TESTING LABORATORY
CERTIFICATE #4820.01

RSS-GEN, ISSUE 5 MARCH 2019 AMENDMENT 1
RSS-210, ISSUE 10, DECEMBER 2019

FCC PART 15.245

TEST REPORT

For

Senstar Corporation

119 John Cavanaugh Drive, Carp, Ontario, Canada

FCC ID: I5T-BR100
IC: 1454B-BR100

Report Type:	**Product Type:**
Original Report	Senstar BR100

Report Number:	RTZ201009001-00A
Report Date:	2021-01-15
Reviewed By:	Ivan Cao Assistant Manager
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Dongguan) No.12, Pulong East 1st Road, Tangxia Town, Dongguan, Guangdong, China Tel: +86-769-86858888 Fax: +86-769-86858891 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:	Senstar BR100
EUT Model:	BR100
Operation Frequency:	24.1025-24.1475 GHz
Modulation Type:	CW
Rated Input Voltage:	DC 12~48V from POE
Serial Number:	RTZ201009001-RF-S1
EUT Received Date:	2020.10.12
EUT Received Status:	Good

Objective

This type approval report is prepared on behalf of ***Senstar Corporation*** in accordance with Part 2-Subpart J, and Part 15-Subparts A and C of the Federal Communication Commissions rules. And RSS-210, Issue 10, December 2019 of the Innovation, Science and Economic Development Canada, and RSS-Gen Issue 5, March 2019 Amendment 1, General Requirements for Compliance of Radio Apparatus.

The tests were performed in order to determine compliance with FCC Rules Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.245 rules. And RSS-210, Issue 10, December 2019 of the Innovation, Science and Economic Development Canada, and RSS-Gen Issue 5, March 2019 Amendment 1, General Requirements for Compliance of Radio Apparatus.

Related Submittal(s)/Grant(s)

N/A

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 and Bay Area Compliance Laboratories Corp. (Dongguan).

Measurement Uncertainty

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
Unwanted Emissions, radiated	30M~200MHz: 4.58 dB for Horizontal, 4.59 dB for Vertical 200M~1GHz: 4.83 dB for Horizontal, 5.85 dB for Vertical 1G~6GHz: 4.45 dB, 6G~26.5GHz: 5.23 dB
Temperature	±1℃
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%
AC Power Lines Conducted Emission	3.12 dB (150 kHz to 30 MHz)

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

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.12, Pulong East 1st Road, Tangxia Town, Dongguan, Guangdong, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218, the FCC Designation No. : CN1220.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0022.

Declarations

BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol "▲". Customer model name, addresses, names, trademarks etc. are not considered data.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

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This report may contain data that are not covered by the accreditation scope and shall be marked with an asterisk "★".

SYSTEM TEST CONFIGURATION

Justification

The EUT was configured in operating mode for testing which was provided by the manufacturer.

The device uses total 6 channels as below:

Channel No.	Frequency (GHz)	Channel No.	Frequency (GHz)
1	24.1025	4	24.1275
2	24.1075	5	24.1425
3	24.1225	6	24.1475

Channel 1, 3, 6 were tested.

EUT Exercise Software

The software " Bk New Tolol. exe "was used for testing and the maximum power was configured as below, which was provided by the manufacturer▲:

Channel	Frequency (GHz)	Power Level Setting
Low	24.1025	default
Middle	24.1225	default
High	24.1475	default

Equipment Modifications

No modifications were made to the EUT.

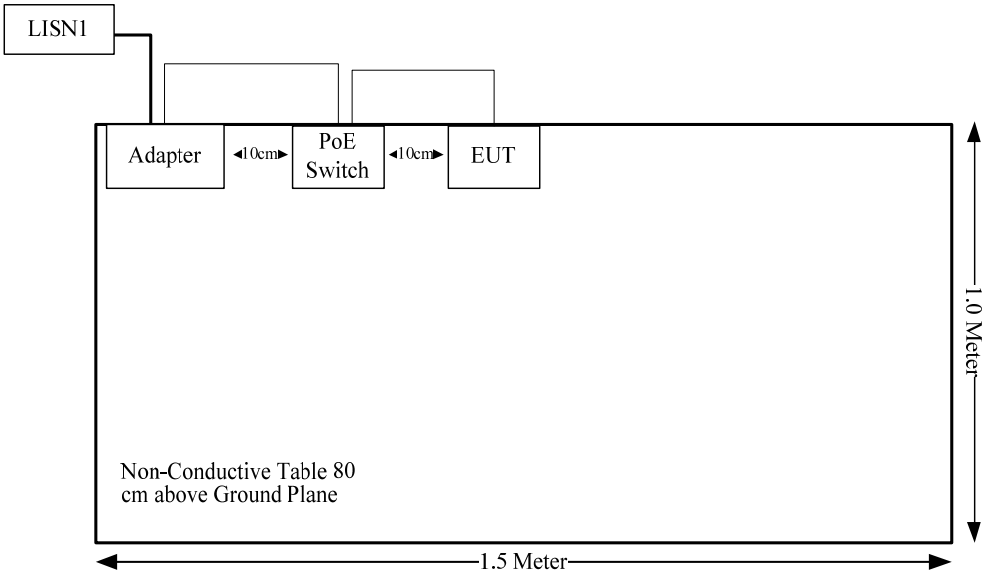
Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
trendnet	POE	TG82G/A H/W V1.1R	CA9F8G1101132
LEADER	Adapter	NU90-J540167-I1	NU90-J540167-I1222

Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
RJ45	No	No	3	POE	EUT
adapter Cable	No	No	2	adapter	POE

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

Rules	Description of Test	Result
RSS-102 Clause 2.5.2	Exemption Limits For Routine Evaluation-RF Exposure Evaluation	Compliance
FCC §15.203 RSS-GEN Clause 6.8	Antenna Requirement	Compliance
FCC §15.207(a) RSS-Gen Clause 8.8	Conduction Emissions	Compliance
FCC §15.205, §15.209, §15.245 RSS-210 Annex F.1 RSS-Gen Clause 8.10	Radiated Emissions	Compliance
FCC §15.215 (c) RSS-Gen Clause 6.7	20 dB Bandwidth and Occupied Bandwidth	Compliance

RSS-102 § 2.5.2 - EXEMPTION LIMITS FOR ROUTINE EVALUATION – RF EXPOSURE EVALUATION

Applicable Standard

According to RSS-102 § (2.5.2):

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2}\ f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

Calculated Data:

Frequency (GHz)	EIRP including Tune-up Tolerance		Exemption limits (mW)
	(dBm)	(mW)	
24.1025-24.1475	21	126	5000

Note: the EIRP Tune up Power was declared by manufacturer.

So the device is compliance exemption from Routine Evaluation Limits –RF exposure Evaluation.

Result: Compliance

FCC§15.203, RSS-GEN CLAUSE 6.8 - 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.
c. Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

According to RSS-Gen §6.8, The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.
The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.
For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).
When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.
The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.
For licence-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

This radio transmitter [enter the device's ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

Antenna Connector Construction

The EUT has internal PCB Antennas permanently attached to the unit, the antenna gain is 10 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

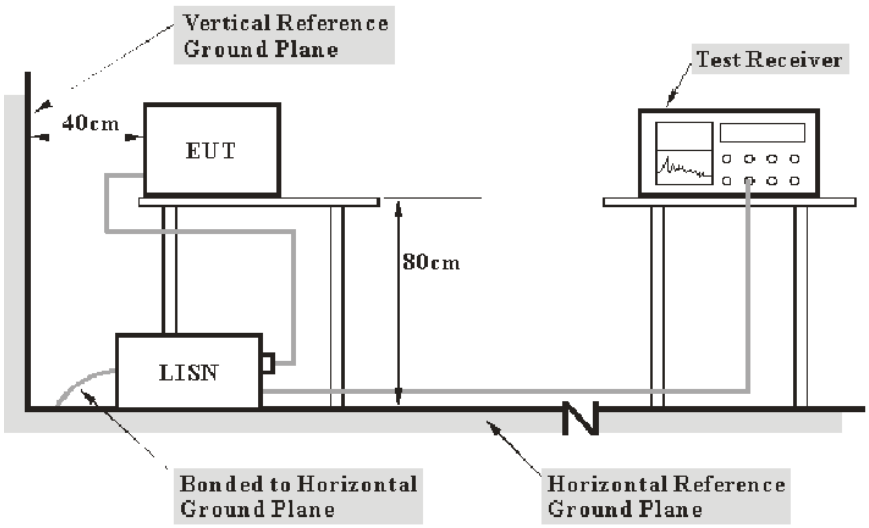
Result: Compliant.

FCC §15.207 (a), RSS-GEN CLAUSE 8.8– AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207(a), RSS-GEN CLAUSE 8.8.

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 setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207, and RSS-Gen limits.

The spacing between the peripherals was 10 cm.

The Adapter was connected to the main LISN with a 120 V/60 Hz AC power source.

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 first LISN.

The frequency and amplitude of the six highest ac power-line conducted emissions relative to the limit, measured over all the current-carrying conductors of the EUT power cords, and the operating frequency or frequency to which the EUT is tuned (if appropriate), should be reported, unless such emissions are more than 20 dB below the limit. AC power-line conducted emissions measurements are to be separately carried out only on each of the phase ("hot") line(s) and (if used) on the neutral line(s), but not on the ground [protective earth] line(s). If less than six emission frequencies are within 20 dB of the limit, then the noise level of the measuring instrument at representative frequencies should be reported. The specific conductor of the power-line cord for each of the reported emissions should be identified. Measure the six highest emissions with respect to the limit on each current-carrying conductor of each power cord associated with the EUT (but not the power cords of associated or peripheral equipment that are part of the test configuration). Then, report the six highest emissions with respect to the limit from among all the measurements identifying the frequency and specific current-carrying conductor identified with the emission. The six highest emissions should be reported for each of the current-carrying conductors, or the six highest emissions may be reported over all the current-carrying conductors.

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$V_C = V_R + A_C + VDF$
$C_f = A_C + VDF$

Herein,
V_C (cord. Reading): corrected voltage amplitude
V_R: reading voltage amplitude
A_c: attenuation caused by cable loss
VDF: voltage division factor of AMN
C_f: Correction Factor

The "**Margin**" column of the following data tables indicates the degree of compliance within 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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	LISN	ENV 216	101614	2020-09-12	2021-09-12
R&S	EMI Test Receiver	ESCI	101121	2020-07-07	2021-07-07
MICRO-COAX	Coaxial Cable	C-NJNJ-50	C-0200-01	2020-09-05	2021-09-05
R&S	Test Software	EMC32	Version 9.10.00	N/A	N/A

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

Test Data

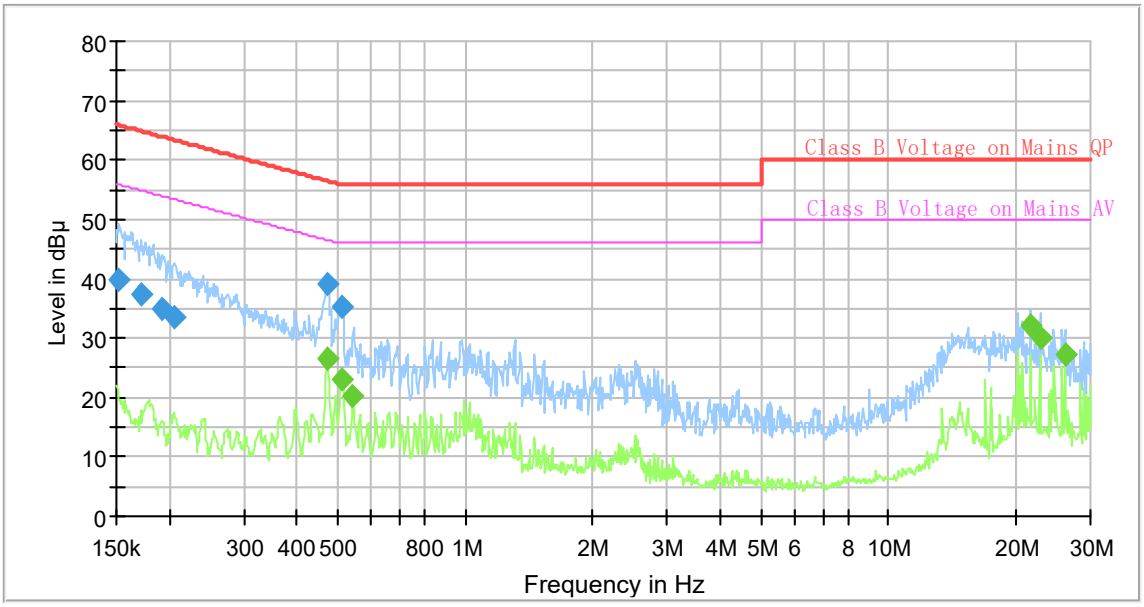
Environmental Conditions

Temperature:	23.9℃
Relative Humidity:	50%
ATM Pressure:	101.2kPa
Tester:	Barry Yang
Test Date:	2020-11-04

Test Mode: *Transmitting*

Test Result: Compliance. *Please refer to following table and plots:*

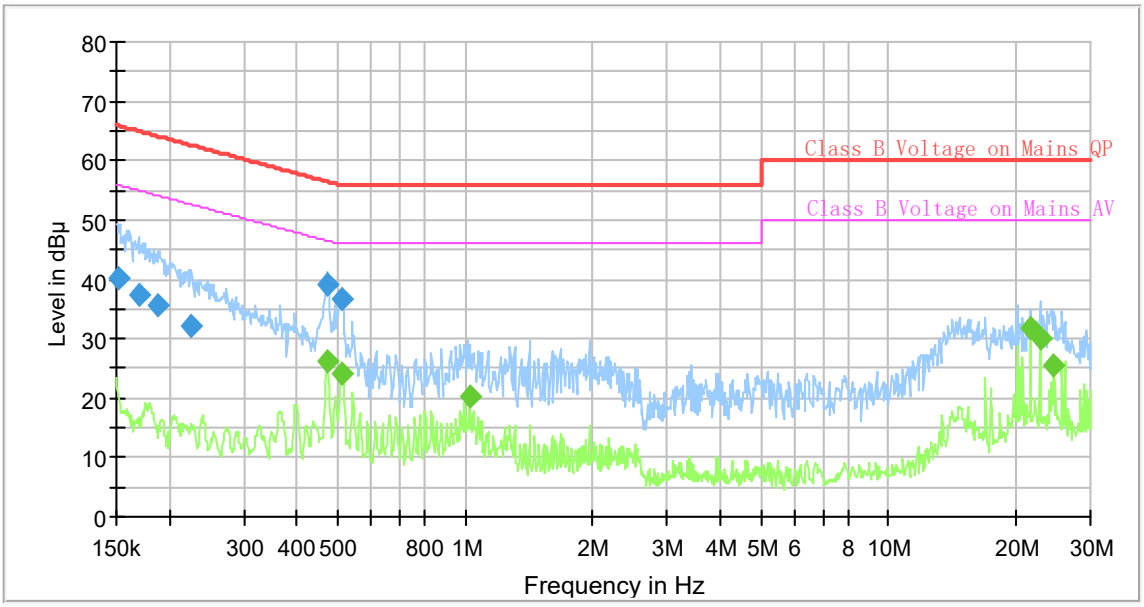
AC120 V, 60 Hz, Line:



Final_Result

Frequency (MHz)	QuasiPeak (dB µ V)	Average (dB µ V)	Limit (dB µ V)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.152261	39.96	---	65.88	25.92	9.000	L1	9.6
0.171623	37.43	---	64.88	27.45	9.000	L1	9.6
0.192484	35.07	---	63.93	28.86	9.000	L1	9.6
0.206405	33.66	---	63.35	29.69	9.000	L1	9.6
0.472373	---	26.65	46.47	19.82	9.000	L1	9.6
0.472373	39.16	---	56.47	17.31	9.000	L1	9.6
0.509069	---	22.89	46.00	23.11	9.000	L1	9.6
0.509069	35.31	---	56.00	20.69	9.000	L1	9.6
0.543169	---	20.14	46.00	25.86	9.000	L1	9.6
21.659819	---	32.05	50.00	17.95	9.000	L1	10.0
22.881343	---	30.20	50.00	19.80	9.000	L1	10.0
26.179731	---	27.13	50.00	22.87	9.000	L1	10.1

AC120 V, 60 Hz, Neutral:



Final_Result

Frequency (MHz)	QuasiPeak (dB µ V)	Average (dB µ V)	Limit (dB µ V)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.151504	40.05	---	65.92	25.87	9.000	N	9.6
0.169074	37.55	---	65.01	27.46	9.000	N	9.6
0.188682	35.54	---	64.09	28.55	9.000	N	9.6
0.225792	32.04	---	62.60	30.56	9.000	N	9.6
0.472373	---	26.17	46.47	20.30	9.000	N	9.6
0.472373	39.11	---	56.47	17.36	9.000	N	9.6
0.509069	---	24.09	46.00	21.91	9.000	N	9.6
0.509069	36.63	---	56.00	19.37	9.000	N	9.6
1.023352	---	20.24	46.00	25.76	9.000	N	9.6
21.659819	---	31.70	50.00	18.30	9.000	N	9.9
22.881343	---	29.92	50.00	20.08	9.000	N	9.9
24.536148	---	25.66	50.00	24.34	9.000	N	9.9

FCC§15.205, §15.209&§15.245, RSS-210 ANNEX F.1, RSS-GEN CLAUSE 8.10- RADIATED EMISSIONS

Applicable Standard

As per FCC§15.245 (b):

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency (MHz)	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (millivolts/meter)
902-928	500	1.6
2435-2465	500	1.6
5785-5815	500	1.6
10500-10550	2500	25.0
24075-24175	2500	25.0

(1) Regardless of the limits shown in the above table, harmonic emissions in the restricted bands below 17.7 GHz, as specified in §15.205, shall not exceed the field strength limits shown in §15.209. Harmonic emissions in the restricted bands at and above 17.7 GHz shall not exceed the following field strength limits:

(i) For the second and third harmonics of field disturbance sensors operating in the 24075-24175 MHz band and for other field disturbance sensors designed for use only within a building or to open building doors, 25.0 mV/m.

(ii) For all other field disturbance sensors, 7.5 mV/m.

(iii) Field disturbance sensors designed to be used in motor vehicles or aircraft must include features to prevent continuous operation unless their emissions in the restricted bands, other than the second and third harmonics from devices operating in the 24075-24175 MHz band, fully comply with the limits given in §15.209. Continuous operation of field disturbance sensors designed to be used in farm equipment, vehicles such as fork lifts that are intended primarily for use indoors or for very specialized operations, or railroad locomotives, railroad cars and other equipment which travels on fixed tracks is permitted. A field disturbance sensor will be considered not to be operating in a continuous mode if its operation is limited to specific activities of limited duration (e.g., putting a vehicle into reverse gear, activating a turn signal, etc.).

(2) Field strength limits are specified at a distance of 3 meters.

(3) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

(4) The emission limits shown above are based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply.

As per RSS-210 Annex F.1

This section sets out the requirements for field disturbance sensors operating in the frequency bands shown in table F1.

Perimeter protection systems, which employ a leaky transmission line as the radiating source, are excluded from the requirements of this annex.

Devices shall comply with the following requirements:

(a) The average field strength of fundamental and harmonic emissions measured at 3 m shall not exceed the limits shown in table F1.

Table F1 — Field strength limits for field disturbance sensors operating at various frequencies

Fundamental frequencies (MHz)	Field strength (mV/m)	
	Fundamental emissions	Harmonic emissions
902-928	500	1.6
2435-2465	500	1.6
5785-5815	500	1.6
10500-10550	2500	25
24075-24175	2500	25

(b) Additionally, harmonic emissions falling into restricted frequency bands listed in RSS-Gen and that are below 17.7 GHz shall meet the general field strength limits specified in RSS-Gen, regardless of the limits given in table F1.

(c) Harmonic emissions falling into restricted frequency bands listed in RSS-Gen and that are at or above 17.7 GHz shall not exceed the following field strength limits measured at a distance of 3 m:

(i) 25 mV/m for the second and third harmonic emissions of field disturbance sensors operating in the band 24075-24175 MHz and for devices designed for use only within buildings or for intermittent use, such as to open building doors

(ii) 7.5 mV/m for all other devices

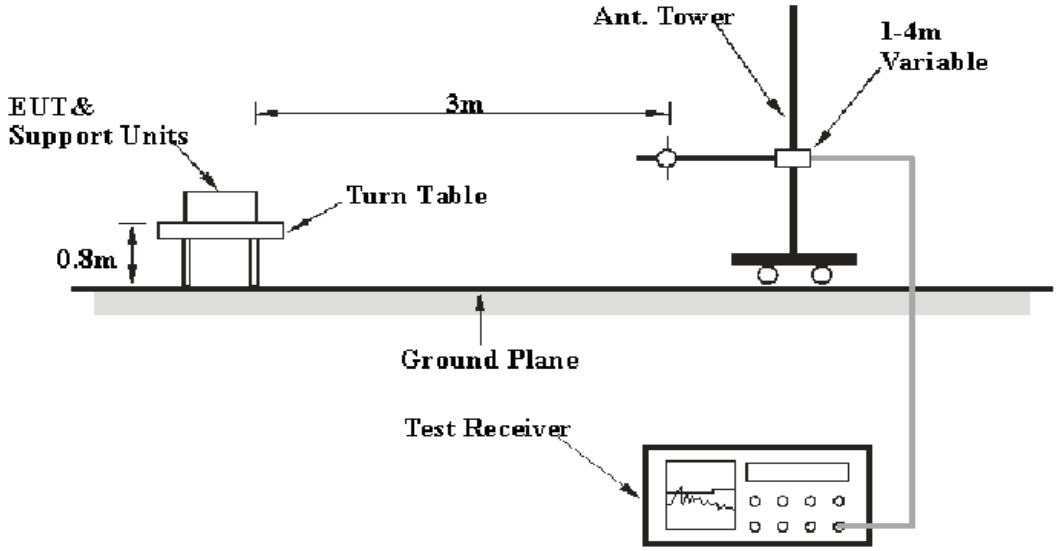
(d) Field disturbance sensors designed to be used in motor vehicles or aircraft must include features to prevent continuous operation, unless their emissions in the restricted frequency bands as listed in RSS-Gen, other than the second and third harmonic emissions from devices operating in the band 24075-24175 MHz, comply with the general field strength limits specified in RSS-Gen.

Continuous operation of field disturbance sensors designed to be used in farm equipment (i.e. forklifts that are intended primarily for use indoors or for very specialized operations), or railroad locomotives, railroad cars, and other equipment that travel on fixed tracks, is permitted. A field disturbance sensor is considered not to be operating in a continuous mode if its operation is limited to specific activities of limited duration (e.g. putting a vehicle into reverse gear, activating a turn signal).

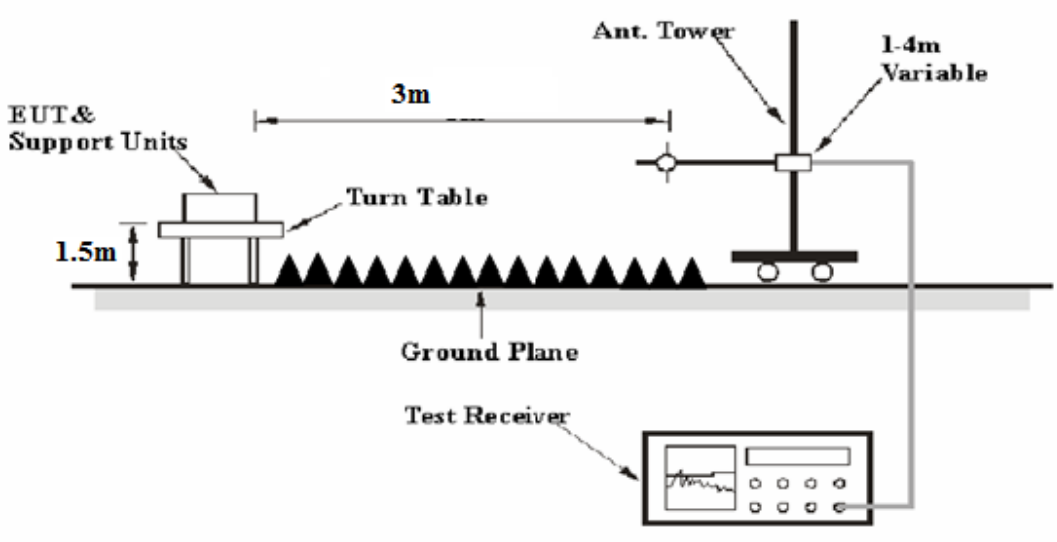
(e) Emissions radiated outside of the specified frequency bands, except for harmonic emissions, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits specified in RSS-Gen, whichever is less stringent.

EUT Setup

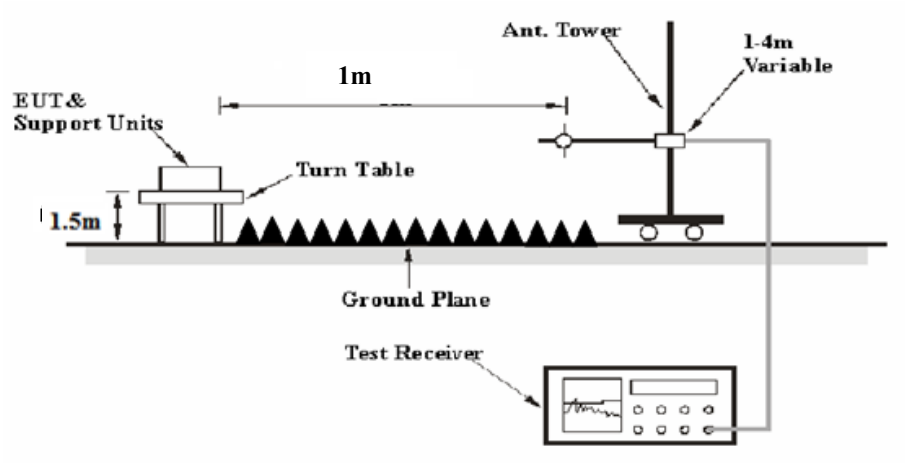
Below 1 GHz:



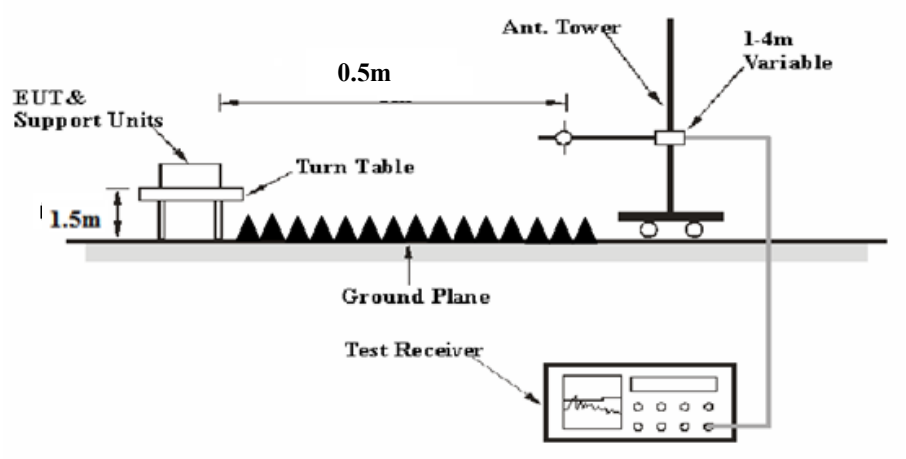
1-26.5 GHz:



26.5-100 GHz:



90-100 GHz:



The radiated emission tests were performed in the 3 meters Chamber A, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209,15.205 and FCC 15.249 limits.

According to C63.10, the 26.5- 100GHz test result shall be extrapolated to the specified distance using an extrapolation factor of 20dB/decade from 3m to 1m

For 26.5-90GHz
Distance extrapolation factor =20 log (specific distance [3m]/test distance [1m]) dB=9.54dB

For 90-100GHz
Distance extrapolation factor =20 log (specific distance [3m]/test distance [0.5m]) dB=15.56dB

Extrapolation result = Corrected Amplitude (dBμV/m) - distance extrapolation factor

For above 40GHz, external harmonic mixers are utilized. The antenna is scanned around the entire perimeter surface of the EUT, in both horizontal and vertical polarizations, at the distance of 1m from the EUT for 40-100GHz. The Mixers and it`s RF cables is compose a system for calibration, the conversion factor was added into the test Spectrum Analyzer in testing.

Test Equipment Setup

The system was investigated from 30 MHz to 100 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	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	AV

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz - 1 GHz, peak and average detection modes for frequencies above 1 GHz.

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

Or

Margin = Limit –Extrapolation result

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Sunol Sciences	Antenna	JB3	A060611-2	2020-08-25	2023-08-25
R&S	EMI Test Receiver	ESCI	100224	2020-09-12	2021-09-12
Unknown	Coaxial Cable	C-NJNJ-50	C-1000-01	2020-09-05	2021-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-02	2020-09-05	2021-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0530-01	2020-09-24	2021-09-24
Sonoma	Amplifier	310N	185914	2020-10-13	2021-10-13
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
TDK RF	Horn Antenna	HRN-0118	130 084	2018-10-12	2021-10-12
Ducommun Technolagies	Horn Antenna	ARH-4223-02	1007726-01 1304	2017-12-05	2020-12-04
Ducommun Technolagies	Horn Antenna	ARH-2823-02	1007726-01 1302	2017-12-05	2020-12-04
R&S	Spectrum Analyzer	FSP 38	100478	2020-07-07	2021-07-07
HUBER+SUHNER	Coaxial Cable	SUCOFLEX 126EA	MY369/26/26EA	2020-09-25	2021-09-25
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2020-09-05	2021-09-05
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2020-06-27	2021-06-27
Unknown	Coaxial Cable	C-2.4J2.4J-50	C-0700-02	2020-06-27	2021-06-27
OML	Harmonic Mixer	WR19/M19HWD	U60313-1	2019-10-14	2022-10-14
OML	Horn Antenna	M19RH	11648-01	2019-10-14	2022-10-14
OML	Harmonic Mixer	WR12/M12HWD	E60120-1	2019-10-14	2022-10-14
OML	Horn Antenna	M12RH	E60120-2	2019-10-14	2022-10-14
OML	Harmonic Mixer	WR08/M08HWD	F60313-1	2019-10-14	2022-10-14
OML	Horn Antenna	M08RH	F60313-2	2019-10-14	2022-10-14
MICRO-COAX	Coaxial Cable	UFA147-1-2362-100100	64639 231029-001	2020-02-24	2021-02-24
Agilent	Spectrum Analyzer	E4440A	SG43360054	2020-07-07	2021-07-07

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

Test Data

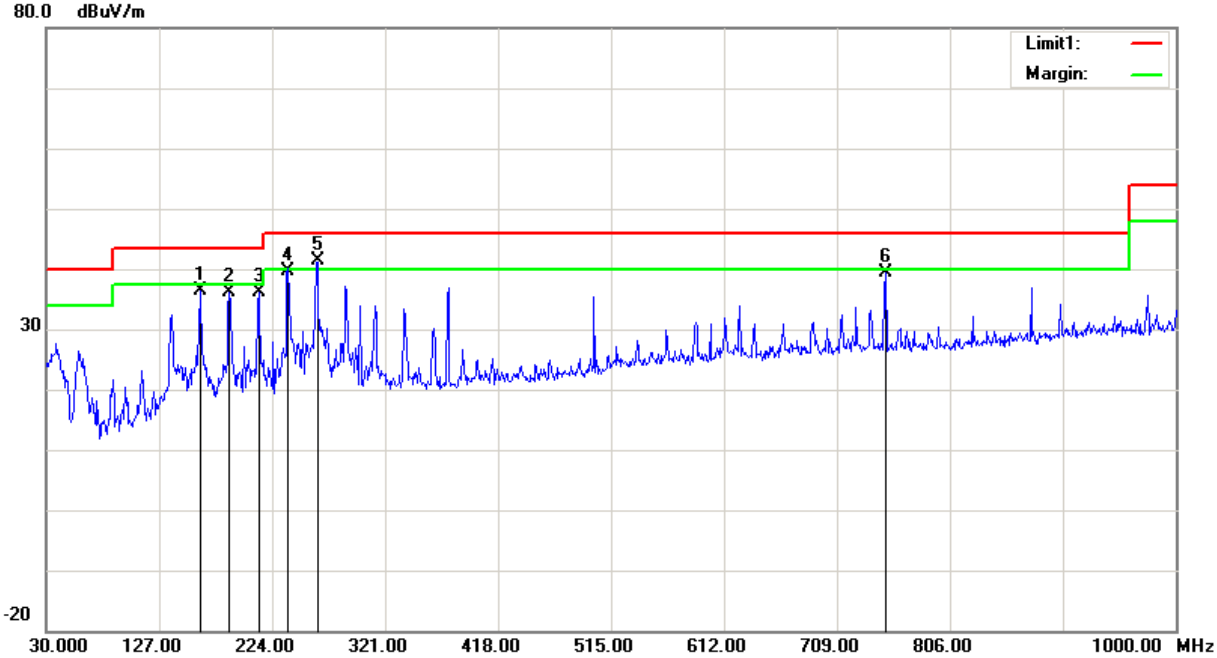
Environmental Conditions

Test Items	Radiation Below 1GHz	Radiation Above 1GHz
Temperature:	21.3 °C	26.3 °C
Relative Humidity:	39%	56%
ATM Pressure:	101.8 kPa	101.0kPa
Tester:	Asa Chen, Fred Li	Jalon Liu, Joker Chen
Test Date:	2020-11-28	2020-11-01

Test Mode: Transmitting

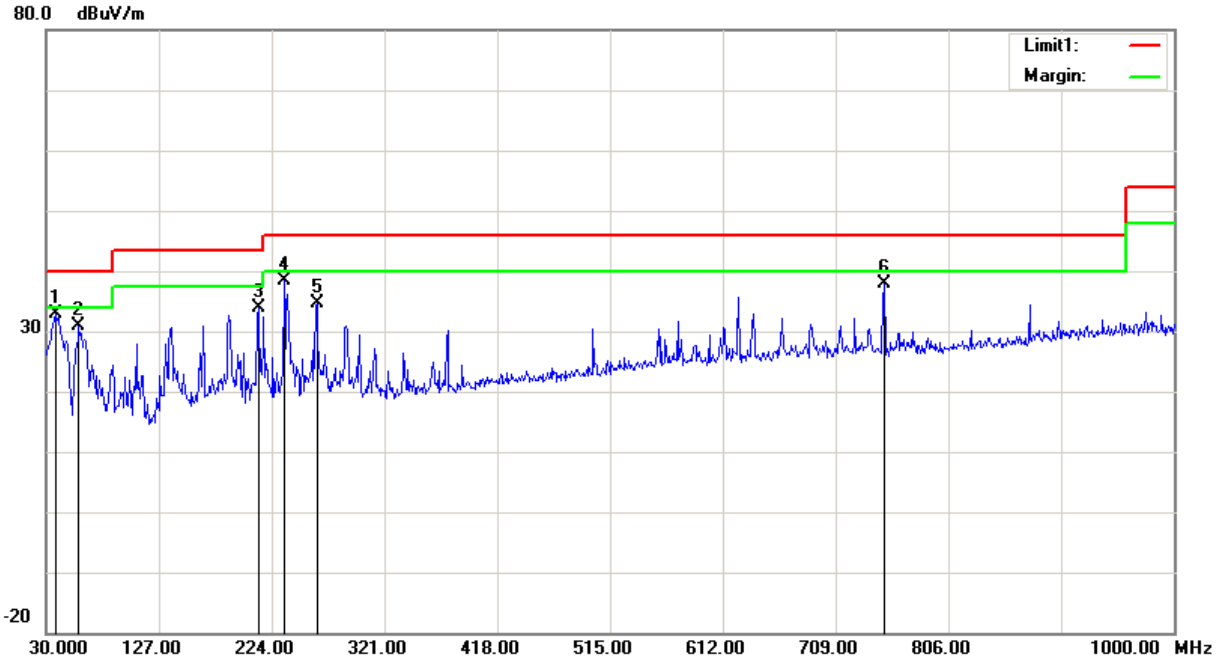
1) 30MHz-1GHz

Horizontal



Frequency (MHz)	Reading (dBµV)	Detector	Corrected (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
161.9200	45.82	peak	-9.48	36.34	43.50	7.16
187.1400	46.43	peak	-10.32	36.11	43.50	7.39
212.3600	47.17	peak	-11.06	36.11	43.50	7.39
237.5800	49.77	QP	-10.07	39.70	46.00	6.30
262.8000	50.31	QP	-9.01	41.30	46.00	4.70
750.7100	38.82	peak	0.56	39.38	46.00	6.62

Vertical:



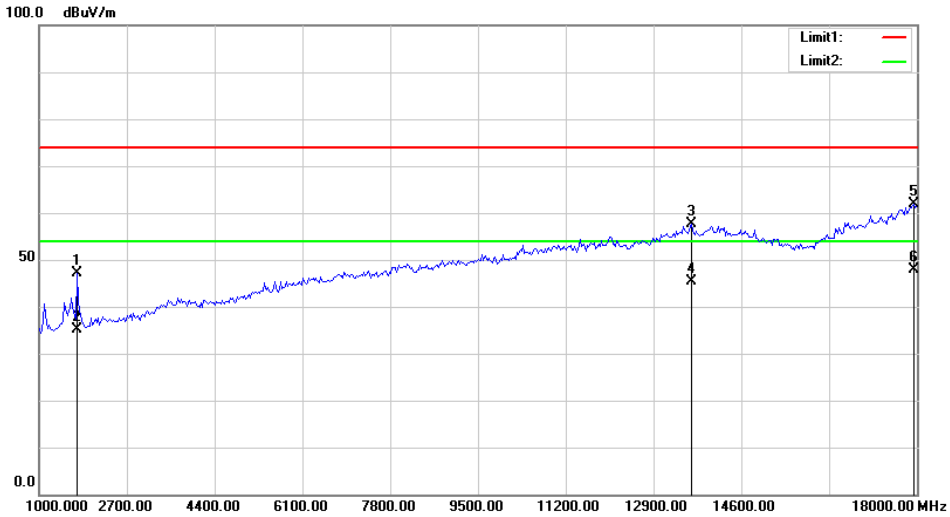
Frequency (MHz)	Reading (dBµV)	Detector	Corrected (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
38.7300	41.51	peak	-8.58	32.93	40.00	7.07
58.1300	47.32	peak	-16.51	30.81	40.00	9.19
212.3600	45.03	peak	-11.06	33.97	43.50	9.53
234.6700	48.52	peak	-10.19	38.33	46.00	7.67
262.8000	43.52	peak	-9.01	34.51	46.00	11.49
750.7100	37.30	peak	0.56	37.86	46.00	8.14

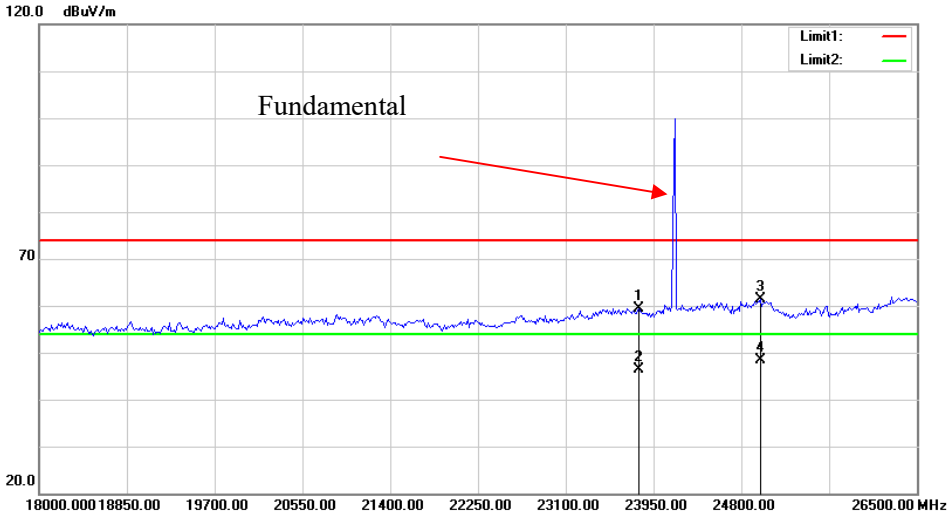
2) 1GHz-40GHz:

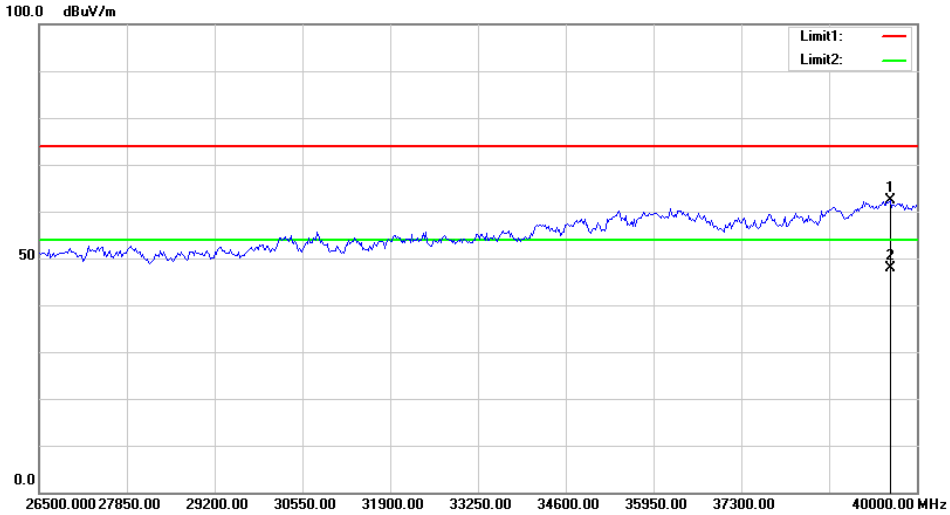
Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Remark	Polar (H/V)	Factor (dB/m)					
Frequency 24102.5 MHz									
1735.58	48.09	PK	H	24.10	2.79	27.90	47.08	74.00	26.92
1735.58	36.05	AV	H	24.10	2.79	27.90	35.04	54.00	18.96
14213.14	35.88	PK	H	40.42	6.17	25.61	56.86	74.00	17.14
14213.14	23.81	AV	H	40.42	6.17	25.61	44.79	54.00	9.21
17891.03	36.29	PK	H	43.40	7.10	24.07	62.72	74.00	11.28
17891.03	21.30	AV	H	43.40	7.10	24.07	47.73	54.00	6.27
1490.39	46.29	PK	V	24.07	2.06	28.04	44.38	74.00	29.62
1490.39	34.18	AV	V	24.07	2.06	28.04	32.27	54.00	21.73
14131.41	36.23	PK	V	40.56	6.17	25.64	57.32	74.00	16.68
14131.41	24.20	AV	V	40.56	6.17	25.64	45.29	54.00	8.71
17891.03	35.23	PK	V	43.40	7.10	24.07	61.66	74.00	12.34
17891.03	21.26	AV	V	43.40	7.10	24.07	47.69	54.00	6.31
24102.50	92.35	PK	H	35.39	8.88	39.82	96.80	147.96	51.16
24102.50	92.01	AV	H	35.39	8.88	39.82	96.46	127.96	31.50
24102.50	110.80	PK	V	35.39	8.88	39.82	115.25	147.96	32.71
24102.50	110.50	AV	V	35.39	8.88	39.82	114.95	127.96	13.01
24075.00	53.18	PK	V	35.38	8.87	39.80	57.63	74.00	16.37
24075.00	41.95	AV	V	35.38	8.87	39.80	46.40	54.00	7.60
25055.00	52.81	PK	V	35.73	8.38	39.10	57.82	74.00	16.18
25055.00	40.52	AV	V	35.73	8.38	39.10	45.53	54.00	8.47
Frequency 24122.5 MHz									
1762.82	48.48	PK	H	24.10	2.86	27.86	47.58	74.00	26.42
1762.82	36.22	AV	H	24.10	2.86	27.86	35.32	54.00	18.68
14485.58	36.89	PK	H	39.93	6.16	25.68	57.30	74.00	16.70
14485.58	24.82	AV	H	39.93	6.16	25.68	45.23	54.00	8.77
17972.76	35.93	PK	H	43.77	7.13	24.53	62.30	74.00	11.70
17972.76	21.43	AV	H	43.77	7.13	24.53	47.80	54.00	6.20
1490.39	46.00	PK	V	24.07	2.06	28.04	44.09	74.00	29.91
1490.39	33.98	AV	V	24.07	2.06	28.04	32.07	54.00	21.93
13913.46	36.04	PK	V	40.73	6.16	25.58	57.35	74.00	16.65
13913.46	24.01	AV	V	40.73	6.16	25.58	45.32	54.00	8.68
17754.81	36.23	PK	V	42.77	7.06	24.50	61.56	74.00	12.44
17754.81	22.38	AV	V	42.77	7.06	24.50	47.71	54.00	6.29
24122.50	92.40	PK	H	35.40	8.89	39.83	96.86	147.96	51.10
24122.50	91.96	AV	H	35.40	8.89	39.83	96.42	127.96	31.54
24122.50	110.86	PK	V	35.40	8.89	39.83	115.32	147.96	32.64
24122.50	110.52	AV	V	35.40	8.89	39.83	114.98	127.96	12.98
25055.00	52.86	PK	V	35.73	8.38	39.10	57.87	74.00	16.13
25055.00	40.59	AV	V	35.73	8.38	39.10	45.60	54.00	8.40

Frequency 24147.5 MHz									
1735.58	48.14	PK	H	24.10	2.79	27.90	47.13	74.00	26.87
1735.58	36.05	AV	H	24.10	2.79	27.90	35.04	54.00	18.96
13641.03	36.99	PK	H	40.51	6.11	26.03	57.58	74.00	16.42
13641.03	24.82	AV	H	40.51	6.11	26.03	45.41	54.00	8.59
17945.51	35.35	PK	H	43.65	7.12	24.33	61.79	74.00	12.21
17945.51	21.40	AV	H	43.65	7.12	24.33	47.84	54.00	6.16
1735.58	48.78	PK	V	24.10	2.79	27.90	47.77	74.00	26.23
1735.58	38.65	AV	V	24.10	2.79	27.90	37.64	54.00	16.36
14022.44	35.93	PK	V	40.76	6.17	25.71	57.15	74.00	16.85
14022.44	23.85	AV	V	40.76	6.17	25.71	45.07	54.00	8.93
17918.27	35.40	PK	V	43.52	7.11	24.13	61.90	74.00	12.10
17918.27	21.32	AV	V	43.52	7.11	24.13	47.82	54.00	6.18
24147.50	92.16	PK	H	35.41	8.90	39.84	96.63	147.96	51.33
24147.50	91.87	AV	H	35.41	8.90	39.84	96.34	127.96	31.62
24147.50	110.60	PK	V	35.41	8.90	39.84	115.07	147.96	32.89
24147.50	110.30	AV	V	35.41	8.90	39.84	114.77	127.96	13.19
24175.00	53.68	PK	V	35.42	8.91	39.86	58.15	74.00	15.85
24175.00	41.74	AV	V	35.42	8.91	39.86	46.21	54.00	7.79
25004.00	53.35	PK	V	35.71	8.32	39.15	58.23	74.00	15.77
25004.00	41.12	AV	V	35.71	8.32	39.15	46.00	54.00	8.00

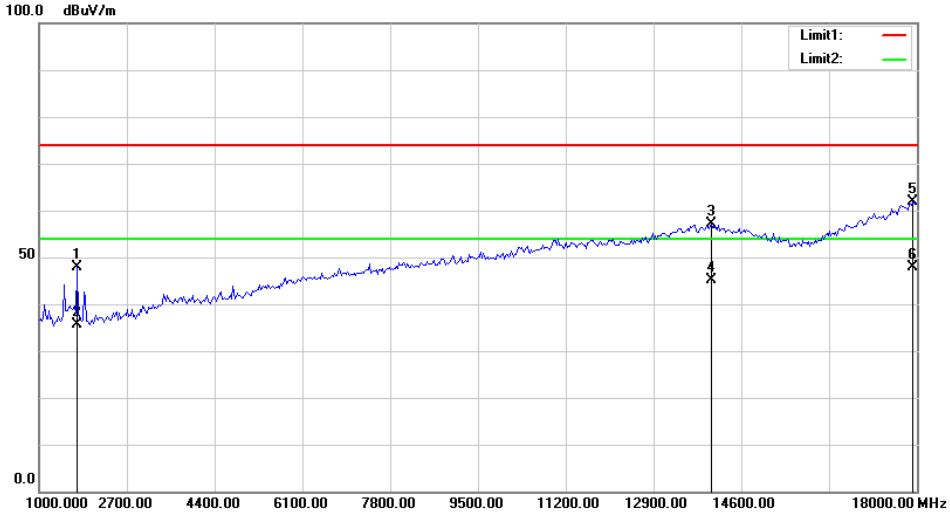
Worst Test plots: High Channel
Horizontal

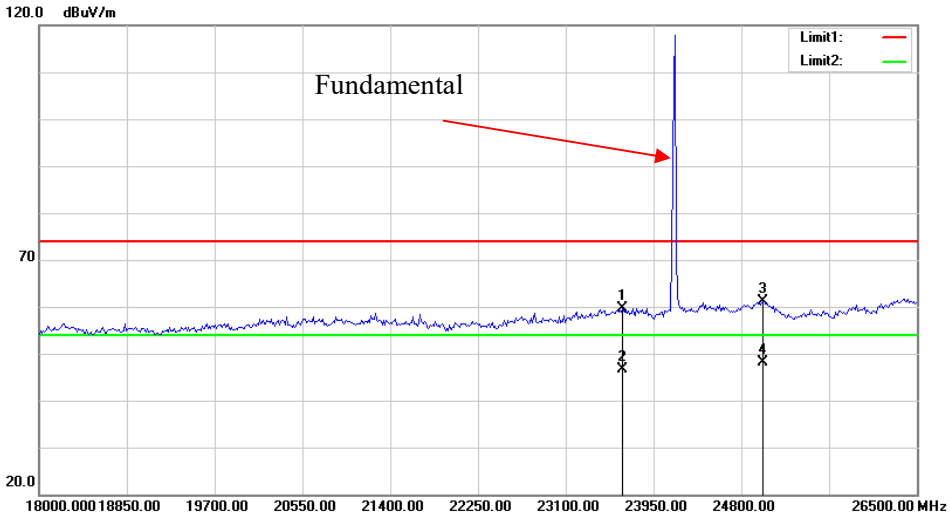


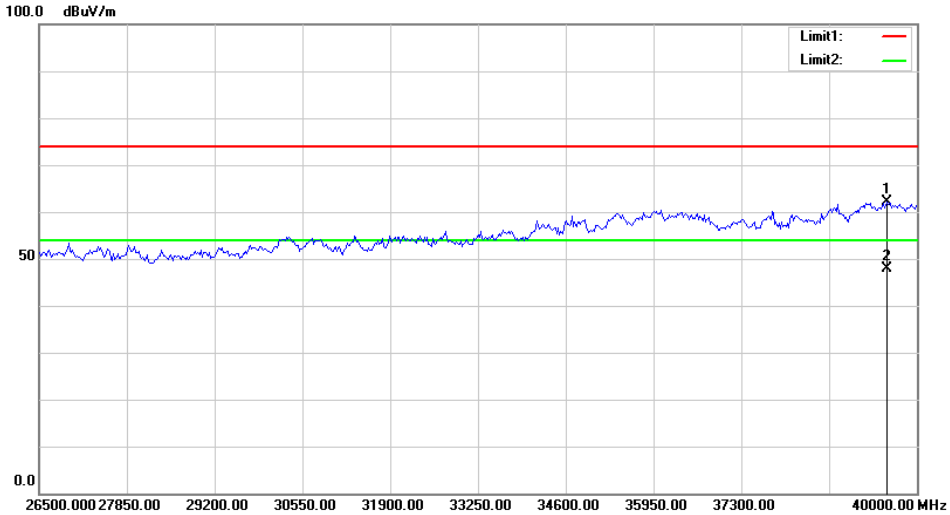




Vertical:


100.0 dBuV/m
Limit1:
Limit2:
50
0.0
1000.000 2700.00 4400.00 6100.00 7800.00 9500.00 11200.00 12900.00 14600.00 18000.00 MHz


120.0 dBuV/m
Limit1:
Limit2:
Fundamental
70
20.0
18000.000 18850.00 19700.00 20550.00 21400.00 22250.00 23100.00 23950.00 24800.00 26500.00 MHz

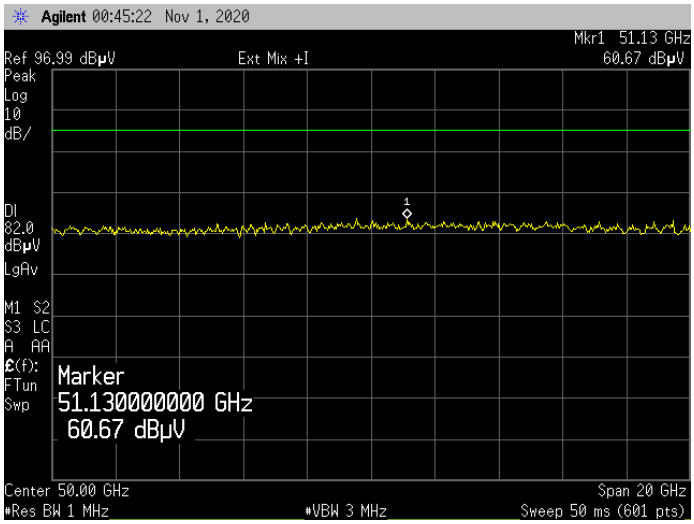

100.0 dBuV/m
Limit1:
Limit2:
50
0.0
26500.000 27850.00 29200.00 30550.00 31900.00 33250.00 34600.00 35950.00 37300.00 40000.00 MHz

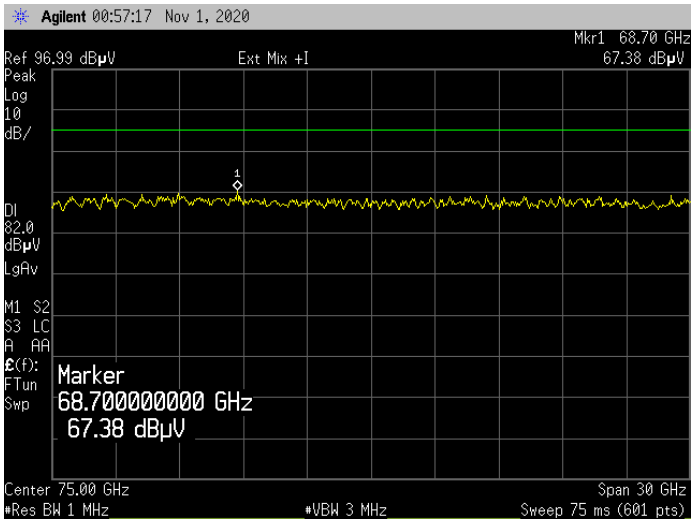
40GHz-100GHz:

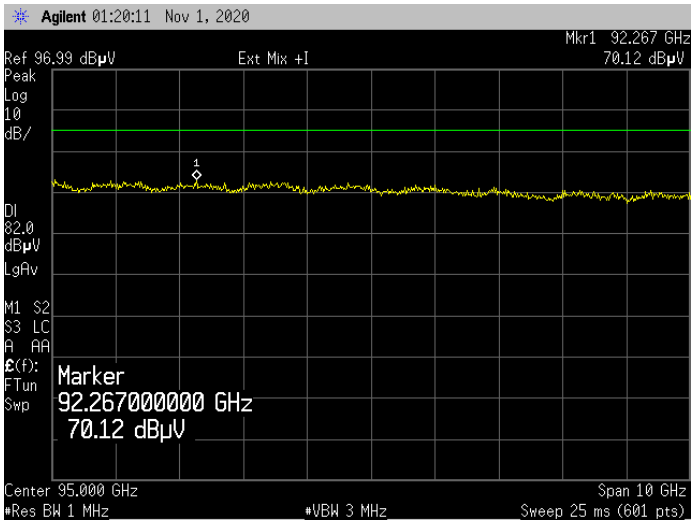
Frequency (GHz)	Receiver		Rx Antenna		Corrected Amplitude (dBµV/m)	Extrapolation result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	Reading (dBµV)	Detector	Polar (H/V)	Factor (dB(1/m))				
24.1025 GHz								
48.205	43.15	PK	H	40.07	83.22	73.68	107.96	34.28
48.205	31.2	AV	H	40.07	71.27	61.73	87.96	26.23
72.3075	39.35	PK	V	43.83	83.18	73.64	107.96	34.32
72.3075	27.32	AV	V	43.83	71.15	61.61	87.96	26.35
96.41	43.56	PK	H	45.9	89.46	73.9	107.96	34.06
96.41	31.33	AV	H	45.9	77.23	61.67	87.96	26.29
24.1225 GHz								
48.245	42.71	PK	H	40.08	82.79	73.25	107.96	34.71
48.245	30.63	AV	H	40.08	70.71	61.17	87.96	26.79
72.3675	38.84	PK	V	43.84	82.68	73.14	107.96	34.82
72.3675	26.81	AV	V	43.84	70.65	61.11	87.96	26.85
96.49	43.11	PK	H	45.91	89.02	73.46	107.96	34.5
96.49	30.89	AV	H	45.91	76.8	61.24	87.96	26.72
24.1475 GHz								
48.295	42.09	PK	H	40.08	82.17	72.63	107.96	35.33
48.295	30.04	AV	H	40.08	70.12	60.58	87.96	27.38
72.4425	38.48	PK	V	43.85	82.33	72.79	107.96	35.17
72.4425	26.24	AV	V	43.85	70.09	60.55	87.96	27.41
96.59	42.69	PK	H	45.92	88.61	73.05	107.96	34.91
96.59	30.45	AV	H	45.92	76.37	60.81	87.96	27.15

Note:1. for the range 40-90GHz, the test performed at the distance 1m. for the range 90-100GHz, the test performed at the distance 0.5m.

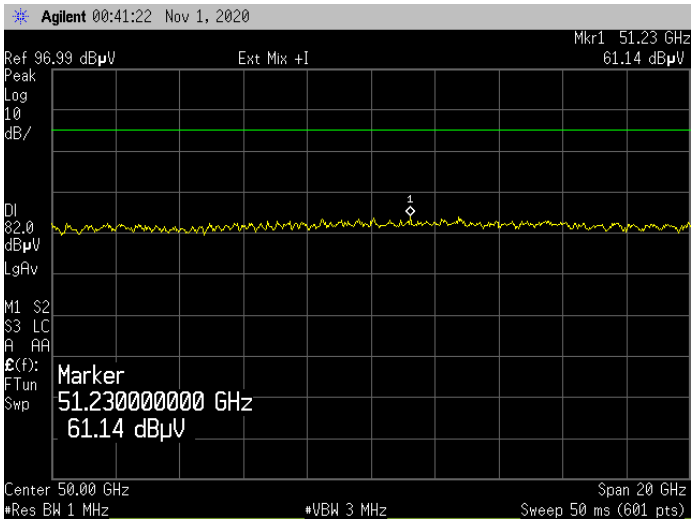
Worst Test plots: Low Channel
Horizontal

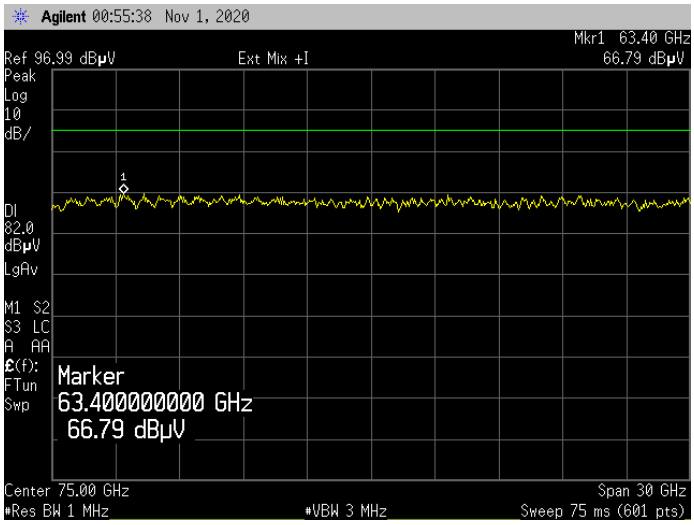


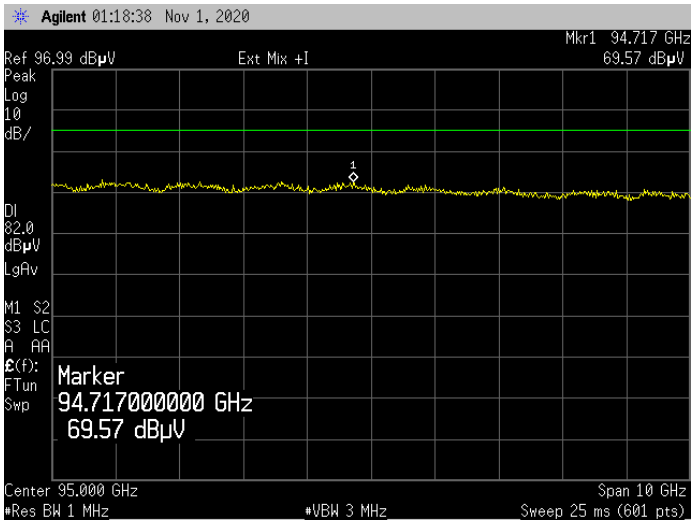




Vertical:


Agilent 00:41:22 Nov 1, 2020
Mkr1 51.23 GHz
Ref 96.99 dBµV
Ext Mix +I
61.14 dBµV
Peak
Log
10
dB/
Dl
82.0
dBµV
LgAv
M1 S2
S3 LC
A AA
£(f):
FTun
Swp
Marker
51.230000000 GHz
61.14 dBµV
Center 50.00 GHz
Span 20 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 50 ms (601 pts)


Agilent 00:55:38 Nov 1, 2020
Mkr1 63.40 GHz
Ref 96.99 dBµV
Ext Mix +I
66.79 dBµV
Peak
Log
10
dB/
Dl
82.0
dBµV
LgAv
M1 S2
S3 LC
A AA
£(f):
FTun
Swp
Marker
63.400000000 GHz
66.79 dBµV
Center 75.00 GHz
Span 30 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 75 ms (601 pts)


Agilent 01:18:38 Nov 1, 2020
Mkr1 94.717 GHz
Ref 96.99 dBµV
Ext Mix +I
69.57 dBµV
Peak
Log
10
dB/
Dl
82.0
dBµV
LgAv
M1 S2
S3 LC
A AA
£(f):
FTun
Swp
Marker
94.717000000 GHz
69.57 dBµV
Center 95.000 GHz
Span 10 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 25 ms (601 pts)

FCC §15.215(c) , RSS-GEN CLAUSE 6.7–BANDWIDTH TESTING

Applicable Standard

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

According to RSS-Gen Clause 6.7:

The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

In some cases, the "x dB bandwidth" is required, which is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated x dB below the maximum in-band power level of the modulated signal, where the two points are on the outskirts of the in-band emission.

The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.
- The detector of the spectrum analyzer shall be set to "Sample". However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or "Max Hold") may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).

Test Procedure

1. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.

2. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
3. Position the EUT on the test table without connection to measurement instrument. Turn on the EUT. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
4. Use Occupied bandwidth test function, measure the 99% Occupied bandwidth.
5. Repeat above procedures until all frequencies measured were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
ETS-Lindgren	Horn Antenna	3115	000 527 35	2018-10-12	2021-10-12
R&S	Spectrum Analyzer	FSP 38	100478	2020-07-07	2021-07-07
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2020-09-05	2021-09-05
Unknown	Coaxial Cable	C-2.4J2.4J-50	C-0700-02	2020-06-27	2021-06-27
Mini-Circuit	Amplifier	ZVA-213-S+	54201245	2020-09-05	2021-09-05

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

Test Data

Environmental Conditions

Temperature:	19.4 °C
Relative Humidity:	34%
ATM Pressure:	100.8kPa
Tester:	Jalon Liu
Test Date:	2020-12-17

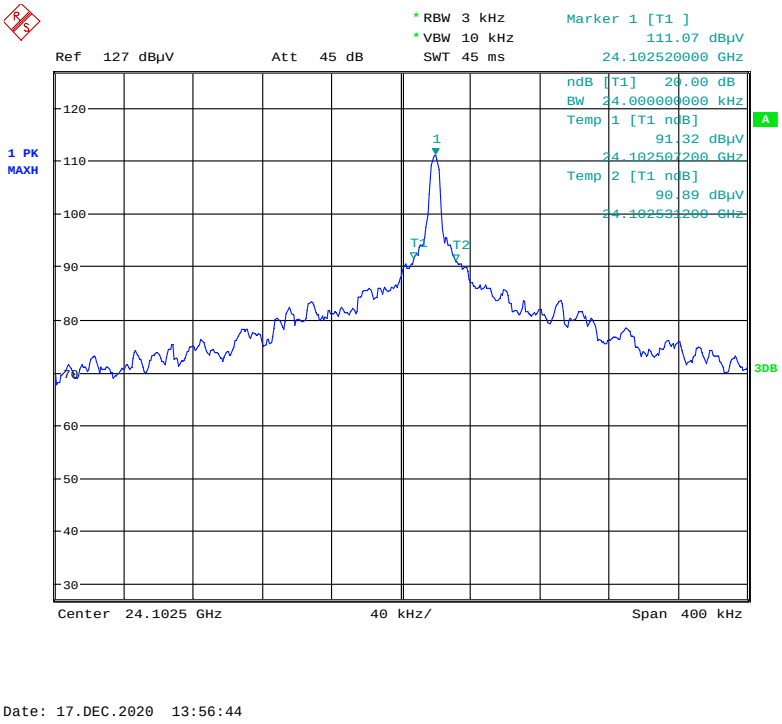
Test Result: Compliant. Please refer to following tables and plots

Test Mode: Transmitting

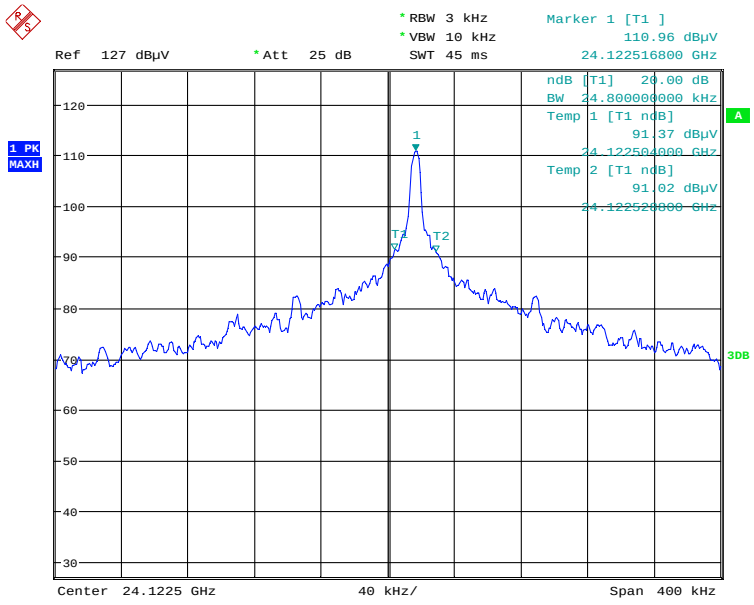
Test Channel	20dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
Low	0.024	0.170
Middle	0.025	0.143
High	0.021	0.138

20dB Bandwidth:

Low Channel

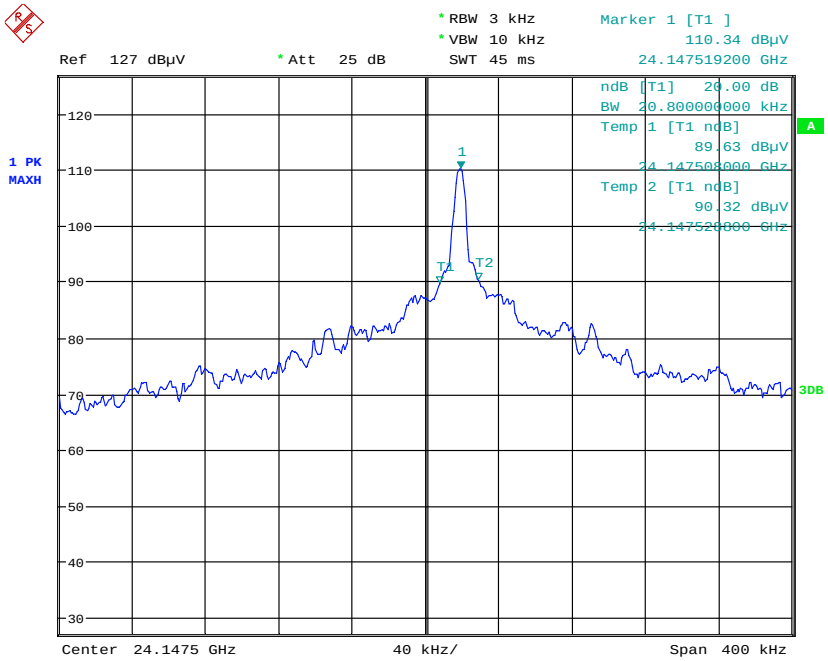


Middle Channel



Date: 17.DEC.2020 15:15:45

High Channel



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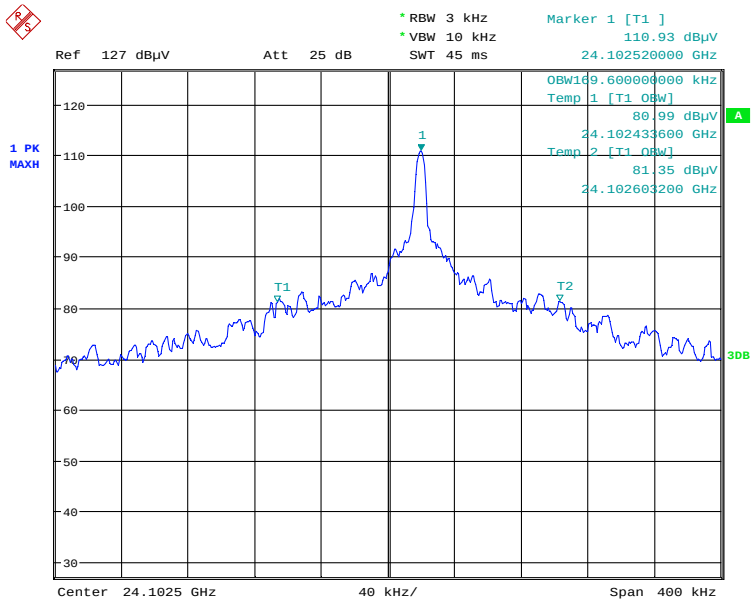
99% Occupied Bandwidth:

Low Channel



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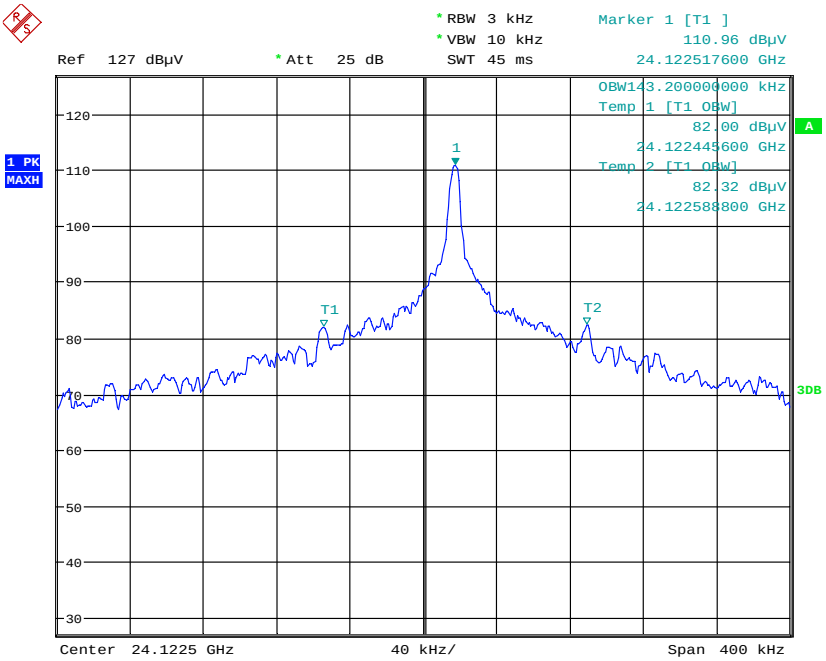
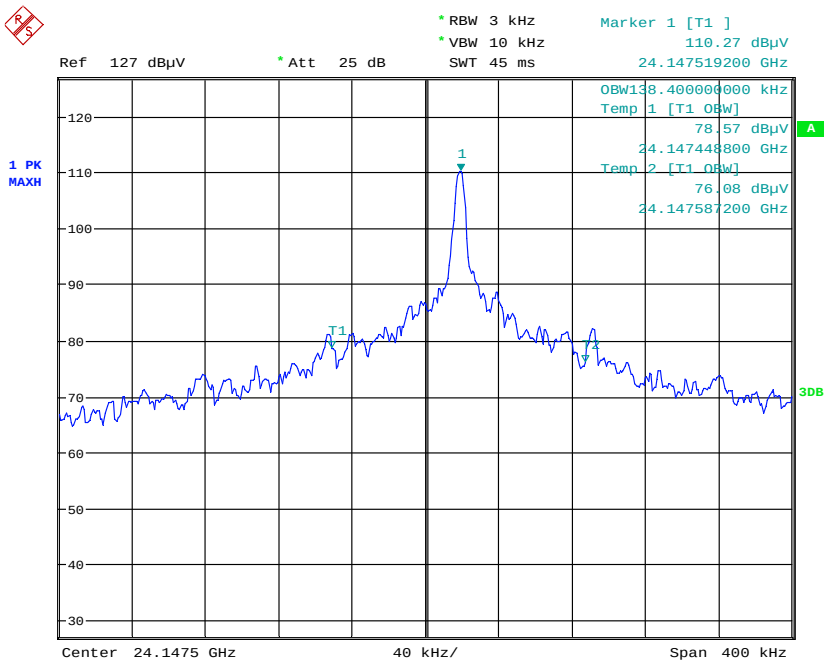
Middle Channel



High Channel



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******* END OF REPORT *******