



**FCC CFR 47 PART 15 SUBPART F §15.519**

**CERTIFICATION TEST REPORT**

**FOR**

**TRACKING TAG**

**MODEL NUMBER: A2187**

**REPORT NUMBER: 12791034-E2V3**

**ISSUE DATE: OCTOBER 1, 2020**

**FCC ID: BCGA2187**

*Prepared for*

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Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
V1	08/25/2020	Initial Issue	Thu Chan
V2	08/27/2020	Section 5.1: Updated Statement Section 6: Updated Statement Section 7: Updated List & Added Statement	Thu Chan
V3	10/1/2020	Section 8.4.1: Changed "dBuV" to "dBuV/m"	Thu Chan

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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** APPLE INC.  
ONE APPLE PARK WAY  
CUPERTINO, CA 95014, USA

**EUT DESCRIPTION:** TRACKING TAG

**MODEL:** A2187

**SERIAL NUMBER:** FDFZ83MUP119

**DATE TESTED:** JULY 01 – NOVEMBER 14, 2019

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC §15 Subpart F	Complies

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Approved & Released For  
UL Verification Services Inc. By:

Tested By:



THU CHAN  
STAFF ENGINEER  
UL Verification Services Inc.

GIA-PIAO CHIN  
TEST ENGINEER  
UL Verification Services Inc.

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with CFR Title 47 Part 15 Subpart F, KDB 393764 D01 UWB FAQ v02 and ANSI C63.10-2013.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
<input type="checkbox"/> Chamber A	<input checked="" type="checkbox"/> Chamber D
<input type="checkbox"/> Chamber B	<input type="checkbox"/> Chamber E
<input type="checkbox"/> Chamber C	<input checked="" type="checkbox"/> Chamber F
	<input type="checkbox"/> Chamber G
	<input type="checkbox"/> Chamber H

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0.

## 4. DECISION RULES AND MEASUREMENT UNCERTAINTY

### 4.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

### 4.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

### 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	U <sub>LAB</sub>
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.39 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.07 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.52 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	4.88 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.24 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.37 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.17 dB

Uncertainty figures are valid to a confidence level of 95%.

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is a UWB portable location tracking tag with an integral antenna and operates on 6.5 GHz (Channel 5) and 8 GHz (Channel 9). The EUT is powered by a 3 VDC battery.

Four signal configurations (Config 0,1,4 & 5) are available for each channel setting.

CH	Config
5	0
5	1
5	4
5	5
9	0
9	1
9	4
9	5

BLE technology incorporated on this device is not covered in this report.

### 5.2. DESCRIPTION OF AVAILABLE ANTENNAS

One integral patch antenna is employed and the antenna gains of each channel are listed as follow:

CH	Freq. Band (GHz)	Antenna Gain (dBi)
5	6.5	-1.6
9	8.0	-0.6

### 5.3. MODULATION

The UWB signal is BPSK pulsed modulated signal.

### 5.4. SOFTWARE AND FIRMWARE

The Software and Firmware version used at test is 1A186.

## 6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT (FOR SETUP PURPOSE ONLY)

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop + Adapter	Apple	Mac Book Air	CO2PS2HGG085	FCC Doc
Kanzi – USB Adapter	Apple	316FF9	--	--
Smart Phone	Apple	A2111	C7CYP0LDMT5Q	BCG-E3309A

### I/O CABLES

EUT is tested with no peripherals attached.

### TEST SETUP

The round convex shaped EUT was examined at pre-scan tests using a fundamental frequency in the flatbed face-up (X+), flatbed face-down (X-), landscape (Y), landscape 90° (Y+90°) positions and the worst case orientation was determined for final in-band and spurious emission measurements.

Measurements of spurious average emissions were made with the device operating at a higher power than production power to ensure compliance. There is no significant power variation among all configurations, therefore Config 0 was set for all spurious emission tests on both CH5 and CH9.

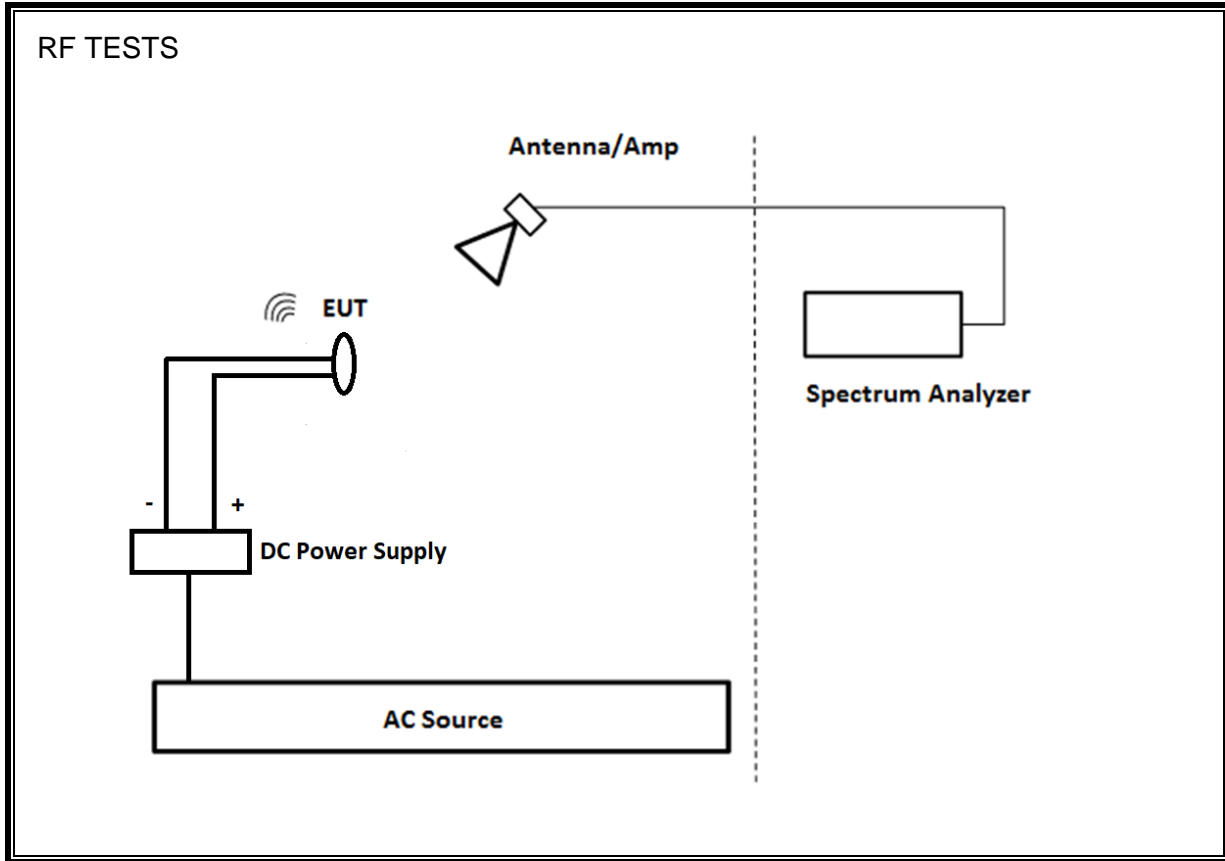
Measurements of the in-band signal (peak and average emissions, 10 dBc bandwidth) were all made at the production power settings.

The EUT was powered by a dummy battery connected to DC power supply set at 3 VDC in all test cases.

For simultaneous transmission of multiple channels in the UWB and BLE bands, no noticeable new emission was found.



**SETUP DIAGRAM FOR TESTS**



## 7. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List						
Description	Manufacturer	Model	S/N	Local ID	Cal Date	Cal Due
EML Test Receiver	Rohde & Schwarz	ESW44	1328.4100K44-101726-gd	PRE0179377	2/15/2019	2/15/2020
Horn Antenna, 1-18 GHz	ETS Lindgren	3117	154523	T712	2/26/2019	2/26/2020
Preamp, 1-18 GHz	Miteq	AFS42-00101800-25-S-42	--	PRE0183530	5/31/2019	5/31/2020
PXA Signal Analyzer	Agilent	N9030A	MY53310959	T906	1/22/2019	1/22/2020
Hybrid Antenna, 30-1000 MHz	Sunol Sciences	JB3	A022813-2	T407	6/11/2019	6/11/2020
Preamp, 0.1-1300 MHz	Sonoma Inst.	310	185623	T173	7/6/2019	7/6/2020
Horn Antenna, 1-18 GHz	ETS Lindgren	3117	143447	T345	5/7/2019	5/7/2020
Preamp, 1-18 GHz	Miteq	AFS42-00101800-25-S-42	--	PRE0183207	12/15/2018	12/15/2019
PXA Signal Analyzer	Agilent	N9030A	MY52350671	T342	1/23/2019	1/23/2020
Amplifier, 10 kHz to 1 GHz	Sonoma Inst.	310	325117	T835	12/15/2018	12/15/2019
Antenna, Active Loop 9KHz to 30MHz	ETS Lindgren	6502	213423	T1616	10/18/2018	10/18/2019*
Spectrum Analyzer, 44GHz	Keysight	N9030A	MY53311010	T905	1/24/2019	1/24/2020
Preamplifier, 1-26.5GHz	Agilent	8449B	3008A04710	T404	3/23/2019	3/23/2020
Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	209336	T447	6/16/2019	6/16/2020
Preamplifier, 26-40 GHz	Miteq	NSTTA2640-35-HG	--	T1864	3/23/2019	3/23/2020
Horn Antenna, 26-40 GHz	ARA	MWH-2640/B	209340	T446	8/9/2019	8/9/2020
DC Power Supply	Hewlett Packard	E3610A	KR24104150	T502	NCR	--
DC Power Supply	All-Bright Technology Co.	8185D	D021364	PRE0129629	NCR	--
Multimeter	Fluke	87-5 True RMS Multimeter	23310084	T360	1/31/2019	1/31/2020
Low Pass Filter, CH5	Wainwright Inst. GMBH	WLKX12-5400-5913-1800-60ST	7	--	NCR	--
Low Pass Filter, CH9	Wainwright Inst. GMBH	WLKX10-6400-7424-2100-60ST	5	--	NCR	--
High Pass Filter, CH5	Wainwright Inst. GMBH	WHW2-7100-10000-18000-40DC	11	--	NCR	--
High Pass Filter, CH9	Wainwright Inst. GMBH	WHW2-8165-11500-21000-40CD	5	--	NCR	--
Radiated Software	UL	UL EMC			Ver 9.5.24, Sep 2019 Ver 9.5.21, Oct 2019	

\*Test data presented in the report was captured with equipment covered within the one year calibration period.

## 8. APPLICABLE LIMITS AND TEST RESULTS

### 8.1. OPERATING BANDWIDTH

#### LIMIT

§15.503 (a) *UWB bandwidth*. For the purpose of this subpart, the UWB bandwidth is the frequency band bounded by the points that are 10 dB below the highest radiated emission, as based on the complete transmission system including the antenna. The upper boundary is designated  $f_H$  and the lower boundary is designated  $f_L$ . The frequency at which the highest radiated emission occurs is designated  $f_M$ .

§15.503 (b) *Center frequency*. The center frequency,  $F_C$ , equals  $(F_H + F_L)/2$ .

§15.503 (c) *Fractional bandwidth*. The fractional bandwidth equals  $2(F_H - F_L) / (F_H + F_L)$ .

§15.503 (d) *Ultra-wideband (UWB) transmitter*. An intentional radiator that, at any point in time, has a fractional bandwidth equal to or greater than 0.20 or has a UWB bandwidth equal to or greater than 500 MHz, regardless of the fractional bandwidth.

§15.519 (b) The UWB bandwidth of a device operating under the provisions of this section must be contained between 3100 MHz and 10,600 MHz.

#### TEST PROCEDURE

ANSI C63.10 Clause 10.1.

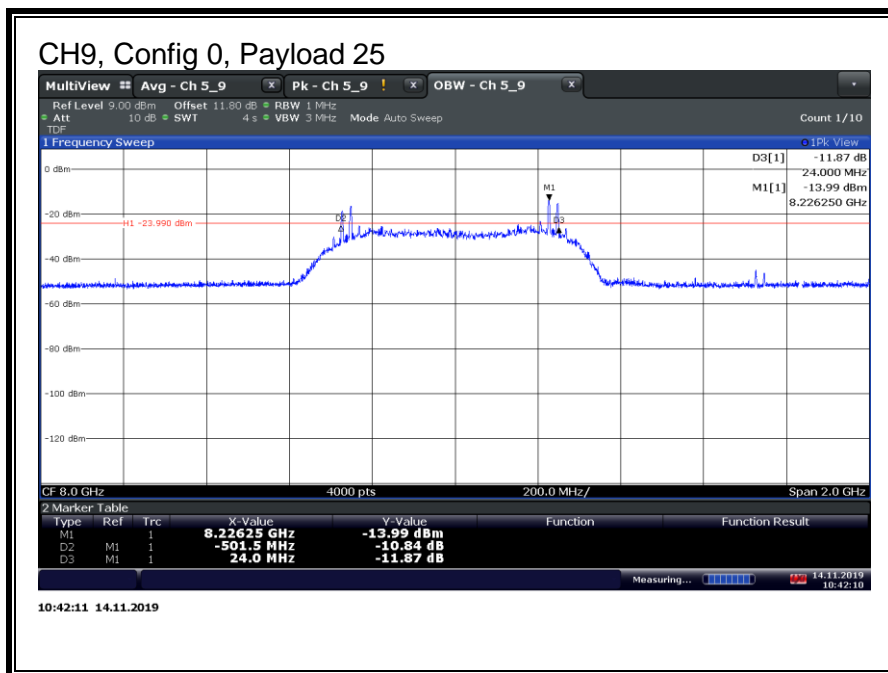
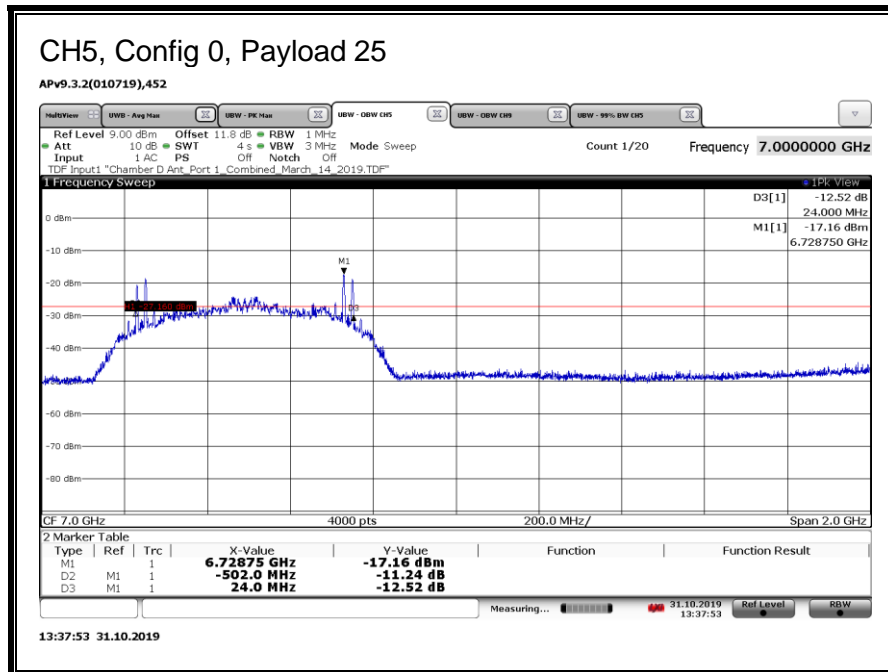
Tabulated data provides the test results of all available test configurations. The plots of Config 0, Payload 25 bandwidth measurement on CH5 and CH9 are presented and same measurement settings were applied to the rest of test configurations.

**RESULTS**

Tested By: 19419 & 12471

CH	Config	Payload	EUT Orientation	Meas. Ant Polarity	FM (GHz)	FL Delta (GHz)	FH Delta (GHz)	FL (GHz)	FH (GHz)	FC (GHz)	OBW (MHz)	Min. OBW (MHz)	OBW Margin (MHz)	OBW Pass/Fail
5	0	25	X-	H	6.72875	0.502	0.024	6.22675	6.75275	6.48975	526	500	26	P
5	0	5	X-	H	6.25025	0.5025	0.024	6.22625	6.75275	6.4895	526.5	500	26.5	P
5	1	45	X+	H	6.25025	0.0235	0.5015	6.22675	6.75175	6.48925	525	500	25	P
5	1	5	X+	H	6.67875	0.5015	0.0235	6.17725	6.70225	6.43975	525	500	25	P
5	4	0	X-	H	6.25050	0.0248	0.5033	6.2257	6.7538	6.48975	528.1	500	28.1	P
5	5	0	X+	H	6.7285	0.5032	0.0263	6.2253	6.7548	6.49005	529.5	500	29.5	P
9	0	125	Y	V	8.22675	0.50155	0.02405	7.7252	8.2508	7.988	525.6	500	25.6	P
9	0	65	Y	V	8.22625	0.501	0.024	7.72525	8.25025	7.98775	525	500	25	P
9	0	25	Y	V	8.22625	0.5015	0.024	7.72475	8.25025	7.9875	525.5	500	25.5	P
9	0	5	Y	V	8.22675	0.502	0.0235	7.72475	8.25025	7.9875	525.5	500	25.5	P
9	1	125	Y	V	8.22675	0.50257	0.0236	7.72418	8.25031	7.9872	526.1	500	26.1	P
9	1	85	Y	V	8.22625	0.5015	0.024	7.72475	8.25025	7.9875	525.5	500	25.5	P
9	1	45	Y	V	7.74825	0.024	0.5015	7.72425	8.24975	7.987	525.5	500	25.5	P
9	1	5	Y	V	7.74825	0.024	0.5015	7.72425	8.24975	7.987	525.5	500	25.5	P
9	4	0	Y+90°	H	8.22625	0.5015	0.024	7.72475	8.25025	7.9875	525.5	500	25.5	P
9	5	0	Y	V	8.22625	0.503	0.025	7.72325	8.25125	7.98725	528	500	28	P

**RESULTS**



## 8.2. PEAK POWER AND MAXIMUM AVERAGE EMISSIONS

### LIMIT

15.519 (e) There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs,  $f_M$ . That limit is 0 dBm EIRP.

15.519 (c) The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency in MHz	EIRP in dBm
3100 - 10600	-41.3

### TEST PROCEDURE

ANSI C63.10 Clause 10.3.

Peak EIPR power is measured using RBW of 50 MHz.

The radiated emissions of 6 - 9 GHz frequency band are performed at 3 meter test distance.

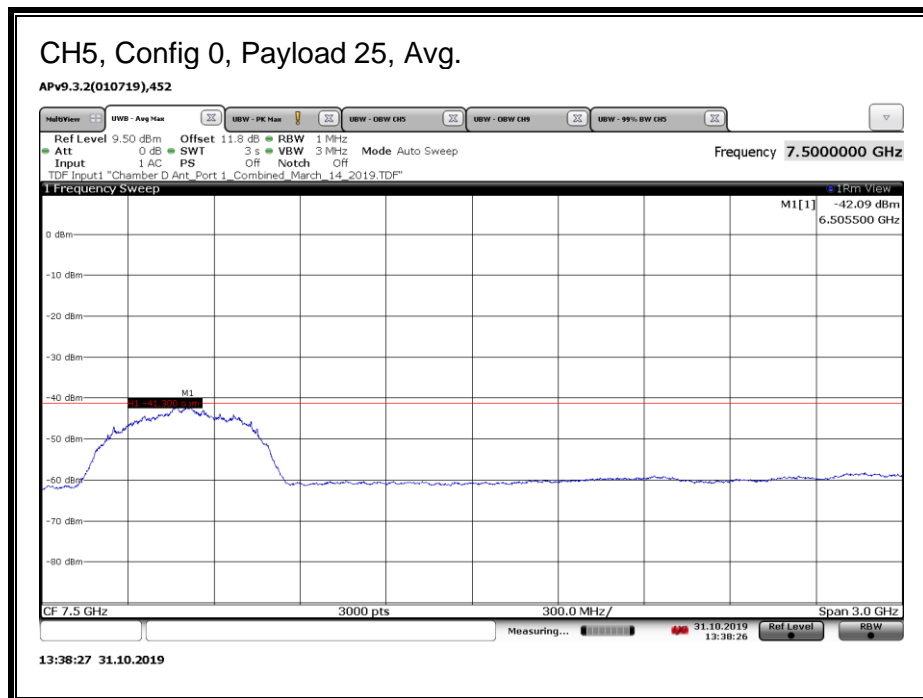
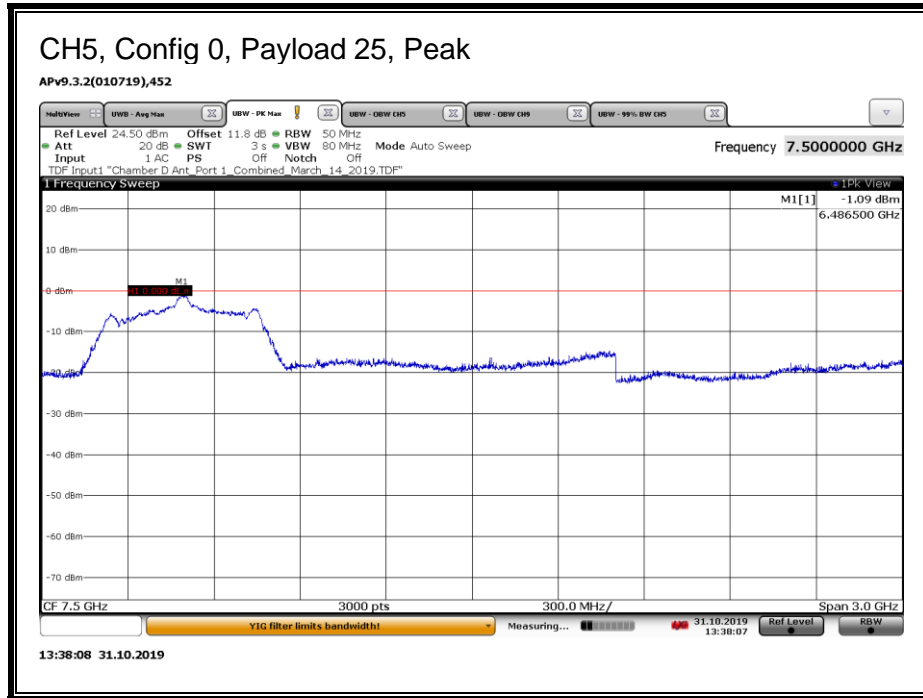
Tabulated data provides the test results of all available test configurations. The plots of Config 0, Payload 25 EIRP measurements on CH5 and CH9 are presented and same measurement settings were applied to the rest of test configurations.

**RESULTS**

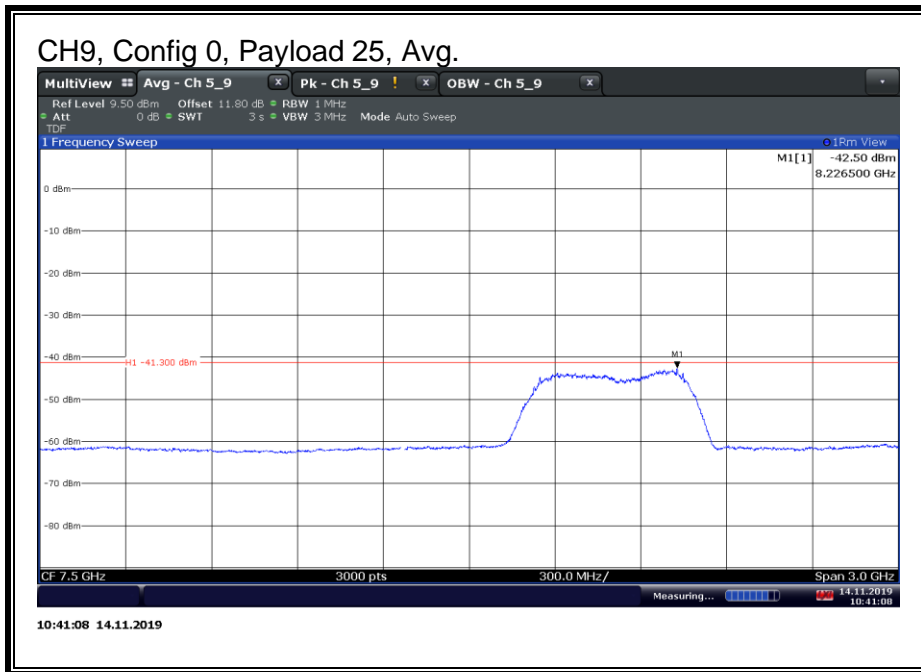
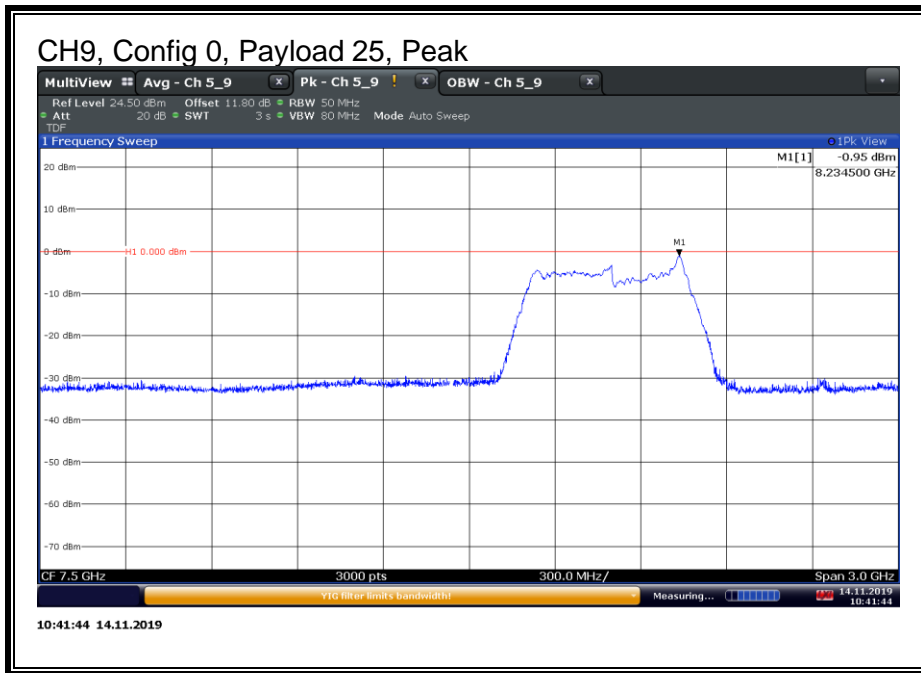
Tested By: 19419 & 12471

CH	Config	Payload	EUT Orientation	Meas. Ant. Polarity	Peak EIRP Power				Average EIRP Power			
					FM (GHz)	Peak Power (dBm/50MHz)	Peak Limit (dBm/50MHz)	Margin (dB)	FM (GHz)	Avg Power (dBm/MHz)	Avg Limit (dBm/MHz)	Margin (dB)
5	0	25	X-	H	6.4865	-1.09	0	-1.09	6.5055	-42.09	-41.3	-0.79
5	0	5	X-	H	6.4785	-1.04	0	-1.04	6.4695	-42.43	-41.3	-1.13
5	1	45	X+	H	6.3805	-4.18	0	-4.18	6.3895	-42.68	-41.3	-1.38
5	1	5	X+	H	6.4905	-0.37	0	-0.37	6.5395	-43.62	-41.3	-2.32
5	4	0	X-	H	6.2395	-5.7	0	-5.7	6.4695	-42.32	-41.3	-1.02
5	5	0	X+	H	6.7405	-4.41	0	-4.41	6.5315	-42.84	-41.3	-1.54
9	0	125	Y	V	8.2221	-2.9	0	-2.9	8.153	-42.09	-41.3	-0.79
9	0	65	Y	V	8.2355	-1.75	0	-1.75	8.2265	-42.6	-41.3	-1.3
9	0	25	Y	V	8.2345	-0.95	0	-0.95	8.2265	-42.5	-41.3	-1.2
9	0	5	Y	V	8.2335	-1.07	0	-1.07	8.1665	-43.33	-41.3	-2.03
9	1	125	Y	V	7.7355	-4.08	0	-4.08	7.8215	-42.43	-41.3	-1.13
9	1	85	Y	V	8.2335	-0.7	0	-0.7	8.2265	-42.01	-41.3	-0.71
9	1	45	Y	V	7.9855	-1.39	0	-1.39	7.8645	-42.4	-41.3	-1.1
9	1	5	Y	V	7.9905	-0.6	0	-0.6	7.8865	-43.45	-41.3	-2.15
9	4	0	Y+90°	H	8.2335	-3.22	0	-3.22	8.1545	-41.84	-41.3	-0.54
9	5	0	Y	V	8.2355	-0.83	0	-0.83	7.9715	-42.31	-41.3	-1.01

**RESULTS**







### 8.3. CESSATION TIME

#### LIMIT

§15.519(a)(1) A UWB device operating under the provisions of this section shall transmit only when it is sending information to an associated receiver. The UWB intentional radiator shall cease transmission within 10 seconds unless it receives an acknowledgement from the associated receiver that its transmission is being received. An acknowledgment of reception must continue to be received by the UWB intentional radiator at least every 10 seconds or the UWB device must cease transmitting.

#### TEST PROCEDURES

Transmission is monitored when the EUT initiates the UWB link with the Smart Phone.

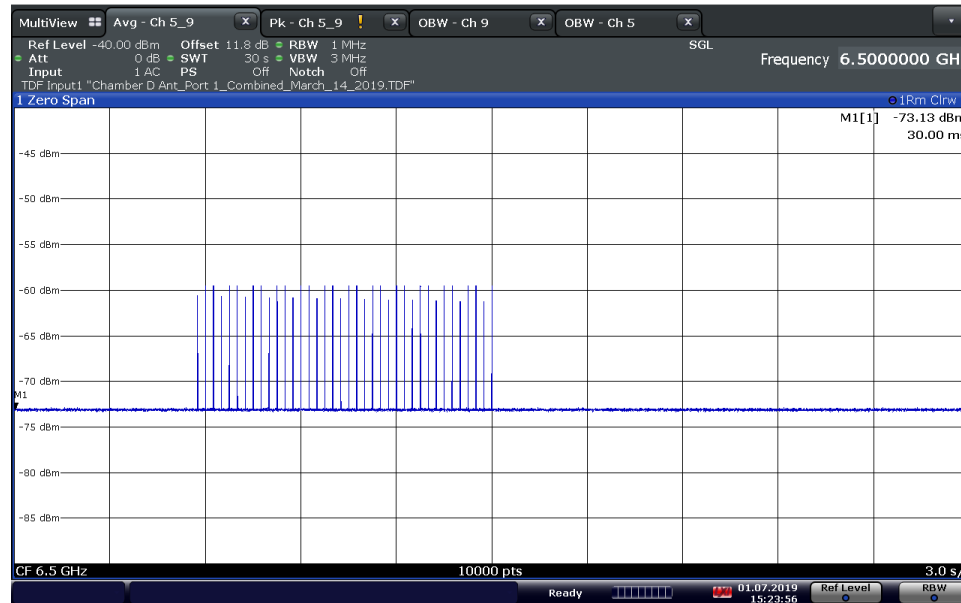
#### RESULTS

Signal Levels on all Plots

- EUT is Low Amplitude
- Smart Phone is High Amplitude

EUT initials the UWB link

APv9.3.2(010719),452



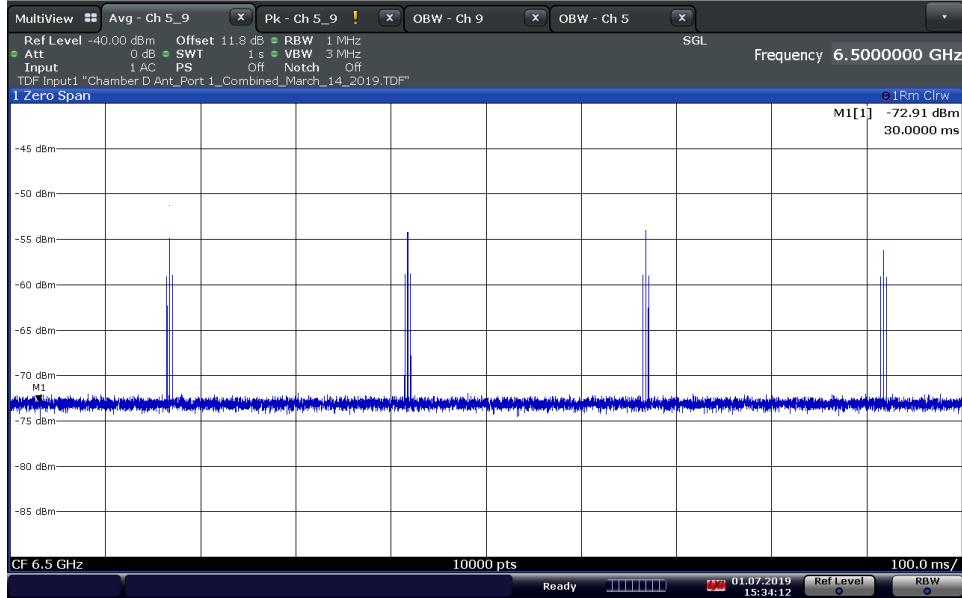
15:23:56 01.07.2019

#### RESULT

- All devices, including the EUT, cease transmissions in 10s.

Zoom-in Plot during On-time and Packets Exchanged

APv9.3.2(010719),452



15:34:13 01.07.2019

## 8.4. EMISSIONS BELOW 960 MHz

### LIMITS

§15.519 (c) The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in §15.209. The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

15.209 (a)

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

### TEST PROCEDURE

ANSI C63.10 Clause 10.2 and 10.3.

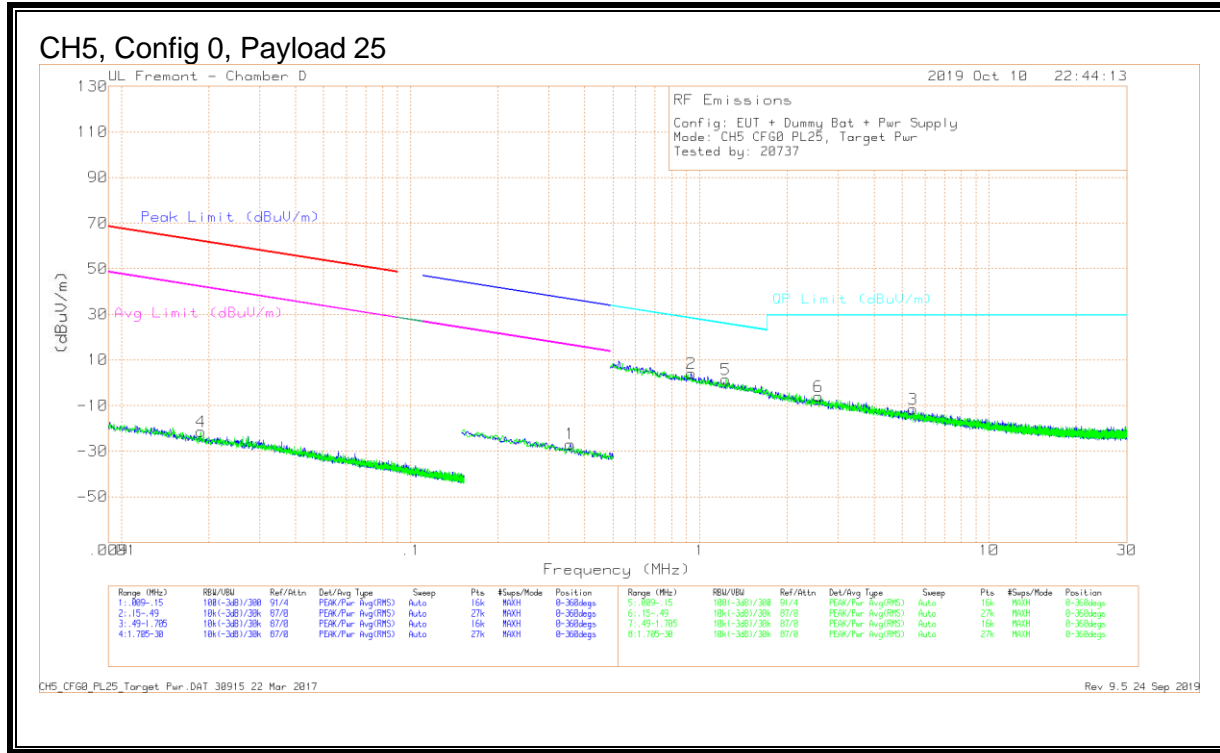
### PROCEDURE FOR 9 kHz TO 960 MHz

Measurements are made with the antenna feeding a spectrum analyzer via a preamplifier and cables, at a maximum distance of 3m from the EUT.

### RESULTS

CH	Config	PL	Frequency Range	
			9 kHz - 30 MHz	30 - 960 MHz
5	0	25	PASS	PASS
9	0	125	PASS	PASS

**8.4.1. EMISSIONS, 9 kHz – 30 MHz**



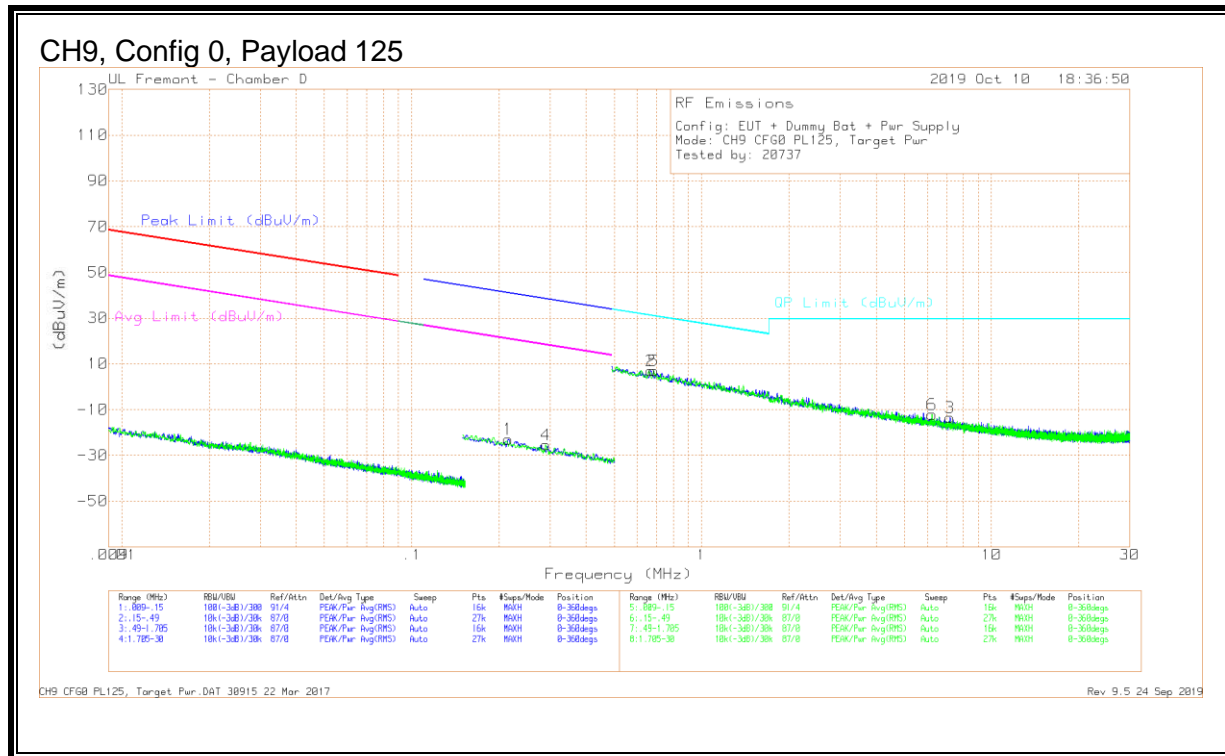
**Trace Markers**

Marker	Frequency (MHz)	Meter Reading (dBuV/m)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr 300m	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.35639	42.14	Pk	10.9	.1	-80	-26.86	36.57	-63.43	16.57	-43.43	0-360
4	.01879	43.79	Pk	14.8	0	-80	-21.41	62.11	-83.52	42.11	-63.52	0-360

Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV/m)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr (dB) 40Log	Corrected Reading (dBuV/m)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
2	.93327	32.66	Pk	11.3	.1	-40	4.06	28.22	-24.16	0-360
3	5.45527	16.99	Pk	11.2	.3	-40	-11.51	29.5	-41.01	0-360
5	1.23108	29.85	Pk	11.4	.1	-40	1.35	25.82	-24.47	0-360
6	2.57222	22.45	Pk	11.3	.2	-40	-6.05	29.5	-35.55	0-360

Pk - Peak detector



Trace Markers

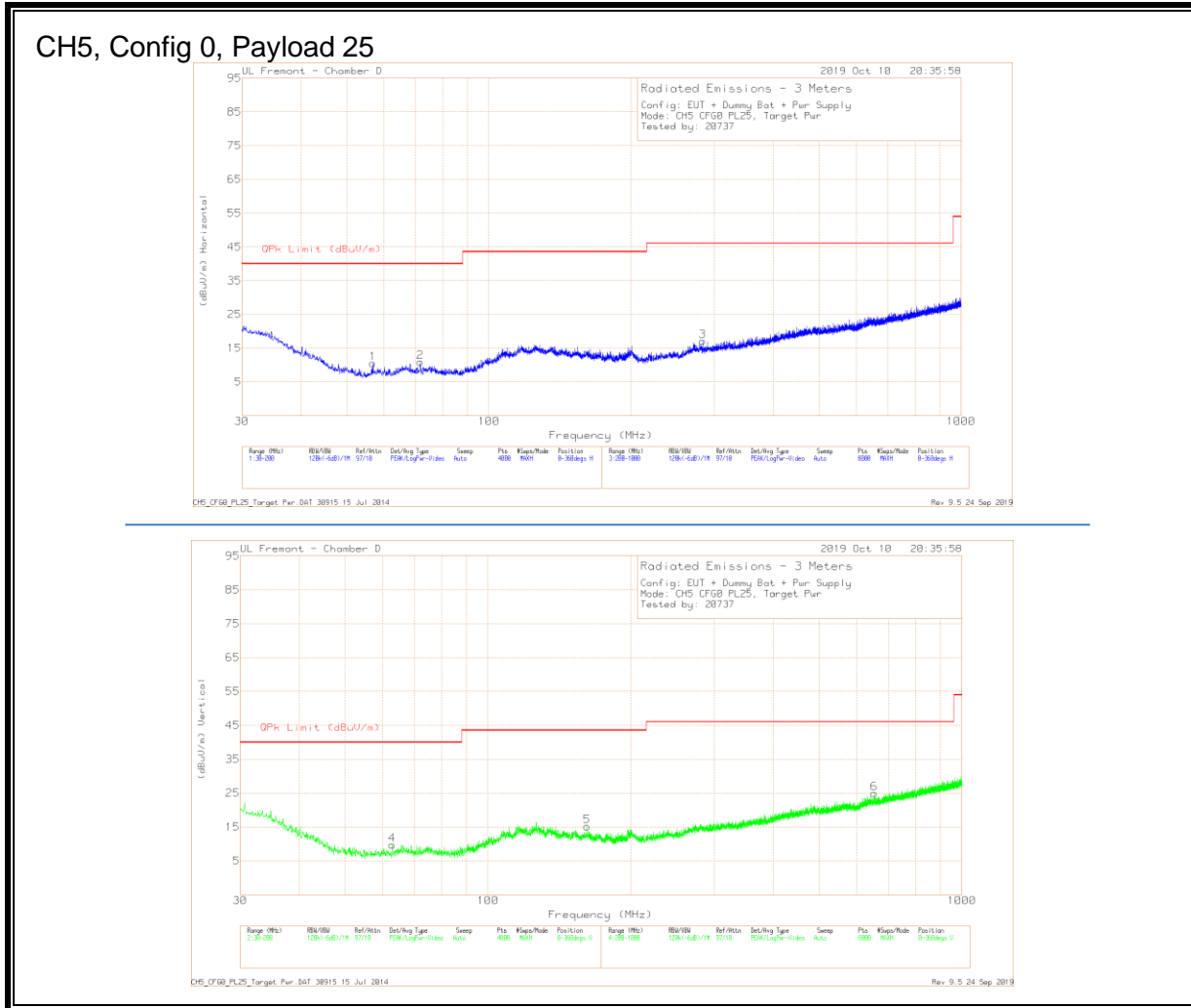
Marker	Frequency (MHz)	Meter Reading (dBuV/m)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr 300m	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.21559	46.02	Pk	11	.1	-80	-22.88	40.94	-63.82	20.94	-43.82	0-360
4	.28995	43.56	Pk	10.9	.1	-80	-25.44	38.37	-63.81	18.37	-43.81	0-360

Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV/m)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr (dB) 40Log	Corrected Reading (dBuV/m)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
2	.66856	35.91	Pk	11.1	.1	-40	7.11	31.11	-24	0-360
5	.68384	35.89	Pk	11.1	.1	-40	7.09	30.91	-23.82	0-360
6	6.23236	16.45	Pk	11.1	.3	-40	-12.15	29.5	-41.65	0-360
3	7.20228	15.11	Pk	11.1	.3	-40	-13.49	29.5	-42.99	0-360

Pk - Peak detector

**8.4.2. EMISSIONS, 30 – 960 MHz**

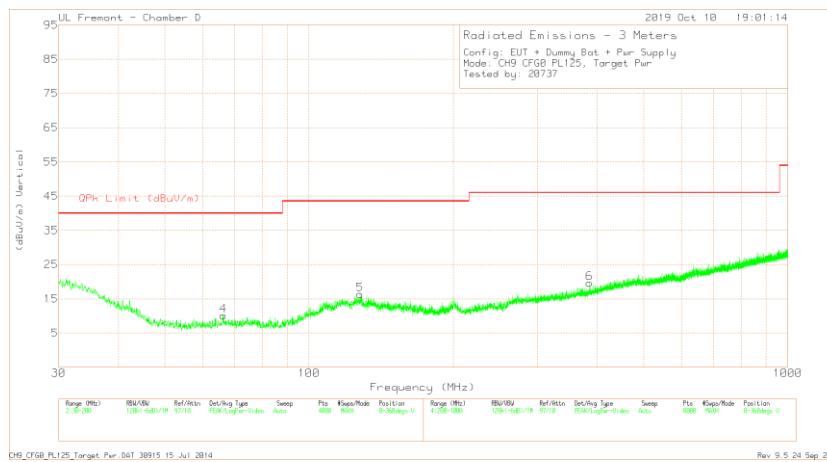
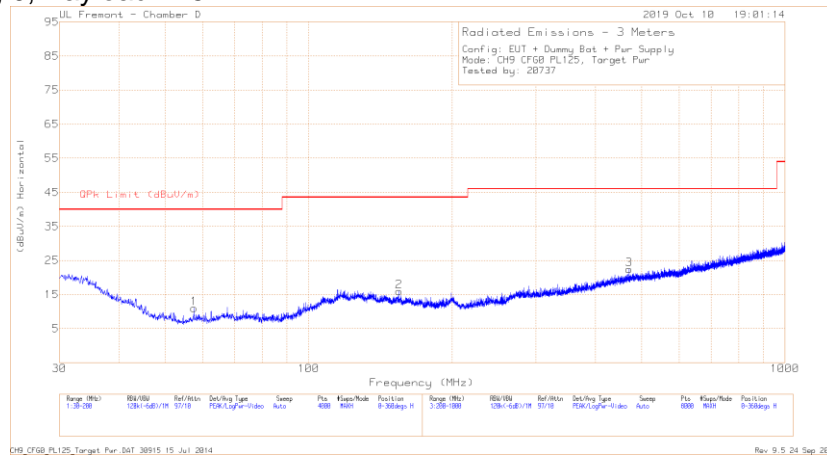


Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T407 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	283.6609	29.84	Pk	17.3	-30	17.14	46.02	-28.88	0-360	199	H
1	56.8244	30.84	Pk	11.2	-31.6	10.44	40	-29.56	0-360	199	H
4	62.8185	29.5	Pk	11.7	-31.5	9.7	40	-30.3	0-360	100	V
2	71.5758	30.32	Pk	12.1	-31.5	10.92	40	-29.08	0-360	99	H
5	161.7416	29.77	Pk	16.1	-30.7	15.17	43.52	-28.35	0-360	100	V
6	653.0589	29.38	Pk	23.8	-28.2	24.98	46.02	-21.04	0-360	299	V

Pk - Peak detector

CH9, Config 0, Payload 125



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T407 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
5	127.7753	29.39	Pk	17.8	-30.9	16.29	43.52	-27.23	0-360	100	V
1	57.5046	31.23	Pk	11.3	-31.5	11.03	40	-28.97	0-360	199	H
4	66.2194	29.67	Pk	12	-31.5	10.17	40	-29.83	0-360	100	V
2	154.8123	30.39	Pk	16.4	-30.8	15.99	43.52	-27.53	0-360	299	H
6	385.6241	30.02	Pk	19	-29.4	19.62	46.02	-26.4	0-360	299	V
3	470.9352	30.07	Pk	21.4	-29.1	22.37	46.02	-23.65	0-360	99	H

Pk - Peak detector



## 8.5. EMISSIONS ABOVE 960 MHz

### LIMITS

15.519 (c)

Frequency in MHz	EIRP in dBm
960-1610	-75.3
1610-1990	-63.3
1990-3100	-61.3
3100-10600	-41.3
Above 10600	-61.3

§15.519 (d) In addition to the radiated emission limits specified in the table in paragraph (c) of this section, UWB transmitters operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz:

Frequency in MHz	EIRP in dBm
1164-1240	-85.3
1559-1610	-85.3

## **TEST PROCEDURE**

ANSI C63.10 Clause 10.2 and 10.3.

### **PROCEDURE FOR 960 MHz TO 6 GHz**

Measurements are made with the antenna feeding a spectrum analyzer via a preamplifier and cables, at a maximum distance of 0.5m from the EUT.

A low pass filter with a cut off frequency of 6 GHz is used to suppress the fundamental and perform measurement for 0.96 - 6 GHz.

### **RESULTS FOR 6 GHz TO 9 GHz**

The 6 - 9 GHz frequency band is covered in Section 8.2.

### **PROCEDURE FOR 9 GHz TO 18 GHz**

Measurements are made with the antenna feeding a spectrum analyzer via a preamplifier and cables, at a maximum distance of 0.5m from the EUT.

A high pass filter with pass band frequency beyond 9 GHz is used to suppress the fundamental and perform measurement for 9 - 18 GHz.

### **PROCEDURE FOR 1.164 TO 1.240 GHz**

Measurements are made with the antenna feeding a spectrum analyzer via a preamplifier and cables, at a maximum distance of 0.5m from the EUT.

RBW = 120kHz & VBW = 360 kHz were used at pre-scan.

A low pass filter with a cut off frequency of 6 GHz is used to suppress the fundamental and perform measurement for 1.164 – 1.240 GHz.

### **PROCEDURE FOR 1.559 TO 1.610 GHz**

Measurements are made with the antenna feeding a spectrum analyzer via a preamplifier and cables, at a maximum distance of 0.5m from the EUT.

RBW = 120kHz & VBW = 360 kHz were used at pre-scan.

A low pass filter with a cut off frequency of 6 GHz is used to suppress the fundamental and perform measurement for 1.559 – 1.610 GHz.

**PROCEDURE FOR 18 GHz TO 40 GHz**

Measurements are made with the antenna feeding a spectrum analyzer via a preamplifier and cables, at a maximum distance of 0.5m from the EUT.

A final test is made at any frequencies at which emissions are found. During this final scan, the antenna is kept no further from the EUT than the maximum distance calculated for each band that yields a minimum system noise floor.

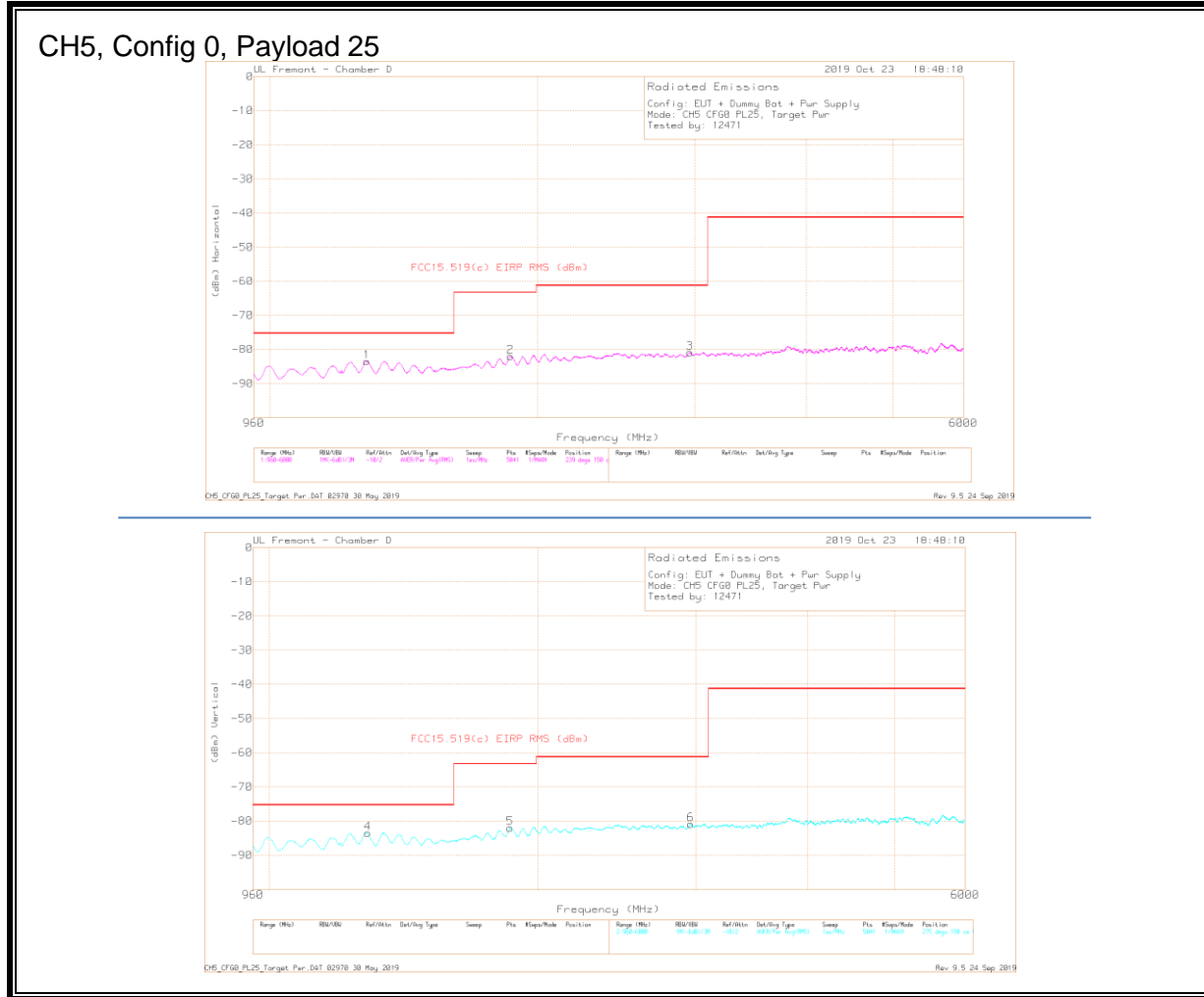
Distance Correction Factor from 3m to 0.5m =  $20 \cdot \log(0.5m/3m) = -15.56 \text{ dB}$

**RESULTS**

**Average Emissions Summary**

CH	Config	PL	Frequency Range				
			1164 - 1240 MHz	1559 - 1610 MHz	0.96 - 18 GHz	18 - 26 GHz	26 - 40 GHz
5	0	25	PASS	PASS	PASS	PASS	PASS
9	0	125	PASS	PASS	PASS	PASS	PASS

### 8.5.1. AVERAGE EMISSIONS, 0.96 – 6 GHz

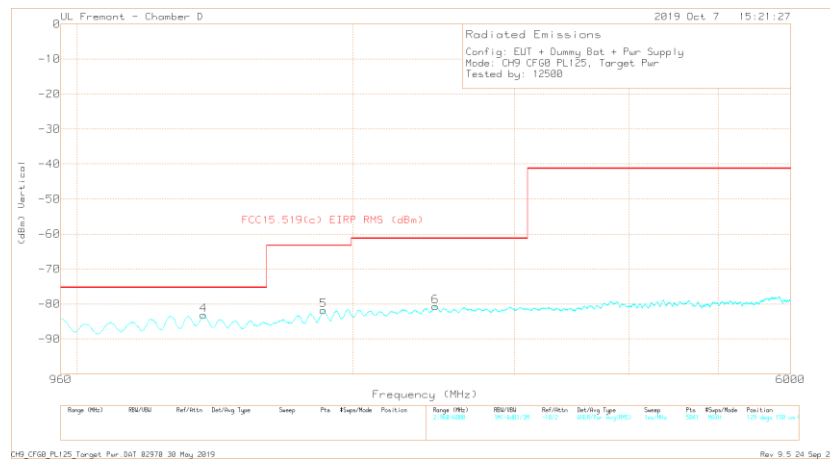
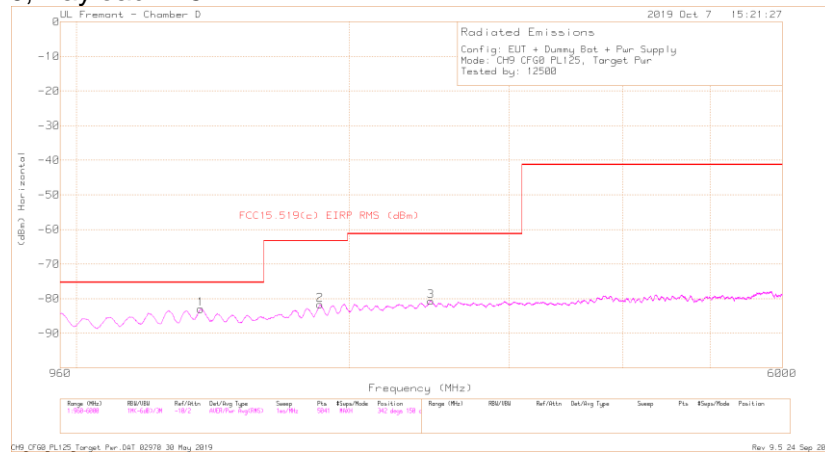


#### Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBm)	Det	AF T345 (dB/m)	Amp/Cbl (dB)	Dist Correction (dB)	Conversion Factor (dB)	CH5 LFP (dB)	Corrected Reading (dBm)	FCC15.519(c) EIRP RMS (dBm)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1286	-62.59	RMS	28.9	-46.3	-15.6	11.8	.2	-83.59	-75.3	-8.29	173	150	H
4	1290	-62.73	RMS	29	-46.3	-15.6	11.8	.2	-83.63	-75.3	-8.33	77	150	V
5	1860	-62.94	RMS	30.5	-46.1	-15.6	11.8	.2	-82.14	-63.3	-18.84	144	150	V
2	1863	-62.9	RMS	30.6	-46.2	-15.6	11.8	.2	-82.1	-63.3	-18.8	107	150	H
6	2959	-65.41	RMS	32.8	-44.9	-15.6	11.8	.3	-81.01	-61.3	-19.71	56	150	V
3	2961	-65.49	RMS	32.9	-44.9	-15.6	11.8	.3	-80.99	-61.3	-19.69	151	150	H

RMS - RMS detection

CH9, Config 0, Payload 125

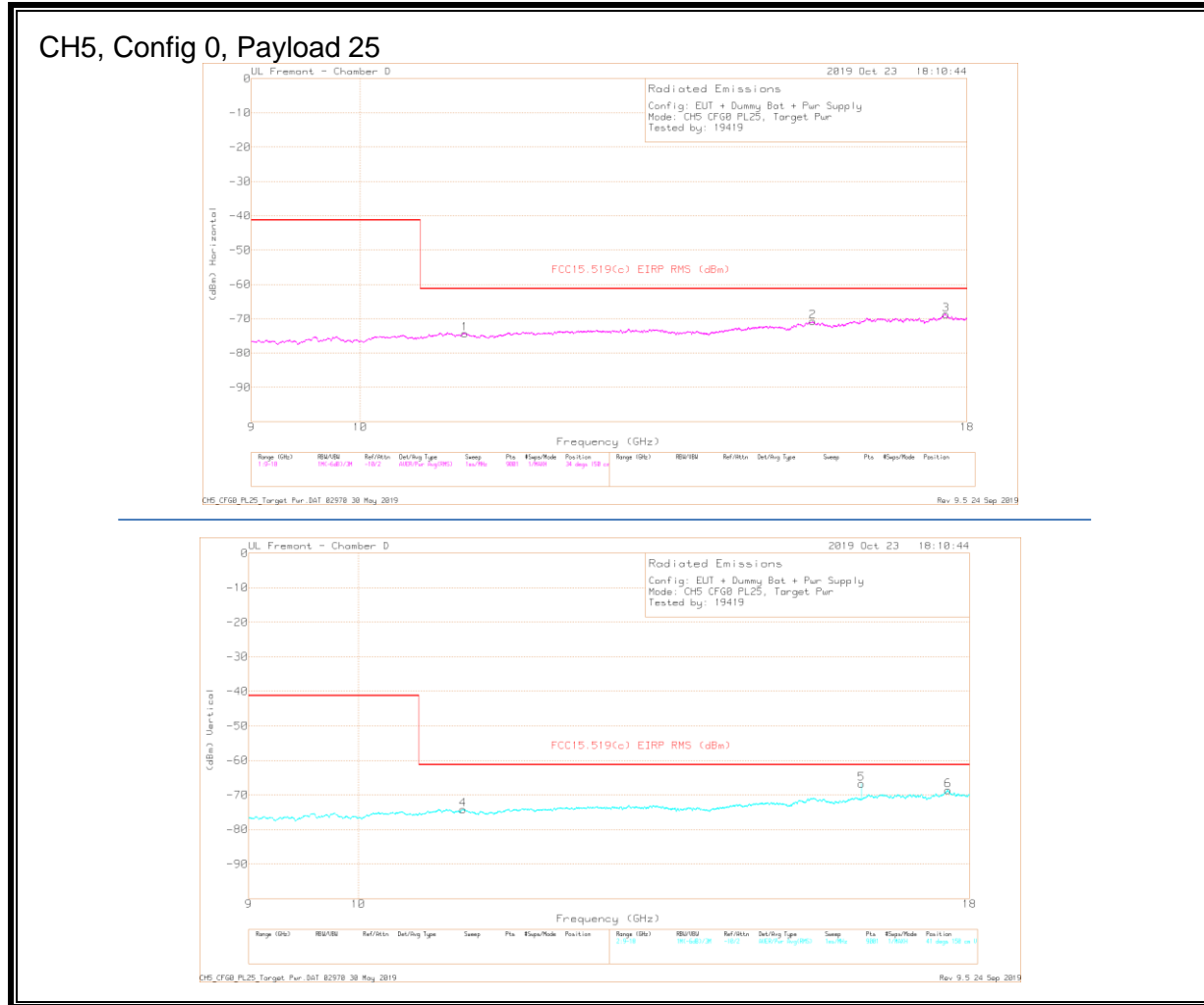


Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBm)	Det	AF T345 (dB/m)	Amp/Cbl (dB)	Dist Correction (dB)	Conversion Factor (dB)	CH9 LFP (dB)	Corrected Reading (dBm)	FCC15.519(c) EIRP RMS (dBm)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1371	-62.86	RMS	29.3	-46.2	-15.6	11.8	.3	-83.06	-75.3	-7.76	231	150	H
4	1374	-62.71	RMS	29.2	-46.2	-15.6	11.8	.3	-83.21	-75.3	-7.91	239	150	V
2	1857	-62.61	RMS	30.6	-46.1	-15.6	11.8	.2	-81.71	-63.3	-18.41	209	150	H
5	1857	-62.79	RMS	30.6	-46.1	-15.6	11.8	.2	-81.89	-63.3	-18.59	86	150	V
6	2458	-63.74	RMS	32.3	-45.8	-15.6	11.8	.3	-80.74	-61.3	-19.44	86	150	V
3	2460	-63.75	RMS	32.3	-45.8	-15.6	11.8	.3	-80.75	-61.3	-19.45	209	150	H

RMS - RMS detection

### 8.5.2. AVERAGE EMISSIONS, 9 – 18 GHz



#### Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T345 (dB/m)	Amp/Cbl (dB)	Dist Correction (dB)	Conversion Factor (dB)	CH5 HPF (dB)	Corrected Reading (dBm)	FCC15.519(c) EIRP RMS (dBm)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	11.0585	-70.27	RMS	37.9	-38.8	-15.6	11.8	.7	-74.27	-61.3	-12.97	20	150	V
1	11.07	-70.49	RMS	37.9	-38.7	-15.6	11.8	.7	-74.39	-61.3	-13.09	341	150	H
2	15.503	-69.44	RMS	40.4	-36.7	-15.6	11.8	.7	-70.84	-61.3	-9.54	341	150	H
5	16.224	-65.34	RMS	41	-39.2	-15.6	11.8	.5	-66.84	-61.3	-5.54	63	150	V
6	17.632	-69.97	RMS	41.6	-37.2	-15.6	11.8	.6	-68.77	-61.3	-7.47	283	150	V
3	17.636	-70.02	RMS	41.6	-37.2	-15.6	11.8	.6	-68.82	-61.3	-7.52	360	150	H

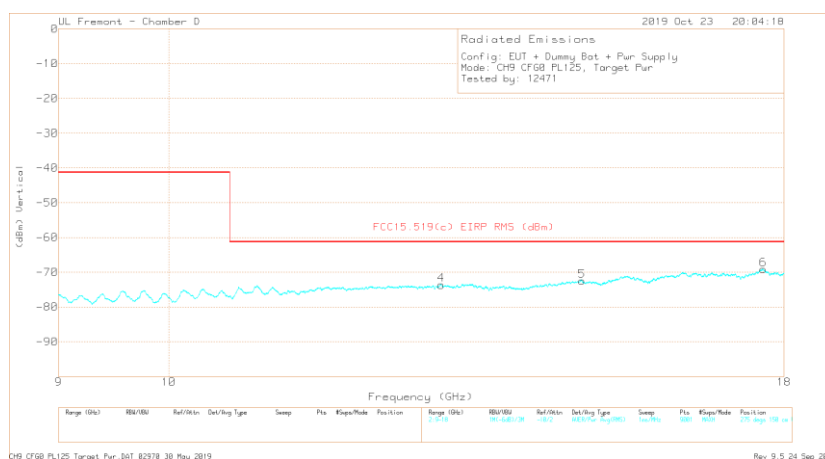
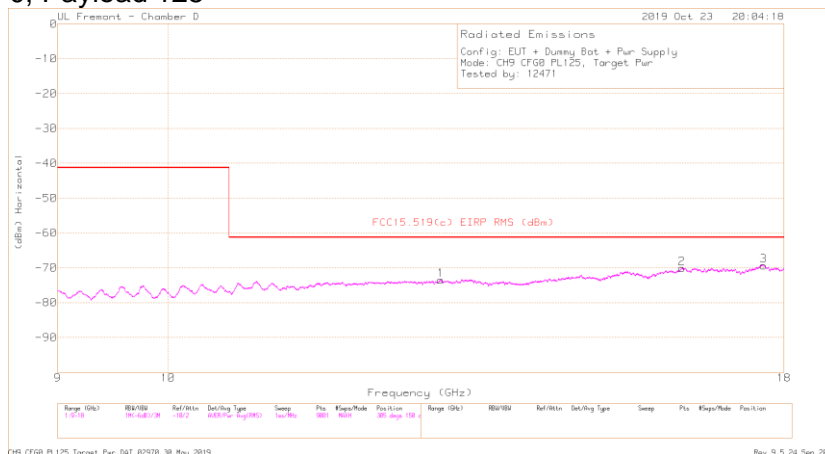
RMS - RMS detection

#### Radiated Emissions

Frequency (GHz)	Meter Reading (dBm)	Det	AF T345 (dB/m)	Amp/Cbl (dB)	Dist Correction (dB)	Conversion Factor (dB)	CH5 HPF (dB)	Corrected Reading (dBm)	FCC15.519(c) EIRP RMS (dBm)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
16.224	-63.76	RMS	41	-39.2	-15.6	11.8	.5	-65.26	-61.3	-3.96	45	150	V

RMS - RMS detection

CH9, Config 0, Payload 125

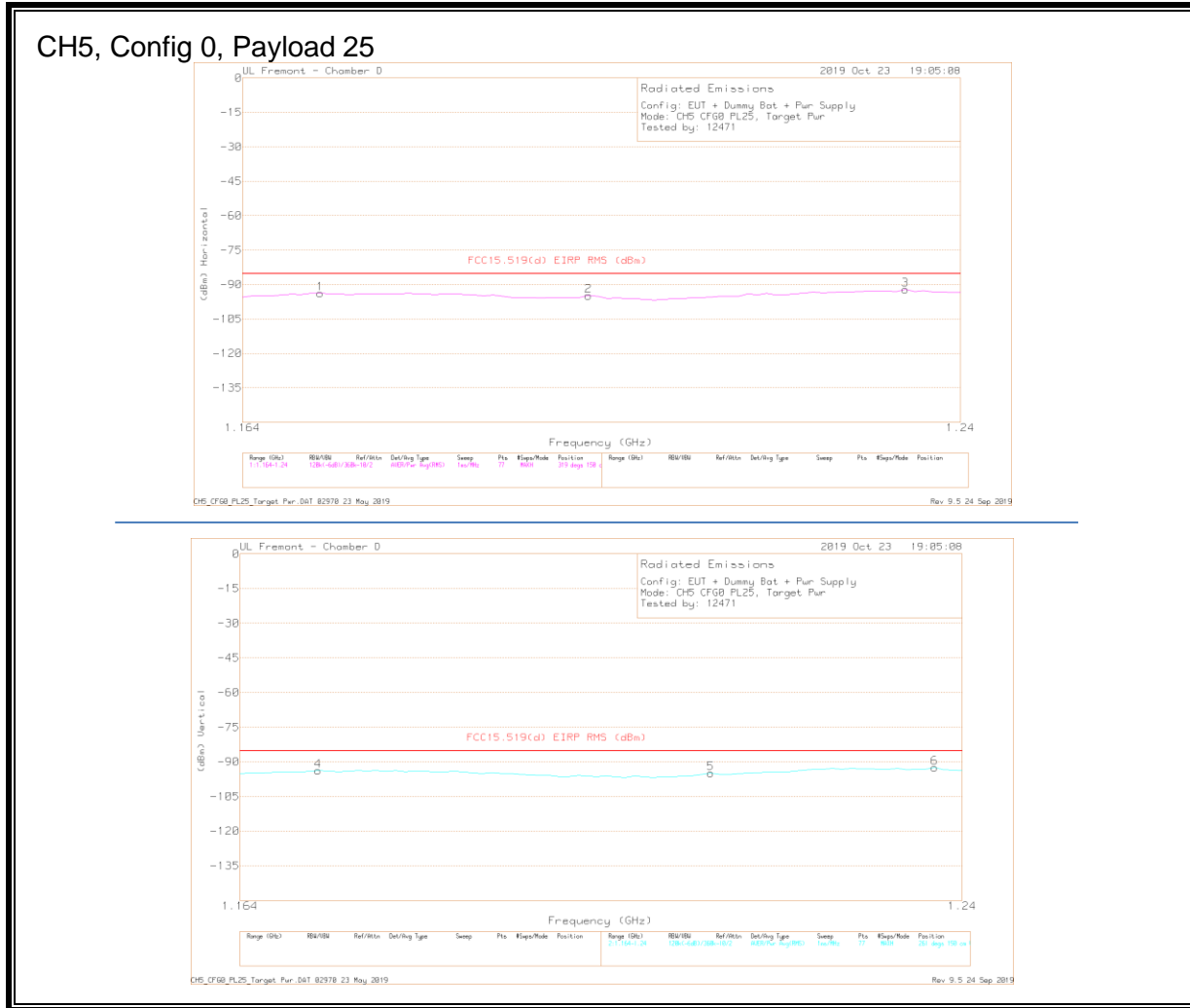


Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AFT345 (dB/m)	Amp/Cbl (dB)	Dist Correction (dB)	Conversion Factor (dB)	CH9 HPF (dB)	Corrected Reading (dBm)	FCC15.519(c) EIRP RMS (dBm)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	12.972	-70.68	RMS	39.4	-38.8	-15.6	11.8	.3	-73.58	-61.3	-12.28	151	150	H
4	12.975	-70.75	RMS	39.3	-38.8	-15.6	11.8	.3	-73.75	-61.3	-12.45	320	150	V
5	14.838	-70.43	RMS	39.7	-38.8	-15.6	11.8	.8	-72.53	-61.3	-11.23	320	150	V
2	16.333	-69.89	RMS	41.2	-38.2	-15.6	11.8	.5	-70.19	-61.3	-8.89	19	150	H
6	17.647	-70.07	RMS	41.5	-37.4	-15.6	11.8	.5	-69.27	-61.3	-7.97	320	150	V
3	17.651	-70.15	RMS	41.5	-37.5	-15.6	11.8	.5	-69.45	-61.3	-8.15	305	150	H

RMS - RMS detection

### 8.5.3. AVERAGE EMISSIONS, 1.164 – 1.240 GHz



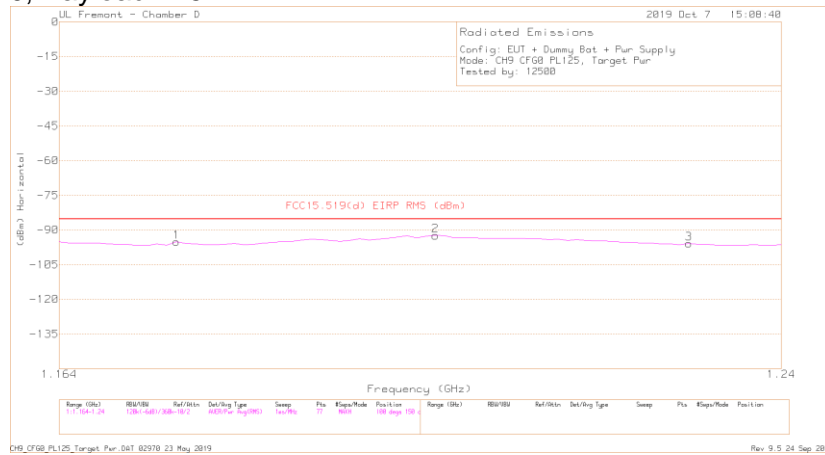
### Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T345 (dBm)	Amp/Cbl (dB)	Dist Correction (dB)	Conversion Factor (dB)	CH5 LP Filter (dB)	Corrected Reading (dBm)	FCC15.519(d) EIRP RMS (dBm)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.172	-71.54	RMS	27.7	-46.5	-15.6	11.8	.2	-93.94	-85.3	-8.64	231	150	H
4	1.172	-71.54	RMS	27.7	-46.5	-15.6	11.8	.2	-93.9	-85.3	-8.6	0	150	V
2	1.2	-73.23	RMS	28.3	-46.4	-15.6	11.8	.2	-94.93	-85.3	-9.63	77	150	H
5	1.213	-73.33	RMS	28.4	-46.5	-15.6	11.8	.2	-95.03	-85.3	-9.73	151	150	V
3	1.234	-70.97	RMS	28.7	-46.4	-15.6	11.8	.2	-92.27	-85.3	-6.97	122	150	H
6	1.237	-71.39	RMS	28.7	-46.4	-15.6	11.8	.2	-92.69	-85.3	-7.39	305	150	V

RMS - RMS detection



CH9, Config 0, Payload 125

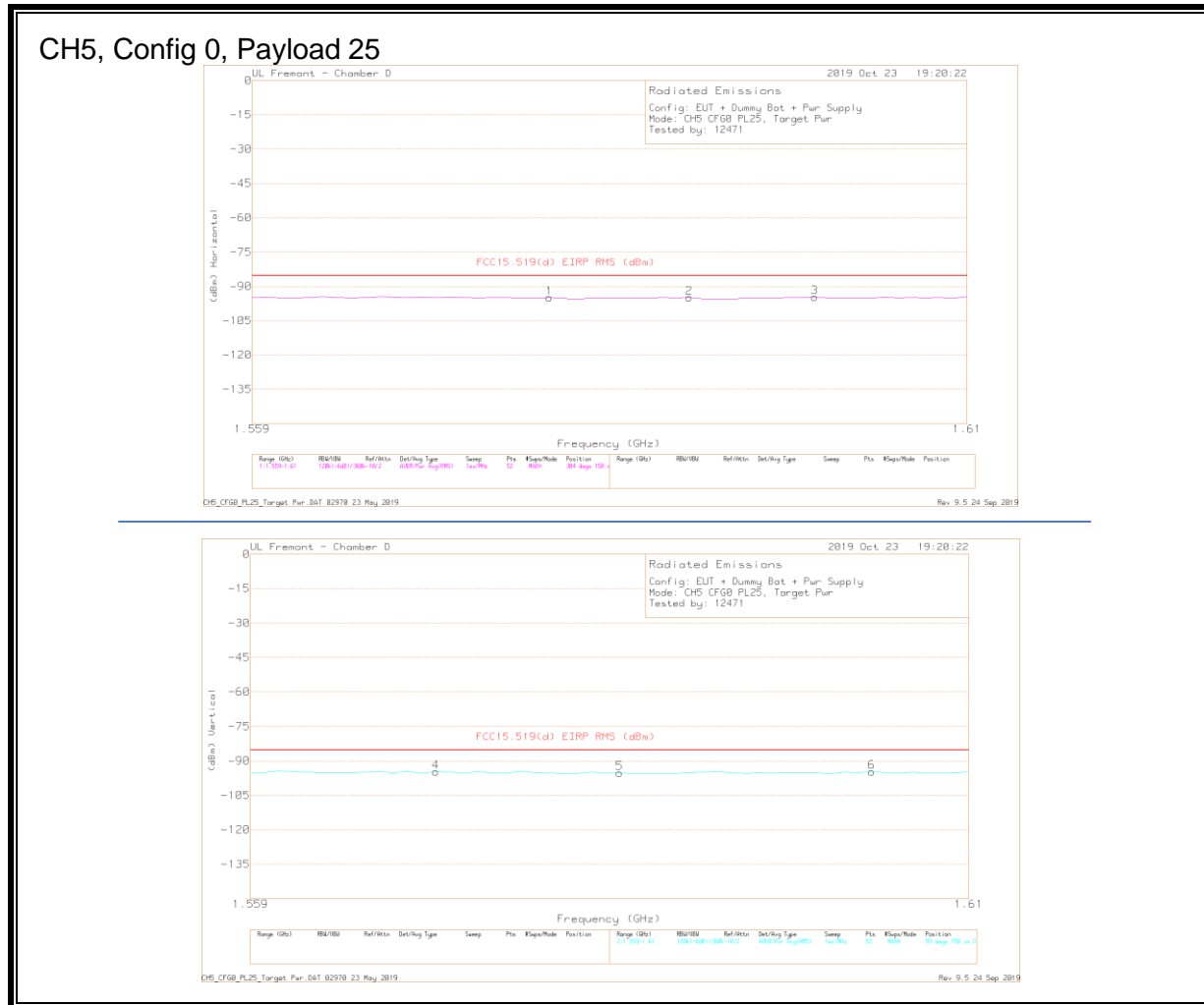


Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T345 (dB/m)	Amp/Cbl (dB)	Dist Correction (dB)	Conversion Factor (dB)	CH9 LP Filter (dB)	Corrected Reading (dBm)	FCC15.519(d) EIRP RMS (dBm)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	1.172	-73.73	RMS	27.7	-46.5	-15.6	11.8	.2	-96.13	-85.3	-10.83	282	150	V
1	1.176	-72.81	RMS	27.7	-46.5	-15.6	11.8	.2	-95.21	-85.3	-9.91	231	150	H
2	1.203	-70.81	RMS	28.3	-46.4	-15.6	11.8	.2	-92.51	-85.3	-7.21	231	150	H
5	1.209	-71.17	RMS	28.2	-46.5	-15.6	11.8	.2	-93.07	-85.3	-7.77	18	150	V
6	1.221	-73.09	RMS	28.5	-46.5	-15.6	11.8	.2	-94.69	-85.3	-9.39	282	150	V
3	1.23	-74.54	RMS	28.6	-46.4	-15.6	11.8	.2	-95.94	-85.3	-10.64	231	150	H

RMS - RMS detection

### 8.5.4. AVERAGE EMISSIONS, 1.559 – 1.610 GHz

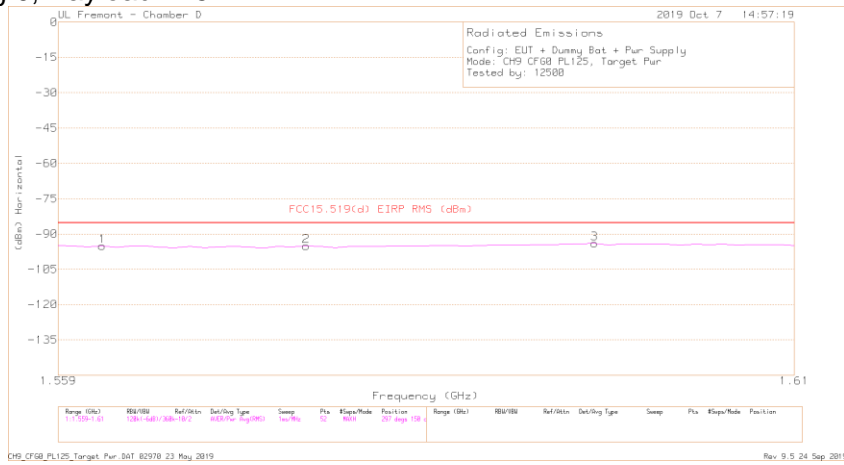


#### Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T345 (dB/m)	Amp/Cbl (dB)	Dist Correction (dB)	Conversion Factor (dB)	CH5 LP Filter (dB)	Corrected Reading (dBm)	FCC15.519(d) EIRP RMS (dBm)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	1.572	-73.13	RMS	28.1	-46.2	-15.6	11.8	.2	-94.83	-85.3	-9.53	34	150	V
1	1.58	-73.24	RMS	28	-46.2	-15.6	11.8	.2	-95.04	-85.3	-9.74	304	150	H
5	1.595	-73.61	RMS	28.1	-46.2	-15.6	11.8	.2	-95.31	-85.3	-10.01	165	150	V
2	1.59	-73.35	RMS	28.1	-46.2	-15.6	11.8	.2	-95.05	-85.3	-9.75	217	150	H
3	1.599	-73.05	RMS	28.1	-46.3	-15.6	11.8	.2	-94.85	-85.3	-9.55	327	150	H
6	1.603	-73.1	RMS	28	-46.2	-15.6	11.8	.2	-94.9	-85.3	-9.6	253	150	V

RMS - RMS detection

CH9, Config 0, Payload 125

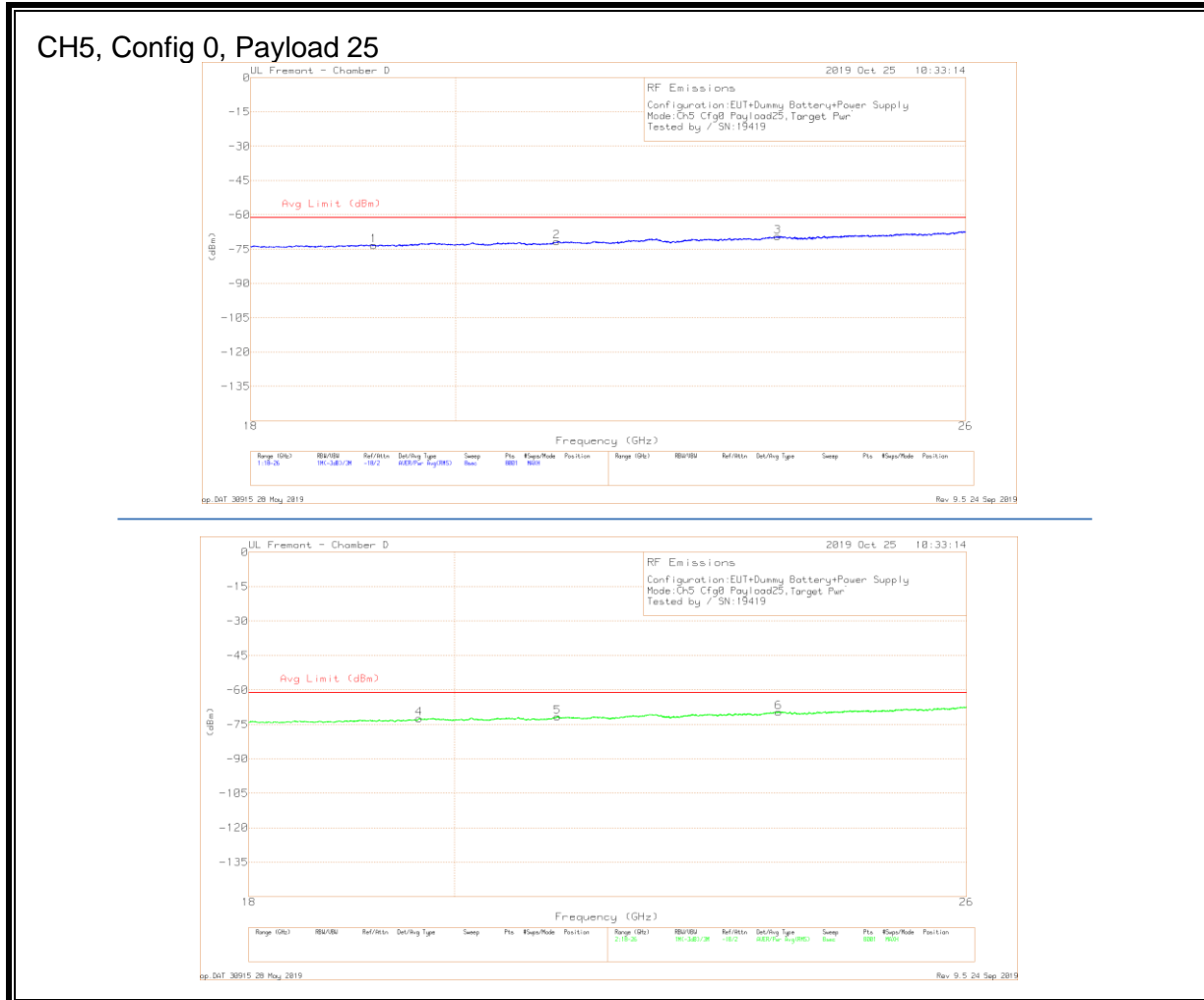


Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T345 (dBm)	Amp/Cbl (dB)	Dist Correction (dB)	Conversion Factor (dB)	CH9 LP Filter (dB)	Corrected Reading (dBm)	FCC15.519(d) EIRP RMS (dBm)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.562	-73.53	RMS	28	-46.2	-15.6	11.8	.3	-95.23	-85.3	-9.93	209	150	H
4	1.564	-73.25	RMS	28	-46.2	-15.6	11.8	.3	-94.95	-85.3	-9.65	129	150	V
2	1.576	-73.57	RMS	28.1	-46.2	-15.6	11.8	.3	-95.17	-85.3	-9.87	231	150	H
5	1.578	-73.42	RMS	28.1	-46.2	-15.6	11.8	.3	-95.02	-85.3	-9.72	261	150	V
3	1.596	-72.41	RMS	28.1	-46.3	-15.6	11.8	.3	-94.11	-85.3	-8.81	276	150	H
6	1.6	-73.05	RMS	28.1	-46.2	-15.6	11.8	.3	-94.65	-85.3	-9.35	0	150	V

RMS - RMS detection

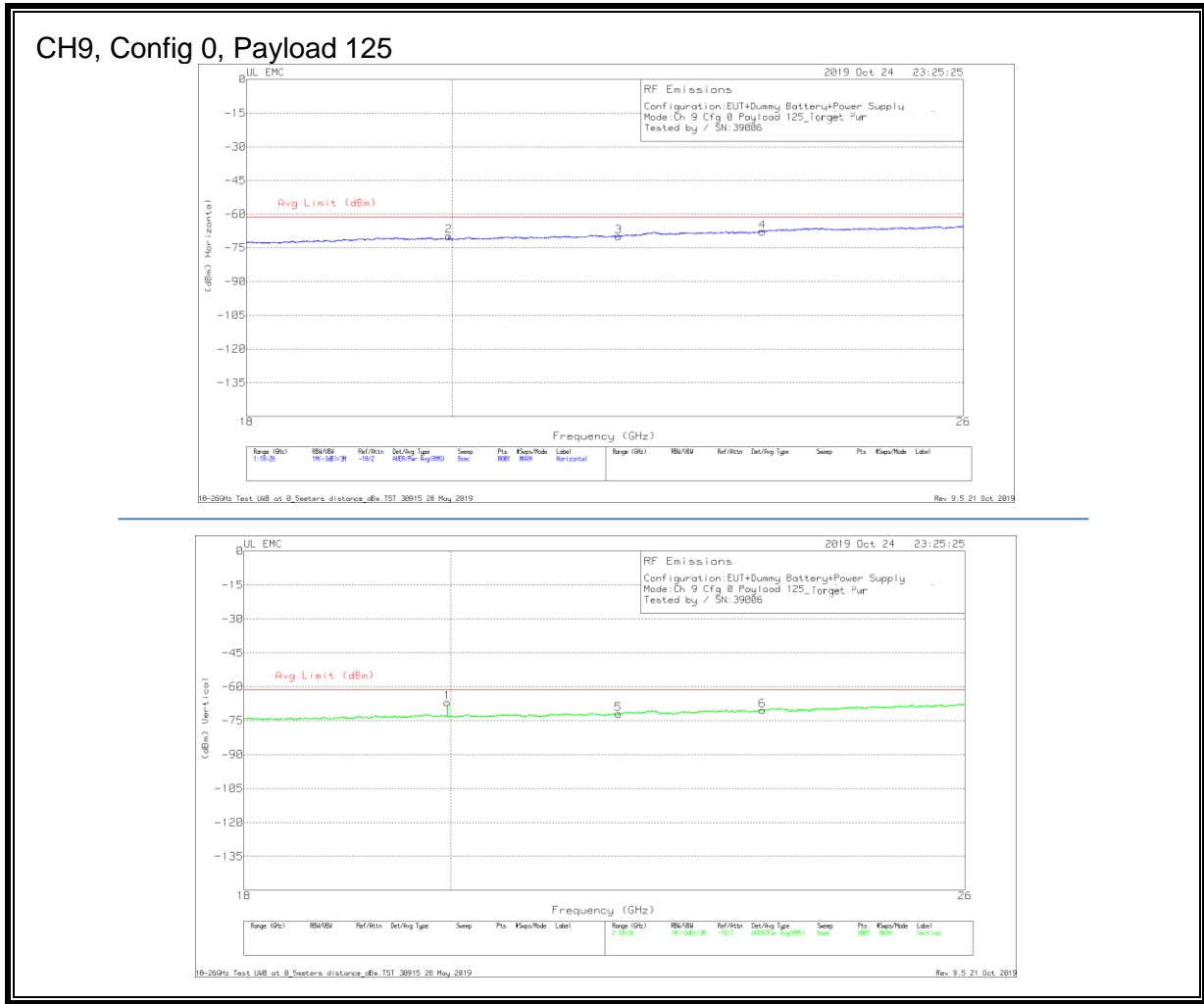
### 8.5.5. AVERAGE EMISSIONS, 18 - 26 GHz



#### Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	T447 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Conversion Factor (dB)	Corrected Reading (dBm)	Avg Limit (dBm)	Margin (dB)
1	19.179	-80.58	RMS	32.6	-21.5	-15.6	11.8	-73.28	-61.3	-11.98
4	19.642	-80.14	RMS	32.8	-21.3	-15.6	11.8	-72.44	-61.3	-11.14
2	21.072	-80.02	RMS	33.1	-21	-15.6	11.8	-71.72	-61.3	-10.42
5	21.082	-80.15	RMS	33.1	-20.8	-15.6	11.8	-71.65	-61.3	-10.35
3	23.603	-79.78	RMS	34.1	-19.9	-15.6	11.8	-69.38	-61.3	-8.08
6	23.611	-79.94	RMS	34.1	-19.9	-15.6	11.8	-69.54	-61.3	-8.24

RMS - RMS detection



**Trace Markers**

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	T447 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Conversion Factor (dB)	Corrected Reading (dBm)	Avg Limit (dBm)	Margin (dB)
2	19.968	-77.01	RMS	32.7	-21.6	-15.6	11.8	-69.71	-61.3	-8.41
1	19.968	-74.21	RMS	32.7	-21.6	-15.6	11.8	-66.91	-61.3	-5.61
3	21.785	-78.38	RMS	33.2	-20.9	-15.6	11.8	-69.88	-61.3	-8.58
5	21.788	-80.52	RMS	33.2	-20.9	-15.6	11.8	-72.02	-61.3	-10.72
6	23.448	-80.42	RMS	34	-20.1	-15.6	11.8	-70.32	-61.3	-9.02
4	23.452	-77.8	RMS	34	-20.1	-15.6	11.8	-67.7	-61.3	-6.4

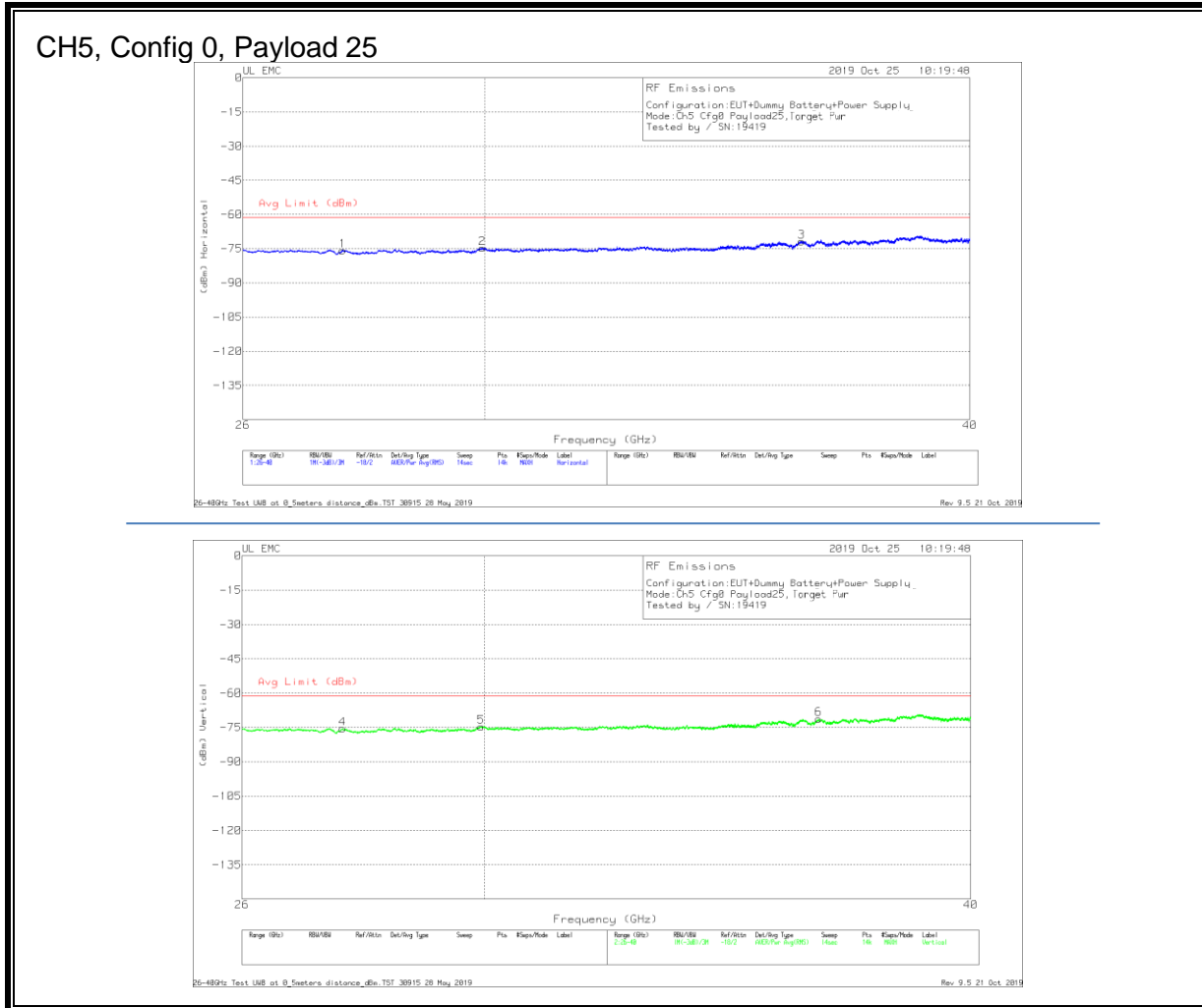
RMS - RMS detection

**Radiated Emissions**

Frequency (GHz)	Meter Reading (dBm)	Det	T447 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Conversion Factor (dB)	Corrected Reading (dBm)	Avg Limit (dBm)	Margin (dB)	Polarity
19.968	-75.74	RMS	32.7	-21.6	-15.6	11.8	-68.44	-61.3	-7.14	V
19.968	-73.05	RMS	32.7	-21.6	-15.6	11.8	-65.75	-61.3	-4.45	H

RMS - RMS detection

**8.5.6. AVERAGE EMISSIONS, 26 – 40 GHz**

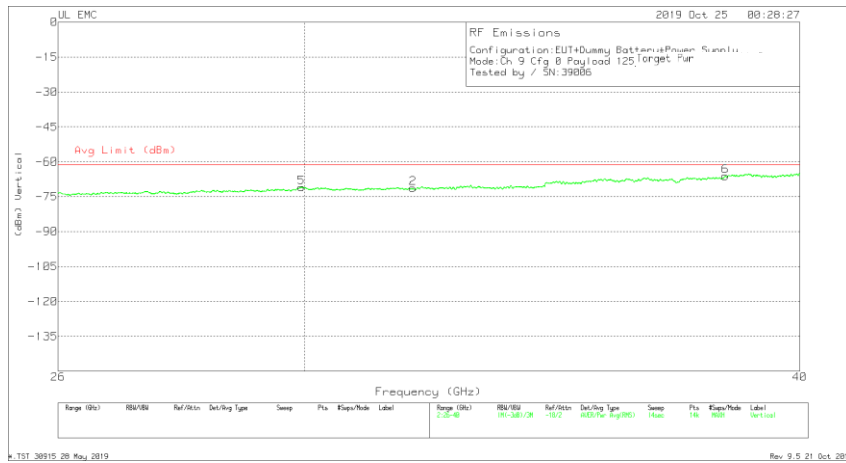
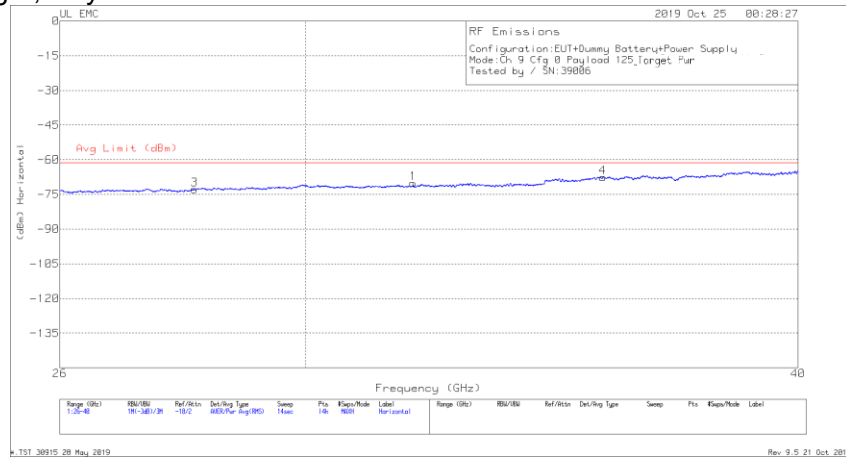


Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	T446 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Conversion Factor (dB)	Corrected Reading (dBm)	Avg Limit (dBm)	Margin (dB)
1	27.58	-77.46	RMS	35.8	-30.3	-15.6	11.8	-75.76	-61.3	-14.46
4	27.592	-76.96	RMS	35.7	-30.4	-15.6	11.8	-75.46	-61.3	-14.16
5	29.948	-79.16	RMS	36.7	-28.4	-15.6	11.8	-74.66	-61.3	-13.36
2	29.963	-79.18	RMS	36.7	-28.4	-15.6	11.8	-74.68	-61.3	-13.38
3	36.2	-77.77	RMS	37.3	-27.6	-15.6	11.8	-71.87	-61.3	-10.57
6	36.557	-77.97	RMS	37.7	-27.2	-15.6	11.8	-71.27	-61.3	-9.97

RMS - RMS detection

CH9, Config 0, Payload 125



Marker	Frequency (GHz)	Meter Reading (dBm)	Det	T446 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Conversion Factor (dB)	Corrected Reading (dBm)	Avg Limit (dBm)	Margin (dB)
3	28.122	-75.26	RMS	36.1	-29.8	-15.6	11.8	-72.76	-61.3	-11.46
5	29.947	-75.44	RMS	36.7	-28.4	-15.6	11.8	-70.94	-61.3	-9.64
1	31.949	-74.12	RMS	36.7	-28.9	-15.6	11.8	-70.12	-61.3	-8.82
2	31.949	-75.23	RMS	36.7	-28.9	-15.6	11.8	-71.23	-61.3	-9.93
4	35.692	-74.09	RMS	37.6	-27.3	-15.6	11.8	-67.59	-61.3	-6.29
6	38.302	-73.8	RMS	38	-26.5	-15.6	11.8	-66.1	-61.3	-4.8

RMS - RMS detection

**Radiated Emissions**

Frequency (GHz)	Meter Reading (dBm)	Det	T446 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Conversion Factor (dB)	Corrected Reading (dBm)	Avg Limit (dBm)	Margin (dB)	Polarity
31.949	-73.46	RMS	36.7	-28.9	-15.6	11.8	-69.46	-61.3	-8.16	H
31.949	-76.13	RMS	36.7	-28.9	-15.6	11.8	-72.13	-61.3	-10.83	V

RMS - RMS detection

**END OF REPORT**

## 9. SETUP PHOTOS

Please refer to 12791034-EP2V1 for setup photos