



Co-Location Test

EUT Name: Wireless RF Bridge Module

EUT Model: CC-WF25

FCC ID: 2ALBX-CAMWFCLR01 and 2ALBX-CAMPRMR01

IC ID: 22533-CAMWFCLR01 and 22533-CAMPRMR01

662911 D01 Multiple Transmitter Output v02r01

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Report/Issue Date: 21 April 2017

Report Number: Supplement to 31750770.001 and 31750771.001; Co-Location

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1 Antenna Colocation Test

1.1 Radiated Emissions of both Transmitters

This test measures the effects of operating two transmitters in close proximity.

This device is categorized as “Completely Uncorrelated” per 662911 D01 Multiple Transmitter Output v02r01, Clause F).

The EUT is tested to the guidance of KDB # 662911 D01 Multiple Transmitter Output v02r01 Clauses E) and F).

1.1.1 Over View of Test

Results	Complies (as tested per this report)				Date	17 March 2017		
Standard	KDB # 662911 D01 Multiple Transmitter Output v02r01							
Product Model	CONCENTRATOR			Serial#	C4:BE:84:F2:FA:40			
Test Set-up	Tested in shielded room. EUT placed on table, see test plans for details							
EUT Powered By	5 V DC USB Powered	Temp	74° F	Humidity	20%	Pressure	1014 mbar	
Frequency Range	150 kHz – 30 MHz							
Perf. Criteria	(Below Limit)		Perf. Verification	Readings Under Limit for L1 & Neutral				
Mod. to EUT	None		Test Performed By	Mark Ryan				

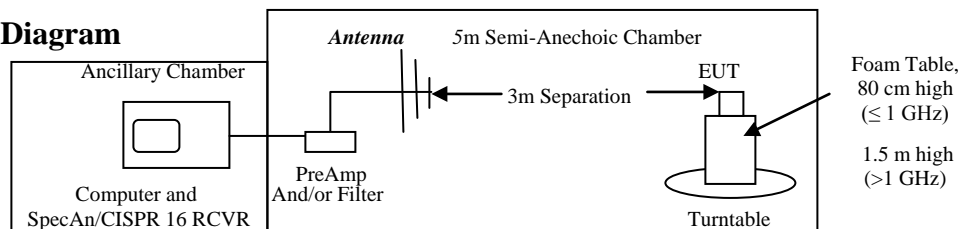
1.1.1 Test Procedure

The EUT has both transmitters activated. The combined transmissions are scanned and checked for compliance to the requirements of KDB # 662911 D01 Multiple Transmitter Output v02r01.

1.1.2 Deviations

There were no deviations from the test methodology.

1.1.3 Test Setup Block Diagram



1.1.4 Test Parameters

EUT set to the highest emissions of the Nemko Test report (Section 8.4.4 on page 22)

Mid-Band V TI Transmitter:

Modulation: 802.11g

Frequency: 2437 MHz (Channel 6)

TI Settings:

18Mbps (OFDM) Data, Pattern: All 1s, Overwrite CCA: checked, Power: 0 (max).

Dust Transmitter:

Modulation: Continuous

Frequency: 2450 MHz (Channel 9)

Dust Settings:

Radiotest tx cm 0x200 8

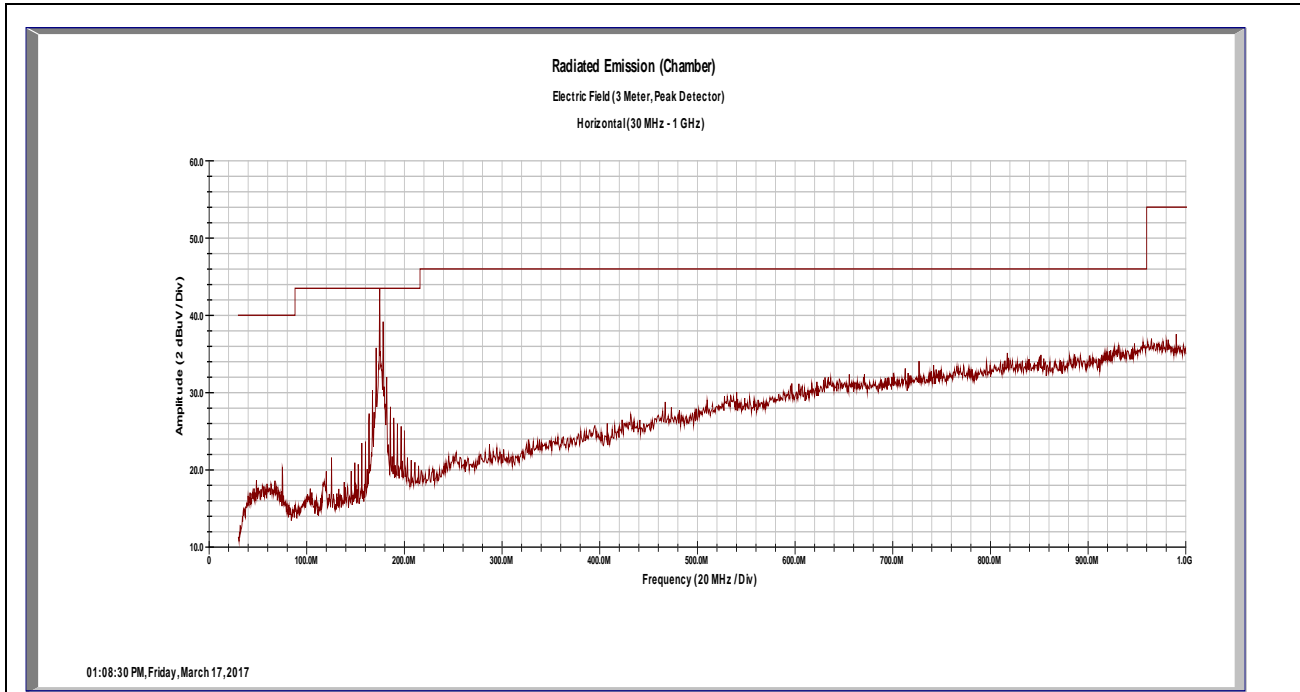
Worst-case emissions were Orientation A for both TI and Dust Transmitters.

1.1.5 Final Test

All final radiated emissions measurements were below (in compliance) the limits.

1.1.6 Final Data and Graphs

Radiated Emissions - 30 to 1000 MHz
Horizontal

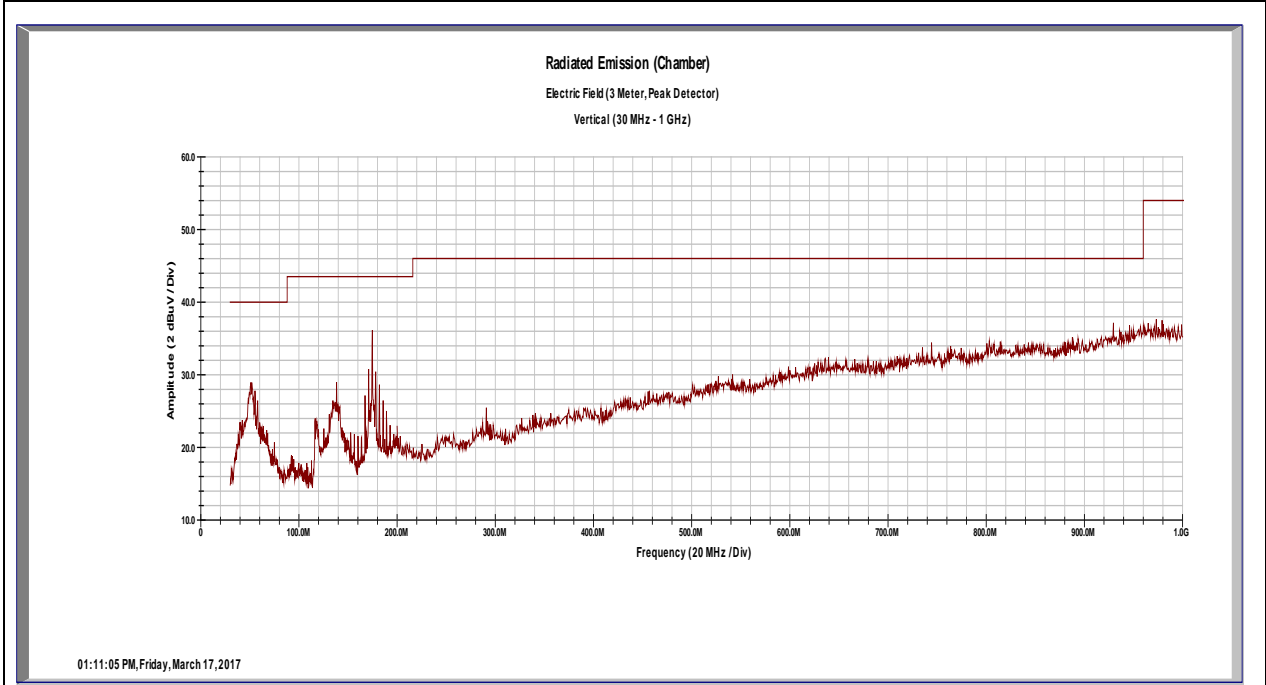


Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBµV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBµV/m)	Spec Limit (dBµV/m)	Spec Margin (dB)
174.52	H	1.6	10	27.55	0.00	1.51	13.08	42.14	43.50	-1.36

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor

Notes: Emissions above are not attributable to the intentional Radiators.

Radiated Emissions - 30 to 1000 MHz
Vertical

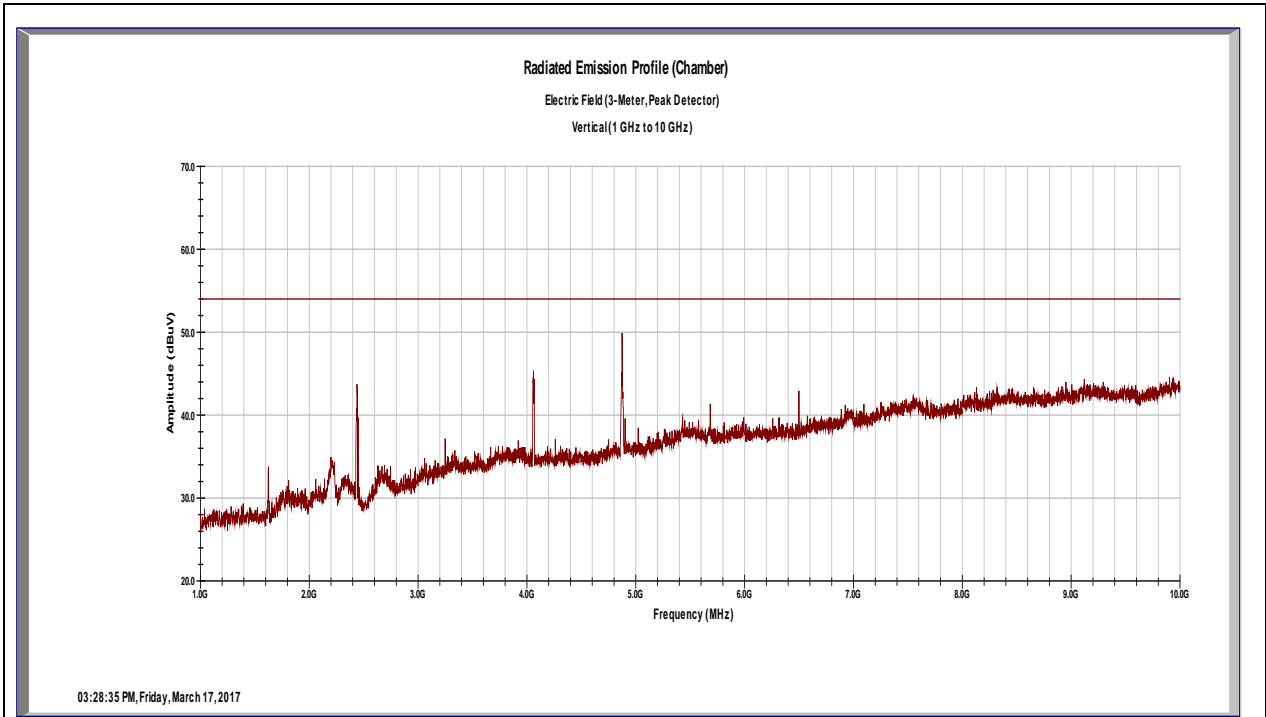


Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBµV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBµV/m)	Spec Limit (dBµV/m)	Spec Margin (dB)
50.84	V	1	355	8.77	0.00	0.84	14.03	23.64	40.00	-16.36
138.20	V	1	271	11.91	0.00	1.35	11.92	25.18	43.50	-18.32
174.52	V	1	260	20.17	0.00	1.51	13.08	34.77	43.50	-8.73

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor

Notes: Emissions above are not attributable to the intentional Radiators.

Radiated Emissions - 1 to 10 GHz
Vertical



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBµV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBµV/m)	Spec Limit (dBµV/m)	Spec Margin (dB)
4870.40	V	2.3	349	25.01	33.77	11.69	32.99	35.92	54.00	-18.08
4870.40	V	2.3	349	44.67	33.77	11.69	32.99	55.58	74.00	-18.42

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor

Notes: Above 1 GHz requires that both the **Peak** and **Average** values are below the respective limits. The signal level of the fundamental was high enough to require the use of a Notch filter. The worst-case harmonic is shown in the table above. There is no additive effect of both transmitter being on at the same time.

The signal at 2.44 GHz range are both the Wi-Fi and Dust transmitters.

1.1.7 Test Setup Photos:



Figure 1: Typical Radiated Emissions – 30 MHz to 1 GHz shown, Front view
Orientation “A” shown

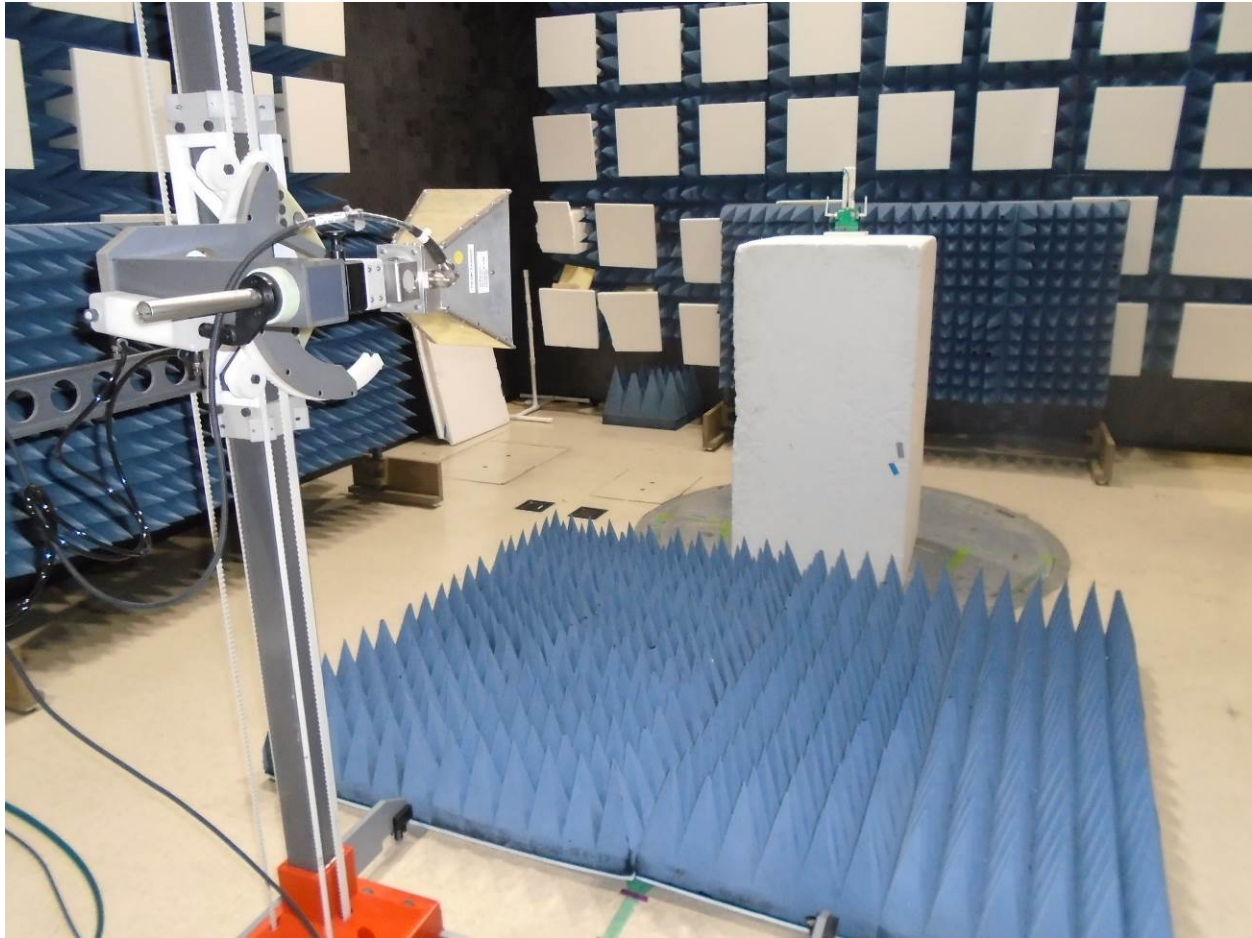


Figure 2: Typical Radiated Emissions – 1 GHz to 18 GHz shown, to ANSI C63.10:2009

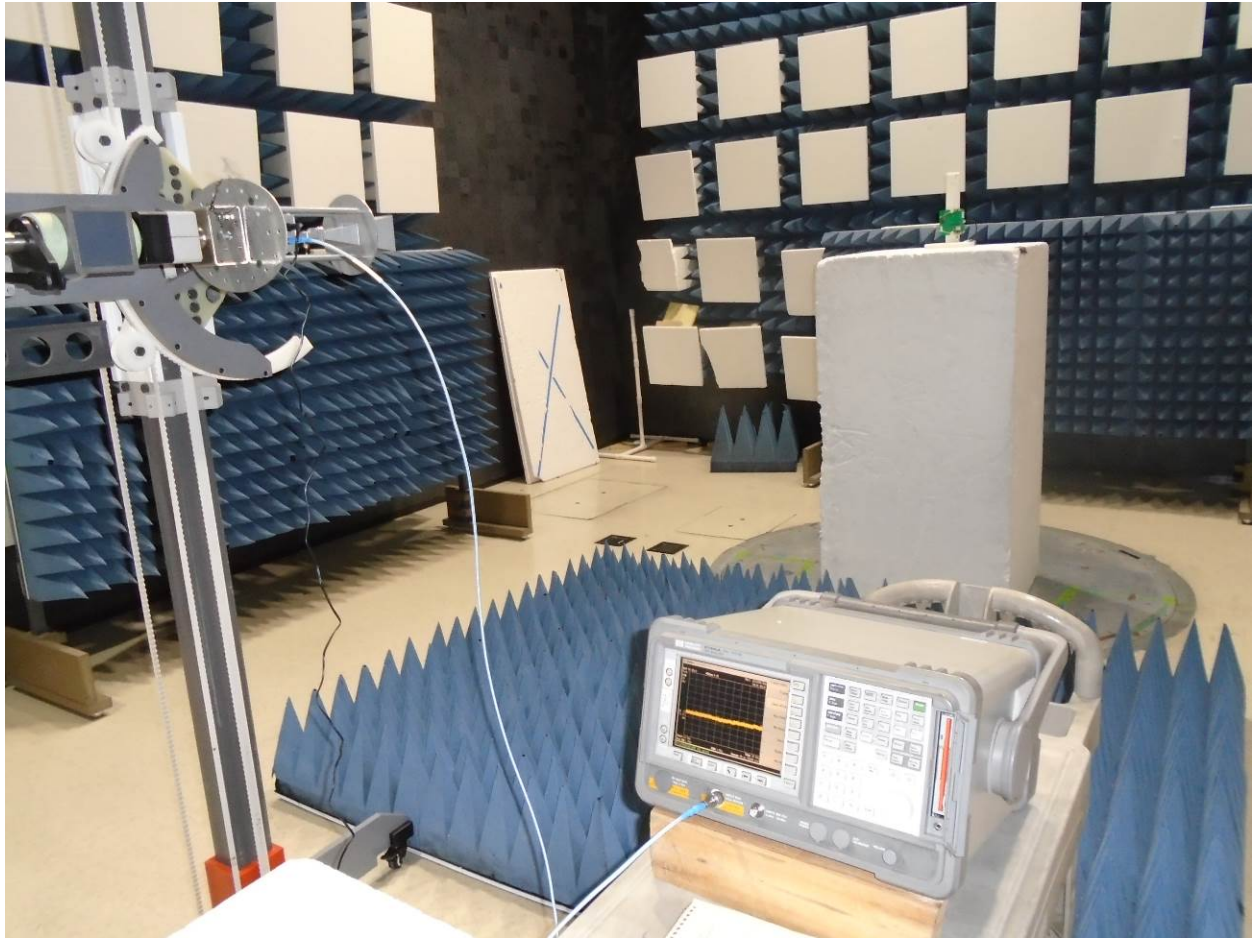


Figure 3: Typical Radiated Emissions – 18 GHz to 25 GHz shown

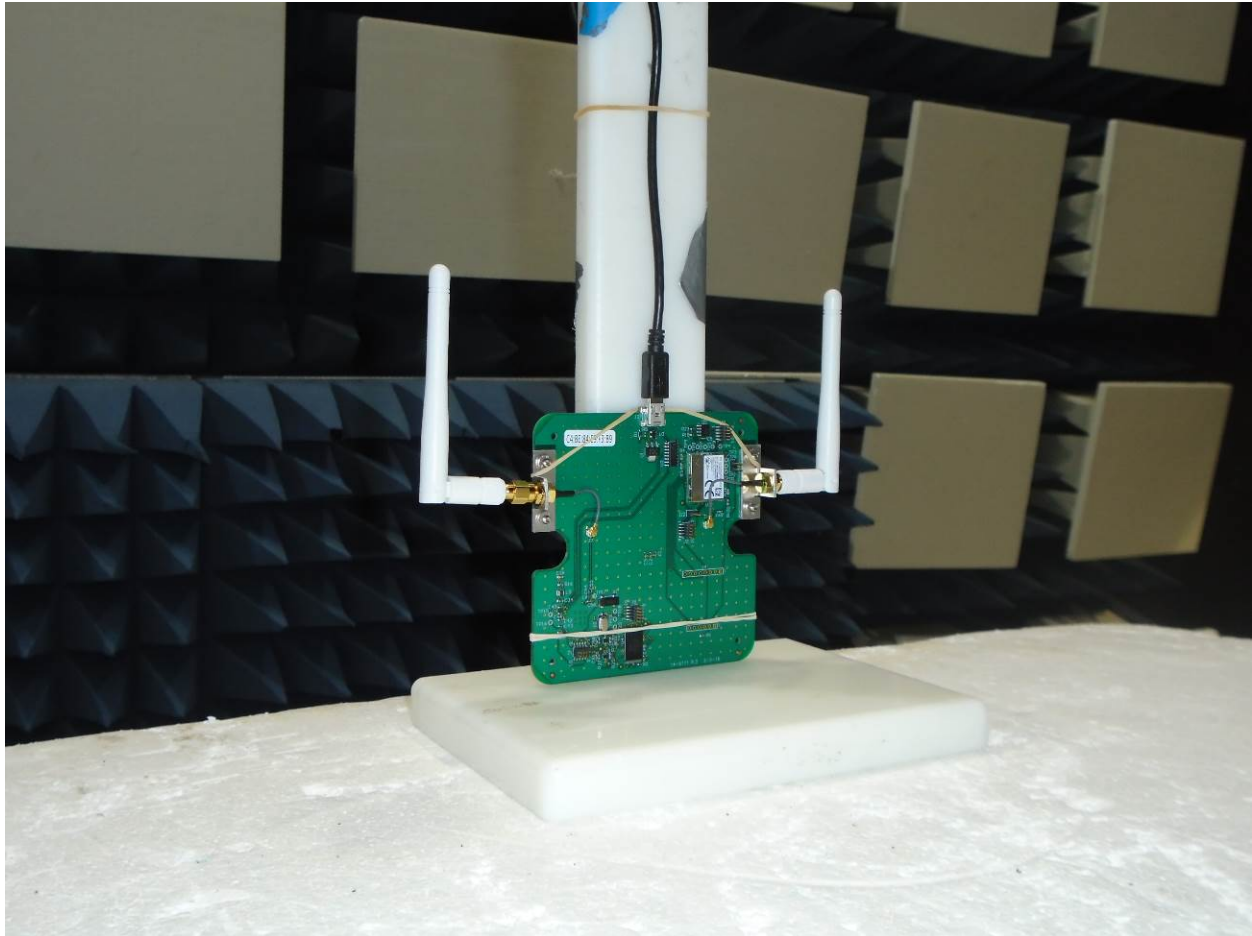


Figure 4: Typical Radiated Emissions co-location Test Setup

1.2 Conducted RF Measurements of both transmitters

1.2.1 Test Over View

Results	Complies (as tested per this report)				Date	15 March 2017	
Standard	KDB # 662911 D01 Multiple Transmitter Output v02r01						
Product Model	CONCENTRATOR			Serial#	C4:BE:84:F2:FA:40		
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	5 VDC (USB)	Temp	70° F	Humidity	18%	Pressure	1002 mbar
Perf. Criteria	(Below Limit)		Perf. Verification		Readings Under Limit		
Mod. to EUT	None		Test Performed By		Mark Ryan		

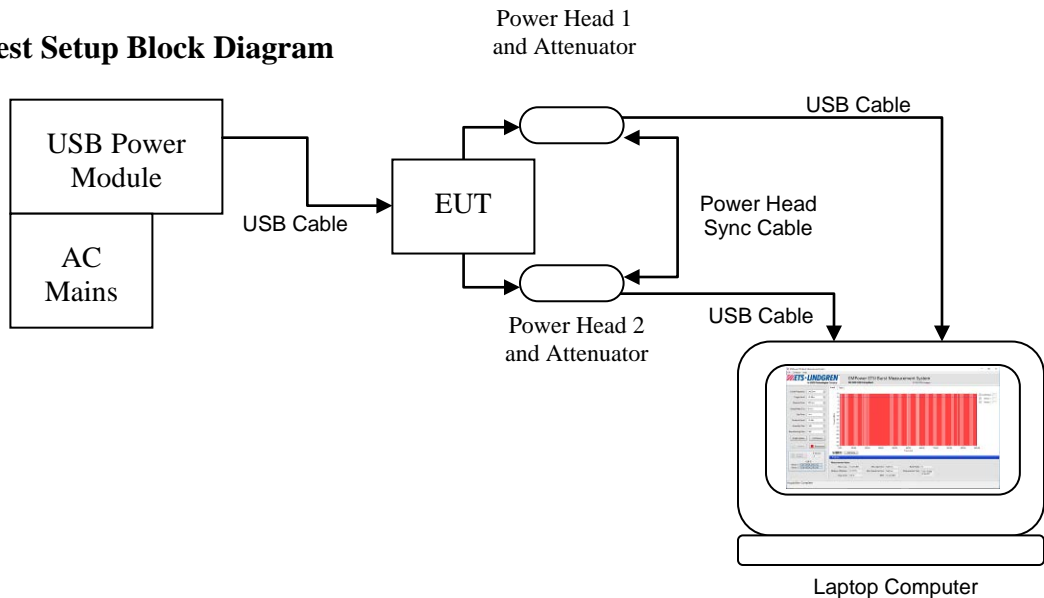
1.2.2 Test Procedure

The EUT is tested to the guidance of KDB # 662911 D01 Multiple Transmitter Output v02r01 Clauses E) and F).

1.2.3 Deviations

There were no deviations from the test methodology listed in the test plan for the Radiated Immunity test.

1.2.4 Test Setup Block Diagram

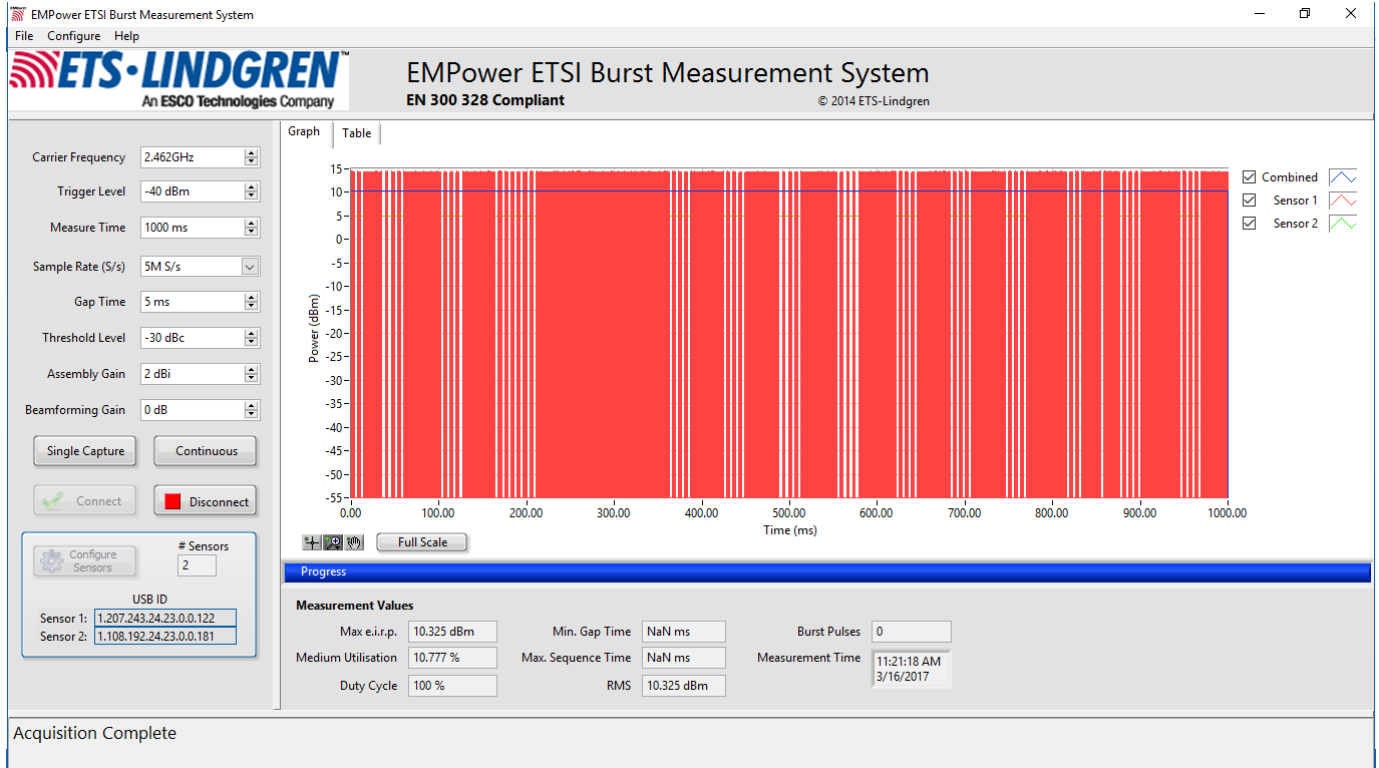


1.2.5 Final Results

Peak Output Conducted Power Measurements:

Emission Freq (MHz)	Combined Eirp Output (dBm)	Eirp Power Limit (dBi)	Margin to limit (dB - EIRP)	Results
2412.00 (f_L)	8.854	36.0	-27.15	PASS
2462.00 (f_M)	10.325	36.0	-25.68	PASS
2475.00 (f_H)	8.526	36.0	-27.47	PASS

Note: These measurements include the maximum antenna gain of 2 dBi and a Duty Cycle of 100%

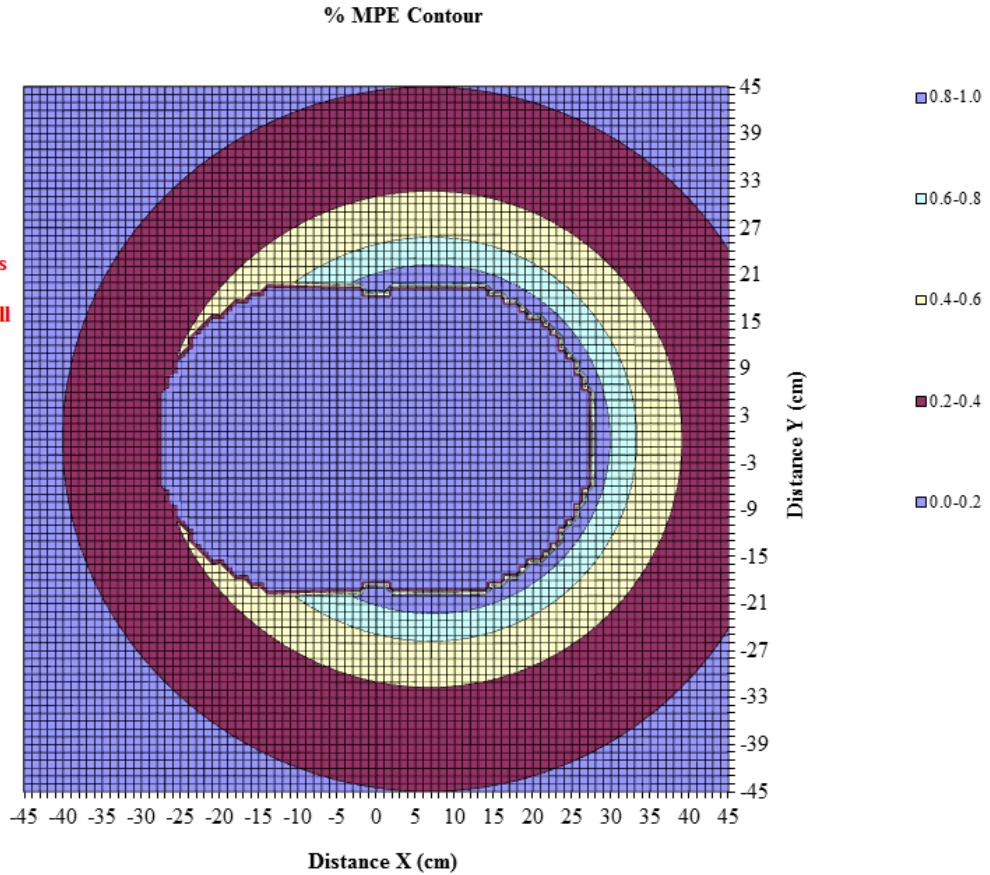


Worst-Case Conducted RF power measurement of combined transmitters.

Note: The 10.325 dBm value shown includes the 2dBi Maximum Gain of the antenna.

The Power Output with the antenna would be 10.325 dBm eirp.

Note: The 0% contour surrounding the antennas identifies a 20 cm perimeter surrounding all active antennas



Parameters used for Contour Map:

Antenna No.		Total	1	2
Tx Status			On	On
Frequency	MHz		2450	2437
MPE Limit	mW/cm ²		1.00	1.00
Max % MPE	%	1.0	0.1	0.9
Power	(W)	0.032	0.003	0.029
Antenna Gain	dBi		2.00	2.00
EIRP	(W)	0.05	0.005	0.046
X	(cm)		-8.0	8.0
Y	(cm)		0.0	0.0

%MPE Contour, using the MPE-mobile.xls spreadsheet.

1.2.6 Photos:



Figure 5: Close-up view of Conducted RF Emissions Test Setup for Co-Location Power test setup

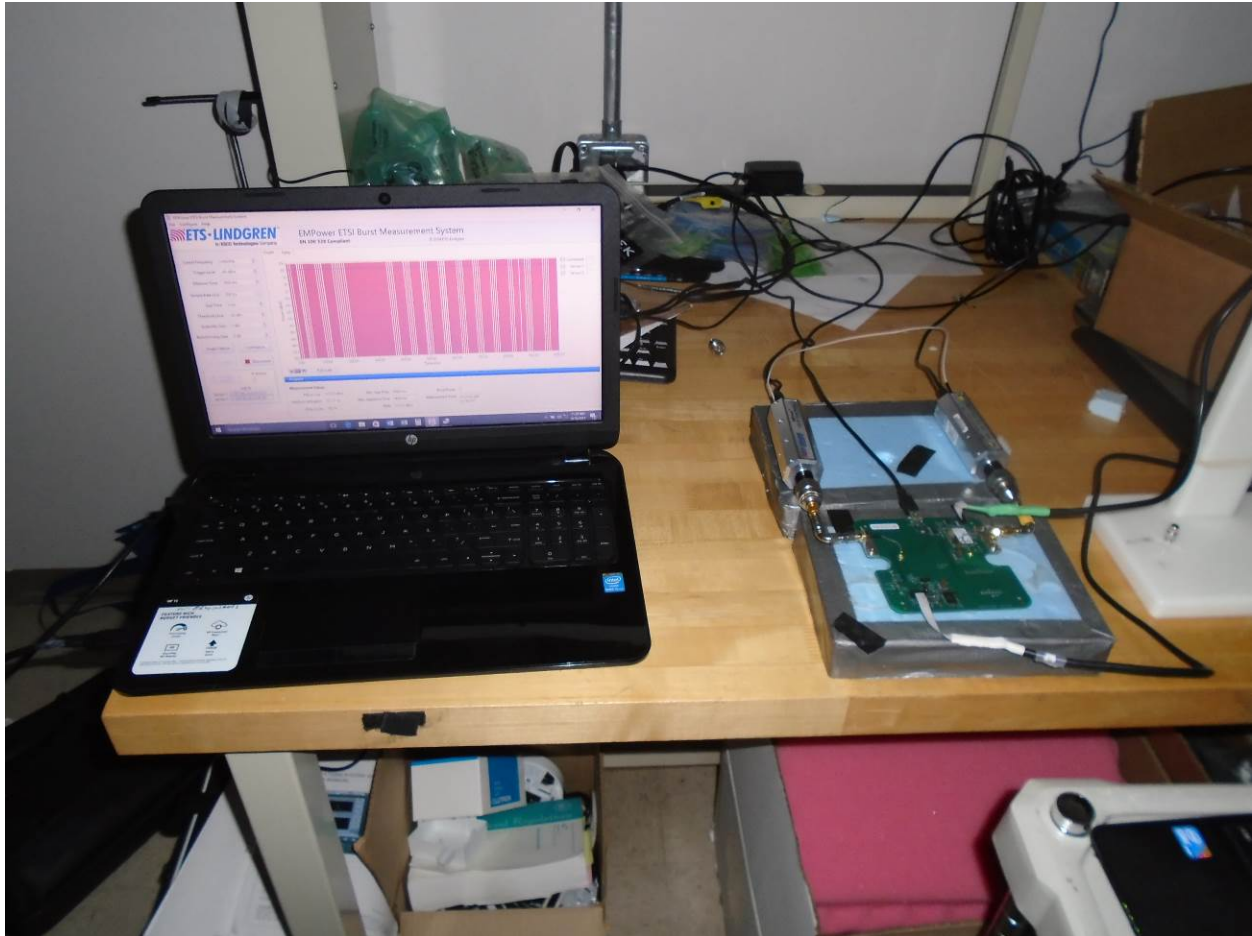


Figure 6: View of Conducted RF Emissions Test Setup for Co-Location Power test setup