Test Report

For:
Banner Engineering Corp.

Brand:
Banner Engineering Corp.

Marketing Name:
77 GHz Indurstrial Radar Presence Detector

Model Name:
Q90R27

Product Description:
Indurstrial Radar Presence Detector

FCC ID: UE3Q90R2-7
IC: 7044A-Q90R27

Applied Rules and Standards:
CRF Title 47 Part 95M
RSS-251 Issue 2, RSS-Gen Issue 5

REPORT #: EMC_BANNE_011_24001_FCC95M_RSS251_Rev1

DATE: 2025-03-14

A2LA Accredited

IC recognized #
3462B
CABID: US0187

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1 Assessment

The following device was evaluated against the applicable criteria specified in

- FCC Rule Part 95M of Title 47 of the Code of Federal Regulations
- RSS-251 Issue 2
- RSS-Gen Issue 5

No deviations were ascertained.

Company	Description	Model #
Banner Engineering Corp.	Indurstrial Radar Presence Detector	Q90R27

Responsible for the Report:

Date	Section	Name	Signature
2025-03-14	Compliance	Guangcheng Huang (Senior EMC Test Engineer)	

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Street Address:	411 Dixon Landing
City/Zip Code	Milpitas, 95035 CA
Country	USA
Telephone:	+ 1 (408) 586 6200
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EMC Lab Manager:	Alvin Ilarina
Project Manager:	Shane Hao

2.2 Identification of the Client

Client's Name:	Banner Engineering Corp.
Street Address:	9714 10th Avenue North
City/Zip Code	Minneapolis, MN 55441
Country	USA

2.3 Identification of the Manufacturer

Manufacturer's Name:	same as client
Manufacturers Address:	same as client
City/Zip Code	same as client
Country	same as client

3 Equipment Under Test (EUT)

3.1 EUT Specifications

Model No:	Q90R27
Marketing Name:	77 GHz Indurstrial Radar Presence Detector
HW Version:	Rev. A
SW Version:	1.0
FCC ID:	UE3Q90R2-7
IC:	7044A-Q90R27
FWIN:	N/A
HVIN:	Q90R2
PMN:	Q90R2
Product Description:	Indurstrial Radar Presence Detector
Power Supply / Rated operating Voltage Range:	10-30 VDC, Nominal 20 VDC
Operating Temperature Range	-40 °C to +65 °C
Sample Revision	Production
EUT Dimensions	90 x 90 x 25 mm
Note: All information provided by the client.	

3.2 Radio Specifications

Embedded Radio Technologies	77 GHz Radar
Frequency Range / number of channels:	77-78.56 GHz
Rated max. EIRP	20 dBm
Tested radio technology	77 GHz Radar
Antenna Type / Gain	Microstrip patch antenna
Modes of Operation	FMCW continuous
Note: All information provided by the client.	

3.3 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Notes/Comments
1	0	Rev. A	1.0	0

3.4 Accessory Equipment (AE) details

AE #	Type	Model	Manufacturer	Serial Number
0	0	0	0	0
0	0	0	0	0

3.5 Mode of Operation

Mode #	Mode of Operation	Comments
1	FMCW	Continuously transmitting FMCW signal

3.6 Justification for Worst Case Mode of Operation

For radiated measurements, all data in this report shows the worst case between horizontal and vertical antenna polarizations and for all orientations of the EUT.

4 Subject of Investigation

The objective of the measurements done by CETECOM Inc. was to evaluate the compliance of the EUT against the relevant requirements specified in section 1 Assessment.

5 Measurement Results Summary

Test Specification	Test Case	Test Condition	Mode[2]	Pass	NA[1]	NP[1]	Result
§95.3367(a)(b) RSS-251, 8&9	Equivalent Isotropic Radiated Power	Nominal and extreme	1	■	☐	☐	Pass
§95.3379(b) RSS-251, 7	99% Occupied Bandwidth	Nominal and extreme	1	■	☐	☐	Pass
§95.3379(b) RSS-251, 11	Frequency Stability	Nominal and extreme	1	■	☐	☐	Pass
§95.3379(a), §15.209(a) RSS-251, 10	Unwanted Emissions	Nominal	1	■	☐	☐	Pass
§15.207 RSS-Gen, 8.8	AC Conducted Emissions	Nominal	1	☐	■	☐	-

Note 1: NA= Not Applicable; NP= Not Performed.
Note 2. See section 3.5 Mode of Operation

6 Measurements

6.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus, with 95% confidence interval (in dB delta to result), based on a coverage factor k=2.

Radiated measurement

9 kHz to 30MHz	±2.5 dB (Magnetic Loop Antenna)
30 MHz to 1000 MHz	±2.0 dB (Biconilog Antenna)
1 GHz to 40 GHz	±2.3 dB (Horn Antenna)
40-60 GHz	±3.95 dB (Horn Antenna)
60-90 GHz	±3.32 dB (External Mixer, Horn Antenna)
90-140 GHz	±4.94 dB (External Mixer, Horn Antenna)
140-225 GHz	±5.42 dB (External Mixer, Horn Antenna)

Conducted measurement

RF conducted measurement	±0.5 dB

6.2 Environmental Conditions During Testing:

The following environmental conditions were maintained during testing:

- Ambient Temperature: 20-25 ˚C
- Relative humidity: 40-60%

6.3 Dates of Testing:

2025-01-06 to 2025-02-07

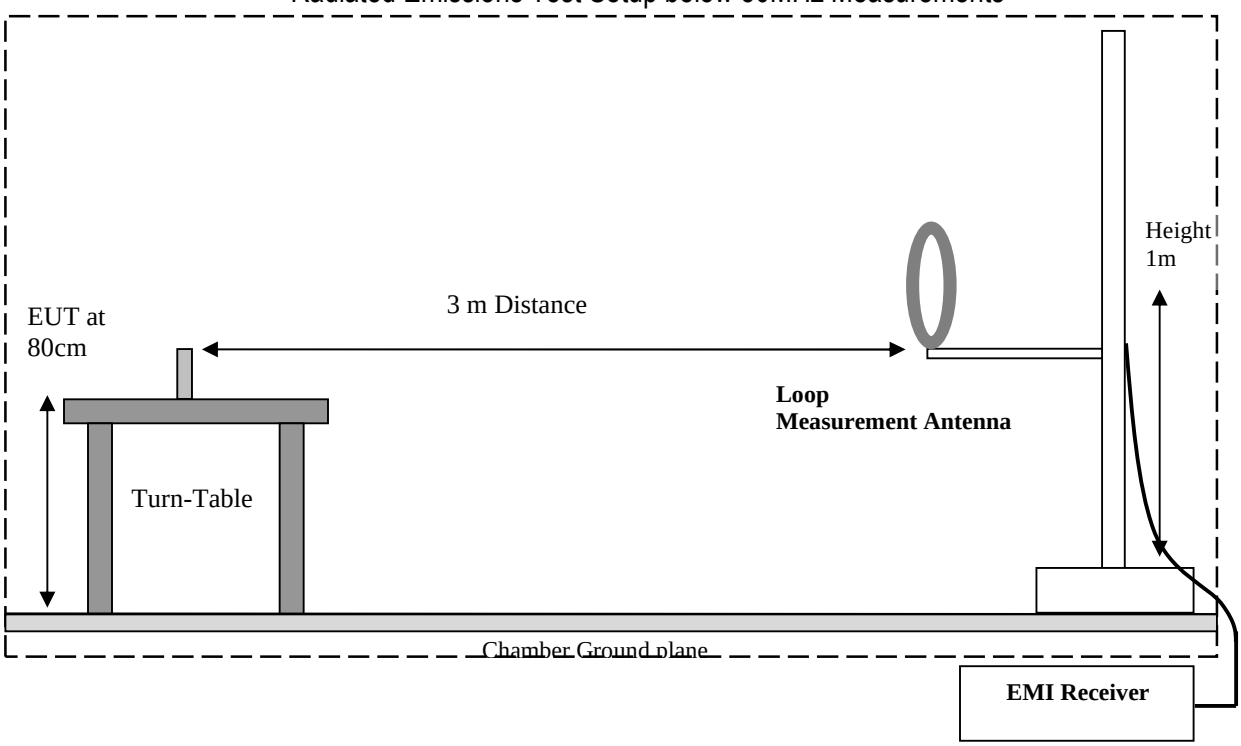
7 Measurement Procedures

7.1 Radiated Measurement

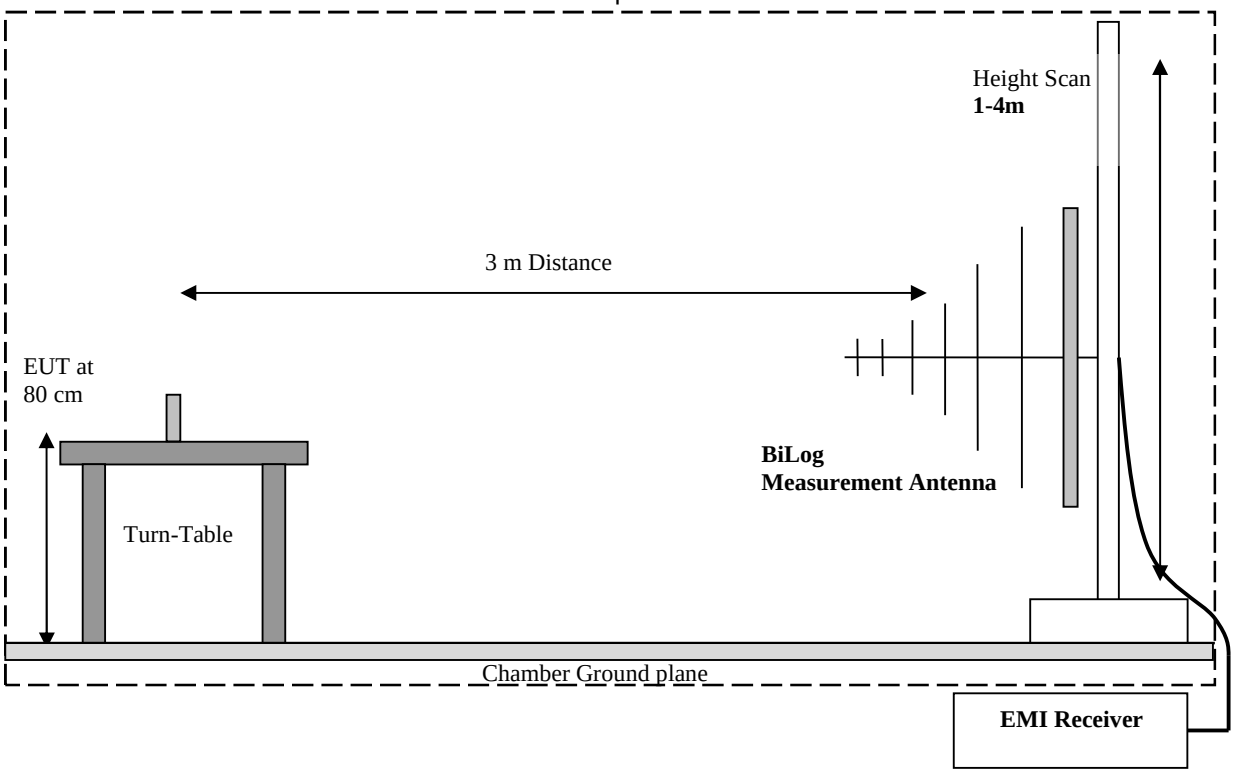
The radiated measurement is performed according to: ANSI C63.10 (2013)

- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 4 positions of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to cover the 3 orthogonal axes of the EUT. A max peak detector is utilized during the exploratory measurement. The Test-SW creates an overall maximum trace for all 12 sweeps and saves the settings for each point of this trace. The maximum trace is part of the test report.
- The 10 highest emissions are selected with an automatic algorithm of EMC32 searching for peaks in the noise floor and ensuring that broadband signals are not selected multiple times.
- The maxima are then put through the final measurement and again maximized in a 90deg range of the turntable, fine search in frequency domain and height scan between 1m and 4m.
- The above procedure is repeated for all possible ways of power supply to EUT and for all supported modulations.
- In case there are no emissions above noise floor level only the maximum trace is reported as described above.
- The results are split up into up to 4 frequency ranges due to antenna bandwidth restrictions. A magnetic loop is used from 9 kHz to 30 MHz, a Biconilog antenna is used from 30 MHz to 1 GHz, and two different horn antennas are used to cover frequencies up to 40 GHz.

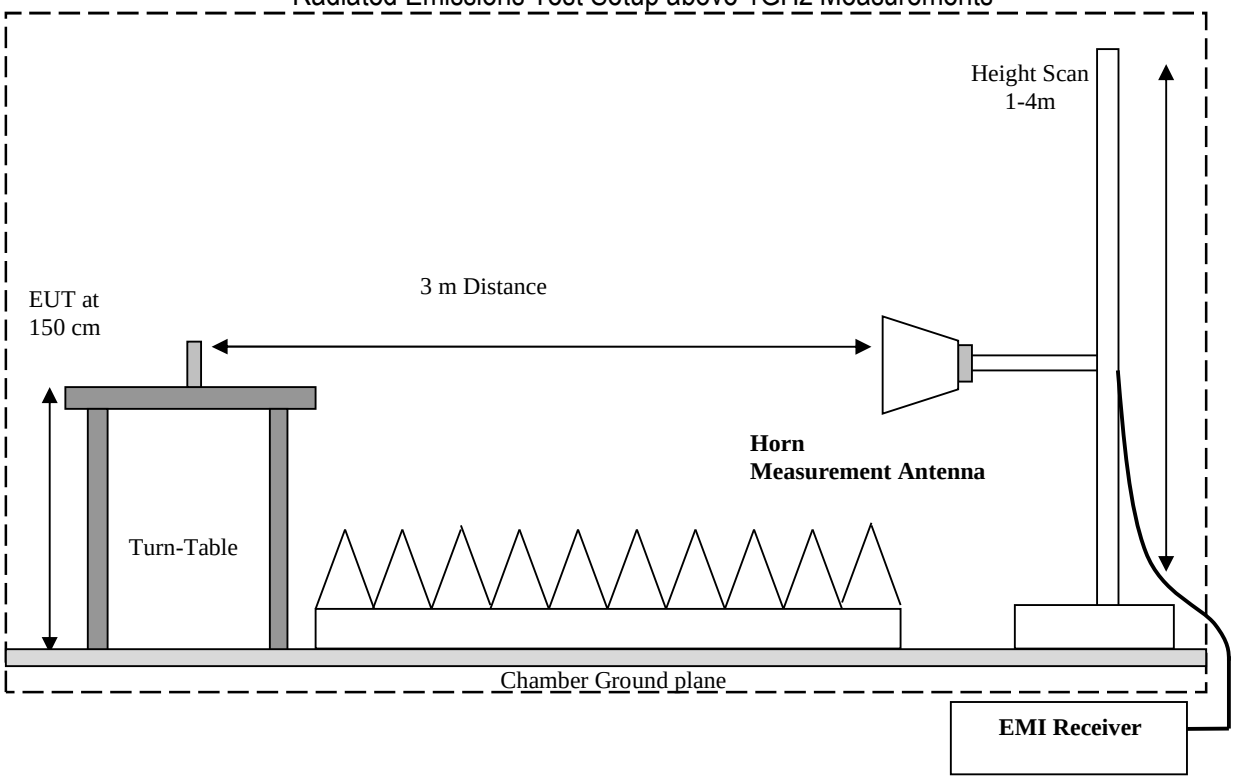
Radiated Emissions Test Setup below 30MHz Measurements



Radiated Emissions Test Setup 30MHz-1GHz Measurements



Radiated Emissions Test Setup above 1GHz Measurements



7.1.1 Sample Calculations for Field Strength Measurements

Field Strength is calculated from the Spectrum Analyzer/ Receiver readings, taking into account the following parameters:

1. Measured reading in dBµV
2. Cable Loss between the receiving antenna and SA in dB and
3. Antenna Factor in dB/m

All radiated measurement plots in this report are taken from a test SW that calculates the Field Strength based on the following equation:

FS (dBµV/m) = Measured Value on SA (dBµV) + Cable Loss (dB) + Antenna Factor (dB/m)

Example:

Frequency (MHz)	Measured SA (dBµV)	Cable Loss (dB)	Antenna Factor Correction (dB/m)	Field Strength Result (dBµV/m)
1000	80.5	3.5	14	98.0

7.1.2 Sample Calculations for Radiated Emission above 40 GHz

Radiated emission measurement over 40 GHz is measured in EIRP. It's done with help of external mixers, which have intrinsic conversion loss (including also cable loss from the external mixer to the spectrum analyzer). The spectrum analyzer includes the table of conversion loss while measuring. At the same time, the spectrum analyzer includes free space loss and the antenna gain of the measurement antenna.

All radiated measurement plots in this report show EIRP level are based on the following equation:

EIRP (dBm) = Measured Value on SA (dBm) + Conversion Loss (dB) + Antenna Gain (dB) + Free Space Loss (dB)

Example:

Frequency (MHz)	Measured SA (dBm)	Conversion Loss (dB)	Antenna Gain (dB)	FSL (dB)	EIRP (dBm)
60000	-68	20	-25	78	5

7.2 Power Line Conducted Measurement Procedure

AC Power Line conducted emissions measurements performed according to: ANSI C63.4 (2014)

8 Test Result

8.1 EIRP peak power and average power

8.1.1 Measurement according to ANSI C63.10-2020 Section 9.8

Peak power: frequency sweep, RBW = 1 MHz, VBW ≥ RBW, peak detector, max-hold, max. emission level when trace stabilizes.
Average power: channel power, RBW = 1 MHz, VBW ≥ RBW, RMS (power average) detector, clear-write, measuring time ≥ transmission cycle time

Measuring distance according to ANSI C63.10-2020 section 9.1.4:

For fundamental or out-of-band emissions the far-field boundary distance of the EUT antenna or measurement antenna, whichever is largest, shall be used.

The far-field boundary $d_{\text{far-field}}$ is

$$d_{\text{far-field}} = {D^2}/{\lambda}$$

Where
D is the max. dimension size of the measurement antenna
λ is the wavelength of the measured emission.

Far-field boundary of the measurement antenna:

Frequency range	Dimension of the measurement antenna.	Min. Wavelength	Far-field boundary
GHz	m	m	m
50-75	0.0307	0.0040	0.236
60-90	0.0208	0.0033	0.131

Far-field boundary of the EUT antenna:

Frequency range	Dimension of the measurement antenna.	Min. Wavelength	Far-field boundary
GHz	m	m	m
77-78.56	0.01	0.0040	0.25

Thus, the measurement for fundamental or out-of-band emissions are done beyond 0.25 m distance.

8.1.2 Limits:

Peak power spectrum density (dBm)	Average channel power (dBm)
55	50

8.1.3 Test conditions and setup:

Test condition	EUT Set-Up	EUT operating mode
Nominal and extreme	1	1

8.1.4 Measurement result:

Plot	Test condition	Peak power density (dBm) Note 2, 3	RMS channel power (dBm)	Result
1, 6	TnomVnom	17.39	11.39	Pass
2, 7	TmaxVnom	14.37	8.43	Pass
3, 8	TminVnom	15.76	9.79	Pass
4, 9	TnomVmax	16.54	10.83	Pass
5, 10	TnomVmin	16.62	11.05	Pass

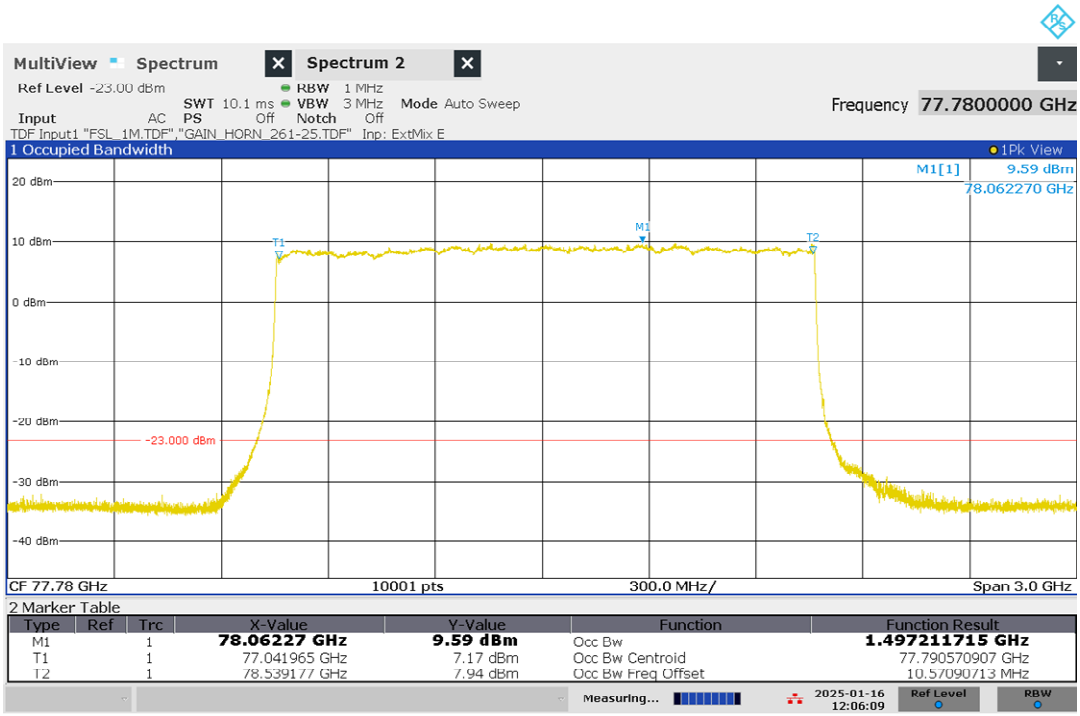
Note 1: The nominal and extreme test conditions are defined as in product description provided by applicant.
Note 2: Correction factor (7.8 dB) has been added to the raw value (of the marker) shown in the following plots 1 to 5. Due to the fast-sweeping nature of the FMCW signal, measurement taken with RBW much smaller than the bandwidth requires desensitization correction. According to the test receiver manufacturer, the correction factor (CF) is calculated

$$\mathrm{CF} = 5 * \log(1 + \mathrm{K} * \left(\frac{span}{t * RBW^2}\right)^2)$$

Where
K = 0.1947 (Gaussian shaped filter)
Span = measurement span in Hz
t = chirp length in s
RBW = resolution bandwidth in Hz

Note 3: the chirp length is 111.3 µs provided by the applicant, which gives CF = 7.8 dB.

8.1.5 Measurement plots:



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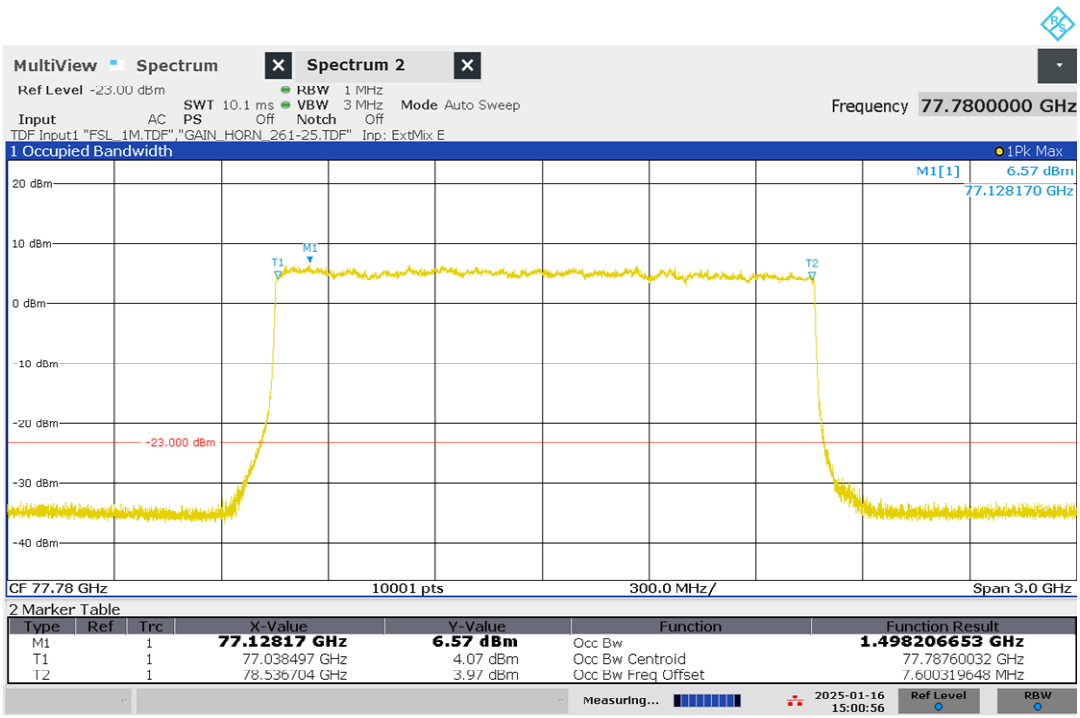
Plot 1: Power spectrum density tested under nominal condition TnomVnom



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Plot 2: Power spectrum density tested under extreme condition TmaxVnom

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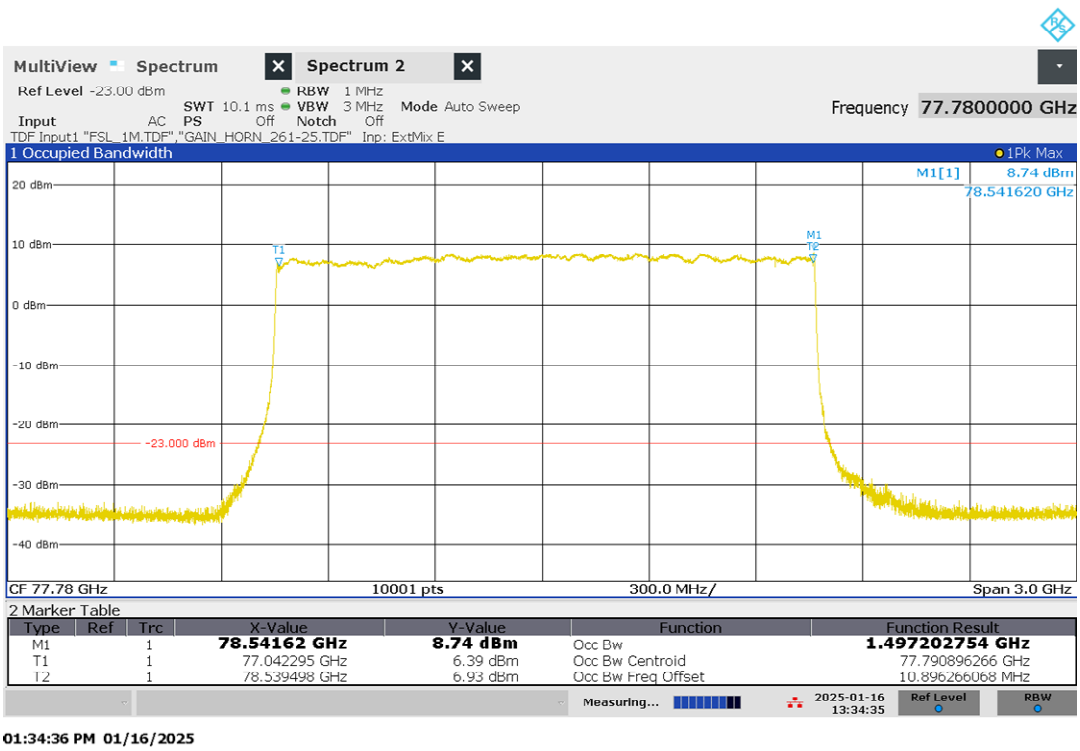
Plot 3: Power spectrum density tested under extreme condition TminVnom



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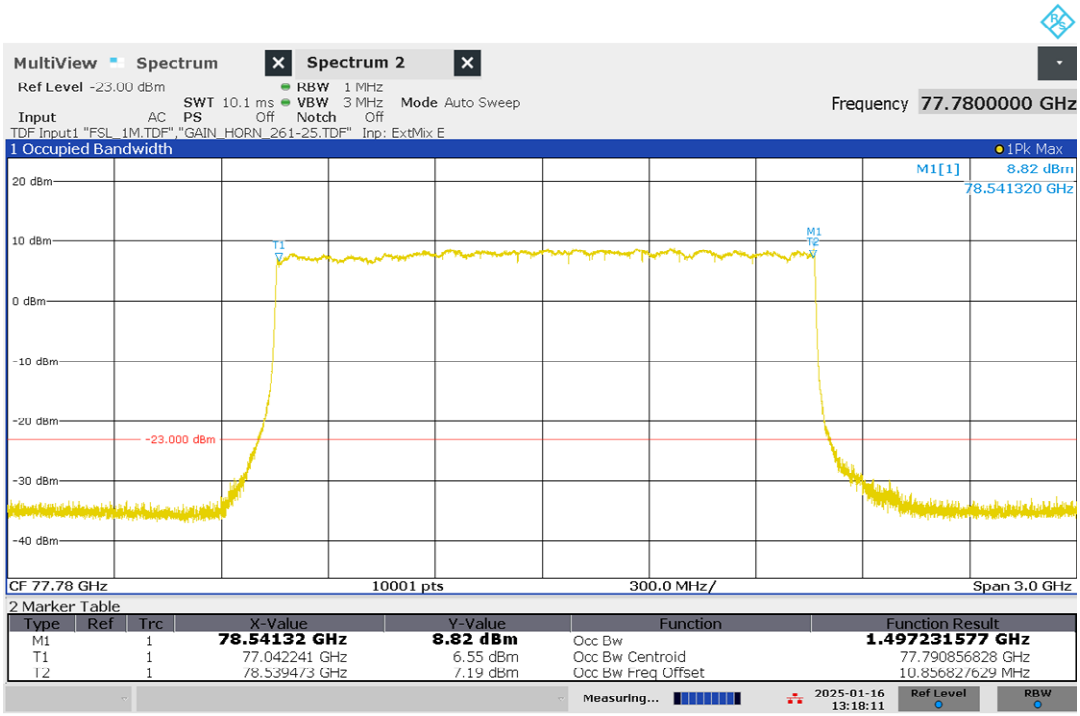
Plot 4: Power spectrum density tested under extreme condition TnomVmax



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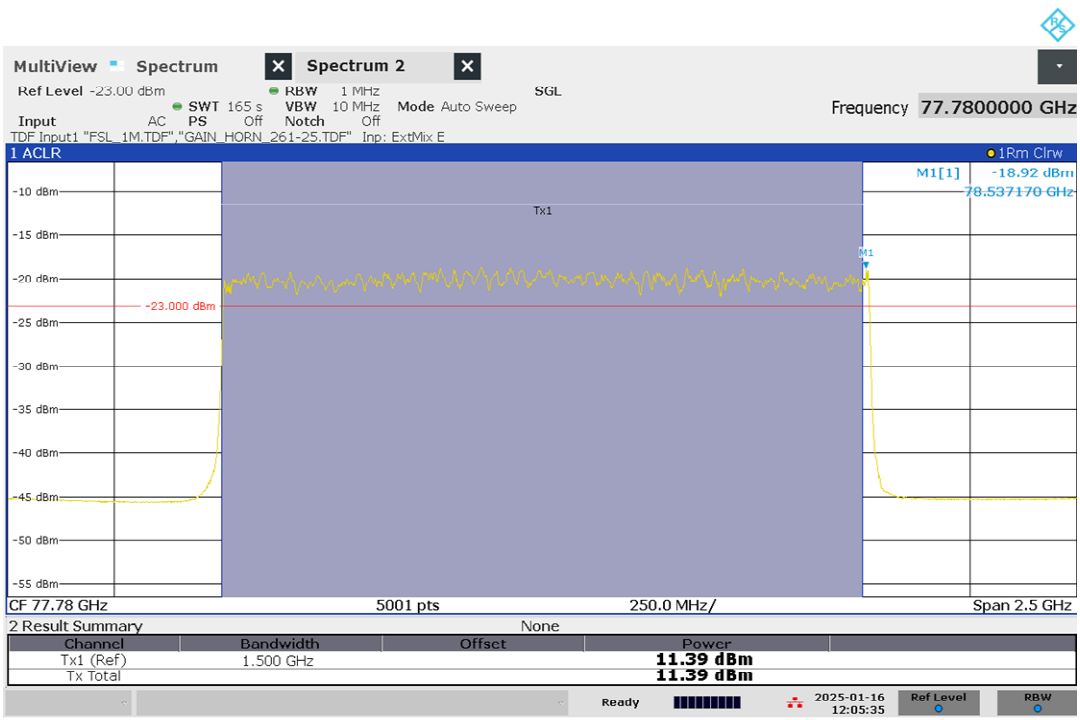
Plot 5: Power spectrum density tested under extreme condition TnomVmin



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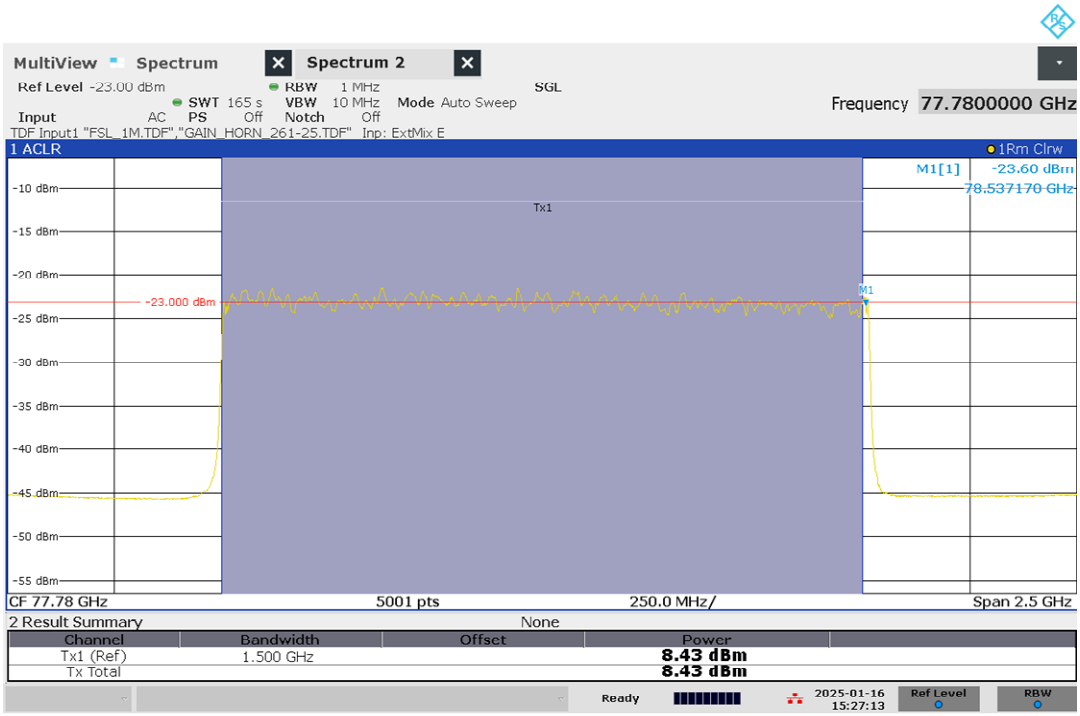
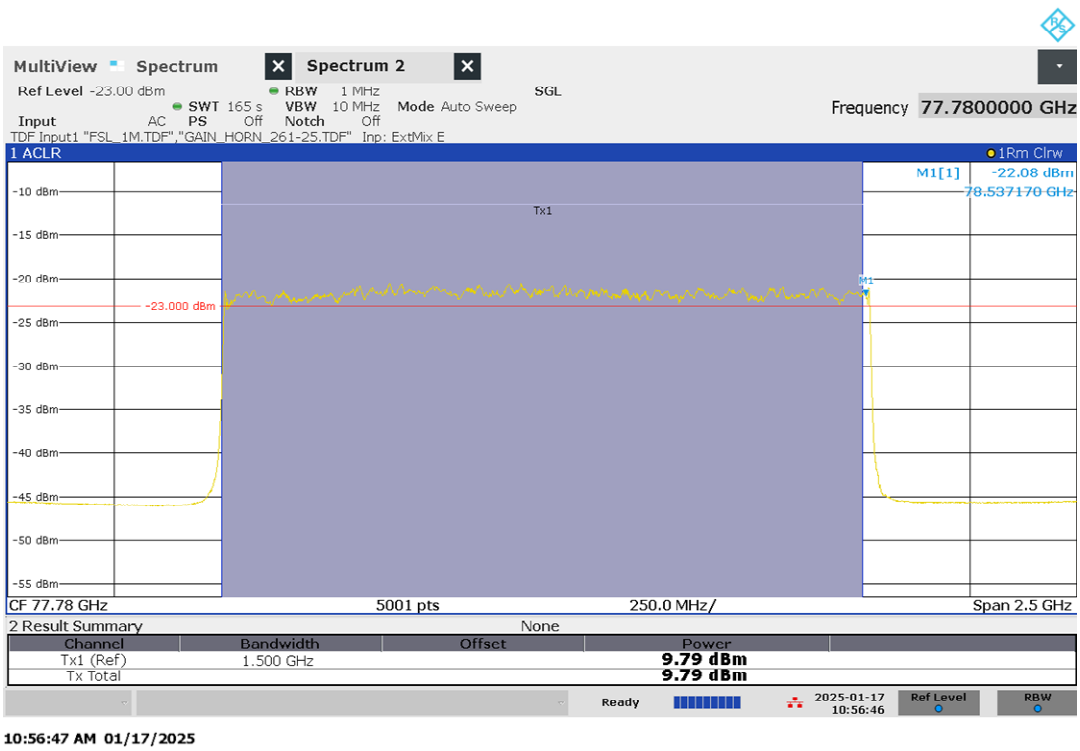
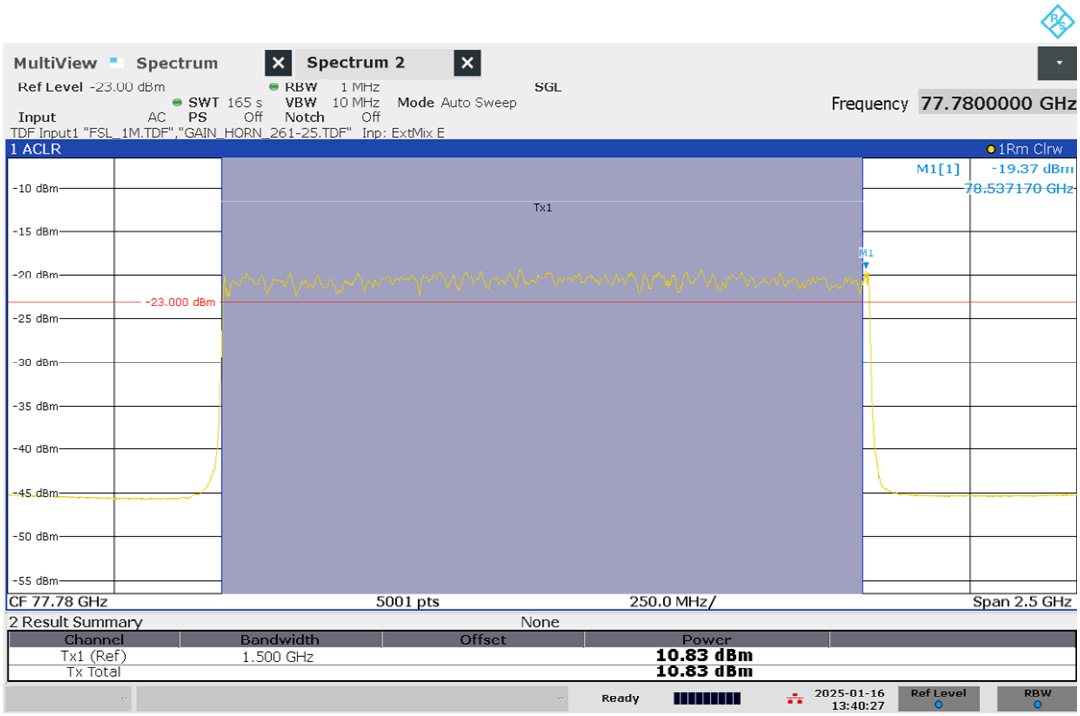
Plot 6: Channel power tested under nominal condition TnomVnom



Plot 7: Channel power tested under extreme condition TmaxVnom



Plot 8: Channel power tested under extreme condition TminVnom



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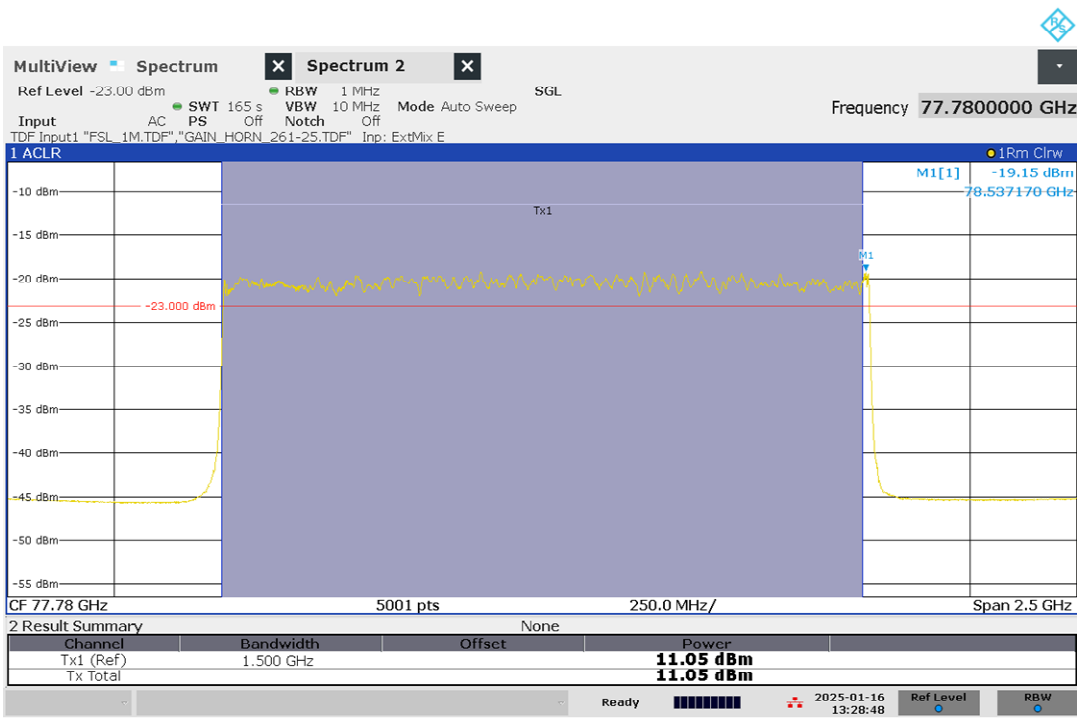
Plot 9: Channel power tested under extreme condition TnomVmax



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Plot 10: Channel power tested under extreme condition TnomVmin

8.2 99% Occupied Bandwidth

8.2.1 Measurement according to ANSI C63.10-2020, section 9.4

Spectrum Analyzer settings:

- OBW function activated
- Span: approximately 1.5 times the OBW, centered on the carrier frequency
- RBW, prefer 1% to 5% of OBW, or a minimum of 1 MHz
- VBW approx. 3 x RBW
- Sweep Time = Auto couple
- Detector = Peak
- Trace = Max-hold

8.2.2 Limits:

Lower edge limit (GHz)	Higher edge limit (GHz)
76	81

8.2.3 Test conditions and setup:

Test condition	EUT Set-Up	EUT operating mode
Nominal and extreme	1	1

8.2.4 Measurement result:

ISED requirement (RBW = 10 MHz)

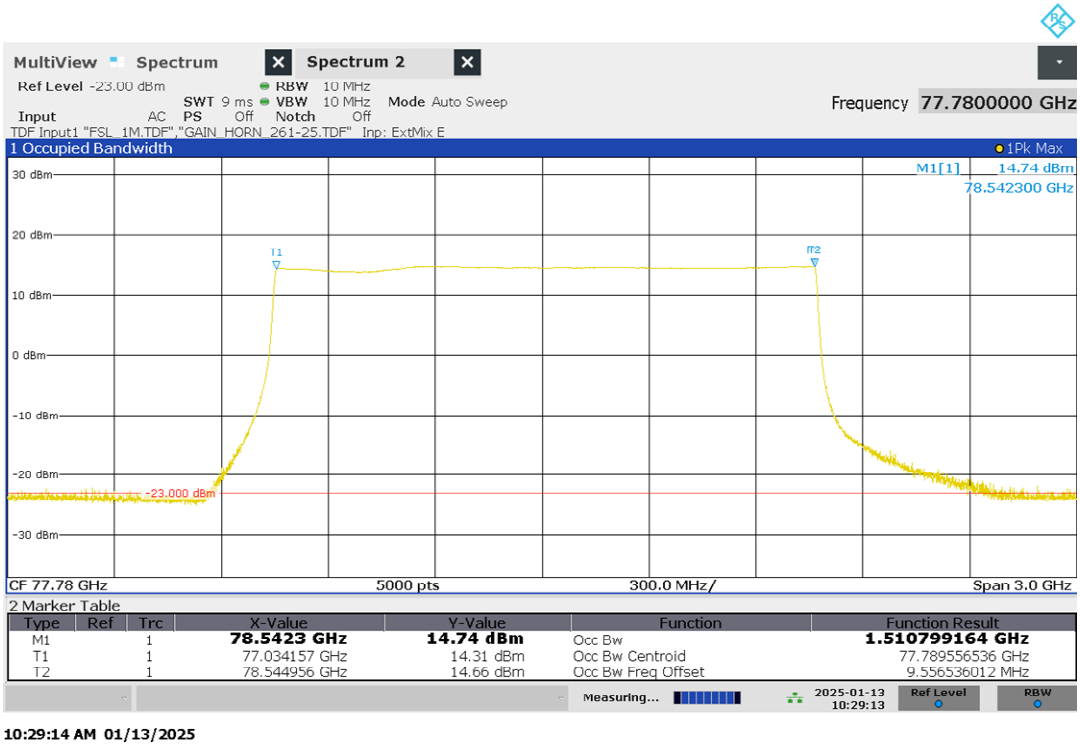
Plot	Test condition	OBW lower edge (GHz)	OBW higher edge (GHz)	OBW (GHz)	Result
1	TnomVnom	77.0342	78.5450	1.5108	For info only

FCC requirement (RBW = 1 MHz)

Plot	Test condition	OBW lower edge (GHz)	OBW higher edge (GHz)	OBW (GHz)	Result
1	TnomVnom	77.042	78.5392	1.4972	Pass
2	TmaxVnom	77.0385	78.5367	1.4982	Pass
3	TminVnom	77.0439	78.541	1.4971	Pass
4	TnomVmax	77.0423	78.5395	1.4972	Pass
5	TnomVmin	77.0422	78.5395	1.4972	Pass

Note: See section 8.1.5 for the measurement under nominal and extreme conditions.

8.2.5 Measurement plots:



Plot 1: bandwidth per ISED requirement (RBW = 10 MHz)

Remark: See section 8.1.5 for the rest of the OBW measurement taken with RBW = 1 MHz under nominal and extreme conditions.

8.3 Frequency Stability

8.3.1 Measurement according to ANSI C63.10-2020, section 9.5

Spectrum Analyzer settings:

- OBW function activated
- Span: approximately 2 to 3 times the emission bandwidth, centered on the carrier frequency
- RBW = 1 MHz, VBW = 3 MHz
- Sweep Time = Auto couple
- Detector = Peak
- Trace = Max hold

8.3.2 Limits:

Fundamental emissions must be contained within the frequency band 76-81 GHz during all conditions of operation, which is given by the manufacturer.

8.3.3 Test conditions and setup:

Test condition	EUT Set-Up	EUT operating mode
Nominal and extreme	1	1

8.3.4 Measurement result:

Plot	Test condition	OBW lower edge (GHz)	OBW higher edge (GHz)	Result
1	TnomVnom	77.042	78.5392	Pass
2	TmaxVnom	77.0385	78.5367	Pass
3	TminVnom	77.0439	78.541	Pass
4	TnomVmax	77.0423	78.5395	Pass
5	TnomVmin	77.0422	78.5395	Pass

Note 1: See section 8.1.5 for the measurement under nominal and extreme conditions.
Note 2: per applicant's declaration in sec.3.1, temperature ranges from -40 °C to +65 °C, voltage ranges from 10 V to 30 V.

8.3.5 Measurement Plots:

Remark: See section 8.1.5 for the measurement under nominal and extreme conditions.

8.4 Transmitter Spurious Emissions

8.4.1 Measurement according to ANSI C63.10

Analyzer Settings:

Frequency range	9 kHz – 30 MHz	30 MHz – 1 GHz	1 GHz – 40 GHz	40 GHz -243 GHz
Detector	Peak / Quasi Peak	Peak / Quasi Peak	Peak / RMS	Peak / RMS
RBW	9 kHz	120 kHz	1 MHz	1 MHz
Sweep time	Coupled (auto) time	Coupled (auto) time	Coupled (auto) time	2 * span / RBW * cycle time

- Radiated spurious emissions shall be measured for the transmit frequencies, transmit power, and data rate for the lowest, middle and highest channel in each frequency band of operation and for the highest gain antenna for each antenna type, and using the appropriate parameters and test requirements.
- The highest (or worst-case) emission level shall be recorded for each measurement.
- For testing frequencies below 30 MHz at distance other than the specified in the standard, the limit conversion is calculated by using the FCC materials for the ANSI 63 committee issued on January, 27 1991.
- For testing frequencies above 40 GHz external harmonic mixers are applied to down-convert the signal for the spectrum analyzer. The lack of tracking preselector for the external mixer can result in image frequencies, which requires confirmation. The spectrum analyzer applies the signal ID function to identify the image frequencies.

Measuring distance:

All measurements above 40 GHz are done in far-field of the measurement antenna. The far-field boundary $d_{\text{far-field}}$ is

$$d_{\text{far-field}} = {D^2}/{\lambda}$$

Where

D is the max. dimension size of the measurement antenna

λ is the wavelength of the measured emission.

The following table illustrates the far-field boundary for the setup of each test frequency range:

Frequency range	Dimension of the measurement antenna.	Min. Wavelength	Far-field boundary
GHz	m	m	m
40-60	0.0384	0.0050	0.295
50-75	0.0307	0.0040	0.236
60-90	0.0208	0.0033	0.131
90-140	0.0165	0.0021	0.130
140-200	0.0107	0.0015	0.076
220-231	0.00705	0.0013	0.038

In order to conduct measurements in the far-field and acquire adequate dynamic, the measurement antenna is set at a distance less than 3 m to the EUT for frequency range above 40 GHz.

8.4.2 Limits:

FCC15.205 Restricted bands

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1]0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

- Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
- PEAK LIMIT = 74 dBµV/m
- AVG. LIMIT = 54 dBµV/m

- Except as shown in CFR 47 Part 15.205 paragraph (d), only spurious emissions are permitted in any of the frequency bands listed below

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

FCC §95.3379

From 40 GHz to 200 GHz, the power density limit is 600 pW/cm^2 at 3 m, which is equivalent to -1.7 dBm EIRP.
From 200 GHz to 243 GHz, the power density limit is 1000 pW/cm^2 at 3 m, which is equivalent to 0.5 dBm EIRP.
The limit conversion is according to ANSI C63.10 formula (25):

$$PD = \frac{EIRP_{Linear}}{4\pi d^2}$$

Where

PD is the power density at the distance specified by the limit, in W/m^2
EIRP$_{Linear}$ is the equivalent isotropic radiated power, in watts
D is the distance at which the power density limit is specified, in m

8.4.3 Test conditions and setup:

Test condition	EUT Set-Up	EUT operating mode
Nominal	1	1

8.4.4 Measurement result:

Plot	Scan Frequency	Spurious emission level with lowest margin	Result
1	9 kHz – 30 MHz	48.920 dBµV/m (QP)	Pass
2	30 MHz – 1 GHz	40.480 dBµV/m (QP)	Pass
3	1 – 3 GHz	38.655 dBµV/m (AV)	Pass
4	3 – 18 GHz	24.424 dBµV/m (AV) *	Pass
5	18 – 40 GHz	59.459 dBµV/m (AV)	Pass
6	40 GHz - 60 GHz	-43 dBm (RMS) *	Pass
7	60 GHz - 90 GHz	-40 dBm (RMS) *	Pass
8	90 GHz - 140 GHz	-38 dBm (RMS) *	Pass
9	140 GHz – 170 GHz	-30 dBm (RMS) *	Pass
10	170 GHz – 220 GHz	-30 dBm (RMS) *	Pass
11	220 GHz – 243 GHz	-30 dBm (RMS) *	Pass

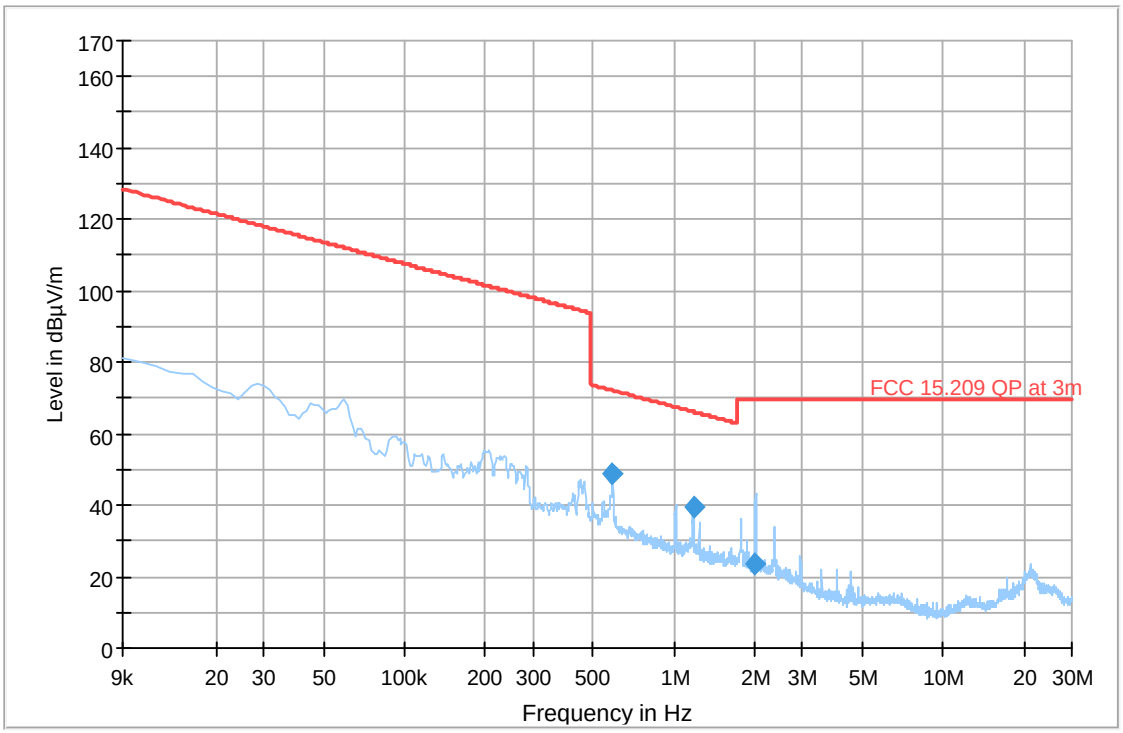
Note *: noise floor level.

8.4.5 Measurement Plots:

The worst case EUT position is determined by comparing fundamental emission level before the test. The tests are carried out at worst case position, which is the standing position.

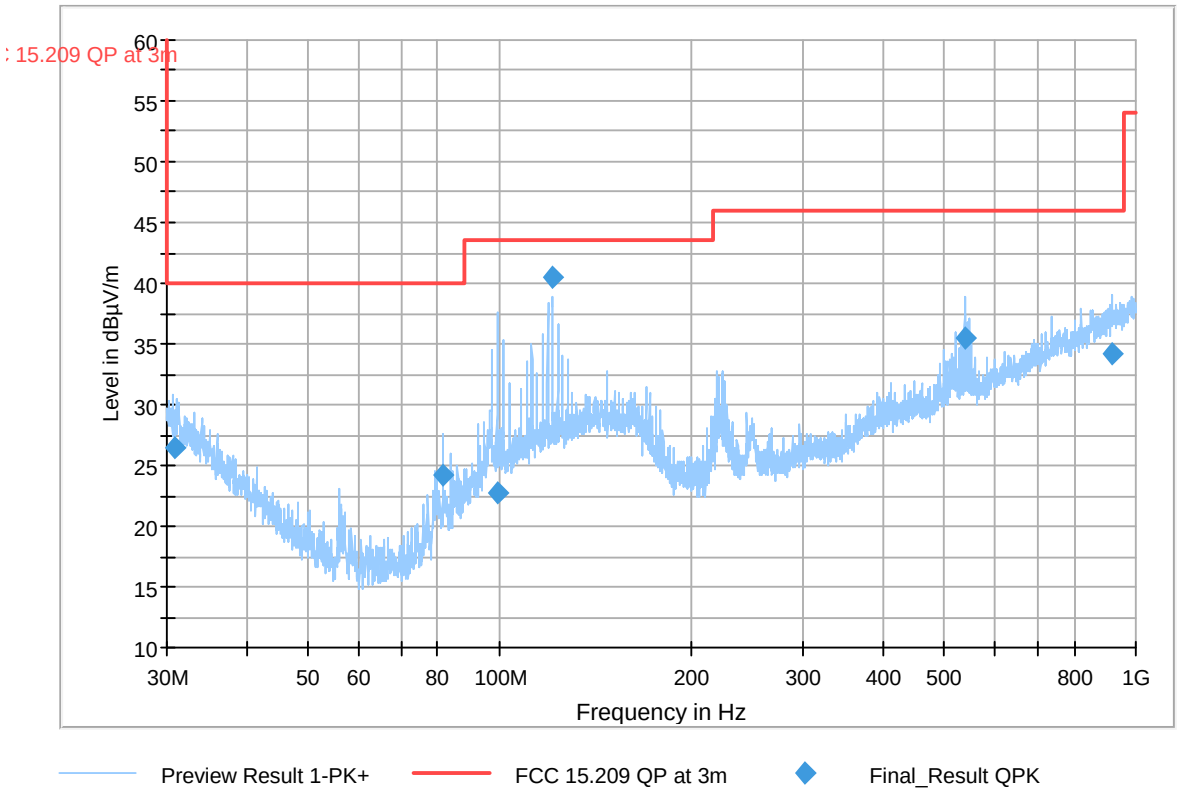
Plot 1: Radiated emissions 9 kHz – 30 MHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
0.592	48.920	72.17	23.24	500.0	9.0	100.0	V	5.0	23.0	0.2	-28.7	51.5	25.9
1.185	39.492	66.15	26.66	500.0	9.0	100.0	H	9.0	17.3	0.2	-28.7	45.8	22.2
2.013	23.470	69.50	46.03	500.0	9.0	100.0	V	34.0	13.3	0.3	-28.7	41.7	10.2



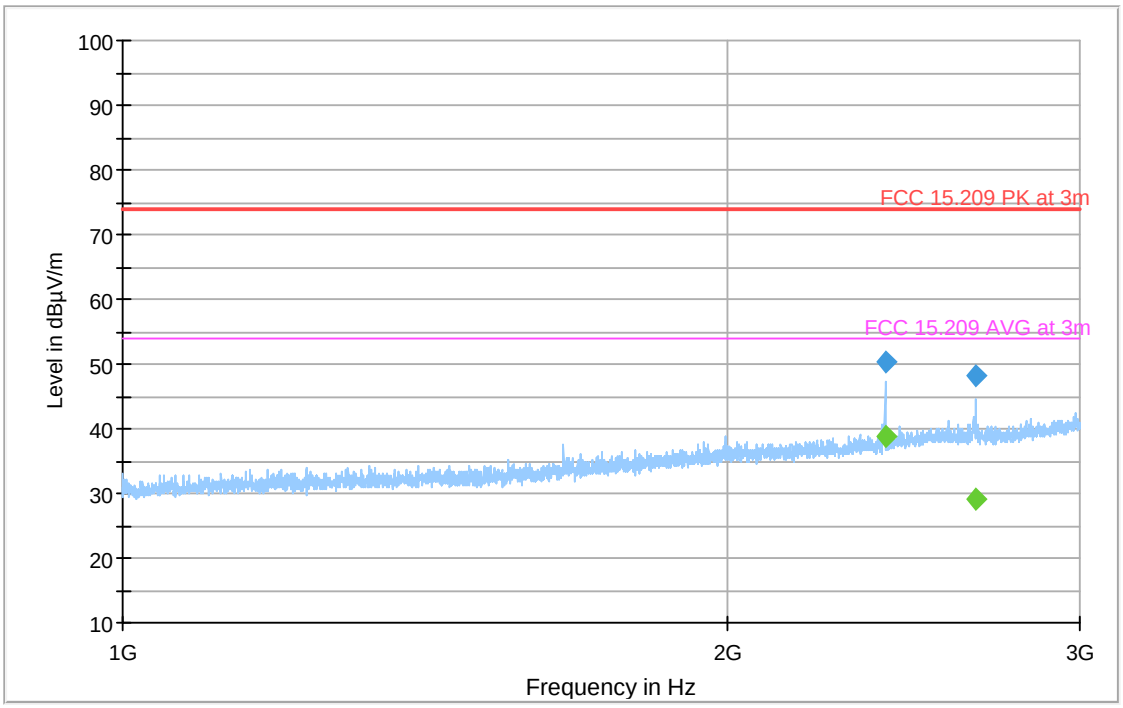
Plot 2: Radiated emissions 30 MHz – 1 GHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
30.779	26.399	40.00	13.60	500.0	120.0	303.0	H	273.0	25.1	0.5	0.0	24.6	1.3
81.576	24.234	40.00	15.77	500.0	120.0	126.0	V	220.0	16.3	0.9	0.0	15.5	7.9
99.630	22.764	43.50	20.74	500.0	120.0	167.0	V	285.0	21.2	1.0	0.0	20.2	1.6
121.273	40.480	43.50	3.02	500.0	120.0	100.0	V	195.0	24.2	1.0	0.0	23.2	16.3
540.297	35.445	46.02	10.58	500.0	120.0	100.0	H	163.0	26.6	2.2	0.0	24.4	8.8
918.014	34.238	46.02	11.78	500.0	120.0	357.0	V	175.0	31.7	2.8	0.0	28.9	2.5



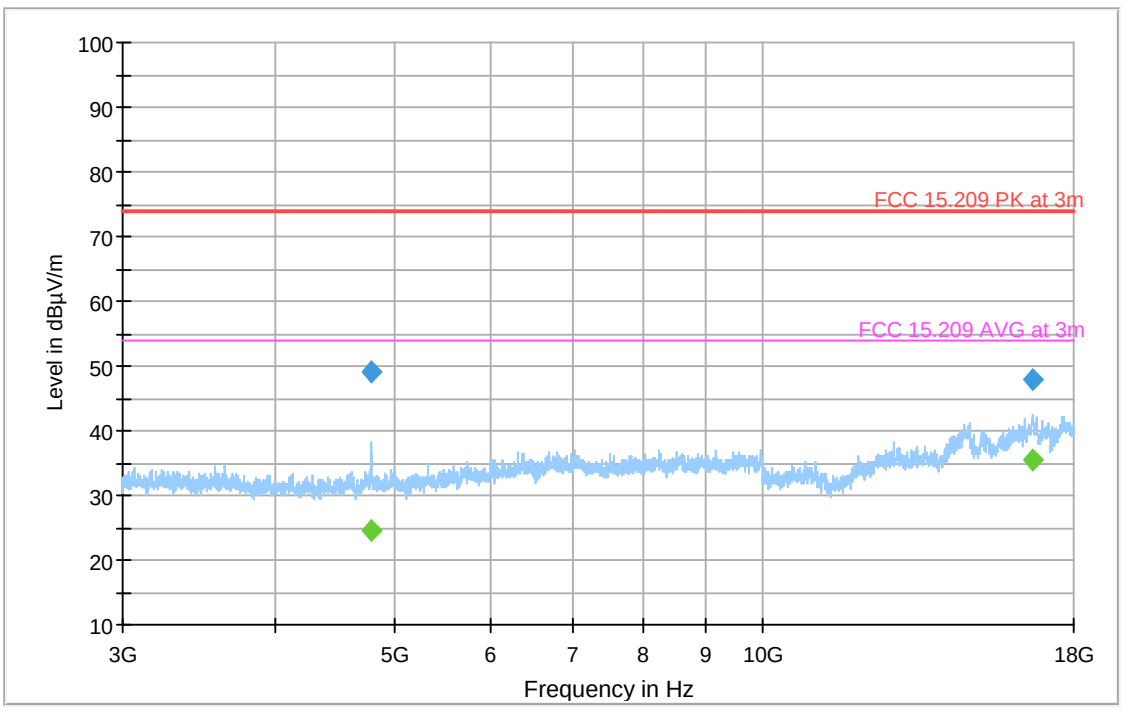
Plot 3: Radiated emissions 1 - 3 GHz

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
2399.900	---	38.655	53.98	15.32	500.0	1000.0	210.0	H	-63.0	32.8	4.7	0.0	28.1	5.8
2399.900	50.235	---	73.98	23.74	500.0	1000.0	210.0	H	-63.0	32.8	4.7	0.0	28.1	17.4
2663.200	---	29.108	53.98	24.87	500.0	1000.0	117.0	V	307.0	33.9	5.0	0.0	28.9	-4.8
2663.200	48.180	---	73.98	25.80	500.0	1000.0	117.0	V	307.0	33.9	5.0	0.0	28.9	14.3



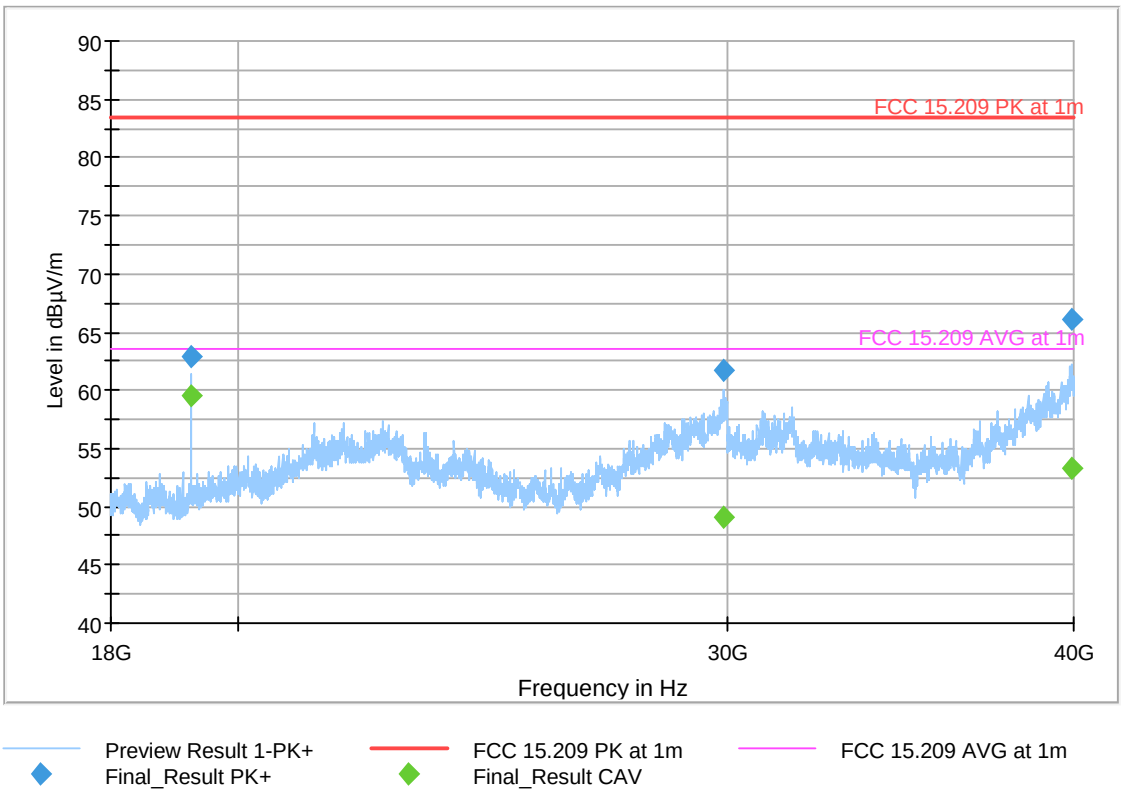
Plot 4: Radiated emissions 3 - 18 GHz

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
4792.520	48.987	---	73.98	24.99	500.0	1000.0	160.0	V	256.0	-4.6	
4792.520	---	24.424	53.98	29.56	500.0	1000.0	160.0	V	256.0	-4.6	
16654.418	47.765	---	73.98	26.21	500.0	1000.0	296.0	H	76.0	14.0	
16654.418	---	35.451	53.98	18.53	500.0	1000.0	296.0	H	76.0	14.0	

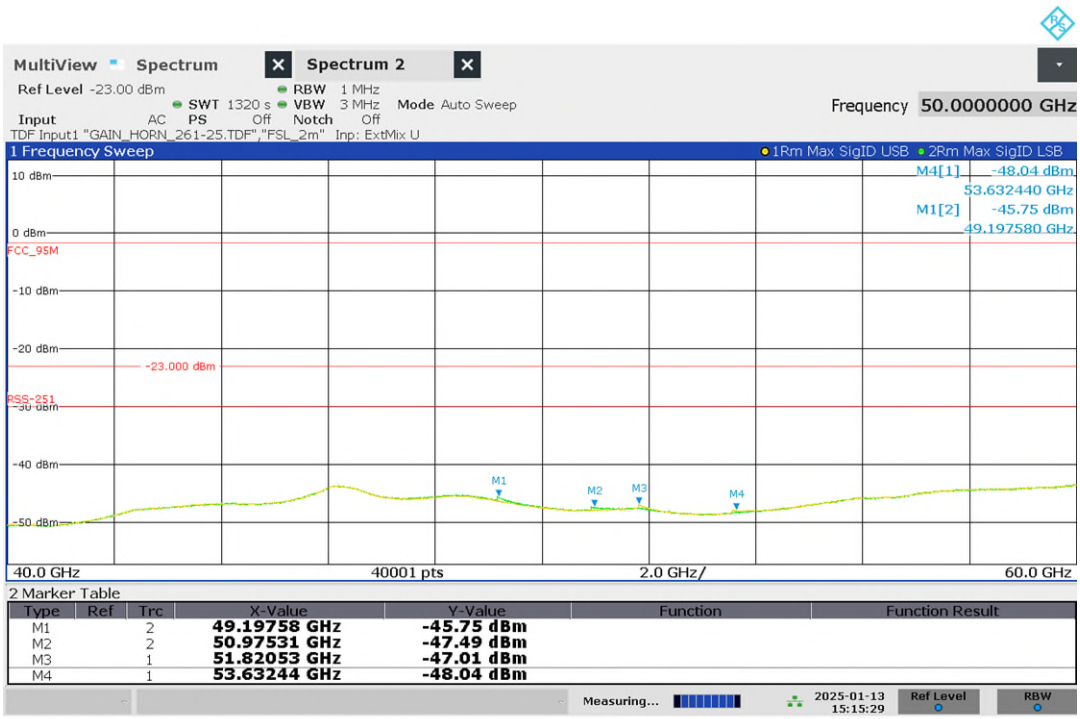


Plot 5: Radiated emissions 18 - 40 GHz

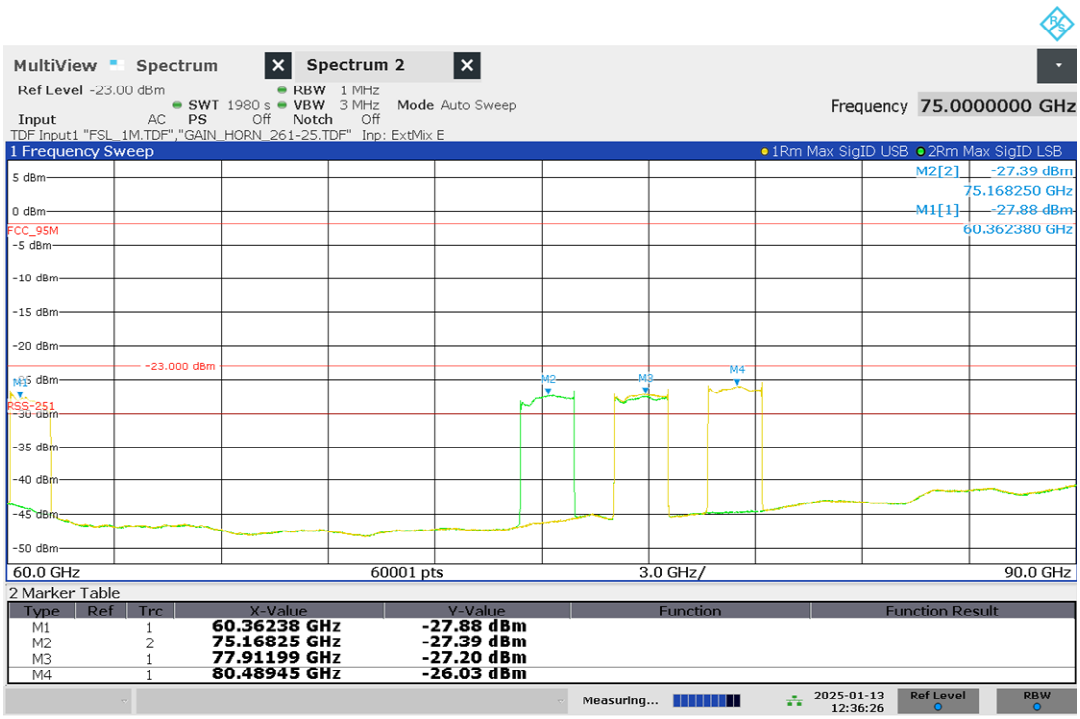
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
19249.500	62.854	---	83.50	20.65	500.0	1000.0	150.0	H	249.0	14.4	9.4	0.0	5.0	48.4
19249.500	---	59.459	63.50	4.04	500.0	1000.0	150.0	H	249.0	14.4	9.4	0.0	5.0	45.0
29900.625	61.774	---	83.50	21.73	500.0	1000.0	150.0	H	268.0	23.2	10.4	0.0	12.8	38.6
29900.625	---	49.121	63.50	14.38	500.0	1000.0	150.0	H	268.0	23.2	10.4	0.0	12.8	25.9
39925.938	---	53.282	63.50	10.22	500.0	1000.0	150.0	V	193.0	24.5	12.7	0.0	11.7	28.8
39925.938	66.113	---	83.50	17.39	500.0	1000.0	150.0	V	193.0	24.5	12.7	0.0	11.7	41.6



Plot 6: Radiated emissions 40 – 60 GHz

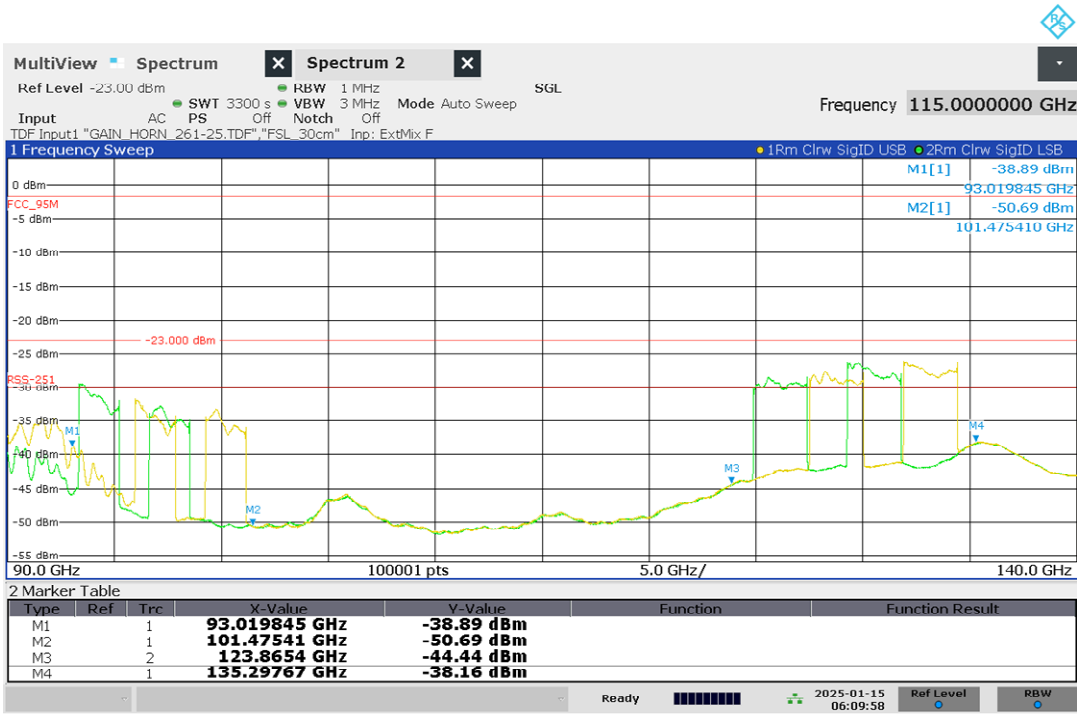


Plot 7: Radiated emissions 60 – 90 GHz



Remark: The emissions at marker M1, M2 and M4 are image signals. The emission at M3 is the wanted signal. They are all irrelevant to the limit.

Plot 8: Radiated emissions 90 – 140 GHz



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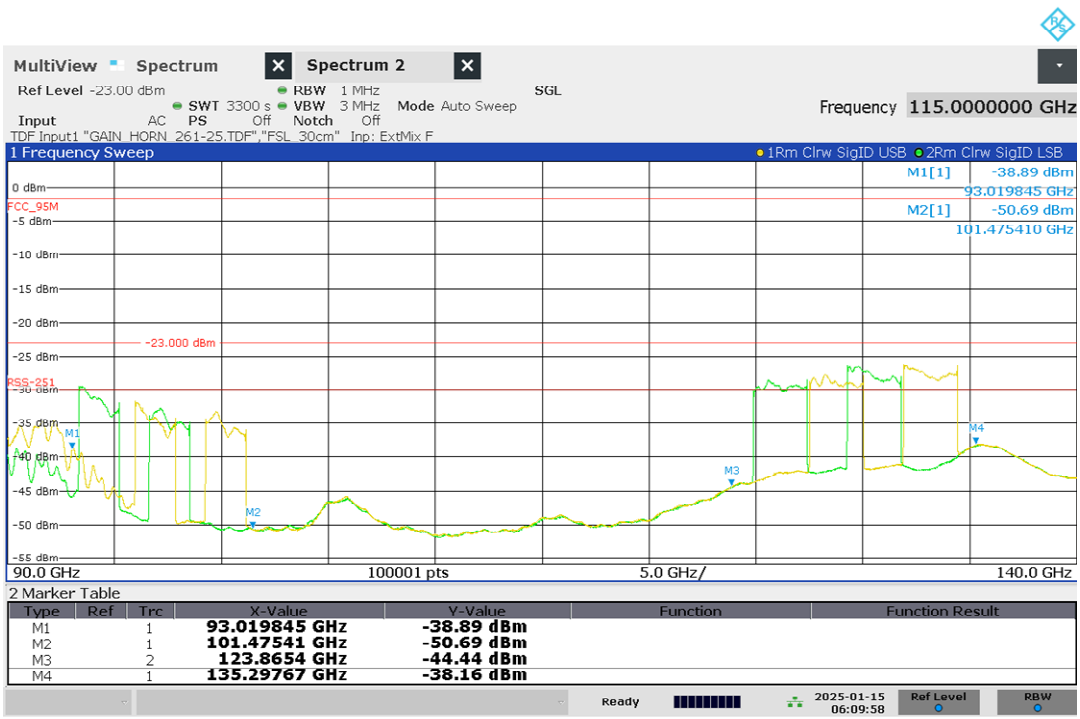
Remark: The emissions between marker M1 and M2 are image signals. So are the emissions between M3 and M4. They are all irrelevant to the limit.



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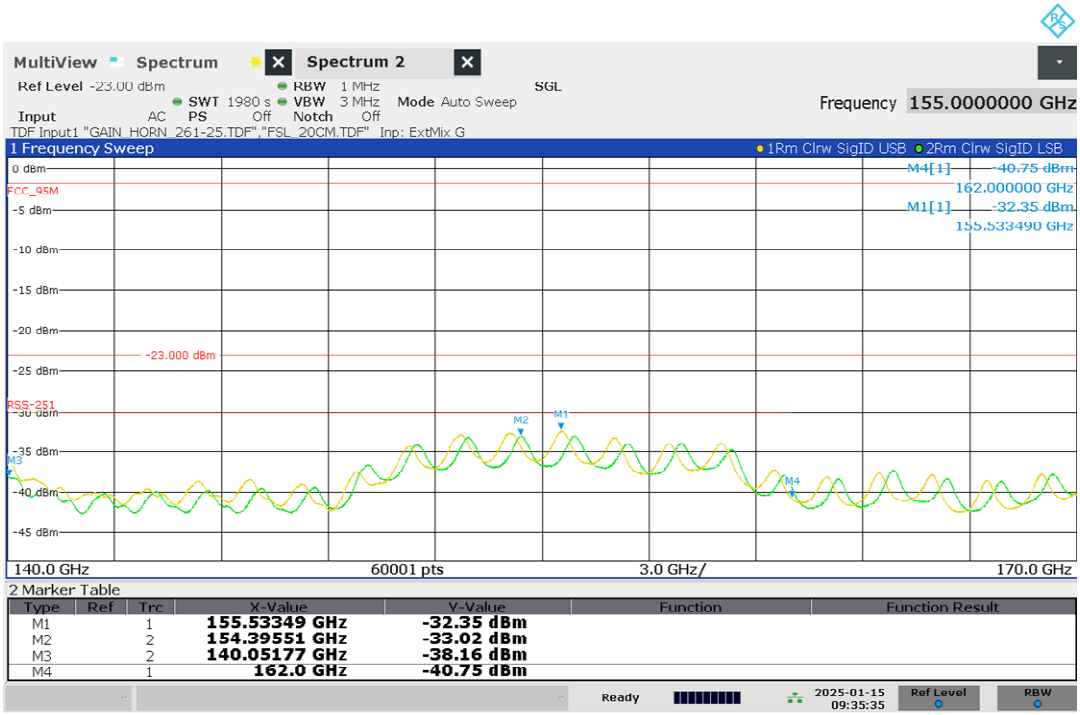
Plot 9: Radiated emissions 140 - 170 GHz



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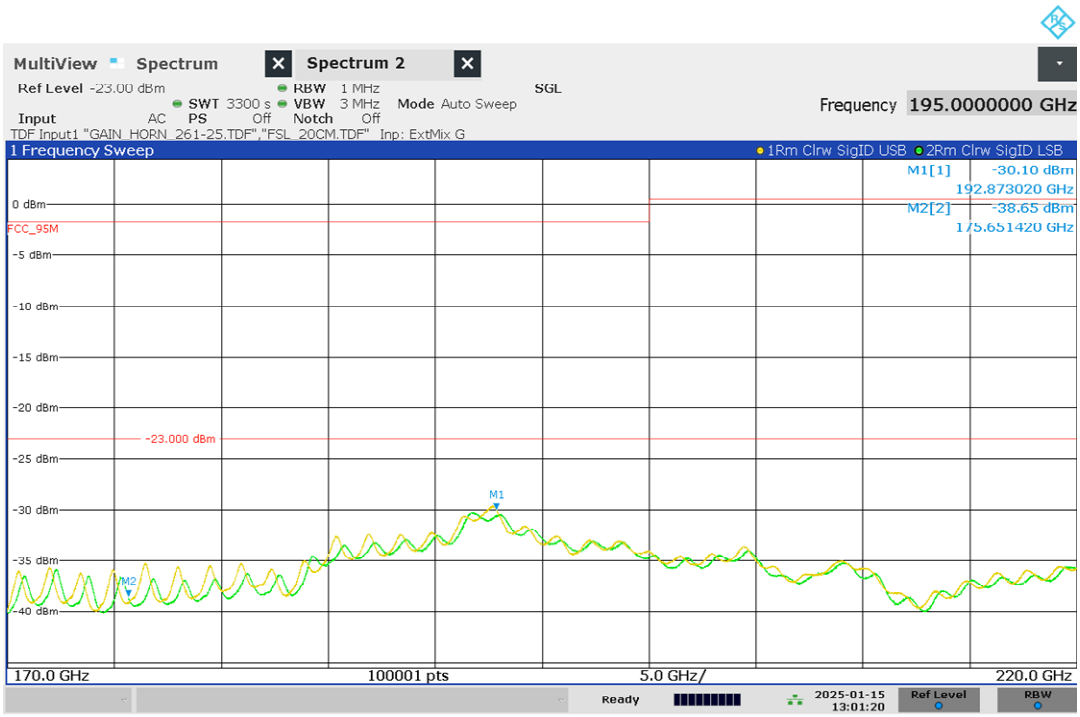
Plot 10: Radiated emissions 170 - 220 GHz



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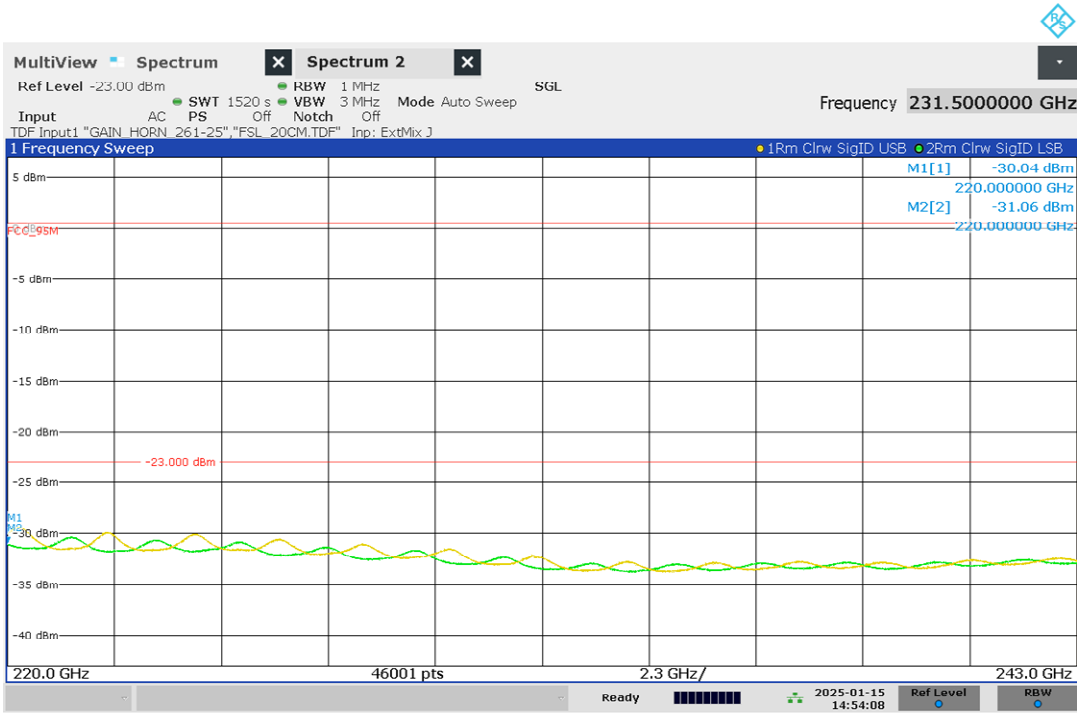
Plot 11: Radiated emissions 220 – 243 GHz



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9 Test setup photos

Setup photos are included in supporting file name:
"EMC_BANNE_011_24001_FCC95M_RSS251_Photos_Rev1.pdf"

10 Test Equipment And Ancillaries Used For Testing

Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
Standard gain horn antenna 40-60 GHz	MI-WAVE	261U-25/383	2021	-	N/A
Standard gain horn antenna 60-90 GHz	MI-WAVE	261E-25/387	2021	-	N/A
Standard gain horn antenna 90-140 GHz	MI-WAVE	261F-25/387	2021	-	N/A
Standard gain horn antenna 140-220 GHz	MI-WAVE	261G-25/387	-	-	N/A
External Mixer 40-60 GHz	R&S	FS-Z60	101025	3 Years	2/01/2022*
External Mixer 50-75 GHz	R&S	FS-Z75	102261	3 Years	2/01/2022*
External Mixer 60-90 GHz	R&S	FS-Z90	102088	3 Years	02/01/2022*
External Mixer 90-140 GHz	R&S	FS-Z140	101145	3 Years	2/01/2022*
External Mixer 140-220 GHz	R&S	FS-Z220	101037	3 Years	2/01/2022*
EMI Test Receiver	R&S	ESW 44	101715	3 Years	10/24/2023
Standard gain horn antenna 49.9-75.8 GHz	FLANN MICROWAVE	25240-20	273463	-	N/A
Oscilloscope	R&S	RTO 1014	1316.1000K14-300087-rf	2 Years	09/27/2023
Signal Generator	R&S	SMF 100A	105358	2 Year	09/27/2023
Frequency Multiplier	MI-WAVE	936EF-10/387	192	-	N/A
Level Setting Attenuator WR-12	ERAVANT	STA-30-12-M2	04778-01	-	N/A
Thermal Power Sensor	R&S	NRP110T	1424.6215K02-101295-xJ	3 years	11/25/2022
PASSIVE LOOP ANTENNA	ETS LINDGREN	6512	000164698	3 Years	09/06/2023
BILOG ANTENNA	A.H. SYSTEMS	BiLA2G	569	3 YEARS	10/30/2023
HORN ANTENNA	EMCO	3115	00035111	3 YEARS	10/26/2023
HORN ANTENNA	ETS LINDGREN	3117-PA	00167061	3 YEARS	9/25/2023
HORN ANTENNA	ETS LINDGREN	3116C-PA	00166821	3 YEARS	10/26/2023
ESW.EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW44	101715	3 YEARS	10/24/2023
DIGITAL THRMOMETER	Control Company	4410,90080-03	230712972	3 YEARS	10/18/2023

Note: Equipment used meets the measurement uncertainty requirements as required per applicable standards for 95% confidence levels. Calibration due dates, unless defined specifically, fall on the last day of the month. Items indicated "N/A" for cal status either do not specifically require calibration or is internally characterized before use.
Note *: In service date

11 Revision History

Date	Report name	Changes to report	Prepared by
2025-02-18	EMC_BANNE_011_24001_FCC95M_RSS251	Initial version	Guangcheng Huang
2025-03-14	EMC_BANNE_011_24001_FCC95M_RSS251 _Rev1	Updated test equipment list. Updated reference of the test procedure in sec.8.1. Updated plot 7, 9 in sec.8.4. Updated measurement distance consideration in sec.8.1. Updated model name.	Guangcheng Huang

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