FCC PART 15.231

RSS-210 Issue 9 , August 2016

TEST REPORT

For

MarineTech Products, Inc.

1360 East County Road E, Vadnais Heights, MN 55110-5511 United States

Model: 550105
FCC ID: 2AILD550105T
IC: 21604-550105T

Report Type Original Report	Product Type: Remote Controller

Test Engineer : David Hsu

Report Number : RTW160503001-00A

Report Date : 2016-11-29

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Revision History

Revision	Issue Date	Description
1.0	2016.11.29	Original Report

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant:	MarineTech Products, Inc. 1360 East County Road E, Vadnais Heights, MN 55110-5511 United States
Manufacturer:	SUPEX PRODUCTS CORP. 1360 East County Road E, Vadnais Heights, MN 55110-5511 United States
Product:	Remote Controller
Model:	550105
Trade Name:	Panther Wireless Remote
Operating Frequency:	433.92 MHz
Voltage Range:	12Vdc from Battery
Dimension:	77.6 mm (L) ×48 mm (W) ×20 mm (H)
Date of Test:	May 05, 2016 ~Nov 29, 2016

**All measurement and test data in this report was gathered from production sample serial number: 16051302 (Assigned by BACL, Taiwan). The EUT supplied by the applicant was received on 2016-05-03.*

Objective

This document is a test report based on the Electromagnetic Interference (EMI) tests performed on the EUT. The EMI measurements were performed according to the measurement procedure described in ANSI C63.10-2013.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.209, 15.35(c) and 15.231 rules.

The tests were performed in order to determine compliance with RSS-210 lssue9 and RSS-Gen lssue4.

Related Submittal(s)/Grant(s)

No Related Submittals.

Test Methodology

All measurements contained in this report were conducted with RSS-210, RSS-Gen and ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Lab Corp. (Taiwan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp.(Taiwan) to collect test data is located on the 70, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

Test site at Bay Area Compliance Laboratories Corp. (Taiwan) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on December 06, 2014. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.10.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 431084. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

SYSTEM TEST CONFIGURATION

Justification

The system was configured in testing mode which was provided by manufacturer.

This product has two buttons to transmit.

Equipment Modifications

No modification on the EUT.

EUT Exercise Software

N/A

Support Equipment List and Details

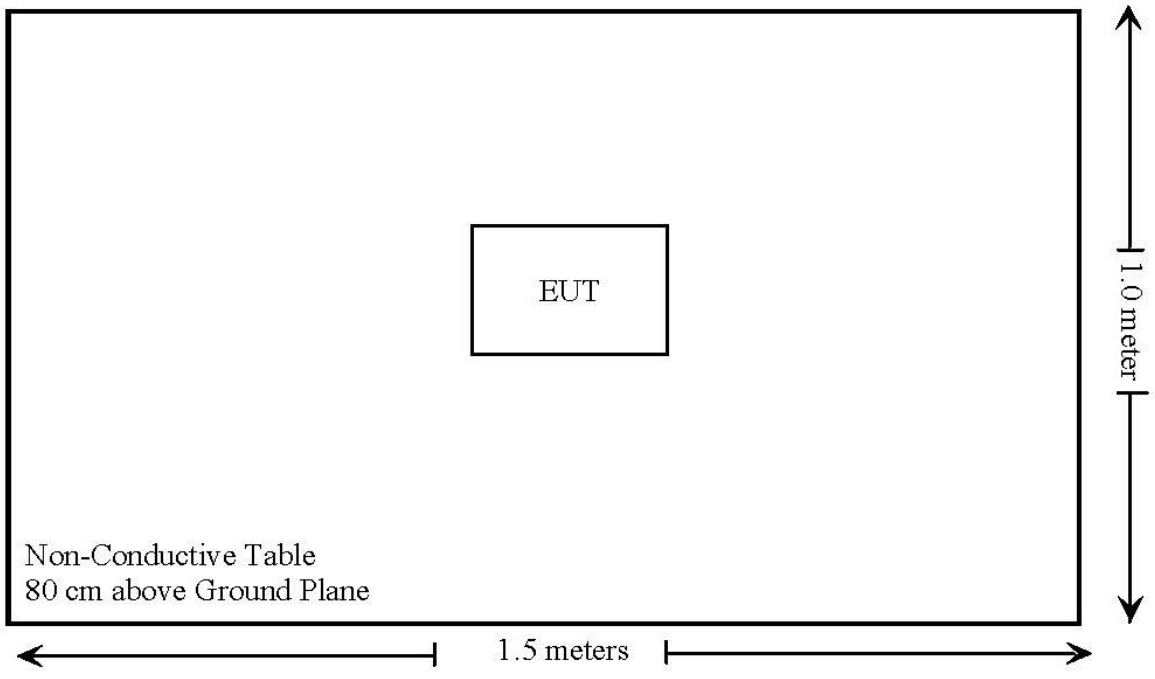
No.	Description	Manufacturer	Model Number	BSMI	FCC ID	S/N
A	N/A	N/A	N/A	N/A	N/A	N/A

External Cable List and Details

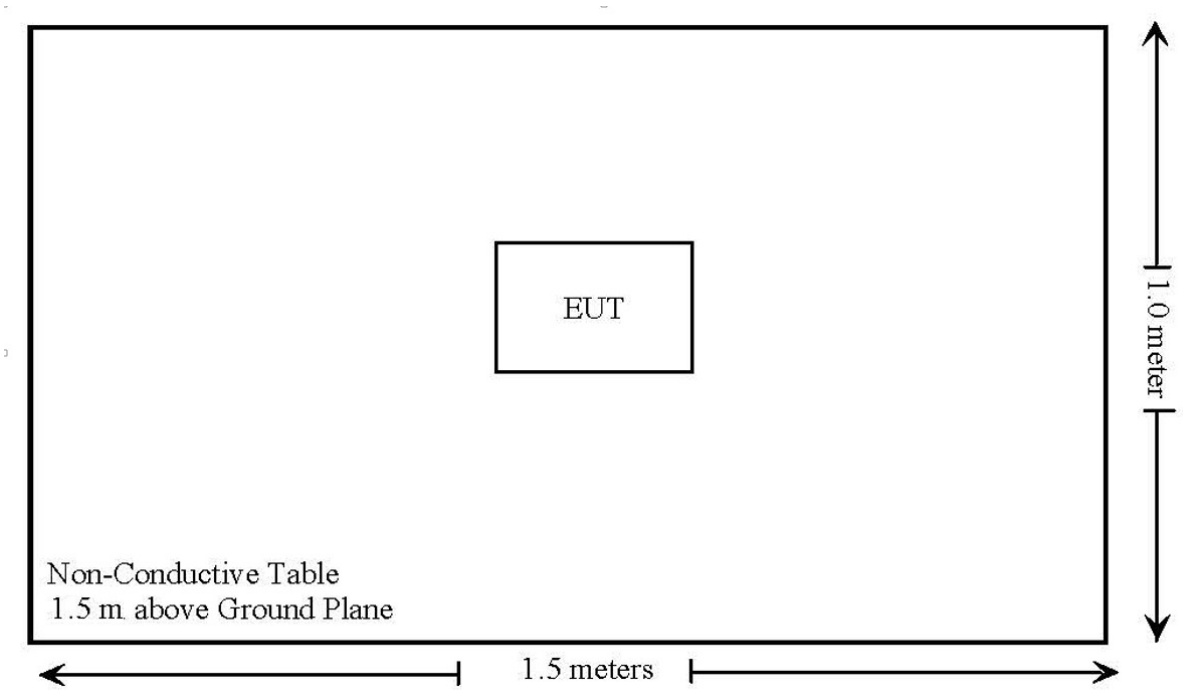
No.	Description	Shielded Type	Ferrite Core	Length
1	N/A	N/A	N/A	N/A

Block Diagram of Test Setup

Below 1GHz:



Above 1GHz:


EUT
1.0 meter
Non-Conductive Table
1.5 m above Ground Plane
1.5 meters

SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§15.203 RSS-Gen 8.3	Antenna Requirement	Compliance
§15.207 RSS-210, RSS-Gen 8.8	AC Line Conducted Emissions	Not Applicable
§15.205 §15.209 §15.231(a)(b) RSS-210 A1.2, RSS-Gen 8.9,8.10	Radiated Emission Test	Compliance
§15.231(c) RSS-210 A1.3	20dB Bandwidth Testing	Compliance
§15.231(a) RSS-210 A1.1	Transmission Time	Compliance

Not applicable*: The EUT is powered by battery only.

FCC §15.203 & RSS-Gen 8.3–ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203,

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited.

According to RSS-Gen 8.3: Transmitter Antenna for Licence-Exempt Radio Apparatus

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the licence-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.
Licence-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the licence-exempt apparatus.
Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level.Footnote8
When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.
User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:
This radio transmitter (identify the device by certification number) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.
Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

Antenna Connector Construction

Manufacturer	Model	Type	Antenna Gain	Result
BlueSEA Co., Ltd.	N/A	PCB Antenna	0 dBi	Compliance

The EUT has one integral antenna arrangement, which was permanently attached; fulfill the requirement of this section. Please refer to the internal photos.

FCC§15.205, §15.209, §15.231(a) (b) & RSS-210 A1.2, RSS-Gen 8.9, 8.10 - RADIATED EMISSIONS TEST

Applicable Standard

FCC §15.205, §15.209, §15.231 (a) (b), RSS-210 A1.2, RSS-Gen 8.9, 8.10

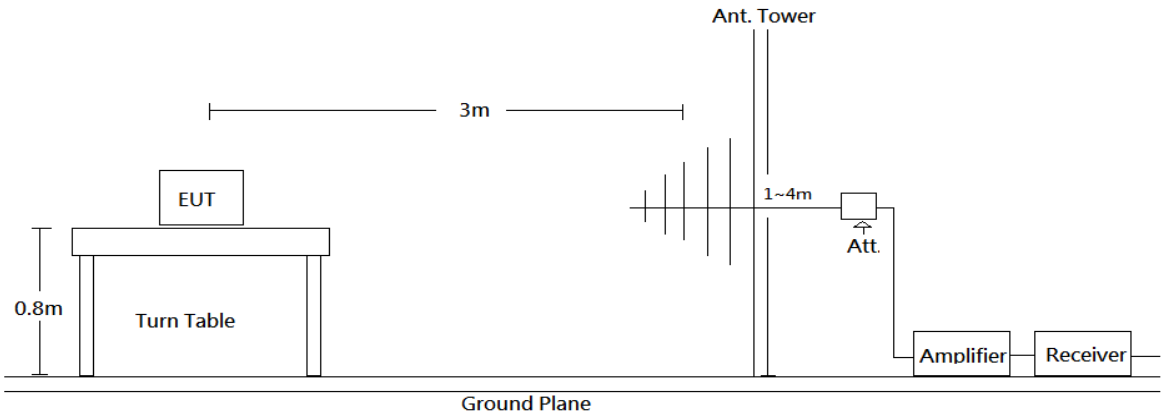
Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

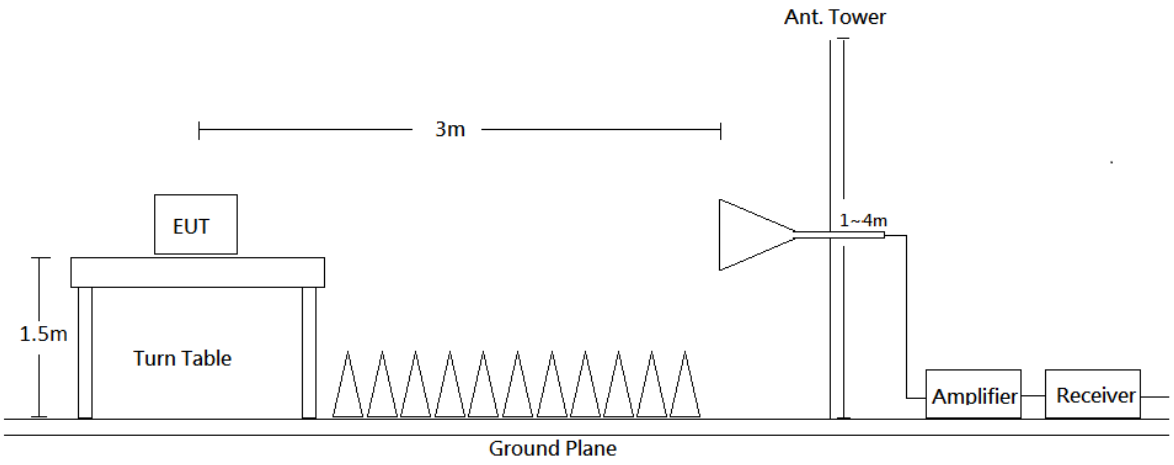
Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of radiation emissions at Bay Area Compliance Laboratories Corp. (Taiwan) is 4.21 dB for 30MHz-1GHz.and 4.51 dB for above 1GHz. And it will not be taken into consideration for the test data recorded in the report.

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3-meter chamber a test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC Part Subpart C limits.

EMI Test Receiver Setup

The system was investigated from 30 MHz to 4.5 GHz.

During the radiated emission test, the EMI test Receiver was set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
1000 MHz – 5000 MHz	1 MHz	3 MHz	/	PK

Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Calibration Date	Calibration Interval
Broadband Antenna	Sunol Sciences	JB6	A050115	2015/12/8	2016/12/7
EMEC Attenuator	EMEC	UNAT-6+	15542	2015/12/8	2016/12/7
Amplifier	Sonoma	310N	130601	2016/7/15	2017/7/14
Horn Antenna	EMCO	3115	9311-4158	2016/5/8	2017/5/7
Preamplifier	EMEC	EM01G18G	060657	2015/12/21	2016/12/20
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2016/11/3	2017/11/2
Mircoflex Cable	UTIFLEX	UFB311A-Q-1440-300300	220490-006	2016/11/2	2017/11/1
Mircoflex Cable	UTIFLEX	UFB197C-1-2362-70U-70U	225757-001	2016/7/15	2017/7/14
Mircoflex Cable	UTIFLEX	UFA210A-1-3149-300300	MFR64639 226389-001	2015/12/2	2016/12/1
Spectrum Analyzer	Rohde & Schwarz	FSEK30	825084/006	2015/12/24	2016/12/23
Mircoflex Cable	ROSNAL	K1K50-UP0264-K1K50-80CM	160309-2	2016/3/24	2017/3/23
Turn Table	Champro	TT-2000	060772-T	N.C.R	N.C.R
Antenna Tower	Champro	AM-BS-4500-B	060772-A	N.C.R	N.C.R
Controller	Champro	EM1000	060772	N.C.R	N.C.R
software	Farad	EZ_EMC	BACL-03A1	N.C.R	N.C.R

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

According to §15.231and RSS-Gen Intentional radiators operating under the provisions of this Section shall demonstrate compliance with the limits on the field strength of emissions, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector.

Applicable Standard

According to §15.231 (b) and RSS-210 A1.2 ,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 emission (microvolts/meter)
40.66-40.70	2250	225
70-130	1250	125
130-174	1250-3750 *	125-375 *
174-260	3750	150
260-470	3750-12500 *	375-1250 *
Above 470	12500	1250

*Linear interpolations.

The above field strength limits are specified at a distance of 3-meters the tighter limits apply at the band edges.

Correct Factor & Margin Calculation

The Correct Factor is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain + Attenuator

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

Margin = Result –Limit

Test Results Summary

According to the data in the following table, the EUT complied with the CFR47 §15.205, §15.209, § 15.231 (b), with the worst margin reading of:

12.48dB at **886.81 MHz** in the **Horizontal** polarization

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL, $U_{(Lm)}$ is less than U_{cispr}, if L_m is less than L_{lim}, it implies that the EUT complies with the limit.

Test Data

Environmental Conditions

Temperature:	23℃
Relative Humidity:	67 %

The testing was performed by David. Hsu on 2016-11-29.

Mode: Transmitting

Horizontal

No.	Frequency	Reading	Correct Factor	Duty Factor	Result	Limit	Margin	Height	Degree	*Remark*
	(MHz)	(dBuV)	(dB/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)	
1	433.92	72.52	-7.14	N/A	65.38	100.82	-35.44	100	285	Peak
2	433.92	---	---	-9.05	56.33	80.82	-24.49	100	285	AVG

Vertical

No.	Frequency	Reading	Correct Factor	Duty Factor	Result	Limit	Margin	Height	Degree	*Remark*
	(MHz)	(dBuV)	(dB/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)	
1	433.92	61.81	-7.14	N/A	54.67	100.82	-46.15	100	136	Peak
2	433.92	---	---	-9.05	45.62	80.82	-35.20	100	136	AVG

Note:

Peak Result = Reading + correct Factor

AVG Result = Peak Result + Duty Factor

Margin = Result – Limit

Calculate Average value based on duty cycle correction factor:

Duty cycle = 35.27%

Duty cycle correction factor = 20*log (duty cycle) = -9.05 dB

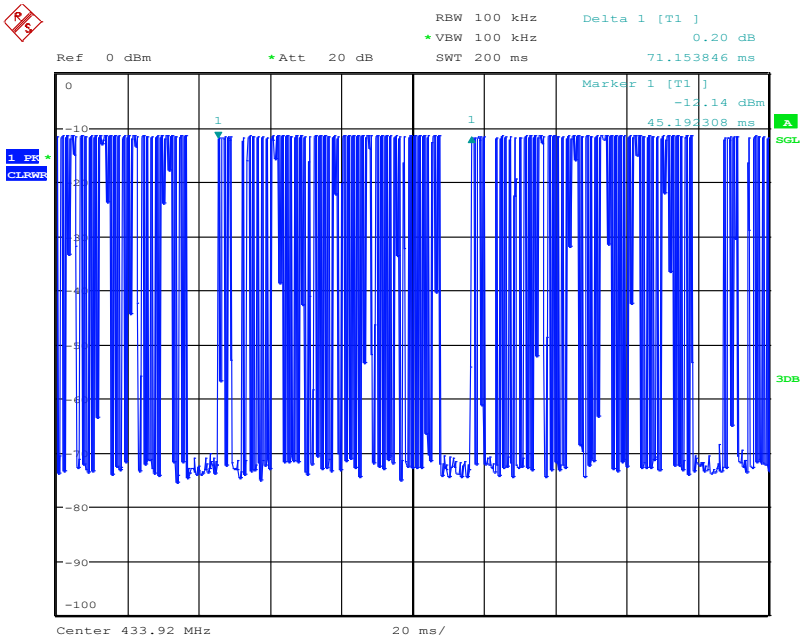
The worst case duty cycle is 35.27%, and correction factor is -9.05 dB.

Please refer to following plots.

Three Group pulse in a Duration time

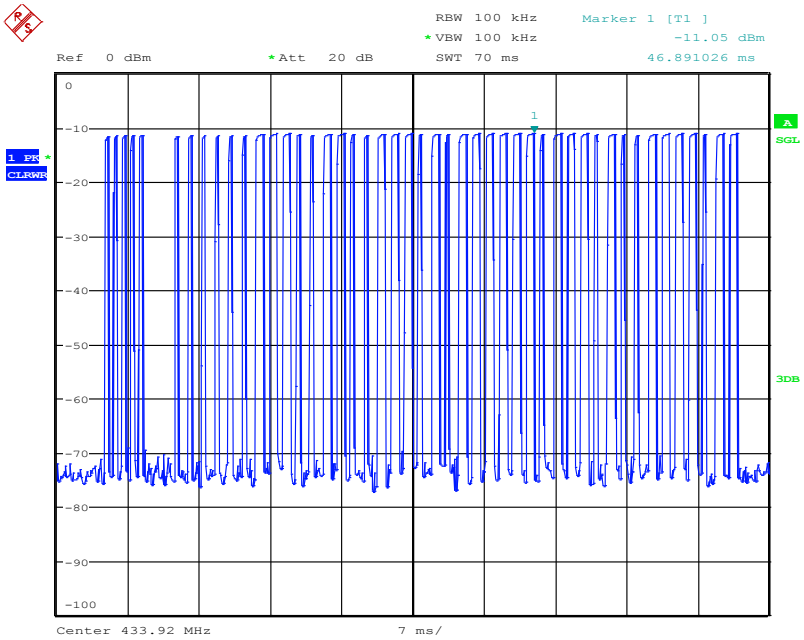
DUTY 1

Tp Time



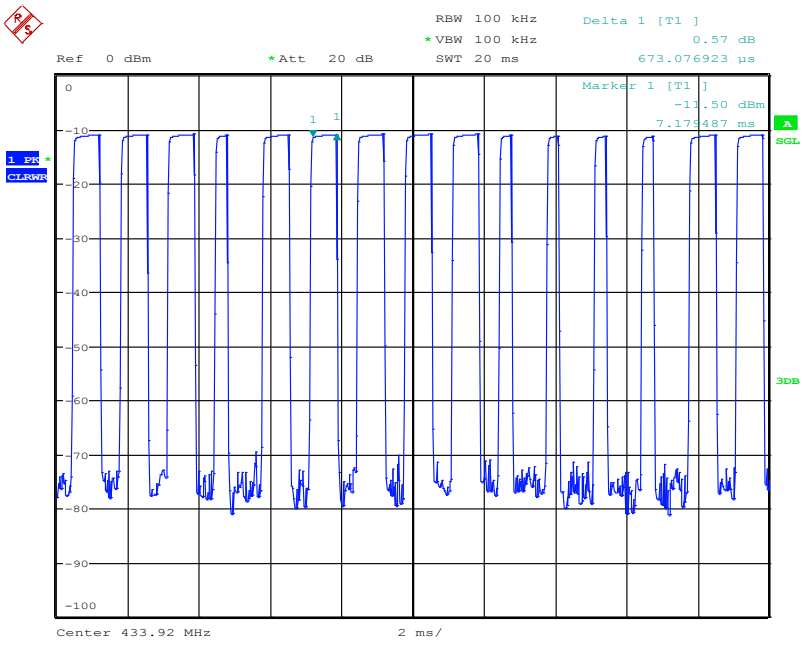
Date: 29.NOV.2016 09:31:55

Ton total number



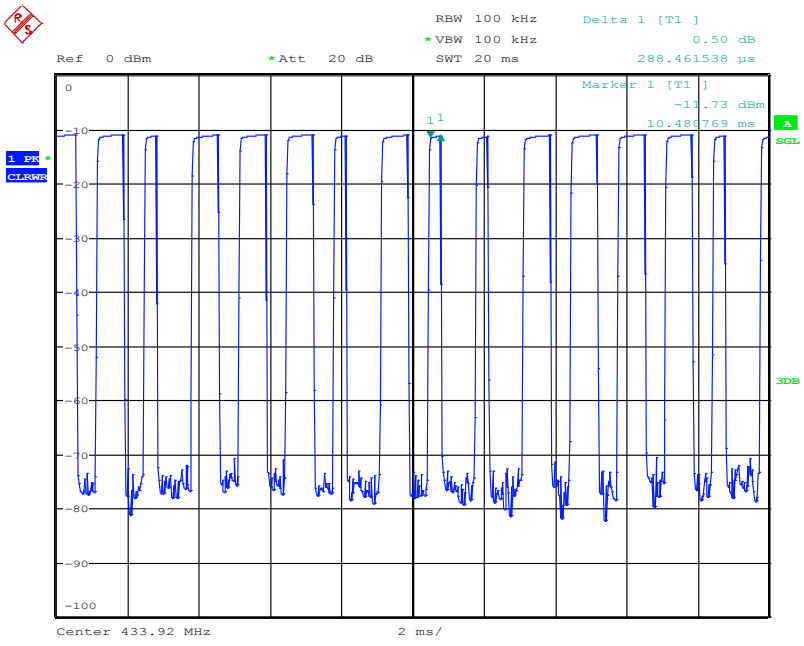
Date: 29.NOV.2016 09:34:25

Ton1



Date: 29.NOV.2016 09:35:36

Ton2



Date: 29.NOV.2016 09:36:09

Duty Cycle = Ton/Tp

Total Ton = Ton1*Number + Ton2*Number

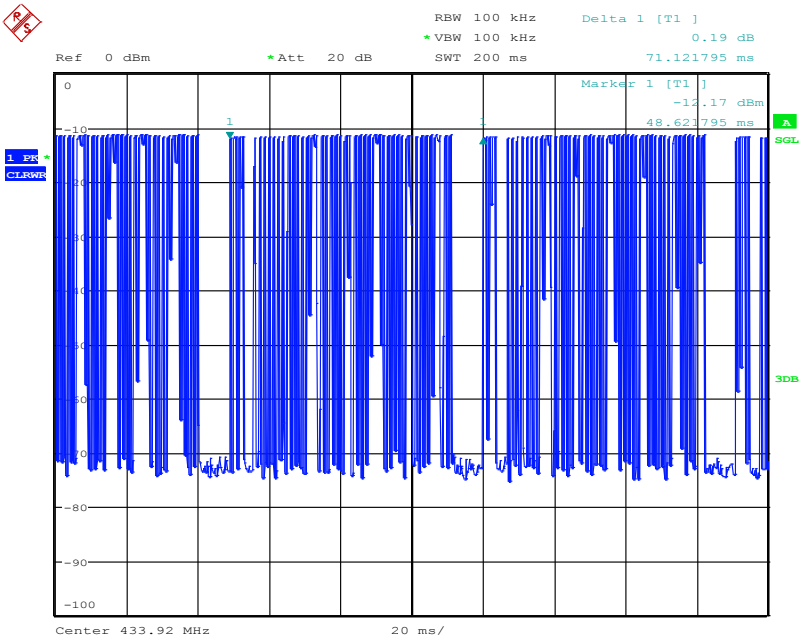
Total Ton = 0.673(ms) * 25 + 0.288(ms)*22 = 23.161 ms

23.161 ms/71.15 ms=32.55 %

Duty cycle correction factor= 20*log (duty cycle) = -9.75 dB

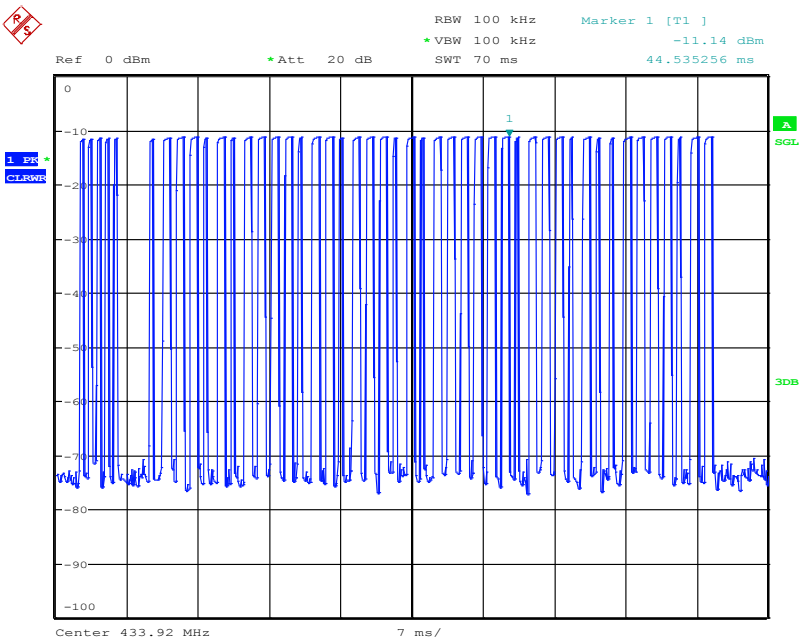
DUTY 2

Tp Time



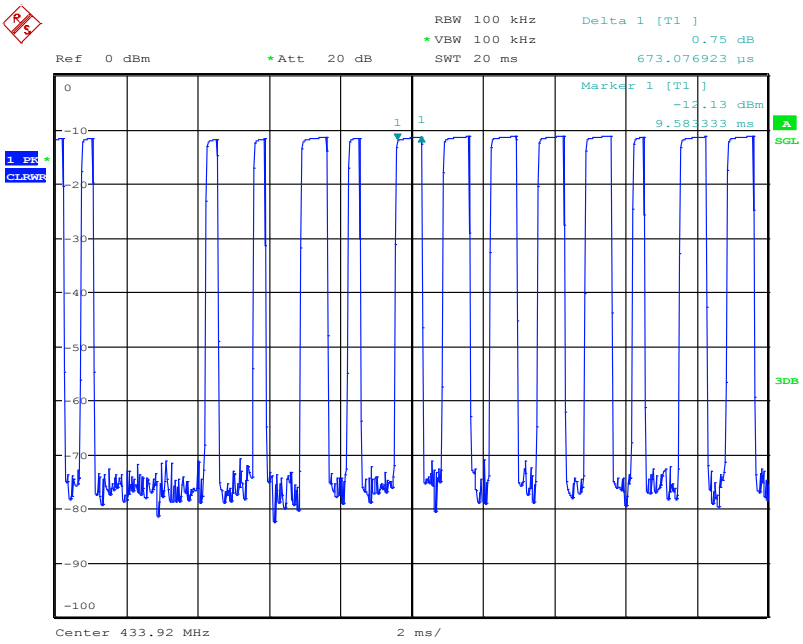
Date: 29.NOV.2016 09:38:17

Ton total number



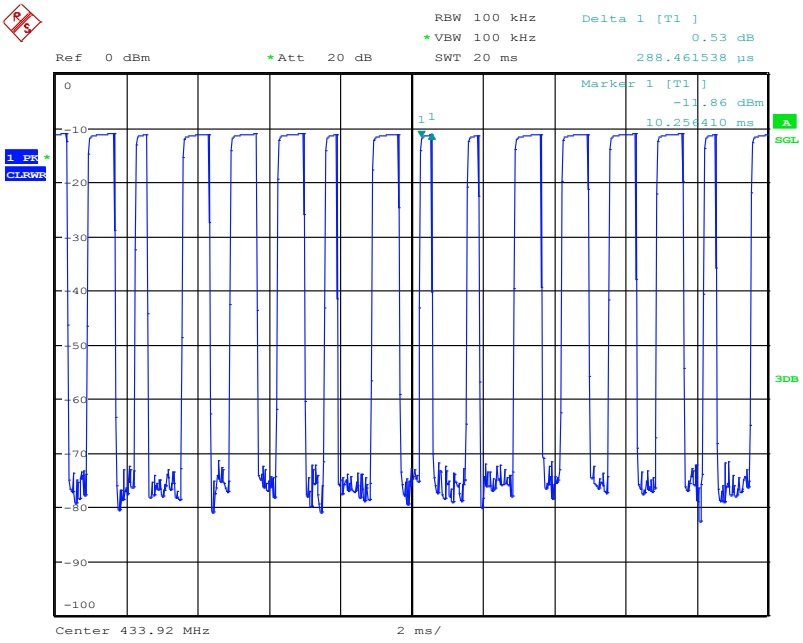
Date: 29.NOV.2016 09:38:51

Ton1



Date: 29.NOV.2016 09:39:34

Ton2



Date: 29.NOV.2016 09:40:04

Duty Cycle = Ton/Tp

Total Ton = Ton1*Number+Ton2*Number

Total Ton = 0.673(ms) * 30 +0.288(ms)*17 = 25.086 ms

25.086 ms/71.12 ms=35.27 %

Duty cycle correction factor= 20*log (duty cycle)= -9.05 dB

Field Strength (30MHz-4.5GHz)

Horizontal

No.	Frequency	Reading	Correct Factor	Duty Factor	Result	Limit	Margin	Height	Degree	*Remark*
	(MHz)	(dBuV)	(dB/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)	
1	494.63	28.66	-5.16	N/A	23.5	43.50	-20.00	100	123	QP
2	886.81	32.68	0.84	N/A	33.52	46.00	-12.48	100	247	QP
3	1302.25	51.37	-11.92	N/A	39.45	74.00	-34.55	100	249	PK
4	1302.25	-----	-----	-9.05	30.40	54.00	-23.60	100	249	AVG
5	1736.25	48.34	-9.47	N/A	38.87	74.00	-35.13	100	123	PK
6	1736.25	-----	-----	-9.05	29.82	54.00	-24.18	100	123	AVG
7	2168.22	47.35	-7.45	N/A	39.90	74.00	-34.10	100	209	PK
8	2168.22	-----	-----	-9.05	30.85	54.00	-23.15	100	209	AVG
9	3889.64	47.35	-6.53	N/A	40.82	74.00	-33.18	100	113	PK
10	3889.64	-----	-----	-9.05	31.77	54.00	-22.23	100	113	AVG

Vertical

No.	Frequency	Reading	Correct Factor	Duty Factor	Result	Limit	Margin	Height	Degree	*Remark*
	(MHz)	(dBuV)	(dB/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)	
1	356.89	30.25	-8.35	N/A	21.90	43.50	-21.60	100	318	QP
2	886.87	30.12	0.84	N/A	30.96	46.00	-15.04	100	354	QP
3	1302.69	48.21	-11.92	N/A	36.29	74.00	-37.71	100	127	PK
4	1302.69	-----	-----	-9.05	27.24	54.00	-26.76	100	127	AVG
5	1736.35	46.22	-9.47	N/A	36.75	74.00	-37.25	100	26	PK
6	1736.35	-----	-----	-9.05	27.70	54.00	-26.30	100	26	AVG
7	2168.76	43.32	-7.45	N/A	35.87	74.00	-38.13	100	142	PK
8	2168.76	-----	-----	-9.05	26.82	54.00	-27.18	100	142	AVG
9	3888.33	44.33	-6.53	N/A	37.80	74.00	-36.20	100	231	PK
10	3888.33	-----	-----	-9.05	28.75	54.00	-25.25	100	231	AVG

Remark:

Peak Result = Reading + correct Factor

AVG Result = Peak Result + Duty Factor

Margin = Result – Limit

FCC §15.231(c) & RSS-210 A1.3 – 20dB BANDWIDTH TESTING

Requirement

Per 15.231(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. Bandwidth is determined at the points 20 dB down from the modulated carrier.

RSS-210 A1.3, The 99% bandwidth of momentarily operated devices shall be less or equal to 0.25% of the centre frequency for devices operating between 70 MHz and 900 MHz. For devices operating above 900 MHz, the 99% bandwidth shall be less or equal to 0.5% of the centre frequency.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSU26	200268	2016/05/02	2017/05/01
WOKEN	Cable	SFL402	00100A1F6A192S	2015/12/18	2016/12/17
Broadband Antenna	Sunol Sciences	JB6	A050115	2015/12/8	2016/12/7

Test Procedure

With the EUT's antenna attached, the waveform was received by the test antenna which was connected to the spectrum analyzer, plot the 20 dB bandwidth.

Test Data

Environmental Conditions

Temperature:	24℃
Relative Humidity:	62 %

The testing was performed by David. Hsu on 2016-05-05.

Test Mode: Transmitting

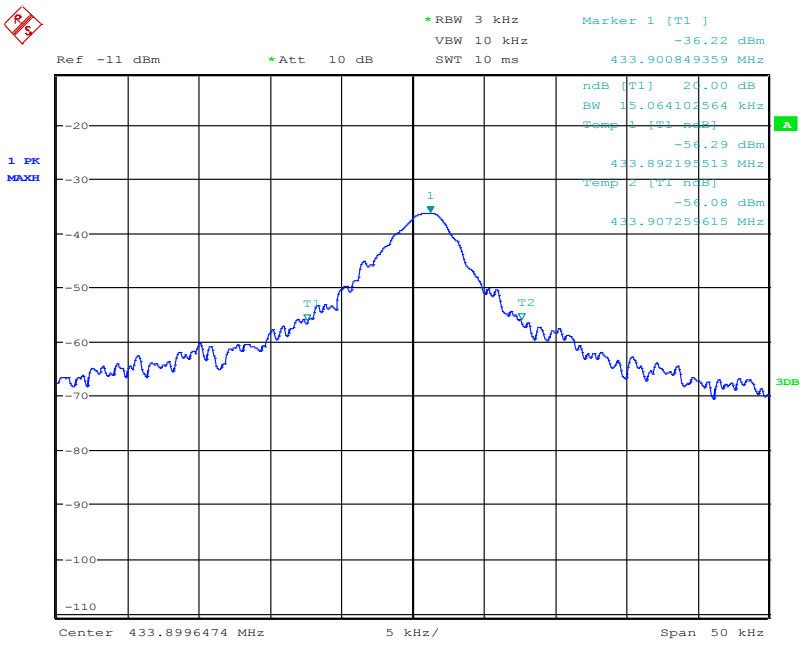
Please refer to following table and plot.

Channel Frequency (MHz)	Occupied Bandwidth 99% (kHz)	20dB Bandwidth (kHz)	Limit (kHz)	Result
433.90	22.035	15.064	1084.75	PASS

Note: Limit = 0.25% * Center Frequency = 0.25% * 433.90 MHz = 1084.75 kHz

FCC 15.231(c):

20 dB Bandwidth



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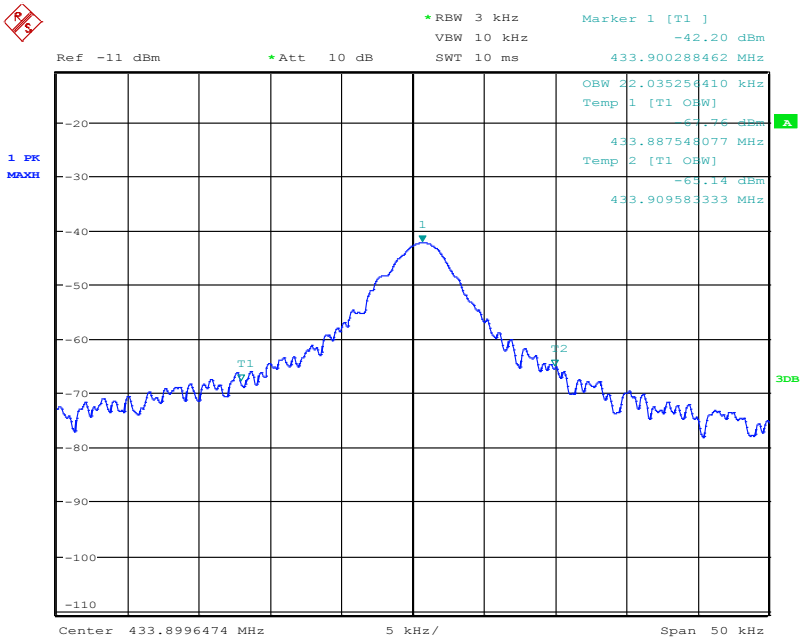
IC RSS-210 A1.1.3:

Occupied Bandwidth 99%



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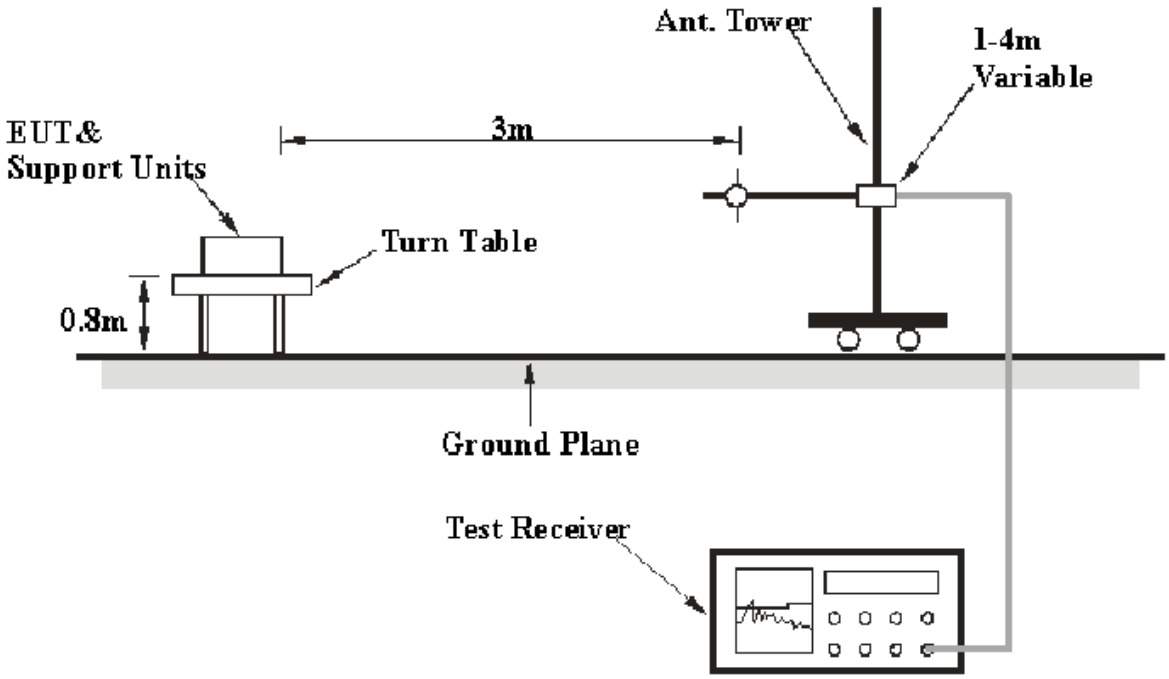
FCC §15.231(a) & RSS-210 A1.1 – TRANSMISSION TIME

Requirement

According to 15.231 (a) and RSS-210 A1.1, a manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

EUT Setup



The deactivation test was performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10 - 2013. The specification used was the FCC 15.231(a) limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSU26	200268	2016/05/02	2017/05/01
WOKEN	Cable	SFL402	00100A1F6A192S	2015/12/18	2016/12/17
Broadband Antenna	Sunol Sciences	JB6	A050115	2015/12/8	2016/12/7

Test Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	62 %

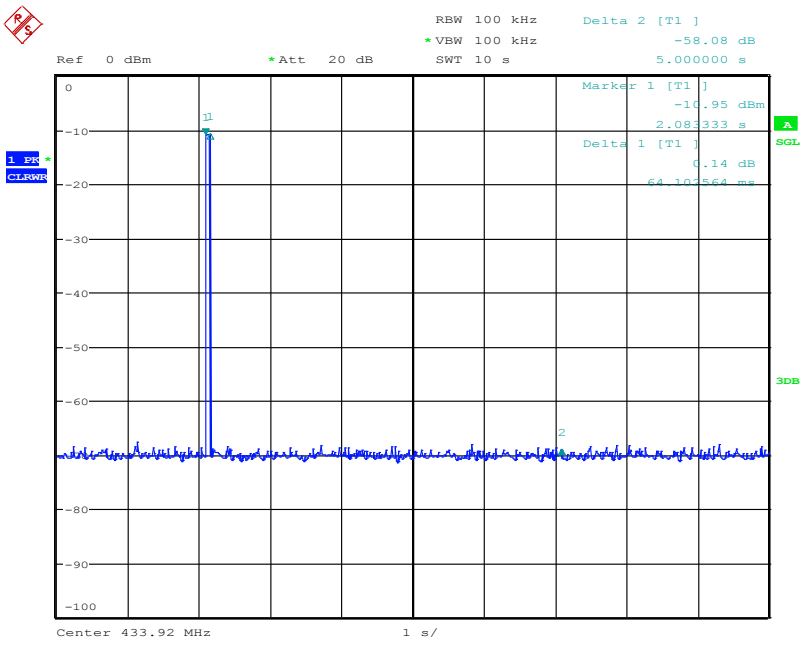
The testing was performed by David. Hsu on 2016-11-29.

Test Mode: Transmitting

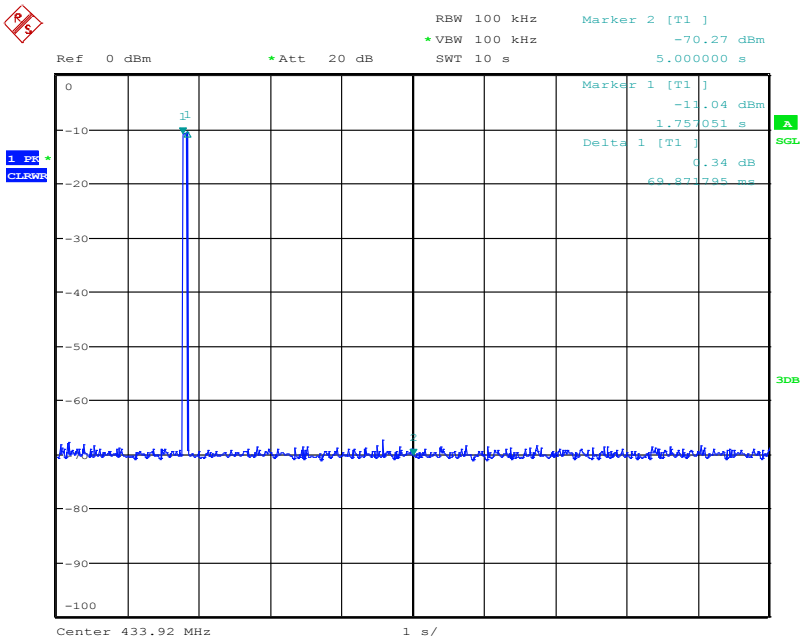
Please refer to following table and plot.

Mode	Transmission Time	Silent time Limit	Result
Duty1	0.064s	< 5s	PASS
Duty2	0.069s	< 5s	PASS

Duty1



Duty2

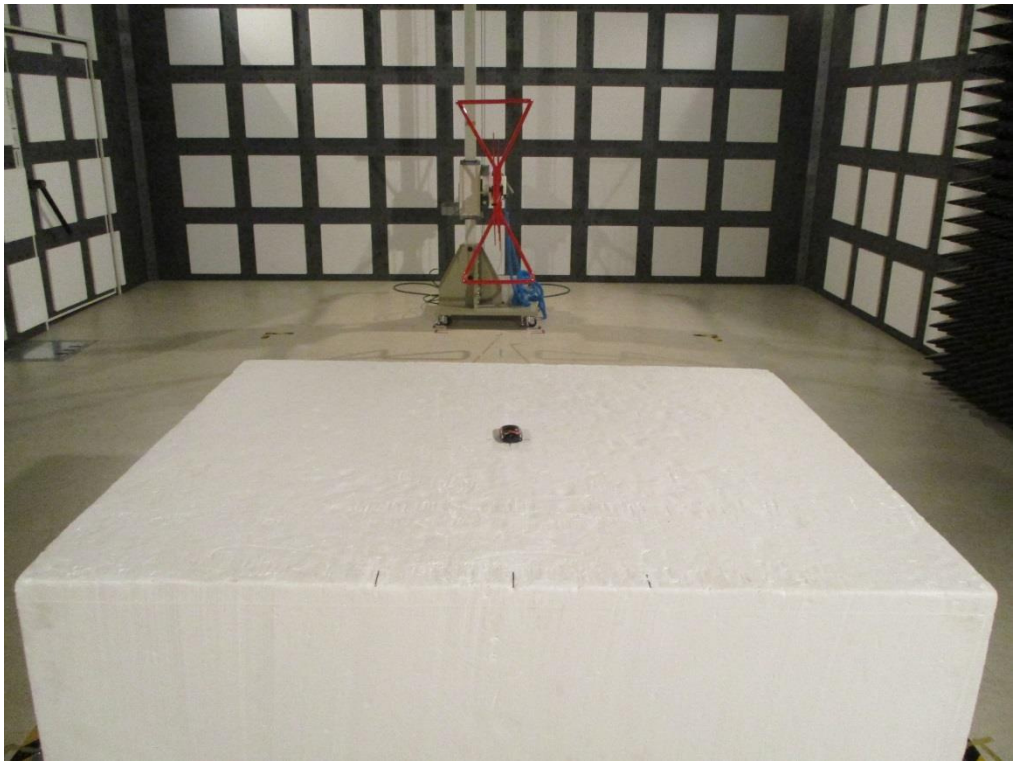


Date: 29.NOV.2016 09:45:36

Appendix 1 - EUT Setup Photographs

Below 1G test Photo:

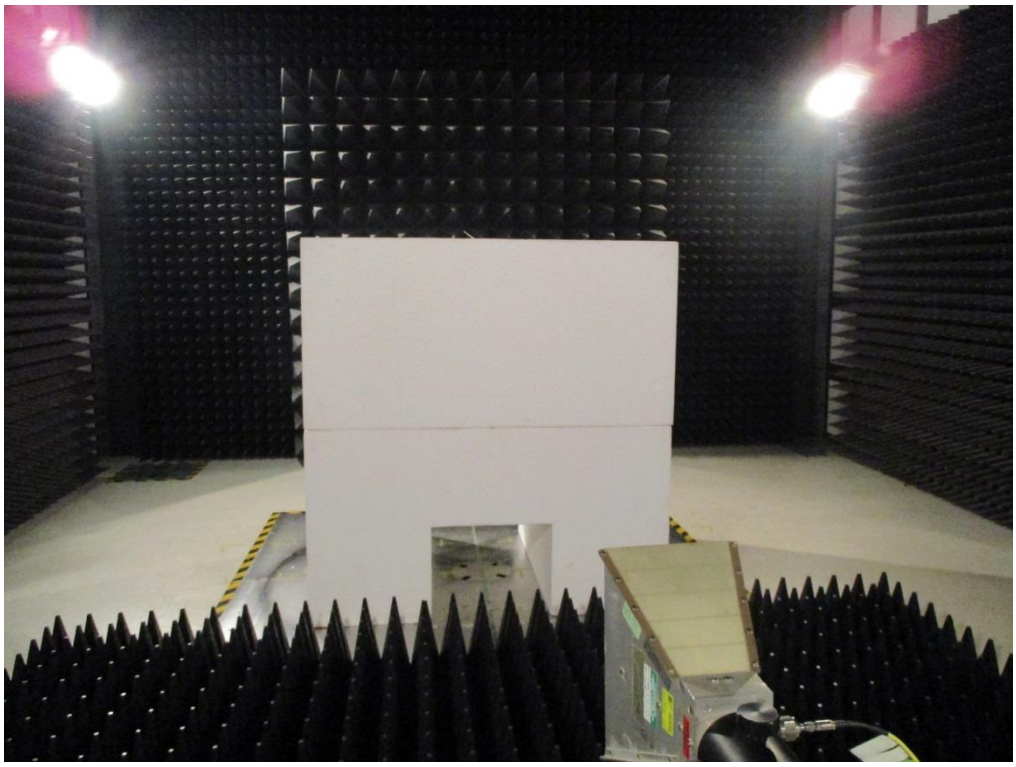
RAD Front View



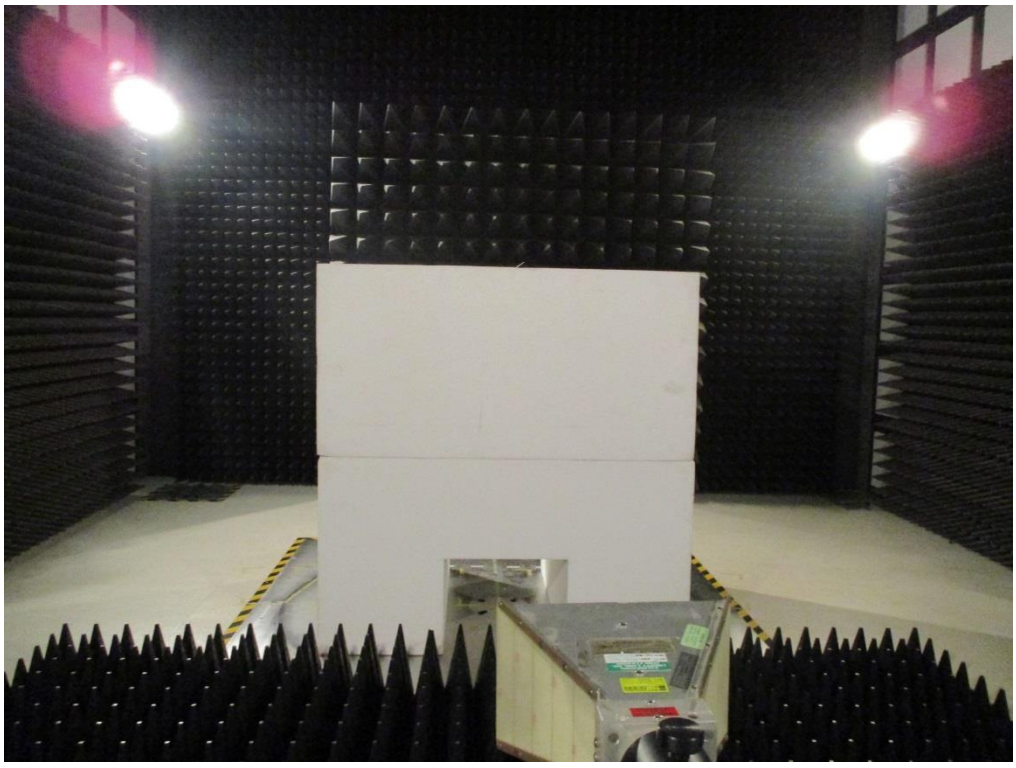
RAD Rear View

Above 1G test Photo:

RAD Front View



RAD Rear View



******* END OF REPORT *******