



Electromagnetic Compatibility Test Report

Test Report No: MLT 180315, Rev.2
Issued on: March 18, 2015

Product Name
ENTR Door Unit

Tested According to
FCC 47 CFR, Part 15.247

Tests Performed for
MUL-T-LOCK

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Test Report details:

Test commencement date: 02.12.2014
Test completion date: 19.02.2015
Customer's Representative: Aharon Vardi
Issued on: 18.03.2015

Revision details:

Version	Date	Details/Reasons
Rev. 1	18.03.2015	-
Rev. 2	23.09.2016	List of Measuring Equipment used was updated

Assessment information:

This report contains an assessment of the EUT against Electromagnetic Compatibility based upon tests carried out on the samples submitted. The results contained in this report relate only to the items tested. Manufactured products will not necessarily give identical results due to production and measurement tolerances. QualiTech, EMC Lab does not assume responsibility for any conclusion and generalization drawn from the test results with regards to other specimens or samples of type of the equipment represented by test item.

The EUT was set up and exercised using the configuration, modes of operation and arrangements defined in this report only.

Modifications:

Modifications made to the EUT

None

Modifications made to the Test Standard

None

Summary of Compliance Status

Test Spec. Clause	Test Case	Remarks
47 CFR §15.247 (a) (2)	DTS Bandwidth	Pass
47 CFR §15.247 (b) (3) (4)	Fundamental Emission Output Power	Pass
47 CFR §15.247 (e)	Maximum Power Spectral Density Level in the Fundamental Emission	Pass
47 CFR §15.247 (d)	Emissions in Non-Restricted Frequency Bands	Pass
47 CFR §15.247 (d), & §15.205, & §15.209(a)	Emissions in Restricted Frequency Bands	Pass
47 CFR §15.247 (d)	Band-edge Measurements	Pass
47 CFR §15.203	Antenna Connector Requirements	Pass

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1. General

1.1. Referenced documents:

ANSI C63.4-2014	Limits and Methods of Measurement for Conducted and Radiated Emissions of Information Technology Equipment
ANSI C63.10-2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

1.2. Description of the EUT system/test Item:

Product name: ENTR Door Unit

FCC ID: 2AHH881130

Description: Electromechanical locking door

Frequency range: 2400 – 2483.5 MHz

Type of Modulation: GFSK

Antenna Gain: 2.0 dBi

1.3. Conducted RF Measurements:

The RF output of the transmitter under test was directly connected to the input of the Spectrum analyzer through a specialized antenna connector provided by the manufacturer, and an attenuator as specified. The external attenuator and cable loss were added to the reading. Worst-case results of the various modulation modes (where applicable) were reported.

For PSD, emission peak was zoomed within the pass band with spectrum analyzer's settings as reported (Sweep time=Span/3 kHz)

For Maximum Conducted Output Power an Average Power Meter was used.

For spurious emissions measurement, the spectrum from 9 kHz to 40 GHz was investigated with the transmitter set to the lowest, middle and highest channel frequencies.

For bandedge measurement allow the trace to stabilize. Set the marker on the emission at the bandedge, or on the highest modulation product outside of the band, if this level is greater than that at the bandedge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission. The marker-delta value now displayed must comply with the limit specified in this Section. Submit this plot.

Radiated Emissions Measurements in the restricted bands:

For radiated emissions, which fall in the restricted bands the spectrum from 1MHz to 25GHz was investigated following the guidelines in ANSI C63.4-2014, with the transmitter set to the lowest, middle and highest channel frequencies. Measurements were performed with peak detector and repeated averaged with $VBW=10$ Hz. Only Peak detection plots are presented. Worst-case results of the various modulation modes (where applicable) were reported.

1.4. Radiated Emission measurements:

Measurements were performed at a 3-meter measurement distance in the semi-anechoic chamber in order to evaluate the radiated electromagnetic interference characteristics of the EUT. The EUT was placed on a non-metallic table/support, 0.8m above the turntable, was configured, arranged and operated in a manner consistent with typical application and load conditions. The test program of exercising the equipment ensured that various parts of the EUT were exercised to permit detection of all EUT disturbances. An appropriate antenna depending upon the frequency range, per ANSI C63.4-2014 clause 4.1.5 was used. While the turntable was being rotated, the height of the antenna was varied from 1 to 4m for the frequency range of 30MHz to 1GHz. The highest radiated emission was detected by manipulating the EUT through three axis(x,y,z) and system cables, a worst-case results are reported by max hold function

This process was repeated for both antenna polarizations. The spectrum up to 40 GHz was investigated for spurious emissions, using a band-reject filter where appropriate.

The amplitudes of worst-case emission were measured with the detector modes and resolution bandwidths over various frequency ranges according to the requirements of ANSI C63.4-2014 clause 4.2.

1.5. Worst Case Results:

In order to determine the worst case emissions for all modes/data rates/tests, all modes/data rates were investigated for each required test to determine which produces the worst- case data and then full testing was performed in that mode/data rate

2. Test Facility & Uncertainty of Measurement

Accreditation/ Registration reference:

- A2LA Certificate Number: 1633.01

2.1. Test Facility description

The tests were performed at the EMC Laboratory, QualiTech Division, ECI Telecom Group

Address: 30, Hasivim St., Petah Tikva, Israel.

Tel: 972-3-926-6994

Semi Anechoic Configuration:

Measurement distance	3m
Chamber dimensions	9.5m x 6.5m x 5.2m
Antenna height	1 - 4m
Shielding Effectiveness	Magnetic field ≥80dB at 15 kHz ≥90dB at 100 kHz Electric field >120dB from 1MHz to 1GHz >110dB from 1GHz to 10GHz
Absorbing material	Ferrite tiles on the walls and ceiling Emerson and Cuming absorbing material in selected positions on the walls
Normalized Site Attenuation measured at 5 positions	±3.9dB, 30MHz to 200MHz ±3dB, 200MHz to 1000MHz
Transmission Loss measured at 5 positions, at 1.5m height	±3dB, 1GHz to 18GHz

Full-Anechoic Configuration:

Measurement distance	3m
Chamber dimensions	7m x 4m x 3m
Antenna height	1.55m at Horizontal & Vertical polarizations
Shielding Effectiveness	Magnetic field ≥80dB at 15 kHz ≥90dB at 100 kHz Electric field >120dB from 1MHz to 1GHz >110dB from 1GHz to 10GHz
Absorbing material	Ferrite tiles on the walls and ceiling Emerson and Cuming absorbing material in selected positions on the walls and floor
Field Uniformity to EN61000-4-3	±3dB 80MHz to 18GHz

2.2. Uncertainty of Measurement:

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report according to CISPR 16-4-2 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements ". Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Test Name	Test Method & Range	Uncertainty	
		Combined std. Uc(y)	Expanded U
Radiated Emission	30MHz÷230MHz, Horiz. polar. 30MHz÷230MHz, Ver. polar. 230MHz÷1000MHz, Horiz. polar. 230MHz÷1000MHz, Vert. polar.	[dB] 1.8 1.967 1.487 1.499	[dB] 3.6 3.934 2.973 2.998
Conducted Emission	9 kHz÷150 kHz 150 kHz÷30MHz	[dB] 1.378 1.095	[dB] 2.756 2.190
Radio frequency	Up to 18 GHz	$\pm 1 \times 10^{-6}$	$< \pm 1 \times 10^{-5}$
Total Conducted RF Power	Up to 18 GHz	± 1.378 dB	$< \pm 1.5$ dB
Conducted Power density	Up to 18 GHz	± 1.378 dB	$< \pm 3$ dB
Temperature	23.6 °C	± 0.6 °C	$< \pm 2$ °C
Humidity	54.9%	± 3.1 %	$< \pm 5$ %
DC Voltage	0-60 VDC	± 0.3 %	$< \pm 3$ %

Note: QualiTech EMC labs expanded measurement instrumentation has less uncertainty than the industry norm and compliance is deemed to occur as no measured disturbance exceeds the disturbance limit.

Note: The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95%.

3. Report of Measurements and Examinations

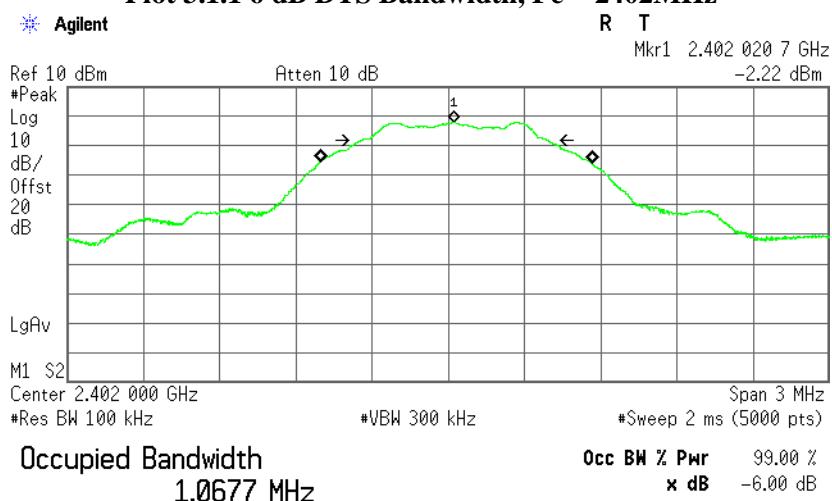
3.1. 6dB DTS Bandwidth

Reference document:	47 CFR §15.247 (a)(2)				
Test Requirements:	Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.				
Method of testing:	KDB 558074 D01 v03r02, Sec.8.1 Conducted	Pass			
Operating conditions:	Under normal test conditions				
S.A. Settings:	RBW: 100 kHz, VBW: 3 MHz				
Environment conditions:	Ambient Temperature: 21°C	Relative Humidity: 48%	Atmospheric Pressure: 1011.4 hPa		
Test Result:	See below	See Plot 3.1.1 – Plot 3.1.3			

Test results:

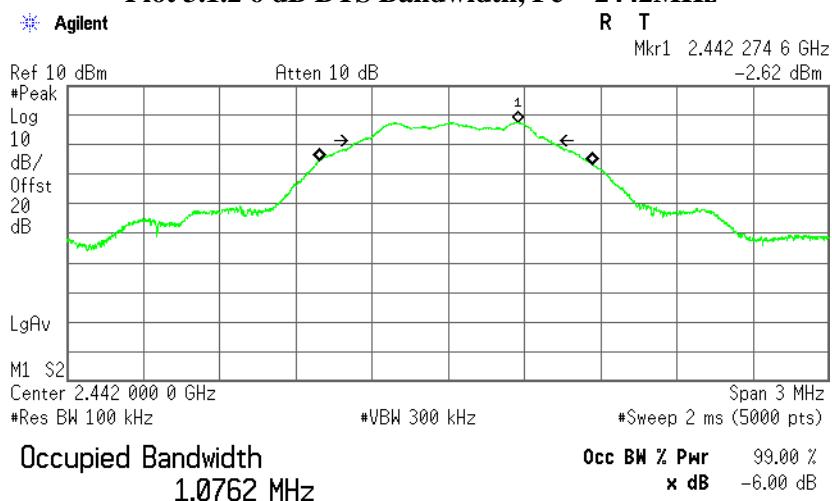
Fundamental Frequency, [MHz]	6 dB DTS Bandwidth, [kHz]	Minimum Bandwidth, [kHz]	Margin, [kHz]	Pass/Fail
2402.000	735.337	500.000	235.337	Pass
2442.000	736.261	500.000	236.261	Pass
2480.000	750.989	500.000	250.989	Pass

Plot 3.1.1 6 dB DTS Bandwidth, Fc = 2402MHz



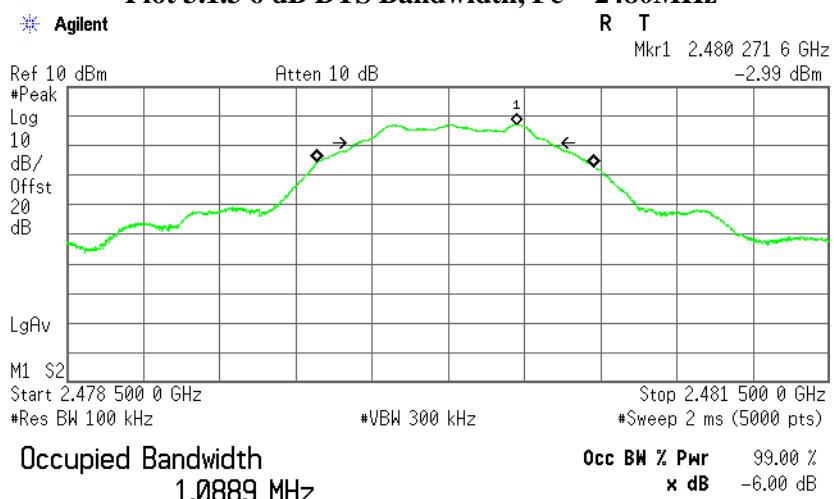
Transmit Freq Error 31.110 kHz
x dB Bandwidth 735.337 kHz

Plot 3.1.2 6 dB DTS Bandwidth, Fc = 2442MHz



Transmit Freq Error 29.106 kHz
x dB Bandwidth 736.261 kHz

Plot 3.1.3 6 dB DTS Bandwidth, Fc = 2480MHz



Transmit Freq Error 27.716 kHz
x dB Bandwidth 750.989 kHz

3.2. Fundamental Emission Output Power

Reference document:	47 CFR §15.247 (b)(3)(4)		
Test Requirements:	<p>The maximum peak conducted output power of the intentional radiator for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands shall not exceed 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted (average) output power. The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.</p>		
Method of testing:	KDB 558074 D01 v03r02, Sec.9.1.2, Conducted PKPM1		
Operating conditions:	Under normal test conditions		
Settings:	Triggered/signal-gated broadband power meter		
Environment conditions:	Ambient Temperature: 21°C	Relative Humidity:48 %	Atmospheric Pressure: 1011.4 hPa
Test Result:	See below	--	

Test Results:

Fundamental Frequency, [MHz]	Fundamental Emission Output Power, [dBm]	Fundamental Emission Output Power, [mW]	Limit, [mW]	Margin, [mW]	Pass/Fail
2402	1.90	1.55	1000.0	-998.45	Pass
2442	1.73	1.50	1000.0	-998.50	Pass
2480	1.54	1.40	1000.0	-998.60	Pass

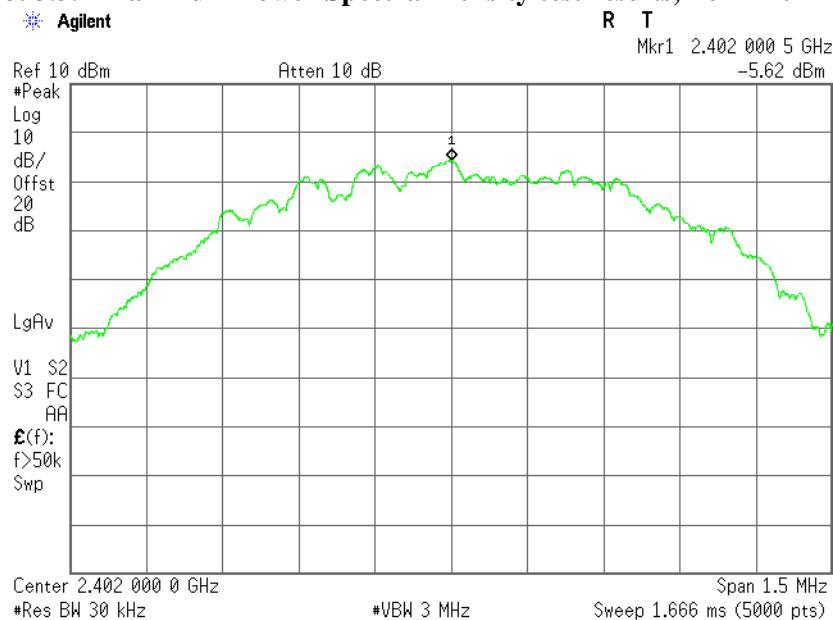
3.3. Maximum Power Spectral Density Level in the Fundamental Emissions

Reference document:	47 CFR §15.247 (e)				
Test Requirements:	For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.				
Method of testing:	KDB 558074 D01 v03r02, Sec.10.2 Conducted, PKPSD method	Pass			
Operating conditions:	Under normal test conditions				
S.A. Settings:	RBW: 30 kHz, VBW: 3 MHz				
Environment conditions:	Ambient Temperature: 21 °C	Relative Humidity: 48%	Atmospheric Pressure: 1011.4 hPa		
Test Result:	See below	See Plot 3.3.1 - Plot 3.3.3			

Test Results:

Fundamental Frequency, [MHz]	PSD Measured, [dBm/3kHz]	PSD Limit, [dBm/3kHz]	Margin, [dB]	Pass/Fail
2402.000	-5.62	8.00	-13.62	Pass
2442.000	-5.88	8.00	-13.88	Pass
2480.000	-6.12	8.00	-14.12	Pass

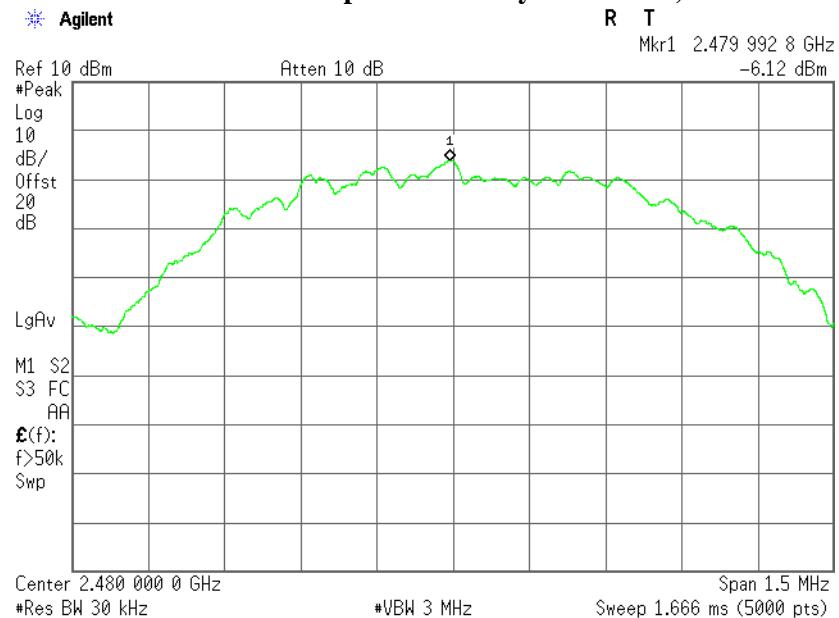
Plot 3.3.1 Maximum Power Spectral Density test results, Fc = 2402MHz



Plot 3.3.2 Maximum Power Spectral Density test results, Fc = 2442MHz



Plot 3.3.3 Maximum Power Spectral Density test results, Fc = 2480MHz



3.4. Emissions in Non-Restricted Frequency Bands

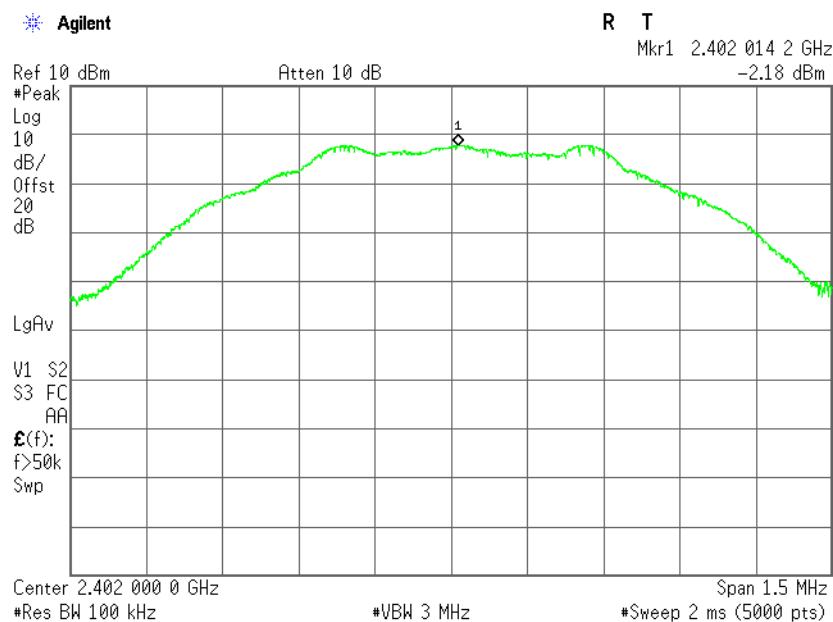
Reference document:	47 CFR §15.247 (d)		
Test Requirements:	<p>In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30dB instead of 20dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (See §15.205(c)).</p>		
Method of testing:	<p>KDB 558074 D01 v03r02 Sec.11.1, a) Conducted</p>		
Operating conditions:	Under normal test conditions		
S.A. Settings:	RBW: 100 kHz, VBW:3 MHz		
Environment conditions:	Ambient Temperature: 21°C		Relative Humidity: 48% Atmospheric Pressure: 1011.4 hPa
Test Result:	See below		See Plot 3.4.1- Plot 3.4.9

Test results:

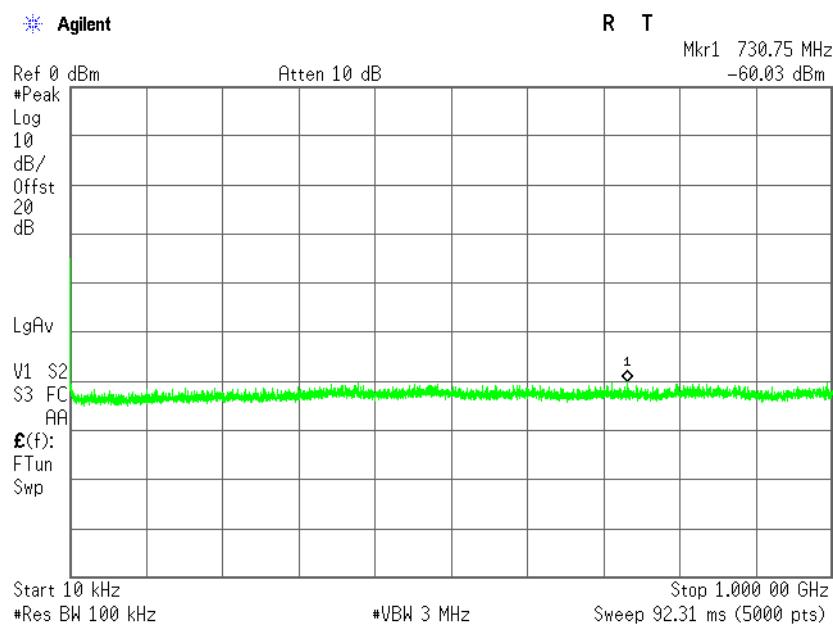
Unwanted Emissions Measurements:

Fundamental Frequency, [MHz]	Fundamental Emission Reference Level, [dBm]	Unwanted Emissions Frequency, [MHz]	Unwanted Emissions Level, [dBm]	Attenuation Below Fundamental, [dB]	Minimum Attenuation Below Fundamental, [dB]	Margin, [dB]	Pass/Fail
2402.0	-2.18	23492.0	-50.29	48.11	≥ 20.00	-28.11	Pass
2442.0	-2.56	23608.0	-48.98	46.42	≥ 20.00	-26.42	Pass
2480.0	-2.92	15821.0	-51.77	48.85	≥ 20.00	-28.85	Pass

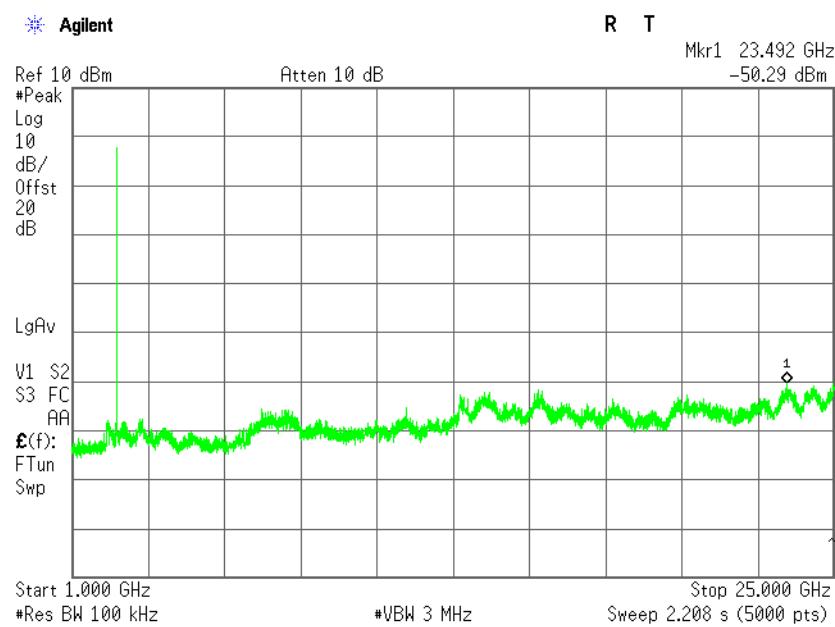
**Plot 3.4.1 Unwanted Conducted Emissions into Non-Restricted Frequency Bands test results,
Fundamental Emission Reference Level, Fc = 2402 MHz**



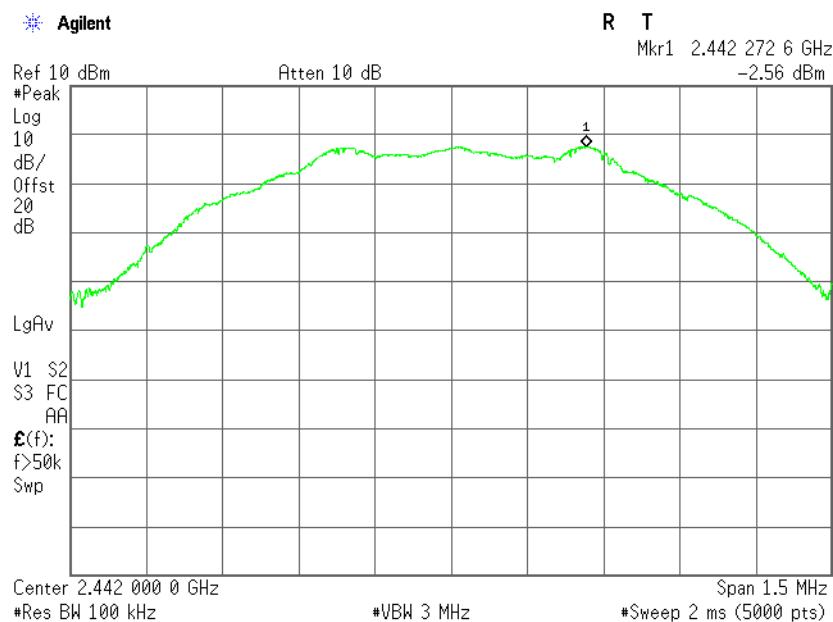
**Plot 3.4.2 Unwanted Conducted Emissions into Non-Restricted Frequency Bands test results in
9 kHz – 1 GHz frequency range, Fc = 2402 MHz**



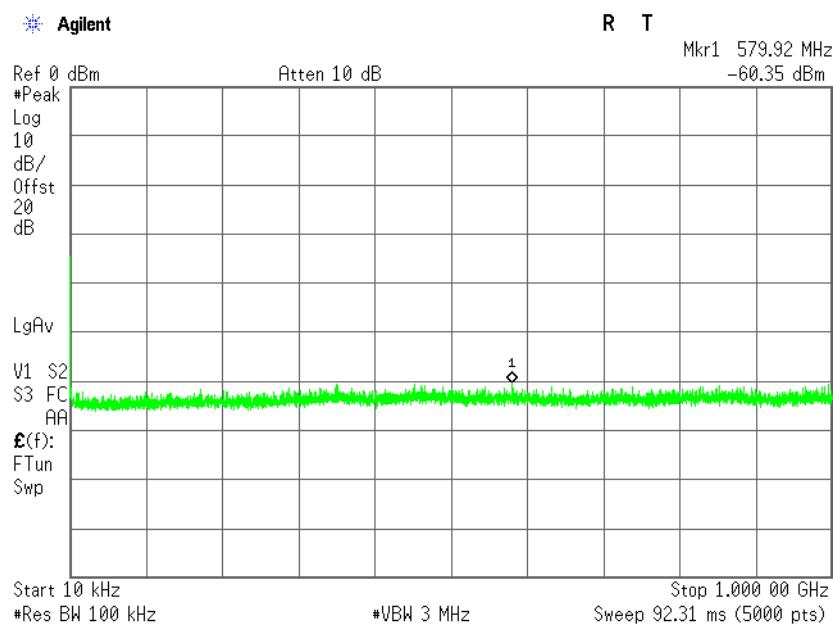
Plot 3.4.3 Unwanted Conducted Emissions into Non-Restricted Frequency Bands test results in 1 GHz – 25 GHz frequency range, Fc = 2402 MHz



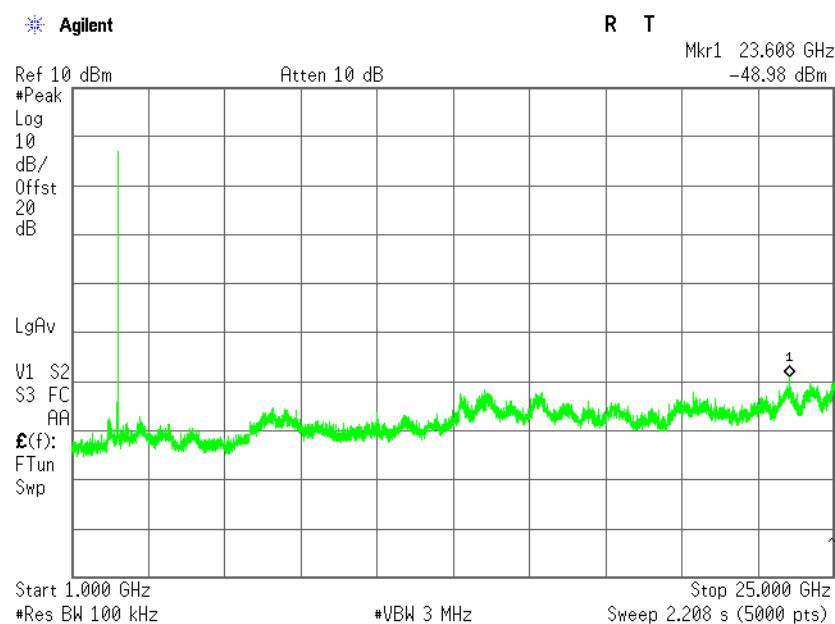
**Plot 3.4.4 Unwanted Conducted Emissions into Non-Restricted Frequency Bands test results,
Fundamental Emission Reference Level, Fc = 2442 MHz**



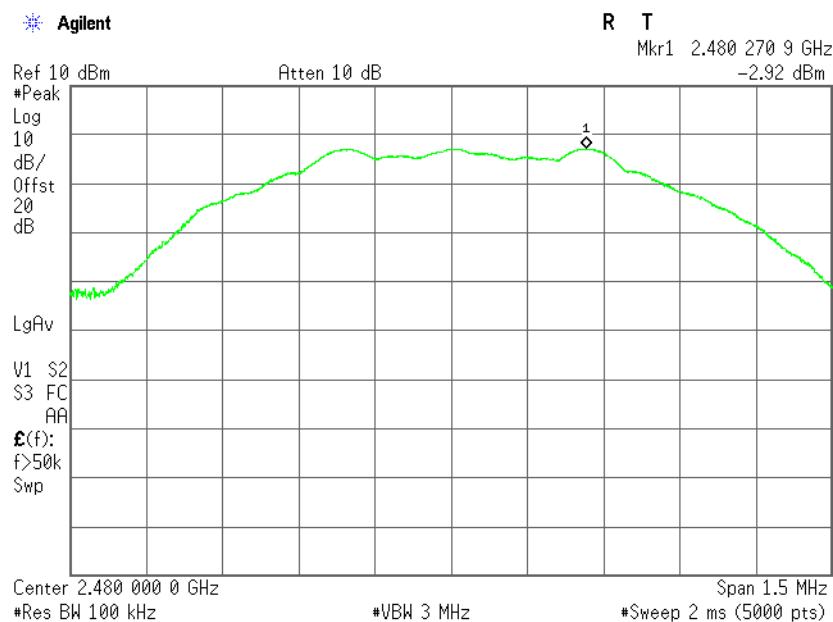
**Plot 3.4.5 Unwanted Conducted Emissions into Non-Restricted Frequency Bands test results in
9 kHz – 1 GHz frequency range, Fc = 2442 MHz**



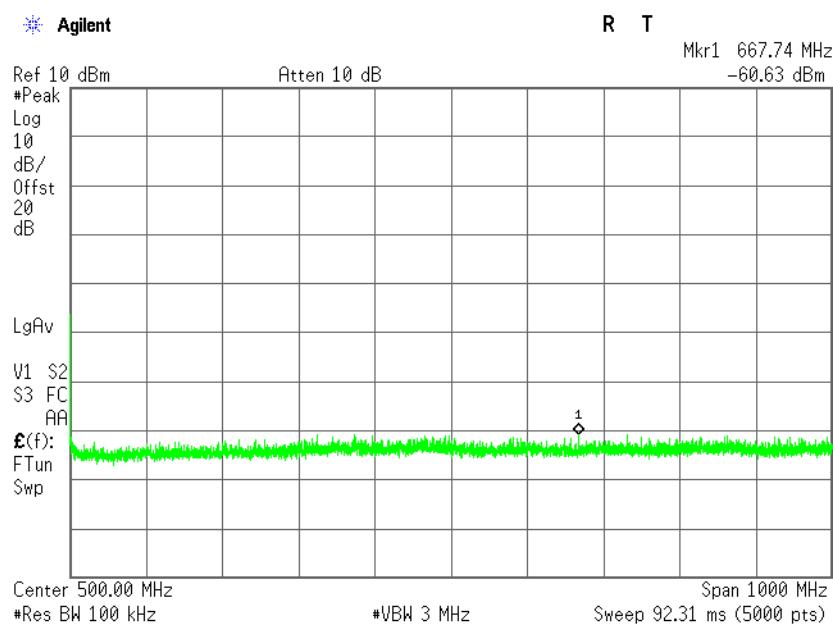
Plot 3.4.6 Unwanted Conducted Emissions into Non-Restricted Frequency Bands test results in 1 GHz – 25 GHz frequency range, Fc = 2442 MHz



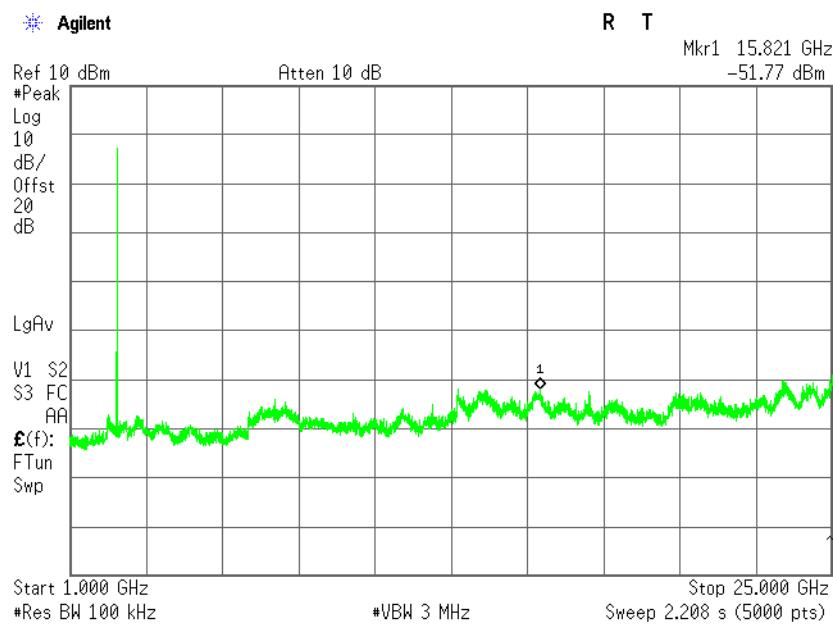
**Plot 3.4.7 Unwanted Conducted Emissions into Non-Restricted Frequency Bands test results,
 Fundamental Emission Reference Level, Fc = 2480 MHz**



**Plot 3.4.8 Unwanted Conducted Emissions into Non-Restricted Frequency Bands test results in
 9 kHz – 1 GHz frequency range, Fc = 2480 MHz**



**Plot 3.4.9 Unwanted Conducted Emissions into Non-Restricted Frequency Bands test results in
1 GHz – 25 GHz frequency range, Fc = 2480 MHz**



3.5. Emissions in restricted frequency bands

Reference document:	47 CFR §15.247 (d), & §15.205, & §15.209(a)		
Test Requirements:	Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emissions limits specified in §15.209(a) (see §15.205(c)).		
Method of testing:	KDB 558074 D01 v03r02, Sec.12.2.1-12.2.5 + 12.2.5.2 Conducted & 12.2.7 Radiated for cabinet/case spurious emissions		
Operating conditions:	Under normal test conditions		
S.A. Settings:	According to KDB 558074 D01 v03r02		
Environment conditions:	Ambient Temperature: 21°C	Relative Humidity: 48%	Atmospheric Pressure: 1011.4 hPa
Test Result:	See below	See Plot 3.5.1 - Plot 3.5.36	

Limits:

30MHz to 1GHz frequency range:

Frequency [MHz]	QP Limit [dB μ V /m] Class A	QP Limit [dB μ V /m] Class B
30÷88	49.5	40.0
88÷216	54.0	43.5
216÷960	57.0	46.0
960÷1000	60.0	54.0

Above 1GHz frequency range:

Frequency [GHz]	AVR Limit [dB μ V m] Class A	AVR Limit [dB μ V /m] Class B
Above 1GHz	74	54

Test results:

Test results below 1GHz (Radiated Spurious emissions form cabinet/case):

All measurements were done in horizontal and vertical polarizations; the results show the worst case.

Fundamental Frequency, MHz	Unwanted Emission Frequency, MHz	Antenna Polarization	QP Measured Emission, dB μ V/m	Limit, dB μ V/m	Delta, dB	Pass/Fail
2402	685.300	V	36.1	46.0	-9.9	Pass
	718.000	H	35.3	46.0	-10.7	Pass

Test results above 1GHz (Radiated Spurious emissions form cabinet/case):

All measurements were done in horizontal and vertical polarizations; the results show the worst case.

Fundamental Frequency, MHz	Unwanted Emission Frequency, MHz	Antenna Polarization	Measured Emission, dB μ V/m		Limit, dB μ V/m		Delta, dB		Pass/ Fail
			Peak	AVG	Peak	AVG	Peak	AVG	
2402	1332.000	V	47.9	36.5	74.0	54.0	-26.1	-17.5	Pass
	2142.000	V	48.8	31.5	74.0	54.0	-25.2	-22.5	Pass
	4804.000	H	51.5	39.0	74.0	54.0	-22.5	-15.0	Pass
2442	1009.000	V	48.4	38.1	74.0	54.0	-25.6	-15.9	Pass
	1367.000	V	46.2	34.9	74.0	54.0	-27.8	-19.1	Pass
	2141.000	V	47.6	32.4	74.0	54.0	-26.4	-21.6	Pass
	4884.000	V	51.8	37.6	74.0	54.0	-22.2	-16.4	Pass
2480	1349.000	V	50.1	39.3	74.0	54.0	-23.9	-14.7	Pass
	2142.000	V	45.5	30.0	74.0	54.0	-28.5	-24.0	Pass
	4960.000	V	49.7	37.8	74.0	54.0	-24.3	-16.2	Pass

Note: Spurious Emission [dB μ V/m] = measured [dB μ V] + Correction-factor [dB (1/m)]

Correction Factor = Antenna factor + Cable Loss

Test results above 1GHz (Antenna-port conducted emission):

Fundamental Frequency, MHz	Unwanted Emission Frequency, MHz	Measured Emission, dBm	Duty Cycle Correction Factor	Max Transmit Antenna Gain, dBi	Max Ground Reflection Factor, dB	Equivalent EIRP, dB μ V/m	Limit, dB μ V/m	Delta, dB	Pass/ Fail
2402	7206.00	-52.1	3.2	2.0	Out of Restricted Band				Pass
	9608.00	-54.4			Out of Restricted Band				Pass
	12010.00	-52.8			0.0	47.6	54.0	-6.4	Pass
	16814.00	-50.4			Out of Restricted Band				Pass
2442	7326.00	-52.7			0.0	47.7	54.0	-6.3	Pass
	9768.00	-55.2			Out of Restricted Band				Pass
	12210.00	-53.6			0.0	46.8	54.0	-7.2	Pass
	17094.00	-51.3			Out of Restricted Band				Pass
2480	7440.00	-51.1			0.0	49.3	54.0	-4.7	Pass
	9920.00	-54.1			Out of Restricted Band				Pass
	12400.00	-52.4			0.0	48.0	54.0	-6.0	Pass
	17360.00	-48.2			Out of Restricted Band				Pass

Note:

-Duty Cycle Correction Factor = $10\log(1/X)$, X is transmit Duty Cycle = $10\log(1/0.48) = 3.2$

-Max Ground Reflection Factor (sec.12.2.2 of KDB) = 6 dB for frequencies ≤ 30 MHz

4.7 dB for frequencies between 30 MHz and 1000 MHz

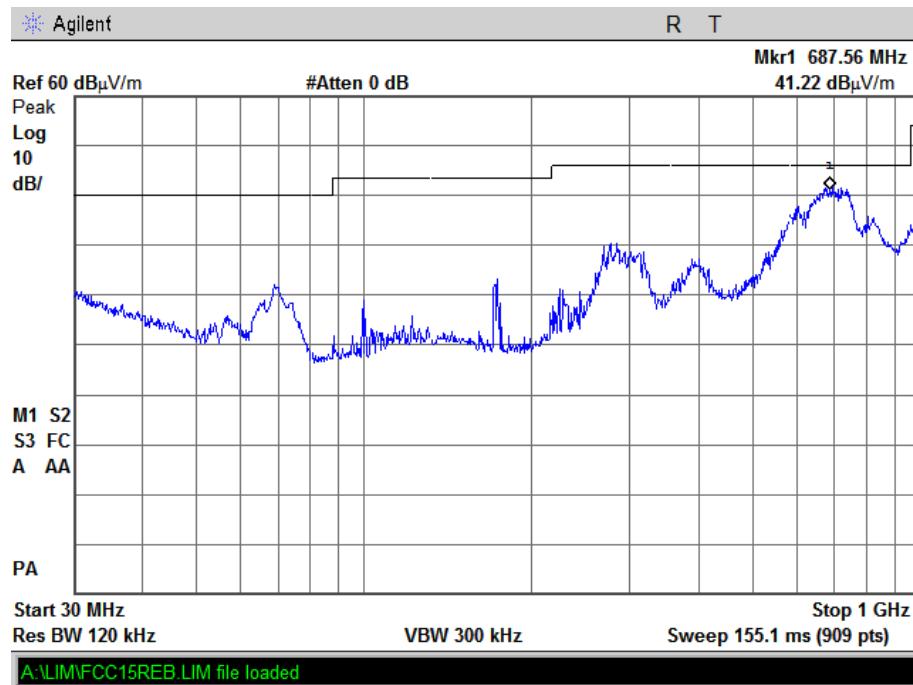
0 dB for frequencies ≥ 1000 MHz

-Max Transmit Antenna Gain (sec.12.2.6 of KDB) = 2.0 dBi

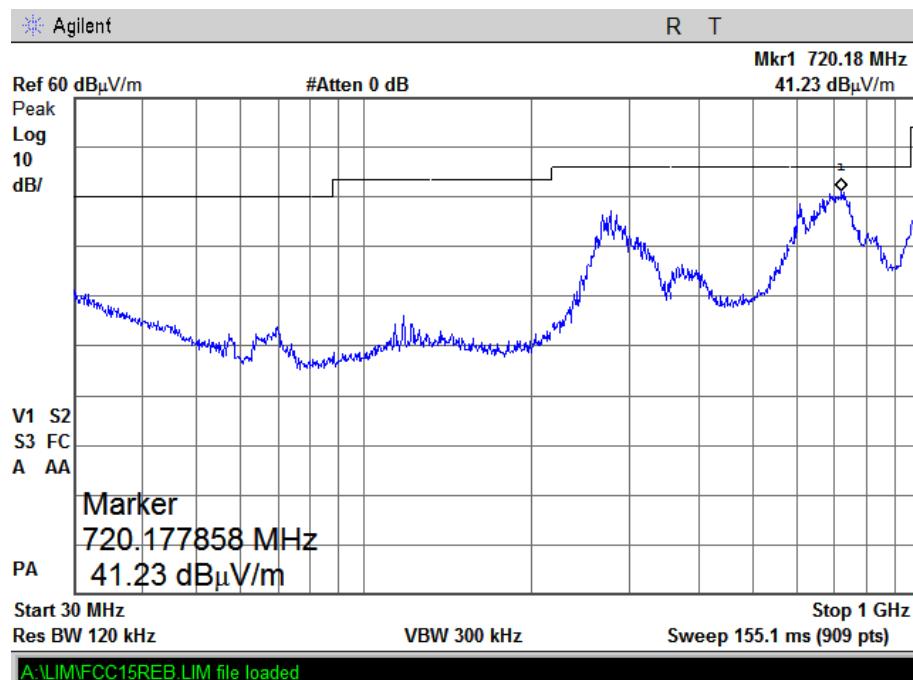
-E[dB μ V/m] = EIRP - $20\log D + 104.8 = EIRP + 95.25$, at D = 3m

EIRP = Measured Emission[dBm] + Max Transmit Gain[dBi] + Duty Cycle Correction Factor

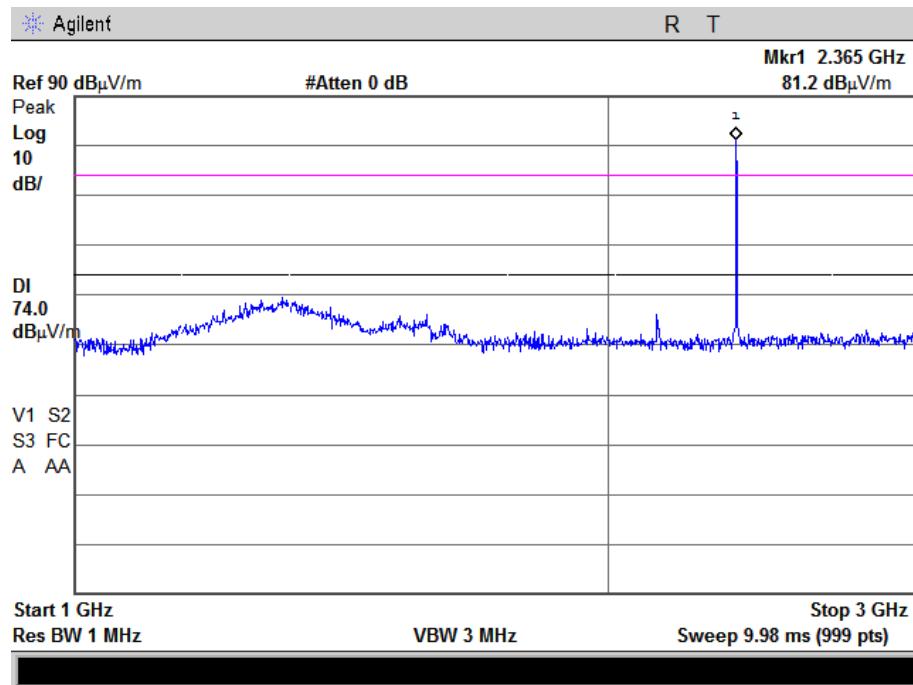
**Plot 3.5.1 Emissions in restricted frequency bands test results, 30 MHz – 1 GHz range,
Vertical polarization, Fc = 2402 MHz (worst case)**



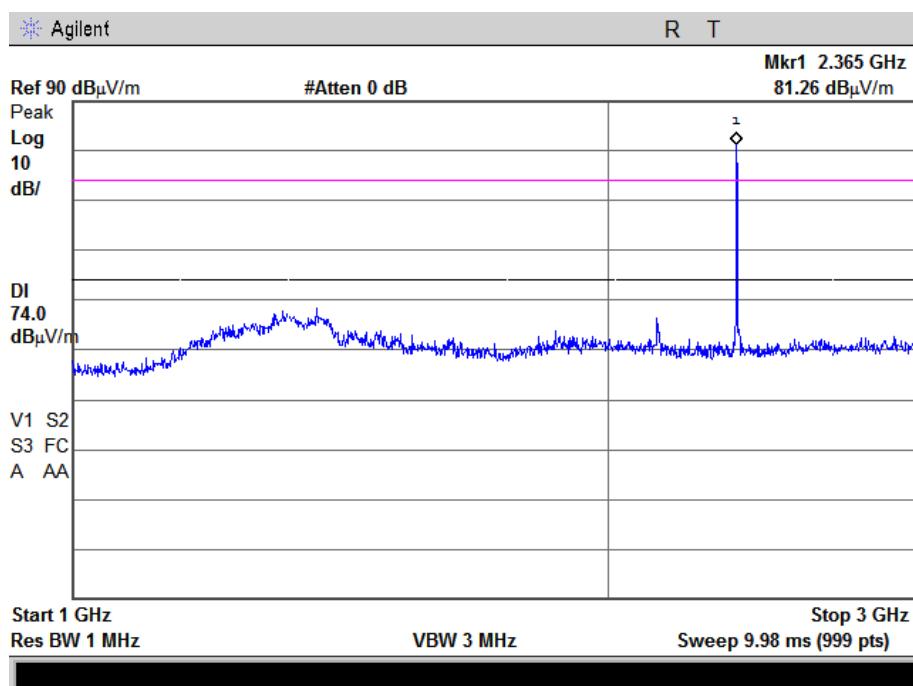
**Plot 3.5.2 Emissions in restricted frequency bands test results, 30 MHz – 1 GHz range,
Horizontal polarization, Fc = 2402 MHz (worst case)**



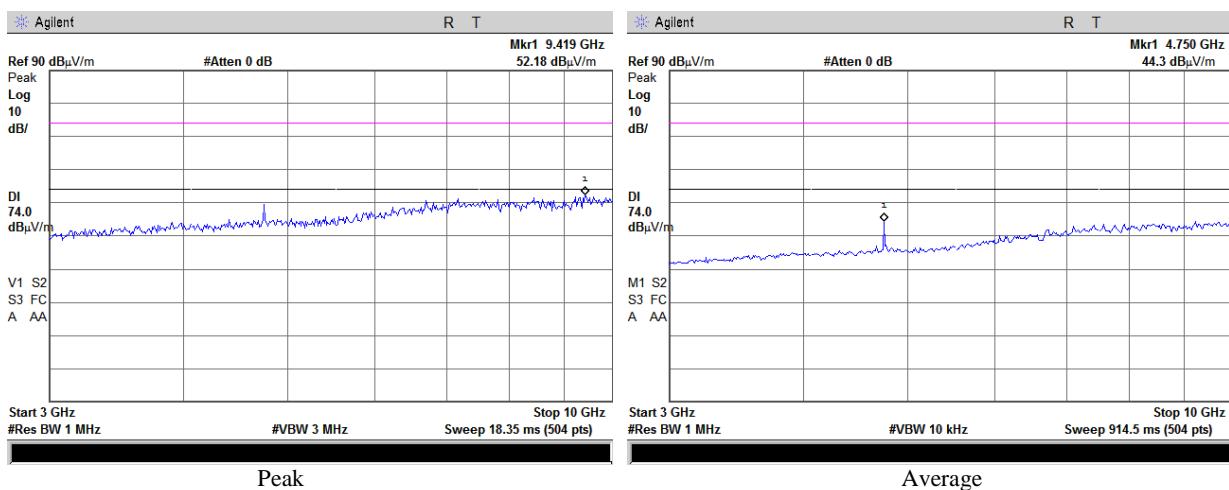
Plot 3.5.3 Emissions in restricted frequency bands test results, 1 – 3 GHz range, Vertical, Fc = 2402 MHz



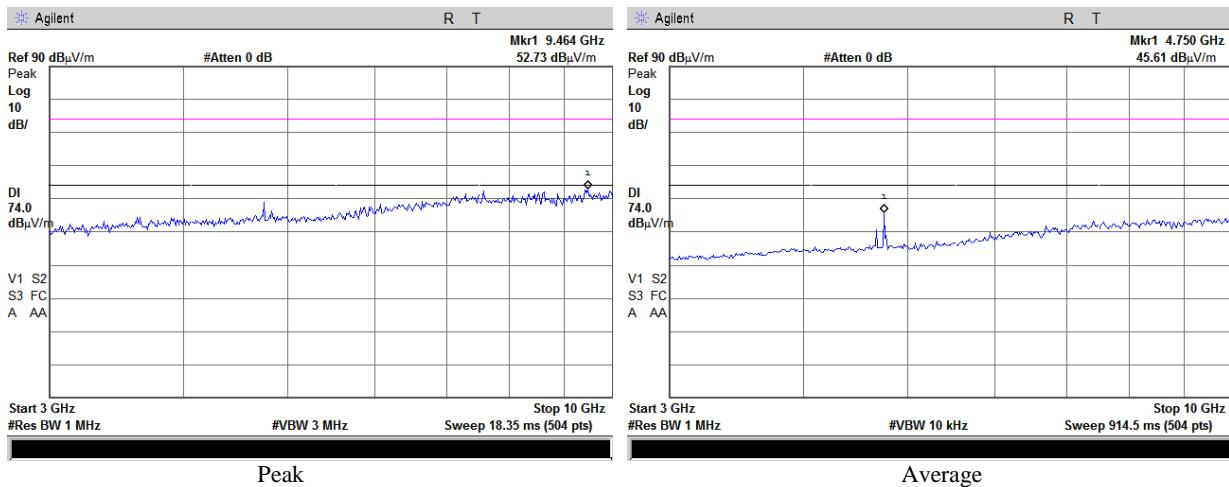
Plot 3.5.4 Emissions in restricted frequency bands test results, 1 – 3 GHz range, Horizontal, Fc = 2402 MHz



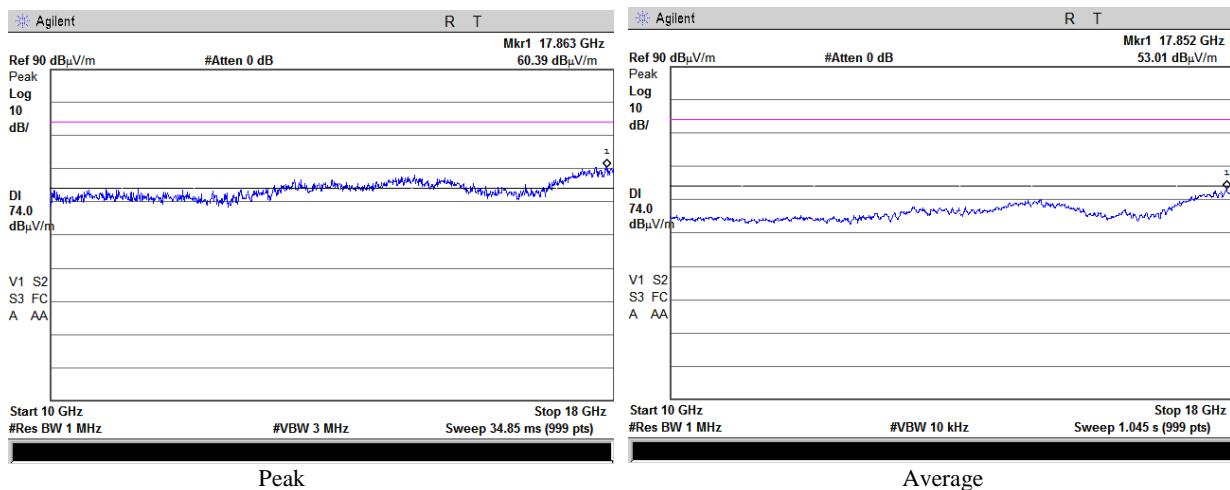
Plot 3.5.5 Emissions in restricted frequency bands test results, 3 – 10 GHz range, Vertical, Fc = 2402 MHz



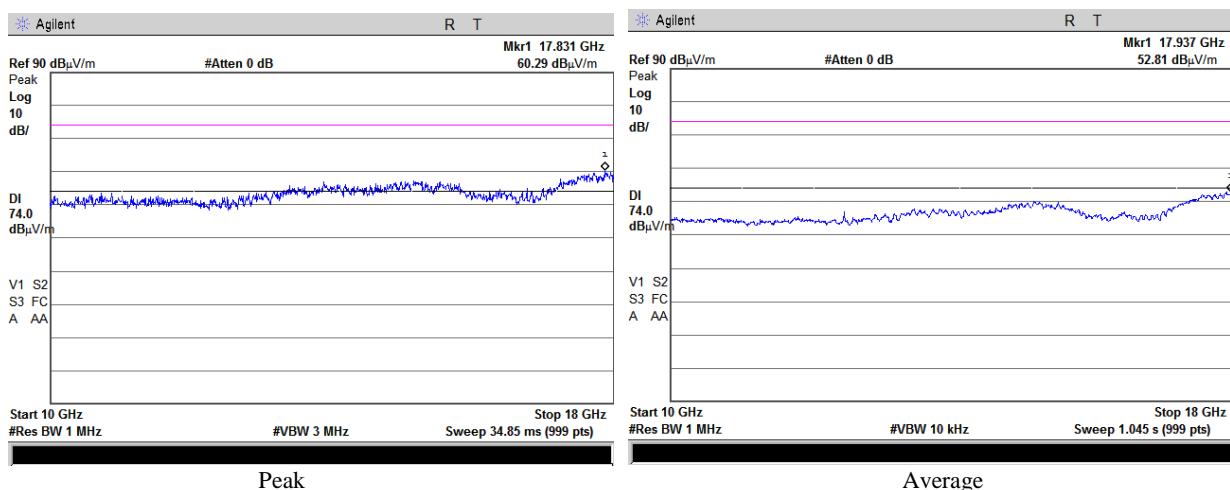
Plot 3.5.6 Emissions in restricted frequency bands test results, 3 – 10 GHz range, Horizontal, Fc = 2402 MHz



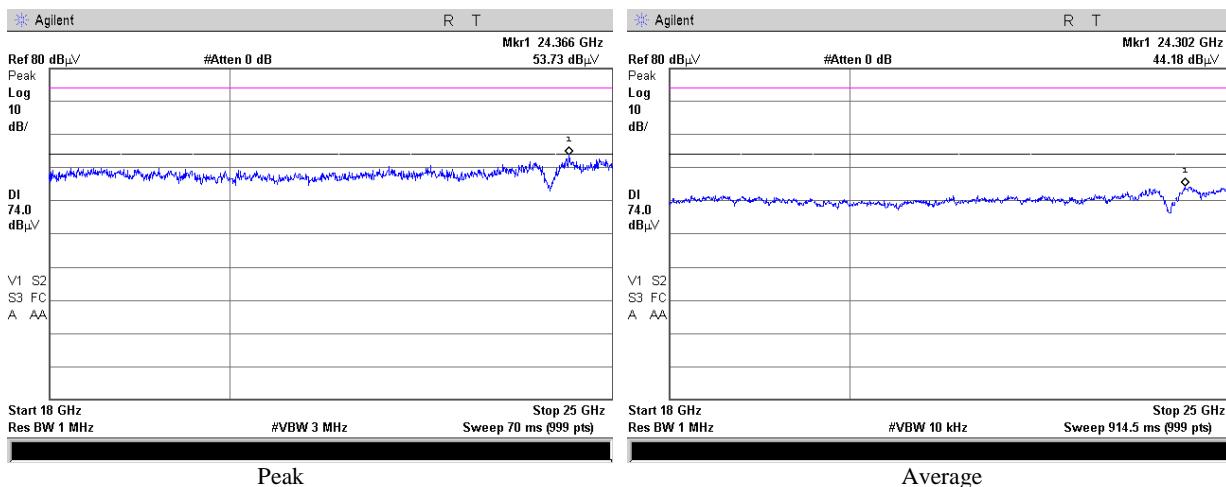
Plot 3.5.7 Emissions in restricted frequency bands test results, 10 – 18 GHz range, Vertical, Fc = 2402 MHz



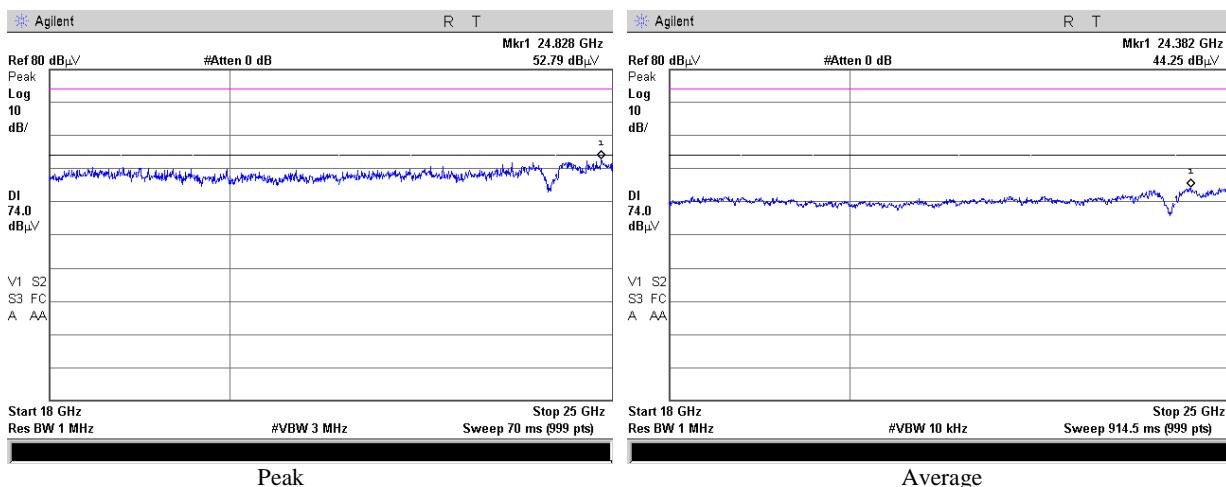
Plot 3.5.8 Emissions in restricted frequency bands test results, 10 – 18 GHz range, Horizontal, Fc = 2402 MHz



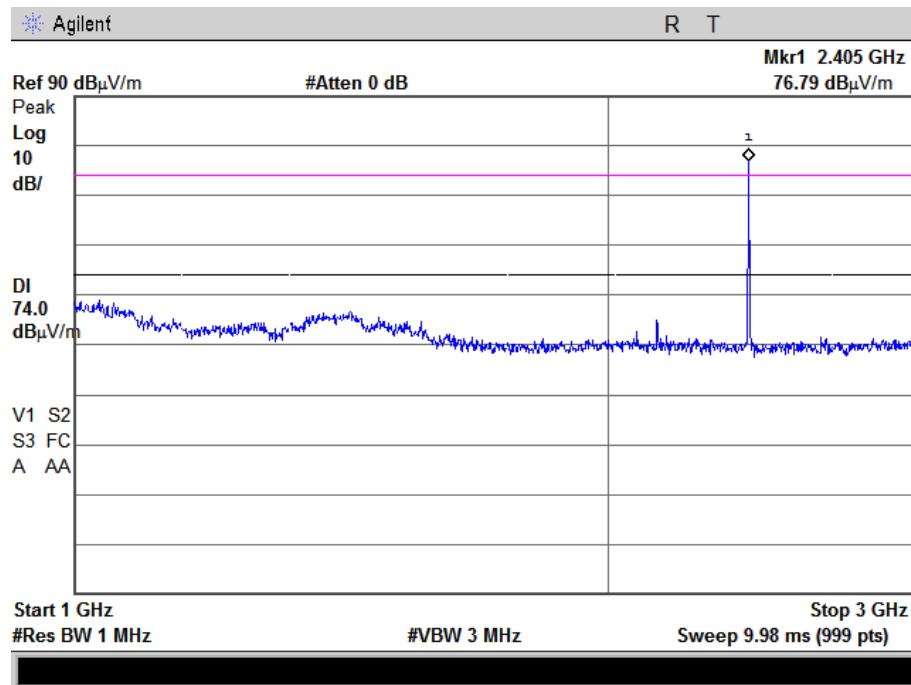
Plot 3.5.9 Emissions in restricted frequency bands test results, 18 – 25 GHz range, Vertical, Fc = 2402 MHz



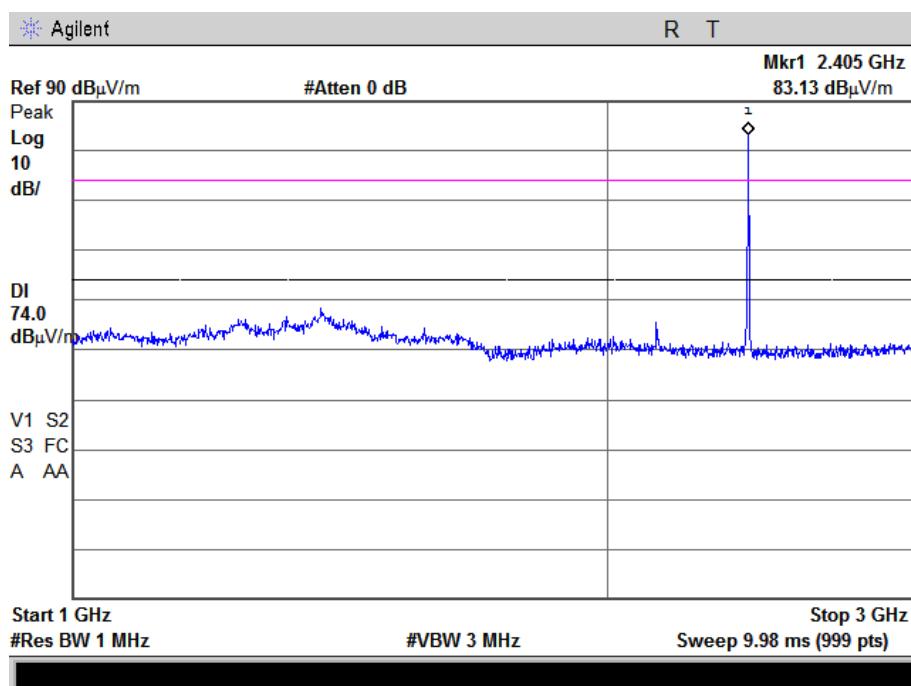
Plot 3.5.10 Emissions in restricted frequency bands test results, 18 – 25 GHz range, Horizontal, Fc = 2402 MHz



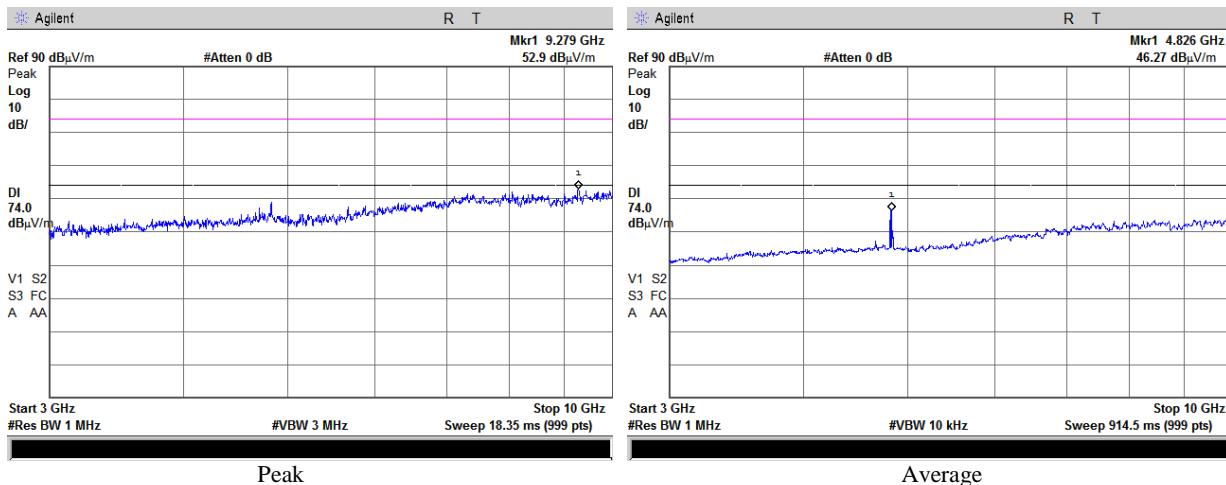
**Plot 3.5.11 Emissions in restricted frequency bands test results, 1 – 3 GHz range, Vertical,
Fc = 2442 MHz**



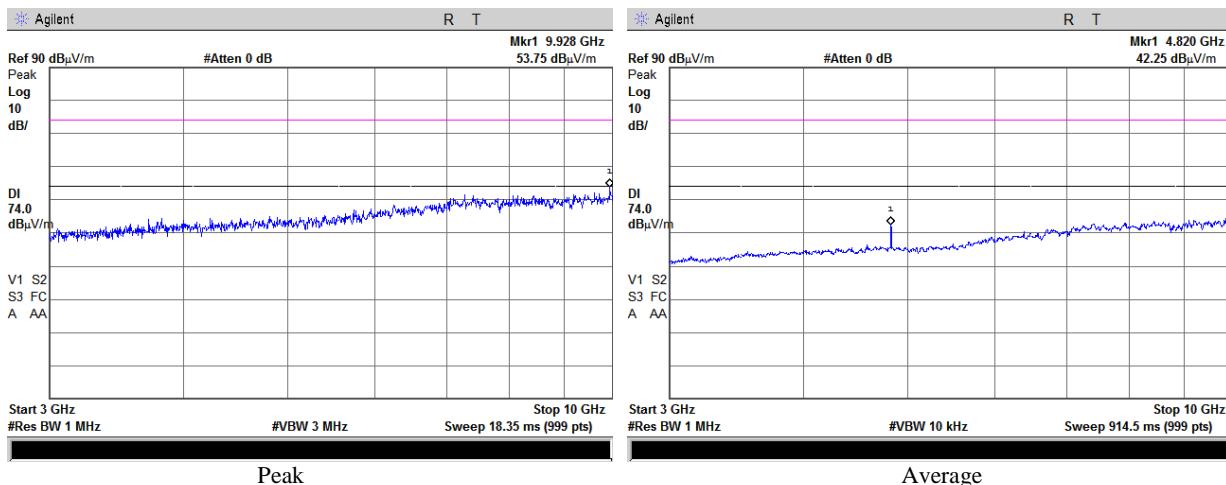
**Plot 3.5.12 Emissions in restricted frequency bands test results, 1 – 3 GHz range, Horizontal,
Fc = 2442 MHz**



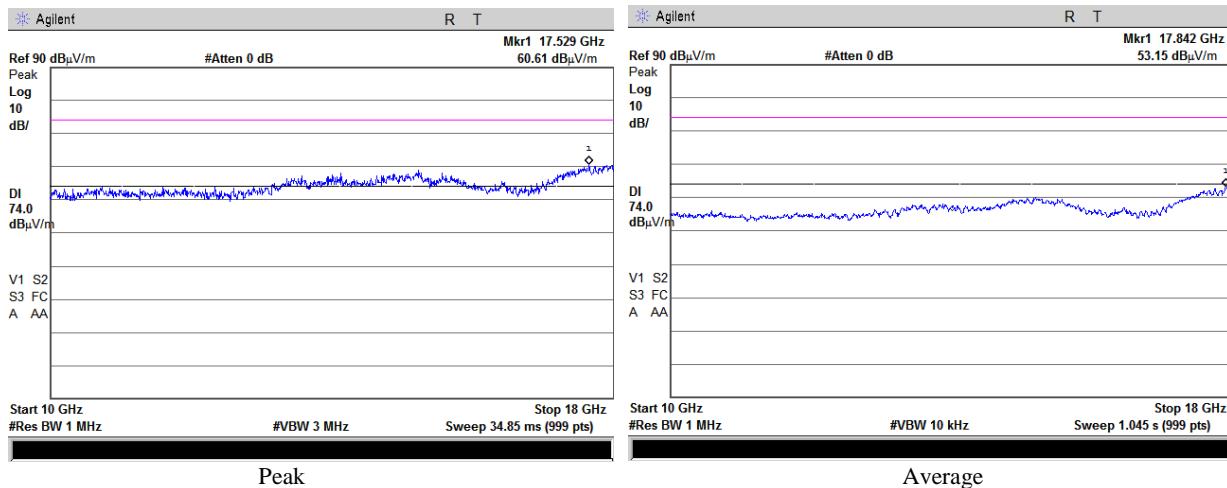
Plot 3.5.13 Emissions in restricted frequency bands test results, 3 – 10 GHz range, Vertical, Fc = 2442 MHz



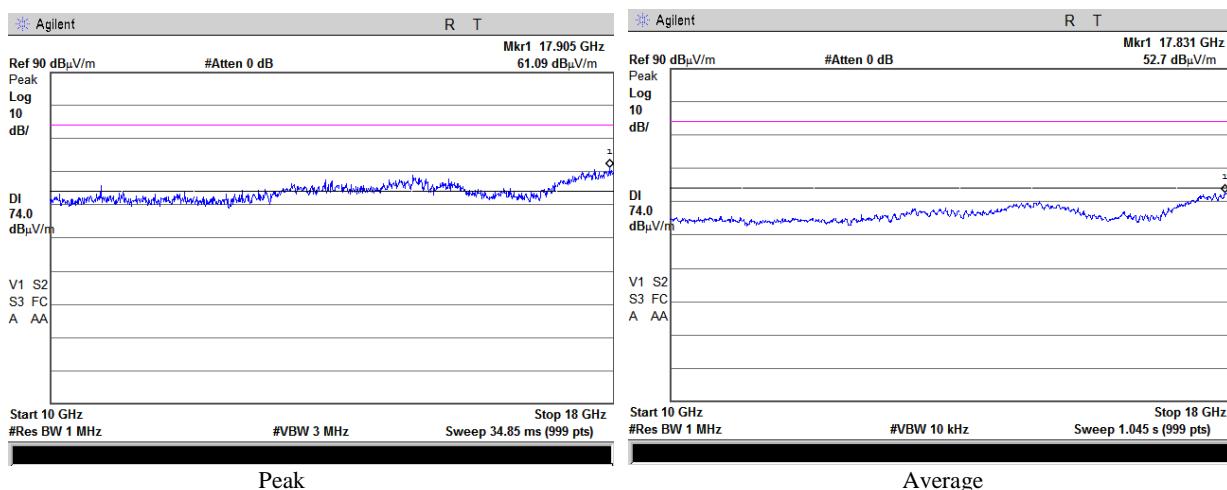
Plot 3.5.14 Emissions in restricted frequency bands test results, 3 – 10 GHz range, Horizontal, Fc = 2442 MHz



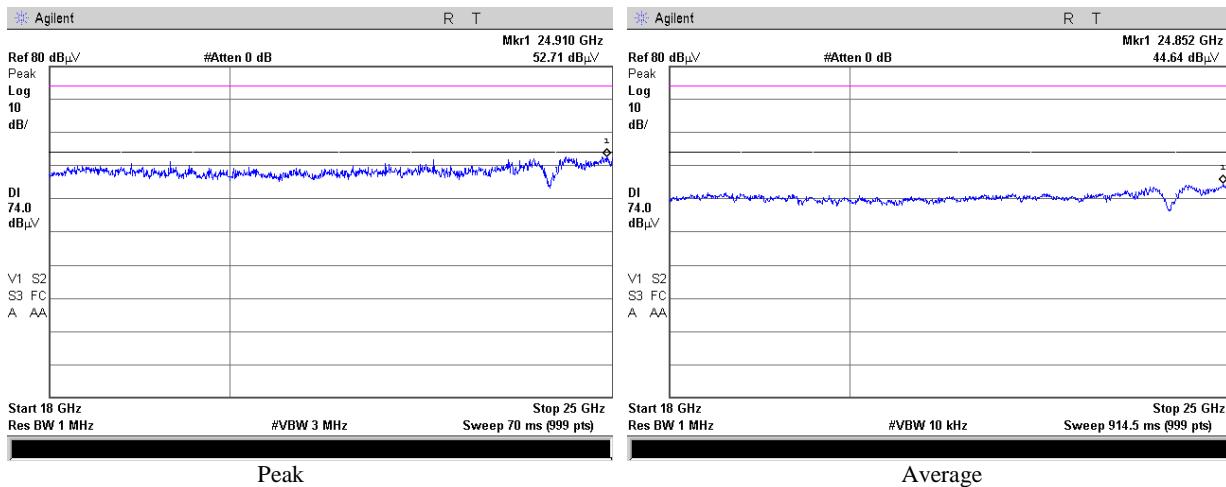
Plot 3.5.15 Emissions in restricted frequency bands test results, 10 – 18 GHz range, Vertical, Fc = 2442 MHz



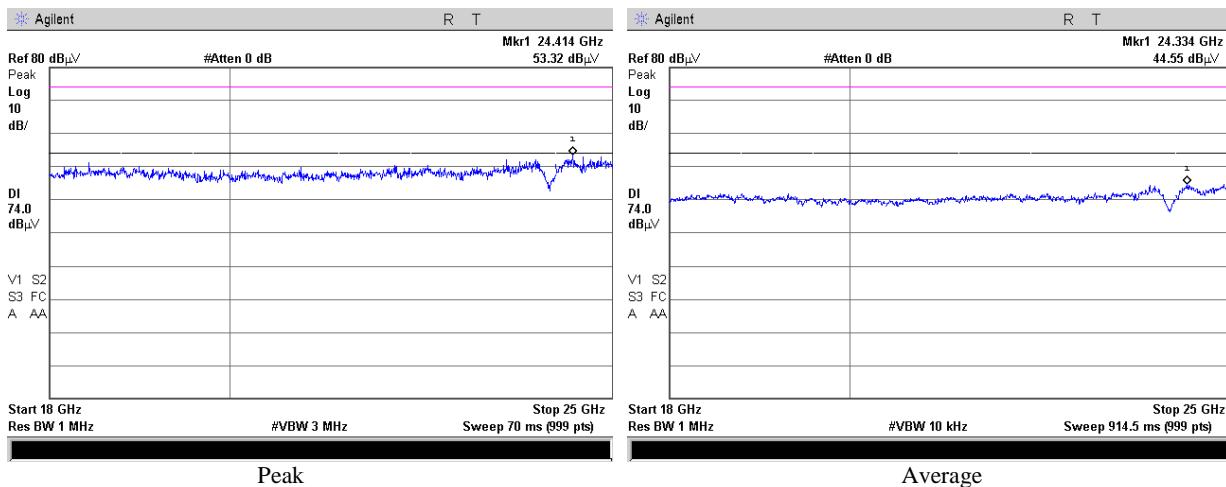
Plot 3.5.16 Emissions in restricted frequency bands test results, 10 – 18 GHz range, Horizontal, Fc = 2442 MHz



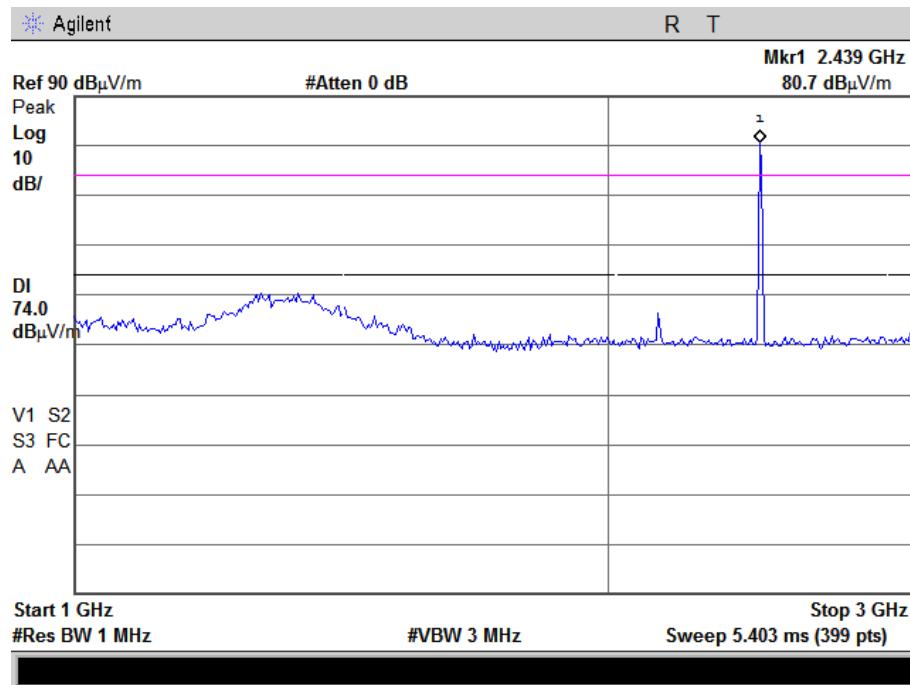
Plot 3.5.17 Emissions in restricted frequency bands test results, 18 – 25 GHz range, Vertical, Fc = 2442 MHz



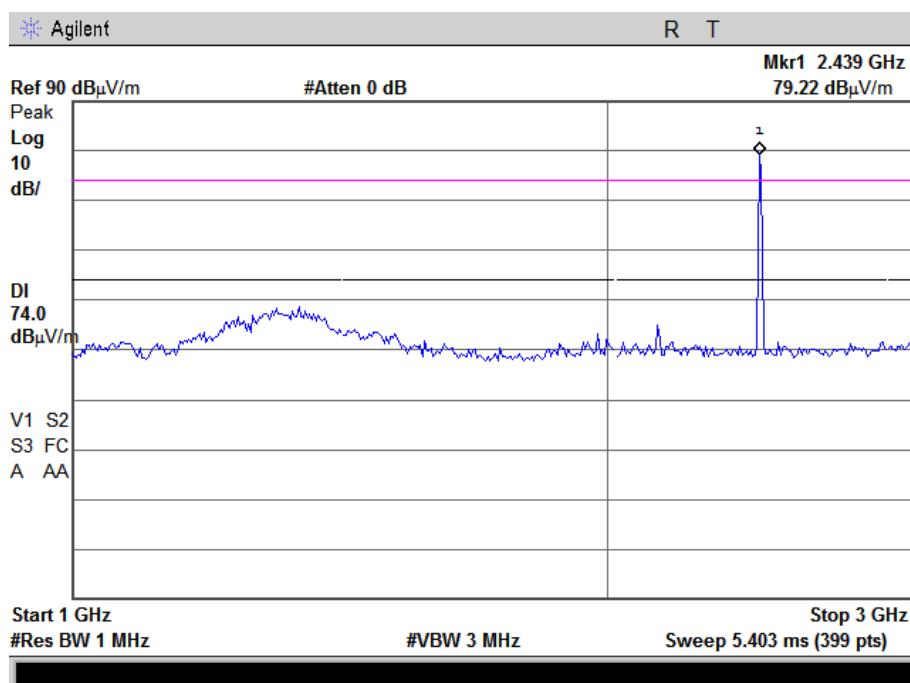
Plot 3.5.18 Emissions in restricted frequency bands test results, 18 – 25 GHz range, Horizontal, Fc = 2442 MHz



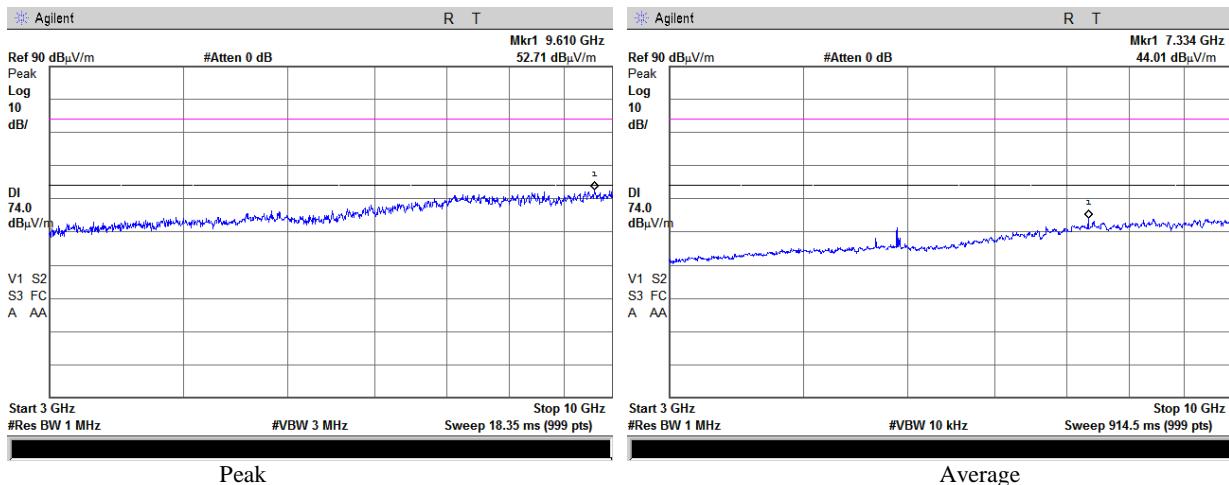
Plot 3.5.19 Emissions in restricted frequency bands test results, 1 – 3 GHz range, Vertical, Fc = 2480 MHz



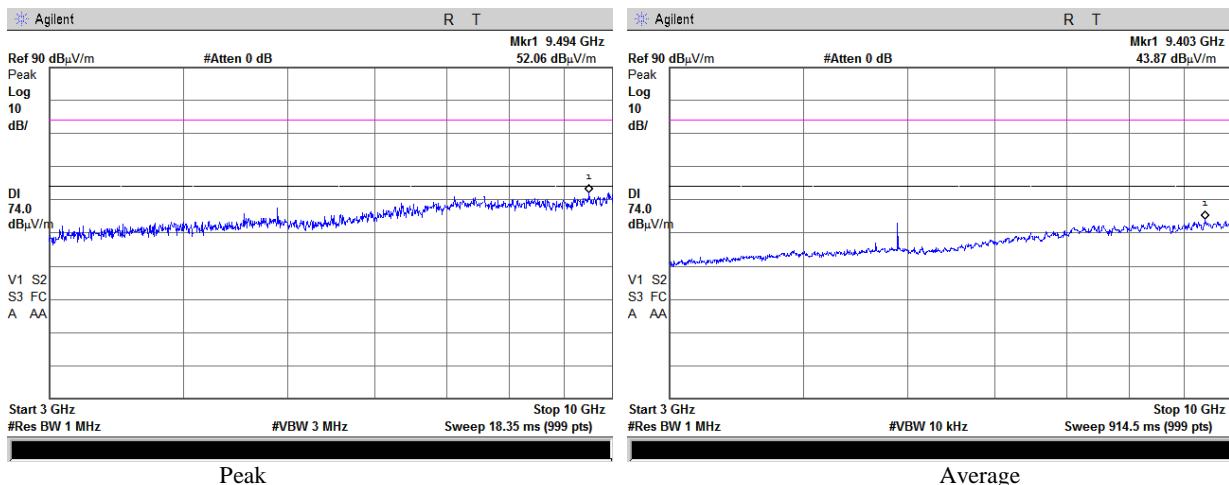
Plot 3.5.20 Emissions in restricted frequency bands test results, 1 – 3 GHz range, Horizontal, Fc = 2480 MHz



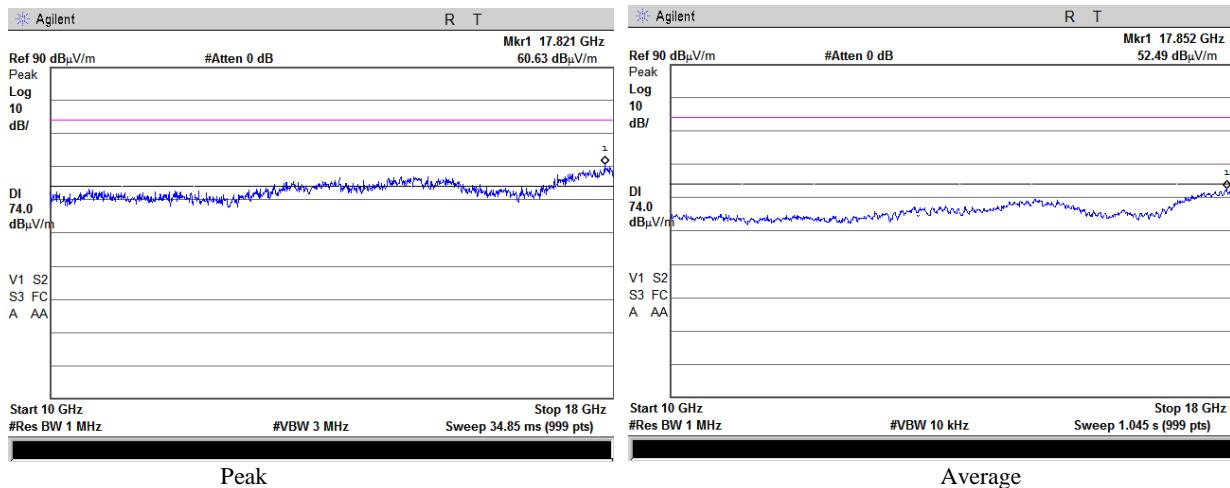
Plot 3.5.21 Emissions in restricted frequency bands test results, 3 – 10 GHz range, Vertical, Fc = 2480 MHz



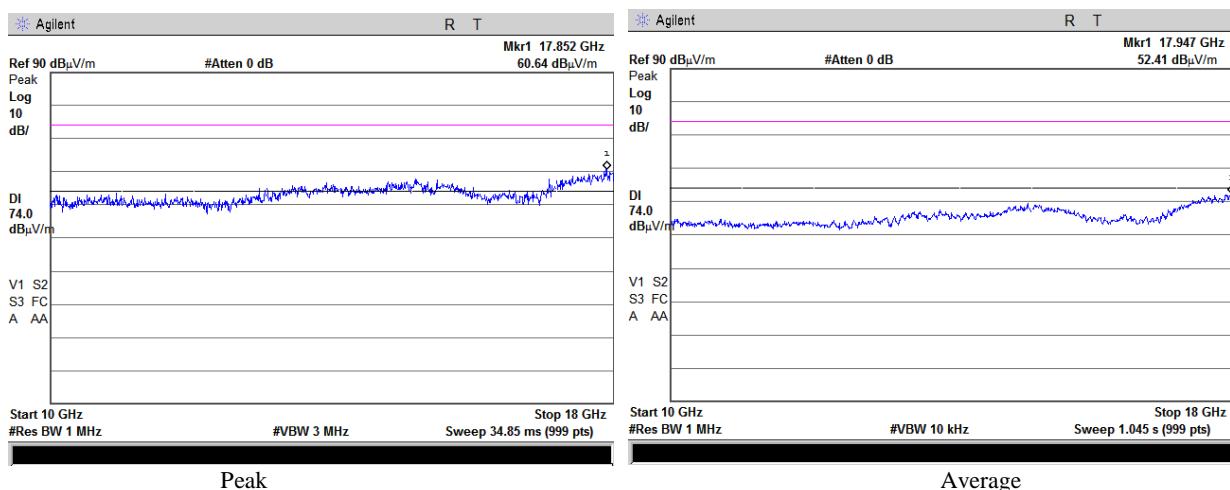
Plot 3.5.22 Emissions in restricted frequency bands test results, 3 – 10 GHz range, Horizontal, Fc = 2480 MHz



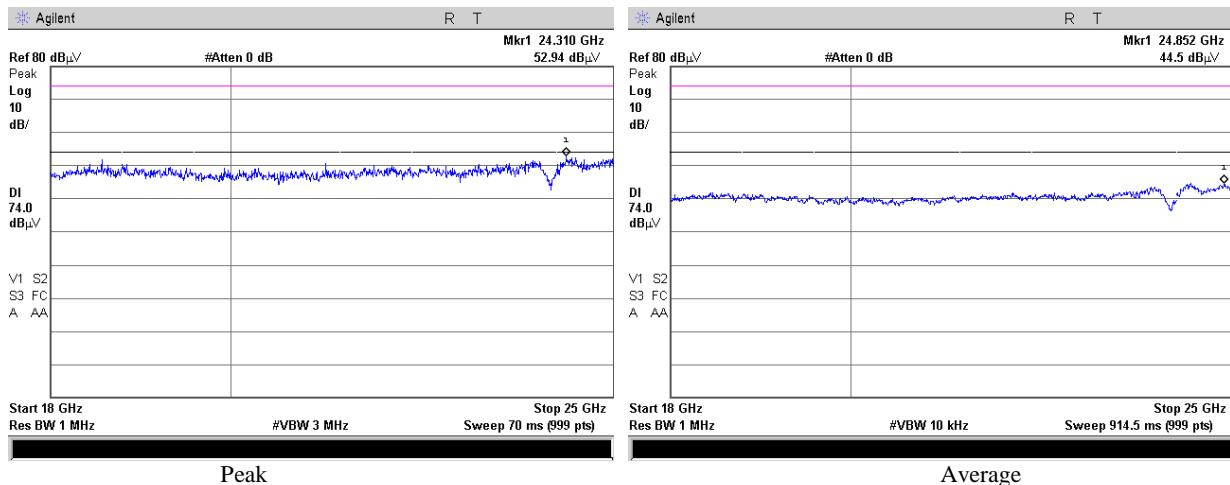
Plot 3.5.23 Emissions in restricted frequency bands test results, 10 – 18 GHz range, Vertical, Fc = 2480 MHz



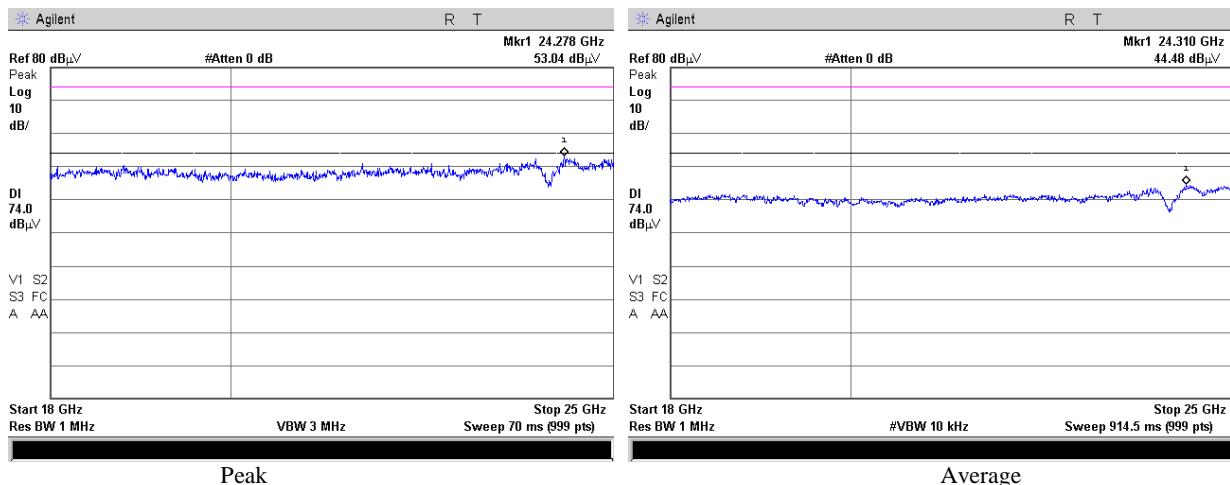
Plot 3.5.24 Emissions in restricted frequency bands test results, 10 – 18 GHz range, Horizontal, Fc = 2480 MHz



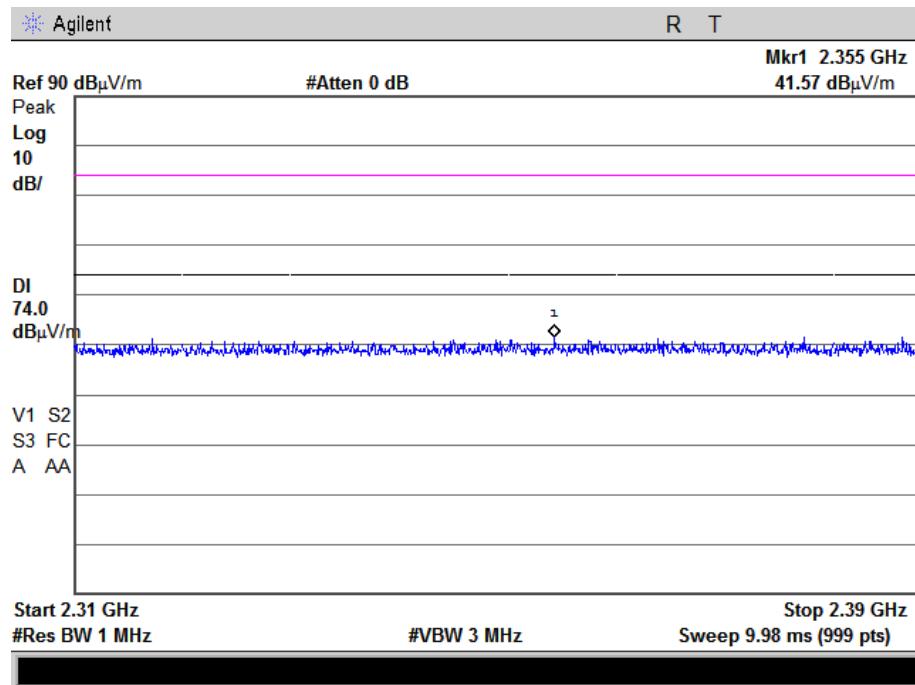
Plot 3.5.25 Emissions in restricted frequency bands test results, 18 – 25 GHz range, Vertical, Fc = 2480 MHz



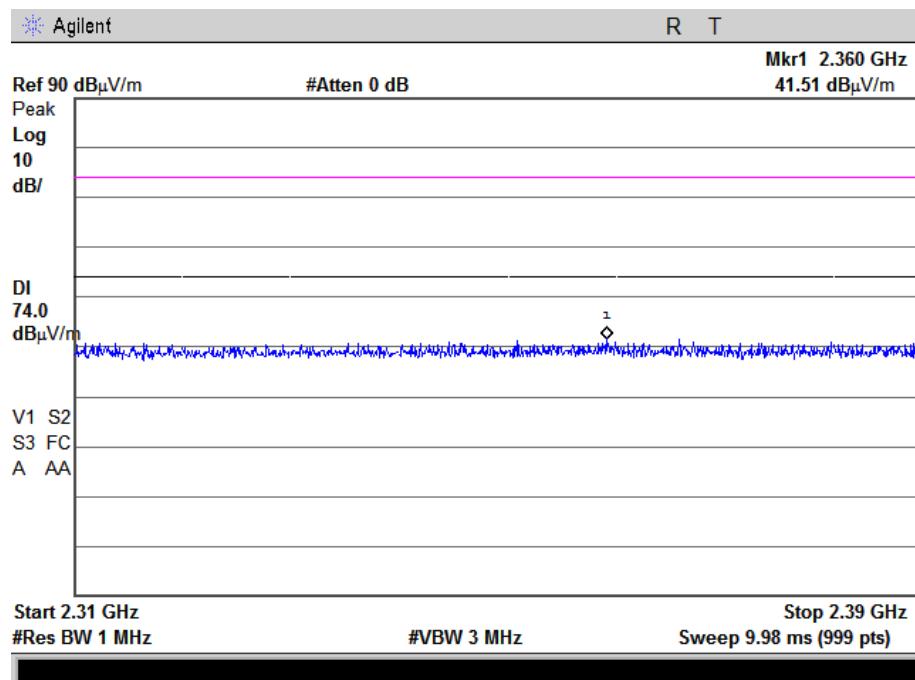
Plot 3.5.26 Emissions in restricted frequency bands test results, 18 – 25 GHz range, Horizontal, Fc = 2480 MHz



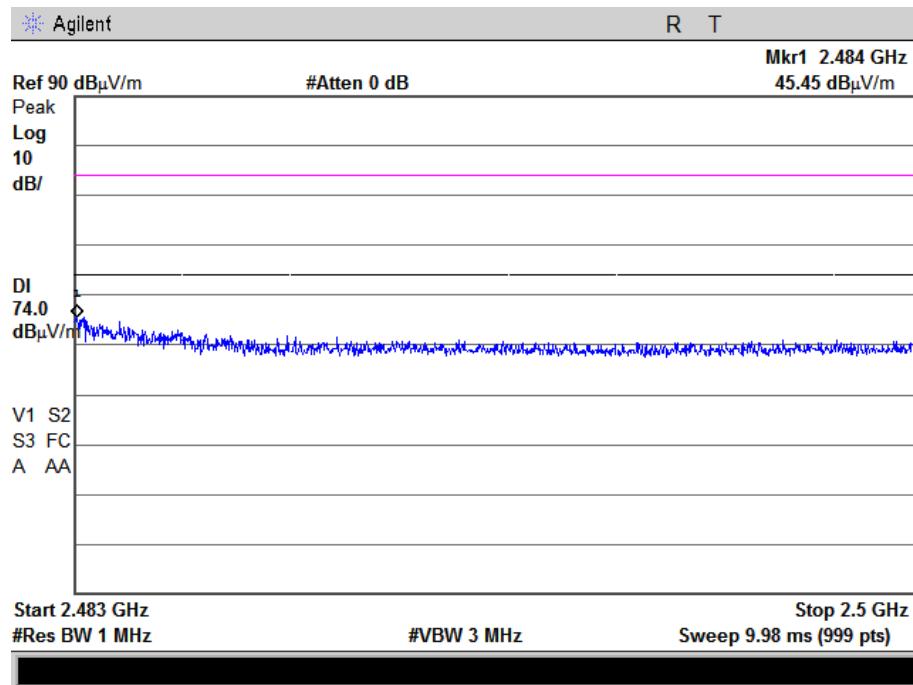
**Plot 3.5.27 Emissions in restricted frequency bands test results, 2310 – 2390 MHz band,
Vertical polarization, Fc = 2402 MHz**



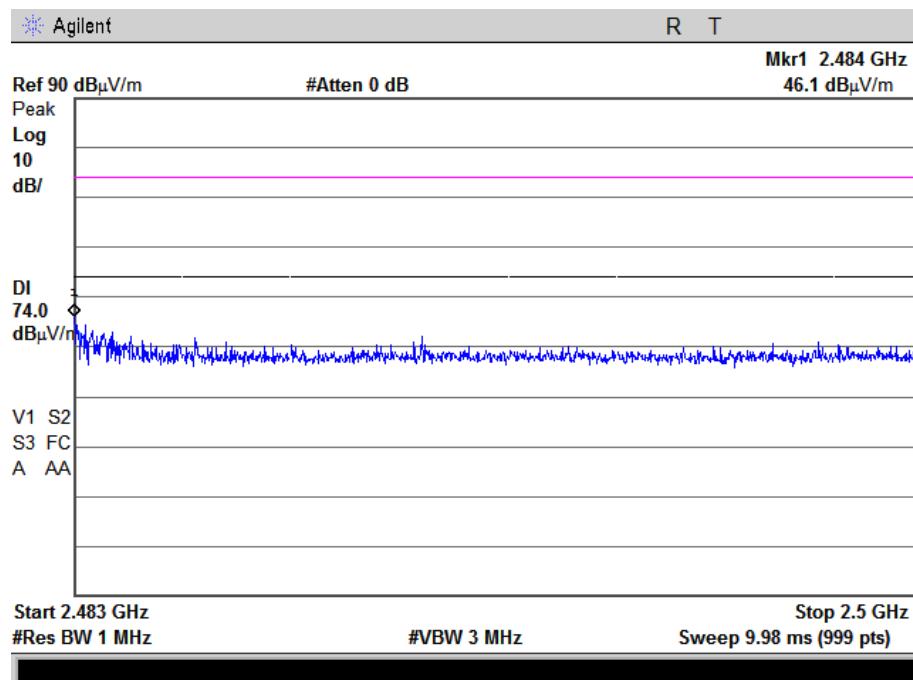
**Plot 3.5.28 Emissions in restricted frequency bands test results, 2310 – 2390 MHz band,
Horizontal polarization, Fc = 2402 MHz**



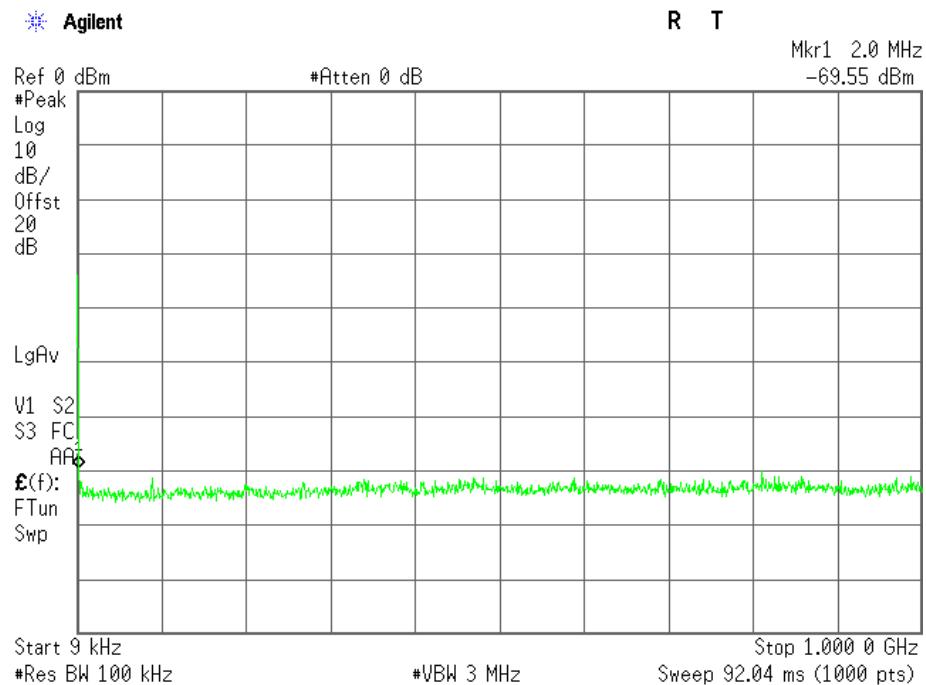
**Plot 3.5.29 Emissions in restricted frequency bands test results, 2483.5 – 2500 MHz band,
Vertical polarization, Fc = 2480 MHz**



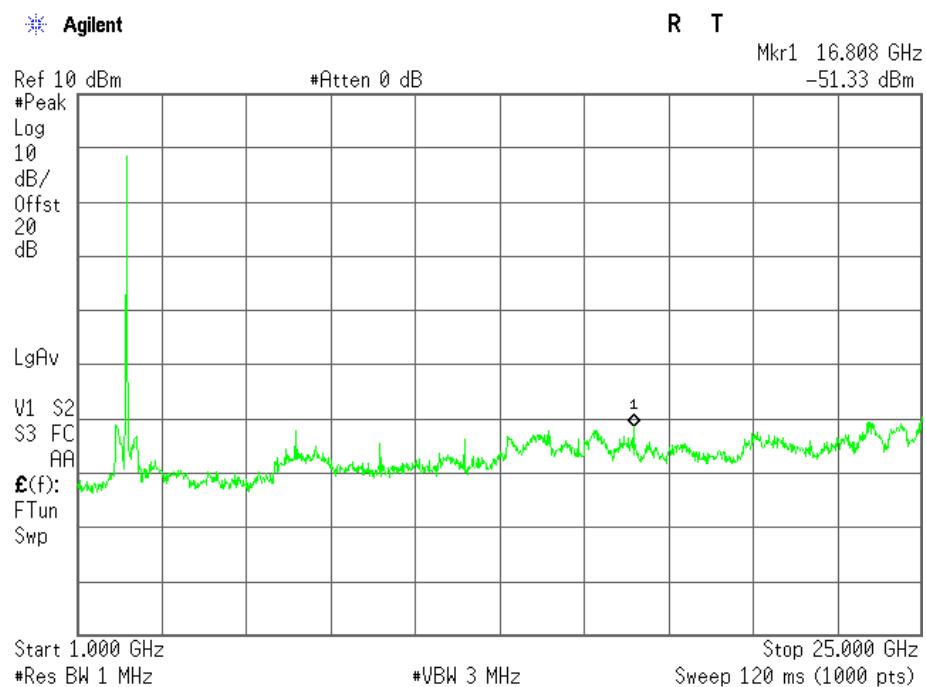
**Plot 3.5.30 Emissions in restricted frequency bands test results, 2483.5 – 2500 MHz band,
Horizontal polarization, Fc = 2480 MHz**



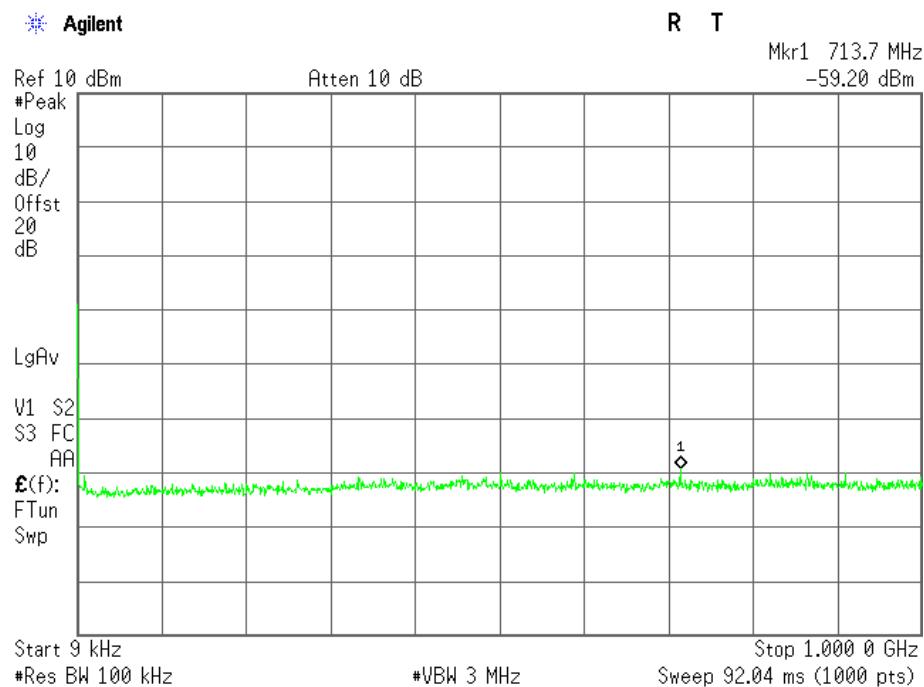
**Plot 3.5.31 Emissions in restricted frequency bands test results, Conducted measurements,
9 kHz – 1 GHz, Fc = 2402 MHz**



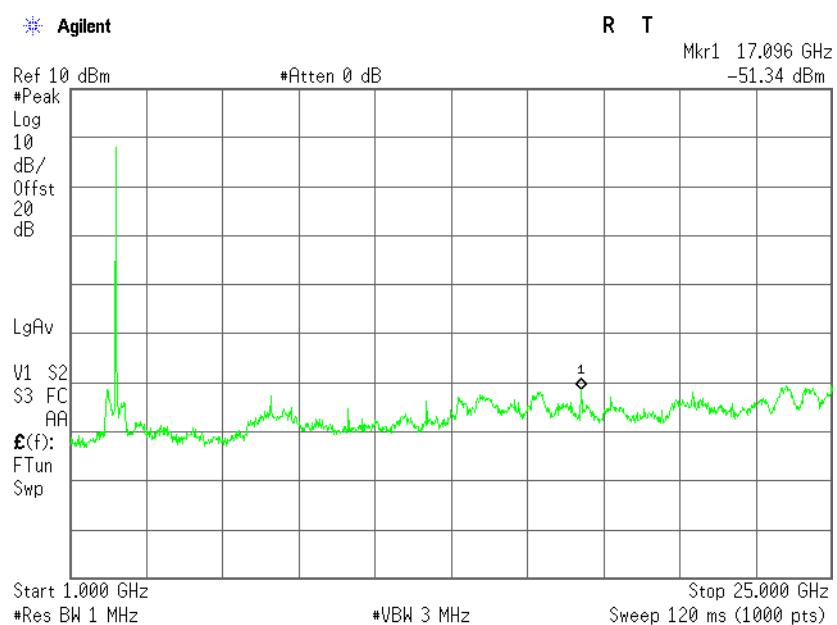
**Plot 3.5.32 Emissions in restricted frequency bands test results, Conducted measurements,
1 GHz – 25 GHz, Fc = 2402 MHz**



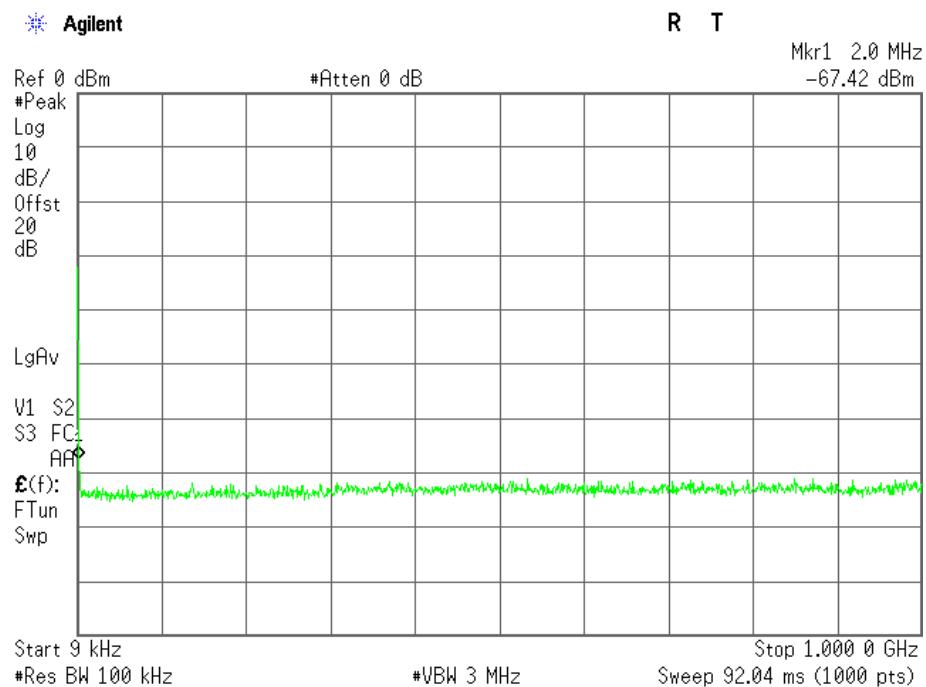
**Plot 3.5.33 Emissions in restricted frequency bands test results, Conducted measurements,
9 kHz – 1 GHz, Fc = 2442 MHz**



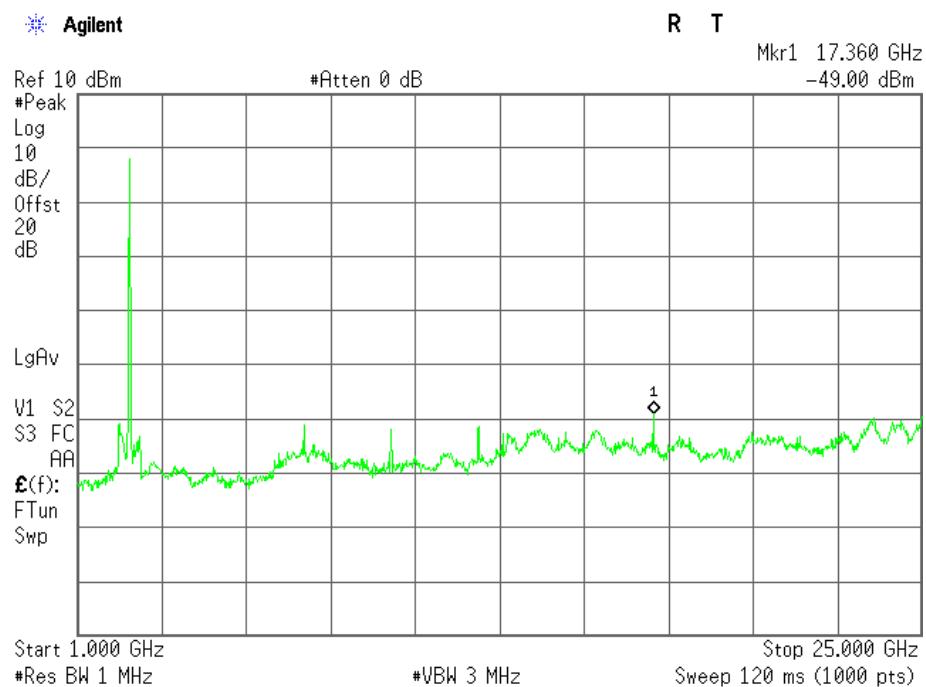
**Plot 3.5.34 Emissions in restricted frequency bands test results, Conducted measurements,
1 GHz – 25 GHz, Fc = 2442 MHz**



**Plot 3.5.35 Emissions in restricted frequency bands test results, Conducted measurements,
9 kHz – 1 GHz, Fc = 2480 MHz**



**Plot 3.5.36 Emissions in restricted frequency bands test results, Conducted measurements,
1 GHz – 25 GHz, Fc = 2480 MHz**



3.6. Band edge measurements

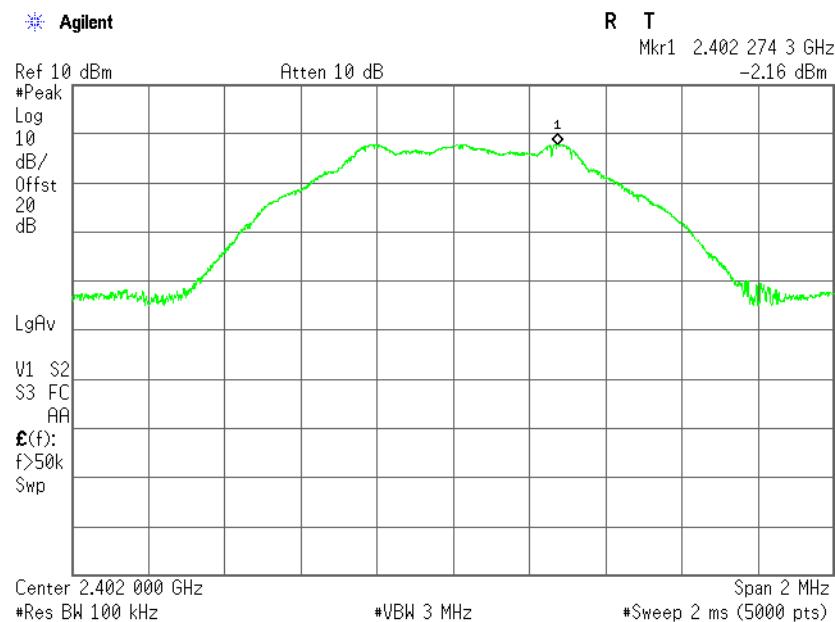
Reference document:	47 CFR §15.247 (d)		
Test Requirements:	<p>In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30dB instead of 20dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (See §15.205(c)).</p>		
Method of testing:	<p>KDB 558074 D01 v03r02, Sec.13.3.2 Conducted</p>		
Operating conditions:	Under normal test conditions		
S.A. Settings:	RBW: 100 kHz, VBW: $\geq 3 \times$ RBW		
Environment conditions:	Ambient Temperature: 21 °C		Relative Humidity: 48% Atmospheric Pressure: 1011.4 hPa
Test Result:	See below		See Plot 3.6.1 - Plot 3.6.4

Test results:

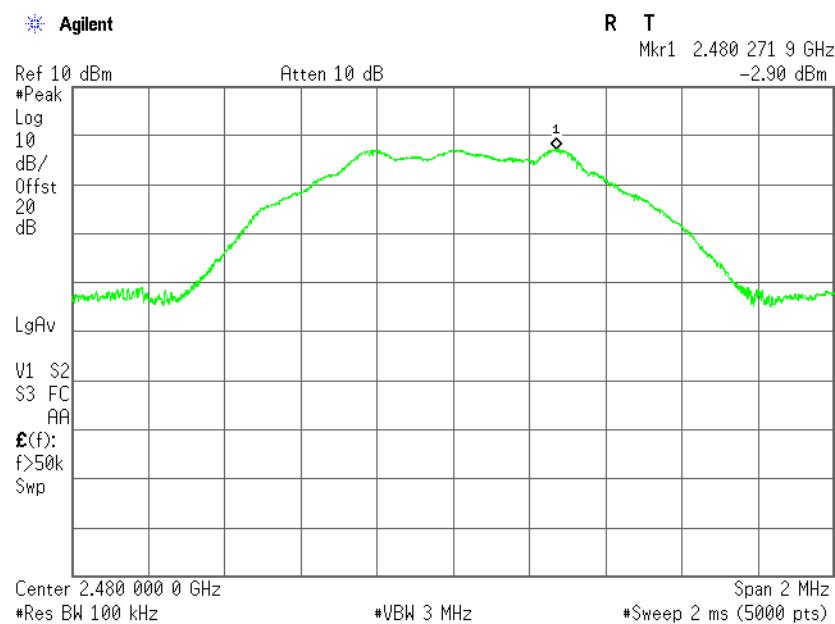
Fundamental Frequency, [MHz]	Fundamental Emission Reference Level, [dBm]	Measured Average Power, [dBm]	Duty Cycle Correction Factor	Calculated Average Power, [dBm]	Attenuation Below Fundamental, [dB]	Minimum Attenuation Below Fundamental, [dB]	Margin, [dB]	Pass/ Fail
2402.000	-2.16	-51.56	3.01	3.01	-48.55	46.39	30.00	16.39
2480.000	-2.90	-53.96	3.01	3.01	-50.95	48.05	30.00	18.05

Duty Cycle Correction Factor = $10\log(1/X) = 10\log(1/0.5) = 3.01$, X is transmit Duty Cycle [1/100%]

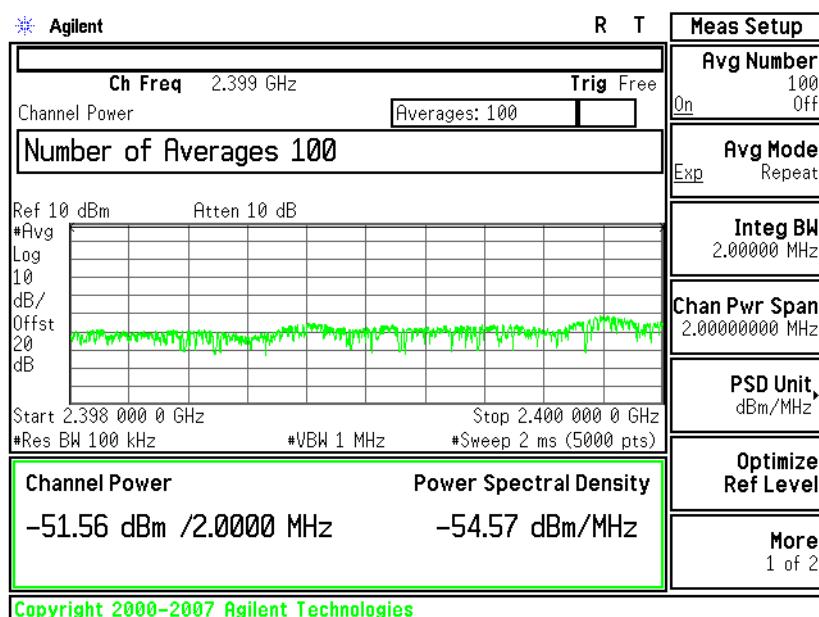
Plot 3.6.1 Band-Edge test results, Fundamental Emission Reference Level, Fc = 2402 MHz



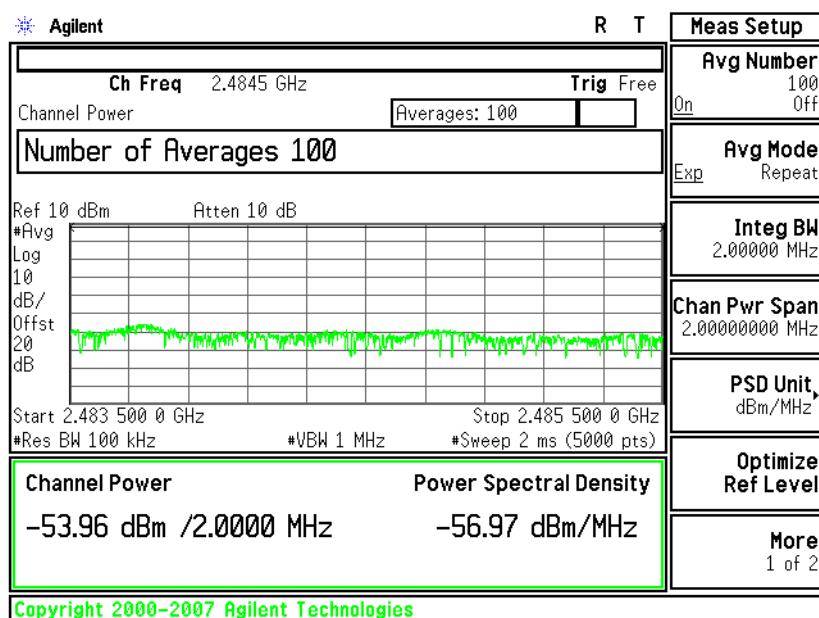
Plot 3.6.2 Band-Edge test results, Fundamental Emission Reference Level, Fc = 2480 MHz



Plot 3.6.3 Band-Edge test results, Fc = 2402 MHz



Plot 3.6.4 Band-Edge test results, Fc = 2480 MHz



3.7. Antenna Connector Requirements

Reference document:	47 CFR §15.203	
Test Requirements:	An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with provisions of this section.	
Test Result:	The EUT contains a permanent antenna – on board printed antenna – no any antenna connector.	Pass

4. Appendix

Appendix A : List of Measuring Equipment used:

Equipment	Manufacturer/ Model	Serial Number	Due date
CISPR 16 EMI Receiver, 9 kHz - 6.5 GHz	HP 8546A	3710A00392	30-05-2015
Spectrum Analyzer, 100 Hz - 26.5 GHz	Agilent E7405A	US41160436	30-06-2015
Spectrum Analyzer, 3 Hz - 44 GHz	Agilent E4446A	MY46180602	30-06-2015
Power Meter	Agilent N1911A	MY45100784	30-06-2015
Wideband power sensor	Agilent N1921A	MY45241242	30-06-2015
Low-Noise Amplifier, 0.1 - 18 GHz	MITEQ, AMF-7D-00101800-30-10P	1544443	30-06-2015
Double Ridged Guide Antenna, 1 - 18 GHz	A.R.A., DRG-118/A	17188	30-06-2015
Bilog Antenna	Teseq ,CBL 6141B	34119	06/07/2015
Horn Antenna 15-40 GHz	Schwarzbeck, BBHA 9170	BBHA9170214	06/03/2018
Turn table	HD 100	100/693	-
Antenna Mast	HD 100	100/693	-
LISN	Fischer 50/250-25-2	9705	30-06-2015
Transient Limiter, 9 kHz ÷ 200 MHz	HP 11947A	3107A04119	30-06-2015
Notch Filter	Micro-Tronics, BRM50702-05	0001	16-05-2015
Tunable Bandreject Filter	K&L, 3TNF-800/1000-0.2-N/N	336	16-05-2015
Tunable Bandreject Filter	K&L, 5TNF-1700/2000-0.1-N/N	212	16-05-2015

Appendix B: Accreditation Certificate



Accredited Laboratory

A2LA has accredited

QUALITECH

Petah-Tikva, Israel

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).

Presented this 28th day of June 2016.

A handwritten signature in blue ink, appearing to read "Jim C. Bent".

Senior Director of Quality and Communications
For the Accreditation Council
Certificate Number 1633.01
Valid to June 30, 2018



For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

End of the Test Report