

FCC PART 15 SUBPART C TEST REPORT

for

Smart Speed & Cadence Sensor

Model No.: T2015

FCC ID: Y8Y-T2015

of

Applicant: **ECHOWELL ELECTRONIC CO., LTD.**

Address: **7F-8, NO.8, SEC.1, JUNGSHING RD., WUGU DIST.,
NEW TAIPEI CITY 24872, TAIWAN, R.O.C**

Tested and Prepared

by

Worldwide Testing Services (Taiwan) Co., Ltd.

FCC Registration No.: 930600

Industry Canada filed test laboratory Reg. No. IC 5679A-1, IC 5107A

A2LA Accredited No.: 2732.01



Report No.: W6M21410-14537-C-1

6F, NO. 58, LANE 188, RUEY-KUANG RD., NEIHU TAIPEI 114, TAIWAN, R.O.C.
TEL: 886-2-66068877 FAX: 886-2-66068879 E-mail: wts@wts-lab.com

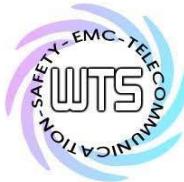


Worldwide Testing Services(Taiwan) Co., Ltd.

Registration number: W6M21410-14537-C-1
FCC ID: Y8Y-T2015

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1 General Information

1.1 Notes

The purpose of conformity testing is to increase the probability of adherence to the essential requirements or conformity specifications, as appropriate.

The complexity of the technical specifications, however, means that full and thorough testing is impractical for both technical and economic reasons.

Furthermore, there is no guarantee that a test sample which has passed all the relevant tests conforms to a specification.

Neither is there any guarantee that such a test sample will interwork with other genuinely open systems. The existence of the tests nevertheless provides the confidence that the test sample possesses the qualities as maintained and that its performance generally conforms to representative cases of communications equipment.

The test results of this test report relate exclusively to the item tested as specified in 1.5.

The test report may only be reproduced or published in full.

Reproduction or publication of extracts from the report requires the prior written approval of the Worldwide Testing Services(Taiwan) Co., Ltd.

Specific Conditions:

Usage of the hereunder tested device in combination with other integrated or external antennas requires at least additional output power measurements, spurious emission measurements, conducted emission measurements (AC supply lines) and radio frequency exposure evaluations for each individual configuration performed, for certification by FCC.

Tester:

October 21, 2014

Kent Lin

Date

WTS-Lab.

Name

Signature

Technical responsibility for area of testing:

October 21, 2014

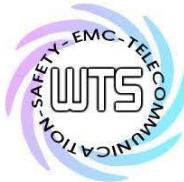
Kevin Wang

Date

WTS

Name

Signature



Worldwide Testing Services(Taiwan) Co., Ltd.

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1.2 Testing laboratory

1.2.1 Location

OATS

No.5-1, Lishui, Shuang Sing Village,
Wanli Dist., New Taipei City 207,
Taiwan (R.O.C.)

3 meter semi-anechoic chamber

No.35, Aly. 21, Ln. 228, Ankang Rd., Neihu Dist., Taipei City 114, Taiwan (R.O.C.)

TEL:886-2-6613-0228

FAX:886-2-2791-5046

Company

Worldwide Testing Services(Taiwan) Co., Ltd.

6F, NO. 58, LANE 188, RUEY-KUANG RD.

NEIHU, TAIPEI 114, TAIWAN R.O.C.

Tel : 886-2-66068877

Fax : 886-2-66068879

1.2.2 Details of accreditation status

Accredited testing laboratory

A2LA accredited number: 2732.01

FCC filed test laboratory Reg. No. 930600

Industry Canada filed test laboratory Reg. No. IC 5679A-1, IC 5107A



Test location, where different from Worldwide Testing Services (Taiwan) Co., Ltd. :

Name: ./.

Accredited number: ./.

Street: ./.

Town: ./.

Country: ./.

Telephone: ./.

Fax: ./.

1.3 Details of approval holder

Name: ECHOWELL ELECTRONIC CO., LTD.

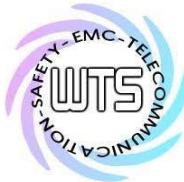
Street: 7F-8, NO.8, SEC.1, JUNGSHING RD., WUGU DIST.,

Town: NEW TAIPEI CITY 24872,

Country: TAIWAN, R.O.C

Telephone: +886-2-8976-9726

Fax: +886-2-8976-9727



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1.4 Application details

Date of receipt of test item: October 09, 2014
Date of test: from October 13, 2014 to October 21, 2014

1.5 General information of Test item

Type of test item: Smart Speed & Cadence Sensor
Model Number: T2015
Brand Name: ECHOWELL
Multi-listing model number: ./.
Photos: see Appendix

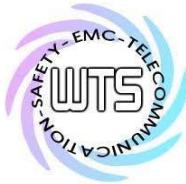
Technical data

Frequency band: 2402 MHz – 2480 MHz

BLE
Frequency (ch 0 or A): 2402 MHz
Frequency (ch 19 or B): 2440 MHz
Frequency (ch 39 or C): 2480 MHz

AN T+
Frequency: 2457 MHz
Number of Channels: 40 (BLE) / 1 (ANT+)
Operation modes: Duplex
Modulation Type: GFSK

Fixed point-to-point operation: Yes / No
Type of Antenna: PCB antenna
Antenna gain: 0 dBi
Power supply: Battery: 3V (CR2032)
Emission designator (BLE): 1M65G1D
Emission designator (ANT+): 1M75G1D



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Host device: none

Classification :

Fixed Device	<input type="checkbox"/>
Mobile Device (Human Body distance > 20cm)	<input type="checkbox"/>
Portable Device (Human Body distance < 20cm)	<input checked="" type="checkbox"/>

Transmitter **Unom**

BLE

Power (ch 0 or A) : Conducted: -0.69 dBm
Power (ch 19 or B) : Conducted: -2.82 dBm
Power (ch 39 or C) : Conducted: -4.54 dBm

ANT+

Power (2457MHz) : Conducted: -7.86 dBm

Manufacturer: (if applicable)

Name: ./.
Street: ./.
Town: ./.
Country: ./.
Additional information: ./.

1.6 Test standards

Technical standard : FCC RULES SUBPART C § 15.247 (2013-10)



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2 Technical test

2.1 Summary of test results

No deviations from the technical specification(s) were ascertained in the course of the tests performed.

or

The deviations as specified in 2.5 were ascertained in the course of the tests performed.

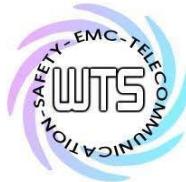
2.2 Test environment

Temperature: 23 °C

Relative humidity content: 20 ... 75 %

Air pressure: 86 ... 103 kPa

Power supply: Battery: 3V (CR2032)

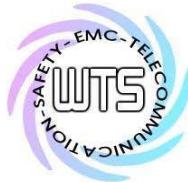


Worldwide Testing Services(Taiwan) Co., Ltd.

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2.3 Test Equipment List

No.	Test equipment	Type	Serial No.	Manufacturer	Cal. Date	Next Cal. Date
ETSTW-CE 001	EMI TEST RECEIVER	ESHS10	842121/013	R&S	2014/9/2	2015/9/1
ETSTW-CE 003	AC POWER SOURCE	APS-9102	D161137	GW		Function Test
ETSTW-CE 008	HF-EICHLEITUNG RF STEP ATTENUATOR 139dB DPSP	334.6010.02	844581/024	R&S		Function Test
ETSTW-CE 009	TEMP.&HUMIDITY CHAMBER	GTH-225-40-1P-U	MAA0305-009	GIANT FORCE	2014/7/8	2015/7/7
ETSTW-CE 016	TWO-LINE V-NETWORK	ENV216	100050	R&S	2013/10/28	2014/10/27
ETSTW-RE 004	EMI TEST RECEIVER	ESI 40	832427/004	R&S	2014/9/2	2015/9/1
ETSTW-RE 005	EMI TEST RECEIVER	ESVS10	843207/020	R&S	2014/9/2	2015/9/1
ETSTW-RE 012	TUNABLE BANDREJECT FILTER	D.C 0309	146	K&L		Function Test
ETSTW-RE 013	TUNABLE BANDREJECT FILTER	D.C 0336	397	K&L		Function Test
ETSTW-RE 018	MICROWAVE HORN ANTENNA	AT4560	27212	AR	2014/9/26	2015/9/25
ETSTW-RE 027	Passive Loop Antenna	6512	00034563	ETS-Lindgren	2014/7/01	2015/6/30
ETSTW-RE 030	Double-Ridged Guide Horn Antenna	3117	00035224	EMCO	2014/2/25	2015/2/24
ETSTW-RE 045	ESA-E SERIES SPECTRUM ANALYZER	E4404B	MY45111242	Agilent		Pre-test Use
ETSTW-RE 049	TRILOG Super Broadband test Antenna	VULB 9160	9160-3185	Schwarzbeck	2014/2/18	2015/2/17
ETSTW-RE 050	Attenuator 10dB	50HF-010-1	None	JFW	2014/3/3	2015/3/2
ETSTW-RE 051	Attenuator 6dB	50HF-006-1	None	JFW	2014/3/3	2015/3/2
ETSTW-RE 053	Attenuator 3dB	50HF-003-1	None	JFW	2014/3/3	2015/3/2
ETSTW-RE 055	SPECTRUM ANALYZER	FSU 26	200074	R&S	2014/6/05	2015/6/04
ETSTW-RE 060	Attenuator 30dB	5015-30	F651012z-01	ATM	2014/3/3	2015/3/2
ETSTW-RE 062	Amplifier Module	CHC 2	None	KMIC	2013/11/27	2014/11/26
ETSTW-RE 064	Bluetooth Test Set	MT8852B-042	6K00005709	Anritsu		Function Test
ETSTW-RE 069	Double-Ridged Guide Horn Antenna	3117	00069377	EMCO		Function Test
ETSTW-RE 072	CELL SITE TEST SET	8921A	3339A00375	HP	2014/9/26	2015/9/25
ETSTW-RE 088	SOLID STATE AMPLIFIER	KMA180265A01	99057	KMIC	2014/9/26	2015/9/25
ETSTW-RE 099	DC Block	50DB-007-1	None	JFW	2014/3/3	2015/3/2
ETSTW-RE 106	Humidity Temperature Meter	TES-1366	091011113	TES	2013/12/04	2014/12/03
ETSTW-RE 111	TRILOG Super Broadband test Antenna	VULB 9160	9160-3309	Schwarz beck	2013/12/27	2014/12/26
ETSTW-RE 112	AC POWER SOURCE	TFC-1005	None	T-Power		Function test
ETSTW-RE 115	2.4GHz Notch Filter	N0124411	473874	MICROWAVE CIRCUITS	2014/1/10	2015/1/09
ETSTW-RE 120	RF Player	MP9200	MP9210-111022	ADIVIC		Function test
ETSTW-RE 122	SIGNAL GENERATOR	SMF100A	102149	R&S	2014/6/11	2015/6/10
ETSTW-RE 125	5GHz Notch filter	5NSL11-5200/E221.3-O/O	1	K&L Microwave	2014/8/12	2015/8/11

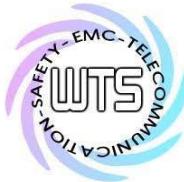


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ETSTW-RE 126	5GHz Notch filter	5NSL11-5800/E221.3-O/O	1	K&L Microwave	2014/8/12	2015/8/11
ETSTW-RE 127	RF Switch Box	RFS-01	None	WTS	2014/3/3	2015/3/2
ETSTW-RE 128	5.3GHz Notch filter	N0153001	SN487233	Microwave Circits	2014/8/12	2015/8/11
ETSTW-RE 129	5.5GHz Notch filter	N0555984	SN487234	Microwave Circits	2014/8/12	2015/8/11
ETSTW-RE 130	Handheld RF Spectrum Analyzer	N9340A	CN0147000204	Agilent	Pre-test Use	
ETSTW-GSM 002	Universal Radio Communication Tester	CMU 200	109439	R&S	2014/9/26	2015/9/25
ETSTW-GSM 019	Band Reject Filter	WRCTF824/849-822/851-40/12+9SS	3	WI	2014/1/10	2015/1/09
ETSTW-GSM 020	Band Reject Filter	WRCD1747/1748-1743/1752-32/5SS	1	WI	2014/1/10	2015/1/09
ETSTW-GSM 021	Band Reject Filter	WRCD1879.5/1880.5-1875.5/1884.5-32/5SS	3	WI	2014/1/10	2015/1/09
ETSTW-GSM 022	Band Reject Filter	WRCT901.9/903.1-904.25-50/8SS	1	WI	2014/1/10	2015/1/09
ETSTW-GSM 023	Power Divider	4901.19.A	None	SUHNER	2014/9/17	2015/9/16
ETSTW-Cable 010	BNC Cable	5 M BNC Cable	None	JYE BAO CO.,LTD.	2014/2/27	2015/2/26
ETSTW-Cable 011	BNC Cable	BNC Cable 1	None	JYE BAO CO.,LTD.	Pre-test Use NCR	
ETSTW-Cable 012	N TYPE To SMA Cable	Cable 012	None	JYE BAO CO.,LTD.	2014/2/27	2015/2/26
ETSTW-Cable 016	BNC Cable	Switch Box	B Cable 1	Schwarz beck	2014/2/27	2015/2/26
ETSTW-Cable 017	BNC Cable	X Cable	B Cable 2	Schwarz beck	2014/2/27	2015/2/26
ETSTW-Cable 018	BNC Cable	Y Cable	B Cable 3	Schwarz beck	2014/2/27	2015/2/26
ETSTW-Cable 019	BNC Cable	Z Cable	B Cable 4	Schwarz beck	2014/2/27	2015/2/26
ETSTW-Cable 022	N TYPE Cable	5006	0002	JYE BAO CO.,LTD.	2014/2/19	2015/2/18
ETSTW-Cable 026	Microwave Cable	SUCOFLEX 104	279075	HUBER+SUHNER	2014/3/3	2015/3/2
ETSTW-Cable 027	Microwave Cable	SUCOFLEX 104	279083	HUBER+SUHNER	2014/3/3	2015/3/2
ETSTW-Cable 028	Microwave Cable	FA147A0015M2020	30064-2	UTIFLEX	2014/9/26	2015/9/25
ETSTW-Cable 029	Microwave Cable	FA147A0015M2020	30064-3	UTIFLEX	2014/9/26	2015/9/25
ETSTW-Cable 030	Microwave Cable	SUCOFLEX 104 (S_Cable 9)	279067	HUBER+SUHNER	2014/3/3	2015/3/2
ETSTW-Cable 031	Microwave Cable	SUCOFLEX 104 (S_Cable 10)	238092	HUBER+SUHNER	2013/11/27	2014/11/26
ETSTW-Cable 043	Microwave Cable	SUCOFLEX 104	317576	HUBER+SUHNER	2013/11/27	2014/11/26
ETSTW-Cable 047	Microwave Cable	SUCOFLEX 104	325518	HUBER+SUHNER	2013/11/27	2014/11/26
ETSTW-Cable 053	N TYPE To SMA Cable	RG142	None	JYE BAO CO.,LTD.	2014/2/19	2015/2/18
ETSTW-Cable 058	Microwave Cable	SUCOFLEX 104	none	HUBER+SUHNER	2014/2/19	2015/2/18
WTSTW-SW 002	EMI TEST SOFTWARE	EZ_EMCA	None	Farad	Version ETS-03A1	



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2.4 General Test Procedure

POWER LINE CONDUCTED INTERFERENCE: The procedure used was ANSI STANDARD C63.4-2014 5.2 using a 50 μ H LISN (if necessary). Both lines were observed. The bandwidth of the spectrum analyzer was 10 kHz with an appropriate sweep speed.

RADIATION INTERFERENCE: The test procedure used was according to ANSI STANDARD C63.4-2014 6.4 employing a spectrum analyzer. For investigated frequency is equal to or below 1GHz, the RBW and VBW of the spectrum analyzer was 100 kHz and 100kHz respectively with an appropriate sweep speed. For investigated frequency is above 1GHz, both of RBW and VBW of the spectrum analyzer were 1 MHz with an appropriate sweep speed. The analyzer was calibrated in dB above a microvolt at the output of the antenna.

FORMULA OF CONVERSION FACTORS: The Field Strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dB μ V) to the antenna correction factor supplied by the antenna manufacturer. The antenna correction factors are stated in terms of dB.

Example:

Freq (MHz)	METER READING + ACF + CABLE LOSS (to the receiver) = FS
33	20 dB μ V + 10.36 dB + 6 dB = 36.36 dB μ V/m @3m

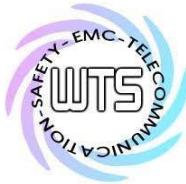
The EUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m (non metallic table) and arranged according to ANSI C63.4-2014 6.3.1. The table used for radiated measurements is capable of continuous rotation. The spectrum was scanned from 30 MHz to the frequency specified as follows:

- (1) If the intentional radiator operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
- (2) If the intentional radiator operates at or above 10 GHz and below 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.
- (3) If the intentional radiator operates at or above 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower, unless specified otherwise elsewhere in the rules.
- (4) If the intentional radiator contains a digital device, regardless of whether this digital device controls the functions of the intentional radiator or the digital device is used for additional control or function purposes other than to enable the operation of the intentional radiator, the frequency range shall be investigated up to the range specified in paragraphs (a)(1)-(a)(3) of this section or the range applicable to the digital device, as shown in paragraph (b)(1) of this Section, whichever is the higher frequency range of investigation.

For hand-held devices, a exploratory test was performed with three (3) orthogonal planes to determine the highest emissions.

Measurements were made by Worldwide Testing Services(Taiwan) Co., Ltd. at the registered open field test site located at No.5-1, Lishui, Shuang Sing Village, Wanli Dist., New Taipei City 207, Taiwan (R.O.C.). The Registration Number: 930600.

When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes.



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When the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.

The formula is as follows:

Average = Peak + Duty Factor

Duty Factor = $20 \log (\text{dwell time}/T)$

T = 100ms when the pulse train period is over 100 ms or the period of the pulse train.

Modified Limits for peak according to 15.35 (b) = Max Permitted average Limits + 20dB

ANSI STANDARD C63.4-2014 10.2.7: Any measurements that utilize special test software shall be indicated and referenced in the test report. During testing, test software 'EZ EMC' was used for setting up different operation modes.



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3 Test results (enclosure)

TEST CASE	Para. Number	Required	Test passed	Test failed
Peak Output Power	15.247(b)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Equivalent isotropically radiated Power	15.247(b)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Spurious Emissions radiated – Transmitter operating	15.247(c): 15.209	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Band Edge Measurement	15.247(d)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Minimum 6 dB Bandwidth	15.247(a)(2)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Peak Power Spectral Density	15.247(e)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Power Line Conducted Emission	15.207	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The following is intentionally left blank.

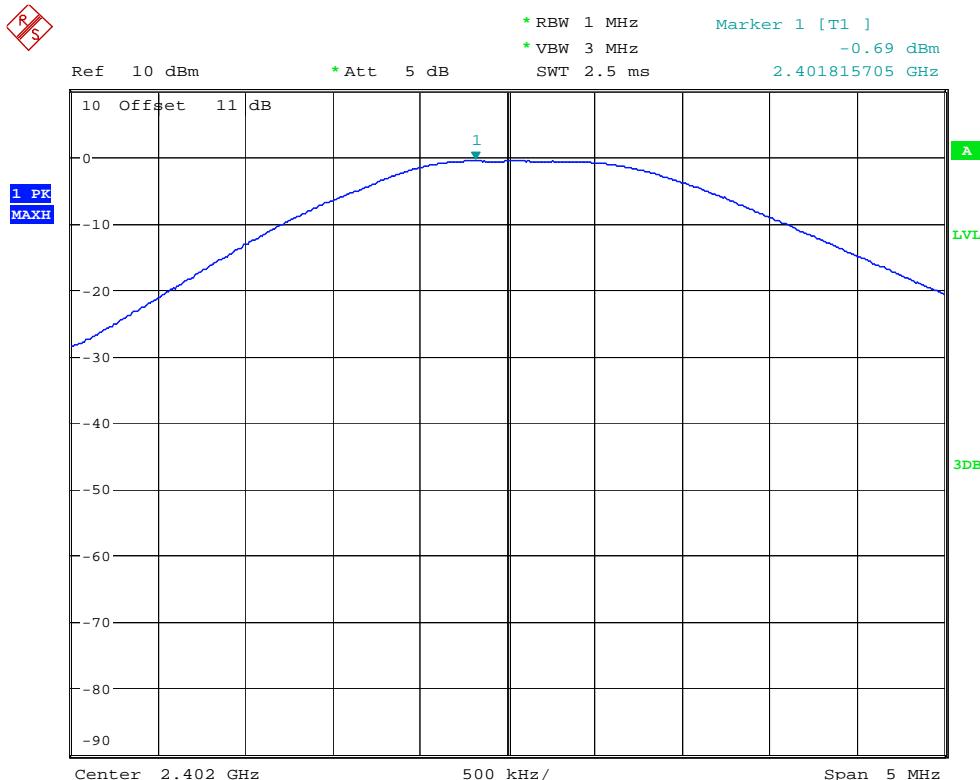
Registration number: W6M21410-14537-C-1
 FCC ID: Y8Y-T2015

3.1 Peak Output Power (transmitter)

FCC Rule: 15.247(b)(3)

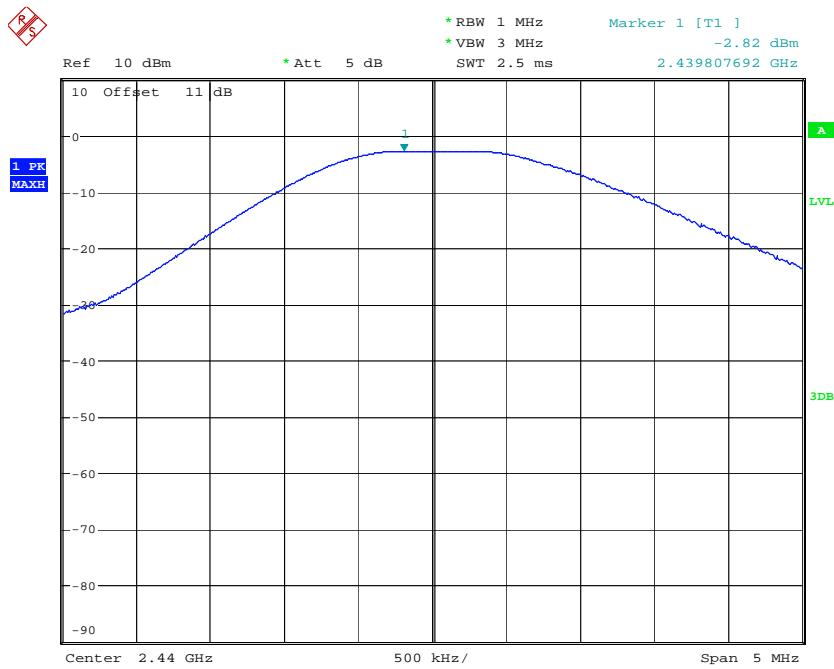
This measurement applies to equipment with an integral antenna and to equipment with an antenna connector and equipped with an antenna as declared by the applicant.

BLE



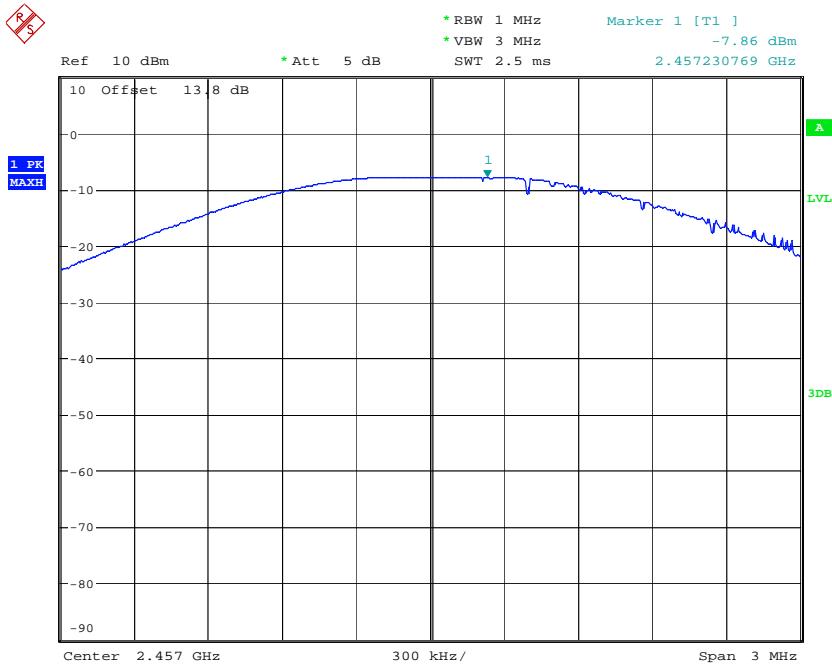
MAX OUTPUT POWER BT4.0 CH00
 Date: 10.OCT.2014 14:00:04

Registration number: W6M21410-14537-C-1
 FCC ID: Y8Y-T2015



Registration number: W6M21410-14537-C-1
 FCC ID: Y8Y-T2015

ANT+



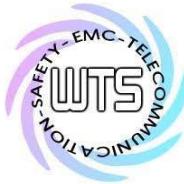
MAX OUTPUT POWER ANT+ 2457MHz
 Date: 18.OCT.2014 13:40:05

Limits:

Frequency MHz	Power dBm
902 - 928	30
2400 - 2483.5	30
5725 - 5850	30

In case of employing transmitter antennas having antenna gain > 6 dBi and using fixed point-to point operation consider §15.247 (b)(4)

Test equipment used: ETSTW-RE 055, ETSTW-RE 050



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3.2 Equivalent isotropic radiated power

FCC Rule: 15.247(b)(3)

EIRP = max. conducted output power + antenna gain

BLE

$$\begin{aligned} \text{EIRP} &= -0.69 \text{ dBm} + (0 \text{ dBi}) \\ &= -0.69 \text{ dBm} \end{aligned}$$

ANT+

$$\begin{aligned} \text{EIRP} &= -7.86 \text{ dBm} + (0 \text{ dBi}) \\ &= -7.86 \text{ dBm} \end{aligned}$$

Limit: EIRP = +36 dBm for Antenna gain <6dBi

Test equipment used: ETSTW-RE 055

3.3 RF Exposure Compliance Requirements

According to KDB447498 10 D01v05:

SAR evaluation, by measurement or numerical simulation, is not required when the corresponding SAR Exclusion Threshold condition, listed below, is satisfied.

The enclosure of the device provides ≥ 0.5 cm separation from the antenna elements to significant metal parts of the enclosure to minimize potential perturbations.

Frequency Band: 2402-2480 MHz

Maximum Power fed to Antenna (BLE): 0.8531 mW

Frequency Band: 2457 MHz

Maximum Power fed to Antenna (ANT+): 0.1637 mW

Separation distances:

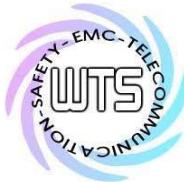
Radiator to user: > 5 mm

Distance prescribed in user manual: > 5 mm

MHz	5	10	15	20	25	mm
2450	10	19	29	38	48	SAR Test Exclusion Threshold (mW)

MHz	30	35	40	45	50	mm
2450	57	67	77	86	96	SAR Test Exclusion Threshold (mW)

MHz	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	mm
2450	96	196	296	396	496	596	696	796	896	996	1096	1196	1296	1396	1496	mW



Worldwide Testing Services(Taiwan) Co., Ltd.

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FCC ID: Y8Y-T2015

3.4 Transmitter Radiated Emissions in Restricted Bands

FCC Rules: 15.247 (c), 15.205, 15.209, 15.35

Radiated emission measurements were performed from 30 MHz to 26500 MHz.

For radiated emission tests, the analyzer setting was as followings:

Frequency \leq 1 GHz, RBW:100 kHz, VBW: 100 kHz (Peak measurements)

Frequency >1 GHz, RBW: 1 MHz, VBW: 1 MHz (Peak measurements)

Frequency > 1 GHz , RBW:1 MHz , VBW: 10 Hz (Average measurements)

Limits.

For frequencies below 1GHz:

Frequency of Emission (MHz)	Field strength (microvolts/meter)	Field Strength (dB microvolts/meter)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above	500	54.0

For frequencies above 1GHz (Average measurements).

Guidance on Measurement of Digit Transmission Systems:

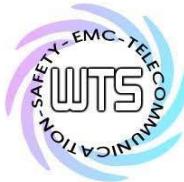
"If the emission is pulsed, modify the unit for continuous operation, use the setting shown above, then correct the reading by subtracting the peak-average correction factor, derived from the appropriate duty cycle calculation."

The correction factor, based on the total channel dwell time in a 100 ms period, may be mathematically applied to a measurement made with an average detector, to further reduce the value.

Duty cycle correction = $20 \log (\text{dwell time} / 100\text{ms})$

Note: No duty cycle correction was added to the reading of this EUT.

Explanation: See attached diagrams in Appendix.



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3.5 Spurious Emissions (tx)

Spurious emission was measured with modulation (declared by manufacturer).

In any 100 kHz bandwidth outside the frequency band in which the intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB 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. 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))

FCC Rule: 15.247(c), 15.35

For out of band emissions that are close to or that exceed the 20 dB attenuation requirement described in the specification, radiated measurements were performed at a 3 m separation distance to determine whether these emissions complied with the general radiated emission requirement.

Limits:

For frequencies above 1GHz (Peak measurements).

Modified Limit for peak according to 15.35 (b) = Max Permitted average Limits + 20dB

For frequencies above 1GHz (Average measurements).

Max. reading – 20dB

Max. reading – 20 dB

Guidance on Measurement of Digit Transmission Systems:

“If the emission is pulsed, modify the unit for continuous operation, use the settings shown above, then correct the reading by subtracting the peak-average correction factor, derived from the appropriate duty cycle calculation.”

The correction factor, based on the total channel dwell time in a 100 ms period, may be mathematically applied to a measurement made with an average detector, to further reduce the value.

Duty Cycle correction = $20 \log (\text{dwell time}/100\text{ms})$

Note: No duty cycle correction was added to the reading of EUT.



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SAMPLE CALCULATION OF LIMIT. All results will be updated by an automatic measuring system in accordance with point 2.3.

Calculation of test results:

Such factors like antenna correction, cable loss, external attenuation etc. are already included in the provided measurement results. This is done by using validated test software and calibrated test system according the accreditation requirements.

The peak and average spurious emission plots was measured with the average limits.

In the Table being listed the critical peak and average value and exhibit the compliance with the above calculated Limits.

If in the column's correction factor states a value then the max. Field strength in the same row is corrected by a value gained from the "Correction Factor".

Summary table with radiated data of the test plots

BLE

Model: T2015 Date: 2014/10/17
Mode: TX BLE 2402MHz Temperature: 24 °C Engineer: Roy
Polarization: Horizontal Humidity: 60 %

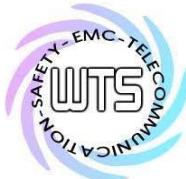
Frequency (MHz)	Reading (dBuV)	Detector	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Table Degree (Deg.)	Ant. High (cm)
239.9398	17.54	peak	14.16	31.70	46.00	-14.30	70	100
300.2004	18.05	peak	16.00	34.05	46.00	-11.95	155	100

Frequency (MHz)	Reading (dBuV)		Factor (dB) Corr.	Result (dBuV/m)		Limit (dBuV/m)		Margin (dB)	Table Degree (Deg.)	Ant. High (m)
	Peak	Ave.		Peak	Ave.	Peak	Ave.			
4804.1020	56.28	50.61	0.28	56.56	50.89	74.00	54.00	-3.11	115	100
7206.0000	42.15	---	3.85	46.00	---	74.00	54.00	-28.00	25	100
9608.0000	35.15	---	7.93	43.08	---	74.00	54.00	-30.92	310	100
12010.0000	33.69	---	12.65	46.34	---	74.00	54.00	-27.66	225	100

Polarization: Vertical

Frequency (MHz)	Reading (dBuV)	Detector	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Table Degree (Deg.)	Ant. High (cm)
39.7194	19.14	peak	13.79	32.93	40.00	-7.07	40	100
88.3166	22.81	peak	9.01	31.82	43.50	-11.68	130	100

Frequency (MHz)	Reading (dBuV)		Factor (dB) Corr.	Result (dBuV/m)		Limit (dBuV/m)		Margin (dB)	Table Degree (Deg.)	Ant. High (m)
	Peak	Ave.		Peak	Ave.	Peak	Ave.			
4804.1300	57.40	51.37	0.28	57.68	51.65	74.00	54.00	-2.35	235	100
7206.0000	41.55	---	3.85	45.40	---	74.00	54.00	-28.60	90	100
9608.0000	34.93	---	7.93	42.86	---	74.00	54.00	-31.14	240	100
12010.0000	34.30	---	12.65	46.95	---	74.00	54.00	-27.05	190	100



Worldwide Testing Services(Taiwan) Co., Ltd.

Registration number: W6M21410-14537-C-1
FCC ID: Y8Y-T2015

Mode: TX BLE 2440MHz

Polarization: Horizontal

Frequency (MHz)	Reading (dBuV)	Detector	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Table Degree (Deg.)	Ant. High (cm)
239.9398	17.86	peak	14.16	32.02	46.00	-13.98	30	100
300.2004	18.30	peak	16.00	34.30	46.00	-11.70	115	100

Frequency (MHz)	Reading (dBuV)		Factor (dB)	Result (dBuV/m)		Limit (dBuV/m)		Margin (dB)	Table Degree (Deg.)	Ant. High (m)
	Peak	Ave.		Peak	Ave.	Peak	Ave.			
4880.0750	56.80	50.82	0.47	57.27	51.29	74.00	54.00	-2.71	145	100
7320.0000	39.94	---	3.65	43.59	---	74.00	54.00	-30.41	330	100
9760.0000	34.85	---	8.29	43.14	---	74.00	54.00	-30.86	210	100
12200.0000	32.39	---	13.72	46.11	---	74.00	54.00	-27.89	95	100

Polarization: Vertical

Frequency (MHz)	Reading (dBuV)	Detector	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Table Degree (Deg.)	Ant. High (cm)
39.7194	19.64	peak	13.79	33.43	40.00	-6.57	205	100
88.3166	23.79	peak	9.01	32.80	43.50	-10.70	120	100

Frequency (MHz)	Reading (dBuV)		Factor (dB)	Result (dBuV/m)		Limit (dBuV/m)		Margin (dB)	Table Degree (Deg.)	Ant. High (m)
	Peak	Ave.		Peak	Ave.	Peak	Ave.			
4880.0790	56.17	49.93	0.47	56.64	50.40	74.00	54.00	-3.60	240	100
7320.0000	40.88	---	3.65	44.53	---	74.00	54.00	-29.47	85	100
9760.0000	34.15	---	8.29	42.44	---	74.00	54.00	-31.56	200	100
12200.0000	32.56	---	13.72	46.28	---	74.00	54.00	-27.72	140	100

Mode: TX BLE 2480MHz

Polarization: Horizontal

Frequency (MHz)	Reading (dBuV)	Detector	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Table Degree (Deg.)	Ant. High (cm)
239.9398	18.08	peak	14.16	32.24	46.00	-13.76	40	100
300.2004	18.00	peak	16.00	34.00	46.00	-12.00	95	100

Frequency (MHz)	Reading (dBuV)		Factor (dB)	Result (dBuV/m)		Limit (dBuV/m)		Margin (dB)	Table Degree (Deg.)	Ant. High (m)
	Peak	Ave.		Peak	Ave.	Peak	Ave.			
4960.1020	54.59	48.37	0.88	55.47	49.25	74.00	54.00	-4.75	240	100
7440.0000	40.52	---	3.93	44.45	---	74.00	54.00	-29.55	320	100
9920.0000	34.48	---	8.50	42.98	---	74.00	54.00	-31.02	220	100
12400.0000	32.08	---	14.46	46.54	---	74.00	54.00	-27.46	105	100



Worldwide Testing Services(Taiwan) Co., Ltd.

Registration number: W6M21410-14537-C-1

FCC ID: Y8Y-T2015

Polarization: Vertical

Frequency (MHz)	Reading (dBuV)	Detector	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Table Degree (Deg.)	Ant. High (cm)
37.7756	18.84	peak	13.62	32.46	40.00	-7.54	100	100
88.3166	23.89	peak	9.01	32.90	43.50	-10.60	165	100

Frequency (MHz)	Reading (dBuV)		Factor (dB) Corr.	Result (dBuV/m)		Limit (dBuV/m)		Margin (dB)	Table Degree (Deg.)	Ant. High (m)
	Peak	Ave.		Peak	Ave.	Peak	Ave.			
4960.0700	54.16	48.53	0.88	55.04	49.41	74.00	54.00	-4.59	250	100
7440.0000	41.44	---	3.93	45.37	---	74.00	54.00	-28.63	45	100
9920.0000	34.96	---	8.50	43.46	---	74.00	54.00	-30.54	290	100
12400.0000	32.37	---	14.46	46.83	---	74.00	54.00	-27.17	75	100

ANT+

Model:

T2015

Date:

2014/10/17

Mode:

TX ANT+ 2457MHz

Temperature:

24

°C

Engineer:

Roy

Polarization: Horizontal

Humidity:

60

%

Frequency (MHz)	Reading (dBuV)		Detector	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Table Degree (Deg.)	Ant. High (cm)
	Peak	Ave.			Peak	Ave.			
306.0321	4.31	peak		16.14	20.45	46.00	-25.55	135	100
667.5952	4.45	peak		23.89	28.34	46.00	-17.66	110	100

Frequency (MHz)	Reading (dBuV)		Factor (dB) Corr.	Result (dBuV/m)		Limit (dBuV/m)		Margin (dB)	Table Degree (Deg.)	Ant. High (m)
	Peak	Ave.		Peak	Ave.	Peak	Ave.			
4914.0000	41.09	---	0.60	41.69	---	74.00	54.00	-32.31	240	100
7371.0000	40.41	---	3.80	44.21	---	74.00	54.00	-29.79	105	100
9828.0000	34.42	---	8.59	43.01	---	74.00	54.00	-30.99	310	100
12285.0000	33.51	---	14.31	47.82	---	74.00	54.00	-26.18	95	100

Polarization: Vertical

Frequency (MHz)	Reading (dBuV)		Detector	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Table Degree (Deg.)	Ant. High (cm)
	Peak	Ave.			Peak	Ave.			
506.2525	4.43	peak		21.04	25.47	46.00	-20.53	105	100
776.4530	4.62	peak		25.52	30.14	46.00	-15.86	60	100

Frequency (MHz)	Reading (dBuV)		Factor (dB) Corr.	Result (dBuV/m)		Limit (dBuV/m)		Margin (dB)	Table Degree (Deg.)	Ant. High (m)
	Peak	Ave.		Peak	Ave.	Peak	Ave.			
4914.0000	41.10	---	0.60	41.70	---	74.00	54.00	-32.30	110	100
7371.0000	40.75	---	3.80	44.55	---	74.00	54.00	-29.45	45	100
9828.0000	34.12	---	8.59	42.71	---	74.00	54.00	-31.29	315	100
12285.0000	33.55	---	14.31	47.86	---	74.00	54.00	-26.14	260	100



Worldwide Testing Services(Taiwan) Co., Ltd.

Registration number: W6M21410-14537-C-1

FCC ID: Y8Y-T2015

Note

1. Correction Factor = Antenna factor + Cable loss - Preamplifier
2. The formula of measured value as: Test Result = Reading + Correction Factor
3. Detector function in the form : PK = Peak, QP = Quasi Peak, AV = Average
4. All not in the table noted test results are more than 20 dB below the relevant limits.
5. Measurement uncertainty for 3m measurement: 30-1000 MHz = ± 3.68 dB, 1-18 GHz = ± 5.37 dB, 18-40 GHz = ± 3.43 dB ; Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.
6. Please see attached diagrams in Appendix.

TEST RESULT (Transmitter): The unit DOES meet the FCC requirements.

Test equipment used: ETSTW-RE 004, ETSTW-RE 030, ETSTW-RE 111,
ETSTW-RE 088, ETSTW-RE 018

Registration number: W6M21410-14537-C-1

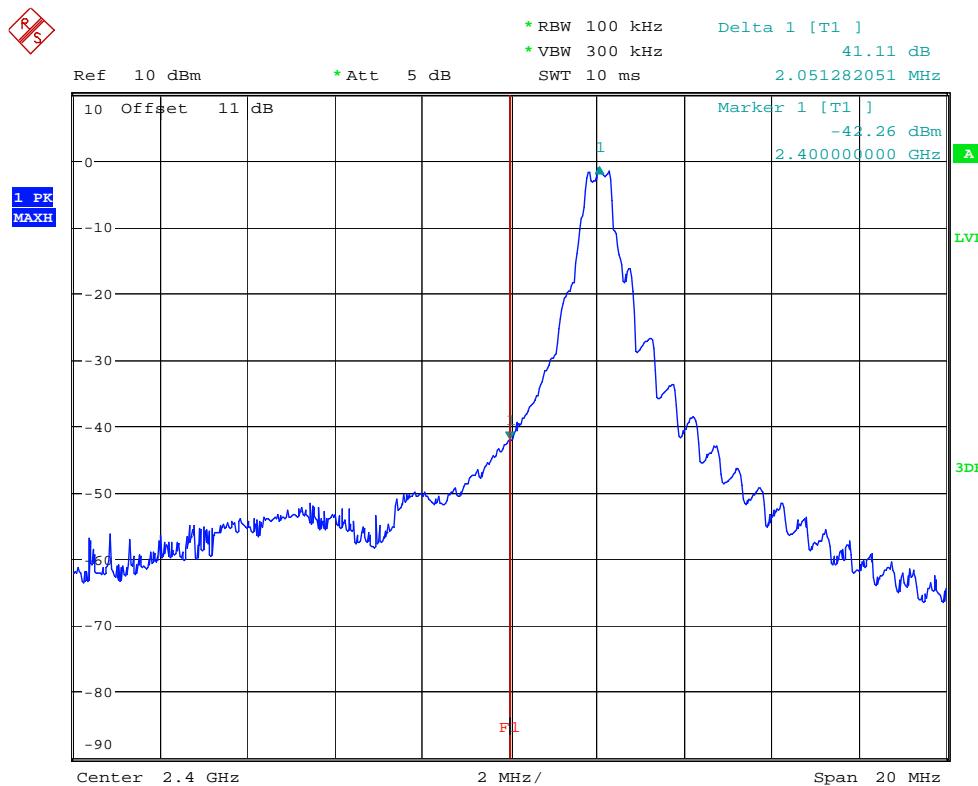
FCC ID: Y8Y-T2015

3.6 Radiated Emission on the band edge

According to FCC rules part 15 subpart C §15.247(d) in any 100 kHz bandwidth outside the frequency band in which the intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB 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. Attenuation below the general limits specified in § 15.209(a) is not required.

In addition radiated emission which fall in the restricted bands, as defined in section 15.205(a), must also with the radiated emission limits.

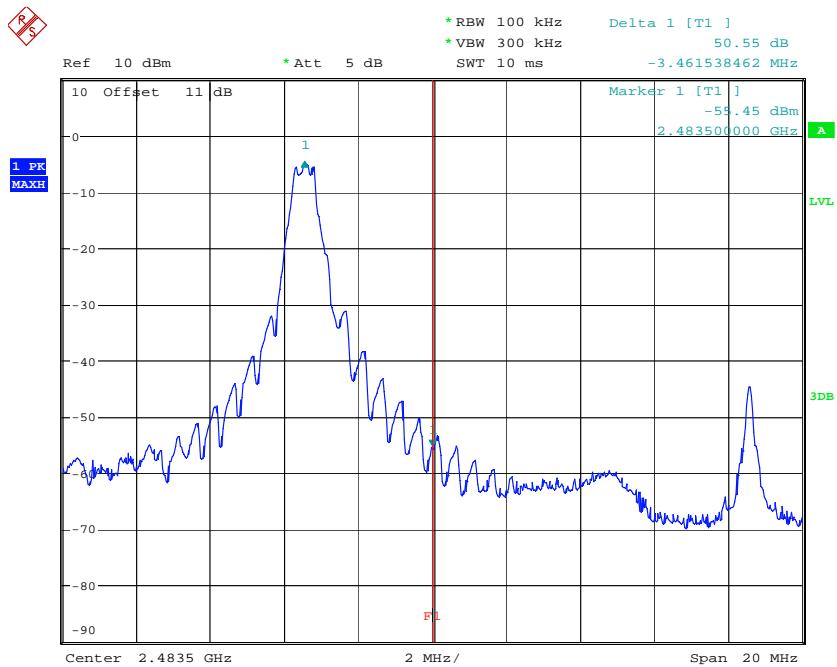
BLE



BANDEdge BT4.0 CH00

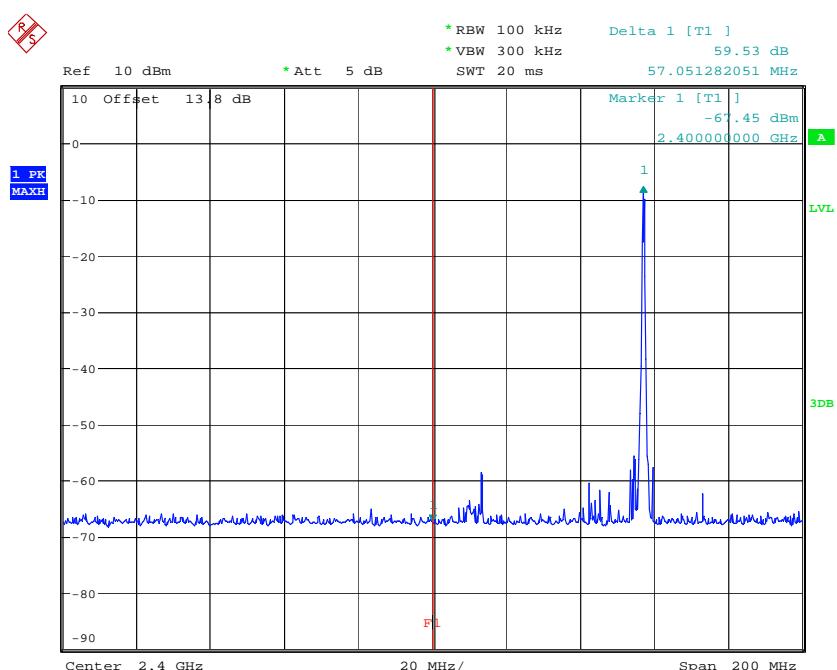
Date: 10.OCT.2014 14:08:32

Registration number: W6M21410-14537-C-1
 FCC ID: Y8Y-T2015



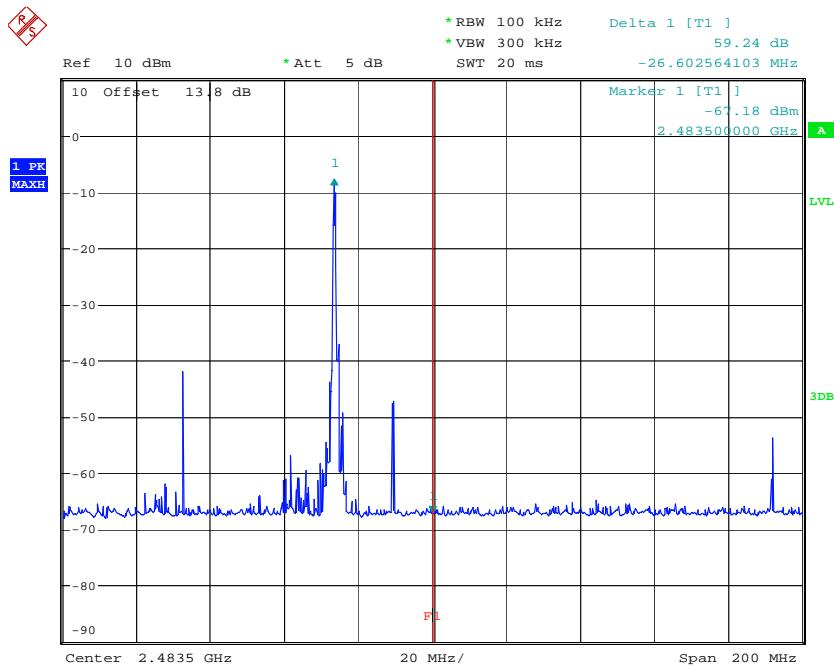
BANDEdge BT4.0 CH39
 Date: 10.OCT.2014 14:07:54

ANT+



BANDEdge ANT+ 2457MHz
 Date: 18.OCT.2014 13:49:28

Registration number: W6M21410-14537-C-1
 FCC ID: Y8Y-T2015



BANDEdge ANT+ 2457MHz
 Date: 18.OCT.2014 13:51:27

Limit:

Frequency Range / MHz	Limit
902 – 928	
2400 – 2483.5	- 20 dB
5725 - 5850	

Test equipment used: ETSTW-RE 055, ETSTW-RE 050

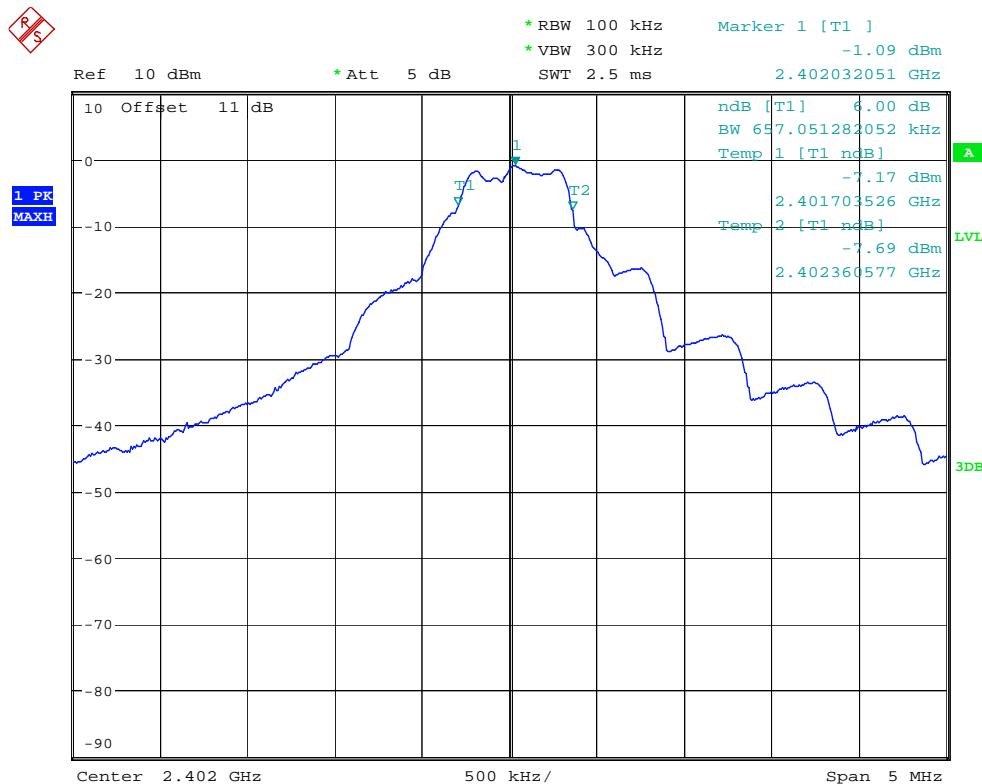
Registration number: W6M21410-14537-C-1
 FCC ID: Y8Y-T2015

3.7 Minimum 6 dB Bandwidth

The analyzer ResBW was set to 100 kHz. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK reading was taken, two markers were set 6 dB below the maximum level on the right and the left side of the emission.

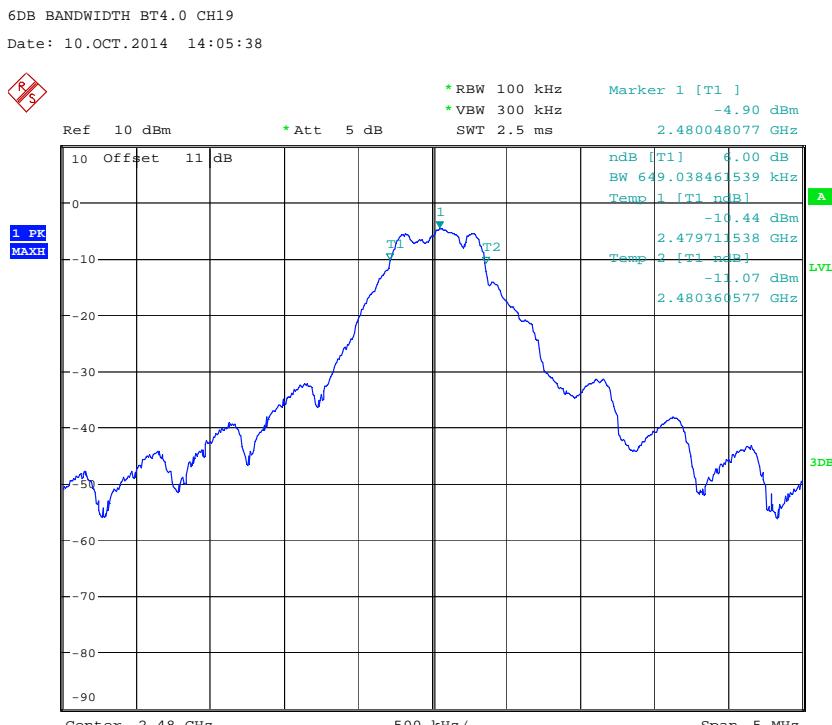
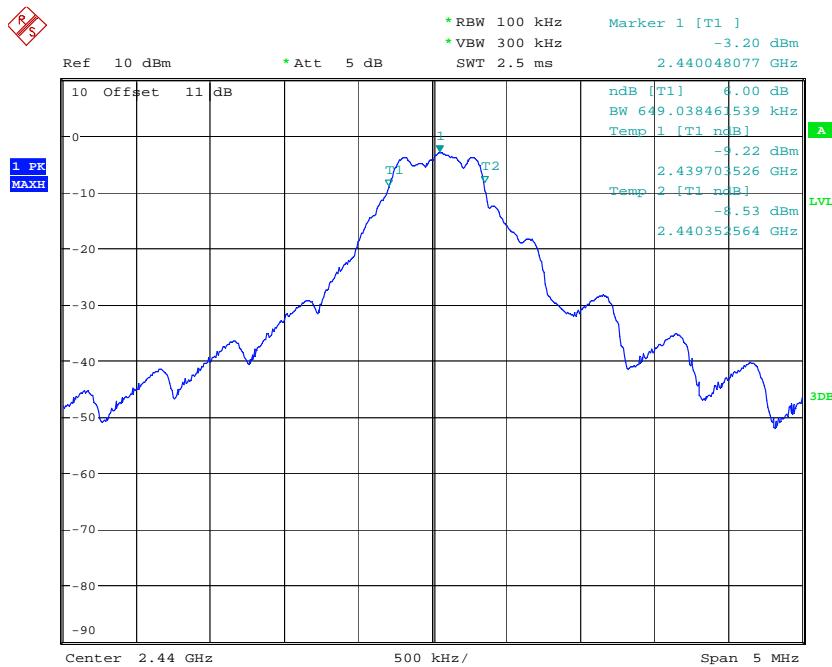
The 6 dB bandwidth is the frequency difference between the two markers.

BLE



6DB BANDWIDTH BT4.0 CH00
 Date: 10.OCT.2014 14:04:59

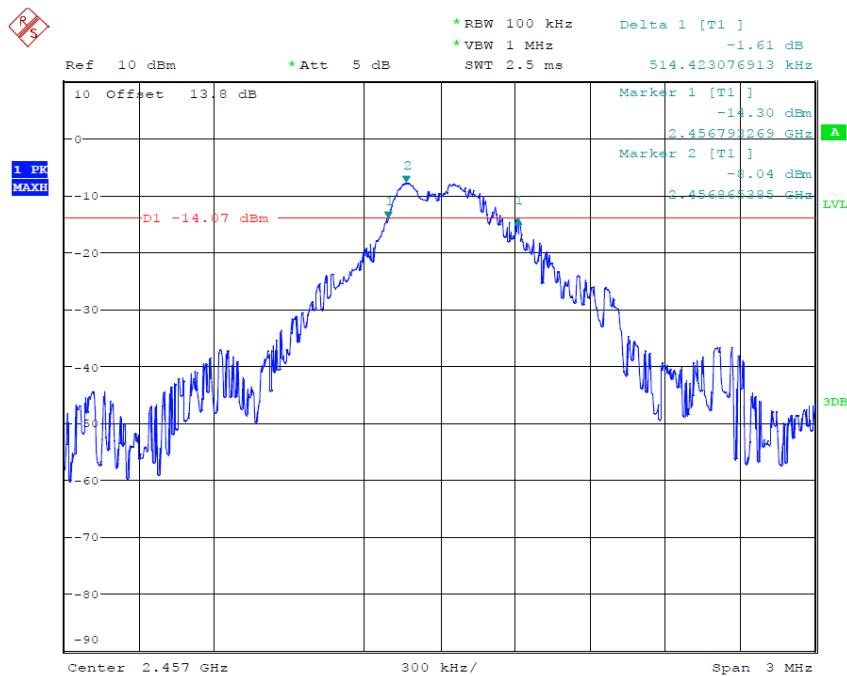
Registration number: W6M21410-14537-C-1
 FCC ID: Y8Y-T2015



6DB BANDWIDTH BT4.0 CH39
 Date: 10.OCT.2014 14:06:12

Registration number: W6M21410-14537-C-1
 FCC ID: Y8Y-T2015

ANT+



6DB BANDWIDTH ANT+ 2457MHz
 Date: 18.OCT.2014 13:31:39

Limits:

Frequency Range MHz	Limits
902-928	min 500 kHz
2400-2483.5	min 500 kHz
5725-5850	min 500 kHz

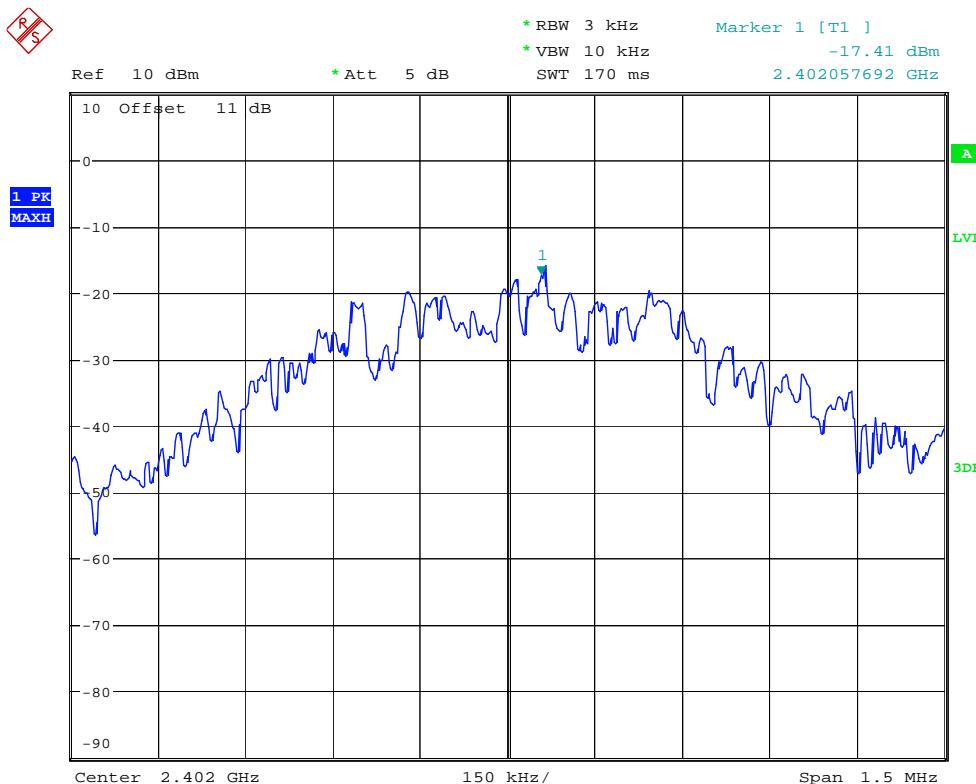
Test equipment used: ETSTW-RE 055, ETSTW-RE 050

Registration number: W6M21410-14537-C-1
 FCC ID: Y8Y-T2015

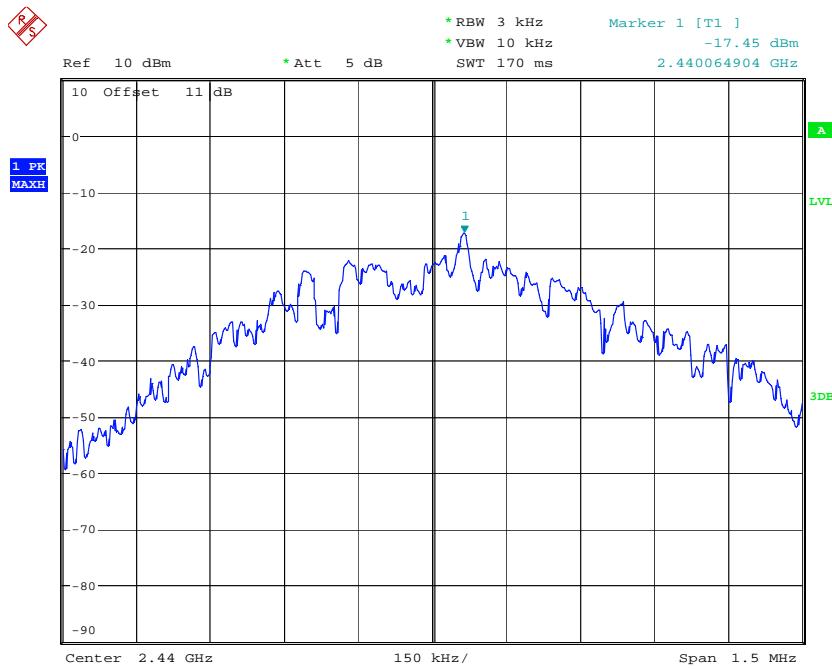
3.8 Peak Power Spectral Density

Peak Power Spectral density is measured at low, middle and high channel. The peak output power is measured with a measurement bandwidth of 10 MHz and displayed on diagram together with Peak Power Spectral Density result which was measured with a bandwidth of 3 kHz, appreciate frequency span and sweep time.

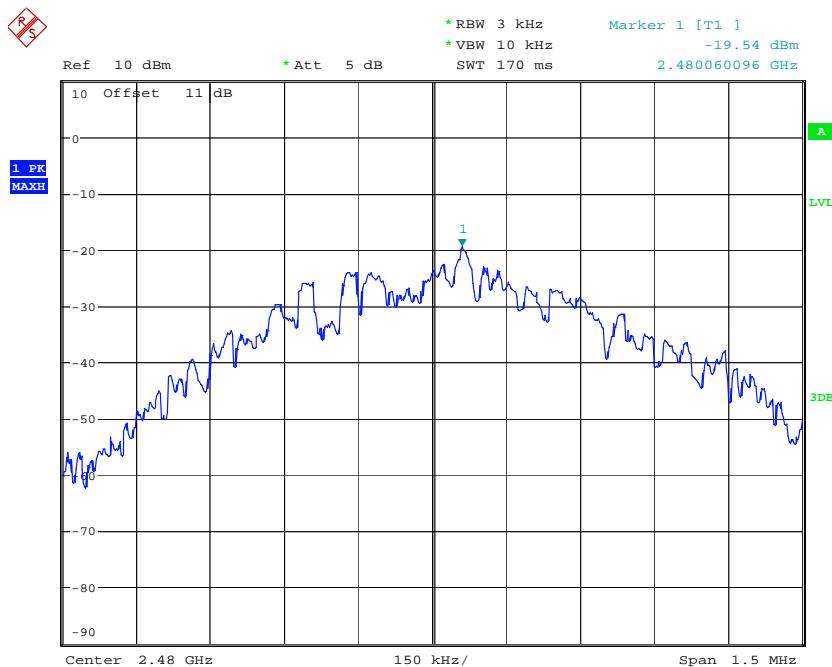
BLE



Registration number: W6M21410-14537-C-1
 FCC ID: Y8Y-T2015



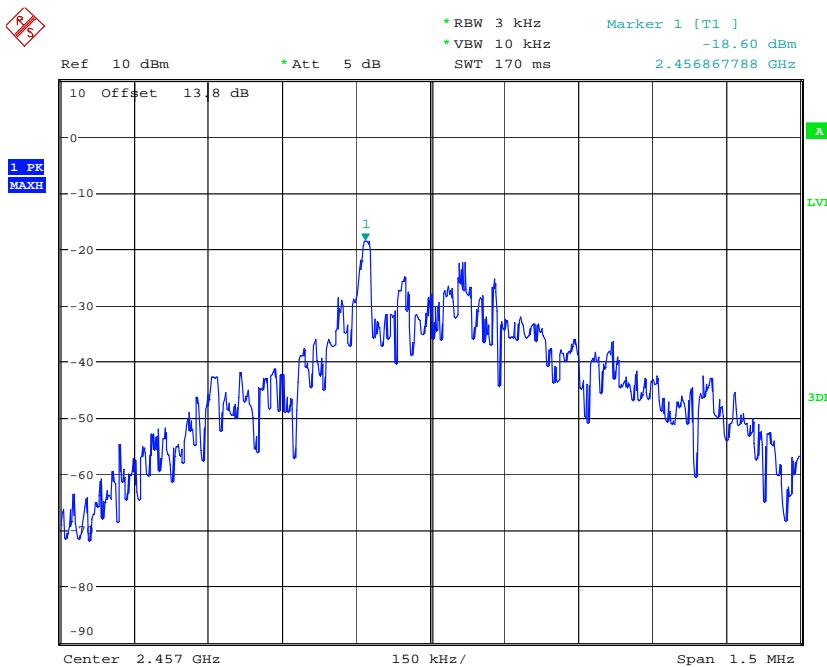
POWER DENSITY BT4.0 CH19
 Date: 10.OCT.2014 14:03:13



POWER DENSITY BT4.0 CH39
 Date: 10.OCT.2014 14:03:41

Registration number: W6M21410-14537-C-1
 FCC ID: Y8Y-T2015

ANT+

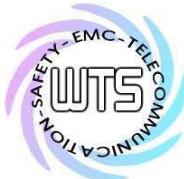


POWER DENSITY ANT+ 2457MHZ
 Date: 18.OCT.2014 13:47:52

Limits:

Frequency Range MHz	dBm
902-928	8
2400-2483.5	8
5725-5850	8

Test equipment used: ETSTW-RE 055, ETSTW-RE 050



Worldwide Testing Services(Taiwan) Co., Ltd.

Registration number: W6M21410-14537-C-1

FCC ID: Y8Y-T2015

3.9 Power Line Conducted Emission

For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the table bellows with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

This measurement was transact first with instrumentation using an average and peak detector and a 10 kHz bandwidth. If the peak detector achieves a calculated level, the measurement is repeated by an instrumentation using a quasi-peak detector.

Model:	T2015	Date:	--						
Mode:		Temperature:	-- °C						
Polarization:	N	Humidity:	-- %						
Frequency (MHz)	Reading (dBuV) QP Ave.	Factor (dB) Corr.	Result (dBuV) QP Ave.	Limit (dBuV) QP Ave.		Margin (dB)			
--	--	--	--	--	--	--	--	--	--

Polarization: L1

Frequency (MHz)	Reading (dBuV) QP Ave.	Factor (dB) Corr.	Result (dBuV) QP Ave.	Limit (dBuV) QP Ave.		Margin (dB)		
--	--	--	--	--	--	--	--	--

Note:

1. The formula of measured value as: Test Result = Reading + Correction Factor
2. The Correction Factor = Cable Loss + LISN Insertion Loss + Pulse Limit Loss
3. Detector function in the form : PK = Peak, QP = Quasi Peak, AV = Average
4. All not in the table noted test results are more than 20 dB below the relevant limits.
5. Measurement uncertainty = $\pm 1.41\text{dB}$; Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.
6. The EUT is battery-used, so this test is not required.

Limits:

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi Peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

Test equipment used: ETSTW-CE 001, ETSTW-CE 016, ETSTW-CE 006, ETSTW-RE 045



Worldwide Testing Services(Taiwan) Co., Ltd.

Registration number: W6M21410-14537-C-1
FCC ID: Y8Y-T2015

Appendix

Measurement diagrams

Spurious Emissions radiated

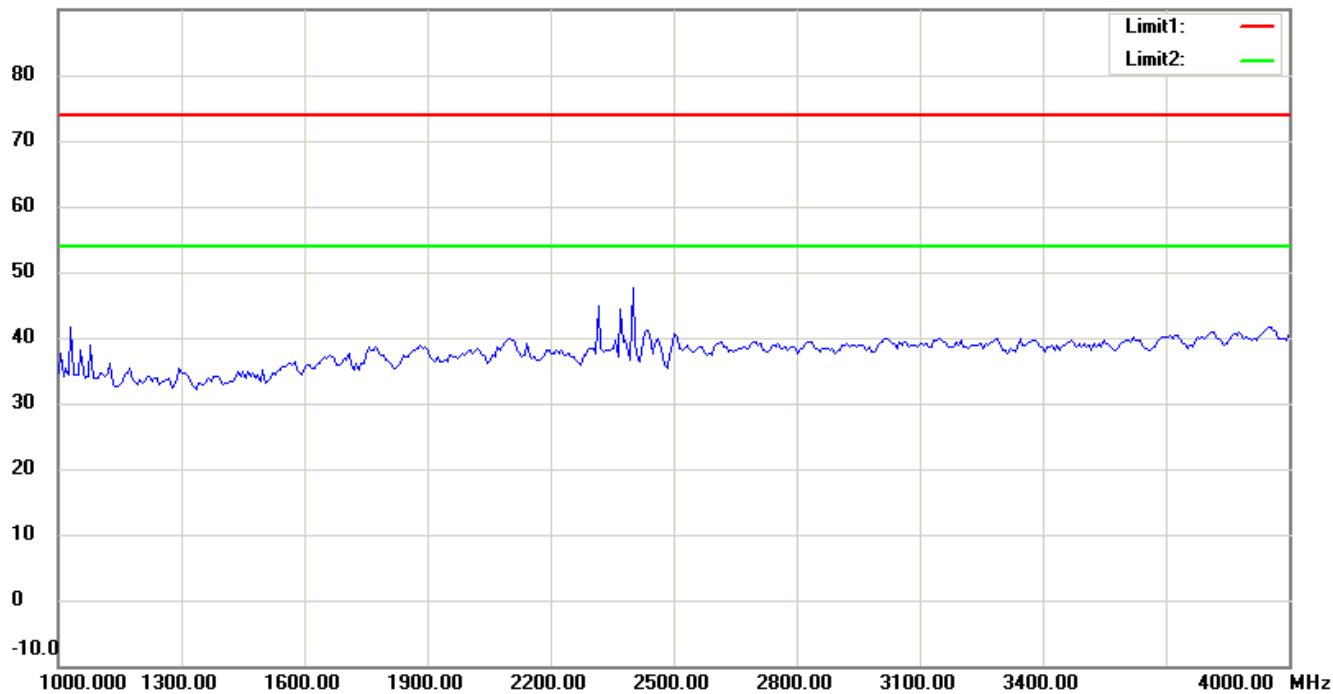
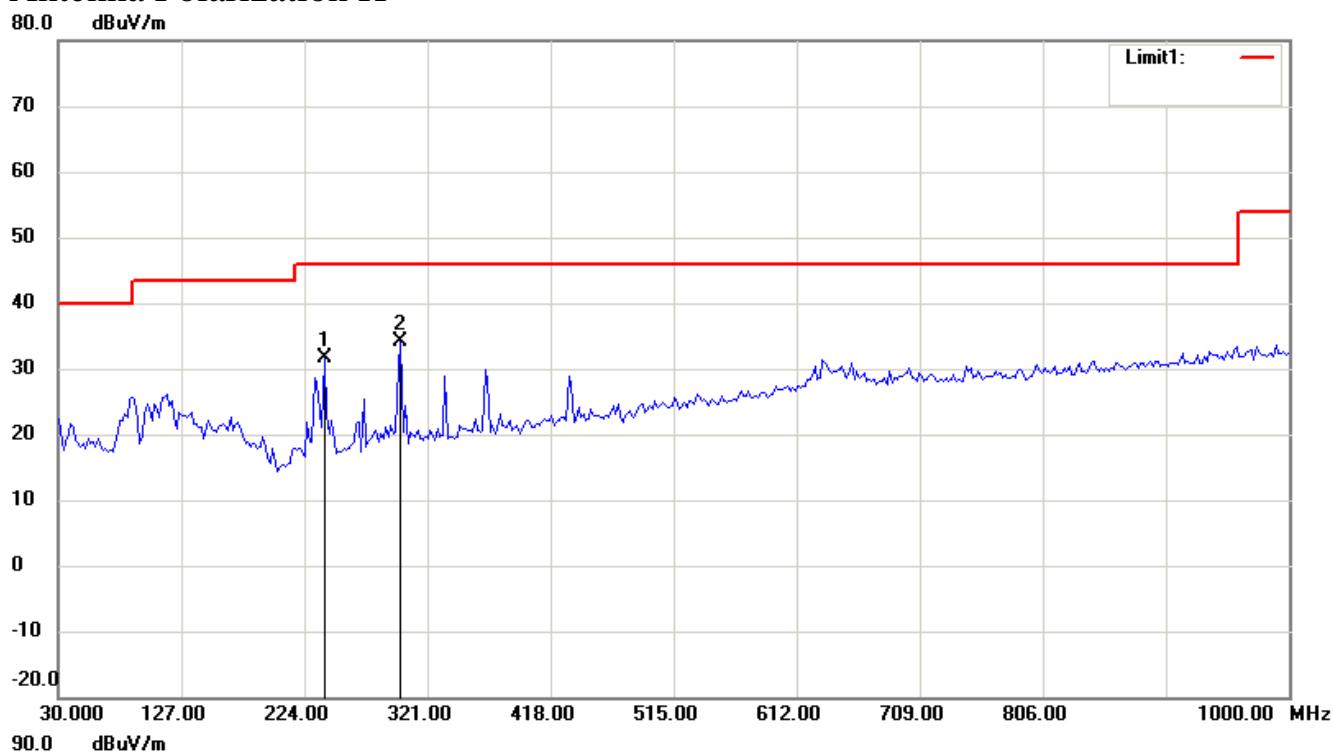
Registration number: W6M21410-14537-C-1

FCC ID: Y8Y-T2015

Radiated Emission_TX

BLE 2402 MHz

Antenna Polarization H



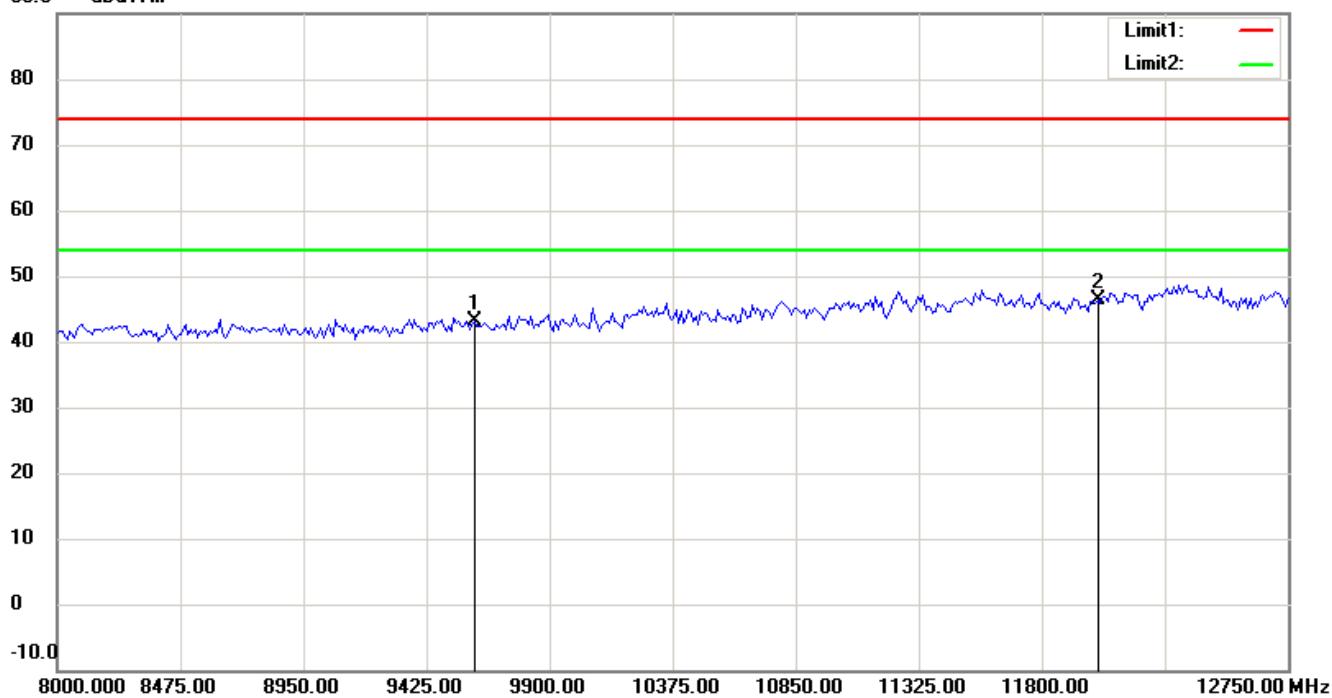
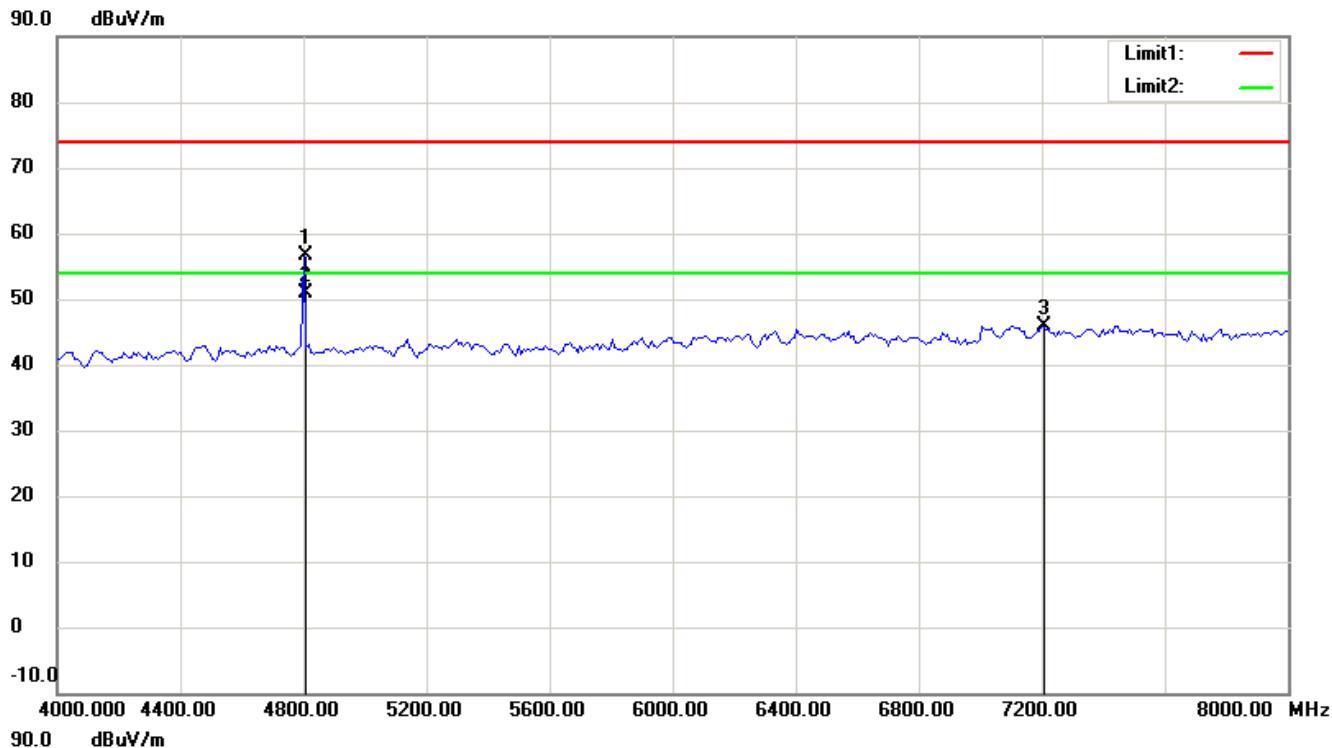
Up Line: Peak Limit Line; Down Line: Ave Limit Line

Note:

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2. The some frequencies may exceed the limit line without the specified detectors, but that cannot present the results are failed to the specification of test standard.
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FCC ID: Y8Y-T2015



Up Line: Peak Limit Line; Down Line: Ave Limit Line

Note:

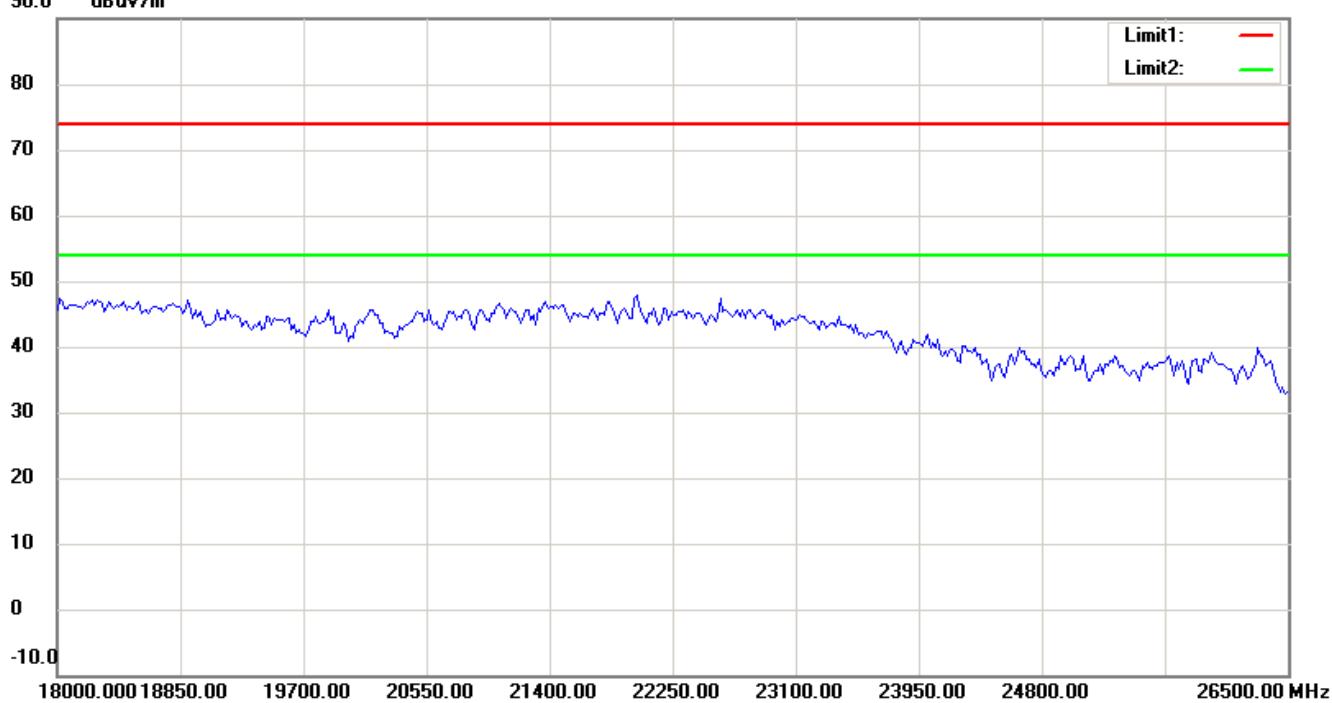
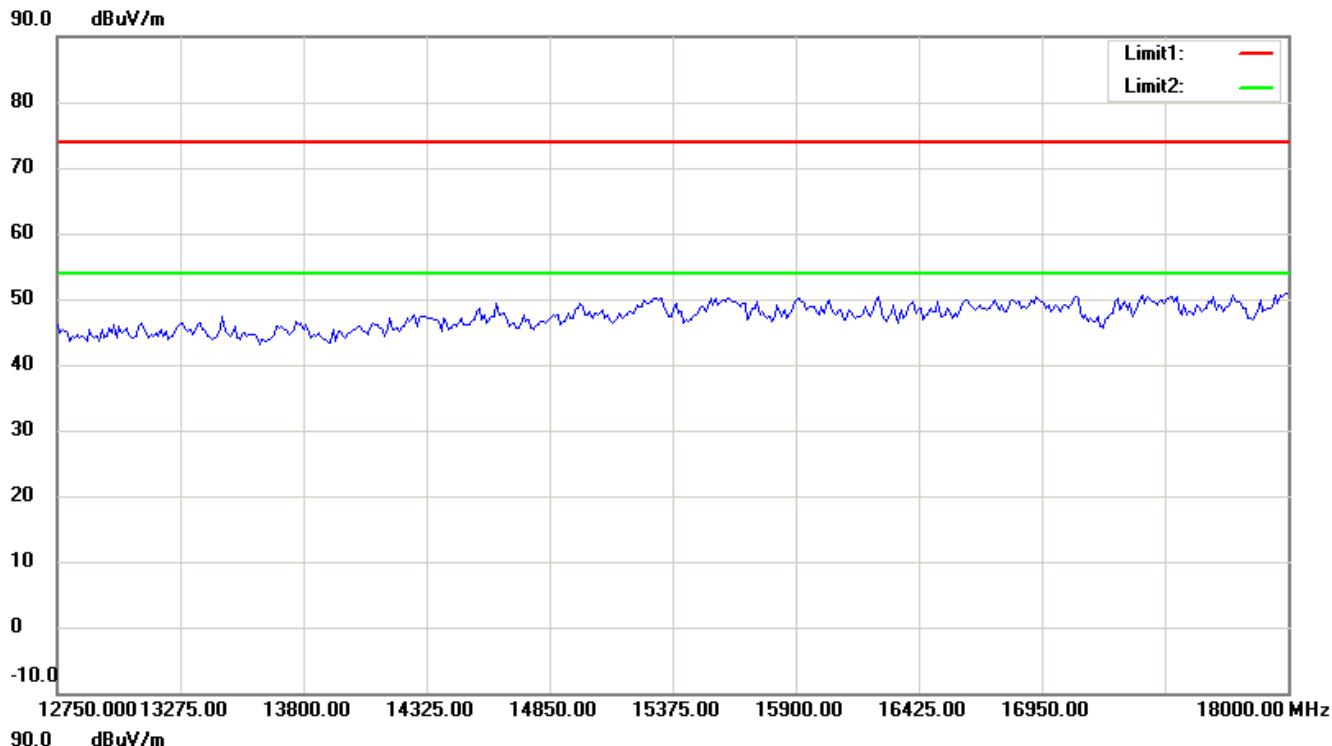
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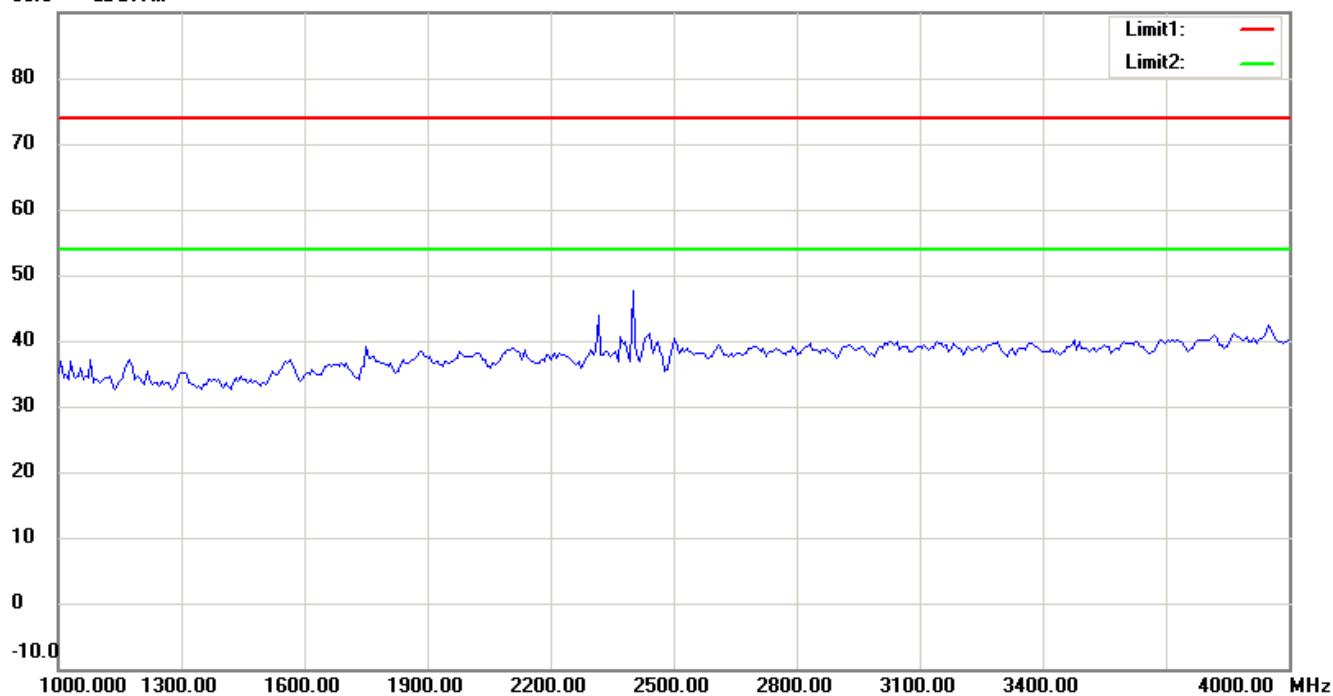
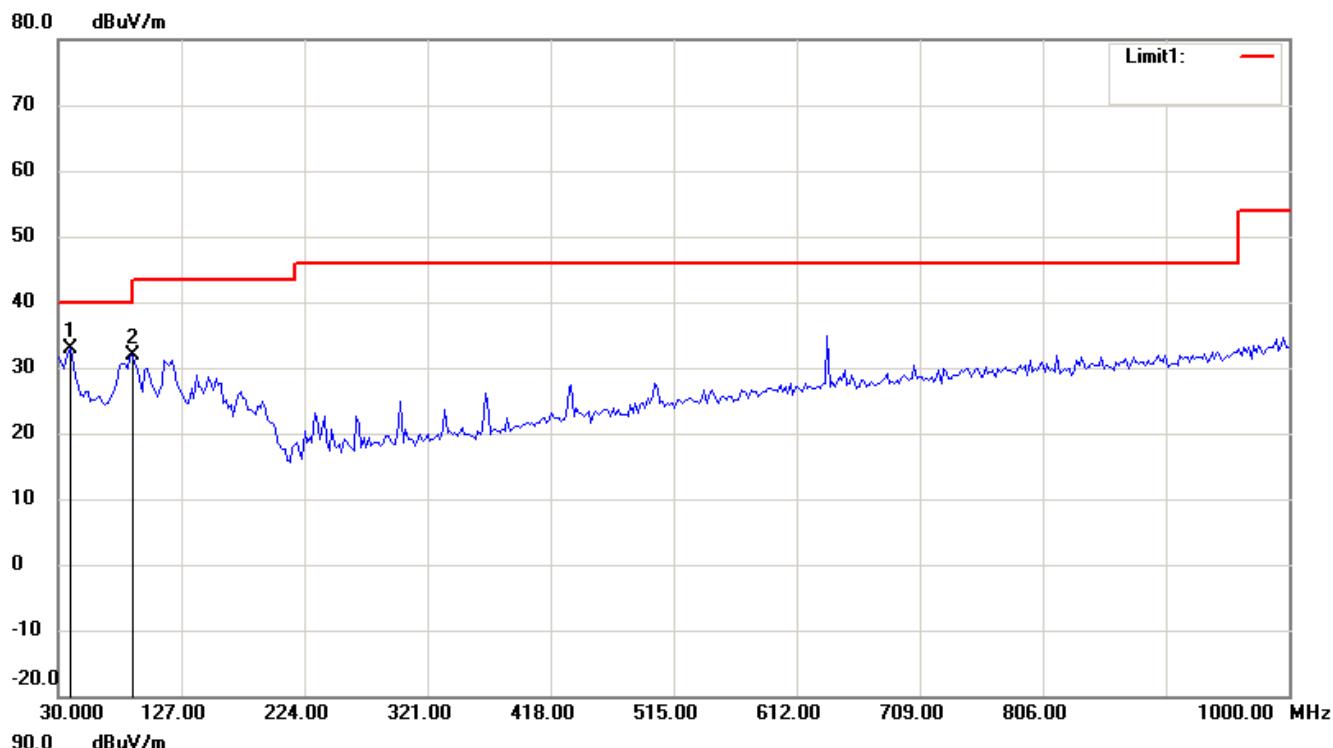
Up Line: Peak Limit Line; Down Line: Ave Limit Line

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Registration number: W6M21410-14537-C-1
 FCC ID: Y8Y-T2015

Antenna Polarization V



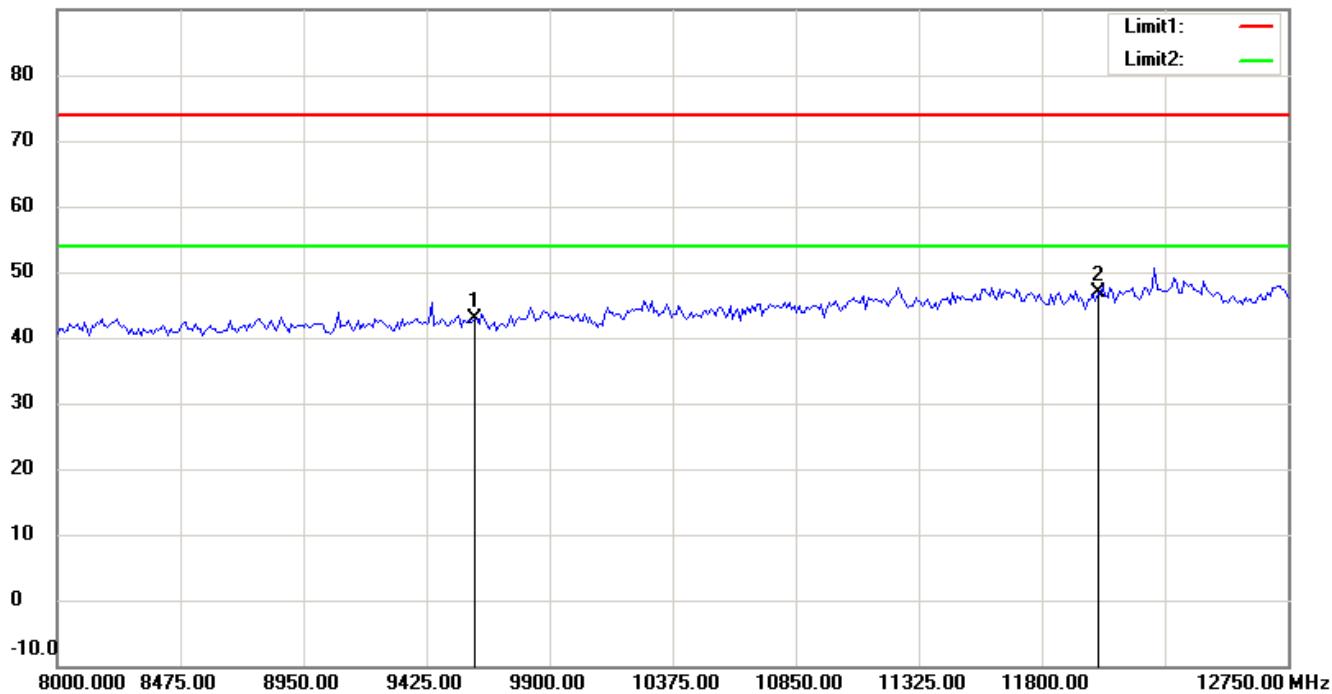
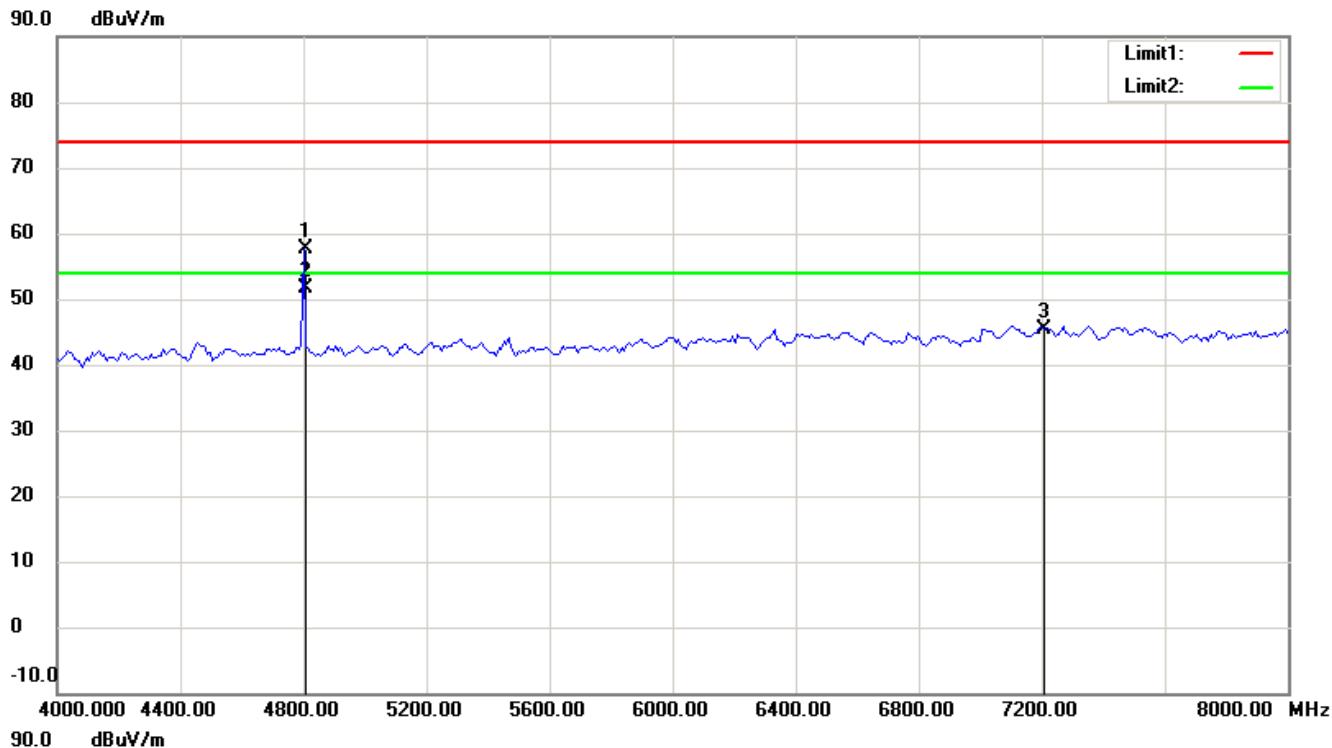
Up Line: Peak Limit Line; Down Line: Ave Limit Line

Note:

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Registration number: W6M21410-14537-C-1

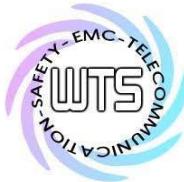
FCC ID: Y8Y-T2015



Up Line: Peak Limit Line; Down Line: Ave Limit Line

Note:

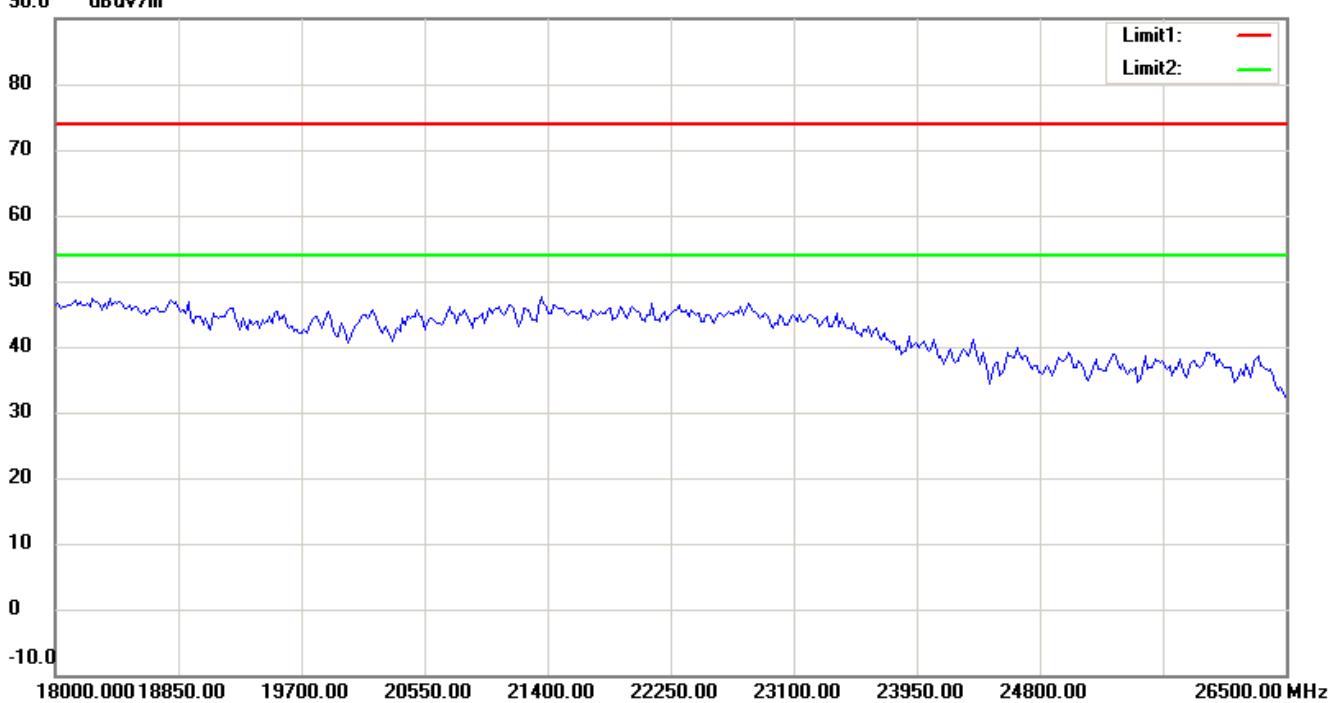
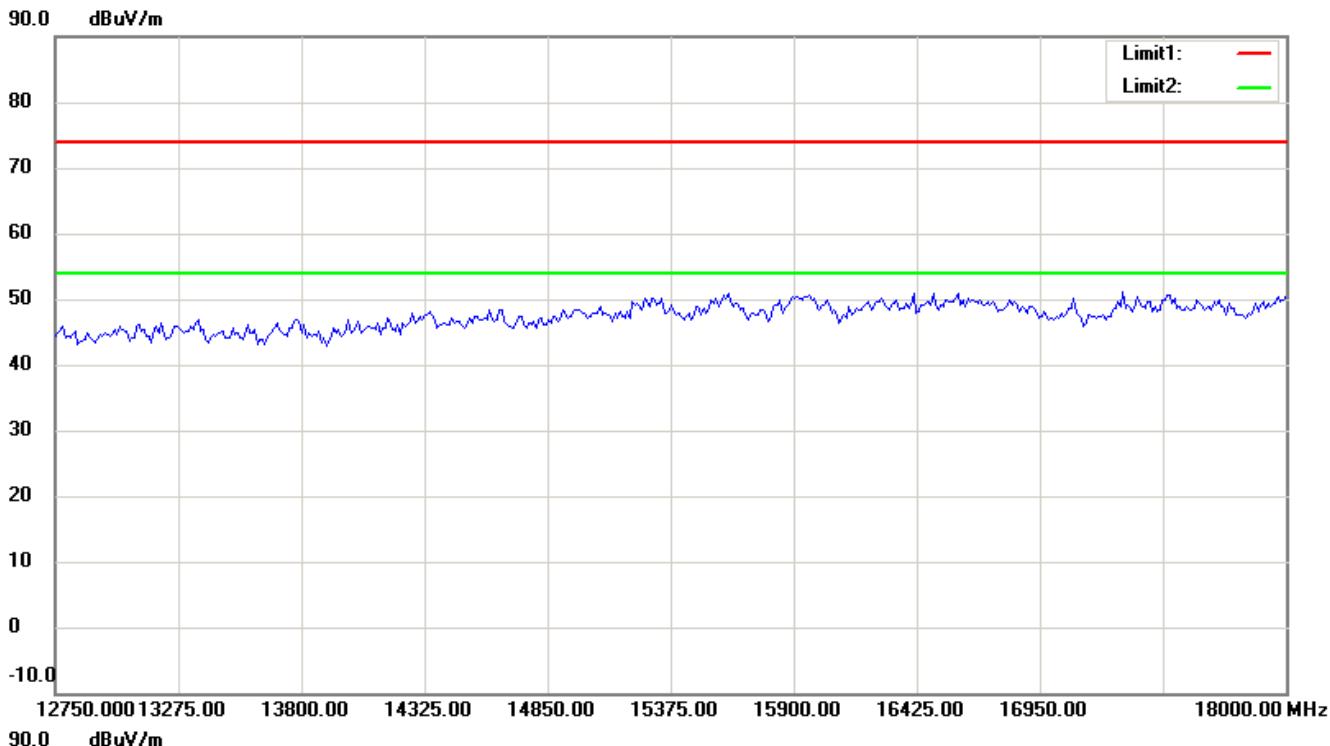
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Up Line: Peak Limit Line; Down Line: Ave Limit Line

Note:

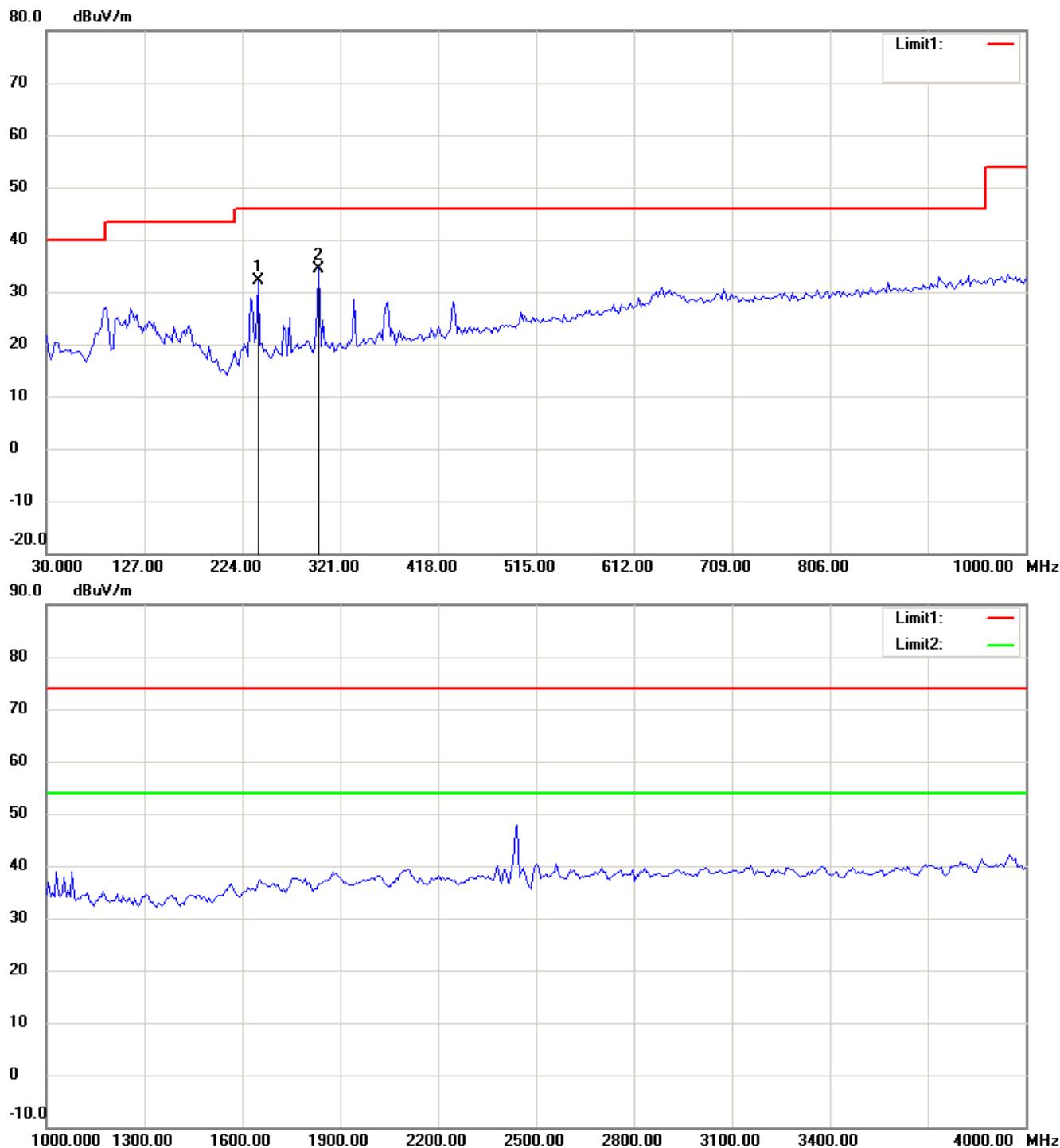
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BLE 2440 MHz

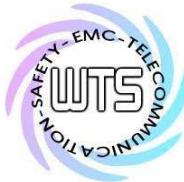
Antenna Polarization H



Up Line: Peak Limit Line; Down Line: Ave Limit Line

Note:

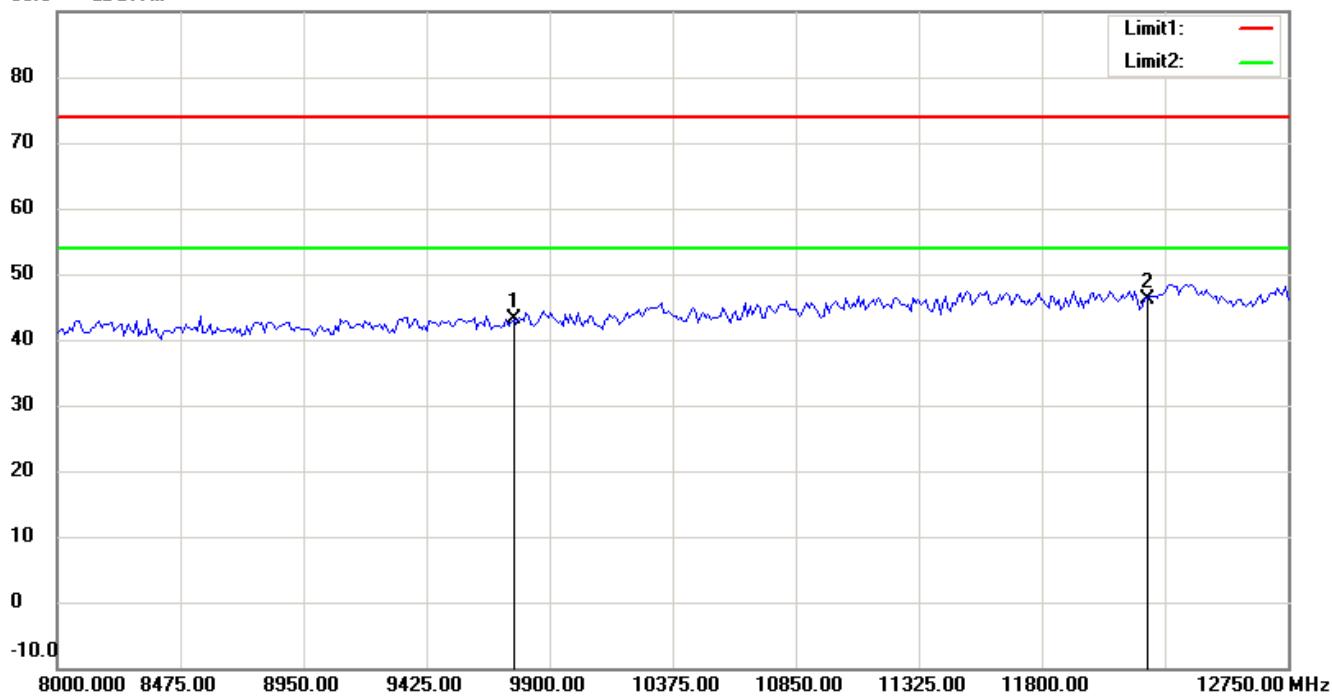
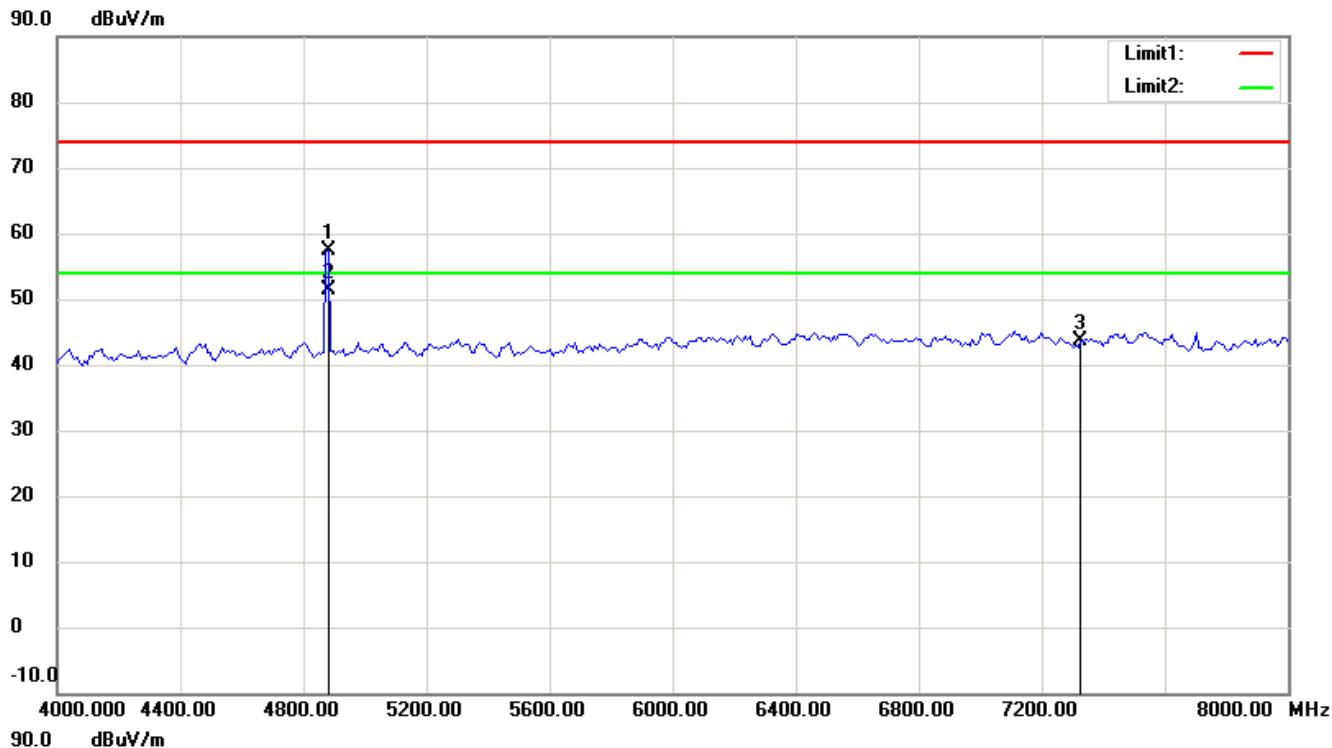
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Registration number: W6M21410-14537-C-1

FCC ID: Y8Y-T2015



Up Line: Peak Limit Line; Down Line: Ave Limit Line

Note:

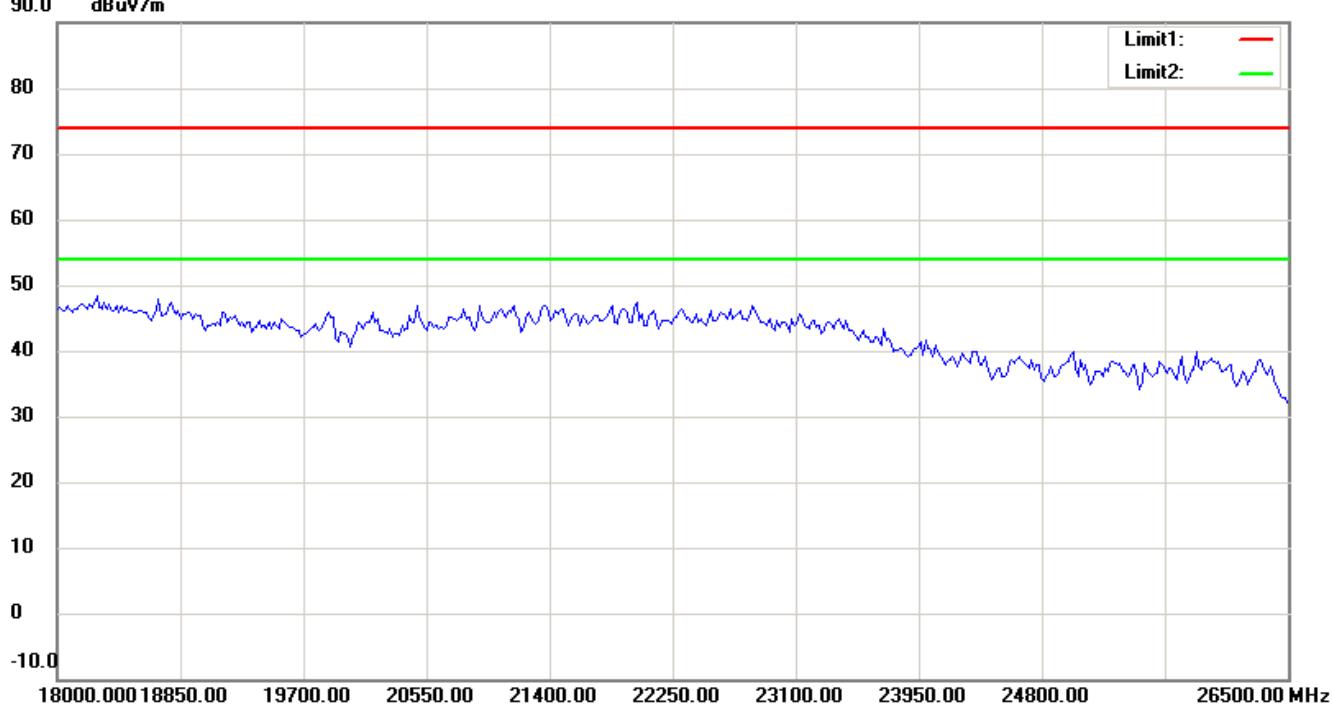
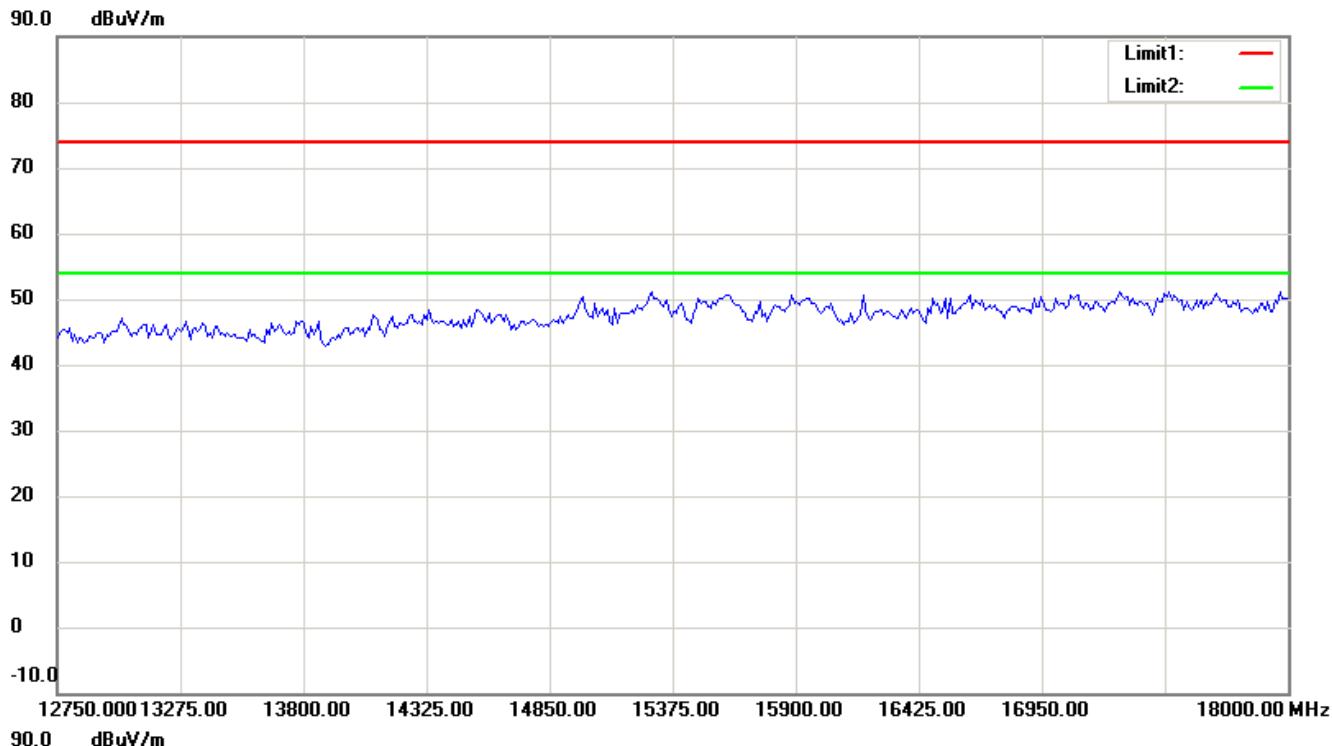
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Registration number: W6M21410-14537-C-1

FCC ID: Y8Y-T2015



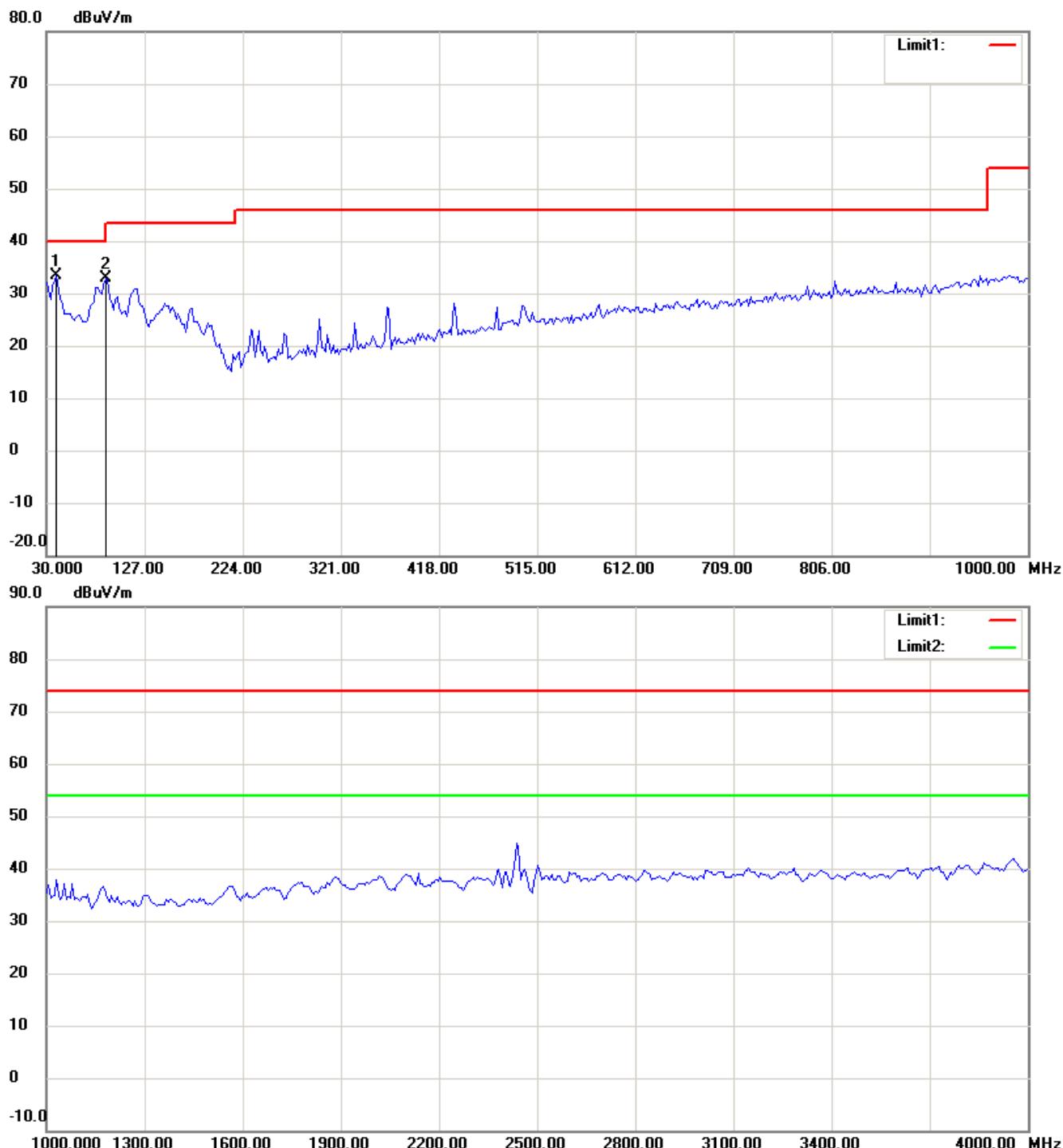
Up Line: Peak Limit Line; Down Line: Ave Limit Line

Note:

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Registration number: W6M21410-14537-C-1
 FCC ID: Y8Y-T2015

Antenna Polarization V



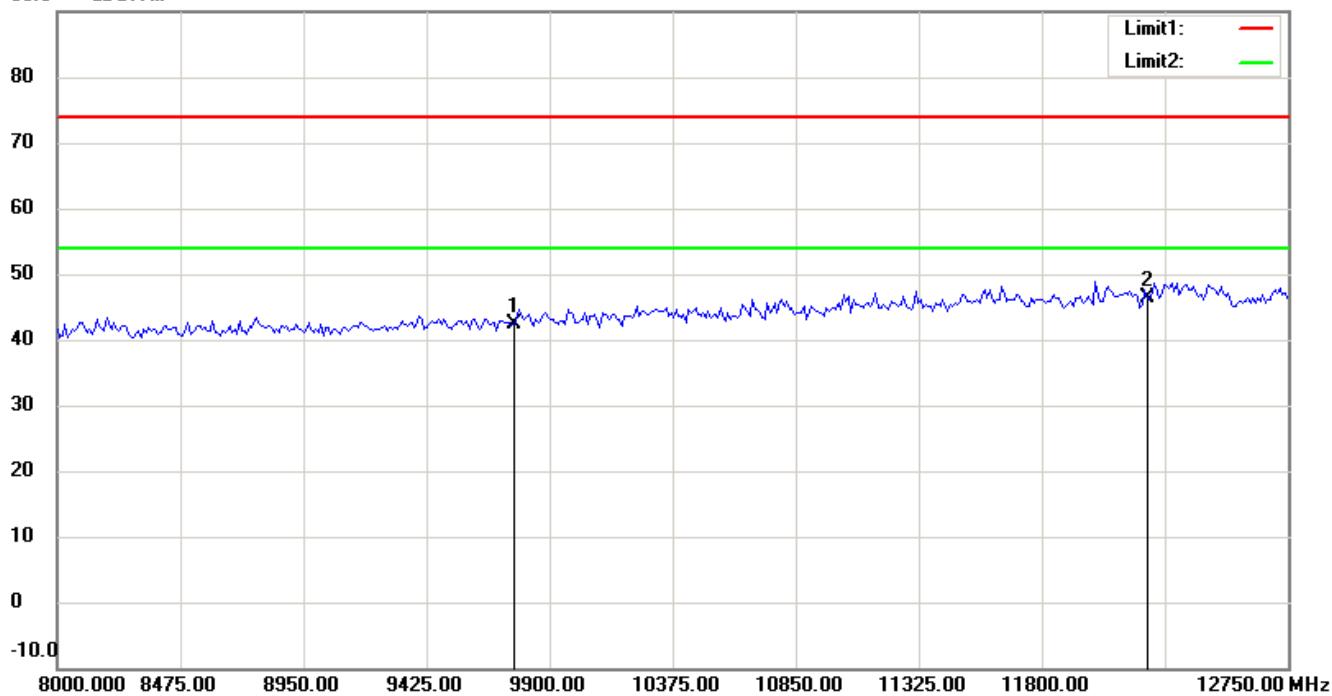
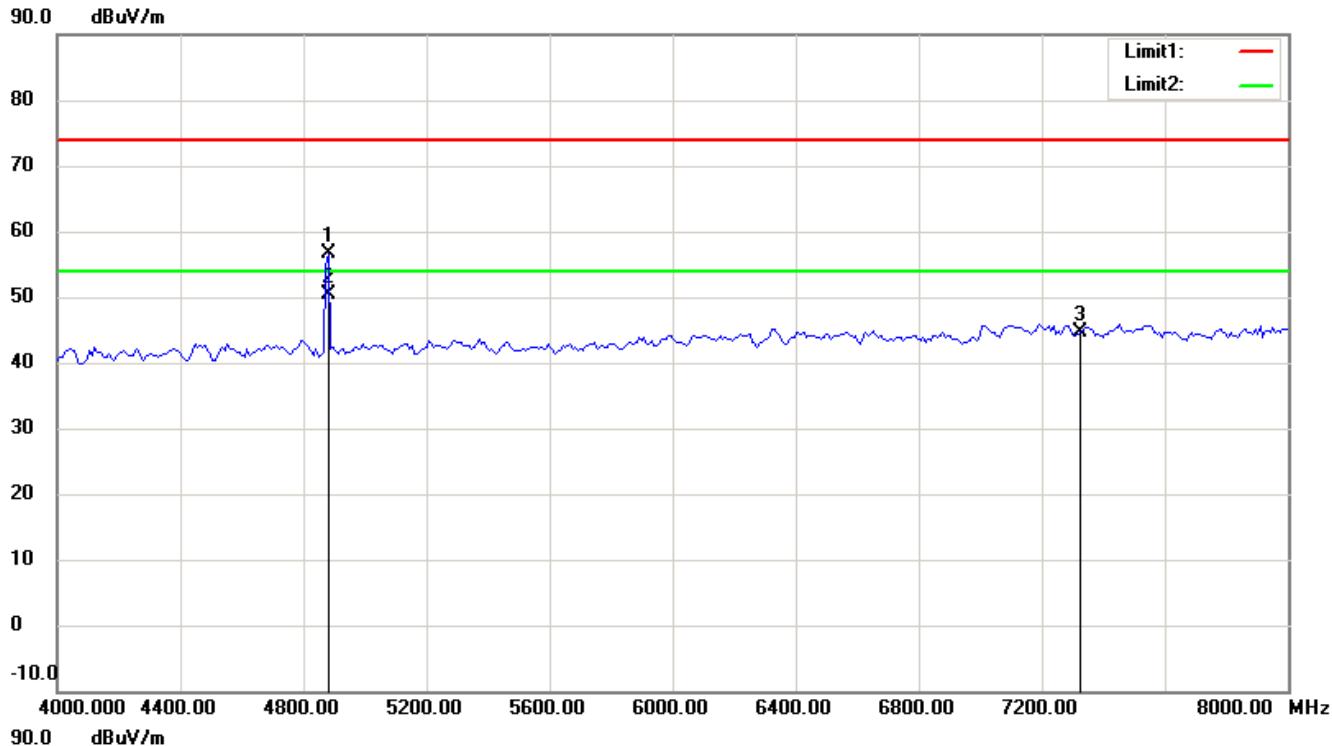
Up Line: Peak Limit Line; Down Line: Ave Limit Line

Note:

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Registration number: W6M21410-14537-C-1

FCC ID: Y8Y-T2015



Up Line: Peak Limit Line; Down Line: Ave Limit Line

Note:

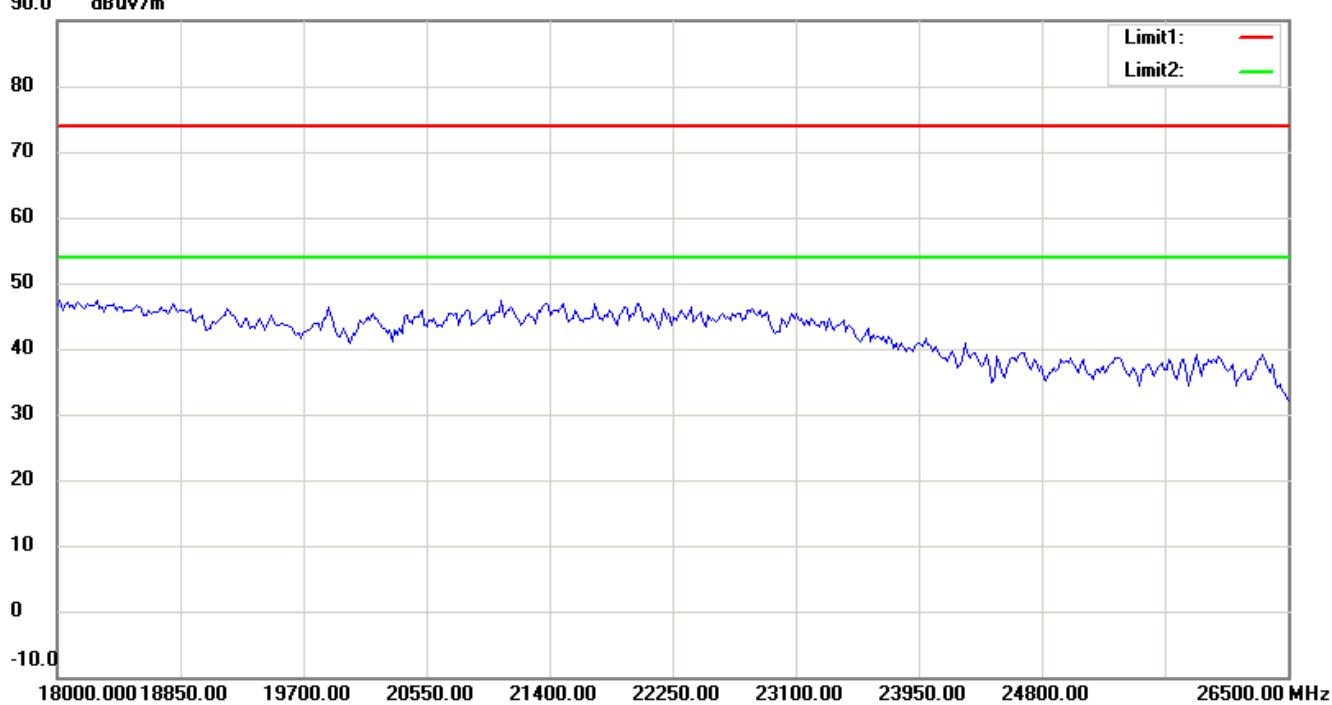
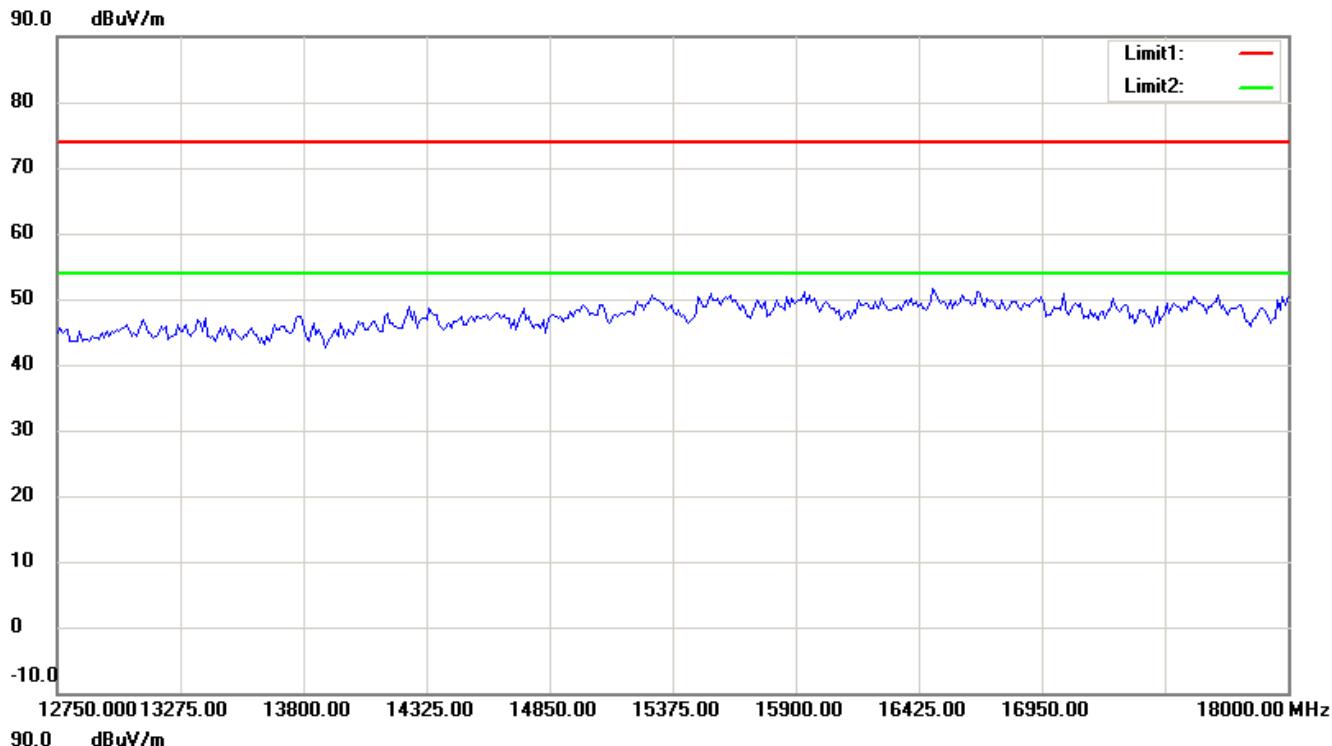
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Worldwide Testing Services(Taiwan) Co., Ltd.

Registration number: W6M21410-14537-C-1

FCC ID: Y8Y-T2015



Up Line: Peak Limit Line; Down Line: Ave Limit Line

Note:

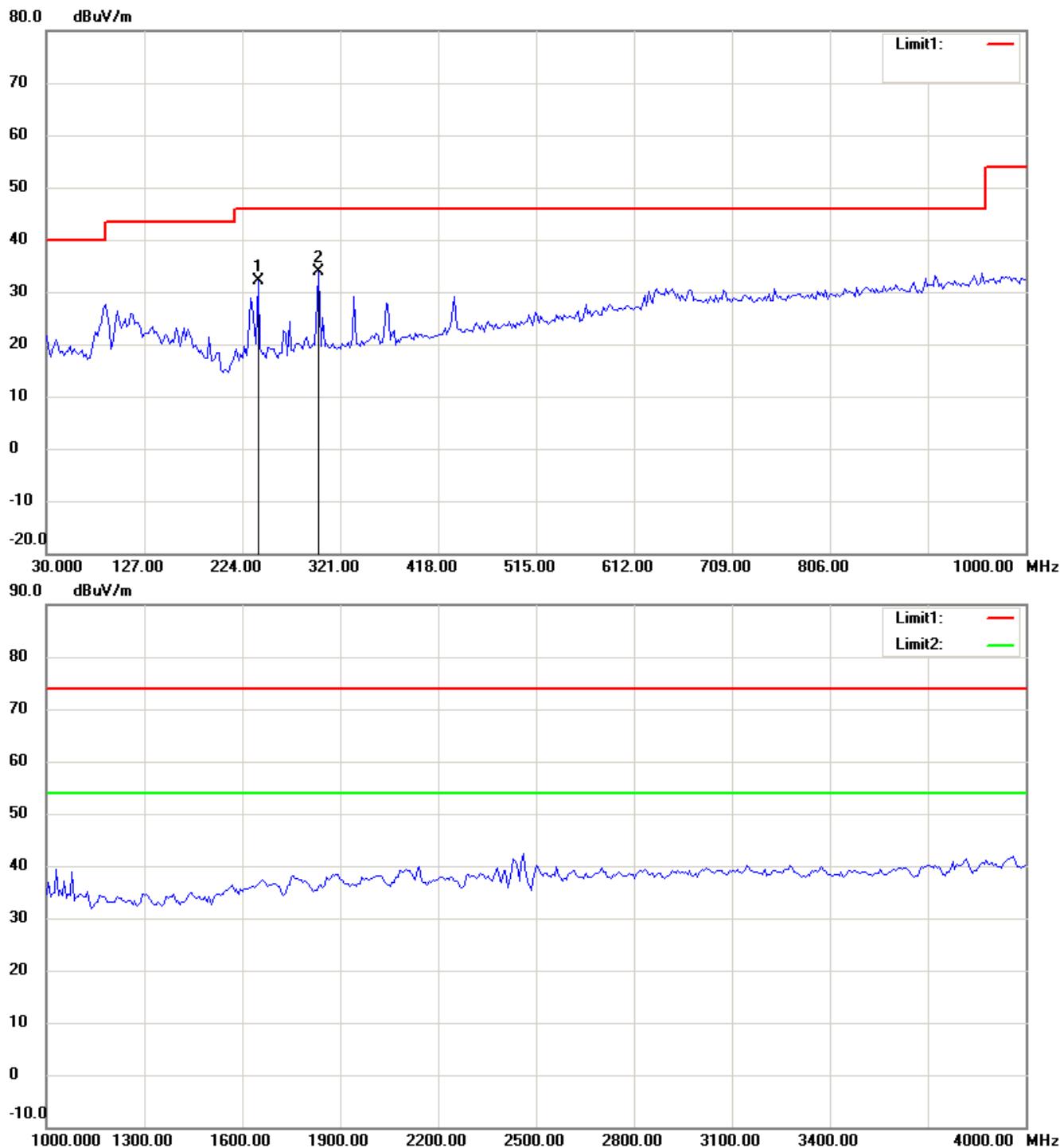
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Registration number: W6M21410-14537-C-1

FCC ID: Y8Y-T2015

BLE 2480 MHz

Antenna Polarization H



Up Line: Peak Limit Line; Down Line: Ave Limit Line

Note:

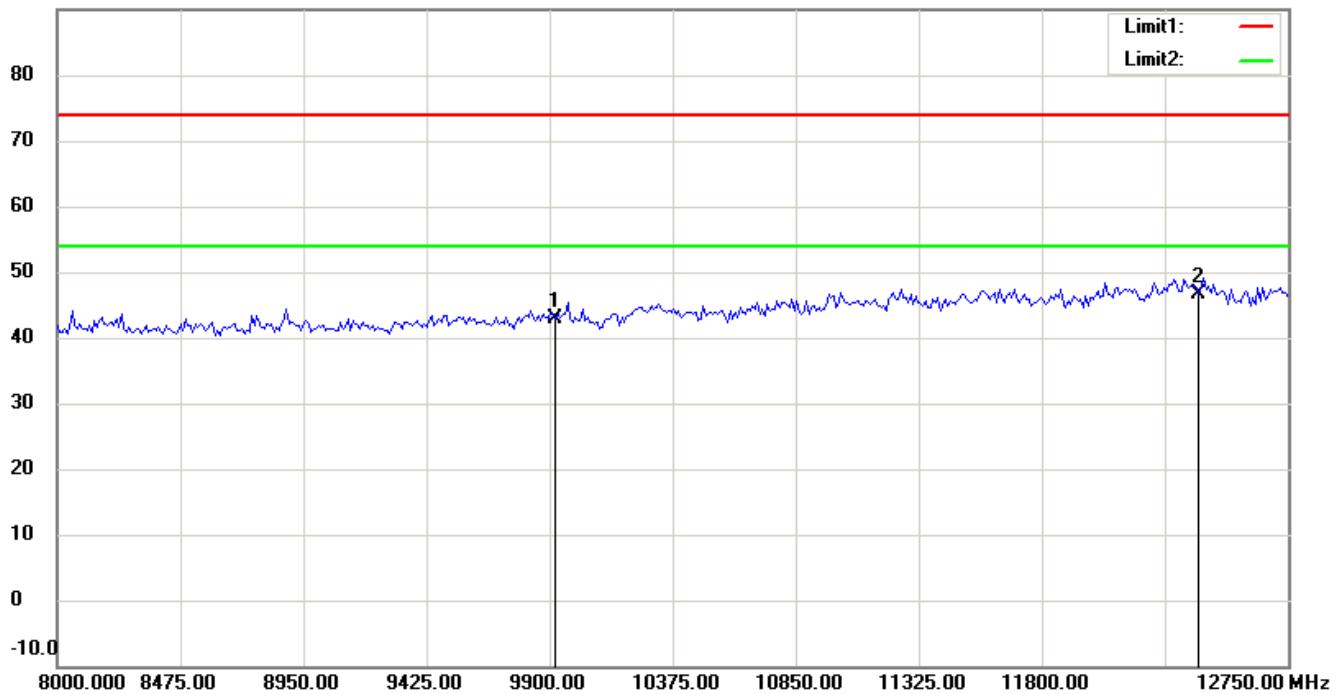
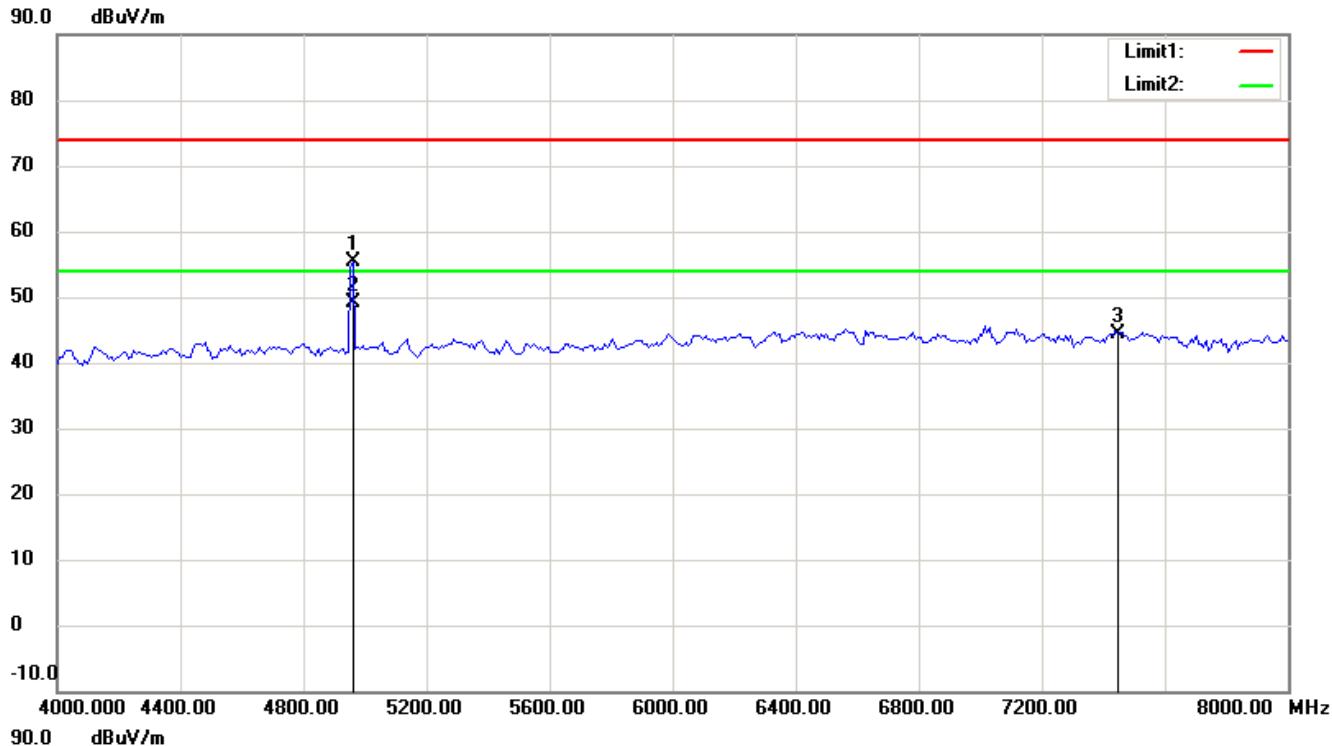
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Worldwide Testing Services(Taiwan) Co., Ltd.

Registration number: W6M21410-14537-C-1

FCC ID: Y8Y-T2015



Up Line: Peak Limit Line; Down Line: Ave Limit Line

Note:

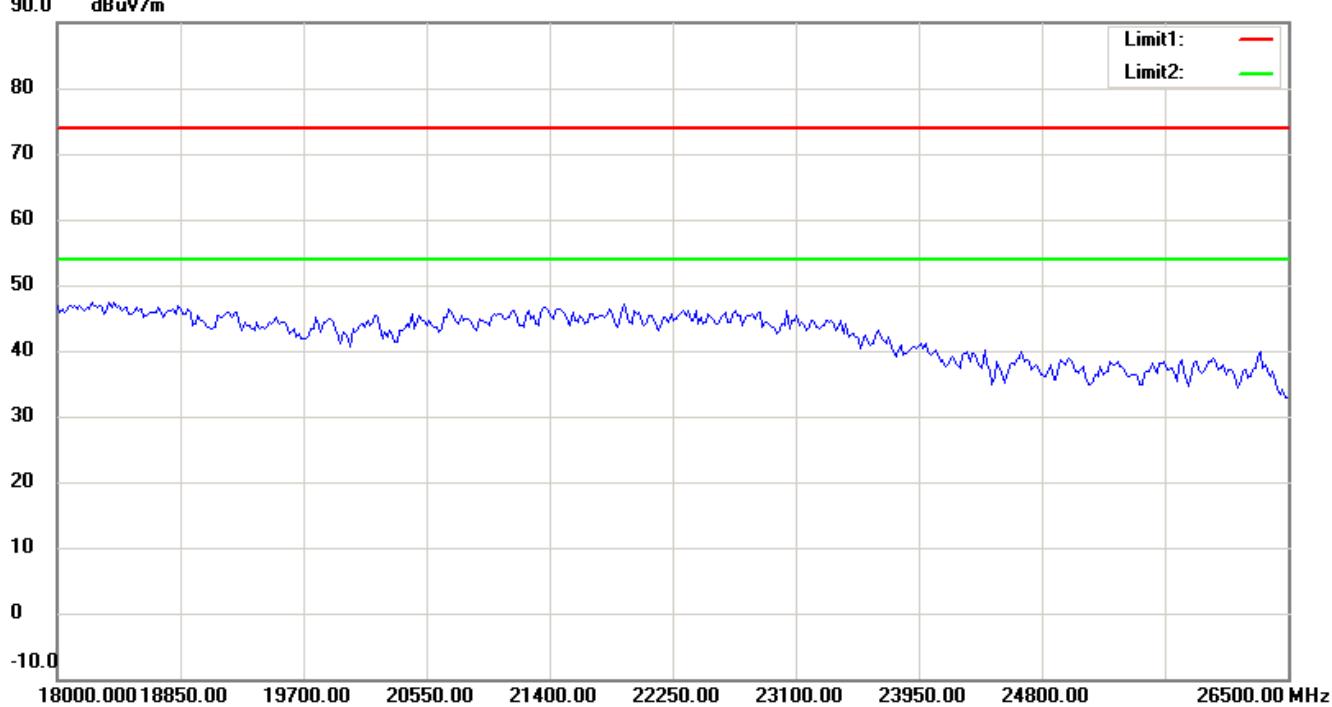
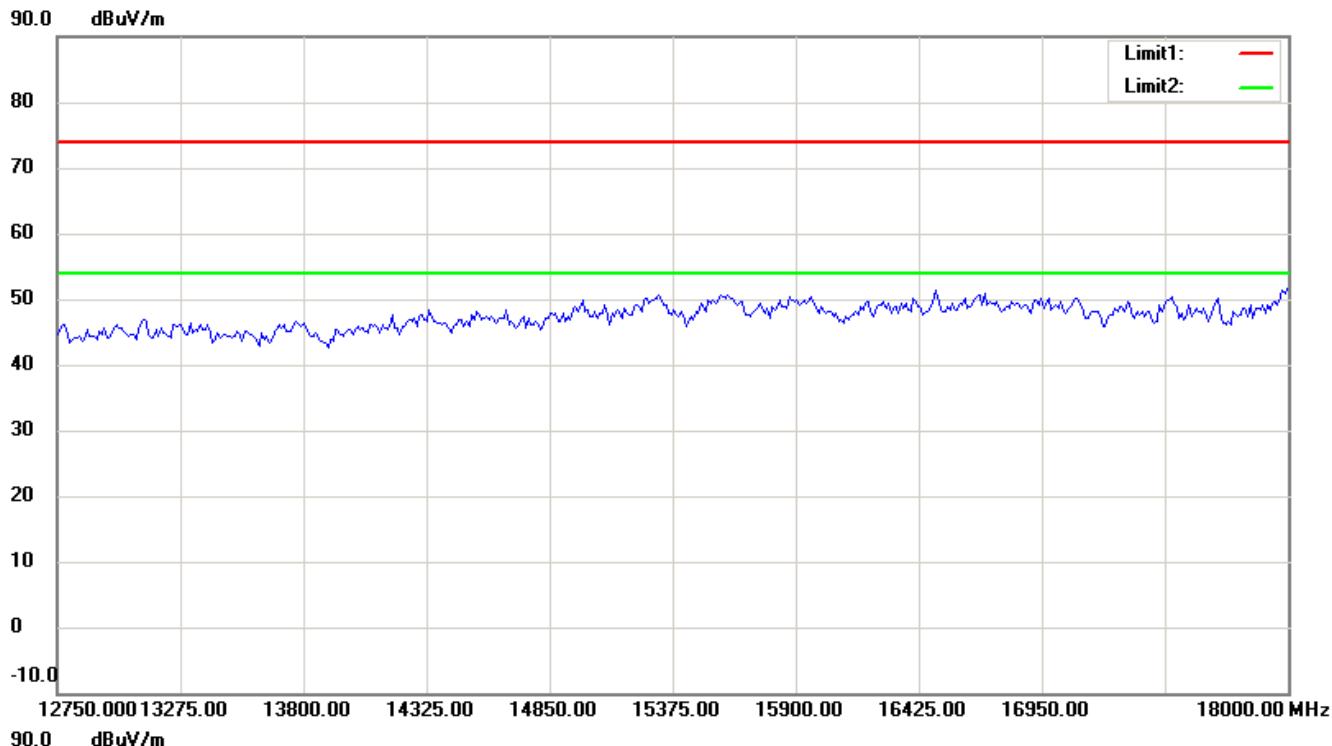
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FCC ID: Y8Y-T2015



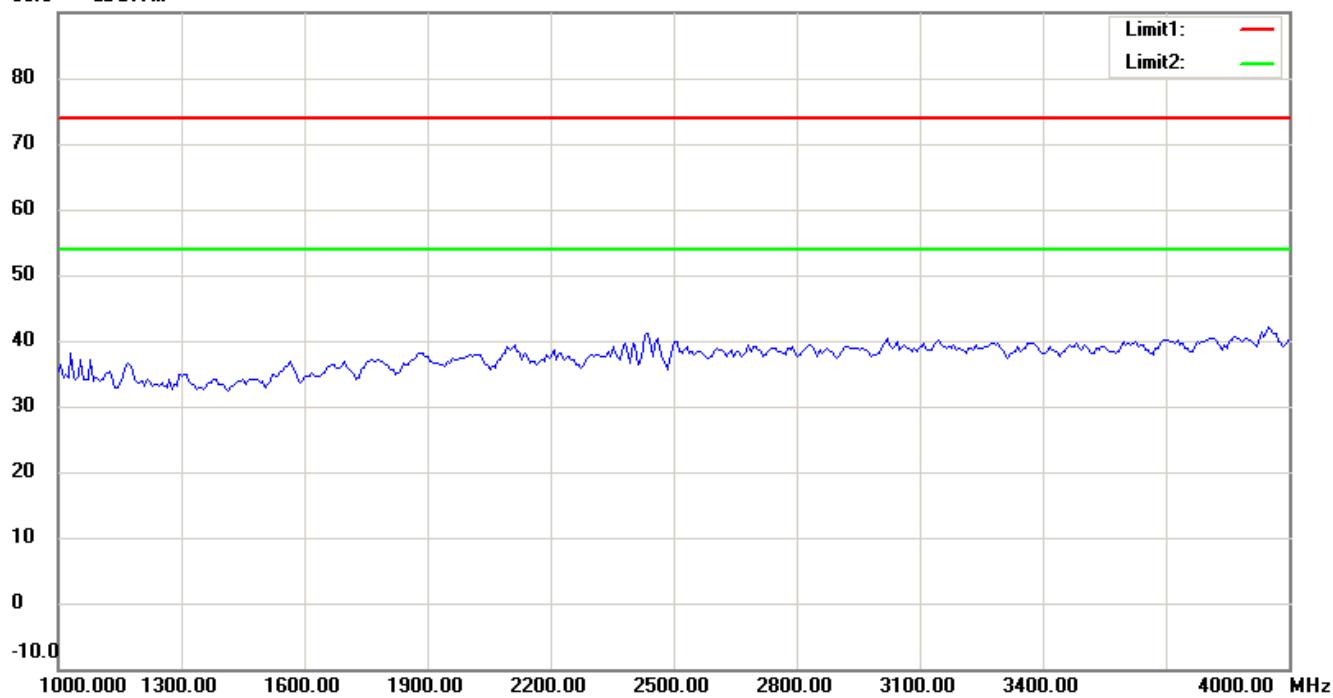
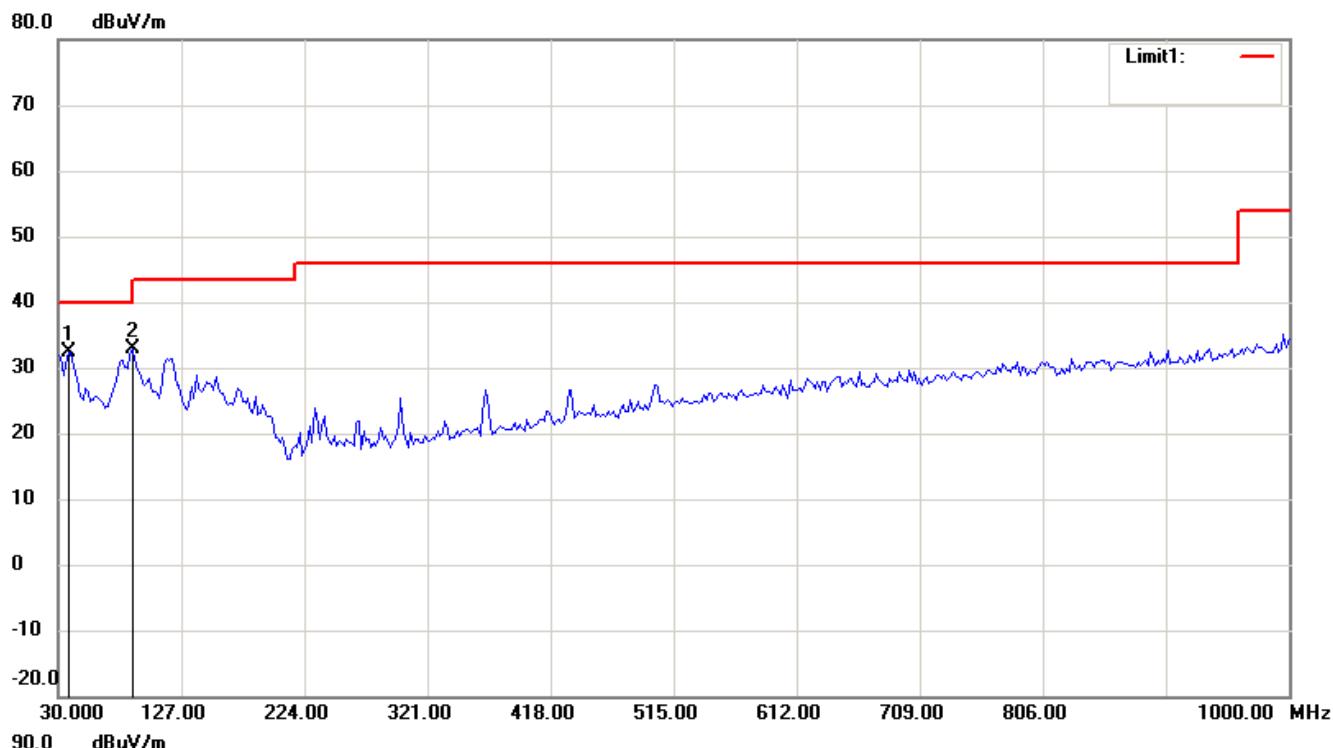
Up Line: Peak Limit Line; Down Line: Ave Limit Line

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Registration number: W6M21410-14537-C-1
 FCC ID: Y8Y-T2015

Antenna Polarization V



Up Line: Peak Limit Line; Down Line: Ave Limit Line

Note:

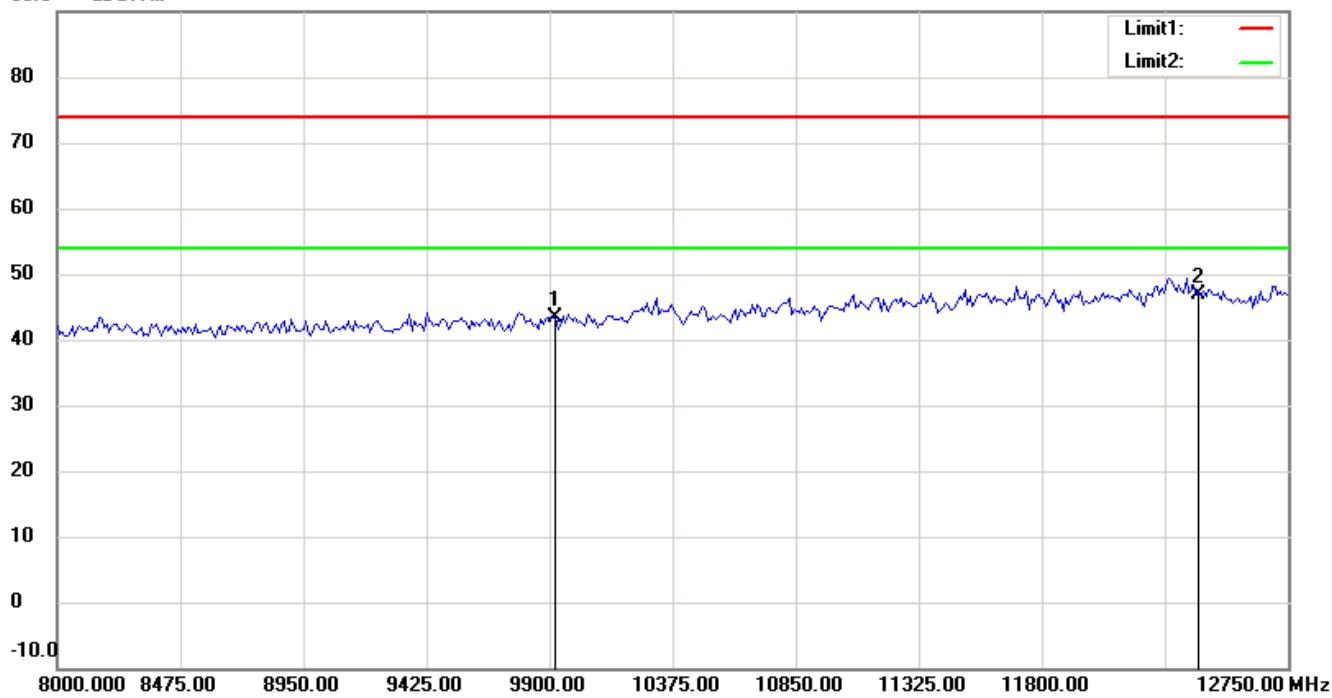
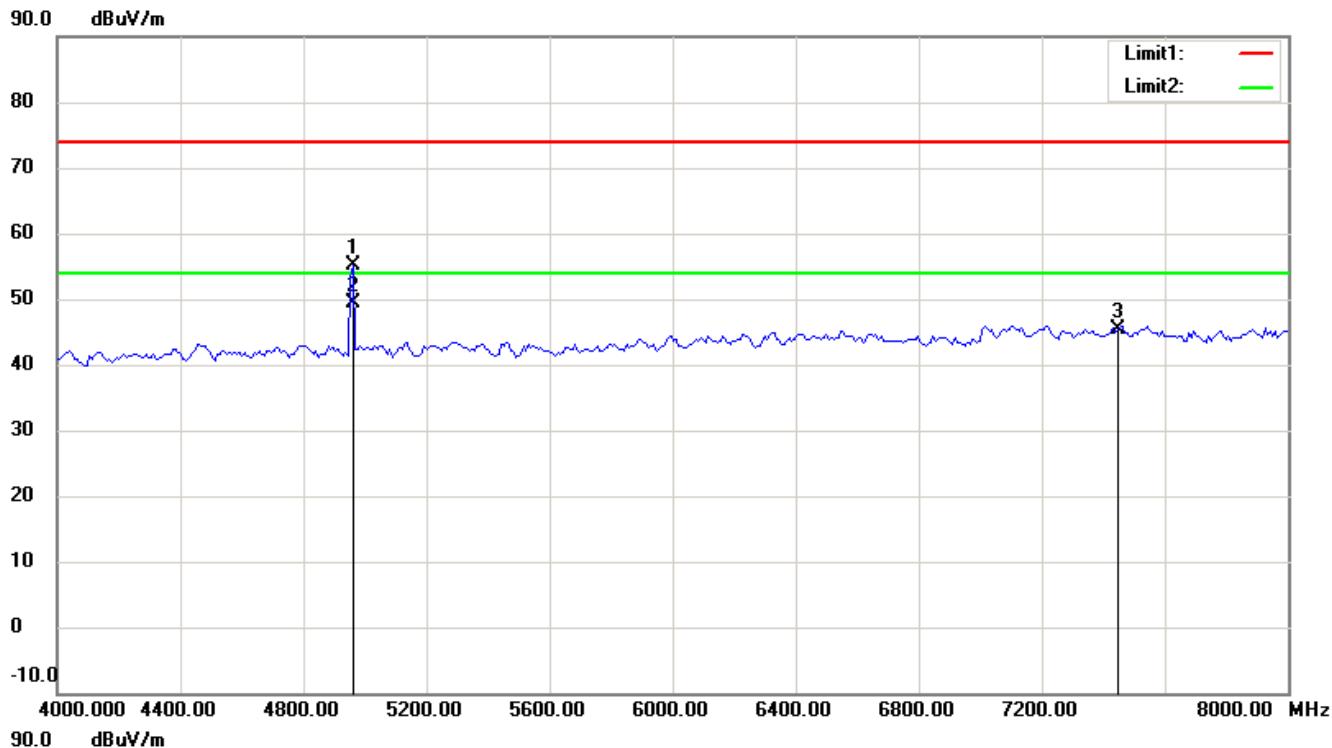
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Registration number: W6M21410-14537-C-1

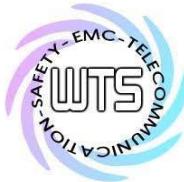
FCC ID: Y8Y-T2015



Up Line: Peak Limit Line; Down Line: Ave Limit Line

Note:

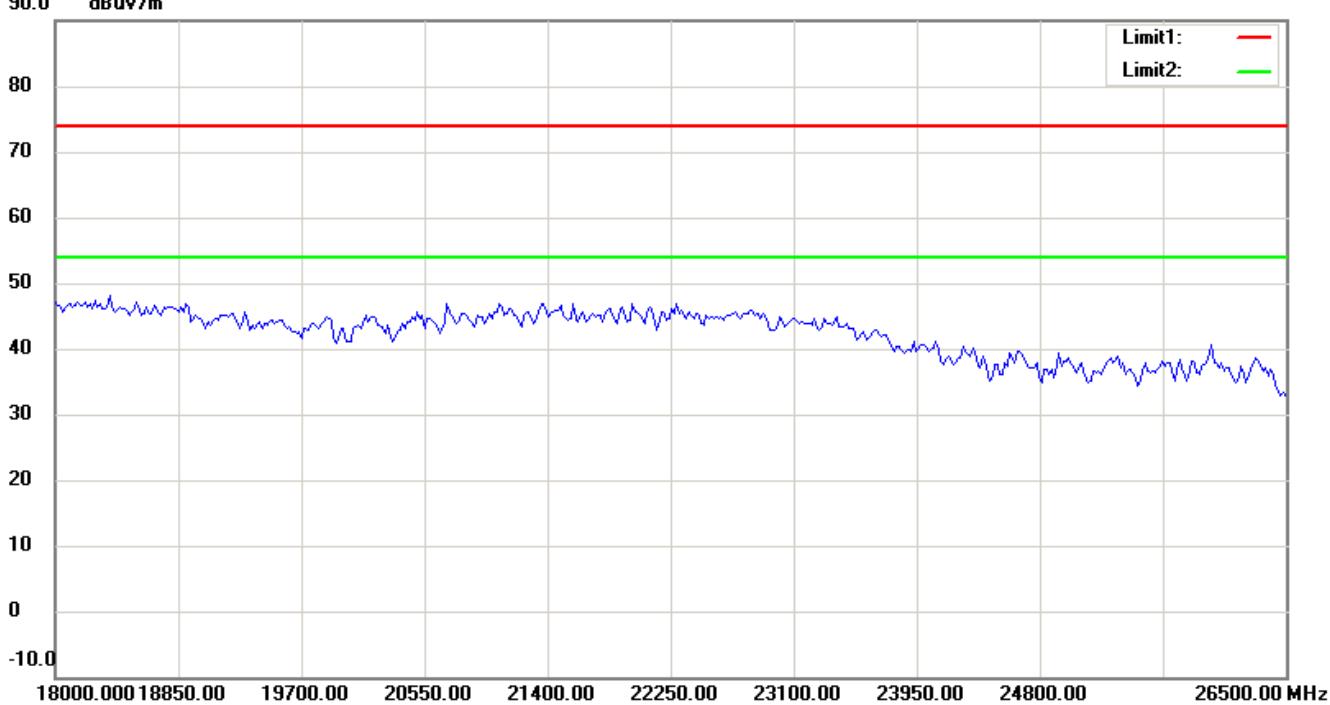
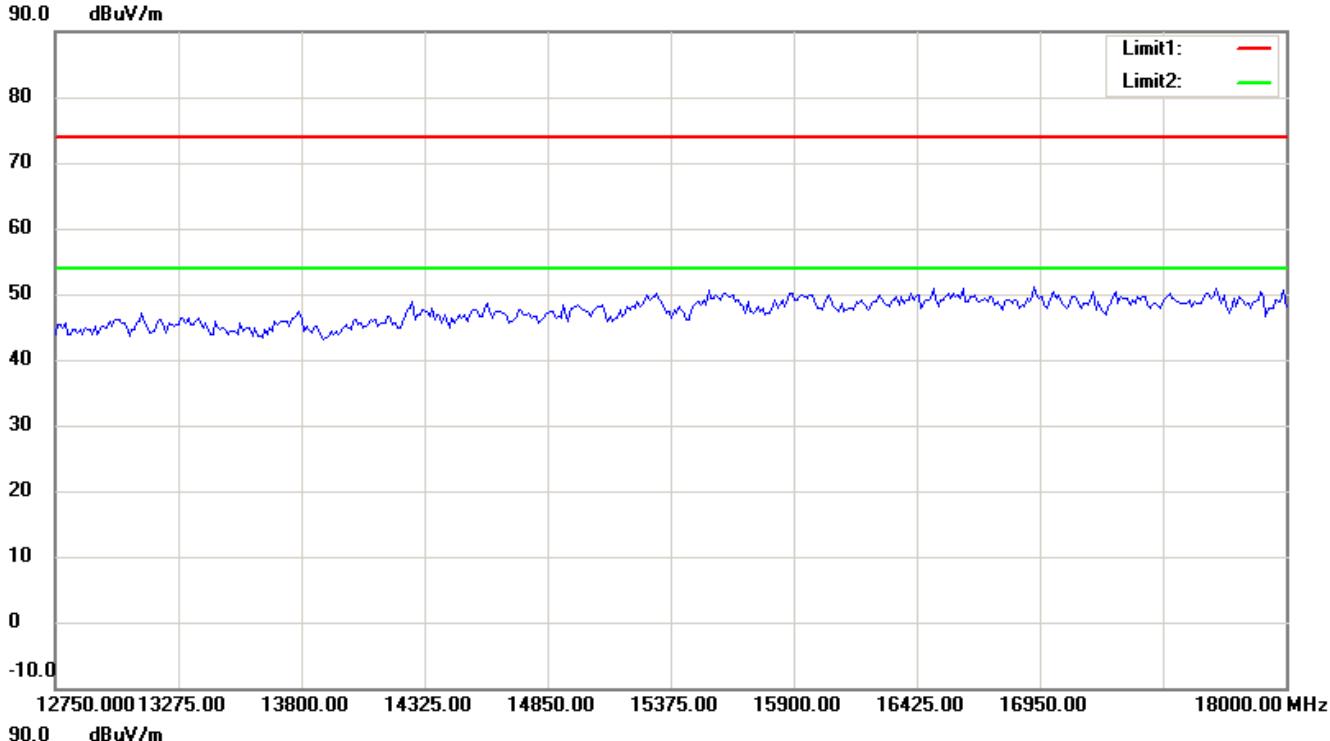
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Registration number: W6M21410-14537-C-1

FCC ID: Y8Y-T2015



Up Line: Peak Limit Line; Down Line: Ave Limit Line

Note:

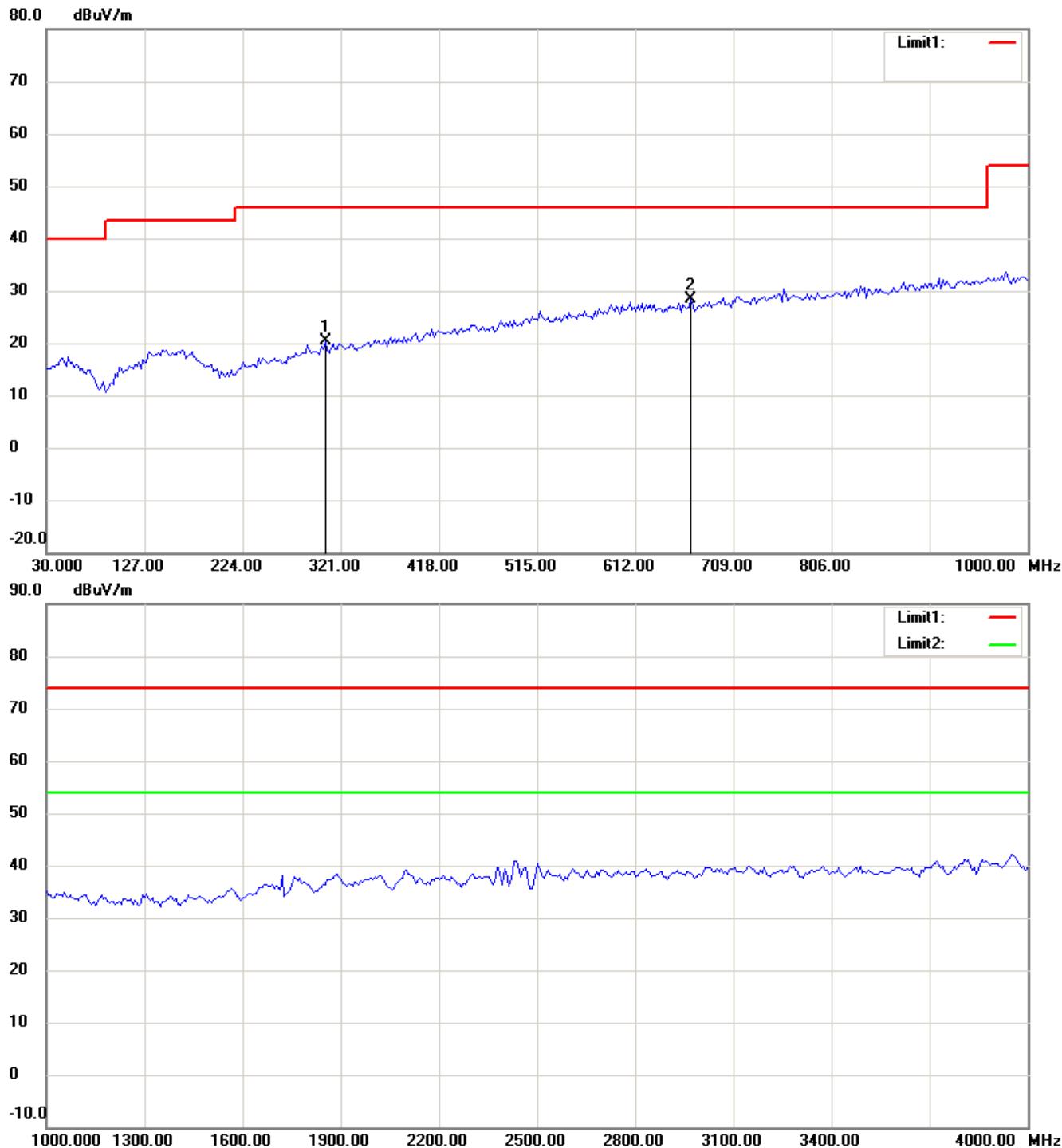
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Registration number: W6M21410-14537-C-1

FCC ID: Y8Y-T2015

ANT+ 2457 MHz

Antenna Polarization H



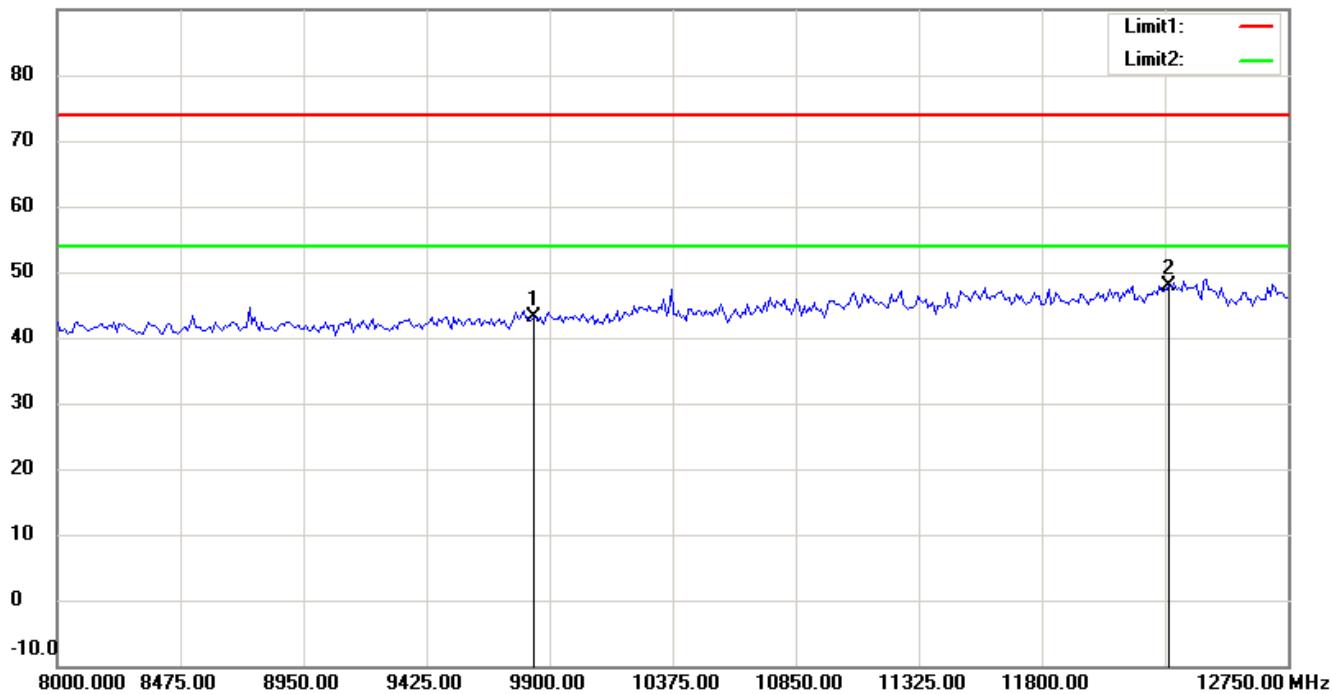
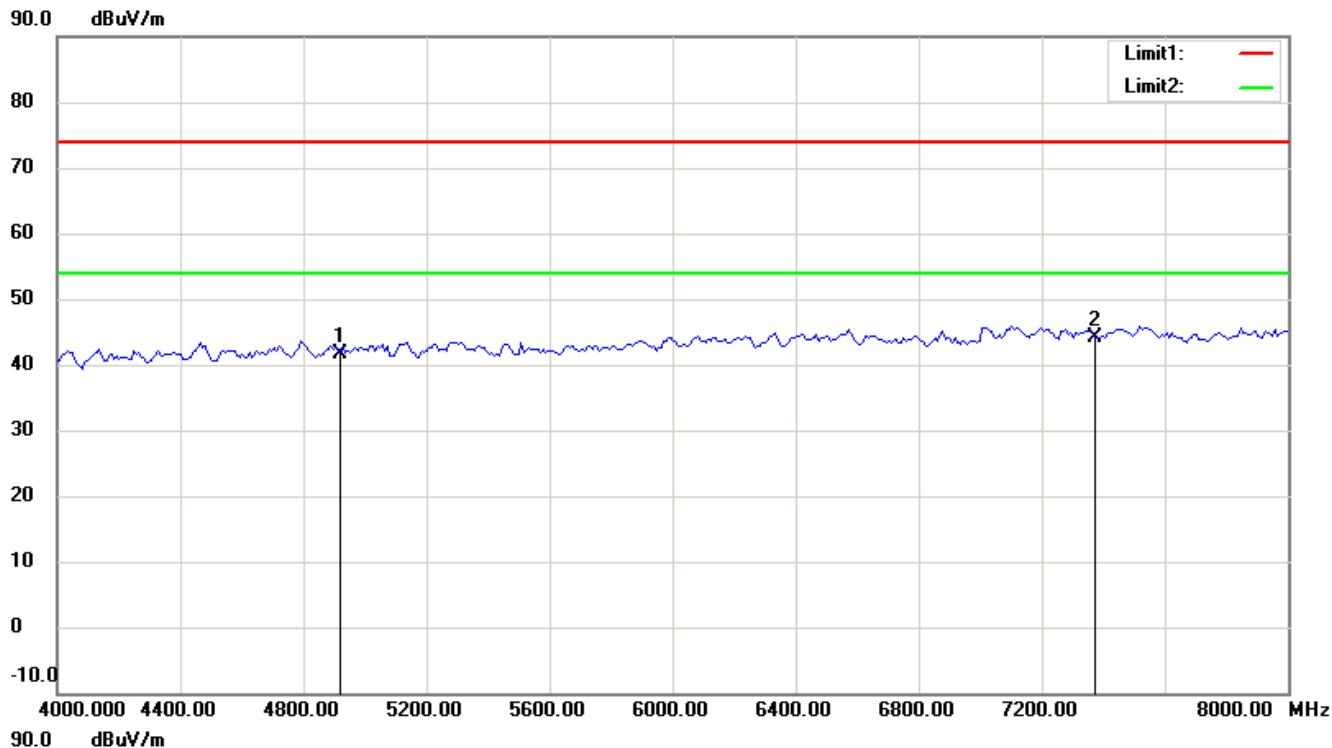
Up Line: Peak Limit Line; Down Line: Ave Limit Line

Note:

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Registration number: W6M21410-14537-C-1

FCC ID: Y8Y-T2015



Up Line: Peak Limit Line; Down Line: Ave Limit Line

Note:

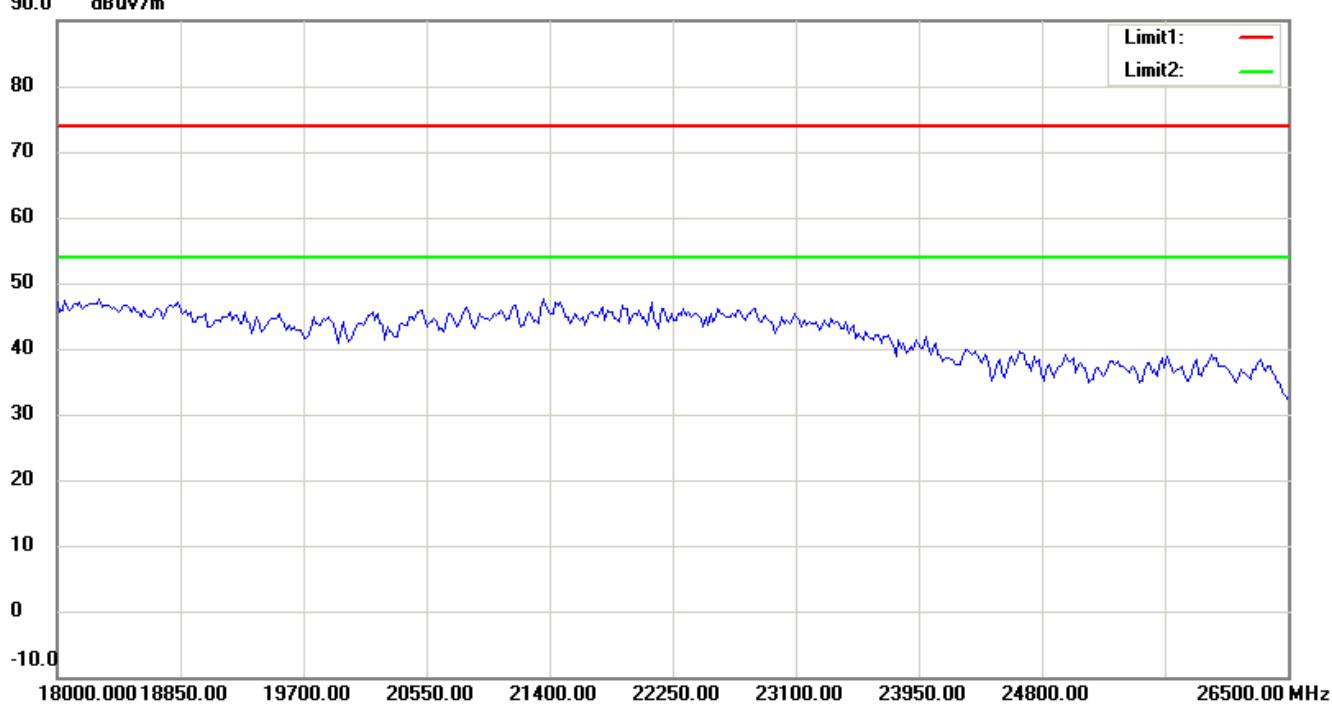
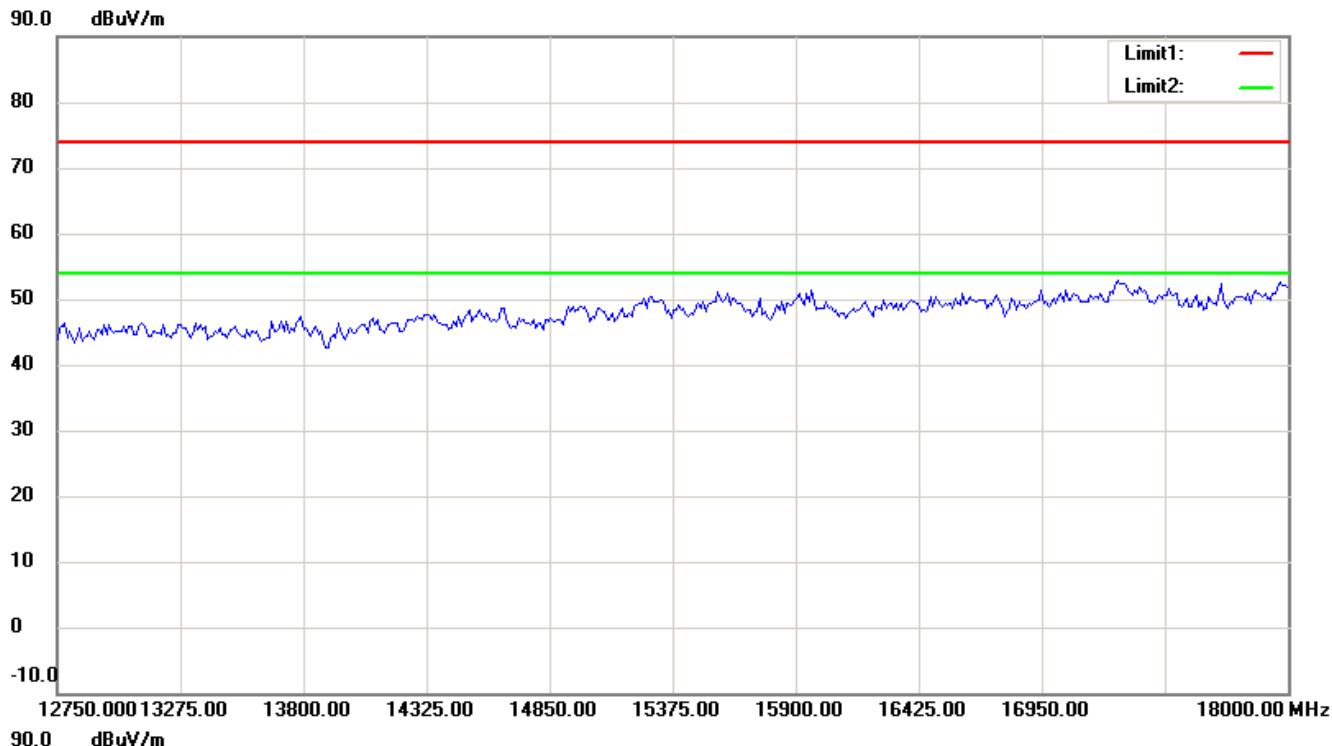
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Registration number: W6M21410-14537-C-1

FCC ID: Y8Y-T2015



Up Line: Peak Limit Line; Down Line: Ave Limit Line

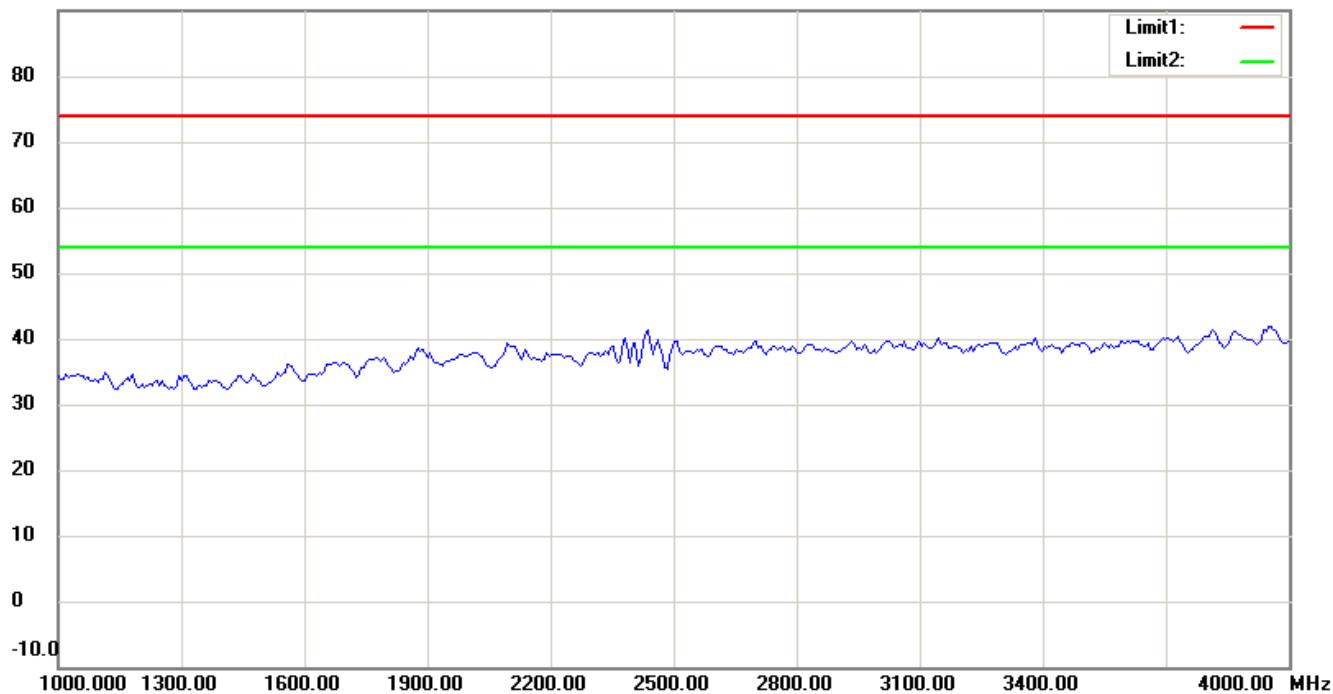
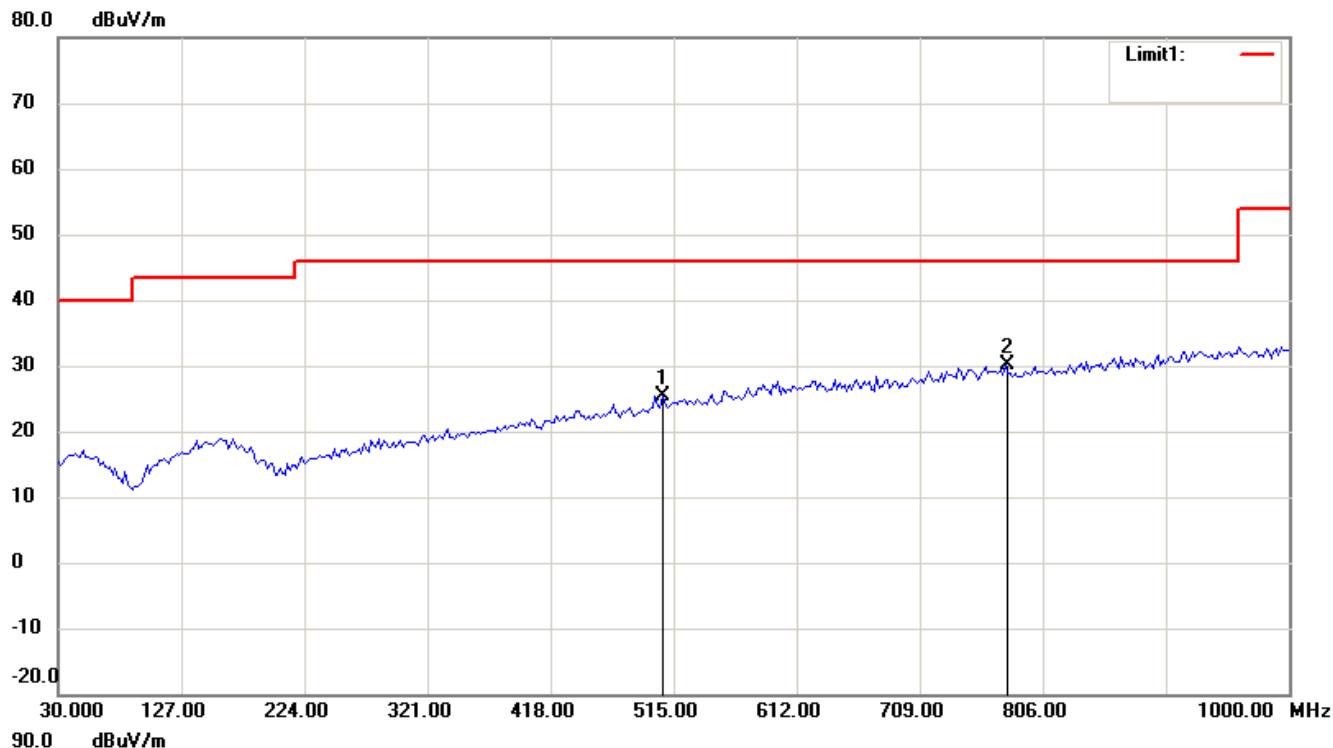
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FCC ID: Y8Y-T2015

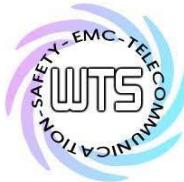
Antenna Polarization V



Up Line: Peak Limit Line; Down Line: Ave Limit Line

Note:

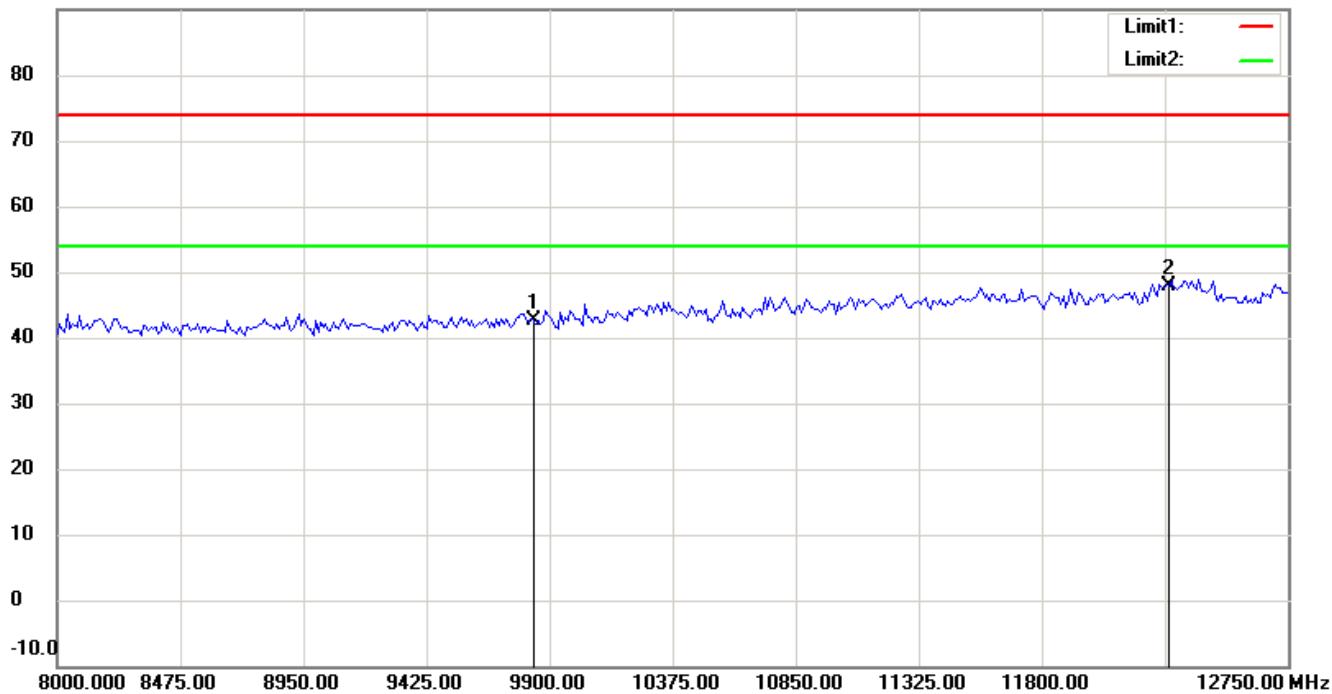
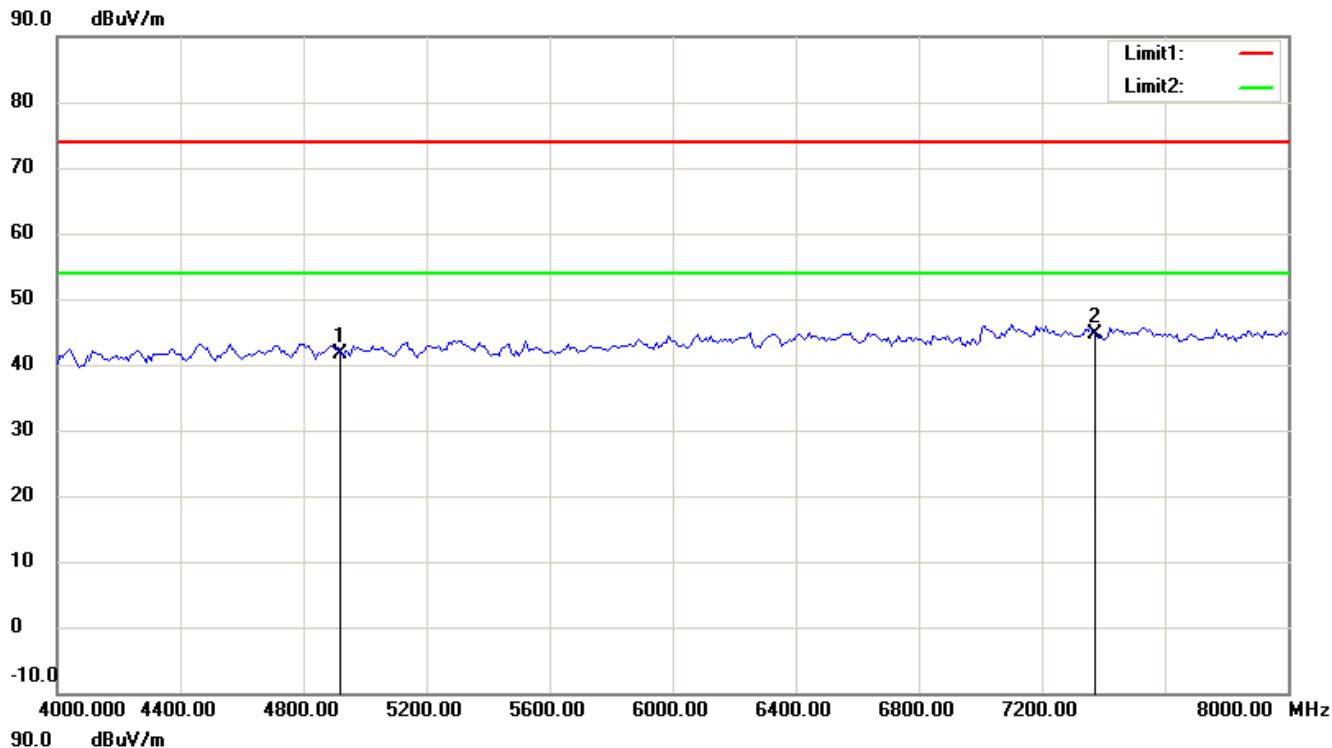
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Registration number: W6M21410-14537-C-1

FCC ID: Y8Y-T2015



Up Line: Peak Limit Line; Down Line: Ave Limit Line

Note:

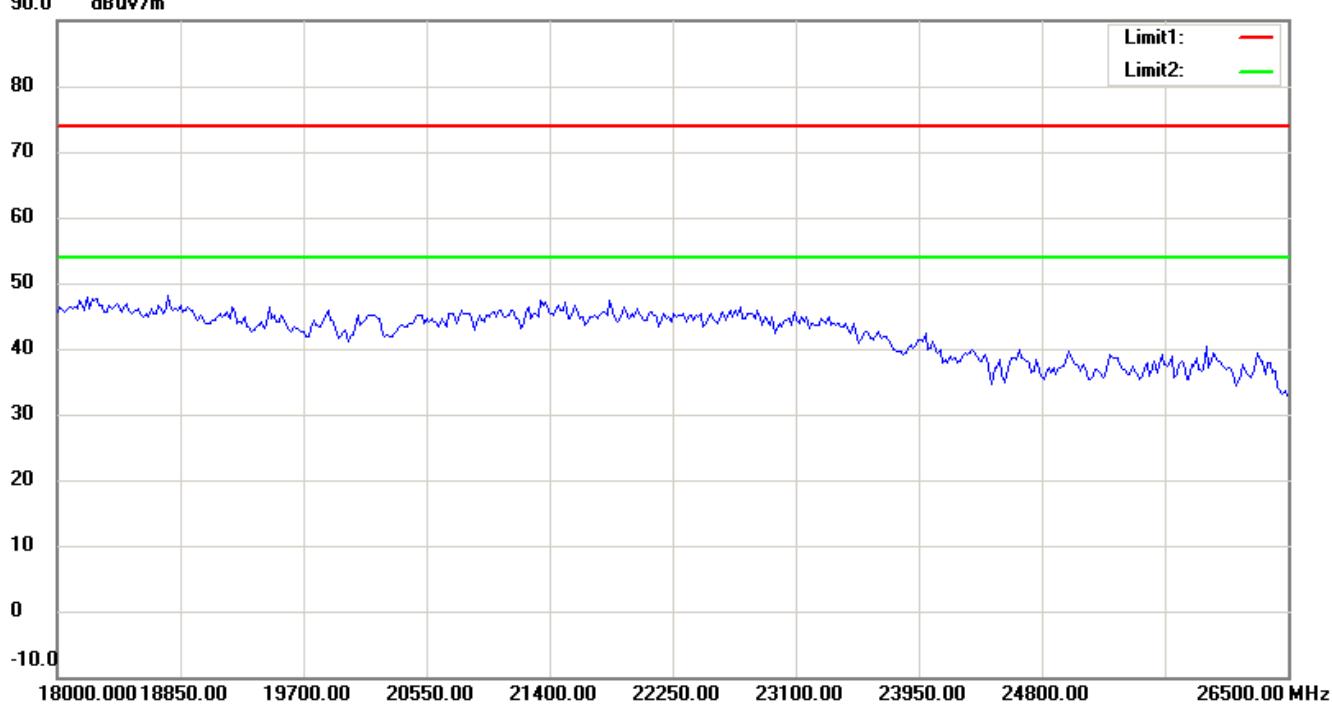
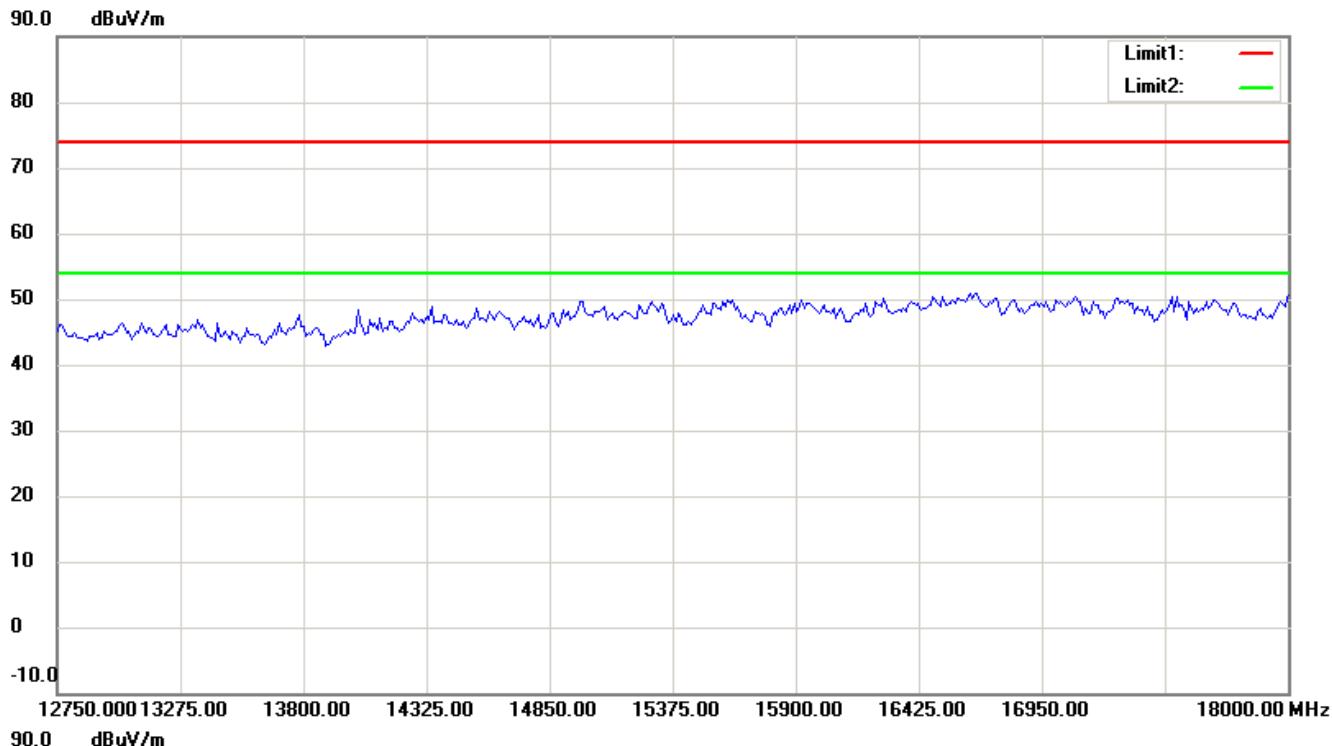
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