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Test report

392162-2R1TRFWL

Date of issue: May 18, 2021

Applicant:

Texas Instruments Incorporated

Product:

Evaluation Board

Model:

IWR6843ISK

Specifications:

- FCC 47 CFR Part 15.255 Subpart C

Operation within the band 57 – 71 GHz.

Lab and test locations

Company name	Nemko USA Inc.
Address	2210 Faraday Ave, Suite 150
City	Carlsbad
State	California
Postal code	92008
Country	USA
Telephone	+1 760 444 3500
Website	www.nemko.com

Tested by	Martha Espinoza, Wireless Test Engineer
Reviewed by	James Cunningham, EMC/MIL/WL Supervisor
Review date	May 7, 2021
Reviewer signature	

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.
This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko USA's ISO/IEC 17025 accreditation.
This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

Copyright notification

Table of Contents

Section 1 Report summary

1.1 Test specifications

FCC 47 CFR Part 15.255, Subpart C	Title 47: Telecommunication; Part 15C— Operation within the band 57 – 71 GHz
ANSI C63.10-2013	American National Standard of procedures for compliance testing of unlicensed wireless devices

1.2 Exclusions

None

1.3 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was performed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

1.4 Test report revision history

Table 1.4-1: Test report revision history

Revision #	Details of changes made to test report
392162-2TRFWL	Original report issued
392162-2R1TRFWL	Legend on radiated emissions plots were added (Below 40 GHz)

Notes: None

Section 2 Summary of test results

2.1 Emissions Test results

Table 2.1-1: *FCC 47 CFR Part 15.203 results.*

Test description	Verdict
Antenna requirement	Pass

Notes: None

Table 2.1-2: *FCC 47 CFR Part 15.255C results.*

Test description	Verdict
Equivalent Isotropically Radiated Power (E.I.R.P.)	Pass
Occupied Bandwidth	Pass
Peak conducted output power	Pass
Transmitter spurious emissions	Pass
Frequency stability	Pass

Notes: None

Table 2.1-3: *FCC 47 CFR Part 15.207 results.*

Test description	Verdict
AC Line conducted emissions	Pass

Notes: None

Section 3 Equipment under test (EUT) details

3.1 Applicant

Company name	Texas Instruments Incorporated
Address	12500 TI Boulevard MS K1-20
City	Dallas
State	TX
Postal/Zip code	75243
Country	USA

3.2 Manufacturer

Company name	Texas Instruments Incorporated
Address	12500 TI Boulevard MS K1-20
City	Dallas
State	TX
Postal/Zip code	75243
Country	USA

3.3 Sample information

Receipt date	February 4, 2020
Nemko sample ID number	NEx: 392162

3.4 EUT information

Product name	Evaluation Board
Model	IWR6843ISK
Model variant	N/A
Serial number	N/A
Power requirements	5 VDC
Description/theory of operation	IWR6843ISK is an easy-to-use 60 GHz mmWave sensor evaluation kit based on IWR6843 device with long-range antenna. The IWR6843ISK may be used to evaluate the IWR6843 and IWR6443 devices. This board enables access to point-cloud data and power over USB interface.
Operational frequencies	Channel 1: 61-61.5 GHz (300 MHz BW) Channel 2: 57-64 GHz (1.3 GHz BW) Channel 3: 57-64 GHz (4 GHz BW)
Software details	N/A

3.5 EUT exercise and monitoring details

For this test, each channel was established through software provided by client (mmWave) using two USB cables connected between the EUT and a laptop. The signal was monitored with a spectrum analyzer using the adequate settings for each channel. Once the chosen channel is activated, the unit runs in a continuous mode.

3.6 EUT setup details

Table 3.6-1: *Support equipment*

Description	Brand name	Model/Part number	Serial number	Rev.
Laptop	Dell	Latitude	N/A	N/A
AC Adapter	Cui Inc.	SWI18-5-N	N/A	N/A

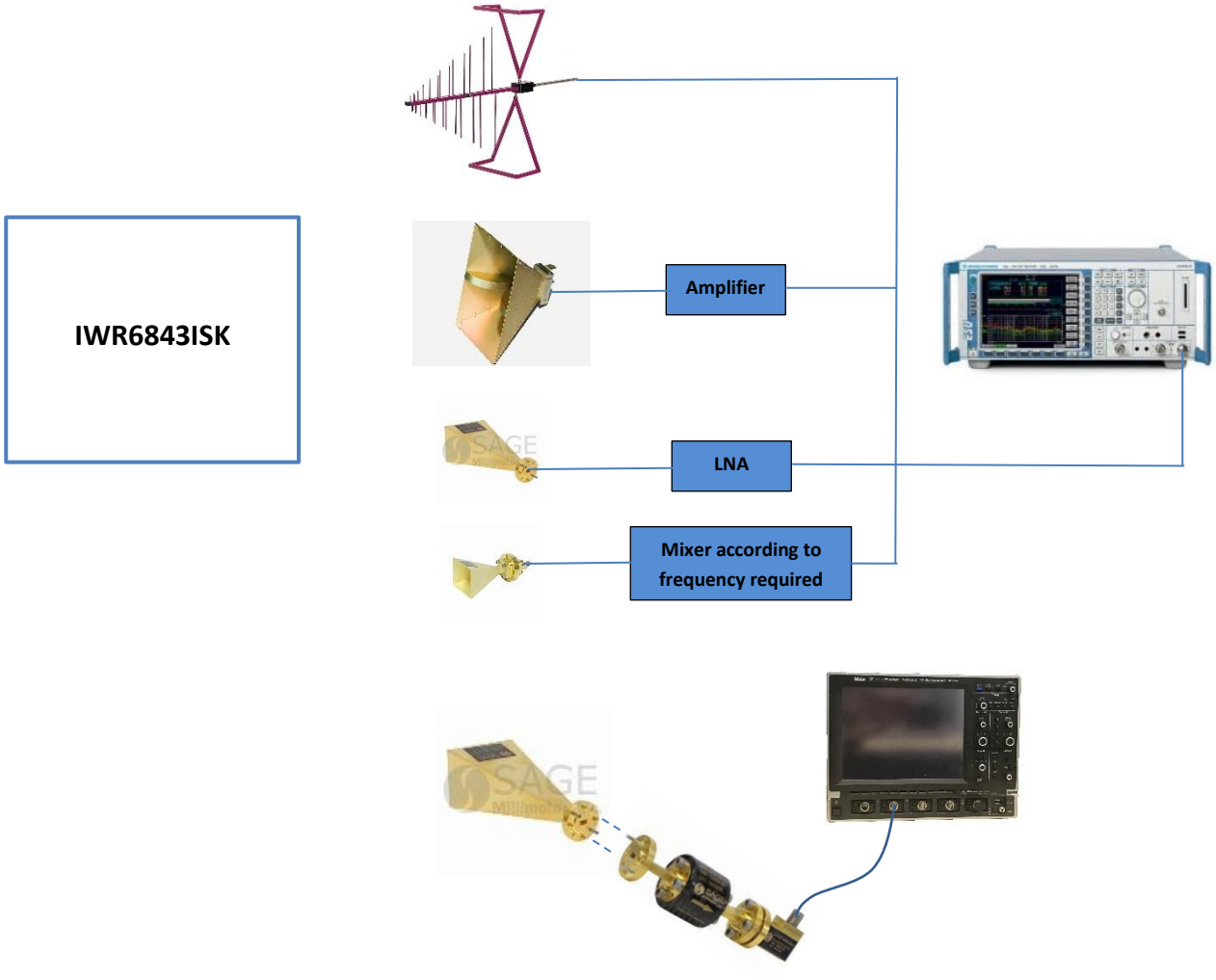
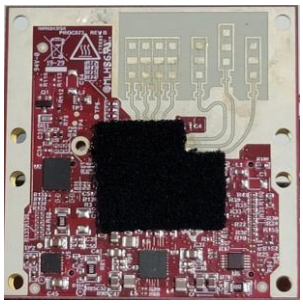


Figure 3.6-1: *EUT Test Setup*

Section 4 Engineering considerations

4.1 Modifications incorporated in the EUT

The following modifications were performed by client:
A carbon loaded foam (0.125”) pad was added on the following position, to reduce an emission spike showed on the range from 26 – 40 GHz:



Measurements completed with this foam, were: EIRP, Conducted power and all the radiated emissions above 26 GHz. Other tests were done without the foam showed in this section and all are valid as it was worst case than using the foam.

4.2 Technical judgment

None

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5 Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	86–106 kPa

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

Section 6 Measurement uncertainty

6.1 Uncertainty of measurement

Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of K = 2 with 95% certainty.

Table 6.1-1: *Measurement uncertainty.*

Test name	Measurement uncertainty, dB
All antenna port measurements/ including OBW	0.55
Conducted spurious emissions	1.13
Radiated spurious emissions	3.78
AC power line conducted emissions	1.38
Supply Voltages	0.05%
Time	2.09%

Important note: All testing in this document were done using the maximum radiation side of the antenna for covering the worst case in all the measurements.

Note: Compliance is deemed to occur if the measured values do not exceed the relevant limit.

Section 7 Testing data

7.1 Equivalent Isotropically Radiated Power (E.I.R.P.)

7.1.1 References

(2) For fixed field disturbance sensors that occupy 500 MHz or less of bandwidth and that are contained wholly within the frequency band 61.0-61.5 GHz, the average power of any emission, measured during the transmit interval, shall not exceed 40 dBm, and the peak power of any emission shall not exceed 43 dBm. In addition, the average power of any emission outside of the 61.0-61.5 GHz band, measured during the transmit interval, but still within the 57-71 GHz band, shall not exceed 10 dBm, and the peak power of any emission shall not exceed 13 dBm.

(3) For fixed field disturbance sensors other than those operating under the provisions of paragraph (c)(2) of this section, and short-range devices for interactive motion sensing, the peak transmitter conducted output power shall not exceed −10 dBm and the peak EIRP level shall not exceed 10 dBm.

(4) The peak power shall be measured with an RF detector that has a detection bandwidth that encompasses the 57-71 GHz band and has a video bandwidth of at least 10 MHz. The average emission levels shall be measured over the actual time period during which transmission occurs.

7.1.2 Test summary

Verdict	Pass		
Test date	April 12, 2021; April 16, 2021	Temperature	22 °C; 24 °C
Test engineer	Martha Espinoza	Air pressure	1006 mbar; 1003 mbar
Test location	3m semi anechoic chamber	Relative humidity	41 %; 50 %

7.1.3 Notes

This test performed using the procedure describe on ANSI C63.10-2013, section 9.11. The procedure indicates several steps using a measurement from EUT through a test antenna, a RF detector, and a digital oscilloscope. A substitution method is used replacing the EUT by a mmWave source to match the delivered power by mmWave source to the EUT. From this data, some calculus was done to determine the EIRP (peak and average for signals with bandwidth equal or less than 500 MHz and within 61 – 61.5 GHz band. Peak for other bandwidths.) and the conducted power from equation (19), (22), (24) and (27) from ANSI C63.10-2013. Antenna gain from EUT declared by manufacturer: 7 dBi; Gain of the test antenna: 24 dBi
Three different scripts were provided by manufacturer corresponding to each occupied bandwidth tested: 300 MHz, 1300 MHz, and 4000 MHz.

7.1.4 Setup details

EUT setup configuration	Tabletop
Test facility	3M Semi anechoic chamber
Measuring distance	0.66 m (300 MHz); 0.055 m (1300 MHz); 0.062 m (4000 MHz)
Antenna height variation	1.62 m
Turn table position	0°
Measurement details	The EUT was measured in the maximum field strength emission.

Receiver/spectrum analyzer settings for frequencies above 1 GHz:

Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Detector mode	Peak and Average (300 MHz); Peak (1300 MHz and 4000 MHz)
Trace mode	Max Hold

Table 7.1-1: *Radiated EIRP equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Antenna, Horn	Sage Millimeter	SAR-2408-15-S2	E1152	NCR	NCR
Signal analyzer	Rohde & Schwarz	FSV40	E1120	11-19-2019	11-19-2021
Mixer	Rohde & Schwarz	FS-Z75	E1149	NCR	NCR
Signal generator	Rohde & Schwarz	SMB100A	E1128	12-14-2020	12-14-2021
Digital oscilloscope	LeCroy	WS64MXS-B	E1041	12-18-2020	12-18-2021
V-Band X2, Passive Frequency Multiplier	Sage	SFP-152KF-S2	N/A	NCR	NCR
RF Detector	Eravant	STD-15SF-PI	E1310	NCR	NCR

Notes: NCR - no calibration required

7.1.5 Test data

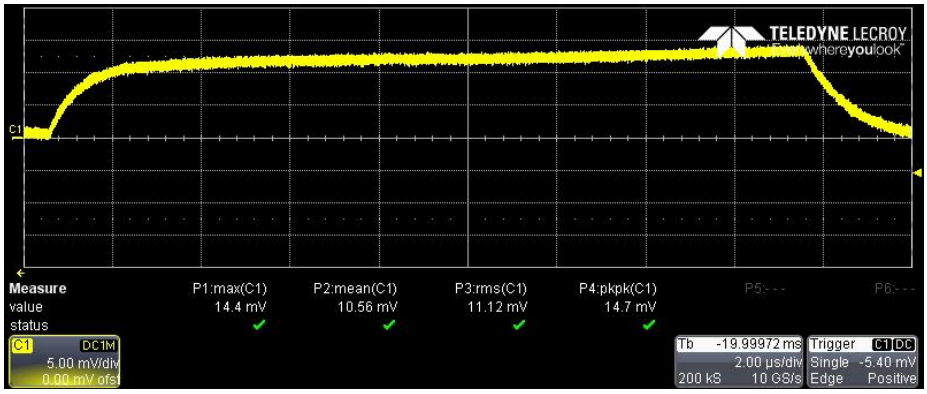


Figure 7.1-1: *300 MHz occupied bandwidth signal, view on oscilloscope.*

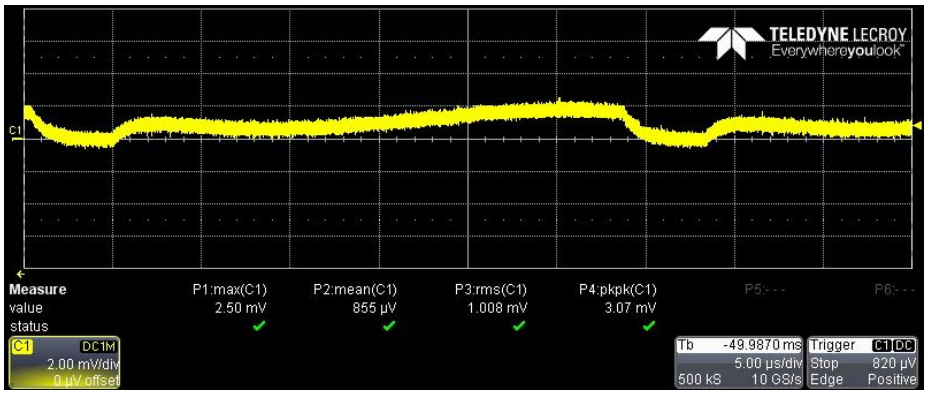


Figure 7.1-2: *1300 MHz occupied bandwidth signal, view on oscilloscope.*

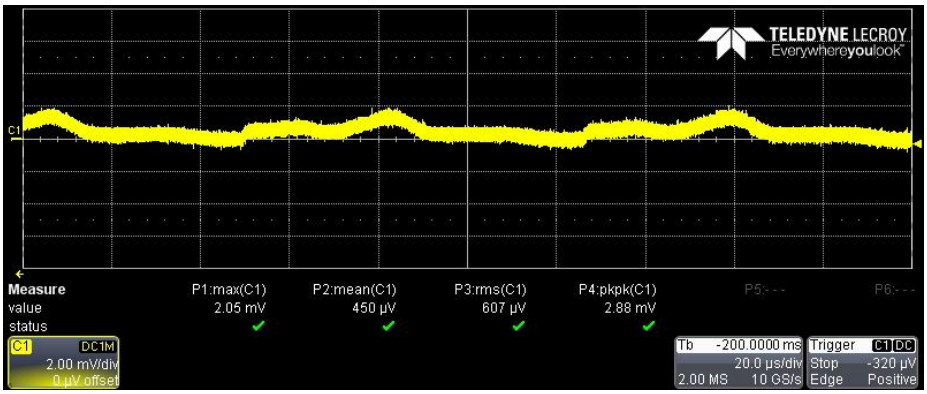


Figure 7.1-3: *4000 MHz occupied bandwidth signal, view on oscilloscope.*

7.1.5 Test data, continued

Center Frequency (GHz)	Bandwidth (MHz)	Power (dBm)	Radiated Power (dBuv/m) (Calculated – see example below)	EIRP (dBm) (Calculated – see example below)	Limit (dBm)	Margin (dB)
61.25505455 (Peak)	300	-25.00	124.00	15.692	+43	27.308
61.25505455 (Av)		-26.08	122.93	14.612	+40	25.388
60.9212431 (Peak)	1300	-35.63	113.33	-16.570	+10	26.570
62.1231215 (Peak)	4000	-37.21	111.92	-16.940	+10	26.940

Table 7.1-2: *EIRP Results: 300 MHz, 1300 MHz and 4000 MHz.*

Using equation (19):

$$E = 126.8 - 20\log(\lambda) + P - G \qquad (19)$$

Where:

$\lambda = \frac{c}{f}$

c=3X10^8 m/s

E = Field strength of the emission at the measurement distance, in dBµv/m

P = Power measured at the output of the test antenna, in dBm

λ = Wavelength of the emission under investigation, in m.

G = Gain of the antenna test, in dBi

E = 126.8 – (20*log10(3e8/61.255054558e9))+(-25)-(24) = 124 dBµv/m

Using equation (22):

$$\mathrm{EIRP} = E_{\mathrm{Meas}} + 20\log(d_{\mathrm{Meas}}) - 104.7 \qquad (22)$$

EIRP = Equivalent Isotropically Radiated Power, in dBm

E_{meas} = Field strength of the emission at the measurement distance, in dBµv/m

d_{meas} = Measurement distance, in m (0.66 m in this case)

EIRP = 124 + (20*log10(0.66))-104.7

EIRP = 15.692 dBm

7.2 Occupied bandwidth

7.2.1 References

§15.255 Operation within the band 57-71 GHz.
(e)(1) Transmitters with an emission bandwidth of less than 100 MHz must limit their peak transmitter conducted output power to the product of 500 mW times their emission bandwidth divided by 100 MHz. For the purposes of this paragraph, emission bandwidth is defined as the instantaneous frequency range occupied by a steady state radiated signal with modulation, outside which the radiated power spectral density never exceeds 6 dB below the maximum radiated power spectral density in the band, as measured with a 100 kHz resolution bandwidth spectrum analyzer. The center frequency must be stationary during the measurement interval, even if not stationary during normal operation (e.g., for frequency hopping devices).
ANSI C63.4-2014

7.2.2 Test summary

Verdict	Pass		
Test date	February 19, 2020; April 12, 2021;	Temperature	19 °C ; 22 °C
Test engineer	Martha Espinoza	Air pressure	1002mbar ; 1006mbar
Test location	3m semi anechoic chamber	Relative humidity	53 %; 41 %

7.2.3 Notes

7.2.4 Setup details

7.2.5 Setup details

EUT setup configuration	Tabletop
Test facility	3M Semi anechoic chamber
Measuring distance	3 m
Antenna height variation	1.62 m
Turn table position	0°

Receiver/spectrum analyzer settings for frequencies above 1 GHz:

Resolution bandwidth	100 kHz (6 dB OBW); 3 MHz and 10 MHz[1] (99% OBW)
Video bandwidth	300 kHz (6 dB OBW); 10 MHz and 40 MHz[1] (99% OBW)
Detector mode	Peak
Trace mode	Max Hold

Note: [1]This value is the maximum RBW permitted by used equipment.

7.2.5 Setup details, continued

Table 7.2-1: *Occupied bandwidth equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Antenna, Horn	Sage Millimeter	SAR-2408-15-S2	E1152	NCR	NCR
Signal analyzer	Rohde & Schwarz	FSV40	E1120	11-19-2019	11-19-2021
Mixer	Rohde & Schwarz	FS-Z75	E1149	NCR	NCR

Notes: NCR - no calibration required

7.2.6 Test data

Center Frequency (GHz)	Bandwidth (MHz)	6 dB BW (MHz)	99% BW (MHz)
61.25[1]	300	282.254	281.466
60.40[1]	1300	1259.092	1256.979
62.05[1]	4000	3642.140	3609.637

[1]Note: These frequencies center are approximate since the transmitting signal is making a sweep in a frequency range considering the occupied bandwidth.

Table 7.2-2: *Occupied Bandwidth Results: 300 MHz, 1300 MHz and 4000 MHz.*

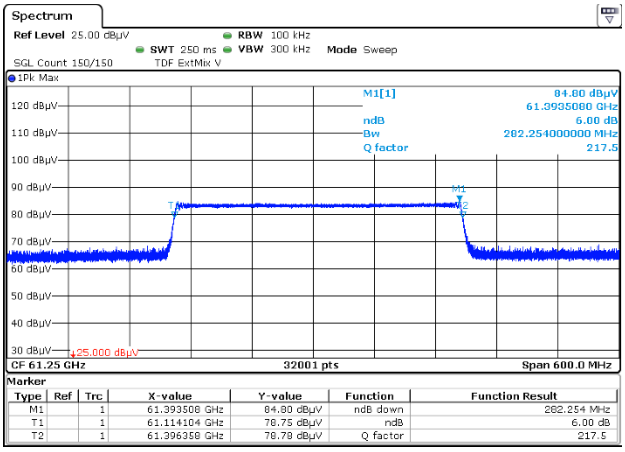


Figure 7.2-1: *6 dB OBW: 300 MHz bandwidth*

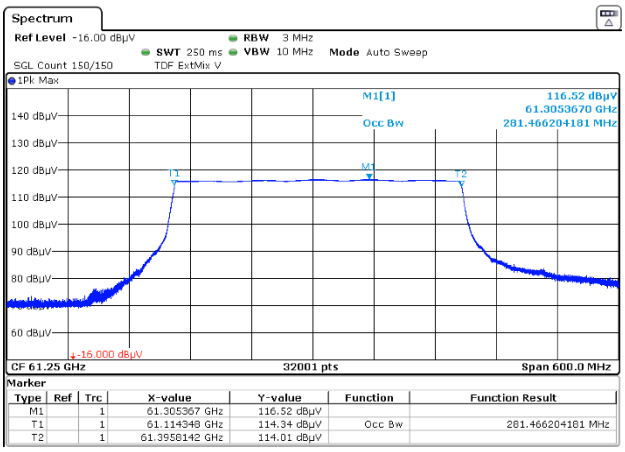


Figure 7.2-2: *99% OBW: 300 MHz bandwidth*

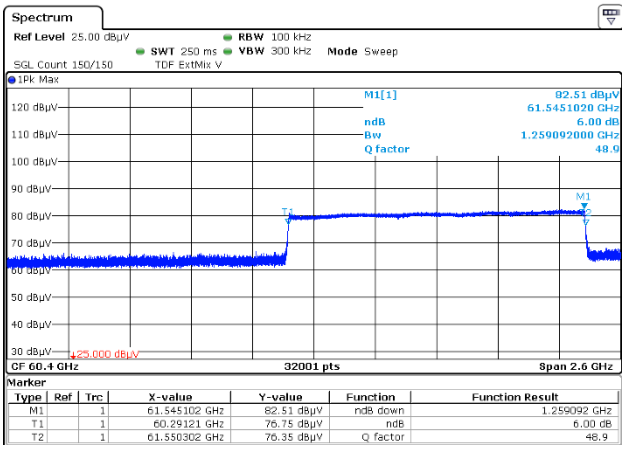


Figure 7.2-3: *6 dB OBW: 1300 MHz bandwidth*

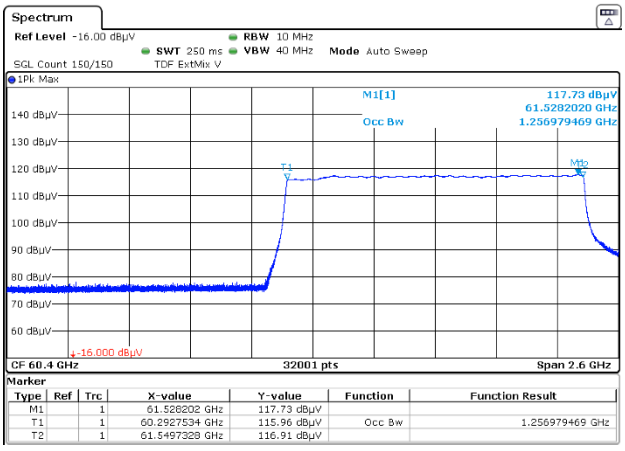


Figure 7.2-4: *99% OBW: 1300 MHz bandwidth*

7.2.6 Test data, continued

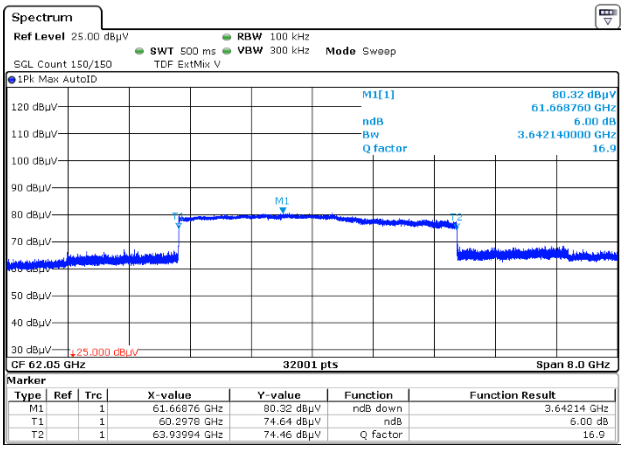


Figure 7.2-5: *6 dB OBW: 4000 MHz bandwidth*

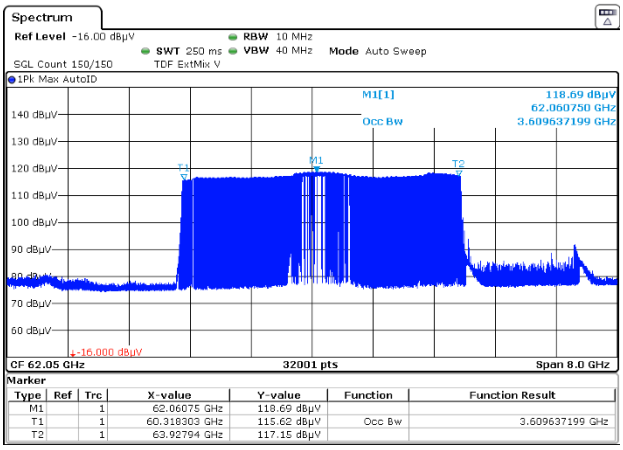


Figure 7.2-6: *99% OBW: 4000 MHz bandwidth*

7.3 Peak conducted output power

7.3.1 References

§15.255 Operation within the band 57-71 GHz.
(3) For fixed field disturbance sensors other than those operating under the provisions of paragraph (c)(2) of this section, and short-range devices for interactive motion sensing, the peak transmitter conducted output power shall not exceed −10 dBm and the peak EIRP level shall not exceed 10 dBm ANSI C63.4-2014

7.3.2 Test summary

Verdict	Pass		
Test date	April 16, 2021	Temperature	24 °C
Test engineer	Martha Espinoza, Wireless Test Engineer	Air pressure	1003 mbar
Test location	3m semi anechoic chamber	Relative humidity	50 %

7.3.3 Notes

These results were calculated from measurement results showed on section 7.1.

7.3.4 Setup details

EUT setup configuration	Tabletop
Test facility	3M Semi anechoic chamber
Measuring distance	0.66 m (300 MHz); 0.055 m (1300 MHz); 0.062 m (4000 MHz)
Antenna height variation	1.62 m
Turn table position	0°
Measurement details	The EUT was measured in the maximum field strength emission.

Receiver/spectrum analyzer settings for frequencies above 1 GHz:

Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Detector mode	Peak and Average (300 MHz); Peak (1300 MHz and 4000 MHz)
Trace mode	Max Hold

Table 7.3-1: *Radiated EIRP equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Antenna, Horn	Sage Millimeter	SAR-2408-15-S2	E1152	NCR	NCR
Signal analyzer	Rohde & Schwarz	FSV40	E1120	11-19-2019	11-19-2021
Mixer	Rohde & Schwarz	FS-Z75	E1149	NCR	NCR
Signal generator	Rohde & Schwarz	SMB100A	E1128	12-14-2020	12-14-2021
Digital oscilloscope	LeCroy	WS64MXS-B	E1041	12-18-2020	12-18-2021
V-Band X2, Passive Frequency Multiplier	Sage	SFP-152KF-S2	N/A	NCR	NCR
RF Detector	Eravant	STD-15SF-PI	E1310	NCR	NCR

Notes: NCR - no calibration required

7.3.4 Test data

These results were calculated from the subtraction from maximum antenna gain declared by manufacturer from the EIRP

Center Frequency (GHz)	Bandwidth (MHz)	EIRP (dBm)	Antenna Gain (dBi)	PK Conducted power (dBm)	PK Conducted power (mW)	Limit (dBm)	Margin (mw)
61.258	300	15.691	7	8.691	7.398	No limit	
60.924	1300	-16.569	7	-23.569	0.00439	-10	13.569
62.124	4000	-16.939	7	-23.939	0.00403	-10	13.939

Table 7.3-2: *Peak conducted output power results: 300 MHz, 1300 MHz, and 4000 MHz.*

7.4 Transmitter spurious emissions

7.4.1 References

§15.255 Operation within the band 57-71 GHz.
(d) Limits on spurious emissions:
(1) The power density of any emissions outside the 57-71 GHz band shall consist solely of spurious emissions.
(2) Radiated emissions below 40 GHz shall not exceed the general limits in §15.209.
(3) Between 40 GHz and 200 GHz, the level of these emissions shall not exceed 90 pW/cm² at a distance of 3 meters.
(4) The levels of the spurious emissions shall not exceed the level of the fundamental emission.
ANSI C63.4-2014
Spurious radiated emissions below 40 GHz must comply with the general field strength limits of Section 15.209. Below 1000 MHz, measurements are made with a CISPR quasi-peak detector and above 1000 MHz measurements are made with an average detector with a 1 MHz RBW at 3 meters. From 40 GHz to 200 GHz the emissions must not exceed 90 pW/cm2 (18,000 µV/m) at 3 meters. Measurements are to be performed at the specified limit distance. If it is impractical to make measurements at the limit distance because of the distance or low signal levels, measurements may be performed at a closer distance but a low noise amplifier and/or a higher gain test antenna should be used to make measurements at the greatest distance from the EUT which provides an adequate signal to noise ratio to permit accurate amplitude measurements and extrapolated to the limit distance as specified in Section 15.31.
200443 D02 RF Detector Method v01

7.4.2 Test summary

Verdict	Pass		
Test date	March 25, 2020; March 26, 2020; March 24, 2021; March 25, 2021;	Temperature	25°C; 24 °C 22°C; 23 °C
Test engineer	Martha Espinoza	Air pressure	1001;1005 mbar 1003;1008 mbar
Test location	3m semi anechoic chamber	Relative humidity	45%; 34 % 53%; 46 %

7.4.3 Notes

This test was done at 3M of distance using the maximum radiated energy from the EUT. The spectrum was explored from 30 MHz to 200 GHz.
Calculation from limit line for this test:

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

Where:
PD = Power density at the distance specified by the limit, in w/cm²
$EIRP_{Linear}$ = Equivalent Isotropically Radiated Power, in watts.
d = Distance at which the power density limit is specified, in cm
$EIRP_{Linear} = (PD)(4\pi)(d^2)$
$EIRP_{Linear} = (90x10^{-12})(4\pi)(300^2)$
$EIRP_{Linear} = 0.10178\ mw \approx 85.31$ dBµv/m @ 3m

From 40 GHz to 200 GHz measurements were made at a 1m distance to ensure at least a limit line 6 dB above from noise floor. At 1m, the limit line is:

$$E_{SpecLimit} = E_{Meas} + 20\ Log\left(\frac{d_{Meas}}{d_{SpecLimit}}\right)$$

$$E_{SpecLimit} = 85.31 + 20\ Log\left(\frac{3}{1}\right) \approx 94.85\ dB\mu v/m\ @\ 1\ m$$

7.4.4 Setup details

EUT setup configuration	Table top
Test facility	3m Semi anechoic chamber
Measuring distance	3m
Antenna height variation	1–4 m
Turn table position	0–360°
Measurement details	A preview measurement was generated with receiver in continuous scan or sweep mode while the EUT was rotated and antenna adjusted to maximize radiated emission. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiver/spectrum analyzer settings for frequencies below 1 GHz:

Resolution bandwidth	120 kHz
Video bandwidth	300 kHz
Detector mode	– Peak (Preview measurement) – Quasi-peak (Final measurement)
Trace mode	Max Hold
Measurement time	– 100 ms (Peak preview measurement) – 5000 ms (Quasi-peak final measurement)

Receiver/spectrum analyzer settings for frequencies from 1 GHz to 40 GHz:

Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Detector mode	Peak (Preview measurement) Peak and CAverage (Final measurement)
Trace mode	Max Hold
Measurement time	– 100 ms (Peak preview measurement) – 5000 ms (Peak and CAverage final measurement)

Receiver/spectrum analyzer settings for frequencies above 40 GHz:

Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Detector mode	Average
Trace mode	Max Hold

7.4.4. Setup details, continued

Table 7.4-1: *Transmitter spurious emissions equipment list*

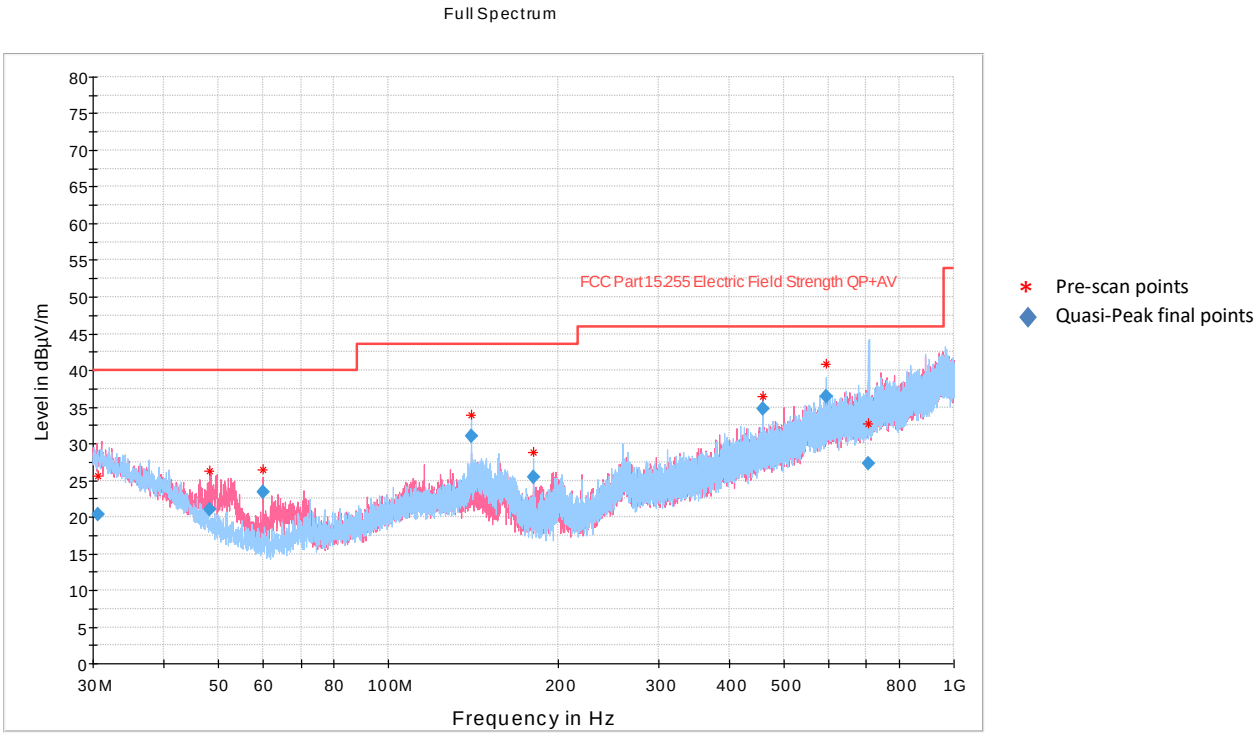
Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMC Test Receiver	Rohde & Schwarz	ESU 40	E1121	12-01-2020	12-01-2021
Signal Analyzer	Rohde & Schwarz	FSV 40	E1120	11-19-2019	11-19-2021
Signal Generator	Rohde & Schwarz	SMB 100A	E1128	12-14-2020	12-14-2021
Antenna, Bilog	Schaffner-Chase	CBL6111C	1480	10-28-2020	10-28-2021
Antenna, Horn	ETS	3117-PA	E1160	12-02-2020	12-02-2021
Antenna, Horn	Sage Millimeter	SAR-2309-42-S2	E1143	11-13-2020	13-11-2022
Antenna, Horn	Sage Millimeter	SAR-2309-28-S2	E1148	11-05-2020	11-05-2022
Low Noise Amplifier	Sage Millimeter	SBL-1834034030-KFKF-SI	E1228	NCR	NCR
Antenna, Horn	Sage Millimeter	SAR-2309-19-S2	E1144	NCR	NCR
Mixer	Rohde & Schwarz	FS-Z60	E1138	NCR	NCR
Antenna, Horn	Sage Millimeter	SAR-2408-15-S2	E1152	NCR	NCR
Mixer	Rohde & Schwarz	FS-Z75	E1149	NCR	NCR
Antenna, Horn	Sage Millimeter	SAR-2507-10-S2	E1146	NCR	NCR
Mixer	Rohde & Schwarz	FS-Z110	E1154	NCR	NCR
Antenna, Horn	Sage Millimeter	SAR-2507-06-S2	E1182	NCR	NCR
Mixer	Radiometer Physics	HM110-170	E1178	NCR	NCR
Antenna, Horn	Sage Millimeter	SAR-2309-05-S2	E1184	NCR	NCR
Mixer	Radiometer Physics	HM140-220	E1177	NCR	NCR

Table 7.4-2: *Radiated disturbance test software details*

Manufacturer of Software	Details
Rohde & Schwarz	EMC 32 V10.00.00

Notes: None

7.4.5 Test data



The spectral plot shows a vertical and horizontal scan with different colors. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

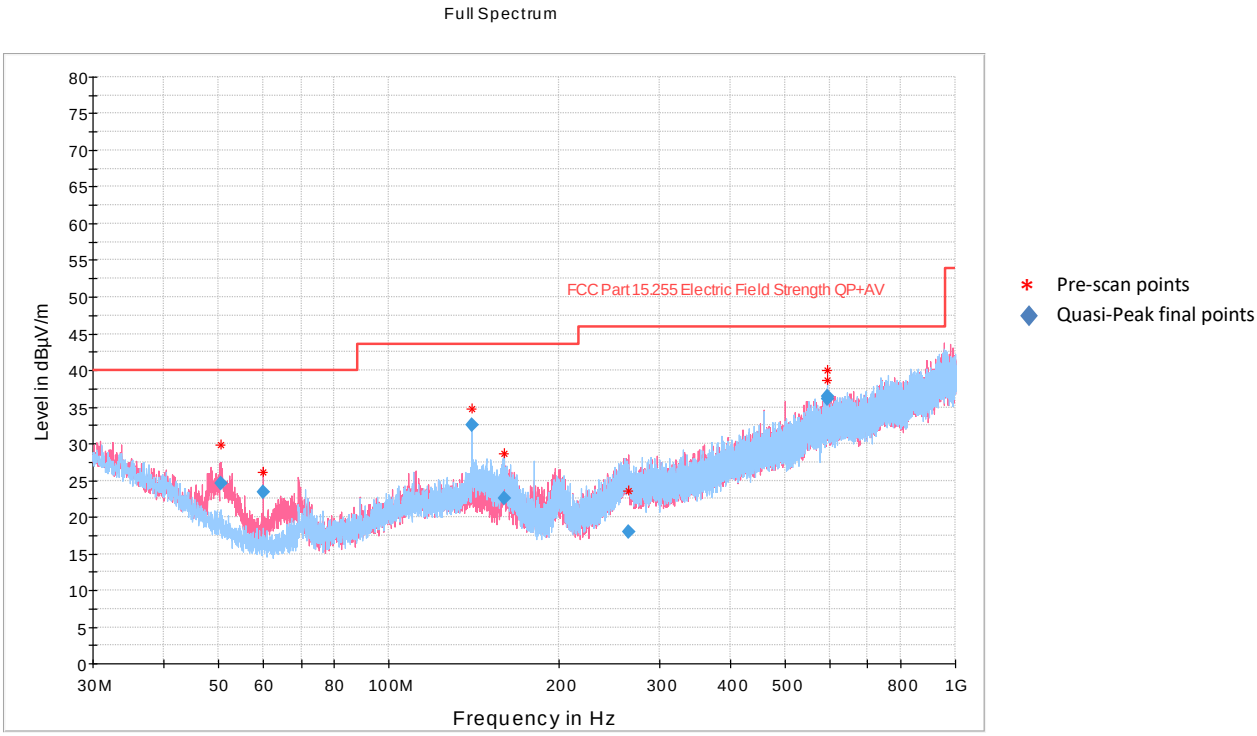
Figure 7.4-1: *Radiated disturbance spectral plot (30 to 1000 MHz): 300 MHz OBW*

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.542333	20.33	40.00	19.67	5000.0	120.000	237.0	V	279.0	25.0
48.236000	20.98	40.00	19.02	5000.0	120.000	151.0	V	200.0	15.7
60.013000	23.33	40.00	16.67	5000.0	120.000	115.6	V	121.0	12.4
139.998000	31.08	43.50	12.42	5000.0	120.000	280.5	H	66.0	18.8
179.986667	25.47	43.50	18.03	5000.0	120.000	252.6	H	216.0	16.5
459.981000	34.78	46.00	11.22	5000.0	120.000	212.5	H	186.0	26.0
593.982667	36.38	46.00	9.62	5000.0	120.000	146.3	H	302.0	29.4
706.668000	27.26	46.00	18.74	5000.0	120.000	320.6	H	216.0	30.5

Table 7.4-3: *Radiated disturbance (Quasi-Peak) results: 300 MHz OBW*

Notes:
[1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB)
[3] The maximum measured value observed over a period of 5 seconds was recorded.

7.4.5 Test data, continued



The spectral plot shows a vertical and horizontal scan with different colors. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

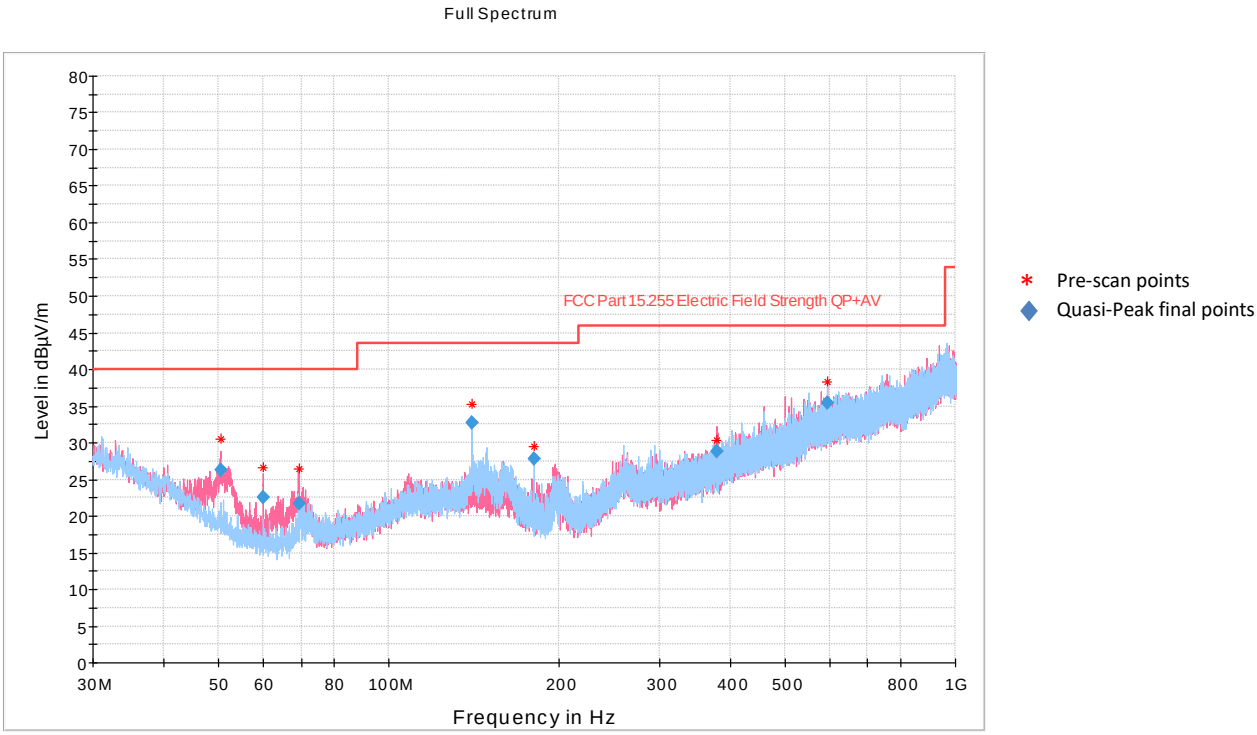
Figure 7.4-2: *Radiated disturbance spectral plot (30 to 1000 MHz): 1300 MHz OBW*

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
50.394667	24.64	40.00	15.36	5000.0	120.000	111.0	V	168.0	14.8
60.013000	23.37	40.00	16.63	5000.0	120.000	112.6	V	82.0	12.4
140.005667	32.62	43.50	10.88	5000.0	120.000	219.8	H	25.0	18.8
159.499667	22.57	43.50	20.93	5000.0	120.000	112.9	V	354.0	17.8
264.889333	17.94	46.00	28.06	5000.0	120.000	257.2	V	26.0	21.7
593.998000	36.37	46.00	9.63	5000.0	120.000	121.8	H	0.0	29.4
594.002667	36.02	46.00	9.98	5000.0	120.000	170.7	H	310.0	29.4

Table 7.4-4: *Radiated disturbance (Quasi-Peak) results: 1300 MHz OBW*

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB)
[3] The maximum measured value observed over a period of 5 seconds was recorded.

7.4.5 Test data, continued



The spectral plot shows a vertical and horizontal scan with different colors. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

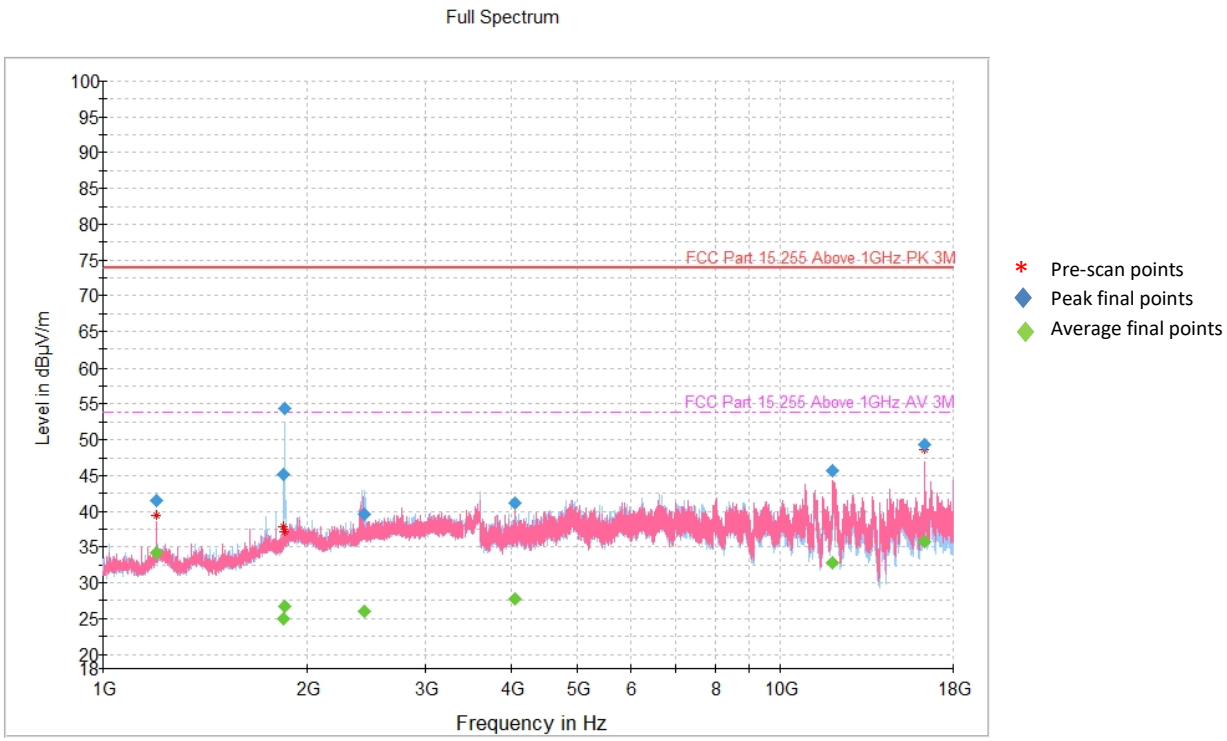
Figure 7.4-3: *Radiated disturbance spectral plot (30 to 1000 MHz): 4000 MHz OBW*

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
50.374667	26.21	40.00	13.79	5000.0	120.000	140.2	V	121.0	14.8
60.013000	22.62	40.00	17.38	5000.0	120.000	126.5	V	113.0	12.4
69.265000	21.71	40.00	18.29	5000.0	120.000	253.5	V	272.0	13.1
140.005667	32.67	43.50	10.83	5000.0	120.000	205.7	H	58.0	18.8
179.982000	27.77	43.50	15.73	5000.0	120.000	148.1	H	50.0	16.5
379.963667	28.80	46.00	17.20	5000.0	120.000	116.2	V	89.0	23.6
594.002667	35.47	46.00	10.53	5000.0	120.000	273.0	H	0.0	29.4

Table 7.4-5: *Radiated disturbance (Quasi-Peak) results: 4000 MHz OBW*

Notes:
[1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB)
[3] The maximum measured value observed over a period of 5 seconds was recorded.

7.4.5 Test data, continued



The spectral plot shows a vertical and horizontal scan with different colors. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

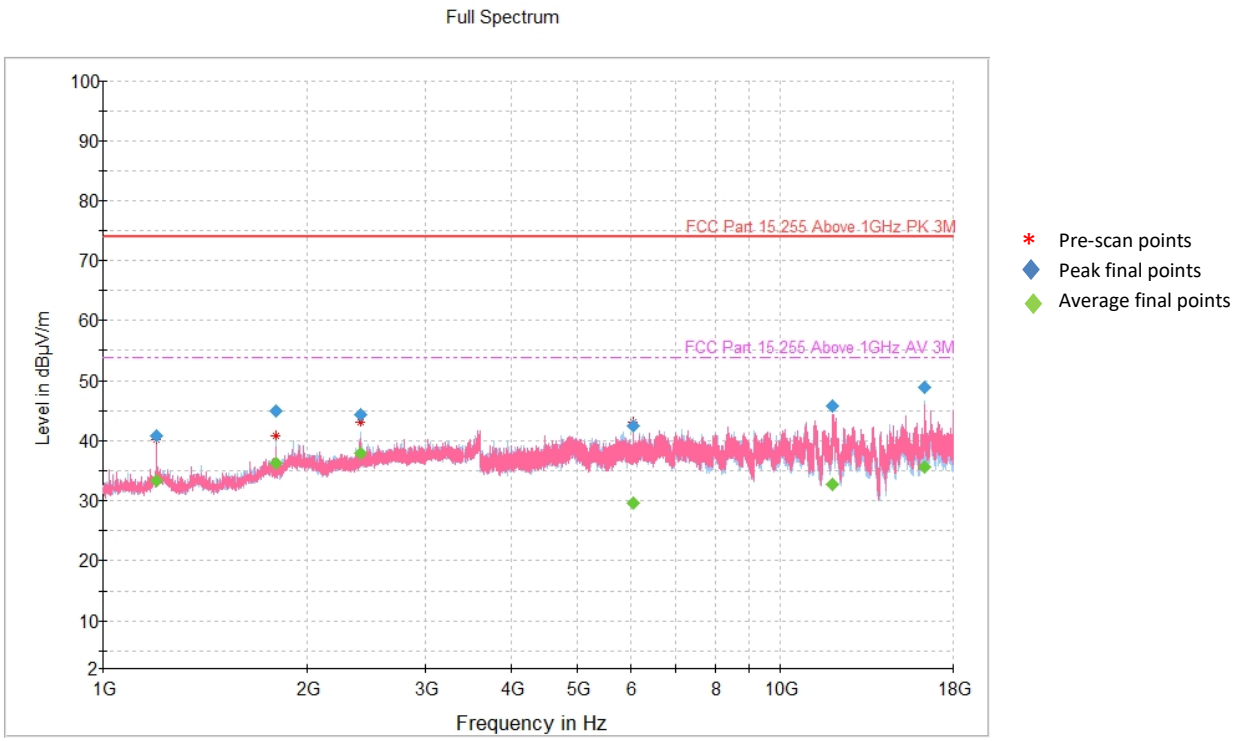
Figure 7.4-4: *Radiated disturbance spectral plot (1 to 18 GHz): 300 MHz OBW*

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)
1200.033333	---	34.28	53.90	19.62	5000.0	1000.000	277.0	V	354.0	-14.5
1200.033333	41.51	---	73.90	32.39	5000.0	1000.000	277.0	V	354.0	-14.5
1851.566667	---	25.03	53.90	28.87	5000.0	1000.000	123.0	H	94.0	-12.2
1851.566667	45.12	---	73.90	28.78	5000.0	1000.000	123.0	H	94.0	-12.2
1859.966667	---	26.66	53.90	27.24	5000.0	1000.000	362.0	H	34.0	-12.1
1859.966667	54.36	---	73.90	19.54	5000.0	1000.000	362.0	H	34.0	-12.1
2437.700000	---	25.94	53.90	27.96	5000.0	1000.000	346.0	H	224.0	-10.7
2437.700000	39.50	---	73.90	34.40	5000.0	1000.000	346.0	H	224.0	-10.7
4045.566667	---	27.82	53.90	26.08	5000.0	1000.000	148.0	V	153.0	-4.5
4045.566667	41.19	---	73.90	32.71	5000.0	1000.000	148.0	V	153.0	-4.5
11942.166667	---	32.74	53.90	21.16	5000.0	1000.000	371.0	V	139.0	3.4
11942.166667	45.67	---	73.90	28.23	5000.0	1000.000	371.0	V	139.0	3.4
16305.300000	---	35.74	53.90	18.16	5000.0	1000.000	271.0	V	231.0	10.3
16305.300000	49.42	---	73.90	24.48	5000.0	1000.000	271.0	V	231.0	10.3

Table 7.4-6: *Radiated disturbance (Peak and CAverage) results: 300 MHz OBW*

Notes:
[1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB) − amplifier gain (dB)
[3] The maximum measured value observed over a period of 5 seconds was recorded.

7.4.5 Test data, continued



The spectral plot shows a vertical and horizontal scan with different colors. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

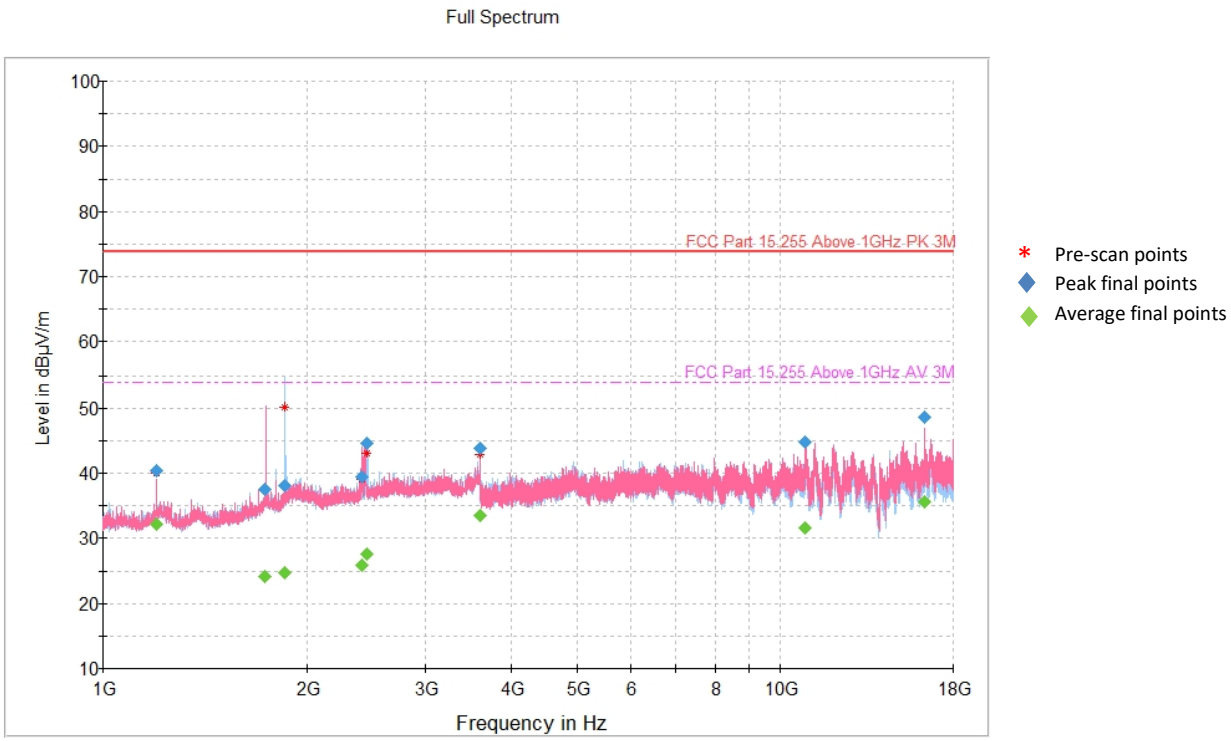
Figure 7.4-5: *Radiated disturbance spectral plot (1 to 18 GHz): 1300 MHz OBW*

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)
1199.866667	40.81	---	73.90	33.09	5000.0	1000.000	257.0	V	340.0	-14.5
1199.866667	---	33.46	53.90	20.44	5000.0	1000.000	257.0	V	340.0	-14.5
1799.966667	45.15	---	73.90	28.75	5000.0	1000.000	336.0	H	41.0	-12.9
1799.966667	---	36.27	53.90	17.63	5000.0	1000.000	336.0	H	41.0	-12.9
2400.066667	---	38.07	53.90	15.83	5000.0	1000.000	293.0	H	43.0	-11.0
2400.066667	44.48	---	73.90	29.42	5000.0	1000.000	293.0	H	43.0	-11.0
6057.233333	42.48	---	73.90	31.42	5000.0	1000.000	226.0	V	70.0	-1.8
6057.233333	---	29.64	53.90	24.26	5000.0	1000.000	226.0	V	70.0	-1.8
11936.266667	45.84	---	73.90	28.06	5000.0	1000.000	381.0	V	32.0	3.4
11936.266667	---	32.71	53.90	21.19	5000.0	1000.000	381.0	V	32.0	3.4
16301.133333	---	35.78	53.90	18.12	5000.0	1000.000	247.0	H	0.0	10.3
16301.133333	48.94	---	73.90	24.96	5000.0	1000.000	247.0	H	0.0	10.3

Table 7.4-7: *Radiated disturbance (Peak and CAverage) results: 1300 MHz OBW*

Notes:
[1]Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2]Correction factor = antenna factor ACF (dB) + cable loss (dB) − amplifier gain (dB)
[3]The maximum measured value observed over a period of 5 seconds was recorded.

7.4.5 Test data, continued



The spectral plot shows a vertical and horizontal scan with different colors. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

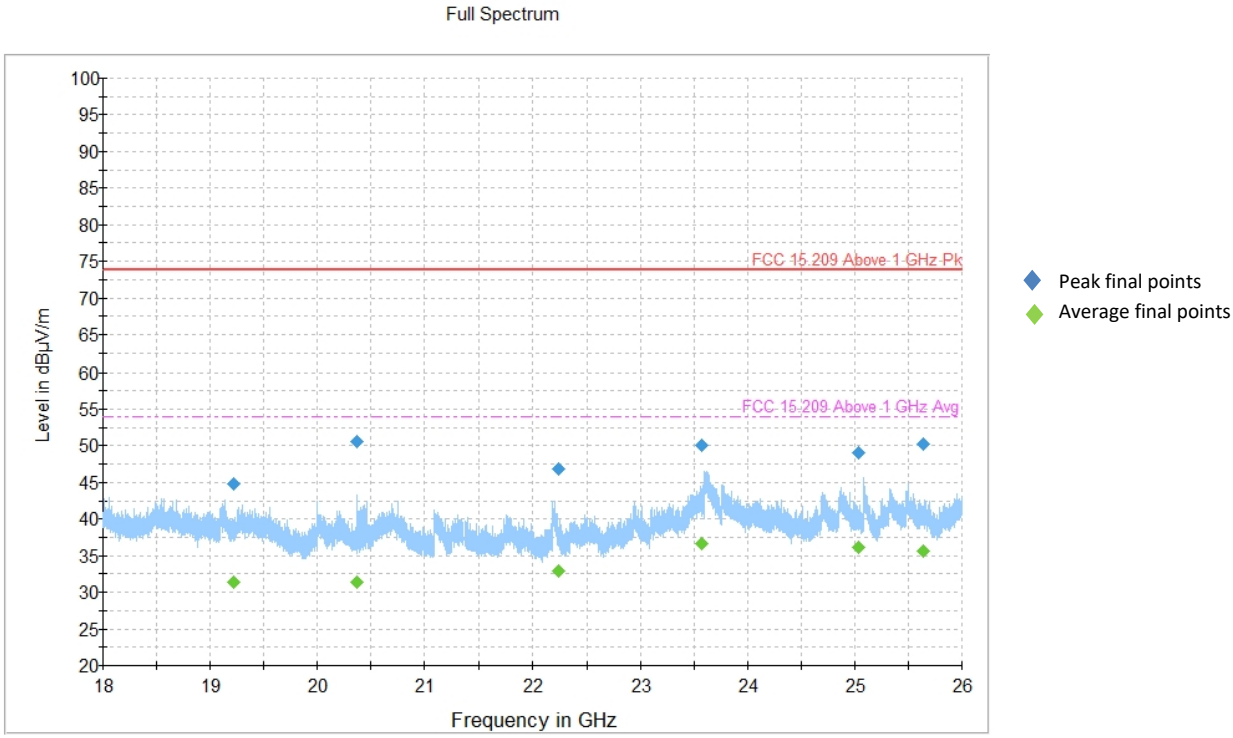
Figure 7.4-6: *Radiated disturbance spectral plot (1 to 18 GHz): 4000 MHz OBW*

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)
1199.866667	---	32.17	53.90	21.73	5000.0	1000.000	219.0	V	301.0	-14.5
1199.866667	40.38	---	73.90	33.52	5000.0	1000.000	219.0	V	301.0	-14.5
1738.000000	37.46	---	73.90	36.44	5000.0	1000.000	342.0	V	0.0	-13.2
1738.000000	---	24.17	53.90	29.73	5000.0	1000.000	342.0	V	0.0	-13.2
1854.266667	---	24.72	53.90	29.18	5000.0	1000.000	378.0	H	69.0	-12.1
1854.266667	38.12	---	73.90	35.78	5000.0	1000.000	378.0	H	69.0	-12.1
2416.733333	39.48	---	73.90	34.42	5000.0	1000.000	328.0	V	266.0	-10.8
2416.733333	---	25.84	53.90	28.06	5000.0	1000.000	328.0	V	266.0	-10.8
2459.566667	44.51	---	73.90	29.39	5000.0	1000.000	181.0	H	290.0	-10.5
2459.566667	---	27.53	53.90	26.37	5000.0	1000.000	181.0	H	290.0	-10.5
3599.700000	---	33.47	53.90	20.43	5000.0	1000.000	198.0	V	200.0	-6.3
3599.700000	43.89	---	73.90	30.01	5000.0	1000.000	198.0	V	200.0	-6.3
10863.733333	44.79	---	73.90	29.11	5000.0	1000.000	262.0	H	74.0	1.9
10863.733333	---	31.66	53.90	22.24	5000.0	1000.000	262.0	H	74.0	1.9
16343.333333	---	35.51	53.90	18.39	5000.0	1000.000	372.0	V	260.0	10.1
16343.333333	48.62	---	73.90	25.28	5000.0	1000.000	372.0	V	260.0	10.1

Table 7.4-8: *Radiated disturbance (Peak and CAverage) results: 4000 MHz OBW*

Notes:
[1]Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2]Correction factor = antenna factor ACF (dB) + cable loss (dB) − amplifier gain (dB)
[3]The maximum measured value observed over a period of 5 seconds was recorded.

7.4.5 Test data, continued



The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

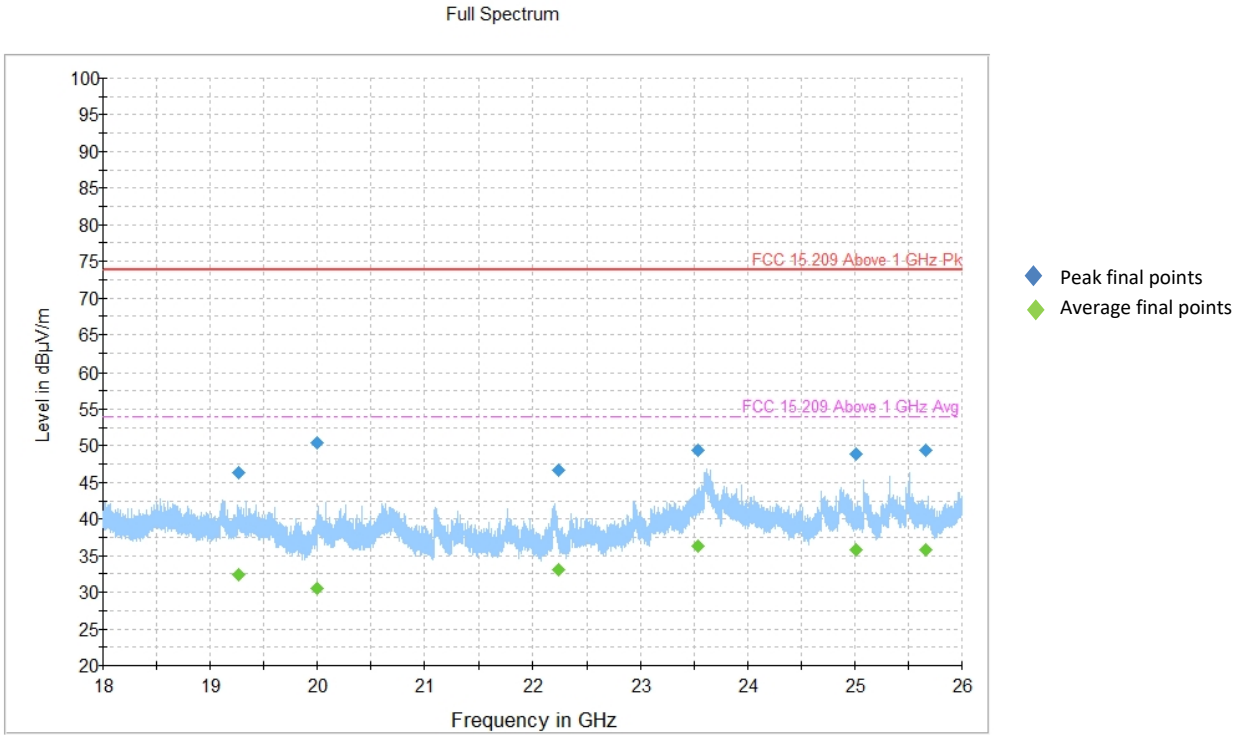
Figure 7.4-7: *Radiated disturbance spectral plot (18 to 26 GHz): 300 MHz OBW*

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)
19223.124167	44.84	---	73.90	29.06	5000.0	1000.000	402.0	H	0.0	14.2
19223.124167	---	31.31	53.90	22.59	5000.0	1000.000	402.0	H	0.0	14.2
20365.279333	50.63	---	73.90	23.27	5000.0	1000.000	196.0	H	51.0	13.9
20365.279333	---	31.33	53.90	22.57	5000.0	1000.000	196.0	H	51.0	13.9
22233.211333	46.87	---	73.90	27.03	5000.0	1000.000	346.0	V	75.0	15.8
22233.211333	---	32.94	53.90	20.96	5000.0	1000.000	346.0	V	75.0	15.8
23570.830167	50.08	---	73.90	23.82	5000.0	1000.000	235.0	H	226.0	20.7
23570.830167	---	36.63	53.90	17.27	5000.0	1000.000	235.0	H	226.0	20.7
25030.909000	---	36.05	53.90	17.85	5000.0	1000.000	151.0	V	258.0	19.1
25030.909000	49.05	---	73.90	24.85	5000.0	1000.000	151.0	V	258.0	19.1
25634.383500	---	35.57	53.90	18.33	5000.0	1000.000	342.0	H	0.0	19.2
25634.383500	50.18	---	73.90	23.72	5000.0	1000.000	342.0	H	0.0	19.2

Table 7.4-9: *Radiated disturbance (Peak and CAverage) results: 300 MHz OBW*

Notes:
[1]Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2]Correction factor = antenna factor ACF (dB) + cable loss (dB) − amplifier gain (dB)
[3]The maximum measured value observed over a period of 5 seconds was recorded.

7.4.5 Test data, continued



The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

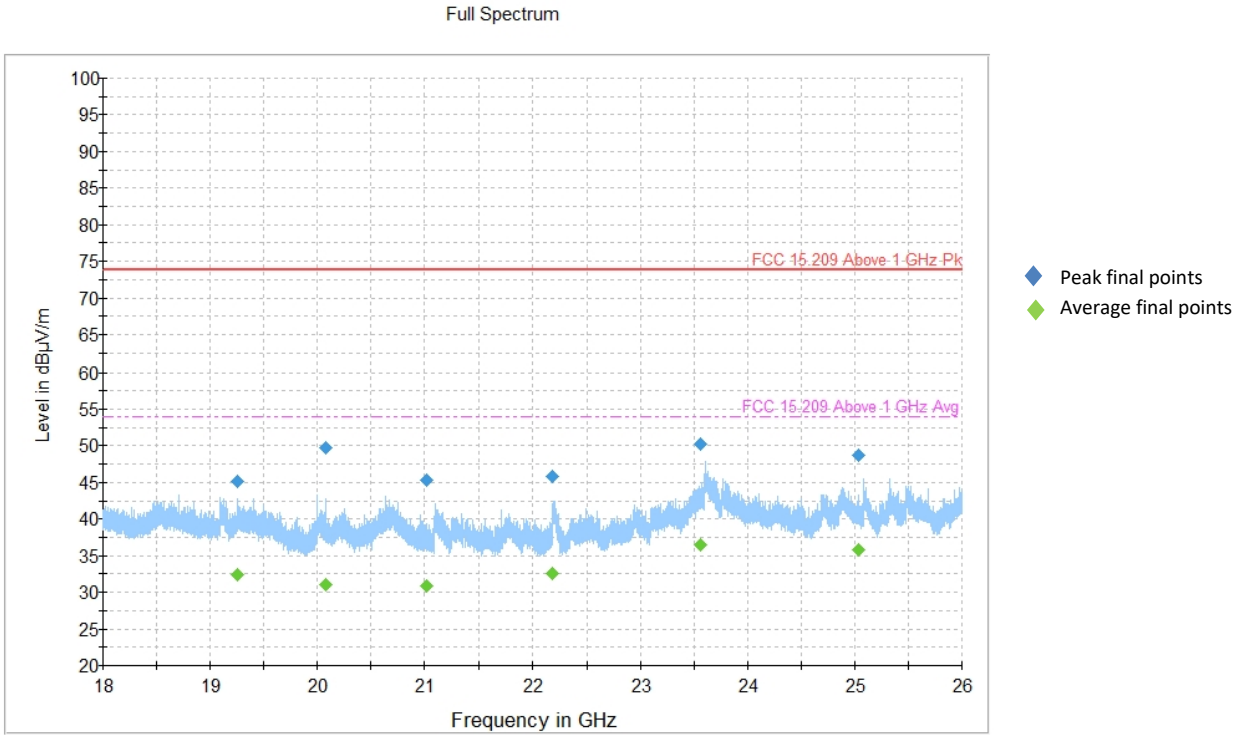
Figure 7.4-8: *Radiated disturbance spectral plot (18 to 26 GHz): 1300 MHz OBW*

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)
19262.233833	46.30	---	73.90	27.60	5000.0	1000.000	237.0	V	12.0	14.6
19262.233833	---	32.43	53.90	21.47	5000.0	1000.000	237.0	V	12.0	14.6
19999.322333	50.43	---	73.90	23.47	5000.0	1000.000	197.0	H	22.0	13.5
19999.322333	---	30.46	53.90	23.44	5000.0	1000.000	197.0	H	22.0	13.5
22241.551000	46.72	---	73.90	27.18	5000.0	1000.000	308.0	H	342.0	15.7
22241.551000	---	33.04	53.90	20.86	5000.0	1000.000	308.0	H	342.0	15.7
23533.140167	49.36	---	73.90	24.54	5000.0	1000.000	227.0	V	0.0	20.4
23533.140167	---	36.38	53.90	17.52	5000.0	1000.000	227.0	V	0.0	20.4
25017.873167	48.94	---	73.90	24.96	5000.0	1000.000	277.0	H	148.0	19.1
25017.873167	---	35.73	53.90	18.17	5000.0	1000.000	277.0	H	148.0	19.1
25660.145667	49.33	---	73.90	24.57	5000.0	1000.000	280.0	H	203.0	19.2
25660.145667	---	35.77	53.90	18.13	5000.0	1000.000	280.0	H	203.0	19.2

Table 7.4-10: *Radiated disturbance (Peak and CAverage) results: 1300 MHz OBW*

Notes:
[1]Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2]Correction factor = antenna factor ACF (dB) + cable loss (dB) − amplifier gain (dB)
[3]The maximum measured value observed over a period of 5 seconds was recorded.

7.4.5 Test data, continued



The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

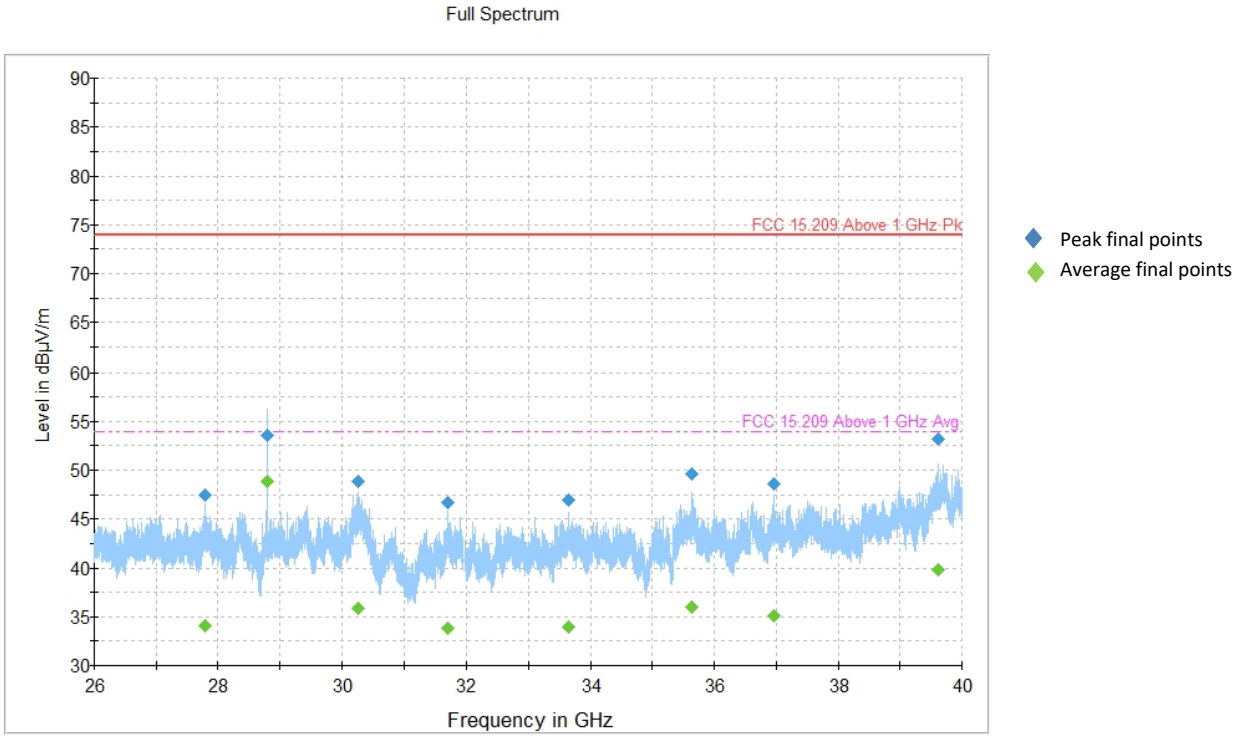
Figure 7.4-9: *Radiated disturbance spectral plot (18 to 26 GHz): 4000 MHz OBW*

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)
19256.551167	45.11	---	73.90	28.79	5000.0	1000.000	207.0	H	309.0	14.5
19256.551167	---	32.40	53.90	21.50	5000.0	1000.000	207.0	H	309.0	14.5
20081.992000	49.74	---	73.90	24.16	5000.0	1000.000	174.0	H	51.0	13.5
20081.992000	---	31.11	53.90	22.79	5000.0	1000.000	174.0	H	51.0	13.5
21015.699167	45.32	---	73.90	28.58	5000.0	1000.000	178.0	H	296.0	13.9
21015.699167	---	30.87	53.90	23.03	5000.0	1000.000	178.0	H	296.0	13.9
22185.637000	45.79	---	73.90	28.11	5000.0	1000.000	205.0	V	182.0	15.8
22185.637000	---	32.54	53.90	21.36	5000.0	1000.000	205.0	V	182.0	15.8
23560.098167	---	36.43	53.90	17.47	5000.0	1000.000	110.0	V	175.0	20.6
23560.098167	50.20	---	73.90	23.70	5000.0	1000.000	110.0	V	175.0	20.6
25031.207000	---	35.82	53.90	18.08	5000.0	1000.000	116.0	H	91.0	19.1
25031.207000	48.75	---	73.90	25.15	5000.0	1000.000	116.0	H	91.0	19.1

Table 7.4-11: *Radiated disturbance (Peak and CAverage) results: 4000 MHz OBW*

Notes:
[1]Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2]Correction factor = antenna factor ACF (dB) + cable loss (dB) − amplifier gain (dB)
[3]The maximum measured value observed over a period of 5 seconds was recorded.

7.4.5 Test data, continued



The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

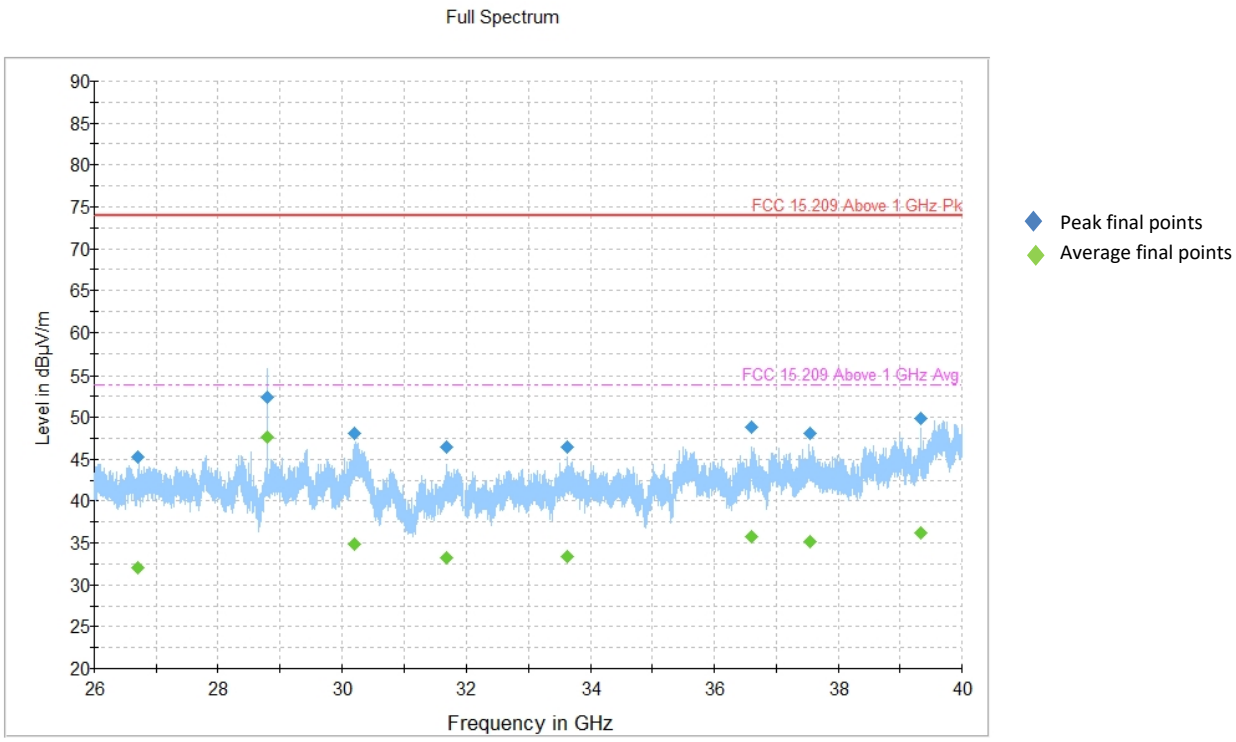
Figure 7.4-10: *Radiated disturbance spectral plot (26 to 40 GHz): 300 MHz OBW*

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)
27781.266667	47.45	---	73.90	26.45	5000.0	1000.000	215.0	V	21.0	9.7
27781.266667	---	34.13	53.90	19.77	5000.0	1000.000	215.0	V	21.0	9.7
28798.800000	53.53	---	73.90	20.37	5000.0	1000.000	147.0	H	282.0	12.2
28798.800000	---	48.90	53.90	5.00	5000.0	1000.000	147.0	H	282.0	12.2
30269.733333	---	35.92	53.90	17.98	5000.0	1000.000	215.0	V	-11.0	12.1
30269.733333	48.86	---	73.90	25.04	5000.0	1000.000	215.0	V	-11.0	12.1
31709.933333	46.64	---	73.90	27.26	5000.0	1000.000	144.0	H	-11.0	12.3
31709.933333	---	33.80	53.90	20.10	5000.0	1000.000	144.0	H	-11.0	12.3
33638.200000	---	33.91	53.90	19.99	5000.0	1000.000	115.0	V	75.0	13.0
33638.200000	46.94	---	73.90	26.96	5000.0	1000.000	115.0	V	75.0	13.0
35642.800000	---	35.95	53.90	17.95	5000.0	1000.000	125.0	H	322.0	14.9
35642.800000	49.64	---	73.90	24.26	5000.0	1000.000	125.0	H	322.0	14.9
36955.733333	---	35.06	53.90	18.84	5000.0	1000.000	104.0	H	54.0	16.3
36955.733333	48.54	---	73.90	25.36	5000.0	1000.000	104.0	H	54.0	16.3
39607.866667	---	39.76	53.90	14.14	5000.0	1000.000	125.0	V	298.0	19.5
39607.866667	53.23	---	73.90	20.67	5000.0	1000.000	125.0	V	298.0	19.5

Table 7.4-12: *Radiated disturbance (Peak and CAverage) results: 300 MHz OBW*

Notes:
[1]Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2]Correction factor = antenna factor ACF (dB) + cable loss (dB) − amplifier gain (dB)
[3]The maximum measured value observed over a period of 5 seconds was recorded.

7.4.5 Test data, continued



The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

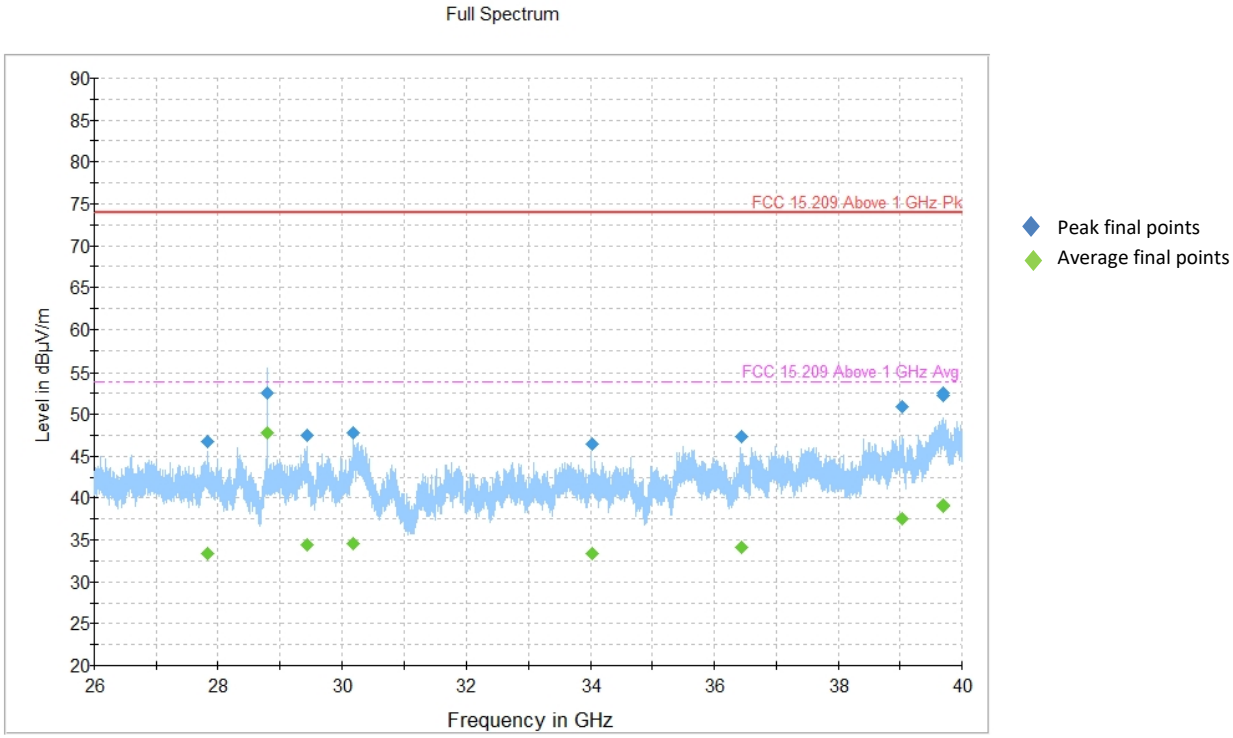
Figure 7.4-11: *Radiated disturbance spectral plot (26 to 40 GHz): 1300 MHz OBW*

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)
26711.533333	45.25	---	73.90	28.65	5000.0	1000.000	157.0	H	10.0	8.8
26711.533333	---	31.99	53.90	21.91	5000.0	1000.000	157.0	H	10.0	8.8
28798.800000	---	47.66	53.90	6.24	5000.0	1000.000	175.0	H	285.0	12.2
28798.800000	52.44	---	73.90	21.46	5000.0	1000.000	175.0	H	285.0	12.2
30207.933333	48.02	---	73.90	25.88	5000.0	1000.000	179.0	H	11.0	12.1
30207.933333	---	34.90	53.90	19.00	5000.0	1000.000	179.0	H	11.0	12.1
31696.000000	46.46	---	73.90	27.44	5000.0	1000.000	124.0	H	-11.0	12.3
31696.000000	---	33.20	53.90	20.70	5000.0	1000.000	124.0	H	-11.0	12.3
33622.733333	46.52	---	73.90	27.38	5000.0	1000.000	100.0	V	10.0	13.0
33622.733333	---	33.31	53.90	20.59	5000.0	1000.000	100.0	V	10.0	13.0
36609.866667	---	35.70	53.90	18.20	5000.0	1000.000	207.0	V	195.0	15.8
36609.866667	48.90	---	73.90	25.00	5000.0	1000.000	207.0	V	195.0	15.8
37542.466667	48.09	---	73.90	25.81	5000.0	1000.000	129.0	H	202.0	16.3
37542.466667	---	35.12	53.90	18.78	5000.0	1000.000	129.0	H	202.0	16.3
39330.466667	49.90	---	73.90	24.00	5000.0	1000.000	154.0	V	251.0	18.3
39330.466667	---	36.17	53.90	17.73	5000.0	1000.000	154.0	V	251.0	18.3

Table 7.4-13: *Radiated disturbance (Peak and CAverage) results: 1300 MHz OBW*

Notes:
[1]Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2]Correction factor = antenna factor ACF (dB) + cable loss (dB) − amplifier gain (dB)
[3]The maximum measured value observed over a period of 5 seconds was recorded.

7.4.5 Test data, continued



The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

Figure 7.4-12: *Radiated disturbance spectral plot (26 to 40 GHz): 4000 MHz OBW*

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)
27826.400000	---	33.39	53.90	20.51	5000.0	1000.000	175.0	H	-1.0	9.7
27826.400000	46.69	---	73.90	27.21	5000.0	1000.000	175.0	H	-1.0	9.7
28798.333333	---	47.73	53.90	6.17	5000.0	1000.000	150.0	H	284.0	12.2
28798.333333	52.61	---	73.90	21.29	5000.0	1000.000	150.0	H	284.0	12.2
29434.666667	47.55	---	73.90	26.35	5000.0	1000.000	204.0	V	10.0	13.0
29434.666667	---	34.46	53.90	19.44	5000.0	1000.000	204.0	V	10.0	13.0
30192.533333	47.78	---	73.90	26.12	5000.0	1000.000	150.0	V	216.0	12.1
30192.533333	---	34.64	53.90	19.26	5000.0	1000.000	150.0	V	216.0	12.1
34022.133333	---	33.34	53.90	20.57	5000.0	1000.000	161.0	V	287.0	13.4
34022.133333	46.41	---	73.90	27.49	5000.0	1000.000	161.0	V	287.0	13.4
36435.466667	47.37	---	73.90	26.53	5000.0	1000.000	107.0	H	179.0	15.4
36435.466667	---	34.14	53.90	19.76	5000.0	1000.000	107.0	H	179.0	15.4
39029.666667	50.91	---	73.90	22.99	5000.0	1000.000	175.0	H	161.0	18.2
39029.666667	---	37.58	53.90	16.32	5000.0	1000.000	175.0	H	161.0	18.2
39704.466667	52.29	---	73.90	21.61	5000.0	1000.000	104.0	H	217.0	20.5
39704.466667	---	39.07	53.90	14.83	5000.0	1000.000	104.0	H	217.0	20.5
39706.066667	52.56	---	73.90	21.34	5000.0	1000.000	124.0	H	195.0	20.5
39706.066667	---	39.23	53.90	14.67	5000.0	1000.000	124.0	H	195.0	20.5

Table 7.4-14: *Radiated disturbance (Peak and CAverage) results: 4000 MHz OBW*

Notes: [1]Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2]Correction factor = antenna factor ACF (dB) + cable loss (dB) − amplifier gain (dB)
[3]The maximum measured value observed over a period of 5 seconds was recorded.

7.4.5 Test data, continued

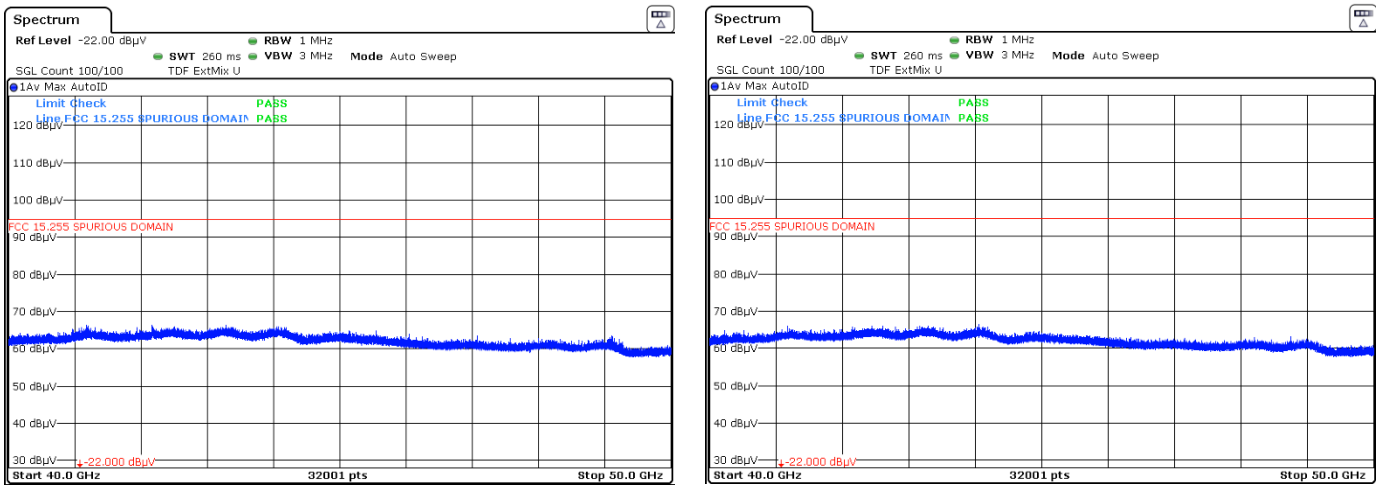


Figure* 7.4-13*: *Unwanted emissions spurious band plot – Measurement from 40 to 50 GHz, horizontal and vertical polarization respectively: 300 MHz OBW*

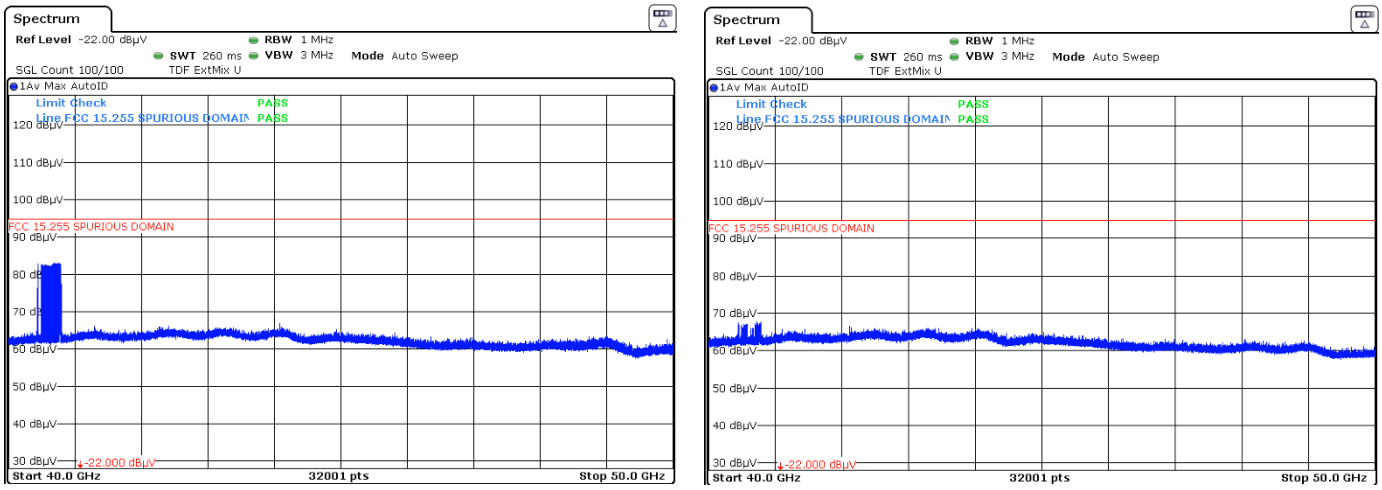


Figure* 7.4-14*: *Unwanted emissions spurious band plot – Measurement from 40 to 50 GHz, horizontal and vertical polarization respectively:1300 MHz OBW.*

Note: The auto ID function was active for avoiding the ghost signal produced by the mixer used, however, an intermodulation product is present in this range because the equipment was unable to suppress it. In any case, the intermodulation product is below the limit line, which indicates compliance with the FCC rules.

7.4.5 Test data, continued

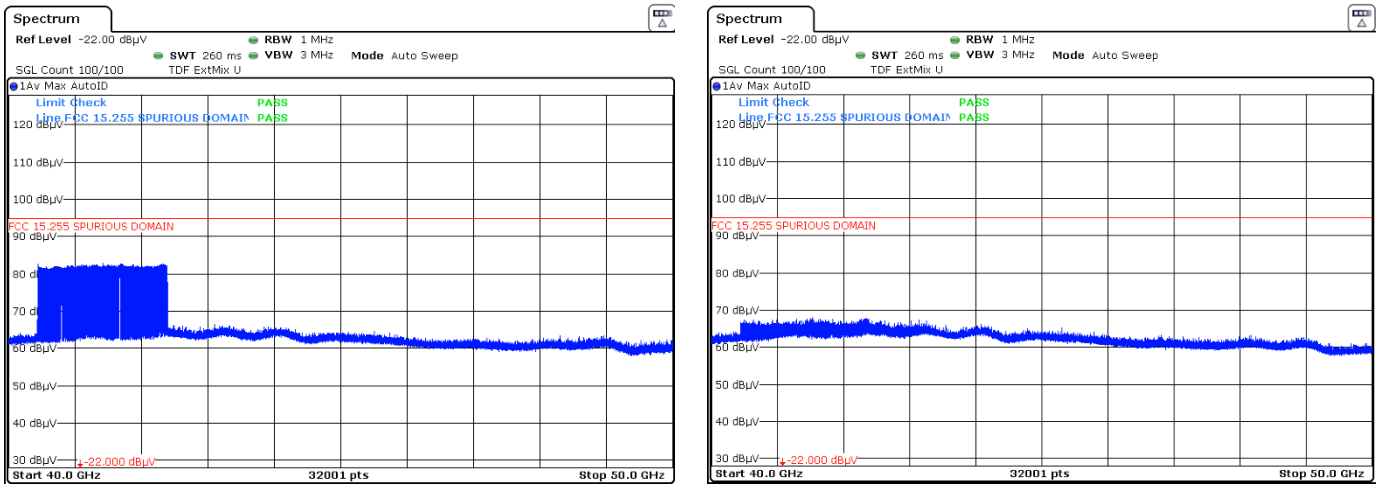


Figure* 7.4-15*: *Unwanted emissions spurious band plot – Measurement from 40 to 50 GHz, horizontal and vertical polarization respectively: 4000 MHz OBW.*

Note: The auto ID function was active for avoiding the ghost signal produced by the mixer used, however, an intermodulation product is present in this range because the equipment was unable to suppress it. In any case, the intermodulation product is below the limit line, which indicates compliance with the FCC rules.

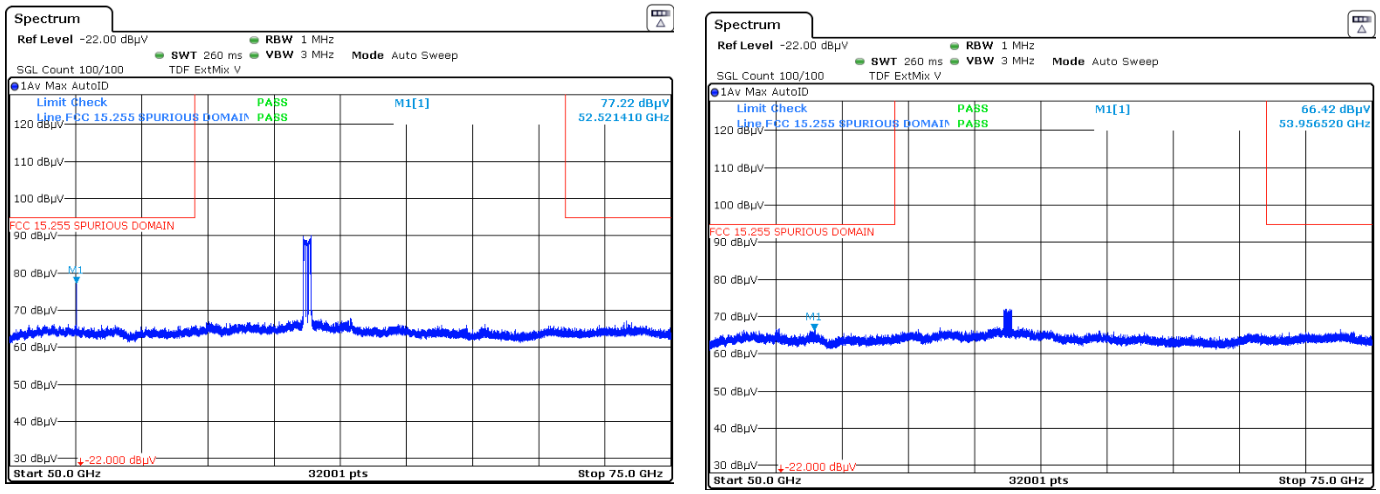


Figure* 7.4-16*: *Unwanted emissions spurious band plot – Measurement from 50 to 75 GHz, horizontal and vertical polarization respectively: 300 MHz OBW.*

Note: The excluded band (non-restrictive) corresponds to the frequency band which is allowed the fundamental transmission (from 57 to 71 GHz) and it was showed on the plot as reference because it is not part of the evaluation in this test.

7.4.5 Test data, continued

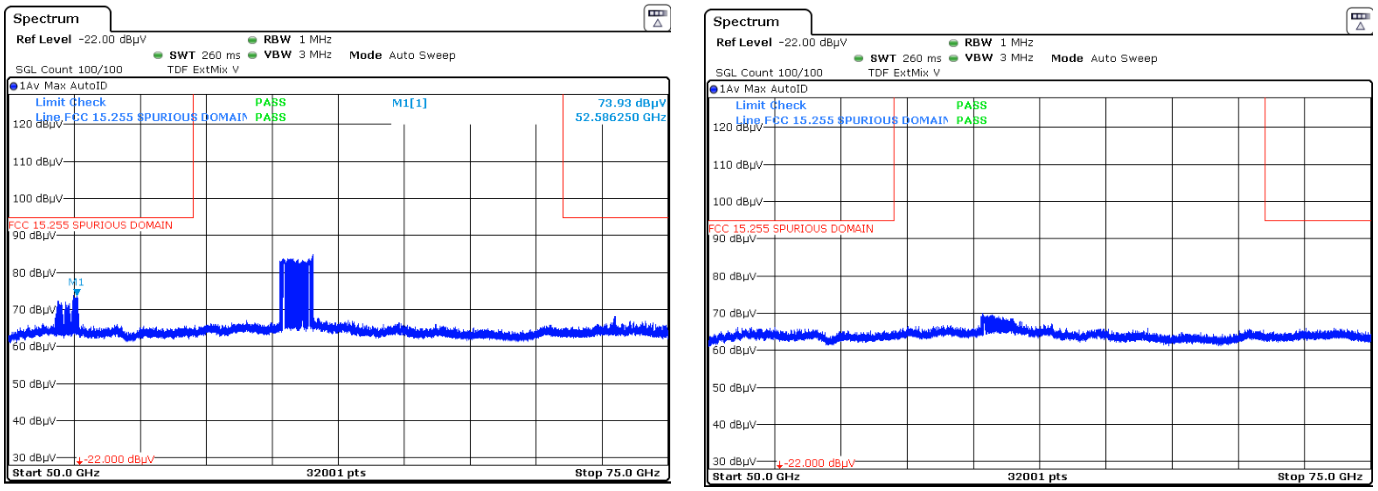


***Figure* 7.4-17:** *Unwanted emissions spurious band plot – Measurement from 50 to 75 GHz, horizontal and vertical polarization respectively: 1300 MHz OBW.*

Note: The excluded band (non-restrictive) corresponds to the frequency band which is allowed the fundamental transmission (from 57 to 71 GHz) and it was showed on the plot as reference because it is not part of the evaluation in this test.

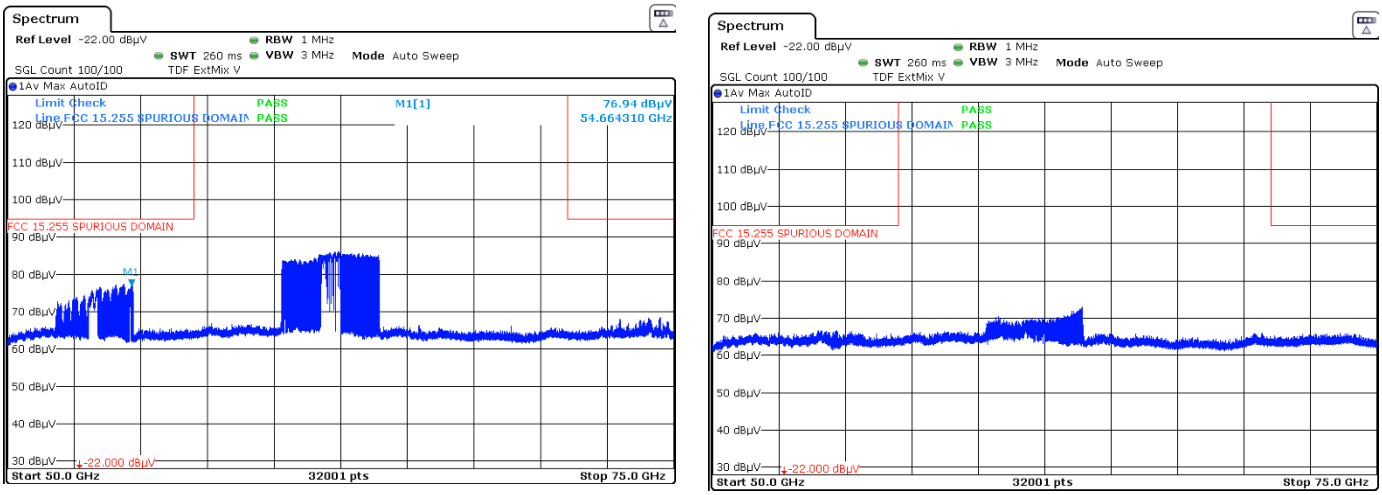


***Figure* 7.4-18:** *Unwanted emissions spurious band plot – Measurement from 50 to 75 GHz, horizontal and vertical polarization respectively: 4000 MHz OBW.*

Note: The excluded band (non-restrictive) corresponds to the frequency band which is allowed the fundamental transmission (from 57 to 71 GHz) and it was showed on the plot as reference because it is not part of the evaluation in this test.

7.4.5 Test data, continued

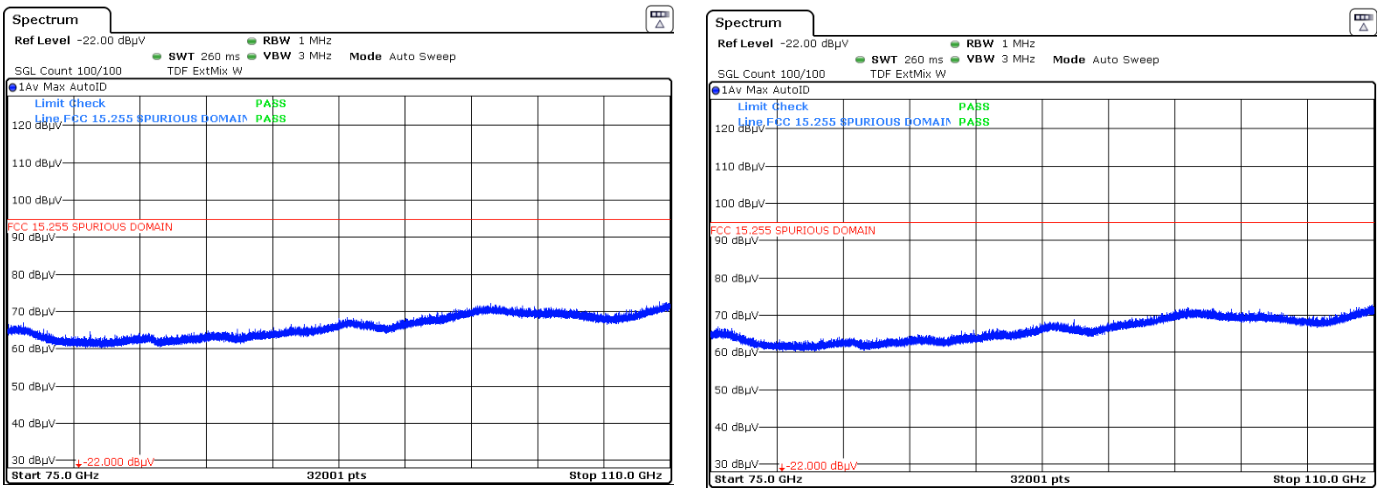


Figure* 7.4-19*: *Unwanted emissions spurious band plot – Measurement from 75 to 110 GHz, horizontal and vertical polarization respectively: 300 MHz OBW.*

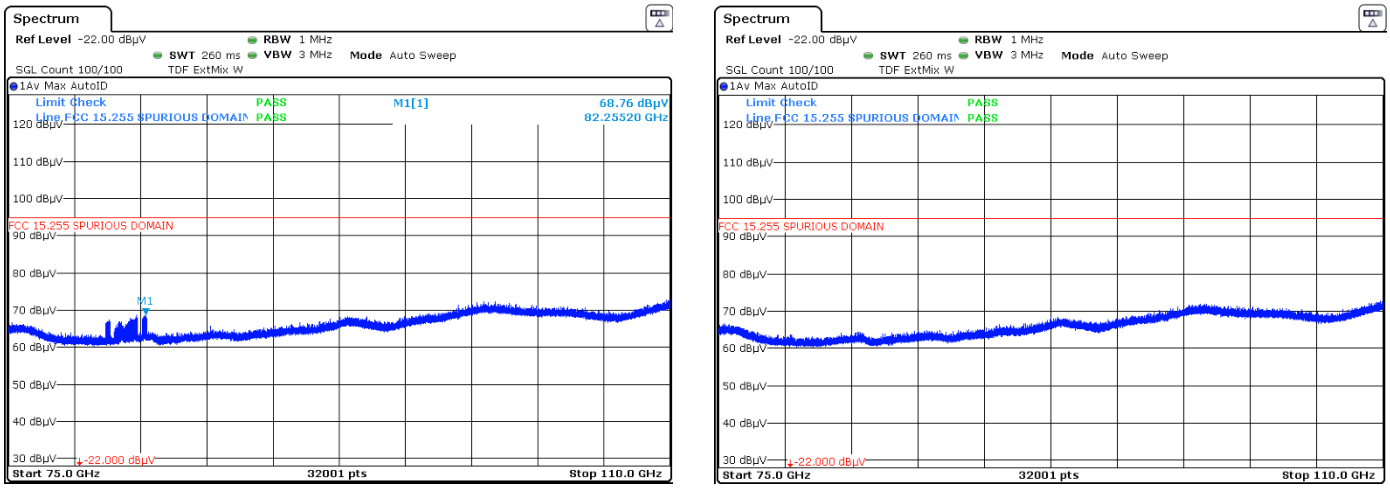


Figure* 7.4-20*: *Unwanted emissions spurious band plot – Measurement from 75 to 110 GHz, horizontal and vertical polarization respectively: 1300 MHz OBW.*

7.4.5 Test data, continued

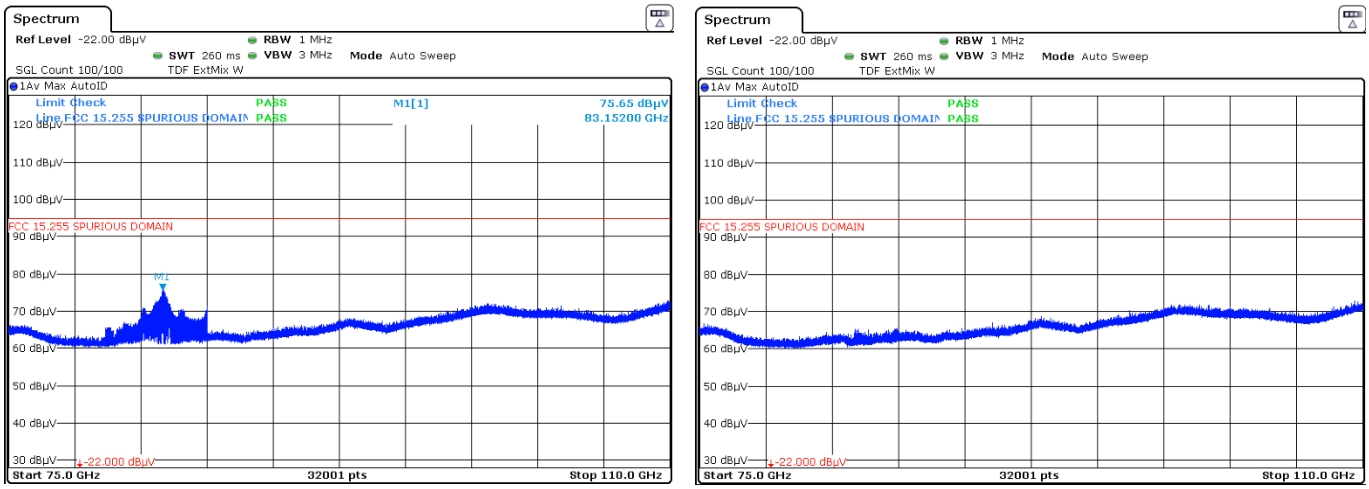


Figure* 7.4-21*: *Unwanted emissions spurious band plot – Measurement from 75 to 110 GHz, horizontal and vertical polarization respectively: 4000 MHz OBW.*

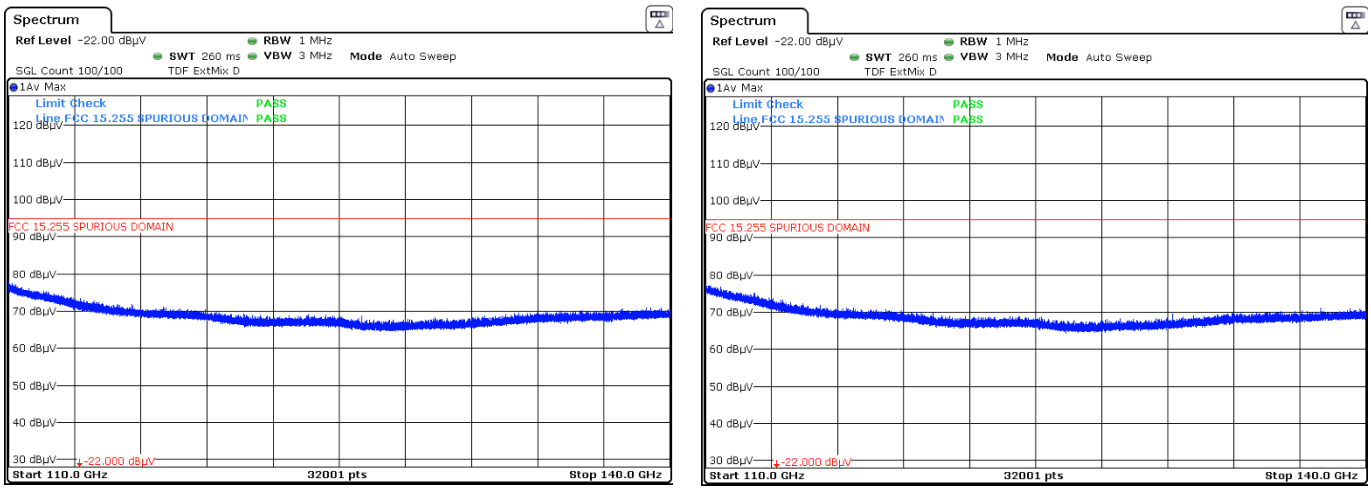


Figure* 7.4-22*: *Unwanted emissions spurious band plot – Measurement from 110 to 140 GHz, horizontal and vertical polarization respectively:300 MHz OBW.*

7.4.5 Test data, continued

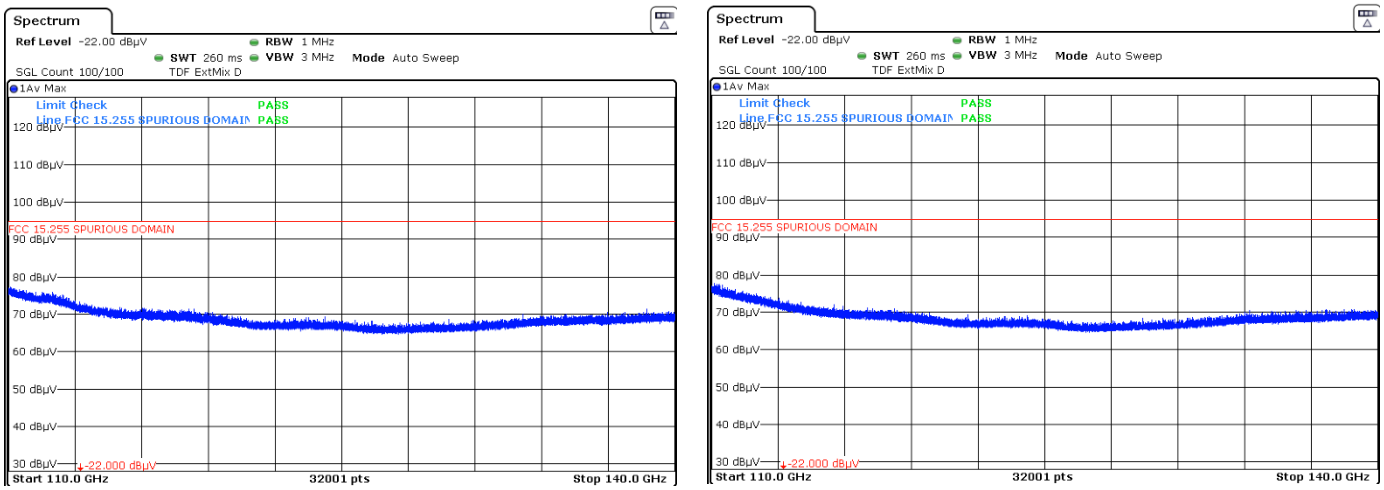


***Figure* 7.4-23:** *Unwanted emissions spurious band plot – Measurement from 110 to 140 GHz, horizontal and vertical polarization respectively:1300 MHz OBW.*

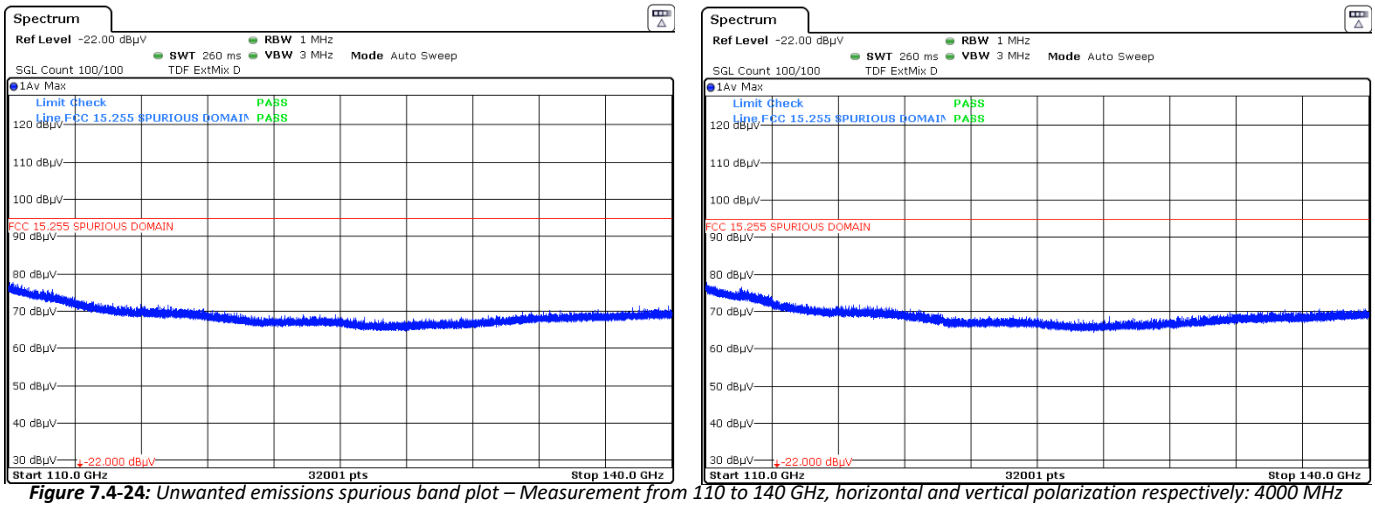


***Figure* 7.4-24:** *Unwanted emissions spurious band plot – Measurement from 110 to 140 GHz, horizontal and vertical polarization respectively: 4000 MHz OBW.*

7.4.5 Test data, continued

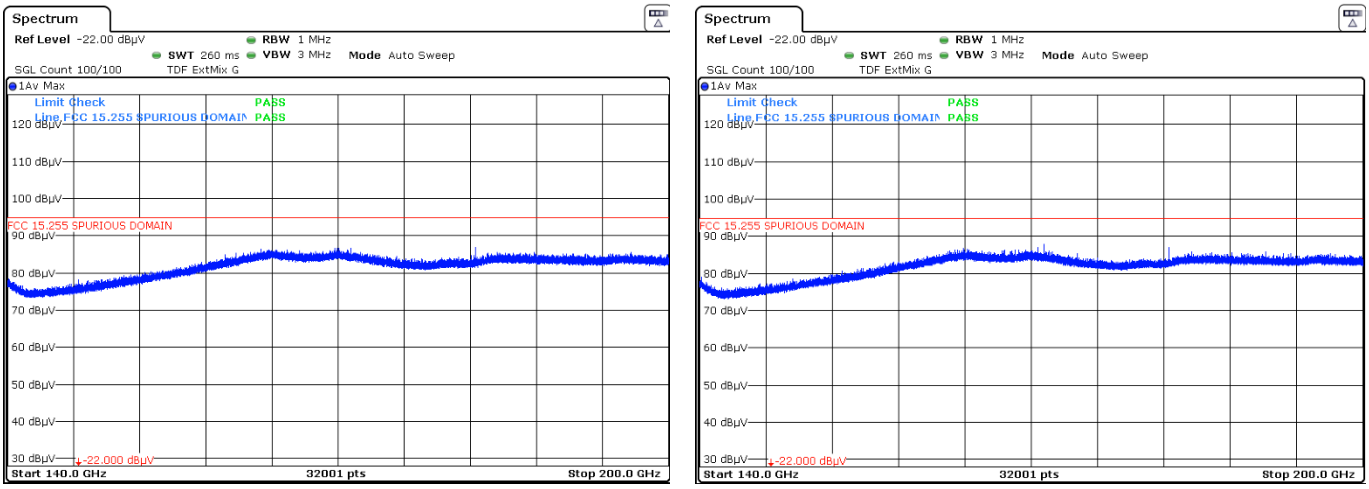


***Figure* 7.4-25:** *Unwanted emissions spurious band plot – Measurement from 140 to 200 GHz, horizontal and vertical polarization respectively: 300 MHz OBW.*

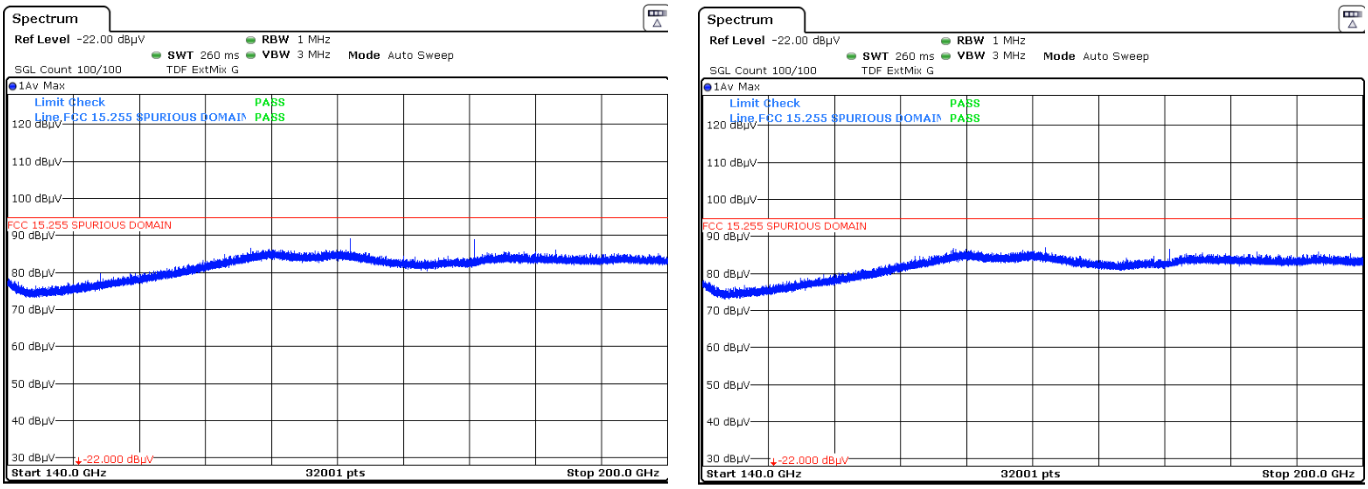


***Figure* 7.4-26:** *Unwanted emissions spurious band plot – Measurement from 140 to 200 GHz, horizontal and vertical polarization respectively: 1300 MHz OBW.*

7.4.5 Test data, continued

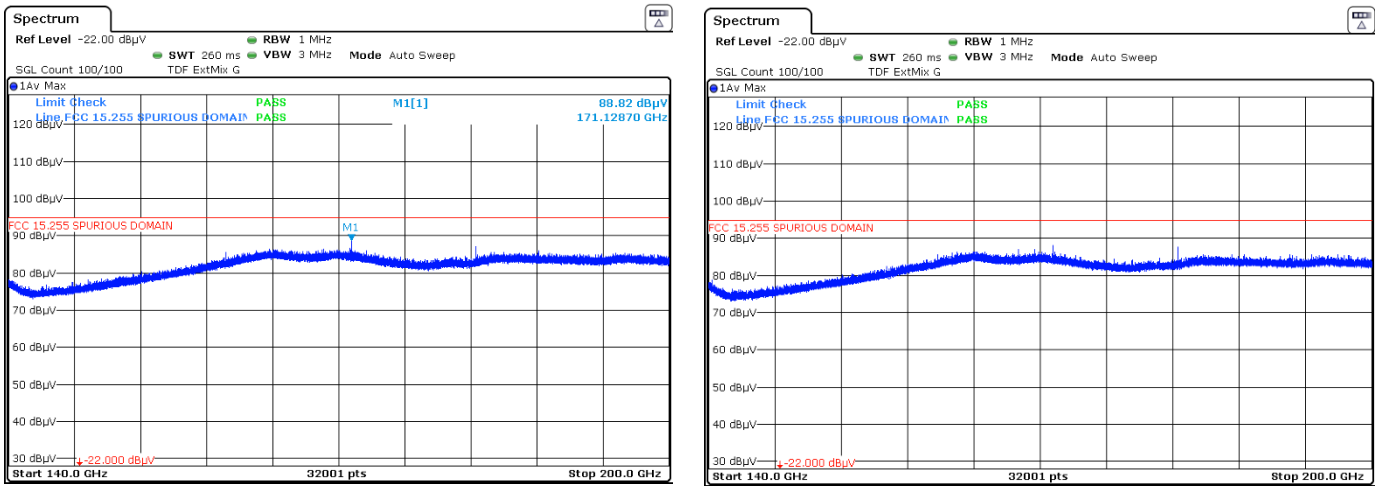


***Figure* 7.4-27:** *Unwanted emissions spurious band plot – Measurement from 140 to 200 GHz, horizontal and vertical polarization respectively: 4000 MHz OBW.*

7.5 Frequency Stability

7.5.1 References

200443 D02 RF Detector Method v01
As specified in Section 15.215(c), the 20 dB bandwidth of the fundamental emission must be contained within the frequency band over the temperature range -20 to +50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage. Frequency stability is to be measured according to Section 2.1055 at the highest and lowest frequency of operation and with the modulation that produces the widest emission bandwidth.
ANSI C63.10-2013
With the EUT at ambient temperature (approximately 25 °C) and voltage source set to the EUT nominal operating voltage (100%), record the spectrum mask of the EUT emission on the spectrum analyzer.
Vary EUT power supply between 85% and 115% of nominal, and record the frequency excursion of the EUT emission mask. Set the power supply to 100% nominal setting, and raise EUT operating temperature to 50 °C.
Record the frequency excursion of the EUT emission mask. Repeat step d) at each 10 °C increment down to 20 °C

7.5.2 Test summary

Verdict	Pass		
Test date	March 30, 2020	Temperature	26 °C
Test engineer	Martha Espinoza	Air pressure	999 mbar
Test location	Wireless Bench	Relative humidity	53 %

7.5.3 Notes

The test was measured using the specific procedure KDB 200443 D02 RF Detector Method v01 which requires a measurement of the 20 dB occupied bandwidth of the fundamental. The ppm were calculated just as reference due to this standard have not a limit for this test. The only requirement a signal maintenance within the limits from the whole band (in this case between from 57 to 71 GHz).

7.5.4 Setup details

EUT setup configuration	Table top
Test facility	Wireless Bench
Measuring distance	0.5 m
Antenna height variation	1 m
Turn table position	0°

Receiver/spectrum analyzer settings for frequencies above 1 GHz:

Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Detector mode	Peak
Trace mode	Max Hold

7.5.4 Setup details, continued

Table 7.5-1: *Frequency stability equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Antenna, Horn	Sage Millimeter	SAR-2408-15-S2	E1152	NCR	NCR
Signal analyzer	Rohde & Schwarz	FSV40	E1120	11-19-2019	11-19-2021
Mixer	Rohde & Schwarz	FS-Z75	E1149	NCR	NCR
Temperature Chamber	Test Equity	115A	E1162	08-03-2020	08-03-2021

7.5.5 Test data

Table 7.5-2: *Frequency stability results, 300 MHz bandwidth operation*

Voltage	*Temperature*	*F1*	*F2*	*CF*	*ppm*
120V	-30	61.10822	61.40089	61.25456	35.670
120V	-20	61.10734	61.40100	61.25417	41.955
120V	-10	61.10778	61.40221	61.25500	28.487
120V	0	61.10865	61.40483	61.25674	Reference
120V	10	61.10997	61.40443	61.25720	-7.509
120V	20	61.11084	61.40746	61.25915	-39.343
120V	30	61.11215	61.40702	61.25959	-46.444
120V	40	61.11215	61.40720	61.25968	-47.913
120V	50	61.11259	61.40789	61.26024	-57.137

Voltage	*Temperature*	*F1*	*F2*	*CF*	*ppm*
120	20	61.10865	61.40264	61.25565	17.876
102	20	61.10865	61.40483	61.25674	Reference
138	20	61.10865	61.40264	61.25565	17.876

Table 7.5-3: *Frequency stability results, 1300 MHz bandwidth operation*

Voltage	*Temperature*	*F1*	*F2*	*CF*	*ppm*
120V	-30	60.28399	61.55620	60.92010	28.725
120V	-20	60.28662	61.56058	60.92360	-28.807
120V	-10	60.28530	61.56101	60.92316	-21.503
120V	0	60.28443	61.55926	60.92185	Reference
120V	10	61.28662	61.55795	61.42229	-8214.459
120V	20	60.28662	61.55926	60.92294	-17.974
120V	30	60.28749	60.56014	60.42382	8174.900
120V	40	60.28705	61.56145	60.92425	-39.477
120V	50	60.28749	61.56276	60.92513	-53.839

Voltage	*Temperature*	*F1*	*F2*	*CF*	*ppm*
120	20	60.28530	61.56145	60.92338	-25.114
102	20	60.28443	61.55926	60.92185	Reference
138	20	60.28530	61.56189	60.92360	-28.725

7.5.5 Test data, continued

Table 7.5-4: *Frequency stability results, 4000 MHz bandwidth operation*

Voltage	*Temperature*	*F1*	*F2*	*CF*	*ppm*
120V	-30	60.29362	63.73488	62.01425	1500.384
120V	-20	60.29405	63.73751	62.01578	1475.749
120V	-10	60.29230	63.93700	62.11465	-116.170
120V	0	60.29274	63.92213	62.10744	Reference
120V	10	60.29537	63.92256	62.10897	-24.635
120V	20	60.29755	63.80882	62.05319	873.486
120V	30	60.29799	63.93088	62.11444	-112.708
120V	40	60.29887	63.88188	62.09038	274.685
120V	50	60.29799	63.91513	62.10656	14.088

Voltage	*Temperature*	*F1*	*F2*	*CF*	*ppm*
120	20	60.29318	63.68370	61.98844	1915.954
102	20	60.29274	63.92213	62.10744	Reference
138	20	60.29449	63.69901	61.99675	1782.154

Note: This standard does not specify a ppm value as a limit. This table is just for reference and the only requirement by standard is the fundamental emission must to be inside to the band assigned.

7.6 AC Line conducted emissions

7.6.1 References

ANSI C63.4-2014

7.6.2 Test summary

Verdict	Pass		
Test date	March 24, 2020	Temperature	25 °C
Test engineer	Martha Espinoza, Wireless Test Engineer	Air pressure	1007 mbar
Test location	Ground Plane	Relative humidity	50 %

7.6.3 Notes

Only one occupied bandwidth was tested: 400 MHz as a representative case of the EUT.

7.6.4 Setup details

Port under test	AC Main Port
EUT setup configuration	Table top
Measurement details	A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiver settings:

Resolution bandwidth	9 kHz
Video bandwidth	30 kHz
Detector mode	– Peak and Average (Preview measurement) – Quasi-peak and CAverage (Final measurement)
Trace mode	Max Hold
Measurement time	– 100 ms (Peak and Average preview measurement) – 5000 ms (Quasi-peak final measurement) – 5000 ms (CAverage final measurement)

Table 7.6-1: Conducted disturbance at mains port equipment list

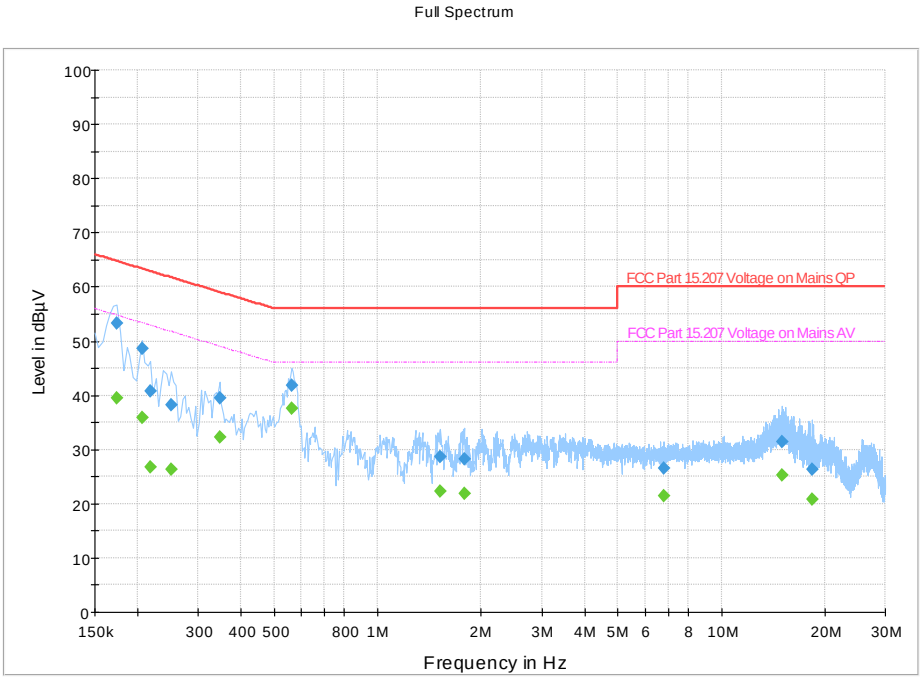
Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Two Line V-Network	Rohde & Schwartz	ENV216	E1019	08-04-2020	08-04-2021
Transient Limiter	HP	11947A	684	01-20-2021	01-20-2022
EMC Test Receiver	Rohde & Schwarz	ESCI 7	E1026	02-24-2021	02-24-2022

Table 7.6-2: *Conducted disturbance at mains port test software details*

Manufacturer of Software	Details
Rohde & Schwarz	EMC 32 V10.20.01

Notes: None

7.6.5 Test data



The spectral plot has been corrected with transducer factors (i.e. cable loss, LISN factors, and transient limiter).

Figure 7.6-1: *Conducted disturbance at mains port spectral plot: 4000 MHz OBW considered as representative case.*

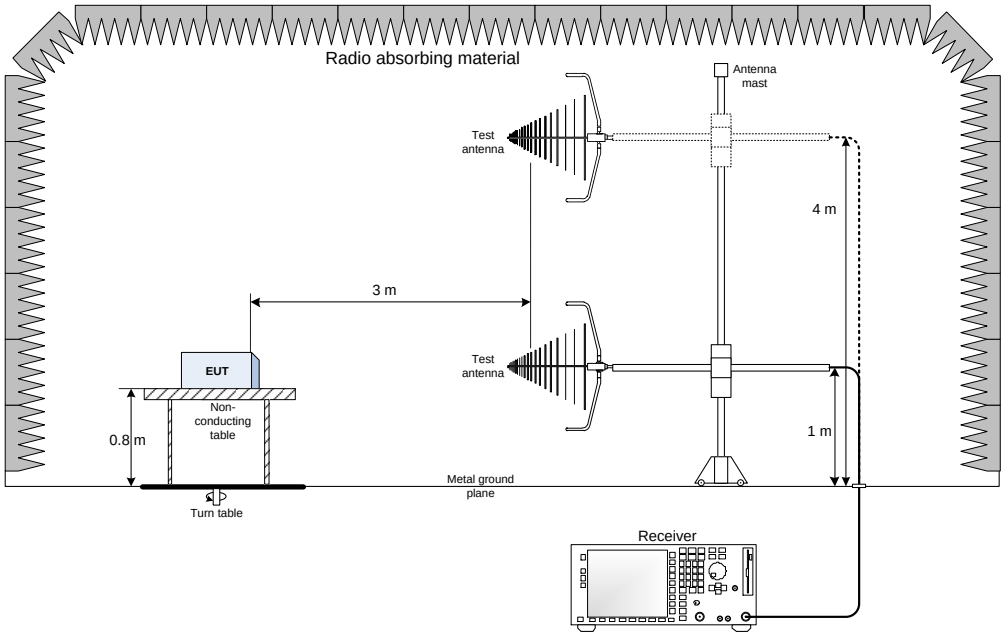
Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.174000	---	39.56	54.77	15.21	5000.0	9.000	N	ON	19.5
0.174000	53.39	---	64.77	11.38	5000.0	9.000	N	ON	19.5
0.206000	---	35.90	53.37	17.47	5000.0	9.000	N	ON	19.5
0.206000	48.62	---	63.37	14.75	5000.0	9.000	N	ON	19.5
0.218000	40.74	---	62.90	22.15	5000.0	9.000	L1	ON	19.5
0.218000	---	26.78	52.90	26.11	5000.0	9.000	L1	ON	19.5
0.250000	38.17	---	61.76	23.59	5000.0	9.000	N	ON	19.5
0.250000	---	26.24	51.76	25.52	5000.0	9.000	N	ON	19.5
0.346000	---	32.23	49.06	16.83	5000.0	9.000	N	ON	19.4
0.346000	39.58	---	59.06	19.48	5000.0	9.000	N	ON	19.4
0.562000	41.73	---	56.00	14.27	5000.0	9.000	N	ON	19.4
0.562000	---	37.65	46.00	8.35	5000.0	9.000	N	ON	19.4
1.522000	---	22.20	46.00	23.80	5000.0	9.000	L1	ON	19.4
1.522000	28.59	---	56.00	27.41	5000.0	9.000	L1	ON	19.4
1.782000	28.20	---	56.00	27.80	5000.0	9.000	L1	ON	19.4
1.782000	---	21.94	46.00	24.06	5000.0	9.000	L1	ON	19.4
6.790000	26.57	---	60.00	33.43	5000.0	9.000	L1	ON	19.3
6.790000	---	21.37	50.00	28.63	5000.0	9.000	L1	ON	19.3
15.014000	31.35	---	60.00	28.65	5000.0	9.000	L1	ON	20.2
15.014000	---	25.28	50.00	24.72	5000.0	9.000	L1	ON	20.2
18.342000	26.37	---	60.00	33.63	5000.0	9.000	N	ON	20.3
18.342000	---	20.78	50.00	29.22	5000.0	9.000	N	ON	20.3

Table 7.6-3: *Conducted disturbance at mains port (Quasi-Peak and CAverage) results: 4000 MHz OBW considered as representative case.*

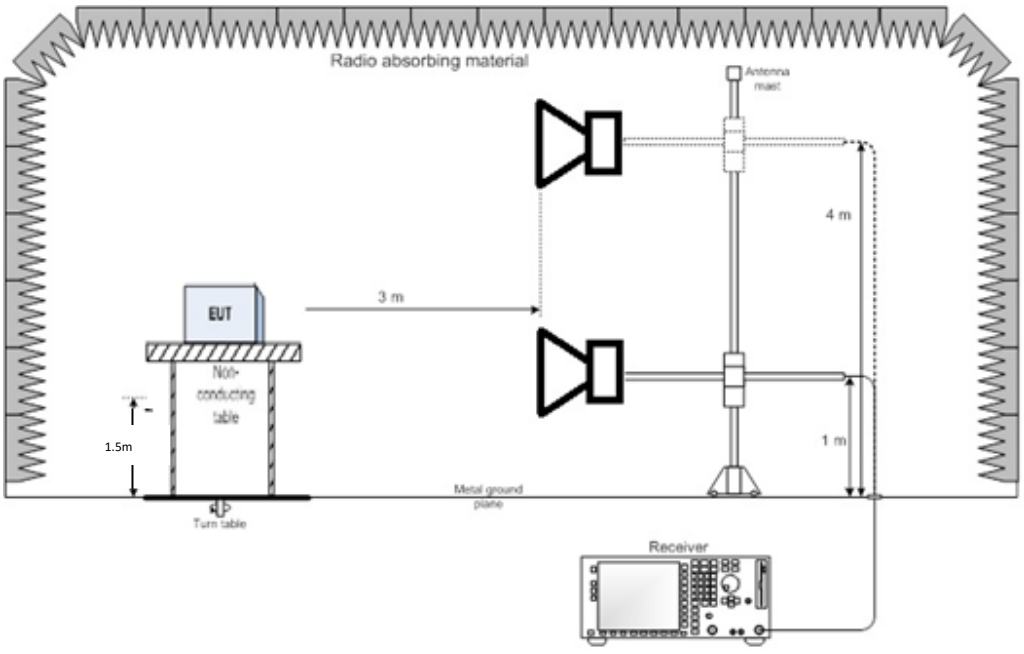
Notes:
[1]Result (dBµV) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2]Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + transient limiter (dB)
[3]The maximum measured value observed over a period of 5 seconds was recorded.

Section 8 Block diagrams of test set-ups

8.1 Radiated emissions set-up



30-1000MHz Setup



Above 1GHz Setup

Thank you for choosing