A.4 Transmitter unwanted emissions - Conducted Spurious Emission

A.4.1 Reference

FCC Part 96, Clause 96.41(e)

A.4.2 Method of measurement

In accordance with FCC rules, the conducted power of emissions below 3530 MHz or above 3720 MHz shall not exceed -40dBm/MHz.

The spurious emissions from the antenna terminal were measured. The transmitter output power was attenuated using an attenuator and the frequency spectrum investigated from 30MHz to 37GHz. The resolution bandwidth of 1MHz was employed for frequency band 30MHz to 37GHz. The spectrum analyzer detector was set to RMS.

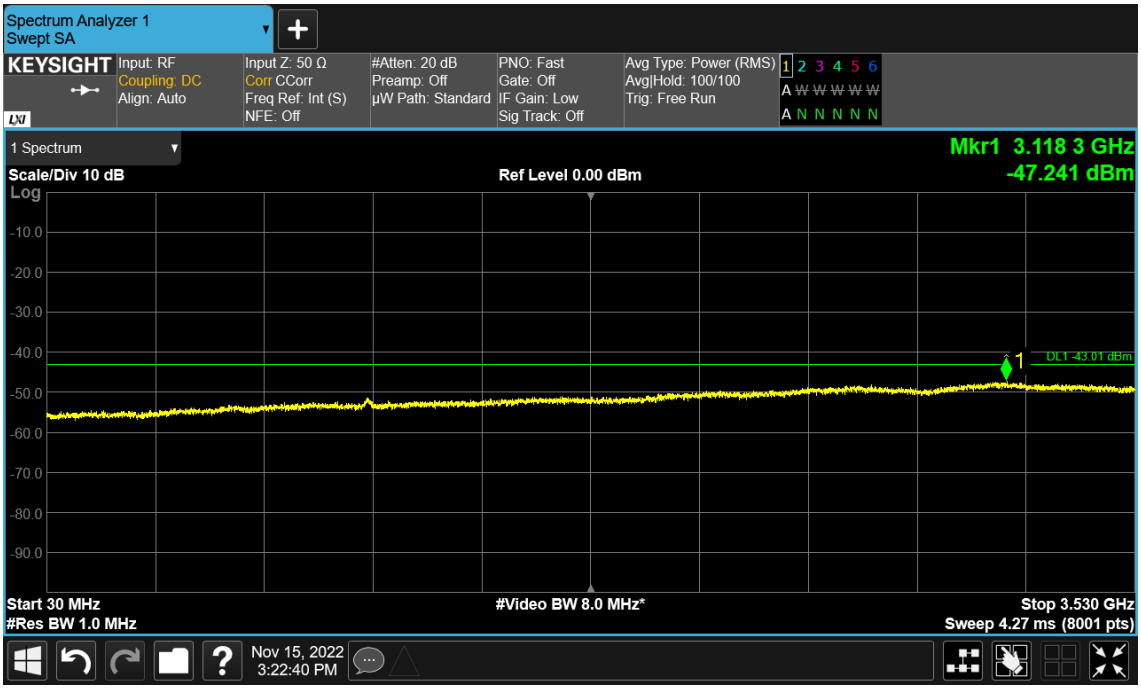
For MIMO mode configurations, the limit was adjusted with a correction of -3.01dB [10Log(1/2)] by using the Measure and Add 10Log(N) dB technique according to KDB 662911 D01 Multiple Transmitter Output accounting for simultaneous transmission from antenna ports. Then the limit was adjust to -43.01dBm.

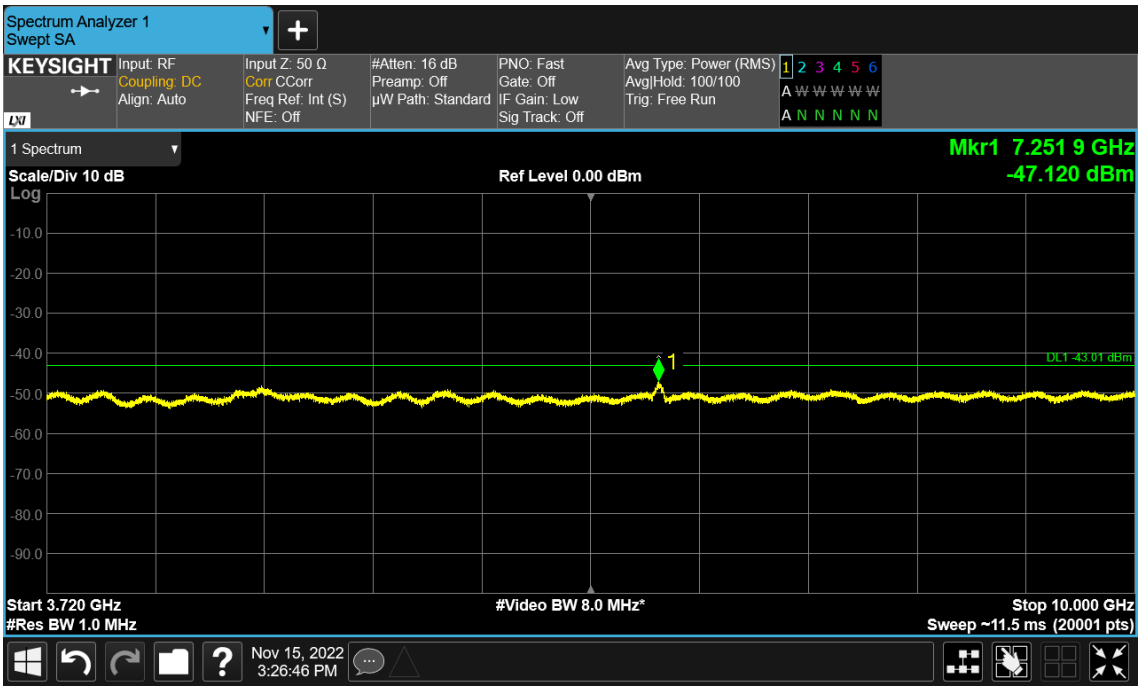
A.4.3 Measurement limit

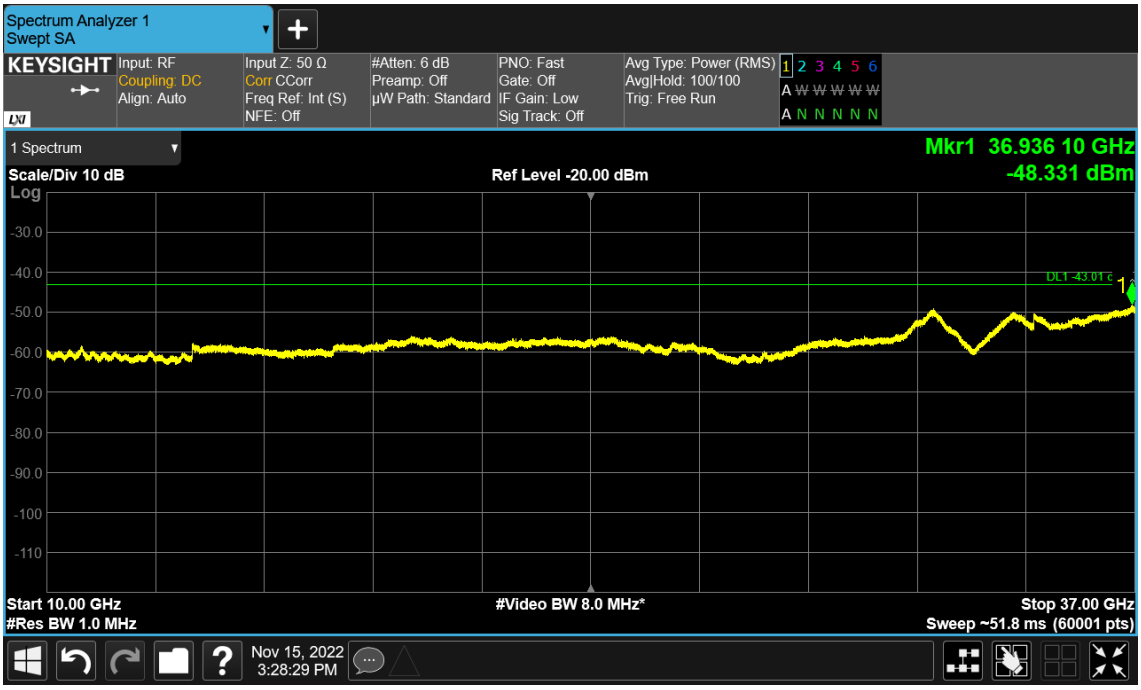
≤-43.01dBm/MHz

A.4.4 Measurement results

Port0, QPSK, Middle Channel, 40MHz







A.5 Radiated Spurious Emission

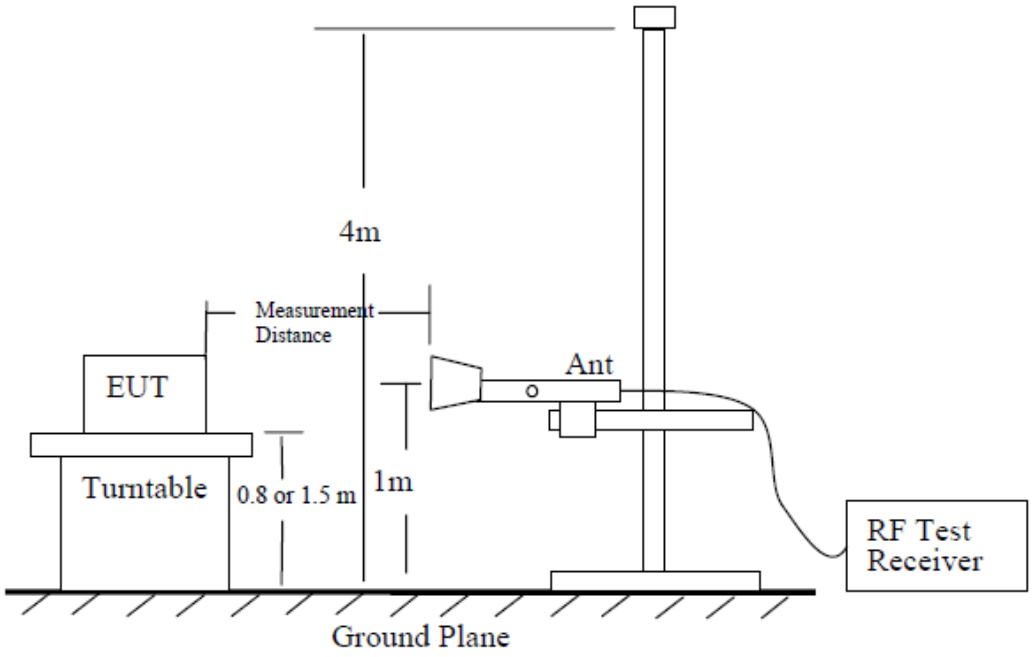
A.5.1 Reference

FCC CFR 47 Part 2, Clause 2.1051
FCC CFR 47 Part 96, Clause 96.41(e)

A.5.2 Method of measurement

The measurements procedures in C63.26 are used.
The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment.

The procedure of radiated spurious emissions is as follows:
Using the test configuration as follow, measure the radiated emissions directly from the EUT and convert the measured field strength or received power to ERP or EIRP, as required, for comparison to the applicable limits.



The emission characteristics of the EUT can be identified from the pre-scan measurement information.

Exploratory radiated measurements (pre-scans) may be performed to determine the general EUT radiated emissions characteristics and, when necessary, the EUT-to-measurement antenna orientation that produces the maximum emission amplitude. Pre-scans shall only be used to determine the emission frequencies (i.e., not amplitude levels). The information garnered from a pre-scan can then be used to perform final compliance measurements using either the substitution or direct field strength method.

For radiated emissions measurements performed at frequencies less than or equal to 1 GHz, the EUT shall be placed on a RF-transparent table or support at a nominal height of 80 cm above the reference ground plane. Radiated measurements shall be made with the measurement

antenna positioned in both horizontal and vertical polarization. The measurement antenna shall be varied from 1 m to 4 m in height above the reference ground in a search for the relative positioning that produces the maximum radiated signal level (i.e., field strength or received power). When orienting the measurement antenna in vertical polarization, the minimum height of the lowest element of the antenna shall clear the site reference ground plane by at least 25 cm.

The radiated emission measurements of all non-harmonic and harmonics of the transmit frequency through the 10th harmonic were measured with peak detector.

For radiated measurements performed at frequencies above 1 GHz, the EUT shall be placed on an RF transparent table or support at a nominal height of 1.5 m above the ground plane. When maximizing the emissions from the EUT for measurement, the EUT and its transmitting antenna(s) shall be rotated through 360°. For each mode of operation to be tested, the frequency spectrum (based on findings from exploratory measurements) shall be monitored.
Final measurements shall be performed for the worst case combination(s) of variable technical parameters that result in the maximum measured emission amplitude, record the frequency and amplitude of the highest fundamental emission (if applicable), and the frequency and amplitude data for the six highest-amplitude spurious emissions.
The measurements in the frequency range 30 to 1000MHz was performed with a RBW of 100kHz.
The measurements in the frequency range 1 to 40GHz was performed with a RBW of 1MHz.
Emissions identified within the range 30MHz to 40GHz were then formally measured using a peak detector as the worst case.

A.5.3 Measurement limit

The limits for outside a licensee's frequency band(s) of operation the power of the spurious emissions have been calculated, as shown below using the following formula:

EIRP = Field Strength of Carrier + 20 log (d) -104.7

Where:

Field Strength is measured in dBμV/m

d is the measurement distance in meter.

As Clause 96.41(e)(1) : Except as otherwise specified in paragraph (e)(2) of this section, for channel and frequency assignments made by the SAS to CBSDs, the conducted power of any CBSD emission outside the fundamental emission bandwidth as specified in paragraph (e)(3) of this section (whether the emission is inside or outside of the authorized band) shall not exceed −13 dBm/MHz within 0-10 megahertz above the upper SAS-assigned channel edge and within 0-10 megahertz below the lower SAS-assigned channel edge.
For 3540MHz-3550MHz and 3700MHz-3710MHz

-13dBm = Field Strength of Carrier + 20 log (3) -104.7

Field Strength of Carrie = -13dBm – (20 log (3) -104.7) = -13dBm – (-95.2) = 82.2 dBμV/m

As Clause 96.41(e)(2) : Notwithstanding paragraph (e)(1) of this section, for CBSDs and End User Devices, the conducted power of emissions below 3540 MHz or above 3710 MHz shall not exceed −25 dBm/MHz, and the conducted power of emissions below 3530 MHz or above 3720 MHz shall not exceed −40dBm/MHz.

For 3530MHz- 3540 MHz and 3710MHz-3720MHz

-25dBm = Field Strength of Carrier + 20 log (3) -104.7

Field Strength of Carrie = -25dBm – (20 log (3) -104.7) = -25dBm – (-95.2) = 70.2 dBμV/m

For below 3530 MHz or above 3720 MHz

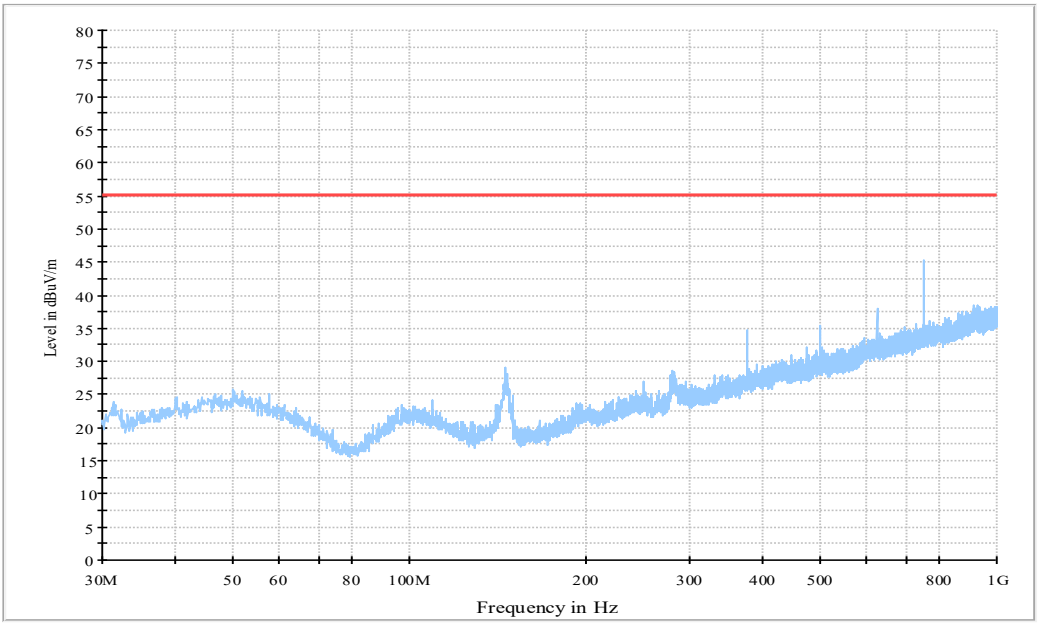
−40dBm = Field Strength of Carrier + 20 log (3) -104.7

Field Strength of Carrie = −40dBm – (20 log (3) -104.7) = −40dBm – (-95.2) = 55.2 dBμV/m

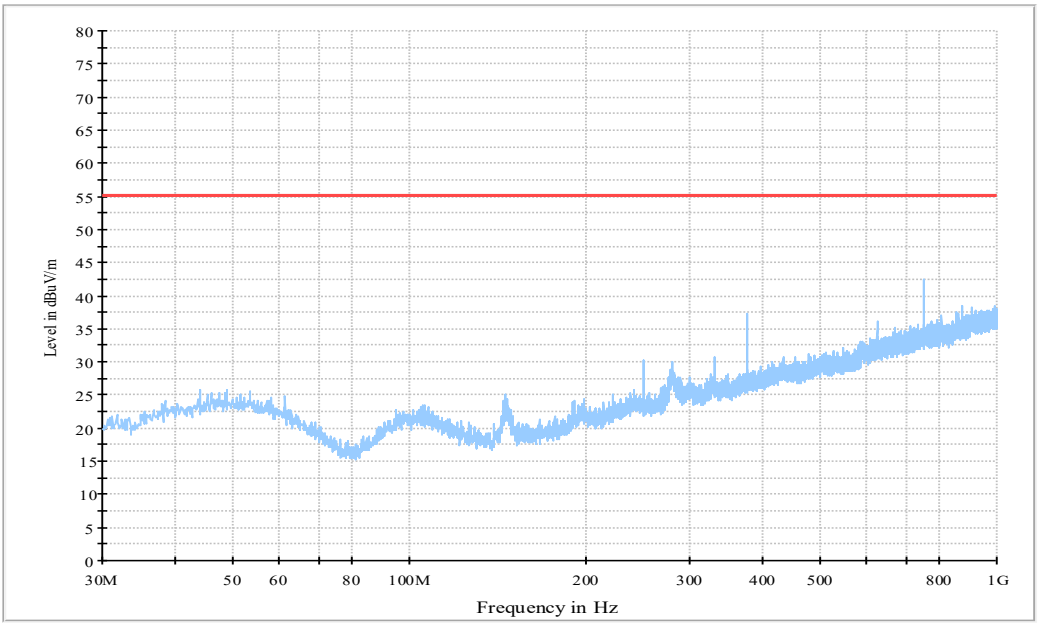
These limits have been used to determine Pass or Fail for the harmonics measured and detailed in the following results.

Frenqucy range(MHz)	Limit(dB μ V/m) Distance = 3m
30-3530	55.2
3530-3540	70.2
3540-3550	82.2
3700-3710	82.2
3710-3720	70.2
3720-40000	55.2

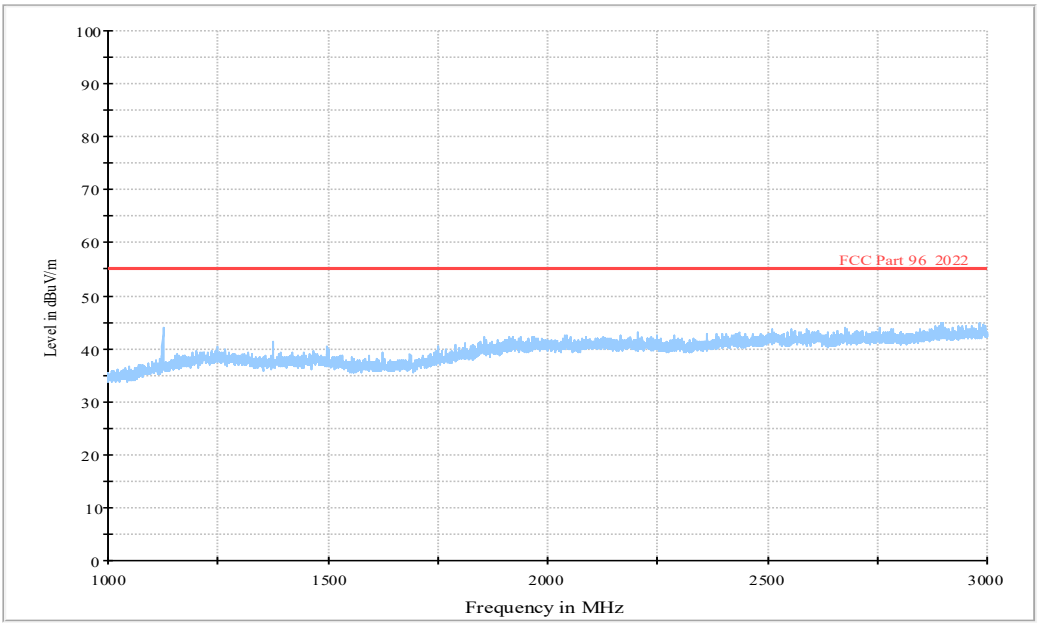
A.5.4 Measurement results



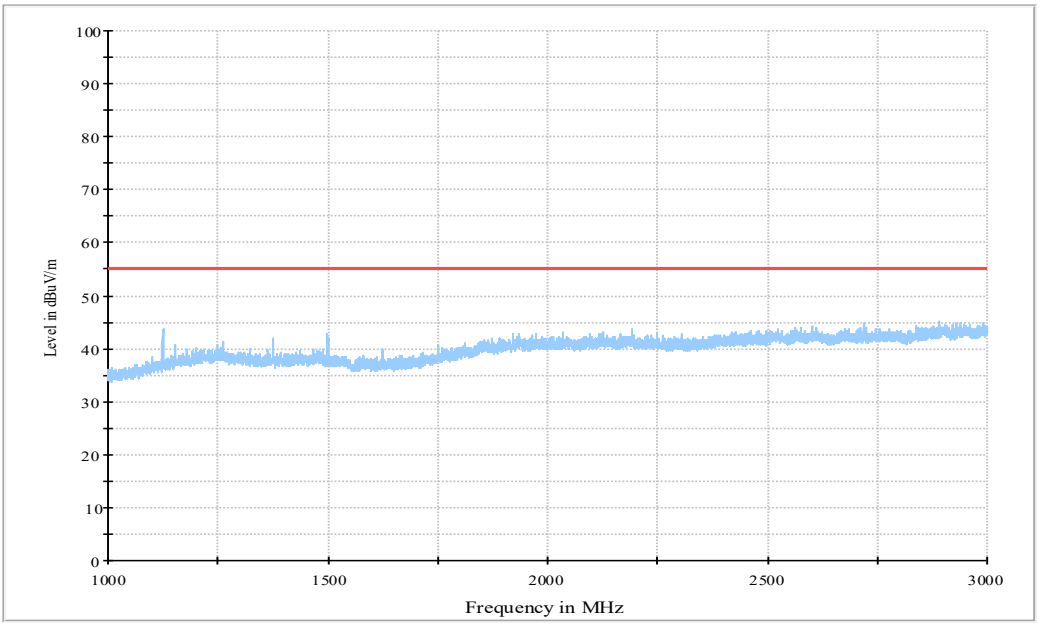
Configuration n48; 40MHz, Port 0, Vertical, 30MHz-1GHz



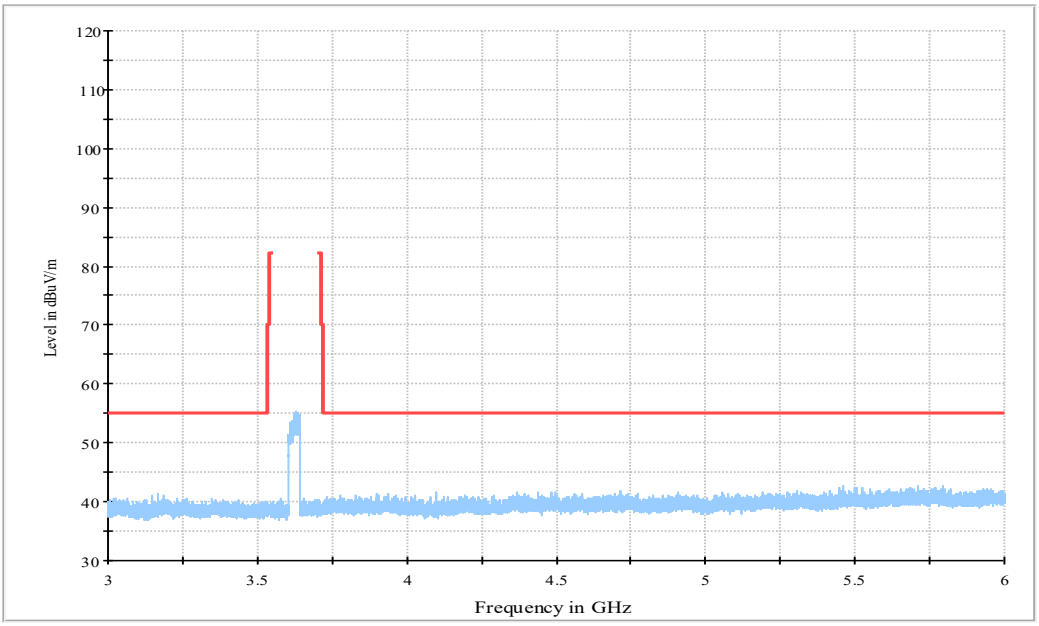
Configuration n48; 40MHz, Port 0, Horizontal, 30MHz-1GHz



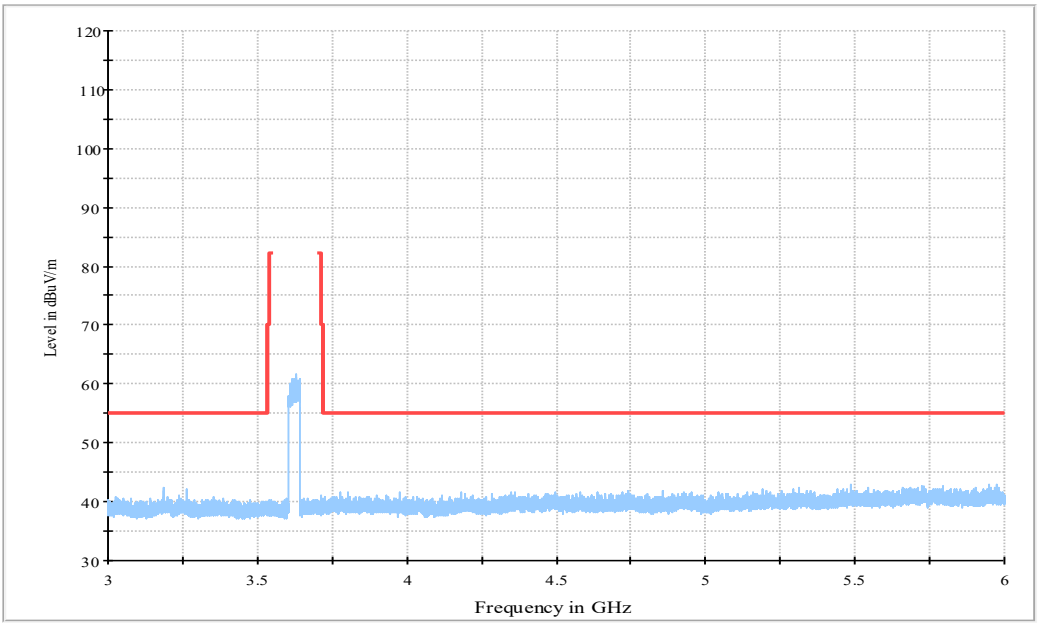
Configuration n48; 40MHz, Port 0, Vertical, 1GHz-3GHz



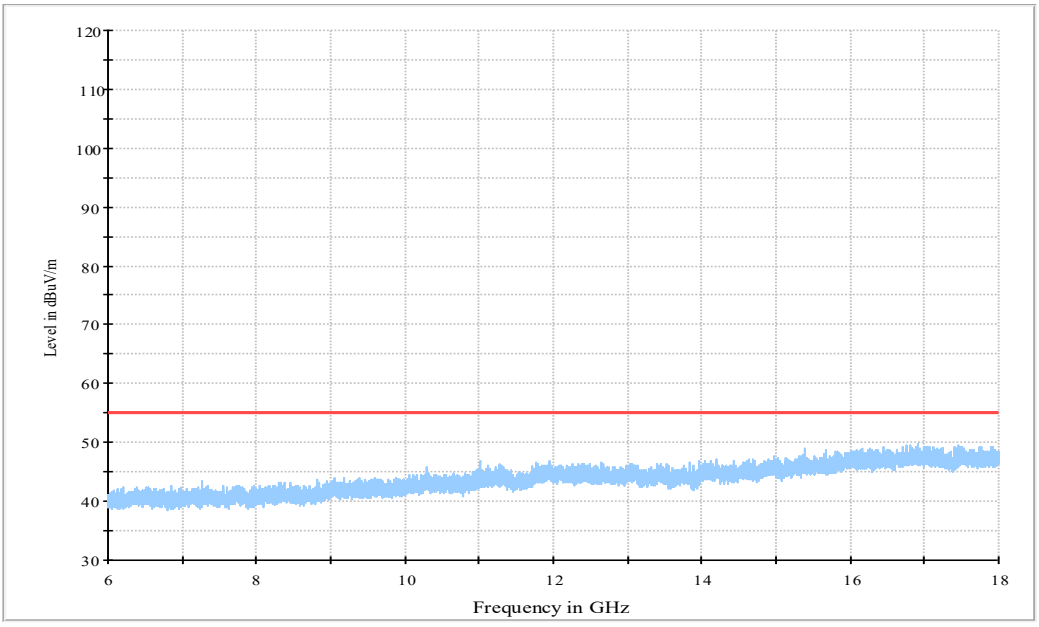
Configuration n48; 40MHz, Port 0, Horizontal, 1GHz-3GHz



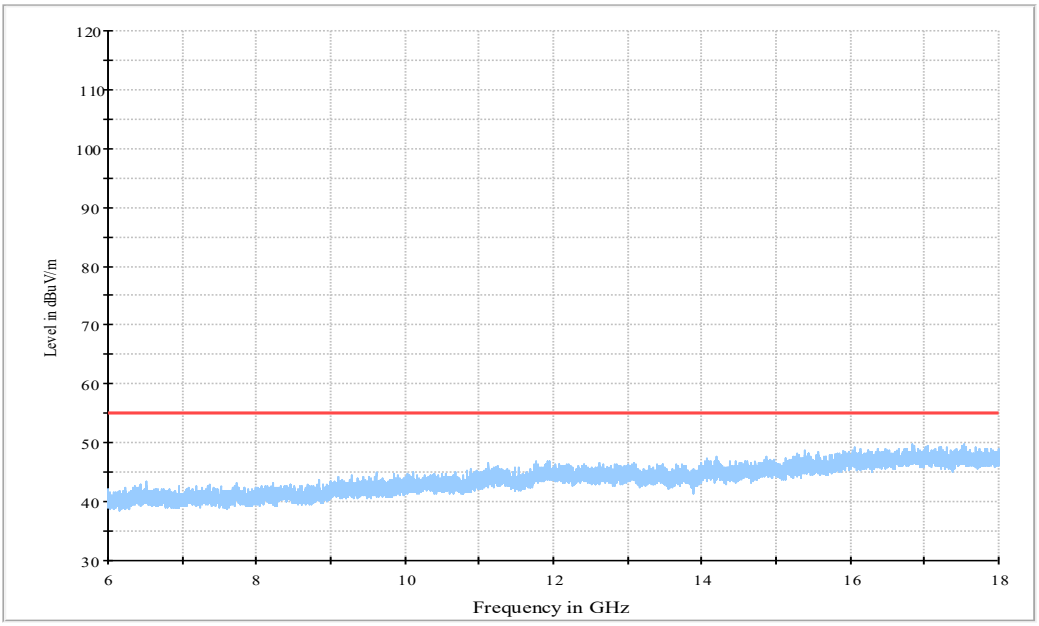
Configuration n48; 40MHz, Port 0, Vertical, 3GHz-6GHz



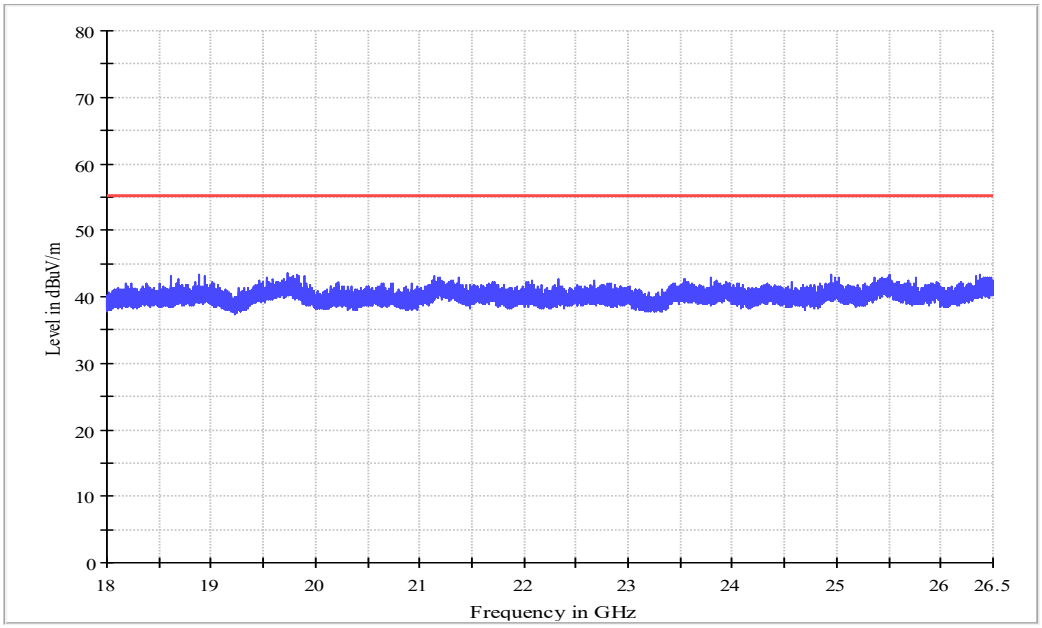
Configuration n48; 40MHz, Port 0, Horizontal, 3GHz-6GHz



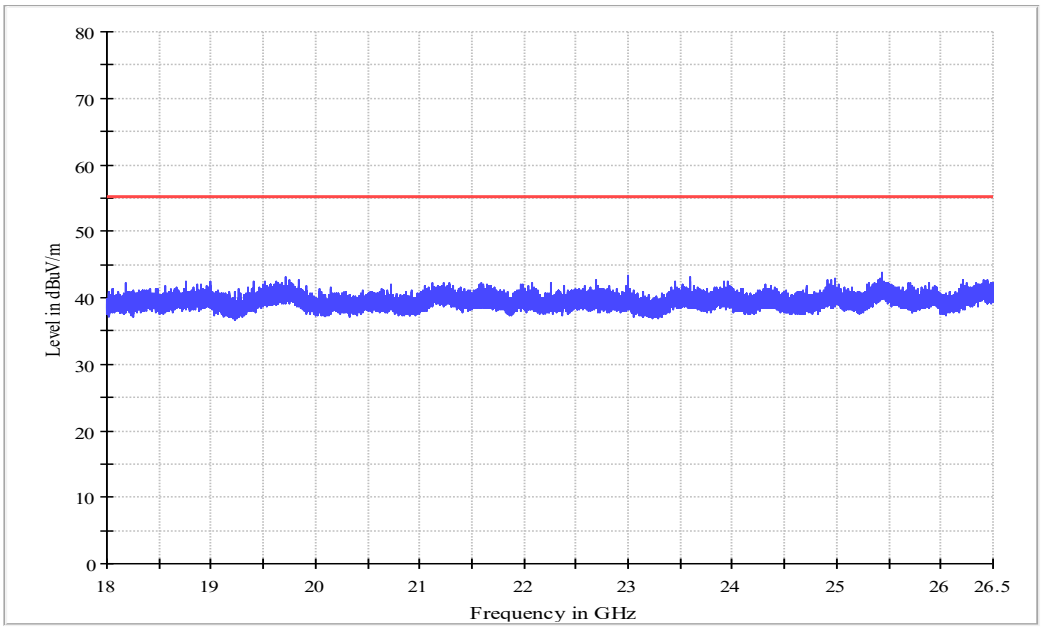
Configuration n48; 40MHz, Port 0, Vertical, 6GHz-18GHz



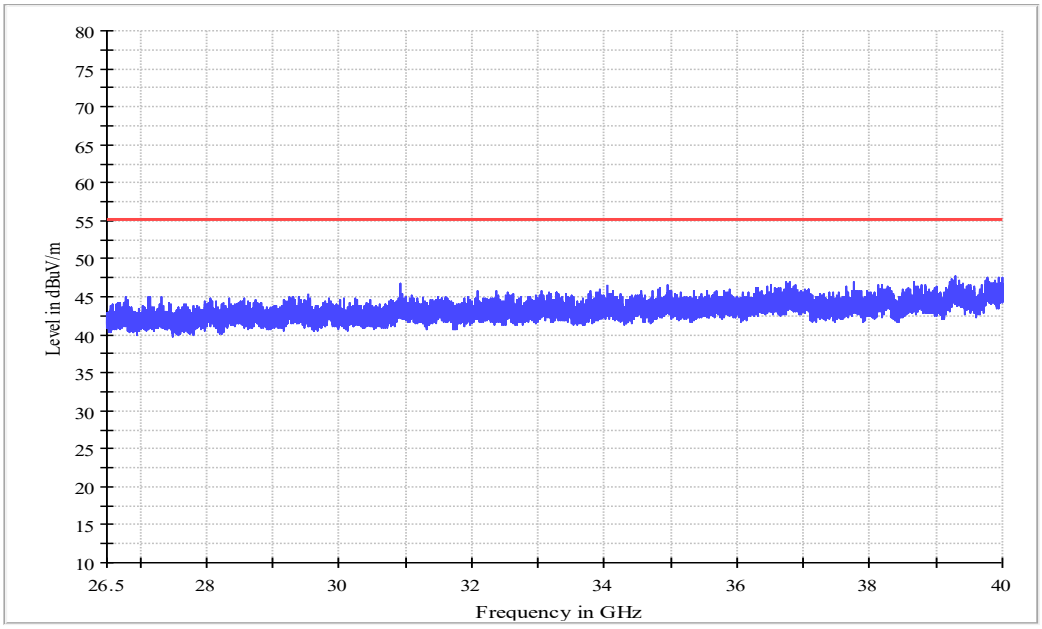
Configuration n48; 40MHz, Port 0, Horizontal, 6GHz-18GHz



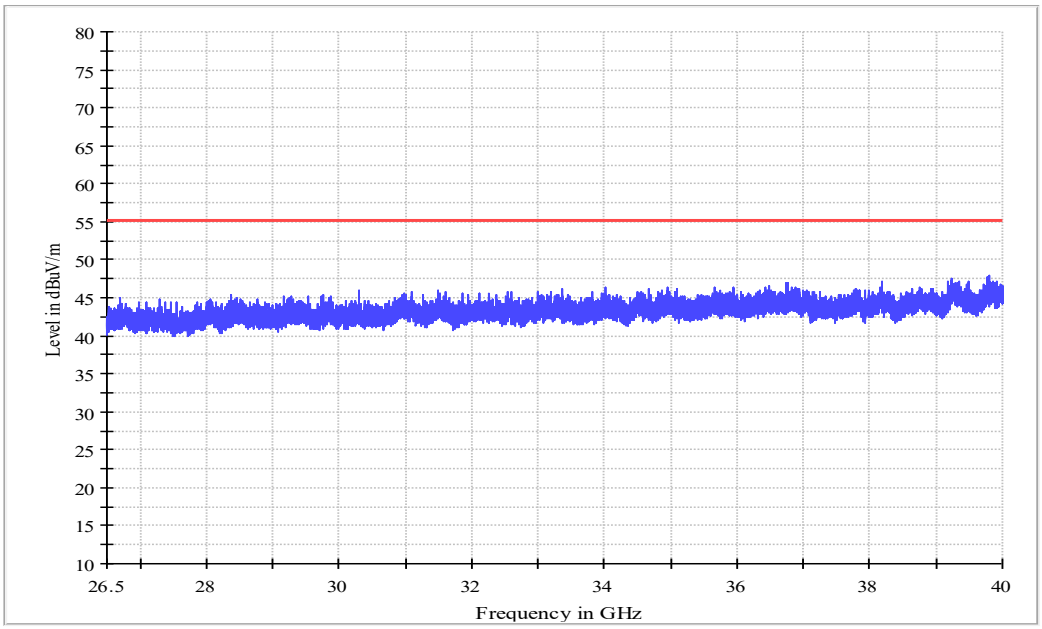
Configuration n48; 40MHz, Port 0, Vertical, 18GHz-26.5GHz



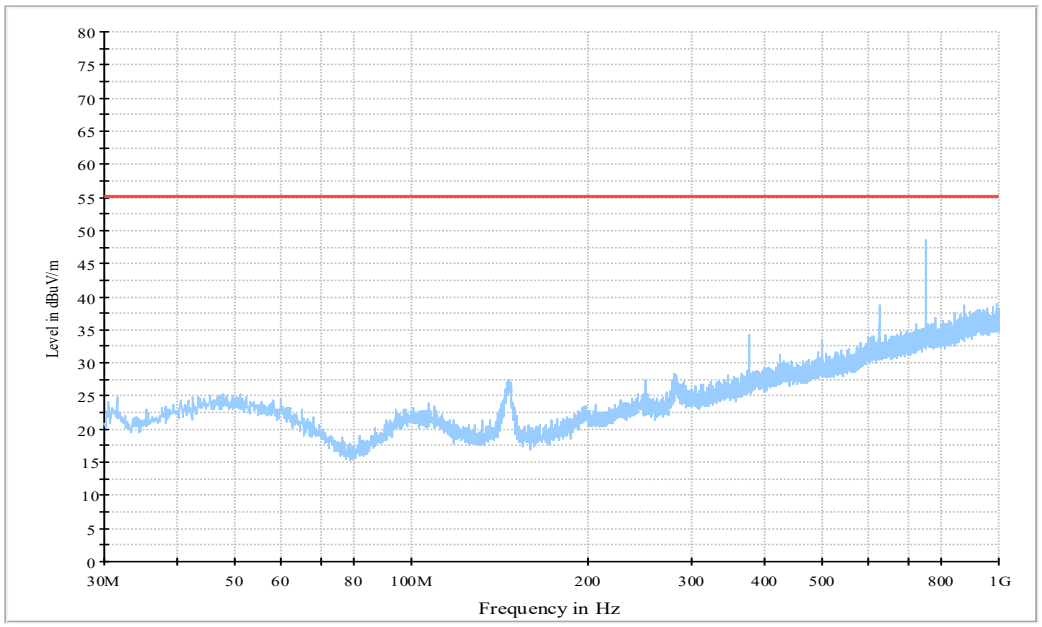
Configuration n48; 40MHz, Port 0, Horizontal, 18GHz-26.5GHz



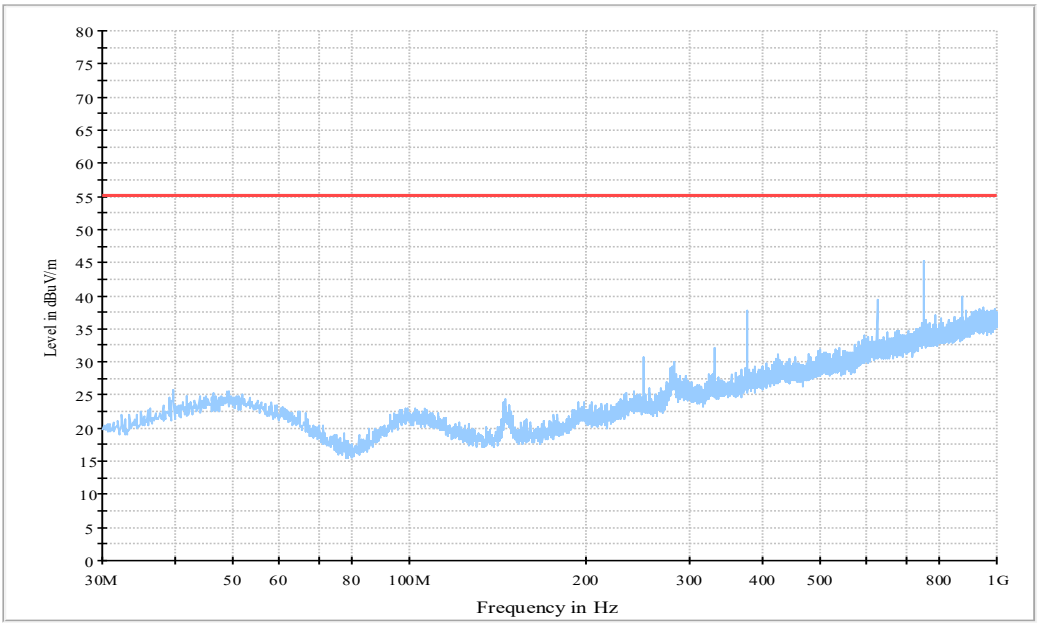
Configuration n48; 40MHz, Port 0, Vertical, 26.5GHz-40GHz



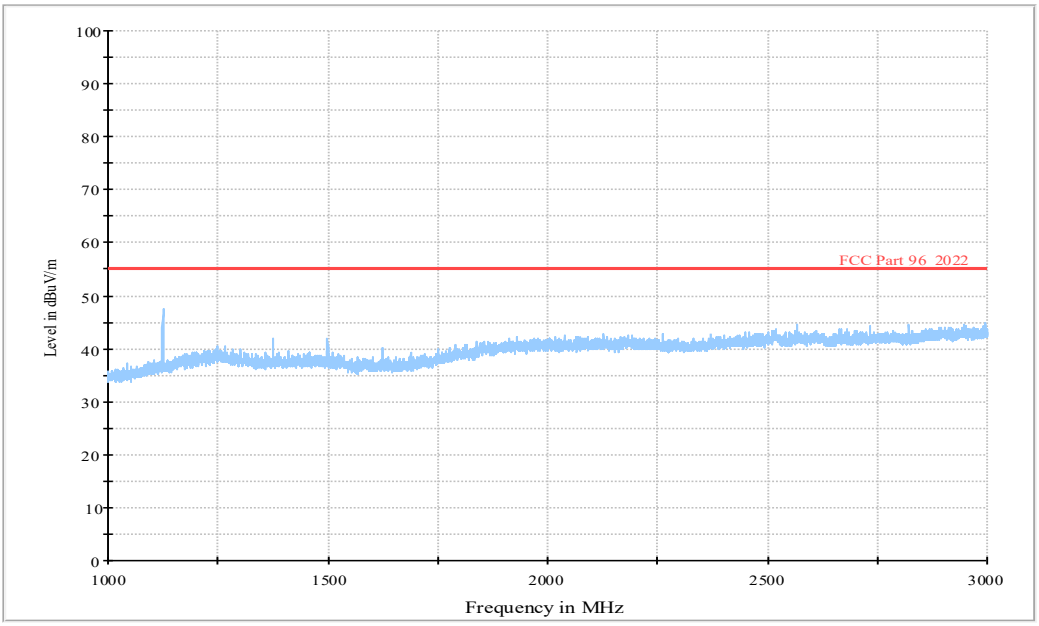
Configuration n48; 40MHz, Port 0, Horizontal, 26.5GHz-40GHz



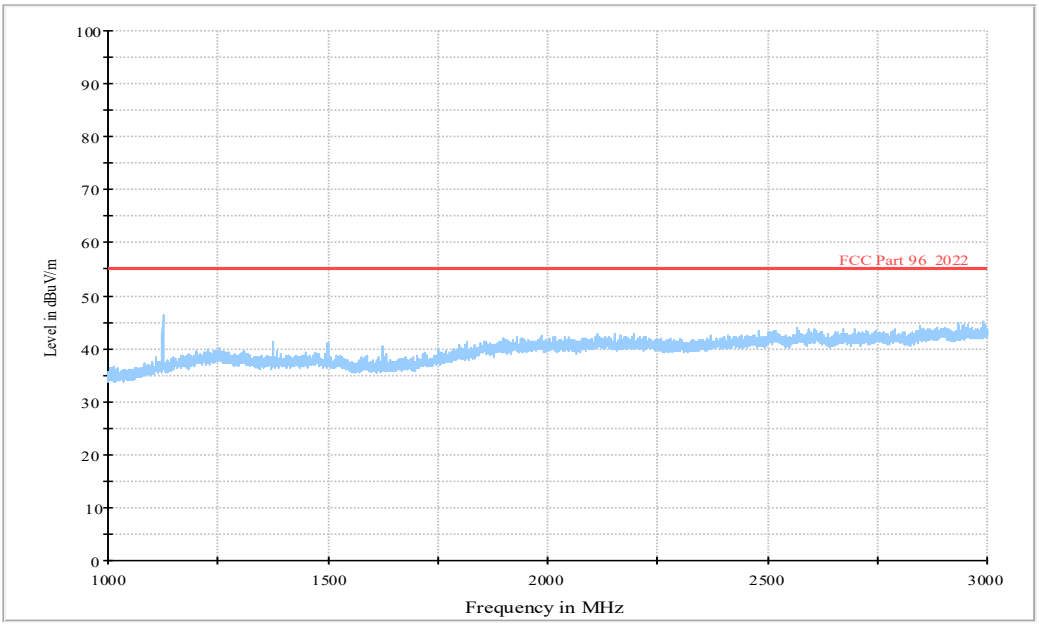
Configuration n48; 40MHz, Port 1, Vertical, 30MHz-1GHz



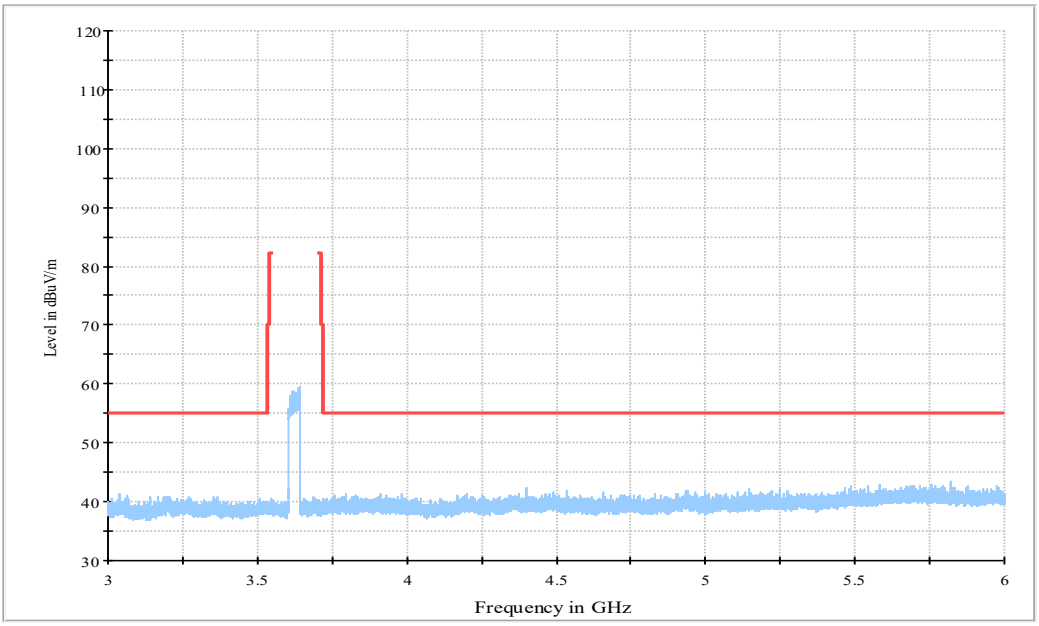
Configuration n48; 40MHz, Port 1, Horizontal, 30MHz-1GHz



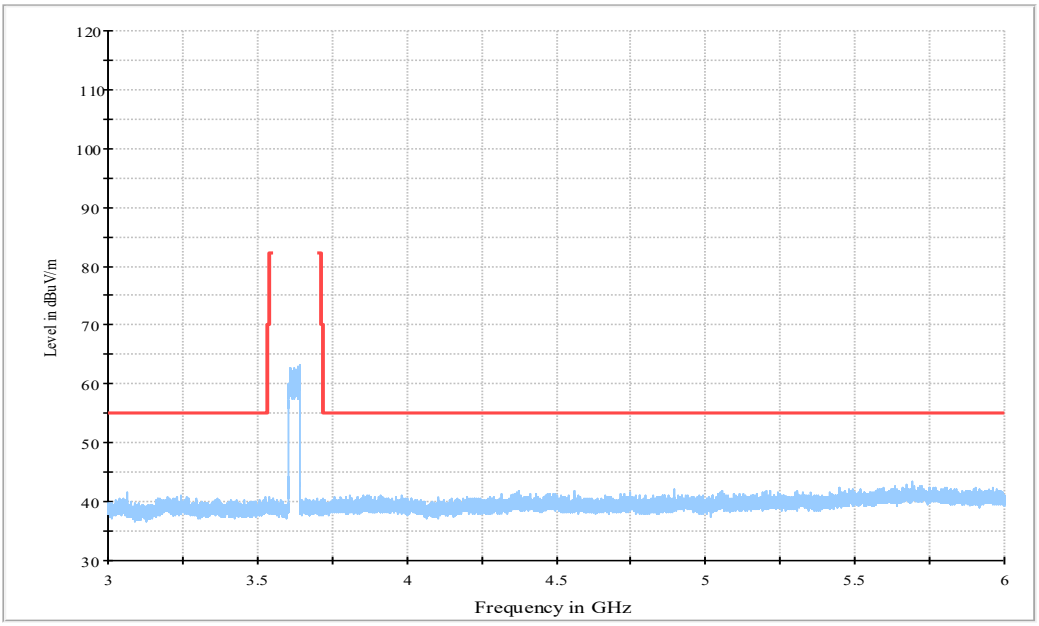
Configuration n48; 40MHz, Port 1, Vertical, 1GHz-3GHz



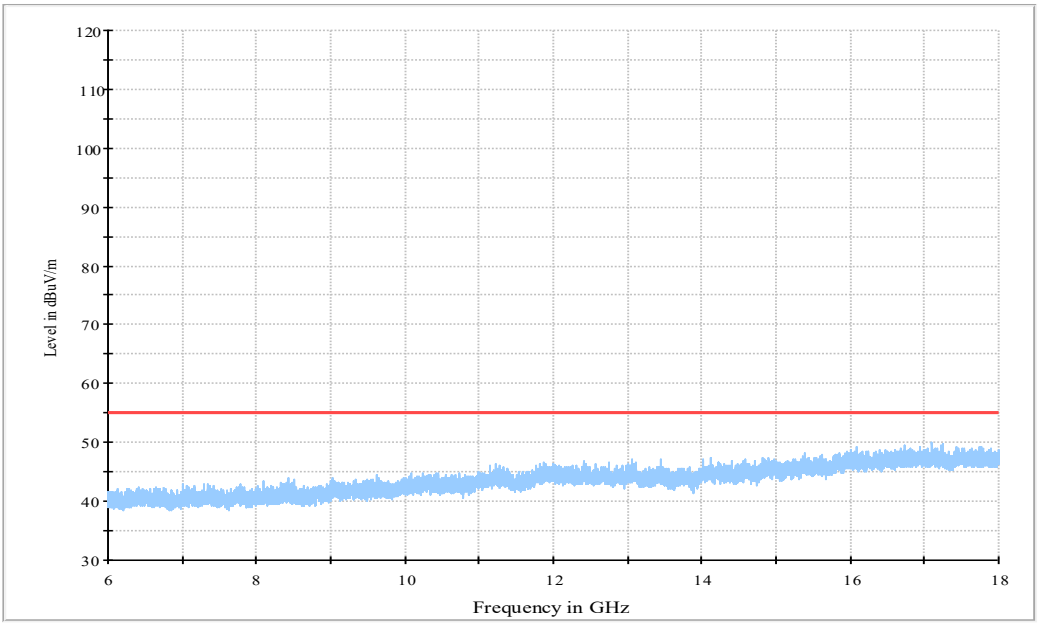
Configuration n48; 40MHz, Port 1, Horizontal, 1GHz-3GHz



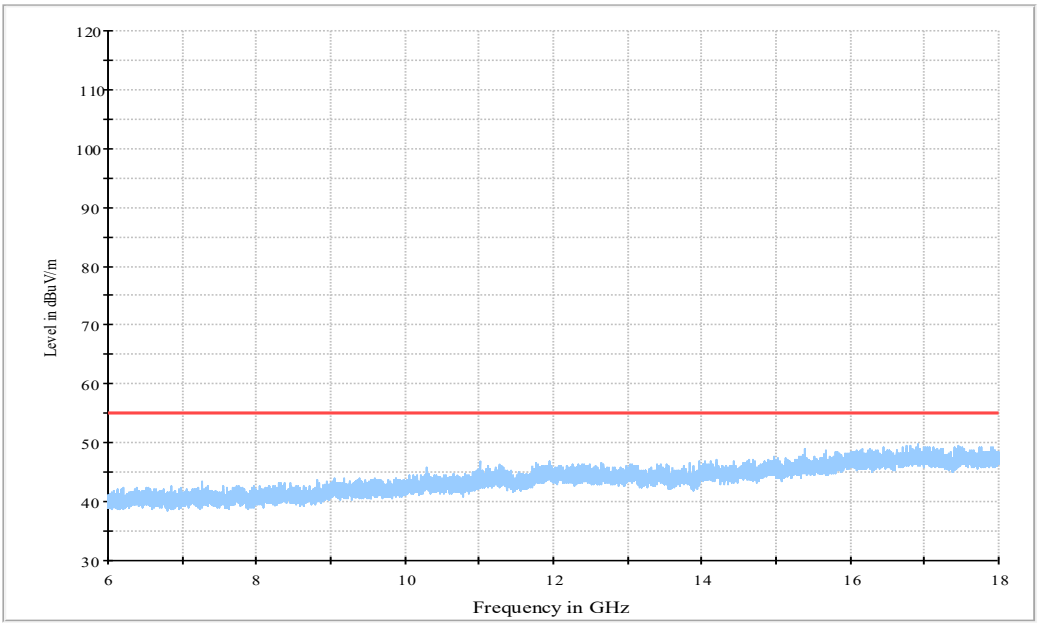
Configuration n48; 40MHz, Port 1, Vertical, 3GHz-6GHz



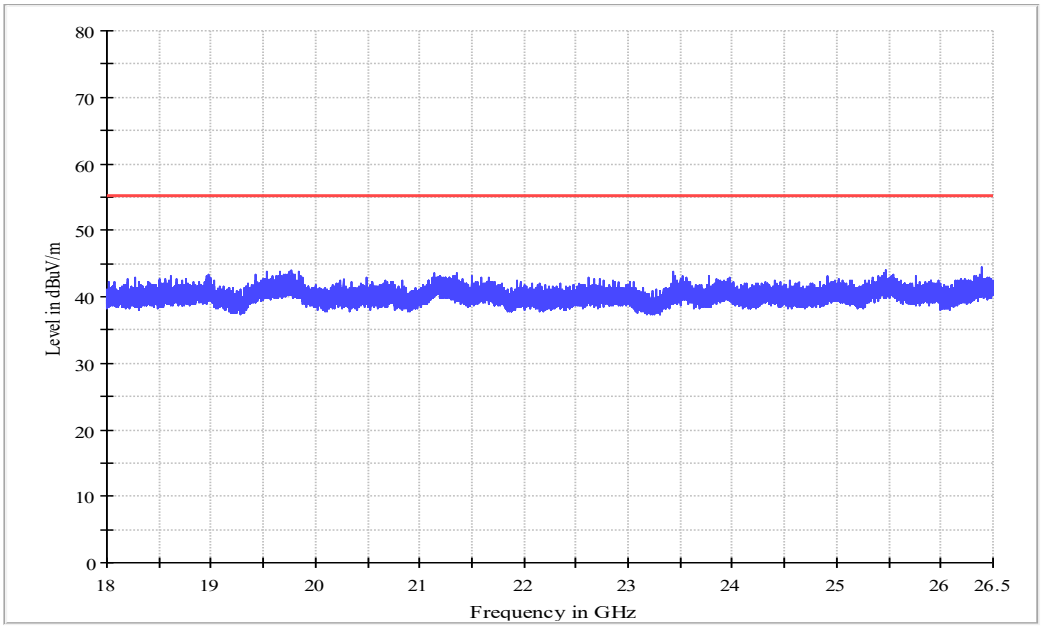
Configuration n48; 40MHz, Port 1, Horizontal, 3GHz-6GHz



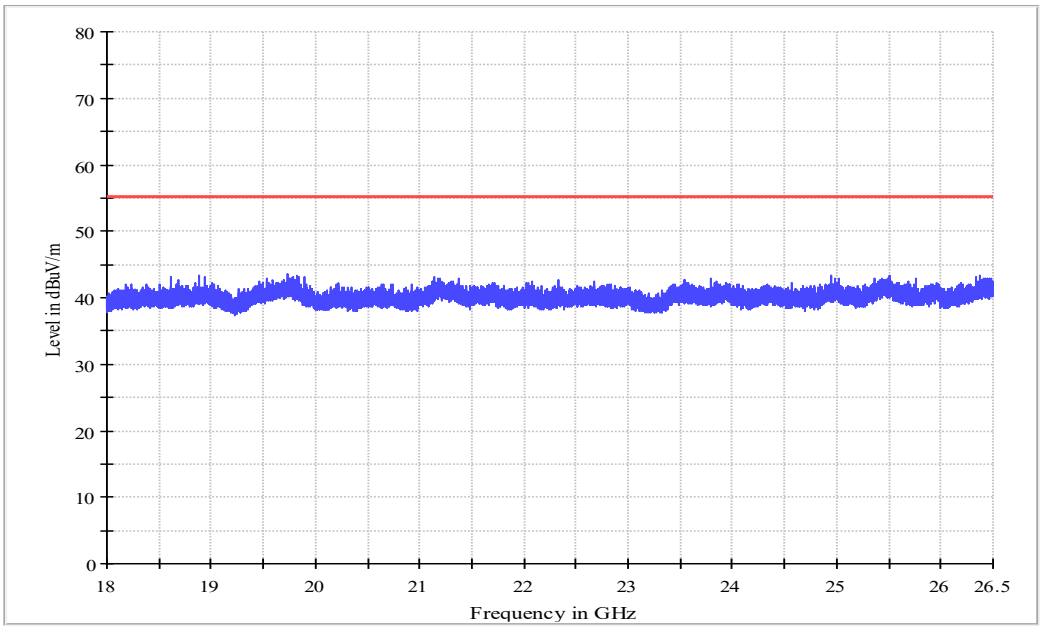
Configuration n48; 40MHz, Port 1, Vertical, 6GHz-18GHz



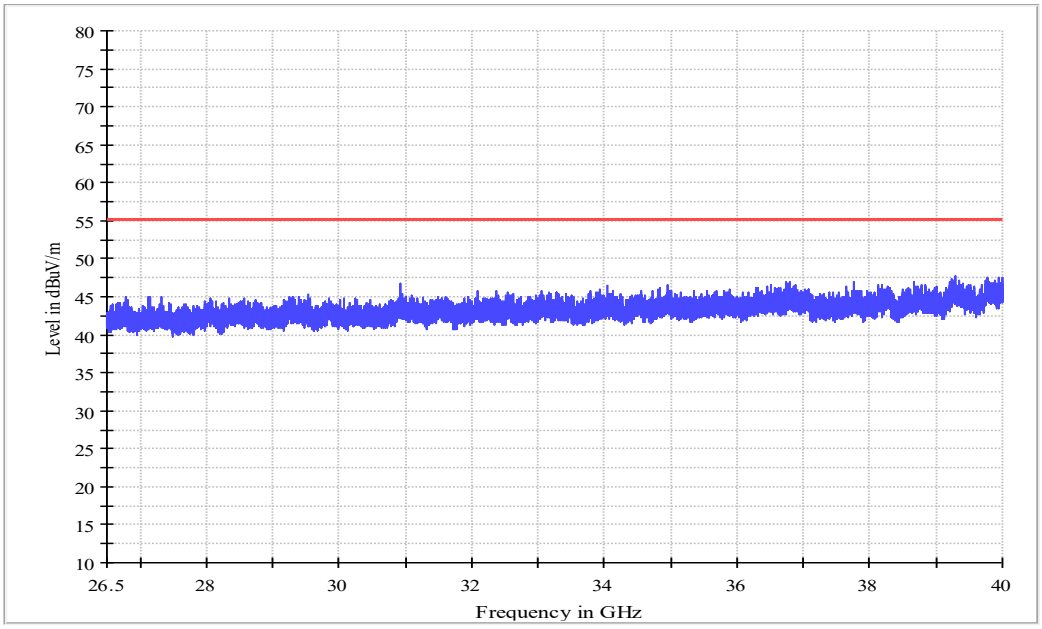
Configuration n48; 40MHz, Port 1, Horizontal, 6GHz-18GHz



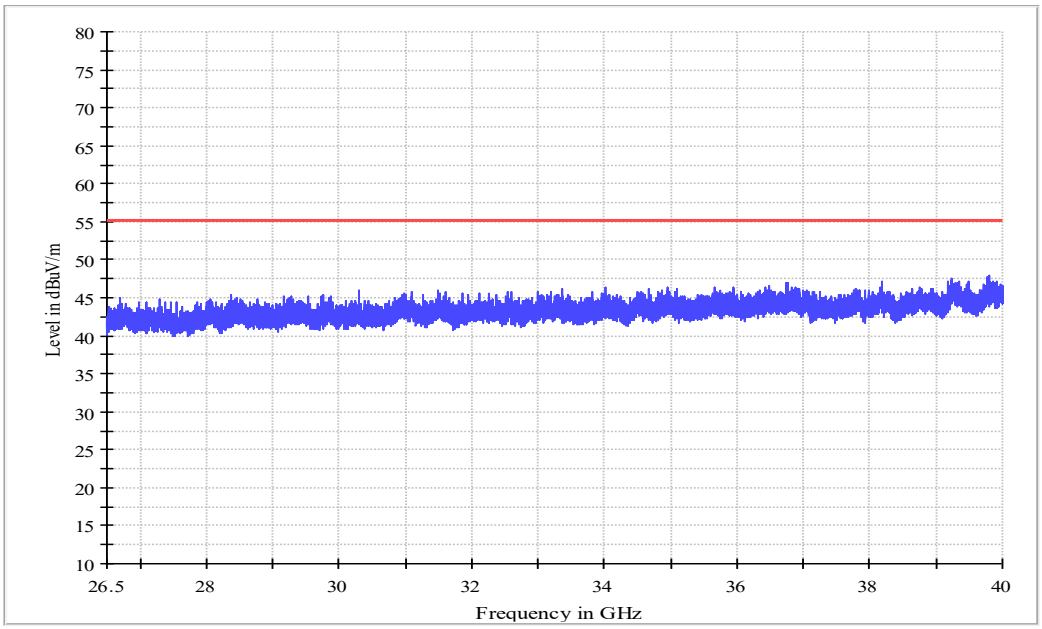
Configuration n48; 40MHz, Port 1, Vertical, 18GHz-26.5GHz



Configuration n48; 40MHz, Port 1, Horizontal, 18GHz-26.5GHz



Configuration n48; 40MHz, Port 1, Vertical, 26.5GHz-40GHz



Configuration n48; 40MHz, Port 1, Horizontal, 26.5GHz-40GHz

A.6 Frequency Stability

A.6.1 Reference

FCC Part 2, Clause 2.1055

A.6.2 Method of measurement

Temperature Variation

The EUT was tested over the temperature range -30°C to +50°C in 10°C steps with 48VDC Power Supply. At each temperature step, the Base Station was configured to transmit a [RAT]* at maximum power on the middle channel of the operating band. After achieving thermal balance, the averages of 200 transmission bursts were measured and the result recorded.

Voltage Variation

The EUT was tested at the supplied voltages varied from 85 to 115 percent of the nominal value of 48 VDC. At +20°C, the Base Station was configured to transmit a [RAT]* at maximum power on the middle channel of the operating band. The average of 200 transmission bursts was measured and the result recorded.

[RAT]*:

NR – QPSK modulation

A.6.3 Measurement results

Frequency Error vs Temperature

Port	Modulation	BW	Voltage	Temperature	Offset(Hz)	Frequency error(ppm)
0	QPSK	40MHz	48V	20℃	-16.81	0.0046
				-30℃	-49.44	0.0136
				-20℃	-33.01	0.0091
				-10℃	-51.74	0.0142
				0℃	-37.18	0.0102
				10℃	29.07	0.0080
				30℃	25.82	0.0071
				40℃	19.38	0.0053
				50℃	-32.11	0.0089

Frequency Error vs Voltage

Port	Modulation	BW	Temperature	Voltage	Offset(Hz)	Frequency error(ppm)
0	QPSK	40MHz	20℃	40.8V	14.74	0.0041
				55.2V	7.03	0.0019

Annex B: Accreditation Certificate

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

ilac-MRA

Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 600118-0

Telecommunication Technology Labs, CAICT
Beijing
China

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Electromagnetic Compatibility & Telecommunications

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2022-10-01 through 2023-09-30
Effective Dates

DEPARTMENT OF COMMERCE · UNITED STATES OF AMERICA

For the National Voluntary Laboratory Accreditation Program

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