.3	19.9	48.9	19.6	Ave.
0.999210	23.9	19.9	46.0	22.1	Ave.
1.018730	23.4	19.9	46.0	22.6	Ave.

AC 120V/60 Hz, Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.154500	44.4	19.8	65.8	21.4	QP
0.177500	43.2	19.8	64.6	21.4	QP
0.285500	39.3	19.7	60.7	21.4	QP
0.352690	37.5	19.9	58.9	21.4	QP
0.530050	37.4	19.8	56.0	18.6	QP
1.022670	36.3	19.8	56.0	19.7	QP
0.154500	29.0	19.8	55.8	26.8	Ave.
0.177500	29.6	19.8	54.6	25.0	Ave.
0.285500	33.1	19.7	50.7	17.6	Ave.
0.352690	30.3	19.9	48.9	18.6	Ave.
0.530050	30.1	19.8	46.0	15.9	Ave.
1.022670	27.3	19.8	46.0	18.7	Ave.

Note:

1) Correction Factor =LISN VDF (Voltage Division Factor) + Cable Loss + Transient Limiter Attenuation
2) Corrected Amplitude = Reading + Correction Factor
3) Margin = Limit – Corrected Amplitude

§15.503 (a), §15.503 (d), §15.517(b) –UWB OPEARTION BANDWIDTH

Applicable Standard

15.503(a): UWB bandwidth. For the purpose of this subpart, the UWB bandwidth is the frequency band bounded by the points that are 10 dB below the highest radiated emission, as based on the complete transmission system including the antenna. The upper boundary is designated fH and the lower boundary is designated fL. The frequency at which the highest radiated emission occurs is designated fM.

15.503(d): Ultra-wideband (UWB) transmitter. An intentional radiator that, at any point in time, has a fractional bandwidth equal to or greater than 0.20 or has a UWB bandwidth equal to or greater than 500 MHz, regardless of the fractional bandwidth.

15.517(b) The UWB bandwidth of a UWB system operating under the provisions of this section must be contained between 3100 MHz and 10,600 MHz.

Test Procedure

Refer to the C63.10 -2013 Section 10.1

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Alan He on 2019-12-10.

Test Result: Pass.

EUT operation mode: Transmitting

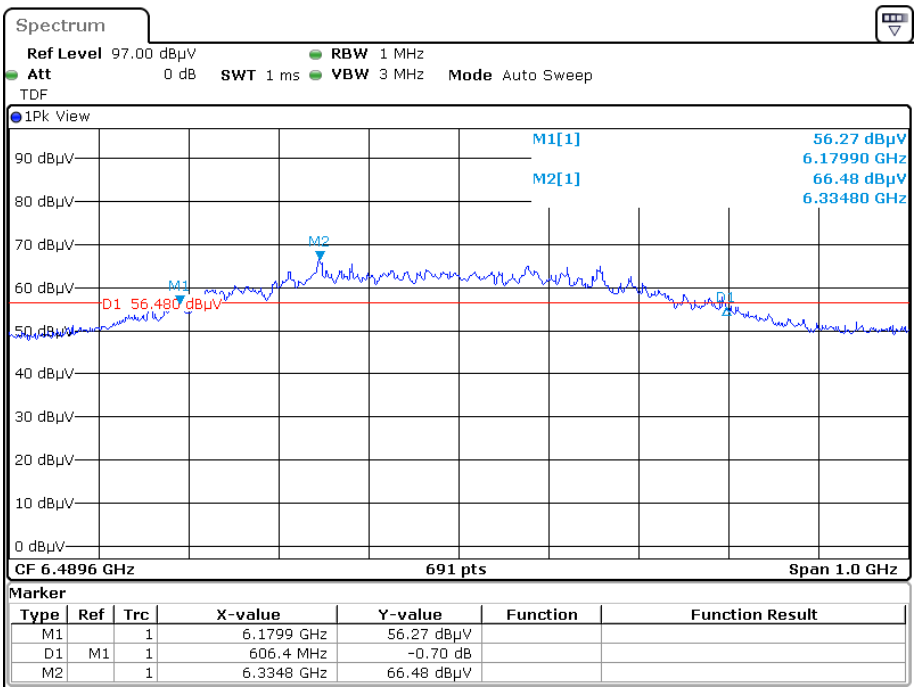
Test distance is 3m.

Please refer to the following table and plots.

Item		Result	Limit (MHz)
f_M(MHz)	The highest emission frequency	6334.8	/
f_L(MHz)	10dB below the highest emission	6179.9	>3100
f_H(MHz)	10dB above the highest emission	6786.3	<10600
f_C(MHz)	$(f_H + f_L)/2$	6483.1	/
10dB bandwidth(MHz)	$f_H - f_L$	606.4	⩾500
Fractional bandwidth	$2(f_H-f_L)/(f_H + f_L)$	0.094	/

Note: $f_H=f_L$+10dB Bandwidth

10dB Bandwidth



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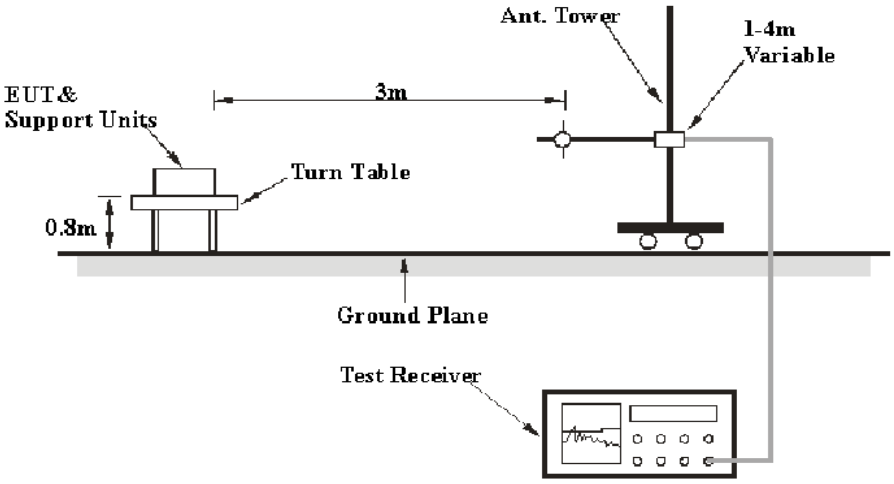
FCC §15.209, §15.517(c), §15.517 (d)- SPURIOUS EMISSIONS

Applicable Standard

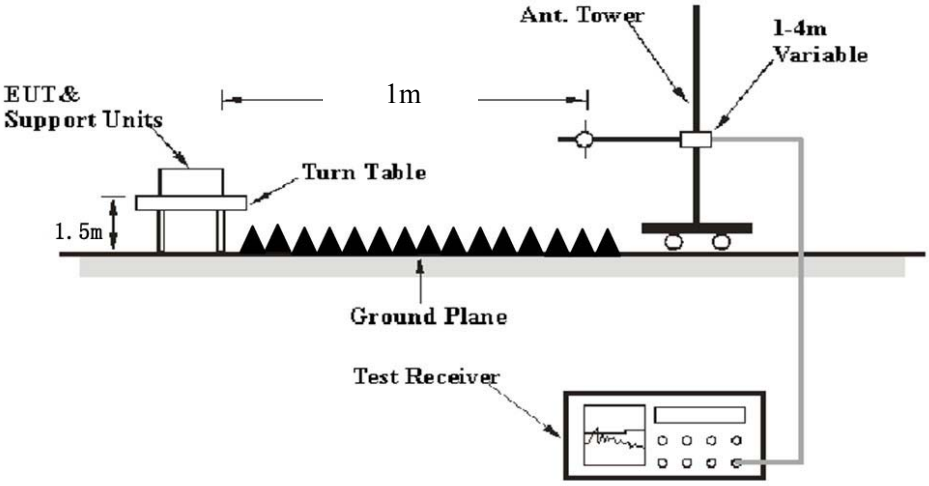
FCC §15.209; §15.517(c), §15.517(d);

EUT Setup

Below 1 GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.517 limits.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 40 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	Average
	1kHz	3kHz	/	Average*

Note: * For the radiated spurious emission in the GPS band.

Test Procedure

Refer to the C63.10 -2013 Section 10.2 & 10.3

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Results Summary

According to the EUT complied with the FCC Title 47, Part 15, Subpart F, section 15.205, 15.209 and 15.517.

Test Data

Environmental Conditions

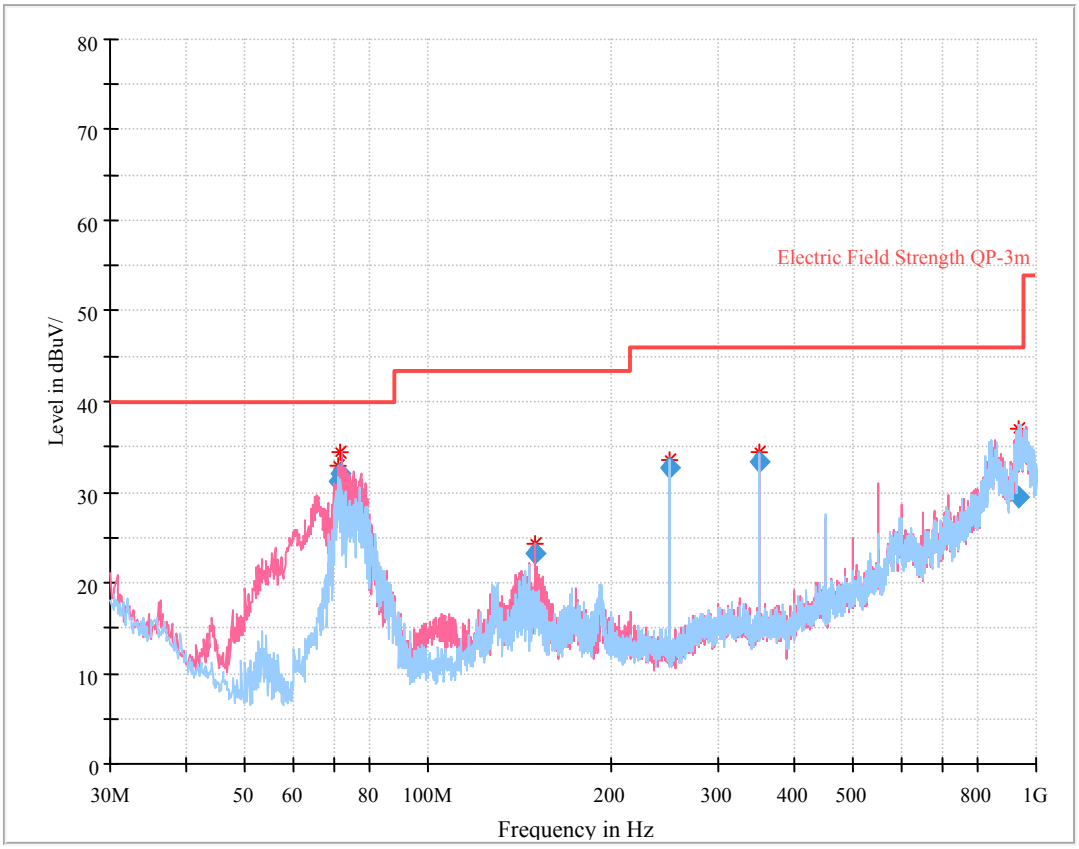
Temperature:	23 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Zero Yan on 2019-12-11 for below 1G and Alen He on 2019-12-10 for above 1G.

EUT operation mode: Transmitting

Powered by adapter (DC port):

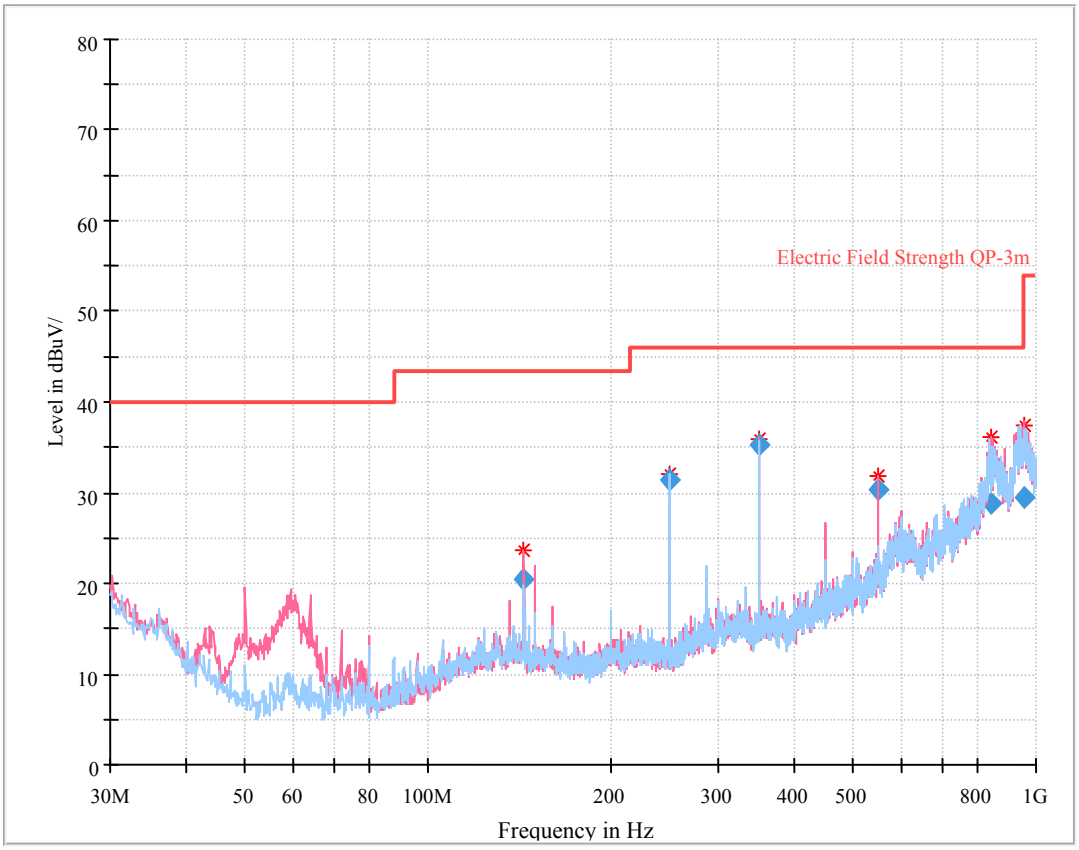
30 MHz~1 GHz:



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
71.156250	31.17	111.0	V	101.0	-20.5	40.00	8.83
71.918625	31.99	122.0	V	64.0	-20.5	40.00	8.01
150.000375	23.12	100.0	V	328.0	-14.2	43.50	20.38
249.996750	32.63	153.0	H	79.0	-14.1	46.00	13.37
349.997875	33.40	108.0	H	257.0	-10.8	46.00	12.60
937.146750	29.42	299.0	H	207.0	8.5	46.00	16.58

Powered by POE:

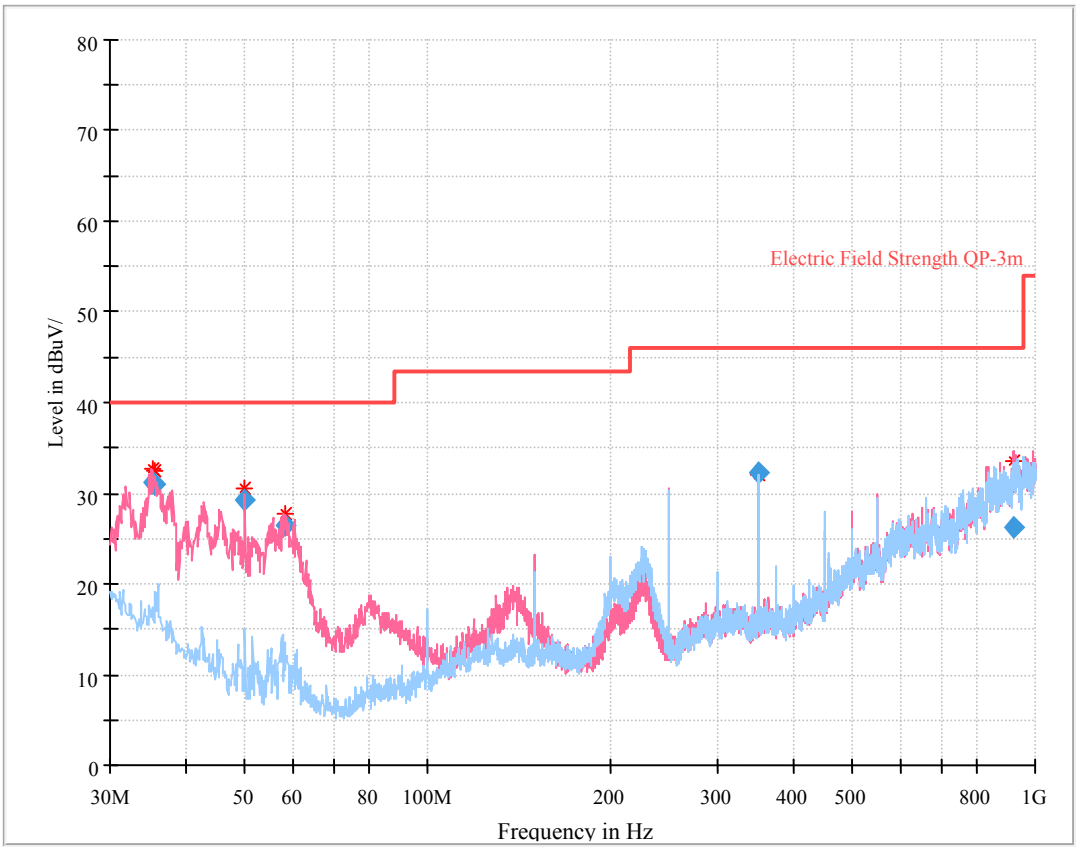
30 MHz~1 GHz:



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
143.972625	20.35	100.0	V	165.0	-14.2	43.50	23.15
249.998750	31.50	130.0	H	84.0	-14.1	46.00	14.50
350.004375	35.33	189.0	V	124.0	-10.8	46.00	10.67
549.989625	30.31	107.0	V	344.0	-5.5	46.00	15.69
841.186750	28.83	350.0	V	327.0	6.1	46.00	17.17
958.429000	29.48	340.0	V	186.0	9.3	46.00	16.52

Powered by adapter (Type-C port):

30 MHz~1 GHz:



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
35.278500	31.18	110.0	V	305.0	-10.7	40.00	8.82
35.598250	31.00	109.0	V	320.0	-10.9	40.00	9.00
49.997375	29.34	101.0	V	279.0	-19.6	40.00	10.66
58.204875	26.53	103.0	V	242.0	-20.1	40.00	13.47
350.009750	32.22	102.0	H	290.0	-10.8	46.00	13.78
920.199375	26.18	351.0	V	172.0	4.6	46.00	19.82

Note:
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Corrected Amplitude = Corrected Factor + Reading
Margin = Limit - Corrected. Amplitude
The other spurious emission which is 20dB to the limit was not recorded.

Spurious radiated emission above 960MHz in non GPS band:

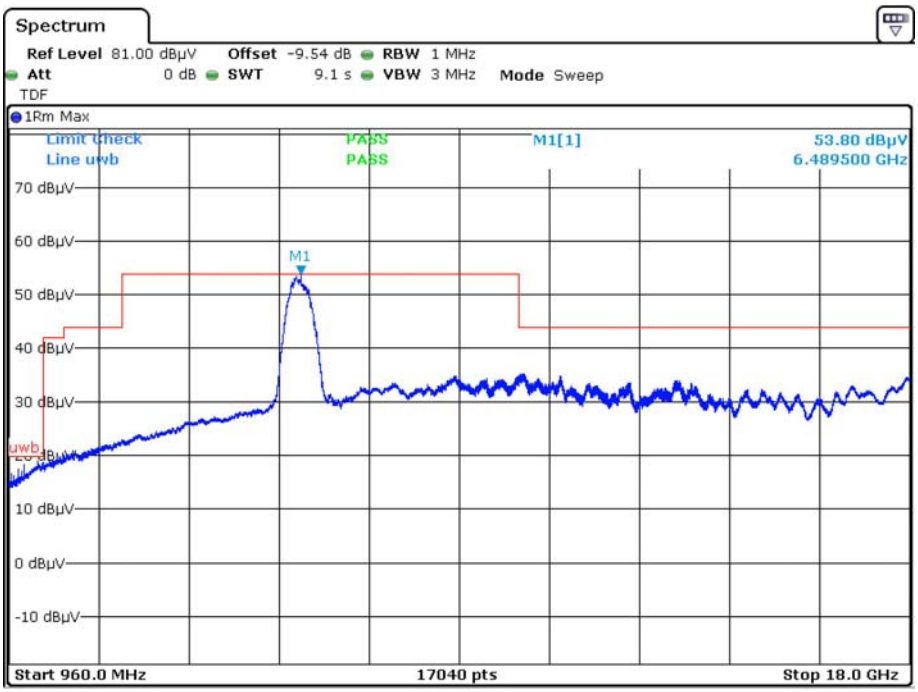
1. The test distance is 1m, so the correct factor from 3m to 1m is 20log(3/1)=9.54dB which was added into the offset on the spectrum analyzer.

2. E[dBμV/m] = EIRP[dBm] + 95.2, for d = 3 meters.

3. The antenna factor, cable loss and preamplifier gain have been entered into the analyzer as the transducer factor.

Frequency (MHz)	Corrected Amplitude (dBμV/m)	EIRP (dBm)	Detector	Turntable Degree	Rx Antenna Height (m)	Rx Antenna Polar (H / V)	Corrected Factor (dB/m)	Part 15.517 EIRP Limit (dBm)	Part 15.517 Margin (dB)
6489.5	53.80	-41.40	RMS	138	1.3	H	8.24	-41.3	0.1
39823.5	34.24	-60.96	RMS	24	1.3	H	18.79	-51.3	9.66
6489.5	51.34	-43.86	RMS	162	1.5	V	8.24	-41.3	2.56
39799.5	33.74	-61.46	RMS	252	1.5	V	16.93	-51.3	10.16

Horizontal



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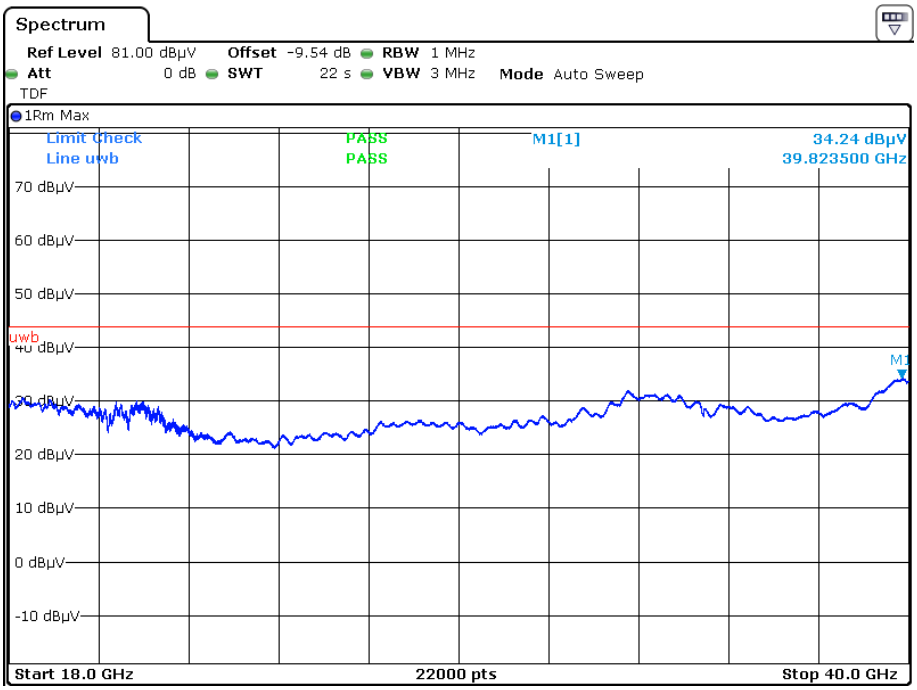

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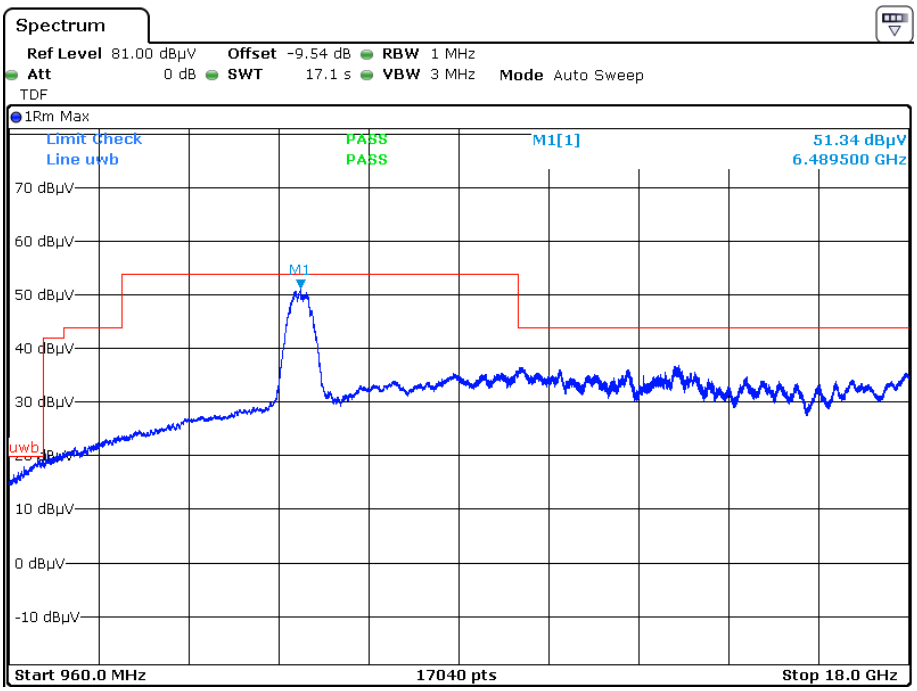
Vertical



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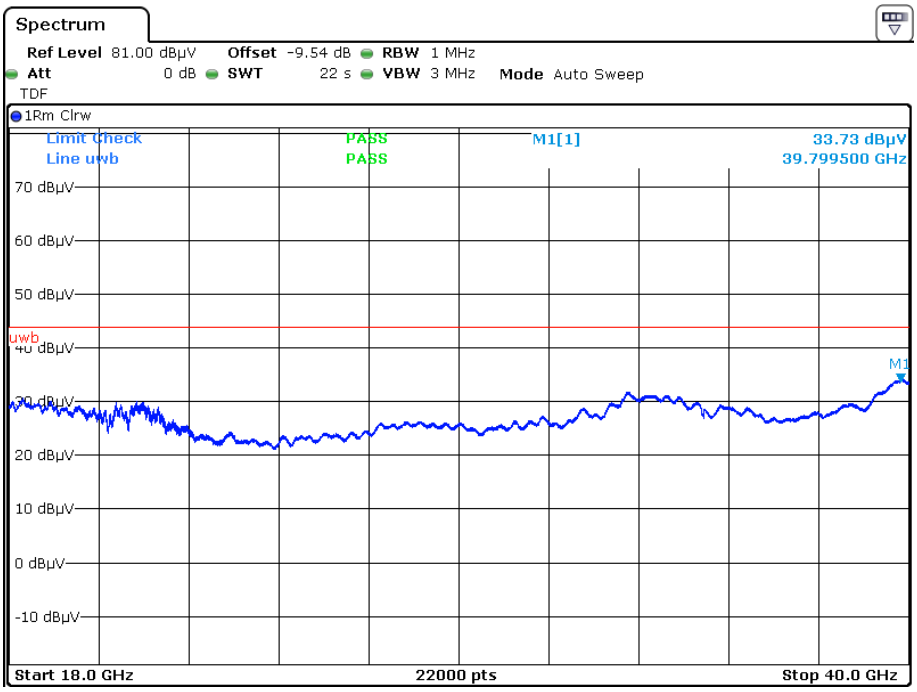

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Spurious radiated emission in GPS band:

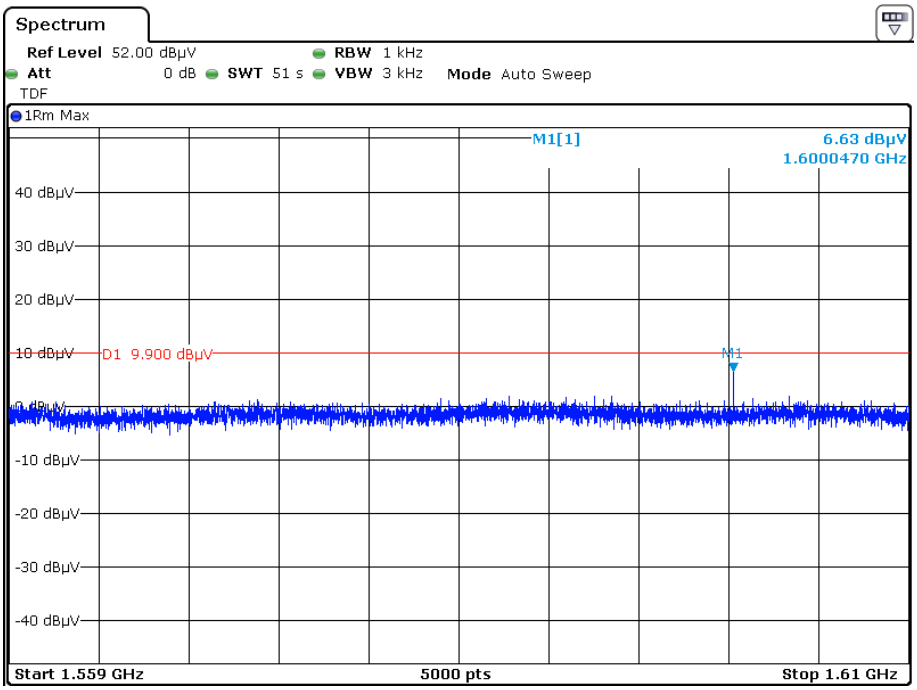
1. The test distance is 3m.

2. E[dBµV/m] = EIRP[dBm] + 95.2, for d = 3 meters.

3. The antenna factor, cable loss and preamplifier gain have been entered into the analyzer as the transducer factor.

Frequency (MHz)	Corrected Amplitude (dBµV/m)	EIRP (dBm)	Detector	Turntable Degree	Rx Antenna Height (m)	Rx Antenna Polar (H / V)	Corrected Factor (dB/m)	Part 15.517 EIRP Limit (dBm)	Part 15.517 Margin (dB)
1225.17	4.61	-90.59	RMS	169	1.4	H	-4.68	-85.3	5.29
1600.05	6.63	-88.57	RMS	251	1.5	H	-2.71	-85.3	3.27
1200.03	0.82	-94.38	RMS	157	1.5	V	-4.88	-85.3	9.08
1600.05	8.99	-86.21	RMS	184	1.4	V	-2.71	-85.3	0.91

Horizontal



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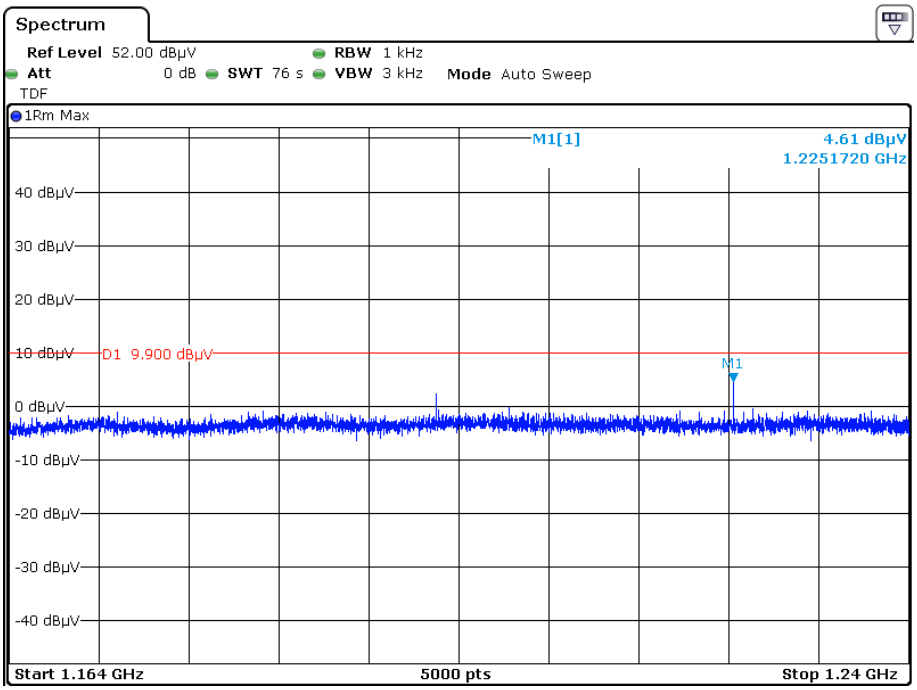

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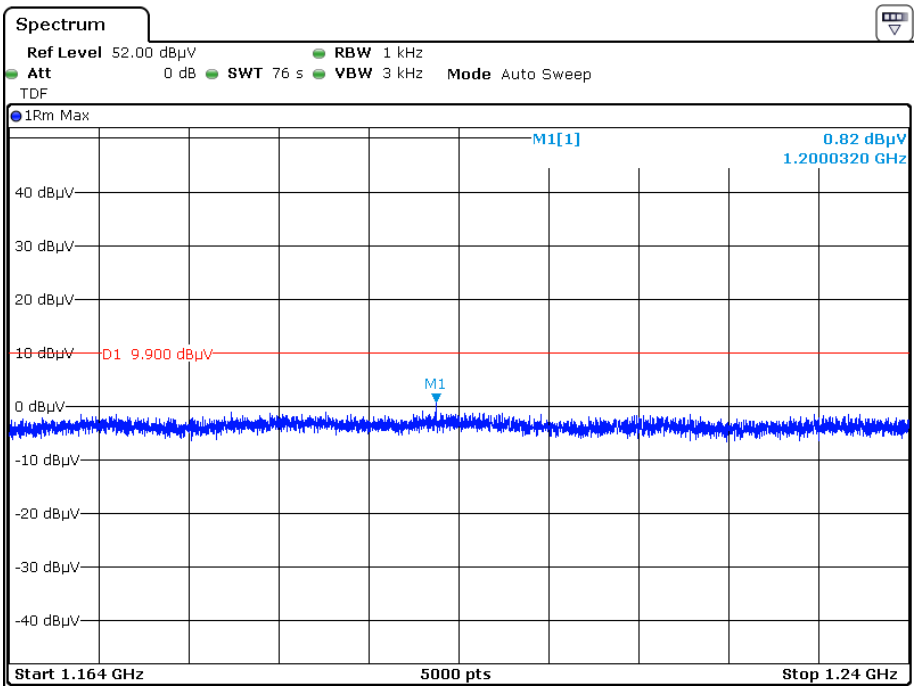
Vertical



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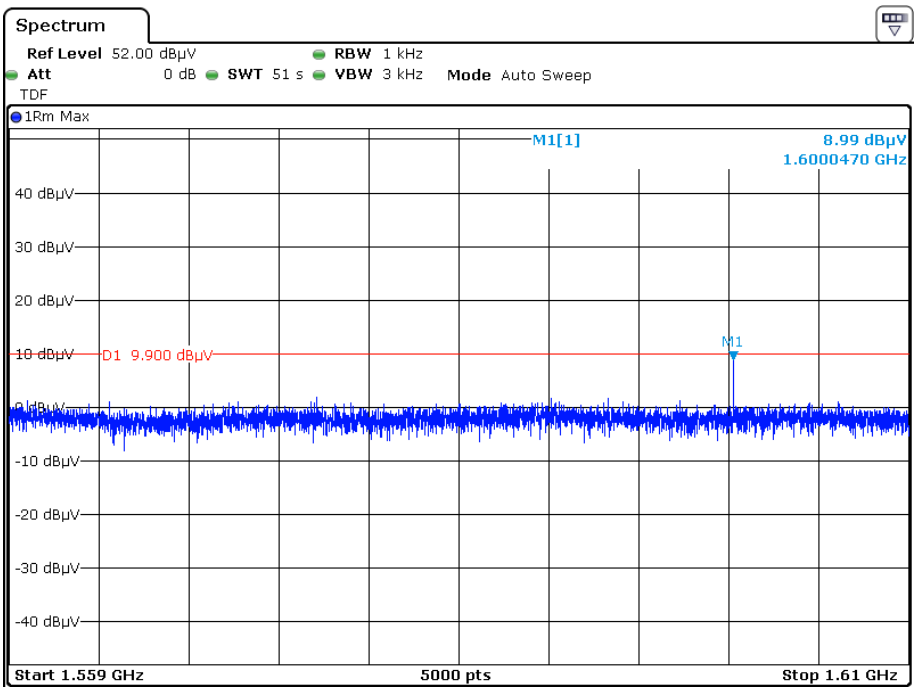

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Co-location radiated emission

UWB & 802.11b low channel

Frequency (MHz)	Corrected Amplitude (dBμV/m)	Detector (PK/QP/Ave.)	Turntable Degree	Rx Antenna Height (m)	Rx Antenna Polar (H / V)	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
350.008	37.61	QP	271	1.0	H	-10.8	46.00	8.39
12979	42.89	RMS	169	1.4	H	-4.68	53.4	10.51
12979	43.01	RMS	251	1.5	V	-2.71	53.4	10.39
4824.00	48.40	PK	269	1.4	H	5.24	83.5	35.10
4824.00	33.27	AV	269	1.4	H	5.24	63.5	30.23
4824.00	48.75	PK	328	1.5	V	5.24	83.5	34.75
4824.00	33.56	AV	328	1.5	V	5.24	63.5	29.94

Note: The test distance is 1m, so the correct factor from 3m to 1m is 20log(3/1)=9.54dB which was added into the limit.
E[dBμV/m] = EIRP[dBm] + 95.2, for d = 3 meters
Margin = Limit- Corr. Amplitude

§15.517(e) - PEAK EMISSION IN A 50 MHZ BANDWIDTH

Applicable Standard

There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, f_M. That limit is 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures described in §15.521.

Test Procedure

Refer to the C63.10 -2013 Section 10.3.5.

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Alan He on 2019-12-10.

EUT operation mode: Transmitting

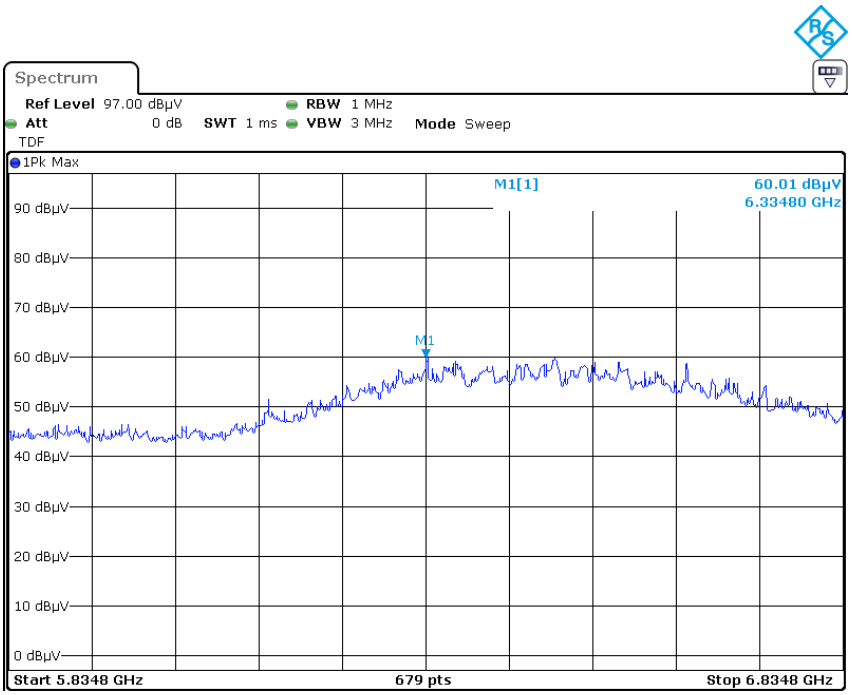
Frequency (MHz)	Reading level (dBµV/m)	EIRP (dBm/MHz)	EIRP (dBm/50MHz)	Limit
				dBm/50MHz
6334.8	60.01	-35.19	-1.19	0

Note: the correct factor of RBW 1MHz to 50MHz is 20 log (50MHz/1 MHz) =34

E[dBµV/m] = EIRP[dBm] + 95.2, for d = 3 meters.

The test distance is 3m.

The antenna factor, cable loss and preamplifier gain have been entered into the analyzer as the transducer factor.



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