FCC PART 15.247

TEST REPORT

For

Hyndsight Vision Systems Inc.

59 Pine Street, Peterborough, NH 03458, United States

FCC ID: 2ACT7-CJRXR

Report Type	Product Type:
Original Report	Hyndsight Vision System Monitor

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Report Number : RDGA161207004-00A

Report Date : 2017-02-13

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Revision History

Revision	Issue Date	Description
1.0	2017.02.13	Original Report

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant:	Hyndsight Vision Systems Inc. 59 Pine Street, Peterborough, NH 03458, United States
Manufacturer:	ALLIED HILL ENTERPRISE LTD SUITE 507, SILVER CORD TOWER 1, 30 CANTON ROAD, T.S.T KOWLOON, HONGKONG
Product:	Hyndsight Vision System Monitor
Model:	HVS001MR
Frequency Range	2406 ~ 2469 MHz
Transmit Power	15.80 dBm
Number of Channels	19 channels
Antenna Specification	Dipole Antenna / Gain: 2.0 dBi
Input:	DC 3.7V from battery or DC 5V from adapter
Dimension	18.0 cm (L) × 12.50 cm (W) ×4.00 cm (H)
Date of Test:	2016.12.15 ~ 2017.02.13

**All measurement and test data in this report was gathered from production sample serial number: 161207004 (Assigned by BACL, Taiwan). The EUT supplied by the applicant was received on 2016-12-08.*

Adapter Information:

Model:XH012-050200USCU

Input: AC100-240V, 50/60Hz, 0.4A Max

Output: DC5.0V, 2.0A

Objective

This report is prepared on behalf of *Hyndsight Vision Systems Inc.* in accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communications Commission's rules.

The tests were performed in order to determine the EUT compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

Part of system submissions with FCC ID: 2ACT7-CJTXR

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.

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, XizhiDist., 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 April 22, 2015. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

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

Description of Test Configuration

The system was configured for testing in engineering mode which was configured under maximum power output and switched the channels by keys.

The device employed hybrid systems, which are employ a combination of both frequency hopping and digital modulation techniques.19 channels are employed by the system as below table:

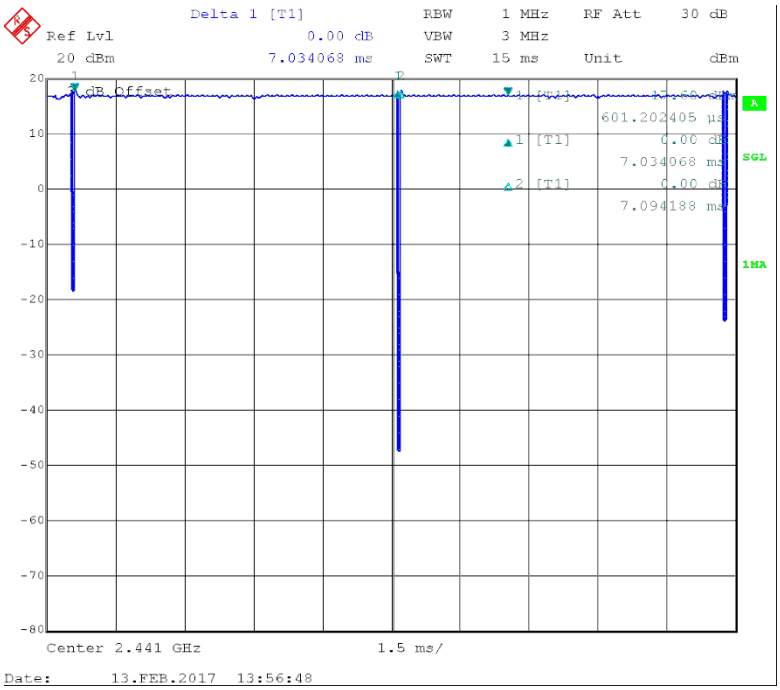
Channels	Frequency (MHz)	Channels	Frequency (MHz)	Channels	Frequency (MHz)
1	2406	8	2430.5	15	2455
2	2409.5	9	2434	16	2458.5
3	2413	10	2437.5	17	2462
4	2416.5	11	2441	18	2465.5
5	2420	12	2444.5	19	2469
6	2423.5	13	2448	/	/
7	2427	14	2451.5	/	/

EUT was tested with Channel 2406 MHz, 2441 MHz and 2469 MHz.

EUT Exercise Software

No software was used in test. The test mode configured maximum power with maximum duty cycle, which provided by the manufacturer.

T_{on} (ms)	T_{on+off} (ms)	Duty Cycle (%)
7.03	7.09	99.15



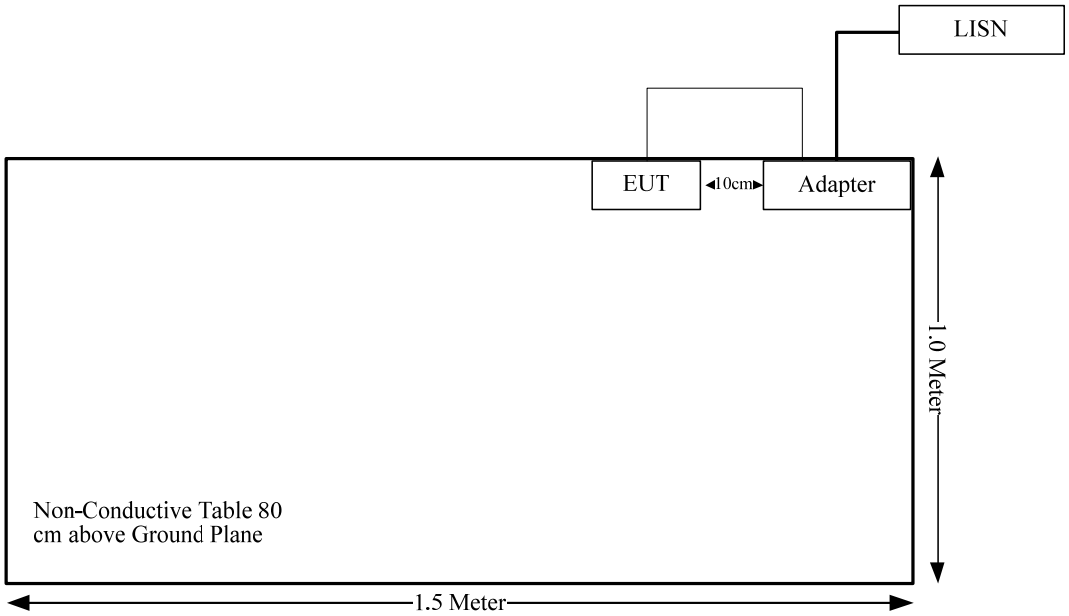
Equipment Modifications

No modification was made to the EUT.

External I/O Cable

Cable Description	Length (m)	From Port	To
Adapter cable	1.53	Adapter	EUT

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
FCC §15.247 (i) & §1.1310 & §2.1091	Maximum Permissable Exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	AC Line Conducted Emissions	Compliance
§15.205, §15.209,§15.247(d)	Spurious Emissions	Compliance
§15.247 (a)(2)	6 dB Emission Bandwidth	Compliance
§ 15.247(f)	Time of Occupancy (Dwell Time)	Compliance
§15.247(b)(3)	Peak Output Power Measurement	Compliance
§ 15.247(d)	Band Edges	Compliance
§ 15.247(f)	Power Spectral Density	Compliance

FCC §15.247 (i) & §1.1310 & §2.1091- MPE

Applicable Standard

According to subpart 15.247(i)and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f²)	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

Calculated Formulary:
Predication of MPE limit at a given distance
$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Measurement Result

Frequency (MHz)	**Antenna Gain**		**Tune-up Power**		**Evaluation Distance (cm)**	**Power Density (mW/cm^2)**	**MPE Limit (mW/cm^2)**
	(dBi)	**(numeric)**	**(dBm)**	**(mW)**			
2406-2469	2	1.58	16	39.81	20.00	0.0126	1.0

Result: The device meet FCC MPE at 20 cm distance

FCC §15.203–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.

Antenna Connector Construction

The EUT has one dipole antenna with RP-SMA connector, the antenna gain is 2.0 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

According to FCC §15.207

Measurement Uncertainty

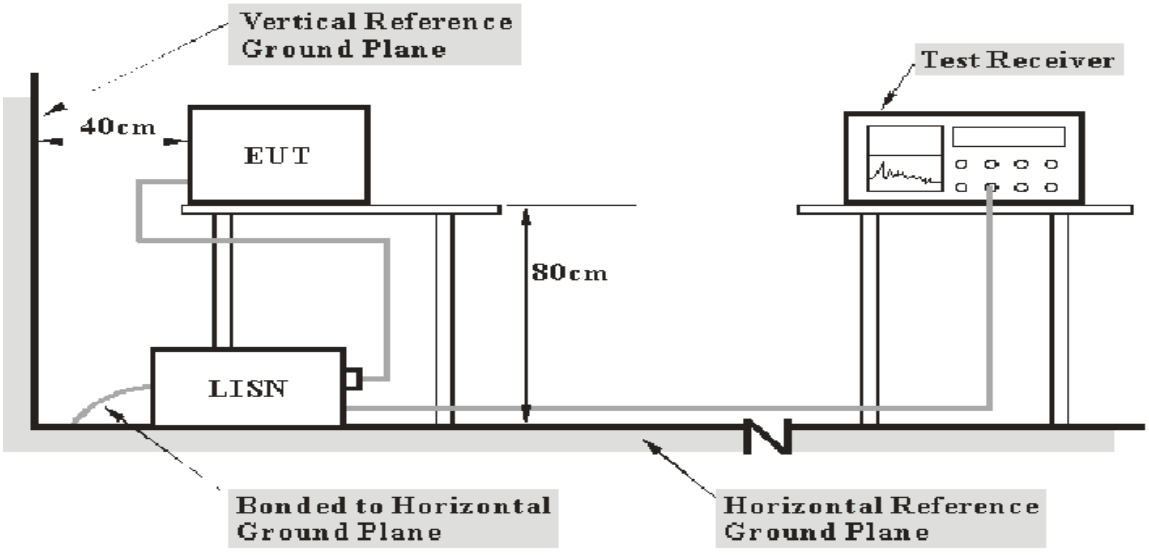
Input quantities to be considered for conducted disturbance measurements maybe receiver reading, attenuation of the connection between LISN/ISN and receiver, LISN/ISN voltage division factor, LISN/ISN VDF frequency interpolation and receiver related input quantities, etc.

Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of conducted disturbance test at Bay Area Compliance Laboratories Corp. (Taiwan) is shown as below. And the uncertainty will not be taken into consideration for the test data recorded in the report

Table 1 – Values of U_{cispr}

Measurement	U_{cispr}
Conducted disturbance at mains port using AMN (150 kHz to 30 MHz)	2.71B

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

The adapter was connected to a 120 VAC/60 Hz power source

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

Corrected Factor & Margin Calculation

The basic equation is as follows:

$V_C = V_R + A_C + VDF$

Herein,

V_C: corrected voltage amplitude

V_R: reading voltage amplitude

A_C: attenuation caused by cable loss

VDF: voltage division factor of AMN or ISN

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the maximum limit.

The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
LISN	Rohde & Schwarz	ENV216	101248	2016/7/27	2017/7/26
LISN	EMCO	3816/2	00075848	2016/8/4	2017/8/3
EMI Test Receiver	Rohde & Schwarz	ESCI	100540	2016/7/22	2017/7/21
RF Cable	EMEC	EM-CB5D	001	2016/7/27	2017/7/26
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207, with the worst margin reading of:

14.0 dB at**12.694276 MHz** in the **Line** conducted mode

Test Data

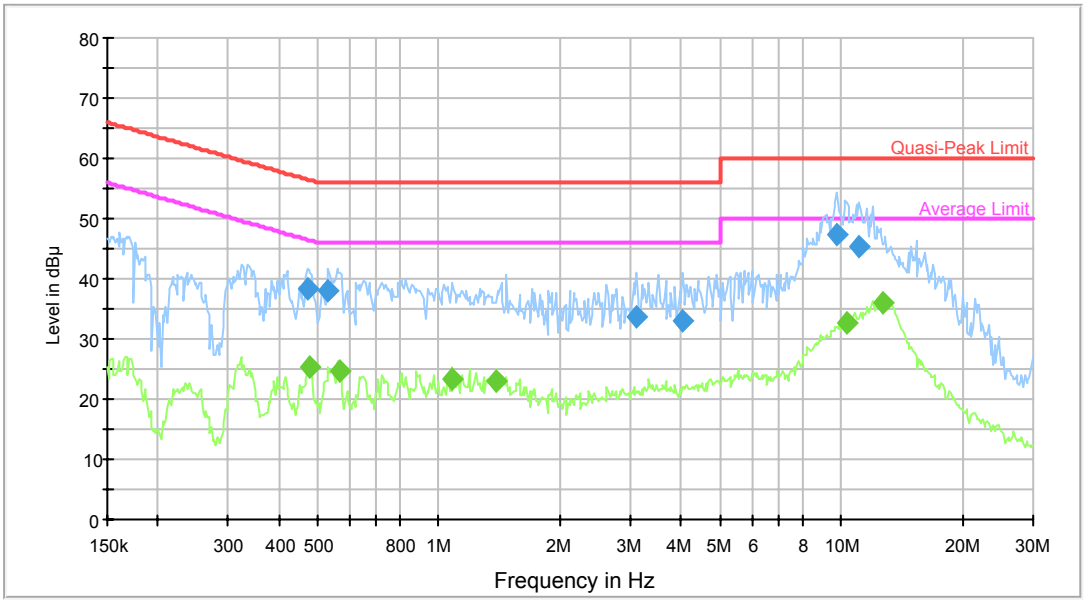
Environmental Conditions

Temperature:	25.2 ℃
Relative Humidity:	36 %
ATM Pressure:	101.7 kPa

The testing was performed by David. Hsu on 2016-12-15.

Test Mode: Charging&Transmitting

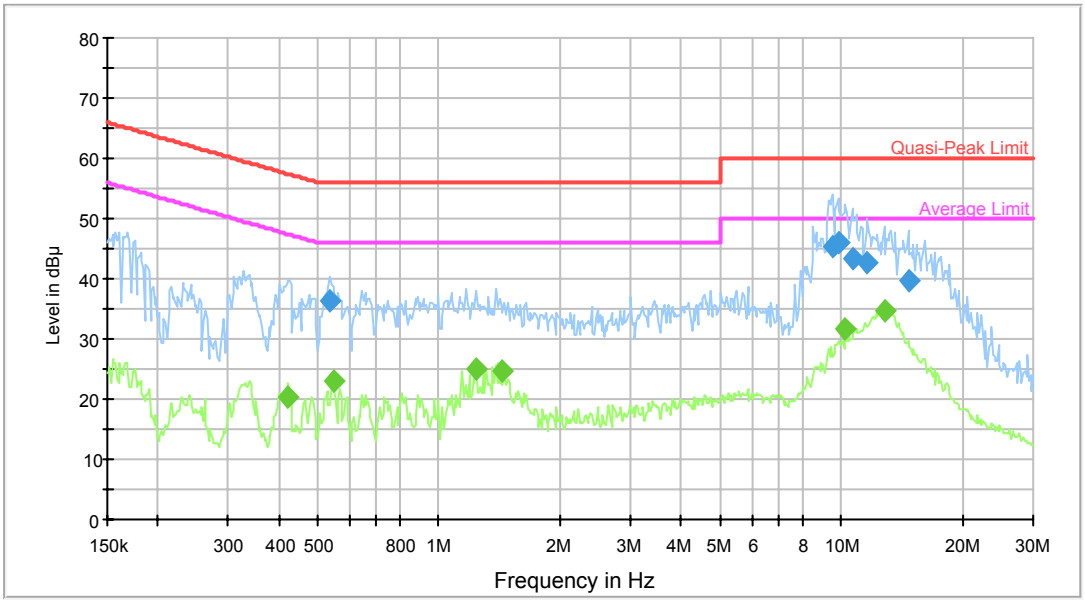
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.472507	38.5	9.000	L1	9.7	18.0	56.5	Compliance
0.532496	38.0	9.000	L1	9.7	18.0	56.0	Compliance
3.098088	33.7	9.000	L1	9.7	22.3	56.0	Compliance
4.029873	32.9	9.000	L1	9.7	23.1	56.0	Compliance
9.759114	47.2	9.000	L1	9.8	12.8	60.0	Compliance
11.086102	45.3	9.000	L1	9.9	14.7	60.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.480097	25.3	9.000	L1	9.7	21.0	46.3	Compliance
0.567545	24.8	9.000	L1	9.7	21.2	46.0	Compliance
1.073601	23.4	9.000	L1	9.7	22.6	46.0	Compliance
1.385415	23.0	9.000	L1	9.7	23.0	46.0	Compliance
10.318917	32.6	9.000	L1	9.8	17.4	50.0	Compliance
12.694276	36.0	9.000	L1	9.9	14.0	50.0	Compliance

AC120 V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.536756	36.4	9.000	N	9.6	19.6	56.0	Compliance
9.528593	45.2	9.000	N	9.8	14.8	60.0	Compliance
9.837187	45.9	9.000	N	9.8	14.1	60.0	Compliance
10.653105	43.4	9.000	N	9.8	16.6	60.0	Compliance
11.628992	42.8	9.000	N	9.9	17.2	60.0	Compliance
14.652020	39.8	9.000	N	10.0	20.2	60.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.422630	20.4	9.000	N	9.6	27.0	47.4	Compliance
0.545378	22.9	9.000	N	9.6	23.1	46.0	Compliance
1.239175	25.0	9.000	N	9.7	21.0	46.0	Compliance
1.430284	24.5	9.000	N	9.7	21.5	46.0	Compliance
10.237020	31.5	9.000	N	9.8	18.5	50.0	Compliance
12.898197	34.7	9.000	N	9.9	15.3	50.0	Compliance

FCC§15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

FCC§15.247 (d); §15.209; §15.205;

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.

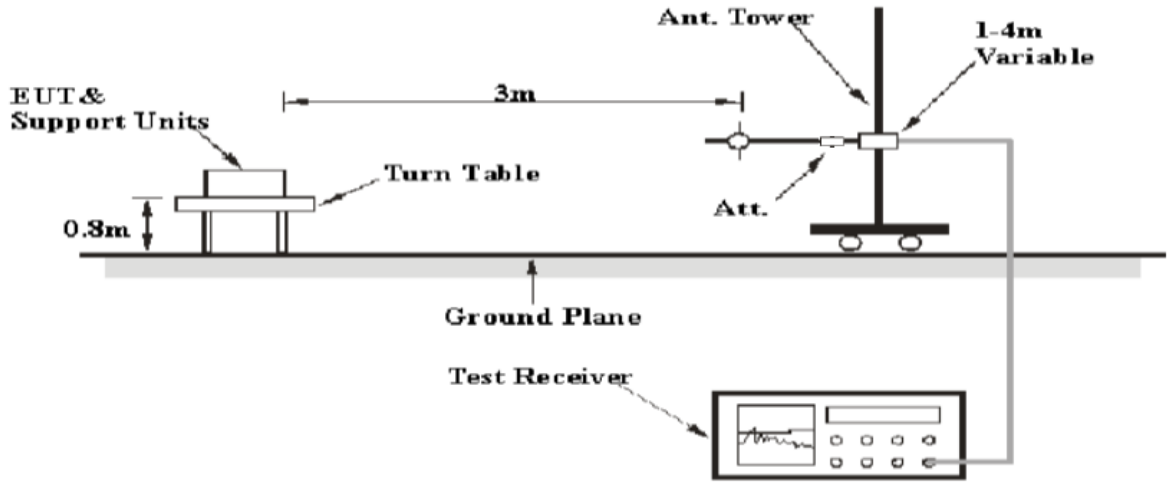
Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of radiation emissions at Bay Area Compliance Laboratories Corp. (Taiwan) is shown in below table. And the uncertainty will not be taken into consideration for the test data recorded in the report

Table 1 – Values of U_{cispr}

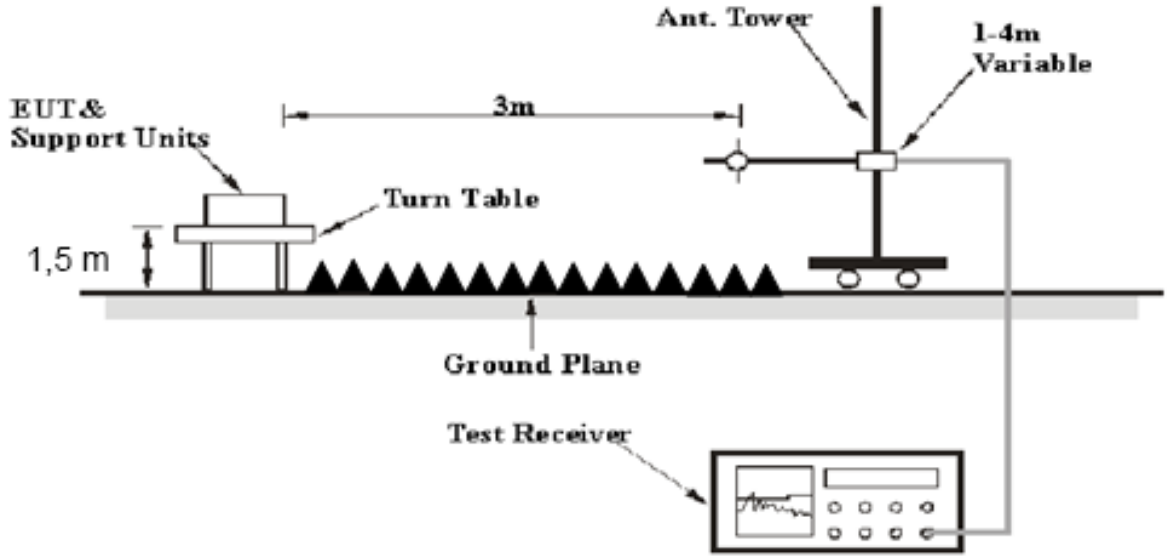
Frequency	Polarity	Measurement uncertainty
30 MHz~200 MHz	Horizontal / Vertical	4.35 dB (k=2, 95% level of confidence)
200 MHz~1 GHz	Horizontal / Vertical	5.78 dB (k=2, 95% level of confidence)
1 GHz~6 GHz	Horizontal / Vertical	4.51 dB (k=2, 95% level of confidence)
6 GHz~18 GHz	Horizontal / Vertical	4.88 dB (k=2, 95% level of confidence)
18 GHz~26 GHz	Horizontal / Vertical	4.30 dB (k=2, 95% level of confidence)
26 GHz~40 GHz	Horizontal / Vertical	4,30 dB (k=2, 95% level of confidence)

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.4-2014. The specification used was the FCC 15.209, and FCC 15.247 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle. The spacing between the peripherals was 10 cm.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were 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
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	Ave.

Test Procedure

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

All data was recorded in the Quasi-peak detector mode from 30 MHz to 1 GHz and PK and average detector modes for frequencies above 1 GHz.

Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Broadband Antenna	Sunol Sciences	JB6	A050115	2016/11/16	2017/11/15
Amplifier	Sonoma	310N	130602	2016/7/15	2017/7/14
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	2016/12/1	2017/11/30
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
Horn Antenna	EMCO	3115	9311-4158	2016/5/10	2017/5/9
Horn Antenna	ETS-Lindgren	3116	00062638	2016/9/5	2017/9/4
Preamplifier	EMEC	EM01G18G	060657	2016/12/13	2017/12/12
Preamplifier	EMEC	EM18G40G	060656	2016/12/13	2017/12/12
Spectrum Analyzer	Rohde & Schwarz	FSV40	101203	2016/7/14	2017/7/13
Mircoflex Cable	ROSNAL	K1K50-UP0264-K1K50-80CM	160309-2	2016/3/24	2017/3/23
Mircoflex Cable	ROSNAL	K1K50-UP0264-K1K50-450CM	160309-1	2016/3/24	2017/3/23

Corrected Amplitude & Margin Calculation

The Corrected Amplitude 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: Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - Amplifier Gain. 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 = Limit – Corrected Amplitude

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, and section 15.205, 15.209 and 15.247, with the worst margin reading of:

1.42 dB at **2483.5 MHz** in the **Vertical** polarization

Test Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	50 %
ATM Pressure:	102kPa

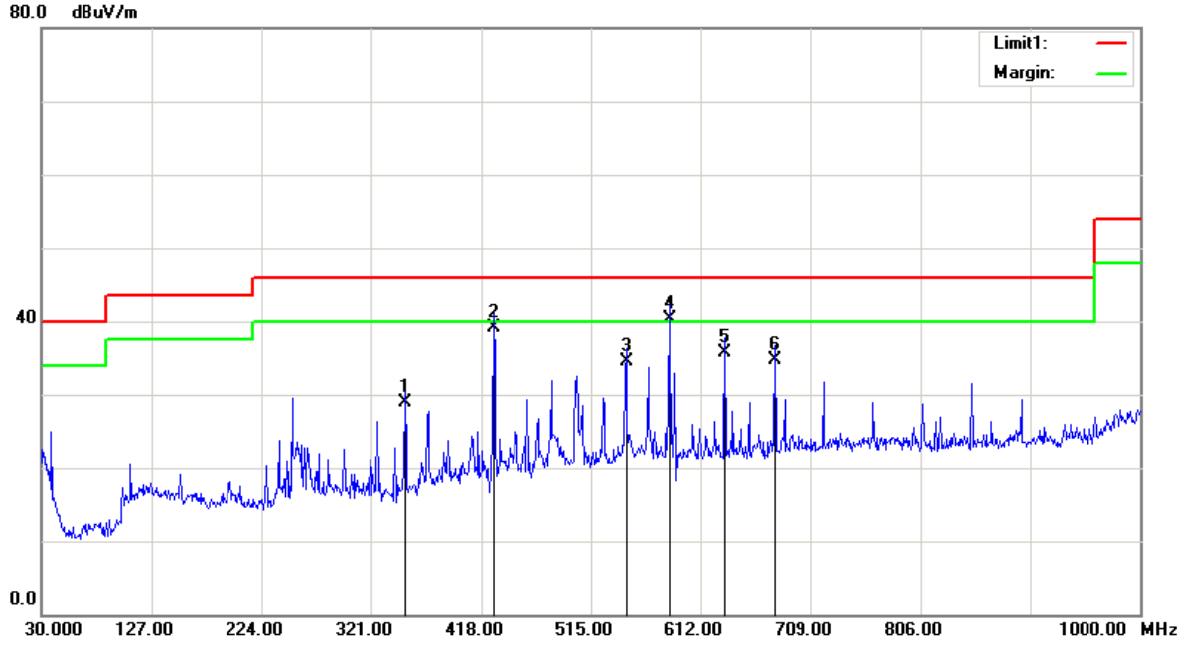
The testing was performed by David Hsu on 2016-12-30.

Test Mode: Transmitting

Below 1 GHz (middle channel was the worst):

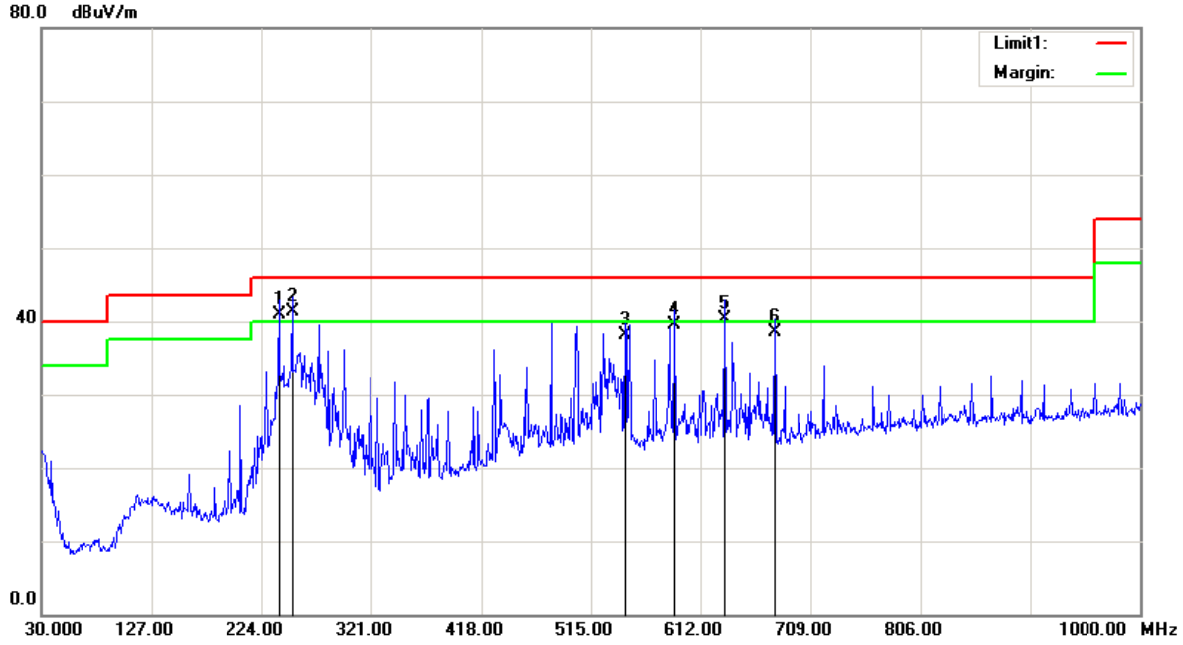
Horizontal

Frequency (MHz)	Receiver Reading (dBµV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
351.0700	33.05	QP	-4.05	29.00	46.00	17.00
428.6700	41.07	QP	-1.97	39.10	46.00	6.90
546.0400	34.97	QP	-0.37	34.60	46.00	11.40
584.8400	40.16	QP	0.24	40.40	46.00	5.60
633.3400	34.54	QP	1.26	35.80	46.00	10.20
676.9900	33.40	QP	1.40	34.80	46.00	11.20



Vertical

Frequency (MHz)	Receiver Reading (dBµV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
239.5200	48.35	QP	-7.35	41.00	46.00	5.00
251.1600	48.61	QP	-7.21	41.40	46.00	4.60
545.0700	38.50	QP	-0.40	38.10	46.00	7.90
589.6900	39.45	QP	0.05	39.50	46.00	6.50
633.3400	39.04	QP	1.26	40.30	46.00	5.70
676.9900	37.10	QP	1.40	38.50	46.00	7.50



1 GHz-25GHz

Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	FCC 15.247	
(MHz)	Reading (dBµV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)	(dB)	(dB)	(dBµV/m)	Limit (dBµV/m)	Margin (dB)
Low Channel: 2406 MHz									
2406	66.98	PK	H	25.66	3.67	0.00	96.31	N/A	N/A
2406	59.34	AV	H	25.66	3.67	0.00	88.67	N/A	N/A
2406	77.94	PK	V	25.66	3.67	0.00	107.27	N/A	N/A
2406	70.95	AV	V	25.66	3.67	0.00	100.28	N/A	N/A
2390	30.91	PK	V	25.61	3.63	0.00	60.15	74.00	13.85
2390	16.49	AV	V	25.61	3.63	0.00	45.73	54.00	8.27
4812	41.31	PK	V	30.61	5.05	27.41	49.56	74.00	24.44
4812	31.76	AV	V	30.61	5.05	27.41	40.01	54.00	13.99
7218	35.19	PK	V	34.12	6.63	25.91	50.03	74.00	23.97
7218	24.87	AV	V	34.12	6.63	25.91	39.71	54.00	14.29
2695	43.25	PK	V	26.41	4.53	27.49	46.70	74.00	27.30
2695	33.43	AV	V	26.41	4.53	27.49	36.88	54.00	17.12
Middle Channel: 2441 MHz									
2441	68.54	PK	H	25.75	3.76	0.00	98.05	N/A	N/A
2441	58.13	AV	H	25.75	3.76	0.00	8.64	N/A	N/A
2441	78.65	PK	V	25.75	3.76	0.00	108.16	N/A	N/A
2441	68.32	AV	V	25.75	3.76	0.00	97.83	N/A	N/A
4882	40.57	PK	V	30.79	5.19	27.42	49.13	74.00	24.87
4882	30.62	AV	V	30.79	5.19	27.42	39.18	54.00	14.82
7323	36.47	PK	V	34.38	6.75	25.88	51.72	74.00	22.28
7323	26.34	AV	V	34.38	6.75	25.88	41.59	54.00	12.41
1538	34.05	PK	V	23.68	2.64	27.56	32.81	74.00	41.19
1538	23.46	AV	V	23.68	2.64	27.56	22.22	54.00	31.78
2716	41.67	PK	V	26.46	4.46	27.50	45.09	74.00	28.91
2716	31.25	AV	V	26.46	4.46	27.50	34.67	54.00	19.33
High Channel: 2469 MHz									
2469	68.25	PK	H	25.82	3.72	0.00	97.79	N/A	N/A
2469	55.34	AV	H	25.82	3.72	0.00	84.88	N/A	N/A
2469	78.84	PK	V	25.82	3.72	0.00	108.38	N/A	N/A
2469	72.48	AV	V	25.82	3.72	0.00	102.02	N/A	N/A
2483.5	35.22	PK	V	25.86	3.67	0.00	64.75	74.00	9.25
2483.5	23.05	AV	V	25.86	3.67	0.00	52.58	54.00	1.42
4938	43.37	PK	V	30.94	5.36	27.43	52.24	74.00	21.76
4938	33.67	AV	V	30.94	5.36	27.43	42.54	54.00	11.46
7407	47.86	PK	V	34.58	6.85	25.88	63.41	74.00	10.59
7407	36.57	AV	V	34.58	6.85	25.88	52.12	54.00	1.88
2735	42.81	PK	V	26.51	4.40	27.51	46.21	74.00	27.79
2735	32.24	AV	V	26.51	4.40	27.51	35.64	54.00	18.36

FCC§15.247(a) (2) – 6 dB EMISSION BANDWIDTH

Applicable Standard

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set are reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSU26	200268	2016/5/7	2017/5/6
N/A	RF Cable	N/A	1	Each Time	/
E-Microwave	DC Block	N/A	2	Each Time	/

Test Data
Environmental Conditions

Temperature:	26.2°C
Relative Humidity:	51 %
ATM Pressure:	101 kPa

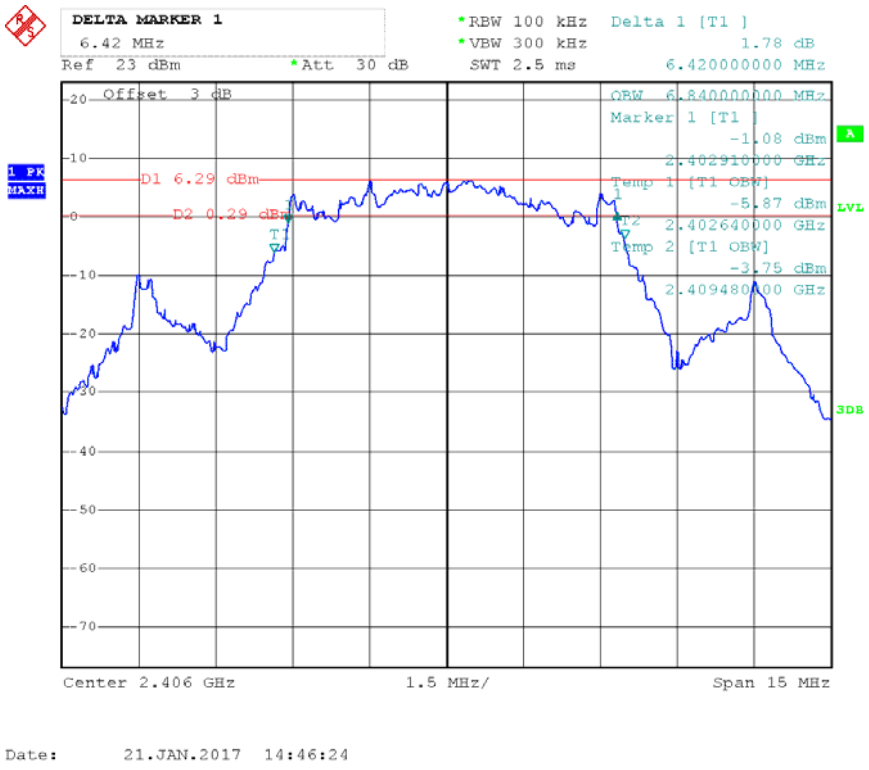
The testing was performed by David. Hsu on 2017-01-21.

Test Mode: Transmitting

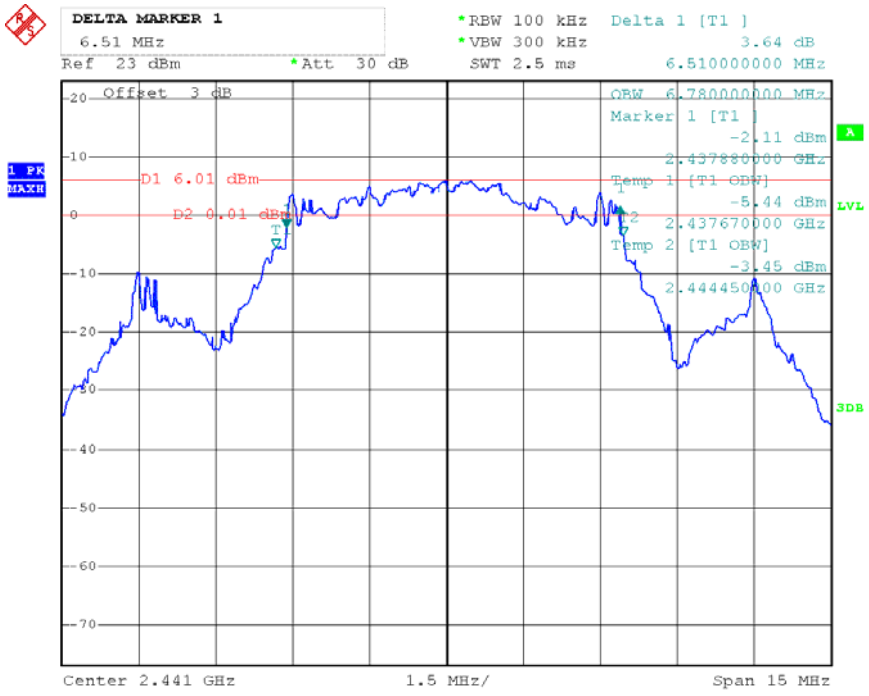
Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Result
Low	2406	6.42	PASS
Mid	2441	6.51	PASS
High	2469	6.42	PASS

Please refer to the following tables and plots.

Low Channel

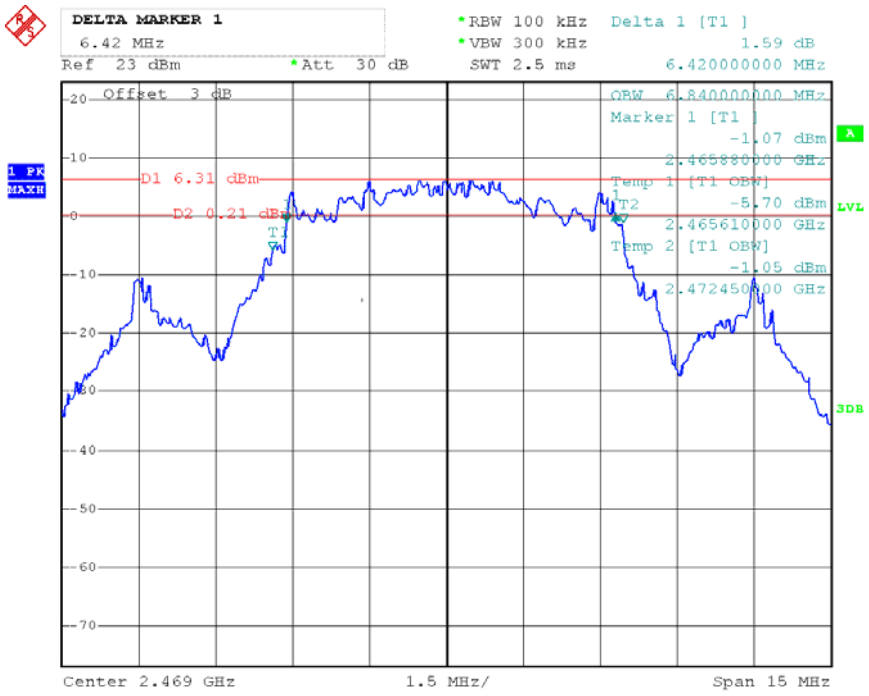


Middle Channel



Date: 21.JAN.2017 14:52:55

High Channel



Date: 21.JAN.2017 14:53:58

FCC§15.24715.247(f) - TIME OF OCCUPANCY (DWELL TIME)

Applicable Standard

For the purposes of this section, hybrid systems are those that employ a combination of both frequency hopping and digital modulation techniques. The frequency hopping operation of the hybrid system, with the direct sequence or digital modulation operation turned-off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4. The power spectral density conducted from the intentional radiator to the antenna due to the digital modulation operation of the hybrid system, with the frequency hopping operation turned off, shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Test Procedure

The EUT was worked in channel hopping; Spectrum SPAN was set as 0. the time of single pulses was tested.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSU26	200268	2016/5/7	2017/5/6
N/A	RF Cable	N/A	1	Each Time	/
E-Microwave	DC Block	N/A	2	Each Time	/

Test Data
Environmental Conditions

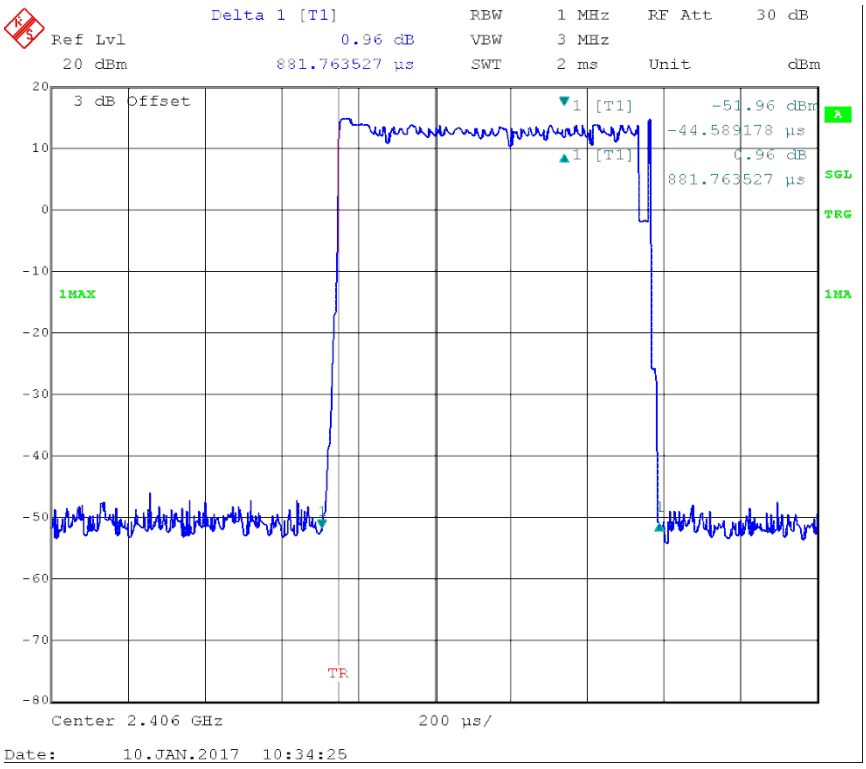
Temperature:	26.1°C
Relative Humidity:	48 %
ATM Pressure:	101.2 kPa

The testing was performed by David. Hsu on 2017-01-10.

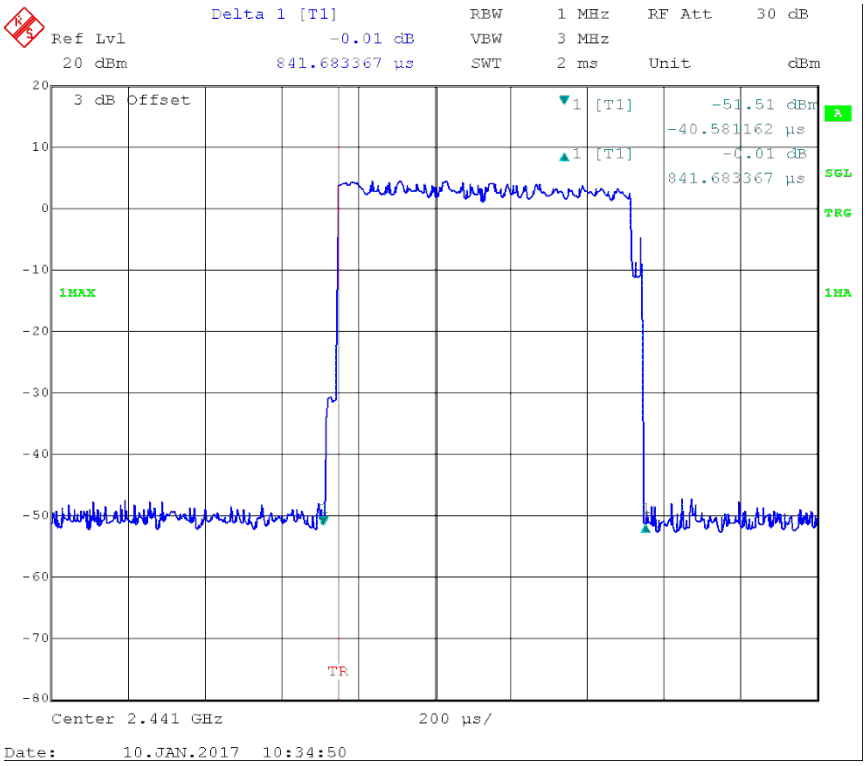
Test Mode: Transmitting

Channel	Pulse Width (ms)	Hopping Number per Second	Dwell Time (s)	Limit (s)	Result
Low	0.882	77	0.027	0.4	Pass
Middle	0.842	77	0.026	0.4	Pass
High	0.866	77	0.027	0.4	pass
Note: Dwell time=Pulse time (ms) × Hopping Number per second*hopping numbers/hopping numbers*0.4 Hopping rate(77 hopping per second) was declared by manufacturer.					

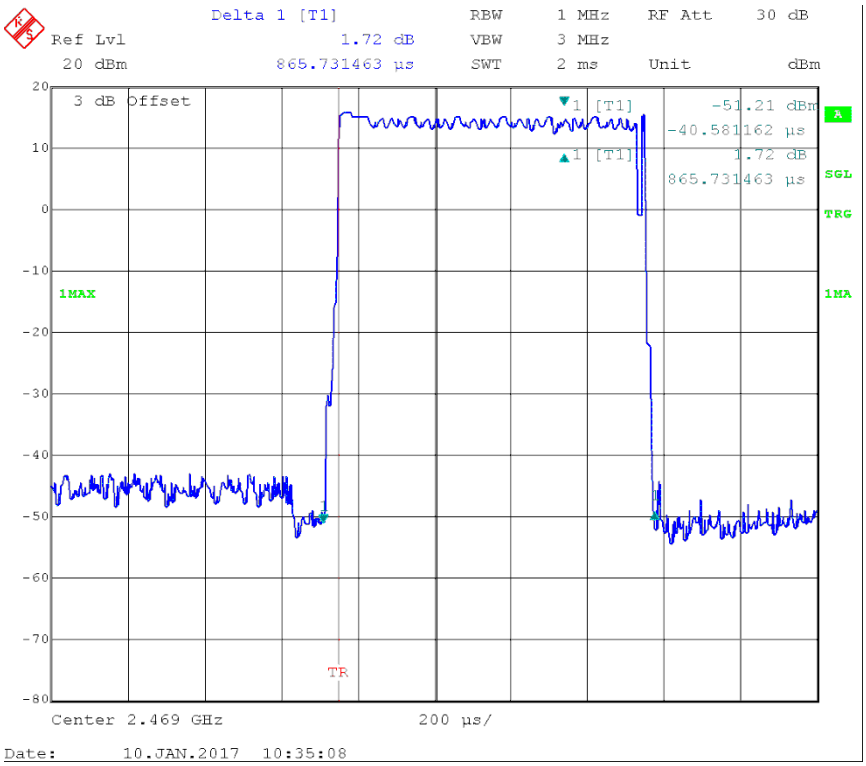
Pulse Width, Low Channel



Pulse Width, Middle Channel



Pulse Width, High Channel



FCC§15.247(b) - PEAK OUTPUT POWER MEASUREMENT

Applicable Standard

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.

Test Procedure

1. Place the EUT on a bench and set in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to an EMI test receiver.
3. Add a correction factor to the display.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSU26	200268	2016/5/7	2017/5/6
N/A	RF Cable	N/A	1	Each Time	/
E-Microwave	DC Block	N/A	2	Each Time	/

Test Data

Environmental Conditions

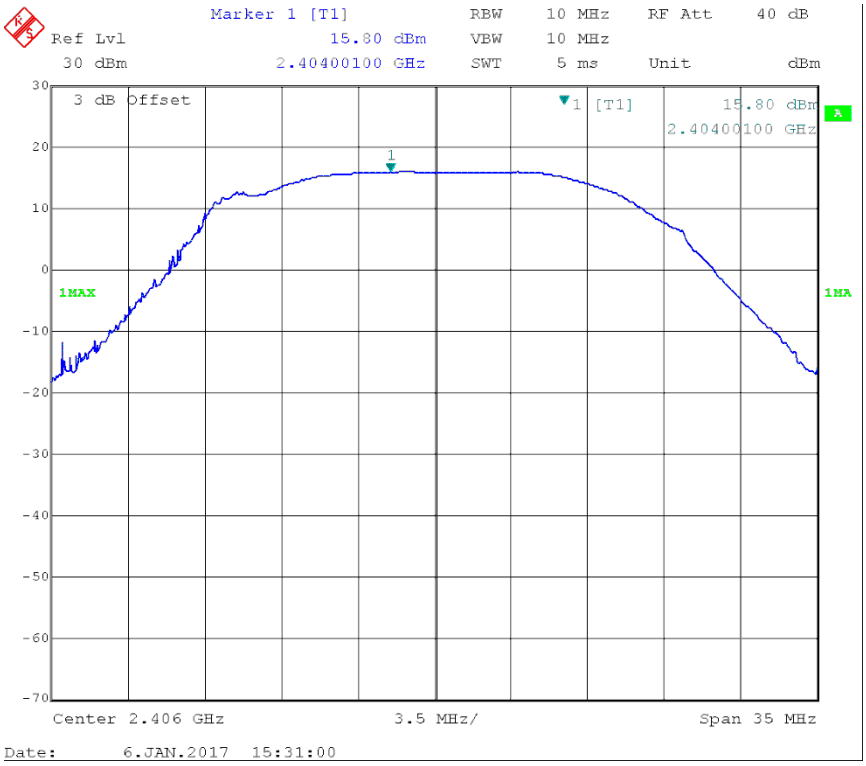
Temperature:	26.2°C
Relative Humidity:	51 %
ATM Pressure:	101.0 kPa

The testing was performed by David. Hsu on 2017-01-06.

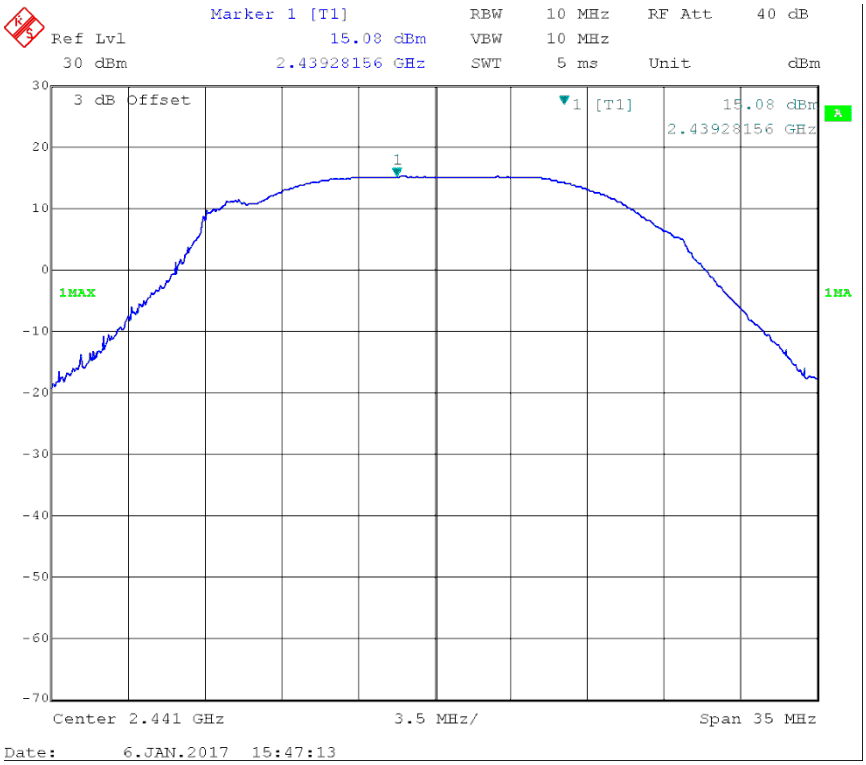
Test Mode: Transmitting

Channel	Frequency (MHz)	Output power (dBm)	Limit (dBm)	Result
Low	2406	15.80	30	Pass
Middle	2441	15.08	30	Pass
High	2469	15.80	30	pass

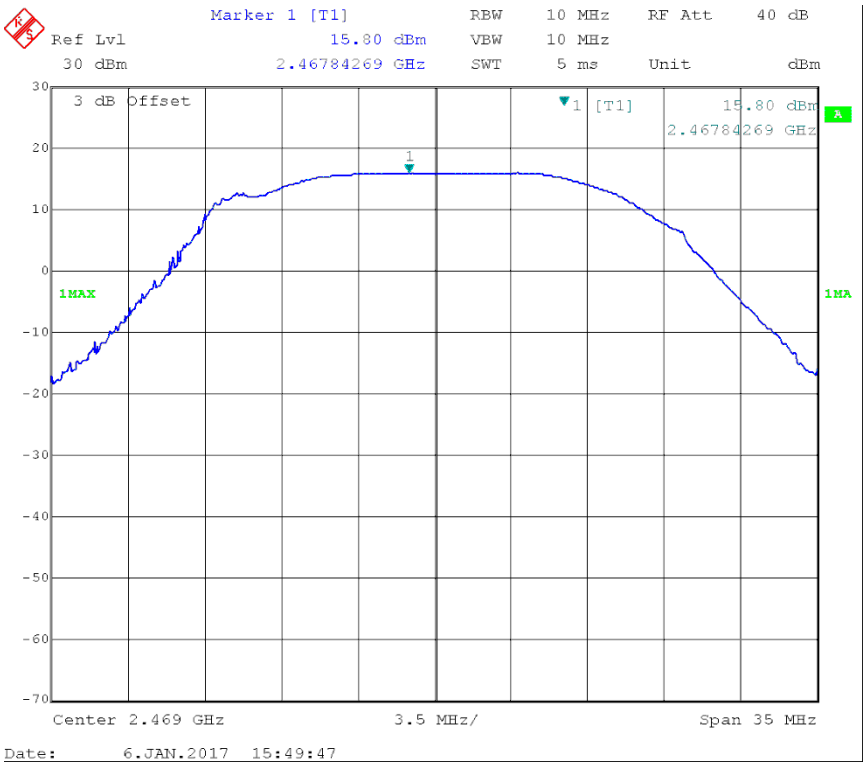
Output Power, Low Channel



Output Power, Middle Channel



Output Power, High Channel



FCC§15.247(d) - BAND EDGES TESTING

Applicable Standard

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSU26	200268	2016/5/7	2017/5/6
N/A	RF Cable	N/A	1	Each Time	/
E-Microwave	DC Block	N/A	2	Each Time	/

Test Data

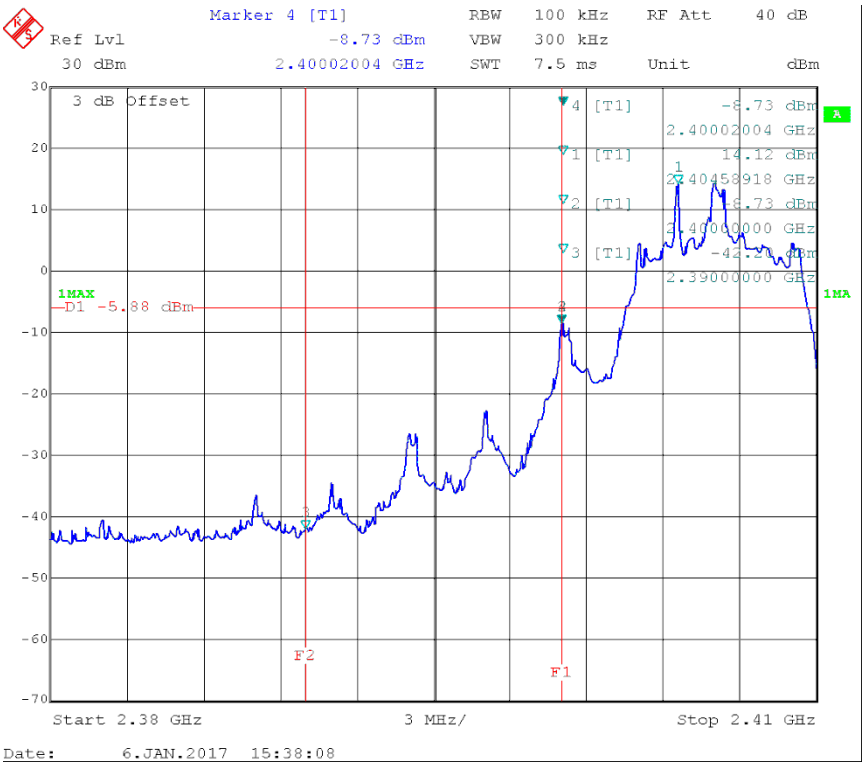
Environmental Conditions

Temperature:	26.2 °C
Relative Humidity:	51 %
ATM Pressure:	101.0 kPa

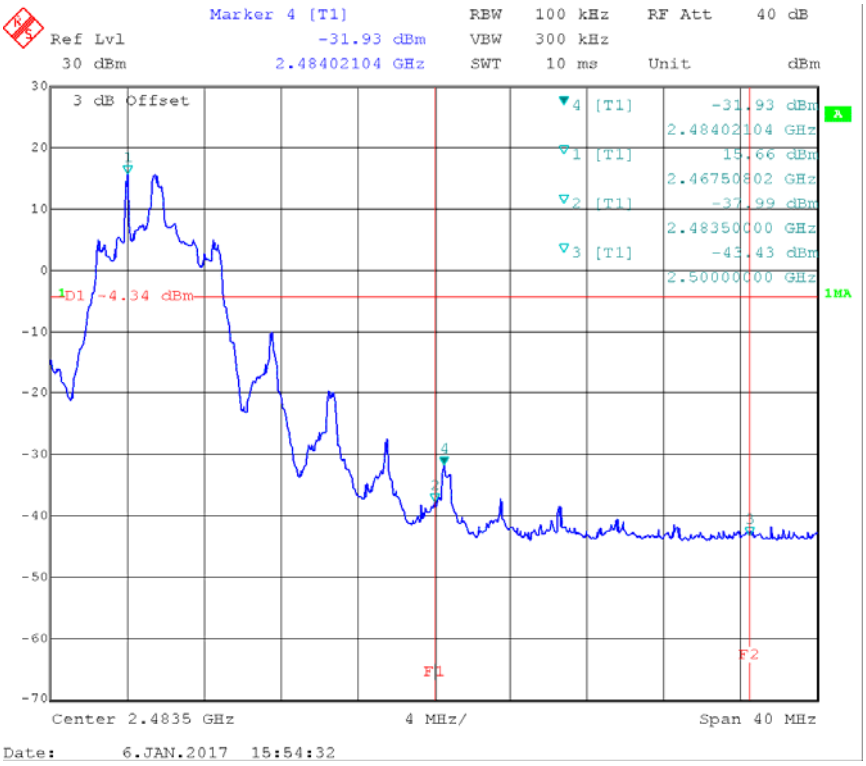
The testing was performed by David. Hsu on 2017-01-06.

Test Result: Compliance

Band Edge, Left Side



Band Edge, Right Side



FCC§15.247(f) - Power Spectral Density

Applicable Standard

For the purposes of this section, hybrid systems are those that employ a combination of both frequency hopping and digital modulation techniques. The frequency hopping operation of the hybrid system, with the direct sequence or digital modulation operation turned-off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4. The power spectral density conducted from the intentional radiator to the antenna due to the digital modulation operation of the hybrid system, with the frequency hopping operation turned off, shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set the RBW = 3 kHz, VBW = 10 kHz, Set the span to 1.5 times the DTS bandwidth.
4. Use the peak marker function to determine the maximum amplitude level.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSU26	200268	2016/5/7	2017/5/6
N/A	RF Cable	N/A	1	Each Time	/
E-Microwave	DC Block	N/A	2	Each Time	/

Test Data

Environmental Conditions

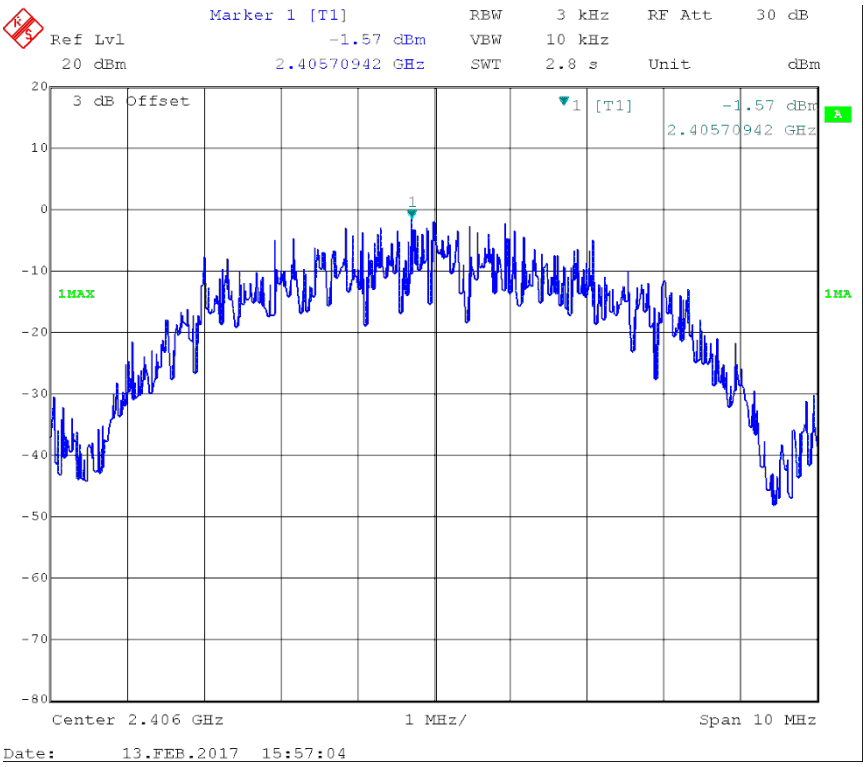
Temperature:	26.2 °C
Relative Humidity:	51 %
ATM Pressure:	101.0 kPa

The testing was performed by David. Hsu on 2017-02-13.

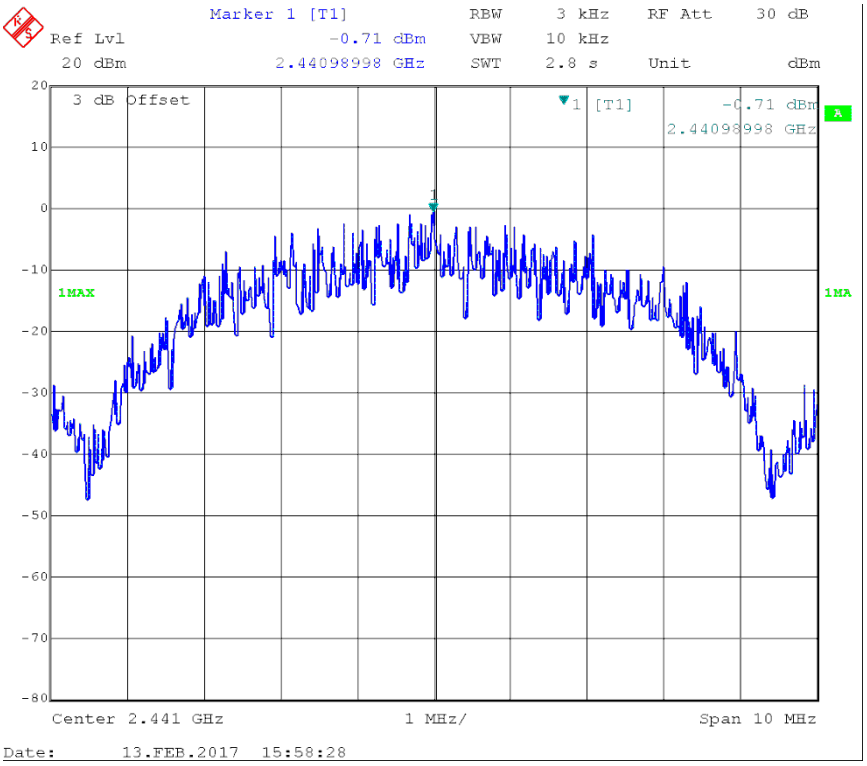
Test Result: Compliance

Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limits dBm/3kHz	Result
Low	2406	-1.57	8	Pass
Middle	2441	-0.71	8	Pass
High	2469	-0.37	8	Pass

Low Channel



Middle Channel



High Channel

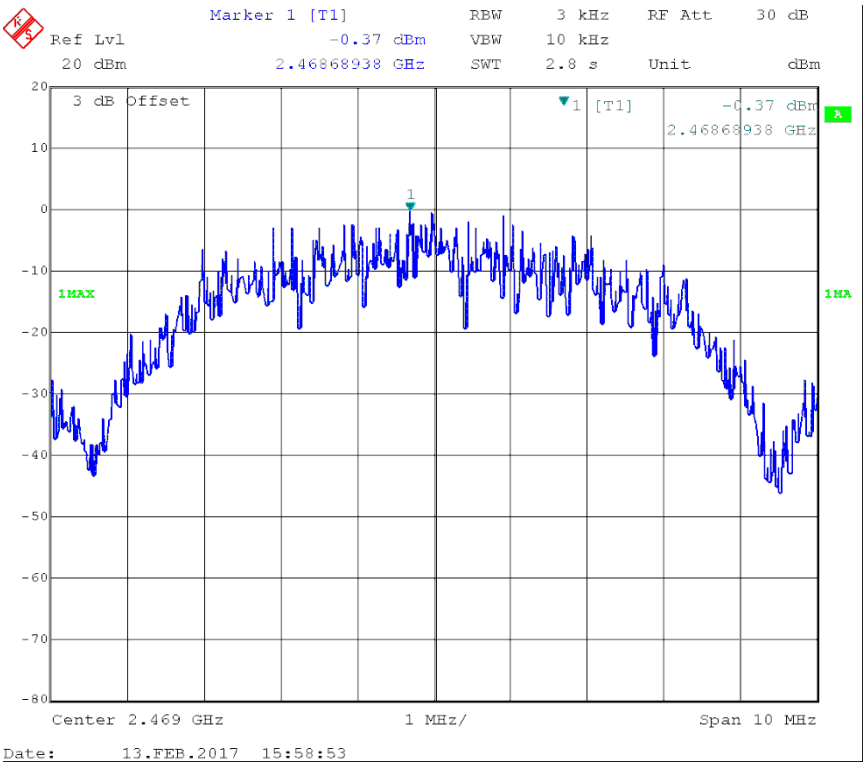
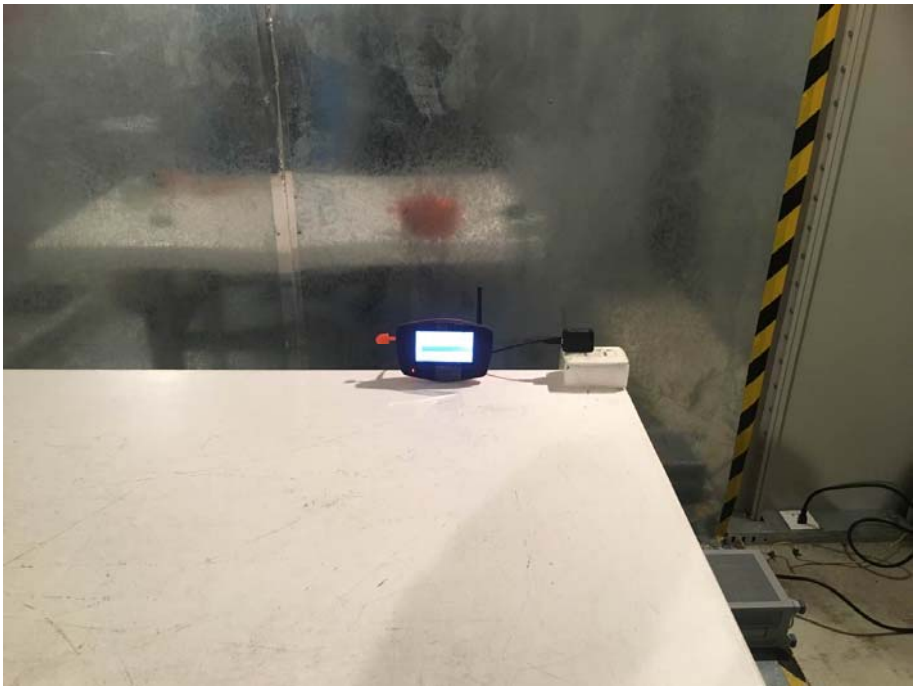
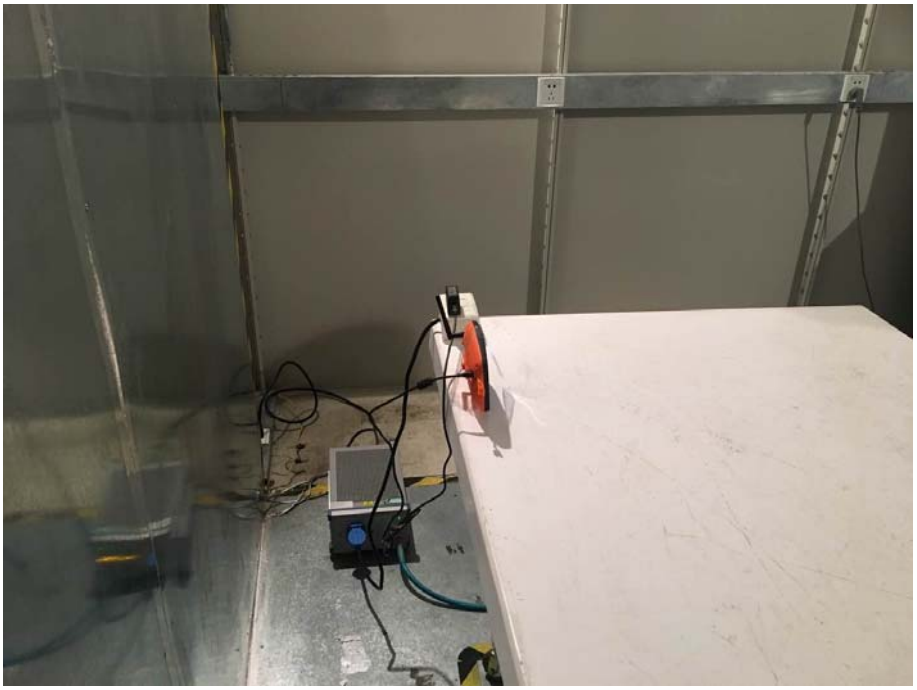


Exhibit A -EUT Setup Photographs

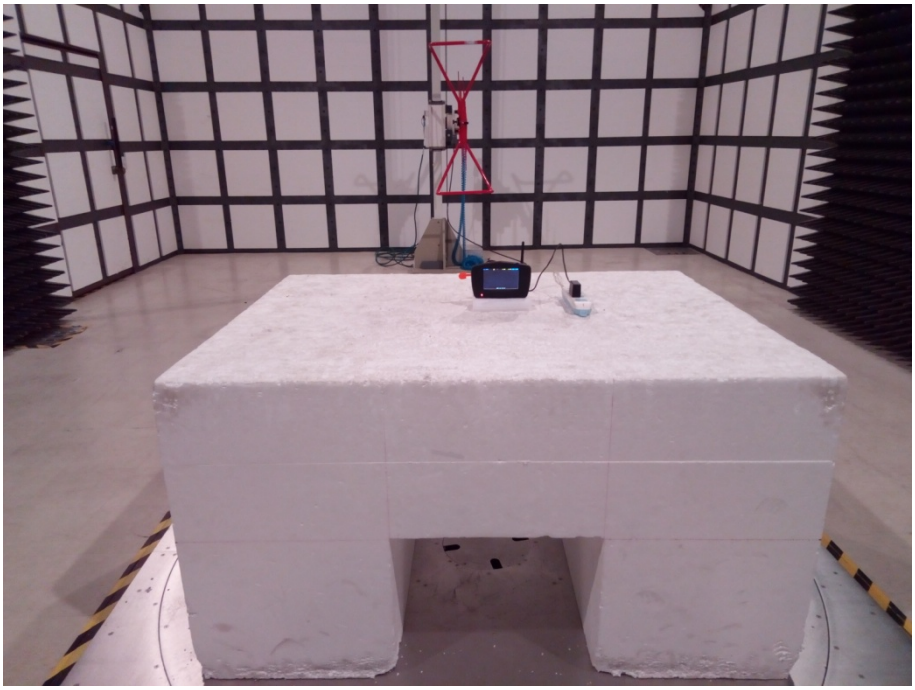
CON Front View



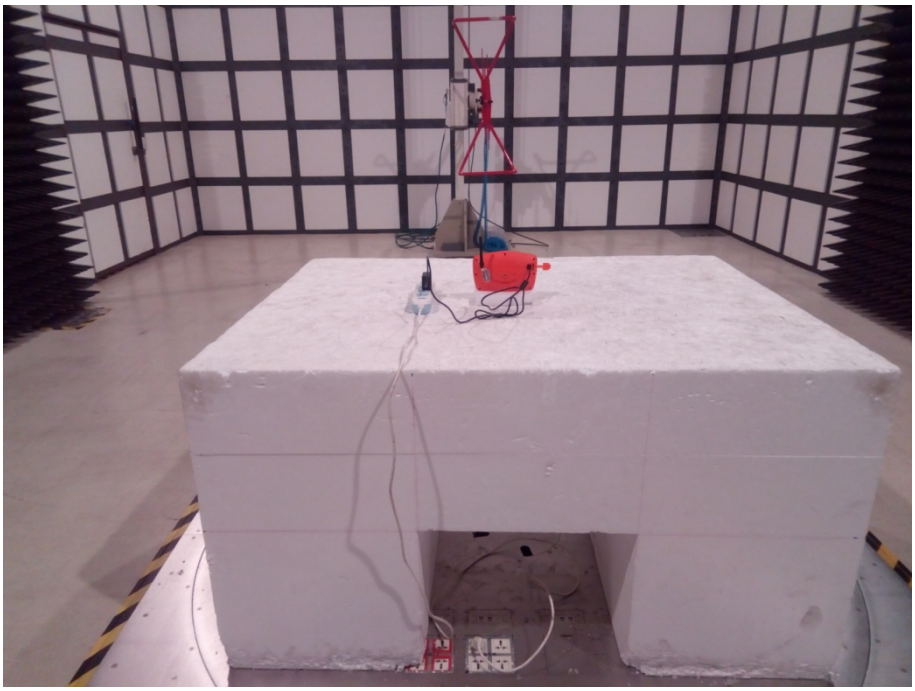
CON Rear View



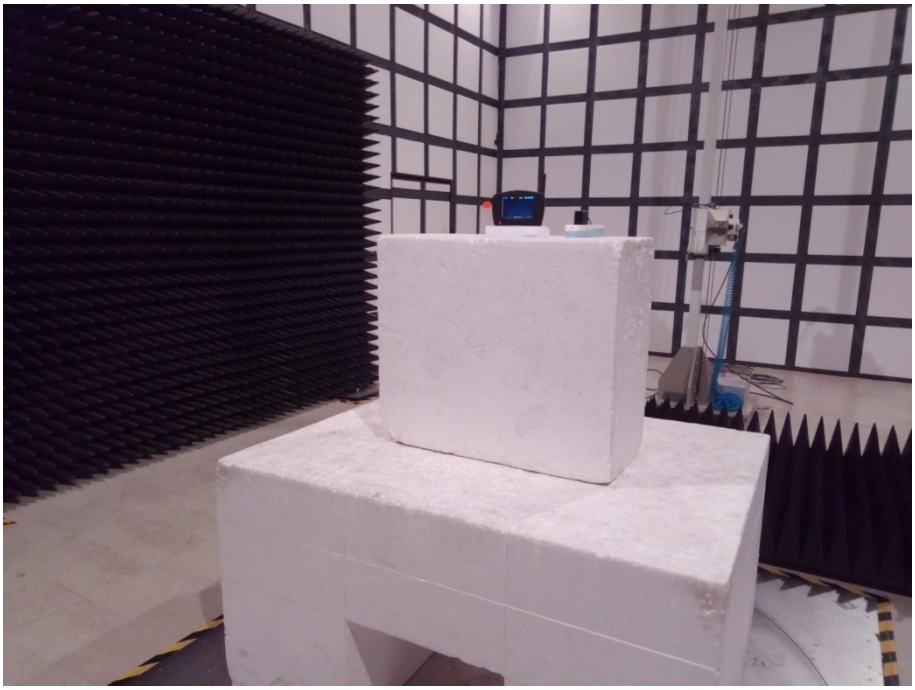
RAD Below 1G - Front View



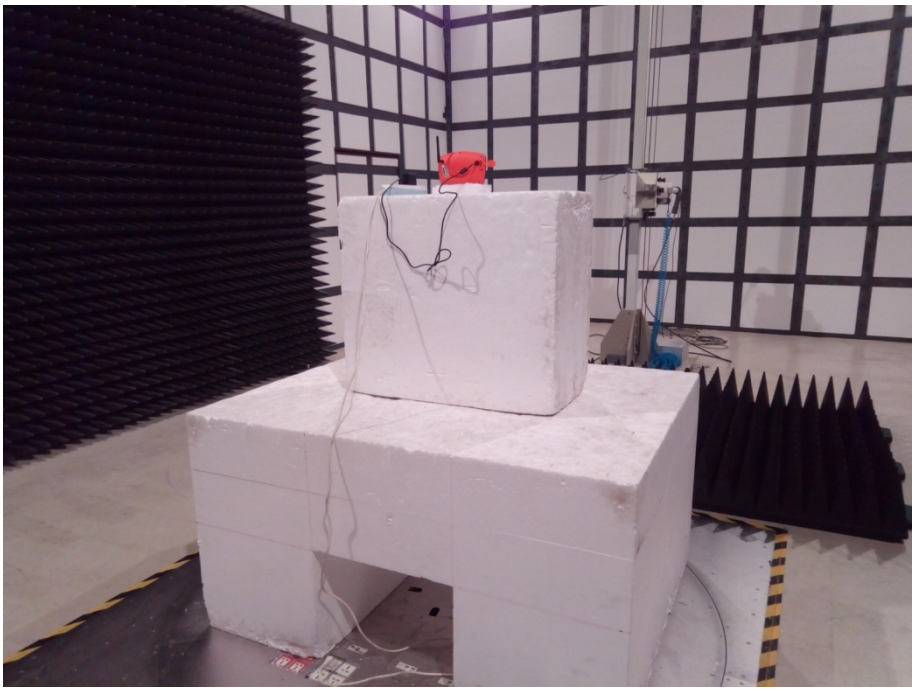
RAD Below 1G -Rear View



RAD Above 1G - Front View



RAD Above 1G -Rear View



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