

Global Product Compliance Laboratory
600-700 Mountain Avenue
Room 5B-108
Murray Hill, New Jersey 07974-0636 USA



TESTING

NVLAP LAB CODE: 100275-0

RF Transmitter Certification Test Report (FCC ID: 2AD8UFW2RMBOM1)

Regulation

FCC CFR 47 Part 15 Subpart E, Section 15.407

Client

Nokia Solutions and Networks Oy

Product Evaluated

**Nokia Flexi Zone FW2RMOM1 LAA RF Module
Operating in Band 46 UNII-3**

GPCL Report Number

TR2019-0029 FCC

GPCL Project Number

2019-0029

Date Issued

February 15, 2019

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Revisions

Date	Revision	Section	Change

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The test results documented in this report refer exclusively to the test model/sample specified, under the conditions and modes of operation as described herein.

Prepared By:

Reviewed By:

Signed:



Q. Yu

GPCL Compliance Engineer

2/15/2019

Date

Signed:



R.J. Johnson

GPCL Technical Manager
NVLAP Approved Signatory

2/15/2019

Date

1. ATTESTATION OF TEST RESULTS

Company Name (Manufacturer)	Nokia Solutions and Networks Oy 2000 W. Lucent Lane Naperville, IL 60563
FCC ID	2AD8UFW2RMBOM1
Product Name	Flexi Zone Multiband Outdoor Micro BTS (MBO) FW2RMBOM1 LAA RF Module
Model Name	MBO LAA: FW2RMBOM1
Serial Number(s)	1M180528260 (Radiated), 1M180528224 (Conducted)
Test Requirement(s)	47 CFR FCC Part 15 Subpart E Section 15.407
Test Procedures/Methods	• ANSI C63.10-2013 • FCC KDB 789033 D02, v02r01, December 2017 • FCC KDB 662911 D01, v02r01, October 2013 • FCC KDB 353028 D01, v01, April 2017
Frequency Band	E-UTRAN Band 46: 5735-5835 MHz (UNII-3)
Operation Mode	Master Device
FCC Part 15 Subpart B Sections 15.107 and 15.109 Class B	Passed
Date Tested	July 6 – December 14, 2018
Type of Application	New Certification
Submission Type	Original Radio Equipment Certification
Test Laboratory	Nokia Global Product Compliance Laboratory 600-700 Mountain Avenue Murray Hill, New Jersey 07974-0636 USA FCC Registration No/Designation No: 328881/US5302
Test Engineers	S. Gordon, M. Soli, O. Okorie and J. Yadav

The above product has been evaluated and found to be in compliance with the Commission's Rules and Regulations set forth in the above standards.

FCC Section 2.911(e) Certification of Technical Test Data

The technical test data presented in this report are accurate.

2. SUMMARY OF THE TEST RESULTS

Applied Standards: 47 CFR FCC Part Subpart E Section 15.407 UNII-3				
Section	FCC Rules	Description of Tests	Test Condition	Results In Compliance
4.4	15.403 (i) & 15.215(c)	Emission Bandwidth (26dB Bandwidth)	Conducted	Yes
4.5	15.407 (e)	Minimum Emission Bandwidth (6dB Bandwidth)		Yes
4.6	15.407 (a)(1)(3)(4)	Maximum Power Output and Maximum Outdoor EIRP		Yes
4.7	15.407 (a)(1)(3)(5)	Peak Power Spectrum Density		Yes
4.8	15.407 (b)(1)(4-5)(8)	Unwanted Radiated Out-of-Band Emissions	Radiated	Yes
4.9	15.407 (b)(1)(4-8)	Unwanted Radiated Spurious Emissions		Yes
4.10	15.407 (b)(6) & 15.207	AC Power Line Conducted Emissions	Conducted	Yes
	15.407 (g)	Frequency Stability*		Yes

* KDB 789033 D02 Section II.A.3: the grantee is responsible for ensuring that the EUT meets 15.407(g) requirements; however, the applications for equipment certification are not required to include test reports with explicit demonstration of compliance.

2.1. Measurement Uncertainties for EMC Conducted and Radiated Emissions

The results of the calculations to estimate uncertainties for the several test methods and standards are shown in the Table below. These are the worst-case values.

Worst-Case Estimated Measurement Uncertainties

Standard, Method or Procedure	Condition	Frequency MHz	Expanded Uncertainty (k=2)
a. EMC Emissions, (e.g., ANSI C63.4, CISPR 11, 14, 22, etc., using ESHS 30, EMC-60, LISNs/AMNs and antennas)	Conducted Emissions	0.009 - 30	± 2.0 dB
	Radiated Emissions (AR-8 Semi-Anechoic Chambers)	30 – 200 200 – 1000	±5.1 ~ ±5.4 dB ±4.3 ~ ±4.7 dB
	Radiated Emissions (OATS)	1000 – 18,000	±3.3 dB

2.2. Measurement Uncertainties for Antenna Port Conducted Testing

Worst-Case Estimated Measurement Uncertainties

Standard, Method or Procedure	Expanded Uncertainty (k=2)
RF Power	± 1.4 dB
Occupied Bandwidth	± 2.2 dB
Conducted Spurious Emissions	± 2.8 dB

3. GENERAL INFORMATION

3.1 Product Descriptions

Table 3.1.1 Product Specifications

Specification Items	Description		
Product Type	MBO LAA LTE RF Module		
Radio Type	Intentional Transceiver		
Operation Mode	Master Device, Point to Multipoint		
Modulation	OFDM (QPSK, 16QAM, 64QAM, 256QAM)		
Radio Access Technology	LAA LTE-TDD		
Frequency Range	E-UTRAN Band 46: 5735-5835 MHz (UNII-3)		
Carrier Operating Frequency	5745 - 5825 MHz		
Channel Bandwidth	20MHz/40MHz (aggregated)		
Maxi. Number of Carriers per Port	2		
Maxi. Spacing between Carriers	Adjacent		
Number of Tx Ports	2		
Number of Rx Ports	2		
MIMO	Yes		
Transmit Diversity	Yes		
Receive Diversity	Yes		
Max Rated Conducted RF Power	5735-5835 MHz (UNII-3)	FA2WA Direc Ant with Max Ave Gain ≤ 6 dBi: 30dBm (1W) total FA2RA Omni-Direc Ant with Max Gain = 7.5 dBi: 28.5dBm (0.7W) total FA2RD Omni-Direc Ant with Max Gain = 10 dBi: 26dBm (0.4W) total	
Max Rated EIRP Power	5735-5835 MHz (UNII-3)	36dBm total	
Minimum Condcuted Power	50mW per path and 100mW per unit		
Deployment Environment	Outdoor		
Environment Temperature Range	-40 °C to 55 °C		
Power Source	Voltage Ranges (VAC)		
	Minimum	Nominal	Maximum
	90.0	110.0	264.0
Software Version (Master)	FLF18		
Hardware Version (Master)	474568A.X22		
Antennas	Refer to Section 3.5		

3.2 Accessories

A Nokia system module for MBO, which provides baseband signals, the baseband processing, control and timing to the radio, was used for all required conducted and radiated testing. The EUT is unmodified and is commercially available.

3.3 Description of Antenna(s)

Currently, there are three available antennas of two types to be equipped for this MBO LAA RF Module operating in Band 46, no beamforming. The demonstration of meeting the FCC Section 15.203 and KDB 353028 D01 requirements on antennas has been presented in Exhibit 5, where it stated that unique (non-standard) antenna connectors were designed with the product and professional installation was used. There are provisions for special connectors to be used for any external antennas.

Table 3.3.1 UNII-1/3 Antenna Data from Manufacturers

Ant No	Model Name	Antenna Type/ Size (mm)	Freq (MHz)	Tx/Rx Port	Max Avg Antenna Gain Over Two Ports (dBi)
1	FA2RD FZ 474881A	Omni-Directional 316(L) × 29(W)	5150 ~ 5850	Tx/Rx 1/2	10
2	FA2WA FZ 473461A	Directional 380(L) × 290(W) × 190(D)	5150 ~ 5925	Tx/Rx 1/2	6
3	FA2RA 473121A	Omni-Directional , 235(L) × 51(D)	5150 ~ 5850	Tx/Rx 1/2	7.5

Table 3.3.2 UNII Antennas Tested (with the Highest Gain of Each Type)

Antenna No	Model Name	Antenna Type	Frequency (MHz)	Max Avg Ant Gain Over Two Ports (dBi)
1	FA2RD	Omni-Directional	5150 ~ 5850	10
2	FA2WA	Directional	5150 ~ 5925	6

The compliance of the EUT with the maximum power setting and the omni-directional antenna #1 and the directional antenna #2, which have the highest antenna gain among the same type, was evaluated, respectively.

The compliance of the EUT with omni-directional antenna #3 FA2RA has been examined as well.

4. REQUIRED MEASUREMENTS AND RESULTS

4.1 Regulatory Requirements

The tests in this report were performed for Unlicensed-National Information Infrastructure Devices Operating in the 5735-5835 MHz Band in accordance with the requirements of FCC CFR 47 Part 15 Subpart E. The requirements are provided in the following:

(1) Emission Bandwidth (FCC 15.403 (i), 15.215(c), KDB 789033D02 III.B)

The emission bandwidth shall be determined by the 26dB bandwidth. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

In the case of intentional radiators operating under the provisions of Subpart E, the emission bandwidth may span across multiple contiguous frequency bands identified in that subpart. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage.

(2) Minimum Emission Bandwidth (FCC 15.407(e))

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

(3) Output Power and Power Spectrum Density Limits (FCC 15.407 (a)(3)(4)(5))

For an access point operating in the band 5.725-5.85 GHz, the maximum conducted output power shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum conducted output power must be measured with *rms* detector. The maximum power spectral density in the 5.725-5.85 GHz band is measured over a reference bandwidth of 500 kHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth.

(4) Unwanted Emission Limits (FCC 15.407 (b)(4-8)), 15.209 (a) and 15.205 (a, b, c).

The peak emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

- i. For transmitters operating in the 5.725-5.85 GHz band: all emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing

linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

- ii. The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.
- iii. Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in Section 15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in Section 15.207.
- iv. The provisions of Section 15.205 apply to UNII intentional radiators, where the field strength of emissions appearing *within Section 15.205 restricted frequency bands* shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1GHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1GHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the *average* value of the measured emissions. The provisions in Section 15.35 apply to these measurements.
- v. When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

Therefore,

- 1) the emissions from the UNII transmitter in the frequency spectrum up to the 10th harmonics are subject to the following requirements:
 - a. For emissions outside the restricted bands, per 15.407(b)(6-7), KDB789033 D02 II.G.2.a-c,
 - (i) $f < 1\text{GHz}$, the limits specified in 15.209 need to be met by QPK or PK;
 - (ii) $f > 1\text{GHz}$, the limits specified in 15.407 (b)(1-4) for UNII-1/2/3 need to be met by PK;
 - b. For emissions in the restricted bands, per 15.407(b)(6-7), 15.205 (b), KDB 789033 D02 II.G.1.a-c,
 - (i) $f < 1\text{GHz}$, the limits specified in 15.209 need to be met by QPK or PK;
 - (ii) $f > 1\text{GHz}$, the limits specified in 15.209 need to be met by AVE and the limits specified in 15.407 (b)(1-4) for UNII-1/2/3 need to be met by PK
- 2) the emissions from the digital circuits of the EUT in the frequency spectrum up to the 5th harmonics are subject to the 15.109 limit.
- 3) the emissions from AC power lines in the frequency range of 150kHz and 30MHz are subject to the 15.107 and 15.207 limits.

Either radiated measurement with antenna in place or Antenna-port conducted measurement plus cabinet emissions test with antenna terminated can be used.

Table 4.1.1 FCC Part 15.205 (a) Restricted Bands of Operation

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
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			

(5) Frequency Stability (FCC 15.407 (g)).

Manufacturers of UNII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

KDB 789033 D02 Section II.A.3 stated that the grantee is responsible for ensuring that the EUT meets Section 15.407(g) requirements; however, the applications for equipment certification are *not* required to include test reports with explicit demonstration of compliance.

(6) Antennas to Be Tested (15.203, 15.204, KDB 353028 D01)

Section 15.204(c)(2) requires that compliance testing use the *actual* antennas to be certified with the part 15 intentional radiator. All devices (*e.g.*, radio card, module) must be tested with the antennas connected to the device.

Section 15.204(b) states that an approved “transmission system” must always be marketed as a complete system, *i.e.*, including the antenna.

KDB 353028 D01 Section III.A stated that when submitting test data for part 15 transmitters to be used with multiple antennas, the testing for the highest gain of each type of antenna (*e.g.*, highest gain for each patch, yagi, grid, dish, monopole, etc.) was required. For systems that can operate at different power levels, test data with the highest output power must be submitted.

4.2 UNII-3 Band Carrier Frequencies

Table 4.2.1 5.8GHz UNII-3 (5735 -5835MHz) Frequency Channel Plan

Channel No.	Freq (MHz)	Bandwidth
149	5745	20MHz
153	5765	
157	5785	
161	5805	
165	5825	
149, 153	5745, 5765	40MHz
157, 161	5785, 5805	
161, 165	5805, 5825	

Table 4.2.2 5.8GHz UNII-3 (5735 -5835MHz) Channels Used for Testing

Channel No.	Freq (MHz)	Bandwidth
149	5745	20MHz
157	5785	
165	5825	
149, 153	5745, 5765	40MHz
157, 161	5785, 5805	
161, 165	5805, 5825	

4.3 Test Configurations and Setup

All measurements were performed with the EUT transmitting at 100% duty cycle (at least 98% if required by the EUT for amplitude control purposes) at the following power control level.

Table 4.3.1 Power Levels Tested

Band	Per Port Power Setting for Antennas #1 (Max Ave $G^{\max}$ = 10 dBi)	Per Port Power Setting for Antennas #2 (Max Ave $G^{\max}$ = 6 dBi)*	Per Port Power Setting for Antennas #3 (Max Ave $G^{\max}$ = 7.5 dBi)
UNII-3	23 dBm	27 dBm	25.5 dBm

Various modulation types (Q/16QAM, 64QAM and 256QAM) and bandwidth modes (20MHz, 40MHz and 60MHz) were evaluated for the conducted and radiated tests, including RF power output, peak power spectrum density, emissions bandwidth and unwanted emissions.

The test setup diagrams are given below.

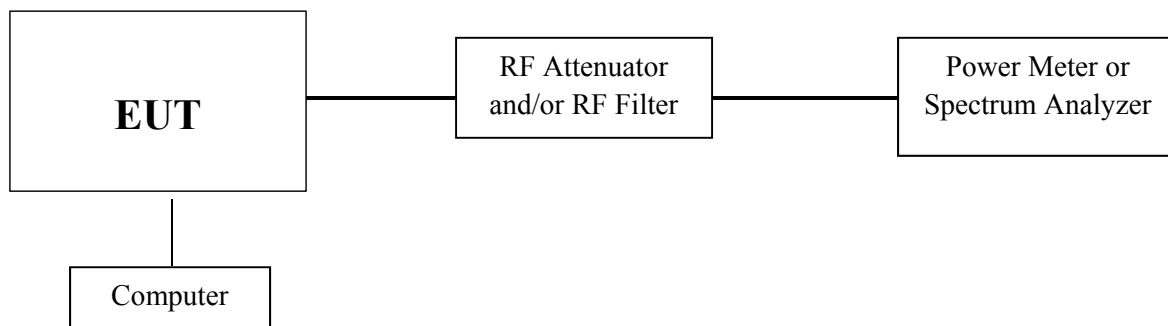


Figure 4.3.1 Setup Diagram of Conducted Test for RF Output Power, Power Spectrum Density, Modulation Characteristics, Occupied Bandwidth and Unwanted Emissions.

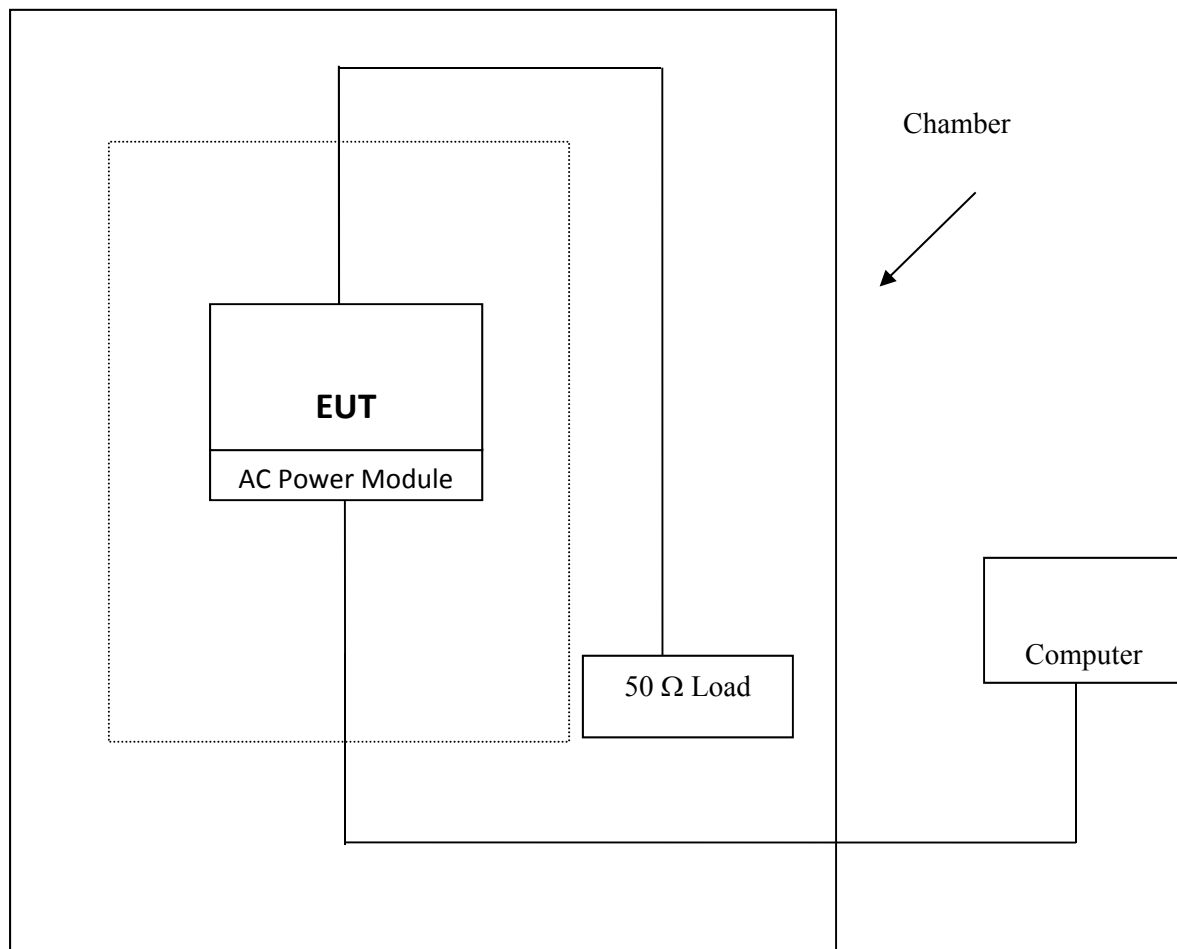


Figure 4.3.2 Setup Diagram of Radiated Test

4.4 MEASUREMENT REQUIRED: EMISSION BANDWIDTH (26 dB BANDWIDTH) – FCC SECTIONS 15.403 (i) & 15.215(c)

The measurement requirements of the emission bandwidth were provided in Section 4.1

The 26dB emission bandwidth was measured at both antenna ports for all channels listed in Table 4.2.2. The measurement follows the procedures given in ANSI C63.10. The automatic bandwidth measurement function of the spectrum analyzer was utilized where the resolution bandwidth (RBW) is initially set to 1% of the bandwidth and the video bandwidth (VBW), that is 200kHz for 20MHz and 400kHz for 40MHz, the video bandwidth was set to 1MHz, and the peak detector with maximum hold and auto sweep was used. Then the maximum width of the emission that is 26 dB down from the maximum of the emission was measure and compared with the RBW setting of the analyzer. The RBW might be readjusted as needed until the RBW/EBW ration is approximately 1%.

The maximum allowable conducted power levels were used for this measurement. The measured results are tabulated below. Three plots which have the widest emission bandwidth are provided below.

Table 4.4.1 26dB Emissions Bandwidth for One 20MHz Carrier UNII-3 (27dBm/port)

Bands (GHz)	Ch No/ Freq (MHz)	Modulation	Port 1 (MHz)	Port 2 (MHz)
UNII-3 (5.735- 5.835)	149/5745	Q/16QAM	20.45	20.49
		64QAM	20.13	20.26
		256QAM	20.38	20.26
	157/5785	Q/16QAM	20.29	20.49
		64QAM	20.33	20.23
		256QAM	20.37	20.37
	165/5825	Q/16QAM	20.17	20.11
		64QAM	20.47	20.35
		256QAM	20.36	20.33

Table 4.4.2 26dB Emissions Bandwidth for Two-20MHz Carriers UNII-3 (27dBm/port)

Bands (GHz)	Ch No/ Freq (MHz)	Modulation	Port 1 (MHz)	Port 2 (MHz)
UNII-3 (5.74- 5.835)	157, 161/ 5785, 5805	Q/16QAM	40.22	40.12
		64QAM	40.23	40.19
		256QAM	40.15	40.48

For UNII-3, the 26dB emission bandwidth measured with 27dBm power setting was in the range of 20.11-20.49 MHz for one-20MHz carriers and 40.12-40.48 MHz for two-20MHz carriers.

The maximum 26dB emissions bandwidths of the EUT measured at its antenna transmitting terminals in the UNII-3 band for various modulations are tabulated below. The results and measurements are in full compliance with the Rules of the Commission.

Table 4.4.3 Maximum 26dB Emissions Bandwidth (EBW) Measured

Bands (GHz)	Bandwidth (MHz)	Max 26dB EBW (MHz)	Test Limit	Test Results
UNII-3 (5.74- 5.835)	1 x 20MHz	20.49	NA	Pass
	2 x 20MHz	40.48		Pass

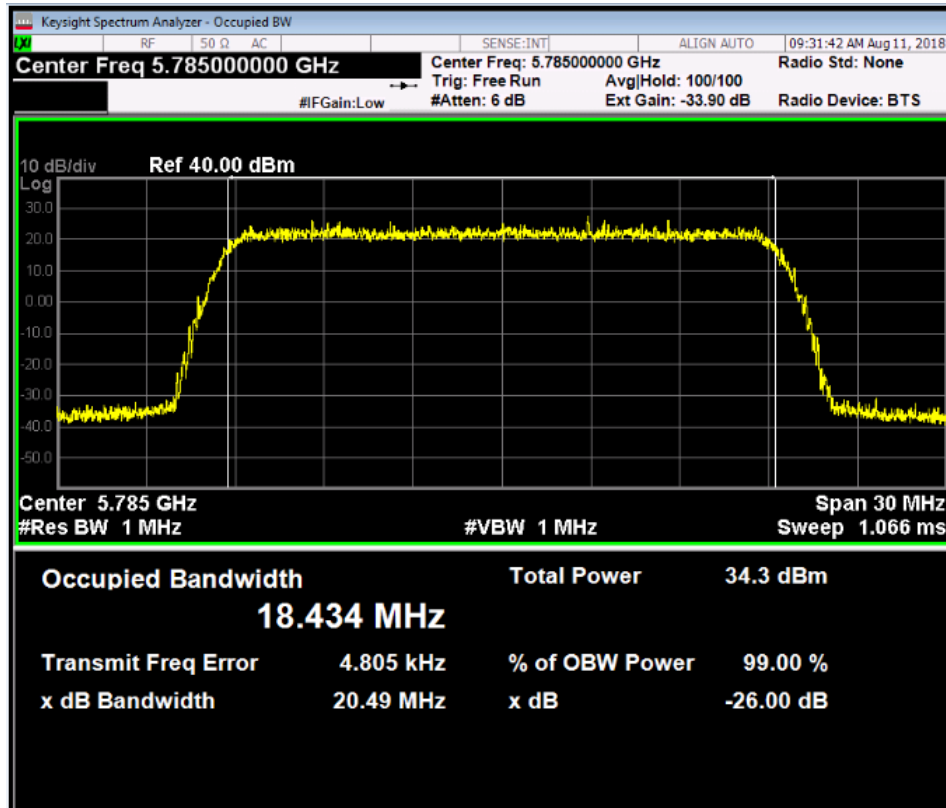


Figure 4.4.2(a) The Maximum 26dB Emission Bandwidth Measured (20.49MHz) for UNII-3 20 MHz Carrier at 157/5785MHz, 27dBm, Q/16QAM, Port 2.

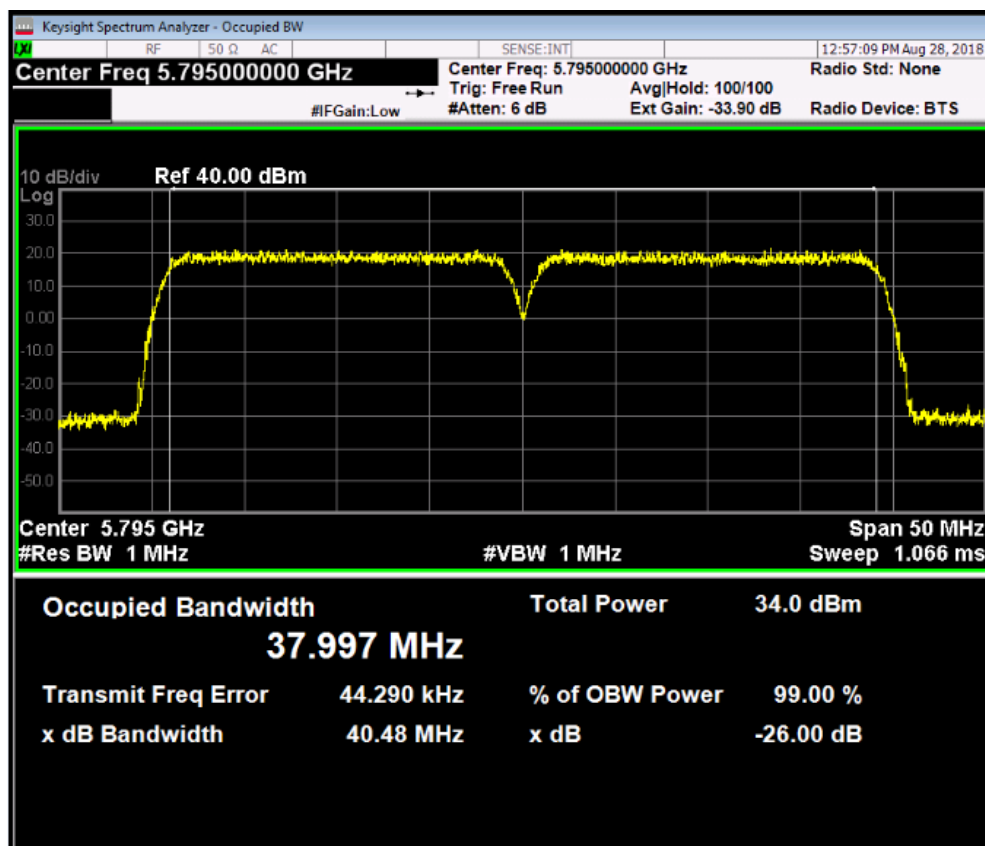


Figure 4.4.2 The Maximum 26dB Emission Bandwidth Measured (40.48MHz) for UNII-3 Two 20 MHz Carrier at Ch 157, 161/5785, 5805MHz, 27dBm, 256QAM, Port 2.

4.5 MEASUREMENT REQUIRED: MINIMUM EMISSION BANDWIDTH (6 dB BANDWIDTH) – FCC SECTION 15.407 (e)

The 6dB emission bandwidth was measured at both antenna ports for the UNII-3 20MHz channels listed in Table 4.2.2 with all modulations. The measurement follows the procedures given in ANSI C63.10. The RBW and VBW were set to 100kHz and 1MHz, respectively. The peak detector with maximum hold and auto sweep was used. Then the maximum width of the emissions that is 6 dB down from the maximum of the emission was measure.

The lowest power level, 23dBm per port, was used for 6dB emission bandwidth measurement. For UNII-3, the 6dB emission bandwidths measured were in the range of 17.77-18.47 MHz for 1x20MHz carriers with 23dBm per port. The results are well larger than 500kHz requirement. The measured results are tabulated below. The plot which has the smallest emission bandwidth is provided below.

Table 4.5.1 6dB Emission Bandwidth for 20MHz Carriers (23dBm/Port)

Bands (GHz)	Ch No/ Freq (MHz)	Modulation	6dB Bandwidth Port 1 (MHz)	6dB Bandwidth Port 2 (MHz)	Test Limit	Test Results
UNII-3 (5.735-5.835)	149/5745	Q/16QAM	17.85	18.47	≥ 500 kHz	Pass
		64QAM	17.96	17.97		Pass
		256QAM	17.78	18.18		Pass
	157/5785	Q/16QAM	17.92	17.77	≥ 500 kHz	Pass
		64QAM	18.36	18.27		Pass
		256QAM	18.15	18.18		Pass
	165/5825	Q/16QAM	18.19	18.20	≥ 500 kHz	Pass
		64QAM	18.15	18.28		Pass
		256QAM	18.20	18.15		Pass

The minimum 6dB emission bandwidth of the EUT measured at its antenna transmitting terminals for the UNII-3 band for all operation modes is 17.77 MHz, larger than 500kHz requirement. The results and measurements are in full compliance with the requirement.

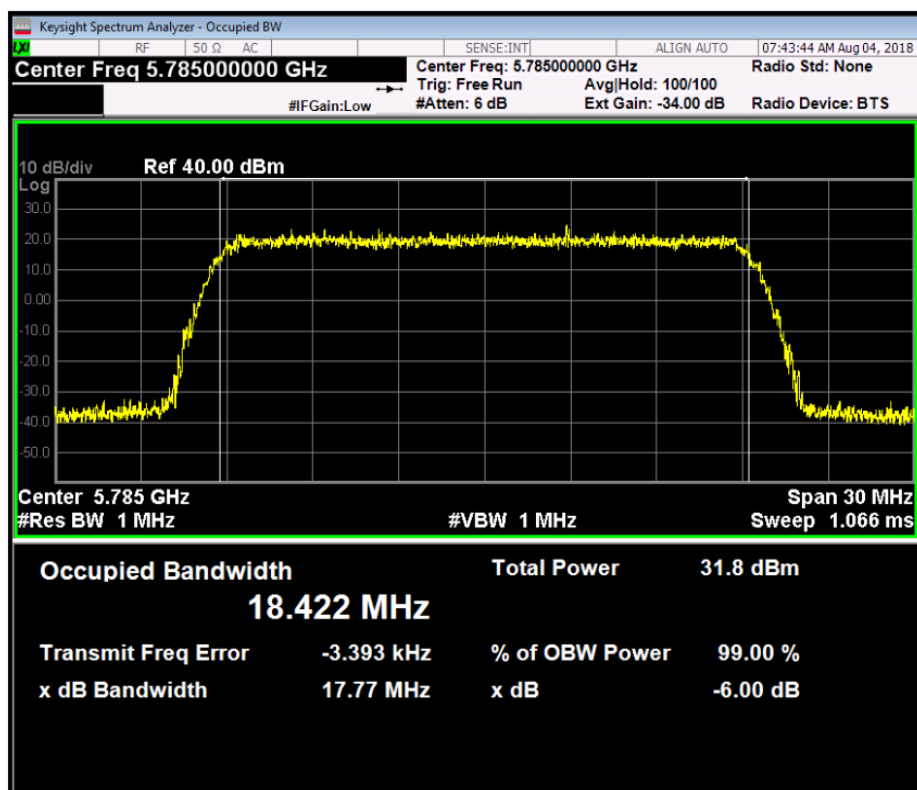


Figure 4.5.1 The Minimum 6dB Emission Bandwidth Measured (17.77MHz) for a 20MHz Carrier at Ch 157/5785MHz, 23dBm, Q/16QAM, Port 2.

4.6 MEASUREMENT REQUIRED: MAXIMUM POWER OUTPUT AND MAXIMUM OUTDOOR EIRP – FCC SECTION 15.407 (a)(3)(4)

The maximum output power was measured at the both antenna ports for all channels listed in Table 4.2.2 and all modulations. The measurement follows the procedures given in ANSI C63.10.

The power limit is 1W (30dBm). The maximum conducted output power shall be reduced by the amount in dB that the antenna gain exceeds 6 dBi.

For multiple antennas with equal transmit power but unequal gains, per KDB 662911 D01, the directional antenna gain of uncorrelated signals is equal to

$$\text{Directional Gain} = 10 \log \left[\frac{10^{G_1/10} + 10^{G_2/10} + \dots + 10^{G_N/10}}{N_{ANT}} \right] \text{dBi}, \quad \text{and}$$

the directional antenna gain of correlated signals is equal to

$$\text{Directional Gain} = 10 \log \left[\frac{(10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_N/20})^2}{N_{ANT}} \right] \text{dBi},$$

where $G_1, G_2, \dots, G_N$ are antenna gains.

For the spatial multiplexing (SM) transmissions, like 802.11n MCS8-15, the EUT operates with two uncorrelated spatial data streams on two transmitting ports. Per KDB 662911 D01 (Section (F)(2)(e)), the directional antenna gain may be calculated by using either of the following methods:

- i. Directional Gain = Max { $G_1, G_2, \dots, G_N$ } + Array Gain = Max { $G_1, G_2, \dots, G_N$ }, where Array Gain = $10 \log (N_{ANT}/N_{SS}) = 0$
- ii. Calculate the directional gain by using the formula for uncorrelated signals provided above if each antenna is only fed by its own data stream.

For Cyclic Delay Diversity (CDD) transmissions, per KDB 662911 D01 (Section (F)(2)(f)), the directional antenna gain may be calculated by using either of the following methods:

- i. Directional Gain = Max { $G_1, G_2, \dots, G_N$ } + Array Gain
 - a. For power measurements, Array Gain = 0 if $N_{ANT} \leq 4$;
 - b. For power spectrum density (PSD) measurement, Array Gain = $10 \log (N_{ANT}/N_{SS})$ dB, where N_{SS} is number of spatial streams and $N_{SS} = 1$ was suggested by the FCC for calculating the worst directional gain.
- ii. Calculate the directional gain by using the formula for correlated signals provided above.

The EUT does not have beamforming function and two signals are not correlated. Hence, for the power and PSD limits, the directional antenna gain was calculated by using the equation above for uncorrelated signals. The limits for the combined maximum transmitting power and PSD are calculated and tabulated below.

Table 4.6.1. Transmitter Power and PSD Limits at Antenna Ports

Band	Antenna	Max Avg Ant Gain* for Spectral Density (dBi)	Max Avg Ant Gain* for Total Power (dBi)	Total PSD Limit (dBm/500kHz)	Total Power Limit (dBm)
UNII-3	#1	10	10	26.0	26
	#2	6	6	30.0	30
	#3	7.5	7.5	28.5	28.5

*Maximum average antenna gain was based on the uncorrelated directional antenna gain calculated from two antennas.

The output power of the EUT was first verified by a power meter and then measured by a spectrum analyzer. The RBW and VBW were set to 1MHz and 3MHz, respectively. The RMS detector and trace average (≥ 100) were used. The output power was calculated by integrating the spectrum across the EBW of the carrier using the SA's band power measurement function with band limits set equal to the EBW band edges. The total combined output power was calculated by summing the measured output power in mW at the various antenna ports.

For UNII-3 band, the maximum total output power measured for the EUT equipped with the antenna #1 among all operation modes supported was 26.0dBm for both one-20MHz carriers and 26.0 for two-20MHz carriers. They are all below the required limits.

For UNII-3 band, the maximum total output power measured for the EUT equipped the antenna #2 among all operation modes supported was 30.0dBm for one-20MHz carriers and 30.0 for two-20MHz carriers. They are all below the required limits.

The measurement results for the conducted output power at both ports are provided in Tables below and 2 plots which have maximum output power among them are given in Figures below.

Since the EUT equipped with the antenna #3 has a different maximum output power than that of the EUT with #1 and #2 antennas, its output power was verified as well for information. For UNII-3 band, the maximum total output power measured for the EUT equipped the antenna #3 among all operation modes supported was 28.5dBm for one-20MHz carriers and 28.4 for two-20MHz carriers. They are all below the required limits.

**Table 4.6.2(a) Maximum Mean Combined RF Power Output at Antenna Ports for 5GHz
1x20MHz Carrier at 23dBm for UNII-3 for Antenna #1 FA2RD**

Bands (GHz)	Ch No/ Freq (MHz)	Modulation	Port 1 (dBm)	Port 2 (dBm)	Total Power (dBm)	Power Limit (dBm)	Test Results
UNII-3 (5.74-5.835)	149/5745	Q/16QAM	22.95	22.90	25.94	26	Pass
		64QAM	22.95	22.95	25.96	26	Pass
		256QAM	22.79	22.86	25.84	26	Pass
	157/5785	Q/16QAM	22.93	22.94	25.95	26	Pass
		64QAM	22.93	22.93	25.94	26	Pass
		256QAM	22.96	22.88	25.93	26	Pass
	165/5825	Q/16QAM	22.76	22.99	25.89	26	Pass
		64QAM	22.80	22.79	25.81	26	Pass
		256QAM	22.75	22.83	25.80	26	Pass

**Table 4.6.2(b) Maximum Mean Combined RF Power Output at Antenna Ports
for 5GHz 1x20MHz Carrier at 27dBm for UNII-3 for Antenna #2 FA2WA**

Bands (GHz)	Ch No/ Freq (MHz)	Modulation	Port 1 (dBm)	Port 2 (dBm)	Total Power (dBm)	Power Limit (dBm)	Test Results
UNII-3 (5.74- 5.835)	149/5745	Q/16QAM	27.00	26.76	29.9	30.0	Pass
		64QAM	26.77	26.77	29.8	30.0	Pass
		256QAM	26.75	27.02	29.9	30.0	Pass
	157/5785	Q/16QAM	26.94	27.02	30.0	30.0	Pass
		64QAM	26.99	26.99	30.0	30.0	Pass
		256QAM	26.95	26.86	29.9	30.0	Pass
	165/5825	Q/16QAM	26.93	27.06	30.0	30.0	Pass
		64QAM	26.80	26.95	29.9	30.0	Pass
		256QAM	26.87	26.98	29.9	30.0	Pass

**Table 4.6.2(c) Maximum Mean Combined RF Power Output at Antenna Ports
for 5GHz 1x20MHz Carrier at 25.5dBm for UNII-3 for Antenna #3 FA2RA**

Bands (GHz)	Ch No/ Freq (MHz)	Modulation	Port 1 (dBm)	Port 2 (dBm)	Total Power (dBm)	Power Limit (dBm)	Test Results
UNII-3 (5.74- 5.835)	149/5745	Q/16QAM	25.23	25.27	28.26	28.5	Pass
		64QAM	25.23	25.21	28.23	28.5	Pass
		256QAM	25.48	25.27	28.39	28.5	Pass
	157/5785	Q/16QAM	25.50	25.45	28.49	28.5	Pass
		64QAM	25.45	25.48	28.48	28.5	Pass
		256QAM	25.48	25.48	28.49	28.5	Pass
	165/5825	Q/16QAM	25.31	25.46	28.40	28.5	Pass
		64QAM	25.44	25.47	28.47	28.5	Pass
		256QAM	25.31	25.41	28.37	28.5	Pass

**Table 4.6.3(a) Maximum Mean Combined RF Power Output at Antenna Ports for 5GHz
2x20MHz Carriers at 27dBm for UNII-3 with Antennas #2 FA2WA**

Bands (GHz)	Ch No/ Freq (MHz)	Modulation	Port 1 (dBm)	Port 2 (dBm)	Total Power (dBm)	Power Limit (dBm)	Test Results
UNII-3 (5.74-5.835)	149, 153/ 5745, 5765	Q/16QAM	26.98	26.98	29.99	30	Pass
		64QAM	26.50	26.97	29.75	30	Pass
		256QAM	26.71	27.02	29.88	30	Pass
	157, 161/ 5785, 5805	Q/16QAM	26.97	26.94	29.97	30	Pass
		64QAM	26.97	26.98	29.99	30	Pass
		256QAM	26.89	26.84	29.88	30	Pass
	161, 165/ 5805, 5825	Q/16QAM	26.84	26.61	29.74	30	Pass
		64QAM	26.58	26.97	29.79	30	Pass
		256QAM	26.59	26.66	29.64	30	Pass

**Table 4.6.3(b) Maximum Mean Combined RF Power Output at Antenna Ports for 5GHz
2x20MHz Carrier at 23dBm for UNII-3 with Antenna #1 FA2RD**

Bands (GHz)	Ch No/ Freq (MHz)	Modulation	Port 1 (dBm)	Port 2 (dBm)	Total Power (dBm)	Power Limit (dBm)	Test Results
UNII-3 (5.74- 5.835)	149, 153/ 5745, 5765	Q/16QAM	22.73	22.95	25.85	26.0	Pass
		64QAM	22.82	22.81	25.83	26.0	Pass
		256QAM	22.93	22.84	25.90	26.0	Pass
	157, 161/ 5785, 5805	Q/16QAM	22.43	22.79	25.62	26.0	Pass
		64QAM	22.97	22.92	25.96	26.0	Pass
		256QAM	22.90	22.93	25.93	26.0	Pass
	161, 165/ 5805, 5825	Q/16QAM	22.85	22.83	25.85	26.0	Pass
		64QAM	22.68	22.99	25.85	26.0	Pass
		256QAM	22.84	22.88	25.87	26.0	Pass

**Table 4.6.3(c) Maximum Mean Combined RF Power Output at Antenna Ports for 5GHz
2x20MHz Carriers at 25.5dBm for UNII-3 with Antennas #3 FA2RA**

Bands (GHz)	Ch No/ Freq (MHz)	Modulation	Port 1 (dBm)	Port 2 (dBm)	Total Power (dBm)	Power Limit (dBm)	Test Results
UNII-3 (5.74-5.835)	149, 153/ 5745, 5765	Q/16QAM	25.48	25.11	28.31	28.5	Pass
		64QAM	25.44	25.10	28.28	28.5	Pass
		256QAM	25.44	25.00	28.24	28.5	Pass
	157, 161/ 5785, 5805	Q/16QAM	25.41	25.24	28.34	28.5	Pass
		64QAM	25.39	25.30	28.36	28.5	Pass
		256QAM	25.31	25.23	28.28	28.5	Pass
	161, 165/ 5805, 5825	Q/16QAM	25.36	25.32	28.35	28.5	Pass
		64QAM	25.25	25.33	28.30	28.5	Pass
		256QAM	25.23	25.26	28.26	28.5	Pass

As a result, the maximum total mean output powers at antenna ports measured are:

Table 4.6.4 Maximum Total Mean Output Power in UNII-3 (5.725-5.835 GHz) at Antenna Ports

Antennas Equipped	Power (dBm) One-20MHz	Power (dBm) Two-20MHz
#1	26.0	26.0
#2	30.0	30.0
#3	28.5	28.4

For the antenna #1, the maximum combined mean RF power outputs of the EUT at its antenna transmitting terminals across the UNII-3 bands for all operation modes are 26.0dBm (0.4W) for one-20MHz and two-20MHz carriers. The maximum EIRPs of the EUT equipped with any antenna #1 are all equal or less than 36.0dBm.

For the antenna #2, the maximum combined mean RF power outputs of the EUT at its antenna transmitting terminals across the UNII-3 bands for all operation modes are 30.0dBm (1W), for both one-20MHz and two-20MHz carriers. The maximum EIRPs of the EUT equipped with any antenna #2 are all equal or less than 36.0dBm.

For the antenna #3, the maximum combined mean RF power outputs of the EUT at its antenna transmitting terminals across the UNII-3 bands for all operation modes are 28.5dBm (0.7W), for one-20MHz and two-20MHz carriers. The maximum EIRPs of the EUT equipped with any antenna #2 are all equal or less than 36.0dBm.

They are all below the required limits and are in full compliance with the regulatory requirement.

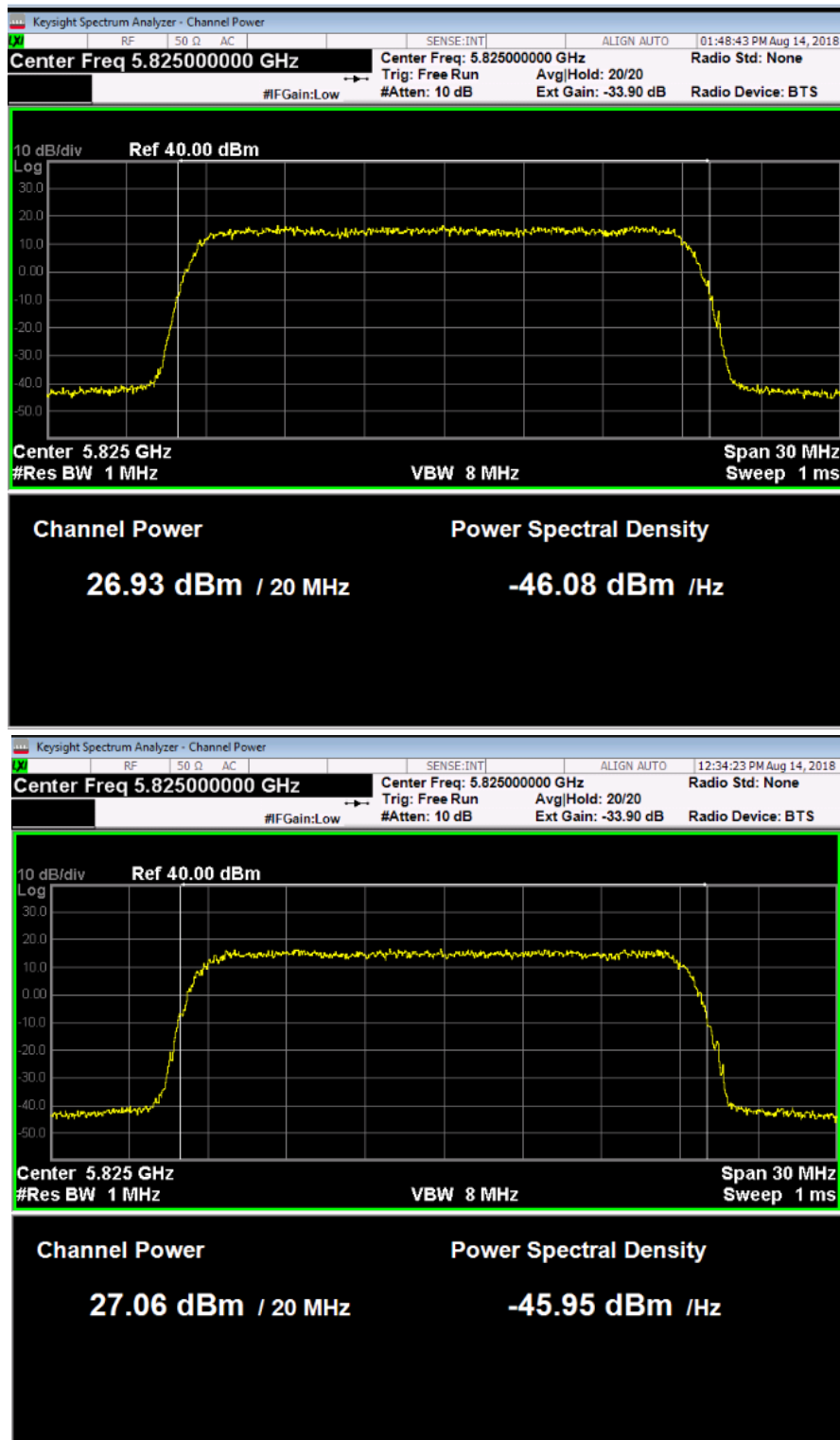


Figure 4.6.1(a) The Mean Output Power Measured for UNII-3 Q/16Q 1x20MHz Carrier at 5825MHz, 27dBm, Port 1 & Port 2, for EUT with Antenna #2 (Combined Output Power 30.0 dBm).

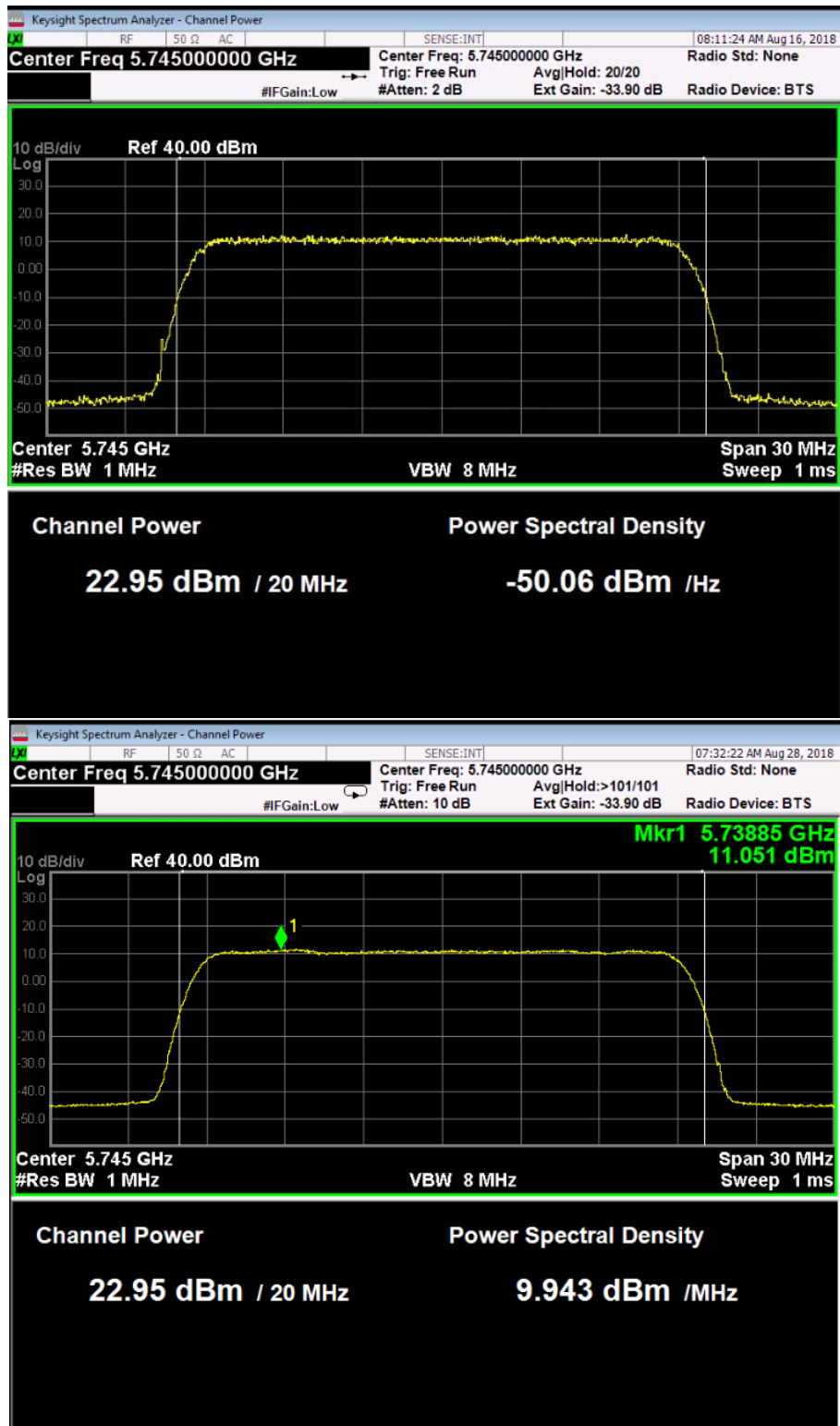


Figure 4.6.1(b) The Mean Output Power Measured for UNII-3 64QAM 1x20MHz Carrier at 5745MHz, 23dBm, Port 1 & Port 2, for EUT with Antenna #1 (Combined Output Power 26.0 dBm).



Figure 4.6.2(a) The Mean Output Power Measured for UNII-3 Q/16Q 2x20MHz Carriers at 5745MHz and 5765MHz, 27dBm, Port 1 & Port 2, for EUT with Antenna #2 (Combined Output Power 30.0 dBm).

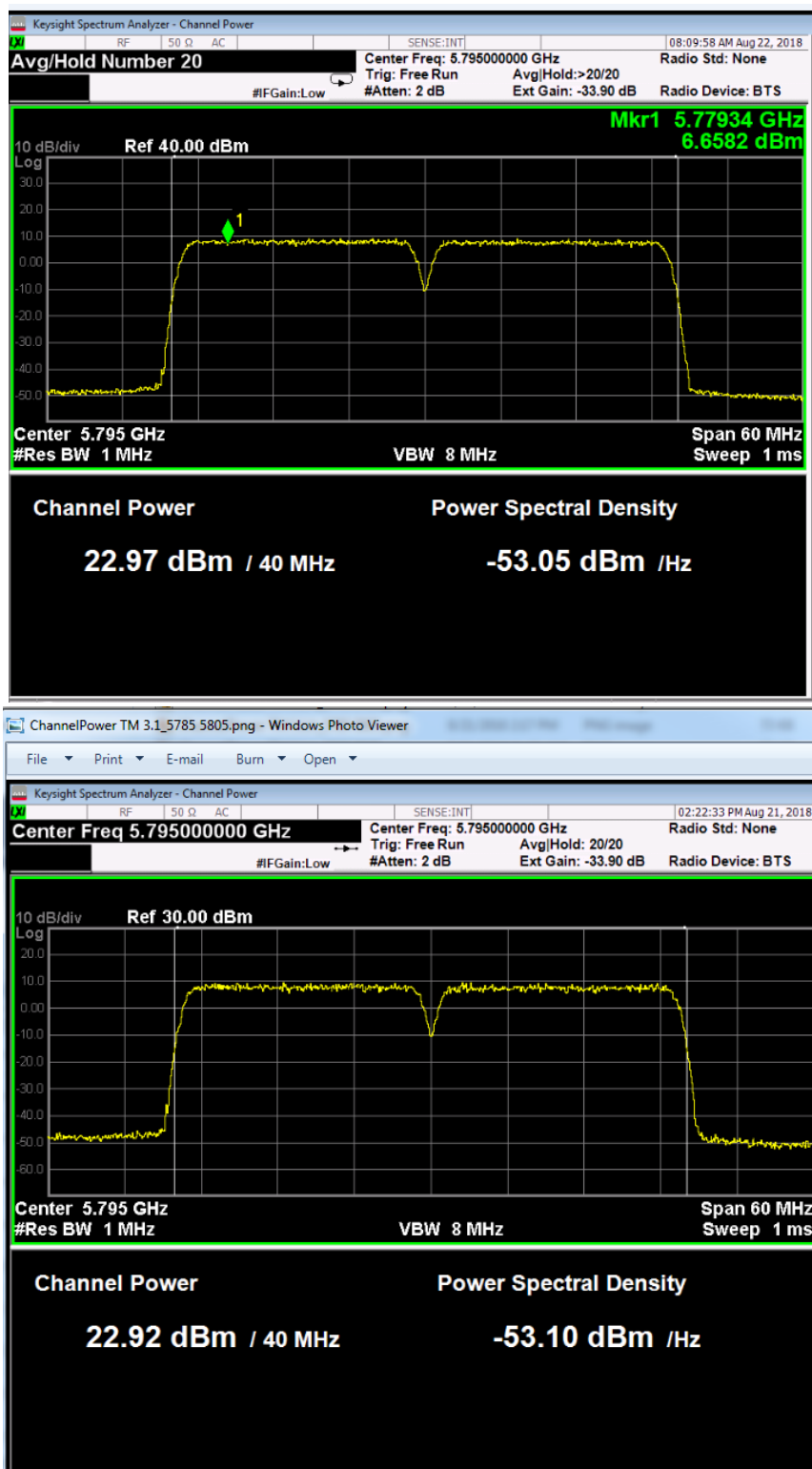


Figure 4.6.2(b) The Mean Output Power Measured for UNII-3 64QAM 2x20MHz Carriers at 5785MHz and 5805MHz, 23dBm, Port 1 and Port 2, for EUT with Antenna #1 (Combined Output Power 26.0 dBm).

4.7 MEASUREMENT REQUIRED: PEAK POWER SPECTRUM DENSITY — FCC SECTION 15.407 (a)(3)(5)

The peak power spectrum density (PPSD) measures the maximum value of the time average of the PSD measured during a period of continuous transmission.

The PPSD was measured at the both antenna ports for all 20MHz channels listed in Table 4.2.2 for all modulations. The measurement follows the procedures given in KDB 789033 D02.

The FCC limit is **30dBm/500kHz (or 33dBm/MHz)** for UNII-3. The peak conducted PSD shall be reduced by the amount in dB that the antenna gain exceeds 6 dBi. The PPSD limits calculated were provided in Table 4.6.1.

The PSD was measured by a spectrum analyzer. The RBW and VBW were set to 1MHz and 3MHz, respectively. The RMS detector and trace average (≥ 100) were used. The PPSD can be found by using either the peak search function on the instrument to find the peak of the spectrum or the spectrum analyzer's PSD function.

Normally, the total PPSD was calculated by the PPSD measured at the port which usually has higher PPSD based on the measurement for output power plus 3dB for two ports. When the margin is slim, the PPSD measurement was performed at both ports to obtain the combined PPSD value, where the total PPSD was obtained by summing the PPSD measured at both antenna ports.

For UNII-3 band, the minimum margin of total PPSD measured for the EUT equipped with the antenna #1 among all operation modes supported was 14.51dBm/MHz for 20MHz carriers, where the total RF power output setting is at 26.0dBm. The total PPSD measured are all below the required limits.

For UNII-3 band, the minimum margin of total PPSD measured for the EUT equipped with the antennas #2 among all operation modes supported was 18.61dBm/MHz for 20MHz carriers, where the total RF power output setting is at 30dBm. The total PPSD measured are all below the FCC required limits.

The above maximum PPSD at 18.61dBm/MHz for 30dBm total output power is also below the PPSD limit 31.5dBm/MHz for the EUT equipped with antenna #3 FA2RA. Therefore, the EUT equipped with antenna #3 will meet FCC PPSD requirement.

The measurement results are given below. The PPSD plots which have the smallest margin for the output powers of the EUT with #1 and # 2 antennas are provided in Figures 4.8.1 – 4.8.2.

The combined PPSD of the EUT at its antenna transmitting terminals across the UNII-3 band for all operation modes are all below FCC required limits and are in full compliance with the regulatory requirements.

Table 4.7.1 Maximum Mean Combined PPSD at Antenna Ports for 5GHz 20MHz Carrier at 23dBm for UNII-3 with Antenna #1 FA2RD

Bands (GHz)	Ch No/ Freq (MHz)	Modulation	PPSD Port1 (dBm/MHz)	PPSD Port2 (dBm/MHz)	Total PPSD (dBm/MHz)	PPSD Limit (dBm/MHz)	Test Results
UNII-3 (5.74-5.835)	149/5745	Q/16QAM	11.152	11.301	14.24	29	Pass
		64QAM	11.051	11.064	14.07	29	Pass
		256QAM	10.812	11.163	14.00	29	Pass
	157/5785	Q/16QAM	11.681	11.311	14.51	29	Pass
		64QAM	10.490	11.041	13.78	29	Pass
		256QAM	11.300	11.287	14.30	29	Pass
	165/5825	Q/16QAM	11.181	10.995	14.10	29	Pass
		64QAM	10.244	11.258	13.79	29	Pass
		256QAM	10.605	11.264	13.96	29	Pass

Table 4.7.2 Maximum Mean Combined PPSD at Antenna Ports for 5GHz 20MHz Carrier at 27dBm for UNII-3 with Antenna #2 FA2WA

Bands (GHz)	Ch No/ Freq (MHz)	Modulation	PPSD Port1 (dBm/MHz)	PPSD Port2 (dBm/MHz)	Total PPSD (dBm/MHz)	PPSD Limit (dBm/MHz)	Test Results
UNII-3 (5.74-5.835)	149/5745	Q/16QAM	14.479	14.723	17.61	33	Pass
		64QAM	15.490	14.639	18.10	33	Pass
		256QAM	14.876	14.784	17.84	33	Pass
	157/5785	Q/16QAM	15.490	15.703	18.61	33	Pass
		64QAM	14.267	14.794	17.55	33	Pass
		256QAM	14.645	14.990	17.83	33	Pass
	165/5825	Q/16QAM	15.340	14.675	18.03	33	Pass
		64QAM	15.302	14.849	18.09	33	Pass
		256QAM	15.133	14.935	18.05	33	Pass

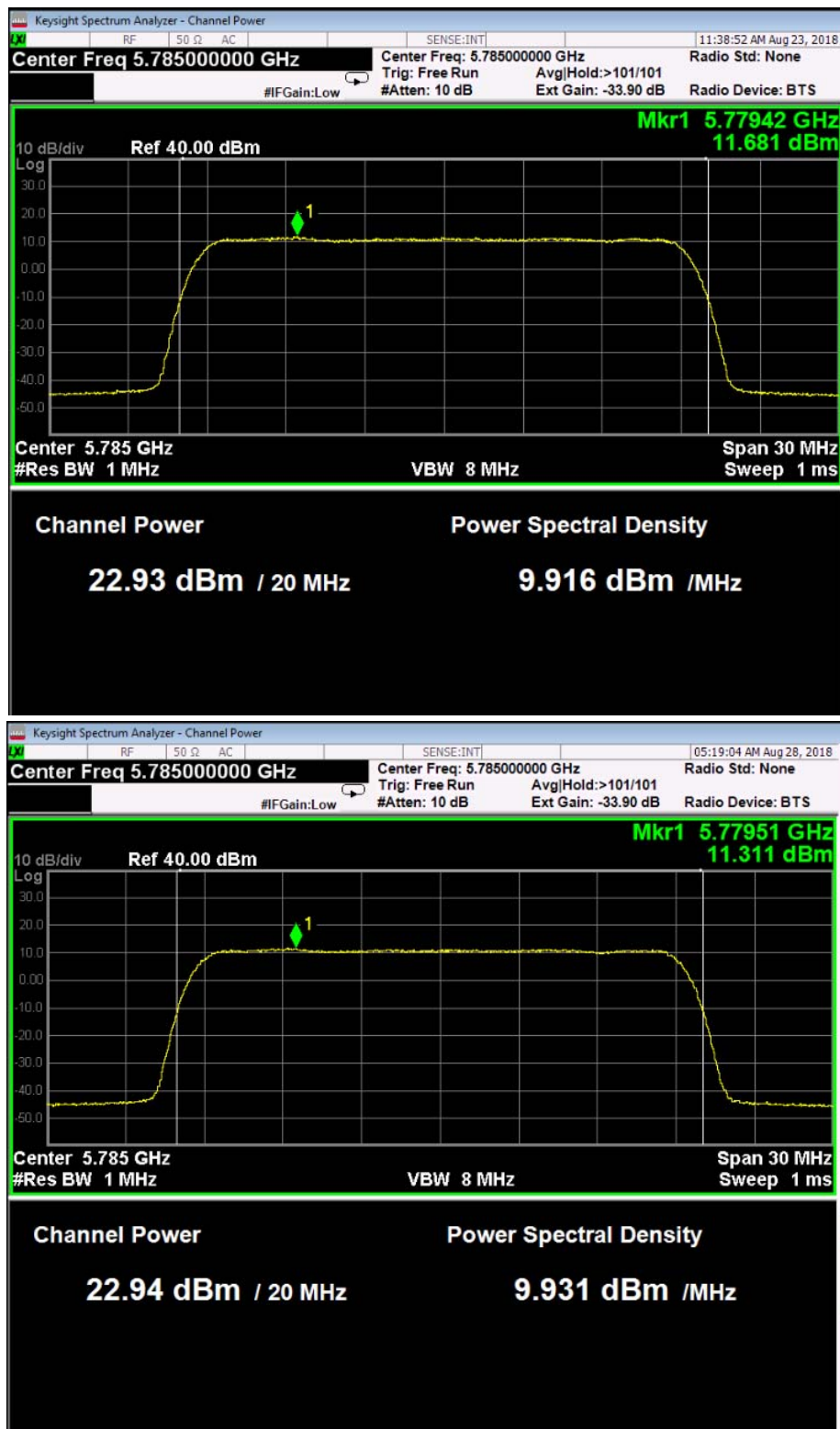


Figure 4.7.1 The Conducted PPSD Measured (Combined 16.87dBm/MHz) for one 20MHz UNII-3 at Channel 5785MHz, 23dBm, Q/16QAM, Port 1 and Port 2, Antenna #1.

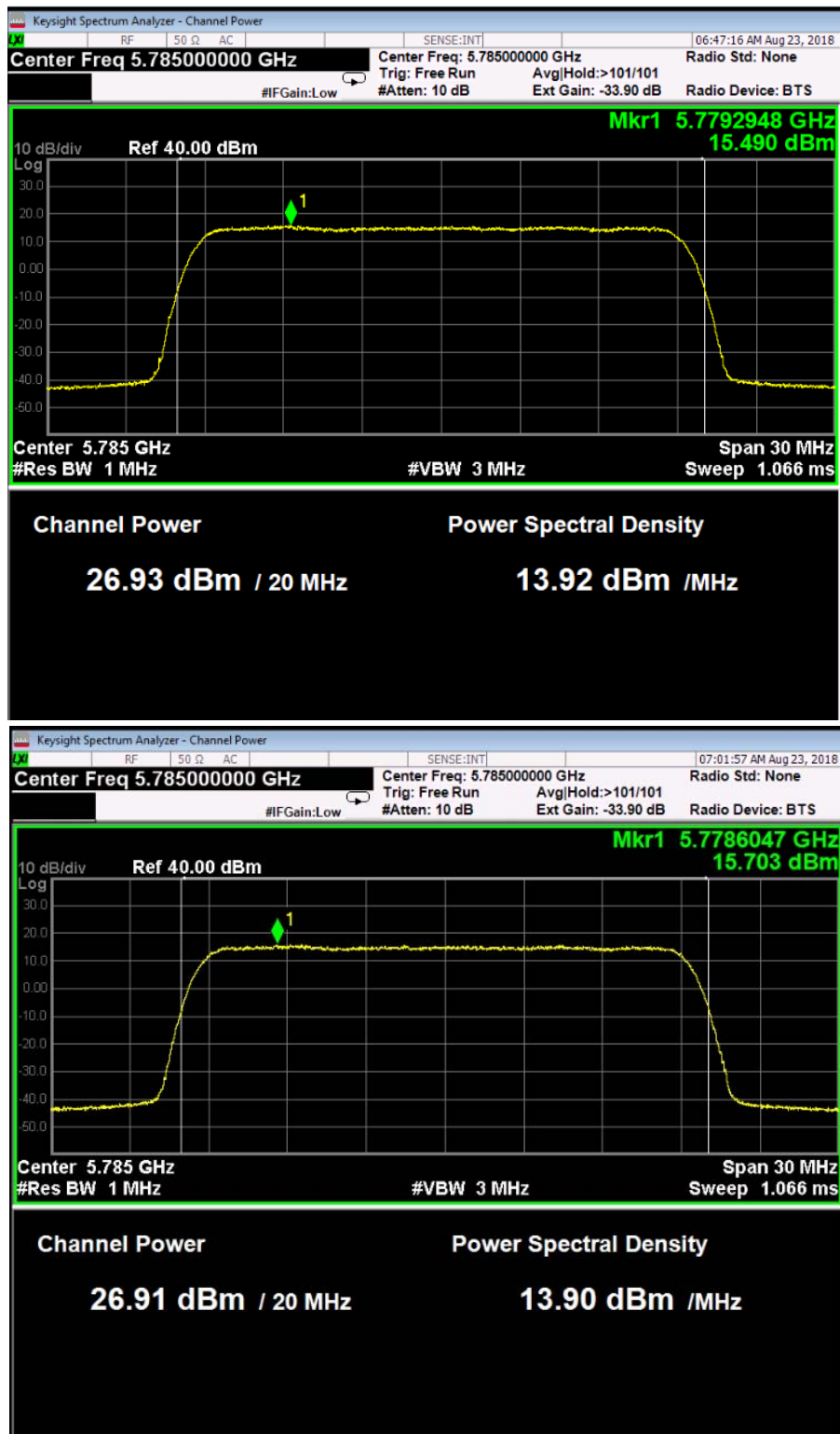


Figure 4.7.2 The Conducted PPSD Measured (Combined 18.61dBm/MHz) for one 20MHz UNII-3 at Channel 157/5785MHz, 27dBm, Q/16QAM, Port 1 and Port 2, Antenna #2.

4.8 MEASUREMENT REQUIRED: UNWANTED OUT-OF-BAND EMISSIONS – FCC SECTION 15.407 (b)(4-5)(8)

The requirements of the out-of-band emissions are provided in Section 4.1. Per ANSI C63.10 12.7.4.2 or KDB 789033 D02 guidance II.G.3.b, the unwanted emission limits in both the restricted and non-restricted bands are based on radiated measurements; however, as an alternative, antenna-port conducted measurements in conjunction with cabinet emissions tests will be permitted to demonstrate compliance.

The out-of-band emissions provided in this section are the unwanted emissions outside and near the band edges. The unwanted emissions at the frequencies away from the band edges were provided in next section.

The out-of-band emissions were evaluated by conducted measurement first for carriers located at the low, middle (1x20MHz only) and high channels of UNII-3 band given in Table 4.2.2 with QPSK/16QAM, 64QAM and 256QAM modulations and the output power of the EUT equipped with the omni-directional antenna #1 and the directional antenna #2, respectively. The recommendations of ANSI C63.10 were followed for the EUT testing setup. The test setup diagram was given in Section 4.3.

Table 4.8.1(a) RSS-247/FCC 15.407 UNII-3 Out-of-Band Conducted Power Limits for Omni-Directional Antenna #1 (P=23dBm/port)

Band (GHz)	Frequency Investigated (GHz)	P (dBuV/m)	Detector	RBW (MHz)
5.725–5.85	5.625-5.950	$75^1 \leq \Delta f$: -37	pk	1
		$25^2 \leq \Delta f \leq 75^1$: -37 to 0	pk	
		$5^3 \leq \Delta f \leq 25^2$: 0 to 5.6	pk	
		$0 \leq \Delta f \leq 5^3$: 5.6 to 17	pk	

¹: 5.65GHz and 5.925GHz

²: 5.7GHz and 5.875GHz

³: 5.720GHz and 5.855GHz

⁴: Δf : frequency away from band edges, 5.725 GHz and 5.85GHz, respectively.

Table 4.8.1(b) RSS-247/FCC 15.407 UNII-3 Out-of-Band Power Limits for Directional Antenna #2 (P=27dBm)

Band (GHz)	Frequency Investigated (GHz)	P (dBuV/m)	Detector	RBW (MHz)
5.725–5.85	5.625-5.950	$75^1 \leq \Delta f$: -33	pk	1
		$25^2 \leq \Delta f \leq 75^1$: -33 to 4	pk	
		$5^3 \leq \Delta f \leq 25^2$: 4 to 9.6	pk	
		$0 \leq \Delta f \leq 5^3$: 9.6 to 21	pk	

¹: 5.65GHz and 5.925GHz

²: 5.7GHz and 5.875GHz

³: 5.720GHz and 5.855GHz

⁴: Δf : frequency away from band edges, 5.725 GHz and 5.85GHz, respectively.

From the measurement results, it was found that for the output power of the EUT equipped with the omnidirectional antenna #1 FA2RD (10dBi), the configurations with the minimum margins for conducted out-of-band emissions were ch 165 (5825MHz) with 256QAM for 1x20MHz and ch 149, 153 (5745MHz, 5765MHz) with 256QAM for 2x20MHz. For the output power of the EUT equipped with the omnidirectional antenna #2 FA2WA (6dBi), the configurations with the minimum margins for conducted out-of-band emissions were ch 165 (5825MHz) with 256QAM for 1x20MHz and ch 161, 165 (5805MHz, 5825MHz) with 256QAM for 2x20MHz.

Based on the conducted measurement results, the test cases with the worst or near worst out-of-band emissions were evaluated by the radiated measurement as well for the EUT equipped with the omnidirectional antenna #1 and the directional antenna #2, respectively.

Per ANSI C63.10 12.7.3, for the radiated measurement, the field strength limit is obtained from the EIRP limit by

$$EIRP = \frac{\sqrt{E \times d}}{30},$$

where

- E is the field strength in V/m;
- d is the measurement distance in m;
- EIRP is the equivalent isotropically radiated power in W.

Therefore, with E in,

$$E \text{ (dB}\mu\text{V/m)} = EIRP(\text{dBm}) - 20 * \log(d) + 104.77.$$

At 3m with EIRP = - 27dBm, E = 68.2 dB μ V/m.

Table 4.8.1 FCC 15.407 UNII-3 Out-of-Band Radiated limits

Band (GHz)	Frequency to Be Investigated (GHz)	E (dB μ V/m)	Detector	RBW (MHz)
5.725–5.85	5.625-5.950	$75^1 \leq \Delta f$: 68.2	PK	1
		$25^2 \leq \Delta f^4 \leq 75^1$: 68.2 to 105.2	PK	
		$5^3 \leq \Delta f \leq 25^2$: 105.2 to 110.8	PK	
		$0 \leq \Delta f \leq 5^3$: 110.8 to 122.2	PK	

¹: 5.65GHz and 5.925GHz

²: 5.7GHz and 5.875GHz

³: 5.720GHz and 5.855GHz

⁴: Δf : frequency away from band edges, 5.725 GHz and 5.85GHz, respectively.

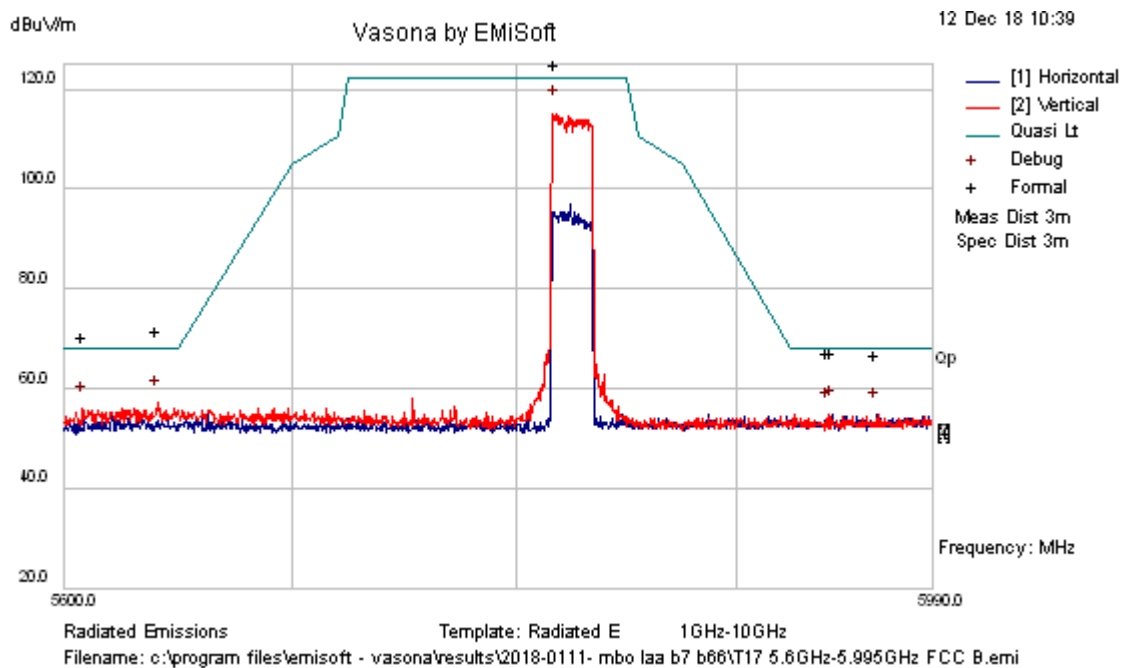
The recommendations of ANSI C63.10 were followed for the EUT testing setup and cabling. The test setup diagram was given in Section 4.3. The emissions were maximized by rotating the turntable 360° and moving the receiving antenna height to scan and capture the emissions from the EUT.

The radiated out-of-band emissions were also examined for the EUT equipped with Antenna #3 FA2RA at three channels with 256QAM modulations and 25.5dBm/port.

The out-of-band radiated emissions measured for the EUT equipped with both omni-directional antenna #1 & #3 and directional antenna #2 are all below the limits required in both the restricted and non-restricted bands (see Table 4.8.3). The restricted bands are provided in Table 4.1.1.

The out-of-band emissions plots which give the minimum emission margin evaluated for the EUT equipped with antennas #1, #2 and #3 were shown below in Figures 4.8.1-3, respectively.

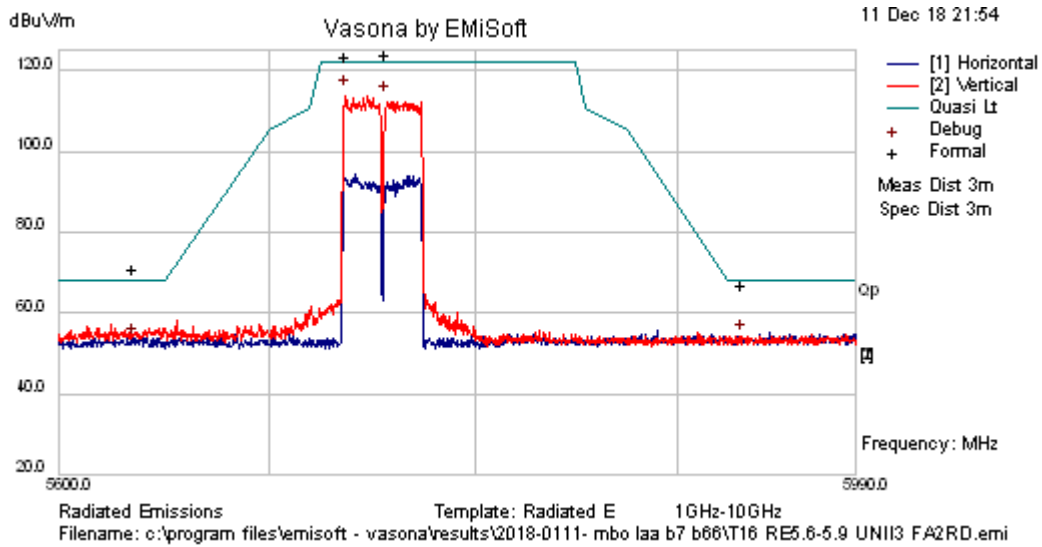
The unwanted out-of-band emissions measured with the EUT transmitting in the UNII-3 band are all below the required regulatory limits for the EUT equipped either omni-directional antenna or directional antenna, respectively, and are in full compliance with the regulatory requirements.



FORMAL DATA

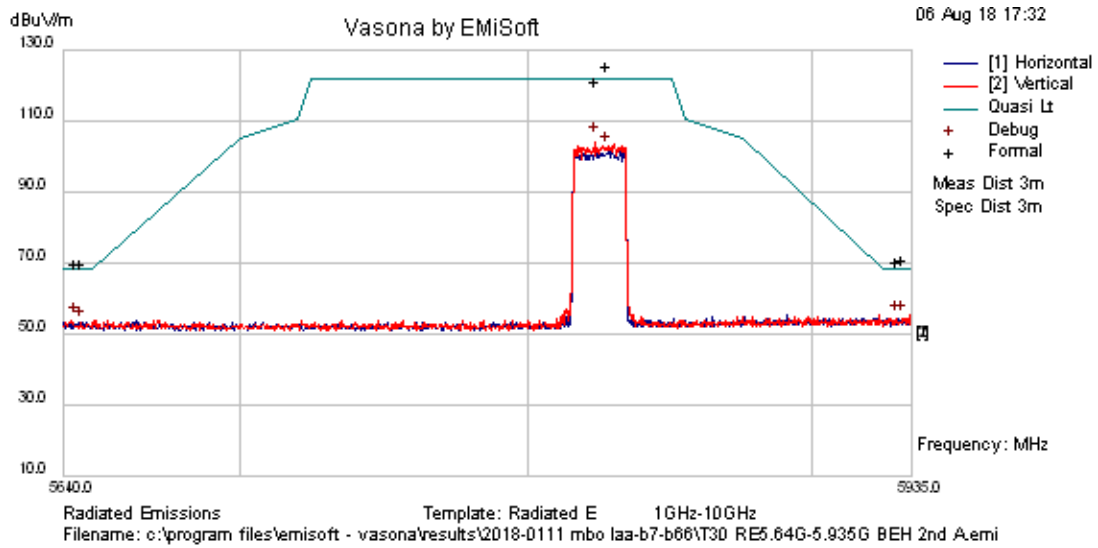
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
5640.6	47.82	22.23	-3.37	66.69	Peak	V	109	146	68.2	-1.51	Pass	
5817.67	101.06	22.25	-3.24	120.07	Peak	V	134	123	122.2	-2.13	Pass	
5607.84	46.91	22.23	-3.4	65.75	Peak	V	127	197	68.2	-2.45	Pass	
5942.02	43.33	22.26	-3.14	62.44	Peak	V	209	171	68.2	-5.76	Pass	
5944.01	43.18	22.26	-3.14	62.29	Peak	H	244	39	68.2	-5.91	Pass	
5964.18	42.83	22.26	-3.13	61.96	Peak	H	228	8	68.2	-6.24	Pass	

Figure 4.8.1 (a) The Radiated Out-of-Band Emissions with the Minimum Margin Evaluated for 1x 20MHz Carrier at UNII-3 Channel 165 (5825MHz), 23dBm per port, 256QAM, Omni-Directional Antenna #1 FA2RD (Formal RBW: 1MHz).



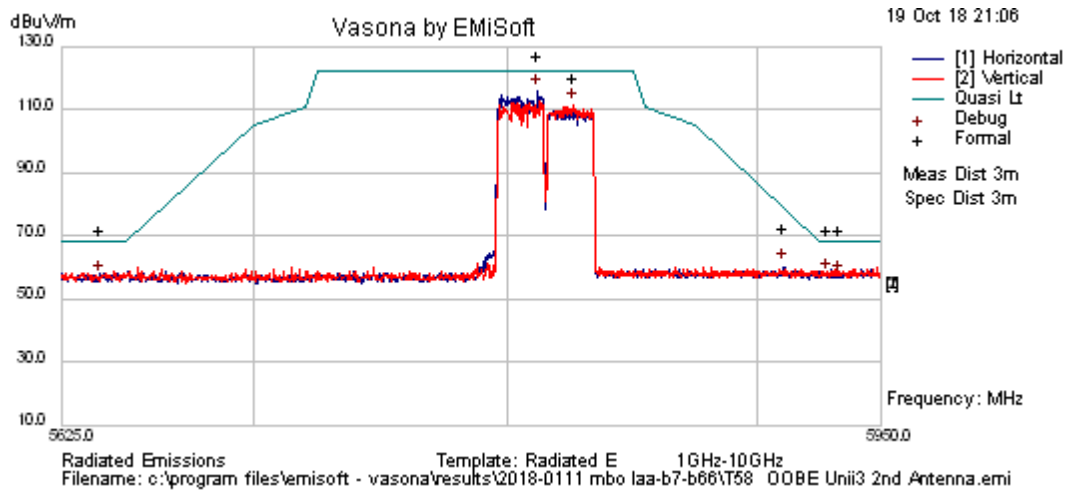
FORMAL DATA												
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
5635.74	48.03	22.23	-3.38	66.89	Peak	V	112	162	68.2	-1.31	Pass	
5757.24	100.78	22.24	-3.28	119.74	Peak	V	127	199	122.2	-2.46	Pass	
5737.46	100.05	22.24	-3.3	118.99	Peak	V	114	208	122.2	-3.21	Pass	
5932.81	43.59	22.26	-3.15	62.69	Peak	V	184	55	68.2	-5.51	Pass	

Figure 4.8.1 (b) The Radiated Out-of-Band Emissions with the Minimum Margin Evaluated for 2x 20MHz Carrier at UNII-3 Channel 149, 153 (5745, 5765), 23dBm per port, 256QAM, Omni-Directional Antenna #1 FA2RD (Formal RBW: 1MHz).



FORMAL DATA												
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
5828.1	98.29	20.77	1.81	120.87	Peak	H	99	352	122.2	-1.33	Pass	Tx
5932.58	43.02	20.81	1.95	65.78	Peak	V	250	180	68.2	-2.42	Pass	
5930.46	42.76	20.81	1.95	65.52	Peak	H	335	28	68.2	-2.68	Pass	
5644.75	42.89	20.68	1.55	65.13	Peak	V	257	347	68.2	-3.07	Pass	
5646.62	42.62	20.69	1.56	64.87	Peak	H	275	346	68.2	-3.33	Pass	
5823.61	93.47	20.77	1.8	116.03	Peak	V	98	354	122.2	-6.17	Pass	Tx

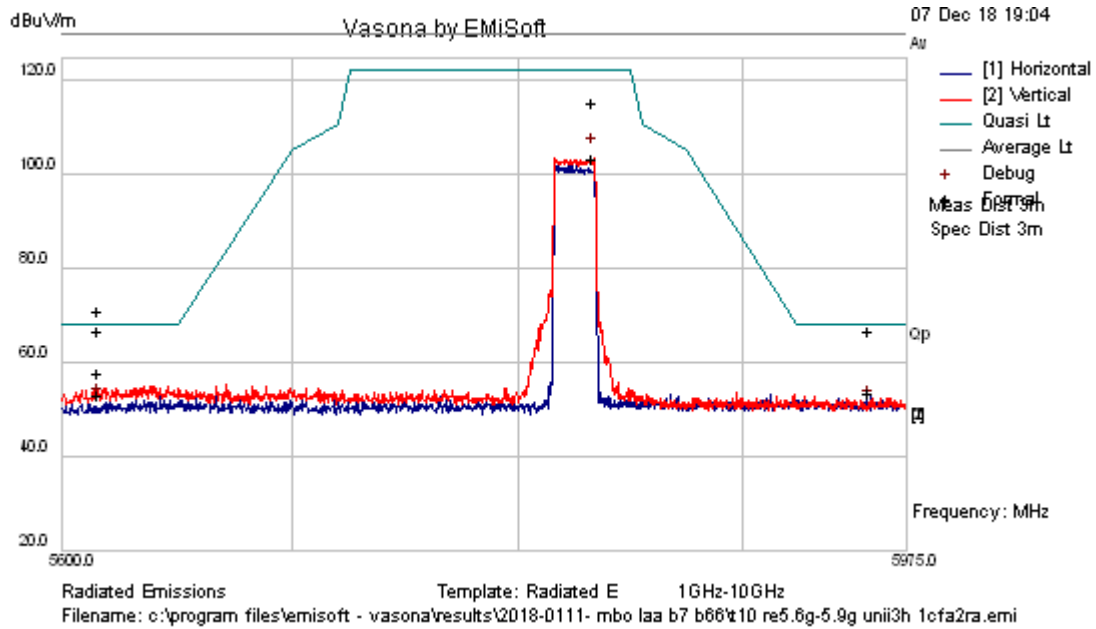
Figure 4.8.2 (a) The Radiated Out-of-Band Emissions with the Minimum Margin Evaluated for 1x 20MHz Carrier at UNII-3 Channel 165 (5825 MHz), 27dBm per port, 256QAM, Directional Antenna #2 FA2WA (Preview RBW: 100k pk and Formal RBW: 1MHz).



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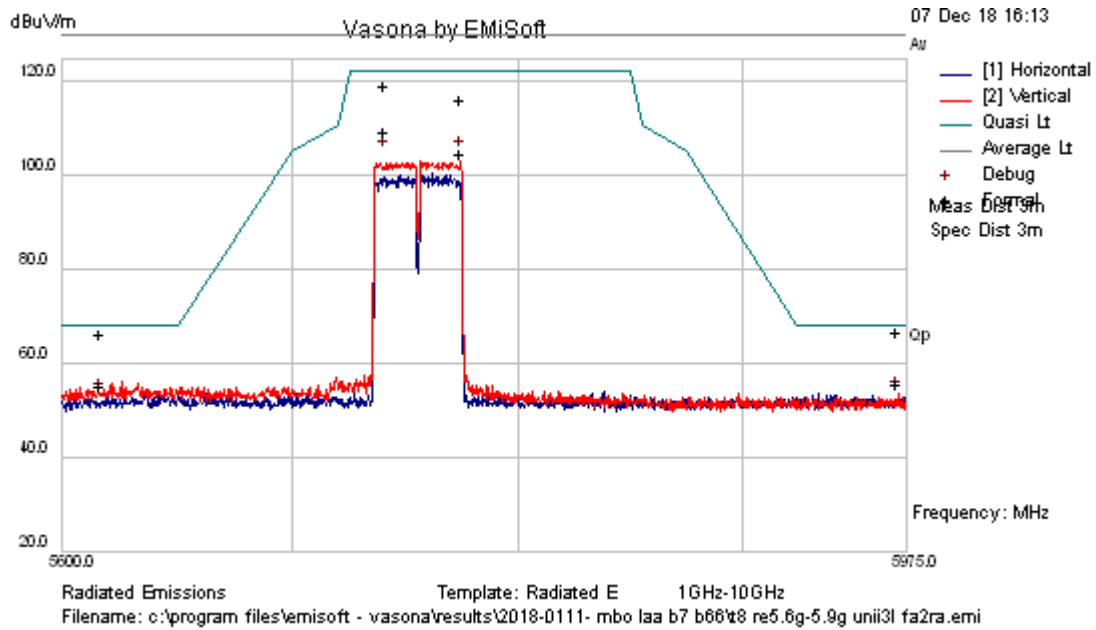
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
5933.31	42.94	23.81	1.14	67.89	Peak	H	237	175	68.2	-0.31	Pass	
5928.48	42.87	23.81	1.13	67.81	Peak	V	153	331	68.2	-0.39	Pass	
5640.66	42.96	23.68	0.84	67.49	Peak	H	325	296	68.2	-0.71	Pass	
5826.25	91.01	23.77	1.03	115.8	Peak	V	127	331	122.2	-6.4	Pass	
5910.87	43.16	23.8	1.11	68.08	Peak	H	151	357	78.62	-10.54	Pass	

Figure 4.8.2 (b) The Radiated Out-of-Band Emissions with the Minimum Margin Evaluated for 2x 20MHz Carrier at UNII-3 Channel 161, 165 (5805, 5825), 27dBm per port, 256QAM, Directional Antenna #2 FA2WA (Preview RBW: 100k pk and Formal RBW: 1MHz).



FORMAL DATA												
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
5615.45	47.39	22.23	-3.39	66.23	Peak	V	148	157	68.2	-1.97	Pass	
5958.37	42.87	22.26	-3.13	62	Peak	V	235	296	68.2	-6.2	Pass	
5615.45	43.11	22.23	-3.39	61.95	Peak	H	157	121	68.2	-6.25	Pass	
5833.63	91.47	22.25	-3.22	110.49	Peak	V	261	182	122	-11.51	Pass	

Figure 4.8.3 (a) The Radiated Out-of-Band Emissions with the Minimum Margin Evaluated for 1x 20MHz Carrier at UNII-3 Channel 165 (5825 MHz), 25.5dBm per port, 256QAM, Omni-Directional Antenna #3 FA2RA (Preview RBW: 100k pk and Formal RBW: 1MHz).



FORMAL DATA												
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
5971.5	42.69	22.26	-3.12	61.83	Peak	H	302	19	68.2	-6.37	Pass	
5616.44	42.92	22.23	-3.39	61.76	Peak	H	152	129	68.2	-6.44	Pass	
5740.53	95.69	22.24	-3.29	114.63	Peak	V	207	241	122	-7.37	Pass	
5773.96	92.53	22.24	-3.27	111.5	Peak	V	176	30	122	-10.5	Pass	

Figure 4.8.3 (b) The Radiated Out-of-Band Emissions for 2x 20MHz Carrier at UNII-3 Channel 149, 153 (5745, 5765), 25.5dBm per port, 256QAM, Omni-Directional Antenna #3 FA2RA (Preview RBW: 100k pk and Formal RBW: 1MHz).

4.9 MEASUREMENT REQUIRED: UNWANTED RADIATED SPURIOUS EMISSIONS – FCC SECTION 15.407 (b)(4-8)

The requirements of the unwanted emissions are provided in Section 4.1. Per ANSI C63.10 12.7.4.2, the unwanted emission limits in both the restricted and non-restricted bands are based on radiated measurements; however, as an alternative, antenna-port conducted measurements in conjunction with cabinet emissions tests will be permitted to demonstrate compliance.

The radiated limits of RSS-GEN Table 5, ICES-003/FCC 15.109 Class B and FCC 15.209 were given in Table 4.9.1. The FCC 15.109/ICES-003 Class B limits are identical to the FCC 15.209/RSS-GEN Table 5 limits between 30MHz and 30GHz for the EUT operating in UNII bands.

The combined conducted limits of RSS-GEN Table 5, RSS-247, ICES-003/FCC 15.109 Class B and FCC 15.209 were given in Table 4.9.2, where the conversion between the EIRP and electrical field strength was given in the above section.

Table 4.9.1. RSS-GEN Table 5, ICES-003, FCC 15.109 Class B and 15.209 Radiated Emissions Limits

Frequency (MHz)	Field Strength at 3m (dB uV/m)		RBW (kHz)	Detector
	FCC 15.109/ ICES-003 Class B	FCC 15.209/ RSS-GEN Table 5		
10 - 30		49.5	9	QP
30 - 88	40	40	120	QP
88 - 216	43.5	43.5		
216 - 230	46	46		
230 - 960	46	46		
960 - 1000	54	54		
1000 - 3000	54 74	54 74	1000	Ave. Peak
> 3000 - $5f_c$	54 74	54 74	1000	Ave. Peak
$5f_c$ - $10f_c$ / 40GHz		54 74	1000	Ave. Peak

Table 4.9.2. Combined Worst Conducted Emission Limits per RSS-GEN Table 5, ICES-003 Class B, FCC 15.407 UNII-1/3, 15.209 and 15.109

Freq (MHz)	P ^{Lim} Ant #1 (G = 6dBi) (dBm)	P ^{Lim} for Ant #2 (G = 10dBi) (dBm)	Detector /RBW
30-88	-66/-42.2	-70/-46.2	qpk/pk 120kHz
88-216	-62.4/-42.2	-66.4/-46.2	
216-960	-60/-42.2	-64/-46.2	
960-1000	-52/-42.2	-56/-46.2	
1G - 40G in Restricted Bands*	-47.2/-33	-51.2/-37	ave/pk/1MHz
1G - 40G in Non-Restricted Bands*	-33	-37	pk/1MHz

* The restricted bands of operation specified in RSS-GEN Table 7 were provided in Section 4.1.

** Below 1GHz, a 4.7dB was added for a ground plane when converting between EIRP and E per KDB 789033D02.

The conducted spurious emissions were investigated with peak detector from 30MHz-40GHz first at both antenna ports for 1x20MHz and 2x20MHz carriers located at the low, middle (1x20MHz) and high channels of UNII-3 band given in Table 4.2.2 with various modulations (QPSK/16QAM, 64QAM and 256QAM) and 27dBm/port output power which is the maximum output power of the EUT equipped with the directional antenna #2 FA2WA (6dBi). The recommendations of ANSI C63.10 were followed for EUT testing setup and measurement procedures. The test setup diagram was given in Section 4.3. The conducted emissions of the EUT in the frequency range of below 1GHz and between 6-40GHz have similar performance for various modulations and carrier placement. For the emissions between 1-5.625GHz, the emissions at channel 5825MHz for 1x20MHz and at channel 5805MHz+5825MHz for 2x20MHz have the smallest margin.

The conducted spurious emissions were investigated from 30MHz-40GHz at both antenna ports for 2x20MHz carriers located at the low and high channels of UNII-3 band with various modulations and 23dBm/port output power which corresponds to the maximum output power of the omni-directional antenna #1 FA2RD (10dBi) as well. FA2RD has the highest gain among all omni-directional antennas. For the emissions between 1-5.625GHz, the emissions at channel 5805MHz+5825MHz for 2x20MHz also show the smallest margin.

The conducted spurious emissions measured in the frequency range of 30MHz-40GHz for the EUT, which operated in UNII-3 band with the maximum output power of the EUT equipped with the omni-directional antenna #1 FA2RD and the directional antenna #2 FA2WA, respectively, all met the -27dBm/MHz EIRP requirement.

Based on the conducted measurement, the spurious emissions in the frequency range of 30MHz to 40GHz were evaluated by the radiated measurement for the QPSK/16QAM modulation at the selected channels for the EUT equipped with the omni-directional antenna #1 & #3 and the directional antenna #2 with full power, respectively.

The spurious emissions below 1GHz and above 18GHz were evaluated at one or two carrier configurations given in Table 4.2.2 for each antenna.

The combined radiated limits of RSS-GEN Table 5, RSS-247, ICES-003/FCC 15.109 Class B and FCC 15.209 were given in Table 4.9.3.

Table 4.9.3. Combined Worst Radiated Emission Limits Per FCC 15.407 UNII-1/3, 15.209, 15.109/ICES-003 Class B, RSS-GEN Table 5 and RSS-247 at 3m

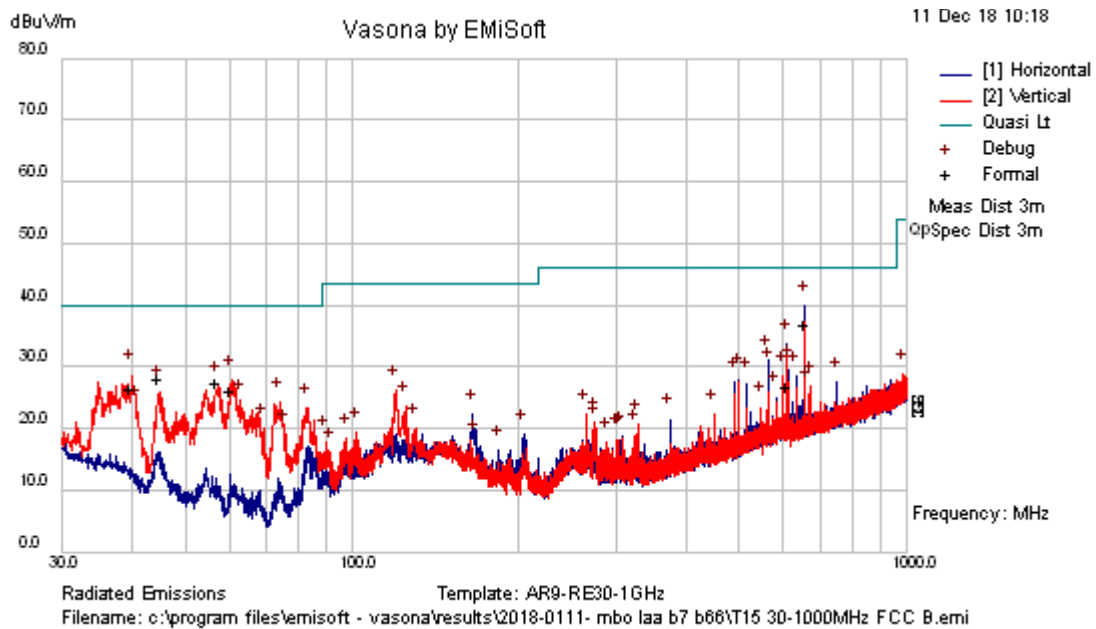
Frequency (MHz)	E (dBuV/m)	RBW (kHz)	Detector
30 - 88	40/63.7*	120kHz	QP/Peak
88 - 216	43.5/63.7		
216 - 960	46/63.7		
960 - 1000	54/63.7		
1G - 40G in Restricted Bands**	54/68.2	1000	Ave/Peak
1G - 40G in Non-Restricted Bands**	68.2	1000	Peak

*A 4.7dB was added for ground floor per KDB. If no 4.7dB, the limit is 59 dBuV/m.

** For a failing signal, need to check if it is from the transmitter. If not, it needs to meet ICES-003/15.109 Class B.

The recommendations of ANSI C63.10 were followed for EUT testing setup and cabling. The test setup diagram was given in Section 4.3. The emissions were maximized by rotating the turntable 360° and moving the receiving antenna height to scan and capture the emissions from the EUT. The plots with the minimum margin in each frequency range evaluated for each antenna were provided in Figures 4.9.1-3, respectively.

The unwanted radiated spurious emissions measured in the frequency range of 30MHz-40GHz for the EUT, which operated in UNII-3 band and was equipped with the omni-directional antenna #1 FA2RD and #3 FA2RA and the directional antenna #2 FA2WA, respectively, met the regulatory requirements for both intentional radiators specified in RSS-247/FCC 15.407 and unintentional radiators specified in ICES-003/FCC 15.109 Class B.



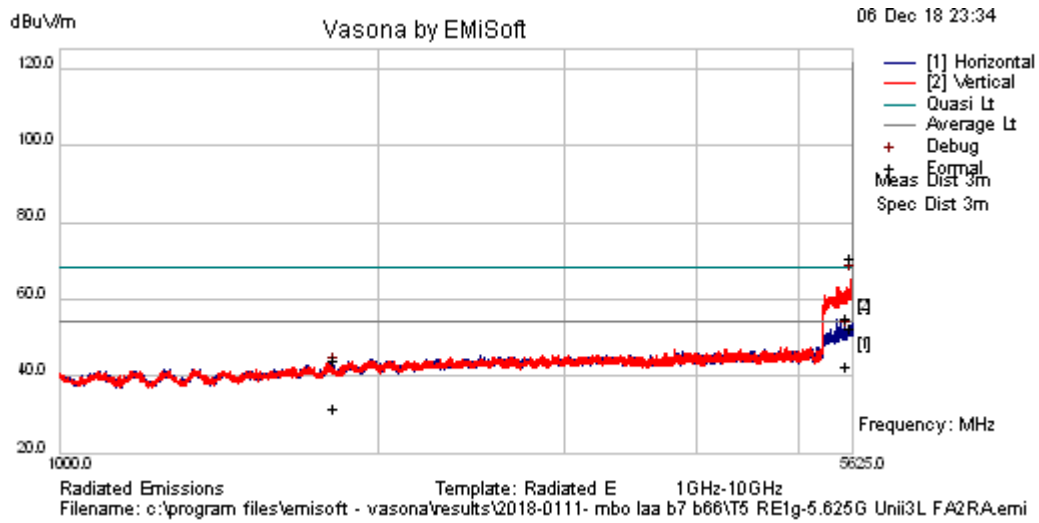
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Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
656.269	39.4	1.59	-7.64	33.35	Quasi Max	H	99	74	46	-12.65	Pass	
44.737	40.85	0.39	-16.9	24.4	Quasi Max	V	104	166	40	-15.6	Pass	
57.23	44.42	0.45	-20.9	24.03	Quasi Max	V	198	276	40	-15.97	Pass	
39.897	37.21	0.36	-14.6	22.96	Quasi Max	V	149	78	40	-17.04	Pass	
60.461	43.75	0.47	-21.5	22.73	Quasi Max	V	141	138	40	-17.27	Pass	
609.388	29.66	1.51	-7.81	23.36	Quasi Max	H	107	75	46	-22.64	Pass	

PREVIEW DATA

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
656.231	46.03	1.59	-7.64	39.98	Preview	H	100	90	46	-6.02	Pass	
39.9231	42.91	0.36	-14.6	28.64	Preview	V	100	180	40	-11.36	Pass	
60.4615	48.74	0.47	-21.5	27.72	Preview	V	100	270	40	-12.28	Pass	
609.385	39.92	1.51	-7.81	33.62	Preview	H	100	90	46	-12.38	Pass	
57.2308	47.37	0.45	-20.9	26.97	Preview	V	100	135	40	-13.03	Pass	
44.7692	42.47	0.39	-16.9	26	Preview	V	100	180	40	-14	Pass	

Figure 4.9.1(a) The Radiated Unwanted Emissions in 30MHz-1GHz for the EUT with Antenna #3 FA2RA in UNII-3, 2x20MHz Carriers at Channel 149 (5745MHz), 153 (5765MHz), Q/16QAM, 25.5dBm/port, against FCC Part 15.209 and 15.109 Class B Limits at 3m Distance (Preview in PK).

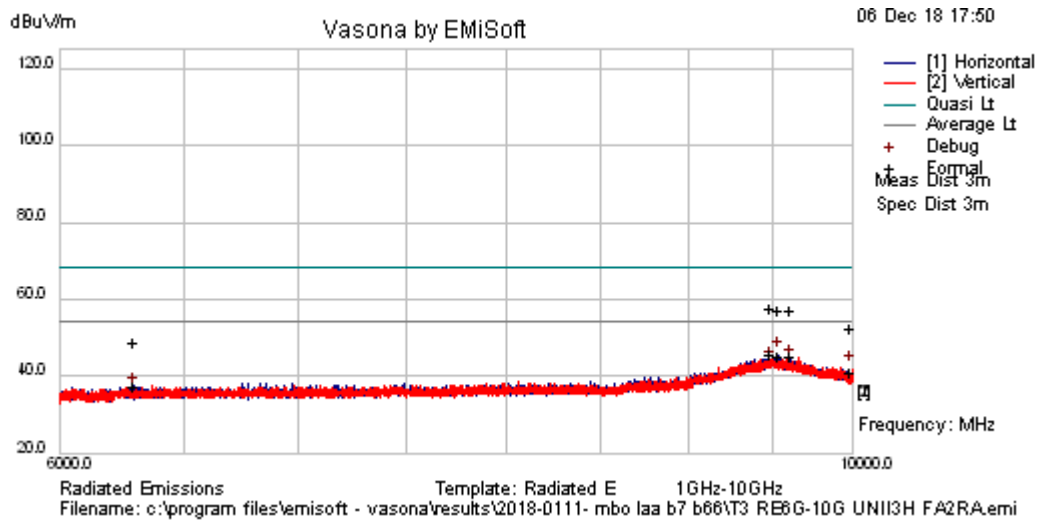


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Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
5610.31	64.95	4.92	-3.4	66.48	Peak	V	187	137	68.2	-1.72	Pass	
5610.31	47.08	4.92	-3.4	48.61	Average	V	187	137	54	-5.39	Pass	NA
5552.6	37.29	4.8	-3.44	38.65	Average	H	108	120	54	-15.35	Pass	NA
5552.6	49.52	4.8	-3.44	50.88	Peak	H	108	120	68.2	-17.32	Pass	
1819.36	33.7	2.52	-8.76	27.47	Average	H	349	201	54	-26.53	Pass	NA
1819.36	46.35	2.52	-8.76	40.12	peak	H	349	201	68.2	-28.08	Pass	

Note: NA = Not Applicable.

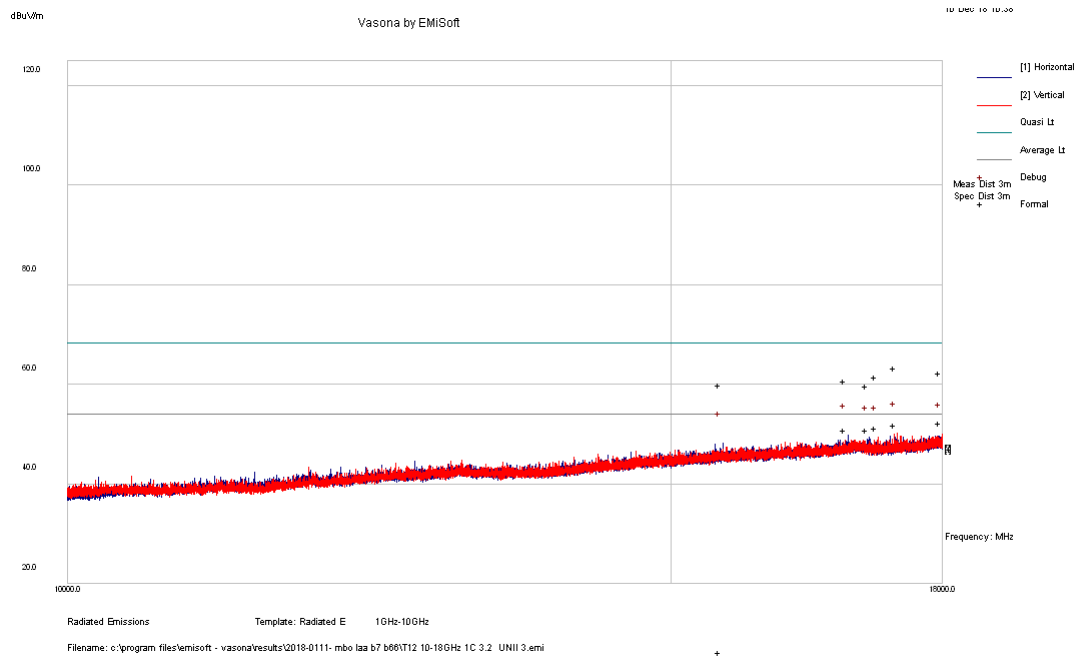
Figure 4.9.1(b) Radiated Spurious Emissions in 1GHz-5.625GHz for the EUT with Ant #3 FA2RA in UNII-3, 2x20MHz Carriers at Ch 149 (5745MHz), 153 (5765MHz), Q/16QAM, 25.5dBm/pt, against FCC Part 15.407 and 15.209 Limits at 3m Distance (RBW 1MHz, Preview in PK).



FORMAL DATA												
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
9485.03	31.59	12.28	-2.38	41.49	Average	H	314	338	54	-12.51	Pass	
9536.24	31.96	11.77	-2.34	41.4	Average	H	215	23	54	-12.6	Pass	NA
9619.21	32.94	10.44	-2.25	41.14	Average	V	266	291	54	-12.86	Pass	NA
9485.03	43.87	12.28	-2.38	53.76	Peak	H	314	338	68.2	-14.44	Pass	
9536.24	43.78	11.77	-2.34	53.22	Peak	H	215	23	68.2	-14.98	Pass	
9619.21	45.01	10.44	-2.25	53.21	Peak	V	266	291	68.2	-14.99	Pass	
9994.34	31.65	7.09	-1.85	36.9	Average	V	132	309	54	-17.1	Pass	NA
9994.34	43.13	7.09	-1.85	48.37	Peak	V	132	309	68.2	-19.83	Pass	
6298.35	31.98	4.41	-2.85	33.54	Average	V	297	8	54	-20.46	Pass	NA
6298.35	43.47	4.41	-2.85	45.03	Peak	V	297	8	68.2	-23.17	Pass	

Note: NA = Not Applicable.

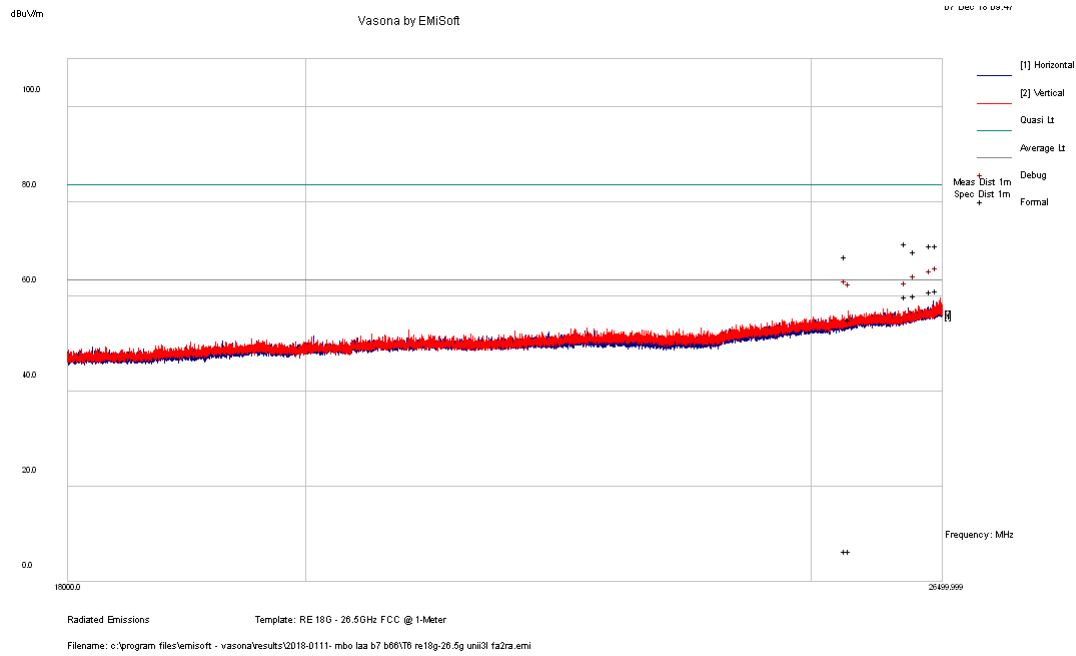
Figure 4.9.1(c) Radiated Spurious Emissions in 6GHz-10GHz for the EUT with Antenna #3 FA2RA in UNII-3, 2x20MHz Carriers at Ch 161 (5805MHz), 165 (5825MHz), Q/16QAM, 25.5dBm/pt, against FCC Part 15.407 and 15.209 Limits at 3m Distance (RBW 1MHz, Preview in PK).



FORMAL DATA												
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
17997.5	30.36	11.13	4.66	46.15	AvgMax	V	99	330	54	-7.85	Pass	
17463.2	30.66	10.59	4.48	45.73	AvgMax	V	117	119	54	-8.27	Pass	NA
17238.9	30.11	10.36	4.66	45.13	AvgMax	V	123	100	54	-8.87	Pass	NA
16889.9	29.85	10.12	4.64	44.61	AvgMax	H	329	246	54	-9.39	Pass	NA
17134.7	29.56	10.25	4.75	44.56	AvgMax	H	311	225	54	-9.44	Pass	NA
17463.2	42.01	10.59	4.48	57.08	Peak	V	117	119	68.2	-11.12	Pass	
17997.5	40.43	11.13	4.66	56.22	Peak	V	99	330	68.2	-11.98	Pass	
17238.9	40.37	10.36	4.66	55.39	Peak	V	123	100	68.2	-12.81	Pass	
15527.9	28.16	10.17	2.28	40.61	Average	H	345	38	54	-13.39	Pass	
16889.9	39.71	10.12	4.64	54.46	Peak	H	329	246	68.2	-13.74	Pass	
15527.9	41.29	10.17	2.28	53.74	Peak	H	345	38	68.2	-14.46	Pass	
17134.7	38.47	10.25	4.75	53.48	Peak	H	311	225	68.2	-14.72	Pass	

Note: NA = Not Applicable.

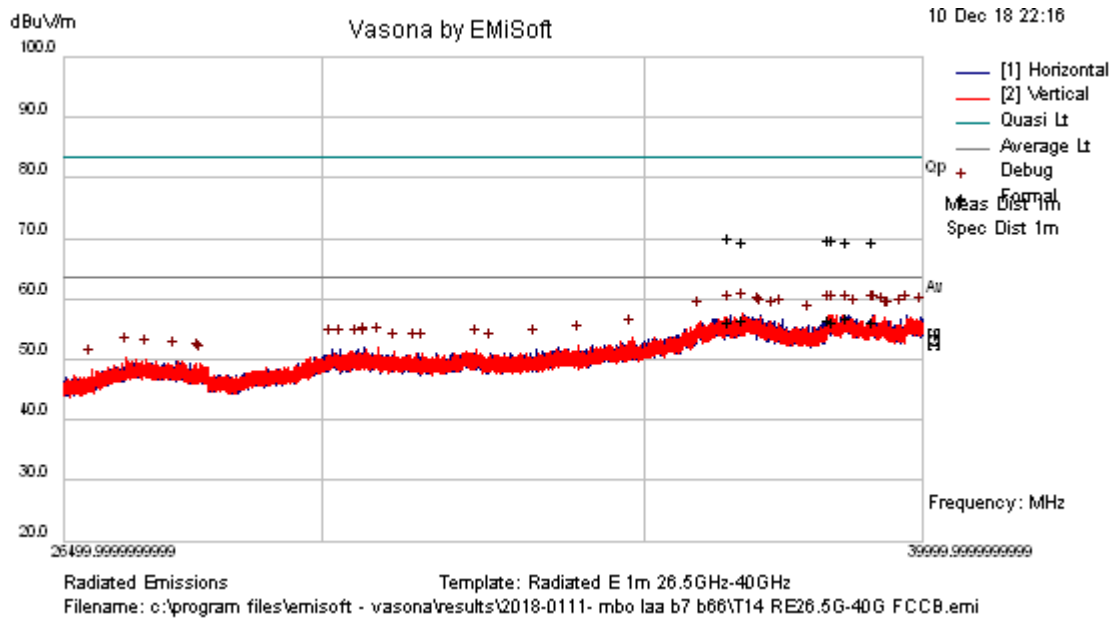
Figure 4.9.1(d) Radiated Spurious Emissions in 10GHz-18GHz for the EUT with Ant #3 FA2RA in UNII-3, 1x20MHz Carrier at Ch 165 (5825MHz), Q/16QAM, 25.5dBm/pt, against FCC Part 15.407 and 15.209 Limits at 3m Distance (RBW 1MHz, Preview in PK).



FORMAL DATA

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
26466.6	32.15	10.28	12.26	54.69	AvgMax	V	134	69	63.5	-8.81	Pass	
26392.3	32.25	10.19	12.05	54.49	AvgMax	H	100	307	63.5	-9.01	Pass	
26213.6	32.07	9.96	11.56	53.59	AvgMax	V	120	241	63.5	-9.91	Pass	
26102.8	32.33	9.83	11.25	53.4	AvgMax	H	190	126	63.5	-10.1	Pass	
25462.9	28.54	9.54	10.47	48.55	AvgMax	H	189	64	63.5	-14.95	Pass	
25420.5	27.79	9.54	10.42	47.75	Average	V	181	138	63.5	-15.75	Pass	
26102.8	43.51	9.83	11.25	64.59	Peak	H	190	126	77.7	-13.11	Pass	
26466.6	41.63	10.28	12.26	64.17	Peak	V	134	69	77.7	-13.53	Pass	
26392.3	41.88	10.19	12.05	64.13	Peak	H	100	307	77.7	-13.57	Pass	
26213.6	41.48	9.96	11.56	63	Peak	V	120	241	77.7	-14.7	Pass	
25462.9	42.08	9.54	10.47	62.09	Peak	H	189	64	77.7	-15.61	Pass	
25420.5	41.86	9.54	10.42	61.81	Peak	V	181	138	77.7	-15.89	Pass	

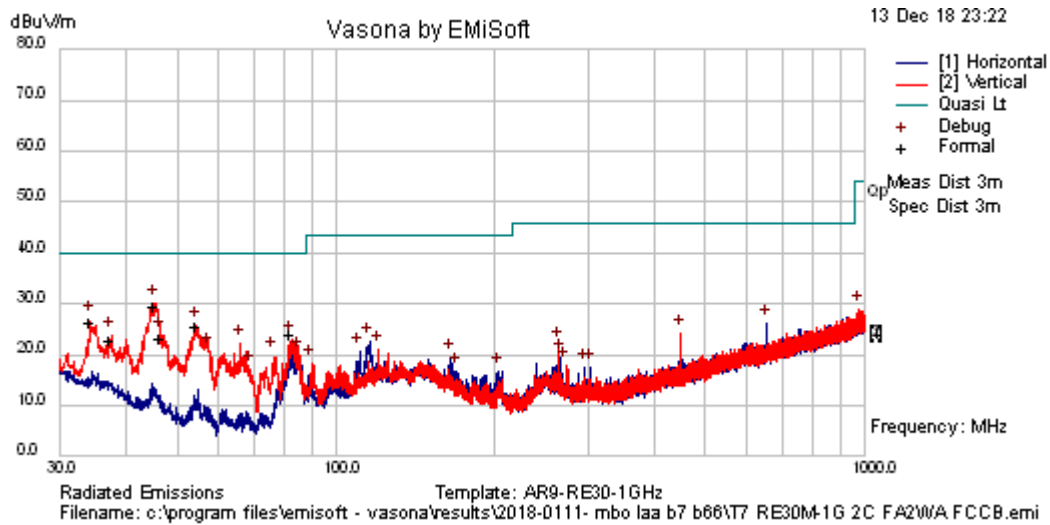
Figure 4.9.1(e) Radiated Spurious Emissions in 18GHz-26.5GHz for the EUT with Ant #3 FA2RA in UNII-3, 2x20MHz Carriers at Ch 149 (5745MHz), 153 (5765MHz), Q/16QAM, 25.5dBm/pt, against FCC Part 15.407 and 15.209 Limits at 1m Distance (RBW 1MHz, Preview 100kHz RBW in PK).



FORMAL DATA												
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
38597.1	25.99	0	27.28	53.27	Average	H	199	107	63.5	-10.23	Pass	NA
38266.7	25.57	0	27.59	53.16	Average	V	121	224	63.5	-10.34	Pass	NA
36711.3	24.55	0	28.37	52.92	Average	V	136	255	63.5	-10.58	Pass	NA
38331	25.27	0	27.52	52.79	Average	V	141	119	63.5	-10.71	Pass	NA
39068.8	25.69	0	27.08	52.77	Average	H	112	267	63.5	-10.73	Pass	
36472.2	24.52	0	28.12	52.64	Average	H	196	10	63.5	-10.86	Pass	
36472.2	38.48	0	28.12	66.6	Peak	H	196	10	77.7	-11.1	Pass	
38266.7	38.77	0	27.59	66.36	Peak	V	121	224	77.7	-11.34	Pass	
38331	38.64	0	27.52	66.16	Peak	V	141	119	77.7	-11.54	Pass	
36711.3	37.73	0	28.37	66.1	Peak	V	136	255	77.7	-11.6	Pass	
39068.8	38.92	0	27.08	66	Peak	H	112	267	77.7	-11.7	Pass	

Note: NA = Not Applicable.

Figure 4.9.1(f) Radiated Spurious Emissions in 26.5GHz-40GHz for the EUT with Ant #3 FA2RA in UNII-3, 2x20MHz Carriers at Ch 149 (5745MHz), 153 (5765MHz), Q/16QAM, 25.5dBm/pt, against FCC Part 15.407 and 15.209 Limits at 1m Distance (RBW 1MHz, Preview 100kHz RBW in PK).

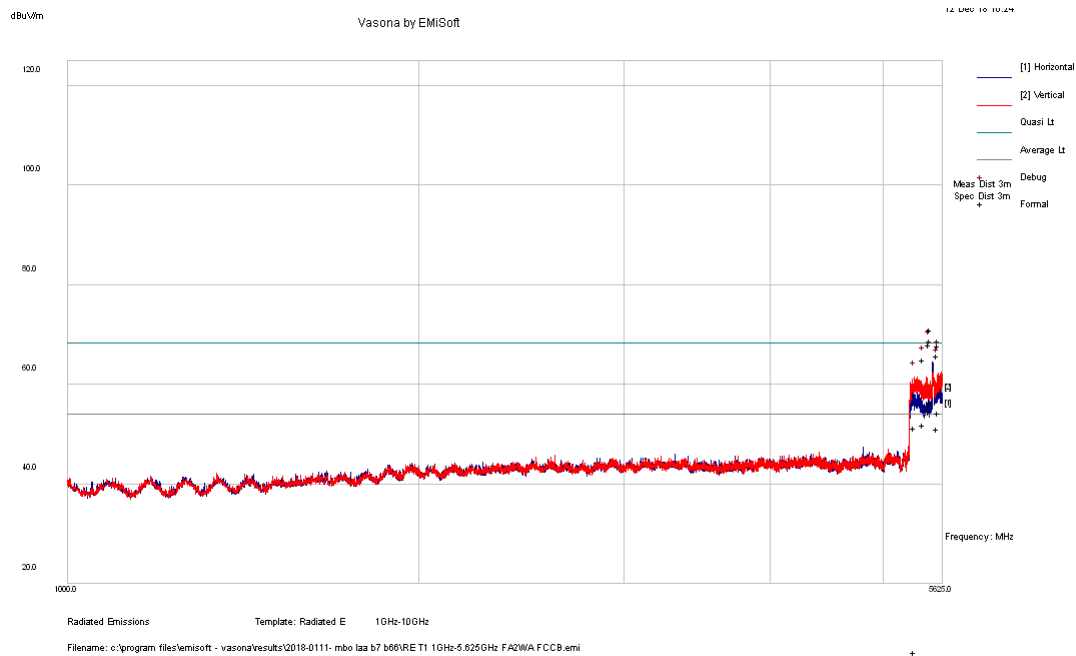


FORMAL DATA												
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
45.4615	43.11	0.39	-17.1	26.36	Quasi Max	V	152	190	40	-13.64	Pass	
34.401	34.66	0.33	-11.7	23.32	Quasi Max	V	137	280	40	-16.68	Pass	
54.276	42.19	0.44	-20.1	22.5	Quasi Max	V	109	210	40	-17.5	Pass	
82.224	39.2	0.55	-18.8	20.92	Quasi Max	V	144	120	40	-19.08	Pass	
46.503	37.22	0.4	-17.5	20.1	Quasi Max	V	175	191	40	-19.9	Pass	
37.5385	32.63	0.35	-13.4	19.59	Quasi Max	V	194	137	40	-20.41	Pass	

PREVIEW DATA												
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
45.4615	46.74	0.39	-17.1	29.99	Preview	V	100	180	40	-10.01	Pass	
34.3077	38.01	0.33	-11.6	26.72	Preview	V	100	270	40	-13.28	Pass	
54.3846	45.39	0.44	-20.2	25.66	Preview	V	100	225	40	-14.34	Pass	
46.6154	40.96	0.4	-17.6	23.8	Preview	V	100	135	40	-16.2	Pass	
37.5385	36.74	0.35	-13.4	23.69	Preview	V	100	180	40	-16.31	Pass	
82.3846	41.32	0.55	-18.8	23.07	Preview	V	100	90	40	-16.93	Pass	
65.7692	43.59	0.49	-21.9	22.22	Preview	V	200	135	40	-17.78	Pass	
57.5385	41.15	0.46	-20.9	20.69	Preview	V	100	180	40	-19.31	Pass	
656.231	32.22	1.59	-7.64	26.17	Preview	H	100	135	46	-19.83	Pass	

Note: Preview data was measured using a peak detector to identify frequencies of interest for formal measurement. Formal data consist of all frequencies in the preview list within 6 dB of specification limit or the top six frequencies. Failure in preview data does not necessarily constitute failure in formal data.

Figure 4.9.2(a) The Radiated Unwanted Emissions in 30MHz-1GHz for the EUT with Antenna #2 FA2WA in UNII-3, 2x20MHz Carriers at Channel 161 (5805MHz), 163 (5825MHz), Q/16QAM, 27dBm/port, against FCC Part 15.209 and 15.109 Class B Limits at 3m Distance (Preview in PK).

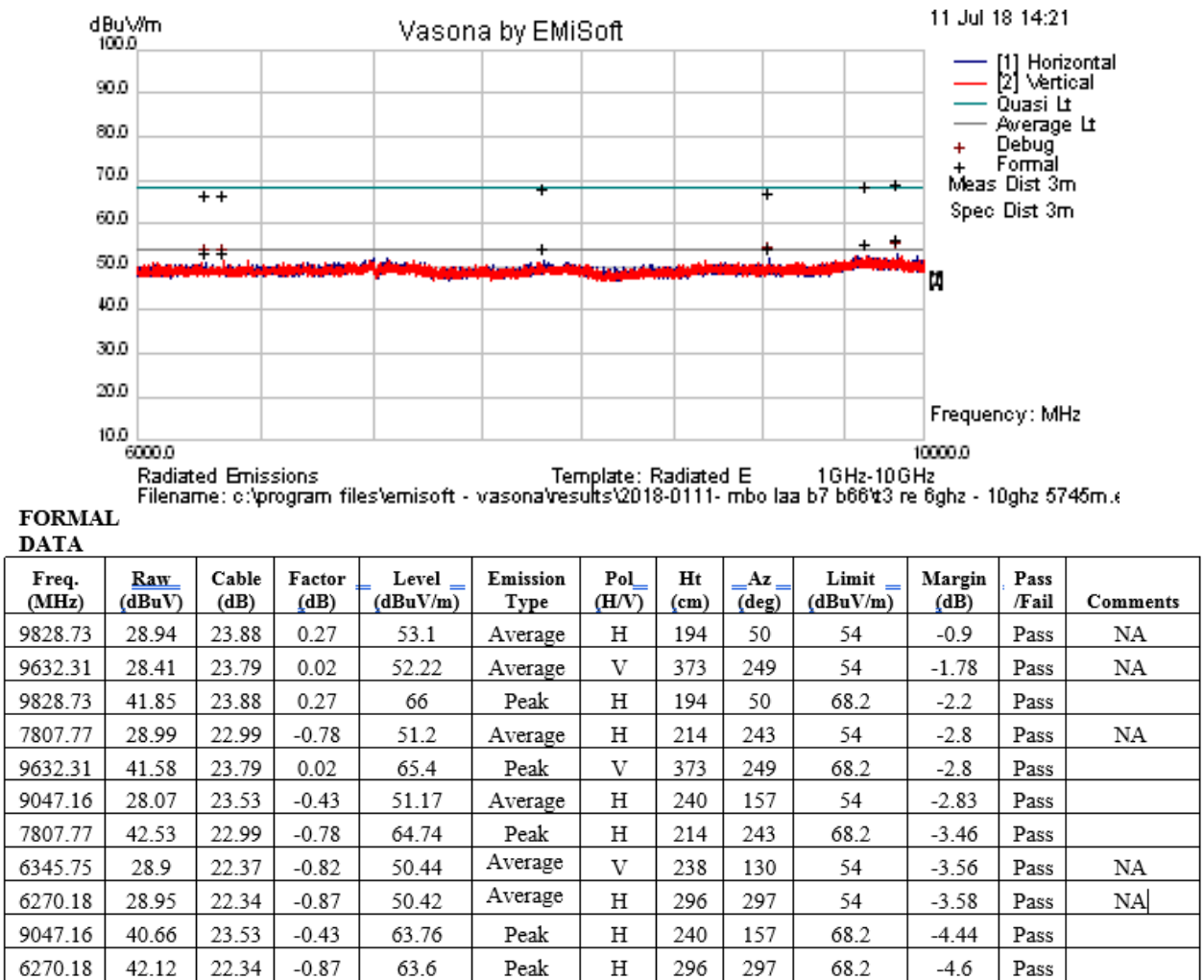


FORMAL DATA

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
5520.78	63.59	4.73	-3.47	64.86	Peak	V	113	341	68.2	-3.34	Pass	
5520.78	48.74	4.73	-3.47	50.01	Average	V	113	341	54	-3.99	Pass	NA
5510.93	47.16	4.71	-3.47	48.4	Average	H	109	355	54	-5.6	Pass	NA
5614.41	46.58	4.93	-3.39	48.12	Average	V	99	350	54	-5.88	Pass	NA
5510.93	60.58	4.71	-3.47	61.81	Peak	H	109	355	68.2	-6.39	Pass	
5614.41	60.05	4.93	-3.39	61.59	Peak	V	99	350	68.2	-6.61	Pass	
5446.98	44.42	4.71	-3.52	45.62	Average	V	99	7	54	-8.38	Pass	
5606.88	57.96	4.92	-3.4	59.48	Peak	H	106	26	68.2	-8.72	Pass	
5350.06	43.99	4.76	-3.6	45.15	Average	H	99	332	54	-8.85	Pass	
5606.88	43.39	4.92	-3.4	44.91	Average	H	106	26	54	-9.09	Pass	NA
5446.98	57.55	4.71	-3.52	58.74	Peak	V	99	7	68.2	-9.46	Pass	
5350.06	57.43	4.76	-3.6	58.6	Peak	H	99	332	68.2	-9.6	Pass	

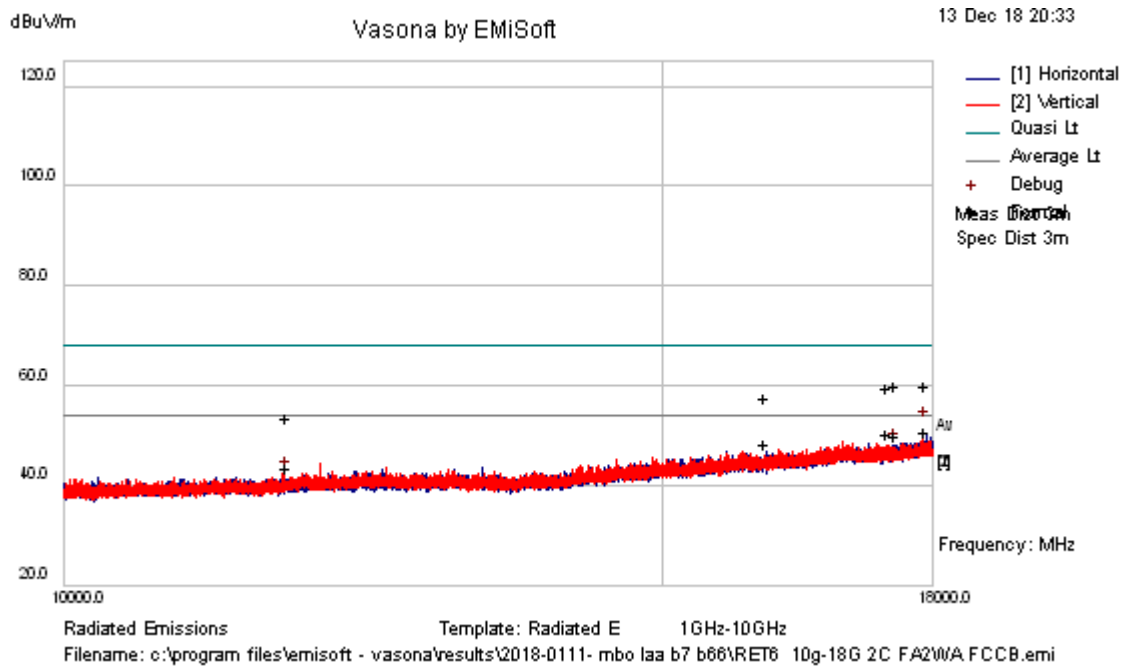
Note: NA = Not Applicable.

Figure 4.9.2(b) Radiated Spurious Emissions in 1GHz-5.625GHz for the EUT with Ant #2 FA2WA in UNII-3, 1x20MHz Carriers at Ch 165 (5825MHz), Q/16QAM, 27dBm/pt, against FCC Part 15.407 and 15.209 Limits at 3m Distance (RBW 1MHz).



Note: NA = Not Applicable.

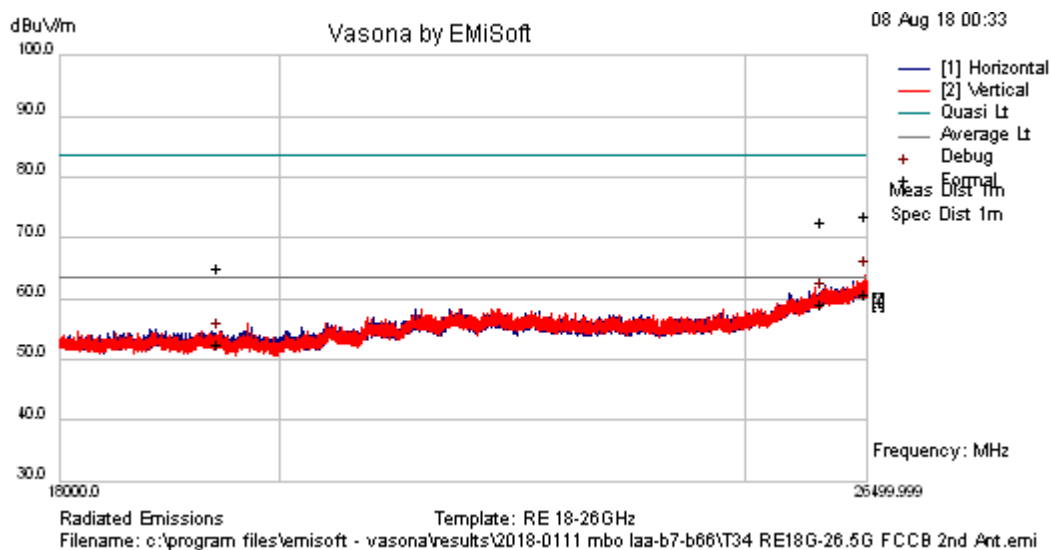
Figure 4.9.2(c) Radiated Spurious Emissions in 6GHz-10GHz for the EUT with Ant #2 FA2WA in UNII-3, 1x20MHz Carriers at Ch 149 (5745MHz), Q/16QAM, 27dBm/pt, against FCC Part 15.407 and 15.209 Limits at 3m Distance (RBW 1MHz, Preview 30kHz RBW in PK).



FORMAL DATA												
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
17926.4	30.17	11.06	4.63	45.86	Average	H	207	180	54	-8.14	Pass	
17478.7	30.25	10.61	4.47	45.33	Average	H	222	322	54	-8.67	Pass	NA
17576.6	30.08	10.71	4.48	45.27	Average	V	244	309	54	-8.73	Pass	NA
16093.2	30.46	10.05	2.8	43.3	Average	V	199	257	54	-10.7	Pass	
17576.6	40.07	10.71	4.48	55.26	Peak	V	244	309	68.2	-12.94	Pass	
17926.4	39.56	11.06	4.63	55.25	Peak	H	207	180	68.2	-12.95	Pass	
17478.7	39.63	10.61	4.47	54.71	Peak	H	222	322	68.2	-13.49	Pass	
11637.5	30.64	7.97	-0.1	38.51	Average	H	339	18	54	-15.49	Pass	
16093.2	39.77	10.05	2.8	52.62	Peak	V	199	257	68.2	-15.58	Pass	

Note: NA = Not Applicable.

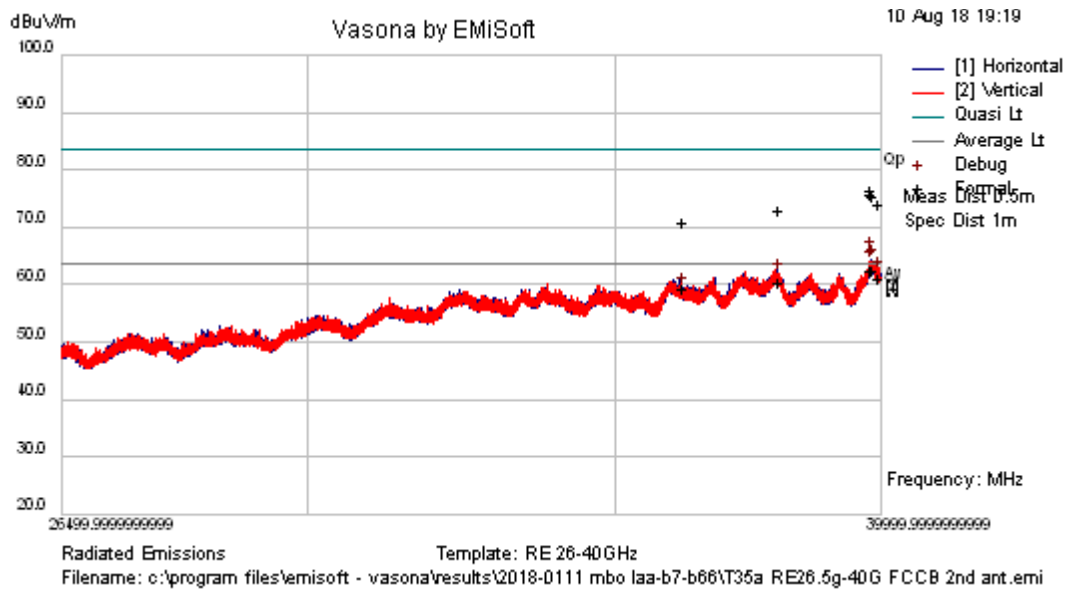
Figure 4.9.2(d) Radiated Spurious Emissions in 10GHz-18GHz for the EUT with Ant #2 FA2WA in UNII-3, 2x20MHz Carriers at Ch 161 (5805MHz) and 165 (5825MHz), Q/16QAM, 27dBm/pt, against FCC Part 15.407 and 15.209 Limits at 3m Distance (RBW 1MHz, Preview 100kHz RBW in PK).



FORMAL DATA												
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
26471.7	26.51	10.29	21.3	58.1	Average	V	133	117	63.5	-5.4	Pass	NA
25937.2	26.36	9.62	20.33	56.31	Average	V	101	33	63.5	-7.19	Pass	NA
26471.7	39.36	10.29	21.3	70.94	Peak	V	133	117	77.8	-6.86	Pass	
25937.2	39.96	9.62	20.33	69.91	Peak	V	101	33	77.8	-7.89	Pass	
19421.3	25.87	8.22	15.49	49.58	Average	V	135	42	63.5	-13.92	Pass	
19421.3	38.67	8.22	15.49	62.38	Peak	V	135	42	77.8	-15.42	Pass	

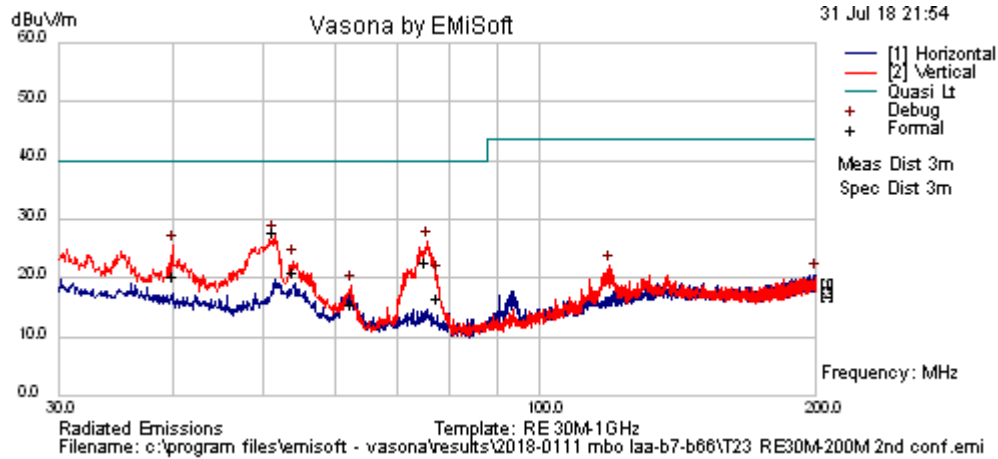
Note: NA = Not Applicable.

Figure 4.9.2(e) Radiated Spurious Emissions in 18GHz-26.5GHz for the EUT with Ant #2 FA2WA in UNII-3, 1x20MHz Carriers at Ch 165 (5825MHz), Q/16QAM, 27dBm/pt, against FCC Part 15.407 and 15.209 Limits at 1m Distance (RBW 1MHz, Preview 100kHz RBW in PK) (B7 and B66 were transmitting at 2125M and 2627.500MHz at full power).



FORMAL DATA												
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
39819.2	37.06	0	22.02	59.08	Average	H	200	232	63.5	-4.42	Pass	
39828.8	37.02	0	22.04	59.06	Average	H	173	240	63.5	-4.44	Pass	
39860.3	36.94	0	22.11	59.05	Average	V	168	343	63.5	-4.45	Pass	
39991.8	35.09	0	22.42	57.51	Average	H	185	230	63.5	-5.99	Pass	
38024.7	35.01	0	22.05	57.07	Average	H	138	205	63.5	-6.43	Pass	
36243.8	34.23	0	21.74	55.97	Average	V	188	284	63.5	-7.53	Pass	
39828.8	50.98	0	22.04	73.02	Peak	H	173	240	77.7	-4.68	Pass	
39819.2	50.33	0	22.02	72.35	Peak	H	200	232	77.7	-5.35	Pass	
39860.3	49.82	0	22.11	71.93	Peak	V	168	343	77.7	-5.77	Pass	
39991.8	48.28	0	22.42	70.7	Peak	H	184	231	77.7	-7.00	Pass	

Figure 4.9.2(f) Radiated Spurious Emissions in 26.5GHz-40GHz for the EUT with Ant #2 FA2WA in UNII-3, 1x20MHz Carriers at Ch 165 (5805MHz), Q/16QAM, 27dBm/pt, against FCC Part 15.407 and 15.209 Limits at 1m Distance (RBW 1MHz, Preview 100kHz RBW in PK) (B7 and B66 were transmitting at full power at 2125MHz and 2627.5MHz).

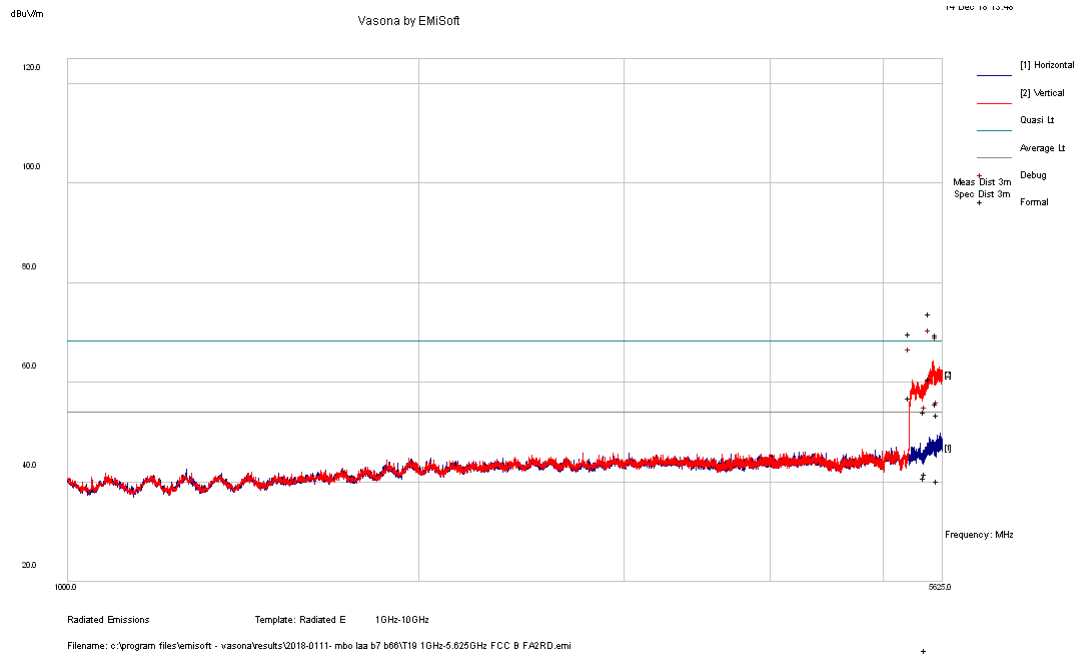


FORMAL DATA												
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
51.499	41.27	6.47	-21.9	25.86	Quasi Max	V	119	107	40	-14.14	Pass	
75.395	38.34	6.65	-24.2	20.78	Quasi Max	V	139	269	40	-19.22	Pass	
54.212	34.91	6.5	-22.3	19.09	Quasi Max	V	118	256	40	-20.91	Pass	
39.95	31.86	6.4	-19.9	18.32	Quasi Max	V	101	331	40	-21.68	Pass	
77.461	32.46	6.66	-24.6	14.49	Quasi Max	V	103	85	40	-25.51	Pass	
62.533	30.41	6.56	-23.6	13.42	Quasi Max	V	107	217	40	-26.58	Pass	

PREVIEW DATA												
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
51.5471	42.69	6.47	-21.9	27.27	Preview	V	100	45	40	-12.73	Pass	
75.5952	43.89	6.65	-24.3	26.28	Preview	V	100	315	40	-13.72	Pass	
40.004	39.01	6.4	-19.9	25.47	Preview	V	100	0	40	-14.53	Pass	
54.1443	38.73	6.49	-22.3	22.92	Preview	V	100	315	40	-17.08	Pass	
77.519	38.47	6.66	-24.7	20.49	Preview	V	100	270	40	-19.51	Pass	
62.513	35.76	6.56	-23.6	18.77	Preview	V	100	180	40	-21.23	Pass	
119.267	35.84	6.88	-20.7	22.02	Preview	V	100	0	43.5	-21.48	Pass	
199.739	31.69	7.15	-18.2	20.61	Preview	H	290	225	43.5	-22.89	Pass	

Note: Preview data was measured using a peak detector to identify frequencies of interest for formal measurement. Formal data consist of all frequencies in the preview list within 6 dB of specification limit or the top six frequencies. Failure in preview data does not necessarily constitute failure in formal data.

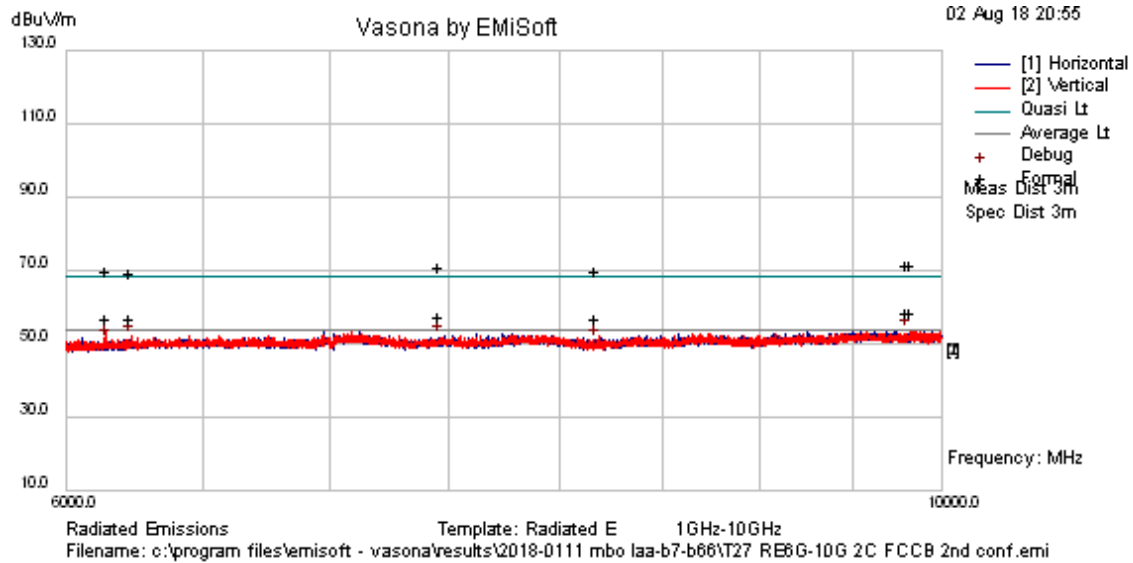
Figure 4.9.3(a) The Radiated Unwanted Emissions in 30MHz-1GHz for the EUT with Antenna #1 FA2RD in UNII-3, 2x20MHz Carriers at Channel 149 (5745MHz), 153 (5765MHz), Q/16QAM, 23dBm/port, against FCC Part 15.209 and 15.109 Class B Limits at 3m Distance (Preview in PK) (B66 Tx at 2125MH Full Power).



FORMAL DATA

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
5518.39	66.41	4.73	-3.47	67.67	Peak	V	119	209	68.2	-0.53	Pass	
5300.05	62.24	5.06	-3.64	63.66	Peak	V	167	183	68.2	-4.54	Pass	
5590.21	61.85	4.88	-3.41	63.32	Peak	V	123	196	68.2	-4.88	Pass	
5455.84	33.47	4.71	-3.52	34.66	AvgMax	H	113	156	54	-19.34	Pass	
5474.64	47.59	4.7	-3.5	48.79	Peak	H	119	164	68.2	-19.41	Pass	
5455.84	46.74	4.71	-3.52	47.93	Peak	H	113	156	68.2	-20.27	Pass	
5599.72	45.83	4.9	-3.4	47.33	Peak	H	156	195	68.2	-20.87	Pass	

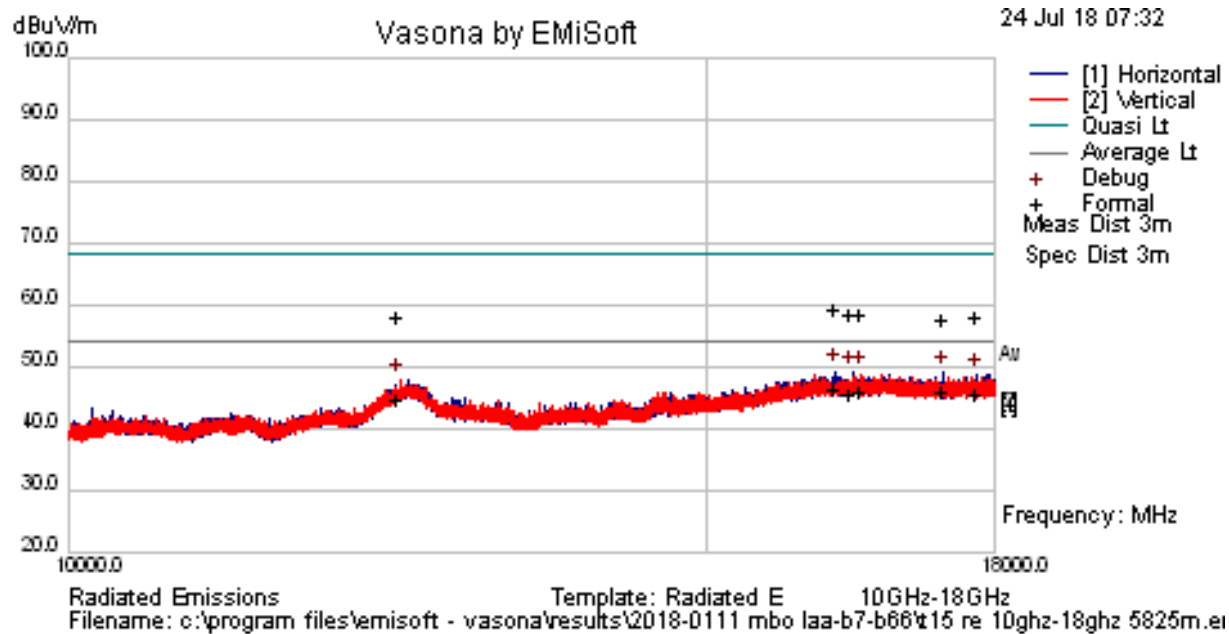
Figure 4.9.3(b) Radiated Spurious Emissions in 1GHz-5.625GHz for the EUT with Ant #1 FA2RD in UNII-3, 2x20MHz Carriers at Ch 161(5805MHz), 165 (5825MHz), Q/16QAM, 23dBm/pt, against FCC Part 15.407 and 15.209 Limits at 3m Distance (RBW 1MHz) (B66 Tx at 2125MHz Full Power).



FORMAL DATA												
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
7468.16	31.44	23.91	-2.7	52.65	Average	V	296	0	54	-1.35	Pass	
9830.97	44.28	24.43	-2.02	66.69	Peak	H	391	212	68.2	-1.51	Pass	
9810.26	44.28	24.43	-2.04	66.67	Peak	V	376	122	68.2	-1.53	Pass	
8181.13	30.96	23.99	-2.76	52.19	Average	V	309	200	54	-1.81	Pass	
6234.33	31.2	23.86	-2.9	52.16	Average	H	219	236	54	-1.84	Pass	NA
6148.94	30.88	23.85	-2.97	51.76	Average	H	178	64	54	-2.24	Pass	NA
7468.16	44.69	23.91	-2.7	65.89	Peak	V	296	0	68.2	-2.31	Pass	
6148.94	44.28	23.85	-2.97	65.17	Peak	H	178	64	68.2	-3.03	Pass	
8181.13	43.73	23.99	-2.76	64.96	Peak	V	309	200	68.2	-3.24	Pass	
6234.33	43.45	23.86	-2.9	64.41	Peak	H	219	236	68.2	-3.79	Pass	

Note: NA = Not Applicable.

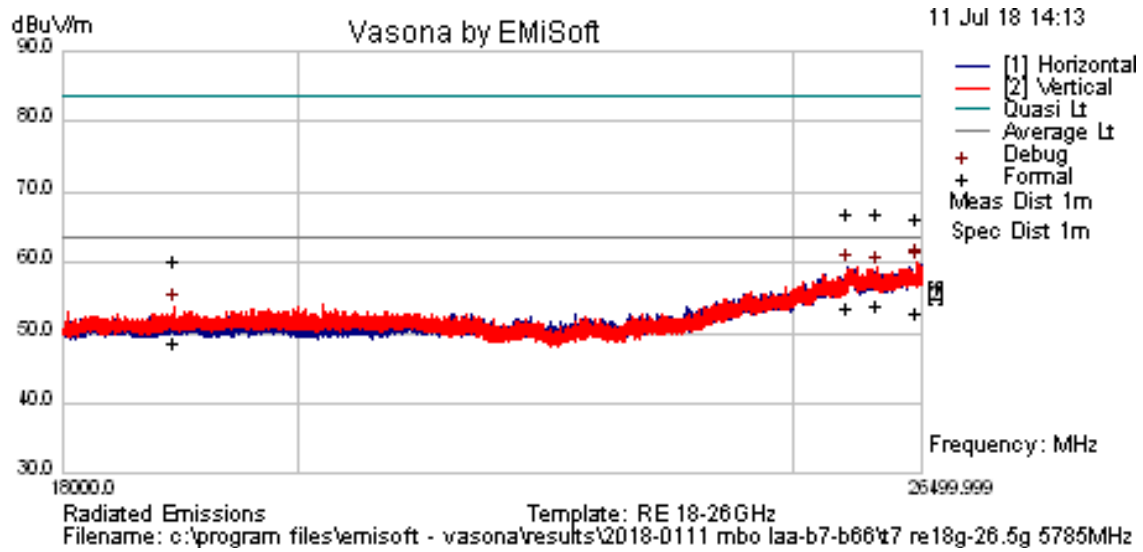
Figure 4.9.3(c) Radiated Spurious Emissions in 6GHz-10GHz for the EUT with Ant #1 FA2RD in UNII-3, 2x20MHz Carriers at Ch 149(5745MHz), 153 (5765MHz), Q/16QAM, 23dBm/pt, against FCC Part 15.407 and 15.209 Limits at 3m Distance (RBW 1MHz) (B66 Tx at 2125MHz Full Power).



**FORMAL
DATA**

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
17786.3	28.19	9.83	4.57	42.58	Average	H	202	154	54	-11.42	Pass	
16276.4	42.71	10.56	3.27	56.54	Peak	H	348	273	68.2	-11.66	Pass	
12329.7	32.63	8.19	0.78	41.61	Average	V	265	22	54	-12.39	Pass	
16438.4	41.62	10.47	3.69	55.77	Peak	H	390	30	68.2	-12.43	Pass	
16536.5	41.36	10.41	3.92	55.68	Peak	V	214	259	68.2	-12.52	Pass	
12329.7	46.15	8.19	0.78	55.13	Peak	V	265	22	68.2	-13.07	Pass	
17786.3	40.68	9.83	4.57	55.08	Peak	H	202	154	68.2	-13.12	Pass	
17412.6	40.4	9.98	4.52	54.9	Peak	H	304	306	68.2	-13.3	Pass	

Figure 4.9.3(d) Radiated Spurious Emissions in 10GHz-18GHz for the EUT with Ant #1 FA2RD in UNII-3, 1x20MHz Carrier at Ch 165(5825MHz), Q/16QAM, 23dBm/pt, against FCC Part 15.407 and 15.209 Limits at 3m Distance (RBW 1MHz, Preview 30kHz) (B7&B66 Tx at 2627.5MHz 2125MHz Full Power).

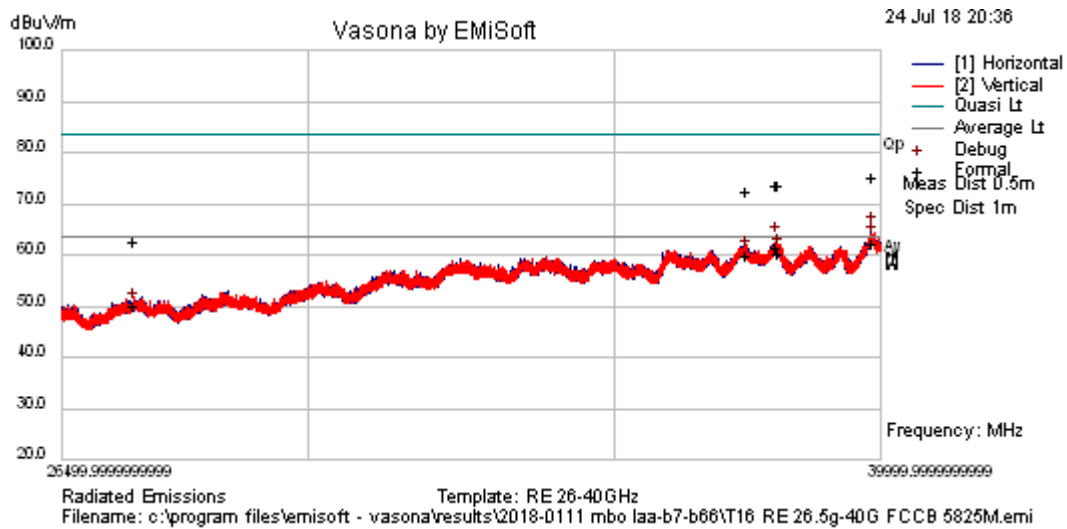


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DATA

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
18925.2	28.99	9.13	8.71	46.83	Average	V	142	133	63.5	-16.67	Pass	
25964.4	42.89	11.18	10.93	65	Peak	V	145	193	77.7	-12.7	Pass	
25964.3	42.89	11.18	10.93	65	Peak	V	113	321	77.7	-12.7	Pass	
25625.2	43.3	11.06	10.62	64.98	Peak	H	101	324	77.7	-12.72	Pass	
26443.3	40.87	11.35	12.19	64.41	Peak	V	132	82	77.7	-13.29	Pass	
26433.5	40.73	11.35	12.17	64.24	Peak	V	200	223	77.7	-13.46	Pass	
18925.2	40.32	9.13	8.71	58.16	Peak	V	142	133	77.7	-19.54	Pass	

Figure 4.9.3(e) Radiated Spurious Emissions in 18GHz-26.5GHz for the EUT with Ant #1 FA2RD in UNII-3, 1x20MHz Carrier at Ch 157(5785MHz), Q/16QAM, 23dBm/pt, against FCC Part 15.407 and 15.209 Limits at 1m Distance (RBW 1MHz, Preview 100kHz) (B7&B66 Tx at 2627.5MHz 2125MHz Full Power).



FORMAL DATA

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
39874.7	36.96	0	22.15	59.11	Average	V	137	216	63.5	-4.39	Pass	
39876.7	36.92	0	22.15	59.07	Average	H	141	32	63.5	-4.43	Pass	
37972.6	36.41	0	22.09	58.5	Average	H	177	143	63.5	-5	Pass	
38009.1	35.12	0	22.07	57.19	Average	H	110	75	63.5	-6.31	Pass	
37403.6	34.51	0	22.42	56.93	Average	V	160	119	63.5	-6.57	Pass	
39874.7	50	0	22.15	72.15	Peak	V	137	216	77.7	-5.55	Pass	
39876.7	49.88	0	22.15	72.03	Peak	H	141	32	77.7	-5.67	Pass	
37972.6	48.46	0	22.09	70.56	Peak	H	177	143	77.7	-7.14	Pass	
38009.1	48.46	0	22.07	70.53	Peak	H	110	75	77.7	-7.17	Pass	
37403.6	47.06	0	22.42	69.48	Peak	V	160	119	77.7	-8.22	Pass	
27506.1	33.32	0	13.89	47.2	Average	V	132	53	77.7	-10.5	Pass	
27506.1	45.88	0	13.89	59.76	Peak	V	132	53	77.7	-17.94	Pass	

Figure 4.9.3(f) Radiated Spurious Emissions in 26.5GHz-40GHz for the EUT with Ant #1 FA2RD in UNII-3, 1x20MHz Carrier at Ch 165(5825MHz), Q/16QAM, 23dBm/pt, against FCC Part 15.407 and 15.209 Limits at 1m Distance (RBW 1MHz) (B7&B66 Tx at 2627.5MHz 2125MHz Full Power).

4.10 MEASUREMENT REQUIRED: AC POWER LINE CONDUCTED EMISSIONS — FCC SECTIONS 15.407(b)(6) & 15.207

The FCC requirements specified in 15.407(b)(6) are provided in Section 4.1, where FCC states that any U-NII devices using an AC power line are required to comply with the conducted limits set forth in 15.207.

FCC 15.207(a) stated that for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

FCC 15.207(c) states that measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provisions for, the use of battery chargers which permit operating while charging, AC adapters or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

The limits are given in Table 4.10.1.

Table 4.10.1. FCC 15.107 and 15.207 AC Power Line Conducted Emissions Limits

Frequency (MHz)	15.207 (dB μ V)		15.107 Class B (dB μ V)		RBW
	Quasi-Peak	Average	Quasi-Peak	Average	
0.15 – 0.5	66 – 56*	56 – 46*	66 – 56*	56 – 46*	9 kHz
0.5 – 5.0	56	46	56	46	
5.0 – 30.0	60	50	60	50	

*Decreases with the logarithm of the frequency.

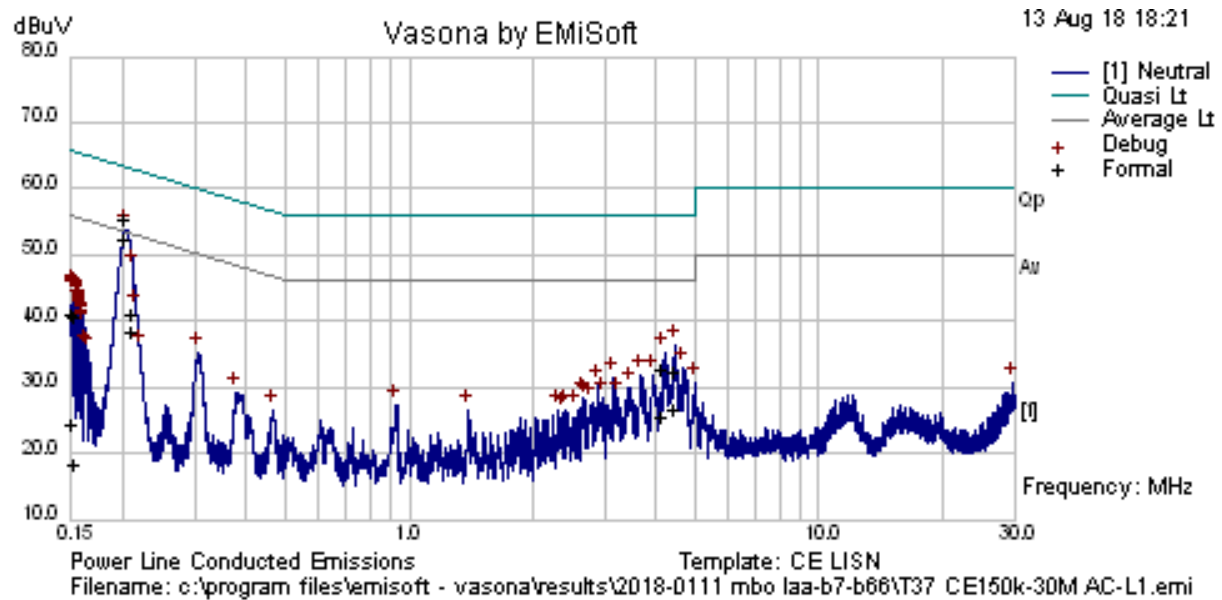
The AC power line conducted emissions of the MBO LAA were evaluated with one UNII-3 20MHz 64QAM carrier transmitting at 5825MHz at the maximum power level, 27dBm, at both ports. The MBO LAA was co-located with MBO B7 FW2HMBOM1 and B66 FW2IMBOM1 RF modules transmitting at 2125MHz (37dBm at each of its two ports) and 2627.5MHz (37dBm at each of its two ports), respectively.

The recommendations of ANSI C63.10 were followed for EUT testing setup and cabling. The test setup photo is given in Section 5.

The conducted emissions were measured at both AC power leads. The AC power line conducted emissions measured in the frequency spectrum 150kHz to 30MHz were all below 15.207 limits with the minimum margin of 4.46dB at 194kHz. The plots are provided in Figures 4.10.1 – 4.10.2.

The FCC 15.107 Class B limits are identical to the 15.207 limits. The AC power line conducted emissions of the EUT are below FCC 15.207 and FCC 15.107 Class B limits and in full compliance with the Rules of the

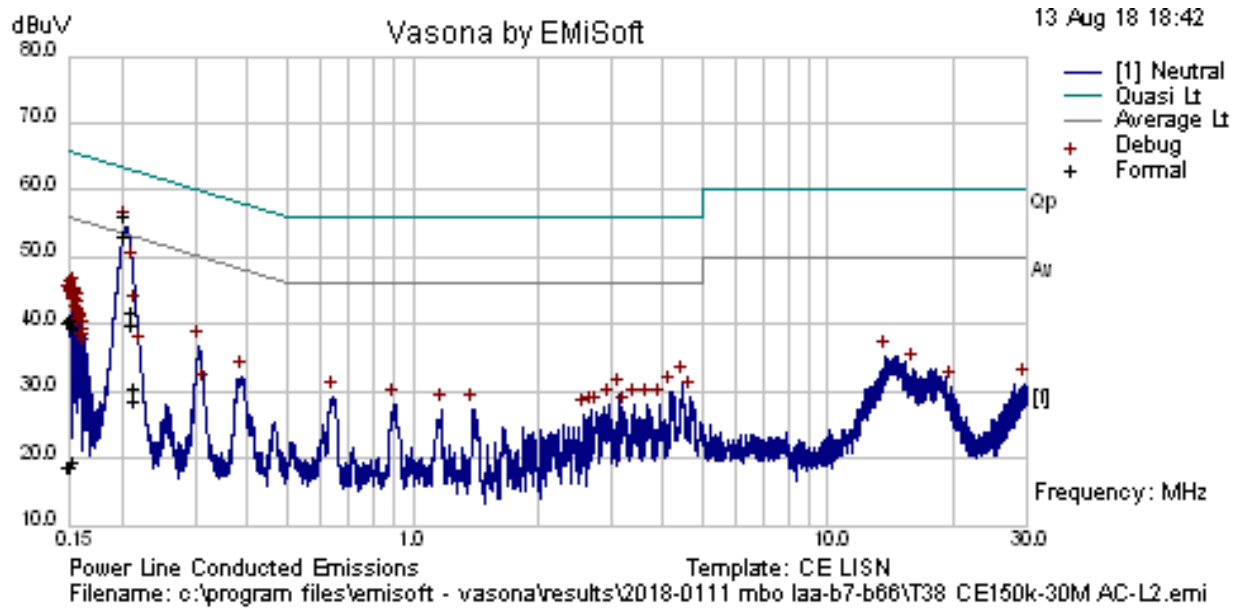
Commission. Therefore, the EUT is in compliance with 15.207 requirements for intentional radiators and the 15.107 Class B requirements for unintentional radiators.



FORMAL DATA

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV)	Emission Type	Line	Limit (dBuV)	Margin (dB)	Pass /Fail	Comments
0.205	39.81	9.93	0.05	49.79	Average	L1	53.41	-3.61	Pass	
0.205	42.9	9.93	0.05	52.88	Quasi Peak	L1	63.41	-10.53	Pass	
0.21174	26.08	9.93	0.05	36.06	Average	L1	53.14	-17.08	Pass	
4.475	14.17	10	0.06	24.23	Average	L1	46	-21.77	Pass	
4.183	13.23	10	0.06	23.29	Average	L1	46	-22.71	Pass	
0.21174	28.62	9.93	0.05	38.61	Quasi Peak	L1	63.14	-24.53	Pass	
4.183	20.14	10	0.06	30.2	Quasi Peak	L1	56	-25.8	Pass	
4.475	19.85	10	0.06	29.91	Quasi Peak	L1	56	-26.09	Pass	
0.15148	28.57	9.92	0.07	38.56	Quasi Peak	L1	65.92	-27.36	Pass	
0.15477	28.07	9.92	0.07	38.06	Quasi Peak	L1	65.74	-27.68	Pass	
0.15148	12.16	9.92	0.07	22.15	Average	L1	55.92	-33.77	Pass	
0.15477	6.03	9.92	0.07	16.02	Average	L1	55.74	-39.72	Pass	

Figure 4.10.1 Conducted Emissions on AC Main Power Lead L1.



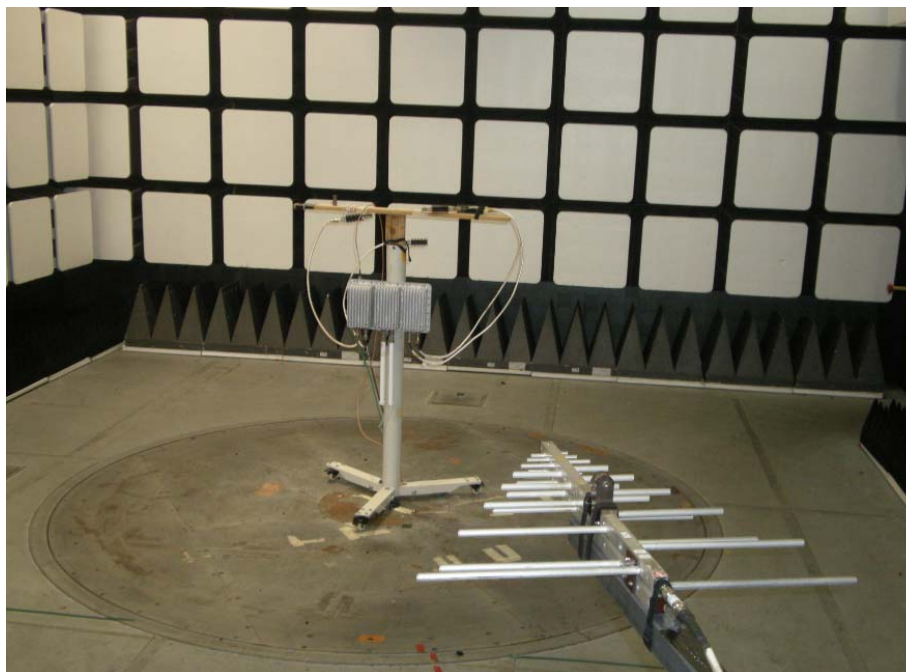
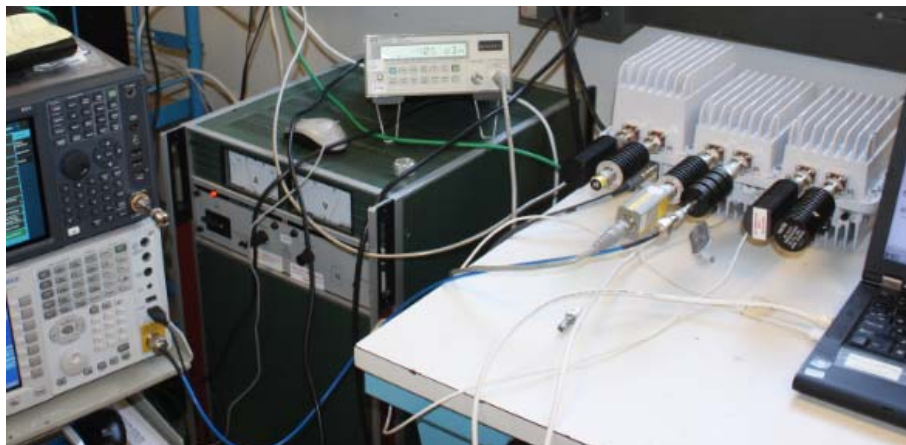
FORMAL DATA

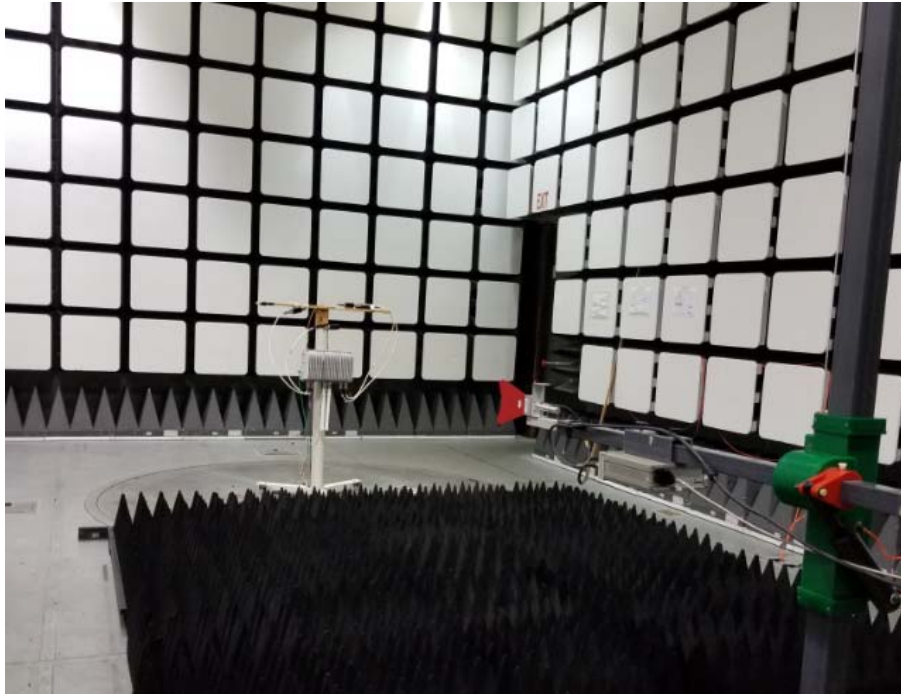
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV)	Emission Type	Line	Limit (dBuV)	Margin (dB)	Pass /Fail	Comments
0.204	40.72	9.93	0.05	50.7	Average	L2	53.45	-2.74	Pass	
0.204	43.72	9.93	0.05	53.7	Quasi Peak	L2	63.45	-9.75	Pass	
0.21158	27.36	9.93	0.05	37.34	Average	L2	53.14	-15.8	Pass	
0.21158	29.49	9.93	0.05	39.47	Quasi Peak	L2	63.14	-23.67	Pass	
0.21583	16.02	9.93	0.05	26	Average	L2	52.98	-26.98	Pass	
0.15259	28.41	9.92	0.07	38.39	Quasi Peak	L2	65.86	-27.46	Pass	
0.15044	27.9	9.92	0.07	37.89	Quasi Peak	L2	65.98	-28.09	Pass	
0.15325	27.17	9.92	0.07	37.16	Quasi Peak	L2	65.82	-28.67	Pass	
0.21583	18.06	9.93	0.05	28.04	Quasi Peak	L2	62.98	-34.94	Pass	
0.15325	6.9	9.92	0.07	16.89	Average	L2	55.82	-38.94	Pass	
0.15259	6.48	9.92	0.07	16.46	Average	L2	55.86	-39.4	Pass	
0.15044	6.48	9.92	0.07	16.46	Average	L2	55.98	-39.51	Pass	

Figure 4.10.2 Conducted Emissions on AC Main Lead L2

5. PHOTOGRAPHS OF EUT SETUP

The setup photos of the conducted and radiated emissions tests, including AC power line test, were provided below.





6. LIST OF TEST EQUIPMENT

Table 6.1 List of Test Equipment Used

Equipment	Manufacturer	Model	Serial #	LastCal Date	Cal Due Date
MXA Signal Analyzer (20Hz-26.5GHz)	Agilent	N9020A	MY53420147	2017-03-13	2019-03-13
MXA Signal Analyzer (20Hz-26.5GHz)	Agilent	N9020B	MY57430927	2018-04-25	2020-04-25
7dB Attenuator, DC - 2 GHz	JFW	50F-007	N/A	N/A	N/A
3 dB Attenuator DC - 4 GHz, 2W	Macom	2082-6171-03	N/A	N/A	N/A
20 dB Attenuator DC - 3 GHz, 2 W	Pasternack	PE7001-20	N/A	N/A	N/A
10 dB Attenuator (DC – 40 GHz, 20W)	Fairview Microwave	SA4023-10	N/A	N/A	N/A
RF Power Meter	Hewlett Packard	437B	3125U21137	2016-12-15	2018-12-15
Power Sensor (0.01-18 GHz)	Hewlett Packard	8481A	US37294629	2017-05-26	2019-05-26
EMC Receiver (20Hz to 40 GHz)	Rohde & Schwarz	ESIB-40	100119	2017-10-30	2019-10-30
EMC Receiver (20Hz - 40GHz)	Rohde & Schwarz	ESU40	100246	2018-09-11	2020-09-11
EMC Receiver (20Hz - 40GHz)	Rohde & Schwarz	ESI	832692/005	2018-03-19	2020-03-19
LAA Notch Filter (50dB,20W)	Fingu	E1365	B6171300036	N/A	N/A
6 dB Attenuator	Weinschel	2-6	CD2518	2017-05-01	2019-05-01
6 dB Attenuator	Weinschel	2-6	CD2534	2017-05-23	2019-05-23
6 dB Attenuator	Weinschel	2-6	CD2545	2017-03-03	2019-03-03
Preamplifier (1-26.5 GHz, 30dB)	Hewlett Packard	8449B	3008A01384	2018-04-10	2020-04-10
Amplifier (9kHz-1GHz)	Sonoma Instrument	310N	185785	2018-01-09	2020-01-09
Double-Ridged Horn (1-18 GHz)	ETS Lindgren	3117	00135198	2017-06-09	2019-06-09
Double-Ridged Horn (18-40 GHz)	EMC Test Systems	3116	2539	2017-06-16	2019-06-16
Ridged Horn (26.5-40GHz)	A.H. Systems	SAS-200/573	137	2017-10-04	2019-10-04
Log Periodic Antenna (0.2-1GHz)	EMCO	3146	2082	2017-05-24	2019-05-24
Biconical Antenna	EMCO	3109	2187	2016-12-01	2019-01-01
High Pass Filter (5-40GHz)	RLC Electronics Inc	F-19414	1444001	N/A	N/A
High Pass Filter (5-40GHz)	RLC Electronics	F-19414	1444002	N/A	N/A

Transient Limiter (9KHz-200MHz)	Agilent	11947A	3107A02947	2018-10-29	2020-10-29
EMI Test Receiver (20Hz to 40 GHz) + 30dBm	Rohde & Schwarz	ESIB40	100119	2017-11-06	2019-11-06
Micro-Ohmmeter	Extech	380460	H273544	2017-05-16	2019-05-16
Multi-Meter (True RMS)	Fluke	16	71520011	2017-03-07	2019-03-07
LISN 50μH 0.25 μF	Solar Electronics	9348-50-R- 24-BNC	018809	2017-05-22	2019-05-22
MXA Signal Analyzer (20Hz-26.5GHz)	Agilent	N9020A	MY48011791	2017-02-23	2019-02-23
Digital Power Meter	Yokogawa	WT210	91HA24429	2017-02-24	2019-02-24
Thermal Logger	Yokogawa	MV200S	S5PB04190	2017-02-23	2019-02-23
GPS Receiver	Symmetric	OM 58503B	KR93200773	N/A	N/A
Power Supply	Behlman	BL1350	04243	N/A	N/A
Multi-Device Controller	ETS Lindgren	2090	0004-1507	N/A	N/A
RF Cable	Micro-Coax Utiflex	142A 503609-G	00000387	N/A	N/A
RF Cables (36", 72" & 278" Long)	Megaphase	D230-N1-N1	004	N/A	N/A
RF Cables (36", 72" & 278" Long)	Megaphase	D230-N1-N1	1003	N/A	N/A
RF Cables (36", 72" & 278" Long)	Megaphase	D230-N1-N1	002	N/A	N/A

7. TEST FACILITIES

All measurement facilities used to collect the measurement data under normal condition are located at 600-700 Mountain Avenue, Murray Hill, New Jersey 07974-0636 USA. The field strength measurements of radiated spurious emissions are made in FCC and IC registered semi-anechoic chambers AR4, AR7 and AR9 (FCC Site Registration Numbers: 439234, 995653 & 896745, IC Filing Numbers: 6933F-4, 6933F-7 & 6933F-9). The sites were constructed and are continuously in conformance with the requirements of ANSI C63.4 and CISPR Publication 32.

Nokia Global Product Compliance Laboratory is accredited with the US Department of Commerce National Institute of Standards and Technology's National Voluntary Laboratory Accreditation Program (NVLAP) for satisfactory compliance with criteria established in Title 15, Part 7 Code of Federal Regulations for offering test services for selected test methods in Electromagnetic Compatibility; Voluntary Control Council for Interference (VCCI), Japan; Australian Communications and Media Authority (ACMA). The laboratory is ISO 9001:2008 Certified.



8. REFERENCES

- [1]. Title 47 Code of Federal Regulations (CFR) Parts 2 and 15.
- [2]. ANSI C63.10, American Nation Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices, 2013.
- [3]. FCC KDB 789033 D02, Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices (Part 15, Subpart E), December 2017, v02r01.
- [4]. FCC KDB 662911D01, Emissions Testing of Transmitters with Multiple Outputs in the Same Band, October 2013, v02r01.
- [5]. FCC KDB 353028 D01, Basic Equipment Authorization Guidance for Antennas Used with Part 15 Intentional Radiators, April 2017, v01.