



5.0 GHz WLAN (UNII Systems) FCC/IC Test Report

FOR:

Honeywell

Model Name: 75eL0N and 75eL00

Product Description: Dolphin 75e Handheld Computer

FCC ID: HD5-75EL0N and HD5-75EL00

IC ID: 1693B-75EL0N and 1693B-75EL00

47 CFR Part 15.407

RSS-210 Issue 8 & RSS-Gen Issue 4

TEST REPORT #: EMC_HONEY_134_14001_15.407_UNII_WLAN_75E
DATE: 2015-Feb-05



FCC listed
A2LA Accredited

IC recognized #
3462B

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1 Assessment

The following device was evaluated against the applicable criteria specified in FCC rules Parts 15.407 of Title 47 of the Code of Federal Regulations and the relevant IC standard RSS-210 issue 8, Annex 9.

Company	Description	Model #
Honeywell International, Inc	Dolphin 75e Handheld Computer	75eL0N and 75eL00

Responsible for Testing Laboratory:

2015-02-05

Compliance

Franz Engert
(Test Lab Manager)



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Date	Section	Name	Signature
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The test results of this test report relate exclusively to the test item specified in Section3.

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2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Address:	411 Dixon Landing Road Milpitas, CA 95035 U.S.A.
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Compliance Manager:	Franz Engert
Responsible Project Leader:	Danh Le

2.2 Identification of the Client

Applicant's Name:	Honeywell International Inc.
Street Address:	9680 Old Bailes Road
City/Zip Code	Fort Mill SC 29707
Country	USA
Contact Person:	Mandana Salahshour
Phone No.	(803)835-8190; (803)835-8097
Fax:	-----
e-mail:	mandana.salahshour@honeywell.com

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as Applicant
Manufacturers Address:	---
City/Zip Code	---
Country	---

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3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Model No:	75eL0N and 75eL00
HW Version :	2.0
FCC-ID:	HD5-75EL0N/ HD5-75EL00
IC-ID:	1693B-75EL0N and 1693B-75EL00
Product Description:	Dolphin 75e Handheld Computer
Technology/ Type(s) of Modulation:	BPSK, QPSK, 16 QAM, 64 QAM, 256 QAM + DSSS/OFDM
Modes of Operation	802.11a/n/ac, TPC supported, Client, Miracast source
Channel Bandwidths	20 MHz / 40 MHz / 80 MHz
Operating Frequency Ranges (MHz)/ Channels:	UNII-1: 5150 MHz – 5250 MHz (Ch. 36 – Ch. 48) UNII-2A: 5250 MHz – 5350 MHz (Ch. 52 – Ch. 64) UNII-2C: 5475 MHz – 5725 MHz (Ch. 100 – Ch.140) UNII-3: 5725 MHz – 5850 MHz (Ch. 149 – Ch. 165)
Antenna info:	Internal dedicated single antenna, 1x1, no beam forming Documented maximum antenna gain: 4.5 dBi (5150-5250 MHz Band) 5.0 dBi (5250-5350 MHz Band) 4.0 dBi (5470-5725 MHz Band) 3.0 dBi (5725-5850 MHz Band)
Declared Maximum Output Powers:	Conducted: 13 dBm (20 mW) for 802.11a, n HT20, n HT40 (MCS0) Conducted: 13 dBm (20 mW) for 802.11ac VTH20,VHT40, VHT80 (MCS0)
Rated Operating Voltage / Power Supply:	Li-ion Battery Vmin: 3.3V dc/ Vnom: 3.7V dc / Vmax: 4.2V dc
Operating temperature range:	-20°C – 50°C
Test Sample:	Prototype
Other Radios included in the device:	1. BT Basic/EDR, BT LE (2.4 GHz band of operation) 2. Wi-Fi 802.11b/g/n (Band of operation: 2.4 GHz) 3. NFC, @ 13.56 MHz (model 75EL0N only)

Note: For details of model variants, see testing notes in section 3.6

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3.2 Identification of the Equipment under Test (EUT)

EUT #	Serial Number	HW Version	SW Version	Notes/Comments
1	14270J002C	2.0	54.0	Radiated RF Sample / model 75eL0N
2	14268J0078	2.0	54.0	Conducted RF Sample / model 75eL0N

3.3 Identification of Accessory equipment

AE #	Type	Manufacturer	Model	Serial Number
1	AC/DC Adapter	PhiHong	PSA105R-050Q	P142302633A1
2	Li-ion Battery	BTEC	70e-BTEC	TGMX142071852

3.4 Environmental conditions during Test:

The following environmental conditions were maintained during the course of testing:

Ambient Temperature: 20-25°C

Relative humidity: 40-60%

3.5 Dates of Testing:

10/28/2014 – 12/30/2014

3.6 Testing Notes:

Two model variants are covered from this test report, models 75eL0N and 75eL00. Radiated and conducted testing were performed on model 75eL0N only, based on the manufacturer's declaration that the 75eL00 has identical hardware, software and maximum output power tune up limits and only differ in the addition of the NFC hardware than model 75eL0N.

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3.7 Test modes of operation:

The table below contains modes of operation, modulations, data rates which are supported by the equipment, associates with all the listed test cases:

Test Cases	Output Power	PSD	OBW	Band Edge Compliance	TX Radiated Emissions
Mode	802.11a 802.11n20 802.11n40 802.11ac80	802.11a 802.11n20 802.11n40 802.11ac80	802.11n20 802.11n40 802.11ac80	802.11n20 802.11n40 802.11ac80	802.11n20 802.11ac80
Modulation	BPSK BPSK QAM QAM	BPSK BPSK QAM QAM	BPSK BPSK QAM QAM	BPSK BPSK QAM QAM	BPSK BPSK QAM QAM
Data Rate (Mbps)	6 7.2 (MCS0) 15.0 (MCS0) 32.5 (MCS0)	6 7.2 (MCS0) 15.0 (MCS0) 32.5 (MCS0)	6 7.2 (MCS0) 15.0 (MCS0) 32.5 (MCS0)	6 7.2 (MCS0) 15.0 (MCS0) 32.5 (MCS0)	6 7.2 (MCS0) 15.0 (MCS0) 32.5 (MCS0)

The device was configured with a manufacturer provided test SW, capable of setting the unit in different supported modulation schemes, data rates and channels of operation.

The Device was set to continuous framed Tx (burst) mode per test SW and could thus be operated with > 98% duty cycle during testing. When 98% duty cycle cannot be achieved, duct cycle correction factor shall be added to the measurement results.

For radiated spurious emissions, the EUT was tested on low, mid and high channels (5.0 GHz) in 802.11a, mode only which represents the worst case mode taken from the output data table.

All testing has been carried out under worst case settings in terms of power. Before testing the EUT has been set to the key value specified in “75e Paris FCC Functional Overview”. According to the customer this is identical to the manufacturing process where units are set to a fixed key value.

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4 Subject Of Investigation

The objective of the evaluation documented in this report was to assess if the performance of the EUT meets the relevant requirements specified in FCC rules Part 15.407 of Title 47 of the Code of Federal Regulations and Radio Standard Specification RSS-210 Issue 8, Annex 9 of Industry Canada.

This test report is to support a request for new equipment authorization under the FCC ID **HD5-75EL0N** and **HD5-75EL00**

All testing was performed on the product referred to in Section 3 as EUT.

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5 Summary of Measurement Results

UNII-1/ UNII-2A/ UNII-2C/ UNII-3 Band (5125 – 5250 MHz, 5250 – 5350 MHz, 5470 – 5725 MHz, 5725 – 5850 MHz)								
Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
FCC §15.407 (a) (iv) (2) (3) RSS-210 A9.2 (1) (2) (3) (4)	Power Spectral Density	Nominal	802.11a/n/ac	■	□	□	□	Complies
RSS-Gen, issue 4 section 6.6	Emission Bandwidth	Nominal	802.11a/n/ac	■	□	□	□	Complies
FCC §15.407 (a) (iv) (2) (3) RSS-210 A9.2 (1) (2) (3) (4)	Maximum Conducted Output Power	Nominal	802.11a/n/ac	■	□	□	□	Complies
FCC §15.407 (b) (4) RSS-210 A9.2 (4)	Band Edge Compliance	Nominal	802.11n/ac	■	□	□	□	Complies
FCC §15.407 (b) (1) (2) (3) (4) RSS-210 A9.2 (1) (2) (3) (4)	Unwanted emissions into non-restricted bands	Nominal	802.11a/n/ac	■	□	□	□	Complies
FCC §15.205(a) (c) RSS-Gen , issue 4 section 8.10	Unwanted emissions into restricted bands	Nominal	802.11a/n/ac	■	□	□	□	Complies
§15.207(a) RSS-Gen , issue 4 section 8.8	Conducted Emissions AC power line	Nominal	802.11a/n/ac	■	□	□	□	Complies

Note: NA= Not Applicable; NP= Not Performed.

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6 Measurements

6.1 Radiated Measurement Procedure

Ref: ANSI C63.10 (2013)

Section 5.4: Measurements around the EUT

Measurements shall be made at a test site that incorporates a turntable allowing EUT rotation of 0° through 360°, except where the EUT is so large that a suitable turntable is not readily available. A remotely controlled turntable shall be installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. Continuous azimuth searches shall be made. The maximum field strength at the frequency being measured shall be reported in the test report.³² See ANSI C63.4 for details of the test site, turntable, and antenna positioner. Where a continuous azimuth search cannot be made, as is the case for example where the EUT is so large that a suitable turntable is not readily available, frequency scans of the EUT field strength with both polarizations of the measuring antenna shall be made, starting with a minimum of 16 azimuth angles around the EUT, nominally spaced by 22.5°, in characterizing the EUT radio-noise profile. If directional EUT radiation patterns are suspected, especially above 1 GHz then additional and smaller azimuth angles shall be examined.

Section 5.3.2: Test distance for frequencies below 30 MHz

Radiated emissions limits are usually defined at a specific distance from the EUT. Where possible, measurements shall be made at the distance specified in the limits. This might not be possible in all cases, however, due to the physical limitations of the test facility, physical access problems at the required distance (especially for measurements that must be made in situ or on-site), or levels of ambient noise or other radiated signals present at the time and location where measurements are made. See 6.4.3 for more information about antenna selection, location, and test distance. If measurements cannot practically be made at the EUT limit distance, then they may be made at a different distance (usually closer) and extrapolated to the limit distance using one of the procedures described in 6.4.4, 6.4.5, or 7.7, depending on the EUT source and size.³¹ The test report shall specify the extrapolation method used to determine compliance of the EUT.

Section 5.3.3: Test distance for frequencies at or above 30 MHz

Measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment (see 4.3.4). Measurements shall not be performed at a distance greater than 30 m for frequencies above 30 MHz, unless it can be further demonstrated that measurements at a distance of 30 m or less are impractical. Measurements from 18 GHz to 40 GHz are typically made at distances significantly less than 3 m from the EUT. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade of distance (inverse of linear distance for field-strength measurements or inverse of linear distance-squared for power-density measurements).

ANSI C63.10 (2013)

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Section 6.6.4.2: Exploratory radiated emissions measurements

Exploratory radiated measurements shall be performed at the measurement distance or at a closer distance than that specified for compliance to determine the emission characteristics of the EUT and, if applicable, the EUT configuration that produces the maximum level of emissions. The frequencies of maximum emission may be determined by manually positioning the antenna close to the EUT, and then moving the antenna over all sides of the EUT while observing a spectral display. It is advantageous to have prior knowledge of the frequencies of emissions, although this may be determined from such a near-field scan. The near-field scan shall only be used to determine the frequency but not the amplitude of the emissions. Where exploratory measurements are not adequate to determine the worst-case operating modes and are used only to identify the frequencies of the highest emissions, additional preliminary tests can be required.

Preliminary tests shall be performed following the procedures in 6.3 on a site meeting the requirements of 5.2. For emissions from the EUT, the maximum level shall be determined by rotating the EUT and its antenna through 0° to 360°. For each mode of operation required to be tested, the frequency spectrum (based on findings from exploratory measurements) shall be monitored.

Section 6.6.4.3: Final radiated emissions measurements

The final measurements are performed on a site meeting the requirements of 5.2. Using the orientation and equipment arrangement of the EUT based on the measurement results found during the preliminary (exploratory) measurements per 6.6.4.2, the EUT arrangement, appropriate modulation, and modes of operation that produce the emissions that have the highest amplitude relative to the limit shall be selected for the final measurement. The final measurement shall follow all the procedures in 6.3 with the EUT operating on frequencies per 5.6. For each mode selected, record the frequency and amplitude of the highest fundamental emission (if applicable), as well as the frequency and amplitude of the six highest spurious emissions relative to the limit. Emissions more than 20 dB below the limit do not need to be reported.

Measurements are performed with the EUT rotated from 0° to 360°; the antenna height scanned in accordance with 6.6.3.1, 6.6.3.2, or 6.6.3.3, as appropriate; and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Variations in cable or wire placement shall be explored to maximize the measured emissions.

NOTES

- 1— Where limits are specified by agencies for both average and peak (or quasi-peak) detection, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.
- 2—Use of waveguide and flexible waveguide may be necessary at frequencies above 10 GHz to achieve usable signal-to noise ratios at required measurement distances. If so, it may be necessary to restrict the height search of the antenna, and special care should be taken to ensure that maximum emissions are correctly measured.
- 3—All presently known devices causing emissions above 10 GHz are physically small compared with the beam-widths of typical horn antennas used for EMC measurements. For such EUTs and frequencies, it may be preferable to vary the height and polarization of the EUT instead of the receiving antenna to maximize the measured emissions.

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6.2 Sample Calculations for Radiated Measurements

6.2.1 Field Strength Measurements:

Measurements from the Spectrum Analyzer/ Receiver are used to calculate the Field Strength, taking into account the following parameters:

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

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

Eg:

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

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

Radiated Measurement Uncertainty: ± 3 dB

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6.3 Conducted Emissions Procedure

Ref: ANSI C63.10 (2013)

Section 6.2: Standard test method for ac power-line conducted emissions from unlicensed wireless devices

Section 6.2.1: General considerations

AC power-line conducted emission measurements shall be made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz, to determine the line-to-ground radio-noise voltage that is conducted from all of the EUT current-carrying power input terminals that are directly (or indirectly via separate transformers or power supplies) connected to a public power network. These measurements may also be required between 9 kHz and 150 kHz.

If the EUT normally receives power from another device that in turn connects to the public utility ac power lines, measurements shall be made on that device with the EUT in operation to demonstrate that the device continues to comply with the appropriate limits while providing the EUT with power. If the EUT is operated only from internal or dedicated batteries, with no provisions for connection to the public utility ac power lines (600 VAC or less) to operate the EUT (such as an adapter), then ac power-line conducted measurements are not required.

For direct current (dc) powered devices where the ac power adapter is not supplied with the device, an “off-the-shelf” unmodified ac power adapter shall be used. If the device is supposed to be installed in a host (e.g., the device is a module or PC card), then it is tested in a typical compliant host (see also 5.10.3).

Section 6.2.2: Measurement requirements

The LISN housing, measuring instrument case, reference ground plane, vertical conducting plane, if used, shall be bonded together.

Measured levels of ac power-line conducted emission shall be the emission voltages from the voltage probe or across the 50 Ω LISN port (to which the EUT is connected), where permitted, terminated into a 50 Ω measuring instrument, or where permitted or required, the emission currents on the power line sensed by a current probe. All emission voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord by the use of mating plugs and receptacles on the LISN, if used. Equipment shall be tested with power cords that are normally supplied or recommended by the manufacturer, and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended by the manufacturer. For those measurements, using a LISN, the 50 Ω measuring port is terminated by a measuring instrument having a 50 Ω input impedance. All other ports are terminated in 50 Ω loads.

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Section 6.2.4: Exploratory ac power-line conducted emission measurements

Exploratory tests shall be run with the modulating signal(s) specified in 5.12 applied to the EUT. Antenna(s) can be integral or detachable. If detachable, the antenna(s) shall be attached during the test. On any one convenient frequency specified in 5.5 and 5.6, exploratory measurements shall be used to identify the frequency of the emission that has the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable positions, and with a typical system equipment configuration and arrangement. For each mode of operation and for each ac power current-carrying conductor, cable manipulation shall be performed within the range of likely configurations. For this measurement or series of measurements, the frequency spectrum of interest shall be monitored looking for the emission that has the highest amplitude relative to the limit. Once that emission is found for each current-carrying conductor of each power cord associated with the EUT (but not the cords associated with non-EUT equipment in the overall system), the one configuration and arrangement and mode of operation that produces the emission closest to the limit over all of the measured conductors shall be recorded.

Section 6.2.5: Final ac power-line conducted emission measurements

Based on the exploratory tests of the EUT performed in 6.2.4, the one EUT cable configuration and arrangement and mode of operation that produced the emission with the highest amplitude relative to the limit is selected for the final measurement, while applying the appropriate modulating signal to the EUT. If the EUT is relocated from an exploratory test site to a final test site, the highest emissions shall be remaximized at the final test location before final ac power-line conducted emission measurements are performed. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment in the system) is then performed for the full frequency range for which the EUT is being tested for compliance without further variation of the EUT arrangement, cable positions, or EUT mode of operation. If the EUT is composed of equipment units that have their own separate ac power connections (e.g., floor-standing equipment with independent power cords for each shelf that are able to connect directly to the ac power network), then each current-carrying conductor of one unit is measured while the other units are connected to a second (or more) LISN(s). All units shall be measured separately. If a power strip is provided by the manufacturer, to supply all of the units making up the EUT, only the conductors in the power cord of the power strip shall be measured.

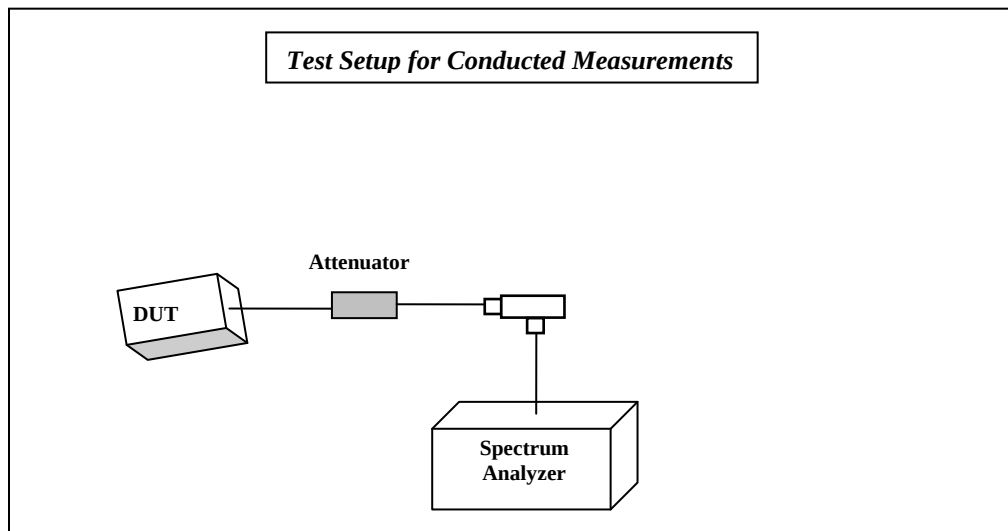
If the EUT operates above 30 MHz and uses a detachable antenna, then these measurements shall be made with a representative antenna connected to the antenna output terminals. These tests shall be made with the antenna connected and, if adjustable, fully extended.

Record the six highest EUT emissions relative to the limit of each of the current-carrying conductors of the power cords of the equipment that comprises the EUT over the frequency range specified by the procuring or regulatory agency.

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6.4 RF Conducted Measurement Procedure

Measurement according to KDB 789033 D02 General UNII Test Procedure New Rules v01: 2014 (Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E)



1. Connect the equipment as shown in the above diagram.
2. Adjust the settings by entering test commands for TX/RX mode on/off, changing channels, modulations and data rates.
3. Measurements are to be performed with the EUT set to the low, middle and high channels.

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7 Maximum Conducted Output Power

7.1 Limits:

U-NII-1 Band

FCC 15.407 (a) (iv): For mobile and portable client devices in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi.

RSS-210: For band 5150-5250 MHz, the maximum e.i.r.p. shall not exceed 200 mW or $10 + 10 \log_{10} B$, dBm, whichever power is less.

U-NII-2A and U-NII-2C Bands

FCC 15.407 (a) (2): For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26 dB emission bandwidth in megahertz. The maximum e.i.r.p shall not exceed 1.0 W or $17 + 10 \log B$, dBm, whichever power is less.

RSS-210 A9.2 (2) (3): For the band 5250 – 5350, 5470 – 5600 MHz and 5650–5725 MHz, the maximum conducted output power shall not exceed 250 mW or $11 \text{ dBm} + 10 \log B$, whichever power is less. The maximum e.i.r.p. shall not exceed 1.0 W or $17 + 10 \log_{10} B$, dBm, whichever power is less. B is the 99% emission bandwidth in MHz.

U-NII-3 Band

FCC 15.407(a) (3): For the band 5.725-5.850 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1.0 W provided the maximum antenna gain does not exceed 6 dBi.

RSS-210 A9.2 (4): For Band 5725–5850 MHz, the maximum e.i.r.p. shall not exceed 1.0 W (30 dBm) or $17 + 10 \log_{10} B$, dBm, whichever power is less. B is the 99% emission bandwidth in MHz. The maximum e.i.r.p shall not exceed 4.0 W (36 dBm) or $23 + 10 \log_{10} B$.

7.2 Test Conditions:

Tnom: 21°C; Vnom: 3.7V

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7.3 Test Procedure

Ref: 789033 D02 General UNII Test Procedures New Rules v01 section E. 2 (d)

Method SA-2 (trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction)

Spectrum Analyzer settings:

Center Frequency = Test channel frequency

Span: Wide enough to capture the entire EBW (or alternatively 99% OBW)

RBW = 1 MHz

VBW $\geq 3 \times$ RBW

Detector = RMS

Trace Average ≥ 100

Average Type = Power average

Sweep = Auto

Sweep Points $\geq 2 \times$ span/ RBW.

Allow trace to fully stabilize. Set channel integration bandwidth = EBW (alternatively 99% OBW).

Perform power integration across 1 MHz bandwidth in which the band edge emission level is to be measured using band power function within the spectrum analyzer. Add duty cycle correction factor (if DC < 98%) and antenna gain to the result.

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7.4 Test Result:

U-NII-1 Band

Maximum Conducted Output Power (dBm)								
FCC Limit = 24 dBm RSS Limit = None			Frequency (MHz)					
			5180 Channel 36		5200 Channel 40		5240 Channel 48	
Mode	Data Rate (Mbps)	Duty Cycle CF	Measured	Corrected	Measured	Corrected	Measured	Corrected
802.11a	6	0.20	13.65	13.85	13.60	13.80	13.38	13.58
802.11n20	7.2	0.22	13.77	13.99	13.72	13.94	13.80	14.02
			5190 Channel 38			5230 Channel 46		
			Measured	Corrected	Measured	Corrected	Measured	Corrected
802.11n40	15	0.81	13.21	14.02	13.47	14.28		
			5210 Channel 42					
			Measured			Corrected		
802.11ac80	32.5	1.47	10.03			11.50		
Calculated EIRP (dBm)								
FCC Limit = 30 dBm RSS Limit = 23 dBm			Frequency (MHz)					
			5180 Channel 36		5200 Channel 40		5240 Channel 48	
Mode	Data Rate (Mbps)	Antenna Gain (dBi)						
802.11a	6	4.5	18.35		18.30		18.08	
802.11n20	7.2	4.5	18.49		18.44		18.52	
			5190 Channel 38			5230 Channel 46		
802.11n40	15	4.5	18.52			18.78		
			5210 Channel 42					
802.11ac80	32.5	4.5	16.00					

Note: EIRP is calculated as *Conducted Measurement + Antenna Gain*

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U-NII-2A Band

Maximum Conducted Output Power (dBm)								
FCC Limit = 24 dBm RSS Limit = 24 dBm			Frequency (MHz)					
			5260 Channel 52		5300 Channel 60		5320 Channel 64	
Mode	Data Rate (Mbps)	Duty Cycle CF	Measured	Corrected	Measured	Corrected	Measured	Corrected
802.11a	6	0.20	13.20	13.40	13.29	13.49	13.34	13.54
802.11n20	7.2	0.22	13.22	13.44	13.87	14.09	13.4	13.62
			5270 Channel 54			5310 Channel 62		
			Measured	Corrected	Measured		Corrected	
802.11n40	15	0.81	13.09	13.90	13.07		13.88	
			5290 Channel 58					
			Measured			Corrected		
802.11ac80	32.5	1.47	9.74			11.21		
Calculated EIRP (dBm)								
FCC Limit = 30 dBm RSS Limit = 30 dBm			Frequency (MHz)					
			5260 Channel 52		5300 Channel 60		5320 Channel 64	
Mode	Data Rate (Mbps)	Antenna Gain (dBi)						
802.11a	6	5.0	18.40		18.49		18.54	
802.11n20	7.2	5.0	18.44		19.09		18.62	
			5270 Channel 54			5310 Channel 62		
802.11n40	15	5.0	18.90			18.88		
			5290 Channel 58					
802.11ac80	32.5	5.0	16.21					

Note: EIRP is calculated as *Conducted Measurement + Antenna Gain*

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U-NII-2C Band

Maximum Conducted Output Power (dBm)								
FCC Limit = 24 dBm RSS Limit = 24 dBm			Frequency (MHz)					
			5500 Channel 100		5600 Channel 120		5700 Channel 140	
Mode	Data Rate (Mbps)	Duty Cycle CF	Measured	Corrected	Measured	Corrected	Measured	Corrected
802.11a	6	0.20	13.98	14.18	13.87	14.07	13.21	13.41
802.11n20	7.2	0.22	13.77	13.99	13.38	13.60	13.37	13.59
			5510 Channel 102			5590 Channel 118		
			Measured	Corrected	Measured		Corrected	
802.11n40	15	0.81	13.05	13.86	12.47		13.28	
			5530 Channel 106					
			Measured			Corrected		
802.11ac80	32.5	1.47	9.59			11.06		
Calculated EIRP (dBm)								
FCC Limit = 30 dBm RSS Limit = 30 dBm			Frequency (MHz)					
			5500 Channel 100		5600 Channel 120		5700 Channel 140	
Mode	Data Rate (Mbps)	Antenna Gain (dBi)						
802.11a	6	4.0	18.18		18.07		17.41	
802.11n20	7.2	4.0	17.99		17.60		17.59	
			5510 Channel 102			5590 Channel 118		
802.11n40	15	4.0	17.86			17.28		
			5530 Channel 106					
802.11ac80	32.5	4.0	15.06					

Note: EIRP is calculated as *Conducted Measurement + Antenna Gain*

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U-NII-3 Band

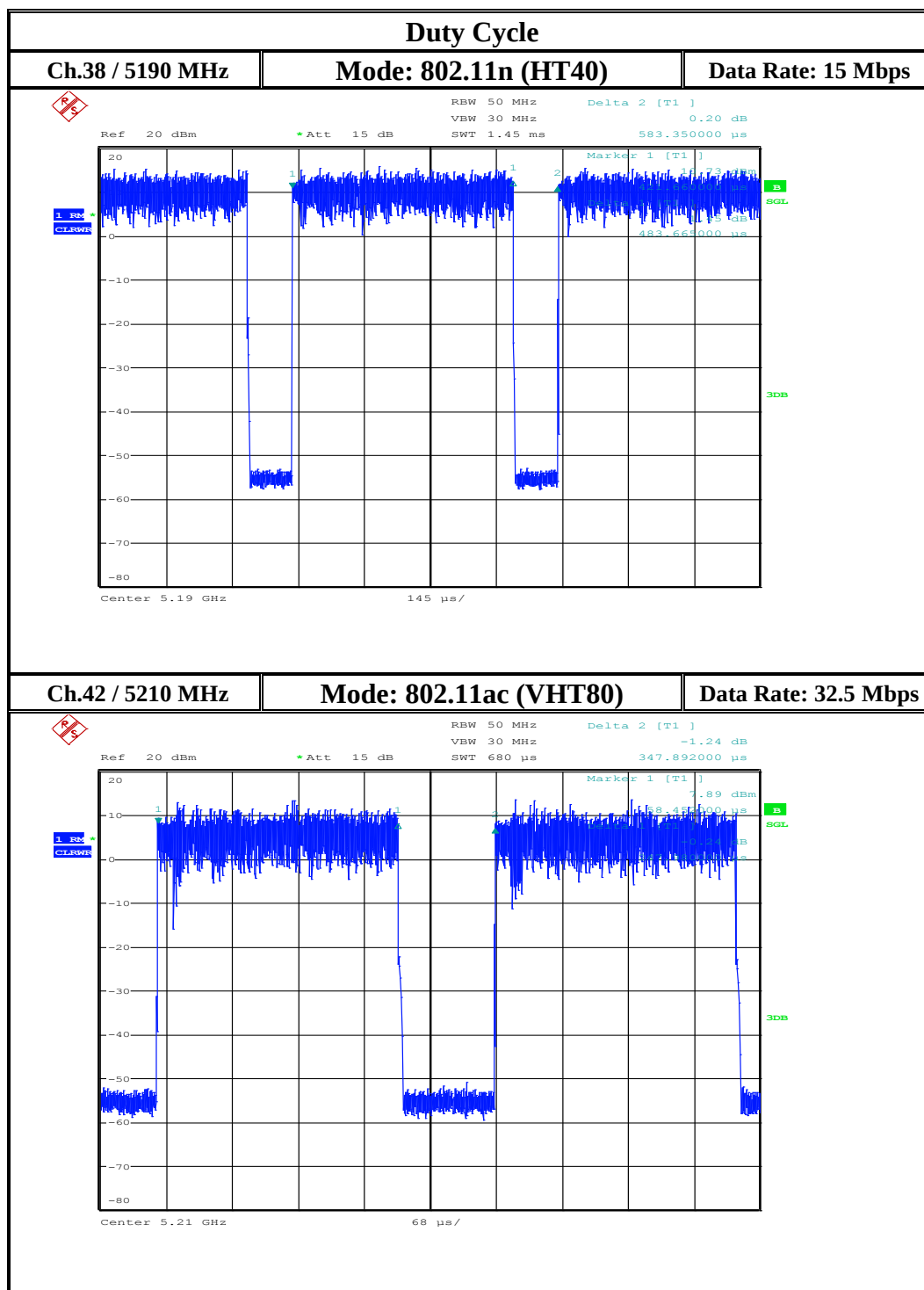
Maximum Conducted Output Power (dBm)								
FCC Limit = 30 dBm RSS Limit = 30 dBm			Frequency (MHz)					
			5745 Channel 149		5785 Channel 157		5825 Channel 165	
Mode	Data Rate (Mbps)	Duty Cycle CF	Measured	Corrected	Measured	Corrected	Measured	Corrected
802.11a	6	0.20	13.27	13.47	13.24	13.44	13.36	13.57
802.11n20	7.2	0.22	13.18	13.4	13.25	13.47	13.23	13.45
			5755 Channel 151			5795 Channel 159		
			Measured	Corrected	Measured		Corrected	
802.11n40	15	0.81	12.71	13.52	12.78		13.59	
			5775 Channel 155					
			Measured			Corrected		
802.11ac80	32.5	1.47	9.41			10.88		
Calculated EIRP (dBm)								
FCC Limit = 36 dBm RSS Limit = 36 dBm			Frequency (MHz)					
			5745 Channel 149		5785 Channel 157		5825 Channel 165	
Mode	Data Rate (Mbps)	Antenna Gain (dBi)	5745 Channel 149		5785 Channel 157		5825 Channel 165	
802.11a	6	3.0	16.47		16.44		16.57	
802.11n20	7.2	3.0	16.40		16.47		16.45	
			5755 Channel 151			5815 Channel 163		
802.11n40	15	3.0	16.52			16.59		
			5775 Channel 155					
802.11ac80	32.5	3.0	13.88					

Note: EIRP is calculated as *Conducted Measurement + Antenna Gain*

7.5 Verdict

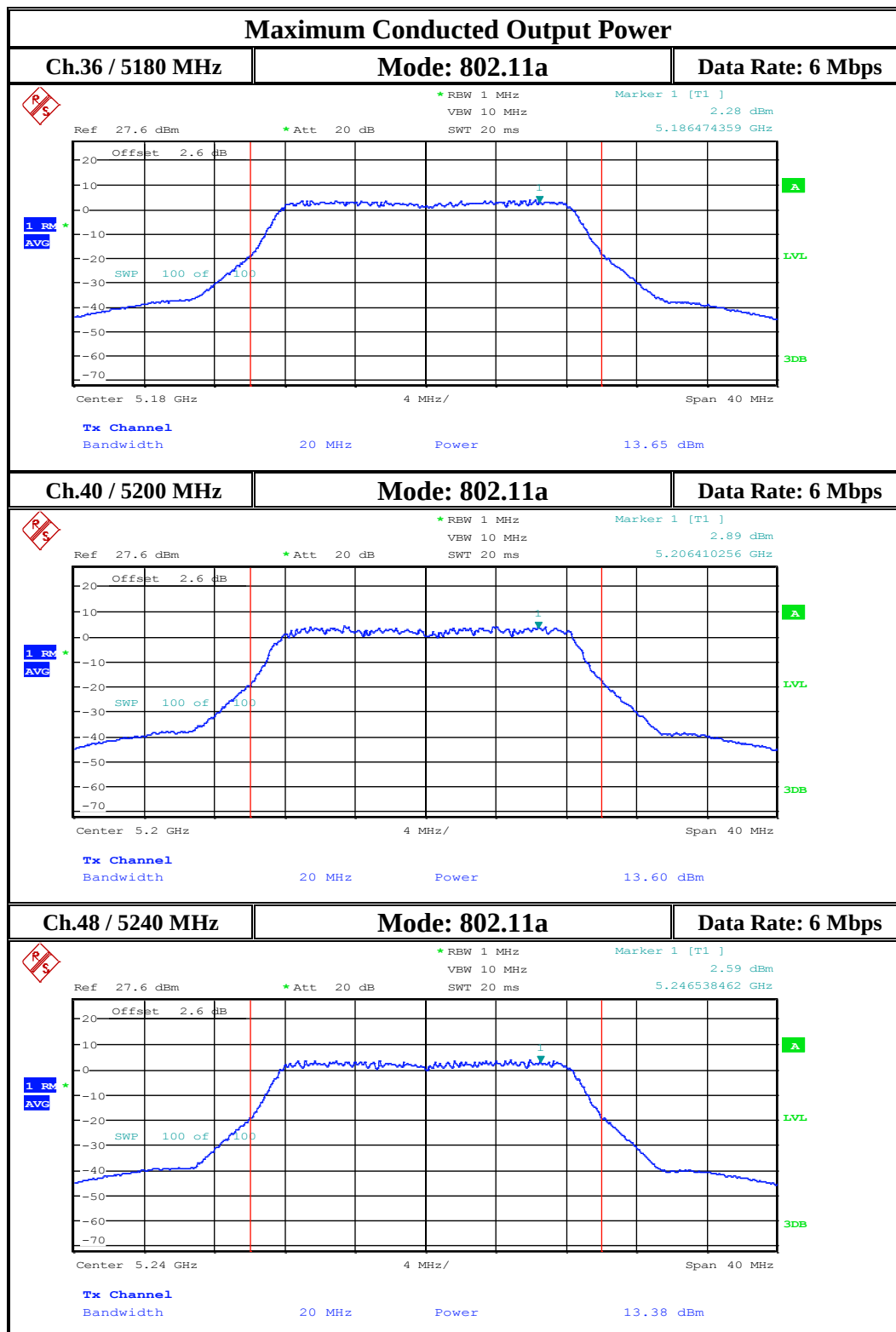
Pass

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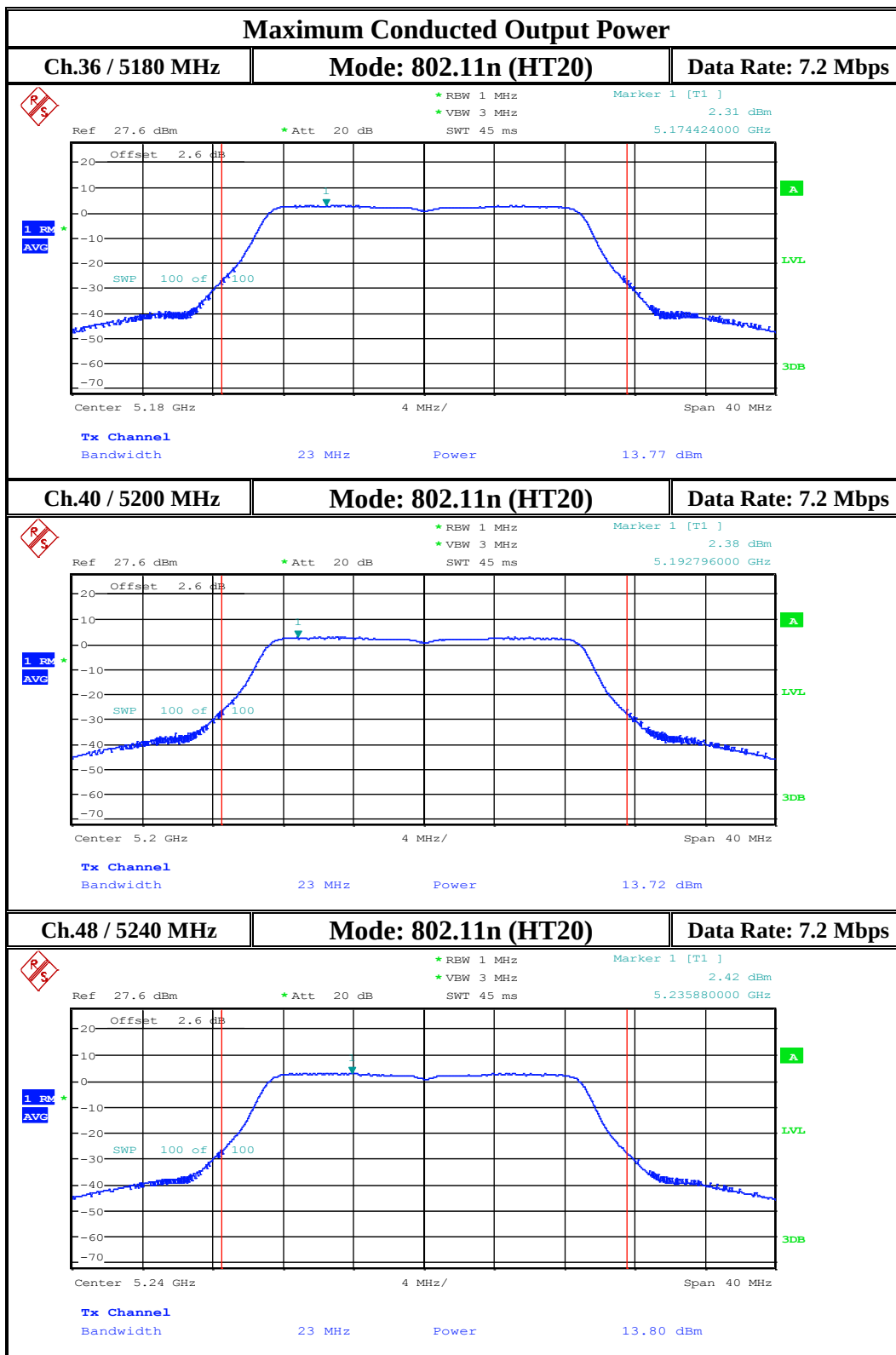
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U-NII-1



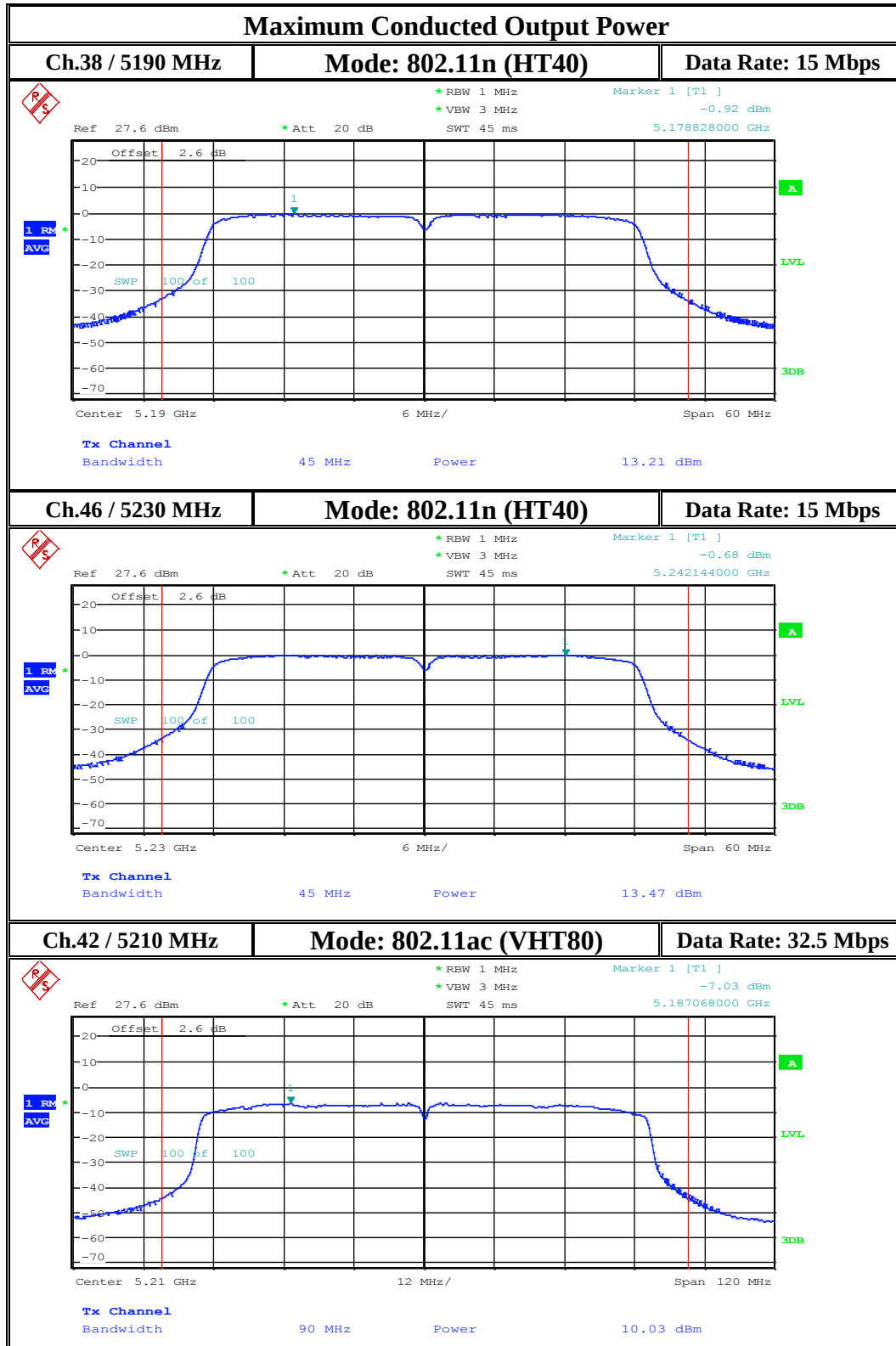
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U-NII-1



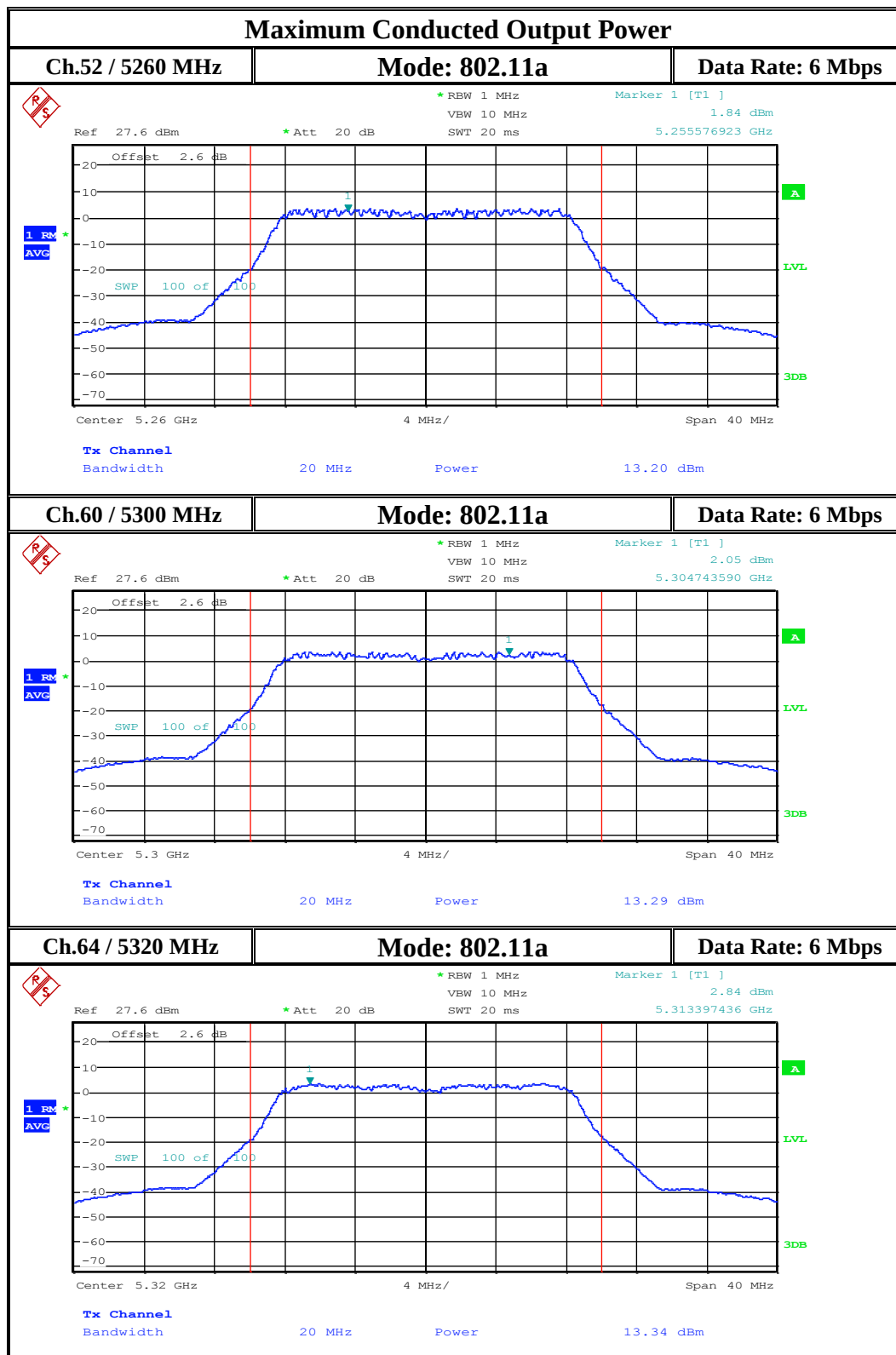
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U-NII-1



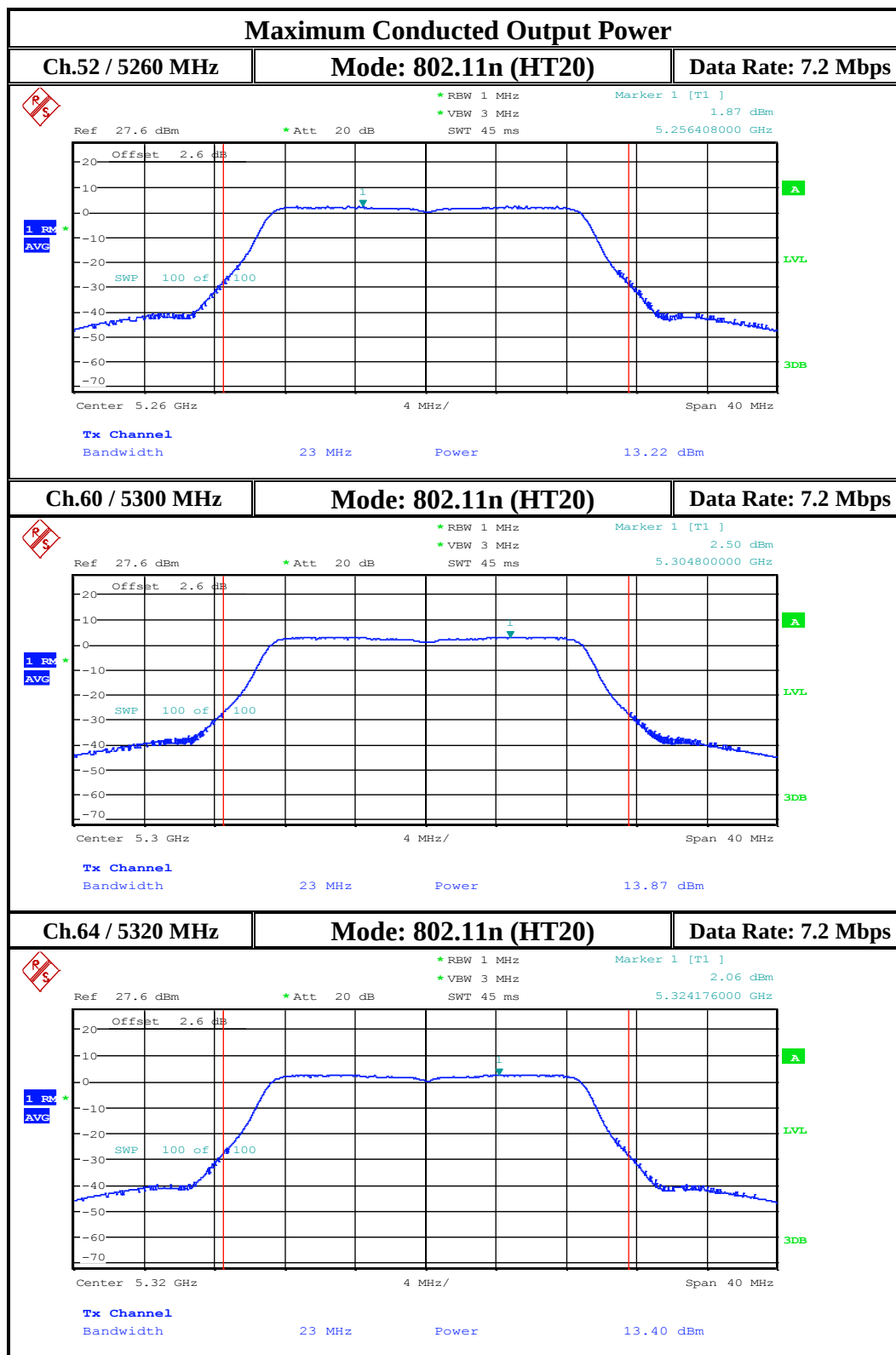
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U-NII-2A



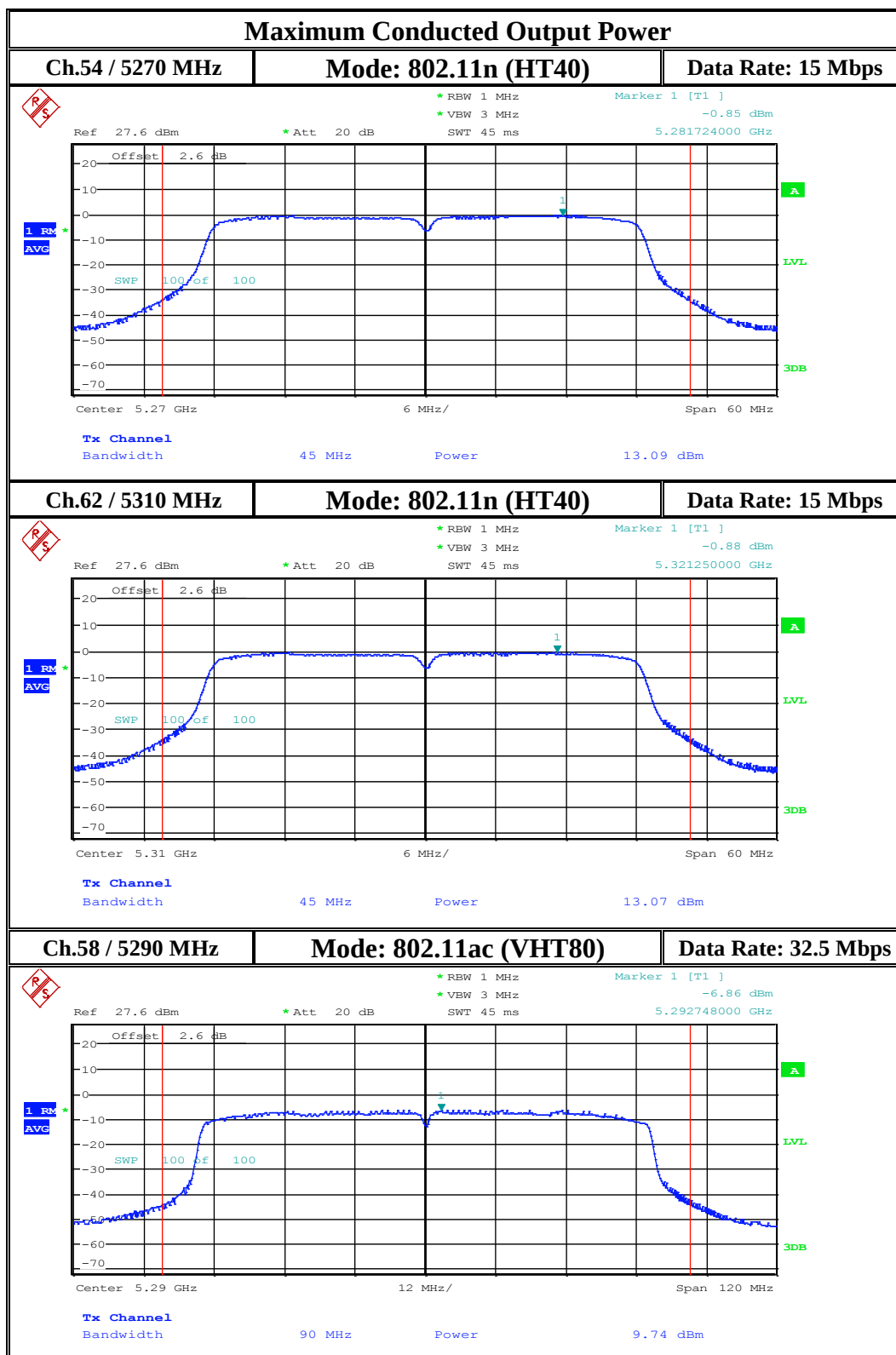
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U-NII-2A



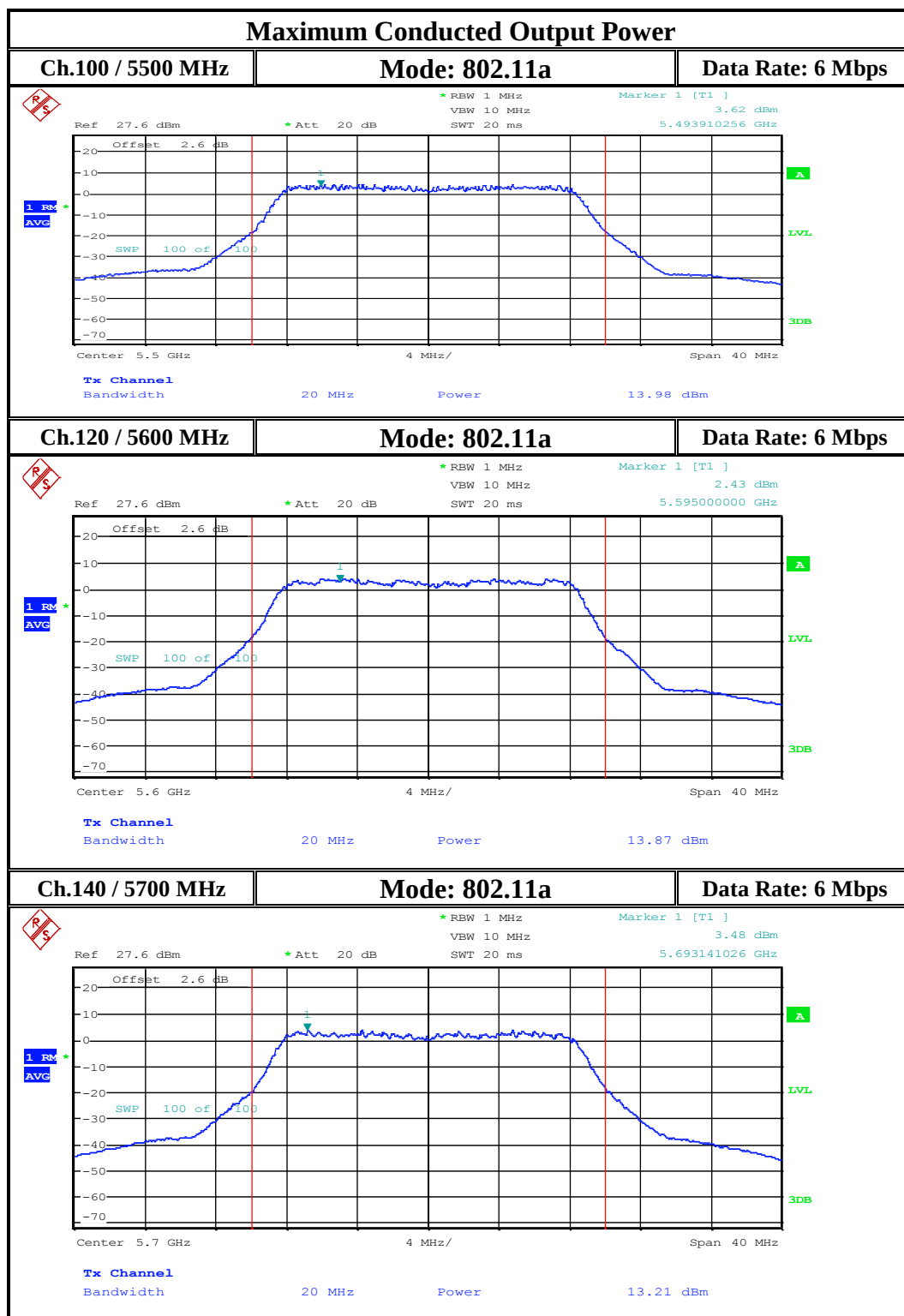
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U-NII-2A



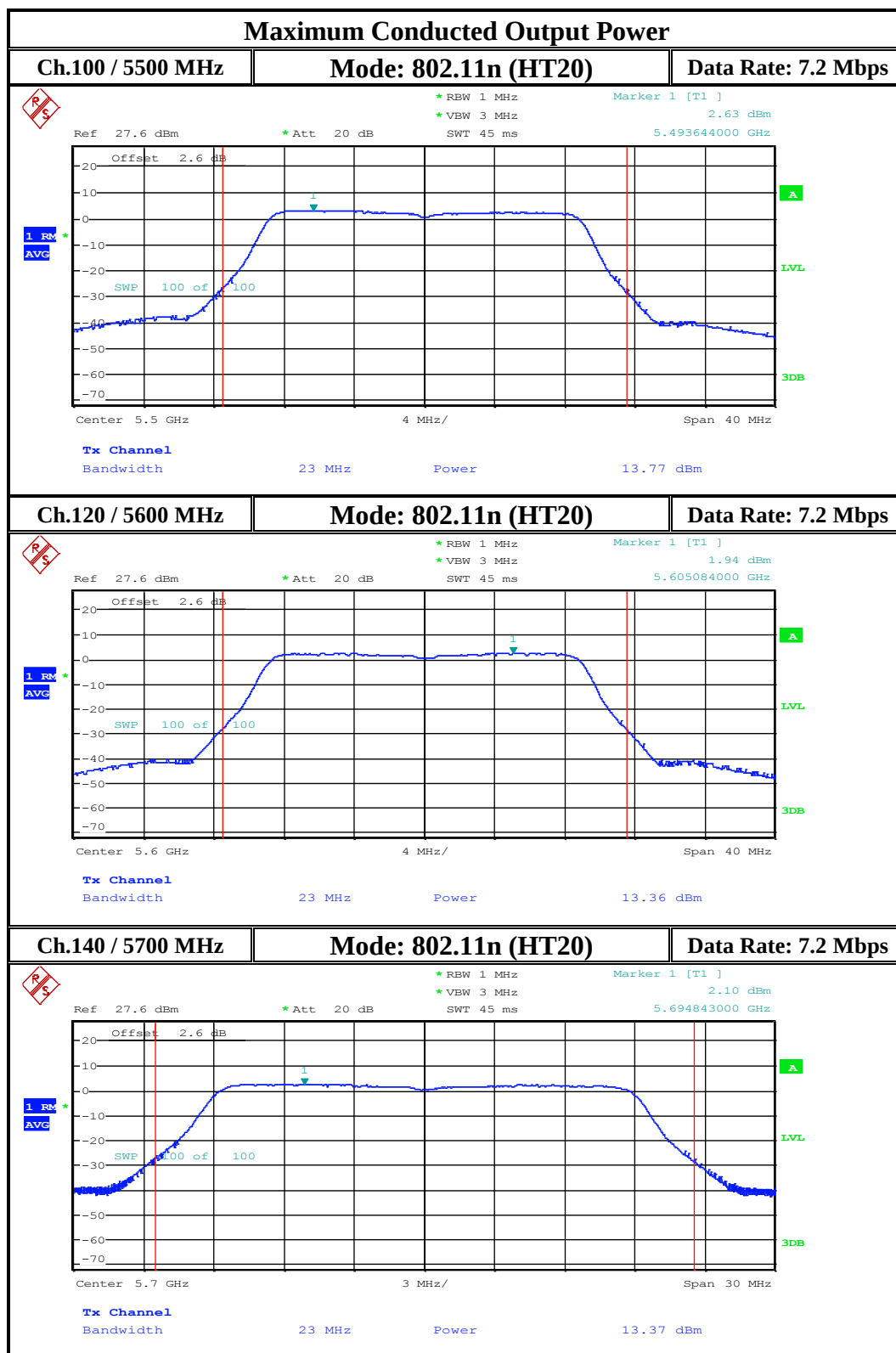
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U-NII-2C



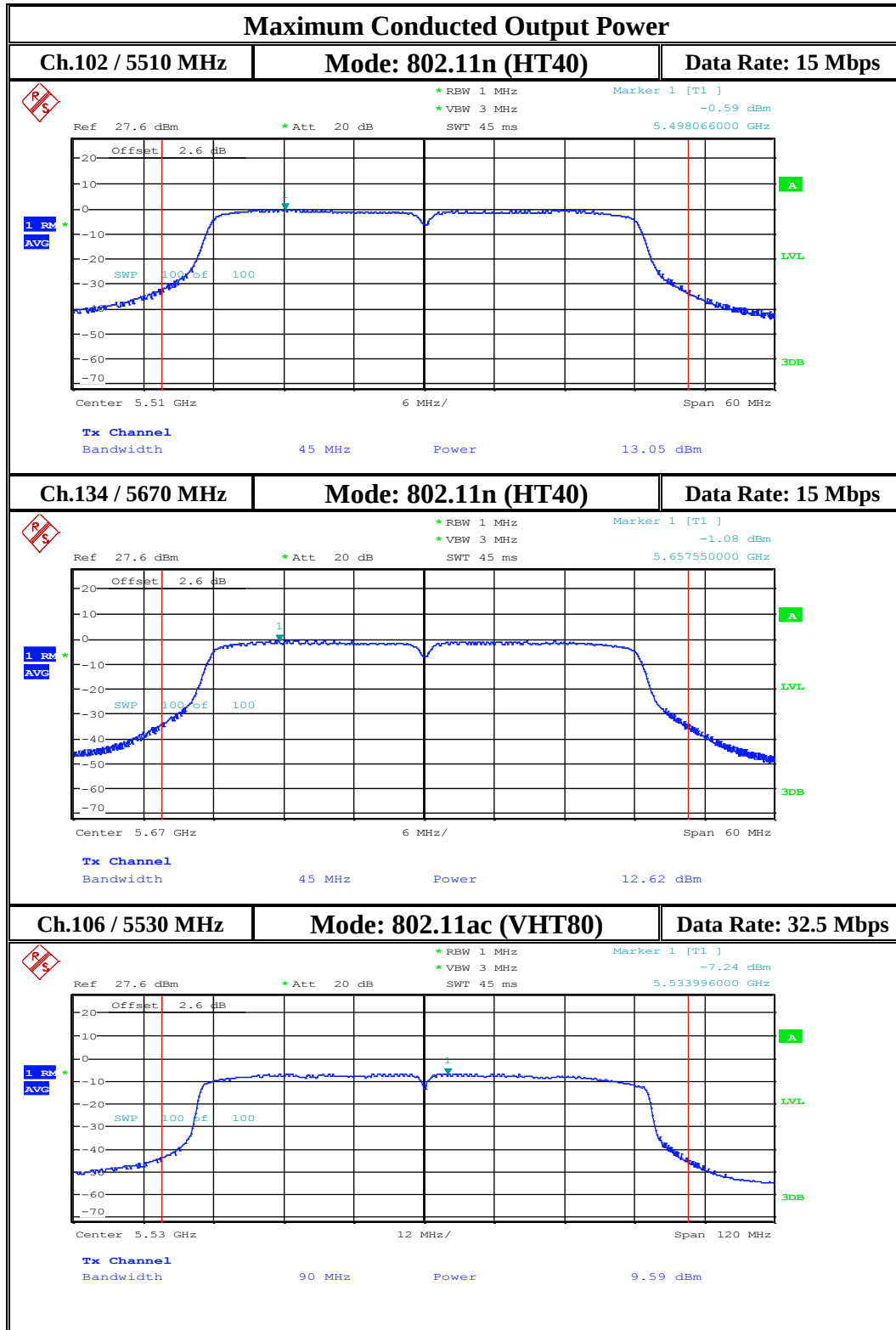
Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	
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U-NII-2C



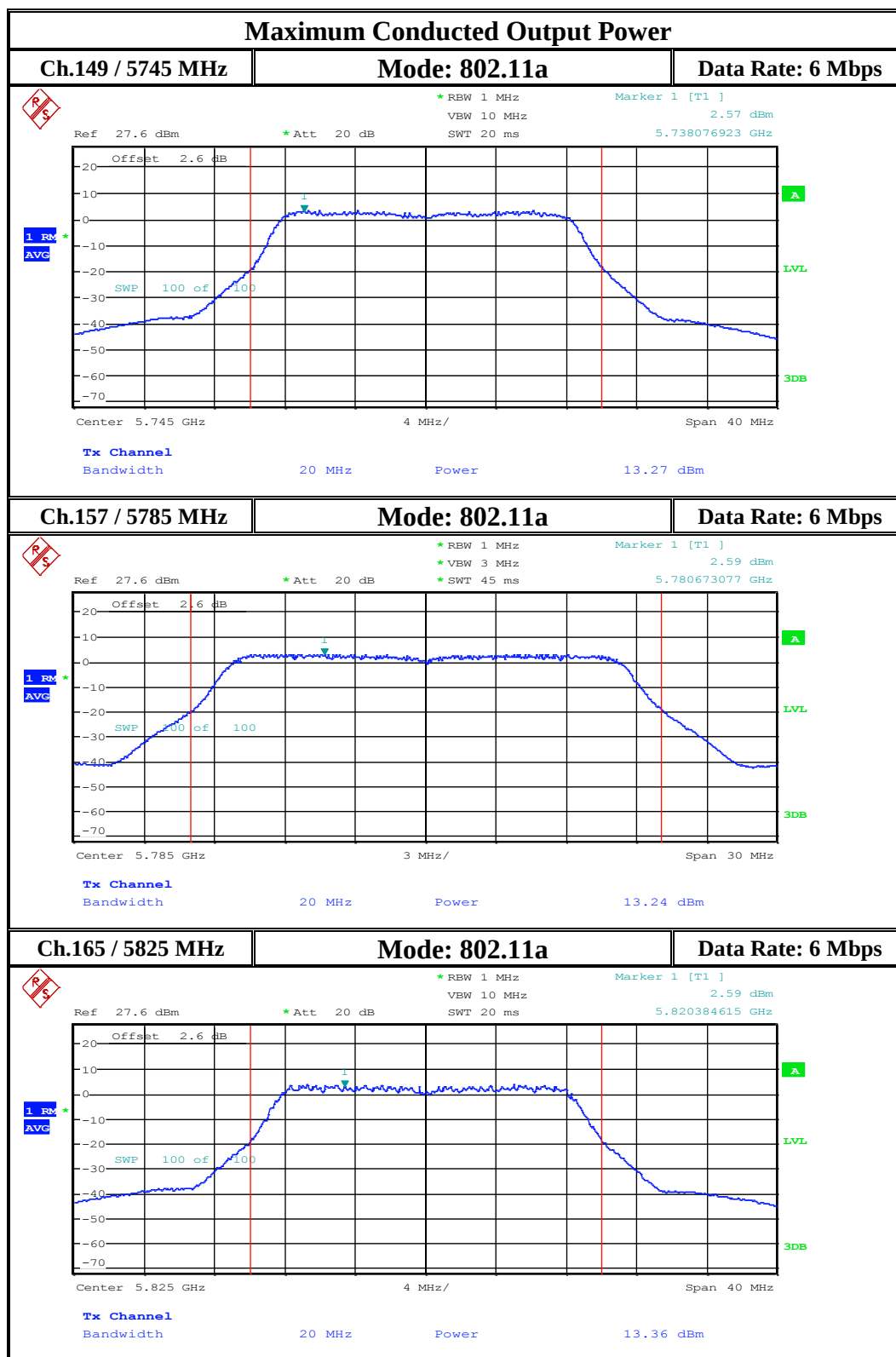
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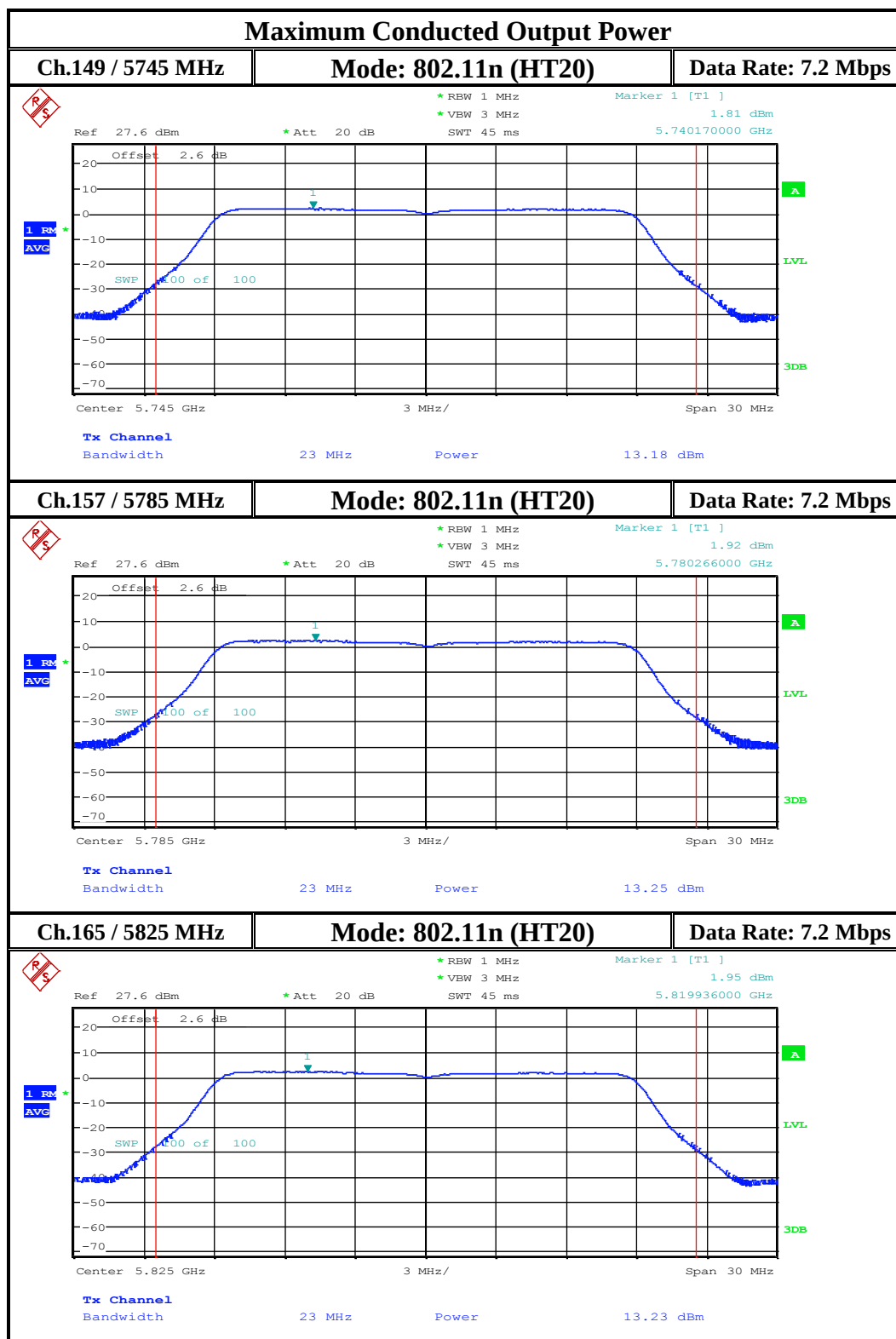
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U-NII-3



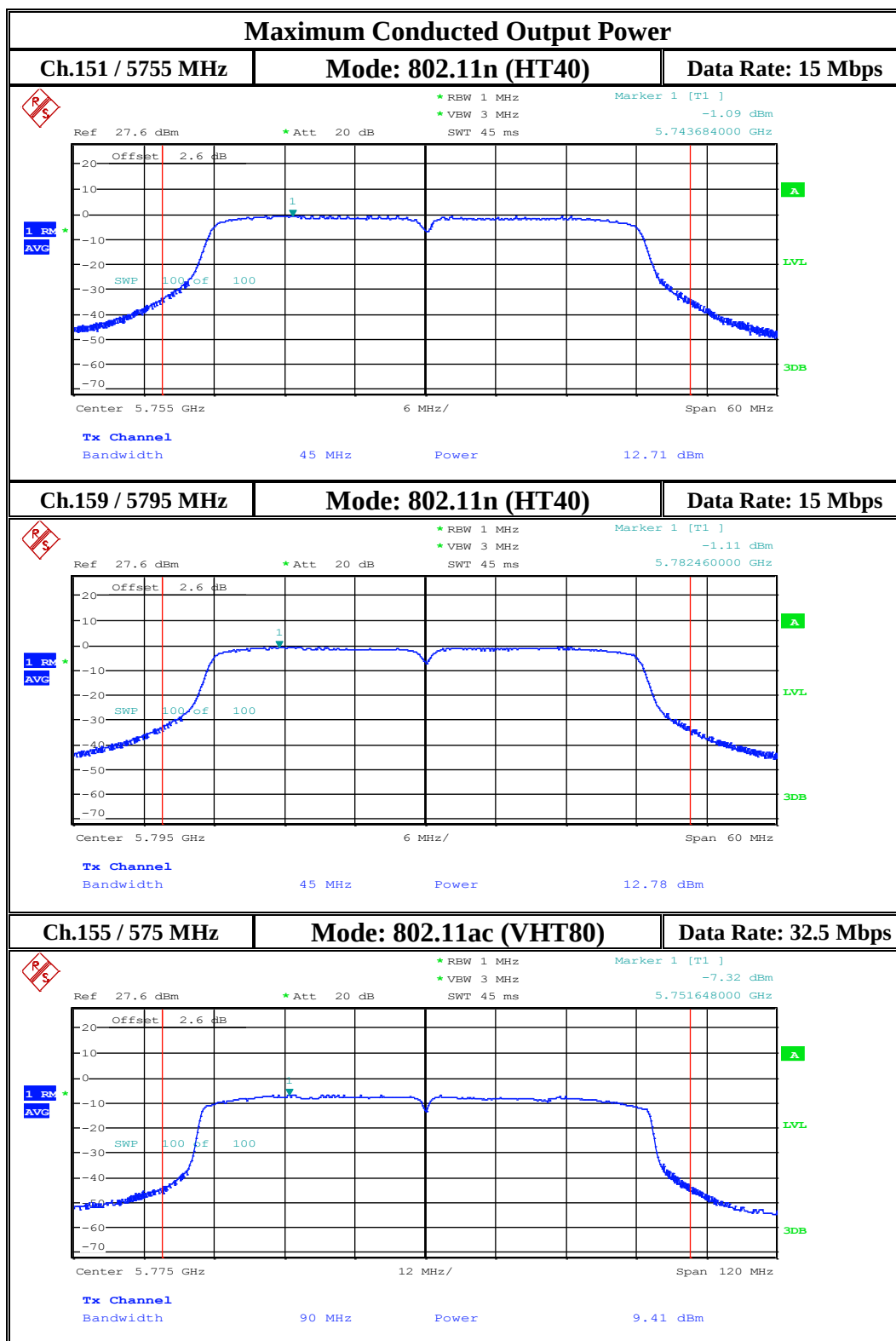
Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	CETECOM™ EMC Test Solutions
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8 Power Spectral Density

8.1 Limits:

U-NII-1 Band

FCC 15.407(a) (iv): For mobile and portable client devices in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 11 dBm in any 1MHz band.

RSS-210 A9.2 (1): For the 5150 – 5250 MHz band, the e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

U-NII-2A Band and U-NII-2C

FCC 15.407(a) (2) (3): For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum power spectral density shall not exceed 11dBm in any 1MHz band.

RSS-210 A9.2 (2), (3): For the 5250 – 5350 MHz, 5470 – 5600 MHz and 5650-5725 MHz band, the power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

U-NII-3 Band

FCC 15.407(a) (3): For the band 5.725-5.850 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500 kHz band.

RSS-210 A9.2 (4): For the 5725 – 5850 MHz band, the power spectral density shall not exceed 17 dBm in any 1 MHz band.

8.2 Test Conditions:

Tnom: 20 °C; Vnom: 3.7V

8.3 Measurement procedure:

Ref. KDB 789033 D02 General UNII Test Procedure New Rules v01 section F (Method SA-2)

The PSD results are taken from the output power measurement plots since the same principle test method is applicable.

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8.4 Test Data:

U-NII-1 Band

Maximum Power Spectral Density (dBm/ 1MHz)								
FCC Limit = 11 dBm/1 MHz			Frequency (MHz)					
			5180 Channel 36		5200 Channel 40		5240 Channel 48	
Mode	Data Rate (Mbps)	Duty Cycle CF	Measured	Corrected	Measured	Corrected	Measured	Corrected
802.11a	6	0.20	2.28	2.48	2.89	3.09	2.59	2.79
802.11n20	6.5	0.22	2.31	2.53	2.38	2.60	2.42	2.64
			5190 Channel 38			5230 Channel 46		
			Measured	Corrected	Measured	Corrected	Measured	Corrected
802.11n40	15	0.81	-0.92	-0.11	-0.68	0.13		
			5210 Channel 42					
			Measured			Corrected		
802.11ac80	32.5	1.47	-7.03			-5.56		
Calculated EIRP Spectral Density (dBm/1MHz)								
RSS Limit = 10 dBm/1 MHz			Frequency (MHz)					
			5180 Channel 36		5200 Channel 40		5240 Channel 48	
Mode	Data Rate (Mbps)	Ant. Gain (dBi)						
802.11a	6	4.5	6.98		7.59		7.29	
802.11n20	6.5	4.5	7.03		7.10		7.14	
			5190 Channel 38			5230 Channel 46		
802.11n40	15	4.5	4.39			4.63		
			5210 Channel 42					
802.11ac80	32.5	4.5	-1.06					

Note: EIRP spectral density is calculated as *Conducted Measurement + Antenna Gain*

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U-NII-2A Band

Maximum Power Spectral Density (dBm/1MHz)								
FCC Limit = 11 dBm/1 MHz RSS Limit = 11 dBm/1 MHz			Frequency (MHz)					
			5260 Channel 52		5300 Channel 60		5320 Channel 64	
Mode	Data Rate (Mbps)	Duty Cycle CF	Measured	Corrected	Measured	Corrected	Measured	Corrected
802.11a	6	0.20	1.84	2.04	2.05	2.25	2.84	3.04
802.11n20	6.5	0.22	1.87	2.09	2.50	2.72	2.06	2.28
			5270 Channel 54			5310 Channel 62		
			Measured	Corrected	Measured	Corrected	Measured	Corrected
802.11n40	15	0.81	-0.85	-0.04	-0.88	-0.07		
			5250 Channel 50					
			Measured			Corrected		
802.11ac80	32.5	1.47	-7.25			-5.78		

U-NII-2C Band

Maximum Power Spectral Density (dBm/1MHz)								
FCC Limit = 11 dBm/1 MHz RSS Limit = 11 dBm/1 MHz			Frequency (MHz)					
			5500 Channel 100		5600 Channel 120		5700 Channel 140	
Mode	Data Rate (Mbps)	Duty Cycle CF	Measured	Corrected	Measured	Corrected	Measured	Corrected
802.11a	6	0.20	3.62	3.82	2.43	2.63	3.48	3.68
802.11n20	6.5	0.22	2.63	2.85	1.94	2.16	2.10	2.32
			5270 Channel 102			5310 Channel 134		
			Measured	Corrected	Measured	Corrected	Measured	Corrected
802.11n40	15	0.81	-1.82	-1.01	-1.35	-0.54		
			5530 Channel 106					
			Measured			Corrected		
802.11ac80	32.5	1.47	-7.24			-5.77		

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U-NII-3 Band

Maximum Power Spectral Density (dBm/1MHz)								
RSS Limit = 17 dBm/1 MHz FCC Limit = 30 dBm/500 kHz (see note below)			Frequency (MHz)					
			5745 Channel 149		5785 Channel 157		5825 Channel 165	
Mode	Data Rate (Mbps)	Duty Cycle CF	Measured (1MHz BW)	Corrected (1MHz BW)	Measured (1MHz BW)	Corrected (1MHz BW)	Measured (1MHz BW)	Corrected (1MHz BW)
802.11a	6	0.20	2.57	2.77	2.59	2.79	2.59	2.79
802.11n20	6.5	0.22	1.81	2.03	1.92	2.14	1.95	2.17
			5755 Channel 151			5795 Channel 159		
			Measured (1MHz BW)	Corrected (1MHz BW)	Measured (1MHz BW)	Corrected (1MHz BW)	Measured (1MHz BW)	Corrected (1MHz BW)
802.11n40	15	0.81	-1.09	-0.28	-1.11	-0.30		
			5775 Channel 155					
			Measured (1MHz BW)			Corrected (1MHz BW)		
802.11ac80	32.5	1.47	-7.32			-5.85		

Note: Since the RSS limit of 17dBm/1MHz is fulfilled with high margins compliance with the FCC limit of 30dBm/500kHz can be assumed without correction.

8.5 Verdict:

Pass.

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9 Band Edge Compliance – at restricted and non-restricted band edges

9.1 Limits:

FCC15.407 (b) (4) / RSS-210 A9.2 (4): For transmitters operating in the 5.725-5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of -27 dBm/MHz.

FCC§15.407 (b) (1) (2) (3) (4) / RSS-210 A9.2 (1) (2) (3) (4)

(b) *Undesirable emission limits:* Except as shown in paragraph (b)(6) of this section, the peak emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.

(3) For transmitters operating in the 5.47-5.725 GHz band: all emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of -27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of -27 dBm/MHz.

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9.2 Measurement Procedure:

Ref. KDB 789033 D02 General UNII Test Procedure New Rules v01

For the non-restricted band edge testing the relevant portions of section II.G.3 and II.G.5 of the mentioned KDB has been applied.

For the restricted band edge testing the relevant portions of section II.G.3 and II.G.5 and G6 of the mentioned KDB has been applied, as appropriate.

9.3 Test Conditions:

Tnom: 20 °C; Vnom: 3.7V

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9.4 Test Data:

Since restricted band edge tests have been performed conducted the readings shown in the plots are adjusted by the duty cycle correction factor (average readings only) and the declared antenna gain for comparison with the dBm value of the restricted band limits for 3m distance (peak = 74dBμV/m relatives to -21.2 dBm; average = 54dBμV/m relatives to -41.2 dBm), as shown below.

9.4.1 U-NII-1 lower band edge

Frequency range: 5150 MHz – 5250 MHz Modulation: MCS0 Test Channel: 42/38/36										
Lower Band Edge Into Restricted Band										
Channel Bandwidth (MHz)	Target Power/ Key value	Test Frequency (MHz)	Detector	Emission level Peak/Average (dBm)	Cable Loss/ ext. attenuator (dB)	Duty Cycle C F (dB)	Antenna Gain (dBi)	Calculated Emission Level (dBm)	Limit Peak/Average (dBm)	Margin (dB)
80	13/130	5149.5	Pk	-40.94	Compensated in SA	0	4.5	-36.44	-21.2	15.24
80	13/130	5149.5	Avg	-53.41	Compensated in SA	1.5	4.5	-47.41	-41.2	6.21
40	13/130	5149.5	Pk	-46.4	Compensated in SA	0	4.5	-41.9	-21.2	20.7
40	13/130	5149.5	Avg	-55.6	Compensated in SA	0.8	4.5	-50.3	-41.2	9.1
20	13/130	5149.5	Pk	-54.9	Compensated in SA	0	4.5	-50.4	-21.2	29.2
20	13/130	5149.5	Avg	-65.2	Compensated in SA	0.2	4.5	-60.5	-41.2	19.3

9.4.2 U-NII-2A upper band edge

Frequency range: 5250 MHz – 5350 MHz Modulation: MCS0 Test Channel: 58/62/64										
Upper Band Edge Into Restricted Band										
Channel Bandwidth (MHz)	Target Power/ Key value	Test Frequency (MHz)	Detector	Emission level Peak/Average (dBm)	Cable Loss/ ext. attenuator (dB)	Duty Cycle C F (dB)	Antenna Gain (dBi)	Calculated Emission Level (dBm)	Limit Peak/Average (dBm)	Margin (dB)
80	13/130	5350.5	Pk	-43.10	Compensated in SA	0	5.0	-38.1	-21.2	16.9
80	13/130	5350.5	Avg	-54.20	Compensated in SA	1.5	5.0	-47.7	-41.2	6.5
40	13/130	5350.5	Pk	-46.0	Compensated in SA	0	5.0	-41	-21.2	19.8
40	13/130	5350.5	Avg	-55.4	Compensated in SA	0.8	5.0	-49.6	-41.2	8.4
20	13/130	5350.5	Pk	-53.7	Compensated in SA	0	5.0	-48.7	-21.2	27.5
20	13/130	5350.5	Avg	-65.3	Compensated in SA	0.2	5.0	-60.1	-41.2	18.9

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9.4.3 U-NII-2C lower band edge

Frequency range: 5470 MHz – 5725 MHz Modulation: MCS0 Test Channel: 106/102/100										
Lower Band Edge Into Restricted Band										
Channel Bandwidth (MHz)	Target Power/Key value	Test Frequency (MHz)	Detector	Emission level Peak/Average (dBm)	Cable Loss/ext. attenuator (dB)	Duty Cycle C F (dB)	Antenna Gain (dBi)	Calculated Emission Level (dBm)	Limit Peak/Average (dBm)	Margin (dB)
80	13/130	5469.5	Pk	-40.65	Compensated in SA	0	4.0	-36.65	-21.2	15.45
80	13/130	5469.5	Avg	-50.37	Compensated in SA	1.5	4.0	-44.87	-41.2	3.67
40	13/130	5469.5	Pk	-40.6	Compensated in SA	0	4.0	-36.6	-21.2	15.4
40	13/130	5469.5	Avg	-50.3	Compensated in SA	0.8	4.0	-45.5	-41.2	4.3
20	13/130	5469.5	Pk	-52.4	Compensated in SA	0	4.0	-48.4	-21.2	27.2
20	13/130	5469.5	Avg	-63.2	Compensated in SA	0.2	4.0	-59	-41.2	17.8

9.4.4 U-NII-2C upper band edge

The band edge channels 138, 142 and 144 are not supported Channel 140 (20MHz) has been tested as worst case

Frequency range: 5470 MHz – 5725 MHz Modulation: MCS0 Test Channel: 140										
Lower Band Edge Into Non Restricted Band										
Channel Bandwidth (MHz)	Target Power/Key value	Test Frequency (MHz)	Detector	Emission level Peak/Average (dBm)	Cable Loss/ext. attenuator (dB)	Duty Cycle C F (dB)	Antenna Gain (dBi)	Calculated Emission Level (dBm)	Limit Average (dBm)	Margin (dB)
20	13/130	5725.5	Pk	-43.61	Compensated in SA	0	4.0	-39.61	-27.0	12.61

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9.4.5 U-NII-3 lower band edge

Frequency range: 5725 MHz – 5850 MHz Modulation: MCS0 Test Channel: 155/151/149 Lower Band Edge Into Non Restricted Band										
Channel Bandwidth (MHz)	Target Power/ Key value	Test Frequency (MHz)	Detector	Emission level Peak/Average (dBm)	Cable Loss/ ext. attenuator (dB)	Duty Cycle C F (dB)	Antenna Gain (dBi)	Calculated Emission Level (dBm)	Limit Average (dBm)	Margin (dB)
80	13/130	5724.5	Pk	-38.07	Compensated in SA	0	3.0	-35.07	-17.0	18.07
40	13/130	5724.5	Pk	-58.6	Compensated in SA	0	3.0	-55.6	-17.0	38.6
20	13/130	5724.5	Pk	-41.3	Compensated in SA	0	3.0	-38.3	-17.0	21.3

9.4.6 U-NII-3 upper band edge

Frequency range: 5725 MHz – 5850 MHz Modulation: MCS0 Test Channel: 155/159/165 Upper Band Edge Into Non Restricted Band										
Channel Bandwidth (MHz)	Target Power/ Key value	Test Frequency (MHz)	Detector	Emission level Peak/Average (dBm)	Cable Loss/ ext. attenuator (dB)	Duty Cycle C F (dB)	Antenna Gain (dBi)	Calculated Emission Level (dBm)	Limit Average (dBm)	Margin (dB)
80	13/130	5850.5	Pk	-39.7	Compensated in SA	0	3.0	-36.7	-17.0	19.7
40	13/130	5850.5	Pk	-56.7	Compensated in SA	0	3.0	-53.7	-17.0	36.7
20	13/130	5850.5	Pk	-49.2	Compensated in SA	0	3.0	-46.2	-17.0	29.2

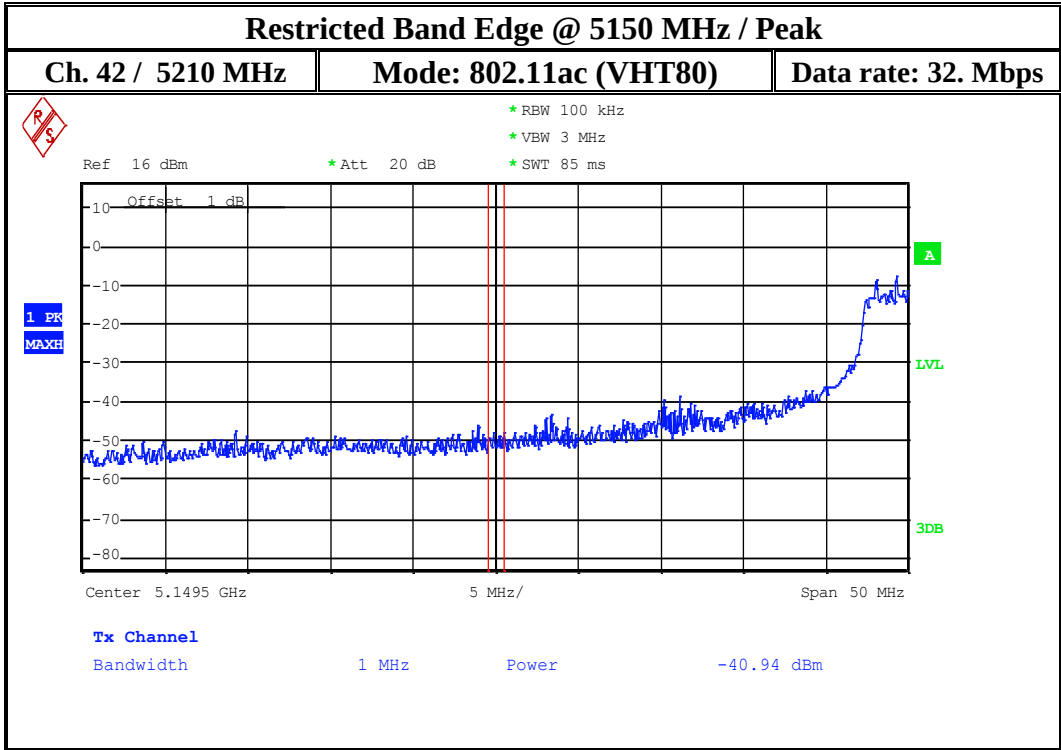
9.5 Verdict:

Pass

Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	CETECOM TESTING & MEASUREMENTS
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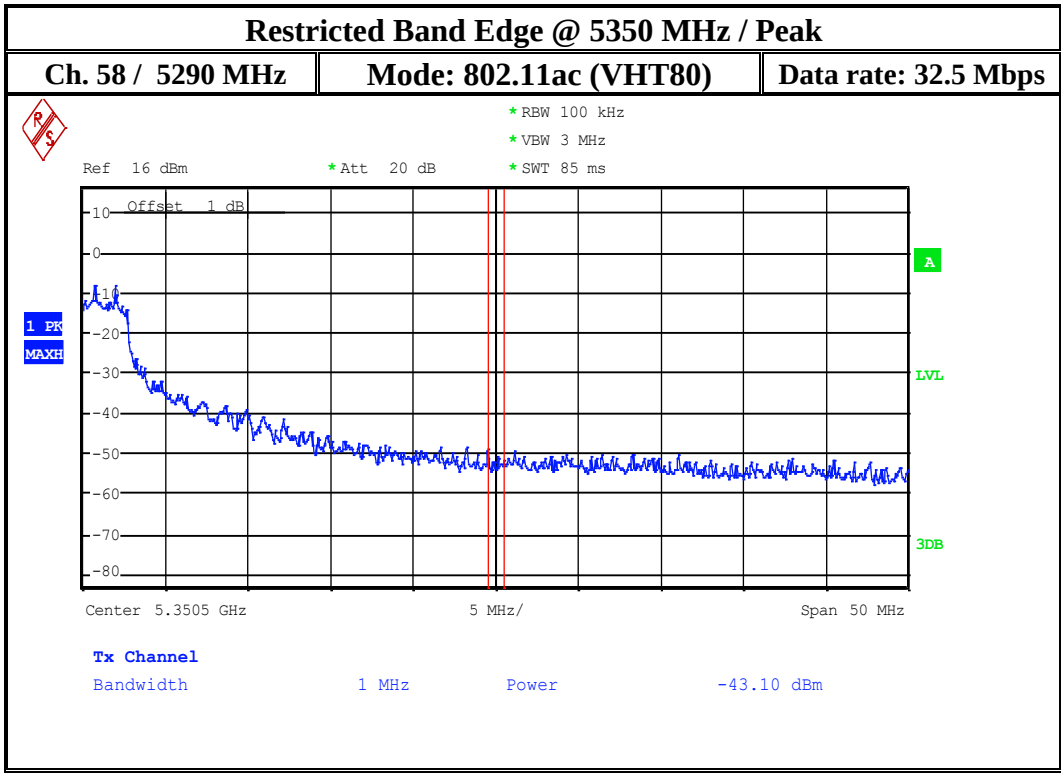
9.6 Measurement plots 80MHz:

9.6.1 U-NII-1-low-pk



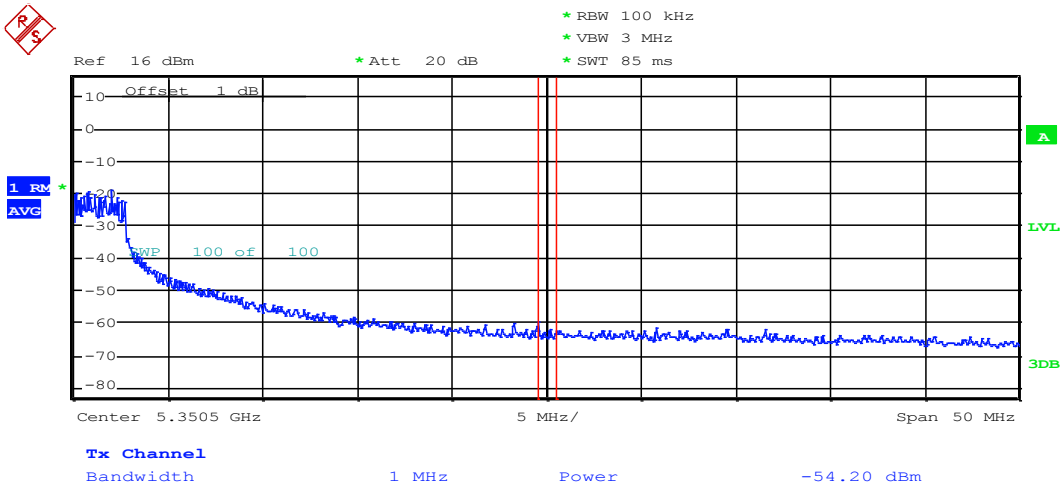
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9.6.3 U-NII-2A-high-pk



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9.6.4 U-NII-2A-high-avg

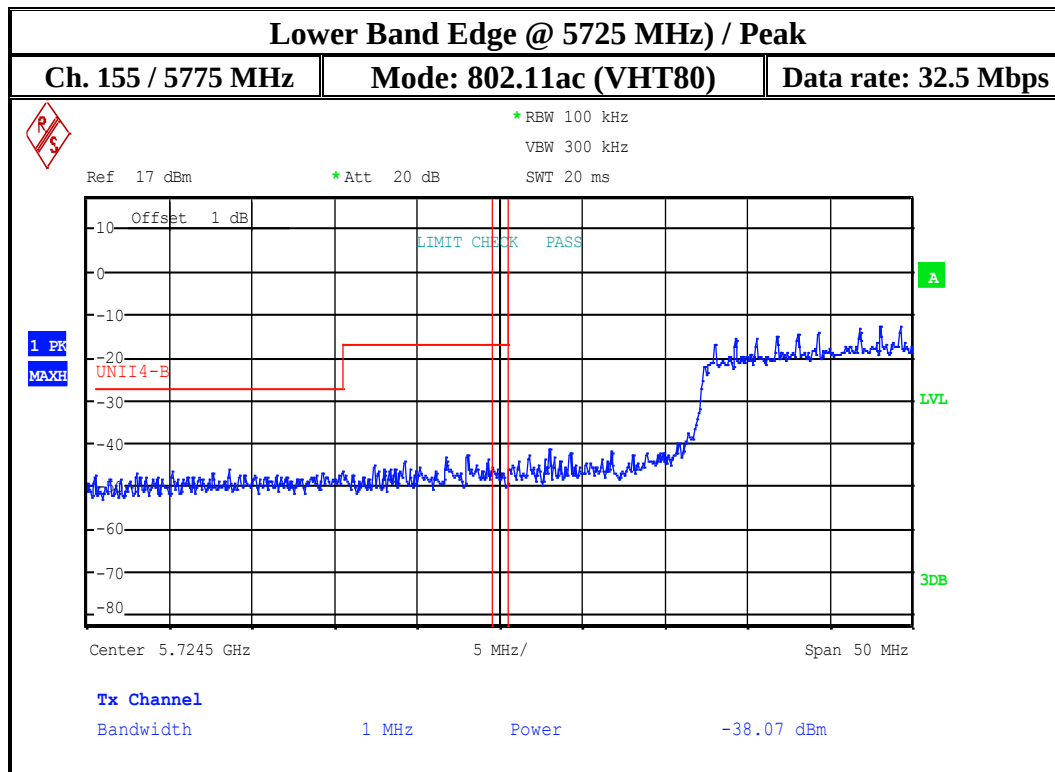


low

Date: 30.JAN.2015 16:28:56

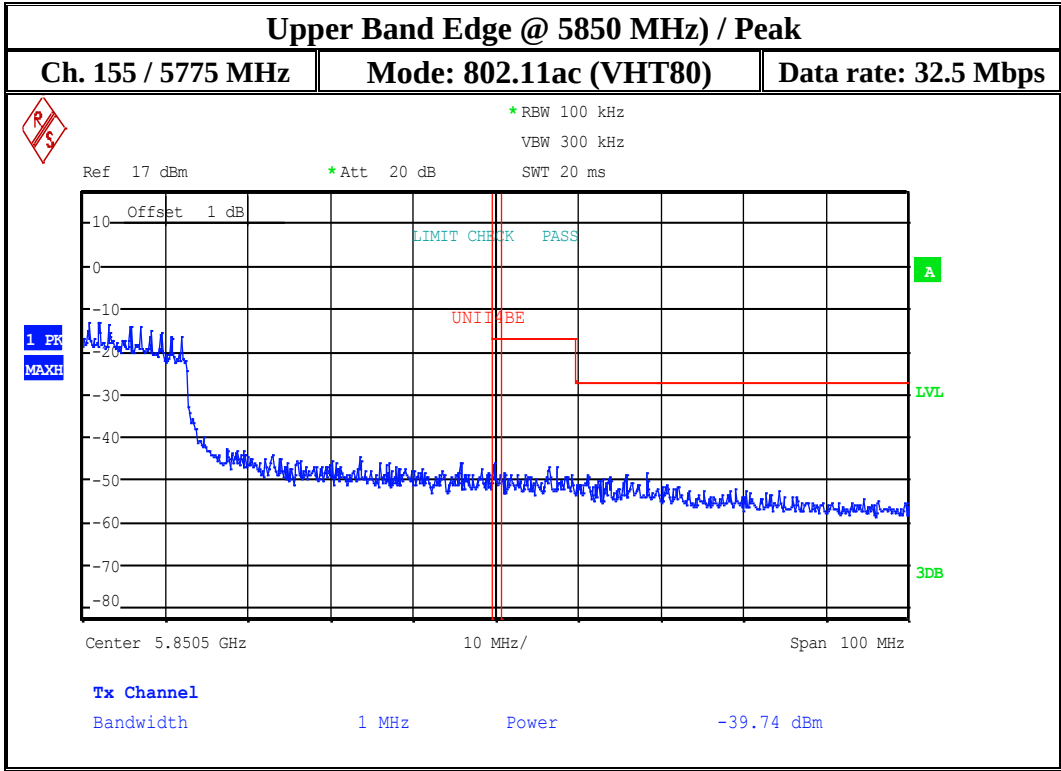
Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	CETECOM TESTING & MEASUREMENTS
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9.6.7 U-NII-3-low-pk



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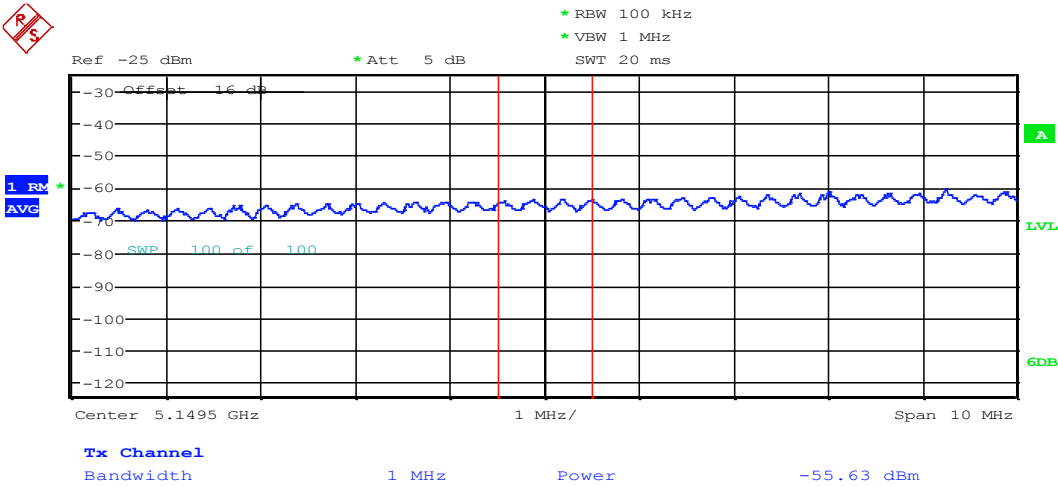
9.6.8 U-NII-3-high-pk



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9.7 Measurement plots 40MHz:

9.7.1 UNII-1-low-avg

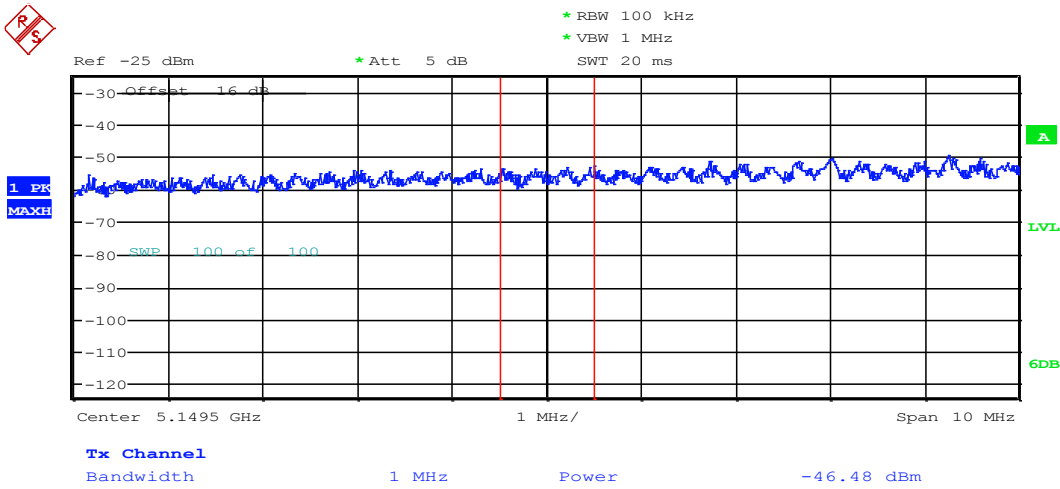


low

Date: 5.FEB.2015 14:50:28

Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	CETECOM RF & EMC Test Equipment
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9.7.2 UNII-1-low-pk

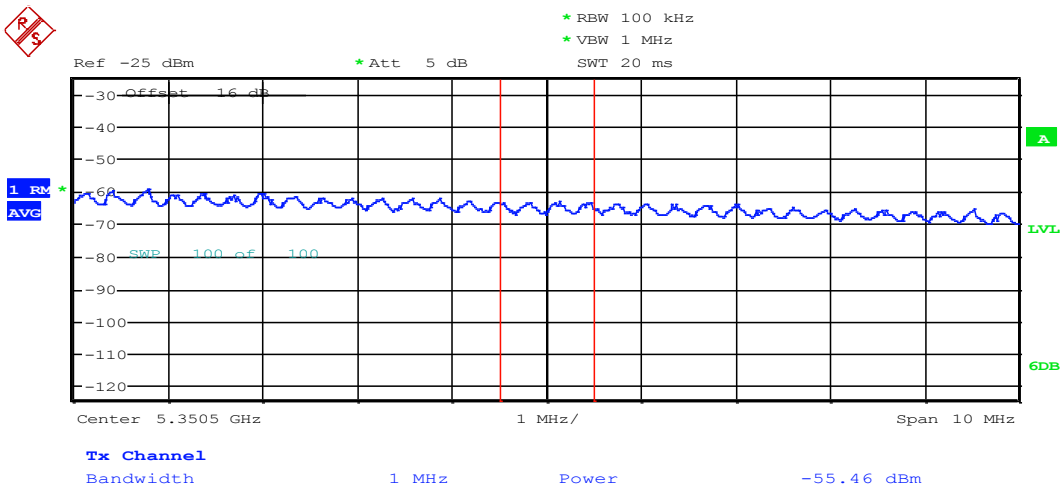


low

Date: 5.FEB.2015 14:51:35

Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	
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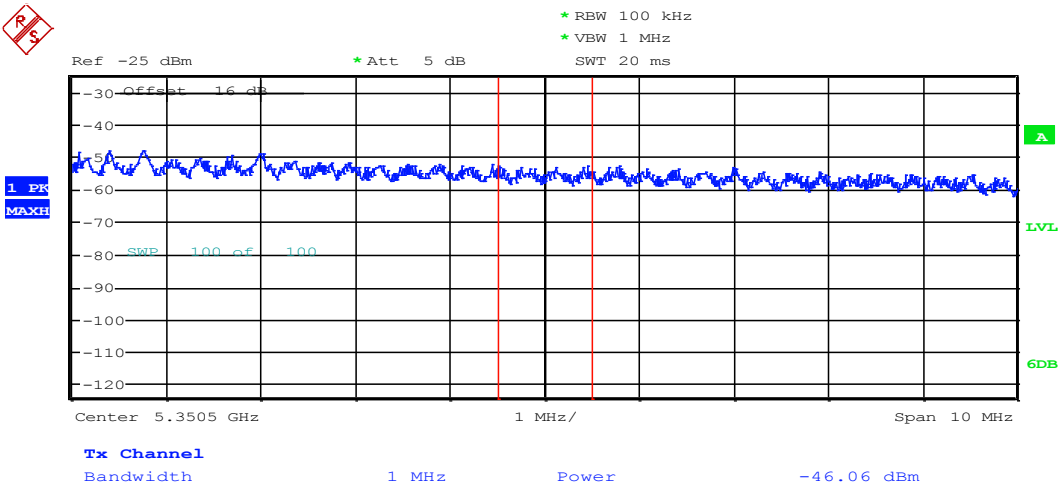
9.7.3 UNII-2A-high-avg



low
Date: 5.FEB.2015 14:55:03

Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	
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9.7.4 UNII-2A-high-pk

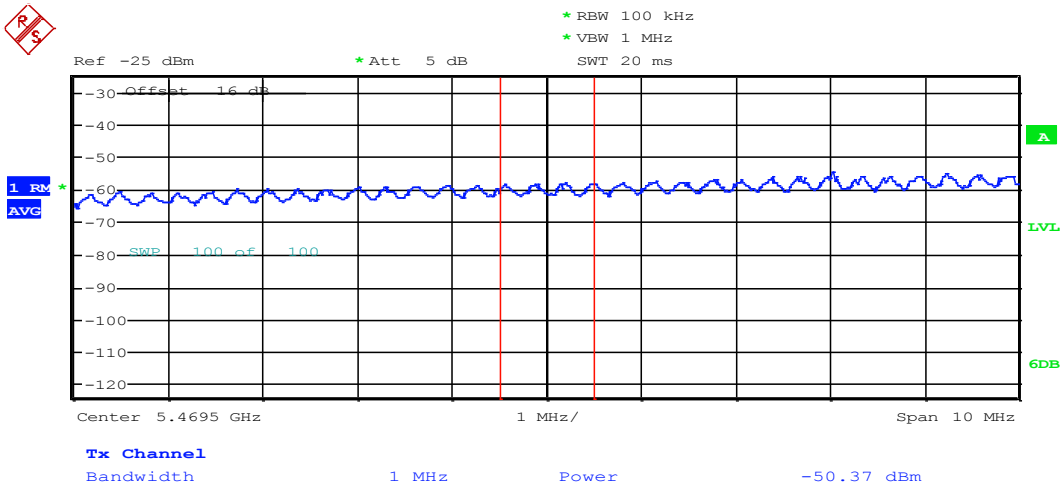


low

Date: 5.FEB.2015 14:53:58

Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	
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9.7.5 UNII-2C-low-avg

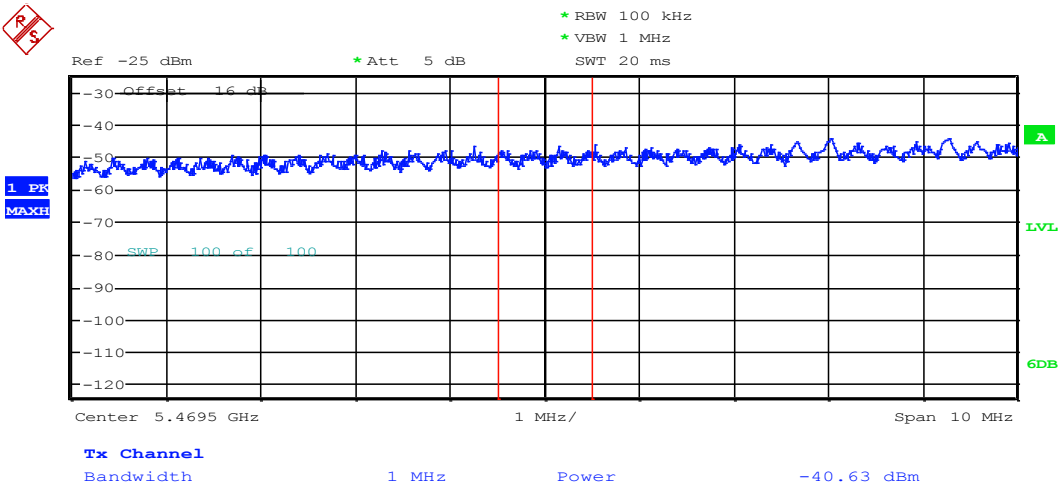


low

Date: 5.FEB.2015 14:55:56

Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	
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9.7.6 UNII-2C-low-pk

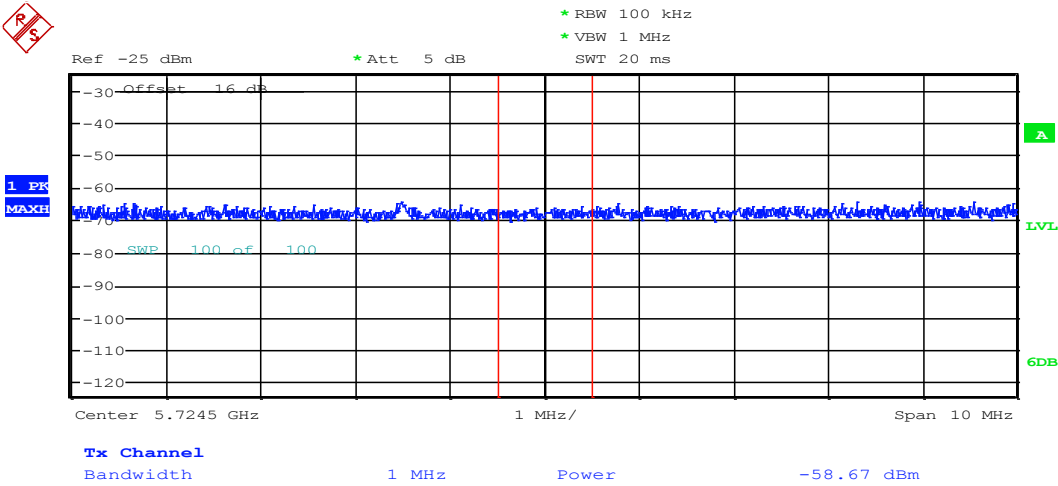


low

Date: 5.FEB.2015 15:17:25

Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	
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9.7.7 UNII-3-low-pk

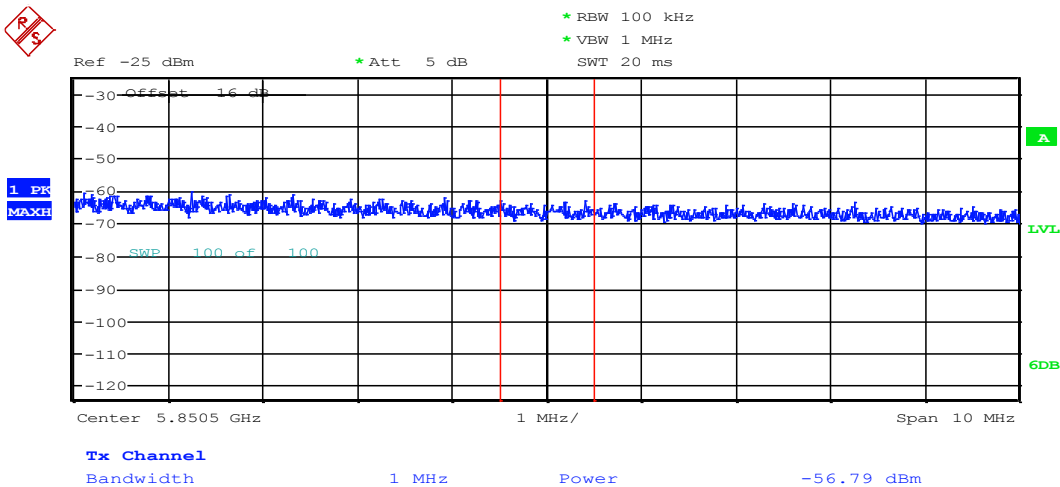


low

Date: 5.FEB.2015 15:07:07

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9.7.8 UNII-3-high-pk



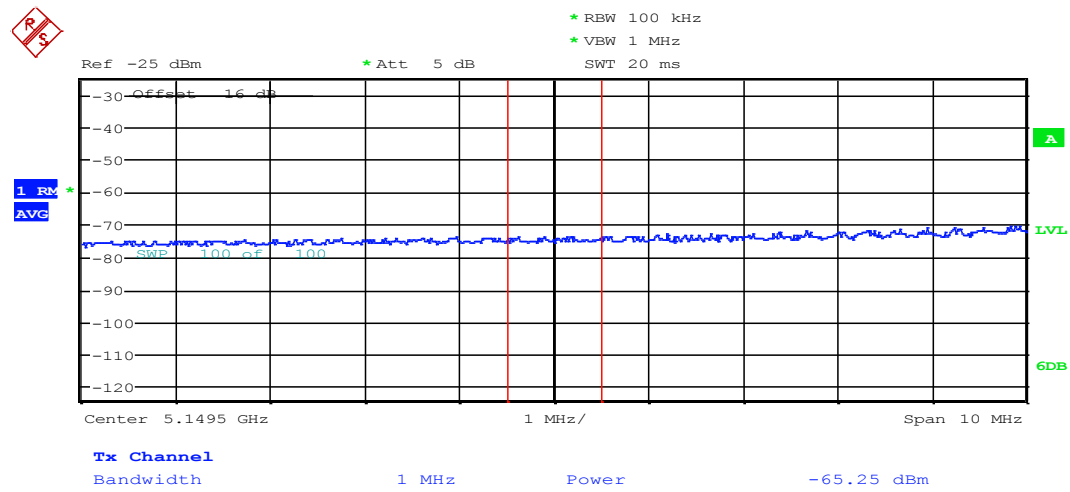
low

Date: 5.FEB.2015 15:07:32

Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	
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9.8 Measurement plots 20MHz:

9.8.1 UNII-1-low-avg

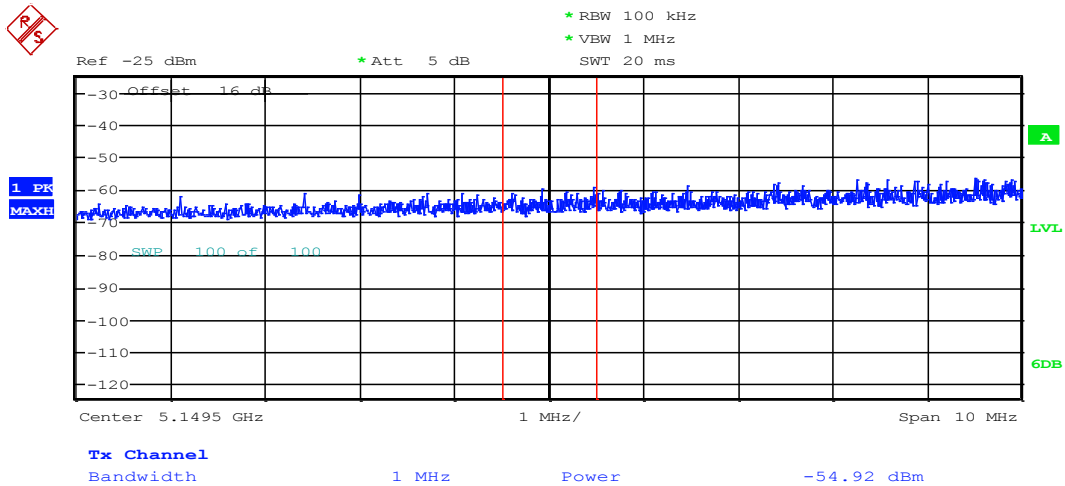


low

Date: 5.FEB.2015 15:28:15

Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	
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9.8.2 UNII-1-low-pk

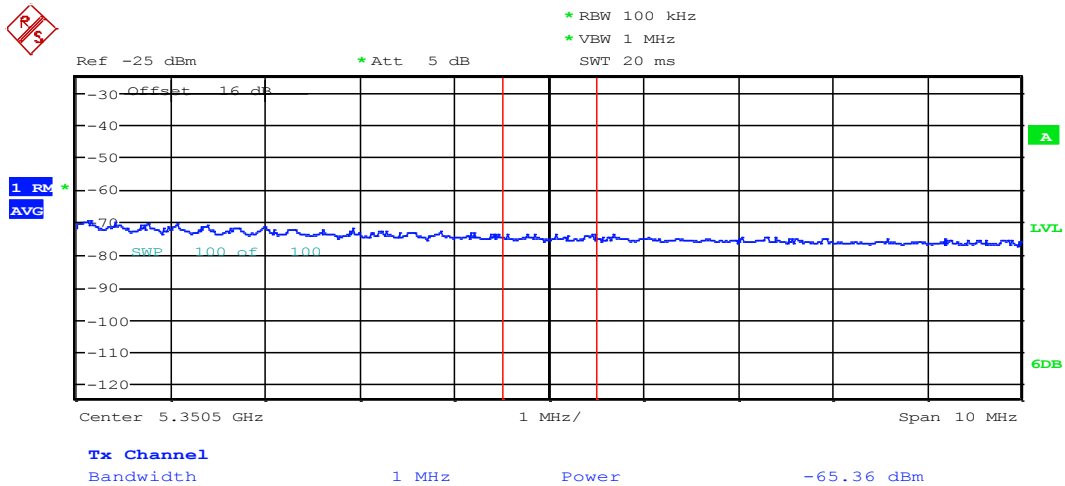


low

Date: 5.FEB.2015 15:26:57

Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	
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9.8.3 UNII-2A-high-avg

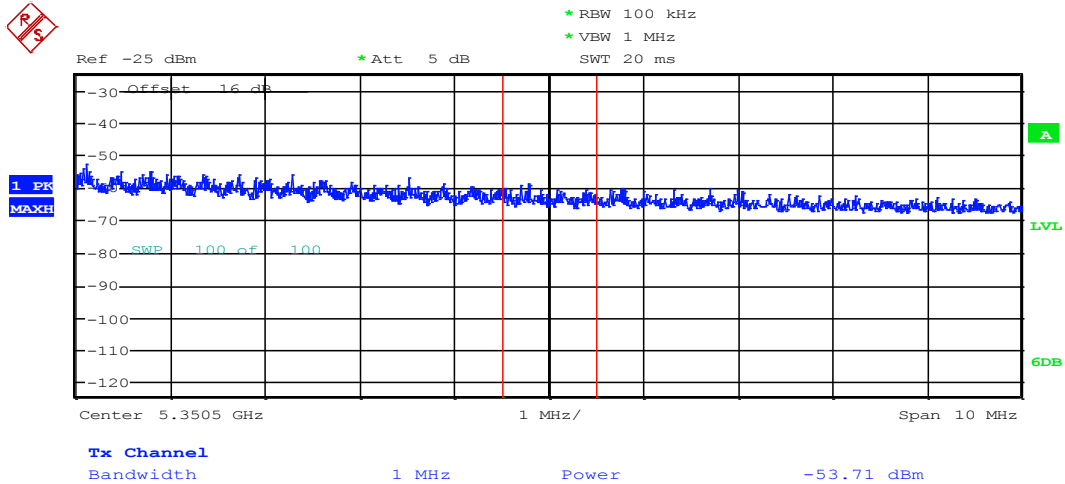


low

Date: 5.FEB.2015 15:29:48

Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	
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9.8.4 UNII-2A-high-pk

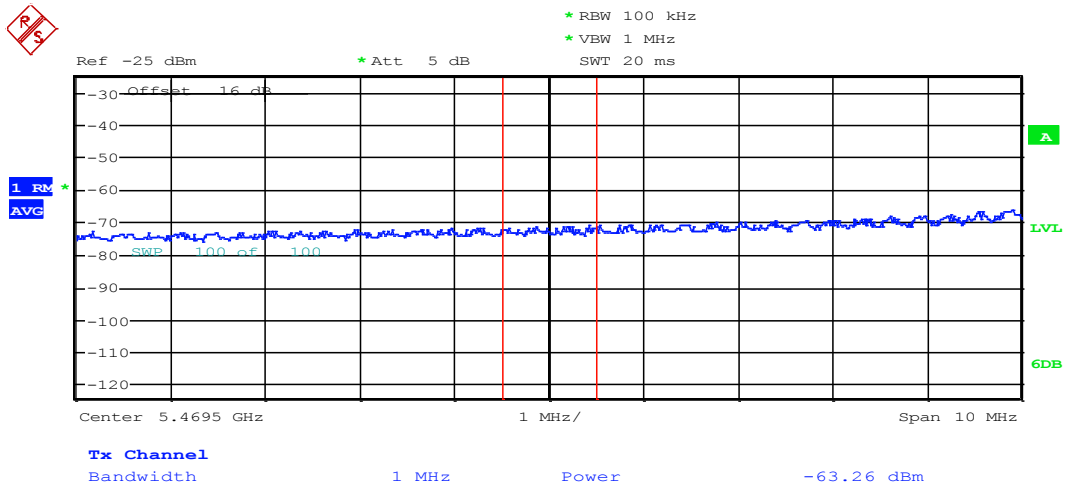


low

Date: 5.FEB.2015 15:32:15

Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	
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9.8.5 UNII-2C-low-avg

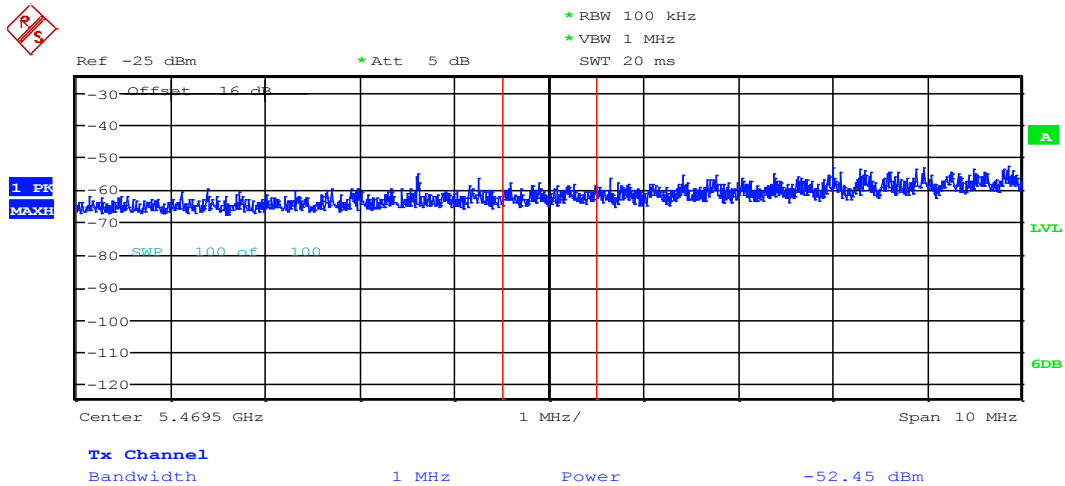


low

Date: 5.FEB.2015 15:35:17

Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	
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9.8.6 UNII-2C-low-pk

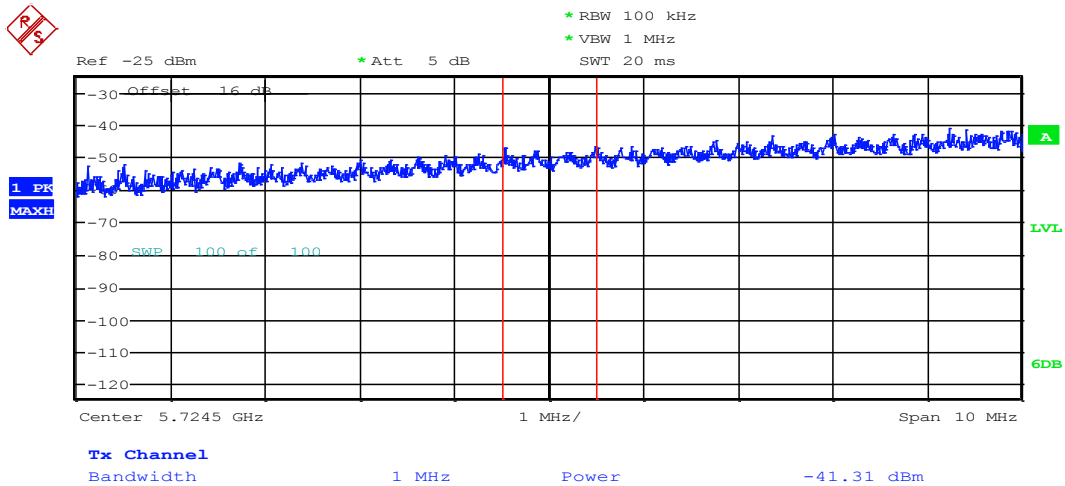


low

Date: 5.FEB.2015 15:34:15

Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	CETECOM RF & EMC Test Equipment
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9.8.8 UNII-3-low-pk

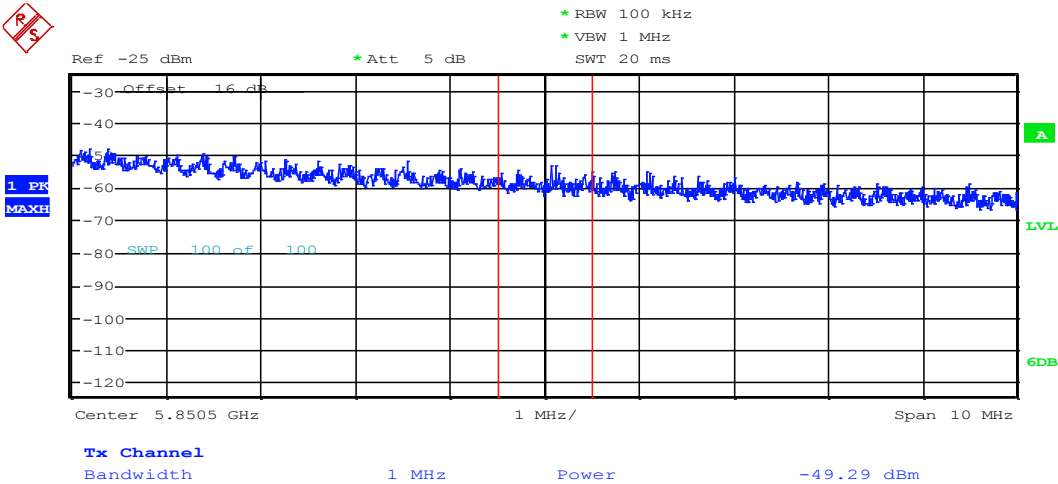


low

Date: 5.FEB.2015 15:39:24

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9.8.9 UNII-3-high-pk



low

Date: 5.FEB.2015 15:38:14

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10 Emission Bandwidths (6dB, 26 dB) & 99% Occupied Bandwidth

The emission bandwidth (x dB) is defined as frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal.

The 99% occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.

10.1 Limits:

§15.407 (e): Within the 5725–5850 MHz bands, the minimum 6 dB bandwidth of the U-NII devices shall be at least 500 kHz.

RSS-Gen 6.6

When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as 99% emissions bandwidth, as calculated or measured.

10.2 Test Conditions:

Tnom: 21 °C; Vnom: 3.7V

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10.3 Measurement procedure:

Emission Bandwidth & 99% OBW

For U-NII-1, U-NII-2A and U-NII-2C

Ref. KDB 789033 D02 General UNII Test Procedure New Rules v01 section II C 1

Spectrum Analyzer settings:

Center Frequency = Test frequency

Span= 2 to 5 x the occupied BW

RBW= 1% to 5 % of the occupied BW, unless otherwise specified

VBW $\geq$ RBW, Detector: Peak- Max hold;

Sweep Time: Auto

Allow the trace to stabilize

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by **26 dB** relative to the peak level measured in the fundamental emission.

For U-NII-3

Ref. KDB 789033 D02 General UNII Test Procedure New Rules v01 section II C 2

Spectrum Analyzer settings:

Center Frequency = Test frequency

Span= 2 to 5 x the occupied BW

RBW= 100 kHz unless otherwise specified

VBW $\geq$ 3 x RBW, Detector: Peak- Max hold;

Sweep Time: Auto

Allow the trace to stabilize

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by **6 dB** relative to the peak level measured in the fundamental emission.

99% Occupied Bandwidth

For U-NII-1, U-NII-2A, U-NII-2C and U-NII-3

Ref. KDB 789033 D02 General UNII Test Procedure New Rules v01 section II D

Spectrum Analyzer settings:

Center Frequency = Test frequency

Span= 2 to 5 x the occupied BW

RBW= 1- 5 % of the occupied bandwidth

VBW $\geq$ 3 x RBW

Detector: RMS or sample where practical. Otherwise use Peak.

Allow the trace to stabilize.

Use the 99% power bandwidth function of the measuring instrument.

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10.4 Test Data:

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Emissions & Occupied Bandwidth (MHz)						
Mode	Frequency (MHz)					
	5180 Channel 36		5200 Channel 40		5240 Channel 48	
	26dB	99%	26dB	99%	26dB	99%
802.11a	NT	NT	NT	NT	NT	NT
802.11n20	22.72	17.95	23.0	17.95	22.57	17.95
	5190 Channel 38			5230 Channel 46		
	26dB	99%		26dB	99%	
802.11n40	43.76	36.40		43.68	36.4	
	5210 Channel 42					
	26dB			99%		
802.11ac80	85.76			74.88		

U-NII-2A

Emission & Occupied Bandwidth (MHz)						
Mode	Frequency (MHz)					
	5260 Channel 52		5300 Channel 60		5320 Channel 64	
	26dB	99%	26dB	99%	26dB	99%
802.11a	NT	NT	NT	NT	NT	NT
802.11n20	22.55	17.95	22.48	17.95	22.76	18.05
	5270 Channel 54			5310 Channel 62		
	26dB	99%		26dB	99%	
802.11n40	43.36	36.4		43.52	36.4	
	5290 Channel 58					
	26dB			99%		
802.11ac80	85.76			74.88		

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Emission & Occupied Bandwidth (MHz)						
Mode	Frequency (MHz)					
	5500 Channel 100		5600 Channel 120		5700 Channel 140	
	26dB	99%	26dB	99%	26dB	99%
802.11a	NT	NT	NT	NT	NT	NT
802.11n20	22.28	17.95	22.52	17.95	23.13	17.95
	5510 Channel 102			5670 Channel 134		
	26dB	99%	26dB	99%	26dB	99%
802.11n40	43.60	36.48	43.76	36.40		
	5530 Channel 106					
	26dB			99%		
802.11ac80	85.28			74.72		

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Emission & Occupied Bandwidth (MHz)						
Mode	Frequency (MHz)					
	5745 Channel 149		5785 Channel 157		5825 Channel 165	
	6dB	99%	6dB	99%	6dB	99%
802.11a	NT	NT	NT	NT	NT	NT
802.11n20	16.34	16.67	16.60	16.60	16.54	16.60
	5755 Channel 151			5795 Channel 159		
	6dB	99%	6dB	99%	6dB	99%
802.11n40	36.03	36.03	35.90	36.03		
	5775 Channel 155					
	6dB			99%		
802.11ac80	75.13			75.04		

Note: The bandwidth of 802.11a is approximately the same as 802.11n (HT20). Therefore 802.11n20 testing is sufficient to satisfy for both modes.

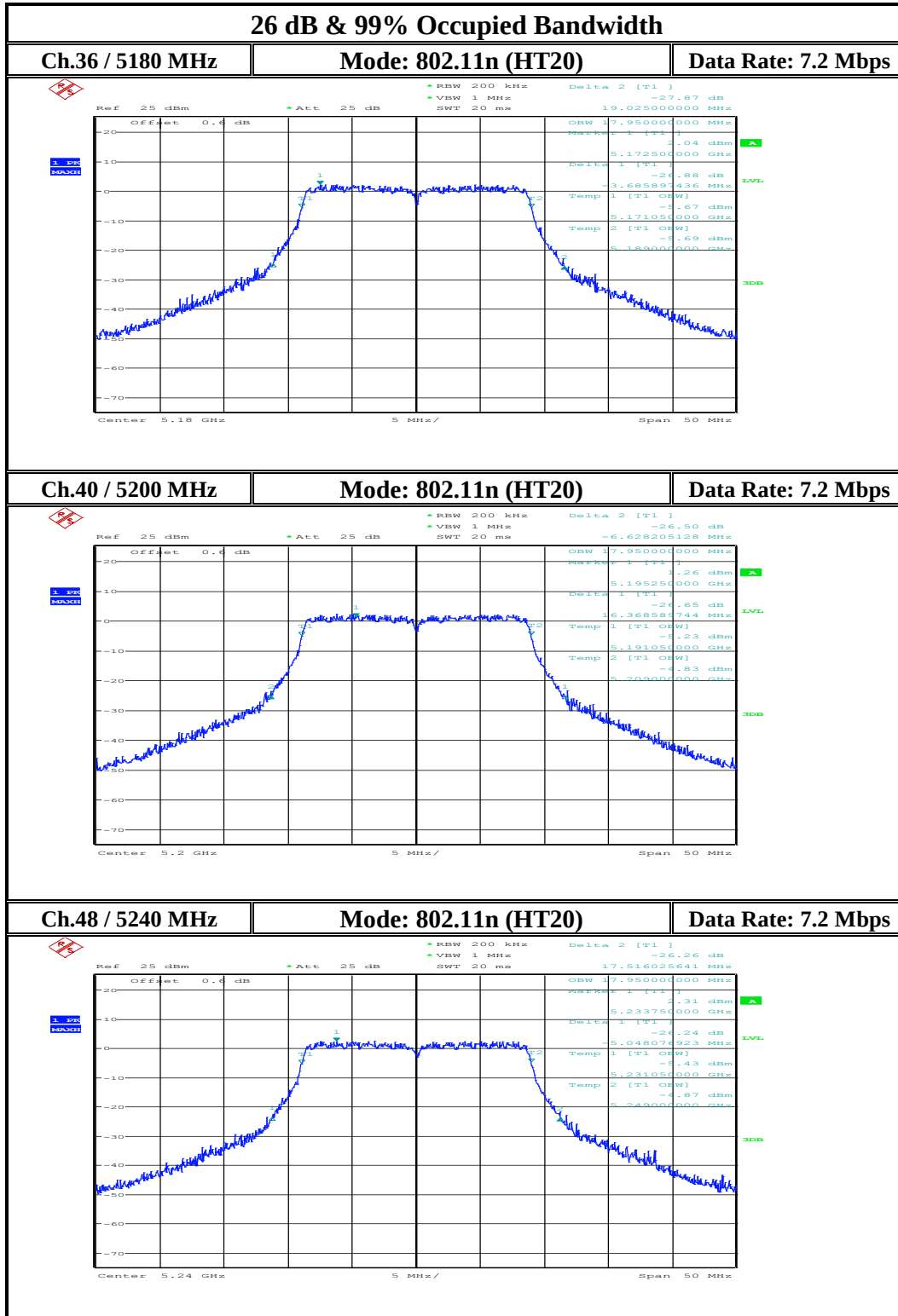
10.5 Verdict

Pass

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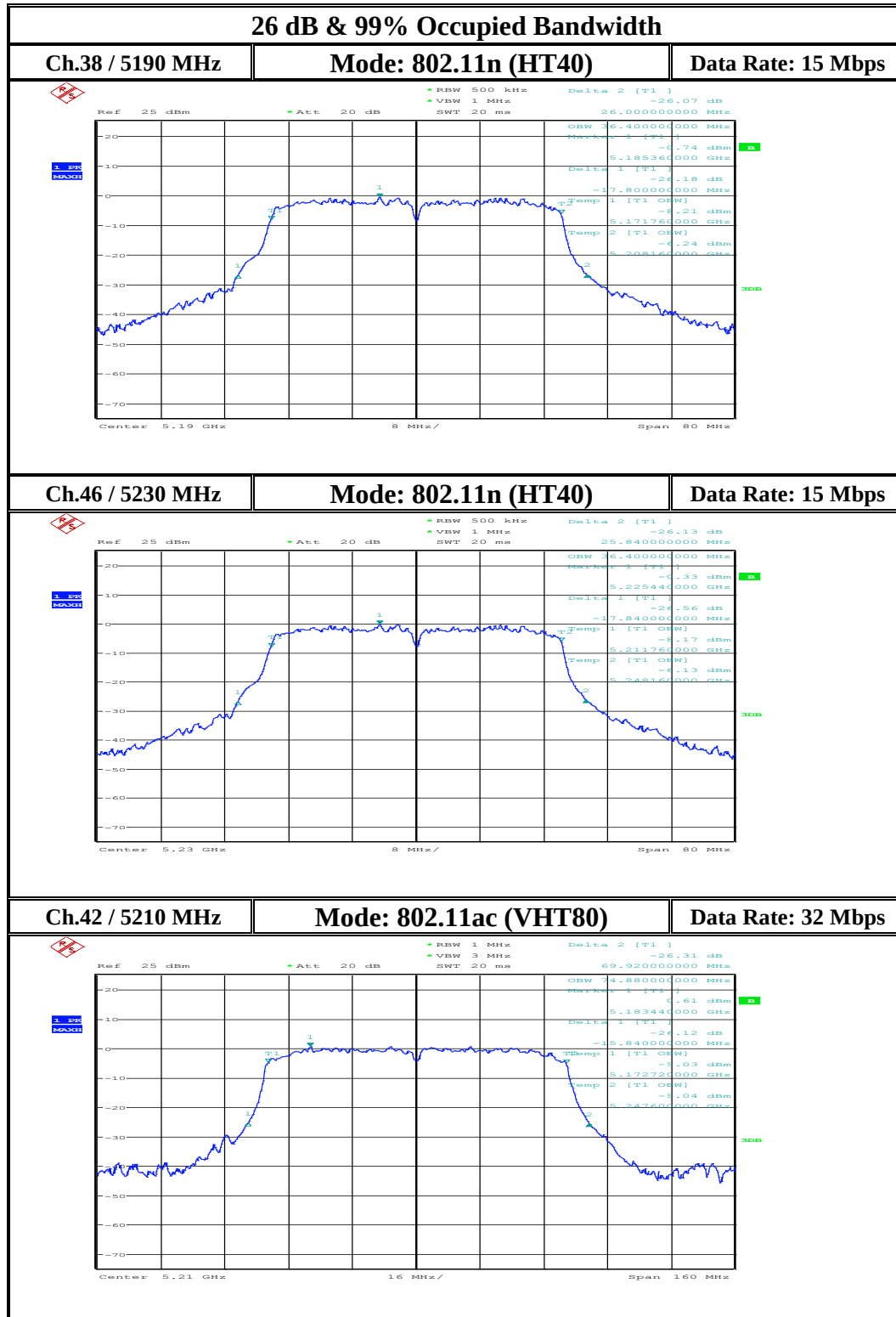
10.6 Measurement Plots

U-NII-1



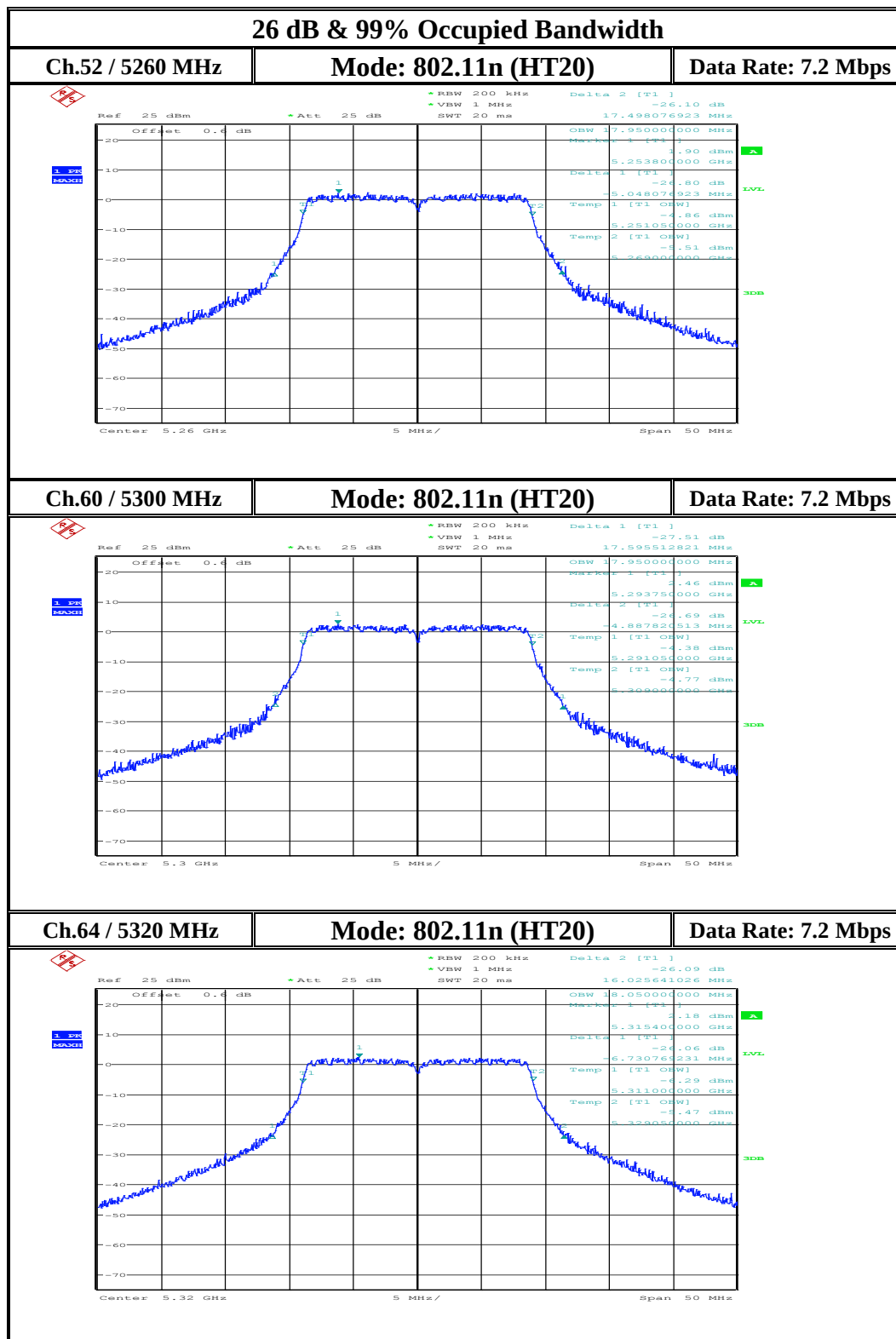
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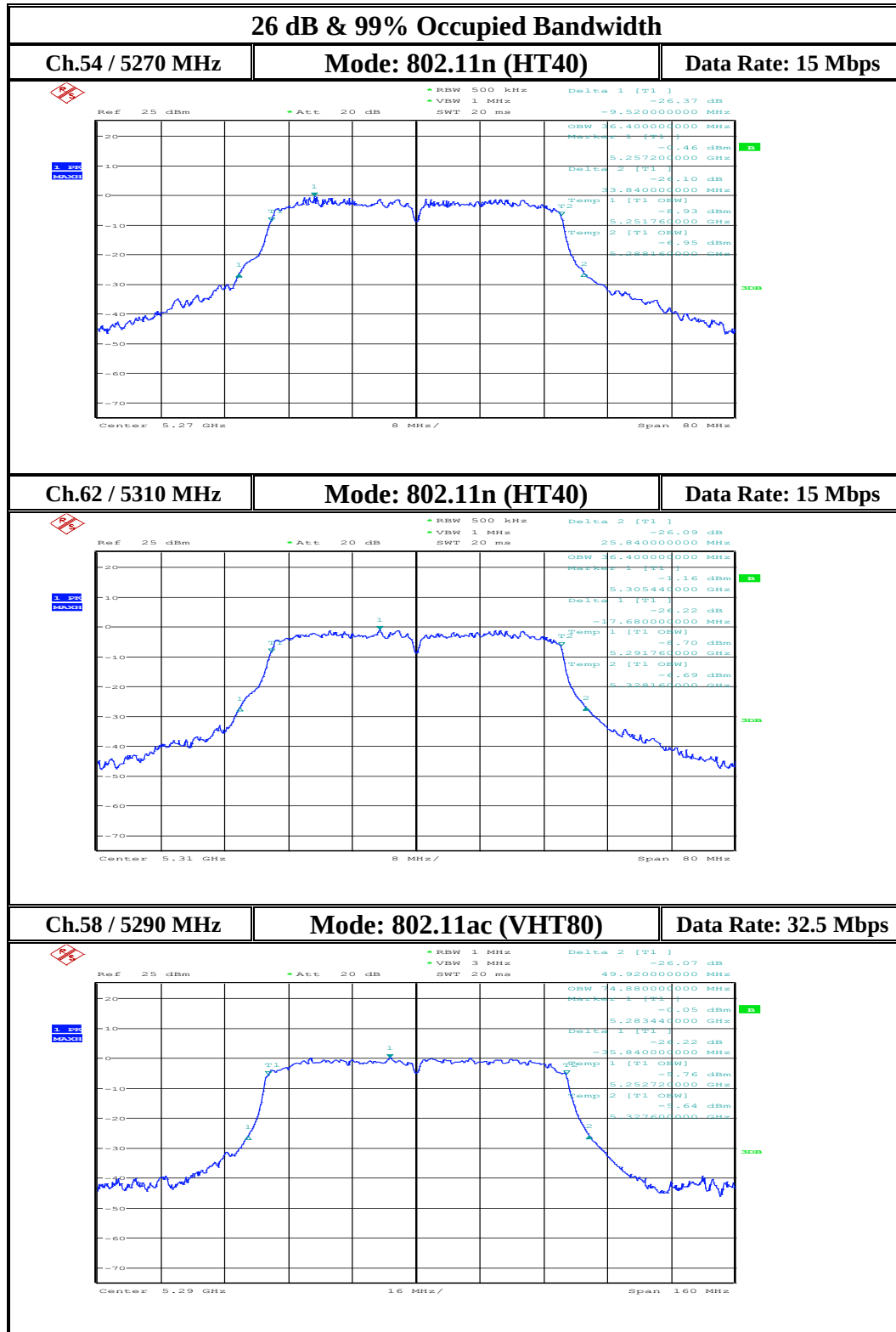
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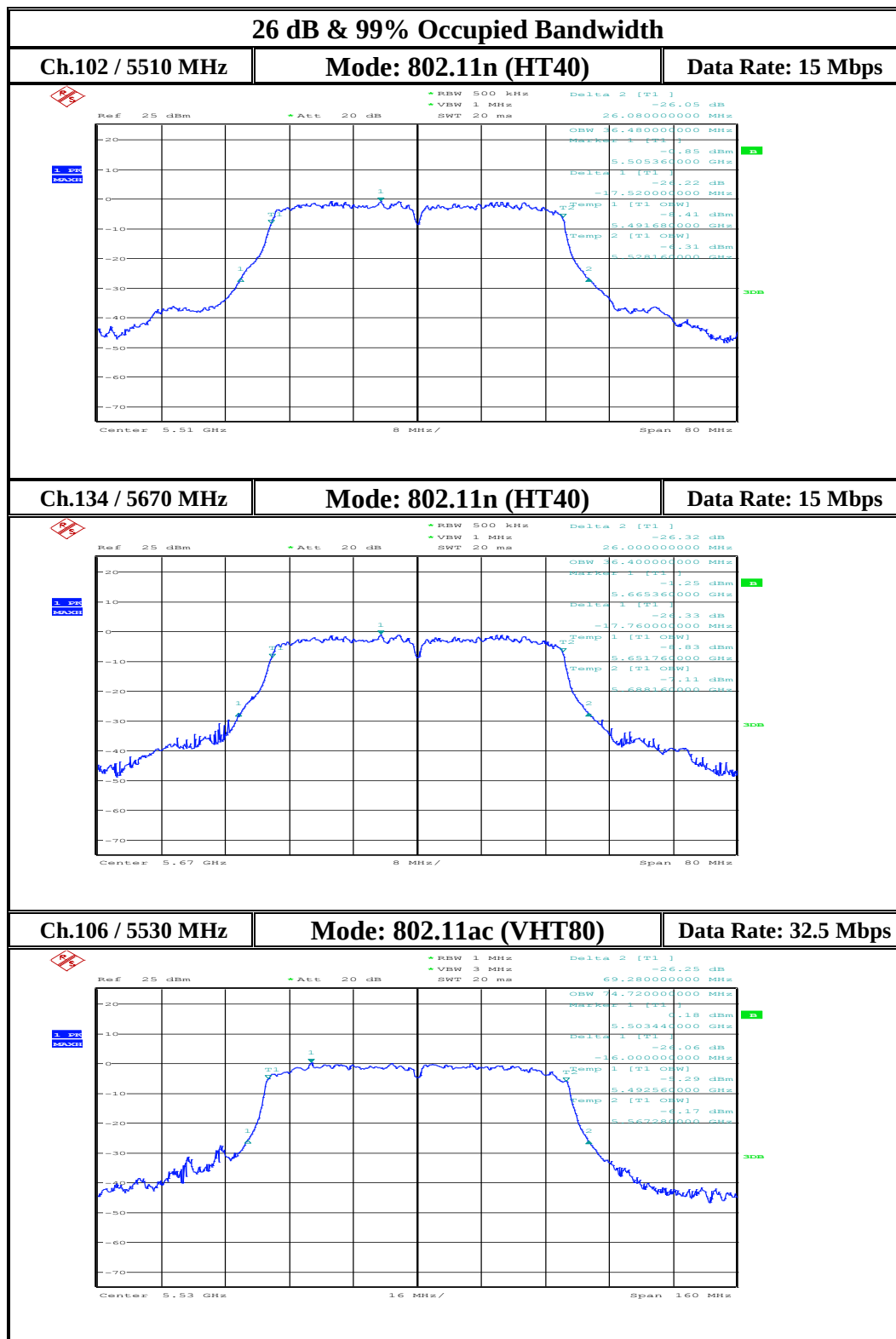
Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	
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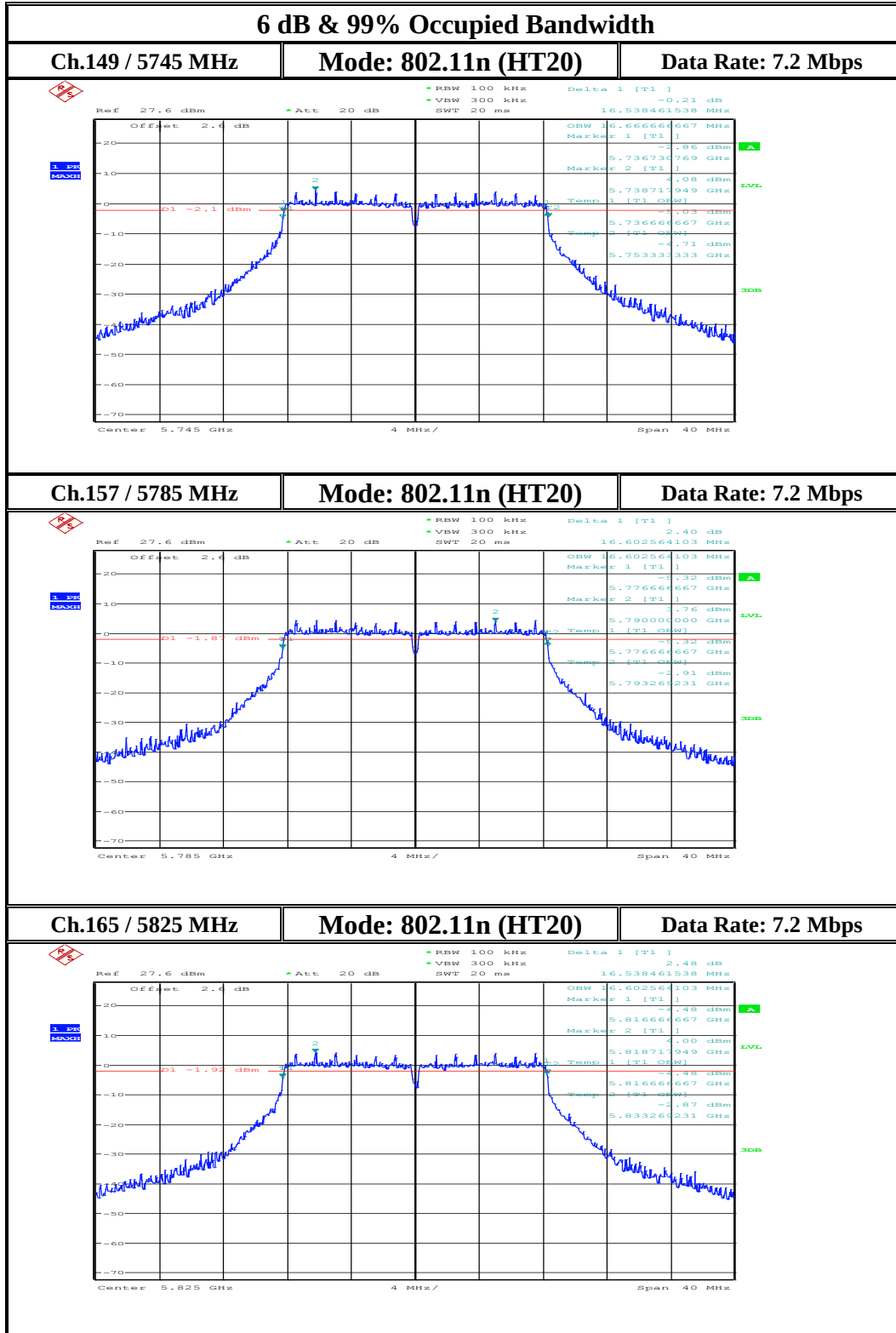
Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	CETECOM™ A Division of Honeywell
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U-NII-2C



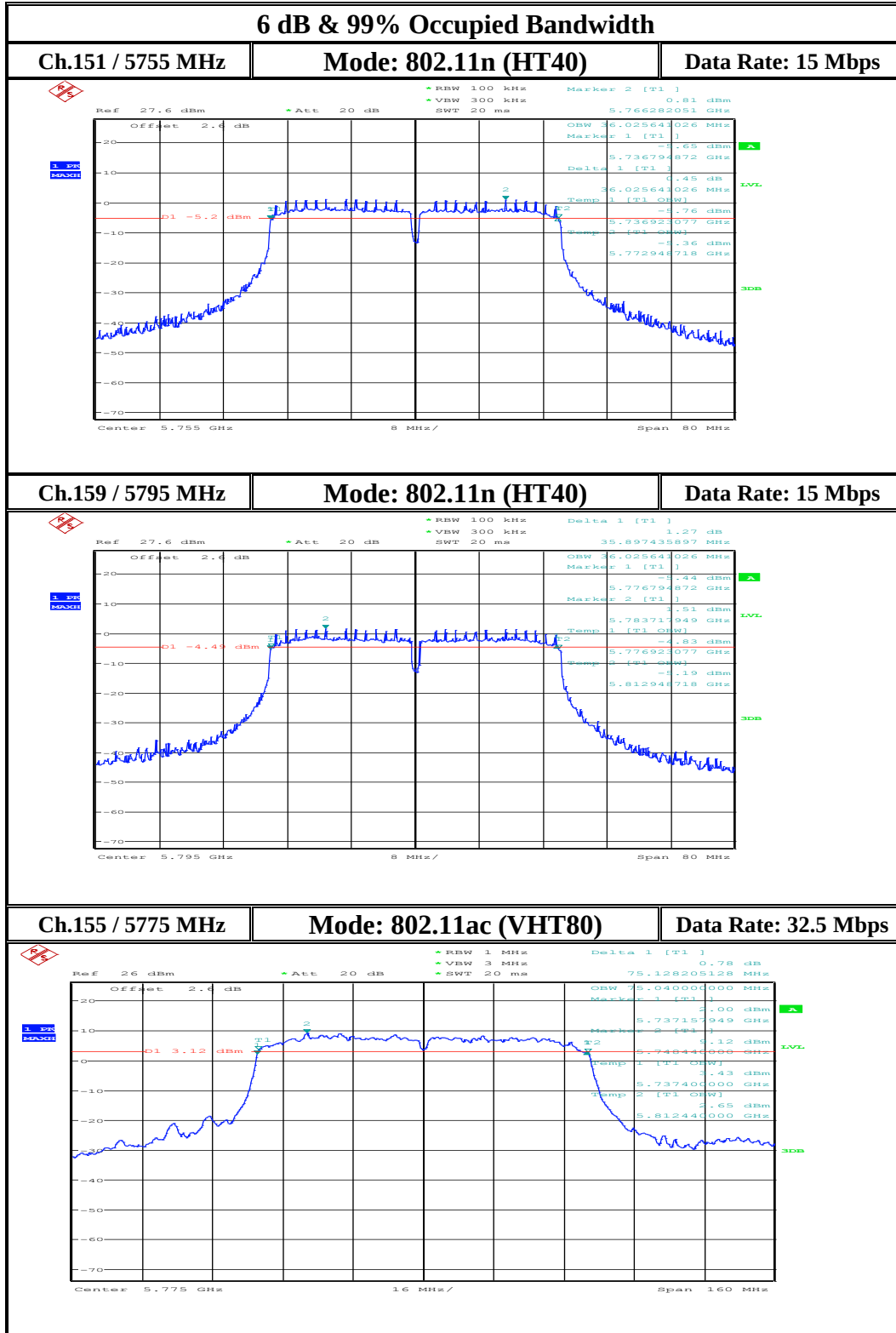
Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	CETECOM™ A Division of Honeywell
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11 Unwanted Emissions into Restricted Bands

11.1 Requirements & Limits:

§15.407 b.) (6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. (7) The provisions of §15.205 apply to intentional radiators operating under this section.

§15.205/15.209 / RSS-Gen 8.9/ 8.10

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)
13.36 - 13.41			

Table 1: Field strength limits table above 30 MHz

Frequency of emission (MHz)	Field strength (µV/m)
30–88	100 (40dBµV/m)
88–216	150 (43.5 dBµV/m)
216–960	200 (46 dBµV/m)
Above 960	500 (54 dBµV/m, average) (Peak limit: 74 dBµV/m,)

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Table 2: Field strength limits table below 30 MHz

Frequency of emission (MHz)	Field strength (μV/m)	Measurement Distance (m)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30

Note: Compliance with the restricted band limits listed above will satisfy the limits for unwanted emissions into the non-restricted bands as given in FCC part 15.407 and RSS-210, Annex 9.

11.2 Test Conditions:

Tnom: 21 °C; Vnom: 3.7V

11.3 Measurement Procedure

Measurement according to ANSI C63.10:2013 section 4 & 6
(also refer to section 6.1 in this test report)

Analyzer Settings:

From 9 KHz – 30 MHz,

RBW = 9 KHz,

Detector: Peak

From 30 MHz – 1 GHz,

Detector = Peak / Quasi-Peak,

RBW=120 KHz (<1GHz)

Above 1 GHz,

Detector = Peak / Average,

RBW= 1MHz

The operational mode 802.11n (HT20) combined with BPSK modulation at 7.2 Mbps (MCS0) produces the highest conducted output power. The operational mode 802.11ac (VHT80) produces the widest bandwidth. These two modes are determined to be the worst case modes and will be selected for final measurement.

Plots reported here represent the worst case emissions for horizontal and vertical antenna polarizations and for three orientations of the EUT.

Unless mentioned otherwise, the emissions outside the limit lines in the plots are from the transmitter fundamental signal.

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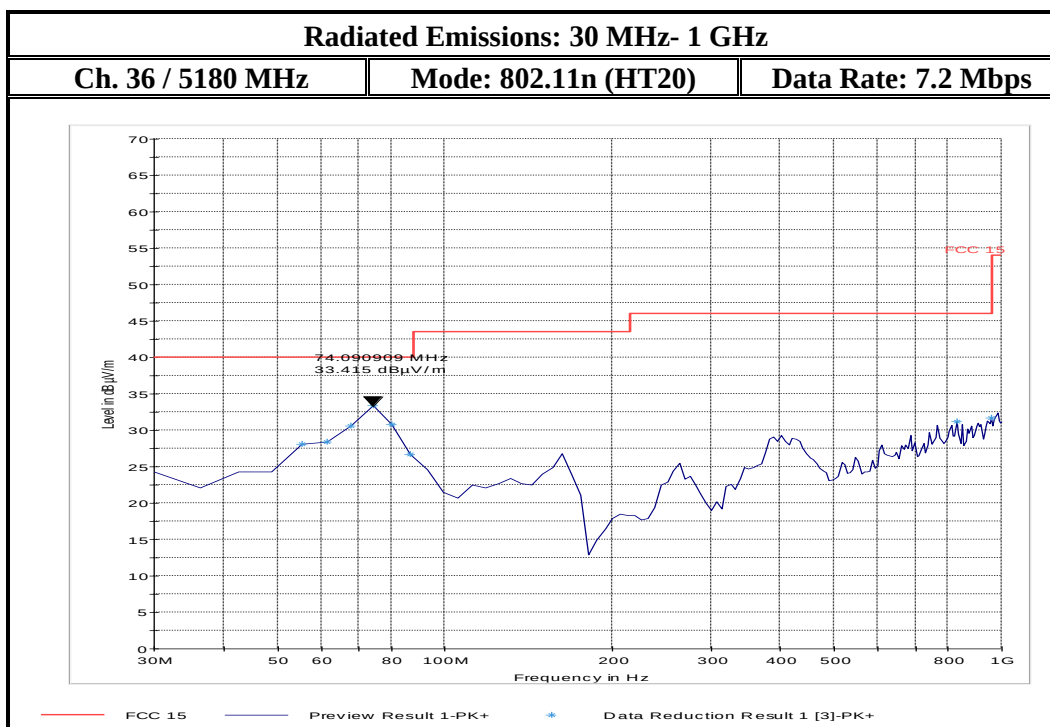
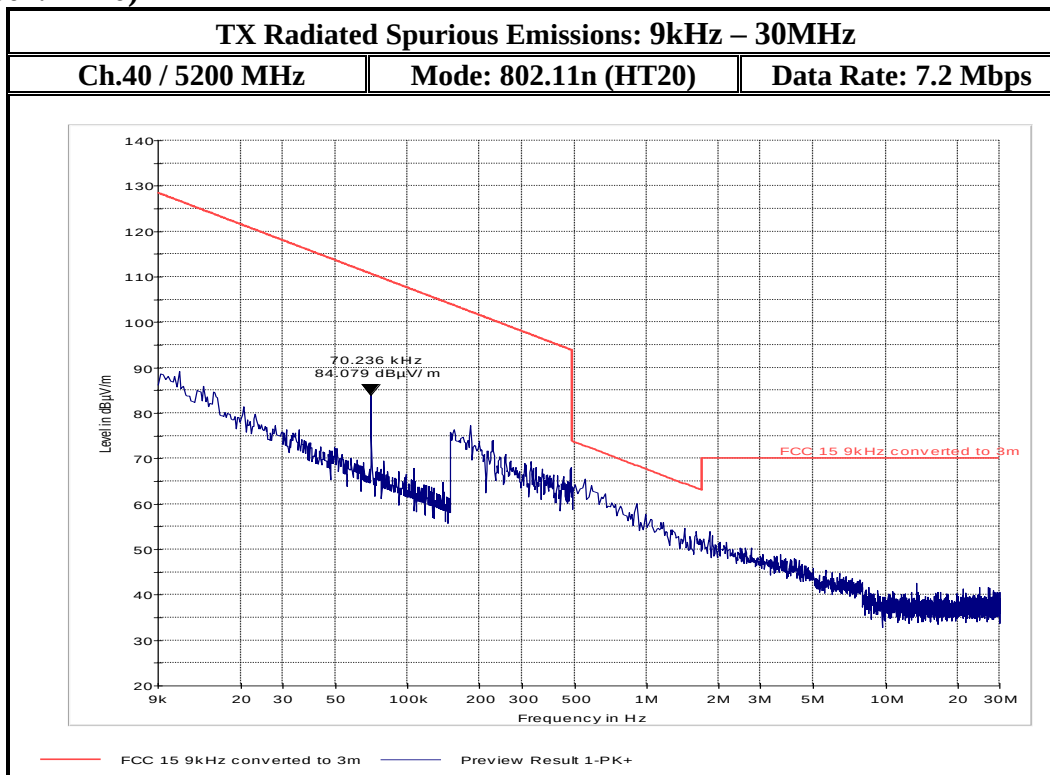
11.4 Verdict:

Pass.

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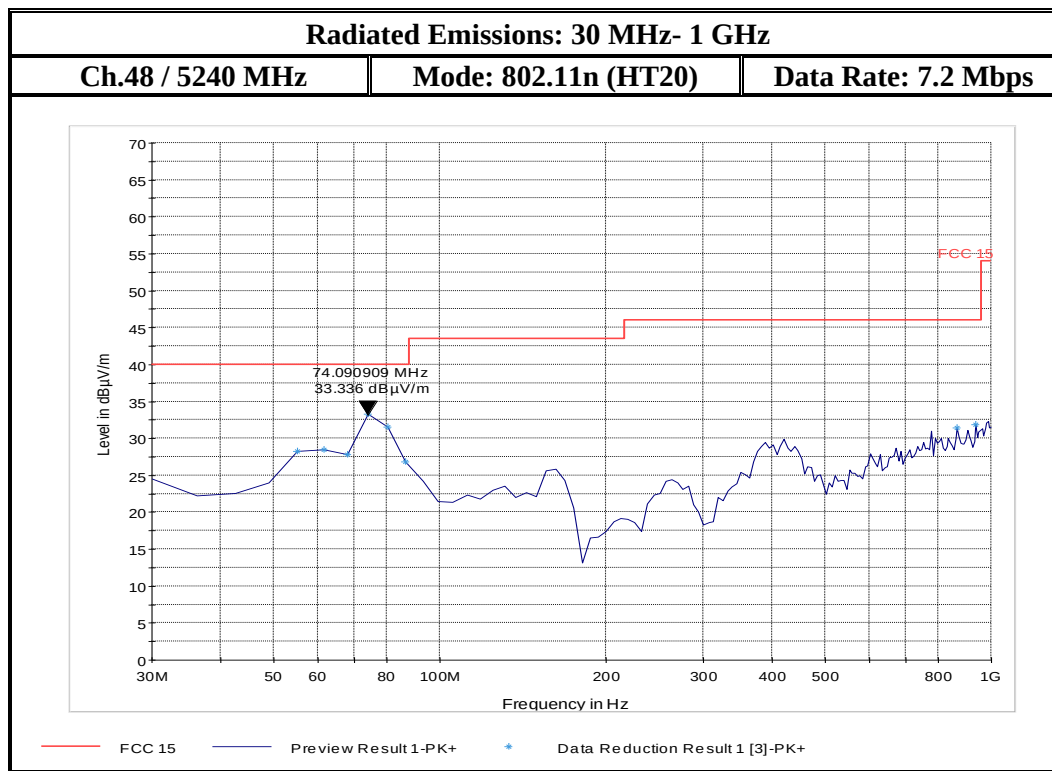
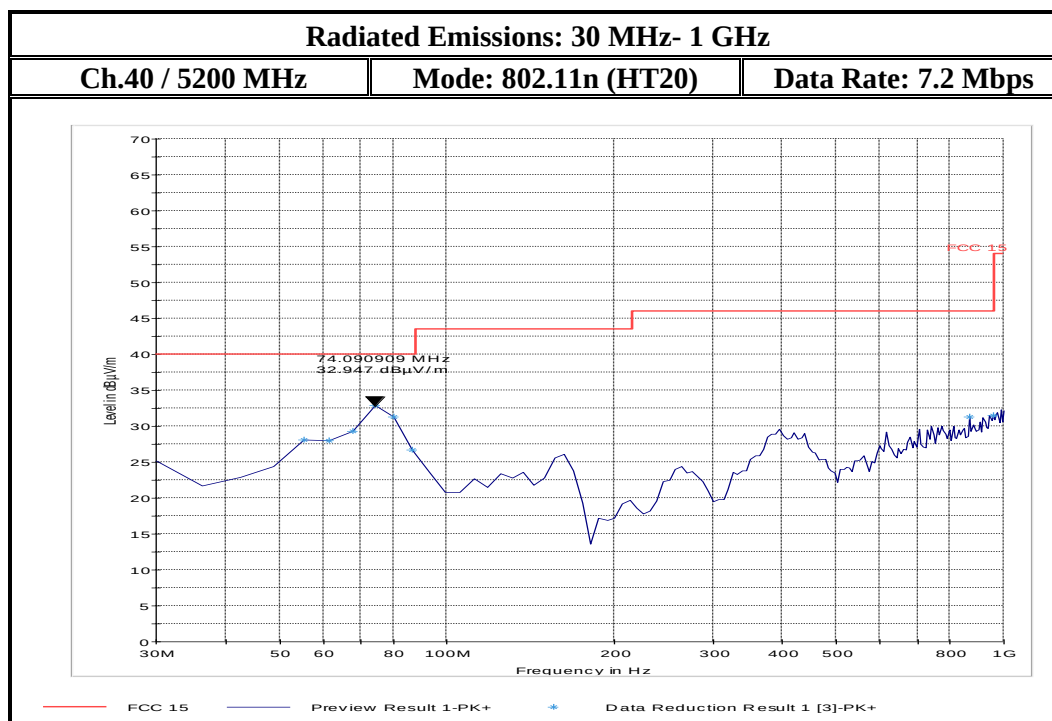
11.5 Test data/ plots:

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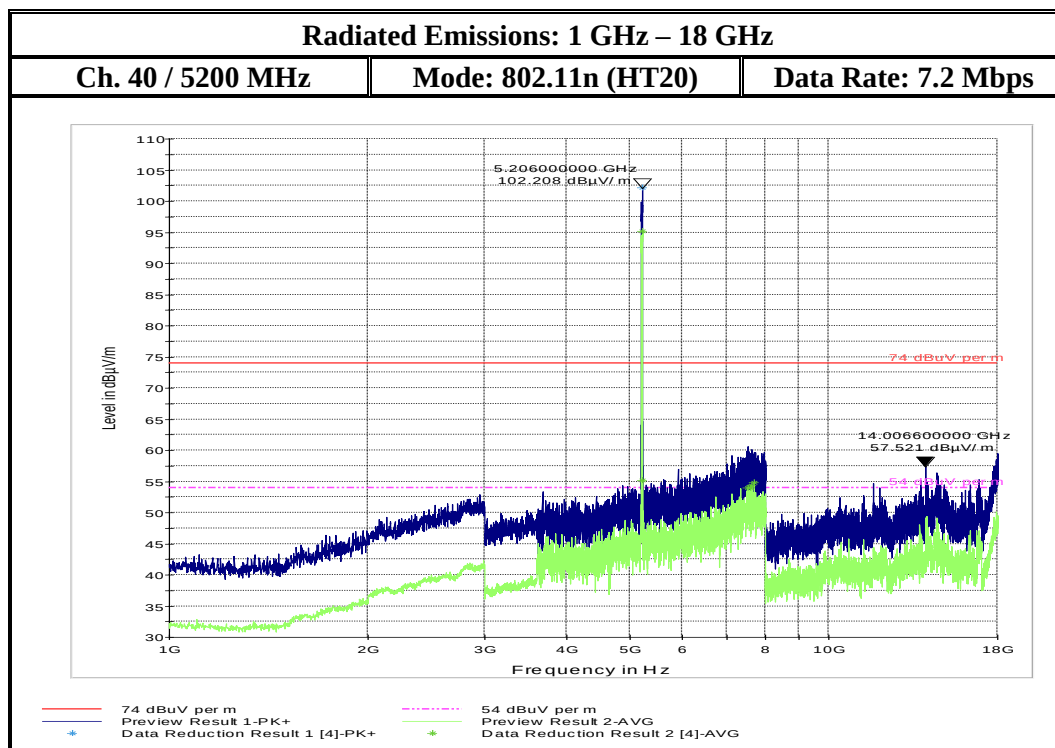
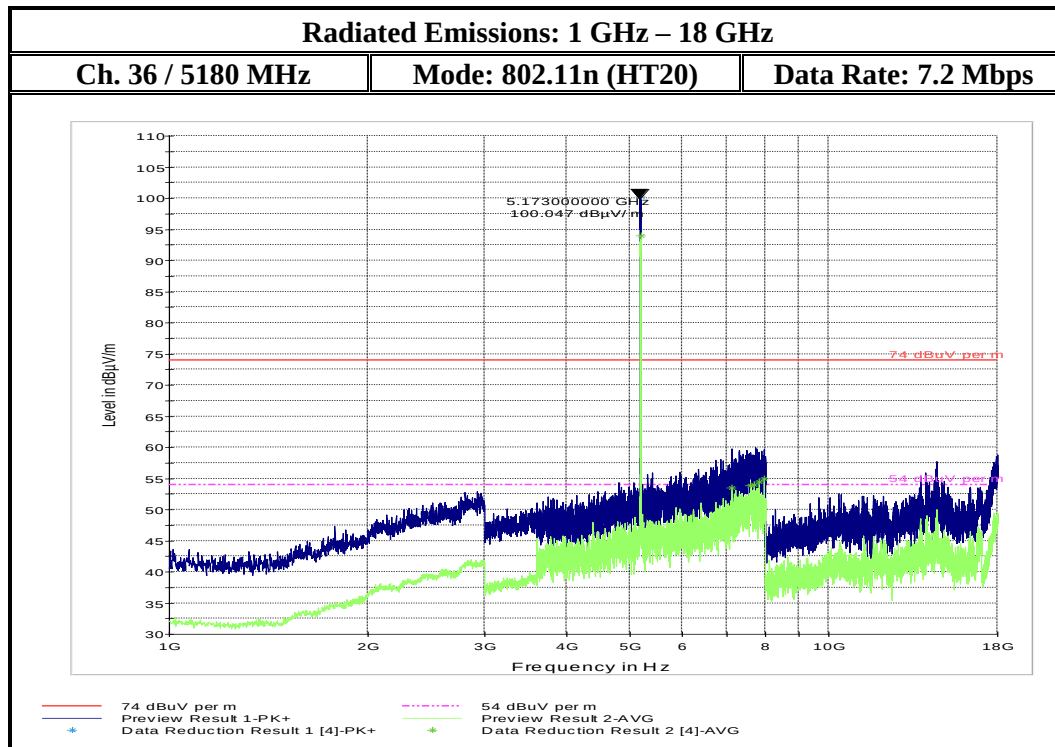
Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	CETECOM™ R&D • MFG • TEST • SERVICE
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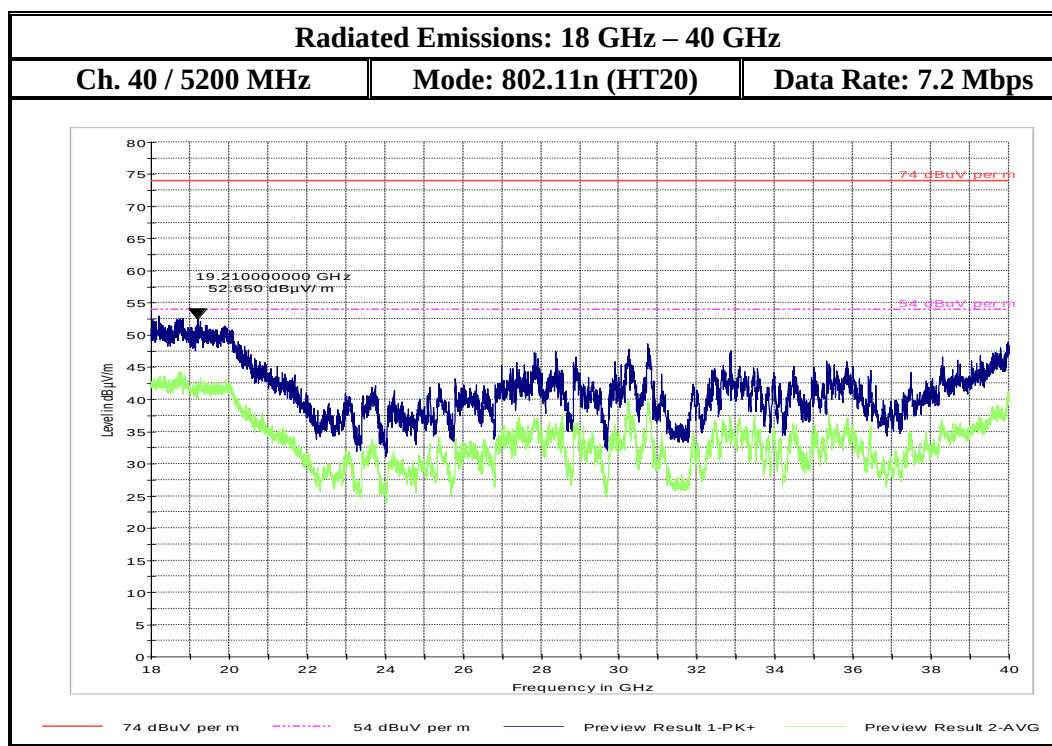
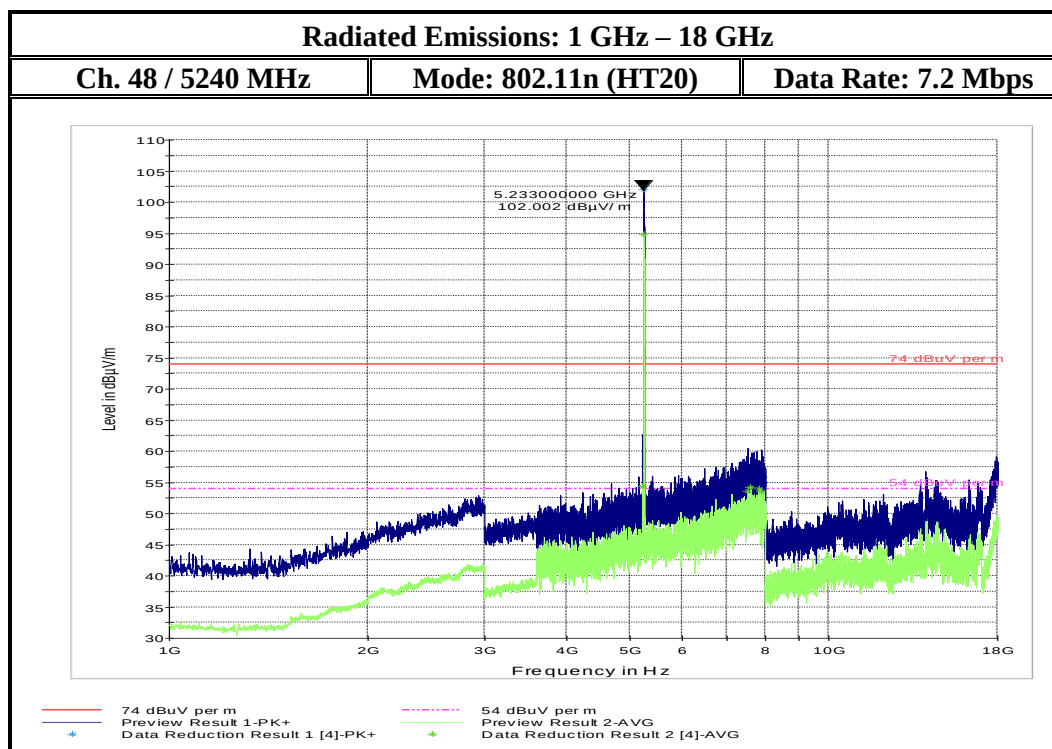
Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	CETECOM™ Solutions for the Connected World
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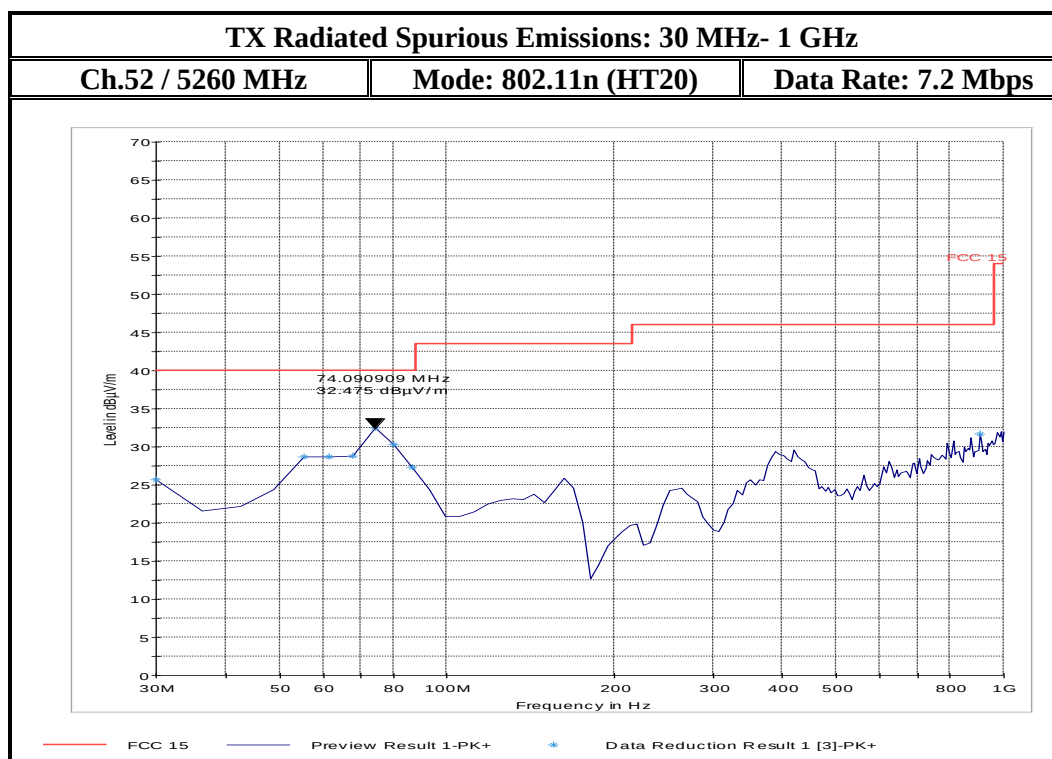
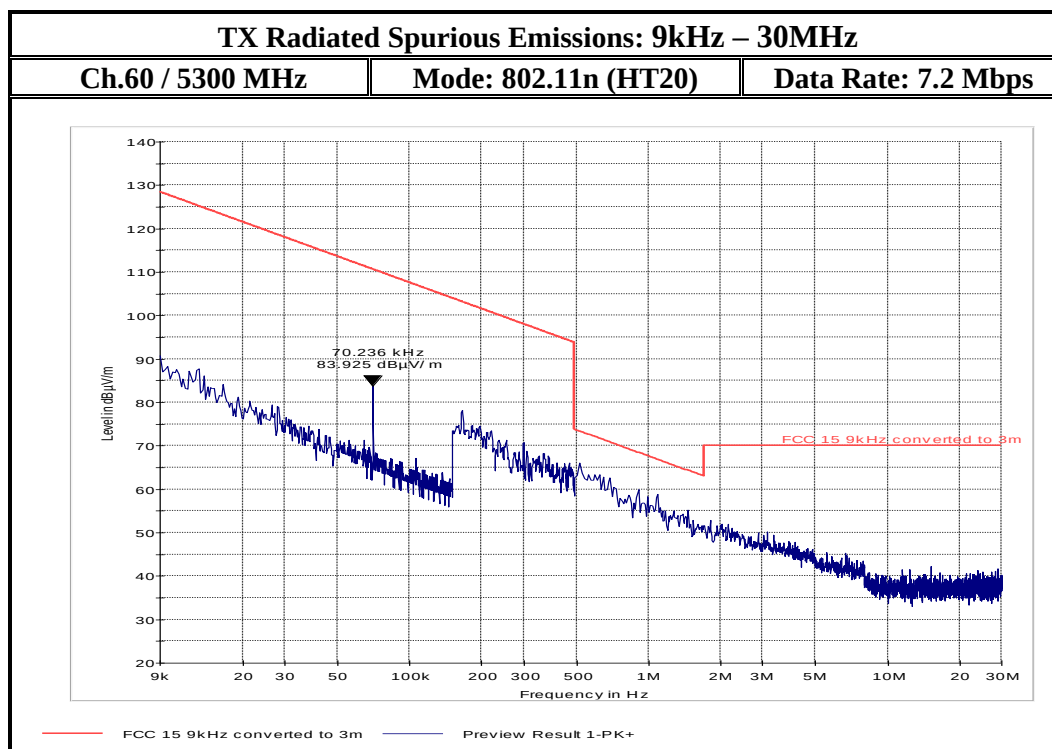
Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	CETECOM™ Electromagnetic Compatibility
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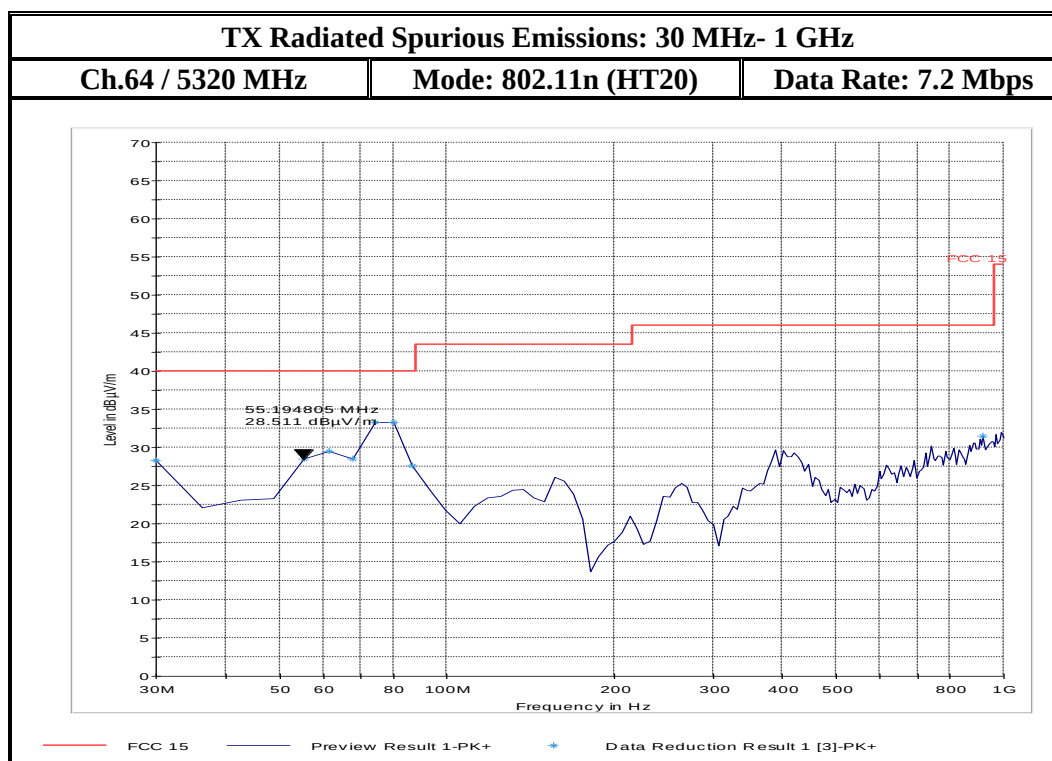
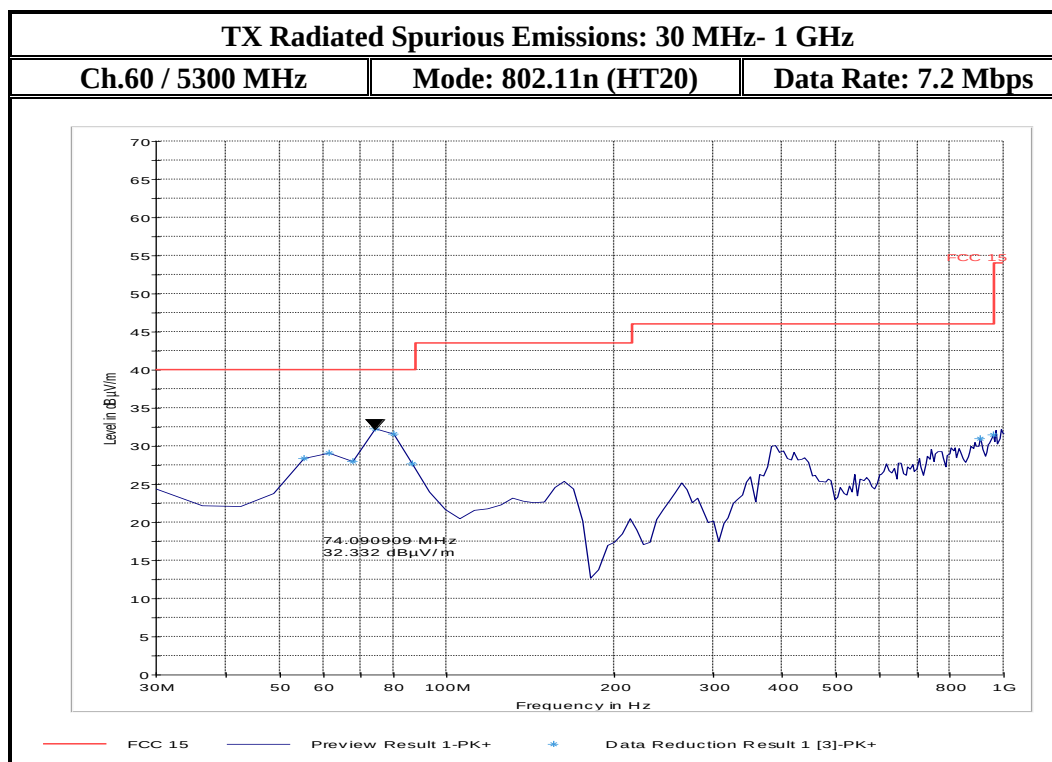
Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	CETECOM™ Electromagnetic Compatibility
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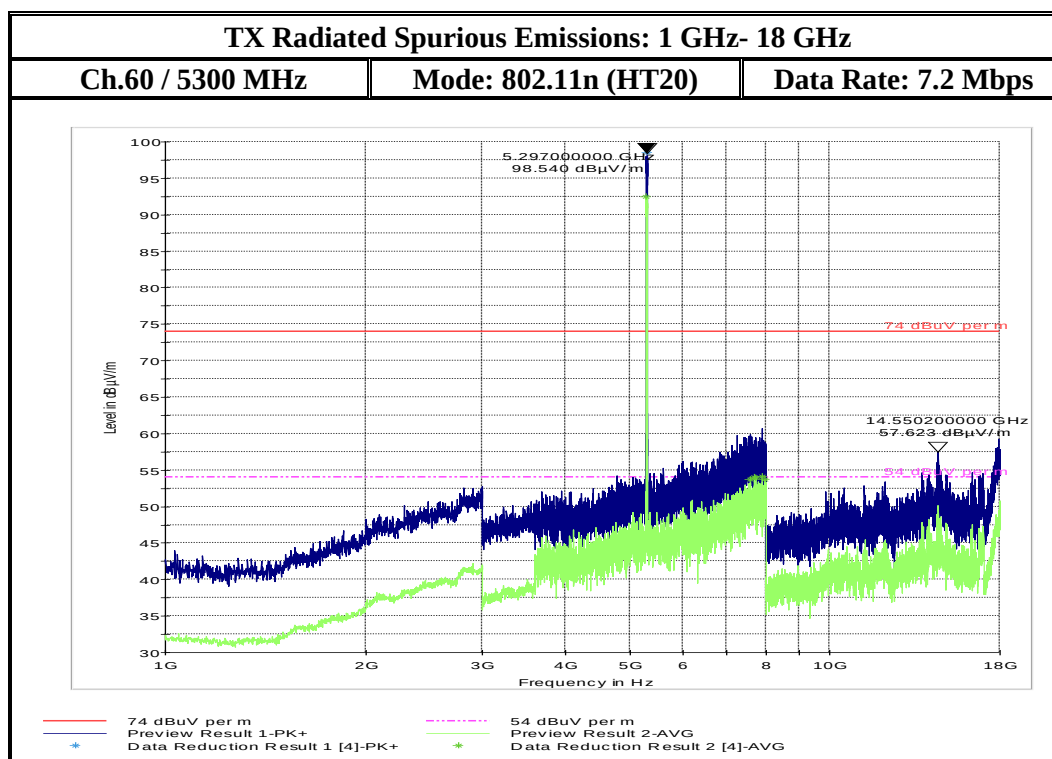
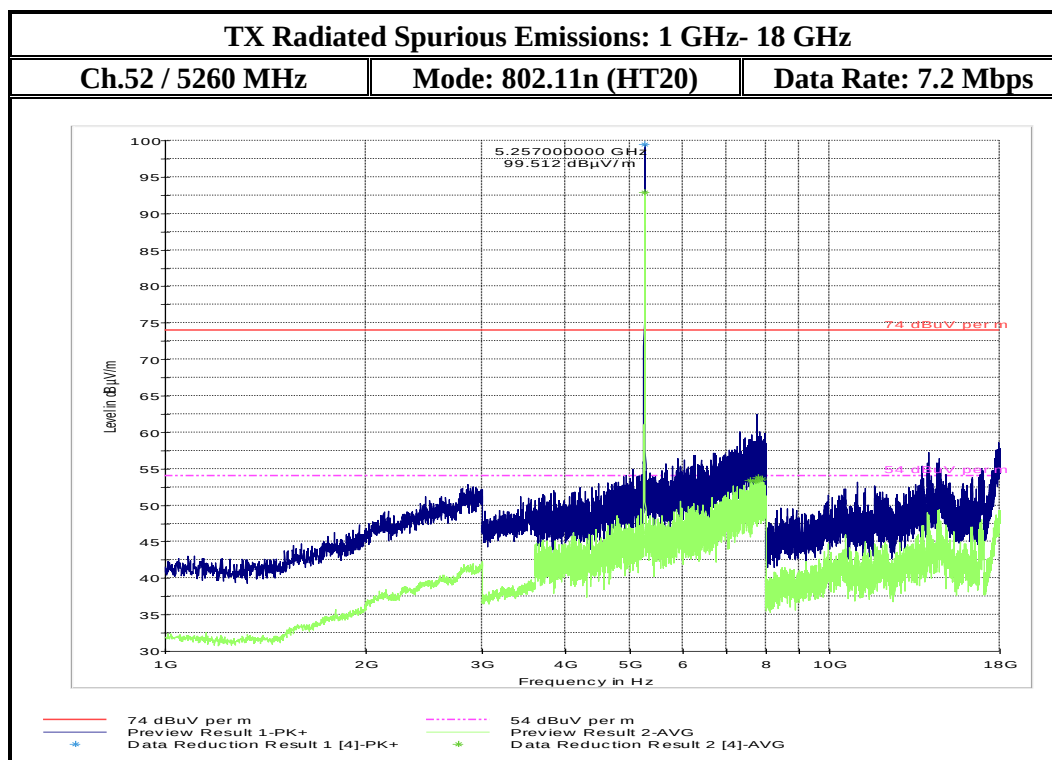
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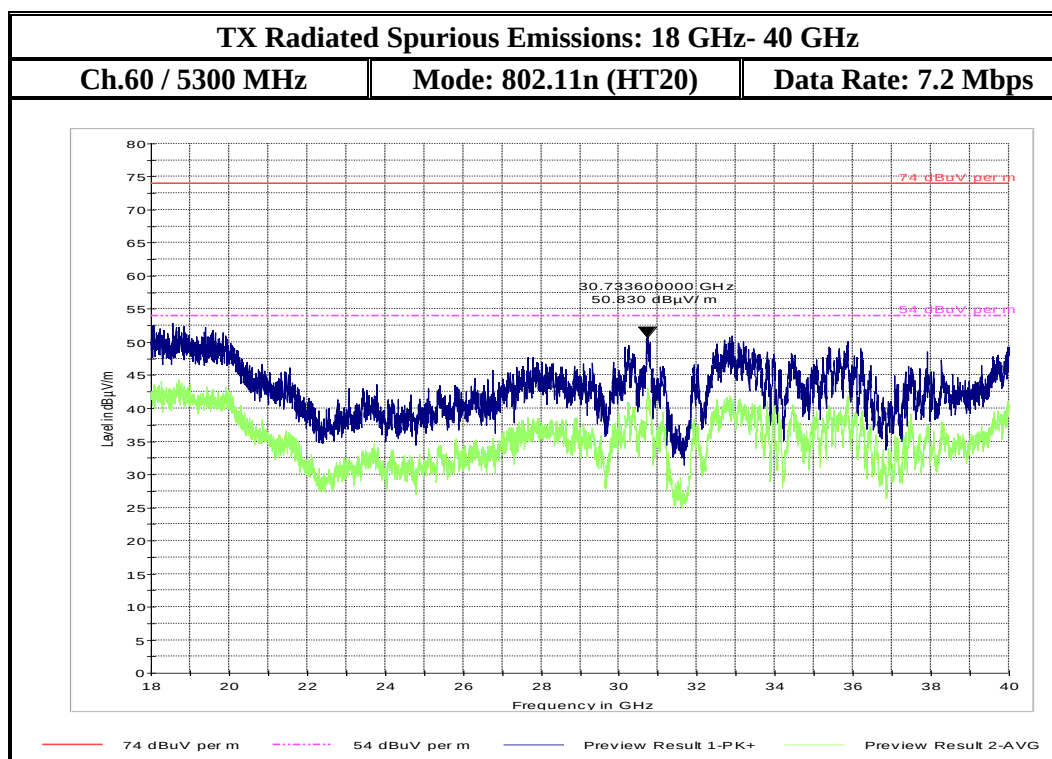
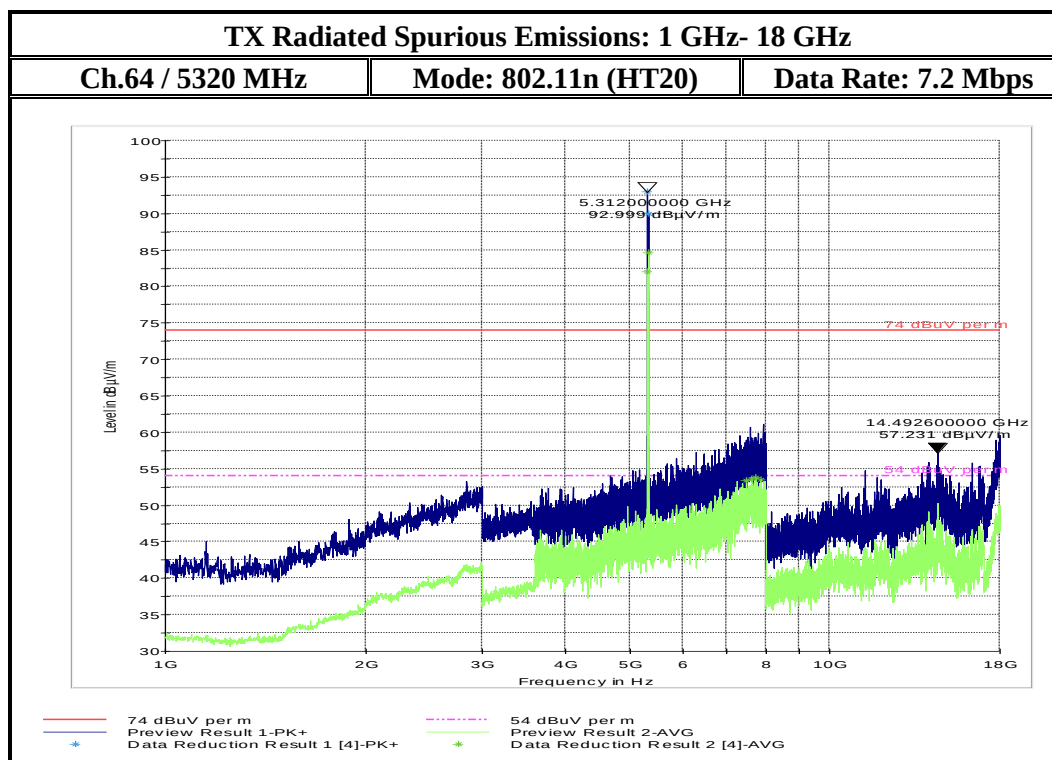
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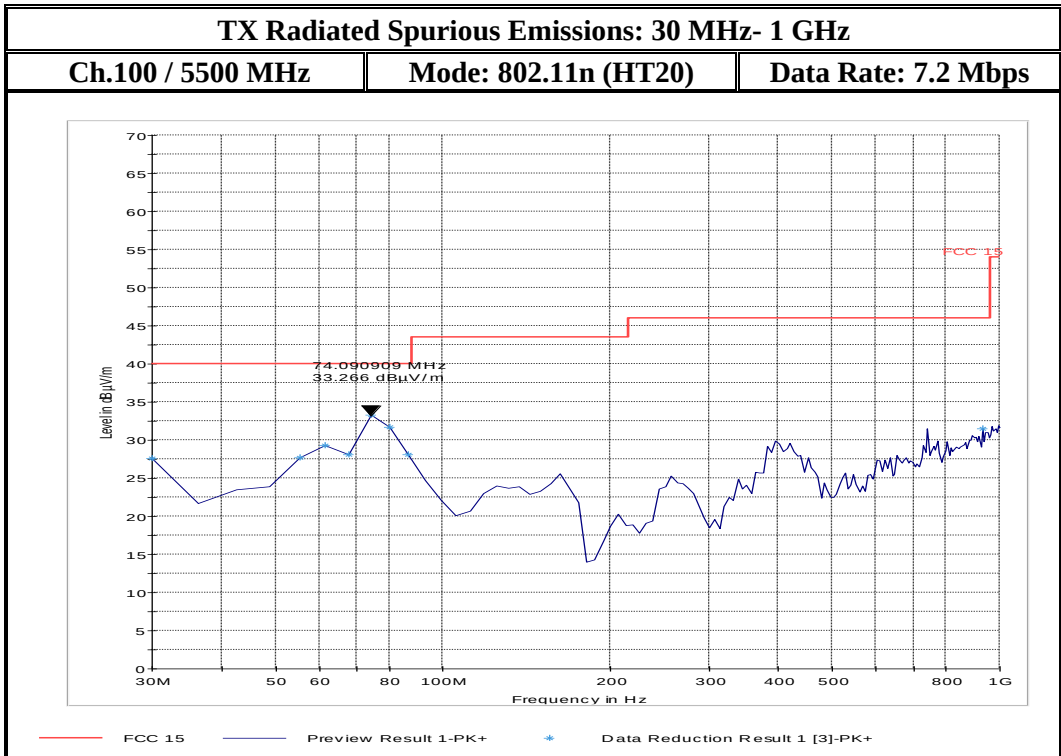
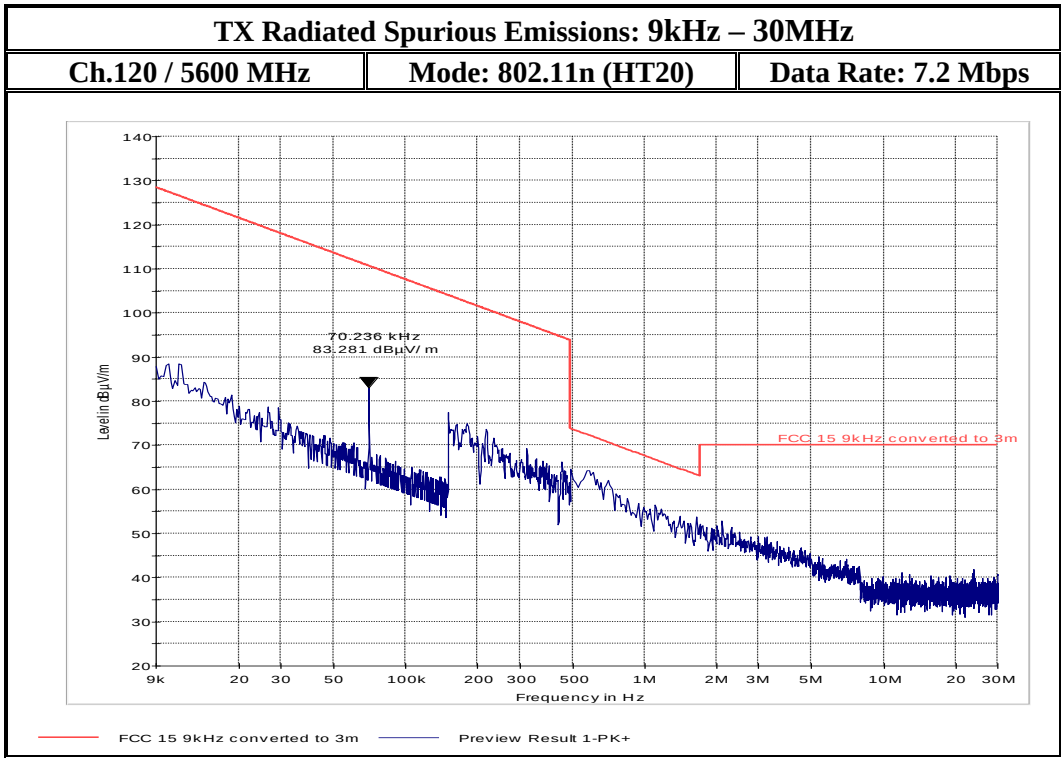
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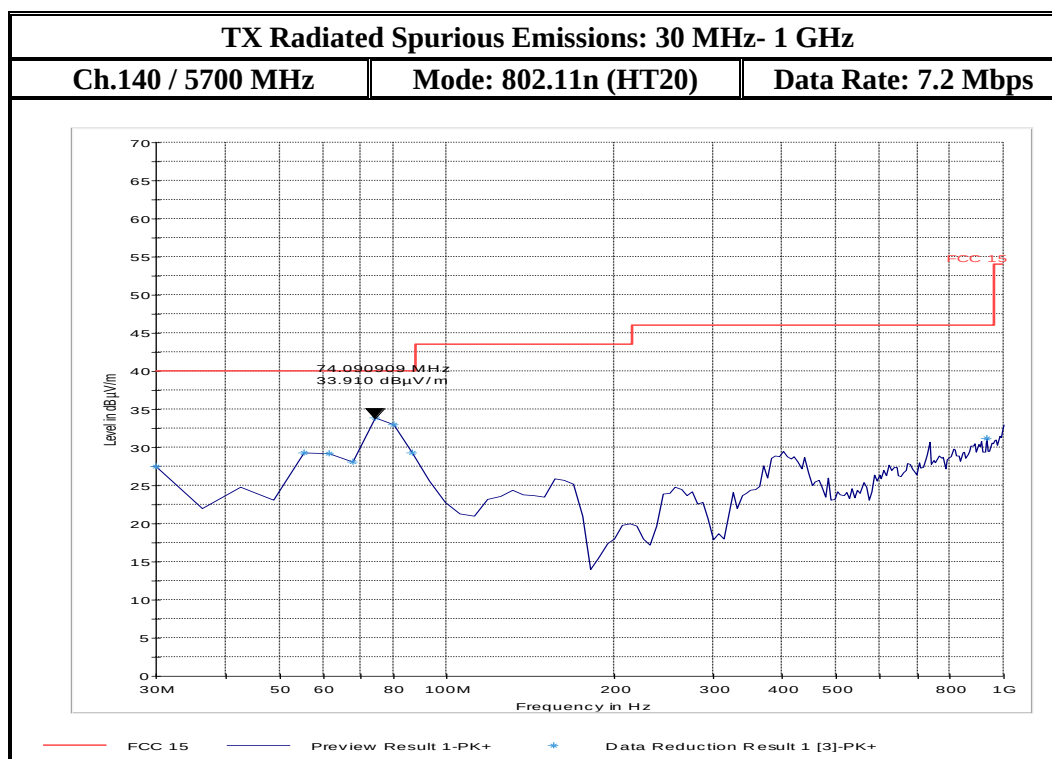
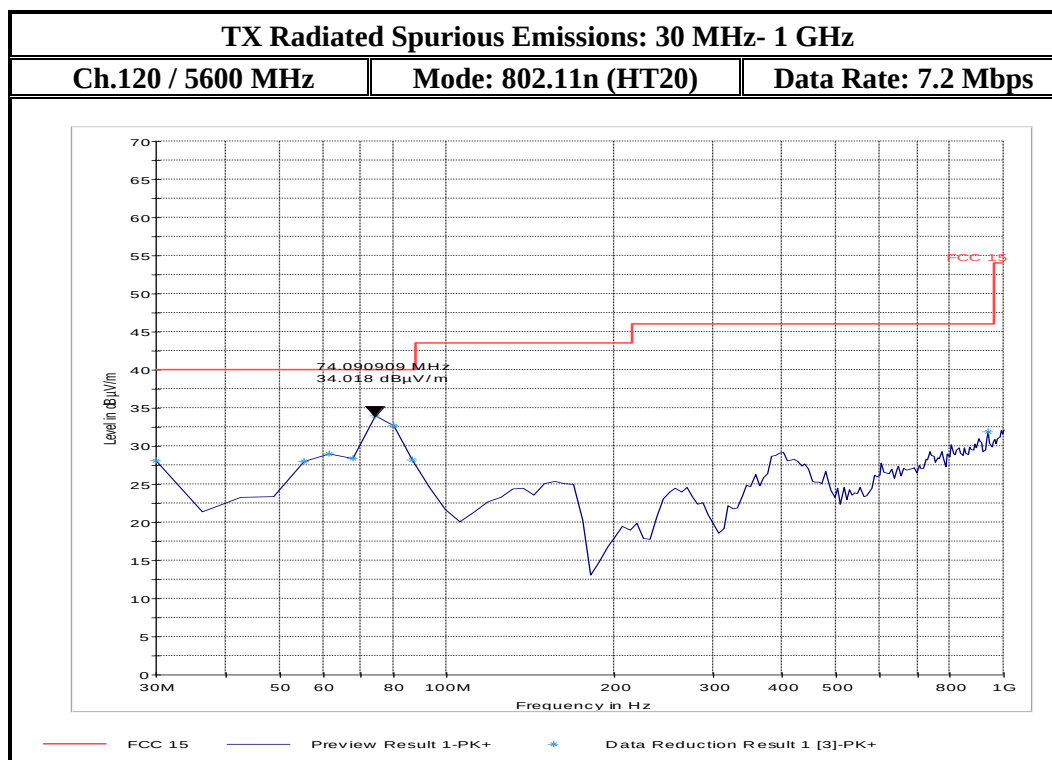
Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	CETECOM™ Electromagnetic Compatibility
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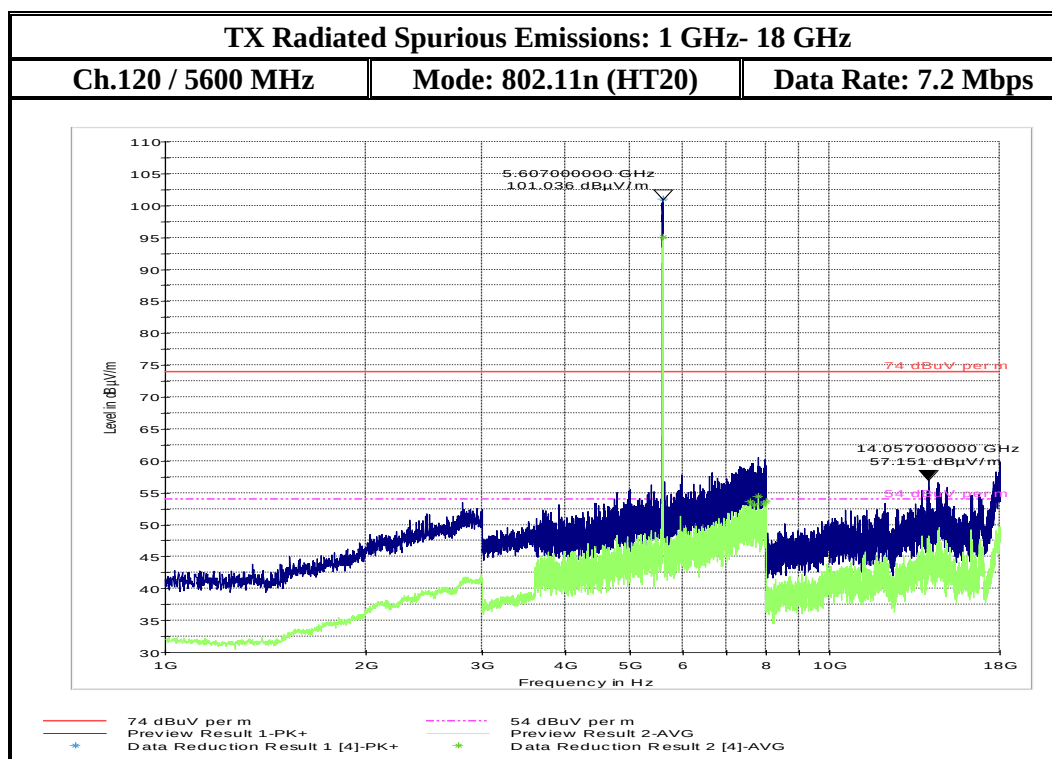
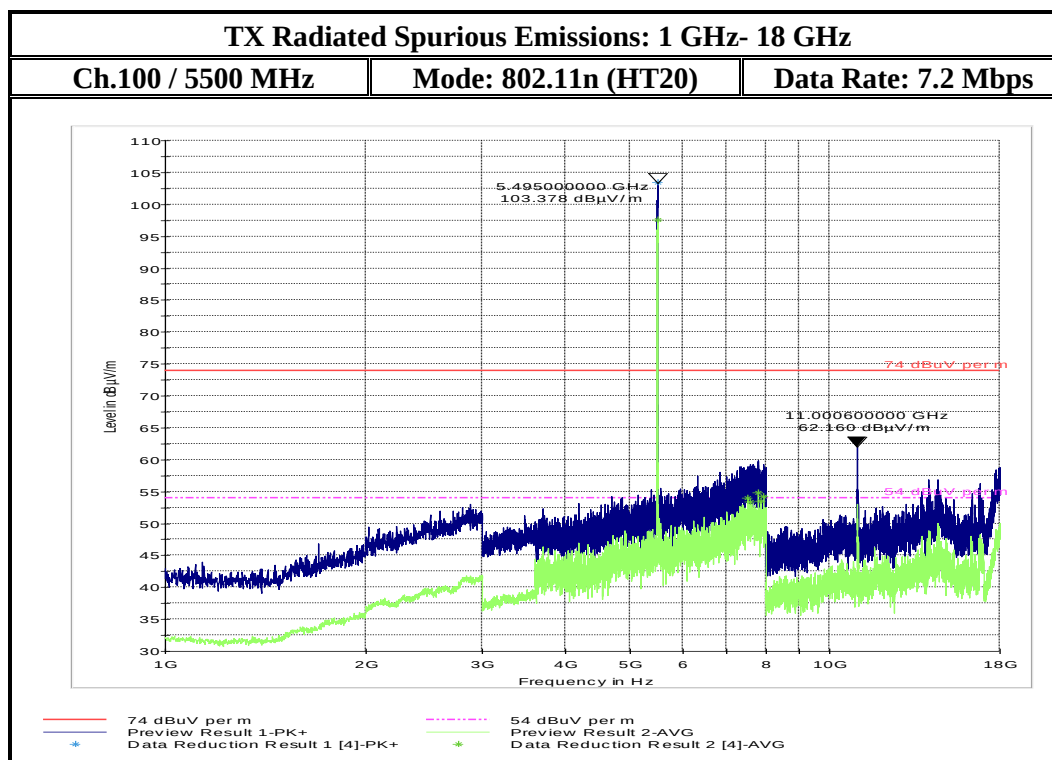
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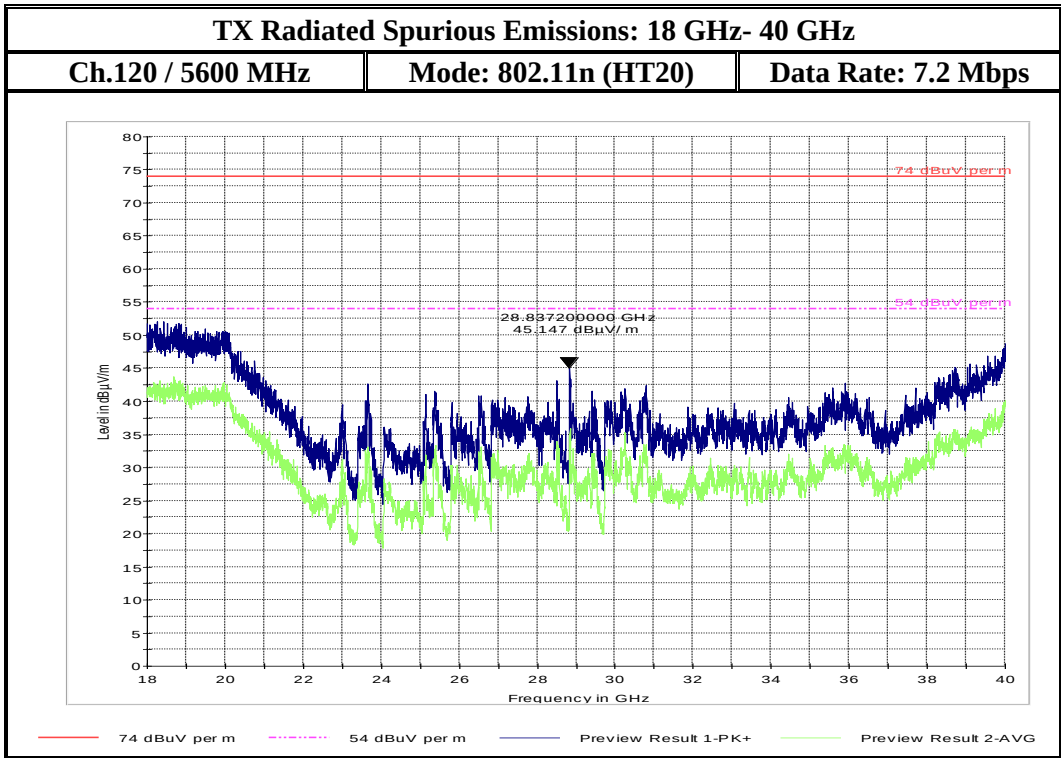
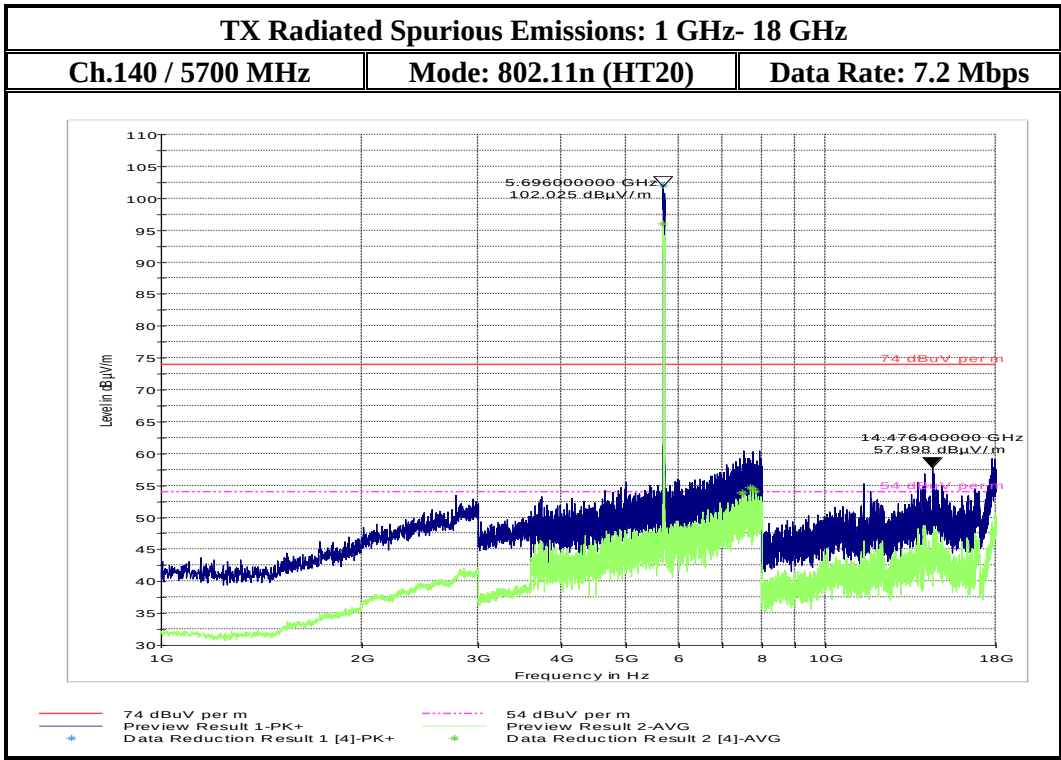
Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	CETECOM Solutions for the Connected World
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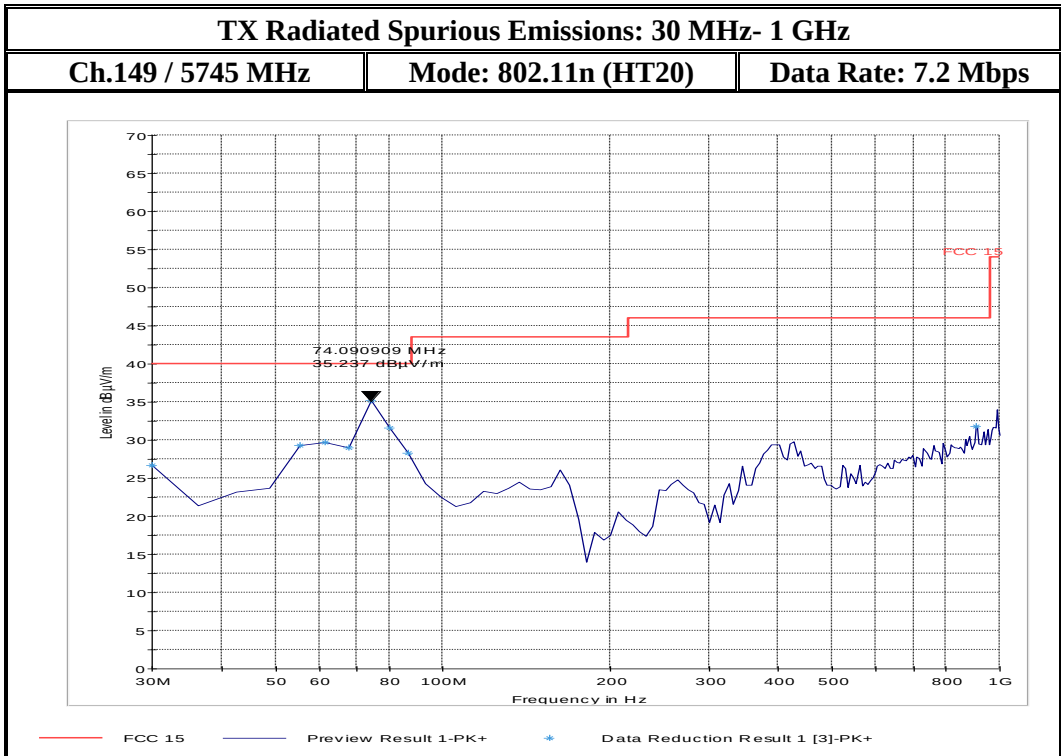
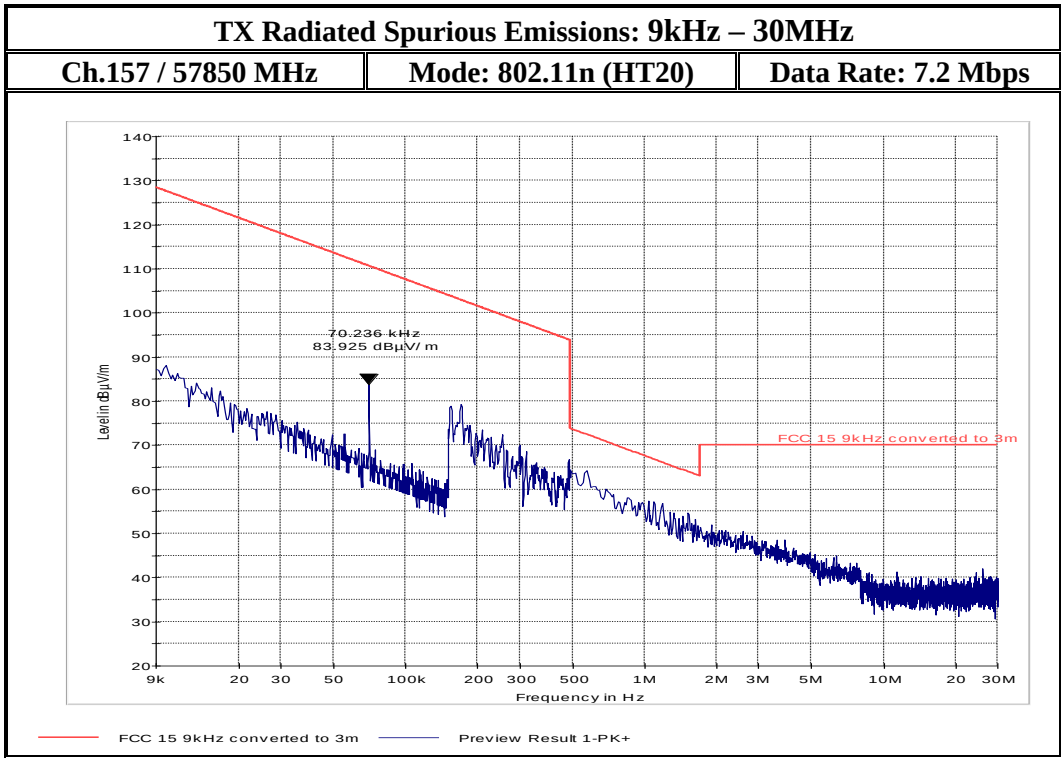
Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	CETECOM™ Electromagnetic Compatibility
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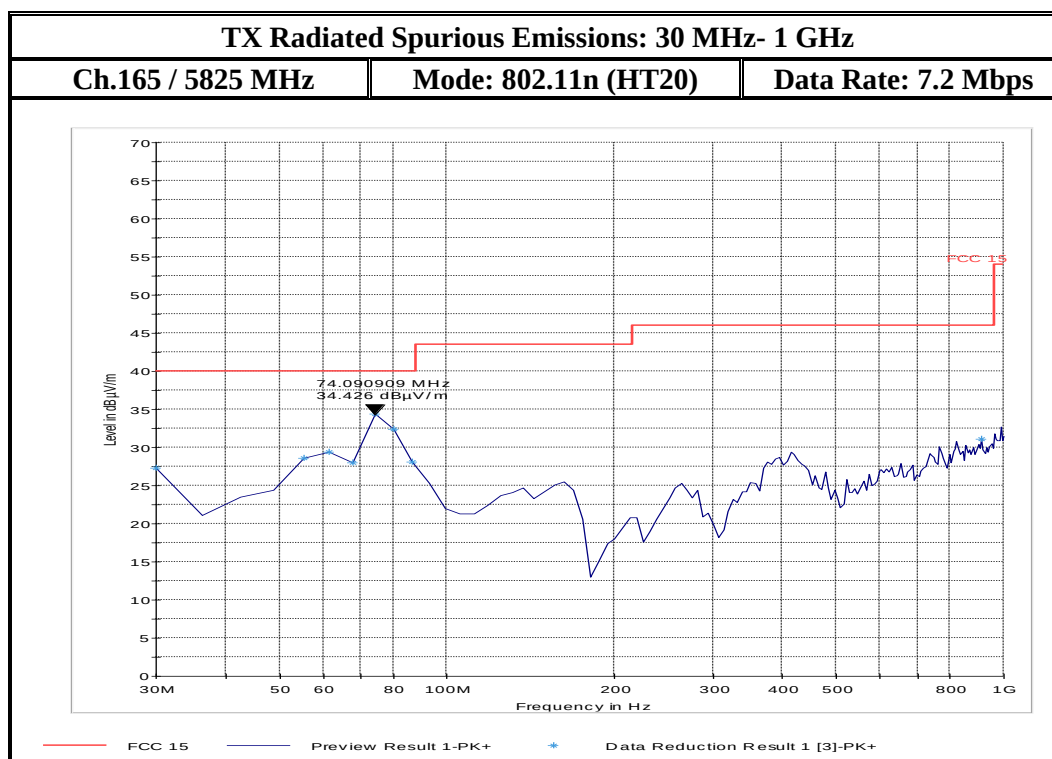
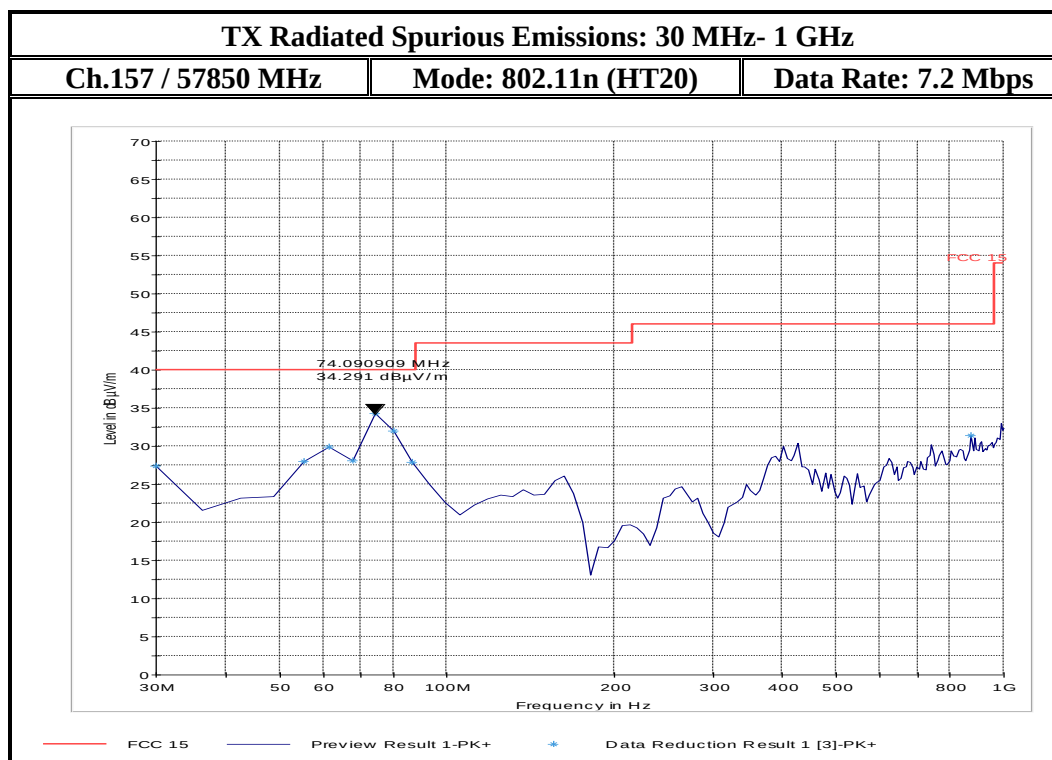
Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	CETECOM™ Electromagnetic Compatibility Center
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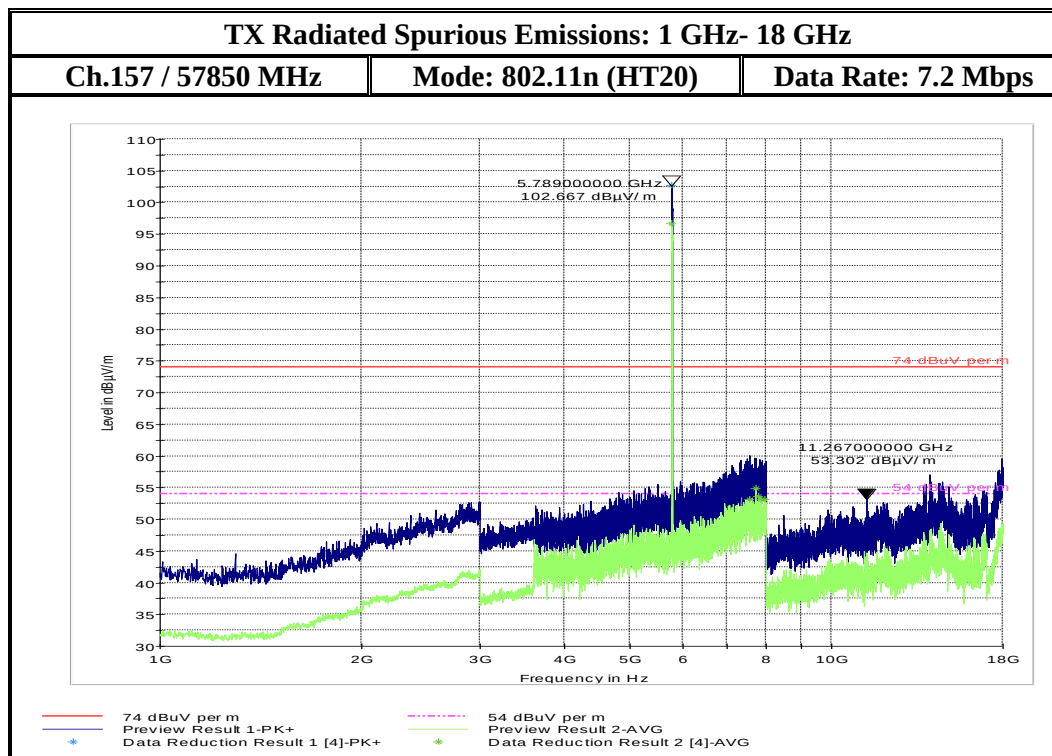
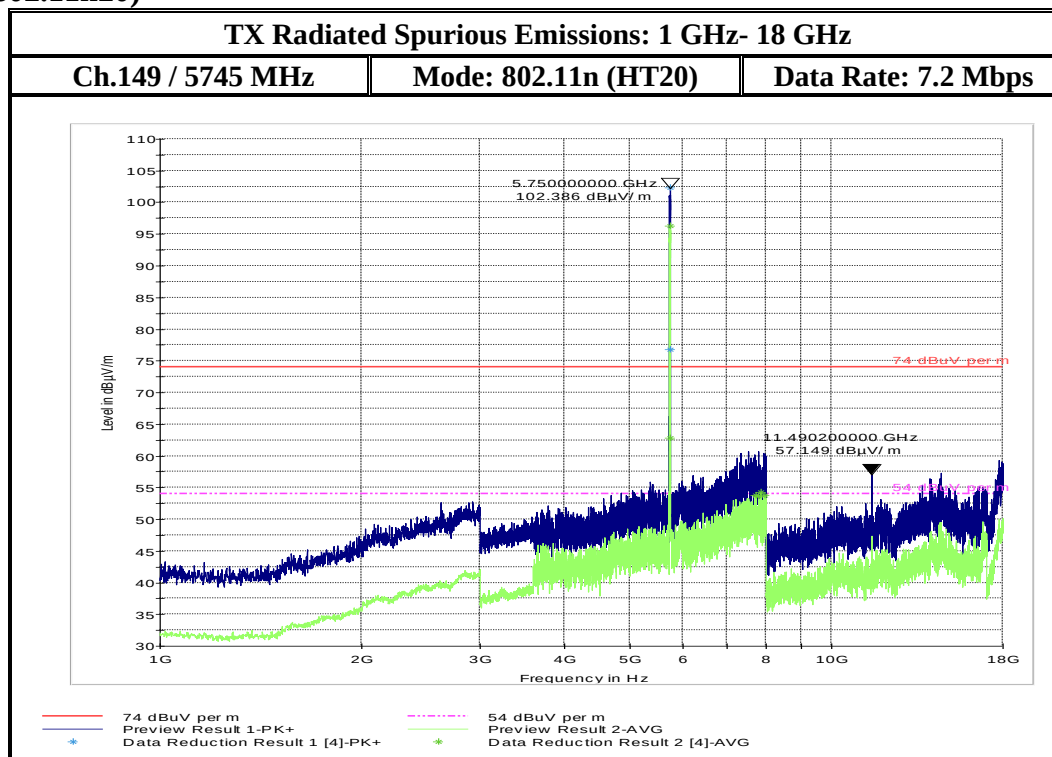
Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	CETECOM™ Electromagnetic Compatibility Center
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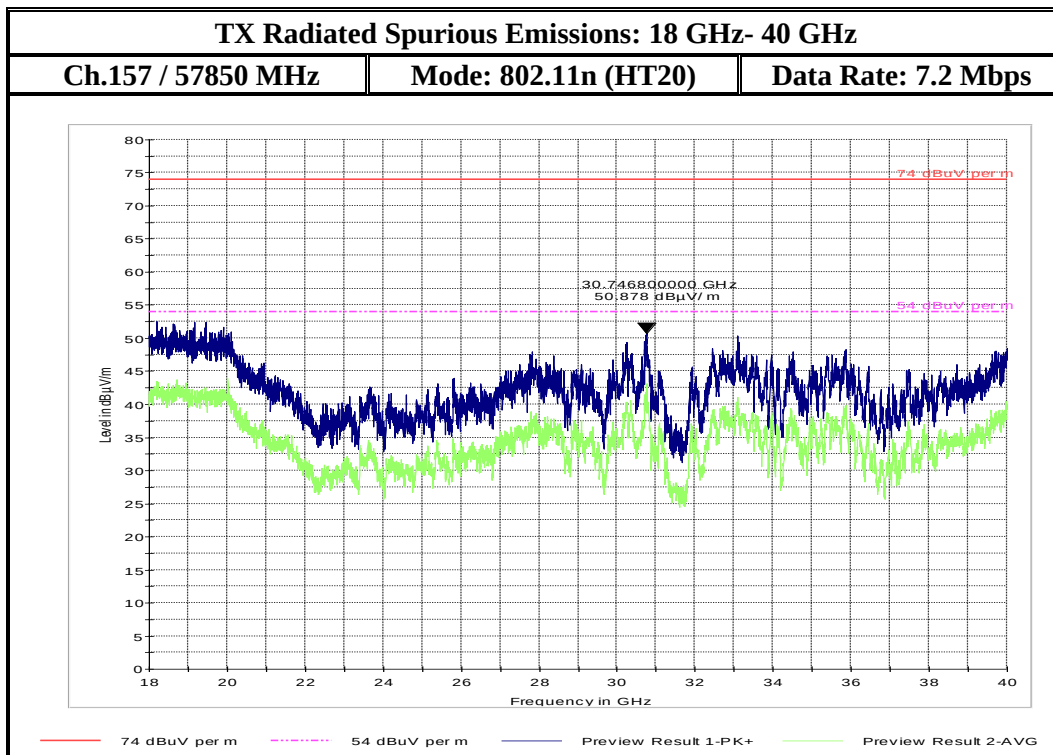
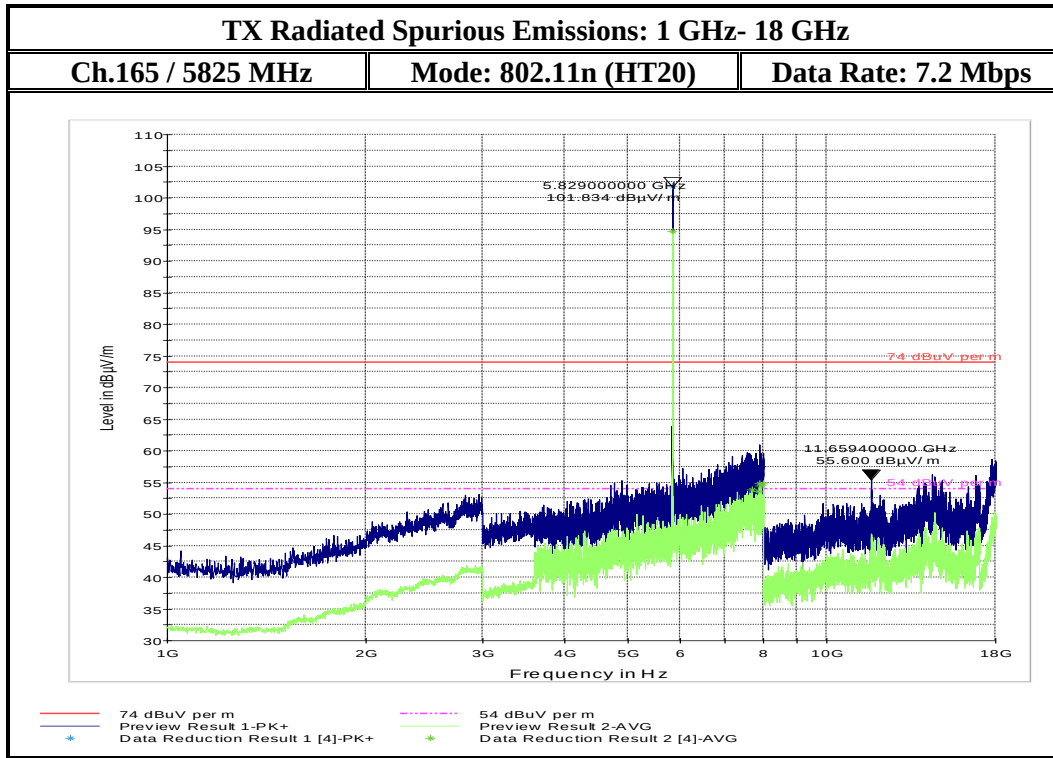
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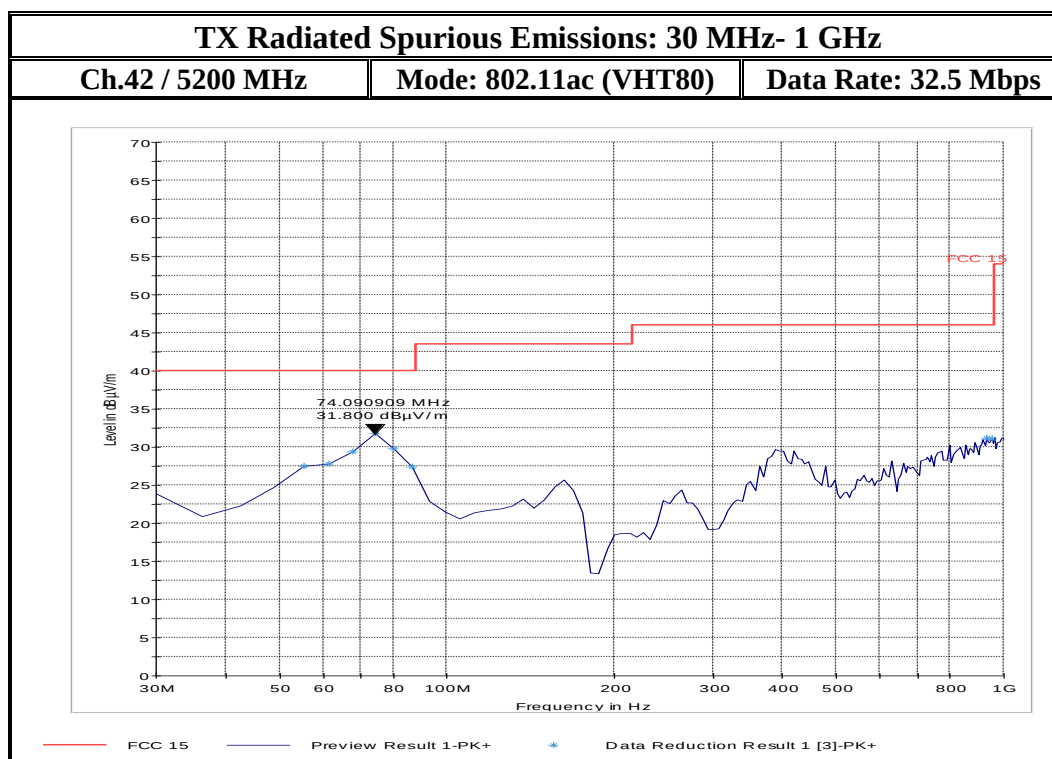
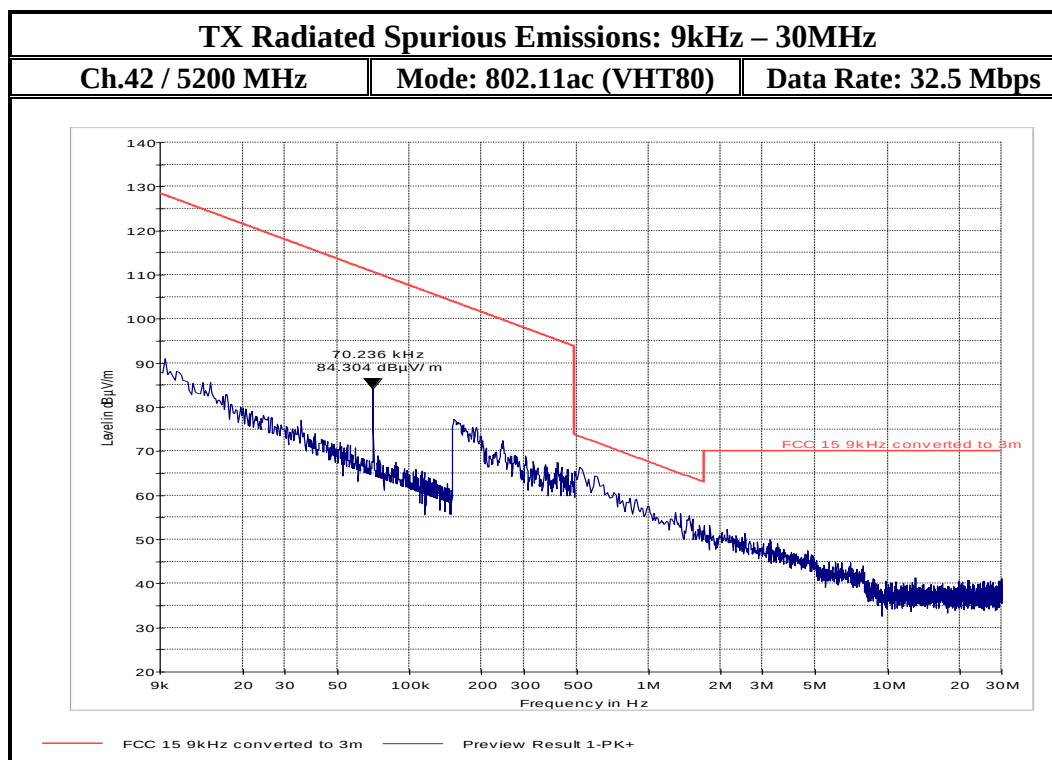
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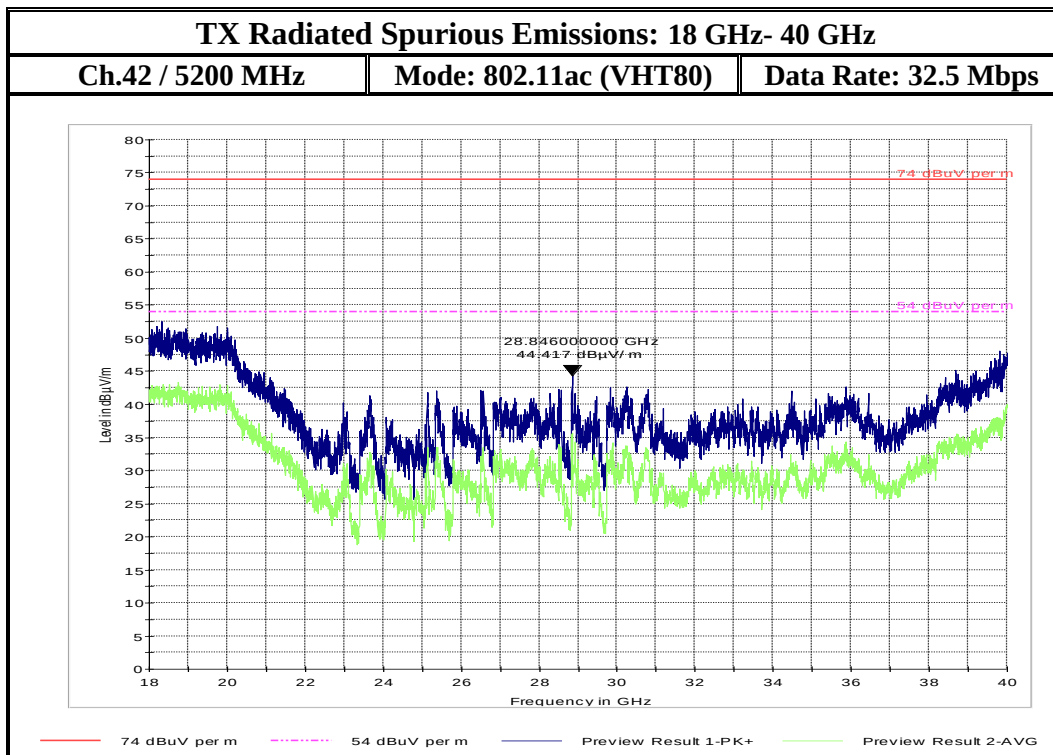
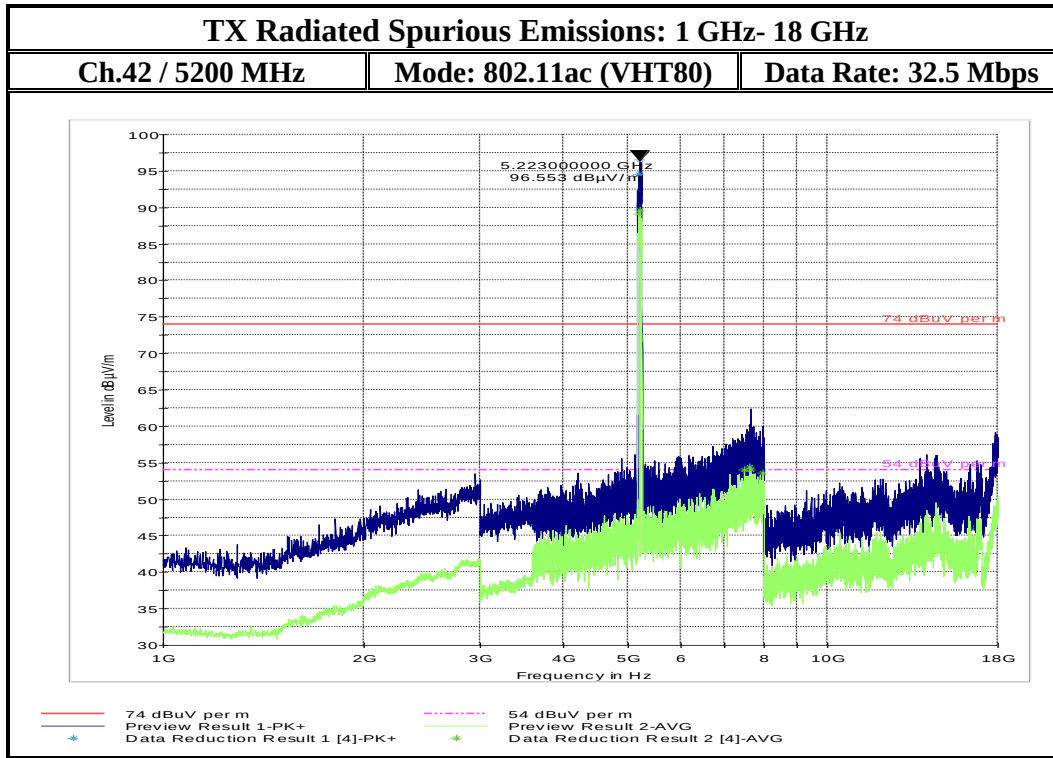
Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	CETECOM™ Electromagnetic Compatibility
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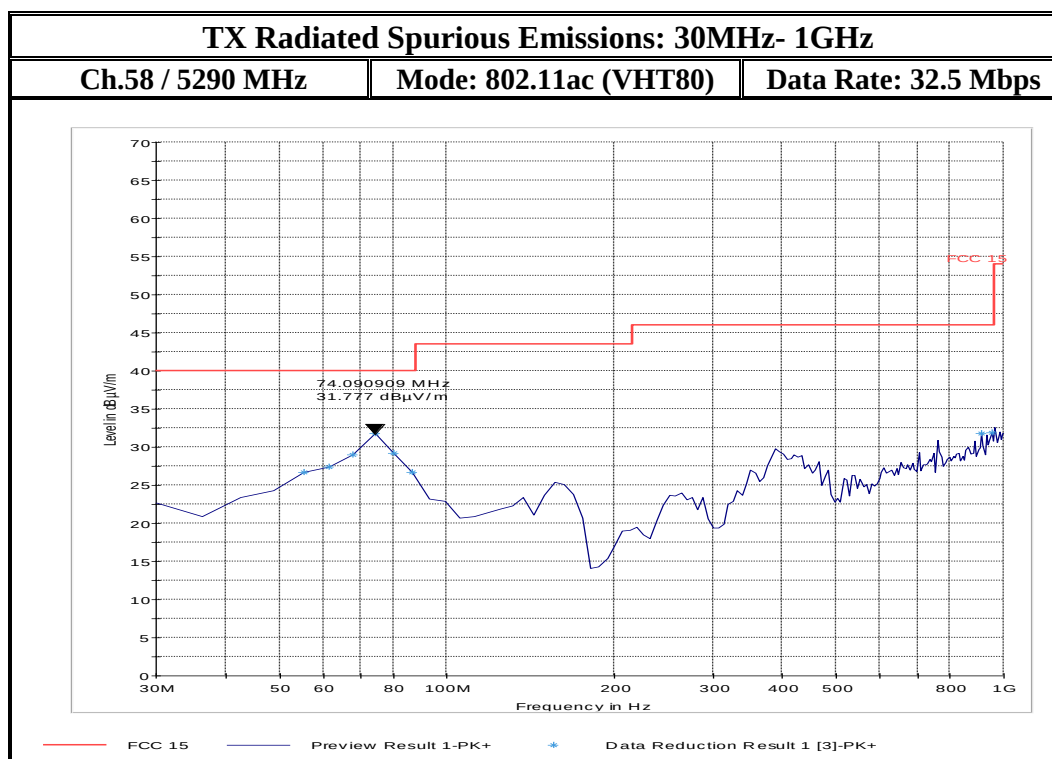
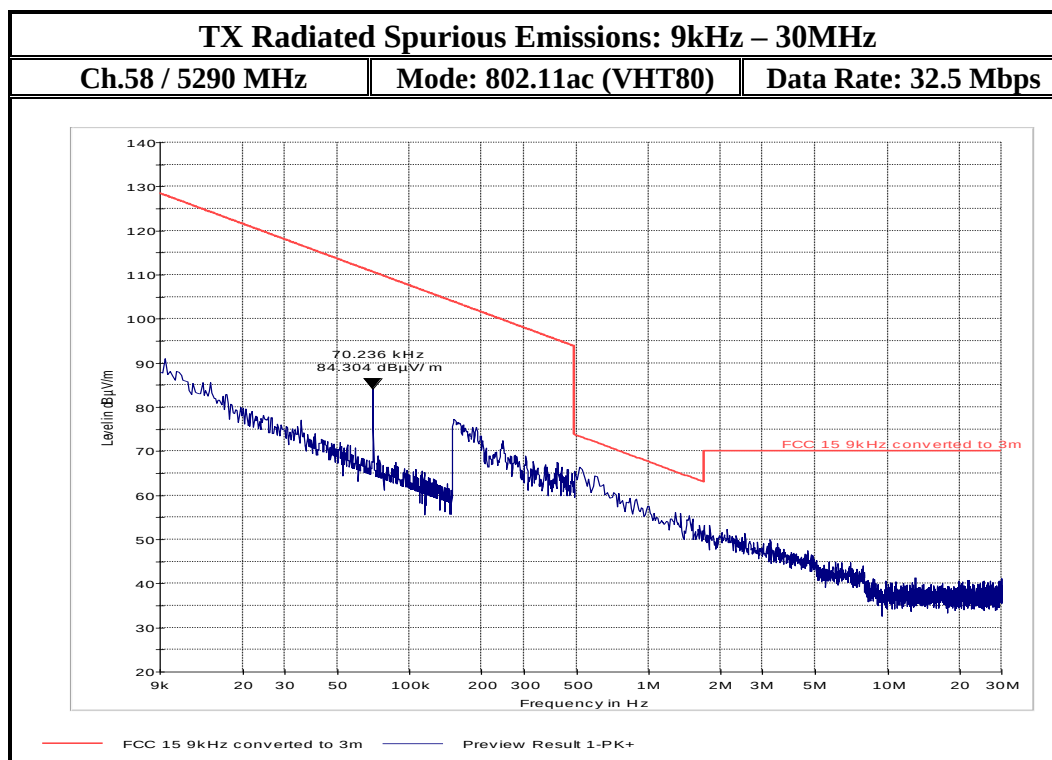
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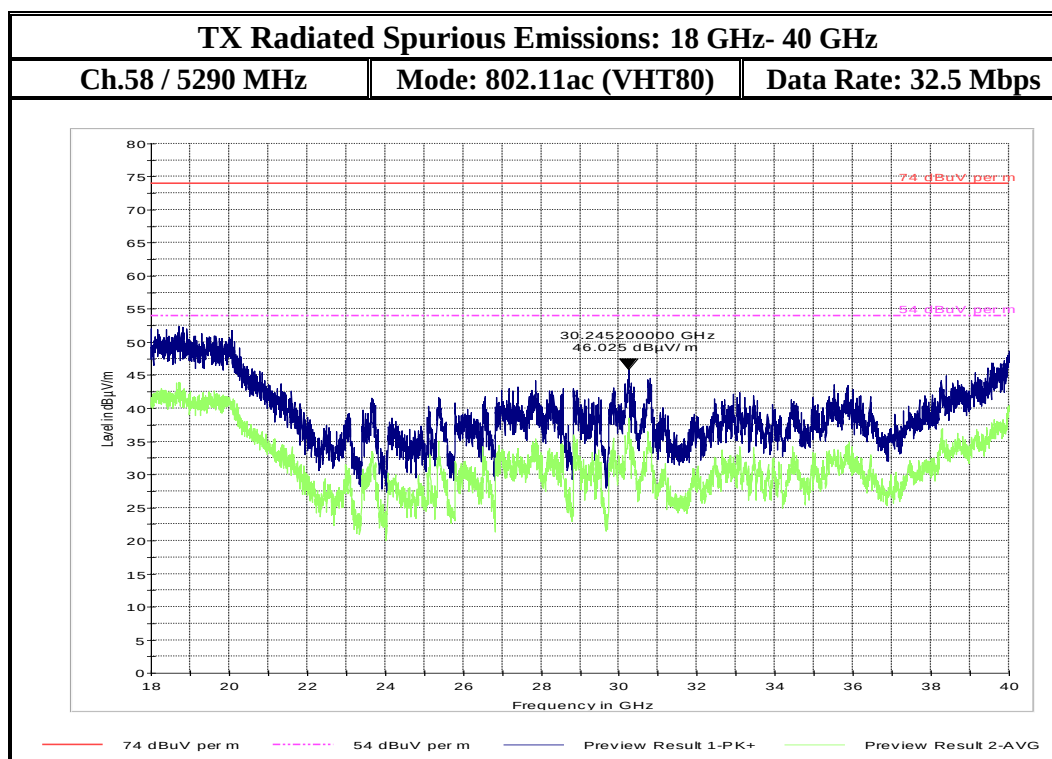
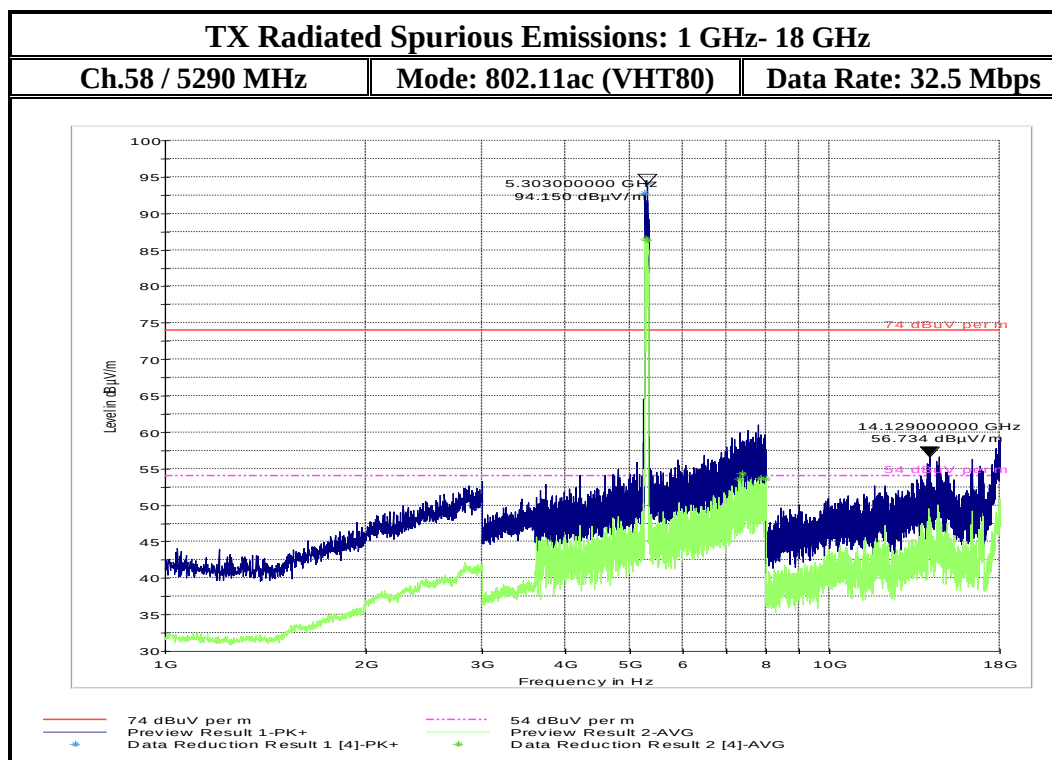
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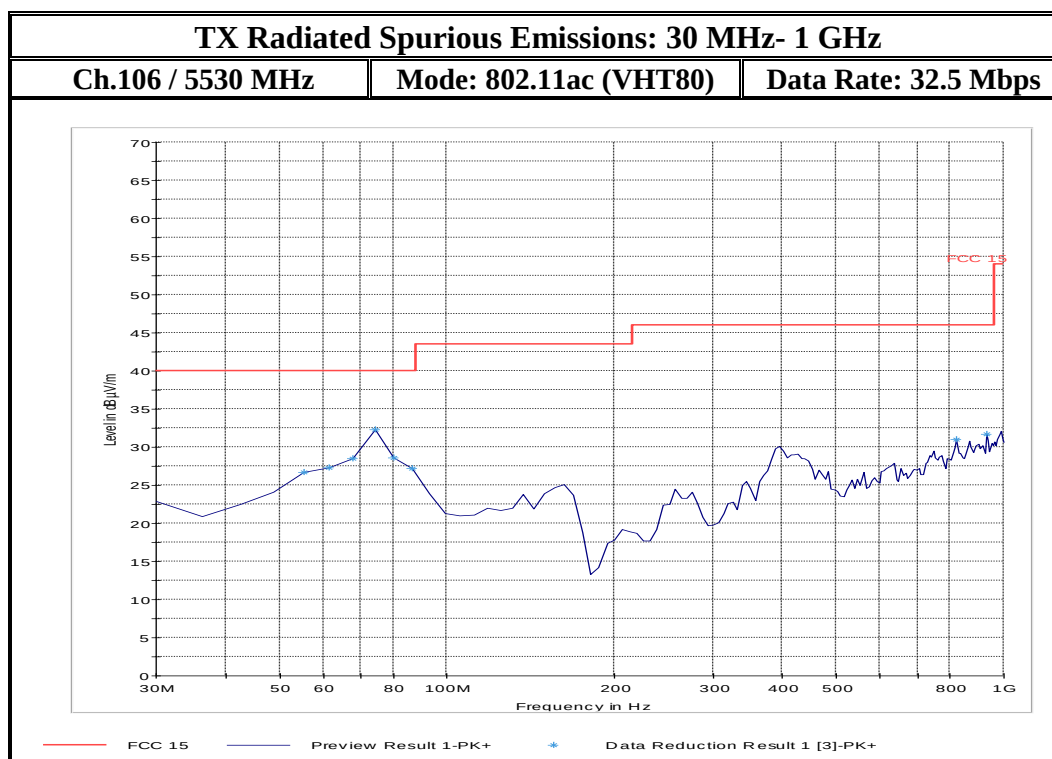
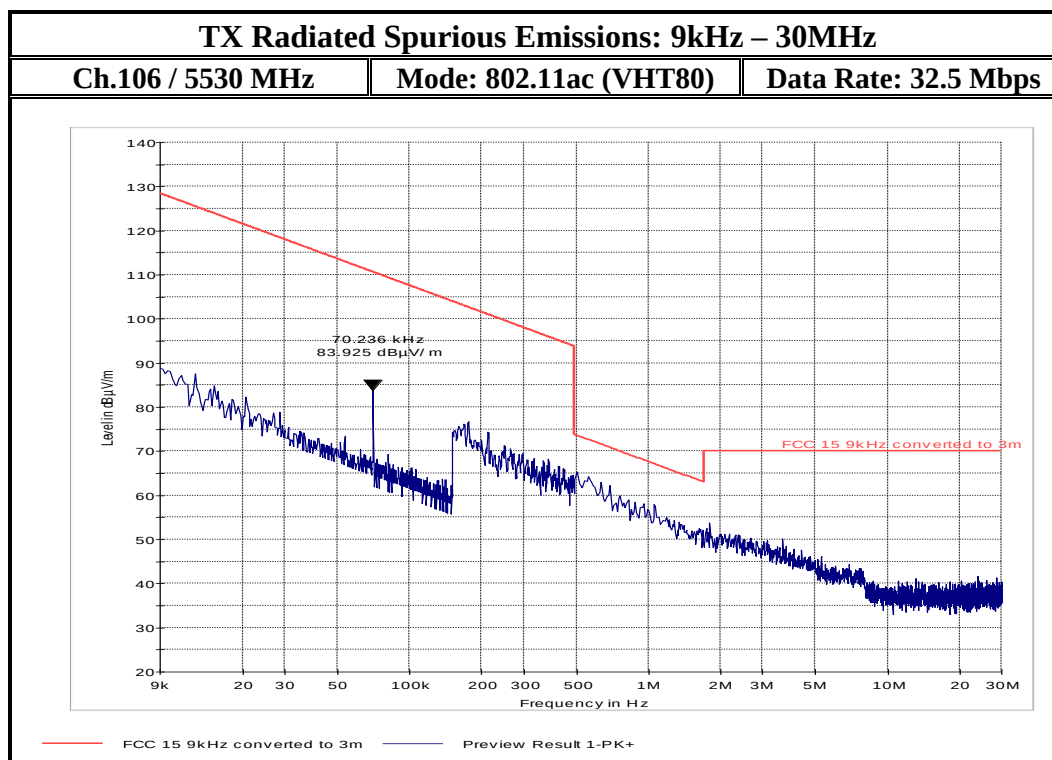
Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	CETECOM Solutions for the Connected World
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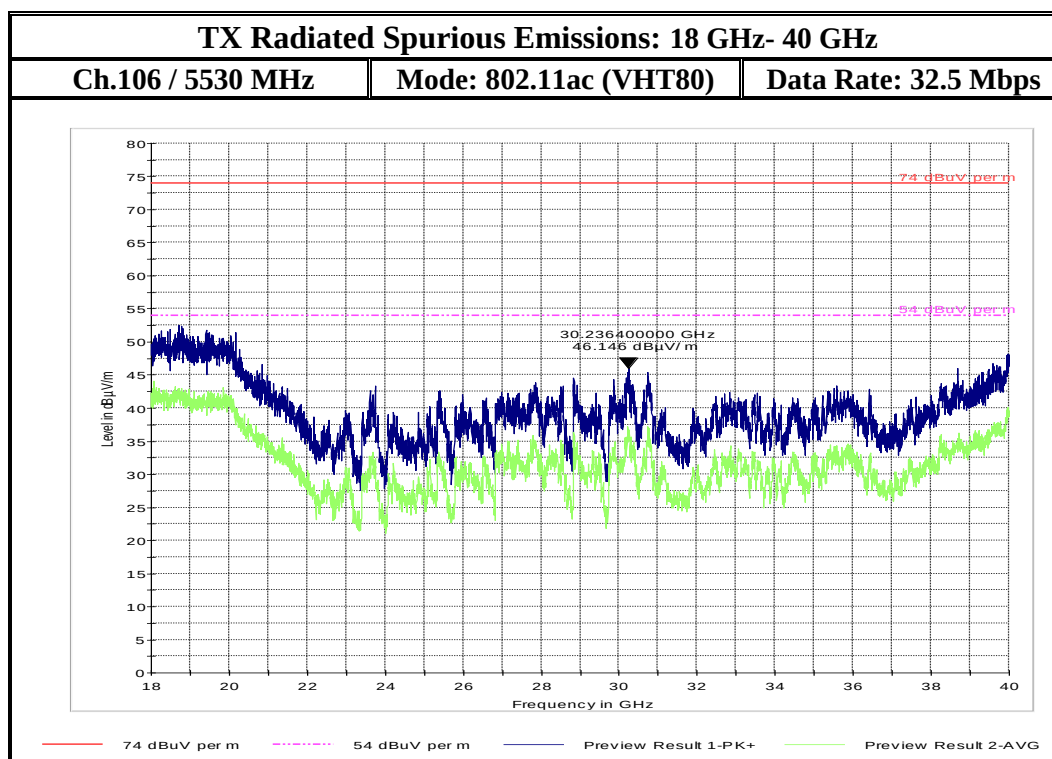
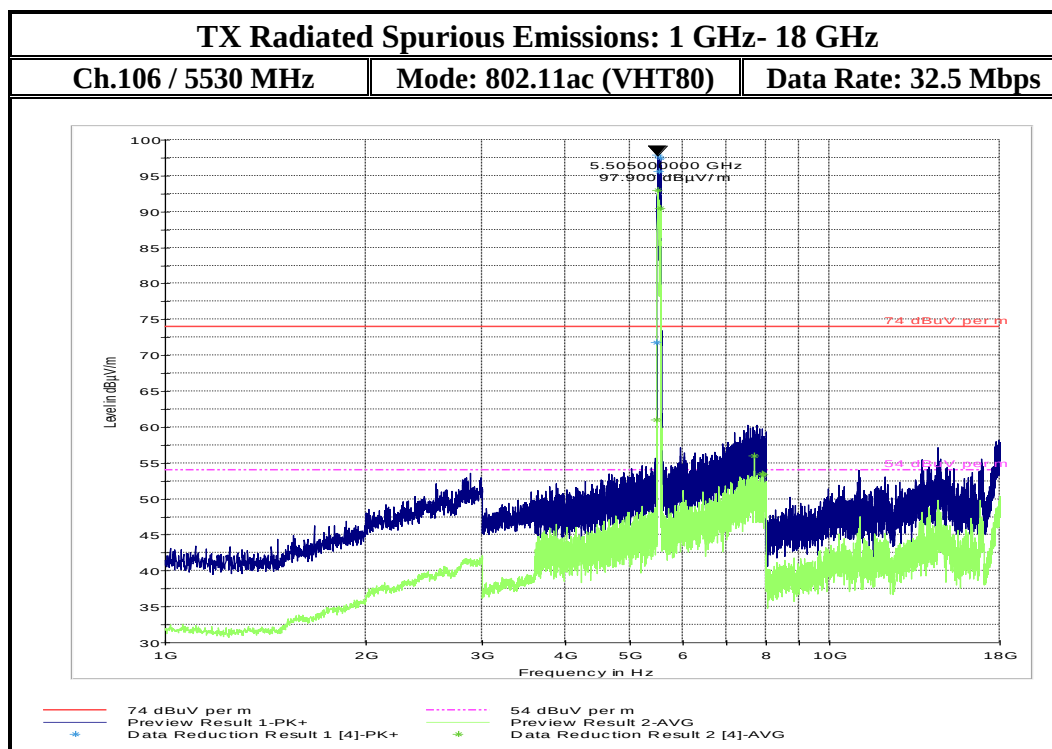
Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	CETECOM™ Electromagnetic Compatibility Center
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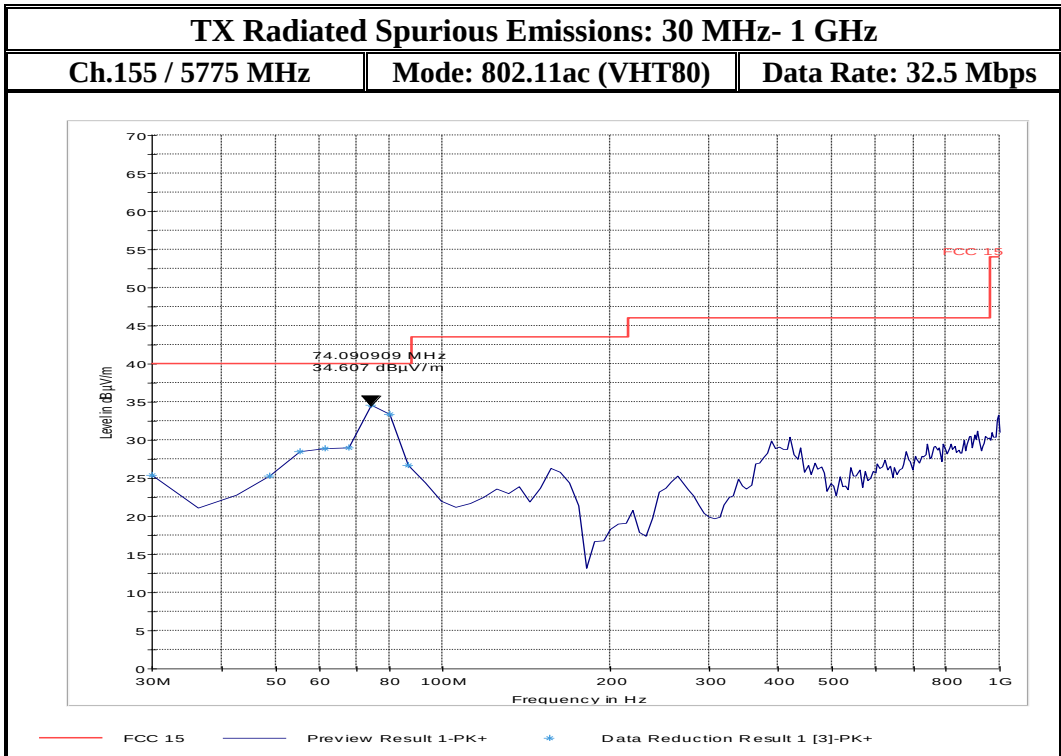
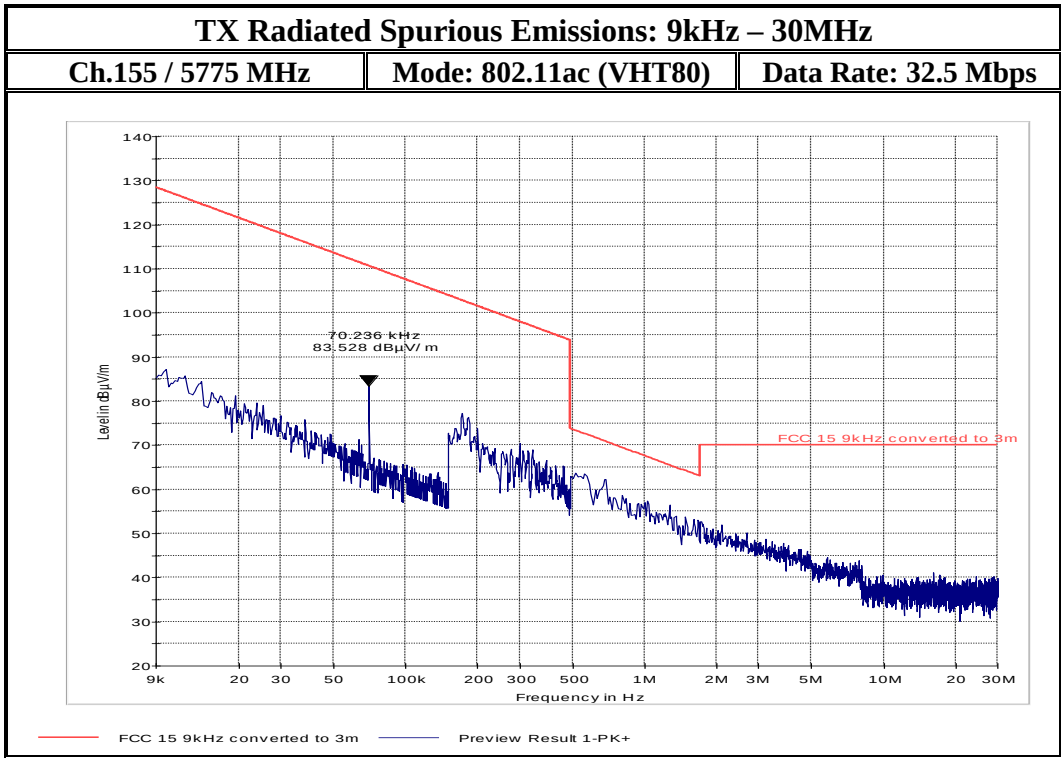
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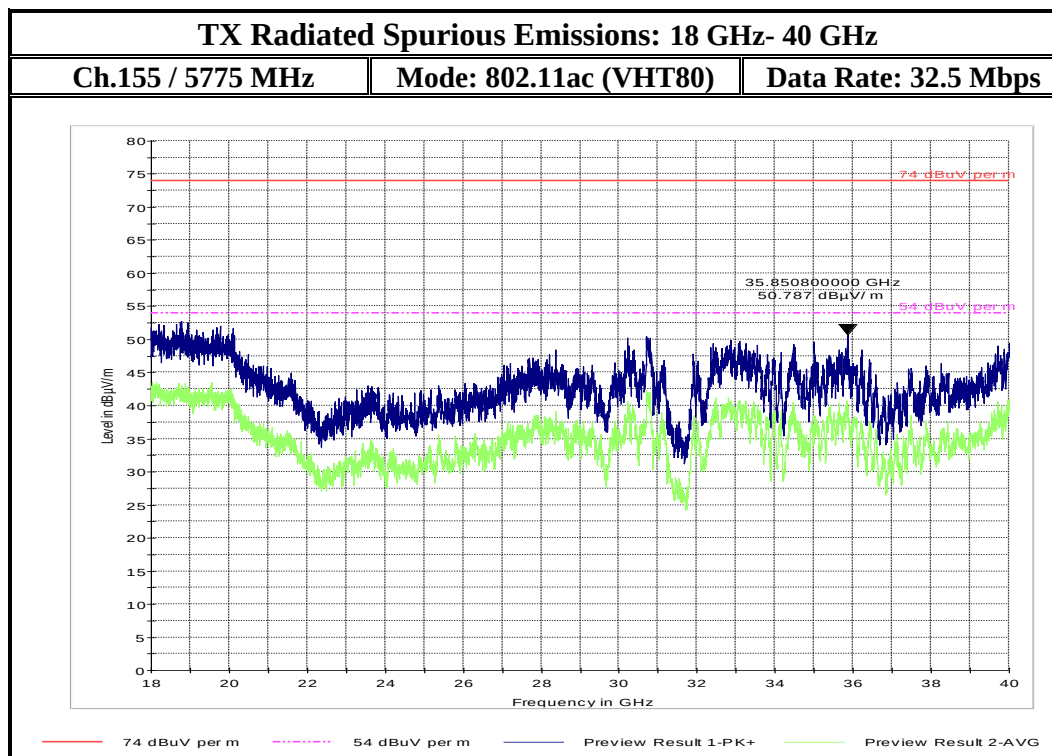
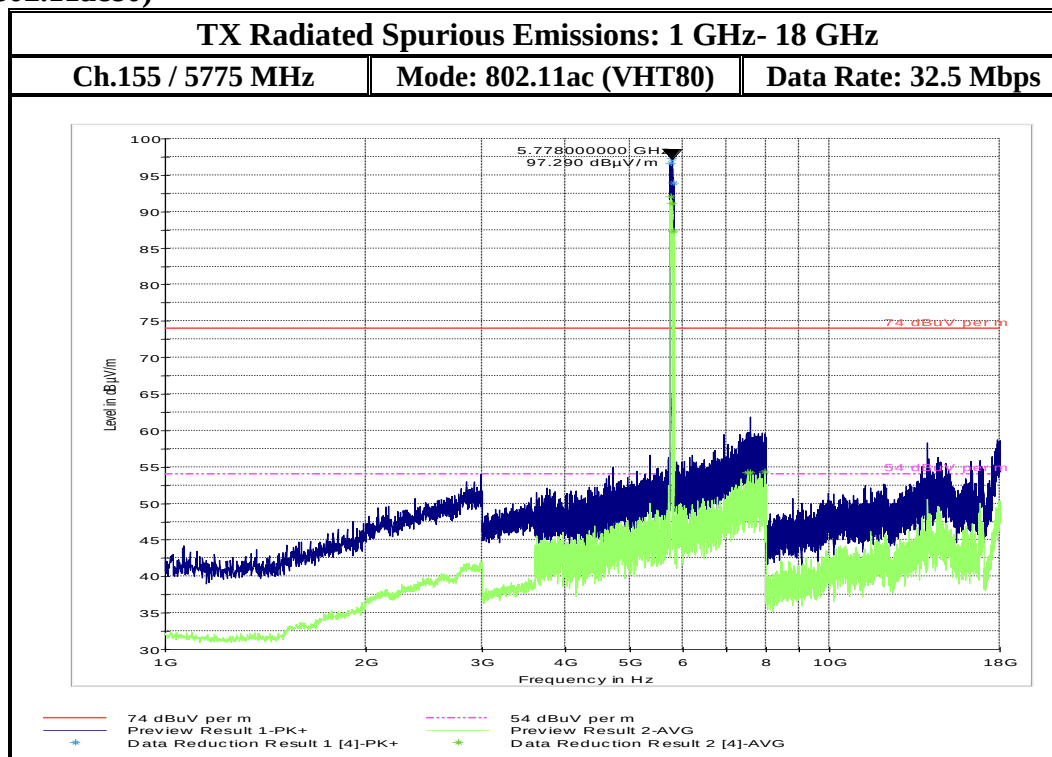
Test Report #:	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	FCC: HD5-75EL0N/00	CETECOM™ Electromagnetic Compatibility
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12 AC Power Line Conducted Emissions

12.1 References:

FCC: CFR Part 15.207/ RSS-Gen 8.8

The purpose of this test is to measure unwanted radio frequency currents induced in any AC conductor external to the equipment which could conduct interference to other equipment via the AC electrical network.

12.2 Limits:

§15.207 & RSS-Gen 8.8

(a) Except as shown in paragraphs (b) and (c) of this section of the CFR, 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 (1), 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.

AC Conducted Emissions Limits Table:

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases with the logarithm of the frequency.

The test shall be performed with the 802.11n (HT20) transmitter mode at MCS0 data rate and shall be repeated in a receiver mode setting.

12.3 Test Conditions:

Tnom: 21 °C; Vnom: 3.7V

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12.4 Measurement procedure:

Measurement according to ANSI C63.10:2013 section 6.2 (also refer to section 6, 6.2 in this test report)

Analyzer Settings:

CISPR Bandwidth- 9KHz.

Detector = Qusi-peak / Average

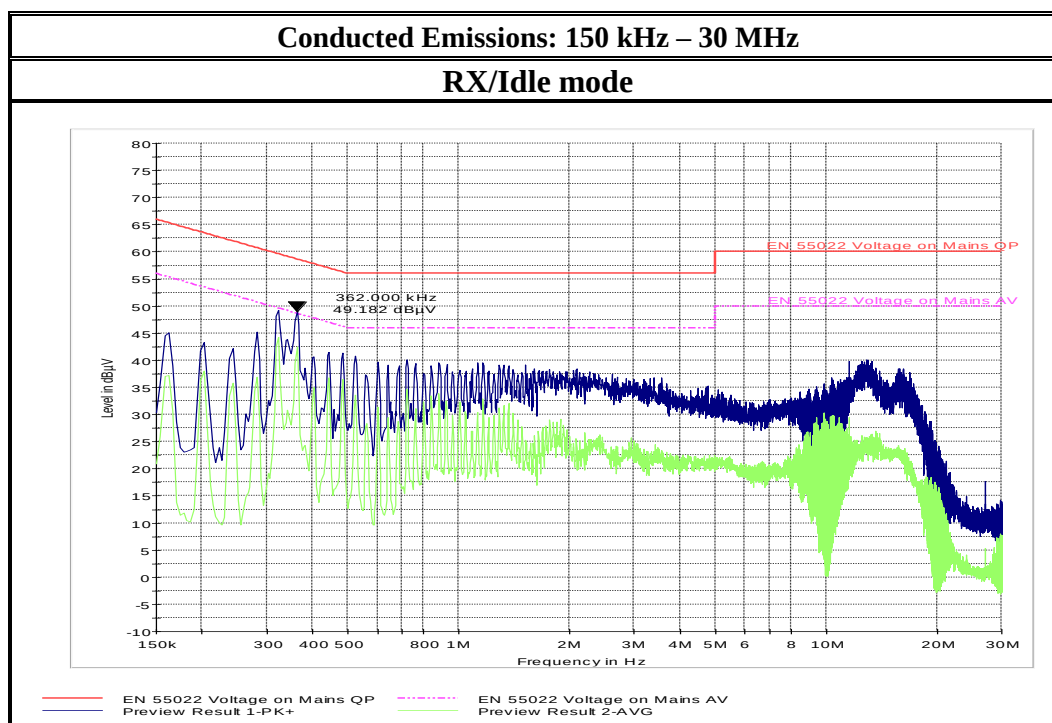
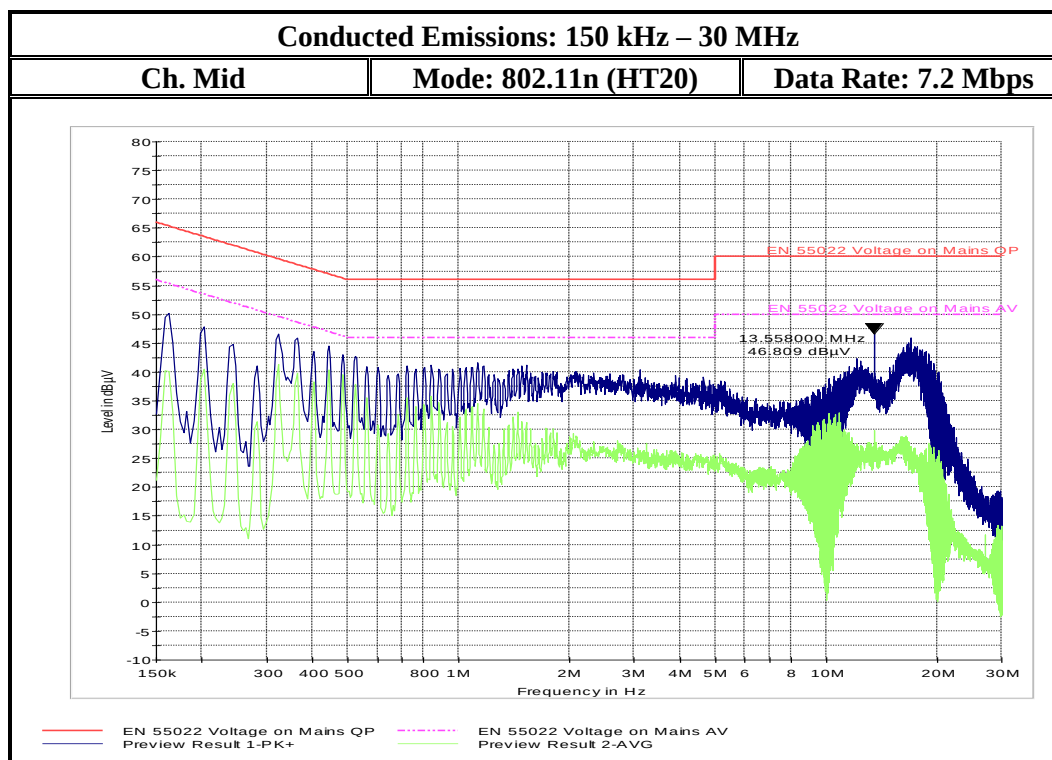
12.5 Verdict

Plots shown here represent the combined worse case emissions for phases and neutral line.

Pass.

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12.6 Test Results:



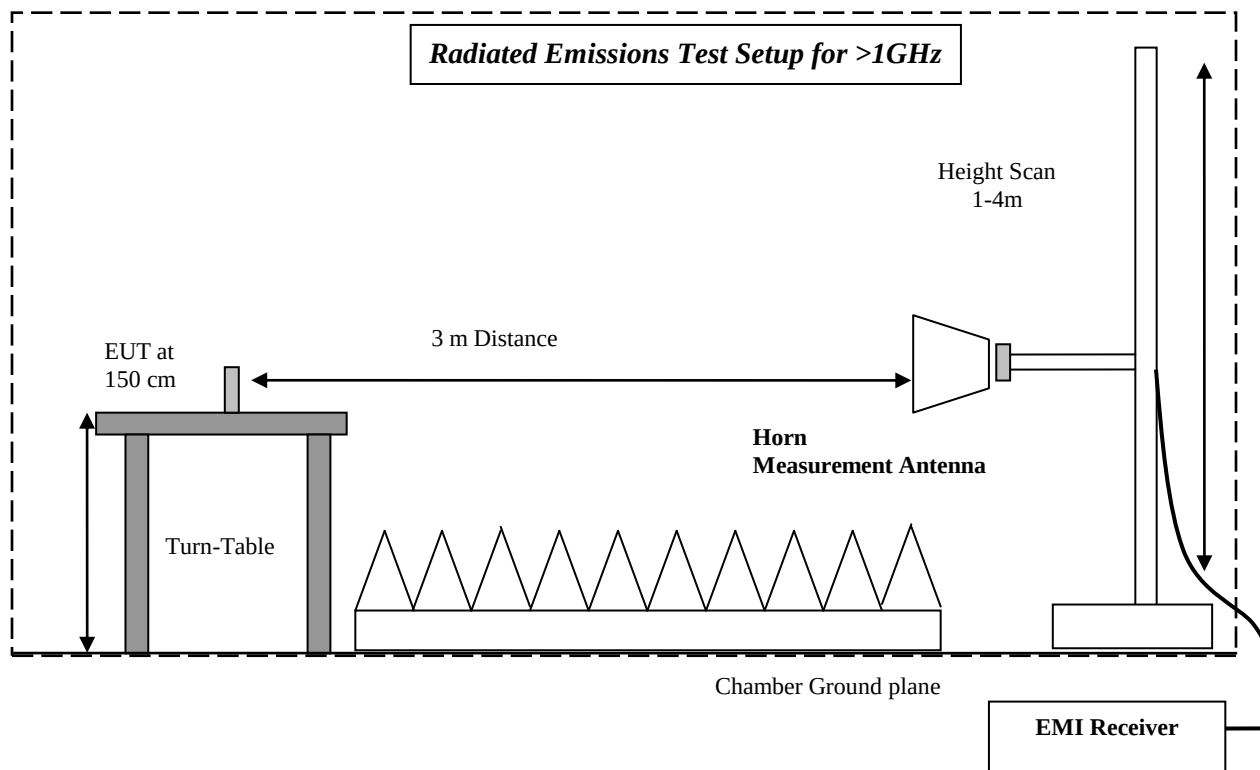
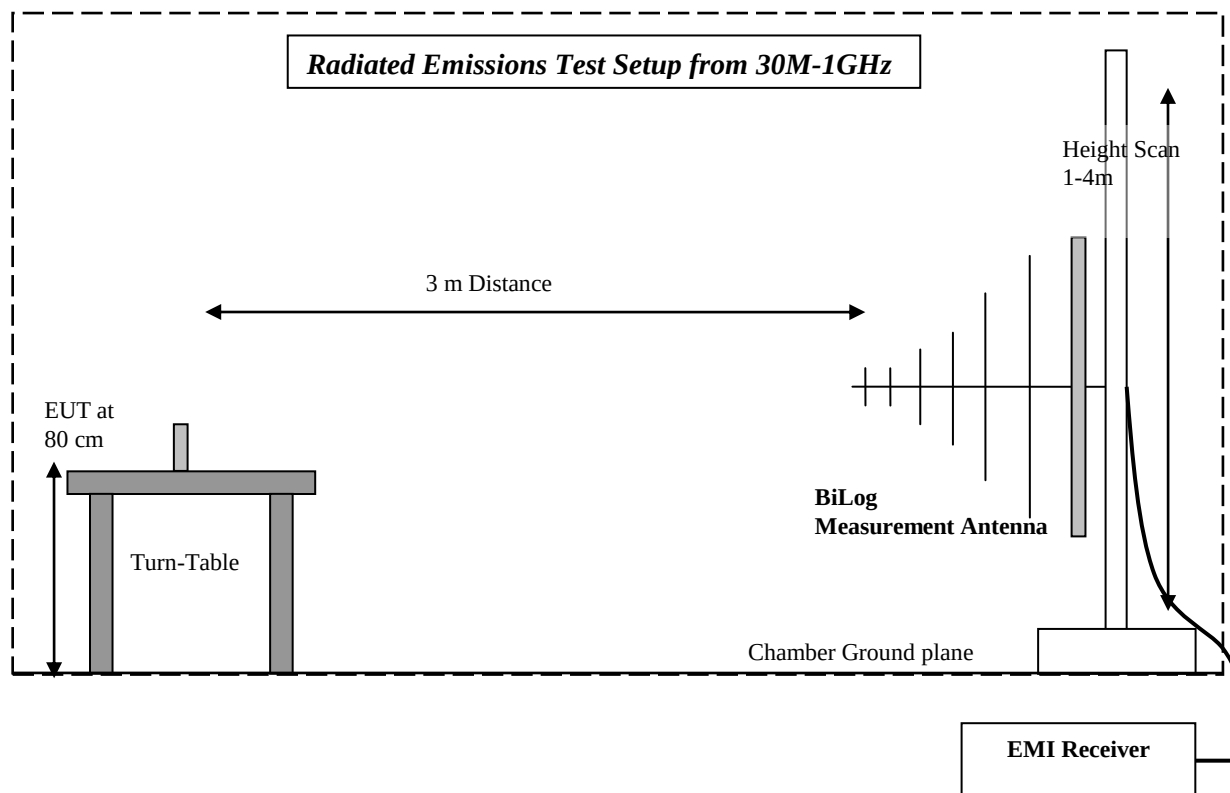
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13 Test Equipment and Ancillaries used for tests

No.	Equipment Name	Manufacturer	Type/model	Serial No.	Cal Date	Cal Interval
	Turn table	EMCO	2075	N/A	N/A	N/A
	MAPS Position Controller	ETS Lindgren	2092	0004-1510	N/A	N/A
	Antenna Mast	EMCO	2075	N/A	N/A	N/A
	High Pass Filter	5HC2700	Trilithic Inc.	9926013	Part of system calibration	
	High Pass Filter	4HC1600	Trilithic Inc.	9922307	Part of system calibration	
	6GHz High Pass Filter	HPM50106	Microtronics	001	Part of system calibration	
	Pre-Amplifier	JS4-00102600	Miteq	00616	Part of system calibration	
	Relay Switch Unit	Rohde&Schwarz	RSU	338964/001	N/A	N/A
	EMI Receiver/Analyzer	Rohde&Schwarz	ESU 40	100251	Sept 2013	2 Year
	Spectrum Analyzer	Rohde&Schwarz	FSU	200302	Jun 2013	2 Years
	1500MHz HP Filter	Filtek	HP12/1700	14c48	N/A	N/A
	2800 MHZ HP Filter	Filtek	HP12/2800	14C47	N/A	N/A
	Pre-Amplifier	Miteq	JS40010260	340125	N/A	N/A
	Binconilog Antenna	EMCO	3141	0005-1186	Apr 2012	3 Years
	Binconilog Antenna	ETS	3149	J000123908	Feb 2012	3 years
	Horn Antenna	EMCO	3115	35114	Mar 2012	3 Years
	Loop Antenna	EMCO	6512	00049838	Apr 2012	3 years
	LISN	R&S	ESH3-Z5	836679/003	Jun 2013	3 Years

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14 Test Setup Diagram:



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15 Revision History

Date	Report Name	Changes to report	Report prepared by
2015-02-05	EMC_HONEY_134_14001_15.407_UNII_WLAN_75E	First official version	Danh Le