

8.6. BAND EDGE EMISSIONS

RULE PART(S)

FCC: §2.1051, §30.203

LIMITS

30.203 (a) - The conductive power or the total radiated power of any emission outside a licensee's frequency block shall be -13 dBm/MHz or lower. However, in the bands immediately outside and adjacent to the licensee's frequency block, having a bandwidth equal to 10 percent of the channel bandwidth, the conductive power or the total radiated power of any emission shall be -5 dBm/MHz or lower.

TEST PROCEDURE

- RBW = 1 MHz
- VBW $\geq 3 \times$ RBW
- Number of measurement points in sweep $> 2 \times$ span / RBW
- Sweep time = auto-couple
- Detector = RMS
- Trace mode = Average

KDB 842590 D01 Upper Microwave Flexible Use Service v01 Section 4.2
ANSI C63.26-2015 Clause 5.2, Clause 5.5, Clause 6.4, and Annex C.5.2

Band Edge measurements were performed at the far field test distance listed in Section 8.1.

Band Edge emission levels were calculated using the equations in ANSI C63.26-2015 Annex C.5.2, as described above in "OUTDOOR SITE SUBSTITUTION MEASUREMENTS".

To properly display of signal level on the plots, the pre-loaded correction factors were intentional lowered by 70 dB and an offset factor of 70 dB was applied on spectrum analyzer to compensate the true correction factors across the frequency range of measurement.

Worse-Case Configuration

All supported CC configurations and modulations were tested at low and high channels.

Per KDB 842590 Section 4.4.2.5, EUT antenna gain correction was applied to all Band Edge measurements to yield conducted output power.

RESULTS

See the following pages.

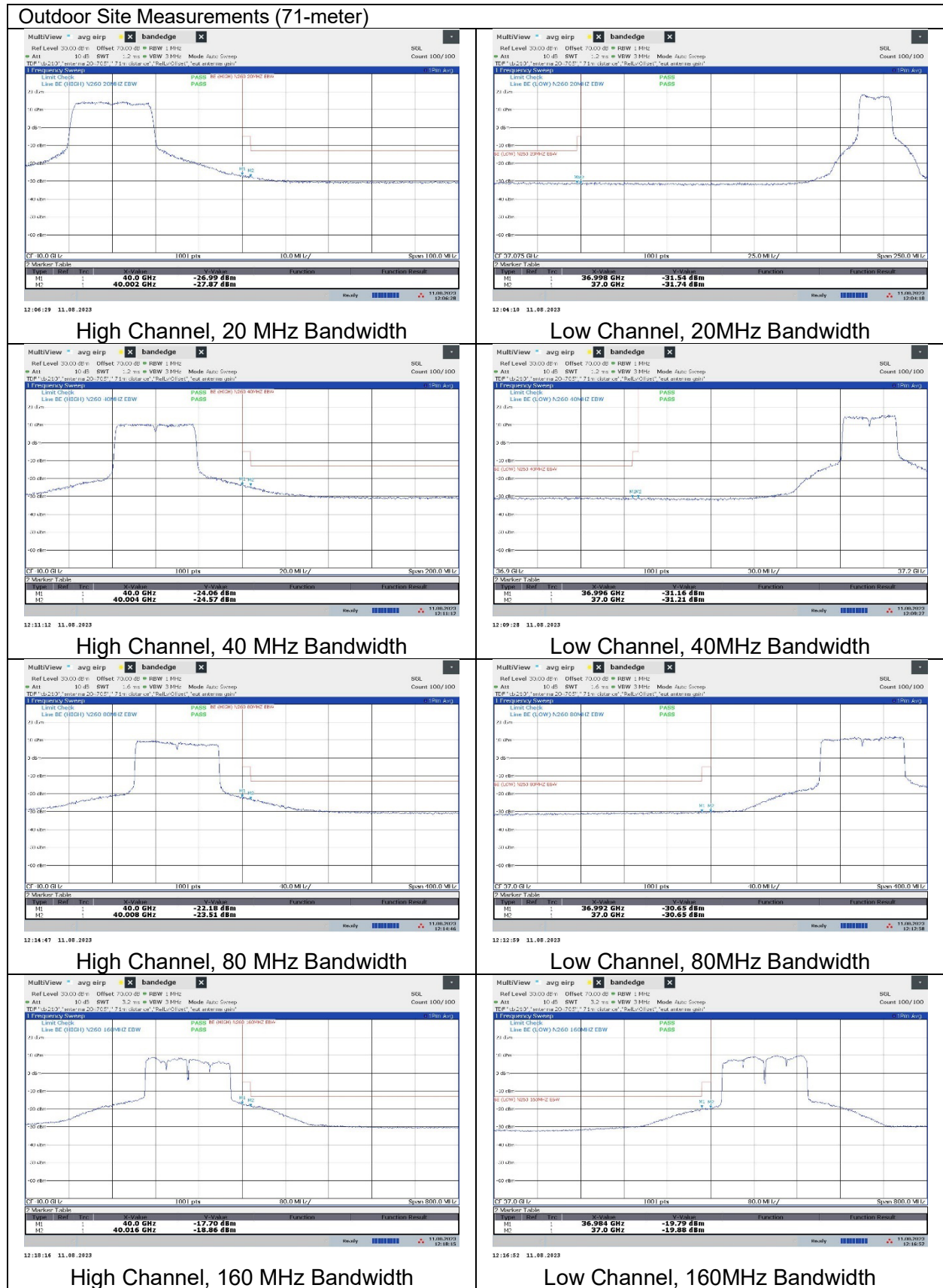
TESTED BY

Employee IDs: 23854, 11322
Test Dates: 2023-08-11, 2023-09-08
Test Location: RTP Outdoor Test Site

8.6.1. BAND EDGE RESULTS

Antenna Configuration	Modulation	Channel	Frequency (GHz)	Channel BW (MHz)	Test Frequency (GHz)	Meas Distance (m)	EUT Antenna Gain (dBi)	L _p Delta (dB)	Corrected Avg Conducted (dBm)	Conducted Limit (dBm)	Margin (dB)
Base Unit + 515mm Unheated Reflector	OFDM, MCS0	Low	37.1	20	36.998	71	38.5	-1.66	-33.2	-13	-20.2
		Low	37.1	20	37	71	38.5	-1.66	-33.4	-5	-28.4
		High	39.9	20	40	71	38.5	-5.51	-32.5	-5	-27.5
		High	39.9	20	40.002	71	38.5	-5.51	-33.38	-13	-20.38
	OFDM, MCS0	Low	37.1	40	36.996	71	38.5	-1.66	-32.82	-13	-19.82
		Low	37.1	40	37	71	38.5	-1.66	-32.87	-5	-27.87
		High	39.9	40	40	71	38.5	-5.51	-29.57	-5	-24.57
		High	39.9	40	40.004	71	38.5	-5.51	-30.08	-13	-17.08
	OFDM, MCS0	Low	37.1	80	36.992	71	38.5	-1.66	-32.31	-13	-19.31
		Low	37.1	80	37	71	38.5	-1.66	-32.31	-5	-27.31
		High	39.9	80	40	71	38.5	-5.51	-27.69	-5	-22.69
		High	39.9	80	40.008	71	38.5	-5.51	-29.02	-13	-16.02
	OFDM, MCS0	Low	37.1	160	36.984	71	38.5	-1.66	-21.45	-13	-8.45
		Low	37.1	160	37	71	38.5	-1.66	-21.54	-5	-16.54
		High	39.9	160	40	71	38.5	-5.51	-23.21	-5	-18.21
		High	39.9	160	40.016	71	38.5	-5.51	-24.37	-13	-11.37





8.7. RADIATED SPURIOUS EMISSIONS

RULE PART(S)

FCC: §2.1051, §30.203

LIMIT

30.203 - (a) The conductive power or the total radiated power of any emission outside a licensee's frequency block shall be -13 dBm/MHz or lower.

TEST PROCEDURE

KDB 842590 D01 Upper Microwave Flexible Use Service v01 Section 4.4.2 and Section 4.4.3. ANSI C63.26-2015 Clause 5.5.4 and Annex C.5.2.

All radiated spurious emissions were measured as EIRP or TRP to compare with the §30.203 TRP limits to demonstrate compliance.

RSE was investigated below 1 GHz at a height of 0.8 meters. RSE was investigated from 1 – 200 GHz at a height of 1.5 meters.

Plots below 18 GHz are corrected field strength levels, measured at 3-meter test distance. The average EIRP reported below is calculated per section 5.2.7 of ANSI C63.26-2015 which states: $EIRP (dBm) = E (dB\mu V/m) + 20\log(D) - 104.8$; where D is the measurement distance (in the far field region) in m. The field strength E is calculated $E (dB\mu V/m) = \text{Spectrum Analyzer Level (dBm)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} + 107$. All appropriate Antenna Factor and Cable Loss have been applied in the spectrum analyzer for each measurement.

RSEs above 18 GHz were measured at the appropriate far field distances listed in Section 8.1. RSEs from 18 – 50 GHz were measured using a spectrum analyzer or EMI receiver with an internal preamplifier when applicable. Emissions above 50 GHz were measured using a downconverter with spectrum analyzer, while an external LNA was used when applicable.

EIRP of RSE was calculated using the equations on ANSI C63.26-2015 Annex C.5.2. The total correction factor of cable loss, horn antenna gain, harmonic mixer loss, LNA gain, and far-field path loss were calculated using equations C.8 and C.9 and pre-loaded into the spectrum analyzer.

Sample calculation of EIRP:

$$\begin{aligned} \text{Total Correction Factor} &= \text{Cable Loss (dB)} - \text{Horn Ant Gain (dBi)} + \text{Mixer Loss (dB)} - \\ &\quad \text{LNA Gain (dB)} + \text{Path Loss (dB)} \\ &= 4 - 23 + 12 - 30 + 71 \\ &= 34 \text{ dB} \end{aligned}$$

$EIRP = P_{\text{measured}} (dBm)$, where Total Correction Factor preloaded.

$$\begin{aligned} \text{Path Loss} &= 20*\log(\text{ Frequency [MHz]}) + 20*\log(\text{ Test Distance [m]}) - 27.5 \\ &= 20*\log(37000) + 20*\log(71) - 27.5 \\ &= 100.9 \text{ dB} \end{aligned}$$

Worse-Case Configuration

Testing was performed on all channels at the bandwidth that yields the highest power, below 18GHz, only worst-case channel plots are reported.

All pre-scans performed using Peak detection. Where the measured average EIRP value exceeds the limit, a TRP measurement is made, otherwise the Peak or average EIRP value is compared with the §30.203 TRP limits to demonstrate compliance.

For simultaneous transmission of multiple channels in the Wifi/BLE bands and 5G FR2 bands, no noticeable new emissions were found.

RESULTS

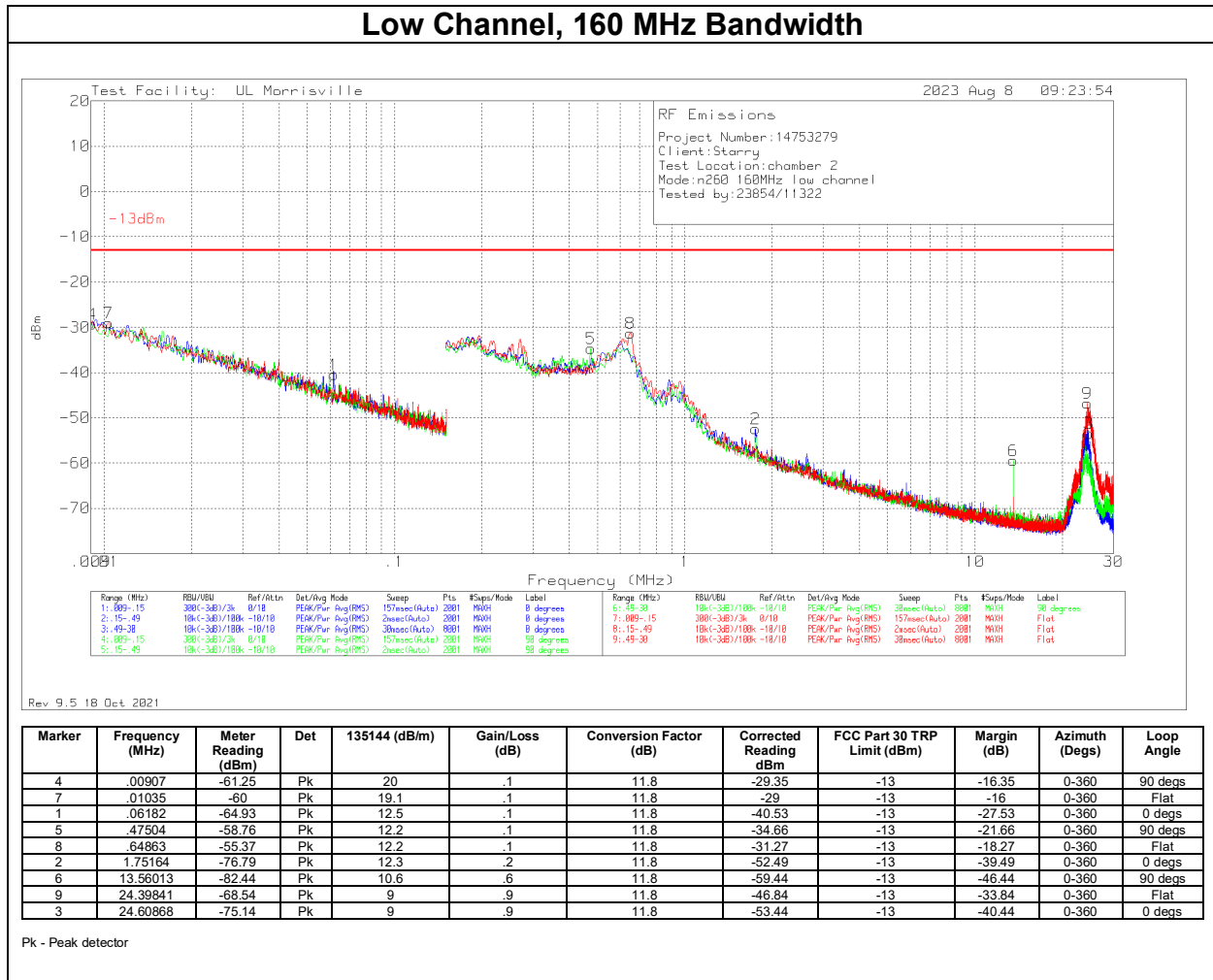
See the following pages.

TESTED BY

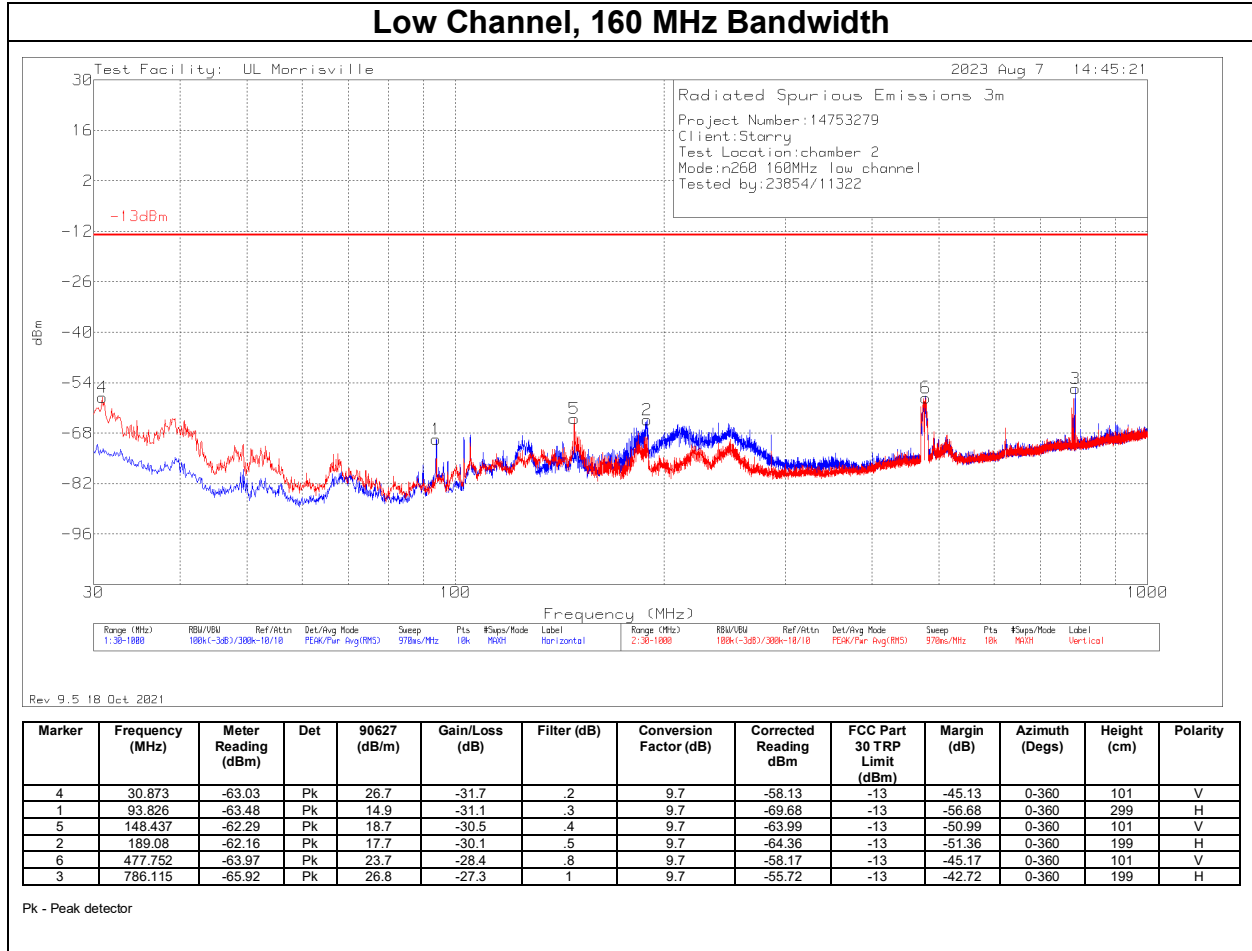
Below 18 GHz Test Site: Chamber 2
Employee IDs: 23854/11322
Test Dates: 2023-08-07 to 2023-08-08

Above 18 GHz Test Site: Chamber 3
Employee IDs: 23854
Test Dates: 2023-08-01 to 2023-08-04, 2023-11-15 to 2023-11-16

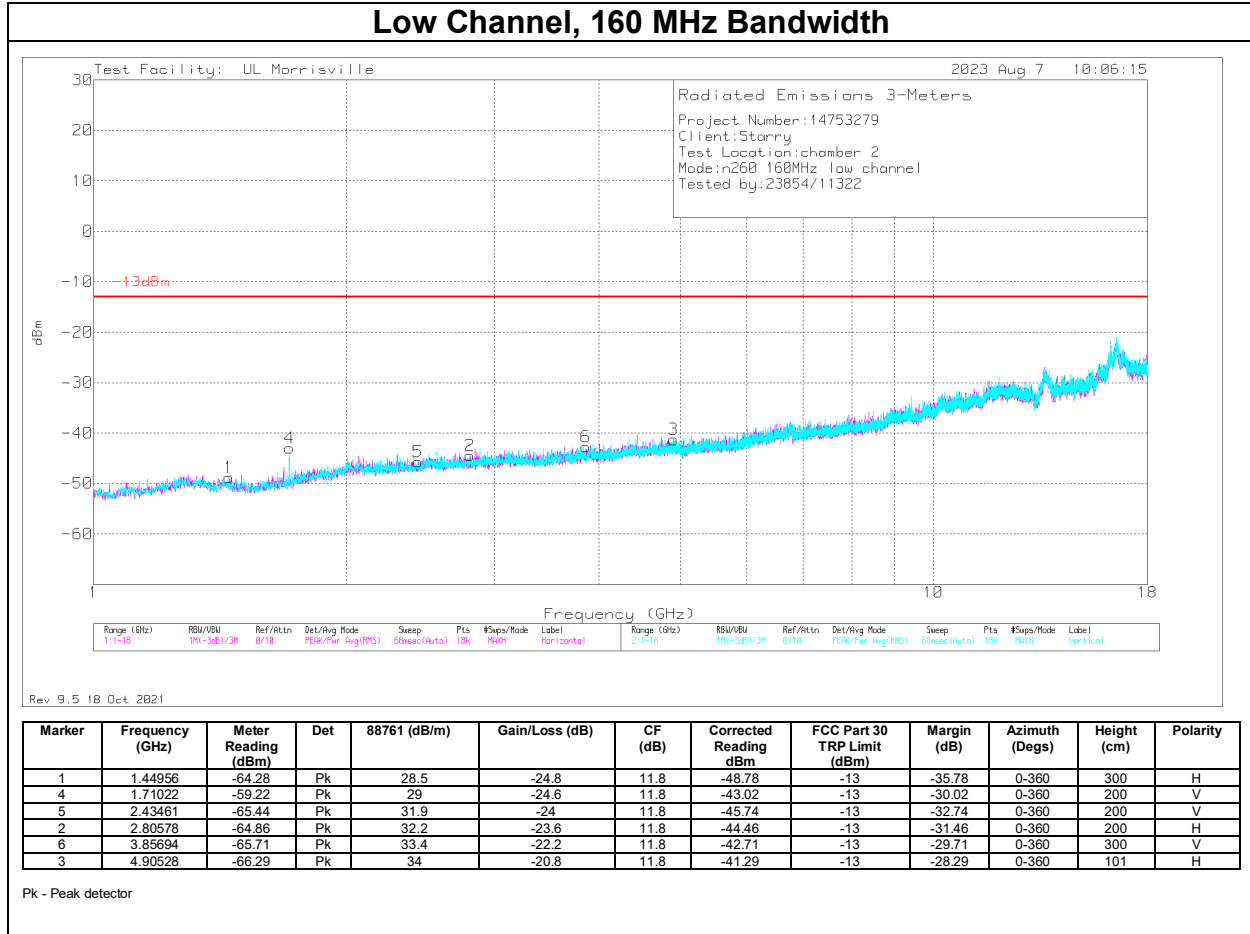
8.7.1. RADIATED EMISSIONS 0.009-30 MHz



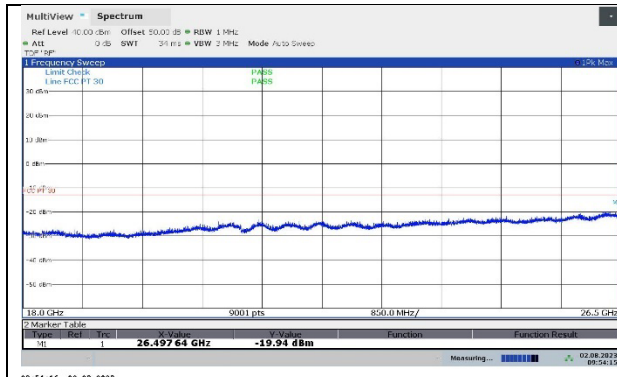
8.7.2. RADIATED EMISSIONS 30-1000 MHz



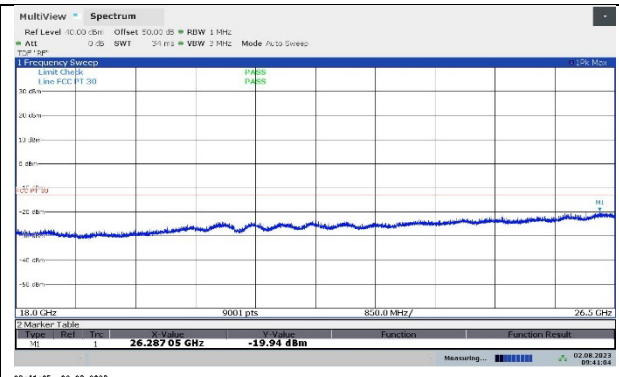
8.7.3. RADIATED EMISSIONS 1-18 GHz



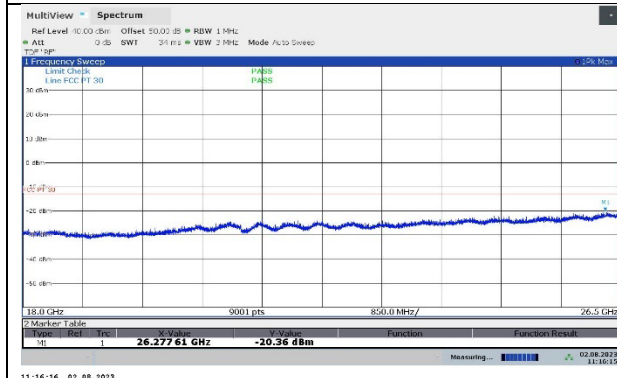
8.7.4. RADIATED EMISSIONS 18-26.5 GHz



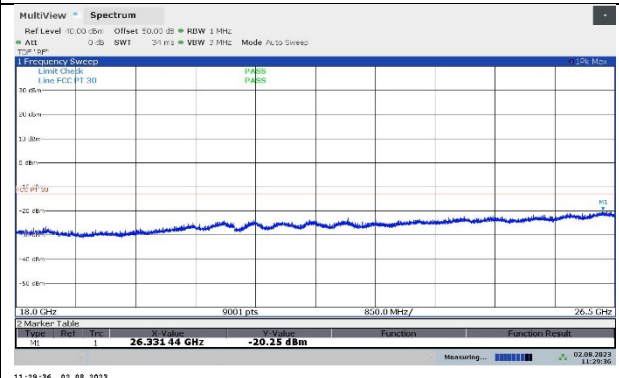
Low Channel, 160 MHz Bandwidth,
Horizontal



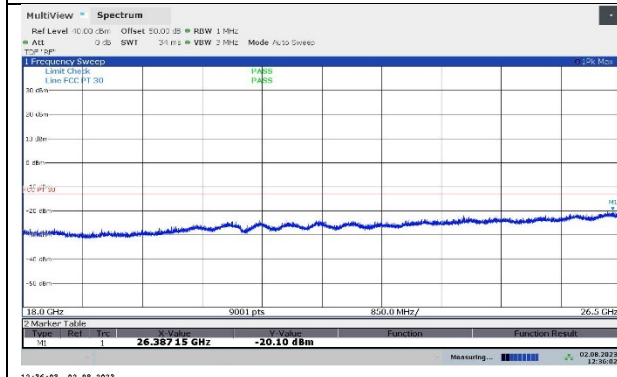
Low Channel, 160 MHz Bandwidth,
Vertical



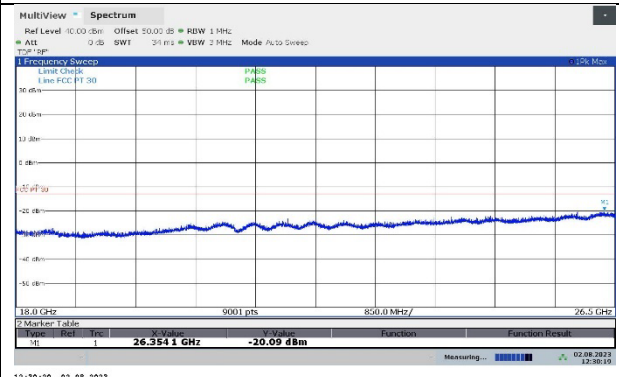
Mid Channel, 160 MHz Bandwidth,
Horizontal



Mid Channel, 160 MHz Bandwidth,
Vertical

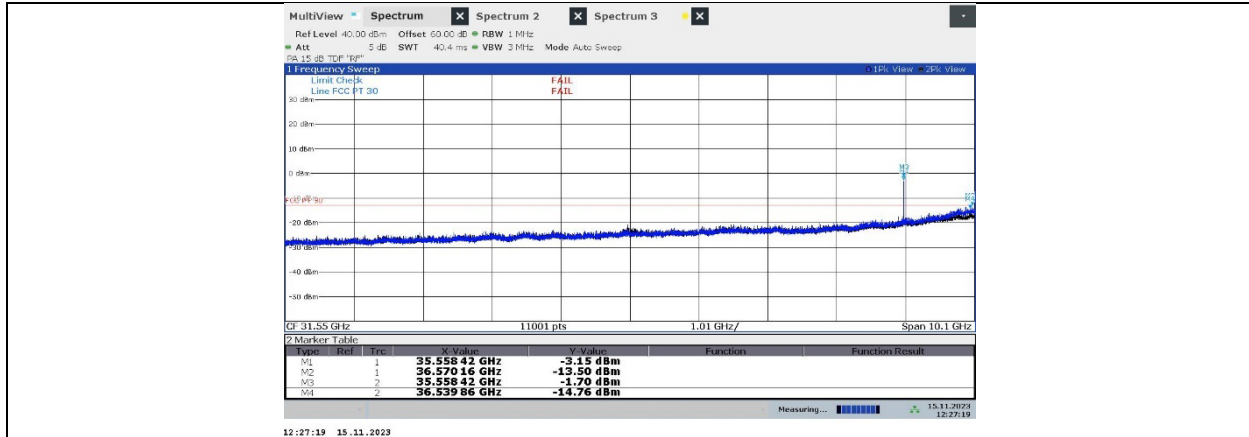


High Channel, 160 MHz Bandwidth,
Horizontal



High Channel, 160 MHz Bandwidth,
Vertical

8.7.5. RADIATED EMISSIONS 26.5-36.6 GHz



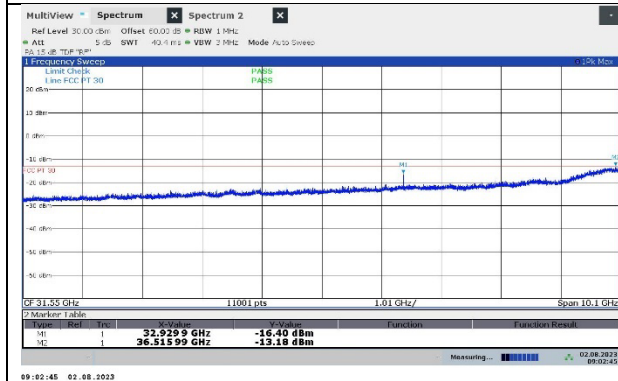
Low Channel, 160 MHz Bandwidth, Horizontal (Trace 1) & Vertical (Trace 2)

Trace Markers

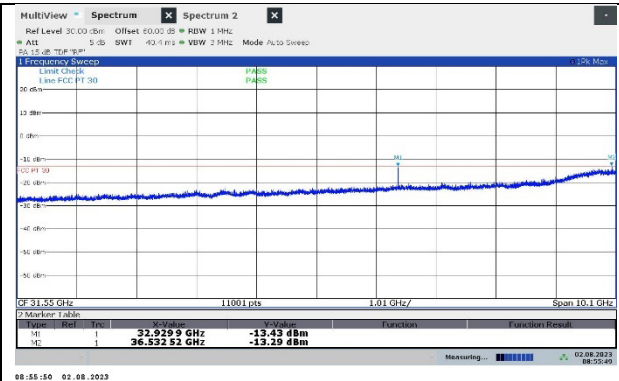
Frequency (GHz)	Meas. Distance (m)	Rx Ant Polarity (H/V)	Corrected Avg EIRP (dBm)	TRP Limit (dBm)	Margin (dB)
36.572	3	H	-25.08	-13	-12.08
36.561	3	V	-26.59	-13	-13.59

Frequency (GHz)	Meas. Distance (m)	Corrected TRP (dBm)	TRP Limit (dBm)	Margin (dB)
35.558	3	-18.99	-13	-5.99

TRP measured using the Spherical Grid Method per KDB 842590, Section 4.4.3.3.4



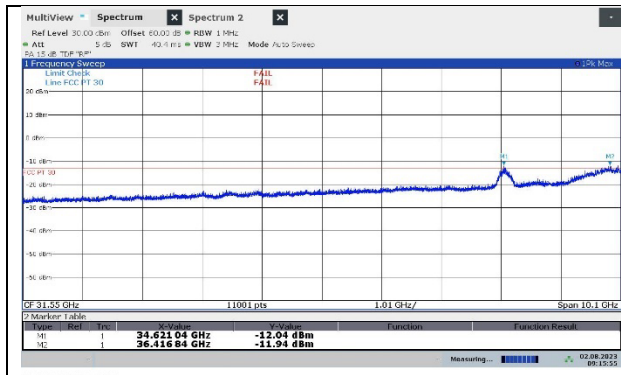
Mid Channel, 160 MHz Bandwidth, Horizontal



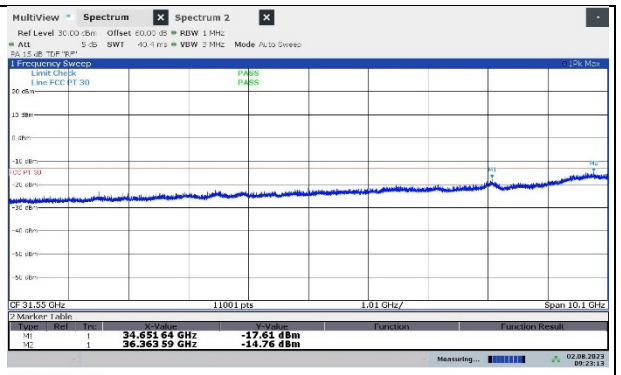
Mid Channel, 160 MHz Bandwidth, Vertical

Trace Markers

Frequency (GHz)	Meas. Distance (m)	Rx Ant Polarity (H/V)	Corrected Avg EIRP (dBm)	TRP Limit (dBm)	Margin (dB)
32.929	3	H	-22.69	-13	-9.69
36.520	3	H	-23.10	-13	-10.1
32.929	3	V	-20.10	-13	-7.1
36.510	3	V	-23.65	-13	-10.65



High Channel, 160 MHz Bandwidth,
Horizontal

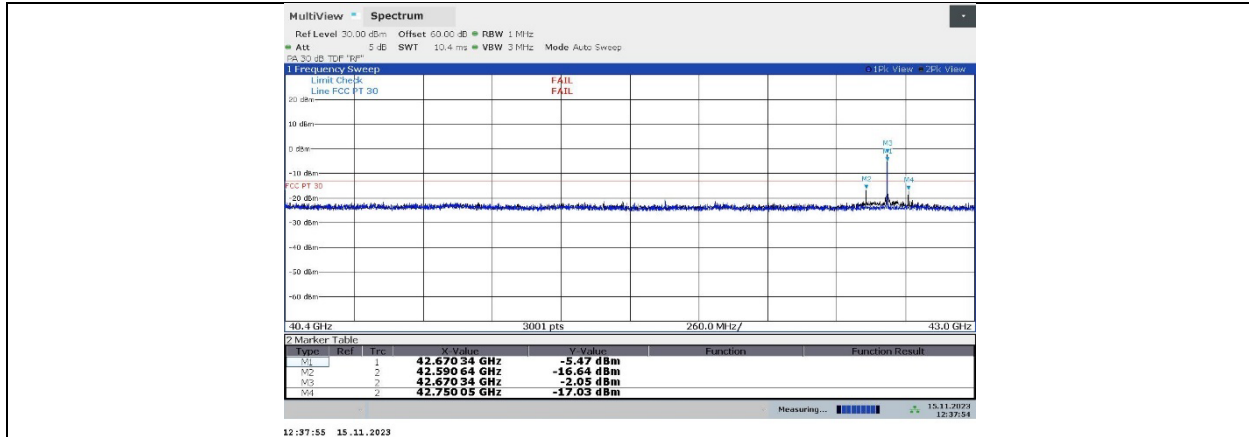


High Channel, 160 MHz Bandwidth,
Vertical

Trace Markers

Frequency (GHz)	Meas. Distance (m)	Rx Ant Polarity (H/V)	Corrected Avg EIRP (dBm)	TRP Limit (dBm)	Margin (dB)
34.642	3	H	-24.08	-13	-11.08
36.432	3	H	-22.35	-13	-9.35
34.650	3	V	-25.18	-13	-12.18
36.355	3	V	-24.08	-13	-11.08

8.7.6. RADIATED EMISSIONS 40.4-43 GHz



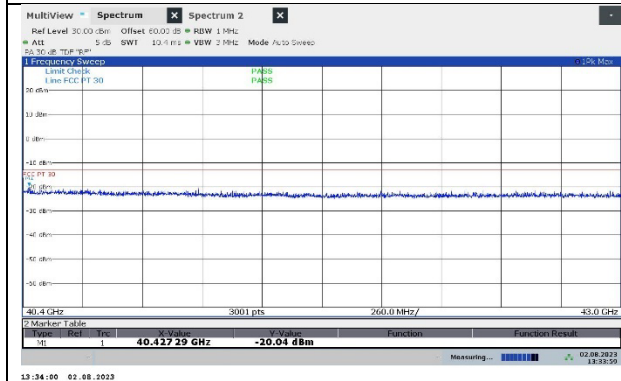
Low Channel, 160 MHz Bandwidth, Horizontal (Trace 1) & Vertical (Trace 2)

Trace Markers

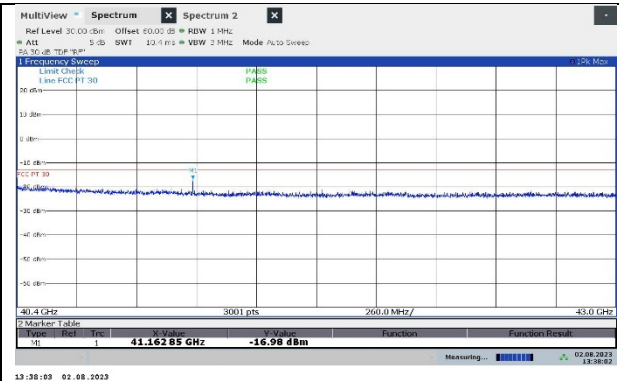
Frequency (GHz)	Meas. Distance (m)	Rx Ant Polarity (H/V)	Corrected Avg EIRP (dBm)	TRP Limit (dBm)	Margin (dB)
42.590	3	V	-30.98	-13	-17.98
42.750	3	V	-31.54	-13	-18.54

Frequency (GHz)	Meas. Distance (m)	Corrected TRP (dBm)	TRP Limit (dBm)	Margin (dB)
42.670	3	-21.46	-13	-8.46

TRP measured using the Spherical Grid Method per KDB 842590, Section 4.4.3.3.4



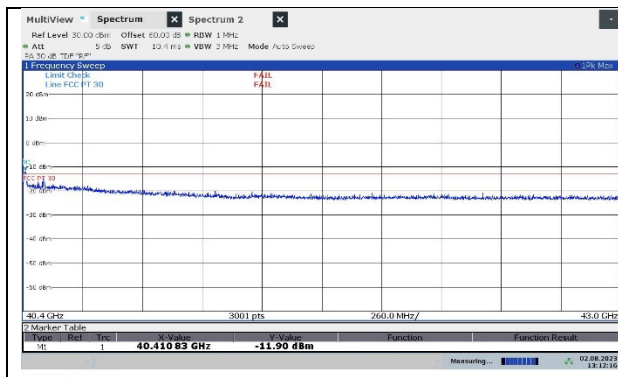
Mid Channel, 160 MHz Bandwidth, Horizontal



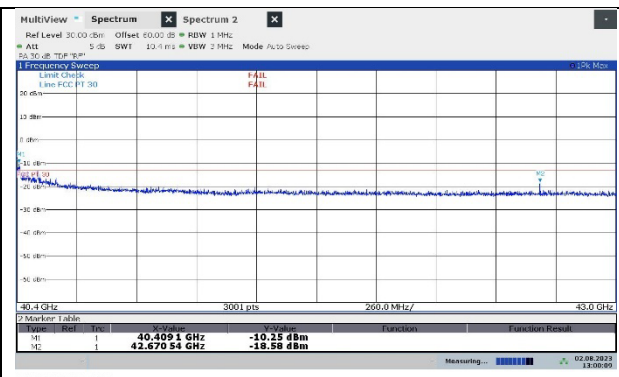
Mid Channel, 160 MHz Bandwidth, Vertical

Trace Markers

Frequency (GHz)	Meas. Distance (m)	Rx Ant Polarity (H/V)	Corrected Avg EIRP (dBm)	TRP Limit (dBm)	Margin (dB)
41.162	3	V	-20.47	-13	-7.47



High Channel, 160 MHz Bandwidth,
 Horizontal

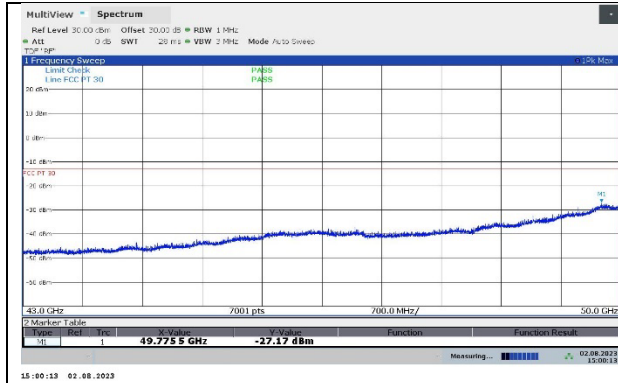


High Channel, 160 MHz Bandwidth,
 Vertical

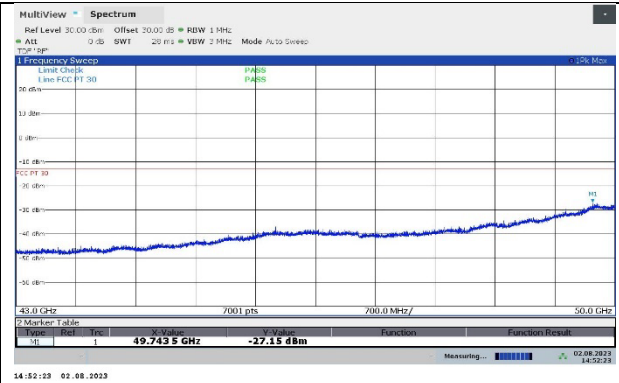
Trace Markers

Frequency (GHz)	Meas. Distance (m)	Rx Ant Polarity (H/V)	Corrected Avg EIRP (dBm)	TRP Limit (dBm)	Margin (dB)
40.407	3	H	-23.95	-13	-10.95
40.402	3	V	-23.18	-13	-10.18
42.658	3	V	-24.78	-13	-11.78

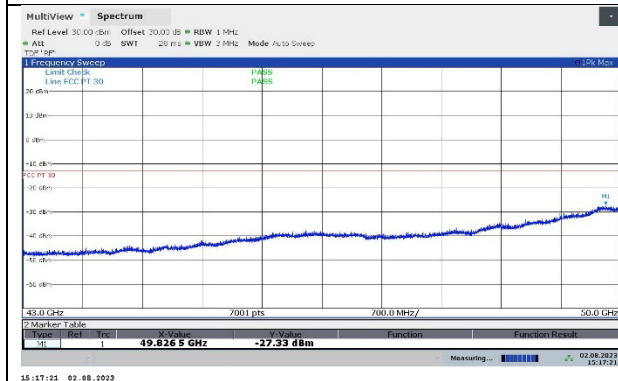
8.7.7. RADIATED EMISSIONS 43-50 GHz



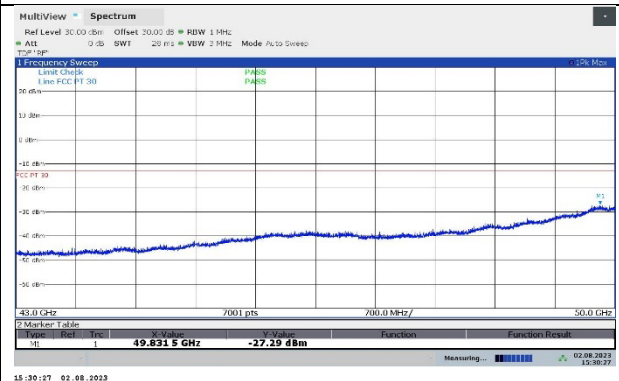
Low Channel, 160 MHz Bandwidth,
 Horizontal



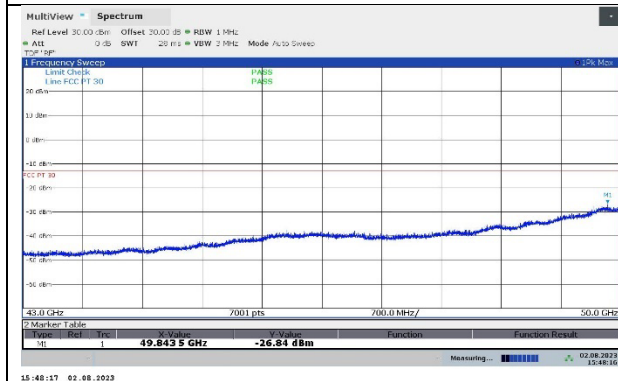
Low Channel, 160 MHz Bandwidth,
 Vertical



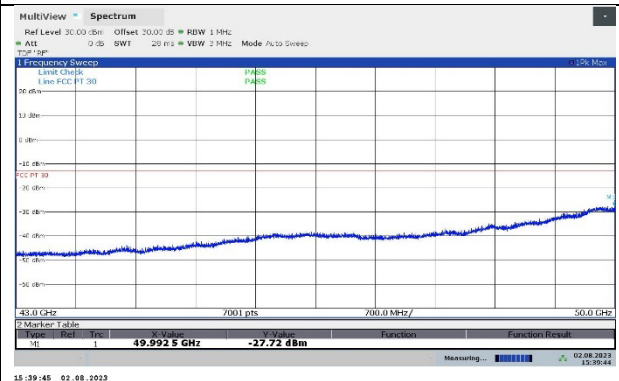
Mid Channel, 160 MHz Bandwidth,
 Horizontal



Mid Channel, 160 MHz Bandwidth,
 Vertical



High Channel, 160 MHz Bandwidth,
 Horizontal



High Channel, 160 MHz Bandwidth,
 Vertical