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Report On

Radio Testing of
GTO Access Systems, LLC.
MMK100

FCC Part 15 Subpart C §15.231
IC RSS-210, Issue 9, August 2016

Report No. TP72129740.100

August 2017



REPORT ON Radio Testing of the
GTO Access Systems, LLC.
MMK100

TEST REPORT NUMBER TP72129740.100

REPORT DATE 11. August 2017

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DATED 11. August 2017



Revision History

TP72129740.100 GTO Access Systems, LLC. MMK100					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
11. August 2017	Initial Release				P. Walsh

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SECTION 1

REPORT SUMMARY

Radio Testing of
GTO Access Systems, LLC.
MMK100



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the GTO Access Systems, LLC. Model MMK100 to the requirements of FCC Part 15 Subpart C §15.231 and IC RSS-210, Issue 9, August 2016.

Objective	To perform Radio Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	GTO Access Systems, LLC.
Model Number(s)	MMK100
FCC ID Number	I6H-MMK100
IC Number	21449-MMK100
Serial Number(s)	None
Number of Samples Tested	1
Test Specification/Issue/Date	• FCC Part 15 Subpart C §15.231 • IC RSS-210, Issue 9, August 2016.
Start of Test	05. July 2017
Finish of Test	12. July 2017
Name of Engineer(s)	David Foerstner
Related Document(s)	None. Supporting documents for EUT certification are separate exhibits.

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC Part 15 Subpart C §15.231 with cross-reference to the corresponding ISED RSS standard shown below.

Section	FCC Part 15	§15.231 Spec Clause	RSS	Test Description	Result	Comments/ Base Standard
-	§15.207 (a)		RSS-Gen 8.8	Conducted Emissions	N/A ¹	
-		§15.231(a)(3)	RSS-210 A1.1 (c)	Polling or Supervision Transmissions, Including Data, To Determine System Integrity Of Transmitters Used In Security Or Safety Applications	Compliant	
2.1		§15.231(c)	RSS-210 A1.3	Bandwidth Requirement	Compliant	
2.2		§15.231(b)	RSS-210 A1.2	Field Strength of Emissions	Compliant	
-		§15.231(d)	-	Frequency Tolerance	N/A ³	
-		§15.231(e)	RSS-210 A1.4	Field Strength of Emissions	N/A ²	
2.3		§15.231(a)(2)	RSS-210 A1.1 (b)	Transmission Verification for Transmitter Activated Automatically	Compliant	

N/A¹ Not applicable. EUT is battery powered.

N/A² Not applicable. Requirements of 15.231(b) were used.

N/A³ Not applicable. EUT does not transmit in the 40.60 – 40.70 MHz band.

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) is a GTO Access Systems, LLC., Model MMK100 as shown in the photograph below. It is a keypad transmitter operating at 317.9 MHz.



Photo 1.3.1-1 – Front ¾ View



1.3.2 EUT General Description

EUT Description	Keypad Transmitter
Model Number(s)	MMK100
Power Source	3 AAA Batteries
EUT Field Strength	69.2 dB μ V/m @ 3meters
Frequency Range	317.9 MHz
Modulation	OOK
Antenna Type	Integral Antenna

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
A	EUT in test mode transmitting CW signal. Configuration used for radiated emissions measurements.
B	EUT in operational mode. Configuration used for Duty Cycle Factor verification.

1.4.2 EUT Exercise Software

No special software was used.

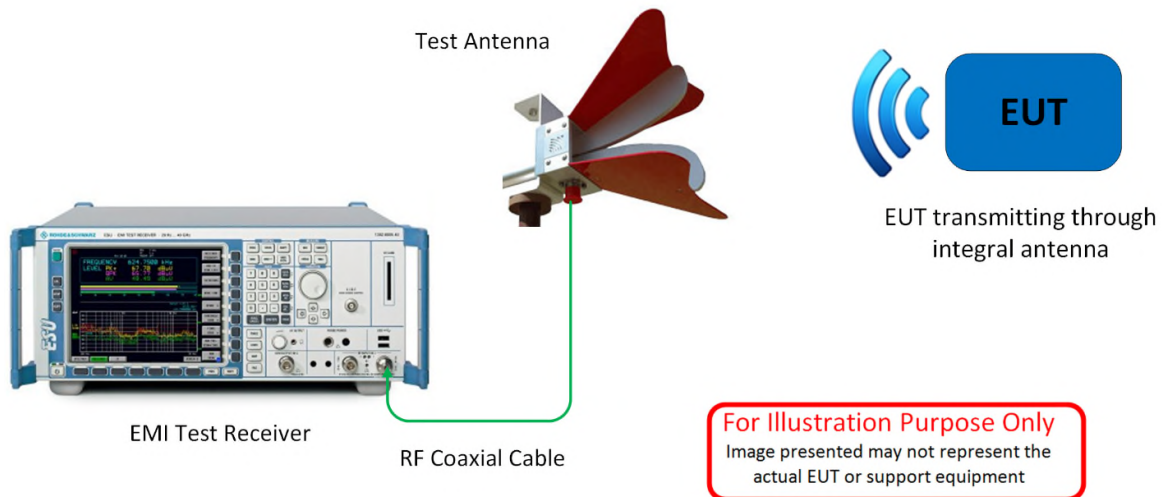
1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description

1.4.4 Worst Case Configuration

For radiated measurements, the EUT was investigated in all orthogonal directions. Testing was completed with the EUT in a horizontal position, which was the worst case.

1.4.5 Simplified Test Configuration Diagrams



1.5 DEVIATIONS FROM THE STANDARD

All deviations made during testing from the applicable test standards or test plan are detailed under Section 1.2 of this test report.

1.6 MODIFICATION RECORD

Description of Modification	Modification Fitted By	Date Modification Fitted
Serial Number N/A		
N/A	-	-

The table above details modifications made to the EUT during the test programme. The modifications incorporated during each test (if relevant) are recorded on the appropriate test pages.

1.7 TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

For conducted and radiated emissions the equipment under test (EUT) was configured to measure its highest possible emission level. This level was based on the maximized cable configuration from exploratory testing per ANSI C63.10-2013. The test modes were adapted per the operating Instructions provided by the manufacturer/client.



1.8 TEST FACILITY LOCATION

1.8.1 TÜV SÜD America Inc. (Tampa)

5610 W. Sligh Ave., Suite 100 Tampa, FL 33634 Phone: 813 284 2715 FAX: 813-413 3813

1.9 TEST FACILITY REGISTRATION

1.9.1 FCC – Registration No

The TÜV SÜD America Inc. (Tampa), test facility has been registered with the Federal Communication Commission as an ISO/IEC 17025 accredited test laboratory and assigned the designation number US1063.

1.9.2 Innovation, Science and Economic Development Canada Registration

The TÜV SÜD America Inc. (Tampa), test facility has been registered with Innovation, Science and Economic Development Canada and assigned the site number 2087A-2.



SECTION 2

TEST DETAILS

Radio Testing of
GTO Access Systems, LLC.
MMK100



2.1 BANDWIDTH REQUIREMENT

2.1.1 Specification Reference

Part 15 Subpart C §15.231(c), RSS-210 Issue A1.3

2.1.2 Standard Applicable

(c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

2.1.3 Equipment Under Test and Modification State

Serial No: None/Test Configuration B

2.1.4 Date of Test/Initial of test personnel who performed the test

06. July 2017/DF

2.1.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.6 Environmental Conditions

Ambient Temperature	22 °C
Relative Humidity	42 %

2.1.7 Additional Observations

- This is a radiated test.
- Span is set to encompass the whole emission
- RBW is 1% of the span while VBW is greater than 3X RBW.
- Sweep is auto.
- Detector is peak.
- Max hold function activated.

2.1.8 Test Results

Transmitter Frequency (MHz)	Modulation	0.25% of the center frequency requirement	Measured 20dB Bandwidth (MHz)	99% Bandwidth (MHz)
317.9	OOK	<794.8 kHz	142.1 kHz	202.6 kHz

2.1.9 Test Results Plots

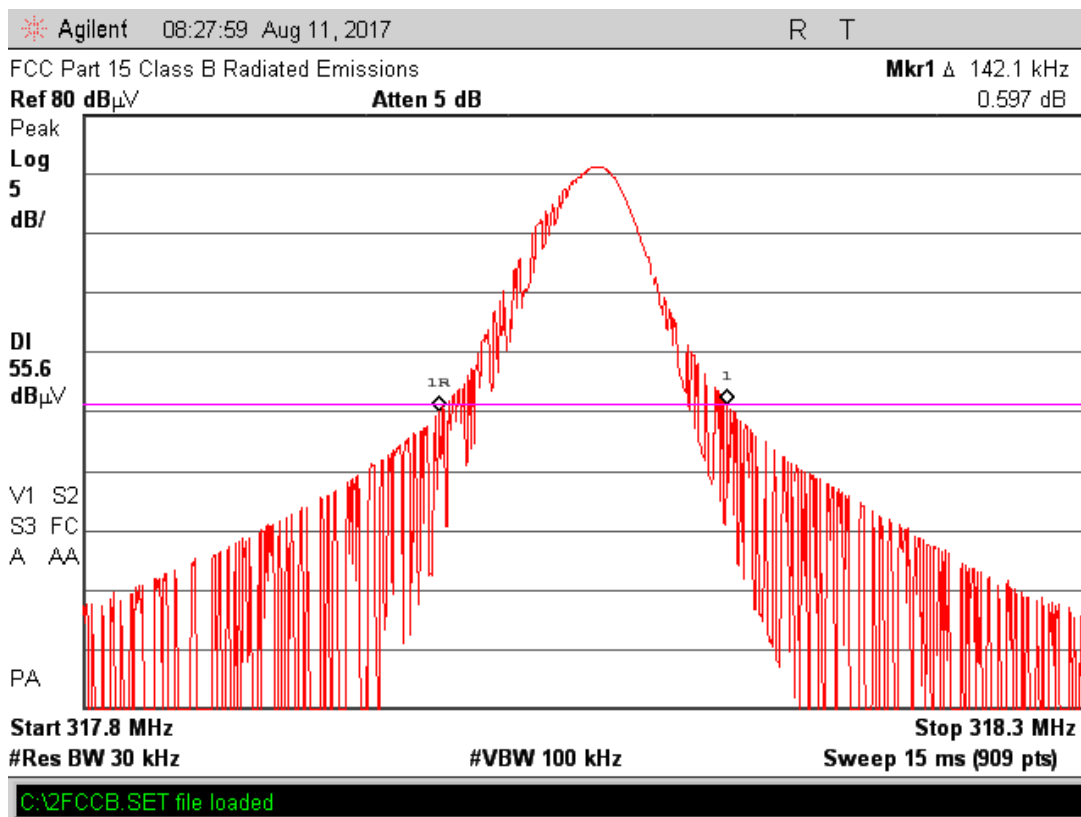


Figure 2.1.9-1 - 20 dB Occupied Bandwidth

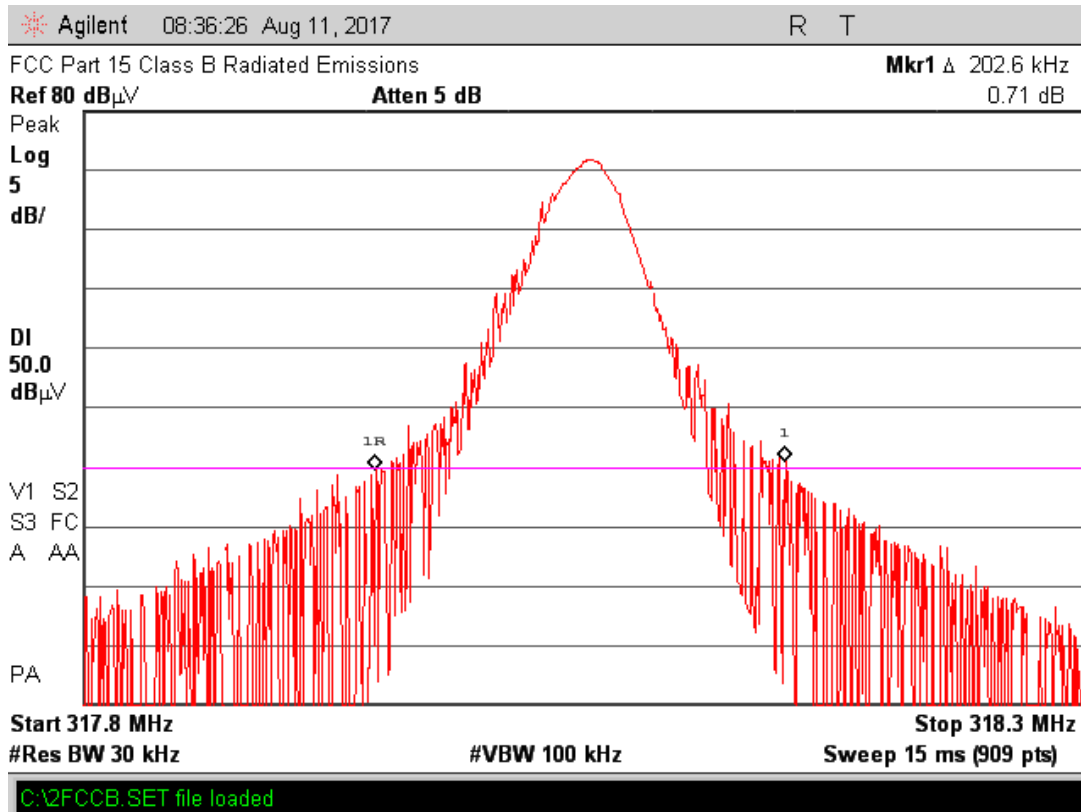


Figure 2.1.9-2 - 99% Occupied Bandwidth

2.2 FIELD STRENGTH OF EMISSIONS

2.2.1 Specification Reference

Part 15 Subpart C §15.231(b), RSS-210 Issue 9 A1.4

2.2.2 Standard Applicable

(b) In addition to the provisions of §15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66-40.70	2,250	225
70-130	1,250	125
130-174	¹ 1,250 – 3,750	¹ 125 - 375
174-260	3,750	375
260-470	¹ 3,750 – 12,500	¹ 375 – 1,250
Above 470	1,250	500

¹Linear Interpolations

2.2.3 Equipment Under Test and Modification State

Serial No: None / Test Configuration A and B

2.2.4 Date of Test/Initial of test personnel who performed the test

12. July 2017 / DF

2.2.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Tampa facility.

Ambient Temperature	23.9-24.3°C
Relative Humidity	44.1-48.6%

2.2.7 Additional Observations

- This is a radiated test. The spectrum was searched from 30MHz to the 10th harmonic, 3.2 GHz.
- There were no emissions found that did not comply with the restricted bands defined in FCC Part 15 Subpart C, 15.205.

- Measurement was done using EMC32 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.5.8 for sample computation.

2.2.8 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (dB μ V) @ 30 MHz			20.0
Correction Factor (dB)	Cable 2	0.24	18.94
	TEM00011 (antenna)	18.70	
Reported QuasiPeak Final Measurement (dB μ V/m) @ 30MHz			38.94

2.2.9 Test Results

See attached plots.

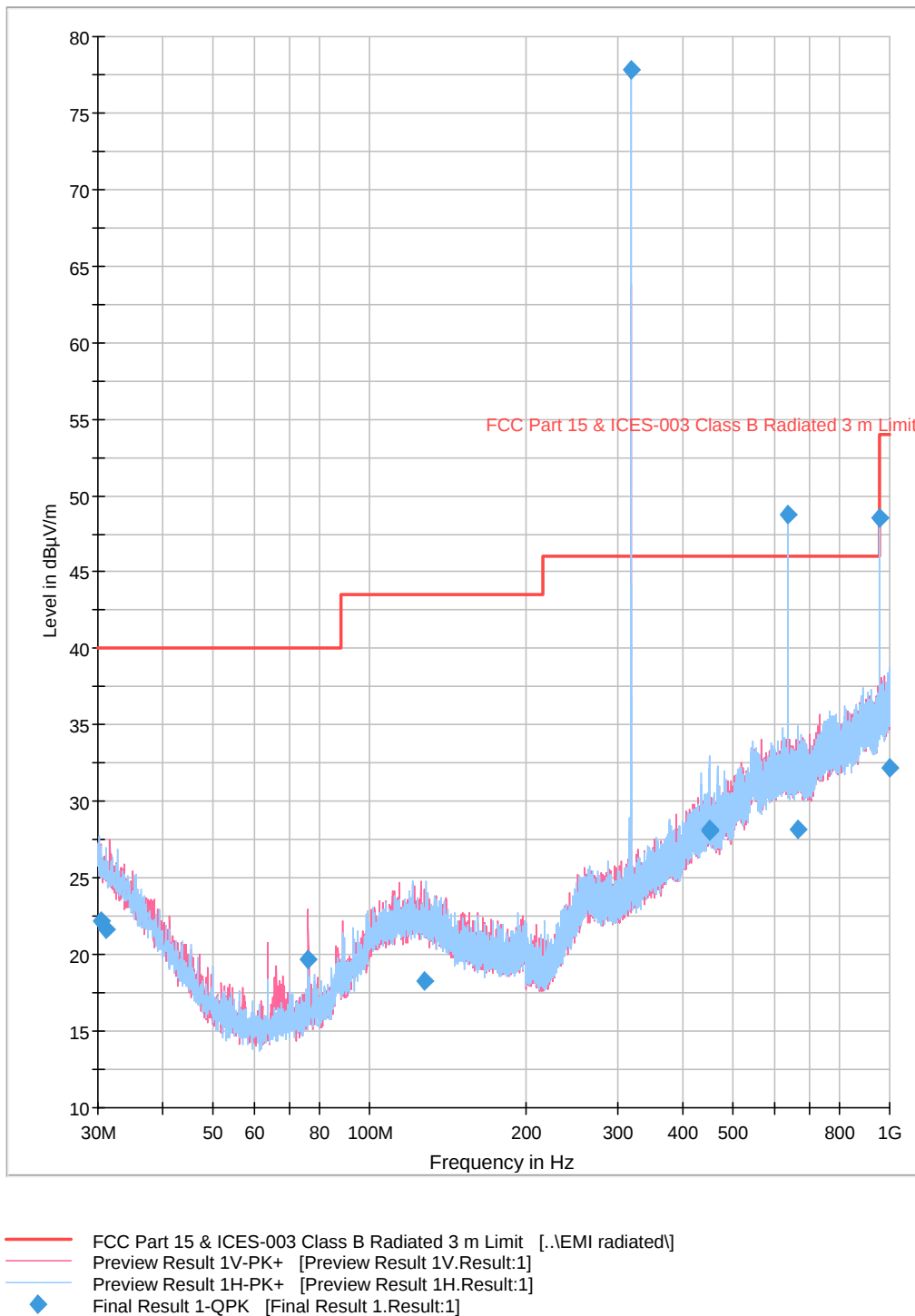


Figure 2.2.9-1 – Radiated Emissions Plot 30 MHz – 1 GHz

Table 2.2.10-1 – Quasi-Peak Data for Unintentional Emissions

Frequency (MHz)	Quasi-Peak (dBμV/m)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBμV/m)
30.360000	22.2	150.0	V	115.0	17.8	40.0
31.160000	21.7	150.0	H	42.0	18.3	40.0
76.320000	19.7	276.0	V	315.0	20.3	40.0
127.840000	18.3	319.0	V	180.0	25.2	43.5
450.360000	28.2	100.0	H	0.0	17.8	46.0
450.440000	28.1	100.0	H	0.0	17.9	46.0
665.800000	28.2	147.0	H	90.0	17.8	46.0
998.400000	32.2	200.0	V	-5.0	21.8	54.0

INTENTIONAL RADIATOR LIMIT CALCULATION

$(12,500 - 3750) / (470-260) = \text{limit change per MHz}$

$(8,750) / (210) = \text{limit change per MHz}$

41.67 = limit change per MHz

470 MHz – 317.9 MHz = 152.1 MHz delta

$152.1 * 41.67 = 6,338 \mu\text{V}$

$12,500 \mu\text{V} - 6,338 \mu\text{V} = 6,162 \mu\text{V} = \text{limit at 317.9 MHz}$

Average limit = $(20 \log 6,162) = 75.79 \text{ dB}\mu\text{V/m}$

Peak Limit = Average limit +20 dB

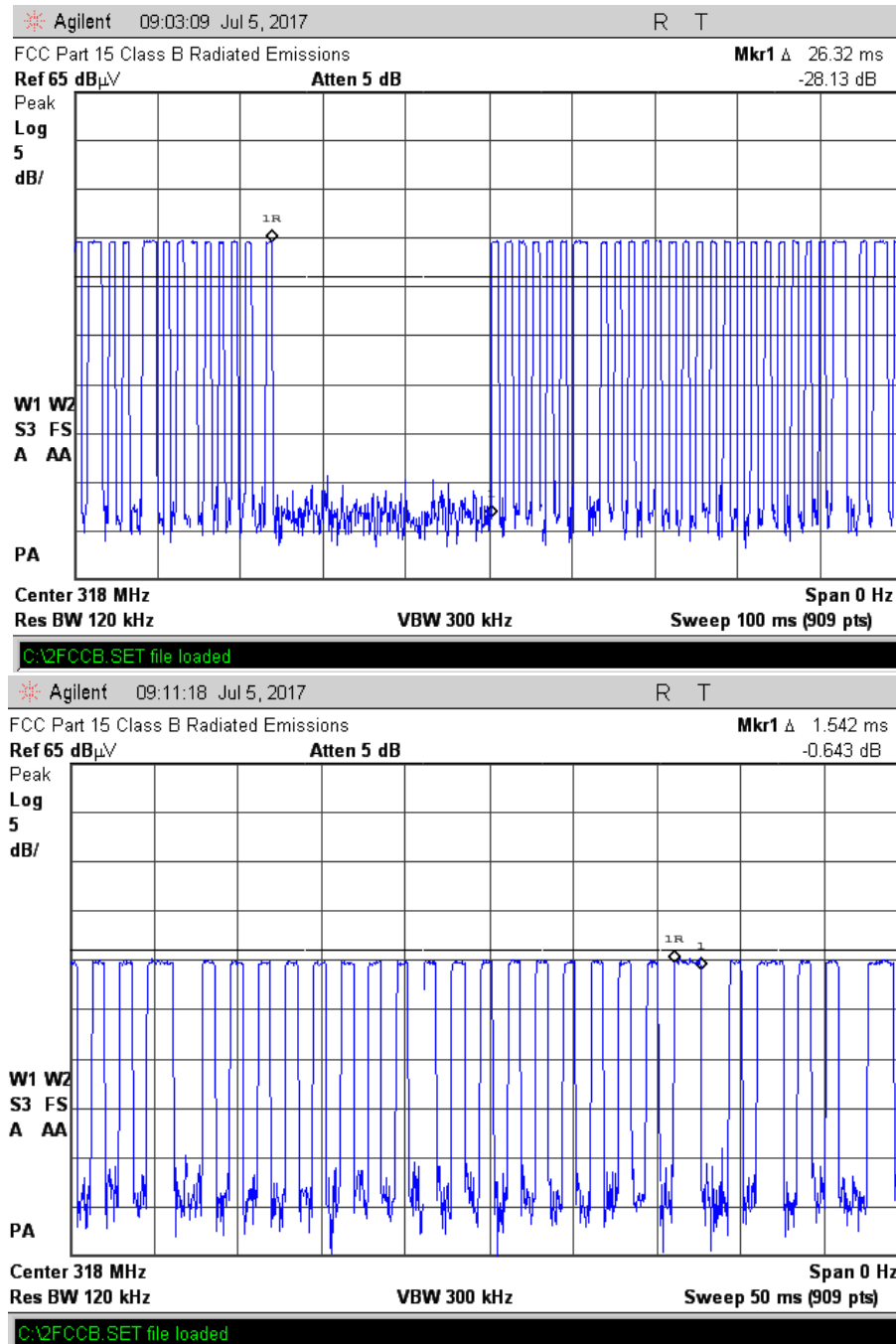
Peak Limit = 95.79 dBμV/m

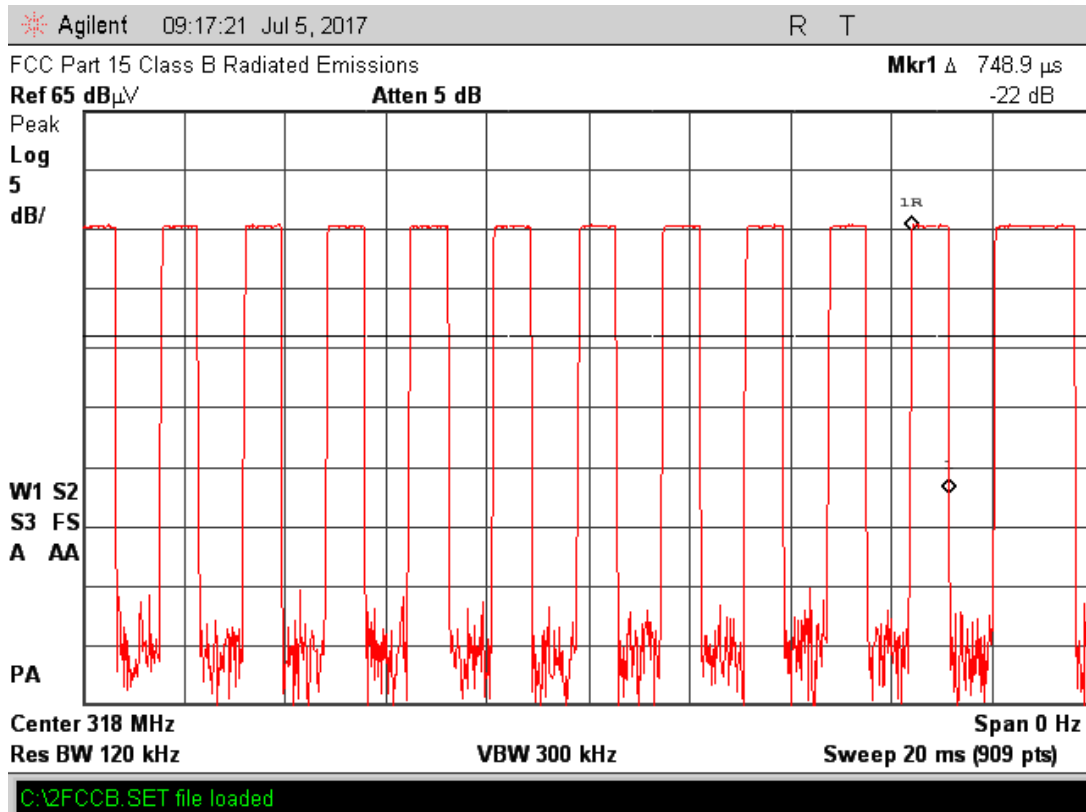
Table 2.2.10-2 – Peak & Average Data for Intentional and Spurious Emissions

Frequency (MHz)	Peak (dBμV/m)	Height (cm)	Pol.	Azimuth (deg)	Duty Cycle Corrected (dBμV/m)	Margin (dB)	Limit (dBμV/m)
318.000000	77.8	100.0	H	205	* 69.2	6.6	75.8
636.000000	48.7	138.0	H	0.0	* 40.1	15.7	55.8
954.000000	48.5	100.0	H	358.0	* 39.9	15.9	55.8

***Duty Cycle Correction is 8.6 dB**

Duty Cycle Correction Calculations





On time = $(35 * 0.749) = 26.22$

On time = $(7 * 1.54) = 10.78$

On time = $26.22 + 10.78$

On time = 37.0 milliseconds

On time / 100 milliseconds = 0.37

20 Log 0.37 = -8.6 dB



2.3 TRANSMISSION VERIFICATION FOR TRANSMITTER ACTIVATED AUTOMATICALLY

2.3.1 Specification Reference

Part 15 Subpart C §15.231(a)(2), RSS-210 Issue 9 A1.1 (b)

2.3.2 Standard Applicable

A transmitter activated automatically shall cease transmission within 5 seconds after activation

2.3.3 Equipment Under Test and Modification State

Serial No: None / Test Configuration A

2.3.4 Date of Test/Initial of test personnel who performed the test

05. July 2017 / DF

2.3.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Tampa facility.

Ambient Temperature 23 °C
 Relative Humidity 36 %

2.3.7 Additional Observations

- This is a radiated test.
- Span was set to zero
- Sweep time set to (5) seconds
- EUT is set to transmit mode and observed for (5) seconds

2.3.8 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (dBμV) @ 30 MHz		20.0
Correction Factor (dB)	Cable 2	0.24
	TEMCO0011 (antenna)	18.70
Reported QuasiPeak Final Measurement (dBμV/m) @ 30MHz		38.94

See attached plots.

2.3.9 Test Results

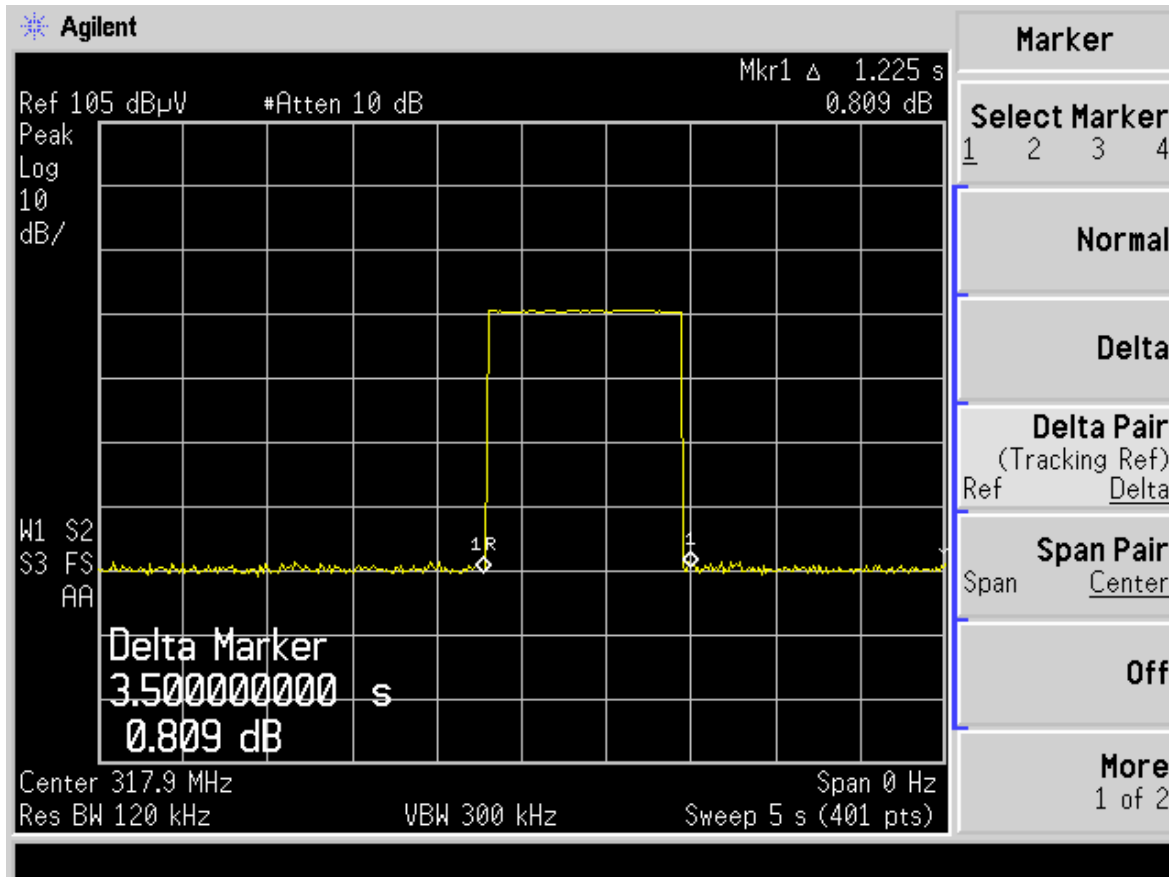


Figure 2.3.9-1 – Time to Cease Transmission

Notes:

Automatically turns off within (1.225) seconds



SECTION 3

TEST EQUIPMENT USED



3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

ID Number	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
Antenna Conducted Port Setup						
Radiated Test Setup						
TEMC00005	Bilog Antenna	6112B	2579	Chase EMC	12/17/2015	12/17/2017
TEMC00061	Double-ridged waveguide horn antenna	3117	00109296	ETS Lindgren	2/3/2016	2/3/2018
TEMC00128	EMI Test Receiver	ESIB 40	100255/040	Rhode & Schwarz	11/7/2016	11/7/2017
TEMC00012	Spectrum Analyzer	E7405A	MY42000055	Agilent	4/10/2015	3/31/2018
TEMC00013	Pre-amplifier	PA-122	181925	Compower	10/3/2016	10/3/2017
TEMC00091	Spectrum Analyzer	E7402A	US39150137	Agilent	4/4/2017	2/4/2018
Conducted Emissions						
Miscellaneous						

3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:

3.2.1 Radiated Emission Measurements (Below 1GHz)

Radiated Measurement 30 - 1000 MHz at a distance of 3 m						
	Input Quantity (Contribution) X_i	Value	Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
1	Receiver reading	0.10 dB	Normal, k=1	1.000	0.10	0.01
2	Attenuation: antenna-receiver	0.20 dB	Normal, k=2	2.000	0.10	0.01
3	Antenna factor AF	0.58 dB	Normal, k=2	2.000	0.29	0.08
4	Receiver sinewave accuracy	0.40 dB	Normal, k=2	2.000	0.20	0.04
5	Receiver pulse amplitude	1.50 dB	Rectangular	1.732	0.87	0.75
6	Receiver pulse repetition rate	1.50 dB	Rectangular	1.732	0.87	0.75
7	Noise floor proximity	0.50 dB	Rectangular	1.732	0.29	0.08
8	Mismatch: antenna-receiver	0.95 dB	U-shaped	1.414	0.67	0.45
9	AF frequency interpolation	0.30 dB	Rectangular	1.732	0.17	0.03
10	AF height deviations	0.10 dB	Rectangular	1.732	0.06	0.00
11	Directivity difference at 3 m	3.12 dB	Rectangular	1.732	1.80	3.24
12	Phase center location at 3 m	1.00 dB	Rectangular	1.732	0.58	0.33
13	Cross-polarisation	0.90 dB	Rectangular	1.732	0.52	0.27
14	Balance	0.00 dB	Rectangular	1.732	0.00	0.00
15	Site imperfections	3.85 dB	Triangular	2.449	1.57	2.47
16	Separation distance at 3 m	0.30 dB	Rectangular	1.732	0.17	0.03
17	Effect of setup table material	0.77 dB	Rectangular	1.732	0.44	0.20
18	Table height at 3 m	0.10 dB	Normal, k=2	2.000	0.05	0.00
19	Near-field effects	0.00 dB	Triangular	2.449	0.00	0.00
20	Effect of ambient noise on OATS	0.00 dB				0.00
Combined standard uncertainty			Normal	2.96	dB	
Expanded uncertainty			Normal, k=2	5.92	dB	

3.2.2 Radiated Emission Measurements (Above 1GHz)

Radiated Measurement Above 1 GHz at a distance of 3 m

	Input Quantity (Contribution) X_i	Value		Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
1	Receiver reading	0.10	dB	Normal, k=1	1.000	0.10	0.01
2	Attenuation: antenna-receiver	0.30	dB	Normal, k=2	2.000	0.15	0.02
3	Preamplifier Gain	0.20	dB	Normal, k=2	2.000	0.10	0.01
4	Antenna factor AF	0.75	dB	Normal, k=2	2.000	0.38	0.14
5	Sinewave accuracy	0.20	dB	Normal, k=2	2.000	0.10	0.01
6	Instability of preamp gain	1.21	dB	Rectangular	1.732	0.70	0.49
7	Noise floor proximity	0.70	dB	Rectangular	1.732	0.40	0.16
8	Mismatch: antenna-preamplifier	1.41	dB	U-shaped	1.414	1.00	0.99
9	Mismatch: preamplifier-receiver	1.30	dB	U-shaped	1.414	0.92	0.85
10	AF frequency interpolation	0.30	dB	Rectangular	1.732	0.17	0.03
11	Directivity difference at 3 m	1.50	dB	Rectangular	1.732	0.87	0.75
12	Phase center location at 3 m	0.30	dB	Rectangular	1.732	0.17	0.03
13	Cross-polarisation	0.90	dB	Rectangular	1.732	0.52	0.27
14	Site imperfections VSWR (Method 2)	2.25	dB	Triangular	2.449	0.92	0.84
15	Effect of setup table material	2.90	dB	Rectangular	1.732	1.67	2.80
16	Separation distance at 3 m	0.30	dB	Rectangular	1.732	0.17	0.03
17	Table height at 3 m	0.00	dB	Normal, k=2	2.000	0.00	0.00
Combined standard uncertainty				Normal	2.73	dB	
Expanded uncertainty				Normal, k=2	5.46	dB	



SECTION 4

DIAGRAM OF TEST SETUP

4.1 RADIATED EMISSION TEST SETUP (BELOW 1GHZ)

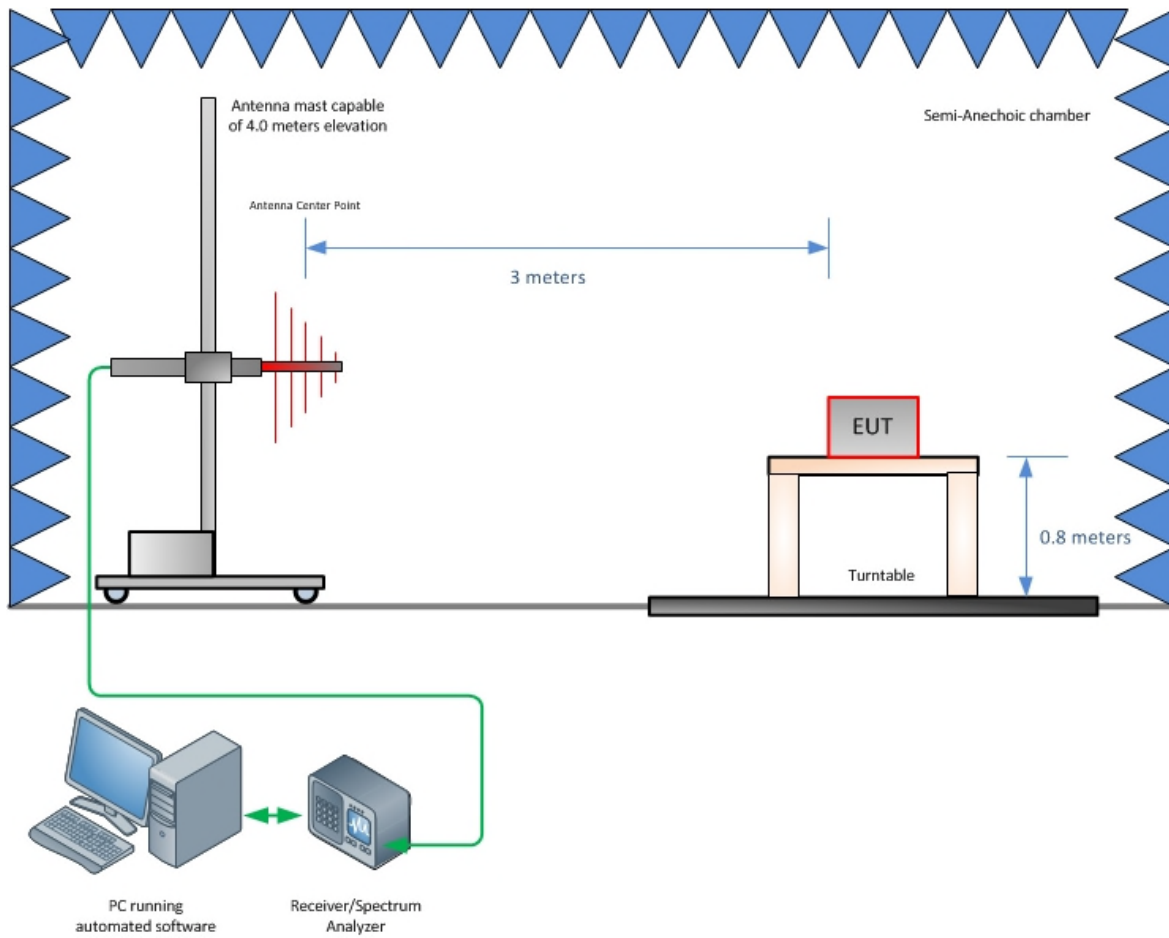


Figure 4.1-1 - Radiated Emission Test Setup (Below 1GHz)

4.2 RADIATED EMISSION TEST SETUP (ABOVE 1GHZ)

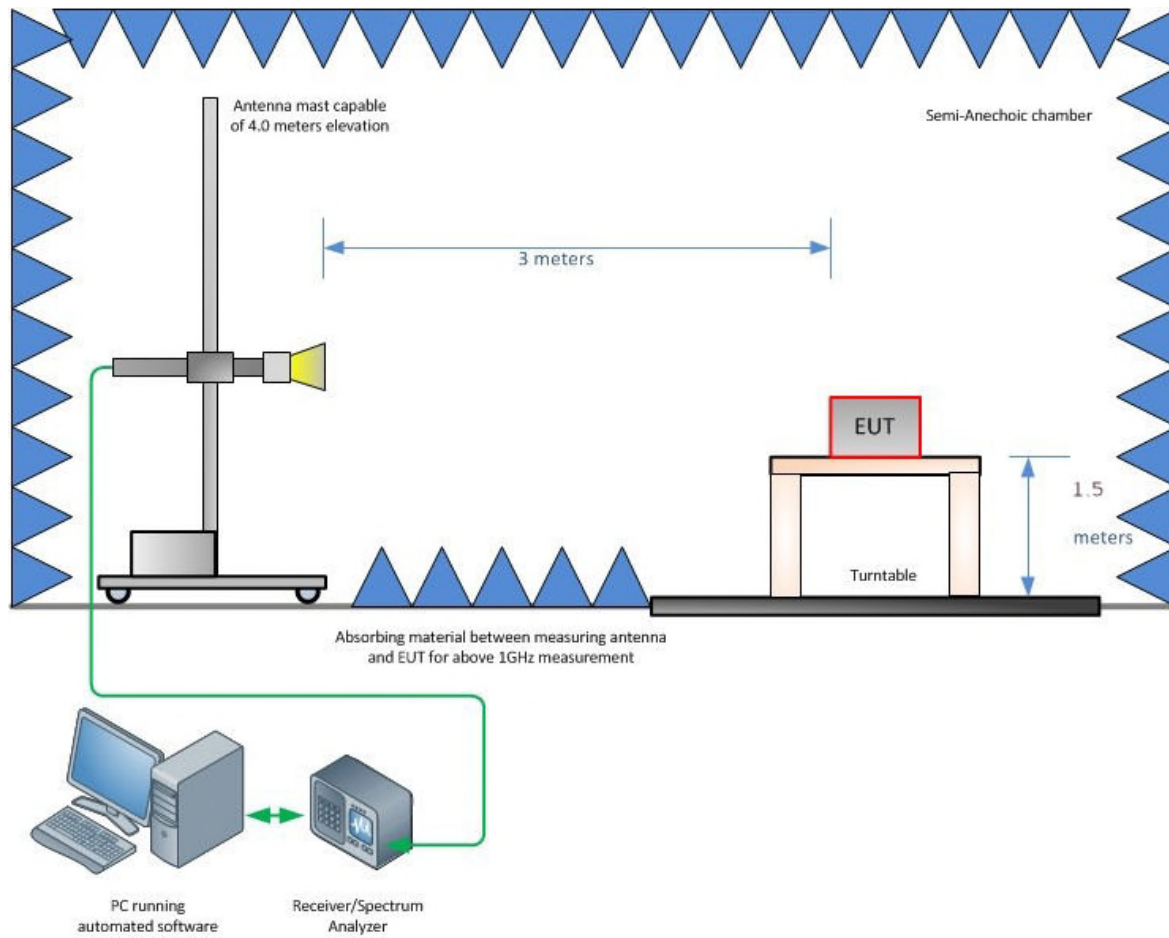


Figure 4.1-2 - Radiated Emission Test Setup (Above 1GHz)



SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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