FCC 47 CFR PART 15 SUBPART C 15.247

TEST REPORT

FOR

Product Name: Transmission Line Monitoring Device

Model : TLS

Issued to

Xrun Co. Ltd.

2F., No.46, Tianshui Rd., Datong Dist., Taipei City 103, Taiwan (R.O.C.)

Issued by
WH Technology Corp.

EMC Test Site	**Xizhi Office and Lab**	**7F., No.262, Sec. 3, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)**

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1. GENERAL INFORMATION

Applicant	:	**Xrun Co. Ltd.**
Address	:	**2F., No.46, Tianshui Rd., Datong Dist., Taipei City 103, Taiwan (R.O.C.)**
Manufacturer	:	**Xrun Co. Ltd.**
Address	:	**2F., No.46, Tianshui Rd., Datong Dist., Taipei City 103, Taiwan (R.O.C.)**
EUT	:	**Transmission Line Monitoring Device**
Model Name	:	**TLS**
Model Differences	:	**N/A**

Is here with confirmed to comply with the requirements set out in the FCC Rules and Regulations Part 15 Subpart C and the measurement procedures were according to ANSI C63.10:2013. The said equipment in the configuration described in this report shows the maximum emission levels emanating from equipment are within the compliance requirements.

FCC part 15 subpart C

Receipt Date : 04/20/2017 Final Test Date : 02/05/2018

Tested By: **Reviewed by:**

Feb. 05, 2018 Bell Wei/ Engineer Feb. 05, 2018 Mike Lee / Manager

Date **Date**

Designation Number: TW2954

1.1 DESCRIPTION OF THE TESTED SAMPLES

EUT Name	:	Transmission Line Monitoring Device
Model Number	:	TLS
FCCID	:	2AOZCGWTCG0001
Receipt Date	:	04/20/2017
Input Voltage	:	DC Power
RF Output Power(e.i.r.p)	:	0.3 dBm
Power From	:	☐Inside ☑Outside ☑Adaptor ☐Battery ☐AC Power Source ☐DC Power Source ☐Support Unit PC
Operate Frequency	:	Refer to the channel list as described below (2405-2480 MHz)
Modulation Technique	:	O-QPSK
Number of Channels	:	16
Channel spacing	:	☐N/A ☑ 5 MHz
Operating Mode	:	☐Simplex ☑ Half Duplex
Antenna Type	:	Omni-directional, λ/4 Dipole
Channel bandwidth	:	5 MHz
Antenna gain		1.5 dBi

Channels	Frequencies (MHz)
11	2405
12	2410
13	2415
14	2420
15	2425
16	2430
17	2435
18	2440
19	2445
20	2450
21	2455
22	2460
23	2465
24	2470
25	2475
26	2480

1.2 LIST OF MEASUREMENTS AND EXAMINATIONS

FCC Rule	Description of Test	Result
15.203	Antenna Requirement	Pass
15.207	Conducted Emission	Pass
15.209	Radiated Emission	Pass
15.247(a)(1)	6dB Bandwidth	Pass
15.247(b)	Peak & Average Output Power	Pass
15.247(b)	Band Edges	Pass
15.247(b)	Power Spectral Density	Pass

2. TEST METHODOLOGY

All testing as described bellowed were performed in accordance with ANSI CC63.10:2013 and FCC CFR 47 Part 15 Subpart C.

2.1 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on a wood table, which is at 0.8 m above ground plane acceding to clause 15.207 and requirements of ANSI CC63.10:2013. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz are using CISPR Quasi-Peak / Average detectors.

Radiated Emissions

The EUT is a placed on a turn table, which is 0.8 m above ground plane. The turntable was rotated through 360 degrees to determine the position of maximum emission level. The EUT is placed at 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

1) Putting the EUT on the platform and turning on the EUT (on/off button on the bottom of the EUT).
2) Setting test channel described as “Channel setting and operating condition”, and testing channel by channel.
3) For the maximum output power measurement, we followed the method of measurement KDB558074 D01.
4) For the spurious emission test based on ANSI(2014), at the frequency where below 1GHz
   used quasi-peak detector mode; where above 1GHz used the peak and average detector mode. IF the peak value may be under average limit, the average mode will not be performed.

2.2 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110 10.495 – 0.505 2.1735 – 2.1905 4.125 – 4.128 4.17725 – 4.17775 4.20725 – 4.20775 6.215 – 6.218 6.26775 – 6.26825 6.31175 – 6.31225 8.291 – 8.294 8.362 – 8.366 8.37625 – 8.38675 8.41425 – 8.41475 12.29 – 12.293 12.51975 – 12.52025 12.57675 – 12.57725 13.36 – 13.41	16.42 – 16.423 16.69475 – 16.69525 16.80425 – 16.80475 25.5 – 25.67 37.5 – 38.25 73 – 74.6 74.8 – 75.2 108 – 121.94 123 – 138 149.9 – 150.05 156.52475 – 156.52525 156.7 – 156.9 162.0125 – 167.17 167.72 – 173.2 240 – 285 322 – 335.4	399.9 – 410 608 – 614 960 – 1240 1300 – 1427 1435 – 1626.5 1645.5 – 1646.5 1660 – 1710 1718.8 – 1722.2 2200 – 2300 2310 – 2390 2483.5 – 2500 2655 – 2900 3260 – 3267 3332 – 3339 3345.8 – 3358 3600 – 4400	4.5 – 5.15 5.35 – 5.46 7.25 – 7.75 8.025 – 8.5 9.0 – 9.2 9.3 – 9.5 10.6 – 12.7 13.25 – 13.4 14.47 – 14.5 15.35 – 16.2 17.7 – 21.4 22.01 – 23.12 23.6 – 24.0 31.2 – 31.8 36.43 – 36.5 ([2])

1 Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

2 Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

2.3 DESCRIPTION OF TEST MODES

The EUT was tested under following modes:

Modes:

1. **Continuous transmitting**

Channels:

1. **2.405GHz (**Lowest Channel**)**
2. **2.445GHz (**Middle Channel**)**
3. **2.480GHz (**Highest Channel**)**

2.4 DESCRIPTION OF THE SUPPORT EQUIPMENTS

Setup Diagram

See test photographs attached in appendix 1 for the actual connections between EUT and support equipment.

Support Equipment

Peripherals Devices:

OUTSIDE SUPPORT EQUIPMENT							
No.	Equipment	Model	Serial No.	FCC ID/ BSMI ID	Trade name	Data Cable	Power Cord
1.	Notebook	HSTNN-Q95C	5CD5514J LJ	R3A304	HP	N/A	Unshielded 1.8m

Note: All the above equipment /cable were placed in worse case position to maximize emission signals during emission test

Grounding: Grounding was in accordance with the manufacturer's requirement and conditions for the intended use.

3. TEST AND MEASUREMENT EQUIPMENT

3.1 CALIBRATION

The measuring equipment utilized to perform the tests documented in the report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

3.2 EQUIPMENT

The following list contains measurement equipment used for testing. The equipment conforms to the requirement of CISPR 16-1, ANSI C63.2 and. Other required standards.

Calibration of all test and measurement, including any accessories that may effect such calibration, is checked frequently to ensure the accuracy. Adjustments are made and correction factors are applied in accordance with the instructions contained in the respective.

Table List of Test and Measurement Equipment

Test Site	Instrument	Manufacturer	Model No.	S/N	Next Cal. Date
Conduction	Power Meter	Anritsu	ML2487A	6K00003893	2018/8/1
	High Accuracy Sensor	Anritsu	MA2444A	1295	2018/8/1
	Receiver	R&S	ESHS10	830223/008	2018/05/22
	Spectrum (9K--3GHz)	R&S	FSP3	833387/010	2018/09/20
	L.I.S.N	Rolf Heine Hochfrequenztechnik	NNB-2/16z	98062	2018/05/25
	ISN	Schwarzbeck	8-Wire ISN CAT5	CAT5-8158-0094	2018/09/21
	RF Cable	N/A	N/A	EMI-3	2018/10/19
Radiation	Bilog antenna (30M-1G)	ETC	MCTD2786B	BLB16M04004/JB-5-004	2018/05/03
	Double Ridged Guide Horn antenna(1G-18G)	ETC	MCTD 1209	DRH15N0 2009	2017/11/23
	Horn antenna (18G-26G)	com-power	AH-826	81000	2018/08/15
	LOOP Antenna (Below 30M)	com-power	AL-130	17117	2018/10/04
	Pre amplifier (30M-1G)	EMC INSTRUMENT	EMC9135	980334	2018/05/04
	Microwave Preamplifier (1G-18G)	EMC INSTRUMENT	EMC051845	980108	2018/10/23
	Pre amplifier (18G~26G)	MITEQ	JS4-18002600-30-5A	808329	2018/08/10
	RF Cable (30M~1G)	EMCI	N male on end of both sides (EMI4)	30m	2018/10/19
	RF CABLE (1~26G) (output)	HARBOUT INDUSTRIES	LL142MI (4M+4M)	N/A	2018/03/08

	RF CABLE (1~26G) (input)	HARBOUR INDUSTRIES	LL142MI (7M)	N/A	2018/08/11
	Receiver	R&S	ESVS30	826006/002	2017/11/28
	Spectrum Analyzer	AGILENT	8564EC	4046A0032	2018/03/01
	TRUE RMS MULTIMETER	VICTOR	VC9805A	991890136	2018/08/18

- **CALIBRATION INTERVAL OF INSTRUMENTS LISTED ABOVE IS ONE YEAR**

4. ANTENNA REQUIREMENTS

4.1 STANDARD APPLICABLE

For intentional device, according to FCC 47 CFR Section 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.

And according to FCC 47 CFR Section 15.247(b), if transmitting antennas of direction gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

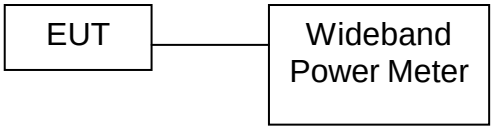
4.2 ANTENNA CONSTRUCTION AND DIRECTIONAL GAIN

Antenna type: Omni-directional, λ/4 Dipole

Antenna Gain: 1.5 dBi

5. PEAK OUTPUT POWER

5.1 TEST SETUP



5.2 LIMIT

The maximum peak output power of the intentional radiator shall not exceed the following:

1. According to § 15.247(b)(3) , for systems using digital modulation in the bands of 902 – 928 MHz , 2400 – 2483.5 MHz: 1 Watt.
2. According to § 15.247(b)(4) , the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section , if transmitting antennas of directional gain greater than 6 dBi are used , the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) , (b)(2) , and (b)(3) of this section , as appropriate , by the amount in dB that directional gain of the antenna exceeds 6 dBi.

5.3 TEST PROCEDURE

1. Peak power is measured using the wideband power meter.
2. Power is integrated over a bandwidth greater than or equal to the 99% bandwidth.

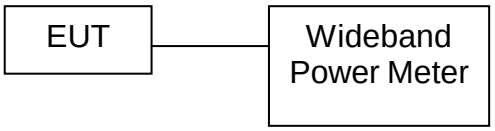
5.4 TEST RESULT: PASSED

5.5 TEST DATA:

Channel No.	Frequency (MHz)	Measurement Level (dBm)	Required Limit (dBm)	Result
11	2405	-1.20	＜30 dBm	PASS
19	2445	-1.57	＜30 dBm	PASS
26	2480	-2.01	＜30 dBm	PASS

6. AVERAGE POWER

6.1 TEST SETUP



6.2 LIMIT

None ; for reporting purposes only.

6.3 TEST PROCEDURE

The transmitter output is connected to the Power Meter. The Power Meter is set to the average power detection.

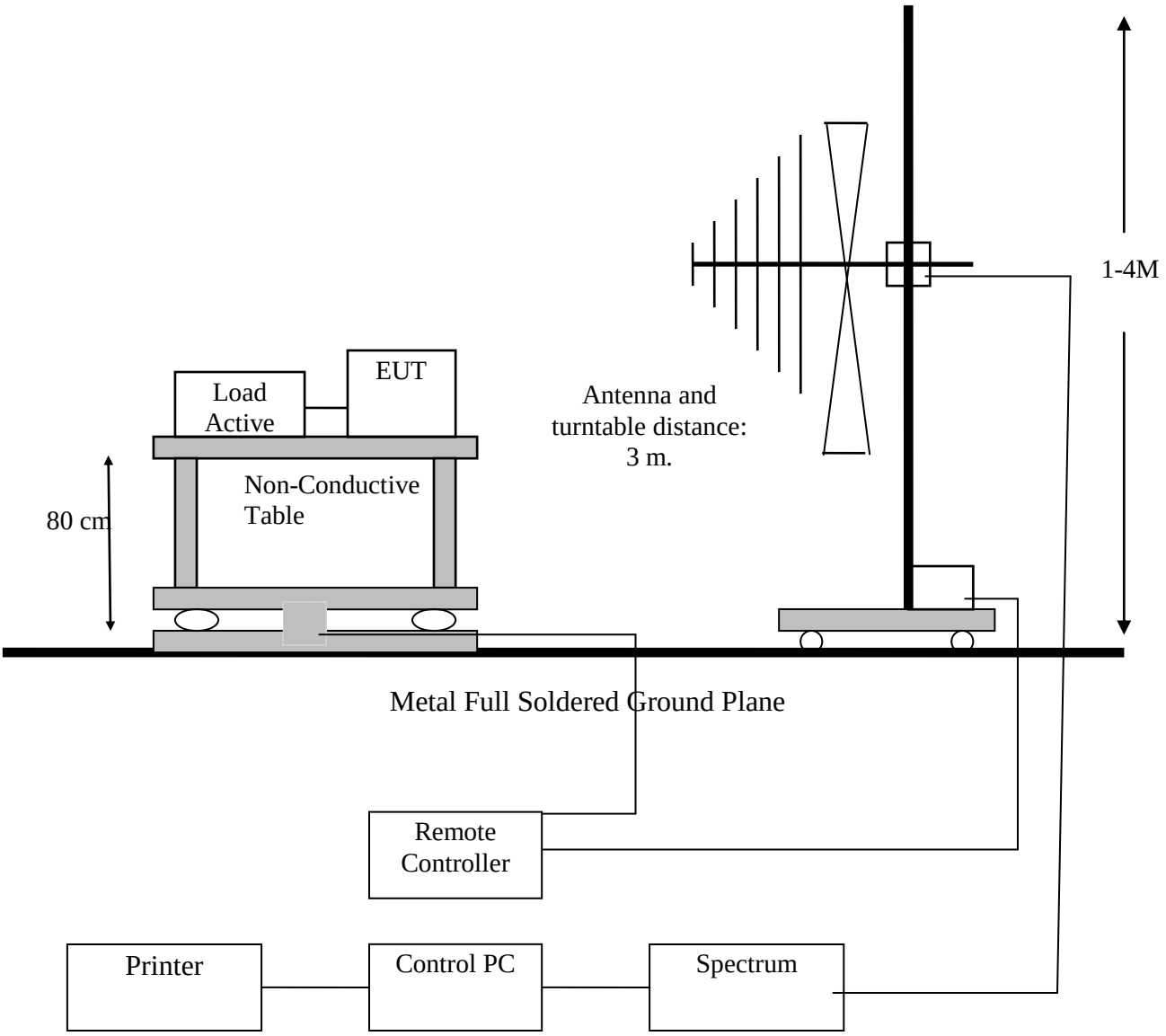
6.4 TEST RESULT: PASSED

6.5 TEST DATA:

Channel No.	Frequency (MHz)	Measurement Level (dBm)	Required Limit (dBm)	Result
11	2405	-1.52	＜30 dBm	PASS
19	2445	-1.90	＜30 dBm	PASS
26	2480	-2.38	＜30 dBm	PASS

7. BAND EDGE

7.1 TEST SETUP



7.2 LIMIT

Restricted Bands:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

Operation within the bands:
902 - 928 MHz, 2400 - 2483.5 MHz, 5725 - 5875 MHz, and 24.0 - 24.25 GHz.

Frequency (Hz)	Field Strength (µV/m at 3-meter)	Field Strength (dBµV/m at 3-meter)
1.705-30	30 (at 30-meter)	69.54
30-88	100	40
88-216	150	43
216-960	200	46
Above 960	500	54

7.3 RESULT: PASSED

7.4 TEST DATA:

Channel 11										Fundamental Frequency: 2405 MHz
Frequency (MHz)	Ant-Pol H/V	Meter Reading (dBuV)	Corrected Factor (dB)	Result (dBuV/m)	Remark	Limit (dBuV/m)		Margin (dB)	Table Deg.	Ant High (m)
						Peak	Ave			
2384.80	H	63.77	-16.72	47.05	Peak	74	54	-26.95	0	1.00
---	H	---	---	---	Ave	74	54	---	---	---
2385.00	V	61.30	-16.72	44.58	Peak	74	54	-29.42	360	1.00
---	V	----	---	---	Ave	74	54	---	---	---
Channel 26										Fundamental Frequency: 2480 MHz
Frequency (MHz)	Ant-Pol H/V	Meter Reading (dBuV)	Corrected Factor (dB)	Result (dBuV/m)	Remark	Limit (dBuV/m)		Margin (dB)	Table Deg.	Ant High (m)
						Peak	Ave			
2483.50	H	62.31	-16.45	45.86	Peak	74	54	-28.14	0	1.00
---	H	---	---	---	Ave	74	54	---	---	---
2483.50	V	63.11	-16.45	46.66	Peak	74	54	-27.34	360	1.00
---	V	---	---	---	Ave	74	54	---	---	---

Note:

1. Emission level = Reading level + Correction factor
2. Correction factor : Antenna factor, Cable loss, Pre-Amp, etc.
3. All emissions as described above were determining by rotating the EUT through three orthogonal axes to maximizing the emissions if the EUT belongs to hand-held or body-worn devices.
4. Measurements above 1000 MHz, Peak detector setting:
   1 MHz RBW with 1 MHz VBW (Peak Detector).
5. Measurements above 1000 MHz, Average detector setting:
   1 MHz RBW with 1 MHz VBW (RMS Detector).
6. Peak detector measurement data will represent the worst case results.

8. 6DB BANDWIDTH

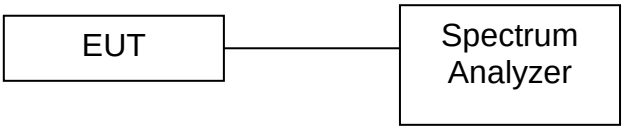
8.1 TEST LIMIT

According to 15.247(a)(2), systems using digital modulation techniques may operate in the 902-928, 2400-2483.5 MHz, and 5725-5820 MHz bands. The minimum 6dB bandwidth shall be least 500 kHz.

8.2 TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
3. Set the spectrum analyzer as RBW=100kHz, VBW=300kHz, Span=Base mode, Sweep Time= auto.
4. Mark the peak frequency and -6dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

8.3 TEST SETUP LAYOUT

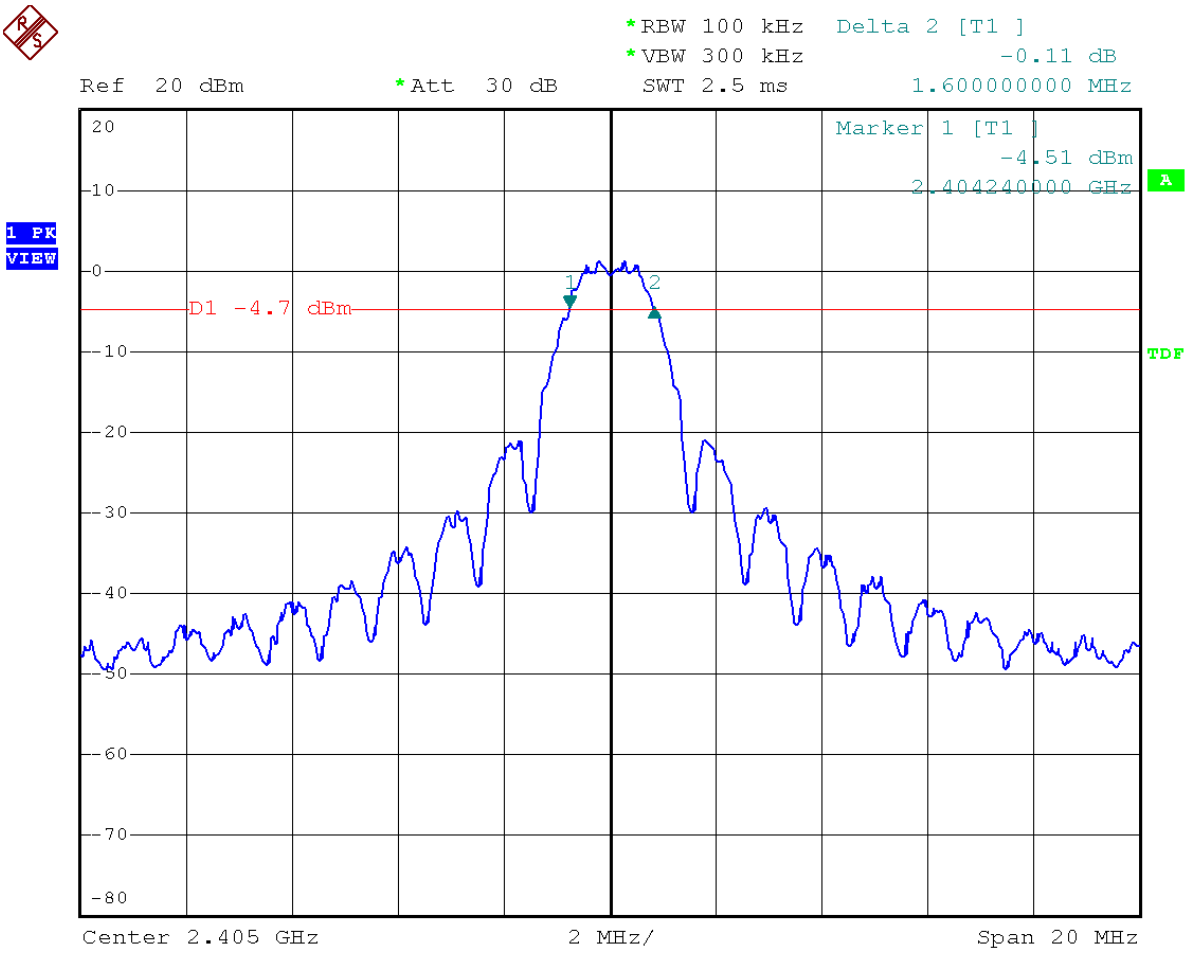


8.4 TEST RESULT AND DATA

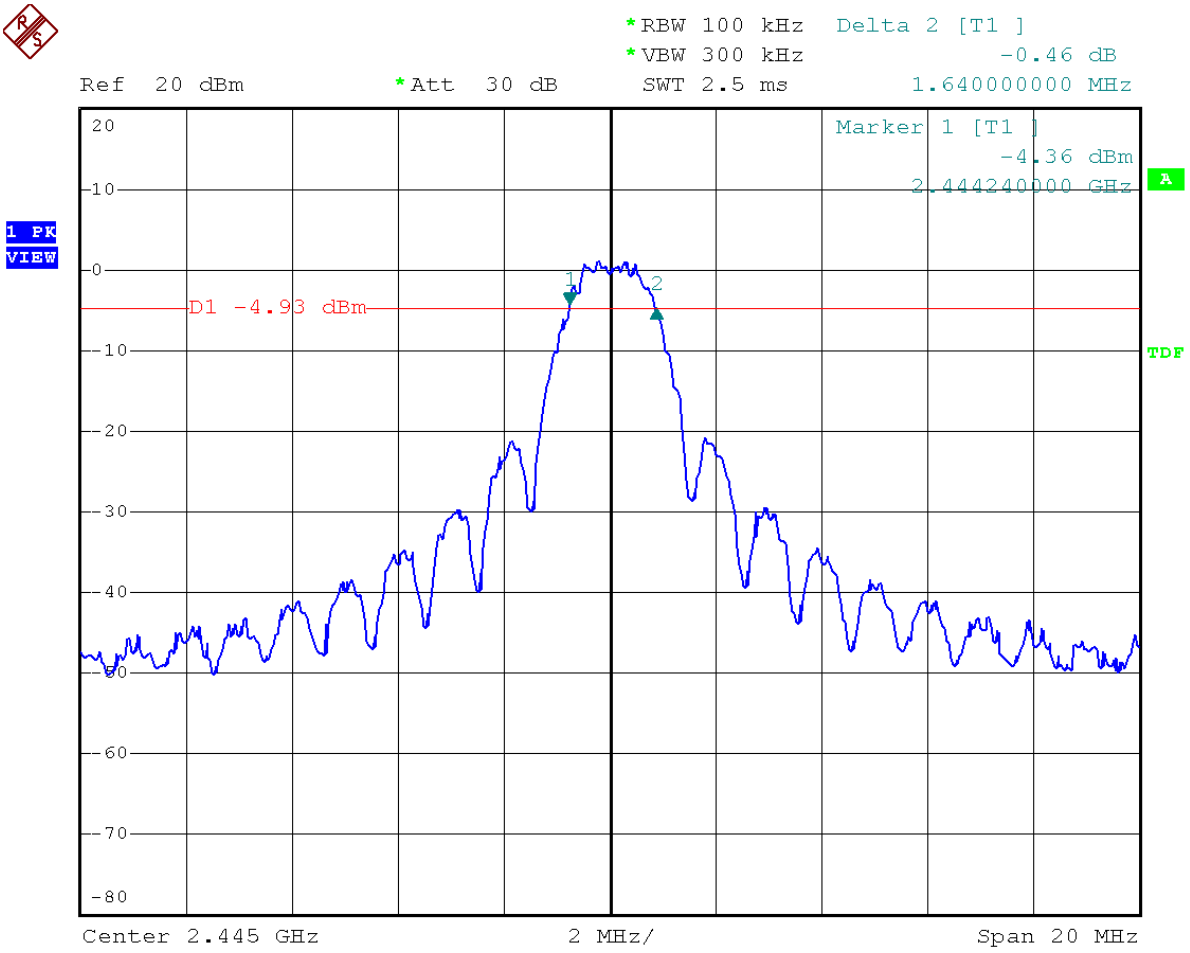
Channel	Frequency (MHz)	6dB Bandwidth (MHz)
11	2405	1.60
19	2445	1.64
26	2480	1.64

8.5 TEST DATA:

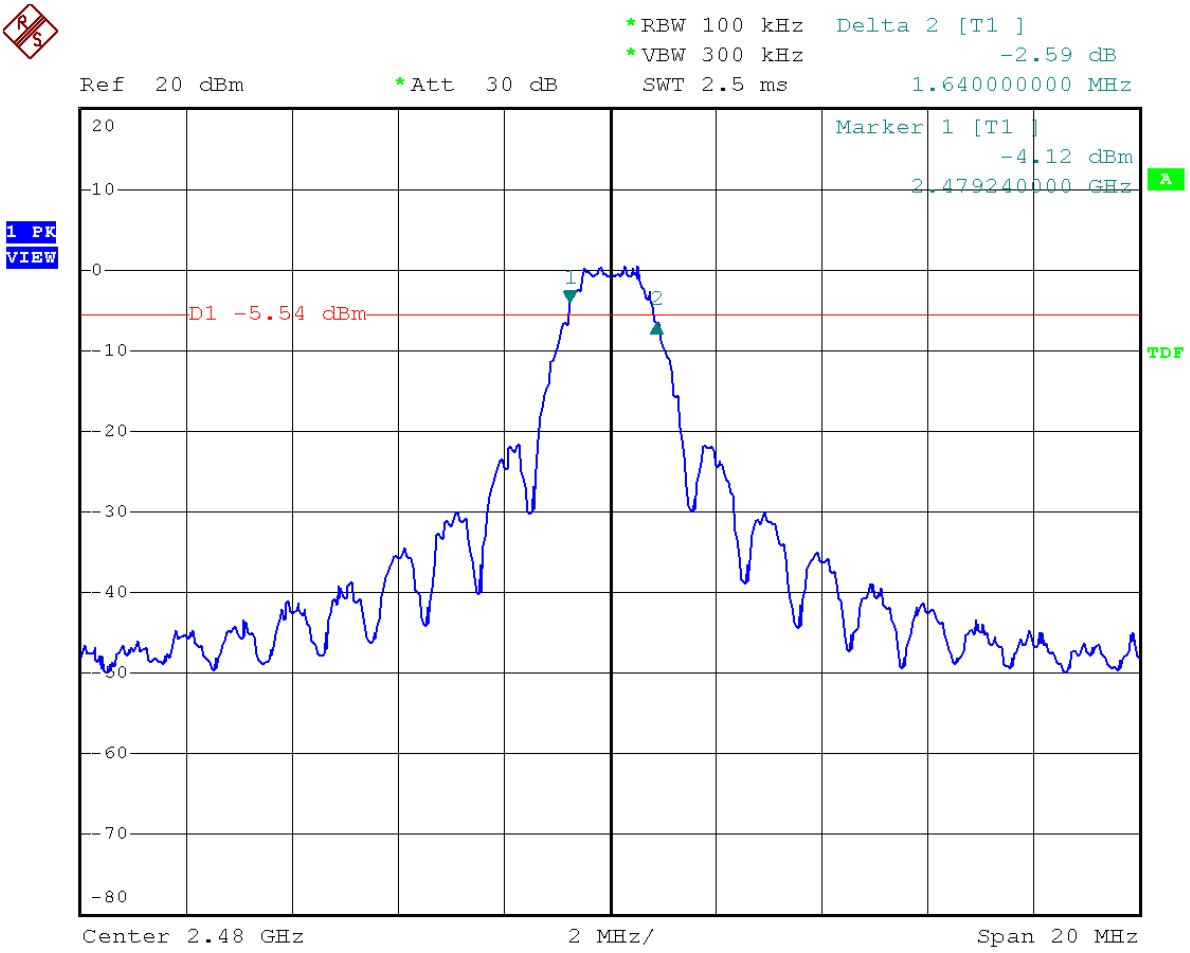
Lowest Channel



Middle Channel



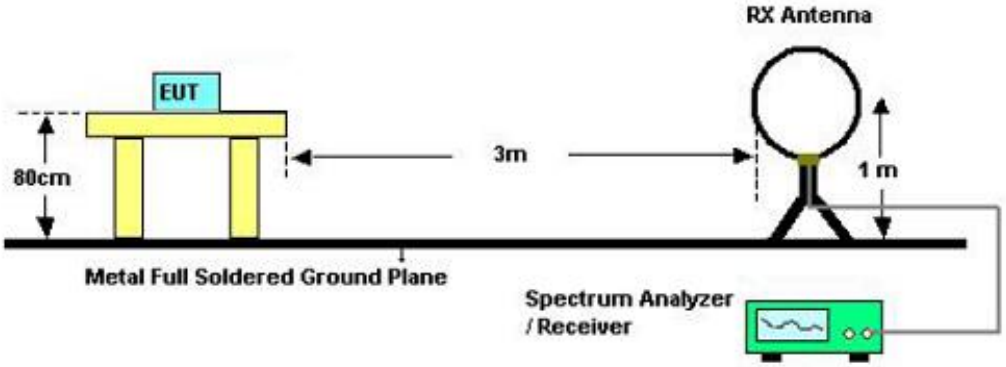
Highest Channel



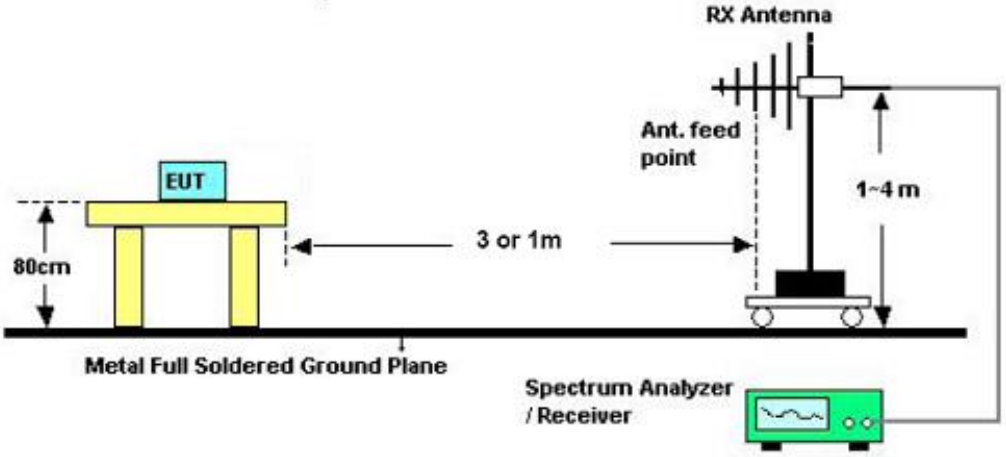
9. RADIATED EMISSION

9.1 TEST SETUP

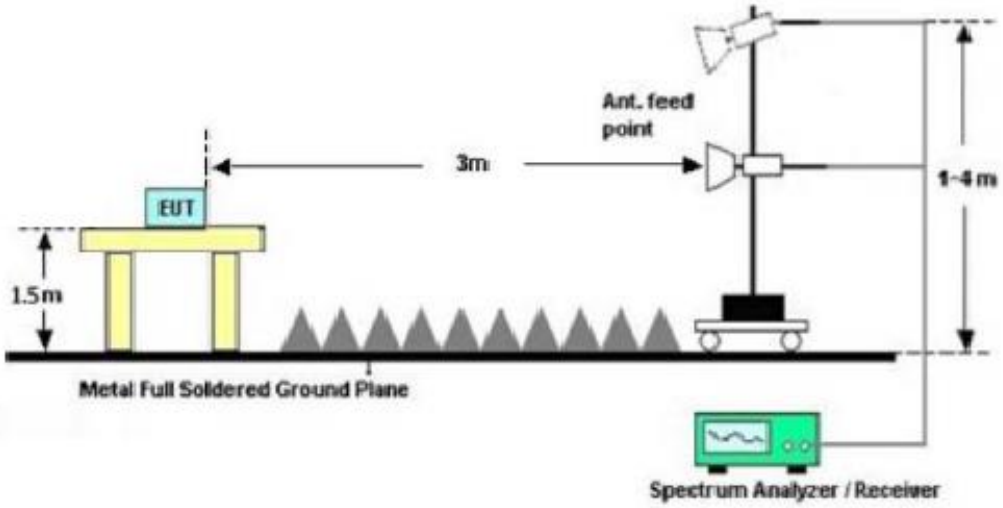
For radiated emissions below 30MHz



For radiated emissions above 30MHz



For radiated emissions above 1GHz



9.2 LIMIT

The field strength of any emissions which appear outside of this band shall not exceed the general radiated emission limits in section 15.209 as below.

Frequency (MHz)	Field Strength (mV/m)	Measurement Distance (m)
1.705-30	30	30
30-88	100*	3
88-216	150*	3
216-960	200*	3
Above 960	500*	3

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz,174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.*

In the above emission table, the tighter limit applies at the band edges.

Frequency (Hz)	Field Strength (µV/m at 3-meter)	Field Strength (dBµV/m at 3-meter)
1.705-30	30 (at 30-meter)	69.54
30-88	100	40
88-216	150	43
216-960	200	46
Above 960	500	54

9.3 TEST PROCEDURE

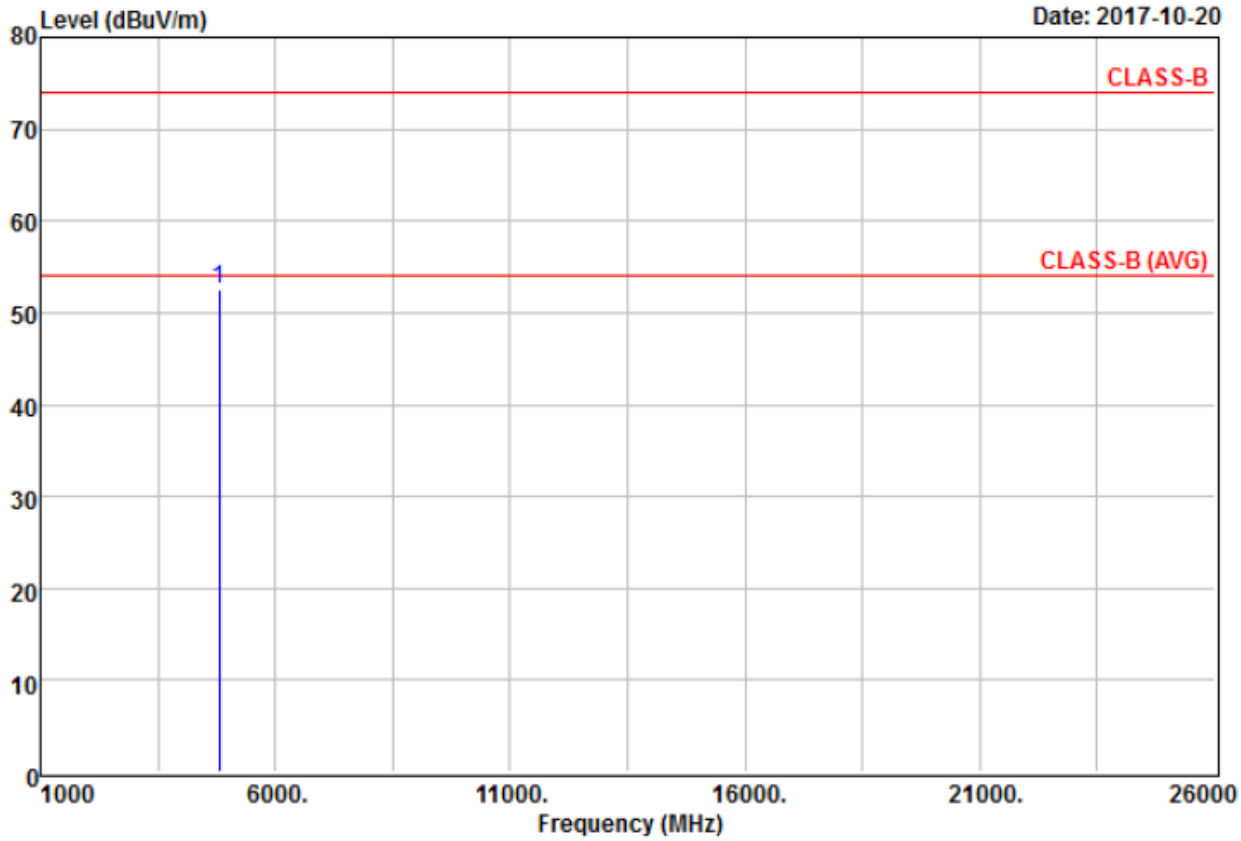
1. The EUT was placed on a turntable, which was 0.8m above ground plane.
2. The turntable was rotated for 360 degrees to determine the position of maximum emission level.
3. EUT was set at 3m away from the receiving antenna, which was varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was maximized by changing the polarization of receiving antenna, both horizontal and vertical.
6. Repeated above procedures until the measurements for all frequencies are completed.

9.4 RESULT: PASSED

9.5 TEST DATA:

All frequencies not described in this test report and within the range of the general radiated emission limits are not detectable significantly. The data as below is representing worst emissions found.

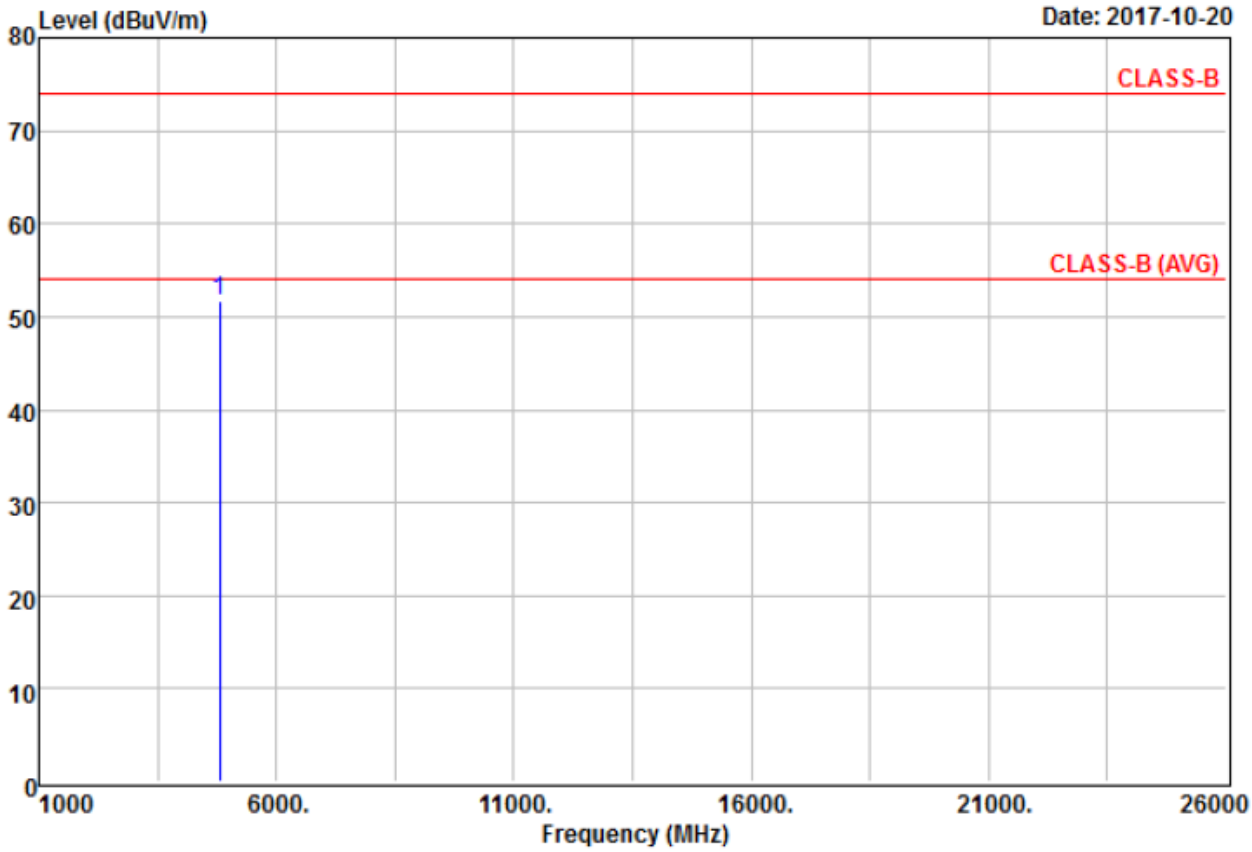
Vertical -Lowest Channel



Temperature: 26
Humidity : 64

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1 @	4810.000	58.82	-6.36	52.46	74.00	-21.54	Peak

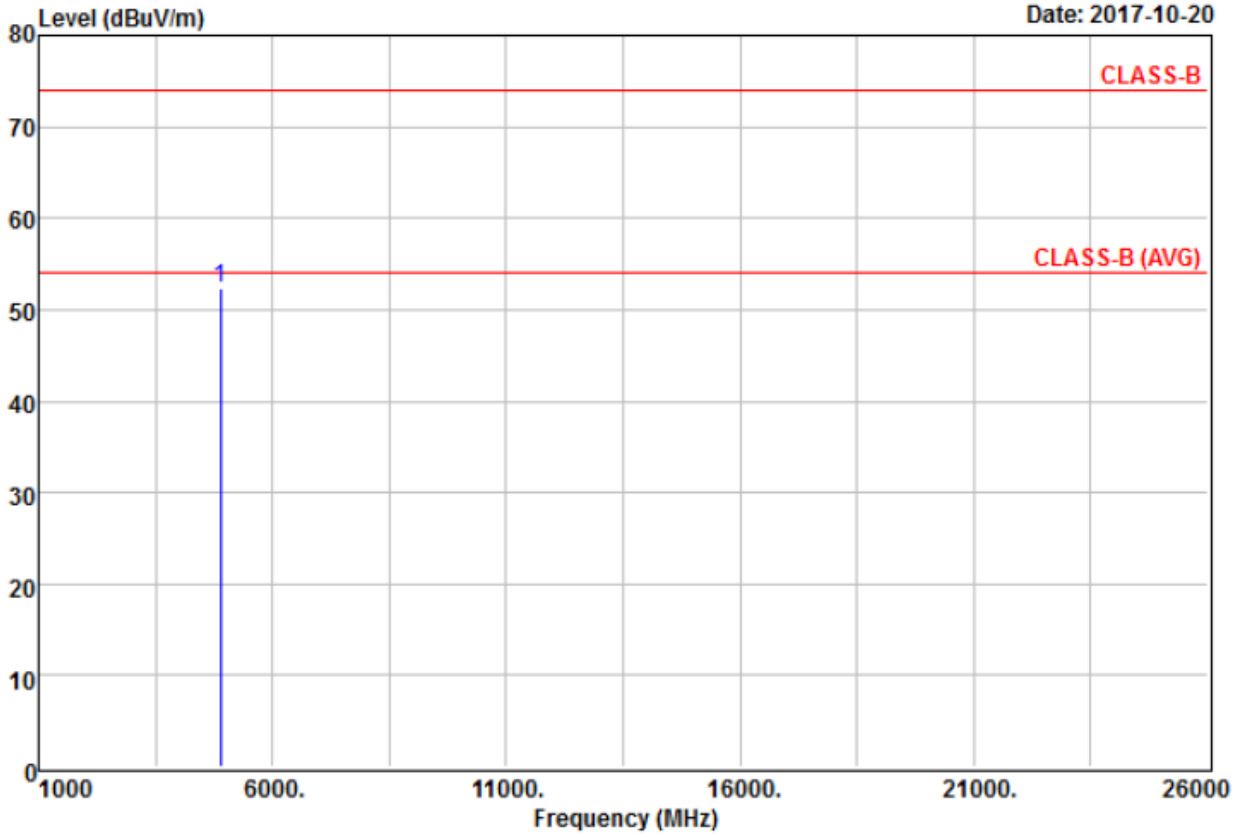
Horizontal -Lowest Channel



Temperature: 26
Humidity : 64

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1 @	4810.000	57.97	-6.36	51.61	74.00	-22.39	Peak

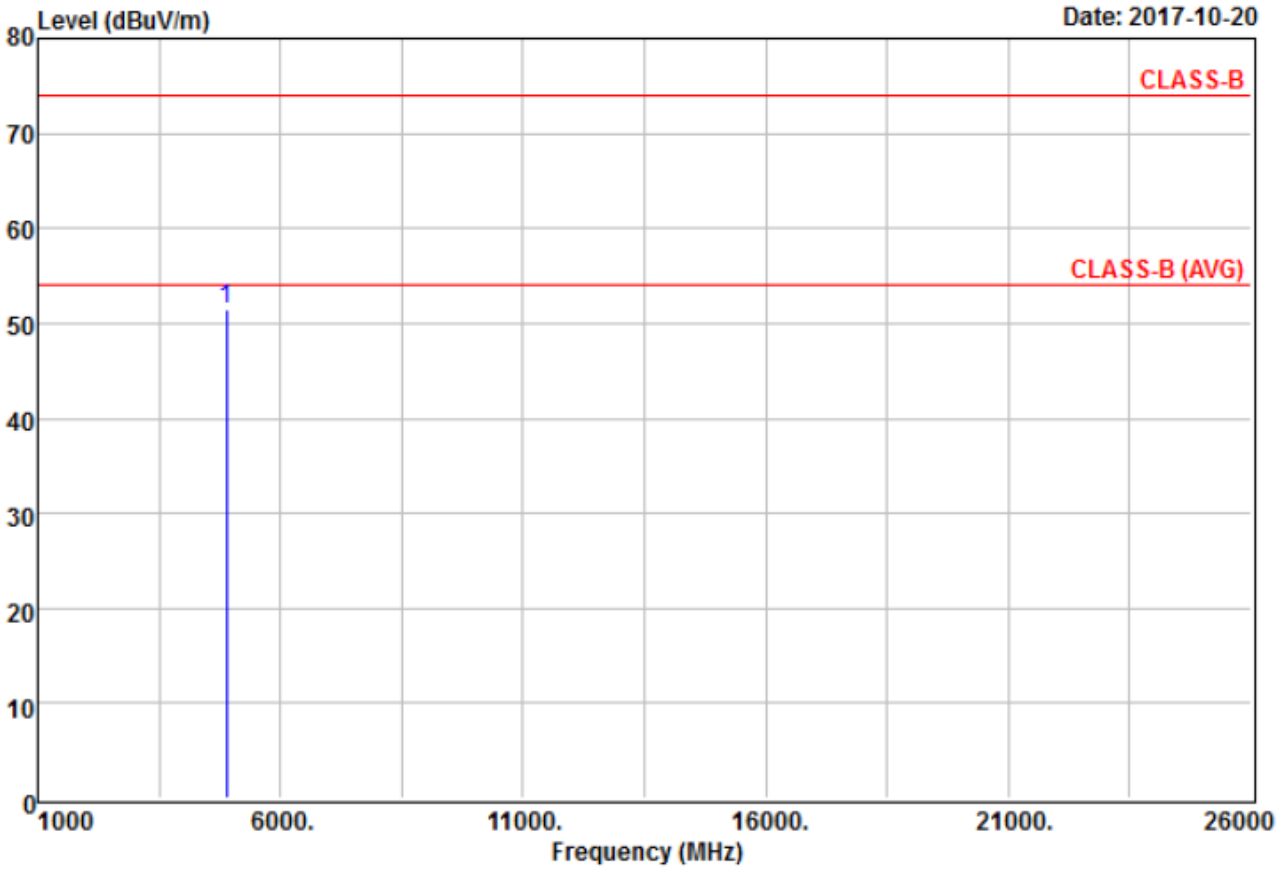
Vertical –Middle Channel



Temperature: 26
Humidity : 64

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1 @	4890.000	58.43	-6.14	52.29	74.00	-21.71	Peak

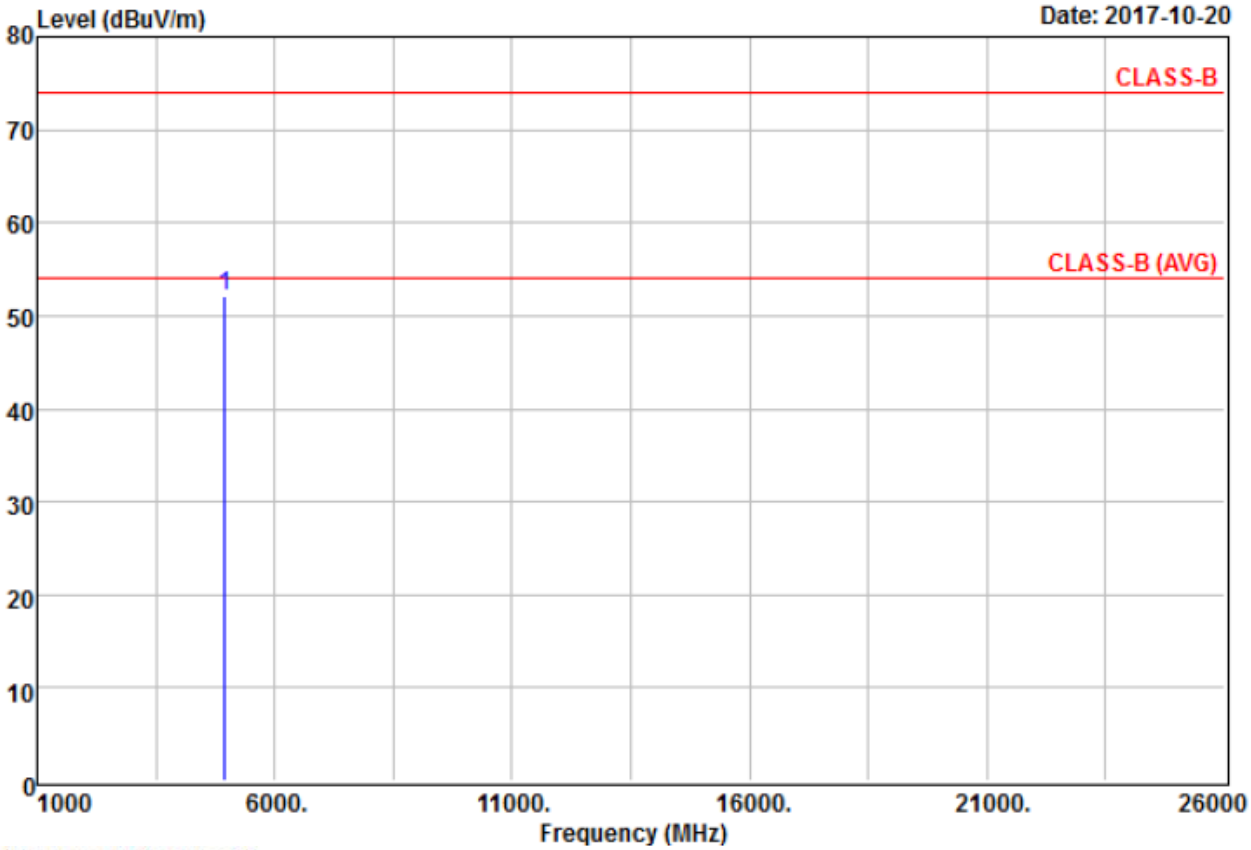
Horizontal –Middle Channel



Temperature: 26
Humidity : 64

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1 @	4890.000	57.51	-6.14	51.37	74.00	-22.63	Peak

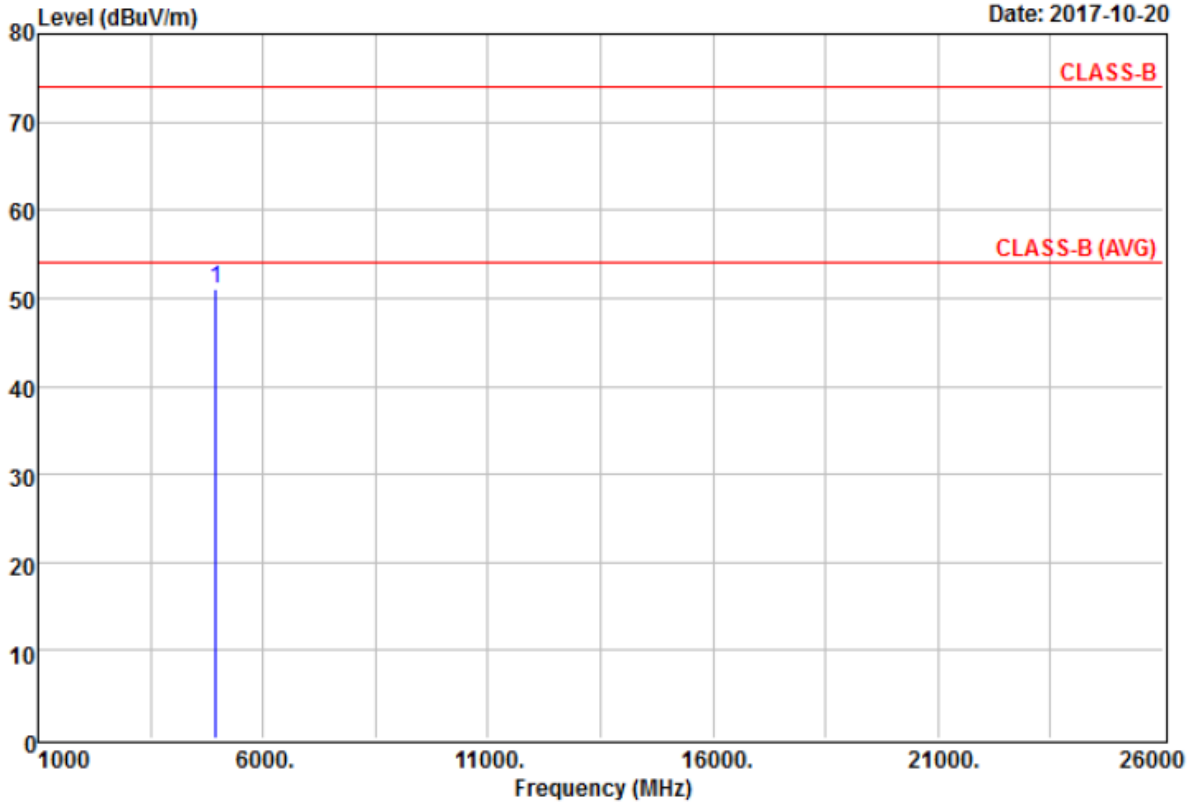
Vertical –Highest Channel



Temperature: 26
Humidity : 64

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1 @	4960.000	58.04	-5.94	52.10	74.00	-21.90	Peak

Horizontal –Highest Channel



Temperature: 26
Humidity : 64

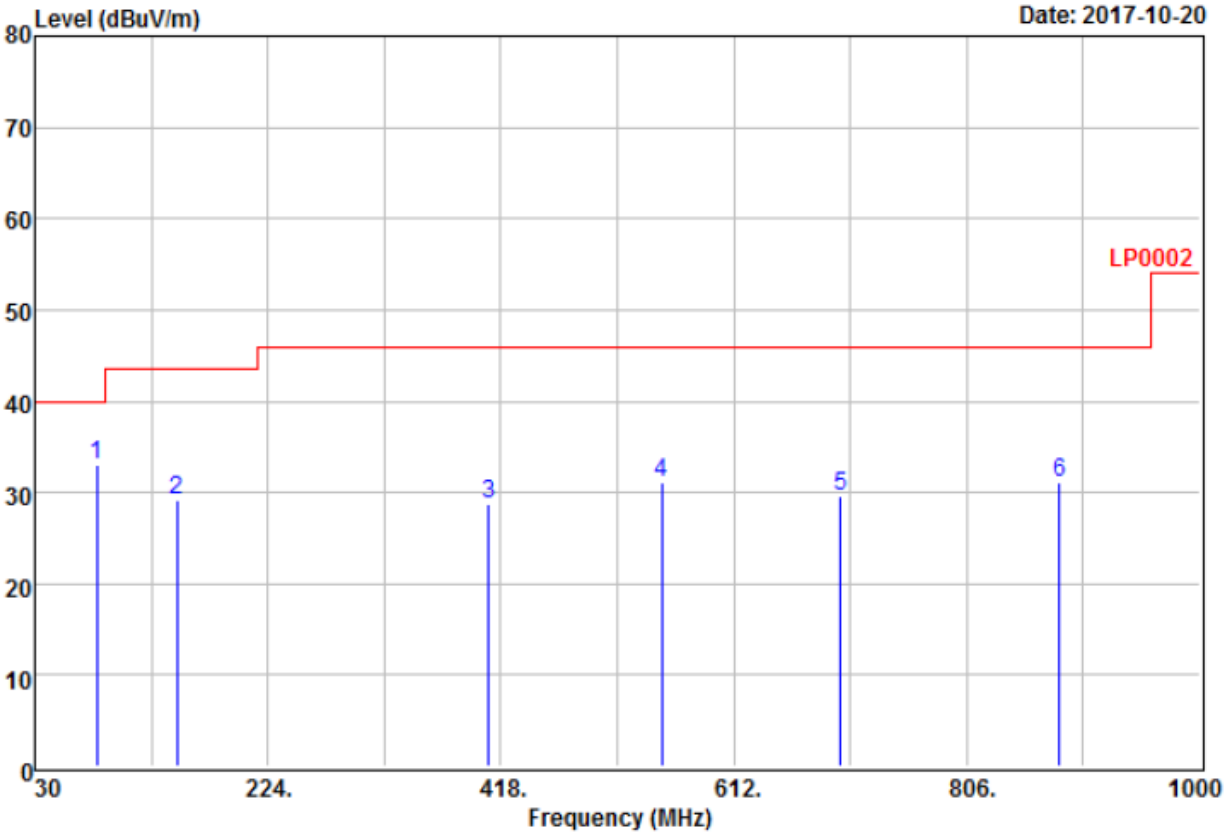
	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1 @	4960.000	57.03	-5.94	51.09	74.00	-22.91	Peak

Note:

1. Emission level = Reading level + Correction factor
2. Correction factor : Antenna factor, Cable loss, Pre-Amp, etc.
3. Measurements above 1000 MHz, Peak detector setting:
   1 MHz RBW with 1 MHz VBW.
4. Measurements above 1000 MHz, Average detector setting:
   1 MHz RBW with 10Hz VBW.
5. Peak detector measurement data will represent the worst case results.
6. Where limits are specified for both average and peak detector functions, if the peak measured value complies with the average limit, it is unnecessary to perform an average measurement.
7. The other emission levels were 20dB below the limit.

Highest Channel (worst emissions found)

Vertical



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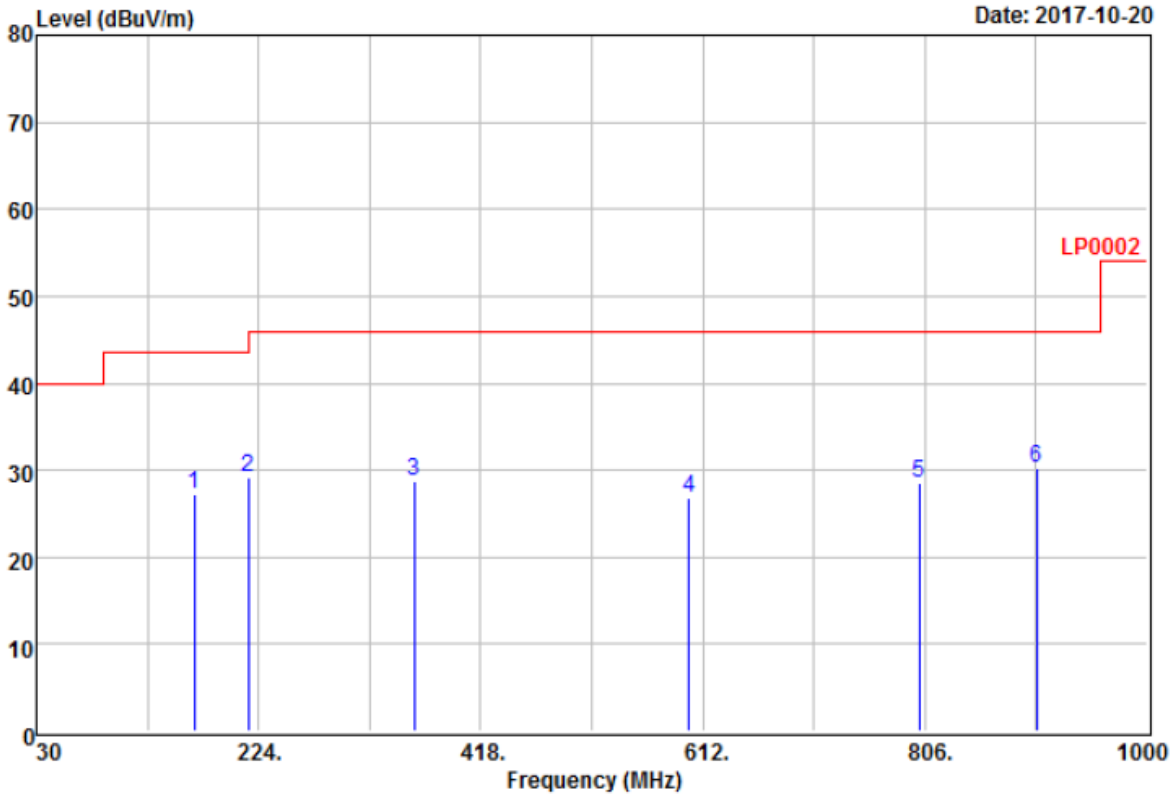
Remarks: **: 1.Result=Read Value+Factor**
: 2.Factor=Antenna Factor+Cable loss-
: Amplifier Factor

		Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1	@	81.410	55.87	-22.83	33.04	40.00	-6.96	QP
2		148.340	44.91	-15.81	29.10	43.50	-14.40	QP
3		408.300	39.49	-10.77	28.72	46.00	-17.28	QP
4		551.860	39.84	-8.77	31.07	46.00	-14.93	QP
5		701.240	36.64	-7.06	29.58	46.00	-16.42	QP
6		883.600	35.15	-4.02	31.13	46.00	-14.87	QP

Horizontal



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Remarks: **: 1.Result=Read Value+Factor**
: 2.Factor=Antenna Factor+Cable loss-
: Amplifier Factor

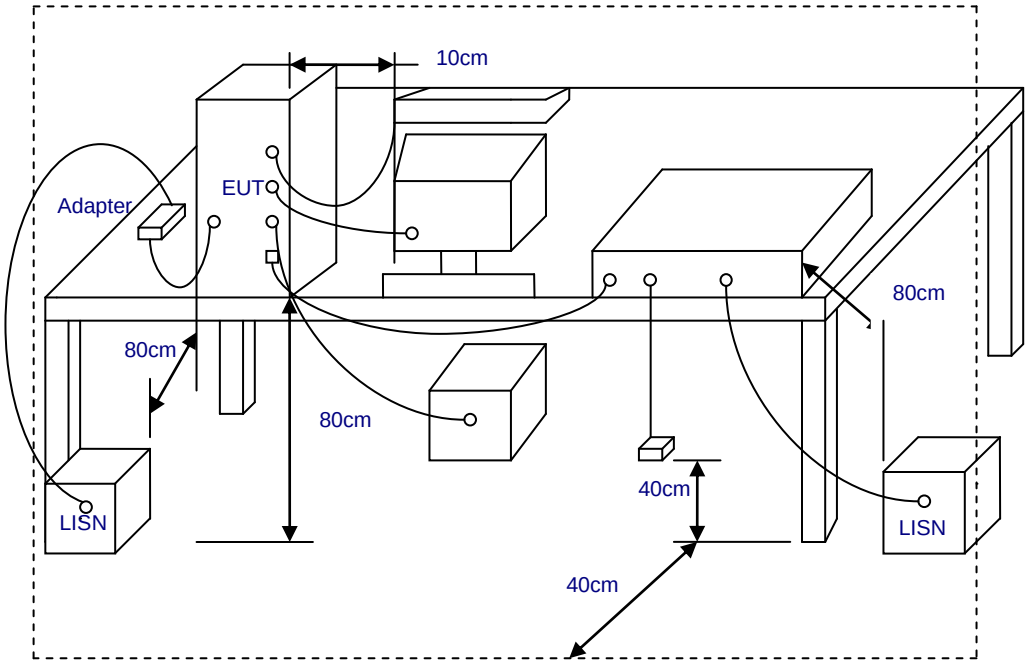
		Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1		167.740	45.37	-18.07	27.30	43.50	-16.20	QP
2	@	215.270	47.53	-18.26	29.27	43.50	-14.23	QP
3		359.800	40.83	-12.10	28.73	46.00	-17.27	QP
4		600.360	35.56	-8.75	26.81	46.00	-19.19	QP
5		801.150	33.72	-5.23	28.49	46.00	-17.51	QP
6		903.970	34.01	-3.82	30.19	46.00	-15.81	QP

Note:

1. Emission level = Reading level + Correction factor
2. Correction factor : Antenna factor, Cable loss, Pre-Amp, etc.
3. All emissions as described above were determining by rotating the EUT through three orthogonal axes to maximizing the emissions if the EUT belongs to hand-held or body-worn devices.
4. Measurements from 9 kHz to 150 kHz, Peak detector setting: 100 Hz RBW
5. Measurements from 150 kHz to 30MHz, Peak detector setting: 10 kHz RBW
6. Measurements from 30 MHz to 1000 MHz, Peak detector setting: 100 kHz RBW
7. Measurements from 9 kHz to 150 kHz, CISPR Quasi-Peak detector: 200 Hz RBW
8. Measurements from 150 kHz to 30MHz, CISPR Quasi-Peak detector: 9 kHz RBW
9. Measurements from 30 MHz to 1000 MHz, CISPR Quasi-Peak detector: 120 kHz RBW
10. Peak detector measurement data will represent the worst case results.

10. CONDUCTED EMISSIONS

10.1 TEST SETUP



10.2 LIMIT

Conducted Emissions were measured from 150 kHz to 30 MHz with a bandwidth of 9 KHz on the 120 VAC power and return leads of the EUT according to the methods defined in ANSI C63.4-2014 Section 3.1. The EUT was placed on a nonmetallic stand in a shielded room 0.8 meters above the ground plane as shown in section 2.2. The interface cables and equipment positioning were varied within limits of reasonable applications to determine the position produced maximum conducted emissions.

Frequency (MHz)	Quasi Peak (dB μ V)	Average (dB μ V)
0.15 – 0.5	66-56*	56-46*
0.5 – 5.0	56	46
5.0 – 30.0	60	50

*Decreases with the logarithm of the frequency.

10.3 TEST PROCEDURE

a. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.

b. Connect EUT to the power mains through a line impedance stabilization network (LISN).

c. All the support units are connecting to the other LISN.

d. The LISN provides 50 ohm coupling impedance for the measuring instrument.

e. The FCC states that a 50 ohm, 50 micro-Henry LISN should be used.

f. Both sides of AC line were checked for maximum conducted interference.

g. The frequency range from 150 kHz to 30 MHz was searched.

h. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

10.4 TEST SPECIFICATION

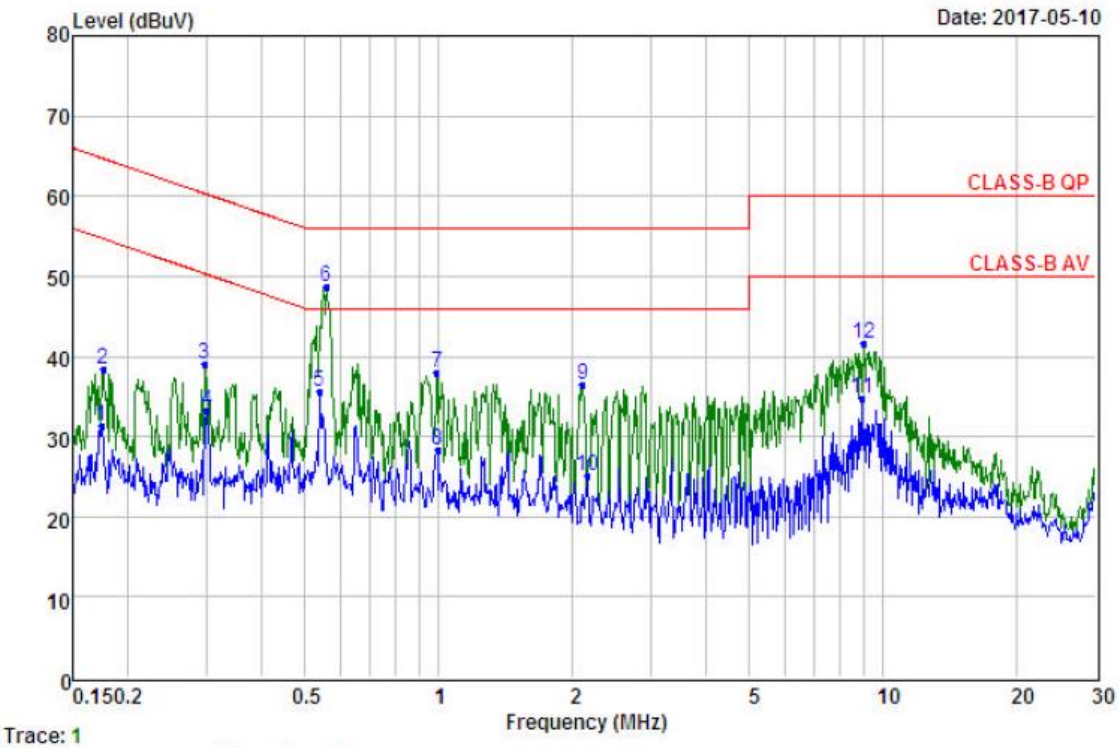
According to PART 15.207

10.5 RESULT: PASSED

EMI Receiver/Spectrum Analyzer Configuration (for the frequencies tested)

Frequency Range:	150KHz--30MHz
Detector Function:	Quasi-Peak / Average Mode
Resolution Bandwidth:	9KHz

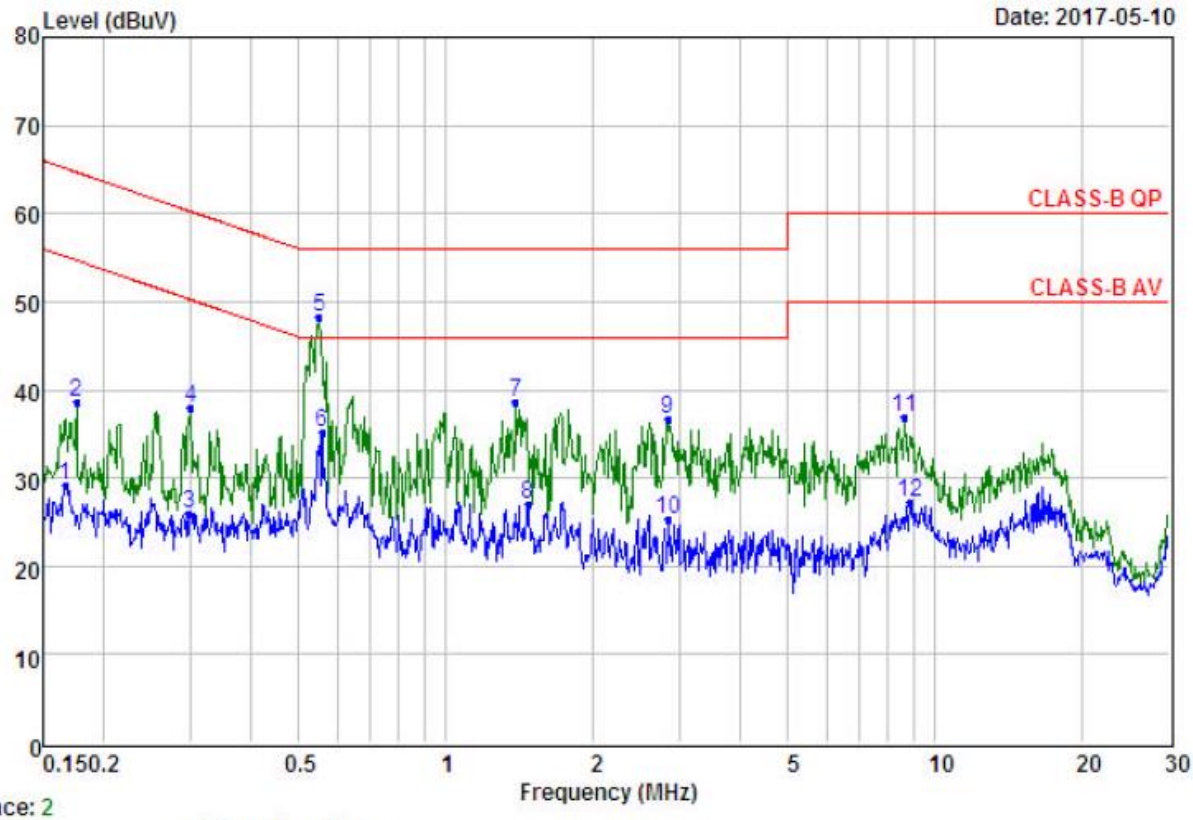
10.6 TEST DATA:



Site : Conduction
Condition : CLASS-B QP CON-LISN-105 LINE
Temperature : 25.7
Humidity : 53
Memo :

Remarks: : Factor=Insertion loss+Cable loss

		Freq	Read Level	Level	Factor	Over Limit	Limit Line	Remark
		MHz	dBuV	dBuV	dB	dB	dBuV	
1		0.17	21.11	31.23	10.12	-23.54	54.77	Average
2		0.18	28.25	38.37	10.12	-26.31	64.68	QP
3		0.30	28.79	38.93	10.14	-21.39	60.32	QP
4		0.30	23.17	33.31	10.14	-16.93	50.24	Average
5		0.54	25.38	35.52	10.14	-10.48	46.00	Average
6	@	0.56	38.55	48.69	10.14	-7.31	56.00	QP
7		0.99	27.90	38.06	10.16	-17.94	56.00	QP
8		0.99	18.11	28.27	10.16	-17.73	46.00	Average
9		2.11	26.19	36.41	10.22	-19.59	56.00	QP
10		2.17	14.77	25.00	10.23	-21.00	46.00	Average
11		8.92	24.34	34.78	10.44	-15.22	50.00	Average
12		9.01	31.14	41.58	10.44	-18.42	60.00	QP



Site : Conduction
Condition : CLASS-B QP CON-LISN-105 NEUTRAL
Temperature : 25.7
Humidity : 53
Memo :

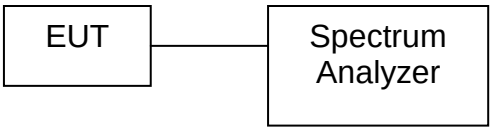
Remarks: : Factor=Insertion loss+Cable loss

		Freq	Read Level	Level	Factor	Over Limit	Limit Line	Remark
		MHz	dBuV	dBuV	dB	dB	dBuV	
1		0.17	19.06	29.15	10.09	-25.97	55.12	Average
2		0.18	28.45	38.55	10.10	-26.13	64.68	QP
3		0.30	15.90	26.04	10.14	-24.24	50.28	Average
4		0.30	27.77	37.91	10.14	-22.33	60.24	QP
5	@	0.55	37.99	48.16	10.17	-7.84	56.00	QP
6		0.56	24.92	35.09	10.17	-10.91	46.00	Average
7		1.39	28.33	38.53	10.20	-17.47	56.00	QP
8		1.47	16.87	27.06	10.19	-18.94	46.00	Average
9		2.84	26.43	36.66	10.23	-19.34	56.00	QP
10		2.85	15.07	25.30	10.23	-20.70	46.00	Average
11		8.64	26.42	36.81	10.39	-23.19	60.00	QP
12		8.87	16.87	27.26	10.39	-22.74	50.00	Average

11. SPURIOUS EMISSIONS

11.1 CONDUCTED MEASUREMENT

11.2 TEST SETUP



11.3 LIMIT

According to § 15.247(d) , in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intention radiator in operating , the radio 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. 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 Section 15.205(c)).

11.4 TEST PROCEDURE

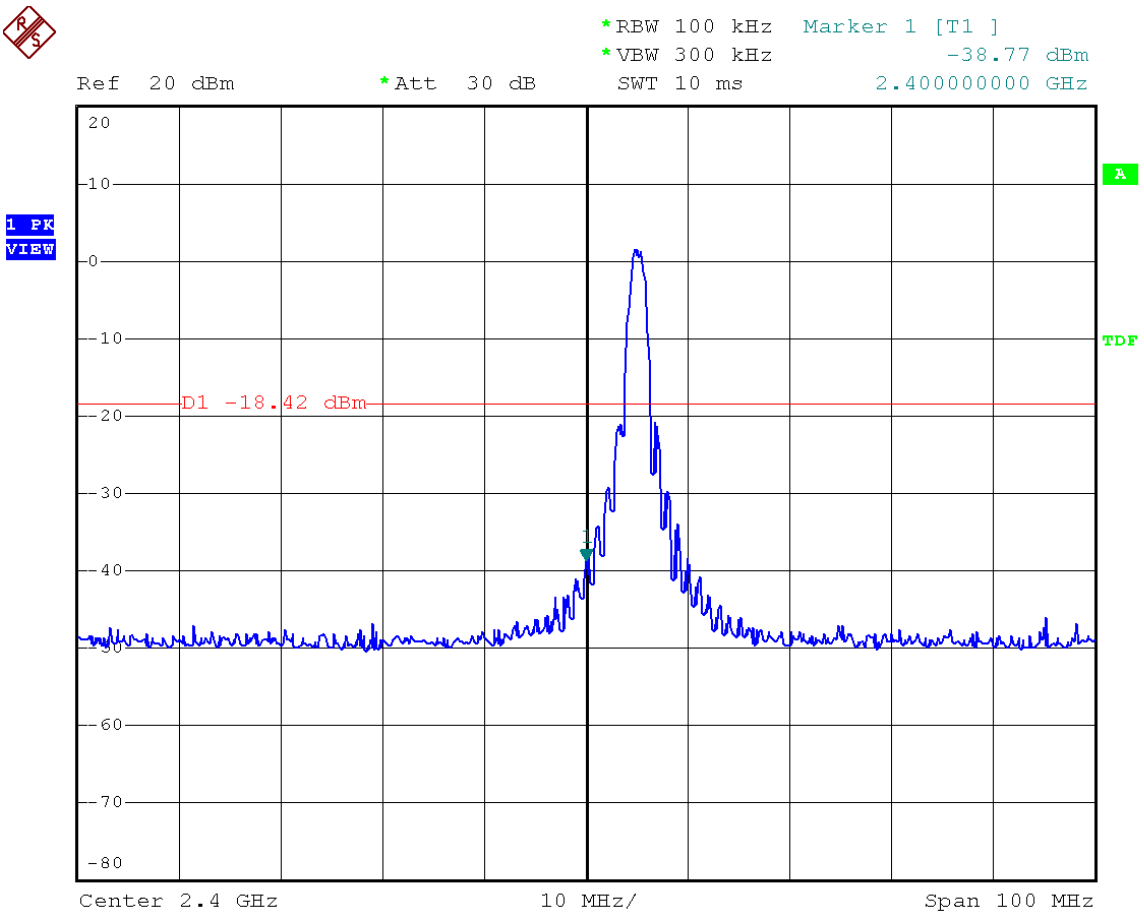
Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 100 kHz.

11.5 RESULT: PASSED

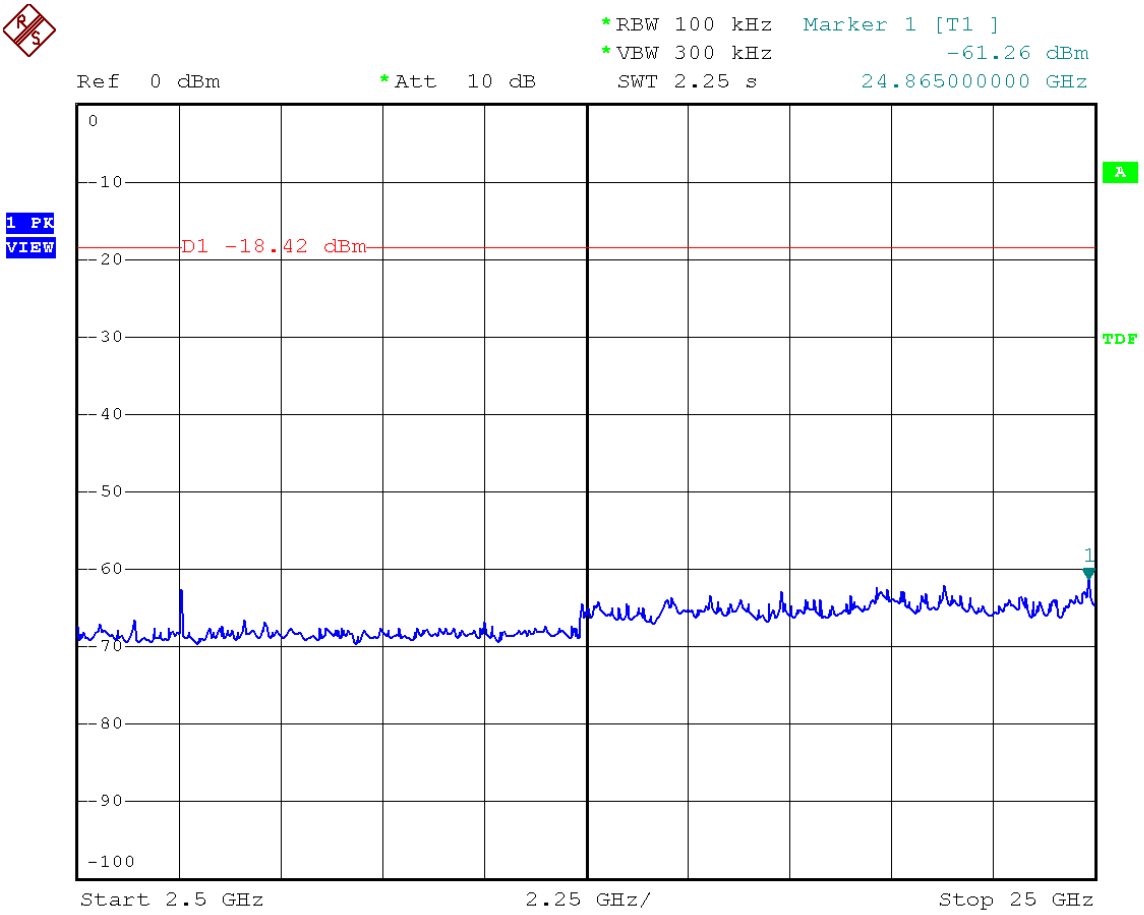
11.6 TEST DATA:

Channel	Frequency (MHz)	Maximum Value In Frequency (MHz)	Maximum Value (dBm)
11	2405	2400.00	-38.77
26	2480	2483.90	-34.80

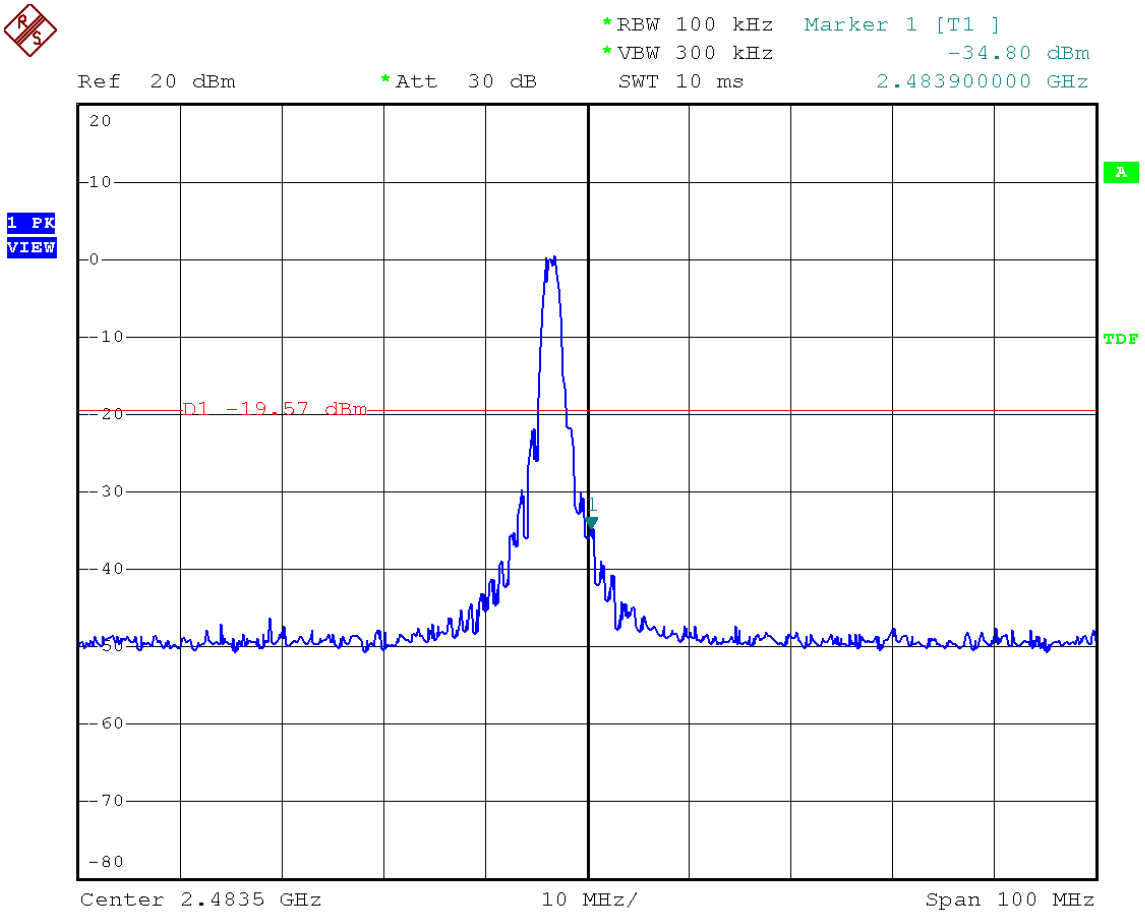
Lowest Channel – Below 2.4GHz



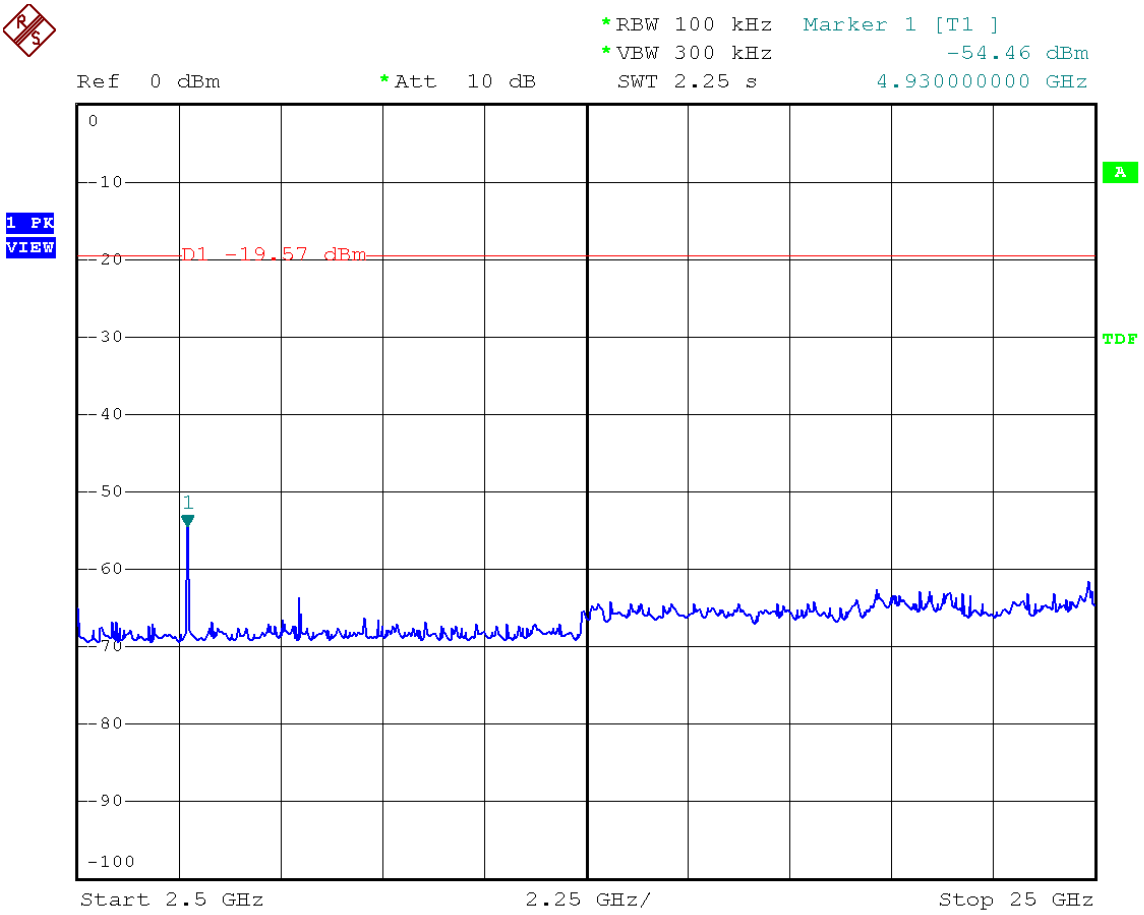
Lowest Channel – 2.5G~25GHz



Highest Channel – Below 2.4GHz



Highest Channel – 2.5G~25GHz



12. POWER SPECTRAL DENSITY

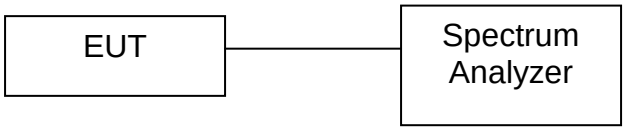
12.1 TEST LIMIT

According to 15.247(a)(2), systems using digital modulation techniques may operate in the 902-928, 2400-2483.5 MHz, and 5725-5820 MHz bands. The Maximum of Power Spectral Density Measurement is 8dBm.

12.2 TEST PROCEDURE

1. The transmitter output was connected to spectrum analyzer.
2. The spectrum analyzer's resolution bandwidth were set at RBW ≥ 3KHz and VBW ≥ 3x RBW as that of the fundamental frequency. Set span to at least 1.5 times the DTS channel bandwidth. Set the sweep time=auto couple.
3. The power spectral density was measured and recorded.

12.3 TEST SETUP LAYOUT

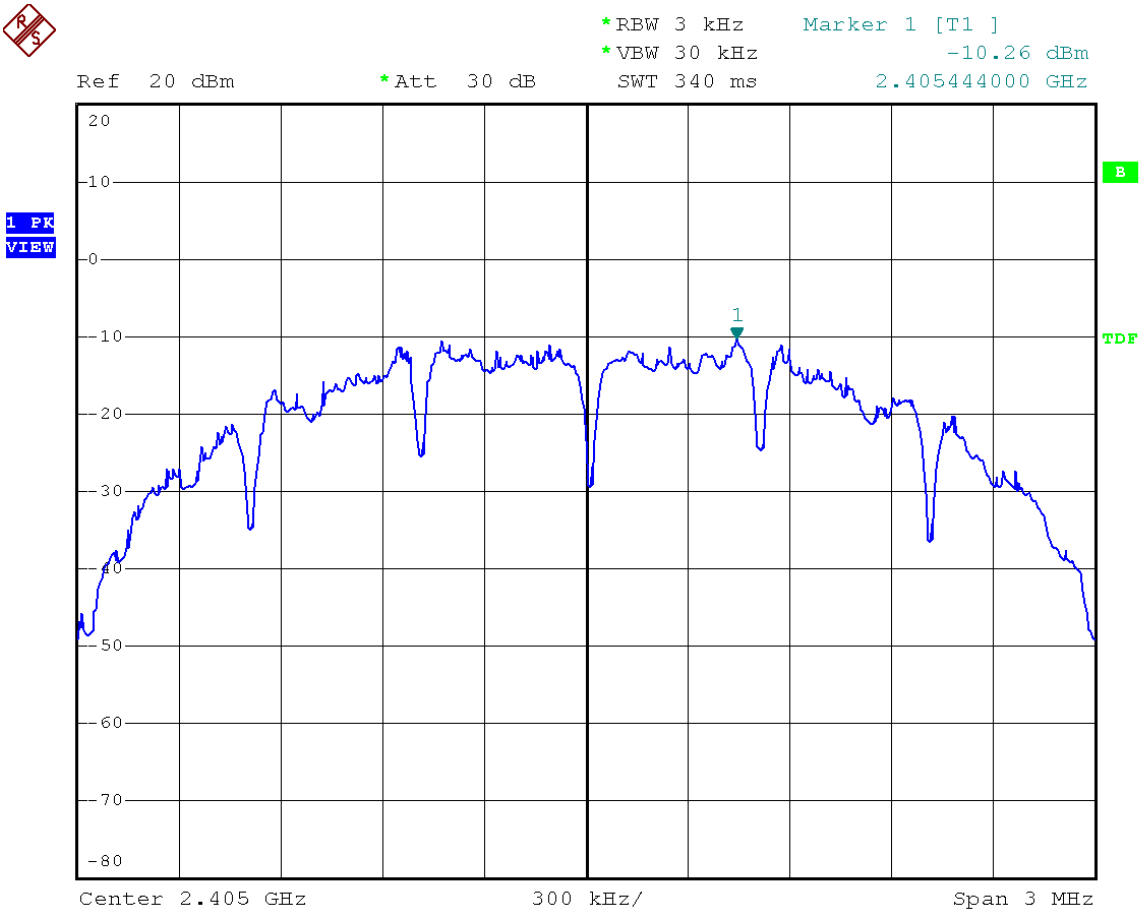


12.4 TEST RESULT AND DATA

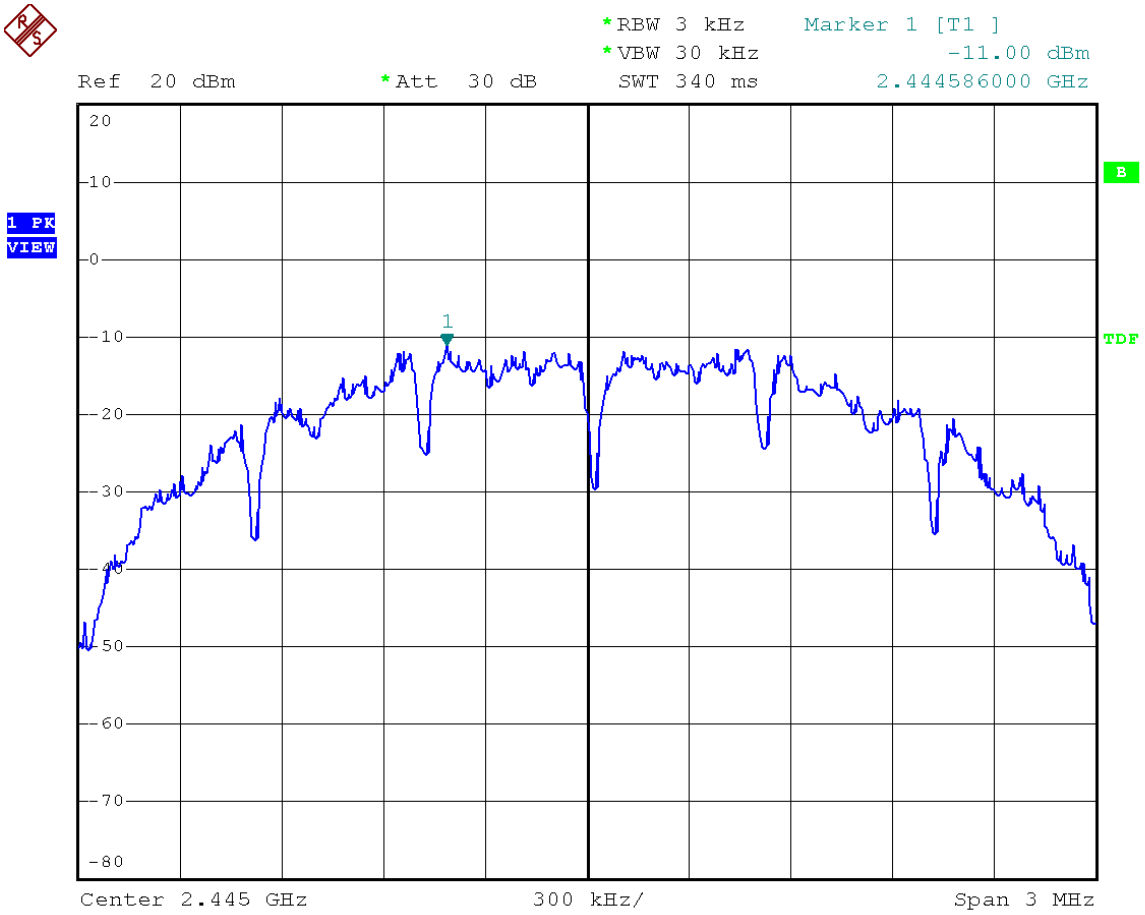
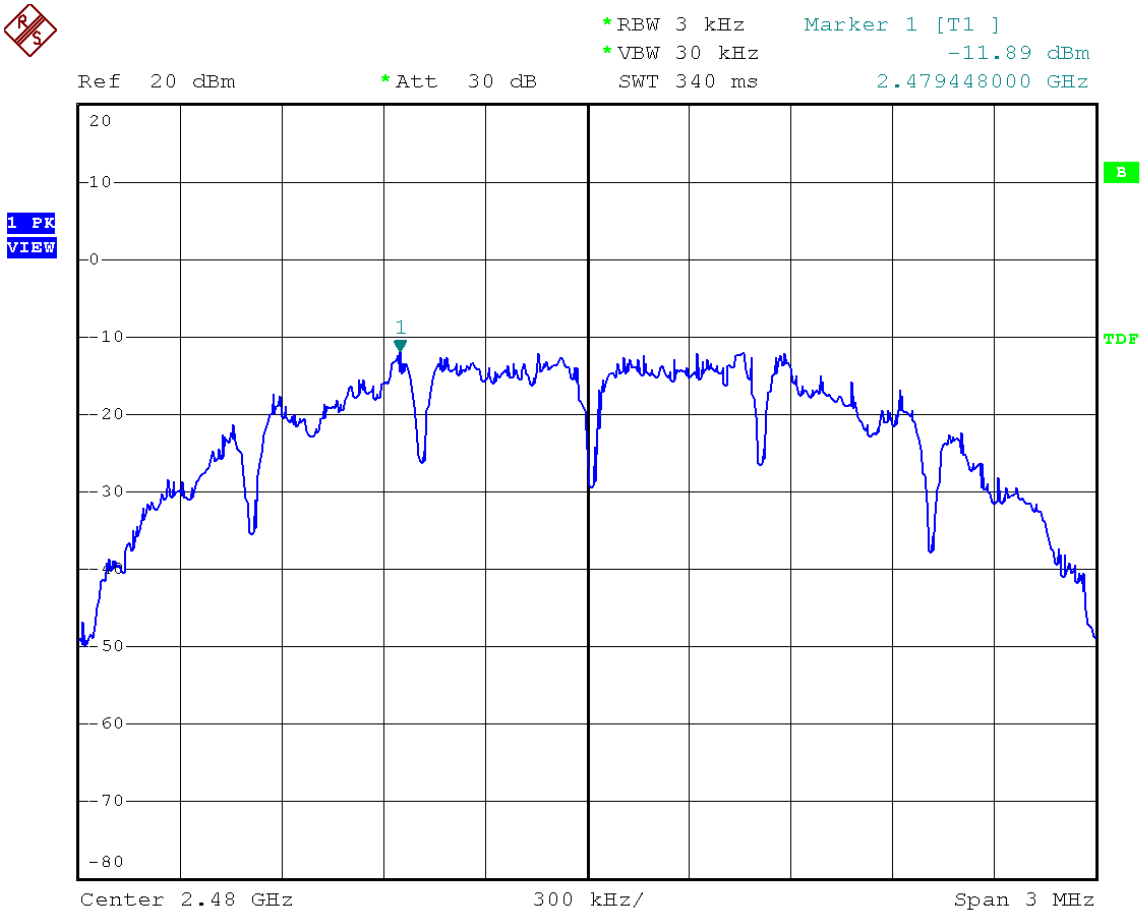
Channel	Frequency (MHz)	Maximum Power Density of 3kHz Bandwidth (dBm)
11	2405	-10.26
19	2445	-11.00
26	2480	-11.89

12.5 TEST DATA:

Lowest Channel



Middle Channel



Highest Channel