

FCC 15.247
2.4 GHz Report

for

INNOINSIGHT INC.

**603, Worldmeridian Venture Center 2 Bldg, 123,
Gasan digital 2-ro, Geumchongu-gu, Seoul, Korea.**

Brand : HOWSKIN
Product Name : HOWSKIN
Model Name : IC-HSP001
FCC ID : 2AG65-IC-HSP001

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APPENDIX A TEST PHOTOGRAPHS

TEST REPORT CERTIFICATION

Applicant : INNOINSIGHT INC.
Manufacture : INNOINSIGHT INC.
Product Name : HOWSKIN
Model No. : IC-HSP001
Serial No. : N/A
Brand : HOWSKIN
Power Supply : DC 5V (Via USB) or DC 3.7V (Via Battery)

Applicable Standards:

FCC Rules and Regulations Part 15 Subpart C, Oct. 2014
ANSI C63.10:2013
KDB 558074 D01 DTS Meas Guidance v03r03

AUDIX Technology Corp. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report. **AUDIX Technology Corp.** does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens and samples.

Date of Test: 2016. 01. 26 ~ 28

Date of Report: 2016. 01. 28

Producer: Annie Yu
(Annie Yu/Administrator)

Signatory: Ben Cheng
(Ben Cheng/Manager)

1. REPORT HISTORY

Revision	Date	Revision Summary	Report Number
0	2016. 01. 28	Original Report.	EM-F160072

2. SUMMARY OF TEST RESULTS

Rule	Description	Results
15.207	Conducted Emission	PASS
15.247(d)/15.205	Radiated Band Edge and Radiated Spurious Emission	PASS
15.247(a)(2)	6dB Bandwidth	PASS
15.247(b)(3)	Maximum Peak Output	PASS
15.247(d)	Conducted Band Edges and Conducted Spurious Emission	PASS
15.247 (e)	Power Spectral Density	PASS
15.203	Antenna Requirement	PASS

3. GENERAL INFORMATION

3.1. Description of EUT

Product	HOWSKIN
Model Number	IC-HSP001
Serial Number	N/A
Brand Name	HOWSKIN
Applicant	INNOINSIGHT INC. 603, Worldmeridian Venture Center 2 Bldg, 123, Gasandigital 2- ro, Geumchongu-gu, Seoul, Korea.
Manufacture	INNOINSIGHT INC. 603, Worldmeridian Venture Center 2 Bldg, 123, Gasandigital 2- ro, Geumchongu-gu, Seoul, Korea.
RF Features	Bluetooth Low Energy (BLE)
Transmit Type	1T1R
Device Category	☐ Outdoor Access Point ☐ Fixed point-to-point Access Point ☐ Indoor Access Point ☒ Mobile and Portable client device
Date of Receipt of Sample	2015. 12. 25

3.2. EUT Specifications Assessed in Current Report

Mode	Fundamental Range (MHz)	Channel Number	Modulation	Data Rate (Mbps)
BLE	2402-2480	40	GFSK	1

Channel List			
Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
00	2402	20	2442
01	2404	21	2444
02	2406	22	2446
03	2408	23	2448
04	2410	24	2450
05	2412	25	2452
06	2414	26	2454
07	2416	27	2456
08	2418	28	2458
09	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480

3.3. Antenna Information

Antenna Part Number	Manufacture	Antenna Type	Frequency	Max Gain (dBi)
---	---	PCB Antenna	2400MHz Band	3.336

3.4. Test Configuration

Mode	Duty Cycle (x)	T (ms)	Duty Cycle Factor (dB)
BLE	1	N/A	N/A

Note: When duty cycle is less than 98% (0.98) that duty cycle factor $10\log(1/x)$ is needed to add in conducted test items measured in average detector.

AC Conduction	
Test Case	Normal operation

Item		Test Channel
Radiated Test Case	Radiated Band Edge ^{Note1}	00/39
	Radiated Spurious Emission (30MHz-1GHz) ^{Note1}	00/20/39
	Radiated Spurious Emission (Above 1GHz) ^{Note1}	00/20/39
Conducted Test Case	6dB Bandwidth	00/20/39
	Peak Power Spectral Density	00/20/39
	Peak Output Power	00/20/39
	Band Edge	00/39
	Spurious Emission	00/20/39

Note 1:

☐ Mobile Device

☒ Portable Device, and 3 axis were assessed. The worst scenario for Radiated Spurious Emission as follow:

☒ Lie

☐ Side

☐ Stand

3.5. Tested Supporting System List

3.5.1. Support Peripheral Unit

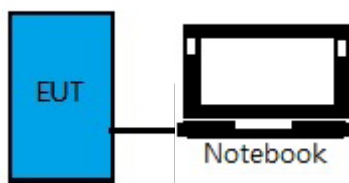
No.	Product	Brand	Model No.	Serial No.	FCC ID
1.	Notebook PC	acer	Acer Aspire 4755G	N/A	HLZ-AR5B97

3.5.2. Cable Lists

No.	Cable Description Of The Above Support Units
1.	AC Adapter: DELTA, M/N ADP-90CDDDB DC Power Cord: Shielded, Undetachable, 1.8m, Bonded a ferrite core AC Power Cord: Non-Shielded, Detachable, 1.8m

3.6. Setup Configuration

3.6.1. EUT Configuration for Power Line



3.6.2. EUT Configuration for Radiated Emission



3.6.3. EUT Configuration for Conducted Test Items



3.7. Operating Condition of EUT

The EUT was set on RF function under continues transmitting and choosing channel.

3.8. Description of Test Facility

Test Firm Name	:	AUDIX Technology Corporation EMC Department No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan
Test Location & Facility	:	No. 7 Shielded Room No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan Semi-Anechoic Chamber No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan Date of Renewal: May 06, 2015 Federal Communication Commission Registration Number: 90993 Fully Semi-Anechoic Chamber No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan IC Test Site Registration No.: 5183B-4 Renewal on August 31, 2015
NVLAP Lab. Code	:	200077-0
TAF Accreditation No	:	1724

3.9. Measurement Uncertainty

Test Item	Frequency Range	Uncertainty
Conduction Test	150kHz~30MHz	±3.5dB
Radiation Test (Distance: 3m)	30MHz~300MHz	± 3.64dB
	300MHz~1000MHz	± 4.70dB
	Above 1GHz	± 2.94dB

Remark : Uncertainty = $ku_c(y)$

Test Item	Uncertainty
6dB Bandwidth	± 0.05kHz
Maximum peak output power	± 0.33dB
Power spectral density	± 0.13dB
Conducted Emission Limitations	± 0.13dB

4. MEASUREMENT EQUIPMENT LIST

4.1. Conducted Emission Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Test Receiver	R&S	ESCI	101276	2015. 04. 04	1 Year
2.	A.M.N.	R&S	ESH2-Z5	100366	2015. 03. 11	1 Year
3.	L.I.S.N.	Kyoritsu	KNW-407	8-881-13	2016. 01. 17	1 Year
4.	Pulse Limiter	R&S	ESH3-Z2	101495	2016. 01. 17	1 Year

4.2. Radiated Emission Measurement

4.2.1. Frequency Range 30MHz~1000MHz

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9010A-526	MY53400071	2015. 09. 14	1 Year
2.	Test Receiver	R & S	ESCS30	100338	2015. 06. 24	1 Year
3.	Amplifier	HP	8447D	2944A06305	2015. 02. 12	1 Year
4.	Bilog Antenna	TESEQ	CBL6112D	33821	2014. 08. 02	1 Year

4.2.2. Frequency Range 30MHz~1000MHz

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	E4446A	US44300366	2015. 08. 20	1 Year
2.	Test Receiver	R & S	ESCS30	100338	2015. 06. 24	1 Year
3.	Amplifier	Agilent	8449B	3008A02676	2015. 02. 11	1 Year
4.	2.4GHz Notch Filter	K&L	7NSL10-244 1.5E130.5-00	1	2015. 07. 22	1 Year
5.	Double-Ridged Waveguide Horn	ETS-Lindgren	3117	00135902	2015. 03. 06	1 Year

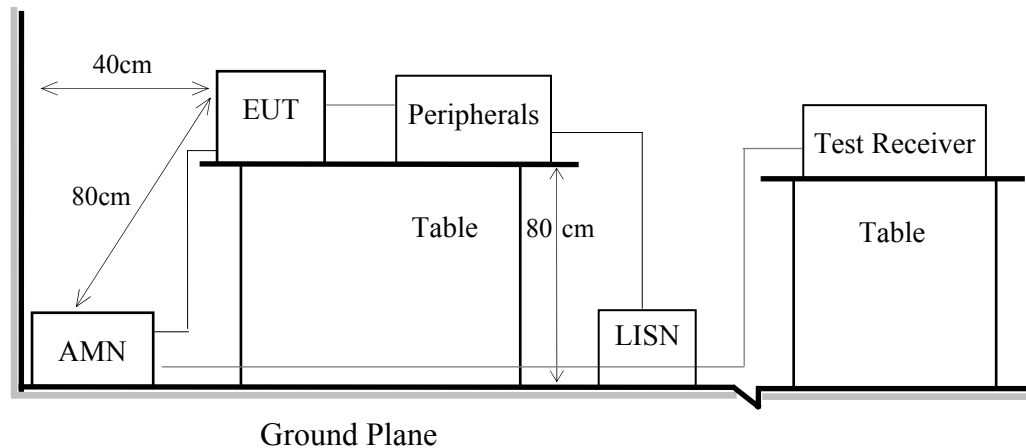
4.3. RF Conducted Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	R&S	FSV30	101181	2015. 03. 06	1 Year
2.	Power Meter	Anritsu	ML2495A	1145008	2015. 10. 23	1 Year
3.	Power Sensor	Anritsu	MA2411B	1126096	2015. 10. 23	1 Year

5. CONDUCTED EMISSION MEASUREMENT

5.1. Block Diagram of Test Setup

Shielded Room Setup Diagram



5.2. Power Line Conducted Emission Limit

Frequency	Conducted Limit	
	Quasi-Peak Level	Average Level
150kHz ~ 500kHz	66 ~ 56 dB μ V	56 ~ 46 dB μ V
500kHz ~ 5MHz	56 dB μ V	46 dB μ V
5MHz ~ 30MHz	60 dB μ V	50 dB μ V

Remark 1.: If the average limit is met when using a Quasi-Peak detector, the measurement using the average detector is not required.

2.: The lower limit applies to the band edges.

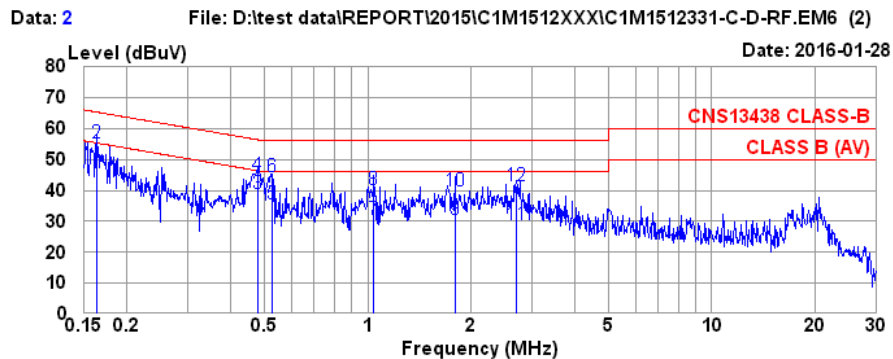
5.3. Test Procedure

- 5.3.1. To set up the EUT as indicated in ANSI C 63.10. The EUT was placed on the table which has 80 cm height to the ground and 40 cm distance to the conducting wall.
- 5.3.2. Power supplier of the EUT was connected to the AC mains through an Artificial Mains Network (A.M.N.).
- 5.3.3. The AC power supplies to all peripheral devices must be provided through line impedance stabilization network (L.I.S.N.)
- 5.3.4. Checking frequency range from 150 kHz to 30 MHz and record the emission which does not have 20 dB below limit.

5.4. Conducted Emission Measurement Results

PASSED.

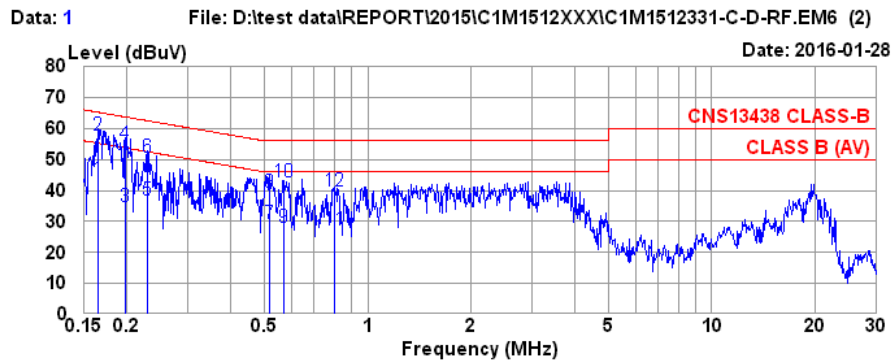
Test Date	2016/01/28	Temp./Hum.	22°C/50%
Test Voltage	DC 5V (Via USB)		



Site no. : No.7 Shielded Room Data no. : 2
Condition : ESH2-Z5 366 Phase : NEUTRAL
Limit : CNS13438 CLASS-B
Env. / Ins. : 22°C / 50% ESCI (1276) Engineer : Ken Yang
EUT : IC-HSP001
Power Rating : DC 5V (via USB)
Test Mode : Charge

	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)	Remark
1	0.163	0.11	0.03	9.85	32.96	42.95	55.30	12.35	Average
2	0.163	0.11	0.03	9.85	45.37	55.36	65.30	9.94	QP
3	0.479	0.14	0.03	9.86	29.13	39.16	46.36	7.20	Average
4	0.479	0.14	0.03	9.86	34.81	44.84	56.36	11.52	QP
5	0.527	0.14	0.03	9.86	25.41	35.44	46.00	10.56	Average
6	0.527	0.14	0.03	9.86	34.30	44.33	56.00	11.67	QP
7	1.043	0.16	0.05	9.85	20.72	30.78	46.00	15.22	Average
8	1.043	0.16	0.05	9.85	30.08	40.14	56.00	15.86	QP
9	1.790	0.19	0.06	9.86	20.54	30.65	46.00	15.35	Average
10	1.790	0.19	0.06	9.86	29.73	39.84	56.00	16.16	QP
11	2.707	0.22	0.07	9.86	18.75	28.90	46.00	17.10	Average
12	2.707	0.22	0.07	9.86	31.44	41.59	56.00	14.41	QP

Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.
2. If the average limit is met when using a quasi-peak detector,
the EUT shall be deemed to meet both limits and measurement
with average detector is unnecessary.



Site no. : No.7 Shielded Room Data no. : 1
Condition : ESH2-Z5 366 Phase : LINE
Limit : CNS13438 CLASS-B
Env. / Ins. : 22°C / 50% ESCI (1276) Engineer : Ken Yang
EUT : IC-HSP001
Power Rating : DC 5V (via USB)
Test Mode : Charge

	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)	Remark
1	0.164	0.11	0.03	9.85	33.40	43.39	55.25	11.86	Average
2	0.164	0.11	0.03	9.85	47.96	57.95	65.25	7.30	QP
3	0.198	0.11	0.03	9.85	24.95	34.94	53.71	18.77	Average
4	0.198	0.11	0.03	9.85	44.71	54.70	63.71	9.01	QP
5	0.229	0.11	0.03	9.85	26.80	36.79	52.48	15.69	Average
6	0.229	0.11	0.03	9.85	40.57	50.56	62.48	11.92	QP
7	0.521	0.13	0.03	9.86	19.50	29.52	46.00	16.48	Average
8	0.521	0.13	0.03	9.86	29.58	39.60	56.00	16.40	QP
9	0.573	0.13	0.04	9.85	18.03	28.05	46.00	17.95	Average
10	0.573	0.13	0.04	9.85	32.68	42.70	56.00	13.30	QP
11	0.804	0.14	0.04	9.86	17.25	27.29	46.00	18.71	Average
12	0.804	0.14	0.04	9.86	29.67	39.71	56.00	16.29	QP

Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.
2. If the average limit is met when using a quasi-peak detector,
the EUT shall be deemed to meet both limits and measurement
with average detector is unnecessary.

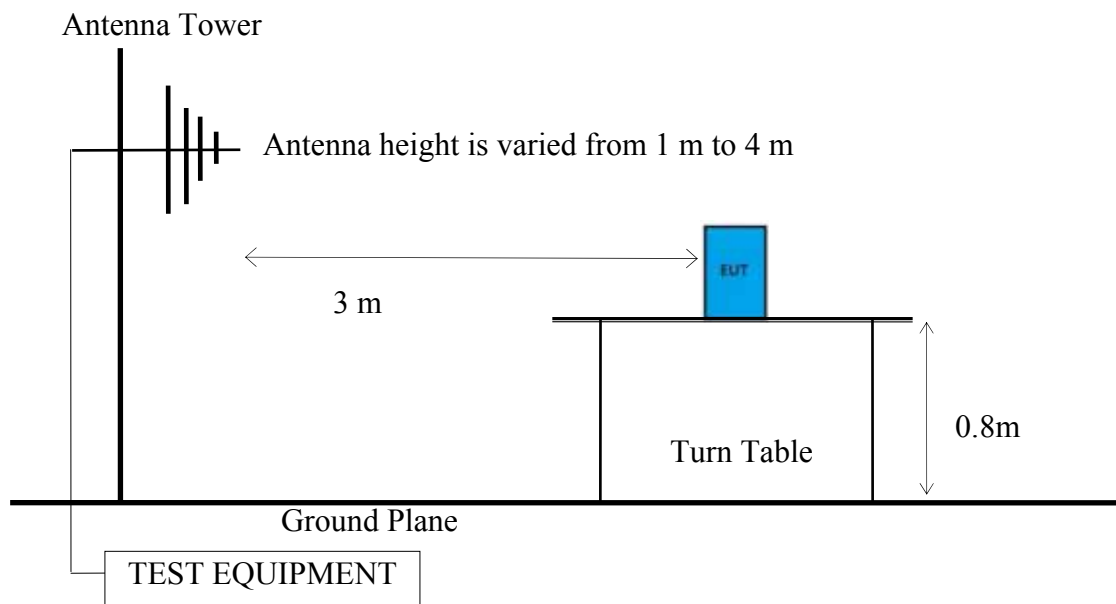
6. RADIATED EMISSION MEASUREMENT

6.1. Block Diagram of Test Setup

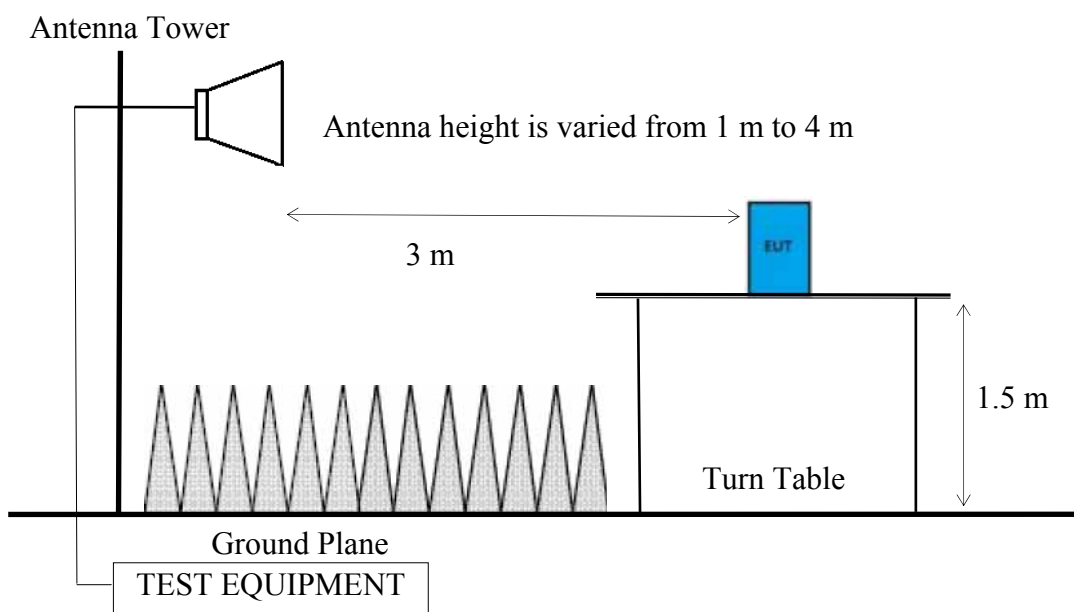
6.1.1. Block Diagram of EUT

Indicated as section 3.6

6.1.2. Setup Diagram for 30-1000 MHz



6.1.3. Semi-Anechoic Chamber (3m) Setup Diagram for above 1GHz



6.2. Radiated Emission Limits

In any 100kHz bandwidth outside the frequency band, the radio frequency power produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified as below.

Frequency (MHz)	Distance (m)	Field Strengths Limits	
		$\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
Above 960	3	500	54.0
Above 1000	3	74.0 $\text{dB}\mu\text{V/m}$ (Peak) 54.0 $\text{dB}\mu\text{V/m}$ (Average)	

Remark : (1) $\text{dB}\mu\text{V/m} = 20 \log (\mu\text{V/m})$

- (2) The tighter limit applies to the edge between two frequency bands.
- (3) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
- (4) Fundamental and emission fall within operation band are exempted from this section.
- (5) Pursuant to ANSI C63.10: 6.6.4.3, if the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.

6.3. Test Procedure

The EUT setup on the turn table which has 1.5m height to the ground. The turn table rotated 360 degrees and antenna varied from 1 m to 4 m to find the maximum emission level. Both horizontal and vertical polarization are required. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

Frequency below 1 GHz:

Spectrum Analyzer is used for pre-testing with following setting:

- (1) RBW = 120KHz
- (2) VBW $\geq 3 \times$ RBW.
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.
- (7) When peak-detected value is lower than limit that the measurement using the Q.P. detector is not required. Otherwise using Q.P. for finally measurement.

Frequency above 1GHz to 10th harmonic:

Peak Detector:

- (1) RBW = 1MHz
- (2) VBW $\geq 3 \times$ RBW.
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.
- (7) When peak-detected value is lower than limit that the measurement using the average detector is not required. Otherwise using average for finally measurement.

Average Measurement:

☒ **Option 1:**

- (1) RBW = 1 MHz
- (2) VBW = 1/T
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.

☐ **Option 2:**

Average Emission Level = Peak Emission Level + D.C.C.F.

6.4. Measurement Result Explanation

☒ Peak Emission Level = Antenna Factor + Cable Loss + Meter Reading

☒ Average Emission Level = Antenna Factor + Cable Loss + Meter Reading

☐ Average Emission Level = Peak Emission Level + DCCF

Duty Cycle Correction Factor (DCCF) = $20\log(TX_{on}/TX_{on+off})$ presented in section 3.4

☐ EPR = Peak Emission Level - 95.2dB - 2.14dBi

6.5. Test Results

PASSED.

Test Date	2016/01/26	Temp./Hum.	24°C/56%
Test Voltage	DC 3.7V (Via Battery)		

6.5.1. Emissions within Restricted Frequency Bands

6.5.1.1. Frequency Below 1 GHz

Mode	BLE	Frequency	TX 2402MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
101.78	11.03	3.23	10.79	25.05	43.50	18.45	Peak
474.26	16.62	6.25	5.96	28.83	46.00	17.17	Peak
763.32	19.58	7.01	2.46	29.05	46.00	16.95	Peak
877.78	20.46	7.46	2.03	29.95	46.00	16.05	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
101.78	11.03	3.23	4.26	18.52	43.50	24.98	Peak
470.38	16.57	6.23	6.00	28.80	46.00	17.20	Peak
746.83	19.38	6.94	2.40	28.72	46.00	17.28	Peak
881.66	20.48	7.47	2.02	29.97	46.00	16.03	Peak

Mode	BLE	Frequency	TX 2442MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
101.78	11.03	3.23	10.68	24.94	43.50	18.56	Peak
481.05	16.71	6.30	5.38	28.39	46.00	17.61	Peak
766.23	19.61	7.02	1.32	27.95	46.00	18.05	Peak
856.44	20.35	7.38	1.66	29.39	46.00	16.61	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
92.08	9.49	3.17	6.42	19.08	43.50	24.42	Peak
470.38	16.57	6.23	5.90	28.70	46.00	17.30	Peak
779.81	19.78	7.08	0.80	27.66	46.00	18.34	Peak
846.74	20.30	7.35	1.76	29.41	46.00	16.59	Peak

Mode	BLE	Frequency	TX 2480MHz
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Antenna at Horizontal Polarization

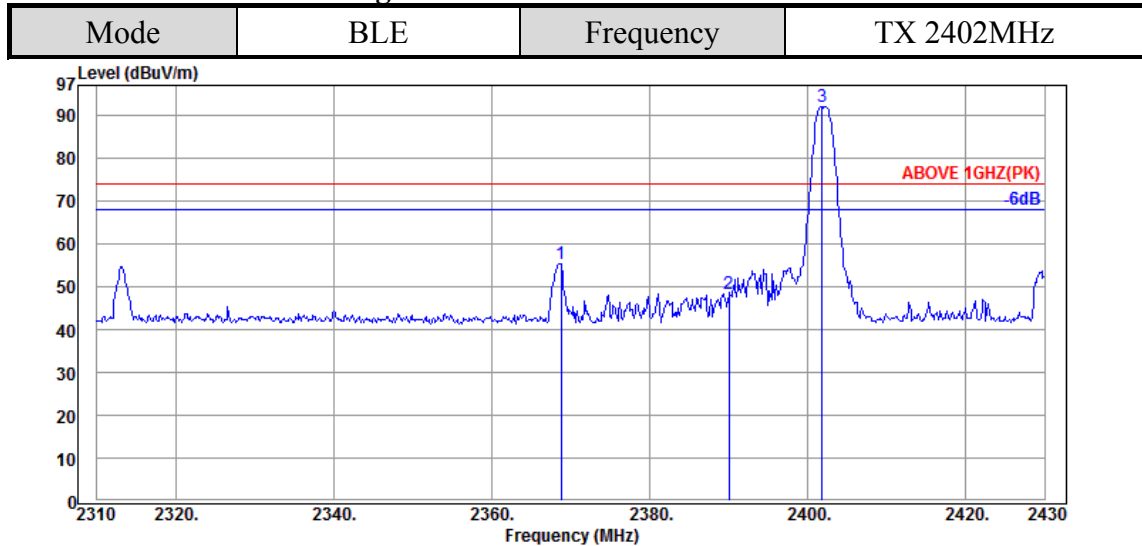
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
101.78	11.03	3.23	10.80	25.06	43.50	18.44	Peak
471.35	16.60	6.24	7.04	29.88	46.00	16.12	Peak
756.53	19.48	6.97	0.77	27.22	46.00	18.78	Peak
861.29	20.37	7.39	1.68	29.44	46.00	16.56	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
101.78	11.03	3.23	3.50	17.76	43.50	25.74	Peak
470.38	16.57	6.23	6.18	28.98	46.00	17.02	Peak
775.93	19.75	7.07	2.04	28.86	46.00	17.14	Peak
872.93	20.43	7.44	1.25	29.12	46.00	16.88	Peak

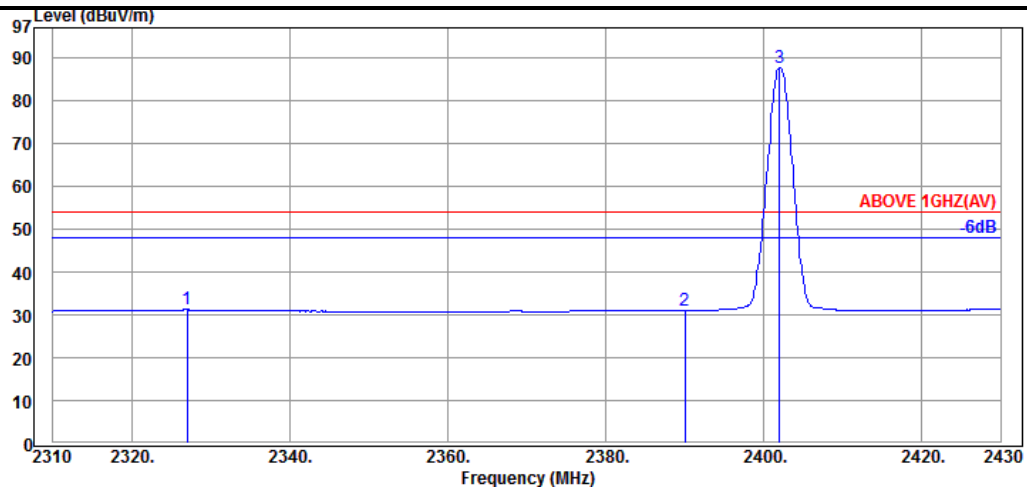
6.5.1.2. Frequency Above 1 GHz to 10th harmonics

Band Edge:



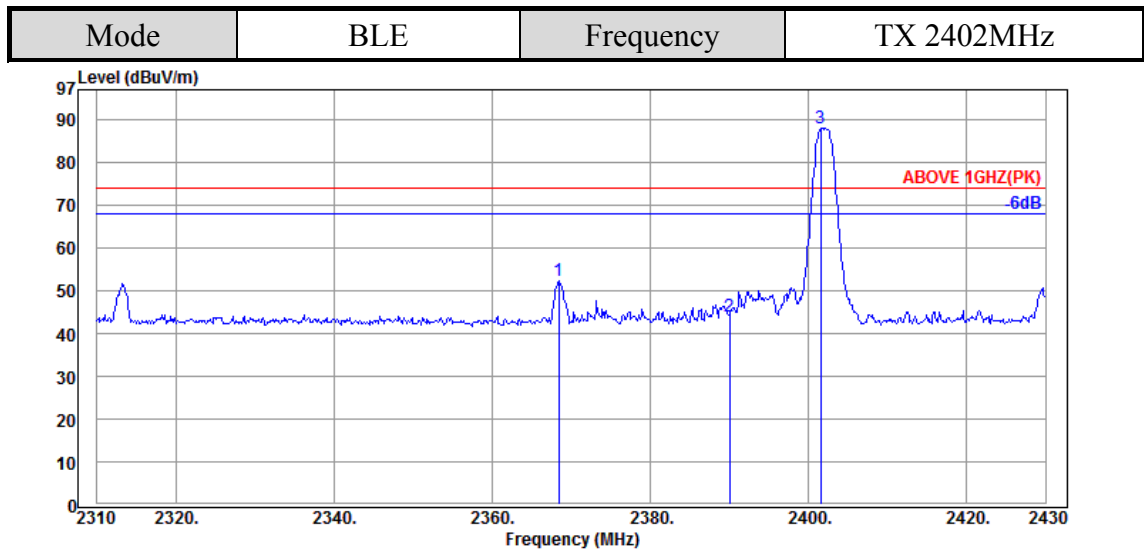
Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2368.80	32.13	5.71	17.62	55.46	74.00	18.54	Peak
2390.04	32.16	5.72	10.59	48.47	74.00	25.53	Peak
2401.80	32.16	5.72	54.00	91.88	---	---	Peak



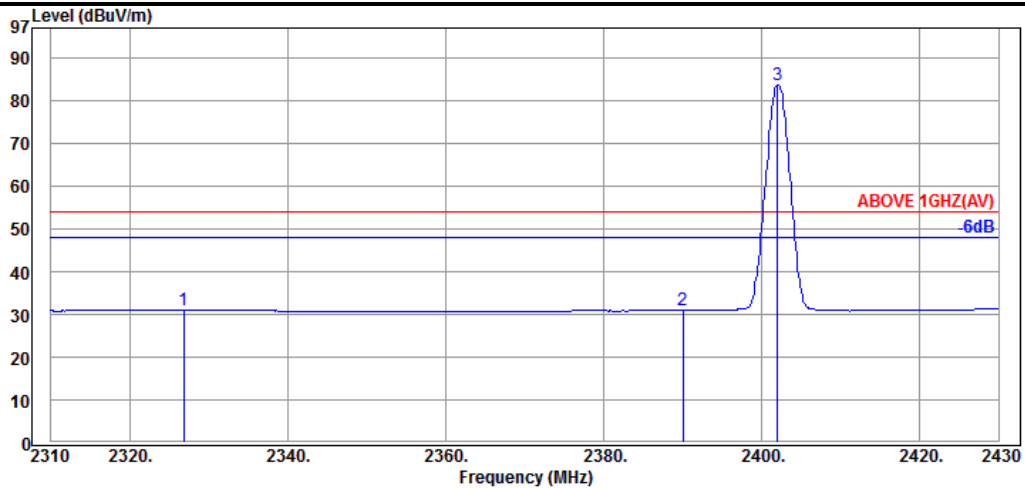
Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2327.04	32.06	5.67	-6.52	31.21	54.00	22.79	Average
2390.04	32.16	5.72	-6.92	30.96	54.00	23.04	Average
2402.04	32.16	5.72	49.76	87.64	---	---	Average



Antenna at Vertical Polarization

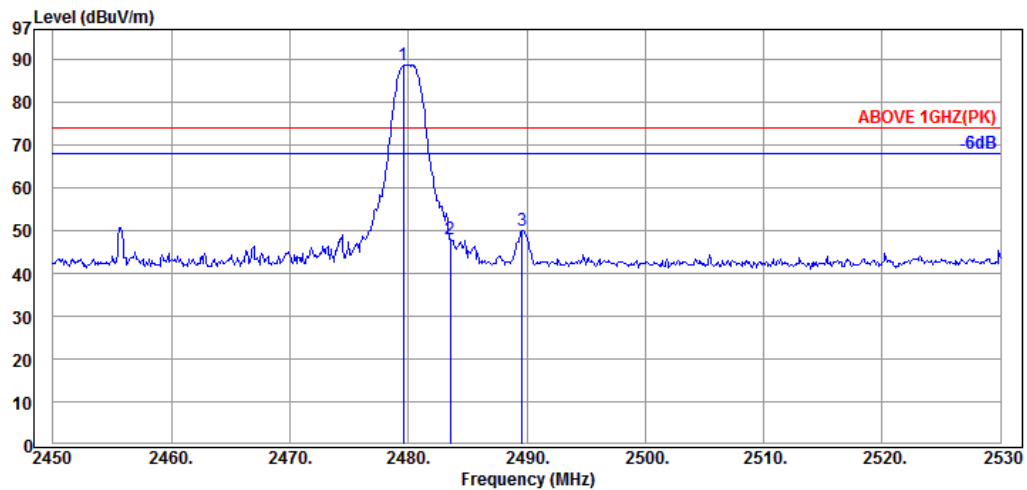
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2368.44	32.11	5.69	14.60	52.40	74.00	21.60	Peak
2390.04	32.16	5.72	6.28	44.16	74.00	29.84	Peak
2401.56	32.16	5.72	50.00	87.88	---	---	Peak



Antenna at Vertical Polarization

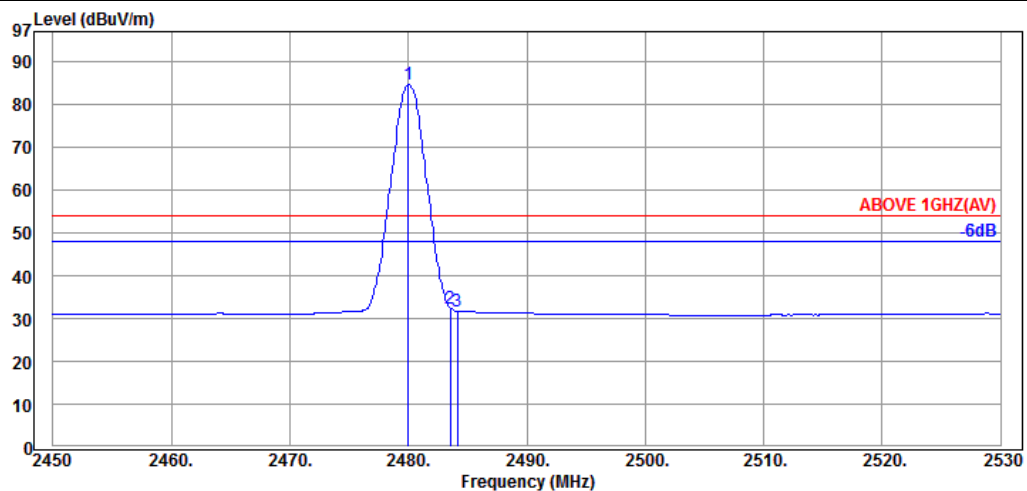
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2326.80	32.06	5.67	-6.70	31.03	54.00	22.97	Average
2390.04	32.16	5.72	-7.02	30.86	54.00	23.14	Average
2402.04	32.16	5.72	45.76	83.64	---	---	Average

Mode	BLE	Frequency	TX 2480MHz
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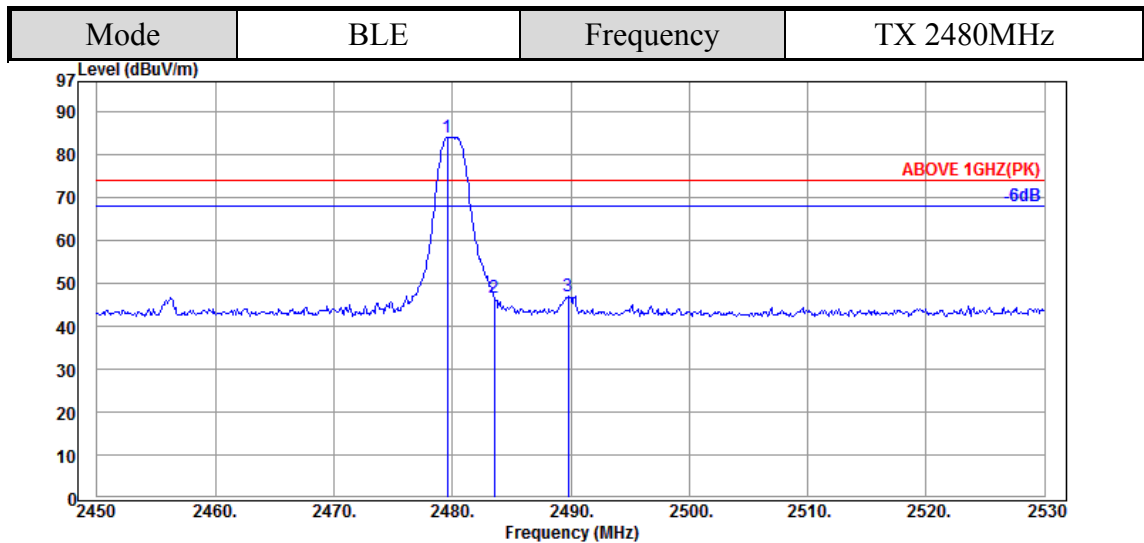
Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2479.60	32.28	5.82	50.50	88.60	---	---	Peak
2483.52	32.28	5.82	9.81	47.91	74.00	26.09	Peak
2489.60	32.30	5.84	11.93	50.07	74.00	23.93	Peak



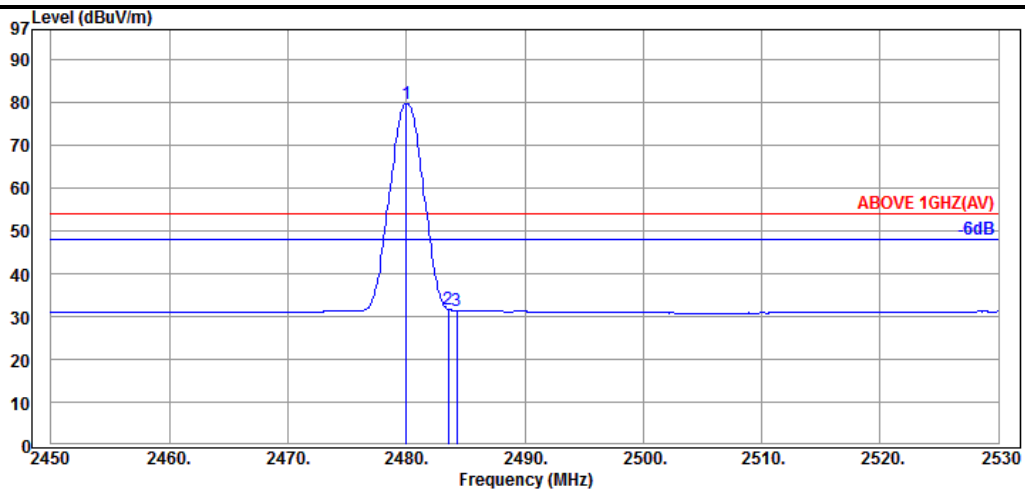
Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2480.00	32.28	5.82	46.41	84.51	---	---	Average
2483.52	32.28	5.82	-5.63	32.47	54.00	21.53	Average
2484.16	32.28	5.82	-6.42	31.68	54.00	22.32	Average



Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2479.60	32.28	5.82	45.93	84.03	---	---	Peak
2483.52	32.28	5.82	8.52	46.62	74.00	27.38	Peak
2489.76	32.30	5.84	8.99	47.13	74.00	26.87	Peak



Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2480.00	32.28	5.82	41.54	79.64	---	---	Average
2483.52	32.28	5.82	-6.40	31.70	54.00	22.30	Average
2484.24	32.28	5.82	-6.73	31.37	54.00	22.63	Average

6.5.2. Emissions outside the frequency band:

The emissions (up to 25GHz) not reported for there is no emission be found.

Mode	BLE	Frequency	TX 2402MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4810.00	34.22	7.86	11.33	53.41	54.00	0.59	Peak
7210.00	35.80	9.22	1.42	46.44	54.00	7.56	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4800.00	34.22	7.86	9.63	51.71	54.00	2.29	Peak
7210.00	35.80	9.22	1.24	46.26	54.00	7.74	Peak

Mode	BLE	Frequency	TX 2442MHz
------	-----	-----------	------------

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4885.00	34.26	8.47	8.33	51.06	54.00	2.94	Peak
7435.00	35.80	10.40	0.55	46.75	54.00	7.25	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4885.00	34.26	8.47	6.92	49.65	54.00	4.35	Peak
7310.00	35.80	9.82	0.76	46.38	54.00	7.62	Peak

Mode	BLE	Frequency	TX 2480MHz
------	-----	-----------	------------

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
4960.00	34.29	8.68	4.73	47.70	54.00	6.30	Peak
7490.00	35.80	10.66	-0.78	45.68	54.00	8.32	Peak

Antenna at Vertical Polarization

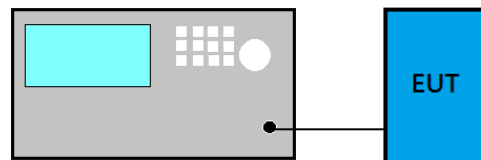
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
4960.00	34.29	8.68	4.37	47.34	54.00	6.66	Peak
7440.00	35.80	10.40	-1.19	45.01	54.00	8.99	Peak

6.5.3. Emissions in Non-restricted Frequency Bands

Pursuant to KDB 558074 D01 v03r03 that emission levels below the 15.209 general radiated emissions limits is not required.

7. 6dB BANDWIDTH MEASUREMENT

7.1. Block Diagram of Test Setup



7.2. Specification Limits

The minimum 6dB bandwidth shall be at least 500kHz.

7.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v03r03:

■ Option 2

- (1) Set RBW = 100 kHz.
- (2) Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- (3) Detector = Peak.
- (4) Trace mode = max hold.
- (5) Sweep = auto couple.
- (6) Allow the trace to stabilize.
- (7) Setting channel bandwidth function x dB to -6 dB to record the final bandwidth.

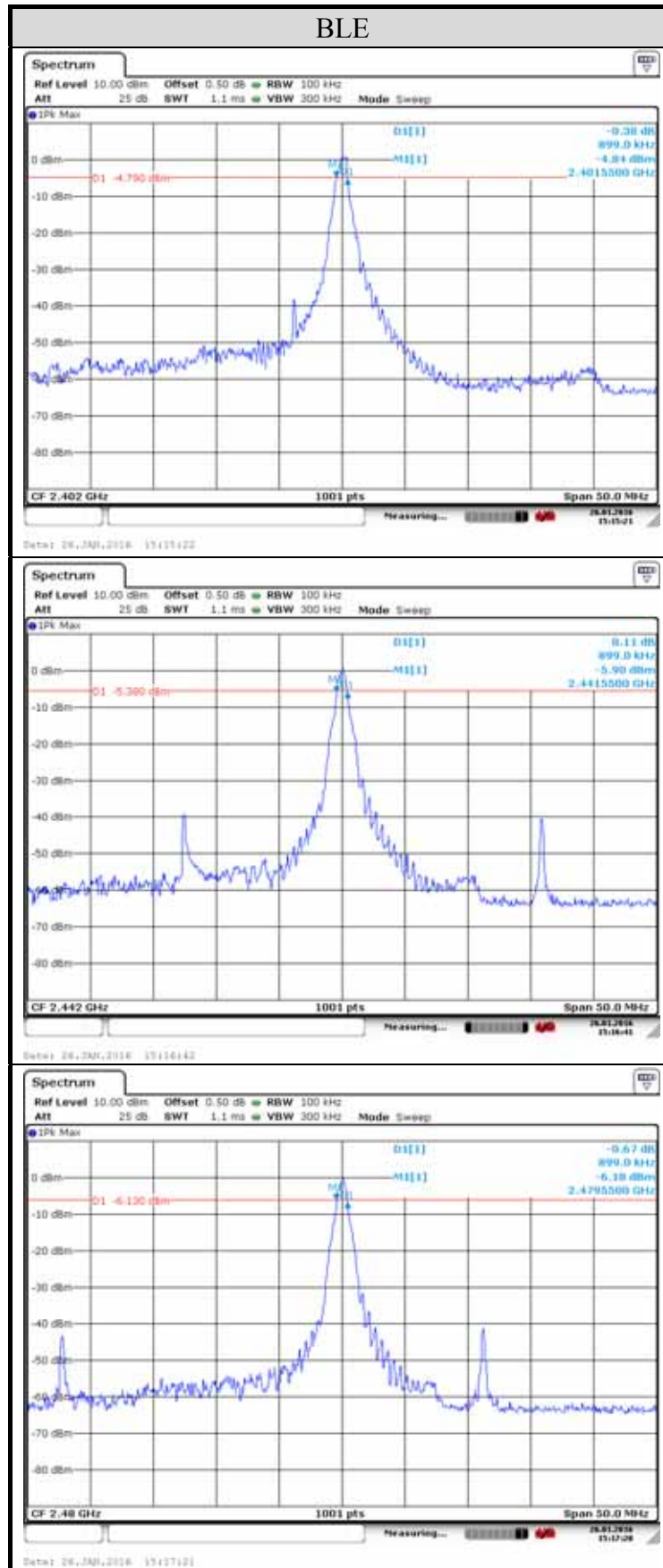
7.4. Test Results

Test Date	2016/01/26	Temp./Hum.	23°C/49%
Cable Loss	0.5dB	Test Voltage	DC 3.7V (Via Battery)

7.4.1. 6dB Bandwidth Result

Mode	Centre Frequency (MHz)	6 dB Bandwidth (MHz)
BLE	2402	0.899
	2442	0.899
	2480	0.899

7.4.2. Measurement Plots



8. MAXIMUM PEAK OUTPUT POWER MEASUREMENT

8.1. Block Diagram of Test Setup



8.2. Specification Limits

The Limits of maximum Peak Output Power for digital modulation in 2400-2483.5MHz is : 1Watt. (30dBm)

8.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v03r03:

☒ **PKPM1 Peak power meter method:**

EUT is connected to power sensor and record the maximum output power.

☐ **Method AVGPM (Measurement using an RF average power meter):**

EUT is connected to power sensor and record the maximum average output power and duty cycle factor is added when duty cycle presented in section 3.5.1 is < 98%.

☐ **RBW ≥ DTS bandwidth**

- (1) Set span to at least 3 times the OBW
- (2) Set $RBW \geq OBW$
- (3) Set the video bandwidth (VBW) $\geq 3 \times RBW$.
- (4) Detector = Peak
- (5) Trace mode = max hold
- (6) Sweep = auto couple.
- (7) To find the peak amplitude level.

8.4. Test Results

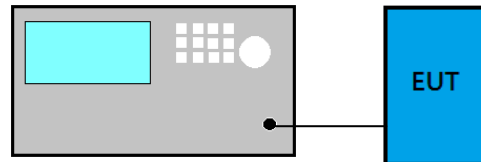
Test Date	2016/01/26	Temp./Hum.	23°C/49%
Cable Loss	0.5dB	Test Voltage	DC 3.7V (Via Battery)

Mode	Centre Frequency (MHz)	Peak Output Power		Limit
		(dBm)	(W)	
BLE	2402	2.65	0.001841	< 30 dBm (1 W)
	2442	1.78	0.001507	
	2480	0.62	0.001153	

Note: The results have been included cable loss.

9. EMISSION LIMITATIONS MEASUREMENT

9.1. Block Diagram of Test Setup



9.2. Specification Limits

In any 100kHz 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 20dB below that in the 100kHz 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 Section 15.209(a) is not required. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (See Section 15.205(c)).

9.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v03r03:

■ Reference Level

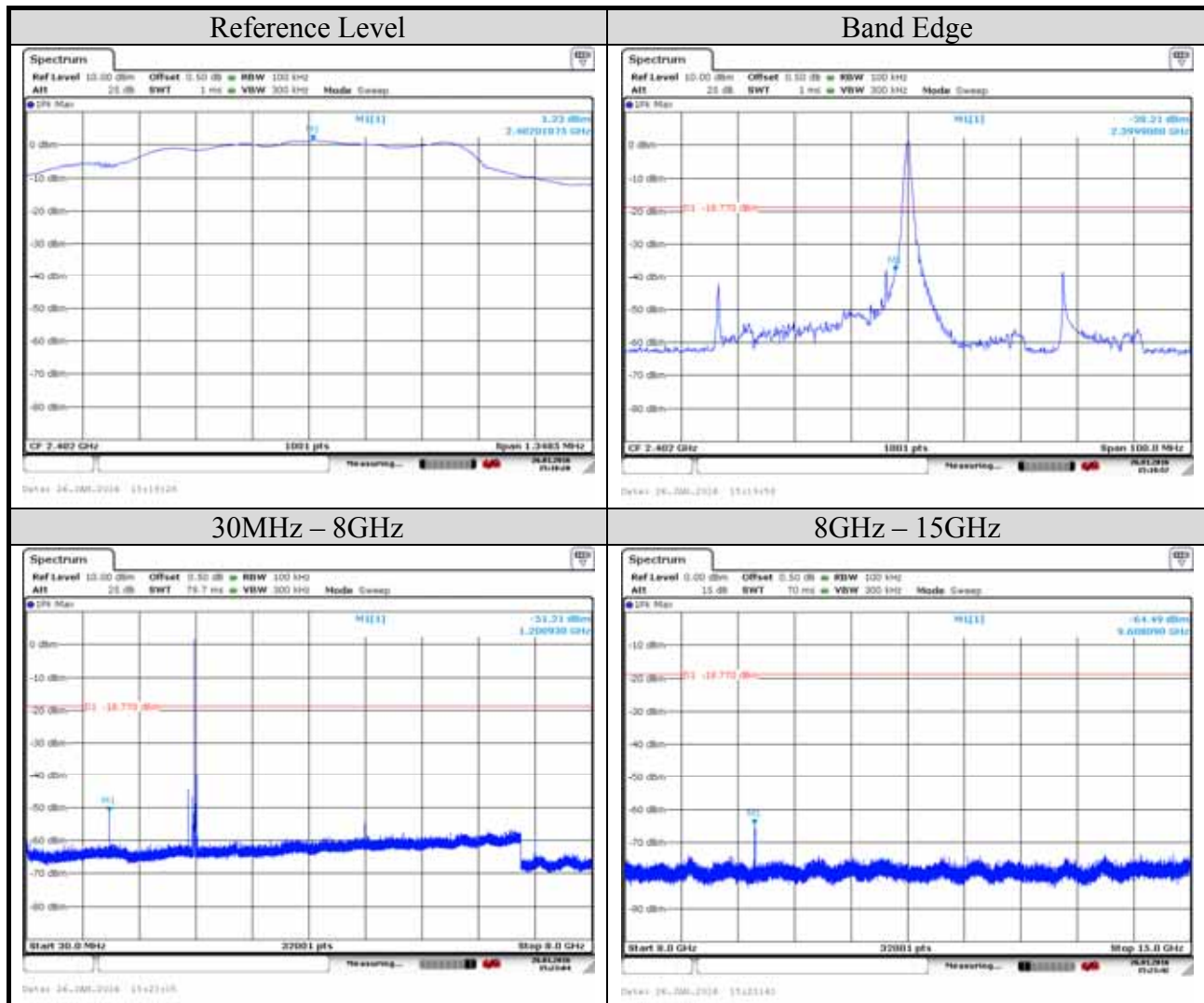
- (1) Set analyzer center frequency to DTS channel center frequency.
- (2) Set the span to 1.5 times the DTS bandwidth.
- (3) Set the RBW to: 100 kHz.
- (4) Set the VBW $\geq 3 \times$ RBW.
- (5) Detector = peak.
- (6) Sweep time = auto couple.
- (7) Trace mode = max hold.
- (8) Allow trace to fully stabilize to find the max PSD as reference level.

■ Emission Level Measurement

- (1) Set analyzer center frequency to DTS channel center frequency.
- (2) Set the span to 1.5 times the DTS bandwidth.
- (3) Set the RBW to: 100 kHz.
- (4) Set the VBW $\geq 3 \times$ RBW.
- (5) Detector = peak.
- (6) Sweep time = auto couple.
- (7) Trace mode = max hold.
- (8) Allow trace to fully stabilize to find the max level.

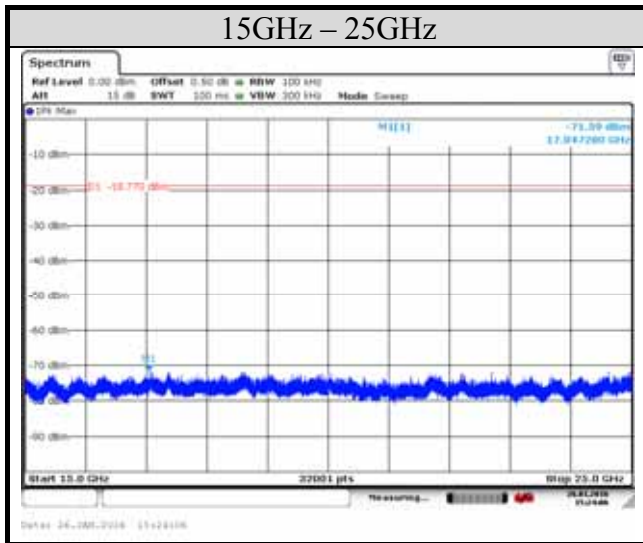
9.4. Test Results

Test Date	2016/01/26	Temp./Hum.	23°C/49%
Mode	BLE	Frequency	TX 2402MHz
Cable Loss	0.5dB	Test Voltage	DC 3.7V (Via Battery)



AUDIX Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City 244, Taiwan

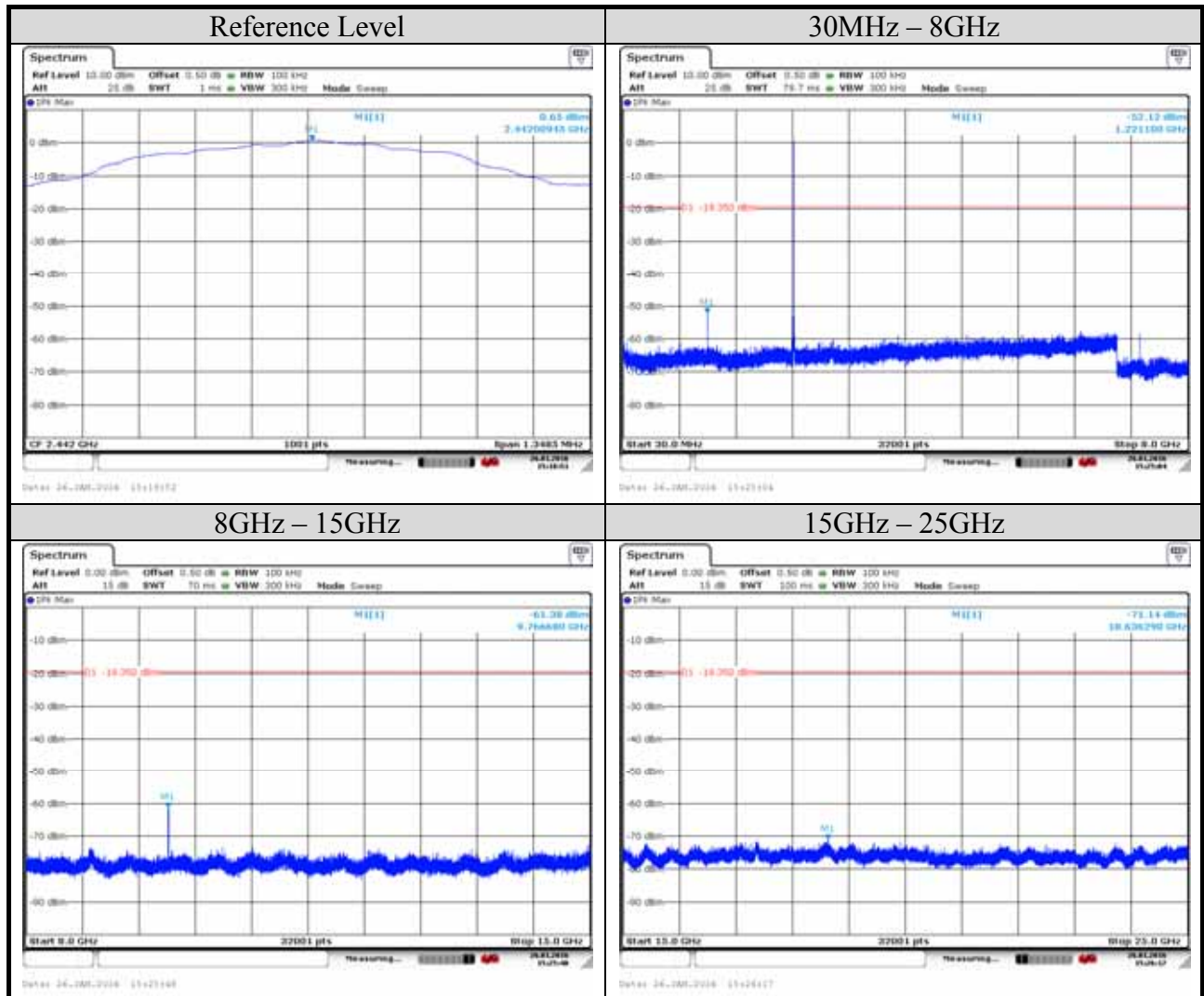
Tel: +886 2 26099301
Fax: +886 2 26099303



AUDIX Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

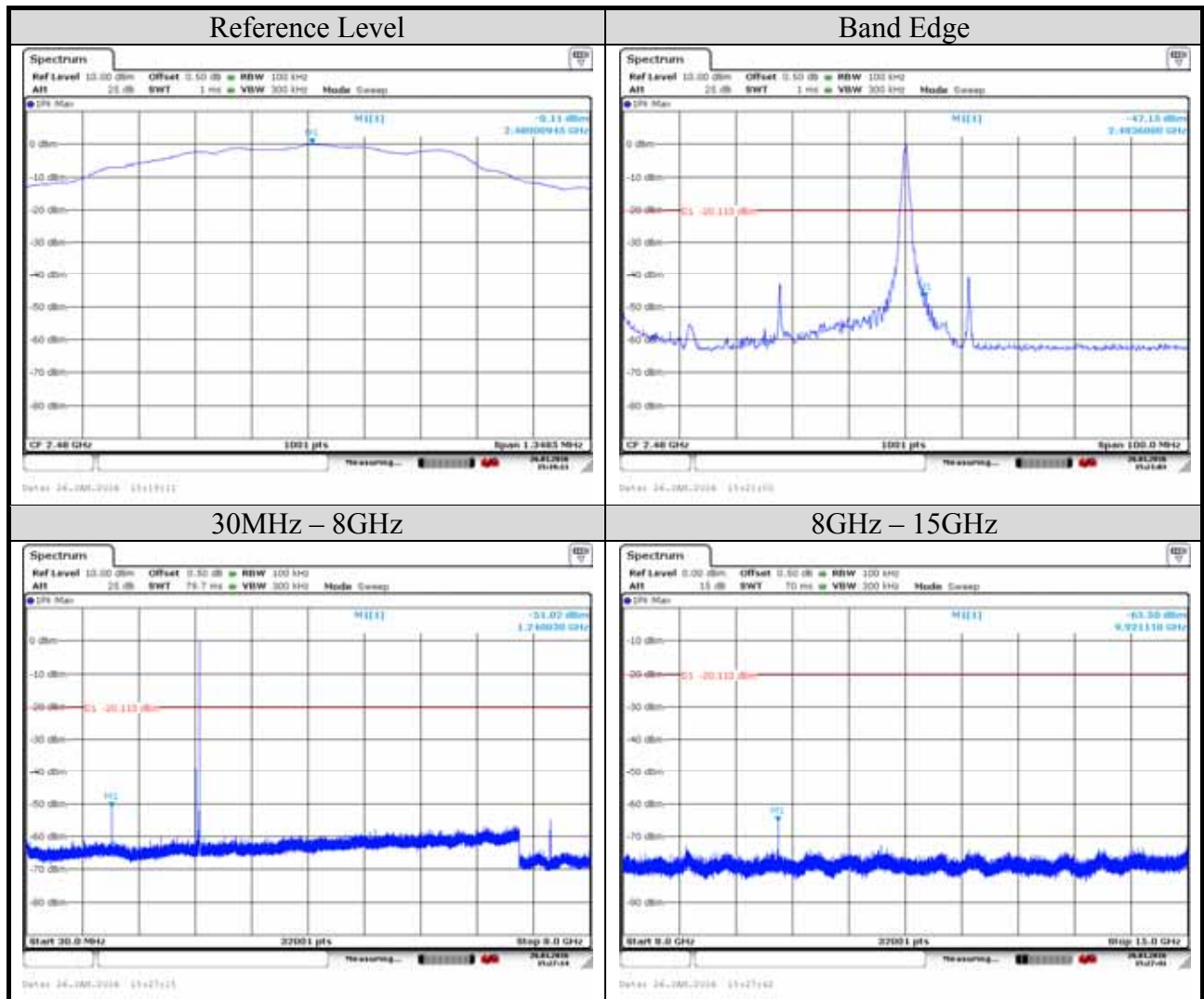
Test Date	2016/01/26	Temp./Hum.	23°C/49%
Mode	BLE	Frequency	TX 2442MHz
Cable Loss	0.5dB	Test Voltage	DC 3.7V (Via Battery)



AUDIX Technology Corp.
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New Taipei City244, Taiwan

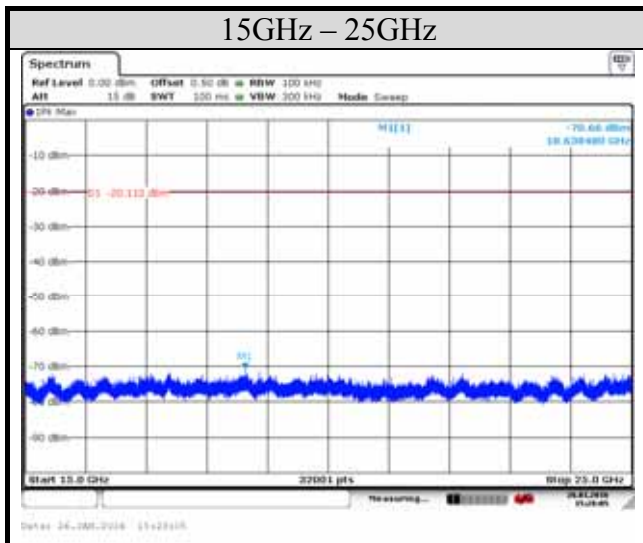
Tel: +886 2 26099301
Fax: +886 2 26099303

Test Date	2016/01/26	Temp./Hum.	23°C/49%
Mode	BLE	Frequency	TX 2480MHz
Cable Loss	0.5dB	Test Voltage	DC 3.7V (Via Battery)



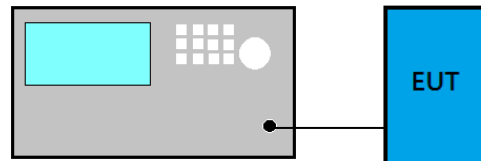
AUDIX Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City 244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303



10. POWER SPECTRAL DENSITY

10.1. Block Diagram of Test Setup



10.2. Specification Limits

The peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band.

10.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v03r03:

■ Method PKPSD (peak PSD)

- (1) Set analyzer center frequency to DTS channel center frequency.
- (2) Set the span to 1.5 times the DTS bandwidth.
- (3) Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- (4) Set the VBW $\geq 3 \times \text{RBW}$.
- (5) Detector = peak.
- (6) Sweep time = auto couple.
- (7) Trace mode = max hold.
- (8) Allow trace to fully stabilize.
- (9) Use the peak marker function to determine the maximum amplitude level.
- (10) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

□ Method AVGPSD-2

- (1) Using peak PSD procedure step 1 to step 4.
- (2) Detector = RMS detector
- (3) Sweep time = auto couple
- (4) Trace mode = trace averaging over a minimum of 100 traces
- (5) Use the peak marker function to determine the maximum amplitude level.
- (6) Duty cycle factor is added when duty cycle presented in section 3.5.1. < 98%.
- (7) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

10.4. Test Results

Test Date	2016/01/26	Temp./Hum.	23°C/49%
Cable Loss	0.5dB	Test Voltage	DC 3.7V (Via Battery)



11.DEVIATION TO TEST SPECIFICATIONS

【NONE】